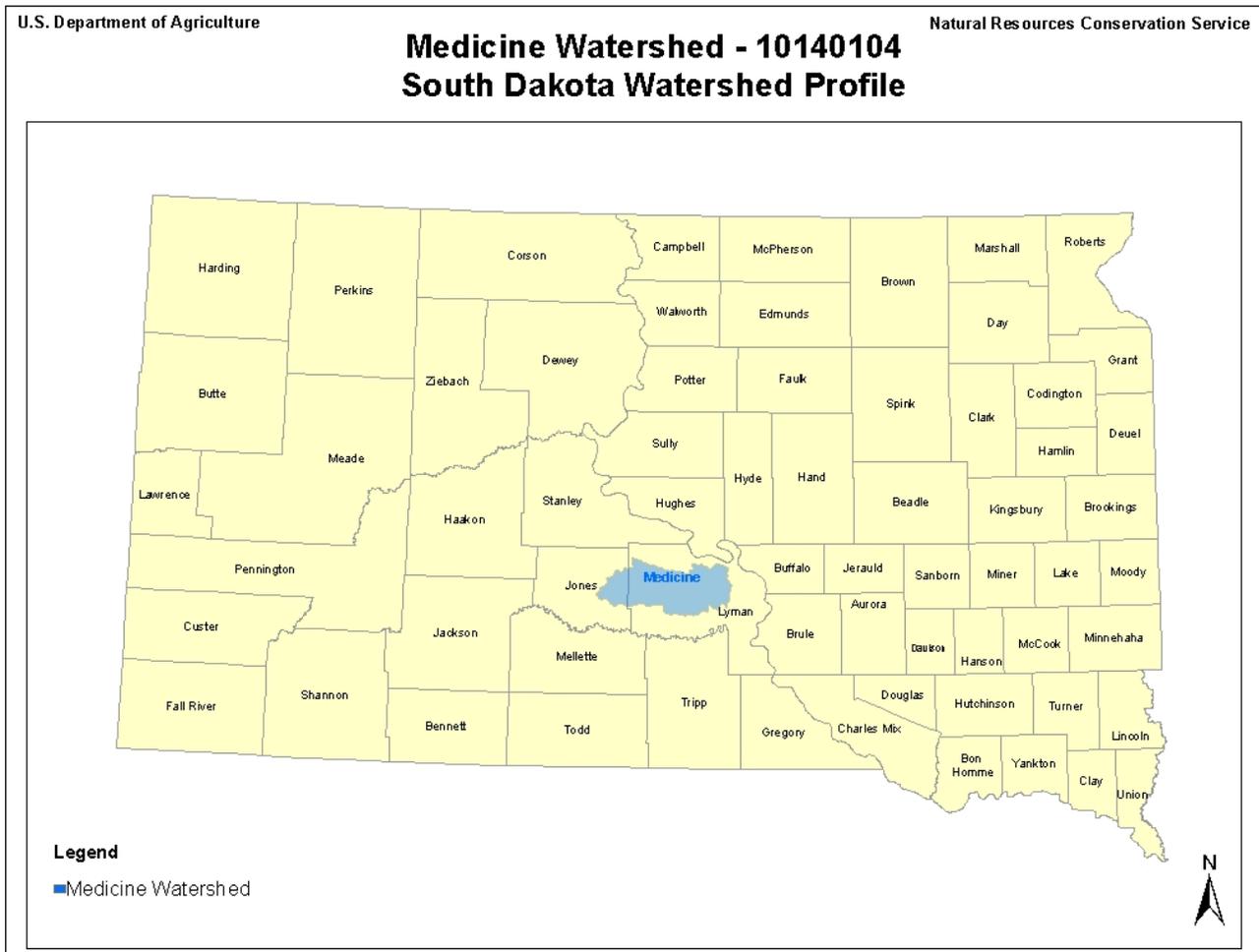


SOUTH DAKOTA

Rapid Watershed Assessment



JULY 2009

Produced by:
United States Department of Agriculture
Natural Resources Conservation Service
200 Fourth Street SW
Huron, South Dakota 57350



MEDICINE - 10140104 8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service (NRCS)

July 2009

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USDA Natural Resources Conservation Service

July 2009

Medicine Watershed
South Dakota (SD)

Rapid Watershed Assessment Project

Sponsored by:

SD Association of Conservation Districts

SD Department of Agriculture

SD Department of Environment and Natural Resources

SD Department of Game, Fish, and Parks

American Creek Conservation District

Jones County Conservation District

Executive Summary

A Rapid Watershed Assessment (RWA) document compiles existing resource information and data within a watershed and is used to assist conservation districts, landowners, and other community organizations and stakeholders to identify where conservation investments are best utilized and set resource conservation goals. The RWA contains summaries of resource concerns and opportunities that are useful for a number of resource conservation activities. Local landowners and organizations can use the RWA as a basis to prioritize resource concerns and estimate the technical and financial resources required to achieve their resource conservation goals within the watershed. The assessment provides information that can be used to develop conservation district annual and long-range plans, or establish a foundation for more detailed watershed, area wide, or site-specific natural resource planning and the development of implementation plans.

A RWA provides sufficient information to help facilitate making some key resource management decisions. The RWA:

- Provides a quick and inexpensive source of information on which to base decisions about conservation priorities, allocation of resources, funding for implementation, and how to report outcomes/results.
- Supplies enough detail to identify conservation activities that can be implemented without waiting on further watershed-level studies or analyses.
- Provides a preliminary source of information for standard environmental evaluations.
- Identifies if there is a need for further detailed analysis or watershed studies.
- Determines if there are infrastructure needs.
- Addresses multiple concerns and objectives of landowners and communities.
- Enhances established local, state, and federal partnerships.
- Enables landowners and communities to decide on the best mix of Natural Resources Conservation Service (NRCS) programs and other funding sources to meet their resource concerns/needs.
- Evaluates availability of conservation program tools (cost-share, easements, and technical assistance).

The RWAs consist of two parts: the watershed profile which provides the physical, biological, and sociological characterization of the watershed resources; and the watershed assessment which defines the identified resource concerns and evaluates the effectiveness, the extent, and the associated costs of the conservation practices that address the identified resource concerns.

The RWAs are developed based on the first six steps of the NRCS conservation resource planning process on a watershed scale. The information is general in nature and is not sufficiently detailed to be used in lieu of an area wide or watershed plan when the identified resource concerns require specific information, for example, flood prevention or control. However, the information does provide a solid starting point for local stakeholders to use should they decide to proceed with a more detailed area wide or watershed planning effort or the development of a watershed implementation plan using existing NRCS conservation programs.

Rapid Watershed Assessment Contents
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I. WATERSHED PROFILE

1.0 PURPOSE

The watershed resource profile compiles the most recent, readily-available data which provides a physical, biological, and sociological characterization of watershed resources. The profile inventories the current resource health and condition of the soil, water, plants, animals, and social resources of a watershed and identifies the known resource concerns. The watershed profile also provides a brief overview of the social and economic composition of the watershed.

The profile summary of the resource conditions, concerns, and opportunities is useful for a number of conservation activities. Local landowners and organizations can use the information to prioritize resource concerns and estimate the technical and financial resources required to achieve resource conservation goals within the watershed. The information can be used to develop conservation district annual and long-range plans, establish a foundation for a more detailed watershed, area wide, or site-specific natural resource plan, or the development of an implementation plan.

2.0 INTRODUCTION

The Medicine Watershed 8-Digit Hydrologic Unit Code (HUC) subbasin is 475,700 acres located in Jones and Lyman counties of south central SD. Unique to the watershed is that most of the Lower Brule Indian Reservation and a portion of the Fort Pierre National Grasslands are located in the watershed.

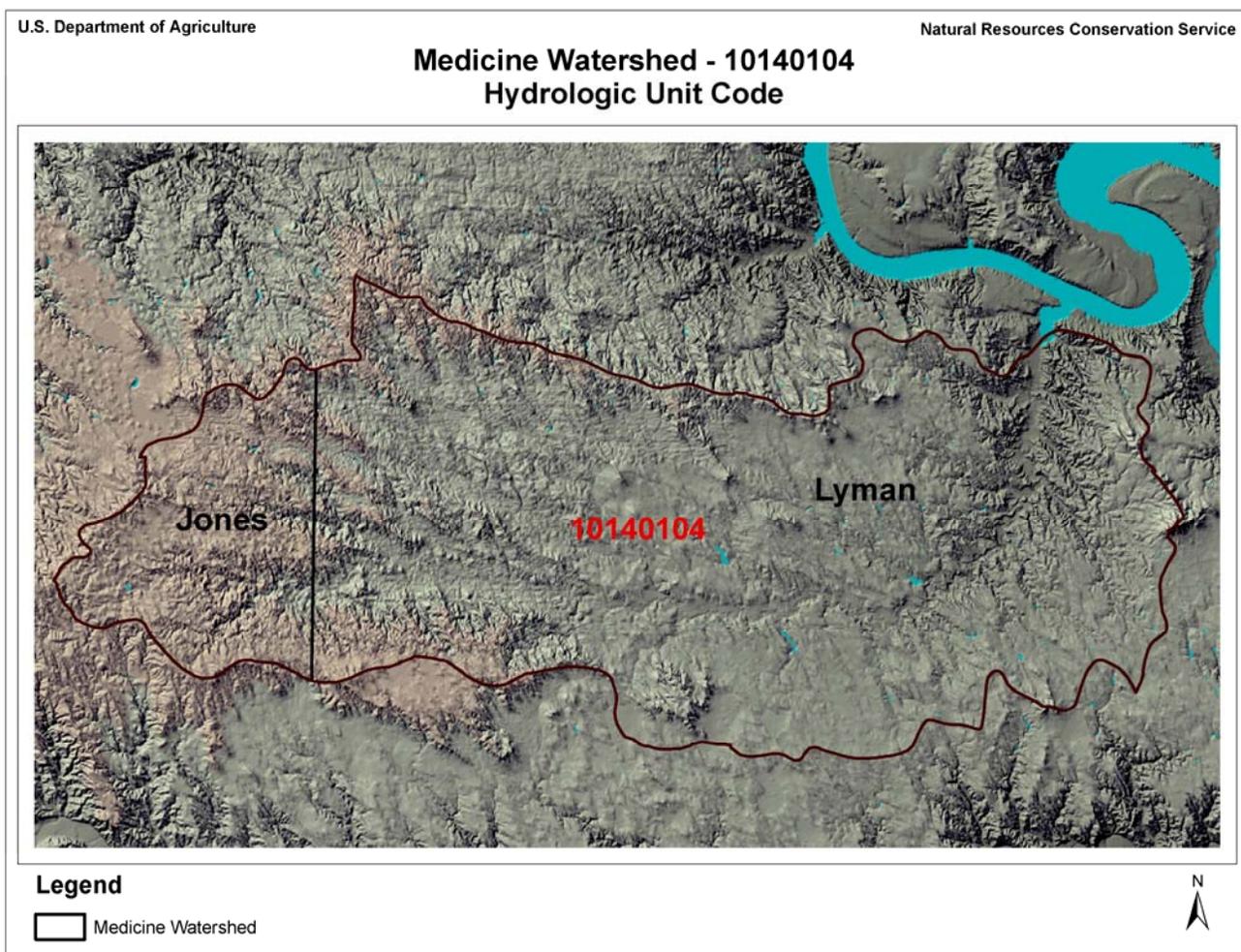
The dominant land use is cultivated cropland, approximately 191,000 acres or 40 percent of the watershed. Corn, small grains, soybeans, and sunflowers are the primary crops grown. Alfalfa and grass hay are also produced and included in some crop rotations. Rangeland and pastureland account for 138,900 acres or 29 percent of the watershed. Beef cattle production is the primary use on pasture and rangeland. Growing cash crops and hay, raising beef cattle, and dairying are the main agricultural enterprises. Agricultural production is a vital part of the local economic base.

3.0 PHYSICAL DESCRIPTION

The physical description of the Medicine subbasin provides a general description of the watershed location, geology, topography, precipitation, and climatic ranges.

3.1 HYDROLOGIC UNIT CODE (HUC)¹

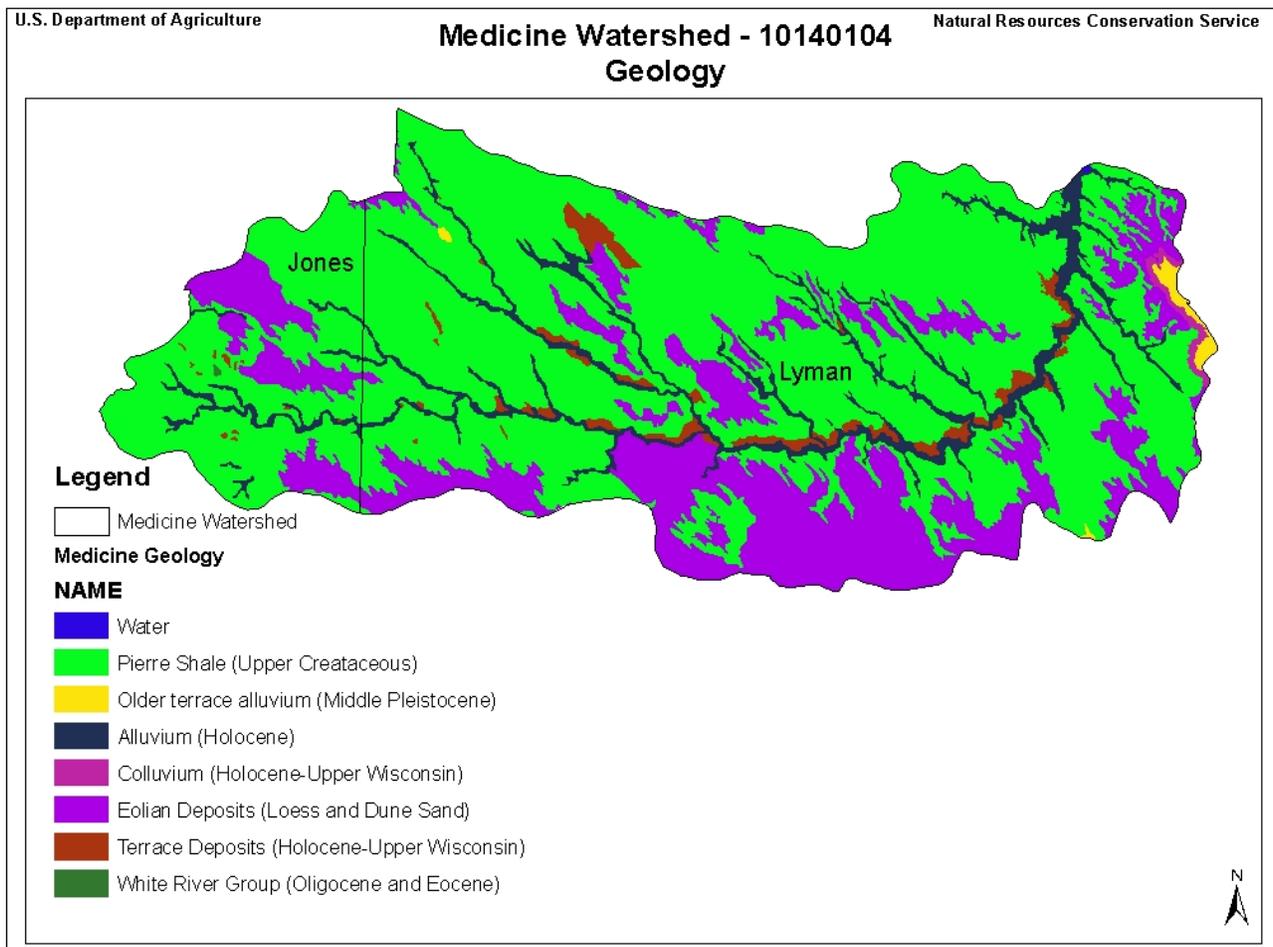
A HU is part of a multi-level watershed mapping classification system. The HU boundaries are defined by hydrographic and topographic criteria used to delineate areas of land that contribute surface water runoff to a designated outlet point, such as a lake or stream segment. The United States Geological Survey (USGS) designates HU drainage areas as subwatersheds (including smaller drainages) numbered with 12-digit HUCs, nested within watersheds (10-digit HUCs). Watersheds are combined into larger drainage areas called subbasins (8 digits), basins (6 digits), and subregions (4 digits), which make up the large regional drainage basins (2 digits).



