Don Williams Lake Watershed Management Plan

Vision Statement

Establish the Don Williams Lake Watershed Project as a study in the joining of people and processes leading to ecological health, recreational enjoyment and Iowa's agriculture for future generations.

Approved January 12, 2012

(Plan will be updated on a 5-year cycle; years 2016, 2021, 2026, and 2031)

Don Williams Lake Watershed Management Plan

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1. Executive Summary

Don Williams Lake was added to the Iowa 303(d) Impaired Waters List in 1998 for a siltation and organic enrichment impacts identified by the Iowa Department of Natural Resources (IDNR). The lake remained on Iowa's Section 303(d) list until the completion of a TMDL in 2005 which moved the waterbody to Category 4a of the 303(d) list. The 2005 TMDL identified phosphorus as the pollutant of concern for the organic enrichment impairment and sediment as the cause of the siltation impairment. The organic enrichment impairment will be removed in the 2012 303(d) list after a review of the 1998 rational for the impairment and finding an assessment error. The siltation impairment will remain until the case can be made for removal. According to IDNR staff the siltation impairment was "based on best professional judgment and there is no means to determine whether this impairment still exists." This watershed management plan will focus on siltation impairment with the understanding that best management practices can have multiple benefits and may result in the reduction of other pollutants, such as phosphorus, reaching Don Williams Lake.

During the development of the watershed management plan, Don Williams Lake was placed on the Iowa's 2010 303(d) Impaired Waters List for a bacterial impairment. Elevated bacteria levels have been found in water samples collected at the swimming beach. The elevated levels have been infrequent, and are often seen after periods of heavy rainfall. Due to the timing of the listing and lack of a completed TMDL, the bacteria impairment will not be addressed in this watershed management plan. As additional bacteria data becomes available, the plan may be revised.

Since Don Williams Lake was completed in 1967 silt deposits flowing from Bluff Creek into the lake have resulted in a loss of a lake volume and have created a small island on the north end of the lake. The identified source of the sediment loading is from nonpoint source pollution within the watershed.

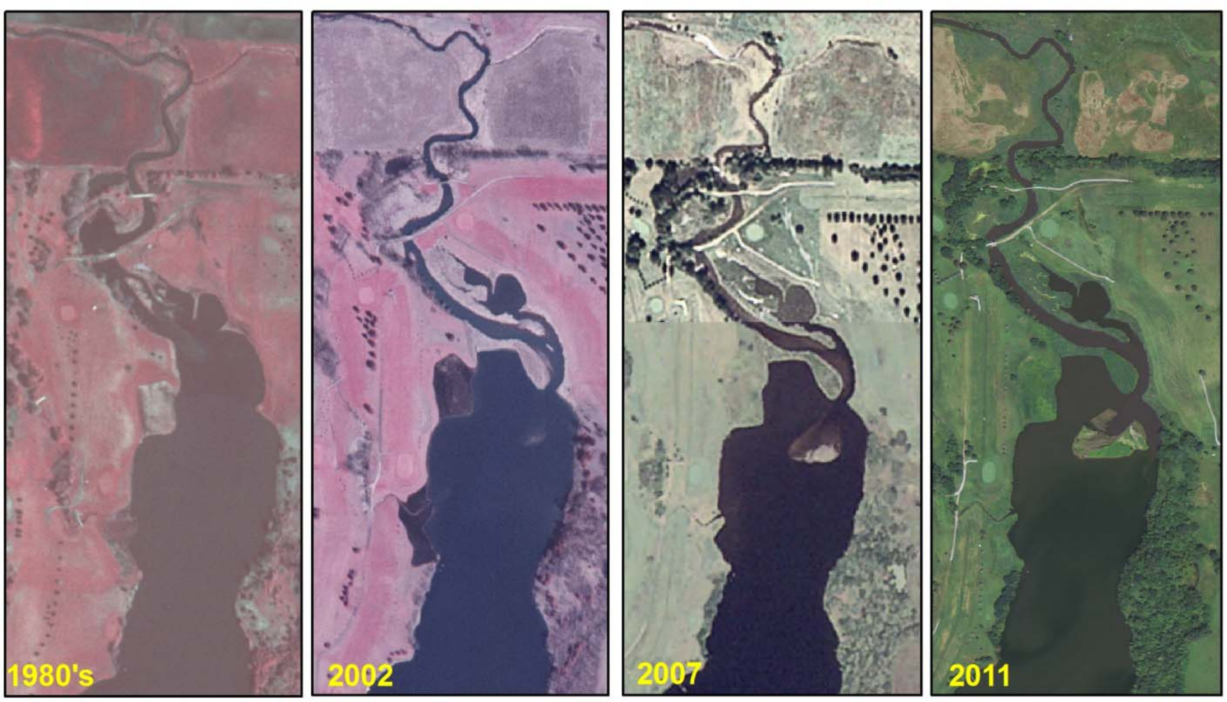

Figure 1. Siltation impacts 1980s-2011.

In 2009, an IDNR sponsored Watershed Planning Grant was awarded to the Boone County Soil and Water Conservation District (SWCD) for purposes of developing this watershed management plan. Watershed assessment work began in 2010 and included land use, streambank, gully, and shoreline investigations. In 2011, the Boone SWCD hired a watershed planner from the Iowa Soybean Association to compile all information gathered into a watershed plan.

The TMDL (2005) load capacity for allowable sediment delivery to Don Williams Lake is 11,600 tons per year. Based on current watershed assessments estimated sediment delivery to Don Williams Lake is 2,473 tons per year. This total is well below the allowable load capacity identified in the TMDL. Based on the current sediment loading estimates, the watershed management plan outlines a 1,593 ton per year reduction for sediment over a 20-year planning cycle. This reduction will reduce the annual loss of lake volume from current estimates of -1.7 acre feet per year to -0.6 acre feet per year, extending the life of Don Williams Lake by 65%.

This plan is also intended to build the foundation for continued improvement efforts within the Don Williams Lake watershed, and be a catalyst for additional watershed improvement projects within Boone County and surrounding areas.

2. Community Based Planning

Public involvement is an important part of the watershed process since it is the land owners, tenants, and citizens who directly manage and live in the watershed that determine the water quality in Don Williams Lake. A planning process has been completed that ensured that local stakeholders were involved in the decision-making process that has set goals, objectives, and actions for improving water quality in Don Williams Lake.

This watershed management plan was developed based on the combined efforts of Boone County Soil and Water Conservation District (SWCD), Boone County Conservation Board, Boone County Landfill/Keep Boone County Beautiful, Boone County Board of Supervisors, Natural Resources Conservation Service, Prairie Rivers RC&D, Iowa State University – Extension, Iowa Department of Natural Resources, Iowa Soybean Association, and local landowners/producers. Funding for the watershed planning process was provided through an IDNR sponsored Watershed Planning and Development Grant awarded to the Boone SWCD.

Several public watershed meetings have been held during the planning process. The first official meeting occurred in January, 2010 to introduce and kick-off the Don Williams Watershed planning process. Plan development activities were discussed and what would take place over the two-year timeline. The community based planning model was described at this meeting and how it would be utilized in the development of the watershed plan. An innovative approach to engage watershed stakeholders was also unveiled at this meeting with the presentation of the Mobile Watershed Education Center (MWEC) that was being developed by Boone County Landfill/Keep Boone County Beautiful. The project utilizes a retired school bus to bring on-site watershed quality learning to any location. Learning opportunities surrounding the MWEC bus include both hands-on and technology – based activities.

The second meeting occurred in May, 2010. The vision statement for the watershed (see cover page for statement) was finalized and approved at this meeting. Additional discussion focused on current watershed conditions and historic watershed planning work that had taken place within the watershed. A project web page developed for the watershed was also highlighted. The web site serves as a central location for anyone wanting to follow the progress of the watershed planning effort. The website can be found on the Boone County web site (www.boonecounty.iowa.gov) under "watershed protection" in the "Keep Boone County Beautiful" section of the web site.

A third meeting was held in March, 2011. Watershed assessment activities were highlighted and discussed. Discussion of the elements of a watershed plan were reviewed, and how a voluntary-based approach would utilized over the 20-year planning cycle.

In June, 2011, the first ever "Celebrate the Lake" event was held at the Don Williams Lake park. The event was open to stakeholders, families, and any interesting patron to come and learn about the lake, its history, and current challenges. Various information/education stations were located within the park to engage participants on aspects surrounding the lake and watershed.

A fourth meeting was held in August, 2011. The Iowa Department of Natural Resources presented an overview of the watershed conditions, along with results of the various assessments conducted for the watershed plan. The assessments (land-use, stream and streambank, and gully and shoreline assessment) provided the current tabulation of sediment delivery reaching the lake. Suggested best management practices (BMPs) were also presented at this public meeting and opened for discussion. Information gathered from this meeting, along with past meetings and watershed assessments was utilized to determine watershed management plan goals, objectives, and management practices.

Upon completion of the plan, the Boone County SWCD will assume responsibility for implementation of the watershed management plan. Future meetings will need to be facilitated by the SWCD, with assistance provided by NRCS, DNR, and affiliated partners.

Table 1. Don Williams Lake Watershed Group

Name	Affiliation/Title
Kevin Griggs	Boone County Soil & Water Conservation District, Chair
Andy Hockenson	Boone County Conservation Board
John Paulin	Prairie Rivers of Iowa RC&D
Bill Lusher	Boone County Supervisor
Scott Smith	Boone County Landfill/KBCB
Kevin Kordick	Natural Resources Conservation Service (NRCS)
Lois Powers	Boone County Landfill/KBCB
Lisa Anderson	Boone County Landfill/KBCB
Jeremy Johannsen	NRCS
Emily Klein	Boone County Naturalist
Jayne Smith	Boone County Soil & Water Conservation District
Adam Kiel	Iowa Department of Natural Resources
Todd Sutphin	Iowa Soybean Association

3. Watershed Characteristics

Don Williams Lake is approximately 151 acres, with 5.6 miles of shoreline. The 600 acre Don Williams Conservation Park and Lake lies within the 21,080 acre watershed located in Boone and Webster Counties. Construction of the lake started in 1964 and was completed in 1967. The lake is named after Don Williams, who worked for the Northwest Bell Telephone Company and was instrumental in the conservation effort in Boone County. The community of Pilot Mound is approximately 2.5 miles upstream of the lake along Bluff Creek. The lake is located 2 miles west of Fraser.

Public use for Don Williams Lake is estimated at approximately 91,000 visitors per year. Users of the lake and the 600-acre Don Williams County Park enjoy fishing, swimming, boating, camping, hiking, golf, and ice-skating. The beach at Don Williams is located on the eastern shore.

The Center for Agricultural and Rural Development (CARD) at Iowa State estimates that between 2002-2005 period, Don Williams Lake averaged 86,000 visitors annually. Those visitors spent an average of $8.26 million annually, which supported 164 jobs and $2.21 million of labor income in the region.

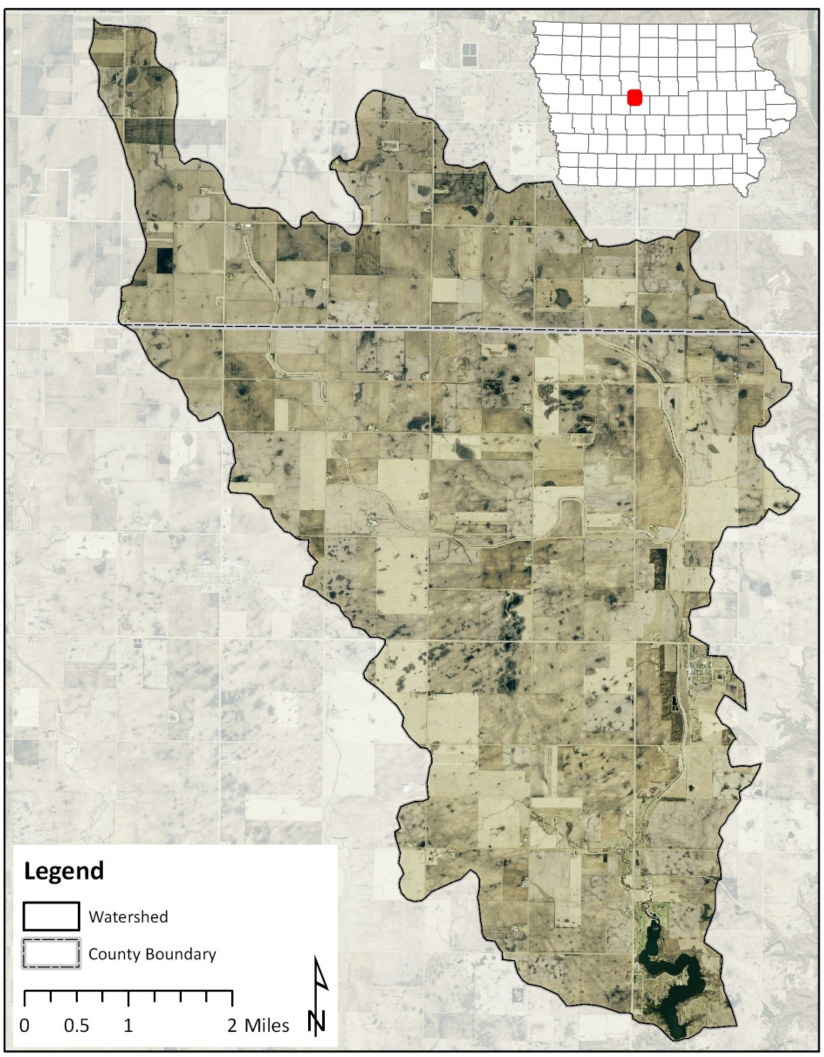

Figure 2. Don Williams Lake Watershed

Physical Characteristics

The following table lists some of the general characteristics of Don Williams Lake and its watershed. Physical characteristics are based on bathyretric survey conducted by IDNR in 2003.

Table 1. Don Williams Lake summary

4. IDNR Waterbody ID	**5. IA 04-UDM-01650-L**
12-Digit Hydrologic Unit Code (HUC 12)	**071000040904**
12-Digit HUC Name	**Bluff Creek (Middle Des Moines River)**
Location	**Boone County, Section 5, T84N, R27W**
Latitude	**42° 7' N**
Longitude	**94° 1' W**
Designated Uses	**1. Primary contact recreation (A1)** **2. Aquatic life support (B(LW))**
Tributaries	**Bluff Creek; Drainage Ditch 107**
Receiving waterbody	**Bluff Creek**
Lake Surface Area	**151 acres**
Maximum depth	**41.9 feet**
Mean depth	**15.3 feet**
Volume	**2,314 acre-feet**
Length of Shoreline	**29,700 feet**
Watershed area	**21,080 acres**
Watershed/Lake area ratio	**141:1**
Estimated detention time	**.17 years (62 days)**

The drainage area to Don Williams Lake is a 21,080 acre watershed, with a lake surface area of 149 acres. The lake has a mean depth of 15.3 feet and a maximum depth of 41.9 feet. Don Williams Lake is fed by Bluff Creek and Drainage Ditch 107. A dam is located at the southern end of the lake and the lake outlet feeds back into Bluff Creek. The estimated retention time for Don Williams Lake is 0.17 years based on outflow. The watershed to lake area ratio is 141:1 which indicates watershed conditions have a potentially large impact on in-lake water quality.

Hydrology

Don Williams Lake lies within the Middle Des Moines River (HUC-8) and Des Moines River-Bluff Creek (HUC-10) watersheds. Bluff Creek is the main contributing source and empties into the north end of Don Williams Lake. See Table 2 above for additional information regarding Don Williams Lake and its features.

