
Jordan River Hydraulic Analysis in Taylorsville

Jordan River - Utah

Prepared for: Badiee Development
Prepared By:



April 2022

1. INTRODUCTION	1
1.1. PURPOSE OF STUDY AND BACKGROUND.....	1
1.2. WATERSHED CHARACTERISTICS AND PEAK FLOWS.....	1
1.3. PREVIOUS STUDIES	2
1.3.1. <i>Original FEMA Study, 1982/1983</i>	2
1.3.2. <i>Jordan River Update, 1994</i>	2
1.3.3. <i>Jordan River Study for Salt Lake County, 2017</i>	2
2. METHODOLOGY AND MODELING.....	2
2.1. TOPOGRAPHIC INFORMATION.....	4
2.2. DISCHARGES.....	4
2.3. DOWNSTREAM BOUNDARY CONDITIONS.....	4
2.4. 2D AREA.....	4
2.5. HYDRAULIC STRUCTURES.....	7
2.6. CALIBRATION.....	7
2.7. ROUGHNESS COEFFICIENTS	7
2.8. RESULTS.....	7
3. REFERENCES	11
LIST OF FIGURES	
Figure 1: Location and Study Area Map for the LOMR	3
Figure 2: Existing Terrain	5
Figure 3: Proposed Terrain	6
LIST OF TABLES	
Table 1: FEMA Discharge	4
Table 2: FEMA Discharge	4
Table 3: Bridge Data	7
Table 4: Manning’s Roughness Coefficients	7
Appendix A – Workmap and Annotated DFIRM (Future Submittal)	
Appendix B – MT-2 Forms (Future Submittal)	
Appendix C – HEC-RAS Model Results	
Appendix D – Proposed Grading	
Appendix E – ESA Compliance (Future Submittal)	
Appendix F – Approved 2016 Hydrology CLOMR	
Appendix G – Buried Trench Riprap Protection	

1. Introduction

1.1. Purpose of Study and Background

Badiee Development contracted with Bowen Collins & Associates (BC&A) to submit an application for a Conditional Letter of Map Revision (CLOMR) for a reach of the Jordan River in the City of Taylorsville in accordance with FEMA Guidelines (FEMA 2018) and City Ordinances. This technical report documents the existing hydrologic design flows expected along the project site and summarizes the 2D existing and proposed hydraulic analyses. A 1D model will be developed in the future as part of the final submittal to FEMA as they will require it. Future submittals will include the final workmaps (Appendix A), MT-2 forms (Appendix B), 1D HEC-RAS results (Appendix C), and endangered species act compliance information (Appendix E) in the appendices. The current submittal includes the results from the 2D analysis in Appendix C, proposed grading/design in Appendix D, and the approved hydrology CLOMR in Appendix F.

There are roughly 20 acres of property Badiee Development would like to develop adjacent to the Jordan River in a Zone AE floodplain with a Floodway. Fill will be placed on the site in the floodplain fringe (but not the floodway) to facilitate construction of multiple buildings. The development will stay outside of the floodway to avoid raising the water surface in the floodway. The project site is located in Salt Lake County, UT approximately two thousand ft south of 4500 South next to the Meadow Brook Golf Course [see FIRM Panel 49035C0291GG (Figure 1)]. The upstream end of the study is 4500 South with the south end being 3900 South.

1.2. Watershed Characteristics and Peak Flows

The study area is in the Jordan River Watershed (HUC8 16020204) in Salt Lake County, Utah. The watershed includes Mill, Big Cottonwood, and Little Cottonwood Creeks as major tributaries to the Jordan River. Residential, commercial, and industrial development has occurred extensively in the floodplain of Little Cottonwood Creek. The eastside tributaries to the Jordan River originate in the high elevations of the Wasatch Mountains and flow westerly across terraces formed by the recession of prehistoric Lake Bonneville. Little Cottonwood Creek is a perennial tributary that helps drain the center portion of the Wasatch Mountains on the east side of the Valley. These Eastside streams have fairly steep gradients as they cross terraces but become quite flat as they reach the valley floor. Soils typically found in the terraces are granular in nature while the valley floor is composed of clays or clayey gravels. Temperatures near the area range from an average low of 20°F in the winter to an average high of 105°F in the summer. Basin average precipitation within the watershed varies with elevation, from 16 inches annually in the valley to 40 inches annually in the high mountains (FIS 2009).

Flooding in the Jordan River Watershed is due to either snowmelt runoff, cloudburst rainstorms, and general rainstorms. Snowmelt floods usually occur during the months of April, May, and June. Cloudburst rainstorms are high-intensity, short duration storms that usually occur over a relatively small area. The storms have high-runoff peaks, but low volumes and generally occur from June to October. History shows that flooding can occur from any of these events, however, the most dramatic and extensive flooding has been due to snowmelt and cloudburst floods.

1.3. Previous Studies

Below is a summary of the previous studies from FEMA related to the project.

1.3.1. Original FEMA Study, 1982/1983

The hydrologic and hydraulic analyses for the original study were performed by Rollins, Brown, and Gunnell Inc. under Contract No H-4593

1.3.2. Jordan River Update, 1994

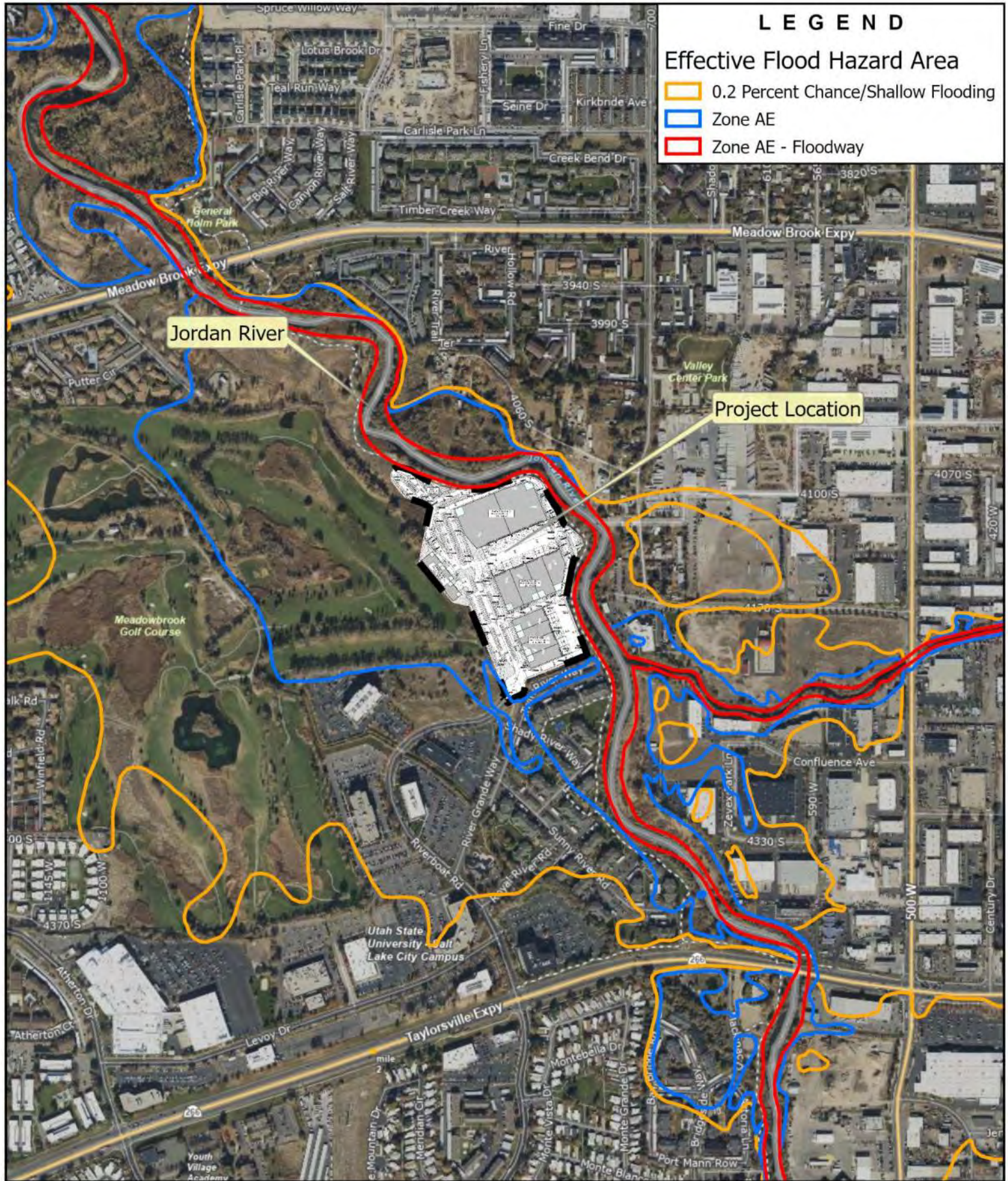
The original study was revised in September of 1994 to incorporate the restudy of the Jordan River conducted by CH2M Hill, for FEMA, under Contract No. EMW-90-C-3104. This work revised hydraulic analysis for a reach from Willow Creek Drive to a point approximately 5,000 ft upstream. This study included more detailed topographic data and was prepared by Bush and Gudgeon, Inc. The result was to decrease the width of the floodway.

1.3.3. Jordan River Study for Salt Lake County, 2017

BC&A created a hydraulic model of the Jordan River in HEC-RAS for Salt Lake County and revised the hydrology. A CLOMR based on Hydrology was sent to FEMA and was approved in 2016 which reduced the discharge in the river. A follow up LOMR with updated mapping using the new discharge has not yet been set to FEMA.

2. Methodology and Modeling

The studied stream reach length is approximately 1 mile long and consists of the main natural river channel with some bank vegetation and urbanized overbanks. The studied stream was analyzed using USACE's HEC-RAS computer program Version 6.2 (HEC 2022) to perform the 2D hydraulic calculations and develop a floodplain and related Base Flood Elevations (BFE), a 1D hydraulic analysis and floodway analysis will be completed as part of the final documentation. The effective FEMA model is a HEC-2 model from the early 1990's so a new 2D model of the area was developed. The topographic data consists of 2013 LiDAR data and recent topographic survey data for the channel. The hydraulic modeling was analyzed using discharge for the 1-percent chance event from the FIS (Higher Discharge) and an approved CLOMR from 2016 (Lower Discharge). A 2D model was chosen as it can model more accurately the flows that are in the overbanks and the impacts of the proposed development than a 1D model. As mentioned above, a 1D or 1D/2D model will be developed as part of the final submittal to FEMA to develop the floodway. The final workmaps showing the detailed floodplain, floodway, and BFE's is provided in the future Appendix A. Figures showing the results from the current 2D hydraulic model are shown in Appendix C.



LEGEND

Effective Flood Hazard Area

- 0.2 Percent Chance/Shallow Flooding
- Zone AE
- Zone AE - Floodway

Jordan River

Project Location

Project Location



BADIEE
Jordan River CLOMR

NORTH:



SCALE:

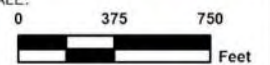


FIGURE NO.

