Section 2
Inventory and Methodology

2.1 Watershed Inventory

The watershed inventory consisted of collecting, compiling and evaluating existing data applicable to the Master Plan development and developing new data sets. A data search was conducted to identify existing information to be used by the project team. Below is a general list of data collected:

GIS data files:

- Aerial imagery
- Agricultural Land Use
- Basin boundaries
- Beltway Corridor Protection Area
- Bridges
- Building footprints
- City and Corporate Limits
- Conservation Easements
- County Road Projects
- Dams
- Endangered Species
  - Proposed Critical Habitat for Tiger Beetle
- Fire Facilities
- Floodplain data
  - current effective floodplain
  - storage areas
  - Lancaster County FIS and Firm
  - Lancaster County Preliminary DFIRM
  - Lancaster County waiting to go into effect
- Future Land Use
- Future Service Limit
- Grassland
- Hillshade
- Historical
- Homeowners Associations
- Impervious Areas
- Lakes Streams and Waterbodies
- Landbase
- Library Facilities
- Lidar
- Medical Facilities
- Natural Resources
- New Growth Flood Standards
- Parcels
- Parks
- Paving
- Retirement Facilities
- Salt Valley Greenway
- Schools
- Soils
- South and East Beltway Alignment
- Startran Bus Routes
- Transportation
- Treemass
- Urban Development
- Utility
  - Cell Towers
  - Communication Lines
  - Electric
  - Fiber
  - Gas
  - Iteris Data Network
  - Sanitary Sewer
  - Stormwater
  - Time Warner Cable
  - Water
  - Williams Pipeline
- Walkability
- Wellhead Protection Areas
- Wetlands
  - National Wetland Inventory
  - Saline
- Zoning

H & H Models:

- Salt Creek FEMA
- Salt Creek DFRIM (Hydrology)
- Salt Creek DFIRM (HEC-RAS)
- Haines Branch 1994 HEC-2
- Middle Creek 1994 HEC-2
- Old Cheney Rd & Salt Creek near Wilderness Park (HEC-RAS)

Reports:

- Lincoln/Lancaster County 2040 Comprehensive Plan
- Central Salt Creek (Urban Drainage Studies)
- Haines Branch
    - Urban Drainage Studies
    - USACE - Salt Creek, Haines Branch and Beal Slough Summary Report
- Middle Creek
    - Middle Creek Drainage Basin and 'D' Street Lift Station Trunk Sewers
    - USACE - Antelope Creek, Dead Man's Run and Middle Creek Summary Report
- Salt Creek
    - USACE - Plan Formulation Phase, Evaluation of Structural Alternatives Documentation
    - Salt Creek Storage Areas 2009
- Salt Valley Greenway and Prairie Corridor Master Plan 2012
- Wilderness Park Subarea Plan 1999

Websites:

- Reports relative to Lincoln and Comprehensive Plan References
    - http://lincoln.ne.gov/city/plan/long/index.htm
- Lancaster County Stream Gage Info
    - http://lancaster.ne.gov/engineer/gis/hydro.htm
- Lincoln GIS Viewer
    - http://lincoln.ne.gov/gis/gisviewer/index.html?config=apps/ncs-nrgis.xml
- Mapshop Link
    - http://lincoln.ne.gov/city/plan/its/gisweb/home.htm
- USGS 7.5 Minute Quadrangle Maps
    - http://lancaster.ne.gov/engineer/gis/use.htm
- University of Nebraska-Lincoln School of Natural Resources GIS Information
    - http://snr.unl.edu/data/geologysoils/digitalgeologicmaps/digitalgeologicmaps.asp

The above data and data sources may not be directly utilized or referenced in this master plan, but rather represent the body of data available for our reference and use as we developed the master plan.

New data sets were developed using GIS technology during the study. The new data sets are summarized below:

- Geomorphic and Channel Data
- Water Quality Data
- Potential projects/ areas of concern
- Other information obtained from the field investigation

New data generated consist of GIS files, the watershed report in pdf and word format, images/photos and any subsequent supplemental data.

2.2 Study Methodology

This Middle Creek Watershed Master Plan includes hydrologic modeling of select subbasins, water quality investigation, geomorphic field investigation and identification of special and unique areas within the watershed study area. Each of these study components was then considered in the development of potential capital improvement projects. A summary of each component is provided below, with references given to each relative section that has in it the full narrative.

