1.0 Introduction

1.1 Purpose

This report has been prepared to provide the City of Lincoln with an update to the 2014 Water Facilities Master Plan (*2014 Master Plan*). Most significantly this report has evaluated revised background data for population and demand forecasts, coupled with impacts associated with climate change, to develop a new 12-year capital improvement program. The recommended improvements plan presented herein will serve as a basis for the planning, design, construction, and financing of facilities to meet the city's anticipated population growth and commercial development through Year 2032. The purpose of the recommended improvements is to provide an adequate and dependable supply of water to existing and future customers.

1.2 Scope

The study period for analysis of population and demand projections is from Year 2020 through the Year 2060. These analyses form the framework for understanding timing for expansion of the existing water supply and water treatment systems. Hydraulic analyses of the distribution system were limited to only evaluating design Years 2020 and 2032 since this study is an update to the previous plan.

The study area for this investigation and report is shown on Figure 1-1 located at the end of this chapter. The various components of the Study Area have been delineated by the Lincoln-Lancaster County Planning Department in the updated *2040 Comprehensive Plan* (*LPlan 2040*) as adopted in December, 2016. In general, the areas evaluated as part of this study include Tier I – Priorities A (Developing), Priorities B (Year 2025), and parts of Priority C (Year 2040).

The principal elements of this master plan study update include consideration and evaluation of the following:

- Update Population Projections - Update the population projections to be consistent with the *LPlan 2040*. Design Years will include Year 2020, 2025, 2040, and 2060. Historical water use trends and projections of future water requirements as originally developed for the *2014 Master Plan* were based on recent population projections provided by the Lincoln-Lancaster County Planning Department.
- Revise Demand Projections – Evaluate trends in water use and update demand projections taking into account climate change. Assign base year (2020) and Year 2032 demands to the hydraulic model.
- Update Water Supply Projections – Determine 30-day, 60-day, and 90-day water supply yields utilizing existing groundwater model. Utilize basin wide groundwater modeling tools, with adjustment for climate impacts, to revise streamflow input into the groundwater model. The chapter on water supply also includes an assessment of Lincoln's current water rights.
- Evaluate the Water Treatment Plant – Review historical records to confirm compliance with water treatment regulations. Perform high level condition assessment to determine necessary improvements for ongoing reliable operations. Evaluate timing and need of plant expansion based upon revised demands, condition assessment, and process considerations.

- Distribution System Analysis - Update the computer model of the Lincoln water distribution system in InfoWater hydraulic analysis software and perform analyses for average day, maximum day, and maximum hour scenarios for Years 2020 and 2032. Specific focus areas to be evaluated include 56th and I-80, 27th and Rokeby, and Folsom and Old Cheney.
- Perform Distribution Water Quality Analyses – Evaluate available historical water quality data, perform distribution water age analyses, and develop protocol for system improvements which enhance water quality in the system.
- Update Transmission Condition Assessment – Develop condition assessment program for the transmission system based upon available technology, inspection cost, pipe material, and main criticality.
- Lead Service Line Review – Review existing records to quantify existing lead service lines, provide summary of regulations and replacement strategies, and summarize potential funding options.
- Capital Improvement Program – Prepare an update of recommended water system improvements.

1.3 Climate Change Considerations

Climate change continues to become an ever-increasing concern to the general public given the volatility of recent weather patterns in the State. This master plan update provided an opportunity for the Lincoln Water System to consider the impacts of climate change for the first time in their water supply planning process. The specific climate change impacts considered under this study included reduced supply capacity as a result of higher temperatures, reduced streamflows, and more variability in precipitation, as well as an increased summer seasonal peak 90-day demand expected due to longer periods of dry weather.

1.4 Acronyms and Abbreviations

Acronyms and abbreviations used in this report are as follows:

AD	(Annual) Average Day
AL	Action Level
AM	Average Month
AOB	Ammonia Oxidizing Bacteria
AWWA	American Water Works Association
BG	Billion Gallons
BPS	Booster Pumping Station
CCI	Construction Cost Index
CCL	Contaminant Candidate List
CCT	Corrosion Control Treatment
CDBG	Community Development Block Grant
CFE	Combined Filter Effluent
cfu	Colony Forming Unit
CIP	Capital Improvements Program
Cl_2	Chlorine

CWSRF	Clean Water State Revolving Fund
DBPR	Disinfectant/Disinfection Byproduct Rule
D/DBPR	Disinfection/Disinfectant By-Product Rule
DWSRF	Drinking Water State Revolving Fund
El.	Elevation
ENR	Engineering News Record
EPA	(United States) Environmental Protection Agency
EPS	Extended Period Simulation
ESRI	Environmental Systems Research Institute
ft	Feet
ft^2	Square Feet
gal	Gallons
GFH®	Granular Ferric Hydroxide®
gpcd	Gallons Per Capita per Day
gpm	Gallons Per Minute
gpm/ft^2	Gallons Per Minute per Square Foot
GIS	Geographic Information Systems
GWUDI	Ground Water Under the Direct Influence
HAA5	Five regulated haloacetic acids
HCW	Horizontal Collector Well
HELP	Homeowner's Emergency Loan Program
HG	Hydraulic Gradient
HGL	Hydraulic Grade Line
hp	Horsepower
HUD	Department of Housing and Urban Development
ICI	Industrial/Commercial/Institutional
IDSE	Initial Distribution System Evaluation
in.	Inch
ISO	Insurance Services Office
LCR	Lead and Copper Rule
LOX	Liquid Oxygen
LSL	Lead Service Line
LT2ESWT	Long-term 2 Enhanced Surface Water Treatment Rule
LWS	Lincoln Water System
MCL	Maximum Contaminant Limit
MCLG	Maximum Contaminant Limit Goal
MD	Maximum Day
MG	Million Gallons

