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King County Levee Breach Analysis, Mapping, and Risk Assessment Project: Raging River Flood Hazard Analysis

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DISCLAIMER

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1 INTRODUCTION

King County (County) retained a team led by Shannon & Wilson to provide engineering services for the Levee Breach Analysis, Mapping, and Risk Assessment Project (Project). The Project is based on recommendations presented in the Levee Breach Analysis for King County Rivers final report (Watershed Science and Engineering, 2019). The scope of work includes collecting data, developing detailed hydraulic models, simulating levee breaches, mapping the resulting inundation, and conducting risk analysis for six levee containment systems in three rivers (Lower Raging River, Lower Tolt River, and South Fork Snoqualmie River). The findings from the Project will be used to update capital project planning strategies and emergency planning efforts.

1.1 Purpose of Report

Northwest Hydraulic Consultants (NHC) is the hydraulics lead for the Project and is leading the hydraulic modeling of the Lower Raging and Lower Tolt rivers, as well as providing review and oversight of the South Fork Snoqualmie River work (which is being completed by Tetra Tech, another Project team member). This report documents the levee breach modeling and flood hazard analysis for the Lower Raging River (LRR) and comprises the hydraulic portion of the technical memorandum deliverable under King County contract E00670E20, Task 300, Subtask 7. In terms of how this report fits within the larger Project, this flood hazard analysis utilizes the hydraulic model developed and documented as part of Task 300, Subtasks 5 and 6 (NHC, 2022). Geotechnical information used to inform the breach modeling was developed by Shannon & Wilson (2021) as part of Task 300, Subtask 4. Lastly, the results of this flood hazard analysis are analyzed to quantify impacts as part of the Task 300, Subtask 8 report (Tetra Tech, 2023).

The study area for the LRR includes existing levee and revetment systems from the 328th Way SE bridge to the mouth of the Raging River at its confluence with Snoqualmie River as depicted in Figure 1.1. The County levee and revetment facilities are approximately 1.5 miles long and are present along the left and right banks of the river. The systems protect residential, commercial, and agricultural properties and infrastructure from flood hazards within the unincorporated community of Fall City.

The flood hazard analysis described in this report includes detailed levee breach progression modeling at two locations along the LRR levee containment system. NHC investigated various breach modeling methodologies and conducted preliminary breach testing at numerous locations in order to aid the County's selection of two final breach locations for mapping and analysis as part of this scope of work. In this document, all references to return period floods are based on existing or historical conditions (EC), unless otherwise indicated as a future conditions (FC) event.

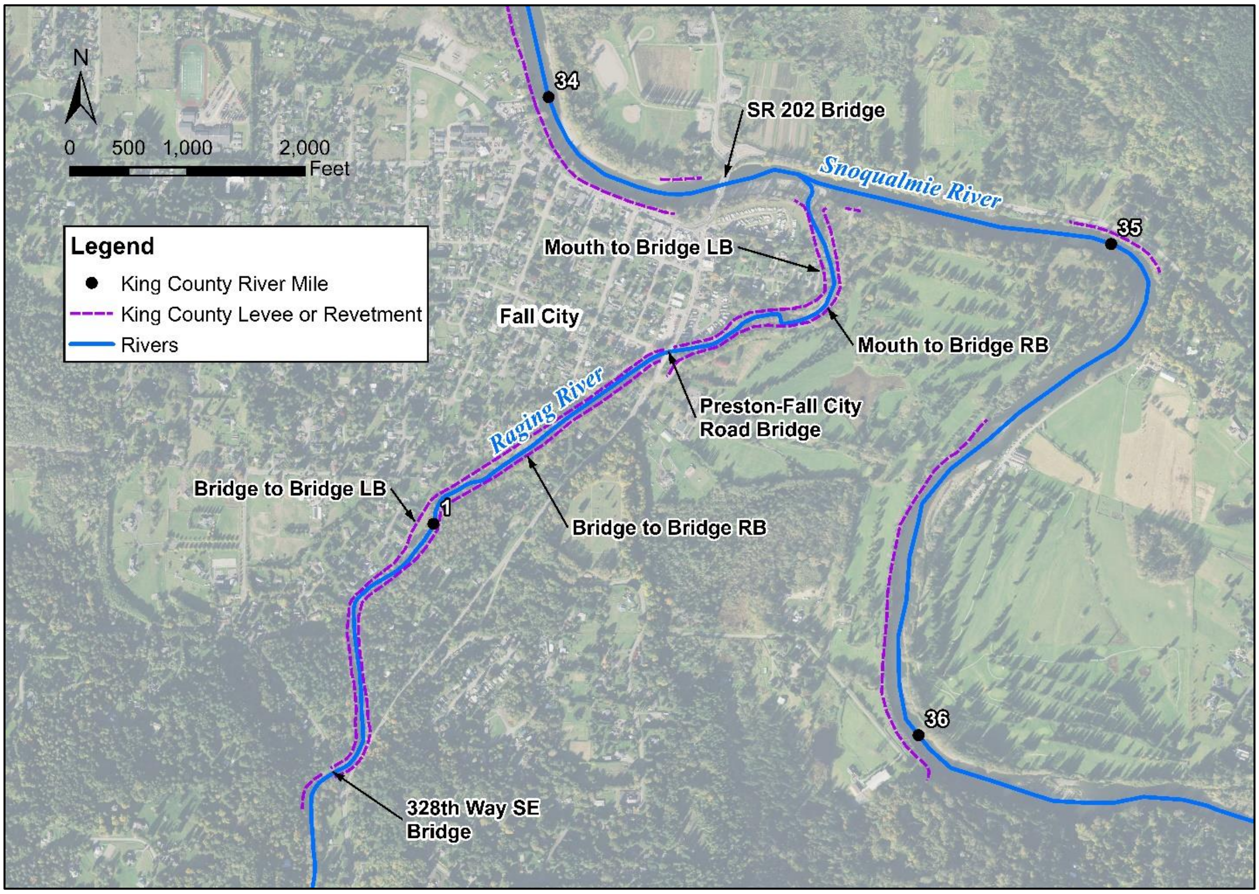

Figure 1.1 King County river facilities along the Lower Raging River

1.2 Model Development

NHC developed the hydrologic inputs and hydraulic model as part of Subtasks 5 and 6 (NHC, 2022). This section provides a brief summary of the previous effort; refer to the technical report (NHC, 2022) for a detailed description of the hydrologic and hydraulic analysis.

As part of Subtask 5, NHC developed existing and future conditions hydrologic inputs for the LRR. The analysis included a flood frequency analysis; historical event considerations; balanced flood hydrograph development for various return intervals; a joint-coincidence analysis of floods from the LRR and Snoqualmie River systems; and the application of climate change projections to develop future conditions balanced hydrographs for the LRR. NHC developed balanced flood hydrographs for eight existing conditions return periods (2-, 5-, 10-, 25-, 50-, 100-, 250-, and 500-year), with peak flows and 5- and 95% confidence intervals reported in Table 1.1. FC hydrographs were then developed by scaling the existing conditions hydrographs with climate change projection factors (FC peak flows reported in Table 1.1). The balanced hydrographs were used as hydrologic inputs for the existing conditions hydraulic model (Subtask 6).

Table 1.1 Existing and future conditions frequency flows for the Raging River at Fall City

Recurrence Interval	Existing Conditions Peak Flow and 95%, 5% confidence limits (cfs) [1]	Future Conditions Peak Flow (cfs) [2]
2-year	2,020 (1810, 2240)	2,240
5-year	2,980 (2690, 3330)	- [3]
10-year	3,650 (3270, 4220)	4,120
25-year	4,510 (3860, 5570)	- [3]
50-year	5,160 (4210, 6780)	6,300
100-year	5,830 (4520, 8210)	7,400
250-year	6,730 (4860, 10500)	- [3]
500-year	7,440 (5100, 12590)	10,480

Notes:
1. USGS Gage 12145500 statistical analysis period spanning 1945 through 2020 plus a historical event in 1932 (NHC, 2022).
2. Future conditions peak flow developed by applying projection factors (NHC, 2022).
3. Recurrence intervals not evaluated as part of FC scope (NHC, 2022).

As part of Subtask 6, NHC conducted detailed hydraulic modeling of the LRR using the U.S. Army Corps of Engineers (USACE) 2D HEC-RAS computer program (version 6.1). The 2D model domain encompasses the LRR from approximately 0.5 miles upstream of the 328th Way SE bridge (River Mile 2.0) to the confluence with the Snoqualmie River, as presented in Figure 1.2. The hydraulic model subtask included terrain development, geometry optimization, landcover/roughness analysis, and calibration. As part of the hydraulic model geometry development, NHC coded levees and embankments into the model as hydraulic structures (weirs). Hydrologic inputs, developed as part of Subtask 5, were used for the upstream boundary conditions for the LRR in the hydraulic model (Table 1.1). Existing condition inundation mapping was prepared for all eight existing condition return periods, in addition to the 100- and 500-year FC scenarios.

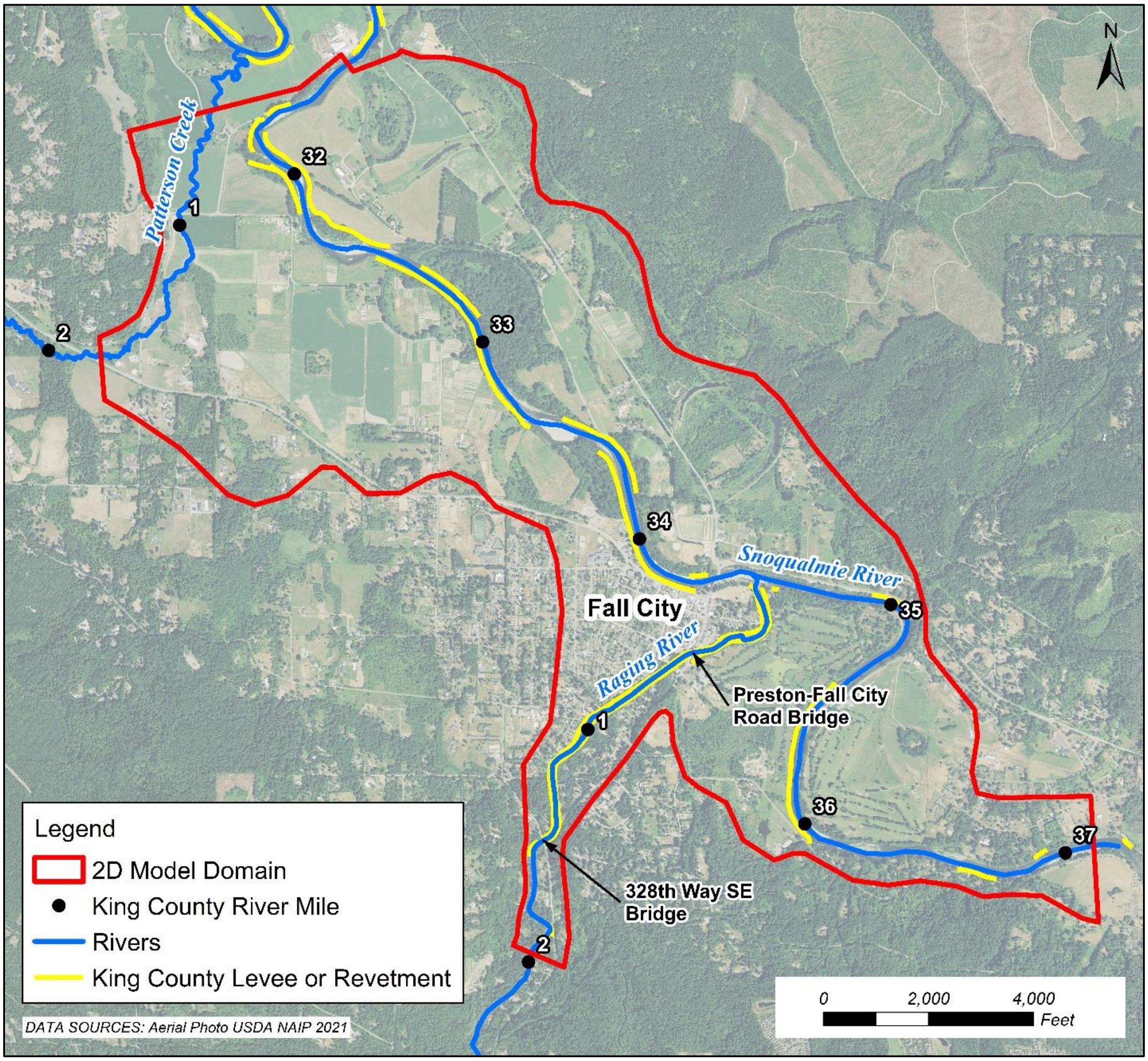

Figure 1.2 2D HEC-RAS model domain

2 LEVEE STABILITY AND BEND SCOUR ASSESSMENT

Shannon & Wilson prepared a technical report documenting the levee segmentation and geotechnical evaluation, as part of Subtask 4 (Shannon & Wilson, 2021). The assessment included identifying a geotechnically representative section, located at River Mile (RM) 0.94, and developing a fragility curve for that section to inform the probability of levee failure. NHC supported this effort by developing a bend scour estimate at the representative section for incorporation into the geotechnical evaluation.

The scour methodology and results are described in Appendix B of the Shannon & Wilson report (2021). Scoured or mobile bed conditions are not considered in the hydraulic modeling portions of this study.

3 LEVEE BREACH LOCATION AND PARAMETER SELECTION

NHC tested several breach locations and methods for estimating the key breach parameters of maximum size and growth rate. The following sections describe how the final breach locations and parameters were developed.

3.1 Breach Locations

NHC conducted preliminary levee breach modeling at eight locations, as depicted in Figure 3.1, using the Zomorodi (Zomorodi, 2020) and USACE methodologies (MMC, 2020), described in Section 3.2. Preliminary simulations were analyzed to assist the County in determining the two final locations for the detailed analysis. The preliminary simulations were run using the 500-year recurrence interval flood, which produced substantial inundation within Fall City. NHC prepared preliminary inundation figures resulting from the eight preliminary breaches and presented findings to the County on April 13, 2022. Based on these results, the County determined the two final breach locations for detailed analysis and mapping should be at Breach Location 3 (BL3) and Breach Location 6 (BL6), both on the left bank. BL3 is located at RM 0.53, at a narrow segment of the levee with a landward height of approximately 9 feet. The BL3 location was selected due to the number of potentially impacted properties northwest of Preston-Fall City Road. The second breach location, BL6, is located at RM 0.94 at the location of the geotechnical representative section. BL6 is situated adjacent to a stormwater pond and has a landward height of approximately 8 feet. Preliminary breach modeling at BL6 resulted in the greatest number of properties impacted by a levee breach scenario.

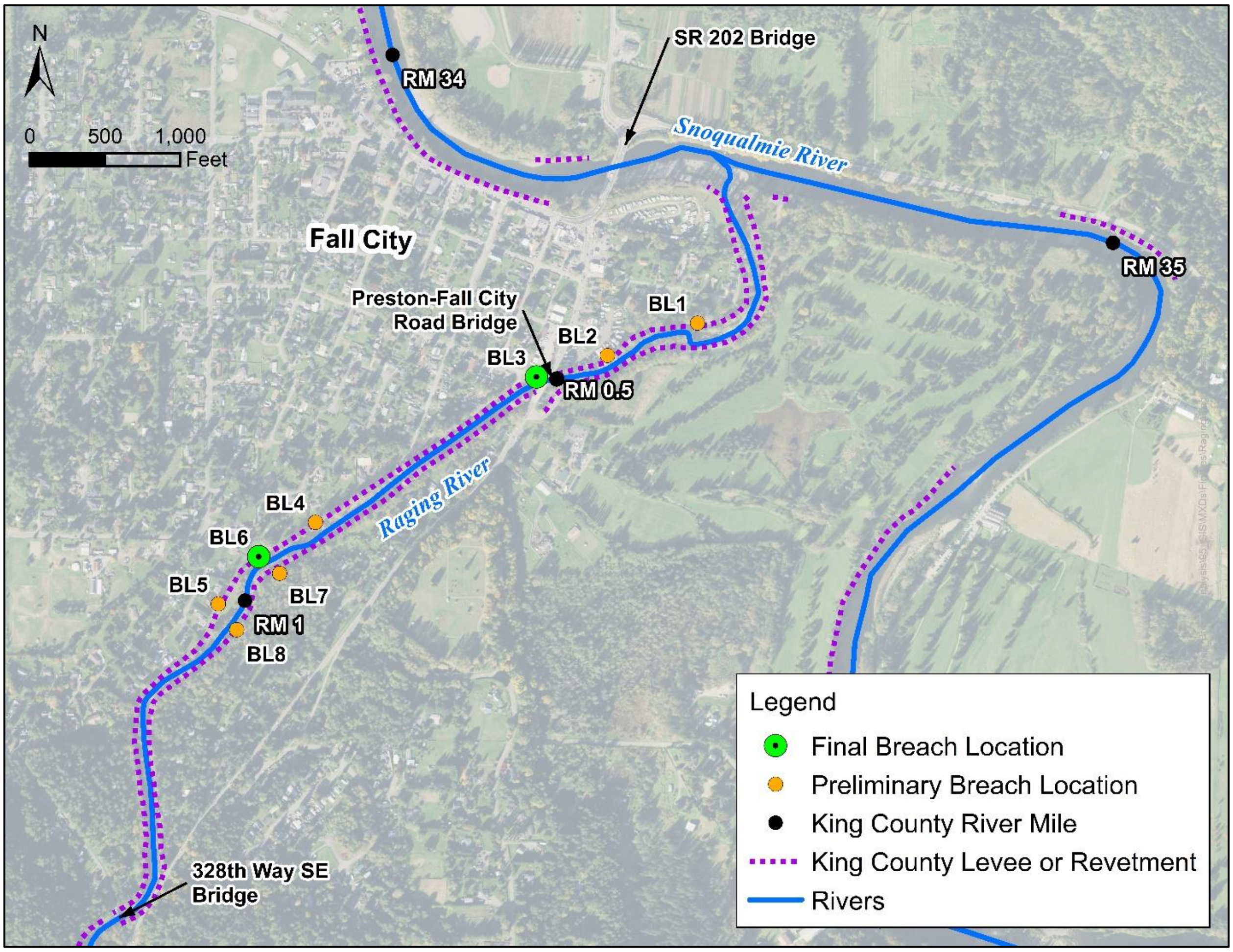

Figure 3.1 Preliminary and final breach locations

3.2 Levee Breach Methodology

NHC investigated three methodologies for determining breach sizes and growth rates: (1) a set of empirical equations for breach size and growth rate (Zomorodi, 2020); (2) HEC-RAS built-in routines (USACE Modeling, Mapping & Consequences (MMC, 2020)); and (3) WinDAM-C software. WinDAM-C was eliminated from consideration early on due to its reliance on an erodibility coefficient that varies over several orders of magnitude and cannot be directly determined from standard geotechnical testing. Additionally, the WinDAM-C equations were developed primarily from dam rather than levee breach data.

NHC tested the remaining two methods (Zomorodi and USACE) at BL6 to evaluate the practical differences that may result depending on the methodology selection. The Zomorodi equations were developed from a database of 55 real-world levee breaches. The method is simple to apply and provides best-fit equations based on levee height and broad classification of the soil into “cohesive” or “non-cohesive” categories. The USACE method develops velocity-erosion rate curves using an equation based on levee height, Manning's 'n', velocity through the breach, critical shear stress, and an erodibility parameter. The USACE documentation (MMC, 2020) recommends using a zero value for critical shear stress, which is conservative and means that a breach will continue to grow if there is any velocity through it. Similar to WinDAM-C, the erodibility parameter varies over a wide range, with guidance given for various levee materials. The velocity-erosion curve is then entered into the HEC-RAS "physically based breach" option. During a breach simulation, HEC-RAS calculates the breach velocity, then applies the matching erosion rates to the breach; the calculation is then repeated at each time step.

NHC presented the findings of the tests of these two methods to the County on April 13, 2022 and recommended the Zomorodi method for use in the LRR breach progression analysis. A key factor in this recommendation was the discovery of a bug[1] in HEC-RAS version 6.1, used for the model development, that interferes with application of the USACE approach with the preferred 2D equation method for calculating flow over levees. Prior to formal adoption of the Zomorodi method, the County directed NHC to further validate the Zomorodi set of equations by testing whether they could reasonably predict the size of historical levee breaches that had occurred in Western Washington. NHC identified seven relatively recent levee breaches (two separate Snohomish River breaches in 1990, the Skagit River breach on Fir Island in 1990, the Snohomish River in 1995, the Tolt River in 2009, and two Nooksack River breaches from 2022). A comparison of actual breach widths versus predicted breach widths using the Zomorodi equations is shown in Figure 3.2 and Figure 3.3. The seven test breaches were plotted using both non-cohesive and cohesive predictive equations. Actual breach widths were estimated from a variety of sources: high-quality imagery/plans for the Nooksack, Tom Bean's account as relayed by Jay Smith (King County) for the Tolt, and Google Earth historic imagery for the older breaches.

[1] In HEC-RAS version 6.2 and older, the USACE physically-based breach growth method cannot be used in conjunction with the 2D equation method for calculating flow over a levee (as represented by a 2D connection in this case). Attempting to do so results in a breach that does not grow according to the specified velocity-growth table. The USACE method only works when paired with the weir equation to calculate flow over the levee. Using a weir equation to calculate flow through a breach is much more unstable than the 2D equation method, and prone to oscillations. NHC reported this bug to the Hydraulic Engineering Center (HEC) in May 2022 and it was acknowledged by HEC in June 2022. Following completion of the breach analysis and modeling, HEC released HEC-RAS version 6.3 in September 2022 and reported the bug as fixed. As of this writing, the bug fix has not been independently tested by NHC. The fact that the bug was reported to be fixed means the breach methodology may be reassessed for future work on other rivers being evaluated as part of this Project.

