C I T Y OF B O U L D E R
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: August 18, 2014

AGENDA TITLE: Information Item - Skunk Creek, Bluebell Creek and King's Gulch Floodplain Mapping Update

PRESENTER/S:
Jeff Arthur, Director of Public Works for Utilities
Bob Harberg, Principal Engineer - Utilities
Annie Noble, Flood and Greenways Engineering Coordinator
Katie Knapp, Engineering Project Manager

EXECUTIVE SUMMARY

The purpose of this memorandum is to provide a general summary of the history and results of the Skunk Creek Floodplain Mapping Update.

Floodplain mapping provides the basis for flood management by identifying the areas subject to the greatest risk of flooding. This information is essential for determining areas where life safety is threatened and property damage is likely and is the basis for floodplain regulations and the National Flood Insurance Program (NFIP). The city's floodplain maps need to be periodically updated to reflect changes in the floodplain resulting from land development, flood mitigation improvements, new topographic mapping information and new mapping study technologies.

The Skunk Creek Floodplain Mapping Update includes the King's Gulch, Skunk and Bluebell Canyon Creek floodplains between the city limits to east of Foothills Parkway where Skunk Creek confluences into Bear Canyon Creek as shown in red below.

Engineering consultants provided hydraulic modeling to update the existing Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) and City of Boulder floodplains, water surface elevations, conveyance and high hazard zones.

The proposed mapping of the Skunk Creek Floodplain would result in a net:

- Increase of 49 structures identified in the 100-year floodplain;
- Decrease of 25 structures identified in the conveyance zone and;
- Decrease of 14 structures identified in the high hazard zone.

The WRAB review of the floodplain mapping update does not require board members to verify the analysis and calculations, but accepts the overall mapping study process and that results are reasonable and acceptable.

Following input from the August WRAB meeting, any information requested about the mapping study will be presented at the September WRAB meeting. A request for a motion will also be made at the September WRAB meeting.

BOARD AND COMMISSION FEEDBACK

The Skunk Creek floodplain mapping update has not been brought to any Boards or Commissions prior to WRAB. Following input from WRAB, the mapping update will be presented to City Council.

PUBLIC FEEDBACK

Public notification post cards about the mapping update have been sent to all property owners in the study area and a project web site has been developed to provide information (https://bouldercolorado.gov/water/skunk-creek-floodplain-mapping-update).

An open house meeting is being held immediately prior to this WRAB meeting to inform the public about the mapping update. A summary of public input gathered at the open house will be provided at the September WRAB meeting.

BACKGROUND

The risk of flash flooding is an important issue for the City of Boulder primarily due to its location at the mouth of Boulder Canyon and other canyon creeks. Approximately 13 percent of the city is located within the 100-year floodplains of Boulder Creek and its 14 tributaries. Additional information about the city's floodplain management program, floodplain regulations and flood insurance can be found at: **Floodplain Management Overview.**

The city delineates four flood zones:

500-year floodplain: The 500-year floodplain delineates the flood limits resulting from a storm that has a 0.2 percent chance of occurring in any given year.

100-year floodplain: The 100-year floodplain delineates the flood limits resulting from a storm that has a one percent chance of occurring in any given year (26 percent chance over a 30-year mortgage).

Conveyance zone: The conveyance zone is defined as the areas in the floodplain that are reserved for the main passage of the entire 100-year flood flow when the 100-year floodplain is artificially narrowed until a maximum six-inch increase in flood water depth is created. This zone is delineated to allow development to occur up to the narrowed floodplain and still provide passage of 100-year storm flows.

High hazard zone: The high hazard zone defines the area of the floodplain where water depth and velocity pose a threat to life and safety. This area is delineated for areas in the floodplain where water depths are four feet or greater or where the water velocity multiplied by water depth equals or exceeds the number four.