1

2.1. Topographic Information

The hydraulic models developed as part of this CLOMR used field survey channel data combined with LiDAR outside the survey extents. All data was set to the NAVD88 datum and the NAD 1983 State Plane projection, Utah Central, FIPS 4302, in US ft.

The channel and overbanks in the project area were surveyed by Apex Land Surveyors in 2016 and 2017. A proposed condition surface was provided by CIR Engineering in AutoCAD format to BC&A. GIS tools were used to assist in combining the different topographic datasets for use in the HEC-RAS model and for generating a surface from the combined data to use as part of the floodplain mapping. Figure 2 and Figure 3 show the contours for both existing conditions and proposed conditions.

2.2. Discharges

The discharges used for this study were taken from the current effective hydraulic model and the approved 2016 CLOMR and are shown in Table 1. For the 2D model, the discharge was set to a constant discharge to simulate steady state conditions.

Table 1: FEMA Discharge

XS Location	FEMA Discharge (cfs)	
	FIS 100yr	CLOMR 100yr
Upstream End	3740	3280
At Big Cottonwood Creek	4535	3360

2.3. Downstream Boundary Conditions

The downstream boundary condition for the FIS discharge was interpolated from the current effective model at between Lettered XS DS and set to a normal depth as show in Table 2. For the 2D model, the water surface elevation was set to a constant value to simulate steady state conditions.

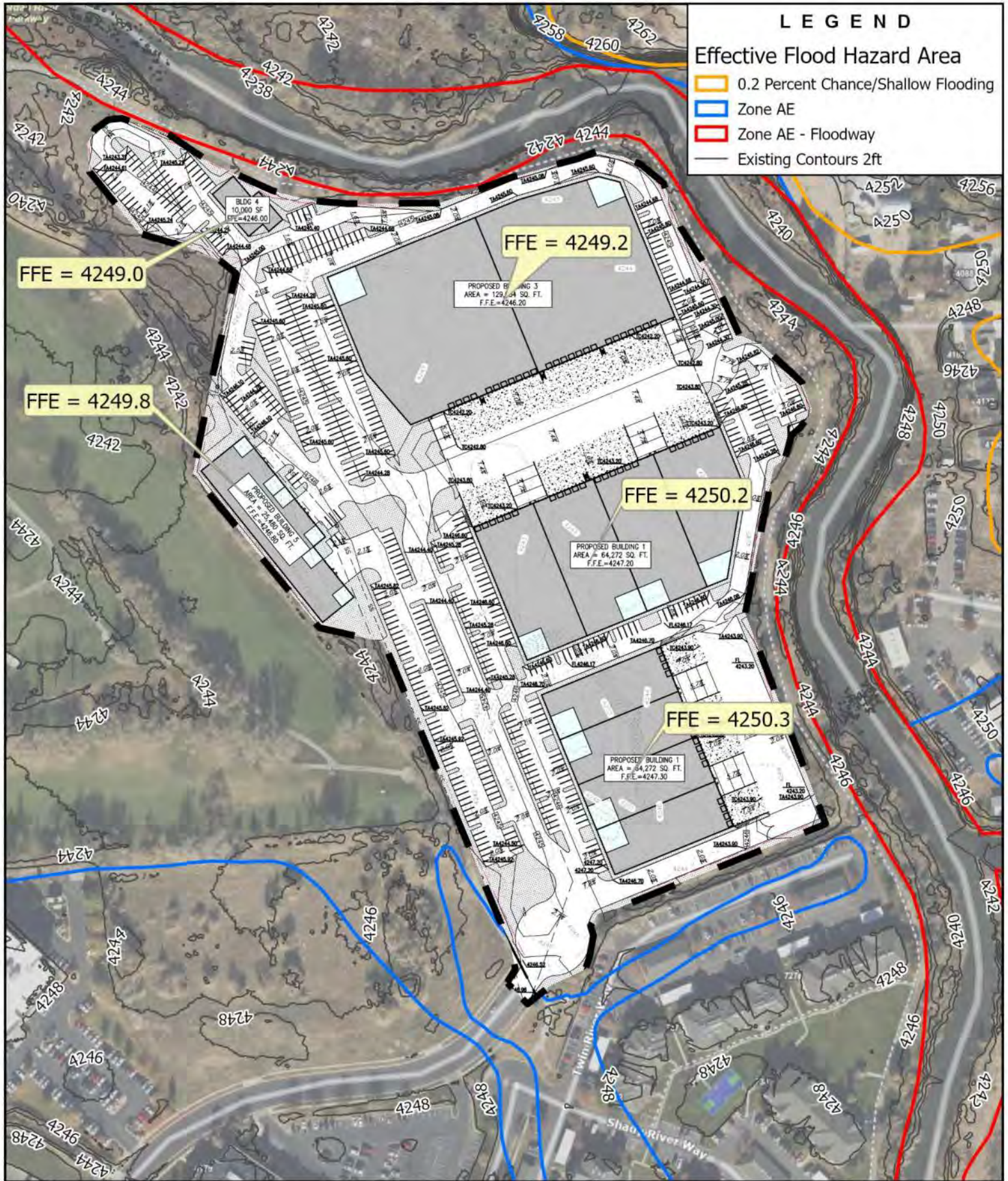
Table 2: FEMA Discharge

XS Location	FEMA Water Surface Elevation (NAVD88 ft)
	100yr
FIS (Higher Discharge)	4442.15
CLOMR (Lower Discharge) ¹	4241.35

¹ Based on Normal Depth of 0.0075

2.4. 2D Area

The model has one 2D areas with cell sizes ranging from 20 ft to 50 ft in size for a total of 5,611 grid cells. Breaklines were placed to help refine the model and pick up the channel. The 2D areas were solved using the diffusion wave solver and an automatic time step adjustor to help reduce errors during runtime.



 BOWEN COLLINS & ASSOCIATES	Proposed Conditions Topographic Data	NORTH: 	SCALE: 0 100 200 Feet
	BADIEE Jordan River CLOMR		

2.5. Hydraulic Structures

There is one hydraulic structure (3900 South) at the downstream end of the project area. Table 3 below includes basic information on the bridge in the model.

Table 3: Bridge Data

Name	Description
3900 South	150 ft Long bridge over Jordan River with 3 piers

2.6. Calibration

There was no calibration performed as there is no data available for calibration in the study area.

2.7. Roughness Coefficients

The Manning's n values used for the model were taken from a 2016 study of the Jordan River for the County and are shown in Table 4

Table 4: Manning's Roughness Coefficients

1D/2D- Land Use Description	Manning's-'n' Coefficient
Channel	0.035
Overbank	0.06

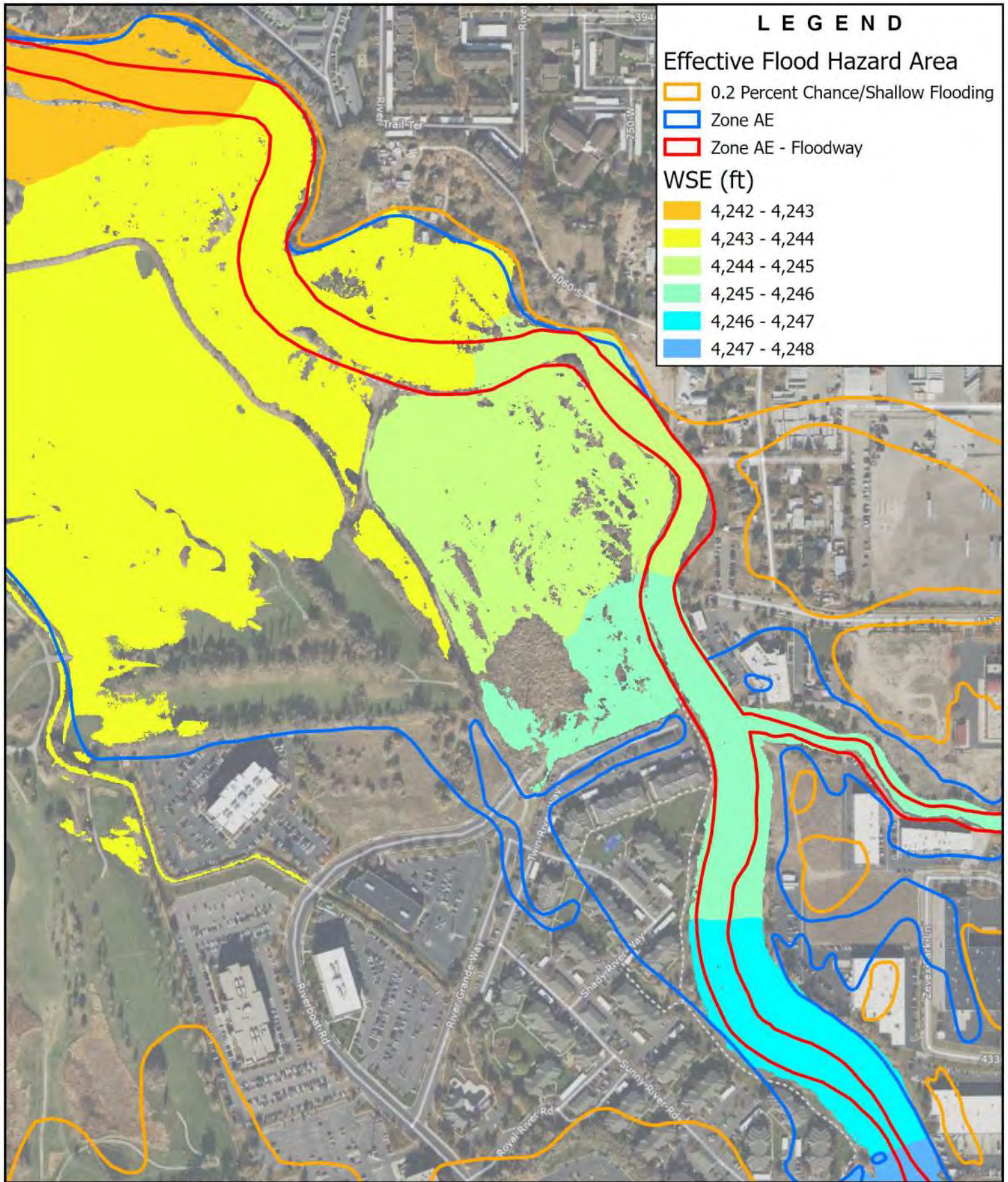
2.8. Results

The water surface and depth results for all modeled scenarios are included in Appendix C. The water surface results for the existing conditions and proposed conditions geometry with the lower discharge are also shown in Figure 4 and Figure 5 with the comparison shown in Figure 6. All of the model results (including both lower and higher discharges) show less flooding in the overbanks than the current effective 100yr FEMA floodplain. The lower discharge runs (existing and proposed) show about a 1 foot decrease in water surface elevation around the site and the water is mostly contained in the channel except downstream of the site where water breaks out. The impacts of the proposed site based on the lower discharge, as shown on Figure 6, is minimal with increases of less than 0.15 feet to BFEs and no impacts to any structure.