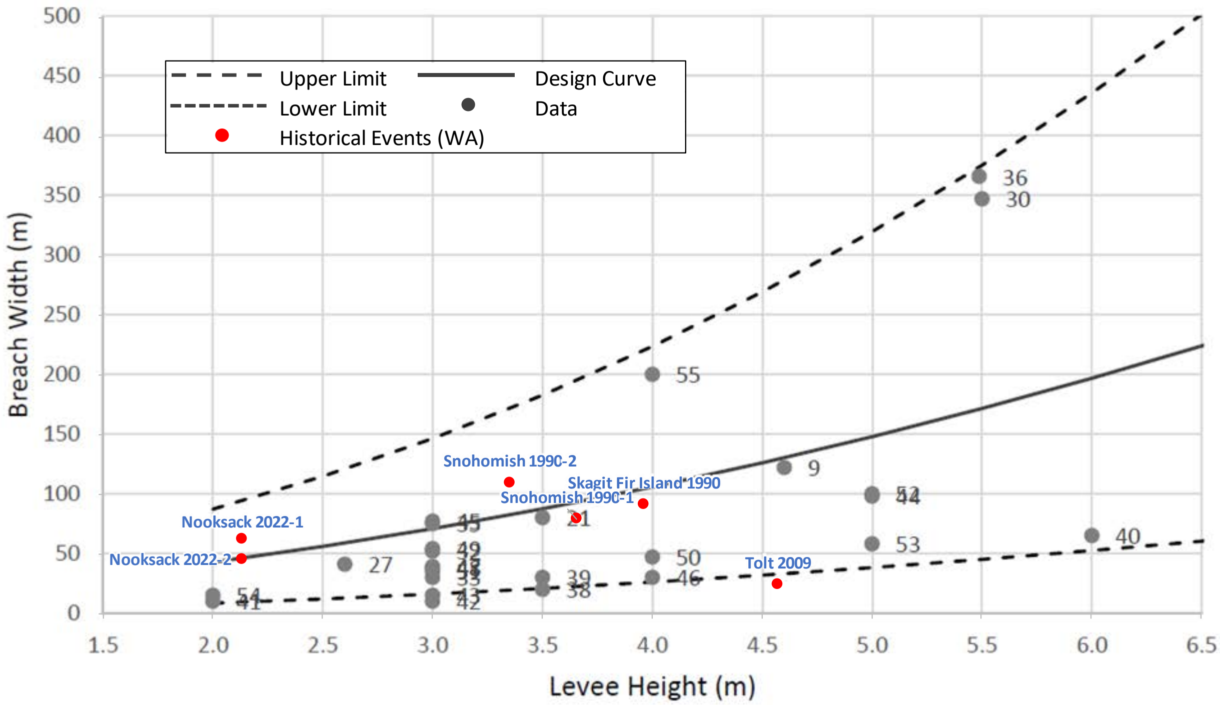

Figure 3.2 Zomorodi method validation with historical events in Washington (non-cohesive soils)

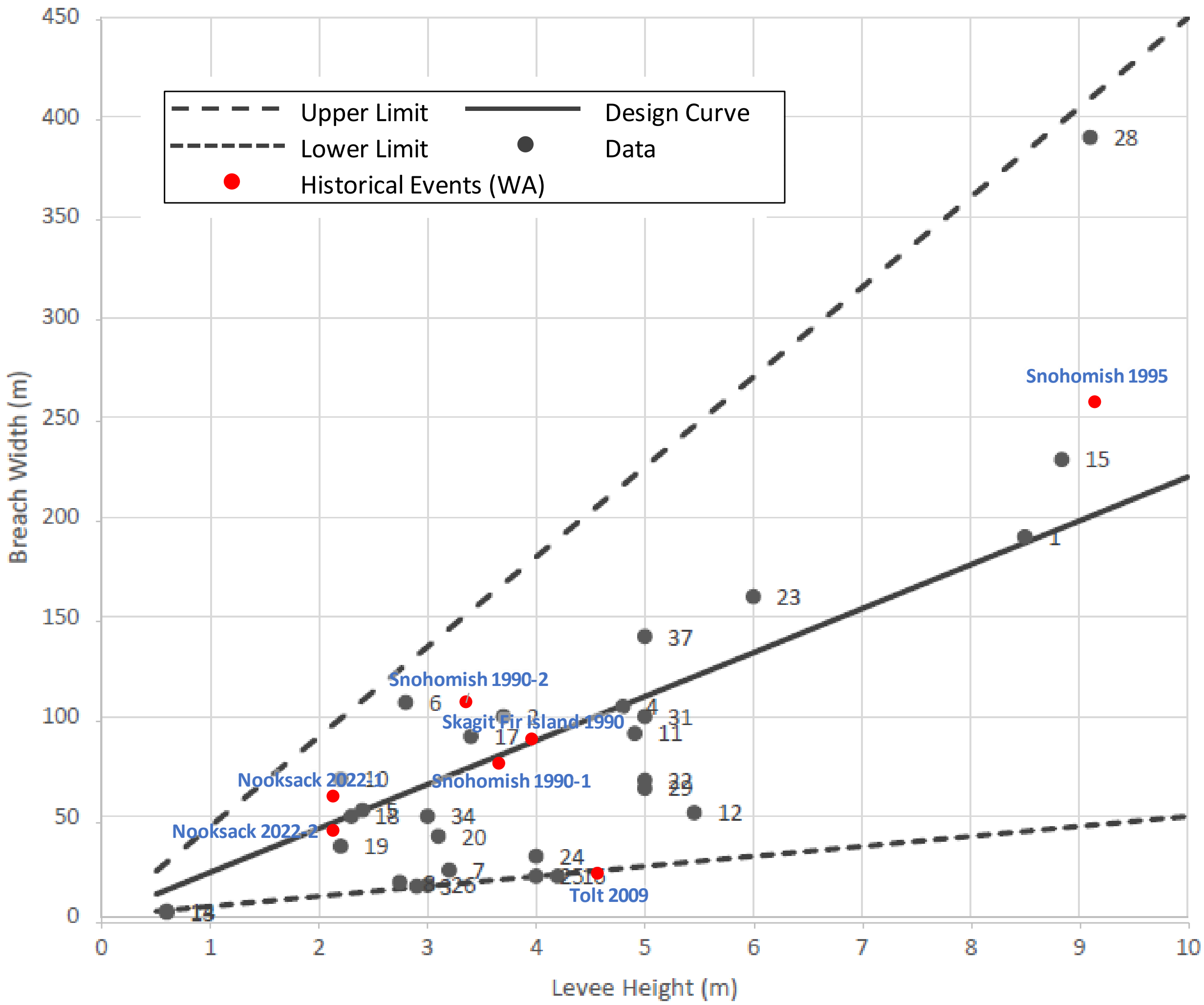

Figure 3.3 Zomorodi method validation with historical events in Washington (cohesive soils)

Overall, the Zomorodi equations reasonably predicted the actual breach widths. The 'Tolt 2009' event occurred in non-cohesive soils as inferred by the 2006 geotechnical investigation for the Lower Tolt River (King County, 2006). The 'Snohomish 1995' and 'Skagit Fir Island 1990' likely occurred in cohesive soils. The remaining historical events are more likely to be non-cohesive soils. In both plots, the 'Tolt 2009' breach is a low outlier, aligning with the lower limit of the design curve. Based on photographic evidence, the Tolt breach may have had restricted growth due to active flood fighting and riprap placement along the breach.

Based on these findings, the Zomorodi method, described further in Section 3.3, was used to determine breach widths and growth rates for the LRR breach simulations. The method is simple, local historic breach widths match well with the predictive equation, and it allows use of the 2D equation method for calculating flow through the breach, a more stable approach for modeling a wide range of flow conditions. It should be noted that regardless of the method selected for this Project, levee breach predictions have large uncertainty bands.

3.3 Selected Breach Parameters

Levee breach parameters (final breach width and lateral erosion rate) were assigned to the two selected breach locations using the Zomorodi method (Zomorodi, 2020). The soil composition for the LRR levee containment system is considered a non-cohesive material, per findings from the geotechnical report (Shannon & Wilson, 2021). The non-cohesive design curve equations for the final levee breach width and erosion rate are presented below, where H_l is the riverward levee height in meters, Wb is the final breach width in meters, and Lea is the lateral erosion rate in meters per hour:

Levee Breach Width $$W_b = 3.5(H_l + 1.5)^{2.0}$$ Eqn. 1

Lateral Erosion Rate $$LE_a = 15 + 10H_l$$ Eqn. 2

Table 3.1 reports the levee height and calculated final breach width and erosion parameters for BL3 and BL6, converted to Imperial units for use in HEC-RAS. Riverward heights at the two breach locations were determined based on a standard cross section at the applicable breach location. The final breach width divided by the lateral erosion rate yields the breach formation time, all three of which are entered into HEC-RAS. Bottom breach elevations were determined from minimum landward elevations at the BL3 and BL6 standard sections. NHC edited the floodplain model mesh slightly at the breach locations to ensure cells receiving flow from the breaches extend well beyond the levee toe, for accuracy and numerical stability. The breach was triggered to fail at the peak of the balanced hydrograph (Section 1.2). The levee failure mechanism was assigned based on observed overtopping during the existing conditions simulations. An overtopping failure method was assigned where the existing conditions model simulated overtopping; this included BL6 at the 500-year FC event, and BL3 at the 250-year, 500-year, 100-year FC, and 500-year FC events. At all other recurrence intervals, a piping failure method was selected where the existing conditions model did not simulate overtopping of the levee structures.

Table 3.1 Calculated levee breach parameters

Parameter	BL3	BL6
Levee Height, Riverward	3.7 meters (12 feet)	3.0 meters (10 feet)
Final Breach Width	93.1 meters (305.5 feet)	72.4 meters (237.5 feet)
Lateral Erosion Rate	51.6 meters per hour (169.2 feet per hour)	45.5 meters per hour (149.2 feet per hour)
Breach Formation Time	1.8 hours	1.6 hours
Bottom Elevation	109.0 feet	124.0 feet

4 LEVEE BREACH MODELING AND INUNDATION MAPPING

NHC used the hydraulic model, documented in Section 1.2 and NHC (2022), to simulate hypothetical levee failures at BL3 and BL6. Levees and embankments were coded into the model as hydraulic structures (weirs). The weirs were divided into segments, ranging from approximately 500 to 1,800 feet in length, to allow more discretization in parameters and calculation methods. The 2D flow equation option was applied to both breach structures, as described in Section 3. The 2D flow equation produces smooth hydrographs through the breaches at BL3 and BL6.

Breach model parameters were assigned as documented in Table 3.1. For each hypothetical breach, the levee was assumed to fail at the peak of the balanced hydrograph inflow (time 12:00). Appendix A contains detailed depth, velocity, and hazard mapping at all modeled recurrence intervals. Hazard mapping was produced based on United States Bureau of Reclamation (USBR) guidelines (1988) for child life safety. The life safety rating scheme is divided into three categories: low danger zone, judgement zone, and high danger zone, based on the depth and velocity results. The low danger zone predicts that a child of any size would not be seriously threatened by water, while the high danger zone predicts a serious threat for all children. The judgement zone is an intermediate danger classification where danger level should be determined based on engineering judgement. The USBR guidelines recommend that whenever possible, several opinions should be considered, and a common agreement reached among analysts when determining potential lives at risk in this zone. There are many factors to consider, including but not limited to: seasonal usage trends of certain facilities such as campgrounds, the total time that depths and velocities are in the judgement zone, and the build quality and number of stories of individual buildings. Figure 4.1 shows the depth and velocity relationship for each hazard classification (reproduced from USBR, 1988).

The next two sections provide interpretation of the hydraulic modeling results at the two hypothetical breach locations. Appendix A contains depth, velocity, and hazard mapping for all modeled flows at both breach locations.

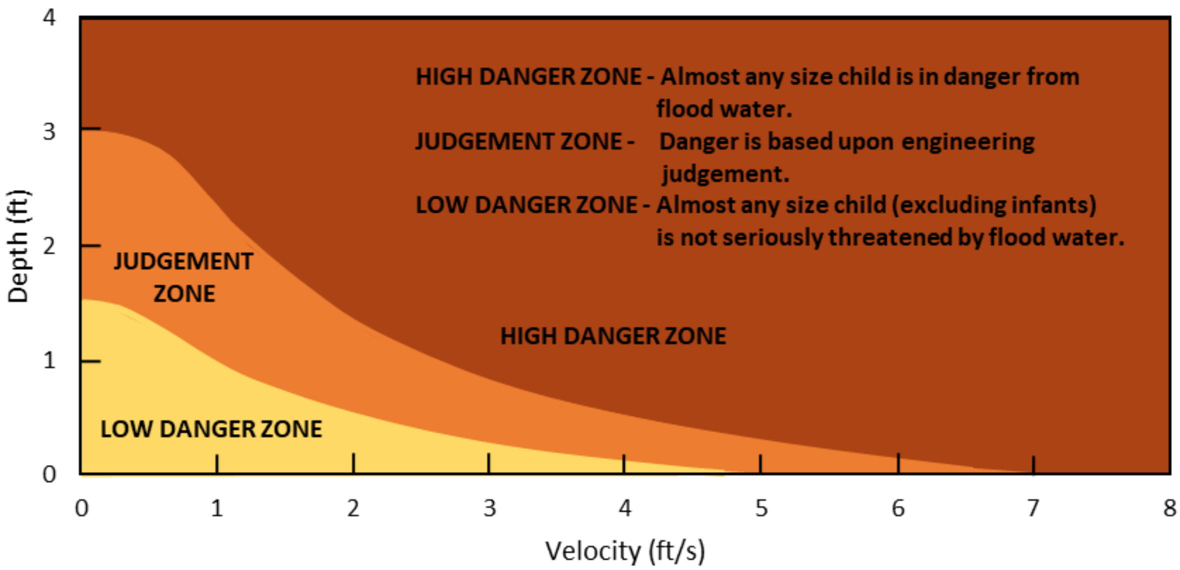

Figure 4.1 Depth-Velocity-Danger relationship for children (USBR, 1988)

4.1 Breach Location 3 (BL3)

A hypothetical levee breach at BL3 generally impacts properties between 337th Place SE and Preston-Fall City Road, as presented with 500-year velocity mapping in Figure 4.2. The hazard paths follow topographic contours directed to the north, with higher velocity zones present along roadway alignments where roughness is lowest. Peak velocities and depths occur approximately two hours after the breach starts, which corresponds with the time it takes for the breach to reach its full width (Table 3.1). Inundation from the 2- to 10-year events is typically confined between 338th Place SE and Preston-Fall City Road. At the 25- to 100-year FC events, flows overtop 338th Place SE, but are confined between 337th Place SE and Preston-Fall City Road. At the 500-year FC event, upstream flows near the geotechnical representative section (BL6) naturally overtop the left bank levee containment system; these overtopping flows interact with the BL3 flows near Preston-Fall City Road. Maximum depths resulting from BL3 occur near the breach location; depths range from 1.5 to 4.5 feet at the 2- and 500-year FC events, respectively. Maximum velocities within the roadway corridors are generally higher than 5 ft/s at all simulated flow events. Velocities near existing structures are generally below 2 ft/s. The King County Fire District 27 building is not impacted by breach flows from BL3 but is shown as inundated at the 500-year FC event, as a result of flood flows naturally overtopping the levee near the geotechnical representative section (BL6). The 2- through 500-year EC hazard mapping depicts judgement (orange) and high danger (red) zones near the confluence with the Snoqualmie River and aligned with Preston-Fall City Road, starting at the King County Storage Yard. At the 500-year FC event, flood flows overtop the left levee near the existing stormwater pond (RM1) and high danger hazard mapping (red) is present near 334th Ct SE and along the 334th Pl SE roadway alignment.

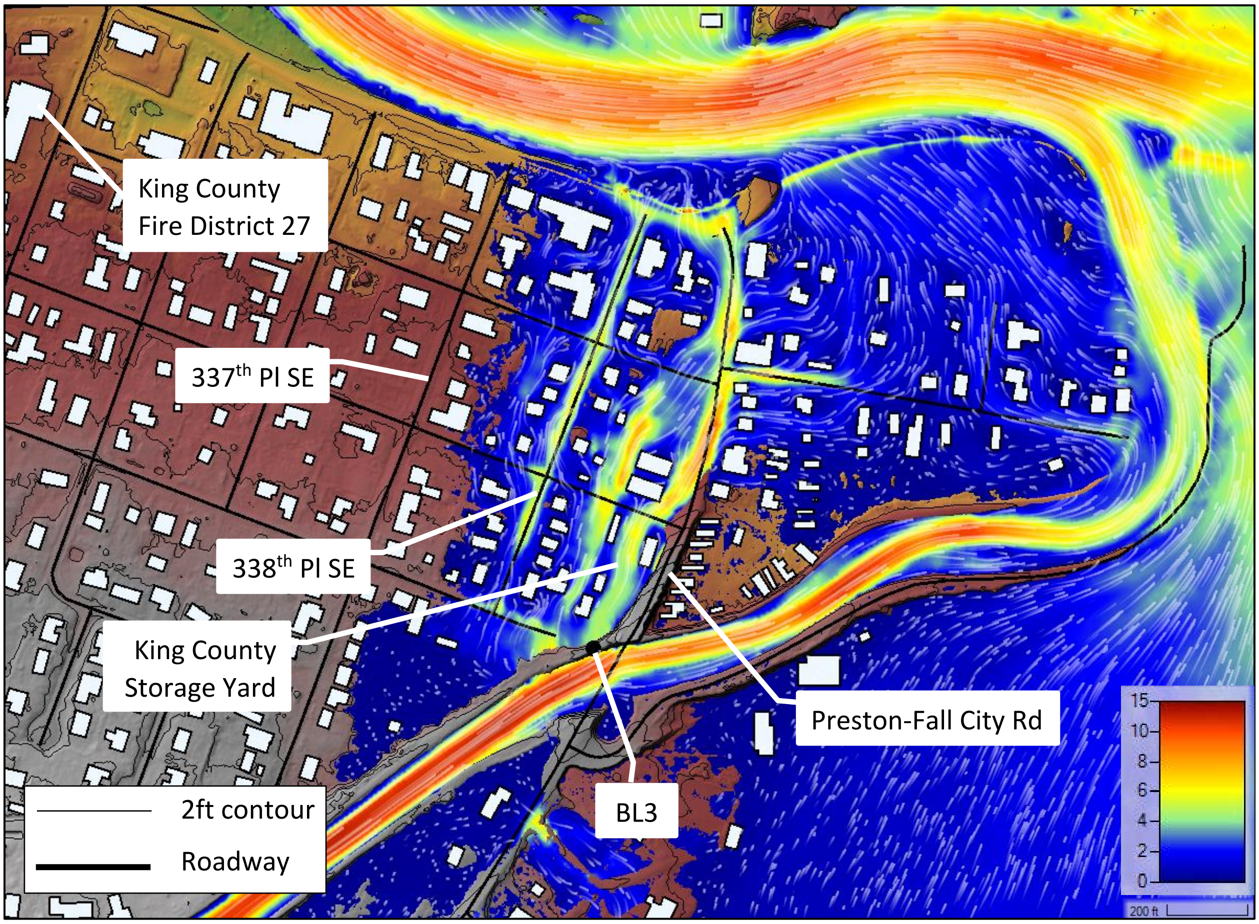

Figure 4.2 BL3 velocity magnitude and flow direction, ft/s (500-year)

4.2 Breach Location 6 (BL6)

A hypothetical levee breach at BL6 is predicted to impact a larger number of properties compared to BL3. Inundation mapping is typically bound between 332nd Avenue SE and Preston-Fall City Road, as presented with 500-year velocity mapping in Figure 4.3. Similar to BL3, the breach flow paths generally follow topographic contours directed to the north, with higher velocity zones along the roadway alignments. Peak velocities and depths occur approximately two hours after the breach starts, which correlates with the breach formation time (Table 3.1). A breach during the 2-year event has very little impact, as breach flows fill the stormwater pond opposite the breach, but barely overtop the landward side of the pond. Hazard paths at and above the 5-year event intersect with SE 45th Street, overtop the roadway, and diverge into several flow paths routed to the north. Maximum depths resulting from BL6 occur near the breach location; depths range from 2.0 to 4.0 feet at the 5- and 500-year FC events, respectively. Maximum velocities within the roadway corridors are generally larger than 4 ft/s at and above the 25-year event and range up to 8 ft/s at the 500-year FC event. Velocities near existing structures are generally below 2 ft/s at all flow events. Flood hazard mapping at the 2-year breach event is confined to the stormwater pond and does not impact downstream properties. The King County Fire

District 27 building is inundated at the 5-year FC event. The 5- through 25-year breach events depict a majority of the inundated areas mapped as low danger zones (yellow), with exception of roadway alignments and areas near BL6 and the Snoqualmie River confluence. Breach scenarios above the 25-year event present judgement (orange) and high danger (red) zones along the majority of roadway alignments, immediately downstream of BL6 and at the confluence with the Snoqualmie River. As seen in existing conditions simulations, the left bank levee directly upstream of the Preston-Fall City Road crossing overtops at events larger than the 100-year. At these events, high danger (red) zones extend northward from the breach along the primary breach flow path, which is generally located between Preston-Fall City Rd and 338th Pl SE.

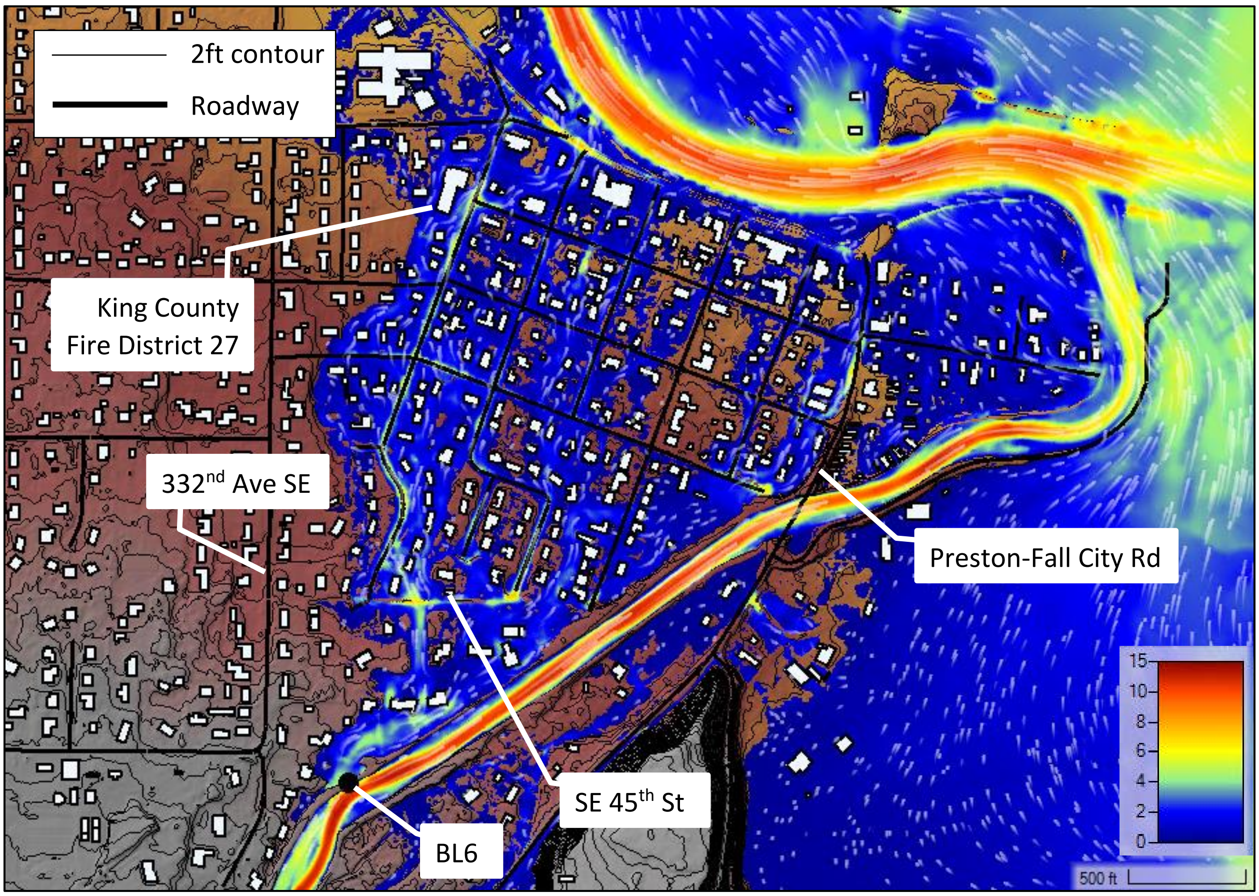

Figure 4.3 BL6 velocity magnitude and flow direction, ft/s (500-year)

5 DEVELOPMENT OF HYDRAULIC-ECONOMIC INPUTS

This section provides results specific to the index locations that serve as part of the economic damage assessment (Tetra Tech, 2023), along with uncertainty estimates required for that assessment. Two index locations were selected near the left bank of the main channel adjacent to the final breach locations (BL3 and BL6). The locations were determined during the meeting with the County, Shannon & Wilson, and Tetra Tech on September 29, 2022.

5.1 Inundation Depth Grids

Depth grids, which are direct outputs from the hydraulic model, were provided to Tetra Tech to perform the economic analysis. This includes both the breach scenario depth grids described in this report and the baseline (without breach) inundation depth grids produced in an earlier phase of this study and documented in NHC (2022).

5.2 Stage-Discharge Curve at Index Locations

Peak stage was extracted from the 2D HEC-RAS model at the index locations, which are located in the main channel adjacent to breach locations BL3 and BL6. These stage values represent peak in-channel water surface elevations in the absence of any breaches.

Table 5.1 Stage-discharge curves at the index locations

Recurrence Interval	Peak Flow (cfs)	BL3 Stage (feet, NAVD88)	BL6 Stage (feet, NAVD88)
2-year	2,020	111.19	126.80
5-year	2,980	112.39	127.94
10-year	3,650	113.12	128.57
25-year	4,510	113.94	129.37
50-year	5,160	114.53	129.95
100-year	5,830	115.06	130.50
250-year	6,730	115.64	131.14
500-year	7,440	115.92	131.60
100-year FC	7,400	115.91	131.59
500-year FC	10,480	116.42	132.81

The levee crest elevation at BL3 is 115.77 feet and at BL6 is 132.01 feet.

5.3 Discharge-Frequency Uncertainty

Discharge-frequency uncertainty for both existing and future conditions was reported as part of the Hydrologic and Hydraulic Analysis portion of this study (NHC, 2022). Specifically, Table 1.2 in Appendix A of NHC (2022) contains existing condition flood frequency analysis results along with 5% and 95% confidence bounds. The same table also includes median estimated future conditions discharges, with minimum and maximum estimates of the potential future conditions flow range.

5.4 Stage-Discharge Uncertainty

This section describes the uncertainty in stage at the two index locations for a given flow. NHC determined stage uncertainty using the methods for gaged streams described in EM 1110-2-1619 (U.S. Army Corps of Engineers, 1996). There are two components to stage uncertainty: natural uncertainty and model uncertainty. Natural uncertainty was assessed by both examination of the joint-coincidence 1D model results and the above referenced EM. The joint-coincidence analysis, described in NHC (2022), included simulating the Raging and Snoqualmie Rivers for the period spanning 1988 to 2020 in order to assess the impact of variable Snoqualmie River backwater on stage in the Raging River. While NHC (2022) documented considerable Snoqualmie River influence near the confluence, that influence diminishes rapidly as one moves upstream in the Raging River, resulting in a standard deviation of stage uncertainty equal to only 0.03-0.04 ft at the index locations. NHC also applied equation 5-5 from EM 1110-2-1619 to estimate natural uncertainty from other sources; a standard deviation of natural uncertainty of 0.15 feet was calculated for each index location. These two estimates of natural uncertainty were combined to generate an estimate of the total standard deviation of natural stage uncertainty. Standard deviation of model uncertainty was taken directly from Table 5-2 in EM 1110-2-1619, a value of 0.7 feet was selected. The standard deviations of natural and model uncertainty were then combined following the procedures in the Corps manual resulting in a standard deviation of total stage uncertainty of 0.73 feet for both index locations.

6 CONCLUSIONS

The flood hazard analysis shows that hypothetical levee breaches at BL3 and BL6 will have varying impacts on Fall City. A breach at BL3 will mainly impact properties west of Preston-Fall City Rd and near the confluence with the Snoqualmie River, which includes the primary commercial district in Fall City. BL6 results in the largest number of impacted properties; mapping presents high danger zone risks near the confluence with the Snoqualmie River, with intermediate judgement zone risks mapped along a majority of the roadway alignments.

