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I. PROJECT EXECUTIVE SUMMARY

The Dry Run Creek Watershed received a biological impairment in 2002 after sampling conducted by the Department of Natural Resources (DNR) revealed a lack in the diversity and abundance of aquatic life along a 2.8 mile reach of stream along the Southwest Branch (Fig. 1.1). Among the primary stressors identified were hydrological change, increased storm sewer inputs, lack of available habitat and sedimentation. High levels of indicator bacteria (e.coli) were observed in 2008 which resulted in a second impaired designation when the Dry Run Creek (DRC) Watershed was placed on the 303 (d) list for bacterial impairment on the Southwest, East, and University Branches (Fig.1.2). Goals put forth by the Watershed Management Plan and the preliminary Total Maximum Daily Load (TMDL) study center around the reduction in storm sewer inputs. The goal set forth by the TMDL was submitted to EPA for approval.

The WIRB awarded grant dollars in the amount of $48,400 went towards the cost to install two parking lot bioretention cells on the campus of the University of Northern Iowa. The two parking lots were constructed in conjunction with the new development of a two phase Student Housing Complex. The North parking lot bioretention cell is 7,000 ft^2 and treats about 751,036 gallons of runoff annually. The South parking lot bioretention cell is 11,000 ft^2 and treats about 991,894 gallons of runoff annually.

II. BACKGROUND INFORMATION

Watershed Characteristics

Dry Run Creek is a 15,177 acre (23.5 square mile) watershed which flows west to east through rural, residential, industrial and commercial areas including the City of Cedar Falls and the University of Northern Iowa before outletting into the Cedar River in Cedar Falls. According to data collected in 2002, there are 30 miles of stream channel with 12 miles of this length being contained in areas of urban development (Brandt et. al., 2005). Approximately 36 percent of the watershed is urban land, with an additional 1 percent being developed each year (Black Hawk SWCD, 2009). Areas of development shift from year to year, but the majority of development in recent years has been conducted in subwatersheds 4 and 8 (Fig. 2.1), both of which drain into the East branch. Agricultural land uses in the area consist primarily of row cropping in a corn and soybean rotation, with limited livestock production being primarily high-density hog confinements (Fig.2.2).

Dry Run Creek is currently classified as a class B (LR) warm water stream by the Iowa Department of Natural Resources (IDNR) and is a Hydrologic Unit Code (HUC) 12 (070802050401 Middle Cedar River). A segment of the southwest branch of Dry Run Creek, within the City of Cedar Falls, is listed for a biological impairment on the State of Iowa's 303(d) list of impaired waters (Fig.1.1).

Dry Run Creek drains 45% of the City of Cedar Falls and a small amount of the City of Hudson. Overall, 36% of the Dry Run Creek Watershed is urbanized, with over 24% of the total watershed being covered with impervious surface.

III. ORIGINAL PROJECT PLAN

Practices proposed in the original WIRB application were to infiltrate the first flush from 5.16 acres of Phase I of a University of Northern Iowa student housing facility. Two

bioretention cells and one green roof were to be installed. The Black Hawk Soil and Water Conservation District was approached by the Environmental Protection Agency Section 319 of the Iowa Department of Natural Resources requesting assistance in spending unobligated funds. In cooperation with the EPA Section 319 and the WIRB board it was decided to redirect WIRB awarded grant dollars to Phase II of the University of Northern Iowa student housing facility. With this change, WIRB awarded grant dollars were redirected towards two parking lot bioretention cells.

The below table shows the practices that were to originally be installed compared to the actual practices installed.

	Original Project Plan		Actual Project Plan	
WIRB Funded Items	**Units**	**Budget**	**Units**	**Budget**
Building/Site Biocell	10,000 ft^2	$16,133	--	--
Green Roof	2,160 ft^2	$16,134	--	--
Parking lot Biocell	8,000ft^2	$16,133	7,000 ft^2	$18,800
Parking lot Biocell	--	--	11,000 ft^2	$29,600
Totals	20,160ft^2	$48,400	18,000 ft^2	$48,400

IV. PROJECT RESULTS

Financial Accountability

All of the WIRB funds that were requested in the original grant will be used in full for the project. The below table shows the breakdown of contributions.

Watershed Improvement Funds

GRANT AGREEMENT BUDGET LINE ITME	TOTAL WIRB FUNDS APPROVED	TOTAL WIRB FUNDS APPROVED – AMENDED	TOTAL WIRB FUNDS EXPENDED *	SECTION 319	UNI CONTRI-BUTIONS	TOTAL
Salary/Benefits**				$60,275		$60,275
Information/ Education ***					$300	$300
Parking Lot Biocell	$16,133			49,425	12,369	61,794
Building Biocell	$16,133			52,500	16,475	68,975
Green Roof	$16,134			50,982	22,125	73107
North Parking Lot Biocell (A)		$18,800	$18,800		$34,743.35	$53,543.35
South Parking Lot Biocell (B)		$29,600	$29,600		$56,686.51	$86286.51
Contractual Services					$13,215.25	13,215.25
Monitoring****				$11,167		11167
TOTAL	**$48,400**	**$48,400**	**$48,400**	**$224,349**	**$142,698.86**	**$415,447.86**

*Please note the amounts listed for total funds expended by WIRB are the reflection after the final report is approved and the remaining funds will be released
**** Salary/Benefits are covered by the Iowa Department of Natural Resources Section 319
*** Informational sign designed and installed by the University of Northern Iowa
****Monitoring agreement with the State of Iowa Hygienic Laboratory for chemical monitoring on 11 sites in the Dry Run Creek Watershed

Program Accountability

The installed practices are depression basins with an engineered soil subgrade. Stormwater runoff from adjacent parking lots is directed towards these cells and is collected in the upper layer of the bioretention cell system where it filters through the surface vegetation, and pervious soil layer and is temporarily stored in a stone aggregate base layer. The Water Quality Volume (WQv) is drained from the aggregated base by infiltration into the underlying soils and/or to an outlet through a perforated pipe subdrain.