2.2.1 Hydrologic Modeling

The Hydrologic Modeling consisted of modeling areas within the Future Service Area Limits of the basin, which have not been previously studied in conjunction with the Urban Drainage Preliminary Engineering Study program as indicated in Figure 2-1. The goal of the hydrologic modeling is to identify predevelopment flow rates for these subbasins. The areas modeled are under development pressure and predevelopment hydrologic data will provide developers information necessary to design site stormwater amenities. See Section 3 for detailed information regarding this process.

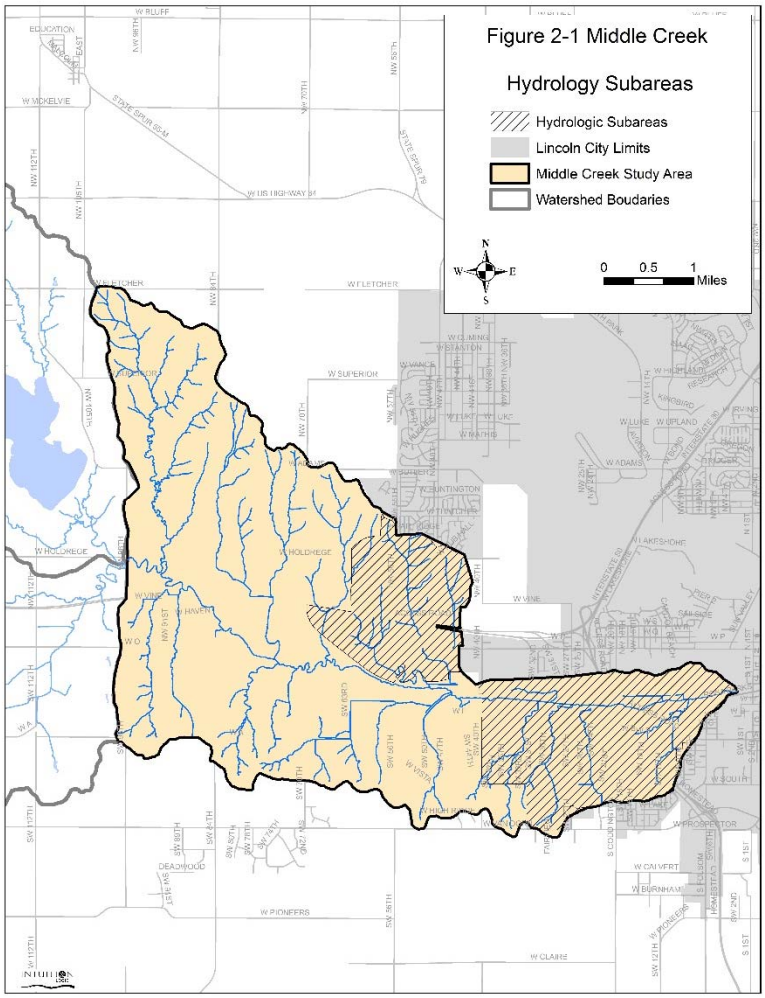

Figure 2-1 Hydrology Study Areas

2.2.2 Water Quality Investigation

The water quality investigation consisted of performing limited water quality sampling at two locations in the watershed. The purpose of the water quality sampling was to gather dry and wet weather data along the main channel, in order to meet the requirements of the City's NPDES permit. The two sample locations are: SW 63rd St Bridge south of W O St and at the Rosa Parks Way bridge upstream from the confluence, west of S Folsom St as shown in Figure 2-2.