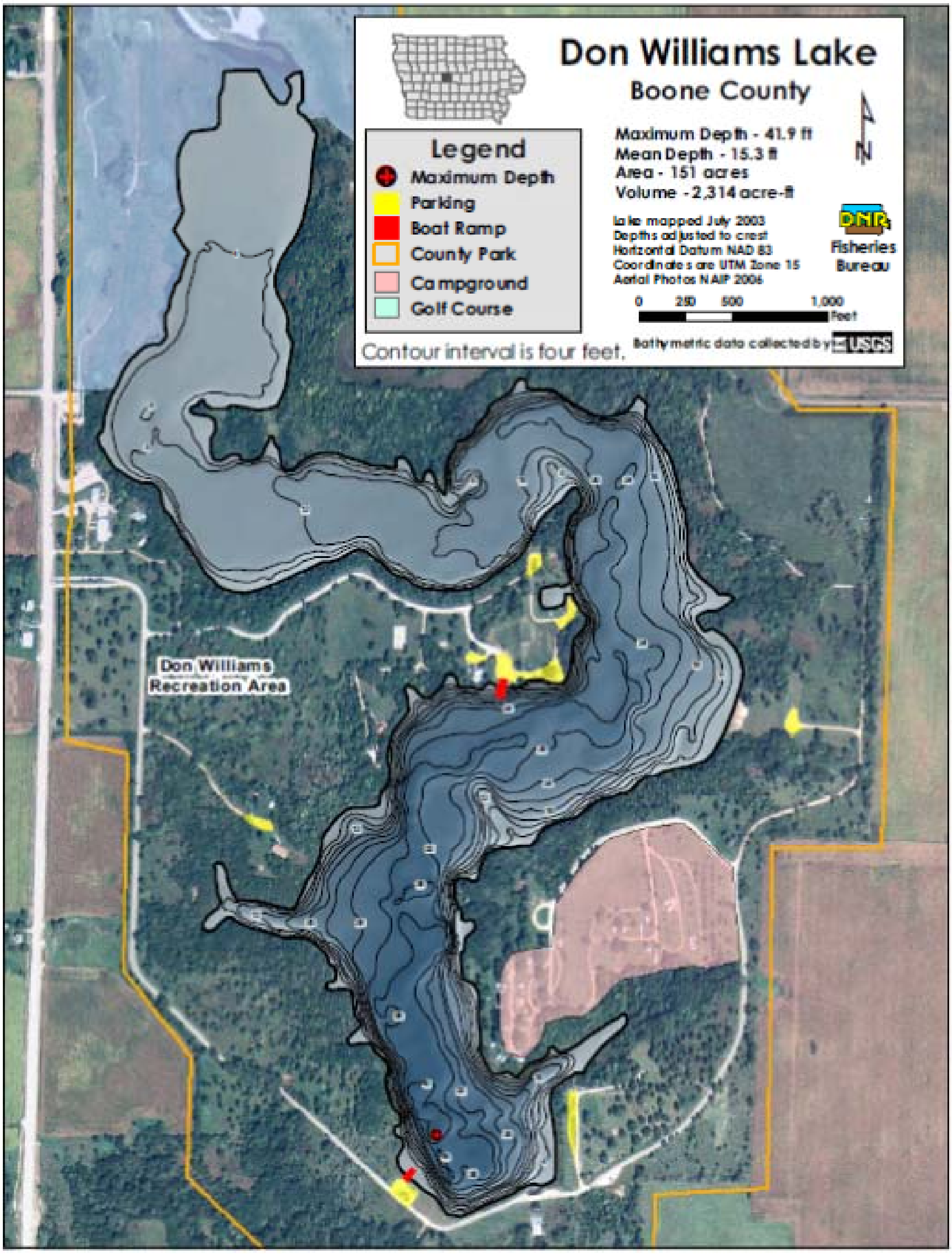

Figure 3. Don Williams Lake, Bathymetric Map

Soils

Don Williams Lake watershed is dominated by the Clarion-Nicollet-Canisteo soil association which comprises a majority of the watershed. Calcareous soils are common in the watershed. Figure 3 shows the soil map generated from the SSURGO coverage developed by the National Cooperative Soil Survey from the USDA-NRCS.

Table 3. Watershed soils.

Dominant Soil	Acres	Percent of Total Area	Ave. Slope	Hydro-Group	Hydric Soil	Drainage Class
CLARION	4,749	22.4%	2-5%	B	3	Well
CANISTEO	4,202	19.8%	0-2%	B/D	1	Poor
NICOLLET	2,160	10.2%	1-3%	B	2	Somewhat Poor
MARNA	2,150	10.1%	0-2%	C/D	1	Poor
WEBSTER	2,021	9.5%	0-2%	B/D	1	Poor
GUCKEEN	1,250	5.9%	1-3%	C	2	Somewhat Poor
HARPS	1,245	5.9%	0-2%	B/D	1	Poor
Other	3,444	16.2%	------	---	1	-----

The Clarion soils series accounts for 22% of the watershed area. The Clarion series consists of very deep, moderately well drained soils on uplands. These soils formed in glacial till. Slopes range from 1 to 9 percent.

The Canisteo soil series accounts for 20% of the watershed area and consist of very deep, poorly and very poorly drained soils that formed in calcareous, loamy. These soils are on rims of depressions, depressions and flats on moraines or till plains. Slope ranges from 0 to 2 percent.

The Nicollet soil series accounts for 10% of the watershed area and consist of very deep, somewhat poorly drained soils that formed in calcareous loamy glacial till on till plains and moraines. Slopes range from 0 to 5 percent.

The Marna soil series accounts for 10% of the watershed area and consist of very deep poorly drained soils that formed in a clayey glacial lacustrine mantle and the underlying calcareous loamy glacial till on lacustrine plains and ground moraines. These soils have slow permeability. Their slopes range from 0 to 2 percent.

The Webster soil series accounts for 10% of the watershed area and consist of very deep, poorly drained, moderately permeable soils formed in glacial till or local alluvium derived from till on uplands. Slope ranges from 0 to 3 percent.

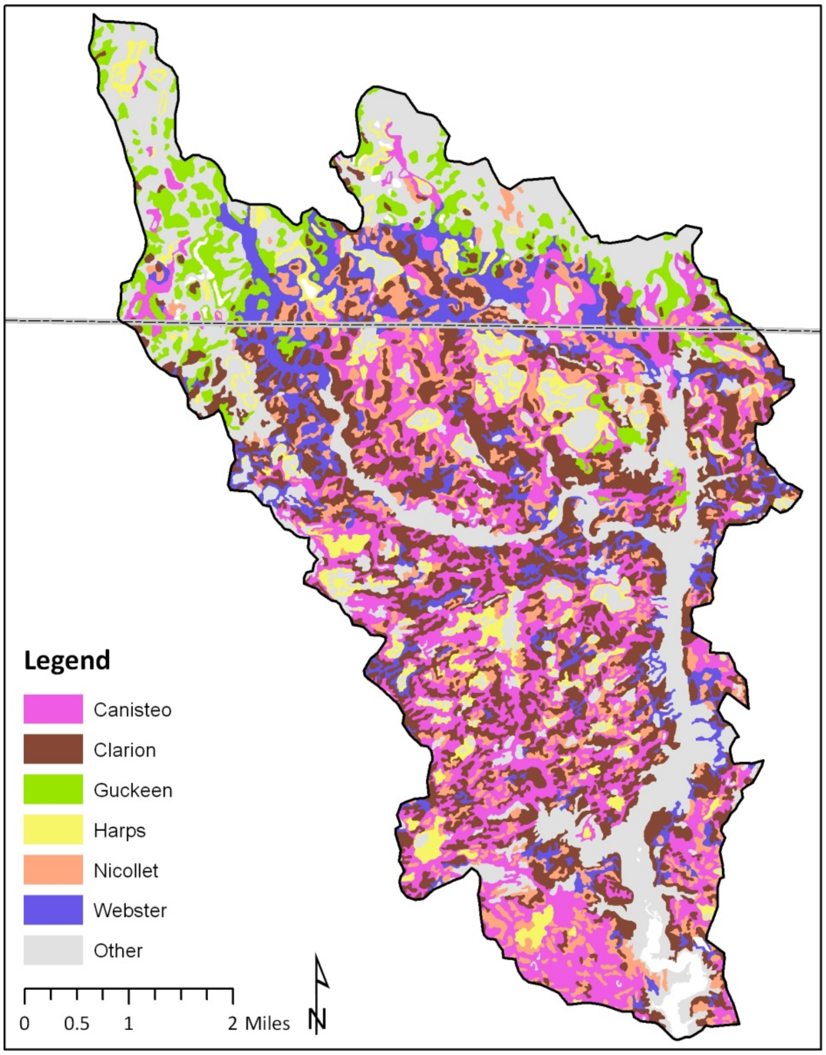

Figure 4. Don Williams Lake watershed soil map derived from the National Cooperative Soil Survey, USDA-NRCS.

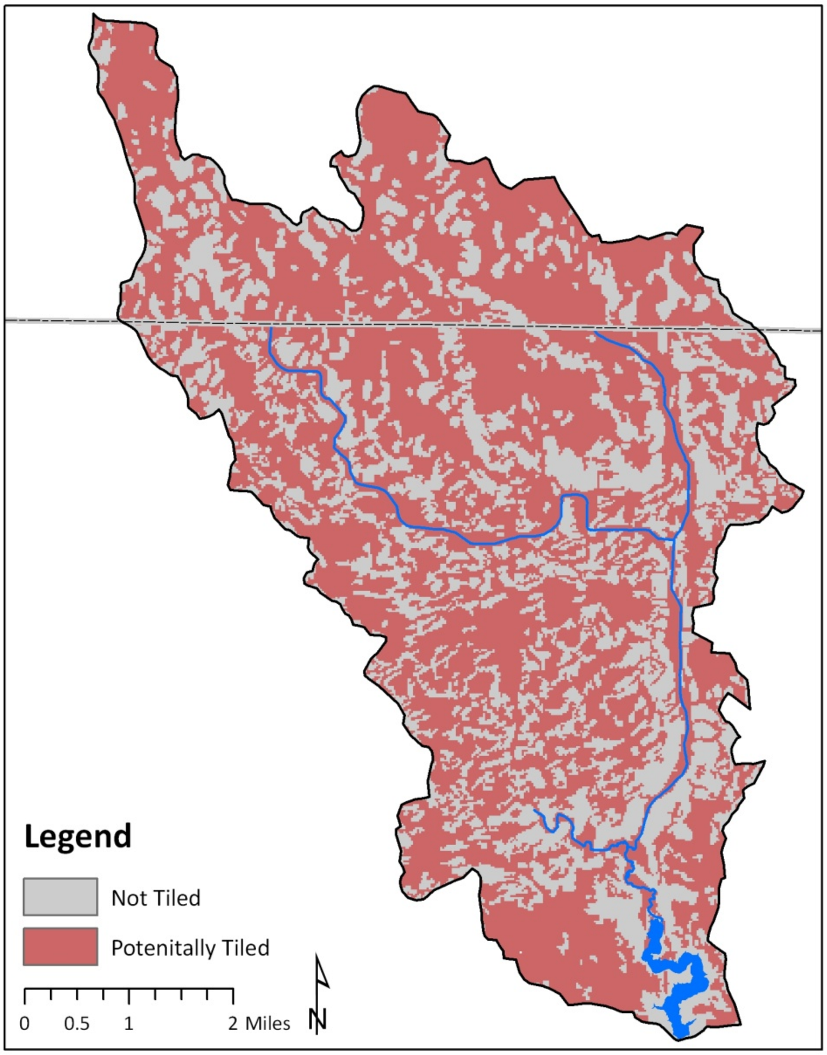

Figure 5. Potentially tile drained soils in Don Williams Lake watershed, Iowa Geological and Water Survey, DNR, Iowa City, Iowa.

Figure 4 is a map of potentially tile drained soils within the watershed. The coverage is provided by the Iowa Geological and Water Survey, DNR, Iowa City, IA. Soils are deemed as potentially tile drained if they have a high slope value of 2% or less with a drainage classification of poor to very poor; or if the high value is 5% or less with a drainage class code < 40%, and a subsoil group of 1 or 2.

Corn suitability ratings provide a relative ranking of soils mapped in the state based on their potential to be utilized for intensive row crop production. The CSR is an index that can be used to rank one soil's yield potential against another. Ratings range from 100 for soils that have no physical limitations, occur on minimal slopes, and can be continuously row cropped to as low as 5 for soils with severe limitations for row crops. Figure 5 is a map of the CSR ratings in the Don Williams Lake watershed.

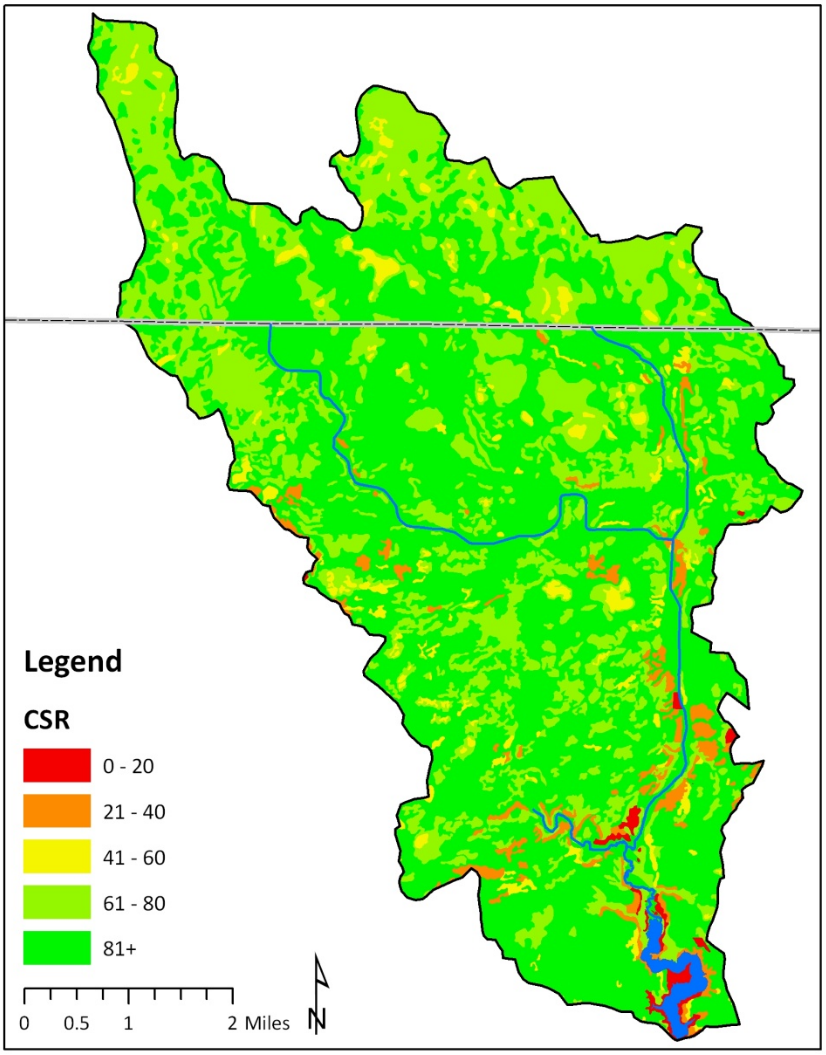

Figure 6. Corn suitability rating in Don Williams Lake Watershed (SSURGO, USDA-NRCS)

Elevation/Topography

Figure 6 shows the generalized elevation map generalized from LiDAR data. The highest elevation in the watershed is 1,196 feet and the lowest is 1,055 feet. Table 3 shows the slope classification within the watershed. Over 74% of the watershed as a slope gradient between 0 to 5%.

Table 4. Average slopes in the Don Williams Watershed.

Slope Gradient	Acres	% of Watershed
0 - 2%	4,781.5	22.5%
2 - 5%	10,996.2	51.8%
5 - 9%	4,204.5	19.8%
9 - 14%	702.6	3.3%
14 - 18%	160.2	.8%
18 - 24%	133.9	.6%
> 24%	242.2	1.1%

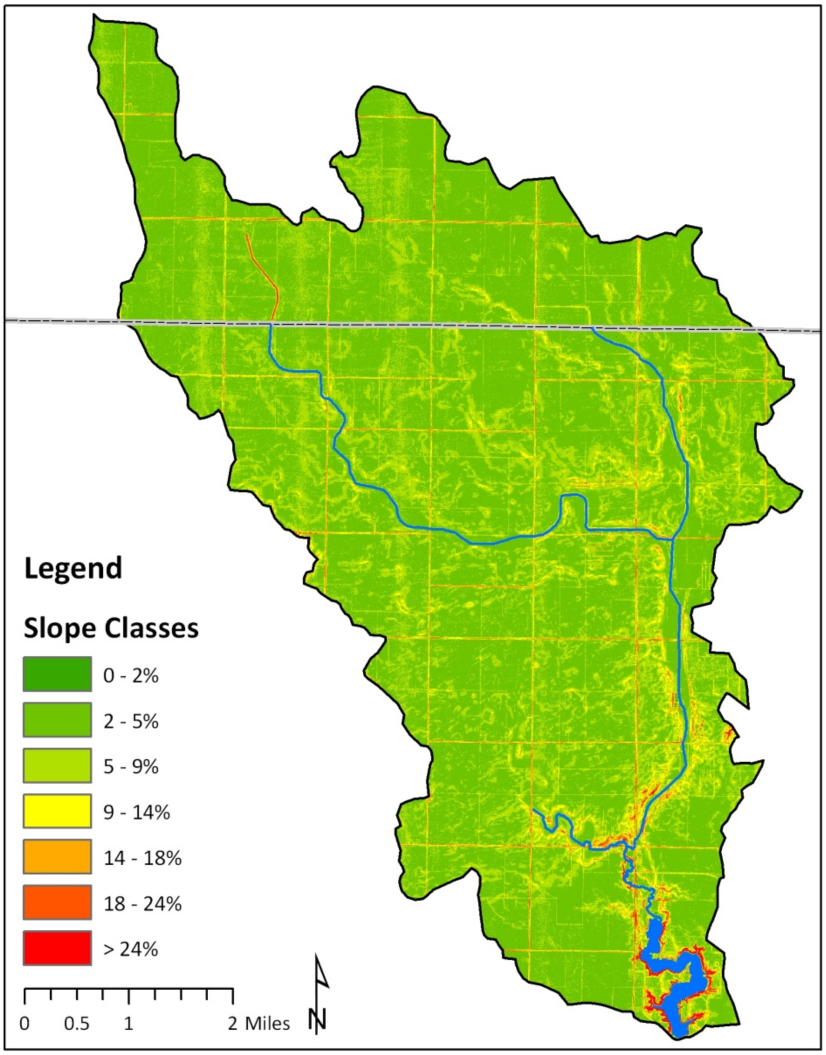

Figure 7. Don Williams watershed slope classification from LiDAR Elevation Data.

