Participant Section for Lincoln

Lower Platte South NRD Multi-Jurisdictional Hazard Mitigation Plan

November 2008

JEO project # 385D23

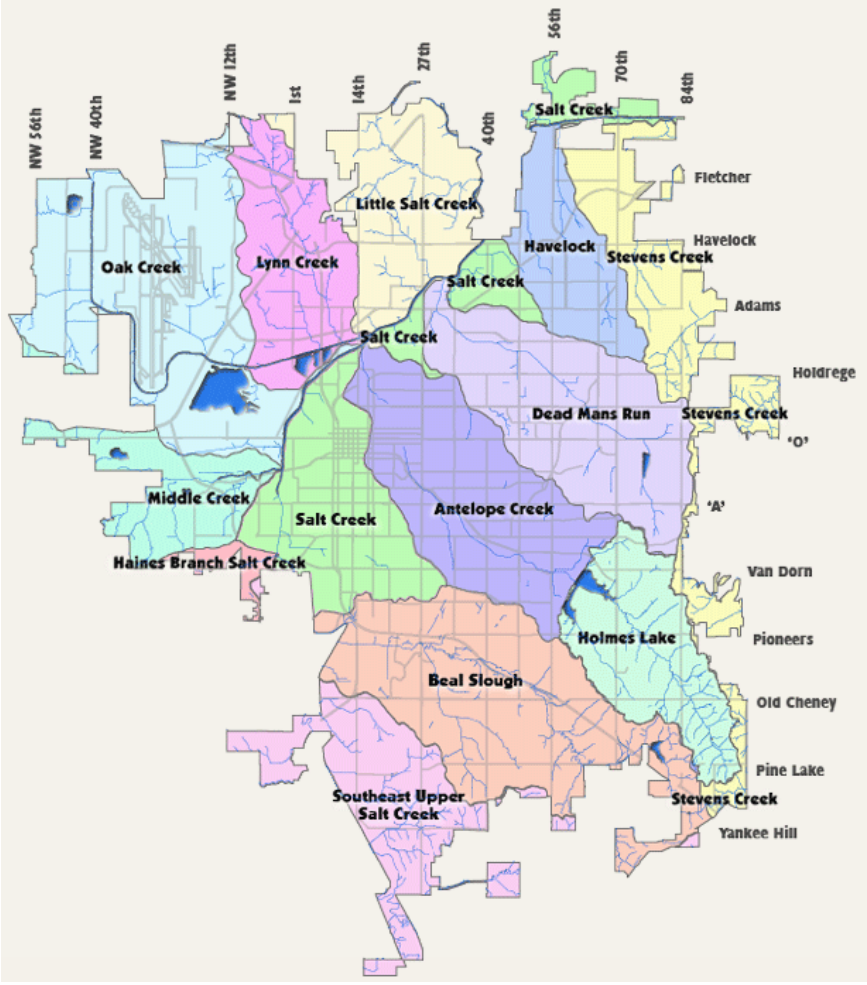
LINCOLN BACKGROUND

LOCATION/GEOGRAPHY/CLIMATE

The City of Lincoln is the center and most populated city of Lancaster County. Located 55 miles west of the eastern state border, the City covers an area of 75.4 square miles comprised of 0.98 percent water. Originally laid out near Salt Creek, the area was selected for its salt flats, marshes, and nearly flat saline wetlands. Lincoln's landscape is mainly comprised of gently rolling hills and sits at 1,189 feet above sea level.

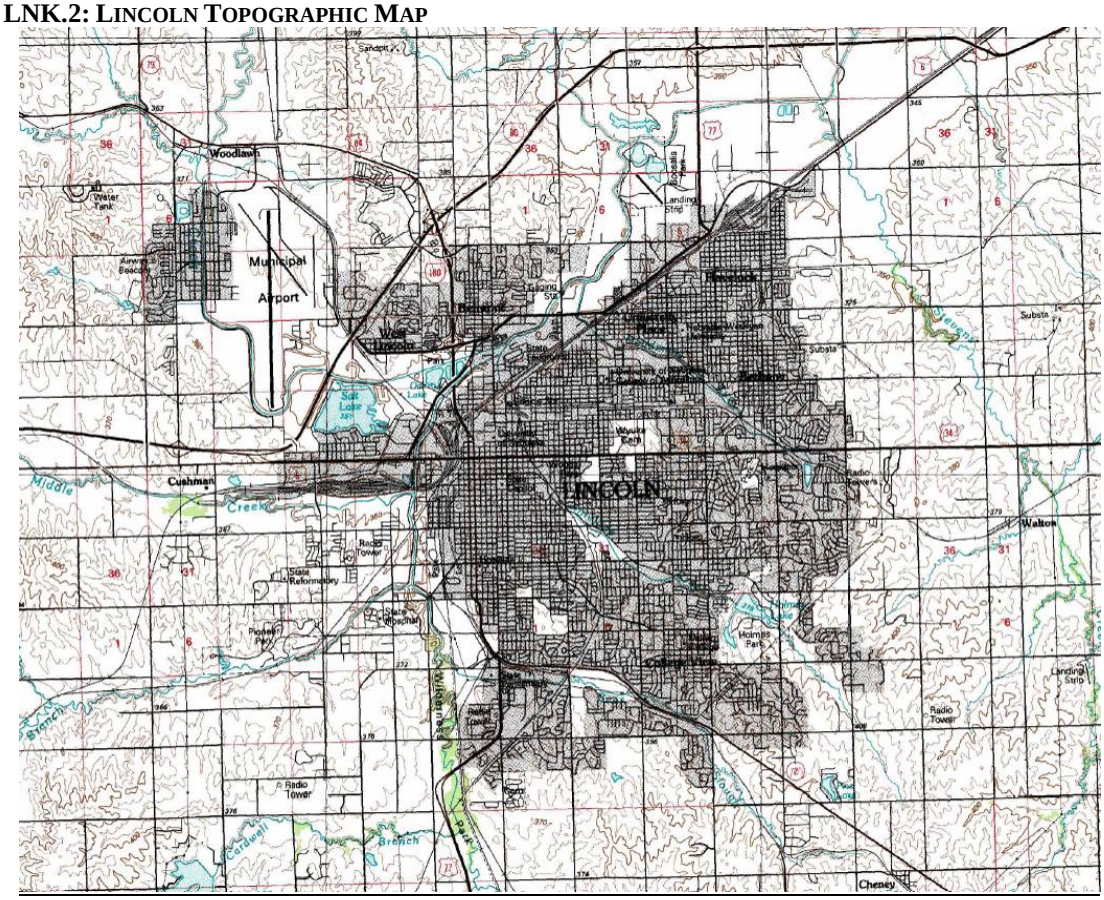
Lincoln's Salt Creek Watershed is comprised of a series of sub-basins such as; Antelope Creek, Beal Slough, Cardwell, Dead Man's Run, Haines Branch Salt Creek, Havelock, Little Salt Creek, Lynn, Middle Creek, Oak Creek, Southeast Upper Salt Creek (SEUSC), and Stevens Creek basins. Below in Figure LNK.1, is Lincoln's watershed map as provided by the City of Lincoln's website: http://lincoln.ne.gov/city/pworks/watrshed.

FIGURE LNK.1: CITY OF LINCOLN WATERSHED MAP



According to the High Plains Regional Climate Center School of National Resources of the University of Nebraska Lincoln, the average high temperature in July is 89.6 degrees while the average January temperature is 11.5 degrees. The highest and lowest temperatures recorded are 115 degrees on July 25th, 1936 and -33 degrees on January 12, 1974. The average annual precipitation, which falls as rain, snow, and sometimes hail, is approximately 28 inches per year. May has the highest precipitation average of 4.23 inches.

FIGURE LNK.2: LINCOLN TOPOGRAPHIC MAP



HISTORY AND DEVELOPMENT OF LINCOLN

Lincoln is the capitol city of Nebraska and is the seat of the county government. Originally known as "Lancaster," the City's name was changed to Lincoln after a legislative motion. The City was incorporated on April 7, 1869.

To insure that the City would prosper, state government and major state institutions were moved to Lincoln. The City also worked hard to recruit railroad services by offering bounties. In fact, the first train arrived and claimed a $50,000 prize on June 26, 1870. Thereafter, the City's population went from 2,500 residents in 1870 to 7,000 residents by 1875, and 13,000 residents by 1880.

Lincoln continued to grow and expand in every direction by 1890, except to the northwest where the rail yards and Salt Creek acted as barriers for the burgeoning 55,000 residents. It was the nationwide depression in the 1890's that adversely impacted Lincoln's population causing a decline to 37,000 by 1900. However, by the early 20th century a significant influx of Germans from Russia helped bolster the city.

