MINUTES

OF THE

ENVIRONMENTAL PROTECTION COMMISSION

MEETING

AUGUST 18, 2015

DNR AIR QUALITY OFFICES
7900 HICKMAN ROAD
WINDSOR HEIGHTS, IOWA

Chuck Gipp, Director

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MEETING MINUTES

CALL TO ORDER

The meeting of the Environmental Protection Commission was called to order by Chairperson Mary Boote at 10:00 a.m. on August 18, 2015 at the DNR Air Quality office in Windsor Heights, Iowa.

COMMISSIONERS PRESENT

Mary Boote, Chair
Nancy Couser
Cindy Greiman, Secretary
LaQuanda Hoskins
Chad Ingels, Vice Chair
Ralph Lents
Joe Riding
Bob Sinclair
Gene Ver Steeg

COMMISSIONERS ABSENT

None

ADOPTION OF AGENDA

Chair Boote amended the agenda to remove the Manure Applicator Certification online training demonstration due to the fact that the web based training platform was still being updated, thus making it unavailable. Motion was made by Joe Riding to approve the agenda as amended. Seconded by Ralph Lents. Motion carried unanimously.

APPROVED AS AMENDED

APPROVAL OF MINUTES

Motion was made by Chad Ingels to approve the July 21, 2015 EPC meeting minutes. Seconded by Cindy Greiman. Motion carried unanimously.

APPROVED AS PRESENTED

MONTHLY REPORTS

- Bill Ehm provided an update on the Air Quality fee rulemaking. He anticipated that the proposed rules will be brought to the EPC for Commission review via a teleconference meeting prior to the September business meeting.
- Bill Ehm shared with the Commission the Department submitted the AFO Workplan Annual Report to EPA on August 1st and the agency has completed 41% of the inspections. All the materials including the inspections are available online for the public to review.
- Bill Ehm thanked the State Hygienic Laboratory for being a partner in continuous improvement. Each year, both agencies tackle a topic to find efficiencies. This past year, the air monitoring teams have been meeting almost every other week to improve their processes.

The following monthly reports have been posted on the DNR website under the appropriate meeting month: http://www.iowadnr.gov/InsideDNR/BoardsCommissions.aspx

1. Rulemaking Status Report
2. Variance Report
3. Enforcement Status Report
4. Administrative Penalty Report
5. Attorney General Referrals Report
6. Contested Case Status Report
7. Bypass Report
8. Manure Report
9. Spill Report

INFORMATION

PUBLIC COMMENT

Bob Hayes – Waukee Resident
Bob Hayes distributed photos of the subdivision where he built his home in the 1990s along with recent photos where sediment is filling in a pond that used to be 15 feet deep. During the June EPC meeting, Joe Pietruszynski said soil is not being moved offsite but Mr. Hayes has photos showing the company moving soil offsite at a nearby project. This week at the project site, Bob Hayes saw and photographed 20 water bottles and latex paint disposed of at the site. He feels the Commission was bamboozled in its recent topsoil rulemaking.

Mel Willits – Waukee Resident
Mel Willits withdrew his request to speak to the Commission. He felt Bob Hayes represented the topic sufficiently.

Steve Anderson – Kossuth County Environmental Health Department
Steve Anderson agrees with the Iowa District Court ruling for the siting of a CAFO in Kossuth County. He asked the Commission to deny the permit.

Barbara Lang – ICCI
Barbara Lang shared with the Commission she was their conscience to remind them of the EPC mission. She wants drinkable, swimmable, and good clean water. In 1995, there were 159 polluted waterways and now there are 725. Objective #6 of the AFO Workplan is to provide strong deterrence for noncompliance. Repetition is important. She believes money talks and levying heavy fines and penalties will stop polluters. She asked the Commission to issue clean water permits where the fines are greater. A factory farmer can be put out of business if they don't follow their permit. She also asked for an AFO database that is up to date and without hidden files. Our waters are deteriorating and she cares about the state.

Cherie Mortice – ICCI
Cherie Mortice expressed concern after hearing Governor Branstad telling Des Moines Water Works to tone it down. She was there to let everyone know she is seeing the escalation of big corporate agriculture; Iowans are feeling humiliated and at risk for their personal health and their family's health. People are rolling the dice when entering the water. Protecting corporate agriculture has made Iowa a national leader in polluted waters. Polluted waterways have climbed 15% in 2 years due to agriculture fertilizer increases, corporate hog factories, and manure application with limited oversight. A food production system does not work with corporate agriculture. The simple truth is, Iowa needs to enforce the Clean Water Act now. The Commission fails to address the continued degradation of Iowa's waterways.

Lee Barclay – ICCI
Lee Barclay reviewed four articles from the Des Moines Register published on water pollution. The first article focused on a blue green algae bloom that killed fish. The second article described toxic blue green blooms and included a recommendation to stay out of the water. Article three highlighted 60 cities and towns with high nitrates in their drinking water. The last article discussed the increase to the Gulf dead zone. He felt the articles were misleading by blaming the polluted water on climate change, rainfall, and golf courses. They did not mention farmlands which is 90% of the cause. He asked the Commission when something would be done to curb the pollution and when they would direct the DNR to enforce the regulations. He did not express confidence in the Commission to stop the pollution.

Vern Tigges – ICCI
Vern Tigges welcomed the new members of EPC. He has been attending commission and board meetings for 20 years and he feels the EPC is the most obstinate board. Some boards were sympathetic and some directors have resigned in disgust over what is going on. The Governor said Des Moines Water Works needs to tone it down. He can't see how DMWW could tone it down. DMWW has dealt with the problem for years and was forced into a corner to do something. ICCI is backing the DMWW lawsuit. He read comments from ICCI members who could not attend the meeting who were concerned with the Governor's manner of dealing with DMWW and corporate agriculture. ICCI and this fight has been going on the last 40 years and will continue for 40 more.

Sheri Hawk – ICCI
Sheri Hawk read Donnelle Eller's article in the Des Moines Register about blue green algae and she is concerned about her family members. Her grandkids were swimming at Twin Lake and the beach was closed shortly after their visit. The symptoms that result from the microcystins are awful and affect vulnerable people like kids and babies. She does not understand Governor Branstad saying tone it down when kids' lives and health are at stake. EPC's number one goal is to have a healthy environment. She doesn't assume any lake is clear of algae.

Janis Elliot – ICCI
Janis Elliot is a retired teacher. When she was teaching, she would give out tests to see if the kids learned and to see if she was getting her message across. If many students failed a test, she realized it was her fault. It was her job to make sure the kids understood. EPC isn't giving tests but they do have data to know how Iowa's water is doing. In 2 years, a 15% increase in impaired waterways and 10% fee increase for DMWW to clean the water is a failure. This failure is the state's fault. Listening to individuals speak to the EPC about how factory farms destroyed their quality of life demonstrates the state is going in the wrong direction.

Carrie Fisher – ICCI
Carrie Fisher shared with the Commission the two year anniversary of the Clean Water Act Report. DNR says they completed 40% of the inspections. She asked DNR how many inspections were done on site compared to desktop inspections. She received the answer of 3,400 desktop assessments and 1,500 onsite

inspections out of 9,000 facilities. She does not believe Google Earth is a reliable source of information to conduct an inspection because one doesn't know when the photo was taken or that one can see equipment that could fail. There are many DNR inspectors that want to do their job and they want to protect the environment as a legacy but they can't do it because the leadership at the organization is involved with corporate agriculture. There is a reason why we are seeing what we see. She asked what side of the fight the Commissioners will be on.

Jess Mazour – ICCI
Jess Mazour shared with Commissioners there have been over 800 manure spills in Iowa and those are just the documented ones. She wonders how many are happening that we don't know about. Nitrates is a problem but so is phosphorous. The DNR is not checking for phosphorous. She walked past Gene Ver Steeg and Director Gipp earlier and overheard them talking about Mr. Ver Steeg's phosphorus buildup on his land. She inquired if the DNR was going to check his land to see if factory farm manure is getting into the water. She believes the top 5 reasons manure is getting into the water are corporate agriculture, profit before people, Director Chuck Gipp, Governor Branstad, and the EPC. These are the reasons Iowa has polluted waterways. Voluntary compliance is not working and it is time to say enough is enough and shut them down. She does not care how many inspections are done when there are more manure spills than last year and more waterways where people can't drink the water. She believes the Workplan isn't working.

Stephen Tews – ICCI
Stephen Tews expressed there is no Branstad, Iowa, or ICCI water, there is only clean water or dirty water. DNR's report shows there are more impaired waterways. The Clean Water Act was signed into law by a president who ran on law and order. President Nixon would not be proud of the EPC for not enforcing the Clean Water Act. He asked the Commission to please do their job.

Mary Clark – ICCI
Mary Clark has a well for her drinking water. After seeing the statistics of the polluted waterways, she has come to the conclusion that voluntary measures are not working. She does not understand how self-regulation by the agriculture industry is acceptable when no other business is allowed to self-regulate. If you get a speeding ticket, you pay it. After a CAFO has had 3 spills of manure, they should be shut down. She believes one CAFO has had 5 spills. CAFOs should be made to pay for the cost of their damage to the land and water. Violators should pay for the nitrates removed from the water. DNR needs to provide regular inspections to protect Iowans from serious health problems caused by pollution. She read a Native American proverb about how we do not inherit land from our ancestors but we borrow it from our children. We have the responsibility to return the earth to our children in a better condition. She asked the Commission to please do what the citizens ask, protect the air, land, and water.

Adam Mason – ICCI
Adam Mason thanked the Commissioners for considering meeting ICCI to review the Workplan. He grew up on farm in Storm Lake. In the early 90's, a lot of factory farms were constructed. Members here today talk about issues that affect their state. ICCI has worked over the years with farmers squeezed out of business by corporate agriculture, and on air quality and water quality. ICCI talks about legacy and looking forward. The decision of the EPC regarding the Kossuth County hog confinement will create a legacy. Communities don't have local control for where a CAFO is sited and so the EPC has the deciding vote. Do the right thing regarding P&J Pork.

Written Comments Submitted

- None

END OF PUBLIC COMMENT

DIRECTORS REMARKS

- Director Gipp shared with the Commission the DNR's 41% completion rate regarding inspections under the AFO Workplan.

INFORMATION

NOTICE OF INTENDED ACTION – CHAPTER 209 – LANDFILL ALTERNATIVES FINANCIAL ASSISTANCE

Tom Anderson, DNR SWAP Coordinator, of the Land Quality Bureau presented the following item.

The Commission was requested to approve this Notice of Intended Action (NOIA) to begin the formal rule making process for the attached proposed 567 IAC 209, "Landfill Alternatives Financial Assistance."

Reason for Rulemaking:
Chapter 209 of the Iowa Administrative Code was reviewed as part of the five year rule review per Iowa Code section 17A.7(2). It was determined that rules for the administration of the Derelict Building Grant Program be added to the existing rules for the Solid Waste Alternatives Program. This determination was based on two basic factors: 1) Financial assistance is awarded on a competitive basis through the Derelict Building Grant Program and for this reason rules to administer the program should be formalized in administrative code. 2) The Derelict Building Grant Program is funded through the Solid Waste Alternatives Program which is administered by Chapter 209.

Because the chapter is being reformatted to incorporate the Derelict Building Grant Program, the NOIA is to rescind and replace the chapter; however, no substantive changes are being made to the SWAP program.

Summary of Proposed Changes:
The following actions are being proposed.

- Rename Chapter 209 to "Landfill Alternatives Financial Assistance."
- Minor corrections to the rules pertaining to SWAP by deleting references to the "Waste Management Assistance Division". This division is now part of the Land Quality Bureau within the Environmental Assistance Division.
- Add rules specific to administering the Derelict Building Grant Program.
- Reformat the chapter so that:
    - rules applicable to both the Solid Waste Alternatives Program and the Derelict Building Grant Program make up the first part of the chapter;
    - rules specific to the Solid Waste Alternatives Program make up the second part of the chapter; and
    - rules specific to the Derelict Building Grant Program make up the final part of the chapter.

Stakeholder Involvement:
A draft of the proposed chapter 567 IAC 209, was provided to 32 stakeholder associations, business and industry representatives, government agencies, nonprofit organizations and to all 46 Iowa solid waste agencies for comments. The proposed chapter was also posted to the DNR website with a solicitation for comment.

The following three comments were received and the resulting actions taken by the Department include:

- Comments received from a private consulting firm and the League of Iowa Cities were in support of the proposed Chapter as presented.
- The third commenter from a nonprofit organization suggested the following:
    - Modify the definition of "abandoned" to include a time period in which a publically owned building must be abandoned before renovation or deconstruction of that building would be eligible for funding assistance. The department found that adding a six (6) month minimum period in which the building must be abandoned to the definition would improve the definition and help ensure that the building in question is a derelict building.
    - Clarify the eligibility of buildings listed on the State or National Register of Historic Places. No change was recommended as the proposed rule clearly sets out that if a property is on the State or National Register of Historic Places it is not eligible for renovation or deconstruction under the Derelict Building Grant Program.

The proposed rule, with the above change was then sent to the three individuals who provided comments. The individuals, who originally commented that proposed rule was acceptable, reiterated their approval. The individual who provided the two comments above provided two additional comments, both of which were included as suggested.

- To move SWAP eligibility requirements to the front of the rule; and
- To include "5,000 or fewer" in 209.16 (description of program) for greater clarity.

Once the above changes were made, the revised proposed Chapter 209 was again distributed to all stakeholders originally solicited for comments. One comment was received requesting removal of the six (6) month requirement for a building to be abandoned. It was suggested by the commenter that this time frame may prevent a community from being able to act quickly. It was determined the six (6) month requirement should remain. Reasons for this determination included: 1) projects cannot be initiated until the city has ownership of the building; and 2) if a city were to receive advanced notice that a building will become abandoned, ownership still must first be secured before any renovation or deconstruction work could commence and this could be a protracted process.

Because the chapter is being reformatted to incorporate the Derelict Building Program, the NOIA is to rescind and replace the chapter; however, no substantive changes are being made to the SWAP program. The proposed chapter 567 IAC 209 has received preclearance from the Governor's Office.

Tom Anderson shared with the Commission how the 6 months timeframe for a building to be considered abandoned was selected.

Motion was made by Gene Ver Steeg to approve the agenda item as presented. Seconded by Nancy Couser. Motion carried unanimously

APPROVED AS PRESENTED

CONTRACT WITH THE STATE HYGIENIC LABORATORY AT THE UNIVERSITY OF IOWA FOR AMBIENT GROUNDWATER ANALYTICAL SUPPORT

Roger Bruner, Supervisor, of the Water Monitoring and Assessment Section of the Water Quality Bureau presented the following item.

Commission approval was requested for a one year-service contract with the State Hygienic Laboratory at the University of Iowa. The contract will begin on September 1, 2015 and terminate on June 30, 2016. The total amount of this contract shall not exceed $ 69,899.76.

Funding Source:
This contract will be funded through Environment First funds through cost center HB8A under the authority of Iowa Administrative Code (IAC) 455B.103.

Background:
A groundwater monitoring program had not been implemented in this State from 2006 to 2012 due to program priorities and increasing costs. The groundwater monitoring program was re-designed in 2012 and will continue as a part of the ambient monitoring tasks for the Department. The data collected in this contract will provide the data necessary to evaluate baseline conditions and long-term trends in groundwater quality. The data will be made available to the public and used by the Department and others to support management and planning decisions.

Purpose:
The parties propose to enter into this Contract for the purpose of retaining the Contractor to provide: analytical assistance to DNR by analyzing groundwater samples collected throughout the state of Iowa.

Contractor Selection Process:
DNR is allowed to contract with the University of Iowa pursuant to Iowa Code section 455B.103. The University of Iowa was chosen for this project because of their expertise in water quality analyses.

Contract History:
Since 2012 a contract with the State Hygienic laboratory has been executed to analyze groundwater samples submitted by selected municipal water operators. The Department has coordinated the sample collection with Municipal water operators who volunteer their time to collect the samples and ship the samples to SHL. Prior to 2006 the Department contracted with the USGS to provide both sample collection and analyses.

Roger Bruner distributed a map of Iowa containing the proposed sites. Chair Mary Boote confirmed with Mr. Bruner that the DNR is monitoring for phosphorus and the public comment today was incorrect. Roger Bruner expects to bring to the September EPC meeting the 2014 monitoring report.

Gene Ver Steeg noted for the record that statements made during public comments were not accurate. His conversation with Director Gipp was about the decrease -- rather than the increase -- of phosphorous on his farm.

Motion was made by Ralph Lents to approve the agenda item as presented. Seconded by Cindy Greiman. Motion carried unanimously

APPROVED AS PRESENTED

CONTRACT WITH IDALS FOR PROGRAM STAFFING--REGIONAL BASIN COORDINATORS

Steve Hopkins, Nonpoint Source Program Coordinator, of the Watershed Improvement Section of the Water Quality Bureau presented the following item.

Commission approval was requested for a contract with the Iowa Department of Agriculture and Land Stewardship--Division of Soil Conservation and Water Quality (IDALS). The contract will begin on September 1, 2015 and terminate on August 31, 2016. The total amount of this contract shall not exceed $150,000.

Funding Source:
This contract will be funded through FFY2015 EPA Section 319 grant funds.

Background:
For more than a decade, the Iowa Department of Agriculture and Land Stewardship- Division of Soil Conservation and Water Quality (IDALS) has provided staffing support to the Section 319 program through the deployment of 3 regional basin coordinators in various locations throughout Iowa. The regional basin coordinators are charged with assisting to implement the State of Iowa's Nonpoint Source Management Plan in coordination with the Iowa Department of Natural Resources, through general outreach opportunities and technical and administrative assistance to local watershed groups, the public, agency staff, municipal leaders and politicians.

Purpose:
The parties propose to enter into this Contract for the purpose of retaining the Contractor to provide Regional Basin Coordinator staffing for watershed planning and project implementation.

Contractor Selection Process:
IDALS Division of Soil Conservation was chosen for this project because of its ongoing overall program coordination with DNR in providing Regional Basin Coordinator staffing for watershed planning and project implementation.

Contract History:
This contract is one of a series of contracts with IDALS to provide Regional Basin Coordinator program staffing to support watershed planning and project implementation.

Motion was made by Chad Ingels to approve the agenda item as presented. Seconded by Ralph Lents. Motion carried unanimously

APPROVED AS PRESENTED

CONTRACT– IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP – PRICE CREEK WATERSHED PROJECT PHASE 1-2

Rachel Glaza, Environmental Specialist, with the Watershed Improvement Section of the Water Quality Bureau presented the following item.

The Department requested Commission approval of a contract in the amount of $383,452 with the Iowa Department of Agriculture and Land Stewardship from August 18, 2015 to June 30, 2018.

Funding Source:
Federal – Environmental Protection Agency. This project will be funded through Section 319 of the Clean Water Act.

Background:
Price Creek is located in northeastern Iowa County and southeastern Benton County. Price Creek is 13.6 miles long and is listed on Iowa's 2012 303(d) list as not supporting primary contact recreation and overall use. Extensive modeling and watershed planning have identified the major sources of bacteria to Price Creek. The sources include unrestricted livestock access to the creek, lack of manure storage facilities, lack of nutrient and manure management plans and inadequate septic systems. The overall goal of the Price Creek Watershed Project is to reduce bacteria loading by 95% to meet the Water Quality Standards by reducing livestock access, addressing failed septic systems and through better manure storage practices and management techniques. Project activities will assist landowners to apply best management practices (BMPs) that will reduce bacteria delivery to Price Creek. This contract will provide funding for staff support and watershed outreach activities and BMP cost-share until June 30, 2018.

Purpose:
The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and water quality educational programming for the project selected.

Contractor Selection Process:
DNR enters into a contract with IDALS-DSCWQ based on Iowa Code section 455B.103(3). This project was chosen using a grant proposal application and committee review process.

During Rachel Glaza's presentation, she was able to describe for Commissioners the livestock fencing and alternative watering practices, cost share breakout for producers, educational programs available, and the collaboration between a number of entities to maximize project success.

Motion was made by Cindy Greiman to approve the agenda item as presented. Seconded by LaQuanda Hoskins. Motion carried unanimously

APPROVED AS PRESENTED

CONTRACT– IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP – WATER QUALITY IN RATHBUN LAKE

Rachel Glaza, Environmental Specialist, with the Watershed Improvement Section of the Water Quality Bureau presented the following item.

The Department requested Commission approval of a contract in the amount of $833,044 with the Iowa Department of Agriculture and Land Stewardship from August 18, 2015 to June 30, 2018.

Funding Source:
Federal – Environmental Protection Agency. This project will be funded through Section 319 of the Clean Water Act.

Background:
The Rathbun Lake watershed includes slightly more than 354,000 acres. The six counties in the Rathbun Lake watershed are Appanoose, Clarke, Decatur, Lucas, Monroe and Wayne. The Wayne Soil and Water Conservation District (SWCD), in cooperation with other partners of the Rathbun Land and Water Alliance, have undertaken a highly effective approach to water quality protection. The overall goal of the Water Quality in Rathbun Lake Project is to reduce sediment and phosphorus delivery to Rathbun Lake and the lake's tributaries. Project activities will assist landowners to apply best management practices (BMPs) that will reduce sediment and phosphorus delivery to Rathbun Lake and its tributaries. This contract will provide funding for staff support and watershed outreach activities and BMP cost-share until June 30, 2018.

Purpose:
The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and water quality educational programming for the project selected.

Contractor Selection Process:
DNR enters into a contract with IDALS-DSCWQ based on Iowa Code section 455B.103(3). This project was chosen using a grant proposal application and committee review process.

Rachel Glaza shared a document created by the Rathbun Alliance describing the project since 2004, the funds spent, and projects completed. Allen Bonini, Supervisor of the Watershed Improvement Section, shared with the Commission the 319 program currently receives $3.4 million which is about half of what it used to receive from EPA.

Motion was made by Chad Ingels to approve the agenda item as presented. Seconded by Joe Riding. Motion carried unanimously

APPROVED AS PRESENTED

CONTRACT– IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP – SILVER CREEK WATERSHED PROJECT (HOWARD COUNTY)

Kyle Ament Environmental Specialist, with the Watershed Improvement Section of the Water Quality Bureau presented the following item.

The Department requested Commission approval of a contract $383,421 with the Iowa Department of Agriculture and Land Stewardship for two years to promote best management practices in the Silver Creek Watershed (Howard County).
Funding Source: Federal – Environmental Protection Agency.
This project will be funded through Section 319 of the Clean Water Act.
Background: Silver Creek Watershed is located in Howard and Winneshiek Counties in Northeast Iowa. The watershed area is 22,410 acres and is a tributary of the Upper Iowa River. The waterbody is currently listed on the impaired waters list due to elevated levels of bacteria. In 2012, a watershed management plan was completed to address the bacteria impairment.
Purpose: The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and public outreach activities for the project selected.

Motion was made by Gene Ver Steeg to approve the agenda item as presented. Seconded by Nancy Couser. Motion carried unanimously

APPROVED AS PRESENTED

CONTRACT– IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP – YELLOW RIVER HEADWATERS WATERSHED PROJECT – PHASE 2

Kyle Ament, Environmental Specialist, with the Watershed Improvement Section of the Water Quality Bureau presented the following item.

The Department requested Commission approval of a contract in the amount of $605,430 with the Iowa Department of Agriculture and Land Stewardship for two years to implement best management practices in the Yellow River Headwaters.
Funding Source: Federal – Environmental Protection Agency
This project will be funded through Section 319 of the Clean Water Act.
Background: The Yellow River Headwaters Watershed encompasses 26,119 acres in northeast Iowa. The watershed is listed on the State of Iowa's 303(d) List of Impaired Waters as impaired due to high bacteria concentration. The TMDL identifies likely sources of bacteria causing the impairment to be cattle in the stream, run-off from field applied manure and pastures, open feedlot runoff, non-functioning septic systems and wildlife. A watershed management plan was completed in 2012 to develop a strategy to address the bacteria impairment in the Yellow River Headwaters. The plan outlines a goal to reduce bacteria delivery in the Yellow River Headwaters by 90% over the next 10 years.
Purpose: The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and water quality educational programming for the project selected.

Motion was made by Joe Riding to approve the agenda item as presented. Seconded by Ralph Lents. Motion carried unanimously

APPROVED AS PRESENTED

STATE OF IOWA PUBLIC DRINKING WATER PROGRAM - 2014 ANNUAL COMPLIANCE REPORT

Diane Moles, Executive Office 2, of the Drinking Water Engineering Section of the Water Quality Bureau presented the following item.

The Department submitted the *State of Iowa Public Drinking Water Program 2014 Annual Compliance Report* to the Environmental Protection Commission for information purposes.

The Safe Drinking Water Act (SDWA) Amendments of 1996 require the Department to issue an annual report of the SDWA violations in the state. This report fulfills the reporting requirement in Iowa for the 2014 calendar year. It was prepared by the Department's Water Supply Engineering & Operations Sections in the Water Quality Bureau of the Environmental Services Division.

The report contains a summary of the program, a description of the requirements that systems must meet, the year's violation statistics, and the list of the systems with each health-based standard or major monitoring or reporting violation incurred during the year. The photographs in the report were from Drinking Water State Revolving Loan Fund projects that were completed during the year. The maps depict the public water supply system universe in Iowa and the locations of the systems that incurred the health-based standards and major monitoring and reporting violations.

Development of the report was accomplished through the use of the state water supply database. It was provided to EPA on July 1st, which met the deadline. An electronic copy has also been provided to the members of the SDWA Technical Advisory Group, the State Library, and is available on the IDNR's website.

2014 Report highlights:

- There were 1,887 regulated public water systems in Iowa that served water at least one day during the year, serving more than 2.89 million people.
- There were no reported waterborne illnesses or deaths from Iowa public water supply systems in 2014.
- There were 208 violations of health-based standards at 118 public water supply systems serving 419,333 people. On a percentage basis, 93.7% of the systems were in compliance with all health-based standards and 85.5% of the population was served water with no violations of health-based standards.
- There were 714 violations of major monitoring and reporting requirements at 285 public water supply systems serving 233,704 people. The system compliance rate was 84.9% and 91.9% of the population of Iowa's systems were served by systems with no major monitoring or reporting violations.
- For the health-based standards, 79% of the violations are attributed to five contaminants: coliform bacteria, nitrite nitrogen, nitrate nitrogen, lead, and total trihalomethanes.
- There were 12 systems with a total of 13 acute *E. coli* bacteria maximum contaminant level violations.
- There were 13 violations of the nitrate standard at 11 systems.
- There were 3 systems that received a violation for failure to obtain a certified operator during the year.
- There were 17 community systems that failed to prepare and distribute their annual consumer confidence report in 2014, which translates to a 98.5% compliance rate.

The electronic report is available at the DNR's website:
www.iowadnr.gov/InsideDNR/RegulatoryWater/WaterSupplyEngineering/AnnualComplianceReport.aspx.

INFORMATION

WATER SUPPLY: WATER USE & ALLOCATION ANNUAL PERMIT FEE

Diane Moles, Executive Office 2, of the Drinking Water Engineering Section of the Water Quality Bureau presented the following item.

The Commission was asked to review the Water Use and Allocation Program budget and SFY 2016 annual permit fee, in anticipation of approving the annual fee at its September meeting. The proposed annual permit fee is $99.00 per permit for SFY 2016.

Background Water use permits are required of any person or entity using 25,000 gallons of water in a single day during the year, and are issued for a period of up to 10 years. Previously, appropriations from the General Fund were used to fund the water allocation and use permits program. During the 2008 legislative session, the legislature authorized the department to collect up to an additional $500,000 in fees each fiscal year. Iowa Code §455B.265(6) requires the fees to be based on the Department's "reasonable cost of reviewing applications, issuing permits, ensuring compliance with the terms of the permits, and resolving water interference complaints." There are two types of fees in the Water Use and Allocation Program: an application fee and an annual permit fee. This request is for the determination of the annual fee for SFY 2016.
The annual fee rule, adopted in 2009, is summarized below (IAC 567-50.4(2)*"b"*):

- Each year, the Commission is asked to set the annual fee based on the budgeted expenses for that year minus the amount of any unused funds from the previous year and any general fund appropriations.
- The department reviews the annual permit fee each year and adjusts the fee as necessary to cover all reasonable costs required to develop and administer the water use permitting program.
- The annual fee is based on the number of active permits.
- Each permit holder pays the same annual fee.
- The fee is not prorated and is nonrefundable.
- The department requests Commission approval of the amount of the annual fee no later than September 30 of each year.
- The department provides an annual fee notice to each permittee at least 60 days prior to the fee due date.
- The annual fee due date is December 1st; 60 days prior is October 1st.

There is no annual fee required for either a water storage permit (permitted for the life of the structure) or a minor nonrecurring water use registration (one-year permit duration).
The annual permit fee was $135.00 in the first two years, $95.00 in SFY 2012, and $66.00 in SFY 2013 and SFY 2014, and $99.00 in SFY 2015.

SFY 2016 Budget The worksheet included with this agenda brief illustrates the actual expenditures in SFY 2009 – 2015 and the budgeted amounts for SFY 2015 and SFY 2016. The final accounting figures for SFY 2015 are not expected to change. In addition to accomplishing the normal work activities of the program, the budget in 2016 includes the following:

- Completion of Phase 2 of the Water Use Program's computer database, including deployment in early SFY 2016; and
- Added 0.5 FTE to the program for modeling and technical assistance functions previously provided by the Iowa Geological Survey.

Fee Analysis The second phase of computer programming required to complete the database functions was primarily conducted in SFY 2015. The business analysis and contract part of the project was completed in SFY 2014. The deployment of the new database occurred in early SFY 2016. At the Water Use Stakeholder meeting on July 30, 2015, the program's activities and budget were reviewed. A $99.00 annual water use permit fee was proposed for SFY 2016, which is the same as the SFY 2015 annual fee. The stakeholder members participating in the meeting concurred.
Based on the budget and stakeholder input, the annual water use permit fee for SFY 2016 should be $99.00.

INFORMATION

General Discussion

- Chair Boote thanked the Commissioners, DNR, and stakeholders for their flexibility during the July meeting to host it via teleconference.
- Nancy Couser shared her positive experience at the DNR building at the Iowa State Fair.
- Jerah Sheets provided an update for tour options in Marshall County for the September EPC tour and business meeting.
- Bill Ehm provided clarification to comments made during public comments. All AFO sites receive a desktop assessment and from the desktop assessment, an onsite inspection may or may not be required. Ted Petersen, Supervisor of the Field Office 5, shared with Commissioners that all aerial imagery is being used during a desktop assessment including, but not limited to, Bing, Yahoo, Google Earth, GIS, and others. Commissioner Joe Riding asked Bill Ehm to provide an estimated cost for the AFO program if it had to inspect each site every 2-3 years.

Kossuth County District Court ruling – Kossuth County v. Iowa DNR et al

David Steward, Assistant Attorney General, represented the Commissioners.

In accordance with Iowa Code section 21.5(1)(c), Chad Ingels moved that the Commission go into closed session to discuss strategy with counsel on a matter presently in litigation. This discussion must be held in closed session so as to not prejudice or disadvantage the position of the Commission in the matter. In addition to the Commission members and counsel, Jerah Sheets will need to be present to keep detailed minutes of all discussion, persons present, and action occurring at the closed session, and he shall also audio record all the closed session. Seconded by Gene Ver Steeg. A roll call vote was conducted as follows: Chad Ingels-yea, Joe Riding-yea, Bob Sinclair-yea, Ralph Lents-yea, LaQuanda Hoskins-yea, Nancy Couser-yea, Gene Ver Steeg-yea, Cindy Greiman-yea, and Mary Boote-yea. Motion passes.

Closed session begun approximately 11:35 a.m. and ended approximately 12:25 p.m.

Chair Mary Boote summarized the timeline of events for the case.

Motion was made by Nancy Couser for the commission's approval that at a future EPC meeting the parties be allowed to present arguments to the EPC on the issue of whether there are facilities within the Plum Creek Wildlife area for purposes of determining if it is a public use area and if a party argues there are facilities that they are the type that the public regularly congregates for extended periods of time. Seconded by Joe Riding. Motion carried unanimously

Reconsideration Granted

Chairperson Boote adjourned the Environmental Protection Commission meeting at 12:35 p.m., Tuesday, August 18, 2015.

1998

August 14th,
2015

MINUTES

OF THE

ENVIRONMENTAL PROTECTION COMMISSION

MEETING

JUNE 16, 2015

Joe Pietruszynski – Hubbel Realty Company
Joe Pietrusynski agrees topsoil should remain on the construction site and used wisely. Transporting the topsoil is illegal. He supports the rule change. Soil is different across the state and should be used in conjunction with storm water practices. He recommends soil to be placed where it can avoid compaction and used with prairie plants to conserve water. Developers are working with cities on local practices.

April 18th, 2015

June 20th, 2015

EPC Public Comments 8-18-15

8-18-15
EPC/DNR Meeting

I'm Mary Clark, a proud member of IACCI and rural Polk County landowner with a well for all our water uses.

After seeing the stats this year on our polluted waterways in Iowa, increasing 15% over last year, with a total of 725 polluted waterways, I have rightly come to the conclusion that the voluntary compliance of the manure reduction strategy is definitely not working. Self regulation of the Ag Industry in Iowa hasn't worked, doesn't work, and can't work.

The animal confinement feeding operations need to be closely regulated, by frequent inspections, prosecuting and punishing multiple violations of manure spills that leak into our waterways. Every violator must obtain a Clean Water Act Permit to continue operating their animal feeding confinements. After three violations that lead to polluting a waterway, the operations must be shut down.

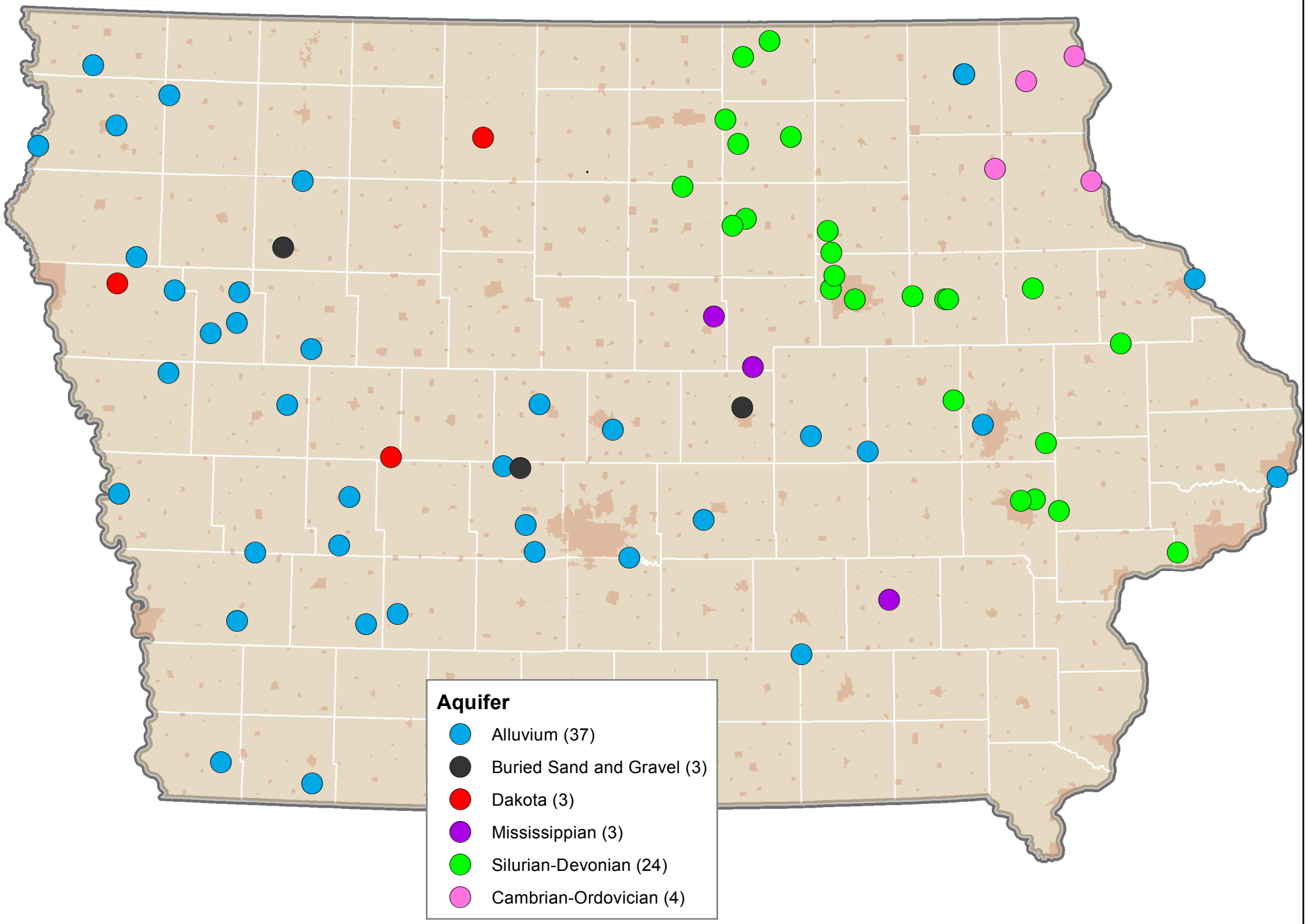
These animal feeding operations that pollute our waterways with their manure must be made to pay for the damages they inflict upon our water and land. The cost of de-nitrification should be solely on the violators, not on Iowa tax payers or the Des Moines Water Works customers. Small municipalities can't afford an expensive de-nitrification system; their alternative is a ban on their drinking water. A well owner is also impacted by these manure spills. Being an owner of a large animal feeding operation does not give free will to destroy the resources on that land or the resources of someone else's land and water.

This destruction of our Iowa waterways is not acceptable! The DNR and the EPC need to ensure frequent inspections and enforcement of the Clean Water Act regulations. Your agencies are funded to protect Iowans from poisoned water and algae blooms that can cause serious health problems or even death.

A Native American proverb says: *We do not inherit our earth from our ancestors; we borrow it from our children.* My dear departed father always said, "If you borrow something, always return it in better condition than you received it".

We have a responsibility to return this earth to our children and grandchildren in better condition than we received it. We aren't fulfilling our responsibility. We are allowing CAFOs to destroy our precious resources in Iowa. This is wrong and immoral! Please do what the citizens of Iowa expect you to do, protect our water, land and air from polluters. **Please put PEPOLE before agriculture profits.**

DNR Groundwater Quality Monitoring (FY2016)



Agenda

Environmental Protection Commission

August 18, 2015
DNR Air Quality Building
7900 Hickman Road
Windsor Heights, Iowa

Tuesday, August 18, 2015 – EPC Business Meeting

8:30 AM – New Commissioner Training – Rulemaking & Referral Process – Ed Tormey
10:00 AM – Meeting begins

Public Participation[1] – Requests to speak during the business meeting Public Participation must be submitted to Jerah Sheets at Jerah.Sheets@dnr.iowa.gov, 502 East 9th Des Moines, IA 50319, 515-313-8909, or in-person by the start of the business meeting. Please indicate who you will be representing (yourself, an association, etc.), the agenda item of interest, and your stance of For, Opposed, or Neutral.

If you are unable to attend the business meeting, comments may be submitted via mail and email for the public record. The Commission encourages data, reports, photos, and additional information provided by noon the day before the meeting to allow ample time for review and consideration.

	Agenda topics	
1	Approval of Agenda	
2	Approval of Minutes	
3	Monthly Reports	Bill Ehm (Information)
4	Public Participation	
5	Director's Remarks	Chuck Gipp (Information)
6	Notice of Intended Action – Chapter 209 – Landfill Alternatives Financial Assistance	Tom Anderson (Decision)
7	Contract with the State Hygienic Laboratory at the University of Iowa for Ambient Groundwater Analytical support	Roger Bruner (Decision)
8	Contract with IDALS for Program Staffing--Regional Basin Coordinators	Steve Hopkins (Decision)
9	Contract– Iowa Department of Agriculture and Land Stewardship – Price Creek Watershed Project Phase 1-2	Rachel Glaza (Decision)
10	Contract– Iowa Department of Agriculture and Land Stewardship – Water Quality in Rathbun Lake	Rachel Glaza (Decision)
11	Contract– Iowa Department of Agriculture and Land Stewardship – Silver Creek Watershed Project (Howard County)	Kyle Ament (Decision)
12	Contract– Iowa Department of Agriculture and Land Stewardship – Yellow River Headwaters Watershed Project – Phase 2	Kyle Ament (Decision)
13	State of Iowa Public Drinking Water Program 2014 Annual Compliance Report	Diane Moles (Information)
14	Water Supply: Water Use & Allocation Annual Permit Fee	Diane Moles (Information)

15	Kossuth County District Court ruling – *Kossuth County v. Iowa DNR et al*	David Steward (Decision)
16	General Discussion • Manure Applicator Certification Online Training Demonstration	
17	Items for Next Month's Meeting • September 14, 2015 – Educational Tour, Marshal County • September 15, 2015 – EPC Business Meeting, Marshal County • October 20, 2015 – EPC Business Meeting, Windsor Heights	

For details on the EPC meeting schedule, visit
http://www.iowadnr.gov/InsideDNR/BoardsCommissions.aspx

[1] Comments during the public participation period regarding proposed rules or notices of intended action are not included in the official comments for that rule package unless they are submitted as required in the Notice of Intended Action.

Any person attending the public meeting and has special requirements such as those related to mobility or hearing impairments should contact the DNR or ADA Coordinator at 515-725-8200, Relay Iowa TTY Service 800-735-7942, or Webmaster@dnr.iowa.gov, and advise of specific needs.

Monthly Variance Report
June 2015

Item No.	Facility/City	Program	DNR Reviewer	Subject	Decision	Date
1	Manchester City of STP	Wastewater	Anne Hildebrand	variance in monitoring aeration basin	approved	5/11/2015
2	Pinnacle Foods Group LLC	NPDES	Wendy Hieb	variance to use grab sampling instead of table ii required composite samples.	approved	5/29/2015
3	Northern Plains Regional Landfill	EMS	Leslie Goldsmith	variance to substitute EMS annual report with for comprehensive plan updates, specifically submission of narrative section of comprehensive plan update.	approved	6/1/2015
4	Carroll Municipal water Supply	Water Supply Construction	Skipp Slattenow	variance allow diesel fueled standby emergency power generator within 10 feet of proposed well, which will be a deep well. Constructed approximately 240 feet below finished well house surface.	approved	6/2/2015
5	Linwood Mining & Minerals	Air Quality	Reid Bermel	variance to temporarily replace kiln dust tank baghouse	approved	6/3/2015
6	Burke Corp	Air Quality	Reid Bermel	variance to install and operate new steam chamber on oven line	approved	6/4/2015
7	Lake Meyer Wetland	Flood Plain	Jon Garton	variance to criterion that requires dam with a single spillway to pass the freeboard design storm with two fee freeboard. 50 year storm was used for freeboard design.	approved	6/5/2015
8	Spencer Municipal Utilities	Water Supply Construction	AJ Montefusco	variance to allow proposed diesel standby generator fuel tanks to be located at least 10 feet from proposed wells.	approved	6/9/2015
9	MPW	Air Quality	Dennis Thielen	variance for PM-CPMs testing	denied	6/10/2015
10	Roquette American Inc	Air Quality	Reid Bermel	variance to temporarily increase natural gas fuel usage for three natural gas fueled boilers	approved	6/11/2015
11	38th Street Bridge over Perry Creek	Flood Plain	Karen Smith	variance to freeboard criterion that states low chord of bridge must be set three feet above 50-year flood elevation	approved	6/11/2015
12	Cargill Inc Ft Dodge	Air Quality	Ann Seda	variance from two construction permits for storage pins that described the sources as SEM Storage Bin and DDG storage bins to Dry Ingredient Bins	approved	6/17/2015
13	Cargill Inc Ft Dodge	Air Quality	Ann Seda	variance to allow facility to direct waste water directly to aerobic system for treatment reducing treatment load on anaerobic system	approved	6/17/2015
14	Urbandale Water Utility	Water Supply Construction	Justin Pettit	variance from required meter vault at river crossing	approved	6/24/2015
15	Alcoa Mills Products	Air Quality	Reid Bermel	variance to try a few trial runs of ammonium fluoroborate in grand-fathered furnaceto reduce amount of moisture and compare data to use of that material with existing furnaces	approved	7/26/2015
16	American Concrete Products	Air Quality	Reid Bermel	variance to temporarily increase throughput of yards of concrete per day for facility	approved	6/26/2015

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION COMMISSION
ATTORNEY GENERAL REFERRALS
August, 2015

Name, Location and Region Number	Program	Alleged Violation	DNR Action	New or Updated Status	Date
Feinberg, Marty; Feinberg Metals Recycling Corp. Fort Madison (6)	Solid Waste	Operation Without Permit; Illegal Disposal	Referred to Attorney General	Referred	4/14/15
Kossuth County (2)	Animal Feeding Operation	DNR Defendent	Defense	Petition for Judicial Review State's Answer P&J Pork Motion to Intervene Order Granting Motion to Intervene Kossuth County Brief State's Brief District Court Review Without Oral Argument	9/18/14 10/08/14 11/07/14 11/20/14 2/03/15 2/13/15 3/04/15
North Central Iowa Regional SWA Fort Dodge (2)	Solid Waste	Operating Permit Violations	Referred to Attorney General	Referred	9/17/13
Peeters Development Co., Inc.; Mt. Joy Mobile Home Park Davenport (6)	Wastewater	Monitoring/Reporting; Compliance Schedule; Discharge Limits; Operation Violations; Certified Operator Discipline	Referred to Attorney General	Referred Petition Filed	3/18/14 6/18/15
Scallon, Jim Austinville (2)	Solid Waste	Illegal Disposal	Referred to Attorney General	Referred Petition Filed Answer Jury Demand Resistance to Jury Demand Jury Demand Hearing Scheduled	5/20/14 5/28/15 6/22/15 6/22/15 6/25/15 7/27/15

Iowa Department of Natural Resources
Environmental Services Division
Second Quarter 2015 Report of Wastewater By-passes

During the period April 1, 2015 through June 30, 2015, 52 reports of a wastewater by-pass were received. A general summary and count by field office is presented below. This does not include by-passes resulting from precipitation events or by-passes resulting in basement backups.

Month	Total	Avg. Length (days)	Avg. Volume (MGD)	Sampling Required	Fish Kill
1ST Quarter '15	35(52)	0.237	0.011	3	0(0)
2ND Quarter '15	52(78)	43.505	0.036	6	0(0)
3RD Quarter '14	58(46)	0.184	0.008	8	0(0)
4TH Quarter '14	34(46)	0.460	0.047	4	0(0)

(numbers in parentheses are for same period last year)

Total Number of Incidents per Field Office This Quarter:

Field Office	**1**	**2**	**3**	**4**	**5**	**6**
Reports	9	3	11	10	2	17

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION COMMISSION
CONTESTED CASES
August, 2015

DATE RECEIVED	NAME OF CASE	F.O.	ACTION APPEALED	PROGRAM	ASSIGNED TO	STATUS
10/29/09	Harlan Rudd; Karen Rudd; dba Rudd Brothers Tires	6	Order/Penalty	UT	Brees	Informal negotiation. CADR was submitted, partially rejected with options. Settlement letter sent 2/24/10.
3/11/10	Bondurant, City of	5	Order/Penalty	WW	Hansen	7/2013-On hold pending further investigation. 5/15 – Letter to City Attorney regarding meeting to discuss appeal.
2/28/11	Manson, City of	3	Order/Penalty	WS	Hansen	4/1/11 – Settlement conference held with City. 6/22/11- Settlement offer received from City attorney. 6/28/11- More information requested from City attorney concerning the settlement proposal. 11/29/11- Settlement meeting with City regarding new well project. 12/2011 – City proceeding with project. 6/2012- Contractor worked on new well to remove debris in well. Test pump to be installed to do test of well capacity. 07/2012- City to abandon new well and select new site for well to increase PWS capacity. 10/2012- Water plant work to be done week of 12/10/12. 5/2013- New well project & appeal on hold, pending UDSA funding decision. 6/2/13 – USDA funding decision received. 6/26/13 – New bid date for well project. . 7/2013- Tentative schedule for new well received from City's engineer. 8/13 – Drilling on test well begun by contractor. 9/13 – Test well not productive, new well site approved by Dept. New test well to be drilled. 10/13- Test well drilled but not successful. Test well abandoned. City Council to decide on next step. 1/24/14 – City's engineer sent revised construction schedule for another test well and production well. 5/23/14- Test well drilled but not successful. City Council to determine next step. 6/20/14- Letter sent to City requesting plan of action and schedule by 8/30/14 for returning to compliance with order. 8/29/14 – New schedule received from City, to be incorporated into proposed consent amendment. 01/26/14- Proposed consent amendment sent to City for review. **07/15 – Discussions with City regarding project schedule.**

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION COMMISSION
CONTESTED CASES
August, 2015

DATE RECEIVED	NAME OF CASE	F.O.	ACTION APPEALED	PROGRAM	ASSIGNED TO	STATUS
8-27-12	Ag Processing, Inc.; Sergeant Bluff	4	Permit Conditions	AQ	Preziosi	**Met with appellant 1/31/14. Met with appellant 3/12/14. Negotiations continuing. Appellant to submit further information in April. Settled in concept. Last communication with appellant on 5/22/14. Communication from appellant 7/22/14. Internal meeting 9/5/14. Letter sent to appellant 12/14 proposing terms of settlement. Met with appellant on 7/8/15.**
11-21-12	Ag Processing Inc.	6	Permit Conditions	AQ	Preziosi	**Continuing negotiations. Last communication with appellant on 5/20/14. Communication from appellant 7/22/14. Internal meeting 9/5/14. Letter sent to appellant 12/14 proposing terms of settlement. Meeting with appellant schedule for 8/6/15.**
3-04-13	Anderson Excavating Co., Inc.	4	Order/Penalty	SW	Scott	**Landfill closure remains in final stages, and discussions concerning post-closure are underway. Company has obtained adequate financial assurance as required by regulation and order. Settlement of pending AO to be addressed once closure is complete.**
6-10-13	Mike Jahnke	1	Dam Application	FP	Schoenebaum	Hearing held 7/30/14. ALJ upheld the permit issued by the Department. Mr. Jahnke appealed but on 11/3/14 he asked that his appeal be put on hold until April, 2015.
10-28-13	Regional Environmental Improvement Commission/Iowa Co. SLF	6	Variance	WW	Tack	2/20/15 – Settlement reached. Awaiting execution.
1/16/14	Council Bluffs Water Works	4	Permit Conditions	WW	Tack	Hearing continued. Settlement discussions ongoing.
4/17/14	REIC/Iowa Co. Sanitary Landfill	6	Permit Conditions	WW	Tack	4/27/15 Consent Order signed by REIC. Awaiting receipt.
10/01/14	Amsted Rail Company, Inc. (Griffin Wheel Co.)		Permit Conditions	SW	Scott	**Remain in discussions with company's counsel concerning appeal of permit conditions and issues related to closure.**
11/13/14	Adam Timmerman	3	Order/Penalty	AFO	Book	**Hearing has been continued. A settlement agreement has been reached and is under review by Mr. Timmerman.**
1/21/15	Sidney, City of	4	Permit Conditions	WS	Hansen	Negotiating before filing. 5/15 – Letter sent to City with settlement offer.

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION COMMISSION
CONTESTED CASES
August, 2015

DATE RECEIVED	NAME OF CASE	F.O.	ACTION APPEALED	PROGRAM	ASSIGNED TO	STATUS
2/05/15	Mahle Engine Components USA	4	Order/Penalty	WW	Hansen	Negotiating before filing. 5/15 – Settlement conference to be scheduled.
3/31/15	Duane Covington	5	Notice to Revoke License	WS	Hansen	**Hearing continued to 9/15/15.**
5/22/15	Cedar Ridge Vineyards	6	Order/Penalty	WW	Hansen	Negotiating before filing.
7/02/15	Emmetsburg, City of	3	Permit Conditions	WW	Hansen	Negotiating before filing.
7/07/15	Boone, City of	5	Permit Conditions	WS	Hansen	Negotiating before filing.
7/10/15	Barry Ewoldt	2	Notice of Verified Well Interference	WR	Crotty	Negotiating before filing.

