Planning and Assistance Division

GENERAL BASIN MAP

LOUP RIVER BASIN

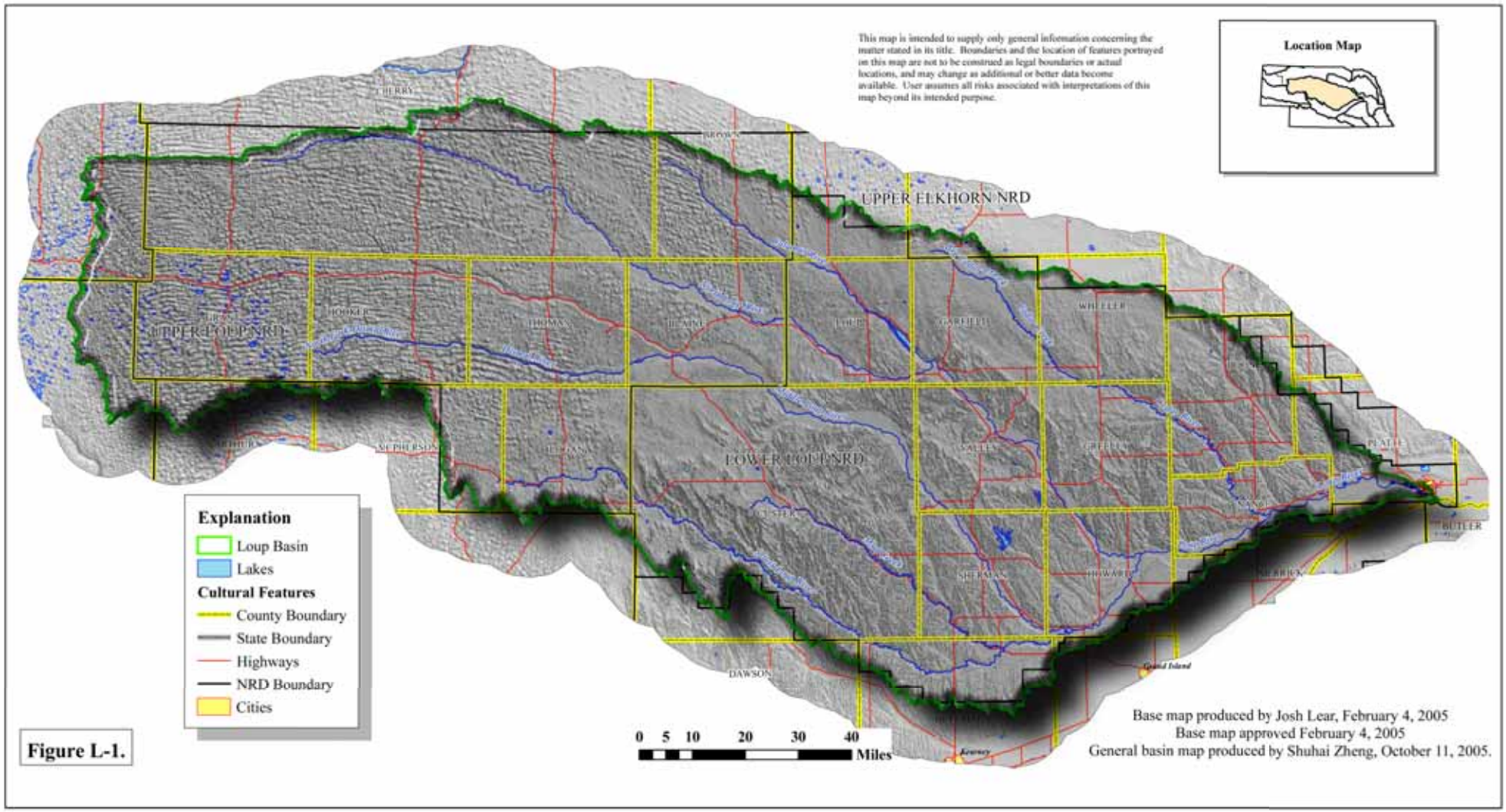


Figure L-1.

GENERAL SURFACE WATER FEATURES

LOUP RIVER BASIN

Planning and Assistance Division

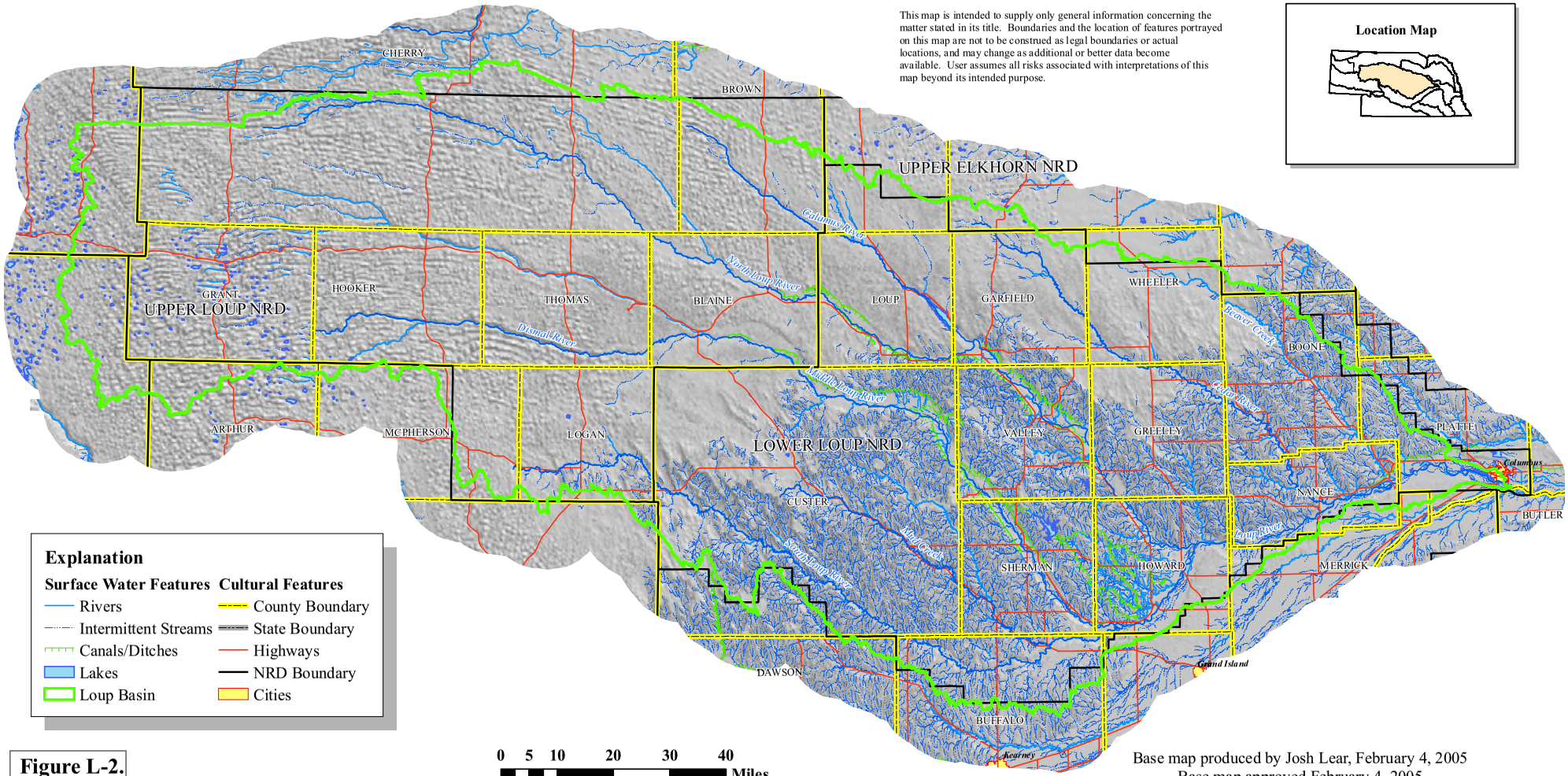


Figure L-2.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
General surface water features map produced by Shuhai Zheng, October 11, 2005.

Figure L-3. Annual Precipitation at Arthur, Nebraska.

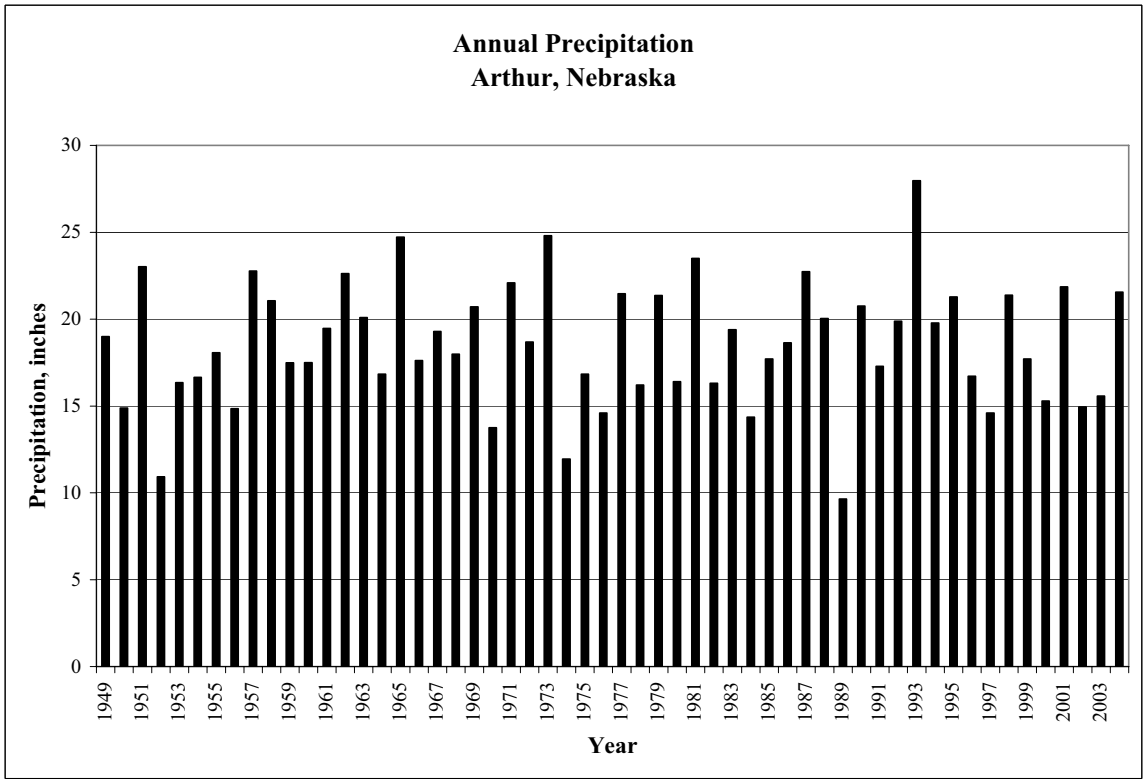
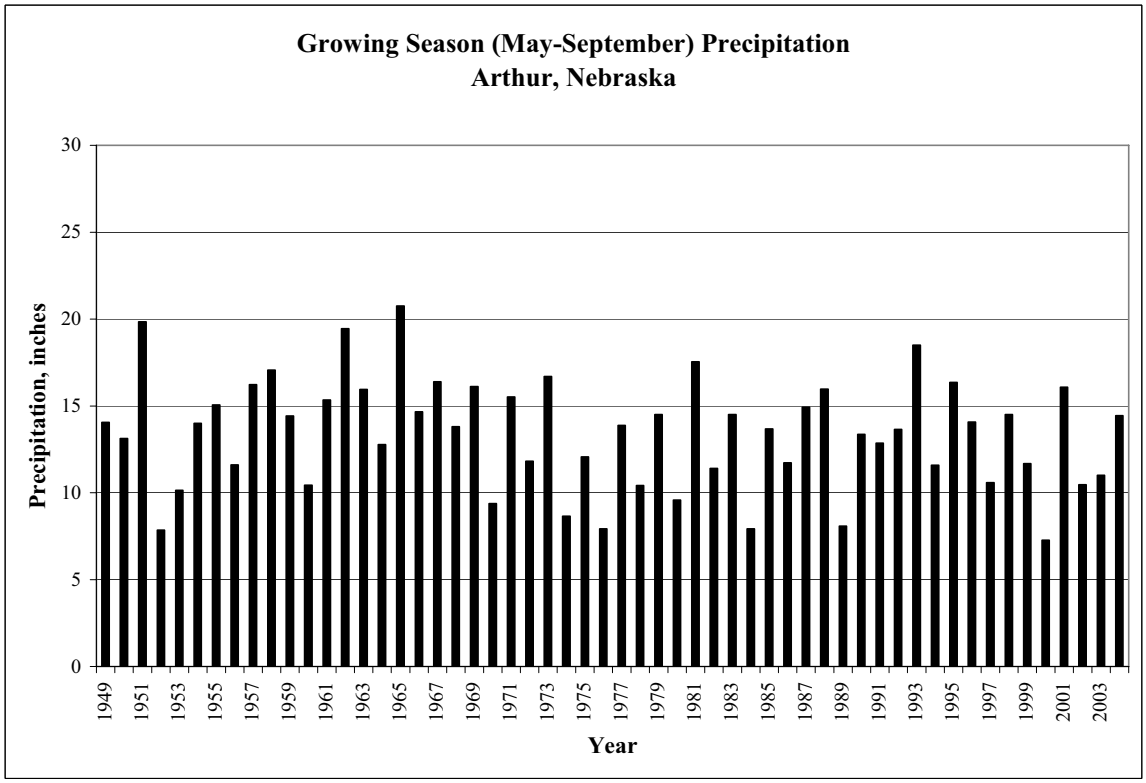


Figure L-4. Growing Season (May-September) Precipitation at Arthur, Nebraska.



Source: High Plains Climate Center

Figure L-5. Annual Precipitation at Broken Bow, Nebraska.

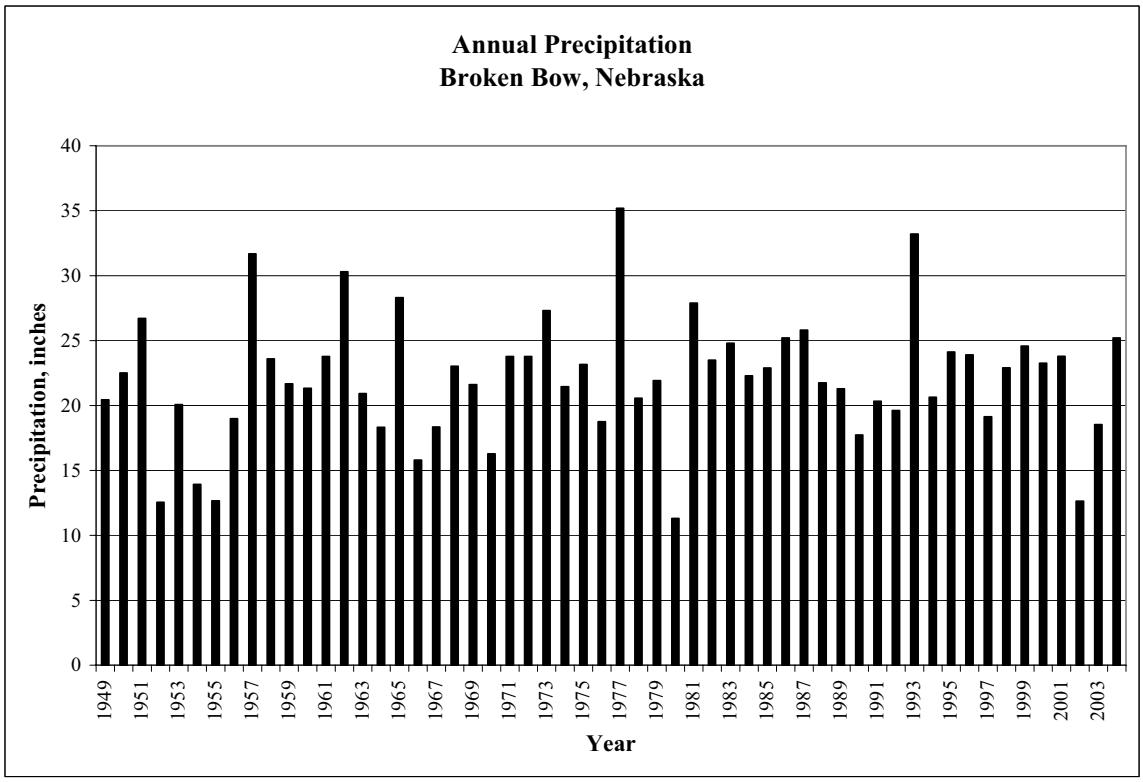
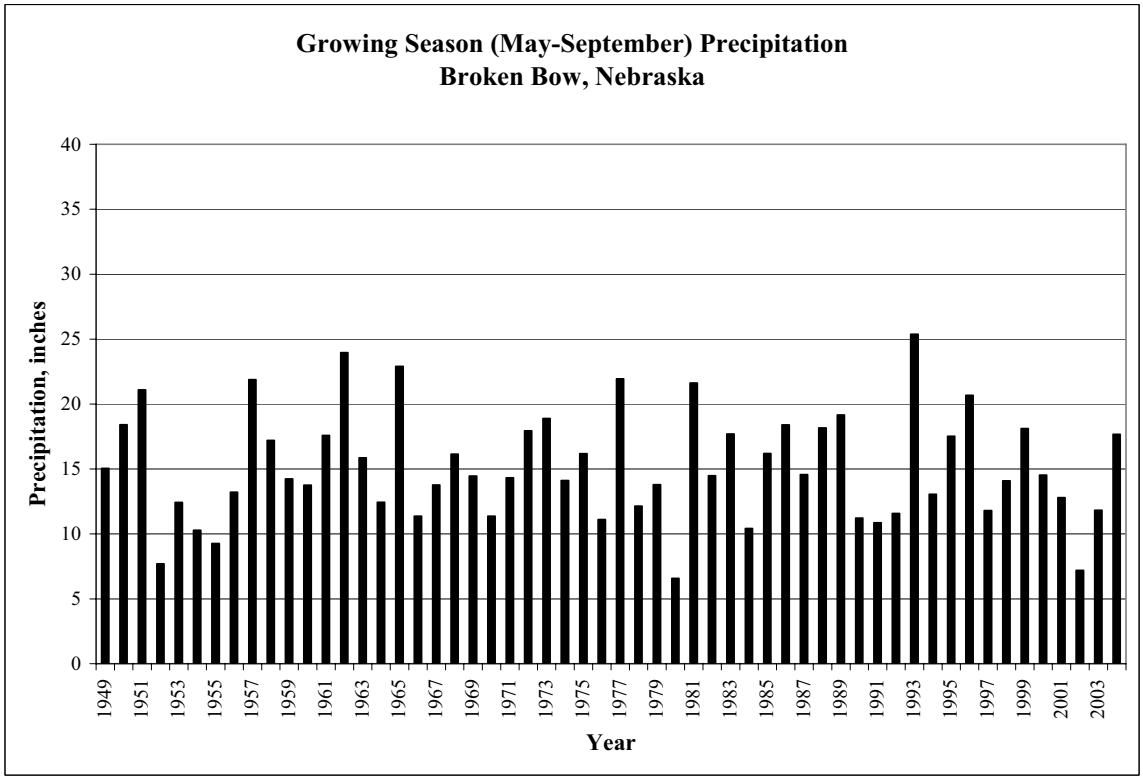


Figure L-6. Growing Season (May-September) Precipitation at Broken Bow, Nebraska.



Source: High Plains Climate Center

Figure L-7. Annual Precipitation at Greeley, Nebraska.

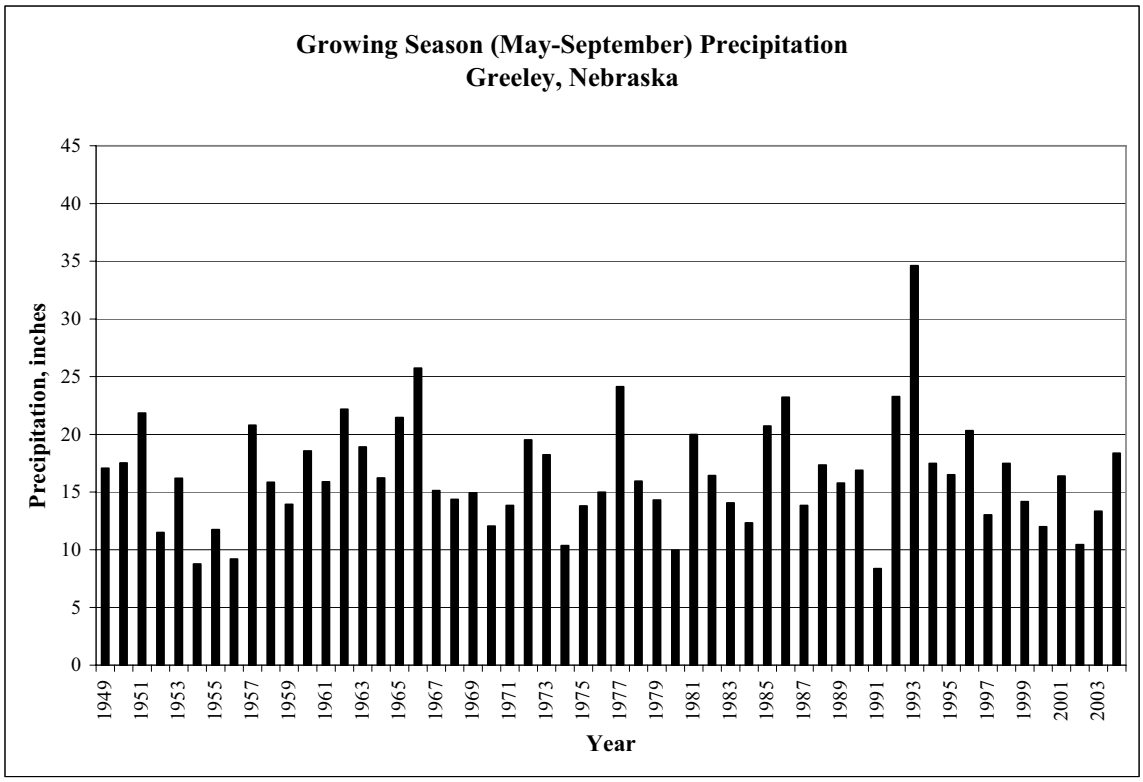
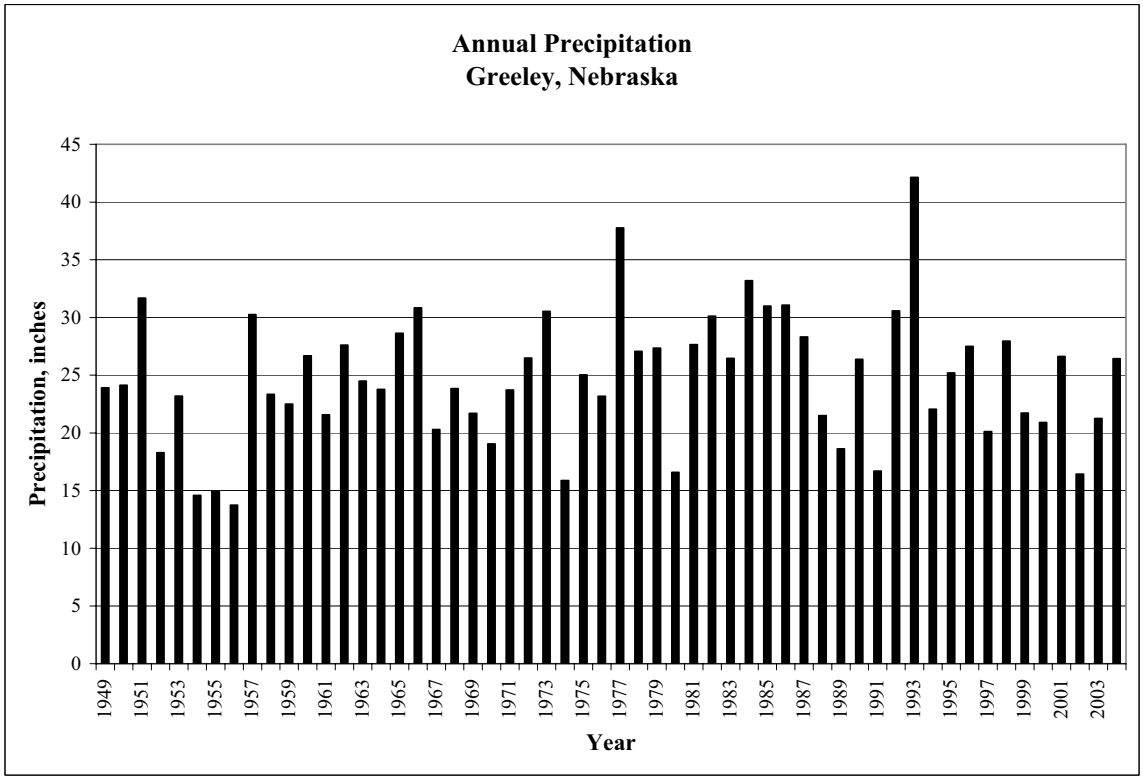


Figure L-8. Growing Season (May-September) Precipitation at Greeley, Nebraska.



Source: High Plains Climate Center

Figure L-9. Annual Precipitation at Loup City, Nebraska.

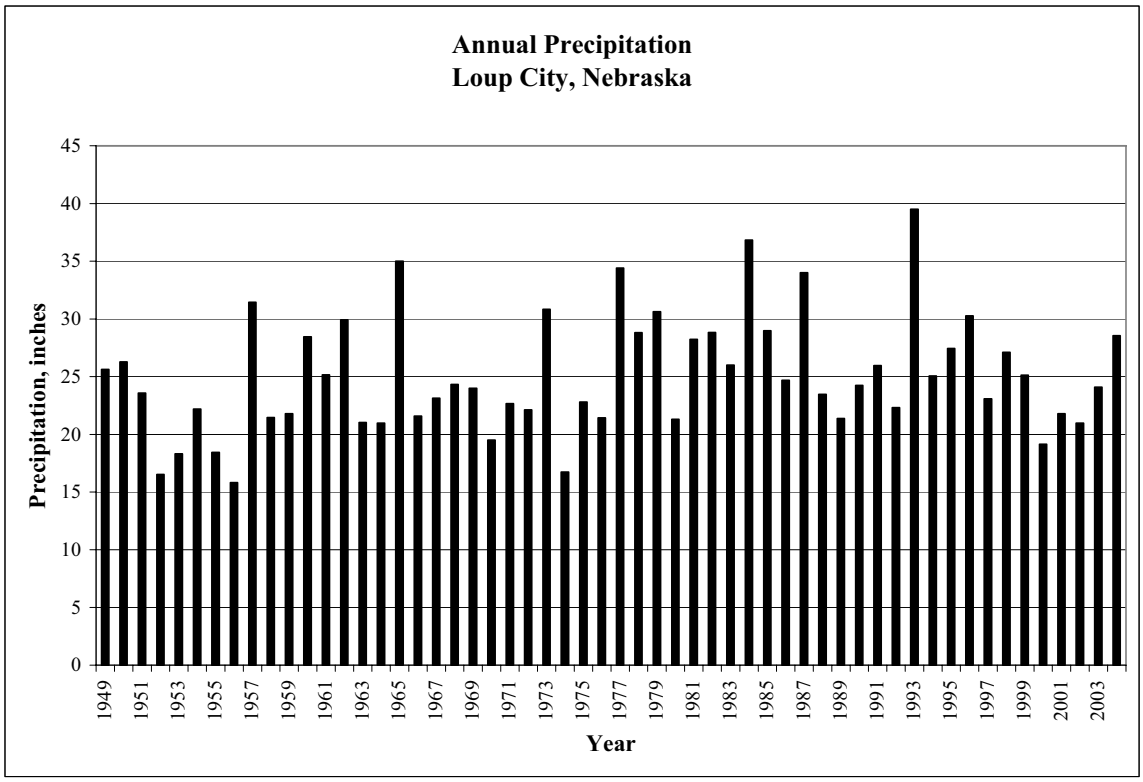
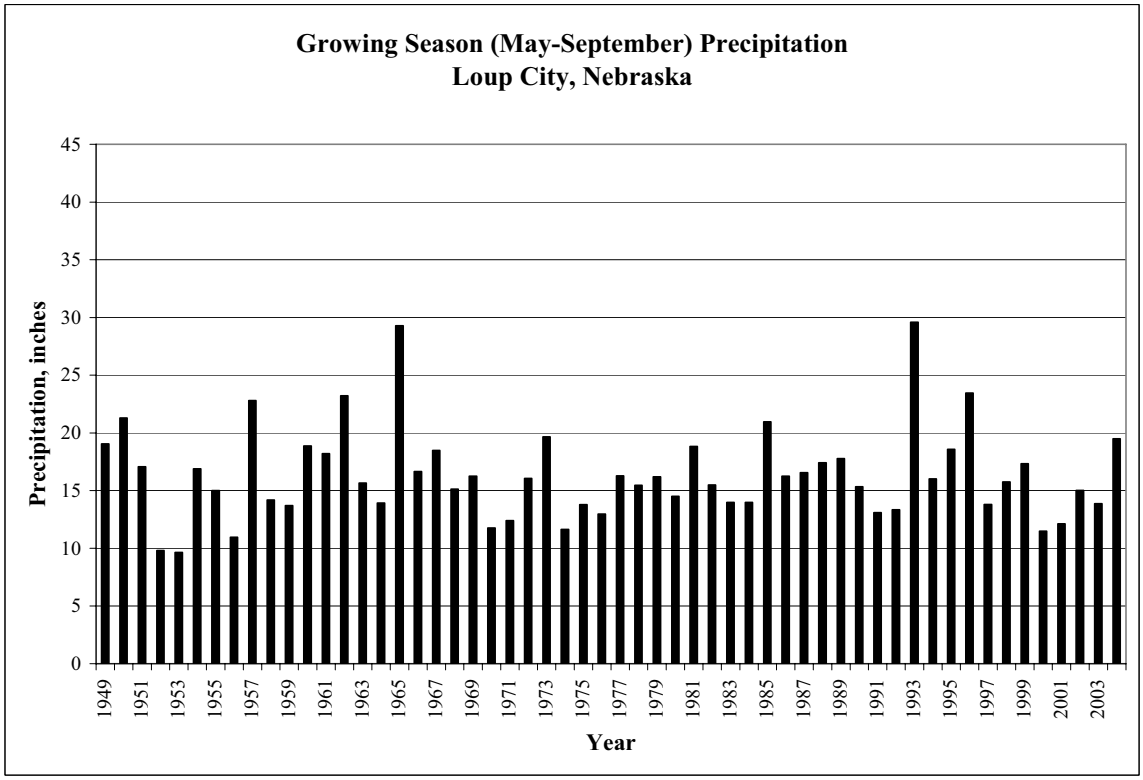


Figure L-10. Growing Season (May-September) Precipitation at Loup City, Nebraska.



