

SECTION 1 – INTRODUCTION AND PURPOSE

1.1. Introduction and Purpose

The water quality in a stretch of Antelope Creek contains elevated levels of *E. coli* and other contaminants that have become a concern to the City of Lincoln (City) and the Lower Platte South Natural Resources District (NRD). Working together, the City and LPSNRD have cooperatively developed the Antelope Creek Watershed Basin Management Plan (Basin Plan) for Antelope Creek from Holmes Lake to its confluence with Salt Creek an area of 7.7 square miles. For the purposes of this report the term ‘Antelope Creek’ only refers to that portion of Antelope Creek downstream/west of Holmes Lake, or approximately along 60th Street.

The Basin Plan is part of an ongoing effort over the last decade to establish Comprehensive Watershed Management Plans within the corporate limits of Lincoln and future growth areas. A basin by basin approach has been used with preparation of individualized watershed master plans for each basin. By identifying structural and non-structural Best Management Practices (BMPs), each plan, including this Basin Plan, will serve as a tool for the City and LPSNRD staff, as well as other planning and design engineers, to proactively forecast, evaluate, and manage stormwater quality impacts associated with existing and future re-development of the City. The watershed master plans are regularly used to identify future capital improvement projects (CIPs).

This Basin Plan differs from past plans that have focused on flood control, stream stability, and erosion. The focus is to improve water quality in Antelope Creek, from Holmes Lake to the confluence with Salt Creek.

An overview of the status of individual comprehensive watershed management plans is presented in Figure 1-1. The City and LPSNRD have adopted master plans for the following basins:

- Beal Slough (2000)
- Southeast Upper Salt Creek (2003)
- Stevens Creek (2005)
- Cardwell Branch (2007)
- Deadmans Run (2007)
- Little Salt Creek (2009)

The previous master planning efforts listed above focused primarily on **water quantity** to address flood management, stream stability, and erosion problems with a secondary focus on **water quality**. This Basin Plan, a continuation of the master planning process, is unique in that its purpose is to determine the source of contaminants impairing the everyday uses of Antelope creek. Antelope Creek watershed is entirely urbanized and has recently had a major project constructed to reduce flooding and stabilize the stream banks (Antelope Valley). The focus of the Basin Plan is to improve water quality in this stretch of Antelope Creek.

The U.S. Environmental Protection Agency (EPA) has established watershed management plan review criteria, the EPA Nine Elements, which will guide development of the Basin Plan. These planning criteria will ensure that the plan is laid out to meet the minimum requirement of the EPA Nine Elements, making the projects and programs eligible for potential Federal, state, and local funding opportunities.

The Basin Plan evaluates and makes recommendations to address several water quality parameters with an emphasis on *E. coli* bacteria, total suspended solids (TSS), and nutrients. By establishing this Basin Plan, the City and LPSNRD will be presented with projects and programs to improve water quality within the basin using stormwater controls. Secondary benefits of stormwater controls include increased aesthetics, use of native vegetation, and others.

Stormwater controls include several structural and non-structural management practices, used both individually and in combination with each other. Practices are intended to improve water quality by limiting the contribution of pollutants (i.e., removal of pet waste) or treating stormwater runoff prior to reaching a water body (i.e., use of a bioretention area). Due to local familiarity with the term best management practice, stormwater controls are generally referred as BMPs for the purposes of this Basin Plan.

