One Hundred Two River – 10240013
8-Digit Hydrologic Unit Profile

Introduction

The One Hundred Two River Rapid Watershed Assessment (RWA) provides initial estimates of where conservation investments would best address the resource concerns of landowners, conservation districts, and other community organizations and stakeholders in Iowa. These assessments help landowners and local leaders set priorities and determine the best actions to achieve their goals to conserve and improve soil and water resources.

Physical Description

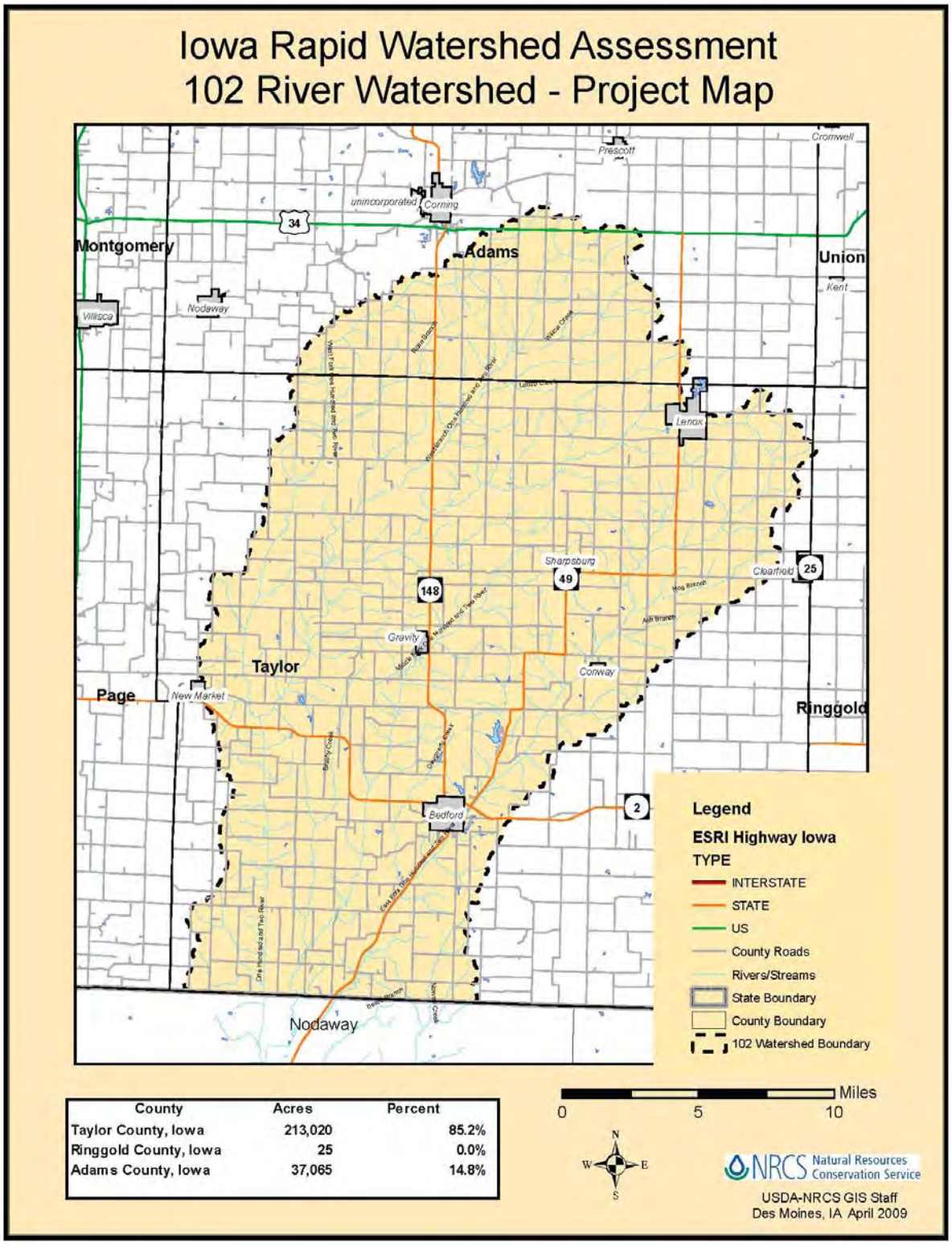
The One Hundred Two River 8-Digit Hydrologic Unit Code (HUC) watershed contains 496,987 acres (*1)* of which 250,116 acres are located in Iowa. Eighty-five percent of the watershed is in Taylor County, 15 percent in Adams County, and less than one percent in Ringgold County, (*1)*. Ninety-eight percent of the watershed is privately owned agricultural land, 0.5 percent is publicly owned, and the remaining 1.5 percent is split between municipal areas and private conservation areas (*2)*.

Fifty percent of the watershed is in cropland, 35 percent is pasture or hayland, 7 percent is woodland, and 8 percent is split between water, wetlands, natural areas, and developed/urban areas (*3)*.

Elevations range from 1,011 feet to 1,331 feet (*4)*. The average watershed slope is 6.7 percent (5). The primary Land Capability Class in the watershed is class 3. The Land Capability Class (LCC) breakdown for the watershed is: 1.6 percent in class 1; 29.5 percent in class 2; 48.7 percent in class 3; 18 percent in class 4; and the remaining 2.2 percent is split between classes 5, 6, 7, and 8 (*6*). Rainfall ranges from 35 to 37 inches per year (*7)*. The HUC includes no interstate highways, one US highway (34), and three state highways (2, 49, and 148) (*8)*.

Conservation assistance is provided by three Soil and Water Conservation Districts (SWCD) and Natural Resources Conservation Service (NRCS) field offices located in Adams, Taylor, and Ringgold Counties. Southern Iowa Resource Conservation and Development (RC&D) Office also provides assistance to the watershed. A USDA Service Center office locator is found at http://offices.sc.egov.usda.gov/locator/app

Physical Description (continued)



County	Acres	Percent
Taylor County, Iowa	213,020	85.2%
Ringgold County, Iowa	25	0.0%
Adams County, Iowa	37,065	14.8%

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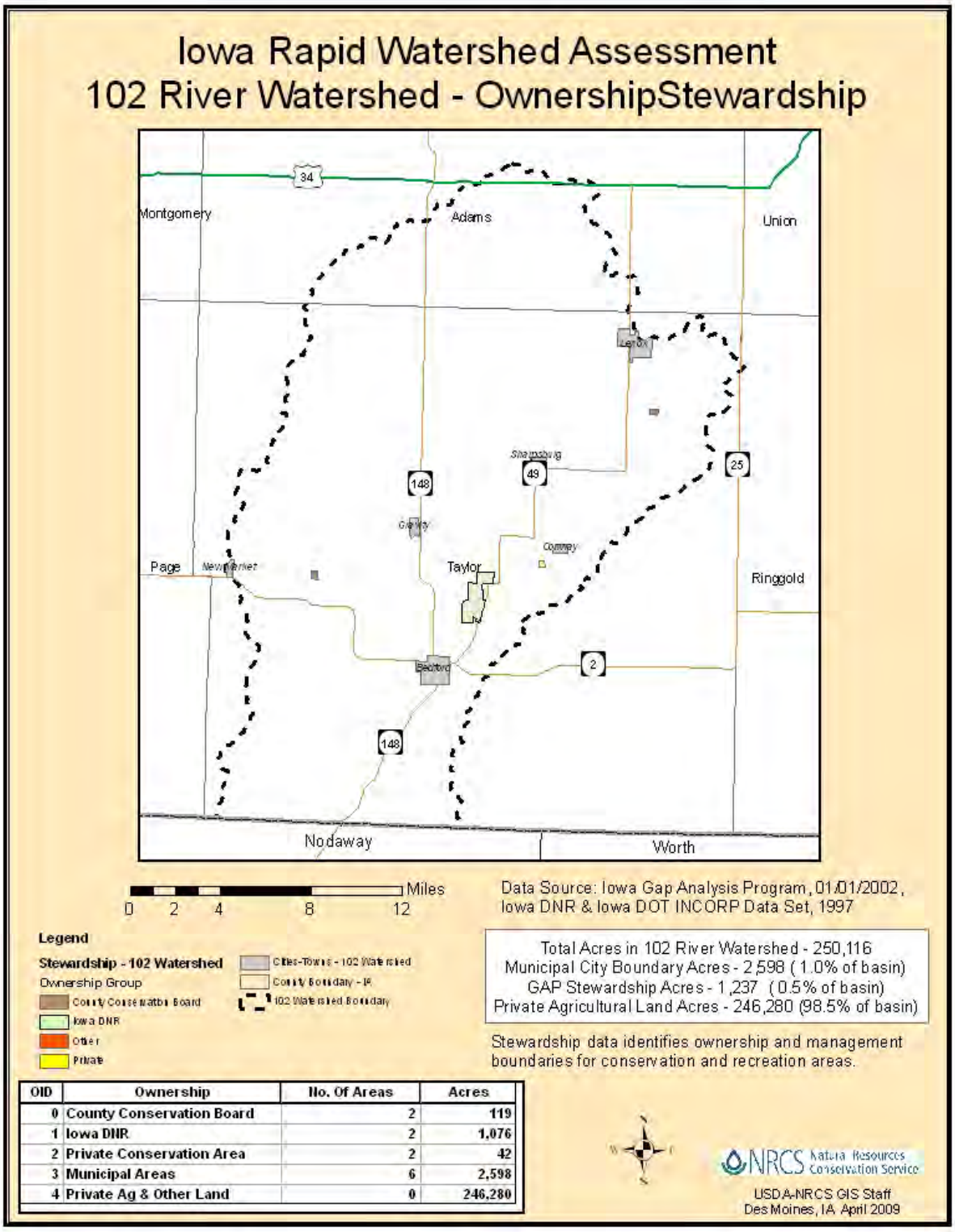

OID	Ownership	No. Of Areas	Acres
0	County Conservation Board	2	119
1	Iowa DNR	2	1,076
2	Private Conservation Area	2	42
3	Municipal Areas	6	2,598
4	Private Ag & Other Land	0	246,280

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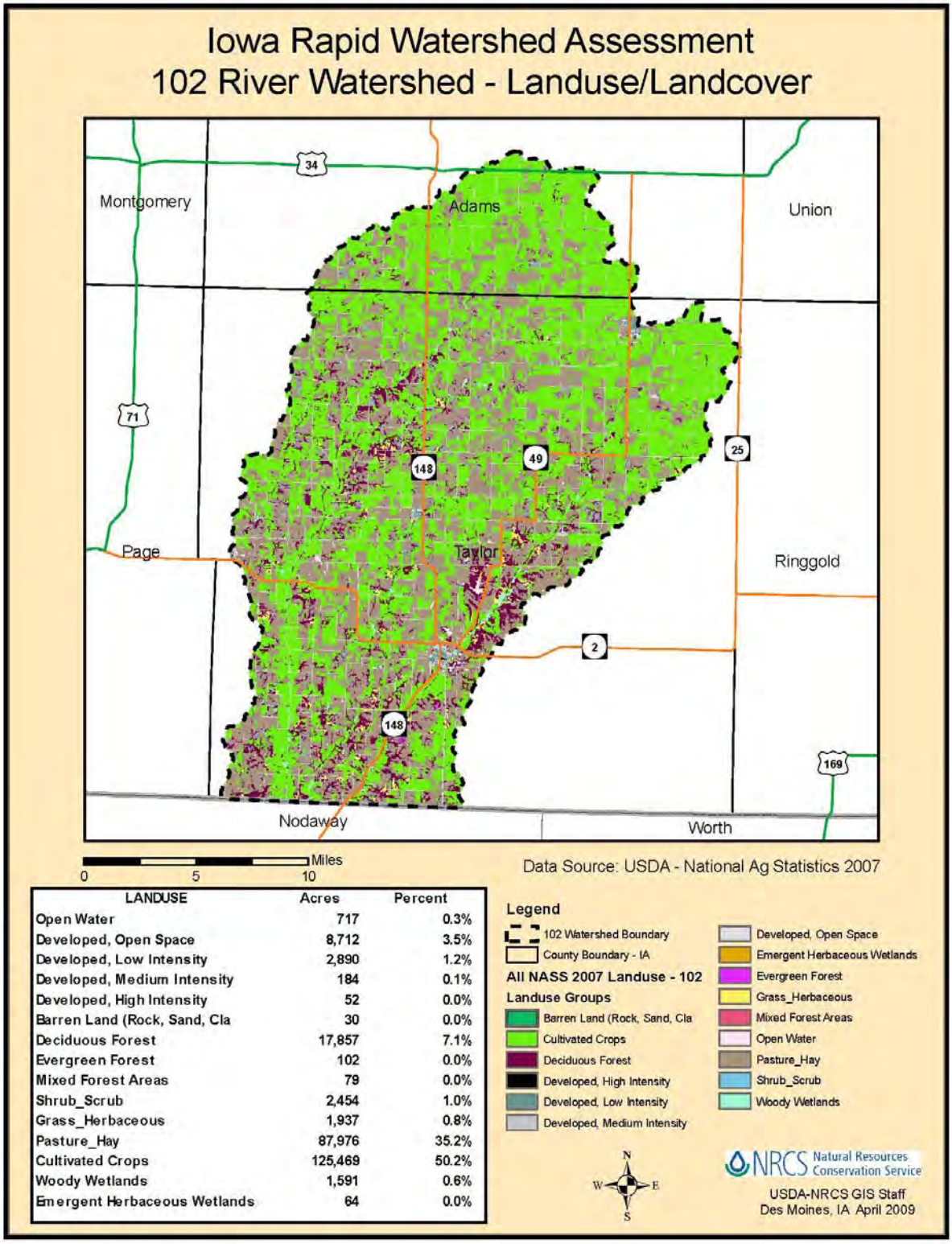
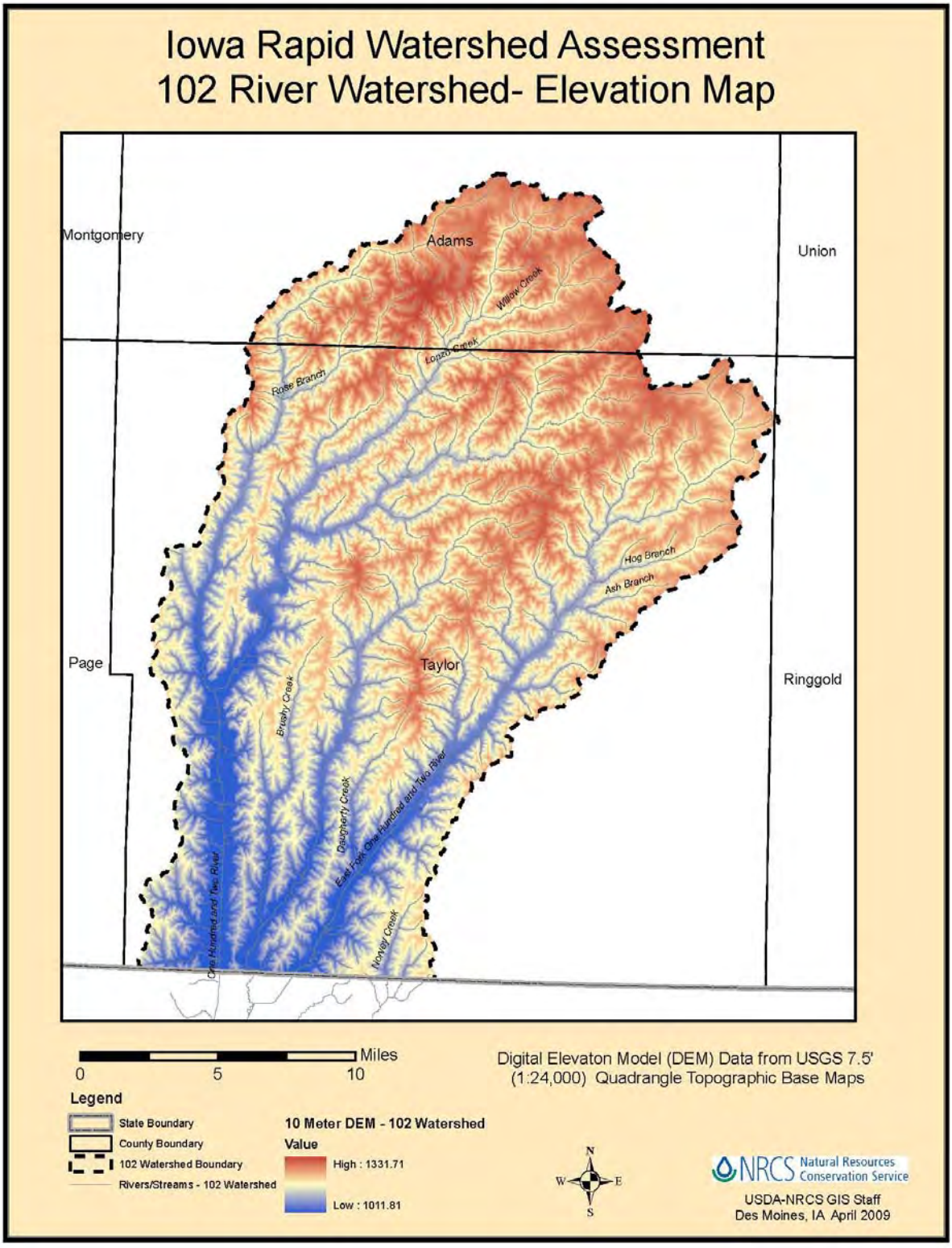


LANDUSE	Acres	Percent
Open Water	717	0.3%
Developed, Open Space	8,712	3.5%
Developed, Low Intensity	2,890	1.2%
Developed, Medium Intensity	184	0.1%
Developed, High Intensity	52	0.0%
Barren Land (Rock, Sand, Cla	30	0.0%
Deciduous Forest	17,857	7.1%
Evergreen Forest	102	0.0%
Mixed Forest Areas	79	0.0%
Shrub_Scrub	2,454	1.0%
Grass_Herbaceous	1,937	0.8%
Pasture_Hay	87,976	35.2%
Cultivated Crops	125,469	50.2%
Woody Wetlands	1,591	0.6%
Emergent Herbaceous Wetlands	64	0.0%

Physical Description (continued)