The inundation mapping and uncertainty parameters documented in this report serve as inputs to the Project economic impact analysis (Tetra Tech, 2023), while the hazard mapping will be considered when prioritizing future capital projects.

There are several components of flood risk that were beyond the scope of this Project to assess. NHC (2022) produced depth, velocity, and water surface elevation figures in the absence of any breaches but did not include hazard mapping of these baseline flooding conditions. This does not imply that there is no risk in the absence of a breach; there is some degree of flood risk in any inundated area. The lack of baseline flood hazard maps must be kept in mind when reviewing the hazard maps in this report, and the reader should be aware that much of the hazard depicted would be present with or without a breach. For example, the mobile home park on the left bank of the Raging River just downstream of

Preston-Fall City Rd is subject to flooding from the Snoqualmie River even absent any breaches, beginning at around a 50-year Snoqualmie River flood.

Fall City is built on the historical alluvial fan of the Raging River. Alluvial fans are inherently hydraulically unstable, and FEMA has special procedures for mapping flood hazards on alluvial fans. In the case of the Raging River, the hazards are minimized by the presence of the levees which provide a high level of protection, so risk associated with the alluvial fan setting was not considered as part of this Project.

Lastly, it should be noted that one portion of the Raging River levee system has a unique risk profile that cannot be adequately assessed without a site-specific study. This is the gabion basket section of levee along the left bank of the Raging River downstream of Preston-Fall City Rd from RM 0.4 to RM 0.5. The levee here is much different in character than the remaining levees, and would be expected to have a different probability of failure at various return interval floods than the representative levee section that was studied in detail in the geotechnical report (Shannon & Wilson, 2021).

7 REFERENCES

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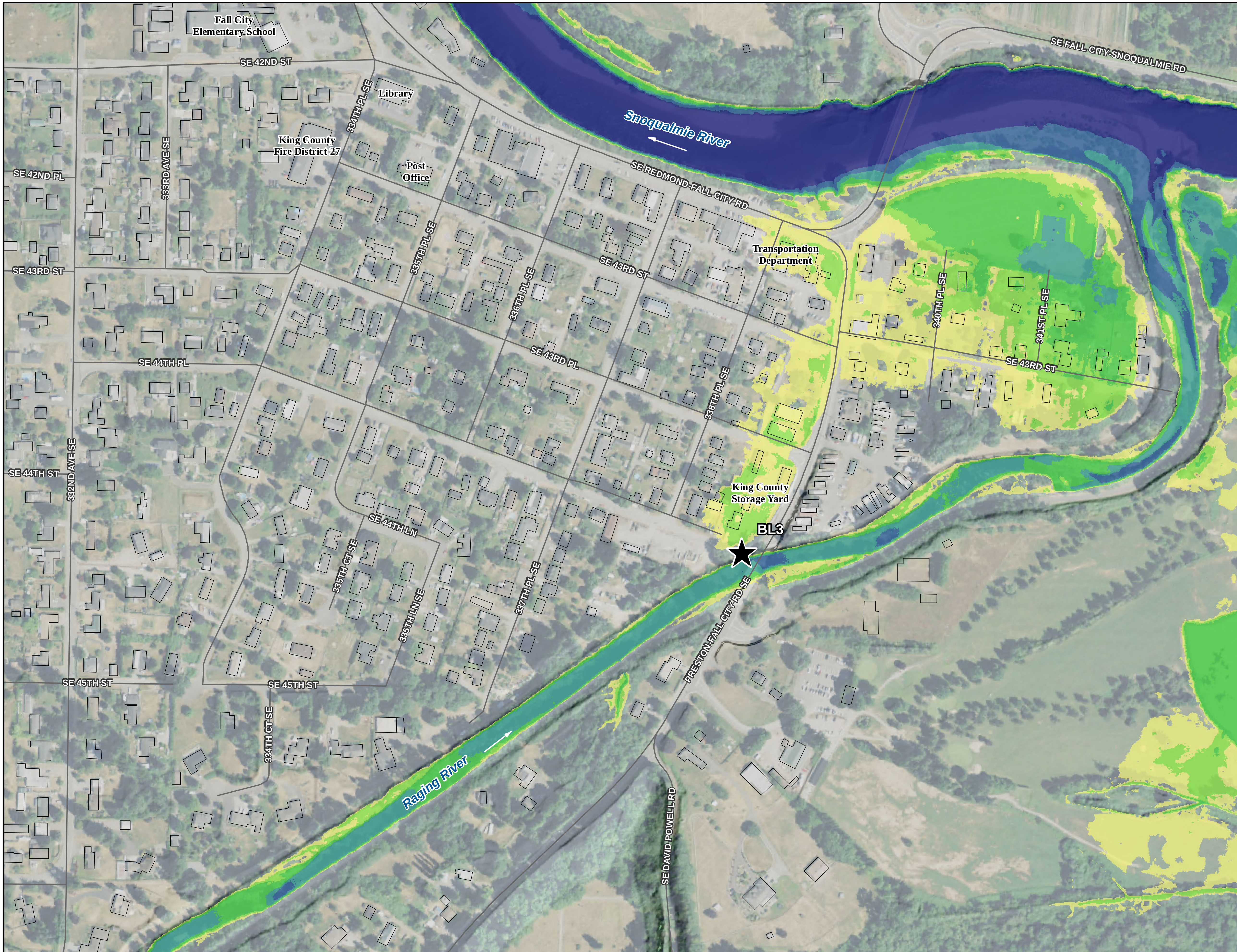
APPENDIX A

BREACH INUNDATION AND HAZARD MAPPING



King County

nhc northwest hydraulic consultants

Legend

- ★ Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 2-year EC flood at BL3

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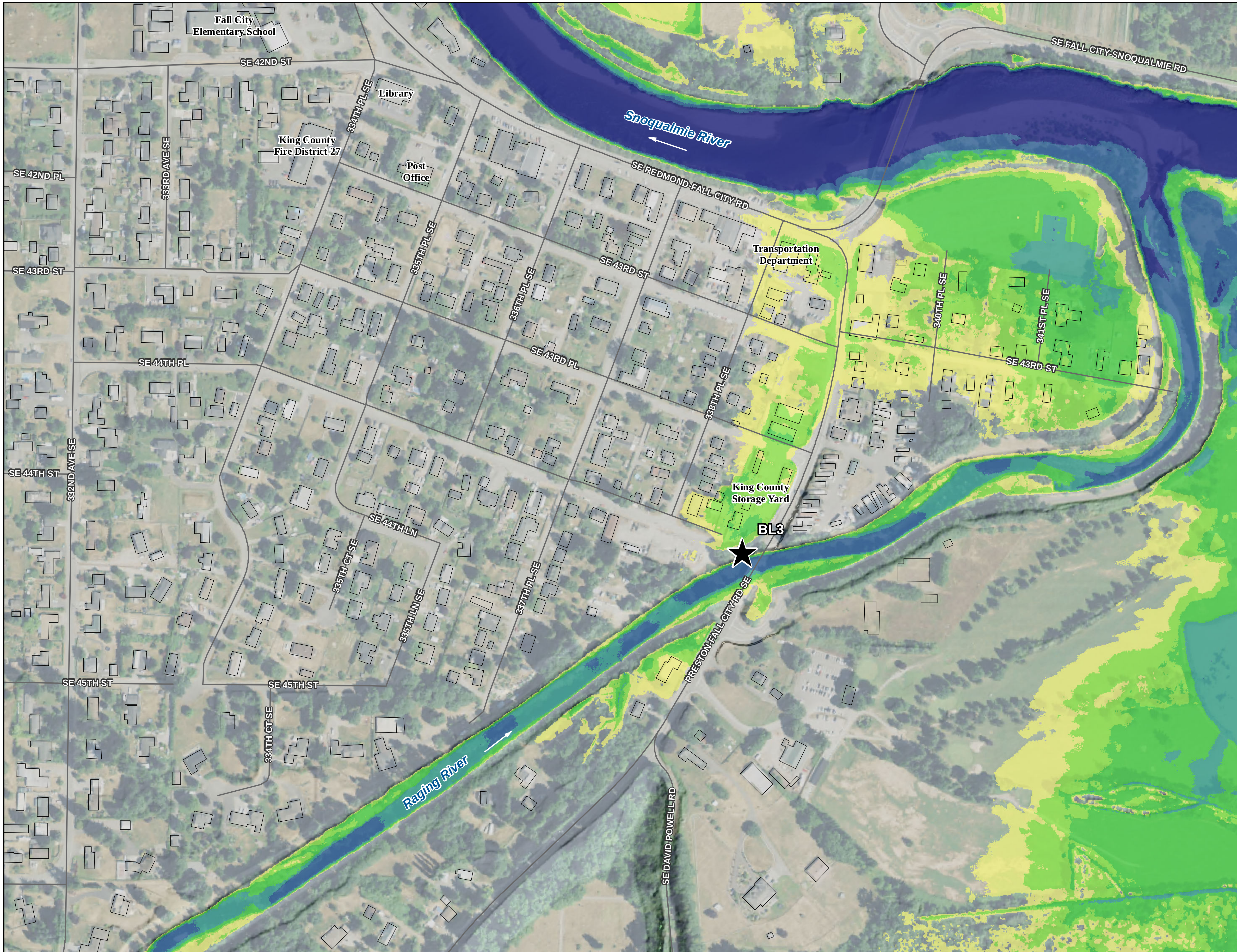

King County

nhc
northwest hydraulic consultants

Legend

- Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 5-year EC flood at BL3

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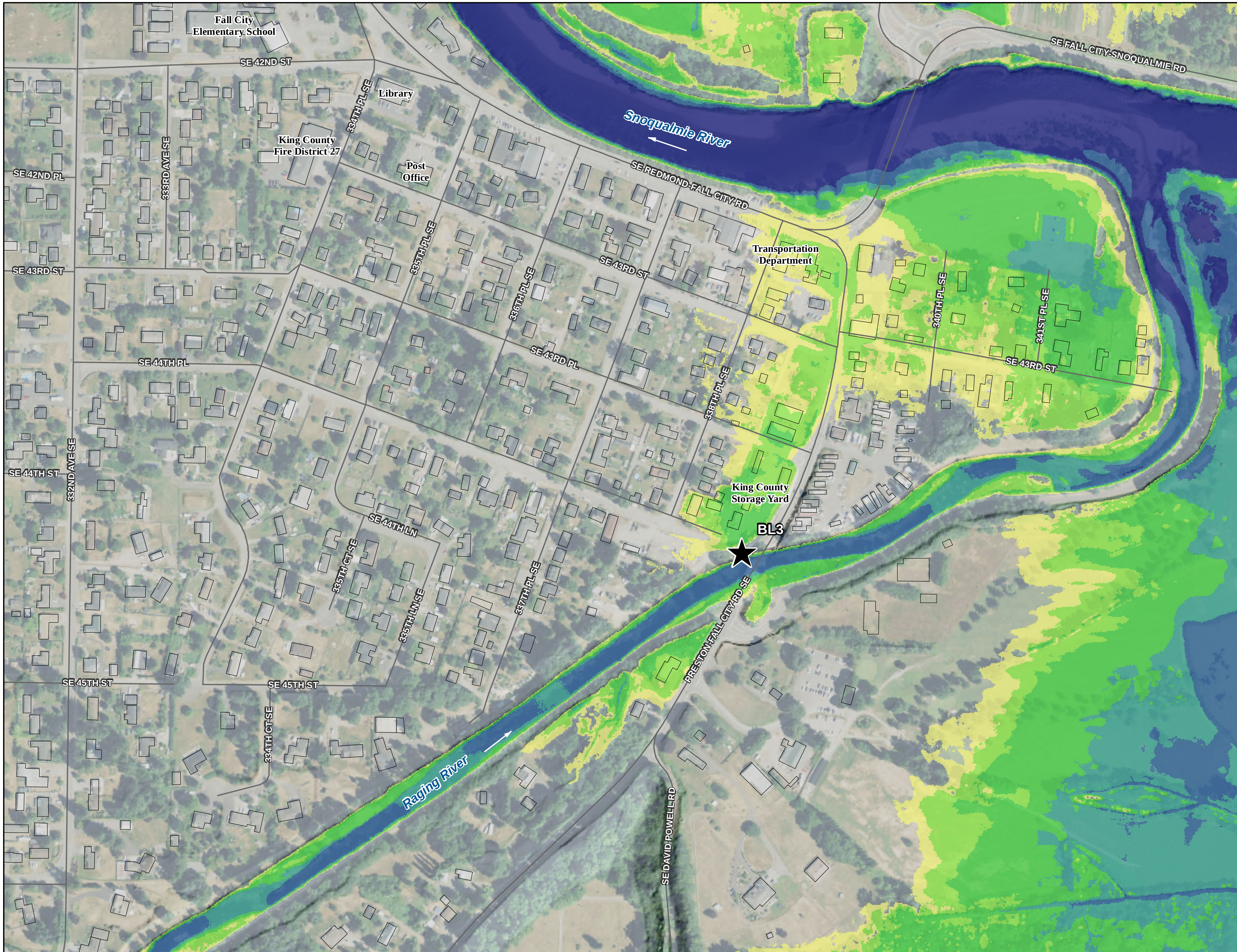

King County

nhc
northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Depth (ft)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 10

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 10-year EC flood at BL3

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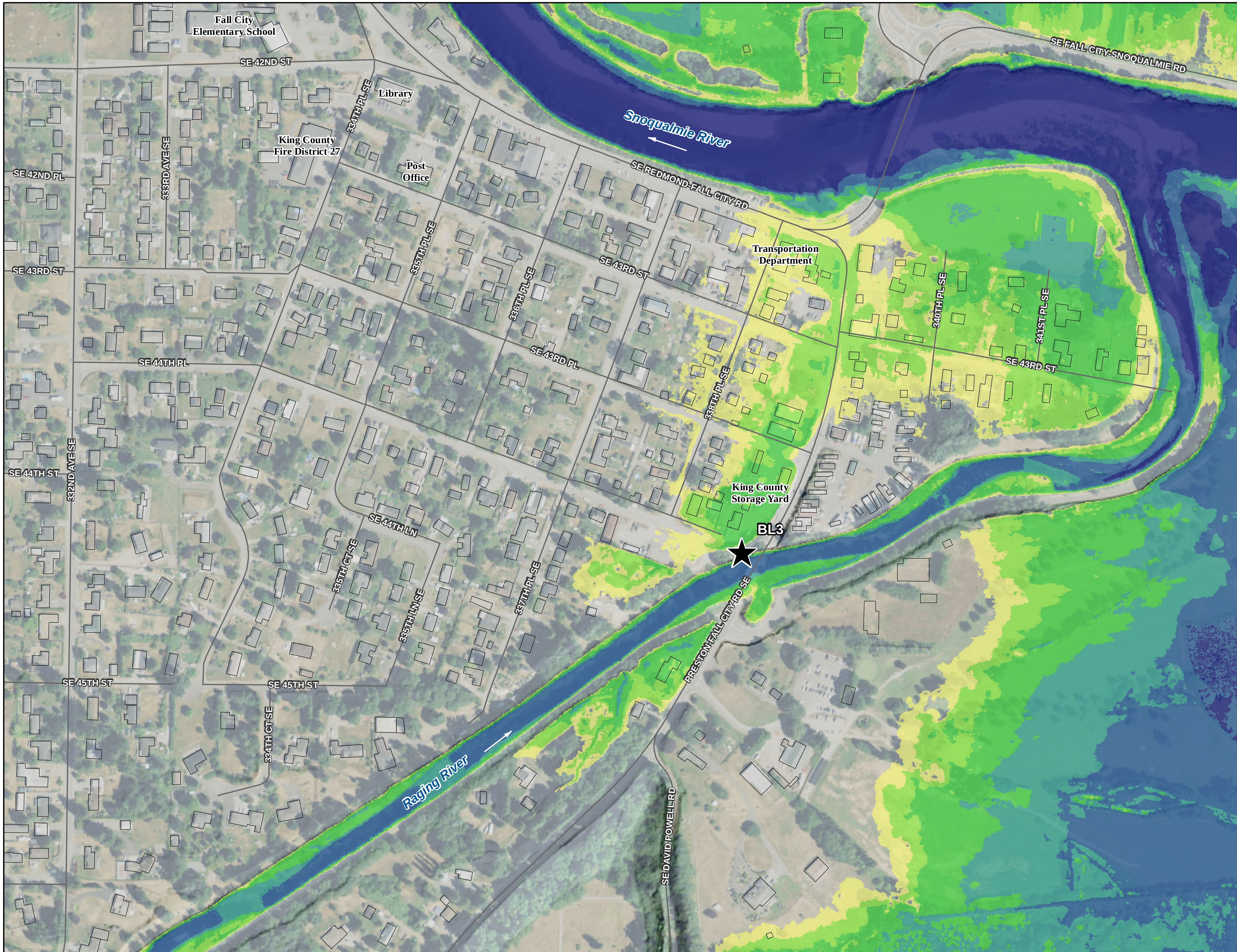

King County

nhc northwest hydraulic consultants

Legend

★ Breach Location

Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 25-year EC flood at BL3

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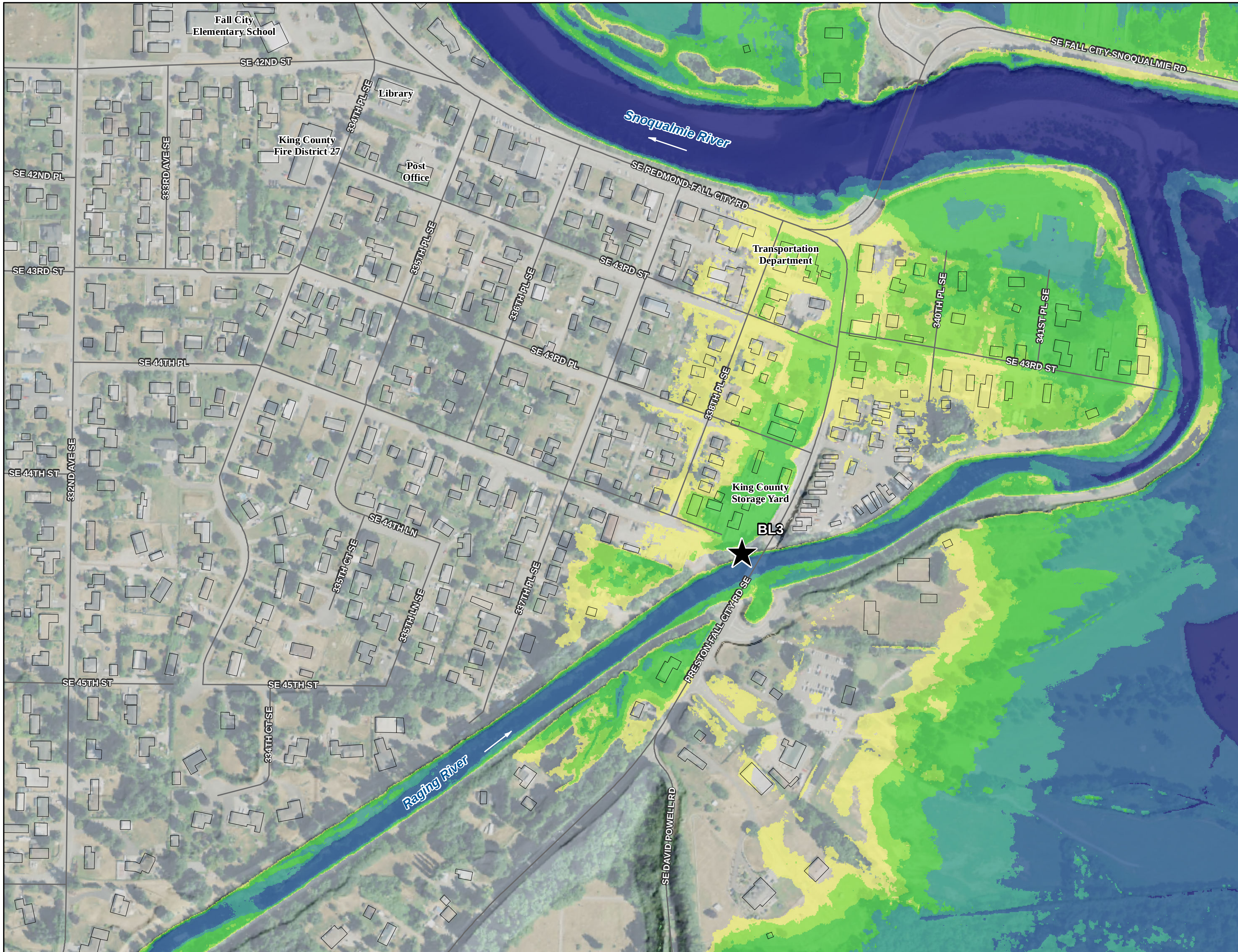

King County

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Legend

★ Breach Location

Building Footprint

Depth (ft)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 10

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 50-year EC flood at BL3

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King County

nhc northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Depth (ft)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 10

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 100-year EC flood at BL3

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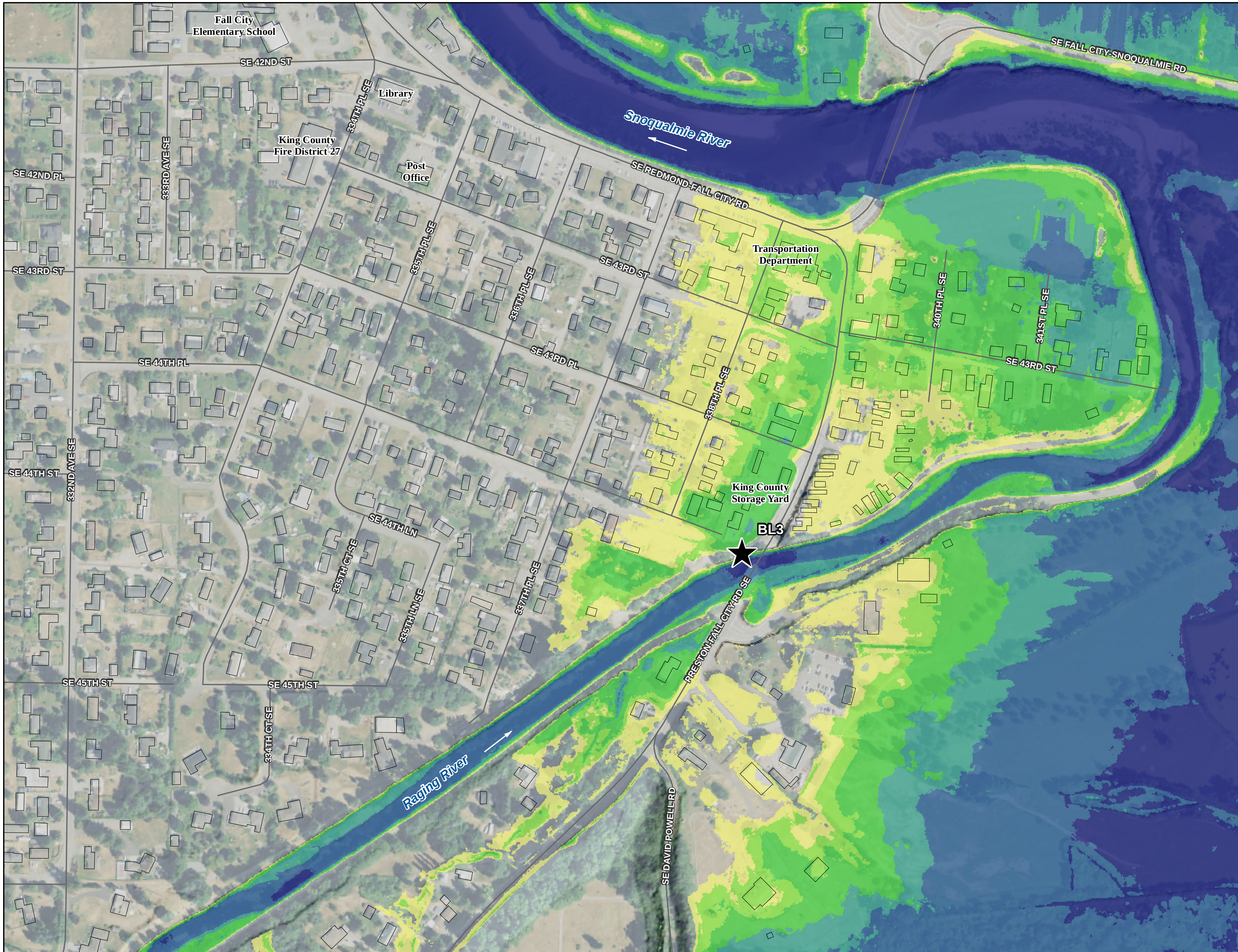

King County

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Legend

- ★ Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600 Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 250-year EC flood at BL3