DATE: August, 2015

TO: EPC

FROM: Ed Tormey

RE: Enforcement Report Update

The following new enforcement actions were taken during this reporting period:

Name, Location and Field Office Number	Program	Alleged Violation	Action	Date
Winter Feedlots, Inc. Plymouth Co. (3)	Animal Feeding Operation	Uncertified Applicator	Consent Order $2,500	7/20/15
Gilbertsville, City of (1)	Wastewater	Compliance Schedule	Consent Order $2,000	7/24/15
R.J. Hauling, Inc. Sac Co. (3)	Animal Feeding Operation	Land Application Separation Distance	Consent Order $1,000	7/27/15

IOWA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION COMMISSION
RULE MAKING STATUS REPORT
August, 2015

Proposal	Stakeholder Engagement	Sent for Governor's Pre-Approval (Job Impact) Statement		Notice to EPC	Notice Published	ARRC No.	ARRC Mtg.	Hearing	Comment Period	Final Summary To EPC	Rules Adopted	Rules Published	ARRC No.	ARRC Mtg.	Rule Effective
1. Ch. 22, 23, 30 31 and 33 – AQ Program Application Fees		7/16/15													
2. Ch. 50, 52 and 53 – Water Allocation and Use – Jordan Aquifer		1/26/15	1/30/15	2/17/15	3/18/15	1914C	4/10/15	4/8, 9, 10/15	4/14/15	6/16/15	6/16/15	7/08/15	2053C		8/12/15
3. Ch. 60, 62, 63, 64 and 67 – for National Pollutant Discharge Elimination System (NPDES) and Iowa Operation Permits		5/28/15 3/23/15													
4. Ch. 64 – NPDES General Permit No. 2 (GP2)		10/21/14	12/12/14	1/21/15	2/18/15	1873C	3/06/15	3/18, 25, 27/15	4/01/15	6/16/15	6/16/15	7/08/15	2054C		8/12/15
5. Ch. 209 – Landfill Alternative Financial Assistance		4/15/15	5/28/15	8/18/15	9/16/15			10/06/05	10/06/15						

IOWA DEPARTMENT OF NATURAL RESOURCES
LEGAL SERVICES BUREAU

DATE: August 1, 2015

TO: Environmental Protection Commission

FROM: Ed Tormey

SUBJECT: Summary of Administrative Penalties

The following administrative penalties are due:

NAME/LOCATION	PROGRAM	AMOUNT	DUE DATE
Robert and Sally Shelley (Guthrie Center)	**SW**	**1,000**	**3-04-91**
Daryl & Karen Hollingsworth d/b/a Medora Store(Indianola)	**UT**	**3,825**	**3-15-96**
Greg Morton; Brenda Hornyak (Decatur Co.)	**SW/AQ/WW**	**3,000**	**11-04-98**
James Harter (Fairfield)	**WW**	**1,336**	**8-01-01**
*** Floyd Kroeze (Butler Co.)**	**AFO**	**1,500**	**2-20-01**
Midway Oil Co.; David Requet (Davenport)	**UT**	**5,355**	**9-20-02**
Midway Oil Co.; David Requet; John Bliss	**UT**	**44,900**	**2-28-03**
Green Valley Mobile Home Park (Mt. Pleasant)	WW	5,000	4-23-03
Midway Oil Company (West Branch)	**UT**	**7,300**	**5-03-03**
Midway Oil Company (Davenport)	**UT**	**5,790**	**5-03-03**
Albert Miller (Kalona)	**AQ/SW**	**9,735**	**9-26-03**
Mike Messerschmidt (Martinsburg)	**AQ/SW**	**500**	**4-13-04**
Interchange Service Co., Inc., et.al. (Onawa)	WW	6,000	5-07-04
# Dunphy Poultry (Union Co.)	**AFO**	**1,500**	**6-27-04**
# Cash Brewer (Cherokee Co.)	**AFO/SW**	**10,000**	**8-25-04**
# Doorenbos Poultry; Scott Doorenbos (Sioux Co.)	**AFO**	**1,500**	**10-09-04**
# Doug Sweeney (O'Brien Co.)	**AFO**	**375**	**12-21-04**
Harold Linnaberry (Clinton Co.)	SW	1,000	5-18-05
# Joel McNeill (Kossuth Co.)	**AFO**	**2,460**	**1 21-06**
Affordable Asbestos Removal, Inc. (Monticello)	**AQ**	**7,000**	**4-28-06**
# Troy VanBeek (Lyon Co.)	**AFO**	**3,500**	**10-16-06**
Larry Bergen (Worth Co.)	**AQ/SW**	**257**	**11-01-06**
# Joshua Van Der Weide (Lyon Co.)	**AFO**	**3,500**	**2-25-08**
Jon Knabel (Clinton Co.)	**AQ/SW**	**2,000**	**12-16-08**
# Rick Renken (LeMars)	**AFO**	**996**	**7-03-09**
# Brian Lill (Sioux Co.)	**AFO**	**2,755**	**7-18-09**
Denny Geer (New Market)	**SW**	**9,476**	**10-31-09**
Shrey Petroleum; Palean Oil; Profuel Three (Keokuk)	UT	10,000	3-19-10
Melvin Wellik; Wellik-DeWitt Implement (Britt)	**AQ/SW**	**2,900**	**4-08-10**
Alchemist USA, LLC; Ravinder Singh (Malcom)	UT	8,260	5-03-10
# LJ Unlimited, LLC (Franklin Co.)	AFO/AQ/SW	3,500	5-27-10
Bret Cassens; J & J Pit Stop (Columbus Junction)	UT	8,700	6-20-10
# Christopher P. Hardt (Kossuth Co.)	AFO	2,000	7-07-10
AKD Investments, LLC; H.M. Mart, Inc. (Blue Grass)	UT	6,900	8-06-10

#Animal Feeding Operation
BOLD Entries Have Been Referred to DRF

# Joe McNeill (Kossuth Co.)	**AFO**	**2,460**	**12-23-10**
Gonzalez & Sons Express, Inc. (DeSoto)	**WW**	**8,000**	**4-20-11**
David C. Kuhlemeier (Cerro Gordo Co.)	**AQ/SW**	**800**	**6-30-11**
Steve Friesth (Webster Co.)	**AQ/SW**	**7,857**	**11-26-11**
Josh Oetken (Worth Co.)	**AQ/SW**	**8,220**	**3-11-12**
Bhupinder Gangahar/Saroj Gangahar/International Business	**UT**	**7,935**	**4-20-12**
Finney Industrial Painting, Inc. (Fairfield)	**AQ/WW**	**525**	**4-23-12**
Terry Philips; TK Enterprises (Washington Co.)	**AQ/WW**	**3,000**	**5-30-12**
# Boerderij De Vedhoek, LLC (Butler Co.)	**AFO**	**8,500**	**11-16-12**
B Petro Corporation (Cedar Rapids)	UT	7,728	5-13-13
Ken Odom (Iowa Co.)	**AQ/SW**	**5,000**	**4-26-13**
Massey Properties, LLC; The Wharf (Dubuque)	**WS**	**10,000**	**10-05-13**
Robert Downing (Mahaska Co.)	**AQ/SW**	**10,000**	**11-20-13**
Shriners Hospital for Children, Inc. (Des Moines)	UT	8,890	12-03-13
Larry Eisenhauer (Woodbury Co.)	**AQ/SW**	**4,675**	**3-01-14**
Randy Wise; Wise Construction (Buena Vista Co.)	AQ/SW	3,000	4-10-14
Advanced Electroforming, Inc. (Cedar Co.)	AQ	1,500	4-03-14
Western Iowa Telephone Assoc. (Lawton)	WW	4,000	5-24-14
Wendall Abkes (Parkersburg)	SW	3,000	7-30-14
Donna J. Jensen (Ringsted)	AQ/SW	3,000	10-17-14
Dennis Habben (Sioux Co.)	SW	3,000	11-01-14
Leda Properties, LTD (Dubuque)	WW	5,000	12-12-14
Annie’s LLC; Togie Pub (Lime Springs)	WS	3,500	12-22-14
Joel Thys; Thys Chevrolet, Inc. (Benton Co.)	AQ/SW	10,000	1-04-15
West Central Cooperative (Halbur)	WW	4,000	1-04-15
Muscatine County Solid Waste Mgmt. Agency (Muscatine)	SW	6,000	2-11-15
# Mark Yeggy; Randalyn Yeggy (Washington Co.)	AFO	5,000	3-23-15
# Benjamin J. Waigand (Union Co.)	AFO	2,500	4-15-15
Aerial Crop Care; Tri State Agri; Hoppe Airspray (Lyon)	WW	3,500	4-23-15
# Cob Rollers Pork, LLC (Bremer Co.)	AFO	3,500	4-30-15
# Tim VanEaton (Orient)	AFO	6,000	7-21-15
Golden Grain Energy, LLC (Mason City)	AQ	10,000	7-17-15
	TOTAL	**348,910**	

The following penalties have been assessed but are not due at this time:

Eastern Iowa Regional Utility, Fairview (Jones Co.)	WW	1,000	-------
Brian Roorda Dairy, LLC (Sioux Co.)	AFO	5,500	8-02-15
# R.J. Hauling, Inc. (Sac Co.)	AFO	1,000	8-27-15
# Winter Feedlots, Inc. (Plymouth Co.)	AFO	2,500	8-19-15
	TOTAL	**10,000**	

The following penalties have been placed on payment plans:

*** Reginald Parcel (Henry Co.)**	**AQ/SW**	**110**	**4-23-05**
*** Country Stores of Carroll, Ltd. (Carroll)**	**UT**	**1,408**	**6-06-05**
*** Douglas Bloomquist (Webster Co.)**	**AQ/SW**	**3,500**	**12-01-07**
* Jack Knudson (Irwin)	UT	10,000	1-15-08
# Jerry Passehl (Latimer)	SW/WW/HC	2,695	7-01-09
Jerry Wernimont (Carroll)	**AQ/SW**	**216**	**4-19-10**

#Animal Feeding Operation

BOLD Entries Have Been Referred to DRF

# Ernest Greiner (Keokuk Co.)	**AFO**	**500**	**10-10-10**
Jim Scallon (Butler Co.)	SW	700	4-15-13
R.H. Hummer Jr., Inc.; 2161 Highway 6 Trail (Iowa Co.)	AQ/SW	3,643	9-15-13
Patrick Baker; Stockton Auto (Davenport)	AQ/SW	83	12-15-14
# Steve Grettenberg; Dragster LLC	AFO	500	11-20-14
Millard Elston III; The Earthman (Jefferson Co.)	**AQ/SW**	**1,815**	**2-15-13**
Simon Simonson (Kossuth Co.)	SW	3,500	11-30-14
Niehouse Cleaners & Draperies, Inc. (Marshalltown)	AQ	2,500	9-15-14
# David Dahlgren (Clarion)	AFO	2,250	12-15-14
# Vicky Kolker; Adams Dairy, LLC (Clayton Co.)	AFO	1,699	8-15-15
	TOTAL	**35,119**	

The following administrative penalties have been appealed:

Harlan Rudd; Karen Rudd; Rudd Bros. Tires (Drakesville)	**UT**	**10,000**
Bondurant, City of	**WW**	**10,000**
Helen and Virgil Homer; Grandmas Snack Shop; (Aredale)	WS	8,461
Manson, City of	**WS**	**10,000**
Anderson Excavating Company, Inc. (Pottawattamie Co.)	**SW**	**10,000**
# Adam Timmerman; AT Livestock Ent. South (Cherokee Co.)	AFO	4,250
Mahle Engine Components USA, Inc. (Atlantic)	WW	10,000
Cedar Ridge Vineyard, LLC (Swisher)	WW	1,500
	TOTAL	**64,211**

The following administrative penalties have been collected:

David C. Kuhlemeier (Cerro Gordo Co.)	**AQ/SW**	**100**
Finney Industrial Painting, Inc. (Fairfield)	**AQ/WW**	**250**
Ellsworth Excavating Co. (Muscatine Co.)	AQ/SW	75
Simon Simonson (Kossuth Co.)	SW	100
M.G. Waldbaum Co.; Michael Foods, Inc. (Hancock Co.)	WW	8,000
# Vicky Kolker; Adams Dairy, LLC (Clayton Co.)	AFO	1,427
Gilbertville, City of	WW	2,000
Valley Machining Co. (Rock Valley)	AQ	4,000
	TOTAL	**15,952**

#Animal Feeding Operation
BOLD Entries Have Been Referred to DRF

Iowa Department of Natural Resources
Environmental Services Division
Report of Manure Releases

During the period April 1, 2015, through June 30, 2015, 10 reports of manure releases were forwarded to the central office. A general summary and count by field office is presented below.

		Total Incidents		Surface Water Impacts		Feedlot		Confinement		Land Application		Transport		Hog		Cattle		Poultry		Other	
Month	**Year**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**	**Cur**	**Yr Ago**
Jan	2015	0	2	0	1	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0
Feb	2015	2	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	0	0
Mar	2015	1	2	0	1	0	0	1	1	0	0	0	1	1	2	0	0	0	0	0	0
Apr	2015	5	4	0	0	0	0	3	3	1	1	1	0	3	4	1	0	0	0	1	0
May	2015	4	2	2	1	0	0	3	1	1	0	0	1	3	1	1	1	0	0	0	0
Jun	2015	1	3	1	1	0	2	0	0	0	0	0	1	1	1	0	2	0	0	0	0
	Total	**13**	**14**	**3**	**4**	**0**	**3**	**8**	**6**	**2**	**1**	**2**	**4**	**9**	**9**	**2**	**4**	**1**	**1**	**1**	**0**

Total Number of Incidents per Field Office for the Selected Period	**Field Office 1**		**Field Office 2**		**Field Office 3**		**Field Office 4**		**Field Office 5**		**Field Office 6**	
	Current	**Previous**	**Current**	**Previous**	**Current**	**Previous**	**Current**	**Previous**	**Current**	**Previous**	**Current**	**Previous**
Total	1	0	0	3	5	5	2	0	1	1	1	0

Iowa Department of Natural Resources
Environmental Services Division
Quarterly Report of Hazardous Conditions

During the period April 1, 2015, through June 30, 2015, 236 reports of hazardous conditions were forwarded to the central office. A general summary and count by field office is presented below. This does not include releases from underground storage tanks, which are reported separately.

				Substance						Mode											
		Total Incidents		Agrichemical		Petroleum Products		Other Chemicals		Transport		Fixed Facility		Pipeline		Railroad		Fire		Other*	
Month	Year	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago	Cur	Yr Ago
Jan	2015	43	68	2	7	30	40	11	21	14	11	23	48	0	0	3	2	0	2	3	5
Feb	2015	40	69	0	5	36	47	4	17	18	19	15	36	0	1	3	4	0	4	4	5
Mar	2015	51	73	4	1	36	48	11	24	13	19	35	46	0	2	2	4	1	0	0	2
Apr	2015	96	75	22	11	46	50	28	14	39	20	48	44	0	2	3	4	0	1	6	5
May	2015	73	66	9	15	39	33	25	18	20	18	47	39	0	2	4	1	0	0	2	6
Jun	2015	67	89	5	14	41	60	21	15	20	27	40	54	1	1	2	3	0	1	4	3
	Total	**370**	**440**	**42**	**53**	**228**	**278**	**100**	**109**	**124**	**114**	**208**	**267**	**1**	**8**	**17**	**18**	**1**	**8**	**19**	**26**

*Other includes dumping, theft, vandalism and unknown

Total Number of Incidents per Field Office This Selected Period	Field Office 1		Field Office 2		Field Office 3		Field Office 4		Field Office 5		Field Office 6	
	Current	Year Ago	Current	Year Ago	Current	Year Ago	Current	Year Ago	Current	Year Ago	Current	Year Ago
Total	37	39	29	33	28	18	53	43	44	50	45	47

Iowa Department of Natural Resources
Environmental Protection Commission

ITEM **6** **DECISION**

TOPIC **Notice of Intended Action – Chapter 209 – Landfill Alternatives Financial Assistance**

The Commission is requested to approve this Notice of Intended Action (NOIA) to begin the formal rule making process for the attached proposed 567 IAC 209, "Landfill Alternatives Financial Assistance."

Reason for Rulemaking:
Chapter 209 of the Iowa Administrative Code was reviewed as part of the five year rule review per Iowa Code section 17A.7(2). It was determined that rules for the administration of the Derelict Building Grant Program be added to the existing rules for the Solid Waste Alternatives Program. This determination was based on two basic factors: 1) Financial assistance is awarded on a competitive basis through the Derelict Building Grant Program and for this reason rules to administer the program should be formalized in administrative code. 2) The Derelict Building Grant Program is funded through the Solid Waste Alternatives Program which is administered by Chapter 209.

Because the chapter is being reformatted to incorporate the Derelict Building Grant Program, the NOIA is to rescind and replace the chapter; however, no substantive changes are being made to the SWAP program.

Summary of Proposed Changes:
The following actions are being proposed.

- Rename Chapter 209 to "Landfill Alternatives Financial Assistance."
- Minor corrections to the rules pertaining to SWAP by deleting references to the "Waste Management Assistance Division". This division is now part of the Land Quality Bureau within the Environmental Assistance Division.
- Add rules specific to administering the Derelict Building Grant Program.
- Reformat the chapter so that:
    - rules applicable to both the Solid Waste Alternatives Program and the Derelict Building Grant Program make up the first part of the chapter;
    - rules specific to the Solid Waste Alternatives Program make up the second part of the chapter; and
    - rules specific to the Derelict Building Grant Program make up the final part of the chapter.

Stakeholder Involvement:
A draft of the proposed chapter 567 IAC 209, was provided to 32 stakeholder associations, business and industry representatives, government agencies, nonprofit organizations and to all

46 Iowa solid waste agencies for comments. The proposed chapter was also posted to the DNR website with a solicitation for comment.

The following three comments were received and the resulting actions taken by the Department include:

- Comments received from a private consulting firm and the League of Iowa Cities were in support of the proposed Chapter as presented.
- The third commenter from a nonprofit organization suggested the following:
    - Modify the definition of "abandoned" to include a time period in which a publically owned building must be abandoned before renovation or deconstruction of that building would be eligible for funding assistance. The department found that adding a six (6) month minimum period in which the building must be abandoned to the definition would improve the definition and help ensure that the building in question is a derelict building.
    - Clarify the eligibility of buildings listed on the State or National Register of Historic Places. No change was recommended as the proposed rule clearly sets out that if a property is on the State or National Register of Historic Places it is not eligible for renovation or deconstruction under the Derelict Building Grant Program.

The proposed rule, with the above change was then sent to the three individuals who provided comments. The individuals, who originally commented that proposed rule was acceptable, reiterated their approval. The individual who provided the two comments above provided two additional comments, both of which were included as suggested.

- To move SWAP eligibility requirements to the front of the rule; and
- To include "5,000 or fewer" in 209.16 (description of program) for greater clarity.

Once the above changes were made, the revised proposed Chapter 209 was again distributed to all stakeholders originally solicited for comments. One comment was received requesting removal of the six (6) month requirement for a building to be abandoned. It was suggested by the commenter that this time frame may prevent a community from being able to act quickly. It was determined the six (6) month requirement should remain. Reasons for this determination included: 1) projects cannot be initiated until the city has ownership of the building; and 2) if a city were to receive advanced notice that a building will become abandoned, ownership still must first be secured before any renovation or deconstruction work could commence and this could be a protracted process.

Because the chapter is being reformatted to incorporate the Derelict Building Program, the NOIA is to rescind and replace the chapter; however, no substantive changes are being made to the SWAP program.

The proposed chapter 567 IAC 209 has received preclearance from the Governor's Office.

Tom Anderson, Executive Officer II
Financial and Business Assistance, Land Quality Bureau
Environmental Services Division

June 29, 2015

ENVIRONMENTAL PROTECTION COMMISSION[567]

Notice of Intended Action

Pursuant to the authority of Iowa Code section 455E.9(1), the Environmental Protection Commission hereby gives Notice of Intended Action to rescind Chapter 209, "Solid Waste Alternatives Program," and adopt **new** Chapter 209, "Landfill Alternative Financial Assistance," Iowa Administrative Code.

This rule making is intended to reorder the existing Chapter 209 and formalize rules pertaining to the awarding of grants to Iowa communities through the Derelict Building Grant Program.

Any person may submit written suggestions or comments on the proposed new Chapter through September 8, 2015. Such written material should be submitted to Tom Anderson, Iowa Department of Natural Resources, 502 East 9th Street, Des Moines, Iowa 50319-0034, fax (515)725-8202, or by E-mail to tom.anderson@dnr.iowa.gov. Persons who have questions may contact Tom Anderson by E-mail or at (515)725-8359.

A public hearing will be held on September 8, at 1:00 p.m. in the 4th floor West Conference Room of the Wallace State Office Building, 502 E. 9th Street, Des Moines, Iowa. Persons attending the public hearing may present their views orally or in writing. At the hearing, persons will be asked to provide their names and addresses for the record and to confine their remarks to the proposed rule making.

Any person who intends to attend the public hearing and has special requirements such as those related to mobility or hearing impairments should contact the Department to advise of any specific needs.

After analysis and review of this rule making it was determined that it has a positive impact on jobs. Jobs are positively impacted by the financial incentives contained within the Derelict Building Grant Program and SWAP. This positive impact includes opportunities resulting from awarding financial assistance to Iowa communities and private sector interests for the deconstruction and renovation of abandoned buildings, the recycling of resulting building materials, and recycling and reuse projects in general. While funding for these programs is set out in statute and both programs are currently being implemented, the proposed rule will facilitate the awarding of funds under the Derelict Building Grant Program.

These rules are intended to implement Iowa Code sections 455B.301A and 455E.11.

The following **new** Chapter is proposed.

ITEM 1. Rescind Chapter 567—Chapter 209, "Solid Waste Alternatives Program.

ITEM 2. Adopt the following **new** 567-Chapter 209, "Landfill Alternatives Financial Assistance" as follows:

CHAPTER 209

LANDFILL ALTERNATIVES FINANCIAL ASSISTANCE

567—209.1(455B,455E) Goal. The goal of this program is to reduce the amount of solid waste being generated and the amount of solid waste being landfilled through implementation of solid waste management projects.

567—209.2(455B,455E) Purpose. The purpose of this program is to provide financial assistance to applicants implementing projects and programs leading to the diversion of solid waste from sanitary landfills.

567—209.3(455B,455E) Definitions.

“Abandoned” means the building has been unoccupied for a minimum of six continuous months.

"Asbestos Containing Material (ACM)" means any material that contains more than 1 percent of asbestos.

"Building Renovation" means repairs that stabilize or improve the structural integrity of the building, including but not limited to roof repair or placement, building stabilization, and tuck pointing exterior walls.

“Cost share” means the applicant’s share of proposed eligible project costs.

"Deconstruction" means the selective dismantlement of a building for the purpose of maximizing reuse and recycling opportunities through source separation while minimizing disposal costs.

“Derelict Building Eligibility” means any county or municipal government with a population of 5,000 or fewer is eligible to apply for a derelict building grant. An applicant may partner with a local non-profit organization on a project.

“Demonstration project” means a project that is innovative or new to the state of Iowa.

“Department” means the Iowa department of natural resources.

“Eligible costs” means costs directly related to the project and for which financial assistance moneys may be used.

“Financial assistance” means monetary assistance awarded under these rules to an applicant in the form of grants, loans, or forgivable loans.

“Forgivable loan” means financial assistance that does not require repayment to the department.

“Indirect costs” means costs that are not directly arising from a specific product, function, or activity.

“Landfill diversion rate” means the weight of materials diverted from a sanitary landfill, divided by the total weight of the building and its contents, expressed as a percentage. Materials diverted from a landfill do not include material combusted without energy recovery or material that is dumped or discarded in violation of Iowa Code sections 455B.307 and 455B.307A.

“Loans” means an award of financial assistance with the requirement that the award be repaid including interest as applicable.

“Phase I environmental assessment” means review of known environmental records and land use information about the site and vicinity.

“Phase II environmental assessment” means actual soil, groundwater and structural material sampling and testing to confirm or deny if contamination is present.

“Overhead costs” means expenses not chargeable to a particular part of the work or product including, but not limited to, utilities, insurance, and rent.

“Recipient” means any applicant selected to receive financial assistance under these rules.

“Solid Waste Alternative Program (SWAP) Eligibility” means any unit of local government, public or private group, business or individual with an interest in or having responsibility for solid waste management in Iowa and is currently in compliance with all

applicable department statutes and regulations is eligible to apply for the solid waste alternatives program.

"Sanitary landfill" means a permitted disposal site where solid waste is buried between layers of earth.

"Waste reduction" means practices which reduce, avoid, or eliminate the generation of solid waste at the source and not merely the shifting of a waste stream from one medium to another medium.

567—209.4(455B,455E) Role of the department of natural resources. The department is responsible for the administration of funds for projects receiving financial assistance under these rules. The department will ensure that funds disbursed meet guidelines established by Iowa Code sections 455E.11(2)(a)(1)(e) and 455E.11(2)(a)(1)(f).

567—209.5(455B,455E) Funding sources. The department will use funds appropriated by the legislature and other sources that may be obtained for the purpose of achieving the goals outlined in these rules. The department will ensure that moneys appropriated meet both federal and state guidelines pertaining to their use.

567—209.6(455B,455E) Reduced award. The department reserves the right to offer financial assistance in an amount less than that requested by the applicant. In the event that financial assistance is offered that is less than the amount requested by an applicant, the applicant may be asked to document the impact on the proposed project. Reduced awards shall be offered where it has been determined by the department that:

209.6(1) Program resources are insufficient to provide the level of financial assistance requested to all applicants to which the department intends to offer financial assistance.

209.6(2) The applicant could implement the project at a reduced level of financial assistance and achieve project objectives and goals of this program.

567—209.7(455B,455E) Fund disbursement limitations. No funds shall be disbursed until the department has:

1. Determined the total estimated cost of the project;
2. Determined that financing for the cost share amount is ensured by the recipient;
3. Received final design plans from the recipient, if applicable;
4. Received confirmation that all permits or permit amendments have been obtained by the recipient;
5. Received commitments from the recipient to implement the project;
6. Executed a written agreement with the recipient; and
7. Determined that the recipient is currently in compliance with all applicable state statutes and regulations.

567—209.8(455B,455E) Minimum applicant cost share. An applicant shall provide a minimum cash match for the purchase of each good and service in which department awarded financial assistance will be used. Minimum applicant cost share shall be in accordance with subrule 209.16(3) for the derelict building grants.

567—209.9(455B,455E) Financial assistance denial. An applicant may be denied financial assistance for any of the following reasons:

209.9(1) Funds are insufficient to award financial assistance to all qualified applicants;

209.9(2) An applicant does not meet eligibility requirements pursuant to provisions of subrule 209.15(1) for the solid waste alternatives program or subrule 209.16(1) for the derelict building grant program;

209.9(3) An applicant does not provide sufficient information requested on forms provided by the department pursuant to rule 209.12(455B,455E);

209.9(4) An applicant has previously received financial assistance under these rules and is determined by the department to be delinquent in repaying the loan or delinquent in submitting required documentation;

209.9(5) The project goals or scope is not consistent with rules 209.1(455B,455E) and 209.2(455B,455E); and

209.9(6) The project does not meet the criteria of an eligible project in subrule 209.15(2) for the solid waste alternatives program or subrule 209.16(2) for the derelict building grant program.

567—209.10(455B,455E) Eligible costs. Applicants may request financial assistance in the implementation and operation of a project which includes, but is not limited to, funds for the purpose of:

1. Waste reduction equipment purchase and installation;
2. Collection, processing, or hauling equipment purchase and installation;
3. Development, printing and distribution of educational materials;

4. Planning and implementation of educational forums including, but not limited to, workshops;

5. Materials and labor for construction, deconstruction, or renovation of buildings;

6. Salaries directly related to implementation and operation of the project;

7. Laboratory analysis costs; and

8. Engineering or consulting fees.

567—209.11(455B,455E) Ineligible costs. Financial assistance shall not be provided or used for costs including, but not limited to, the following:

1. Taxes;

2. Vehicle registration;

3. Overhead expenses;

4. Indirect costs;

5. Legal costs;

6. Contingency funds;

7. Proposal preparation;

8. Contractual project administration;

9. Land acquisition;

10. Office furniture, office computers, fax machines and other office furnishings and equipment;

11. Costs for which payment has or will be received under another federal, state or private financial assistance program;

12. Costs incurred before a written agreement has been executed between the applicant and the department; and

13. Insurance premiums and other costs associated with insuring items purchased using program funds.

567—209.12(455B,455E) Applications. Applicants shall submit applications on forms provided by the department. Applications are considered part of the public record. Applications will be accepted during normal business hours throughout the year by the department unless otherwise designated in the solid waste alternatives program application forms and the derelict building grant program application guideline forms.

567—209.13(455B,455E) Selection. To receive consideration under these rules, applications submitted to the department for financial assistance must be provided to the agency responsible for submitting an approved solid waste comprehensive plan or a subsequent solid waste comprehensive plan or by solid waste agencies participating in the environmental management system for agency review and comment. Applications shall be provided to the agency in the area in which the proposed project is located or the area or areas in which the proposed project will be implemented.

The department shall coordinate evaluation of applications and applicants will be awarded financial assistance based on review committee recommendations.

567—209.14(455B,455E) Written agreement. Recipients shall enter into a contract with the department for the purposes of implementing the project for which financial assistance has been awarded. The agreement shall be signed by the appropriate department signatory and the recipient's authorized signatory. Conditions to successfully implement and manage agreements shall be expressed in the signed agreement. The department may terminate agreements and seek

the return of funds released under the agreement for failure by the recipient to perform under the terms and conditions of the agreement. Amendments to agreements may be adopted by mutual written consent of the department and the recipient.

567—209.15(455B,455E) Solid waste alternatives program. Financial assistance awarded under this program shall be used to implement activities that support the practical and beneficial use of solid waste materials and for activities leading to a reduction in the reliance on sanitary landfills for disposal of solid waste.

209.15(1) Eligible applicants. Any unit of local government, public or private group, business or individual with an interest in or having responsibility for solid waste management in Iowa and is currently in compliance with all applicable department statutes and regulations is eligible to apply for the solid waste alternatives program.

209.15(2) Eligible projects. The department may provide financial assistance to applicants for the following types of projects that are consistent with the goal and purpose of this program:

a. Best practices — practices and programs that will move Iowa toward long-term pollution prevention, waste reduction and recycling sustainability;

b. Education — practices and programs that are consistent with a coordinated statewide message on pollution prevention, waste reduction, and recycling to ensure ongoing support of these integrated solid waste management activities; and

c. Market development — practices and programs that develop a demand for value-added recyclables sufficient to provide increased and stable commodity markets.

209.15(3) Type of financial assistance. The type of financial assistance offered to an applicant (forgivable loan, zero interest loan, low interest loan) is dependent upon such factors as, but not limited to, the amount of program funds awarded, level of new landfill diversion, profit generation and project uniqueness The department reserves the right to offer any combination of financial assistance types to any selected project.

209.15(4) Loans. The term of all loans, executed under these rules, shall be determined on a case-by-case basis and shall be based on the specific capital costs financed, as well as the terms of other financing provided for the project. The written agreement between the department and the recipient will establish other conditions or terms needed to manage or implement the project.

567—209.16(455B,455E) **Derelict building grant program.** Financial assistance is available to communities of 5,000 or fewer to help improve the attractiveness and appearance of their jurisdictions by providing financial assistance to eligible projects. Each project must have a landfill diversion component.

209.16(1) Eligible applicants. Any county or municipal government with a population of 5,000 or fewer is eligible to apply for a derelict building grant. An applicant may partner with a local non-profit organization on a project.

209.16(2) Eligible projects. A community's building is eligible for the program if it meets the following criteria:

a. An abandoned commercial or public building that a local government has ownership of or intent to own.

b. The building is not on the State or National Historic Register.

209.16(3) Eligible activities and amount of financial assistance. The eligible activities and amount of financial assistance for each are:

a. Asbestos containing material inspections: 100 percent reimbursement for inspection costs conducted by a State of Iowa licensed asbestos contractor.

b. Abatement of asbestos containing material: 100 percent reimbursement, not to exceed $10,000, for abatement of ACM performed by a State of Iowa licensed asbestos contractor. A 50 percent cost share is required for those costs exceeding $10,000.

c. Structural engineering analysis: 100 percent reimbursement not to exceed $1,500 for a structural engineering analysis conducted by a licensed structural engineer or architectural historian to determine ability to renovate the building. Recipient is responsible for all costs exceeding $1,500.

d. Phase I Environmental Assessment: 100 percent reimbursement not to exceed $3,000 for conducting a Phase I Environmental Assessment. Recipient is responsible for all costs exceeding $3,000.

e. Phase II Environmental Assessment: 50 percent reimbursement not to exceed $2,500 for conducting a Phase II Environmental Assessment. Recipient is responsible for all costs exceeding $5,000. The need for this assessment is determined by the results of the Phase I Assessment and involves sampling of structure components, soil and groundwater to confirm or deny if contamination is present.

f. Building Renovation**:** 50 percent reimbursement not to exceed $50,000 for renovation costs including but not limited to:

(1) Restoring or removing materials for reuse, either at the site or offsite, or for recycling.

(2) Roof repair or replacement,

(3) Building stabilization,

(4) Tuck pointing of exterior walls,

g. Deconstruction**:** 50 percent reimbursement not to exceed $50,000 for costs related to deconstruction. All deconstruction projects must achieve a minimum landfill diversion rate of 30 percent of the structure by weight to receive reimbursement for deconstruction costs.

209.16(4) Deconstruction cost share incentive. For every additional 10 percent of landfill diversion by weight above 30 percent that is documented upon completion of the project, the applicant's cost share is reduced by 5 percent and the grant award amount will increase by 5 percent. The maximum grant award for deconstruction projects shall not exceed $75,000.

_____

Date

_____

Chuck Gipp, Director

Administrative Rules
FISCAL IMPACT STATEMENT

Date: April 15, 2015

Agency: Iowa Department of Natural Resources (DNR) / Environmental Protection Commission
IAC Citation: 567 IAC Chapter 209 "Solid Waste Alternatives Program"
Agency Contact: Tom Anderson (515) 725-8323

Summary of the Rule: To provide the standards and criteria to award financial assistance to communities with populations of 5,000 or less that are seeking financial assistance through the Derelict Building Grant Program to address abandoned publicly-owned buildings, either through renovation or deconstruction. To accomplish this goal, existing Chapter 209 is being rescinded and replaced to add the rules specific to the Derelict Building Grant Program. There are no substantive changes to existing rules relating to the Solid Waste Alternatives Program (SWAP).

Fill in this box if the impact meets any of these criteria:

_X_ No Fiscal Impact to the State.
___ Fiscal Impact of less than $100,000 annually or $500,000 over 5 years.
___ Fiscal Impact cannot be determined.

Brief Explanation: No fiscal impact to the state is expected as a result of this proposed rule.

Fill in this box if the impact meets this criteria:

___ Fiscal Impact of $100,000 annually or $500,000 over 5 years.

Brief Explanation:

Assumptions:

Describe how estimates were derived:

Estimated Impact to the State by Fiscal Year

	Year 1 (FY 16)	Year 2 (FY 17)
Revenue by Each Source:		
GENERAL FUND	$0	$0
FEDERAL FUNDS	$0	$0
OTHER (Specify)	$0	$0
TOTAL REVENUE	$0	$0
Expenditures:		
GENERAL FUND	$0	$0
FEDERAL FUNDS	$0	$0
OTHER (Specify)	$0	$0
TOTAL EXPENDITURES	$0	$0
NET IMPACT	$0	$0

_X_ This rule is required by State law or Federal mandate.
Please identify the state or federal law:
Iowa Code section 455E.11

___ Funding has been provided for the rule change.
Please identify the amount provided and the funding source:

_x_ Funding has not been provided for the rule.
Please explain how the agency will pay for the rule change:
No additional funding has been provided to DNR to implement this proposed rule.

Fiscal impact to persons affected by the rule: There will be a positive fiscal impact to those entities awarded funds under the Derelict Building Grant Program and SWAP.

Fiscal impact to Counties or other Local Governments (required by Iowa Code 25B.6): There will be a positive fiscal impact to those entities awarded funds under the Derelict Building Grant Program and SWAP.

Administrative Rules
JOBS IMPACT STATEMENT

1. BACKGROUND INFORMATION

Agency:	**Iowa Department of Natural Resources (DNR) / Environmental Protection Commission**
IAC Citation:	**567 IAC Chapter 209 "Solid Waste Alternatives Program"**
Agency Contact:	**Tom Anderson (515) 725-8323**
Statutory Authority:	**Iowa Code section 455E.9**

Objective:	To provide the standards and criteria to award financial assistance to communities with populations of 5,000 or less that are seeking financial assistance through the Derelict Building Grant Program to address abandoned publicly-owned buildings, either through renovation or deconstruction. To accomplish this goal, existing Chapter 209 is being rescinded and replaced to add the rules specific to the Derelict Building Grant Program. There are no substantive changes to existing rules relating to the Solid Waste Alternatives Program (SWAP).
Summary:	This rule making is intended to reorder existing Chapter 209 and formalize rules pertaining to the awarding of grants to Iowa communities through the Derelict Building Grant Program.

2. JOB IMPACT ANALYSIS

☐ *Fill in this box if impact meets these criteria:*

____ No Job Impact on private sector jobs and employment opportunities in the State.
(If you make this determination, you must include the following statement in the preamble to the rule: "After analysis and review of this rulemaking, no impact on jobs has been found.")

Explanation:

☐ *Fill in this box if impact meets either of these criteria:*

x Positive Job Impact on private sector jobs and employment opportunities in the State.

____ Negative Job Impact on private sector jobs and employment opportunities in the State.

Description and quantification of the nature of the impact the proposed rule will have on private sector jobs and employment opportunities:
Jobs are positively impacted by the Derelict Building Grant Program and SWAP. This positive impact includes opportunities resulting from awarding financial assistance to Iowa communities and private sector interests for the deconstruction and renovation of abandoned buildings, the recycling of resulting building materials, and recycling and reuse projects in general. While funding for these programs is set out in statute and both programs are currently being implemented, the proposed rule will facilitate the awarding of funds under the Derelict Building Grant Program because it formalizes through rule the

standards and criteria for eligibility and funding. Therefore this rule making will likely have a positive impact on jobs.
Categories of jobs and employment opportunities that are affected by the proposed rule: Skilled and unskilled laborers.
Number of jobs or potential job opportunities: Unknown. Not every Derelict Building project will have a clearly identified job related impact, but job retention through new business opportunities is a positive impact resulting from this program.
Regions of the state affected: Statewide - Funding assistance to stakeholders from this program is available in every county in Iowa.
Additional costs to the employer per employee due to the proposed rule: (if not possible to determine, write "Not Possible to Determine.") Not possible to determine.

3. COST-BENEFIT ANALYSIS

The Agency has taken steps to minimize the adverse impact on jobs and the development of new employment opportunities before proposing a rule. See the following Cost-Benefit Analysis:

The DNR has determined that the proposed rule will facilitate the already existing positive impact on private sector jobs. There is no cost to the state or other entities.

4. FISCAL IMPACT

Please see the Fiscal Impact Statement for an identification and description of costs the Department anticipates state agencies, local governments, the public, and the regulated entities, including regulated businesses and self-employed individuals, will incur from implementing and complying with the proposed rule.

5. PREAMBLE

The information collected and included in this Jobs Impact Statement must be included in the preamble of the proposed rule, written in paragraph form. For rules that have no impact on jobs (see the first box in number 2 above), the following statement must be included in the preamble: "After analysis and review of this rulemaking, no impact on jobs has been found."

Environmental Protection Commission
Iowa Department of Natural Resources

ITEM	**7**	**DECISION**
TOPIC	**Contract with the State Hygienic Laboratory at the University of Iowa for Ambient Groundwater Analytical support**	

Recommendations:
Commission approval is requested for a one year-service contract with the State Hygienic Laboratory at the University of Iowa. The contract will begin on September 1, 2015 and terminate on June 30, 2016. The total amount of this contract shall not exceed $ 69,899.76.

Funding Source:
This contract will be funded through Environment First funds through cost center HB8A under the authority of Iowa Administrative Code (IAC) 455B.103.

Background:
A groundwater monitoring program had not been implemented in this State from 2006 to 2012 due to program priorities and increasing costs. The groundwater monitoring program was re-designed in 2012 and will continue as a part of the ambient monitoring tasks for the Department. The data collected in this contract will provide the data necessary to evaluate baseline conditions and long-term trends in groundwater quality. The data will be made available to the public and used by the Department and others to support management and planning decisions.

Purpose:
The parties propose to enter into this Contract for the purpose of retaining the Contractor to provide: analytical assistance to DNR by analyzing groundwater samples collected throughout the state of Iowa.

Contractor Selection Process:
DNR is allowed to contract with the University of Iowa pursuant to Iowa Code section 455B.103. The University of Iowa was chosen for this project because of their expertise in water quality analyses.

Contract History:
Since 2012 a contract with the State Hygienic laboratory has been executed to analyze groundwater samples submitted by selected municipal water operators. The Department has coordinated the sample collection with Municipal water operators who volunteer their time to collect the samples and ship the samples to SHL. Prior to 2006 the Department contracted with the USGS to provide both sample collection and analyses.

Roger Bruner, Supervisor
Water Quality Bureau, Environmental Services Division
August 18, 2015

Attachment(s): Scope of Work from the Special Conditions for Contract

Obligation	Task Milestone Date
Task 1: Ambient Sample Container Shipment Description for Ambient Monitoring of Vulnerable Wells: SHL shall provide sample containers, chain of custody paperwork for all water samples, and coolers to specified municipal water operators during the contract period. DNR staff will provide SHL with shipping labels for all municipal water operators associated with sampling sites listed in Table 1.	Materials shall be mailed to all sites no later than October 31, 2015.
Task 2: Ambient Sample Analysis Description for Ambient Sample Analysis: SHL shall provide chemical analysis of groundwater samples submitted by water operators pursuant to Task 1, for the analytes listed in Table 2. Samples for this activity shall be coded as **gwmambient.**	No later than May 30, 2016.
Task 3: Data Transfer Description: SHL shall make the data generated pursuant to this Contract available to DNR electronically through the State Hygienic Laboratory OpenELIS database web portal. Data shall be available for download by DNR staff in a mutually agreeable format. The available sample information shall include the STORET station identification number, which will be provided by DNR for all station locations. Data shall be retrievable via the web portal by DNR staff. SHL OpenELIS/Telcor Organization ID number: 3916 DNR Contract Number: 16S-ESD-WQB-Kkrie_0002 SHL Project Code: GWMAMBIENT	Analytical chemistry data shall be made available to DNR staff no later than 30 calendar days following the end of the month of collection. If the contractor determines that extra time is needed to complete required analyses, then a written notification shall be made to the DNR submitter or contract manager. The notification shall include the reason for the delay and the specific analytical chemistry data requiring delayed reporting. The notification shall occur as soon as possible after the contractor has determined the need for a reporting delay.

Table 1. List of Ambient Groundwater Sampling Locations and Quality Assurance

	Well Name	STORET ID	WNUMBER	USGS ID
1	Adel 3	31250002	34349	413749093592601
2	Algona 8	31550004	60210	430412094142301
3	Audubon 13	31050005	36202	414315094524201
4	Avoca Regional Water 19	31830004	63981	413022095202301
5	Battle Creek 1	31470004	23199	421908095353701
6	Belle Plaine 4	31860001	12850	415417092180101
7	Boone 20	31080001	36518	420451093561301
8	Blue Grass (2), 1	31820001	22757	413040090455001
9	Brayton 1	31050001	36526	413234094552401
10	Bristow 2	31100008	20256	424627092542302
11	Camanche 2	31230002	37104	414652090153201
12	Carlisle 5	31770001	37787	413040093290501
13	Carson (5), 3	31780001	37796	411501095251301
14	Cascade 4	31530003	23975	421731091011501
15	Cedar Falls 8	31070007	37620	423045092283401
16	Cedar Falls 9	31070008	37621	423341092273001
17	Cedar Rapids S6	31570001	37641	420005091431201

18	Charles City 8	31340005	67030	430444092403001
19	Clayton 1	31220006	26579	425400091091601
20	Conrad 3	31380001	13238	421322092522001
21	Coon Rapids 1, N	31140001	38232	415233094403201
22	Correctionville 1 W	31970001	38220	422831095465102
23	Decorah 6	31960001	39056	431828091473201
24	Decorah 7	31960007	39057	431829091472001
25	Dubuque 9	31310002	39381	423135090383201
26	Dumont 2	31100009	34682	424455092582001
27	Eddyville 3	31900001	37238	410907092375301
28	Elgin 2	31330001	39679	425717091382602
29	Farragut 79-2 N	31360001	39766	404327095284801
30	Fontanelle 5	31010001	24758	411727094374001
31	Hawarden 4	TBD	TBD	TBD
32	Holstein 3	31470002	40222	422915095323504
33	Ida Grove 7	31470003	56576	422138095274401
34	Independence 3	31100006	1856	422808091531801
35	Independence 7	31100007	28344	422814091540401
36	Janesville 3	31090003	28340	423902092272502
37	Jesup 2	31100001	9382	422852092040101
38	Kingsley 1	31750001	40518	423537095583901
39	Lansing 4	31030002	24826	432202091133001
40	Lyon-Sioux RWS 3	31600004	40669	431808096140101
41	Manchester 7	31280001	26440	423020091273701
42	Mapleton 5	31670001	40727	420955095475601
43	Marshalltown 5	31640007	40763	420420092552701
44	Massena 6	31150006	62594	411501094465901
45	Mondamin 2, S	31430001	40889	414236096012501
46	Mount Vernon 9	31570013	64887	415539091243301
47	Moville 5	31970011	51614	422933096041501
48	Newton 13	31500002	7999	413913093070001
49	Nevada 8	31850009	64759	415919093341001
50	Nora Springs 4	31340006	64868	430842093002601
51	Orchard View Estates 1	31520006	36817	414313091280701
52	Perry 22	31250013	32303	415030094014301
53	Perry 9R	31250001	28614	415057094065301
54	Riverview Estates 1	31520007	16174	414254091321201
55	Rockford 2	31340007	25694	430315092563401
56	Saint Ansgar 2	31660001	41731	432241092550802
57	Shambaugh 3	31730001	41775	403906095015001
58	Sheffield 5	31350004	54095	TBD
59	Sheldon 6	31710001	42404	431202095502301
60	Shellsburg 2	31060001	42414	420535091524002
61	Sigourney 02-5	31540004	55861	412109092115201
62	Sioux Center 13	31840007	42486	430449096061301
63	Sioux Rapids 2	31110001	42522	425344095090401
64	Stacyville 3	31660005	63960	432610092465803
65	Steamboat Rock 1	31420009	5188	422453093035001
66	Storm Lake 18	31110007	64085	423849095142501

67	Tama 5	31860002	18841	415753092350201
68	Vail (1), 2	31240001	42688	420336095115601
69	Van Meter 3	31250003	57592	413148093571103
70	Wall Lake 3	31810001	43023	421617095051001
71	Waterloo 17	31070001	12031	422819092212701
72	Waukon 2	31030003	43055	431638091282902
73	Waverly 6	31090002	26606	424341092291901
74	West Branch 4	31160001	25589	414032091210001
Q	QC/QA samples (10)	multiple	multiple	multiple

Table 2. List of Analytes

Parameter	**Cost/ Sample**	**Number of Samples**	**Cost/Analyte/ Project**
Total Dissolved Solids by SM 2540 C 18th	$14.50	84	$1218.00
Alkalinity as CaCO3: carbonate and bicarbonate	$14.50	84	$1218.00
Nitrate + Nitrite as N	$14.50	84	$1218.00
Ammonia as N	$14.50	84	$1218.00
TKN	$36.50	84	$3066.00
Total Phosphorus as P	$14.50	84	$1218.00
Ortho-phosphate as P	$14.50	84	$1218.00
Total Suspended Solids	$14.50	84	$1218.00
Chloride by EPA 300.0	$14.50	84	$1218.00
ESA/OXA and Parents: Acetochlor, Acetochlor ESA, Acetochlor OXA, Alachlor, Alachlor ESA, Alachlor OXA, Dimethenamid, Dimethenamid ESA, Dimethenamid OXA, Metolachlor, Metolachlor ESA, Metolachlor OXA at a quantitation limit of 0.025 µg/L or better using LC/MS/MS	$309.00	84	$25,956.00
Triazine Pesticides and Degradates by EPA 536: Atrazine, Desethyl Atrazine, Deisopropyl Atrazine at a quantitation limit of 0.02 ug/L or lower using LC/MS/MS	$309.00	84	$25,956.00
Subtotal for Analysis of 84 Ambient Groundwater Samples			**$64,722.00**

Environmental Protection Commission
Iowa Department of Natural Resources

ITEM **8** **DECISION**

TOPIC **Contract with IDALS for Program Staffing--Regional Basin Coordinators**

Recommendations:
Commission approval is requested for a contract with the Iowa Department of Agriculture and Land Stewardship--Division of Soil Conservation and Water Quality (IDALS). The contract will begin on September 1, 2015 and terminate on August 31, 2016. The total amount of this contract shall not exceed $150,000.

Funding Source:
This contract will be funded through FFY2015 EPA Section 319 grant funds.

Background:
For more than a decade, the Iowa Department of Agriculture and Land Stewardship- Division of Soil Conservation and Water Quality (IDALS) has provided staffing support to the Section 319 program through the deployment of 3 regional basin coordinators in various locations throughout Iowa. The regional basin coordinators are charged with assisting to implement the State of Iowa's Nonpoint Source Management Plan in coordination with the Iowa Department of Natural Resources, through general outreach opportunities and technical and administrative assistance to local watershed groups, the public, agency staff, municipal leaders and politicians.

Purpose:
The parties propose to enter into this Contract for the purpose of retaining the Contractor to provide Regional Basin Coordinator staffing for watershed planning and project implementation.

Contractor Selection Process:
IDALS Division of Soil Conservation was chosen for this project because of its ongoing overall program coordination with DNR in providing Regional Basin Coordinator staffing for watershed planning and project implementation.

Contract History:
This contract is one of a series of contracts with IDALS to provide Regional Basin Coordinator program staffing to support watershed planning and project implementation.

Steve Hopkins
Nonpoint Source Program Coordinator, Watershed Improvement Section
Water Quality Bureau, Environmental Services Division
July 21, 2015

Attachment: IDALS Program Staffing--Regional Basin Coordinator Project Summary and Scope of Work

IDALS Program Staffing--Regional Basin Coordinators
Project Summary and Scope of Work

Project Name: IDALS Program Staffing--Regional Basin Coordinators
Amount: $150,000
Time Frame: September 1, 2015 – August 31, 2016
Description: New Funding for Continued Regional Basin Coordinator Program Staffing
Project Goal: To provide Regional Basin Coordinator staffing within IDALS charged with assisting to implement the State of Iowa's Nonpoint Source Management Plan in coordination with the Iowa Department of Natural Resources.

Summary:

The purpose of this project is to continue the Regional Basin Coordination program administered by the Iowa Department of Agriculture and Land Stewardship-Division of Soil Conservation and Water Quality (IDALS). Specifically, funds will provide continued staffing support for three (3) Regional Basin Coordinators. These coordinators are currently employed by IDALS and situated to provide leadership and coordination of watershed activities in river basins in northeastern, southeastern, and western Iowa. They also assist in ongoing implementation of the State of Iowa's Nonpoint Source Management Plan. **Background Information**

Regional Watershed Coordination

For more than a decade, the Iowa Department of Agriculture and Land Stewardship- Division of Soil Conservation and Water Quality (IDALS) has provided staffing support to the Section 319 program through the deployment of regional basin coordinators in various locations throughout Iowa. Staffing levels have fluctuated over the years, but generally there have been 3 coordinators on staff with IDALS charged with assisting implementation of the State of Iowa's Nonpoint Source Management Plan in coordination with the Iowa Department of Natural Resources. Specifically, Regional Basin Coordinators provide assistance through general outreach opportunities and technical and administrative assistance to local watershed groups, the public, agency staff, municipal leaders and politicians.

Role of IDALS in Nonpoint Source Management Plan Implementation

The Division of Soil Conservation and Water Quality is housed in the Iowa Department of Agriculture and Land Stewardship (IDALS) and is the arm of IDALS responsible for the protection and management of soil, water and mineral resources. This division assists Soil and Water Conservation Districts (SWCD) and private landowners to achieve their agricultural and environmental objectives.

IDALS supports a number of Project Coordinators on watershed projects throughout the state, many of which are shared in funding with the DNR Section 319 program. IDALS and DNR also share in the responsibility of Regional Basin Coordinators, high level liaisons for all watershed groups in a particular major river basin or basins. These employees are on the front line of watershed work by working with landowners directly to improve water quality by applying the resources available across the partner groups. IDALS administers numerous programs targeted to address nonpoint source issues and improve water quality. These programs include the following:

Watershed Protection Fund

- Resource Enhancement and Protection Water Protection Fund
- Iowa Financial Incentives Program
- Watershed Development and Planning Grants program
- SWCD Initiatives program
- Conservation Reserve Program Buffers initiative
- Agricultural Conservation Cost-Share program and Publicly-Owned Lakes program
- Conservation Reserve Enhancement Program
- Integrated Farm and Land Management Demonstration program
- Abandoned Mine Land Reclamation program
- Agricultural Drainage Well Closure program
- Watershed Improvement Fund grant program
- Conservation Practice No-Interest Revolving Loan Fund
- Water Quality Initiative (implementation of Iowa Nutrient Reduction Strategy)

Project Plan

Lead Agency

The lead agency for implementation of this project is the Iowa Department of Agriculture and Land Stewardship-Division of Soil Conservation and Water Quality (IDALS). Staffing support for regional basin coordinators will be provided through the Water Resources Bureau of the division.

Project Objectives

The primary objective for this project is to outline the role of the IDALS Regional Basin Coordinators in implementing Iowa's Nonpoint Source Management Plan. Key tasks to be completed by IDALS are as follows:

Task 1: IDALS Division of Soil Conservation and Water Quality shall assign three (3) qualified individuals to its Water Resources Bureau on a full-time basis. These individuals will be classified as Environmental Specialist Seniors, according to the job classifications of the Iowa Department of Administrative Services, and will be unofficially designated as Regional Basin Coordinators. In addition to regular duties assigned by IDALS, these individuals will each provide up to 0.25 FTE assistance to DNR in the implementation of Iowa's nonpoint source pollution management program and 0.25 FTE assistance to for the provision of direct technical assistance to Section 319-funded watershed projects during the period of this contract. These assigned individuals shall be located in offices in three different river basins within the State of Iowa.

Task 2: The Regional Basin Coordinators will provide DNR assistance with professional services and other activities pertaining to the Section 319 program including, but not limited to:

- Advise and serve as liaison between the DNR Nonpoint Source Program, the Iowa Department of Agriculture and Land Stewardship (IDALS) - Division of Soil Conservation and Water Quality, local watershed coordinators, Soil and Water Conservation Districts (SWCD), and other local watershed groups.
- Serve as a resource to and assist SWCDs and other local watershed groups with the development of new watershed management plans consistent with the US EPA and DNR watershed planning process and template.
- Facilitate implementation of active and ongoing DNR and IDALS-supported watershed planning initiatives and Section 319 watershed projects.
- Coordinate with the DNR Project Officers in conducting 319 project performance reviews and other project site visits, and assist with follow-up on project performance issues.

Task 3: The DNR and IDALS shall jointly convene meetings on a quarterly basis, unless needed more frequently, of DNR nonpoint source program staff, IDALS water resources program staff and the Regional Basin Coordinators to discuss program coordination needs, to review progress toward completion of assigned activities, and to provide direction for future activities.

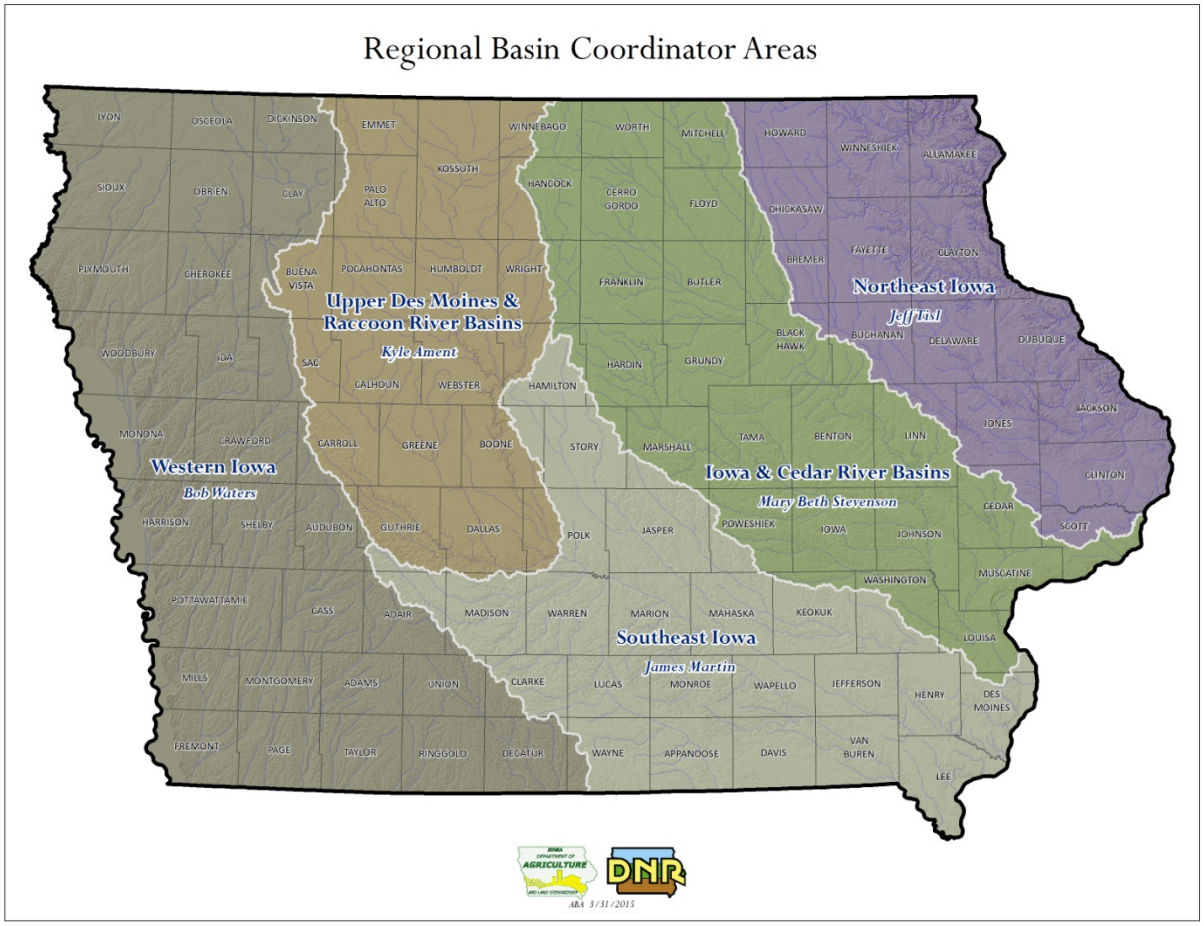
Task 4: The Regional Basin Coordinators and IDALS supervisory staff shall assist DNR nonpoint program staff in submission of relevant progress reports and annual reports on program administration activities to pertinent funding agencies and partners, including but not limited to the United States Environmental Protection Agency and the Iowa Legislature.

Time Frame and Implementation Schedule

Specific activities to be completed in support of the tasks identified are as follows:

Activity	Frequency
Program Implementation	
Attend quarterly Basin Coordinator partner meetings.	Quarterly (4 meetings)
Meet quarterly with each active non-Section 319 watershed group.	Quarterly (4 meetings)
Work with non- Section 319 projects to hold at least one project field day event annually.	One field day per project.
Collectively organize Basin Coordinator outreach meetings.	Minimum of 10 meetings.
Review applications and make selection recommendations for implementation project grants.	As needed.
Meet with local stakeholder groups and encourage the development or updating of watershed plans.	As needed.
Provide technical assistance to Watershed Management Authorities.	Ongoing
Provide suggested projects/watersheds for annual Success Story report.	Minimum of 6 by May 2016.

