ELLIOTT COMMUNITY WATER SUPPLY

Submitted: January 1, 2012

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SOURCE WATER PROTECTION ACTION PLAN

For Elliott Community Water Supply

PWSID# 6915015 Last Update: Dec. 1, 2011

Activity	Start Date	Completion Date	Responsible Person(s)	% Complete	Comments
Organize and continue the Source Water Protection (SWP) Team.	Jan. 2008	On-going	Mayor Steve Howell	50%	Held a meeting to organize the SWP Team and begin to create a membership list. This list will increase as the SWP project advances.
Develop expanded list of Planning Team Members. Develop member contact list.	10/7/ 2010	12/1/2010	Mayor Howell/ Golden Hills RC&D/ Rebecca Ohrtman/ Team members	100%	Additional members now include 3 landowners, school superintendent, county board of supervisor rep, as well as RC&D board member, city officials, DNR, NRCS, SWCD, PF, & DSC representatives
Hold SWP Team Meeting – Presentation of GW Site Investigation	12/1/ 2010	2/1/2011	Dan Cook, Becky Ohrtman/Golden Hills RC&D/ Mayor Howell/Farm Bill Biologist (PF)/ IDNR Environmental Specialist/ Team members	100%	Dan Cook presented final investigation report to add to the initial 2010 findings and present conclusions. The Team discussed in detail BMP options/resources for SWP. These included: CRP-23, CRP-27 & 28, CRP-9 and WRP. Plan to organize NRCS, RC&D, SWCD, and DSC to assist in BMP development and resources.
Activity	**Start**	**Completion**	**Responsible Person(s)**	**%**	**Comments**

	Date	Date		Complete	
Team Meeting with Conservation Partners (NRCS, DSC, SWCD, RC&D, DNR, PF) to begin planning for BMP implementation	12/15/ 2010	1/15/2011	Becky Ohrtman/ Steve Howell/ Dan Cook/ Matt Allen/Jeff Godwin Steve Howell/ Shirley Frederiksen/Keith Wilken/Tom Burkheiser, Dan Case/ Team members	100%	Discussion included BMP placement, interested landowners, design of BMP, resources available for implementation. Resulted in NRCS engineer developing wetland design, options for landowners, and watershed coordinator conducting further federal and state resources for BMP implementation.
Team Meeting to discuss SWP BMPs, land acquisition, appraisals, etc	2/8/ 2011	2/8/2011	Dan Cook/Becky Ohrtman/Steve Howell/Golden Hills RC&D/ landowners/ Team members	100%	IDNR presented findings from his January site investigation. RC&D began organizing individuals with tasks for the process of BMP planning for future SWP implementation. RC&D facilitated city & landowner with land appraisal information and potential acquisition of land for future BMP implementation.
Team Meeting to discuss BMP options, resources, design and available conservation programs (local, state, federal).	3/17/ 2011	3/17/2011	USFWS-Steve Van Riper/ DSC-Tom Burkhiser/ NRCS- Dan Case, Brian Holmes/ PF-DNR-Matt Allen/ Golden Hills RCD-Shirley Frederiksen, Becky Von Weihe/ Team members	100%	Discussed various options to wetland—size, placement, depth, etc. Discussed what the landowners are agreeable to, and what is best for city of Elliott. Included discussion of flood control for Elliott that may also tie into water quality improvement and economic benefits to Elliott. RC&D assigned tasks to county supervisor, NRCS, DSC, DNR for May meeting reports.
Activity	**Start**	**Completion**	**Responsible Person(s)**	**%**	**Comments**

	Date	Date		Complete	
Team Meeting to discuss further findings for BMP options, review map options for wetland,	4/6/ 2011	4/6/2011	Mayor Howell/ Becky Ohrtman/ Golden Hills RC&D/ IDNR Environmental Specialists/ landowners/ Team members	100%	Reviewed site investigation findings. Discussed 2 wetland options and cost estimates for wetland restoration. Assignments given to gather information on 4 options. Discussed public meeting to be held July 13th.
Team Meeting to discuss 3 possible short-term options with cost estimates	5/17/ 2011	5/17/2011	Mayor Howell/ Golden Hills RC&D/ Becky Ohrtman/ DNR Environmental Specialist/NRCS/ landowners/Elliott City Council Member/ Team members	100%	Discussed 3 possible short term solutions/options—RO system, Rural Water, and Ion Exchange system. Cost estimates for each were given—decided all were cost prohibitive but ion exchange would be researched further. Public meeting agenda discussed and assignments given.
Elliott City Council Meeting	6/13/ 2011	6/13/2011	Mayor Howell/ Golden Hills RC&D- Shirley Frederiksen, Becky Von Weihe/ DNR Environmental Specialist- Keith Wilken/ City Council Members/ Elliott Citizens	100%	Explained the 2 site investigations and their findings. DNR explained nitrate level regulations. Discussed the possible BMP options and the cost estimates for each with the city council and guests attending the meeting. Answered questions and responded to the concerns of the council.
Activity	**Start**	**Completion**	**Responsible Person(s)**	**%**	**Comments**

	Date	Date		Complete	
Team Meeting-Reviewed BMP options and public meeting responsibilities.	6/23/ 2011	6/23/2011	Mayor Howell/ Golden Hills RC&D/ NRCS/ DNR/ County Supervisor/ Team members	100%	Reviewed all information gathered on BMP options. Consensus taken on which option to recommend to city council. Decided RO and Rural Water were too costly. Listed advantages/ disadvantages of Ion Exchange and Wetland/native grasses BMPs/NMP. Decided to continue with BMP options. Assigned tasks for engineer list and land appraisal. Final plans for public meeting with all tasks assigned.
Public Meeting-generate awareness and inform citizens of Elliott Prepared handouts/fact sheets on nitrate information to give to the public	7/13/ 2011	7/13/2011	Mayor Howell/ IDNR-Becky Ohrtman, Dan Cook, Keith Wilken, Thad Nanfito/ Golden Hills RC&D-Shirley Frederiksen, Becky Von Weihe/ SWP Team members	100%	58 residents attended—great turn out. Power point presentations on: **IDNR**—SWP Program, SWP site investigation and SWP conclusions **IDNR**—nitrate level regulations **GHRCD**—the 4 options to address the nitrate issue. Gave the public the recommendations that will be given to the Elliott City Council. Took questions throughout the presentations. Also gave out handouts on BMPs.
Activity	**Start**	**Completion**	**Responsible Person(s)**	**%**	**Comments**

	Date	Date		Complete	
Acquire a list of appraisers for the land identified for extension of the wetland.	July 2011	7/15/2011	Golden Hills RC&D	100%	Acquired and compiled a list of appraisers/ Professional Engineer. This will be presented to the Elliott City Council on July 18, 2011.
Obtain Elliott City Council approval of options to address nitrate issue	7/18/ 2011	7/18/2011	Golden Hills RC&D- Shirley Frederiksen	100%	Explained all the BMP options reviewed by the SWP Team and the reasons for the recommended options. The recommended BMPs are: Wetland/Native Grass Restoration/NMP
Acquire a Preliminary Engineer to get estimate on Ion Exchange	7/20/ 2011	August – January 2011	Elliott City Council/ Mayor Steve Howell	100%	The council is considering possibility of short term option - engineered Ion Exchange.
Acquire a land appraisal and survey land to acquire for wetland construction	July 2011	December 2011	Elliott City Council/ Mayor Steve Howell Shirley Frederiksen	100%	Hired an appraiser. A land appraisal and survey is being conducted to begin purchase process
After the appraisal and survey is complete an attorney will be hired for the legal purchase process	August 2011	August 2011	Elliott City Council/ Mayor Steve Howell		The city must hire an attorney to help them through the legal purchase process. WIRB funds will be utilized for the land purchase.

Activity	Start Date	Completion Date	Responsible Person(s)	% Complete	Comments
Obtain cooperation of Griswold/Elliott Community School Board for implementation of SWP BMP's. Develop partnership with School for the SWP BMP and potential outdoor classroom to promote SWP.	July 2011	7/25/2011	Golden Hills RC&D	100%	Shirley (RC&D/NRCS)and Mayor Steve Howell attended the School Board meeting to discuss the Wetland Restoration BMP. Placing 1-2 acres into native grasses and the future opportunity for an outdoor classroom was recommended. The Griswold School Board approved to partner with the city of Elliott to use 5.5 acres of land north of Elliott Elementary School for the SWP project.
Secure assistance from the County Board of Supervisors	Winter 2011		County Board of Supervisors Member—Randy Tye	100%	Request and secure assistance from the Montgomery County Engineer in the form of large equipment for creating, dirt removal, etc. for implementing the shallow water wetland.
Work towards procuring funding for the land acquisition and shallow water wetland with native grass buffer	August 2011		Golden Hills RC&D/ City of Elliott	95%	Acquired grants: **WIRB**—Watershed Improvement Review Board = cost of land/wetland construction **PF**—Pheasants Forever (Matt Allen) **DU**—Ducks Unlimited (Matt Allen) **US Fish & Wildlife**—(Steve Van Riper) Apply for when needed: **SRF** (0% interest loan) & CDBG

Activity	Start Date	Completion Date	Responsible Person(s)	% Complete	Comments
Investigate funding for the Ion Exchange System – if needed	Nov 2011		City of Elliott/GHRCD	80%	**CDBG** is being applied for in case an ion exchange system is needed
Development of design for shallow water wetland and obtain maps.	Dec. – March 2011	March 15, 2012	NRCS— Tom Burkhiser Dan Case, Brian Holmes	50%	Tom, Brian and Dan (NRCS) develop the design for converting agricultural crop land to native grasses and shallow water wetland using parameters decided by the landowner, city council and school board.
Preparation for planting of 5.5 acres of school ground	Spring 2012	June 15, 2012	Elliott City Council, Mayor Steve Howell, Matt Allen (Pheasants Forever & Ducks Unlimited)		Restoration of native vegetation entails killing current vegetation, securing a native grass drill, purchasing seed and drill seed.
Maintenance of restored wetland	2010 and in future		City of Elliott, Montgomery County Conservation Board	On-going	In a letter written July 27, 2011 the Montgomery Co. Conservation Board stated they would support and assist Elliott with the acquisition, construction and maintenance of wetland.
Monitoring of the nitrate levels after restoration/expansion of the wetland.	2012 and in future		City of Elliott/ City Utilities Employee	On-going	City will purchase a nitrate test kit and will have their city water operator monitor the nitrate levels in the individual wells weekly. DNR SWP program will monitor results annually.

Elliott SWP Implementation Resources – December 2011

NRCS -	$5,000 (In-kind) engineering costs
Griswold Community School -	$31,900 (In-kind) use of 5.5 acres for native wetland restoration/grass buffer
Montgomery County Board of Supervisors -	$18,500 (In-kind) wetland structure/excavation
Montgomery County Conservation Board -	$1,000 donation for native prairie restoration $7,650 (In-kind) wildlife & habitat management
Montgomery County Pheasants Forever -	$2,000 donation for native prairie restoration (In-kind) use of native grass drill
Pottawattamie County Pheasants Forever -	$2,000 donation for wetland/prairie restoration
US Fish & Wildlife -	$7,000 Letter of support. Possible $7,000 additional funds in 2012

TOTAL..... $ 75,050 SFY 2012 funds

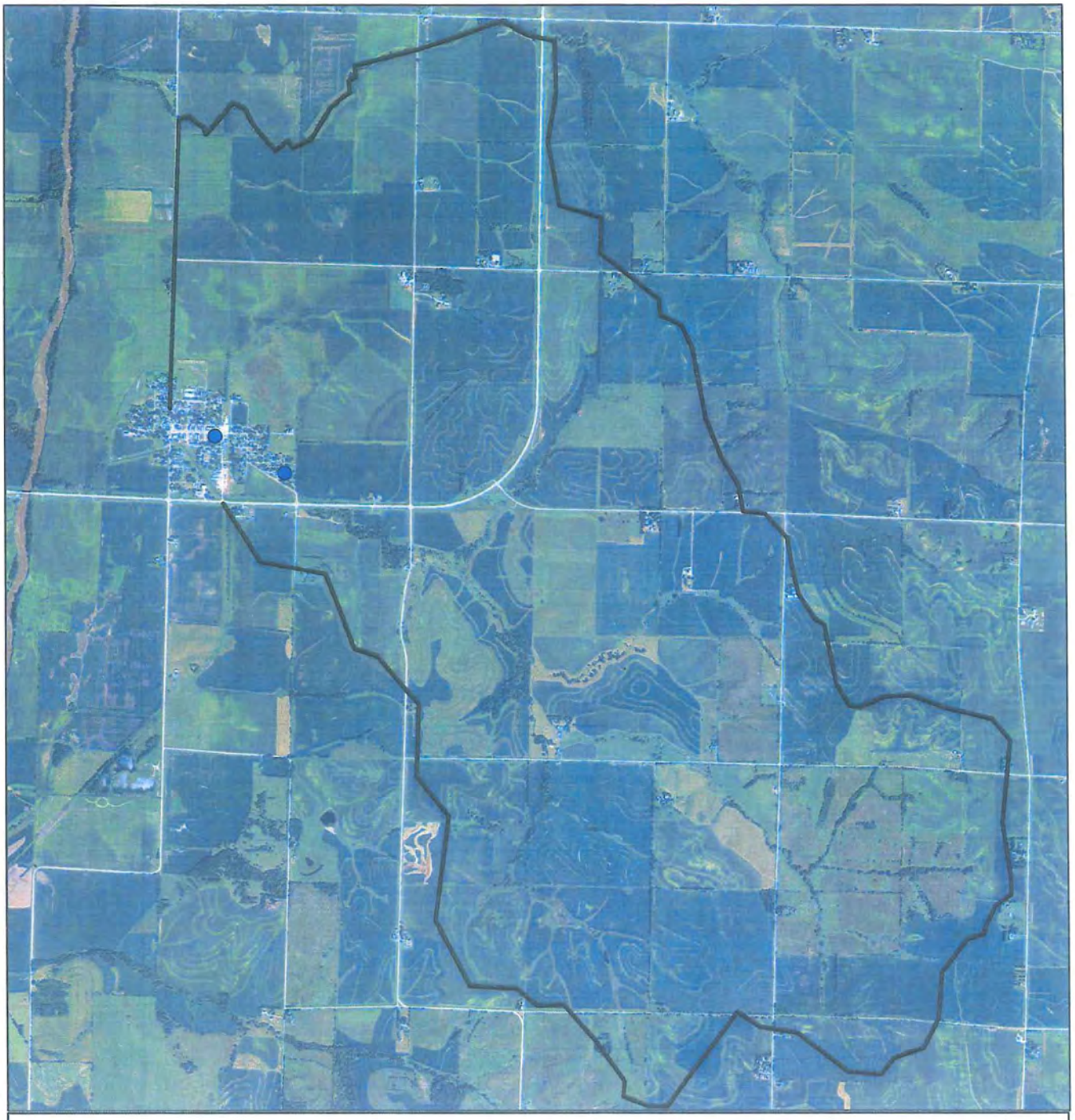
Possible grants:

WIRB grant -	Request and Approved for $166,460
CDBG -	Applied in November 2011
SRF	
WSPF	

TOTAL Grants (as of 12/8/11)..... $166,460

OVERALL TOTAL $241,510

Elliot Drainage Areas and Muncipal Wells



• Muncipal Wells

Potential Contaminant Sources And Municipal Wells

- ELLIOTT #1
- ELLIOTT #2
- Leaking UST
- Underground Storage Tank

Elliot Public Water Supply
Contaminant Inventory and Ranking

Non-Point Sources

1. **Source Water Contribution Areas**. Figure 1 shows the two source water contribution areas. Area "A" is approximately 970 acres. The Coe Creek watershed ("B") is approximately 3800 acres. Based on the Phase II results, source water for well No. 1 is from area "A". Well No. 2 probably draws water from the Coe Creek alluvium to the south and east as well as water from the north and west.