Figure 7 shows the watershed drainage network generated from LiDAR data. The map identifies pot-holes (closed basins) and those areas draining to these pot-holes. Because of this disconnected drainage pattern the areas not directly draining to the stream are not thought to be priority areas for sediment reducing practices. This information was not used in the TMDL because the necessary data to calculate potholes and their drainage areas was not available in 2005. Pothole areas were not excluded in the sediment delivery analysis but these areas were taken into consideration when indentifying priority locations for best management practice placement.

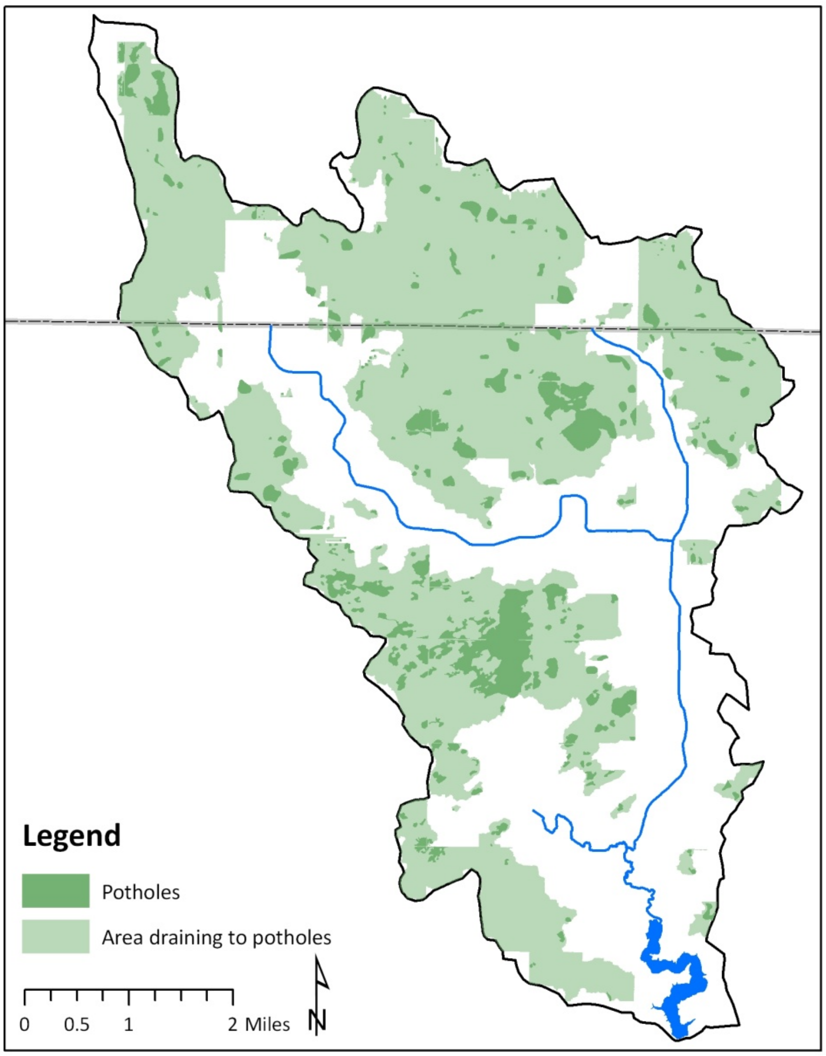

Figure 8. Don Williams Lake Drainage Network

Climate

According to the Midwest Regional Climate Center the average annual maximum temperature for Boone County is 59.1 degrees Fahrenheit, and average minimum temperature is 36.8 degrees Fahrenheit. The average number of days above 32 degrees Fahrenheit is 214 days. Average annual precipitation is 36.30 inches, with 8.3 days of rainfall greater than 1 inch and 23.8 days of rainfall greater than ½ inch. Below is a table list annual rainfall for the City of Boone over the past 20 years.

Table 5. Boone Rainfall Data; 1990 to 2011

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1990	0.54	0.59	6.12	1.39	10.24	10.42	6.52	3.55	1.29	1.57	1.48	2.35	**46.06**
1991	1.25	0.2	4.62	7.96	5.6	3.71	1.56	3.24	2.83	3.27	3.99	1.98	**40.21**
1992	1.38	1.64	3.17	4.4	1.52	0.67	10.6	2.09	3.81	0.45	5.06	1.87	**36.66**
1993	1.29	1.28	3	3.1	6.16	7.95	16.28	9.75	3.55	1.54	1.13	0.84	**55.87**
1994	1.45	1.57	0.15	2.74	1.45	6.11	2.98	5.34	4.68	3.96	1.64	1.91	**33.98**
1995	1.04	0.57	3.19	4.68	4.67	3.62	3.12	4.47	2.83	1.25	2.1	0.59	**32.13**
1996	2.96	0.4	1.73	1.73	5.66	7.82	3.88	3.84	3.24	2.73	4.69	1.58	**40.26**
1997	1.29	1.77	1.83	2.92	3.2	4.03	4.81	1.98	2.25	4.05	1.82	1.12	**31.07**
1998	1.38	2	4.37	2.86	4.38	13.06	4.4	4.55	0.99	4.3	1.06	0.47	**43.82**
1999	1.67	1.55	1.67	7.87	5.94	7.46	5.43	6.75	1.77	0.38	1.1	0.95	**42.54**
2000	0.72	1.01	0.86	0.91	4.32	5.05	2.7	2.29	1.18	1.72	2.53	2.39	**25.68**
2001	1.83	1.92	1.61	4.08	7.38	3.72	2.57	1.86	5.75	2.81	1.61	0.68	**35.82**
2002	0.47	1.46	1.05	4.69	4.98	3.34	4.15	7.6	1.48	3.44	0.3	0	**32.96**
2003	0.45	1.26	1.58	5.18	4.81	5.05	6.91	1.23	2.55	1	4.12	1.67	**35.81**
2004	1.65	2.15	4.19	2.27	7.01	3.46	1.63	7.88	0.96	1.35	3.13	0.45	**36.13**
2005	1.58	1.66	1.31	2.91	3.28	4.02	3.04	6.87	3.89	0.39	2.88	1.73	**33.56**
2006	0.43	0.37	3.29	4.92	2.73	1.42	8.09	5.91	7.24	2.26	1.37	2.25	**40.28**
2007	1.42	2.15	3.11	6.93	5.99	2.94	2.32	13.11	2.03	5.49	0.2	2.05	**47.74**
2008	0.67	1.51	1.8	6.63	11	9.83	9.32	1.83	2.19	4.59	2.7	1.71	**53.79**
2009	1.57	0.21	4.1	5.38	3.73	4.48	3.08	4.66	1.08	7.72	1.17	3.28	**40.46**
2010	1.55	1.2	2.18	3.39	4.2	10.63	8.49	8.72	5.33	0.37	1.76	0.39	**48.21**
2011	0.33	0.61	0.85	2.72	3.88	0.02	M	M	M	M	M	M	**M**
MEAN	1.03	1.13	2.3	3.6	4.61	5.21	4.37	4.4	3.24	2.49	1.84	1.28	**35.11**
# IEM Climodat http://mesonet.agron.iastate.edu/climodat/													

Historical Land Use

The Government Land Office (GLO) conducted the original public land survey of Iowa during the period 1832 to 1859. Deputy Surveyors and their assistants produced both field notes and township maps that briefly described the land and its natural resources (vegetation, water, soil, landform, and so on) at the time of the survey. These maps and survey notes are one of few data sources about vegetation distribution before much of Iowa changed to a landscape of intensive agriculture. This coverage represents the observed vegetation by the deputy surveyors when laying out the public land surveys in Boone and Webster Counties. During this time period over 99% of the land area was in prairie, with intermittent marsh land.

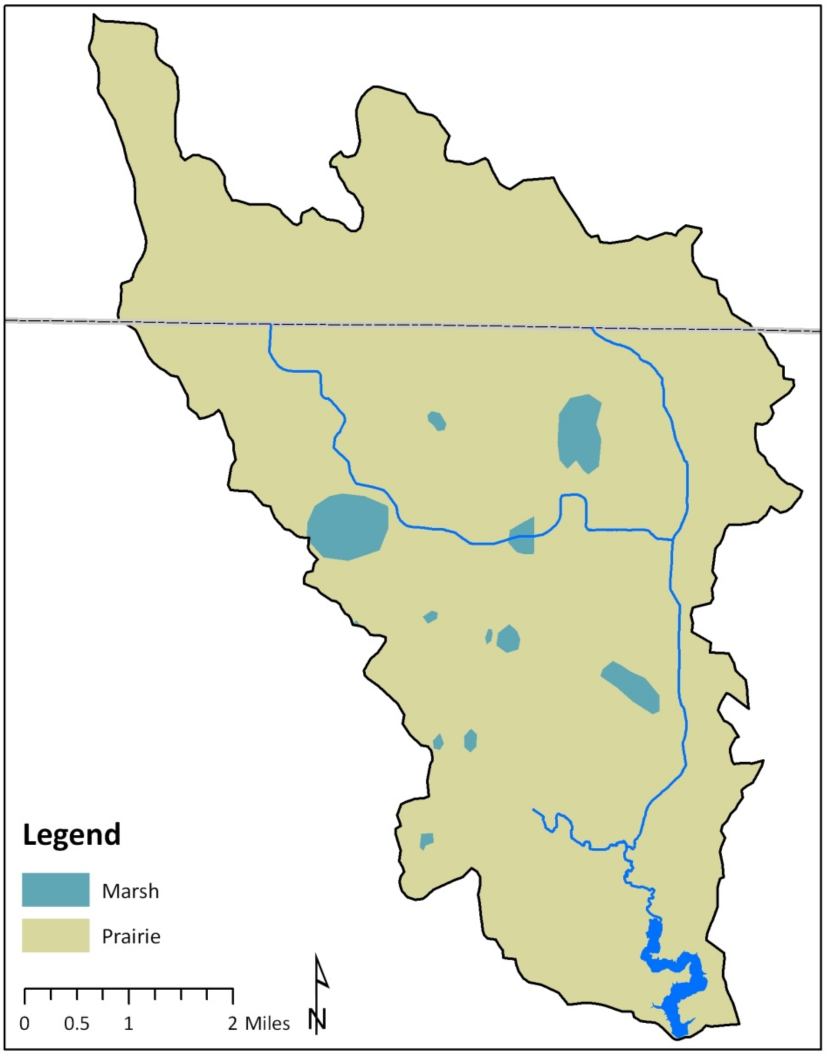

Figure 9. Historic land use for the Don Williams Lake watershed

Current Land Use

A field level land use survey was conducted in 2010 for the Don Williams Lake watershed in order to obtain land use and conservation practice data at the field level. The key data collected as part of the survey included current land use, tillage practice, crop residue, and conservation practices. The survey was performed primarily via visual reconnaissance, although local NRCS and other agency personal were consulted to obtain information on certain parts of the watershed. While there is certain level of subjectivity to this type of survey, especially when determining crop rotations and residue levels, this approach is the only way to collect this amount of detail at this time.

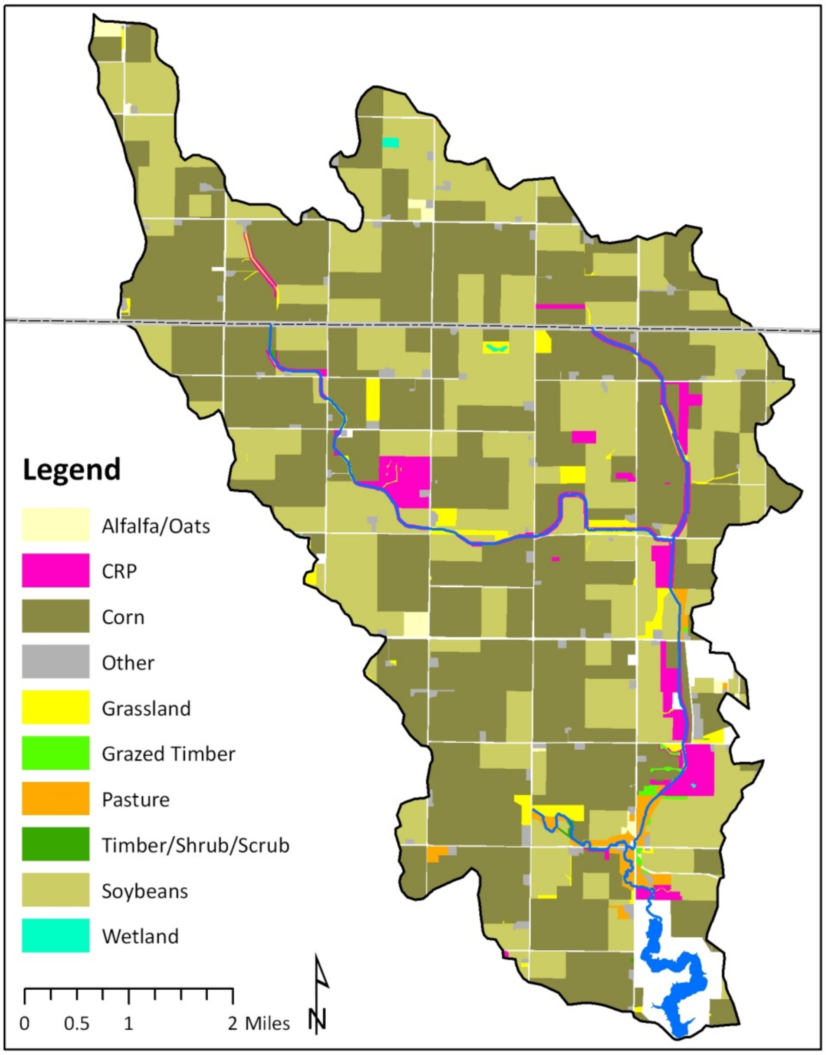

Figure 10. 2010 Land Use Assessment for Don Williams Lake Watershed.

Table 6. 2010 Land Use.