3.2 GEOLOGY²

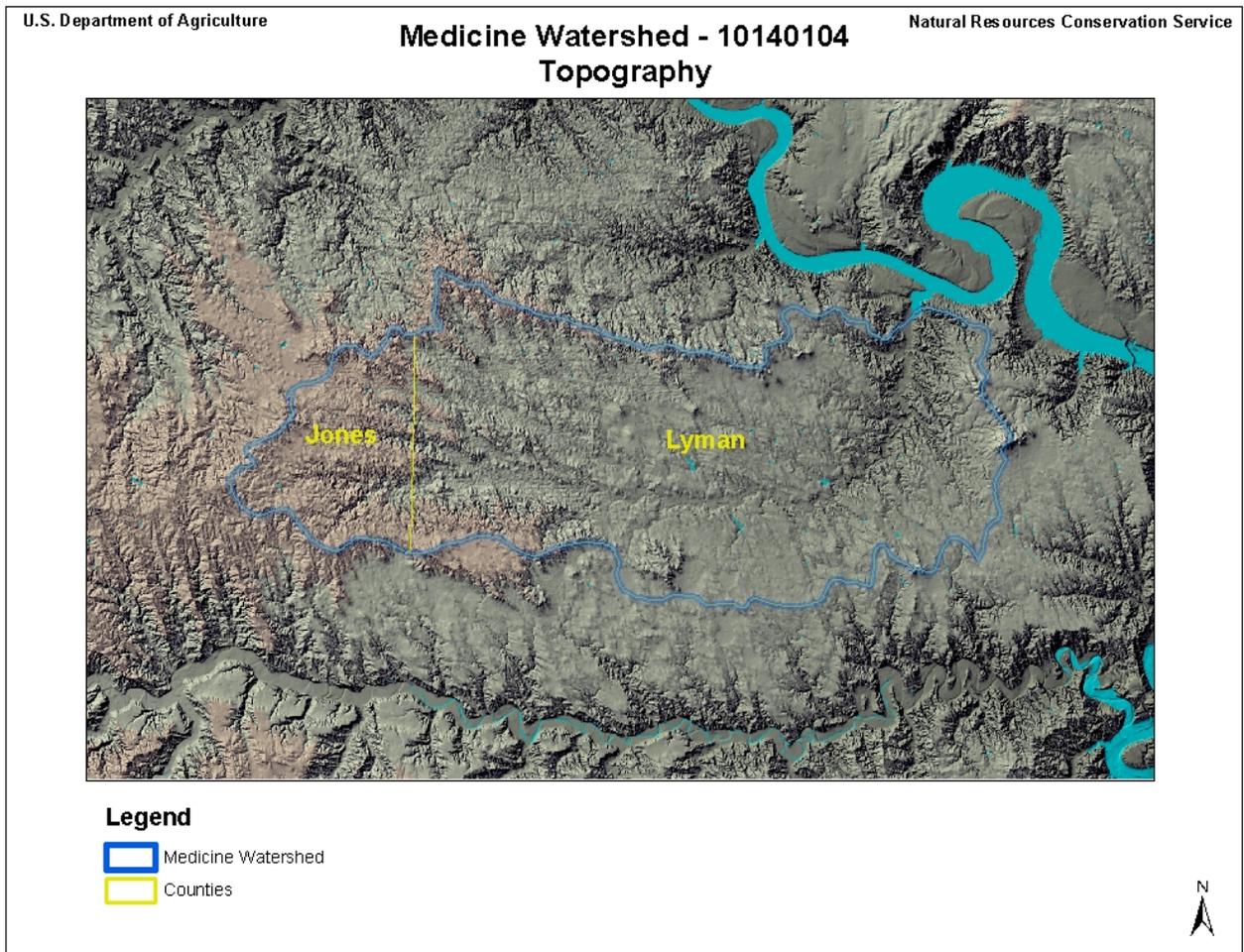
The bedrock geology of the watershed consists of a sequence of essentially horizontal, well stratified Cretaceous age sedimentary rocks (shale, sandstone, and limestone) of marine origin. A large inner-continental sea periodically inundated the area depositing thick layers of sediment followed by a period of non-deposition and erosion. Near the end of the Cretaceous era the sea permanently receded and an extended period of erosion began. The bedrock layers commonly range between 100 and 300 feet thick, but may be in excess of 2,000 feet thick in some areas.

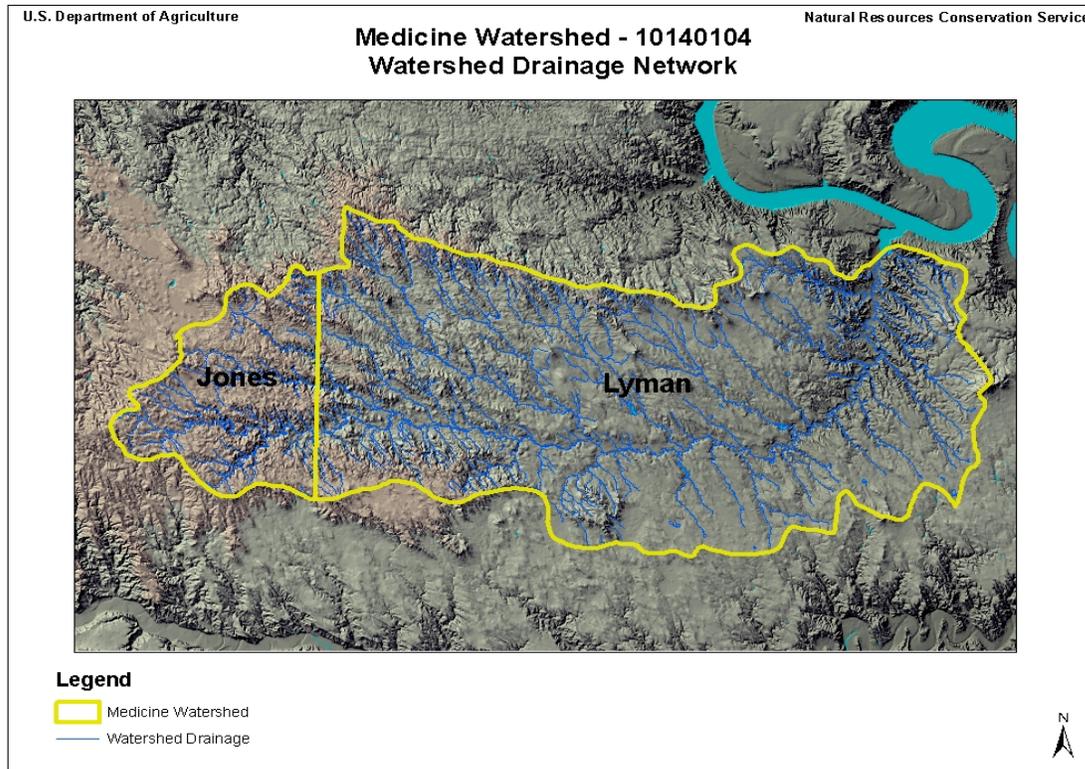
The surface geology of the watershed is profoundly influenced by the erosion of the poorly consolidated sedimentary rock. The major streams and the tributary drainages in the watershed are highly dissected exposing the sedimentary layers. The surface of the exposed layers is deeply cracked and weathers to a light gray or brown smectitic clay.



3.3 TOPOGRAPHY¹

The watershed lies within the physical divisions of the Pierre Hills region of the Missouri Plateau section of the Great Plains Physiographic Province. The Missouri River is the principal drainage system in this region and forms the eastern boundary of the watershed. The relief of the watershed varies from nearly level or gently sloping to strongly sloping in the steep and irregular breaks along the Missouri River corridor.





3.4 CLIMATE

The climate of the Medicine Watershed is semi-humid and continental, characterized by large, seasonal fluctuations in temperature, long winters, warm summers with moderate to high relative humidity, and frequent high winds. Storms are generally of moderate intensity and short duration; localized convective, high intensity storms of short duration are common. Recurring periods of drought and near drought conditions are common. Less frequently, periods of short duration yield higher than normal amounts of precipitation. Warm to hot summer months give way to cold winters. On the average, between 70 and 80 percent of the annual precipitation occurs from April through September, the growing season for most of the crops raised in the area, with the largest amount generally occurring in June. The average growing season ranges from 115 days to 130 days with the last killing frost in mid-May and the first killing frost in mid-September. Many freeze-thaw events occur in the fall and early spring.

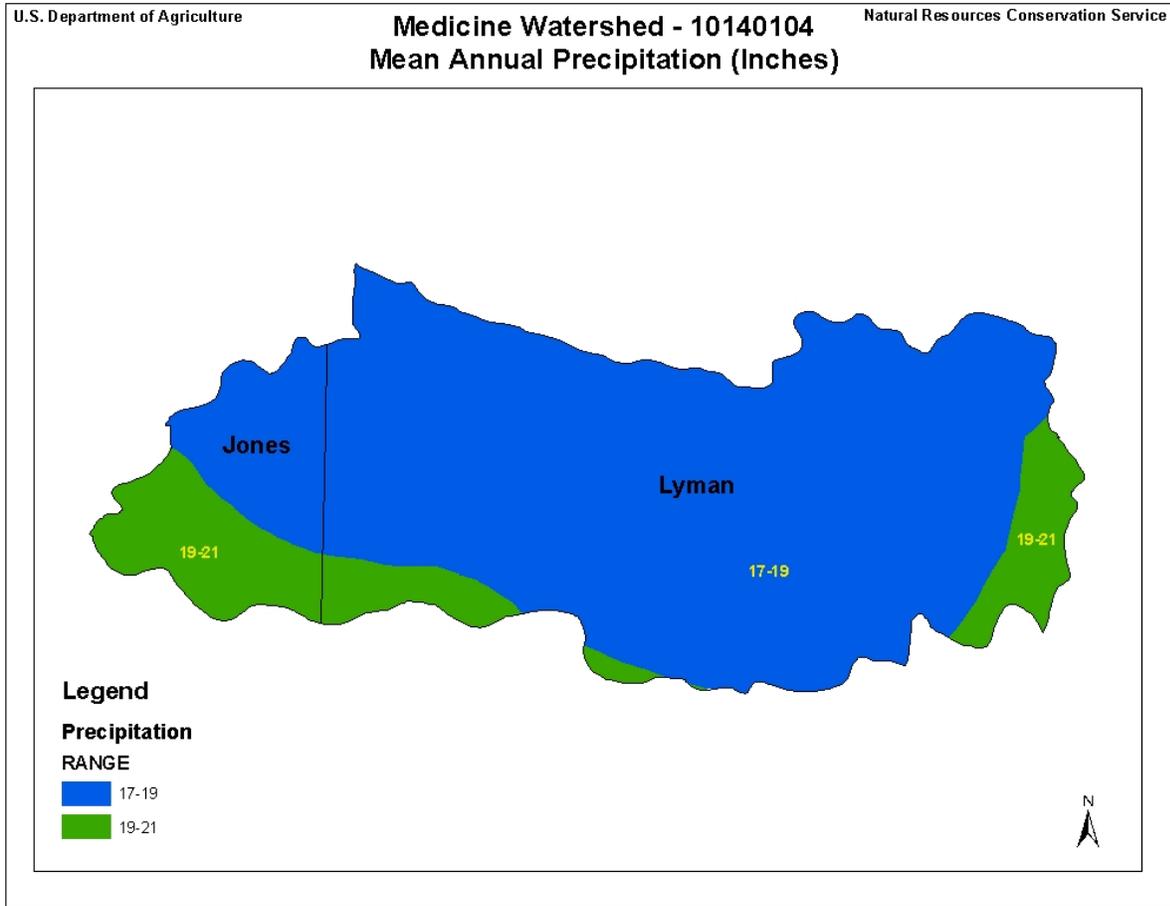
It is estimated that more than 75 percent of the annual runoff occurs during the four-month period of March through June. The high runoff in March and April is usually from snowmelt while the runoff in May and June is from rainfall. Heavy runoff during the summer months is caused by brief, intense thunderstorms. Annual runoff can vary widely from year-to-year; the average annual runoff totals 1.25 inches. Most of the tributaries will show periods of low or no flow almost every year during the fall and winter months.

The historical data records for average temperature, wind speed, and relative humidity data used to represent the watershed are from the U.S. Weather Bureau reporting station at Kennebec, SD, the county seat of Lyman County, which is centrally located in the watershed.

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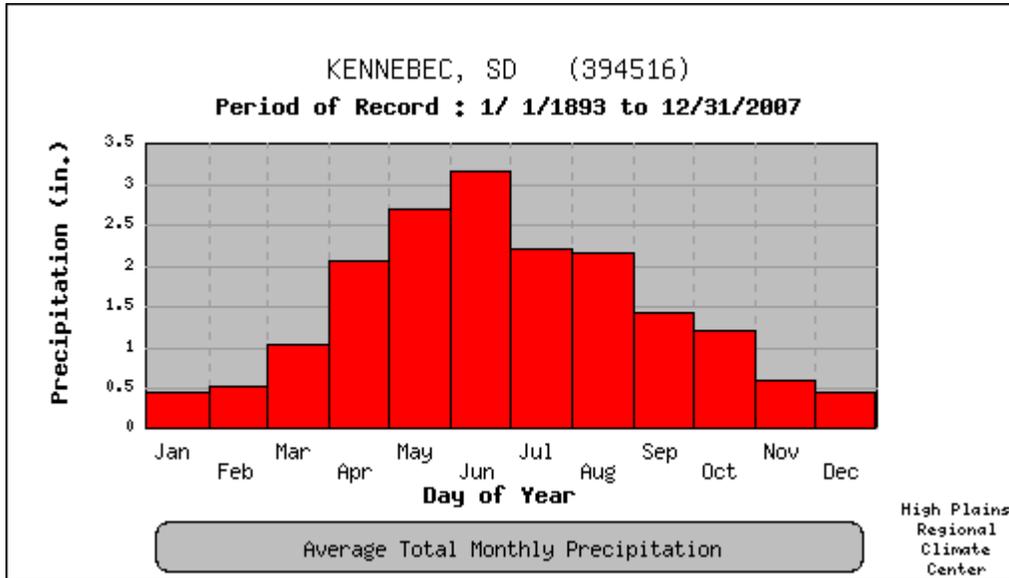
3.4.1 Precipitation³

The average annual precipitation for the watershed area is approximately 19 inches per-year measured at the U.S. Weather Bureau Station at Kennebec, SD.