In the late 1800's, satellite towns just outside the city began to emerge:

- In 1888, East of Lincoln's city limits, Nebraska Wesleyan University was established. The following year the site was incorporated as "University Place." By 1926 the community had reached 5,000 residents and was incorporated.

- In 1889, Nebraska Christian University was established. The community in 1890 was incorporated as "Bethany Heights." In 1922 the community residents voted to join Lincoln, and it wasn't until four years later was it annexed.

- In 1892, "College View" was incorporated with 1,000 residents. In 1929 Lincoln annexed the community when the population reached 2,900.

- The blue-collar suburban town of "Havelock", northeast of University Place, was incorporated in 1893. Havelock grew to 3,602 residents by 1920 and actively opposed annexation by Lincoln, until a strike by the Burlington Shops in 1922 continued without resolution.

- West Lincoln, which was established in 1887 on the west bank of the Salt Creek, was annexed in the 1960's after an increased interest in aviation was spawned as a result of the Lincoln Army Air Field (1942). Over 25,000 aviation mechanics were trained in Lincoln and 40,000 troopers were processed for combat through the facility.

LINCOLN ELECTRIC SYSTEM (LES)

Lincoln Electric System (LES), formed on February 1, 1966, is a single power utility that provides power in and around Lincoln, and is owned by the City. In 1970 Lincoln voters approved formation of a semi-autonomous administrative board of local citizens to oversee operations of the non-profit, customer-owned utility. LES currently serves an approximate 200 square miles within Lancaster County, including the communities of Lincoln, Prairie Home, Waverly, Walton, Cheney and Emerald. Lincoln Electric System services over 180,000 residential customers and 15,000 commercial and industrial customers.

LINCOLN WATER SYSTEM (LWS)

Lincoln Water System (LWS) is part of the Public Works and Utilities Department. As defined by the Lincoln Municipal Code Title 17-Water/Wastewater, they are the property, organization, and operation of the public water supply system, waterworks, water mains, and each and every part thereof. They have two treatment plants located in Ashland that serves 240,000 citizens in the City of Lincoln by way of 1,200 miles of pipe; Of the approximate 70,000 water services provided by LWS, 90 percent are residential, the remaining ten percent commercial and industrial. Additionally, LWS provides water for recreational facilities such as parks and pools and maintains a fire protection system that involves over 9,000 fire hydrants.

Currently, as of 2008, Lincoln Water System is undergoing the construction of a new sixty-inch water main to increase capacity for ten miles from Greenwood to Ashland. General fund tax dollars do not support the LWS; water rates pay for planned future expansion, operation, and maintenance costs associated with running the system.

LINCOLN WASTEWATER SYSTEM TREATMENT FACILITIES

The Lincoln Wastewater System treats Lincoln's residential and industrial wastewater at two local facilities; the Theresa Street Plant and the Northeast Facility. Lincoln's wastewater collection dates back to 1888, when the first sewer lines were installed, but it wasn't until 1923 that the original wastewater treatment facilities were constructed at the Theresa Street site. Multiple expansions were made to the Theresa Plant until 1980 when it was decided to construct a second plant, the Northeast Facility.

Continual testing, maintenance and improvements are being made by the 100-plus employees of the Lincoln Wastewater System. Between the two facilities, approximately 24.5 million gallons of wastewater are treated daily. The Theresa Street facility receives close to two-thirds of Lincoln's wastewater, presently treating about 18 million gallons per day, the Northeast facility treating around 6.5 million gallons a day.

LINCOLN DEMOGRAPHICS

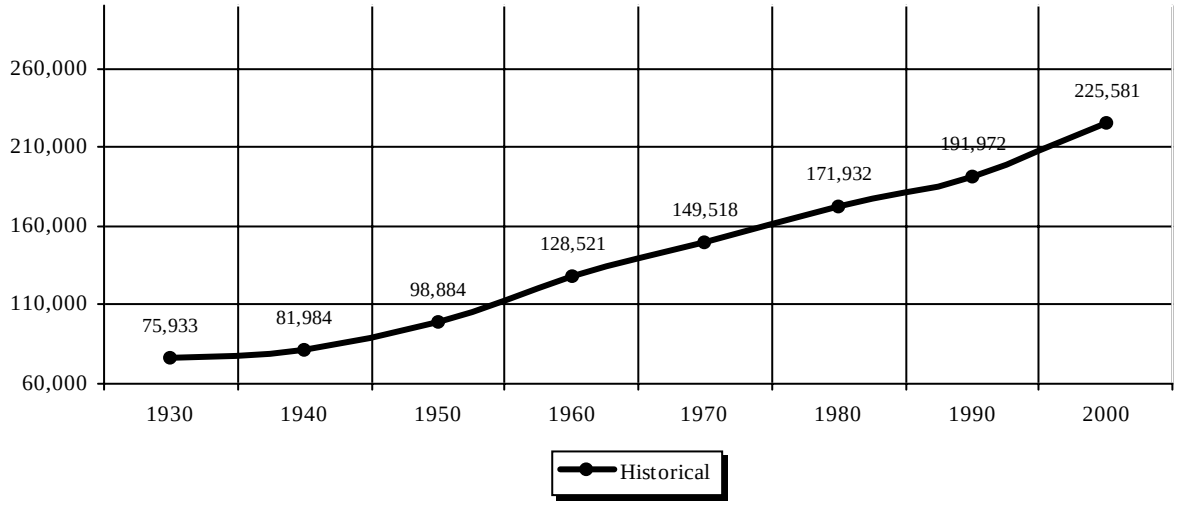
Lincoln's population has steadily increased from 1930 to 2000. Some of the increase was the result of the annexations of surrounding communities. The population has nearly tripled since 1930 to 2000 from 75,933 residents to 225,581 residents.

Between the years of 1990 and 2000, Lincoln and Lancaster County's minority communities more than doubled; markedly occurring within the Black/African Americans, Asians, and "Other" racial groups. This trend is anticipated to continue into the future.

The City of Lincoln's population makes up about 90 percent of Lancaster County's population. The Lincoln/Lancaster County Comprehensive Plan indicates that Lincoln's population is expected to reach 350,000 by 2030, growing at a rate of about 1.5 percent per year.

Lincoln's population density since 1970 has remained about 3,000 persons per square mile. The Lincoln/Lancaster County Comprehensive Plan expects that the overall city-wide population density to stay around 3,000 persons per square mile for the next 25 years.

FIGURE LNK.3: LINCOLN, NEBRASKA POPULATION 1930-2000



FUTURE DEVELOPMENT TRENDS

As Lincoln's population grows, so too will the number of structures within. In 1990, Lincoln had 91 percent of Lancaster County's dwelling units at 79,079 units. From 1991 to 2000, dwelling unit construction permits were issued for 17,867 units in Lincoln. In 2000, Lincoln had 91.3 percent of Lancaster County's dwelling units at 95,199. From the 2006 Lincoln/Lancaster County Comprehensive Plan, it is assumed by 2030 that 52 square miles of service limits will be incorporated and somewhere around 53,000 dwelling units will be added. This averages out to be around 2,200 dwelling units per year.

Urban growth in Lincoln is expected to expand in multiple directions around the City. Growth building on the foundations of Lincoln's established neighborhoods, as well as growth and strengthening of its downtown core, are the anticipated primary areas for urban growth and development.