The biocells were designed with a 70% sand, 30% compost mix and installed with a nominal soil depth of 30". Each biocell was designed to provide storage for the water quality volume of storm runoff with a ponded depth of 9". The biocell soil mixture was designed to bridge the drainage gravel based upon relative particle size characteristics. Subdrainage pipe in the drainage gravel collects water that has been filtered by the biocell soil mix and brings it to the stormwater system. The biocells are topped with 3" of shredded bark mulch (also a good filtering media) and then planted with a mixture of native and locally adapted perennial plants with deep roots for nutrient uptake.

The biggest challenge encountered during the installation was several extreme rainfall events during a very wet spring. Much of the stormwater (especially roof runoff) was diverted from the bioswales to the greatest extent possible. Erosion control matting and filter fabric over the top of the bioswale mix prevented siltation from compromising the biocell drainage media. There were a few small cases where the fabric broke down and some soil washed onto the biocell media, but physical removal of the soils was possible off the top and the biocells continued to function as designed.

To help prevent erosion from occurring within the cells, it might be recommended for future projects to apply a 2” layer of mulch. This could aid in runoff absorption and filtering out pollutants. However with practices as large as the ones installed, having a yearly mulch application might prove to be too time consuming and rather costly. Continual spot checks will need to take place to determine if additional attention is needed where the runoff enters the cells.

Research and assessment continues on the best mixture for biocells, specifically sand content. We will want to continue to evaluate whether 70% sand is sufficient and how to best balance drainage and organic matter content in future mix designs.

Both the Watershed Coordinator for the DRC project and the Assistant Director of Operations Planning at UNI have been responsible for outreach and educational activities highlighting the grant funded practices. Tours were provided to University capstone classes focused on civic engagement. Tours given by the Watershed Coordinator were to members of the Iowa Economic Development Authority (IEDA) (April 19, 2012), a consulting firm focusing on Low Impact Development and Green Infrastructure, one to the Iowa Watershed Improvement Review Board (WIRB) on April 25, 2012, one to the Trails Summit organization in May of 2013, and one to the Basin Coordinator’s Quarterly Meeting in April of 2013. These

tours visited multiple infiltration based practices on the university's campus; among those highlighted were the New Student housing bioretention cell practices during installation.

In addition to walking tours, numerous presentations to various groups and organizations have been given highlighting practices installed in the watershed including the WIRB funded practices. Approximately 25 individuals were present at each presentation. Among the organizations and groups that received presentations about the DRC project and infiltration based practices and conservation practices installed in the watershed were: The Cedar Falls Rough Riders Kiwanis Club, Cedar Falls Women's Club, The Cedar Valley Contractor's Conference, Master Conservationist Series at Hartman Reserve Nature Center, Lin County officials in regards to the Indian Creek Watershed, Waterloo Garden Club, the 2013 Spring Homeowner's Workshop, and the Clean Water Act Event organized by the Cedar River Coalition.

Over the past year, the multiple walking tours and presentations have been considered a success. In many cases, local residents, surrounding city officials and organizations were not aware of the Dry Run Creek Watershed Improvement Project nor were they aware of the efforts to install best management practices in the area. In many cases, this was the first time the individuals had seen infiltration based practices. As a result, participants walked away with a greater understanding of the importance of stromwater management and the continual efforts to improve the Dry Run Creek Watershed. These same individuals also began to think how they can responsibly manage their own runoff. Educational brochures of the Dry Run Creek Watershed Improvement Project (Appendix B) were administered as well as information on the various types of infiltration based and conservation practices. An informational sign has been ordered and received indicating how the bioretention cells function and acknowledging the WIRB as the funding source for the practices (see Appendix B). In retrospect, greater effort should have been given to writing news articles highlighting these installed practices.

Environmental Accountability

Twice a year (Spring/Fall) Water Quality Monitoring Snapshot events are held in the DRC Watershed. Volunteers are trained following IOWATER parameters and are given locations within the watershed to test and collect samples. Over thirty different sites on DRC are monitored and have samples collected. Information gathered from these events help provide water quality information on the health of the creek. Snapshot events from past years can be compared to determine if trends or improvement on the creek is occurring. Volunteer numbers average at about 25 per snapshot event.

In addition to the scheduled snapshot events, seasonal monitoring of eleven locations throughout the Dry Run Creek Watershed is conducted by the project coordinator. Results are shared with and analyzed by the State Hygienic Laboratory at the University of Iowa. It is difficult to determine water quality trends by only looking at a few select data collection dates. Continued monitoring of the DRC watershed is needed to determine if water quality improvement in the watershed is occurring.