Source: High Plains Climate Center

Figure L-11. Annual Precipitation at Ord, Nebraska.

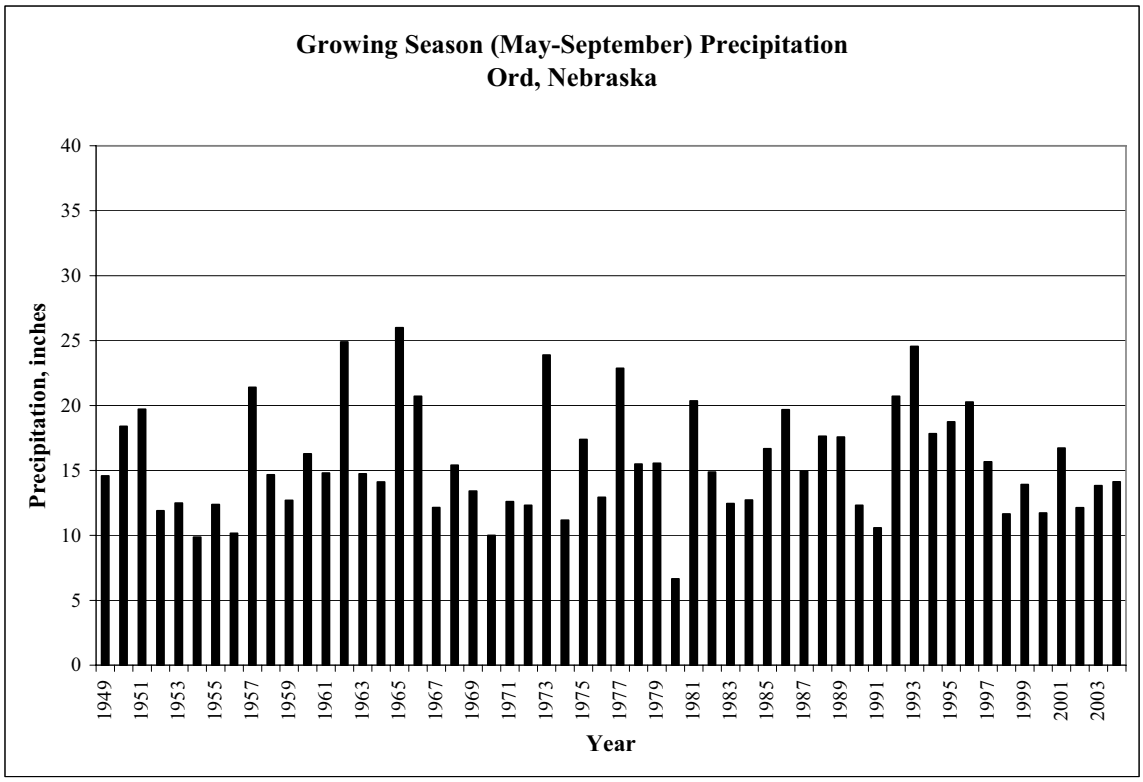
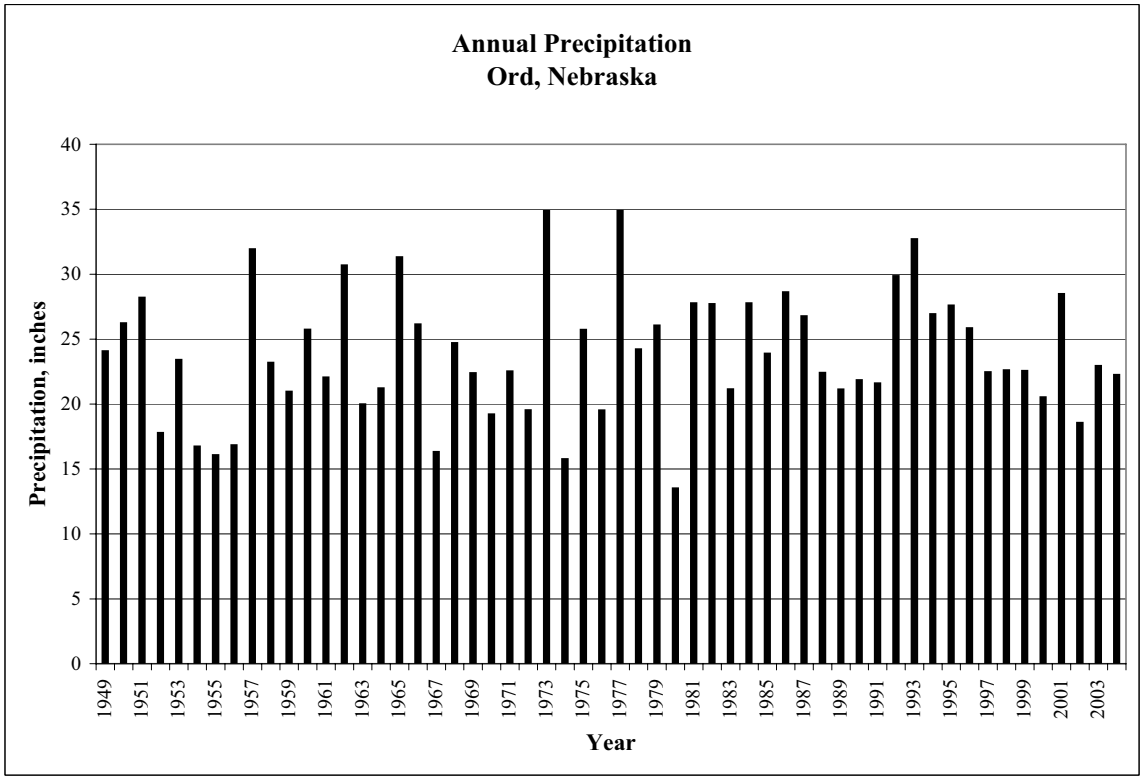


Figure L-12. Growing Season (May-September) Precipitation at Ord, Nebraska.



Source: High Plains Climate Center

Figure L-13. Annual Precipitation at St. Paul, Nebraska.

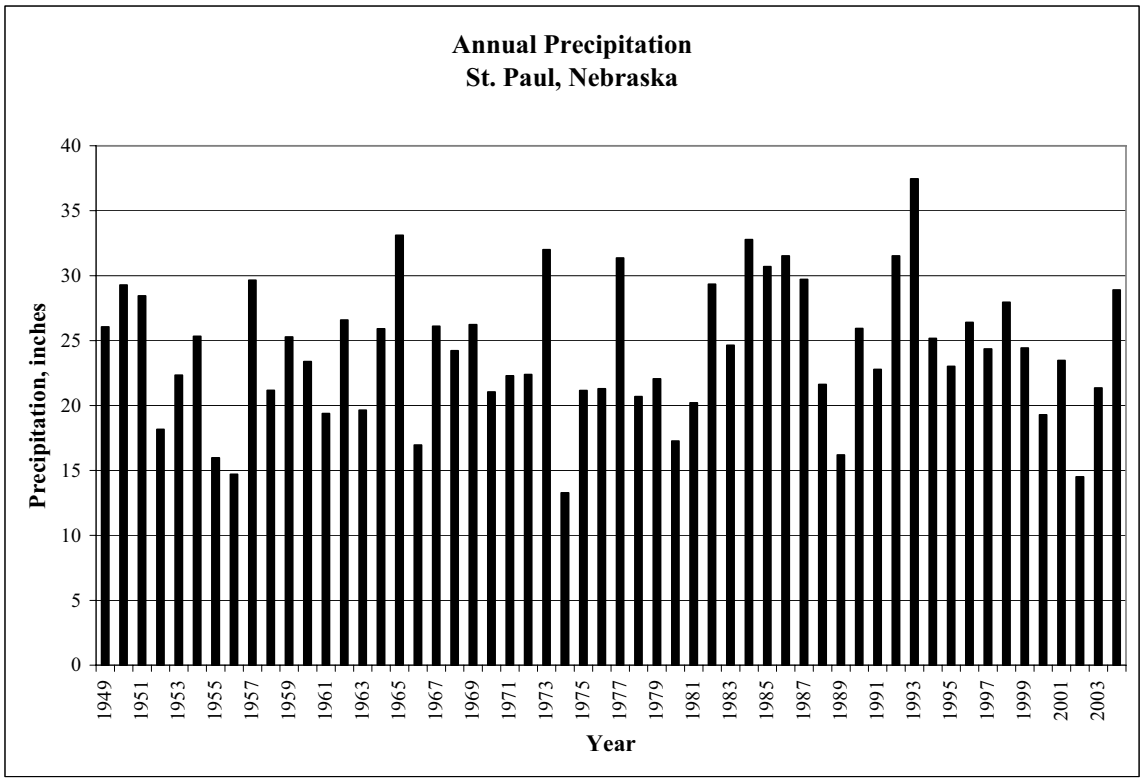
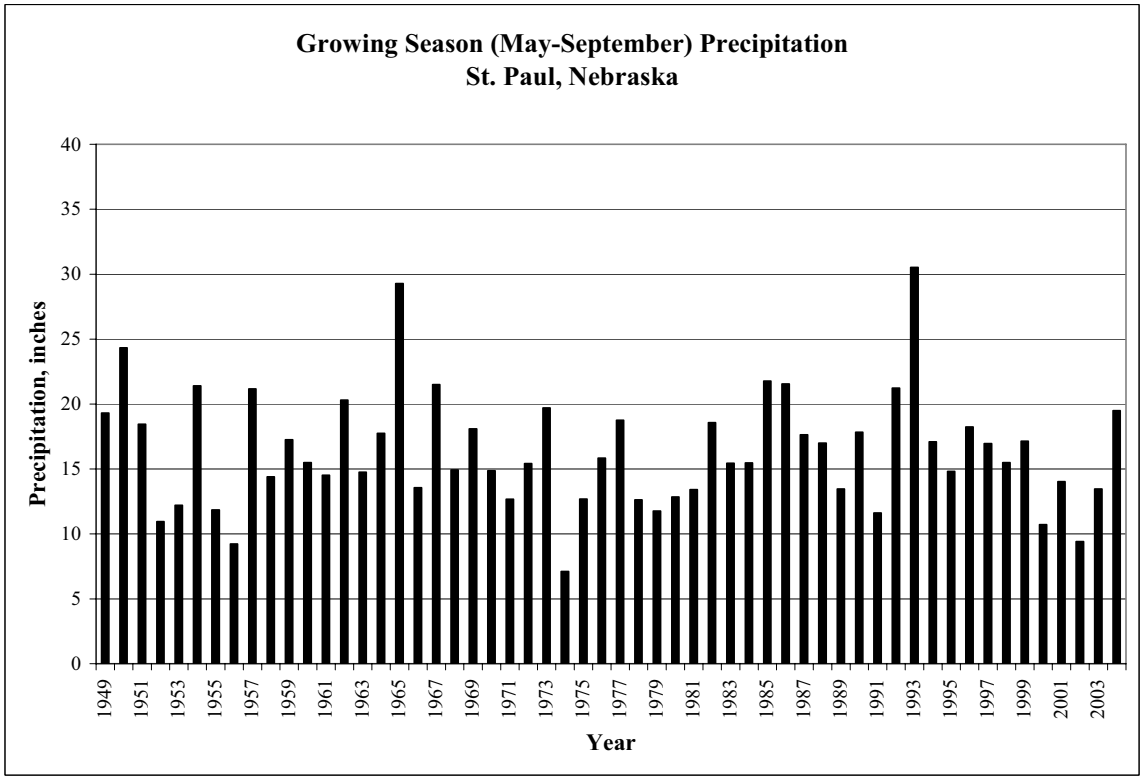


Figure L-14. Growing Season (May-September) Precipitation at St. Paul, Nebraska.



Source: High Plains Climate Center

Figure L-15. Annual Precipitation at Taylor, Nebraska.

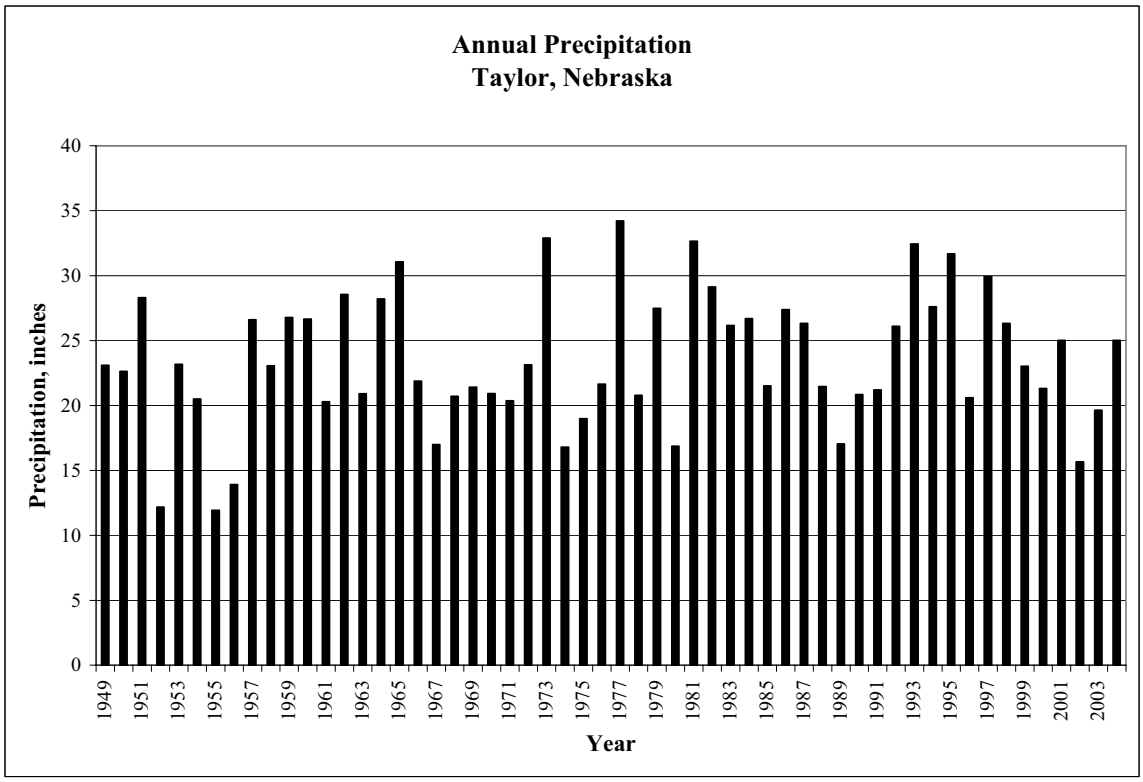
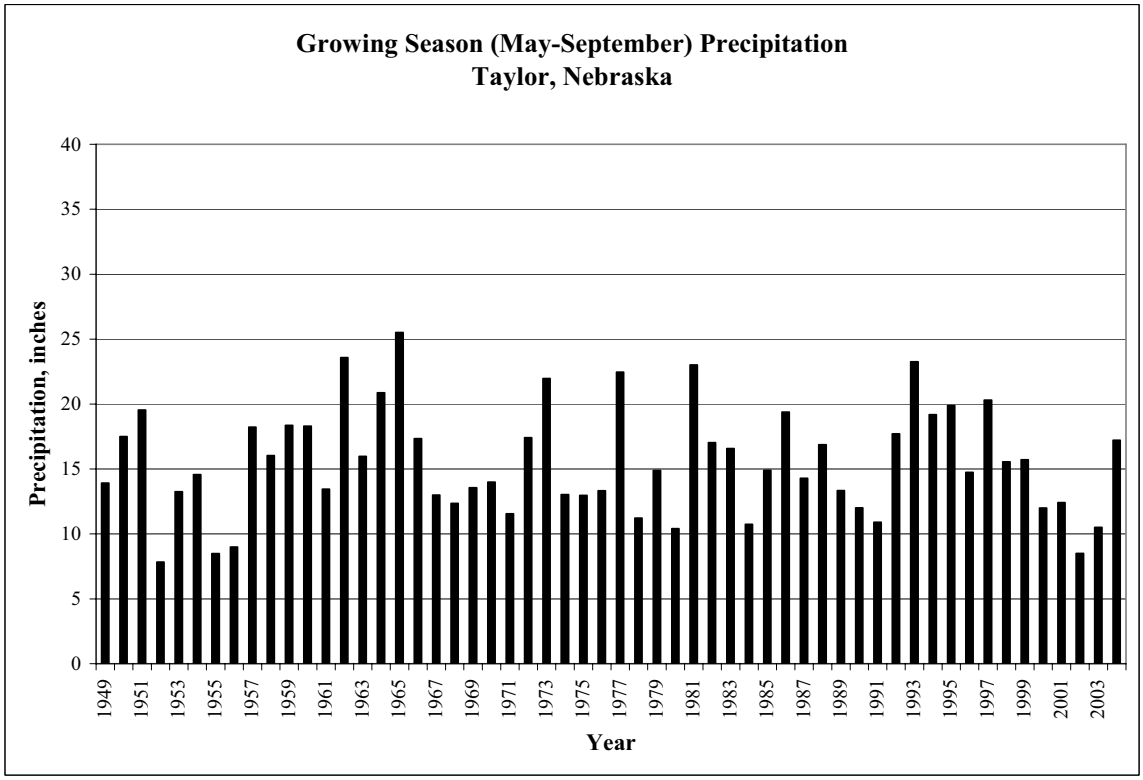


Figure L-16. Growing Season (May-September) Precipitation at Taylor, Nebraska.



Source: High Plains Climate Center

Figure L-17. Annual Precipitation at Valentine, Nebraska.

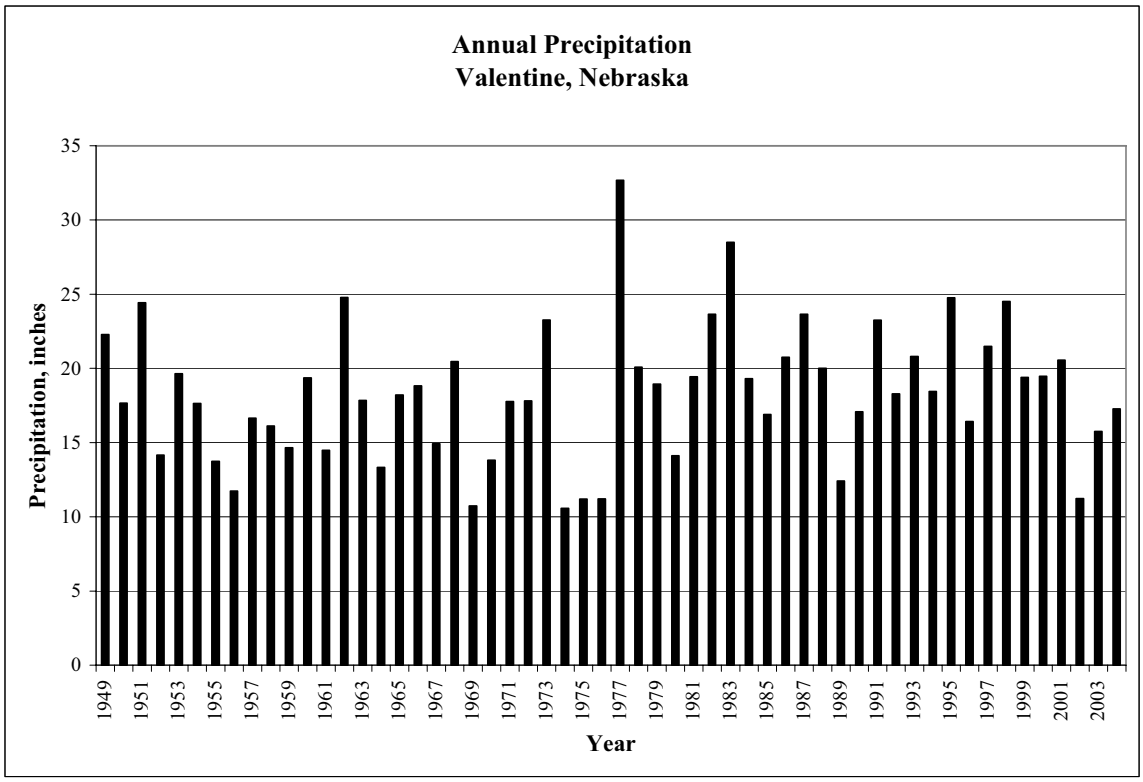
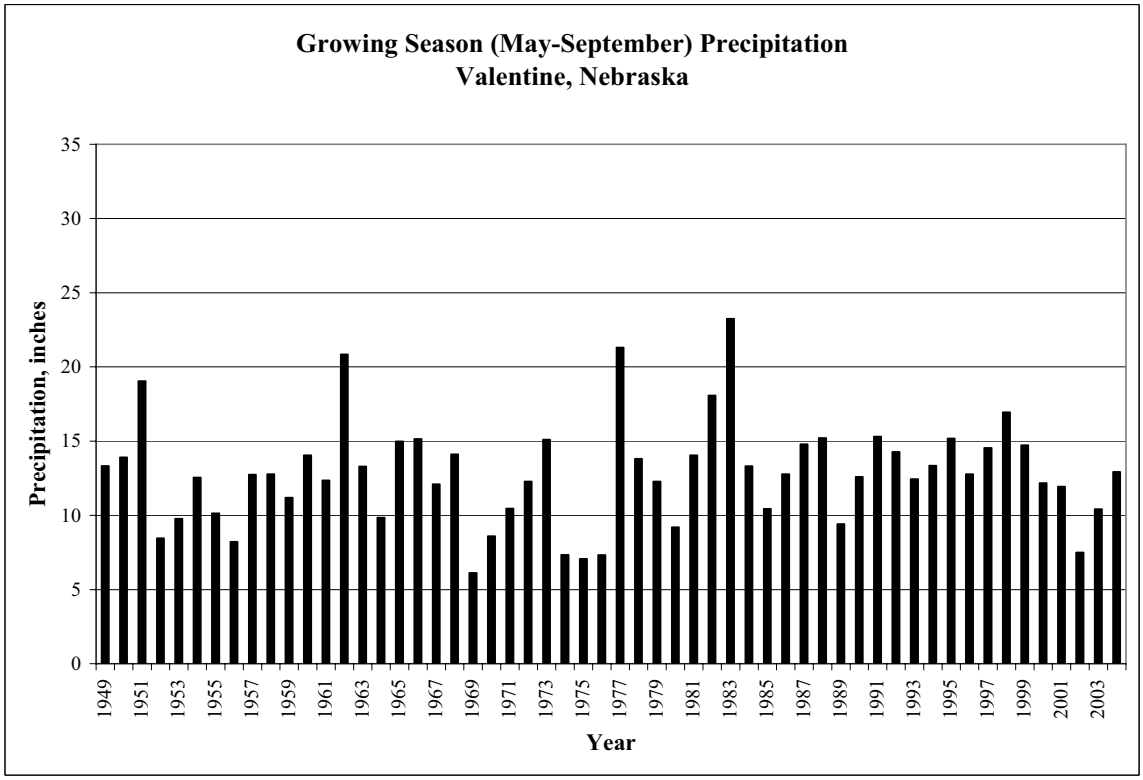


Figure L-18. Growing Season (May-September) Precipitation at Valentine, Nebraska.



Source: High Plains Climate Center

Planning and Assistance Division

Precipitation Gages

LOUP RIVER BASIN

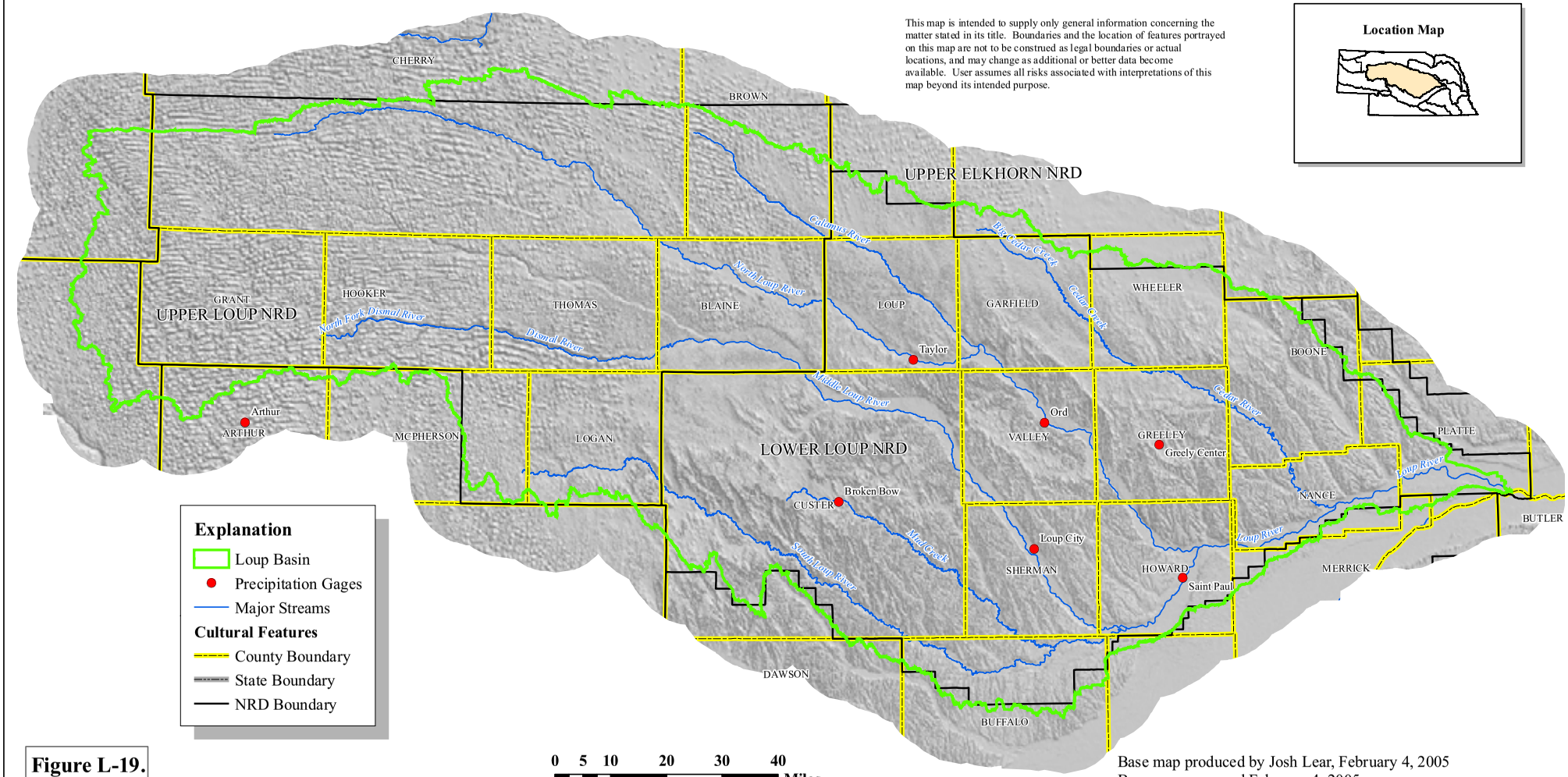


Figure L-19.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Precipitation gages map produced by Jeff Shafer, October 19, 2005.

