Agenda Item 10

Memorandum

To: Programs, Projects and Operations Subcommittee

Subject: Papio-Missouri River NRD Master Plan

Date: March 24, 2010

From: Gerry Bowen

The District's Master Plan was last updated in 1999. State law requires that it be updated every ten years. The 2010 draft revision is attached for your review.

Currently, the District's priority areas, in order of importance, are as follows:

1. Reduce flood damages.
2. Maintain water quality and quantity.
3. Reduce soil erosion and sedimentation damages.
4. Provide outdoor recreation facilities.
5. Provide domestic water supply.
6. Develop and improve fish and wildlife habitat and forest resources.
7. Participate in solid waste management and recycling efforts.

The plan was written with these priority areas in mind. It is recommended that the Subcommittee reaffirm these priorities.

It is proposed that the following schedule be followed to complete the adoption of the Master Plan:

April 6, 2010	PPO Subcommittee review draft master plan and set public meeting dates
April 27, 2010	Public meeting in Dakota City at Service Center
April 29, 2010	Public meeting in Omaha at the Natural Resources Center
May 13, 2010	Board adopts updated Master Plan

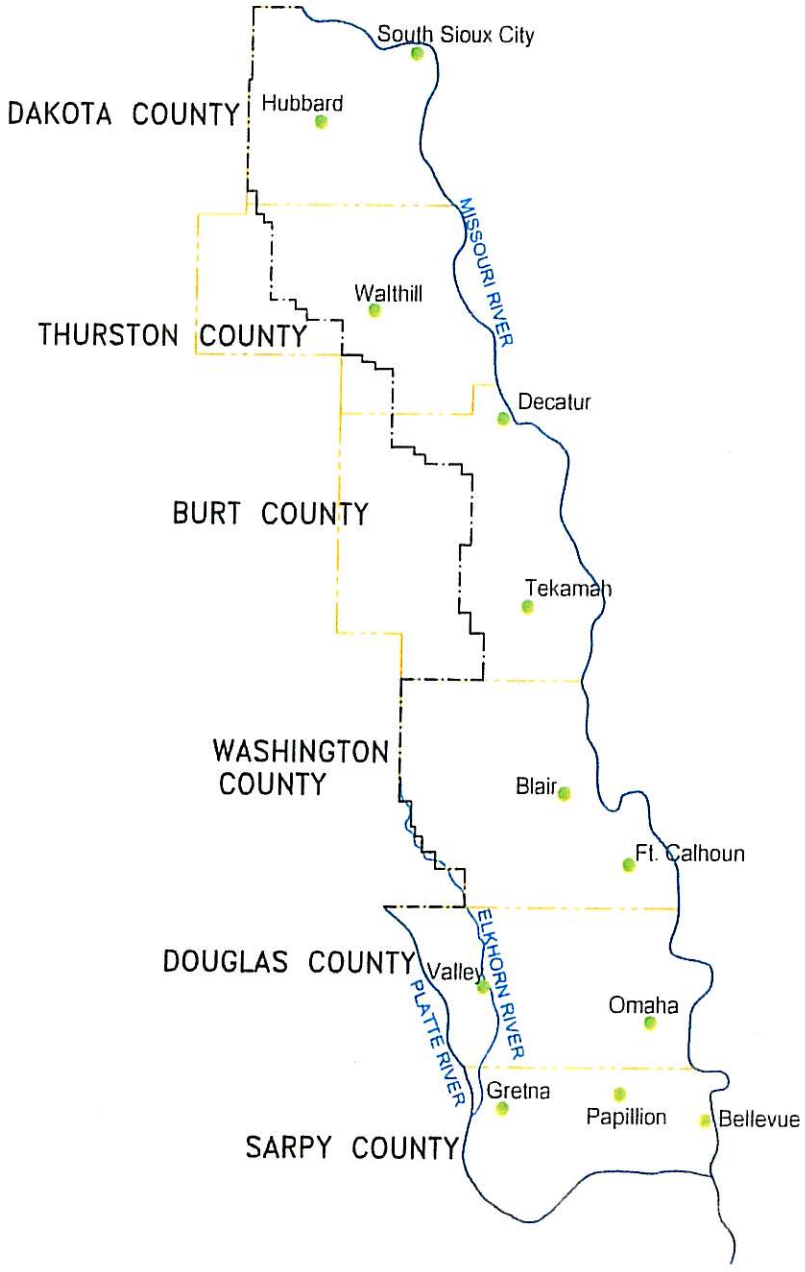
- **It is recommended that the Subcommittee recommend to the Board that the NRD's priority areas be adopted and that the proposed adoption schedule be approved.**

DRAFT

Papio-Missouri River Natural Resources District

Master Plan

April, 2010



PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT

MASTER PLAN

Papio-Missouri River Natural Resources District
8901 South 154th Street
Omaha, Nebraska 68138-3621
402-444-6222

Web Site: www.papionrd.org

Table of Contents

I. Introduction

Each of the State's Natural Resources Districts is required to update their Master Plan every ten years. This update process offers an opportunity to look back over the last ten years and reflect upon how well the District addressed the goals, objectives, and recommendations of the last Master Plan. It also offers an opportunity to once again take stock of where the District currently is, consider if it is addressing the needs of a changing District, and to project where the District should be in the next ten years. It is also a critical time to re-evaluate the goals of Natural Resources Districts and what they might look like in the next ten years.

The Master Plan is intended to provide an overall framework for the management of the District's natural resources.

A. Natural Resources District Authorities

In July of 1972, over 150 special purpose districts, each dealing with a variety of different and in some cases overlapping responsibilities, were merged together to form 24 Natural Resources Districts.

On January 5, 1989, the Papio Natural Resources District and the Middle Missouri Tribs Natural Resources District were merged to form the Papio-Missouri River Natural Resources District. The current 23 Natural Resources Districts are shown in Figure 1 in the Appendix.

Under Nebraska State Law, the Natural Resources Districts have been given specific authority and powers as described in Chapter 2-3229 of the Statutes relating to the Nebraska Natural Resources Commission:

> "The purpose of the Natural Resources Districts shall be to develop and execute, through the exercise of powers and authorities contained in this act, plans, facilities, works, and programs relating to:
>
> 1. Erosion prevention and control
> 2. Prevention of damages from flood water and sediment
> 3. Flood prevention and control
> 4. Soil conservation
> 5. Water supply for any beneficial uses
> 6. Development, management, utilization, and conservation of groundwater and surface water
> 7. Pollution Control
> 8. Solid waste disposal and sanitary drainage
> 9. Drainage improvement and channel rectification
> 10. Development and management of fish and wildlife habitat
> 11. Development and management of recreational and park facilities
> 12. Forest and range management."

When NRD's were created, they were given the authority to levy a property tax to finance District programs and projects. Property taxes are still the primary source of revenue, however, the District can receive funds from other state, federal, and private sources for specific projects.

In 2009, the District was granted the authority to issue general obligation bonds to finance flood control and water quality enhancement projects including, but not limited to dams, levees, reservoir basins, floodplain buyouts, and low impact development best management practices.

B. Papio-Missouri River Natural Resources District

The Papio-Missouri River Natural Resources District (District) encompasses approximately 1,790 square miles within seven counties of eastern Nebraska (see Figure 2 in the Appendix). The PMRNRD includes all of Washington, Douglas and Sarpy Counties, most of Dakota County, and the eastern 60% of Thurston County, the eastern 55% of Burt County, and a small portion of southeast Dodge County.

The PMRNRD is the most populous district containing almost 39% of Nebraska's total population, or approximately 700,245 people (2008 estimate). It also has the highest tax base of $50.89 billion (2009), or, almost 34.5% of the total taxable real estate base of Nebraska. It is the only district that contains a metropolitan class city (Omaha).

Portions of three major river basins are contained within the District; The Missouri, the Platte, and the Elkhorn. The District is bounded by the Missouri River on the east and north, by the Platte on the south and west, and by tributaries to both on the west.

In order to facilitate the implementation of the twelve legislative authorities listed in Part A, the District combined the authorities into the following seven general resource management needs:

1. Reduce flood damages.
2. Maintain water quality and quantity.
3. Reduce soil erosion and sedimentation damages.
4. Provide outdoor recreation facilities.
5. Provide domestic water supply.
6. Develop and improve fish and wildlife habitat and forest resources.
7. Participate in solid waste management and recycling efforts.

The District is governed by an elected Board of Directors. There are currently eleven subdistricts, each representing approximately the same number of people. The following are the current District Directors and their subdistricts (see maps on pages 5 and 6):

Sub-district	Director	County(ies)	Address
1	Scott Japp	Washington, Burt, Thurston, Dakota	Arlington, Nebraska
2	Fred Conley	Douglas	Omaha, Nebraska
3	Larry Bradley	Douglas	Omaha, Nebraska
4	John Conley	Douglas	Omaha, Nebraska
5	Richard Tesar	Douglas	Valley, Nebraska
6	James Thompson	Douglas	Omaha, Nebraska
7	Dorothy Lanphier	Douglas	Omaha, Nebraska
8	Tim Fowler	Douglas	Omaha, Nebraska
9	Rick Kolowski	Douglas	Omaha, Nebraska
10	David Klug	Sarpy	Omaha, Nebraska
11	John Schwope	Sarpy	Bellevue, Nebraska

The District operates on a daily basis with both full and part-time employees. The staff is maintained to implement the District's various programs and projects. The staff is divided into three departments: Administrative Services, Program and Project Services, and Information and Education Services (see chart on Page 7).

Administrative Services:

John Winkler	General Manager
Patricia Teer	Administrative Coordinator
Penny Burch	District Secretary
Jean Tait	Secretary/Purchasing Agent
Sonya Carlson	Receptionist/Secretary
Carey Fry	Senior District Accountant
Barbara Sudrla	District Accountant (part time)
Jolene Kohout	Accounting Assistant
Trent Heiser	Information Technology Manager
Ross Hoppock	Information Technology Technician

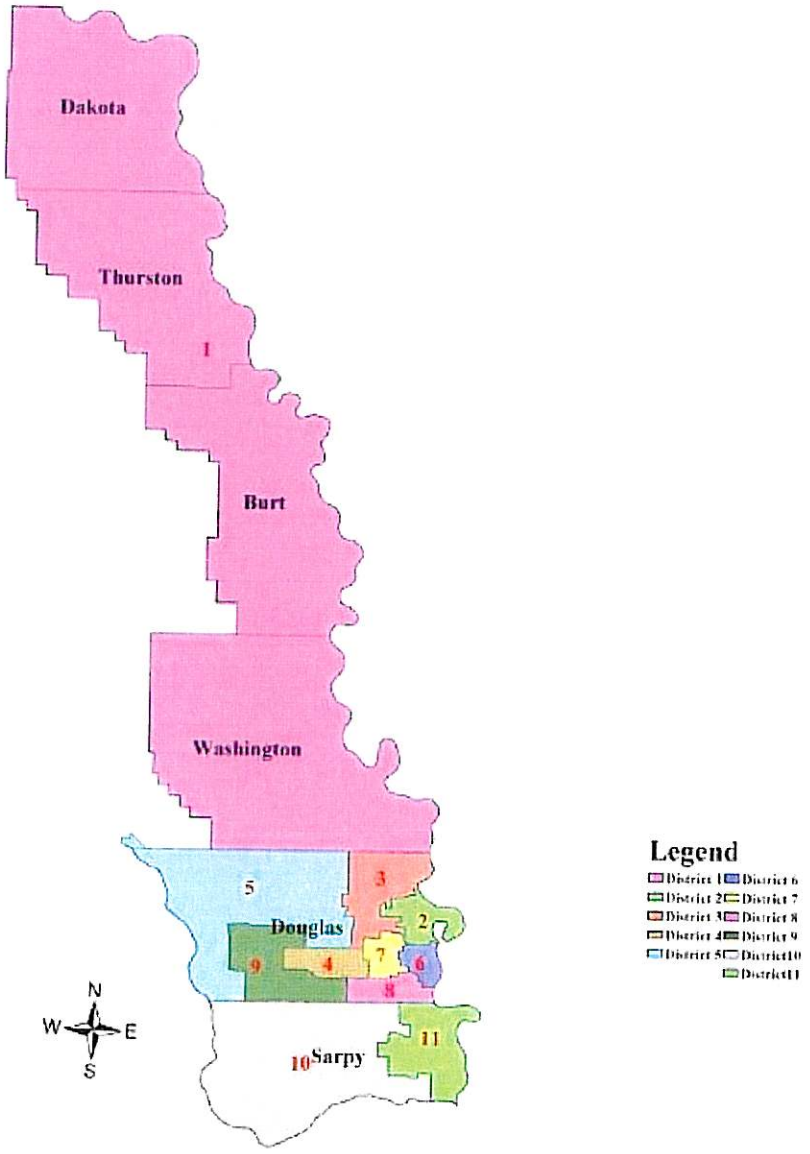
Program and Project Services:

Marlin Petermann	Assistant General Manager
Brian Henkel	Groundwater Management Engineer
Jim Becic	Environmental Coordinator
Gerry Bowen	Natural Resources Planner
Martin Cleveland	Construction Engineer
Mike McNaney	Survey Coordinator
Justin Novak	Surveyor/Engineering Aide
Marty Nissen	Draftsman/Engineering Aide
Jerry Herbster	Park Superintendent
Tom Pleiss	Lead Land Steward (Chalco Hills)
Michael Bickley	Land Steward
Ron Gouker	Custodian
Dave Krueger	Security (part time)
Amanda Grint	Water Resources Engineer
Lori Laster	Stormwater Management Engineer

Ralph Puls	Land and Water Programs Coordinator
Terry Schumacher	Field Representative (Blair)
Dennis Piper	Field Representative (Walthill)
John Zaugg	Field Representative (Omaha)
Dennis Cady	Conservation Technician (Walthill)
Linda Ellett	Administrative Secretary (Omaha)
Darlene Hensley	Program Assistant (Blair)
Evelyn Maslonka	Program Assistant (Lyons)
Teresa Murphy	Program Assistant (Walthill)
Kelly Fravel	Program Assistant (Dakota City)
Richard Sklenar	Project Manager
Marty Thieman	Water System Superintendent (Blair)
George Tillwick	Water System Operator (Blair)
Lance Olerich	Water System Superintendent (Dakota City)
Marge Stark	Water System Bookkeeper (Dakota City)
(Vacant)	Water System Operator (Dakota City)
Marvin Baker	Water System Technician (Pender)
Ronnie Lehman	Operation and Maintenance Superintendent
William Warren	Assistant Operation and Maintenance Superintendent
Keith Butcher	Heavy Equipment Operator
Keith Lienemann	Heavy Equipment Operator
Jason Schnell	Medium Equipment Operator
Terry Keller	Medium Equipment Operator
Ryan Trapp	Medium Equipment Operator

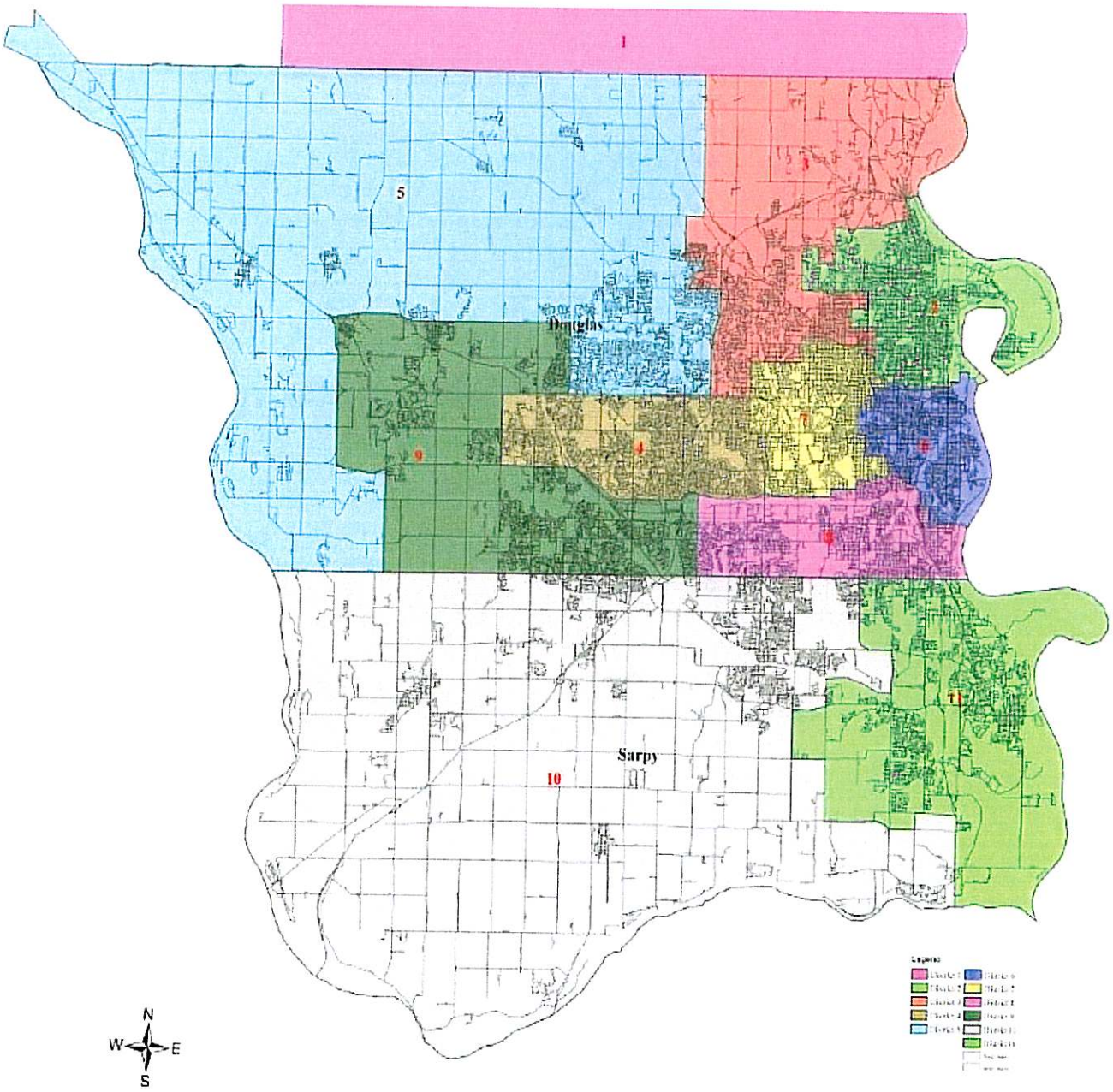
Information and Education Services:

Emmett Egr	Information/Education Coordinator
Christy Jacobsen	Education/Volunteer Specialist
Heather Guthridge	Environmental Education Assistant



Papio-Missouri River NRD Subdistricts

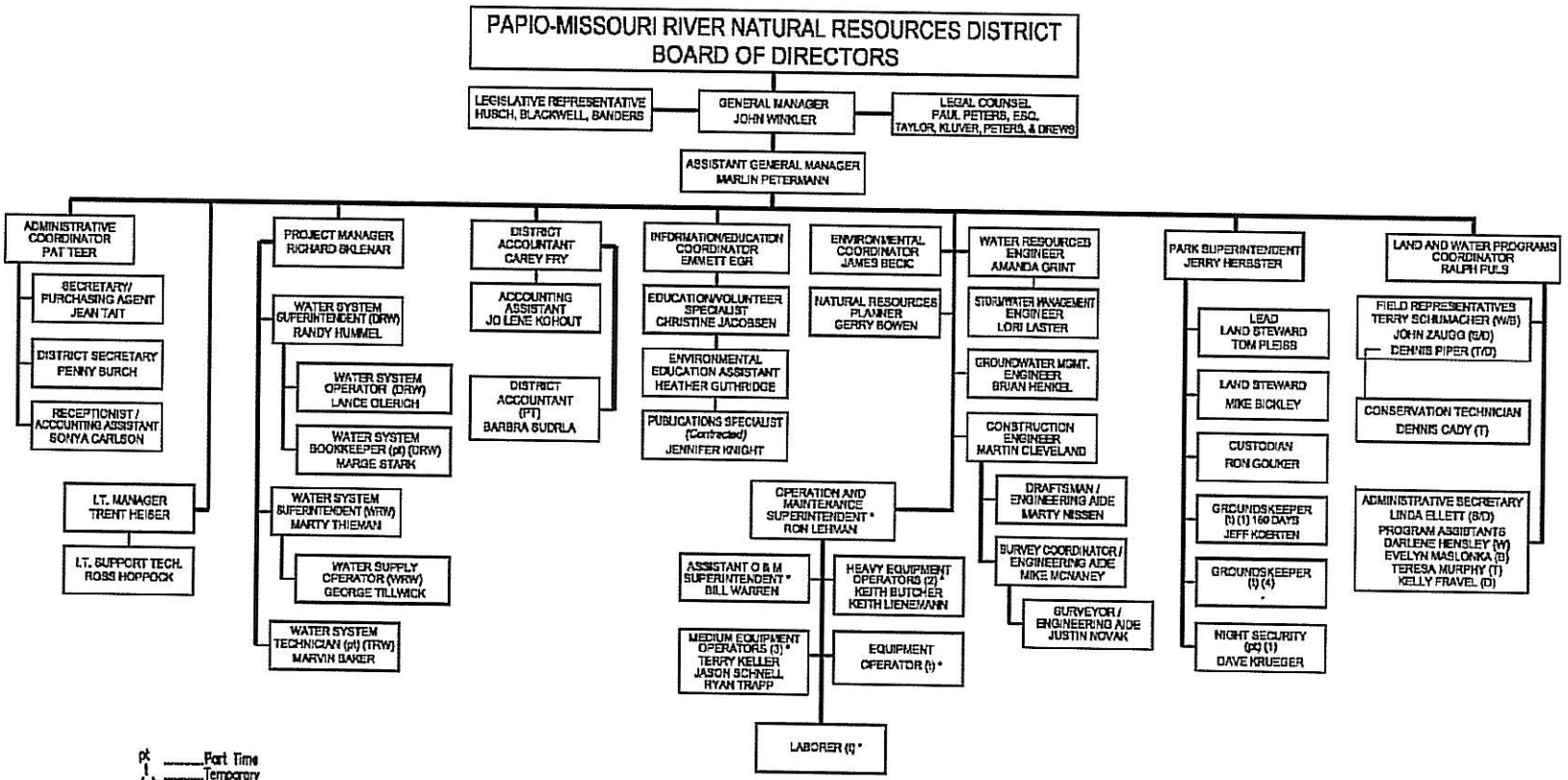
MAPA
A Council of Governments



Papio-Missouri River NRD Subdistricts

MAPA

PAPIO-MISSOURI RIVER NATURAL RESOURCES DISTRICT
BOARD OF DIRECTORS



pt ..... Part Time
( ) ..... Temporary
( ) ..... Number of Employees in this Position
* ..... P-MRNRD Operation and Maintenance
(S/D) ..... Natural Resources Conservation Service – Sarpy /Douglas Co. Office (Omaha)
(W) ..... Natural Resources Conservation Service – Washington Co. Office (Blair)
(B) ..... Natural Resources Conservation Service – Burt Co. Office (Lyons)
(T) ..... Natural Resources Conservation Service – Thurston Co. (Walthill)
(D) ..... Natural Resources Conservation Service – Dakota Co. (South Sioux City)
(DRW) ..... Dakota County Rural Water (Dakota City)
(TRW) ..... Thurston County Rural Water (Pender)
(WRW) ..... Washington County Rural Water (Blair)

NOTE: Organizational Chart Implemented by the General Manager on November 1, 1986

Updated: AUGUST, 2009

PAPIO–MISSOURI RIVER NATURAL RESOURCES DISTRICT
8901 S. 154th St.
Omaha, NE 68138-3621
Fax 402-895-6543 Office 402-444-6222
www.papionrd.org

II. Inventory of Resources

A. Geography

As stated earlier, the District is located in eastern Nebraska and occupies all or parts of seven counties. The total area is approximately 1,790 square miles. The District includes portions of three major river basins (see Figure 3 in the Appendix):

1. Missouri River
   a. Papillion Creek
      - Big Papillion Creek
      - West Papillion Creek
      - Little Papillion Creek
   b. Mill Creek
   c. Ponca Creek
   d. New York Creek
   e. Tekamah Creek
   f. Elm Creek
   g. Blackbird Creek
   h. Omaha Creek
   i. Pigeon Creek
   j. Jones Creek
   k. Fiddler Creek
   l. Silver Creek
   m. Elk Creek
   n. Platte River
2. Platte River
   a. Springfield Creek
   b. Turtle Creek
   c. Buffalo Creek
   d. Elkhorn River
   e. Zweibel Creek
3. Elkhorn River
   a. Rawhide Creek
   b. Bell Creek

The District is the most populated district in the state and contains over 39% of the state's population, and 75% of the District's population resides in Douglas County. Omaha, located in eastern Douglas County is the largest community in the District. Omaha serves as a major center for agricultural processing, industry, manufacturing, retailing, and wholesaling. Within the District, those population centers having a population greater than 1,000 residents include South Sioux City, Dakota City, Tekamah, Arlington, Blair, Bellevue, Gretna, LaVista, Ralston, Papillion, and Valley.

B. Topography

The topography of the District is characterized by broad, flat floodplains adjacent to the three major rivers. These floodplains sometimes extend up to five miles in width and are used extensively for highly productive agricultural uses. Beyond the floodplains, are generally steep, precipitous bluff lines rising abruptly. The bluff lines range in height from small banks to 200 foot cliffs. The areas behind the bluff lines consist of open and rolling hills. The majority of the rolling hills are devoted to pasture and row crops. Woodlands are common throughout the numerous stream courses, bluffs, and some floodplain areas (See Figure 4 in the Appendix).

C. Soils

The soils vary considerably in types, textures, and relief. The majority of soils are deep, well drained to excessively drained, gently sloping to very steep, silty and loamy, formed in loess and colluvium on the uplands and foot slopes. A portion of the soils are deep, well drained to excessively drained, strongly sloping to very steep silty and loamy, formed in loess and glacial till on the uplands. There are some small areas of shale and sandstone outcrops in the uplands. The soils of the Missouri River bottom are deep, poorly drained to excessively drained, nearly level and gently sloping, silty, clayey and sandy, formed in alluvium on bottom lands (see Figures 5, 6, and 7 in the Appendix).

The various soil association areas are listed below:

1. Albaton, Onawa, Haynie, Sarpy, Blake – Poorly drained and moderately well-drained, nearly level, clayey to loamy soils on river bottoms.

2. Aowa, Alcester, Kennebec, Josburg – Moderately well-drained and well-drained, nearly level to gently sloping, silty soils on bottom lands and foot slopes.

3. Blyburg, Blenco, Luton, Forney, Omadi – Moderately well-drained to poorly drained, nearly level, silty and clayey soils on high bottom lands.

4. Inavale, Cass, Barney, Platte, Boel – Deep, somewhat excessively drained to somewhat poorly drained, nearly level loamy and sandy soils on bottom lands.

5. Crofton, Alcester, Nora, Aowa – Well-drained, gently sloping to steep, silty soils on bluffs, uplands an foot slopes.

6. Gibbon, Luton, Saltine, Wann, Zook – Deep, poorly drained to well-drained, nearly level silty and clayey soils on bottom lands.

7. Ida, Monona, Napier, Hobbs – Well-drained, sloping to very steep, silty soils on uplands.

8. Kennebec, Wabash, Zook, Nodaway, Colo – Well-drained to somewhat poorly drained, nearly level to gently sloping, silty soils along bottom lands and upland drainageways.

9. Luton, Forney, Solomon, Malvern, Salix – Deep, poorly drained, nearly level, clayey soils formed in alluvium on bottom lands.

10. Marshall, Ponca, Johnson, Kennebec, Nodaway – Deep, well-drained, nearly level to moderately steep silty soils on loess uplands.

11. Monona, Ida, Judson, Kennebec, Nodaway – Well-drained, sloping to very steep, silty soils in uplands.

12. Moody, Nora, Judson, Belfore, Colo – Deep, well-drained nearly level to strongly sloping, silty soils formed in loess and colluvium on uplands and foot slopes.

13. Nora, Crofton, Moody, Alcester, Aowa – Well-drained, gently sloping to steep, silty soils on uplands.

14. Nora, Crofton, Judson, Moody, Aowa – Well-drained, gently sloping to moderately sloping, silty soils on uplands and foot slopes.

15. Sarpy, Onawa, Haynie, Grable, Albaton – Deep, moderately well-drained, poorly drained and excessively drained, nearly level and gently sloping, silty, clayey and sandy soils on bottom lands.

16. Steinauer, Pawnee, Burchard, Sharpsburg, Shelby – Deep, well-drained to excessively drained, strongly sloping to very steep, silty and loamy soils formed in loess and glacial till on uplands.

D. Climate

The climatic conditions of the District are a typical Midwestern temperate zone climate. The District experiences seasonal changes characterized by warm, humid summers with southerly winds, and cold, dry winters with northerly winds. The majority of the annual precipitation occurs between April and September.

Average daily temperatures range from lows of 18-22° F in January, to highs of 76-77° F during July. The mean temperature for the District is 48° F in South Sioux City in the north, and 51° F in the Omaha area. Annual precipitation averages between 26 inches in the north to 29 inches in the Omaha area. Frost free days average 184 days generally between the end of April and the middle of October.

E. Land Use

The majority of the District is utilized for agricultural uses (see Figure 8 in the Appendix). The large metropolitan area of Omaha is a small percentage of the overall District. The following is a general breakdown of the 1,790 square miles of the District based on 2005 estimates:

Land Use	Square Miles	Percentage
Cropland	906	51%
Irrigated Cropland	151	8%
Pasture/Rangeland	315	18%
Woodlands	134	7%
Water/Wetlands	23	1%
Urban/Other	261	15%
Total	1790	100%

F. Demographics

Based upon the 2008 update to the 2000 Census, the population of the District is approximately 700,245, an increase of 10.1% over the 2000 Census. The population estimates by county are as follows:

County	2000 Census	2008 Estimate	Change	Percent change
Douglas	464,674	502,032	+37,358	+ 8.0%
Sarpy	122,595	150,467	+27,872	+22.7%
Washington	18,780	19,812	+1,032	+ 5.5%
Burt	4,920	3,866	-1,054	-21.4%
Thurston	4,898	3,894	-1,004	-20.5%
Dakota	20,253	20,174	-79	-0.4%
Total	636,120	700,245	64,125	+10.1%

The largest increase in population has occurred in Sarpy County, with the greatest increase in the City of Papillion. Bellevue, Gretna and LaVista also recorded increases. In Douglas County, Omaha showed the greatest increase, while other communities showed minimal growth. The unincorporated part of Douglas County showed a decrease in population. Washington County showed a minimal growth with the greatest increase in the City of Blair and the unincorporated part of the county.

Major decreases in population were recorded in Burt and Thurston Counties, with Dakota County remaining about the same, although slightly lower.

G. Surface Water

1. Missouri River – The Missouri River forms the eastern boundary of the District and lies in a broad, flat valley which averages about five miles in width. The channel averages 700 feet wide and 8.5 feet deep with an average daily discharge of 30,140 cubic feet per second (cfs) at Omaha, Nebraska. The river gradient averages one foot per mile. During major spring flooding periods, the Missouri River has reached 190,000 cfs. Major uses of the river are domestic water supply, recreation and commercial barge traffic. The District contains 140 miles of Missouri River frontage.

2. Platte River – The Platte River is a major right bank tributary of the Missouri River and is the principal river in Nebraska. It drains an area of 89,100 square miles which includes the more populous and highly developed areas of Colorado, Wyoming, and Nebraska. The Platte is the western boundary of the District in Douglas County, and the western and southern boundary in Sarpy County. The channel capacity of the Platte ranges from 40,000 cfs to 44,000 cfs, and the river bank ranges from four to eight feet in height. The river gradient averages 4.6 feet per mile. Major uses of the river are recreation, irrigation, and groundwater recharge. The District contains the lower 50 miles of the Platte River.

3. Elkhorn River – The Elkhorn River is a major left bank tributary of the Platte River. The Elkhorn drains about 6,960 square miles and joins the Platte at the western edge of Sarpy County. The channel capacity ranges from 30,000 cfs to 35,000 cfs, with banks typically 10-15 feet in height. The river gradient averages two feet per mile. The major uses of the river are recreation and irrigation. The District contains the lower 35 miles of the Elkhorn River.

4. Lakes – There are many small lakes and farm ponds in the District. The largest lakes were constructed as flood control reservoirs surrounding Omaha. These are Cunningham Lake, Standing Bear Lake, Wehrspann Lake, Zorinsky Lake, Candlewood Lake, Walnut Creek Lake, Newport Landing Lake, and Youngman Lake. Summit Lake, located west of Tekamah, was built as a part of the Tekamah-Mud Watershed Project.

   Other lakes formed as the result of sand and gravel quarry excavation. These include Hansen lakes, Chris Lake, Ginger Cove, Ginger Woods, Hawaiian Village, Villa Springs, Riverside Lakes, and Grey's Lake. The predominant use of these lakes is for private recreation.

H. Groundwater

Groundwater quantities in the District are extremely diverse in nature (see Figures 9, 10, 11, and 12 in the Appendix). Wells located in the floodplains of the Missouri, Platte, and Elkhorn Rivers produce large quantities of water. Groundwater supplies in the upland areas are scattered with many wells drilled into perched (confined) water tables. Some wells in the upland area can produce for only short periods of time, while others produce a constant supply of water. Figure 13 in the Appendix shows the locations of the District's water level monitoring wells.

Groundwater quality is generally good throughout the District except for the Missouri River Valley. Historically, groundwater in this area is high in dissolved solids, particularly iron and manganese, which produce taste and odor problems in the water. Figure 14 in the Appendix shows the locations of the District's water quality monitoring wells.

Wells in the Platte Valley produce large amounts of good quality groundwater. The Cities of Omaha, Papillion, Valley, Lincoln and Fremont maintain municipal well fields in the Platte Valley.

The District's Groundwater Management Plan was adopted in March, 1994. Data collection is a major component of the plan. However, the plan does include "triggers" for additional action by the District. Recent legislation by the Nebraska Legislature may require changes to the Groundwater Management Plan. The changes, if any, will be included in that document.

I. Recreational Facilities

The District probably has the most diversity of the NRDs. It includes sparsely populated rural areas and the highly urbanized areas of metropolitan Omaha. From a recreation standpoint, the District includes a typical cross-section of recreational opportunities from passive to highly organized sports. The latest (September, 2005) Nebraska State Outdoor Recreation Plan (SCORP) indicates that there is a need for more facilities to meet existing demand.

Over the past 10-15 years, the types of recreation activities which the majority of the population is involved with have not changed significantly. Those activities which provide the ability to be outside, closer to a more natural environment, are generally preferred.

Trails, picnic areas, camping, boat launch facilities, and fishing appear to be the most appropriate recreational activities for large resource areas. They are an integral part of these resources and provide the facilities which are participated in by the largest part of the population.

Today, a particularly high priority for recreational opportunities is multi-use trails. Trails provide a variety of experiences within a resource are important, but also the linkages within a given recreation area, and with other recreational areas within a community is just as important. To meet this need, the District has either constructed, or cost shared on almost 130 miles of trails in the Omaha area alone. Other communities have established similar trail networks serving the same purposes.

J. Cooperating Agencies

The District cooperates regularly with a variety of state, federal and local agencies to accomplish its mission. The following agencies are important partners of the District.