3.4.1a Precipitation Distribution Graph

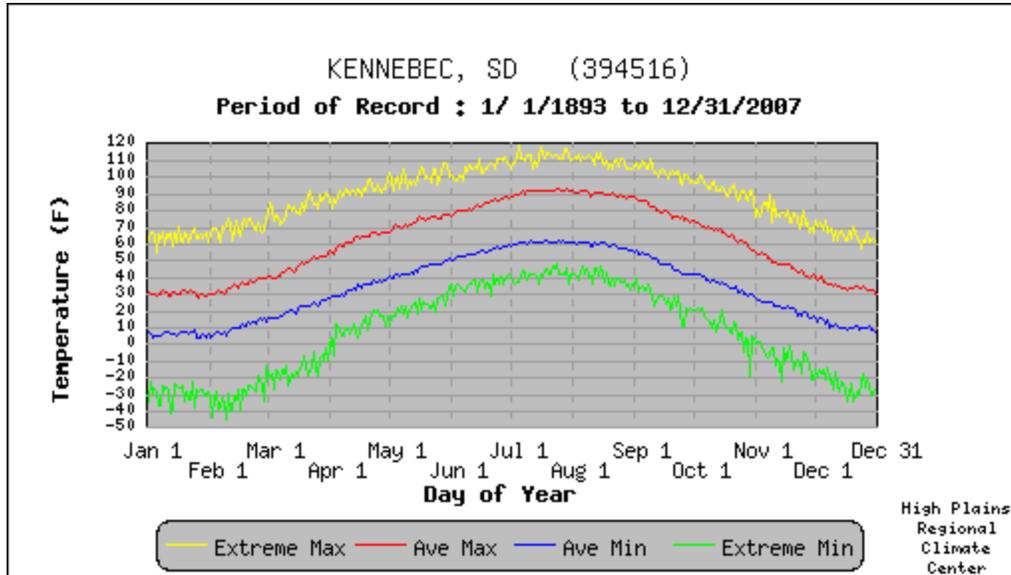
Period of Record - Monthly Average Total Precipitation



 - Average precipitation recorded for the month.

3.4.2 Average Monthly Temperature⁴

Temperatures vary considerably throughout the year. The average winter temperature is 19 degrees F and the average summer temperature is 72 degrees F. Extreme temperatures for the year often range from below zero in the winter to an occasional 100 plus degree summer day.



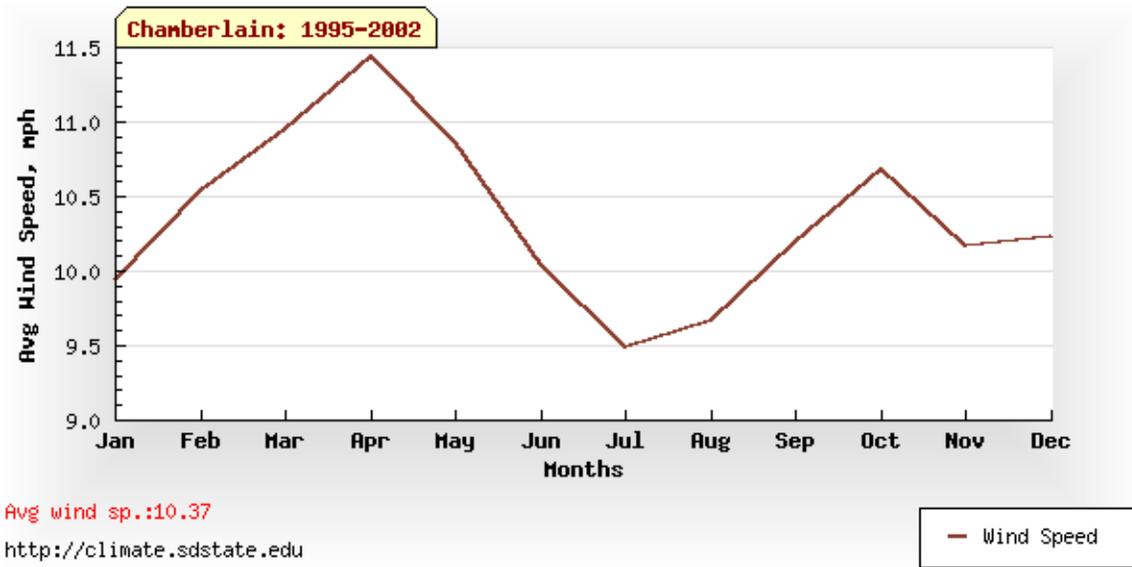
Data is smoothed using a 29 day running average.

- - Extreme Max. is the maximum of all daily maximum temperatures recorded for the day of the year.
- - Ave. Max. is the average of all daily maximum temperatures recorded for the day of the year.
- - Ave. Min. is the average of all daily minimum temperatures recorded for the day of the year.
- - Extreme Min. is the minimum of all daily minimum temperatures recorded for the day of the year.

3.4.3 Average Monthly Wind Speed⁴

The Chamberlain, SD municipal airport is the closest airport to the watershed that maintains average wind speed and relative humidity records.

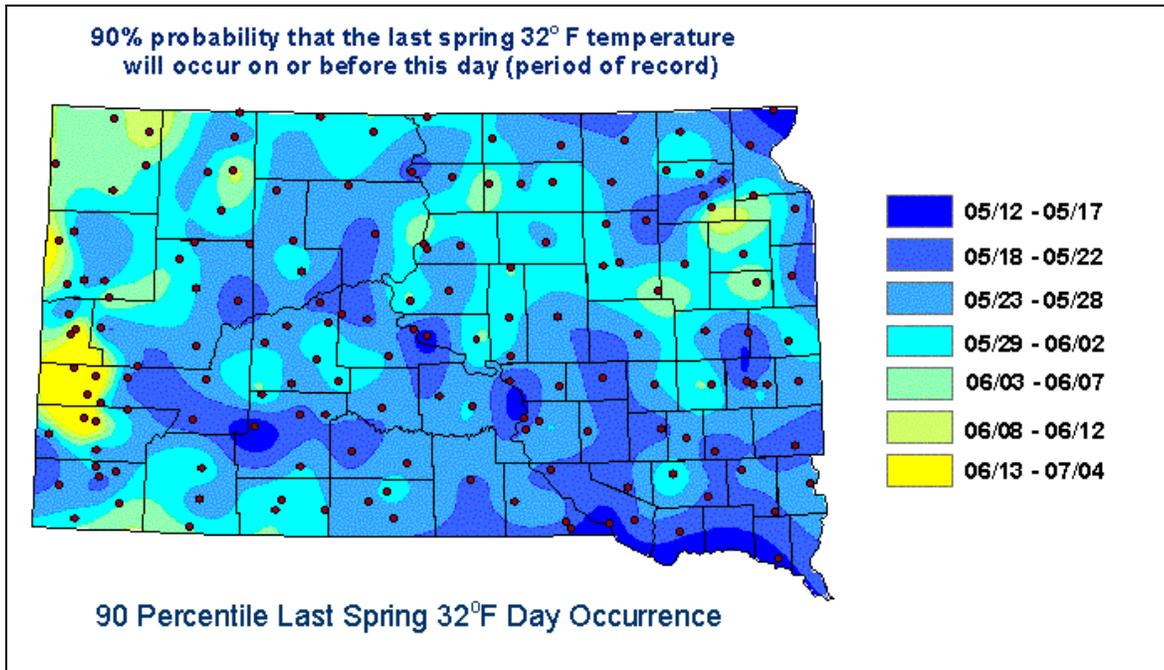
Average Wind



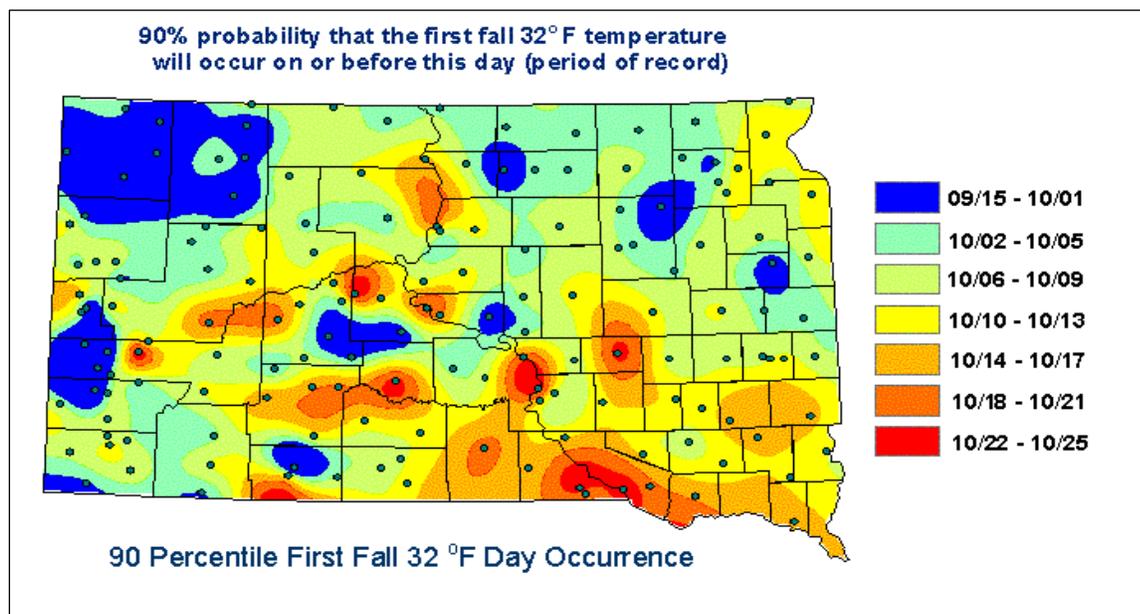
3.4.4 Average Monthly Relative Humidity⁴



3.4.5 Last Spring Freeze⁴



3.4.6 First Fall Freeze⁴



3.4.7 Climate Summary⁵

Overall monthly climatic summary of temperature and precipitation averages for the watershed.

KENNEBEC, SOUTH DAKOTA (394516)

Period of Record Monthly Climate Summary

Period of Record : 1/ 1/1893 to 12/31/2007

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| Average Max. Temperature (F) | 30.3 | 34.5 | 46.1 | 62.0 | 73.1 | 82.6 | 90.9 | 89.3 | 79.5 | 65.5 | 46.9 | 34.3 | 61.3 |
| Average Min. Temperature (F) | 5.9 | 9.7 | 20.5 | 33.4 | 44.6 | 54.8 | 60.5 | 58.7 | 48.1 | 35.4 | 21.3 | 10.7 | 33.6 |
| Average Total Precipitation (in.) | 0.43 | 0.49 | 1.02 | 2.05 | 2.64 | 3.06 | 2.21 | 2.06 | 1.42 | 1.15 | 0.59 | 0.43 | 17.54 |
| Average Total SnowFall (in.) | 4.7 | 6.0 | 7.0 | 3.5 | 0.3 | 0.0 | 0.1 | 0.0 | 0.1 | 1.1 | 4.1 | 5.0 | 31.8 |
| Average Snow Depth (in.) | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |

Percent of possible observations for period of record:

Maximum Temperature: 99.1 percent;

Minimum Temperature: 98.7 percent;

Precipitation: 99.5 percent;

Snowfall: 99.2 percent;

Snow Depth: 97.6 percent.

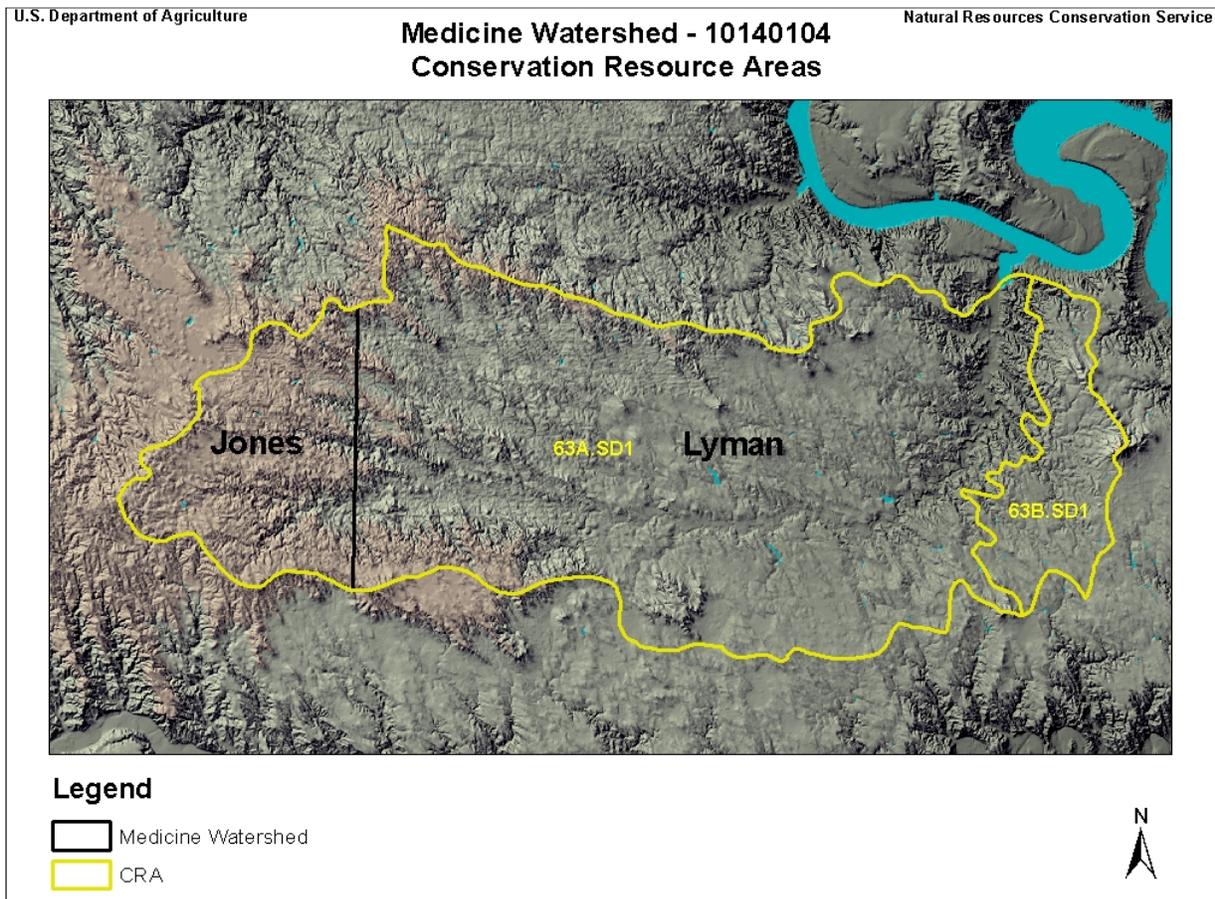
Check [Station Metadata](#) or [Metadata graphics](#) for more detail about data completeness.

4.0 RESOURCE INVENTORY

The resource inventory provides a general summary of the existing conditions of the natural resources in the watershed that are related to the soil, water, animals, plants, air, and humans (SWAPA+H). The resource descriptions provide general information on land use, land capability, soils and productivity, and prime farmland.

4.1 MAJOR LAND RESOURCE AREAS (MLRA) AND COMMON RESOURCE AREA (CRA)¹

The MLRA's are a part of a USDA classification system that defines land as a resource for farming, ranching, forestry, engineering, recreation, and other uses. The MLRA is a broad-based geographic area characterized by a uniform pattern of soils, elevation, topography, climate, water resources, potential natural vegetation, and land uses. Large MLRAs may be further subdivided to create smaller more homogeneous resource areas. The CRAs are the basic unit of an MLRA, a subdivision based on significant geographic differences in climate, water resources, or land use and resource concerns where resource problems or treatment needs are similar. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a CRA. In SD, the MLRA and CRA boundaries coincide.