Table L-1. – Aquifers in unconsolidated surficial deposits (modified from Brown, 1955; CSD, 1990; LLNRD, 1995; and NNRC, 1993)

System	Hydrogeologic unit	Character and description	Maximum thickness, in feet	Hydrogeologic characteristics
Recent to Quaternary	Undifferentiated sand, gravel, silt and clay.	Eolian (dune) sand and alluvial fill. Sandy and clayey silt and sandy clay.	180	Provides moderate to high well yields.
	Todd Valley sand	Fine sand and gravel deposited as valley fill.	50	Yields water to wells in areas where it is saturated.
	Crete Formation	Sand and gravel deposited as channel fill. Modified by local materials.	30	Yields water to wells in areas where it is saturated.
	Grand Island Formation	Sand and gravel deposited by streams.	60	Yields water to wells in areas where it is saturated.
	Holdrege Formation	Sand and gravel deposited by streams.	15	Yields abundant supplies of water to wells.
Tertiary	Plio-Pleistocene sands and gravels	Sand and gravel interbedded with silt.	>100	High capacity wells drilled to Plio-Pleistocene sands and gravels

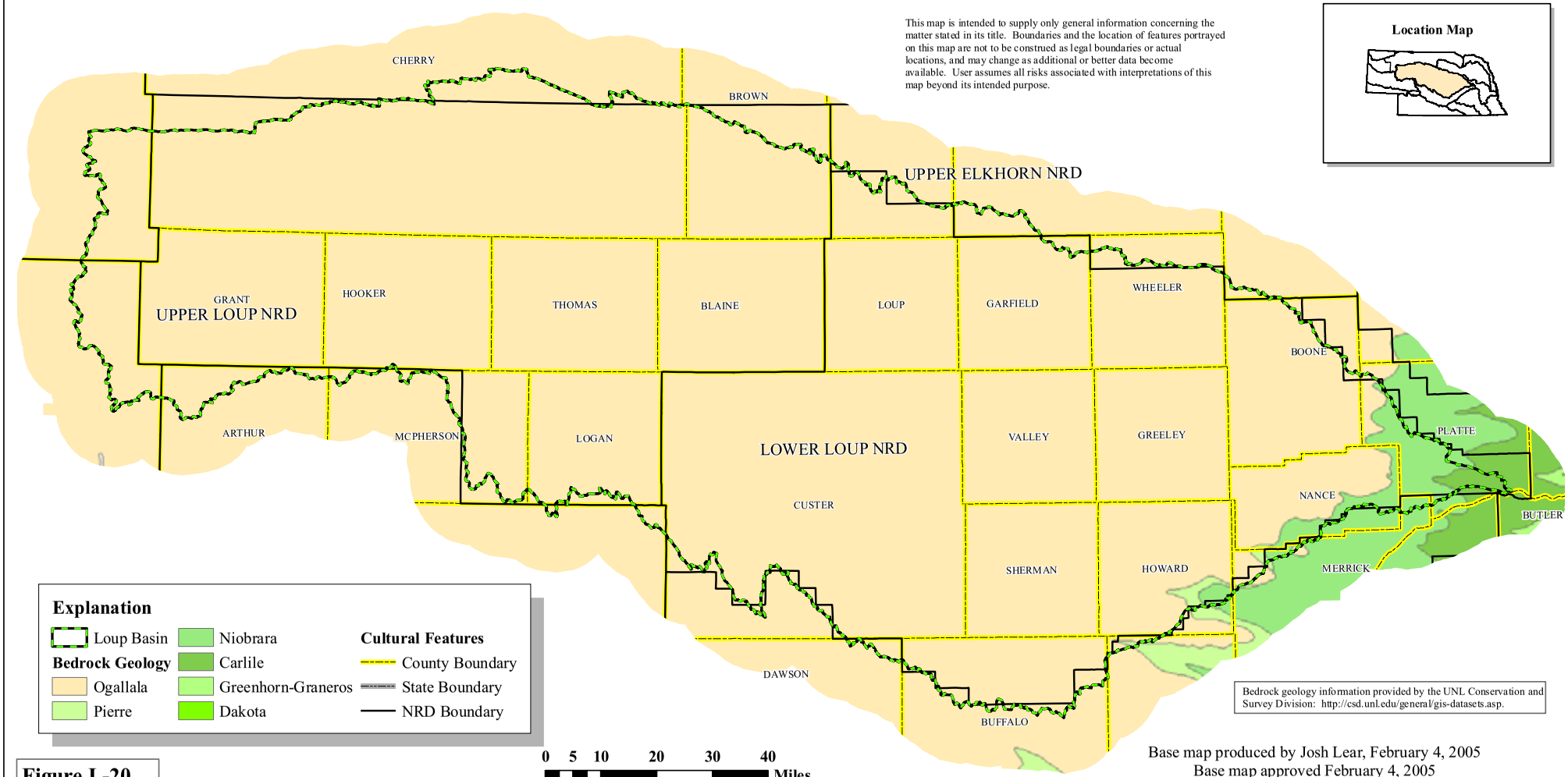
Table L-2. – Characteristics of bedrock aquifers (modified from Keech and Dreeszen, 1959, 1968; LLRD, 1995)

System	Hydrogeologic unit	Character and description	Maximum thickness, in feet	Hydrogeologic characteristics
Tertiary	Ogallala Group	Sand, silty sand, sandy and clayey silt, sandstone, siltstone and some gravel.	600	Hydraulically connected to unconsolidated sediments, part of the primary aquifer.
Cretaceous	Niobrara Formation	Shaley chalk and limestone	400	Secondary aquifer where fractured.
	Dakota Sandstone	Sandstone and shale.	2000	Secondary aquifer. May be highly mineralized.
Ordovician and Cambrian	Undifferentiated shale, limestone, dolomite and sandstone	Shale, limestone, dolomite, some sandstone.	unknown	Cambrian and Ordovician sandstones may yield moderate to large amounts of water to wells but is too deep and highly mineralized to be of use.

Planning and Assistance Division

Bedrock Geology

LOUP RIVER BASIN



Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Bedrock geology map produced by Kevin J. Schwartman, October 11, 2005

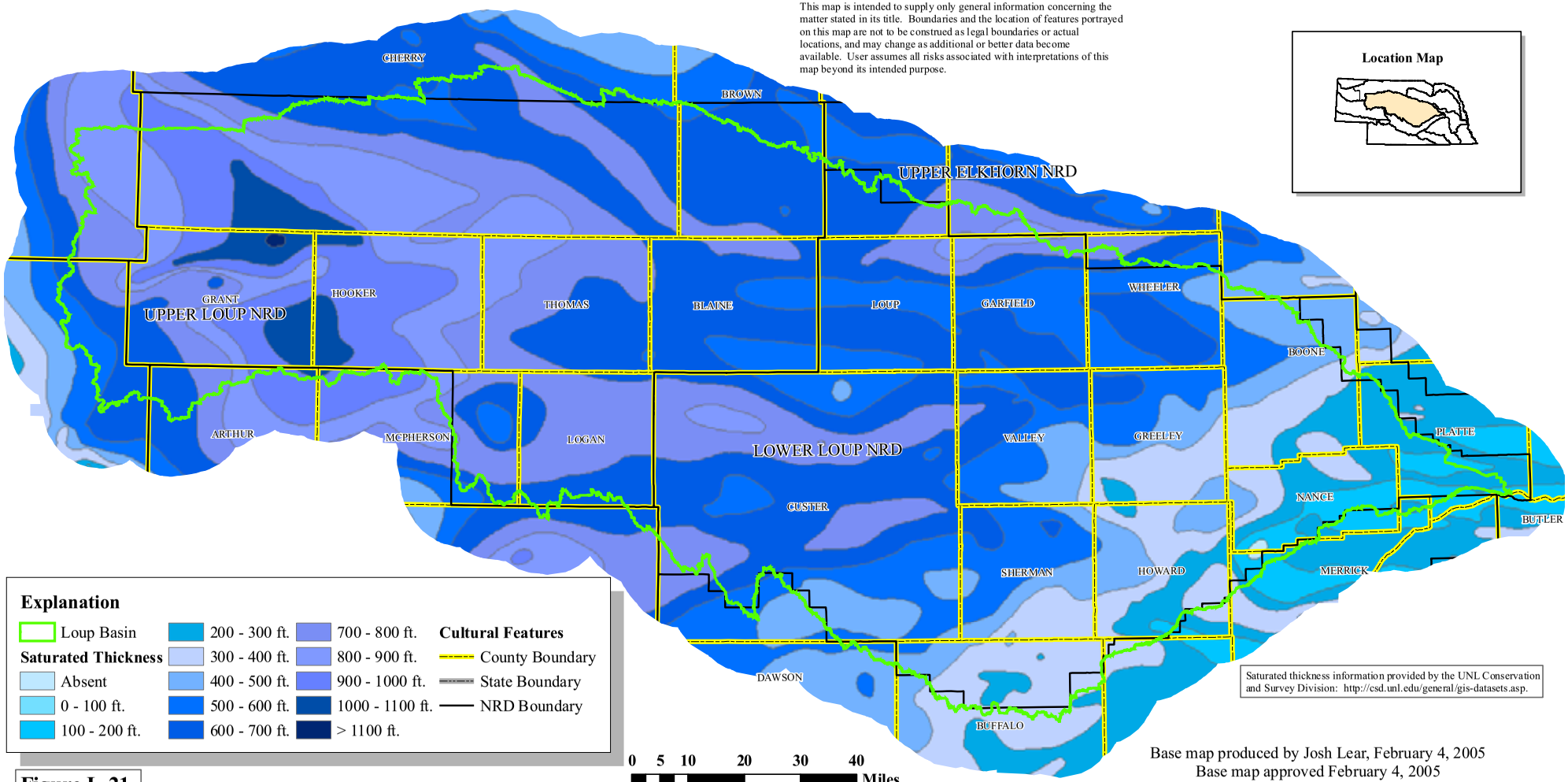
Figure L-20.

Planning and Assistance Division

Saturated Thickness

LOUP RIVER BASIN

This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.



Location Map

Explanation

Loup Basin

Saturated Thickness

- Absent
- 0 - 100 ft.
- 100 - 200 ft.
- 200 - 300 ft.
- 300 - 400 ft.
- 400 - 500 ft.
- 500 - 600 ft.
- 600 - 700 ft.
- 700 - 800 ft.
- 800 - 900 ft.
- 900 - 1000 ft.
- 1000 - 1100 ft.
- > 1100 ft.

Cultural Features

- County Boundary
- State Boundary
- NRD Boundary

0 5 10 20 30 40 Miles

Saturated thickness information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Saturated thickness map produced by Kevin J. Schwartman, October 11, 2005

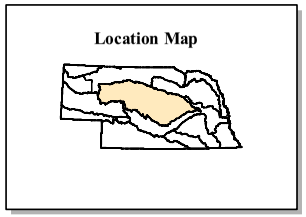
Figure L-21.

Planning and Assistance Division

Depth to Water

LOUP RIVER BASIN

This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.



CHERRY
BROWN
UPPER ELKHORN NRD
GRANT
UPPER LOUP NRD
HOOKER
THOMAS
BLAINE
LOUP
GARFIELD
WHEELER
BOONE
ARTHUR
MCPHERSON
LOGAN
LOWER LOUP NRD
VALLEY
GREELEY
PLATTE
NANCE
CUSTER
BUTLER
SHERMAN
HOWARD
MERRICK
DAWSON
BUFFALO

Explanation

Loup Basin

Depth to Water

- 0 - 50 feet
- 50 - 100 feet
- 100 - 200 feet
- > 200 feet

Cultural Features

- County Boundary
- State Boundary
- NRD Boundary

0 5 10 20 30 40 Miles

Depth to water information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Depth to water map produced by Kevin J. Schwartman, October 11, 2005

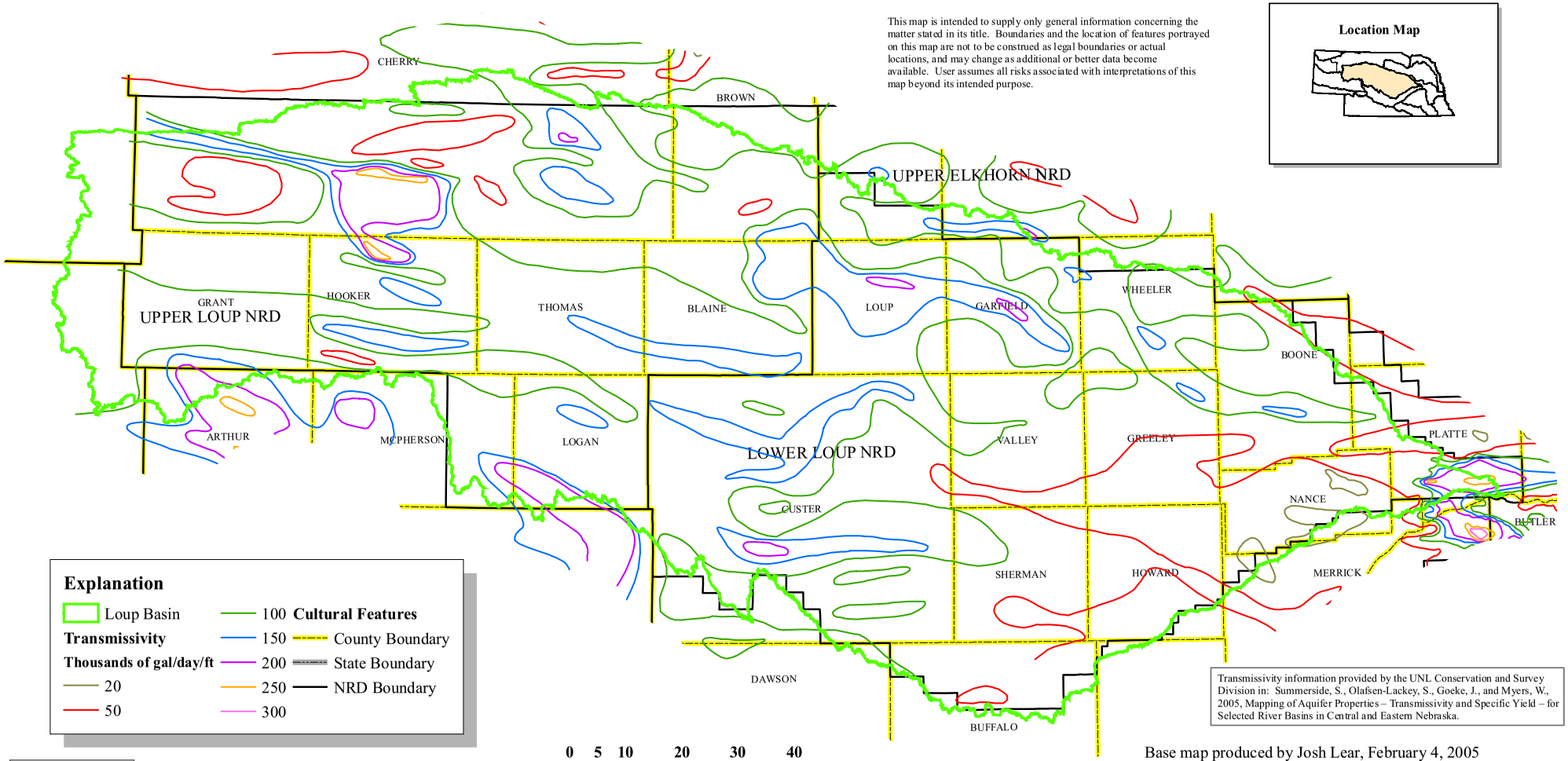
Figure L-22.

Planning and Assistance Division

Transmissivity

LOUP RIVER BASIN

This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.



Transmissivity information provided by the UNL Conservation and Survey Division in: Summerside, S., Olafsen-Lackey, S., Goeke, J., and Myers, W., 2005, Mapping of Aquifer Properties – Transmissivity and Specific Yield – for Selected River Basins in Central and Eastern Nebraska.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Transmissivity map produced by Kevin J. Schwartman, October 11, 2005

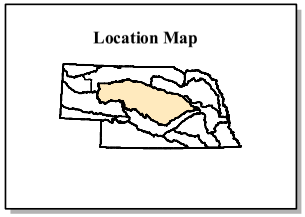
Figure L-23.

Planning and Assistance Division

Specific Yield

LOUP RIVER BASIN

This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.



CHERRY
BROWN
UPPER ELKHORN NRD
GRANT
UPPER LOUP NRD
HOOKER
THOMAS
BLAINE
LOUP
GARFIELD
WHEELER
BOONE
ARTHUR
MCPHERSON
LOGAN
LOWER LOUP NRD
CUSTER
VALLEY
GREELEY
PLATTE
NANCE
BUTLER
SHERMAN
HOWARD
MERRICK
DAWSON
BUFFALO

Explanation

- Loup Basin
- **Specific Yield (Percent)**
  - 5
  - 10
  - 15
  - 17
  - 20
  - 25
- **Cultural Features**
  - County Boundary
  - State Boundary
  - NRD Boundary

0 5 10 20 30 40 **Miles**

Specific yield information provided by the UNL Conservation and Survey Division in: Summerside, S., Olafsen-Lackey, S., Goeke, J., and Myers, W., 2005, Mapping of Aquifer Properties – Transmissivity and Specific Yield – for Selected River Basins in Central and Eastern Nebraska.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Specific yield map produced by Kevin J. Schwartman, October 11, 2005

Figure L-24.

Planning and Assistance Division

1995 Ground Water Table

LOUP RIVER BASIN

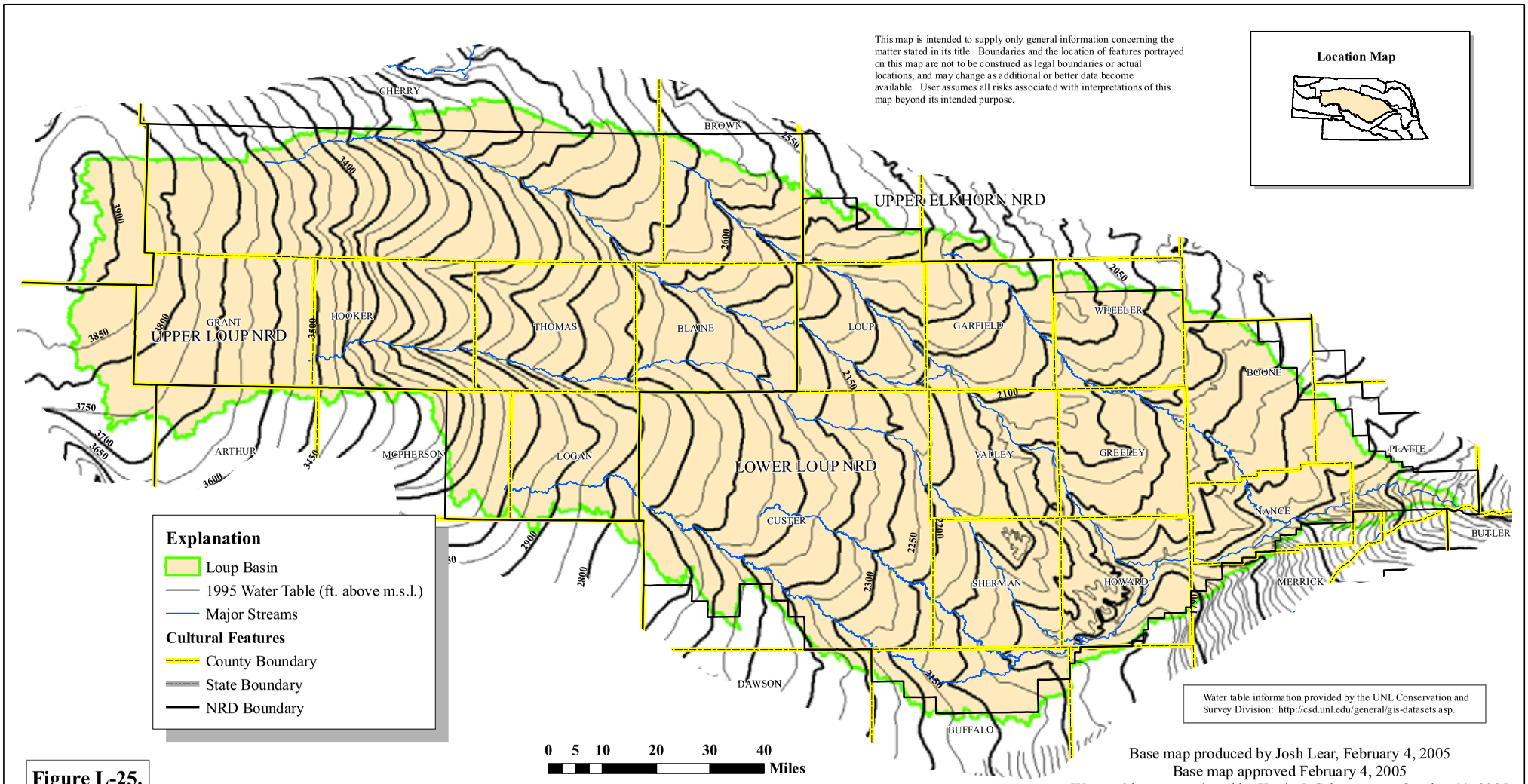


Figure L-25.

Planning and Assistance Division

Depletive Ground Water Wells

LOUP RIVER BASIN

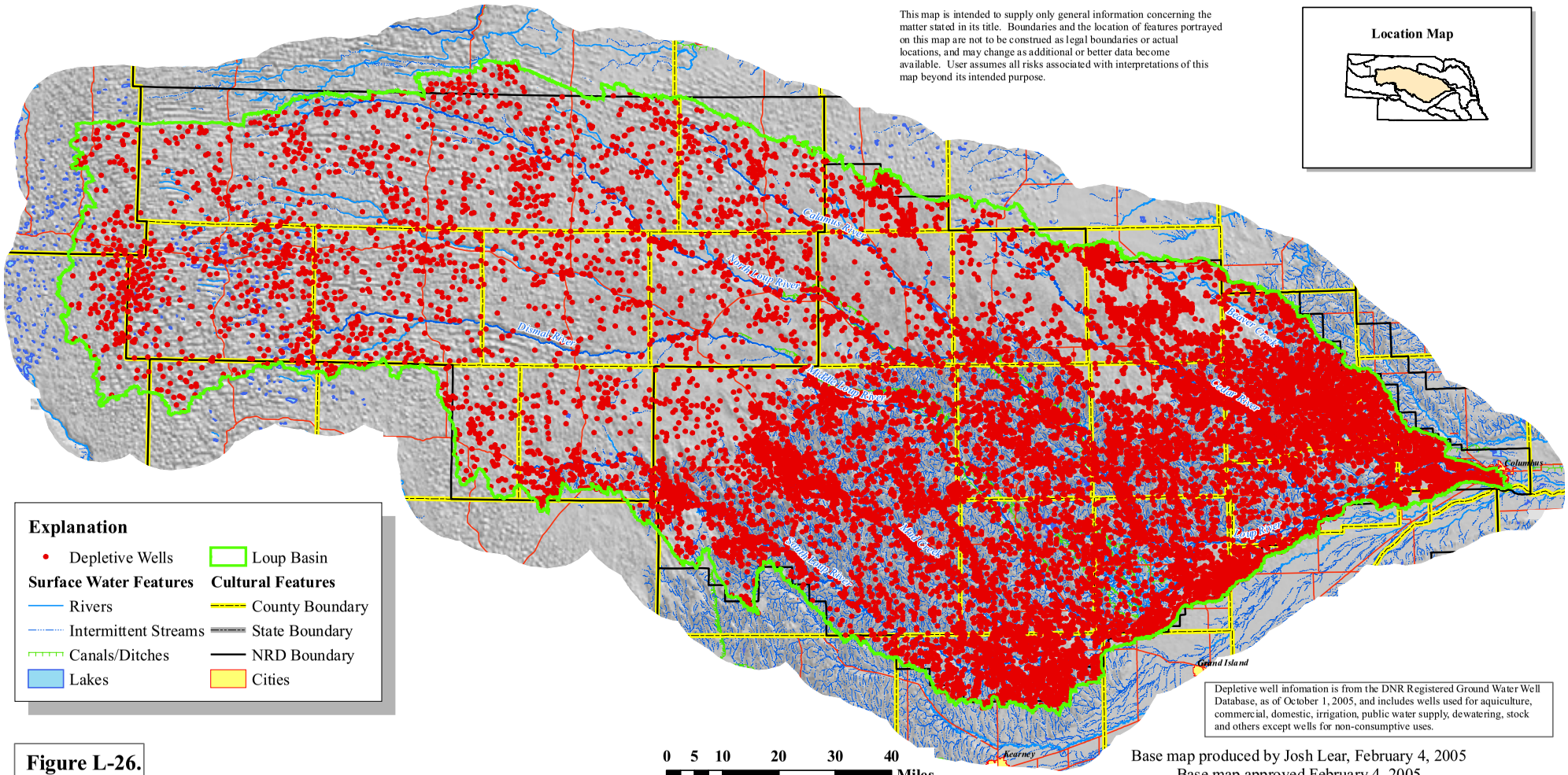


Figure L-26.

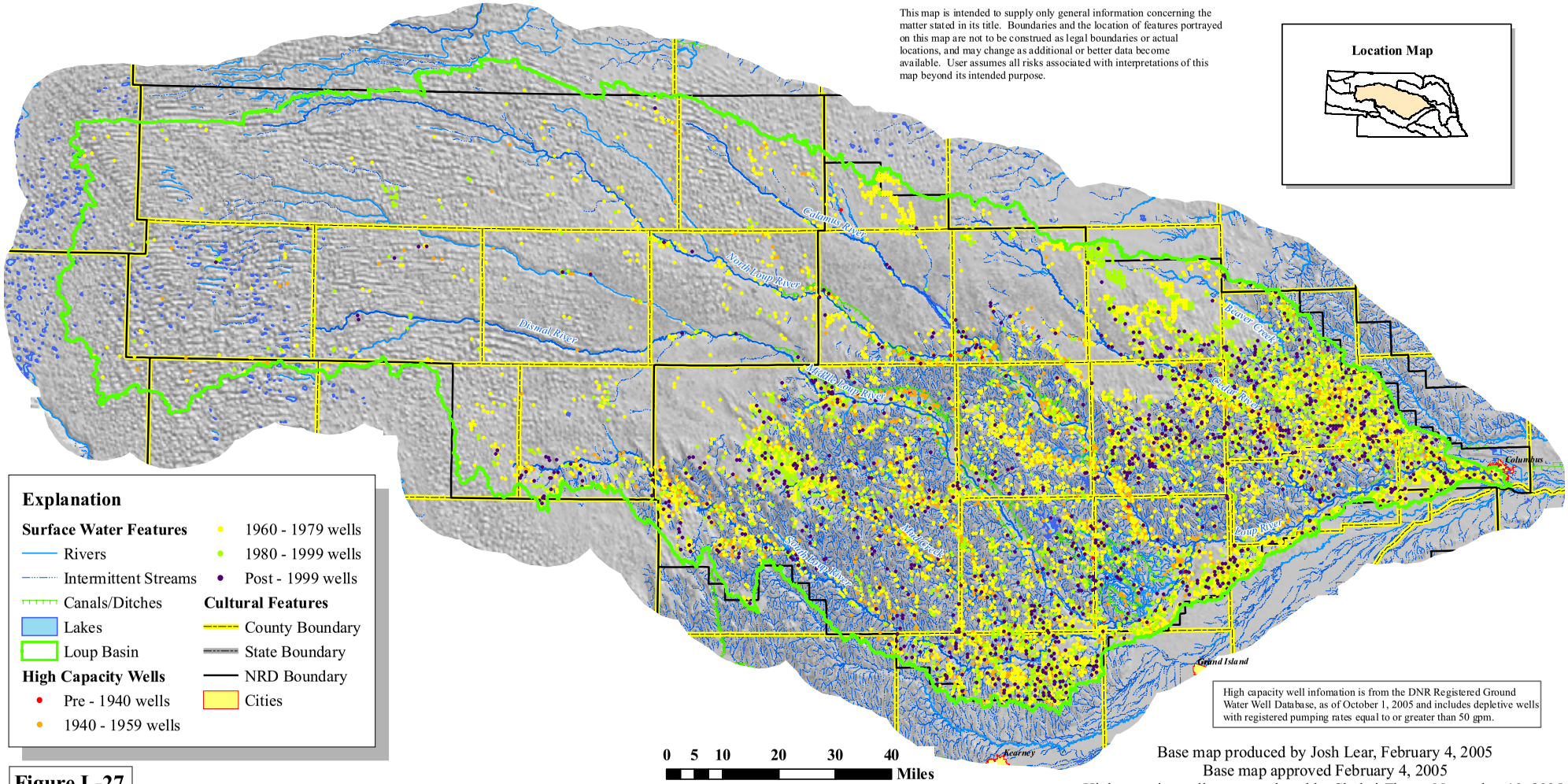
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Depletive ground water wells map produced by Shuhai Zheng, October 11, 2005.