1. Federal
    a. USDA Natural Resources Conservation Service
    b. USDA Farm Services Agency
    c. US Army Corps of Engineers
    d. US Environmental Protection Agency
    e. US Fish and Wildlife Service
    f. National Park Service
    g. US Geological Survey
    h. Federal Emergency Management Agency
    i. Federal Highway Commission

2. State
    a. Nebraska Department of Natural Resources

b. Nebraska Department of Environmental Quality
c. Nebraska Game and Parks Commission
d. Nebraska Department of Health and Human Services
e. Nebraska Department of Roads
f. Nebraska Emergency Management Agency
g. Board of Educational Lands and Funds
h. Nebraska Department of Economic Development
i. University of Nebraska – Lincoln Cooperative Extension

3. Local
   a. Cities and Villages Governing Bodies
   b. County Governing Bodies
   c. Metropolitan Area Planning Agency
   d. Metropolitan Utilities District
   e. Omaha Public Power District
   f. Sanitary and Improvement Districts

4. Cooperating Associations
   a. Nebraska Association of Resources Districts
   b. Nebraska Water Resources Association
   c. Greater Omaha Chamber of Commerce
   d. Nebraska League of Municipalities
   e. Nebraska County Officials Association
   f. Nebraska Rural Water Association
   g. Association of State Floodplain Managers
   h. Nebraska Stormwater and Floodplain Managers Association
   i. Nebraska Groundwater Federation
   j. National Association of Conservation Districts
   k. Nebraska Society of Professional Engineers
   l. Omaha Safety Council

III. Resource Management Needs

In the Introduction to this Master Plan, the various authorities resting with Nebraska's NRD's were outlined. As stated earlier, each NRD decides how these authorities will be addressed and prioritized. The District has combined these twelve authorities into seven resource management needs. These needs are prioritized by the District's Board of Directors from time to time to meet current issues and needs of the District.

Based on current needs, the District's Board of Directors have prioritized these resources management needs as follows:

1. Reduce flood damages.
2. Maintain water quality and quantity.
3. Reduce soil erosion and sedimentation damages.
4. Provide outdoor recreation facilities.
5. Provide domestic water supply.
6. Develop and improve fish and wildlife habitat and forest resources.
7. Participate in solid waste management and recycling.

Each of these needs will be discussed in more detail below.

A. Reduce flood damages.

Flood control has been, and will continue to be, a major function of the District, especially in the Papillion Creek Watershed. The District has sponsored numerous channel and levee projects in the area, and will continue to operate and maintain these projects into the future. A listing of these projects will appear later in this section.

In response to the 1987 Water Quality Amendments to the Clean Water Act, EPA published the rules for Phase I of the National Pollutant Discharge Elimination System (NPDES) stormwater program in 1990. The Phase I program requires municipalities with populations of 100,000 or greater to implement a stormwater management program as a means to control discharges from the "Municipal Separate Storm Sewer System" (MS4). The NPDES stormwater program is a permit based program that established requirements that municipalities must meet to discharge storm water from MS4s to the nation's surface waters. The City of Omaha is operating under a Phase I permit issued October 1, 2003.

In March 2003, EPA initiated the Phase II program, which required smaller MS4s located in urbanized areas to implement a stormwater management program. Douglas County, Sarpy County, Elkhorn, La Vista, Ralston, Bellevue, Papillion, Girls and Boys Town of Omaha are operating under a Phase II permit issued August 1, 2004.

Storm water management programs for both Phase I and Phase II, require that communities reduce the discharge of pollutants to the "maximum extent practicable". The regulations require that the management program address (at a minimum) six elements, that when implemented are expected to result in significant water quality benefits.

In response to this requirement, the Cities of Omaha, LaVista, Ralston, Papillion, Bellevue, Bennington and Boys Town, plus Douglas and Sarpy Counties formed the Papillion Creek Watershed Partnership (PCWP). In 2009, Douglas County and Bennington decided not to remain in the PCWP. Although each member of the partnership is required to have its own NPDES Stormwater permit, the partnership provided a means to standardize the requirements for the whole area. The District is included in the partnership due to its jurisdiction over the entire Papillion Creek Watershed, and for its authorities in flood control and water quality.

In 2006, the District adopted the recommended PCWP Stormwater Policies (included in the appendix). The six policy areas address both stormwater quantity and quality and are listed below:

1. Water Quality
2. Peak Flow Reduction
3. Landscape Preservation, Restoration, and Conservation
4. Erosion and Sediment Control and Other BMPs
5. Floodplain Management
6. Stormwater Financing

The policies aim to reduce stormwater quantity through the installation of fifteen regional stormwater detention basins (See Figure 15 in the Appendix), and to improve water quality, the requirement was added that the first ½ inch of runoff from all new developments and significant re-development in the watershed be retained and treated. Additionally, PCWP members are requiring a "no net increase" in runoff from the 2 year storms.

Stormwater quality is also addressed with the installation of twelve water quality basins in the watershed designed to primarily trap sediments and nutrients from the drainage basins. These basins will compliment the requirement to retain the first ½ inch of runoff from new developments. In many cases, the ½ inch retention can be accomplished through the use of "Low Impact Development" techniques and include such BMPs as rain gardens and bio-swales.

The following programs and projects address flood control in the District.

1. Channel Maintenance Program (CMP) – The District maintains channels and levees along the Papillion Creek in Douglas and Sarpy Counties.

2. West Papillion Creek Channel Project – The District is constructing a 100 year channel between Papillion and Giles Road. Upon completion, it will be included with the CMP.

3. Missouri River R-613 Levee – The District, as local sponsor, maintains this Corps of Engineers levee along the Platte and Missouri Rivers, and the lower Papillion Creek in Sarpy County.

4. Missouri River R-616 Levee – The District, as local sponsor, maintains this Corps of Engineers levee along the Missouri River north of the Papillion Creek outlet.

5. Union Dike – The District maintains this levee along the north side of the Platte River between Valley and Fremont.

6. Big Papillion Creek Channel Project – The District constructed and maintains this channel project between Harrison and Blondo Streets in Douglas County.

7. Papio Reservoirs and Water Quality Basins – The District has constructed several of the Corps' original 21 flood control structures in the Papillion Creek Watershed. These include Newport Landing (Site 6), Walnut Creek (Site 21), and Youngman (Site 13). Operation and maintenance will continue on these structures. Currently, two regional reservoirs, WP5 and 15A, are in the planning stages. In the future, the District, through the PCWP and partnerships with developers, additional sites may be installed.

8. Little Papillion Creek Channel Project – The District maintains the channel improvement project along the Little Papillion Creek between Boyd and Q Streets in Douglas County. Douglas County was the original sponsor of this Corps of Engineers project.

9. Floodplain Management Program – The District provides technical assistance to communities, developers, and individuals concerning the wise use of designated floodplains in the District.

10. Western Sarpy/Clear Creek Levee Project – The District merged with the Western Sarpy Drainage District in 1999. Following the severe flooding in 1993, the District, along with the Lower Platte South NRD and the Lower Platte North NRD, is sponsoring a levee improvement project with the Corps of Engineers. Construction is anticipated to be complete in 2010. This project is located in southwest Sarpy County along the Platte and Elkhorn Rivers.

11. Floodway Purchase Program – The District participates in the buy-out of structures in the floodway to lessen flood damages and prevent loss of life during flood events.

12. Flood Mitigation Planning Program – The District developed, and consistently updates a regional All Hazards Mitigation Plan. The District also cost-shares with communities in the development of All Hazard Mitigation Plans for their communities.

13. Pigeon/Elk Creek Improvement Project Area – The District merged with Drainage District #5 in Dakota County encompassing the Elk Creek and Pigeon Creek Watersheds. The project includes levee improvement and maintenance, plus measures to reduce sedimentation. Grade stabilization structures are planned for the area.

14. Pigeon/Jones Site 15 – This is a multi-purpose flood control, sediment retention, and recreation in Dakota County. Construction is anticipated for 2011-12.

15. Small Flood Control Program – This program provides technical and financial assistance to landowners for the installation of small flood control structures (less than one square mile drainageway area) in the Papillion Creek Watershed.

16. Urban Stormwater Program – This program encourages wise management of stormwater in urbanized and developing areas in the District. The PCWP was an outgrowth of this program.

17. Stormwater BMP Program – This District program provides technical and financial assistance to communities for the installation of innovative best management practices to control stormwater and to improve water quality.

18. Offutt Drain Project – The District, in cooperation with the City of Bellevue and Offutt Air Force Base, improved a drainage channel from the base to Missouri River Levee R-616 in Sarpy County. The District maintains the project.

19. Urban Drainageway Program – The District provides technical and financial assistance to units of government to solve major erosion and flooding concerns on drainageways in urban areas.

20. Elkhorn River Breakout Improvement Project Area – The District is cooperating with the Lower Platte North NRD on this flood control project. The project itself is along the Elkhorn River in Dodge County, but a portion of the benefited area is in Douglas County. The Lower Platte North is the lead agency on this project.

B. Maintain Water Quality and Quantity

Groundwater and surface water quality is an important natural resource issue from the public's viewpoint. The District plans to ensure that an adequate supply of good quality water, both surface and groundwater, for all beneficial uses.

According to state law, the District developed its Groundwater Management Plan (GWMP) in 1994 to address both quantity and quality issues. The plan provides triggers for additional actions, plus a matrix on how to address issues as they develop.

Recently, the interconnectedness between surface and groundwater, called conjunctive use, must now be considered in water planning efforts. The Legislature directed the Nebraska Department of Natural Resources to conduct evaluations of the state's major river basins to determine if the water resources are either "not fully appropriated", "fully appropriated", or "over appropriated" based on the impacts of continued pumping of groundwater on stream flow.

Currently, there are no fully or over appropriated basins in the District. However, the lower Platte River Basin is currently of concern. Should any basin be declared fully or over appropriated, an integrated water management plan must be developed.

The following programs and projects address water quality and quantity issues.

1. Groundwater Monitoring Program – As required in the Groundwater Management Plan, the District gathers monitoring, both quantity and quality, on over 100 wells in the District in five groundwater areas; Missouri, Platte, Elkhorn, Dakota, and Upland areas.

2. Eastern Nebraska Water Resources Assessment Project (ENWRA) – The District is cooperating with five other NRD's (Lower Platte South, Lower Platte North, Lower Elkhorn, Lewis and Clark, and Nemaha NRD's) to assess the water resources in Eastern Nebraska. This long term project will characterize the geology and water bearing formations to assist the NRD's in implementing their GWMP's.

3. Chemigation Certification Program – Center pivot irrigators who apply chemicals through these systems are required to obtain a permit from the District. In order to obtain the permit, operators must demonstrate that the required safety equipment has been installed and is operational.

4. Well Abandonment Program – The District cost-shares with landowners to properly decommission a well that is no longer in use.

5. Clean Lakes Program – The District cooperates with various units of government on the development and implementation of watershed management plans above recreation reservoirs in the District. Plans have been completed on Wehrspann, Zorinsky, Standing Bear, Cunningham, and Walnut Creek Lakes.

6. Lake Dredging Program – The District cost-shares with units of government to dredge sediment basins in watersheds above recreation lakes.

7. Lower Platte River Corridor Alliance – The Lower Platte River Corridor Alliance (LPRCA) was formed in 1996 between the District, the Lower Platte South, the Lower Platte North NRD's and the Nebraska Departments of Natural Resources, Environmental Quality, Gamer and Parks Commission, and the Health and Human Services. The LPRCA attempts to coordinate the development of land and water resources in the Lower Platte River Basin. The efforts are primarily aimed at protecting the natural resource base in the corridor.

C. Reduce Soil Erosion and Sedimentation Damages

One of the most visible detriments to water quality is erosion following heavy rain events. Erosion transports sediment making the water murky. Sediment carried by stormwater is deposited in lakes, streams, roadside ditches, city streets, and many other places.

Control of sediment at its source is the most economical means to control erosion and reduce sedimentation.

The following District programs and projects address erosion and sedimentation:

1. Conservation Assistance Program (CAP) – The District cost-shares with landowners on agricultural best management practices to control erosion. In addition, certain watershed areas are designated for special land treatment, including terraces, waterways, and grade stabilization structures. Silver Creek Watershed in Burt County and Pigeon/Jones Watershed in Dakota County are two examples.

2. Nebraska Soil and Water Conservation Program – The District administers this state cost-share program on the local level. Agricultural best management practices, including terraces and waterways are the primary practices.

3. NRCS Assistance Program – The District provides staff to the Natural Resources Conservation Service to provide technical assistance to landowners in the installation of best management practices, and to help administer District programs.

4. Urban Conservation Program – The District provides technical assistance to units of government in the review of new developments for erosion and sedimentation issues, drainageway concerns, and floodplain considerations.

5. Urban Conservation Assistance Program – The District cost-shares with units of government to install urban best management practices for erosion and stormwater management.

6. Papillion Creek P.L. 566 Watershed Project – The District is local sponsor of this special project to address grade control (gully erosion) problems in the Papillion Creek Watershed in Douglas, Washington, and Sarpy Counties. Twenty-eight of fifty-two structures have been constructed. The District operates and maintains the completed structures.

7. Tekamah-Mud P.L. 566 Watershed Project – The District is the local sponsor of this special project to provide grade stabilization in the Tekamah and Mud Creek Watersheds in Burt County. All fifteen structures have been installed and are operated and maintained by the District.

8. Turtle Creek P.L. 566 Watershed Project – The District is the local sponsor for this special project to provide grade stabilization in the Turtle Creek watershed in Sarpy County. Both structures have been installed and are operated and maintained by the District.

9. Buffalo Creek Watershed – This special watershed project in Sarpy County addressed grade stabilization problems. All ten structures have been installed and are operated and maintained by the District.

10. Elkhorn River Improvement Project Area – Landowners along the Elkhorn River in Douglas County petitioned the District to help solve a severe streambank erosion problem in the reach between King Lake and Highway 36. Financial assistance was obtained from the Nebraska Natural Resources Commission (75%). The District contributed 15% and

the landowners contributed the remaining 10%. The project was completed in 1999. The District operates and maintains the project, with the costs paid by the landowners through a special assessment.

11. Erosion and Sediment Control Program – The Nebraska Erosion and Sediment Control Act of 1986 provides for a complaint system whereby landowners whose property is damaged by sediment from soil erosion on adjacent lands, can get this erosion controlled. The District administers this program on the local level.

D. Provide Outdoor Recreation Facilities

The majority of recreational facilities built, operated, and/or maintained by the District are part of a larger project, usually a flood control facility, or habitat restoration project. Recreational facilities usually include trails, camping, boating, and picnicking.

The District also encourages other units of government to install and maintain recreational facilities through cost share programs.

The following programs and projects involve outdoor recreation.

1. Chalco Hills Recreation Area – The District is the recreation sponsor of this Corps of Engineers flood control project. The recreation area surrounds Wehrspann Lake in Sarpy County and was originally referred to Dam Site 20. The dam is maintained by the Corps while the recreation facilities are operated and maintained by the District.

2. Elkhorn Crossing Recreation Area – This area was built as a part of the Elkhorn River Bank Stabilization Project. It contains a boat ramp for canoes and airboats, and provides space for primitive camping.

3. Platte River Landing Recreation Area – This relatively small recreation area is located west of Valley on the Platte River to provide a public access to the river.

4. Prairie View Recreation Area – The reservoir for this area was built by a private developer as a water quality basin above Newport Landing (Dam Site 6). The District constructed recreational facilities, including a trail and a boat ramp.

5. Elkhorn River Canoe Access – The District built the canoe launch site in 2006. The site provides a public access to the Elkhorn River at Waterloo, Nebraska. The Village of Waterloo operates and maintains the site.

6. Graske Crossing Canoe Access – The District built, operates and maintains this canoe access site on the Elkhorn River at West Dodge Road.

7. Papio Trails Project – The District has added a recreational trail to its some of the levees projects. Trails are planned, designed, and constructed under this program.

8. Trails Assistance Program – The District cost shares with communities to construct trails within their jurisdictions.

9. Recreation Area Development Program – The District cost shares with communities to acquire, develop, and improve recreational facilities in their jurisdictions.

E. Provide Domestic Water Supply

The legislation that created natural resources districts allowed existing rural water districts to be included or not. The legislation also noted that nay future rural water districts had to be formed by NRD's. Those rural water districts that chose to remain independent are still operational in the state.

The District operates four rural water districts; Dakota County, Thurston County, Washington County #1, and Washington County #2. These projects are operated separately and independently with no District funds.

The following projects address this resource management need.

1. Washington County Rural Water Project #1 – The District has operated this project since 1980 in southeast Washington County. The project purchases treated water from the Metropolitan Utilities District. The City of Fort Calhoun and 465 rural water customers are served by the project.

2. Washington County Rural Water Project #2 – This system located between Blair and Fort Calhoun was established in 2005. Treated water is purchased from Blair and serves 265 rural households. In addition, this system was designed to connect the municipal water systems of Blair and Omaha such that either could provide water to the other in the event of a catastrophe.

3. Dakota County Rural Water Project – This system purchases treated water from Dakota City and serves 650 rural households. An interconnection exists between the municipal systems of Dakota City and South Sioux City such that either could provide water to the other in the event of a catastrophe.

4. Thurston County Rural Water Project – This system, located in central Thurston County, purchases treated water from Pender and serves 145 rural customers.

F. Develop and Improve Fish and Wildlife Habitat and Forest Resources

Fish and wildlife habitat is a natural outcome of many District programs and projects. It may not even be the primary purpose of the project. Grass cover on a levee, windbreak trees, permanent water in a reservoir, and water quality wetlands all create habitat for wildlife.

The following programs and projects address habitat and forest resources.

1. Missouri River Corridor Project – Approximately 140 miles of the Missouri River borders the District. This project was started to restore, renovate, and create wetland habitat along the river, as well as reconnecting oxbow lakes and other backwater areas. Additionally, cultural and historic resources are also identified and restored where practical. The District works with various agencies such as the Corps of Engineers and the Fish and Wildlife Service, tribes, and other private entities on these projects.

2. Back to the River Project – This program is an outgrowth of the Missouri River Corridor Project and is aimed at getting people "back to the river". Many recreational measures have been planned and installed under this program, including trails and cultural resource facilities.