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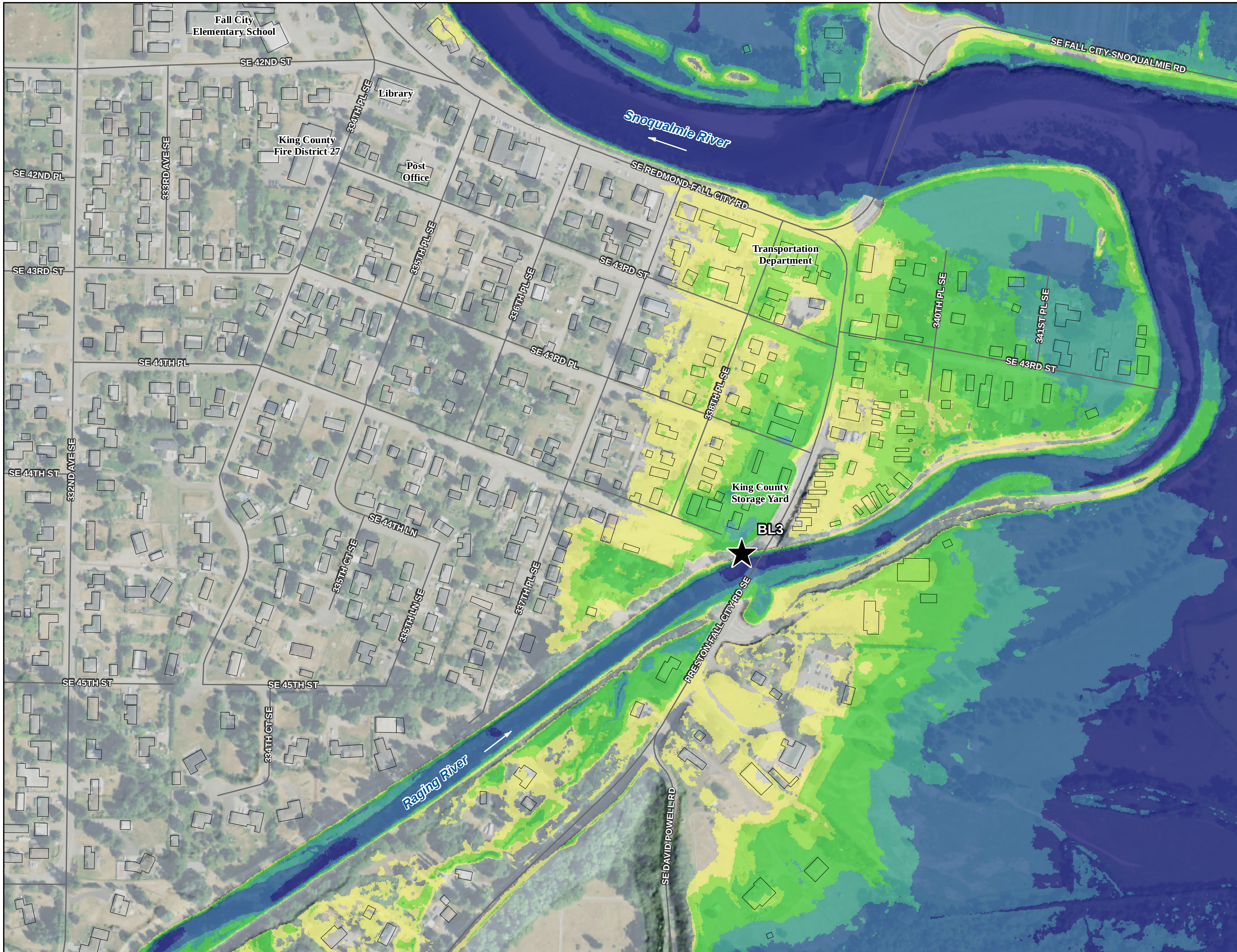

King County

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Legend

Breach Location

Building Footprint

Depth (ft)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 10

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 500-year EC flood at BL3

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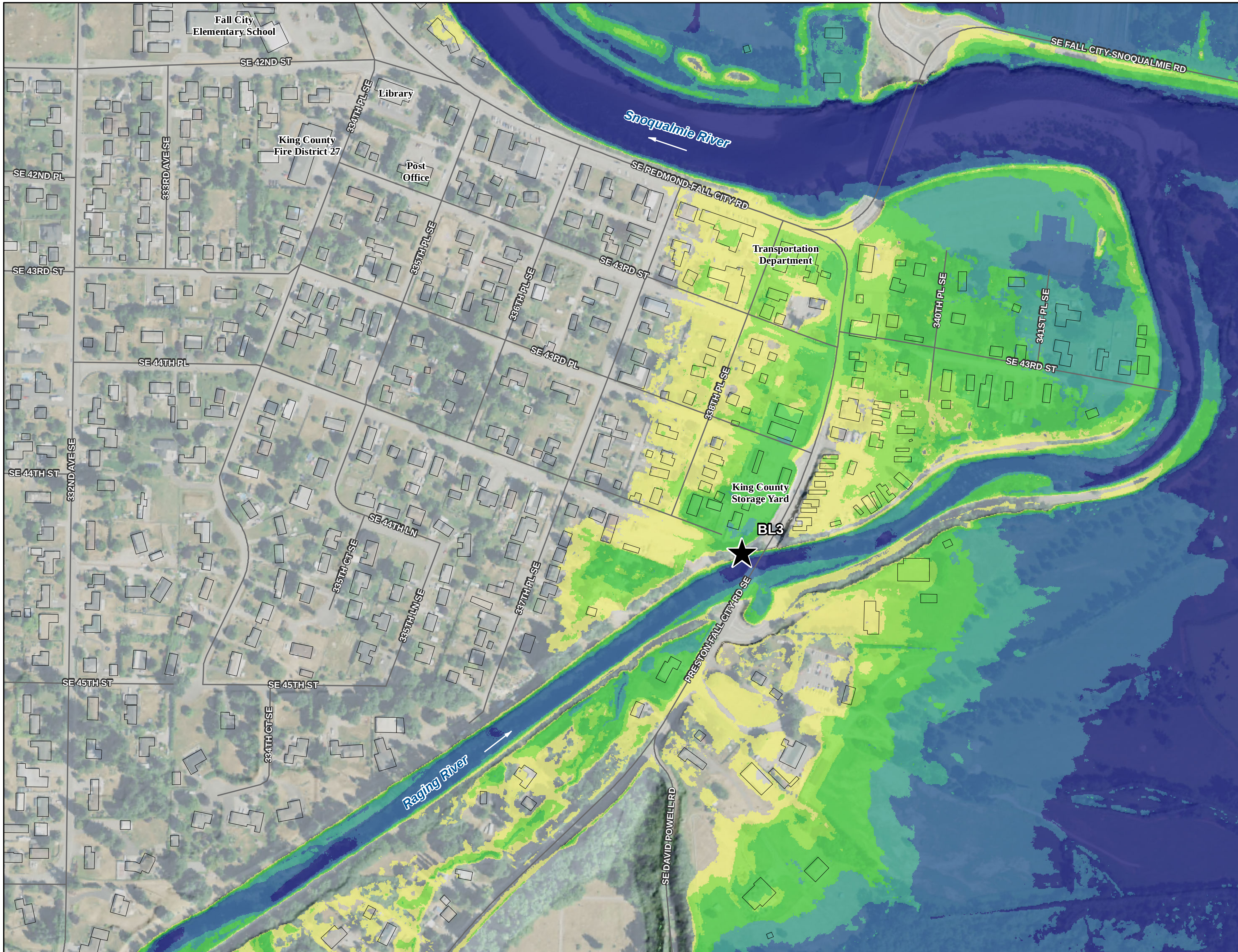

King County

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Legend

- Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 100-year FC flood at BL3

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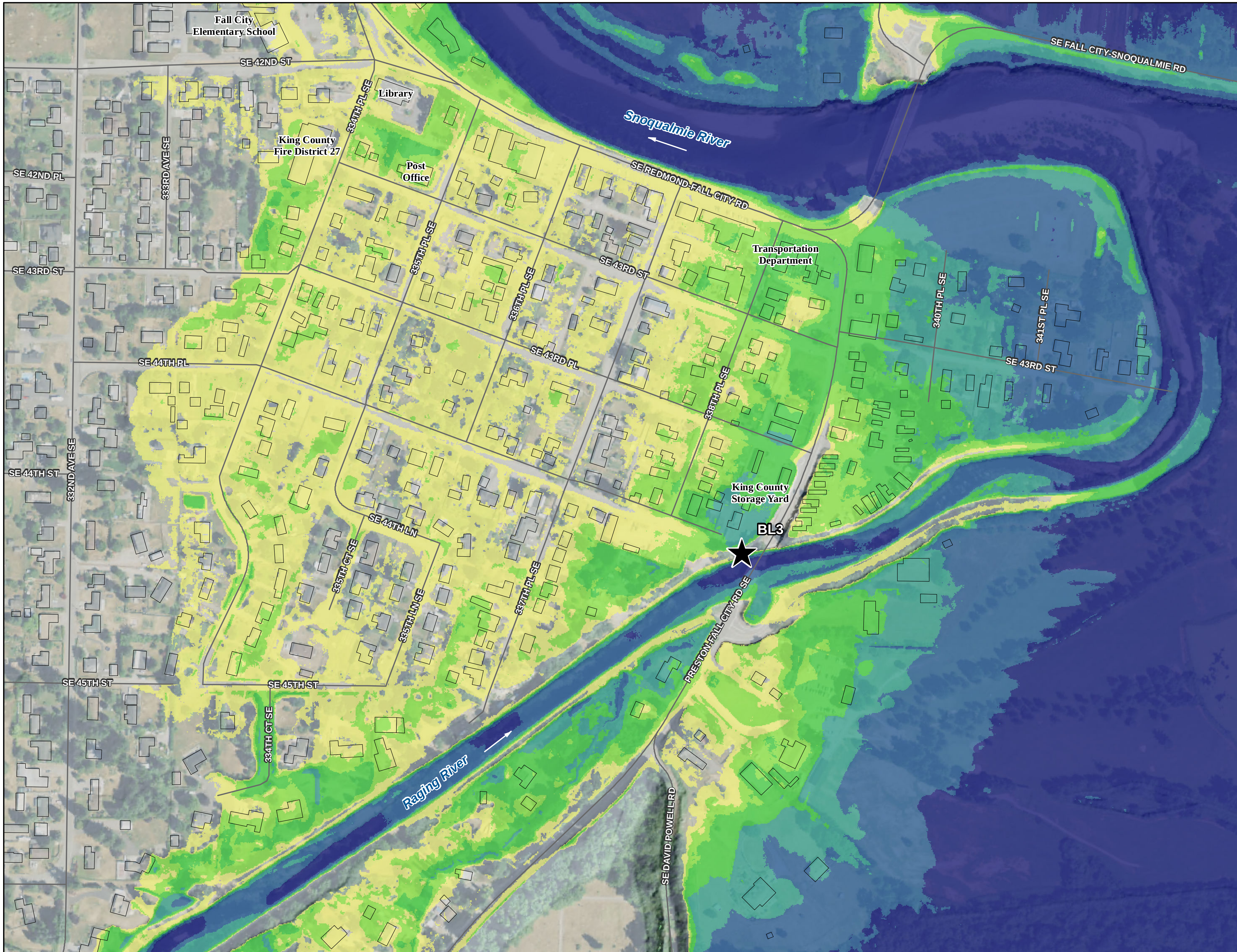

King County

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Legend

★ Breach Location

Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 500-year FC flood at BL3

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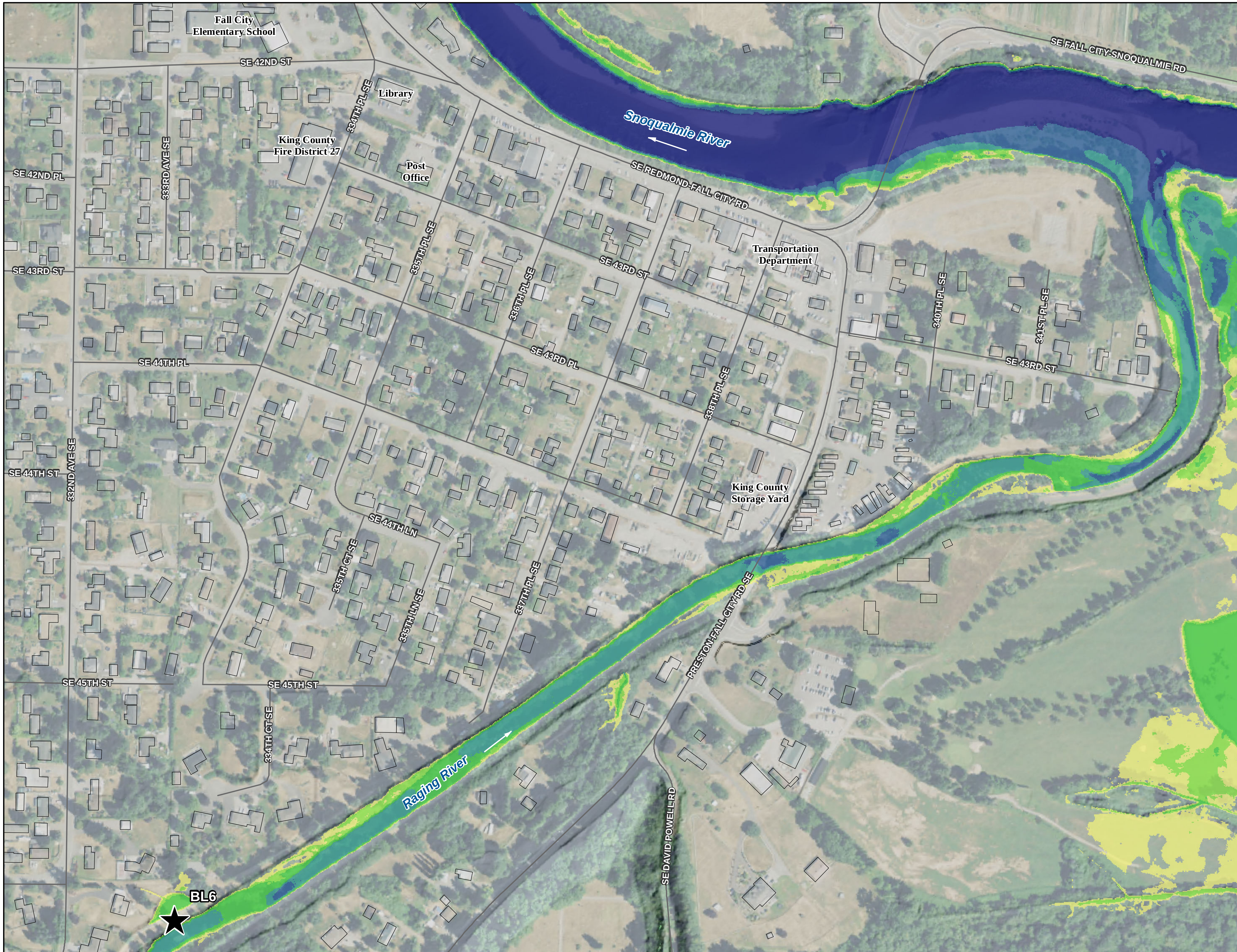

King County

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Legend

- ★ Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 2-year EC flood at BL6

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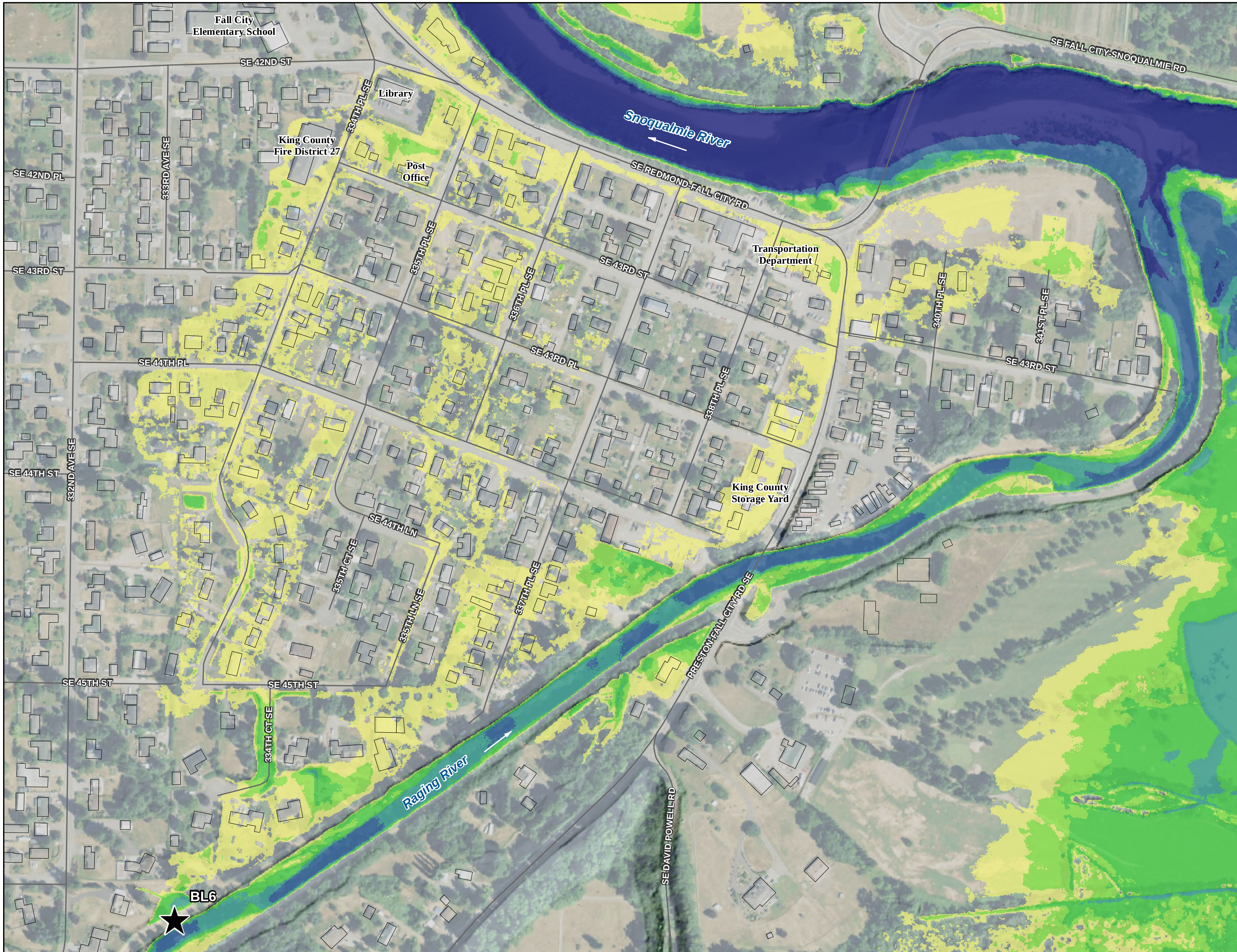


King County

nhc
northwest hydraulic consultants

Legend

- Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

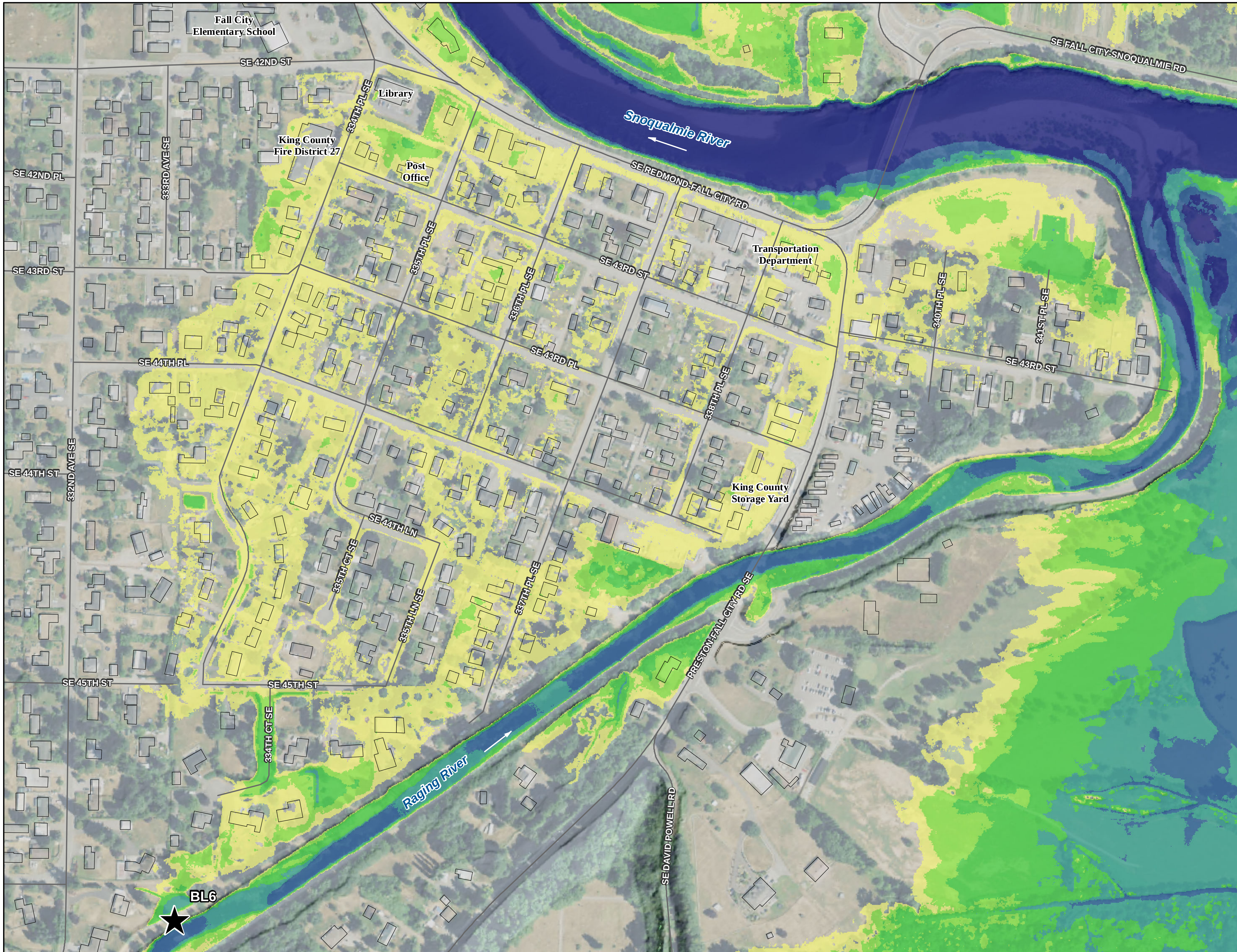
N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 5-year EC flood at BL6



King County

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Legend

- ★ Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 10-year EC flood at BL6

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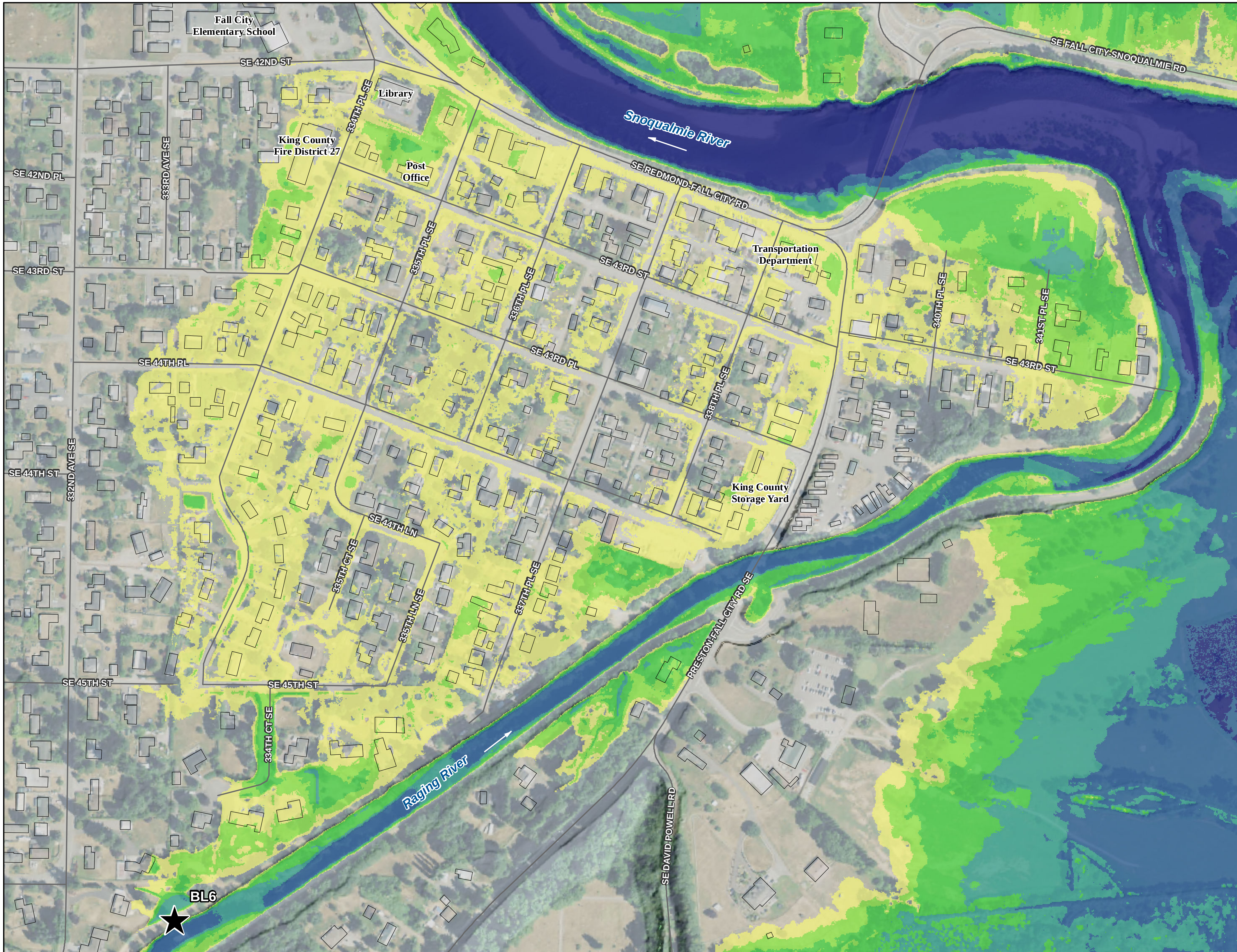