Planning and Assistance Division

High Capacity Wells by Completion Date

LOUP RIVER BASIN

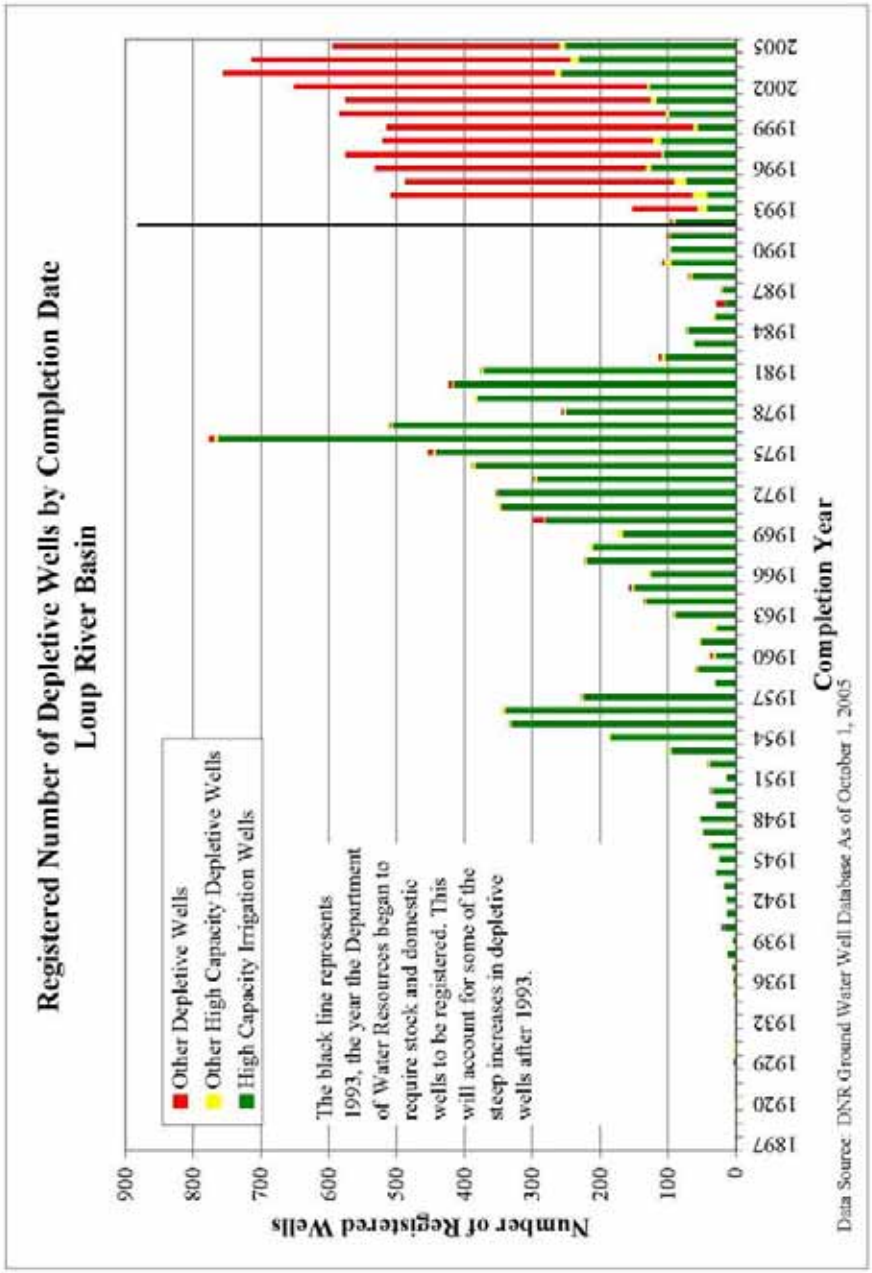
This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.



High capacity well infomation is from the DNR Registered Ground Water Well Database, as of October 1, 2005 and includes depletive wells with registered pumping rates equal to or greater than 50 gpm.

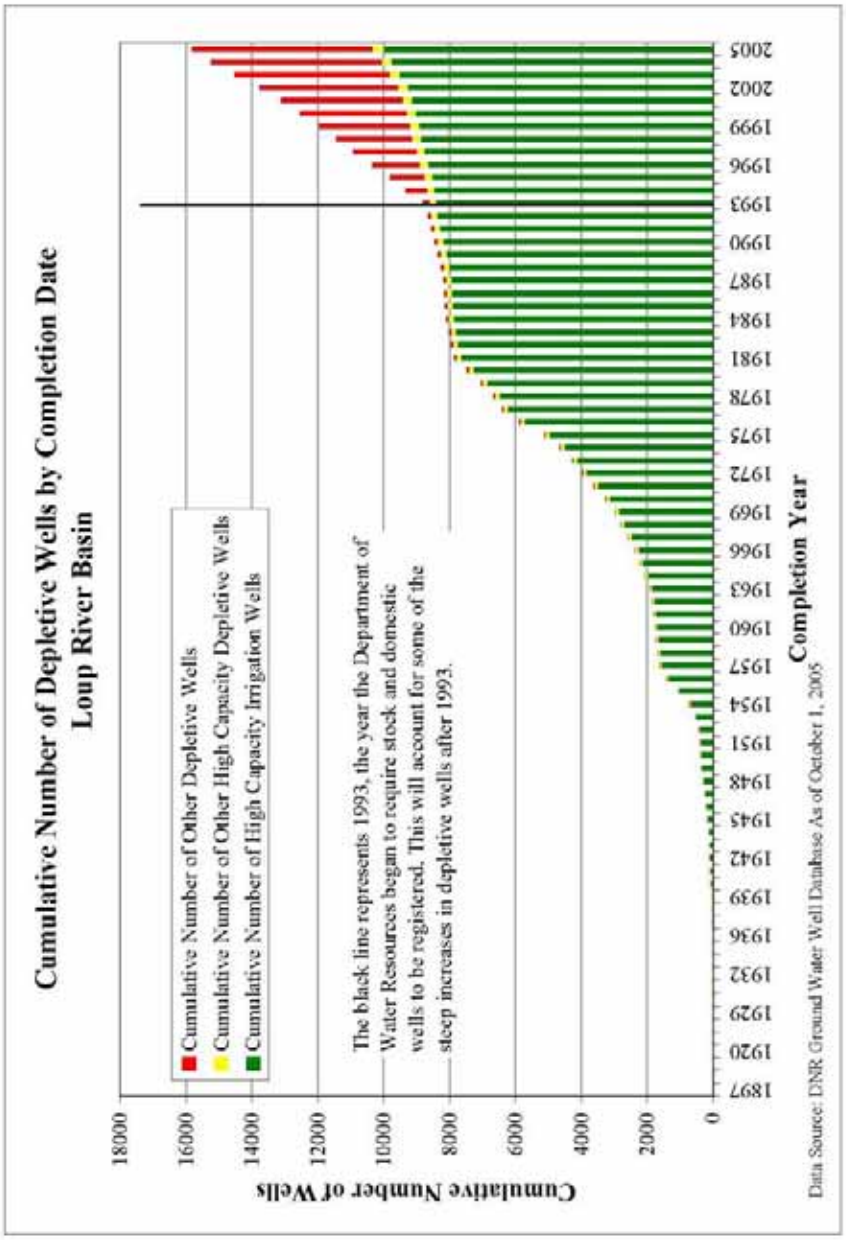
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
High capacity wells map produced by Shuhai Zheng, November 10, 2005.

Figure L-27.



By Shuhai Zheng, 10/1/2005

Figure L-28



By Shuhai Zheng 10/1/2005

Figure L-29

Table L-3. Average Irrigated Acreage 1950-2003 for Counties Fully or Partially in the Loup River Basin

	Estimated Average Irrigated Acreage by County						
County Name	*Percent of County in Loup Basin*	*1950-1959*	*1960-1969*	*1970-1979*	*1980-1989*	*1990-1999*	*2000-2003*
Antelope	2	3140	14709	89076	160910	184990	213225
Arthur	17	46	347	3250	8830	8260	5625
Blaine	100	90	1042	7511	9220	7570	5175
Boone	85	10299	25671	63326	111210	141590	164400
Brown	40	1995	10633	46396	52650	49940	47775
Buffalo	40	60018	95577	154823	203500	210930	227375
Cherry	38	139	2852	19585	27460	26650	25350
Custer	88	18919	47711	114878	171360	192050	207600
Dawson	2	102807	127624	169535	219020	226860	238175
Garden	15	3798	9278	19728	31360	31940	31825
Garfield	96	3173	5654	12800	19450	14610	14650
Grant	100		134	910	2770	1114	1133
Greeley	100	6054	14867	37837	58930	66220	76725
Hall	3	74528	109932	152834	179920	203930	215075
Holt	3	2746	27950	133669	195120	210960	220725
Hooker	100	15	435	1260	2790	3000	2275
Howard	91	6340	31685	69820	92660	105980	108900
Lincoln	1	27188	46809	94503	159670	184990	212175
Logan	95	1323	3219	8049	16340	16820	15825
Loup	100	2462	4984	10403	10330	10670	10800
McPherson	34	35	654	4179	6860	5940	5975
Merrick	13	47192	78962	119629	145480	162730	173650
Nance	89	3250	13356	33954	48950	58040	62525
Platte	30	10651	31718	77881	127710	161700	188775

Shuhai Zheng, November 23, 2005

	Estimated Average Irrigated Acreage by County						
County Name	*Percent of County in Loup Basin*	*1950-1959*	*1960-1969*	*1970-1979*	*1980-1989*	*1990-1999*	*2000-2003*
Rock	20	115	1646	27958	38410	37150	36825
Sheridan	10	4211	15936	30268	52550	53330	48800
Sherman	100	7099	16077	33523	55340	64340	72475
Thomas	100	30	455	2015	3400	2500	1400
Valley	100	15787	28012	52600	65880	78520	85775
Wheeler	80	442	1804	16334	41330	42820	44050
Total		**413892**	**769733**	**1608534**	**2319410**	**2566144**	**2765058**
% Change from Previous 10 Years			85.97%	108.97%	44.19%	10.64%	7.75%

* The percentage is the percentage of the county area which is in the Loup Basin. It does not necessarily represent the percentage of irrigated county acreage in the Loup River Basin.

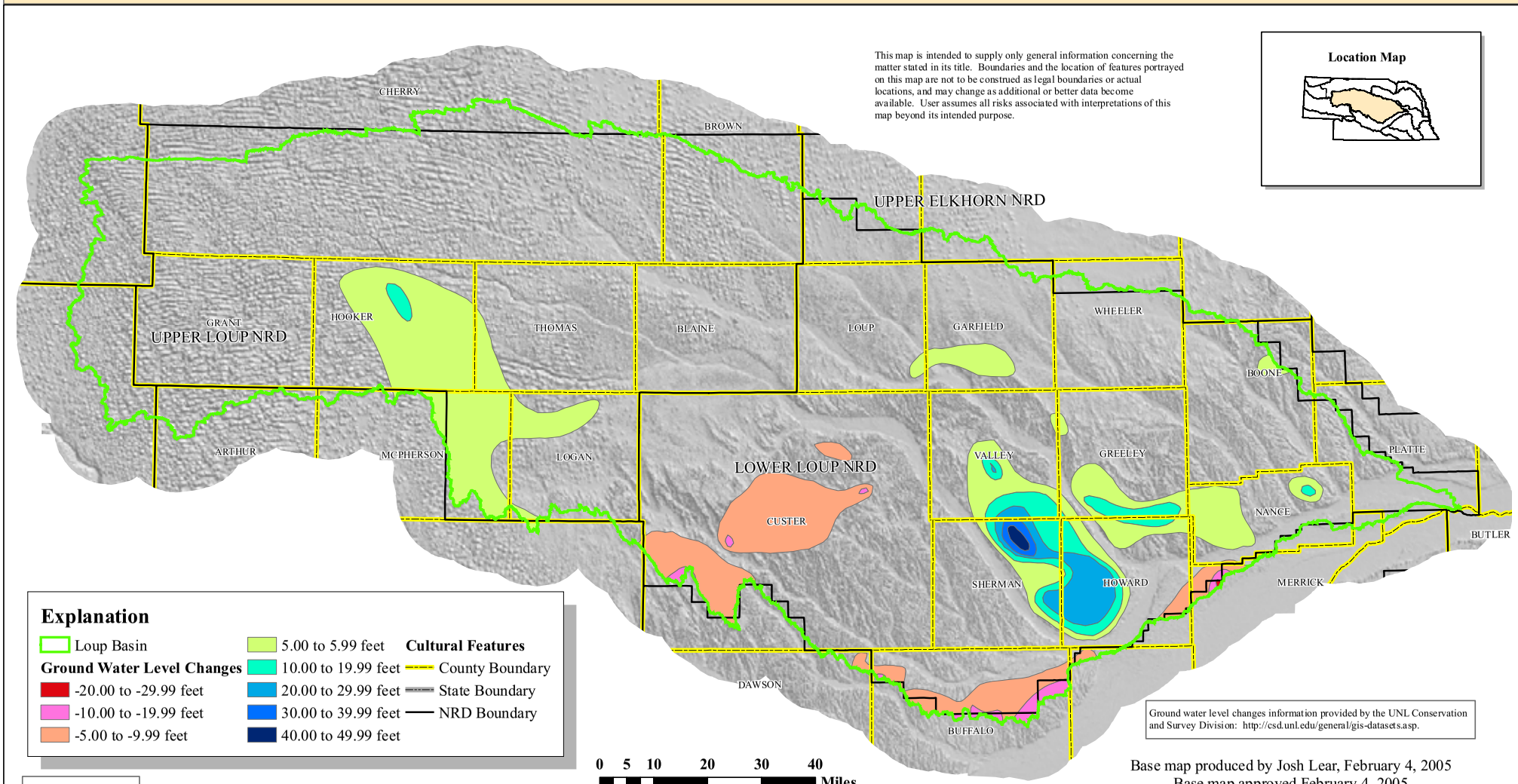
Data Source: http://www.usda.gov/nass/, National Agricultural Statistics Service, U.S. **Department of Agriculture**

Shuhai Zheng, November 23, 2005

Planning and Assistance Division

Ground Water Level Changes Predevelopment to Spring 2005

LOUP RIVER BASIN



Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Ground water level changes added by Shuhai Zheng, October 13, 2005

Figure L-30.

Planning and Assistance Division

Ground Water Hydrograph Locations

LOUP RIVER BASIN

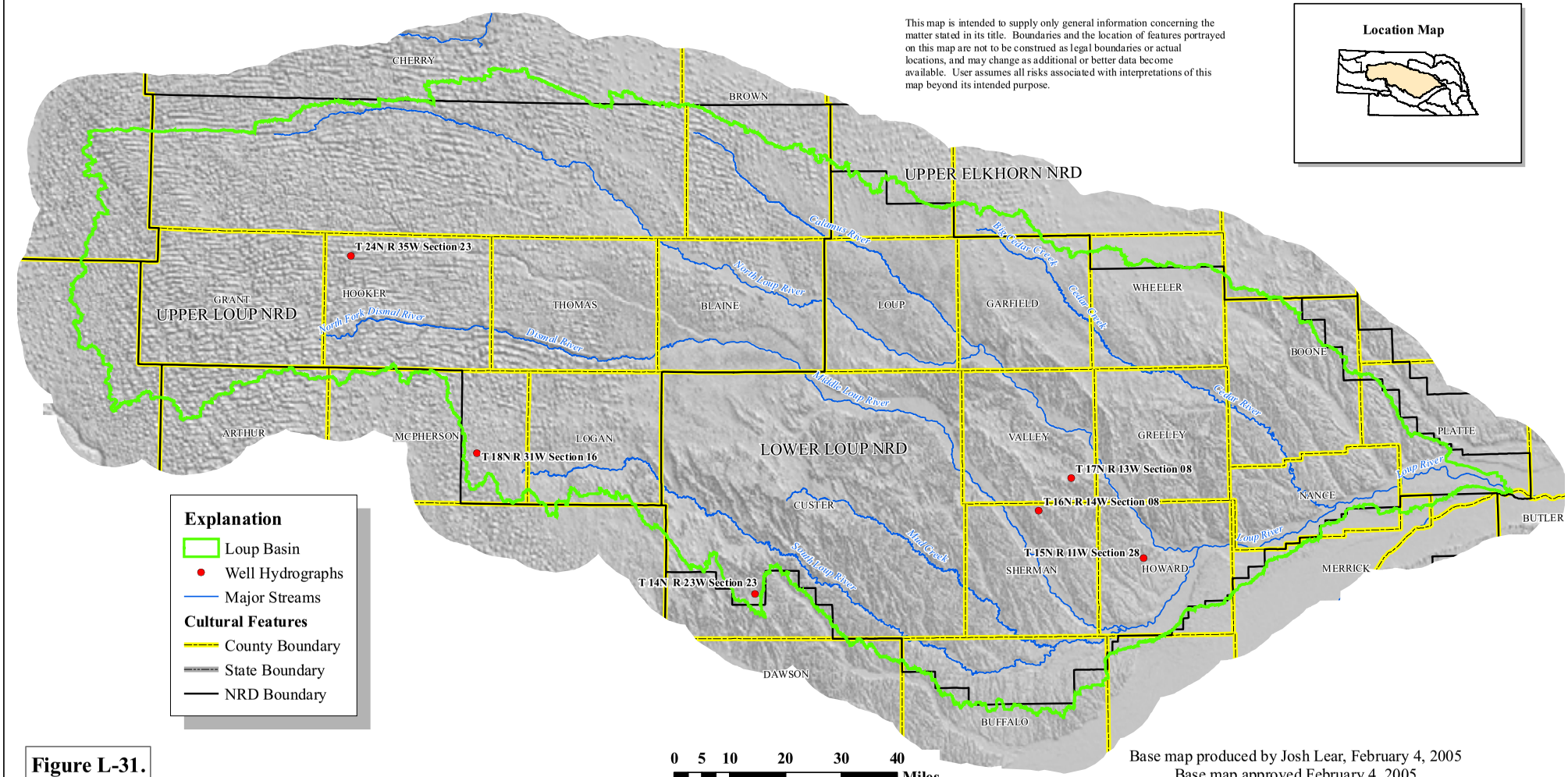
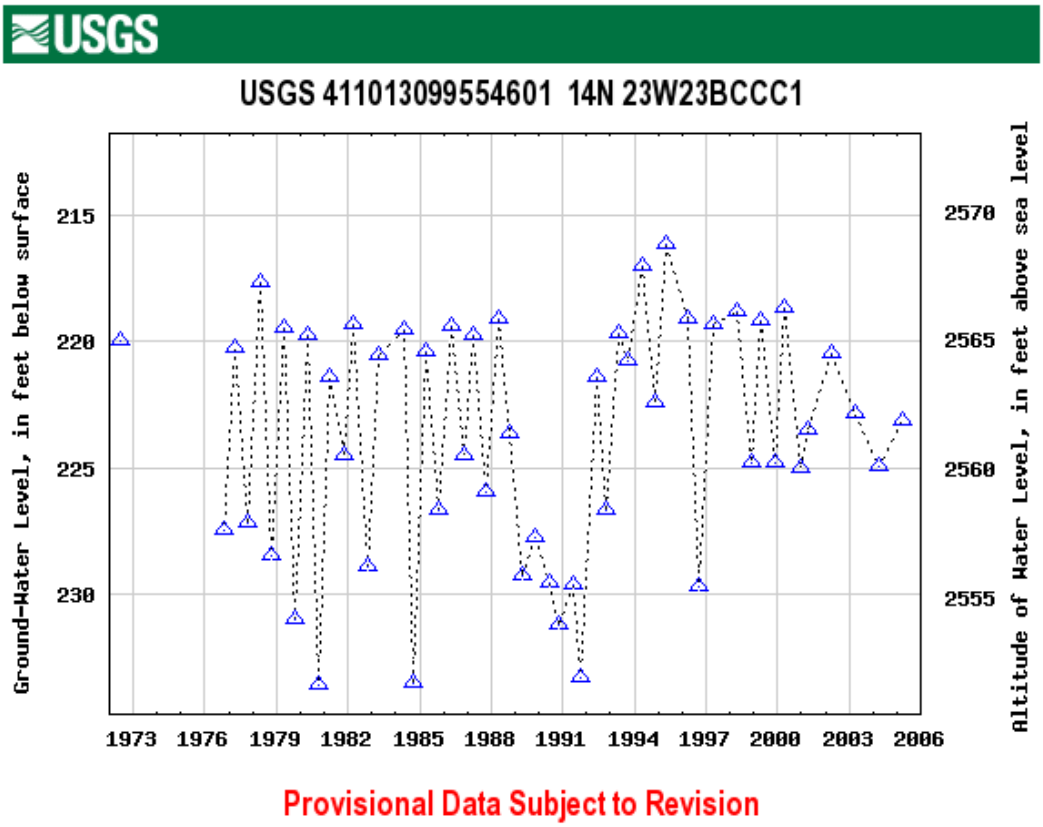


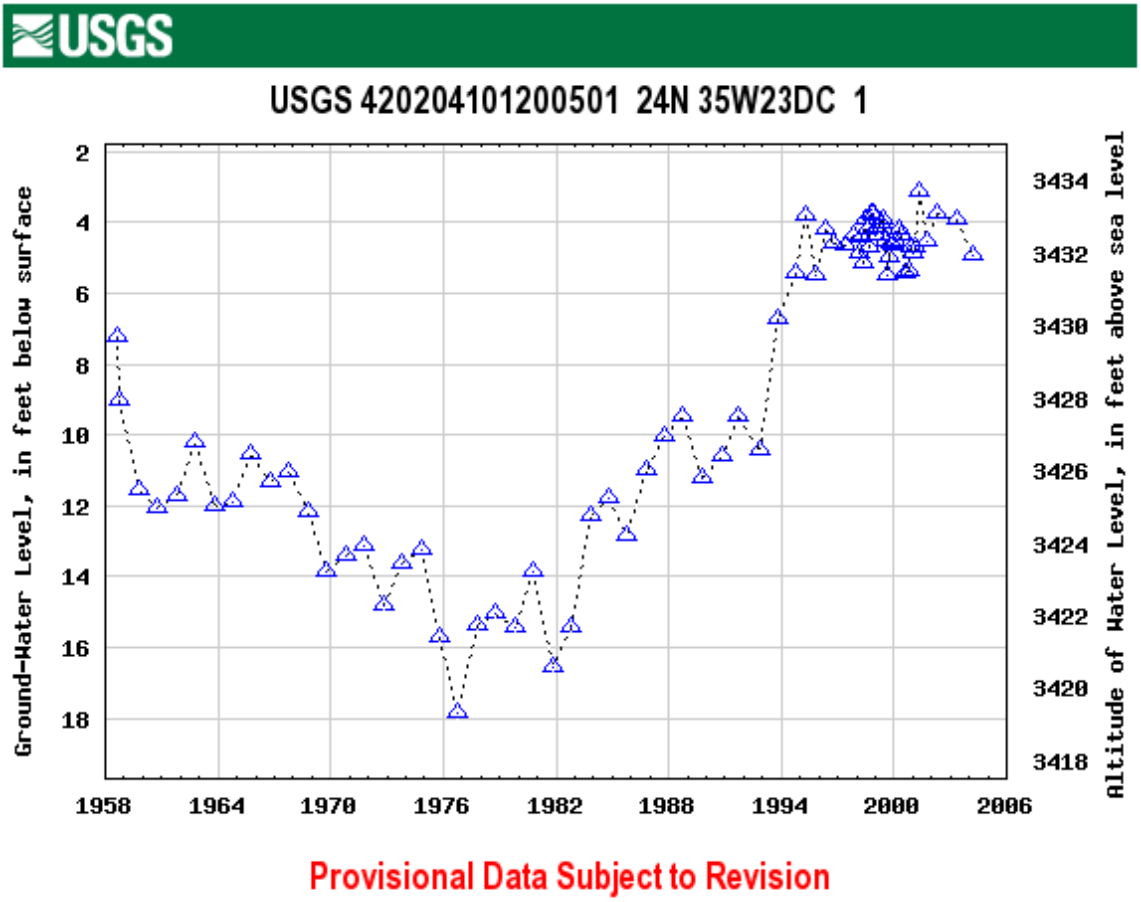
Figure L-31.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Ground water hydrograph map produced by Kevin J. Schwartman, November 1, 2005.



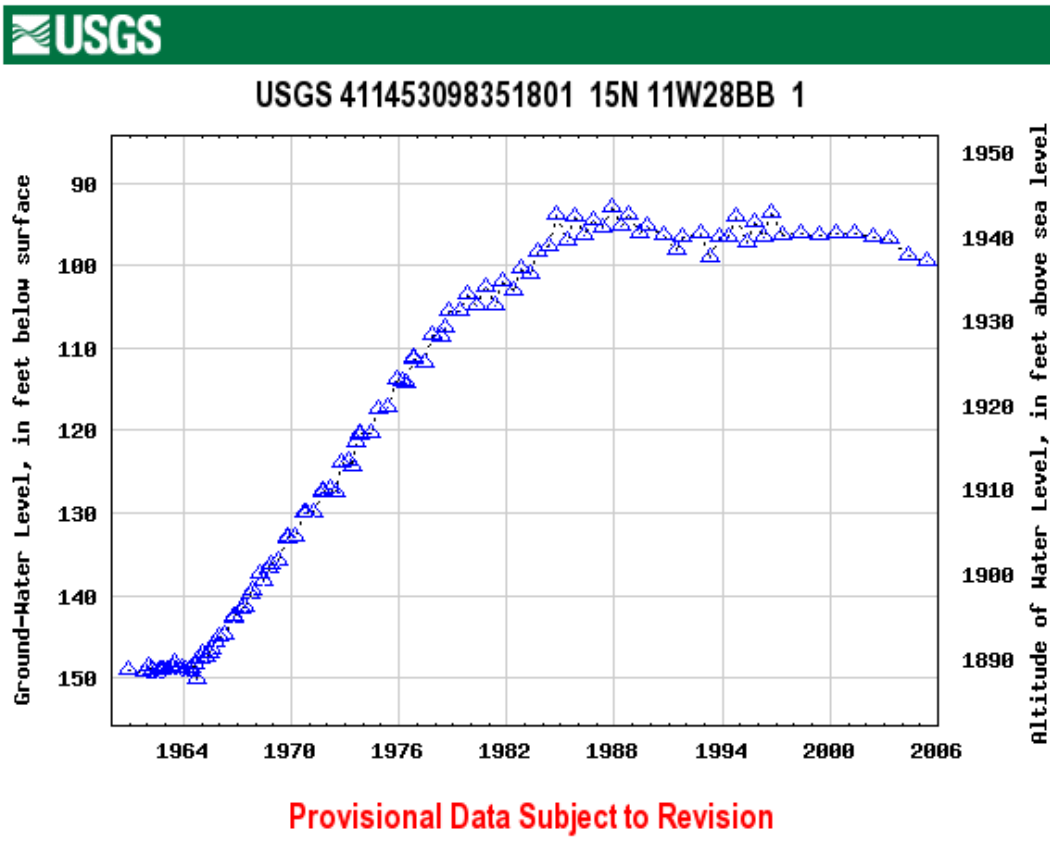
Custer County, Nebraska
Hydrologic Unit Code 10210004
Latitude 41°10'13", Longitude 99°55'46" NAD27
Land-surface elevation 2,785. feet above sea level NGVD29
The depth of the well is 481.0 feet below land surface. This well is completed in the TERTIARY OGALLALA GROUP DEPOSITS (112SDGV) regional aquifer.

Figure L-32 (T 14N R 23W Section 23)



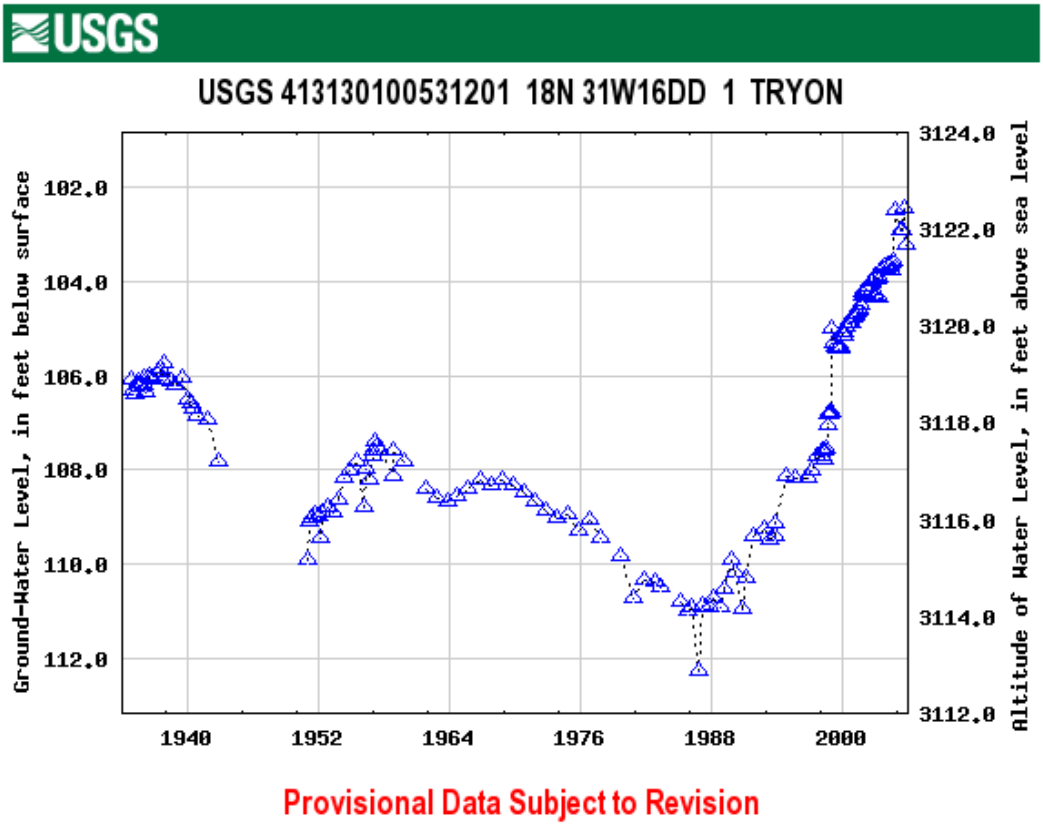
Hooker County, Nebraska
Hydrologic Unit Code 10210001
Latitude 42°02'04", Longitude 101°20'05" NAD27
Land-surface elevation 3,437.00 feet above sea level NGVD29
The depth of the well is 20.0 feet below land surface. This well is completed in the QUATERNARY SAND AND GRAVEL DEPOSITS (112SDGV) local aquifer.