Point Sources

1. Leaking Underground Storage Tanks – Former S & M Oil – Closed
2. Underground Storage Tanks – Robert Artlip – Active
3. Underground Storage Tanks – Laird Service – Closed
4. Underground Storage Tanks – Montgomery County - Closed
5. Underground Storage Tanks – Griswold Community Schools - Closed

Public Water Supply Contingency / Emergency Plan Affidavit

The Safe Drinking Water Act amendments of 1986 and 1996 established the concept of wellhead protection, and subsequently the Source Water Protection program. The program is currently overseen by the Iowa Department of Natural Resources (IDNR) and attempts to prevent potential contaminants from entering source waters and prepare for situations in which drinking water may be impaired through contamination, power outage and treatment or distribution system interruptions. In order to ensure a public water supply's preparedness in such events, a Contingency/Emergency Plan has been required in every approved Source Water Protection Plan (SWPP) or Wellhead Protection Plan (WHPP).

Due to recent and growing concerns over water system security and due to many systems having previously prepared such a plan under the provisions of the 2002 Bioterrorism Act, the IDNR is now allowing an affidavit in lieu of including a completed Contingency/Emergency Plan within the submitted SWPP/WHPP. Although public water supplies do not need to send IDNR completed plans, each must have an accessible and up-to-date plan in case a catastrophic event occurs within their system. It is necessary for the completed water supply Contingency/Emergency Plan to contain the following information, at a minimum:

- Contact information for the city's mayor, city clerk, water/wastewater operator.
- Contact information for the city's power company, a professional electrician, a professional plumber and an equipment repair company.
- System's critical users must be identified and a plan for immediate notification must be created. (i.e. hospitals, nursing homes, schools, etc.)
- Contact information for local media, including newspaper, radio and television.
- Contact information for a certified laboratory, local emergency contacts, state and local public health departments and the National Guard.
- Contact information for the IDNR's 24 hour emergency contact and the local IDNR field office.

I, Stephen Howell, representing City of Elliott
certify that a Contingency / Emergency Plan has been created for our public water supply system and that this information can be presented to the IDNR upon request.

Stephen E Howell
Signature

Aug 18, 2011
Date

SOURCE WATER PROGRAM

SITE ASSESSMENT RESULTS

For

CITY OF ELLIOTT MUNICIPAL WATER SUPPLY
MUNICIPAL WELL #1 (DNR Well ID # 1419)

ELLIOTT, MONTGOMERY COUNTY, IOWA

December 22, 2008

IOWA DEPARTMENT OF NATURAL RESOURCES

Prepared by

Daniel Cook
Environmental Specialist Senior
IDNR Project Manager
Contaminated Sites Section

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INTRODUCTION

At the request of the Iowa Department of Natural Resources, Source Water Program, the Iowa Department of Natural Resources, Contaminated Sites Section (IDNR), has conducted an environmental assessment around Municipal Water Well Number 1, City of Elliott, Montgomery County, Iowa. The purpose of this investigation was to evaluate the sites hydrological profile and identify possible source(s) for the elevated nitrate and petroleum levels found in Municipal Well Number 1.

SITE DESCRIPTION

2.1 Location

The City of Elliott is located in the SE ¼ of the SE ¼ of Section 1, Tier 73 North, Range 38 West, Montgomery County, Iowa, Latitude 41.149N, Longitude - 95.163W (Figure 1).

2.2 Site Description

Elliott, Iowa, founded in 1879, was named for Charles Elliott Perkins, Vice President of Chicago, Burlington, and Quincy (C.B.&Q.) Railroad, and has a current population of 367. Elliott is a farm-oriented community located in the East Nishnabotna River Valley 12 miles north of the City of Red Oak and 8 miles south of the City of Griswold on Iowa Highway 48.

Montgomery County is primarily an agricultural county. The topography is rolling and is in the Nishnabotna and Tarkio watersheds. Major streams that run through the county from north to south include Coe Creek, Indian Creek, Walnut Creek, East Nishnabotna River, West Tarkio Creek and Tarkio River.

Elliott, Iowa is located within a land form known as the Southern Iowa Drift Plain with loess, till, gravel, and sand seams overlying the Fort Benton (Lower Dakota Colorado) Sandstone locally known as the Dakota Sandstone. The City of Elliott Municipal Well Number 1 does not have a well log but is known to be finished in the top of the Dakota Sandstone at 56 feet deep. At this location the surface of the Dakota Sandstone is at 39 feet deep. The City of Elliott Municipal Well Number 2 is located 1,500 feet east of Well Number 1. Well Number 2's log shows loess from the surface down to 20 feet, silt - sand and gravel - and sand from 20 to 45 feet deep, then Dakota Sandstone from 45 feet to the finished depth of 108 feet. Both Well Number 1 and Well Number 2 have had detectable levels of nitrates in the past that approach and sometimes exceed the MCL of 10 mg/L.

2.3 Operational History and Waste Characteristics

Well Number 1 was drilled in 1935 and is located on the southwest corner of Main Street and Chestnut Street.

Well Number 1 was developed in an area surrounded by commercial and residential lots.

A historical records search for petroleum sites has found at least eight (8) former petroleum storage facilities within a short distance of Well Number 1 (Figure 2). Six (6) of the eight (8) facilities were closed prior to any governmental reporting regulations. Laird Service and S & M Oil are both found in the IDNR Underground Storage Tank Section's database. However, S & M Oil is the only site that has completed the soil and groundwater testing and monitoring requirements found in Iowa Administrative Code (IAC) 567-135, *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks.*

Two bulk agriculture chemical dealers are found 500 feet to the south of Well Number 1, Miller Farm Supply and Agriland FS (formerly Elliott Farm Center). Earlier investigations conducted by IDNR have found nitrate impacted groundwater due to the uncontrolled release of fertilizers but determined the two facilities were not contributing to the nitrates found in Well Number 1. Both sites are currently addressing the elevated nitrate levels under the authority of IAC 567-133, *Rules for Determining Cleanup Actions and Responsible Parties.*

2.4 Nitrates and Nitrites

Nitrates and nitrites are nitrogen-oxygen chemical units which combines with various organic and inorganic compounds. Once taken into the body, nitrates are converted into nitrites. The greatest use of nitrates is as a fertilizer.

In 1974, Congress passed the Safe Drinking Water Act. This law requires the US Environmental Protection Agency (EPA) to determine safe levels of chemicals in drinking water which are known to or may cause health problems. These non-enforceable levels, based solely on possible health risks and exposure, are called Maximum Contaminant Level Goals. The MCLG for nitrates has been set at 10 parts per million (ppm), and for nitrites at 1 ppm, because EPA believes this level of protection would not cause any of the potential health problems described below.

Based on this MCLG, EPA has set an enforceable standard called a Maximum Contaminant Level (MCL). MCLs are set as close to the MCLGs as possible, considering the ability of public water systems to detect and remove contaminants using suitable treatment technologies. The MCL for nitrates has been set at 10 ppm, and for nitrites at 1 ppm, because EPA believes, given present technology and resources, this is the lowest level to which water systems can reasonably be required to remove this contaminant should it occur in drinking water. These drinking water standards and the regulations for ensuring these standards are met, are called National Primary Drinking Water Regulations. All public water supplies must abide by these regulations.

Short-term: Excessive levels of nitrate in drinking water have caused serious illness and sometimes death. The serious illness in infants is due to the conversion of nitrate to nitrite by the body, which can interfere with the oxygen-carrying capacity of the child's blood. This can be an acute condition in which health deteriorates rapidly over a period of days. Symptoms include shortness of breath and blueness of the skin (Blue Baby Syndrome).

Long-term: Low to moderate levels of nitrates and nitrites have the potential to cause diuresis, increased starchy deposits and hemorrhaging of the spleen from a lifetime exposure at levels above the MCL.

The regulation for nitrates and nitrites became effective in 1992. Between 1993 and 1995, EPA required your water supplier to collect water samples at least once a year and analyze them to find out if nitrates and or nitrites are present above 50 percent of their MCLs. If it is present above this level, the system must continue to monitor this contaminant every 3 months. If contaminant levels are found to be consistently above their MCLs, your water supplier must take steps to reduce the amount of nitrates/nitrites so that they are consistently below that level. Ion exchange, Reverse Osmosis, Electro-dialysis are treatment methods that have been approved by EPA for removing nitrates/nitrites.

If the levels of nitrates/nitrites exceed their MCLs, the system must notify the public via newspaper, radio, TV and other means. Additional actions, such as providing alternative drinking water supplies, may be required to prevent serious risks to public health.

3. COLLECTION OF NON-SAMPLING DATA

Soil strata data was collected utilizing the Department's Geoprobe® with the conductivity probe attachment in an earlier investigation (CERCLA Pre-Remedial Extended Site Screening Work Plan Results for the Miller Farm Supply, Elliott, Montgomery County, Iowa, July 15, 2008). In the earlier investigation the data was used to determine continuity of different soil layers and help identify preferential groundwater paths. Conductivity probe data was collected in a south to north line along Chestnut Street from just north of Coe Creek to 2nd Street. The conductivity probe results indicate, in general, the soil consists of loess from the surface down to twelve (12) feet deep then a layer of glacial till from twelve (12) feet to approximately twenty (20) feet deep. Silty sand, sand and gravel layers were found from twenty (20) feet deep down to the Dakota Sandstone at approximately thirty-nine (39) feet deep. The conductivity probe results also indicated the further north you went the more silty material was found in the aquifer material.

During the November 2008 field work groundwater samples were collected in a grid pattern around Municipal Well Number 1 with field observations of the sediment makeup and color collected for the deep sample, at the Dakota

Sandstone, and the shallow sample, at the till/sand interface. Sample observations indicated the area to the south and east of Municipal Well Number 1 consist of a cleaner oxidized (yellow) course sand wile the area north and west consist of unoxidized (grey) silty sands (Figure 3). Groundwater was also more available in the cleaner course sands.

COLLECTION OF SAMPLING DATA

4.1 Soil Samples

No soil samples, other then the sediment in the groundwater samples, were collected during this sampling event.

4.2 Groundwater Samples

Attempts were made to collect twenty-six (26) groundwater samples from thirteen (13) locations identified on Figure 4 for nitrate and ammonia analysis. Two (2) samples were collected from each of the thirteen (13) locations, one from the top of the aquifer (shallow) and the other from the interface between the sand/gravel aquifer and the Dakota Sandstone (deep). However, the shallow sample at SWP-01 did not yield any groundwater so only twenty-five samples were collected. Samples were analyzed for nitrates and ammonia using the HACH DR2800 Spectrophotometer serial number 1254017. HACH Sample Method 10206 was utilized for the nitrate analysis and was capable of measuring nitrate levels as NO_3^- - N in water from 1.0 to 35.0 mg/L. HACH Sample Method 10205 was used to measure nitrogen, ammonia levels in water within a range of 2 to 47 mg/L.

Attempts were also made to collect fourteen (14) groundwater samples from seven (7) locations identified on Figure 5 for petroleum analysis. Again, two (2) samples were collected from each of the fourteen (14) locations, one shallow and the other deep. Once again several shallow locations (SWP-04 and SWP-09) did not yield enough groundwater so only 12 samples were collected. The petroleum samples were analyzed for gasoline using Iowa Method OA-01 and diesel/waste oil using Iowa Method OA-02.

The results for the groundwater samples are found in Table 1, the sample collection information sheets are located in Appendix C and the petroleum lab results are found in Appendix D.

4.3 Surface Water Samples

One (1) surface water sample was collected from Coe Creek near sample point SWP-01. The results for the surface water sample are found in Table 1 and the sample collection information sheet is located in Appendix C.

4.4 Sample Collection Method

All groundwater samples were collected in a manor utilizing the procedures in ASTM D6001-96e1, *Standard Guide for Direct-Push Water Sampling for Geo-Environmental Investigations*, for direct push groundwater sampling. All

groundwater collecting equipment was decontaminated after sample collection was complete at each location in accordance with Quality Assurance Project Plan for Iowa Department of Natural Resources, Land Quality Bureau, Contaminated Sites Section.

The Geoprobe® samples were collected using the procedures found in the SOP and manual for the Geoprobe® Screen Point 15 Groundwater Sampler (SOP; Technical Bulletin No. 95-1500).

FIELD ACTIVITIES

Field personnel traveled to the site on the 19th and the 20th of November 2008. Field activities were performed in Level D personal protective equipment that consisted of steel-toed boots, safety glasses, hearing protection and hard hats. Iowa One Call was contacted at least 48 hours prior to the site visit in order to have all underground utilities located before the field work started. Access agreements were pre-arranged by IDNR Source Water Program staff and City of Elliott officials.