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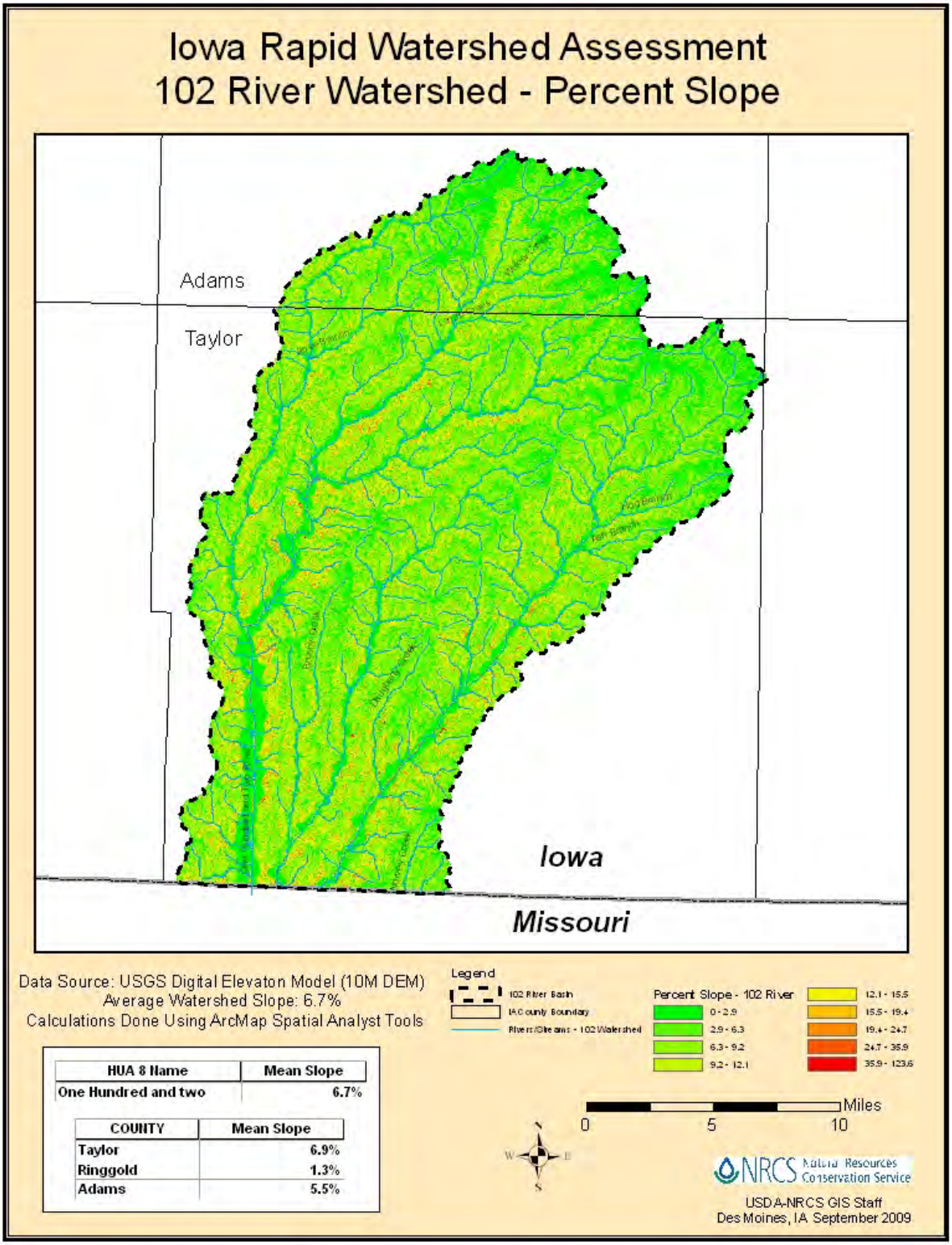
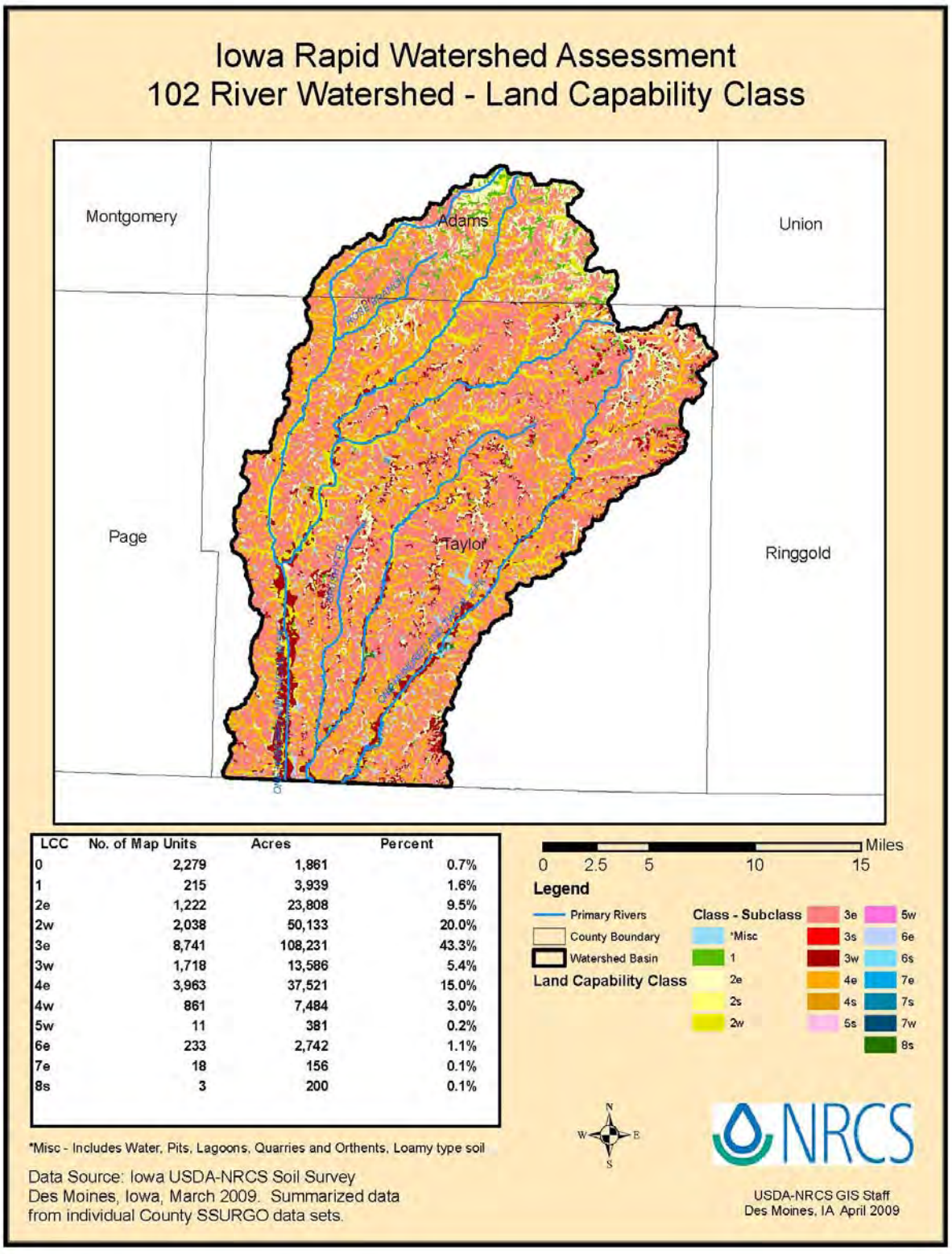


HUA 8 Name	Mean Slope
One Hundred and two	6.7%

COUNTY	Mean Slope
Taylor	6.9%
Ringgold	1.3%
Adams	5.5%

Physical Description (continued)

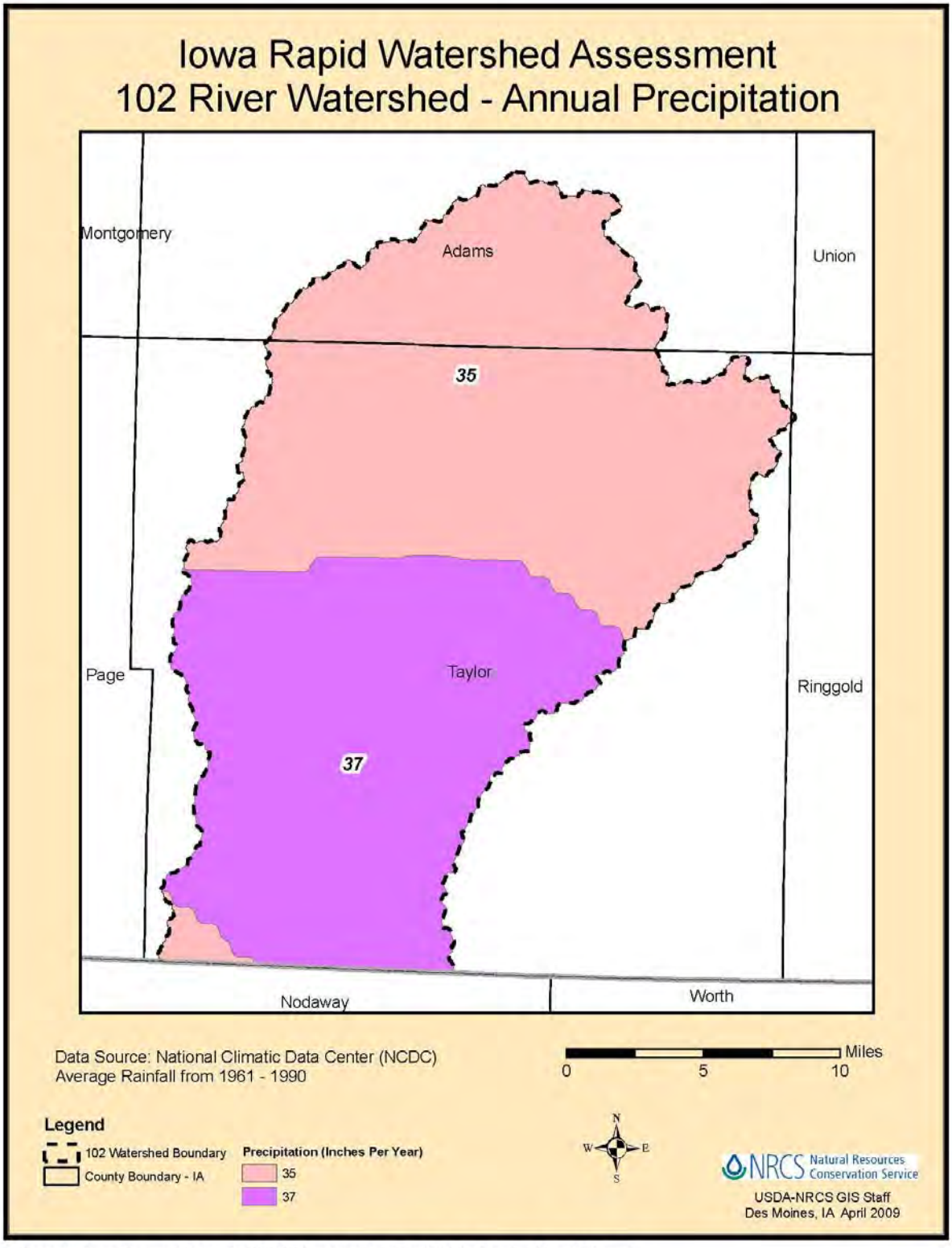


LCC	No. of Map Units	Acres	Percent
0	2,279	1,861	0.7%
1	215	3,939	1.6%
2e	1,222	23,808	9.5%
2w	2,038	50,133	20.0%
3e	8,741	108,231	43.3%
3w	1,718	13,586	5.4%
4e	3,963	37,521	15.0%
4w	861	7,484	3.0%
5w	11	381	0.2%
6e	233	2,742	1.1%
7e	18	156	0.1%
8s	3	200	0.1%

*Misc - Includes Water, Pits, Lagoons, Quarries and Orthents, Loamy type soil

Data Source: Iowa USDA-NRCS Soil Survey
Des Moines, Iowa, March 2009. Summarized data
from individual County SSURGO data sets.

Physical Description (continued)



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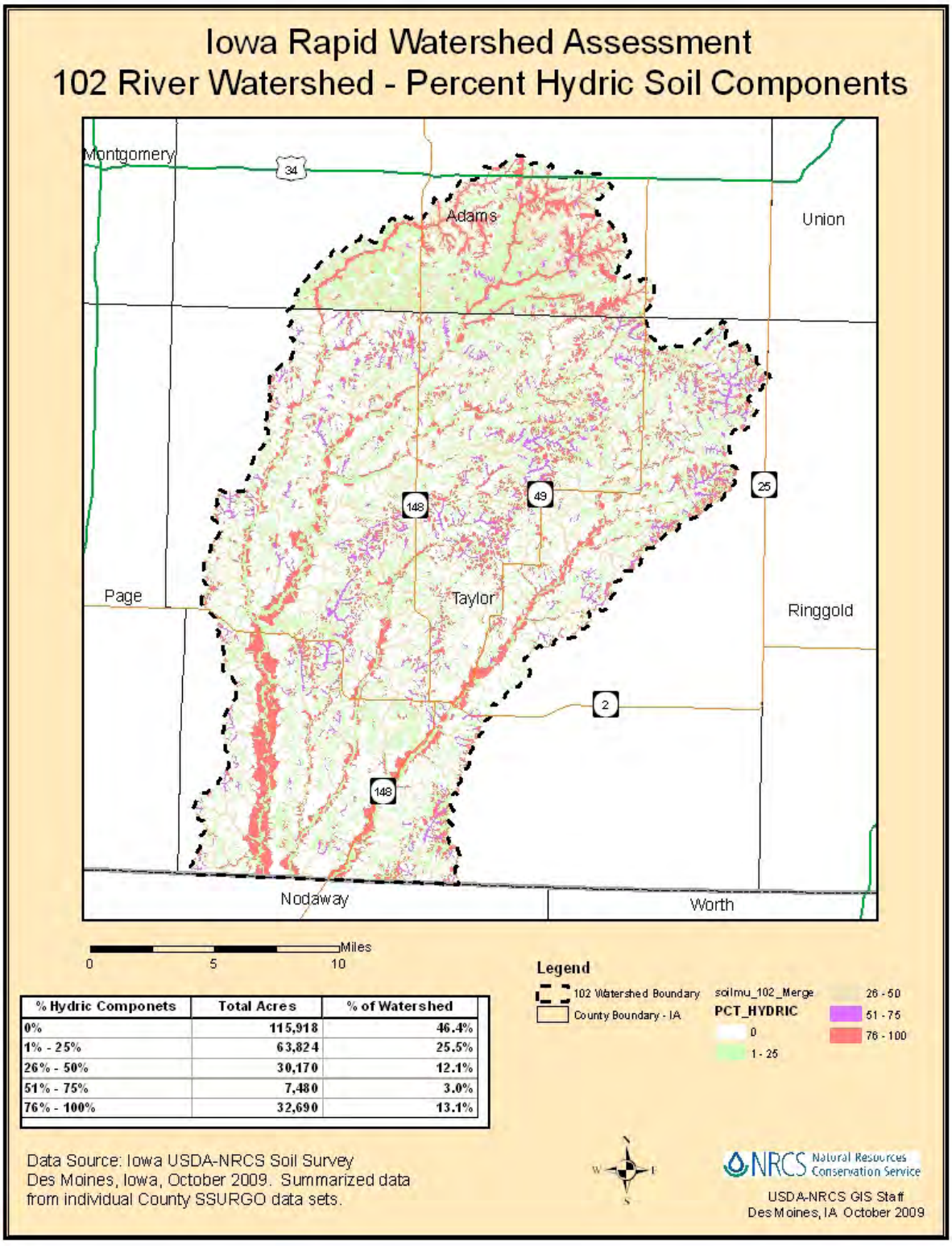
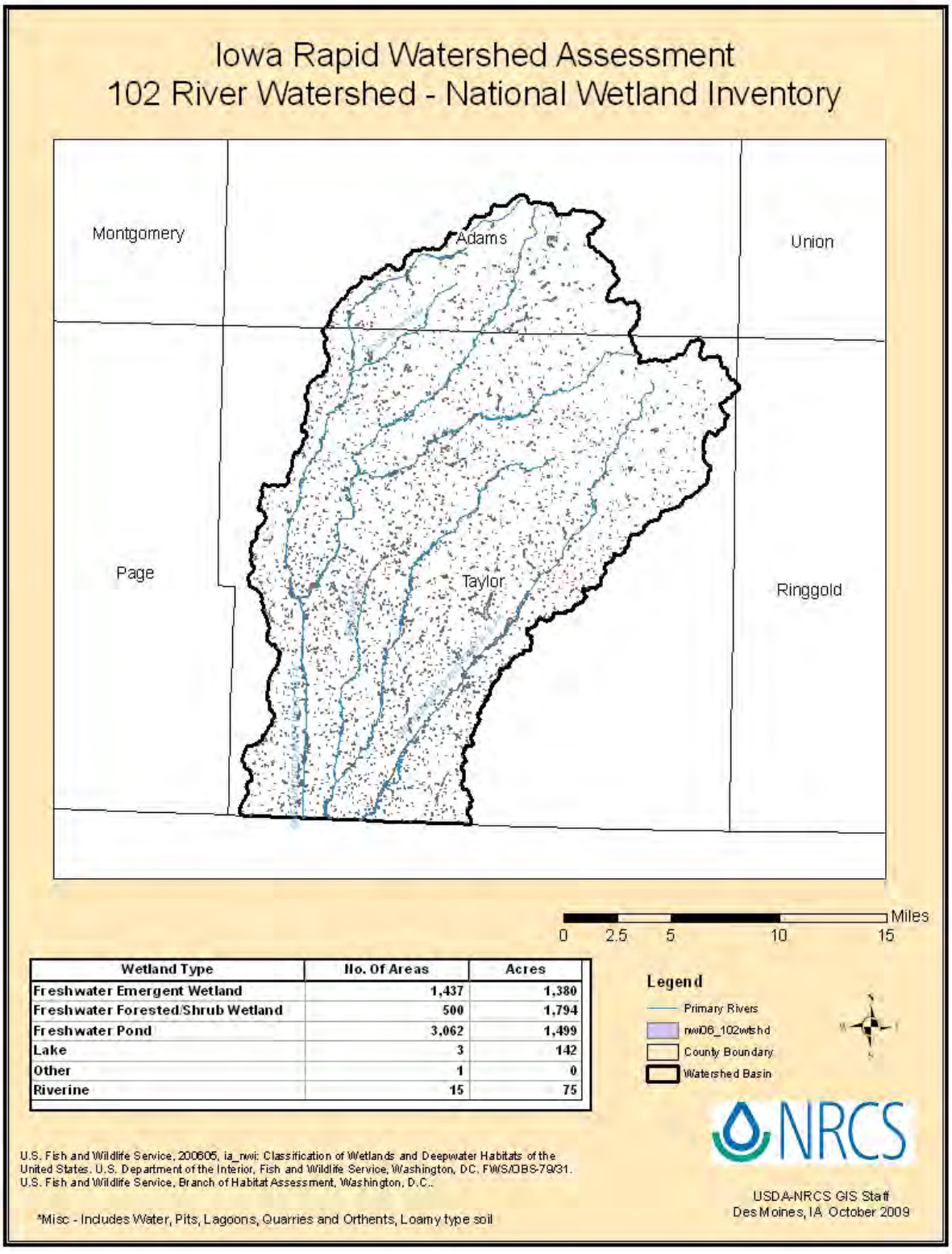


% Hydric Componets	Total Acres	% of Watershed
0%	115,918	46.4%
1% - 25%	63,824	25.5%
26% - 50%	30,170	12.1%
51% - 75%	7,480	3.0%
76% - 100%	32,690	13.1%

Physical Description (continued)

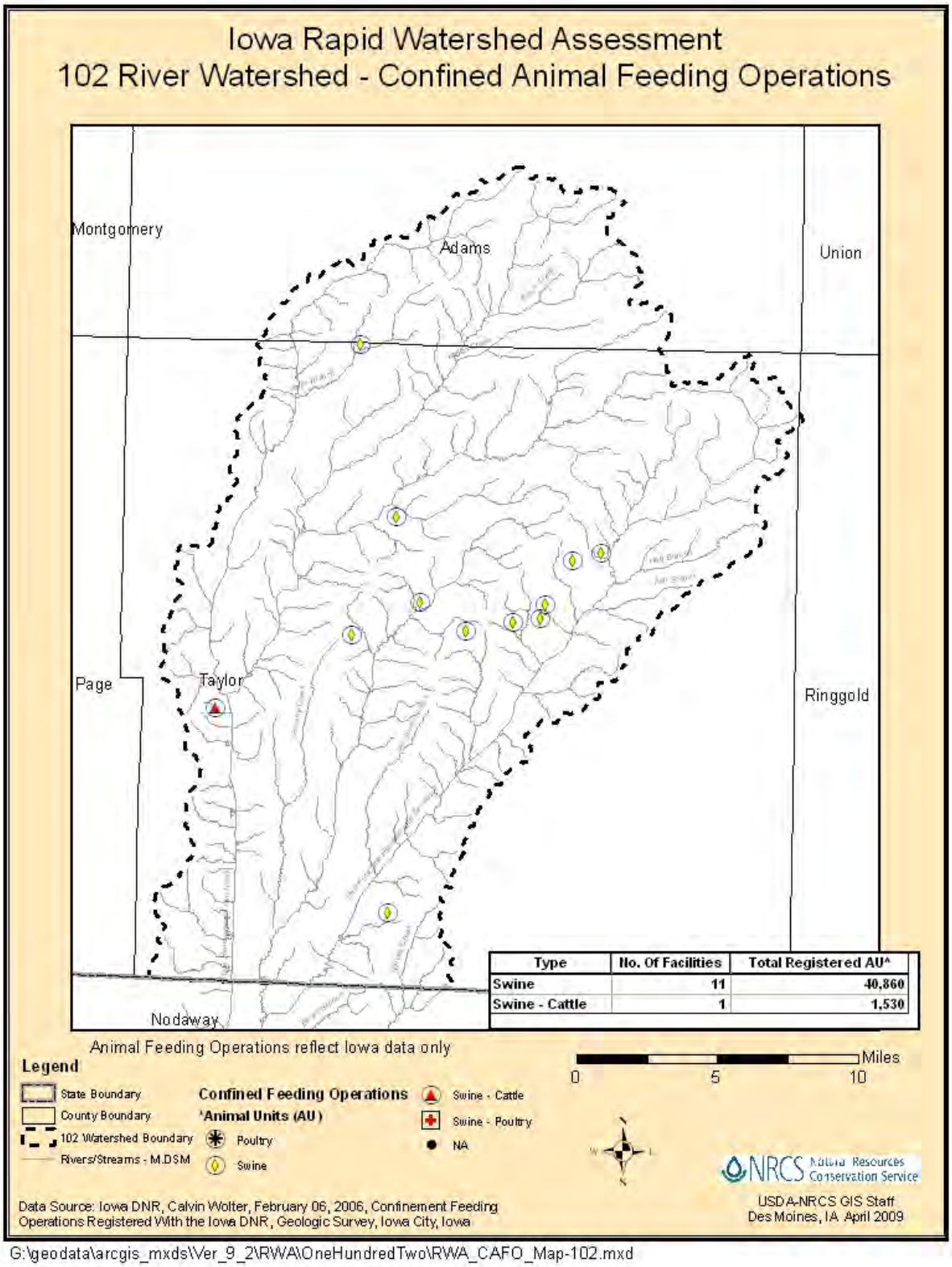


Wetland Type	No. Of Areas	Acres
Freshwater Emergent Wetland	1,437	1,380
Freshwater Forested/Shrub Wetland	500	1,794
Freshwater Pond	3,062	1,499
Lake	3	142
Other	1	0
Riverine	15	75

U.S. Fish and Wildlife Service, 200605, ia_nwi: Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Branch of Habitat Assessment, Washington, D.C..