Antelope Creek Watershed Basin Management Plan

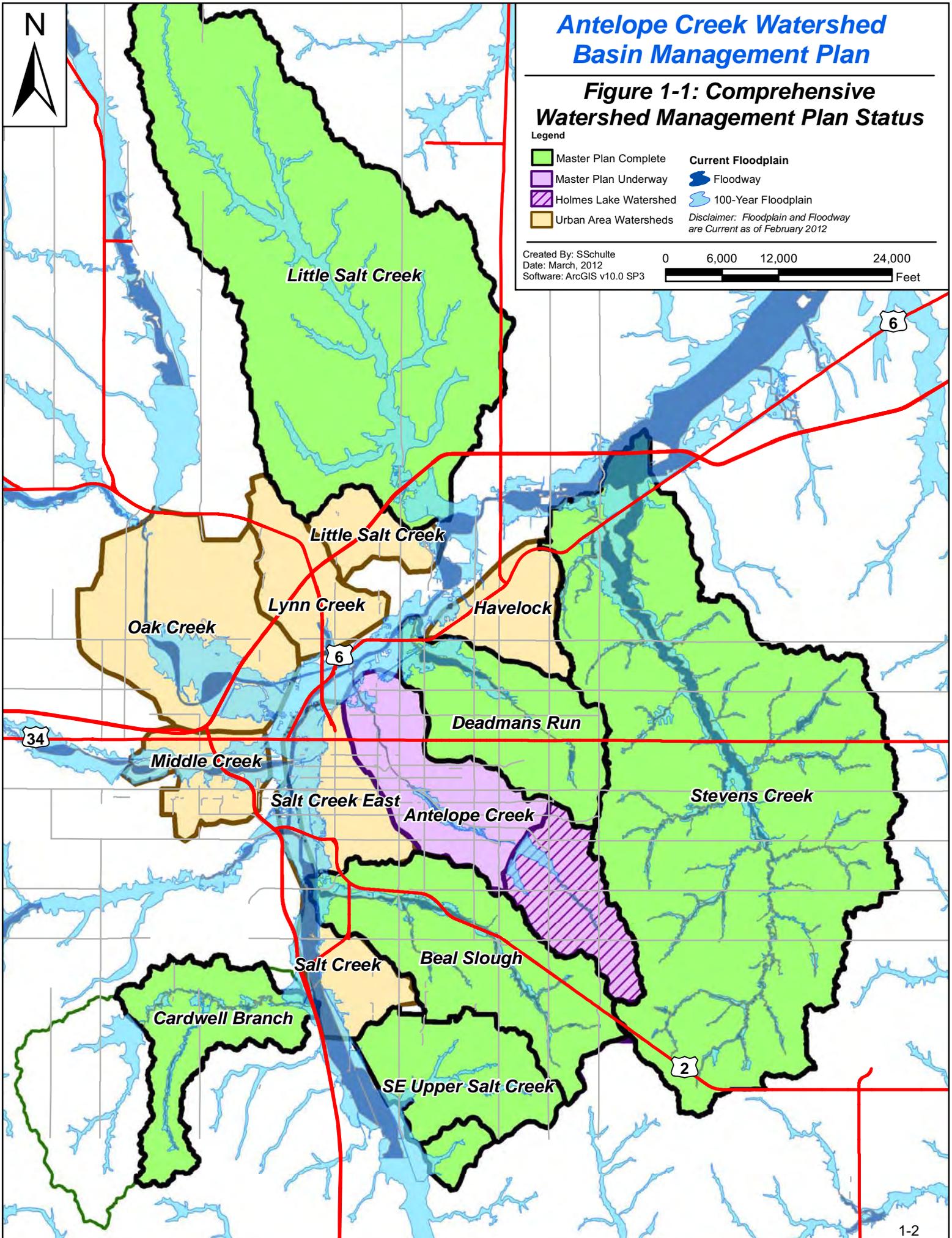
Figure 1-1: Comprehensive Watershed Management Plan Status

Legend

- | | |
|---|---|
|  Master Plan Complete |  Current Floodplain |
|  Master Plan Underway |  Floodway |
|  Holmes Lake Watershed |  100-Year Floodplain |
|  Urban Area Watersheds | <i>Disclaimer: Floodplain and Floodway are Current as of February 2012</i> |

Created By: SSchulte
Date: March, 2012
Software: ArcGIS v10.0 SP3

0 6,000 12,000 24,000
Feet



Regulatory Background

In Nebraska, water quality regulations are administered through the Nebraska Department of Environmental Quality’s (NDEQ) Water Quality Division. NDEQ is authorized through the Environmental Protection Agency’s (EPA) Clean Water Act of 1972; which requires states, territories, and authorized tribes to identify and establish priority ranking for water bodies. Once these water bodies are identified, NDEQ establishes a Total Maximum Daily Load (TMDL) for the pollutants causing impairments in those water bodies. This is completed through the Water Quality Integrated Report, completed every 2 years by NDEQ, and most recently in April 2010.