King County

nhc northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 25-year EC flood at BL6

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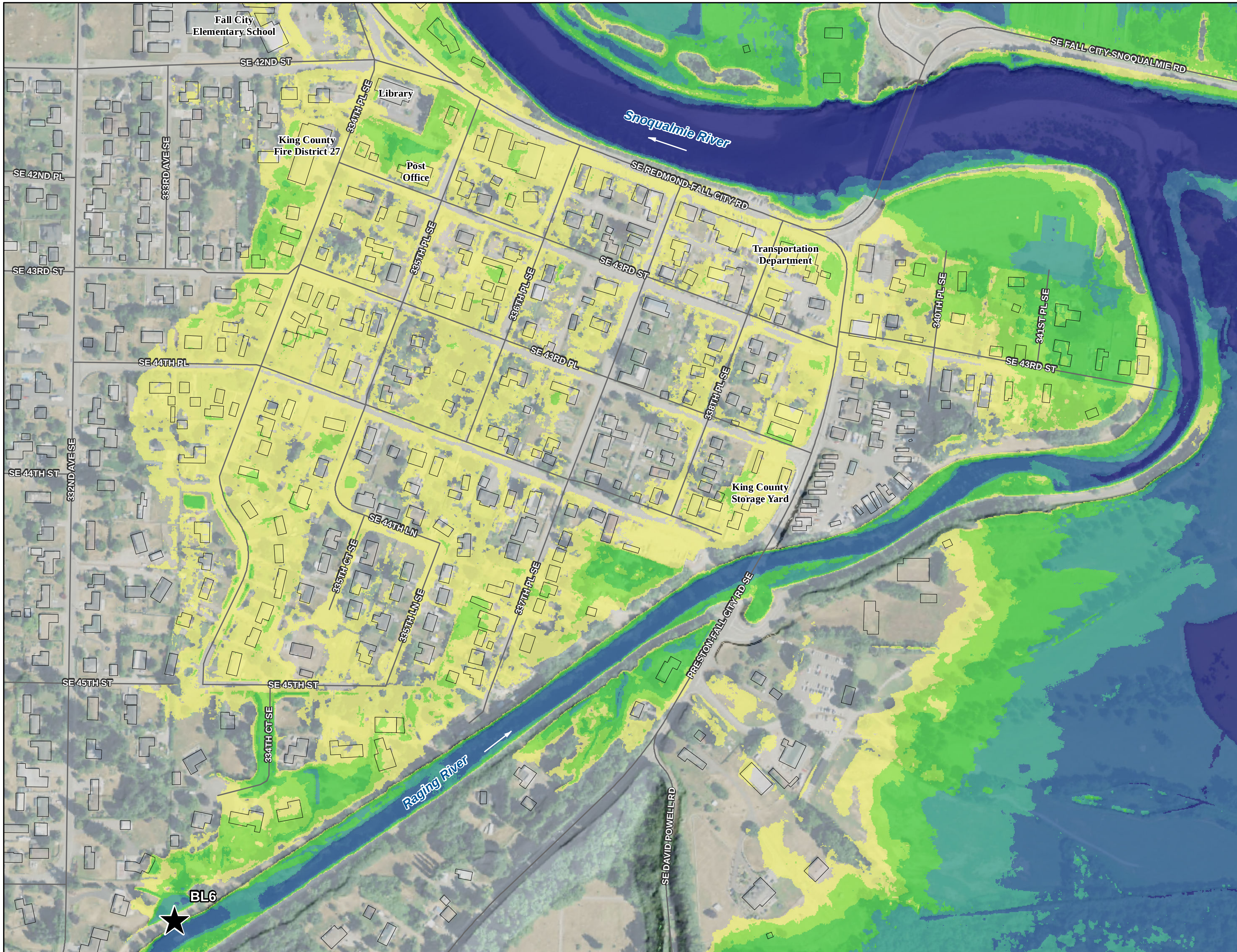


King County

nhc
northwest hydraulic consultants

Legend

- ★ Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

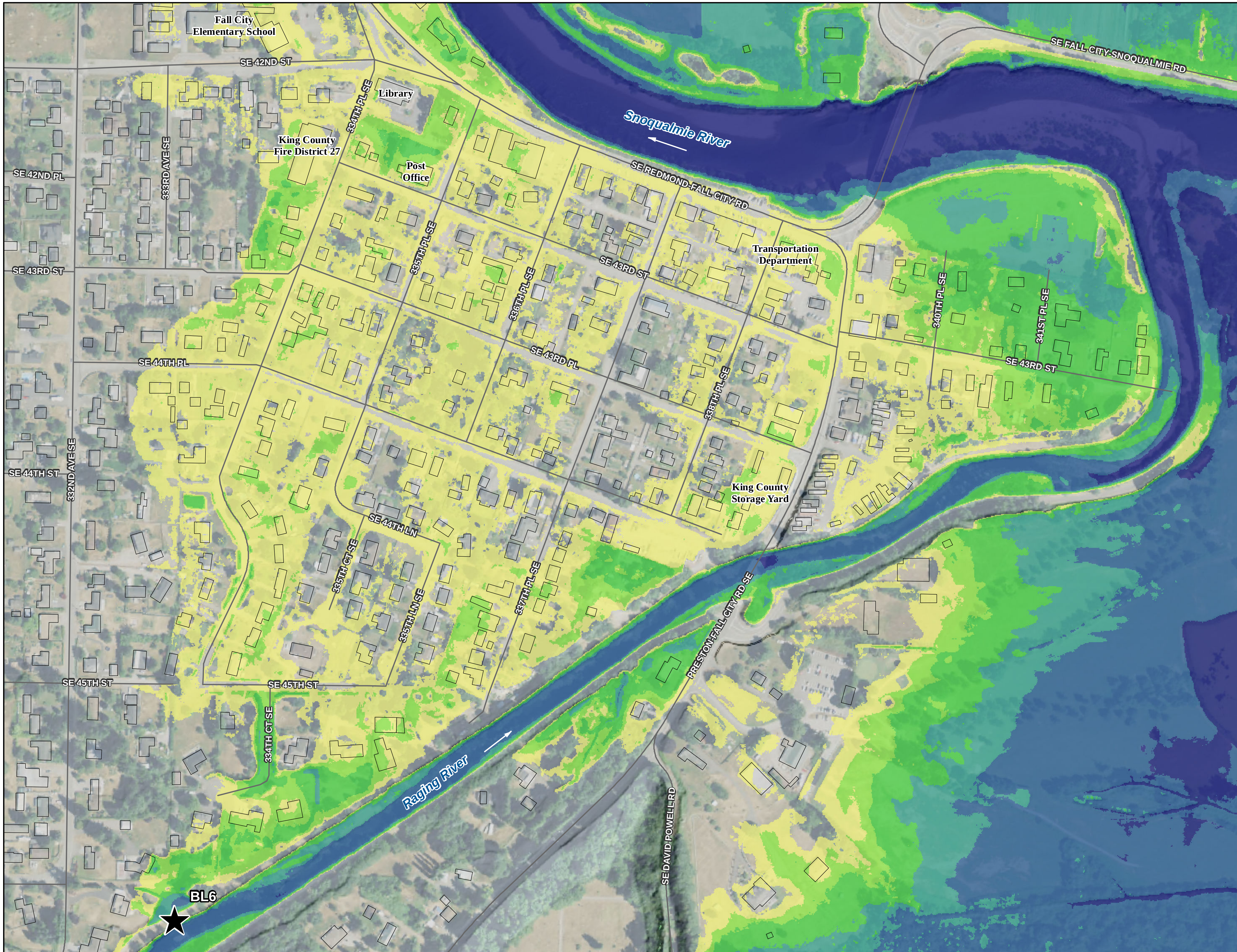
N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 50-year EC flood at BL6



King County

nhc
northwest hydraulic consultants

Legend

★ Breach Location

Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

Carnation
Soaring Eagle Regional Park
Fall City
Grand Ridge Park
West Tiger
Snoqualmie

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 100-year EC flood at BL6

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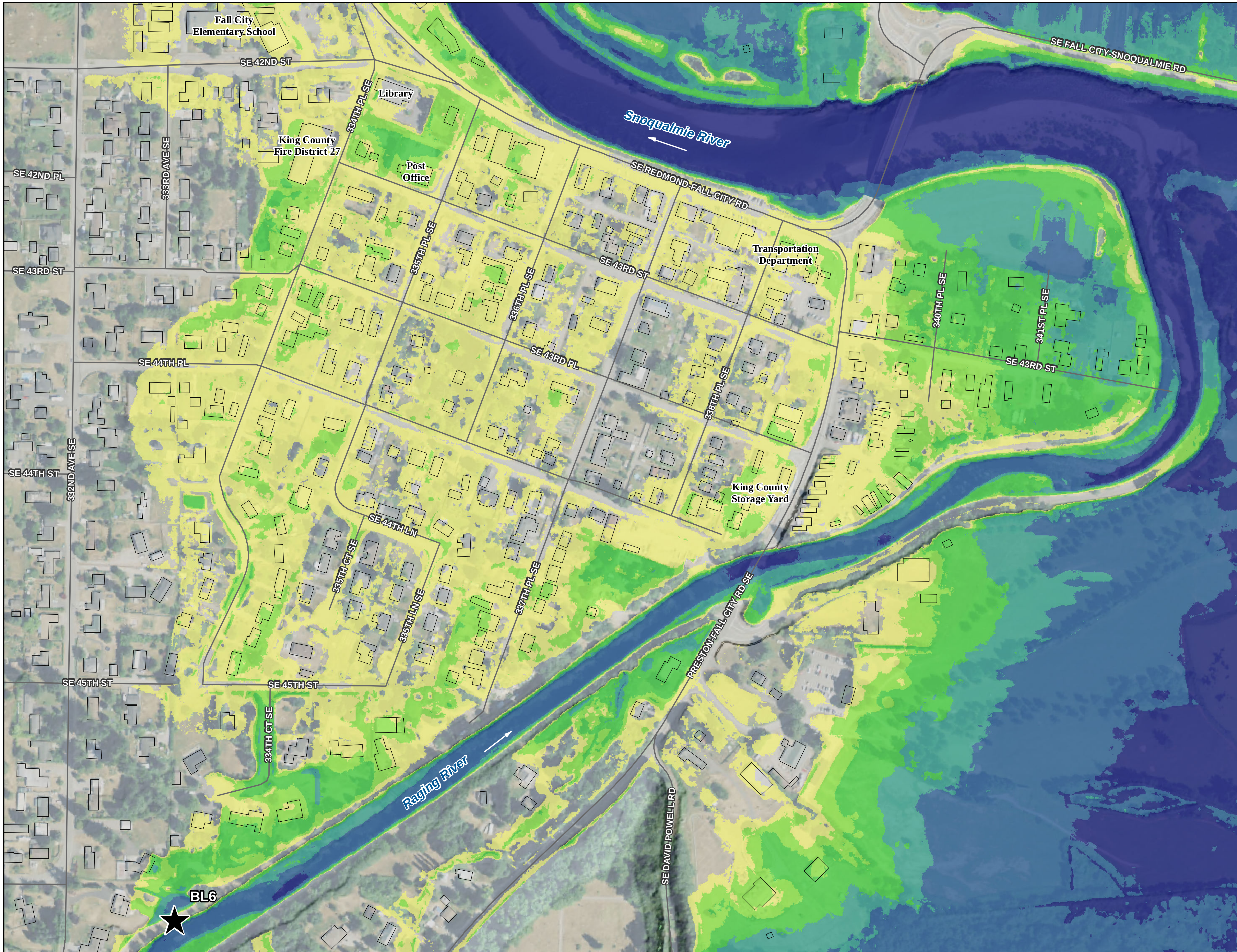


King County

nhc
northwest hydraulic consultants

Legend

- Breach Location
- Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

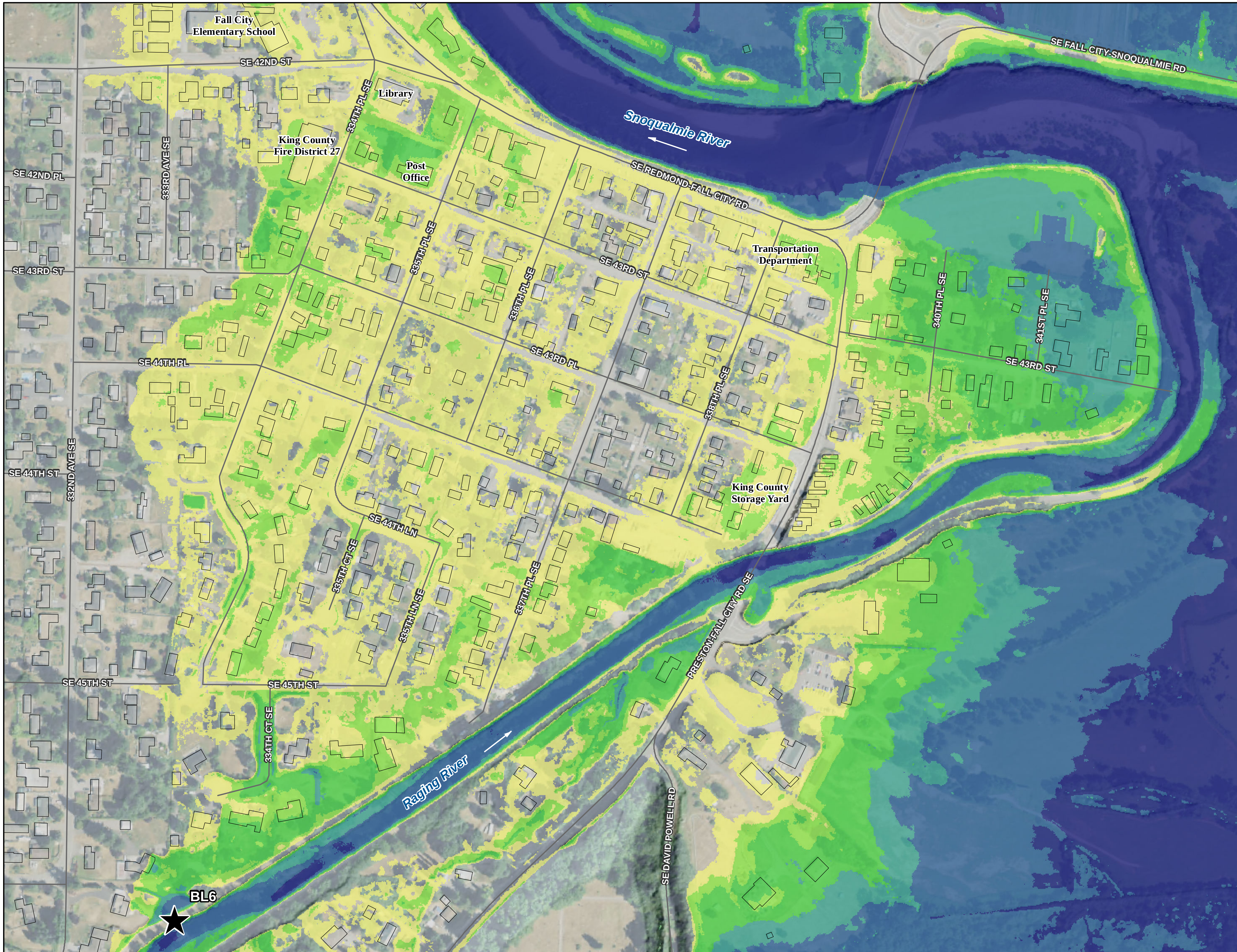
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 250-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Depth.mxd



King County

nhc
northwest hydraulic consultants

Legend

★ Breach Location

Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 500-year EC flood at BL6

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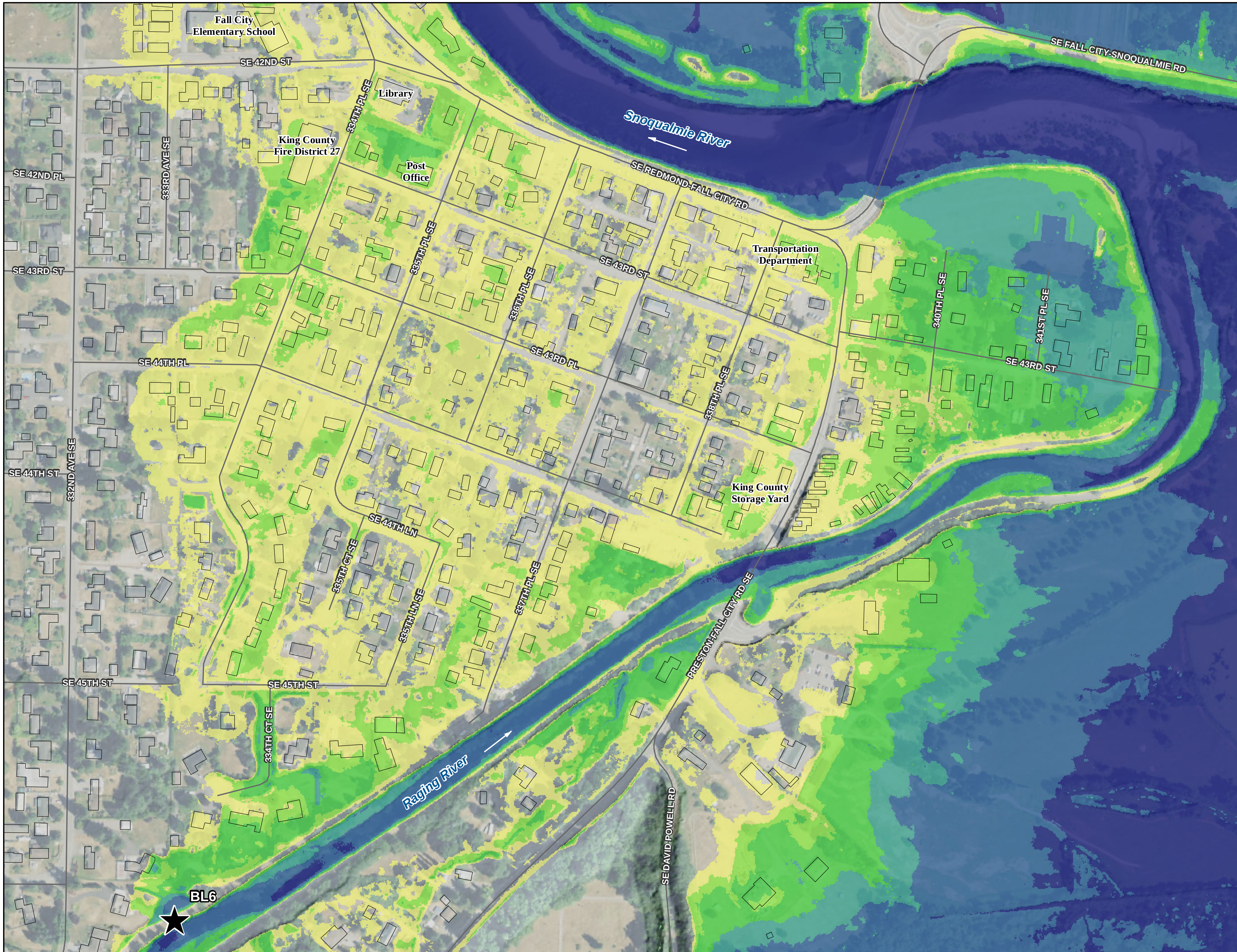

King County

nhc
northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Depth (ft)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 10

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 100-year FC flood at BL6

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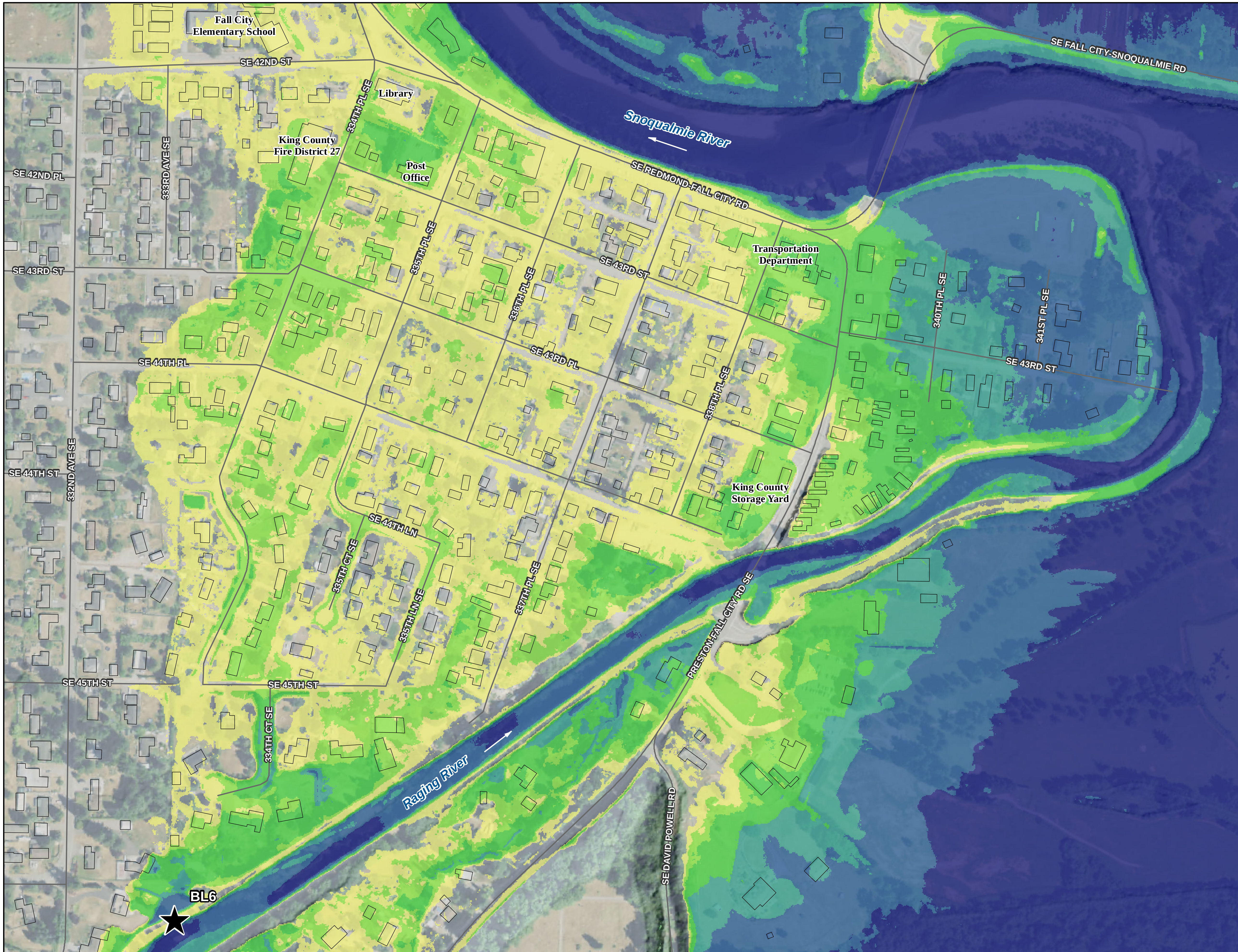


King County

nhc
northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Depth (ft)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

