Salt Creek Floodplain Mapping Update
Floodway Approach Summary
City of Lincoln, Nebraska

Introduction

The Federal Emergency Management Agency (FEMA) is undertaking a comprehensive, multi-year initiative to update aging flood hazard maps for communities across the country. As part of this federal program, FEMA is partnering with the City of Lincoln (City) in cooperation with the Lower Platte South Natural Resources District (NRD) to develop more accurate floodplain information for various streams and channels within and adjacent to the City. One of these streams is Salt Creek, which is the major local tributary that runs through the City from south to the northeast for over 20 miles.

The purpose of this document is to summarize the technical approach for updating the floodway along the levee system of Salt Creek.

Study Area Description

A parallel levee system flanks both sides of the Salt Creek channel spanning Calvert Street to Superior Street. The location of the levee system is depicted on Figure 1. The levee system along the channel, in concert with the street network perpendicular to the channel, creates a series of flood storage cells and an "ice cube tray" effect, which calls into question the suitability of applying FEMA's traditional conveyance model and floodway/flood fringe approach at this location. These inherent complexities in the floodplain through this area required a unique modeling approach to produce floodplain and floodway boundaries that were technically accurate.

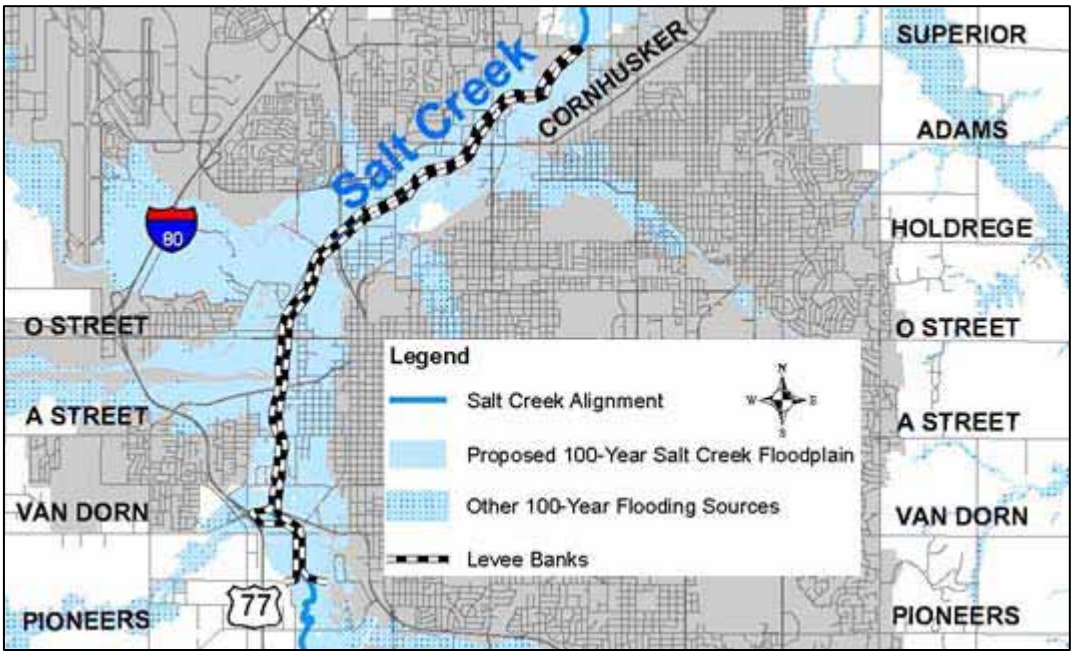

Figure 1 – Levee System in Lincoln, Nebraska

Storage Area Model Development

A unique approach was undertaken by the U. S. Army Corps of Engineers (USACE) in developing the Flood Insurance Study effective floodway in this area. The floodway boundary was set at the levee crest, and the percentage storage volume to be preserved within each storage area was defined to prevent flood heights from increasing greater than 1 foot because of development in the flood fringe. In general, the floodway procedure for the Salt Creek Floodplain Mapping Update is consistent with the approach used by USACE and is based on the premise that the floodway should protect the flood conveyance portion of the channel, and provisions should be in place to limit the amount of encroachment of critical storage areas to keep the floodplain elevations from increasing by more than 1 foot. The following paragraphs outline the procedure.

Storage Area Delineation

Between Calvert Street and Superior Street, the floodway boundary was delineated along the levee system to protect the major flood conveyance portion of the floodplain. In addition, the 100-year floodplain was delineated and divided into storage areas. The storage area boundaries were delineated using GIS tools and field observations. The boundaries were based on key topographic features including road and railroad embankments as well as natural ridge lines.

Allowable Fill Percentage Calculation

Two concurrent analyses were then performed to calculate the allowable fill percentage for each of the delineated storage areas. Both analyses were based on fill within the storage areas and the subsequent flow increase that would cause the Salt Creek floodplain to rise no more than 1 foot.

