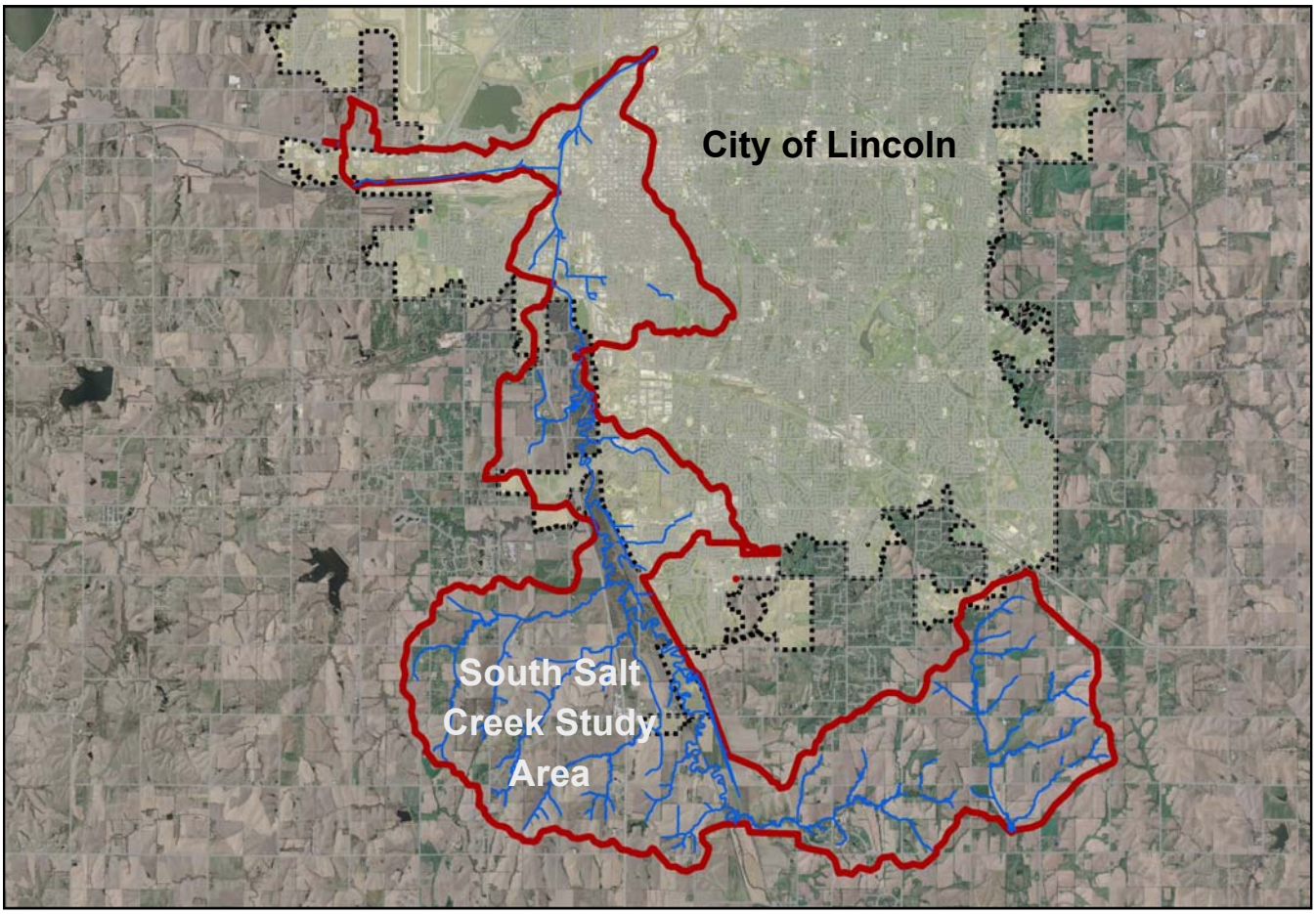
CITY OF LINCOLN NEBRASKA

Lower Platte South Natural Resources District

South Salt Creek Watershed Master Plan Study



INTUITION LOGIC

In Association With:
United States Geological Survey

USGS science for a changing world

The Heartland Center for Leadership Development

Heartland Center for Leadership Development

January 2015

South Salt Creek Watershed Master Plan

Lower Platte South
Natural Resources District

Mark Edward Meyer E-11103

INTUITION & LOGIC

In Association With:
United States Geological Survey
The Heartland Center for Leadership Development