Skunk Creek, Bluebell Canyon Creek, and Kings Gulch were first studied in 1987 by the consulting firm Greenhorne & O'Mara and the resulting Flood Hazard Area Delineation (FHAD) report included the delineation of the 100-year floodplain along these creeks. The Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) approved for these creeks were originally based on the 1987 FHAD and included a federally-regulated one foot rise floodway. Since that time, both the City of Boulder and the State of Colorado have adopted a ½ foot rise floodway, which the City refers to as the Conveyance Zone.

In 1989, Love and Associates delineated the High Hazard Zone and City of Boulder Conveyance Zone (½ foot rise floodway). The delineations were based on the hydraulic models used in the 1987 FHAD.

On May 6, 1991, FEMA issued a Letter of Map Revision (LOMR) for Skunk Creek to incorporate the results of a channel improvement project. The limit of the LOMR was in the University of Colorado's Research Park, downstream of Colorado Avenue to just upstream of the confluence of Boulder Creek.

Several road-crossing structures for Skunk Creek have been improved since the regulatory floodplain was adopted in 1991. Culverts at Broadway and at 27th Way, crossings at Anderson Ditch and the cemetery maintenance road, and the low water crossing upstream of 27th Way were not included in the 1991 regulatory model, but were incorporated into the current mapping study.

The City initially contracted with Belt Collins to develop the updated floodplain maps but they closed their Boulder office in 2013. ICON Engineering provided a peer review of Belt Collin's 2011 initial study and was selected to complete the project.

In 2013, the city acquired state-of-the-art Light Detection and Ranging (LiDAR) technology to produce high-resolution topographic mapping. The new LiDAR mapping was compared to the 2003 topographic base mapping and areas showing substantial differences were updated in the hydraulic models.

ANALYSIS

This mapping study updates the hydraulic models and flood hazard mapping for the 100-year floodplain, Conveyance and High Hazard Zones for the entire reach of Skunk Creek, including the King's Gulch, and Bluebell Canyon Creek tributaries.

A 2-dimensional hydraulic model was developed for the creek system to determine primary flow paths and split flow areas. Information from the 2-dimensional model was used as a "roadmap" to develop the conventional 1-dimensional hydraulic model used for the analysis.

The existing 100-year floodplain for Skunk Creek, King's Gulch and Bluebell Canyon Creek is primarily along the creek corridors and roadway areas with some spillage into surrounding properties. The proposed 100-year floodplain is more extensive than the existing mapping in most areas and bears resemblance to the September 2013 flood extents. The September 2013 flood extents were not used to delineate the floodplains but were used to check assumptions on flow paths. For Skunk Creek, King's Gulch and Bluebell Canyon Creek, the September 2013 flood extents are similar to the proposed floodplain mapping.

The existing Conveyance and High Hazard Zone mapping for Bluebell Canyon Creek and King's Gulch did not include a significant neighborhood area that has a history of flooding east of 15th Street. The proposed mapping extends the Conveyance and High Hazard Zones through this residential area to their confluence with Skunk Creek along Broadway. The proposed mapping also extends the Conveyance and High Hazard Zones for Skunk Creek north of Broadway to include more roadways, split flows and other areas not previously mapped.

The revised mapping indicates that the flood risk impacts more structures in the Skunk Creek Drainage Basin than was shown in the previous mapping. A majority of the structures newly identified as being at risk are located within the bounds of 15th Street to

the east, Broadway to the west, Baseline to the north and King Avenue to the south. This area experienced significant damage during the September 2013 flood.

Attachments A through D present figures showing a comparison between existing and proposed floodplain mapping. A summary of how these changes impact existing structures is included in **Attachment E**.

NEXT STEPS:

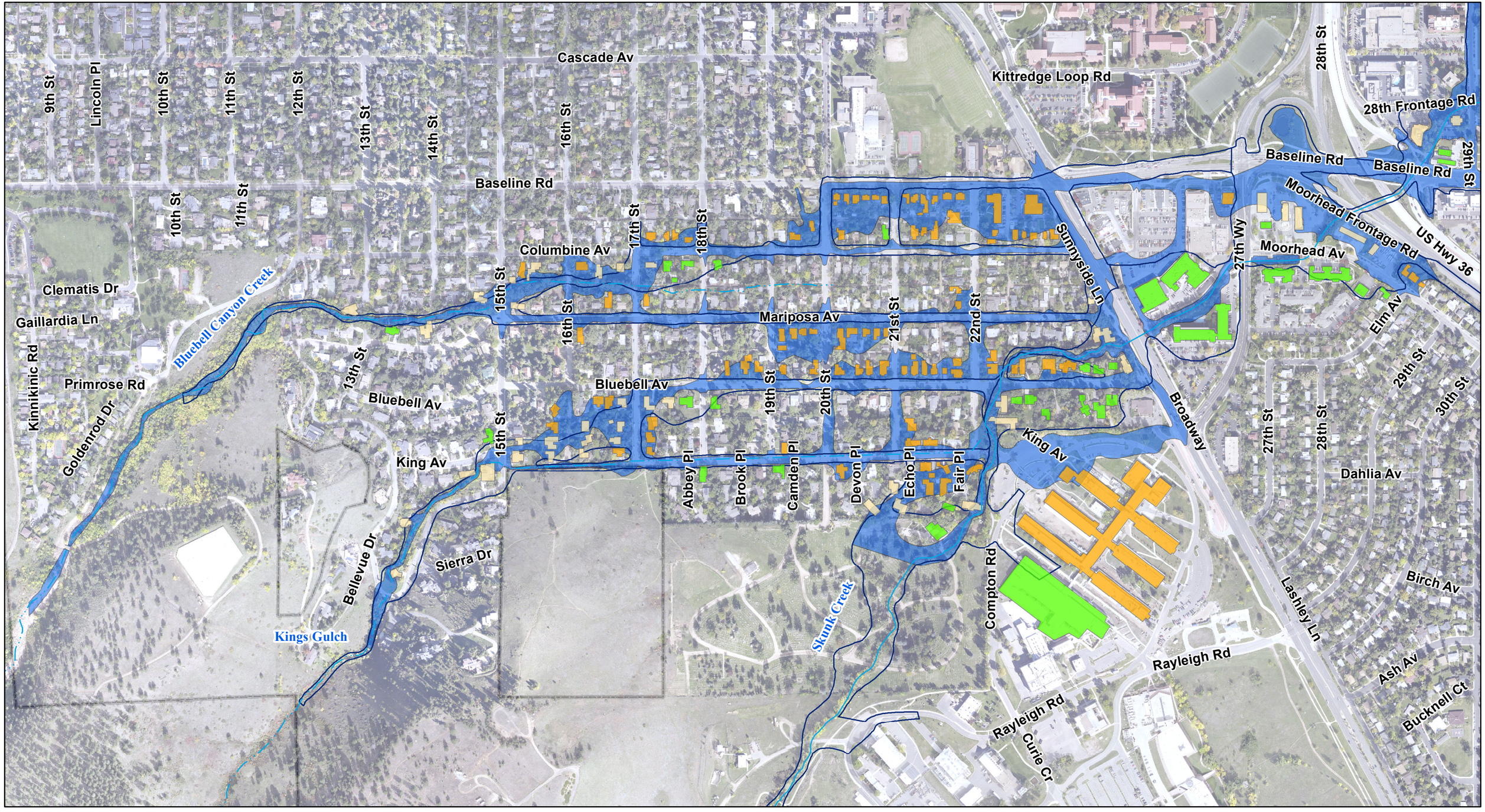
Following input from the August WRAB meeting, any information requested about the mapping study will be presented at the September WRAB meeting. A request for a motion to approve the new mapping will also be made at the September WRAB meeting.

The WRAB review of the floodplain mapping update does not require board members to verify analysis and calculations, but indicates the overall mapping study process and results are reasonable and acceptable.

Following input from the September WRAB meeting, the mapping revisions will be considered by City Council. If City Council approves the map revisions, the city will submit a request to FEMA for review. During the FEMA review and approval process it is recommended that the new mapping be used for regulatory purposes by regulating to the more restrictive of the existing and proposed mapping. This would mean that development within the newly identified flood zones would be subject to the city floodplain regulations. In order to comply with FEMA requirements, development within the areas that are being removed from the floodplain would still be subject to the city's floodplain regulations until FEMA officially adopts the new floodplain mapping. Following formal adoption by FEMA, the city would regulate solely based on the new mapping.