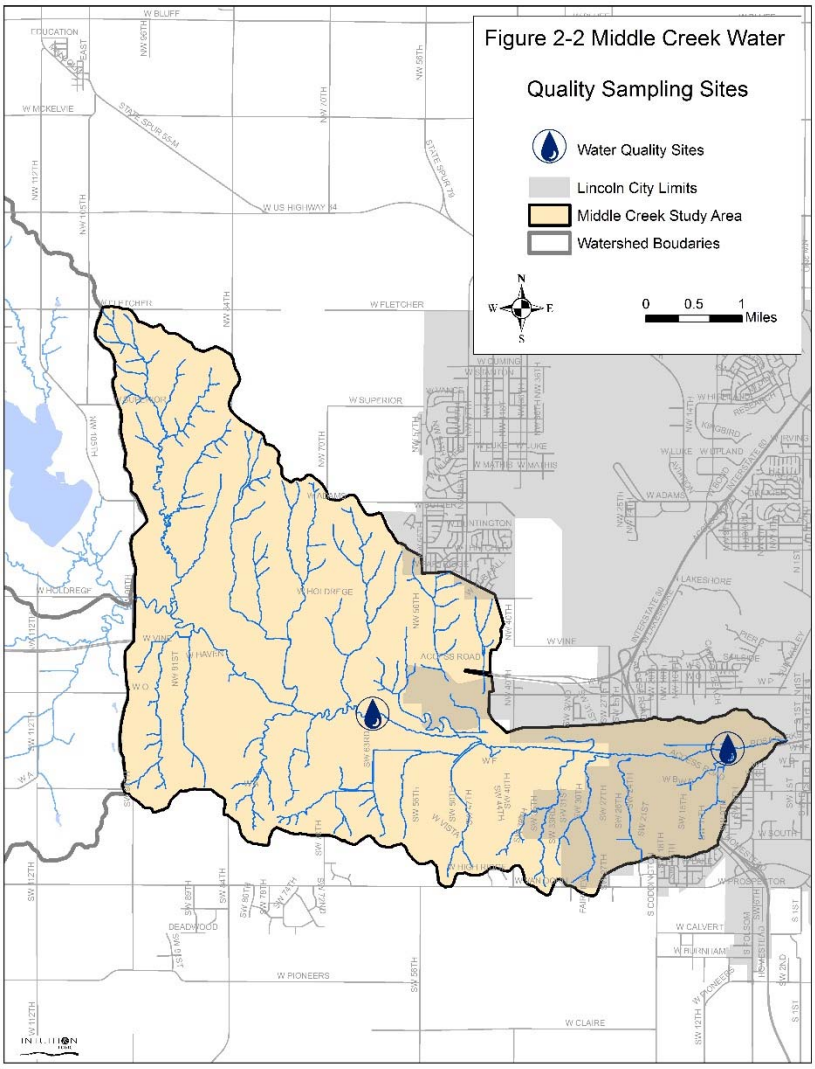

Figure 2-2 Water Quality Sampling Sites

Two dry weather and one wet weather sample was collected at each sampling location. The two dry-weather samples occurred on May 1, 2013 and August 7, 2013 and the wet-weather sample occurred on November 5, 2013. Water quality samples were lab tested for the following:

- Total suspended solids
- Total phosphorous
- pH
- Dissolved oxygen
- Temperature
- Conductivity
- Hardness
- Selenium
- Ammonia
- Total organic carbon
- Copper
- E. Coli

The E. Coli samples were analyzed in-house at the USGS Nebraska Water Science Center. All other samples were submitted to the USGS National Water Quality Laboratory (NWQL)

located in Denver, Colorado. See Section 4 for detailed information regarding the water quality sampling method and results.

2.2.3 Geomorphic Field Investigation

The geomorphic evaluation is based on field reconnaissance of 28 miles of channel divided into 49 reaches as shown in Figure 2-3.