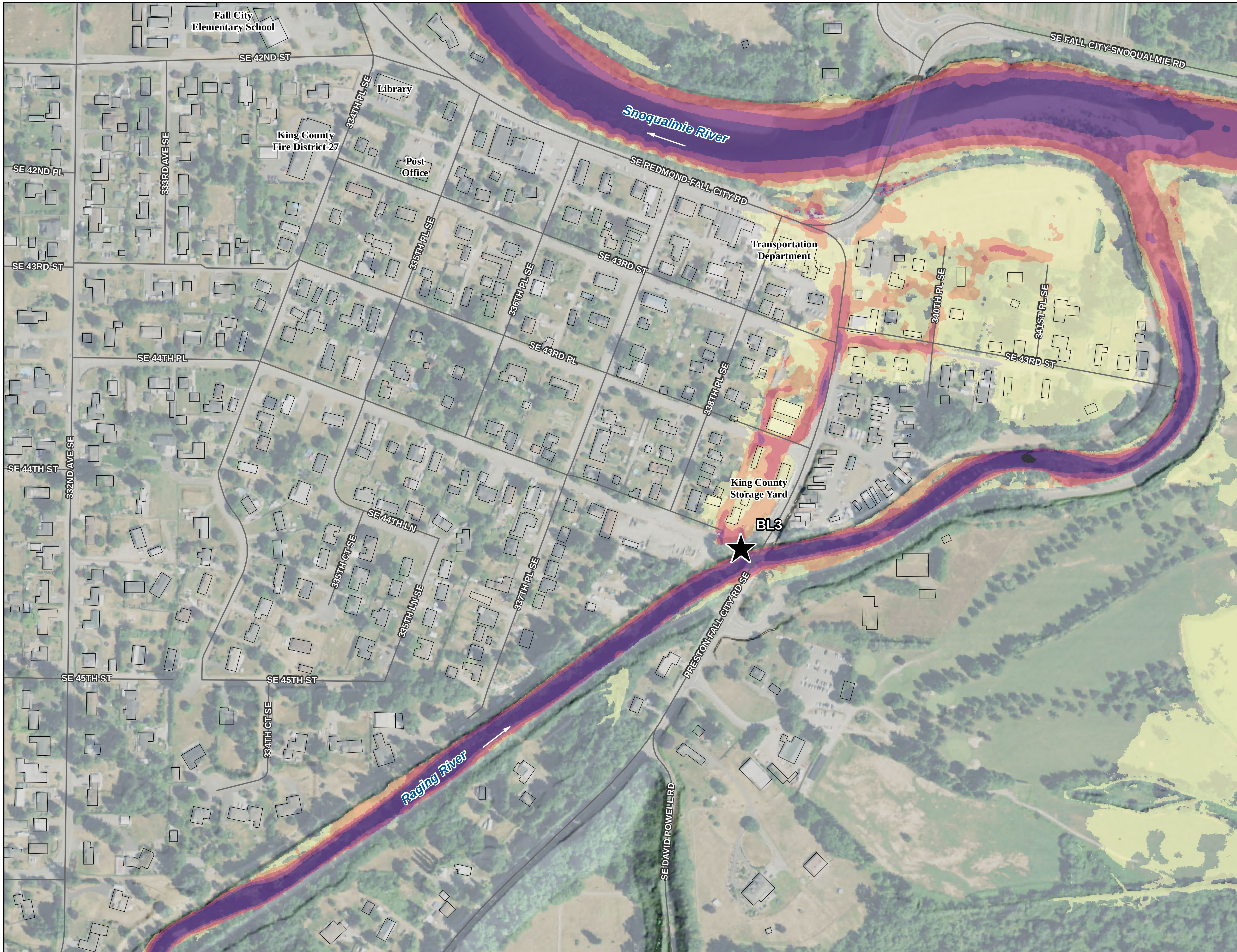
N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Depth resulting from a hypothetical levee breach during a 500-year FC flood at BL6



King County

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Legend

- Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

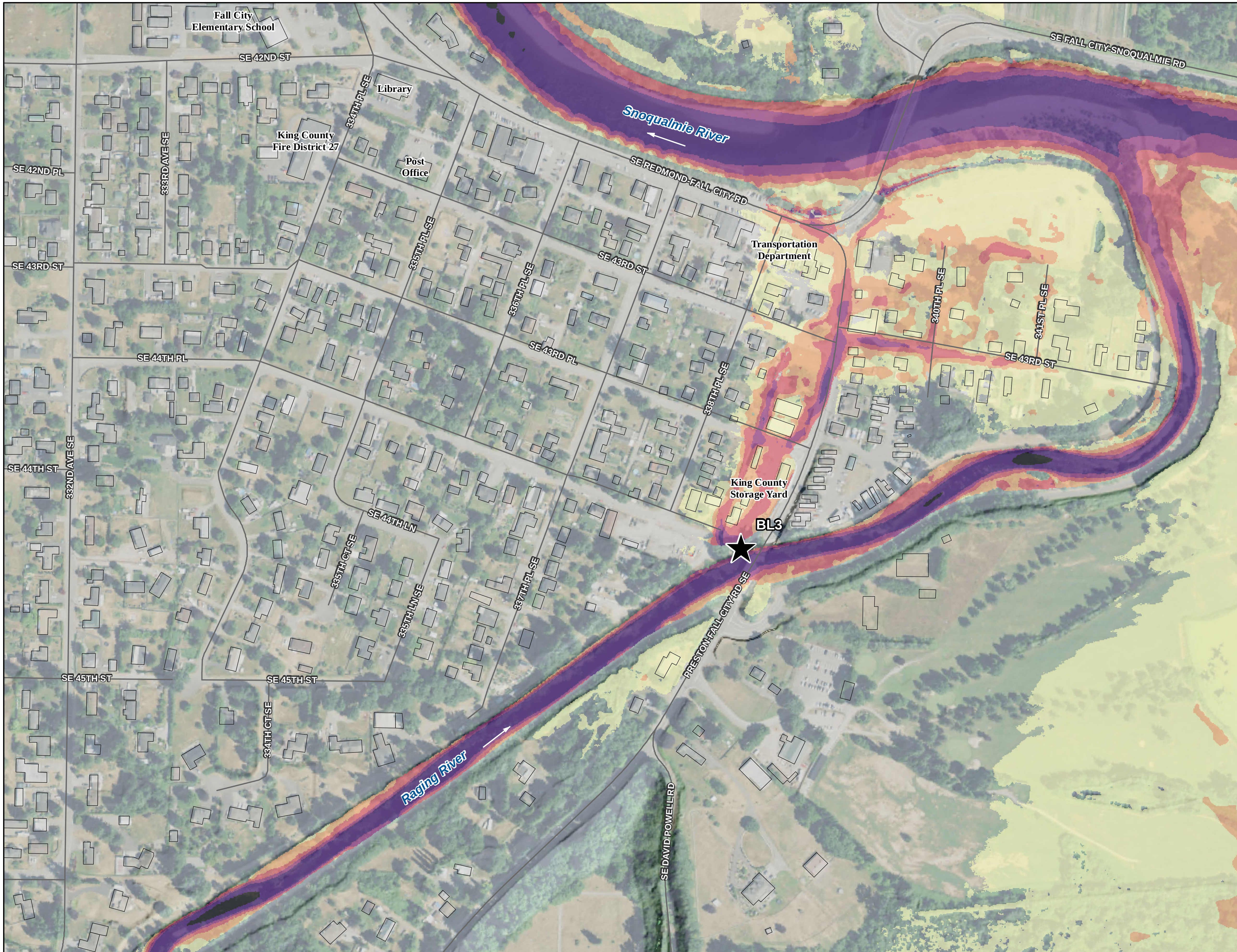
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 2-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

★ Breach Location

Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

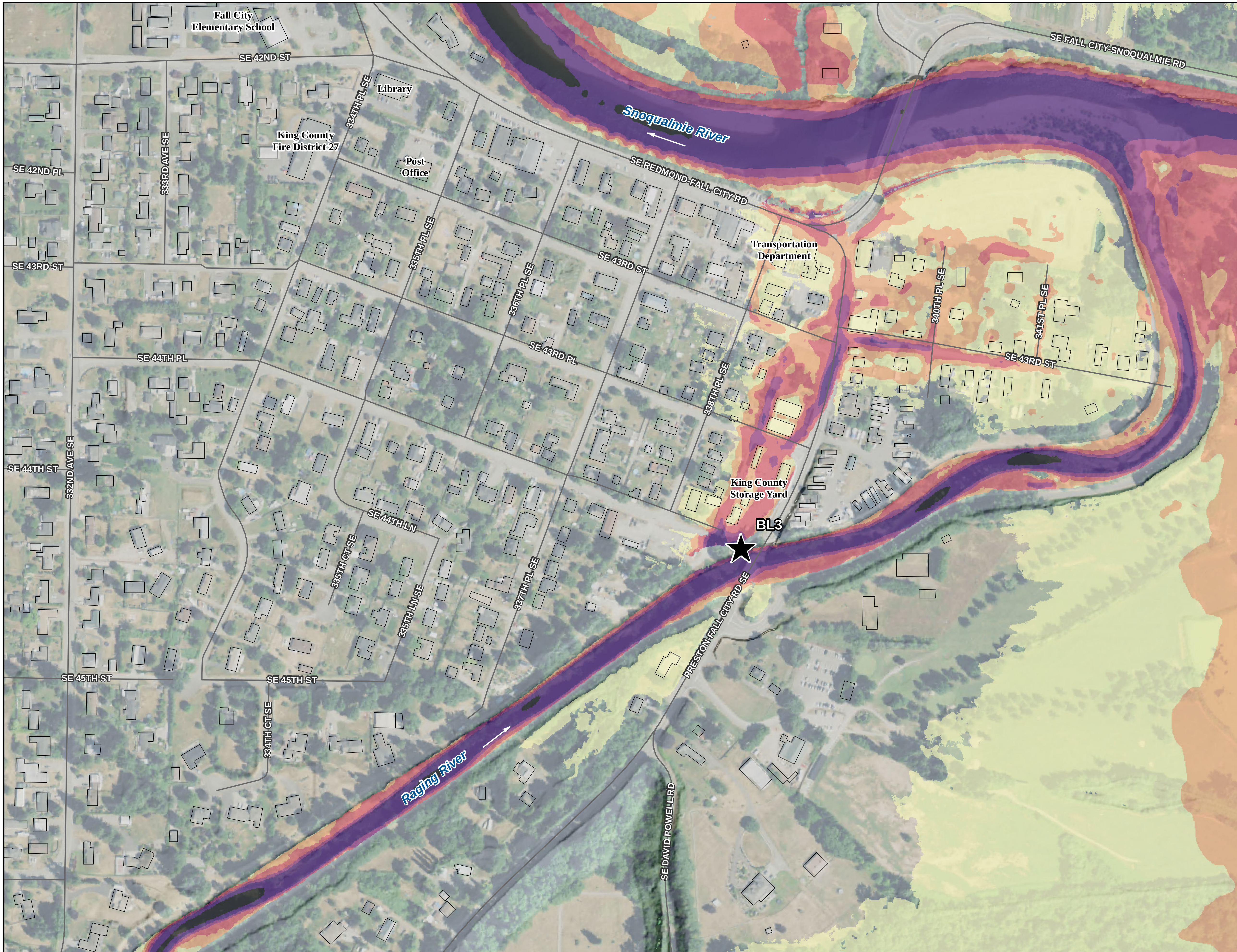
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 5-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 10-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd

King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

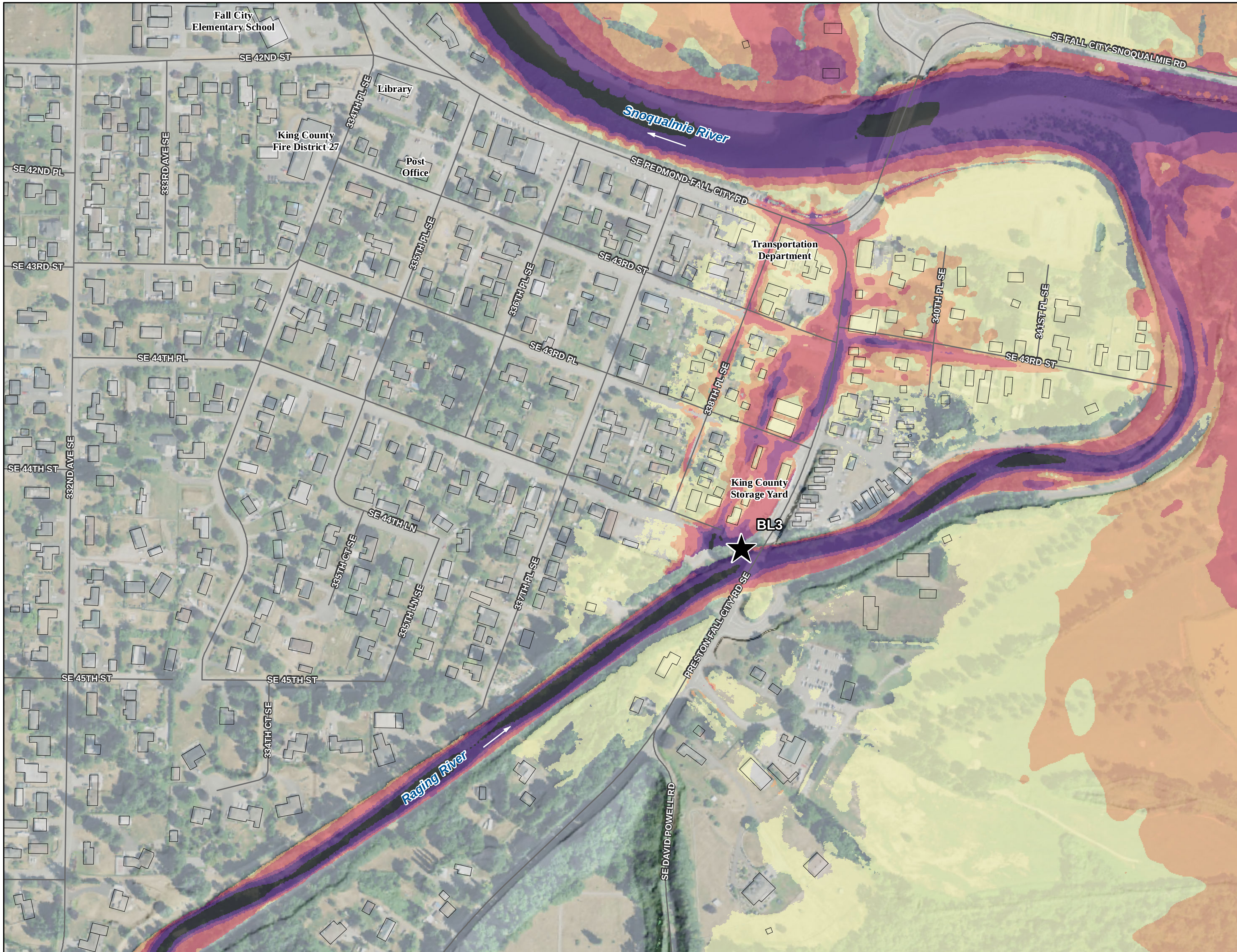
N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 25-year EC flood at BL3



King County

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Legend

Breach Location

Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

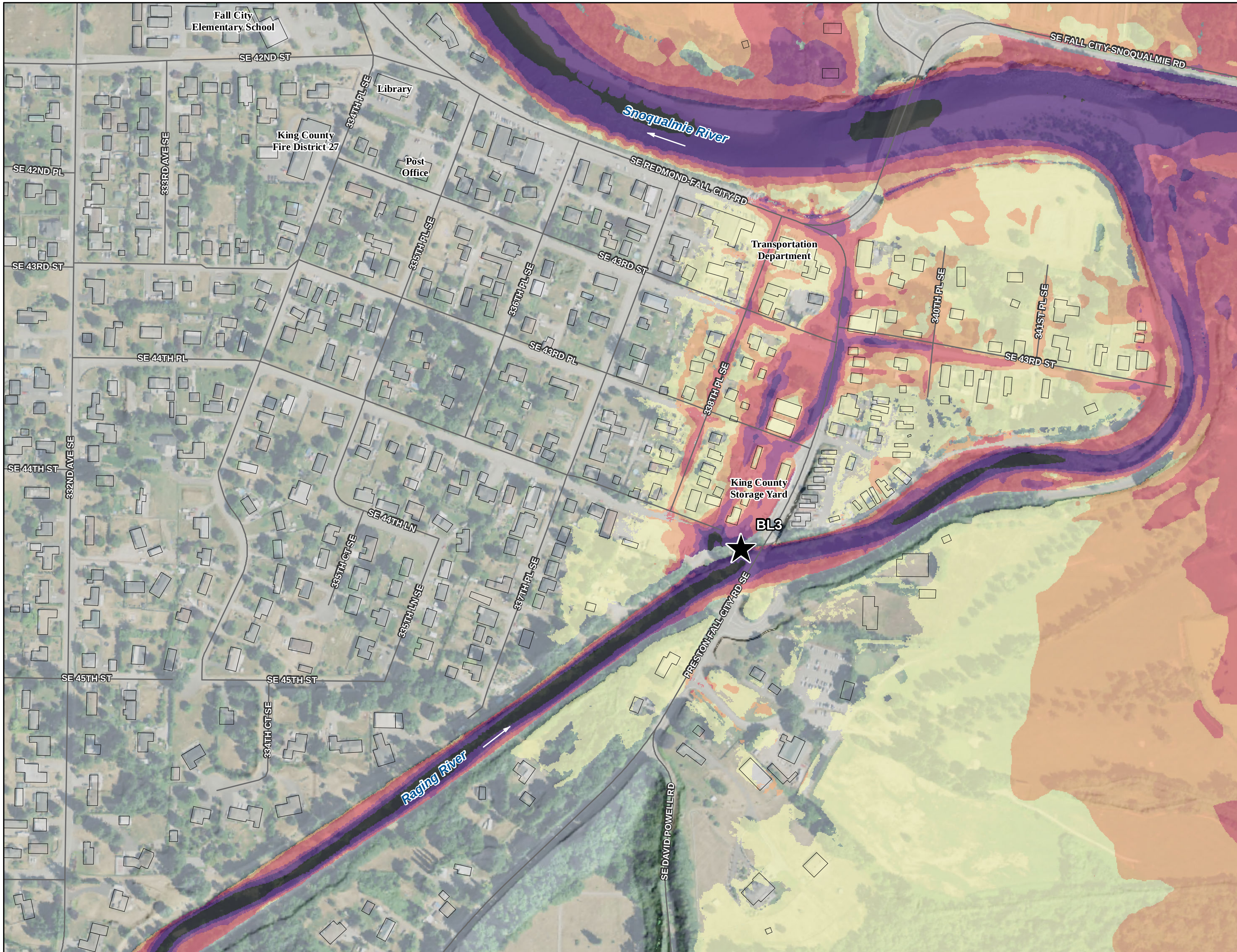
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 50-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

Breach Location

Building Footprint

Velocity (ft/s)

Velocity (ft/s)
0 - 1
1 - 2
2 - 4
4 - 6
6 - 8
>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

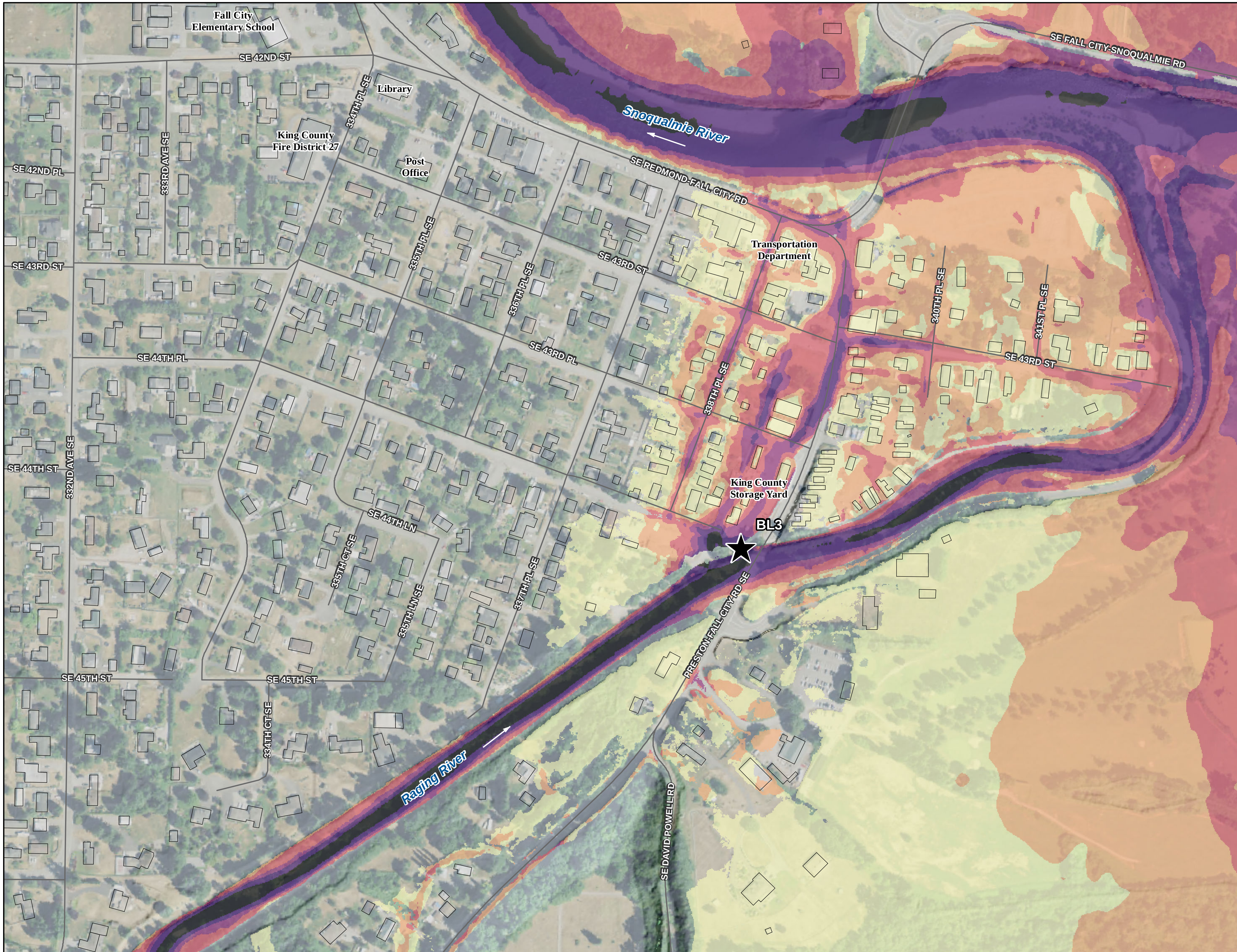
N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 100-year EC flood at BL3



King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

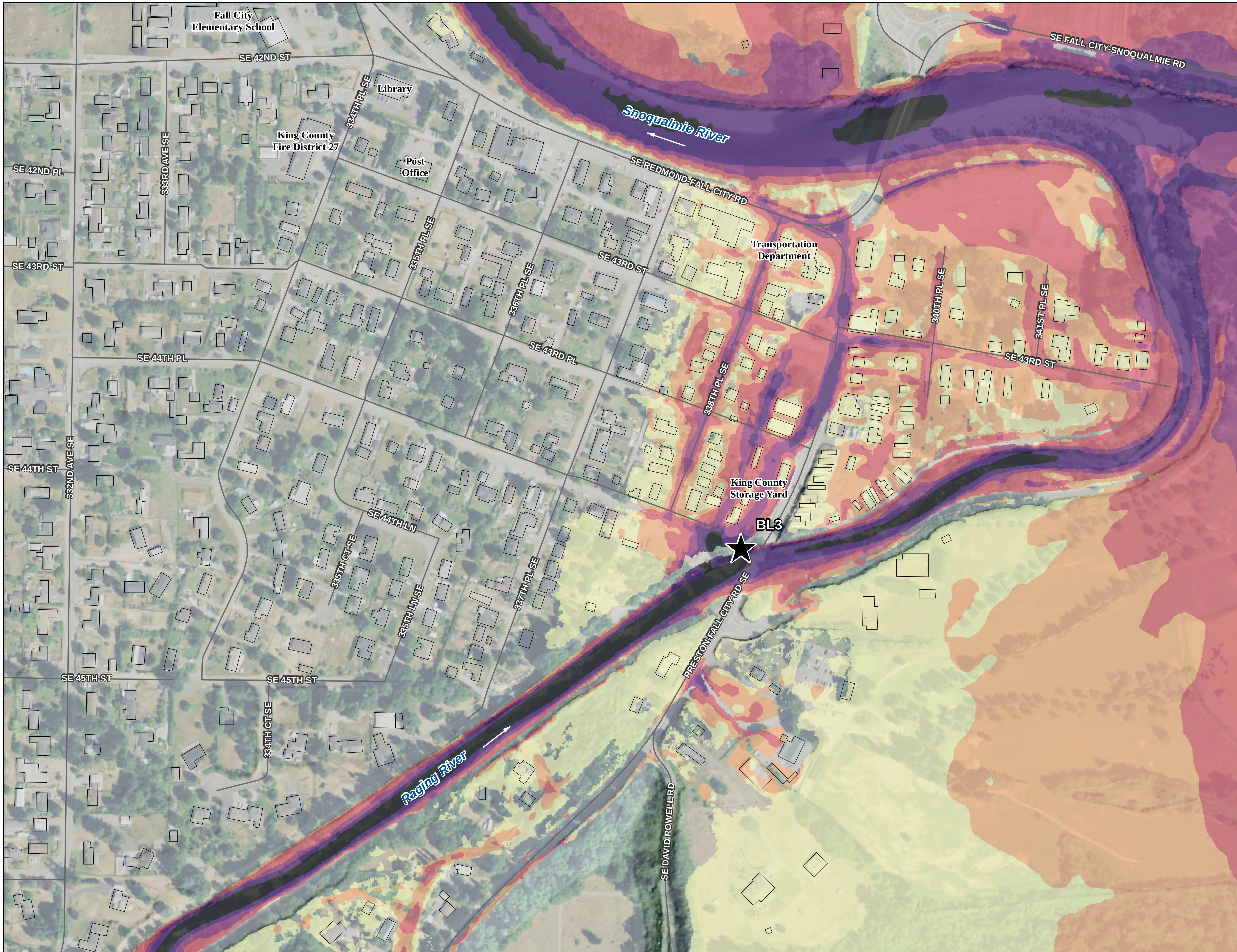
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 250-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