ATTACHMENTS

A. Existing and Proposed 100-Year Floodplain
B. Existing and Proposed Conveyance Zone
C. Existing and Proposed High Hazard Zone
D. Summary of Impacts to Existing Structures



Legend

- Proposed Skunk Creek 100 Year Floodplain
- FEMA Effective 100 Year Floodplain
- Revised Boulder Creek 100 Year Floodplain
- Buildings Newly Affected by 100 Year Floodplain (108)
- Buildings Remaining in the 100 Year Floodplain (122)
- Buildings No Longer Affected by 100 Year Floodplain (53)
- Creeks
- Intermittent Creek
- City Limits

N

0 250 500 1,000 1,500 Feet

1:5,500

The information depicted on this map is provided as graphical representation only. The City of Boulder provides no warranty,expressed or implied, as to the accuracy and/or completeness of the information contained hereon.

Skunk Creek

Proposed 100 Year Floodplain Compared to FEMA Effective

Map 1 of 2

CITY OF BOULDER

Utilities Division

Rev: 7/31/2014

Legend

- Proposed Skunk Creek 100 Year Floodplain
- FEMA Effective 100 Year Floodplain
- Revised Boulder Creek 100 Year Floodplain
- Buildings Newly Affected by 100 Year Floodplain (108)
- Buildings Remaining in the 100 Year Floodplain (122)
- Buildings No Longer Affected by 100 Year Floodplain (53)
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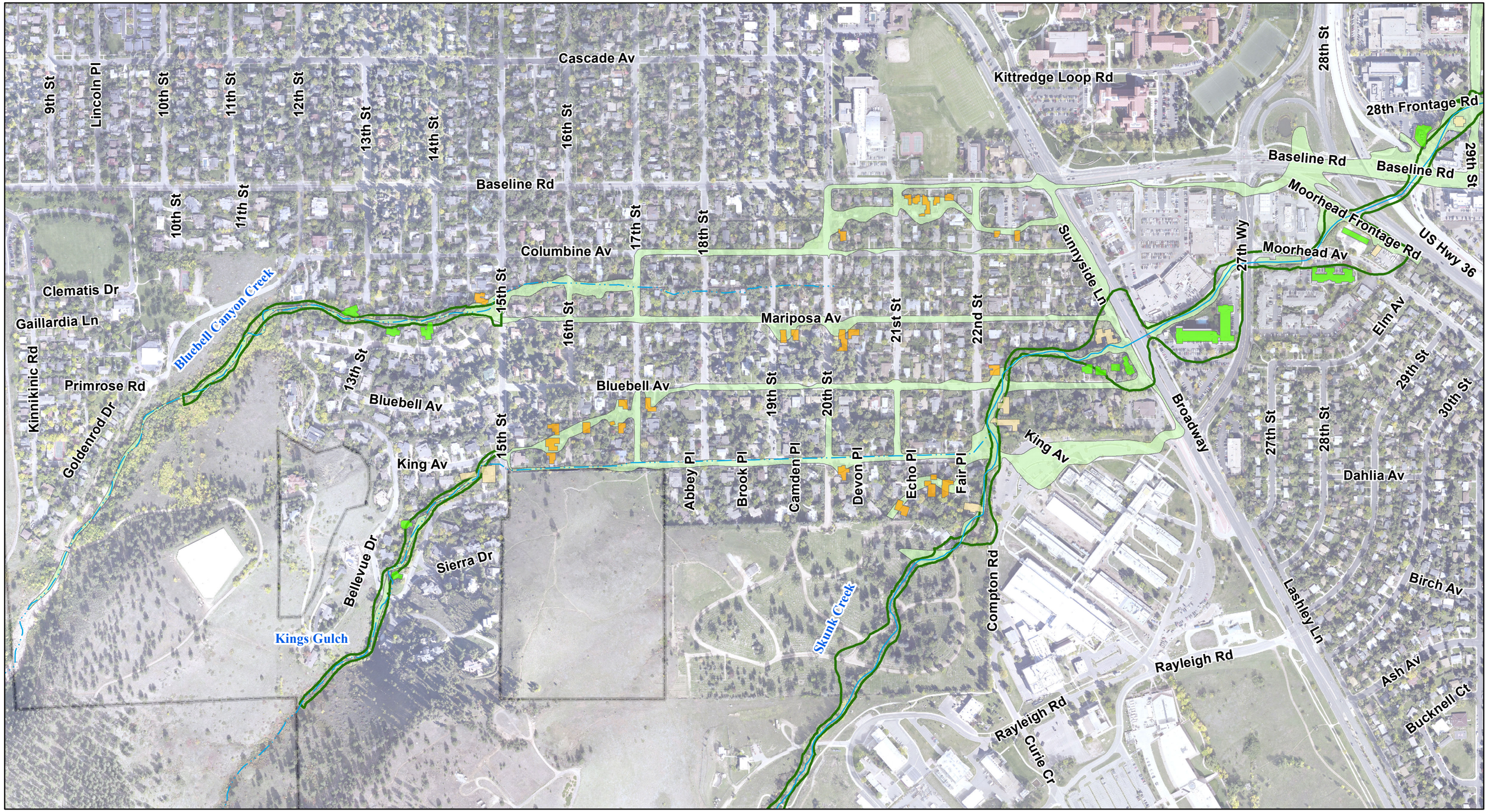
Skunk Creek