3. Buried Trench Riprap Protection

As the project is located in the Jordan River Meander Corridor, some type of protection is required near the channel banks to protect the study area from possible erosion and movement of the Jordan River. The current plan is to place a buried riprap trench west of the Jordan River trail and a final design will be developed as part of a future submittal and included in Appendix G.

The design will be similar to the Taylorsville-Bennion Improvement District buried riprap trench which protects a waterline that follows the banks of the Jordan River. The length of protection is approximately 1,000 ft inside the project area and it would be extended as part of this project. The Taylorsville Bennion Improvement District buried trench plan is included in Appendix G.



LEGEND

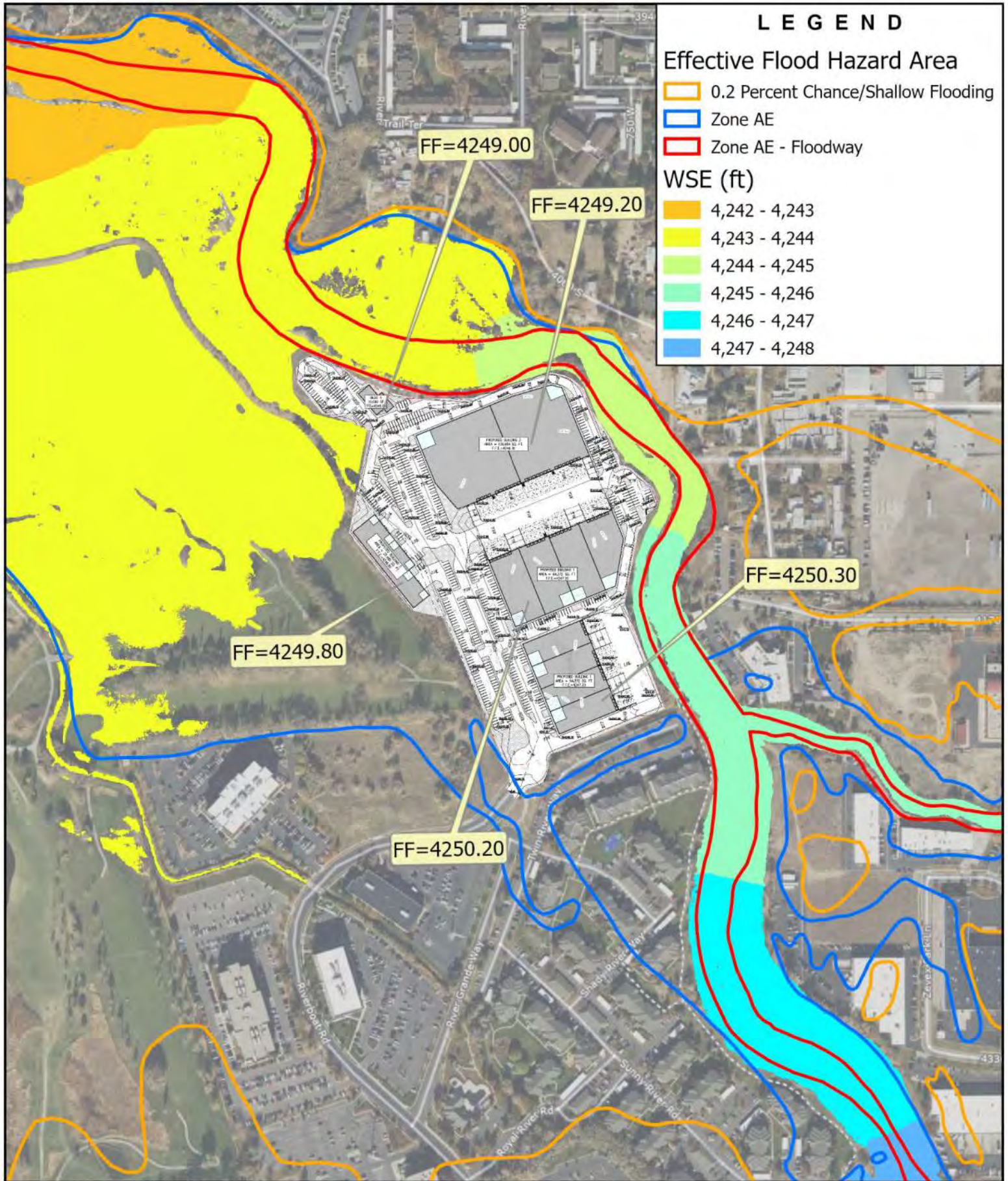
Effective Flood Hazard Area

- 0.2 Percent Chance/Shallow Flooding
- Zone AE
- Zone AE - Floodway

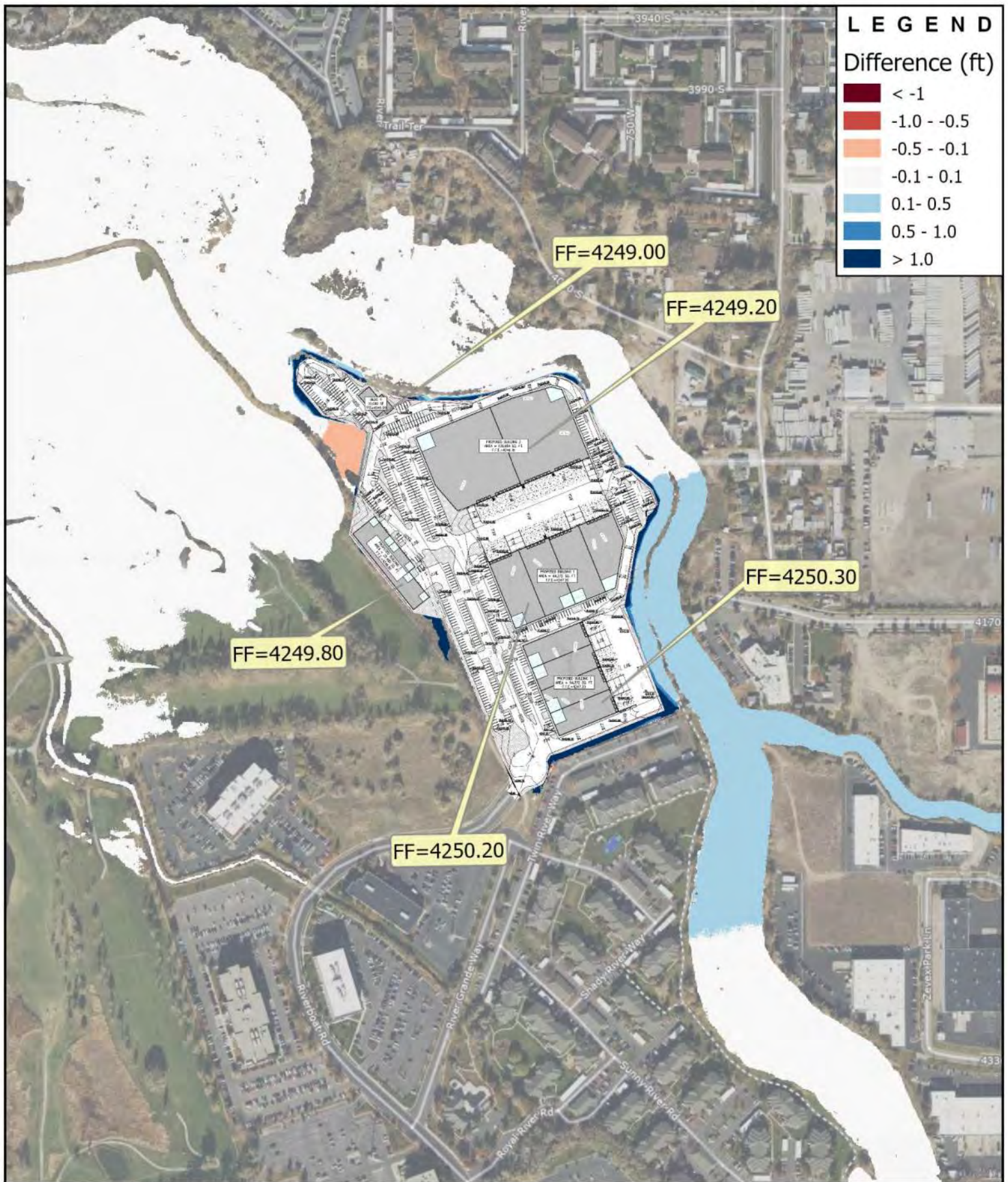
WSE (ft)

- 4,242 - 4,243
- 4,243 - 4,244
- 4,244 - 4,245
- 4,245 - 4,246
- 4,246 - 4,247
- 4,247 - 4,248





 BOWEN COLLINS & ASSOCIATES	Proposed Max WSE Lower Discharge (Approved CLOMR)	NORTH: 	SCALE: 0 200 400 Feet
	BADIEE Jordan River CLOMR		



 BOWEN COLLINS & ASSOCIATES	Proposed vs Existing WSE Comparison Higher Discharge (FIS)	NORTH: 	SCALE: 0 200 400 Feet
	BADIEE Jordan River CLOMR		FIGURE NO. 6

4. References

Federal Emergency Management Agency, Flood Insurance Study, Salt Lake County, UT and Incorporated Areas, September, 2009.

Federal Emergency Management Agency, FEMA Policy Standards for Flood Risk Analysis and Mapping, FEMA Policy #FP 204-078-1 (Rev 7), February, 2018.

Hydrologic Engineering Center, HEC-RAS computer software program, Version 6.0 U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS User's Manual, Version 6.0, May 2021.

Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 6.1, U.S. Army Corps of Engineers, Davis, California, Sept 2021.