Breach Location

Building Footprint

Velocity (ft/s)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 8

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 500-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd

King County

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Legend

- Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 100-year FC flood at BL3

King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

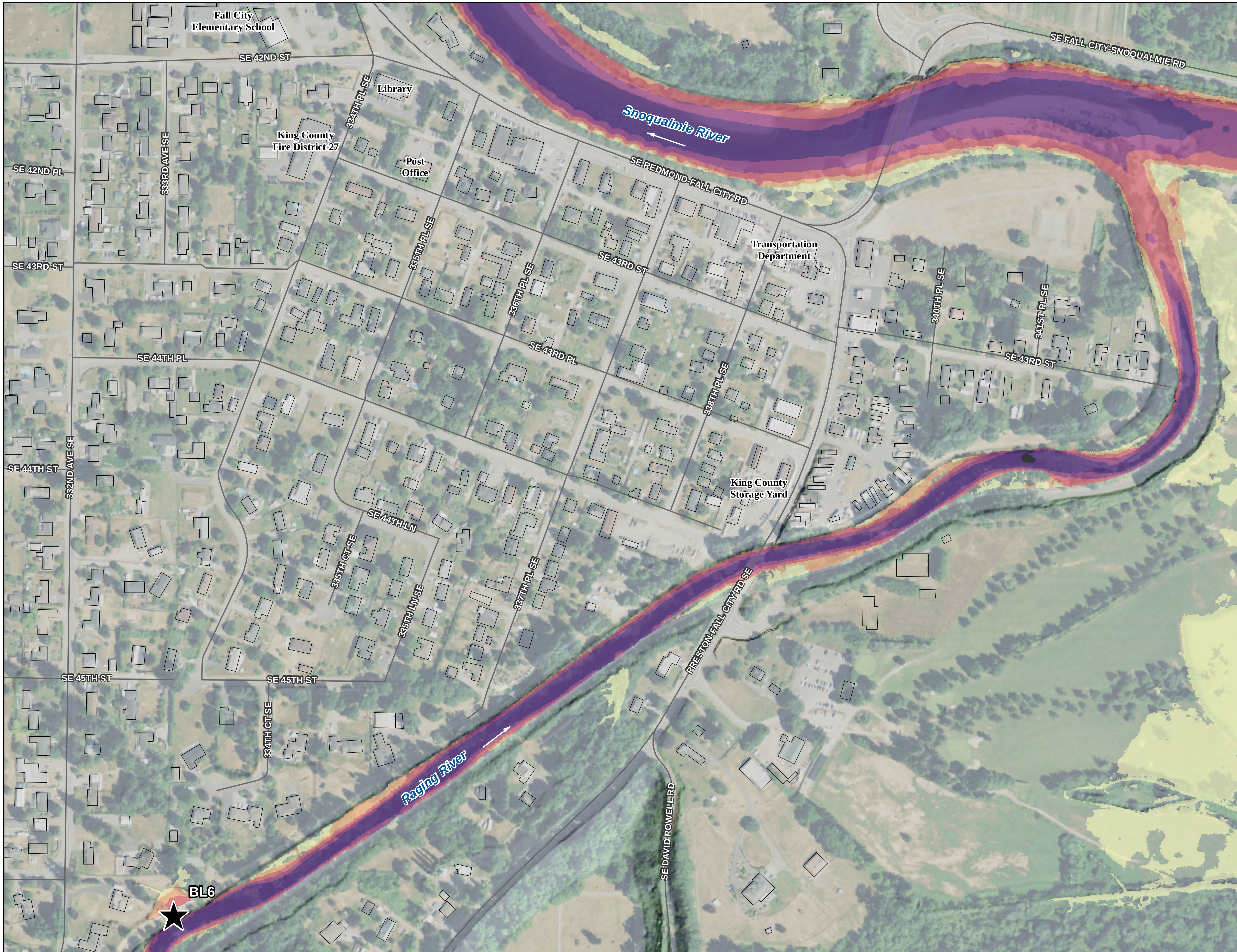
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 500-year FC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600 Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 2-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd

King County

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Legend

Breach Location

Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 5-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd

King County

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Legend

Breach Location

Building Footprint

Velocity (ft/s)

0 - 1

1 - 2

2 - 4

4 - 6

6 - 8

>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

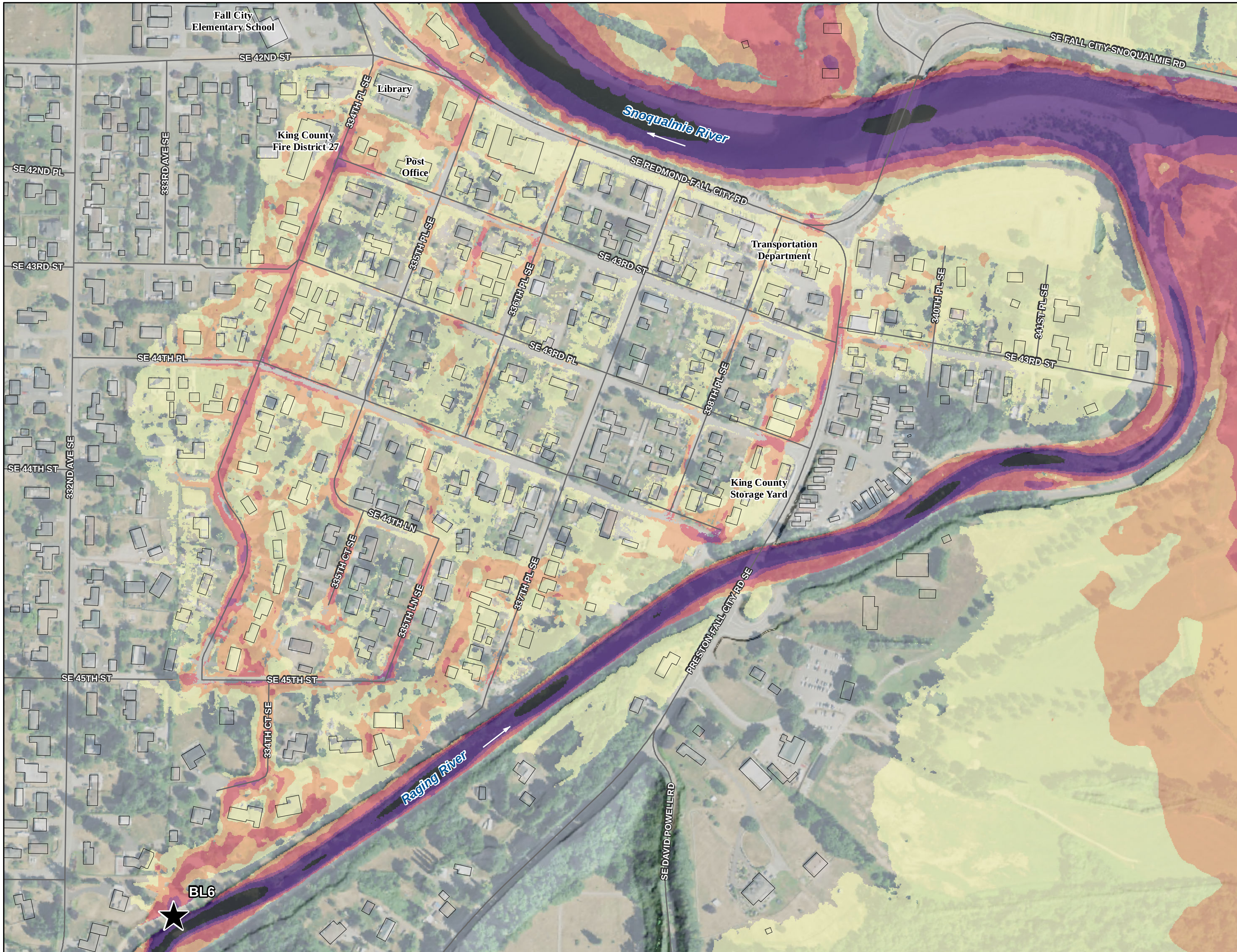
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 10-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

★ Breach Location

Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

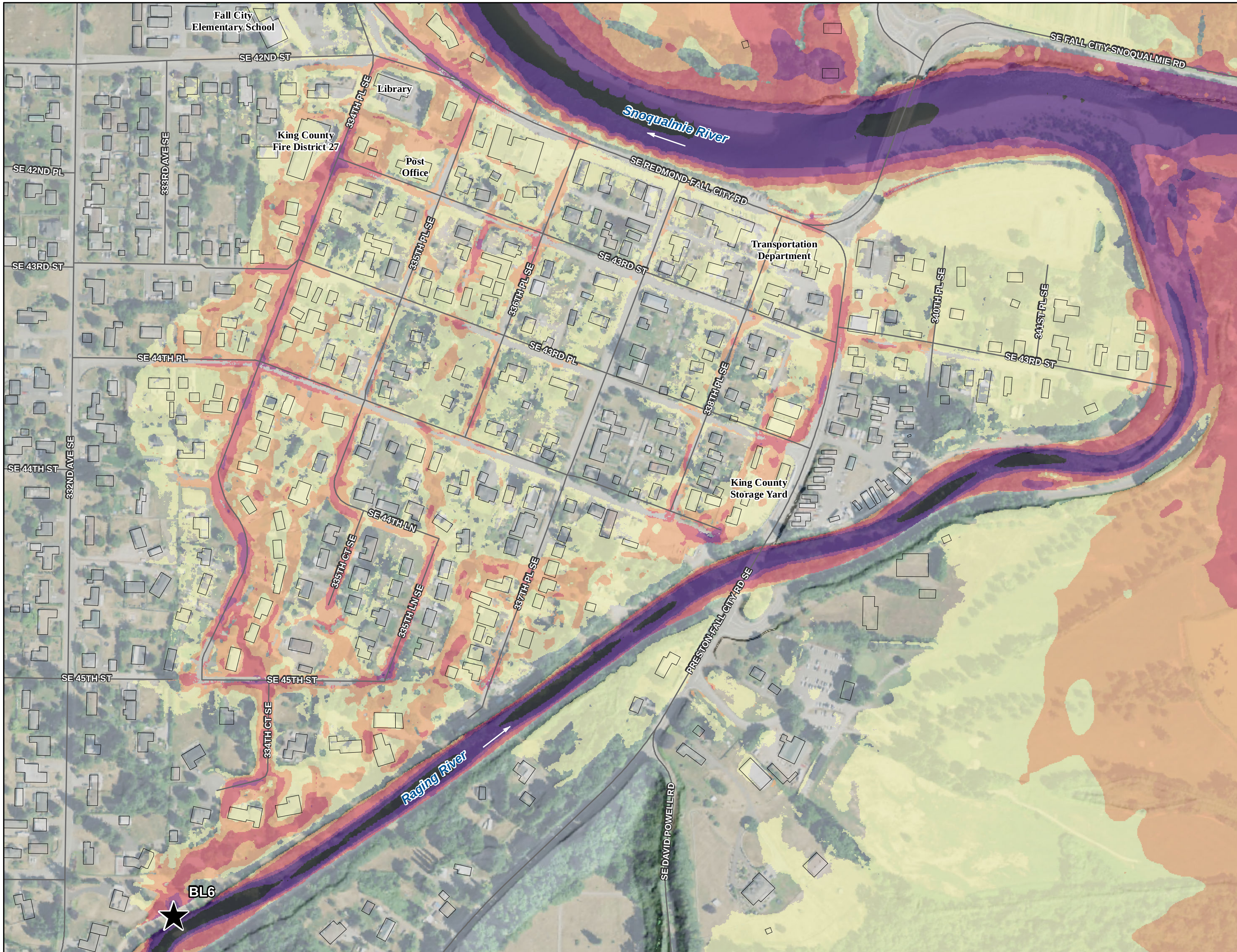
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 25-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

- Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

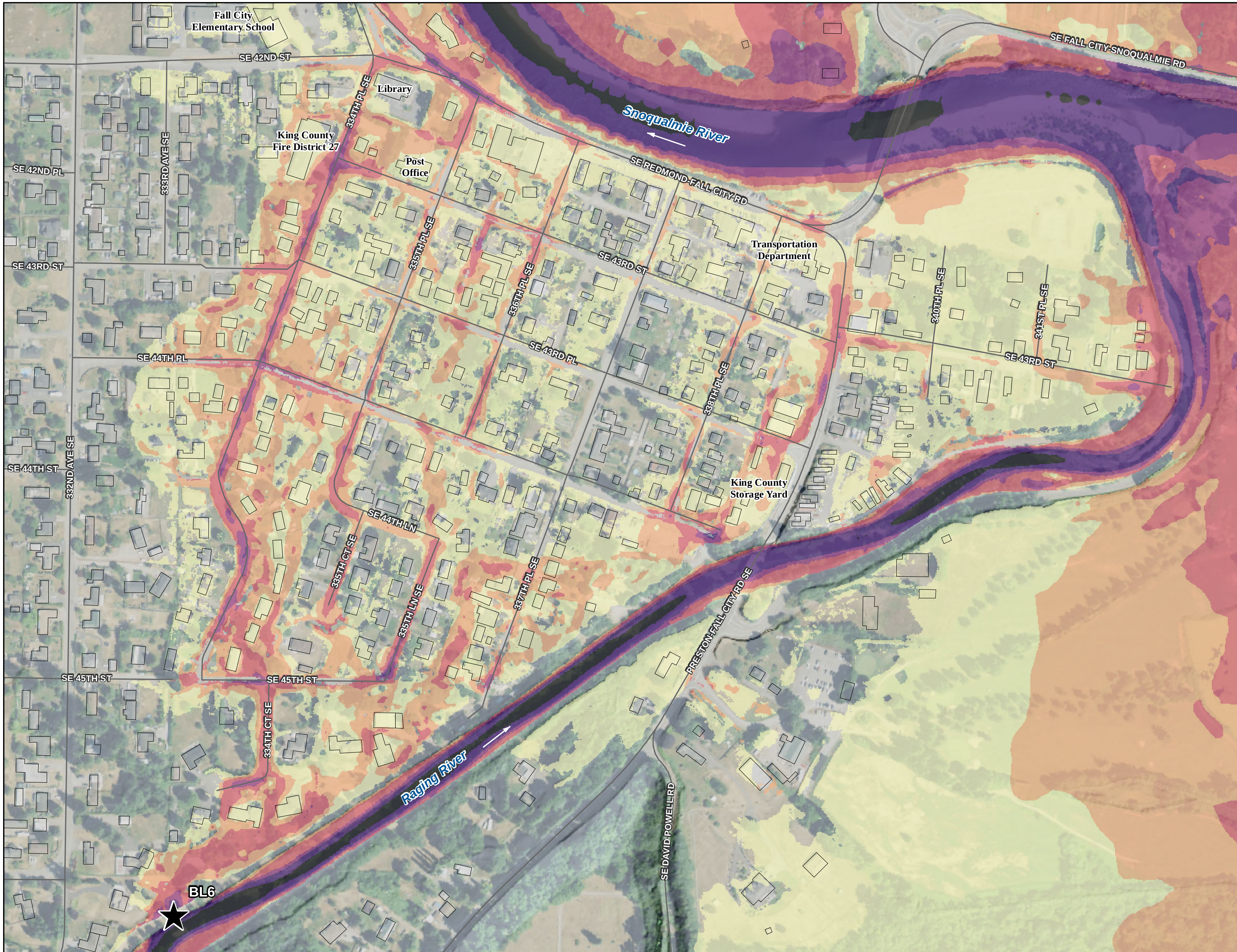
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 50-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

★ Breach Location

Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600

Feet

N

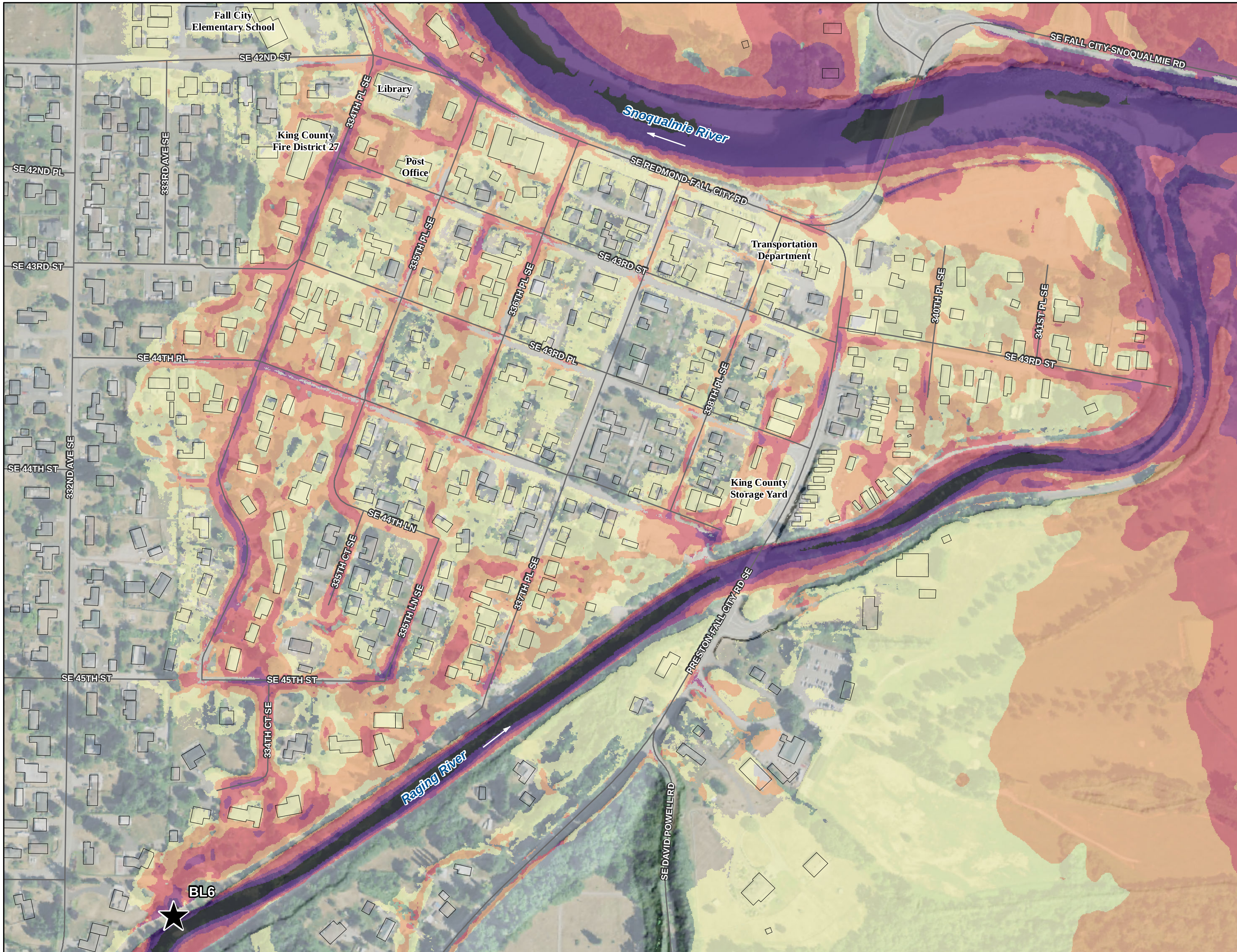
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 100-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600 Feet

N

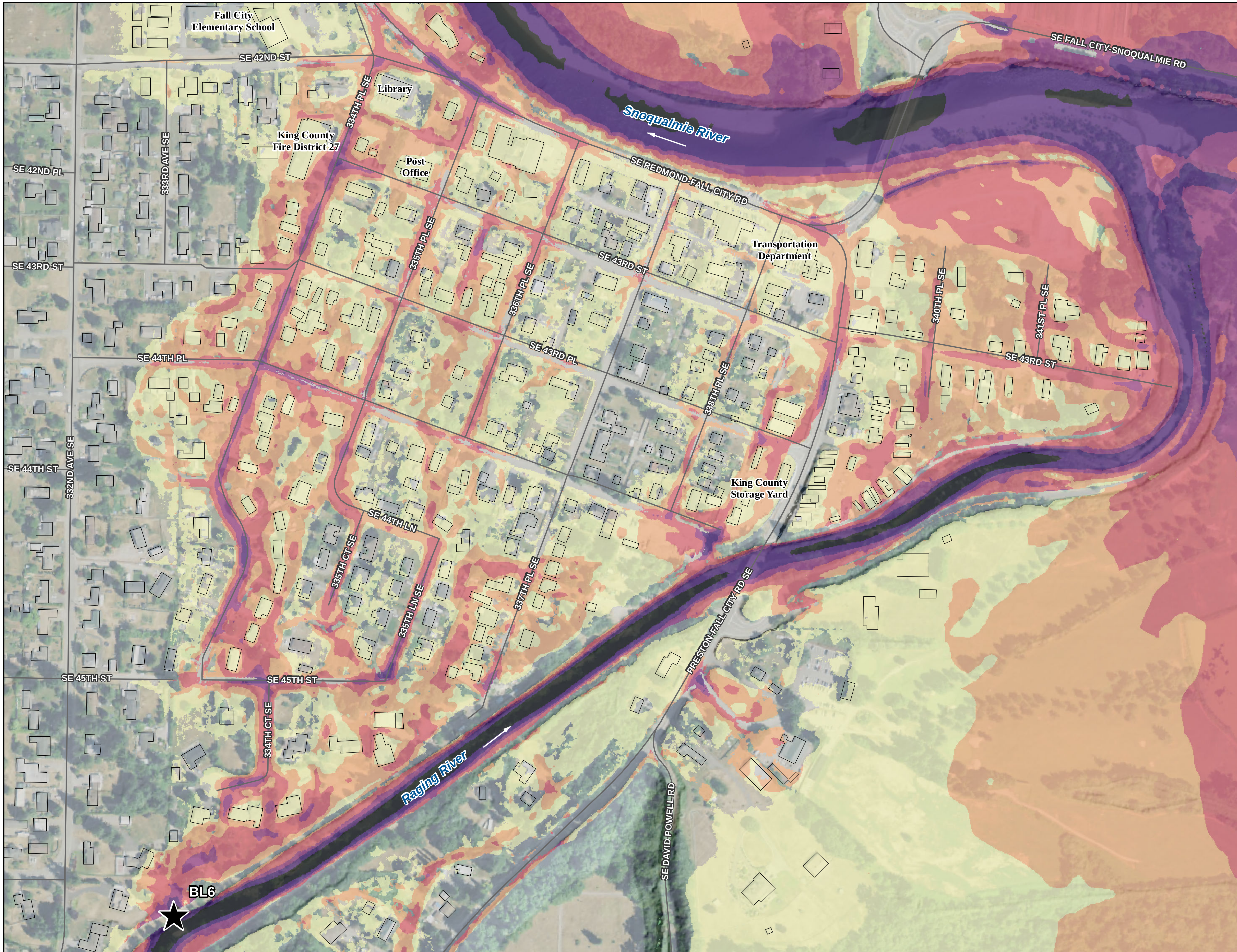
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 250-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

- ★ Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.