2010 Land Use	Area (in Acres)	Percent of Total Area
Corn	11,148.0	55.3
Soybeans	7,014.7	34.8
Alfalfa	27.8	0.1
CRP	661.2	3.3
Oats	75.0	0.4
Grassland/Pasture	669.7	3.3
Timber/Grazed Timber	37.3	0.2
Shrub/Scrub	9.0	0.0
Farmstead Abandon	46.9	0.2
Farmstead Active	289.7	1.4
Urban/Residential	25.7	0.1
Wetland	15.0	0.1
No Data (i.e. – road, lake, etc)	124.4	0.6
	20,144.3	100.0

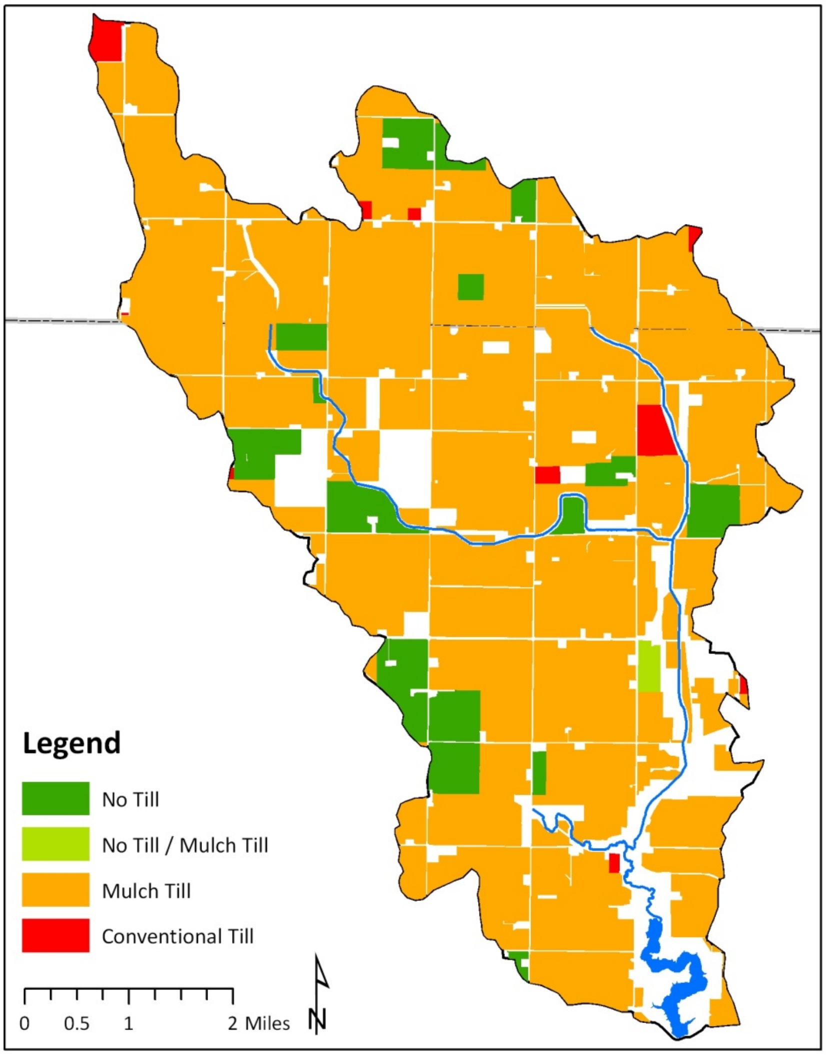

Figure 11. Tillage practices from 2010 land use survey

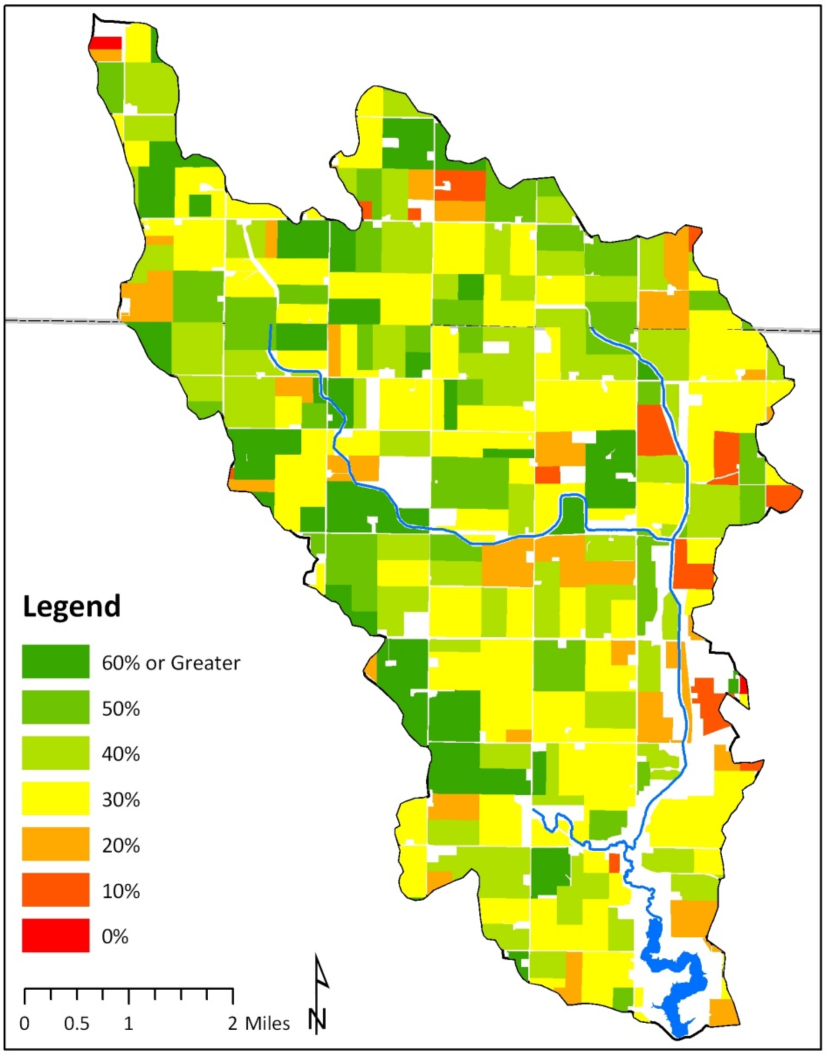

Figure 12. Residue cover from 2010 land use survey

Stream Conditions

The Boone County Soil and Water Conservation District has conducted a Rapid Assessment of Stream Conditions Along Length (RASCAL). The RASCAL involves walking the length of the stream and collecting information onto a hand held GPS unit. Data collected relates to adjacent land use, streamside vegetation, streambank stability, and stream habitat etc. Overall 14.34 stream miles were assessed for 24 different parameters. One can get a general feel for the type of watershed and the health of the stream by aggregating the data for the following five parameters:

1. *Adjacent Land Cover* – Different land uses (row crop, pasture, residential, commercial, forested, etc.) are thought to place different types of stress on a stream corridor. Land that is in a more natural state (i.e. a remnant forest) and is not used for production or residential purposes is thought to have a less detrimental impact on a stream because the natural systems are typically closed when it comes to nutrient cycling and sediment movement. There are also different stresses caused by various types of production i.e. row crop agriculture vs. livestock production.

2. *Riparian Zone Width* – Areas next to the stream are considered the riparian zone, these areas, when left out of production and in perennial vegetation, act as a valuable buffer to the stream. The buffer can reduce the impact of the adjacent land use by filtering nutrients in surface flow, and can offer stream bank stabilization through root establishment.

3. *Bank Stability* – Areas of high stream bank erosion deliver significant amounts of sediment to a stream, causing issued with high phosphorus loads, turbidity, and embeddedness of stream substrate.

4. *Substrate* – A stream's substrate plays a vital role in providing for a diverse aquatic community. A silt dominated substrate is an indication of a degraded stream, and that sediment is being deposited from upland and in stream sources (such as stream banks).

5. *Stream Habitat* – A diversity of stream habitat provides for a higher quality of aquatic species (fish and insects). Stream habitat encompasses a variety of parameters including: substrate, # of 3' pools, and #of riffles, in-stream cover, and canopy cover.

Results
The following table summarizes the findings of the five parameters previously mentioned. The value represents the percentage of stream length observed for the respective category. For example, in the dominant substrate parameter, 65.9% of the stream length is dominated by gravel; or 9.45 stream miles consist of mainly a gravel substrate.

Table 7. Don Williams Lake watershed stream summary.

Survey Parameter	**Categories**				
Adjacent Land Cover (of 14.34 miles)	**Row Crop**	**Trees**	**Grass**	**Pasture**	**Other**
	66%	4%	15%	9%	5%
Riparian Zone Width (of 14.34 miles)	**< 10 ft**	**10 - 30 ft**	**30 – 60 ft**	**> 60 ft**	
	5%	9%	15%	71%	
Bank Stability (of 14.34 miles)	**Stable**	**Mod. Stable**	**Mod. Unstable**	**Unstable**	**Art. Stable**
	29%	54%	14%	3%	--
Dominant Substrate (of 14.34 miles)	**Cobble**	**Gravel**	**Sand**	**Silt/Mud**	
	< 1%	66%	4%	29%	
Stream Habitat (of 14.34 miles)	**Poor**	**Average**	**Excellent**		
	--%	18%	77%		

The adjacent land cover is 66% row crop agriculture, with an additional 9% recognized as pasture. Grasslands were dispersed among the stream constituting about 15% of the adjacent land use. A majority of the stream (86%) had at least a 30 foot riparian zone with 15% having a riparian zone ranging 30 – 60 ft wide with 71% having a riparian zone width of at least 60 feet. The stream banks were recorded as being 29% stable, 54% moderately stable, 14% moderately unstable, and 3% unstable. The dominant substrate of Bluff Creek was gravel as it was the dominant substrate for 66% of the stream length with silt/mud accounting for 29%. The stream habitat was reported as being 77% excellent, 18% average and the remaining 5% was unreported.

The following figure shows Bluff Creek broken down into segments. By breaking the stream down into segments and looking at the data recorded, one can start to determine where the priority areas are, and which parameters are leading concerns in the watershed. The segments consist of aggregations of smaller sections in which the assessments were taken. Assessments were taken every time there was a significant change in stream conditions or approximately every 500 feet if conditions were uniform.

Figure 13. RASAL stream assessment segments.

The following table contains the parameters that were thought to be the main concerns in the stream. An "X" indicates that the segment scored low for a particular parameter, and a "XX" indicates that the segment scored very low for the parameter. The main concerns that the RASCAL brought out in Bluff

Creek were canopy cover, riffle frequency, pool frequency, observed bank erosion, and embeddedness.

Table 8. Locations of parameters of concern.

Segment	Canopy Cover	Riffle Frequency	Pool Frequency	Observed Bank Erosion	Embeddedness
A	X	X	X		X
B	XX		X	X	XX
C	XX		X	X	X
D	XX	X	X	XX	XX
E	X	X		XX	

The stream assessment revealed that most of Bluff Creek lacked canopy cover. Segments A and E were the only segments that there was at least some partial canopy cover reported. The rest of the segments revealed that canopy cover was not present. Riffle and pool frequency was also found to be low in segments. Ideally there would be a riffle and pool sequence at least once within a distance equal to approximately six times the bank full width. Segments A, D, and E were categorized as having low riffle frequency (generally less than 2 riffles per assessment section). Pools were lacking in segments A, B, C, and D. The upper portion of segment A did have pools present, but the lower half of A scored very low. Observed bank erosion was a concern for segments B, C, D, and E.

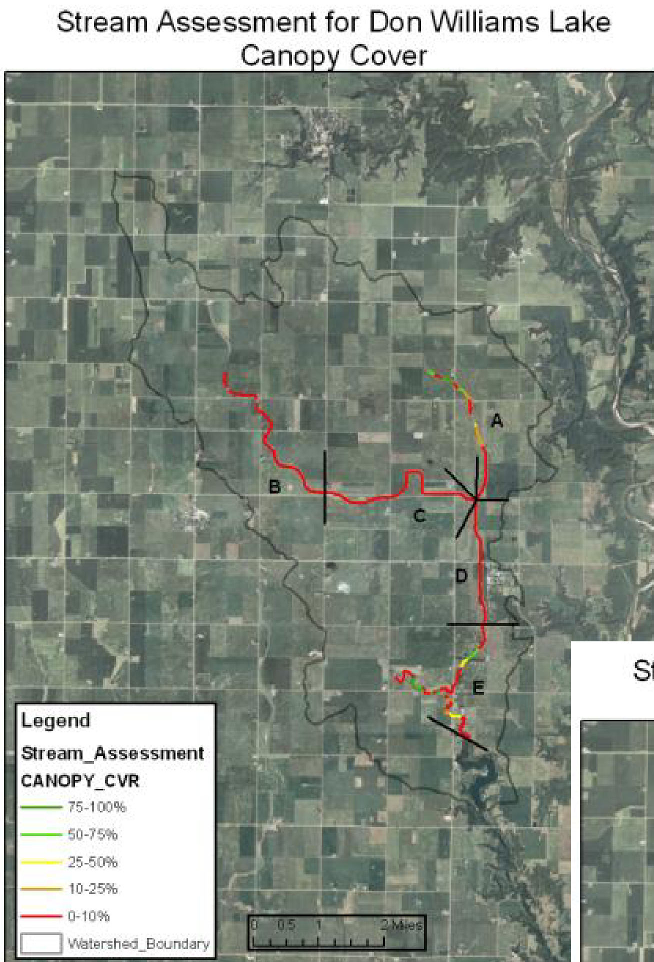

Figure 14. Canopy cover.

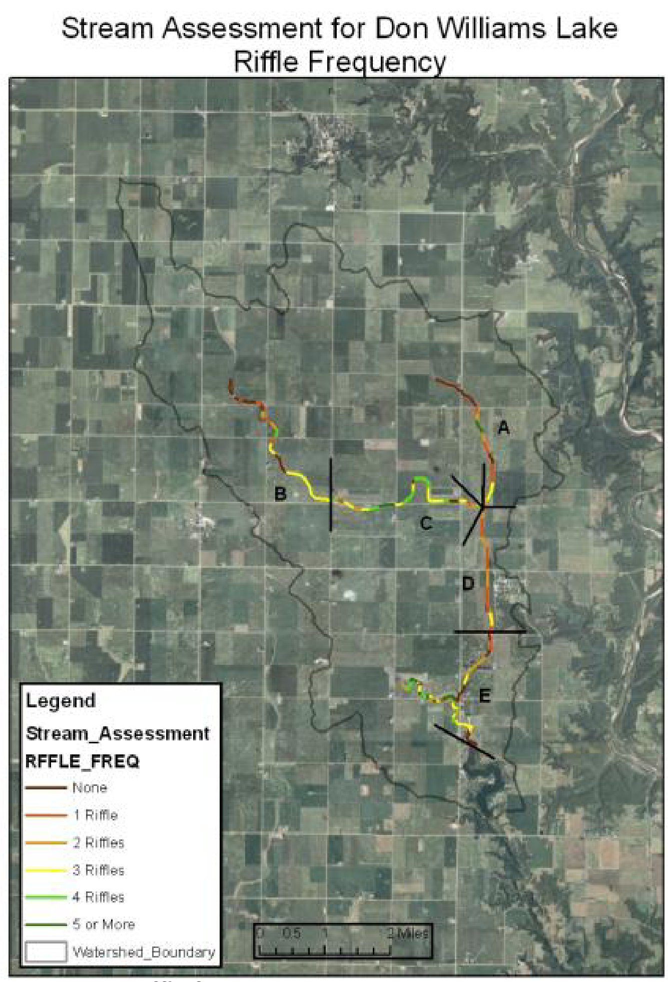

Figure 15. Riffle frequency.

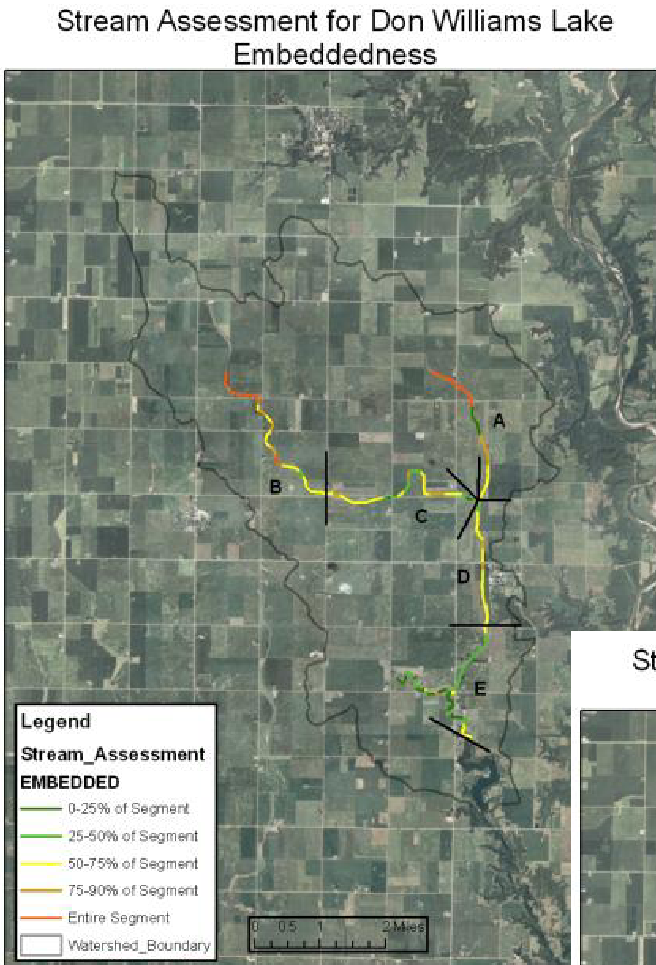

Figure 16. Stream embeddedness.

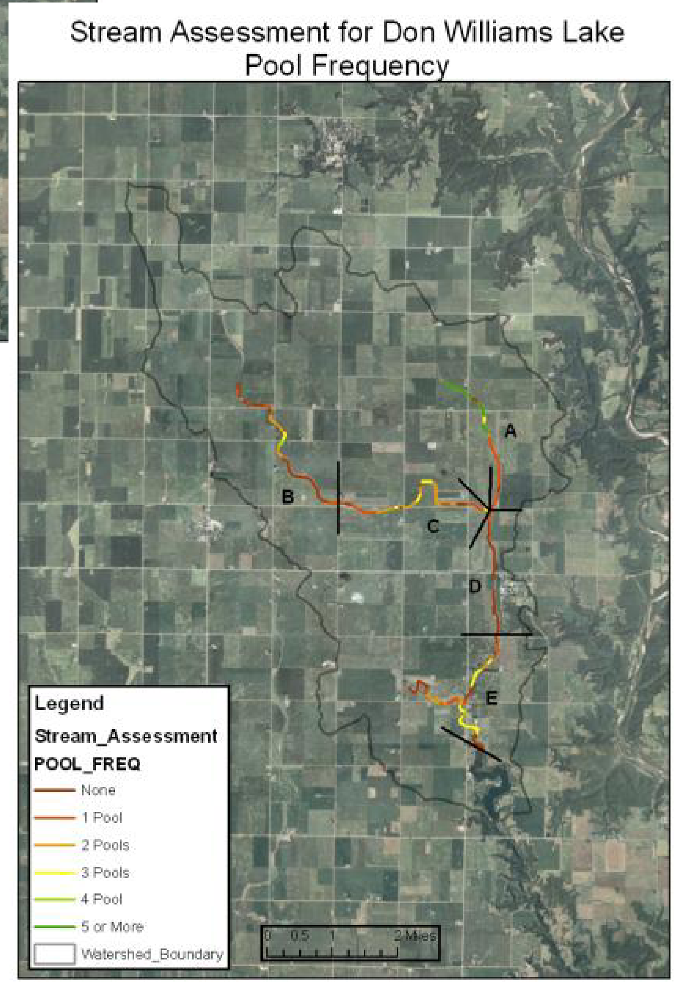

Figure 17. Pool frequency.