CONCLUSIONS

6.1 Sediment Mapping Results

During the November 2008 field work groundwater samples were collected in a grid pattern around Municipal Well Number 1 with field observations of the sediment makeup and color collected for the deep sample, at the Dakota Sandstone, and the shallow sample, at the till/sand interface. For all the individual sample point locations the same sediment type was noted at the shallow location and the deep location approximately twenty (20) feet deeper. For example, the sediments collected at SWP-07 from the shallow and deep locations were both course oxidized sand. The sediment information is displayed on Figure 3 and notes a clear difference between the northwest and southeast side of town. Municipal Well Number 1 is located in the fine silty unoxidized sands.

6.2 Groundwater Results

In general no clear 'point source' for the elevated nitrate levels detected in Municipal Well Number 1 was found; instead it appears the source is most likely from a 'nonpoint source' coming from the wide spread application of fertilizers north and northeast of the City of Elliott. A point source is defined as any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or any site or area where a contaminant has been deposited, stored, disposed of, or placed, or otherwise come to be located and for some reason is released into the environment contaminating the soil and or groundwater.

A nonpoint source is defined as incidental contamination caused by application of agriculture chemicals such as fertilizer on agriculture crop grounds. Nonpoint source groundwater contamination occurs when fertilizers and or pesticides are applied at proper manufacture recommended rates but the groundwater is close to the surface and inadvertently becomes contaminated. The improper application of agriculture chemicals would be considered a point source and subject to State and Federal environmental regulations.

The results for the nitrate samples are found in Table 1 and Figure 4. The levels of nitrates in the groundwater samples were found to be higher northwest of Municipal Well Number 1 and lower to the southeast corresponding to the sediment conditions. Samples collected in the course oxidized sands were significantly lower then the samples collected in the fine silty unoxidized sediments. Additional sampling would be required in order to determine exactly why the course oxidized sands contain lower levels of nitrates but with the lower levels found right next to the higher levels in the unoxidized silty sands it appears conditions are better for more rapid denitrification in the course sands.

Denitrification is a microbially facilitated process of dissimilatory nitrate reduction that may ultimately produce molecular nitrogen (N2) through a series of intermediate gaseous nitrogen oxide products. This respiratory process reduces oxidized forms of nitrogen in response to the oxidation of an electron donor such as organic matter. The wetland located directly up gradient (groundwater flow wise) of the course oxidized sands may be providing the organic matter creating the source for the electron donors. Surface water infiltration from the marsh provides electron donors to the groundwater then the groundwater flows more freely through the course sands than the silt laden unoxidized sands providing the oxidized sands with more denitrification potential (Figure 6).

Select groundwater samples were also analyzed for petroleum products utilizing Iowa Method OA-01 for gasoline and Iowa Method OA-02 for waste oil and diesel. As noted in Table 1 all analysis for petroleum products indicated no detectable levels of gasoline, waste oil, or diesel fuel in the groundwater around Municipal Well Number 1. The petroleum analysis was done due to the numerous former petroleum storage sites found around Well Number 1 (Figure 2).

6.3 Surface Water Results

Only one (1) surface water sample was collected from Coe Creek and was found to be at a level of 2.94mg/L. Surface water bodies are highly susceptible to seasonal fluctuations of nitrate levels. For that reason monthly samples from Coe Creek over several years would be required to determine if Coe Creek is a source for the elevated nitrates in the area.

###

APPENDIX A

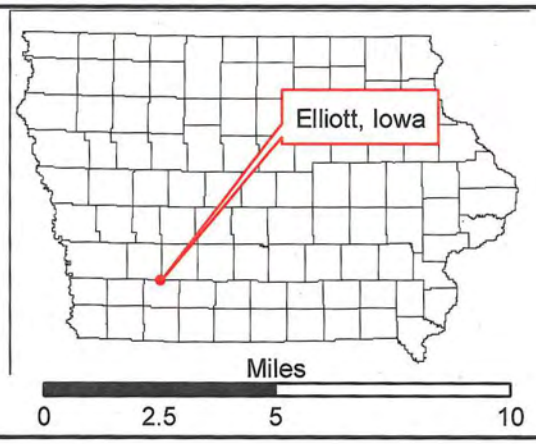
Figures

SOURCE WATER PROGRAM

SITE ASSESSMENT RESULTS

For

CITY OF ELLIOTT MUNICIPAL WATER SUPPLY
MUNICIPAL WELL #1 (DNR Well ID # 1419)



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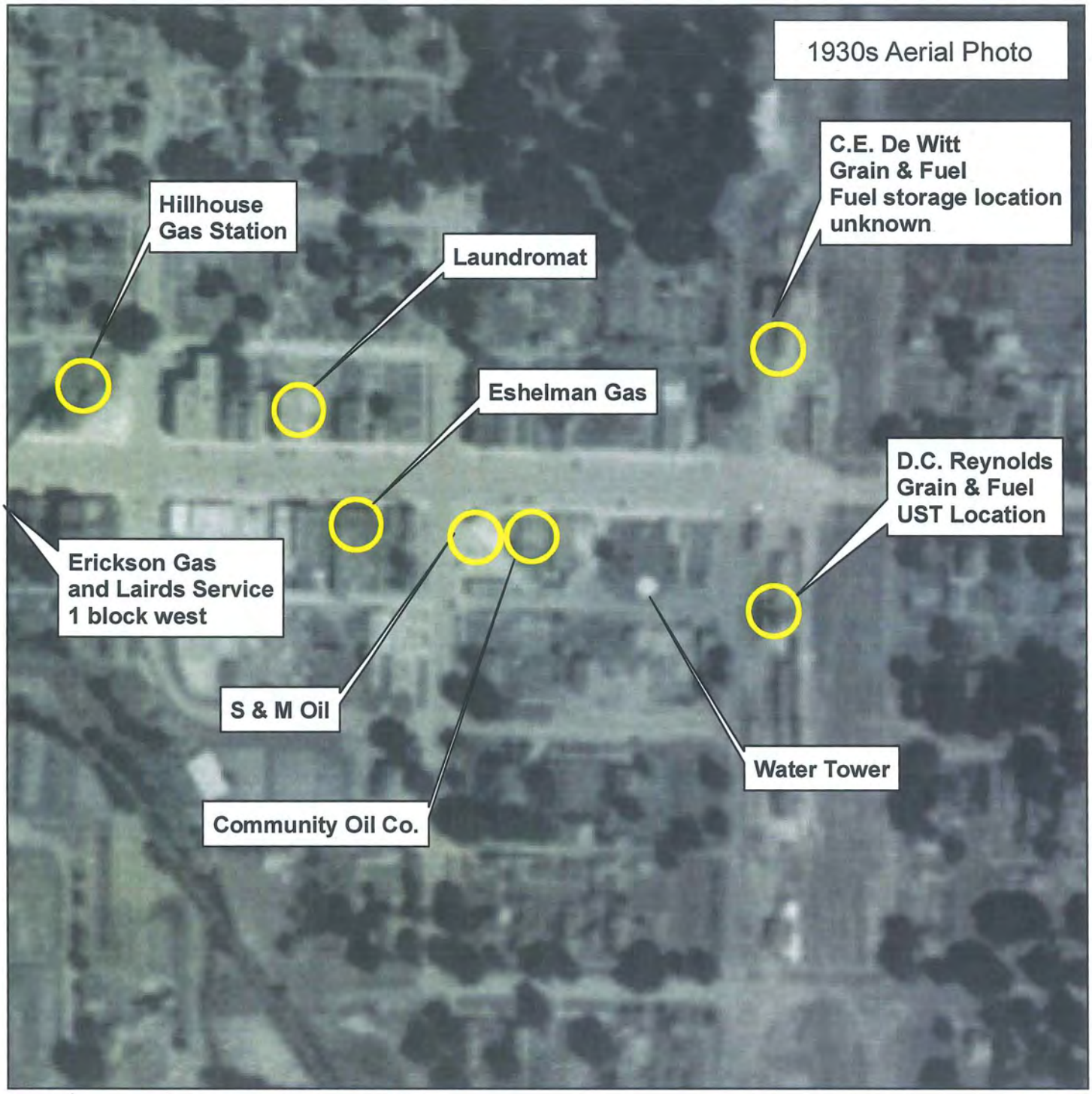
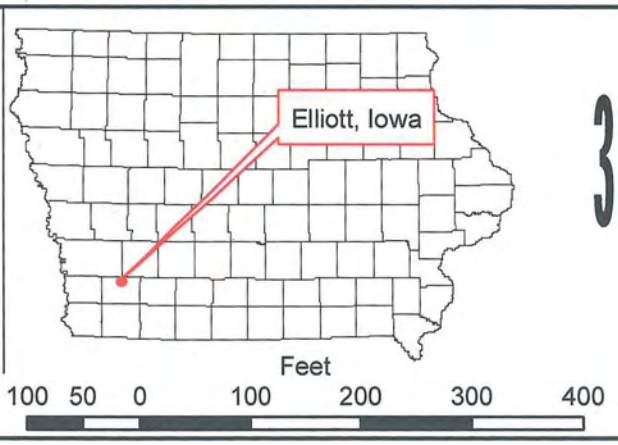
Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Site Location
Figure 1





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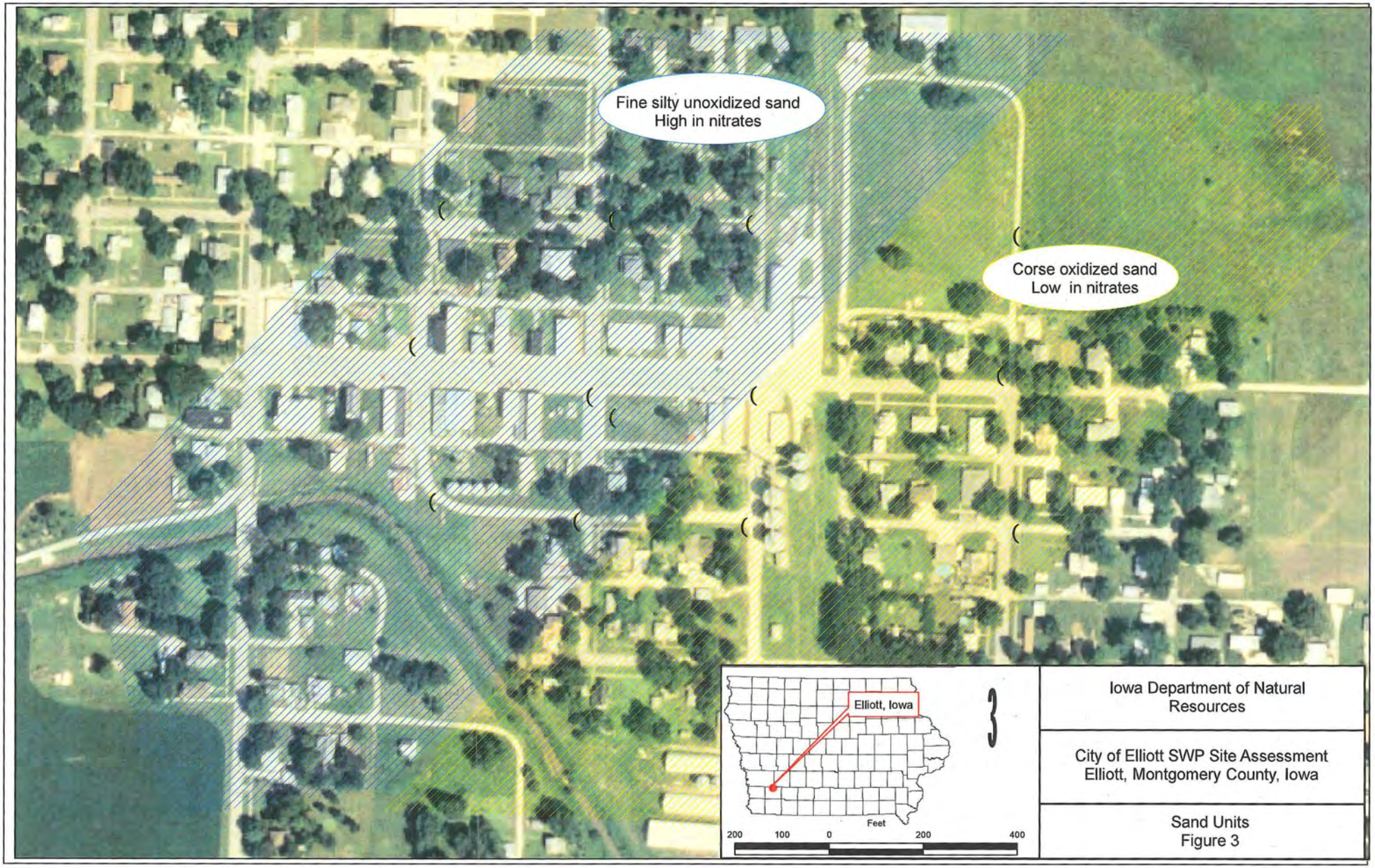
Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Former Petroleum Sites
Figure 2