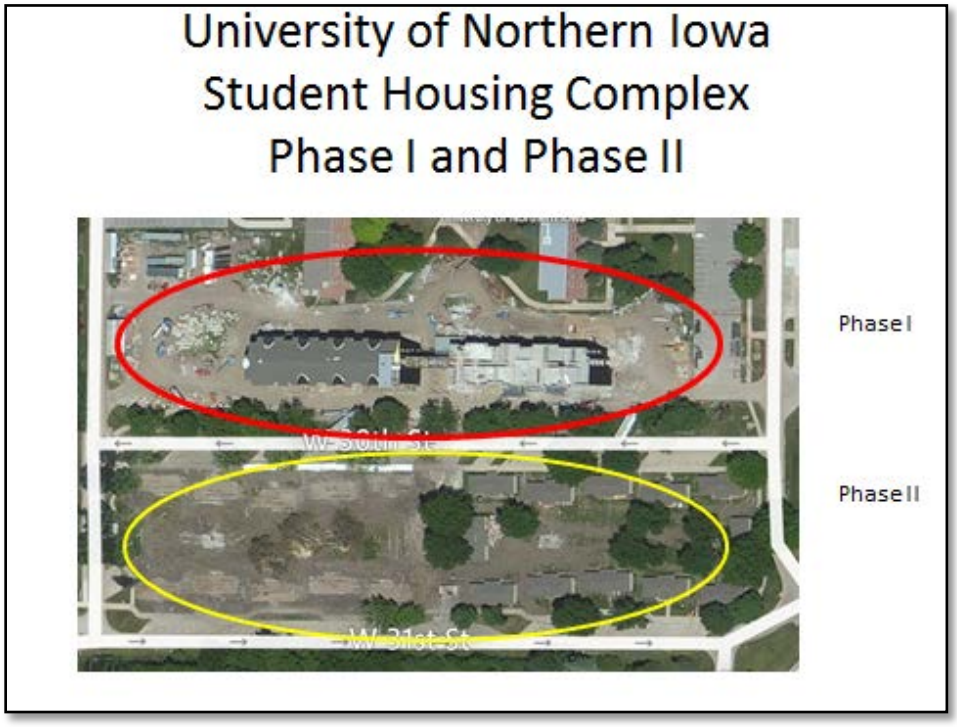
The below table shows results from the past four snapshot events in the last two years.

Three snapshot sites adjacent to the installed practices (Spring/Fall - 2012/2013)

Site	Date	Time	Transparency	Water Temp	pH	Nitrite-N	Nitrate-N	Dissolved Oxygen	Phosphate	Chloride
166	**4/21/12**	12:20	60	49	7	0	10	12	0	<33
171	**4/21/12**	9:50	58	47	8	0	5	12	0	<33
144	**4/21/12**	10:31	50	49	7	0	5	10	0	<33
166	**9/1/12**	10:00	60	67	7	0	0	8	.1	<33
171	**9/1/12**	10:00	60	66	6	0	2	8	.1	48
144	**9/1/12**	-	-	-	-	-	-	-	-	-
166	**4/27/13**	10:48	60	56	6	0	10	12	0	<29
171	**4/27/13**	10:00	60	54	6	0	5	10	0	29
144	**4/27/13**	10:00	60	50	6	0	1	8	0	48
166	**9/21/13**	10:14	60	55	7	0	0	-	-	<29
171	**9/21/13**	9:45	60	58	9	0	2	8	1	35
144	**9/21/13**	10:25	60	60	8	0	1	8	.1	41

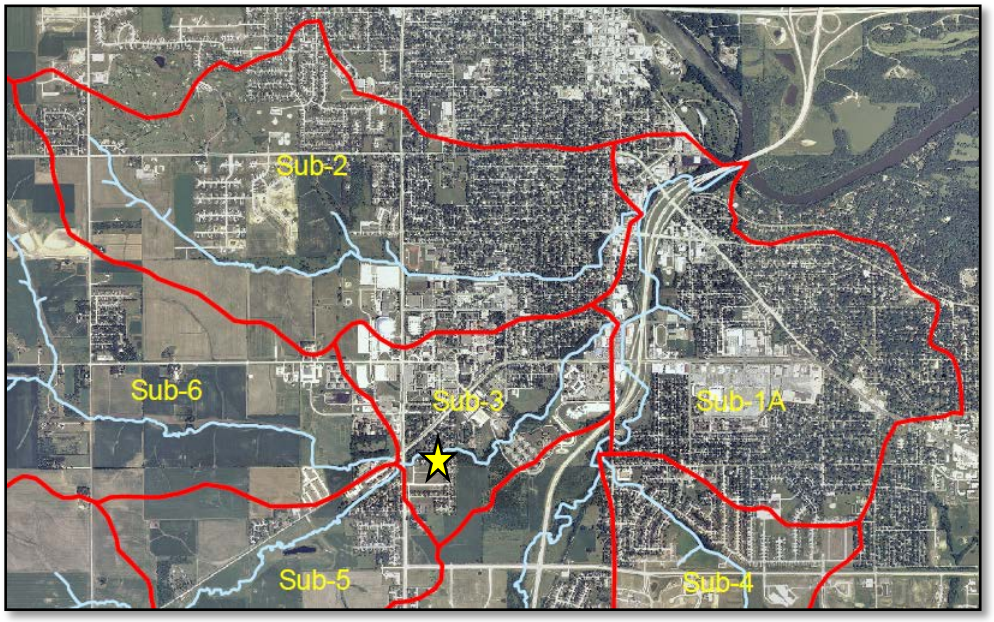
As previously noted, originally, two large bioretention cells (one building and one parking lot) and one green roof were to be installed in conjunction with the New Student Housing facility phase I. Actual practices installed were an 11,000 ft^2 parking lot bioretention cell and a 7,000 ft^2 parking lot bioretention cell as part of the New Student Housing facility phase II as seen in the below photo.

Location for Phase I and Phase II of the UNI Student Housing Complex



Over thirty additional stormwater management practices have been installed in the Dry Run Creek Watershed since the project began in 2004. For a map of all the grant funded practices installed in the watershed please see Figure 4.1. These practices are installed with multiple partners and are all working towards addressing the goals of the Dry Run Creek Watershed Improvement Project by either infiltrating the 1.25" rainfall event in urban areas, reducing sediment delivery by 30% or by improving streambank habitat along 25% of the stream.

Location of Installed Bioretention Cells in Priority Subwatershed 3



The following sections include details on each of the WIRB funded practices. It includes photographs of the installed practices at various stages of installation. Each of the below practices were designed following the guidelines of the Iowa Stormwater Management Manual (Section 2E-4) to provide stormwater filtering and the reduction of non-point sources pollution and sediment from the project site. Each of the practices are anticipated to retain and remove over 80% of Total Suspended Solids (TSS) from 90% of the average annual rainfall (WQv) on the project site.