Stream Assessment for Don Williams Lake
Embeddedness

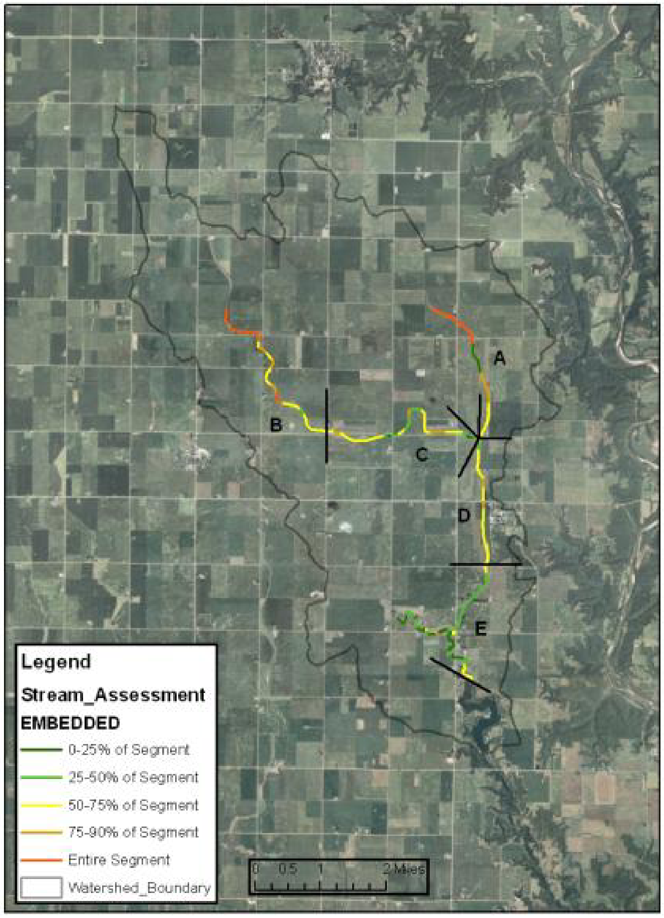

Figure 18. Stream embeddedness.

6. Pollutant(s) and Impairment(s)

Iowa's Water Quality Standards classify all surface waters in Iowa as being protected for general uses. Waters can also be protected for other designated uses, including drinking water, recreation uses like swimming, and supporting fish and other aquatic life. Designated uses are protected by specific water quality criteria and the state's anti-degradation policy, as described in the Iowa Water Quality Standards.

4.1 Designation
The designated uses for Don Williams Lake watershed are:

- **Class A1**
- **Class B(LW)**
- **Class HH**

A1 = Waters in which recreational or other uses may result in prolonged and direct contact with the water, involving considerable risk of ingesting water in quantities sufficient to pose a health hazard. Such activities would include, but not be limited to, swimming, diving, water skiing, and water contact recreational canoeing.

B(LW) = Artificial and natural impoundments with hydraulic retention times and other physical and chemical characteristics suitable to maintain a balanced community normally associated with lake-like conditions.

HH = Waters in which fish are routinely harvested for human consumption or waters both designated as a drinking water supply and in which fish are routinely harvested for human consumption.

**Definitions from Chapter 61 – Iowa Water Quality Standards*

4.2 2010 305(b) Assessment for Don Williams Lake
SUMMARY: The Class A1 (primary contact recreation) uses are assessed (monitored) as "not supported" due to exceedances of the Iowa's indicator bacteria standard. The Class B(LW) (aquatic life) uses are assessed (evaluated) as "partially supported" due to nutrients in the water column and siltation impacts, especially in the upper portions of the lake. Fish consumption uses are assessed (evaluated) as "fully supported" based on fish contaminant monitoring in 1996. Sources of data for this assessment include (1) results of the statewide survey of Iowa lakes conducted from 2004 through 2007 by Iowa State University (ISU), (2) results of the statewide ambient lake monitoring program conducted from 2005 through 2008 by University Hygienic Laboratory (UHL), (3) information from the IDNR Fisheries Bureau, and (4) results from the IDNR-county voluntary beach monitoring program in 2006-08.

Note: A TMDL for organic enrichment and siltation at Don Williams Lake was prepared by IDNR and approved by EPA in 2005. Because not all Section 303(d) impairments identified for the 2010 assessment/listing cycle (indicator bacteria) are addressed by the TMDL, this waterbody is placed in IR Category 5a (impaired; TMDL needed).

EXPLANATION: Results of IDNR county beach monitoring from 2006 through 2008 suggest that the Class A1 uses are assessed (monitored) as "not supported." Levels of indicator bacteria at Don Williams Lake beach were monitored approximately once per week during the primary contact recreation seasons (May *through August) of 2006 (16 samples), 2007 (15 samples), and 2008 (13 samples) as part of the IDNR county beach monitoring program. According to IDNR's assessment methodology, all thirty-day geometric means for the three-year assessment period must be less than the state's geometric mean criterion of 126 E. coli orgs/100 ml for results of beach monitoring to indicate "full support" of the Class A1 (primary contact recreation) uses. If a 5-sample, 30-day geometric mean exceeds the state criterion of 126 orgs/100 ml during the three-year assessment period, the Class A1 uses should be assessed as "not supported". This assessment approach is based on U.S. EPA guidelines (see pgs 3-33 to 3-35 of U.S. EPA 1997b).*

At Don Williams Lake beach, the geometric means of 1 thirty-day periods during the summer recreation seasons of 2008 exceeded the Iowa water quality standard of 126 E. coli orgs/100 ml. The percentage of samples exceeding Iowa's single-sample maximum criterion (235 E. coli orgs/100 ml) was 0% in 2006, 7% in 2007 and 23% in 2008. According to IDNR's assessment methodology and U.S. EPA guidelines, the exceedance of the geometric mean standard suggests nonsupport of the Class A1 (primary contact recreation) uses. It should be noted that the bacteria impairment will not be addressed at this time. Once additional information is available regarding bacteria, the plan may be updated.

For the 2010 reporting cycle, results from the ISU statewide survey of lakes and the UHL ambient lake monitoring program suggest "full support" of the Class A1 uses. Using the median values from these surveys from 2004 through 2008 (approximately 28 samples), Carlson's (1977) trophic state indices for Secchi depth, chlorophyll a, and total phosphorus were 59, 59, and 61 respectively for Don Williams Lake. According to Carlson (1977) the Secchi depth and chlorophyll a values place Don Williams Lake at the upper end of the eutrophic category, while the total phosphorus value places Don Williams Lake in between the eutrophic and hypereutrophic categories. These values suggest relatively low levels of chlorophyll a and suspended algae in the water, relatively good water transparency, and moderately high levels of phosphorus in the water column.

The level of inorganic suspended solids is moderately high at this lake and does not suggest impairment due to high non-algal turbidity. The median inorganic suspended solids concentration at Don Williams Lake was 5.3 mg/L, which was the 50th highest of the 132 monitored lakes.

Populations of cyanobacteria are very low at this lake and do not suggest impairment due to nuisance aquatic life. Data from the ISU and UHL lake surveys show that the median cyanobacteria wet mass at Don Williams Lake (0.6 mg/L) is the 2nd lowest of all 132 monitored lakes. The data also show that cyanobacteria comprised only 8% of the phytoplankton wet mass at this lake.

The Class B(LW) (aquatic life) uses are assessed (evaluated) as "partially supported" due to excessive nutrient loading to the water column, high levels of non-algal turbidity, and siltation in the lake. Information from the IDNR Fisheries Bureau suggests that siltation and non-algal turbidity cause the aquatic life uses to be "partially supported" at Don Williams Lake. A large gizzard shad population also exists in this lake.

The ISU and UHL lake survey results show generally good chemical water quality at Don Williams Lake. From 2004-2008 there were no violations of the Class B(LW) criterion for ammonia (28 samples), or dissolved oxygen (28 samples), and only one violation of the Class A1,B(LW) criterion for pH in 28 samples. According to IDNR's assessment methodology this pH violation is not significantly greater than 10% of the samples and therefore does not constitute an impairment of the Class B(LW) uses of Don Williams Lake.

Fish consumption uses were "not assessed" due to a lack of recent fish contaminant monitoring at this lake. The most recent fish tissue monitoring was conducted in 1996. While these results suggest that levels of contaminants were low at Don Williams Lake, they are now too old (greater than 10 years) to be used for an assessment.

4.3 Don Williams Lake TMDL

The Federal Clean Water Act requires the Iowa Department of Natural Resources (IDNR) to develop a Water Quality Improvement Plan, also known as a Total Maximum Daily Load (TMDL) for waters that have been identified on the state's 303(d) list as impaired by a pollutant. Don Williams Lake was added to the Section 303(d) list in 1998 by the Iowa Department of Natural Resources (IDNR) for a siltation and organic enrichment impairments identified by IDNR Fisheries. (As previously mentioned the organic enrichment impairment was the result of assessment error and will be delisted in 2012.) The purpose of the TMDL for Don Williams Lake is to calculate the maximum allowable sedimentloading for to the lose less than one third of its original volume over a design life of 100 years.

The pollutant causing the water quality impairments is sediment from nonpoint source pollution.. Excessive sediment deposition impairs recreation and aquatic life uses in many ways:

- Some of the most critical areas for feeding and reproduction of aquatic life are the upstream areas of tributary arms. This is also the area where most sediment settles as stream velocities rapidly decrease.
- As lakes lose depth, they are more susceptible to summer algal blooms and winter fish kills. There is a smaller volume of water under the winter ice that can provide dissolved oxygen.
- Shallow water favors the increase of the rough fish population such as bullheads and carp.

Pollution Source Assessment

Two categories of sediment sources have been identified in the Don Williams Lake watershed. Upland sources are sheet and rill erosion; non-upland sources are gully, streambed, and stream bank erosion. Other less significant sources are runoff from construction and development activities, grasslands, and forest.

One NPDES permitted facility is present in the watershed. The City of Pilot Mound owns and operates a municipal wastewater treatment facility (IA NPDES Permit # 0862001) consisting of a three-cell acultative lagoon system constructed in 1977. This facility has never discharged, reportedly due to low influent relative to the design volume. There are no other point source dischargers in the watershed.

Pollution Load Reduction

The targeted total sediment loading capacity for Don Williams Lake is 11,600 tons per year. The 2005 TMDL estimated the existing sediment load to the lake is 14,200 tons per year. A sediment load reduction of 2,600 tons per year was called for in the TMDL. However, based an updated watershed assessment using improved techniques the current estimated sediment delivery to Don Williams Lake is 2,473 tons per year. This current estimate is well below the allowable capacity identified in the TMDL but this level of siltation is still causing less than desirable conditions in Don Williams Lakes, especially on the far northern end of the lake.

TMDL Targets

The Phase 1 TMDL siltation target for Don Williams Lake is the average annual siltation rate that equals the rate at which it would take to fill one third of the original volume over a design life of 100 years. The

100-year design life has been selected because it is frequently used by the U.S. Army Corps of Engineers for its reservoir projects. It is usually considered an economic parameter and not a physical limitation. The original volume of the lake was 2,655 acre-feet and one third of this is 885 acre-feet. Over 100 years, this results in an average annual allowable volume loss of 8.9 acre-feet per year. Over the past 36 years, 359 acre-feet have been lost, leaving an allowable volume loss for the next 64 years of 526 acre-feet or 8.2 acre-feet per year.

The water quality target for the siltation is the volume of sediment that can be delivered to the lake annually and not cause an impairment of the lake's designated uses. One of the biggest obstacles to assessing the nature and extent of a siltation problem is knowing how much silt has accumulated and how much volume has been lost. IDNR and US Geological Survey cooperated to develop a method to map the lake bottom and sediment volume using special sonar equipment. These estimates show that the lake has lost significant volume, depth and some surface area near the inlet. The Don Williams Lake watershed to lake area ratio of 141:1 is much higher than the desired maximum of 20:1

The sedimentation impairment is expressed in the form of a loss of volume. For the 2003 USGS bathymetry and siltation estimate, the volume between the existing lake bottom and the sonar-derived original bottom was calculated. This volume is the estimate for the current siltation volume of 359 acre-feet. The volume loss, or inversely, the sediment gain, between 1967 and 2003 was 359 acre feet, a 7.4% volume loss over 36 years. The average annual sedimentation rate between 1967 and 2003 was 10 acre-feet per year.

7. Pollutant Source Assessment

5.1 Sediment

Several sources of sediment delivered to Don Williams Lake were identified and quantified during watershed assessments conducted in 2010 and 2011. This includes classic gully erosion within Don Williams Park, ephemeral erosion from upland areas, sediment delivery from sheet and rill erosion, streambank erosion, and shoreline erosion. From these assessments, an estimated sediment delivery budget was calculated for the Don Williams Lake watershed. Pothole areas of the watershed were included in the sediment budget but actual sediment loading may be minimal due to subsurface tile drainage. The sediment sources and relative contributions are provided in Table 8 and Figure 12.

Table 9. Don Williams Sediment Budget, 2011.

Sediment Source	Estimate (tons/year)	Sediment Delivery Rate (SDR)	Total Sediment Delivery (tons/year)
Sheet & Rill	23,315	3.7%	855
Classic Gully (knick points, head cuts, and sidewalls)	68.1	90%	61
Ephemeral Gully	1,797.6	35%	629
Streambank Erosion	992.3	90%	893
Shoreline Erosion	35	100%	35
Total Sediment Delivery			2,473

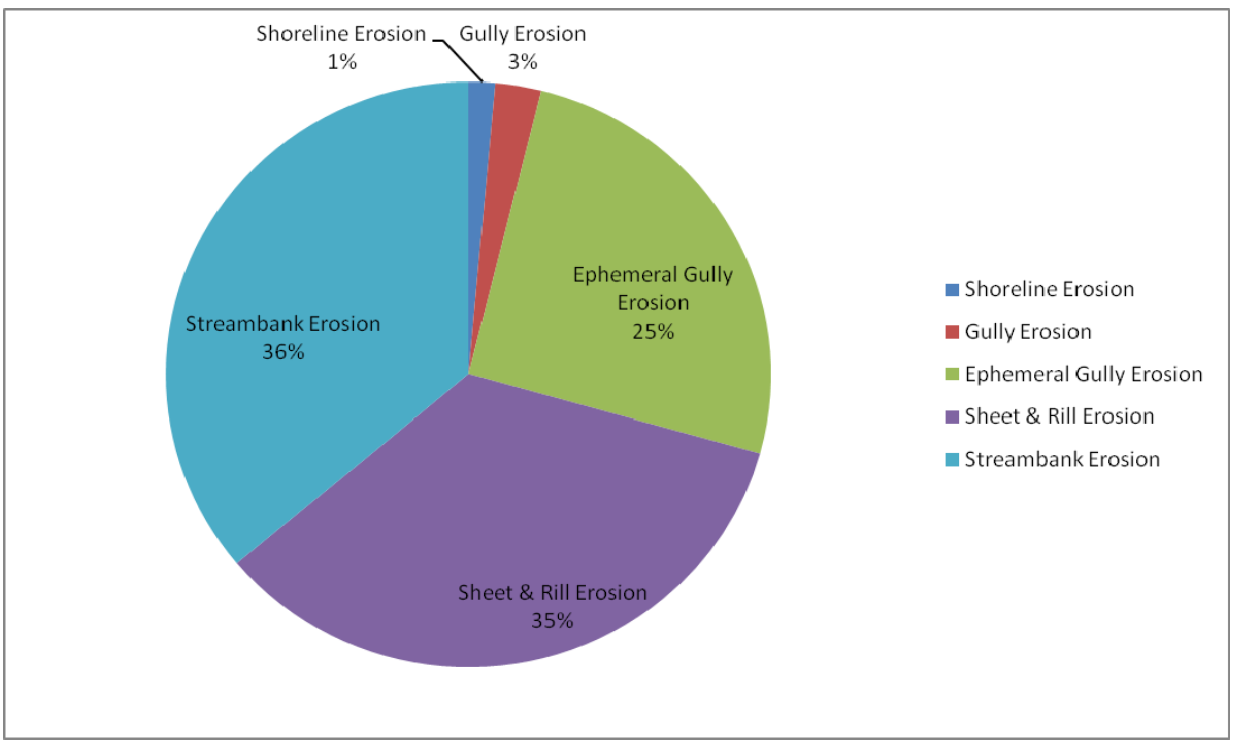

Figure 19. Sediment loading.