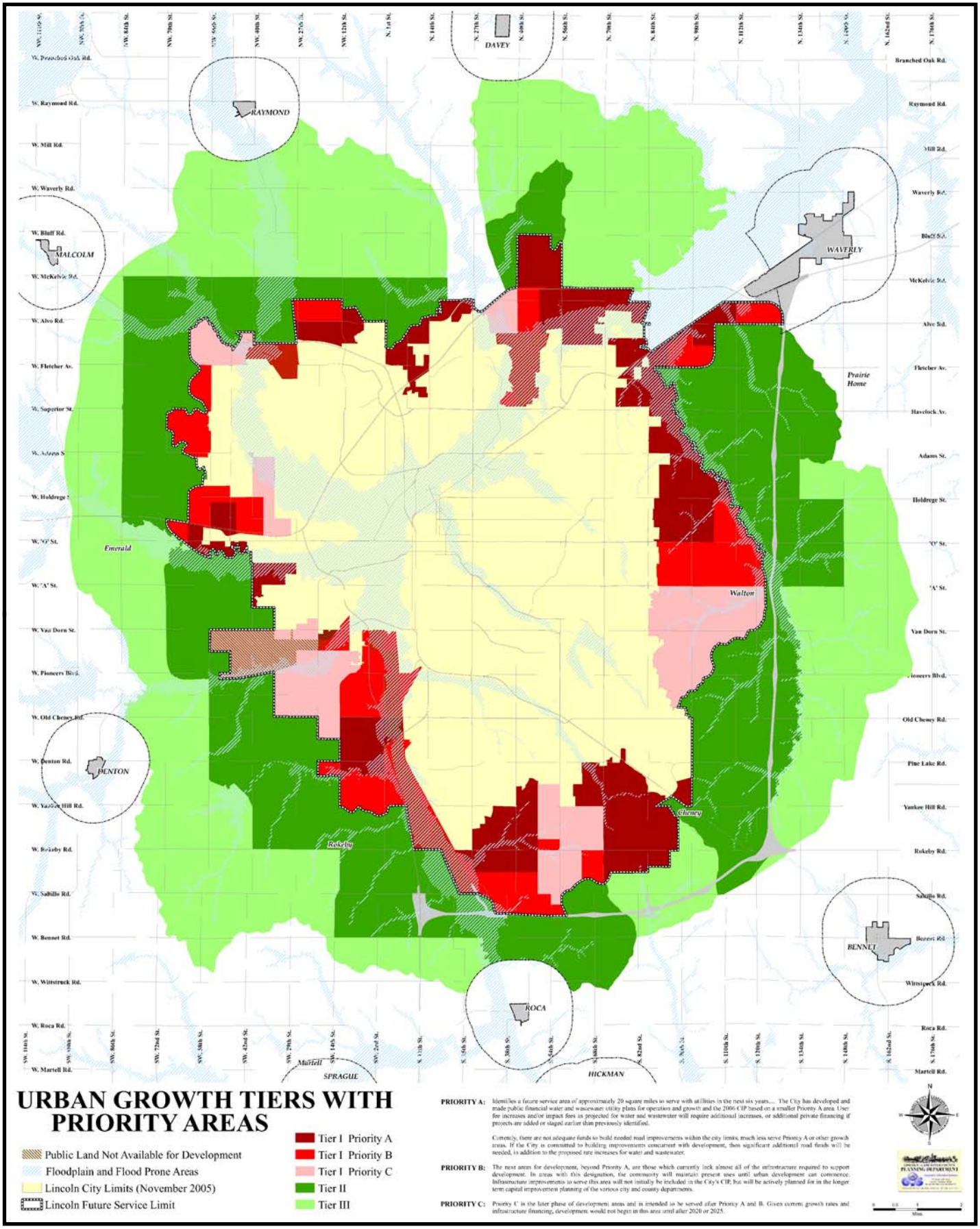
The City of Lincoln encourages the preservation and renewal of historic buildings, districts and landscapes. Development in and around these areas is expected to maintain the integrity of these historical patterns and precedents. Additionally, conservation methods are expected to be implemented when developing in natural, and environmentally sensitive areas.

The following tier map, Figure LNK.4, reflects Lincoln's urban growth tiers with priority areas for the next 50 plus years. This figure is taken directly from the 2006 Lincoln/ Lancaster County Comprehensive Plan.

Tier I is a 52 square mile area that is expected to be developed within the next 25 year period. Land within this area should remain generally in the present use in order to permit future urbanization by the City.

Tier II contains around 70 square miles that is intended to (1) define the geographic area the city is assumed to grow into immediately beyond the 25 year time frame of Tier I; (2) serve as the basis for long term, advanced utility planning; and; (3) act as a secondary reserve area for urban growth should the Tier I area development occur more quickly than assumed for the 25 year period. Tier II should remain in its present use in order to provide for future development.

Tier III is approximately 85 square miles that is indicative of Lincoln's long term growth potential, perhaps 50 years and beyond. No active development or infrastructure planning should occur in this Tier within the next 25 years.



URBAN GROWTH TIERS WITH PRIORITY AREAS

- Public Land Not Available for Development
- Floodplain and Flood Prone Areas
- Lincoln City Limits (November 2005)
- Lincoln Future Service Limit
- Tier I Priority A
- Tier I Priority B
- Tier I Priority C
- Tier II
- Tier III

PRIORITY A: Identifies a future service area of approximately 20 square miles to serve with utilities in the next six years.... The City has developed and made public financial water and wastewater utility plans for operation and growth and the 2006 CIP based on a smaller Priority A area. User fee increases and/or impact fees as projected for water and wastewater will require additional increases, or additional private financing if projects are added or staged earlier than previously identified.

Currently, there are not adequate funds to build needed road improvements within the city limits, much less serve Priority A or other growth areas. If the City is committed to building improvements concurrent with development, then significant additional road funds will be needed, in addition to the proposed rate increases for water and wastewater.

PRIORITY B: The next areas for development, beyond Priority A, are those which currently lack almost all of the infrastructure required to support development. In areas with this designation, the community will maintain present uses until urban development can commence. Infrastructure improvements to serve this area will not initially be included in the City's CIP, but will be actively planned for in the longer term capital improvement planning of the various city and county departments.

PRIORITY C: Priority C is the later phase of development areas and is intended to be served after Priority A and B. Given current growth rates and infrastructure financing, development would not begin in this area until after 2020 or 2025.

Prepared By: JEO Consulting Group, Inc.
Source of Aerials and City Limits: NDNR
Software Used: ESRI ArcView 9.2 sp2

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Created By: J. Nelson, July 25, 2008
Contact Person: Jared Nelson
JEO Project Number: 385023

City of Lincoln NE
- Lower Platte South NRD Hazard Mitigation Plan -
Figure LNK.4: Urban Growth Tiers with Priority Areas
From 2006 Lincoln/Lancaster Comprehensive Plan

JEO Consulting Group, Inc.

PLANS, DOCUMENTS, AND INFORMATION USED

Throughout the planning process, a number of studies, reports and technical information have been used to develop the plan. General sources of information used for all sections of the plan are discussed in *Section 2: Planning Process.* Below is a list of specific sources used to establish Lincoln's participant section and their program status as provided by Lincoln.

TABLE LNK.1: SOURCEES, REPORTS, REGULATIONS, AND PROGRAMS

Source/Report/Regulation	Yes/No	Date Completed	Incorporated into Plan?
http://www.lincoln.ne.gov/	Yes	Current	Yes
Lincoln Journal Star	Yes	Various	Yes
Comprehensive Plan	Yes	November 16, 2006	Yes
Zoning	Yes	Adopted May 8, 1979;	No
Subdivision Regulations	Yes	May 19, 1975 updated	No
Floodplain maps and FIS	Yes	September 21, 2001	Yes
Lancaster County Local Emergency Operations Plan	Yes	January 1, 2007	Yes
Hazard Assessment Plan	Yes	January 27, 2007	Yes
Beal Slough Master Plan Report	Yes	May 2000	No
Cardwell Branch Master Plan Report	Yes	Draft September 2007	No
Lower Little Salt Creek Interim Storm Water Hydrology and Hydraulics Report	Yes	N/A	No
Southeast Upper Salt Creek Master Plan Report	Yes	October 2003	No
Stevens Creek Master Plan Report	Yes	March 2005	No
Deadman's Run Master Plan Study	Yes	N/A	Yes
Little Salt Creek Master Plan Study	Yes	In Progress	No
Floodplain Task Force Report	Yes	March 2003	No
Preliminary Flood Reduction Study Antelope Creek South 27th to South 56th	Yes	In Progress	Yes
Lincoln Comprehensive Watershed Management Plan (in conjunction with NRD)	Yes	In Progress	No
Phase 1 & 2 Beal Slough at 40th Street, Flood Reduction Study	Yes	November 2007	Yes
Preliminary Flood Reduction Study, Beal Slough—Pioneers Boulevard to Southwood Drive	Yes	July 26, 2007	Yes
Program	**Participation?**	**Membership Date**	**Incorporated into Plan?**
CRS	Yes	October 1, 1999	Yes
NFIP	Yes	April 23, 1971	Yes

CITY OF LINCOLN RISK ASSESSMENT

The City of Lincoln's risk assessment was established through public input, information provided by participating citizens of Lincoln, government officials, and by research of each hazard identified in the State of Nebraska Hazard Mitigation Plan.

HAZARD IDENTIFICATION

Below, in Table LNK.2 is a composite of hazards identified in the community, their likelihood to occur again, and to what extent damage may occur. The Lincoln 'Public Opinion Composite Hazard Identification' table was compiled after receiving responses from the public and community officials.