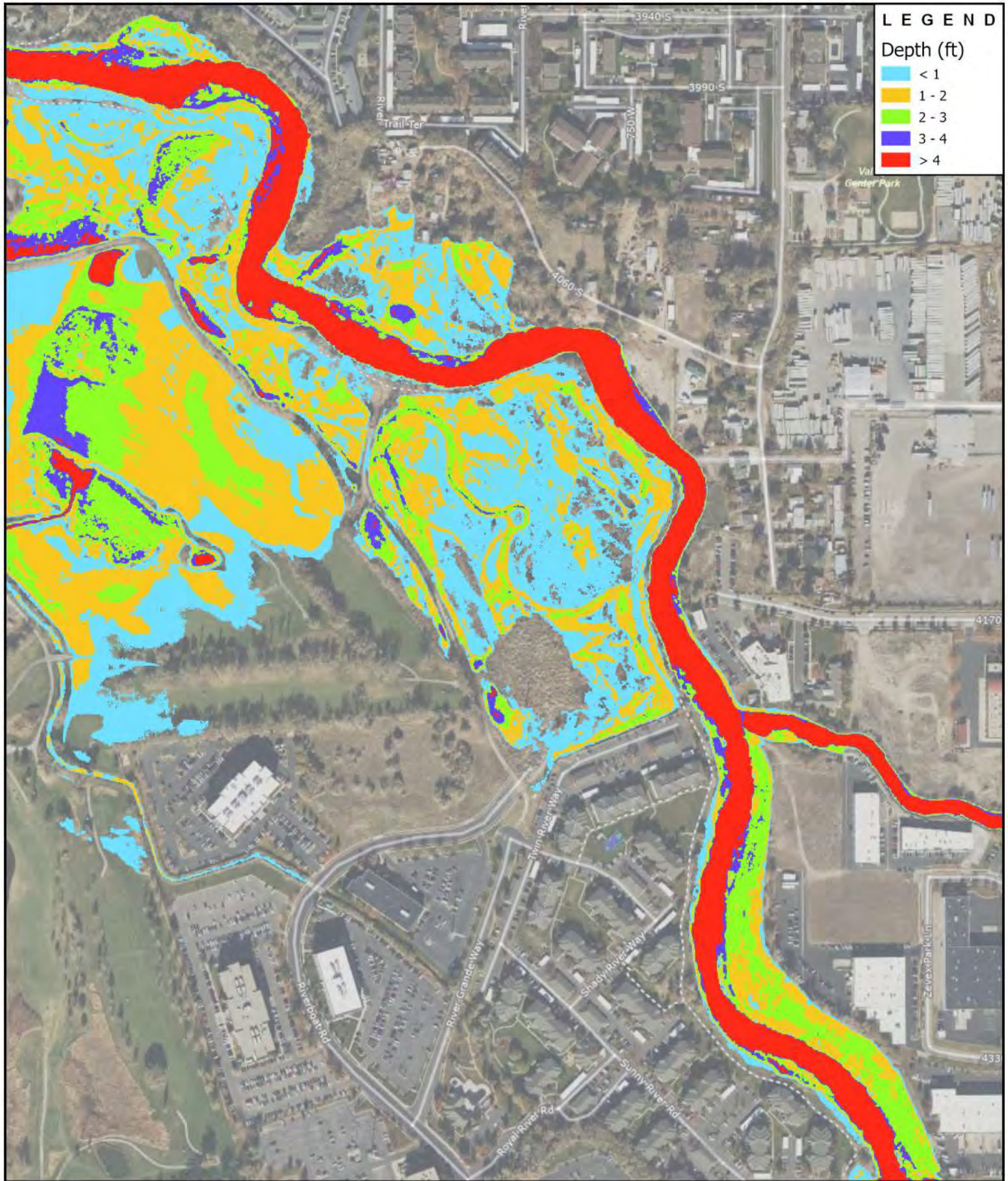
APPENDIX A
Workmap and Annotated DFIRM
(Future Submittal)

Replace

DRAFT

APPENDIX B
MT-2 Forms
(Future Submittal)

APPENDIX C
HEC-RAS MODEL RESULTS



LEGEND

Depth (ft)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4



BOWEN COLLINS
& ASSOCIATES

Existing Max Depths
Lower Discharge (Approved CLOMR)

BADIEE

Jordan River CLOMR

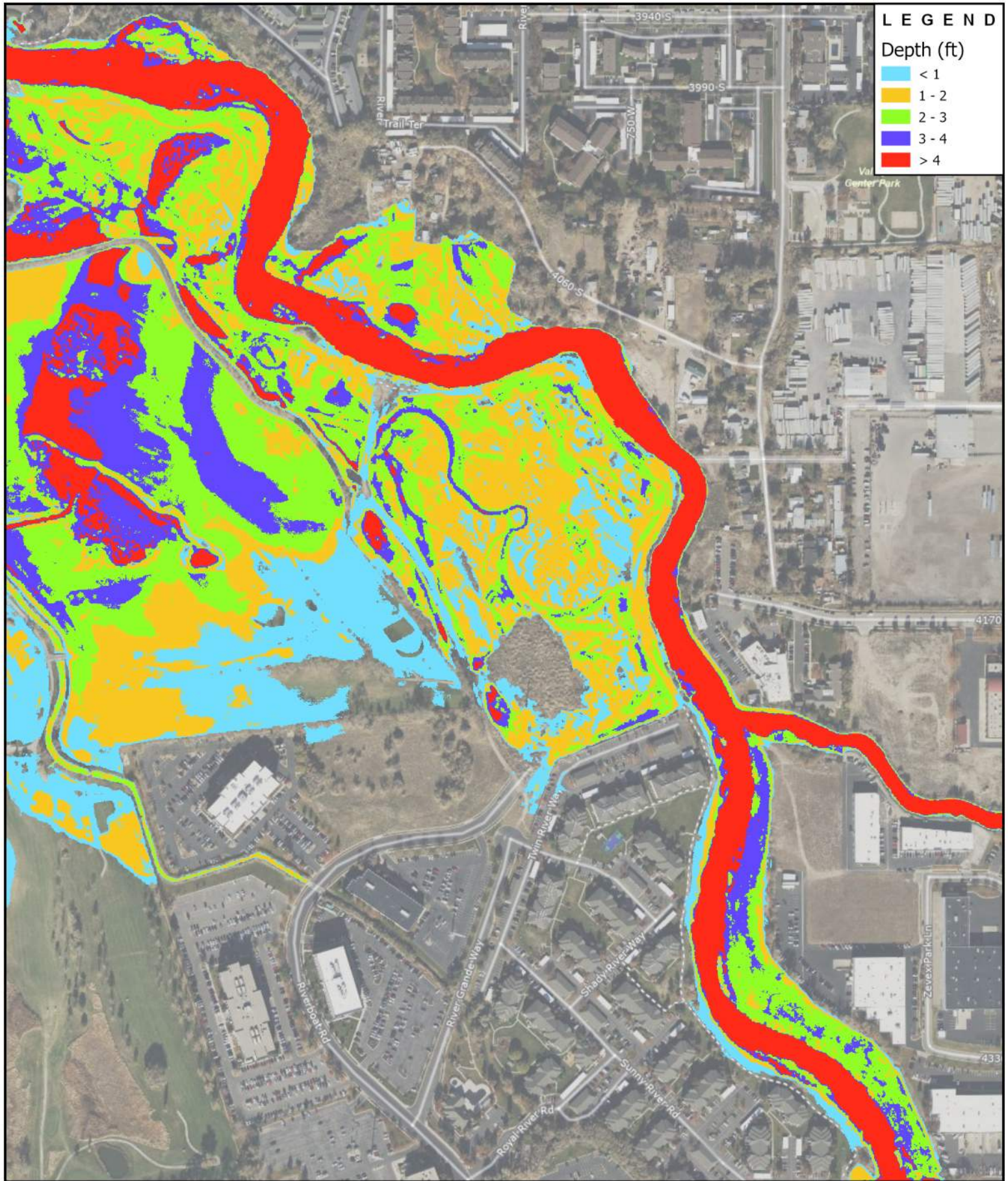
NORTH:



SCALE:
0 200 400
Feet

FIGURE NO.

C1



LEGEND

Depth (ft)

- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

BOWEN COLLINS
& ASSOCIATES

Existing Max Depths
Higher Discharge (FIS)