To achieve the calculated target increase in flow, an iterative analysis was performed. The iterative analysis took into account the following:

- To be fair and equitable to all land owners within the levee system, the initial percent allowable fill for all storage areas was estimated at 50 percent of the original volume. Using the initial percentages as a baseline, a peak flow comparison was made by modifying the allowable fill of each individual storage area. This process identified storage areas that were particularly sensitive to increases or decreases in allowable fill. During the iterative analysis, confluence locations and storage areas that do not allow a transfer of flood waters to adjacent storage areas were determined to be particularly sensitive. Table 1 outlines the sensitivity factors for each storage area.

- Storage areas were grouped based on their physical characteristics along the Salt Creek channel. By incrementally adjusting the percent allowable fill for groups of storage areas based on the overall sensitivity of the area, the percent was generalized across a larger scale, keeping the percent allowable fill similar across storage area boundaries.

The storage area boundaries and fill percentage results are depicted on Figure 2. The percentages of allowable fill in each storage area must be maintained to prevent adverse impacts downstream. The percentages of allowable fill estimated for the storage areas range from 35 percent to 65 percent.

Table 1
Storage Area Sensitivity Factors

Individual Flood Storage Area	*% by Volume Allowable Fill*	*Sensitivity Factors*
SA 1	40	Isolated storage area receiving inflow from local drainage and minimal amount of Salt Creek levee overtopping. Available storage is decreased because of limited transfer of flood waters between storage areas.
SA 2	60	Local drainage contributes to inflow. Allowable fill is increased because of conveyance of flood waters into downstream Storage Area 4.
SA 3	50	Local drainage contributes to inflow. Allowable fill is increased because of conveyance of flood waters into downstream Storage Area 6.
SA 4	50	Local drainage contributes to inflow. Allowable fill is increased because of conveyance of flood waters into downstream Storage Area 5.
SA 5	50	Local drainage contributes to inflow. Allowable fill is increased because of conveyance of flood waters into downstream Storage Area 7.
SA 6 & 8	35	Coincident peaks occur at the confluence of Salt Creek and Middle Creek creating a backwater effect from Salt Creek. The backwater causes Middle Creek to overtop its banks resulting in a reduction of available storage.
SA 7	55	Local drainage and a minimal amount of Salt Creek Main Channel overtopping of the levee contribute to inflow. Allowable fill is increased because of conveyance of flood waters into downstream Storage Area 9.
SA 9	40	Majority of flow is received via local drainage sources and the Capitol Parkway underpass from Storage Area 7. Allowable fill is reduced because of Interstate 180 embankment that causes water to backup at the downstream end the storage area.
SA 10	40	Local drainage is main inflow source. Allowable fill is reduced because of railroad embankment causing water to backup at the downstream end of the storage area as well as limited conveyance via storage area connections.
SA 11	55	Significant overtopping of Oak Creek and Salt Creek levees contributes to inflow. Flow conveyance on two sides of the storage area allows for distribution of flow into Oak Creek and an increase in available storage. A portion of the flow into Oak Creek from the storage area is distributed into Storage Areas 12 and 13, rather than Salt Creek Main Channel.
SA 12	60	Local drainage is main inflow source to the storage area. The storage area eastern boundary is North 14th Street, which is overtopped and conveys flood water to Storage Area 16.
SA 13	35	Significant overtopping of the Oak Creek and Salt Creek levee reduce available storage near the Oak Creek confluence.
SA 14	60	Topographically isolated storage area receiving inflow from local drainage and minimum amount of Salt Creek/Antelope Creek backwater. Available storage is decreased compared to Storage Area 15 because of limited transfer of flood waters between storage areas.
SA 15	65	Antelope Creek depletes a minimal amount of available flood storage compared to the backwater of Salt Creek. Allowable fill is increased because of conveyance of flood waters into adjacent Storage Area 17.
SA 16	40	Local drainage inflow, Salt Creek Main Channel overtopping levee downstream of Oak Creek, and flow from Storage Area 12 across North 14th Street all contribute to reduction in available flood storage.
SA 17	60	Local drainage is sole inflow source to the storage area. The storage area eastern boundary is North 27th Street, which is overtopped and conveys flood water to Storage Area 18.
SA 18	40	Deadmans Run contributing flow consumes some of the available flood storage, reducing amount of volume available when Salt Creek peak flow is observed. Storage Area 17 also conveys flood water across North 27th, reducing available storage.
SA 19 & 20	35	The most sensitive storage areas in the model with respect to impacts downstream of the levee. Encroachment upstream increases flows in the main channel allowing overtopping of the levees. Upstream storage areas also contribute flood waters across storage area boundaries, reducing allowable fill.

Figure 2 – Storage Area Allowable Fill Percentages