This page left intentionally blank

A88680

14R-296 Introduce: 11-24-14

Comprehensive Plan Amendment No. 14005

RESOLUTION NO. A-88680

WHEREAS, the Planning Director has made application to amend the 2040 Lincoln/Lancaster County Comprehensive Plan to add the South Salt Creek Watershed Master Plan as a subarea plan and to the list of adopted watershed studies; and

WHEREAS, the Lincoln City-Lancaster County Planning Commission has recommended approval of said proposed amendment.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Lincoln, Nebraska:

That the 2040 Lincoln/Lancaster County Comprehensive Plan be amended as follows:

1. Under Energy and Utilities on page 11.13 revise the first full paragraph to read as follows:

> As part of the overall watershed management program, the City, in cooperation with the LPSNRD, is developing a unified master watershed management plan. This plan will provide information and computer models to aid in analyzing stormwater management alternatives. Individual watershed plans for ~~seven~~ several watersheds in Lincoln and the surrounding area have already been completed and are adopted as subarea plans in this document (see "Plan Realization" chapter). These plans evaluate and propose projects to address a wide range of water resources and they are formulated in cooperation with other local, state and federal agencies. Ideally, additional watershed plans are completed and adopted prior to urban development occurring within a new basin. This allows projects and recommendations in the plan to be considered during the review of specific development proposals.

2. Under Plan Realization on page 12.16 add the South Salt Creek Watershed Master Plan, 2014 to the list of Watershed Master Plans.

BE IT FURTHER RESOLVED that any other references in said plan which may be affected by the above-specified amendments be, and they hereby are amended to conform to such specific amendments.

Introduced by:

Jonathan Cook

AYES: Camp, Christensen, Cook, Emery, Eskridge, Fellers, Gaylor Baird; NAYS: None.

Approved as to Form & Legality:

City Attorney

Approved this 16th day of Dec., 2014:

Mayor

ADOPTED

DEC 08 2014

BY CITY COUNCIL

Table of Contents

Executive Summary ES-1

Section 1 – Introduction and Purpose

1.1 Introduction 1-1
1.2 Watershed Characteristics 1-2
1.3 Study Area Characteristics 1-2
1.4 Goals and Objectives 1-7
1.5 Public Participation Process 1-8
1.5.1 Open House Events 1-8
1.5.2 Website and Newsletter 1-9

Section 2 – Inventory and Methodology

2.1 Watershed Inventory 2-1
2.2 Study Methodology 2-3
2.2.1 Hydrologic Modeling 2-3
2.2.2 Water Quality Investigation 2-4
2.2.3 Geomorphic Field Investigation 2-6
2.2.4 Special Areas Consideration 2-8

Section 3 – Hydrologic Model Development

3.1 Introduction 3-1
3.2 Methodology 3-1
3.2.1 Sub-basin Delineation 3-1
3.2.2 Rainfall 3-6
3.2.3 Runoff Volume 3-6
3.2.3 Runoff Hydrographs 3-10
3.3 Modeling Results 3-10
3.4 Culvert Analysis 3-14
3.4.1 Flowrates 3-14
3.4.2 Culvert Identification 3-14
3.4.3 HY-8 Analysis 3-14
3.4.4 Results 3-15

Section 4 – Water Quality

4.1 Introduction 4-1
4.2 Methodology 4-1
4.2.1 Sampling Protocol 4-3
4.2.2 Analytical Procedures 4-3
4.3 Results 4-4
4.3.1 Applicability to Water-Quality Criteria 4-5