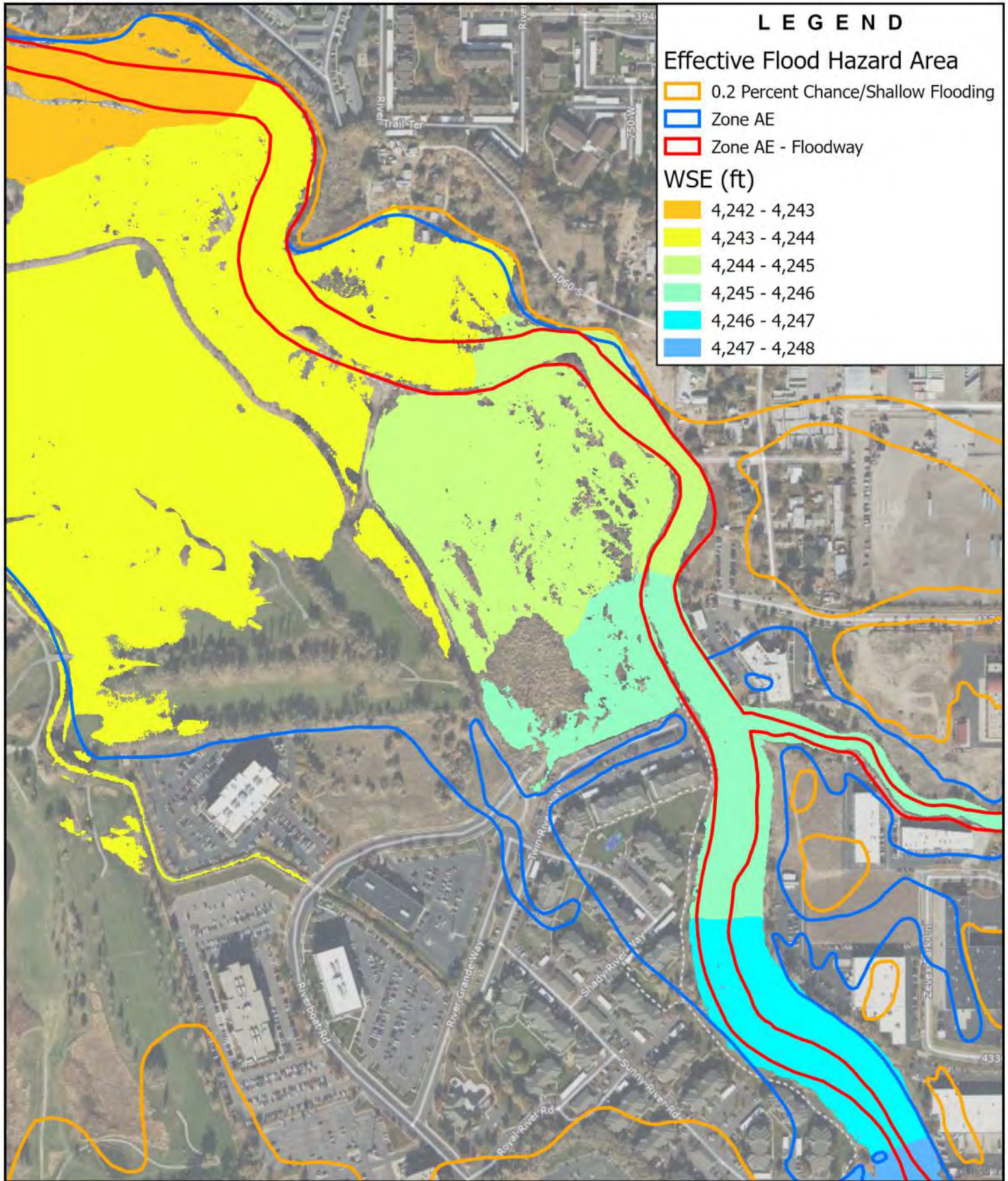
BADIEE

Jordan River CLOMR

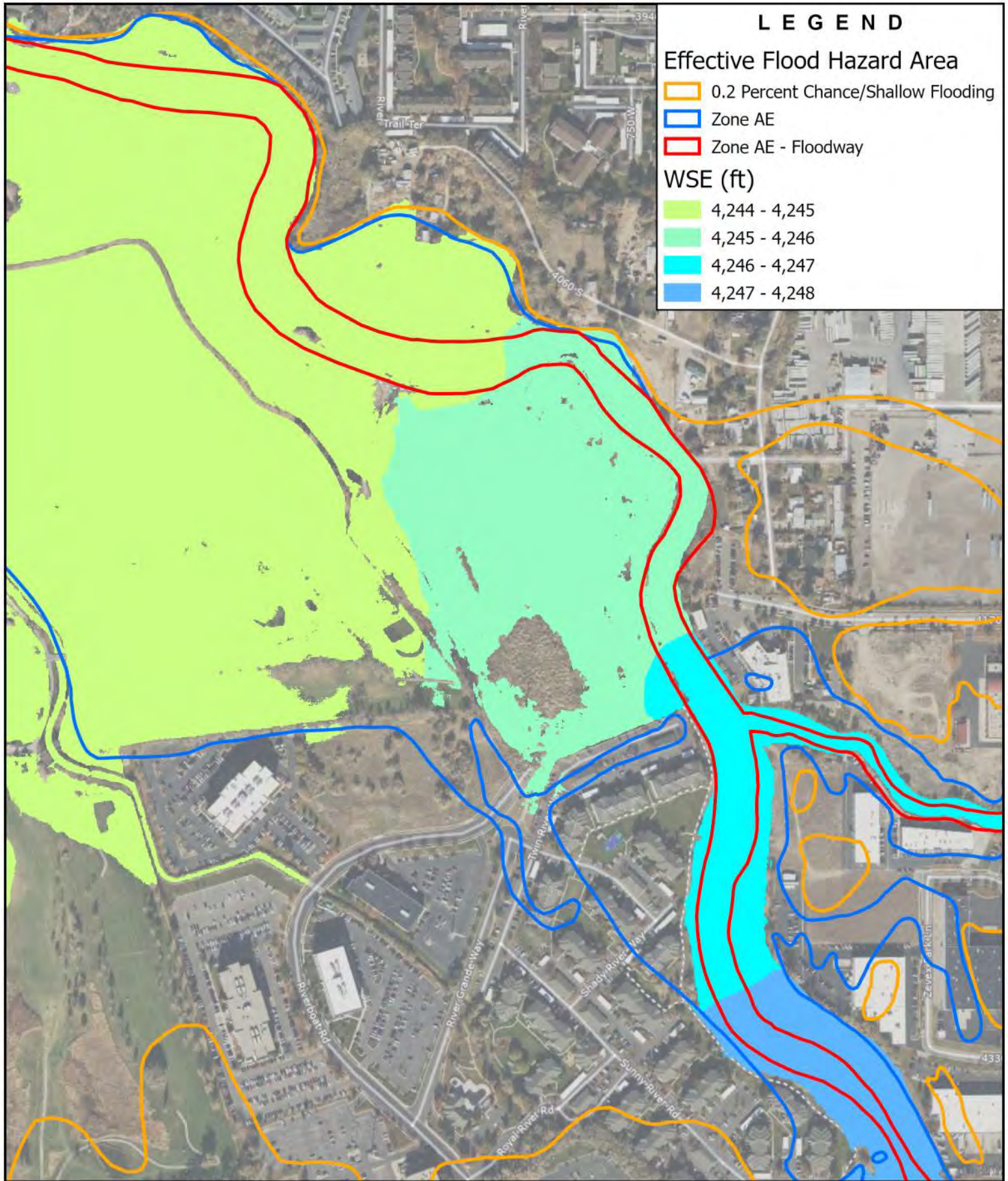
NORTH:

SCALE:
0 200 400
Feet

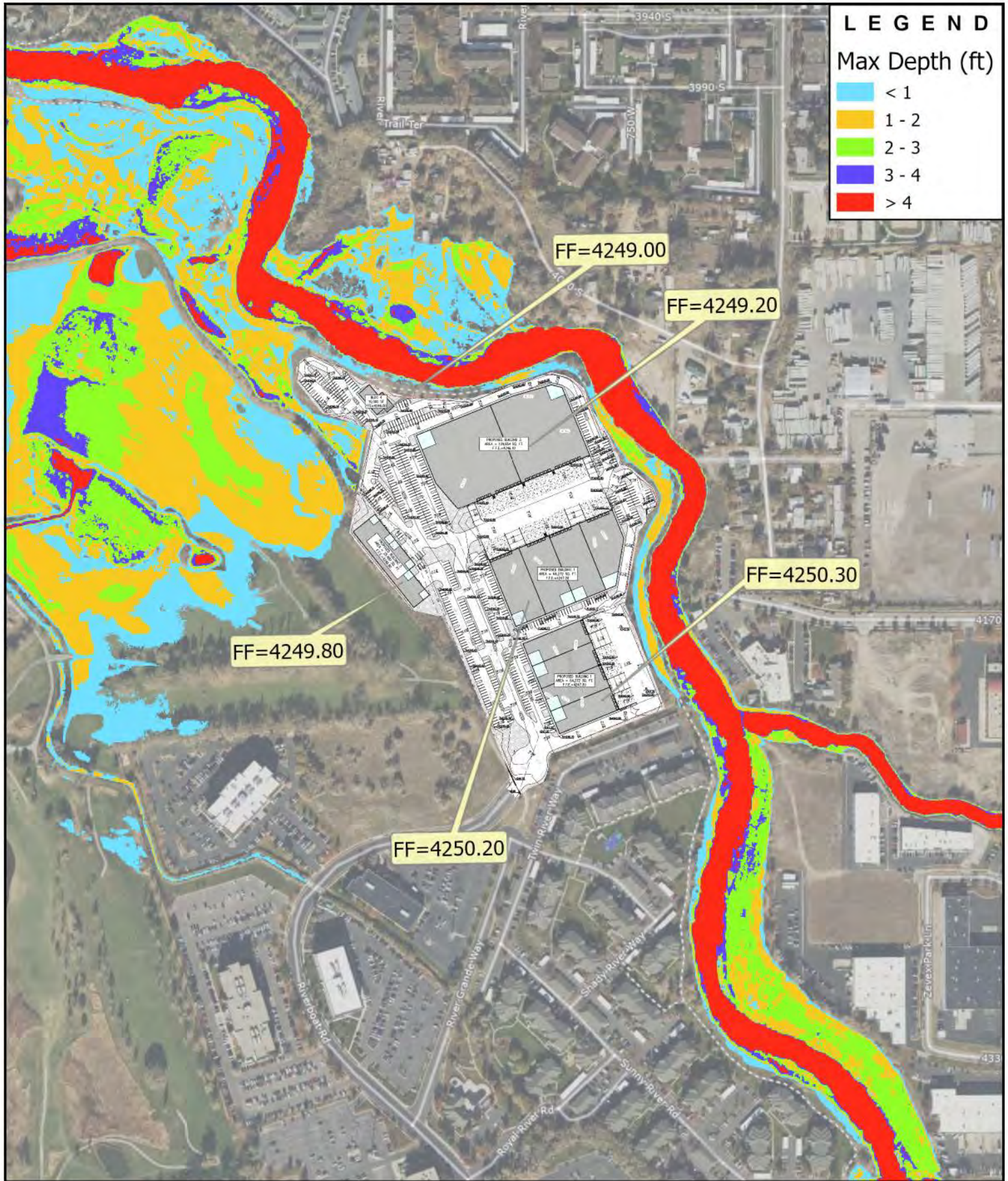
FIGURE NO.
C2



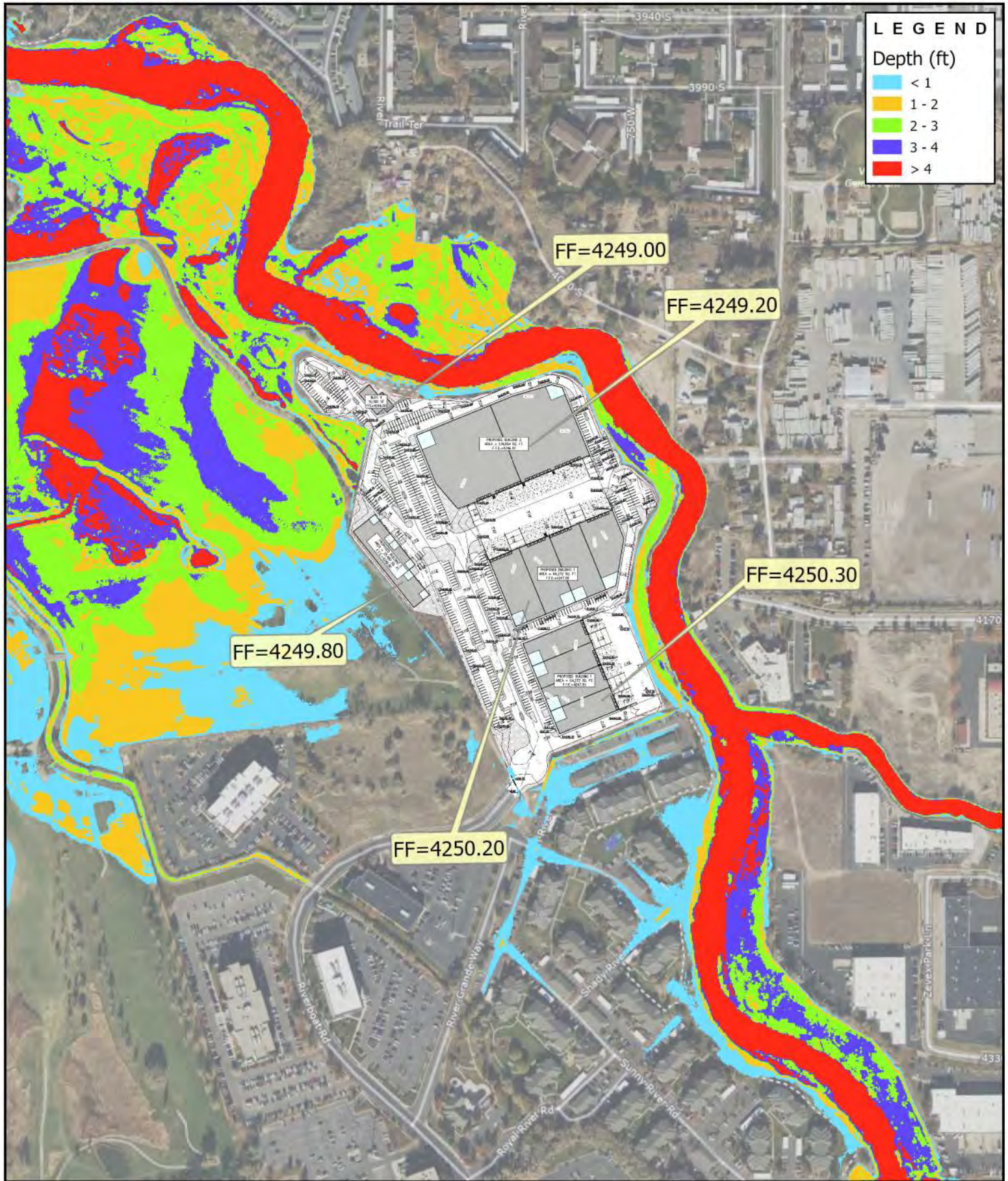
 BOWEN COLLINS & ASSOCIATES	Existing Max WSE Lower Discharge (Approved CLOMR)	NORTH: 	SCALE: 0 200 400 Feet
	BADIEE Jordan River CLOMR		FIGURE NO. C3