NDEQ also administers the National Pollutant Discharge Elimination System (NPDES) permitting program. Activities listed in the Basin Plan are above and beyond NPDES requirements listed in the City’s municipal separate storm drainage system (MS4) permit. Activities listed in this Basin Plan are non-regulatory and specific to address water quality issues in Antelope Creek. The City allocates funding separately for projects that support MS4 activities.

Table 1-1. Antelope Creek 2010 Water Quality Integrated Report

Water Body ID	Water Body Name	Recreation	Aquatic Life	Public Drinking Water	Agriculture Water Supply	Industrial Water Supply	Aesthetics	Overall Assessment	2010 IR	Impairments	Parameters of Concern	Comments / Actions
LP2-20900	Antelope Creek	I	I	NA	S	NA	S	I	5	<i>E. coli</i> , Selenium, Copper, Chloride, Conductivity	<i>E. coli</i> , Selenium, Copper, Chloride	<i>E. coli</i> and ammonia TMDL approved 9/07

Source: NDEQ 2010 Water Quality Integrated Report (S=Supported Beneficial Use; I=Impaired)

As seen in Table 1-1 above, this stretch of Antelope Creek has listed impairments to the Aquatic Life and Recreation uses due to *E. coli* bacteria, Selenium, Copper, Chloride, and Conductivity. Parameter violations of Nebraska’s Surface Water Quality Standards – Title 117 (NDEQ, 2009) have resulted in a 2010 Section 303 (d) Category 5 listing for this segment of Antelope Creek. While there are currently no state water quality standards for phosphorus and nitrogen in flowing waters, the City will proactively address these pollutants through the implementation of this Basin Plan. Each of the above listed parameters is further detailed in SECTION 4 - TMDL ASSESSMENT.

In order to establish goals for improving the water quality in lakes and streams, NDEQ develops a TMDL, which outlines the maximum loading of certain contaminants a stream or lake can handle before being considered impaired. Antelope Creek’s TMDL was approved in September 2007. At that time, listed parameters of concern were Total Ammonia and *E. coli*. During establishment of the Basin Plan each parameter of concern listed in the 2008 and 2010 Water Quality Integrated Report, as well as the two listed in the 2007 TMDL, were evaluated.

Ammonia was removed from the Antelope Creek sampling for this project because recent NDEQ ambient stream monitoring data and data from the first round of Antelope Creek sampling conducted by EA indicated that the ammonia levels previously reported for Antelope Creek were no longer above the water quality criteria. Determining the source of ammonia, and reasoning for the recent reduction in ammonia concentrations, was not included as part of the scope of this project and is unknown.

Nutrients and sediments are not currently contributing to regulatory impairments in Antelope Creek and have been added to the Basin Plan based upon the intentions of the City to holistically address water quality issues.

Basin Plan Project Area

The area addressed in this Basin Plan includes the lower portion of the Antelope Creek watershed below Holmes Lake Dam to its confluence with Salt Creek as illustrated in Figure 1-2. The project area encompasses approximately 7.7 total square miles and has a maximum width of about 2.1 miles. Prior to the Antelope Valley Project, a total of 5.7 miles of stream length existed, including over 0.75 miles that flowed through an underground conduit (23rd and N to 20th and Vine). Several factors brought on by urban development, greatly increased the

peak flow during flood events causing the flood capacity of the underground conduit to no longer be adequate, leading to necessary improvements to reduce the threat of flooding.