3. Rumsey Station Wetland – The District acquired this property as a part of the West Branch Channel Improvement Project. The wetland area has been enhanced to provide mitigation for the channel project, as well as then establishment of a wetland bank to offset wetland losses on other District projects.

4. Heron Haven Wetland – The District cooperated with the Omaha Chapter of the Audubon Society to acquire and develop this wetland in west central Omaha. Currently, the Friends of Heron Haven operate the site as an educational center.

5. Wetland Mitigation Bank – The District established its first wetland bank at Rumsey Station. This program identifies and constructs wetland and channel mitigation banks for use on District projects, or providing units for sale to others as mitigation sites.

6. Conservation Easement Program – Under this program, the District can acquire (purchase) a conservation easement over a piece of property protecting natural resources on the site from destruction, or development.

7. Nebraska WILD Program – The Nebraska Game and Parks Commission and the District cooperate to create and improve wildlife habitat on private lands.

8. Tree Planting Program – The District works with individual landowners to plant trees for windbreaks, shelterbelts, and/or wildlife habitat. This program is also used in urban areas.

G. Participate Solid Waste Management and Pollution Control

The District's involvement with solid waste is limited to household hazardous waste and the use of recycled products. The following program addresses this need.

1. Solid Waste and Recycling Program – The District cooperates with the Nebraska Recycling Association, MAPA, and other agencies to develop markets for recycled products and alternative means to disposal of solid waste.

IV. The Master Plan

The purpose of this Master Plan is to outline an action plan for the District for the next ten year period. The Plan sets a direction for the future, but does not address the specifics of day-to-day operations.

Currently:

- Concern for the environment and related natural resources issues are a high priority for the general public.
- Conversion of agricultural lands to urban uses continues to be a challenge for resource management.
- NRD's address a wide variety of natural resources issues and concerns.
- Since NRD's are formed along hydrologic boundaries, they are not limited by jurisdictional boundaries.

Given the specific issues related to the District, the following goals and objectives represent the master plan through the year 2020. While goals are listed according to the priorities established by the Board of Directors, the objectives for each goal are not listed in any particular order.

A. Reduce flood damages.

The District will reduce losses due to flooding through the following measures:

- Watershed planning, land treatment and management.
- Construction of structural measures such as levees, dams, and/or channels to contain flood waters, where practical.
- Promote proper floodplain management principles and techniques to help separate the general public from the flood waters.
- Promote non-structural measures such as low impact development measures to control flood waters, where practical.

Objectives:

1. In cooperation with the Papillion Creek Watershed Partnership (PCWP), construct regional flood control reservoirs.
   a. 2011-13 – Structures West Papillion #5 (WP5) and Dam Site 15A
   b. 2014-17 – Structure Dam Site 19
   c. 2018-20 – West Papillion #6, West Papillion #8, and West Papillion #4

2. In cooperation with the PCWP, construct regional water quality basins.
   a. 2011-13 – Basins WP5-1, DS 15A-1, DS 15A-2, Zorinsky Basin 1, and Cunningham Lake 6.
   b. 2014-17 – Zorinsky Basin 2
   c. 2018-20 – Cunningham Basin 5

3. Construct Pigeon/Jones Structure 15, a regional flood control project, in Dakota County in 2010-11.

4. Promote removal of structures within the floodway through voluntary purchase programs.

5. Provide technical assistance to individuals and units of government for sound floodplain management.

6. Provide technical and financial assistance to units of government for the installation of non-structural flood control measures.

7. Promote, and provide technical and financial assistance for low impact development measures to improve surface water quality, and to control runoff from lower intensity rainfall events.

8. Provide technical and financial assistance to units of government outside the Papillion Creek Watershed for the installation of structural flood control measures.

9. Provide technical and financial assistance to communities for the development of Flood Hazard Mitigation Planning.

10. Continue to re-evaluate and update flood insurance studies for water courses in the District.

11. Merge with existing drainage districts upon request.

B. Maintain water quality and quantity.

The District will continue to ensure that an adequate supply of good quality water, both surface and groundwater, is available for all beneficial uses. In addition, the District will promote best management practices to prevent contamination of water.

Objectives:

1. Implement the District's Groundwater Management Plan. In addition, update the plan as necessary.

2. Continue to provide technical assistance in the establishment of wellhead protection areas surrounding municipal well fields.

3. Continue to provide technical and financial assistance in the proper decommissioning of abandoned wells.

4. Continue to co-sponsor the Eastern Nebraska Water Resources Assessment Project with the Lower Platte South, Lower Platte North, Nemaha, Lower Elkhorn, and Lewis and Clarks NRD's.

5. Work with sponsors of publicly-owned recreational lakes and reservoirs to install water quality basins and other measures to improve and protect water quality.

6. Continue to participate in the Lower Platte River Corridor Alliance and its various programs and projects.

7. Evaluate requests for assistance from communities desiring to participate in regional wastewater treatment operations to improve water quality.

8. Assist with the development and implementation of approved community-based watershed management plans for area lakes and reservoirs.

C. Reduce soil erosion and sedimentation damages.

The District will promote programs and projects to control erosion and sedimentation in the District through the following measures:

- Reduce soil erosion and sedimentation on agricultural lands.
- Control gully and ephemeral erosion.
- Reduce sedimentation from developed and developing areas.
- Control streambank erosion.

Objectives:

1. Provide technical and financial assistance to rural landowners for the utilization of best management practices for erosion and sediment control.

2. Assist units of government with the implementation of NPDES (National Pollution Discharge Elimination System) permit requirements on developing urban areas.

3. Provide accelerated technical and financial assistance in priority watershed areas including but not limited to the following:
   a. Blackbird Creek
   b. Silver Creek
   c. Pigeon Creek
   d. Elk Creek
   e. Omaha Creek
   f. Pigeon/Jones

4. Administer the Nebraska Erosion and Sediment Control Program.

5. Provide technical assistance to landowners to address streambank erosion.

6. Continue to cooperate with USDA agencies, such as the Natural Resources Conservation Service and Farm Services Agency, in the development and implementation of soil conservation programs and projects.

D. Provide outdoor recreation facilities.

The District will continue to promote multi-purpose projects that include public recreation facilities. In addition, the District will assist other units of government with the installation of public recreation projects.

Objectives:

1. Continue to operate and maintain the following public recreation projects:
   a. Chalco Hills Recreation Area
   b. Elkhorn Crossing Recreation Area
   c. Platte River Landing Recreation Area
   d. Prairie View Recreation Area
   e. Graske Crossing Recreation Area

2. Continue implementation of the Metropolitan Area Trails Plan.

3. Monitor status of railroad abandonments in the District for possible conversion to recreational trails.

4. Provide technical and financial assistance to units of government in the development and improvement of public recreation facilities, such as trails and parks.

E. Provide domestic water supply.

The District will continue to investigate, develop, operate and maintain potable water supply systems for areas within the District upon request.

Objectives:

1. Continue to operate and maintain the following rural water projects:
   a. Washington County #1 Rural Water Project
   b. Washington County #2 Rural Water Project
   c. Dakota County Rural Water Project
   d. Thurston County Rural Water Project.

2. Continue to evaluate requests from groups and communities to provide a dependable source of potable water and implement feasible water supply systems.

3. Cooperate with other entities to provide water service in rural areas.

F. Develop and improve fish and wildlife habitat and forest resources.

The District will continue to promote best management practices that will:

- Provide adequate habitat for wildlife, including food and shelter.
- Establish and maintain woodland areas in both rural and urban areas.
- Preserve, protect, and enhance wetlands and other natural features.

Objectives:

1. Continue the implementation of the Missouri River Corridor Project restoring habitat and wetlands various areas.

2. Continue as a sponsor of the "Back to the River" Project.

3. Identify, develop, operate, and maintain wetland mitigation banks in the District.

4. Evaluate areas proposed for conservation easements in the District, particularly along the Platte, Elkhorn and Missouri River.

5. Provide technical and financial assistance to landowners, both rural and urban, in the establishment and management of woodland areas.

6. Provide technical and financial assistance to landowners in the establishment, improvement, and management of wildlife habitat areas.

7. Cooperate with other federal, state, and local agencies to prepare a detailed natural resources inventory of the District to identify ecologically unique areas.

G. Participate in solid waste management and pollution control.

The District will continue to assist other units of government with:

- pollution control
- the proper disposal of solid, household, and hazardous wastes
- to promote

Objectives:

1. Promote proper disposal of solid wastes.

2. Promote expanded development of markets for recycled products.

H. Develop programs, policies, and other resources to implement the Master Plan.

The District will continue to develop innovative programs and policies to help the District implement this Master Plan.

Objectives:

1. Continue to evaluate personnel needs to fully implement the master plan.

2. Continue to seek outside funding sources, such as the Nebraska Environmental Trust and the Nebraska Resources Development Fund, for projects.

3. Pursue use of funding from private foundations for projects.

4. Continue to utilize public-private partnerships in the development of major projects.

V. Public Input

(This section to be added after public meetings.)

VI. Appendix

1. Papio-Missouri River Natural Resources District Stormwater Management Policies
2. Figure Number 1 - Nebraska's Natural Resources Districts
3. Figure Number 2 – P-MRNRD Base Map
4. Figure Number 3 - Watershed Drainage Basins
5. Figure Number 4 - Generalized Elevation Map
6. Figure Number 5 - Soils from NRCS Statsgo
7. Figure Number 6 - Simplified Soil Classification from NRCS Statsgo
8. Figure Number 7 - Erosion Index Derived from NRCS Statsgo Soils
9. Figure Number 8 - Land Use/Cover Map
10. Figure Number 9 - Groundwater Regions Map
11. Figure Number 10 - Geologic Bedrock Map
12. Figure Number 11 - Thickness of the Principal Aquifer
13. Figure Number 12 - Configuration of the Water Table
14. Figure Number 13 - Water Level Monitoring Location Map
15. Figure Number 14 - Groundwater Quality Monitoring Location Map
16. Figure Number 15 - Papillion Creek Watershed Management Plan

Papio-Missouri River NRD Stormwater Management Policies

POLICY GROUP #1: WATER QUALITY IMPROVEMENT

ISSUE: Waters of the Papillion Creek Watershed are impaired.

"ROOT" POLICY: Improve water quality from all contributing sources, including but not limited to, agricultural activities, urban stormwater, and combined sewer overflows, such that waters of the Papillion Creek Watershed and other local watersheds can meet applicable water quality standards and community-based goals, where feasible.

SUB-POLICIES:

1) Water Quality LID shall be required on all new developments and significant redevelopments.
2) Protect surface and groundwater resources from soil erosion (sheet and rill, wind erosion, gully and stream bank erosion), sedimentation, nutrient and chemical contamination. Buffer strips and riparian corridors should be established along all stream segments.
3) Preserve and protect wetland areas to the fullest extent possible to maintain natural hydrology and improve water quality by minimizing the downstream transport of sediment, nutrients, bacteria, etc. borne by surface water runoff. Reestablishment of previously existing wetlands and the creation of new wetlands should be promoted. Any impacted wetlands shall be mitigated at a 3:1 ratio.
4) Support NDEQ in an accelerated TMDL development process that addresses potential pollutant sources in a fair and reasonable manner based on sound technical data and scientific approach.
5) Implement Best Management Practices (BMPs) that reduce both urban and rural pollution sources, maintain or restore designated beneficial uses of streams and surface water impoundments, minimize soil loss, and provide sustainable production levels. Water quality basins shall be located in general conformance with an adopted Papillion Creek Watershed Management Plan.

REFERENCE INFORMATION

DEFINITIONS:

1) Low-Impact Development (LID). A land development and management approach whereby stormwater runoff is managed using design techniques that promote infiltration, filtration, storage, evaporation, and temporary detention close to its source. Management of such stormwater runoff sources may include open space, rooftops, streetscapes, parking lots, sidewalks, medians, etc.
2) Water Quality LID. A level of LID using strategies designed to provide for water quality control of the first ½ inch of stormwater runoff generated from each new development or significant redevelopment and to maintain the peak discharge rates during the 2-year storm event to baseline land use conditions, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
3) Best Management Practice (BMP). "A technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of stormwater runoff in the most cost-effective manner." *[Source: U.S. Environmental Protection Agency (EPA)]*

4) Total Maximum Daily Load (TMDL). A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Water quality standards are set by States, Territories, and Tribes. They identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. The Clean Water Act, Section 303, establishes the water quality standards and TMDL programs, and for Nebraska such standards and programs are administered by the Nebraska Department of Environmental Quality. *[Source: EPA and Nebraska Surface Water Quality Standards, Title 117].*

POLICY GROUP #2: PEAK FLOW REDUCTION

ISSUE

Urbanization within the Papillion Creek Watershed has and will continue to increase runoff leading to more flooding problems and diminished water quality.

ROOT POLICY

Maintain or reduce stormwater peak discharge during development and after full build-out land use conditions from that which existed under baseline land use conditions.

SUB-POLICY

1) Regional stormwater detention facilities and other structural and non-structural BMPs shall be located in general conformance with an adopted Papillion Creek Watershed Management Plan and shall be coordinated with other related master planning efforts for parks, streets, water, sewer, etc.
2) Maximum LID shall be required to reduce peak discharge rates on all new developments and significant redevelopments as identified in the Papillion Creek Watershed Management Plan.
3) All significant redevelopment shall maintain peak discharge rates during the 2, 10, and 100-year storm event under baseline land use conditions.

REFERENCE INFORMATION

DEFINITIONS

1) Low-Impact Development (LID). A land development and management approach whereby stormwater runoff is managed using design techniques that promote infiltration, filtration, storage, evaporation, and temporary detention close to its source. Management of such stormwater runoff sources may include open space, rooftops, streetscapes, parking lots, sidewalks, medians, etc.
2) Water Quality LID. A level of LID using strategies designed to provide for water quality control of the first ½ inch of stormwater runoff generated from each new development or significant redevelopment and to maintain the peak discharge rates during the 2-year storm event to baseline land use condition, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
3) Maximum LID. A level of LID using strategies, including water quality LID and on-site detention, designed not to exceed peak discharge rates of more than 0.2 cfs/acre during the 2-year storm event or 0.5 cfs/acre during the 100-year storm event based on the contributing drainage from each site, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.
4) Peak Discharge or Peak Flow. The maximum instantaneous surface water discharge rate resulting from a design storm frequency event for a particular hydrologic and hydraulic analysis, as defined in the Omaha Regional Stormwater Design Manual. The measurement of the peak discharge shall be at the lower-most drainage outlet(s) from a new development or significant redevelopment.
5) Regional Stormwater Detention Facilities. Those facilities generally serving a drainage catchment area of 500 acres or more in size.
6) Baseline Land Use Conditions. That which existed for Year 2001 for Big and Little Papillion Creeks and its tributaries (excluding West Papillion Creek) and for Year 2004 for West Papillion Creek and its tributaries.

7) Full Build-Out Land Use Conditions. Fully platted developable land use conditions for the combined portions of the Papillion Creek Watershed that lie in Douglas and Sarpy Counties that are assumed to occur by the Year 2040, plus the projected 2040 land uses within the Watershed in Washington County; or as may be redefined through periodic updates to the respective County comprehensive plans.

POLICY GROUP #3: LANDSCAPE PRESERVATION, RESTORATION, AND CONSERVATION

ISSUE: Natural areas are diminishing, and there is a need to be proactive and integrate efforts directed toward providing additional landscape and green space areas with enhanced stormwater management through restoration and conservation of stream corridors, wetlands, and other natural vegetation.

"ROOT" POLICY: Utilize landscape preservation, restoration, and conservation techniques to meet the multi-purpose objectives of enhanced aesthetics, quality of life, recreational and educational opportunities, pollutant reduction, and overall stormwater management.

SUB-POLICIES:

1) Incorporate stormwater management strategies as a part of landscape preservation, restoration, and conservation efforts where technically feasible.
2) Define natural resources for the purpose of preservation, restoration, mitigation, and/or enhancement.
3) For new development or significant redevelopment, provide a creek setback of 3:1 plus 50 feet along all streams as identified in the Papillion Creek Watershed Management Plan and a creek setback of 3:1 plus 20 feet for all other watercourses.
4) All landscape preservation features as required in this policy or other policies, including all stormwater and LID strategies, creek setbacks, existing or mitigated wetlands, etc., identified in new or significant redevelopment shall be placed into an out lot or within public right of way or otherwise approved easement.

REFERENCE INFORMATION

DEFINITIONS

1) Creek Setback. See Figure 1 below and related definitions in Policy Group #5. A setback area equal to three (3) times the channel depth plus fifty (50) feet (3:1 plus 50 feet) from the edge of low water on both sides of channel shall be required for any above or below ground structure exclusive of bank stabilization structures, poles or sign structures adjacent to any watercourse defined within the watershed drainage plan. Grading, stockpiling, and other construction activities are not allowed within the setback area and the setback area must be protected with adequate erosion controls or other Best Management Practices, (BMPs). The outer 30 feet adjacent to the creek setback limits may be credited toward meeting the landscaping buffer and pervious coverage requirements.

   A property can be exempt from the creek setback requirement upon a showing by a licensed professional engineer or licensed landscape architect that adequate bank stabilization structures or slope protection will be installed in the construction of said structure, having an estimated useful life equal to that of the structure, which will provide adequate erosion control conditions coupled with adequate lateral support so that no portion of said structure adjacent to the stream will be endangered by erosion or lack of lateral support. In the event that the structure is adjacent to any stream which has been channelized or otherwise improved by any agency of government, then such certificate providing an exception to the creek setback requirement may take the form of a certification as to the adequacy and protection of the improvements installed by such governmental agency. If such exemption is granted, applicable rights-of-way must be provided and a minimum 20 foot corridor adjacent thereto.