 BOWEN COLLINS & ASSOCIATES	Existing Max WSE Higher Discharge (FIS)	NORTH: 	SCALE: 0 200 400 Feet
	BADIEE Jordan River CLOMR		



 BOWEN COLLINS & ASSOCIATES	Proposed Max Depths Lower Discharge (Approved CLOMR) BADIEE Jordan River CLOMR	NORTH: 	SCALE: 0 200 400 Feet FIGURE NO. C5
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LEGEND	
Depth (ft)	
■	< 1
■	1 - 2
■	2 - 3
■	3 - 4
■	> 4



Proposed Max Depths Higher Discharge (FIS)

BADIEE
Jordan River CLOMR

NORTH:



SCALE:

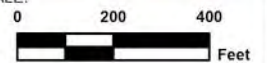
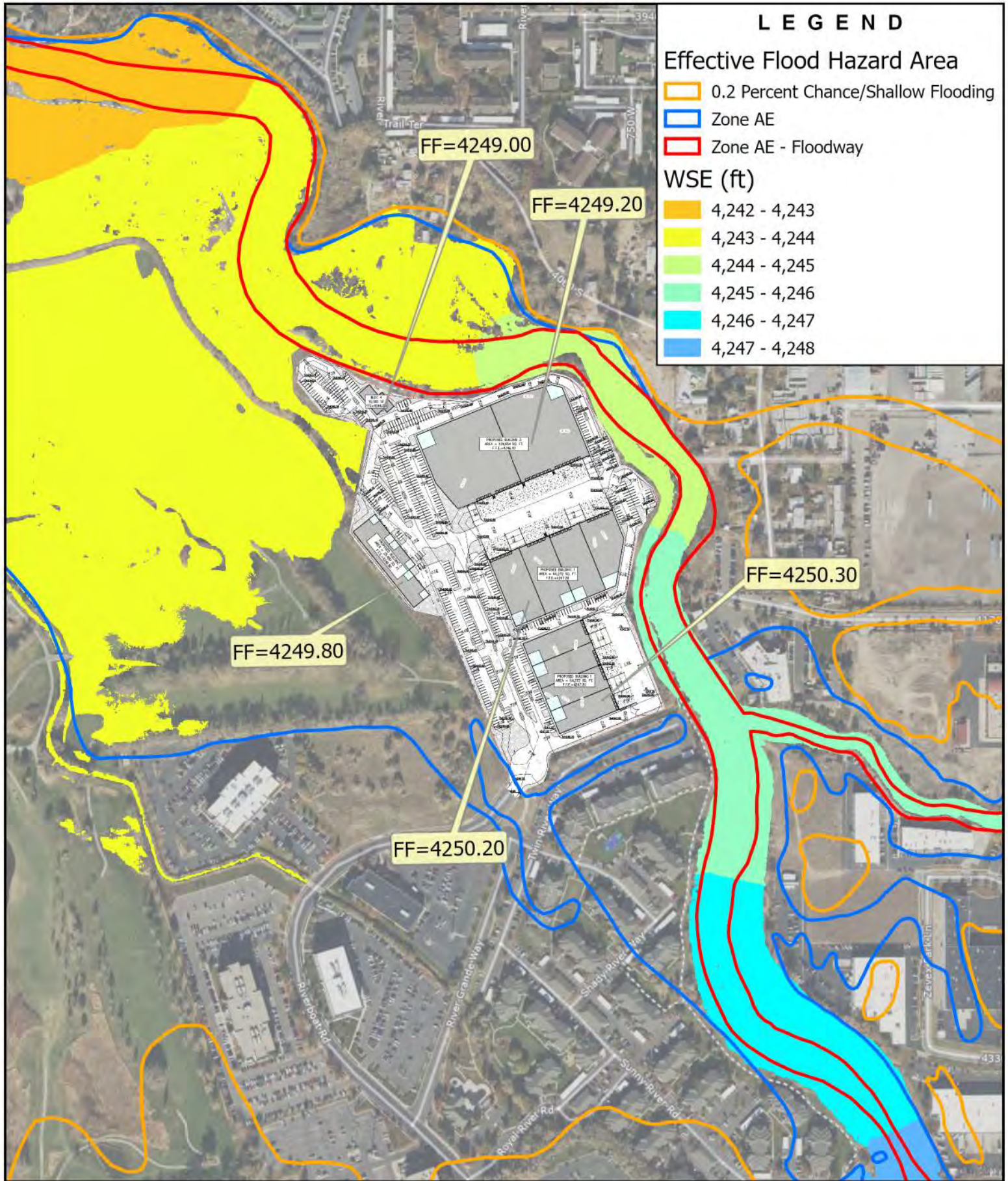
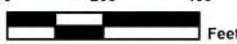
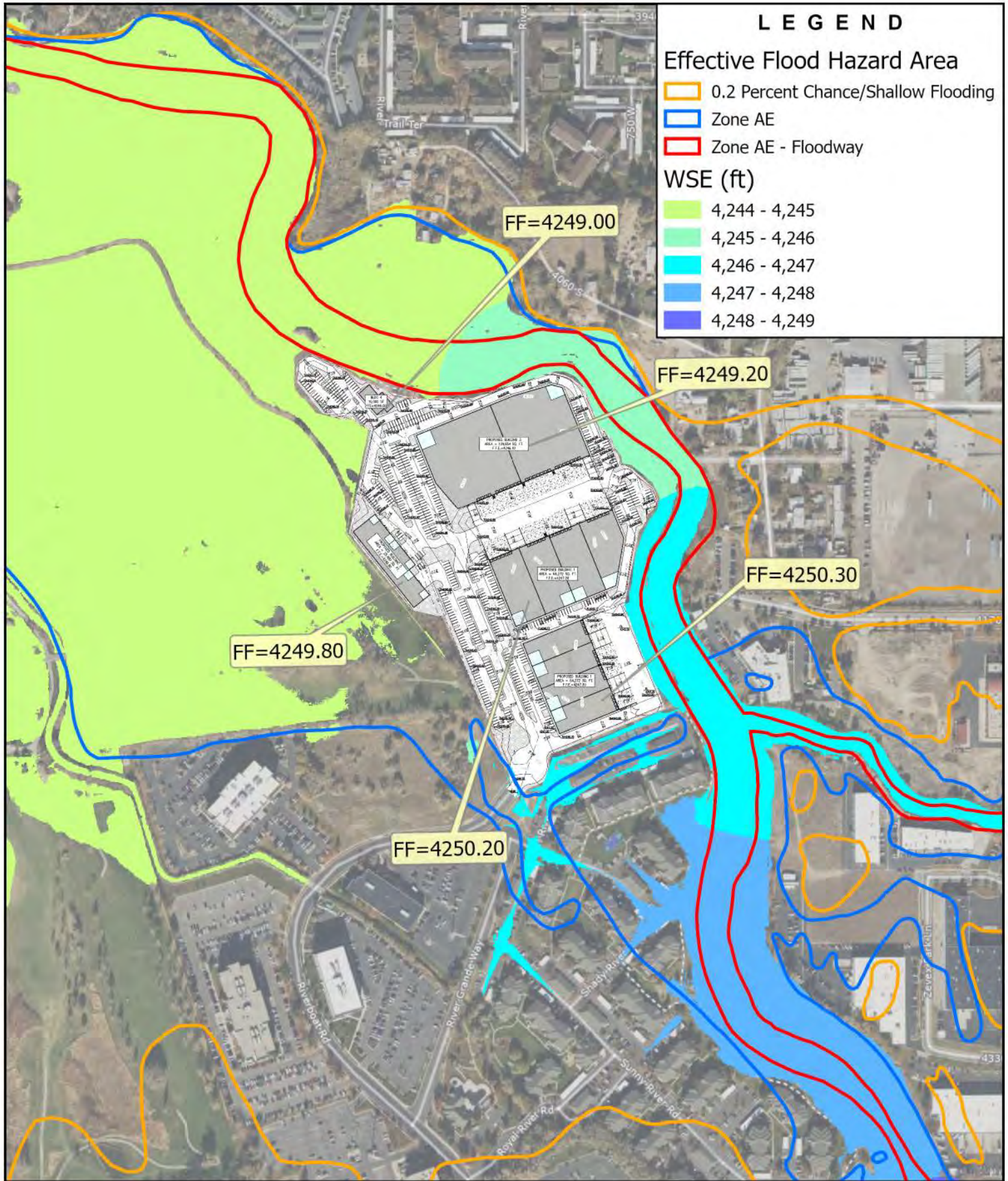


FIGURE NO.