Sheet and Rill Erosion

Estimated sheet and rill erosion for the Don Williams Lake watershed were created using the NRCS Revised Universal Soil Loss Equation (RUSLE). Local watershed personnel helped define C and P factor information for sediment loss classification. The sediment delivery or amount of sediment from sheet and rill erosion reaching Don Williams Lake was calculated using NRCS methods. Results of the RUSLE and sediment delivery calculations are provided in Figures 13 and 14.

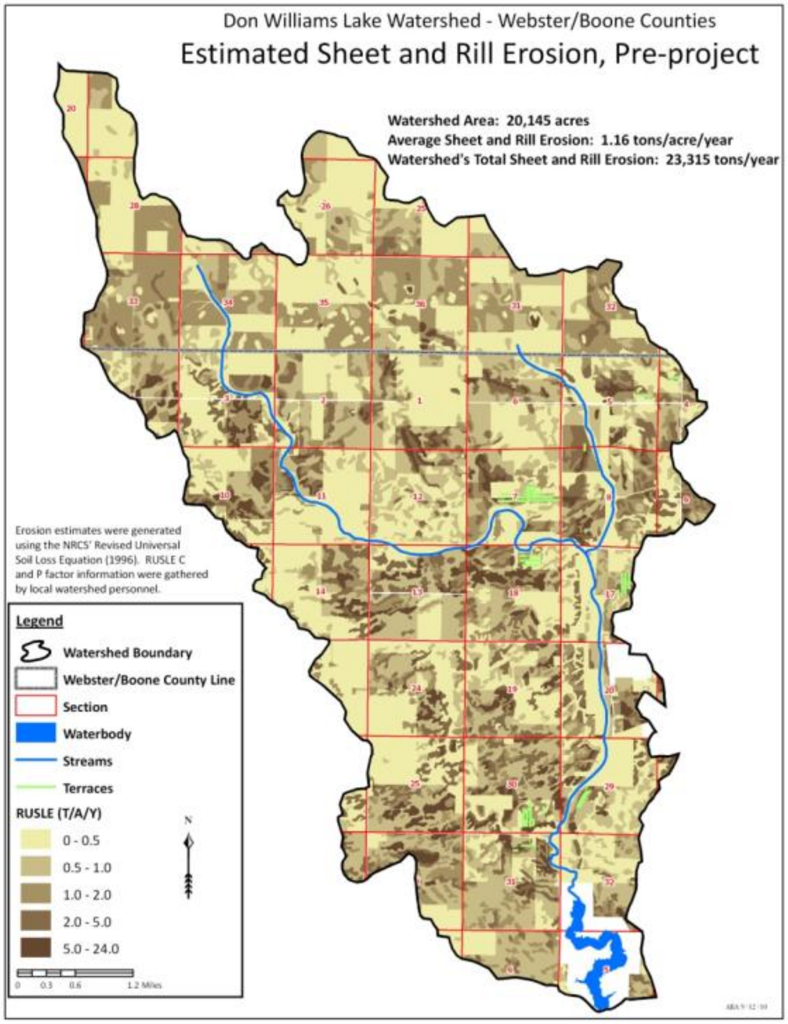

Figure 20. Estimated Sheet and Rill Erosion, 2010.

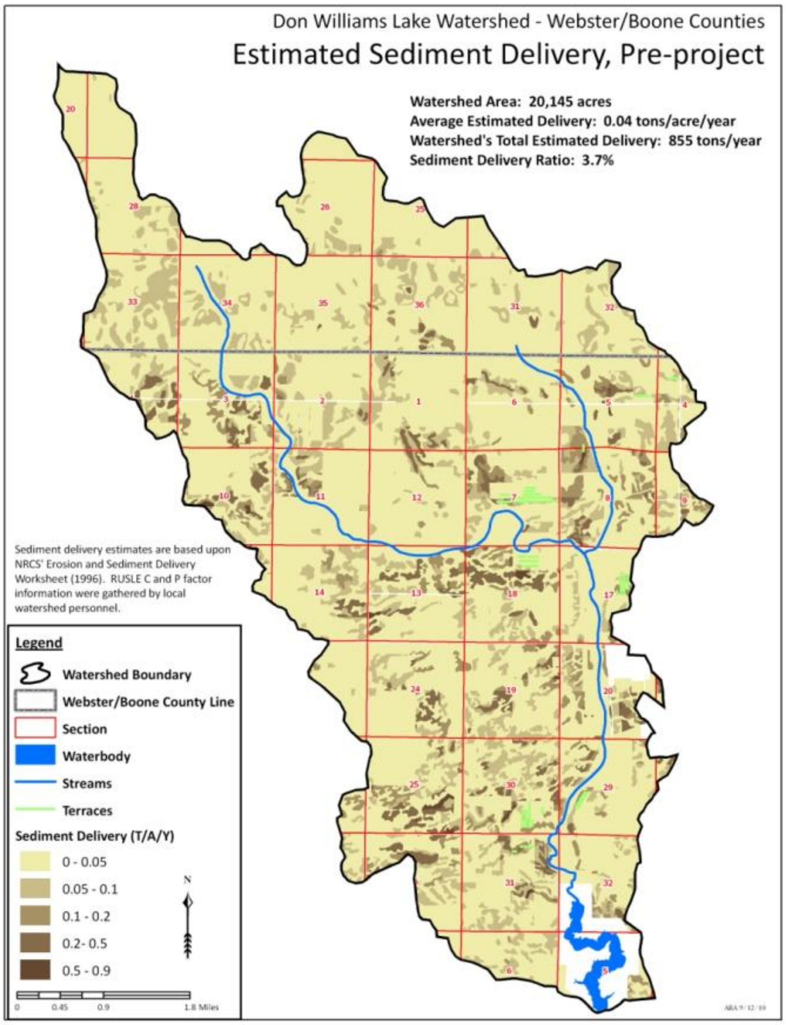

Figure 21. Estimated Sediment Delivery, 2010.

Classic Gully Erosion (on publically management land)

Field assessment activities were conducted around the entire perimeter of Don Williams Lake to identify and measure all classic gullies terminating at the lake for sediment delivery calculations. Approximately 23 gullies and headcuts were identified during the assessment. See Figure 15 below for a map of the gully locations.

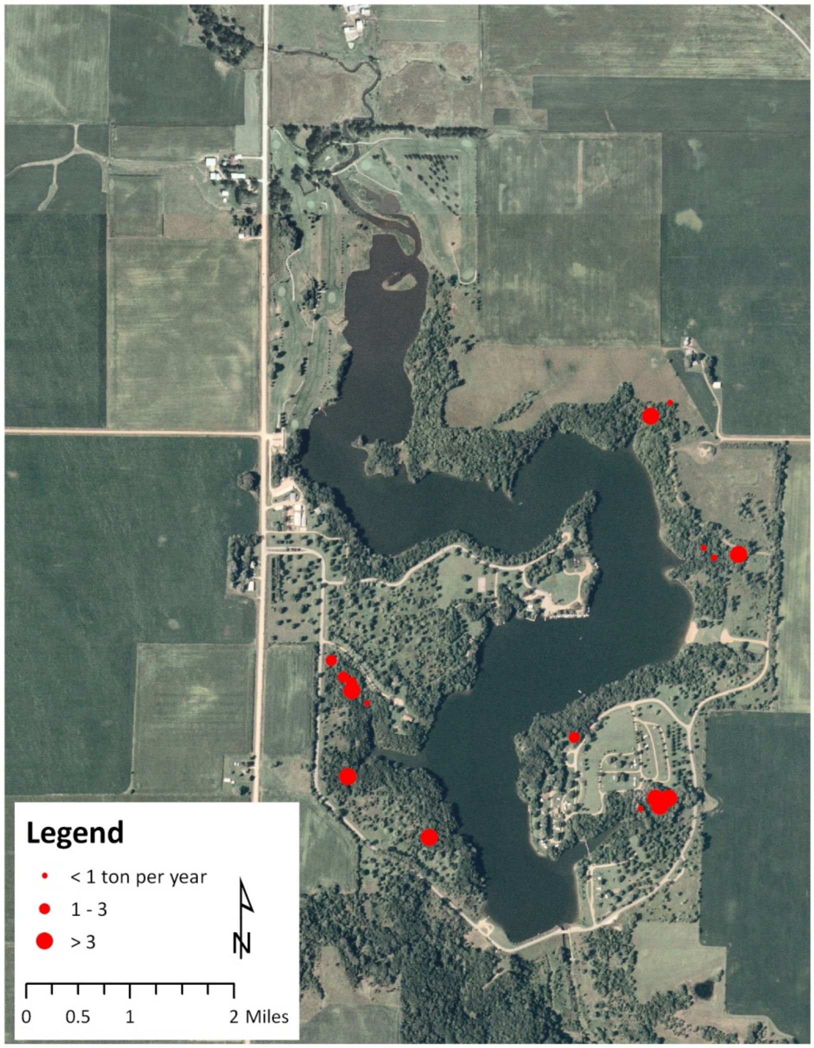

Figure 22. Gully assessment, 2010.

Ephemeral Gully Erosion

An NRCS endorsed formula for calculating ephemeral gully erosion was unitized to estimate the contribution from ephemeral gullies in the watershed. A total of 629 tons of sediment from ephemeral gullies is estimated to reach Don Williams Lake annually. The calculation assumed 1 ton/acre/year of ephemeral gully erosion from un-terraced cropland with 5% slopes or greater.

Streambank Erosion

From stream assessment in 2010, an estimated 992 tons/year erodes from the streambanks in the Don Williams Lake watershed. Of that, 90% or 893 tons/year is estimated to reach Don Williams Lake annually. This contribution of sediment is largest among all categories assessed within the watershed, and is often the most expensive to correct. Figure 13 shows locations and severity of streambank erosion. Erosion estimates were made by recording the visual estimate of erosion rate class (stable, minor, moderate, or severe), bank length, and bank height. The erosion rate class has a corresponding depth of soil loss in inches per year. This depth is then multiplied by the surface area of the bank (bank height x bank length) to get an overall volume of soil loss. The soil volume is then multiplied by the density of soil (assumed to be 87 lbs/ft^3).

Shoreline Erosion
A shoreline assessment was conducted in 2011, with the entire perimeter of Don Williams Lake being assessed via motor boat. Overall, the condition of the shoreline around Don Williams Lake is in good condition with only a few locations needing attention. Limited sediment delivery was estimated to be reaching the lake with only a total of 35 tons/year.

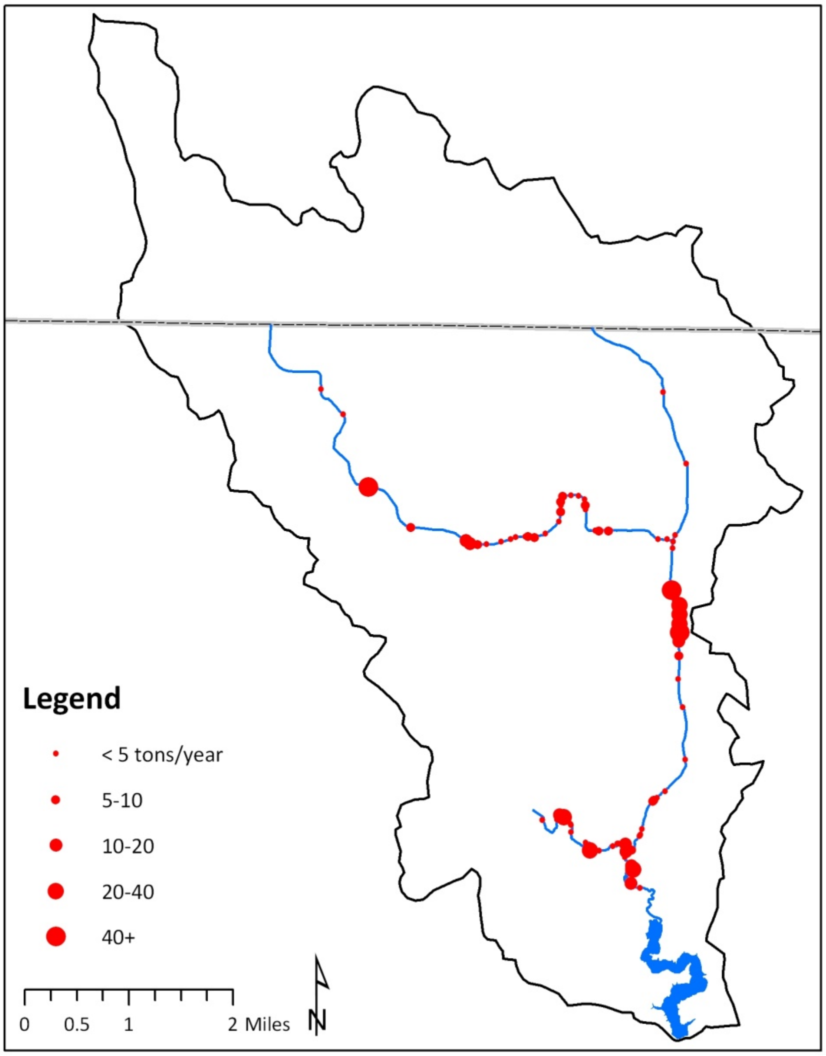

Figure 23. Streambank erosion location points.

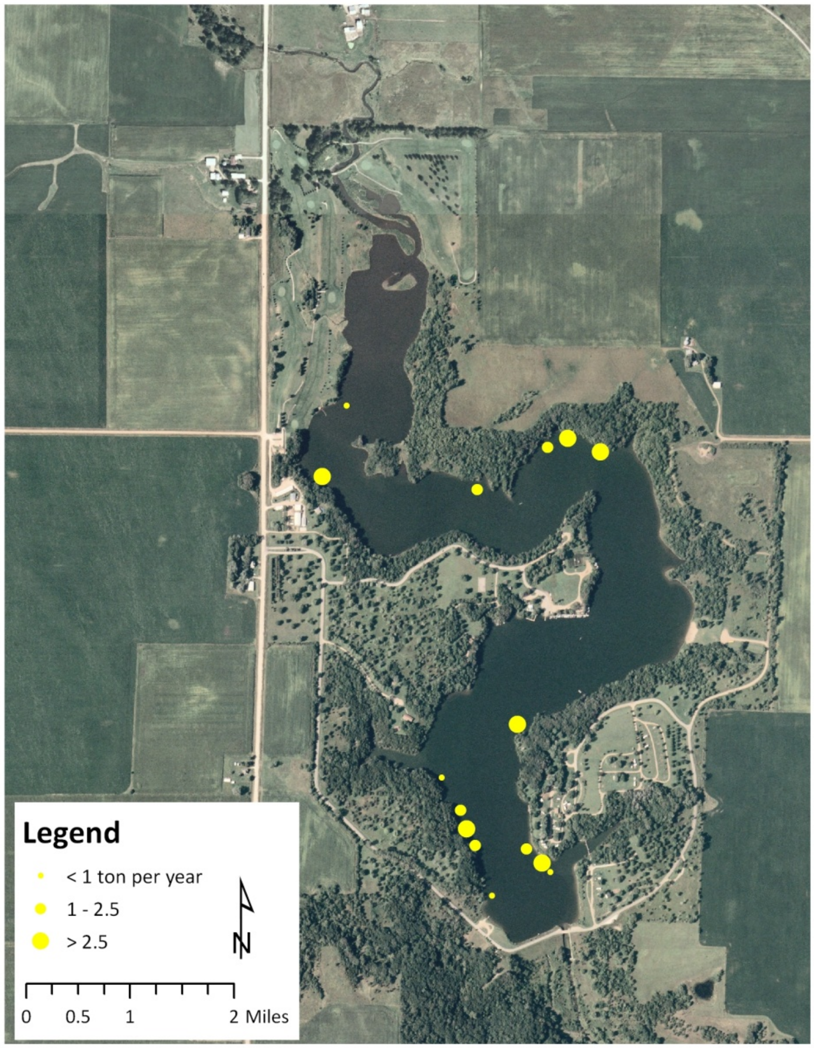

Figure 24. Shoreline erosion locations.


Figure 25. An example of shoreline erosion along Don Williams Lake.