Proposed 100 Year Floodplain Compared to FEMA Effective

Map 2 of 2

CITY OF BOULDER
Utilities Division
Rev: 8/1/2014



Legend

- Proposed Skunk Creek Conveyance Zone
- Effective Other Creeks Conveyance Zone
- Revised Boulder Creek Conveyance Zone
- Buildings Newly Affected by Conveyance Zone (28)
- Buildings Remaining in the Conveyance Zone (125)
- Buildings No Longer Affected by Conveyance Zone (53)
- Creeks
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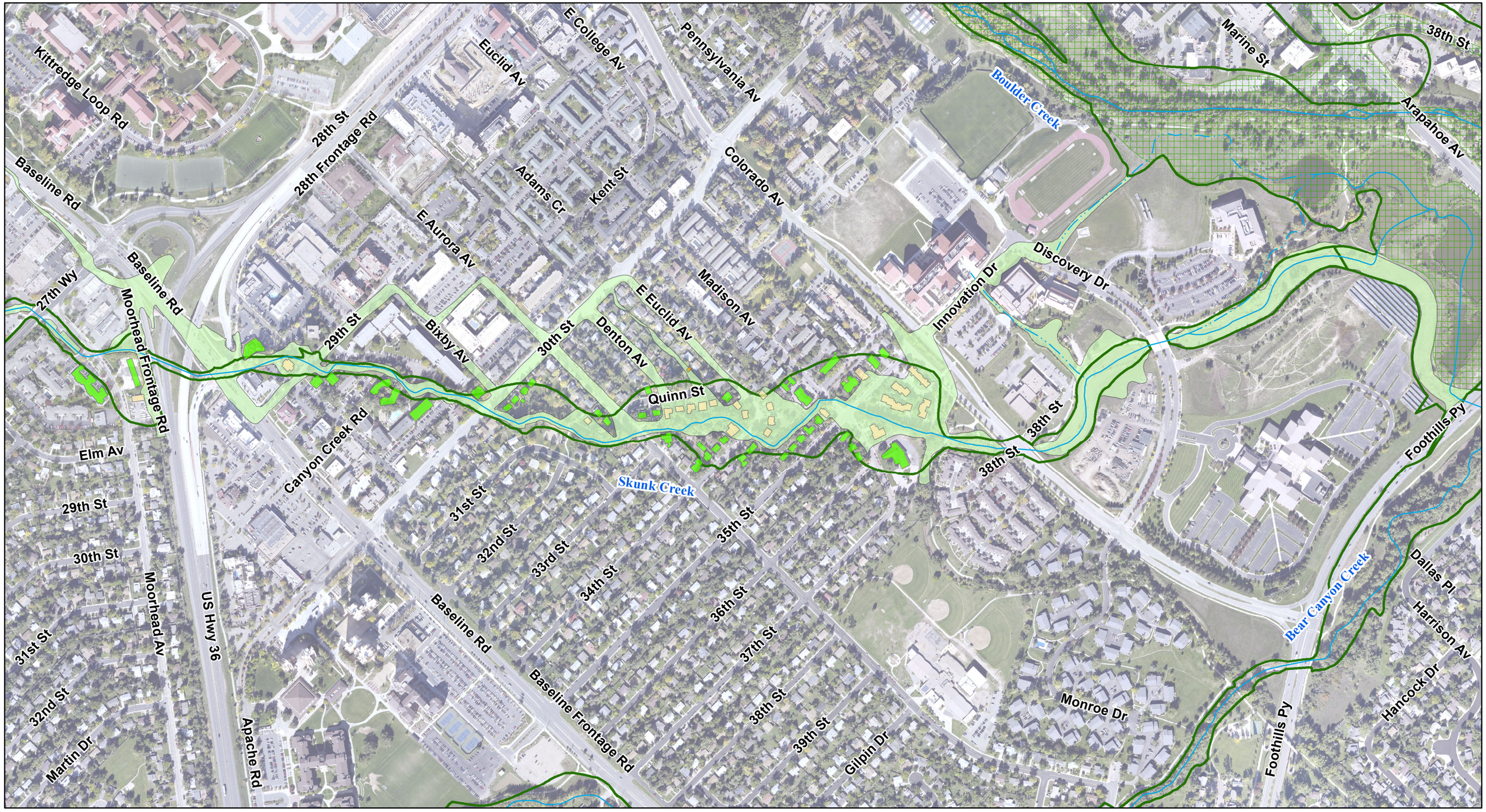
Skunk Creek