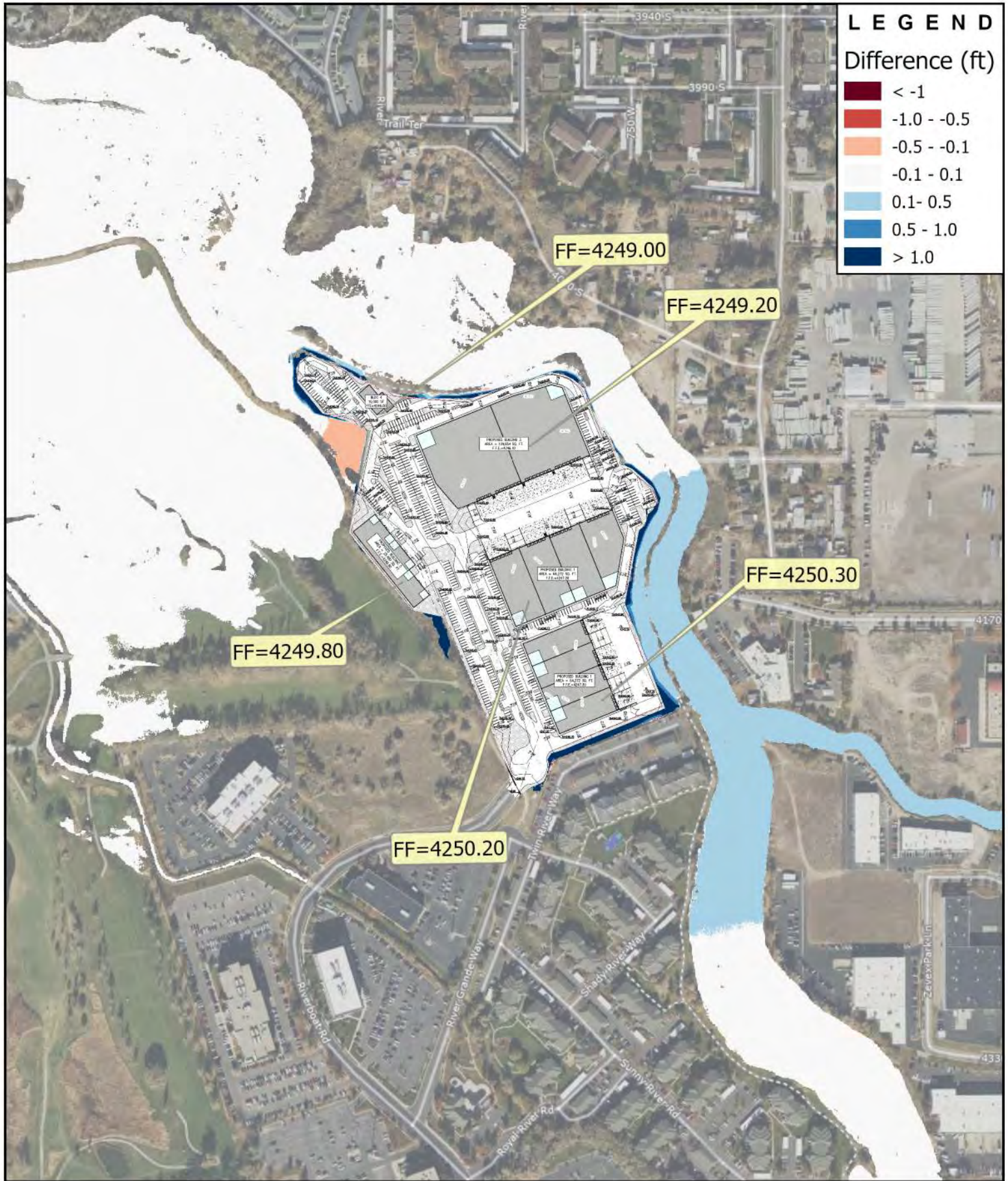
C6



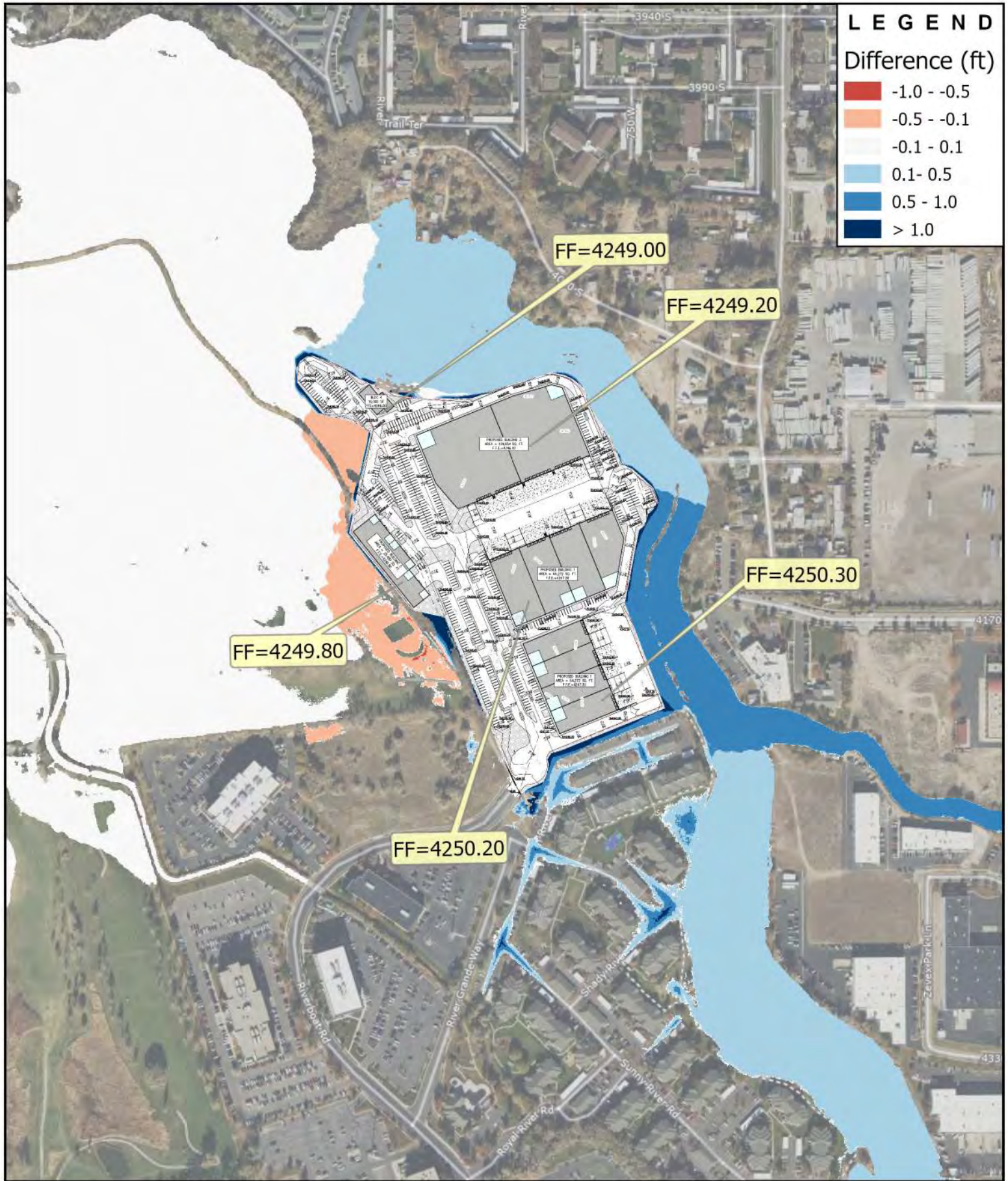
 BOWEN COLLINS & ASSOCIATES	Proposed Max WSE Lower Discharge (Approved CLOMR)	NORTH: 	SCALE: 0 200 400 Feet 
	BADIEE Jordan River CLOMR		



 BOWEN COLLINS & ASSOCIATES	Proposed Max WSE Higher Discharge (FIS)	NORTH: 	SCALE: 0 200 400 Feet FIGURE NO. C8
	BADIEE Jordan River CLOMR		

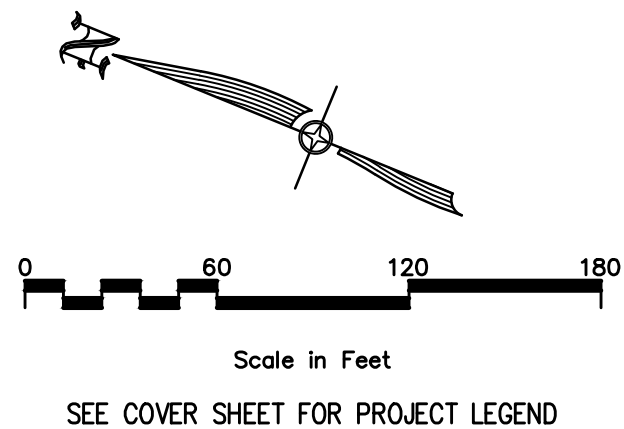


 BOWEN COLLINS & ASSOCIATES	Proposed vs Existing WSE Comparison Higher Discharge (FIS)	NORTH: 	SCALE: 0 200 400 Feet
	BADIEE Jordan River CLOMR		FIGURE NO. C9



 BOWEN COLLINS & ASSOCIATES	Proposed vs Existing WSE Comparison Higher Discharge (FIS)	NORTH: 	SCALE: 0 200 400 Feet FIGURE NO. C10
	BADIEE Jordan River CLOMR		

APPENDIX D
Proposed Bridge and Grading



APPENDIX E
ESA Compliance
(Future Submittal)

Replace

APPENDIX F
Approved 2016 Hydrology CLOMR

September 14, 2015

LOMC Clearinghouse

Subject: Request for a Hydrology Revision for the Jordan River and Surplus Canal

Dear LOMC Clearinghouse Representative:

This letter, attached forms and supporting information are respectfully submitted on behalf of Salt Lake County with the petition that the current effective hydrology for the Jordan River and Surplus Canal be revised. The attached Technical Memorandum (TM) explains that the 1985 Compromise Agreement is not accounted for in the current effective hydrology. Table 1 below indicates both the current effective and proposed discharges for the Jordan River and Surplus Canal. The proposed discharges are based on the legal requirement that discharges from Utah Lake into the Jordan River be regulated at the Utah Lake Outlet such that the peak discharge in the Jordan River at 2100 South does not exceed 3,400 cfs (and therefore in the Surplus Canal immediately downstream).

Table 1
Summary of Proposed Flood Insurance Discharges for the Jordan River and Surplus Canal (cfs)

Location	10-Year	50-Year	100-Year	500-Year
At Head of Surplus Canal	1,900	(NA) 3,300	(NA) 3,300	(NA) 3,300
At 2100 South	2,000	(3,800) 3,400	(4,700) 3,400	(7,400) 3,400
At Mill Creek Confluence	2,000	(3,800) 3,400	(4,700) 3,400	(7,400) 3,400
At Big Cottonwood Creek Confluence	1,930	(3,665) 3,360	(4,535) 3,360	(7,145) 3,360
At Little Cottonwood Creek Confluence	1,585	3,010	(3,740) 3,015	(5,925) 3,015
At 5800 South	1,200	2,280	2,850	(4,560) 2,935
At 9000 South	1,170	2,230	2,790	(4,465) 2,900
At Jordan Narrows	1,260	2,400	3,000	(4,800) 3,220

Note: Black numbers are current effective flood insurance study discharges. Red numbers are proposed discharges that have been reduced to account for the regulation of discharges from Utah Lake in accordance with the 1985 Compromise Agreement requirements to keep peak flows at 2100 South below 3,400 cfs.

September 14, 2015

Page 2

The goal of this submittal is to obtain FEMA's approval of the proposed discharges shown in Table 1. Once that is complete, Salt Lake County will begin making plans to certify the levees along the Surplus Canal. Revising discharge values is a critical component to certifying the levees as it returns the discharge values to the original levee design discharge values. The original levees were design to convey 3,300 cfs. Based on the current effective discharge of 4,700 cfs, the levees are freeboard deficient.

We understand this is a unique request and we look forward to working with you to the successful completion of this request. Your prompt attention to this request will be greatly appreciated. If you have any technical questions pertaining to this request or accompanying backup data, or if you need additional information, please contact Craig Bagley (cbagley@bowencollins.com) or Matt Stayner (mstayner@bowencollins.com).

Sincerely,

Bowen Collins & Associates, Inc.

A handwritten signature in blue ink, appearing to read "Matt Stayner", with a stylized flourish at the end.