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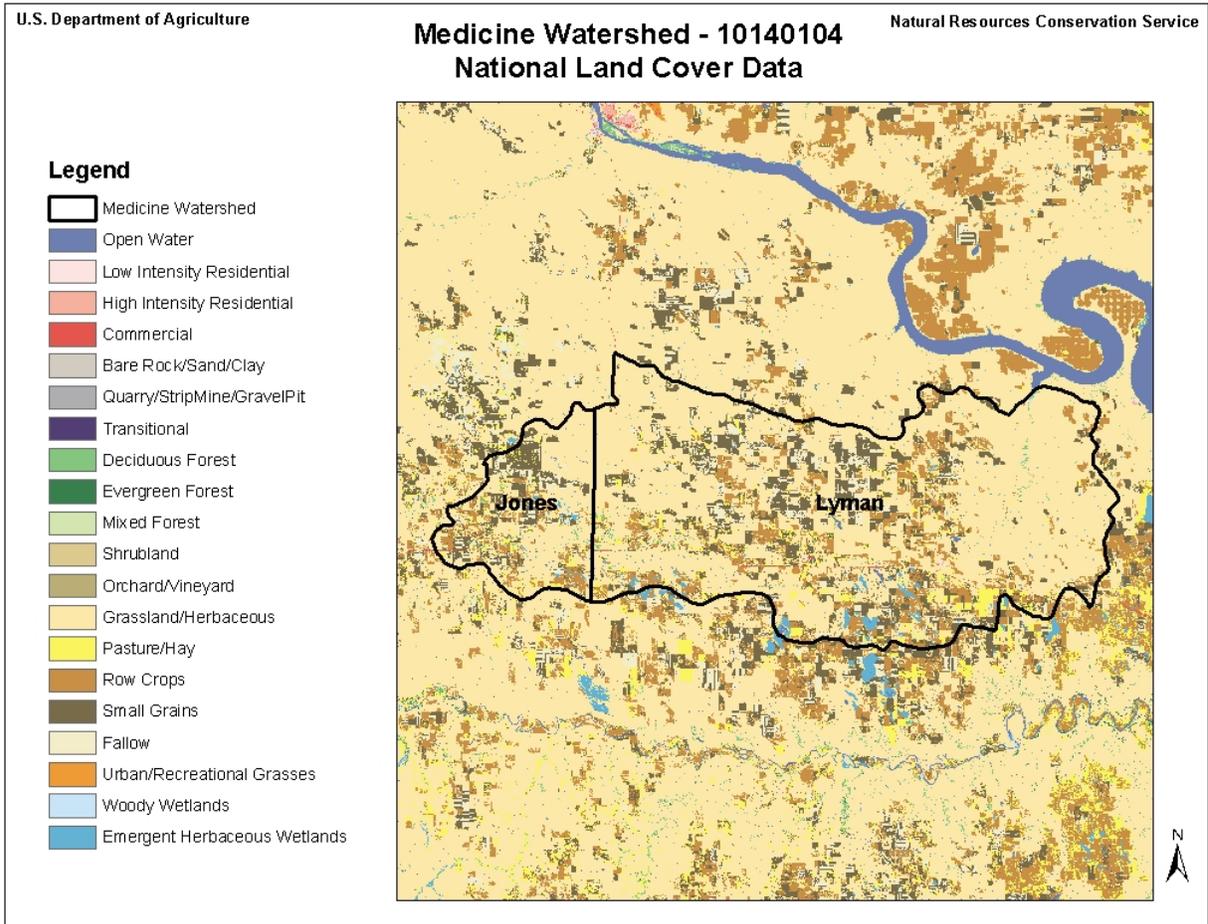
July 2009

4.1.1 Common Resource Area Descriptions

| Symbol | Name | Brief Description |
|---------------|---|--|
| 63A.SD1 | Northern Rolling Pierre Shale Plains | Most of the area is used for livestock production with some cropped areas. Winter wheat is the main crop. Most of these soils are fine and very fine textured with a mesic temperature regime. |
| 63B.SD1 | Southern Rolling Pierre Shale Plains | Most of the area is used for livestock production with some cropped areas. Winter wheat and grain sorghum are the main crops with some soybeans and corn. Most of the soils are fine and very fine textured with a mesic temperature regime. |

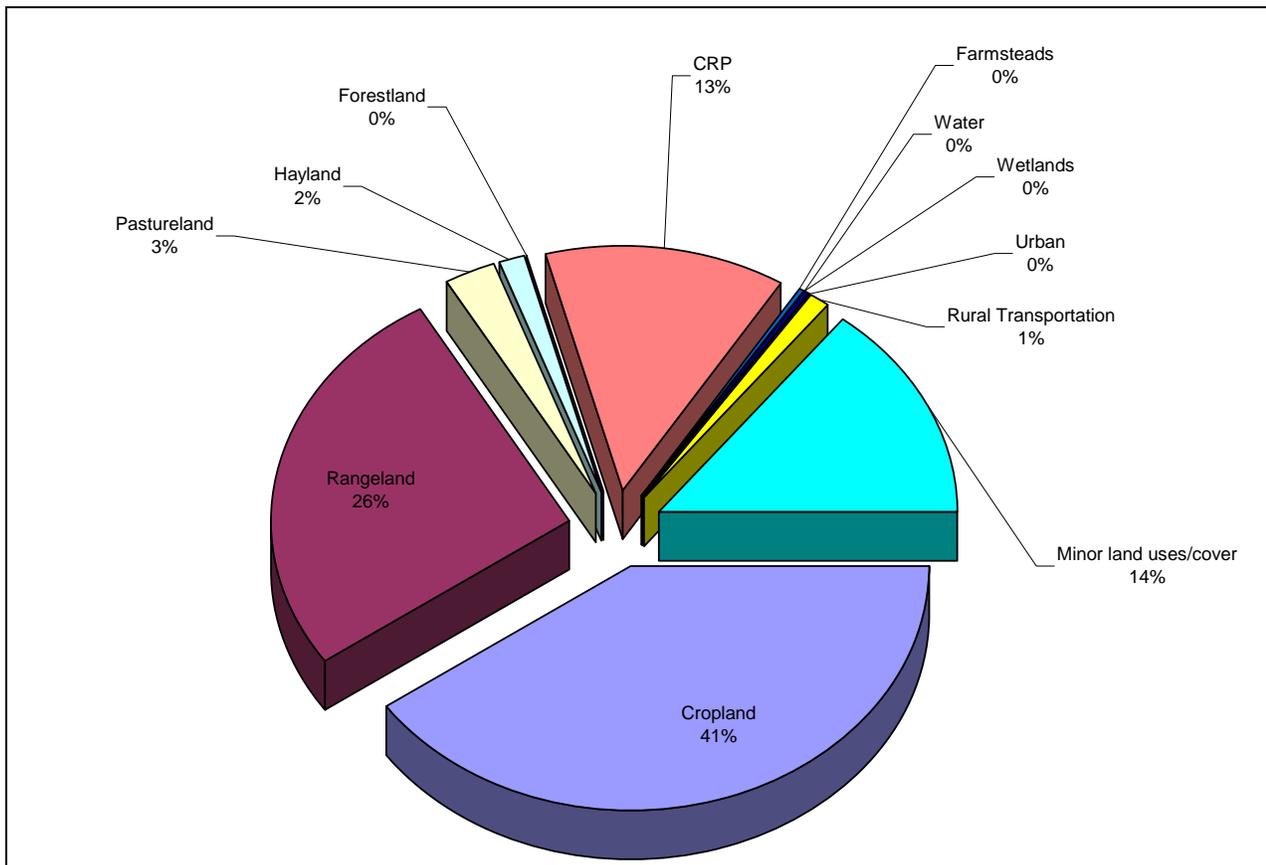
4.2 LAND COVER AND LAND USE DISTRIBUTION⁶

The National Resources Inventory (NRI) uses the term land cover/use to identify the categories that account for all the surface area in the U.S. Land cover describes the different types of vegetation or other kind of material that covers the land surface. Land use is defined as the purpose of human activity on the land, it is usually, but not always, related to land cover.



4.2.1 Land Cover and Land Use Summary

| Land Use Cover 1997 NRI | Acres | Percent |
|----------------------------|----------------|------------|
| Cropland | 191,000 | 40 |
| Rangeland | 125,900 | 26 |
| Pastureland | 13,000 | 3 |
| Hayland | 7,700 | 2 |
| Forestland | 0 | 0 |
| CRP | 61,300 | 13 |
| Farmsteads | 1,600 | 0 |
| Wetlands | 0 | 0 |
| Water | 1,700 | 0 |
| Urban | 100 | 0 |
| Rural Transportation | 4,900 | 1 |
| Minor land uses/cover | 68,500 | 14 |
| Total | 475,700 | 100 |



Primary Land Uses [NRI-97]

Cropland - A land cover/use category that includes areas used for the production of adapted crops for harvest. Two subcategories of cropland are recognized: cultivated and noncultivated. Cultivated cropland consists land in row crops or close-grown crops and other cultivated cropland, for example, hayland or pastureland that is in a rotation with row or close-grown crops. Noncultivated cropland includes permanent hayland and horticultural cropland.

Pastureland –A land use category managed primarily for the production of introduced or native forage plants for livestock grazing. Pastureland may consist of one species in a pure stand, a grass mixture, or a grass-legume mixture. Management consists of cultural treatments; fertilization, weed control, reseeding or renovation, and controlled grazing. For NRI, this includes land that has a vegetative cover of grasses, legumes, and/or forbs, regardless of whether or not it is being grazed by livestock.)

Hayland - A subcategory of cropland managed for the production of forage crops that are machine harvested. These crops may be grasses, legumes, or a combination. Hayland also includes land in set-aside or other short-term agricultural programs. [NRI-97]

Rangeland - A land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. This would include areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities of low forbs and shrubs, such as mesquite, chaparral, mountain shrub, and pinyon-juniper, are also included as rangeland. [NRI-97]

Urban and built-up –Land that is used for residential, industrial, commercial, and institutional land; construction sites; public administrative sites; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water control structures and spillways; small parks (less than 10 acres) within urban and built-up areas; and transportation facilities if they are surrounded by urban areas. This also includes tracts of less than 10 acres that do not meet the above definition but are completely surrounded by urban and built-up land. Two size categories are recognized in the NRI: (i) areas 0.25 to 10 acres, and (ii) areas greater than 10 acres. [NRI-97]

Minor land cover/use includes farmsteads, farm structures, field windbreaks, barren land, and marshland.

Federal land - A land ownership category designating land that is owned by the federal government. It does not include Trust lands administered by the Bureau of Indian Affairs. No data is collected for any year that land is in this ownership category.

Rural transportation land consists of all highways, roads, railroads, and associated right-of-ways outside urban and built-up areas; also includes private roads to farmsteads or ranch headquarters, logging roads, and other private roads (field lanes are not included).

Conservation Reserve Program - (CRP) land is highly erodible or other environmentally sensitive acreage normally devoted to crop production which is converted to long-term vegetative cover.

4.2.2 Land Capability Class (LCC)¹

Land capability classification (LCC) is a system of grouping soils primarily on the basis of their ability to produce common cultivated crops and pasture plants without the deterioration of the soil resource over a long period of time. The LCC reflects the physical and chemical properties, along with the topographic relief of a soil. The LCC can be used as a guide for land management decisions based on the capability or limitations of the soil.

| Land Capability Class (1997 NRI Estimate) | Acres | Percent |
|---|----------------|----------------|
| I - slight limitations | 0 | 0 |
| II - moderate limitations | 6,800 | 1 |
| III - severe limitations | 273,700 | 58 |
| IV - very severe limitations | 31,400 | 7 |
| V - no erosion hazard, but other limitations | 11,300 | 2 |
| VI - very severe limitations, unsuited for cultivation, limited to pasture, range, forest | 81,500 | 17 |
| VII - very severe limitations, unsuited for cultivation, limited to grazing, forest, wildlife | 0 | 0 |
| VIII – misc. areas have limitations, limited to recreation, wildlife, and water supply | 4,300 | 1 |
| Other Acres Not Determined – includes water, rock outcrop, non-soil areas | 66,700 | 14 |
| Total Acres | 475,700 | 100 |

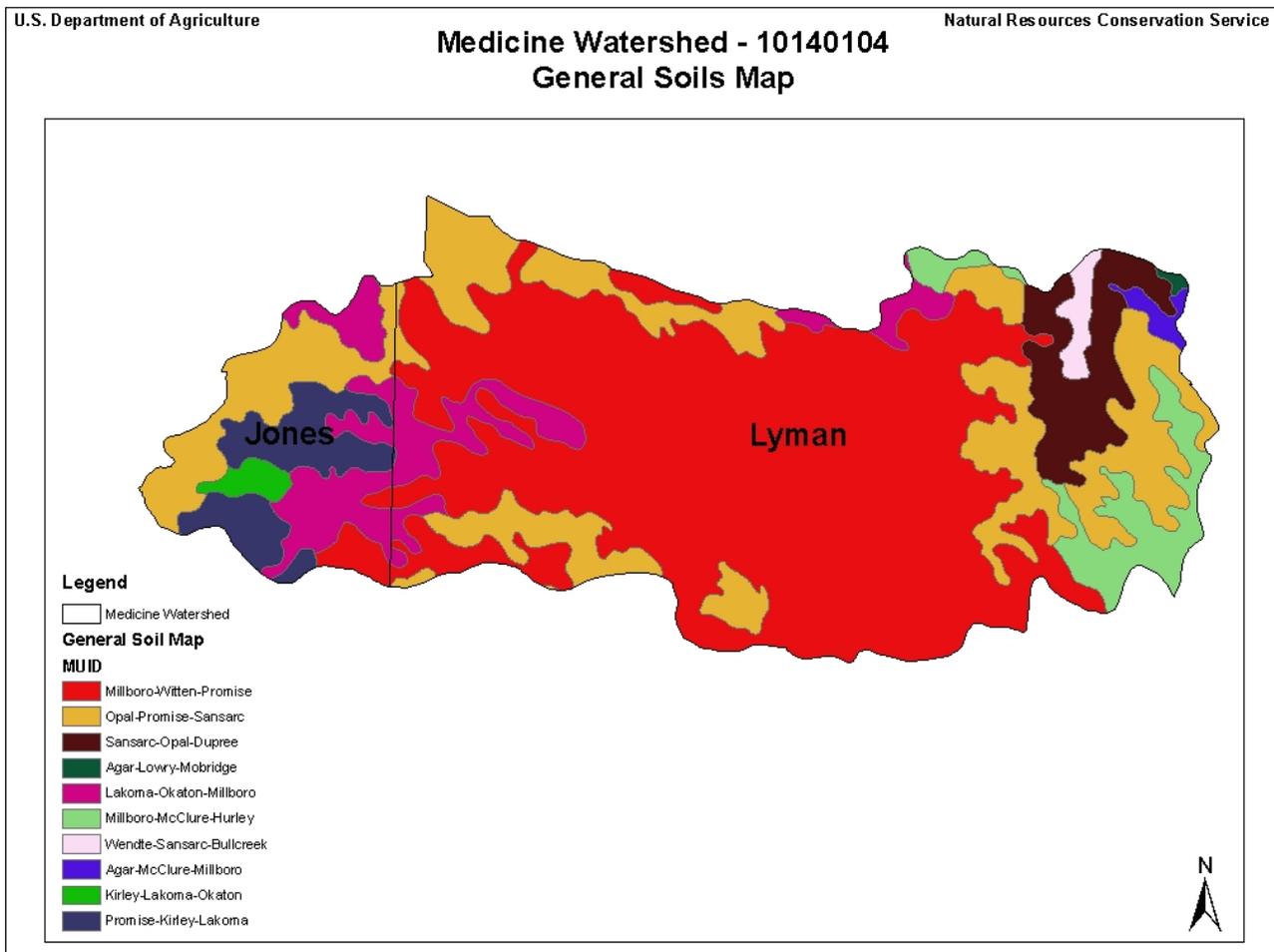
4.2.3 Prime Farmland¹

Prime farmland, as defined by the USDA, is land that has the best combination of physical and chemical characteristics for food, feed, forage, fiber, and oilseed crop production. It must also be available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Prime farmland soils are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

| Prime Farmland 1997 NRI | Acres | Percent |
|--------------------------------|--------------|----------------|
| Total Acres Prime Farmland | 0 | 0 |
| Other Acres | 475,700 | 100 |

4.3 GENERAL SOILS

Most of the soils in the watershed were formed in the marine sedimentary materials exposed when the inland sea permanently receded. There was an extensive period of erosion and wind and water weathered the exposed surface to form the parent materials for the clayey soils formed in clay materials or clayey soils formed in the shale residuum. Soil formation is influenced not only by geologic forces but also topographic relief. Factors such as drainage, runoff, erosion, plant cover, and soil temperature cause soils to develop with certain characteristics and qualities.