*Misc - Includes Water, Pits, Lagoons, Quarries and Orthents, Loamy type soil

Physical Description (continued)



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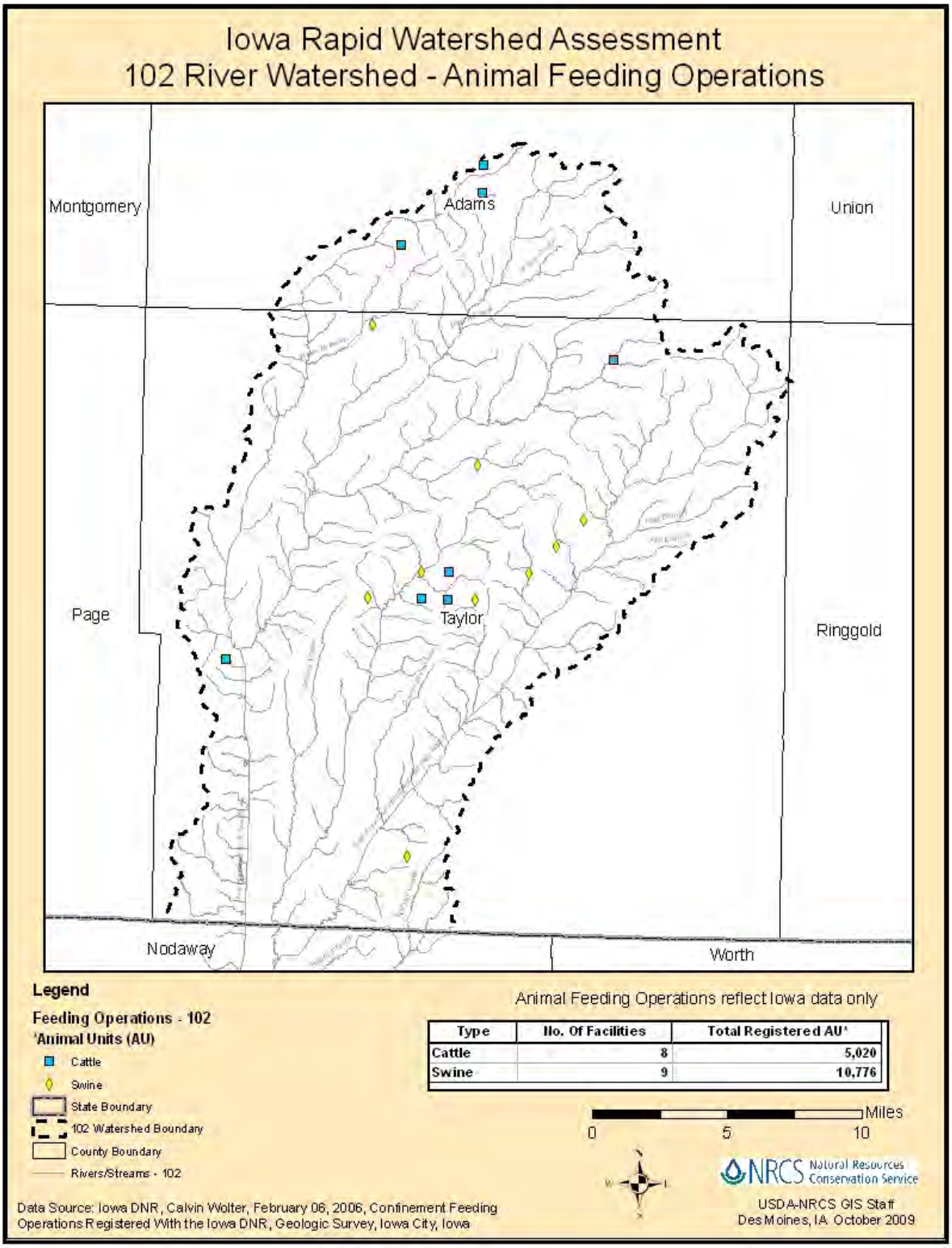
Physical Description (continued



Physical Description (continued)

Common Resource Area

The One Hundred and Two River HUC is located in the National Common Resource Area (CRA) 108D.1 (*13, 14*). A CRA is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA) map delineation or polygon. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a CRA (General Manual Title 450, Subpart C, §401.21) (*13, 14*).

Common Resource Area Description *(13, 14*)

108D.1 Nodaway River Loess Hills and Till: This gently undulating to hilly area incorporates a variety of landscapes but dominantly pre-Illinoisan glacial till with a thin cover of loess. Native vegetation was prairie and timber, spatially associated with the pattern of ridges and valleys. Most of this area is devoted to farming, with row crops on the smoother uplands and broad valley bottoms and with pastures and woodlands on sloping lands. Resource concerns are water erosion, nutrient management, and pasture and woodland management.

For additional information, see http://soils.usda.gov/survey/geography/cra.html.

The National Coordinated CRA Geographic Database provides:

- A consistent CRA geographic database;
- CRA geographic data compatible with other GIS data digitized from 1:250,000 scale maps, such as land use/land cover, political boundaries, Digital General Soil Map of the U.S. (updated STATSGO), and ecoregion boundaries;
- A consistent (correlated) geographic index for Conservation Management Guide Sheet information and the eFOTG;
- A geographic linkage with the national MLRA framework.

Physical Description (continued)

Geology

This watershed is drained by the East Fork, Middle Fork, and West Fork of the One Hundred and Two River in Taylor County, and the continuation of the West Fork and the West Branch of the West Fork of the One Hundred and Two River in Adams County. Named tributaries of the individual forks of the One Hundred and Two River include the Rose Branch, Middle Branch, Brushy Creek, Daugherty Creek, East River, Hog Branch, and Ash Branch. Soils and landforms of the watershed developed in deposits laid down by ice and water during the Pleistocene and Holocene Epochs. The unconsolidated deposits rest on Paleozoic bedrock. These older rocks primarily consist of Pennsylvanian limestones and shales of the Wabaunsee and Shawnee Groups respectively. Bedrock exposure is largely limited only to localized stream and river drainages, or in surface quarries.

The entire RWA occurs within the boundaries of the Southern Iowa Drift Plain landform region. The landscape of the watershed is all glacial in origin. Southwestern Iowa contains some of the most complete Pre-Illinoian glacial stratigraphy in North America. Up to eight Pre-Illinoian glacial advances have been recorded, all older than 500,000 years. Landscape features within the watershed have been shaped by fluvial erosion carving down through the Pre-Illinoian glacial plain. This Quaternary erosion has shaped the landscape into a series of gently to steeply rolling hills and valleys. Elevations in the watershed range from about 1,050 feet to about 1,305 feet.

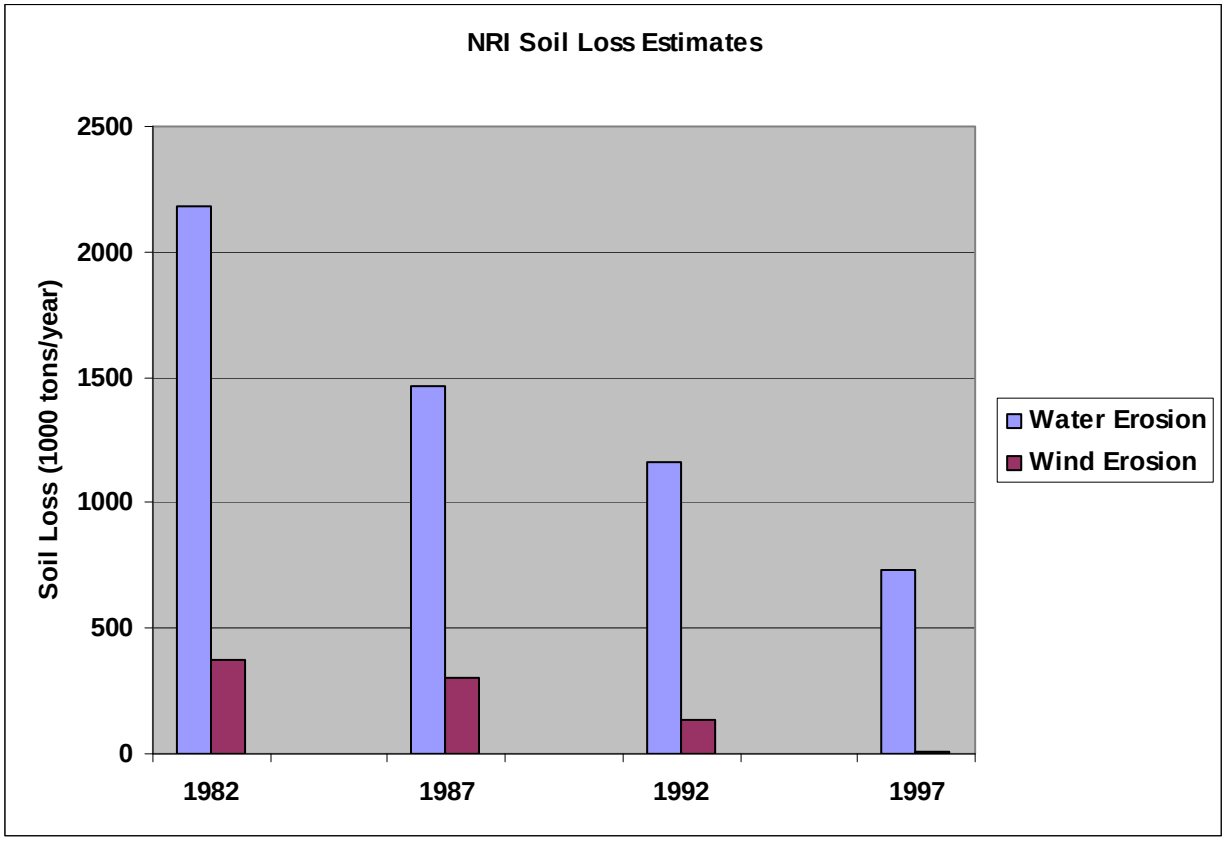
The surficial deposits in the watershed include variable glacial deposits, primarily basal till with lesser abundances of glaciofluvial and glaciolacustrine sediments. Peoria loess is the primary surficial deposits within the watershed, and was deposited as a result of intense periglacial conditions and strong winds during the Wisconsinan glaciation. This wind-blown loess covered the Pre-Illinoian glacial plain, and currently mantles the upland drainage divides in the area. Younger loess-derived deposits of the DeForest Formation occur in stream bottoms and floodplains and were deposited by streams in the last 8,000 years.

Soils are predominantly clay loams, silt loams and silty clay loams formed in glacial till, loess, and loess-derived alluvium. Drainage class of the soils ranges from poorly-drained to well-drained and is largely dependent on landscape position. In general, the upland loess-covered divides and alluvial flood plains are poorly drained, while the gently-sloping upland loess ridges are moderately well-drained to somewhat poorly-drained. Till soils predominantly occur along strongly sloping hillsides, and are generally well-drained.

Soil Loss

Water erosion (sheet and rill) from cropland accounts for nearly 90 percent of Iowa's soil erosion. In Iowa, there has been a steady decline in sheet and rill erosion from 1982 to 1997, but on average soil erosion remains above the sustainable levels. In order to maintain sustainable levels of soil stability, soil erosion should not exceed 5 tons/acre/year *(22)*.

National Resource Inventory (NRI) estimates for sheet and rill erosion by water on cropland and pastureland in the 102 River Watershed in Iowa decreased by approximately 1,447,000 tons (66 percent) of soil loss between 1982 and 1997. NRCS estimates indicate wind erosion rates in this watershed decreased by 372,100 tons (98 percent) between 1982 and 1997 *(22)*.



The percentage of land in the Conservation Reserve Program (CRP) has played an important role in soil loss reduction in the 102 River Watershed. Approximately 15-20 percent of the watershed has been in CRP since 1985.

Water Quality

Under Section 303(d) of the Clean Water Act, states are required from "time to time" to submit a list of waters for which effluent limits will not be sufficient to meet all state water quality standards. The EPA has defined "time to time" to mean April 1 of even numbered years. The failure to meet water quality standards might be due to an individual pollutant, multiple pollutants, "pollution," or an unknown cause of impairment. The 303(d) listing process includes waters impaired by point sources and nonpoint sources of pollutants. States must also establish a priority ranking for the listed waters, taking into account the severity of pollution and uses. The EPA regulations that govern 303(d) listing can be found in the Code of Federal Regulations 40 CFR 130.7.

The Iowa Department of Natural Resources compiles this impaired water list, or 303(d) listing. The 303(d) listing is composed of those lakes, wetlands, streams, rivers, and portions of rivers that do not meet all state water quality standards. These are considered "impaired waterbodies" and states are required to calculate total maximum daily loads (TMDLs) for pollutants causing impairments *(15)*.

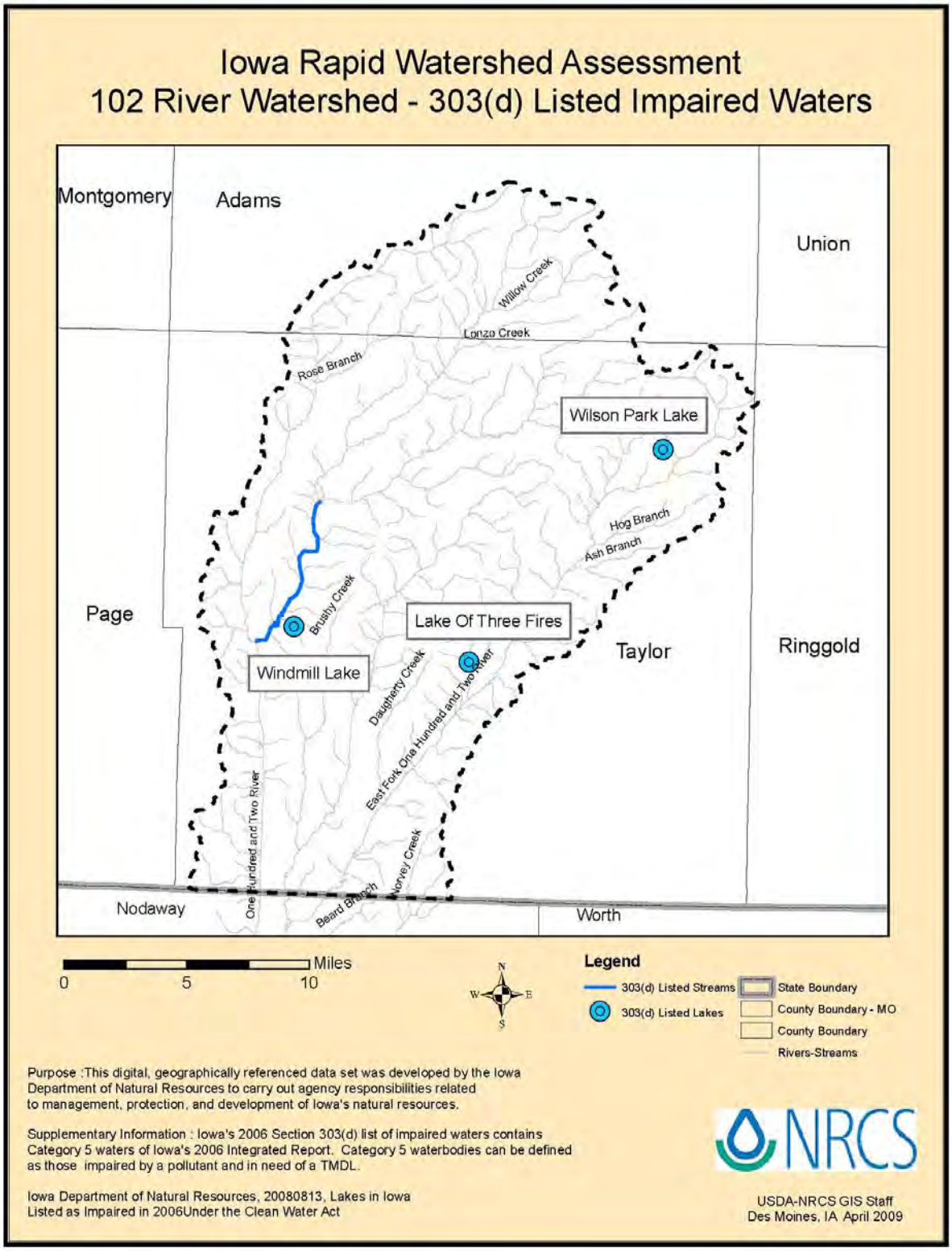
Sediment, nutrients, pathogens, and their affects are the major pollutants impacting surface waters of the One Hundred and Two River Watershed. Surface waters, especially lakes and ponds, have a repeated history of algal blooms. A variety of human activities contribute directly to pollutant loads in the water bodies, including intensive row crop agriculture; urban storm run off; failing septic systems; and Confined Animal Feeding Operations (CAFOs). The change in hydrology due to stream channel straightening, subsurface drainage systems, wetland destruction, and lack of perennial groundcover has resulted in flashy stream flows, thus contributing to stream down cutting and increased stream bank instability.

For more information on water quality and IDNR's Water Quality Index go to the following website: http://www.igsb.uiowa.edu/wqm/wqi/wqi.asp

For more information on water quality and IDNR's Regional Watershed Assessment Tool go to the following website: http://programs.iowadnr.gov/iowawaterweb/rwa.aspx

This assessment tool should be beneficial to watershed stakeholders who are interested in improving water resources at the watershed scale. The first DNR regional watershed assessment covers nutrients. Assessments of other issue areas will follow as they are developed. Note that the text for each HUC-8 assessment is the same, but the data, charts, and maps provided are specific to the individual watershed. For locating the watershed on the website type the watershed name in the "For" box and click on **Go.** This website is a work in progress so not all watersheds and issue areas are completed yet.