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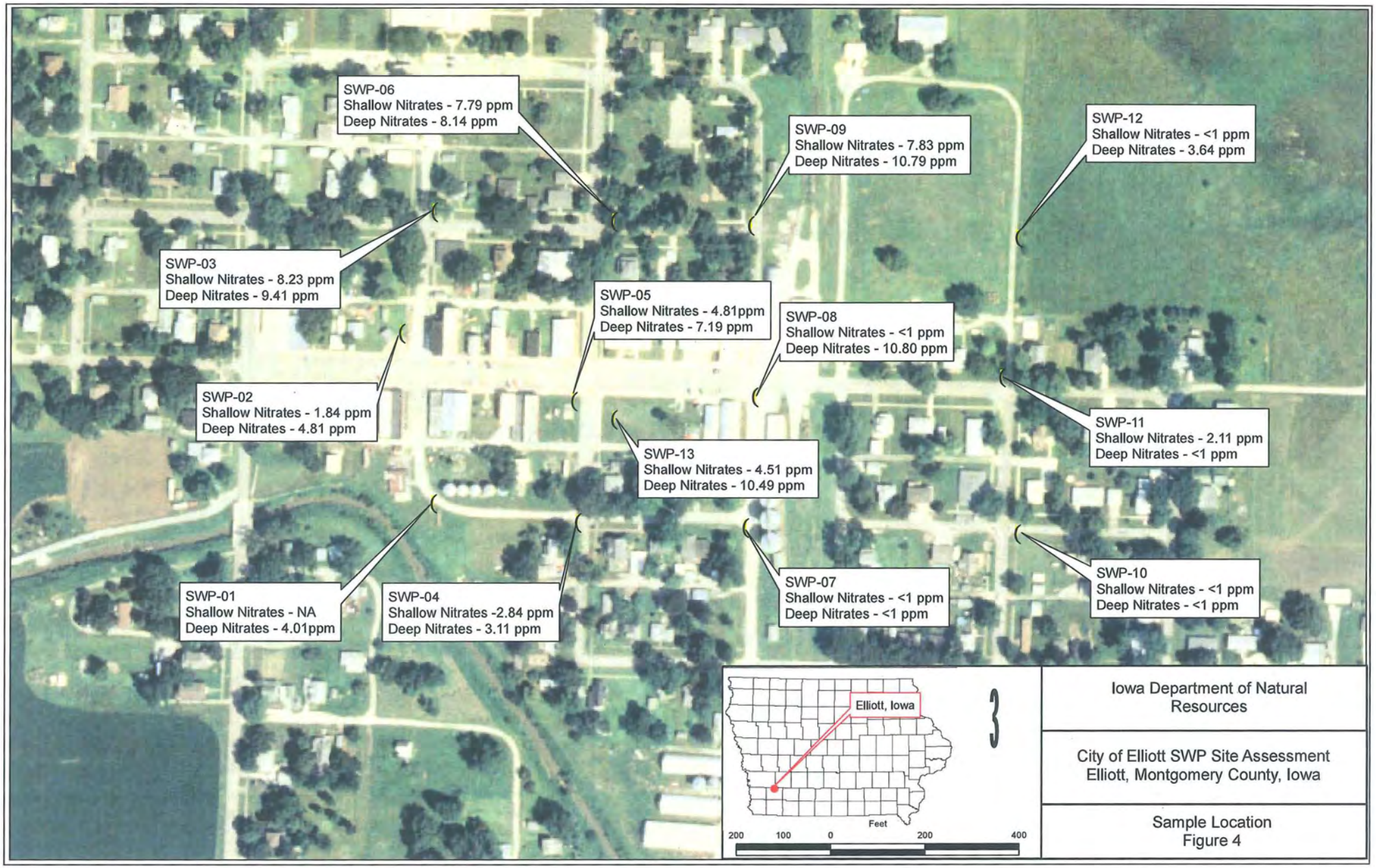
Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Sand Units
Figure 3



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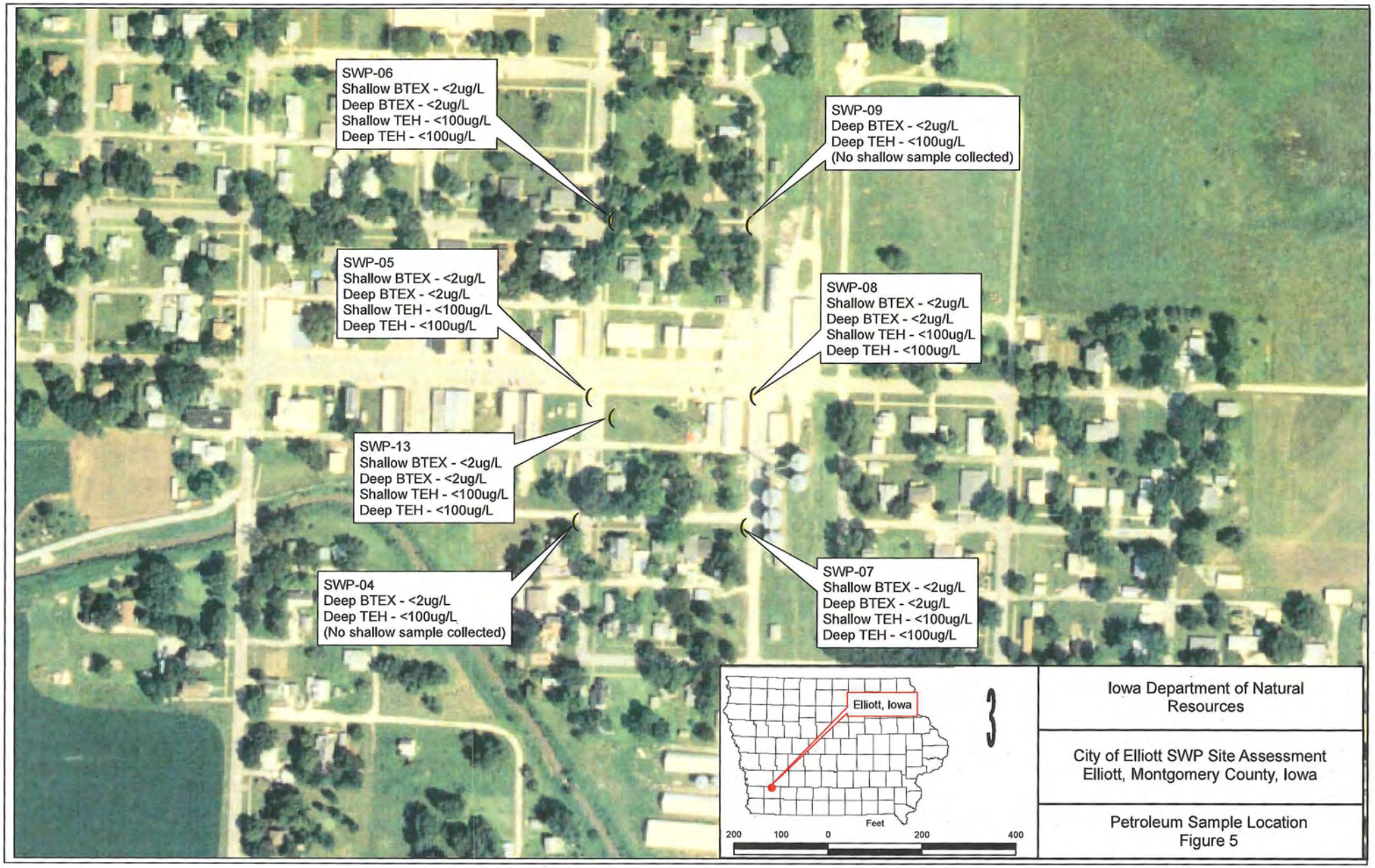
Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Sample Location
Figure 4



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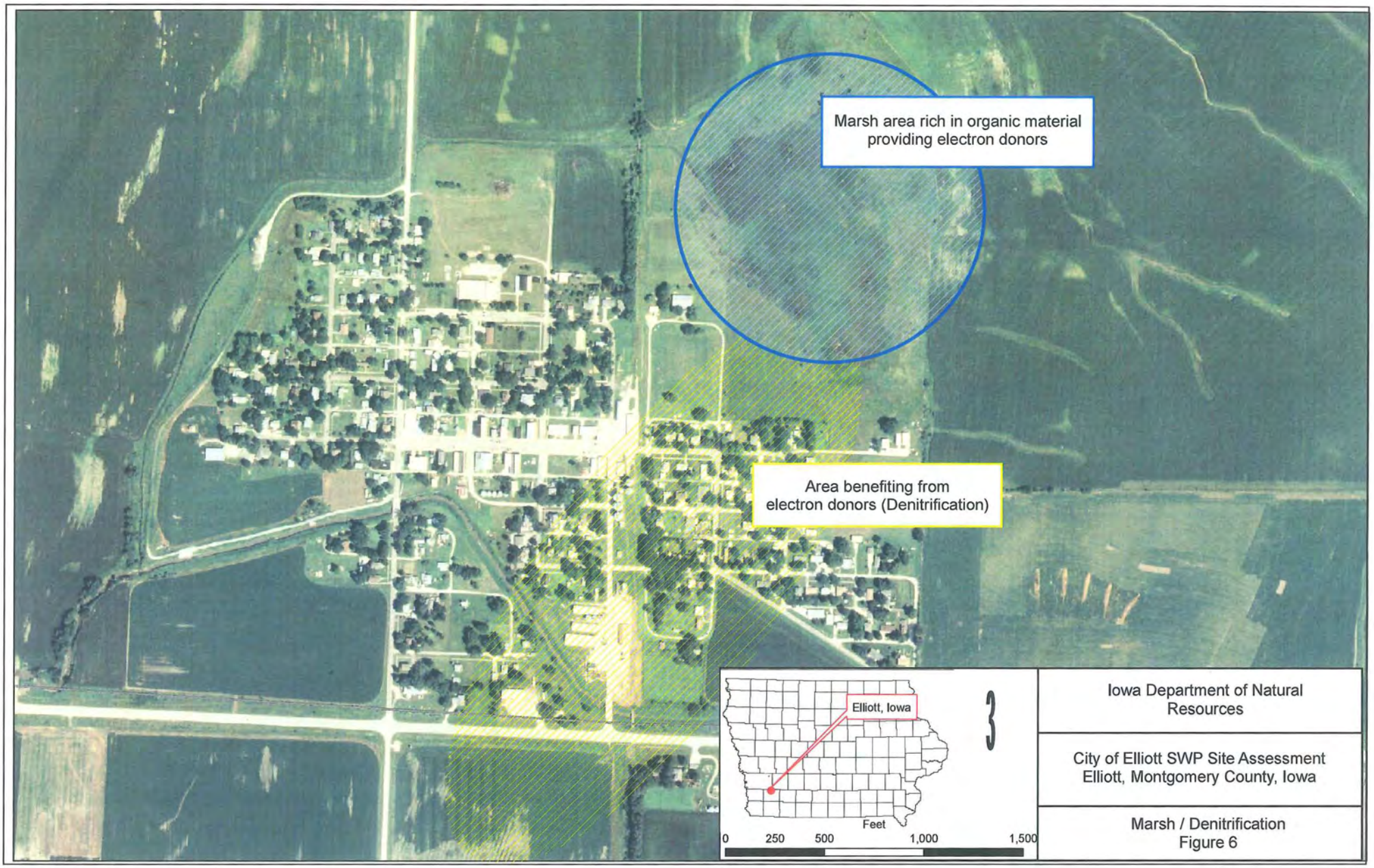
Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Petroleum Sample Location
Figure 5



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Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Marsh / Denitrification
Figure 6

APPENDIX B

Tables

SOURCE WATER PROGRAM

SITE ASSESSMENT RESULTS

For

CITY OF ELLIOTT MUNICIPAL WATER SUPPLY
MUNICIPAL WELL #1 (DNR Well ID # 1419)

Source Water Program

Site Assessment Results

City of Elliott Municipal Water Supply

Groundwater Sample Data

Collected November 19 and 20, 2008

Table 1

Location	Nitrates* (Test Strips)	Nitrates** (HACH)	Ammonia	OA-01 (All Analytes)	OA-02 (All Analytes)
SWP-01S	NA	NA	NA	NA	NA
SWP-01D	3ppm	4.01mg/L	<2mg/L	NA	NA
SWP-02S	2ppm	1.84mg/L	<2mg/L	NA	NA
SWP-02D	5ppm	4.81mg/L	<2mg/L	NA	NA
SWP-03S	6ppm	8.23mg/L	<2mg/L	NA	NA
SWP-03D	10ppm	9.41mg/L	<2mg/L	NA	NA
SWP-04S	4ppm	2.84mg/L	<2mg/L	NA	NA
SWP-04D	5ppm	3.11mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-05S	5ppm	4.81mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-05D	8ppm	7.19mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-06S	5ppm	7.79mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-06D	10ppm	8.14mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-07S	ND	<1mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-07D	ND	<1mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-08S	Trace	<1mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-08D	10ppm	10.80mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-09S	5ppm	7.83mg/L	<2mg/L	NA	NA
SWP-09D	8ppm	10.79mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-10S	Trace	<1mg/L	<2mg/L	NA	NA
SWP-10D	Trace	<1mg/L	<2mg/L	NA	NA
SWP-11S	ND	2.11mg/L	<2mg/L	NA	NA
SWP-11D	Trace	<1mg/L	<2mg/L	NA	NA
SWP-12S	Trace	<1mg/L	<2mg/L	NA	NA
SWP-12S Dup	NA	<1mg/L	<2mg/L	NA	NA
SWP-12D	3ppm	3.64mg/L	<2mg/L	NA	NA
SWP-12D Dup	NA	3.28mg/L	<2mg/L	NA	NA
SWP-13S	5ppm	4.51mg/L	<2mg/L	<2ug/L	<100ug/L
SWP-13D	10ppm	10.49mg/L	<2mg/L	<2ug/L	<100ug/L
Coe Creek	3ppm	2.94mg/L	<2mg/L	NA	NA

* Nitrate Test Strips - HACH Catalog Number 27454-25 with results in ppm nitrate as nitrogen

** HACH DR2800 Spectrophotometer Serial Number 1254017, Sample Method 10206 with results in mg/L nitrate as nitrogen

<1 - Not detected, analyte below method detection limit.

NA - Not analyzed for

ND - Not detected

APPENDIX C

Sample Collection Sheets

SOURCE WATER PROGRAM

SITE ASSESSMENT RESULTS

For

CITY OF ELLIOTT MUNICIPAL WATER SUPPLY
MUNICIPAL WELL #1 (DNR Well ID # 1419)

Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-01 S&D	Sample Matrix:	Groundwater
Latitude:	41° 08' 54.63" N	Collection Date:	11-20-2008
Longitude:	95° 09' 50.18" W	Collection Time:	D - 11:55am S - 12:20pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

Collection Notes:

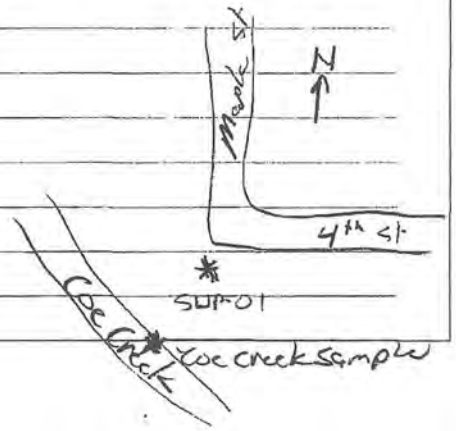
Pushed screen point 15 down to the Dakota Sandstone at 39 feet deep. Aquifer was slow yeilding but got deep sample. Pulled up 3 rods to put screen at 27 feet deep. Found Dry hole so pulled up one more rod placing the screen at 23 feet deep. Still a dry hole so pulled up all equipment and decon'ed

Deep Sediments - fine silty unoxidized.
Shallow Sediments - None collected.