Figure L-33 (T 24N R 35W Section 23)



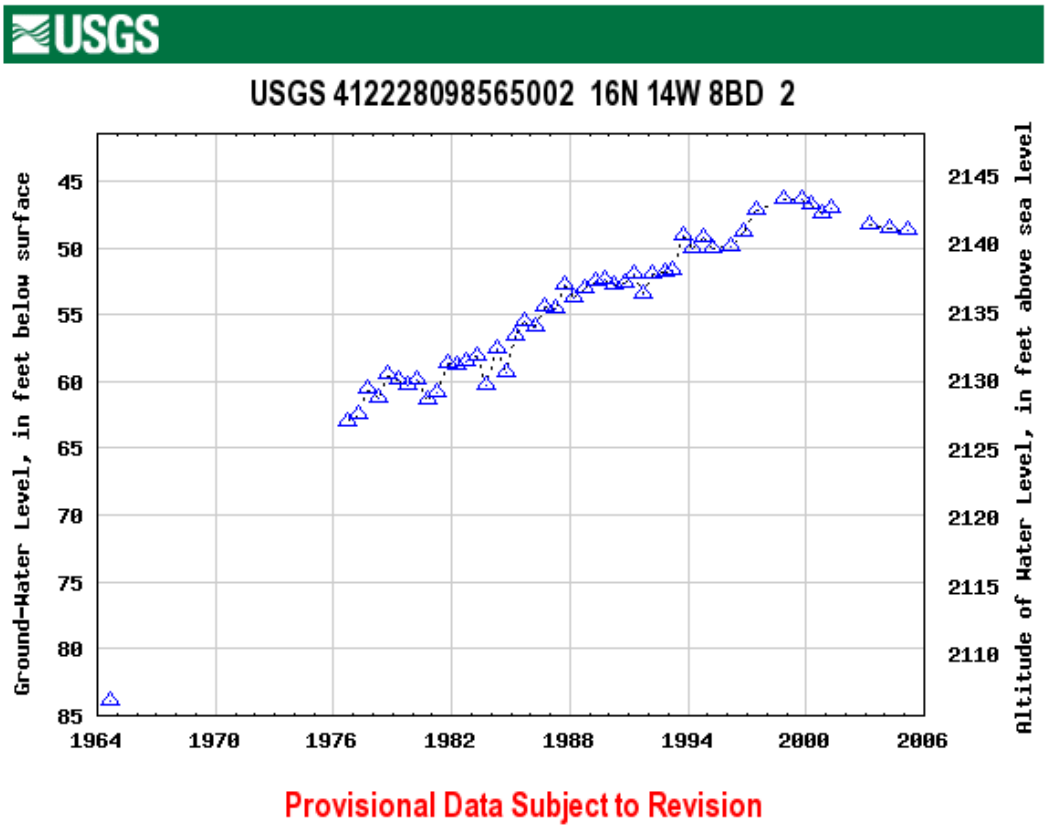
Howard County, Nebraska
Hydrologic Unit Code 10210007
Latitude 41°14'53", Longitude 98°35'18" NAD27
Land-surface elevation 2,037.00 feet above sea level NGVD29
The depth of the well is 182 feet below land surface. This well is completed in the TERTIARY OGALLALA GROUP DEPOSITS (112SDGV) regional aquifer.

Figure L-34 (T 15N R 11W Section 28)



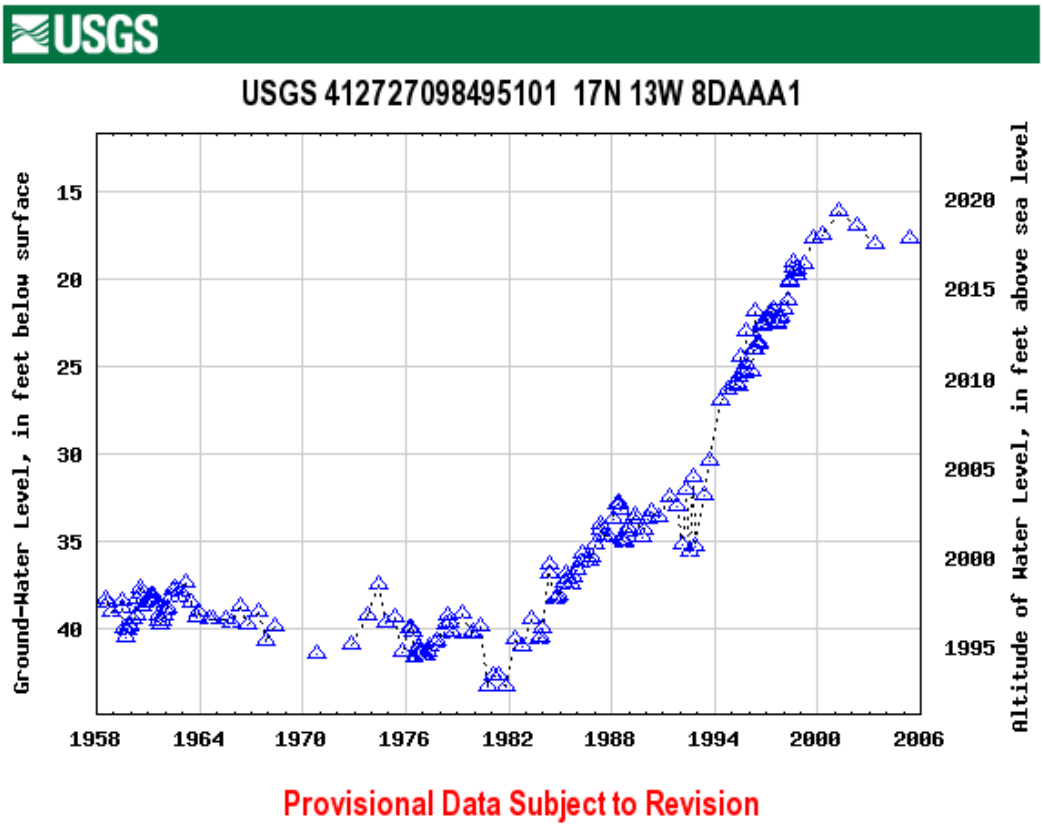
McPherson County, Nebraska
Hydrologic Unit Code 10210004
Latitude 41°31'30", Longitude 100°53'12" NAD27
Land-surface elevation 3,225.00 feet above sea level NGVD29
The depth of the well is 120 feet below land surface. This well is completed in the QUATERNARY SAND DEPOSITS (112SDGV) local aquifer.

Figure L-35 (T 18N R 31W Section 16)



Sherman County, Nebraska
Hydrologic Unit Code 10210003
Latitude 41°22'28", Longitude 98°56'50" NAD27
Land-surface elevation 2,190. feet above sea level NGVD29
The depth of the well is 199.0 feet below land surface. This well is completed in the TERTIARY OGALLALA GROUP DEPOSITS (112SDGV) regional aquifer.

Figure L-36 (T 16N R 14W Section 08)



Valley County, Nebraska
Hydrologic Unit Code 10210007
Latitude 41°27'27", Longitude 98°49'51" NAD27
Land-surface elevation 2,035.71 feet above sea level NGVD29
The depth of the well is 94.0 feet below land surface. This well is completed in the QUATERNARY SAND DEPOSITS (112SDGV) local aquifer just above the TERTIARY OGALLALA GROUP DEPOSITS regional aquifer.

Figure L-37 (T 17N R 13W Section 08)

Figure L-38. Annual Flows, Beaver Creek at Loretto.

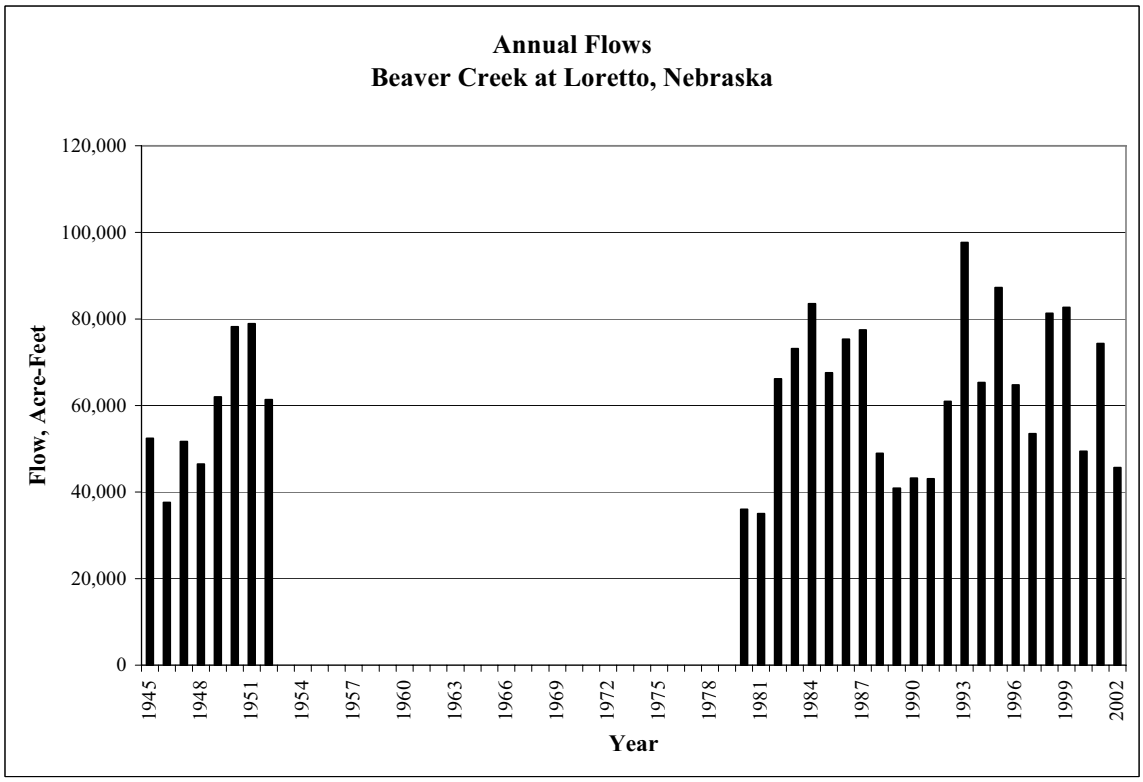
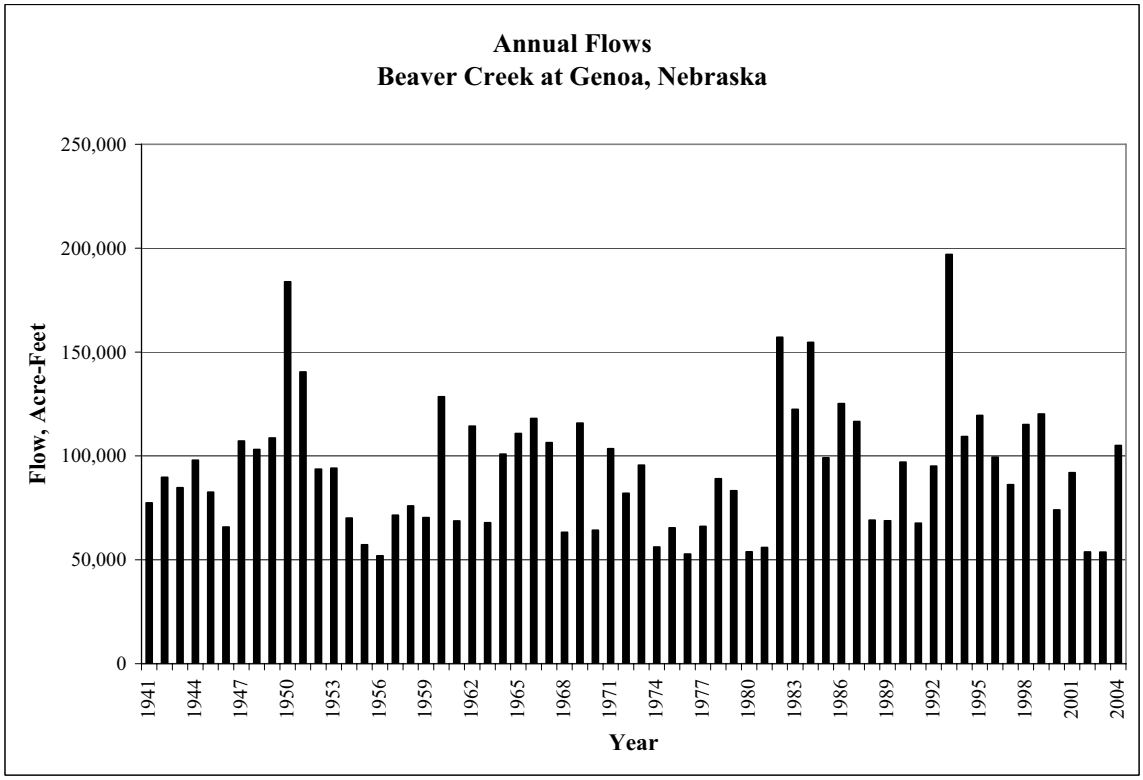


Figure L-39. Annual Flows, Beaver Creek at Genoa.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-40. Annual Flows, Cedar River near Spalding.

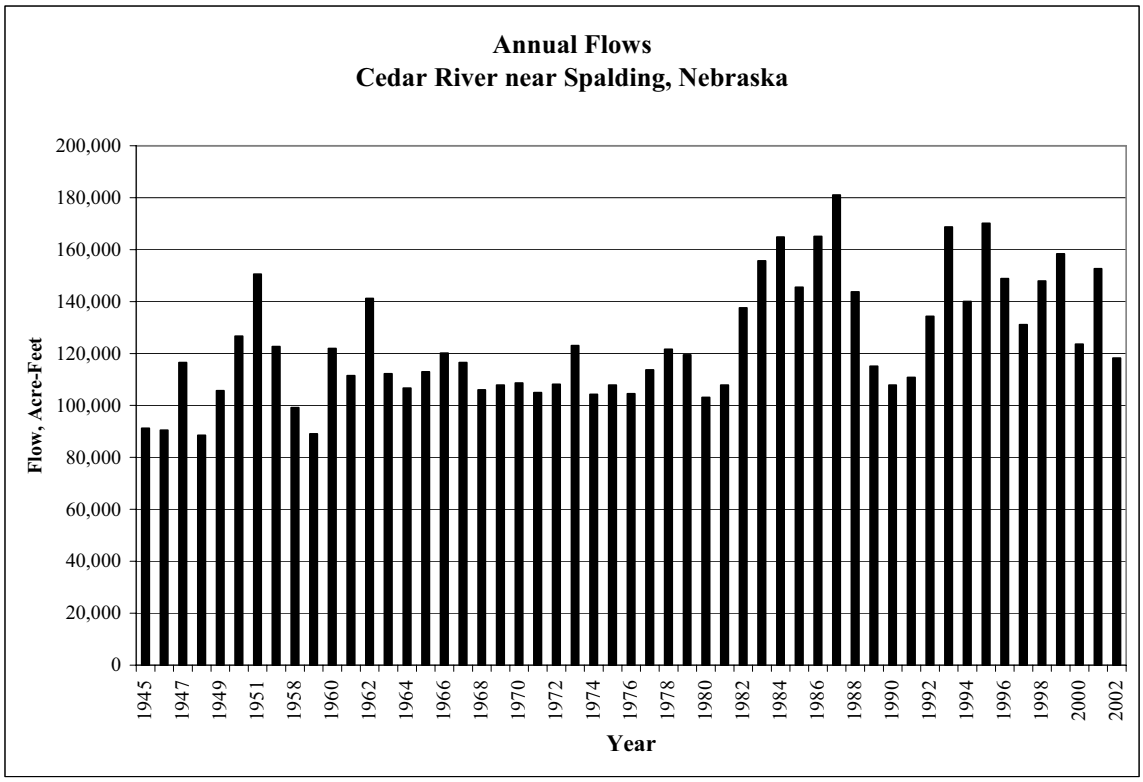
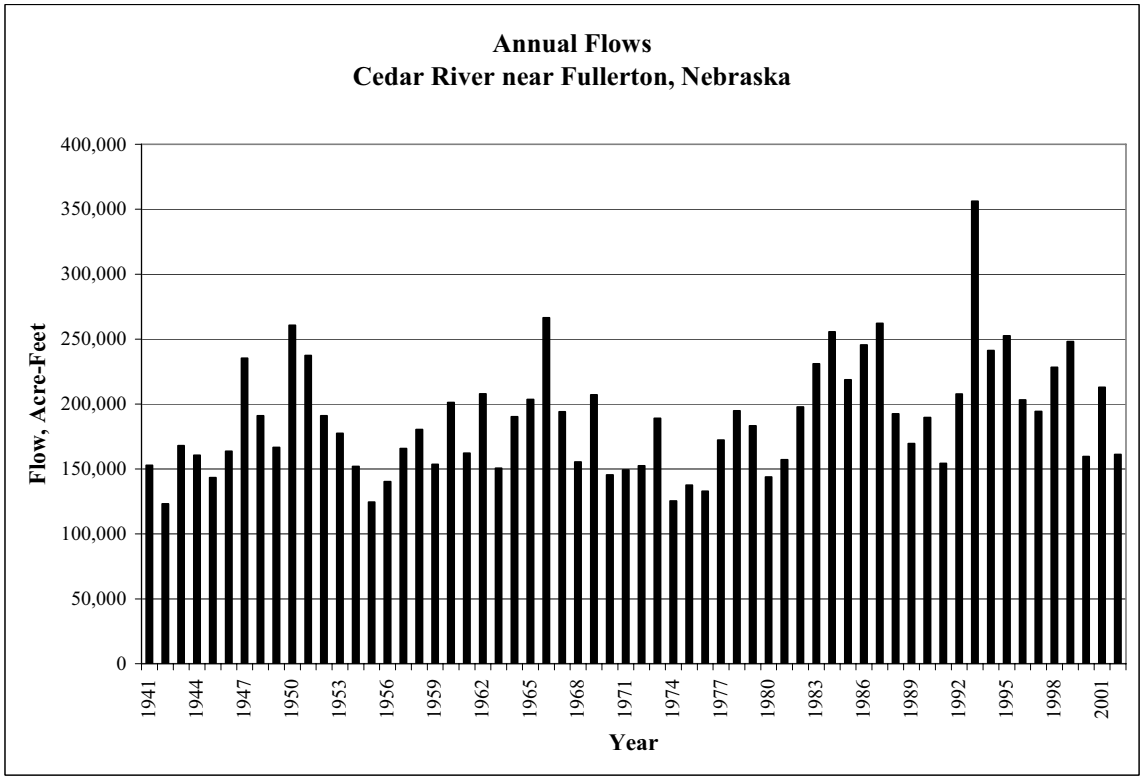


Figure L-41. Annual Flows, Cedar River near Fullerton.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-42. Annual Flows, Dismal River at Dunning.

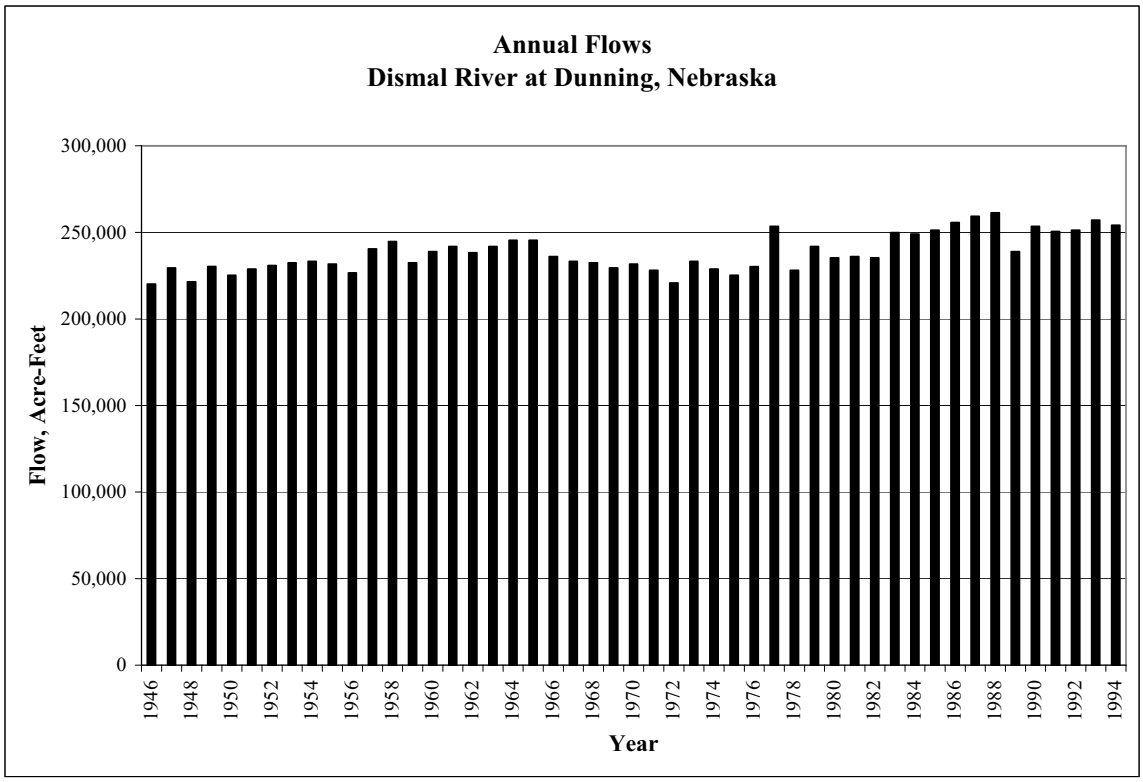
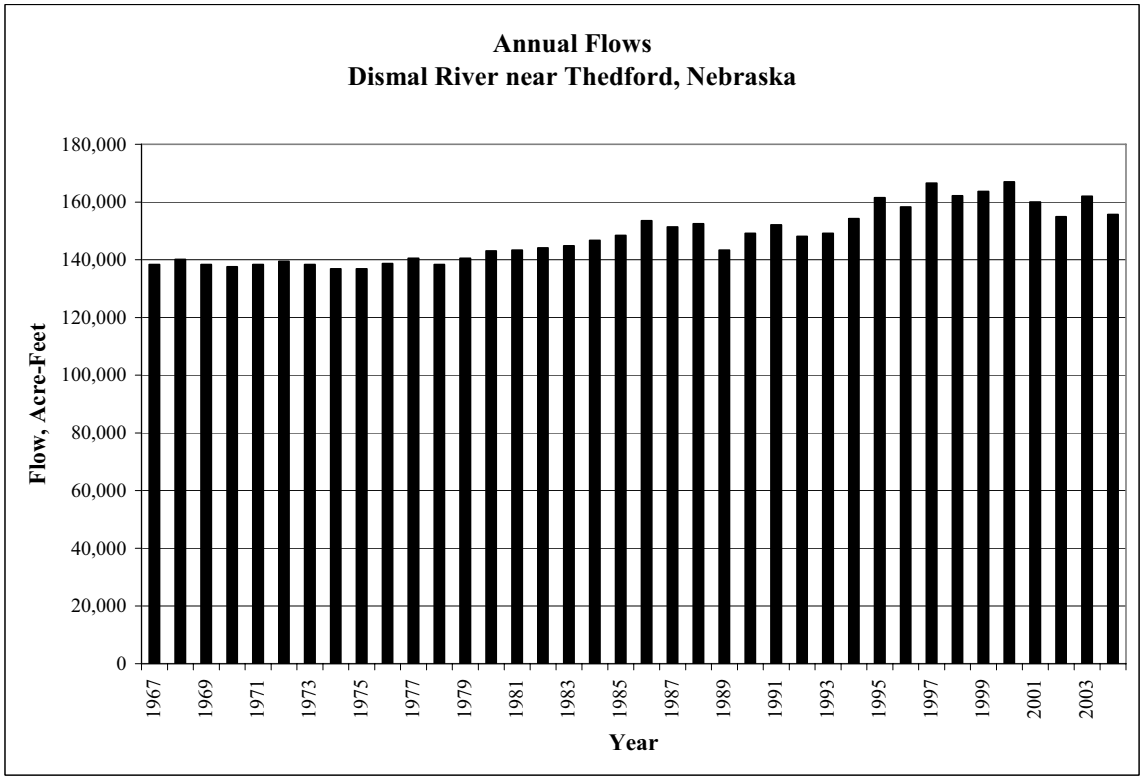


Figure L-43. Annual Flows, Dismal River near Thedford.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-44. Annual Flows, Mira Creek near North Loup.

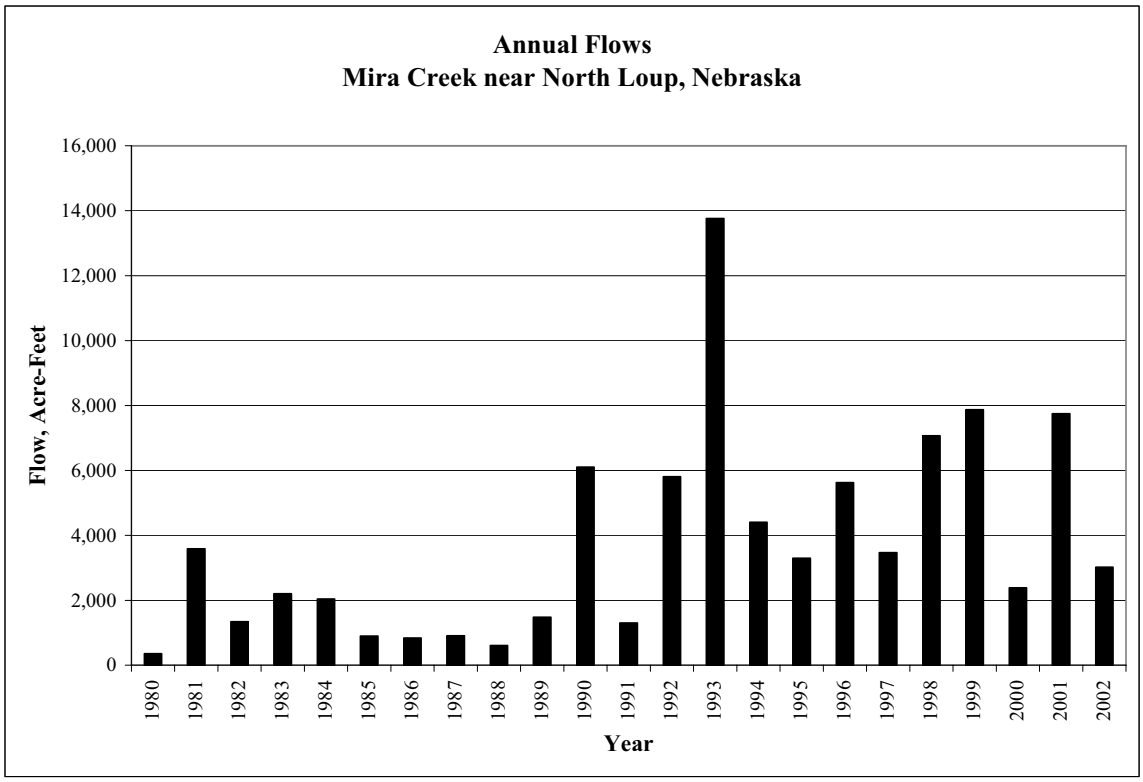
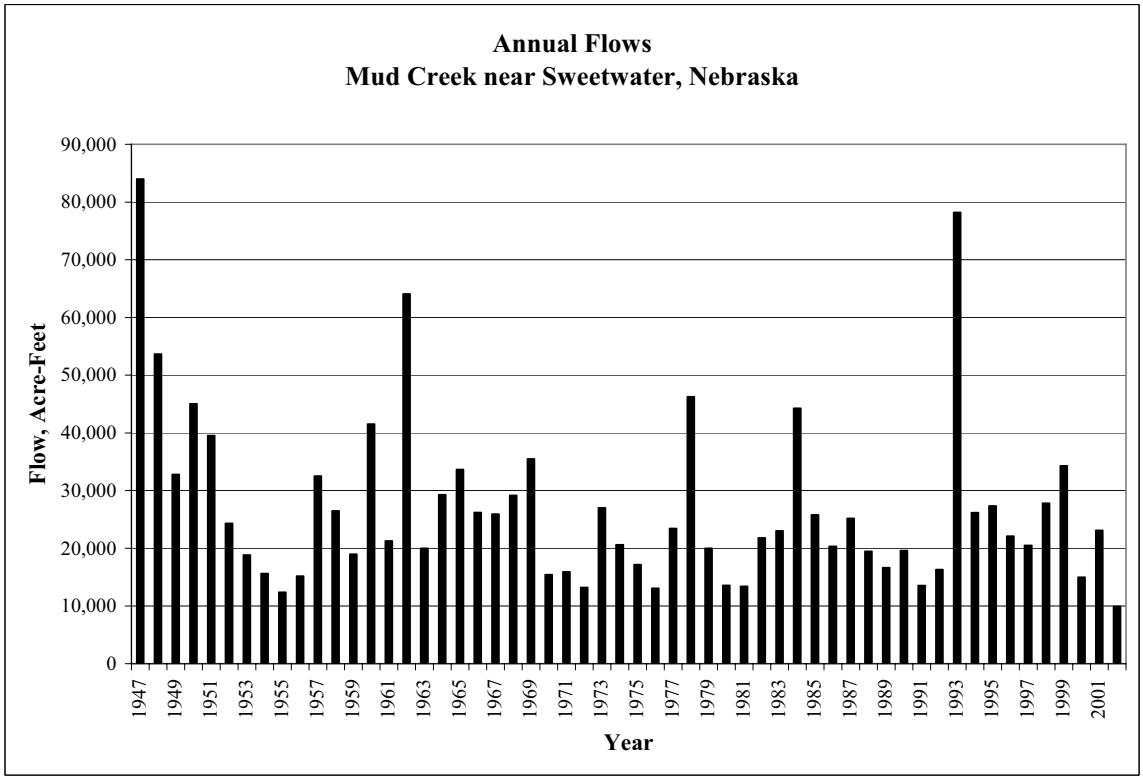


Figure L-45. Annual Flows, Mud Creek near Sweetwater.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-46. Annual Flows, Calamus River near Burwell.