mgd	Million Gallons per Day
mg/L	Milligrams per Liter
MH	Maximum Hour
min	Minutes
mL	Milliliter
MM	Maximum Month
ND	Non-detect
NPDWR	National Primary Drinking Water Regulations
NRW	Non-Revenue Water
NTU	Nephelometric Turbidity Units
ppd	Pound Per Day
ppmv	Parts Per Million by Volume
PRV	Pressure Reducing Valve
PSA	Pressure Swing Adsorption
psi	Pounds per Square Inch
PWS	Public Water System
rpm	Revolutions Per Minute
SCADA	Supervisory Control and Data Acquisition
SL	Service Level
SMP	Standard Monitoring Plan (for Stage 2 D/DBPR)
SP	Seasonal Peak
SSS	System Specific Study (for Stage 2 D/DBPR)
SWTR	Surface Water Treatment Rule
TAZ	Traffic Analysis Zone
TDH	Total Dynamic Head
TOU	Time of Use
TTHM	Total Trihalomethanes
µg/L	Micrograms per Liter
UNF	Unaccounted-for Water
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WIFIA	Water Infrastructure Finance and Innovation Act
WIIN	Water Infrastructure Improvements for the Nation
WQP	Water Quality Parameter
WSE	Water Surface Elevation
WTP	Water Treatment Plant

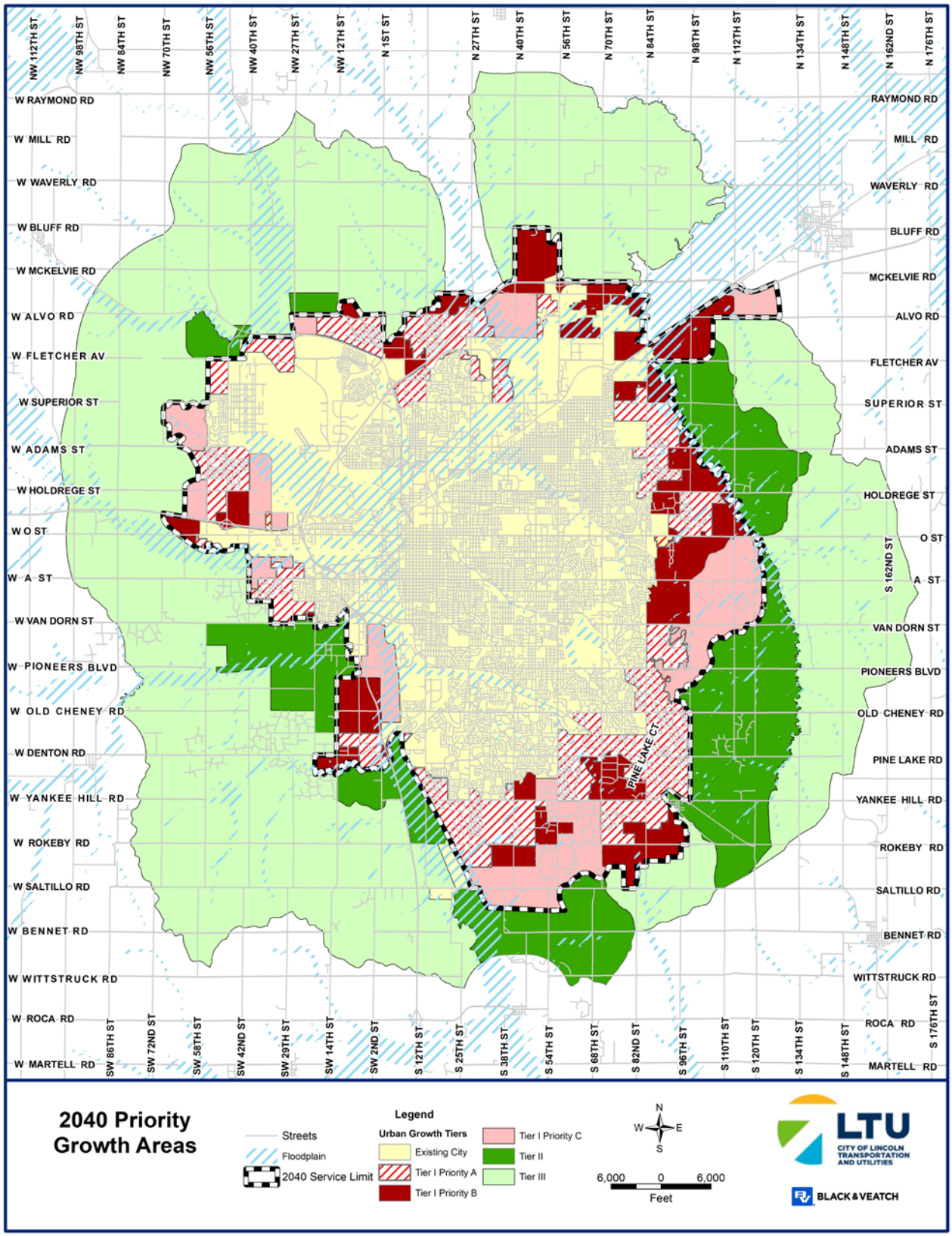

Figure 1-1 2040 Priority Growth Area