As of 2010, major improvements have been made to the creek and surrounding area as part of the Antelope Valley Project including the creation of 0.83 miles of open channel that includes the area through Union Plaza. The new design of Antelope Creek allows high flow events to run through both the underground conduit and the new open channel segment; drastically increasing the capacity of the creek. Before the project, flows that the underground conduit could not carry would flow overland and flood the neighborhood. That floodwater can now flow in the new and improved channel, reducing the floodplain and the threat of flooding. These structural improvements allow for a more effective conveyance of large rainfall events and reduced the existing floodplain to further protect approximately 800 homes and 200 businesses in the project area as illustrated in Figure 1-3. In addition to The Antelope Valley improvements, a significant flood control project was completed in 2011 which increased the flood capacity for a segment of the creek near the Lincoln Children's Zoo. Figure 1-3 represents these improvements.

Approximately 48,500 full-time residents and 8,500 University of Nebraska students live and work within the watershed study area (City Planning Department, 2010). Land use categories describe how property owners utilize the land, such as residential for homes, commercial for businesses, and industrial for manufacturing. The amount of stormwater runoff can vary greatly depending upon the type of land use. The majority of the 4,932 acre project area is residential (44%) with the remaining land use consisting of transportation (roadways, right-of-ways, etc.) (25%), and other various uses (31%). A full breakdown of land uses in the Basin Plan project area is found in Table 3.2.

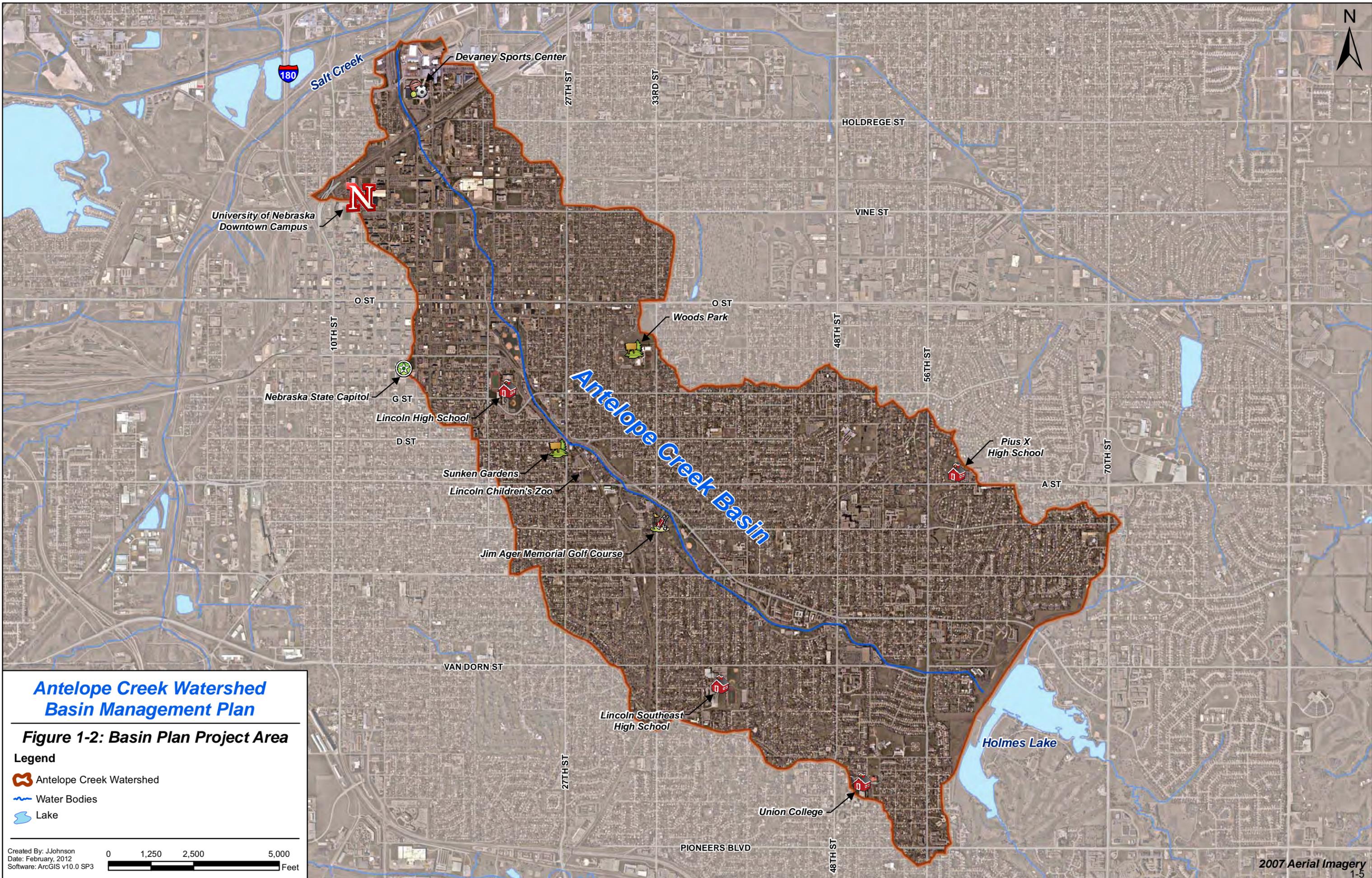
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Previous Antelope Creek Watershed Projects