Water Quality Continued



Water Quality Continued

Water Quality Concerns Data Graph/Table *(23)*

Impaired Water Bodies	Stream Miles	Sediment & Siltation	Nutrients	PH	Bacteria & Pathogens	Temperature	Turbidity	Flow Alteration	Algae	Other or Unknown
Wilson Park Lake	17 ac			X					X	
Lake of Three Fires	97 ac				X					
Windmill Lake	24 ac			X			X		X	
West Branch One Hundred and Two River	7.6 miles									X

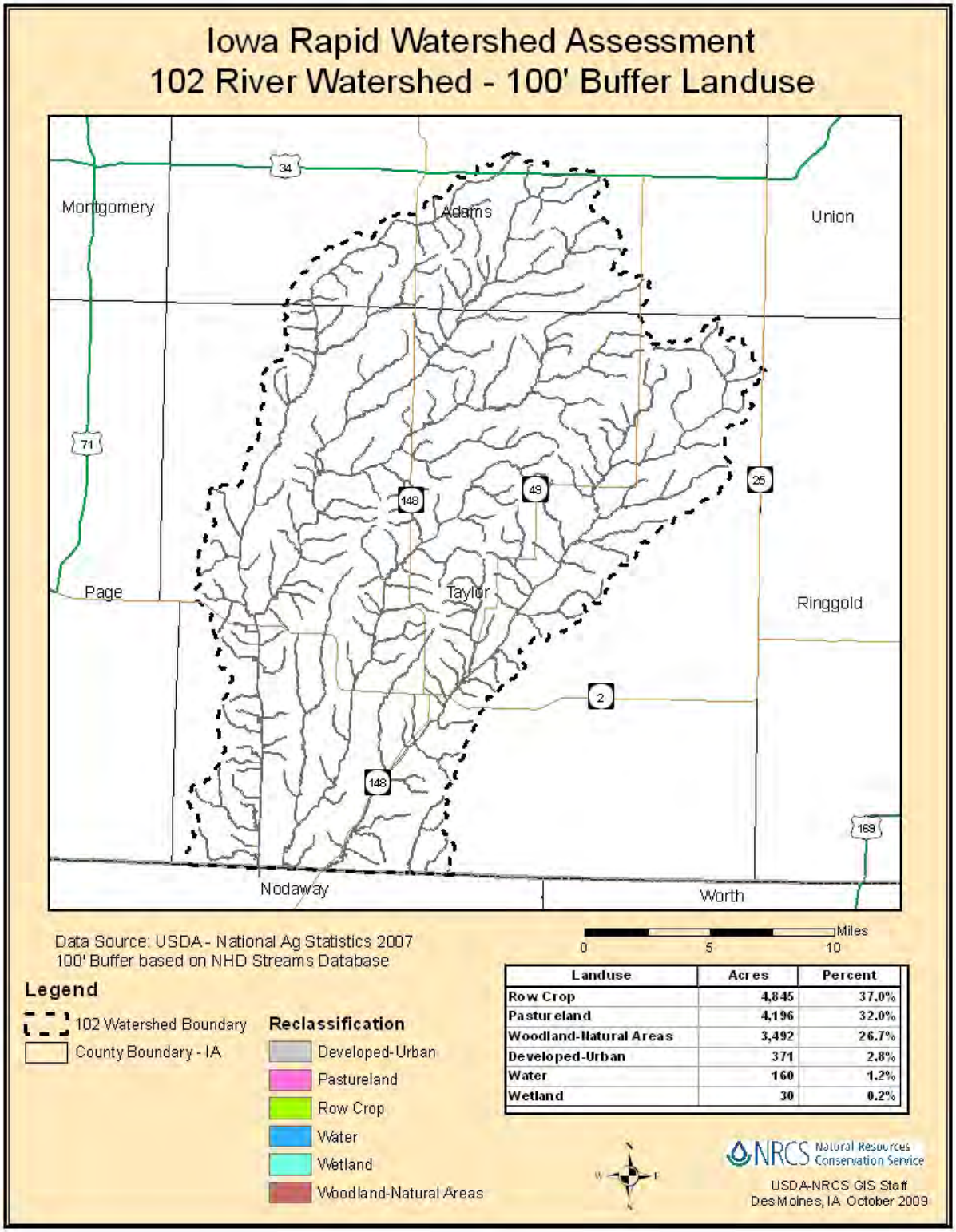
Impaired and TMDL Needed

Other Impairments, TMDL not needed

Impaired, TMDL Complete & Approved

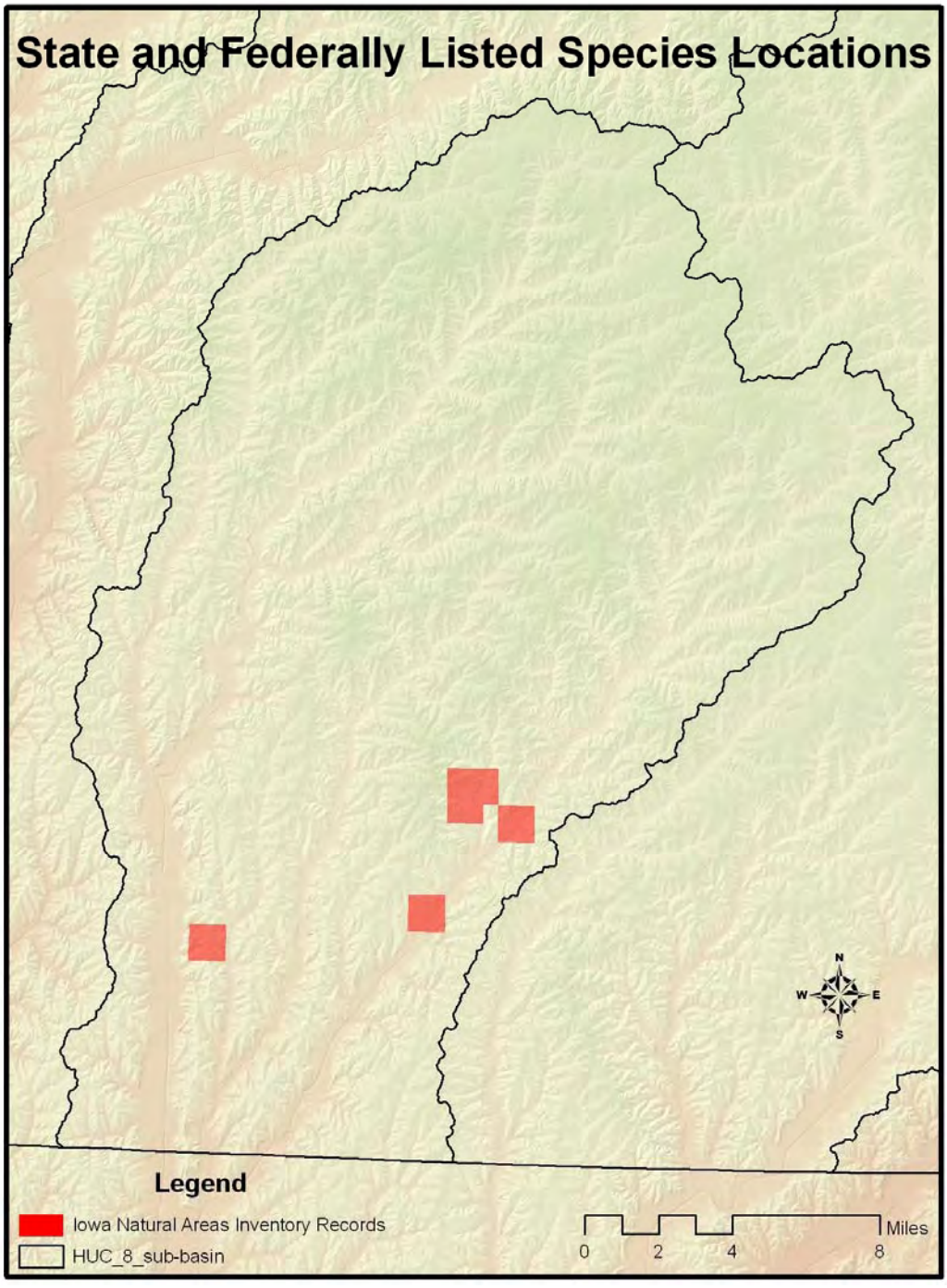
Conservation practices that can be used to address these water quality issues include Erosion Control Structures, Residue Management, Nutrient Management, Riparian Buffers, and Improved Septic Systems *(24)*. For more information on Impaired Water see: http://www.iowadnr.gov/water/watershed/impaired.html

Water Quality Continued



Threatened and Endangered Species

	SPECIES	Status	
		State	Federal
Animals	Bald Eagle (Haliaeetus leucocephalus)	E	
	Smooth Green Snake (Liochlorophis vernalis)	S	
	Topeka Shiner (Notropis topeka)	T	E
	Barn Owl (Tyto alba)	E	
Plants	Earleaf Foxglove (Tomanthera auriculata)	S	
	Spring Avens (Geum vernum)	S	
	Swamp Rose (Rosa palustris)	S	
	Smooth Black-haw (Viburnum prunifolium)	S	
	Bush's Sedge (Carex bushii)	S	
	E = Endangered Species T = Threatened Species C = Candidate/Species of Concern		


State and Federally Listed Species Locations
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W
E
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Iowa Natural Areas Inventory Records
HUC_8_sub-basin
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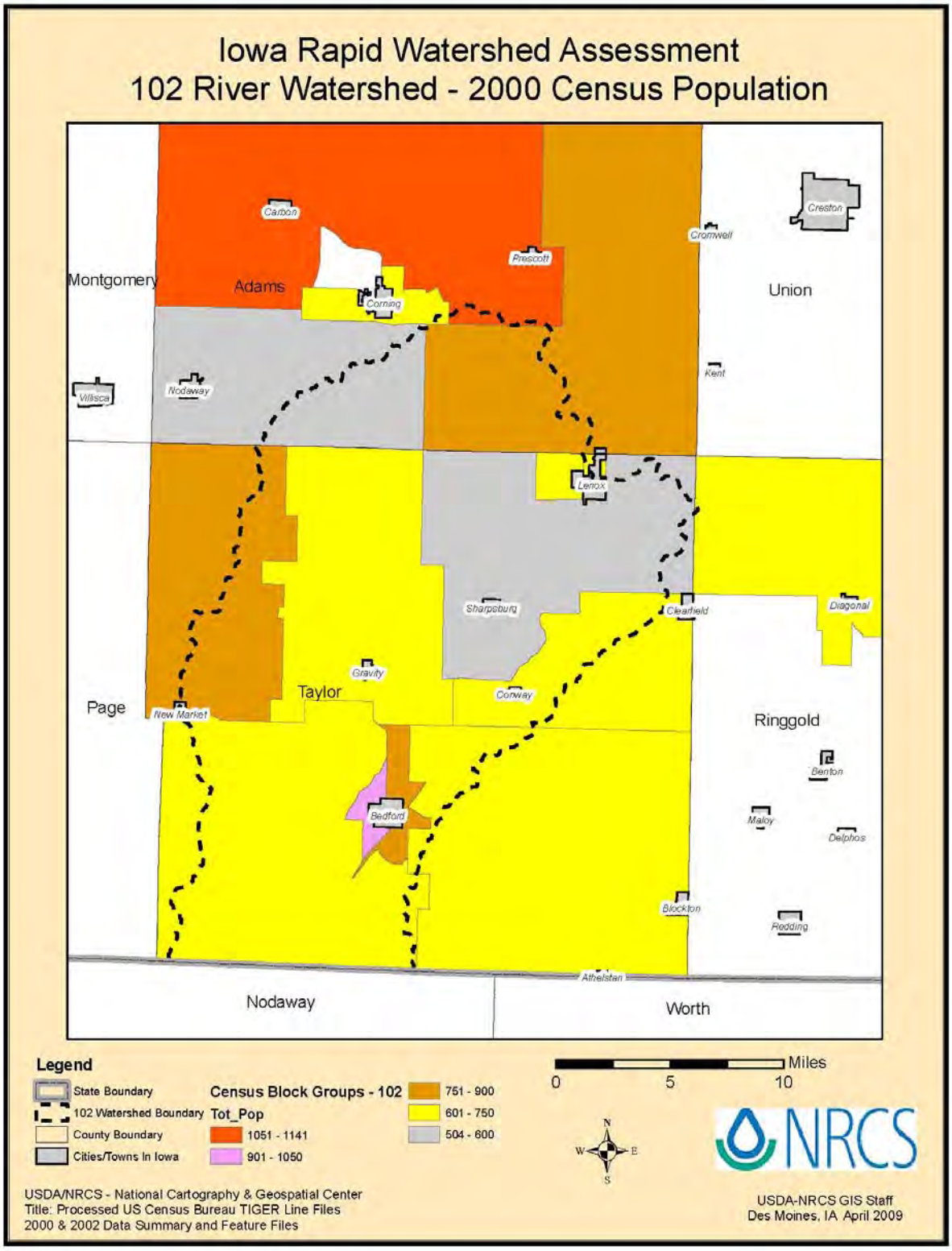
8

Census and Social Data

There are 828 total farm operators in the watershed. Of these, 591 are male and 237 are female. There are 568 principal operators, including 43.8 percent working full time on the farm *(27)*.

There are 568 farms in the One Hundred and Two River Watershed with farm size ranging from one acre to over 1,000 acres. Size of farms: 4.7 percent are 1-9 acres; 13.9 percent are 10-49 acres; 35.6 percent are 50-179 acres; 27.1 percent are 180-499 acres; 11.1 percent are 500-999 acres; and 7.6 percent are over 1,000 acres. The Census of Agriculture is authorized under Public Law (PL) 105-113 and uses the definition of a farm as any place from which $1,000 or more of agricultural products are produced and sold, or normally would have been sold, during the census year *(27)*.

Census and Social Data Continued



Census and Social Data Continued

Total Farms By Size Per County
One Hundred and Two River Watershed

COUNTY	ACRES	PERCENT of COUNTY	1-9 ACRES	10-49 ACRES	50-179 ACRES	180-499 ACRES	500-999 ACRES	>1000 ACRES	TOTAL FARMS
Taylor	213020	62.27	22	69	175	128	51	37	482
Adams	37065	13.61	5	10	27	26	12	6	86
Ringgold	25	0.00	0	0	0	0	0	0	0
TOTAL	250110		27	79	202	154	63	43	568

Data Source: 2007 National Ag Statistics
County numbers obtained by correlating the percent county which lies within the watershed to determine an estimated number (shown in table).

Census and Social Data Continued

NASS Farm Operators
One Hundred and Two River Watershed

COUNTY	ACRES	PERCENT of COUNTY	All Operators	Female Op.	Male Op.	Principal Operators	Full Time Op.	Part Time Op.
Taylor	213020	62.27	709	204	505	485	209	276
Adams	37065	13.61	119	33	86	83	40	43
Ringgold	25	0.00	0	0	0	0	0	0
TOTAL	250110		828	237	591	568	249	319

Data Source: 2007 National Ag Statistics
County numbers obtained by correlating the percent county which lies within the watershed to determine an estimated number (shown in table).

Principal Operators - Person considered to be primarily responsible for managing operations on a farm.
Full Time - Works > 200 Days per year conducting farming activities
Part Time - Works < 200 Days per year conducting farming activities

Resource Concerns

Resource Descriptions by Land Use

Pasture (*16*)

Vegetation typically consists of introduced cool season forage. Predominant species are introduced cool season forages, including Kentucky Bluegrass, Smooth Bromegrass and Tall Fescue, with lesser amounts of Orchardgrass and Timothy. Some introduced legumes are present, with White (Ladino) Clover being the most predominant. Some Red Clover, Birdsfoot Trefoil and Alfalfa are included in lesser amounts. Continuous overgrazing is common. *(16)*

Typically soil erosion as a result of sheet and rill will be less than 1 ton/acre/year. There is evidence of classic gully erosion and stream bank erosion. Stream bank erosion may be more significant in pastures where grazing animals typically have unlimited access to streams. In time, undesirable woody species may invade older pastures and decrease the productivity of the forage. Soil compaction on cattle paths and around watering sources can increase soil erosion and create a niche for undesirable plant species. Forage Quality and Palatability, Inadequate Quantities and Quality of Feed and Forage, and Inadequate Stock Water are other resource concerns in pastures.

Hayland *(16)*

Hayland has been seeded to introduce species, including predominantly Smooth Bromegrass and Alfalfa. There also exist Orchardgrass and Red Clover, to a lesser extent. Erosion is not typically a problem on hayland except during the establishment period. Nutrient and pest management are often under-utilized. Typically, two to three cuttings of hay are taken from May through early September.

Cropland *(17)*

Approximately 75 percent of the cropland is intensively used, primarily for corn and soybeans production, 11 percent oats and hayland as part of a rotation and about 14 percent in the Conservation Reserve Program (CRP). Corn acres increased in recent years, compared to soybean acres, due to increased grain prices caused by the increase in biofuel production.

The average slope is 6.7 percent. Predominant resource concerns on cropland include soil erosion (sheet and rill, and ephemeral gully); organic matter depletion; excessive suspended sediment and turbidity in surface water.

Natural Areas/Woodland *(20)*

Natural areas in Iowa consist mostly of poor quality woodlands, degraded meadow found mostly in odd areas along property corners, fence lines, or abandoned pastures.

Vegetation includes a mix of native trees and shrubs with increasing undesirable populations of introduced and often noxious species of woody or non-woody plants. Predominant resource concerns include invasive species, classic gully erosion, T&E Species: declining species, and species of concern.

Resource Concern Trends

Focus of Past 7 Years of Progress

Efforts in the past seven years have included: promotion of conservation tillage and no-till; promotion of Conservation Reserve Program (CRP) and contract extensions to protect sensitive lands; applying comprehensive nutrient management plans; pest management plans; and water monitoring through IOWATER (Iowa's volunteer water monitoring program).

Resource Concerns that Require Ongoing Attention

The Southern Iowa Rural Water Association (SIRWA) provides rural water to individuals and communities in a seven county area of southern Iowa and northern Missouri (including the entire 102 River Watershed in Iowa). In 2007, SIRWA identified a water supply demand in the year 2027 of 10.4555 million gallons per day (mgd). In contrast, SIRWA projects that it will have an available supply of 5.2875 mgd at that time leaving a shortage of 5.1680 mgd. (*25*)

Soil erosion by water is an ongoing concern, especially on cropland. Ongoing efforts are needed to increase acres utilizing conservation tillage, terraces, no-till, and contoured buffer strips. Limiting factors to conservation practice application include such human issues as lack of knowledge, prohibitive costs, lack of management knowledge and skills, and resistance to changes in crop yield and profitability.

Water quality concerns are increased by manure from livestock that is commonly spread on cropland as fertilizer. Using manure as a fertilizer creates potential water quality challenges from bacteria and nutrients delivered through runoff and subsurface drainage Additional water quality concerns include cattle feedlots and pastures, especially with livestock grazing along streams. Grazing along streams also creates problems with stream bank stability and creates erosion, which is reduced when management restricts cattle access.

There are 12 Confined Animal Feeding Operations (CAFO) in the watershed, with a total of 42,390 animal units. Ninety-two percent of the CAFOs are swine, and 8 percent are cattle. There are 17 Animal Feeding Operations (AFO) in the watershed, with a total number of 15,796 animal units. Fifty-Three percent of the AFOs are swine, and 47 percent are cattle. *(29, 30).* The primary natural resource concerns with animal feeding operations are water and air pollution. Concerns include over-application of manure and associated spills; odor; particulates; and ammonia. Potential air quality issues include: effects on human and animal health; impacts on property values; increased risk of nuisance litigation; and NO and NO^2 pollution.

Other identified resource concerns include flood damage to land, infrastructure damage from degrading stream channels, lack of adequate wastewater facilities, and infrastructure for renewable energy efforts in small towns and unincorporated towns.

There are opportunities for development of alternative and renewable energy resources such as wind, geothermal, biomass, or methane from livestock facilities.

There is a lack of alternative crop production and agricultural diversity, thus decreasing opportunities for positive affects on water quality.

Wildlife habitat and recreational area resource protection and improvement are ongoing concerns. This includes agricultural land and urban/rural lands that have a lack of recreation trails and greenbelts along river systems.