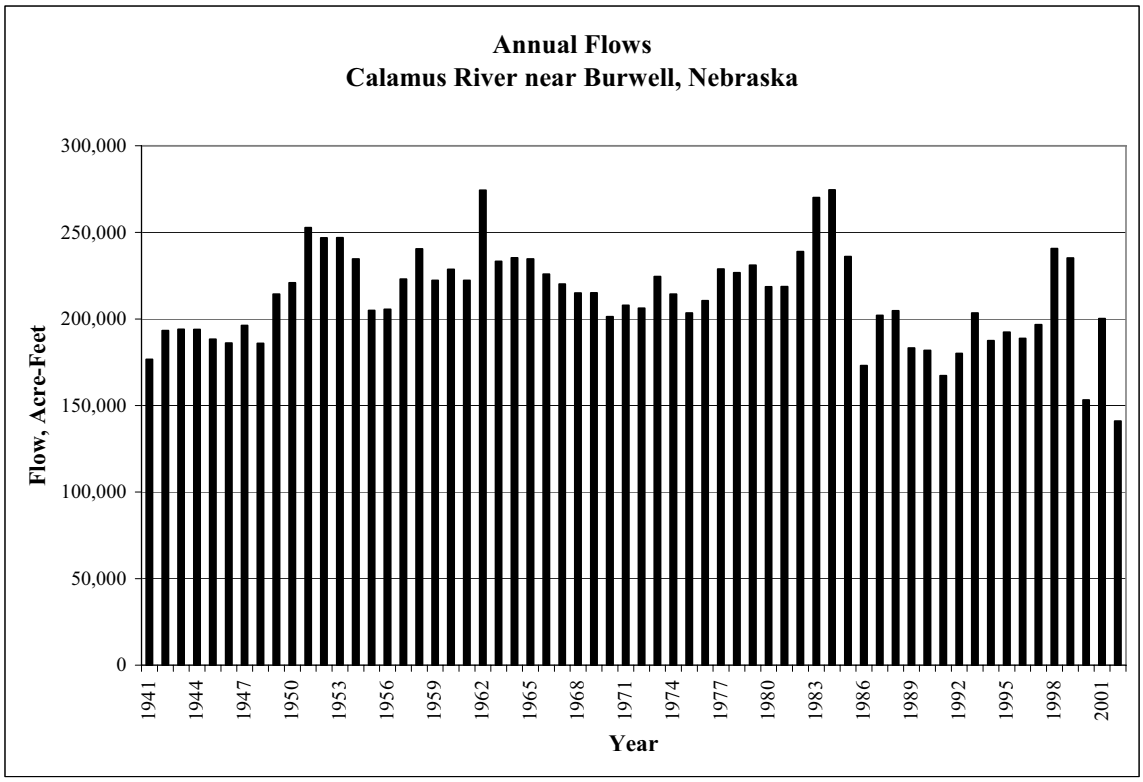
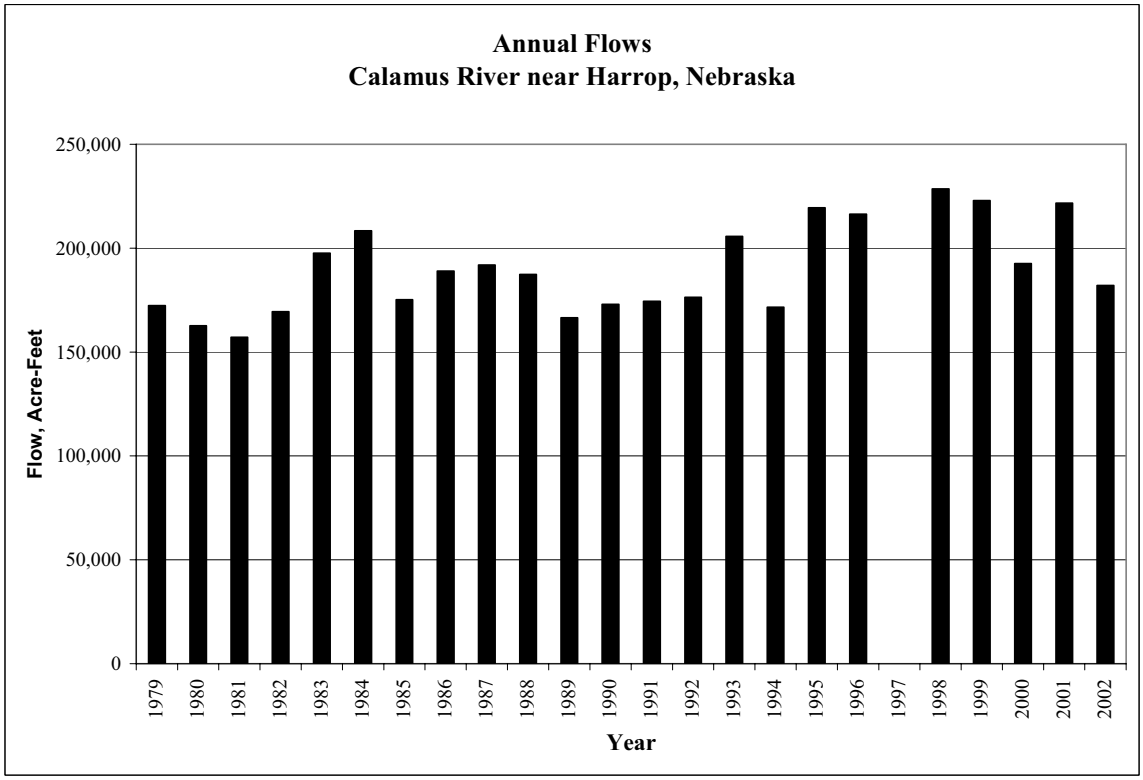


Figure L-47. Annual Flows, Calamus River near Harrop.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-48. Annual Flows, South Loup River at St. Michael.

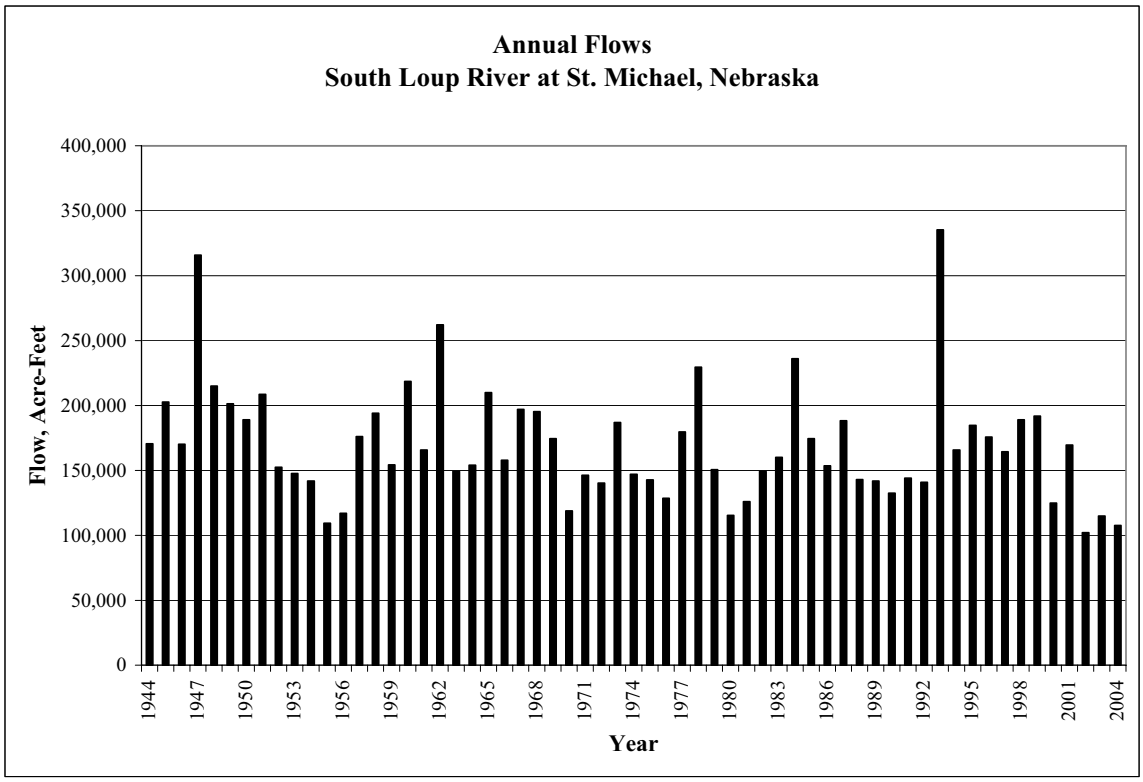
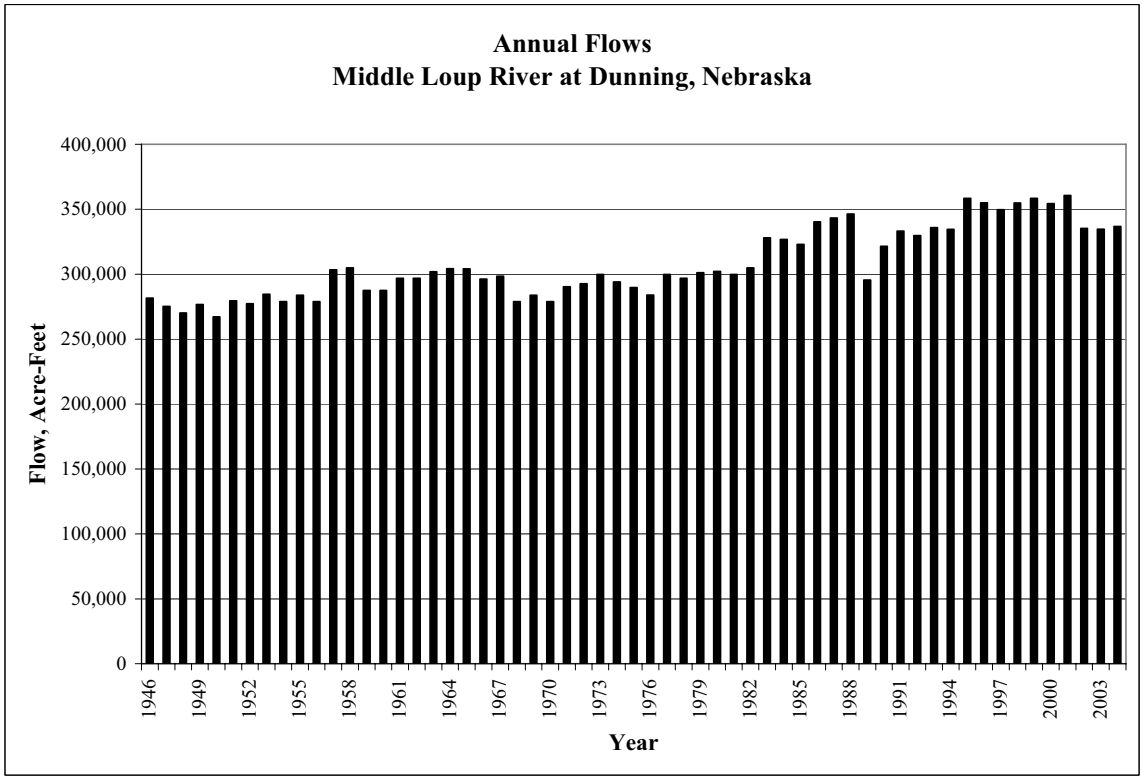


Figure L-49. Annual Flows, Middle Loup River at Dunning.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-50. Annual Flows, Middle Loup River at Arcadia.

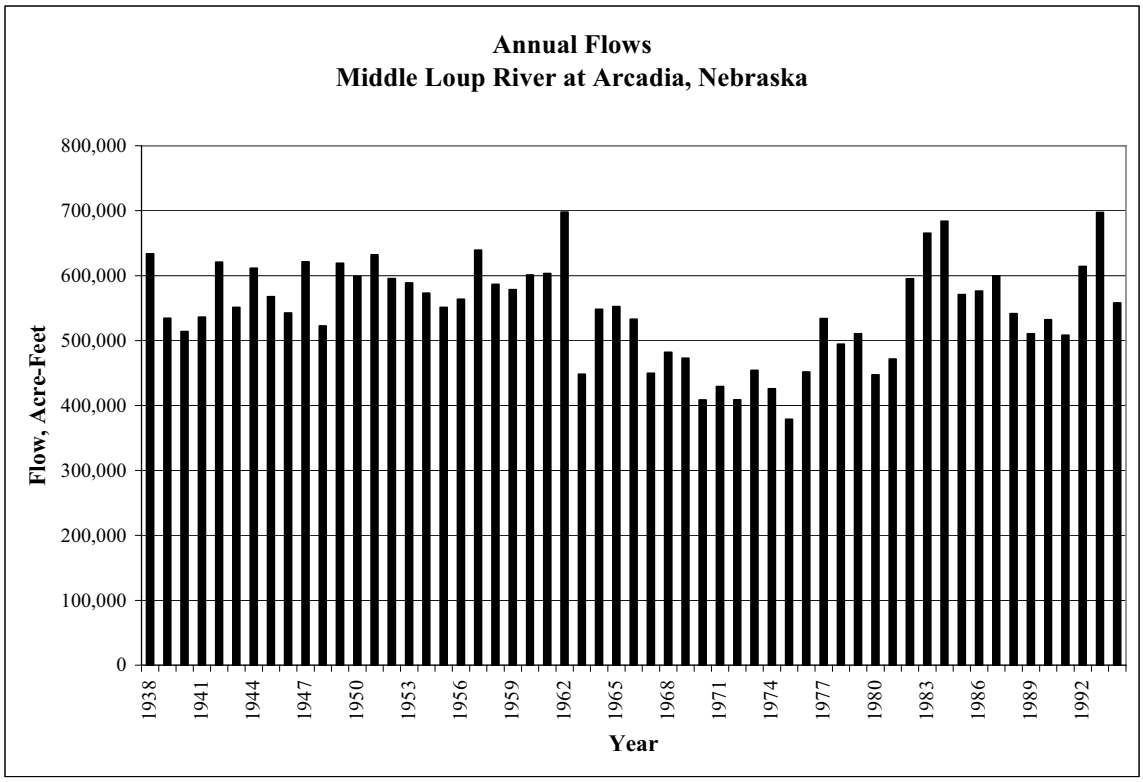
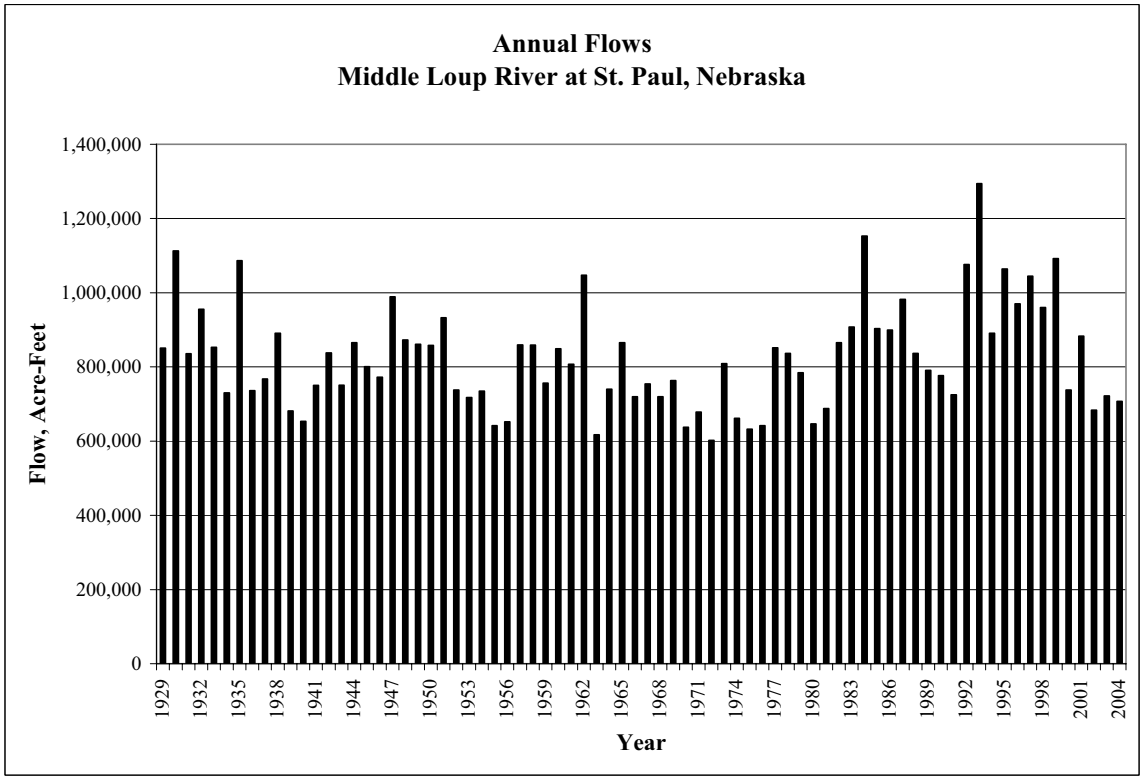


Figure L-51. Annual Flows, Middle Loup River at St. Paul.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-52. Annual Flows, North Loup River at Taylor.

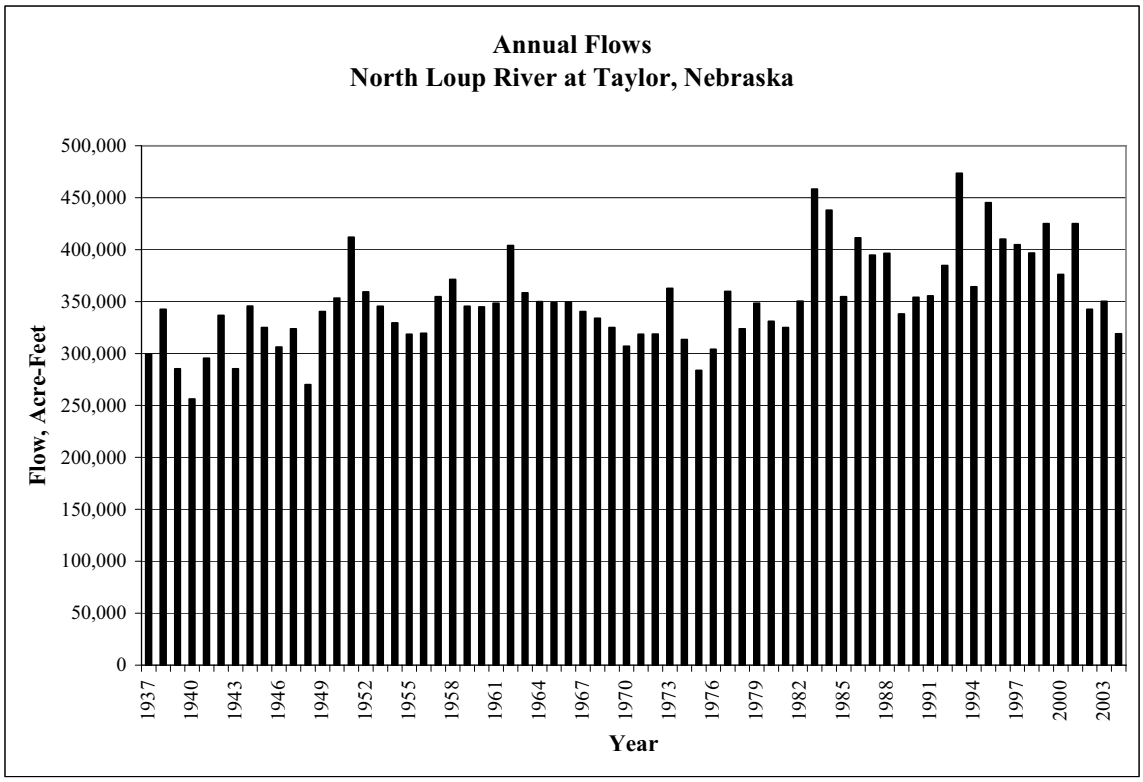
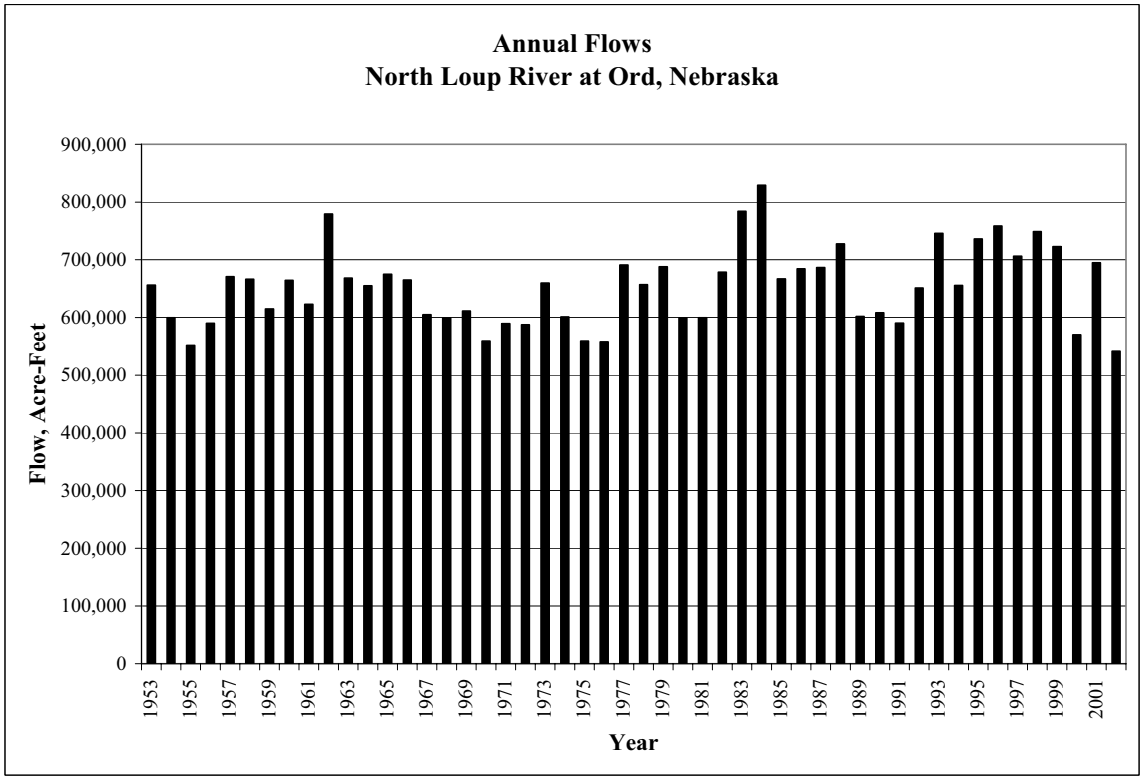


Figure L-53. Annual Flows, North Loup River at Ord.



Data from: US Geological Survey and NE Department of Natural Resources

Figure L-54. Annual Flows, North Loup River near St. Paul.

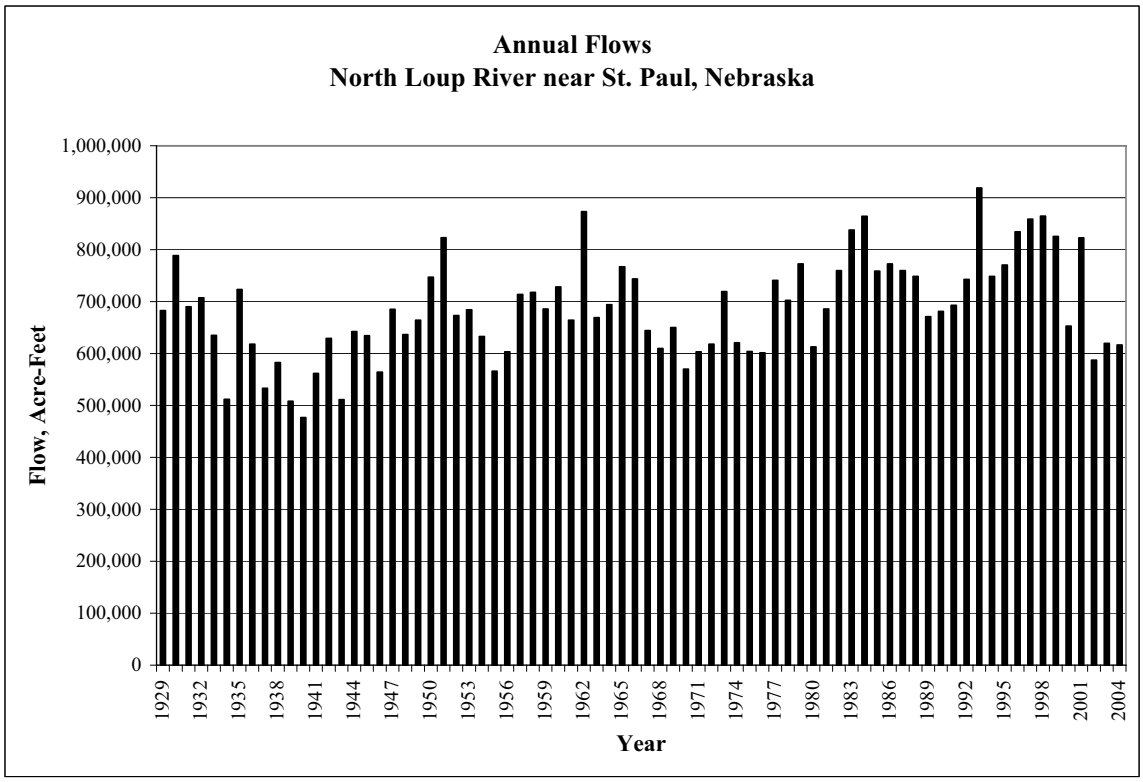
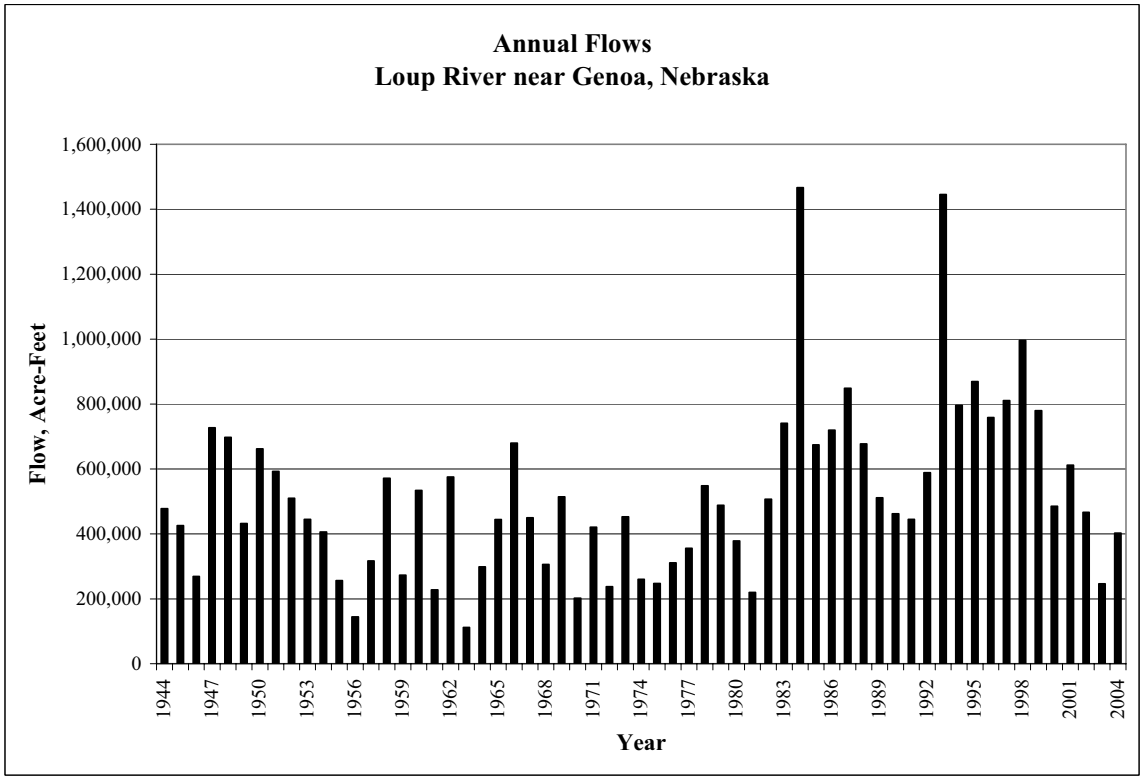


Figure L-55. Annual Flows, Loup River near Genoa.