4.3.2 Naturally Elevated Specific Conductance and Sodium 4-9
4.3.3 Runoff Characteristics 4-9
4.3.3.1 Total Suspended Solids 4-12
4.3.3.2 Bacteria 4-13
4.3.3.3 Total Phosphorus 4-14
4.3.3.4 Atrazine 4-15
4.4 Managing Stormwater Quality..... 4-15

Section 5 – Geomorphic Evaluation

5.1 Introduction..... 5-1
5.2 Methodology..... 5-3
5.3 Results..... 5-8
5.4 Stream Recommendations 5-14

Section 6 – Special Areas

6.1 Introduction..... 6-1
6.2 Methodology 6-1
6.3 Evaluation Results 6-1
6.4 Special Area Recommendations 6-6

Section 7 – Capital Improvement Projects

7.1 Introduction..... 7-1
7.2 Problem Identification 7-1
7.3 Evaluation Approach 7-2
7.3.1 Stream Erosion Evaluation 7-2
7.3.2 Water Quality Considerations..... 7-2
7.3.3 Special Areas Considerations 7-3
7.3.4 Capital Improvement Project Types 7-3
7.4 Capital Improvement Projects..... 7-4
7.4.1 Project SSC-1..... 7-6
7.4.2 Project SSC-2..... 7-7
7.4.3 Project SSC-3..... 7-8
7.4.4 Project SSC-4..... 7-9
7.4.5 Project SSC-5..... 7-10
7.4.6 Project SSC-6..... 7-11
7.4.7 Project SSC-7..... 7-12
7.4.8 Project SSC-8..... 7-13
7.4.9 Project SSC-9..... 7-14
7.4.10 Project SSC-10..... 7-15
7.4.11 Project SSC-11..... 7-16
7.4.12 Project SSC-12..... 7-17
7.4.13 Project SSC-13..... 7-18
7.4.14 Project SSC-14..... 7-19

7.4.15 Project SSC-15 7-20
7.4.16 Project SSC-16 7-21
7.4.17 Project SSC-17 7-22
7.4.18 Project SSC-18 7-23
7.4.19 Project SSC-19 7-24
7.5 Prioritization 7-25
7.6 Other Improvement Recommendations 7-27
7.6.1 Project SSC Other-1 7-29
7.6.2 Project SSC Other-2 7-30
7.6.3 Project SSC Other-3 7-31
7.6.4 Project SSC Other-4 7-32
7.6.5 Project SSC Other-5 7-33
7.6.6 Project SSC Other-6 7-34
7.6.7 Project SSC Other-7 7-35
7.6.8 Project SSC Other-8 7-36
7.6.9 Project SSC Other-9 7-37
7.6.10 Project SSC Other-10 7-38
7.6.11 Project SSC Other-11 7-39
7.6.12 Project SSC Other-12 7-40
7.6.13 Project SSC Other-13 7-41
7.6.14 Project SSC Other-14 7-42
7.6.15 Project SSC Other-15 7-43
7.6.16 Project SSC Other-16 7-44
7.6.17 Project SSC Other-17 7-45
7.6.18 Project SSC Private 1 7-46
7.6.19 Project SSC Private 2 7-47
7.6.20 Project SSC Private 3 7-48
7.6.21 Project SSC Private 4 7-49
7.6.22 Project SSC Private 5 7-50
7.6.23 Project SSC Private 6 7-51
7.6.24 Project SSC Private 7 7-52

Section 8 – Implementation

8.1 Introduction 8-1
8.2 Capital Improvement Project Implementation 8-1
8.3 Education Program 8-1
8.4 Project Funding 8-1
8.5 Coordination Efforts 8-1
8.6 Additional Studies 8-2