Proposed Conveyance Zone Compared to FEMA Effective

Map 1 of 2

CITY OF BOULDER
Utilities Division
Rev: 8/1/2014



Legend

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- Effective Other Creeks Conveyance Zone
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- Buildings Newly Affected by Conveyance Zone (28)
- Buildings Remaining in the Conveyance Zone (125)
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Skunk Creek

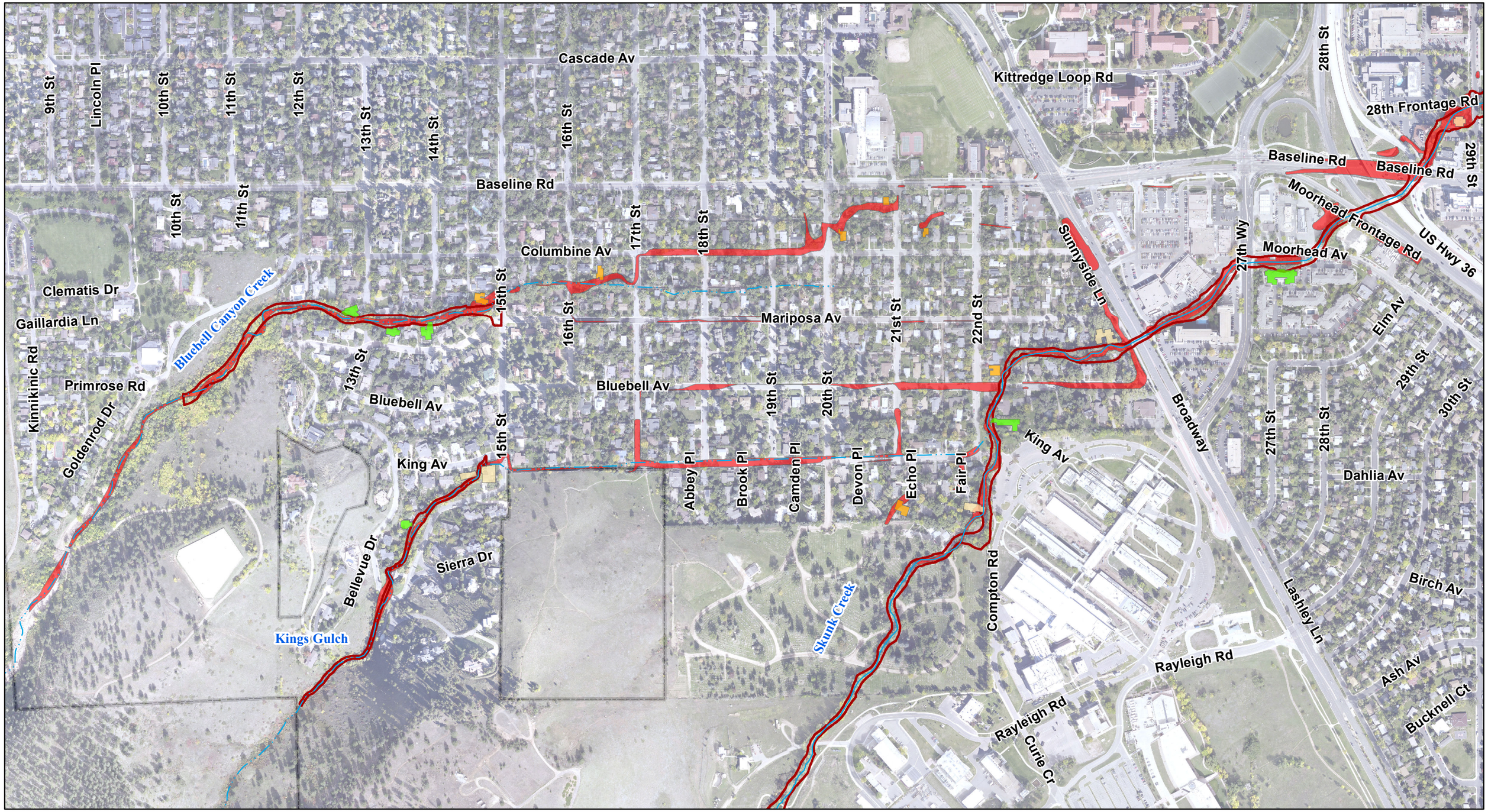
Proposed Conveyance Zone Compared to FEMA Effective

Map 2 of 2

CITY OF BOULDER

Utilities Division

Rev: 8/1/2014



Legend

- Proposed Skunk Creek High Hazard Zone
- Effective Other Creeks High Hazard Zone
- Revised Boulder Creek High Hazard Zone
- Buildings Newly Affected by High Hazard Zone (28)
- Buildings Remaining in the High Hazard Zone (125)
- Buildings No Longer Affected by High Hazard Zone (53)
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N

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Skunk Creek

Proposed High Hazard Zone Compared to FEMA Effective

Map 1 of 2

CITY OF BOULDER
Utilities Division
Rev: 8/1/2014

Legend

- Proposed Skunk Creek High Hazard Zone
- Effective Other Creeks High Hazard Zone
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- Buildings Newly Affected by High Hazard Zone (28)
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Skunk Creek

Proposed High Hazard Zone Compared to FEMA Effective

Map 2 of 2

CITY OF BOULDER
Utilities Division
Rev: 8/1/2014

Attachment D
Skunk Creek, Bluebell Canyon Creek and Kings Gulch
Floodplain Mapping Revisions

The tables below present a summary of how the proposed floodplain mapping revisions impact existing structures.

Summary of Proposed Changes

Skunk Creek			
Number of Structures	**100-Year Floodplain**	**Conveyance Zone**	**High Hazard Zone**
Existing Floodplain	178	81	31
Proposed Floodplain	221	56	17
Change			
No Longer Affected	56	53	23
Newly Affected	108	28	9
No Change	122*	28	8

**There are (9) LOMRs which exclude structures from the 100-year floodplain*