In the state of Iowa, as of November 2008, there were approximately 60 biofuel plants that are in operation or under construction. At this time, the nearest ethanol plant is located at Brooks, a few miles southwest of Corning in Adams County. Estimates shows that it takes 2 - 4 gallons of water for every gallon of biofuel produced. There have been concerns expressed around the state about the effect of increase of biofuel production on future water quantity *(28).*

Resource Concerns Table *(26)*

The table below lists the resource concern/priorities of stakeholders and landowners in the watershed. The concerns were summarized from the Environmental Quality Incentive Program (EQIP) Work Group Plans from Adams and Taylor counties *(26)*

Resource Concerns/Issues by Land Use				
	Specific Resource Concerns/Issues	Cropland	Pasture	Natural Areas/Woodland
Soil Erosion	Sheet and Rill	X		
	Ephemeral Gully	X		
	Classic Gully		X	X
	Streambank		X	X
Water Quality, Surface	Excessive Suspended Sediment & Turbidity	X		
	Harmful levels of Pesticides	X		
	Excessive Nutrients & Organics		X	
	Harmful levels of Pathogens	X	X	
Soil Condition	Organic Matter Depletion	X		
Plant Condition	Productivity, Health, and Vigor		X	
	Forage Quality and Palatability		X	
	Noxious and Invasive Plants		X	X
Domestic Animals	Inadequate Quantity & Quality Feed & Forage		X	
	Inadequate Stock Water		X	
Air Quality	Excessive Greenhouse Gas-CO2	X		
	Undesirable Air Movement	X		
Wildlife	Inadequate cover & shelter			X
	T&E Species: Declining Species, Species of Concern			X

Human Considerations: Implementation of conservation practices and enhancements has the potential for change in management and cost of production. Installation of practices will have an upfront cost and require maintenance. In the short run, increased management may be required as new techniques are learned.

Resource Concerns Table Continued *(26)*

Land may be taken out of production for installation of practices or conversion to other uses, such as wildlife habitat. Long term benefits should result from increased soil health, benefits to water quality, improved domestic livestock, air quality, and wildlife habitat. Other considerations by humans in the watershed may include recreation, rural and urban perceptions, market trends and how they relate to conservation practice costs, profitability, and current high land values.

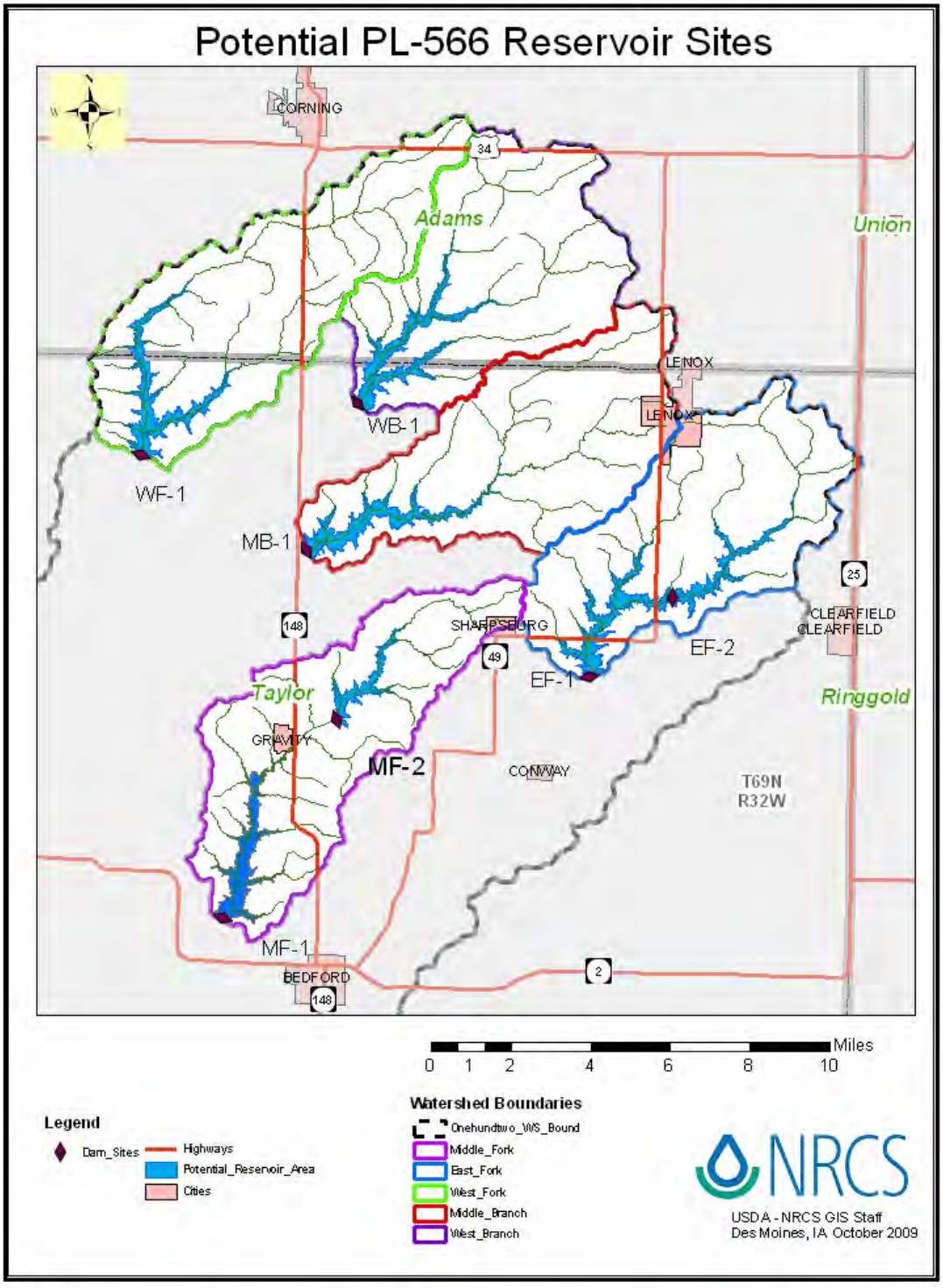
Special Considerations: Use of this Document as a Feasibility Study for the Potential Development of a Water Supply Reservoir

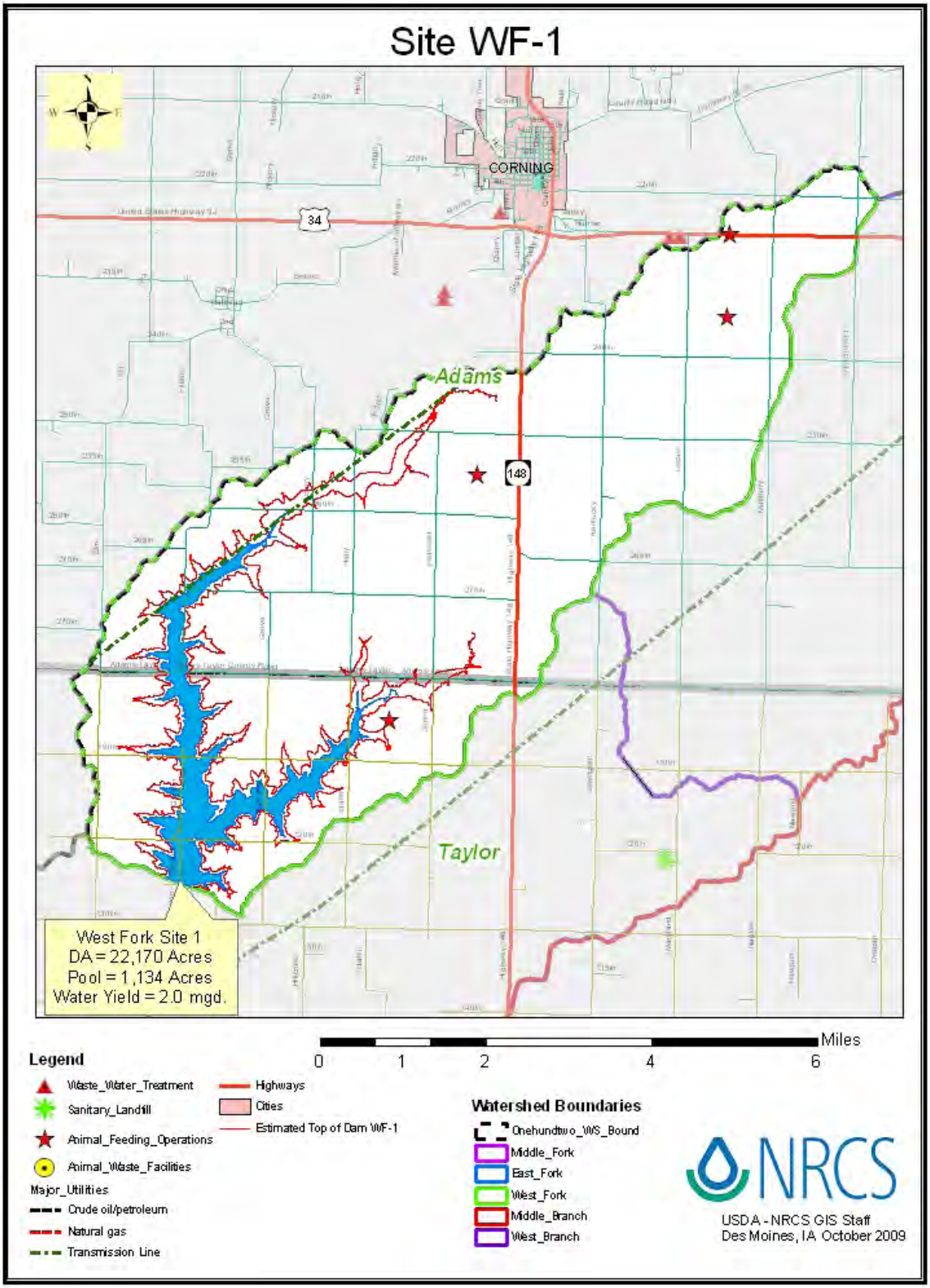
This Rapid Watershed Assessment is also serving as a feasibility study for the development of a surface water supply that would serve Taylor County and surrounding areas. This study was requested by the 102 River Valley Authority (102 RVA).

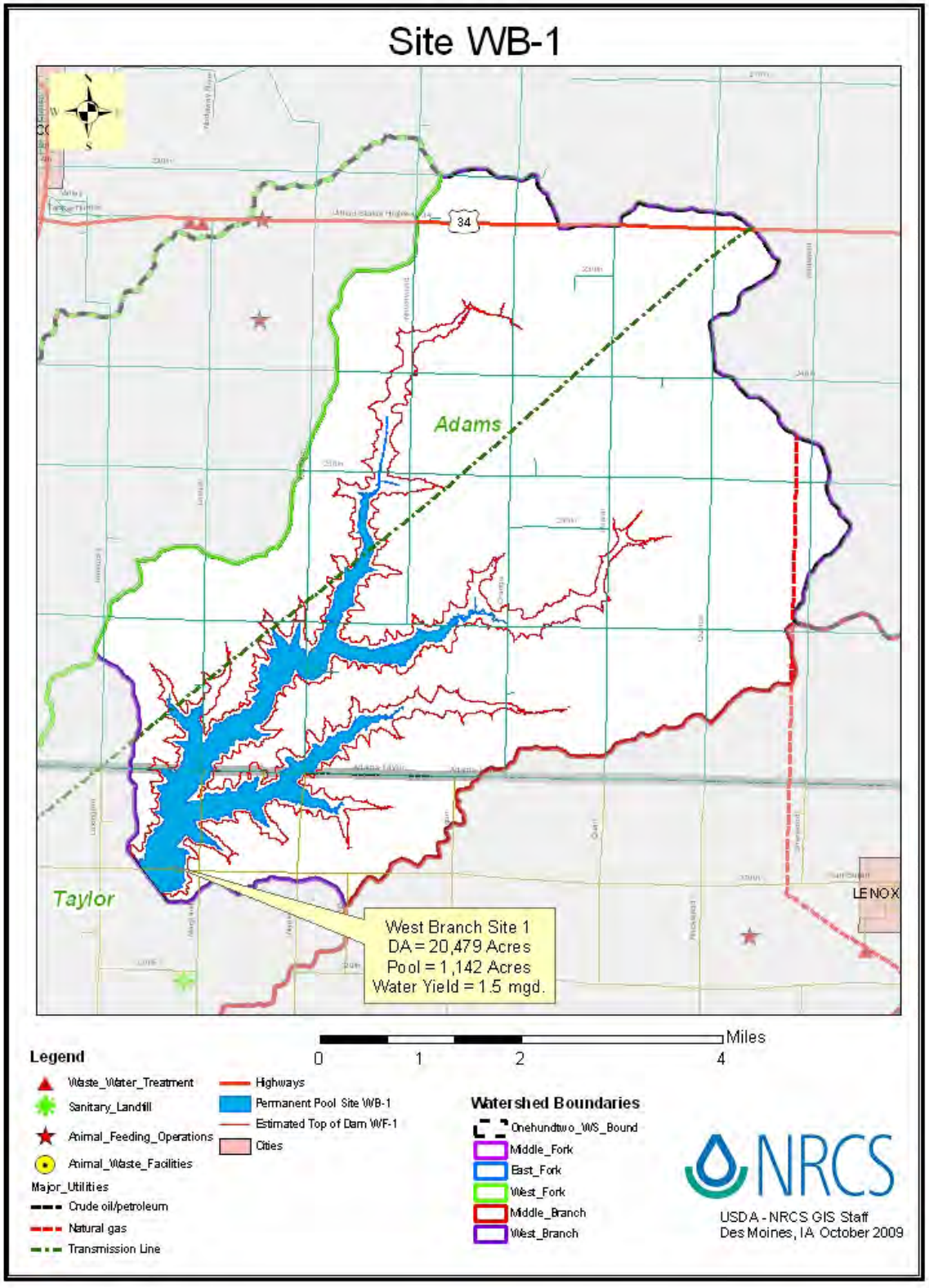
The (102 RVA) hereafter referred to as (Authority) was created by an Intergovernmental Agreement in 2006. Its members (Sponsors) include: Bedford Waterworks Board of Trustees; City of Bedford; City of Blockton; City of Clearfield; City of Conway; City of Gravity; City of Lenox; City of New Market; City of Sharpsburg; Lenox Municipal Waterworks; SIRWA; Taylor County; Taylor County Conservation Board; and the Taylor County Soil and Water Conservation District.

The Authority's purpose is to provide a framework within which local leadership can formulate and implement a comprehensive plan of action for the accelerated development and orderly maintenance of a reservoir to be constructed within Taylor County, Iowa, and to assist with the economic stability and growth of areas served by the sponsors through the following means: reducing flood damages, soil erosion, and sedimentation; maintaining long-term productivity of soil; improving quality and productivity of forest resources; creating a source for municipal, industrial, agricultural, and rural water; improving the quality of wildlife habitat for the species evaluated; and providing outdoor recreational opportunities.

The following maps identifies potential locations and yields for a water supply reservoir in the 102 River Watershed in Taylor County. For further details see feasibility report in the Appendix A. The environmental effects of installing a water supply reservoir see Appendix B.




Site WF-1
CORNING
34
148
Adams
Taylor
West Fork Site 1
DA = 22,170 Acres
Pool = 1,134 Acres
Water Yield = 2.0 mgd.
Miles
0 1 2 4 6
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Cities
Estimated Top of Dam WF-1
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
USDA - NRCS GIS Staff
Des Moines, IA October 2009