TABLE LNK.2: PUBLIC OPINION COMPOSITE HAZARD IDENTIFICATION TABLE

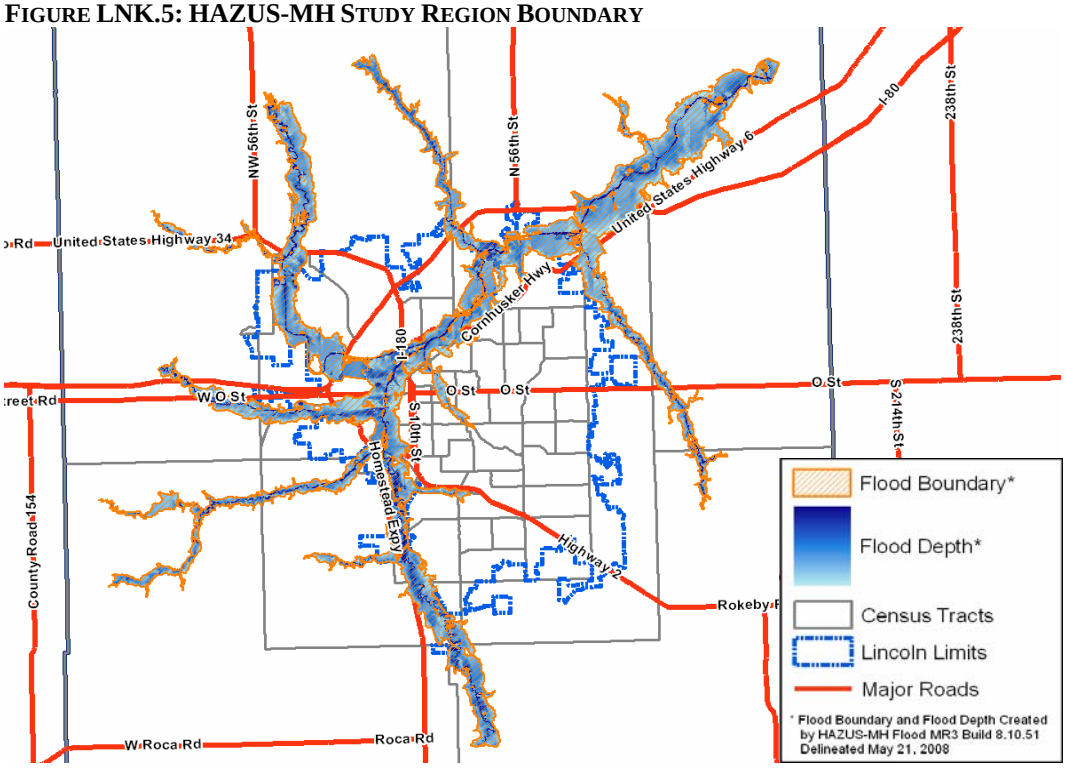
HAZARD TYPE	PREVIOUS OCCURRENCE? Yes/No	LIKELY TO EXPERIENCE? Yes/No	PROBABILITY Highly Likely/ Likely/Possible/Unlikely	EXTENT Catastrophic/Severe/Limited/None
Severe Winter Storm	Yes	Yes	Highly Likely	Severe
Tornado/High Winds	Yes	Yes	Likely	Catastrophic
Severe Thunderstorm	Yes	Yes	Highly Likely	Severe
Flooding	Yes	Yes	Likely	Severe
Extreme Heat	Yes	Yes	Possible	Limited
Drought	Yes	Yes	Likely	Limited
Earthquake	No	Yes	Possible	Limited
Wildfire	No	No	Unlikely	Limited
Landslide	Yes	Yes	Possible	Limited
Dam Failure	No	Yes	Possible	Limited
Levee Failure	No	Yes	Possible	Limited

In the following sections the hazard types which have a significant likelihood of occurring, or have reason to potentially occur, are discussed. Due to geographic location, the following hazard types were not considered: volcanic eruption, avalanches, tidal surges and tsunamis. As discussed in *Section 3: Risk Assessment*, wildfires also do not pose a significant enough threat to warrant a detailed discussion for Lincoln.

STRUCTURAL INVENTORY AND VALUATION

A structural inventory and loss estimate was completed for the corporate limits of Lincoln using FEMA's HAZUS-MH Loss Estimation Software. As described in *Section 2: Planning Process*, the HAZUS software employs a Digital Evolution Model (DEM) and performs hydrology and hydraulic calculations to identify a 100-year flood boundary and obtain flood depths for the study area. See Figure LNK.5 for this estimated flood boundary generated by HAZUS. It shall be noted that this flood boundary and flood depth should not be used for insurance purposes. The structural inventory and loss valuation was calculated by HAZUS using Census Tract data.

FIGURE LNK.5: HAZUS-MH STUDY REGION BOUNDARY



The following Table LNK.3 shows the Building Exposure by Occupancy Type for the study region, as calculated by HAZUS. This table indicates the exposure or value of the different general occupancy types. HAZUS estimated that buildings in the region have an aggregate total replacement value of $17,190,725,000 (2006 dollars). This number seems reasonable since the 2008 valuation indicated in the Nebraska Directory of Municipal Officials recorded that the City of Lincoln has a valuation of $15,657,130,261. The discrepancy can be explained due to the fact that the Census Tracts used in HAZUS extended beyond the Corporate Limits of Lincoln.

TABLE LNK.3: BUILDING EXPOSURE BY OCCUPANCY TYPE

Occupancy	Building Exposure
Residential	$12,403,109,000
Commercial	$3,038,325,000
Industrial	$800,979,000
Agricultural	$68,504,000
Religion	$292,829,000
Government	$229,113,000
Education	$357,866,000
TOTAL	**$17,190,725,000**

In terms of the number of structures in the City of Lincoln, HAZUS indicated there are 97,179 housing units in Lincoln. The 2006 Lincoln/Lancaster Comprehensive Plan indicated 95,199 housing units in Lincoln. The discrepancy here can also be explained due to the fact that the Census Tracts used in HAZUS extended beyond the Corporate Limits of Lincoln. According to the HAZUS model, 89,445 buildings, or 92.04 percent of Lincoln's 97,179 housing units, are associated with residential housing. Figure LNK.6 shows the parcels in Lincoln broken down by primary use of the parcel. Parcel Data was obtained from the Lancaster County Assessors office. The primary usage in this map utilizes where the different structure types are located.

CRITICAL FACILITIES AND SIRENS

Critical facilities were identified through the Emergency Support Functions (ESF) of Lancaster County's Critical Infrastructure. Critical facilities are structures with either historical significance, or are essential for returning the community's functions to normal during and after a disaster. Critical facilities are those which are vital for disaster response and providing shelter to the public.

The ESF is maintained by the Lincoln/Lancaster County Emergency Operations Center (EOC) as Critical Infrastructures and according to the FEMA website, the ESF provides the structure for coordinating federal interagency support for a federal response to an incident. They are mechanisms for grouping functions most frequently used to provide federal support to states and federal-to-federal support; both for declared disasters, and emergencies under the Stafford Act and for Non-Stafford Act incidents.

The critical infrastructures are organized under the following ESF categories with their coordinating quantities in Lincoln, Table LNK.4. The complete list of structures described by the ESF may be found in the Lincoln/ Lancaster County LEOP for all of Lancaster County.

Due to limited resources and data limitations of locations, locations of all critical facilities in Lincoln was not discussed or displayed in a map for this plan. This could be done in future updates of the plan.

TABLE LNK.4: LINCOLN CRITICAL INFRASTRUCTURE BY ESF CATEGORY

ESF Category	# of Structures
ESF 1- Transportation	19
ESF 2- Communications	16
ESF 3- Public Works	19
ESF 4- Firefighting	27
ESF 5- Information and Planning	252
ESF 6- Mass Care	8
ESF 7- Resource Support	14
ESF 8- Health and Medical	47
ESF 9- Search and Rescue	1
ESF 10- Hazardous Materials	11

The HAZUS model run for the City of Lincoln identified the following "Essential Facilities":

- 5 Hospitals
- 97 Schools
- 19 Fire Stations
- 2 Police Stations
- 1 Emergency Operations Center

Warning siren locations and ranges were identified through discussions with the Lancaster County Emergency Manager. The Lincoln/Lancaster EOC maintains a listing of all sirens in the County and can trigger all of them from their office in Lincoln, NE. All the sirens are on a regular maintenance schedule. In Lincoln, the electric system is organized in a grid style which helps ensure there is power always reaching the sirens. See Figure LNK.7 for a map showing the siren ranges and locations. There are three different types of sirens in Lincoln, as indicated by color in Figure LNK.7:

- Pink: Federal T22 90 decibels 2000 FT Effective Range
- Green: Federal Thunderbolt 104 decibels 4000 FT Effective Range
- Yellow: Federal Signal Sirens 128 decibels 5280 FT Effective Range

Legend

- Commercial / Industrial
- Public / Quasi Public
- Residential Structures
- City Limits

N

1 0.5 0 1 Miles

LNK.6

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Source of Aerials and City Limits: NDNR
Software Used: ESRI ArcView 9.2 sp2