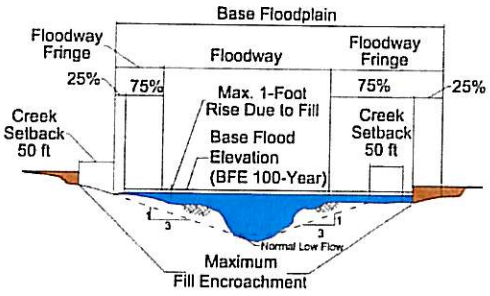


Figure 1 – Floodway Fringe Encroachment and Creek Setback Schematic

DEFINITIONS

1) Base Flood. The flood having a one percent chance of being equaled or exceeded in magnitude in any given year (commonly called a 100-year flood). *[Adapted from Chapter 31 of Nebraska Statutes]*
2) Floodway. The channel of a watercourse and the adjacent land areas that are necessary to be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. *[Adapted from Chapter 31 of Nebraska Statutes]*. The Federal Emergency Management Agency (FEMA) provides further clarification that a floodway is the central portion of a riverine floodplain needed to carry the deeper, faster moving water.
3) Floodway Fringe. That portion of the floodplain of the base flood, which is outside of the floodway. *[Adapted from Chapter 31 of Nebraska Statutes]*
4) Floodplain. The area adjoining a watercourse, which has been or may be covered by flood waters. *[Adapted from Chapter 31 of Nebraska Statutes]*
5) Watercourse. Any depression two feet or more below the surrounding land which serves to give direction to a current of water at least nine months of the year and which has a bed and well-defined banks. *[Adapted from Chapter 31 of Nebraska Statutes]*
6) Low Chord Elevation. The bottom-most face elevation of horizontal support girders or similar superstructure that supports a bridge deck.
7) Updated Flood Hazard Maps. The remapping of flooding sources within the Papillion Creek Watershed where Digital Flood Insurance Rate Maps (DFIRMs) are based on 2004 or more recent conditions hydrology and full-build out conditions hydrology. West Papillion Creek and its tributaries are currently under remapping and will become regulatory in 2009. Updating flood hazard maps for Big Papillion Creek and Little Papillion Creek are planned to be completed in the future.
8) New Development. New development shall be defined as that which is undertaken to any undeveloped parcel that existed at the time of implementation of this policy.

POLICY GROUP #4: EROSION AND SEDIMENT CONTROL AND OTHER BMPs

ISSUE: Sound erosion and sediment control design and enforcement practices are needed in order to protect valuable land resources, stream and other drainage corridors, and surface water impoundments and for the parallel purpose of meeting applicable Nebraska Department of Environmental Quality regulatory requirements for construction activities that disturb greater than one acre.

"ROOT" POLICY: Promote uniform erosion and sediment control measures by implementing consistent rules for regulatory compliance pursuant to State and Federal requirements, including the adoption of the Omaha Regional Stormwater Design Manual.

SUB-POLICIES:

1) Construction site stormwater management controls shall include both erosion and sediment control measures.

2) The design and implementation of post-construction, permanent erosion and sediment controls shall be considered in conjunction with meeting the intent of other Stormwater Management Policies.

3) Sediment storage shall be incorporated with all regional detention facilities where technically feasible.

REFERENCE INFORMATION

DEFINITIONS

1) Erosion Control. Land and stormwater management practices that minimize soil loss caused by surface water movement.
2) Sediment Control. Land and stormwater management practices that minimize the transport and deposition of sediment onto adjacent properties and into receiving streams and surface water impoundments.

POLICY GROUP #5: FLOODPLAIN MANAGEMENT

ISSUE: Continued and anticipated development within the Papillion Creek Watershed mandates that holistic floodplain management be implemented and maintained in order to protect its citizens, property, and natural resources.

"ROOT" POLICY: Participate in the FEMA National Flood Insurance Program, update FEMA floodplain mapping throughout the Papillion Creek Watershed, and enforce floodplain regulations to full build-out, base flood elevations.

SUB-POLICIES:

1) Floodplain management coordination among all jurisdictions within the Papillion Creek Watershed and the Papio-Missouri River Natural Resources District (P-MRNRD) is required.
2) Flood Insurance studies and mapping throughout the Papillion Creek Watershed shall be updated using current and full-build out conditions hydrology.
3) Encroachments for new developments or significant redevelopments within floodway fringes shall not cause any increase greater than one (1.00) foot in the height of the full build-out base flood elevation using best available data.
4) Filling of the floodway fringe associated with new development within the Papillion Creek System shall be limited to 25% of the floodway fringe in the floodplain development application project area, unless approved mitigation measures are implemented. The remaining 75% of floodway fringe within the project area shall be designated as a floodway overlay zone. For redevelopment, these provisions may be modified or waived in whole or in part by the local jurisdiction.
5) The low chord elevation for bridges crossing all watercourses within FEMA designated floodplains shall be a minimum of one (1) foot above the base flood elevation for full-build out conditions hydrology using best available data.
6) The lowest first floor elevation of buildings associated with new development or significant redevelopment that are upstream of and contiguous to regional dams within the Papillion Creek Watershed shall be a minimum of one (1) foot above the 500-year flood pool elevation.

REFERENCE INFORMATION

DEFINITIONS (See Figure 1 below and related definitions in Policy Group #3: Landscape Preservation, Restoration, and Conservation).

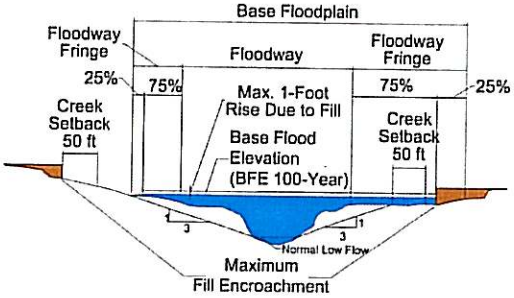


Figure 1 – Floodway Fringe Encroachment and Creek Setback Schematic

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2) Floodway. The channel of a watercourse and the adjacent land areas that are necessary to be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. *[Adapted from Chapter 31 of Nebraska Statutes].* The Federal Emergency Management Agency (FEMA) provides further clarification that a floodway is the central portion of a riverine floodplain needed to carry the deeper, faster moving water.
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8) New Development. New development shall be defined as that which is undertaken to any undeveloped parcel that existed at the time of implementation of this policy.

BASIC FEMA REQUIREMENTS

On March 1, 2003, FEMA became part of the U.S. Department of Homeland Security (DHS). In order for a community to participate in the FEMA National Flood Insurance Program, it must first define base flood elevations and adopt a floodway for all its major streams and tributaries. Once a community adopts its floodway, the requirements of *44 CFR 60.3(d)* must be fulfilled. The key concern is that each project in the floodway must receive an encroachment review; i.e., an analysis to determine if the project will increase flood heights or cause increased flooding downstream. Note that the FEMA regulations call for preventing any increase in flood heights. Projects, such as filling, grading or construction of a new building, must be reviewed to determine whether they will obstruct flood flows and cause an increase in flood heights upstream or adjacent to the project site. Further, projects, such as grading, large excavations, channel improvements, and bridge and culvert replacements should also be reviewed to determine whether they will remove an existing obstruction, resulting in increases in flood flows downstream. *[Adapted from Federal Emergency Management Agency guidance]*

POLICY GROUP #6: STORMWATER MANAGEMENT FINANCING

ISSUE: Regulatory requirements for stormwater management and implementation of Stormwater Management Policies intended to accommodate new development and significant redevelopment will impose large financial demands for capital and operation and maintenance beyond existing funding resources.

"ROOT" POLICY: Dedicated, sustainable funding mechanisms shall be developed and implemented to meet capital and operation and maintenance obligations needed to implement NPDES Stormwater Management Plans, Stormwater Management Policies, and the Papillion Creek Watershed Management Plan.

SUB-POLICIES:

1) All new development and significant redevelopment will be required to fund the planning, implementation, and operation and maintenance of water quality LID.
2) A Watershed Management Fee system shall be established to equitably distribute the capital cost of implementing the Papillion Creek Watershed Management Plan among new development or significant redevelopment. Such Watershed Management Fee shall only apply to new development or significant redevelopment within the Papillion Creek Watershed and the initial framework shall consist of the following provisions:
    a. Collection of fees and public funding shall be earmarked specifically for the construction of projects called for in the Papillion Creek Watershed Management Plan, including Maximum LID costs such as on site detention, regional detention basins, and water quality basins.
    b. Multiple fee classifications shall be established which fairly and equitably distribute the cost of these projects among all undeveloped areas within the Papillion Creek Watershed.
    c. Watershed Management Fees (private) are intended to account for approximately one-third (1/3) of required capital funds and shall be paid to the applicable local zoning jurisdiction with building permit applications.
    d. Watershed Management Fee revenues shall be transferred from the applicable local zoning jurisdiction to a special P-MRNRD construction account via inter-local agreements.
    e. The P-MRNRD (public) costs are intended to account for approximately two-thirds (2/3) of required capital funds, including the cost of obtaining necessary land rights, except as further provided below; and the P-MRNRD shall be responsible for constructing regional detention structures and water quality basins using pooled accumulated funds.
    f. The P-MRNRD will seek general obligation bonding authority from the Nebraska Legislature to provide necessary construction scheduling flexibility.
    g. Financing for Papillion Creek Watershed Management Plan projects may require public-private partnership agreements between the P-MRNRD and developers/S&IDs on a case-by-case basis.
    h. On approximately three (3)-year intervals, the Papillion Creek Watershed Management Plan and Watershed Management Fee framework, rates, and construction priority schedule shall be reviewed with respect to availability of needed funds and rate of development within the Papillion Creek Watershed by the parties involved (local zoning jurisdictions, P-MRNRD, and the development community). Subsequent changes thereto shall be formally approved by the respective local zoning jurisdictions and the P-MRNRD.

3) A Stormwater Utility Fee System shall be established to equitably distribute the costs for ongoing operation and maintenance of all stormwater BMPs and infrastructure among all existing property owners within NPDES Phase I or II municipal jurisdictions.
   a. NPDES Phase I and II cities and counties should actively seek legislation from the Nebraska Legislature to allow for the establishment of an equitable stormwater utility fee.
   b. The initial framework for the Stormwater Utility Fee System should consist of the following provisions provided Nebraska statutes allow for such a fee:
      i. A county or city shall establish by resolution user charges to be assessed against all real property within its zoning jurisdiction and may issue revenue bonds or refunding bonds payable from the proceeds of such charges, all upon terms as the county board or city council determines are reasonable.
      ii. Such charges shall be designed to be proportionate to the stormwater runoff contributed from such real property and based on sound engineering principles.
      iii. Such charges should provide credits or adjustments for stormwater quantity and quality BMPs utilized in order to encourage wise conservation and management of stormwater on each property.
      iv. Such charges shall be collected in a manner that the county or city determines as appropriate and shall not be determined to be special benefit assessments.
      v. A county or city shall establish a system for exemption from the charges for the property of the state and its governmental subdivisions to the extent that it is being used for a public purpose. The local elected body shall also provide an appeals process for aggrieved parties.
      vi. A county shall not impose these charges against real property that is being charges user charges by a city.
      vii. Any funds raised from a Stormwater Utility Fee shall be placed in a separate fund and shall not be used for any purpose other than those specified.

REFERENCE INFORMATION

DEFINITIONS

1) Stormwater Management Policies. Stormwater management policies developed by the Technical Workgroup and Policy Workgroup that were commissioned by the Papillion Creek Watershed Partnership (PCWP) subsequent to the "Green, Clean, and Safe" initiatives developed through the "Watershed by Design" public forums conducted in 2004 and 2005 and subsequently revised by the PCWP in 2009. The following policy groups contain "root" policies and sub-policies for stormwater management that have been developed in addition to the Stormwater Management Financing Policy Group herein:

   - Policy Group #1 – Water Quality Improvement
   - Policy Group #2 – Peak Flow Reduction
   - Policy Group #3 – Landscape Preservation, Restoration, and Conservation
   - Policy Group #4 – Erosion and Sediment Control and Other BMPs
   - Policy Group #5 – Floodplain Management

2) Stormwater Management Plan (SWMP). A SWMP is a required part of the NPDES Phase II Stormwater Permits issued to many of the Omaha metropolitan area Papillion Creek Watershed Partnership (PCWP) members. Development of Stormwater Management Policies is an integral part of the SWMP, and such policies are to be adopted by respective PCWP partners.

3) Comprehensive Development Plans. Existing plans developed by local jurisdictions that serve as the basis for zoning and other land use regulations and ordinances. The Stormwater Management Policies are to be incorporated into the respective Comprehensive Development Plans.

4) Policy Implementation. The implementation of the policies will be through the development of ordinances and regulations, in years 3 through 5 of the NPDES permit cycle; that is, by the year 2009. Ordinances and regulations are intended to be consistent for, and adopted by, the respective PCWP members. Such ordinances and regulations shall need to be consistent with the Comprehensive Development Plans of the respective PCWP members.

5) Low-Impact Development (LID). A land development and management approach whereby stormwater runoff is managed using design techniques that promote infiltration, filtration, storage, evaporation, and temporary detention close to its source. Management of such stormwater runoff sources may include open space, rooftops, streetscapes, parking lots, sidewalks, medians, etc.

6) Water Quality LID. A level of LID using strategies designed to provide for water quality control of the first ½ inch of stormwater runoff generated from each new development or significant redevelopment and to maintain the peak discharge rates during the 2-year storm event to baseline land use conditions, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.

7) Maximum LID. A level of LID using strategies, including water quality LID and on-site detention, designed not to exceed peak discharge rates of more than 0.2 cfs/acre during the 2-year storm event or 0.5 cfs/acre during the 100-year storm event based on the contributing drainage from each site, measured at every drainage (stormwater discharge) outlet from the new development or significant redevelopment.

8) Baseline Land Use Conditions. That which existed for Year 2001 for Big and Little Papillion Creeks and its tributaries (excluding West Papillion Creek) and for Year 2004 for West Papillion Creek and its tributaries. That which existed in 2007 for all areas not within the Papillion Creek Watershed.

BASIS FOR STORMWATER MANAGEMENT FINANCING ISSUE

1) Time is of the essence for policy development and implementation:
   a) Under the existing Phase II Stormwater Permits issued by the Nebraska Department of Environmental Quality, permitees must develop strategies, which include a combination of structural and/or non-structural best management practices and incorporate them into existing Comprehensive Development Plans by the end of 2009.
   b) The S&ID platting process is typically several years ahead of full occupation of an S&ID. Therefore, careful pre-emptive planning and program implementation is necessary in order to construct regional stormwater detention and water quality basin improvements in a timely manner to meet the purposes intended and to avoid conflicts from land use encroachments from advancing development.
2) Financing to meet capital and O&M obligations for stormwater management projects requires a comprehensive, uniformly applied approach and not a project-by-project approach.