Attend statewide/regional workshops, training and/or conferences.	Minimum of 5 meetings/ trainings.
Assist local watershed groups in applying for local, state, and federal water quality improvement grants.	In compliance with various program deadlines.
Project Technical Assistance	
Work with Section 319 projects to hold at least one project field day event annually.	One field day per project.
Meet quarterly with each active Section 319 watershed group.	Quarterly (4 meetings)
Track progress and evaluate implementation of approved WMPs.	Annually
Promote the use of USDA funds by active Section 319 watershed projects.	Ongoing
Promote the use of SRF funds by active Section 319 watershed projects.	Ongoing
Provide Additional Technical support to existing watershed coordinators.	As needed.



Environmental Protection Commission
Iowa Department of Natural Resources

ITEM | **9** | **DECISION**

TOPIC **Contract– Iowa Department of Agriculture and Land Stewardship – Price Creek Watershed Project Phase 1-2**

Recommendations:
The Department requests Commission approval of a contract in the amount of $383,452 with the Iowa Department of Agriculture and Land Stewardship from August 18, 2015 to June 30, 2018.

Funding Source:
Federal – Environmental Protection Agency**.** This project will be funded through Section 319 of the Clean Water Act.

Background:
Price Creek is located in northeastern Iowa County and southeastern Benton County. Price Creek is 13.6 miles long and is listed on Iowa's 2012 303(d) list as not supporting primary contact recreation and overall use. Extensive modeling and watershed planning have identified the major sources of bacteria to Price Creek. The sources include unrestricted livestock access to the creek, lack of manure storage facilities, lack of nutrient and manure management plans and inadequate septic systems. The overall goal of the Price Creek Watershed Project is to reduce bacteria loading by 95% to meet the Water Quality Standards by reducing livestock access, addressing failed septic systems and through better manure storage practices and management techniques. Project activities will assist landowners to apply best management practices (BMPs) that will reduce bacteria delivery to Price Creek. This contract will provide funding for staff support and watershed outreach activities and BMP cost-share until June 30, 2018.

Purpose:
The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and water quality educational programming for the project selected.

Contractor Selection Process:
DNR enters into a contract with IDALS-DSCWQ based on Iowa Code section 455B.103(3). This project was chosen using a grant proposal application and committee review process.

Scope of Work:
For an outline of the **scope of work**, see the attached project summary.

Rachel Glaza, Environmental Specialist
Watershed Improvement Section, Water Quality Bureau – ESD
July 22, 2015

DNR Section 319-Funded Watershed Project Summary

PROJECT NAME: PRICE CREEK WATERSHED PROJECT PHASE 1-2

Amount: $383,452
Time Frame: August 18, 2015 – June 30, 2018
Description: Provide funding for staff support, information/education activities and best management practices cost-share for high priority areas within the Price Creek Watershed
Project Goal: Reduce bacteria sources and sediment delivery within the Price Creek Watershed.

The Price Creek Watershed Project addresses the bacteria impairment of Price Creek through the implementation of a Watershed Management Plan. Price Creek is located in Washington and Lenox townships in northeastern Iowa County and St. Clair and Florence Townships in southeastern Benton County. The 12-didgit Hydrologic Unit Code (HUC) is 070802081002 – Price Creek.

Price Creek is 13.6 miles long and divided into two segments (IA 02-IOW-0175_0 and IA 02-IOW-0175_2). Both segments have designated uses of primary contact recreation (A1) and aquatic life (BWW-2) and are listed on Iowa's 2012 303(d) list as not supporting primary contact recreation and overall use. In addition, Price Creek is the first major body of water to join the impaired portion of the Iowa River and it has been theorized that Price Creek is a major contributor to the Iowa River's bacteria impairment.

Extensive modeling and watershed planning have identified the major sources of bacteria to Price Creek. The sources include unrestricted livestock access to the creek, lack of manure storage facilities, lack of nutrient and manure management plans and inadequate septic systems. The secondary water quality concern is a high sediment load from sheet and rill, stream bank and gully erosion. Row crop management on highly erodible land and unrestricted livestock access to vulnerable stream banks are the contributing factors to the sediment load. A SWAT model shows existing loads in the Price Creek Watershed as well as expected load reductions.

To meet bacteria water quality standards, the required load reductions to Price Creek are nearly 95% during any given flow condition. To meet the sediment delivery goal, loading needs to be reduced by 4,500 t/y.

The Best Management Practices necessary to meet the water quality standard for bacteria and sediment delivery goals include: reducing livestock access to Price Creek, improving grazing efficiency, improving manure management, replacing failing septic systems, proper nutrient management, riparian pasture buffers, cropland buffers, cover crops, terraces, water and sediment control basins, grade stabilization structures, and stream bank stabilization. Progress will be measured in terms of projects installed, landowners contacted, reductions calculated with models and water quality sampling as described in the Price Creek monitoring plan and QAPP.

See attached Critical Area Map and Table 1 for proposed BMP implementation with this contract.

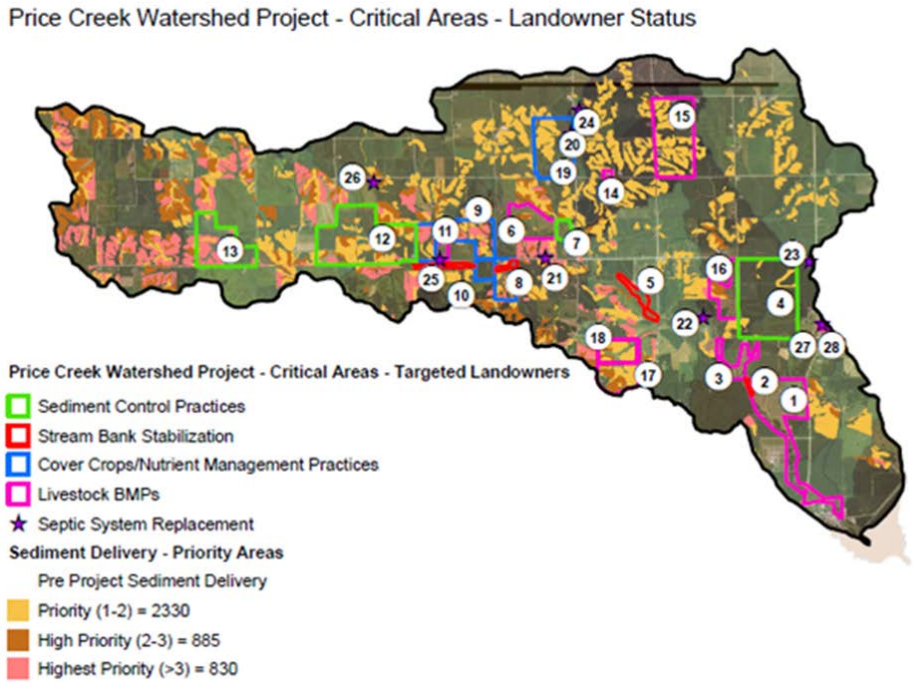


TABLE 1
PRICE CREEK WATERSHED PROJECT – CRITICAL AREAS – Landowner Status

Critical Area	Practice
1	Grazing System/Exclusion
2	Streambank Stabilization
3	Wetland/Exclusion/Grazing
4	Grade Stabilization, Waterways
5	Streambank Stabilization
6	Grazing System
7	Water and Sediment Control Basin
8	Streambank Stabilization
9	Cover Crops/Nutrient Management
10	Streambank Stabilization
11	Waste Storage Facility
12	Filter Strips, Buffers
13	Terraces, Basins, Waterways
14	Waste Storage Facility
15	Grazing System
16	Grazing System/Exclusion
17	Grazing System/Exclusion
18	Grazing System/Exclusion
19	Cover Crop
20	Septic System Replacement
21	Septic System Replacement
22	Septic System Replacement
23	Septic System Replacement
24	Septic System Replacement
25	Septic System Replacement
26	Septic System Replacement
27	Septic System Replacement
28	Waste Storage Facility

Environmental Protection Commission
Iowa Department of Natural Resources

ITEM **10** **DECISION**

TOPIC **Contract– Iowa Department of Agriculture and Land Stewardship – Water Quality in Rathbun Lake**

Recommendations:
The Department requests Commission approval of a contract in the amount of $833,044 with the Iowa Department of Agriculture and Land Stewardship from August 18, 2015 to June 30, 2018.

Funding Source:
Federal – Environmental Protection Agency**.** This project will be funded through Section 319 of the Clean Water Act.

Background:
The Rathbun Lake watershed includes slightly more than 354,000 acres. The six counties in the Rathbun Lake watershed are Appanoose, Clarke, Decatur, Lucas, Monroe and Wayne. The Wayne Soil and Water Conservation District (SWCD), in cooperation with other partners of the Rathbun Land and Water Alliance, have undertaken a highly effective approach to water quality protection. The overall goal of the Water Quality in Rathbun Lake Project is to reduce sediment and phosphorus delivery to Rathbun Lake and the lake's tributaries. Project activities will assist landowners to apply best management practices (BMPs) that will reduce sediment and phosphorus delivery to Rathbun Lake and its tributaries. This contract will provide funding for staff support and watershed outreach activities and BMP cost-share until June 30, 2018.

Purpose:
The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and water quality educational programming for the project selected.

Contractor Selection Process:
DNR enters into a contract with IDALS-DSCWQ based on Iowa Code section 455B.103(3). This project was chosen using a grant proposal application and committee review process.

Scope of Work:
For an outline of the **scope of work**, see the attached project summary.

Rachel Glaza, Environmental Specialist
Watershed Improvement Section, Water Quality Bureau – ESD
July 22, 2015

DNR Section 319-Funded Watershed Project Summary

PROJECT NAME: WATER QUALITY IN RATHBUN LAKE

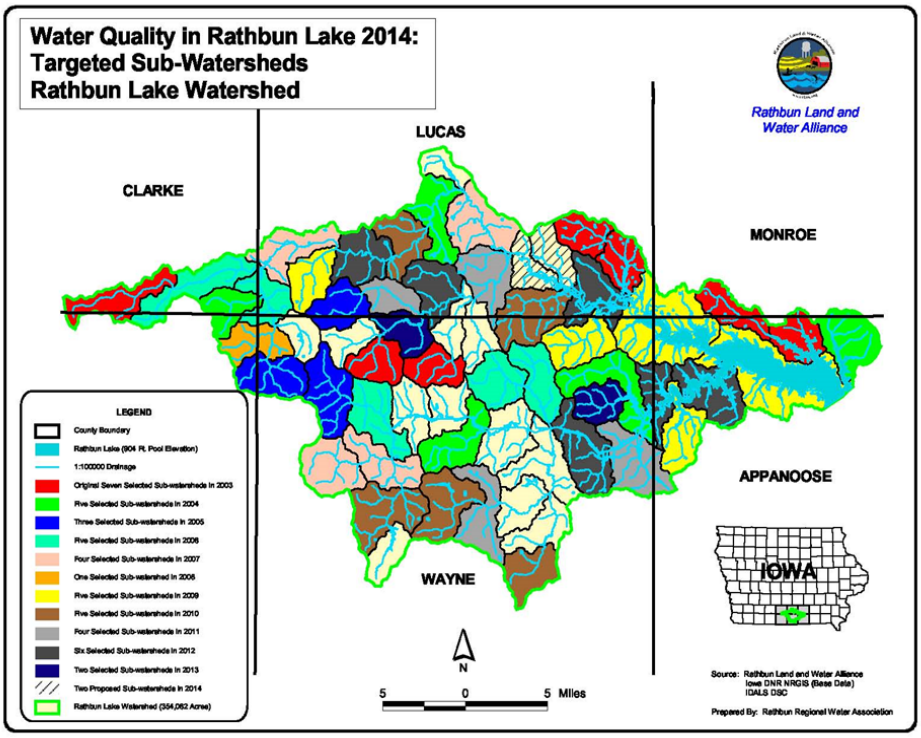
Amount: $833,044
Time Frame: August 18, 2015 – June 30, 2018
Description: Provide funding for staff support, information/education activities and best management practices cost-share for high priority areas within the Rathbun Lake Watershed.
Project Goal: Reduce sediment and phosphorus delivering to Rathbun Lake.

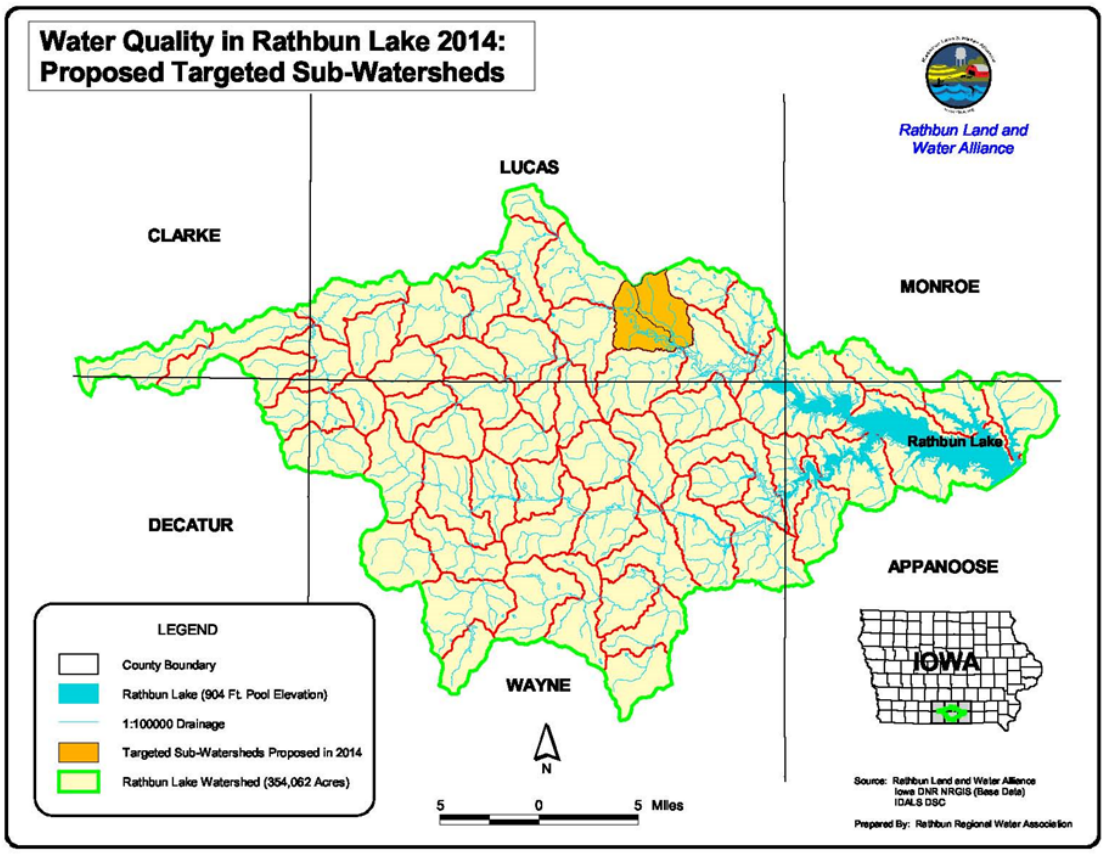
The Wayne SWCD, in cooperation with the Rathbun Land and Water Alliance, has undertaken a highly effective approach to water quality protection through the Water Quality in Rathbun Lake Project. This approach is achieving a significant reduction in the sediment and phosphorus that impair water quality in Rathbun Lake and its tributaries through the targeted application of best management practices (BMPs) for priority land in the watershed. The Alliance and its partners have developed an approved Watershed Management Plan that guides the activities of the Water Quality in Rathbun Lake Project, including those described in this project implementation plan. This plan proposes to initiate the implementation of project activities in two new targeted sub-watersheds. Specifically, project activities will assist landowners to apply BMPs that will reduce sediment and phosphorus delivery from priority land used primarily for row crop production in the two targeted sub-watersheds. Planned activities include: (1) geographic information system (GIS) analysis to confirm the location of priority land that requires BMPs; (2) assistance for landowners to apply BMPs including terrace systems, grade stabilization structures, and water and sediment control basins for 1,500 acres that will reduce the annual delivery of sediment by 2,250 tons and phosphorus by 7,500 pounds; (3) evaluation of the benefits from BMP application using GIS analysis and water quality monitoring; and (4) watershed outreach activities that encourage landowners to apply BMPs for priority land to protect water quality. Initiation of the next phase of the Water Quality in Rathbun Lake Project as proposed in this contract will result in the installation of BMPs for more than 1,500 acres in two new targeted sub-watersheds. At least 750 of these acres will be priority land with the remaining acres considered associate priority land since, due to its location, this land must also be treated to adequately address the priority land. These BMPs will reduce the annual delivery of sediment and phosphorus to Rathbun Lake and its tributaries by an estimated ***2,250 tons of sediment and 7,500 pounds of phosphorus***.

The two targeted sub-watersheds identified for this phase of the Water Quality in Rathbun Lake Project are:

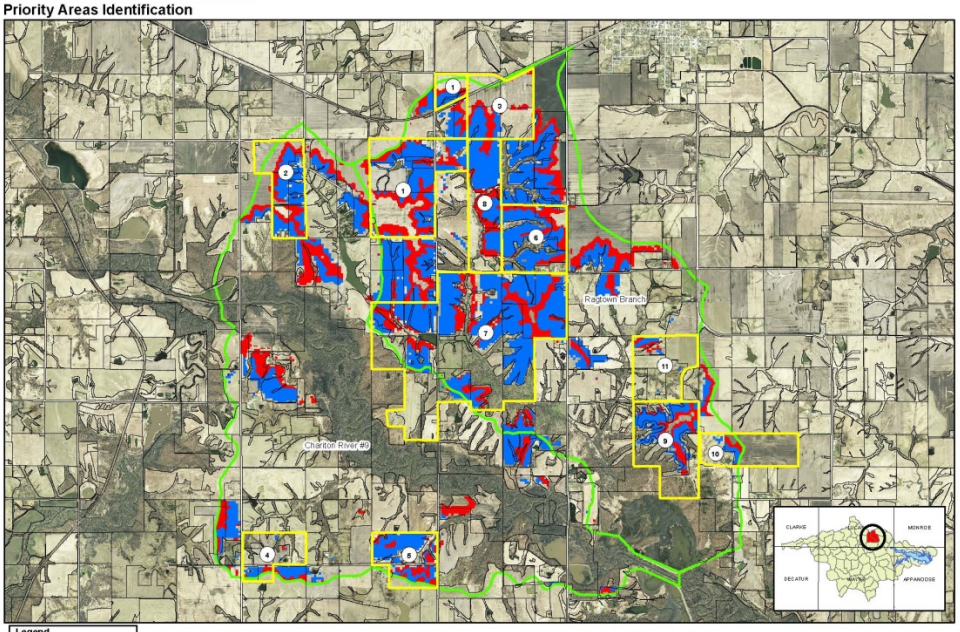
- **Ragtown Branch (Lucas County)** GIS analysis and field data collection completed during a recent assessment update identified 1,374 acres of priority land in this sub-watershed. Assessment findings indicate that this priority land delivers an estimated 4,414 tons of sediment and 11,814 pounds of phosphorus per year to Rathbun Lake and its tributaries. Twelve landowners own and/or operate farms with priority land in the sub-watershed. At least eight of these landowners are likely to install BMPs for this priority land.
- **Chariton River #9 (Lucas County)** GIS analysis and field data collection completed during a recent assessment update identified 482 acres of priority land in this sub-watershed. Assessment findings indicate that this priority land delivers an estimated 1,628 tons of sediment and 4,151 pounds of phosphorus per year to Rathbun Lake and its tributaries. Eight landowners own and/or operate farms with priority land in the sub-watershed. At least six of these landowners are likely to install BMPs for this priority land.

These two targeted sub-watersheds are located in the 12-digit hydrologic unit with code 102802010208 and name Lost-Branch-Chariton River. Please see attached maps.


Water Quality in Rathbun Lake 2014:
Targeted Sub-Watersheds
Rathbun Lake Watershed
Rathbun Land and Water Alliance
LUCAS
CLARKE
MONROE
APPANOOSE
WAYNE
IOWA
LEGEND
County Boundary
Rathbun Lake (904 Ft. Pool Elevation)
1:100000 Drainage
Original Seven Selected Sub-watersheds in 2003
Five Selected Sub-watersheds in 2004
Three Selected Sub-watersheds in 2005
Five Selected Sub-watersheds in 2006
Four Selected Sub-watersheds in 2007
One Selected Sub-watershed in 2008
Five Selected Sub-watersheds in 2009
Five Selected Sub-watersheds in 2010
Four Selected Sub-watersheds in 2011
Six Selected Sub-watersheds in 2012
Two Selected Sub-watersheds in 2013
Two Proposed Sub-watersheds in 2014
Rathbun Lake Watershed (354,062 Acres)
N
5 0 5 Miles
Source: Rathbun Land and Water Alliance
Iowa DNR NRGIS (Base Data)
IDALS DSC
Prepared By: Rathbun Regional Water Association


Water Quality in Rathbun Lake 2014:
Proposed Targeted Sub-Watersheds
Rathbun Land and Water Alliance
LUCAS
CLARKE
MONROE
Rathbun Lake
DECATUR
APPANOOSE
WAYNE
IOWA
LEGEND
County Boundary
Rathbun Lake (904 Ft. Pool Elevation)
1:100000 Drainage
Targeted Sub-Watersheds Proposed in 2014
Rathbun Lake Watershed (354,062 Acres)
N
5 0 5 Miles
Source: Rathbun Land and Water Alliance
Iowa DNR NRGIS (Base Data)
IDALS DSC
Prepared By: Rathbun Regional Water Association

Chariton River #9 and Ragtown Branch
Sub-Watershed Assessment Results
Priority Areas Identification



Legend

- Field Boundaries
- Watershed Boundary

Priority Lands

- No Priority
- Priority
- High Priority
- Highest Priority
- (1) Landowner ID Number (See Table)

Summary of Assessment Results

Acres in the sub-watersheds	7,764 acres
Acres in the priority areas	1,856 acres
Sediment delivery from priority areas before BMPs	6,042 tons per year
Reduction in sediment delivery as a result of BMPs	2,250 tons per year
Phosphorus delivery from priority areas before BMPs	15,965 pounds per year
Reduction in phosphorus delivery as a result of BMPs	7,500 pounds per year

Prepared By: Tyler J. Jacobson (RWA)

Updated Jacobson (RWA) and Wilkerson (KLWA) - completed April 2013

16Environmental Protection Commission
Iowa Department of Natural Resources

ITEM **11** **DECISION**

TOPIC **Contract– Iowa Department of Agriculture and Land Stewardship – Silver Creek Watershed Project (Howard County)**

Recommendations:
The Department requests Commission approval of a contract $383,421 with the Iowa Department of Agriculture and Land Stewardship for two years to promote best management practices in the Silver Creek Watershed (Howard County).

Funding Source: Federal – Environmental Protection Agency**.**
This project will be funded through Section 319 of the Clean Water Act.

Background:
Silver Creek Watershed is located in Howard and Winneshiek Counties in Northeast Iowa. The watershed area is 22,410 acres and is a tributary of the Upper Iowa River. The waterbody is currently listed on the impaired waters list due to elevated levels of bacteria. In 2012, a watershed management plan was completed to address the bacteria impairment.

Purpose:
The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and public outreach activities for the project selected.

Scope of Work:
For an outline of the **scope of work**, see the attached project summary.

Kyle Ament, Environmental Specialist Sr.
Watershed Improvement Section, Water Quality Bureau – ESD
August 18, 2015

DNR Section 319-Funded Watershed Project Summary

Project Name: Silver Creek (Howard) Watershed Project
Amount: $383,421
Time Frame: August 18, 2015 – June 30, 2017
Description: Funding for an existing watershed project.
Project Goal: Reduce Bacteria Concentrations in Silver Creek

The Silver Creek Watershed is located in Howard and Winneshiek Counties in northeast Iowa. Silver Creek Watershed's land area is 22,410 acres (13,104 acres in Howard County and 9,306 acres in Winneshiek County) and is a tributary of the Upper Iowa River. Manure runoff and manure application from open and confinement livestock operations contribute bacteria to Silver Creek. The Silver Creek Watershed is on the Iowa Department of Natural Resources 303(d) impaired water bodies list due to bacteria levels at five times the state criterion and therefore does not support primary contact recreation. The primary goal of the project is to reduce the bacteria levels by 40% within Silver Creek. The implementation of best management practices that address sources of bacteria are expected to result in attainment of this goal over the course of the six-year watershed management plan.
This contract will address priority concerns listed in the watershed management plan. Funding will be used for salary, benefits, public outreach, and best management practices. Other parties involved in the project include: Howard and Winneshiek Soil and Water Conservation District, Natural Resources Conservation Service, and the City of Cresco. Currently the watershed project has eight agricultural waste projects planned, of which two have been completed. The remaining six structures will be funded through this contract.

Environmental Protection Commission
Iowa Department of Natural Resources

ITEM | **12** | **DECISION**

TOPIC **Contract– Iowa Department of Agriculture and Land Stewardship – Yellow River Headwaters Watershed Project – Phase 2**

Recommendation:
The Department requests Commission approval of a contract in the amount of $605,430 with the Iowa Department of Agriculture and Land Stewardship for two years to implement best management practices in the Yellow River Headwaters.

Funding Source: Federal – Environmental Protection Agency
This project will be funded through Section 319 of the Clean Water Act.

Background:

The Yellow River Headwaters Watershed encompasses 26,119 acres in northeast Iowa. The watershed is listed on the State of Iowa's 303(d) List of Impaired Waters as impaired due to high bacteria concentration. The TMDL identifies likely sources of bacteria causing the impairment to be cattle in the stream, run-off from field applied manure and pastures, open feedlot runoff, non-functioning septic systems and wildlife. A watershed management plan was completed in 2012 to develop a strategy to address the bacteria impairment in the Yellow River Headwaters. The plan outlines a goal to reduce bacteria delivery in the Yellow River Headwaters by 90% over the next 10 years.

Purpose:
The parties propose to enter into this contract for the purpose of implementing watershed improvement practices and water quality educational programming for the project selected.

Scope of Work:
For an outline of the **scope of work**, see the attached project summary.

Kyle Ament, Environmental Specialist Sr.
Watershed Improvement Section, Water Quality Bureau
Environmental Services Division

August 18, 2015

Project Name: Yellow River Headwaters Watershed Project: Phase 2
Amount: $605,430
Time Frame: August 18, 2015 – June 30, 2017
Description: Funding for an existing watershed project.
Project Goal: Reduce Bacteria Concentration in the Yellow River Headwaters

The Yellow River Headwaters Watershed (YRHW) encompasses 26,119 acres in northeast Iowa and is composed of two main stream branches, the North Fork Yellow River and Yellow River. The two branches join near the base of the YRHW to form the Yellow River, which downstream becomes the State of Iowa's largest coldwater trout stream and a High Quality Resource Water. Sections of the two branches of the Yellow River Headwaters are listed on the State of Iowa's 303(d) List of Impaired Waters due to elevated bacteria levels that do not support primary contact recreation.
The Yellow River TMDL indicates that a reduction of bacteria delivery to the stream could be most effectively accomplished by addressing the most significant contributors of bacteria: cattle in the stream and field applied manure from CAFOs. BMPs such as alternative watering sources, heavy use protection, stream crossings, flash grazing, nutrient management plans, clean water diversion, filter strips, and animal waste control structures are identified in the management plan as potential treatment options. The Yellow River watershed management plan outlines a goal to reduce bacteria delivery to the streams in the YRHW by 90% over the next 10 years. These reductions will bring the streams in line with allowable limits for indicator bacteria and potentially lead to removal from the Section 303(d) List.

This contract will address priority concerns listed in the watershed management plan. Funding will be used for salary, benefits, public outreach, and best management practices. Other parties involved in the project include Winneshiek and Allamakee Soil and Water Conservation District, and Natural Resources Conservation Service.

Iowa Department of Natural Resources
Environmental Protection Commission

ITEM **13** **INFORMATION**

TOPIC State of Iowa Public Drinking Water Program
2014 Annual Compliance Report

The Department is submitting the *State of Iowa Public Drinking Water Program 2014 Annual Compliance Report* to the Environmental Protection Commission for information purposes.

The Safe Drinking Water Act (SDWA) Amendments of 1996 require the Department to issue an annual report of the SDWA violations in the state. This report fulfills the reporting requirement in Iowa for the 2014 calendar year. It was prepared by the Department's Water Supply Engineering & Operations Sections in the Water Quality Bureau of the Environmental Services Division.

The report contains a summary of the program, a description of the requirements that systems must meet, the year's violation statistics, and the list of the systems with each health-based standard or major monitoring or reporting violation incurred during the year. The photographs in the report were from Drinking Water State Revolving Loan Fund projects that were completed during the year. The maps depict the public water supply system universe in Iowa and the locations of the systems that incurred the health-based standards and major monitoring and reporting violations.

Development of the report was accomplished through the use of the state water supply database. It was provided to EPA on July 1st, which met the deadline. An electronic copy has also been provided to the members of the SDWA Technical Advisory Group, the State Library, and is available on the IDNR's website.

2014 Report highlights:

- There were 1,887 regulated public water systems in Iowa that served water at least one day during the year, serving more than 2.89 million people.
- There were no reported waterborne illnesses or deaths from Iowa public water supply systems in 2014.
- There were 208 violations of health-based standards at 118 public water supply systems serving 419,333 people. On a percentage basis, 93.7% of the systems were in compliance with all health-based standards and 85.5% of the population was served water with no violations of health-based standards.
- There were 714 violations of major monitoring and reporting requirements at 285 public water supply systems serving 233,704 people. The system compliance rate was 84.9% and 91.9% of the population of Iowa's systems were served by systems with no major monitoring or reporting violations.
- For the health-based standards, 79% of the violations are attributed to five contaminants: coliform bacteria, nitrite nitrogen, nitrate nitrogen, lead, and total trihalomethanes.
- There were 12 systems with a total of 13 acute *E. coli* bacteria maximum contaminant level violations.
- There were 13 violations of the nitrate standard at 11 systems.
- There were 3 systems that received a violation for failure to obtain a certified operator during the year.
- There were 17 community systems that failed to prepare and distribute their annual consumer confidence report in 2014, which translates to a 98.5% compliance rate.

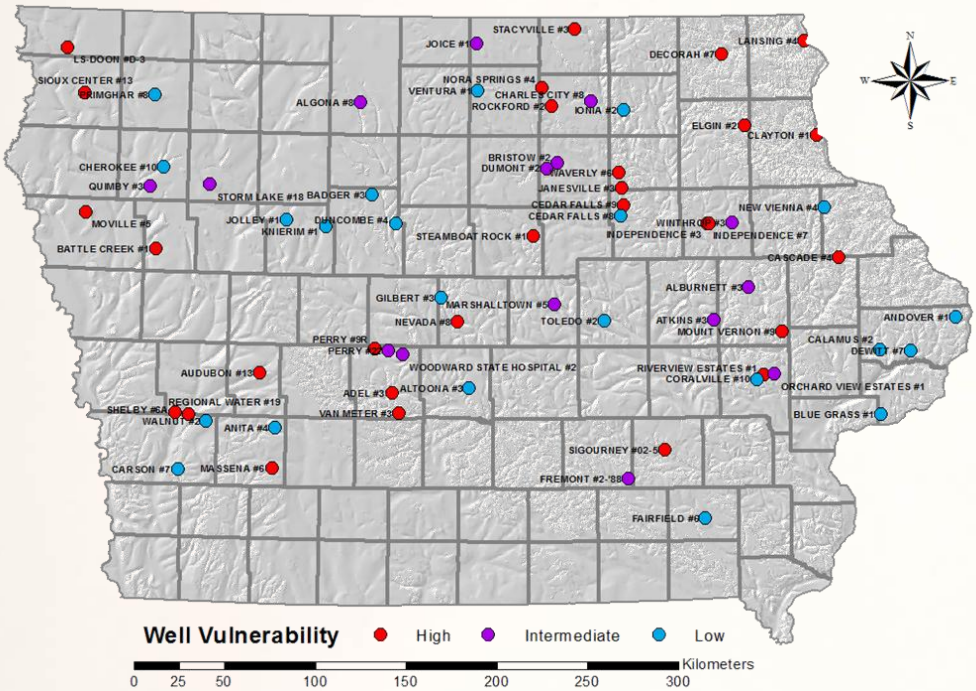
The electronic report is available at the DNR's website: www.iowadnr.gov/InsideDNR/RegulatoryWater/WaterSupplyEngineering/AnnualComplianceReport.aspx.

Jon Tack, Chief
Water Quality Bureau

IOWA DEPARTMENT OF NATURAL RESOURCES

2013 SURVEY OF IOWA GROUNDWATER

and Evaluation of Public Well Vulnerability Classifications for Contaminants of Emerging Concern



Iowa Geological and Water Survey
Technical Information Series 57

Robert D. Libra, State Geologist
Chuck Gipp, Director

May 2015

2013 Survey of Iowa Groundwater and Evaluation of Public Well Vulnerability Classifications for Contaminants of Emerging Concern

Iowa Geological and Water Survey
Technical Information Series 57

Authors: Claire E. Hruby[a], Robert D. Libra[a], Chad L. Fields[a], Dana W. Kolpin[b], Laura E. Hubbard[b], Mark R. Borchardt[bc], Susan K. Spencer[bc], Michael D. Wichman[d], Nancy Hall[d], Michael D. Schueller[d], Edward T. Furlong[b], and Peter J. Weyer[e]

a - Iowa Department of Natural Resources (IDNR)
b - United States Geological Survey (USGS)
c - United States Department of Agriculture (USDA)
d - State Hygienic Laboratory (SHL)
e - Center for Health Effects of Environmental Contamination (CHEEC)

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ABSTRACT

Studies in Iowa have long documented the vulnerability of wells with less than 50 feet (15 meters) of confining materials above the source aquifer to contamination from nitrate and various pesticides. Recent studies in Wisconsin have documented the occurrence of viruses in untreated groundwater, even in wells considered to have little vulnerability to contamination from near-surface activities. In addition, sensitive methods have become available for analyses of pharmaceuticals and pesticides. This study represents the first comprehensive examination of contaminants of emerging concern in Iowa's groundwater conducted to date, and one of the first conducted in the United States.

Raw groundwater samples were collected from 66 public supply wells during the spring of 2013, when the state was recovering from drought conditions. Samples were analyzed for 206 chemical and biological parameters; including 20 general water-quality parameters and major ions, 19 metals, 5 nutrients, 10 virus groups, 3 species of pathogenic bacteria, 5 microbial indicators, 108 pharmaceuticals, 35 pesticides and pesticide degradates, and tritium. The wells chosen for this study represent a diverse range of ages, depths, confining material thicknesses, pumping rates, and land use settings.

The most commonly detected contaminant group was pesticide compounds, which were present in 41% of the samples. As many as 6 pesticide compounds were found together in a sample, most of which were chloroacetanilide degradates. While none of the measured concentrations of pesticide compounds exceeded current benchmark levels, several of these compounds are listed on the U.S. Environmental Protection Agency's Contaminant Candidate List and could be subject to drinking water standards in the future. Despite heavy use in the past decade, glyphosate was not detected, and its metabolite, aminomethylphosphonic acid, was only detected in two of 60 wells tested (3%) at the detection limit of 0.02 μg/L.

Pharmaceutical compounds were detected in 35% of 63 samples. Of the 14 pharmaceuticals detected, six had reported concentrations above the method reporting limit, with the maximum reported concentration of 826 ng/L for acetaminophen. Diphenhydramine was the only pharmaceutical to have two detections above the reporting limit, at 24.5 and 145 ng/L. Eight pharmaceuticals had confirmed detections at concentrations below the method reporting limit. Caffeine was the most frequently detected pharmaceutical compound (25%), followed by the caffeine metabolite, 1,7-dimethylxanthine (16%).

Microorganisms were detected in 21% of the wells using quantitative polymerase chain reaction methodologies. The most frequently detected microorganism was the pepper mild mottle virus (PMMV), a plant pathogen found in human waste. PMMV was detected in 17% of samples at concentrations ranging from 0.4 to 6.38 gene copies per liter. GII norovirus, human polyomavirus, bovine polyomavirus, and *Campylobacter* were also detected, while adenovirus, enterovirus, GI norovirus, swine hepatitis E, *Salmonella*, and enterohemmorhagic *E. coli* were not detected. No correlations were found between viruses or pathogenic bacteria and microbial indicators.

Wells with less than 50 feet (15 meters) of confining material were shown to have greater incidence of surface-related contaminants; however, significant relationships ($p<0.05$) between confining layer thickness and contaminants were only found for nitrate and herbicides.

INTRODUCTION

Groundwater supplies drinking water to about 80% of Iowa's 3 million people, with over 2 million of these people obtaining their drinking water from public water supplies (PWS). Such PWS are required by the United States Environmental Protection Agency (US EPA) to monitor finished water for a variety of chemical, physical, and biological contaminants to protect public health. The remaining 300,000 Iowans rely on groundwater for their drinking water obtained from unregulated private wells.

Pharmaceuticals, viruses, and other contaminants of emerging concern (CECs), which are largely unregulated, are of increasing public interest. CECs have commonly been found in aquatic systems (e.g., Kolpin et al., 2002, 2004), including groundwater (Barnes et al., 2008; Erickson et al., 2014; Schaider et al., 2014). There is mounting evidence that exposures to select CECs can affect aquatic and terrestrial organisms (Brodin et al., 2013; Jonsson et al., 2014; Oaks et al., 2004; Rosi-Marshall et al., 2013). Potential effects to human health have not yet been widely identified (Bruce et al., 2010); however, health-based benchmark values have been assessed for some pesticides and pharmaceuticals (Minnesota Department of Health, 2013; Toccalino et al., 2012; US EPA, 2014b). Increased risk of acute gastrointestinal illness has been associated with viruses found in non-disinfected municipal drinking water (Borchardt et al., 2012).

In addition to the primary and secondary drinking-water contaminants that PWS are required to monitor under the Safe Drinking Water Act, the US EPA continues to evaluate potential contaminants on their "Contaminant Candidate List" (CCL) to determine appropriate standards (US EPA, 2013a). Contaminants needing further assessment are listed under the Unregulated Contaminant Monitoring Rule 3 (UCMR

3), which requires additional monitoring from a subset of PWS for a combination of metals, volatile organic compounds, hormones, viruses, and perfluorinated compounds (US EPA, 2013b). This is the first time the UCMR list included CECs. The CCL was last updated in 2010, and is scheduled to be updated every six years. These lists will likely be revised to include other CECs as new analytical methods become available, detection levels improve, and health effects are studied.

In order to determine whether selected CECs, pesticides, and UCMR 3 contaminants occur in Iowa's aquifers prior to treatment, targeted sampling and analysis of raw groundwater from a strategically selected population of 66 PWS wells was conducted in 2013. A total of 206 unique parameters were measured, including 108 pharmaceutical compounds, 35 pesticide compounds, 19 metals, 5 microbial indicators, 3 bacterial pathogens, and 10 groups of viruses. Concurrent analysis of this untreated groundwater for 20 general water-quality parameters and major ions, 5 nutrients, and tritium provided context for the potential occurrence of CECs. The sampling network represented all major aquifers in Iowa and a broad set of well characteristics. This study represents the first comprehensive examination of CECs in Iowa's groundwater conducted to date, and one of the first conducted in the United States. This project will provide further understanding of CECs in groundwater, help assess future safe drinking water program needs, guide source water protection activities for both public and domestic wells, help evaluate choice of fecal indicators for the Groundwater Rule in Iowa, and serve as a foundation for future epidemiological studies.

Previous Statewide Groundwater-Quality Monitoring

A number of past studies have assessed groundwater quality in Iowa on a state-wide basis, and provided important background information for this study, including the following:

- *Iowa Groundwater Monitoring (IGWM) Network*. Beginning in 1982, the Iowa Geological Survey, U.S. Geological Survey (USGS), and State Hygienic Lab (SHL) collaborated to collect and analyze raw groundwater from public wells. In the 1980s, as it became evident that agricultural practices were affecting groundwater quality, a formal monitoring scheme was developed, and wells in the network tapping vulnerable aquifers were sampled for agricultural chemicals and other surface-related contaminants. Data from the IGWM network have documented the occurrence of herbicides and their metabolites in public wells (Detroy et al., 1988; Kolpin et al., 1997a), allowed for analysis of trends in agrichemical occurrence (Kolpin et al., 1997b), and provided a description of the occurrence and distribution of ammonia-nitrogen (Schilling, 2002) and arsenic (Libra, 2011).

Budgetary constraints resulted in the program stopping annual monitoring in 2006 but the network was sampled again in 2012.

- *Synthetic Organic Compound (SOC) Sampling Survey of Public Water Supplies.* During 1984-85, 128 public wells were sampled for a variety of SOCs. Seventy of these wells were also sampled for commonly-used pesticides. Forty-five percent of the wells contained one or more SOC (Kelley, 1985).

- *The State-Wide Rural Well Water Survey (SWRL).* SWRL was a statistically designed, population-based sampling of private wells in Iowa, designed to assess the exposure to nitrates, bacteria, and commonly-used herbicides (Kross et al., 1990). SWRL sampled 686 wells during 1988-89, in all counties of the state.

- *Iowa Community Private Well Study.* While SWRL focused on private wells in unincorporated areas, this 2002 study sampled private wells in communities without a public water supply. The study included a random sampling of wells and a component focused on communities with multiple potential contaminant sources. The results of the study indicated these private "in-town" wells exhibit generally similar levels of contamination as rural private wells (Iowa DNR, 2004).

- *The Iowa Statewide Rural Well Water Survey Phase 2 (SWRL2)*. SWRL2 sampled 473 private wells in Iowa, located in 89 of the state's 99 counties. The wells included 116 wells sampled in the original SWRL study (Kross et al., 1990), with the remainder being mainly wells drilled since SWRL. The contaminants analyzed for this study included nitrate, total coliform bacteria, arsenic, atrazine, and herbicides, including chloroacetanilide degradates (CHEEC, 2009).

In addition to these specific projects, raw, public well groundwater has been sampled for a variety of purposes since early in the 20th century by both state and federal agencies, including the Iowa DNR and precursor agencies, the SHL, USGS, and the Iowa Department of Public Health. These wells have been linked, when possible, to well logs and construction records, and those with sufficient documentation have been chosen for a variety of groundwater monitoring studies that have primarily taken place since the 1980s.

Groundwater Vulnerability in Iowa

Investigations into the occurrence of nonpoint source agricultural chemicals in Iowa groundwater during the early 1980s led to the development and testing of a groundwater vulnerability scheme (Hallberg et al., 1983; Hallberg et al., 1984; Libra et al., 1984). This classification provides a general mappable description of the geologic settings where mobile contaminants may reach aquifers. This concept was adapted to produce a groundwater vulnerability map for the state (Hoyer and Hallberg, 1991) and continues to be refined. This classification scheme, shown in Figure 1, guides

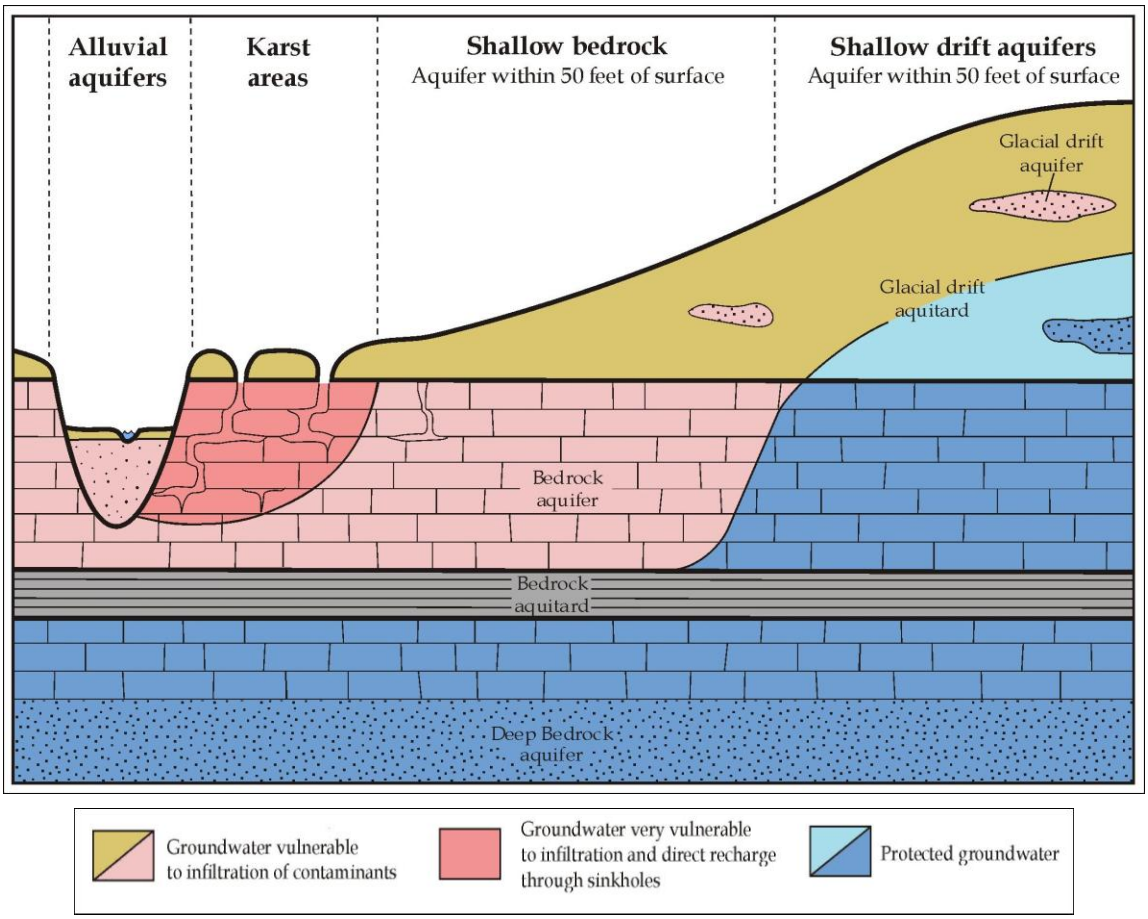

Figure 1. Diagram of the groundwater vulnerability classification used in Iowa (Iowa DNR, 2011).

groundwater-quality monitoring priorities, such as those described above, as well as groundwater and source-water protection activities (Iowa DNR, 2011).

Areas where aquifers are overlain by less than 50 feet (15 meters) of slowly permeable confining beds (typically clayey glacial till or shale bedrock) are vulnerable to contamination, and their groundwater commonly contains mobile contaminants such as nitrate. Shallow bedrock aquifers are most common in the eastern half of the state, while alluvial aquifers occur in river valleys statewide. In northeast Iowa, karst areas with sinkholes and losing streams occur in some shallow bedrock settings and add to

the overall vulnerability of the underlying groundwater. In contrast, areas where aquifers are covered by more than 50 feet (15 meters) of confining bed material have a significant degree of natural protection from surficial contamination. Contamination can reach these relatively protected aquifers via direct conduits such as abandoned or inadequately constructed wells, or preferential flow pathways such as fractures, but the geologic setting generally limits contaminant inputs from the surface.

This vulnerability classification was largely derived using nitrate results from private wells. When applied to public wells, several factors alter this approach. First, public wells typically pump significantly larger quantities of water than private wells, resulting in steep downward gradients and the potential to move contaminants to greater depth if pathways exist. Second, these drawdowns result in larger capture zones for pubic wells, relative to private wells. This increases the potential variability in the confining bed thickness across the capture zone, and the potential for windows of less protected aquifer within the zone. Existing geologic data may be inadequate in terms of density to map this variability. Given this uncertainty and much higher pumping rates (often for many decades) the application of the vulnerability concept to public wells errs on the conservative side, and requires a greater confining bed thickness to be considered naturally protected (Iowa DNR, 2011). For this study, wells with less than 50 feet (15 meters) of confining bed thickness were classified as "high vulnerability" wells, wells between 50 – 100 feet (15-30 meters) of confining materials were classified as "intermediate vulnerability," and wells with greater than 100 feet (>30 meters) of confining material were classified as having "low vulnerability."

Background for Selected Analytes

For this study, a comprehensive analysis of the water samples was conducted, with a total of 206 water quality parameters measured, including tritium, 20 general water-quality parameters and major ions, 5 nutrients, 19 metals, 5 microbial indicators, 35 pesticide compounds, 108 pharmaceutical compounds, 10 viruses, and 3 bacterial pathogens. The measurements of commonly assessed water constituents were included to provide context and to evaluate their value as predictors of CECs occurrence.

Twenty-eight contaminants analyzed for this study are currently regulated by the Safe Drinking Water Act. It should be noted; however, that the standards for drinking water only apply to finished water. In addition, multiple treatment methods are used in Iowa and many systems blend water from multiple wells and/or surface sources. Therefore, conclusions about the quality of finished drinking water cannot be drawn from this study of raw groundwater sampling.

Tritium

To complement vulnerability rankings, knowledge of the relative age of groundwater can help determine whether groundwaters are vulnerable to surface-related contamination. Groundwater recharged in the past 50 years is more likely to contain contaminants associated with wastewater and agricultural activities. Tritium (^3H) is a radioactive isotope of hydrogen, naturally formed by the interaction of incoming cosmic rays with the upper atmosphere. Human nuclear activities add to the concentrations of tritium in the atmosphere and hydrologic cycle. In particular, atmospheric testing of nuclear weapons during the 1950s and 1960s resulted in precipitation containing several thousand tritium units (TU) in the upper Midwest, whereas natural processes previously are estimated to have resulted in concentrations around 10 TU (Michel, 2004). Tritium has a half-life of approximately 12.4 years; therefore, the concentration of tritium in the atmosphere continues to decline, but it remains a useful indicator of recent groundwater recharge.

General Water-Quality, Major Ions, and Nutrients

Among the groundwater constituents examined for this study were a number of commonly measured parameters that provide insights into the groundwater's history, and were relevant to predicting the probability of the occurrence of surface-derived contaminants. Some of these parameters are also useful for distinguishing between surface-related and naturally derived contamination. It is possible; however, for there to be multiple sources of these constituents. Additionally, subsurface processes can affect these parameters, thus is it best to look at multiple parameters before drawing conclusions about potential sources of contamination. In Iowa for example, nitrate is commonly derived from a combination of inorganic fertilizer application, mineralization/nitrification of soil organic matter, human and animal waste, legume fixation, and atmospheric deposition (Schilling and Wolter, 2008). Because nitrate is regulated for drinking-water use (US EPA, 2013c), it is widely monitored in groundwater. However, one drawback to using nitrate as a tracer of surface contamination is that microbes can transform nitrate to other forms of nitrogen (denitrification) under anoxic subsurface conditions when organic matter is present.

Chloride, which can be introduced into groundwater from human and animal waste and road salts, can also be used as a tracer of surface activities. The benefit of using chloride as a tracer is that, unlike nitrate, it is not removed by chemical or biological processes in the subsurface. However, chloride is contained in certain rock formations, and thus, can be found in some deep protected aquifers. While some correlation between chloride and nitrate are seen in IGWM data, the highest chloride values (1,000 mg/L or more) occur in samples from deep wells drawing water from Cambrian-Ordovician bedrock aquifers (IDNR, 2013).

Dissolved oxygen (DO) is derived from the atmosphere and higher concentrations are generally indicative of shorter duration flow paths and relatively recent recharge. The presence of DO affects many natural and anthropogenic contaminants (Stumm and Morgan, 1981). Water containing greater than 0.5 mg/L DO is defined as oxic. As groundwater moves, DO reacts with organic matter and reduced mineral species, resulting in declining concentrations along its flow path (Rose and Long, 1988); thus, DO can provide a general indication of groundwater age. However, the rate of these reactions is a function of the organic carbon and mineral species the groundwater encounters, and relatively deep and old groundwater may contain substantial DO (Winogrand and Robertson, 1982).

Unlike nitrate, ammonia is a form of nitrogen found in groundwater that is predominantly derived from natural sources at some depth in Iowa (Schilling, 2002); however, it can also be derived from surface activities and persist in groundwater under reducing conditions. Ammonia concentrations above 1 mg/L are a concern for public water supplies, as nitrification of ammonia during treatment processes can generate nitrite. Nitrite as nitrogen (N) has a maximum contaminant level (MCL) of 1 mg/L, and nitrification of more than 1 mg/L ammonia-N may generate nitrite-N concentrations above the MCL (US EPA, 2013c).

Total dissolved solids (TDS) is another frequently measured water-quality parameter that is often associated with dissolution of aquifer material over time, but it can also come from human activities, such as the application of manure on fields, or road salt use during the winter. Common inorganic salts that contribute to TDS concentrations in Iowa groundwater include calcium, magnesium, potassium, and sodium (cations), bicarbonates, and chlorides and sulfates (anions).

Water-quality monitoring also often includes turbidity, a measure of the cloudiness of water. While turbidity does not have direct health effects, it has been associated with the presence of disease-causing microorganisms (US EPA, 2014a). Water systems are required to remove turbidity, usually by filtration or settling.

Metals

Arsenic is a metalloid that can be dissolved into groundwater from minerals in the subsurface. Like ammonia, arsenic is more often found in deep aquifers, protected from surface activities (IDNR, 2013). Most detections of arsenic in Iowa's groundwater occur in the Des Moines Lobe landform region of the state (IDNR, 2013); however, a localized hotspot has been documented near Clear Lake in Cerro Gordo County (Schnoebelen and Walsh, 2014). Arsenic is regulated in drinking water because it has been shown to

be associated with health effects such as skin damage, problems with circulatory systems, and the potential increased risk of cancer (US EPA, 2013c). The SWRL2 study conducted in Iowa found 8% of samples exceeding the MCL for arsenic in drinking-water of 0.010 mg/L arsenic (CHEEC, 2009).

Chromium, cobalt, strontium, and vanadium are metals listed on the UCMR 3 (US EPA, 2013b). These metals may be derived from dissolution of naturally occurring minerals or from pipes and industrial processes. Concerns over exposure to these metals have been raised due to potential for reproductive and developmental effects, carcinogenicity, and other human health impacts. For this study, samples were only analyzed for dissolved chromium; however, the UCMR 3 requires drinking-water systems to be tested for total choromium and hexavalent chromium.

Pesticides and Pesticide Degradates

Atrazine is one of the most commonly used herbicides in the US, with annual use of over 60 million pounds for the past two decades (USGS, 2013a). Both atrazine and its degradates, desethyl atrazine and deisopropyl atrazine, have been detected in Iowa's groundwater since the 1980s (Detroy et al., 1998; IDNR, 2013; Kolpin et al., 1997a; 1997b; CHEEC, 2009). The MCL established by the US EPA for drinking-water is 3 μg/L for long-term exposure, and concentrations below 298 μg/L atrazine are considered safe for short-term exposures. Atrazine was detected in 19.5% of groundwater samples collected between 1982 - 1995 in Iowa, with a maximum concentration measured at 21 μg/L, and less than 1% of the samples exceeding the MCL (Kolpin et al., 1997a). Although atrazine was detected in 8% of private wells sampled between 2006 - 2007 in Iowa, none of the measured concentrations exceeded the MCL (CHEEC, 2009).

Chloroacetanilide herbicides, including acetochlor, alachlor, and metolachlor, have been widely used for pre-emergent control of annual grasses in Iowa and throughout the US, primarily for corn production. Metolachlor use has dropped considerably since the 1990s, while alachlor use has remained consistent since it replaced acetochlor in 1994 (USGS, 2013a). These herbicides, and their ethanesulfonic acid (ESA) and oxanilic acid (OXA) degradates, have been documented widely in groundwater in Iowa, with greater concentrations and higher detection frequencies in unconfined aquifers with younger water, and more frequent detections of degradates than their parent compounds (Detroy et al., 1988; IDNR, 2013; Kolpin et al., 1997a; 1997b; CHEEC, 2009). The primary mechanism for degradation of the parent compounds is microbial activity in the soil (Potter and Carpenter, 1995), and, in general, the chloroacetanilide degradates are more soluble than their parent compounds, increasing their potential for leaching (Thurman et al., 1996). Of these compounds, only alachlor has a drinking water standard established by the US EPA of 2 μg/L. Chloroacetanilides and their degradates that are

included on US EPA's CCL include acetochlor, acetochlor ESA, acetochlor OXA, alachor ESA, alachlor OXA, metolachlor, metolachor ESA, and metolachlor OXA.