The infiltration of runoff through the use of bioretention cells not only reduces the volume of stormwater surges but also removes pollutants by means of percolation. According to the Iowa Stormwater Management manual bioretention cells remove 80% of suspended solids, 65-85% of phosphorous, 50% of nitrogen, 70-100% of pathogens, 45%-95% of heavy metals, and 30-65% of hydrocarbons from the lands draining into the practice (IDNR, 2012). According to Source Loading and Management Model for Windows (WinSLAMM), the two installed bioretention cells, totaling 18,000 ft^2 treat 2.48 acres of impervious surfaces and treat 232,996 cu. ft. or 1,742,931.12 gallons of runoff annually and reduce annual phosphorus levels by 2.47lbs.

A. NORTH PARKING LOT BIORETENTION CELL

Runoff from the .92 acre parking lot will percolate into the engineered sand/compost bioretention cell soils and, based on EPA estimates, we would expect a minimum of 80% of the TSS in this runoff to be captured and treated. The bioretention cell is designed with a rock chamber to provide storage space that will aid percolate of the stormwater runoff. The 7,000ft^2 bioretention cell infiltrates about 100,399 cu. ft. runoff or about 751,036.67 gallons and about 1.05 lbs. of annual phosphorus reduction according to WinSLAMM (Source Loading and Management Model for Windows).

Photographs taken during installation

Taken February 18, 2013

Taken February 18, 2013

Taken August 8, 2013

Taken October 3, 2013

B. SOUTH PARKING LOT BIORETENTION CELL

The 11,000 ft^2 bioretention cell is designed with a rock chamber to provide storage space to treat 132,597 cubic feet or about 991,894 gallons of runoff and about1.42 lbs. of annual phosphorus reduction according to WinSLAMM. All of the parking lot runoff from the site is directed to vegetated swale areas which slow the velocity of water, allowing the settling out of suspended soil particles. The swales are armored with Scoustop to help prevent erosion. The runoff from the parking lot is directed through the swales to the bioretention cell. Runoff will percolate into the engineered sand/compost biocell soils and, based on EPA estimates, we would expect a minimum of 80% of the TSS in this runoff to be captured and treated.

Photographs taken during installation

Taken February 18, 2013

Taken August 14, 2013

Taken October 3, 2013

Taken October 3, 2013

Note: Blue arrows indicate the flow of runoff towards the bioretention cell

The below two tables show the environmental benefits of the original planned practices and the actual environmental benefits of the installed practices.

	Original Estimated Environmental Benefits			
WIRB Funded Practices	**Units Installed**	**Acres Treated**	**Annual Runoff Treated**	**Annual Phosphorus Reduction**
Parking lot Biocell	8,000ft^2	2	210,473 cu. ft.	1.16 lb.
Building/Site Biocell	10,000 ft^2	2.44	312,593 cu. ft.	1.43 lb.
Green Roof	2,160 ft^2	.05	6,696 cu. ft.	N/A
Totals	20,160ft^2	5.16	529,762 cu. Ft.	2.91 lb.

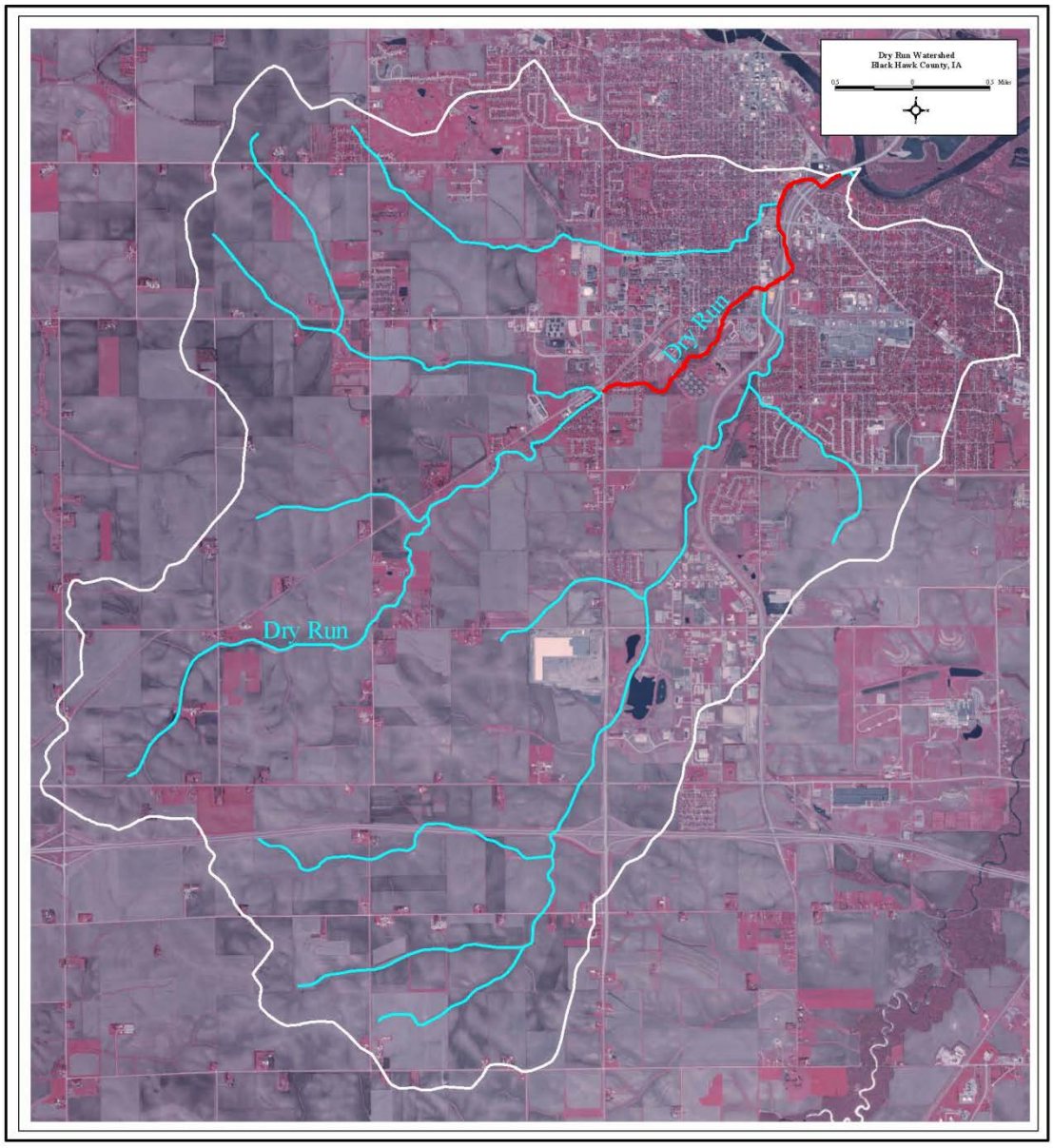
*Original practices to be installed with their environmental benefits according to WinSLAMM (Source Loading and Management Model for Windows)