8. Goals and Objectives

Goals and objectives and action plan

This watershed management plan will be of little value to real water quality improvement unless watershed improvement activities and BMPs are implemented. This will require the active engagement of local stakeholders and the collaboration of state and federal agencies. In addition to the implementation of Best Management Practices (BMPs), continued monitoring is necessary. Monitoring is a crucial element to assess the attainment of water quality standards and designated uses, to determine if water quality is improving, degrading, or remaining unchanged, and to assess the effectiveness of implementation activities and the possible need for additional BMPs.

This plan is intended to be used by local agencies, watershed managers, and citizens for decision-making support and planning purposes. The best management practices listed below represent a package of tools that will help achieve water quality goals if appropriately utilized. It is up to land owners, producers, and local conservation professionals to determine exactly how to best implement them. Locally-driven efforts have proven to be the most successful in obtaining real and significant water quality improvements.

The last element of the planning process, which is the implementation of the plan, begins once the goals, objectives, and action statements have been identified. Plan implementation continues through adherence to the goals, objectives, and action statements set forth in this plan. However, it should be emphasized that these goals, objectives, and action statements are not "cast in concrete." While the Watershed Advisory Committee has developed these goals, objectives, and action statements based on the best information available, and the needs/opportunities of the watershed at a point in time, changing needs and desires within the watershed or economy (or Farm Bill) may mean that these goals, objectives, and action statements will need to be re-evaluated. This plan must remain flexible enough to respond to changing needs and conditions, while still providing a strong guiding mechanism for future work.

<u>Don Williams Lake Watershed Goals and Objectives</u>

Goal 1: Reduce non-point source pollution in the Don Williams Lake watershed while maintaining agricultural productivity.

> *Objective 2:* Reduce sediment delivery to Don Williams Lake by 1,195 tons within 10 years, and an additional 397 tons by year 20 for a <u>1,593 ton per year</u> or 65% load reduction. These goals aim to reduce the annual lake loss volume loss from current conditions of 1.7 acre feet of loss per year to 0.6 acre feet per year. (These goals were calculated using NRCS soil loss and sediment delivery documentation and soil weights from the 2005 Don Williams TMDL.)
>
> > *Task 1:* Target restoration activities at eroding stream bank locations.
> > *Task 2*: Target conservation practices on priority upland areas within the watershed.
> > *Task 3:* Implement conservation practices on publically owned land within the watershed.

Goal 2: Deliver information and education activities to ensure the public understands the benefits of lake/watershed improvement activities.

Objective 1: Encourage adoption of conservation practices.

Objective 2: Provide awareness to watershed stakeholders and visitors of their role in protecting the water quality of Don Williams Lake through posters, signage, web postings, mailings, and educational meetings.

Task 1: Utilize demonstrations, field days, outreach workshops, and one to one contacts.

Task 2: Disseminate the results of activities online, through conventional media outlets, and watershed awareness days.

Task 3: Conduct periodic follow-up surveys with landowner/producers; conduct surveys on 5-year watershed plan update cycle.

Goal 3: Document sediment loading reductions to Don Williams Lake.

Objective 1: Implement a water monitoring plan to measure water quality trends and to determine if progress is being made on water quality improvements.

Objective 2: Analyze yearly water monitoring results to verify and identify 'hotspots' regarding local resource concerns.

Objective 3: Utilize the Iowa Sediment Delivery Calculator to estimate sediment load reductions resulting from practice implementation and gauge progress towards reaching Goal 1.

Objective 4: Work with partner agencies to map lake volume every five years to determine if WMP goals are being achieved.

9. BMP Targets and Load Reduction

Best management practices (BMPs) are part of the foundation for achieving water quality goals. BMPs include practices and programs that are designed to improve water quality and other identified resource concerns. BMPs may include changes in land management or land use, physical structures to mitigate against pollutant sources, or changes in human behavior or attitudes about the resources in the watershed and how they are perceived or valued. (*From Watershed Management Action Plan – Iowa DNR, 2009*). Efforts are made to encourage that BMPs are long-term (e.g. – re-enrollment of CRP acres) but this is often dependent upon land tenure, commodity prices, and other market trends that may potentially compete with conservation efforts.

It is important to identify all BMPs needed to achieve the goals of the watershed project. From an initial list of potential practices, the number of practices was narrowed down to those that were the most acceptable to watershed stakeholders. When selecting and implementing BMPs it is important to identify if the practice is feasible in a given location (e.g. – are the site features suitable or does it match stakeholder values). It is also important to determine how effective the practice will be at achieving goals, objectives, and targets.

Load reductions are important to measure the success of watershed improvement efforts and track progress towards reaching TMDL recommendations. The following load reductions have been identified for the Don Williams Lake watershed. Table 9 highlights specific conservation practices that will be used to meet load reduction goals.

Sediment: The current TMDL load capacity for allowable sediment delivery to Don Williams Lake is 11,600 tons per year. Based on current watershed assessments, gully erosion, and upland sediment delivery the total estimated sediment delivery to Don Williams Lake is 2,473 tons per year. This total is well below the allowable load capacity identified in the TMDL. This watershed management outlines a 1,593 ton reduction (65%) over a 20-year timeframe.

The approach for this watershed management plan is a “maintenance” strategy that will employ the use of several BMPs that are targeted to reduce load reductions, and improve the quality of Don Williams Lake.

Potential riparian and upland practices identified as possible implementation/program strategies within Don Williams Lake Watershed:

Table 9. Summary of Best Management Practices.

Upland practices	Overall Goal (Acres/Practices)	Erosion Target Type	Source Control or Trap	Erosion Reduction (tons/year)	Delivery Ratio	Sediment Reduction to Lake (tons/year)	
Nutrient management	7,000	NA	Source Control	0	NA	0	
Residue & Tillage Mgmt, No-till Strip-Till[1]	7,000	Sheet and rill erosion	Source Control	9,388	4%	347	
Cover crops[1]	2,000	Sheet and rill erosion	Source Control				
Grassed Waterways	50	Ephemeral gullies	Source Control	638	35%	223	
Filter Strip *(could be enrolled under CRP)*	10	Sheet and rill erosion	Trap	20	4%	1	
Riparian, In-Stream, Edge of Field Practices							
Water and Sediment Control Basin	20(#)	Sheet and rill erosion	Trap	NA	NA	50	
Grade stabilization structure (parkland)	3(#)	Gully erosion	Trap	NA	NA	44	
Pasture Management	100	Streambank erosion	Source Control	35	90%	32	
Streambank/bed & Shoreline Protection	2,000 (ft)	Streambank erosion	Source Control	299	90%	269	
Shoreline		Shoreline Erosion	Source Control	30	100%	30	
Lakeside Buffer *(golf course)*	4	None	Source Control	0	0%	0	

Other Riparian, In-Stream, Edge of Field Practices							
Channel bed stabilization	2,000 (ft)	Streambank erosion	Source Control	418	90%	376	
Streambank stabilization; 2-stage ditch design *(drainage district maintenance)*	2,000 (ft)	Streambank erosion	Source Control				
Silt dam *(upper end of lake)*[2]	1	All sources	Trap	NA	NA	221	
Total						1,593	

[1] Cover crops and tillage management were modeled in combination

[2] Modeled assuming all watershed practices are in place and a 20% trapping efficiency

[3] Sediment load reductions were calculated using IDNR and NRCS methods for soil loss and sediment delivery. The RUSLE model was used to estimate load reductions resulting from in-field practices (cover crops, tillage management, etc), the NRCS sediment delivery method was used to calculate reductions from trapping practices (sediment basins, filter strips, etc) and the NRCS Direct-Volume Method was used to calculate reductions from in-stream practices (Streambank and shoreline stabilization).

References:

The Iowa State-Wide Trace Element Soil Sampling Project: Design and Implementation. Iowa DNR, June 2010.
Erosion and Sediment Delivery. NRCS, March 1998.

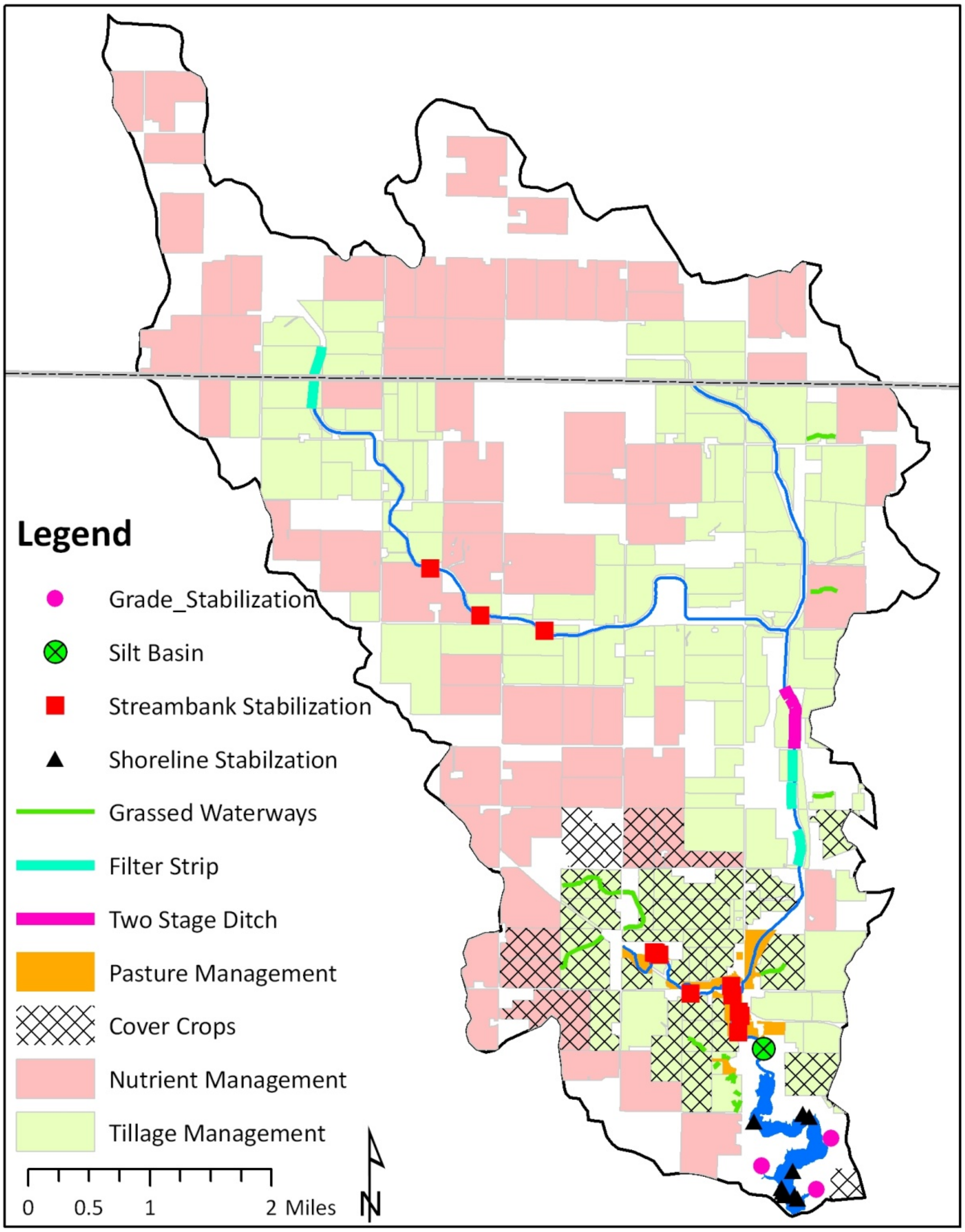

Figure 26. Ideal BMP placement scenario.

Targeted areas were identified based on location within the watershed, proximity to the stream, and areas identified during assessment activities. From the watershed drainage network generated from LiDAR data (see Figure 7), those areas draining to pot-holes (closed basin) are targeted for nutrient management. Other field locations near the stream are targeted for tillage management. Grade stabilization structures, filter strips, streambank stabilization, and other practices were identified and targeted during field assessment activities.

10.Water Quality Monitoring Plan

Water monitoring is an important tool to assess progress in any watershed improvement project. This section describes recommendations/needs for future monitoring actions for documenting water quality improvements from watershed plan implementation.

Site locations

In-Lake: Two sites will be monitored in-lake; DW-Ambient and DW-Beach. Figure 21 shows these locations. The beach site will be monitored weekly through the DNR beach monitoring program. DW-Ambient will be monitored by Iowa State University 3 times per year by the DNR's ambient lake monitoring program. Additional IOWATER monitoring locations are also included. The IOWATER sites are sampled on an as-scheduled basis.

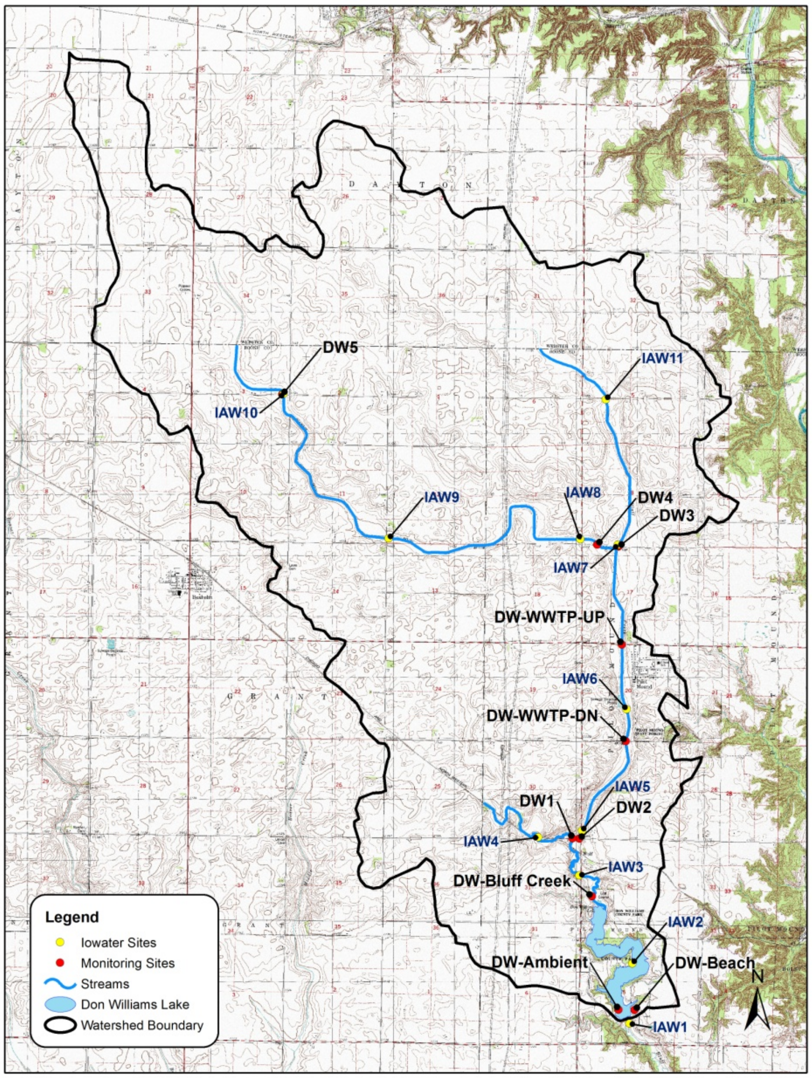

Figure 27. Monitoring locations

Tributary: Eight stream and tributary sites have been identified to potentially be monitored depending on available funding; DW-Bluff Creek, DW1, DW2, DW-WWTP-UP, DW-WWTP-DN, DW3, DW4, and DW5.

Frequency
In-Lake: Monthly (April – October)

Tributary: Twice per month (April – October) and grab samples during a maximum of 5 storms events during the sampling season.

Parameters
In-Lake: Total suspended solids, total fixed suspended solids, total phosphate, orthophosphate, Secchi depth (field), dissolved oxygen (field), temperature (field), pH (field), and turbidity (field).

Tributary: Total suspended solids, total , total phosphate, orthophosphate, dissolved oxygen (field), temperature (field), pH (field), and turbidity (field).

Lab Analysis Budget (one sampling season using 2011 dollars)
In-Lake:

Table 10. In-lake monitoring.

Parameter	Cost per Sample	# of Sites	# of Samples	Total Cost
Total Suspended Solids	$13	2	7	$182
Total Fixed Suspended Solids	$26	2	7	$364
Total Phosphate Orthophosphate	$26	2	7	$364
			Shipping Estimate	**$140**
			Total	**$1,050**

Table 11. Tributary monitoring.

Parameter	Cost per Sample	# of Sites	# of Samples*	Total Cost
Total Suspended Solids	$13	8	19	$1,976
Total Phosphate Orthophosphate	$26	8	19	$3,952
			Shipping Estimate	**$300**
			Total	**$6,228**

*Assumes 5 storm events are collected.