Nitrate Test Strips
SWP-01D - 3ppm Coe Creek 3ppm
SWP-01S - No sample

DR-2800 sample results $NO_3^- - N$
SWP-01D - 4.01 mg/L
SWP-01S - No sample

Coe Creek 2.94 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-02 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 08 ' 58.22" N	Collection Date:	11/19/2008
Longitude:	95 ° 09 ' 51.18" W	Collection Time:	D - 1.15pm S - 2:20pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	~~3 - 40 ml Vials~~		~~Iowa OA-1 plus MtBE~~
	~~Bottle # 18 (Amber Quart Glass/TFE Lid)~~		~~Iowa OA-2~~

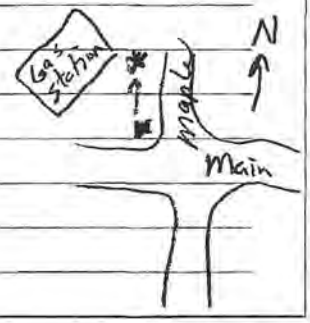
Collection Notes:

Started SWP-02 and pushed the screenpoint 15 down to 39 feet. Had problems deploying the screen so the string was pulled up. Found the screenpoint 15 was damaged. Replaced the screenpoint moved a few feet to the north and pushed to 39 feet deep Collected the deep water sample and a duplicate sample Pulled up 4 rods to place the screen at 23 feet. Collected shallow sample the pulled and decon-ed the equipment.

Deep Sediment - Fine, silty unoxidized
Shallow Sediments - Fine, silty unoxidized.

Nitrate test strips
SWP-02D - 5 ppm
SWP-02S - 2 ppm

DR-2800 Sample Results (NO_3^- - N)
SWP-02D 4.81 mg/L Dup 4.8 mg/L
SWP-02S 1.84 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-03 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 09 ' 0.76" N	Collection Date:	11-19-2008
Longitude:	95 ° 09 ' 50.31" W	Collection Time:	D - 2:55pm S - 3:15pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	~~3 - 40 ml Vials~~		~~Iowa OA-1~~ plus MtBE
	~~Bottle # 18 (Amber Quart Glass/TFE Lid)~~		~~Iowa OA-2~~

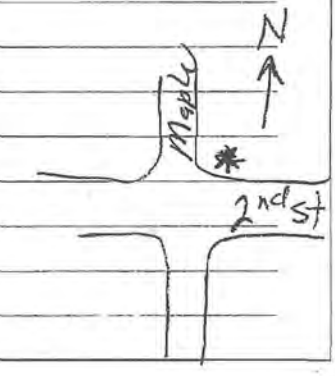
Collection Notes:

Started Location SWP-03 and pushed screenpoint 15 to 37 feet deep to the Dakota Sandstone. Collected the deep sample. Pulled up 4 Rods to place the screen at 23 feet deep. Collected shallow sample then pulled out all equipment and decon-ed

Deep sediments - Fine silty unoxidized
Shallow Sediments - Fine silty unoxidized

Nitrate Test strips
SWP-03D - 10ppm
SWP-03S - 6ppm

DR-2800 Sample Results (NO_3^- -N)
SWP-03D - 9.41 mg/L
SWP-03S - 8.23 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-04 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 08 ' 54.31" N	Collection Date:	11-20-2008
Longitude:	95 ° 09 ' 46.16" W	Collection Time:	D - 10:20am S - 10:45am

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

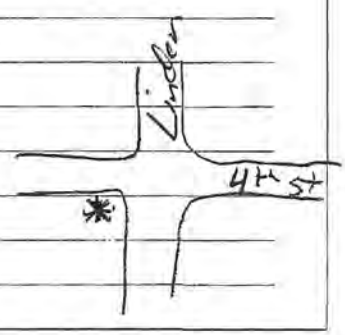
Collection Notes:

Pushed Screenpoint 15 down to 39 feet deep at the Dakota sandstone. Collected the deep samples. Pulled up 4 rods to place the screen at 23 feet deep. Found little water and was only able to collect enough water for the Nitrate test. Pulled up all equipment and decon-ed

Deep Sediments - Fine silty unoxidized
Shallow Sediments - Fine silty unoxidized.

Nitrate test strips
SWP-04D - 5ppm
SWP-04S - 4ppm

DR-2800 Sample Results (NO_3^--N)
SWP-04D - 3.11 mg/L
SWP-04S - 2.84 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-05 S&D	Sample Matrix:	Groundwater
Latitude:	41° 08' 56.89" N	Collection Date:	11-19-2008
Longitude:	95° 09' 46.32" W	Collection Time:	D-12:20 S-12:45

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

Collection Notes:

Started SWP-05 and pushed the screen point 15 down to 39 Feet (the Dakota Sandstone). Collected the deep sample. Pulled up 4 rods to place the screen at 23 Feet deep. Collected the shallow sample then pulled up all equipment & decomed

Deep Sediments - fine silty unoxidized
Shallow Sediments - Fine silty unoxidized

Nitrate Test strips
SWP-05D - 8 ppm
SWP-05S - 5 ppm

DR-2800 Sample Results (NO_3^- - N)
SWP-05D - 7.19 mg/L
SWP-05S - 4.81 mg/L

Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-06 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 09 ' 0.61 " N	Collection Date:	11-19-2008
Longitude:	95 ° 09 ' 45.37 " W	Collection Time:	D - 3:35pm S - 3:55pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

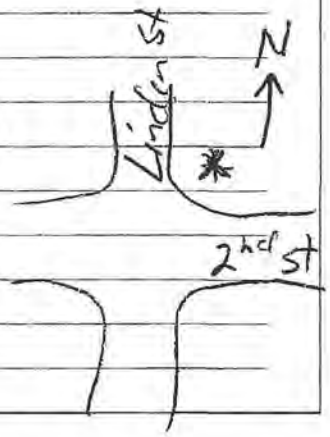
Collection Notes:

Started SWP-06 and pushed to 38 feet deep at the Dakota Sandstone. Collected the deep sample. Pulled up 4 rods to place the screen at 23 feet deep. Collected the shallow sample the decon-ed the equipment. Last Sample collected today.

Deep sediments - Fine silty unoxidized
Shallow Sediments - Fine silty unoxidized.

Nitrate Test Strips
SWP-06D - 10 ppm
SWP-06S - 5 ppm

DR-2800 Sample Results (NO_3^--N)
SWP-06D - 8.14 mg/L
SWP-06S - 7.79 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-07 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 08 ' 54.28" N	Collection Date:	11-20-2008
Longitude:	95 ° 09 ' 41.50" W	Collection Time:	D - 9:30am S - 10:00am

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

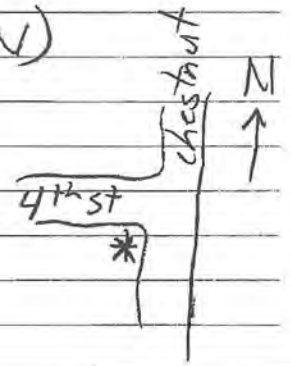
Collection Notes:

Pushed screenpoint 15 down to 38 feet deep at the Dakota sandstone. Collected deep sample. Pulled up 4 rods to place screen at 23 Feet deep. Collected the shallow sample then pulled up all equipment and decon-ed

Deep Sediments - corse oxidized sand
Shallow Sediments - Corse oxidized sand

Nitrate Test Strips
SWP-07 D - ND
SWP-07S - ND

DR-2800 Sample Results (NO_3^- - N)
SWP-07D <1 mg/L
SWP-07S <1 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-08 D&S	Sample Matrix:	Groundwater
Latitude:	41 ° 08 ' 57.05" N	Collection Date:	11-19-2008
Longitude:	95 ° 09 ' 41.31" W	Collection Time:	D - 10.30am S 10:55am

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

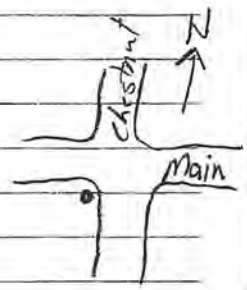
Collection Notes:

Pushed the screenpoint 15 to 39 feet deep to the Dakota sandstone. Deployed the screen and collected the deep samples. Pulled up 4 rods to place the screen at 23 feet deep and collected the shallow samples. Pulled up all the equipment and Decon-ed.

Deep sediments - Fine silty unoxidized
Shallow Sediments - Fine silty unoxidized

Nitrate Test strips
SWP-08D - 10ppm
SWP-08S - Trace

DR2800 sample results NO_3^- - N
SWP-08D 10.80mg/L
SWP-08S <1.0mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-09 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 09 ' 0.65 " N	Collection Date:	11-20-2008
Longitude:	95 ° 09 ' 41.55 " W	Collection Time:	D - 8:30am S - 8:50am

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

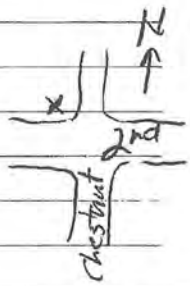
Collection Notes:

Started with SWP-09 and pushed screenpoint 15 down to 36 feet deep at the Dakota sandstone and collected the deep samples. Pulled up 3 rods to place the screen at 23 feet deep but was only able to collect enough groundwater for the DR 2800 sample. Pulled up the equipment and decon-ed.

Deep Sediments - Fine Silty unoxidized
Shallow Sediments - Fine Silty unoxidized

Nitrate test strips
SWP-09D - 8ppm
SWP-09S - 5ppm

DR-2800 Sample results NO_3^- - N
SWP09D - 10.79mg/L
SWP-09S - 7.83 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-10 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 08 ' 54.30 " N	Collection Date:	11-20-2008
Longitude:	95 ° 09 ' 33.94 " W	Collection Time:	D - 12:45pm S - 1:10pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	~~3 - 40 ml Vials~~		~~Iowa OA-1~~ plus MtBE
	~~Bottle # 18 (Amber Quart Glass/TFE Lid)~~		~~Iowa OA-2~~

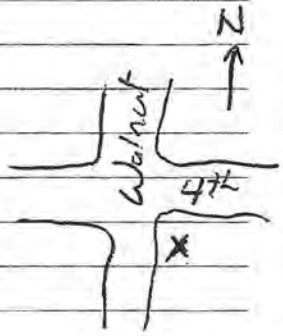
Collection Notes:

Started SWP-10 and pushed the screenpoint 15 ft to the Dakota Sandstone at 34 feet deep. Collected deep sample. Pulled up 3 rods to place the screen at 23 feet deep. Collected the shallow samples. Pulled up all equipment and decon-ed.

Deep Sediment - corse oxidized sand
Shallow Sediment - corse oxidized sand.

Nitrate Test strips
SWP-10D - Trace
SWP-10S - Trace

DR-2800 sample results NO_3^--N
SWP-10D <1.0 mg/L
SWP-10S <1.0 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-11 S&D	Sample Matrix:	Groundwater
Latitude:	41 ° 08 ' 57.60 " N	Collection Date:	11-20-2008
Longitude:	95 ° 09 ' 34.49 " W	Collection Time:	D - 1:20pm S - 1:35pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	~~3 - 40 ml Vials~~		~~Iowa OA-1 plus MtBE~~
	~~Bottle # 18 (Amber Quart Glass/TFE Lid)~~		~~Iowa OA-2~~

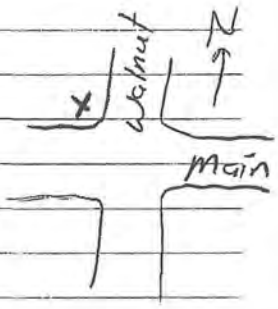
Collection Notes:

Pushed the screenpoint 15 down to the Dakota sandstone at 37 feet deep. Collected the deep sample. Pulled up 4 rods to place the screen at 23 feet deep and collected the shallow sample. Pulled up all equipment and decon-ed.

Deep sediment - corse oxidized sand
Shallow sediment - corse oxidized sands

Test Strips
SWP-11D - Trace
SWP-11S - Non detect

DR-2800 sample results NO_3^- - N
SWP-11D - <1.0mg/L
SWP-11S - 2.11 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-12 S&D	Sample Matrix:	Groundwater
Latitude:	41° 09' 0.52" N	Collection Date:	11-20-2008
Longitude:	95° 09' 34.18" W	Collection Time:	D - 2:00pm S - 2:20pm

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	~~3 - 40 ml Vials~~		Iowa ~~OA-1~~ plus MtBE
	~~Bottle # 18 (Amber Quart Glass/TFE Lid)~~		Iowa ~~OA-2~~

Collection Notes:

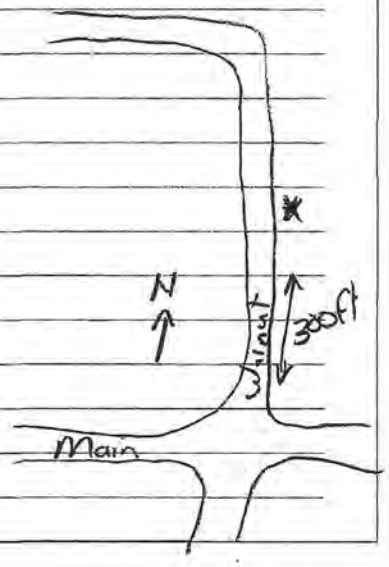
Pushed screenpoint 15 down to the Dakota Sandstone at 34 feet deep. Collected the deep sample and duplicate. Pulled up 3 rods to place the screen at 23 feet deep and collected sample and duplicate. Pulled up all equipment and decon-ed.