Glyphosate is a non-selective, broad spectrum herbicide that is the most widely used herbicide in the United States having both substantial agricultural and urban uses (Baylis, 2000). Dramatic increases in the agricultural use of glyphosate occurred in 1997 corresponding to the introduction of genetically altered glyphosate-resistant crops through a glyphosate-resistant protein product isolated from a naturally occurring gene that was cloned and expressed in the target crops (e.g., Pline et al., 2001). Sales of products containing glyphosate in Iowa have increased from 33.6 million dollars in 1997 to 237.4 million dollars in 2009 (Iowa Department of Agriculture and Land Stewardship, 2014). National data indicate a significant increase in use of glyphosate since 1992, reaching just under 250 million pounds in 2011 (USGS, 2013a). Dill et al. (2008) estimated that 80% of genetically modified crops worldwide are glyphosate resistant. Microbial degradation of glyphosate produces aminomethylphosphonic acid (AMPA), the primary glyphosate transformation product (Forlani et al., 1999). AMPA is also formed by the degradation of phosphonic acids in detergents (Skark et al., 1998). Concerns over the development of glyphosate resistance, and problems with control of volunteer corn in corn-soybean rotations, has led to incorporation of the herbicide glufosinate into weed management regiments (Shaner, 2000).

The high polarity and water solubility of glyphosate, AMPA, and glufosinate make their analysis in water samples problematic. Thus, compared to other heavily used pesticides (e.g., atrazine), there are relatively few studies on the environmental occurrence of glyphosate and AMPA. In one study, losses of these compounds in runoff from crop fields was shown to be smaller than from the herbicides that these compounds commonly replace, such as atrazine, metribuzin, and alachlor (Shipitalo et al., 2008). The potential human and ecological impacts of these newer compounds are not well understood, although research has suggested a potential link between the exposure to glyphosate and human placenta cell damage, especially in the presence of adjuvants (Richard et al., 2005). Recent research has documented the frequent occurrence of glyphosate and AMPA in streams and the atmosphere from samples collected in Iowa (Battaglin et al., 2005; Chang et al., 2011), and the less frequent occurrence of glufosinate (Battaglin et al., 2005). Less is known about such occurrences in Iowa groundwater. No detections of glyphosate or AMPA were observed in 86 Iowa PWS wells sampled in 2001 (Kolpin et al., 2004). Glyphosate was detected in 5.8% and AMPA in 14.3% of the 1,171 groundwater sampled across 23 U.S. states (Battaglin et al., 2014). With an additional decade of widespread application of glyphosate across Iowa, it was decided a resampling for glyphosate and AMPA in Iowa's groundwater was an important addition to this study, along with the addition of glufosinate analyses.

Pharmaceuticals

The occurrence of pharmaceuticals in the environment has become an increasing public concern worldwide. As used in this report, these compounds include over-the-counter and prescription drugs, narcotics, and common stimulants such as caffeine and nicotine. Such compounds have been frequently detected in streams (Kolpin et al., 2002), groundwater (Barnes et al., 2008), and drinking water sources (Focazio et al., 2008) across the United States. Because conventional treatment is insufficient to completely remove pharmaceuticals, these compounds have also been documented in finished drinking water (Benotti et al., 2009; Stackelberg et al., 2004). Pharmaceuticals can be introduced into the environment through a variety of pathways including discharge of treated wastewater, land application of human and animal waste, septic systems, sewer lines, and landfills (Kummerer, 2008). In general, less research on pharmaceutical occurrence has been conducted in groundwater compared to surface water (Schaider et al., 2014). An intensive groundwater monitoring effort was conducted in California (Fram and Belitz, 2011); however, only 14 pharmaceuticals were analyzed. A recent statewide groundwater CEC study in Minnesota analyzed 127 chemicals (Erickson et al., 2014).

Microbial Indicators

Five microbial indicators were chosen for this study: total coliform bacteria, *Escherichia coli (E. coli)*, enterococci, male-specific coliphages, and somatic coliphages. Total coliform bacteria and *E. coli* are currently primary drinking water contaminants under the Safe Drinking Water Act and are routinely monitored in PWS finished drinking water in Iowa. These bacteria are used to indicate whether a sanitary defect exists in the water system (total coliform presence) and whether contamination could be from a sewage source (*E. coli* presence), which is an acute health hazard. Another fecal bacteria indicator tested in this study was the enterococci group. This group of bacteria is thought to persist longer in freshwater environment, especially soils, than fecal coliform bacteria (Anderson et al., 2005).

Coliphages are viruses that infect the bacterium, *E. coli,* and are associated with recent fecal contamination. Because they are viruses and from a sewage source, the fate and transport of coliphages are expected to be similar to that of pathogenic viruses; thus, coliphages have been suggested as a possible indicator for enteric viral contamination (Gerba, 1987).

US EPA's Groundwater Rule calls for source water monitoring using one or all three of the aforementioned fecal indicators: *E. coli*, enterococci, and coliphage. Because virus and pathogenic bacteria sampling and analyses are still very expensive and generally

low recovery, this study will evaluate whether any of these indicators will be associated with the occurrence of viruses or pathogenic bacteria.

Viruses and Pathogenic Bacteria

Viruses can occur in high concentrations (up to 10^8 copies per liter) in human and animal wastewaters (Hamza et al., 2011; Hundesa et al., 2009; Kitajima et al., 2014; Wong and Xagoraraki, 2011). Recent studies have also shown that viruses are not completely inactivated by common treatment methods (Gerba et al., 2013) and can survive for months to over a year in groundwater (Nevecherya et al., 2005; Charles et al., 2009). In addition, viruses are small enough (10-300 nm) to fit though fine pores, compared to larger bacteria (200-5000 nm) and pathogenic protozoans such as *Cryptosporidium* (5,000-7,000 nm). Enteric viruses have been reported to migrate in the subsurface as far as 400 meters (1300 feet) in glacial till and 2.5 kilometers (~1.5 miles) in fractured limestone (Keswick and Gerba, 1980). More recent research in Iowa indicates that viruses originating in surface waters can migrate over 1 km through an alluvial aquifer to city wells (Davison et al., 2013). Sampling methods that concentrate viruses from large volumes of water onto glass filters (Lambertini et al., 2008) combined with the use of quantitative polymerase chain reaction (qPCR) analyses, now make it possible to study the occurrence of viruses in groundwater at low concentrations (<10 copies per liter).

Recent studies have demonstrated relatively widespread occurrence of viruses in domestic and municipal wells in the United States (Abbaszadegan et al., 2003; Borchardt et al., 2003; Fout et al., 2003; Hunt et al., 2010). In addition, several studies have described the association of virus occurrence in groundwater supplies with disease outbreaks, and sporadic and endemic illnesses (Keswick and Gerba, 1980; Azadpour-Keeley et al., 2003; Borchardt et al., 2012; Wallender et al., 2013). Investigations in Wisconsin, in locales with generally similar geology to Iowa, including aquifers considered protected from surface contamination, have shown the common and frequent presence of human enteric viruses in PWS well source water commonly and frequently enough to prompt a regulatory response at the state level (Borchardt et al. 2003; 2004; 2007; and Bradbury et al.. 2013). An investigation of virus occurrence in groundwater in La Crosse, Wisconsin, implicated leaking sanitary sewer lines as a probable source, whereas septic systems, application of human waste, waste lagoons, and transport from surface waters have also been indicated as potential sources of these virus detections (Hunt et al., 2010; Azadpour-Keeley et al., 2003). Given the widespread occurrence of viruses in water supplies, the US EPA has placed four virus species on its CCL.

This study is unique because of the inclusion of analysis for the pepper mild mottle virus (PMMV). PMMV is a plant virus that occurs at high levels in human wastewater and has been shown to be a useful indicator of the presence of other viruses in surface waters (Hamza et al., 2011; Kitijama et al., 2014; Rosario et al., 2009). This is the first state-wide survey for PMMV in groundwater.

Enterohemmorhagic *E. coli, Salmonella,* and *Campylobacter jejeuni* are bacterial species known to cause gastroenteritis and other serious illnesses in humans. *Salmonella* and *Campylobacter* are listed on the US EPA's CCL. While transport of these bacteria through soils, from human and animal wastes, has been documented, transport to all but the most vulnerable aquifers should be limited due to the size of these organisms. A recent pilot study in the karst-dominated Kewaunee County in Wisconsin showed detectable levels of both *Salmonella* and *Campylobacter* (Borchardt et al., 2014). It should be noted that the quantitative polymerase chain reaction (qPCR) method used to detect these pathogens in groundwater does not differentiate between genetic material from living or dead cells.

METHODS

Well Selection

For this study, a total of 66 public water supply wells were strategically selected for sampling. This network represents 2% of the approximately 3,268 active or stand-by public wells in Iowa. The sampling network represented all major aquifers in Iowa and captured a range of confining layer thickness, construction methods, well ages, pumping rates, and dominant land uses in the capture zones. In addition, this study was a test of the long-term groundwater vulnerability classification scheme used in Iowa, and represents the first time this scheme has been related to CECs. Minimum selection criteria required that wells were drilled in the last 60 years; had adequate location, geologic, and construction information housed within Iowa Department of Natural Resource databases; and could be pumped for 4 hours during the sample collection process. Most wells had previously been sampled for conventional water quality at least once, or were near wells in the same aquifer where such samples had been collected. The selected network of wells sampled for this study is shown in Figure 2 and well characteristics are summarized in Table 1. A complete list of wells and associated characteristics can be found in Appendix A.

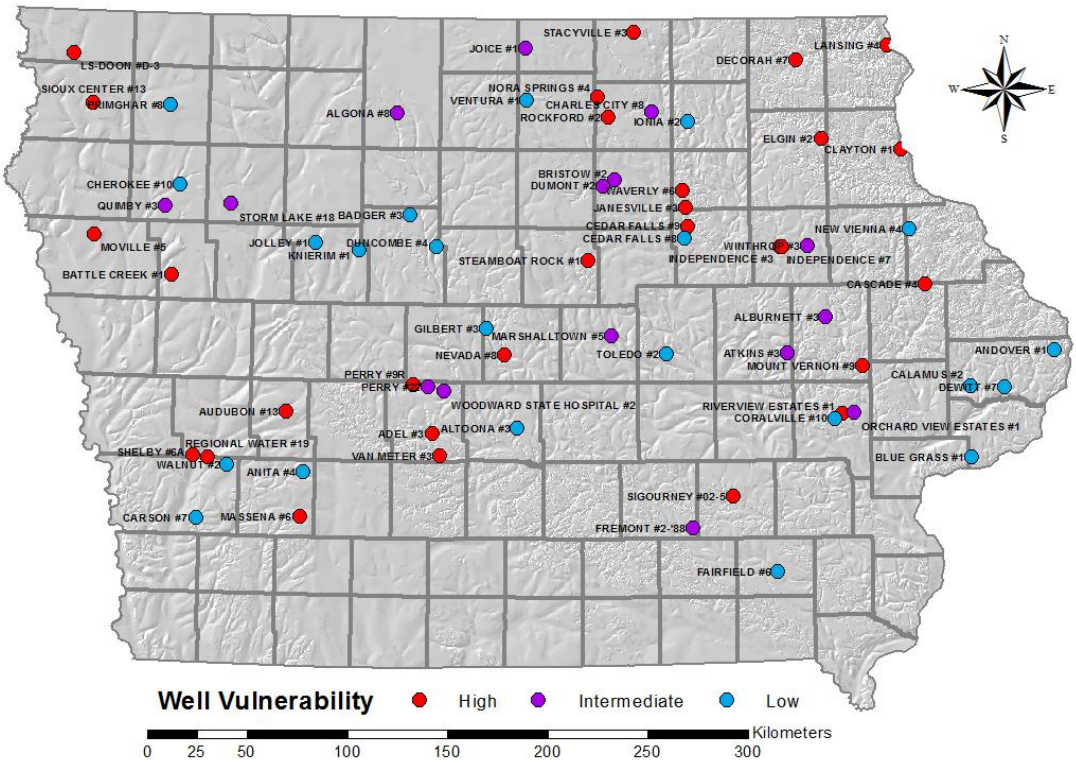

Figure 2. Map of the public water supply wells sampled for this study by vulnerability class.

Table 1. Characteristics of wells used in this study.

Well Characteristic	Number of Wells	Percent	Well Characteristic	Number of Wells	Percent
Aquifer Group			**Pumping Rate**		
Alluvial	12	18%	< 151,000 L/day (< 40,000 gpd)	28	42%
Buried Sand and Gravel	7	11%	> 151,000 L/day (> 40,000 gpd)	38	58%
Cretaceous (Dakota)	7	11%	**Age (Year Drilled)**		
Silurian-Devonian	23	35%	1943-1979	24	36%
Mississippian	5	8%	1980-1999	21	32%
Cambrian-Ordovician	12	18%	2000-2010	21	32%
Vulnerability Class			**Confining Layer Thickness**		
Low	22	33%	> 30 m (> 100 ft)	22	33%
Intermediate	13	20%	15 - 30 m (50-100 ft)	13	20%
High	31	47%	< 15 m (< 50 ft)	31	47%
Well Depth			**Dominant Land Use within 1000 feet**		
< 30 m (< 100 ft)	15	23%	Row Crop	17	26%
30 - 76 m (100-250 ft)	20	30%	Grasses	19	29%
> 76 m (> 250 ft)	31	47%	Developed	30	45%

Sampling and Analyses

Samples were collected with cooperation from municipal well operators. Sampling began on March 4, 2013, and was completed by June 18, 2013. Samples were collected by staff from the SHL of Iowa and the USGS following standard collection protocols for pharmaceuticals, including the "clean hands/dirty hands" technique, wearing latex gloves, and other precautionary measures (USGS, 2006). In addition, staff attended training for virus sampling conducted by Dr. Mark Borchardt. Specific bottle requirements, handling, analytical procedures, and quality assurance/quality control procedures for each group of analytes are summarized, below.

Tritium

Samples for tritium analysis were collected in 500-milliliter (mL) plastic bottles, sealed with plastic wrap, and refrigerated until transported to the laboratory for analysis. Tritium concentrations were quantified by the Environmental Isotope Laboratory at the University of Waterloo, Ontario, using liquid scintillation counting (LSC) (e.g., Hoffman and Stewart, 1966). Tritium concentrations are typically reported as tritium units (TU), where a TU equals 1 atom of tritium per 10^{18} atoms of hydrogen, or 3.2 pCi/L. Direct tritium measurements have a detection limit at about 6 TU. Samples with tritium content near this level were enriched 15 times by electrolysis (Taylor, 1977) and then counted. The detection limit for enriched samples is 0.8 +/-0.8 TU. Each batch of

samples includes three background samples: water from a well near Newmarket, Ontario with no detectable tritium and radiocarbon age dated to >6000 BP, a long term monitor (lab deionized water), and a National Institute of Standards and Technology (NIST) standard (NIST-4926-E) which has been calibrated with NIST-SRM-4361B-21. Repeated analyses were performed within each batch and samples from each batch were repeated in a subsequent batch.

General Water-Quality, Major Ions, Nutrients, and Metals

Sampling and analysis of general water-quality characteristics, major ions, nutrients, and metals were determined according to standard operating procedures based on approved US EPA drinking water methods for regulated drinking water analytes (US EPA, 2013d) at SHL. For those parameters/analytes that are not regulated drinking water analytes (e.g., total organic carbon), all analyses were also performed according to US EPA approved methods. Analytes and their corresponding quantitation limits and method numbers are listed in Table 2. Four field blanks and five field replicate samples were collected and analyzed for these parameters during the course of the investigation.

Table 2. Quantitation limits and methods used by the State Hygienic Laboratory to analyze water samples for general water-quality parameters, major ions, nutrients, and metals.

	Analyte	Quantitation Limit(s)	Units	Method Number*
General Water Quality	pH			SM 4500 H+ B
	Conductivity	1	umho/cm	ISO 7888-1985
	Total Hardness	1	mg/L	SM 2340 C
	Total Alkalinity	1	mg/L	SM 2320 B
	Dissolved Oxygen	0.1	mg/L	ASTM D 888-05 C
	Total Organic Carbon	0.05	mg/L	SM 5310 B
	Total Dissolved Solids	1	mg/L	SM 2540 C 18th
	Total Suspended Solids	1	mg/L	USGS I-3765-85
	Turbidity	1.0	NTU	SM 2130 B 18th
Major Ions	Bromide	0.25/0.5	mg/L	EPA 300.0
	Chloride	1.0	mg/L	EPA 300.0
	Fluoride	0.1	mg/L	SM 4500-F C
	Sulfate	1.0	mg/L	EPA 300.0
	Silica as SiO2	1.0	mg/L	SM 4500-SI D
	Carbonate Alkalinity	1.0	mg/L	SM 2320 B
	Bicarbonate Alkalinity	1.0	mg/L	SM 2320 B
	Calcium (dissolved)	1.0	mg/L	EPA 200.7
	Magnesium (dissolved)	0.5	mg/L	EPA 200.7
	Potassium (dissolved)	1.0	mg/L	EPA 200.7
	Sodium (dissolved)	0.5	mg/L	EPA 200.7
Nutrients	Ammonia as N	0.05	mg/L	LAC 10-107-06-1J (based on EPA 350.1)
	Nitrate + Nitrite as N	0.1	mg/L	LAC 10-107-04-1J (based on EPA 353.2)
	Total Kjeldahl Nitrogen as N	0.1	mg/L	LAC 10-107-06-2E (based on SM 4500N_{ORG} D (1997))
	Ortho-Phosphate as P	0.02	mg/L	LAC 10-115-01-1A (based on EPA 365.1)
	Total Phosphorus as P	0.02	mg/L	LAC 10-115-01-1C OR -1D (based on SM 4500 P HN (1999))
Metals (dissolved)	Aluminum	0.1	mg/L	EPA 200.8
	Antimony	0.005	mg/L	EPA 200.8
	Arsenic	0.001	mg/L	EPA 200.8
	Barium	0.05	mg/L	EPA 200.8
	Beryllium	0.002	mg/L	EPA 200.8
	Chromium	0.01	mg/L	EPA 200.8
	Cobalt	0.05	mg/L	EPA 200.8
	Copper	0.01	mg/L	EPA 200.8
	Iron	0.02	mg/L	EPA 200.7
	Lead	0.001	mg/L	EPA 200.8
	Manganese	0.02	mg/L	EPA 200.8
	Nickel	0.05	mg/L	EPA 200.8
	Selenium	0.01	mg/L	EPA 200.8
	Strontium	0.02	mg/L	EPA 200.8
	Thallium	0.001	mg/L	EPA 200.8
	Titanium	0.05	mg/L	EPA 200.8
	Uranium	0.001	mg/L	EPA 200.8
	Vanadium	0.05	mg/L	EPA 200.8
	Zinc	0.02	mg/L	EPA 200.8

*Acronyms reference standard method sources as follows: ISO = International Organization for Standardization (ISO, 1985), EPA = US EPA Approved General Purpose Methods (US EPA, 2013d), LAC = 21st edition of Lachat Standard Methods (Lachat, 2008), SM = Standard Methods for the Examination of Water and Wastewater - 18th edition (Greenberg, 1992), ATSM = American Society for Testing Materials (ASTM Standard D888, 2012) and USGS = United States Geological Survey (USGS, 1989).

Pesticides and Pesticide Degradates

For the determination of pesticides and chloroacetanilide herbicides and their degradates, samples were collected in unpreserved amber glass bottles (1 L) with Teflon-lined lids, and stored at < 4° C prior to analysis. Two bottles were collected; one for the analysis for the EPA Method 8270 pesticides and a second bottle was used to test for the chloroacetanilides and their degradates. Samples were shipped on ice packs and stored at 4 degrees C until time of sample preparation. Extraction of samples for the

EPA method 8270 pesticides was within seven days of collection and analysis of the sample extracts was within 40 days of preparation. Sample preparation for the chloroacetanilides and their degradates was within 14 days of collection and the analysis of the extracts was within 28 days of extraction.

All study pesticides with the exception of the chloroacetanilides were measured at SHL and determined by EPA Method 8270 (US EPA, 2013e) with reporting limits of 0.1 μg/L for all compounds. Chloroacetanilide herbicides (acetochlor, alachlor, dimethenamid, and metolachlor) and their ethanesulfonic- and oxanilic acid-environmental degradates were determined according to SHL SOP UHL-H-016 LC/MS/MS which is based on EPA Method 535 (US EPA, 2013e). Reporting limits for all the chloroacetanilide compounds , including the degradates, were 0.025 μg/L. Four field blanks and five field replicate samples were collected and analyzed for these parameters during the study period.

For the determination of glyphosate, glufosinate, and AMPA, whole water samples were collected in a 125-mL baked, amber glass bottle and shipped on ice to the USGS Organics Geochemistry Research Laboratory in Lawrence, KS. Upon receipt at the laboratory, samples were filtered through a 0.7-μm pore sized baked glass-fiber filter. Samples were separated on a liquid chromatograph using a gradient separation and analyzed by liquid chromatography/tandem mass spectrometery (LC/MS/MS) with electrospray ionization in negative-ion mode using multiple reaction monitoring (MRM) (Meyer et al., 2009). Sample aliquots of 10 mL were derivatized. A 5-mL aliquot of the derivatized sample and 5.5 mL of deionized water are added to the autosampler vials, loaded into the cartridge, and placed in the liquid chromatography mobile-phase stream using solid-phase extraction. Comparing the retention times to the internal standards in each sample and comparing the ratio of the quantitation MRM daughter-ion to the confirming MRM daughter-ion allows for the identification of the compounds. The ratio of the area response produced by the quantitation daughter-ion of the analyte to the area response produced by the quantitation daughter-ion of the corresponding internal standard calculates the concentration of each identified compound. Two blanks (pesticide grade organic blank water) and four replicate samples were collected and analyzed alongside environmental samples in the field for quality assurance. Laboratory quality assurance protocols included duplicates, carryover blanks, and check standards for every analytical run. A duplicate sample, matrix spiked sample, and carryover blank were analyzed after every tenth sample. Two check standards and a carryover blank were also inserted at the beginning, middle, and end of each analytical run. Two blank samples were also interspersed between each set of five environmental samples. All standard solutions, blanks, and matrix spikes were treated the same as the environmental water samples.

Pharmaceuticals

Roughly 30 mL of unfiltered water for pharmaceutical analysis was collected in a 40-mL amber glass vial and shipped within seven days to the USGS National Water Quality Laboratory in Denver, CO, for analysis. Upon receipt at the laboratory, 10 to 30 mL of the leachate sample was filtered through a 0.7-µm nominal pore size glass-fiber filter (Whatman GF/F). A 100-µL aliquot of the filtered water sample was injected into a high-performance liquid chromatograph (HPLC) coupled to a triple quadrupole mass spectrometer (MS/MS) by using an electrospray ionization source operated in the positive ion mode. The 109 compounds were separated using a reversed-phase gradient of formic acid/ammonium formate-modified water and methanol. Multiple reaction-monitoring (MRM) of two fragmentations of the protonated molecular ion of each analyte to two unique product ions was used to specifically and sensitively identify each compound. The primary MRM precursor-product ion transition was quantified for each compound relative to the primary MRM precursor-product transition of the specific isotope-dilution standard chosen for that compound. The secondary MRM precursor-product ion transition was used to qualitatively confirm compound identity. The use of direct analysis without prior sample preconcentration and cleanup steps, combined with the separation provided by the HPLC and the selectivity and specificity of the MRM-MS/MS technique, resulted in method detection limits (MDLs; determined in reagent water) that range between 0.45 and 94.1 ng/L; the median MDL for all pharmaceuticals was 5.2 ng/L. The majority of MDLs for this method, as defined by the 25th and 75th percentiles of MDL distribution, were between 2.8 and 18 ng/L. Laboratory reagent spike and laboratory reagent blank samples were included with every 17 environmental samples. This method and the associated validation results and performance characteristics are described in detail elsewhere (Furlong et al., 2014). Two field blanks (pesticide grade organic blank water) and five field replicate samples were collected and analyzed for pharmaceuticals during the study period.

Original pharmaceutical results from the laboratory were given an additional screening using three main steps. First, a technique (similar to the algorithm technique now used with schedule 2440) was used to screen detection values less than the method detection limit and list them as non-detections. Second, all detections less than 1 ng/L were treated as non-detections. Third, all value qualifier codes from the laboratory were closely examined. The following are examples of how these qualifier codes were used for decision-making purposes.

- Example 1. Detection was below the laboratory reporting limit but above the long term method detection limit, the compound was considered present in the sample but cannot be quantified ("detection").

- Example 2. The value was below the long term method detection limit, the value was treated as a non-detection.
- Example 3. The analyte was detected in the laboratory blank, the blank detection value was compared to the environmental sample value; if the environmental sample detection was >3× the blank detection value then the concentration was reported; if sample detection was <3× the blank detection value then the concentration was treated as a non-detection.

One of the organic compounds analyzed was atrazine, which was also analyzed at a higher detection limit using EPA method 8270 as described on the previous page. Results for atrazine are reported along with the pesticides and pesticide degradates in this report. The remaining 108 compounds are grouped as "pharmaceuticals" in this report.

Microbial Indicators

Samples for microbial indicators were collected in sterile 100-mL bottles supplied by SHL. Sterile, 4-ounce sampling containers were used for all microbial indicator samples; one bottle for each analyte. Samples were kept on ice packs and shipped daily to SHL to allow for analysis within 24 hours of sample collection.

The method performed by SHL for the total coliform and *E. coli* analyses was Standard Method 9223 using the IDEXX Colilert® product. Enterococci analysis was performed using IDEXX Enterolert® reagent. All analyses were reported in most-probable-number (MPN) per 100 milliliters. SHL used EPA Method 1602, a single agar layer procedure, to detect male-specific and somatic coliphages. The quantity of coliphages is expressed in plaque-forming units per 100mL (PFU/100mL). For quality control purposes, both coliphage positive and negative reagent water were analyzed for each type of coliphage with each sample batch. Four field blanks and five field replicate samples were collected and analyzed for microbial indicators during the March – May sampling period.

Viruses and Pathogenic Bacteria

Samples were obtained directly from the wellhead prior to any water treatment following the method of concentration on glass-wool filters of Lambertini et al. (2008). 1000 liters (L) of well water were sampled (with a few exceptions when flow through the filters was unusually slow) using a sampling apparatus as shown in Figure 3. The filtered volume was measured using an in-line flowmeter. For wells with pH levels greater than 7.5, a constant pH of 6.5 – 7.0 was maintained during sampling by using an in-line acid pump supplied with an acid buffer. Field blanks were collected by pumping 19 L of autoclaved tap water through a glass wool filter using decontaminated

field equipment. Glass wool filters were shipped overnight to the USGS-ARS laboratory (Marshfield, WI) on ice and processed the day after sampling. Upon receipt at the laboratory, elution of the glass wool filters, extraction of RNA and DNA, and analyses by quantitative polymerase chain reaction (qPCR) proceeded as described in Borchardt et al. (2012). Primers and probes used to quantify specific organisms are listed in Table 3 along with corresponding references.

Sampling equipment blanks were conducted in the field three times during the March-May sampling period. Filter recovery controls were conducted with water from four sampling sites (Appendix C). Inhibition to the PCR assays was measured on every sample and mitigated following the methods described in Borchardt et al. (2012) and Gibson et al. (2012). Negative controls were performed for every batch of PCR analyses including nucleic acid extraction, PCR master mix, and reverse transcription master mix (for RNA viruses). Positive controls for each target also were performed for every batch of analyses. Standard curve efficiencies (equal to $10^{-1/slope}$) and error values indicate highly efficient amplification reactions (perfect amplification would have an efficiency of 2) and accurate quantification (<0.2) as reported in Table 3.

Using the theoretical detection limit of 3 genomic copies per PCR reaction (Wittwer and Kusawaka, 2004), and assuming a 1000-L sample, the calculated limit of detection (LOD) for RNA viruses is 3.1 genomic copies/L, and for DNA targets it is 0.54 genomic copies/L. LOD is defined here as 95% probability of detection. Measured concentrations below the LOD are reported, though the probability of detection is lower.

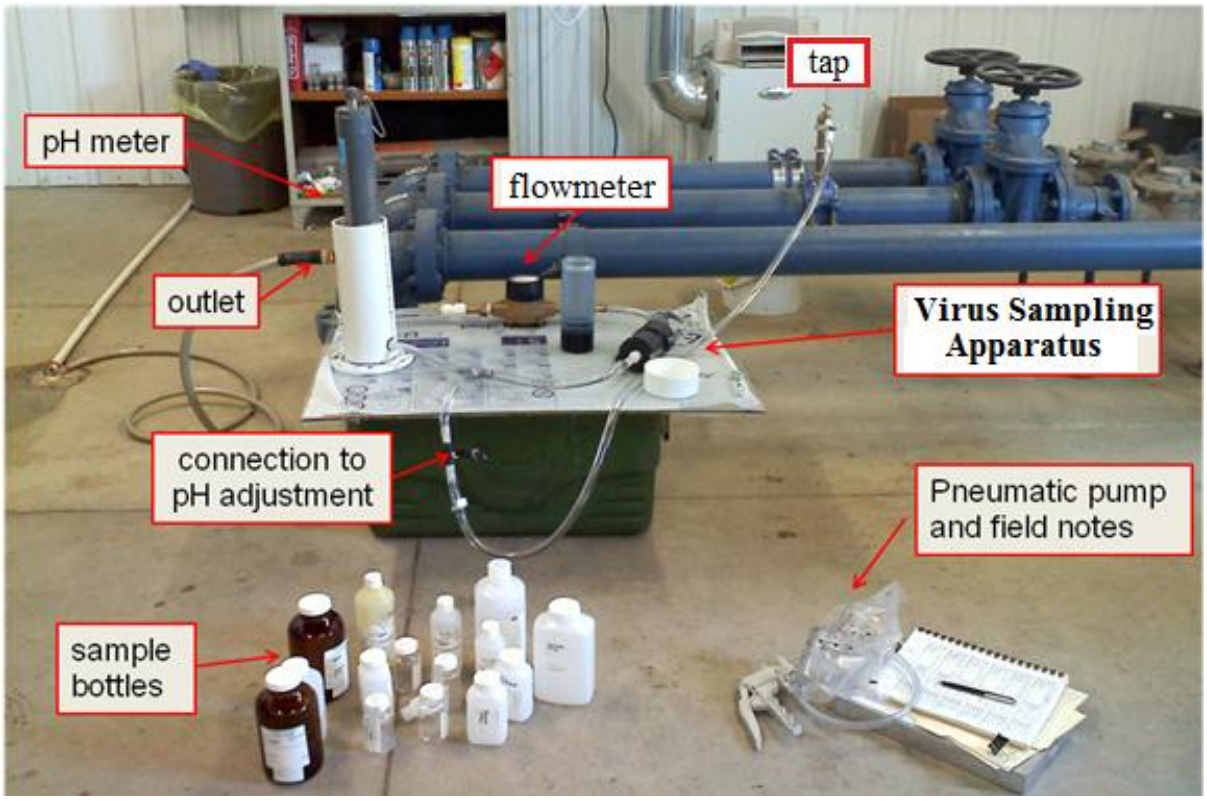

Figure 3. Virus sampling apparatus at one of the study locations (pH adjustment not shown).

Table 3. Targets, citations, and amplicon size in base pairs (bp) for microorganisms quantified by quantitative polymerase chain reaction.

Microorganism	Target	Primer & Probe Citations	Amplicon Size (bp)	Standard Curve	
				Efficiency	Error
Adenovirus Group A	Hexon gene	Kuo et al., 2009	290	1.914	0.0134
Adenovirus Group B	Hexon gene	Kuo et al .,2009	255	1.965	0.0187
Adenovirus Groups C, D, & F	Hexon gene	Kuo et al .,2009	263	1.896	0.118
Enterovirus	UTR region	De Leon et al., 1990; Monpoeho et al., 2000	196	1.912	0.0407
Norovirus Genogroup I	ORF1-ORF2 junction	Jothikumar et al., 2005	95	1.913	0.0225
Norovirus Genogroup II	ORF1-ORF2 junction	Kageyama et al., 2003	97	1.961	0.0279
Human polyomavirus	T antigen	McQuaig et al., 2009	173	1.927	0.0228
Bovine polyomavirus	VP1 gene	Wong and Xagoraraki, 2011	79	1.888	0.00997
Swine hepatitis E	ORF 3 region	Jothikumar et al., 2006; Garson et al., 2012	69	1.95	0.00273
Pepper mild mottle virus	PPMV replication-associated protein	Zhang et al ., 2006	68	1.979	0.0237
Enterohemorrhagic *E. coli*	eae gene	Ibekwe et al., 2004	106	1.926	0.0559
Campylobacter jejuni	mapA gene	Best et al., 2003	95	1.956	0.00686
Salmonella spp.	invA gene	Hoofar et al., 2000	119	1.972	0.0232

Statistical Analyses

Spearman's rank correlation analyses using JMP software (SAS Institute, Cary, NC) were performed to evaluate whether commonly measured analytes could be used as indicators of less frequently assessed contaminants, and to determine whether numerical well characteristics correlated to analyte concentrations. This nonparametric statistical method was chosen because analyte concentrations were rarely normally distributed and often heavily left-censored. This method assumes a monotonic relationship between variables. The closer the absolute values of the resulting Spearman's rho (ρ) coefficients are to 1, the higher degree of correlation. Negative values of ρ denote negative correlations. Results of these analyses were considered significant at $\alpha = 0.05$. Numerical well characteristics included well age (by year constructed), confining layer thickness, well depth, pumping rates, and recent precipitation totals. Given the sample size and the total population of wells in the state, measured concentrations from at least 12 wells (33% of samples) were needed to meet a 95% confidence level standard with a confidence interval of 12%. Four of the analytes selected for correlation analyses were not detected frequently enough to meet this standard (uranium, alachlor ESA, atrazine, and metolachlor OXA); therefore, caution should be used when interpreting those results. For these analyses, concentrations reported as non-detections were assigned values of half the limit of quantitation (Helsel and Hirsch, 2002). Occurrence of individual pharmaceuticals was not sufficient to support correlation analyses, and the more frequently detected pharmaceuticals often were reported only as "detects;" therefore, correlation analyses were done for the number of pharmaceuticals detected per well and for the sum of all pharmaceutical detections. This method has been used previously by Schaider and others (2014). Correlation analyses were also performed for the number of microbial indicators and the number of microorganisms detected by qPCR.

To assist the IDNR's Source Water program with evaluation of risks to wells, relationships between individual contaminant concentrations and occurrence of groups of contaminants were investigated. To determine whether distributions of concentrations of selected parameters differed between pairs of vulnerability classes, Wilcoxon rank sum analyses were performed using JMP software (SAS, NC). For these analyses, non-detections were assigned the value of the limit of detection, with the exception of the pharmaceuticals and atrazine, for which, non-detections were assigned half the method reporting limit, and the value of the method reporting limit was assigned to those samples with confirmed detections below the method reporting limit.

Given the low detection rates for some contaminant groups, the effectiveness of current well vulnerability classification scheme was also evaluated for predicting the

presence/absence of groups of contaminants. These analyses were completed using the chi-squared (χ^2) statistic, or the "Fisher Exact Probability" test, when detection frequencies were below five percent. These contingency analyses were completed using the R software package (R Foundation for Statistical Computing, Vienna, Austria). Contaminant groups included nitrate + nitrite, pesticides and pesticide degradates, pharmaceuticals, microbial indicators, and viruses and pathogens by qPCR. As with the numerical correlation analyses, these categorical analyses were considered significant at $\alpha = 0.05$. Wilcoxon rank sum analyses were also performed to determine whether differences between concentrations of surface-derived contaminants could be associated with primary land use around wells classified as highly vulnerable. Land use around a well can have a strong influence on water quality, with both urban and rural settings providing the potential for contaminants to reach groundwater. For this study, primary land use within 1000 ft (305 m) of the well was determined from 2012 satellite imagery (USDA, 2013) and grouped into three categories: developed (urban), grasses, and row crop. These analyses were performed both with non-detections excluded and with non-detections assigned the value of the reporting limit.

HYDROLOGIC CONDITIONS

Numerous studies in Iowa have shown the presence and concentration of contaminants in relatively shallow, vulnerable aquifers often varies with recent recharge conditions (Hallberg et al., 1983; 1984; Libra et al., 1984; 1987; Seigley and Hallberg, 1991). Periods with significant recharge deliver contaminants to groundwater, resulting in generally greater rates of occurrence and/or concentrations. While this is a generality that depends upon the geologic setting and the contaminant type and source (i.e., point vs. nonpoint), the timing and magnitude of recharge events often impact groundwater quality. The Wisconsin virus studies, which included temporal sampling, suggest that this is true for virus occurrence in groundwater as well (Bradbury et al., 2013, Hunt et al., 2010).

Initial planning for this study targeted October-November 2012 for sample collection. However, by late summer severe drought conditions had developed across much of the state and continued into the fall. Figure 4 shows departure from normal precipitation estimates by county for calendar-year 2012. Much of the state was substantially below normal, and in addition, the summer of 2012 was marked by significantly above-average temperatures. In particular, July was the driest and second hottest month on record in Iowa (Iowa State Climatologist, 2013). Soil moisture and hydrologic conditions responded accordingly. Figure 5a shows Iowa's drought status at the beginning of October (Drought Monitor, 2013). As a result of prolonged statewide

drought conditions, the sample collection window was moved to March and April of 2013. Conditions improved in late fall and winter, with the greatest improvement in the east. In early March, roughly the northwest half of the state remained in severe to extreme drought, and the southeast half was classified as moderate drought to abnormally dry (Figure 5b). Average precipitation fell in March across much of the state, and April was the wettest April on record, at almost 200% of normal; May continued this trend, and was also the wettest on record (Iowa State Climatologist, 2013). By early May, about 60% of the state was considered to have returned to normal conditions, with only a few of the northwest counties still in severe drought (Figure 5c). The transition from drought to wetter-than-average conditions prompted the re-sampling of five wells for a subset of analytes, including viruses, in June of 2013. The five wells chosen for the resampling were high-vulnerability wells and were selected to provide a wide spatial distribution while accommodating limited staff time and resources.

The wetter conditions during the spring of 2013 generated groundwater recharge. Water levels are monitored continuously in nine shallow wells distributed across the state, as part of a joint Iowa DNR – USGS Iowa Water Science Center monitoring effort. Figure 6 shows the well locations and Figure 7 shows hydrographs for eight of the nine wells from March 1, 2013, through June 20, 2013, based on data extracted from USGS (2013c). Wells in eastern Iowa, such those in Fayette and Hancock counties, show recharge occurred during the sampling period. In contrast, wells in western Iowa (Crawford and O'Brien counties) show little water table response until late in or after the sampling period.

Precipitation estimates for each sampled well location were obtained from the Iowa Mesonet, which utilizes Stage 4 analysis (Iowa Mesonet, 2013). Early in March, snow was present in parts of the state, and snowmelt was not factored into precipitation estimates. Estimated 7-day, 30-day, and 60-day antecedent precipitation totals are included in Appendix A. The 7-day totals varied from 0 to 10.5 centimeters (4.1 in), 30-day totals ranged from 1.75 to 20.2 cm (0.69 to 7.95 in), and 60-day totals ranged from 3.20 to 41.91 cm (1.26 to 16.50 in).

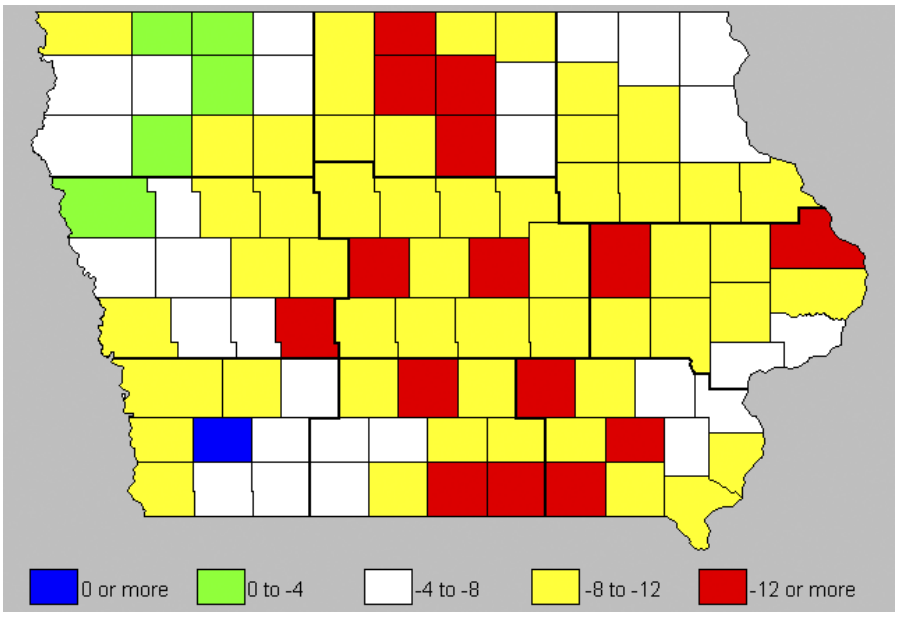

Figure 4. Estimated departure from normal precipitation by county (in inches) for 2012 (Iowa State Climatologist, 2013).

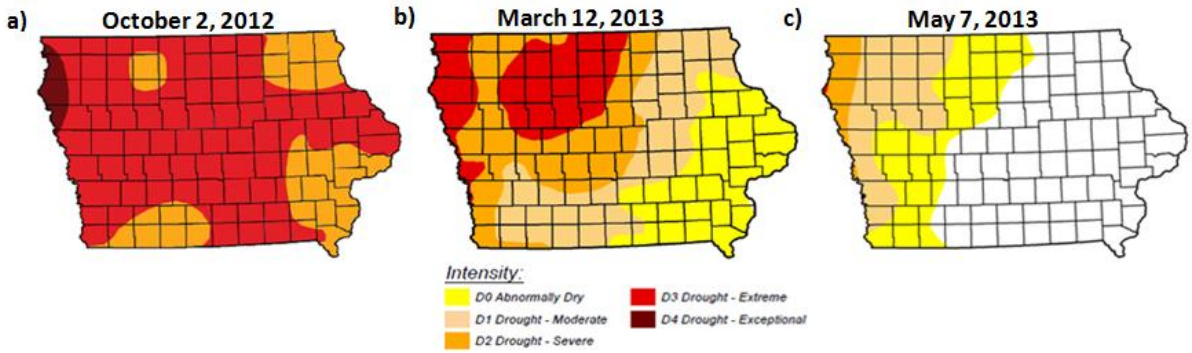

Figure 5. Drought conditions for a) October 2, 2012; b) March 12, 2013; and c) May 7, 2013 (Drought Monitor, 2013).

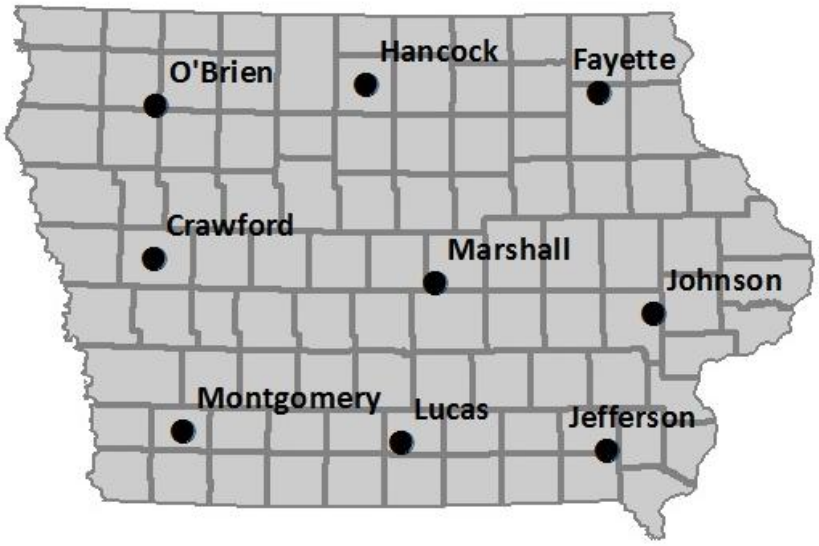

Figure 6. Locations of wells with continuous water-level monitoring as part of joint Iowa DNR – USGS efforts.

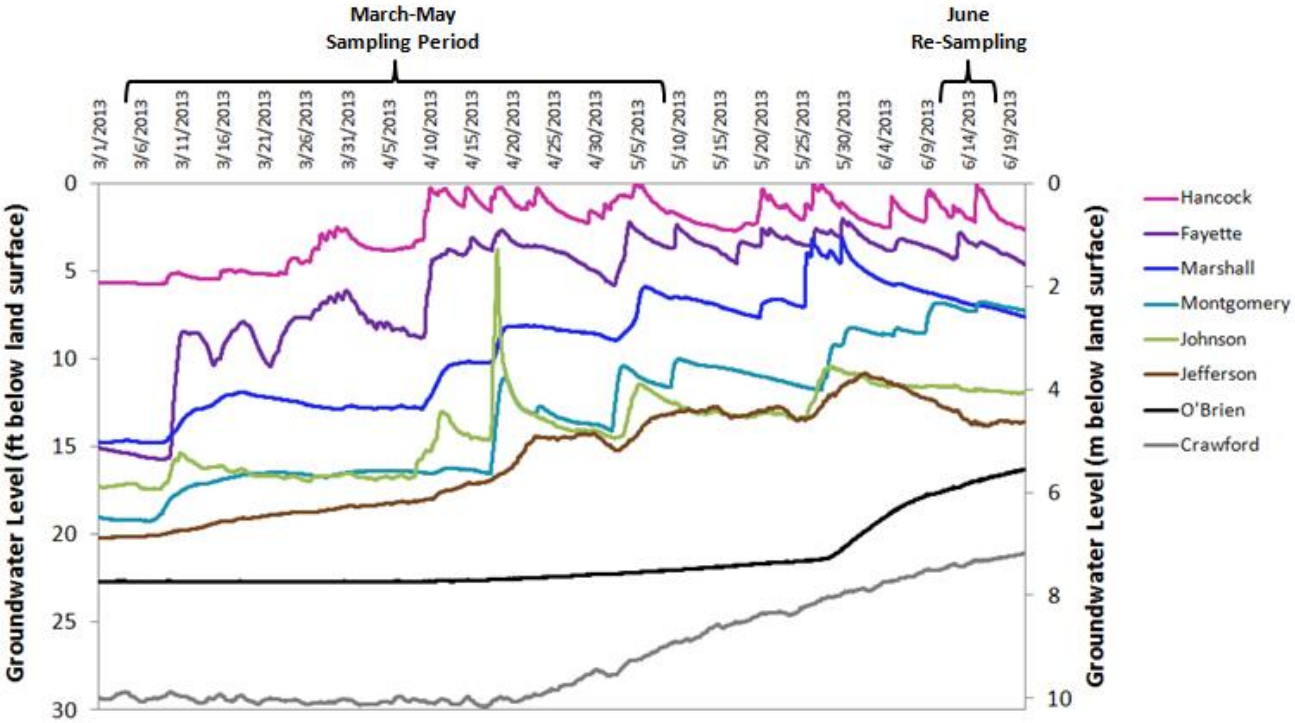

Figure 7. Hydrographs for eight shallow groundwater level monitoring wells across Iowa during the March-May and June 2013 sampling periods (from USGS, 2013c). Water table depths are displayed in feet below the surface on the left axis and meters below the surface on the right.

RESULTS

Results are summarized below by groups of parameters. For a listing of individual sample results, including quality assurance samples, refer to Appendix B.

Tritium, General Water-Quality, Major Ions, and Nutrients

Table 4 summarizes the results of tritium, general water-quality parameters, major ions, and nutrients, with basic statistical parameters and water-quality standards where applicable.

Twenty-three (46%) of 50 samples contained tritium above the 0.8 TU detection limit, with a maximum concentration of 5.5 TU and a median of detections at 4.4 TU. Standard deviations resulting from repeated analyses were reported for each sample and ranged from 0.3 to 0.6 TU. No differences in reported tritium concentrations were shown between laboratory duplicate samples as all of these analyses resulted in non-detections (< 0.8 TU).

Several of the general water quality parameters were detected at low concentrations (close to or at the quantitation limit) in the four field blanks. Total hardness was detected at a concentration of 1 mg/L in one of the four samples. Total alkalinity was detected in two of the four field blanks at concentrations of 2 and 3 mg/L. Total organic carbon was detected at 0.8 mg/L in two of the blanks. One of the blank samples contained 4 mg/L total dissolved solids, and one sample contained 1 mg/L total suspended solids. Of the major ions, only silica and bicarbonate alkalinity were detected in field blanks at 0.12 mg/L and 2 mg/L, respectively. Of the five nutrients, only total phosphorus was detected in the field blanks at a maximum concentration of 0.08 mg/L.

Results of field replicate analyses were generally consistent with those of their counterparts. The largest differences were seen for turbidity (up to 13 NTU), total Kjeldahl nitrogen as N (up to 1.8 mg/L), and orthophosphate as P with a maximum difference of 0.37 mg/L.

General water-quality characteristics of samples are illustrated using a Piper diagram (Figure 8). In general, samples from the Cambrian-Ordovician had higher proportion of sodium (Na) and potassium (K) relative to other aquifers, which contain more calcium (Ca) and magnesium (Mg). Samples from Silurian/Devonian wells generally have more bicarbonate (HCO_3), while Mississippian and Cretaceous (Dakota) wells have higher proportion of sulfate. Samples from both Cambrian-Ordovician and alluvial wells had

relatively higher proportions of chloride (Cl) than samples from other aquifers. The chemistry of water drawn from buried sand and gravel aquifers varied widely.

Ammonia was detected in 74% of the wells, while nitrate + nitrite was detected in 26% of the wells. The maximum concentration of ammonia was 6.1 mg/L, which was found in a 170 m (558 ft) deep Silurian-Devonian well with 18 m (60 ft) of confining material. The maximum concentration of nitrate + nitrite (12.0 mg/L) was found in a 32 m (105 ft) deep Silurian well with no confining materials above the aquifer. Nitrate + nitrite concentrations exceeded the drinking-water MCL for nitrate in two of 66 (3%) wells.

Metals

Table 5 summarizes the results of analyses for 19 metals, along with applicable water-quality standards and action levels. Samples were analyzed for four metals that are on the US EPA's CCL and UCMR 3 lists: chromium, cobalt, strontium, and vanadium. Of these, only strontium was detected. While all but one of the samples had detectable levels of strontium, only two of 66 (3%) exceeded the health based screening level of 4 mg/L. Of the 16 metals with current drinking water standards, eight were detected, but only three (arsenic, iron, and manganese) ever exceeded the current standards. As mentioned previously, exceedances of these standards in the sampled wells do not indicate that drinking-water standards were violated in the finished drinking water. No metals were detected in the four field blanks, and results of field replicates were consistent with their counterpart samples.

Table 4. Summary of results for tritium, general water-quality, major ions, and nutrients. Maximum contaminant levels (MCL) and secondary drinking-water standards (2nd Std) are set by the EPA (US EPA, 2013c).

	Analyte	N	% Detect-ions	Quantitation Limit	Units	Minimum	Maximum	Median of Detections	Benchmark Value	Benchmark Type	% Exceed-ances
Age	Tritium	50	46%	0.8	TU	<0.8	5.5	4.4			
General Water Quality	pH	66				6.9	7.7	7.2	6.5 - 8.5	2nd Std	0%
	Conductivity	66	100%	1.0	umho/cm	420	2300	670			
	Total Hardness	64	100%	1.0	mg/L	170	1100	320			
	Total Alkalinity	66	100%	1.0	mg/L	91	1100	280			
	Dissolved Oxygen	66	59%	0.1	mg/L	<0.1	7.4	0.5			
	Total Organic Carbon	66	94%	0.1	mg/L	<0.5	5.0	1.2			
	Total Dissolved Solids	66	100%	1.0	mg/L	250	1970	420	500	2nd Std	33%
	Total Suspended Solids	66	33%	1.0	mg/L	<1.0	46.0	3.5			
	Turbidity	66	61%	1.0	NTU	<1.0	190.0	12.5			
Major Ions	Bromide	66	2%	0.25/0.5	mg/L	<0.25	0.59	0.47			
	Chloride	66	91%	1.0	mg/L	<1.0	230	12.0	250	2nd Std	0%
	Fluoride	66	100%	0.1	mg/L	0.12	3.0	0.43	4.0	MCL	0%
									2.0	2nd Std	5%
	Sulfate	66	97%	1.0	mg/L	1.0	970.0	51.5	250	2nd Std	15%
	Silica as SiO2	66	100%	1.0	mg/L	7.4	37.0	15.5			
	Carbonate Alkalinity	66	0%	1.0	mg/L	<1.0	<1.0				
	Bicarbonate Alkalinity	66	100%	1.0	mg/L	91.0	480.0	280.0			
	Calcium (dissolved)	66	100%	1.0	mg/L	34.0	310.0	87.5			
	Magnesium (dissolved)	66	100%	0.5	mg/L	13.0	100.0	28.5			
	Potassium (dissolved)	66	97%	1.0	mg/L	<1.0	36.0	2.8			
	Sodium (dissolved)	66	100%	0.5	mg/L	2.7	280.0	16.5			
Nutrients	Ammonia as N	66	74%	0.05	mg/L	<0.05	6.1	0.64			
	Nitrate + Nitrite as N	65	26%	0.1	mg/L	<0.1	12	5.4	10	MCL*	3%
	Total Kjeldahl Nitrogen as N	66	71%	0.1	mg/L	<0.1	6.4	0.7			
	Orthophosphate as P	66	48%	0.02	mg/L	<0.02	0.78	0.05			
	Total Phosphorus as P	66	85%	0.02	mg/L	<0.02	1.6	0.06			

*Maximum contaminant level (MCL) is for Nitrate as Nitrogen.

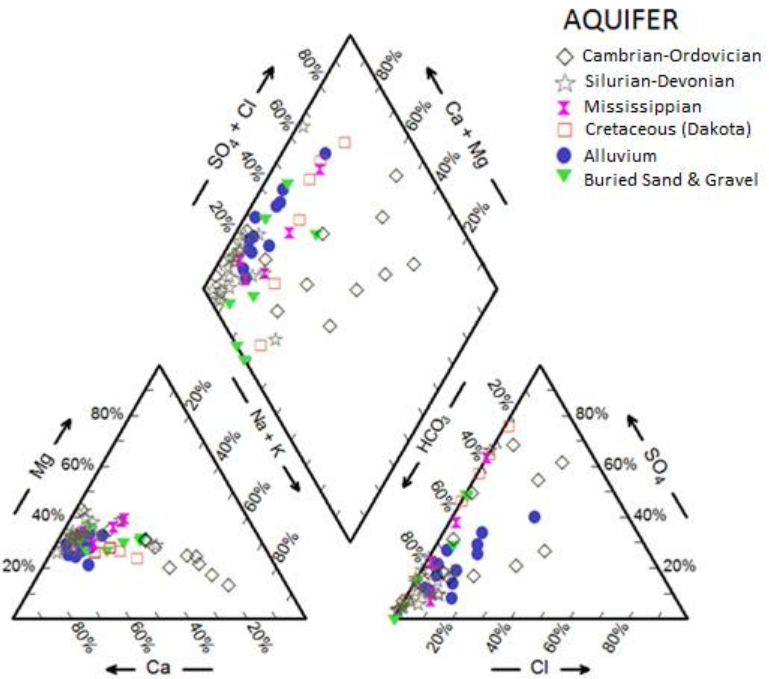

Figure 8. Basic water-quality parameters plotted on a Piper diagram by aquifer.

Table 5. Summary of the results for metal analyses, maximum contaminant levels (MCL), secondary drinking water standards (2nd Std), and action levels (US EPA, 2013c), and health-based screening levels (HBSL) (USGS, 2013b).