	Actual Estimated Environmental Benefits			
WIRB Funded Practices	**Units Installed**	**Acres Treated**	**Annual Runoff Treated**	**Annual Phosphorus Reduction**
North Parking lot Biocell (A)	7,000 ft^2	.92	100,399 cu. ft.	1.05 lb.
South Parking lot Biocell (B)	11,000 ft^2	1.56	132,597 cu. ft.	1.42 lb.
Totals	18,000 ft^2	2.48	232,996 cu.ft.	2.47 lb.

*Actual practices installed with their environmental benefits according to WinSLAMM (Source Loading and Management Model for Windows)

Appendix A: Maps of the Watershed

Figure 1.1 - Watershed Map and Biological Impairment



= Impaired Stretch, Biological

Figure 1.2 – Bacterial Impairment

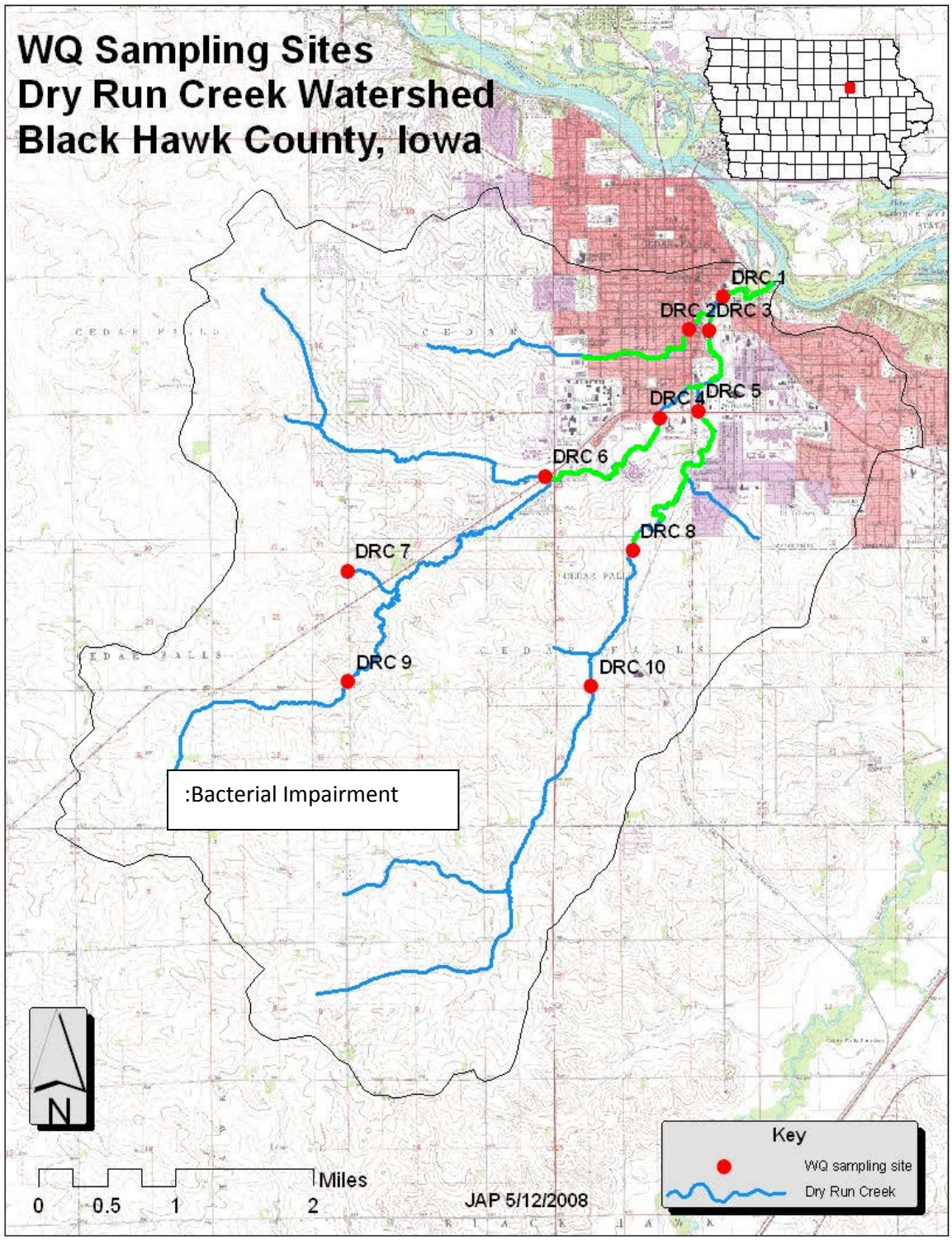