The City and LPSNRD have worked extensively to improve flood control, reduce erosion, and minimize stream degradation in Antelope Creek. Below is a listing of three specific efforts recently completed in or near the Basin Plan area. This list does not include several smaller completed, ongoing, and planned improvements within Antelope Creek Watershed.

Antelope Valley Project—Since 2000, significant changes have occurred in the project area primarily due to the Antelope Valley Project; substantially complete as of 2011. Construction on the Antelope Valley Project has improved flood control, improved transportation, and provided community enhancements. Major projects have been completed adjacent to Antelope Creek including the creation of 0.83 miles of open channel, new bike trails, and pedestrian walkways. Several new transportation routes have been constructed as well as the establishment of a community park, Union Plaza.

Holmes Lake Renovation—In 2005, the City worked with Nebraska Game and Parks Commission (NGPC), NDEQ/USEPA, and Nebraska Environmental Trust to restore and improve the 110 acre lake and enhance the surrounding park area. This project removed sediment, increased the depth of the reservoir, improved sediment entrapment capabilities, and renovated the aquatic habitat of the reservoir. The project extended the recreational life span of the lake by 100 years.



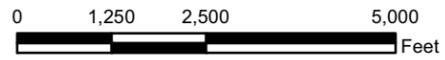
**Antelope Creek Watershed
Basin Management Plan**