	Analyte	N	% Detect-ions	Detection Limit (mg/L)	Minimum (mg/L)	Maximum (mg/L)	Median of Detections (mg/L)	Benchmark Value (mg/L)	Benchmark Type	% Exceed-ances
Metals (dissolved)	Aluminum	66	0%	0.1	<0.1	<0.1		0.05-0.2	2nd Std	0%
	Antimony	66	0%	0.005	<0.005	<0.005		0.006	MCL	0%
	Arsenic	66	36%	0.001	<0.001	0.033	0.004	0.010	MCL	8%
	Barium	66	67%	0.05	<0.05	1.60	0.14	2	MCL	0%
	Beryllium	66	0%	0.002	<0.002	<0.002		0.004	MCL	0%
	Chromium*†	66	0%	0.01	<0.01	<0.01		0.1	MCL	0%
	Cobalt*†	66	0%	0.05	<0.05	<0.05				
	Copper	66	0%	0.01	<0.01	<0.01		1.3	Action Level	0%
	Iron	66	80%	0.02	<0.02	16.00	0.50	0.3	2nd Std	47%
	Lead	66	3%	0.001	<0.001	0.011	0.007	0.015	MCL	0%
	Manganese	66	50%	0.02	<0.02	1.20	0.09	0.05	2nd Std	0%
	Nickel	66	0%	0.05	<0.05	<0.05		0.1	HBSL	0%
	Selenium	66	5%	0.01	<0.01	0.01	0.01	0.05	MCL	0%
	Strontium*†	66	98%	0.02	<0.02	8.50	0.42	4	HBSL	3%
	Thallium	66	0%	0.001	<0.001	<0.001		0.002	MCL	0%
	Titanium	66	0%	0.05	<0.05	<0.05				
	Uranium	66	21%	0.001	<0.001	0.016	0.003	0.03	MCL	0%
	Vanadium*†	66	0%	0.05	<0.05	<0.05				
	Zinc	66	9%	0.02	<0.02	0.07	0.03	5	2nd Std	0%

Analytes with one or more detections are listed in **bold**
* = analyte on Contaminant Candidate List (US EPA, 2013a)
† = analyte on Unregulated Contaminant Monitoring Rule 3 List (US EPA, 2013b)

Pesticides and Pesticide Degradates

Samples were analyzed for 24 pesticides (herbicides and insecticides), and 11 pesticide degradates as summarized in Table 6. Pesticide compounds were present in 41% of the samples. Of the 24 parent compounds, only atrazine and dimethanamid were detected. Atrazine was not detected above the 0.1 µg/L detection limit reported by SHL, whereas analyses at a detection limit of 0.0194 µg/L, included in the suite of chemicals analyzed by the USGS laboratory in Denver, CO, produced 13% detections. Glyphosate, AMPA, and glufosinate were analyzed in 63 of the 66 wells by USGS using a method with a detection limit of 0.02 µg/L (Meyer et al., 2009). Glyphosate and glufosinate were not present in any samples at or above that concentration, and AMPA was present at the quantitation limit (0.02 µg/L) in two of 63 samples (3%). None of the pesticide compounds were detected in field blanks, and differences between original samples and field replicates were always smaller than the applicable method detection limit.

Pesticide degradate occurrence was higher than that of the parent compounds for pesticides with comparable detection limits. Acetanilide degradate detections included acetochlor ESA (20%), acetochlor OXA (8%), alachlor ESA (29%), alachlor OXA (5%), dimethenamid ESA (2%), metolachlor ESA (41%), and metolachlor OXA (14%). OXA degradates of these acetanilide herbicides generally occurred less frequently than the ESA degradates. None of the pesticides or pesticide degradates exceeded the health based screening levels (HBSLs) (USGS, 2013b), or the maximum contaminant levels (MCLs) or human health benchmarks for pesticides (HHBPs) set by the US EPA (US EPA, 2013c; US EPA, 2014b). Figure 9 illustrates the occurrence and distribution of concentrations for pesticide detections. Metolachlor ESA was both the most frequently detected pesticide and also the pesticide with the highest measured concentrations. All but two samples had pesticide concentrations below 1 μg/L, and medians of the concentrations of positive detections were below 0.1 μg/L, except for metolachlor ESA (0.23 μg/L) and alachlor ESA (0.12 μg/L). Co-occurrence of pesticide compounds (i.e., mixtures of pesticide degradates and parent compounds) was common. Twenty-three of the 27 samples with a pesticide detection had more than one pesticide compound present and as many as 6 chemicals measured in a single sample (Figure 10). Metolachlor ESA was present in all samples with pesticide detections.

Table 6. Summary of results for pesticides and their degradates along with benchmark values where available. Detected compounds are highlighted in bold, and degradates are indented below their parent compound. Health-based screening levels (HBSL) are listed by the U.S. Environmental Protection Agency (US EPA, 2013c; US EPA, 2014b).

	Analyte	N	% Detect-ions	Detection Limit (µg/L)	Minimum (µg/L)	Maximum (µg/L)	Median of Detections (µg/L)	Benchmark Value (µg/L)	Benchmark Type	% Exceed-ances
Pesticides and Pesticide Degradates	Acetochlor*	66	0%	0.025	<0.025	<0.025		1	HBSL	0%
	Acetochlor ESA*	66	20%	0.025	<0.025	0.240	0.058	600	HBSL	0%
	Acetochlor OXA*	66	8%	0.025	<0.025	0.290	0.082	200	HBSL	0%
	Alachlor	66	0%	0.025	<0.025	<0.025		2	MCL	0%
	Alachlor ESA*	66	29%	0.025	<0.025	0.780	0.120	100	HBSL	0%
	Alachlor OXA*	66	5%	0.025	<0.025	0.110	0.046	100	HBSL	0%
	Ametryn	66	0%	0.1	<0.1	<0.1				
	Atrazine	66	0%	0.1	<0.1	<0.1		3	MCL	0%
	Atrazine‡	60	13%	0.02	<0.02	0.13	0.04	3	MCL	0%
	Desethyl Atrazine	66	0%	0.1	<0.1	<0.1				
	Deisopropyl Atrazine	66	0%	0.1	<0.1	<0.1				
	Bromacil	66	0%	0.1	<0.1	<0.1				
	Butachlor	66	0%	0.1	<0.1	<0.1				
	Butylate	66	0%	0.1	<0.1	<0.1				
	Carbaryl	66	0%	0.1	<0.1	<0.1		40	HBSL	0%
	Carbofuran	66	0%	0.1	<0.1	<0.1		40	MCL	0%
	Clomazone	66	0%	0.1	<0.1	<0.1		5880	HHBP	0%
	Cyanazine	66	0%	0.1	<0.1	<0.1		1	HBSL	0%
	Dimethenamid	66	2%	0.025	<0.025	0.03	0.03	350	HHBP	0%
	Dimethenamid ESA	66	2%	0.025	<0.025	0.035	0.035			
	Dimethenamid OXA	66	0%	0.025	<0.025	<0.025				
	EPTC	66	0%	0.1	<0.1	<0.1		350	HHBP	0%
	Glyphosate‡	63	0%	0.02	<0.02	<0.02		700	MCL	0%
	Aminomethylphosphonic acid (AMPA)‡	63	3%	0.02	<0.02	0.02	0.02			
	Glufosinate‡	63	0%	0.02	<0.02	<0.02				
	Metolachlor*	66	0%	0.025	<0.025	<0.025		700	HBSL	0%
	Metolachlor ESA*	66	41%	0.025	<0.025	1.200	0.230			
	Metolachlor OXA*	66	14%	0.025	<0.025	0.190	0.059			
	Metribuzin	66	0%	0.1	<0.1	<0.1		90	HBSL	0%
	Pendimethalin	66	0%	0.1	<0.1	<0.1		210	HHBP	0%
	Prometon	66	0%	0.1	<0.1	<0.1		400	HBSL	0%
	Propachlor	66	0%	0.1	<0.1	<0.1				
	Propazine	66	0%	0.1	<0.1	<0.1				
	Simazine	66	0%	0.1	<0.1	<0.1		4	MCL	0%
	Triallate	66	0%	0.1	<0.1	<0.1		175	HHBP	0%
	Trifluralin	66	0%	0.1	<0.1	<0.1				

Analytes with one or more detections are listed in **bold**

* Listed on the US EPA's Contaminant Candidate List (US EPA, 2013a)

‡ Analyzed by the U.S. Geological Survey (all other pesticides analyzed by the State Hygienic Laboratory of Iowa)

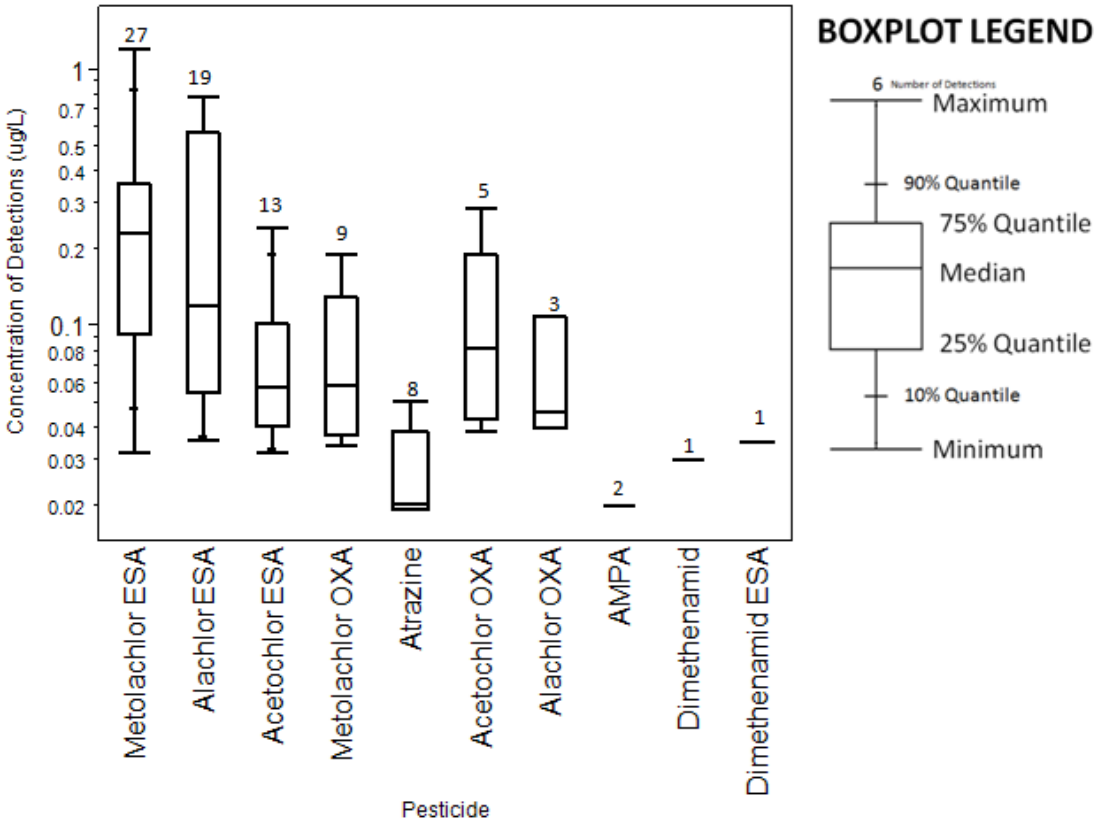

Figure 9. Boxplots representing distributions of concentration for pesticides and pesticide degradates with non-detections excluded. As the legend illustrates, the line inside the box represents the median of the detections, 50% of the data lie within the box, short lines on the whiskers indicate the bounds of 90% of the data, and the numbers of detections are displayed above.

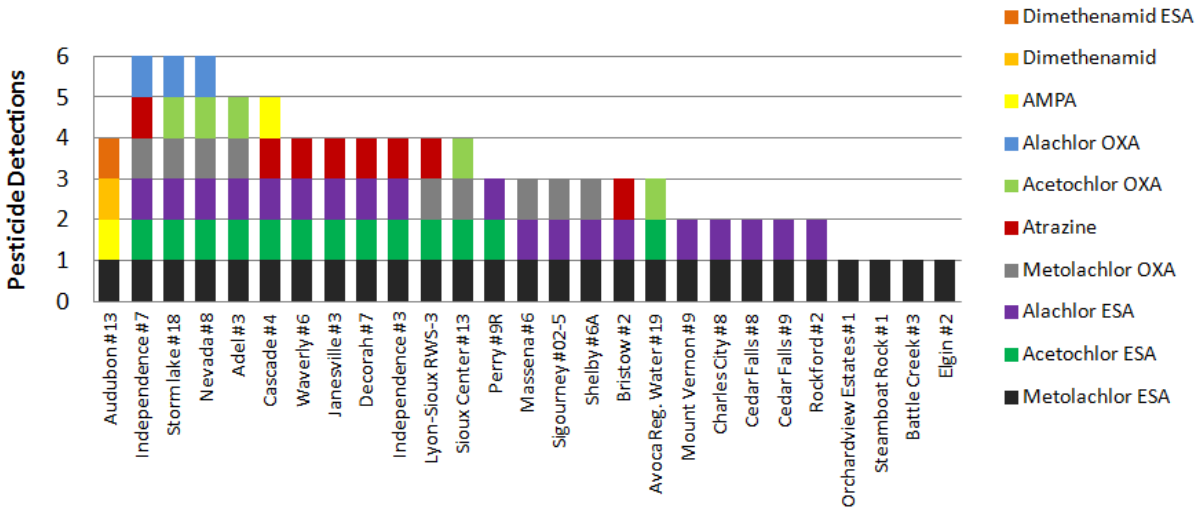

Figure 10. Co-occurrence of pesticide detections by location.

Pharmaceuticals

Samples for pharmaceutical analyses were taken from 60 of the 66 wells during the March-May sampling period. Of the five wells sampled in June, two were obtained for the first time, and three were resampled from wells sampled during the March-May period. A total of 63 samples were collected from 60 wells. Samples were analyzed for 109 individual pharmaceutical compounds. Pharmaceuticals were detected in 22 (35%) of 63 samples, including two wells that had no detections of pharmaceuticals during the March-May sampling, but did have detections during the June sampling period. Table 7 summarizes the results of detected pharmaceuticals and lists their common name or use. A full list of pharmaceutical results can be found in Appendix B.

Table 7. Summary of results for detected pharmaceuticals. Confirmed detections below the method reporting limit are designated by "det." Metabolites are indented under their parent compounds.

	Analyte	N	% Detections	Method Reporting Limit	Minimum	Maximum	Use/Common Name
				ng/L			
Pharmaceuticals	acetaminophen	63	2%	7.13	< 7.13	826	analgiesic
	atenolol*	63	2%	13.3	< 13.3	det	hypertension
	caffeine	63	25%	90.7	< 90.7	173	stimulant
	1,7-dimethylxanthine	63	16%	87.7	< 87.7	det	caffeine metabolite
	carisoprodol	63	2%	12.5	< 12.5	det	muscle relaxant
	chlorpheniramine	63	2%	4.68	< 4.68	det	antihistamine
	diphenhydramine	63	3%	5.79	< 5.79	145	antihistamine
	lidocaine	63	8%	15.2	< 15.2	48.6	anesthetic
	nicotine	63	2%	57.8	< 57.8	det	stimulant
	cotinine	63	2%	6.37	< 6.37	det	nicotine metabolite
	sulfamethoxazole	63	2%	26.1	< 26.1	det	antibiotic
	thiabendazole	63	2%	4.1	< 4.1	127	fungicide/parasiticide
	tramadol*	63	2%	15.1	< 15.1	det	narcotic
	warfarin	63	2%	6.03	< 6.03	7.78	anticoagulant

* Atenolol and tramadol were detected during the June resampling period, but not during the March-May sampling period.

Of the 14 pharmaceuticals detected, six had reported concentrations above the method reporting limit, with the maximum reported concentration of any pharmaceutical at 826 ng/L (acetaminophen). Diphenhydramine was the only pharmaceutical to have two detections above the reporting limit, at 24.5 and 145 ng/L. Eight pharmaceuticals had confirmed detections at concentrations below the method reporting limit (reported as "det" in Table 7). Caffeine was the most frequently detected compound (25% detection frequency; maximum concentration 173 ng/L), followed by the caffeine metabolite, 1,7-dimethylxanthine (16% detection frequency) (Figure 11).

Most of the pharmaceuticals detected have specific human uses (1,7-dimethylxanthine, acetaminophen, atenolol, caffeine, carisoprodol, chlorpheniramine, cotinine,

diphenhydramine, nicotine, sulfamethoxazole, and tramadol). Some, however, have multiple uses. Thiabendazole has both human pharmaceutical uses (used to treat parasitic worms; Kappagoda et al., 2011) and human commercial uses as a preservative, but it is also commonly used as fungicide, and is increasingly used as a seed coating on soybeans (US EPA, 2002). Warfarin is used as both a rodenticide and as an anticoagulant used in heart medication (US EPA, 1991). Lidocaine is an anesthetic commonly used in anti-itch creams, and there are reports of lidocaine use in cattle operations (Duffield et al., 2010). Multiple pharmaceuticals were detected in 13 (21%) of the 63 samples (Figure 12), with up to four pharmaceuticals present in a single sample. Nine samples had one pharmaceutical detection, including two wells that had detections during the June sampling period, but not the March-May sampling period.

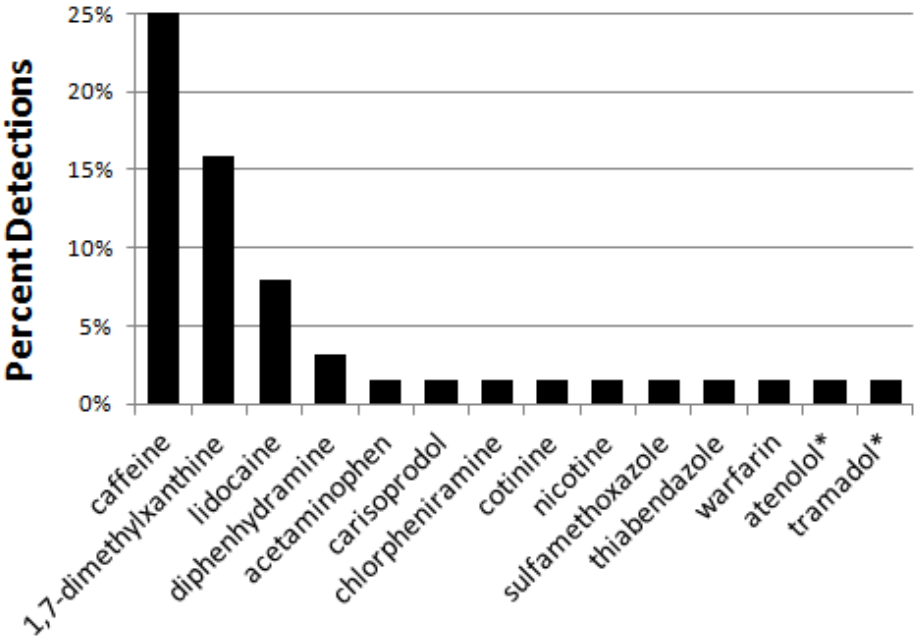

Figure 11. Occurrence of pharmaceuticals detected in study wells. *Atenolol and tramadol were detected during the June resampling period, but not during the March-May sampling period.

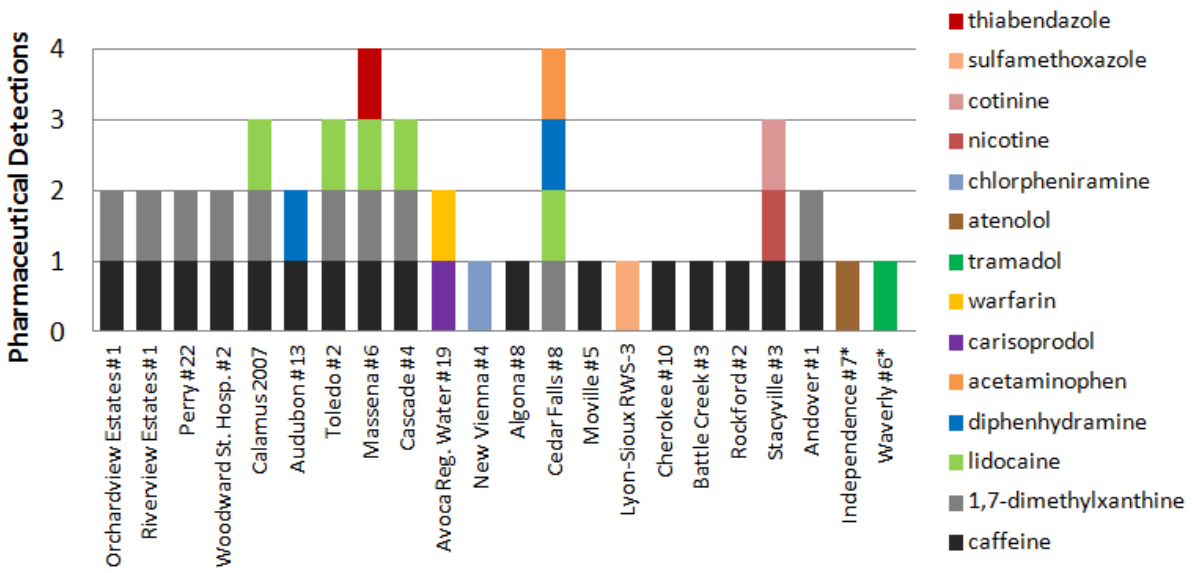

Figure 12. Pharmaceutical occurrence by well in chronological order of sampling. *Indicates communities where the pharmaceuticals were detected during the June resampling period.

Microbial Indicators

Five microbial indicators were analyzed in all 66 samples from the initial sampling period (Table 8). Male specific coliphage and enterococci bacteria were each detected once out of 66 samples (2%) and total coliform bacteria were detected in two of 66 samples (3%) during the initial sampling. During the resampling period, samples were only analyzed for *E. coli*, enterococci, and total coliform. Of the five samples from this period, total coliform bacteria were detected in one sample at a concentration of 4.1 MPN/100 ml. Somatic coliphage and *E. coli* were never detected.

Table 8. Summary of results for microbial indicator analyses. Items listed in bold have one or more detections.

	Analyte	N	% Detect-ions	Detection Limit	Units	Minimum	Maximum
Microbial Indicators	**Coliphage Male Specific**	66	2%	1.0	PFU/100mL	< 1.0	3.0
	Coliphage Somatic	66	0%	1.0	PFU/100mL	< 1.0	< 1.0
	E. coli	66	0%	1.0	MPN/100ml	< 1.0	< 1.0
	Enterococci	66	2%	1.0	MPN/100ml	< 1.0	1.0
	Total Coliform Bacteria	66	3%	1.0	MPN/100ml	< 1.0	1.0*

*Total coliform bacteria were measured at 4.1 MPN/100ml in one sample obtained in June.

Viruses and Pathogenic Bacteria

The results of qPCR analyses for ten virus groups and three human pathogenic bacteria are shown in Table 9. Sample volumes ranged from 392 to 1107 L, with a median value of 1003 L, and a mean of 953 L. Volumes less than 1000 L were obtained from wells when the flow rate through the filter dropped below 4 L per minute. Virus concentrations ranged from 0.46 to 6.38 copies/L. None of the wells had detections of more than one microbial species using qPCR. Fourteen of the 66 samples (21%) from the initial sampling period had viral nucleic acid detections, and only one sample (2%) tested positive for bacterial DNA. Adenoviruses, enteroviruses, GI noroviruses, swine hepatitis E, *Salmonella*, and enterohemorrhagic *E. coli* were not detected in any of the samples. Three wells (5% of samples) were positive for human pathogens; two viruses, the GII norovirus (4.23 copies/L) and human polyomavirus (3.07 copies/L), and one species of bacteria, *Campylobacter jejuni* (0.40 genomic copies/L). One sample (2%) was positive for RNA from the animal pathogen, bovine polyomavirus, at a concentration of 0.46 genomic copies/L. All controls were in compliance; negative controls showed no quantification cycle measure (i.e., zero fluorescence increase) and positive controls had Cq (concentration quantification) values ± 0.5 cycles within their reference controls. No viruses or bacterial pathogens were detected in the three field equipment blanks.

Pepper Mild Mottle Virus (PMMV) was the most prevalent virus, detected in 11 of 66 samples (17%), with a maximum concentration of 6.38 copies/L, and a median of positive detections of 4.28 genomic copies/L. No PMMV or the other microbes were detected in samples collected in June. Of the five resampled wells, two were positive for PMMV during the initial sampling period. There was no co-occurrence of microbial indicators and microorganisms detected by qPCR, with the exception of one well (Janesville #3), where male specific coliphage was detected in the same sample as PMMV (Figure 13).

Recovery controls using poliovirus, *Campylobacter* jejuni, and *Giardia lamblia* spiked into water from four wells yielded percent recovery ranges of 13%-102%, 23%-105%, and 22%-72%, respectively. Given that some matrix recovery rates were below 50% and filter recoveries were usually less than 100%, reported concentrations are conservative estimates.

Table 9. Summary of the results for virus and pathogenic bacteria analyses by qPCR. The theoretical limits of detection (LOD) as defined by Wittwer and Kusawaka (2004) were modified using an assumed sample volume of 1000 L and defined by a 95% probability of detection. Concentrations reported below these LODs have lower probabilities of detection.

	Analyte	N	% Detections	Theoretical Limit of Detection	Maximum Reported Value
				genomic copies/L	
Viruses & Pathogens by qPCR	Adenovirus C,D,F	66	0%	3.0	ND
	Adenovirus A	66	0%	3.0	ND
	Adenovirus B	66	0%	3.0	ND
	Enterovirus*†	66	0%	3.0	ND
	GI Norovirus*†	66	0%	3.0	ND
	GII Norovirus*†	66	2%	3.0	4.23
	Human Polyomavirus	66	2%	3.0	3.07
	Hepatitis E Virus	66	0%	3.0	ND
	Bovine Polyomavirus	66	2%	3.0	0.46
	PMMV	66	17%	3.0	6.38
	Campylobacter*	66	2%	0.54	0.40
	Salmonella*	66	0%	0.54	ND
	Enterohemorrhagic *E. coli*	66	0%	0.54	ND

Analytes with one or more detections are listed in **bold**
* = analyte on Contaminant Candidate List (US EPA, 2013a)
† = analyte on Unregulated Contaminant Monitoring Rule 3 List (US EPA, 2013b)

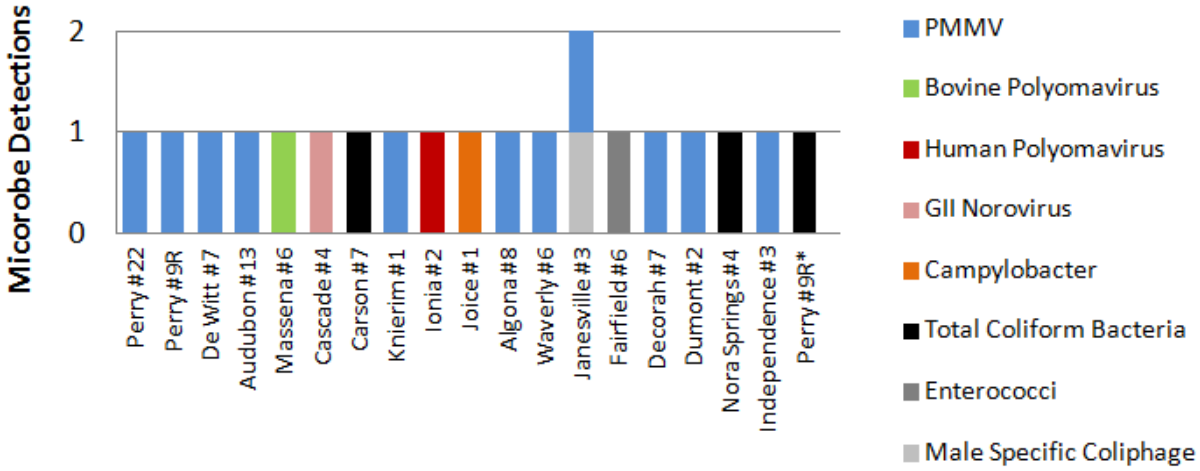

Figure 13. Microbe detections in chronological order of sampling. Well samples and microbes with no detections are not shown. *The asterisk indicates a well sampled during the June resampling period.

Correlations Between Analytes

Spearman's rank correlation analyses between analyte concentrations were performed to determine how commonly measured groundwater-quality parameters relate to each

other and to concentrations and/or numbers of CECs. Table 10 displays results of these analyses for selected analytes.

In general, concentrations of surface-derived analytes, including tritium, DO, chloride, nitrate, atrazine, and acetanilide degradates, were positively correlated to each other and negatively correlated to analytes considered to be naturally-derived, such as arsenic and ammonia. All Spearman's rho (ρ) correlation coefficients between tritium concentrations and nitrate + nitrite and pesticides/degradates were greater than 0.05, and significant at $p < 0.001$ or 0.0001. Correlation coefficients between chloride and nitrate + nitrite and pesticides/degradates were less than 0.5, and were generally less significant. None of the commonly measured parameters significantly correlated to CECs with the exception of atrazine, which correlated significantly to concentrations of PMMV and to the number of microbe detections using qPCR.

Strontium was the only metal listed on the UCMR3 list to be detected. Strontium showed a significant positive correlation with TDS, turbidity, fluoride, and ammonia as nitrogen, and significant negative correlations with the surface-indicators: tritium, dissolved oxygen, and nitrate.

Detection frequency of individual microbial indicators was too low to run correlation analyses. Instead, the total number of microbial indicators per sample was used for analysis. No significant correlation was seen between turbidity and the number of microbial indicators tested. The sample with the maximum turbidity value of 190 NTU did have the only reported detection of bovine polyomavirus; however, the reported concentration of this virus was below the theoretical limit of detection.

A closer look at the data confirms the usefulness of certain indicators for predicting whether nitrate and pesticide degradates will be present in raw groundwater. Fifty percent of wells with detectable tritium levels (indicating recent recharge) contained nitrate. Only one well without detectable tritium levels contained nitrate + nitrite (4%). Tritium was an even better predictor of the occurrence of acetanilide degradates, which occurred in 86% of the tritium-positive samples and only 4% of the tritium-negative samples. Combining tritium and DO revealed even stronger prediction of occurrence of these contaminants. One hundred percent of oxic (>0.5 mg/L DO) wells with detectable tritium contained detectable levels of both nitrate + nitrite and pesticide degradates. Only two (17%) of the 12 anoxic tritium-positive samples contained nitrate + nitrite, and these were the only two samples where ammonia and nitrate + nitrite co-occurred.

Redox conditions are also likely to play an important role in determining whether or not dissolved arsenic is present in samples. As shown in Figure 14, the five samples

that exceeded the MCL for arsenic occurred in anoxic waters (less than 0.5 mg/L dissolved oxygen).

Table 10. Spearman's rho correlation coefficients resulting from one-to-one correlation analyses between analyte concentrations and detection counts for select contaminant groups.

	Analyte or Analyte Group	Tritium	pH	TOC	TDS	TSS	Turbidity	DO	Cl	F	NH_4-N	NO_x-N	PO_4-P	As	ATZ
General WQ, Ions, & Nutrients	pH	-0.16													
	Total Organic Carbon (TOC)	-0.06	-0.28												
	Total Dissolved Solids (TDS)	-0.26	-0.33*	0.31											
	Total Suspended Solids (TSS)	0.09	-0.29	0.57***	0.29										
	Turbidity	-0.16	-0.20	0.56***	0.27	0.79***									
	Dissolved Oxygen (DO)	0.22	0.05	-0.26	-0.08	-0.44**	-0.59***								
	Chloride (Cl)	0.49**	-0.03	-0.12	0.22	-0.07	-0.15	0.19							
	Fluoride (F)	-0.45*	-0.47	0.23	0.41**	0.07	0.27	-0.27	-0.10						
	Ammonia as N (NH_4-N)	-0.62***	0.03	0.55***	0.45**	0.42**	0.60***	-0.50***	-0.23	0.53***					
	Nitrate + Nitrite as N (NO_x-N)	0.58***	0.05	-0.26	-0.12	-0.29	-0.51***	0.63***	0.27	-0.52***	-0.60***				
	Orthophosphate as P (PO_4-P)	0.14	0.01	0.45**	0.09	0.42**	0.36*	-0.11	0.03	-0.24	0.07	0.15			
Metals	Arsenic (As)	0.07	-0.14	0.45**	0.01	0.66***	0.66***	-0.44**	-0.20	0.12	0.29	-0.34*	0.24		
	Barium	0.24	-0.06	0.21	-0.48***	0.16	0.09	-0.10	-0.21	-0.33*	-0.16	0.11	0.30	0.20	0.20
	Iron	-0.16	-0.12	0.50***	0.22	0.80***	0.92***	-0.64***	-0.11	0.28	0.58***	-0.56***	0.37*	0.65***	0.65***
	Manganese	0.19	-0.40**	0.43**	0.20	0.75***	0.60***	-0.34*	-0.09	-0.08	0.15	-0.17	0.50***	0.58***	0.58***
	Strontium	-0.60***	0.01	0.23	0.56***	0.14	0.32*	-0.38*	-0.06	0.81***	0.69***	-0.50***	-0.13	0.01	0.01
	Uranium	0.39*	-0.42**	0.08	0.22	0.10	-0.13	0.26	0.17	-0.15	0.33*	0.39*	0.19	0.08	0.08
Pesticides & Degs	Atrazine (ATZ)	0.59***	0.14	-0.29	-0.18	-0.24	-0.36*	0.38*	0.30	-0.50***	-0.43**	0.51***	-0.14	-0.23	
	Acetochlor ESA	0.72***	-0.07	0.07	0.00	0.14	-0.06	0.16	0.47***	-0.35*	-0.35*	0.34*	0.09	-0.01	0.60***
	Alachlor ESA	0.70***	0.07	-0.16	-0.39*	0.09	-0.04	0.02	0.26	-0.45**	-0.38*	0.28	-0.05	0.09	0.56***
	Metolachlor ESA	0.86***	-0.02	-0.04	-0.31	0.03	-0.19	0.27	0.43**	-0.45**	-0.53***	0.53***	0.10	-0.02	0.47**
	Metolachlor OXA	0.51**	-0.25	0.27	0.03	0.38*	0.25	-0.21	0.36*	-0.16	-0.03	0.07	0.31	0.24	0.12
	Sum of acetanilide metabolites	0.86***	0.00	-0.07	-0.32*	0.04	-0.19	0.24	0.43**	-0.48***	-0.54***	0.51***	0.08	-0.01	0.51***
	Number of pesticide detections	0.88***	-0.03	-0.07	-0.30	0.05	-0.18	0.23	0.45**	-0.49***	-0.54***	0.51***	0.11	0.00	0.57***
	Number of microbial indicators	-0.13	0.07	0.00	0.01	-0.10	-0.19	0.11	0.12	0.05	0.04	0.03	-0.01	-0.19	0.08
CECs	Pepper mild mottle virus (PMMV)	0.20	0.10	0.03	0.09	0.01	0.01	0.08	0.09	-0.16	-0.11	0.16	0.02	-0.04	0.32
	Number of microbe detections	0.15	0.00	0.09	-0.03	0.04	0.06	0.14	0.03	-0.23	-0.11	0.15	0.03	0.03	0.38*
	Sum of pharmaceuticals	-0.04	-0.05	-0.03	-0.08	-0.10	-0.03	-0.01	-0.01	0.05	-0.02	-0.02	0.01	0.03	-0.09
	Number of pharmaceuticals	0.00	-0.03	-0.01	-0.11	-0.09	-0.02	0.00	0.00	0.07	-0.03	-0.02	0.02	0.04	-0.08

Items in bold and shaded in gray are significant at P<0.05, *P<0.01, **P<0.001, ***P<0.0001

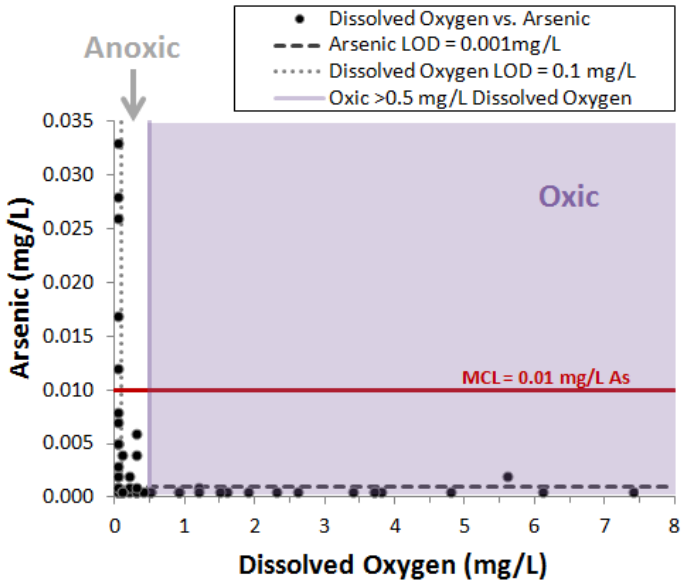

Figure 14. Dissolved oxygen concentrations vs. arsenic concentrations for study wells. Dashed and dotted lines indicate limits of detection (LOD) for dissolved oxygen and arsenic, respectively.

Relationships Between Well Characteristics and Contaminants

Numerical and contingency analyses were performed to determine whether characteristics of each well, or conditions around the well, could be used to predict well water quality. The results of Spearman's rank correlation analyses for numerical well characteristics and measured concentrations of selected analytes are presented in Table 11. Significant negative correlations indicate that as confining layer thickness increases, concentrations of surface-derived analytes, including tritium, nitrate + nitrite, orthophosphate, total phosphorus, atrazine, and the sum of acetanilide degradates, tend to decrease. Conversely, significant positive correlations show that as confining layer thickness increases, concentrations of naturally derived analytes, including ammonia and strontium, tend to increase. Similar results were seen for well depth, although orthophosphate, total phosphorus, barium, and manganese showed stronger negative correlations with well depth than with confining layer thickness. Results indicate that more recently drilled wells had lower concentrations of nitrate + nitrite and atrazine, but higher turbidity, iron, and manganese values. Higher pumping rates were significantly positively correlate to some, but not all indicators of surface influence, including tritium, chloride, and two of the acetanilide degradates. None of the well characteristics showed significant correlation with PMMV concentrations, the number of microbial indicators, the total number of microbes detected by qPCR, the sum of pharmaceutical concentrations, or the number of pharmaceutical detections. Negative correlations were observed between the antecedent precipitation estimates and a variety of both natural and surface-derived water-quality parameters.

Testing the Vulnerability Classification Scheme

A major objective of this study was to test whether the vulnerability classes (low, intermediate, and high), as defined by confining layer thickness, effectively predicted surface-related contamination, including CECs.

Significant differences were seen for concentrations of tritium and nitrate + nitrite in high vulnerability wells compared to low and intermediate vulnerability wells (Figure 15). Statistical differences between vulnerability classes were not seen for DO concentrations; however, the median DO value was higher (1.5 mg/L) for the high vulnerability class compared to the intermediate (0.5 mg/L) and low (0.3 mg/L) vulnerability classes. Ammonia concentrations were significantly higher in low vulnerability wells than in intermediate or high vulnerability wells.

Results of the contingency analysis showed significant differences ($p < 0.001$) in detection frequencies between vulnerability classes for both nitrate + nitrite and the pesticide and degradates group (Figure 16). Differences between vulnerability categories were not significant for microbial indicators, pharmaceuticals, or the viruses and bacterial pathogens group.

Statistical analysis revealed significantly higher concentrations of four of the five most commonly detected pesticides/degradates in high vulnerability wells compared to intermediate and low vulnerability wells, and no differences between low and intermediate vulnerability wells (Figure 17). Metolachlor OXA showed significantly higher concentrations in high vulnerability wells than low vulnerability wells.

Table 11. Spearman's correlation coefficient (rho) for selected water-quality parameters vs. numerical well characteristics and antecedent 7-, 30-, and 60-day precipitation totals.

		Well Characteristics				Antecedent Precipitation		
	Analytes and Analyte Groups	Confining Layer Thickness	Depth	Age (Year Drilled)	Pumping Rate	7-Day	30-Day	60-Day
	Tritium	**-0.69*** **	**-0.72*** **	-0.11	**0.26**	0.04	-0.09	-0.06
General Water Quality	pH	0.03	0.21	-0.20	0.19	0.01	0.23	**0.35***
	Total Hardness	0.19	-0.03	-0.13	-0.08	-0.15	**-0.39***	**-0.39***
	Total Alkalinity	**0.27**	-0.02	-0.03	-0.19	-0.06	**-0.39***	**-0.42***
	Total Organic Carbon	0.11	**-0.28**	0.18	-0.09	**-0.25**	**-0.58*** **	**-0.62*** **
	Turbidity	0.02	-0.14	**0.31**	0.02	0.15	-0.22	-0.21
	Dissolved Oxygen	-0.13	-0.06	-0.18	-0.14	-0.22	-0.03	-0.04
	Chloride	-0.19	-0.11	0.01	**0.29**	-0.09	-0.07	-0.03
Nutrients	Ammonia as N	**0.60*** **	**0.33***	0.15	0.02	0.09	0.01	-0.05
	Nitrate + Nitrite as N	**-0.49*** **	**-0.41** **	**-0.35***	0.12	-0.05	-0.06	-0.01
	Total Kjeldahl Nitrogen	**0.48*** **	0.17	0.09	0.02	0.02	-0.07	-0.12
	Orthophosphate as P	**-0.25**	**-0.49*** **	-0.07	-0.12	-0.04	**-0.41** **	**-0.39***
	Total Phosphorus	**-0.26**	**-0.52*** **	0.00	-0.02	0.15	**-0.25**	-0.22
Metals	Arsenic	0.14	**-0.29**	0.12	0.09	0.06	**-0.24**	-0.20
	Barium	**-0.33***	**-0.44** **	0.09	-0.04	0.08	-0.03	-0.05
	Iron	0.19	-0.13	**0.30**	0.00	0.16	-0.17	-0.14
	Manganese	-0.14	**-0.55*** **	**0.28**	-0.08	0.15	**-0.46** **	**-0.42** **
	Strontium	**0.62*** **	**0.42** **	0.14	0.04	-0.01	0.12	0.02
	Uranium	**-0.32***	**-0.31**	-0.08	-0.04	0.00	**-0.35***	**-0.32***
Pesticides	Atrazine	**-0.37***	-0.20	**-0.25**	0.20	-0.11	-0.02	0.05
	Acetochlor ESA	**-0.53*** **	**-0.46** **	0.01	**0.31**	-0.15	**-0.30**	**-0.28**
	Alachlor ESA	**-0.45** **	**-0.35***	-0.04	**0.37***	-0.02	0.04	0.08
	Metolachlor ESA	**-0.64*** **	**-0.58*** **	-0.12	0.24	-0.07	-0.10	-0.04
	Metolachlor OXA	**-0.31**	**-0.46*** **	0.18	0.16	0.07	**-0.25**	-0.20
	Sum of acetanilide metabolites	**-0.64*** **	**-0.56*** **	-0.11	**0.27**	-0.06	-0.09	-0.04
	Number of pesticides	**-0.64*** **	**-0.60*** **	-0.10	0.22	-0.02	-0.11	-0.06
	Number of microbial indicators	0.04	0.04	0.17	0.01	-0.19	0.02	-0.01
CECs	PMMV	-0.15	-0.21	-0.09	0.06	-0.10	-0.13	-0.09
	Number of microbes detected by qPCR	-0.18	-0.11	0.00	0.09	-0.09	-0.09	-0.13
	Number of pharmaceuticals	0.02	-0.08	0.03	-0.10	-0.01	-0.06	-0.14
	Sum of pharmaceuticals	0.04	-0.05	-0.01	-0.09	-0.01	-0.09	-0.14

Items in bold with gray shading are significant at P<0.05, *P<0.01, **P<0.001, ***P<0.0001

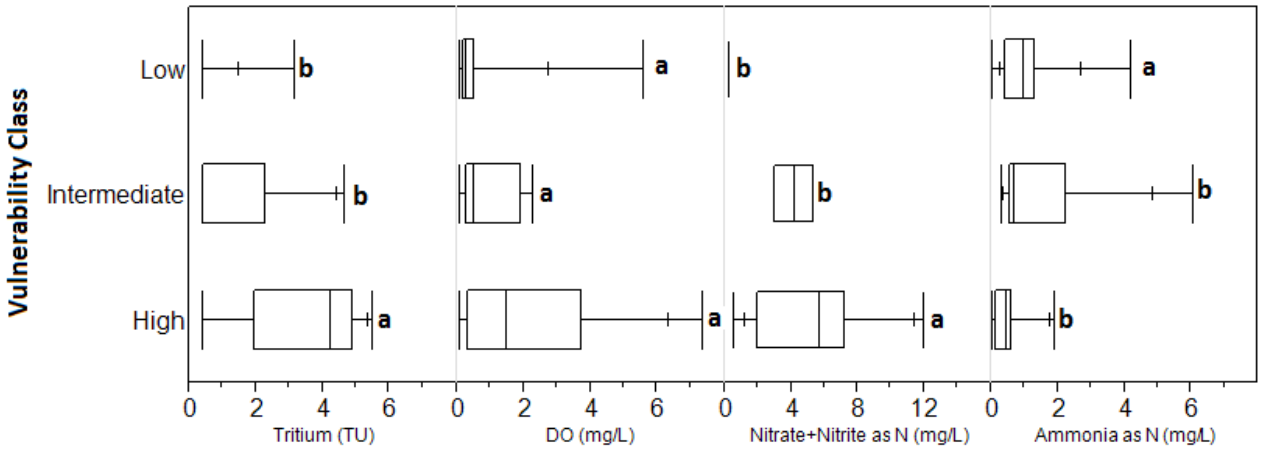

Figure 15. Boxplots representing distributions of concentrations of common water-quality parameters. Letters indicate significant differences between well vulnerability classes.

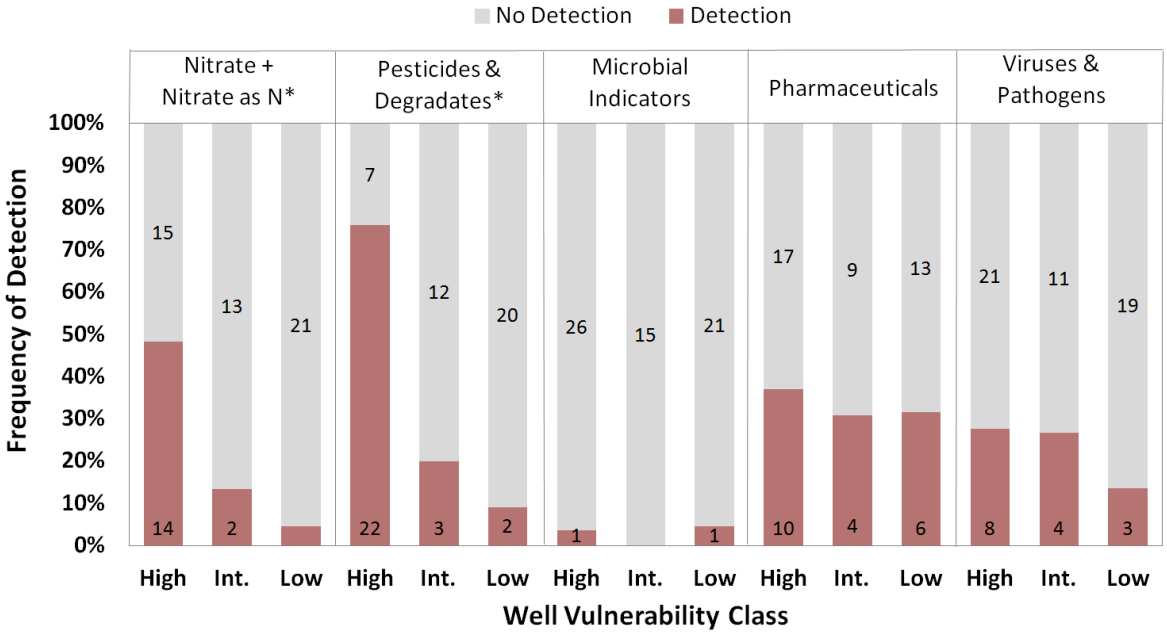

Figure 16. Graph of detection frequencies of contaminant groups by well vulnerability classes. Numbers of detections are located within the columns. *Asterisks indicate contaminant groups for which differences between vulnerability classes are significant.

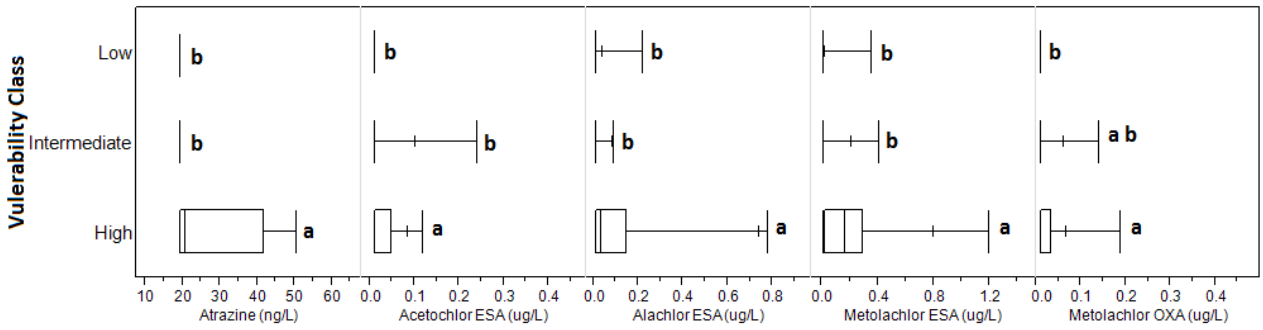

Figure 17. Boxplots representing distributions of the five most commonly detected pesticides/degradates by well vulnerability class. Letters indicate differences between classes as determined by Wilcoxon rank sum analyses.

Further examination of results from high vulnerability wells was conducted to determine whether concentrations of surface-derived contaminants could be associated with nearby land use. These analyses were limited to nitrate and the five most commonly detected pesticides/degradates due to the low detection rates of other contaminant groups. Figure 18 shows the results of these analyses with non-detections excluded; however, the same statistical differences were seen when the analyses included non-detections. Highly vulnerable wells surrounded by grasses had significantly lower nitrate + nitrite concentrations than those in developed areas or areas surrounded by row crop. While the differences were not significant due to low detection frequencies, the median and maximum atrazine concentrations were higher in wells surrounded by developed and grassy areas, than for wells surrounded mostly by row crops. The highest median observed concentration of acetochlor ESA was associated with grassed areas. Wells in developed areas contained significantly higher concentrations of alachlor ESA. No significant differences were observed between land use categories for metolachlor ESA, the most commonly detected pesticide degradate. Although the differences were not significant, it appears that metolachlor OXA occurred at lower concentrations in wells surrounded by developed land than the other land uses.

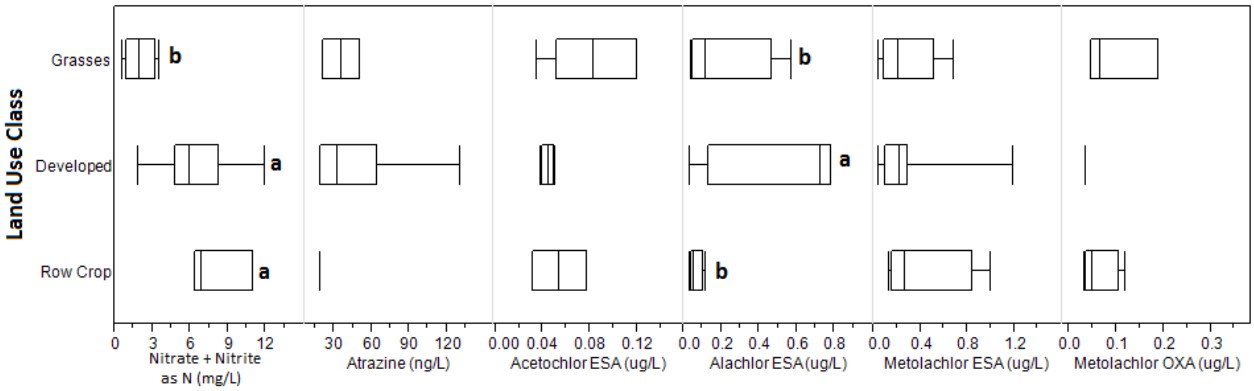

Figure 18. Boxplots representing distributions of detected concentrations of nitrate and the five most commonly detected pesticides/degradates in samples from high vulnerability wells by land use class. Lettering indicates differences between classes as determined by Wilcoxon rank sum analyses with non-detections excluded. Where no letters are displayed, no significant differences were found.

DISCUSSION

The results of this 2013 survey provide a baseline for evaluation of CECs in Iowa's groundwater. In addition, these results expand our understanding of water-quality parameters and contaminants that have previously been studied.

Tritium concentrations found in this study were within a reasonable range, given other recent tritium analyses of readily recharged groundwater and surface water in Iowa (Schilling and Tassier-Surine, 2006; Fields et al., 2012) and southern Wisconsin (Bradbury et al., 2010). These recent studies suggest that precipitation entering groundwater systems in the area currently contain 5-10 TU. Interpretations of tritium concentrations must consider that groundwater can be a mixture of waters of various ages. Groundwater containing as much as 15% post-1953 recharge may not have detectable tritium at the detection limit used in the current study. In general, highly vulnerable wells had younger water than the intermediate and low vulnerability wells, as determined by tritium content; thus, the vulnerability classification serves as a reasonably reliable water age predictor. The detection of tritium in a few individual wells classified as low vulnerability suggests that additional investigation of the hydrogeology surrounding these wells may be necessary. If the tritium analysis had a lower quantitation limit, differentiation between estimated ages of water in intermediate and low vulnerability wells may have been improved.

Continued assessment of nitrate concentrations in Iowa's drinking-water sources is imperative in order to meet drinking water standards aimed at protecting the health of infants, and to assess additional public health risks (Ward et al, 2005). Comparison

between the results of this study and previous groundwater surveys are difficult because of differences in analytes, analytical methods, limits of quantitation, and well selection protocols; nevertheless, these comparisons help us assess risk and are useful for informing future investigations. For example, both occurrence and concentrations of nitrate + nitrite as N measured in this study were lower than levels of nitrate as N found in the SWRL2 study of private wells. The frequency of detection of nitrate in the SWRL2 study was 49% (CHEEC, 2009) compared to 26% in this study. The maximum concentration of nitrate found in SWRL2 was 63 mg/L nitrate as N (CHEEC, 2009), whereas the maximum for this study was 12 mg/L. Although nitrate + nitrite (as N) was measured for this study, and only nitrate (as N) was measured for the SWRL study, the values for these two tests should be comparable in an aquatic environment.

Like nitrate, bacterial indicators of surface-related contamination were found less frequently in this study than in SWRL2. *E. coli* were not detected in any wells in this study, whereas they were found in 11% of wells in SWRL2 (CHEEC, 2009). Enterococci bacteria were found in 2% of the wells in this study, compared to 19% of SWRL2 wells (CHEEC, 2009). These differences do not necessarily indicate an improvement in statewide groundwater quality, but could result from differences between the populations of wells sampled, including the locations, construction methods, age, maintenance status, or source-water protection activities.

Both this 2013 study and SWRL2 report 8% of wells in exceedance of 0.010 mg/L arsenic, a naturally-derived contaminant. The IGWM network, which includes arsenic analyses for 2,289 samples of raw public well groundwater, shows 10% exceedance of the arsenic MCL (Libra, 2011). As shown in Figure 14, redox conditions (as indicated by DO concentrations) play an important role in determining whether arsenic will be present in groundwater samples. Many others have also documented the effects of redox conditions on arsenic mobility. For example, Gotkowitz et al. (2004) documented sources of arsenic and differences between the effects of redox conditions on arsenic mobility within the aquifer and the borehole. Additional work is necessary to better understand the relationships between geologic formations, redox conditions, and arsenic occurrence in groundwater, and to determine if other arsenic hotspots exist, like the area in Cerro Gordo County, recently documented by Schnoebelen and Walsh (2014). The current IGWM network averages less than one well per county, which is insufficient to identify localized areas with high concentrations of arsenic in groundwater.