4.3.1 General Soil Descriptions

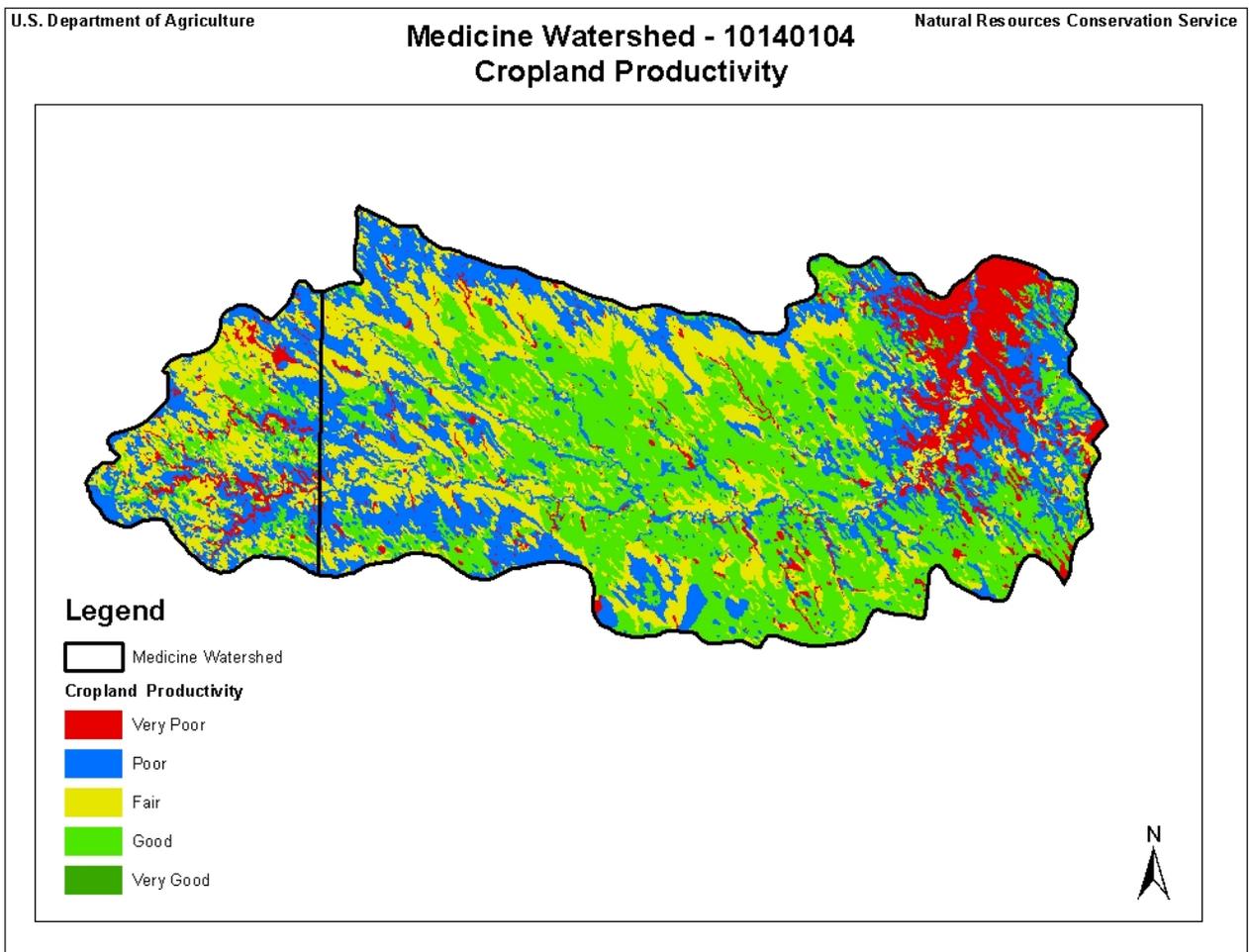
Soils in the watershed have been placed into 10 broad groups or associations that are geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit. Each soil association has a distinctive pattern of soils, relief, drainage, and natural landscape. The dominant soils within the watershed are silty and clayey soils formed in clayey materials or clayey soils formed in clayey shale residuum in the uplands; silty and clayey soils formed in clayey materials on the plains; and silty and clayey soils formed in alluvium on the floodplains and low terraces.

More detailed information on individual soils is available in the published county soil survey reports or from the Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov>). The accompanying map is of a general nature and is not intended for any type of intensive planning and management.

| | | |
|-------|--------------------------|--|
| SD063 | MILLBORO-WITTEN-PROMISE | Deep, well-drained, level to gently sloping, silty and clayey soils on plains. |
| SD064 | OPAL-PROMISE-SANSARC | Shallow to deep, well-drained, nearly level to very steep, clayey soils on shale hills. |
| SD066 | SANSARC-OPAL-DUPREE | Shallow and moderately deep, well-drained, gently sloping to very steep clayey soils on shale hills. |
| SD075 | AGAR-LOWRY-MOBRIDGE | Deep, well and moderately well-drained, level to moderately sloping silty soils on loess plains |
| SD187 | LAKOMA-OKATON-MILLBORO | Shallow to deep, well-drained, gently sloping to very steep, clayey soils on shale plains and hills. |
| SD213 | MILLBORO-MCCLURE-HURLEY | Deep, well-drained and moderately well-drained, level to moderately sloping, clayey soils on shale plains. |
| SD216 | WENDTE-SANSARC-BULLCREEK | Deep and shallow, well-drained and moderately well-drained, level to very steep, clayey soils on flood plains, uplands, and stream terraces. |
| SD217 | AGAR-MCCLURE-MILLBORO | Deep, well-drained, nearly level to moderately sloping silty, and clayey soils on mixed shale and drift plains. |
| SD218 | KIRLEY-LAKOMA-OKATON | Very deep to shallow, well-drained, gently sloping to very steep loamy and clayey soils on shale plains and hills. |
| SD230 | PROMISE-KIRLEY-LAKOMA | Deep and moderately deep, well-drained, level to moderately sloping, clayey soils on shale plains and terraces. |

4.4 CROPLAND PRODUCTIVITY¹

Cropland Productivity Index (CPI) is a rating assigned to each soil map unit to rate the soil for cropland production. The rating is based on a scale of 1 to 100, with 100 being the most productive map unit in the county. The CPI assigned to each map unit is based on the physical and chemical properties of each soil type in the map unit. Properties such as slope, organic matter levels, topsoil thickness, soil texture, available water capacity, pH, and salinity levels will directly affect the productivity level of each soil type. The experience of soil scientists and university researchers is used to develop the ratings.





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| Cropland Productivity Index | | | Descriptions |
|------------------------------------|-----------|-------------|---|
| 1-25 | Very Poor | Red | Soils with >15 percent slopes; soils with claypan, bedrock or gravels near the surface; high salinity soils |
| 26-50 | Poor | Blue | Soils with 9-15 percent slopes; soils with claypan, bedrock, or gravels within 20 inches of the surface |
| 51-75 | Fair | Yellow | Soils with 6-9 percent slopes; soils with claypan, bedrock, or gravels at 20 to 40 inches of the surface |
| 76-89 | Good | Light Green | Soils with 2-6 percent slopes |
| 90-100 | Very Good | Dark Green | Silty or loamy soils with high soil organic matter levels |

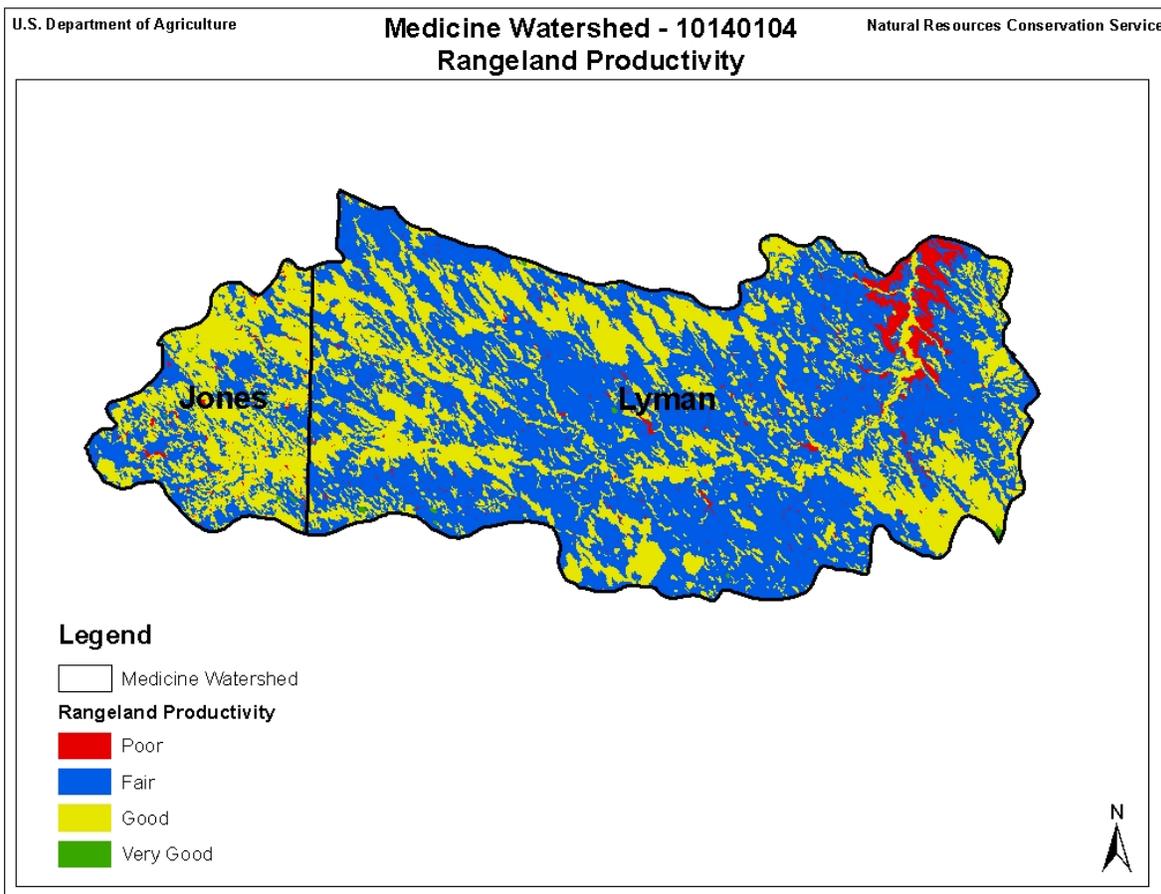
4.5 RANGELAND PRODUCTION (NORMAL YEAR)¹

Rangeland has a native vegetation of grasses, grasslike plants, forbs, and shrubs. In many areas, introduced forage species are also managed as rangeland. The vegetation is suitable for grazing and browsing by animals. Rangeland includes natural grasslands, savannahs, many wetlands and deserts, tundra, and certain shrub and forb communities.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils, vegetation, and water.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It is expressed in pounds per acre of air-dry vegetation for normal years.

Yield and production values are represented as a single value for the map unit. They are calculated based on a weighted average.





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8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service (NRCS) July 2009

| Rangeland Normal Year Production | | | Descriptions |
|---|----------------------|------------------------|--|
| 1-1700 lbs/Ac | Poor | Red | Low rainfall areas or shallow soils |
| 1701-2600 lbs/Ac | Fair | Blue | Areas that are high in sodium or salts or shallow to bedrock or gravel |
| 2601-4500 lbs/Ac | Good | Yellow | Areas where there is no additional moisture and the soil properties do not influence the grasses |
| 4501-9000 lbs/Ac | Very Good | Light Green | Low lying areas that receive additional moisture |

5.0 RESOURCE CONCERNS

Resource concerns or problems are issues related to the environment that impact the health, productivity, or condition of natural resources in a watershed. The most common resource concerns are associated with the SWAPA+H.

5.1 SUMMARY OF RESOURCE CONCERNS¹

Specific resource concerns have been identified for each major land use at the state level. The following table is a summary of state level concerns. The resource concerns specific to the watershed have been identified and evaluated by land use in the watershed assessments.

| SWAPA + H Concerns | Specific Resource Concerns/Issue | Pasture/Hay | Cropland | Rangeland | Forest | Wildlife |
|--------------------|---|-------------|----------|-----------|--------|----------|
| Soil Erosion | Streambank | X | X | X | X | X |
| | Sheet and Rill | | X | | | |
| | Wind | | X | | | |
| | Ephemeral Gully | | X | | | |
| | Classic Gully | | X | | | |
| Soil Condition | Organic Matter | | X | | | |
| | Excess Nitrogen | | X | | | |
| | Excess Phosphorous | | X | | | |
| | Compaction | | X | | | |
| | Soil Salinity | | X | | | |
| | Rangeland Site Stability | | X | | | |
| Water Quantity | Inefficient Water Use on Irrigated Lands | | X | | | |
| Water Quality | Harmful levels of Pesticides in Ground Water | | X | | | |
| | Harmful levels of Pesticides in Surface Water | | X | | | |
| | Nutrients and Organics in Ground Water | | X | | | |
| | Nutrients and Organics in Surface Water | | X | | | |
| | Suspended Sediment in Surface Water | X | X | X | X | X |
| Plant Suitability | Plants Not Adapted to Site | X | | | | |
| Plant Condition | Productivity Health and Vigor | X | | X | X | |
| | Forage Quality and Palatability | X | | X | X | |
| | Noxious and Invasive Plants | X | | X | | X |
| Domestic Animals | Inadequate Feed and Forage Quantities and Quality | X | | X | X | |
| | Inadequate Stock Water | X | | X | X | |
| Fish and Wildlife | Species of Concern | X | X | X | X | X |
| | Inadequate Cover and Shelter | X | X | X | X | X |