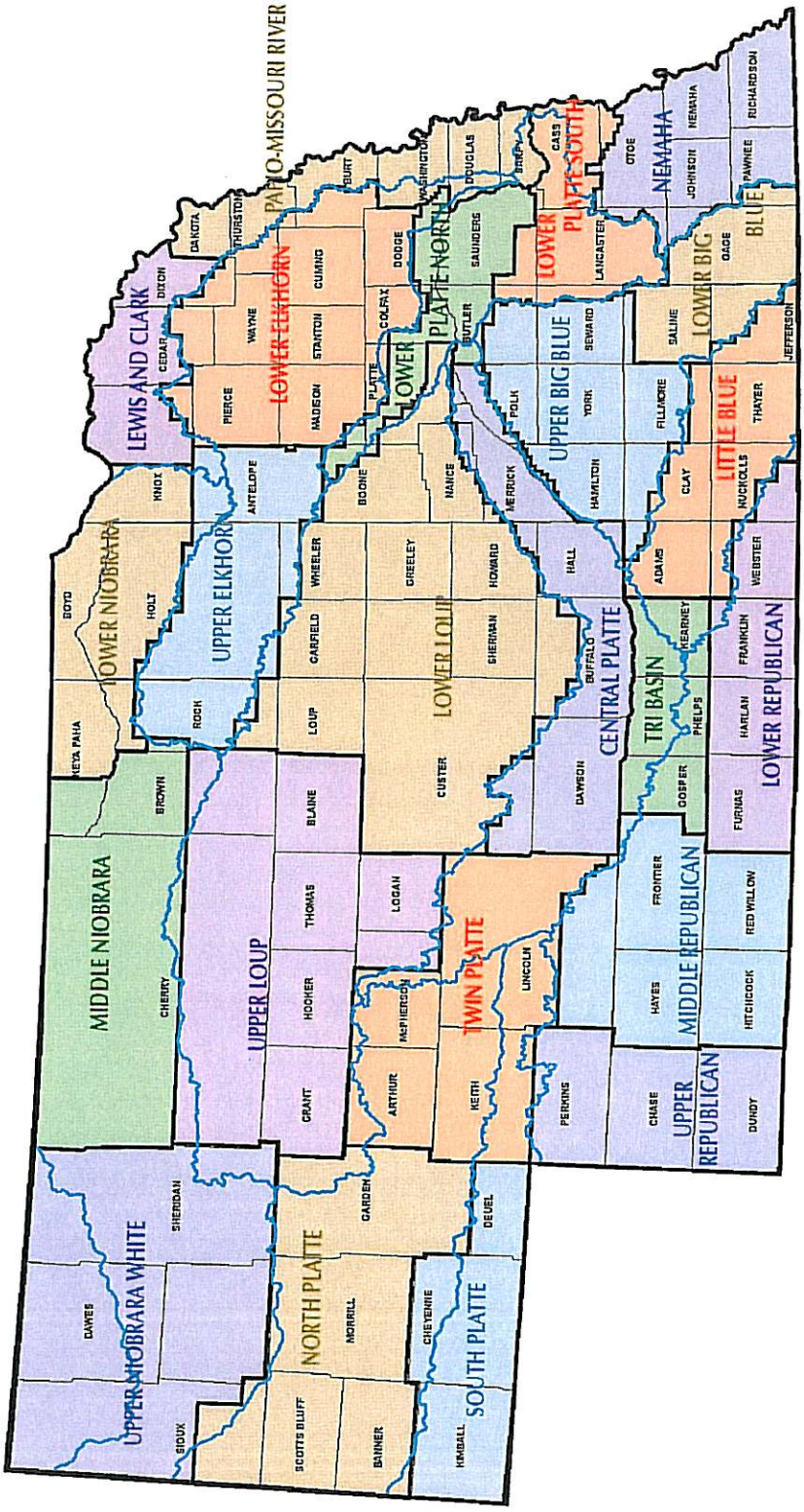


Figure 1
April, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Base Map

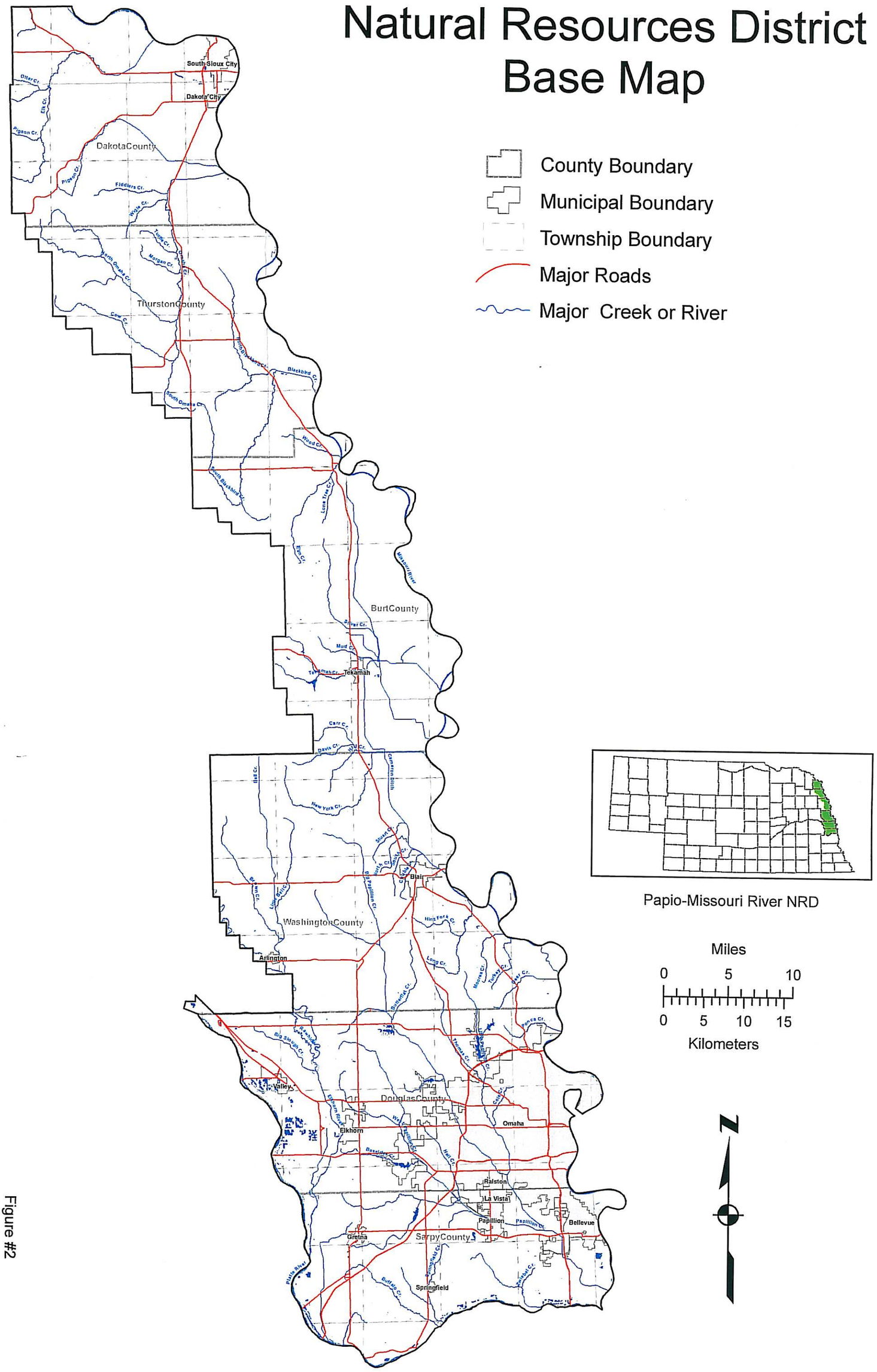


Figure #2
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Watershed Drainage Basins

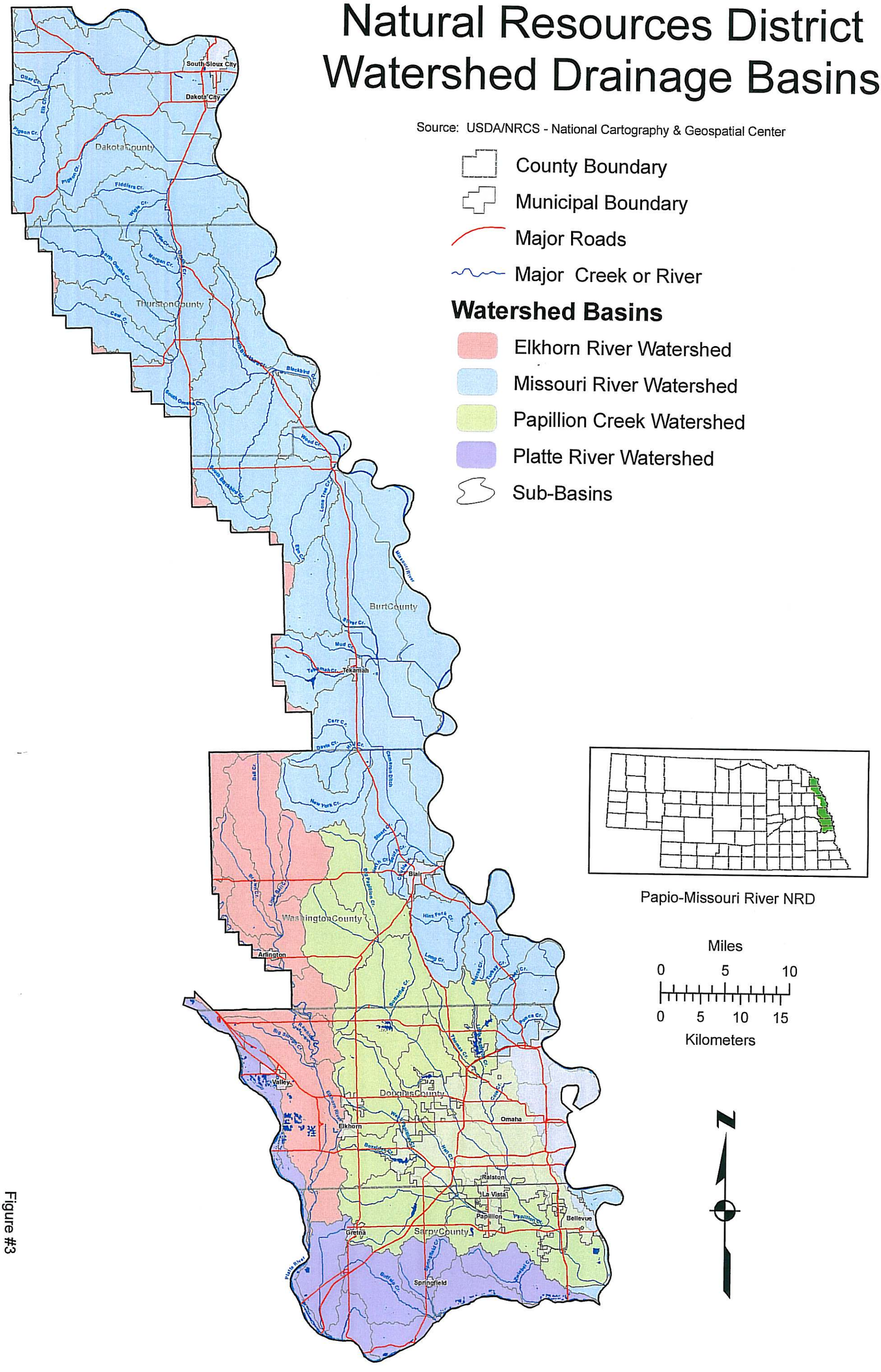


Figure #3
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Generalized Elevation

Source: Conservation and Survey Division, University of Nebraska-Lincoln

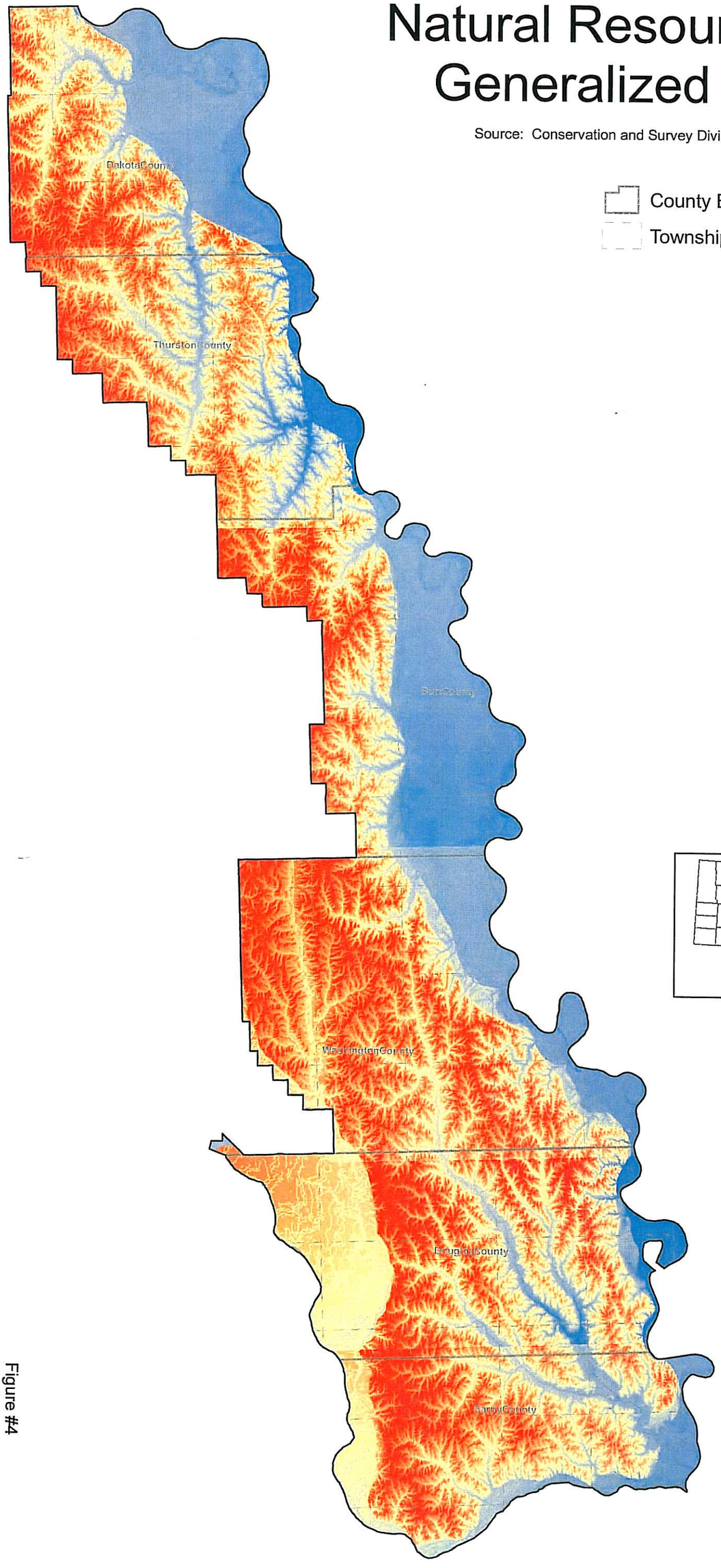
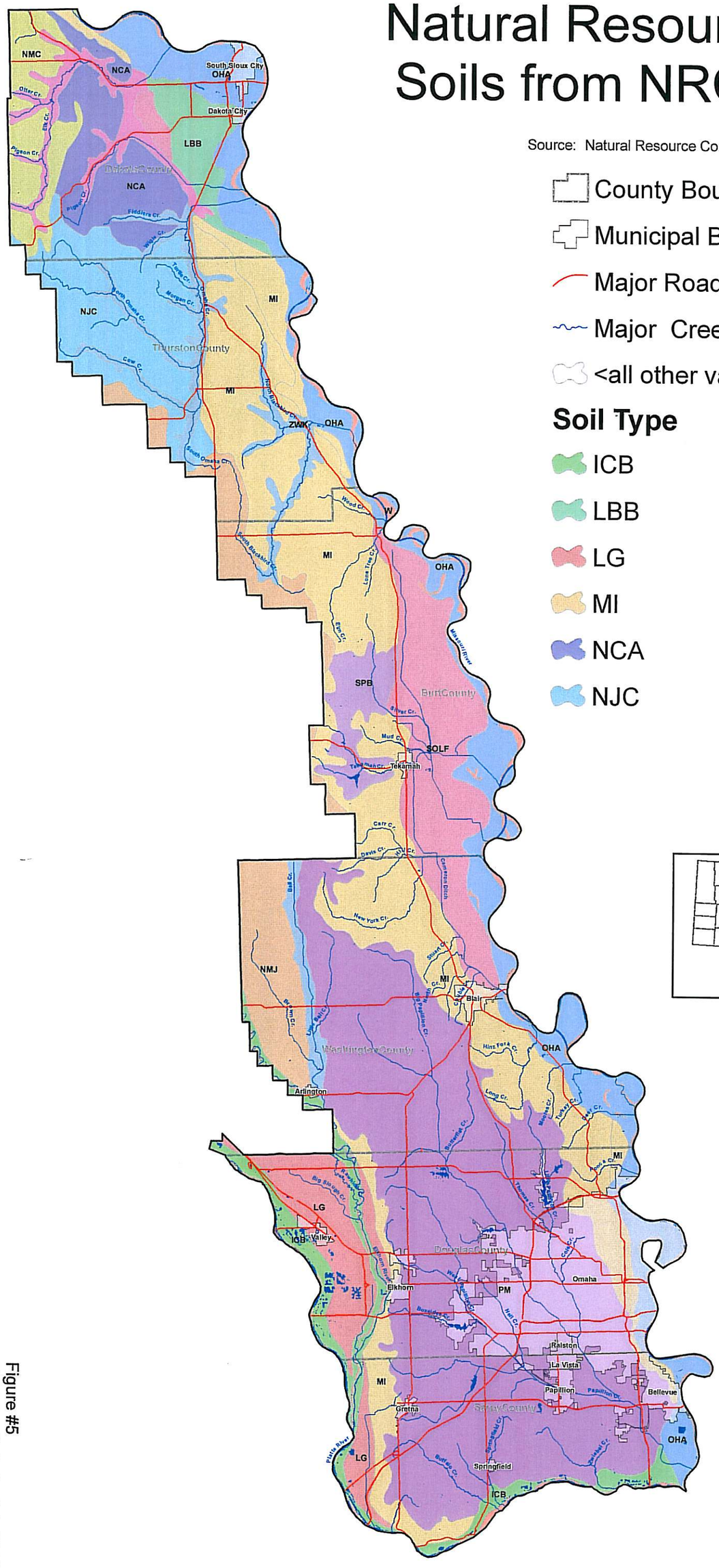


Figure #4
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Soils from NRCS Statsgo

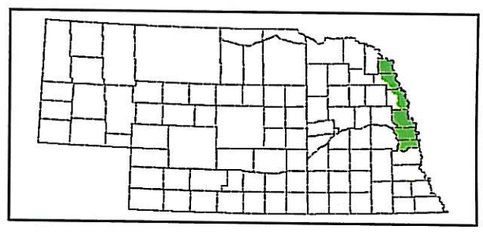


Source: Natural Resource Convservation Sevice

- County Boundary
- Municipal Boundary
- Major Roads
- Major Creek or River
- <all other values>

Soil Type

- ICB
- LBB
- LG
- MI
- NCA
- NJC
- NMC
- NMJ
- OHA
- PM
- SHGFB
- SKAA
- SOH
- SOLF
- SPB
- W
- ZWK



Papio-Missouri River NRD

Miles

0 5 10

0 5 10 15

Kilometers

N

Figure #5
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Simplified Soil Clasification