Data from: US Geological Survey and NE Department of Natural Resources

Planning and Assistance Division

Stream Gages

LOUP RIVER BASIN

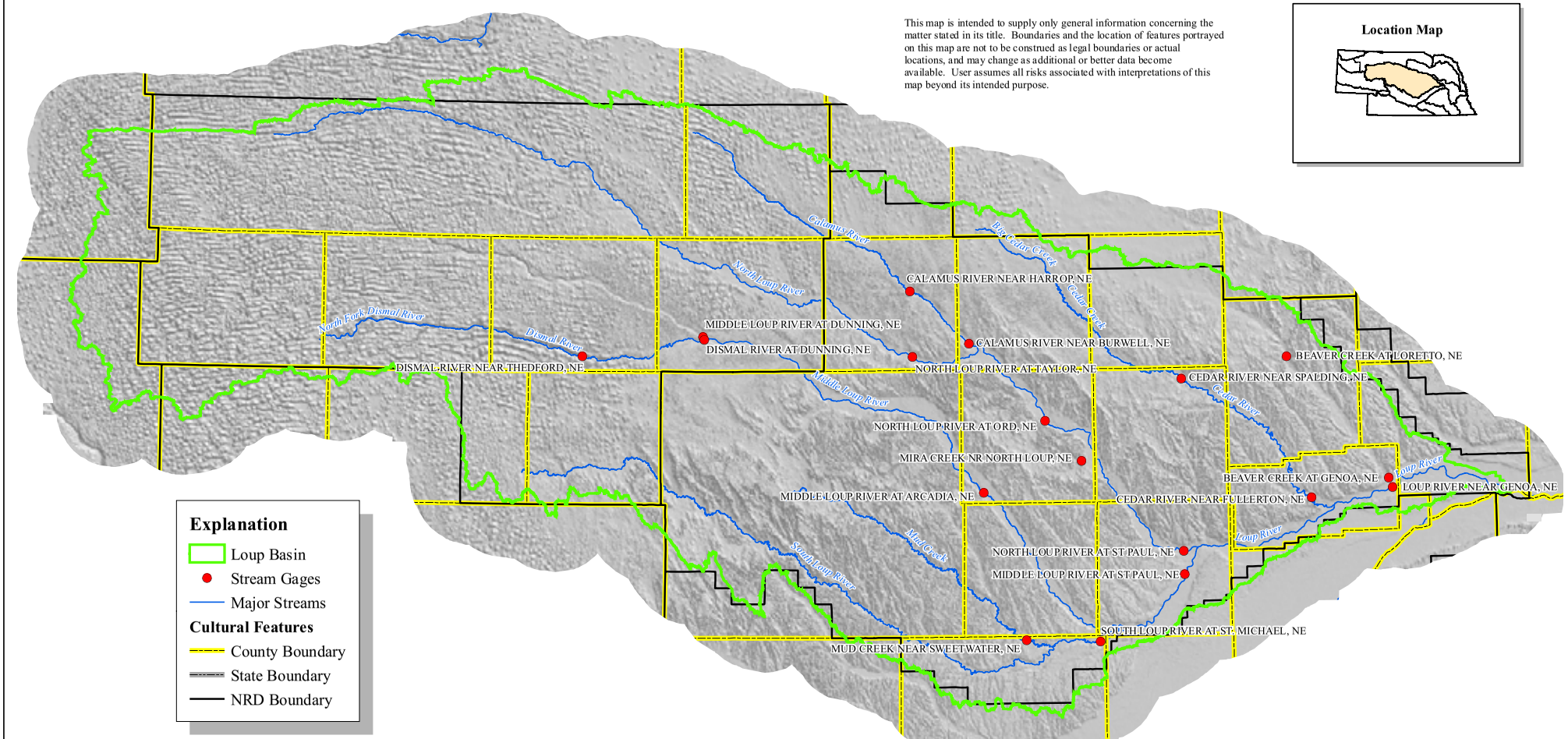
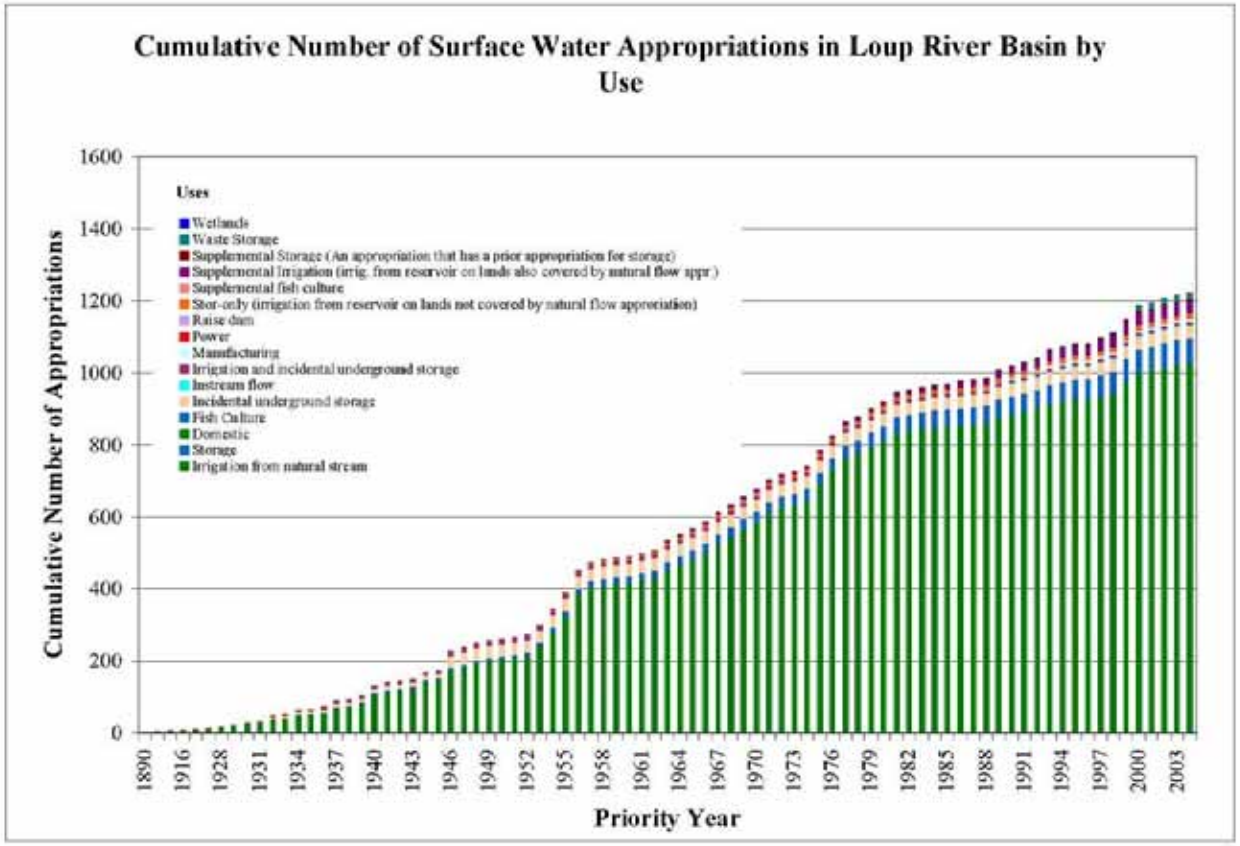


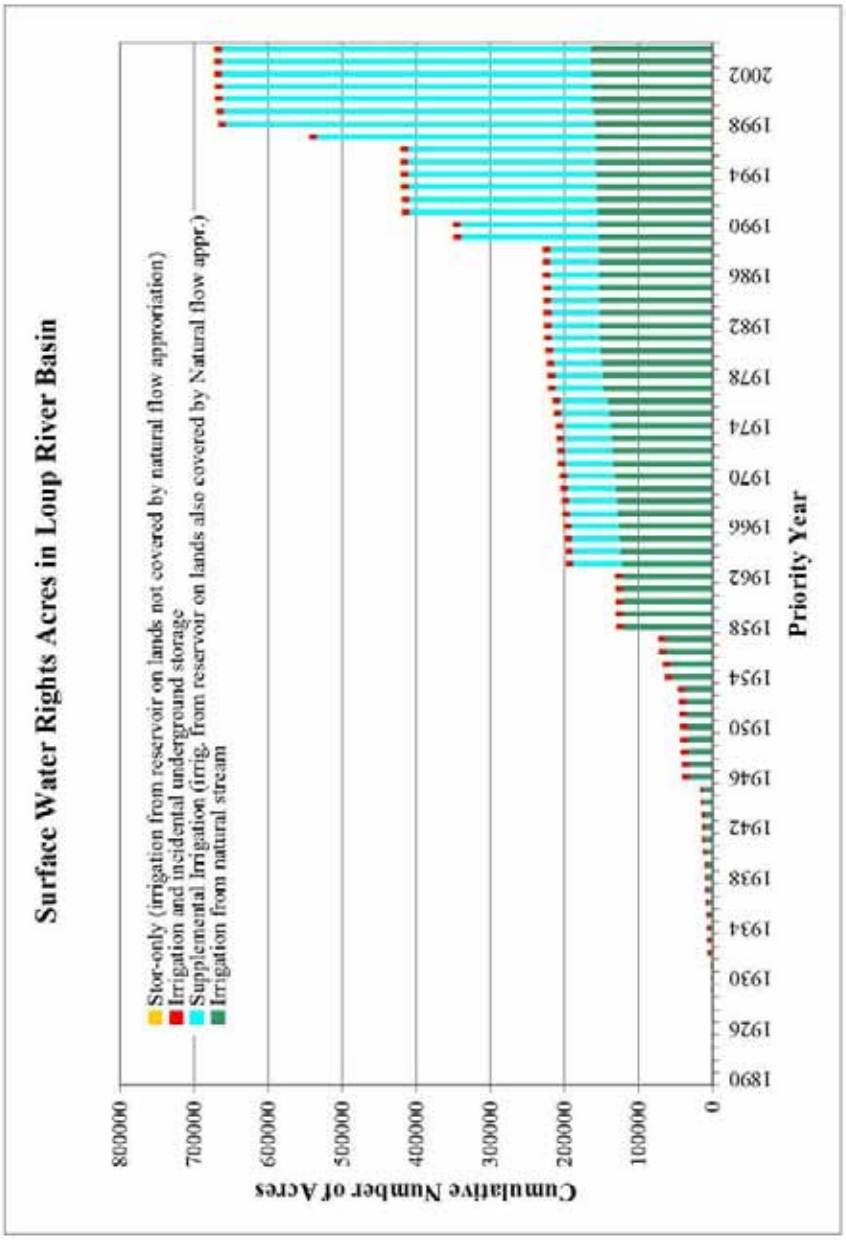
Figure L-56.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Stream gages map produced by Jeff Shafer, October 19, 2005.



Source: DNR Surface Water Rights Database
Figure L-57

11/23/2005 by Shuhai Zheng



Source: DNR Surface Water Rights Database
Figure L-58

11/29/2005 by Shuhai Zheng

Planning and Assistance Division

Surface Water Points of Diversion

LOUP RIVER BASIN

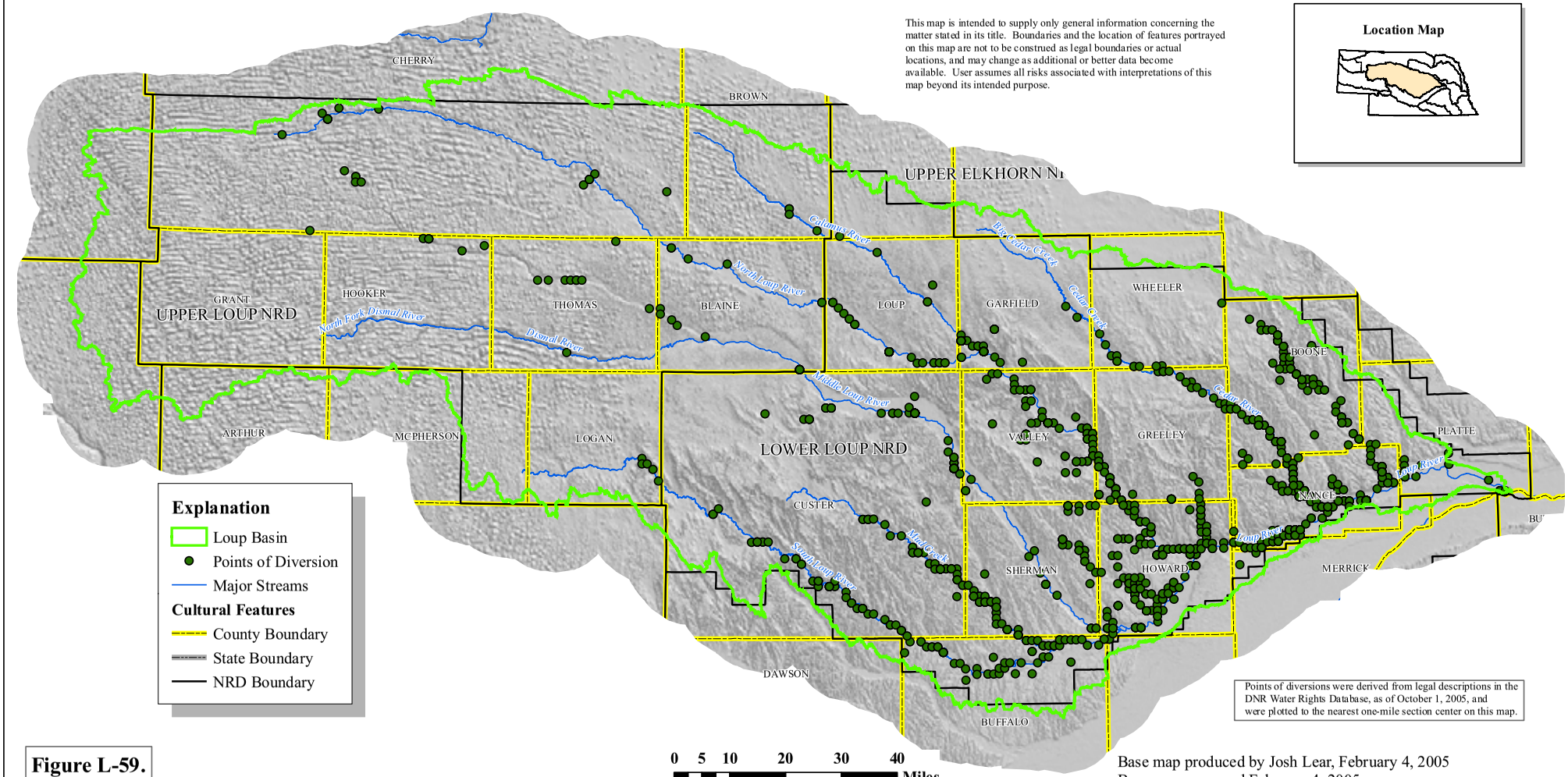


Figure L-59.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Points of diversion map produced by Shuhai Zheng, October 11, 2005.

Figure L-60. Annual Diversions, Burwell-Sumter Canal.

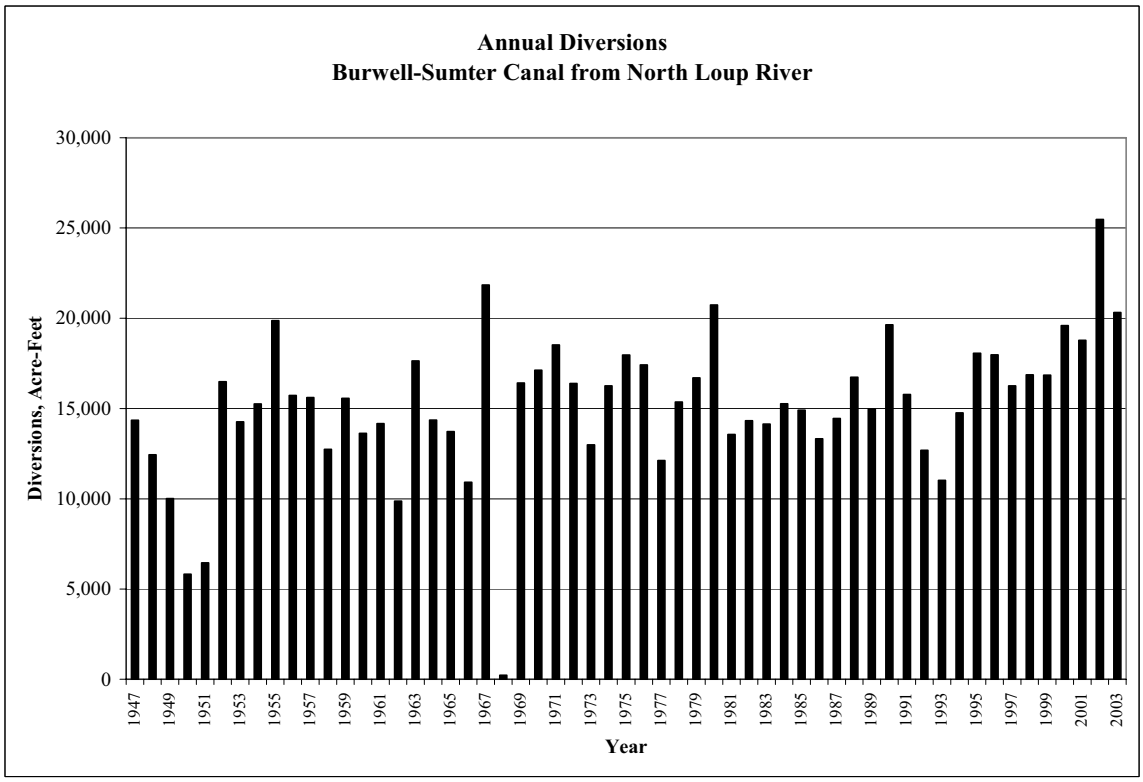
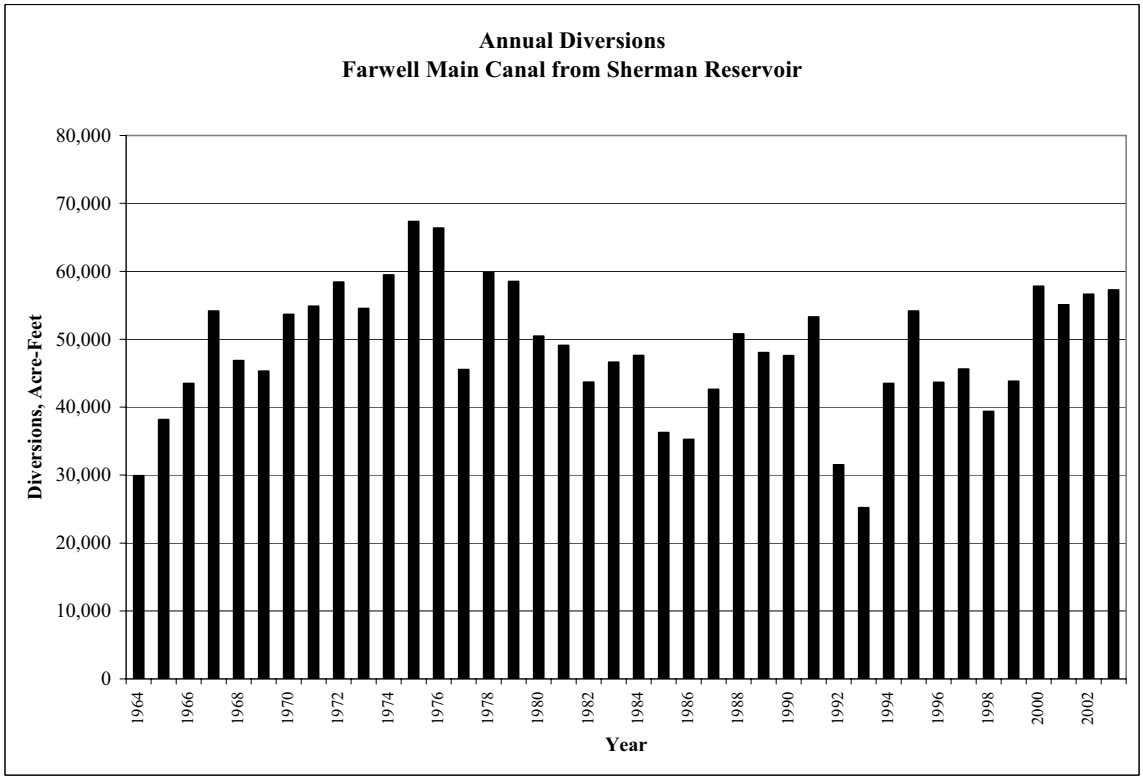


Figure L-61. Annual Diversions, Farwell Main Canal.



Source: NE Department of Natural Resources

Figure L-62. Annual Diversions, Farwell South Canal.

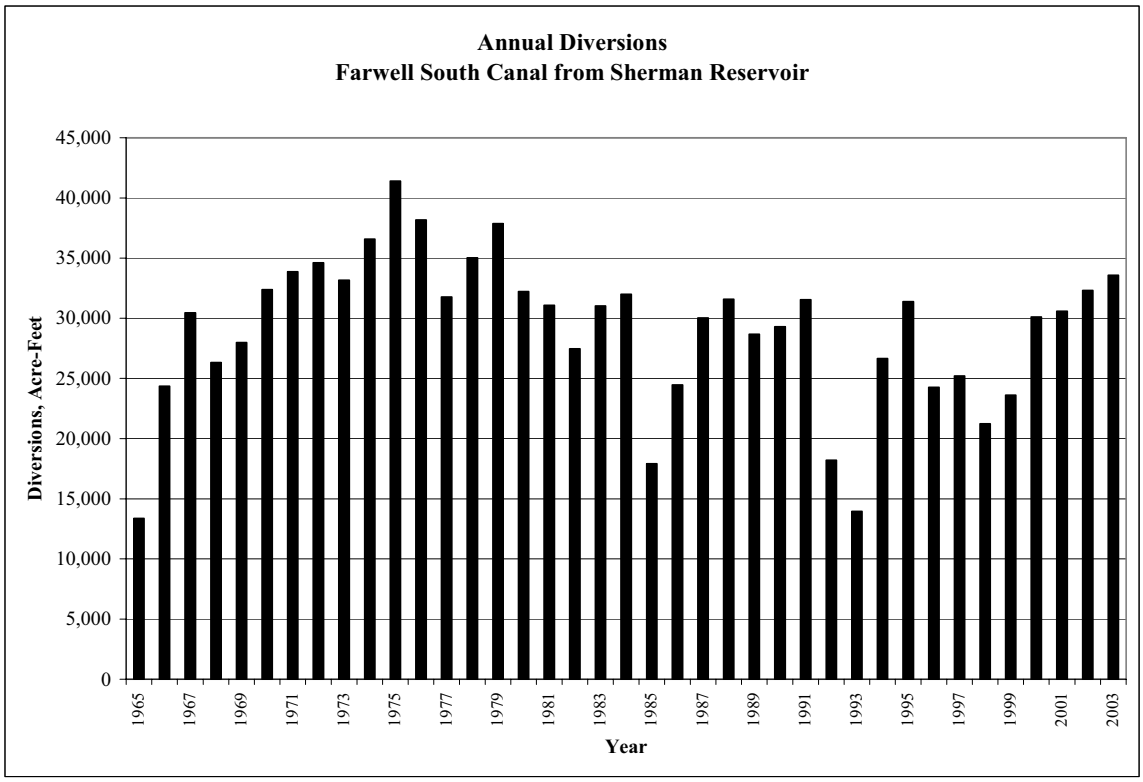
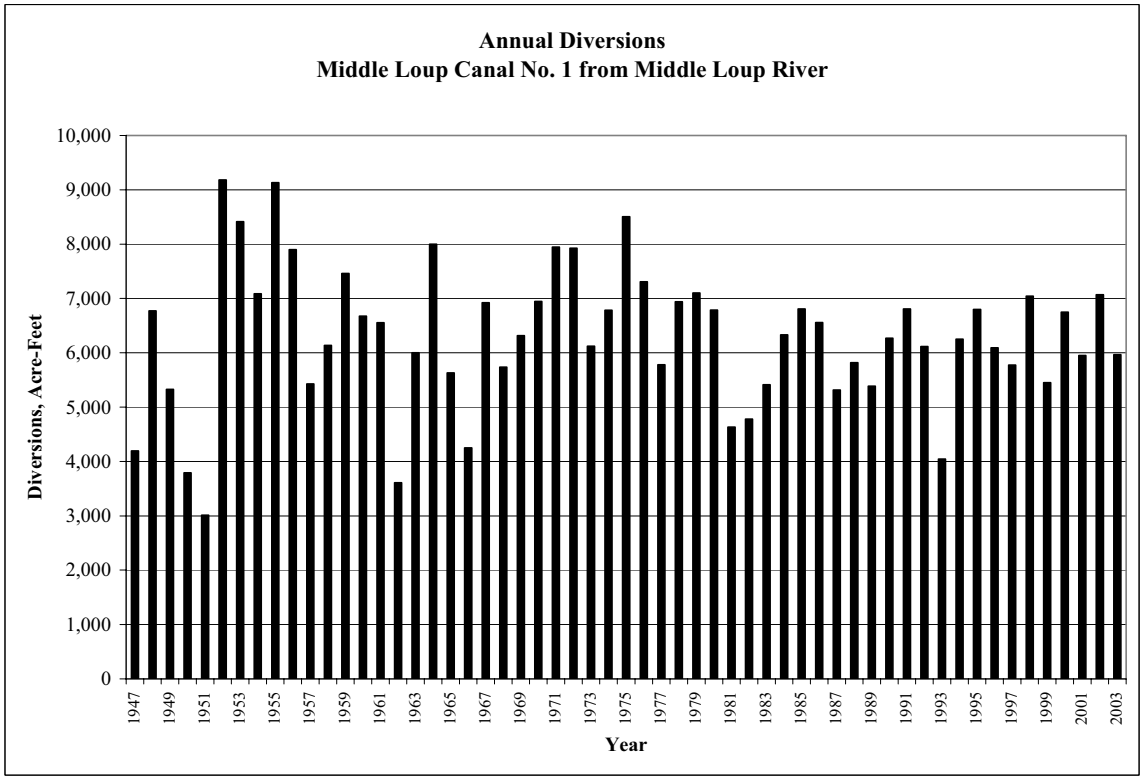


Figure L-63. Annual Diversions, Middle Loup Canal No. 1.



Source: NE Department of Natural Resources

Figure L-64. Annual Diversions, Middle Loup Canal No. 2.

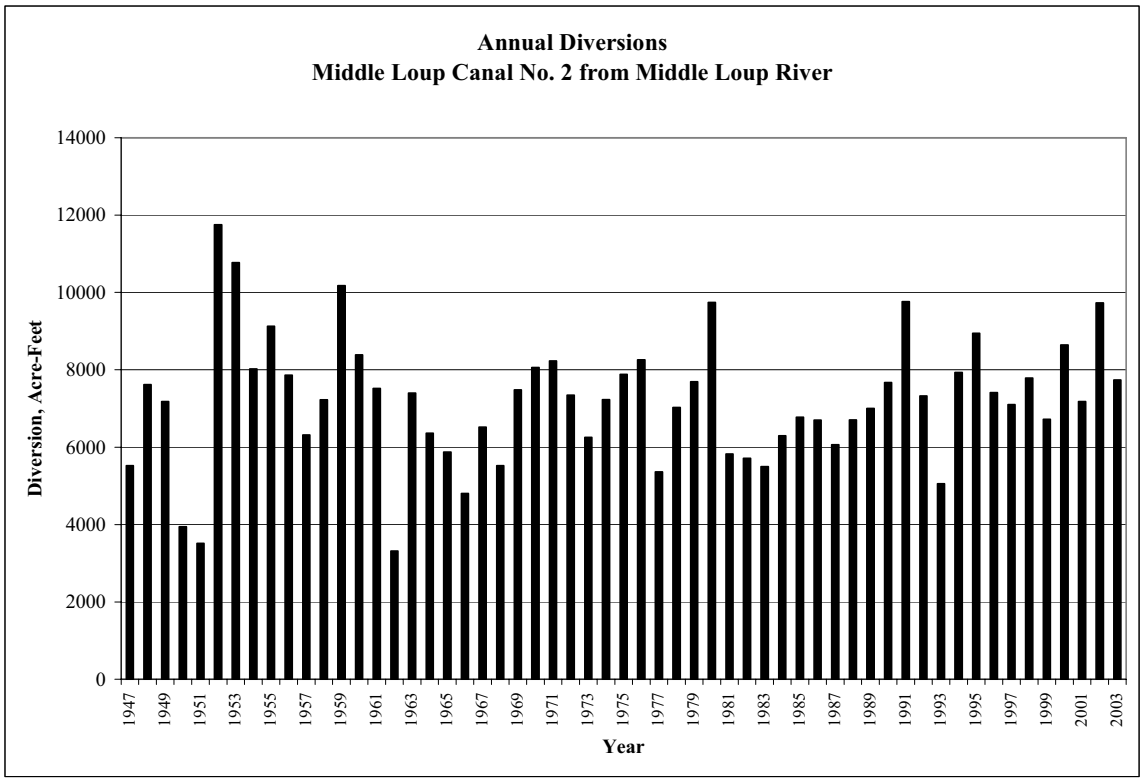
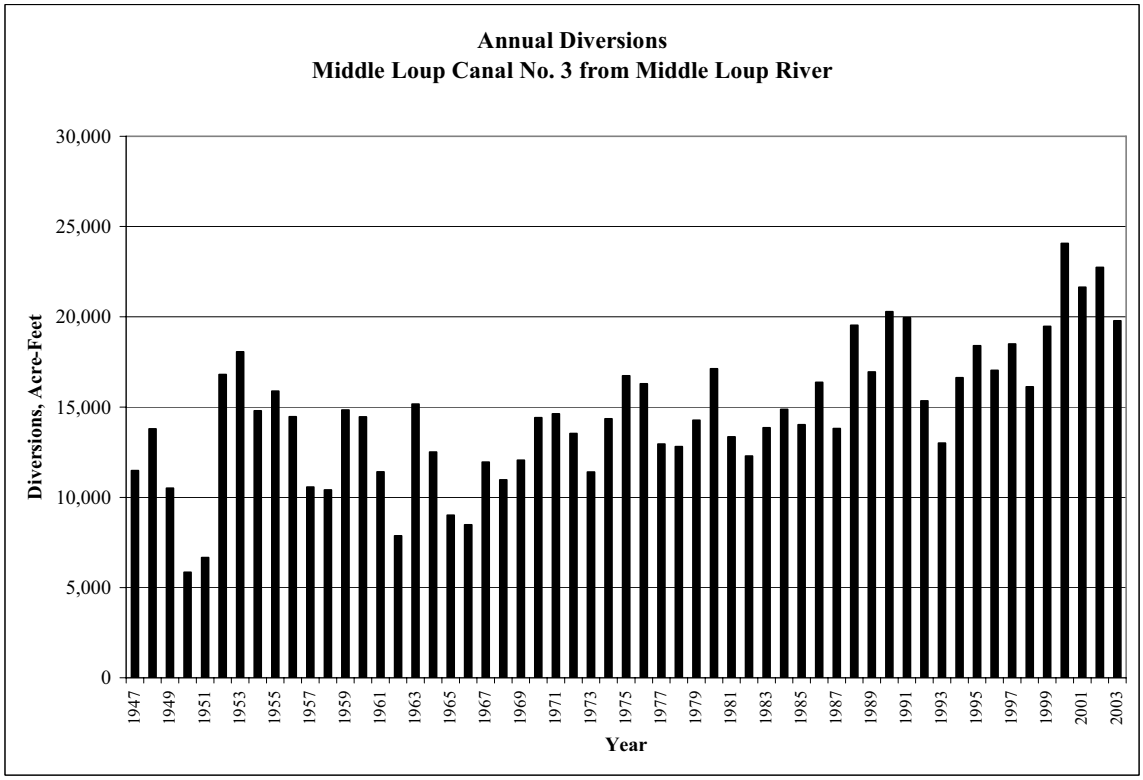


Figure L-65. Annual Diversions, Middle Loup Canal No. 3.