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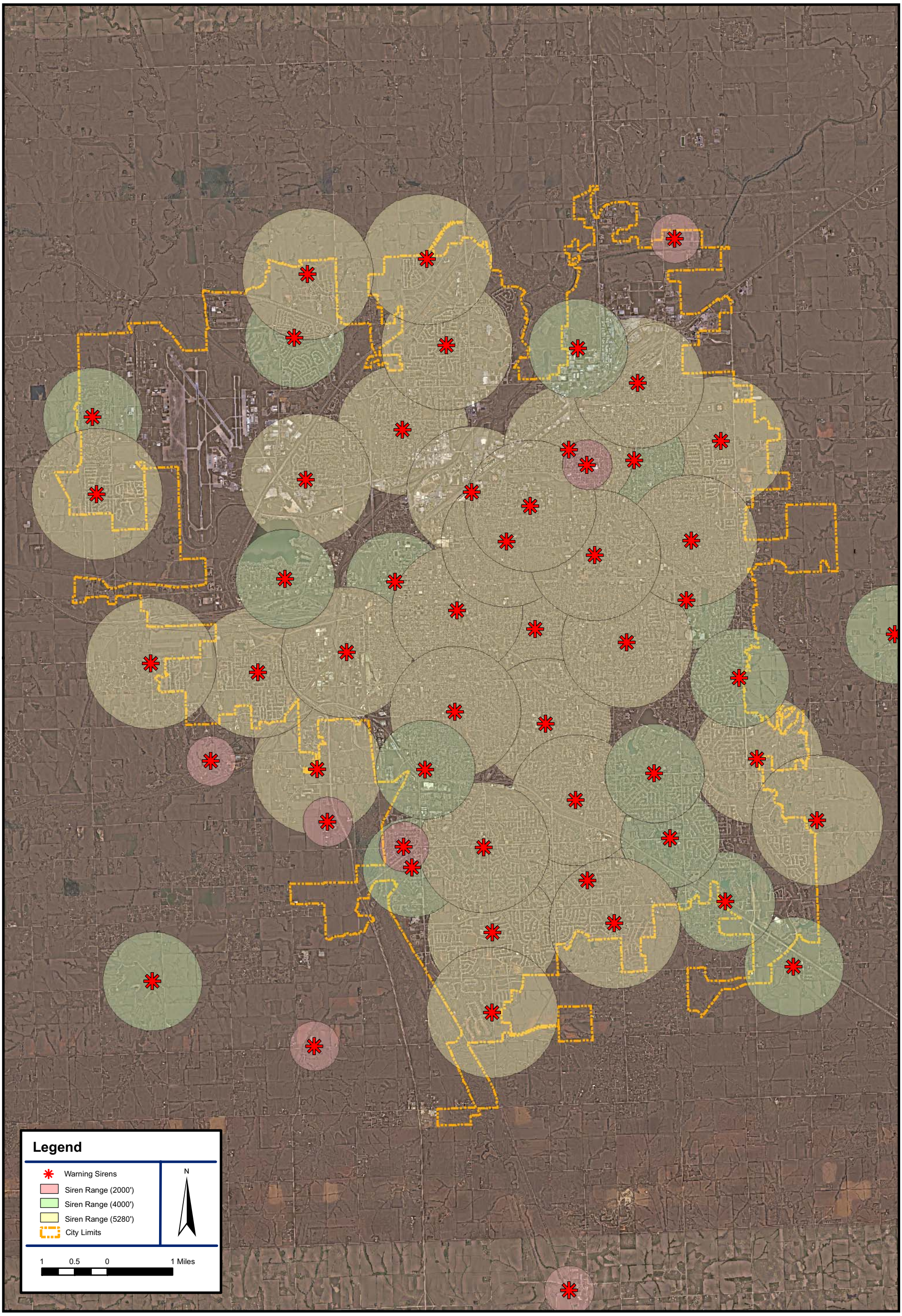
Created By: M Schwab, July 23, 2008
Contact Person: Jared Nelson
JEO Project Number: 385D23

City of Lincoln, NE
- Lower Platte South NRD Hazard Mitigation Plan -
Figure LNK.6: Primary Use of Parcels in Lincoln

JEO Consulting Group, Inc.



LNK.7

Prepared By: JEO Consulting Group, Inc.
Source of Aerials and City Limits: NDNR
Software Used: ESRI ArcView 9.2 sp2

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Created By: M Schwab, July 22, 2008
Contact Person: Jared Nelson
JEO Project Number: 385D23

City of Lincoln, NE
- Lower Platte South NRD Hazard Mitigation Plan -
Figure LNK.7: Warning Siren and Warning Siren Coverage Area

JEO Consulting Group, Inc.

The following sections provide historical occurrences, vulnerability assessments, potential losses and other hazard specific information for the City of Lincoln. Historical occurrence data was collected from a number of resources including: The National Climatic Data Center (NCDC), the world's largest archive of weather data, administered by the NOAA and U.S. Department of Commerce, The Lancaster County Local Emergency Operations Plan (LEOP), 2007, The Tornado History Project Database, The Lincoln Water System, The Lincoln Journal Star, and reports as documented by, local community members.

For a general background and description of each hazard see S*ection 3: Risk Assessment.*

SEVERE WINTER STORM

Historical Occurrences
The Lancaster County LEOP reports four separate severe winter storm occurrences for the City of Lincoln:

- **October 9, 1970**: The Columbus Day snowstorm dumped 6.6 inches of snow on the City causing extensive tree damage.

- **January 12, 1975:** The snowstorm referred to as "The Blizzard of the Century", produced 16 inches of snowfall that transpired over a 24 hour period. Both of Nebraska's metropolitan cities, Lincoln and Omaha, were brought to a standstill. Record low atmospheric pressures in the region were recorded, and strong winds created snow drifts reaching 15 feet.

- **1982:** An ice storm caused massive power outages. Nearly all of Lancaster County was impacted and some of the county residents were without power for three days.

- **January 26, 1994:** Freezing rain and sleet caused icing of trees and power lines. Some electrical outages also occurred. $50,000 worth of property damage was incurred.

- **September 22, 1995:** Record low temperatures from the lower 20s to the lower 30s put an end to an already stunted growing season across the Midlands. Nearly the entire state fell below 28 degrees. Hardest hit were the milo, soybean, and corn crops. Crop damages reported were $262 million.

- **October 25, 1997:** A rare winter storm brought 13 inches of wet, heavy, snow that weighed down and broke power lines and tree limbs. As a result, many residential areas and businesses were without power for several days and some areas for over a week. "Disaster areas" were declared and accrued over $50 million in public property damage. The clean up was extensive, continuing well into the following summer. The Lincoln Water System reported that they were without power at three critical pumping stations for several hours. The Lincoln Airport and West Lincoln business areas were two pressure districts affected by the storm.

Sever winter storms generally affect a broad area, devastating numerous communities, and sometimes entire counties. Lincoln is no stranger to the affects of severe winter storms. There were no specific historical winter storm occurrences mentioned by the community.

No other historical occurrences in Lincoln were recorded by residents, city officials, or found in any other document.

Potential Losses
During major events, Lincoln's entire structural valuation of $15,657,130,261 is at risk. Based upon statewide information from the NCDC, 543 incorporated communities have recorded personal property damage from ice storm events over the last 57 years. The average amount of damage per event in Nebraska was $1.82

million. Throughout the Midwest, average damage per event was $2.27 million. Based upon previous occurrences of severe winter storms and their damages in eastern Nebraska, it is estimated that Lincoln could likely sustain potential losses between $80 million and $160 million. This does not include loss due to displacement, functional downtime, economic loss, injury or loss of life. A loss of electricity due to downed power lines can negatively affect any jurisdiction's economy, cause loss of power to critical facilities, such as waste water plants and health facilities, and pose a threat to human life.

TORNADO AND HIGH WINDS

Historical Occurrences

Below is a listing of historical occurrences or tornado and high wind events as reported by the Tornado History Project Database, The National Climatic Data Center (NCDC), and the Lancaster County LEOP, 2007. No additional reports were found for the City of Lincoln nor did any community member make reference to any additional tornadic or high wind events. Refer to neighboring communities' 'participant sections' for the tornado and high wind events in their communities.

The following information was reported by the Tornado History Project database:

- **June 6, 1971:** Two tornados hit the City of Lincoln causing a total of $6,000 in damage.
- **April 27, 1975:** A category F0 tornado in the City caused $25,000 in damage.
- **August 15, 1977:** A tornado in the City caused $25,000 in damage.
- **May 22, 2004:** An F4 touched down in Hallam that resulted in one death and $100 million in property damage.

The NCDC reports two tornadic events in Lincoln:

- **May 8, 1995:** A funnel cloud was reported.
- **May 22, 1996:** An F0 tornado was reported. Fortunately no injuries or monetary damages resulted.

Lancaster County LEOP 2007, reports three tornadic occurrences:

- **1957:** An F4 tornado damaged residential structures, there were no deaths or injuries reported.
- **1975:** An F4 tornado touched down in the northwestern portion of Lincoln. A significant amount of property damage was incurred, however there were no deaths or injuries reported.
- **1993:** A strong summer storm with 90 mph straight line winds spawned four small tornados that moved across Lincoln and the northern part of Lancaster County. There were thousands of trees destroyed and several millions of dollars in property damage.