Deep Sediment - Corse oxidized sand
Shallow Sediment - Corse oxidized sand

Test Strips
SWP-12D - 3 ppm
SWP-12S - Trace

DR-2800 Sample Results NO_3^- - N
SWP-12D - 3.64 mg/L
SWP-12S - <1.0 mg/L

SWP-12D-Dup - 3.28 mg/L
SWP-12S-Dup - <1.0 mg/L



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(City wide)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number	SWP-13 S&D	Sample Matrix:	Groundwater
Latitude:	41° 08' 56.49" N	Collection Date:	11-19-2008
Longitude:	95° 09' 45.35" W	Collection Time:	D-11:30am S-11:50am

Container:	1 - 40 ml Vial	Analysis:	Nitrate (HACH TNT 836) Ammoinia (HACH TNT 832)
	3 - 40 ml Vials		Iowa OA-1 plus MtBE
	Bottle # 18 (Amber Quart Glass/TFE Lid)		Iowa OA-2

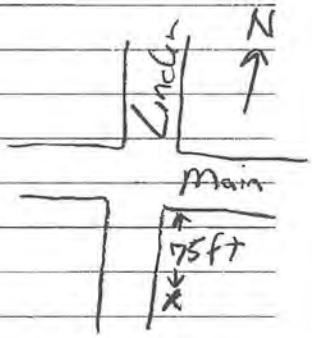
Collection Notes:

Pushed screenpoint 15 to the Dakota sandstone at 39 feet deep. Collected the deep samples. Pulled up 4 rods to place the screen at 23 feet deep and collected the shallow samples. Pulled up all equipment and decon-ed.

Deep Sediments - fine silty unoxidized
Shallow Sediments - fine silty unoxidized

Test strips
SWP-13D - 10ppm
SWP-13S - 5ppm

DR-2800 sample results NO_3^--N
SWP-13D 10.49mg/L
SWP-13S 4.51mg/L



APPENDIX D

UHL Petroleum Lab Sheets

SOURCE WATER PROGRAM

SITE ASSESSMENT RESULTS

For

CITY OF ELLIOTT MUNICIPAL WATER SUPPLY
MUNICIPAL WELL #1 (DNR Well ID # 1419)

Hygienic Laboratory

The University of Iowa

Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044647
Date Received	11-25-2008
Project	WQUST
Date Collected	11-20-2008 08:30
Collection Site	swp-09d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-02-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Hygienic Laboratory

The University of Iowa

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Iowa Environmental Laboratory ID #027.

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The University of Iowa

Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044646
Date Received	11-25-2008
Project	WQUST
Date Collected	11-20-2008 10:00
Collection Site	swp-07s
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-02-2008
Method: OA-2
Date Prepared: 11-26-2008

Analyst: WB
Verified: SM
Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008
Method: OA-1

Analyst: JN
Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter

Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044645
Date Received	11-25-2008
Project	WQUST
Date Collected	11-20-2008 09:30
Collection Site	swp-07d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-02-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044644
Date Received	11-25-2008
Project	WQUST
Date Collected	11-20-2008 10:20
Collection Site	swp-04d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-02-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

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DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044643
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 11:30
Collection Site	swp-13d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-02-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044642
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 11:50
Collection Site	swp-13s
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044641
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 10:30
Collection Site	swp-08d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Hygienic Laboratory

The University of Iowa

Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044640
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 10:55
Collection Site	swp-08s
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Iowa Laboratories Complex
2220 S. Ankeny Blvd, Ankeny, Iowa 50023
515/725-1600 Fax: 515/725-1642

Hygienic Laboratory

The University of Iowa

Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044639
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 15:35
Collection Site	swp-06d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

Michael D. Wichman, Ph.D.
Associate Director

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Iowa Environmental Laboratory ID #027.

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044638
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 15:55
Collection Site	swp-06s
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044637
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 12:20
Collection Site	swp-05d
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 Analyst: WB
Method: OA-2 Verified: SM
Date Prepared: 11-26-2008 Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 Analyst: JN
Method: OA-1 Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Date of report: 12-08-2008

DAN COOK
IDNR CONTAMINATED SITES
WALLACE STATE OFFICE BLDG
502 EAST NINTH STREET
DES MOINES IA 50319-0034

Sample Number	2008044636
Date Received	11-25-2008
Project	WQUST
Date Collected	11-19-2008 12:45
Collection Site	swp-05s
Collection Town	
Description	water
Reference	ELLIOTT SWP
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments: *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Results of Analyses

Total Extractable Hydrocarbons

Analyte	Concentration ug/L	Quantitation Limit ug/L
Gasoline	< 100	100
Mineral spirits	< 100	100
Kerosene	< 100	100
Diesel Fuel	< 100	100
Motor Oil	< 100	100
Total Extractable Hydrocarbons	< 100	100

Date Analyzed: 12-01-2008 — Analyst: WB
Method: OA-2 — Verified: SM
Date Prepared: 11-26-2008 — Analyst: MS,KB
Verified: GJ

Volatile Petroleum Hydrocarbons by GC/MS

Analyte	Concentration ug/L	Quantitation Limit ug/L
Methyl-t-butyl ether (MtBE)	< 2	2
Benzene	< 2	2
Toluene	< 2	2
Ethylbenzene	< 2	2
Total Xylenes	< 5	5

Comments: *Please note that the pH of this sample was less than or equal to 2.*

Date Analyzed: 11-26-2008 — Analyst: JN
Method: OA-1 — Verified: TC

Description of units used within this report

ug/L - Micrograms per Liter — Quant Limit - Lowest concentration reliably measured

Page 1 - Continued on next page

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Hygienic Laboratory

The University of Iowa

CHAIN-OF-CUSTODY

Contact Name	Phone	Purchase Order #
Dan Cook	515-281-4171	UST / LUST (WQUST)
Company	**Fax**	**Project Name and/or Number**
IDNR Contaminated Sites	515-281-8895	Elliott SWP
Address		**Collector's Phone #**
502 E 9th st		515-281-4171
City	**State / Zip**	**Print Collector's Name**
Des Moines	IA 50319	Dan Cook
		Collector's Signature

Sample ID/Description	Date	Time	Sample Matrix W	S	Other	BTEX+MTBE by OA-1	TEH by OA-2	ELIS
1. SWP-05S	11/19/08	12:45				X	X	2008044636 AK 1
2. SWP-05D	11/19/08	12:20				X	X	2008044637 AK 2
3. SWP-06S	11/19/08	3:55				X	X	2008044638 AK 3
4. SWP-06D	11/19/08	3:35				X	X	2008044639 AK 4
5. SWP-08S	11/19/08	10:55				X	X	2008044640 AK 5
6. SWP-08D	11/19/08	10:30				X	X	2008044641 AK 6
7. SWP-13S	11/19/08	11:50				X	X	2008044642 AK 7
8. SWP-13D	11/19/08	11:30				X	X	2008044643 AK 8

ELIS 2008-11-25 13:39

Relinquished by	Date	Time	Comments
D Cook	11-25-2008	1337	
Relinquished by	**Date**	**Time**	
Sample receiving custodian	**Date**	**Time**	**Sample Receipt Comments**
Robin Echer MLH	11-25-08 11-26-08	1337 0730	8-#18, 8-seals #45 Rec'd 1-18, 3-45 Ech IC @ 7°C

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Blue - Client Copy

61945/1-07

SOURCE WATER PROGRAM

SITE ASSESSMENT RESULTS ADDENDUM No. 02 (MARSH SAMPLING)

For

CITY OF ELLIOTT MUNICIPAL WATER SUPPLY MUNICIPAL WELL #1 (DNR Well ID # 1419)

ELLIOTT, MONTGOMERY COUNTY, IOWA

February 4, 2011

IOWA DEPARTMENT OF NATURAL RESOURCES

Prepared by

Daniel Cook
Environmental Specialist Senior
IDNR Project Manager
Contaminated Sites Section

Iowa Department of Natural Resources Contaminated Sites Section staff collected three additional groundwater samples for the City of Elliott Source Water Protection Site Assessment to determine if the existing marsh area northeast of the City of Elliot was causing denitrification of the groundwater as the groundwater passed underneath. As noted in the December 22, 2008 Site Assessment Results and Addendum 01 the level of nitrate in the groundwater samples were found in the 7 to 8 mg/L range north of the marsh and less than 1 mg/L south of the marsh. The results of this sampling event were used to determine if the marsh was removing nitrate from the groundwater as the nitrate impacted groundwater migrated under the marsh. IDNR staff members traveled to the site on January 20, 2011 to install the wells and then collect samples on January 21st. Samples remained in IDNR custody until ether submitted to SHL for analysis or analyzed with IDNR equipment.

Three temporary monitoring wells were placed in and just south of the marsh to a depth of 24 feet and were be screened from 19 to 24 feet deep (Figure 1). The wells were purged of 5 gallons of groundwater to remove as much fine silt and sand as possible. The wells were also surveyed in with the measurements used to determine the groundwater flow direction.

The following morning the groundwater heads were be measured in each well and samples were collected for nitrates, dissolved oxygen (DO), dissolved organic carbon (DOC), and total organic carbon (TOC). The wells were then properly plugged according to IAC-567-39, *Requirements for Properly Plugging Abandoned Wells.* DO samples will confirm the existence of hydric soils (oxygen depleted soils) and the DOC and TOC samples will confirm the existence of a carbon source that is required for the denitrification process to take place. TOC is a measurement of dissolved and suspended carbon in the groundwater whereas the DOC sample is filtered therefore measuring only the dissolved carbon.

Nitrate and DO testing was completed on site with IDNR's HACH DR 2800 Spectrophotometer using HACH Method 10206 for the nitrates and HACH Method 8166 for the DO DOC and TOC samples were sent the State Hygienic Laboratory (SHL) for analysis using Method SM-5310B.

Sample analysis indicate the denitrification process is taking place, earlier testing showed the groundwater migrating towards the marsh was impacted with nitrates and leaving the marsh area at very low levels, sample results from this addendum help to explain why. Table 1 shows low levels of DO and DOC in MW-02 and MW-03 which were collected directly under the marsh (where denitrification should be taking place). Low levels of DOC but higher levels of TOC indicate that as the carbon dissolves it is being used up by the biological denitrification process in anaerobic conditions (low DO).

Higher levels of DO and DOC were recorded at MW-01 which was located 400 feet to the southwest of the marsh where the demand for oxygen isn't as strong

because the nitrate level is very low and aerobic conditions exist. Normal groundwater contains DO at 5.4 to 14.8 mg/L depending on the temperature; groundwater is normally around 55° F at which pure water is saturated with oxygen at 10.6mg/L. Fish can survive in water with DO levels greater then 2mg/L.

Elliott SWP Site Assessment Addendum No. 02
Marsh Sampling Results
Table 1

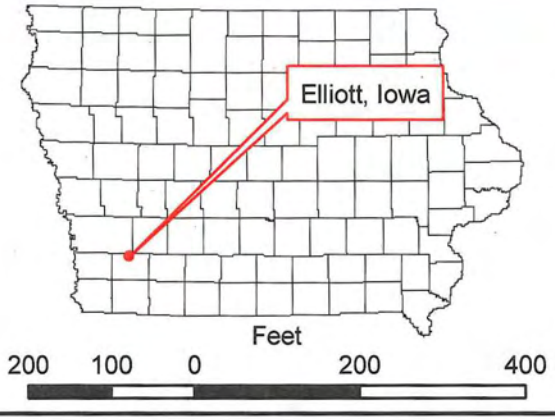
	Nitrate (mg/L)	Oxygen (mg/L)	Carbon (Total) (mg/L)	Carbon (Dissolved) (mg/L)
MW-01	0.47	4.9	5.9	0.7
MW-02	0.42	0.36	3.1	< 0.5
MW-03	< 0.32	0.28	3.3	< 0.5

Samples collected January 21, 2011

The conversion of ammonium to nitrate is performed primarily by soil-living bacteria and other nitrifying bacteria. The primary stage of nitrification, the oxidation of ammonium (NH4+) is performed by bacteria such as the Nitrosomonas species, which converts ammonia to nitrites (NO2-). Other bacterial species, such as the Nitrobacter, are responsible for the oxidation of the nitrites into nitrates (NO3-). It is important for the nitrites to be converted to nitrates because accumulated nitrites are toxic to plant life.

Denitrification is a microbial facilitated process of nitrate reduction that may ultimately produce molecular nitrogen (N2) through a series of intermediate gaseous nitrogen oxide products. This respiratory process reduces oxidized forms of nitrogen in response to the oxidation of an electron donor such as organic matter (carbon). The preferred nitrogen electron acceptors in order of most to least thermodynamically favorable include nitrate (NO3−), nitrite (NO2−), nitric oxide (NO), and nitrous oxide (N2O). In terms of the general nitrogen cycle, denitrification completes the cycle by returning N2 to the atmosphere.

Overall, sample results indicate denitrification is taking place in the groundwater under the marsh due to anaerobic conditions and high levels of dissolved carbon caused by the natural decay process of plant matter in the surface waters of the marsh. As the oxygen depleted zone, along with the carbon, migrates down through the water column the microbes switch from oxygen to nitrate as the primary electron acceptor rapidly denitrifying the groundwater.