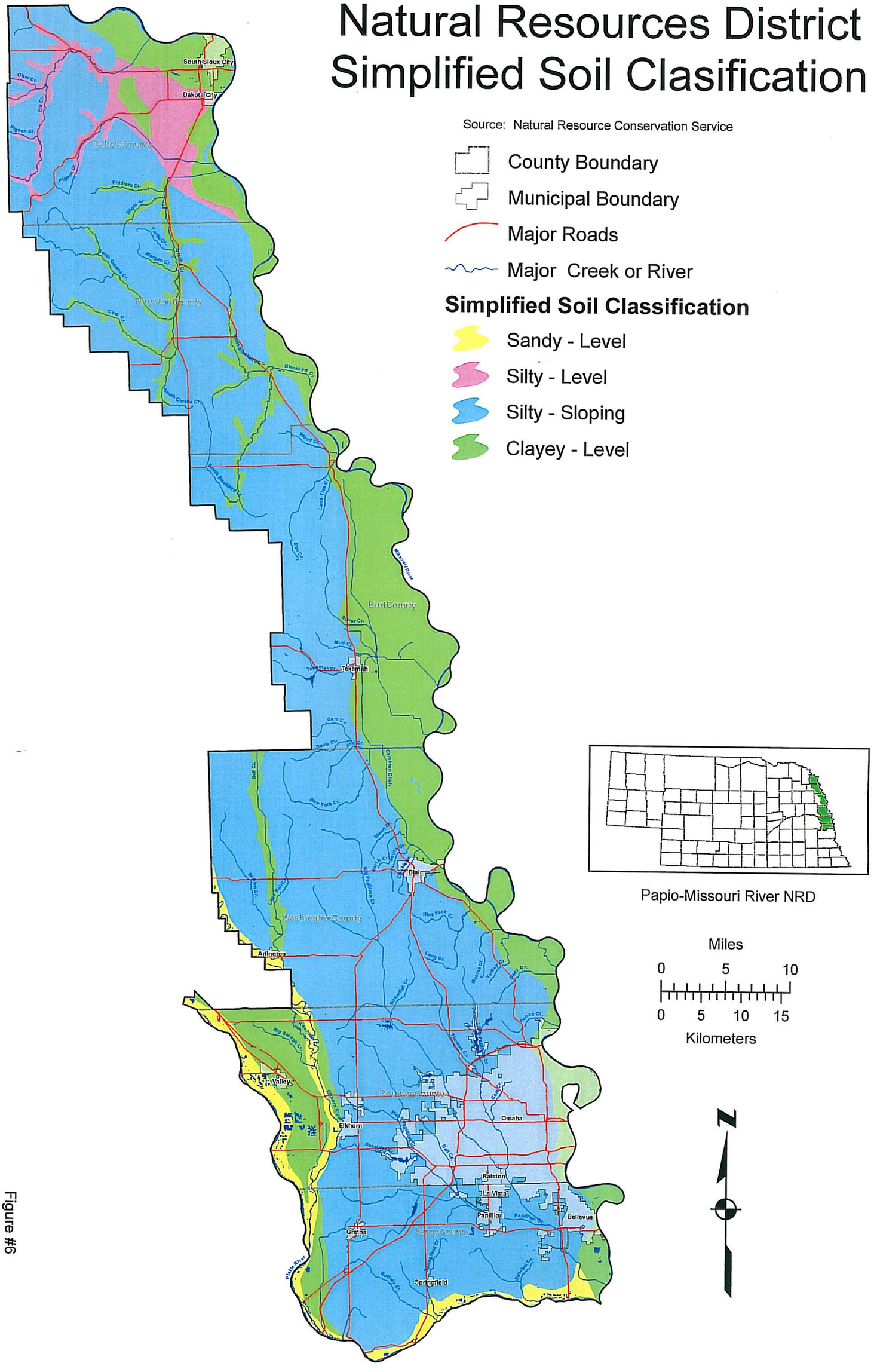
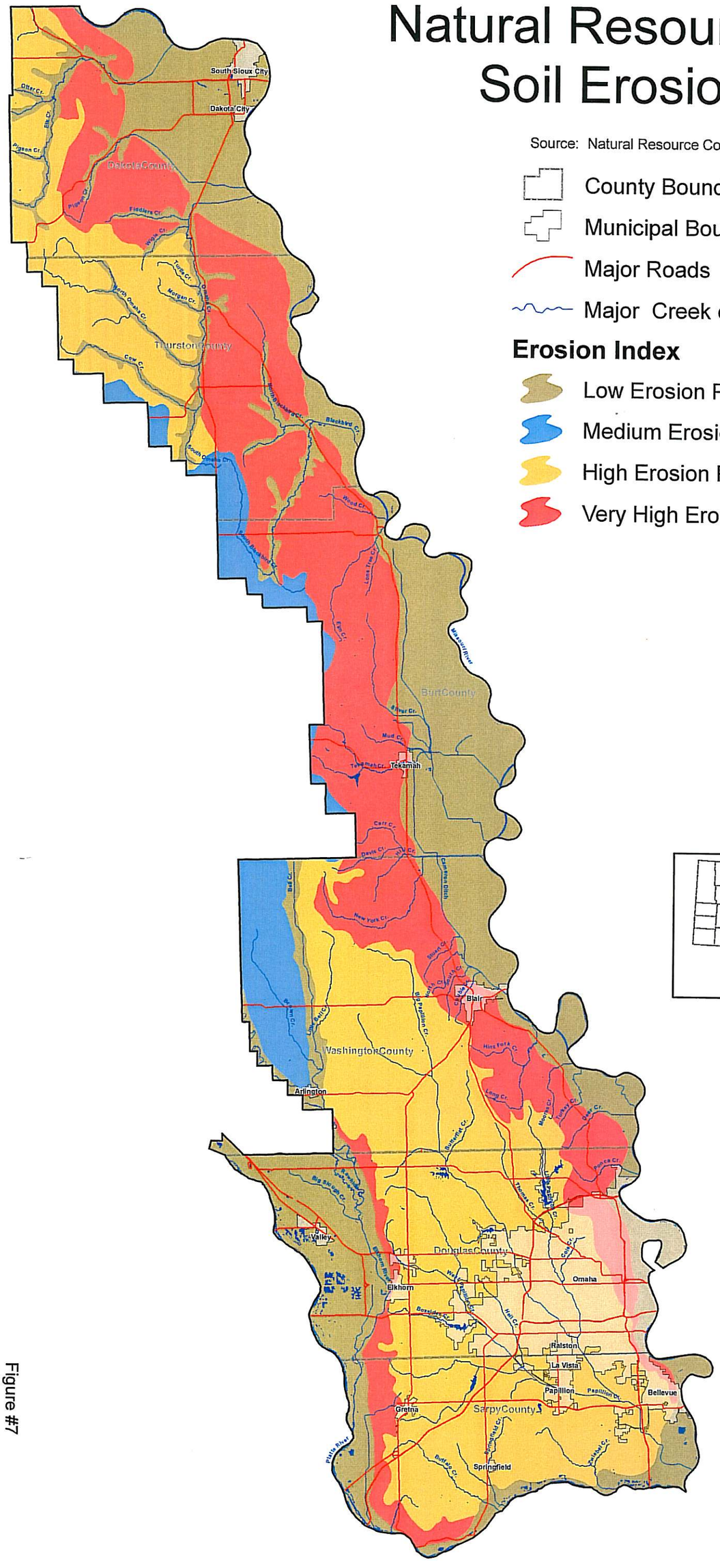


Figure #6
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Soil Erosion Index

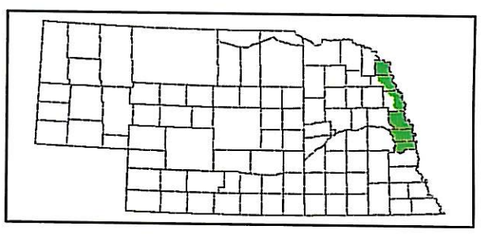


Source: Natural Resource Conservation Service

- County Boundary
- Municipal Boundary
- Major Roads
- Major Creek or River

Erosion Index

- Low Erosion Potential
- Medium Erosion Potential
- High Erosion Potential
- Very High Erosion Potential



Papio-Missouri River NRD

Miles

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Kilometers

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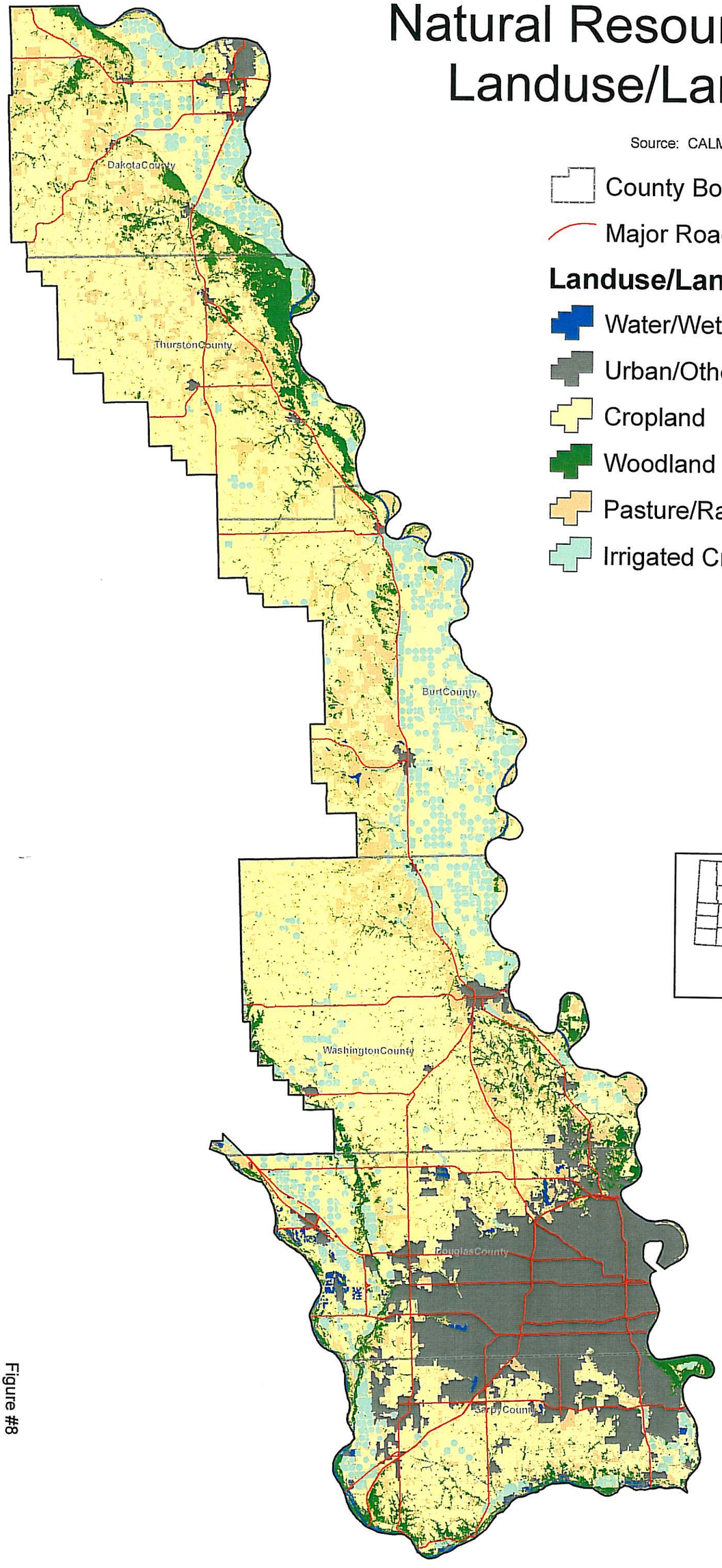
Figure #7
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Landuse/Land Cover



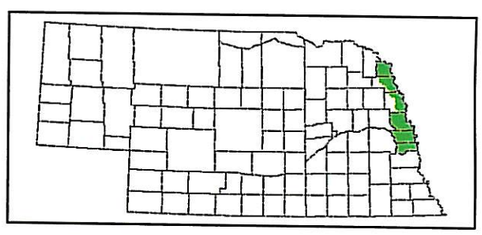
Source: CALMIT

County Boundary

Major Roads

Landuse/Land Cover

- Water/Wetlands
- Urban/Other
- Cropland
- Woodland
- Pasture/Rangeland
- Irrigated Cropland



Papio-Missouri River NRD

Miles

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0 5 10 15

Kilometers

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Figure #8
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Groundwater Regions

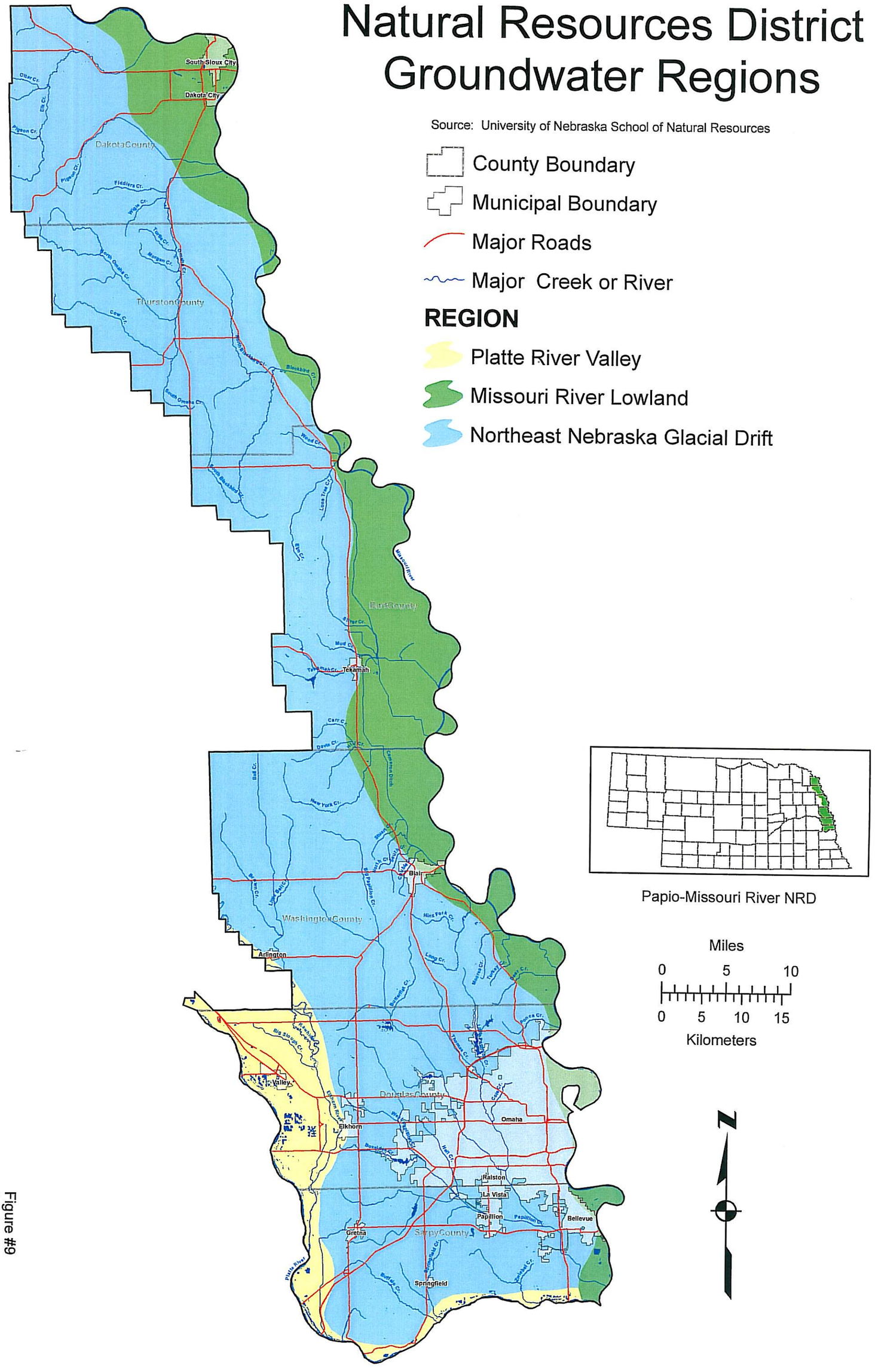


Figure #9
Revision Date April 1, 2010
P-MRNRD Master Plan

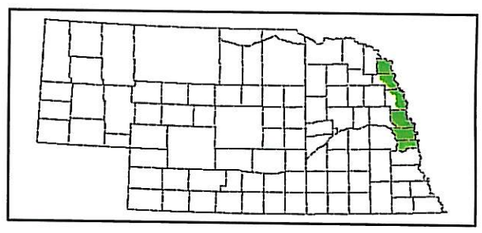
Papio-Missouri River Natural Resources District Geologic Bedrock

Source: University of Nebraska School of Natural Resources

- County Boundary
- Major Roads
- Major Creek or River

Bedrock Name

- Kc - Carlile
- Kd - Dakota
- Kgg - Greenhorn-Graneros
- Pd - Douglas
- Pkc - Kansas City
- Pl - Lansing
- Pm - Marmaton
- Ps - Shawnee



Papio-Missouri River NRD

Miles

0 5 10

0 5 10 15

Kilometers

N

Figure #10
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Principle Aquifer Thickness

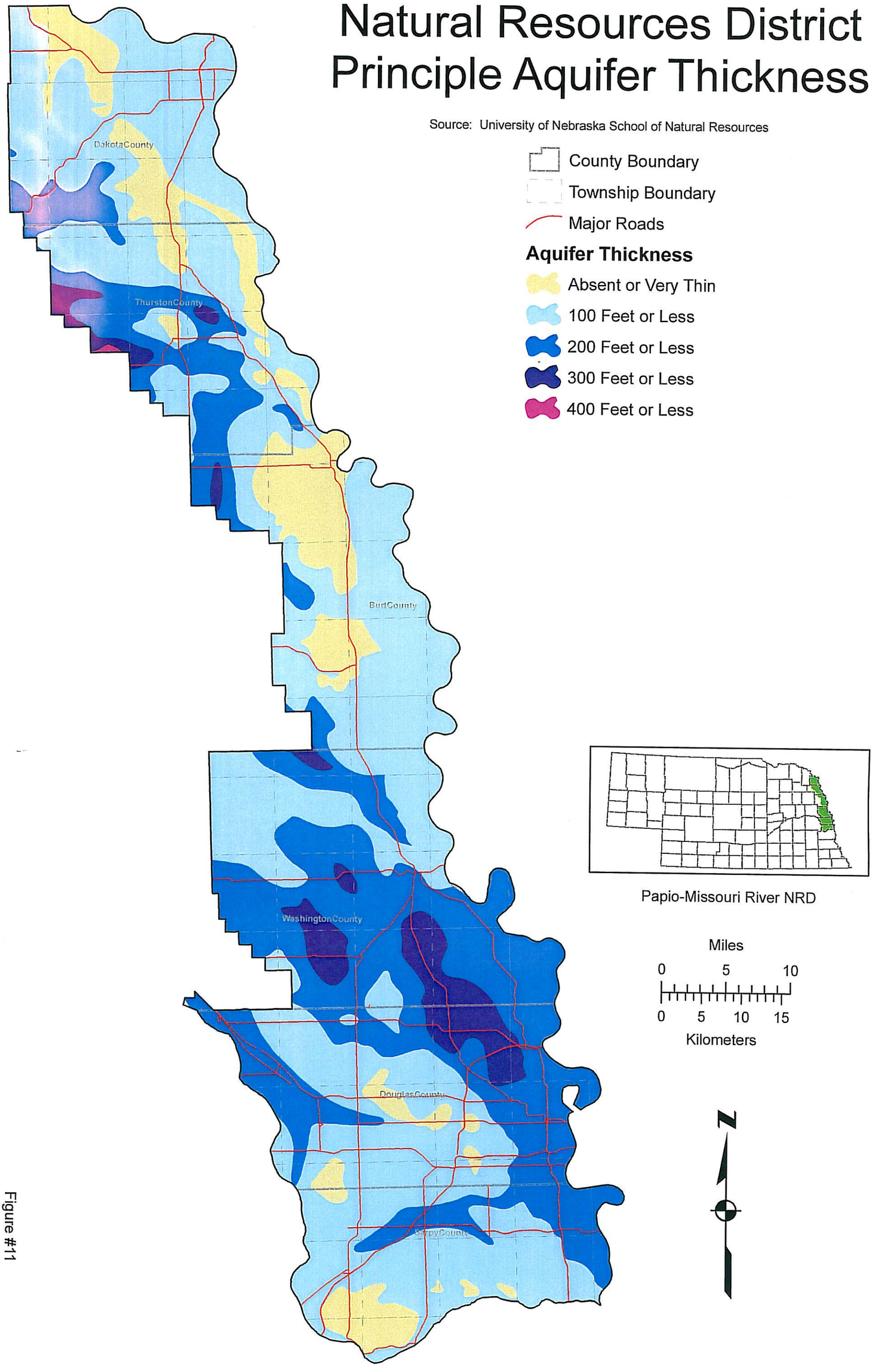


Figure #11
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Water Table Elevation