Section 9 – Glossary of Terms and References

9.1 Glossary of Terms 9-1
9.2 References 9-9

Appendices

Appendix A - Digital Deliverables
Appendix B - Public Participation Materials (Summary Documents, Attendance Lists, Minutes, Watershed News)
Appendix C - Hydrologic Model Input Data and Results
Appendix D - Water Quality Sampling Data
Appendix E - Fundamentals of Fluvial Geomorphic Principles
Appendix F - Channel Condition Scoring Matrix and Channel Condition Data
Appendix G - Dominant Process Indicators and Reach Summary Data Sheets
Appendix H - Capital Improvement Project Prioritization Ranking Worksheets
Appendix I - Capital Improvement Project Cost Worksheets

Figures

ES-1 Status of Watershed Master Plans....ES-2
ES-2 Study Area Map....ES-3
ES-3 CIP Locations....ES-5
1-1 Status of Basin Plans Map....1-3
1-2 Watershed Map....1-4
1-3 Study Area Map....1-5
2-1 Hydrology Study Areas....2-4
2-2 Water Quality Sampling Sites....2-5
2-3 Study Reaches....2-6
3-1 Subbasin Boundaries....3-2
3-2 Subbasin Boundaries....3-3
3-3 Subbasin Boundaries....3-4
3-4 Subbasin Boundaries....3-5
3-5 Existing Land Use....3-8
3-6 Hydologic Soil Groups....3-9
3-7 Watershed Culvert Analysis....3-16
4-1 Water Quality Sampling Sites....4-2
4-2 Geometric Mean of Sodium-Absorption Ratio....4-10
4-3 Total Suspended Solid Concentrations Increase....4-12
4-4 *E. coli* Concentrations Increase....4-13
4-5 Total Phosphorus Concentrations....4-14
4-6 Atrazine Concentrations Increase....4-15
5-1 Channel Evolution Stages....5-2
5-2 Study Reaches....5-7
5-3 Channel Condition Points....5-11
5-4 Stream Channel Dominant Process....5-14
6-1 Special Areas Map 1....6-3
6-2 Special Areas Map 2....6-4
6-3 Special Areas Map 3....6-5
7-1 Rock Grade Control Structure Detail....7-3
7-2 Bank Stabilization Structure Detail....7-4
7-3 Stilling Basin Structure Detail....7-4
7-4 Watershed Projects - CIP....7-5
7-5 Incision in channel....7-6
7-6 Conceptual Layout of SSC-1....7-6
7-7 Failing Grade Control....7-7
7-8 Incising channel north of Irvingdale Park....7-7
7-9 Conceptual Layout of SSC-2....7-9
7-10 Knickpoint and Exposed Bridge Piers....7-8
7-11 Conceptual Layout of SSC-3....7-8
7-12 Old Cheney Rd Bridge Piers Exposed....7-9
7-13 Conceptual Layout of SSC-4....7-9