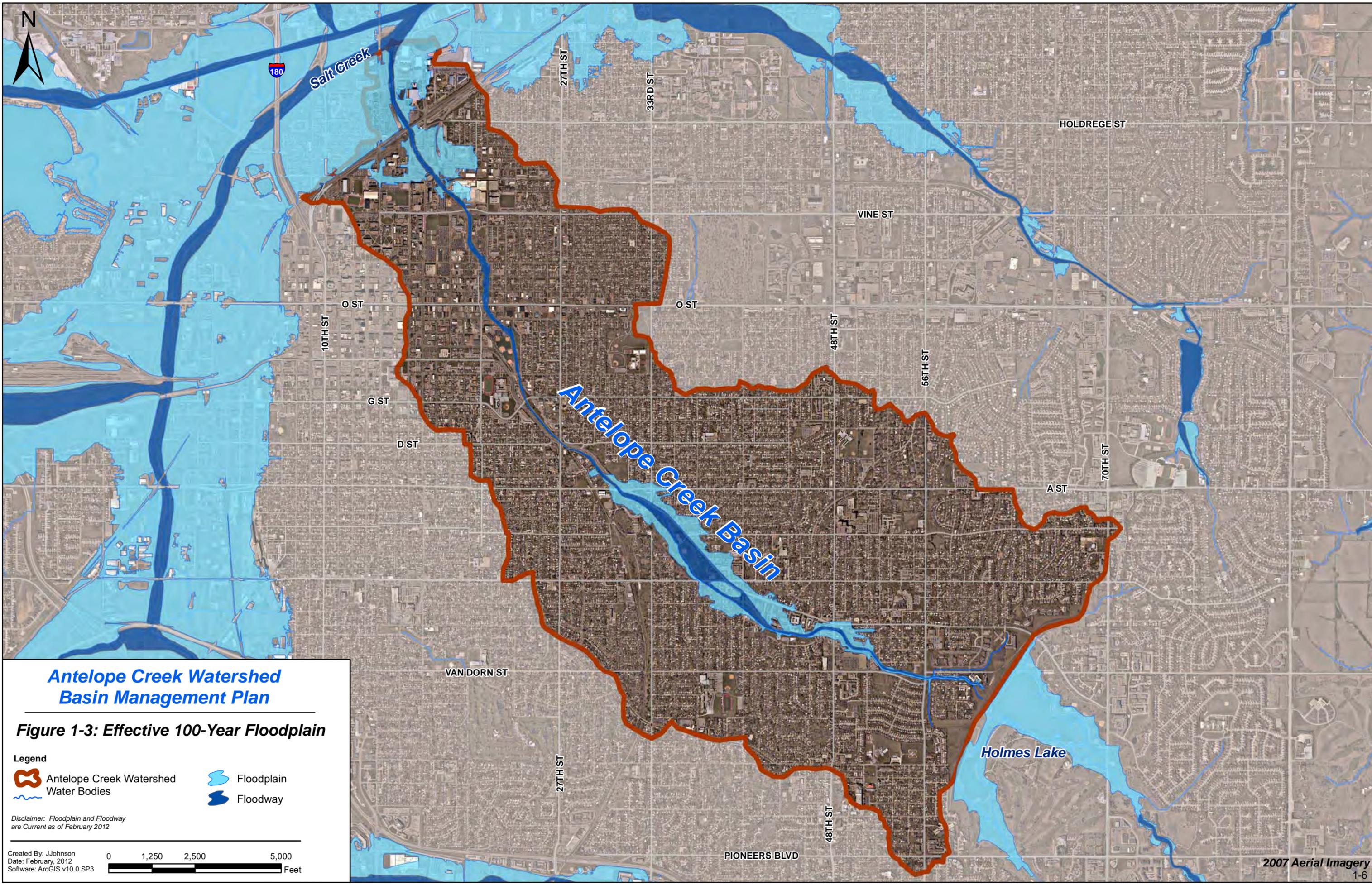
Figure 1-2: Basin Plan Project Area

Legend

-  Antelope Creek Watershed
-  Water Bodies
-  Lake

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 Date: February, 2012
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**Antelope Creek Watershed
Basin Management Plan**

Figure 1-3: Effective 100-Year Floodplain

- Legend**
-  Antelope Creek Watershed
 -  Floodplain
 -  Water Bodies
 -  Floodway