In a study of agricultural chemicals in 1,019 public water supply wells in Iowa, atrazine, alachlor, cyanazine, and metolachlor detection frequenciesof 13.2%, 3.3%, 4.1%, and 14.1%, respectively for the period from 1992-1995 at the detection limit of 0.1 μg/L

(Kolpin et al., 1997b). Since this previous study, cyanazine has been voluntarily removed from the market, alachlor is in the process of being replaced with acetochlor, and metolachlor had a change in formulation, which resulted in lower rates per acre being applied. Data from Iowa indicate reductions in annual use of these pesticides from 1992-2011 (USGS, 2013a). Our study found a 13% detection frequency for atrazine at a lower detection limit (0.01 μg/L). Cyanazine was not detected at the 0.01 μg/L detection limit, and neither alachlor or metolachlor were detected at 0.025 μg/L. Our results indicate a possible reduction in risks from these four compounds; however, differences in sample populations and timing between these studies indicates that caution is necessary when drawing comparisons. Interpretation of these results should also take into consideration seasonal variations in pesticide applications. For this study, samples were taken in late winter, prior to the typical application period for pre- and post-emergent herbicides. Monitoring of shallower, typically more susceptible, private wells has shown atrazine detections from 8-19% of the wells sampled, at a detection limit of 0.1 μg/L (Kross et al., 1990; Iowa DNR, 2004; CHEEC, 2009).

As with previous studies (Kolpin et al., 1996; 1997a), pesticide degradate occurrence was higher than that of the parent compounds for pesticides with comparable detection limits. In this study, the three most commonly detected pesticides degradates were metolachlor ESA (41%), alachlor ESA (29%), and acetochlor ESA (20%). OXA degradates of these acetanilide herbicides generally occurred less frequently than the ESA degradates. Testing on human health effects indicates that acetanilide herbicide degradates may be less potent than their parent compounds (Gadagbui et al., 2010); however, studies are limited and complicated by the potential for synergistic effects of contaminant mixtures (Toccalino et al. 2012). Drinking water standards for individual degradates or mixtures may be assigned in the future (US EPA, 2014b). Continued monitoring of vulnerable groundwater supplies for these contaminants should be a priority.

Over a decade has passed since Kolpin et al. (2004) reported no detections of glyphosate or AMPA in 86 Iowa raw PWS well samples. In a more recent nationwide study that included groundwater samples from Iowa, 5.8% of over 1,171 samples had detections of glyphosate and 14.3% had detections of AMPA (Battaglin et al., 2014). Despite increased usage and sales, glyphosate remained undetected in this 2013 Iowa study, suggesting that under drought or post-drought conditions, the risks of glyphosate reaching and/or persisting in groundwater is low. AMPA was found in 2 (3%) of the samples at the limit of quantitation (0.02 μg/L). It is possible that the AMPA was detected more frequently than glyphosate because it persists in soils for slightly longer than its parent compound, glyphosate (Bergstrom et al., 2011); however, glyphosate is not the only potential source of AMPA. AMPA can also be formed from the breakdown

of phosphonic acids, such as those found in cleaning products (Skark et al., 1998). Additional groundwater monitoring shortly after application and/or during wetter periods would be necessary to fully understand potential risks from these compounds.

Studies in Wisconsin showed virus detection rates of 20 to 40% during normal-to-wet weather (Bradbury et al., 2013), with detections dropping to 2 to 4% during or following very dry periods (Gotkowitz et al., 2014). Excluding the results of PMMV analyses in this study, which were not included in the studies in Wisconsin, our results are consistent with their results during very dry periods. Variations in the levels of viruses in wastewater sources could also play a role. Shedding of enteric viruses, for example, often varies seasonally in human and animal wastes. Communities generally have a higher incidence of enterovirus circulating in late summer months and early autumn and infections are more common in these months (Nelson et al., 1979). Norovirus infections tend to be more frequent in late summer and early autumn as well (Rohayem, 2009). It is also possible that the population of wells selected for this study may be less vulnerable or less prone to preferential flow than the wells studied in Wisconsin. No significant correlations were observed between 7-day, 30-day, or 60-day antecedent rainfall estimates and virus occurrence. Further study is needed to better establish the relationship between climate, subsurface conditions, and virus occurrence in groundwater.

The detection frequency of PMMV in this study (17%) was relatively high compared to all other viruses, pathogenic bacteria, and microbial indicators. PMMV has been reported to be present at consistently high concentrations in human wastewater influent and effluent and has been suggested as a promising indicator for human enteric viruses in aquatic environments (Kitajima et al., 2014). Future studies are needed to understand why PMMV was detected far more than all the other enteric viruses in this study and determine the source(s) of these viruses, such as wastewater treatment effluents or leaking sanitary sewers as described by Davison et al. (2013). It should be noted that there is currently no direct evidence of PMMV human infections, although one study found an association between PMMV ingestion and itching, abdominal pain, and fever, which the authors concede could have been caused by confounding factors, such as eating spicy food (Colson et al., 2010). Atrazine was the only commonly analyzed parameter that correlated significantly to PMMV concentrations and to the number of microbe detections by qPCR. Confidence in these correlation is low given that both atrazine and the microbes detected by qPCR occurred in less than one-third of the samples. Further investigation revealed that four of the 11 PMMV-positive samples contained detectable concentrations of atrazine.

The frequency of detection of one or more pharmaceutical compounds in untreated groundwater in this study (35%) was greater than reported by a California study (2.3%; Fram and Belitz, 2011) but less than a national study of susceptible groundwater (81%; Barnes et al., 2008). The most commonly detected pharmaceutical in this study was caffeine (25%), which is a higher detection frequency than reported by Barnes et al. (2008) for untreated public water supply wells. In a study targeting vulnerable wells in urbanized areas of Minnesota by Erickson et al. (2014), the antibiotic sulfamethoxazole was the most commonly detected pharmaceutical (11.4% greater than 5 ng/L), while caffeine was only detected once (<1% of samples above 60 ng/L). Whereas our study targeted only public water supply wells, the Minnesota study included monitoring wells, three of which were in close proximity to landfills, and one of these had 10 CEC detections in a single well (Erickson et al., 2014).

Analyses revealed significant correlations between nitrate + nitrite, atrazine, several pesticide degradate compounds, and tritium (a measure of relative water age), and to a less degree, chloride. However, none of the commonly measured water-quality parameters were good predictors of CEC concentrations. Additionally, the well vulnerability categories are good predictors of the occurrence of nitrate + nitrite and pesticide degradates, but no differences between microbial or pharmaceutical occurrence were found between well vulnerability classes. Larger sample size, or different hydrological conditions, could result in more significant results if detection rates are increased. Results of analysis of alachlor ESA concentrations in high vulnerability wells by land use suggests greater use of alachlor in developed areas, but it is also possible that characteristics of the subsurface control the fate and transport of this compound: the four wells with highest alachlor ESA concentrations are within a limited geographical region (~35 miles) dominated by karst.

Our analyses showed no correlation between pharmaceutical data and any of the physical well characteristics, land use, precipitation values, or commonly measured water-quality parameters. Well vulnerability class, based on confining layer thickness, was also not a useful predictor. Additional research is needed to improve our ability to understand the fate and transport of pharmaceutical compounds in groundwater.

Correlation analyses revealed that more recently drilled wells have lower concentrations of nitrate + nitrite and atrazine, but higher turbidity, iron, and manganese values. This correlation may result from improved well construction, source water protection activities, and required separation distances from contaminant sources. Recently, there has been an emphasis on properly installing casings to depths that take advantage of existing geologic confining layers as a natural protective layer. It is also possible that communities prefer to use protected bedrock aquifers rather than

aquifers with known surface contamination, despite the potential for naturally-derived contamination.

CONCLUSIONS

The primary objective of this study was to document the occurrence of a large suite of potential contaminants in wells that are representative of the various groundwater resources in this state. While this study was unique in its coverage of contaminants of emerging concern, it highlights the fact that well-known naturally derived and surface-derived contaminants like arsenic and nitrate continue to pose water-quality challenges for residents of this state. Arsenic was detected in 36% of the samples and 8% exceeded the MCL of 0.010 μg/L. Nitrate + nitrite was detected in 26% of the wells sampled and 3% of these samples exceeded the MCL of 10 mg/L. Occurrence of microbial indicators was low (6%).

At 41% detection, the most commonly detected contaminant group was pesticide compounds. Of these, the most common were acetanilide degradates. None of the measured concentrations of pesticide compounds exceeded current benchmark levels; however, several of these compounds are listed on the EPA's CCL and could be subject to drinking water standards in the future. Despite heavy use in the past decade, glyphosate was not detected, and its metabolite, AMPA, was only detected in two of the 60 wells tested (3%) at the detection limit of 0.02 μg/L.

Pharmaceuticals were the most commonly detected CEC, as a group, with at least one pharmaceutical detected in 35% of the samples. While detection of pharmaceuticals was relatively high given the recent drought conditions and the proportion of low vulnerability wells included in the study, concentrations of these chemicals were low. Most pharmaceutical detections were at concentrations below the state-of-the-art method reporting levels and the maximum measured concentration was 826 ng/L acetaminophen (parts per trillion). For perspective, it would take almost 200,000 cups of untreated well water to equal the dose of acetaminophen recommended for infants (40 mg).

Viruses and pathogenic bacteria were detected in 21% of the samples by qPCR. Most of the microbes detected were not pathogenic to humans. The human pathogens, human polyomavirus, GII norovirus and *Campylobacter* were each detected once at concentrations close to their respective quantitation limits. The most common virus detected was PMMV (17% of samples). Our results confirms what other studies have shown, that transport of viruses to groundwater is possible, even in wells considered to be protected from surface contamination. Further study will be necessary to determine possible sources of the viruses and bacterial pathogen that were detected, and to see if trends respond to changes in precipitation and subsurface conditions.

A secondary objective of this study was to determine if any commonly measured analytes could be used as indicators for pharmaceuticals, viruses, and pathogenic bacteria. While common indicators of contamination from the surface were positively correlated to each other, they showed no significant correlation to CECs. On the other hand, individual analytes within each group of contaminants appear to be promising indicators for their respective groups. Metolachlor ESA was the most frequently detected pesticide and also the pesticide with the highest measured concentrations. Additionally, metolachlor was always present in wells where pesticides or pesticide degradates were detected. For pharmaceuticals, caffeine was the most commonly detected compound, although, concentrations were often below the method reporting level. The study confirms that PMMV is a promising indicator for virus occurrence in groundwater. Additional research is necessary to determine potential sources of PMMV in Iowa.

The final objective of this study was to determine if a system of vulnerability classification based on confining layer thickness, originally developed for nitrate, was applicable to groups of CECs. While we confirmed that this vulnerability classification method is well-suited to predict the occurrence of nitrate and degradates of acetanilide pesticides, it is not reliable for prediction of occurrence of pharmaceuticals or viruses. The lack of predictability of pharmaceutical and virus occurrence also means that identification of preferential transport pathways will become more important for source water protection assessments, where risks from these contaminants are identified.

Results of this study point to differences in the potential sources and behaviors of these contaminant groups, and the need to look more closely at potential transport pathways and other interactions, specifically for pharmaceuticals and viruses. As this was the first time groundwater was systematically sampled for these CECs, additional monitoring will be necessary to determine whether the results presented here are consistent with sampling under different (wetter) hydrological conditions. This study will provide a baseline for future studies aimed at evaluating groundwater-quality trends and risk assessment related to viruses and pharmaceuticals. Additionally, follow-up investigations of individual PWS with CECs detections are recommended to determine the possible sources of this surface-related contamination.

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APPENDIX A

	Well Characteristics													Antecedent Precipitation		
Well Name	PWS ID Number	Well Number	USGS ID	Date Drilled	Well Depth (m)	Well Depth (ft)	Aquifer Group	Confining Layer Thickness (m)	Confining Layer Thickness (ft)	Vulner-ability Class	Pumping Rate (1000L/day)	Pumping Rate (gpd)	Land Use Class*	7-day (cm)	30-day (cm)	60-day (cm)
Adel #3	2503003	34349	413749093592601	8/19/1977	13.41	44	All.	1	3	High	385	101656	grasses	1.65	3.18	4.60
Alburnett #3	5704012	72342	420859091373701	5/10/2010	121.3	398	S-D	20	65	Int.	63088	16666	row crop	0.56	8.61	12.67
Algona #8	5502015	60210	430412094142301	10/27/2003	49.99	164	D-C	22	73	Int.	776955	205250	developed	0.00	2.21	4.78
Altoona #3	7707030	23701	413931093292001	2/15/1976	772.1	2533	C-O	126	415	Low	1414483	373667	developed	7.92	15.88	20.83
Andover #1	2307001	61574	415844090150801	7/8/2008	237.7	780	C-O	70	230	Low	757	200	row crop	0.89	19.56	26.24
Anita #4	1503053	65303	412708094461101	4/28/2008	72.54	238	D-C	17	57	Int.	101260	26750	developed	2.29	4.29	7.04
Atkins #3	603072	62894	415932091514001	1/1/2005	170.1	558	S-D	18	60	Int.	310404	82000	developed	5.49	8.46	11.02
Audubon #13	505077	36202	414315094524201	2/19/1968	10.52	34.5	All.	5	16	High	65613	17333	row crop	4.06	6.27	8.74
Avoca Reg. Water #19	8300184	63981	413022095202301	6/27/2007	10.06	33	All.	2	6	High	96906	25600	grasses	0.33	5.79	8.13
Badger #3	9405082	23299	423650094085501	6/1/1973	167	548	Miss.	41	135	Low	123026	32500	row crop	0.05	4.98	8.23
Battle Creek #3	4709090	23199	421908095353701	6/30/1972	17.98	59	All.	5	17	High	100313	26500	developed	6.10	9.55	13.79
Blue Grass #1a	8215021	22757	413040090455001	7/1/1971	195.1	640	S-D	40	130	Low	157727	41667	developed	0.66	8.69	13.64
Bristow #2	1222044	20256	424627092542302	9/11/1967	54.86	180	S-D	21	69	Int.	52996	14000	row crop	4.75	15.85	24.28
Calamus 2007	2320062	64546	414932090450801	3/10/2006	393.2	1290	C-O	110	362	Low	142710	37700	row crop	5.49	8.36	14.99
Carson #7	7809078	58045	411401095241401	9/16/2003	47.24	155	D-C	37	120	Low	54056	14280	developed	0.46	5.00	7.09
Cascade #4	3118080	23975	421731091011501	6/16/1976	74.37	244	S-D	7	23	High	368131	97250	row crop	4.72	7.75	12.98
Cedar Falls #8	709084	37620	423045092283401	1/1/1971	67.06	220	S-D	32	105	Low	2058317	543750	grasses	0.08	8.46	14.20
Cedar Falls #9	709084	37621	423341092273001	1/1/1975	83.82	275	S-D	6	21	High	2058317	543750	developed	0.08	8.46	14.20
Cedar Falls #9 (RS)	709084	37621	423341092273001	1/1/1975	83.82	275	S-D	6	21	High	2058317	543750	developed	3.51	24.18	41.91
Charles City #8	3405012	67030	430444092403001	4/3/2009	70.1	230	S-D	2	7	High	1766522	466666	developed	0.23	6.71	9.88
Cherokee #10	1811101	42300	424340095331301	8/9/1996	75.9	249	D-C	37	120	Low	312770	82625	developed	0.33	4.32	6.15
Clayton #1	2203039	26579	425400091091601	12/31/1981	114.3	375	C-O	2	6	High	82143	21700	grasses	5.59	7.19	16.41
Coralville #10	5208071	31377	414145091350101	8/1/1990	521.2	1710	C-O	61	200	Low	2124228	561162	developed	0.03	19.94	27.10
De Witt #7	2330036	57176	414907090333301	1/23/2003	409.3	1343	C-O	61	200	Low	701758	185385	grasses	5.28	8.64	15.54
Decorah #7	9630012	39057	431829091472001	1/1/1980	15.24	50	All.	0	1	High	772224	204000	grasses	4.29	7.49	13.69
Dumont #2	1240081	34682	424455092582001	1/25/1983	86.87	285	S-D	15	50	Int.	117348	31000	developed	4.83	17.63	26.44
Duncombe #4	9427082	39389	422811093591901	1/1/1988	167.6	550	Miss.	44	145	Low	75708	20000	row crop	0.05	5.69	8.99
Elgin #2	3338010	39679	425717091382602	1/1/1955	67.06	220	C-O	0	0	High	92743	24500	developed	5.16	6.63	16.92
Fairfield #6	5131033	35411	410040091560901	6/13/1994	634.6	2082	C-O	151	495	Low	2321717	613333	grasses	0.03	7.04	11.35
Fremont #2-88	6234070	29828	411239092261901	7/12/1988	21.64	71	BSG	17	55	Int.	88011	23250	developed	6.63	7.77	15.62
Gilbert #3	8531083	39923	420626093404101	4/2/1972	47.85	157	BSG	32	106	Low	325545	86000	row crop	5.54	6.43	12.80
Independence #3	1037070	1856	422808091531801	12/30/1943	93.57	307	S-D	6	20	High	549642	145200	developed	4.70	20.19	24.23
Independence #7	1037070	28344	422814091540401	1/1/1984	80.77	265	S-D	8	25	High	549642	145200	developed	1.37	5.36	9.83
Independence #7 (RS)	1037070	1856	422814091540401	1/1/1984	80.77	265	S-D	8	25	High	549642	145200	developed	3.05	22.38	39.04
Ionia #2	1946078	28342	430211092270702	2/10/1983	76.81	252	S-D	42	138	Low	77601	20500	developed	0.28	8.03	12.17
Janesville #3	932001	28340	423902092272502	1/1/1984	32	105	S-D	0	0	High	130597	34500	developed	0.03	5.61	10.08

RS = samples obtained during the June resampling period

Aquifer abbreviations: All. = Alluvium, S-D = Silurian-Devonian, D-C = Dakota Cretaceous, C-O = Cambrian-Ordovician, Miss. = Mississippian, and BSG = Buried sand & gravel.

*Primary land use class within 1000 feet of the well as determined by 2012 satellite imagery (USDA, 2013).

APPENDIX A

	Well Characteristics													Antecedent Precipitation		
Well Name	PWS ID Number	Well Number	USGS ID	Date Drilled	Well Depth (m)	Well Depth (ft)	Aquifer Group	Confining Layer Thickness (m)	Confining Layer Thickness (ft)	Vulner-ability Class	Pumping Rate (1000L/day)	Pumping Rate (gpd)	Land Use Class*	7-day (cm)	30-day (cm)	60-day (cm)
Joice #1	9835001	64060	432157093271701	5/17/2007	91.44	300	S-D	28	93	Int.	18927	5000	grasses	0.00	3.05	5.51
Jolley #1	1335001	27238	422844094431301	1/1/1984	135.6	445	Miss.	34	110	Low	18927	5000	developed	0.33	3.43	5.82
Knierim #1	1340001	24966	422656094271901	5/5/1978	51.82	170	BSG	38	125	Low	39368	10400	row crop	0.25	4.75	7.67
Lansing #4	345054	24826	432202091133001	1/1/1977	245.4	805	C-O	0	0	High	347122	91700	grasses	4.39	7.52	13.74
Lyon-Sioux RWS-3	6000733	40669	431808096140101	1/1/1978	10.36	34	All.	3	10	High	370213	97800	grasses	0.03	2.69	4.55
Marshalltown #5	6469042	40763	420420092552701	1/1/1972	67.67	222	BSG	30	100	Int.	2119830	560000	grasses	7.09	8.13	16.10
Massena #6	1558055	62594	411501094465901	6/13/2006	10.06	33	All.	4	12	High	32555	8600	row crop	2.06	4.37	7.16
Mount Vernon #9	5758021	64887	415539091243301	6/17/2008	110	361	S-D	49	162	Low	404093	106750	row crop	0.89	8.89	14.35
Moville #5	9753022	51614	422933096041501	11/16/1999	74.37	244	D-C	8	27	High	344472	91000	developed	1.04	4.83	6.78
Nevada #8	8562044	64759	415919093341001	3/7/2008	27.74	91	All.	5	18	High	1684507	445000	grasses	5.72	6.48	12.60
New Venna #4	3165014	35996	423228091064701	5/20/1995	297.5	976	C-O	34	110	Low	115834	30600	grasses	0.99	8.08	13.34
Nora Springs #4	3423069	64868	430842093002601	6/4/2008	96.01	315	S-D	14	45	High	246525	65125	developed	3.07	10.52	15.01
Orchardview Est. #1	5282304	36817	414313091280701	9/16/1995	148.4	487	S-D	17	55	Int.	19684	5200	grasses	0.89	4.90	8.31
Perry #22	2561036	32303	415030094014301	5/28/1991	39.01	128	BSG	23	77	Int.	241683	63846	row crop	1.24	2.74	3.94
Perry #9R	2561036	28614	415057094065301	9/21/1987	13.94	46	All.	1	3	High	241683	63846	grasses	0.51	2.46	3.63
Perry #9R (RS)	2561036	28614	415057094065301	9/21/1987	13.94	46	All.	1	3	High	241683	63846	grasses	3.30	17.63	33.58
Primghar #8	7155059	57231	430516095373502	4/4/2002	182.9	600	D-C	109	359	Low	255515	67500	developed	0.15	4.55	6.40
Quimby #3	1855066	57083	423744095383302	7/20/2005	85.34	280	D-C	24	80	Int.	68137	18000	developed	5.38	8.51	11.53
Riverview Estates #1	5200347	16174	414254091321201	11/5/1963	89.31	293	S-D	9	31	High	45425	12000	grasses	0.89	4.95	8.31
Rockford #2	3430091	25694	430315092563401	1/1/1978	65.23	214	S-D	2	6	High	144792	38250	developed	3.68	12.17	17.45
Shelby #6A	8369038	46400	413054095254501	7/3/1998	14.63	48	All.	8	25	High	41640	11000	row crop	7.39	12.07	18.31
Sigourney #02-5	5475050	55861	412109092115201	10/18/2001	20.42	67	Miss.	15	48	High	503460	133000	row crop	6.99	7.77	15.34
Sioux Center #13	8486053	42486	430449096061301	1/1/1992	13.41	44	All.	2	5	High	257677	68071	row crop	0.13	4.52	6.43
Stacyville #3	6677089	63960	432610092465803	6/7/2007	88.39	290	S-D	8	26	High	143846	38000	developed	3.15	13.31	18.95
Steamboat Rock #1	4289094	5188	422453093035001	9/28/1951	35.05	115	Miss.	14	47	High	45425	12000	grasses	0.05	6.35	9.96
Storm Lake #18	1178097	64085	423849095142501	6/28/2007	29.26	96	BSG	16	52	Int.	1630815	430816	grasses	0.15	1.75	3.20
Toledo #2	8676027	24528	415935092351801	1/1/1977	606.6	1990	C-O	143	470	Low	522387	138000	developed	4.90	9.27	13.28
Van Meter #3	2570046	57592	413148093571103	7/14/2003	20.12	66	All.	3	9	High	170798	45120	developed	1.78	3.73	5.00
Van Meter #3 (RS)	2570046	57592	413148093571103	7/14/2003	20.12	66	All.	3	9	High	170798	45120	developed	3.25	16.36	27.86
Ventura #1	1785032	25538	430756093263201	12/19/1977	152.4	500	S-D	34	110	Low	279363	73800	grasses	0.00	3.76	6.81
Walnut #2	7872062	22927	412832095132701	1/1/1971	803.1	2635	C-O	78	255	Low	133750	35333	developed	0.66	6.05	8.66
Waverly #6	990085	26606	424341092291901	1/1/1980	52.43	172	S-D	0	1	High	855503	226000	developed	0.03	4.95	8.86
Waverly #6 (RS)	990085	26606	424341092291901	1/1/1980	52.43	172	S-D	0	1	High	855503	226000	developed	6.88	25.48	40.46
Winthrop #3	1093031	25801	422833091431701	1/1/1980	70.1	230	S-D	30	100	Int.	302833	80000	developed	10.54	14.99	22.23
Woodward St. Hos. #2	800923	43160	414915093561001	9/9/1965	34.75	114	BSG	18	60	Int.	397468	105000	row crop	0.51	2.95	4.50

RS = samples obtained during the June resampling period

Aquifer abbreviations: All. = Alluvium, S-D = Silurian-Devonian, D-C = Dakota Cretaceous, C-O = Cambrian-Ordovician, Miss. = Mississippian, and BSG = Buried sand & gravel.

*Primary land use class within 1000 feet of the well as determined by 2012 satellite imagery (USDA, 2013).

APPENDIX B

		Age (TU)		General Water Quality (mg/L)								
Well/Sample Name	Sample Date-Time	Tritium	± 1 std. deviation	pH	Conductivity (umho/cm)	Total Hardness	Total Alkalinity	Dissolved Oxygen	Total Organic Carbon	Total Dissolved Solids	Total Suspended Solids	Turbidity (NTU)
Adel #3	3/5/2013 14:10	4.5	0.5	7.1	740	360	310	<0.1	2.5	480	4	13.0
Alburnett #3	3/18/2013 14:00	<0.8	0.3	7.4	480	240	260	0.3	1.1	250	<1	<1.0
Algona #8	3/26/2013 14:15	2.9	0.4	7.1	790	390	400	<0.1	2.4	510	4	29.0
Altoona #3	4/23/2013 14:30	<0.8	0.3	7.2	640	240	260	0.1	<0.5	430	<1	1.1
Altoona #3 (blank)	4/23/2013 14:00					1	2		<0.5	<1	<1	<1.0
Andover #1	4/29/2013 12:15	<0.8	0.3	7.2	640	280	270	0.1	<0.5	350	<1	5.5
Andover #1 (lab rep)	4/29/2013 12:15	<0.8	0.4									
Anita #4	3/13/2013 14:40	<0.8	0.3	7.0	860	380	280	1.6	1.0	580	1	2.5
Atkins #3	3/12/2013 12:45	<0.8	0.3	7.2	790	290	400	0.1	2.9	450	<1	25.0
Audubon #13	3/12/2013 14:15	4.5	0.5	7.2	600	270	240	2.6	1.1	390	<1	<1.0
Avoca Reg. Water #19	3/19/2013 15:15	4.4	0.5	7.6	510	210	91	1.2	1.2	300	1	2.6
Badger #3	3/26/2013 12:50	<0.8	0.3	6.9	730	410	390	<0.1	1.7	510	<1	<1.0
Battle Creek #3	4/9/2013 13:00	2.7	0.4	7.4	640	320	300	3.7	0.7	420	<1	<1.0
Blue Grass #1a	3/20/2013 13:15	<0.8	0.3	7.1	630	320	360	0.9	0.7	360	<1	<1.0
Bristow #2	4/22/2013 15:10	4.7	0.5	7.4	540	290	230	1.9	0.6	330	<1	<1.0
Calamus 2007	3/11/2013 15:40	<0.8	0.3	7.4	1300	260	250	0.3	1.0	740	<1	4.9
Carson #7	3/19/2013 13:45	<0.8	0.4	7.3	800	310	420	<0.1	1.7	480	2	5.0
Cascade #4	3/13/2013 14:00	3.9	0.5	7.1	800	420	350	6.1	1.0	480	<1	<1.0
Cedar Falls #8	3/27/2013 13:45	3.2	0.5	7.4	460	230	220	0.2	1.1	260	<1	<1.0
Cedar Falls #9	3/27/2013 16:00			7.4	520	260	220	3.4	0.9	310	<1	<1.0
Cedar Falls #9 (RS)	6/12/2013 14:00			7.4	520			3.0				
Charles City #8	3/25/2013 14:45			7.4	460	230	230	<0.1	1.7	280	1	14.0
Cherokee #10	4/8/2013 12:30	<0.8	0.3	7.1	1100	600	280	<0.1	1.0	920	2	11.0
Clayton #1	4/10/2013 13:50	<0.8	0.3	7.4	420	280	260	0.1	0.6	280	<1	<1.0
Coralville #10	5/1/2013 13:15			7.2	1550	460	240	0.1	<0.5	1110	<1	6.9
Coralville #10 (field rep)	5/1/2013 13:15			7.2	1550	460	240	0.1	<0.5	1170	<1	6.8
De Witt #7	3/11/2013 15:00	<0.8	0.3	7.5	950	240	260	0.9	1.3	550	<1	1.1
De Witt #7 (lab rep)	3/11/2013 15:00	<0.8	0.3									
Decorah #7	4/9/2013 13:35	5.4	0.6	7.2	640	320	270	1.5	1.0	370	<1	<1.0
Dumont #2	4/22/2013 15:35	<0.8	0.3	7.7	1000	560	220	<0.1	0.8	730	<1	6.7
Duncombe #4	3/27/2013 12:55	<0.8	0.3	7.1	940	450	360	<0.1	1.8	610	<1	<1.0
Elgin #2	4/10/2013 13:15			7.2	630	330	260	0.4	0.9	380	<1	<1.0
Fairfield #6	4/3/2013 13:15	<0.8	0.4	7.4	1800	300	250	0.3	1.2	1150	<1	<1.0
Fairfield #6 (field rep)	4/3/2013 13:15			7.4	1800	310	240	0.3	1.2	1150	<1	<1.0
Fremont #2-88	4/15/2013 15:20			7.0	670	350	370	<0.1	1.1	400	2	12.0
Gilbert #3	4/16/2013 15:30			7.4	730	310	400	<0.1	3.1	410	8	36.0
Independence #3	5/8/2013 12:30	4.1	0.5	7.3	580	310	260	0.1	0.6	340	2	<1.0
Independence #7	4/8/2013 13:30	4.9	0.6	7.3	640	310	260	<0.1	0.8	390	<1	1.5
Independence #7 (RS)	6/11/2013 12:50			7.0	380			<0.1				
Ionia #2	3/25/2013 16:15	<0.8	0.3	7.3	590	290	290	0.3	1.9	340	<1	5.5
Janesville #3	4/2/2013 14:40			7.5	530	260	210	7.4	0.8	320	<1	<1.0

blank = field blank

lab rep = laboratory replicate

field rep = field replicate

RS = samples obtained during the June resampling period

APPENDIX B

APPENDIX B

		Age (TU)		General Water Quality (mg/L)								
Well/Sample Name	Sample Date-Time	Tritium	± 1 std. deviation	pH	Conductivity (umho/cm)	Total Hardness	Total Alkalinity	Dissolved Oxygen	Total Organic Carbon	Total Dissolved Solids	Total Suspended Solids	Turbidity (NTU)
Joice #1	3/26/2013 12:45	<0.8	0.4	7.2	620	340	330	0.5	2.1	340	2	14.0
Jolley #1	3/25/2013 14:40			6.9	1400	780	390	5.6	2.6	1200	4	20.0
Knierim #1	3/25/2013 13:40	<0.8	0.4	7.3	1400	590	480	<0.1	5.0	1000	1	16.0
Lansing #4	4/9/2013 14:35	<0.8	0.3	7.6	620	170	230	<0.1	<0.5	370	<1	2.2
Lyon-Sioux RWS-3	4/2/2013 13:43	5.5	0.6	7.3	710	350	230	3.8	1.7	450	<1	<1.0
Marshalltown #5	4/15/2013 14:15	<0.8	0.5	7.3	900	430	300	0.3	1.2	640	7	31.0
Massena #6	3/13/2013 13:45			7.0	490	220	210	<0.1	2.3	280	46	190.0
Mount Vernon #9	3/18/2013 16:00			7.4	480	250	260	0.3	0.7	270	<1	<1.0
Mount Vernon (blank)	3/18/2013 14:45					<1	<1		0.8	<1	<1	<1.0
Moville #5	4/1/2013 16:10			7.1	600	330	280	0.9	1.0	390	<1	<1.0
Moville #5 (field rep)	4/1/2013 16:10			7.1	600	340	290	0.9	0.9	400	<1	<1.0
Nevada #8	4/16/2013 14:15	4.9	0.6	7.1	770	370	250	<0.1	1.8	470	10	60.0
New Venna #4	3/19/2013 16:00			7.4	550	200	250	0.2	0.8	310	<1	2.3
Nora Springs #4	4/23/2013 12:05	0.9	0.3	7.2	600	310	310	<0.1	1.2	340	<1	<1.0
Orchardview Est. #1	3/4/2013 12:00	<0.8	0.3	7.0	730	380	390	2.3	1.4	420	<1	<1.0
Perry #22	3/4/2013 15:25	<0.8	0.3	7.1	840	390	420	<0.1	2.3	510	6	34.0
Perry #9R	3/6/2013 15:15	5.3	0.6	7.0	670		300	0.1	1.6	470	3	21.0
Perry #9R (RS)	6/18/2013 11:00			7.0	740			0.2				
Primghar #8	4/3/2013 13:30	<0.8	0.4	7.3	1800	1100	1100	<0.1	2.9	1970	8	34.0
Quimby #3	4/9/2013 12:55			7.1	900	490	270	<0.1	1.0	750	3	13.0
Riverview Estates #1	3/4/2013 14:40	<0.8	0.4	7.4	850	400	420	<0.1	1.3	500	<1	<1.0
Rockford #2	4/23/2013 13:05	1.6	0.4	7.3	500	280	240	<0.1	0.7	280	<1	1.0
Rockford #2 (field rep)	4/23/2013 13:05			7.3	500	270	240	<0.1	0.8	270	<1	<1.0
Shelby #6A	4/22/2013 14:30	4.8	0.6	7.0	650	320	280	<0.1	2.6	400	18	93.0
Shelby #6A (field rep)	4/22/2013 14:30			7.0	650	320	280	<0.1	2.6	400	17	81.0
Sigourney #02-5	4/15/2013 17:00	2.1	0.4	7.3	560	280	270	<0.1	0.9	320	4	13.0
Sigourney (blank)	4/15/2013 12:45					<1	3		<0.5	4	1	<1.0
Sioux Center #13	4/2/2013 12:42	4.4	0.5	7.1	1100	560	340	1.2	2.3	740	1	<1.0
Stacyville #3	4/24/2013 13:40			7.3	510	270	240	<0.1	1.2	280	<1	12.0
Steamboat Rock #1	4/1/2013 14:35	4	0.5	7.2	720	360	330	4.8	1.1	420	<1	<1.0
Storm Lake #18	4/8/2013 13:35	3.9	0.5	7.1	840	460	340	<0.1	2.8	580	7	28.0
Toledo #2	3/12/2013 15:10			7.2	1000	400	310	<0.1	1.1	690	1	2.7
Van Meter #3	3/5/2013 15:10	4	0.5	6.9	840	440	360	0.3	1.0	520	<1	<1.0
Van Meter #3 (RS)	6/18/2013 9:00			6.8	880			0.4				
Ventura #1	3/26/2013 13:15	<0.8	0.3	7.2	610	320	340	<0.1	1.9	340	<1	6.9
Walnut #2	3/18/2013 14:30	<0.8	0.4	7.3	2300	680	170	0.2	1.1	1600	2	8.6
Walnut (blank)	3/18/2013 13:45					<1	<1		0.8	<1	<1	<1.0
Waverly #6	4/2/2013 13:05	5.4	0.6	7.4	620	300	250	3.7	0.9	350	<1	<1.0
Waverly #6 (RS)	6/12/2013 10:30			7.3	610			3.7				
Winthrop #3	4/17/2013 12:05			7.3	710	320	320	<0.1	1.3	440	4	13.0
Woodward St. Hos. #2	3/6/2013 13:25	<0.8	0.4	7.7	730		420	<0.1	4.1	430	7	17.0

blank = field blank

lab rep = laboratory replicate

field rep = field replicate

RS = samples obtained during the June resampling period

APPENDIX B

		Major Ions (mg/L)											Nutrients (mg/L)				
Well/Sample Name	Sample Date-Time	Bromide	Chloride	Fluoride	Sulfate	Silica as SiO_2	Carbonate Alkalinity	Bicarbonate Alkalinity	Calcium	Magnesium	Potassium	Sodium	Ammonia as N	Nitrate + Nitrite as N	Total Kjeldahl Nitrogen as N	Ortho-Phosphate as P	Total Phosphorus as P
Adel #3	3/5/2013 14:10	<0.25	32.0	0.32	67	22.0	<1	310	88	33	3.3	26.0	0.81	0.61	1.1	0.10	0.160
Alburnett #3	3/18/2013 14:00	<0.25	<0.5	0.34	6	8.5	<1	260	64	22	1.3	8.3	0.67	<0.10	0.4	<0.020	<0.020
Algona #8	3/26/2013 14:15	<0.5	11.0	0.47	92	21.0	<1	400	100	32	3.8	52.0	0.72	<0.10	0.8	0.08	0.120
Altoona #3	4/23/2013 14:30	<0.5	12.0	1.69	100	11.0	<1	260	57	26	12.0	54.0	0.64	<0.10	0.6	<0.020	0.050
Altoona #3 (blank)	4/23/2013 14:00	<0.5	<1.0	<0.10	<1.0	<1.0	<1	2	<1.0	<0.5	<1.0	<0.5	<0.05	<0.10	<0.1	<0.020	0.08
Andover #1	4/29/2013 12:15	<0.5	24.0	0.43	47	8.3	<1	270	68	29	8.6	20.0	0.35	<0.10	0.4	<0.020	<0.020
Anita #4	3/13/2013 14:40	<0.25	1.0	0.50	190	23.0	<1	280	100	32	3.0	41.0	0.86	<0.10	<0.1	<0.020	0.050
Atkins #3	3/12/2013 12:45	<0.25	2.0	0.48	52	7.4	<1	400	64	31	6.0	68.0	6.10	<0.10	6.4	0.02	0.030
Audubon #13	3/12/2013 14:15	<0.25	8.2	0.53	55	24.0	<1	240	89	20	1.0	9.4	<0.05	6.90	<0.1	0.10	0.130
Avoca Reg. Water #19	3/19/2013 15:15	<0.25	47.0	0.49	90	11.0	<1	91	64	13	1.3	17.0	<0.050	<0.10	<0.1	0.04	0.070
Badger #3	3/26/2013 12:50	<0.5	5.5	2.29	90	7.6	<1	390	87	46	6.7	38.0	0.29	<0.10	0.1	<0.020	0.020
Battle Creek #3	4/9/2013 13:00	<0.5	10.0	0.27	34	29.0	<1	300	88	25	2.9	20.0	<0.05	6.00	<0.1	0.78	1.600
Blue Grass #1a	3/20/2013 13:15	<0.25	<0.5	0.31	11	16.0	<1	360	79	34	1.2	14.0	0.06	<0.10	<0.1	<0.020	<0.020
Bristow #2	4/22/2013 15:10	<0.5	14.0	0.19	34	13.0	<1	230	76	23	1.1	5.2	<0.05	5.40	<0.1	0.02	0.060
Calamus 2007	3/11/2013 15:40	0.59	160.0	1.10	150	8.6	<1	250	60	27	13.0	170.0	1.30	<0.10	0.8	<0.020	0.030
Carson #7	3/19/2013 13:45	<0.25	3.4	0.35	26	21.0	<1	420	85	27	1.5	66.0	1.00	<0.10	0.9	0.19	0.200
Cascade #4	3/13/2013 14:00	<0.25	28.0	0.18	33	18.0	<1	350	100	43	1.2	11.0	<0.05	6.40	<0.1	<0.020	0.030
Cedar Falls #8	3/27/2013 13:45	<0.5	7.2	0.72	23	12.0	<1	220	64	21	1.6	5.8	0.28	<0.10	0.3	<0.020	0.020
Cedar Falls #9	3/27/2013 16:00	<0.5	11.0	0.20	21	18.0	<1	220	72	22	1.2	5.5	<0.05	8.30	0.1	0.04	0.040
Cedar Falls #9 (RS)	6/12/2013 14:00		11.0														
Charles City #8	3/25/2013 14:45	<0.5	3.6	0.77	22	13.0	<1	230	67	19	1.4	5.0	0.56	<0.10	<0.1	<0.020	0.060
Cherokee #10	4/8/2013 12:30	<0.5	2.4	0.71	410	28.0	<1	280	170	46	4.9	48.0	0.53	<0.10	0.5	<0.020	0.040
Clayton #1	4/10/2013 13:50	<0.5	<1.0	0.21	15	12.0	<1	260	61	29	<1.0	2.7	<0.05	<0.10	<0.1	<0.020	0.030
Coralville #10	5/1/2013 13:15	<0.5	40.0	1.48	520	8.8	<1	240	97	52	16.0	180.0	1.20	<0.10	0.8	<0.020	0.030
Coralville #10 (field rep)	5/1/2013 13:15	<0.5	39.0	1.47	530	8.9	<1	240	96	52	16.0	180.0	1.30	<0.10	1.0	<0.020	0.020
De Witt #7	3/11/2013 15:00	0.35	100.0	1.00	89	8.8	<1	260	49	25	12.0	110.0	1.10	<0.10	0.5	<0.020	0.030
Decorah #7	4/9/2013 13:35	<0.5	33.0	0.12	22	14.0	<1	270	94	21	2.8	14.0	<0.05	2.00	<0.1	<0.020	0.030
Dumont #2	4/22/2013 15:35	<0.5	<1.0	0.88	340	13.0	<1	220	170	37	1.2	6.7	0.45	<0.10	0.7	0.02	0.100
Duncombe #4	3/27/2013 12:55	<0.5	8.9	2.46	180	7.7	<1	360	95	54	9.7	43.0	0.84	<0.10	0.9	<0.020	<0.020
Elgin #2	4/10/2013 13:15	<0.5	17.0	0.25	50	11.0	<1	260	92	26	2.4	4.7	<0.05	4.80	<0.1	<0.020	0.030
Fairfield #6	4/3/2013 13:15	<0.5	140.0	1.81	460	11.0	<1	250	74	30	17.0	280.0	1.40	<0.10	1.5	<0.020	<0.020
Fairfield #6 (field rep)	4/3/2013 13:15	<0.5	140.0	2.05	460	11.0	<1	240	73	30	17.0	280.0	1.30	<0.10	1.3	<0.020	<0.020
Fremont #2-88	4/15/2013 15:20	<0.5	3.0	0.53	16	27.0	<1	370	93	25	2.0	20.0	0.34	<0.10	0.5	0.03	0.040
Gilbert #3	4/16/2013 15:30	<0.5	1.2	0.57	<1.0	18.0	<1	400	74	29	4.4	39.0	2.90	<0.10	1.9	0.24	0.350
Independence #3	5/8/2013 12:30	<0.5	12.0	0.18	51	9.6	<1	260	91	22	1.6	5.5	0.05		<0.1	<0.020	0.040
Independence #7	4/8/2013 13:30	<0.5	24.0	0.27	54	11.0	<1	260	90	23	2.0	13.0	0.07	<0.10	<0.1	<0.020	<0.020
Independence #7 (RS)	6/11/2013 12:50		33.0														
Ionia #2	3/25/2013 16:15	<0.5	<1.0	0.95	42	11.0	<1	290	72	26	2.6	16.0	2.00	<0.10	2.2	<0.020	0.020
Janesville #3	4/2/2013 14:40	<0.5	12.0	0.16	16	15.0	<1	210	70	22	1.0	4.4	<0.050	12.00	<0.1	0.02	0.030

blank = field blank

field rep = field replicate

RS = samples obtained during the June resampling period

APPENDIX B

		Major Ions (mg/L)											Nutrients (mg/L)				
Well/Sample Name	Sample Date-Time	Bromide	Chloride	Fluoride	Sulfate	Silica as SiO_2	Carbonate Alkalinity	Bicarbonate Alkalinity	Calcium	Magnesium	Potassium	Sodium	Ammonia as N	Nitrate + Nitrite as N	Total Kjeldahl Nitrogen as N	Ortho-Phosphate as P	Total Phosphorus as P
Joice #1	3/26/2013 12:45	<0.5	3.3	0.33	12	24.0	<1	330	87	26	1.8	10.0	0.56	<0.10	0.4	0.09	0.160
Jolley #1	3/25/2013 14:40	<0.5	1.6	1.18	530	13.0	<1	390	180	83	3.7	71.0	0.41	<0.10	0.5	0.03	0.060
Knierim #1	3/25/2013 13:40	<0.5	6.0	0.43	360	29.0	<1	480	140	68	5.3	110.0	4.20	<0.10	4.0	0.25	0.300
Lansing #4	4/9/2013 14:35	<0.5	40.0	0.19	47	8.8	<1	230	34	20	4.3	77.0	0.16	<0.10	<0.1	0.66	0.700
Lyon-Sioux RWS-3	4/2/2013 13:43	<0.5	34.0	0.41	93	19.0	<1	230	89	32	2.6	16.0	<0.05	3.60	0.1	0.05	0.060
Marshalltown #5	4/15/2013 14:15	<0.5	1.5	0.54	230	17.0	<1	300	110	44	3.6	47.0	2.20	3.00	2.0	0.03	0.060
Massena #6	3/13/2013 13:45	<0.25	9.5	0.26	23	28.0	<1	210	63	16	1.2	11.0	0.49	<0.10	0.7	0.09	0.910
Mount Vernon #9	3/18/2013 16:00	<0.25	<0.5	0.36	7	14.0	<1	260	59	28	<1.0	4.9	<0.05	0.25	<0.1	<0.020	<0.020
Mount Vernon (blank)	3/18/2013 14:45	<0.5	<1.0	<0.10	<1.0	<1.0	<1	<1	<1.0	<0.5	<1.0	<0.5	<0.05	<0.10	<0.1	<0.020	<0.02
Moville #5	4/1/2013 16:10	<0.5	5.3	0.23	42	22.0	<1	280	93	25	3.3	8.0	<0.05	5.40	<0.1	0.05	0.060
Moville #5 (field rep)	4/1/2013 16:10	<0.5	5.3	0.22	42	21.0	<1	290	95	26	3.3	8.1	<0.05	5.40	<0.1	0.05	0.070
Nevada #8	4/16/2013 14:15	<0.5	40.0	0.31	85	24.0	<1	250	97	28	2.8	15.0	0.57	<0.10	0.7	0.03	0.140
New Venna #4	3/19/2013 16:00	<0.25	5.0	1.00	45	7.8	<1	250	47	23	8.3	37.0	0.67	<0.10	0.5	<0.020	<0.020
Nora Springs #4	4/23/2013 12:05	<0.5	12.0	1.14	15	12.0	<1	310	81	28	2.9	9.5	0.41	<0.10	0.4	<0.020	0.070
Orchardview Est. #1	3/4/2013 12:00	<0.25	6.4	0.34	22	16.0	<1	390	97	32	2.0	16.0	0.55	<0.10	0.7	<0.020	<0.020
Perry #22	3/4/2013 15:25	<0.25	2.6	0.40	60	30.0	<1	420	100	30	3.3	38.0	1.10	<0.10	0.9	<0.020	0.150
Perry #9R	3/6/2013 15:15	<0.25	13.0	0.34	93	25.0	<1	300	110	29	1.9	6.6	<0.05	<0.10	0.2	0.02	0.040
Perry #9R (RS)	6/18/2013 11:00		14.0														
Primghar #8	4/3/2013 13:30	<0.5	16.0	0.54	970	22.0	<1	370	310	100	9.1	130.0	1.30	<0.10	1.4	0.10	0.110
Quimby #3	4/9/2013 12:55	<0.5	3.3	0.86	290	18.0	<1	270	140	37	6.6	38.0	0.62	<0.10	0.4	<0.020	0.030
Riverview Estates #1	3/4/2013 14:40	<0.25	1.3	0.26	78	12.0	<1	420	100	37	3.5	30.0	1.70	<0.10	1.9	0.05	<0.020
Rockford #2	4/23/2013 13:05	<0.5	3.8	0.74	28	14.0	<1	240	66	22	1.1	4.0	0.14	<0.10	1.8	<0.020	0.100
Rockford #2 (field rep)	4/23/2013 13:05	<0.5	4.0	0.72	29	14.0	<1	240	66	22	1.1	4.0	0.16	<0.10	<0.1	<0.020	0.100
Shelby #6A	4/22/2013 14:30	<0.5	14.0	0.39	49	37.0	<1	280	86	25	3.8	11.0	1.90	<0.10	0.3	0.60	0.810
Shelby #6A (field rep)	4/22/2013 14:30	<0.5	14.0	0.39	48	36.0	<1	280	87	25	3.7	11.0	1.80	<0.10	1.8	0.23	0.820
Sigourney #02-5	4/15/2013 17:00	<0.5	17.0	0.32	18	16.0	<1	270	72	22	1.2	18.0	0.23	<0.10	0.3	0.02	0.070
Sigourney (blank)	4/15/2013 12:45	<0.5	<1.0	<0.10	<1.0	11.0	<1	<1	<1.0	<0.5	<1.0	<0.5	<0.05	<0.10	<0.1	<0.020	0.02
Sioux Center #13	4/2/2013 12:42	<0.5	50.0	0.49	170	19.0	<1	340	150	54	2.1	23.0	0.05	11.00	0.3	0.04	0.050
Stacyville #3	4/24/2013 13:40	<0.5	1.4	0.66	14	16.0	<1	240	67	20	2.0	5.7	0.54	<0.10	0.7	<0.020	0.050
Steamboat Rock #1	4/1/2013 14:35	<0.5	20.0	0.19	31	22.0	<1	330	93	33	2.0	12.0	<0.05	1.90	<0.1	<0.020	0.050
Storm Lake #18	4/8/2013 13:35	<0.5	19.0	0.51	120	29.0	<1	340	120	37	2.2	16.0	0.61	<0.10	0.9	0.07	0.220
Toledo #2	3/12/2013 15:10	<0.25	7.8	1.20	250	8.3	<1	310	90	43	16.0	71.0	1.10	<0.10	0.8	<0.020	0.020
Van Meter #3	3/5/2013 15:10	<0.25	39.0	0.22	54	25.0	<1	360	110	36	1.5	14.0	<0.05	1.90	0.1	0.03	0.040
Van Meter #3 (RS)	6/18/2013 9:00		44.0														
Ventura #1	3/26/2013 13:15	<0.5	2.1	0.44	11	19.0	<1	340	85	28	2.1	11.0	0.46	<0.10	0.4	0.08	0.190
Walnut #2	3/18/2013 14:30	<0.5	230.0	3.00	710	11.0	<1	170	180	60	36.0	230.0	1.30	<0.10	0.5	<0.020	0.030
Walnut (blank)	3/18/2013 13:45	<0.5	<1.0	0.12	<1.0	<1.0	<1	<1	<1.0	<0.5	<1.0	<0.5	<0.05	<0.10	<0.1	<0.020	<0.02
Waverly #6	4/2/2013 13:05	<0.5	20.0	0.16	22	15.0	<1	250	81	26	1.3	7.7	<0.05	6.90	<0.1	<0.020	0.030
Waverly #6 (RS)	6/12/2013 10:30		21.0														
Winthrop #3	4/17/2013 12:05	<0.5	1.1	0.37	78	14.0	<1	320	69	37	3.1	31.0	2.30	<0.10	1.2	<0.020	0.200
Woodward St. Hos. #2	3/6/2013 13:25	<0.25	1.0	0.40	<1.0	23.0	<1	420	66	30	5.4	49.0	3.60	<0.10	3.9	0.28	0.370

blank = field blank

field rep = field replicate

RS = samples obtained during the June resampling period

APPENDIX B

Well/Sample Name	Sample Date-Time	Metals (dissolved) (mg/L) Aluminum	Antimony	Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Iron
Adel #3	3/5/2013 14:10	<0.1	<0.005	<0.001	0.31	<0.002	<0.01	<0.05	<0.01	1.40
Alburnett #3	3/18/2013 14:00	<0.1	<0.005	<0.001	0.11	<0.002	<0.01	<0.05	<0.01	0.03
Algona #8	3/26/2013 14:15	<0.1	<0.005	0.012	0.09	<0.002	<0.01	<0.05	<0.01	2.80
Altoona #3	4/23/2013 14:30	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.17
Altoona #3 (blank)	4/23/2013 14:00	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Andover #1	4/29/2013 12:15	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.50
Anita #4	3/13/2013 14:40	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.11
Atkins #3	3/12/2013 12:45	<0.1	<0.005	<0.001	0.19	<0.002	<0.01	<0.05	<0.01	0.03
Audubon #13	3/12/2013 14:15	<0.1	<0.005	<0.001	0.10	<0.002	<0.01	<0.05	<0.01	<0.02
Avoca Reg. Water #19	3/19/2013 15:15	<0.1	<0.005	0.001	0.08	<0.002	<0.01	<0.05	<0.01	0.34
Badger #3	3/26/2013 12:50	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Battle Creek #3	4/9/2013 13:00	<0.1	<0.005	<0.001	0.16	<0.002	<0.01	<0.05	<0.01	0.05
Blue Grass #1a	3/20/2013 13:15	<0.1	<0.005	<0.001	0.30	<0.002	<0.01	<0.05	<0.01	<0.02
Bristow #2	4/22/2013 15:10	<0.1	<0.005	<0.001	0.10	<0.002	<0.01	<0.05	<0.01	0.03
Calamus 2007	3/11/2013 15:40	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.45
Carson #7	3/19/2013 13:45	<0.1	<0.005	<0.001	0.34	<0.002	<0.01	<0.05	<0.01	0.61
Cascade #4	3/13/2013 14:00	<0.1	<0.005	<0.001	0.15	<0.002	<0.01	<0.05	<0.01	<0.02
Cedar Falls #8	3/27/2013 13:45	<0.1	<0.005	0.001	0.16	<0.002	<0.01	<0.05	<0.01	0.08
Cedar Falls #9	3/27/2013 16:00	<0.1	<0.005	<0.001	0.10	<0.002	<0.01	<0.05	<0.01	<0.02
Cedar Falls #9 (RS)	6/12/2013 14:00									
Charles City #8	3/25/2013 14:45	<0.1	<0.005	<0.001	0.34	<0.002	<0.01	<0.05	<0.01	1.20
Cherokee #10	4/8/2013 12:30	<0.1	<0.005	0.005	<0.05	<0.002	<0.01	<0.05	<0.01	0.12
Clayton #1	4/10/2013 13:50	<0.1	<0.005	<0.001	0.09	<0.002	<0.01	<0.05	<0.01	0.08
Coralville #10	5/1/2013 13:15	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.51
Coralville #10 (field rep)	5/1/2013 13:15	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.57
De Witt #7	3/11/2013 15:00	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.15
Decorah #7	4/9/2013 13:35	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Dumont #2	4/22/2013 15:35	<0.1	<0.005	<0.001	0.08	<0.002	<0.01	<0.05	<0.01	0.70
Duncombe #4	3/27/2013 12:55	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Elgin #2	4/10/2013 13:15	<0.1	<0.005	<0.001	0.09	<0.002	<0.01	<0.05	<0.01	<0.02
Fairfield #6	4/3/2013 13:15	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.05
Fairfield #6 (field rep)	4/3/2013 13:15	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.05
Fremont #2-88	4/15/2013 15:20	<0.1	<0.005	0.007	0.24	<0.002	<0.01	<0.05	<0.01	1.10
Gilbert #3	4/16/2013 15:30	<0.1	<0.005	0.028	0.81	<0.002	<0.01	<0.05	<0.01	3.70
Independence #3	5/8/2013 12:30	<0.1	<0.005	<0.001	0.07	<0.002	<0.01	<0.05	<0.01	0.09
Independence #7	4/8/2013 13:30	<0.1	<0.005	0.001	0.06	<0.002	<0.01	<0.05	<0.01	0.12
Independence #7 (RS)	6/11/2013 12:50									
Ionia #2	3/25/2013 16:15	<0.1	<0.005	0.006	0.05	<0.002	<0.01	<0.05	<0.01	0.45
Janesville #3	4/2/2013 14:40	<0.1	<0.005	<0.001	0.09	<0.002	<0.01	<0.05	<0.01	<0.02