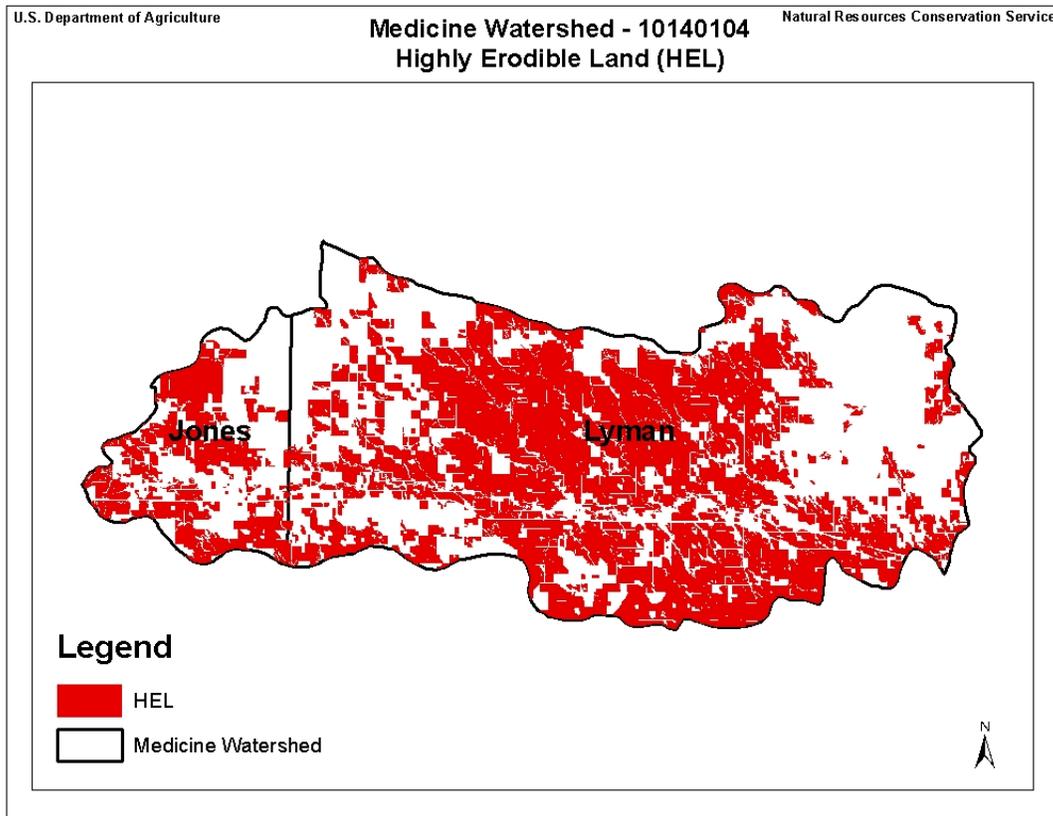
5.2 SOIL EROSION - WIND AND WATER¹

Soil erosion is defined as the detachment and movement of topsoil, or soil material from the upper part of the soil profile, through the action of wind or running water, especially as a result of changes associated with human activity related to agricultural practices. Soil erosion from water includes rill, gully, and sheet.

| Soil loss wind and water (cultivated cropland, hayland, pastureland and CRP). | Erosion | Average Annual Erosion Rate (T/Ac/Yr) | Acres | Total (T/Yr) |
|--|--------------|---------------------------------------|---------|--------------|
| | Wind (WEQ) | 2.6 | 273,000 | 709,800 |
| | Water (USLE) | 1.29 | 273,000 | 352,170 |

5.3 HIGHLY ERODIBLE LAND (HEL)

The basis for identifying highly erodible land (HEL) is the erodibility index (EI) of a soil map unit. The "EI" of a soil is determined by dividing the potential erodibility for each soil by the soil loss tolerance (T) value established for the soil as of January 1, 1990. The "T" value represents the maximum annual rate of soil erosion that can take place without causing a decline in long-term productivity. A soil map unit with an "EI" of eight or more is a highly erodible soil map unit. Refer to the National Food Security Act Manual, for further guidance.



5.4 WATER RESOURCE CONSIDERATIONS

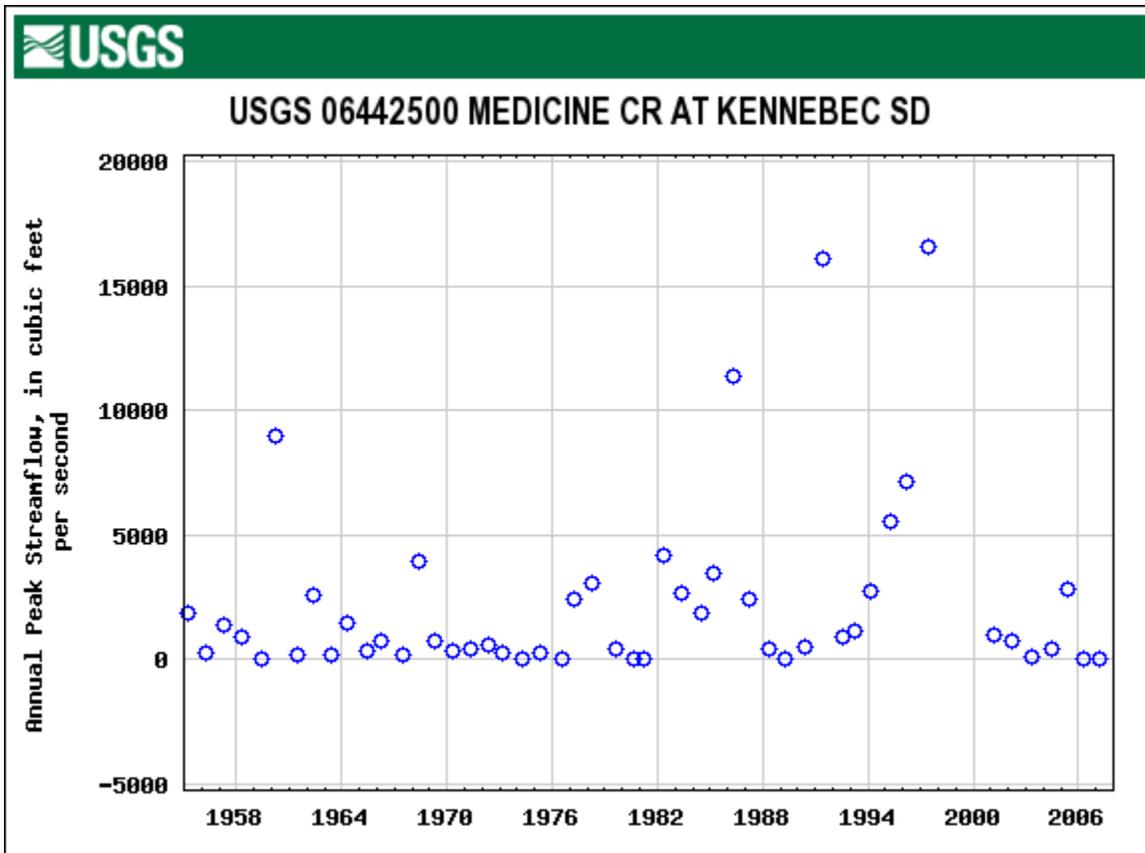
5.4.1 Water Resources Table¹

The NRI data collected for streams and water bodies within the watershed.

| Water Resources 1997 NRI | Acres | Percent |
|--|-------|---------|
| Streams <660' wide and water bodies <40 Ac | 1,300 | 0.3 |
| Streams >660' wide and water bodies >40 Ac | 400 | 0.1 |

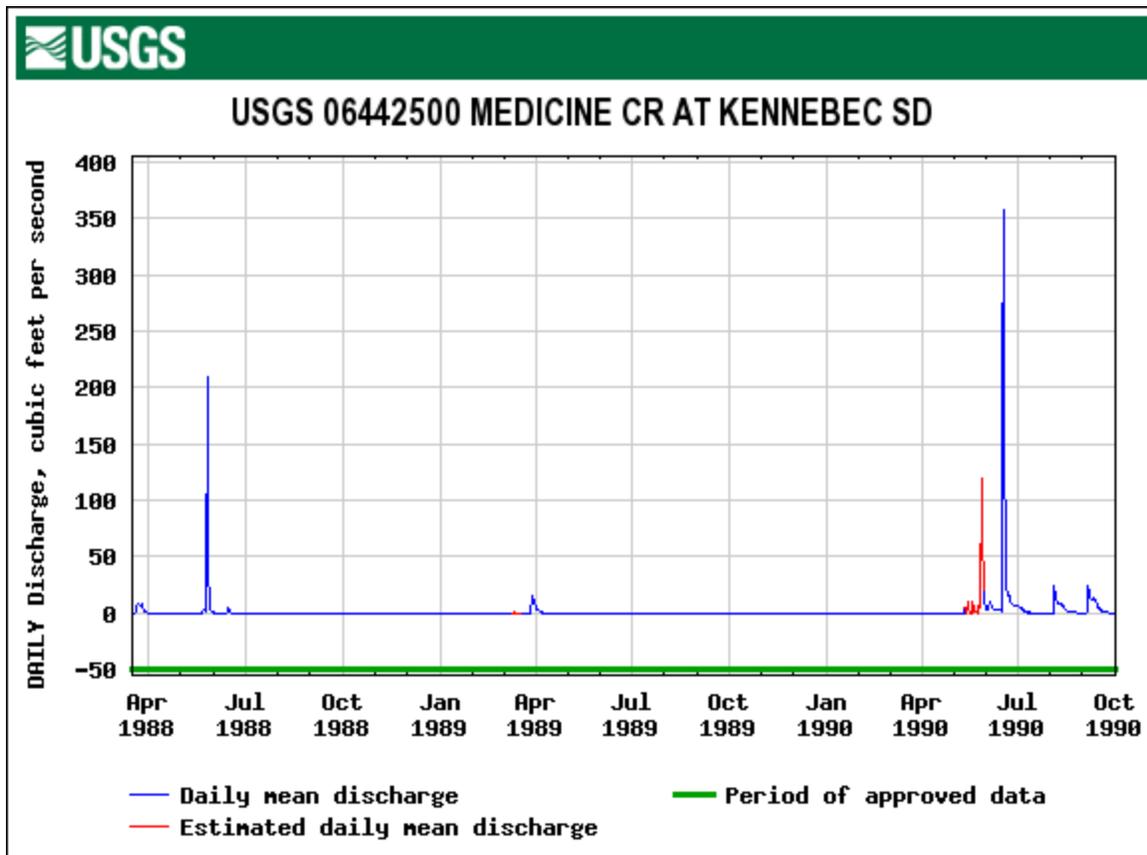
5.4.2 Peak Stream Flow⁶

The USGS collected peak stream flow data from a gage station located on Medicine Creek at Kennebec, SD. The site is centrally located within the Medicine watershed and has a drainage area of 464 square miles. This station collected peak stream flow data from 1955 through 2008 and daily discharge data from 1987 to 1990.



5.4.3 Daily Discharge⁶

The USGS gauging stations used to collect peak stream flow data was also used to collect daily discharge data within the watershed.



5.4.4 Groundwater¹

Several major and minor aquifers of varying depths and water quality are utilized for domestic and agricultural purposes. Shallow aquifers tend to be smaller, localized alluvial or colluvial deposits of sands and gravels along floodplains. These aquifers usually have higher quality water but are also more vulnerable to leaching of nutrients, pesticides, organic waste, and pathogens. Recharge of shallow aquifers occurs primarily from infiltration of precipitation but also from wetlands, lakes, and streams. Deep aquifers occur between confining layers of impermeable bedrock. The quality of this water is often variable but usually of lower quality than that of shallow aquifers. As a result of the confining layers protecting these aquifers and the depth at which they occur, they are less susceptible to leaching and other surface activities and impacts. Important aquifers within this watershed are:

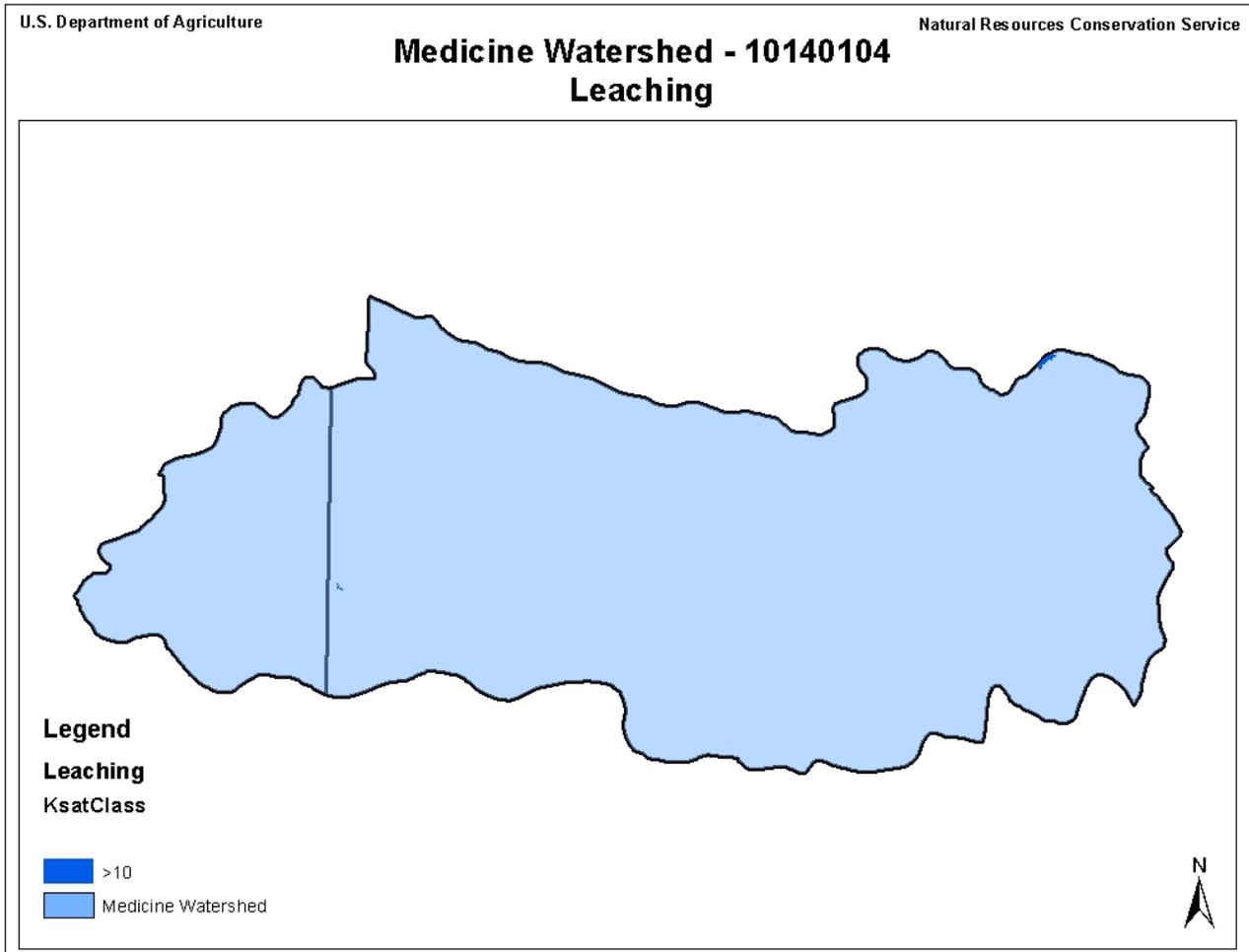
Shallow Aquifers:

Undifferentiated alluvial deposits of sands and gravels

Bedrock Aquifers:

- Niobrara Formation
- Inyan Kara Group
- Minnelusa Formation
- Madison Limestone

The NRCS makes groundwater leaching assessments based on a soils “saturated hydraulic conductivity” (Ksat). Ksat refers to the ease with which pores in a saturated soil transmit water and is expressed in terms of micrometers per second. Soil map units that have a Ksat value of 10 micrometers/second or greater and with <6 percent slope would be considered to have a “high leaching risk”.



5.4.5 Public Water Supply Systems⁷

Approximately 670 public water systems (PWS) currently exist in SD. The public water supply systems within this watershed rely on both surface and ground water sources. These systems meet the needs of rural and municipal households as well as industrial and agricultural needs. Protection and conservation of both surface and groundwater sources is critical.

Primary enforcement of the federal Safe Drinking Water Act (SDWA) began in 1983. The SD Drinking Water Program, part of the Department of Environment and Natural Resources (DENR), develops and enforces the SD Drinking Water Regulations (<http://www.state.sd.us/denr/des/drinking/regs.htm>) that apply to public water systems in the state. To see a list of drinking water contaminants that the Drinking Water Program regulates visit the Drinking Water Standards Web page at <http://www.state.sd.us/denr/des/drinking/standard.htm>. Plans and specifications reviews are part of the department's regulatory efforts to protect the state's surface and groundwater resources and public health. The areas of responsibility include design criteria development, technical assistance, and plan approvals for the Drinking Water, Groundwater Quality, Minerals and Mining, Surface Water and Waste Management Programs within the Division of Environmental Services.