Figure 2.1 - Subwatersheds

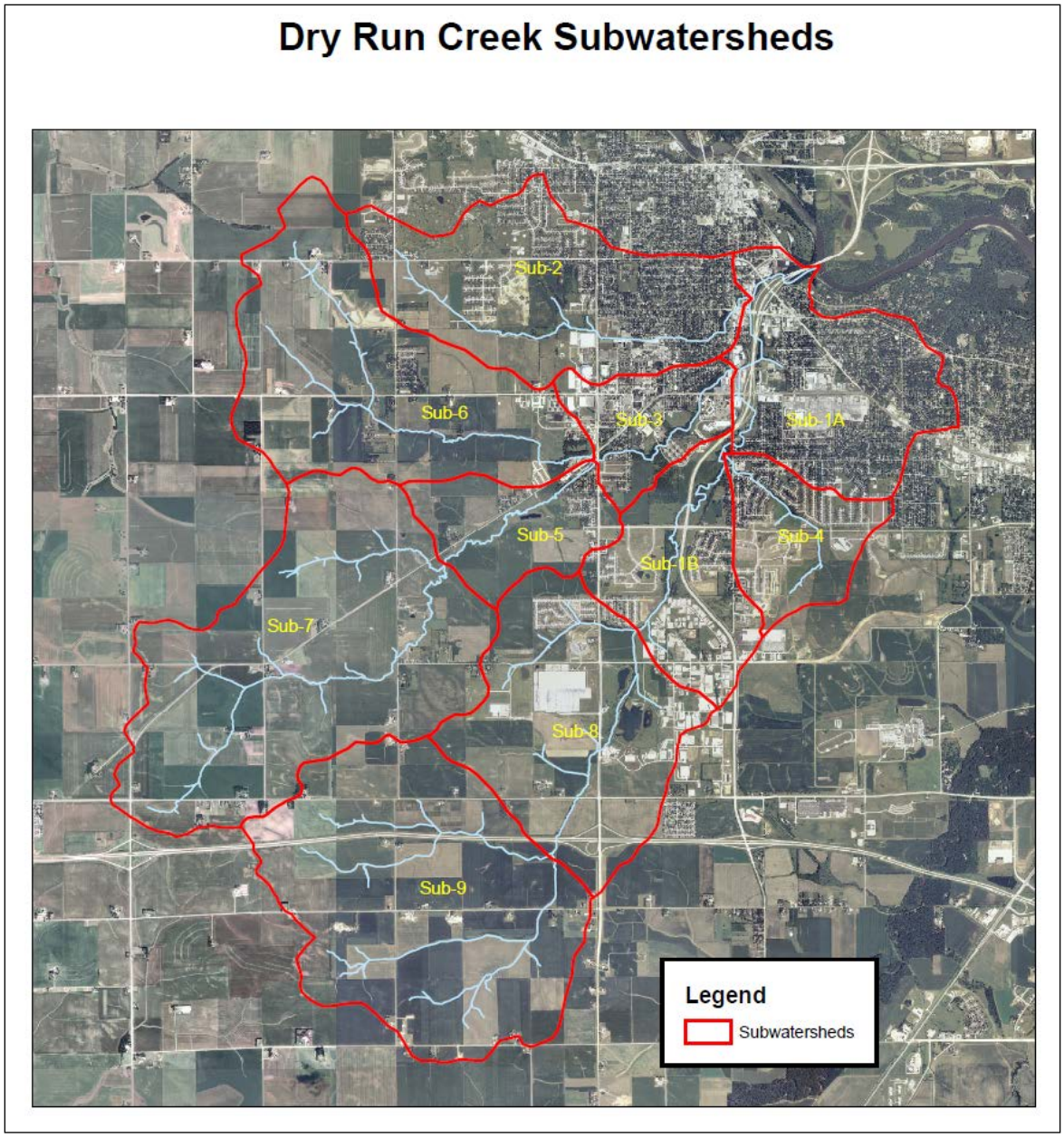


Figure 2.2 - Land Use Map

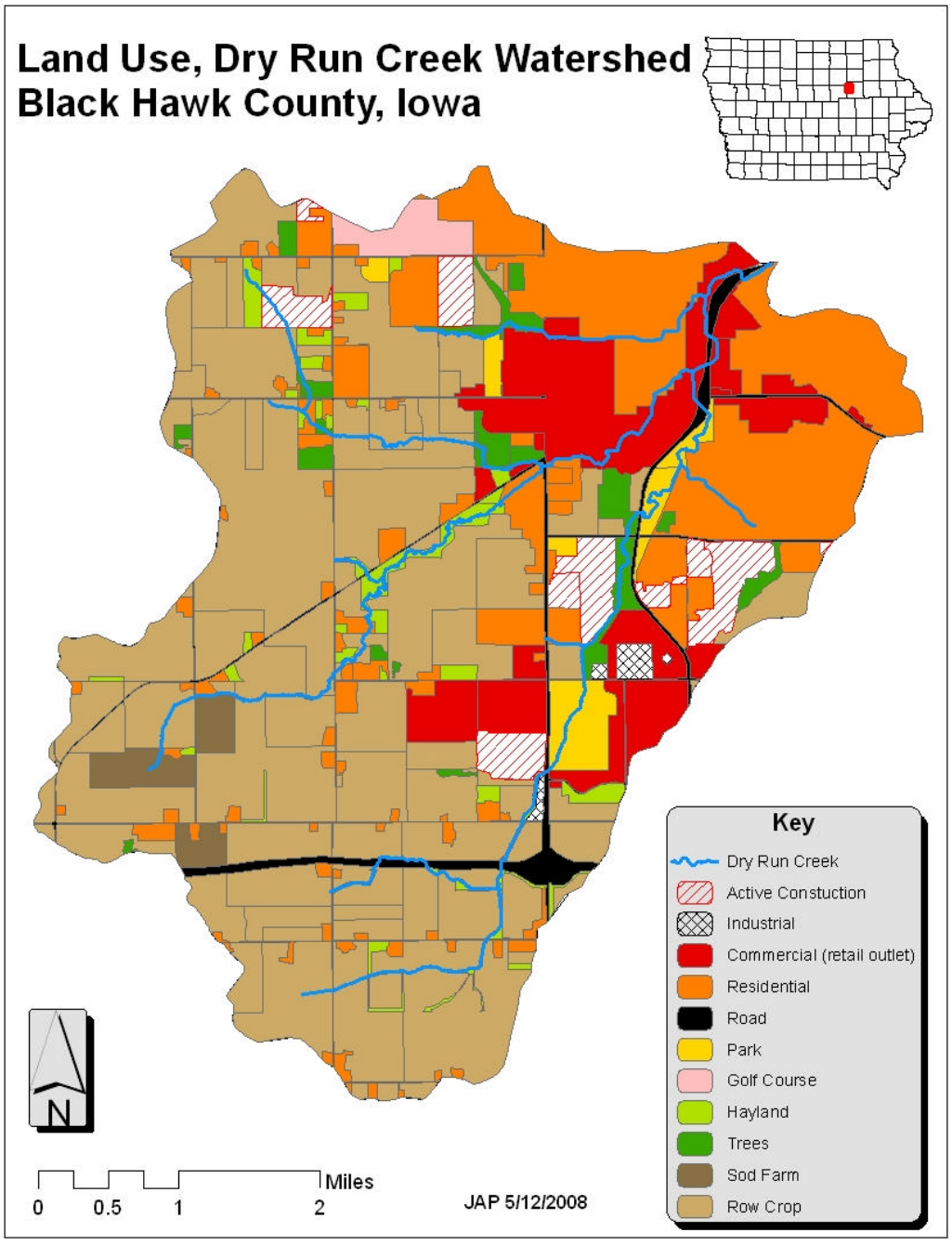
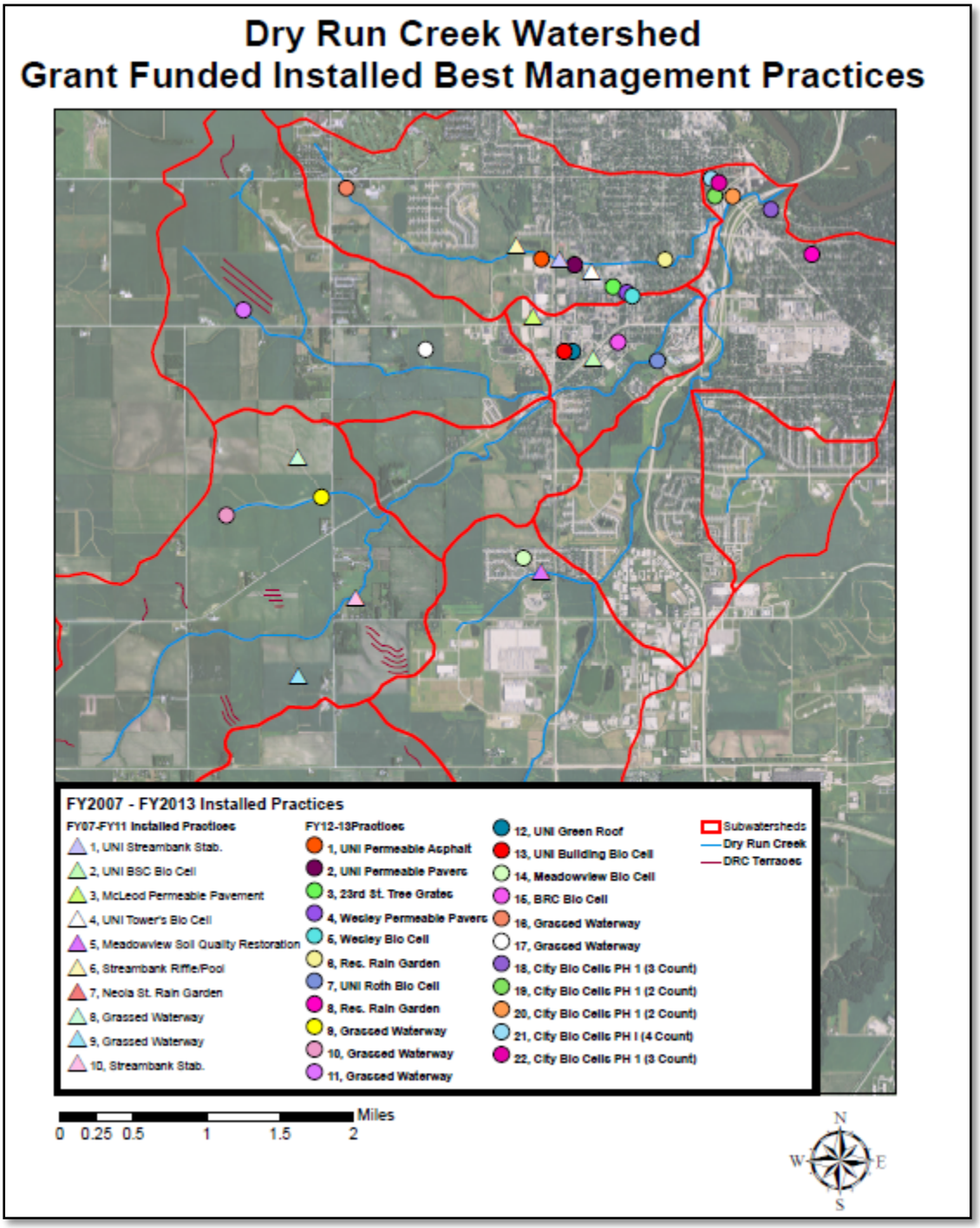


Figure 4.1 – Grant Funded Installed Best Management Practices



Appendix B: Dry Run Creek Outreach Material

How Can You Get Involved?