Site WB-1
34
Adams
Taylor
LENOX
West Branch Site 1
DA = 20,479 Acres
Pool = 1,142 Acres
Water Yield = 1.5 mgd.
Miles
0
1
2
4
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Permanent Pool Site WB-1
Estimated Top of Dam WF-1
Cities
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
USDA - NRCS GIS Staff
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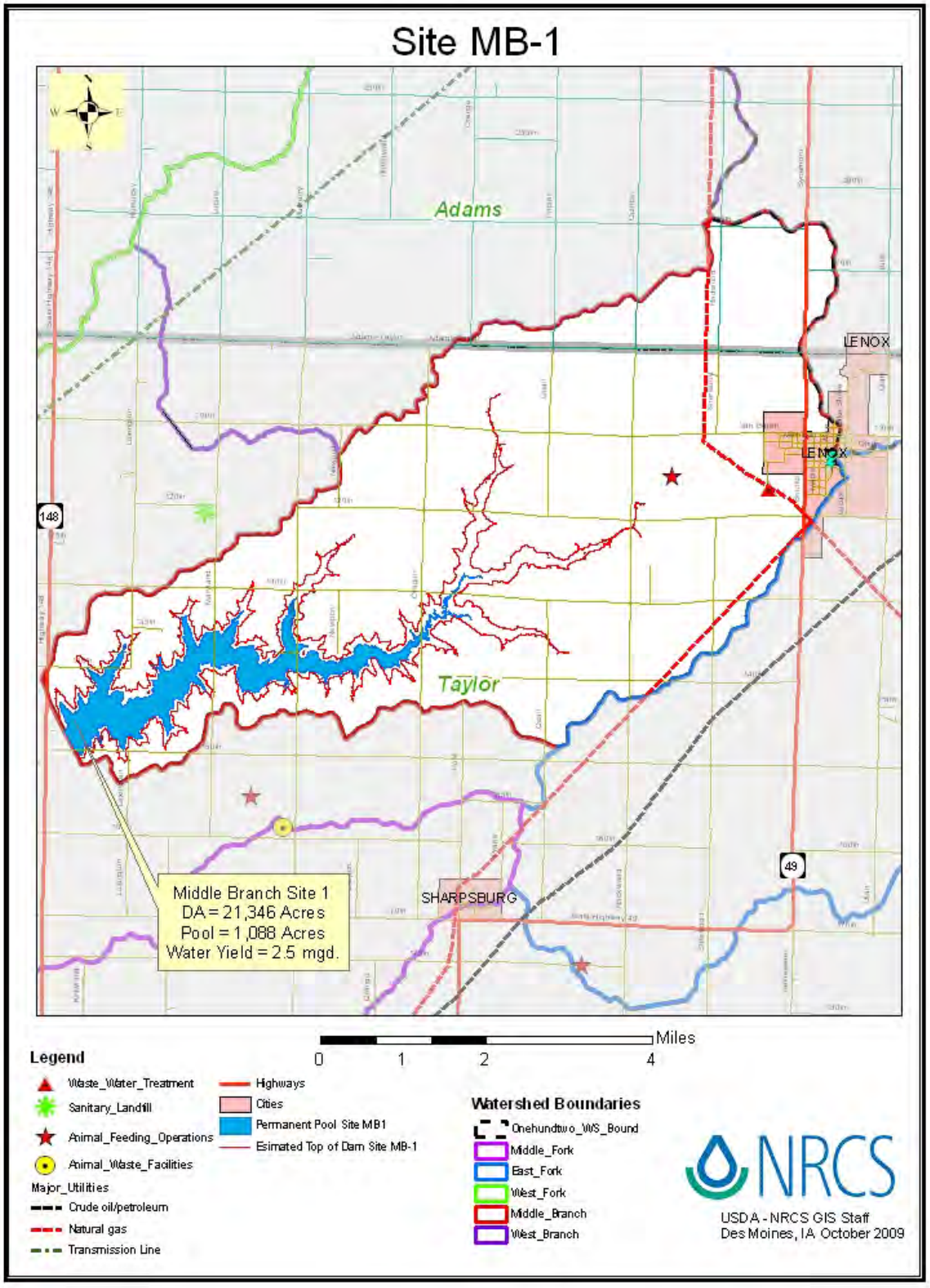
Site MB-1
Adams
Taylor
LENOX
LENOX
SHARPSBURG
148
49
Middle Branch Site 1
DA = 21,346 Acres
Pool = 1,088 Acres
Water Yield = 2.5 mgd.
Miles
0
1
2
4
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Cities
Permanent Pool Site MB1
Esimated Top of Dam Site MB-1
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
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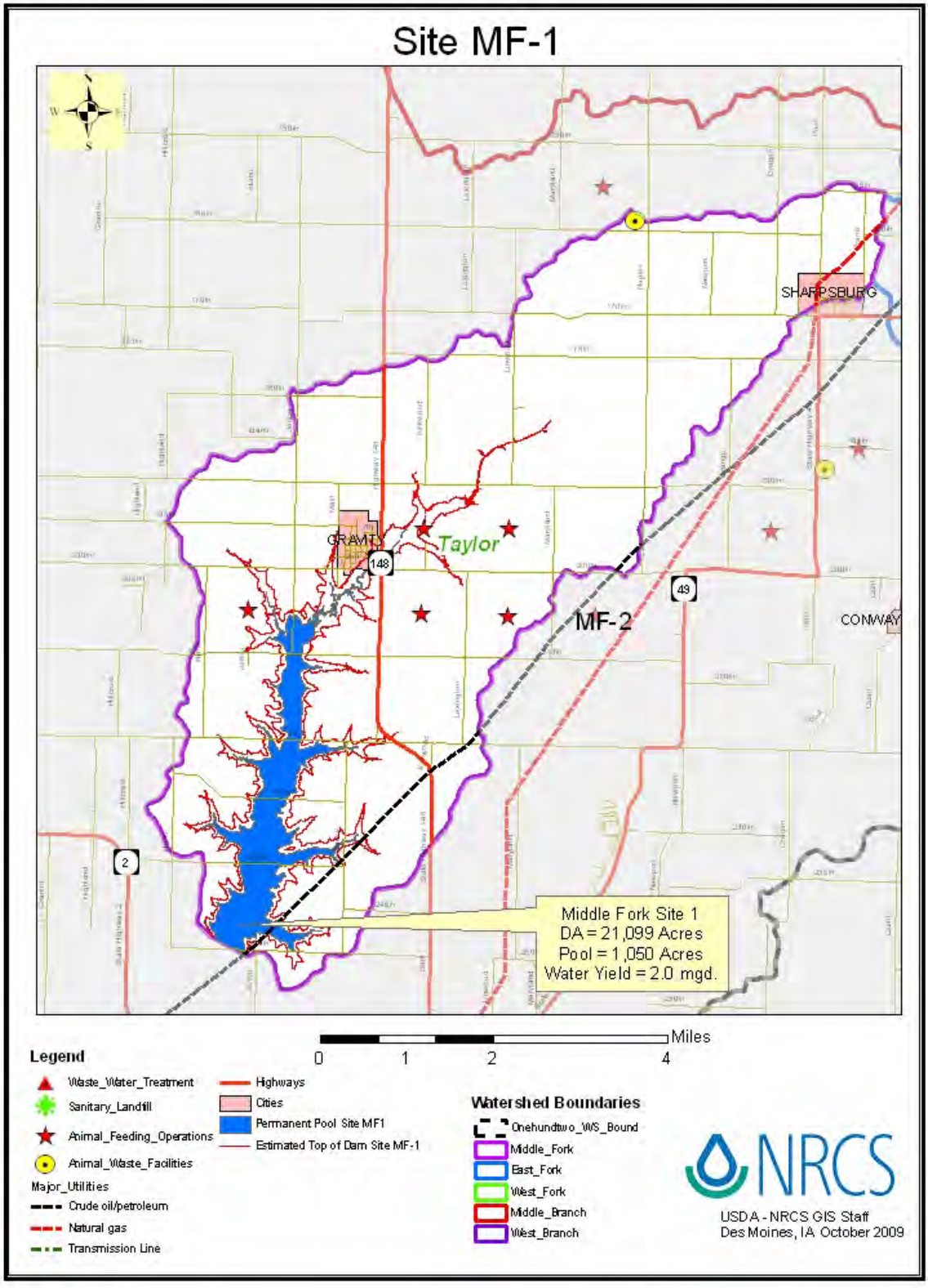
Site MF-1
SHARPSBURG
CRAMTY
Taylor
148
49
MF-2
CONWAY
2
Middle Fork Site 1
DA = 21,099 Acres
Pool = 1,050 Acres
Water Yield = 2.0 mgd.
Miles
0
1
2
4
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Cities
Permanent Pool Site MF1
Estimated Top of Dam Site MF-1
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
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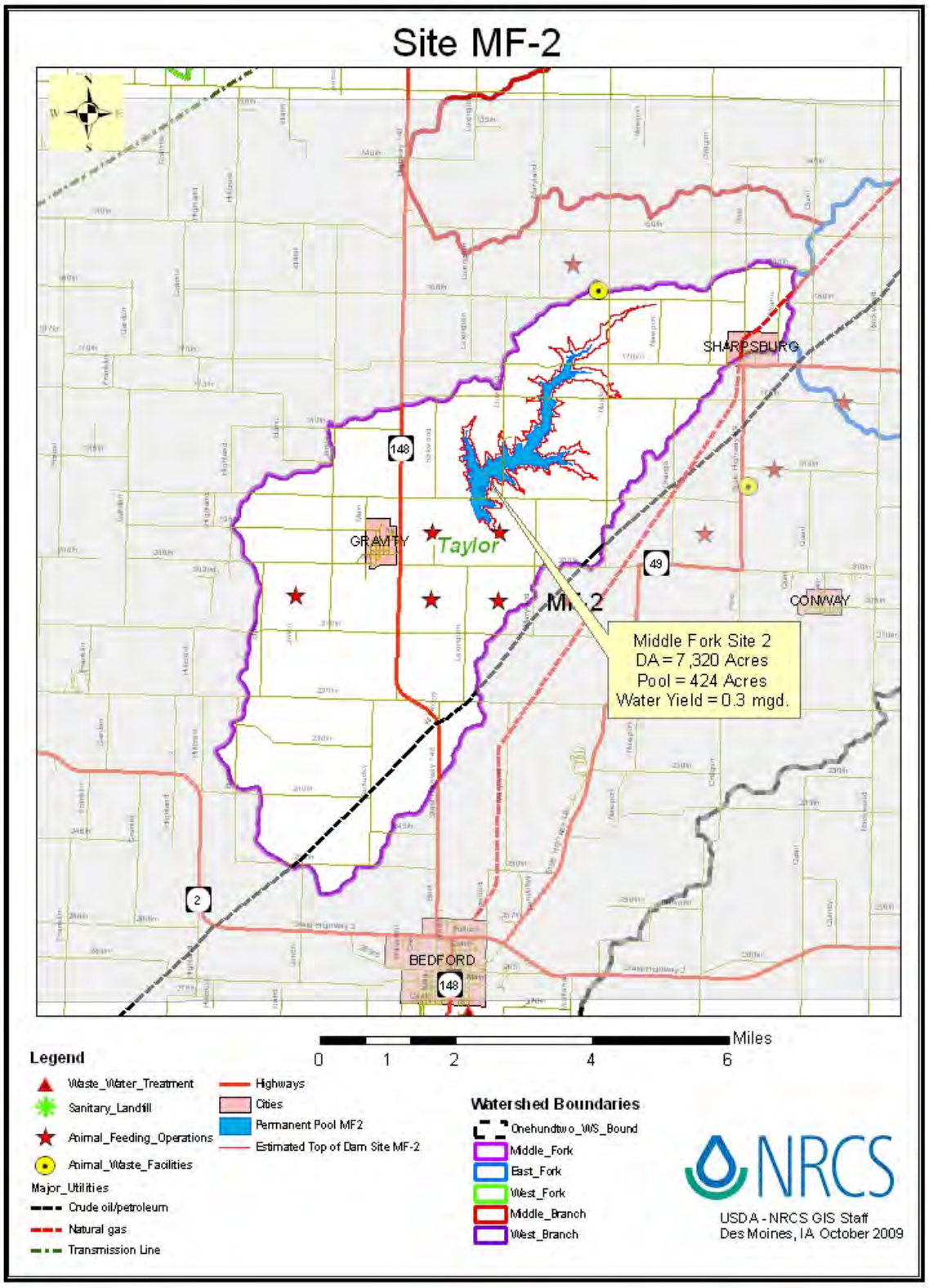
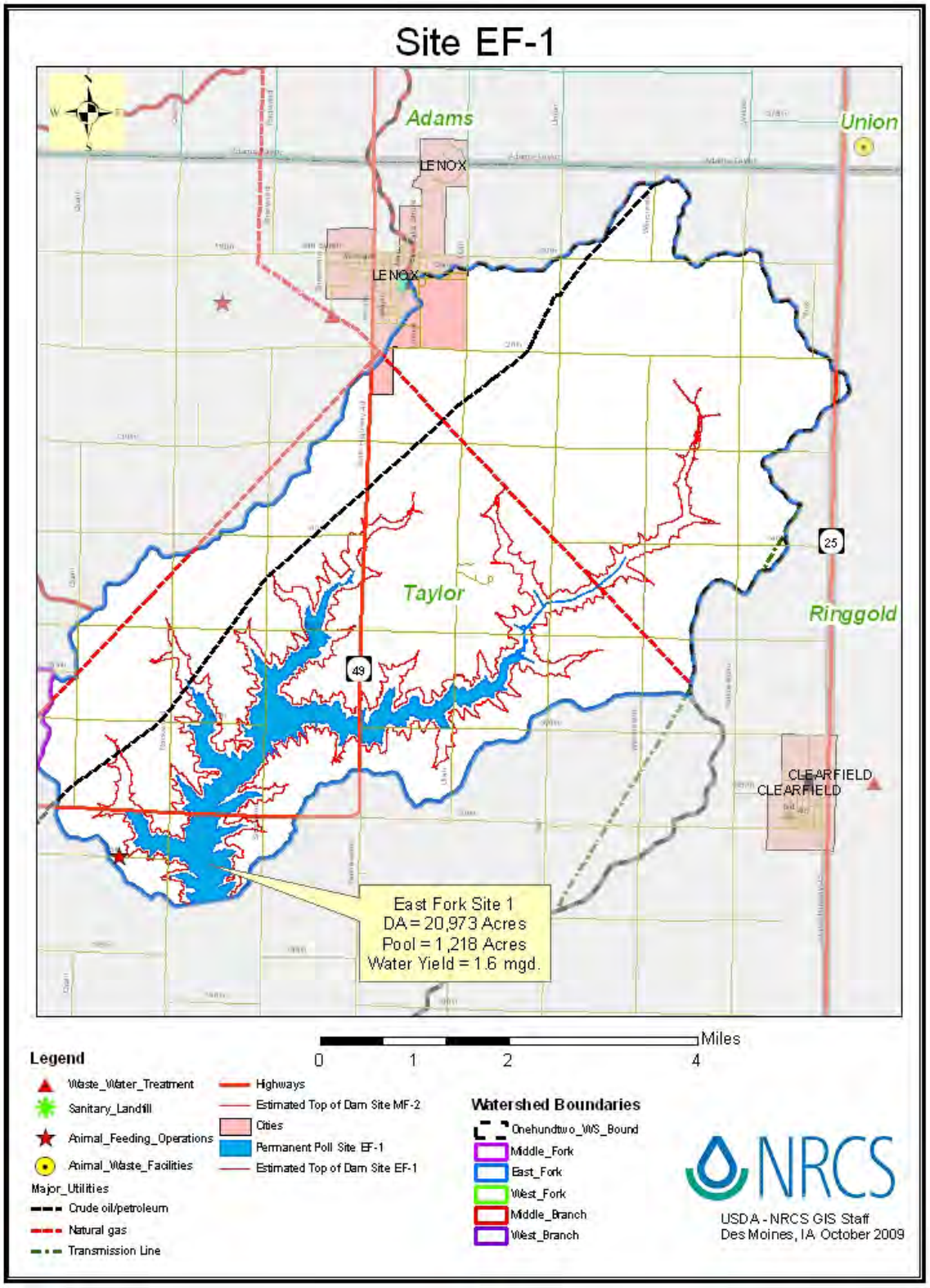
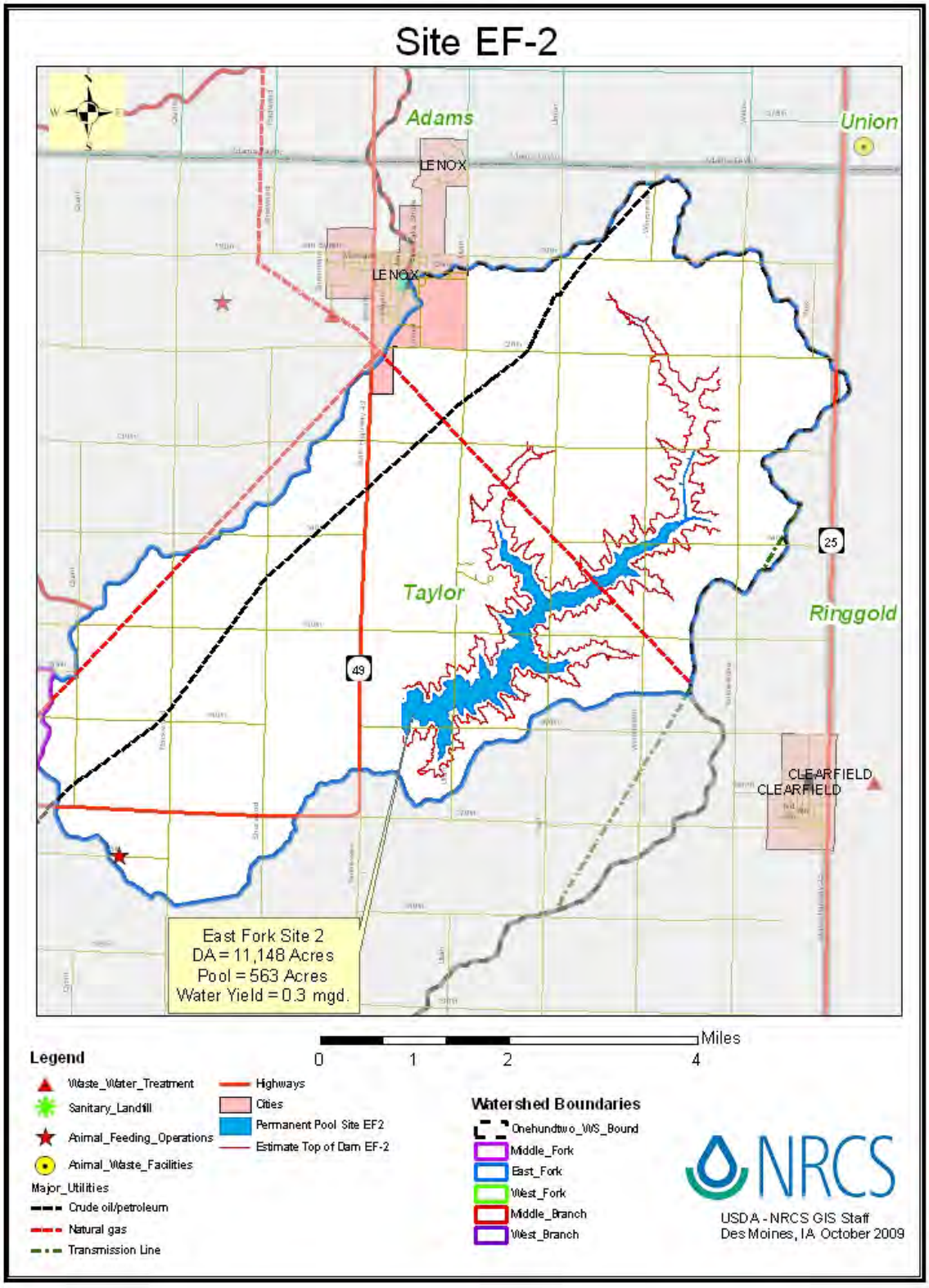

Site MF-2
SHARPSBURG
GRAMTY
Taylor
CONWAY
BEDFORD
148
49
2
Middle Fork Site 2
DA = 7,320 Acres
Pool = 424 Acres
Water Yield = 0.3 mgd.
Miles
0 1 2 4 6
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Cities
Permanent Pool MF2
Estimated Top of Dam Site MF-2
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
USDA - NRCS GIS Staff
Des Moines, IA October 2009


Site EF-1
Adams
Union
LENOX
LENOX
Taylor
Ringgold
25
49
CLEARFIELD
CLEARFIELD
East Fork Site 1
DA = 20,973 Acres
Pool = 1,218 Acres
Water Yield = 1.6 mgd.
Miles
0
1
2
4
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Estimated Top of Dam Site MF-2
Cities
Permanent Pool Site EF-1
Estimated Top of Dam Site EF-1
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
USDA - NRCS GIS Staff
Des Moines, IA October 2009


Site EF-2
Adams
Union
LENOX
LENOX
Taylor
Ringgold
25
49
CLEARFIELD
CLEARFIELD
East Fork Site 2
DA = 11,148 Acres
Pool = 563 Acres
Water Yield = 0.3 mgd.
Miles
0
1
2
4
Legend
Waste_Water_Treatment
Sanitary_Landfill
Animal_Feeding_Operations
Animal_Waste_Facilities
Major_Utilities
Crude oil/petroleum
Natural gas
Transmission Line
Highways
Cities
Permanent Pool Site EF2
Estimate Top of Dam EF-2
Watershed Boundaries
Onehundtwo_WS_Bound
Middle_Fork
East_Fork
West_Fork
Middle_Branch
West_Branch
NRCS
USDA - NRCS GIS Staff
Des Moines, IA October 2009

Watershed Projects, Plans, Studies, and Assessments *	
Federal:	***State:***
NRCS Watershed Plans/Studies/Assessments	**IDNR TMDLs**
One Hundred and Two River Rapid Watershed Assessment (10/09)	None
Feasibility Report for Potential Surface Water Supply Reservoirs (10/09)	**IDNR 319 Projects**
	None
IOWATER (Volunteer water quality monitoring)	
Lower East Fork 102 River (Water Quality Monitoring 2006)	
Middle Branch 102 River (Water Quality Monitoring 2006-2007)	
Upper East Fork 102 River (Water Quality Monitoring 2000-2006)	
Middle East Fork 102 River (Water Quality Monitoring 2001-2006)	

***** Listing includes past efforts in the watershed, and ongoing studies and assessments.

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23. Iowa Department of Natural Resources (IDNR). North Central Iowa – Impaired Waters (2006). http://wqm.igsb.iowa.edu/WQA/303d/2006/303dFO2.htm. *Last Accessed October 6, 2009.*

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APPENDIX A

FEASIBILITY REPORT
POTENTIAL SURFACE WATER SUPPLY RESERVOIRS
ONE HUNDRED & TWO RIVER VALLEY AUTHORITY (102RVA)
TAYLOR COUNTY, IOWA

Prepared By:
Water Resources Planning Staff
October 2009
US Department of Agriculture
Natural Resources Conservation Service
210 Walnut Street
693 Federal Building
Des Moines, Iowa 50309

APPENDIX A

Table of Contents

APPENDIX A

INTRODUCTION

In 2009 the Natural Resources Conservation Service (NRCS) was requested by the One Hundred & Two River Valley Authority (102RVA) to identify and present information concerning the feasibility of a surface water supply site, or sites, in the One Hundred and Two River Basin in Taylor County. Consequently, a preliminary investigation of the One Hundred and Two River Basin in Taylor County has been conducted with that objective.

The water demand objective for a water supply reservoir has not been precisely defined at this time. The inventory of possible sites in the watershed was therefore conducted using general principles of hydrology for water supply design and then a water budget analysis was conducted for each site to estimate what demand each could support during the design drought.

The general hydrologic criteria used for the reservoir inventory includes the following:

1. All stream segments within the county that have a drainage area between 8,000 acres and 40,000 acres served as the first cut of the inventory based the body of work completed for other projects in the same region of Iowa in the past three years. That work indicates that feasible options for a water supply reservoir will fall within this range.
2. A minimum drainage area to pool area (DAPA) ratio of approximately 20:1 was used as an overall guide to assuring reliable yield from the watershed to maintain the reservoir.
3. The maximum water yield for each reservoir, based on hydrologic factors, is estimated modeling the reservoir for the one in fifty year drought. Modeling of the reservoir is done using a water budget analysis program, Reservoir Operation Study Computer Program (RESOP) that takes into account rainfall, runoff, evaporation, seepage, spillage, demand, and seasonal water use variations.

The inventory also takes into consideration other factors at a preliminary planning level such as impacts to infrastructure and cultural resources, existing facilities that could affect reservoir water quality, and program limits. The inventory of infrastructure and cultural resources was completed with available GIS data as well as available utility maps. This data is comprehensive and provides a reasonably accurate account of impacts for this level of analysis. Development of a plan/EIS will require additional field work to more accurately quantify these impacts.