Source: NE Department of Natural Resources

Figure L-66. Annual Diversions, Middle Loup Canal No. 4.

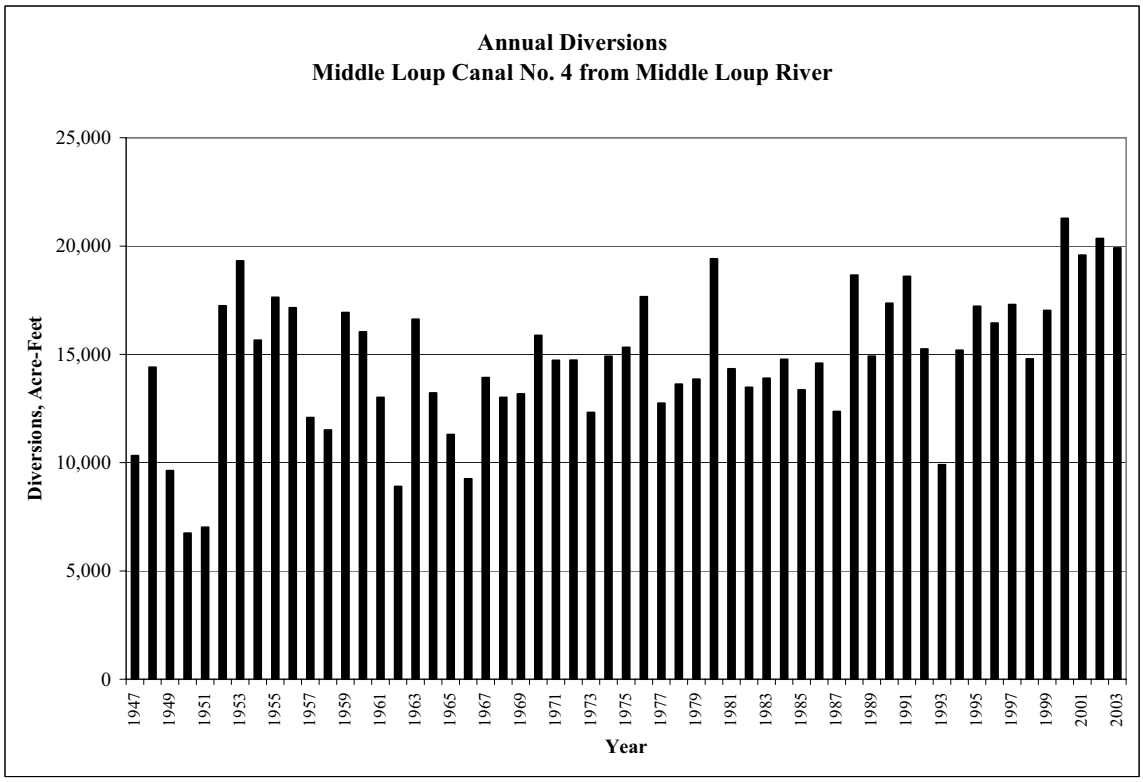
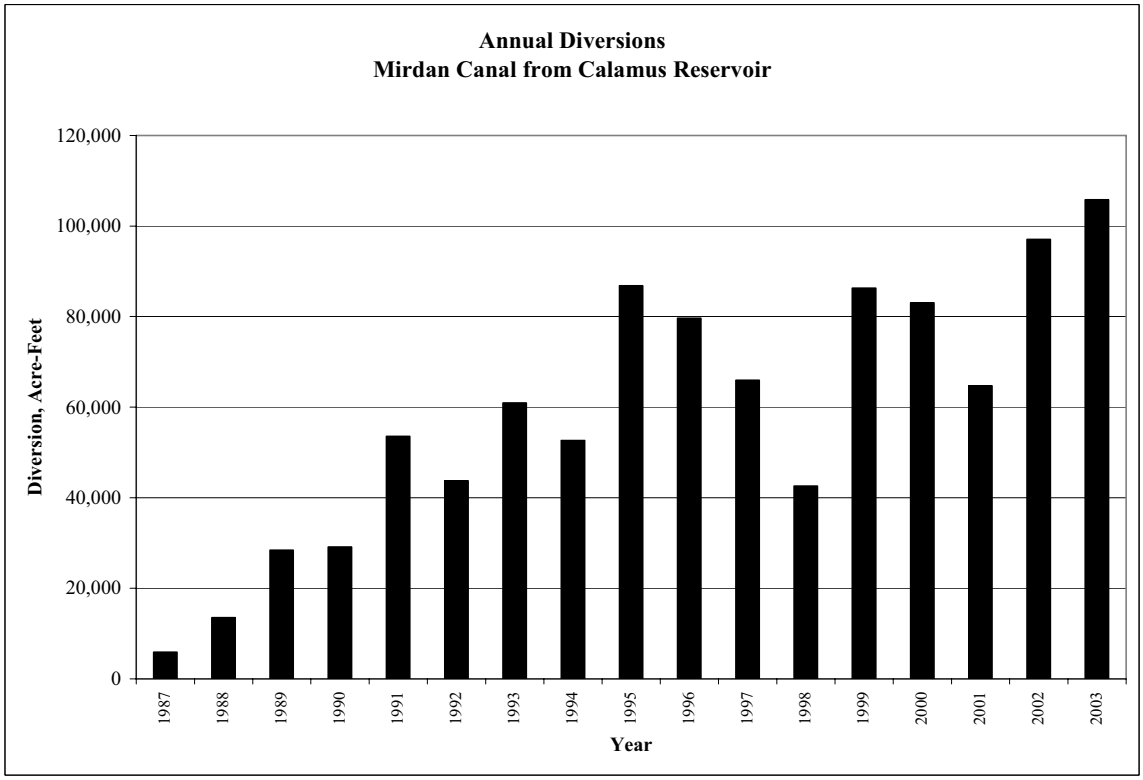


Figure L-67. Annual Diversions, Mirdan Canal.



Source: NE Department of Natural Resources

Figure L-68. Annual Diversions, Ord-North Loup Canal.

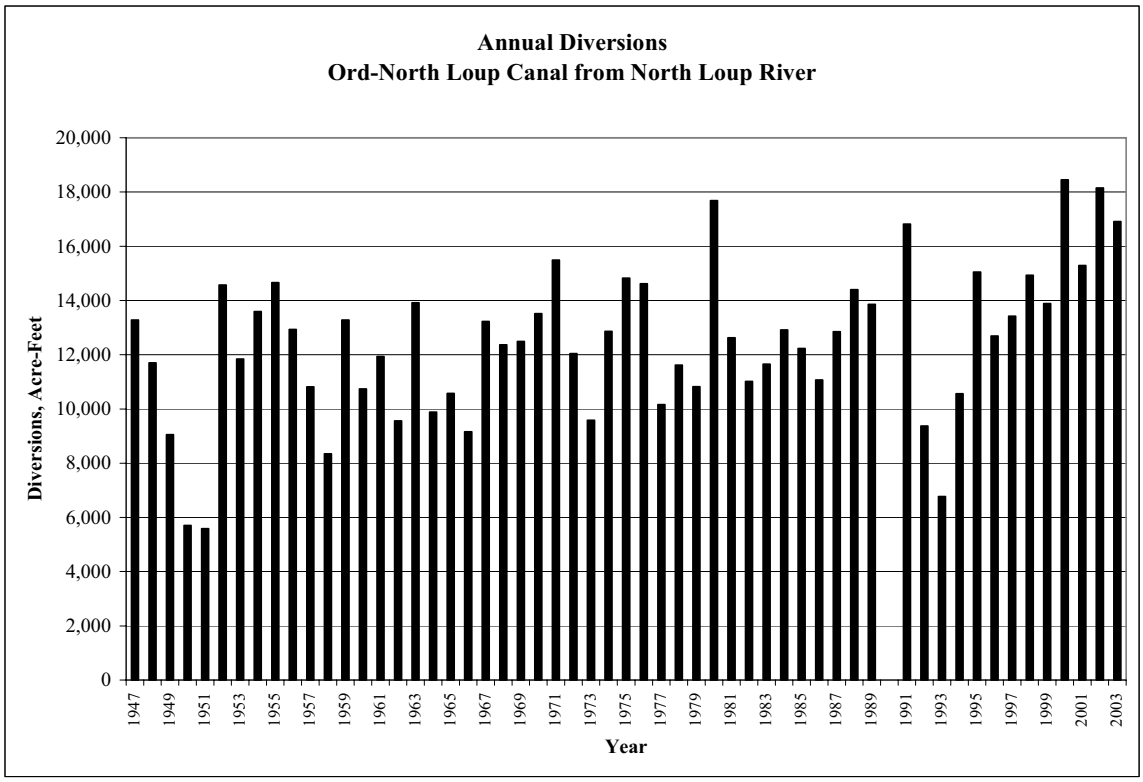
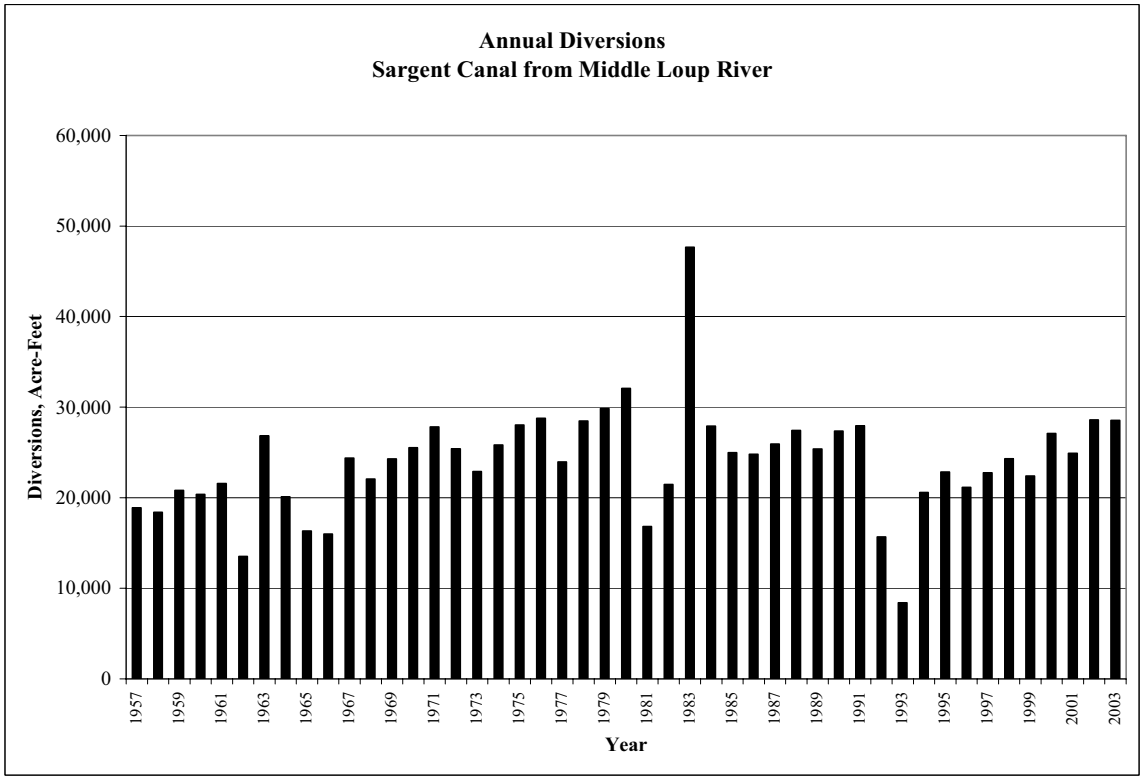


Figure L-69. Annual Diversions, Sargent Canal.



Source: NE Department of Natural Resources

Figure L-70. Annual Diversions, Taylor-Ord Canal.

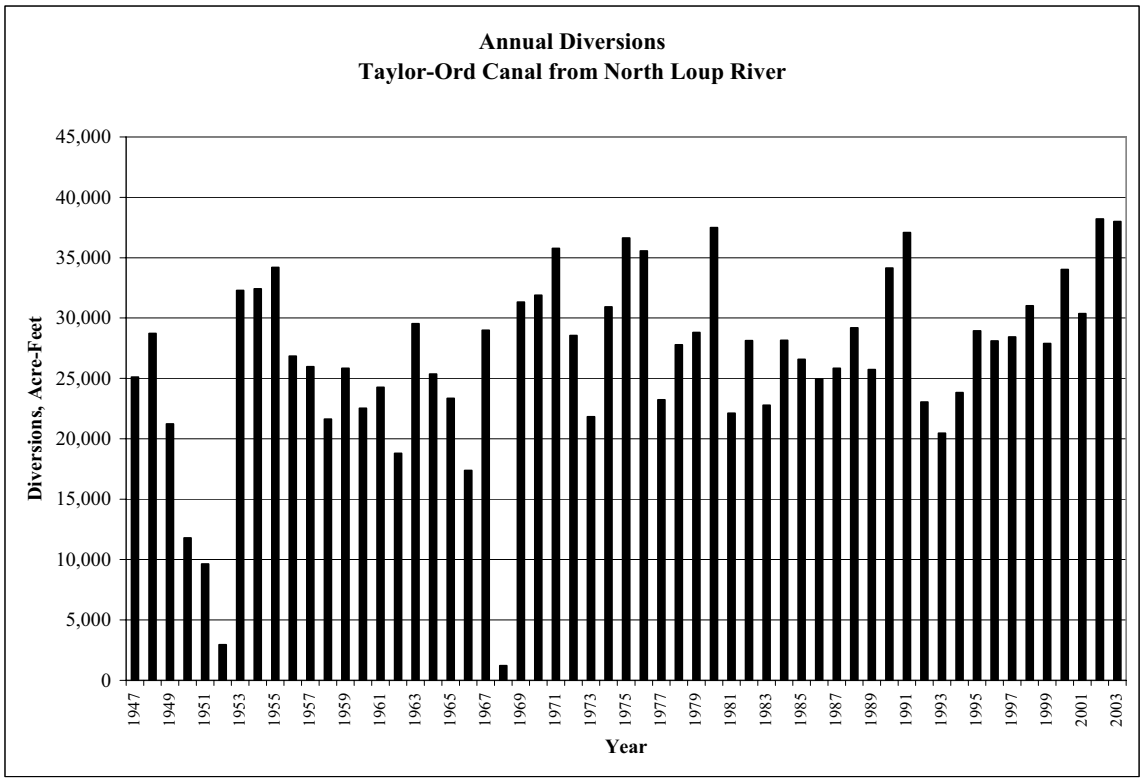
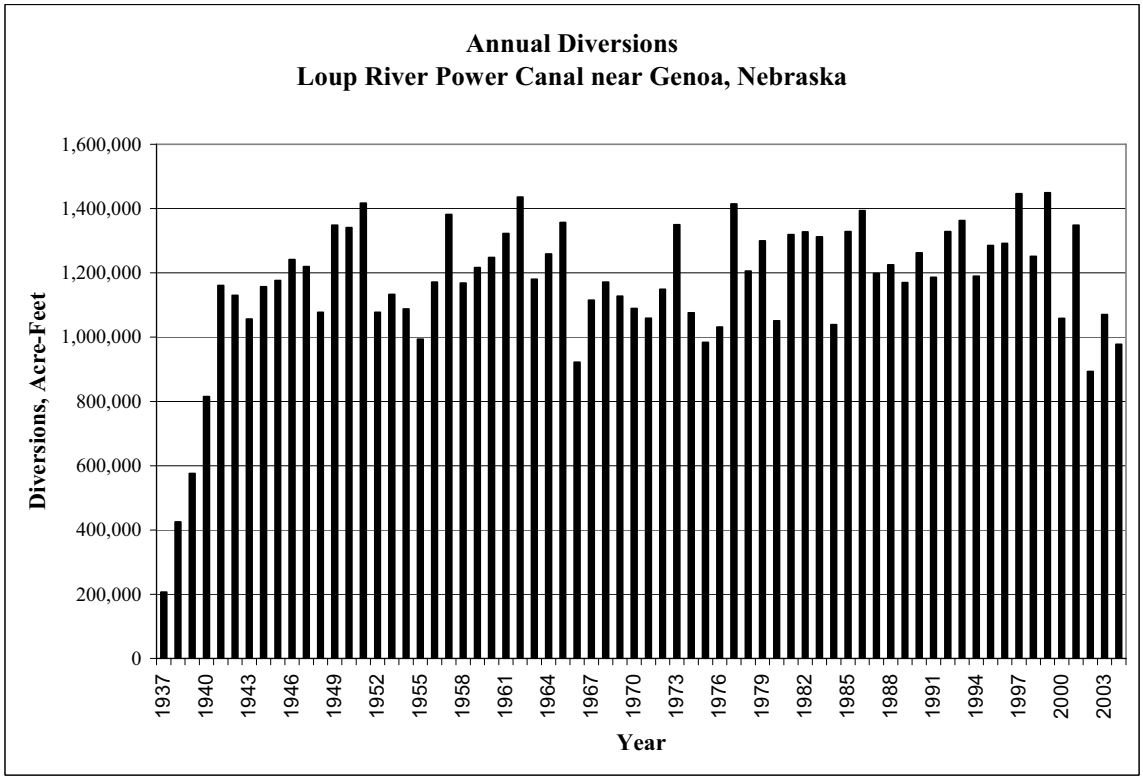


Figure L-71. Annual Diversions, Loup Power Canal.



Source: NE Department of Natural Resources

Planning and Assistance Division

Map of Geographic Area within which Surface Water and Ground Water Are Hydrologically Connected For Purposes of the Determination of Fully Appropriated

NEBRASKA DEPARTMENT OF NATURAL RESOURCES
LOUP RIVER BASIN

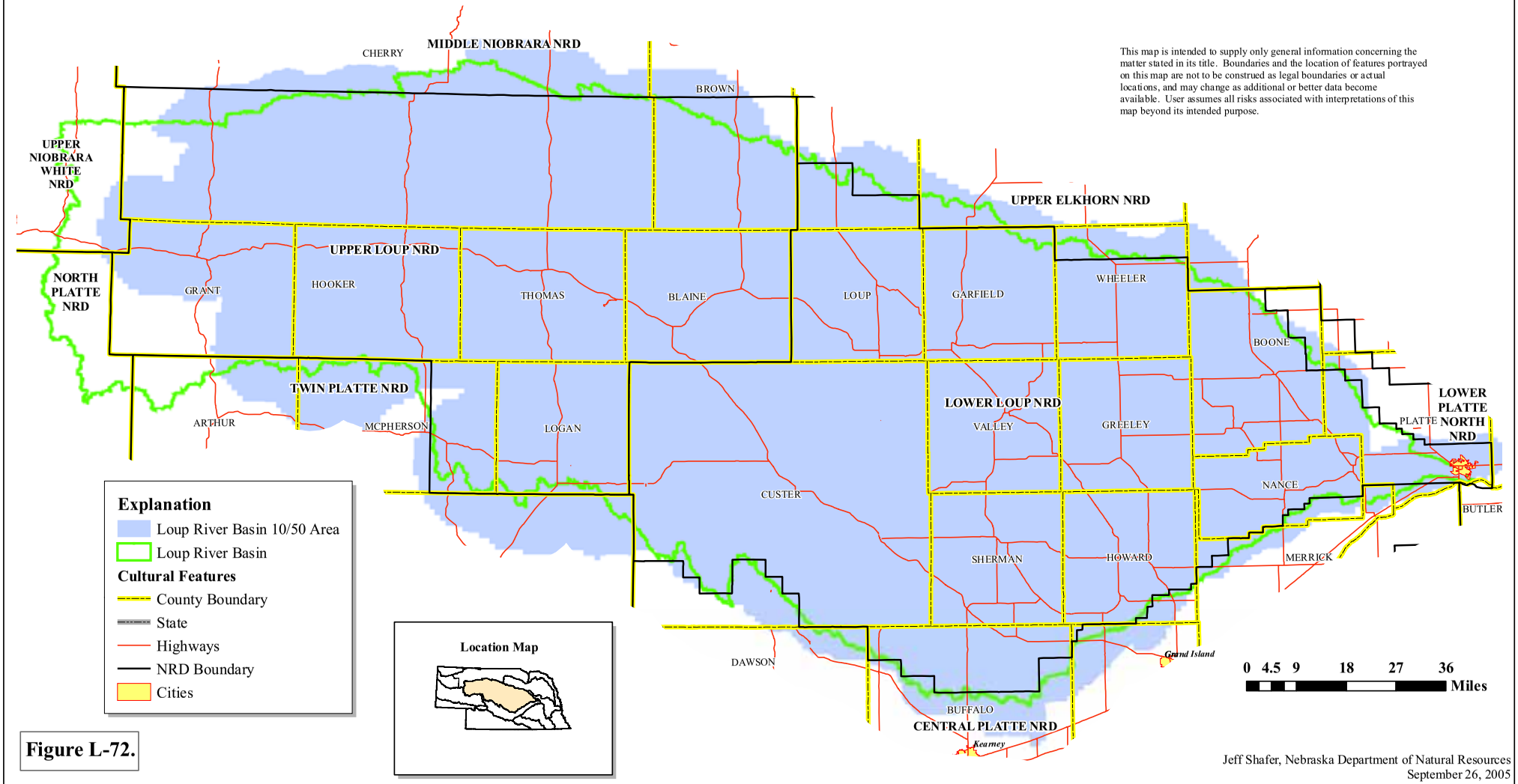
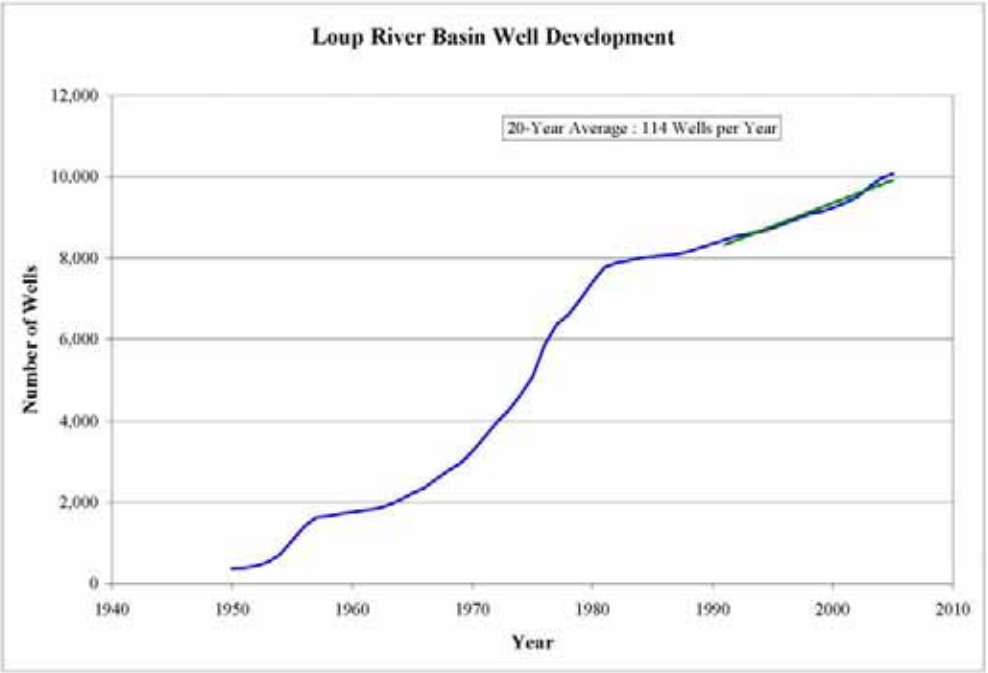


Figure L-72.

Jeff Shafer, Nebraska Department of Natural Resources
September 26, 2005

Figure L-73. Historic High Capacity Well Development in the Loup Basin.



Source: DNR Registered Ground Water Well Database

Planning and Assistance Division

Net Corn Crop Irrigation Requirements

LOUP RIVER BASIN

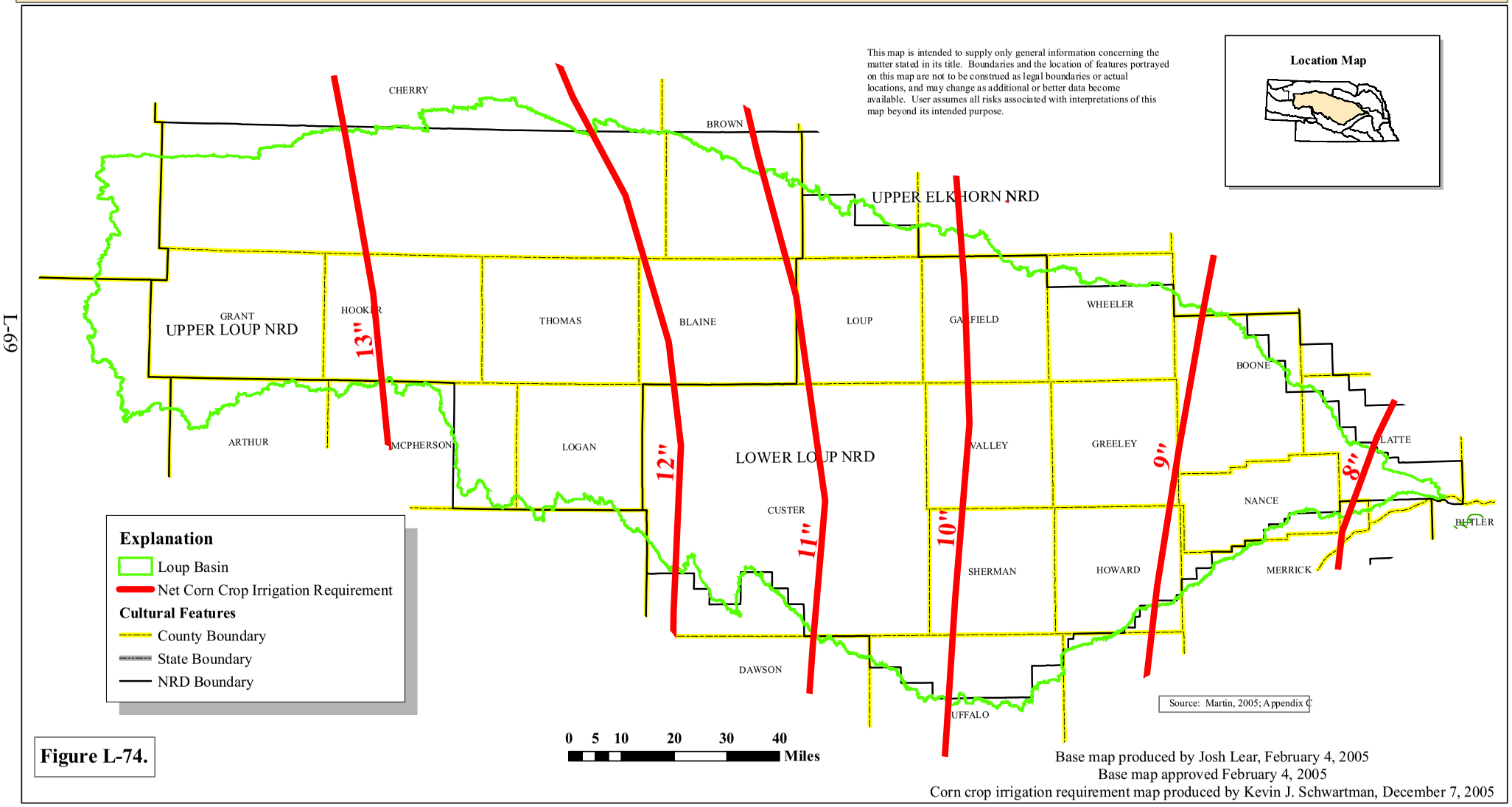


Figure L-74.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Corn crop irrigation requirement map produced by Kevin J. Schwartman, December 7, 2005

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Citation

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Citation

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Citation

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