No other historical occurrences in Lincoln were recorded by residents, city officials, or found in any other document.

Potential Losses

A large scale tornado, such as an EF5, has the potential to devastate Lincoln. Nebraska's most devastating tornado even occurred only 15 miles away in Hallam; On May 22, 2004 an F4 tore through the community, causing damages over $100 million effectively destroying the whole community. Based on historical

occurrences in southeast Nebraska, a reasonable estimation of the potential structural damages incurred from a tornadic event could be between $200 million and $1 billion if it were to strike the downtown area. A large EF5 tornado could have a path several miles wide, and every structure and critical facility in its path could be destroyed. Additionally, there could be substantial loss of contents, loss due to displacement, functional downtime cost, economic loss, injury and loss of life.

SEVERE THUNDERSTORMS

Historical Occurrences

According to the NCDC, the City has a reported 95 thunderstorms from 1993 to 2006 with a net total damage of nearly $2 million. Much of the damage was caused by lightning strikes that led to fires. Additional property damage was incurred by strong winds and large, 4.5 inch diameter hail. Other than what is listed below, no other information or details were identified for Lincoln's historical occurrences of severe thunderstorms.

Specific occurrences and monetary damaged incurred as recorded by the NCDC are as follows:

- **May 7, 1993:** $50,000 in property damage was caused by a lightning strike at a radio station that damaged a computer system, telephone and satellite equipment.

- **September 2, 1995:** $20,000 in property damage resulted from 4.5 inch diameter hail.

- **May 22, 1996:** $1.4 million in property damage occurred when 83 mph winds blew the roof off at the Duncan Aviation facility and overturned multiple aircrafts. The roof at the State Fair Park's grandstand was also damaged. The City also suffered damage to power lines and trees.

- **August 14, 1996:** $20,000 worth of property damage occurred when 80 mph winds snapped the gates of a railroad crossing, damaged fences and several businesses.

- **July 10, 1997:** $25,000 worth of property damage was caused when a lightning set fire to the roof of a home.

- **August 19, 2003:** $90,000 in property damage was caused by lightning that struck three businesses resulting in smoke, fire, and electrical damage.

- **August 8, 2006:** $225,000 in property damage resulted from a lightning strike that set fire to a laundry facility.

The Lincoln Journal Star reports:

- **August 1, 1981:** A 25 year storm hit, producing from 4.3 to 5.5 inches of rain in some areas.

- **September 25, 1981:** A storm producing three inches of rain in the southern and eastern part of the City caused two major power outages and six or seven smaller ones. The 911 call center reported receiving an estimated 150 phone calls regarding flooded basements.

- **June 22, 1981:** Hail, heavy rains, flooding, strong wind gusts and lightning damaged power lines, vehicles, and trees.

In August 2007, the Lincoln Water System also reported that a thunderstorm with high winds damaged power lines and transformers in several counties within southeast Nebraska. Electrical power at the Treatment Plant

was sporadic for two hours. They were also unable to pump water from all of Lincoln's well fields to the plant for 10 hours.

No other historical occurrences in Lincoln were recorded by residents, city officials, or found in any other document.

Potential Losses

Severe thunderstorms occur on an irregular basis with varying magnitudes and can cause a wide degree of damages that can range from a few downed limbs to wide spread tree loss, hail damage, and damage to property. Based upon the historical occurrences Lincoln's worst event caused $1.4 million in damage, it would not be unreasonable to predict that this amount of damage could be incurred again. If multiple businesses and homes were affected by hail, lightening, and wind, damages could reach $10 million. Additionally, there could be losses due to displacement, functional downtime, as well as injury, and loss of life.

FLOODING

Historical Occurrences

The NCDC reports three flash flood occurrences, one of which reported damages:

- **August 14, 1996:** $60,000 in reported property damage was caused by four inches of rain that produced a flash flood. Local businesses and homes were also damaged.

The following list of storms and information was provided by the Lancaster County LEOP:

- Salt Creek flooded 136 times between 1900 and 1952. Of these events, 22 were considered major.
- **May 8, 1950:** Salt Creek peaked at a height of 26.05 feet with a flow of 27,800 cfs. This occurred after 5.5 inches of rain fell in six hours and accumulated to 14 inches. 20,000 acres of land was flooded including 600 homes and 80 businesses. The total damage incurred amounted to $1,643,000 and nine deaths.
- **June 2, 1951:** Antelope Creek flooded. Water was waist deep at 28th and D streets, and one foot deep at 33rd and Normal. Salt Creek peaked at 26.15 feet with a flow of 28,200 cfs.
- **June 14, 1951:** Antelope Creek flooded. Eight inches of rain fell and caused $2,000,000 worth of damage. 92 businesses, 298 homes and the railroad were all damaged in the area.
- **June, 1952:** Another Antelope Creek flood occurred when 2.18 inches fell, causing $63,000 in damage.
- Between 1962 and 1993, a series of eight floods occurred on Salt Creek. The total amount of federal funds contributed was $668,800, with the largest lump sum contribution of $487,185 in 1993.
- **June 13, 1984:** Little Salt Creek flooded when three to four inches of rain caused the creek to peak at 16.20 feet and flow 7,500 cfs. The flood was classified as a 10-year flood.

The Lincoln Journal Star recounts the following flood events:

- **1892:** Extensive flooding drove 300 people from their homes.

- **1902:** Flooding left 1,000 residents homeless and caused 9 deaths.

- **July 23, 1993:** Little Salt Creek peaked at 4 feet over flood stage. Lynn and Stevens Creek tributaries left their banks flooding streets, parking lots, businesses, and homes. The City received $823,997 from the Federal Emergency Management Agency for partial damage reimbursement. The total damage to public property was $2.9 million.

- **June 15, 1982:** Stevens Creek peaked at a height of 18.85 feet with a flow of 3,820 cfs. Up to five inches of rain blocked roads, threatened homes, and left cars stranded in high water. There was a police advisory encouraging Lincoln residents not to drive and at one point during the downpour, the police were instructed to park their cruisers unless they were needed somewhere. Lincoln Electric System reported several power outages, one of which was the result of flooded underground cables.

- **June 13, 1984:** Stevens Creek flooded with a peak of 19.57 feet and a flow of 4,620 cfs. The flood was classified as a 10-year flood and it claimed two lives when a car was swept off Highway 34.

- **July 4, 1984:** Water back log from Beal's Slough caused damage to local area businesses. One business reported damage of $4,000.

- **September 13, 1989:** Heavy rains caused $20,000 in damage to Lancaster County rock and gravel roads.

- **July 25, 1990:** Five inches of rain washed out roads, flooded basements, damaged businesses, and flooded parking lots.

Participants from the City of Lincoln recollected the following events:

- **March 1993:** The Lincoln Water System reports an ice jam on the Platte River that caused severe flooding along Salt Creek and Highway 6. The flood waters eroded embankments and exposed a 48-inch and 54-inch water transmission line from one of the Lincoln Water System's well fields. This exposure caused sections of the pipe line to break and float away.

- **July 24, 1993:** Flooding resulted when Lincoln received three times the normal amount of rain for July.

- **July 20, 1996:** Beal Slough flooded when over five inches of rain fell in south Lincoln over an 18 hour period. Flooding occurred on a number of roadways including Highway 2. Residential basements and recreational areas were flooded. Flooding also occurred near 33rd Street and Pioneers Boulevard as well as in many areas along the Tierra Branch in the Tierra, Williamsburg, Seven Oaks, and Cripple Creek Subdivisions. A similar incident occurred in 1989 when heavy rains filled and overtopped the creek. The waters spread to Tierra and Briarhurst Parks, and other nearby open spaces.

No other historical occurrences in Lincoln were recorded by residents, city officials, or found in any other document.

Vulnerability Assessment

It was determined that the flooding hazard area boundaries are limited to the estimated 100-year flood boundary as shown in Figure LNK.8. The estimated 100-year flood boundary shows the up-to-date 'Flood prone Area' boundaries and Floodways that are being submitted to FEMA to update the FEMA floodplains maps. They were obtained from the City of Lincoln, and have been formally recognized by resolution of the

Lincoln City Council as the best available information for local flood regulations. However, they have not been through a final review by FEMA and should not be used for insurance purposes.

The model build in HAZUS was run to simulate a 100-year storm. As previously discussed, HAZUS generated its own estimated flood boundary as shown in Figure LNK.5. These structures along with critical facilities within the flood boundary are susceptible to flooding. HAZUS also estimated that there are 938 structures that could be damaged by a 100-year flood. HAZUS estimates there are two fire stations that would suffer moderate damages, five schools with moderate damage and one school will not be able to be used. These are the only essential facilities that HAZUS reported being affected by flooding. The damages which may be caused by flooding include loss of structures, destruction of infrastructure such as bridges and roads, loss of utilities, and potentially loss of life. Due to limited resources, losses associated with utilities, roads, and bridges were not calculated.