5.4.6 Surface Waters - Designated Beneficial Uses⁷

Surface waters in SD are classified for one or more of the following beneficial uses:

- (1) Domestic water supply waters;
- (2) Cold water permanent fish life propagation waters;
- (3) Cold water marginal fish life propagation waters;
- (4) Warm water permanent fish life propagation waters;
- (5) Warm water semipermanent fish life propagation waters;
- (6) Warm water marginal fish life propagation waters;
- (7) Immersion recreation waters;
- (8) Limited contact recreation waters;
- (9) Fish and wildlife propagation, recreation, and stock watering waters;
- (10) Irrigation waters; and
- (11) Commerce and industry waters.

All streams, in SD, are assigned the beneficial uses (9) and (10) unless otherwise stated. All lakes, in SD, are assigned the beneficial uses of (7), (8), and (9).

5.4.7 Total Maximum Daily Loads (TMDLs) 2008 Report⁷

Section 303(d) of the federal Clean Water Act requires that states develop TMDLs for water bodies that are impaired. The SD DENR is responsible for managing the monitoring of water bodies and development of TMDLs in SD. The TMDLs are calculations to determine the sum allowable load of a pollutant from all contributing point and nonpoint sources, that a waterbody can receive and still meet the applicable water quality standards. The TMDLs must be developed for water bodies that do not meet the water quality standards. The TMDLs developed by DENR are required to be approved by the Environmental Protection Agency (EPA) and to public notice the TMDL.

The following data was presented by the DENR in “THE 2008 SOUTH DAKOTA INTEGRATED REPORT FOR SURFACE WATER QUALITY ASSESSMENT.” This information represents the current status of water quality for waters within Medicine Watershed.

| Lower Missouri River | | | | | |
|-----------------------------|--------------------------|------------|--|-------------|-----------------|
| Segment or Lake Name | Segment or Lake Location | Impairment | Status | Status Date | Initial Listing |
| | Lakes | | | | |
| Brakke Dam | Lyman County | TSI | Water impaired but has an approved TMDL | 9//29/04 | 1998 |
| Byre Lake | Lyman County | TSI | Water impaired but has an approved TMDL | 6/3/04 | 1998 |
| Fate Dam | Lyman County | TSI | All beneficial uses met and has an approved TMDL | 1/14/05 | 2002 |
| Medicine Creek | Lyman County | Fecal/TSS | All beneficial uses met and has an approved TMDL | 8/30/06 | 2002 |

| Impairments | |
|--------------------|---|
| DO - | Dissolved Oxygen, results from the photosynthetic and respiratory activities of the biota in the water body. DO is essential for aquatic life. |
| pH - | Acidity/Alkalinity the measure of the hydrogen ion concentration. pH can affect many chemical reactions in water. |
| TSI - | Carlson's (1977) Trophic State Indices (TSI), Carlson's TSI is a measure of productivity in a lake or reservoir. Typically Secchi depth, chlorophyll <i>a</i> , and phosphorus measurements are used to calculate a mean TSI value. |
| TSS - | Total Suspended Solids, the organic and inorganic material left on a standard glass fiber filter (0.45 micron) after a water sample is filtered through it. TSS can be used to measure the volume of solids in a water body. Too much suspended solids can be harmful to the biota in a stream. |

| TMDL Project Status | |
|--------------------------------|---|
| Assessment Initiated - | Data for developing the TMDL is being collected. |
| Delist - | A water body has been removed from the TMDL list. Delisting may occur when a TMDL is approved by EPA, water quality standards are met, a water body was listed in error, additional state effluent controls address water quality problems, reservoirs have been breached and are no longer a viable water body, or data assessment methodologies have been modified. |
| Delist* - | Water quality standards have been met; however, a TMDL was completed because an assessment had already been initiated while the segment was previously listed. |
| Not Initiated - | Projects are proposed and waiting final funding to begin assessment. |
| Special Approvals - | A water body that had sufficient data to write a TMDL before the first 303(d) list was published. |
| TMDL in Public Notice - | During the public notice phase, a TMDL has been developed and is ready for public review and comment. Comments received are reviewed and considered before submitting a final TMDL to EPA for approval. |
| TMDL Public Noticed - | The public notice comment period has passed. Comments received are being reviewed and considered before submitting a final TMDL to EPA for approval. |
| TMDL Approved - | EPA has approved a TMDL as submitted by the state. |
| TMDL Not Required - | Water body is meeting its beneficial uses. |

Watershed Projects, Plans, Studies, and Assessments

| Medicine Watershed Projects, Plans, Studies, and Assessments | | | | | |
|---|-------------|--|--|--------|-------|
| NRCS Watershed Projects | | | NRCS Watershed Plans, Studies, and Assessments | | |
| Name | Status | Goals: | Name | Status | Goals |
| None | NA | NA | None | NA | NA |
| SD DENR Water Quality Projects or Conservation District Projects | Status | Results: | | | |
| Medicine Creek Watershed Implementation Project Segments 1 and 2 | In progress | Implement BMPs that enhance water quality. | | | |

5.4.8 Confined Animal Feeding Operations (CAFO)⁸

The SD DENR is the state agency responsible for regulating animal feeding operations. A CAFO is a lot or facility that stables or confines and feeds or maintains animals for a total of 45 days or more in any 12-month period and meets the criteria for either a large, medium, or small concentrated animal feeding operation. Concentrated Animal Feeding Operations are regulated by a general water pollution control permit. Producers must submit plans for manure management systems to DENR. These plans must meet DENR design requirements and be approved by a department engineer.

Livestock production is an important industry within the Medicine watershed. Farms and ranches raise mainly beef cattle.

| CAFO Watershed Summary | | | | | |
|--|--------|-------|-------|---------|---------------|
| Animal/Operation Type | Cattle | Sheep | Swine | Poultry | Not Specified |
| Number of Permitted Farms | 3 | | | | |
| - Number of Permitted Animals | 8,494 | | | | |
| - Permitted Acres for Waste Management | 3,775 | | | | |
| | | | | | |
| Partially Permitted Farms | | | | | |
| - # of Animals Permitted | | | | | |
| - Total Animals | | | | | |
| - # of Acres | | | | | |
| | | | | | |
| Approved Farms Not yet permitted | | | | | |
| - # of Animals | | | | | |
| - # of Acres | | | | | |
| | | | | | |
| Operations Under Review | | | | | |
| - # of Animals | | | | | |
| - # of Acres | | | | | |
| | | | | | |
| Other Acres Not Specified | | | | | 3,888 |

Current as of May 2007

5.5 RESOURCES OF SPECIAL CONCERN

In support of federal actions proposed by the NRCS, the agency prepares programmatic, policy, legislative, and other Environmental Assessments (EA) or Environmental Impact Statements (EIS), as necessary, for environmental compliance with federal regulations. All conservation programs administered by the agency have a program level EA or EIS. Additionally, the NRCS policy requires that for all projects or conservation practices where the NRCS provides financial or technical assistance, a site-specific environmental evaluation (EE) of practice effects is completed to ensure the proposed action has been sufficiently analyzed in an existing NRCS environmental document.

The SD NRCS site-specific EE reviews and evaluates the proposed activity impacts with regard to the following federal laws, Executive Orders, regulations, or agency policy as applicable:

- National Historic Preservation Act (1966), as amended, and implementing regulations found at 36 CFR Part 800;
- Endangered Species Act (1973), as amended;
- Fish and Wildlife Coordination Act (1943), as amended;
- Executive Order 11988 (1987) - Floodplain Management;
- Executive Order 13112 (1999) - Invasive Species;
- Migratory Bird Treaty Act (1918), as amended, and Executive Order 13186 – Responsibility of Federal Agencies to Protect Migratory Birds;
- The NRCS policy General Manual (GM), Title 190, Part 410.23 - Natural Areas;
- Farmland Protection Policy Act and 7 CFR 658.5 regulations;
- The NRCS policy GM, Title 190, Part 411.03(d) Riparian Areas;
- Clean Water Act and Waters of the U.S. (1972);
- Executive Order 11990 “Protection of Wetlands,” the Food Security Act of 1985, revised NRCS Wetland Technical Assistance Policy - 7 CFR Part 650 (1997);
- Wild and Scenic Rivers Act – PL 90-542.

5.5.1 Endangered and Threatened Species¹

Status of federally and state listed threatened and endangered species in the watershed.

| Scientific Name | Common Name | Federal Status | State Status |
|------------------------------------|----------------------|----------------|--------------|
| <i>Haliaeetus leucocephalus</i> | Bald Eagle | | Threatened |
| <i>Graptemys pseudogeographica</i> | False Map Turtle | | Threatened |
| <i>Lutra canadensis</i> | Northern River Otter | | Threatened |
| <i>Charadrius melodus</i> | Piping Plover | Threatened | Threatened |
| <i>Macrhybopsis gelida</i> | Sturgeon Chub | | Threatened |
| <i>Vulpes velox</i> | Swift Fox | | Threatened |
| <i>Grus americana</i> | Whooping Crane | Endangered | Endangered |



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USDA Natural Resources Conservation Service (NRCS)

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5.6 RESOURCE ACCOMPLISHMENTS

5.6.1 Performance Results Systems (PRS) Data

The PRS is an Integrated Accountability System (IAS) application that collects practice-based information for NRCS conservation programs. Currently, the PRS program is used by NRCS employees and partners to record performance data on conservation plans and practices that are planned and applied.

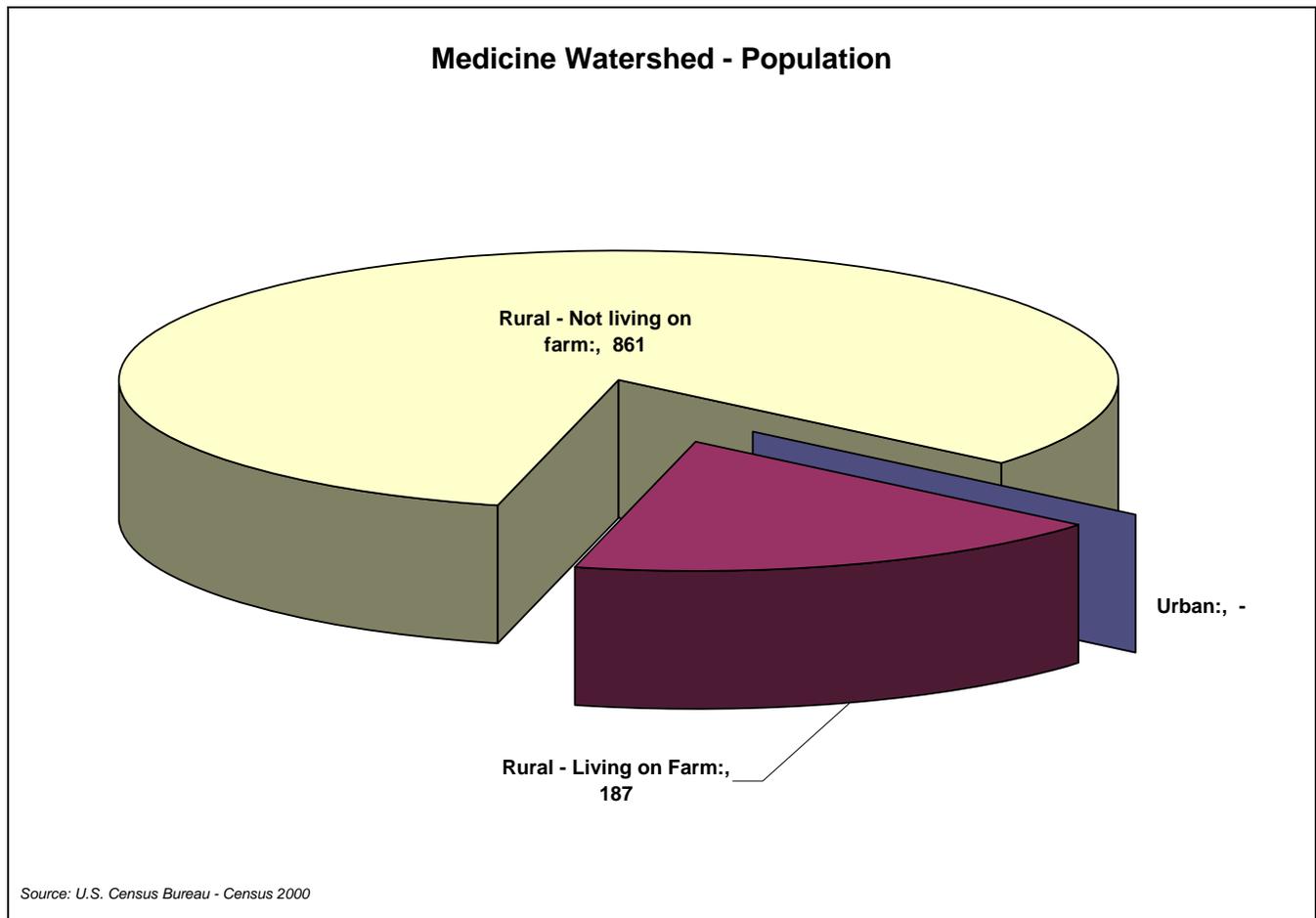
| PRS Data | FY 04 | FY 05 | FY 06 | FY 07 | FY 08 | FY 09 |
|--|---------|---------|--------|--------|--------|--------|
| Applied Conservation Treatment (Units/Acres) | | | | | | |
| Access Control (472) (ac) | 177 | 2,920 | 1,704 | 2,419 | 1,843 | 1,631 |
| Comprehensive Nutrient Management Plan (100) (no) | | 1 | | | | |
| Conservation Cover (327) (ac) | 5,559 | 3,925 | 2,819 | 3,570 | 3,107 | 3,636 |
| Conservation Crop Rotation (327) (no) | 337 | | | 73 | | |
| Critical Area Planting (342) (ac) | | 30 | 29 | 6 | 2 | 10 |
| Fence (382) (ft) | 8,306 | | 55,927 | 50,909 | 21,987 | 20,092 |
| Filter Strip (393) (ac) | | | 103 | 9 | | |
| Forage Harvest Management (511) (ac) | | | | | 105 | |
| Grassed Waterway (412) (ac) | | 30 | 29 | 6 | 2 | 5 |
| Irrigation Water Management (449) (ac) | | | | | | |
| Mulching (484) (ac) | 8 | 2,779 | 154 | 149 | 71 | 124 |
| Nutrient Management (590) (ac) | | 171 | | 73 | | |
| Pasture and Hay Planting (512) (ac) | | | 144 | 85 | 86 | 29 |
| Pest Management (595) (ac) | 719 | 4,506 | 1,739 | 4,502 | 12,241 | 880 |
| Pipeline (516) (ft) | 7,329 | 43,338 | 13,723 | 45,477 | 70,964 | 18,733 |
| Heavy Use Protection (561) (ac) | 1 | | | | 1 | |
| Prescribed Grazing (528) (ac) | 1,477 | 6,469 | | 306 | 2,653 | 163 |
| Range Planting (550) (ac) | | | | 130 | 105 | |
| Residue and Tillage Mgmt, NoTill/Strip Till/Direct Seed (329) (ac) | | | | | 457 | |
| Residue Management, Mulch Till (329B) (ac) | 217 | | | | | |
| Residue Management, No-Till/Strip Till(329A) (ac) | 110 | 24 | | 73 | 807 | |
| Riparian Forest Buffer (391) (ac) | 14 | 4 | 7 | 25 | | 27 |
| Riparian Herbaceous Cover (390) (ac) | | | | 370 | 11 | |
| Sediment Basin (350) (no) | | | | | | 2 |
| Salinity and Sodic Soil Management (610) (ac) | | | | 4 | 36 | |
| Upland Wildlife Habitat Management (645) (ac) | | 195 | 971 | 688 | 1,013 | |
| Waste Storage Facility (313) (no) | | | 1 | | | 1 |
| Watering Facility (614) (no) | 2 | 47 | 3 | 18 | 11 | 18 |
| Windbreak/Shelterbelt Establishment (380) (ft) | 138,405 | 117,070 | 44,439 | 49,542 | 30,734 | 28,775 |