Matthew H Stayner, P.E., C.F.M.
Project Manager



Federal Emergency Management Agency

Washington, D.C. 20472

July 5, 2016

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Ben McAdams
Mayor, Salt Lake County
2001 South State Street, Suite N2-100
Salt Lake City, UT 84114

IN REPLY REFER TO:

Case No.: 15-08-1395R
Community: Salt Lake County, UT
Community No.: 490102

104

Dear Mayor McAdams:

This responds to a request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) comment on the effects that revised flood hazard information would have on the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) report for your community in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a report dated September 2015, Mr. Matthew Stayner, P.E., CFM, of Bowen Collins and Associates, Inc., requested that FEMA evaluate the effects that a revised hydrologic analysis would have on the flood hazard information shown on the effective FIRM and FIS report.

All data required to complete our review of this request for a Conditional Letter of Map Revision (CLOMR) were submitted with letters from Mr. Matthew Stayner, P.E., CFM, of Bowen Collins and Associates, Inc.

Because this revision request also affects the Cities of Murray, Salt Lake City, South Salt Lake City, West Valley City, Taylorsville, Midvale, West Jordan, Sandy City, South Jordan, Draper, Riverton and Bluffdale; separate CLOMRs for those communities were issued on the same date as this CLOMR.

Information pertinent to this revision request is listed below.

Identifier:	Jordan River Surplus Canal Hydrology
Flooding Source:	Jordan River and Surplus Canal
FIRM Panels Affected:	49035C0120E, 0137E, 0139E, 0140E, 0141E, 0143E, 0280E, 0281E, 0283F, 0291G, 0293G, 0431G, 0433G, 0434G, 0441G, 0442G, 0443G, 0581G, & 0583G
FIRM Panels Affected within the Unincorporated Areas of Salt Lake County:	49035C0120E, 0137E, 0291G, 0431G & 0433G

We have completed our review of the submitted data and determined that the discharges presented in the report entitled, "Technical Support for a Hydrology LOMR for the Jordan River and the Surplus Canal" prepared by Bowen Collins and Associates, Inc., dated September 2015, are reasonable and that the effective discharges should be revised. We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic analysis.

Upon completion of a revised hydraulic analysis utilizing this submitted hydrologic analysis, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM and FIS report. Upon completion of the revised hydraulic analysis, a revision to the FIRM and FIS report would be warranted.

- Detailed application and certification forms must be used for requesting final map revisions. Therefore, when the map revision request for the area covered by this letter is submitted, please include the following forms, which may be accessed at <https://www.fema.gov/media-library/assets/documents/1343>.
 - Form 1, entitled "Overview and Concurrence Form"
 - Form 2, entitled "Riverine Hydrology and Hydraulics Form" Hydraulic analyses of the base flood, the 10-percent, 2-percent, and 0.2-percent-annual-chance floods, and the regulatory floodway, must be submitted with Form 2.
- A certified topographic work map showing the revised and effective base floodplain boundaries. Please ensure that the revised information ties-in with the current effective information at the downstream and upstream ends of the revised reach.
- An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base floodplain boundary delineations shown on the submitted work map and how they tie-in to the base floodplain boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.
- Documentation of the individual legal notices sent to property owners who will be affected by any widening or shifting of the base floodplain or any Base Flood Elevation (BFE) establishment along the Jordan River.

FEMA's fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps may be accessed at <https://www.fema.gov/flood-map-related-fees>. The fee at the time of the map revision submittal must be received before we can begin processing the request. Payment of this fee can be made through a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card (Visa or MasterCard only). Please either forward the payment, along with the revision application, to the following address:

LOMC Clearinghouse
Attention: LOMR Manager
847 South Pickett Street
Alexandria, Virginia 22304-4605

or submit the LOMR using the Online LOMC portal at:
<https://hazards.fema.gov/femaportal/onlinelomc/signin>.

After receiving appropriate documentation to show that the hydraulic analysis for Jordan River and Surplus Canal has been completed, FEMA will initiate a revision to the FIRM and FIS report.

This CLOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development, and for ensuring all necessary permits required by Federal or State/Commonwealth law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

If you have general questions about your request, FEMA policy, or the NFIP, please contact the FEMA Map Information eXchange (FMIX) toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact Mr. Sean McNabb, either by telephone at (303) 235-4303 or by e-mail at sean.mcnabb@fema.dhs.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Rick F. Sacbibit".

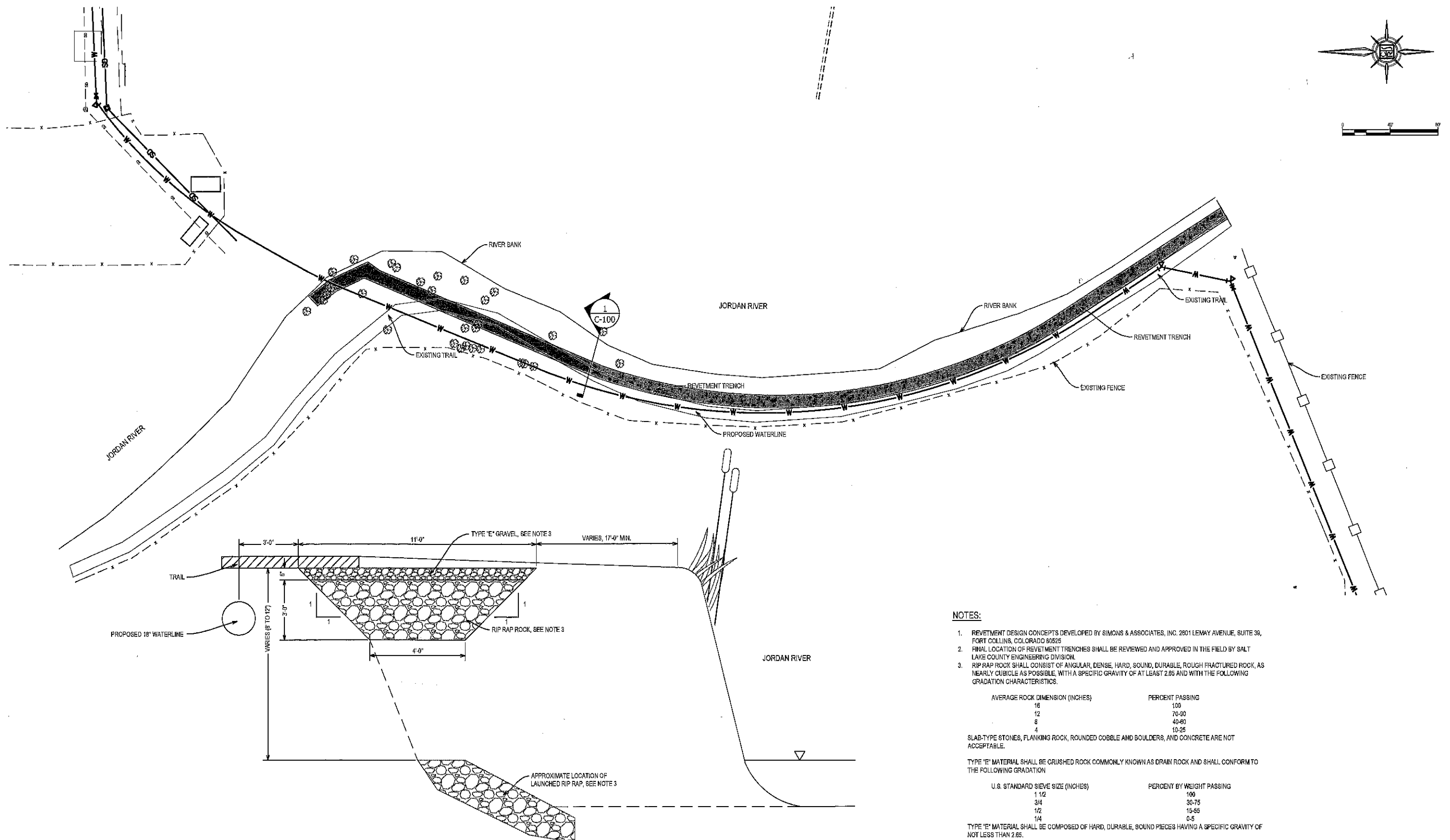
Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

cc: Mr. Rolen Yoshinaga
Director of Planning and Development Services
Salt Lake County

Mr. Matthew Stayner, P.E., CFM
Project Engineer
Bowen Collins and Associates, Inc.

APPENDIX G
Buried Riprap Trench Design

FILE PATH AND NAME: P:\00000000\TAYLORSVILLE\WATER\STABILIZATION\STABILIZATION.dwg
TAB: STABILIZATION
PLOT DATE AND TIME: 8/20/11 3:16 PM



1 TYPICAL REVETMENT TRENCH SECTION
Scale: N.T.S.

NOTES:

1. REVETMENT DESIGN CONCEPTS DEVELOPED BY SIMONS & ASSOCIATES, INC. 2801 LEMAY AVENUE, SUITE 30, FORT COLLINS, COLORADO 80526
2. FINAL LOCATION OF REVETMENT TRENCHES SHALL BE REVIEWED AND APPROVED IN THE FIELD BY SALT LAKE COUNTY ENGINEERING DIVISION.
3. RIP RAP ROCK SHALL CONSIST OF ANGULAR, DENSE, HARD, SOUND, DURABLE, ROUGH FRACTURED ROCK, AS NEARLY CUBIC AS POSSIBLE, WITH A SPECIFIC GRAVITY OF AT LEAST 2.85 AND WITH THE FOLLOWING GRADATION CHARACTERISTICS.

AVERAGE ROCK DIMENSION (INCHES)	PERCENT PASSING
16	100
12	70-90
8	40-60
4	10-25

SLAB-TYPE STONES, FLANKING ROCK, ROUNDED COBBLE AND BOULDERS, AND CONCRETE ARE NOT ACCEPTABLE.

TYPE "E" MATERIAL SHALL BE CRUSHED ROCK COMMONLY KNOWN AS DRAIN ROCK AND SHALL CONFORM TO THE FOLLOWING GRADATION

U.S. STANDARD SIEVE SIZE (INCHES)	PERCENT BY WEIGHT PASSING
1 1/2	100
3/4	30-75
1/2	15-55
1/4	0-5

TYPE "E" MATERIAL SHALL BE COMPOSED OF HARD, DURABLE, SOUND PIECES HAVING A SPECIFIC GRAVITY OF NOT LESS THAN 2.85.

REV.	BY	DATE	DESCRIPTION

PRINCIPAL PAUL J. HIRST	DATE ISSUED AUGUST 31, 2011
PROJECT MANAGER TAMMY NORTH	
CHECKED BY DOUG CROMAR	
DRAWN BY DAN EGBERT	
SCALE NA	

CALDWELL RICHARDS SORENSEN
ANSWERS TO INFRASTRUCTURE

SALT LAKE CITY OFFICE:
2080 EAST 2100 SOUTH
SALT LAKE CITY, UTAH 84109
PHONE: 801.359.5585
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TAYLORSVILLE-BENNION IMPROVEMENT DISTRICT
VALLEY WELL WATER & STORM DRAIN LINES
JORDAN RIVER BANK
STABILIZATION REVETMENT PLAN
APPROX. 700 WEST 4020 SOUTH
TAYLORSVILLE, UTAH

C-100
SHEET 3 OF 18
TB-809 09004C
PROJECT NUMBER