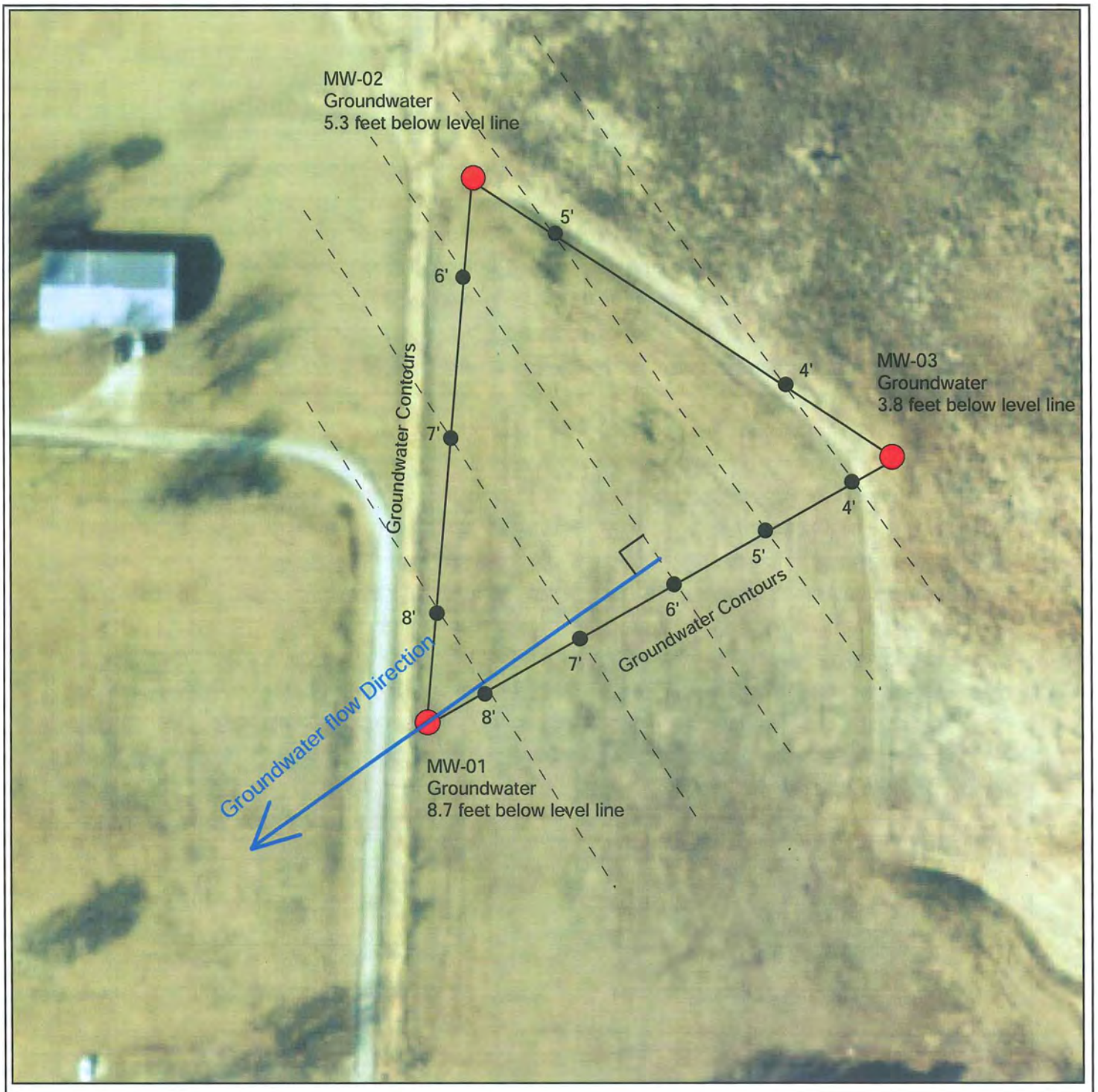


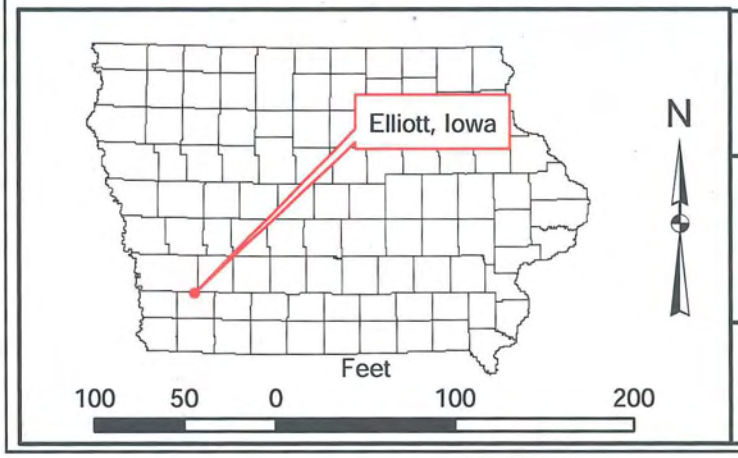
N

Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Sampling Locations
Figure 1





Iowa Department of Natural Resources

City of Elliott SWP Site Assessment
Elliott, Montgomery County, Iowa

Groundwater Flow Direction
Figure 2

Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(Marsh Area)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number:	MW-01	Sample Matrix:	Groundwater
Latitude:	41° 09' 01.41" N	Collection Date:	January 21, 2011
Longitude:	95° 09' 34.26" W	Collection Time:	8:40am

Container:	1 - #74 250ml Plastic Bottle (w/HCl)	Analysis:	Total Organic Carbon (SM-5310B)
	1 - #74 250ml Plastic Bottle (w/HCl)		Dissolved Organic Carbon (SM-5310B)

Collection Notes: January 20, 2011
Arrived on site at 11:35AM, the weather was clear calm and cold (10°F). Checked utility locates and all 3 proposed boring locations were clear of any underground utilities. Set up Geoprobe to place MW-01. Pushed the 2¼" rods down to 24 feet deep and inserted 5 feet of screen and 20 feet of riser. Pulled the geoprobe rods and sealed the new well with bentonite. Purged 5 gallons of groundwater. Measured groundwater head and found it 7.06 feet below top of casing. Sampled well for nitrates and found level at 0.45 mg/L (HACH Method 10206 - TNTplus 835)
Left the monitoring well in place and moved to MW-02

January 21, 2011 8:00Am - 0°F with snow showers
Returned to MW-01 after having it set overnight and Measured the head and found no change from previous day (7.06 feet below top of casing). Purged an additional 5 gallons of ground water and collected samples for dissolved organic carbon and total organic carbon. DOC was Field filtered with a

Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(Marsh Area)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number:	MW-02	Sample Matrix:	Groundwater
Latitude:	41° 09' 05.62" N	Collection Date:	January 21, 2011
Longitude:	95° 09' 33.98" W	Collection Time:	9:20 am

Container:	1 - #74 250ml Plastic Bottle (w/HCl)	Analysis:	Total Organic Carbon (SM-5310B)
	1 - #74 250ml Plastic Bottle (w/HCl)		Dissolved Organic Carbon (SM-5310B)

Collection Notes:

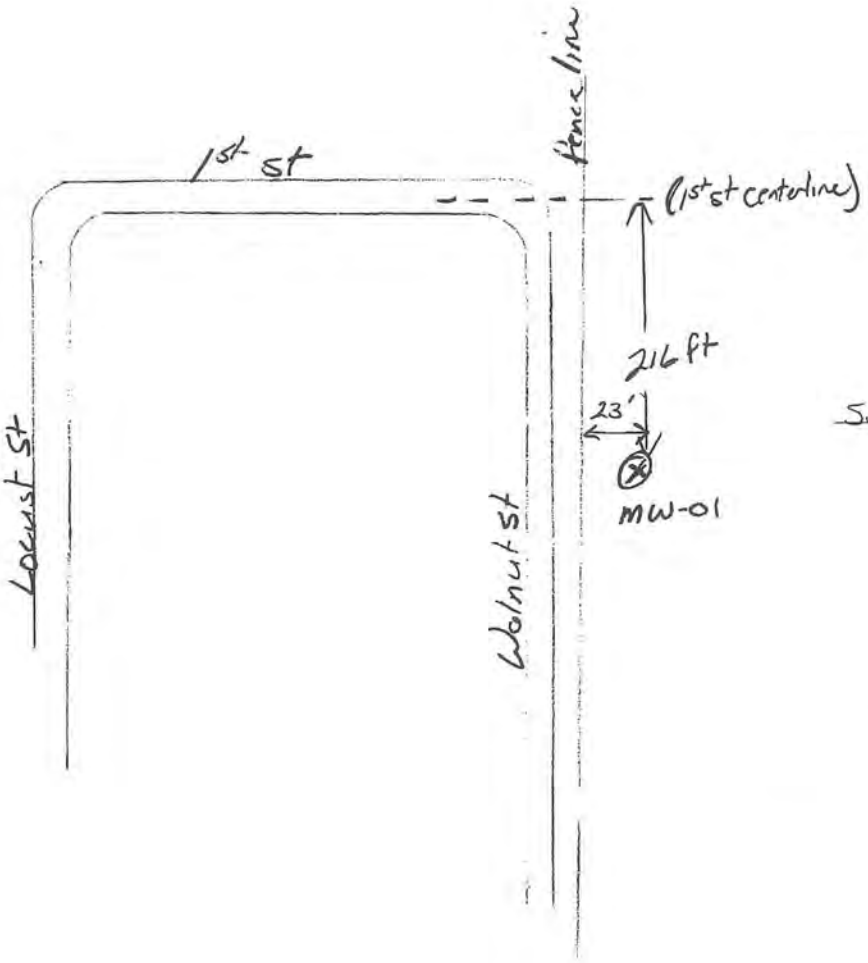
January 20, 2011 Set up Geoprobe to bore MW-02 and pushed the 2 1/4" rod down to 24 ft deep. Placed 5 feet of screen and 20 feet of riser (All 1" OD PVC) and removed Geoprobe rods. Placed a bentonite plug in annular space. Measured head at 2.06 feet below top of casing. Purged 5 gallons of groundwater then collected sample to measure nitrates. Using HACH method 10206 the nitrate level was found at 0.36 mg/L. The well was then surveyed in then we moved to the next monitoring well location.

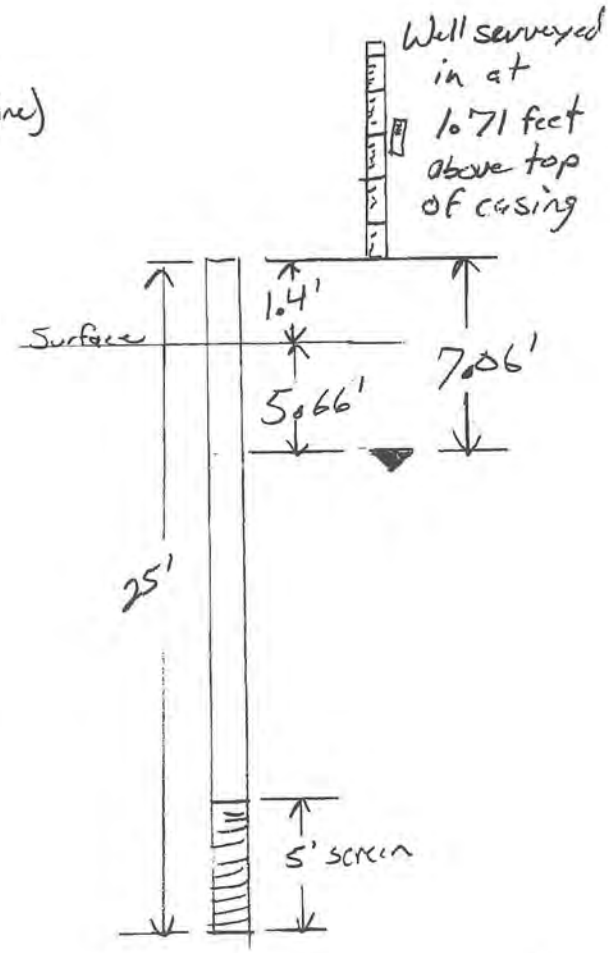
January 21, 2011 9:10 am
Returned to MW-02 and measured head at 2.05 feet below the top of casing. Then we purged 5 gallons of groundwater and collected samples for total organic carbon and dissolved organic carbon. The DOC was field filtered through a 0.45 µm filter before placing in sample bottle. MW-02d was collected as a TOC duplicate.

MW 01 continued.

0.45 um filter before placing in sample bottle. Nitrate was sampled again and found at 0.47 mg/L. Dissolved Oxygen was sampled for using HACH method 8166 AccuVac Ampuls HR and found at 4.9 mg/L.

Head was measured one more time and found at 7.06 feet above the top of casing again indicating a very fast recovering well. The monitoring well was then pulled and plugged with bentonite. All equipment was loaded and moved to MW-02.





Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(Marsh Area)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number:	MW-02	Sample Matrix:	Groundwater
Latitude:	41° 09' 05.62" N	Collection Date:	January 21, 2011
Longitude:	95° 09' 33.98" W	Collection Time:	9:20am

Container:	1 - #74 250ml Plastic Bottle (w/HCl)	Analysis:	Total Organic Carbon (SM-5310B)
	1 - #74 250ml Plastic Bottle (w/HCl)		Dissolved Organic Carbon (SM-5310B)

Collection Notes:

January 20, 2011 Set up Geoprobe to bore MW-02 and pushed the 2 1/4" rod down to 24 ft deep. Placed 5 feet of screen and 20 feet of riser (All 1" OD PVC) and removed Geoprobe rods. Placed a bentonite plug in annular space. Measured head at 2.06 feet below top of casing. Purged 5 gallons of groundwater then collected sample to measure nitrates. Using HACH method 10206 the nitrate level was found at 0.36 mg/L. The well was then surveyed in then we moved to the next monitoring well location.