Disclaimer: Floodplain and Floodway are Current as of February 2012

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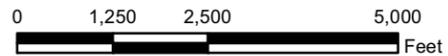
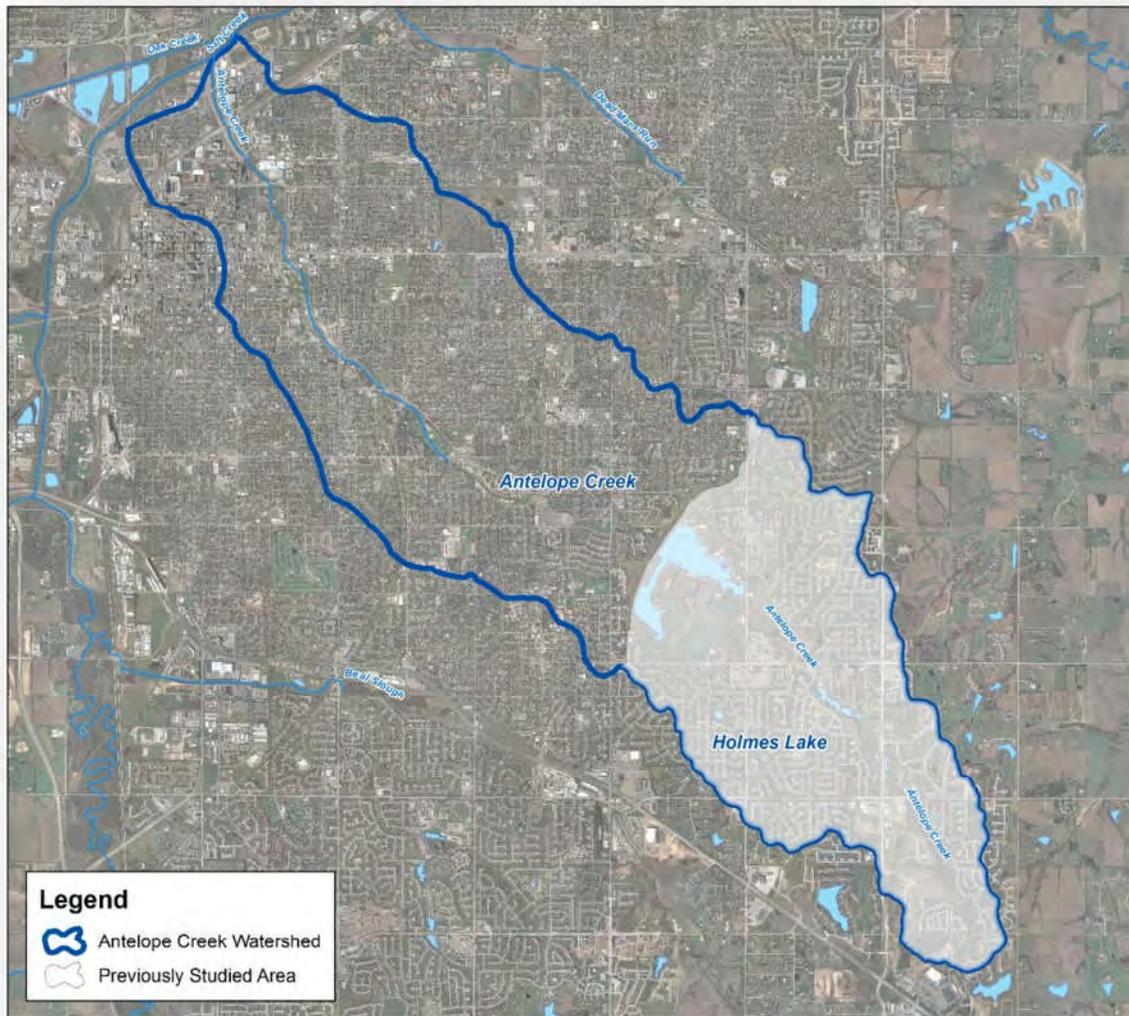


Figure 1-4. Antelope Creek Watershed Planning Areas



Holmes Lake Watershed Plan—The City of Lincoln worked with NDEQ/USEPA to establish a watershed plan for the portion of the watershed above Holmes Lakes, as seen in Figure 1-4 above. The intent of this community-based plan was to reduce the pollution flowing into the newly renovated Holmes Lake. As part of the plan’s implementation, a pilot-program was launched by the City in 2007. The City paid for 90% of rain garden cost and property owner paid 10%, free rain barrel installation, and free Low/No-phosphorus fertilizer. A Holmes Park Advisory Committee was established prior to the Holmes Lake renovation in 2003 to reduce the threat of future pollution at Holmes Lake through public education, wetland enhancement, and drainage improvements.