If assistance is provided by the NRCS on this project, planning and implementation would likely be carried out, in part or totally, under the Watershed Protection and Flood Prevention Act (Public Law 83-566). There are a number of limitations to the application of Public Law 83-566. Two limitations that can restrict project size are total watershed size and storage at the auxiliary spillway crest. The watershed may not exceed 250,000 acres and the storage at the auxiliary spillway crest may not exceed 25,000 acre-feet. These are referred to in this report as programmatic limits. There is no risk that any site in this inventory will exceed 250,000 acres. It is possible to exceed the storage limit however. To evaluate the maximum potential yield at each site, it was assumed that the auxiliary spillway storage will be just below 25,000 acre-feet. Two of the seven sites are further limited by the DAPA ratio and will have much less than 25,000 acre-feet at the auxiliary spillway crest.

APPENDIX A

SUMMARY

A report titled "Water Needs Assessment for Southern Iowa Rural Water Association, January 2007", by Garden & Associates, LTD, consulting engineers, provides a predicted water need through the year 2027 for SIRWA's service area based on projected growth in customers and water usage. This service area takes in all of Taylor County and includes access for rural residents as well as the communities of Athelstan, Bedford, Blockton, Clearfield, Conway, Gravity, Lenox, and Sharpsburg. SIRWA's current water supply comes from water utility for the cities of Corning, Creston, Greenfield, Leon and Osceola. Each of these water supplies were developed and/or expanded with the assistance of SIRWA and in turn unique percentages of capacity are reserved for SIRWA within each water supply. Currently, SIRWA has a water supply capacity of about 5.3 mgd. The total predicted water need by 2027 is about 10.5 mgd leaving a shortfall in 2027 of 5.2 mgd.

SIRWA is actively seeking additional water supplies in south central Iowa. They are looking at both new and expanded water supply sources. New water supply sources would include reservoirs in Madison and Clarke counties. Expanded water supplies are being sought in Union and Adair counties near the towns of Creston and Greenfield. The prospects for the reservoir in Madison County is very low and it appears that project will not come to fruition. The Clarke County reservoir, at about 2.2 mgd, is moving through the planning phase. It will not receive federal funding for at least several years. If projections are close, this reservoir will be in service before the year 2027 and contribute to SIRWA's water supply. However, SIRWA will not be contracting for the total amount so this will only be a marginal contribution. The expansions in Adair and Union counties have a higher probability than the Madison County reservoir but they won't significantly reduce the shortfall.

Given that a definite water demand is unknown at this time, the feasibility study focused on determining potential maximum yield of reservoirs and watersheds while not exceeding programmatic limits. All the resulting sites represent yield estimates (0.3 mgd to 2.5 mgd) that will probably fall short of meeting SIRWA's overall water supply need, but some sites could provide a significant contribution.

While detailed study may reveal impediments not discovered in this assessment, the finding of this study at this preliminary stage of investigation is that there are feasible sites for developing a surface water supply reservoir in the One Hundred and Two River Watershed in Taylor County.

APPENDIX A

SITE DESCRIPTIONS

Seven potential structure sites in the One Hundred and Two River watershed in Taylor County were studied. Those sites and there locations are as follows:

East Fork Subwatershed:	EF-1 and EF-2
Middle Branch Subwatershed:	MB-1
Middle Fork Subwatershed:	MF-1 MF-2
West Branch Subwatershed:	WB-1
West Fork Subwatershed:	WF-1

Site EF-1 is located in the SW ¼ of Section 32, T70N, R32W, approximately 4 miles south of Lenox. Site EF-2 is located in the SW ¼ of Section 12, T69N, R33W, approximately 2 miles southwest of Sharpsburg.

Site MB-1 is located in the SW ¼ of Section 26, T70N, R34W, approximately 4.5 miles north of Grant.

Site MF-1 is located in the SE ¼ of Section17, T68N, R34W, approximately 2 miles northwest of Bedford. Site MF-2 is located in the NW ¼ of Section 24, T69N, R34W, approximately 1 mile east of Gravity.

Site WB-1 is located in the NW ¼ of Section 12, T70N, R34W, approximately 7 miles west of Lenox.

Site WF-1 is located on the section line between Section 13, T70N, W35W and Section 18, T70N, R34W, approximately 7.5 miles northwest of Gravity.

Most of the sites have little to no significant timber. The reservoir areas vary in the amount of timber cover, but the amount of clearing required for construction will be low. The abutments consist mostly of Pre-Illinioan glacial till which is suitable for fill material in the earth dams. The alluvial soils of the valley floor will require foundation drains and relief wells to control seepage and piping.

APPENDIX A

POTENTIALLY IMPACTED INFRASTRUCTURE

A summary of the inventory of major infrastructure at each site is shown in the following table.

Infrastructure Table								
Site	Pipeline or Transmission Line Crosses the Reservoir	Pipeline or Transmission Line Crosses the Temporary Pool	Highway Potentially Flooded by Reservoir	Animal Feeding Operations	Animal Waste Facilities	Sanitary Landfill in the Drainage Area	Municipal Wells Flooded by Reservoir	Wastewater Treatment Plant Upstream of Reservoir
EF-1	1	2	Hwy 49	1	0	0	0	0
EF-2	1	1	0	0	0	0	0	0
MB-1	0	0	0	1	0	0	0	1
MF-1	1	1	Hwy 148	5	1	0	4	0
MF-2	0	0	0	1	1	0	0	0
WB-1	1	1	0	0	0	0	0	0
WF-1	1	1	0	4	0	0	0	2 Possible

APPENDIX A

DESIGN CONSIDERATIONS

A. Hydrology and Hydraulics

Each site's hydrologic factors were determined and used in this review as they relate to water supply yield and the water budget analysis. Those factors were: drainage area, elevation-area-volume data, rainfall and runoff from gauging stations, pan evaporation, and seepage loss. The water budget analysis was done using the Reservoir Operation Study Computer Program, or RESOP, modeling the one in fifty year drought. In addition to the hydrologic data, water use data is a necessary input to do a water budget analysis. Seasonal water use was modeled from data collected at the SIRWA water treatment plant near Twelve Mile Creek Watershed Site M-1 (a multiple purpose reservoir in Union County). The table below shows the monthly water use recorded and this data was used to develop the demand distribution for the water budget analysis.

Demand Distribution by Month

Month	Usage (Gallons per Month)	Percent of Total
January	113,000	7.7
February	108,000	8.3
March	118,000	8.2
April	113,000	8.1
May	123,000	8.5
June	132,000	9.4
July	140,000	9.7
August	131,000	9.0
September	114,000	8.1
October	115,000	7.9
November	104,000	7.4
December	111,000	7.7
Total	1,422,000	100

The process for developing the site inventory began with an inventory of all the streams within the One Hundred and Two River watershed within Taylor County (see Exhibit 1). The drainage area was limited to a range of 8,000 to 40,000 acres. This range has been used on similar projects in the past two years. Five stream segments in five subwatersheds, West Fork, West Branch, Middle Branch, Middle Fork and East Fork, were identified in this step.

The top end of the drainage area size was reduced to about 22,000 acres based on the programmatic limit of 25,000 acre-feet of storage at the auxiliary spillway crest. One site was selected near the 22,000 acre limit in each of the five watersheds and a water budget analysis was run to determine yield.

The estimated yield at all five of the initial sites was below the maximum potential demand of 5.2 mgd. Given the known topographic and programmatic constraints, no single site will provide the total unmet demand of 5.2 mgd.

Additional sites were explored in two of the subwatersheds (East Fork and Middle Fork). This was done because the initial site would likely flood an existing highway such as Highway 148 upstream of MF-1 or Highway 49 upstream of EF-1. Consequently MF-2 and EF-2 were added to the site inventory list. See Exhibit 2 for a map of potential water supply sites. Additional alternate sites could be explored in the other three subwatersheds. West Fork and West Branch are near the Adams County line. If the county line is not a barrier, alternate sites could be explored farther upstream in these watersheds, though they would yield a lower water supply. The Middle Branch has the highest probability of a feasible alternate site.

Hydraulics of spillways at each site were not done in this analysis. To fully estimate impacts due to the temporary flood pool, each site would have to be flood routed. However, this analysis would require significant input data and numerous iterations that exceed resources for this level of investigation. Therefore, the auxiliary spillway elevation at each site was estimated to be near the programmatic level of 25,000 acre-feet. The minimum stage necessary to assure adequate flood storage was subtracted from the auxiliary spillway crest. The remaining storage volume was assigned to sediment storage and water supply and this is the estimated permanent storage. The elevation that corresponded to the permanent storage was the theoretical maximum permanent pool elevation. The DAPA ratio was checked at this initial elevation for each site to assure there would be adequate drainage area for the resulting reservoir. If the DAPA ratio was between 17:1 and 20:1, or higher, the yield was estimated for the reservoir. If the DAPA ratio was below 17:1 the reservoir elevation was lowered until the DAPA ratio exceeded 17:1 and the yield was estimated at that level.

Determining more specific impacts due to the temporary pool will require flood routings and some geologic investigation. The data required for planning level evaluation includes: drainage area, stage-area-volume data, soils classification, land use, channel slope, precipitation, sediment rates, and properties of the materials that will be encountered in the auxiliary spillway. Precipitation amounts and design criteria will be governed by Technical Release 60 (TR 60) with actual rainfall data taken from the Iowa Amendment to National Engineering Handbook (NEH) Part 650, Chapter 2.

The hydrologic soil groups in the watershed are predominantly B and C indicating internal drainage characteristics are moderate to low and runoff potential is moderate to high. No projections have been made at this time on future landuse. Current landuse is estimated to be 50 percent cropland, 35 percent pasture and hay ground, 8 percent forest and shrubs, 4 percent developed open space, 1 percent developed low intensity space, and about 2 percent other uses (see RWA report titled “One Hundred Two River – 10240013, 8-Digit Hydrologic Unit Profile”). Detailed landuse analysis will be needed to develop the runoff curve number and sediment computations for prospective drainage areas.

No breach analysis of the inventory sites has been done at this point in time. Therefore no assessment of impacts due to a dam breach has been prepared for this report. However, given the size and scope of the dams and reservoirs being contemplated, it is reasonable to assume that every site in the inventory would be classified as “High” hazard. This would hold true even if present impacts did not warrant such a rating because the long term potential for development would dictate that such a rating be assigned in the design. “High” hazard dam classification is defined as “dams located where failure may cause loss of life, serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads.”

APPENDIX A

Design rainfall will be taken from NEH Part 650. The TR-60 and Iowa Department of Natural Resources (IDNR) Technical Bulletin 16 structure hydrology criteria are met with the following design rainfall amounts:

Dam Class	Principal Spillway (Inches)		Auxiliary Spillway (Inches)	Freeboard Storm (Inches)	
	1 – Day	10 – Day	6 – Hour	6 – Hour	24 – Hour (5 Point)
"High"	7.0	11.8	10.9	26.8	33.0

B. Geology

This watershed is drained by the East Fork, Middle Fork, and West Fork of the One Hundred and Two River in Taylor County, and the continuation of the West Fork and the West Branch of the West Fork of the One Hundred and Two River in Adams County. Named tributaries of the individual forks of the One Hundred and Two River include the Rose Branch, Middle Branch, Brushy Creek, Daugherty Creek, East River, Hog Branch, and Ash Branch. Soils and landforms of the watershed developed in deposits laid down by ice and water during the Pleistocene and Holocene Epochs. The unconsolidated deposits rest on Paleozoic bedrock. These older rocks primarily consist of Pennsylvanian limestones and shales of the Wabaunsee and Shawnee Groups respectively. Bedrock exposure is largely limited only to localized stream and river drainages, or in surface quarries.

The entire watershed occurs within the boundaries of the Southern Iowa Drift Plain landform region. The landscape of the watershed is all glacial in origin. Southwestern Iowa contains some of the most complete Pre-Illinoian glacial stratigraphy in North America. Up to eight Pre-Illinoian glacial advances have been recorded, all older than 500,000 years. Landscape features within the watershed have been shaped by fluvial erosion carving down through the Pre-Illinoian glacial plain. This Quaternary erosion has shaped the landscape into a series of gently to steeply rolling hills and valleys. Elevations in the watershed range from about 1,050 feet to about 1,305 feet.

The surficial deposits in the watershed include variable glacial deposits, primarily basal till with lesser abundances of glaciofluvial and glaciolacustrine sediments. Peoria loess is the primary surficial deposits within the watershed, and was deposited as a result of intense periglacial conditions and strong winds during the Wisconsinan glaciation. This wind-blown loess covered the Pre-Illinoian glacial plain, and currently mantles the upland drainage divides in the area. Younger loess-derived deposits of the DeForest Formation occur in stream bottoms and floodplains and were deposited by streams in the last 8,000 years.

Soils are predominantly clay loams, silt loams and silty clay loams formed in glacial till, loess, and loess-derived alluvium. Drainage class of the soils ranges from poorly-drained to well-drained and is largely dependent on landscape position. In general, the upland loess-covered divides and alluvial flood plains are poorly drained, while the gently-sloping upland loess ridges are moderately well-drained to somewhat poorly-drained. Till soils predominantly occur along strongly sloping hillsides, and are generally well-drained.
In general, the soils in the One Hundred Two watershed are suitable for earthfill dam construction and for surface water supply development. Site specific geology is recommended for verification of materials during the planning stage and required for the design stage.

C. Cultural Resources

The inventory of cultural resources was examined to determine if any significant cultural resources were known to exist in the vicinity of any of the planned reservoirs. Fifteen potential cultural resources sites were listed. Of those, six have been reviewed by the State Historical Preservation Office (SHPO) and found to be not eligible. The remaining nine have not been reviewed but there were none listed as "significant". At this time no known significant cultural resource sites have been identified. However, a more exhaustive study of any potential reservoir project area must be conducted in developing the environmental impact statement and prior to construction. It is possible that sites designated "significant" could be found during this study.

D. Engineering

1. Earthfill

The seven sites evaluated have estimated fill heights from 55 feet to 68 feet. The cross sectional template (see Exhibit 3) of the proposed fills will have a top width that could vary site to site from 18 to 22 feet, depending on the final overall height of fill. The side slopes (upstream and downstream) will be no steeper than 3:1. The upstream berm will be armored with riprap to protect the embankment from wave action. And it is probable that a slope stability berm on the downstream side of the embankment will be necessary.

The auxiliary spillway and valley slopes should be composed of suitable earthfill material and provide adequate quantities of borrow. The alluvial soils in the pool area will provide top dressing material for the earth dam and other areas disturbed by construction.

2. Foundation Drainage

The extent of foundation drainage will be determined from a detailed geologic investigation at the site. Preliminary geology has not been completed for this report. It is anticipated that the foundation area will have significant alluvial deposits comprised of fine-grained and sandy soils. This would be typical of sites in southern Iowa. It is therefore anticipated that managing seepage and piping in these materials will be accomplished using foundation and embankment drains comprised of trench drains, relief wells, and possibly chimney drains.

3. Principal Spillway

The principal spillway conduit will consist of reinforced concrete. The barrel section will either be reinforced concrete pipe (RCP) or reinforced concrete (R/C) box conduit.

The inlet will be R/C covered riser with draw down gate and the outlet may consist of either an R/C impact basin (see Exhibit 3) or an R/C chute. A closed R/C barrel has the following advantages.

a. Simple design (RCP simpler than the R/C box conduit)
b. Ease of construction
c. Less maintenance
d. Has a flood retarding pool

4. Auxiliary Spillway

The auxiliary spillway will be designed as a vegetated, open channel around the earthfill dam into the valley abutment and outlet a distance far enough downstream that no damage will occur to the earthfill of the dam. This design allows large runoff events to be safely conveyed downstream. This spillway can be vegetated using grasses and legumes because the frequency of use is very small. Advantages of this type of auxiliary spillway are:

a. Hydraulic capacity
b. Efficient construction – generally the excavated material can be used for the earthfill in the dam and so haul distances are relatively short
c. Little or no armor is required

5. Drawdown Facility

Fishery management and maintenance activities sometimes require lowering the water level in the reservoir. The drawdown conduit will be a RCP set near the bottom of the pool and outlet into the principal spillway riser. The drawdown must equal or exceed the IDNR drawdown criteria in TB 16. The design life will be equal to the principal spillway.

E. Environmental Effects

Construction of any dam and reservoir will result in environmental effects to plants, wildlife, and aquatic life both upstream and downstream of the dam that must be studied and evaluated in detail.

The reservoir will replace stream habitat with flatwater habitat. Stream mitigation will be required at any site but may vary based on the existing quality of stream. The loss of wildlife habitat must also be mitigated.

The project would likely effect wetlands at the dam site and the reservoir of all the sites in the inventory. The National Wetland Inventory (NWI) would be consulted to assess the amount of wetland area affected and whether or not those wetlands were significant.

Should the sponsors choose to construct any of these reservoirs with federal assistance, either technical or financial, the lead federal agency would be responsible for ensuring the project complies with all provisions of the National Environmental Policy Act (NEPA) to minimize any adverse effects of the project.

APPENDIX A

ALTERNATIVES

a. Alluvial Aquifers

Alluvial aquifers are used in southern Iowa where yield is adequate to meet demand. The city of Shenandoah in Page County is an example of a community currently drawing water from alluvial aquifer wells to meet current demand. Most of Shenandoah's wells are located in the East Nishnabotna River Valley just north of the city. Groundwater and surface water interact closely in alluvial aquifers so alluvial aquifers are responsive to changes in precipitation and river levels. Yield from alluvial aquifers depends largely on the extent of the sand and gravel deposits in the river valley and the river stage itself. A preliminary investigation of the One Hundred and Two River would be necessary to determine the potential quantity and quality of water available in that aquifer.

b. Bedrock Aquifers

Bedrock aquifers occur in sedimentary rock layers composed of limestone, dolomite and sandstone which originated as deposits in seas and rivers that occupied Iowa from 75 to 550 million years ago. Total thickness of these rocks ranges from 5,200 feet in southwest Iowa to about 800 feet in northeast Iowa.

Yield from bedrock aquifers tends to be very good. In northeast Iowa, bedrock aquifers see significant use. However, the gradient on these aquifers is generally from north to south so that the water under the southwest part of Iowa is older and mineralized. Treatment of this water is possible but much more expensive. There is little use of bedrock aquifers in southern Iowa.

c. Treated Water Pipeline

There are sources of treated water in southern Iowa. The cities of Council Bluffs and Des Moines distribute water on a regional basis as does the Rathbun Regional Water Association. However, the south central area of Iowa is served predominantly by SIRWA and other regional water supplies lack the distribution system that SIRWA currently has in place. SIRWA would have to make a determination that contracting water from alternative treated water sources was the most feasible option.

d. A Stream or River Source

Direct diversion of stream flow for drinking water supply is an important source for some communities in Iowa. The city of Clarinda pumps water directly from the Nodaway River with a drainage area of about 762 square miles. In 2002 Bartlett & West Engineers submitted a report for Page 1 Rural Water District and the City of Clarinda titled "Preliminary Engineering Report For Construction of a New Water Treatment Plant", in which the peak day demand was reported to be near 700,000 gallons per day (gpd). Average annual daily usage was reported at over 500,000 gpd. The streams and rivers in Taylor County appear to be much more limited in yield due to smaller drainage areas.

The Platte River is the largest in terms of drainage, over 250 square miles, but is located in the extreme southeast corner of the county. The West Fork of the One Hundred and Two River is located in the western one-third of the county and has a maximum drainage area of about 212 square miles. And the East Fork of the One Hundred and Two River is located in the middle of the county with a maximum drainage area of about 111 square miles. Stream gauge data at Bedford, Iowa shows the minimum median daily flow over 25 years to be about 640,000 gpd. This would not account for maintaining a protected low flow.

Additional research would be needed to evaluate this alternative, but it does not appear that stream flow in Taylor County is a practical water supply source for addressing SIRWA's projected unmet demand of 5.2 mgd in 2027.