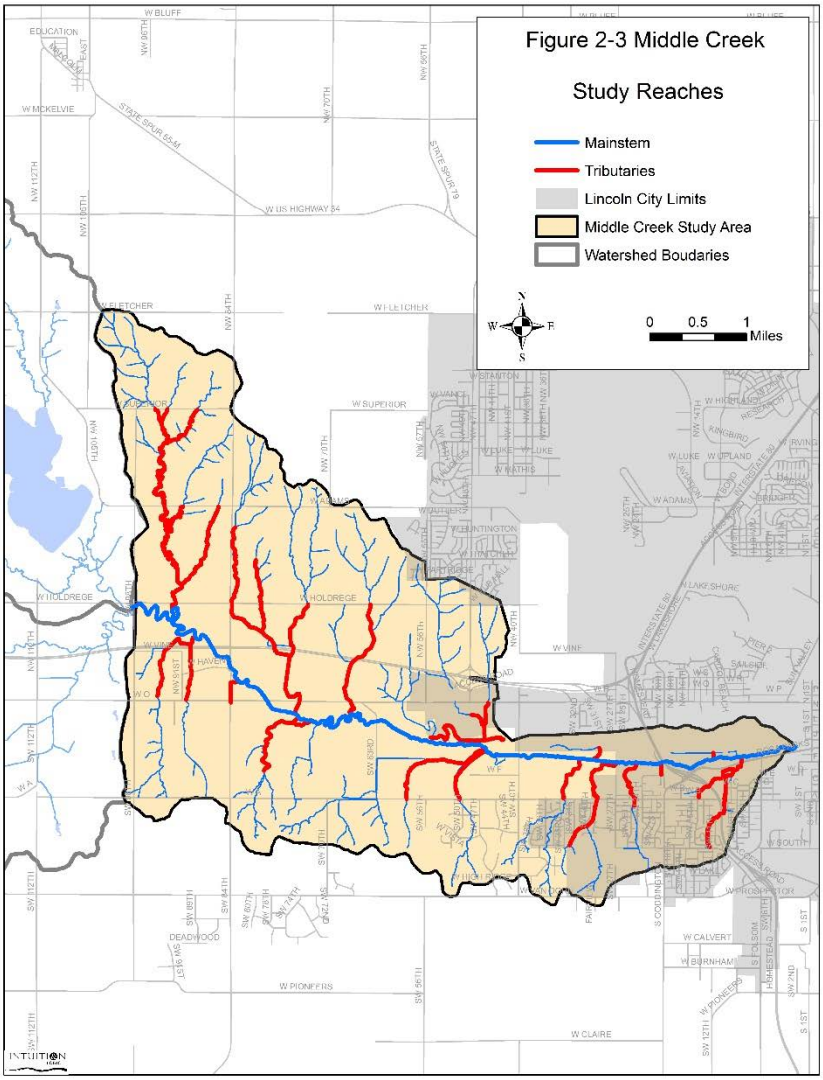

Figure 2-3 Middle Creek Study Reaches

The main stem fieldwork limit was taken as the confluence with Salt Creek to the limit of the City's extraterritorial jurisdictional limit. The tributary fieldwork limits were developed by focusing on the higher stream order reaches (the larger channels). The tributary upstream fieldwork limits began where there was one mile or more of identified drainage way contributing to the tributary. Typically, the upstream stopping point was set to the nearest roadway or confluence. Some exceptions to the contributing stream length were made where the tributary was fed by a development or where known issues were present.

Geomorphic data points were collected in GIS during the field investigation along each reach to provide reconnaissance level analysis of reach stability. Field data were collected using the following data categories:

1) Bank soil texture and coherence per Uniform Soil Classification using the visual-manual procedures (ASTM D 2488-00)
2) Average bank slope angle as measured where obvious breaks in slope create a top of bank and toe of slope
3) Average bank height as measured from the lowest point in the channel cross section to the top of bank
4) Vegetative bank protection
5) Bank cutting
6) Mass wasting (wedge or slide slope failure)
7) Bar development
8) Debris jam potential
9) Obstructions, flow deflectors and sediment traps
10) Channel bed material consolidation and armoring
11) Percentage of channel cross section constriction
12) Sediment movement
13) Sinuosity
14) Opinion of Dominant Process

The data categories are weighted and scored to provide an overall indication of stability for each data point. The data points were then summarized to provide an overall reach score and an opinion of dominant process was also provided for each reach based on observations.

Field data were also collected at potential project locations. The following field data were also collected for potential projects:

- Project type (Bed Stabilization and/or Bank Stabilization)
- Project length
- Brief problem description
- Brief recommended solution description
- Additional notes as needed

Data points were also collected at observed seeps and photo locations. See Section 5 for a detailed description of the geomorphic evaluation and results of the geomorphic data points and indicators as listed above.

2.2.4 Special Areas Consideration

Identification of Special Areas was conducted to identify unique or special areas containing ecological, archeological, cultural and/or other community assets that merit consideration when developing capital improvement plans. The following methodology was used to identify special areas within the watershed:

- Coordinate with the City, County and NRD to identify and locate the special areas
- Obtain existing GIS files and identify previously generated reports containing information regarding the special areas
- Develop GIS maps of the special areas; develop a list of the areas and what existing documents and data are available; and review of the documents to extract information regarding the special areas.
- Use the special area maps and data to evaluate what, if any, effect the capital improvement projects might have on special areas and what measures need to be considered in the implementation of the capital improvement projects to mitigate the potential effects.

See Section 6 for a detailed description of the special areas evaluation and results.