We are currently seeking landowners who would be interested in the following practices:

*Soil Quality Restoration
*Rain Gardens
*Riparian Buffers
*Grassed Waterways
*Native Grass Filterstrips
*Bioretention Cells
*Pervious Pavers
*Porous Asphalt

Financial incentives through cost-share programs and grant subsidies are available for these practices

For more information, check out our website http://blackhawkswcd.org or look us up on Facebook!

Rain garden at Taylor Veterinary Clinic (Downtown Cedar Falls)

Our Partners

Black Hawk Soil and Water Conservation District
City of Cedar Falls
University of Northern Iowa
IDNR (Iowa Department of Natural Resources)
IDALS-DSC (Iowa Department of Agriculture and Land Stewardship – Division of Soil Conservation)
NRCS (Natural Resources Conservation Service)
WIRB (Iowa Watershed Improvement Review Board)

This project is supported in part by the Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation, through funds of the Water Protection Funds and/or Watershed Protection Fund, by the Iowa Watershed Improvement Fund administered by the Iowa Watershed Improvement Review Board and, by the Iowa Department of Natural Resources through a grant from the U.S. Environmental Protection Agency under the Federal Non-point Source Management Program (Section 319 of the Clean Water Act). Technical assistance is provided by the U.S. Department of Agriculture, Natural Resources Conservation Service.

Black Hawk SWCD is an equal opportunity provider and employer.

For more information about watershed conservation, volunteering, or the Dry Run Creek Project, please contact:

Ashley Kittle
Watershed Conservationist
Black Hawk SWCD
2950 Southland Dr. Ste. 2
Waterloo, IA 50701
Phone: 319.296.3262
Email: ashley.kittle@ia.nacdnet.net

Dry Run Creek Watershed Improvement Project

DRY RUN CREEK WATERSHED
CONNECTING URBAN & RURAL

Black Hawk Soil and Water Conservation District
2950 Southland Dr. Ste. 2
Waterloo, IA 50701
http://blackhawkswcd.org

Background About Dry Run Creek

The Dry Run Creek Project began in 2004 as an effort to rehabilitate the Dry Run Creek Watershed. The creek was designated an impaired water body in 2002 by the Iowa Department of Natural Resources, citing a lack in the abundance and diversity of aquatic life. The creek later received a second impairment for high levels of bacteria. Factors contributing to these impairments are many, but generally center around flow alteration resulting from increases in impervious surfaces connected to storm sewer systems. This increase results in more runoff reaching the stream faster during storm events. These storm surges wash out habitat and cause significant erosion of stream banks.

Permeable Pavement

Our Partnerships

In addition to practice implementation, regular monitoring and assessment is conducted on the stream through partnerships with IOWATER, the Iowa Department of Natural Resources, Black Hawk Soil and Water Conservation District, and the University of Northern Iowa. Weekly and monthly sampling is performed and IOWATER volunteers assist in performing the annual SNAPSHOT sampling event.

Funding

The Dry Run Creek Watershed is funded by the Environmental Protection Agency's Section 319, the Watershed Protection Fund, and the Watershed Improvement Review Board.

Project Accomplishments

The Black Hawk Soil and Water Conservation District, through the Dry Run Creek Project, works to provide technical and financial assistance to watershed stakeholders interested in implementing conservation practices. Much of this effort has focused on infiltration based practices, which serve to remove water from the storm sewer system and infiltrate it into the ground in a manner which mimics the native prairie hydrology. Working with partners such as the City of Cedar Falls, the University of Northern Iowa, and private businesses and landowners, the Dry Run Creek project has developed the capacity to infiltrate over 170,000 gallons of storm water per day through practices such as rain gardens, bioretention cells, permeable pavement, and bioswales. We've also worked to repair damage that has been done to the stream and reduce sedimentation through a number of stream bank stabilization and habitat enhancement projects, as well as traditional rural sediment runoff practices such as filter strips, grassed waterways, and conservation tillage. Over 100 annual tons of sediment runoff has been removed from the stream due to the Dry Run Creek Project.

Soil Quality Restoration
Top left — Application of compost
Bottom left — Deep tine aeration
Top right — Picture taken in early spring. Yard on left had fall application of soil quality restoration. Yard on right did not.

Outreach and Education

Outreach activities are conducted in the watershed as an effort to educate and motivate watershed stakeholders to address watershed issues in their neighborhoods. Presentations, press releases, watershed tours, and an annual workshop are all part of this outreach program.

Volunteer

Monitoring water quality is a very important component to the Dry Run Creek Watershed Improvement Project. We are looking for IOWATER volunteers within the watershed!

IOWATER Volunteer – Water Quality Monitoring

Watershed Characteristics

- 15,177 acre Watershed
- Approximately 24.5 miles of stream
- 35% urban, 65% rural and agricultural
- 45% of the City of Cedar Falls is in the watershed
- 4 main branches

Informational Sign to be Installed at Practice Location

Appendix C: Supporting Information - Bibliography

Black Hawk Soil and Water Conservation District. 2009. Dry Run Creek Watershed Management Plan. Unpublished Report.

Brandt, et. al, University of Northern Iowa, 2005. *Stream Channel Analysis on Dry Run Creek, Black Hawk County, Iowa*. Unpublished Report.

Iowa Department of Natural Resources, 2008. *2008 Water Quality Assessment: Results from 2004 through 2006.*