11.Phased Implementation Schedule, Load Reductions and Milestones

Below is a phased approach for implementing the Don Williams Lake watershed management plan. This implementation schedule is intended to serve as a reference tool to recognize tasks that are scheduled for the upcoming year, and to help focus the necessary resources for the current phase of the project. The implementation schedule should be adaptable and updated on regular basis due to shifting priorities, new opportunities, and expected delays.

Table 12. Implementation schedule.

Goal 1	Reduce non-point source pollution in the Don Williams Lake watershed while maintaining agricultural productivity	**Phase 1**			**Phase 2**			**Phases 3&4**		
		Years 1-5			**Years 5-10**			**Years 10-20**		
Objectives 1&2	Reduce sediment delivery to the lake.	**Units**	**Sediment Reduction (tons)**		**Units**	**Sediment Reduction (tons)**		**Units**	**Sediment Reduction (tons)**	
	Nutrient management (590)	*2,800 ac*	0		2,100 ac	0		2,100 ac	0	
	Residue & Tillage Mgmt, No-till Strip-Till (329)	*2,800 ac*	139		2,100 ac	104		2,100 ac	104	
	Cover crops (340)	*800 ac*			600 ac			600 ac		
	Grassed Waterways (412)	*20 ac*	89		15 ac	67		15 ac	67	
	Filter Strip (393)	*4 ac*	.4		3 ac	.3		3 ac	.3	
	Water and Sediment Control Basin (638)	*8*	20		6	15		6	15	
	Grade stabilization structure (410)	*3*	44							
	Pasture Management (528/512)	*40*	13		30 ac	10		30 ac	9	

		a *c*								
	Streambank & Shoreline Protection (580)	*800 ft*	108		600 ft	81		600 ft	80	
	Shoreline		12			9			9	
	Conservation Cover (327)	*4 ac*	0							
	Channel Bed Stabilization (584)	*800 ft*	150		600 ft	113		600 ft	113	
	Streambank stabilization; 2-stage ditch	*800 ft*			600 ft			600 ft		
	Silt dam	*1*	221							
Goal 2	Deliver information and education activities to ensure the public understands the benefits of lake/ watershed improvement activities	**Phase 1 (Years 1-5)** **Unit (yr)**			**Phase 2 (Years 6-10)** **Unit (yr)**			**Phases 3&4 (Years 10-20)** **Unit (yr)**		
Objective 1	Encourage adoption of conservation practices	Continuous; Implement Outreach/ Education plan (yearly)			Continuous; Implement Outreach/ Education plan (yearly)			Continuous; Implement Outreach/ Education plan (yearly)		
Objective 2	Provide awareness to watershed stakeholders; education and outreach	Continuous; Conduct landowner/ producer follow-up survey with plan update (every 5 years)			Continuous; Conduct landowner/ producer follow-up survey with plan update (every 5 years)			Continuous; Conduct landowner/ producer follow-up survey with plan update (every 5 years)		
Goal 3	Document sediment reductions to Don Williams Lake	**Phase 1**			**Phase 2**			**Phases 3&4**		
Objective 1	Implement a water monitoring plan to measure water quality trends and to determine if progress is being made on water quality improvements	Continuous			Continuous			Continuous		

Table 13 shows the sediment load reductions and resulting in-lake improvements. The in-lake improvements have been expressed as the reductions to the annual loss of volume. Based on current sediment loading estimates Don Williams Lake is losing 1.7 acre feet of volume per year. If all proposed BMPs were implemented the annual lake volume loss would be reduced to 0.6 acre feet per year. Lake mapping (bathymetry) will occur on a five year interval and will be used to determine if the volume reductions are being achieved.

Table 13. Milestones.

WMP Phase	Sediment Load to Lake (tons/year)	Annual Sediment Load Reduction (tons/year)	Annual Lake Volume Loss[1] (cubic feet/year)	Annual Lake Volume Loss (acre feet/year)	Reduction in Annual Lake Volume Loss (from Current Conditions)
Current Conditions	2,473	0	76,092	1.7	0%
End of Phase 1	1,677	796	51,588	1.2	-32%
End of Phase 2	1,277	1,196	39,302	0.9	-48%
End of Phase 3 & 4	880	1,593	27,077	0.6	-64%

[1] Calculated using 65 pound per cubic foot specific weight from 2005 TMDL

12. Public Outreach/Education

Results from past research indicate the producers' actual behavior patterns must be brought into the design of both best management practices and implementation strategies for water quality programs. (Dinnes, 2002). To effect changes in behavior there must be strategies in place to direct education and outreach to the target audience. Many obstacles to the adoption of conservation practices may be overcome by providing adequate education, outreach, and awareness of how land management practices influence non-point source losses to surface water resources. Knowledge becomes awareness, which may then motivate changes in behavior.

As with any watershed project, an education, communication, and outreach program will need to be designed to teach producers and other stakeholders about the resource issues facing Don Williams Lake. The outcome of this education and outreach is to bring attention to what impact their land use and management decisions might be, how they can effectively address those impacts, and what opportunities and innovative solutions exist. The following plan will guide public outreach activities in the Don Williams Lake watershed.

The plan's education component is based on the community based outreach model that has been successfully utilized in other areas of environmental concern such as solid waste management. This model uses a wide variety of educational strategies on an ongoing basis to reinforce the core messages and support continuous improvements.

1. **Plan Goals**

- o Reduce non-point source pollution in the Don Williams Lake watershed while maintaining agricultural productivity.
- o Document sediment loading reductions to Don Williams Lake.
- o Deliver information and education activities to ensure the public understands the benefits of lake/watershed improvement activities.

2. **Target Audiences**

   Who will be needed in order to make changes to the land and water?

   - Landowners (Agricultural)
   - Tenants (Agricultural)
   - Rural residents
   - Managers of publically owned land
   - Iowa NRCS
   - Iowa Department of Natural Resources

   Who will be depended upon to advance this project?

   - Boone County Soil and Water Conservation District
   - Boone County Conservation Board
   - Boone County Landfill /Keep Boone County Beautiful
   - Boone County Board of Supervisors
   - Iowa Department of Natural Resources
   - Iowa NRCS

Who will be needed to communicate plan goals to these people?

- Project partners, community leaders, and stakeholders
    - SWCD Commissioners
    - Boone County Supervisors
    - Boone County Landfill /Keep Boone County Beautiful) personnel
    - NRCS, County Conservation, and other agency personnel
    - Key landowners and agricultural producers
    - Iowa Department of Natural Resources
    - Farm Service Agency (FSA)
- Local agriculture and outdoor groups
    - Pheasants Forever
    - Ducks Unlimited
    - 4-H
    - FFA
    - Farm Bureau
    - Local sportsmen's clubs
- Newspapers
    - Boone News Republican
    - Madrid Register
    - Ogden Reporter
    - Des Moines Register
- Radio
    - KWBG 1590 AM
    - KBGG 98.3 FM

3. Target Audience Outreach Strategy

The following section outlines assumptions regarding target audiences developed during public outreach efforts and input received from watershed stakeholders related to the development of this plan. This does not represent extensive research of the target audience however.

<u>Potential Barriers to Participation</u>

Agricultural landowners/operators/other stakeholders

- Possible reduction in productive agricultural land
- Loss of rental income from placing productive ground into conservation
- Cost of installing and maintaining practices
- Perception of yield loss when adopting new practices; producer takes on the risk
- Reluctant to change current practice implementation
- Concern of working with government employees and programs
- Those in targeted areas not participating in conservation programs
- Increasing commodity prices driving decisions
- Absentee land owner contact and education/outreach efforts

<u>Potential Solutions, Motivators, Incentives or Benefits to Encourage Participation</u>

- Increase cost share rates for targeted conservation practices; identify additional funding assistance programs to help offset costs.

- Educate landowners/producers on how best to minimize loss (e.g. – nutrient management strategies, tillage practices) while still maintaining yields.
- Utilize baseline line data gathered during the watershed planning process to target areas for appropriate land use and agriculture/conservation practices
- Utilize field days, demonstrations, and public meetings to encourage adoption of practices; enlist the support of "farmer leaders" in the watershed that are utilizing targeted conservation practices.

4. Use Research to Develop Outreach Strategy

With knowledge of potential barriers and motivators, education and outreach efforts can be developed around the target audiences' accepted means of receiving information and watershed management education. This includes demonstrations, field days, outreach workshops, one to one contacts, outdoor classrooms for school children, adult educational activities, and traditional media outlets.

<u>Potential outreach strategies</u>

- Develop a Watershed Advisory Committee to assist in plan implementation, outreach, and education efforts.
- Develop an annual outreach plan/schedule that coordinates with key seasons/dates (e.g. – spring planting season) to ensure messages and activities are received by the correct audience.
- Hold additional public meetings to educate stakeholders on status of watershed impairment and implementation efforts identified in the watershed management plan.
- Utilize internet resources to advance watershed plan implementation efforts; utilize internet for education and outreach efforts.
- Utilize producers and other landowners in the watershed that have implemented target practices to encourage adoption of others in the watershed.
- Arrange annual field days to increase awareness of watershed activities, and utilize to help show project progress.
- Identify/develop/seek to secure funding sources to offset the cost of installation practices.
- Identify opportunities to have direct exposure to members of the target audiences and/or one to one conversations with individuals to educate them on the watershed project, targeted areas of concern, cost share options, and other related activities.

5. Specific Community-Based Education Outreach Activities

The following demonstrate some of the current and ongoing community-based activities that will be utilized to support the watershed's core messages and to aid continuous improvements. Surveys will be completed by participants in Environmental Education programs, Celebrate the Lake, Dragoon River Romp, and by campers and Don Williams Park to evaluate impacts of water conservation education on behaviors and attitudes of general public (updated on 4-5 year cycle):

Celebrate the Lake: This event, sponsored by the Boone County Conservation Board, was developed in conjunction with the development of the Watershed Improvement Plan and will become an annual event. The 2011 Celebrate the Lake event had over 100 attendees. A number of learning stations were set up around the lake where people could learn about water quality, history of the lake, canoeing, fishing and proactive farming strategies.

Tales from the River Trail: Quarterly Newsletter (Boone County Landfill/Keep Boone County Beautiful): This quarterly newsletter informs subscribers about ongoing environmental efforts occurring within the Boone County Landfill's service area which includes Boone County.

Dragoon River Romp: The goal of the Dragoon River Romp event is to develop and implement a successful river cleanup program with the ability to: attract other entities, recruit volunteers, and provide environmental and historical education to participants. Many of the recreational opportunities and historic significance within the county owe their fortune to the Des Moines River.

The event encompasses both river-based and land-based cleanup teams. This provides additional opportunity for volunteers to become involved.

This event reinforces our commitment to protecting the environment, raises awareness about relationships of proper solid waste disposal and watershed protection and provides educational opportunities for citizens.

The Des Moines River plays a major role in Boone County and it is imperative that we do everything we can to protect and nurture it. The Dragoon River Romp provides an excellent opportunity to take care of the river and educate volunteers about the importance of their work. The event also provides some much needed publicity and awareness about the need to take care of our river.

Environmental Education Programs:

Canoeing (All ages; 2 to 3 hours) Fall=8; Spring=6
One of the best ways to explore Boone County is by canoe. In this program we talk about water safety, water conservation practices, and how to canoe. Students will also learn about different life jackets, paddles, river maps, and other gear when out on the water. If the schedule allows, youth can paddle at Don Williams Lake , Dickcissel Park, Jay Carlson Park, or can do a canoe float down the Des Moines River.

Fish Iowa (4th – 8th; 1 to 3 hours) Spring=3
This program was started by the DNR to help educate youth on the basics of fishing. We will cover knot tying, basic equipment, bait, how to cast, and how to practice catch and release. This program can occur at Don Williams or Dickcissel County Parks. Other activities: Fish Jeopardy, Bass—Minnow, Fashion a Fish, and Fish Identification. Ice Fishing is also possible in January.

Get Hooked on Fishing (3^{rd} grade and older; 3 hours) annually Spring=2
Students go fishing and learn about basic fishing tackle and fishing skills. Emphasis is placed on water conservation, proper handling of bait fish, and the importance of purchasing fishing licenses. These fishing clinics for kids are a joint effort between Iowa State University/Boone County Extension and Outreach, IDNR Fish IOWA program, and the Boone County Conservation Board.

Mobile Watershed Education Training

This unique and innovative learning experience that can be set up at any location. The Mobile Watershed Education Center (MWEC) includes both technology based and hands-on learning opportunities encouraging the importance of protecting our watersheds.

Stream Table (4th—8th grades; 1 hour) Fall=2; Spring=4

The stream table model shows the efforts of bank stabilization, cut bank erosion, channelization, sedimentation of rivers, and the natural meandering process of rivers.

Enviroscape Watershed Model (4th—8th grades; 1 hour) Fall-1; Spring=4

We all live in a watershed with water pollution. Learn about nonpoint and point source pollution and how it affects our watershed and impacts our quality of life. This table top model can be set up inside your classroom, in the school yard or on a field trip.

The Incredible Journey of Water (3rd - 8th grades;1 to 2 hours) Fall=2; Spring=2

Where will the water you drink this morning be tomorrow? Students will describe the movement of water within the water cycle. They will also identify the state of water as it moves through the water cycle in this hands-on game.

IOWATER Monitoring (5th grade and up; 1-3 hours) Fall=2; Spring=4

Water quality is one of our state's top environmental concerns. Students can collect chemical/physical, biological and habitat assessments of a local stream in Boone County. Data collected will be entered in the IOWATER database. Besides the responsibility of collecting data properly such as nitrites, nitrates, phosphate and dissolved oxygen it's just a lot of fun getting wet and dirty.

Outdoor Classroom (3^{rd} & 4^{th} grades) Annually Fall=1; Spring=1

In the fall and spring all the 3^{rd} grade and 4^{th} grade classes in Boone County are invited to attend the Outdoor Classrooms. The Outdoor Classrooms consist of a day of hands-on learning activities presenting by professionals in the community. There are eight stations ranging in topics from, wildlife, geology, water conservation, environmental responsibility, and outdoor recreation.

6. Evaluation and Measurement of Effectiveness

Annually, the Outreach/Education plan should be reviewed and evaluated to determine if specific activities listed above are being accomplished.

- Meeting attendance and participation (e.g. – Advisory committee, public meetings, other)
- Number of landowners/producers involved in project
- Attendance at field days, demonstration days, community-based outreach activities, other.
- Periodic surveys with landowners/producers; conduct on 5-year watershed plan update cycle.
- Follow-up with directs mailings; phone calls; one on one interviews.
- Copies of news articles published; internet content updated; dates/times of radio and television spots.
- Park and lake usage.
- Evaluation of practice implementation; water quality monitoring information.
- Surveys completed by participants after community-based outreach activities.

13. Resource Needs

Below are costs associated with implementation, and based on current estimates and the amount of BMPs identified above. Potential funding sources are listed with each task along with a total cost estimate. This funding matrix predicts a need for funding from multiple sources to reach the identified goals, objectives, and milestones.

Table 14. Resource needs.

Component	Possible Funding Source(s)*	Phase 1 Year 1-5	Phase 2 Year 5-10	Phase 3 & 4 Year 10-20	Total
Nutrient management (590)	EQIP, 319	$61,600	$46,200	$46,200	$154,000
Residue & Tillage Mgmt, No-till Strip-Till (329)	EQIP, 319	$210,000	$157,500	$157,500	$525,000
Cover crops (340)	EQIP, 319	$42,400	$31,800	$31,800	$106,000
Grassed Waterways (412)	CRP	$52,000	$39,000	$39,000	$130,000
Filter Strip (393)	CRP	$856	$642	$642	$2,140
Water and Sediment Control Basin (638)	EQIP, POL, WPF, WSPF	$28,000	$21,000	$21,000	$70,000
Grade stabilization structure (410)	EQIP, POL, WPF, WSPF	$75,000	-------	-------	$75,000
Pasture Management (528/512)	EQIP, 319	$3,280	$2,460	$2,460	$8,200
Fence (382)	EQIP, 319	$3,156	$2,367	$2,367	$7,890
Watering Facility (614)	EQIP, 319	$6,000	$2,000	$2,000	$10,000
Streambank & Shoreline Protection (580)	319, LRP, WPF	$40,000	$30,000	$30,000	$100,000
Conservation Cover (327)	EQIP, 319	$856	-------	-------	$856
In-stream structures	319, WPF, POL	$2,000	$1,500	$1,500	$5,000
Streambank stabilization ; 2-stage ditch design	319	$20,000	$15,000	$15,000	$50,000
Silt dam	319	$200,000			
Salary and Benefits	319, WSPF	$250,000	$250,000	$500,000	$1,000,000
Indirect Costs		Included	Included	Included	
Equipment & Supplies		Included	Included	Included	
Travel & Training		Included	Included	Included	
Education and Outreach	319	$25,000	$25,000	$50,000	$100,000
Water Monitoring	DNR	$36,390	$36,390	$72,780	$145,560
Total		**$1,056,538**	**$660,859**	**$972,249**	**$2,689,646**