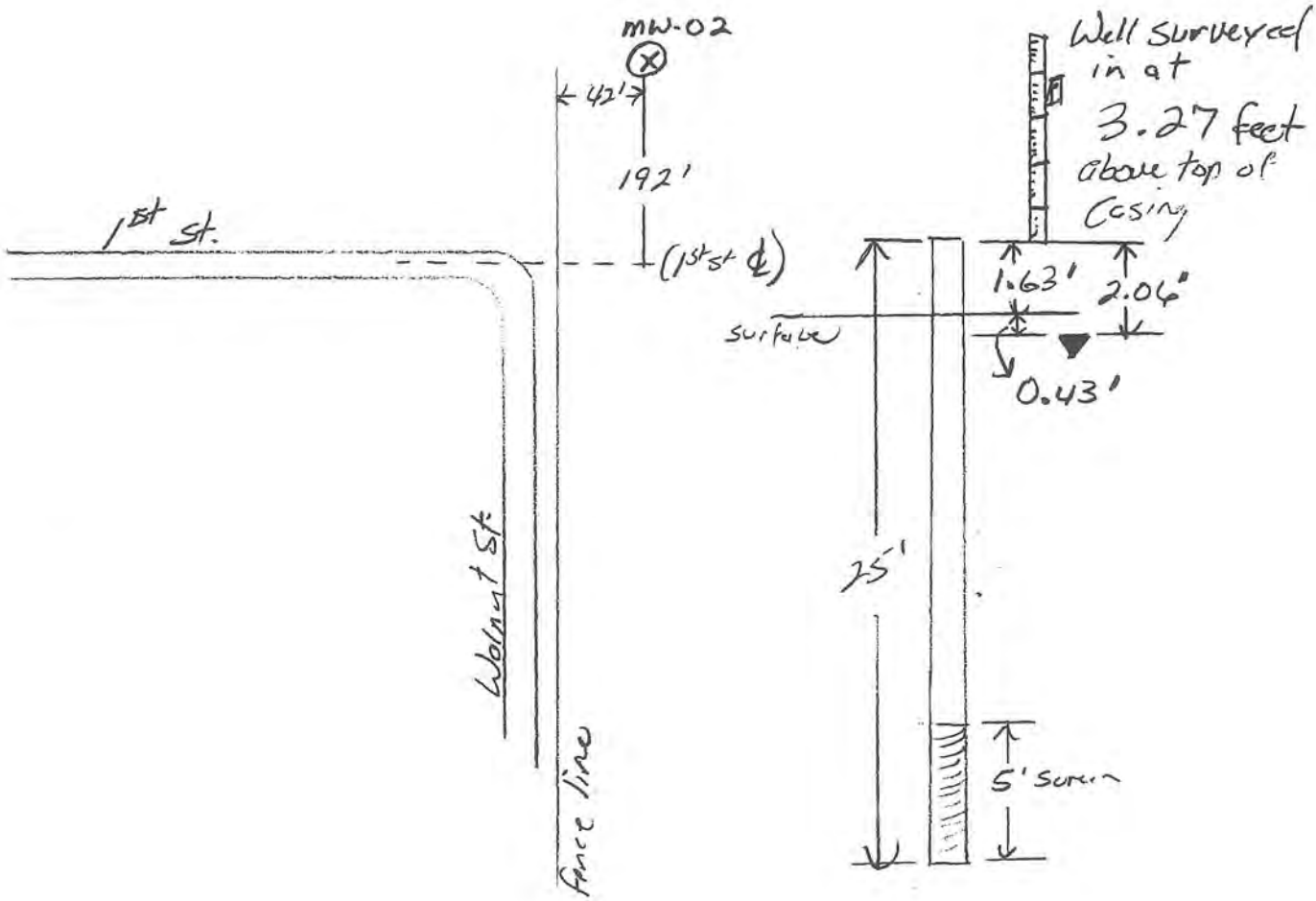
January 21, 2011 9:10am
Returned to MW-02 and measured head at 2.05 feet below the top of casing. Then we purged 5 gallons of groundwater and collected samples for total organic carbon and dissolved organic carbon. The DOC was field filtered through a 0.45µm filter before placing in sample bottle. MW-02d was collected as a TOC duplicate.

MW-02 continued.

Nitrate levels were checked again and found at 0.32 mg/L. Dissolved oxygen was sampled for using HACH Method 8166 High Range AccuVac Ampuls and the level was found at 0.37 mg/L. This level was close to the Lower detection limit of the Method so another sample was measured using HACH Method 8316 - Low Range AccuVac Ampuls and the dissolved Oxygen level was found at 357 ug/L or 0.357 mg/L.

The head was measured one more time and found at 2.06 feet below top of casing.

The monitoring well was pulled and the hole plugged with bentonite.



Sample Collection Field Sheet
Iowa Department of Natural Resources
Des Moines, Iowa

Project Name:	Elliott SWP	Project Manager:	Dan Cook
Address:	(Marsh Area)	Program:	SWP
City, State:	Elliott, Iowa 51532		

Sample Number:	MW-03	Sample Matrix:	Groundwater
Latitude:	41° 09' 02.98" N	Collection Date:	January 21, 2011
Longitude:	95° 09' 30.40" W	Collection Time:	10:10am

Container:	1 - #74 250ml Plastic Bottle (w/HCl)	Analysis:	Total Organic Carbon (SM-5310B)
	1 - #74 250ml Plastic Bottle (w/HCl)		Dissolved Organic Carbon (SM-5310B)

Collection Notes:

January 20, 2011 Set up Geoprobe to bore MW-03, pushed the 2 1/4" geoprobe rods down to 24 feet deep. Place 5 feet of 1" pvc screen and 20 feet of riser down the Geoprobe rods. Removed the Geoprobe rods leaving the pvc well in place. Filled the angular space around the pvc with bentonite.
Purged 5 gallons of water from the well then collected sample to test for nitrates using HACH method 10206. Nitrates were measured at less than 0.23 mg/L (below the method detection limit). Measured ground water head in the well and found it at 1.46 feet below the top of the casing. The casing is 1.66 feet above the surface so the head is 0.2 feet above the surface.

January 21, 2011
Purged 5 more gallons of water from the well and collected samples for total organic carbon and dissolved organic carbon. The DOC was field filtered with a 0.45 µm filter. MW-03d is a duplicate for DOC.

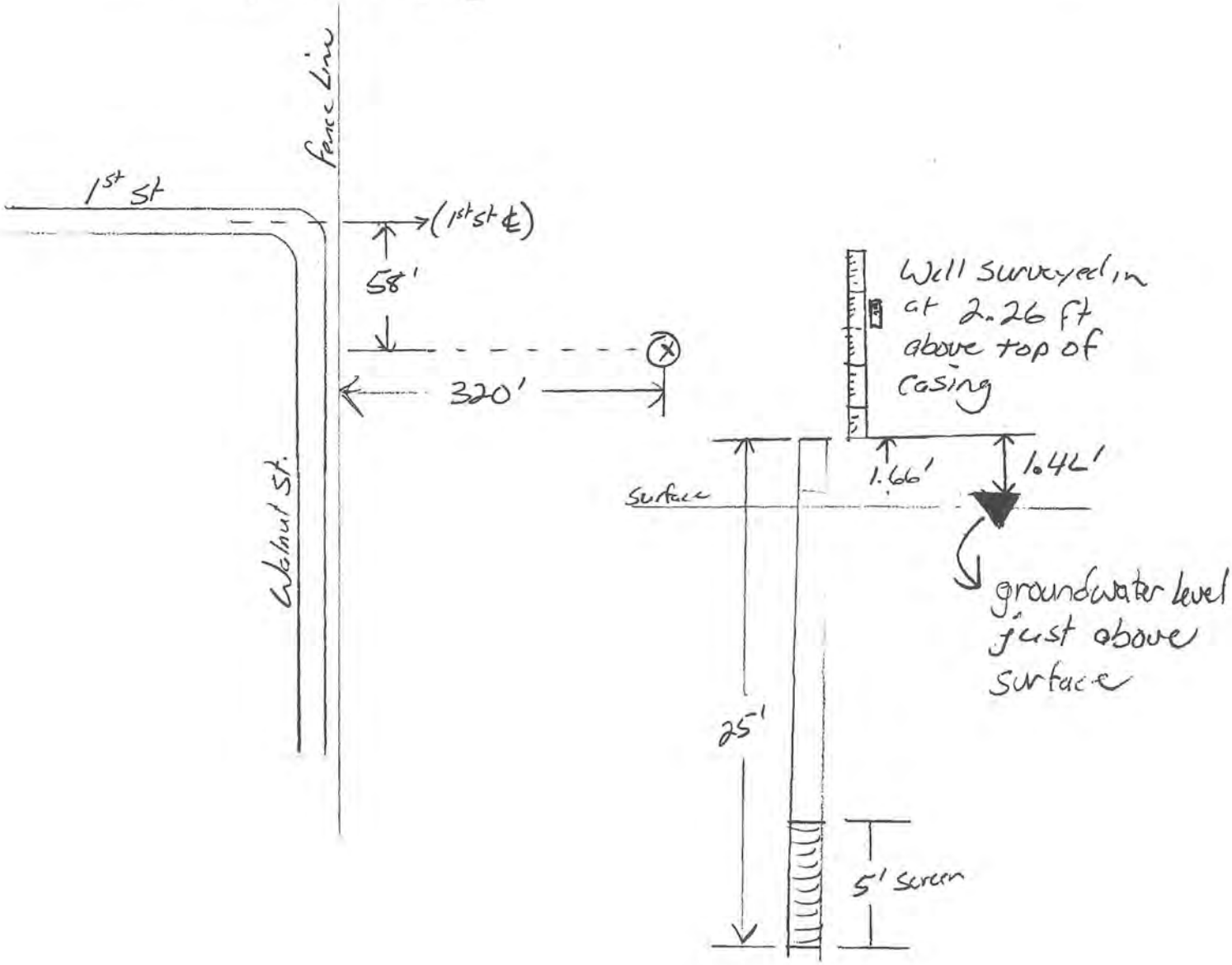
MW-03 Continued

The nitrate level was checked again a was still below the method detection limit of 0.23 mg/L. Dissolved Oxygen was test for using HACH Method 8316 for Low Range and the level was at 276 ug/L or 0.276 mg/L.

The head was measured again and it was still at 1.42 feed below the top of the casing or just above the surface elevation.

The monitoring well was pulled and the hole plugged with bentonite.

Stowed all equipment in the truck and finished for the day (12:45pm)



State Hygienic Laboratory

The University of Iowa

Date of report: 02-07-2011

DAN COOK
IDNR CONTAMINATED SITES
502 EAST NINTH STREET

DES MOINES IA 50319-0034

Sample Number	2011002283
Date Received	01-21-2011
Project	WMSF
Date Collected	01-21-2011 10:10
Collection Site	mw-03d
Collection Town	
Description	water
Reference	ELLIOTT MARSH
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	WMSF

Comments	*Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Additional Information

DNR Project Code (Circle One):	Not provided

Preliminary Results of Analyses

Dissolved Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Dissolved Organic Carbon	1.6	0.5

Date Analyzed: 02-04-2011 Analyzed at: Ankeny Analyst: LD/AB
Method: SM 5310 B Verified: BW

Description of units used within this report

mg/L - Milligrams per Liter Quant Limit - Lowest concentration reliably measured

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Iowa Environmental Laboratory IDs are: Ankeny #397, Iowa City #027, Lakeside #393.

If you have any questions please call Client Services at 800/421-IOWA (4692) or 319/335-4500. Thank you.

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State Hygienic Laboratory

The University of Iowa

Date of report: 02-07-2011

DAN COOK
IDNR CONTAMINATED SITES
502 EAST NINTH STREET

DES MOINES IA 50319-0034

Sample Number	2011002282
Date Received	01-21-2011
Project	WMSF
Date Collected	01-21-2011 10:10
Collection Site	mw-03
Collection Town	
Description	water
Reference	ELLIOTT MARSH
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	

Comments	*Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Additional Information

DNR Project Code (Circle One):	Not provided

Preliminary Results of Analyses

Total Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Total Organic Carbon	3.3	0.5

Date Analyzed: 02-04-2011 Analyzed at: Ankeny Analyst: LD/AB
Method: SM 5310 B Verified: BW

Dissolved Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Dissolved Organic Carbon	< 0.5	0.5

Date Analyzed: 02-04-2011 Analyzed at: Ankeny Analyst: LD/AB
Method: SM 5310 B Verified: BW

Description of units used within this report

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The University of Iowa

Date of report: 02-07-2011

DAN COOK
IDNR CONTAMINATED SITES
502 EAST NINTH STREET

DES MOINES IA 50319-0034

Sample Number	2011002281
Date Received	01-21-2011
Project	WMSF
Date Collected	01-21-2011 09:20
Collection Site	mw-02d
Collection Town	
Description	water
Reference	ELLIOTT MARSH
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	WMSF

Comments	*Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Additional Information

DNR Project Code (Circle One):	Not provided

Preliminary Results of Analyses

Total Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Total Organic Carbon	3.0	0.5

Date Analyzed: 02-04-2011 Analyzed at: Ankeny Analyst: LD/AB
Method: SM 5310 B Verified: BW

Description of units used within this report

mg/L - Milligrams per Liter Quant Limit - Lowest concentration reliably measured

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The University of Iowa

Date of report: 02-07-2011

DAN COOK
IDNR CONTAMINATED SITES
502 EAST NINTH STREET

DES MOINES IA 50319-0034

Sample Number	2011002280
Date Received	01-21-2011
Project	WMSF
Date Collected	01-21-2011 09:20
Collection Site	mw-02
Collection Town	
Description	water
Reference	ELLIOTT MARSH
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	WMSF

Comments: *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Additional Information

DNR Project Code (Circle One):	Not provided

Preliminary Results of Analyses

Total Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Total Organic Carbon	3.1	0.5

Date Analyzed: 02-04-2011 Analyzed at: Ankeny Analyst: LD/AB
Method: SM 5310 B Verified: BW

Dissolved Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Dissolved Organic Carbon	< 0.5	0.5

Date Analyzed: 02-04-2011 Analyzed at: Ankeny Analyst: LD/AB
Method: SM 5310 B Verified: BW

Description of units used within this report

mg/L - Milligrams per Liter

Quant Limit - Lowest concentration reliably measured

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Date of report: 02-07-2011

DAN COOK
IDNR CONTAMINATED SITES
502 EAST NINTH STREET

DES MOINES IA 50319-0034

Sample Number	2011002279
Date Received	01-21-2011
Project	WMSF
Date Collected	01-21-2011 08:40
Collection Site	mw-01
Collection Town	
Description	water
Reference	ELLIOTT MARSH
Collector	COOK DAN
Phone	(515) 281-4171
Purchase Order	WMSF

Comments: *Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.*

Additional Information

DNR Project Code (Circle One):	Not provided

Preliminary Results of Analyses

Total Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Total Organic Carbon	5.9	0.5

Date Analyzed: 01-31-2011 Analyzed at: Ankeny Analyst: AB
Method: SM 5310 B Verified: JE

Dissolved Organic Carbon

Analyte	Concentration mg/L	Quantitation Limit mg/L
Dissolved Organic Carbon	0.7	0.5

Date Analyzed: 01-31-2011 Analyzed at: Ankeny Analyst: AB
Method: SM 5310 B Verified: JE

Description of units used within this report

mg/L - Milligrams per Liter Quant Limit - Lowest concentration reliably measured

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