It should be noted that the City of Lincoln identifies 5975 insurable structures in the floodplain within Lincoln city limits and the three mile extraterritorial jurisdiction while the HAZUS program estimates 938 structures damaged in a flood. The discrepancy between the number of structures in the floodplain recorded by the City, and the number of structures damaged reported by HAZUS, is due to the methodology used by the HAZUS program which assigns a 100-year flood hazard boundary that does not include all tributary flooding and determines a percentage of structures within that area that are damaged, based on Census Tract data from the 2000 census. In future updates of the Plan, potential damage to structures in the floodplain could be refined.

Potential Losses

According to HAZUS, the total building exposure by occupancy type for a 100-year flood is $2,207,335,000. Below, in Table LNK.5, the Building Exposure and Damages by Occupancy Type is shown for the flooding scenario. This information in the Table is also taken from HAZUS and can be found in Appendix C.

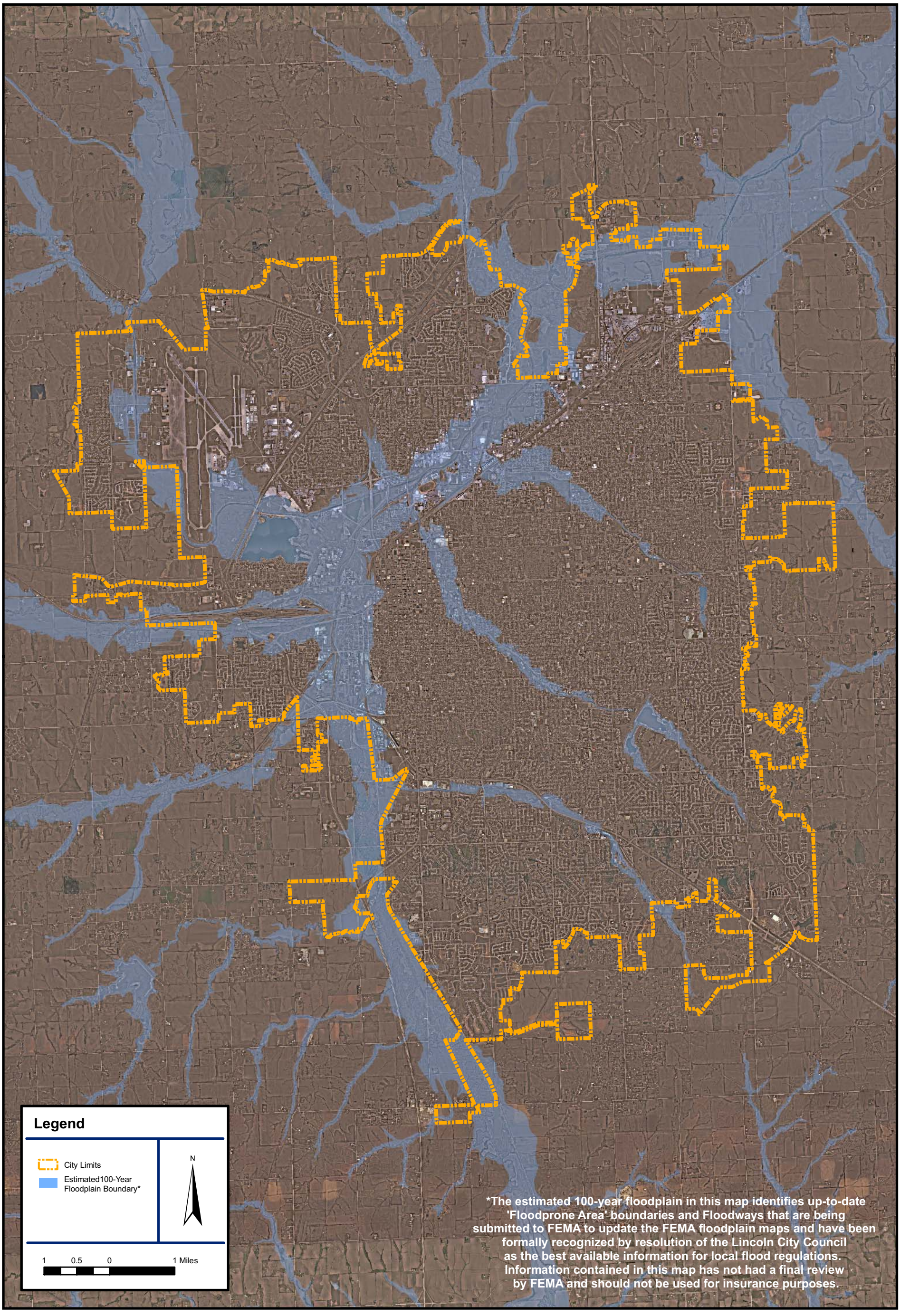
TABLE LNK.5: BUILDING EXPOSURE AND DAMAGES BY OCCUPANCY TYPE

Occupancy	Building Exposure	Slightly Damaged (1-10%)	Moderately Damaged (11-50%)	Substantially Damaged (51-100%)
Agriculture	$15,489,000	0	1	0
Commercial	$614,180,000	4	35	0
Education	$86,453,000	1	0	0
Government	$43,316,000	1	2	0
Industrial	$294,127,000	0	9	0
Religion	$27,570,000	0	1	0
Residential	$1,126,200,000	8	642	234
TOTAL	**$2,207,335,000**	**14**	**690**	**234**

HAZUS also estimated that in a 100-year flood event 3,614 households would be displaced. Displacement, as indicated by HAZUS, includes households evacuated from within or very near to the inundated areas. Of these, 9,153 people will need to seek temporary shelter in public shelters. The model further estimates 51,223 tons of debris will be generated and this flooding will cause $547.16 million in total economic loss, 99 percent of which being building-related.

Community Rating System

The City of Lincoln is a Community Rating System (CRS) eligible community. They entered the program on October 1, 1991 and have been current effective date of May 1, 2003. They are currently class seven, their community number is 315273. It is important for Lincoln to remain a CRS community as it educates citizens to reduce risk and reduce insurance rates.



LNK.8

Prepared By: JEO Consulting Group, Inc.
Source of Aerials and City Limits: NDNR
Software Used: ESRI ArcView 9.2 sp2

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Created By:M Schwab, July 23, 2008
Contact Person: Jared Nelson
JEO Project Number: 385D23

City of Lincoln, NE
- Lower Platte South NRD Hazard Mitigation Plan -
Figure LNK.8: Structures Located within Estimated 100-Year Flood Boundary

JEO Consulting Group, Inc.

LANDSLIDE

Historical Occurrences
According to the University of Nebraska Lincoln's School of Natural Resources Landslides in Nebraska Database, there have only been two landslide occurrences in Lincoln:

- **October 1, 1985:** A rotational slide slope movement of earth material, Peorian loess over glacial till, caused by a road cut occurred at I-180 and Superior Street on the east facing slope.

- **March 15, 1987:** A rotational slide slope movement of earth, geologically described as Pleistocene materials, caused by a stream cut occurred on the bike path on Capitol Parkway and Washington on the east facing slope.

Vulnerability Assessment
While landslides don't generally occur in Southeast Nebraska, there are particular man-made areas that are more vulnerable to them. Landslides in Lincoln have only occurred along cuts in the roads and highways. Any area where man-made or constructed slopes are too steep, it is susceptible to landslides. This is especially true along highways in Lincoln such as I-80, I-180, Hwy 2, Hwy 6, Hwy 34 and Hwy 77.

The slopes along these interstates and highways vary greatly and, due to limited resources, it was not feasible to identify specific locations that are vulnerable to landslides.

Potential Losses
Potential losses from a landslide event vary greatly depending on the area it affects. Road damages can vary in repair costs, and it is also possible for a landslide to occur without causing any monetary losses. Landslides also damage the land or the hillsides, making roadway conditions unsafe. It would be accurate to say that, depending on the magnitude and severity of a landslide event, losses could reach $100,000. Additionally, landslides potentially present a threat to life and functional downtime if a road closure occurs.

DAM FAILURE

Historical Occurrences
In Lincoln, there have been no historical occurrences of dam failure recorded by residents, city officials, or found in any other resources.

Vulnerability Assessment
Dam failure has not occurred in the past but could occur in the future. According to the NDNR dam database, 22 high hazard dams are upstream of the City of Lincoln.