Project Team

The Basin Plan is a joint project led by the City and LPSNRD, with the City serving as the primary sponsor. The City and LPSNRD retained the consulting team led by EA Engineering, Science, and Technology, Inc. (EA) in association with JEO Consulting Group, Inc. (JEO) and Wright Water Engineers, Inc. (WWE). Serving as part of the WWE team, additional expertise for the project was provided by Dr. Robert Pitt, P.E., of the University of Alabama. The consulting team worked directly with a Core Work Group, consisting of staff from City Departments, LPSNRD, and NDEQ, in addition to an Advisory Council consisting of key stakeholders from the project area. Both the Core Work Group and Advisory Council are detailed in SECTION 2 - PUBLIC PARTICIPATION AND EDUCATION.

1.2. Basin Plan Goals and Objectives

Goals and objectives have been established in order to achieve the vision of the City and LPSNRD, which intends to improve the water quality in Antelope Creek. The Basin Plan will allow the City and LPSNRD staff, as well as other planning and design engineers, to proactively forecast, evaluate, and manage stormwater impacts as well as other existing impacts and impacts which could result from future development. Below are primary goals of the Basin Plan:

- Goals—broad based desires, written as statements, of the ultimate result being undertaken
- Objectives—steps or actions performed and assigned to individuals and/or groups, to attain a goal

Goal One: Determine the source of contaminants in Antelope Creek through establishment of the Antelope Creek Watershed Basin Management Plan.

Objectives:

- Basin Inventory—Collect, compile, and evaluate available data within the Antelope Creek Basin utilizing GIS to organize data.
- TMDL Assessment—Evaluate the feasibility of meeting the 2007 TMDL through review and evaluation of the database used to establish the TMDL and compare to other available water quality data.
- Water Quality Monitoring—Conduct water quality sampling to provide additional information regarding spatial and seasonal variation of contaminant levels.
- Pollution Sources—Evaluate relationship between land use and water quality, conduct visual inspection of dry weather flows into Antelope Creek, and identify possible pollution sources within the watershed.

Goal Two: Determine what can be done to reduce levels of each contaminant to maintain or improve the quality of water in Antelope Creek.

Objectives:

- Watershed Pollutant Modeling—Develop a water quality model for evaluation of BMPs. Evaluate structural and non-structural BMPs, their targeted pollutant removal efficiencies, appropriate land use applications, and long-term maintenance requirements.
- Site Screening and Conceptual Design—Identify a site inventory of at least 30 locations within the basin suitable for implementation of various BMPs; evaluate, rank, and prioritize site locations; and create the conceptual design of at least 10 structural BMPs at selected locations throughout the watershed.
- Improvement Projects—Develop capital and non-capital improvement projects and programs to improve water quality.
- Load Reduction—Establish a phased implementation strategy that will outline actions necessary to remove Antelope Creek from the 303(d) list. Include strategies that will limit loading of sediments, nutrients, and bacteria.

Goal Three: Educate the public about water quality and provide awareness of the Antelope Creek Watershed Basin Management Plan.

Objective:

- Public Information and Education—Disseminate information and solicit feedback from the public through open house meetings, newsletters, stakeholder meetings, and an advisory council.
- Public Acceptance—Work to achieve at least 50% implementation rate of non-structural stormwater controls amongst property owners and residents.

Goal Four: The City of Lincoln will apply lessons learned during the establishment of the Antelope Creek Watershed Basin Management Plan to other basins within the City and future growth areas.

Objective:

- City-Wide Load Reduction—Develop City-wide recommendations for reducing pollutant load through BMPs for other watersheds within the City.