7-14 Headcut and Knickzone associated with Channel Incision 7-10
7-15 Conceptual Layout of SSC-5 7-10
7-16 Knickpoint Downstream of old Railroad Bridge Knickpoint 7-11
7-17 Trail Bridge with exposed footings..... 7-11
7-18 Conceptual Layout of SSC-6 7-11
7-19 Perched Culvert at W Rokeby Rd..... 7-12
7-20 Conceptual Layout of SSC-7 7-12
7-21 Perched SW 12th St culvert outfall..... 7-13
7-22 Conceptual Layout of SSC-8 7-13
7-23 Eroding farm crossing holding up knickpoint 7-14
7-24 Conceptual Layout of SSC-9 7-14
7-25 Headcut propagating into field..... 7-15
7-26 Conceptual Layout of SSC-10 7-15
7-27 Knickpoint in channel. 7-16
7-28 Conceptual Layout of SSC-11 7-16
7-29 Perched S 1st St Culvert 7-17
7-30 Conceptual Layout of SSC-12 7-17
7-31 Perched S 1st St culvert 7-18
7-32 Conceptual Layout of SSC-13 7-18
7-33 Perched Saltillo Rd culvert 7-19
7-34 Conceptual Layout of SSC-14 7-19
7-35 Knickpoint Beneath Trail Bridge..... 7-20
7-36 Conceptual Layout of SSC-15 7-20
7-37 Root mass holding up 3 foot knickpoint on main stem. 7-21
7-38 Conceptual Layout of SSC-16 7-21
7-39 Knick at confluence 7-22
7-40 Conceptual Layout of SSC-17 7-22
7-41 1 foot knickpoint held up by tree roots 7-23
7-42 Conceptual Layout of SSC-18 7-23
7-43 Debris jam holding up knickpoint..... 7-24
7-44 Conceptual Layout of SSC-19 7-24
7-45 Other & Private Projects 7-28
7-46 SSC Other-1 Project Location. 7-29
7-47 SC015R005 upstream of the dam 7-30
7-48 SSC Other-2 Project Location 7-30
7-49 Tributary SC015R015..... 7-31
7-50 SSC Other-3 Project Location 7-31
7-51 SC015R005 upstream of the dam 7-32
7-52 SSC Other-4 Project Location 7-32
7-53 incised channel reach 7-33
7-54 SSC Other-5 Project Location 7-33
7-55 Incised channel reach. 7-34
7-56 SSC Other-6 Project Location 7-34

7-57 SSC Other-7 Project Location 7-35
7-58 SSC Other-8 Project Location 7-36
7-59 SSC Other-1 Project Location 7-37
7-60 S 54th St culvert 7-38
7-61 SSC Other-10 Project Location 7-38
7-62 SSC Other-11 Project Location 7-39
7-63 Bennet Rd culvert 7-40
7-64 SSC Other-12 Project Location. 7-40
7-65 W Rokeby Rd culvert 7-41
7-66 SSC Other-13 Project Location 7-41
7-67 W Rokeby Rd culvert 7-42
7-68 SSC Other-14 Project Location 7-42
7-69 S 1st St culvert 7-43
7-70 SSC Other-15 Project Location 7-43
7-71 SW 12th St culvert 7-44
7-72 SSC Other-16 Project Location 7-44
7-73 SSC Other-17 Project Location. 7-45
7-74 Petroleum pipe exposed in bed 7-46
7-75 SSC Private-1 Project Location 7-46
7-76 Pipe exposed in bed 7-47
7-77 SSC Private-2 Project Location 7-47
7-78 Petroleum pipe exposed in bed 7-48
7-79 SSC Private-3 Project Location 7-48
7-80 Natural gas pipe exposed in bed 7-49
7-81 SSC Private-4 Project Location 7-49
7-82 Petroleum pipe exposed in channel 7-50
7-83 SSC Private-5 Project Location 7-50
7-84 Broken up and deteriorated concrete channel 7-51
7-85 SSC Private-6 Project Location 7-51
7-86 Bank Erosion and Incision Upstream of Warlick Blvd 7-52
7-87 SSC Private-7 Project Location 7-52

Tables

ES-1 Project Priority, Rank and Cost ES-6
1-1 Watershed Characteristics..... 1-2
1-2 Study Area Characteristics..... 1-2
3-1 Rainfall Depths 3-6
3-2 Lookup table 3-7
3-3 Peak Flow Rates..... 3-11
3-4 Culvert Overtopping Analysis 3-15
4-1 Analytes Evaluated For Each Sample..... 4-4
4-2 Geometric Means of Selected Analytes..... 4-6
4-3 Total-suspended solid concentrations increase..... 4-12
4-4 E. coli. concentrations tend to increase..... 4-13
4-5 Total phosphorus concentrations 4-14
4-6 Atrazine concentrations tend to increase 4-15
5-1 Average Field Score Per Channel Condition Rating Category 5-8
5-2 Number of GOOD, FAIR and POOR Field Scores 5-9
7-1 Project Priority, Rank and Cost 7-26