After reviewing the NDNR dam database and holding discussions with the NDNR, 14 high hazard dams could potentially inundate parts of Lincoln. The high hazard dams that could inundate parts of Lincoln outside of the 100-year floodplain are noted with an asterisk below. The remaining eight high hazard dams include an inundation area that remains upstream of Lincoln, or is contained within the 100-year floodplain; therefore, if any effects due to these eight dams failing are observed, said effects would be similar to a flood. The effects and damages of flooding are covered under the "Flooding" section of this report.

Figure LNK.9 shows the low, significant and high hazard dams upstream of Lincoln. The 22 high hazard dams, listed by their State Identification Number are as follows:

NIDID	Dam Name	County	Year Completed	Last Inspected
NE00068	Oak-Middle 82-B	Seward	1963	4/23/2007
NE00076	Oak-Middle 84-A	Seward	1964	4/23/2007
NE00523	Upper Salt Creek 35-A	Lancaster	1961	8/24/2007
*NE00527	Wedgewood Lake Dam	Lancaster	1961	7/5/2006
NE00533	Upper Salt Creek 10-A	Lancaster	1963	1/5/2006
*NE01055	Conestoga/Site 12	Lancaster	1964	5/13/1999
*NE01056	Wagon Train/Site 8	Lancaster	1963	5/19/2007
*NE01057	Pawnee/Site 14	Lancaster	1965	5/13/1999
*NE01058	Yankee Hill/Site 10	Lancaster	1965	8/27/2004
*NE01059	Stagecoach/Site 9	Lancaster	1964	5/19/2007
*NE01060	Twin Lakes/Site 13	Seward	1965	8/27/2004
*NE01061	Holmes Lake/Site 17	Lancaster	1962	5/25/2006
*NE01062	Olive Creek/Site 2	Lancaster	1964	5/18/2005
*NE01063	Branched Oak/Site 18	Lancaster	1967	5/19/2005
*NE01064	Bluestem/Site 4	Lancaster	1963	5/24/2006
*NE02516	Hartland Homes North Dam	Lancaster	1972E	12/23/2005
NE02518	Upper Little Nemaha 21	Lancaster	1998E	3/23/2007
NE02652	Korver Dam	Lancaster	2003	1/9/2008
NE02757	Stevens Creek A17-1	Lancaster	2005	7/24/2007
*NE02805	Campbell Dam	Lancaster	2006	1/9/2008
NE02837	Waterford Estates Dam	Lancaster	2008	N/A
*NE02366	Highlands Golf Course Dam	Lancaster	1992	3/11/2005

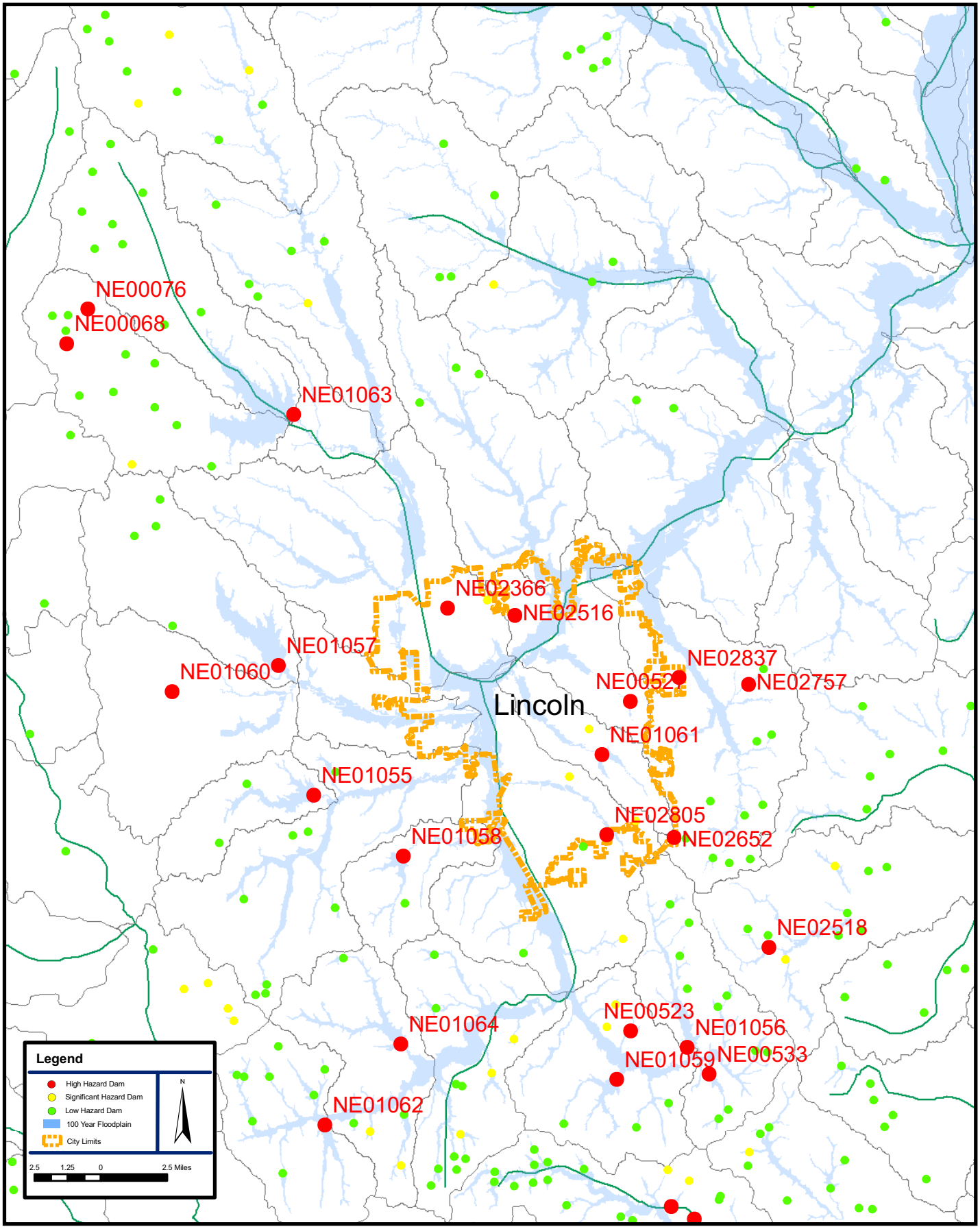
The vulnerability of Lincoln to dam failure is high and effects will vary depending on the magnitude of the dam failure. It shall be noted that the inundation maps for the above 22 dams are not available for public viewing. More detailed information can be sought after through the NDNR.

All dams are inspected on a regular basis and after extreme conditions have occurred. If problems are found during an inspection, the proper course of action is taken to ensure the structural integrity of the dam is preserved. In the event that dam failure is imminent, the Emergency Action Plan (EAP) for the dam governs the course of action.

Due to data limitations on where the inundations areas occur and what structures get inundated, a complete assessment of the structures could not be completed. This could be completed in future updates of the plan.

Potential Losses

Due to limited resources and the sensitivity of the inundation maps from high hazard dams, it is beyond the scope of this hazard mitigation plan to estimate potential losses from dam failure. Losses could occur to structures and human life if significant enough.



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Created By: E. Wright, July 23, 2008
Contact Person: Jared Nelson
JEO Project Number: 385D23

City of Lincoln, NE
- Lower Platte South NRD Hazard Mitigation Plan -
Figure LNK.9: High Hazard Dam Locations

JEO Consulting Group, Inc.

LEVEE FAILURE

Historical occurrences
There have been no recorded instances of levee failure in the City of Lincoln.

Vulnerability Assessment
Levee failure has not previously occurred in Lincoln but could possibly occur in the future. Investigation into the FIRM map floodplain indicated that the 13.5 miles of the Salt Creek Levee System (owned and maintained by the Lower Platte South NRD) **does not provide 100 year flooding protection**. It is not FEMA certified. This levee could be providing some protection to the areas behind the levee, but due to data limitations, a more accurate vulnerability analysis could not be completed at this time. The number of structures protected by this levee, if any, could not be determined either due to these data limitations. In the event that a levee failure occurred, effects would be similar to those of a flood. The effects, damages, and locations of flooding are covered under the "Flooding" section of this report. Damages which may be caused by flooding include loss of structures, destruction of infrastructure such as bridges and roads, loss of utilities and potential for loss of life. The location of the Salt Creek Levee System can be viewed in the Lower Platte South NRD participant section.

See the critical facility map for Lower Platte South NRD participant section for a map showing the location of the levee.

Due to lack of resources and data limitations, there was not enough information to fully assess the vulnerability of levee failure in Lincoln. A more in-depth vulnerability assessment could be completed for the next plan update.

Potential Losses
Due to the lack of resources and data deficiencies, potential losses were not calculated for a levee failure. Losses could be similar to those of a flood, damaging or destroying structures that are protected by the levee, displacing people and losses of functional down time, economic effects, or recovery and replacement costs. An estimate for losses for structures protected by the levee could be completed for the next plan update.