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

Well/Sample Name	Sample Date-Time	Metals (dissolved) (mg/L) Aluminum	Antimony	Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Iron
Joice #1	3/26/2013 12:45	<0.1	<0.005	<0.001	0.16	<0.002	<0.01	<0.05	<0.01	1.50
Jolley #1	3/25/2013 14:40	<0.1	<0.005	0.002	<0.05	<0.002	<0.01	<0.05	<0.01	1.80
Knierim #1	3/25/2013 13:40	<0.1	<0.005	<0.001	0.06	<0.002	<0.01	<0.05	<0.01	1.80
Lansing #4	4/9/2013 14:35	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.35
Lyon-Sioux RWS-3	4/2/2013 13:43	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Marshalltown #5	4/15/2013 14:15	<0.1	<0.005	0.001	<0.05	<0.002	<0.01	<0.05	<0.01	2.70
Massena #6	3/13/2013 13:45	<0.1	<0.005	0.017	0.27	<0.002	<0.01	<0.05	<0.01	16.00
Mount Vernon #9	3/18/2013 16:00	<0.1	<0.005	0.004	0.37	<0.002	<0.01	<0.05	<0.01	0.04
Mount Vernon (blank)	3/18/2013 14:45	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Moville #5	4/1/2013 16:10	<0.1	<0.005	<0.001	0.14	<0.002	<0.01	<0.05	<0.01	<0.02
Moville #5 (field rep)	4/1/2013 16:10	<0.1	<0.005	<0.001	0.13	<0.002	<0.01	<0.05	<0.01	<0.02
Nevada #8	4/16/2013 14:15	<0.1	<0.005	0.003	0.27	<0.002	<0.01	<0.05	<0.01	5.50
New Venna #4	3/19/2013 16:00	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.25
Nora Springs #4	4/23/2013 12:05	<0.1	<0.005	<0.001	1.60	<0.002	<0.01	<0.05	<0.01	0.14
Orchardview Est. #1	3/4/2013 12:00	<0.1	<0.005	<0.001	0.12	<0.002	<0.01	<0.05	<0.01	0.10
Perry #22	3/4/2013 15:25	<0.1	<0.005	0.008	0.14	<0.002	<0.01	<0.05	<0.01	2.60
Perry #9R	3/6/2013 15:15	<0.1	<0.005	0.004	0.07	<0.002	<0.01	<0.05	<0.01	1.70
Perry #9R (RS)	6/18/2013 11:00									
Primghar #8	4/3/2013 13:30	<0.1	<0.005	0.005	<0.05	<0.002	<0.01	<0.05	<0.01	3.10
Quimby #3	4/9/2013 12:55	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	1.20
Riverview Estates #1	3/4/2013 14:40	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.08
Rockford #2	4/23/2013 13:05	<0.1	<0.005	<0.001	0.19	<0.002	<0.01	<0.05	<0.01	0.13
Rockford #2 (field rep)	4/23/2013 13:05	<0.1	<0.005	<0.001	0.20	<0.002	<0.01	<0.05	<0.01	0.14
Shelby #6A	4/22/2013 14:30	<0.1	<0.005	0.033	0.81	<0.002	<0.01	<0.05	<0.01	8.20
Shelby #6A (field rep)	4/22/2013 14:30	<0.1	<0.005	0.033	0.81	<0.002	<0.01	<0.05	<0.01	8.10
Sigourney #02-5	4/15/2013 17:00	<0.1	<0.005	0.002	0.20	<0.002	<0.01	<0.05	<0.01	1.20
Sigourney (blank)	4/15/2013 12:45	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Sioux Center #13	4/2/2013 12:42	<0.1	<0.005	<0.001	0.11	<0.002	<0.01	<0.05	<0.01	0.08
Stacyville #3	4/24/2013 13:40	<0.1	<0.005	0.001	0.11	<0.002	<0.01	<0.05	<0.01	1.00
Steamboat Rock #1	4/1/2013 14:35	<0.1	<0.005	<0.001	0.19	<0.002	<0.01	<0.05	<0.01	<0.02
Storm Lake #18	4/8/2013 13:35	<0.1	<0.005	0.002	0.07	<0.002	<0.01	<0.05	<0.01	3.40
Toledo #2	3/12/2013 15:10	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	0.19
Van Meter #3	3/5/2013 15:10	<0.1	<0.005	<0.001	0.13	<0.002	<0.01	<0.05	<0.01	0.07
Van Meter #3 (RS)	6/18/2013 9:00									
Ventura #1	3/26/2013 13:15	<0.1	<0.005	0.001	0.18	<0.002	<0.01	<0.05	<0.01	0.69
Walnut #2	3/18/2013 14:30	<0.1	<0.005	0.002	<0.05	<0.002	<0.01	<0.05	<0.01	0.65
Walnut (blank)	3/18/2013 13:45	<0.1	<0.005	<0.001	<0.05	<0.002	<0.01	<0.05	<0.01	<0.02
Waverly #6	4/2/2013 13:05	<0.1	<0.005	<0.001	0.09	<0.002	<0.01	<0.05	<0.01	<0.02
Waverly #6 (RS)	6/12/2013 10:30									
Winthrop #3	4/17/2013 12:05	<0.1	<0.005	0.005	<0.05	<0.002	<0.01	<0.05	<0.01	1.30
Woodward St. Hos. #2	3/6/2013 13:25	<0.1	<0.005	0.026	1.60	<0.002	<0.01	<0.05	<0.01	1.80

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

Well/Sample Name	Sample Date-Time	Metals (dissolved) (mg/L)									
		Lead	Manganese	Nickel	Selenium	Strontium	Thallium	Titanium	Uranium	Vanadium	Zinc
Adel #3	3/5/2013 14:10	<0.001	0.36	<0.05	<0.01	0.28	<0.001	<0.05	0.002	<0.05	0.02
Alburnett #3	3/18/2013 14:00	<0.001	<0.02	<0.05	<0.01	0.29	<0.001	<0.05	<0.001	<0.05	<0.02
Algona #8	3/26/2013 14:15	<0.001	0.08	<0.05	<0.01	0.41	<0.001	<0.05	<0.001	<0.05	<0.02
Altoona #3	4/23/2013 14:30	<0.001	<0.02	<0.05	<0.01	1.20	<0.001	<0.05	<0.001	<0.05	<0.02
Altoona #3 (blank)	4/23/2013 14:00	<0.001	<0.02	<0.05	<0.01	<0.02	<0.001	<0.05	<0.001	<0.05	<0.02
Andover #1	4/29/2013 12:15	<0.001	<0.02	<0.05	<0.01	1.50	<0.001	<0.05	<0.001	<0.05	<0.02
Anita #4	3/13/2013 14:40	<0.001	0.66	<0.05	<0.01	0.69	<0.001	<0.05	0.004	<0.05	<0.02
Atkins #3	3/12/2013 12:45	<0.001	<0.02	<0.05	<0.01	1.00	<0.001	<0.05	<0.001	<0.05	<0.02
Audubon #13	3/12/2013 14:15	<0.001	0.02	<0.05	0.01	0.19	<0.001	<0.05	0.002	<0.05	<0.02
Avoca Reg. Water #19	3/19/2013 15:15	<0.001	0.08	<0.05	<0.01	0.18	<0.001	<0.05	<0.001	<0.05	<0.02
Badger #3	3/26/2013 12:50	<0.001	<0.02	<0.05	<0.01	1.00	<0.001	<0.05	<0.001	<0.05	<0.02
Battle Creek #3	4/9/2013 13:00	<0.001	0.08	<0.05	<0.01	0.46	<0.001	<0.05	<0.001	<0.05	<0.02
Blue Grass #1a	3/20/2013 13:15	<0.001	<0.02	<0.05	<0.01	0.17	<0.001	<0.05	<0.001	<0.05	<0.02
Bristow #2	4/22/2013 15:10	<0.001	<0.02	<0.05	<0.01	0.12	<0.001	<0.05	<0.001	<0.05	<0.02
Calamus 2007	3/11/2013 15:40	<0.001	<0.02	<0.05	<0.01	2.20	<0.001	<0.05	<0.001	<0.05	<0.02
Carson #7	3/19/2013 13:45	<0.001	0.12	<0.05	<0.01	0.68	<0.001	<0.05	<0.001	<0.05	<0.02
Cascade #4	3/13/2013 14:00	<0.001	<0.02	<0.05	<0.01	0.14	<0.001	<0.05	0.002	<0.05	<0.02
Cedar Falls #8	3/27/2013 13:45	<0.001	0.04	<0.05	<0.01	0.59	<0.001	<0.05	<0.001	<0.05	<0.02
Cedar Falls #9	3/27/2013 16:00	<0.001	<0.02	<0.05	<0.01	0.13	<0.001	<0.05	<0.001	<0.05	<0.02
Cedar Falls #9 (RS)	6/12/2013 14:00										
Charles City #8	3/25/2013 14:45	<0.001	<0.02	<0.05	<0.01	3.00	<0.001	<0.05	<0.001	<0.05	<0.02
Cherokee #10	4/8/2013 12:30	<0.001	0.38	<0.05	<0.01	1.50	<0.001	<0.05	<0.001	<0.05	<0.02
Clayton #1	4/10/2013 13:50	0.002	0.06	<0.05	<0.01	0.08	<0.001	<0.05	<0.001	<0.05	<0.02
Coralville #10	5/1/2013 13:15	<0.001	<0.02	<0.05	<0.01	3.20	<0.001	<0.05	<0.001	<0.05	<0.02
Coralville #10 (field rep)	5/1/2013 13:15	<0.001	<0.02	<0.05	<0.01	3.50	<0.001	<0.05	<0.001	<0.05	<0.02
De Witt #7	3/11/2013 15:00	<0.001	<0.02	<0.05	<0.01	2.00	<0.001	<0.05	<0.001	<0.05	<0.02
Decorah #7	4/9/2013 13:35	<0.001	<0.02	<0.05	<0.01	<0.02	<0.001	<0.05	<0.001	<0.05	<0.02
Dumont #2	4/22/2013 15:35	<0.001	<0.02	<0.05	<0.01	1.90	<0.001	<0.05	<0.001	<0.05	<0.02
Duncombe #4	3/27/2013 12:55	<0.001	<0.02	<0.05	0.01	8.50	<0.001	<0.05	<0.001	<0.05	<0.02
Elgin #2	4/10/2013 13:15	<0.001	<0.02	<0.05	<0.01	0.18	<0.001	<0.05	0.002	<0.05	<0.02
Fairfield #6	4/3/2013 13:15	<0.001	<0.02	<0.05	<0.01	2.40	<0.001	<0.05	<0.001	<0.05	<0.02
Fairfield #6 (field rep)	4/3/2013 13:15	<0.001	<0.02	<0.05	<0.01	2.30	<0.001	<0.05	<0.001	<0.05	<0.02
Fremont #2-88	4/15/2013 15:20	0.011	0.16	<0.05	<0.01	0.45	<0.001	<0.05	0.004	<0.05	<0.02
Gilbert #3	4/16/2013 15:30	<0.001	0.09	<0.05	<0.01	0.98	<0.001	<0.05	<0.001	<0.05	<0.02
Independence #3	5/8/2013 12:30	<0.001	<0.02	<0.05	<0.01	0.16	<0.001	<0.05	0.001	<0.05	<0.02
Independence #7	4/8/2013 13:30	<0.001	0.02	<0.05	<0.01	0.22	<0.001	<0.05	<0.001	<0.05	<0.02
Independence #7 (RS)	6/11/2013 12:50										
Ionia #2	3/25/2013 16:15	<0.001	<0.02	<0.05	<0.01	0.51	<0.001	<0.05	<0.001	<0.05	<0.02
Janesville #3	4/2/2013 14:40	<0.001	<0.02	<0.05	<0.01	0.11	<0.001	<0.05	<0.001	<0.05	<0.02

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Metals (dissolved) (mg/L)									
Well/Sample Name	Sample Date-Time	Lead	Manganese	Nickel	Selenium	Strontium	Thallium	Titanium	Uranium	Vanadium	Zinc
Joice #1	3/26/2013 12:45	<0.001	0.05	<0.05	<0.01	0.22	<0.001	<0.05	<0.001	<0.05	<0.02
Jolley #1	3/25/2013 14:40	<0.001	0.05	<0.05	<0.01	0.44	<0.001	<0.05	0.002	<0.05	0.03
Knierim #1	3/25/2013 13:40	<0.001	0.06	<0.05	<0.01	1.30	<0.001	<0.05	<0.001	<0.05	<0.02
Lansing #4	4/9/2013 14:35	<0.001	<0.02	<0.05	<0.01	0.21	<0.001	<0.05	<0.001	<0.05	0.02
Lyon-Sioux RWS-3	4/2/2013 13:43	<0.001	<0.02	<0.05	<0.01	0.33	<0.001	<0.05	0.007	<0.05	<0.02
Marshalltown #5	4/15/2013 14:15	<0.001	0.04	<0.05	<0.01	0.94	<0.001	<0.05	<0.001	<0.05	<0.02
Massena #6	3/13/2013 13:45	<0.001	1.20	<0.05	<0.01	0.22	<0.001	<0.05	<0.001	<0.05	0.07
Mount Vernon #9	3/18/2013 16:00	<0.001	<0.02	<0.05	<0.01	0.13	<0.001	<0.05	<0.001	<0.05	<0.02
Mount Vernon (blank)	3/18/2013 14:45	<0.001	<0.02	<0.05	<0.01	<0.02	<0.001	<0.05	<0.001	<0.05	<0.02
Moville #5	4/1/2013 16:10	<0.001	0.05	<0.05	0.01	0.29	<0.001	<0.05	0.005	<0.05	<0.02
Moville #5 (field rep)	4/1/2013 16:10	<0.001	0.05	<0.05	0.01	0.28	<0.001	<0.05	0.005	<0.05	<0.02
Nevada #8	4/16/2013 14:15	<0.001	0.56	<0.05	<0.01	0.20	<0.001	<0.05	<0.001	<0.05	<0.02
New Venna #4	3/19/2013 16:00	<0.001	<0.02	<0.05	<0.01	0.85	<0.001	<0.05	<0.001	<0.05	<0.02
Nora Springs #4	4/23/2013 12:05	<0.001	<0.02	<0.05	<0.01	0.42	<0.001	<0.05	<0.001	<0.05	<0.02
Orchardview Est. #1	3/4/2013 12:00	<0.001	<0.02	<0.05	<0.01	0.35	<0.001	<0.05	<0.001	<0.05	<0.02
Perry #22	3/4/2013 15:25	<0.001	0.14	<0.05	<0.01	0.42	<0.001	<0.05	<0.001	<0.05	<0.02
Perry #9R	3/6/2013 15:15	<0.001	0.41	<0.05	<0.01	0.21	<0.001	<0.05	0.007	<0.05	<0.02
Perry #9R (RS)	6/18/2013 11:00										
Primghar #8	4/3/2013 13:30	<0.001	0.44	<0.05	<0.01	2.70	<0.001	<0.05	0.002	<0.05	<0.02
Quimby #3	4/9/2013 12:55	<0.001	0.17	<0.05	<0.01	1.40	<0.001	<0.05	<0.001	<0.05	<0.02
Riverview Estates #1	3/4/2013 14:40	<0.001	<0.02	<0.05	<0.01	0.57	<0.001	<0.05	<0.001	<0.05	<0.02
Rockford #2	4/23/2013 13:05	<0.001	<0.02	<0.05	<0.01	2.70	<0.001	<0.05	<0.001	<0.05	<0.02
Rockford #2 (field rep)	4/23/2013 13:05	<0.001	<0.02	<0.05	<0.01	2.60	<0.001	<0.05	<0.001	<0.05	<0.02
Shelby #6A	4/22/2013 14:30	<0.001	0.54	<0.05	<0.01	0.38	<0.001	<0.05	<0.001	<0.05	<0.02
Shelby #6A (field rep)	4/22/2013 14:30	<0.001	0.54	<0.05	<0.01	0.37	<0.001	<0.05	<0.001	<0.05	<0.02
Sigourney #02-5	4/15/2013 17:00	<0.001	0.12	<0.05	<0.01	0.23	<0.001	<0.05	<0.001	<0.05	0.03
Sigourney (blank)	4/15/2013 12:45	<0.001	<0.02	<0.05	<0.01	<0.02	<0.001	<0.05	<0.001	<0.05	<0.02
Sioux Center #13	4/2/2013 12:42	<0.001	0.06	<0.05	<0.01	0.57	<0.001	<0.05	0.016	<0.05	<0.02
Stacyville #3	4/24/2013 13:40	<0.001	0.02	<0.05	<0.01	0.23	<0.001	<0.05	<0.001	<0.05	<0.02
Steamboat Rock #1	4/1/2013 14:35	<0.001	<0.02	<0.05	<0.01	0.21	<0.001	<0.05	<0.001	<0.05	<0.02
Storm Lake #18	4/8/2013 13:35	<0.001	0.33	<0.05	<0.01	0.42	<0.001	<0.05	<0.001	<0.05	<0.02
Toledo #2	3/12/2013 15:10	<0.001	<0.02	<0.05	<0.01	2.70	<0.001	<0.05	<0.001	<0.05	<0.02
Van Meter #3	3/5/2013 15:10	<0.001	0.22	<0.05	<0.01	0.35	<0.001	<0.05	0.003	<0.05	<0.02
Van Meter #3 (RS)	6/18/2013 9:00										
Ventura #1	3/26/2013 13:15	<0.001	0.03	<0.05	<0.01	0.27	<0.001	<0.05	<0.001	<0.05	0.03
Walnut #2	3/18/2013 14:30	<0.001	<0.02	<0.05	<0.01	6.10	<0.001	<0.05	<0.001	<0.05	<0.02
Walnut (blank)	3/18/2013 13:45	<0.001	<0.02	<0.05	<0.01	<0.02	<0.001	<0.05	<0.001	<0.05	<0.02
Waverly #6	4/2/2013 13:05	<0.001	<0.02	<0.05	<0.01	0.13	<0.001	<0.05	<0.001	<0.05	<0.02
Waverly #6 (RS)	6/12/2013 10:30										
Winthrop #3	4/17/2013 12:05	<0.001	0.13	<0.05	<0.01	0.71	<0.001	<0.05	<0.001	<0.05	<0.02
Woodward St. Hos. #2	3/6/2013 13:25	<0.001	0.06	<0.05	<0.01	0.71	<0.001	<0.05	<0.001	<0.05	<0.02

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Viruses & Pathogens (genomic copies/L)												
Well/Sample Name	Sample Date-Time	Adenovirus C,D,F	Adenovirus A	Adenovirus B	Enterovirus	GI Norovirus	GII Norovirus	Human Polyomavirus	Hepatitis E Virus	Bovine Polyomavirus	Pepper Mild Mottle Virus (PMMV)	*Campylobacter*	*Salmonella*	Enterohemorrhagic *E. coli*
Adel #3	3/5/2013 14:10	0	0	0	0	0	0	0	0	0	0	0	0	0
Alburnett #3	3/18/2013 14:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Algona #8	3/26/2013 14:15	0	0	0	0	0	0	0	0	0	4.64	0	0	0
Altoona #3	4/23/2013 14:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Andover #1	4/29/2013 12:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Andover (blank)	4/29/2013 12:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Anita #4	3/13/2013 14:40	0	0	0	0	0	0	0	0	0	0	0	0	0
Atkins #3	3/12/2013 12:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Audubon #13	3/12/2013 14:15	0	0	0	0	0	0	0	0	0	4.28	0	0	0
Avoca Reg. Water #19	3/19/2013 15:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Badger #3	3/26/2013 12:50	0	0	0	0	0	0	0	0	0	0	0	0	0
Battle Creek #3	4/9/2013 13:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue Grass #1a	3/20/2013 13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue Grass (blank)	3/20/2013 13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Bristow #2	4/22/2013 15:10	0	0	0	0	0	0	0	0	0	0	0	0	0
Calamus 2007	3/11/2013 15:40	0	0	0	0	0	0	0	0	0	0	0	0	0
Carson #7	3/19/2013 13:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Cascade #4	3/13/2013 14:00	0	0	0	0	0	4.23	0	0	0	0	0	0	0
Cedar Falls #8	3/27/2013 13:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Cedar Falls #9	3/27/2013 16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Cedar Falls #9 (RS)	6/12/2013 14:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Charles City #8	3/25/2013 14:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Cherokee #10	4/8/2013 12:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Clayton #1	4/10/2013 13:50	0	0	0	0	0	0	0	0	0	0	0	0	0
Clayton (blank)	4/10/2013 13:50	0	0	0	0	0	0	0	0	0	0	0	0	0
Coralville #10	5/1/2013 13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
De Witt #7	3/11/2013 15:00	0	0	0	0	0	0	0	0	0	4.92	0	0	0
Decorah #7	4/9/2013 13:35	0	0	0	0	0	0	0	0	0	3.06	0	0	0
Dumont #2	4/22/2013 15:35	0	0	0	0	0	0	0	0	0	1.33	0	0	0
Duncombe #4	3/27/2013 12:55	0	0	0	0	0	0	0	0	0	0	0	0	0
Elgin #2	4/10/2013 13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Fairfield #6	4/3/2013 13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Fremont #2-88	4/15/2013 15:20	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilbert #3	4/16/2013 15:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Independence #3	5/8/2013 12:30	0	0	0	0	0	0	0	0	0	1.12	0	0	0
Independence #7	4/8/2013 13:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Independence #7 (RS)	6/11/2013 12:50	0	0	0	0	0	0	0	0	0	0	0	0	0
Ionia #2	3/25/2013 16:15	0	0	0	0	0	0	3.07	0	0	0	0	0	0
Janesville #3	4/2/2013 14:40	0	0	0	0	0	0	0	0	0	2.64	0	0	0

blank = field blank

RS = samples obtained during the June resampling period

APPENDIX B

		Viruses & Pathogens (genomic copies/L)												
Well/Sample Name	Sample Date-Time	Adenovirus C,D,F	Adenovirus A	Adenovirus B	Enterovirus	GI Norovirus	GII Norovirus	Human Polyomavirus	Hepatitis E Virus	Bovine Polyomavirus	Pepper Mild Mottle Virus (PMMV)	*Campylobacter*	*Salmonella*	Enterohemorrhagic *E. coli*
Joice #1	3/26/2013 12:45	0	0	0	0	0	0	0	0	0	0	0.40	0	0
Jolley #1	3/25/2013 14:40	0	0	0	0	0	0	0	0	0	0	0	0	0
Knierim #1	3/25/2013 13:40	0	0	0	0	0	0	0	0	0	6.38	0	0	0
Lansing #4	4/9/2013 14:35	0	0	0	0	0	0	0	0	0	0	0	0	0
Lyon-Sioux RWS-3	4/2/2013 13:43	0	0	0	0	0	0	0	0	0	0	0	0	0
Marshalltown #5	4/15/2013 14:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Massena #6	3/13/2013 13:45	0	0	0	0	0	0	0	0	0.46	0	0	0	0
Mount Vernon #9	3/18/2013 16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Moville #5	4/1/2013 16:10	0	0	0	0	0	0	0	0	0	0	0	0	0
Nevada #8	4/16/2013 14:15	0	0	0	0	0	0	0	0	0	0	0	0	0
New Venna #4	3/19/2013 16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Nora Springs #4	4/23/2013 12:05	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchardview Est. #1	3/4/2013 12:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Perry #22	3/4/2013 15:25	0	0	0	0	0	0	0	0	0	3.26	0	0	0
Perry #9R	3/6/2013 15:15	0	0	0	0	0	0	0	0	0	4.30	0	0	0
Perry #9R (RS)	6/18/2013 11:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Primghar #8	4/3/2013 13:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Quimby #3	4/9/2013 12:55	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverview Estates #1	3/4/2013 14:40	0	0	0	0	0	0	0	0	0	0	0	0	0
Rockford #2	4/23/2013 13:05	0	0	0	0	0	0	0	0	0	0	0	0	0
Shelby #6A	4/22/2013 14:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Sigourney #02-5	4/15/2013 17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Sioux Center #13	4/2/2013 12:42	0	0	0	0	0	0	0	0	0	0	0	0	0
Stacyville #3	4/24/2013 13:40	0	0	0	0	0	0	0	0	0	0	0	0	0
Steamboat Rock #1	4/1/2013 14:35	0	0	0	0	0	0	0	0	0	0	0	0	0
Storm Lake #18	4/8/2013 13:35	0	0	0	0	0	0	0	0	0	0	0	0	0
Toledo #2	3/12/2013 15:10	0	0	0	0	0	0	0	0	0	0	0	0	0
Van Meter #3	3/5/2013 15:10	0	0	0	0	0	0	0	0	0	0	0	0	0
Van Meter #3 (RS)	6/18/2013 9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
Ventura #1	3/26/2013 13:15	0	0	0	0	0	0	0	0	0	0	0	0	0
Walnut #2	3/18/2013 14:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Waverly #6	4/2/2013 13:05	0	0	0	0	0	0	0	0	0	4.73	0	0	0
Waverly #6 (RS)	6/12/2013 10:30	0	0	0	0	0	0	0	0	0	0	0	0	0
Winthrop #3	4/17/2013 12:05	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodward St. Hos. #2	3/6/2013 13:25	0	0	0	0	0	0	0	0	0	0	0	0	0

RS = samples obtained during the June resampling period

APPENDIX B

Microbial Indicators

Well/Sample Name	Sample Date-Time	Coliphage Male Specific (PFU/100mL)	Coliphage Somatic (PFU/100mL)	*E.coli* (MPN/ 100mL)	Enterococci (MPN/ 100mL)	Total Coliform Bacteria (MPN/100mL)
Adel #3	3/5/2013 14:10	<1.0	<1.0	<1.0	<1.0	<1.0
Alburnett #3	3/18/2013 14:00	<1.0	<1.0	<1.0	<1.0	<1.0
Algona #8	3/26/2013 14:15	<1.0	<1.0	<1.0	<1.0	<1.0
Altoona #3	4/23/2013 14:30	<1.0	<1.0	<1.0	<1.0	<1.0
Altoona #3 (blank)	4/23/2013 14:00	<1.0	<1.0	<1.0	<1.0	<1.0
Andover #1	4/29/2013 12:15	<1.0	<1.0	<1.0	<1.0	<1.0
Anita #4	3/13/2013 14:40	<1.0	<1.0	<1.0	<1.0	<1.0
Atkins #3	3/12/2013 12:45	<1.0	<1.0	<1.0	<1.0	<1.0
Audubon #13	3/12/2013 14:15	<1.0	<1.0	<1.0	<1.0	<1.0
Avoca Reg. Water #19	3/19/2013 15:15	<1.0	<1.0	<1.0	<1.0	<1.0
Badger #3	3/26/2013 12:50	<1.0	<1.0	<1.0	<1.0	<1.0
Battle Creek #3	4/9/2013 13:00	<1.0	<1.0	<1.0	<1.0	<1.0
Blue Grass #1a	3/20/2013 13:15	<1.0	<1.0	<1.0	<1.0	<1.0
Bristow #2	4/22/2013 15:10	<1.0	<1.0	<1.0	<1.0	<1.0
Calamus 2007	3/11/2013 15:40	<1.0	<1.0	<1.0	<1.0	<1.0
Carson #7	3/19/2013 13:45	<1.0	<1.0	<1.0	<1.0	1.00
Cascade #4	3/13/2013 14:00	<1.0	<1.0	<1.0	<1.0	<1.0
Cedar Falls #8	3/27/2013 13:45	<1.0	<1.0	<1.0	<1.0	<1.0
Cedar Falls #9	3/27/2013 16:00	<1.0	<1.0	<1.0	<1.0	<1.0
Cedar Falls #9 (RS)	6/12/2013 14:00			<1.0	<1.0	<1.0
Charles City #8	3/25/2013 14:45	<1.0	<1.0	<1.0	<1.0	<1.0
Cherokee #10	4/8/2013 12:30	<1.0	<1.0	<1.0	<1.0	<1.0
Clayton #1	4/10/2013 13:50	<1.0	<1.0	<1.0	<1.0	<1.0
Coralville #10	5/1/2013 13:15	<1.0	<1.0	<1.0	<1.0	<1.0
Coralville #10 (field rep)	5/1/2013 13:15	<1.0	<1.0	<1.0	<1.0	<1.0
De Witt #7	3/11/2013 15:00	<1.0	<1.0	<1.0	<1.0	<1.0
Decorah #7	4/9/2013 13:35	<1.0	<1.0	<1.0	<1.0	<1.0
Dumont #2	4/22/2013 15:35	<1.0	<1.0	<1.0	<1.0	<1.0
Duncombe #4	3/27/2013 12:55	<1.0	<1.0	<1.0	<1.0	<1.0
Elgin #2	4/10/2013 13:15	<1.0	<1.0	<1.0	<1.0	<1.0
Fairfield #6	4/3/2013 13:15	<1.0	<1.0	<1.0	1.0	<1.0
Fairfield #6 (field rep)	4/3/2013 13:15	<1.0	<1.0	<1.0	1.0	<1.0
Fremont #2-88	4/15/2013 15:20	<1.0	<1.0	<1.0	<1.0	<1.0
Gilbert #3	4/16/2013 15:30	<1.0	<1.0	<1.0	<1.0	<1.0
Independence #3	5/8/2013 12:30	<1.0	<1.0	<1.0	<1.0	<1.0
Independence #7	4/8/2013 13:30	<1.0	<1.0	<1.0	<1.0	<1.0
Independence #7 (RS)	6/11/2013 12:50			<1.0	<1.0	<1.0
Ionia #2	3/25/2013 16:15	<1.0	<1.0	<1.0	<1.0	<1.0
Janesville #3	4/2/2013 14:40	3.0	<1.0	<1.0	<1.0	<1.0

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Microbial Indicators				
Well/Sample Name	Sample Date-Time	Coliphage Male Specific (PFU/100mL)	Coliphage Somatic (PFU/100mL)	*E.coli* (MPN/ 100mL)	Enterococci (MPN/ 100mL)	Total Coliform Bacteria (MPN/100mL)
Joice #1	3/26/2013 12:45	<1.0	<1.0	<1.0	<1.0	<1.0
Jolley #1	3/25/2013 14:40	<1.0	<1.0	<1.0	<1.0	<1.0
Knierim #1	3/25/2013 13:40	<1.0	<1.0	<1.0	<1.0	<1.0
Lansing #4	4/9/2013 14:35	<1.0	<1.0	<1.0	<1.0	<1.0
Lyon-Sioux RWS-3	4/2/2013 13:43	<1.0	<1.0	<1.0	<1.0	<1.0
Marshalltown #5	4/15/2013 14:15	<1.0	<1.0	<1.0	<1.0	<1.0
Massena #6	3/13/2013 13:45	<1.0	<1.0	<1.0	<1.0	<1.0
Mount Vernon #9	3/18/2013 16:00	<1.0	<1.0	<1.0	<1.0	<1.0
Mount Vernon #9 (blank)	3/18/2013 14:45	<1.0	<1.0	<1.0	<1.0	<1.0
Moville #5	4/1/2013 16:10	<1.0	<1.0	<1.0	<1.0	<1.0
Moville #5 (field rep)	4/1/2013 16:10	<1.0	<1.0	<1.0	<1.0	<1.0
Nevada #8	4/16/2013 14:15	<1.0	<1.0	<1.0	<1.0	<1.0
New Venna #4	3/19/2013 16:00	<1.0	<1.0	<1.0	<1.0	<1.0
Nora Springs #4	4/23/2013 12:05	<1.0	<1.0	<1.0	<1.0	1.0
Orchardview Est. #1	3/4/2013 12:00	<1.0	<1.0	<1.0	<1.0	<1.0
Perry #22	3/4/2013 15:25	<1.0	<1.0	<1.0	<1.0	<1.0
Perry #9R	3/6/2013 15:15	<1.0	<1.0	<1.0	<1.0	<1.0
Perry #9R (RS)	6/18/2013 11:00			<1.0	<1.0	4.1
Primghar #8	4/3/2013 13:30	<1.0	<1.0	<1.0	<1.0	<1.0
Quimby #3	4/9/2013 12:55	<1.0	<1.0	<1.0	<1.0	<1.0
Riverview Estates #1	3/4/2013 14:40	<1.0	<1.0	<1.0	<1.0	<1.0
Rockford #2	4/23/2013 13:05	<1.0	<1.0	<1.0	<1.0	<1.0
Rockford #2 (field rep)	4/23/2013 13:05	<1.0	<1.0	<1.0	<1.0	<1.0
Shelby #6A	4/22/2013 14:30	<1.0	<1.0	<1.0	<1.0	<1.0
Shelby #6A (field rep)	4/22/2013 14:30	<1.0	<1.0	<1.0	<1.0	<1.0
Sigourney #02-5	4/15/2013 17:00	<1.0	<1.0	<1.0	<1.0	<1.0
Sigourney (blank)	4/15/2013 12:45	<1.0	<1.0	<1.0	<1.0	<1.0
Sioux Center #13	4/2/2013 12:42	<1.0	<1.0	<1.0	<1.0	<1.0
Stacyville #3	4/24/2013 13:40	<1.0	<1.0	<1.0	<1.0	<1.0
Steamboat Rock #1	4/1/2013 14:35	<1.0	<1.0	<1.0	<1.0	<1.0
Storm Lake #18	4/8/2013 13:35	<1.0	<1.0	<1.0	<1.0	<1.0
Toledo #2	3/12/2013 15:10	<1.0	<1.0	<1.0	<1.0	<1.0
Van Meter #3	3/5/2013 15:10	<1.0	<1.0	<1.0	<1.0	<1.0
Van Meter #3 (RS)	6/18/2013 9:00			<1.0	<1.0	<1.0
Ventura #1	3/26/2013 13:15	<1.0	<1.0	<1.0	<1.0	<1.0
Walnut #2	3/18/2013 14:30	<1.0	<1.0	<1.0	<1.0	<1.0
Walnut (blank)	3/18/2013 13:45	<1.0	<1.0	<1.0	<1.0	<1.0
Waverly #6	4/2/2013 13:05	<1.0	<1.0	<1.0	<1.0	<1.0
Waverly #6 (RS)	6/12/2013 10:30			<1.0	<1.0	<1.0
Winthrop #3	4/17/2013 12:05	<1.0	<1.0	<1.0	<1.0	<1.0
Woodward St. Hos. #2	3/6/2013 13:25	<1.0	<1.0	<1.0	<1.0	<1.0

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Pesticides and Pesticide Degradates (µg/L) Analyzed by USGS			
Well/Sample Name	Sample Date-Time	Atrazine using the pharm method	Glyphosate	Aminomethyl-phosphonic acid (AMPA)	Glufosinate
Adel #3	3/5/2013 14:10				
Alburnett #3	3/18/2013 14:00	<0.02	<0.02	<0.02	<0.02
Algona #8	3/26/2013 14:15	<0.02	<0.02	<0.02	<0.02
Algona #8 (field rep)	3/26/2013 14:20	<0.02	<0.02	<0.02	<0.02
Altoona #3	4/23/2013 14:30				
Andover #1	4/29/2013 12:15	<0.02	<0.02	<0.02	<0.02
Anita #4	3/13/2013 14:40				
Atkins #3	3/12/2013 12:45	<0.02	<0.02	<0.02	<0.02
Audubon #13	3/12/2013 14:15	<0.02	<0.02	0.02	<0.02
Audubon #13 (field rep)	3/12/2013 14:20	<0.02	<0.02	0.02	<0.02
Avoca Reg. Water #19	3/19/2013 15:15	<0.02	<0.02	<0.02	<0.02
Badger #3	3/26/2013 12:50	<0.02	<0.02	<0.02	<0.02
Battle Creek #3	4/9/2013 13:00	<0.02	<0.02	<0.02	<0.02
Blue Grass #1a	3/20/2013 13:15	<0.02	<0.02	<0.02	<0.02
Bristow #2	4/22/2013 15:10	det	<0.02	<0.02	<0.02
Calamus 2007	3/11/2013 15:40	<0.02	<0.02	<0.02	<0.02
Carson #7	3/19/2013 13:45	<0.02	<0.02	<0.02	<0.02
Cascade #4	3/13/2013 14:00	det	<0.02	0.02	<0.02
Cedar Falls #8	3/27/2013 13:45	<0.02	<0.02	<0.02	<0.02
Cedar Falls #9	3/27/2013 16:00				
Cedar Falls #9 (RS)	6/12/2013 14:00	<0.02	<0.02	<0.02	<0.02
Charles City #8	3/25/2013 14:45	<0.02	<0.02	<0.02	<0.02
Cherokee #10	4/8/2013 12:30	<0.02	<0.02	<0.02	<0.02
Clayton #1	4/10/2013 13:50	<0.02	<0.02	<0.02	<0.02
Coralville #10	5/1/2013 13:15				
De Witt #7	3/11/2013 15:00	<0.02	<0.02	<0.02	<0.02
Decorah #7	4/9/2013 13:35	0.05	<0.02	<0.02	<0.02
Decorah #7 (field rep)	4/9/2013 13:40	0.04	<0.02	<0.02	<0.02
Dumont #2	4/22/2013 15:35	<0.02	<0.02	<0.02	<0.02
Duncombe #4	3/27/2013 12:55	<0.02	<0.02	<0.02	<0.02
Elgin #2	4/10/2013 13:15	<0.02	<0.02	<0.02	<0.02
Fairfield #6	4/3/2013 13:15	<0.02	<0.02	<0.02	<0.02
Fremont #2-88	4/15/2013 15:20	<0.02	<0.02	<0.02	<0.02
Gilbert #3	4/16/2013 15:30	<0.02	<0.02	<0.02	<0.02
Independence #3	5/8/2013 12:30	det	<0.02	<0.02	<0.02
Independence #7	4/8/2013 13:30	<0.02	<0.02	<0.02	<0.02
Independence #7 (RS)	6/11/2013 12:50	det	<0.02	<0.02	<0.02
Ionia #2	3/25/2013 16:15	<0.02	<0.02	<0.02	<0.02
Janesville #3	4/2/2013 14:40	0.04	<0.02	<0.02	<0.02

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Pesticides and Pesticide Degradates (µg/L) Analyzed by USGS			
Well/Sample Name	Sample Date-Time	Atrazine using the pharm method	Glyphosate	Aminomethyl-phosphonic acid (AMPA)	Glufosinate
Joice #1	3/26/2013 12:45				
Jolley #1	3/25/2013 14:40	<0.02	<0.02	<0.02	<0.02
Knierim #1	3/25/2013 13:40	<0.02	<0.02	<0.02	<0.02
Lansing #4	4/9/2013 14:35	<0.02	<0.02	<0.02	<0.02
Lyon-Sioux RWS-3	4/2/2013 13:43	0.02	<0.02	<0.02	<0.02
Marshalltown #5	4/15/2013 14:15	<0.02	<0.02	<0.02	<0.02
Massena #6	3/13/2013 13:45	<0.02	<0.02	<0.02	<0.02
Mount Vernon #9	3/18/2013 16:00	<0.02	<0.02	<0.02	<0.02
Mount Vernon #9 (field rep)	3/18/2013 16:05	<0.02	<0.02	<0.02	<0.02
Moville #5	4/1/2013 16:10	<0.02	<0.02	<0.02	<0.02
Nevada #8	4/16/2013 14:15	<0.02	<0.02	<0.02	<0.02
Nevada #8 (blank)	4/16/2013 14:20	<0.02	<0.02	<0.02	<0.02
New Venna #4	3/19/2013 16:00	<0.02	<0.02	<0.02	<0.02
Nora Springs #4	4/23/2013 12:05	<0.02	<0.02	<0.02	<0.02
Orchardview Est. #1	3/4/2013 12:00	<0.02	<0.02	<0.02	<0.02
Perry #22	3/4/2013 15:25	<0.02	<0.02	<0.02	<0.02
Perry #9R	3/6/2013 15:15	<0.02	<0.02	<0.02	<0.02
Perry #9R (RS)	6/18/2013 11:00	0.13	<0.02	<0.02	<0.02
Primghar #8	4/3/2013 13:30	<0.02	<0.02	<0.02	<0.02
Quimby #3	4/9/2013 12:55	<0.02	<0.02	<0.02	<0.02
Riverview Estates #1	3/4/2013 14:40	<0.02	<0.02	<0.02	<0.02
Rockford #2	4/23/2013 13:05	<0.02	<0.02	<0.02	<0.02
Shelby #6A	4/22/2013 14:30	<0.02	<0.02	<0.02	<0.02
Sigourney #02-5	4/15/2013 17:00	<0.02	<0.02	<0.02	<0.02
Sioux Center #13	4/2/2013 12:42	<0.02	<0.02	<0.02	<0.02
Stacyville #3	4/24/2013 13:40	<0.02	<0.02	<0.02	<0.02
Steamboat Rock #1	4/1/2013 14:35	<0.02	<0.02	<0.02	<0.02
Storm Lake #18	4/8/2013 13:35	<0.02	<0.02	<0.02	<0.02
Toledo #2	3/12/2013 15:10	<0.02	<0.02	<0.02	<0.02
Van Meter #3	3/5/2013 15:10				
Van Meter #3 (RS)	6/18/2013 9:00	<0.02	<0.02	<0.02	<0.02
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<0.02			
Ventura #1	3/26/2013 13:15				
Walnut #2	3/18/2013 14:30	<0.02	<0.02	<0.02	<0.02
Waverly #6	4/2/2013 13:05	0.03	<0.02	<0.02	<0.02
Waverly #6 (RS)	6/12/2013 10:30	0.04	<0.02	<0.02	<0.02
Winthrop #3	4/17/2013 12:05	<0.02*	<0.02	<0.02	<0.02
Winthrop #3 (blank)	4/17/2013 12:10	<0.02*	<0.02	<0.02	<0.02
Woodward St. Hos. #2	3/6/2013 13:25	<0.02	<0.02	<0.02	<0.02

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate collected 1 minute later

APPENDIX B

		Pesticides and Pesticide Degradates (µg/L) Analyzed by SHL											
Well/Sample Name	Sample Date-Time	Acetochlor	Acetochlor ESA	Acetochlor OXA	Alachlor	Alachlor ESA	Alachlor OXA	Dimethenamid	Dimethenamid ESA	Dimethenamid OXA	Metolachlor	Metolachlor ESA	Metolachlor OXA
Adel #3	3/5/2013 14:10	<0.025	0.120	0.082	<0.025	0.041	<0.025	<0.025	<0.025	<0.025	<0.025	0.250	0.067
Alburnett #3	3/18/2013 14:00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Algona #8	3/26/2013 14:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Altoona #3	4/23/2013 14:30	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Altoona #3 (blank)	4/23/2013 14:00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Andover #1	4/29/2013 12:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Anita #4	3/13/2013 14:40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Atkins #3	3/12/2013 12:45	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Audubon #13	3/12/2013 14:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.030	0.035	<0.025	<0.025	0.200	<0.025
Avoca Reg. Water #19	3/19/2013 15:15	<0.025	0.058	0.039	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.093	<0.025
Badger #3	3/26/2013 12:50	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Battle Creek #3	4/9/2013 13:00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.050	<0.025
Blue Grass #1a	3/20/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Bristow #2	4/22/2013 15:10	<0.025	<0.025	<0.025	<0.025	0.093	<0.025	<0.025	<0.025	<0.025	<0.025	0.075	<0.025
Calamus 2007	3/11/2013 15:40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Carson #7	3/19/2013 13:45	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Cascade #4	3/13/2013 14:00	<0.025	0.032	<0.025	<0.025	0.120	<0.025	<0.025	<0.025	<0.025	<0.025	1.000	<0.025
Cedar Falls #8	3/27/2013 13:45	<0.025	<0.025	<0.025	<0.025	0.220	<0.025	<0.025	<0.025	<0.025	<0.025	0.360	<0.025
Cedar Falls #9	3/27/2013 16:00	<0.025	<0.025	<0.025	<0.025	0.410	<0.025	<0.025	<0.025	<0.025	<0.025	1.200	<0.025
Cedar Falls #9 (RS)	6/12/2013 14:00												
Charles City #8	3/25/2013 14:45	<0.025	<0.025	<0.025	<0.025	0.130	<0.025	<0.025	<0.025	<0.025	<0.025	0.260	<0.025
Cherokee #10	4/8/2013 12:30	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Clayton #1	4/10/2013 13:50	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Coralville #10	5/1/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Coralville #10 (field rep)	5/1/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
De Witt #7	3/11/2013 15:00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Decorah #7	4/9/2013 13:35	<0.025	0.035	<0.025	<0.025	0.070	<0.025	<0.025	<0.025	<0.025	<0.025	0.170	<0.025
Dumont #2	4/22/2013 15:35	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Duncombe #4	3/27/2013 12:55	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Elgin #2	4/10/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.230	<0.025
Fairfield #6	4/3/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Fairfield #6 (field rep)	4/3/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Fremont #2-88	4/15/2013 15:20	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Gilbert #3	4/16/2013 15:30	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Independence #3	5/8/2013 12:30	<0.025	0.044	<0.025	<0.025	0.740	<0.025	<0.025	<0.025	<0.025	<0.025	0.140	<0.025
Independence #7	4/8/2013 13:30	<0.025	0.045	<0.025	<0.025	0.780	0.110	<0.025	<0.025	<0.025	<0.025	0.230	0.035
Independence #7 (RS)	6/11/2013 12:50												
Ionia #2	3/25/2013 16:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Janesville #3	4/2/2013 14:40	<0.025	0.051	<0.025	<0.025	0.730	<0.025	<0.025	<0.025	<0.025	<0.025	0.280	<0.025

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Pesticides and Pesticide Degradates (µg/L) Analyzed by SHL											
Well/Sample Name	Sample Date-Time	Acetochlor	Acetochlor ESA	Acetochlor OXA	Alachlor	Alachlor ESA	Alachlor OXA	Dimethenamid	Dimethenamid ESA	Dimethenamid OXA	Metolachlor	Metolachlor ESA	Metolachlor OXA
Joice #1	3/26/2013 12:45	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Jolley #1	3/25/2013 14:40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Knierim #1	3/25/2013 13:40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Lansing #4	4/9/2013 14:35	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Lyon-Sioux RWS-3	4/2/2013 13:43	<0.025	0.082	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.520	0.048
Marshalltown #5	4/15/2013 14:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Massena #6	3/13/2013 13:45	<0.025	<0.025	<0.025	<0.025	0.062	<0.025	<0.025	<0.025	<0.025	<0.025	0.130	0.034
Mount Vernon #9	3/18/2013 16:00	<0.025	<0.025	<0.025	<0.025	0.052	<0.025	<0.025	<0.025	<0.025	<0.025	0.032	<0.025
Mount Vernon #9 (blank)	3/18/2013 14:45	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Moville #5	4/1/2013 16:10	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Moville #5 (field rep)	4/1/2013 16:10	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Nevada #8	4/16/2013 14:15	<0.025	0.120	0.048	<0.025	0.570	0.040	<0.025	<0.025	<0.025	<0.025	0.690	0.190
New Venna #4	3/19/2013 16:00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Nora Springs #4	4/23/2013 12:05	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Orchardview Est. #1	3/4/2013 12:00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.088	<0.025
Perry #22	3/4/2013 15:25	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Perry #9R	3/6/2013 15:15	<0.025	0.085	<0.025	<0.025	0.170	<0.025	<0.025	<0.025	<0.025	<0.025	0.210	<0.025
Perry #9R (RS)	6/18/2013 11:00												
Primghar #8	4/3/2013 13:30	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Quimby #3	4/9/2013 12:55	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Riverview Estates #1	3/4/2013 14:40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Rockford #2	4/23/2013 13:05	<0.025	<0.025	<0.025	<0.025	0.037	<0.025	<0.025	<0.025	<0.025	<0.025	0.053	<0.025
Rockford #2 (field rep)	4/23/2013 13:05	<0.025	<0.025	<0.025	<0.025	0.036	<0.025	<0.025	<0.025	<0.025	<0.025	0.051	<0.025
Shelby #6A	4/22/2013 14:30	<0.025	<0.025	<0.025	<0.025	0.036	<0.025	<0.025	<0.025	<0.025	<0.025	0.350	0.040
Shelby #6A (field rep)	4/22/2013 14:30	<0.025	<0.025	<0.025	<0.025	0.038	<0.025	<0.025	<0.025	<0.025	<0.025	0.340	0.038
Sigourney #02-5	4/15/2013 17:00	<0.025	<0.025	<0.025	<0.025	0.055	<0.025	<0.025	<0.025	<0.025	<0.025	0.170	0.059
Sigourney #02-5 (blank)	4/15/2013 12:45	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Sioux Center #13	4/2/2013 12:42	<0.025	0.077	0.093	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.800	0.120
Stacyville #3	4/24/2013 13:40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Steamboat Rock #1	4/1/2013 14:35	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.040	<0.025
Storm Lake #18	4/8/2013 13:35	<0.025	0.240	0.290	<0.025	0.087	0.046	<0.025	<0.025	<0.025	<0.025	0.410	0.140
Toledo #2	3/12/2013 15:10	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Van Meter #3	3/5/2013 15:10	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Van Meter #3 (RS)	6/18/2013 9:00												
Ventura #1	3/26/2013 13:15	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Walnut #2	3/18/2013 14:30	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Walnut #2 (blank)	3/18/2013 13:45	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Waverly #6	4/2/2013 13:05	<0.025	0.038	<0.025	<0.025	0.780	<0.025	<0.025	<0.025	<0.025	<0.025	0.300	<0.025
Waverly #6 (RS)	6/12/2013 10:30												
Winthrop #3	4/17/2013 12:05	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Woodward St. Hos. #2	3/6/2013 13:25	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

Pesticides and Pesticide Degradates

(µg/L)

Analyzed by SHL

Well/Sample Name	Sample Date-Time	Ametryn	Atrazine	Desethyl Atrazine	Deisopropyl Atrazine	Bromacil	Butachlor	Butylate	Carbaryl	Carbofuran	Clomazone	Cyanazine	EPTC	Metribuzin	Pendimethalin	Prometon	Propachlor	Propazine	Simazine	Triallat	Trifluralin
Adel #3	3/5/2013 14:10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alburnett #3	3/18/2013 14:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Algona #8	3/26/2013 14:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Altoona #3	4/23/2013 14:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Altoona #3 (blank)	4/23/2013 14:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Andover #1	4/29/2013 12:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anita #4	3/13/2013 14:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Atkins #3	3/12/2013 12:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Audubon #13	3/12/2013 14:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Avoca Reg. Water #19	3/19/2013 15:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Badger #3	3/26/2013 12:50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Battle Creek #3	4/9/2013 13:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Blue Grass #1a	3/20/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bristow #2	4/22/2013 15:10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calamus 2007	3/11/2013 15:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carson #7	3/19/2013 13:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cascade #4	3/13/2013 14:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cedar Falls #8	3/27/2013 13:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cedar Falls #9	3/27/2013 16:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cedar Falls #9 (RS)	6/12/2013 14:00																				
Charles City #8	3/25/2013 14:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cherokee #10	4/8/2013 12:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Clayton #1	4/10/2013 13:50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Coralville #10	5/1/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Coralville #10 (field rep)	5/1/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
De Witt #7	3/11/2013 15:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Decorah #7	4/9/2013 13:35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dumont #2	4/22/2013 15:35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Duncombe #4	3/27/2013 12:55	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Elgin #2	4/10/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fairfield #6	4/3/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fairfield #6 (field rep)	4/3/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fremont #2-88	4/15/2013 15:20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Gilbert #3	4/16/2013 15:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Independence #3	5/8/2013 12:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Independence #7	4/8/2013 13:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Independence #7 (RS)	6/11/2013 12:50																				
Ionia #2	3/25/2013 16:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Janesville #3	4/2/2013 14:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Pesticides and Pesticide Degradates (µg/L) Analyzed by SHL																		
Well/Sample Name	Sample Date-Time	Ametryn	Atrazine	Desethyl Atrazine	Desopropyl Atrazine	Bromacil	Butachlor	Butylate	Carbaryl	Carbofuran	Clomazone	Cyanazine	EPTC	Metribuzin	Pendimethalin	Prometon	Propachlor	Propazine	Simazine	Triallat	Trifluralin
Joice #1	3/26/2013 12:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Jolley #1	3/25/2013 14:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Knierim #1	3/25/2013 13:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lansing #4	4/9/2013 14:35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lyon-Sioux RWS-3	4/2/2013 13:43	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Marshalltown #5	4/15/2013 14:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Massena #6	3/13/2013 13:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mount Vernon #9	3/18/2013 16:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mount Vernon #9 (blank)	3/18/2013 14:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Moville #5	4/1/2013 16:10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Moville #5 (field rep)	4/1/2013 16:10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nevada #8	4/16/2013 14:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
New Venna #4	3/19/2013 16:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nora Springs #4	4/23/2013 12:05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Orchardview Est. #1	3/4/2013 12:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perry #22	3/4/2013 15:25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perry #9R	3/6/2013 15:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perry #9R (RS)	6/18/2013 11:00																				
Primghar #8	4/3/2013 13:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Quimby #3	4/9/2013 12:55	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Riverview Estates #1	3/4/2013 14:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Rockford #2	4/23/2013 13:05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Rockford #2 (field rep)	4/23/2013 13:05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Shelby #6A	4/22/2013 14:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Shelby #6A (field rep)	4/22/2013 14:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sigourney #02-5	4/15/2013 17:00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sigourney #02-5 (blank)	4/15/2013 12:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sioux Center #13	4/2/2013 12:42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Stacyville #3	4/24/2013 13:40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Steamboat Rock #1	4/1/2013 14:35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Storm Lake #18	4/8/2013 13:35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toledo #2	3/12/2013 15:10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Van Meter #3	3/5/2013 15:10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Van Meter #3 (RS)	6/18/2013 9:00																				
Ventura #1	3/26/2013 13:15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Walnut #2	3/18/2013 14:30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Walnut #2 (blank)	3/18/2013 13:45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Waverly #6	4/2/2013 13:05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Waverly #6 (RS)	6/12/2013 10:30																				
Winthrop #3	4/17/2013 12:05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Woodward St. Hos. #2	3/6/2013 13:25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Detected Pharmaceuticals (ng/L)													
Well/Sample Name	Sample Date-Time	acetaminophen	atenolol	caffeine	1,7-dimethykanthine	carisoprodol	chlorpheniramine	diphenhydramine	lidocaine	nicotine	cotinine	sulfamethoxazole	thiabendazole	tramadol	warfarin
Adel #3	3/5/2013 14:10														
Alburnett #3	3/18/2013 14:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Algona #8	3/26/2013 14:15	<7.13	<13.3	det	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Algona #8 (field rep)	3/26/2013 14:20	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Altoona #3	4/23/2013 14:30														
Andover #1	4/29/2013 12:15	<7.13	<13.3	173	det	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Anita #4	3/13/2013 14:40														
Atkins #3	3/12/2013 12:45	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Audubon #13	3/12/2013 14:15	<7.13	<13.3	det	<87.7	<12.5	<4.68	24.5	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Audubon #13 (field rep)	3/12/2013 14:20	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	19.8	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Avoca Reg. Water #19	3/19/2013 15:15	<7.13	<13.3	<90.7	<87.7	det	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	7.78
Badger #3	3/26/2013 12:50	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Battle Creek #3	4/9/2013 13:00	<7.13	<13.3	det	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Blue Grass #1a	3/20/2013 13:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Bristow #2	4/22/2013 15:10	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Calamus 2007	3/11/2013 15:40	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	det	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Carson #7	3/19/2013 13:45	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Cascade #4	3/13/2013 14:00	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	48.6	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Cedar Falls #8	3/27/2013 13:45	826	<13.3	<90.7	det	<12.5	<4.68	145	det	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Cedar Falls #9	3/27/2013 16:00														
Cedar Falls #9 (RS)	6/12/2013 14:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Charles City #8	3/25/2013 14:45	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Cherokee #10	4/8/2013 12:30	<7.13	<13.3	det	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Clayton #1	4/10/2013 13:50	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Coralville #10	5/1/2013 13:15														
De Witt #7	3/11/2013 15:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Decorah #7	4/9/2013 13:35	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Decorah #7 (field rep)	4/9/2013 13:40	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Dumont #2	4/22/2013 15:35	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Duncombe #4	3/27/2013 12:55	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Elgin #2	4/10/2013 13:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Fairfield #6	4/3/2013 13:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Fremont #2-88	4/15/2013 15:20	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Gilbert #3	4/16/2013 15:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Independence #3	5/8/2013 12:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Independence #7	4/8/2013 13:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Independence #7 (RS)	6/11/2013 12:50	<7.13	det	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Ionia #2	3/25/2013 16:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Janesville #3	4/2/2013 14:40	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Detected Pharmaceuticals (ng/L)													
Well/Sample Name	Sample Date-Time	acetaminophen	atenolol	caffeine	1,7-dimethylxanthine	carisoprodol	chlorpheniramine	diphenhydramine	lidocaine	nicotine	cotinine	sulfamethoxazole	thiabendazole	tramadol	warfarin
Joice #1	3/26/2013 12:45														
Jolley #1	3/25/2013 14:40	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Knierim #1	3/25/2013 13:40	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Lansing #4	4/9/2013 14:35	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Lyon-Sioux RWS-3	4/2/2013 13:43	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	det	<4.1	<15.1	<6.03
Marshalltown #5	4/15/2013 14:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Massena #6	3/13/2013 13:45	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	det	<57.8	<6.37	<26.1	127	<15.1	<6.03
Mount Vernon #9	3/18/2013 16:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Mount Vernon #9 (field rep)	3/18/2013 16:05	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Moville #5	4/1/2013 16:10	<7.13	<13.3	det	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Nevada #8	4/16/2013 14:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Nevada #8 (blank)	4/16/2013 14:20	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
New Venna #4	3/19/2013 16:00	<7.13	<13.3	<90.7	<87.7	<12.5	det	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Nora Springs #4	4/23/2013 12:05	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Orchardview Est. #1	3/4/2013 12:00	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Perry #22	3/4/2013 15:25	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Perry #9R	3/6/2013 15:15	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Perry #9R (RS)	6/18/2013 11:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Primghar #8	4/3/2013 13:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Quimby #3	4/9/2013 12:55	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Riverview Estates #1	3/4/2013 14:40	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Rockford #2	4/23/2013 13:05	<7.13	<13.3	det	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Shelby #6A	4/22/2013 14:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Sigourney #02-5	4/15/2013 17:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Sioux Center #13	4/2/2013 12:42	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Stacyville #3	4/24/2013 13:40	<7.13	<13.3	det	<87.7	<12.5	<4.68	<5.79	<15.2	det	det	<26.1	<4.1	<15.1	<6.03
Steamboat Rock #1	4/1/2013 14:35	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Storm Lake #18	4/8/2013 13:35	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Toledo #2	3/12/2013 15:10	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	det	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Van Meter #3	3/5/2013 15:10														
Van Meter #3 (RS)	6/18/2013 9:00	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Ventura #1	3/26/2013 13:15														
Walnut #2	3/18/2013 14:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Waverly #6	4/2/2013 13:05	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Waverly #6 (RS)	6/12/2013 10:30	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	det	<6.03
Winthrop #3	4/17/2013 12:06	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Winthrop #3 (blank)	4/17/2013 12:11	<7.13	<13.3	<90.7	<87.7	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03
Woodward St. Hos. #2	3/6/2013 13:25	<7.13	<13.3	det	det	<12.5	<4.68	<5.79	<15.2	<57.8	<6.37	<26.1	<4.1	<15.1	<6.03