6.0 CENSUS AND SOCIAL DATA⁹

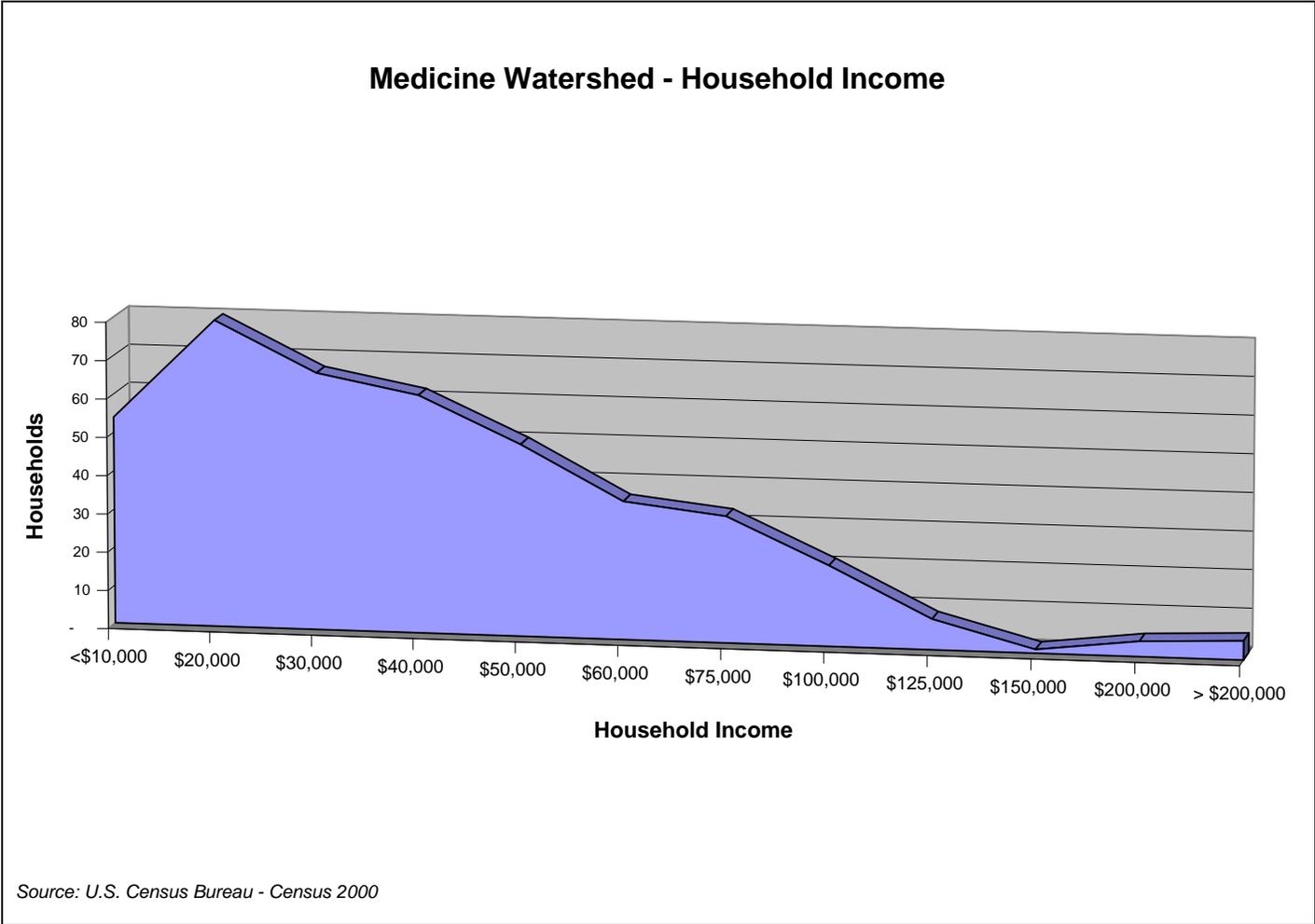
This section provides basic social data gathered through the 2002 Census

6.1 POPULATION CHART

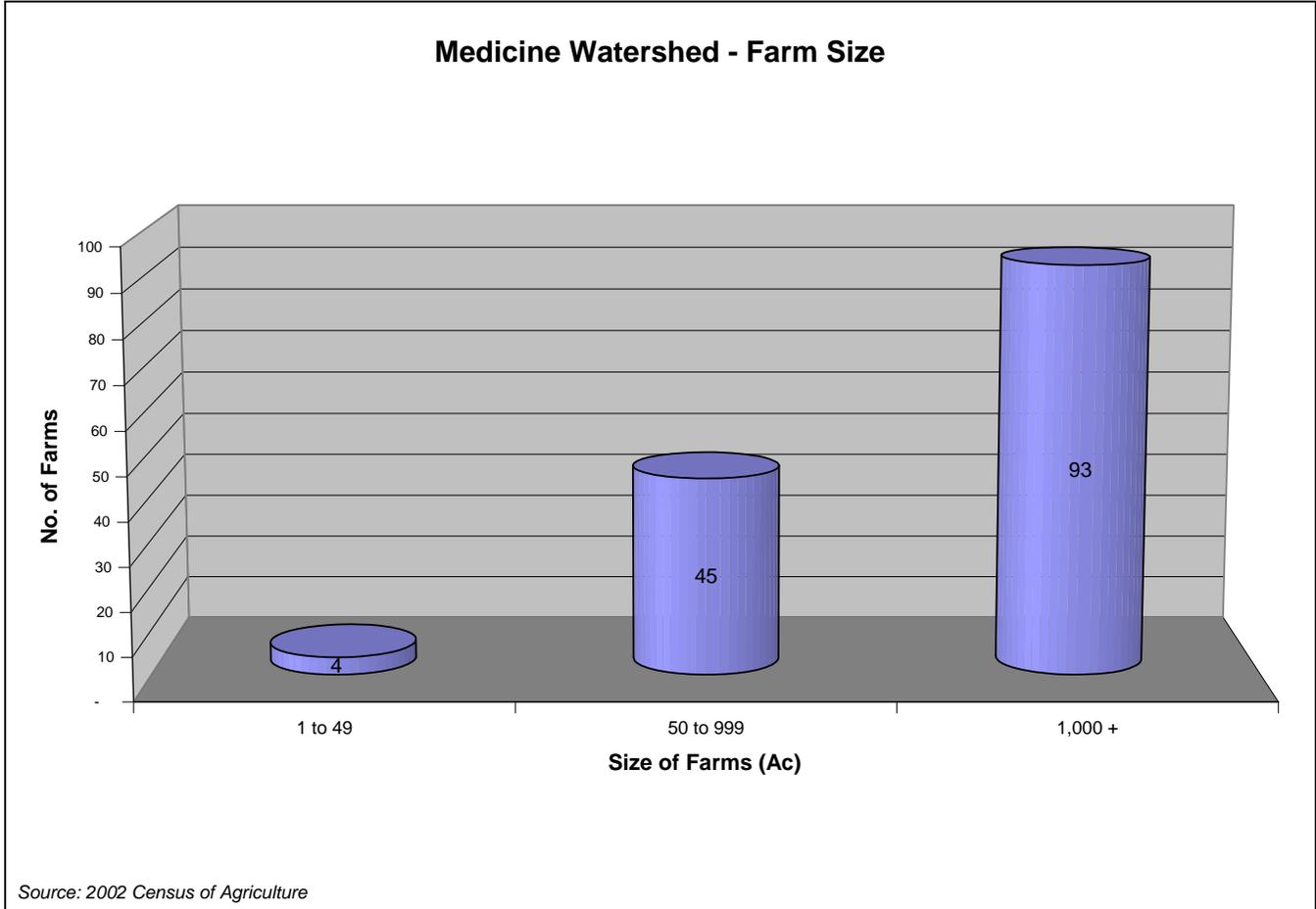
United States Census Bureau (2000) data on the rural and urban population within the watershed. A portion of the watershed lies within the Crow Creek Indian Reservation.



6.2 HOUSEHOLD INCOME

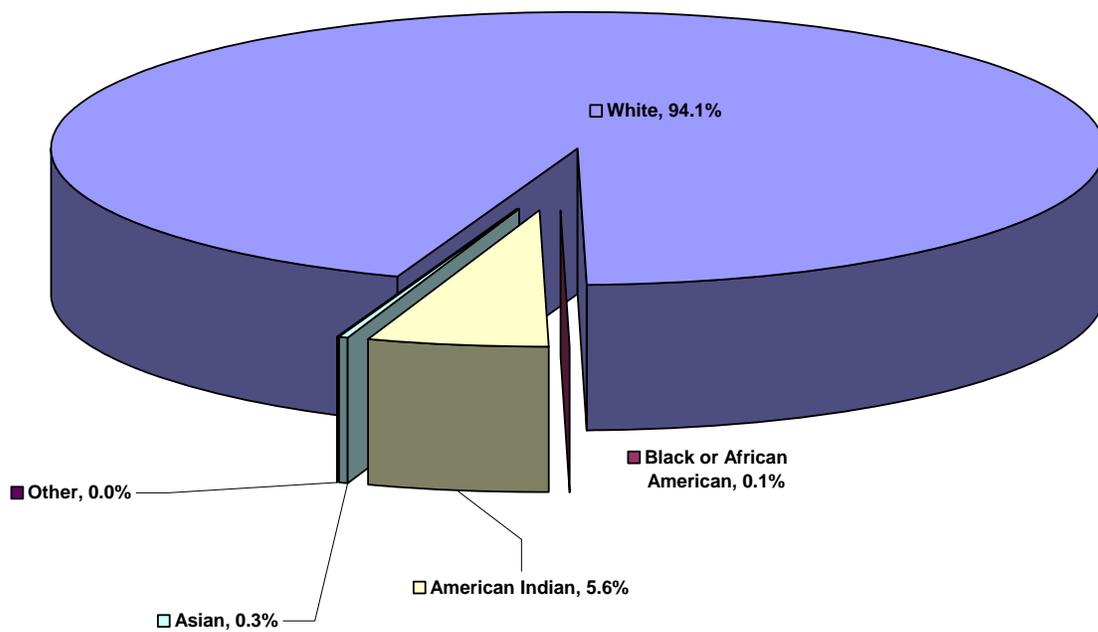


6.3 FARM SIZE



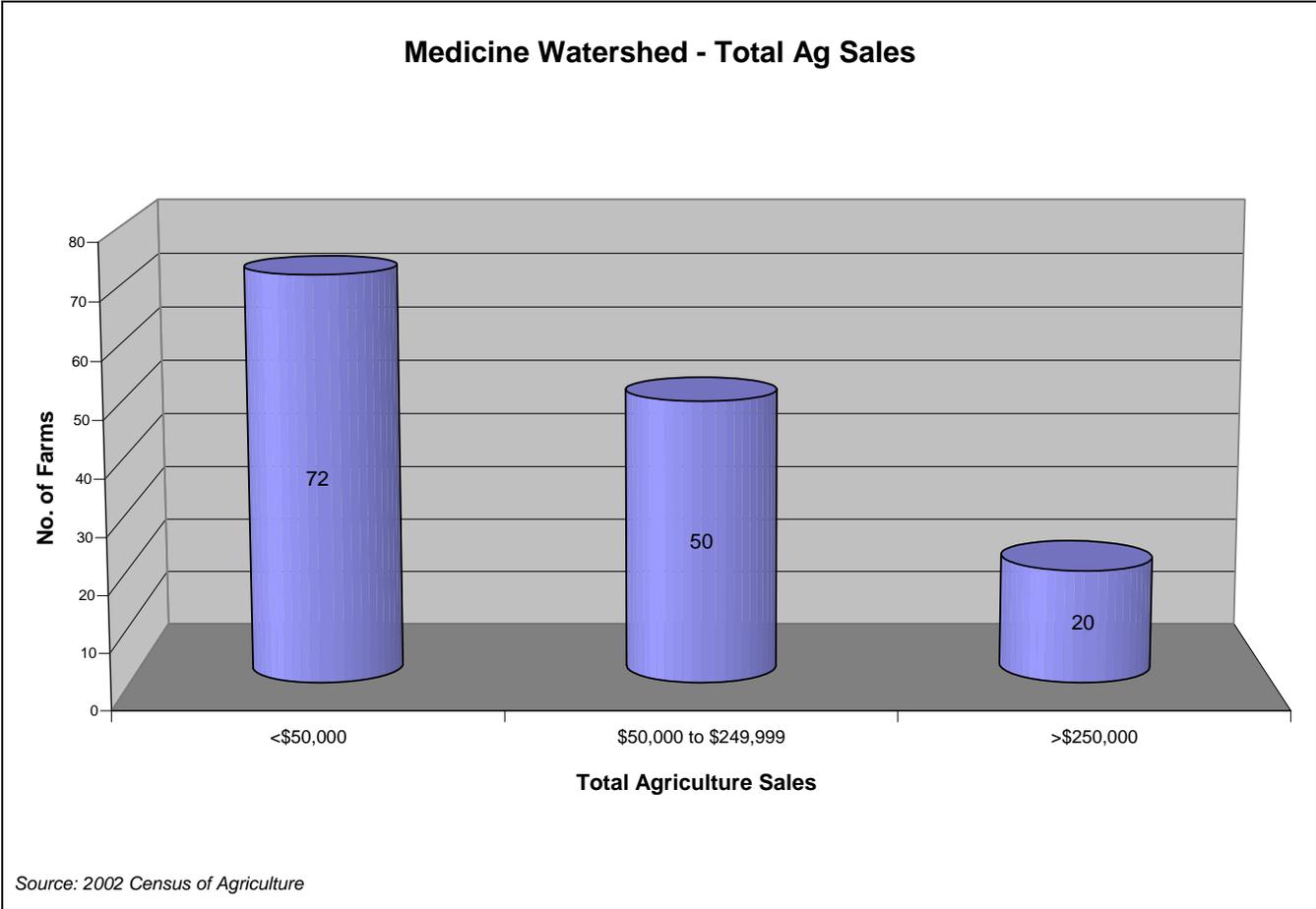
6.4 DEMOGRAPHICS

Medicine Watershed - Demographics



Source: U.S. Census Bureau - Census

6.5 TOTAL AGRICULTURAL SALES



7.0 REFERENCES/PREPARERS

7.1 LIST OF PREPARERS

This RWA was prepared by an interdisciplinary team composed of the following personnel:

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|-----------------|--|---------------------|
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| Paul Wegleitner | Natural Resources Project Engineer | DENR |
| Doug Vik | Economist | NRCS |

7.2 REFERENCES

¹ Natural Resources Conservation Service, 2002
² South Dakota Geological Survey, 2004
³ Prism Group, 1990. South Dakota Annual Precipitation Data 1961-1990
⁴ South Dakota State University, 2007. South Dakota Office of Climatology
⁵ High Plains Regional Climate Center, 2007.
⁶ United States Geological Survey (USGS) – Originator of National Land Cover Dataset (NLCD)
⁷ South Dakota Department of Environment and Natural Resources (SD DENR)
⁸ SD DENR – Surface Water Quality
⁹ 2002 Agricultural Census. Adjusted by percent of HUC in the county or by percent of zip code in the HUC, depending on the level of data available.