APPENDIX A

COSTS

Sufficient analysis has not been completed for this report to estimate costs for any of the sites. It is instructive to look at other projects of similar scope that have been analyzed in detail. The West Tarkio Creek Watershed Plan in Page County had an estimated project cost of almost $63,000,000 in 2007. The draft watershed plan for the Clarke County Water Supply project in Clarke County had an estimated project cost of about $43,000,000 in early 2009. Both of these projects were likely larger than a single reservoir site would be in the One Hundred and Two River Basin. And the project in Clarke County included a major road realignment that added over $3,000,000 to the project. However, those projects do not include any costs for stream mitigation. Also, changes in energy and material prices and costs of wages and land values can fluctuate significantly during the planning and implementation stages of a project. The sponsors need to be aware that final costs will be in the same order of magnitude as these projects.

Some of the probable major cost items are as follows:

1. Construction costs of the dam, raw water intake, raw water pipeline, and other structures/facilities related to other potential project purposes such as water quality or recreation.
2. Real Property Rights
3. Relocation
4. Engineering Services
5. Project Administration
6. Wildlife Habitat Mitigation
7. Stream Channel Mitigation
8. Land Treatment

In addition to these initial project costs, there would also be operation, maintenance and replacement costs on an annual basis. A rough estimate of OM&R costs would be about 0.35 percent of the construction cost plus annual on-site inspection costs.

APPENDIX A

COMPARISON OF DATA

Site	Drainage Area (Acres)	Reservoir Surface Area (Acres)	Estimated Water Yield (Million Gallons Per Day)
EF-1	20,970	1,220	1.6
EF-2	11,150	565	0.3
MB-1	21,350	1,090	2.5
MF-1	21,100	1,050	2.0
MF-2	7,320	425	0.3
WB-1	20,480	1,140	1.5
WF-1	22,170	1,135	2.0

APPENDIX A

RECOMMENDATIONS

General

1. The sponsors (102 RVA) may want to evaluate the level of support for the project among the entities within their 28E organization and with the residents and businesses within Taylor County at large to determine if the resources and public support are substantial enough to proceed with additional studies for a project of this magnitude.

2. Assuming support is substantial, a business plan developed specifically for this project may be an essential tool in developing a watershed plan/EIS and implementing that plan. Developing a business plan should be completed prior to watershed planning activities.

3. A comprehensive water supply plan for SIRWA is needed to establish the design demand that will be applied to a surface water supply in the One Hundred and Two River Basin. Assessing the feasibility of the project is predicated on determining a design demand. The water supply plan must also be developed in consideration of the requirements of the Iowa eminent domain law. If the sponsors wish to develop a watershed plan/EIS under Public Law 83-566, they shall acquire, or provide assurances satisfactory to the Secretary of the US Department of Agriculture that they will acquire, such real property rights as will be needed in connection with works of improvement to be installed. In order to give such assurances, the sponsors will have to satisfy all the requirements of Iowa's eminent domain law.

APPENDIX A

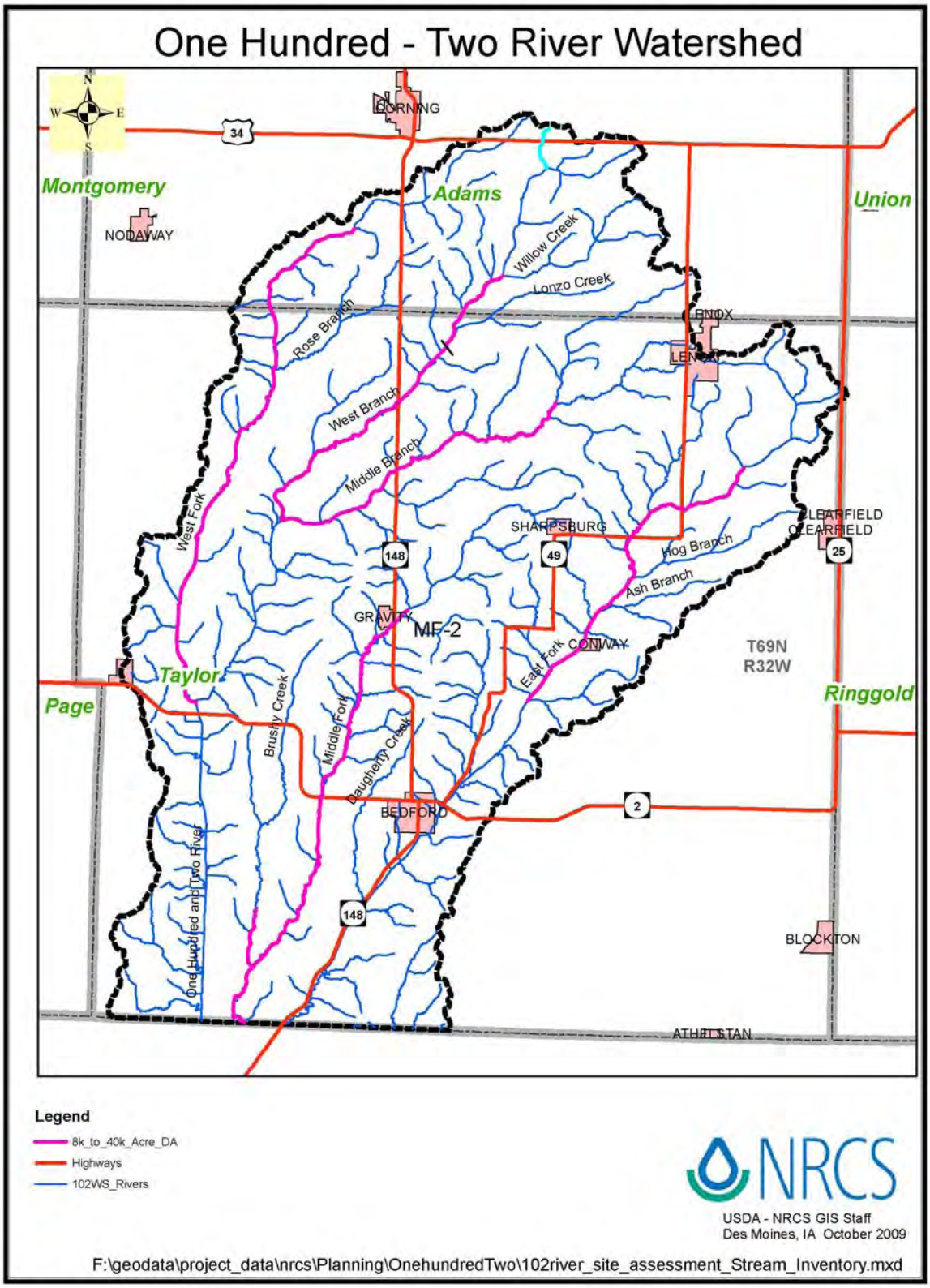

EXHIBIT 1

APPENDIX A

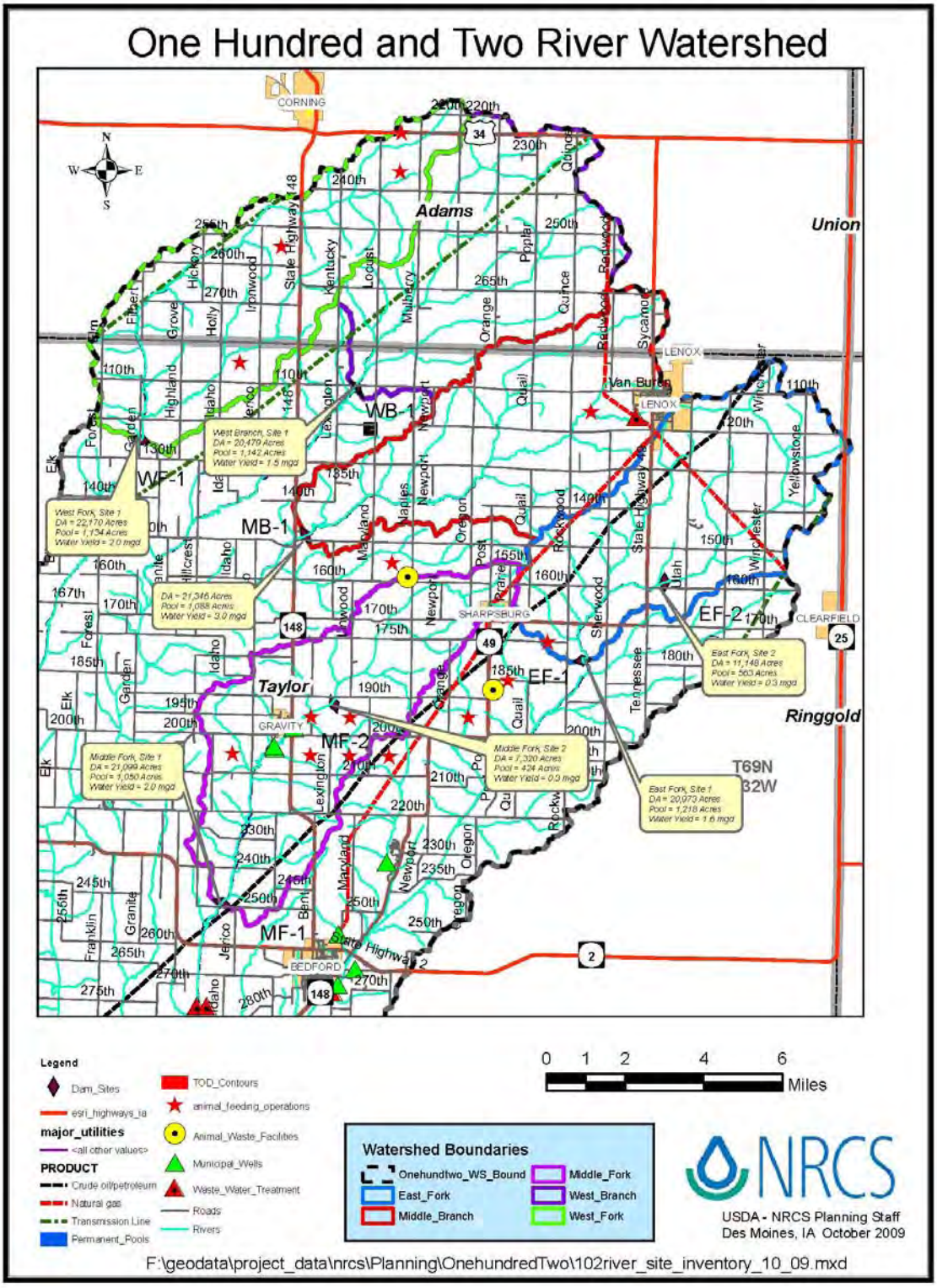

EXHIBIT 2

APPENDIX A

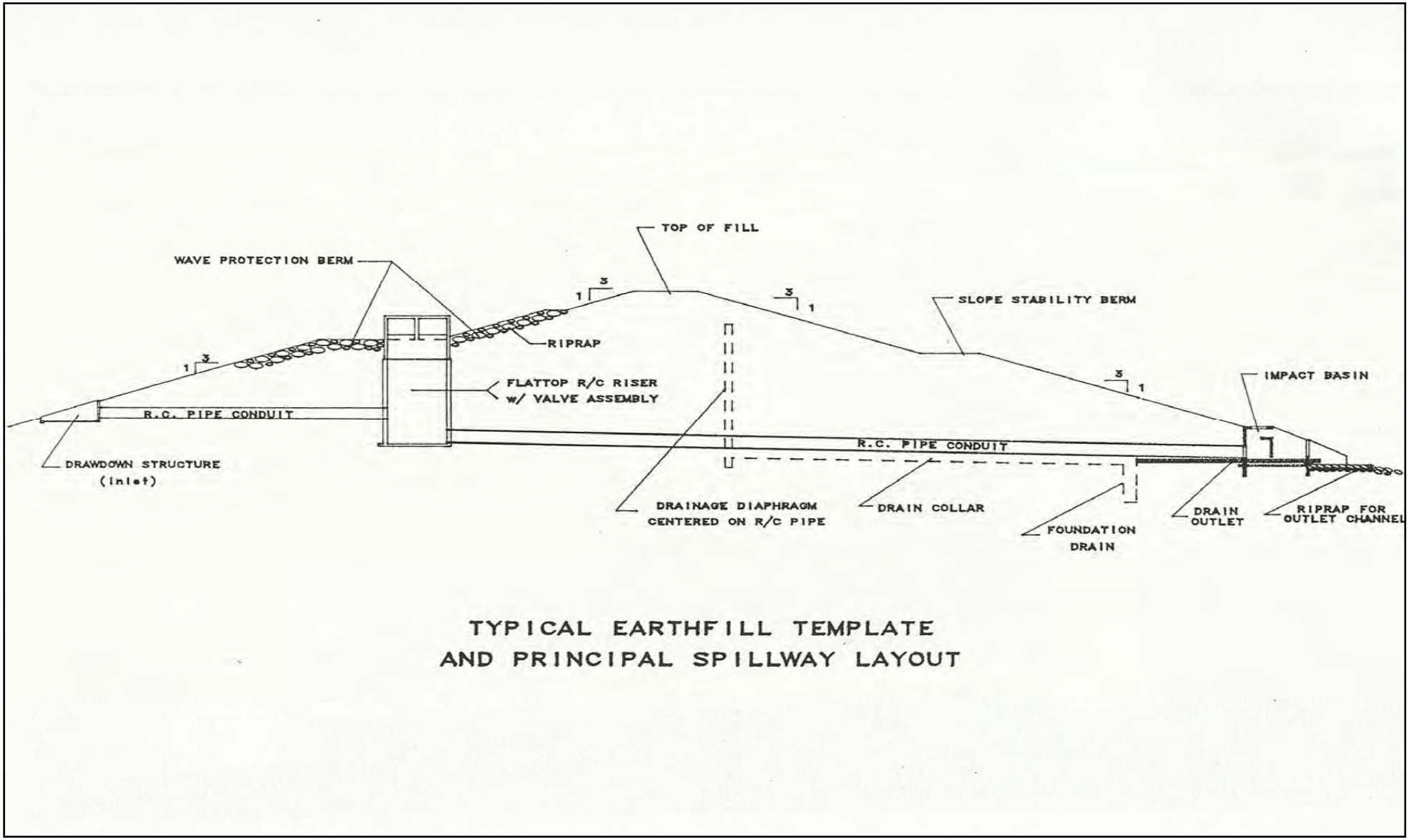

EXHIBIT 3

APPENDIX B

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service
Iowa

One Hundred and Two River – 10240013
8-Digit Hydrologic Unit Profile

October 2009

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	IA-CPA-52 March 2009	A. Client: The One Hundred and Two River Valley Authority (102RVA)
ENVIRONMENTAL EVALUATION WORKSHEET		B. Tract None
		C. Fields: None
D. Client objective and proposed action(s): The 102 (RVA) proposes a reservoir in the 102 River Watershed in Taylor County that will serve as a public water supply and recreation area.		

Short term refers to installation period and long term refers to the effects during the life span of the practice or system. Effect codes: (+) beneficial, (-) adverse, (0) no effect. N/A does not apply.

E. Resource Concerns	F. Effects			Comments
	No Action	Short-Term	Long-Term	
SOIL				
1. Erosion	0	-	+	There is potential for soil loss during the construction period. After site is installed and seeded erosion will be less than current conditions
2. Condition	0	-	0	Some soil compaction during construction
WATER				
1. Quantity				
Reduced Capacity or Reduced Storage	-	0	+	Water storage increased with the proposed reservoir.
Excessive Runoff/Ponding	0	-	+	Reservoir will reduce down stream runoff
2. Quality				
Excessive Nutrients & Organics	0	0	+	Nutrients and organics from the watershed of the reservoir will be stored in the pool and improve water quality downstream. Conservation practices will be applied in the watershed to reduce excessive nutrients and organics.
Excessive Pesticides	0	0	+	Reservoir will collect pesticides that attached to the sediment and improve water quality downstream. Conservation practices will be applied in the watershed to reduce excessive pesticides.
Excessive Sediment	0	-	+	Stream sedimentation possible during construction. The reservoir will collect sediment from the watershed and reduce sedimentation downstream. Conservation practices will be applied in the watershed to reduce excessive sediment
AIR				
1. Quality				
Dust (particulate matter)	0	-	+	Dust will increase during construction but will be less than the no action alternative when the area is seeded.
Excessive Carbon Dioxide				Trees and grasses planted in conjunction with the reservoir will reduce excess carbon dioxide.
Odors	0	0	0	Odors from livestock facilities still exist

APPENDIX B

USDA NRCS
United States Department of Agriculture
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One Hundred and Two River – 10240013
8-Digit Hydrologic Unit Profile

October 2009

PLANTS				
1. Suitability	0	0	0	
2. Condition				
Productivity, Health, & Vigor	0	0	0	
Noxious & Invasive Plants	0	0	-	Potential for aquatic invasive species to become established
3. Threatened & Endangered Species	Y			Species are present in the watershed possible impact on federal listed species
ANIMALS				
1a. Fish – Aquatic Habitat	0	-		Habitat will be reduced and will need to be mitigated
1b. Wildlife – Terrestrial Habitat	0	-		Habitat will be reduced and will need to be mitigated
2. Threatened & Endangered Species	Y			Species are present in the watershed possible impact on federal listed species
3. Domestic Animals	0	0	0	
Inadequate Quantities & Quality of Feed & Forage	0	-	-	Will take pasture and, cropland out of production.
Inadequate Shelter	0	0	0	
Inadequate Stock Water	0	0	+	Provides additional water that can be used for livestock water
Stress and Mortality	0	0	0	

HUMAN CONSIDERATIONS		
1. Economic	Evaluated (Y, N)	Remarks
Land Use (use change and/or outputs)	N	Will need to be studied when EIS is developed.
Sustainability	N	Will need to be studied when EIS is developed.
2. Social		
Client Well Being	N	The well being of landowners that lose land to the project that will be impacted.
Community Well Being	N	The well being of the community may improve.

G. Related Environmental Concerns	If 'Present' is Y, record 'Effect', then explain in 'Remarks'. Effect codes: (+) beneficial, (-) adverse, (0) no effect		
CONSIDERATION	Present (Y, N)	Effect (+, -, 0)	Remarks
Cultural Resources, does the planned practice have the potential to affect cultural resources?(see Part 601 Subpart G 601.69 National Cultural Resources Procedures Handbook Iowa Appendices Exhibit A Conservation Practices Potential to Affect Cultural Resources)	Y	-	Installing reservoir will likely disturb cultural resources. Cultural Resource Studies will be required. Cultural resource sites discovered during the study will be evaluated for their significance and mitigation may be required
Environmental Justice: Minority or Protected Groups, Limited Resource Farmer	Y	-	Minority and/or limited resource farmers may be present. These groups will be affected if reservoir is installed on property they own or operate.
Flood Plain Management	Y	-	Flood plain upstream will be inundated; flooding will be reduced on the flood plain down stream of the reservoir. EAP will be developed prior to construction.
Invasive Species	?		Potential for aquatic invasive species to become established

APPENDIX B

USDA NRCS United States Department of Agriculture Natural Resources Conservation Service
Iowa

One Hundred and Two River – 10240013
8-Digit Hydrologic Unit Profile

October 2009

Natural Area	?		Possible presence of prairie remnants.
Prime & Unique Farmlands	Y	-	Loss of Prime farmland likely in the inundated area.
Riparian Area	Y	-	Loss of riparian area likely in the inundated area
Scenic Beauty	Y	0	Proposed action enhances visual diversity
Wetland	Y	-	Loss of wetland likely in the inundated area. Loss of wetland functions and values will need to be mitigated.
Stream /Channel Modification	Y	-	Loss of stream values caused by installing the reservoir will need to be mitigated

H. Alternatives considered, include "No Action:"

No Action no new additional water sources are developed. Water shortage in SIRWA water supply system occurs in the future.

Alternative One Water Supply Reservoir is constructed with additional conservation practices to protect water quality that will provide additional water supply capacity to the SIRWA system.

I. The information recorded above is based on the best available information:

NEPA REQUIREMENTS IDENTIFIED

J. Findings

_____	is not a Federal action. No additional analysis is required.
_____	is categorically excluded from further environmental analysis and there are no extraordinary circumstances. No additional analysis is required.
_____	has been sufficiently analyzed in an existing NRCS environmental document. No additional analysis is required.
_____X_____	will require preparation of an EA or EIS..