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)														
Well/Sample Name	Sample Date-Time	abacavir	acyclovir	albuterol	alprazolam	amitriptyline	amphetamine	antipyrine	benztropine	betamethasone	buproprion	carbamazepine	cimetidine	citalopram	clonidine	codeine
Adel #3	3/5/2013 14:10															
Alburnett #3	3/18/2013 14:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<18.4	<4.18	<27.8	<6.58	<60.8	<88.3
Algona #8	3/26/2013 14:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Algona #8 (field rep)	3/26/2013 14:20	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Altoona #3	4/23/2013 14:30															
Andover #1	4/29/2013 12:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Anita #4	3/13/2013 14:40															
Atkins #3	3/12/2013 12:45	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<18.5	<4.18	<27.8	<6.58	<60.8	<88.3
Audubon #13	3/12/2013 14:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<19.9	<4.18	<27.8	<6.58	<60.8	<88.3
Audubon #13 (field rep)	3/12/2013 14:20	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20.1	<4.18	<27.8	<6.58	<60.8	<88.3
Avoca Reg. Water #19	3/19/2013 15:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20.4	<4.18	<27.8	<6.58	<60.8	<88.3
Badger #3	3/26/2013 12:50	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Battle Creek #3	4/9/2013 13:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Blue Grass #1a	3/20/2013 13:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<19.3	<4.18	<27.8	<6.58	<60.8	<88.3
Bristow #2	4/22/2013 15:10	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Calamus 2007	3/11/2013 15:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Carson #7	3/19/2013 13:45	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<22.9	<4.18	<27.8	<6.58	<60.8	<88.3
Cascade #4	3/13/2013 14:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Cedar Falls #8	3/27/2013 13:45	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Cedar Falls #9	3/27/2013 16:00															
Cedar Falls #9 (RS)	6/12/2013 14:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Charles City #8	3/25/2013 14:45	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Cherokee #10	4/8/2013 12:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Clayton #1	4/10/2013 13:50	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Coralville #10	5/1/2013 13:15															
De Witt #7	3/11/2013 15:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Decorah #7	4/9/2013 13:35	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Decorah #7 (field rep)	4/9/2013 13:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Dumont #2	4/22/2013 15:35	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Duncombe #4	3/27/2013 12:55	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Elgin #2	4/10/2013 13:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Fairfield #6	4/3/2013 13:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Fremont #2-88	4/15/2013 15:20	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Gilbert #3	4/16/2013 15:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Independence #3	5/8/2013 12:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Independence #7	4/8/2013 13:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Independence #7 (RS)	6/11/2013 12:50	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Ionia #2	3/25/2013 16:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Janesville #3	4/2/2013 14:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)														
Well/Sample Name	Sample Date-Time	abacavir	acyclovir	albuterol	alprazolam	amitriptyline	amphetamine	antipyrine	benztropine	betamethasone	buproprion	carbamazepine	cimetidine	citalopram	clonidine	codeine
Joice #1	3/26/2013 12:45															
Jolley #1	3/25/2013 14:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Knierim #1	3/25/2013 13:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Lansing #4	4/9/2013 14:35	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Lyon-Sioux RWS-3	4/2/2013 13:43	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Marshalltown #5	4/15/2013 14:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Massena #6	3/13/2013 13:45	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<18.0	<4.18	<27.8	<6.58	<60.8	<88.3
Mount Vernon #9	3/18/2013 16:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Mount Vernon #9 (field rep)	3/18/2013 16:05	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<22.9	<4.18	<27.8	<6.58	<60.8	<88.3
Moville #5	4/1/2013 16:10	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Nevada #8	4/16/2013 14:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Nevada #8 (blank)	4/16/2013 14:20	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
New Venna #4	3/19/2013 16:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<19.2	<4.18	<27.8	<6.58	<60.8	<88.3
Nora Springs #4	4/23/2013 12:05	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Orchardview Est. #1	3/4/2013 12:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<22.5	<4.18	<27.8	<6.58	<60.8	<88.3
Perry #22	3/4/2013 15:25	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20.2	<4.18	<27.8	<6.58	<60.8	<88.3
Perry #9R	3/6/2013 15:15	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Perry #9R (RS)	6/18/2013 11:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Primghar #8	4/3/2013 13:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Quimby #3	4/9/2013 12:55	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Riverview Estates #1	3/4/2013 14:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<22.8	<4.18	<27.8	<6.58	<60.8	<88.3
Rockford #2	4/23/2013 13:05	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Shelby #6A	4/22/2013 14:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Sigourney #02-5	4/15/2013 17:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Sioux Center #13	4/2/2013 12:42	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Stacyville #3	4/24/2013 13:40	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<12.2	<27.8	<6.58	<60.8	<88.3
Steamboat Rock #1	4/1/2013 14:35	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Storm Lake #18	4/8/2013 13:35	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Toledo #2	3/12/2013 15:10	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Van Meter #3	3/5/2013 15:10															
Van Meter #3 (RS)	6/18/2013 9:00	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Ventura #1	3/26/2013 13:15															
Walnut #2	3/18/2013 14:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Waverly #6	4/2/2013 13:05	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<20	<4.18	<27.8	<6.58	<60.8	<88.3
Waverly #6 (RS)	6/12/2013 10:30	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Winthrop #3*	4/17/2013 12:06	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Winthrop #3 (blank)*	4/17/2013 12:11	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<17.8	<4.18	<27.8	<6.58	<60.8	<88.3
Woodward St. Hos. #2	3/6/2013 13:25	<8.21	<22.2	<6.06	<21.3	<37.2	<8.14	<116	<15.8	<114	<22.2	<4.18	<27.8	<6.58	<60.8	<88.3

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)															
Well/Sample Name	Sample Date-Time	dehydronifedipine	desvenlafaxine	dextromethorphan	diazepam	diltiazem	duloxetine	erythromycin	ezetimibe	fadrozole	famotidine	fenofibrate	fexofenadine	fluconazole	fluoxetine	fluticasone	fluvoxamine
Adel #3	3/5/2013 14:10																
Alburnett #3	3/18/2013 14:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Algona #8	3/26/2013 14:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Algona #8 (field rep)	3/26/2013 14:20	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Altoona #3	4/23/2013 14:30																
Andover #1	4/29/2013 12:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Anita #4	3/13/2013 14:40																
Atkins #3	3/12/2013 12:45	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Audubon #13	3/12/2013 14:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Audubon #13 (field rep)	3/12/2013 14:20	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Avoca Reg. Water #19	3/19/2013 15:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Badger #3	3/26/2013 12:50	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Battle Creek #3	4/9/2013 13:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Blue Grass #1a	3/20/2013 13:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Bristow #2	4/22/2013 15:10	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Calamus 2007	3/11/2013 15:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Carson #7	3/19/2013 13:45	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Cascade #4	3/13/2013 14:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Cedar Falls #8	3/27/2013 13:45	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Cedar Falls #9	3/27/2013 16:00																
Cedar Falls #9 (RS)	6/12/2013 14:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Charles City #8	3/25/2013 14:45	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Cherokee #10	4/8/2013 12:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Clayton #1	4/10/2013 13:50	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Coralville #10	5/1/2013 13:15																
De Witt #7	3/11/2013 15:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Decorah #7	4/9/2013 13:35	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Decorah #7 (field rep)	4/9/2013 13:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Dumont #2	4/22/2013 15:35	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Duncombe #4	3/27/2013 12:55	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Elgin #2	4/10/2013 13:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Fairfield #6	4/3/2013 13:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Fremont #2-88	4/15/2013 15:20	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Gilbert #3	4/16/2013 15:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Independence #3	5/8/2013 12:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Independence #7	4/8/2013 13:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Independence #7 (RS)	6/11/2013 12:50	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Ionia #2	3/25/2013 16:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Janesville #3	4/2/2013 14:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)															
Well/Sample Name	Sample Date-Time	dehydronifedipine	desvenlafaxine	dextromethorphan	diazepam	diltiazem	duloxetine	erythromycin	ezetimibe	fadrozole	famotidine	fenofibrate	fexofenadine	fluconazole	fluoxetine	fluticasone	fluvoxamine
Joice #1	3/26/2013 12:45																
Jolley #1	3/25/2013 14:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Knierim #1	3/25/2013 13:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Lansing #4	4/9/2013 14:35	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Lyon-Sioux RWS-3	4/2/2013 13:43	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Marshalltown #5	4/15/2013 14:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Massena #6	3/13/2013 13:45	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Mount Vernon #9	3/18/2013 16:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Mount Vernon #9 (field rep)	3/18/2013 16:05	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Moville #5	4/1/2013 16:10	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Nevada #8	4/16/2013 14:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Nevada #8 (blank)	4/16/2013 14:20	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
New Venna #4	3/19/2013 16:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Nora Springs #4	4/23/2013 12:05	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Orchardview Est. #1	3/4/2013 12:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Perry #22	3/4/2013 15:25	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Perry #9R	3/6/2013 15:15	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Perry #9R (RS)	6/18/2013 11:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Primghar #8	4/3/2013 13:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Quimby #3	4/9/2013 12:55	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Riverview Estates #1	3/4/2013 14:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Rockford #2	4/23/2013 13:05	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Shelby #6A	4/22/2013 14:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Sigourney #02-5	4/15/2013 17:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Sioux Center #13	4/2/2013 12:42	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Stacyville #3	4/24/2013 13:40	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Steamboat Rock #1	4/1/2013 14:35	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Storm Lake #18	4/8/2013 13:35	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Toledo #2	3/12/2013 15:10	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Van Meter #3	3/5/2013 15:10																
Van Meter #3 (RS)	6/18/2013 9:00	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Ventura #1	3/26/2013 13:15																
Walnut #2	3/18/2013 14:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Waverly #6	4/2/2013 13:05	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Waverly #6 (RS)	6/12/2013 10:30	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Winthrop #3*	4/17/2013 12:06	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Winthrop #3 (blank)*	4/17/2013 12:11	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8
Woodward St. Hos. #2	3/6/2013 13:25	<24.5	<7.49	<8.2	<2.24	<10.2	<36.6	<53.1	<63.5	<7.32	<10.7	<6.28	<19.9	<71	<26.9	<4.62	<53.8

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX B

Well/Sample Name	Sample Date-Time	Undetected Pharmaceuticals (ng/L)												
		glipizide	glyburide	hydrocodone	hydrocortisone	hydroxyzine	iminostilbene	ketoconazole	lamivudine	loperamide	loratadine	lorazepam	meprobamate	metaxalone
Adel #3	3/5/2013 14:10													
Alburnett #3	3/18/2013 14:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Algona #8	3/26/2013 14:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Algona #8 (field rep)	3/26/2013 14:20	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Altoona #3	4/23/2013 14:30													
Andover #1	4/29/2013 12:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Anita #4	3/13/2013 14:40													
Atkins #3	3/12/2013 12:45	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Audubon #13	3/12/2013 14:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Audubon #13 (field rep)	3/12/2013 14:20	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Avoca Reg. Water #19	3/19/2013 15:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Badger #3	3/26/2013 12:50	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Battle Creek #3	4/9/2013 13:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Blue Grass #1a	3/20/2013 13:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Bristow #2	4/22/2013 15:10	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Calamus 2007	3/11/2013 15:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Carson #7	3/19/2013 13:45	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Cascade #4	3/13/2013 14:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Cedar Falls #8	3/27/2013 13:45	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Cedar Falls #9	3/27/2013 16:00													
Cedar Falls #9 (RS)	6/12/2013 14:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Charles City #8	3/25/2013 14:45	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Cherokee #10	4/8/2013 12:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Clayton #1	4/10/2013 13:50	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Coralville #10	5/1/2013 13:15													
De Witt #7	3/11/2013 15:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Decorah #7	4/9/2013 13:35	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Decorah #7 (field rep)	4/9/2013 13:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Dumont #2	4/22/2013 15:35	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Duncombe #4	3/27/2013 12:55	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Elgin #2	4/10/2013 13:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Fairfield #6	4/3/2013 13:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Fremont #2-88	4/15/2013 15:20	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Gilbert #3	4/16/2013 15:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Independence #3	5/8/2013 12:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Independence #7	4/8/2013 13:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Independence #7 (RS)	6/11/2013 12:50	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Ionia #2	3/25/2013 16:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Janesville #3	4/2/2013 14:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)												
Well/Sample Name	Sample Date-Time	glipizide	glyburide	hydrocodone	hydrocortisone	hydroxyzine	iminostilbene	ketoconazole	lamivudine	loperamide	loratadine	lorazepam	meprobamate	metaxalone
Joice #1	3/26/2013 12:45													
Jolley #1	3/25/2013 14:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Knierim #1	3/25/2013 13:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Lansing #4	4/9/2013 14:35	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Lyon-Sioux RWS-3	4/2/2013 13:43	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Marshalltown #5	4/15/2013 14:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Massena #6	3/13/2013 13:45	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Mount Vernon #9	3/18/2013 16:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Mount Vernon #9 (field rep)	3/18/2013 16:05	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Moville #5	4/1/2013 16:10	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Nevada #8	4/16/2013 14:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Nevada #8 (blank)	4/16/2013 14:20	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
New Venna #4	3/19/2013 16:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Nora Springs #4	4/23/2013 12:05	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Orchardview Est. #1	3/4/2013 12:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Perry #22	3/4/2013 15:25	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Perry #9R	3/6/2013 15:15	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Perry #9R (RS)	6/18/2013 11:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Primghar #8	4/3/2013 13:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Quimby #3	4/9/2013 12:55	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Riverview Estates #1	3/4/2013 14:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Rockford #2	4/23/2013 13:05	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Shelby #6A	4/22/2013 14:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Sigourney #02-5	4/15/2013 17:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Sioux Center #13	4/2/2013 12:42	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Stacyville #3	4/24/2013 13:40	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Steamboat Rock #1	4/1/2013 14:35	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Storm Lake #18	4/8/2013 13:35	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Toledo #2	3/12/2013 15:10	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Van Meter #3	3/5/2013 15:10													
Van Meter #3 (RS)	6/18/2013 9:00	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Ventura #1	3/26/2013 13:15													
Walnut #2	3/18/2013 14:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Waverly #6	4/2/2013 13:05	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Waverly #6 (RS)	6/12/2013 10:30	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Winthrop #3*	4/17/2013 12:06	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Winthrop #3 (blank)*	4/17/2013 12:11	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6
Woodward St. Hos. #2	3/6/2013 13:25	<34.6	<3.95	<10.5	<147	<7.43	<145	<113	<16.1	<11.5	<6.95	<116	<86	<15.6

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX B

Well/Sample Name	Sample Date-Time	Undetected Pharmaceuticals (ng/L)												
		metformin	methadone	methocarbamol	methotrexate	methyl-1h benzotriazole	metoprolol	morphine	nadolol	n-desmethyldiltiazem	nevirapine	nizatidine	nordiazepam	norethindrone
Adel #3	3/5/2013 14:10													
Alburnett #3	3/18/2013 14:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Algona #8	3/26/2013 14:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Algona #8 (field rep)	3/26/2013 14:20	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Altoona #3	4/23/2013 14:30													
Andover #1	4/29/2013 12:15	UTA	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Anita #4	3/13/2013 14:40													
Atkins #3	3/12/2013 12:45	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Audubon #13	3/12/2013 14:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Audubon #13 (field rep)	3/12/2013 14:20	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Avoca Reg. Water #19	3/19/2013 15:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Badger #3	3/26/2013 12:50	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Battle Creek #3	4/9/2013 13:00	<13.1	UTA	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Blue Grass #1a	3/20/2013 13:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Bristow #2	4/22/2013 15:10	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Calamus 2007	3/11/2013 15:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Carson #7	3/19/2013 13:45	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Cascade #4	3/13/2013 14:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Cedar Falls #8	3/27/2013 13:45	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Cedar Falls #9	3/27/2013 16:00													
Cedar Falls #9 (RS)	6/12/2013 14:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Charles City #8	3/25/2013 14:45	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Cherokee #10	4/8/2013 12:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Clayton #1	4/10/2013 13:50	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Coralville #10	5/1/2013 13:15													
De Witt #7	3/11/2013 15:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Decorah #7	4/9/2013 13:35	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Decorah #7 (field rep)	4/9/2013 13:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Dumont #2	4/22/2013 15:35	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Duncombe #4	3/27/2013 12:55	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Elgin #2	4/10/2013 13:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Fairfield #6	4/3/2013 13:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Fremont #2-88	4/15/2013 15:20	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Gilbert #3	4/16/2013 15:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Independence #3	5/8/2013 12:30	UTA	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Independence #7	4/8/2013 13:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Independence #7 (RS)	6/11/2013 12:50	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Ionia #2	3/25/2013 16:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Janesville #3	4/2/2013 14:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)												
Well/Sample Name	Sample Date-Time	metformin	methadone	methocarbamol	methotrexate	methyl-1h benzotriazole	metoprolol	morphine	nadolol	n-desmethyldiltiazem	nevirapine	nizatidine	nordiazepam	norethindrone
Joice #1	3/26/2013 12:45													
Jolley #1	3/25/2013 14:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Knierim #1	3/25/2013 13:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Lansing #4	4/9/2013 14:35	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Lyon-Sioux RWS-3	4/2/2013 13:43	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Marshalltown #5	4/15/2013 14:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Massena #6	3/13/2013 13:45	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Mount Vernon #9	3/18/2013 16:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Mount Vernon #9 (field rep)	3/18/2013 16:05	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Moville #5	4/1/2013 16:10	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Nevada #8	4/16/2013 14:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Nevada #8 (blank)	4/16/2013 14:20	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
New Venna #4	3/19/2013 16:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Nora Springs #4	4/23/2013 12:05	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Orchardview Est. #1	3/4/2013 12:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Perry #22	3/4/2013 15:25	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Perry #9R	3/6/2013 15:15	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14.0	<80.8	<12.4	<15.1	<19.0	<41.4	<10.9
Perry #9R (RS)	6/18/2013 11:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Primghar #8	4/3/2013 13:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Quimby #3	4/9/2013 12:55	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Riverview Estates #1	3/4/2013 14:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Rockford #2	4/23/2013 13:05	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Shelby #6A	4/22/2013 14:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Sigourney #02-5	4/15/2013 17:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Sioux Center #13	4/2/2013 12:42	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Stacyville #3	4/24/2013 13:40	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Steamboat Rock #1	4/1/2013 14:35	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Storm Lake #18	4/8/2013 13:35	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Toledo #2	3/12/2013 15:10	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Van Meter #3	3/5/2013 15:10													
Van Meter #3 (RS)	6/18/2013 9:00	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Ventura #1	3/26/2013 13:15													
Walnut #2	3/18/2013 14:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Waverly #6	4/2/2013 13:05	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Waverly #6 (RS)	6/12/2013 10:30	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Winthrop #3*	4/17/2013 12:06	UTA	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Winthrop #3 (blank)*	4/17/2013 12:11	UTA	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9
Woodward St. Hos. #2	3/6/2013 13:25	<13.1	<7.61	<8.72	<52.4	<141	<27.5	<14	<80.8	<12.4	<15.1	<19	<41.4	<10.9

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)												
Well/Sample Name	Sample Date-Time	norfluoxetine	norsertraline	norverapamil	omeprazole	orlistat	oseltamivir	oxazepam	oxycodone	paroxetine	penciclovir	pentoxifylline	phenazopyridine	phendimetrazine
Adel #3	3/5/2013 14:10													
Alburnett #3	3/18/2013 14:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Algona #8	3/26/2013 14:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Algona #8 (field rep)	3/26/2013 14:20	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Altoona #3	4/23/2013 14:30													
Andover #1	4/29/2013 12:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Anita #4	3/13/2013 14:40													
Atkins #3	3/12/2013 12:45	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Audubon #13	3/12/2013 14:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Audubon #13 (field rep)	3/12/2013 14:20	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Avoca Reg. Water #19	3/19/2013 15:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Badger #3	3/26/2013 12:50	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Battle Creek #3	4/9/2013 13:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Blue Grass #1a	3/20/2013 13:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Bristow #2	4/22/2013 15:10	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Calamus 2007	3/11/2013 15:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Carson #7	3/19/2013 13:45	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Cascade #4	3/13/2013 14:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Cedar Falls #8	3/27/2013 13:45	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Cedar Falls #9	3/27/2013 16:00													
Cedar Falls #9 (RS)	6/12/2013 14:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Charles City #8	3/25/2013 14:45	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Cherokee #10	4/8/2013 12:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Clayton #1	4/10/2013 13:50	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Coralville #10	5/1/2013 13:15													
De Witt #7	3/11/2013 15:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Decorah #7	4/9/2013 13:35	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Decorah #7 (field rep)	4/9/2013 13:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Dumont #2	4/22/2013 15:35	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Duncombe #4	3/27/2013 12:55	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Elgin #2	4/10/2013 13:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Fairfield #6	4/3/2013 13:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Fremont #2-88	4/15/2013 15:20	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Gilbert #3	4/16/2013 15:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Independence #3	5/8/2013 12:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Independence #7	4/8/2013 13:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Independence #7 (RS)	6/11/2013 12:50	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Ionia #2	3/25/2013 16:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Janesville #3	4/2/2013 14:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)												
Well/Sample Name	Sample Date-Time	norfluoxetine	norsertraline	norverapamil	omeprazole	orlistat	oseltamivir	oxazepam	oxycodone	paroxetine	penciclovir	pentoxifylline	phenazopyridine	phendimetrazine
Joice #1	3/26/2013 12:45													
Jolley #1	3/25/2013 14:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Knierim #1	3/25/2013 13:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Lansing #4	4/9/2013 14:35	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Lyon-Sioux RWS-3	4/2/2013 13:43	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Marshalltown #5	4/15/2013 14:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Massena #6	3/13/2013 13:45	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Mount Vernon #9	3/18/2013 16:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Mount Vernon #9 (field rep)	3/18/2013 16:05	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Moville #5	4/1/2013 16:10	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Nevada #8	4/16/2013 14:15	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Nevada #8 (blank)	4/16/2013 14:20	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
New Venna #4	3/19/2013 16:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Nora Springs #4	4/23/2013 12:05	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Orchardview Est. #1	3/4/2013 12:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Perry #22	3/4/2013 15:25	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Perry #9R	3/6/2013 15:15	<199	<192	<8.58	<5.62	<52.0	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Perry #9R (RS)	6/18/2013 11:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Primghar #8	4/3/2013 13:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Quimby #3	4/9/2013 12:55	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Riverview Estates #1	3/4/2013 14:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Rockford #2	4/23/2013 13:05	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Shelby #6A	4/22/2013 14:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Sigourney #02-5	4/15/2013 17:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Sioux Center #13	4/2/2013 12:42	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Stacyville #3	4/24/2013 13:40	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Steamboat Rock #1	4/1/2013 14:35	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Storm Lake #18	4/8/2013 13:35	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Toledo #2	3/12/2013 15:10	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Van Meter #3	3/5/2013 15:10													
Van Meter #3 (RS)	6/18/2013 9:00	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Ventura #1	3/26/2013 13:15													
Walnut #2	3/18/2013 14:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Waverly #6	4/2/2013 13:05	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Waverly #6 (RS)	6/12/2013 10:30	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Winthrop #3*	4/17/2013 12:06	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Winthrop #3 (blank)*	4/17/2013 12:11	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1
Woodward St. Hos. #2	3/6/2013 13:25	<199	<192	<8.58	<5.62	<52	<14.6	<140	<24.9	<20.6	<40.2	<9.35	<13.3	<31.1

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)											
Well/Sample Name	Sample Date-Time	phenytoin	piperonyl butoxide	prednisolone	prednisone	promethazine	propoxyphene	propranolol	pseudoephedrine	quinine	raloxifene	ranitidine	sertraline
Adel #3	3/5/2013 14:10												
Alburnett #3	3/18/2013 14:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Algona #8	3/26/2013 14:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Algona #8 (field rep)	3/26/2013 14:20	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Altoona #3	4/23/2013 14:30												
Andover #1	4/29/2013 12:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Anita #4	3/13/2013 14:40												
Atkins #3	3/12/2013 12:45	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Audubon #13	3/12/2013 14:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Audubon #13 (field rep)	3/12/2013 14:20	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Avoca Reg. Water #19	3/19/2013 15:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Badger #3	3/26/2013 12:50	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Battle Creek #3	4/9/2013 13:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Blue Grass #1a	3/20/2013 13:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Bristow #2	4/22/2013 15:10	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Calamus 2007	3/11/2013 15:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Carson #7	3/19/2013 13:45	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Cascade #4	3/13/2013 14:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Cedar Falls #8	3/27/2013 13:45	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Cedar Falls #9	3/27/2013 16:00												
Cedar Falls #9 (RS)	6/12/2013 14:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Charles City #8	3/25/2013 14:45	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Cherokee #10	4/8/2013 12:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Clayton #1	4/10/2013 13:50	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Coralville #10	5/1/2013 13:15												
De Witt #7	3/11/2013 15:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Decorah #7	4/9/2013 13:35	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Decorah #7 (field rep)	4/9/2013 13:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Dumont #2	4/22/2013 15:35	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Duncombe #4	3/27/2013 12:55	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Elgin #2	4/10/2013 13:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Fairfield #6	4/3/2013 13:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Fremont #2-88	4/15/2013 15:20	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Gilbert #3	4/16/2013 15:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Independence #3	5/8/2013 12:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Independence #7	4/8/2013 13:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Independence #7 (RS)	6/11/2013 12:50	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Ionia #2	3/25/2013 16:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Janesville #3	4/2/2013 14:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)											
Well/Sample Name	Sample Date-Time	phenytoin	piperonyl butoxide	prednisolone	prednisone	promethazine	propoxyphene	propranolol	pseudoephedrine	quinine	raloxifene	ranitidine	sertraline
Joice #1	3/26/2013 12:45												
Jolley #1	3/25/2013 14:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Knierim #1	3/25/2013 13:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Lansing #4	4/9/2013 14:35	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Lyon-Sioux RWS-3	4/2/2013 13:43	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Marshalltown #5	4/15/2013 14:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Massena #6	3/13/2013 13:45	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Mount Vernon #9	3/18/2013 16:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Mount Vernon #9 (field rep)	3/18/2013 16:05	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Moville #5	4/1/2013 16:10	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Nevada #8	4/16/2013 14:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Nevada #8 (blank)	4/16/2013 14:20	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
New Venna #4	3/19/2013 16:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Nora Springs #4	4/23/2013 12:05	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Orchardview Est. #1	3/4/2013 12:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Perry #22	3/4/2013 15:25	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Perry #9R	3/6/2013 15:15	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Perry #9R (RS)	6/18/2013 11:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Primghar #8	4/3/2013 13:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Quimby #3	4/9/2013 12:55	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Riverview Estates #1	3/4/2013 14:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Rockford #2	4/23/2013 13:05	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Shelby #6A	4/22/2013 14:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Sigourney #02-5	4/15/2013 17:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Sioux Center #13	4/2/2013 12:42	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Stacyville #3	4/24/2013 13:40	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Steamboat Rock #1	4/1/2013 14:35	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Storm Lake #18	4/8/2013 13:35	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Toledo #2	3/12/2013 15:10	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Van Meter #3	3/5/2013 15:10												
Van Meter #3 (RS)	6/18/2013 9:00	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Ventura #1	3/26/2013 13:15												
Walnut #2	3/18/2013 14:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Waverly #6	4/2/2013 13:05	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Waverly #6 (RS)	6/12/2013 10:30	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Winthrop #3*	4/17/2013 12:06	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Winthrop #3 (blank)*	4/17/2013 12:11	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2
Woodward St. Hos. #2	3/6/2013 13:25	<188	<3.07	<150	<168	<50	<17.2	<26.3	<11.1	<79.9	<9.72	<192	<16.2

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)											
Well/Sample Name	Sample Date-Time	sitagliptin	sulfadimethoxine	sulfamethizole	tamoxifen	temazepam	theophylline	tiotropium	triamterene	trimethoprim	valacyclovir	venlafaxine	verapamil
Adel #3	3/5/2013 14:10												
Alburnett #3	3/18/2013 14:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Algona #8	3/26/2013 14:15	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Algona #8 (field rep)	3/26/2013 14:20	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Altoona #3	4/23/2013 14:30												
Andover #1	4/29/2013 12:15	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Anita #4	3/13/2013 14:40												
Atkins #3	3/12/2013 12:45	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Audubon #13	3/12/2013 14:15	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Audubon #13 (field rep)	3/12/2013 14:20	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Avoca Reg. Water #19	3/19/2013 15:15	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Badger #3	3/26/2013 12:50	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Battle Creek #3	4/9/2013 13:00	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Blue Grass #1a	3/20/2013 13:15	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Bristow #2	4/22/2013 15:10	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Calamus 2007	3/11/2013 15:40	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Carson #7	3/19/2013 13:45	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Cascade #4	3/13/2013 14:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Cedar Falls #8	3/27/2013 13:45	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Cedar Falls #9	3/27/2013 16:00												
Cedar Falls #9 (RS)	6/12/2013 14:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Charles City #8	3/25/2013 14:45	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Cherokee #10	4/8/2013 12:30	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Clayton #1	4/10/2013 13:50	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Coralville #10	5/1/2013 13:15												
De Witt #7	3/11/2013 15:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Decorah #7	4/9/2013 13:35	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Decorah #7 (field rep)	4/9/2013 13:40	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Dumont #2	4/22/2013 15:35	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Duncombe #4	3/27/2013 12:55	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Elgin #2	4/10/2013 13:15	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Fairfield #6	4/3/2013 13:15	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Fremont #2-88	4/15/2013 15:20	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Gilbert #3	4/16/2013 15:30	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Independence #3	5/8/2013 12:30	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Independence #7	4/8/2013 13:30	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Independence #7 (RS)	6/11/2013 12:50	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Ionia #2	3/25/2013 16:15	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Janesville #3	4/2/2013 14:40	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5

RS = samples obtained during the June resampling period

field rep = field replicate

APPENDIX B

		Undetected Pharmaceuticals (ng/L)											
Well/Sample Name	Sample Date-Time	sitagliptin	sulfadimethoxine	sulfamethizole	tamoxifen	temazepam	theophylline	tiotropium	triamterene	trimethoprim	valacyclovir	venlafaxine	verapamil
Joice #1	3/26/2013 12:45												
Jolley #1	3/25/2013 14:40	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Knierim #1	3/25/2013 13:40	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Lansing #4	4/9/2013 14:35	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Lyon-Sioux RWS-3	4/2/2013 13:43	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Marshalltown #5	4/15/2013 14:15	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Massena #6	3/13/2013 13:45	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Mount Vernon #9	3/18/2013 16:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Mount Vernon #9 (field rep)	3/18/2013 16:05	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Moville #5	4/1/2013 16:10	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Nevada #8	4/16/2013 14:15	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Nevada #8 (blank)	4/16/2013 14:20	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
New Venna #4	3/19/2013 16:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Nora Springs #4	4/23/2013 12:05	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Orchardview Est. #1	3/4/2013 12:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Perry #22	3/4/2013 15:25	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Perry #9R	3/6/2013 15:15	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Perry #9R (RS)	6/18/2013 11:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Primghar #8	4/3/2013 13:30	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Quimby #3	4/9/2013 12:55	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Riverview Estates #1	3/4/2013 14:40	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Rockford #2	4/23/2013 13:05	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Shelby #6A	4/22/2013 14:30	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Sigourney #02-5	4/15/2013 17:00	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Sioux Center #13	4/2/2013 12:42	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Stacyville #3	4/24/2013 13:40	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Steamboat Rock #1	4/1/2013 14:35	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Storm Lake #18	4/8/2013 13:35	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Toledo #2	3/12/2013 15:10	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Van Meter #3	3/5/2013 15:10												
Van Meter #3 (RS)	6/18/2013 9:00	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Van Meter #3 (RS) (field rep)	6/18/2013 9:05	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Ventura #1	3/26/2013 13:15												
Walnut #2	3/18/2013 14:30	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Waverly #6	4/2/2013 13:05	<97.3	<65.5	<104	UTA	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Waverly #6 (RS)	6/12/2013 10:30	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Winthrop #3*	4/17/2013 12:06	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Winthrop #3 (blank)*	4/17/2013 12:11	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5
Woodward St. Hos. #2	3/6/2013 13:25	<97.3	<65.5	<104	<52.4	<18.4	<41.5	<43.1	<5.25	<19	<163	<4.48	<15.5

blank = field blank

RS = samples obtained during the June resampling period

field rep = field replicate

*USGS pharmaceutical analyses were run on a frozen field replicate

APPENDIX C

Matrix Recovery Results for Analyses by qPCR

Samples	Poliovirus Sabin 3		Campylobacter		Giardia lamblia	
	Concentration (genomic copies)	% Recovery	Concentration (genomic copies)	% Recovery	Concentration (genomic copies)	% Recovery
Decorah #7 spiked sample	9.37E+06	102	1.44E+06	105	5.42E+03	72
Decorah #7 positive control	9.14E+06		1.37E+06		7.54E+03	
Elgin #2 spiked sample	1.35E+07	85	4.09E+05	76	2.93E+03	47
Elgin #2 positive control	1.58E+07		5.38E+05		6.24E+03	
Independence #7 spiked sample	6.22E+05	13	3.99E+05	32	1.64E+03	66
Independence #7 positive control	4.70E+06		1.25E+06		2.48E+03	
Lansing #4 spiked sample	1.80E+06	29	1.00E+05	23	1.11E+03	22
Lansing #4 positive control	6.21E+06		4.27E+05		5.10E+03	

Iowa Department of Natural Resources
Environmental Protection Commission

ITEM **14** **Information**

TOPIC Water Supply: Water Use & Allocation Annual Permit Fee

The Commission is asked to review the Water Use and Allocation Program budget and SFY 2016 annual permit fee, in anticipation of approving the annual fee at its September meeting. The proposed annual permit fee is $99.00 per permit for SFY 2016.

Background

Water use permits are required of any person or entity using 25,000 gallons of water in a single day during the year, and are issued for a period of up to 10 years. Previously, appropriations from the General Fund were used to fund the water allocation and use permits program. During the 2008 legislative session, the legislature authorized the department to collect up to an additional $500,000 in fees each fiscal year. Iowa Code §455B.265(6) requires the fees to be based on the Department's "reasonable cost of reviewing applications, issuing permits, ensuring compliance with the terms of the permits, and resolving water interference complaints." There are two types of fees in the Water Use and Allocation Program: an application fee and an annual permit fee. This request is for the determination of the annual fee for SFY 2016.

The annual fee rule, adopted in 2009, is summarized below (IAC 567-50.4(2)*"b"*):

- Each year, the Commission is asked to set the annual fee based on the budgeted expenses for that year minus the amount of any unused funds from the previous year and any general fund appropriations.
- The department reviews the annual permit fee each year and adjusts the fee as necessary to cover all reasonable costs required to develop and administer the water use permitting program.
- The annual fee is based on the number of active permits.
- Each permit holder pays the same annual fee.
- The fee is not prorated and is nonrefundable.
- The department requests Commission approval of the amount of the annual fee no later than September 30 of each year.
- The department provides an annual fee notice to each permittee at least 60 days prior to the fee due date.
- The annual fee due date is December 1st; 60 days prior is October 1st.

There is no annual fee required for either a water storage permit (permitted for the life of the structure) or a minor nonrecurring water use registration (one-year permit duration).

The annual permit fee was $135.00 in the first two years, $95.00 in SFY 2012, and $66.00 in SFY 2013 and SFY 2014, and $99.00 in SFY 2015.

SFY 2016 Budget

The worksheet included with this agenda brief illustrates the actual expenditures in SFY 2009 – 2015 and the budgeted amounts for SFY 2015 and SFY 2016. The final accounting figures for SFY 2015 are not expected to change. In addition to accomplishing the normal work activities of the program, the budget in 2016 includes the following:

- Completion of Phase 2 of the Water Use Program's computer database, including deployment in early SFY 2016; and
- Added 0.5 FTE to the program for modeling and technical assistance functions previously provided by the Iowa Geological Survey.

Fee Analysis

The second phase of computer programming required to complete the database functions was primarily conducted in SFY 2015. The business analysis and contract part of the project was completed in SFY 2014. The deployment of the new database occurred in early SFY 2016. At the Water Use Stakeholder meeting on July 30, 2015, the program's activities and budget were reviewed. A $99.00 annual water use permit fee was proposed for SFY 2016, which is the same as the SFY 2015 annual fee. The stakeholder members participating in the meeting concurred.

Based on the budget and stakeholder input, the annual water use permit fee for SFY 2016 should be $99.00.

Mark Moeller
Supervisor, Water Supply Engineering Section
Environmental Services Division
July 30, 2015

Water Allocation and Use (7152)	FY09 Final Expenses	FY10 Final Expenses	FY11 Final Expenses	FY12 Final Expenses	FY13 Final Expenses	FY14 Final Expenses	FY15 Budget	FY15 Actual (through 6-15)	FY16 Budget
REVENUES									
General Fund	$346,846	$172,321	$190,354	$136,814	$148,885	$154,268	$219,156	$189,105	$192,450
Water Use Permit Fund		$300,035	$444,161	$319,232	$347,397	$359,958	$511,365	$441,245	$449,049
WU Permit Fund Carryforward*			$200,570	$270,992	$247,076	$164,822	$200,019	$126,748	$0
TOTAL REVENUES	$346,846	$472,356	$634,515	$456,046	$496,282	$514,226	$730,521	$630,349	$641,499
EXPENSES									
FTE	3.13	3.87	3.40	4.17	3.54	3.72	4.50	4.01	4.25
Personal Services	$287,909	$321,390	$324,284	$299,955	$384,080	$411,419	$465,343	$462,879	$461,891
Permanent	0	321,390	324,284	299,955	384,080	411,419	465,343	462,879	461,891
Non-Permanent	0	0	0	0	0	0	0	0	0
Personal Travel In-State	2,067	397	28	245	0	469	500	790	500
State Vehicle	0	0	0	0	0	0	0	0	0
Depreciation	0	0	0	0	0	0	0	0	0
Personal Travel Out-of-State	0	0	72	0	467	6,162	1,800	2,153	2,000
Office Supplies	3,840	1,906	2,251	0	1,036	3,484	650	526	750
Facility Main. Supplies	23	0	0	0	78	0	0	0	0
Equipment Maintenance	112	0	0	0	0	38	600	0	100
Prof Supplies	0	0	0	0	0	0	0	0	0
Ag Supplies	0	0	0	0	0	0	0	0	0
Other Supply	46	78	204	65	373	42	250	12	100
Print & Binding	0	308	1,288	458	843	542	800	422	800
Uniforms	0	0	0	0	0	0	50	60	100
Postage	597	240	254	240	240	120	250	0	250
Communications	690	1,137	1,218	1,309	1,365	2,953	1,800	2,177	3,000
Rentals	9,637	12,307	11,647	13,098	13,828	8,256	1,000	0	100
Utilities	0	0	0	0	0	0	0	0	0
Professional Services	0	81,454	216,399	93,570	28,890	0	0	0	0
Outside Services	0	5,442	26,875	0	6,937	0	0	54	0
Intra-State Transfers	0	0	0	0	0	0	0	0	0
Advertising & Publishing	2,208	1,401	1,110	1,863	3,746	3,350	2,700	1,139	3,300
Auditors Reimbursement	0	0	0	0	0	0	0	0	0
Reimbursement	104	96	162	303	88	98	100	285	100
ITS Reimbursement	0	126	0	0	0	1	0	114	0
IT Outside Services					0	18,000	190,000	100,350	103,000
Govt Transfers-AG Office					0	0	0	0	0
Govt Transfers-Auditor					0	0	0	0	0
Govt Trans.-Other Agency					0	0	0	0	0
Equipment Inventoriable	0	0	0	0	0	1,937	500	0	0
Equipment Non-Inv.	0	0	0	0	0	6,292	1,000	0	500
IT Hardware	0	597	0	523	2,873	0	1,500	5,774	1,000
Other Expenses	0	317	404	413	356	336	5,000	1,221	1,500
Securities	0	0	0	0	0	0	0	0	0
Licenses	0	69	0	0	0	0	2,000	0	2,000
Fees					0	0	0	0	0
Refunds					0	0	0	0	0
State Aid	0	0	0	0	0	0	0	0	0
Capitals	0	0	0	0	0	0	0	0	0
Indirects	39,616	45,091	48,318	44,003	51,083	50,728	54,678	52,393	60,508
General Fund Rescission									
TOTAL EXPENSES	$346,846	$472,356	$634,514	$456,045	$ 496,282	$ 514,227	$730,521	$630,349	$641,499

Notes: Actual Expenditures for SFY2009 - SFY2014 are final. Projected actual & proposed budget expenditures for SFY2015 & SFY2016 are subject to change. This spreadsheet shows the actual revenue amount drawn from WU Permit Fund and General Fund, not the fund balances.
*Actual carryforward is not additive for the revenue.

Document Date: 7/28/2015

E-FILED 2015 JUL 30 4:04 PM KOSSUTH - CLERK OF DISTRICT COURT

IN THE IOWA DISTRICT COURT FOR KOSSUTH COUNTY

KOSSUTH COUNTY, IOWA, Petitioner, vs. IOWA DEPARTMENT OF NATURAL RESOURCES, IOWA ENVIRONMENTAL PROTECTION COMMISSION, Respondent, And also concerning P& J PORK, L.L.C., Applicant	* * * * * * * * * * * * * *	No. CVCV026743 RULING ON PETITION FOR JUDICIAL REVIEW OF AGENCY ACTION

On March 4, 2015, the Petition for Judicial Review of Agency Action filed by Petitioner Kossuth County, Iowa, on September 18, 2014, was submitted to the court for final ruling without oral argument.

After having now reviewed the pleadings contained in the court file, after having reviewed the administrative record, after considering the arguments of counsel, and after reviewing the applicable law, the court enters the following ruling.

FINDINGS OF FACT

A) Course of the Proceedings

On or about May 6, 2013, Applicant P&J Pork, L.L.C., (hereinafter "P & J Pork") submitted a Construction Permit Application to Respondent Iowa Department of Natural Resources (hereinafter "the DNR") for the construction of a second hog confinement building on property owned by P&J Pork in Kossuth County locally known as 2508 140th Avenue, Algona, Iowa 50511. A copy of P&J Pork's permit application was also filed with Petitioner Kossuth County, Iowa (hereinafter "the County) on August 16, 2013.

On December 4, 2013, P&J Pork's application was denied through a preliminary decision by the DNR. On January 2, 2014, P&J Pork filed an appeal of that decision with the DNR, which was then transferred to the Iowa Department of Inspections and Appeals for a contested case hearing on February 17, 2014. On April 11, 2014, the

County was granted leave to intervene in those proceedings.

On April 23, 2014, a contested case hearing was held before Administrative Law Judge Heather Palmer. On June 10, 2014, Judge Palmer issued a Proposed Decision again denying P&J Pork's application. P&J Pork filed a timely appeal of that Proposed Decision with Respondent Iowa Environmental Protection Commission (hereinafter "the EPC") on June 18, 2014. During its regular meeting held on August 19, 2014, the EPC voted 6 to 2 to reverse Judge Palmer's Proposed Decision and approve P&J Pork's permit application. In a follow-up telephonic meeting held on September 8, 2014, the EPC amended its prior motion to reverse by clarifying that the grounds for the reversal was "because Plum Creek Wildlife Area does not constitute a 'facility' and therefore is not a 'public use area' as defined in 567 IAC 65.1." Another vote of the EPC members was taken, which again resulted in a 6 to 2 vote in favor of reversing Judge Palmer's Proposed Decision.

On September 18, 2014, the County filed its Petition for Judicial Review of Agency Action presently before this court. On November 20, 2014, P&J Pork was granted leave to intervene in these judicial review proceedings.

B.) <u>Undisputed Facts</u>

Father and son, Paul and Josh Broesder, are members of P&J Pork and are the operators of the existing hog confinement building located in Section 18 of Plum Creek Township in Kossuth County, Iowa. The addition of the second confinement building would expand P&J Pork's hog marketing capacity from 2,496 head to 4,992 head. The first confinement facility was constructed on or about April 1, 2002, and has been in operation ever since. Paul and Josh both live in the area near the facility. Josh would like to be a full-time farmer but will not be able to do so, unless he is allowed to build a second confinement building.

Plum Creek Wildlife Area, now owned by the County, is a former gravel mining area. The area consists of two pits that are filled with water, including flood water that routinely enters from the nearby East Fork of the Des Moines. The County took possession of the pits in 1981. In 2001, the DNR chemically treated the east pit, killing all existing fish, and then restocked both the east and west pits with blue gill, largemouth bass, and catfish. When the area is flooded, the pits become one

continuous body of water.

During the spring and summer, the pits are use used by area fishermen. While the number of fisherman present at the pits varies, when the fish are biting, the banks of the pits will have several fisherman present; particularly, near the "riffle", which is a rock structure the County constructed nearby to slow water flow and improve fishing. Ice fishing also occurs on the pits during the winter. Other activities the pits are used for include canoeing, kayaking, bow hunting, and swimming. It is undisputed that, other than a road into the area, a parking lot between the pits, and the availability of a rope swing for the public's use at the east pit, there are no other structures or amenities in Plum Creek Wildlife area such as a shelter house, picnic tables, campgrounds, a public swimming beach, a boat ramp, or a dock. There are, however, signs present at the entrance to the area; one that sets forth the designated name of the area; another that sets forth information about the spread of Eurasian milfoil; and a third that sets forth information about the riffle.

Having found these to be the relevant facts of this case, the court turns now to its conclusions of law. Additional facts will be set forth below where relevant to the issues under consideration by the court.

CONCLUSIONS OF LAW

A) Standard of Review

Under Iowa Code section 17A.19(1), a person aggrieved or adversely affected by a final agency action is entitled to judicial review. Iowa Code Section 17A.19(10) (2015) provides that the district court exercises its power of judicial review when it acts in an appellate capacity to review an agency action and correct errors of law. Heartland Express, Inc. v. Terry, 631 N.W.2d 260, 265 (Iowa 2001) (citing IBP, Inc. v. Al-Gharib, 604 N.W.2d 621, 627 (Iowa 2000)). The district court does not exercise de novo review. St. Luke's Hosp. v. Gray, 604 N.W.2d 646, 649 (Iowa 2000). Rather, the scope of judicial review is limited to the determination of whether the agency committed any errors of law specified in Iowa Code section 17A.19(10)(a)–(n) (2015). IBP, Inc. v. Harpole, 621 N.W.2d 410, 414 (Iowa 2001).

B) Analysis

Iowa Code Chapter 459 (2013), titled the Animal Agriculture Compliance Act, sets for the requirements for livestock feeding operations within the State of Iowa. At issue in this case is the separation requirement set forth in Iowa Code Section 459. 202(5) (2013), which requires that any confinement animal feeding operation structure built after March 1, 2003, that has a capacity of between 1,000 and 3,000 animal units must have a minimum separation distance from any public use area of 2, 500 feet.

There is no dispute that P&J Pork's new confinement building will house between 1,000 and 3,000 animal units, and that its location will be less than 2,500 feet from a portion of the Plum Creek Wildlife Area. Therefore, the only issue requiring resolution by the court is whether the EPC was correct in concluding that Plum Creek Wildlife Area is not a "public use area" as defined in the Code of Iowa and the governing administrative rules.

Iowa Code Section 459.102(45) (2013), in relevant part, defines a "public use area" as "a portion of land owned by . . . a political subdivision with facilities which attract the public to congregate and remain in the area for significant periods of time as provided by rules which shall be adopted by [the DNR] pursuant to chapter 17A." As required by statute, the DNR adopted Iowa Administrative Code 567 IAC 65.1 (3) (2013), which states in relevant part, that:

> "Public use area" means that portion of land owned by the United States, the state, or a political subdivision with facilities which attract the public to congregate and remain in the area for significant periods of time. Facilities include, but are not limited to, picnic grounds, campgrounds, cemeteries, lodges, shelter houses, playground equipment, lakes as listed in Table 2 at the end of this chapter, and swimming beaches. It does not include a highway, road right-of-way, parking areas, recreational trails or other areas where the public passes through, but does not congregate or remain in the area for significant periods of time.

Table 2 appended to Iowa Administrative Code 567 IAC 65 lists over 250 bodies of water located throughout the State of Iowa that the DNR designate as "lakes" for purposes of this rule. Only two of the lakes listed, however, are in Kossuth County; specifically, Burt Lake, which is located north and west of Swea City, and Smith Lake located three (3) miles North of Algona.

In its amended motion, the EPC simply stated that it was reversing the proposed decision of Judge Palmer "because the Plum Creek Wildlife Area does not constitute a 'facility' and therefore is not a 'public use area' as defined in 567 IAC 65.1" (EPC 9/8/14 Minutes, p.2). The EPC failed, however, to set forth any specific facts it considered or the reasoning it used in reaching that conclusion. Further complicating the court's review of this matter is that the County has alleged seven (7) of the available grounds set forth in Iowa Code Section 17A.19(10) as grounds for this court to consider in support of its contention that the decision of the EPC should be reversed. After reviewing the arguments offered by the County in support of those grounds, however, the court concludes that only one of those grounds merits consideration and requires a reversal of the EPC's decision with that ground being that the EPC's decision is inconsistent with the rule adopted by the DNR as set forth in Iowa Administrative Code 567 IAC 65.1 (3) (2013). See Iowa Code Section 17A.19(10)(g) (2013).

Application of Iowa Administrative Code 567 IAC 65.1 (3) requires a three-prong analysis. First, a determination must be made by the fact-finder whether the property in question is land owned by the United States, the state, or another type of political subdivision. In the present case, this factor is not in dispute. Secondly, a determination must be made whether the property in question has any "facilities". In making this determination the fact-finder is to consider the non-inclusive list of examples of "facilities" set forth in the next sentence of the rule. This is the contested issue in the present case. Finally, the fact-finder must determine whether the "facilities" are of the type "which attract the public to congregate and remain in the area for significant periods of time."

If the fact-finder determines that all three prongs have been proven concerning the property in question, then the property is considered a "public use area", and is subject to the 2,500 foot separation requirement. If all three prongs are not proven, then the property in question is not a "public use area", and thus, is not subject to the separation requirement. Based on the plain language of its amended motion, it is clear to the court that the EPC failed to properly apply the foregoing analysis to the Plum Creek Wildlife Area, as required by Iowa

Administrative Code 567 IAC 65.1 (3), and, instead, analyzed the facts in the record to determine whether or not the Plum Creek Wildlife Area was a "facility" itself, rather than determining whether there were "facilities" located within the Area that might fit within the non-inclusive definition set forth in the rule, and then determining whether or not those facilities met the requirements of the third prong of the analysis. By improperly focusing its decision on whether or not the Plum Creek Wildlife Area was a "facility", the EPC not only made a decision that was not required by the rule, but also made a decision that is inconsistent with the plain language of the rule

Based on the foregoing, the court concludes that the EPC misapplied the rule set forth in Iowa Administrative Code 567 IAC 65.1 (3) to the facts of the case before it, which resulted in a decision that is inconsistent with that rule. Therefore, the decision of the EPC must be reversed and this case remanded to the EPC for further proceedings consistent with this ruling pursuant to Iowa Code Section 17A.19 (10) (2013).

Because this issue is likely to arise again on remand, the court feels compelled to address another issue raised by the parties in their briefing with that issue being whether the list of lakes contained in Table 2 appended to Iowa Administrative Code 567 IAC 65.1 (3) is an inclusive or a non-inclusive list. For the reasons that follow, the court concludes it is a non-inclusive list.

As noted in the brief filed by P&J Pork, the legislative and rule-making history certainly suggests that the list was intended to be inclusive at the time the rule was adopted. However, the wording used by the DNR is the rule is clearly contrary to that history. As noted above, the definition of "facilities" in the rule includes the language "lakes **as listed** in Table 2 at the end of this chapter . . ." (emphasis added). By definition, "as" means "like; in like manner; similar to; for example." Webster's New Encyclopedia of Dictionaries 26 (22nd ed. 1992). Therefore, the court concludes that the word "as" used by the DNR in referring to the lakes named in Table 2 can only logically be read as requiring the fact-finder, in a case such as the present one that involves a body of water, to exercise discretion and determine whether or not that body of water is "like" or similar to"

the lakes listed in Table 2. Then and only then can the fact-finder properly determine whether the body of water qualifies as a facility under the rule. Had the DNR wanted the list of lakes in Table 2 to be all inclusive, the word "as" would or should have been eliminated so the language, instead, read "lakes listed in Table 2 at the end of this chapter."

ORDER

IT IS THEREFORE ORDERED as follows**:**

1) All of the above.

2) The Petition for Judicial Review filed by Petitioner Kossuth County, Iowa, is granted in part, as set forth above.

3) The August 19, 2014, decision of Respondent Iowa Environmental Protection Agency, as amended on September 8, 2014, is reversed, and this case is remanded to that agency for further proceedings consistent with this ruling.

4) The costs of this action as taxed by the Clerk of Court are assessed one-half to Respondent Iowa Environmental Protection Agency and one-half to Applicant P&J Pork, LLC.

5) The Clerk of Court shall provide copies of this ruling to counsel of record.

SO ORDERED.

State of Iowa Courts

Type: OTHER ORDER

Case Number	**Case Title**
CVCV026743	KOSSUTH COUNTY, IOWA V. IOWA DEPARTMENT OF NATURAL

So Ordered

David A. Lester, District Court Judge,
Third Judicial District of Iowa