Source: University of Nebraska Conservation and Survey Division
Revision Date 1995

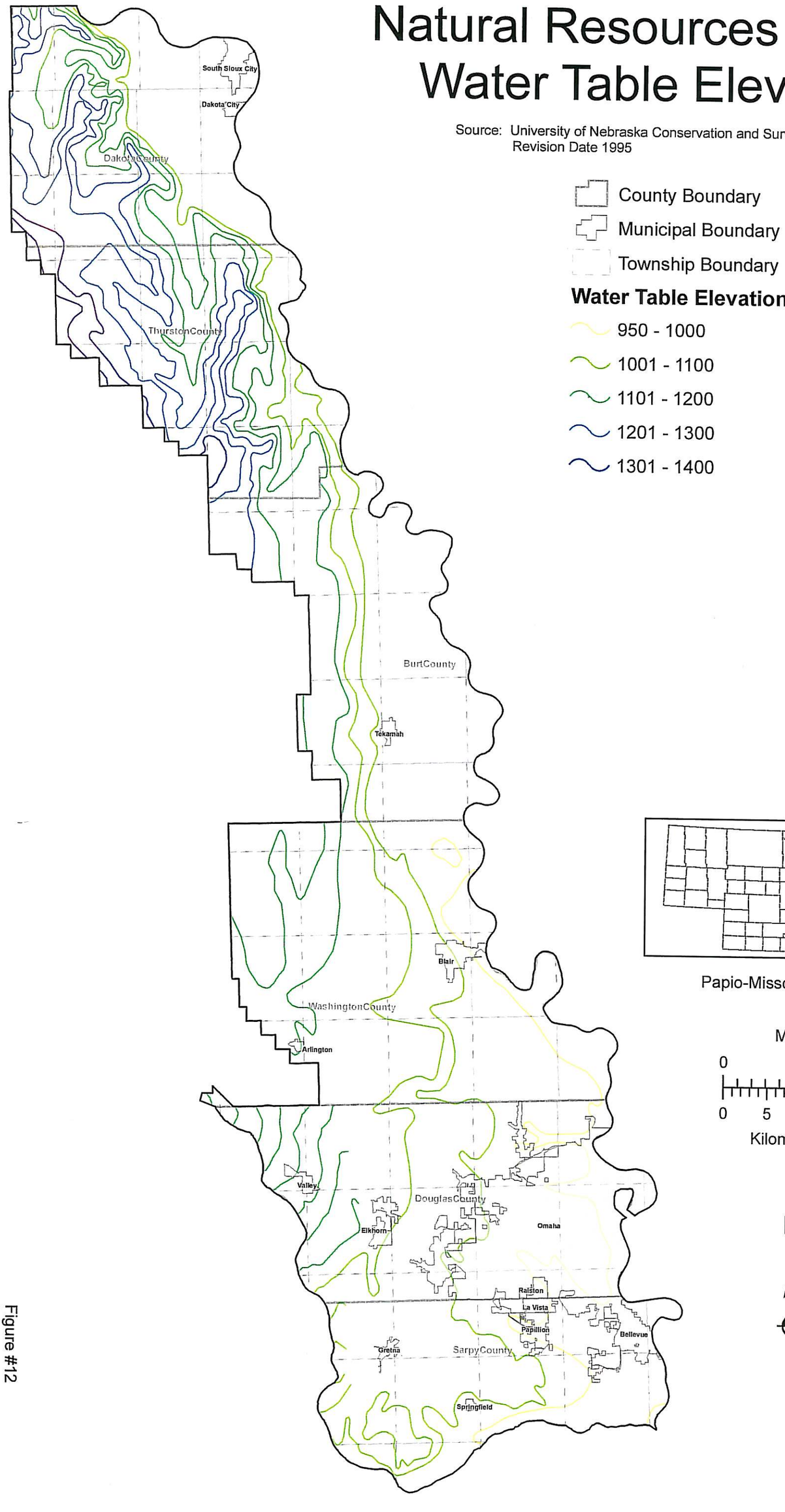


Figure #12
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Water Level Locations

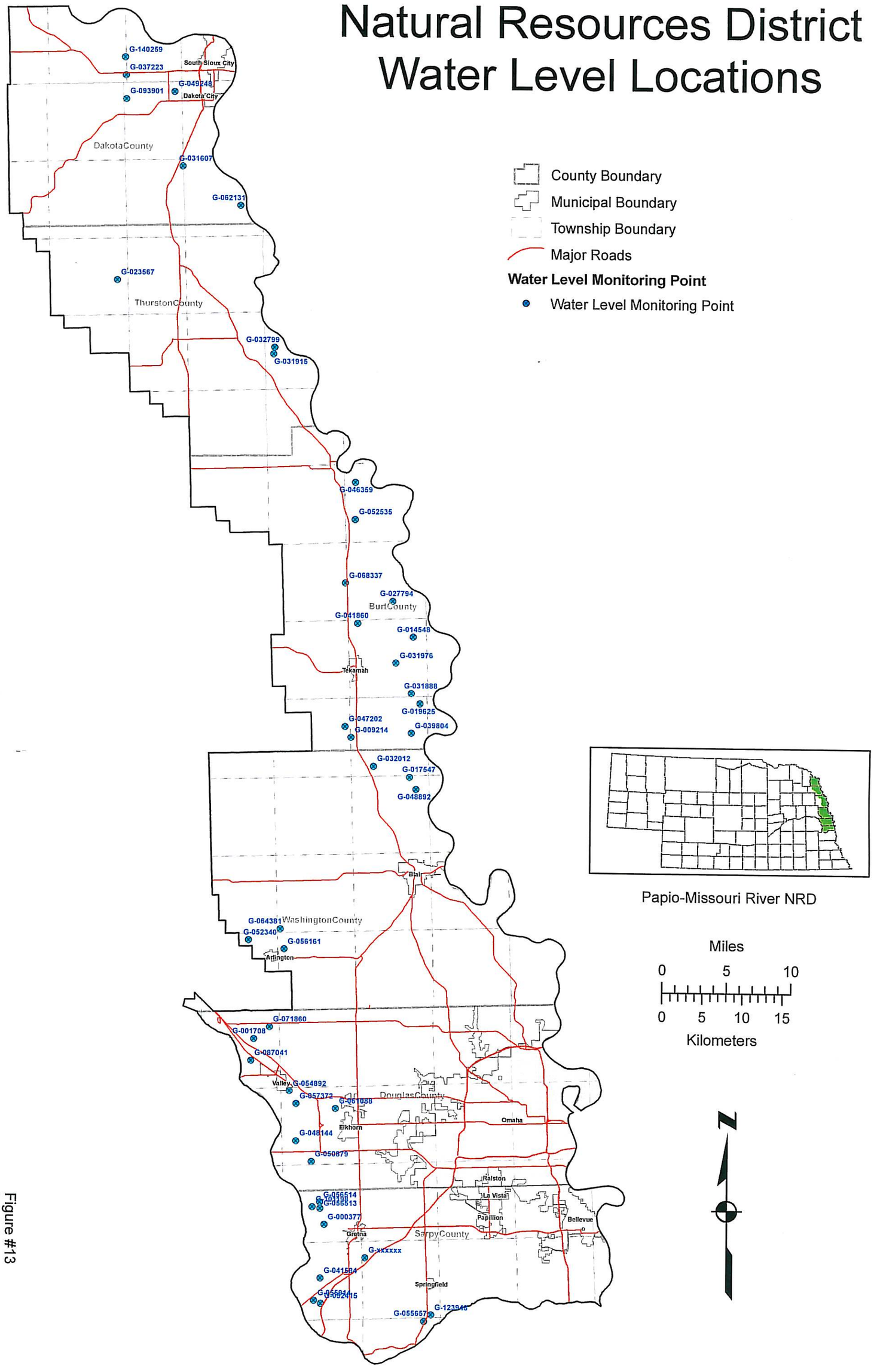
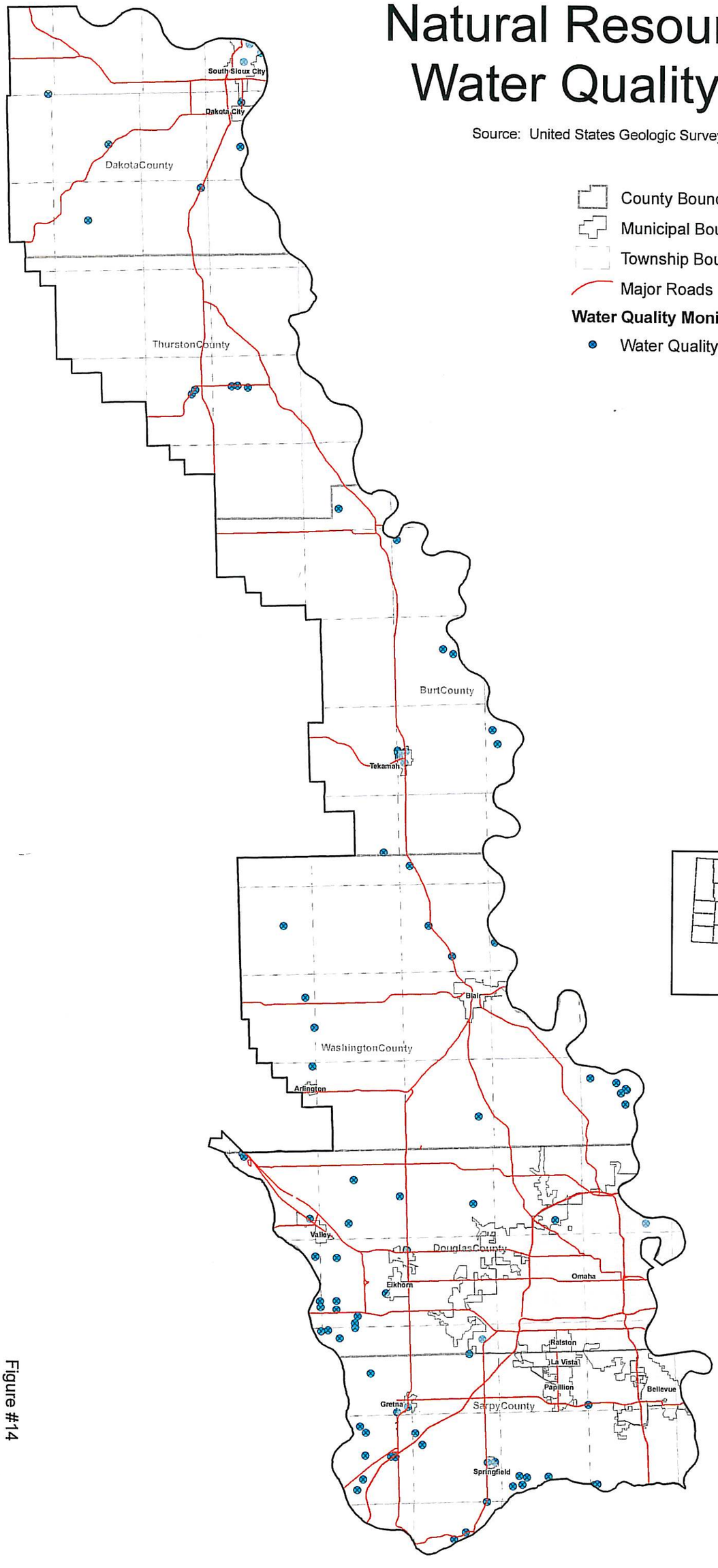


Figure #13
Revision Date April 1, 2010
P-MRNRD Master Plan

Papio-Missouri River Natural Resources District Water Quality Locations

Source: United States Geologic Survey, Nebraska Water Science Center



County Boundary

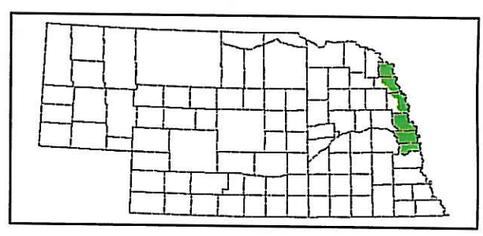
Municipal Boundary

Township Boundary

Major Roads

Water Quality Monitoring Point

Water Quality Monitoring Point



Papio-Missouri River NRD

Miles

0 5 10

0 5 10 15

Kilometers

N

Figure #14
Revision Date April 1, 2010
P-MRNRD Master Plan

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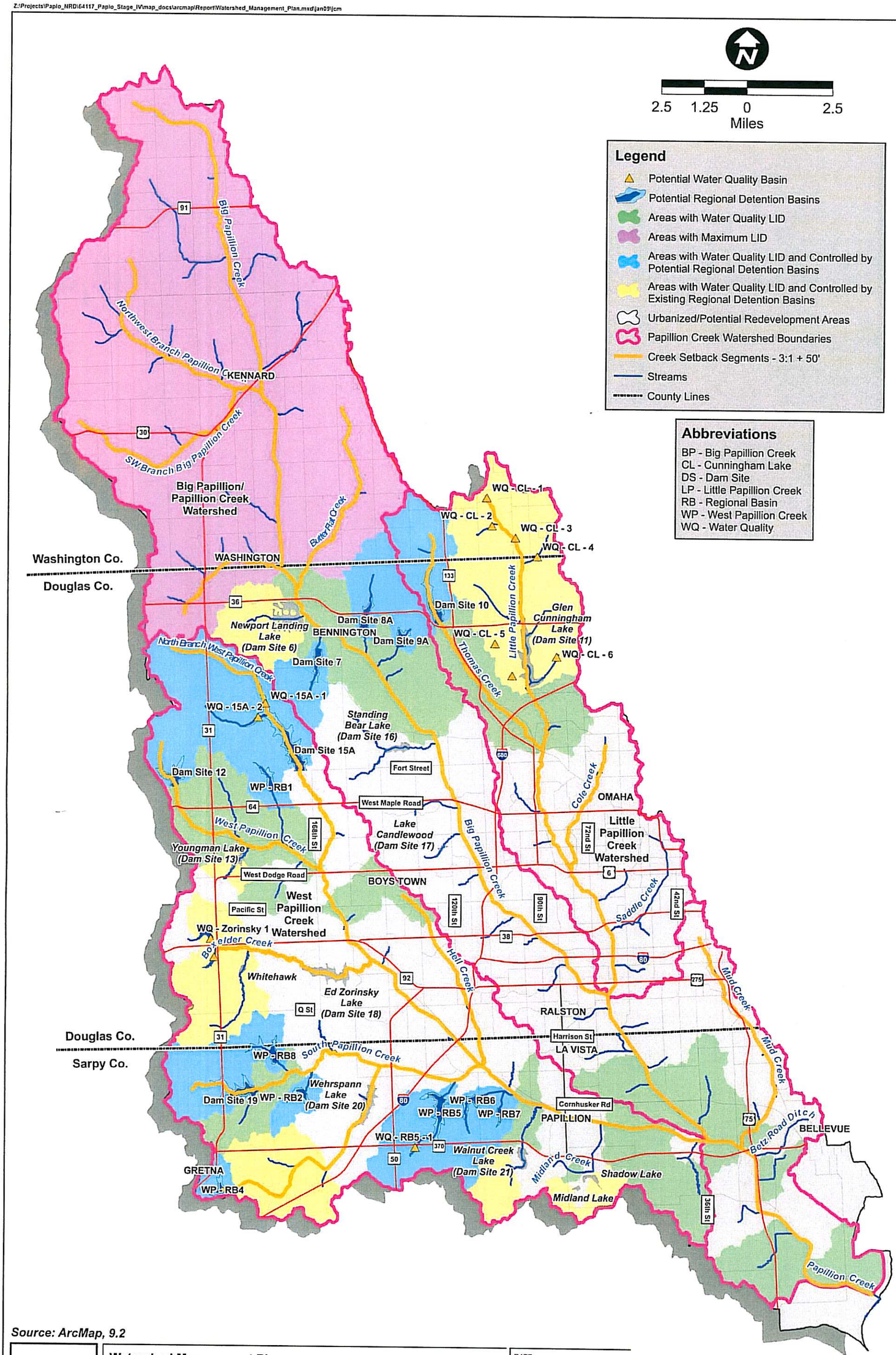

Source: ArcMap, 9.2

HDR

Watershed Management Plan
Papillion Creek Watershed

Papillion Creek Watershed Partnership
www.papiopartnership.org

Papillion Creek Watershed Plan - Stage IV
Papillion Creek Watershed Partnership

DATE
April 2010

FIGURE
15