SCALE - 1:3,600

0 150 300 600
Feet

N

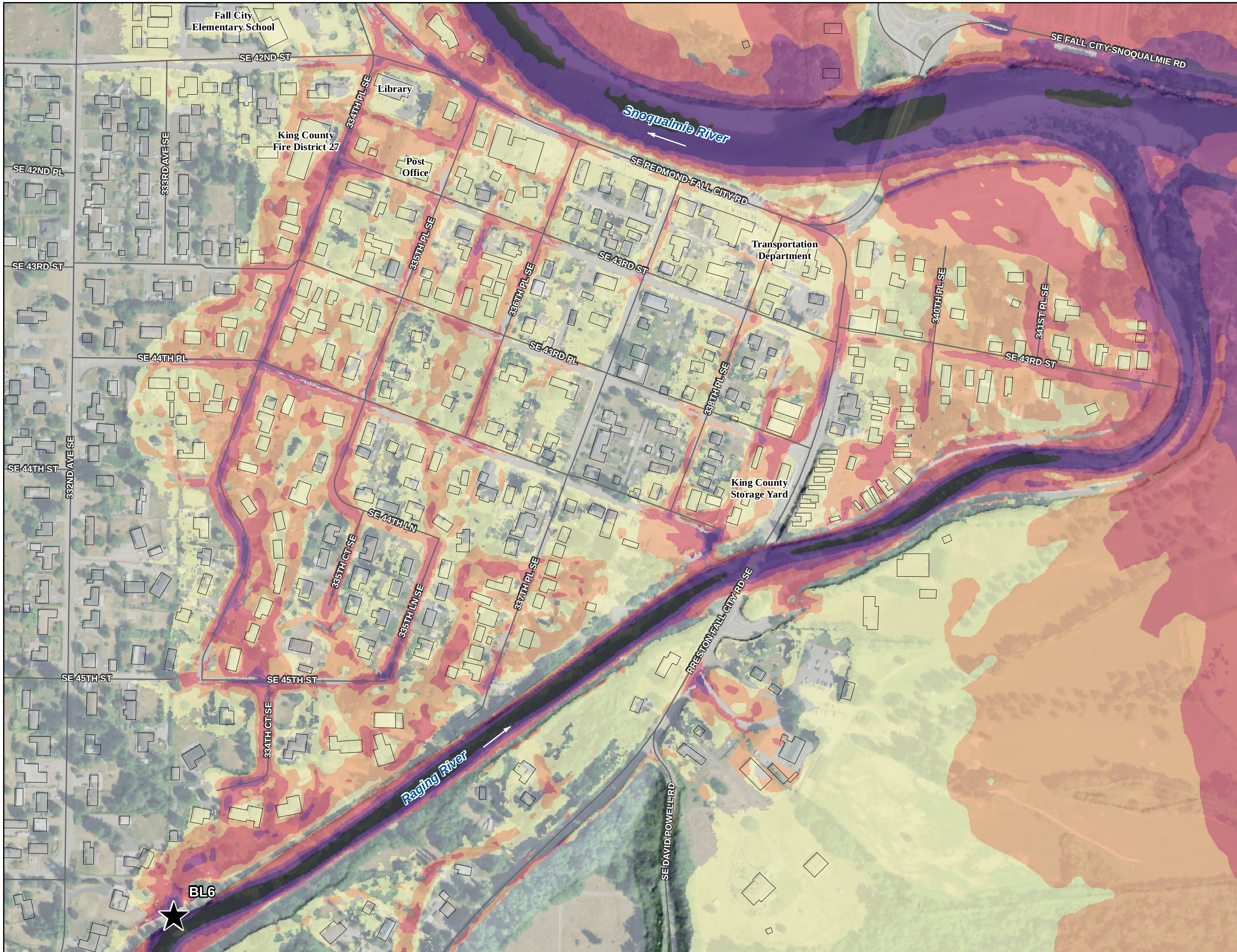
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 500-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

- Breach Location
- Building Footprint

Velocity (ft/s)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- >10

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SCALE - 1:3,600

0 150 300 600
Feet

N

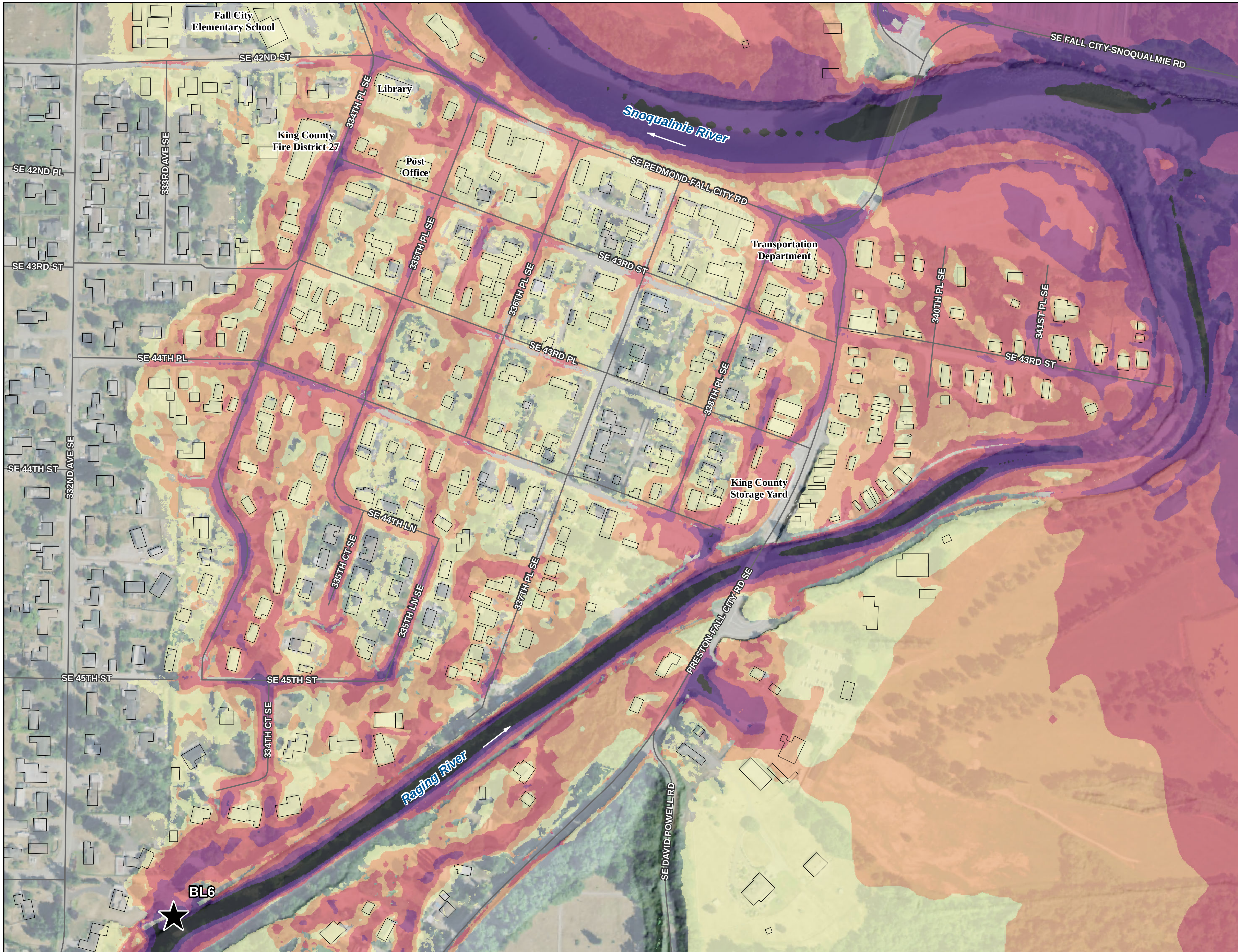
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 100-year FC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



Legend

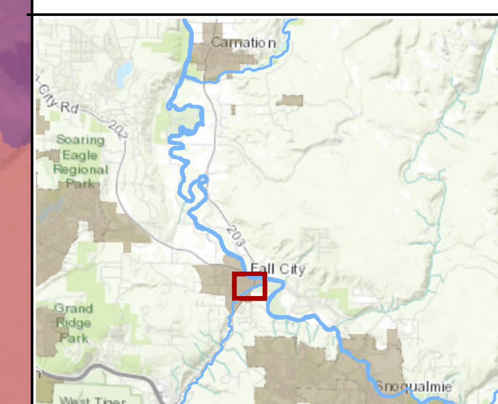
Breach Location

Building Footprint

Velocity (ft/s)

0 - 1
1 - 2
2 - 4
4 - 6
6 - 8
>10

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood.



SCALE - 1:3,600

0 150 300 600

Feet

N

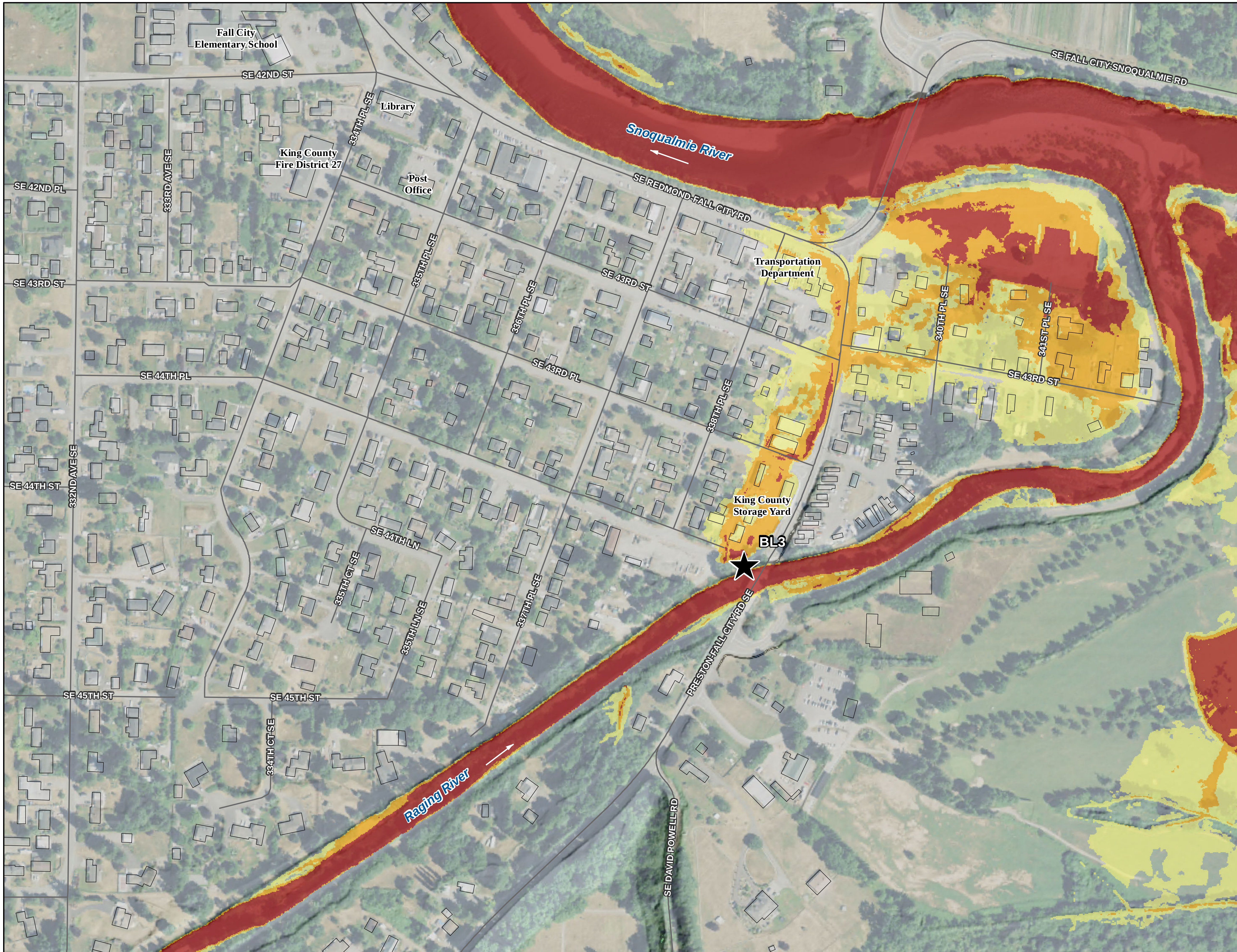
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Velocity resulting from a hypothetical levee breach during a 500-year FC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\05_GIS\MXDs\Figures\Raging\Raging_Velocity.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

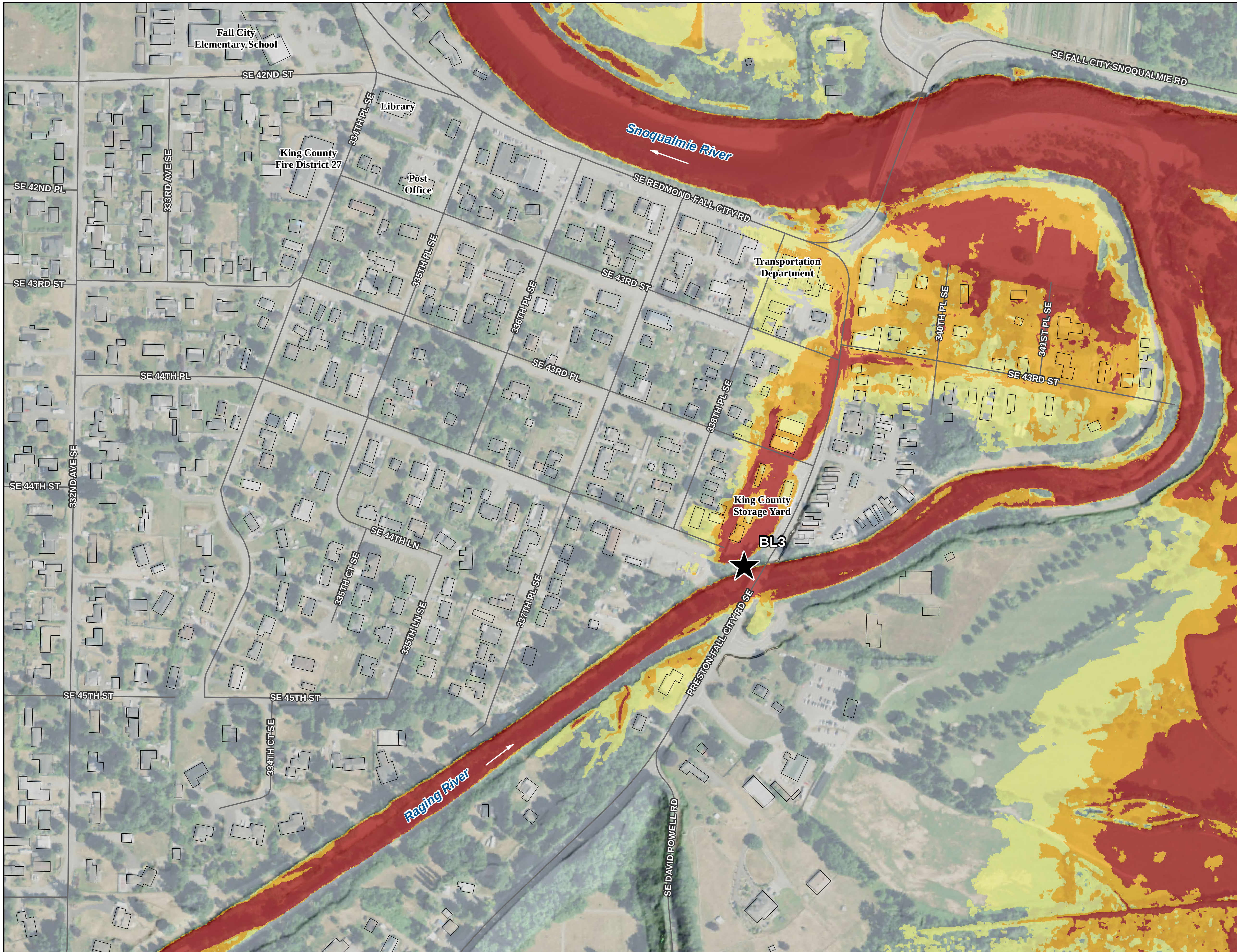
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 2-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

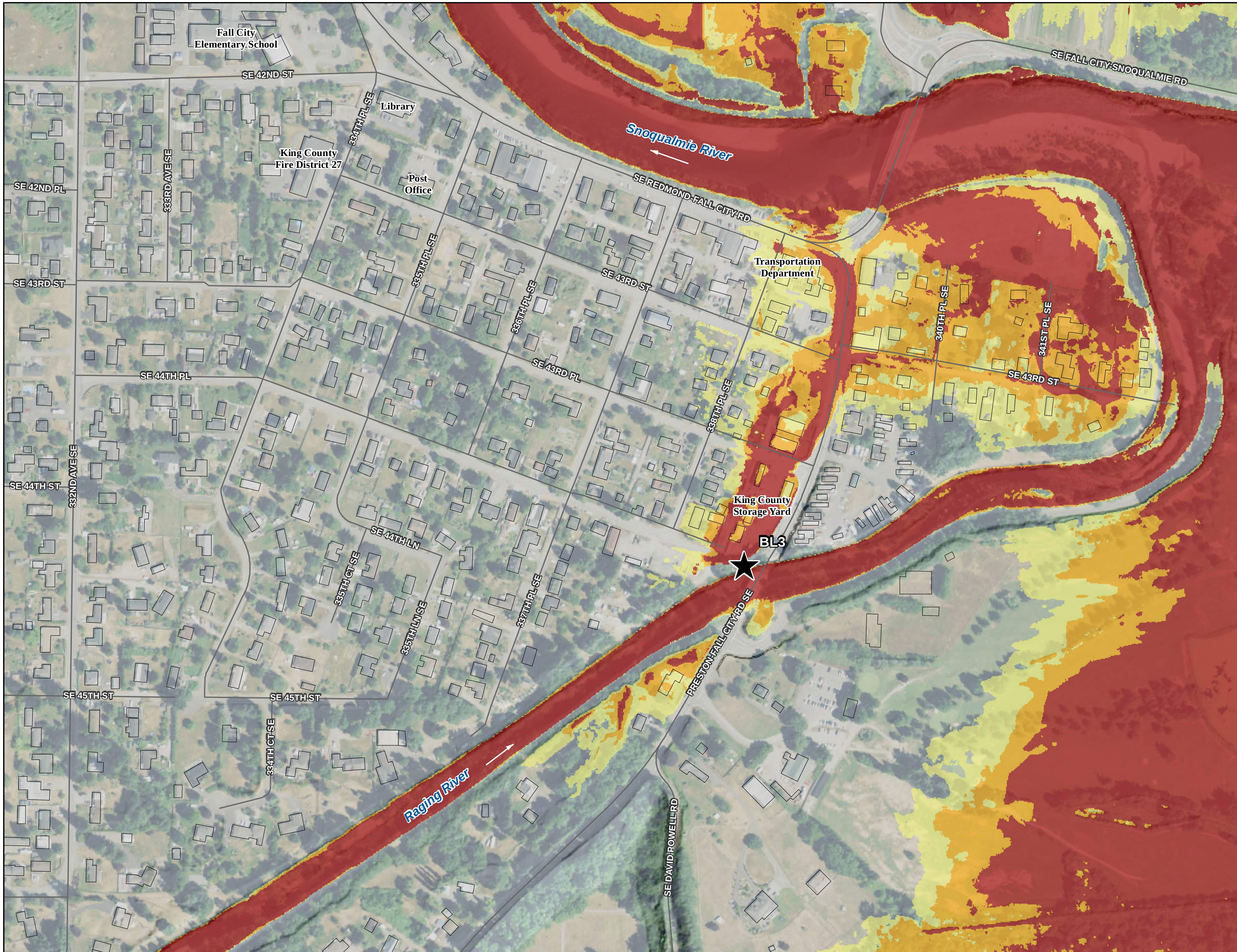
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 5-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

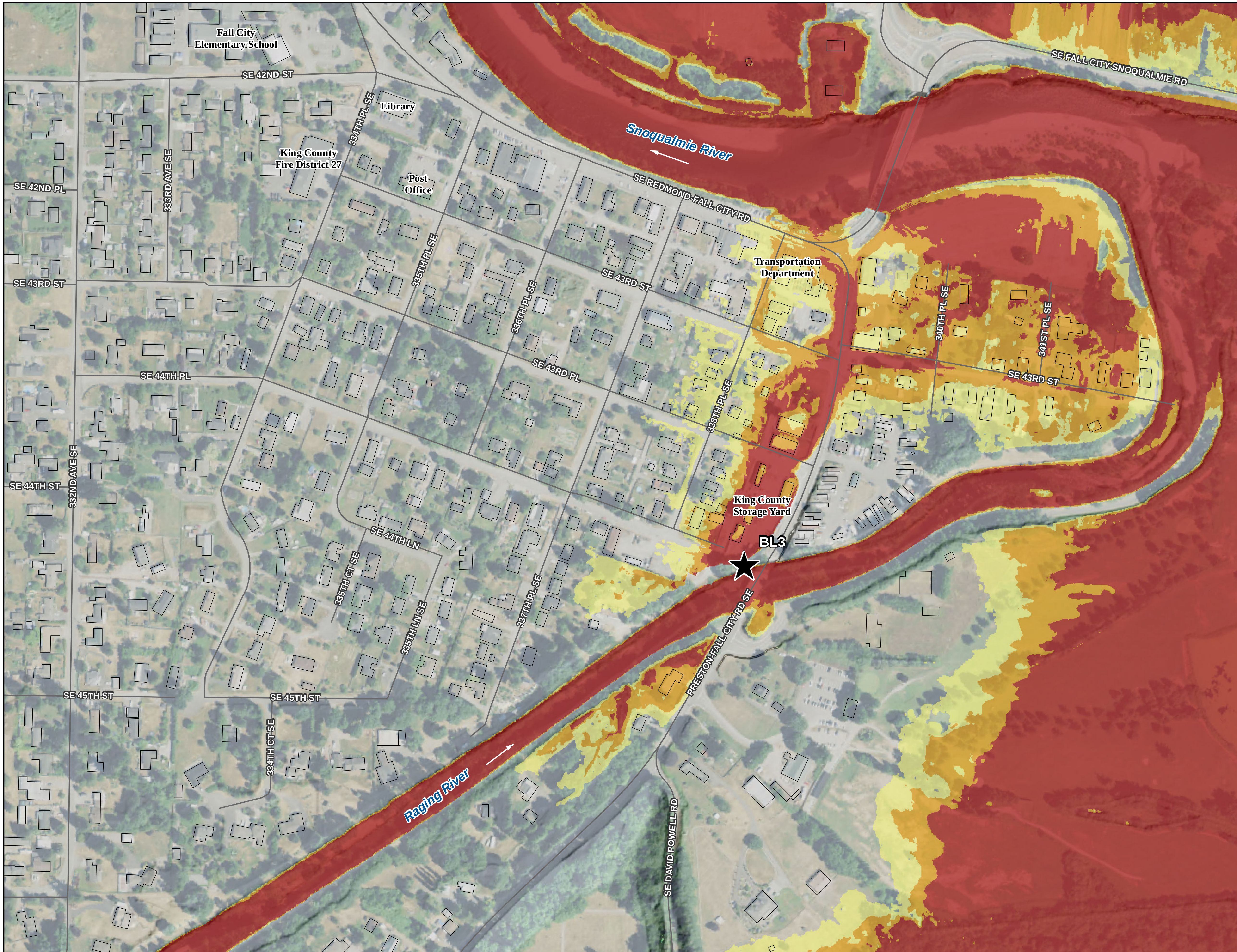
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 10-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

nhc
northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600
Feet

N

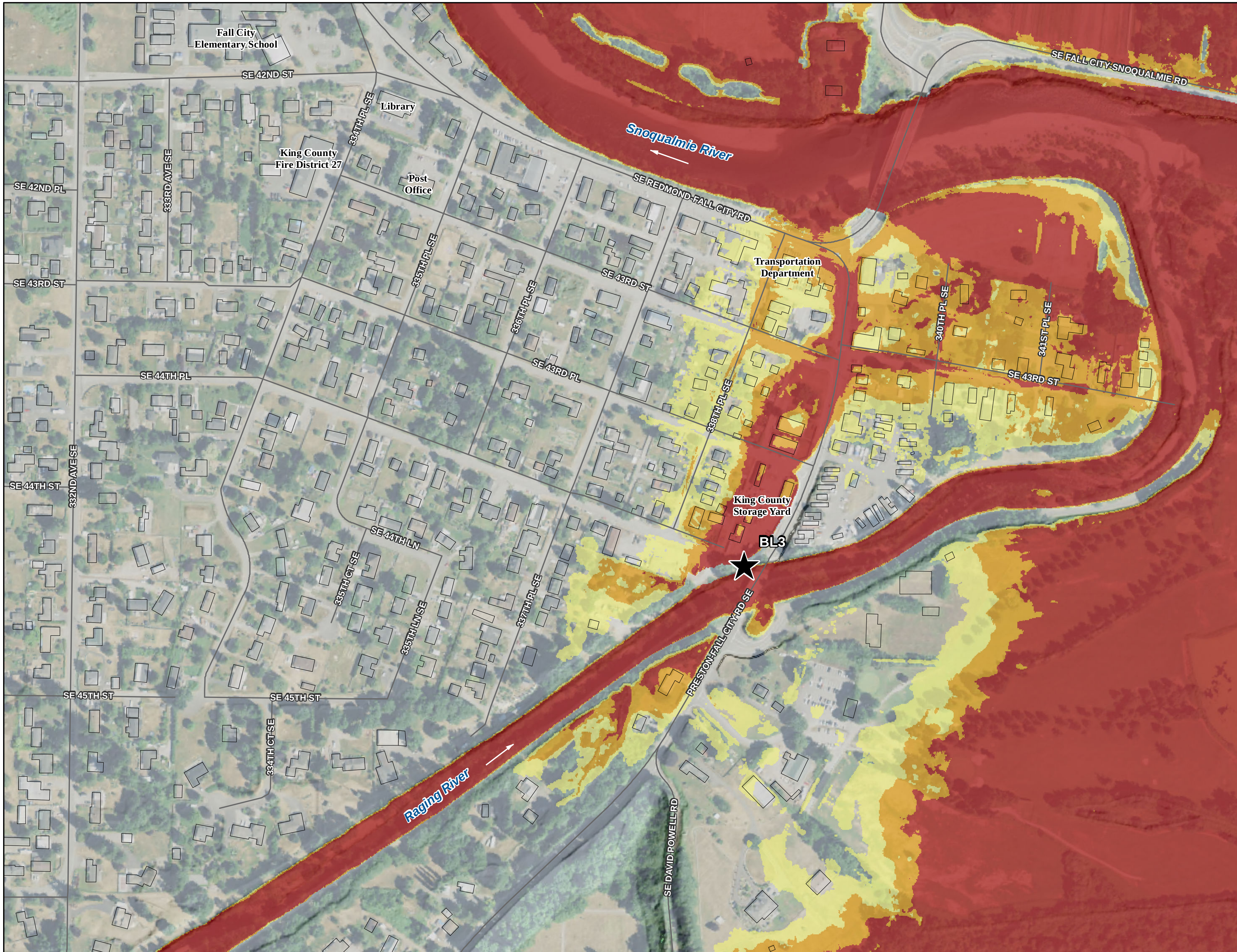
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 25-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

nhc
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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600
Feet

N

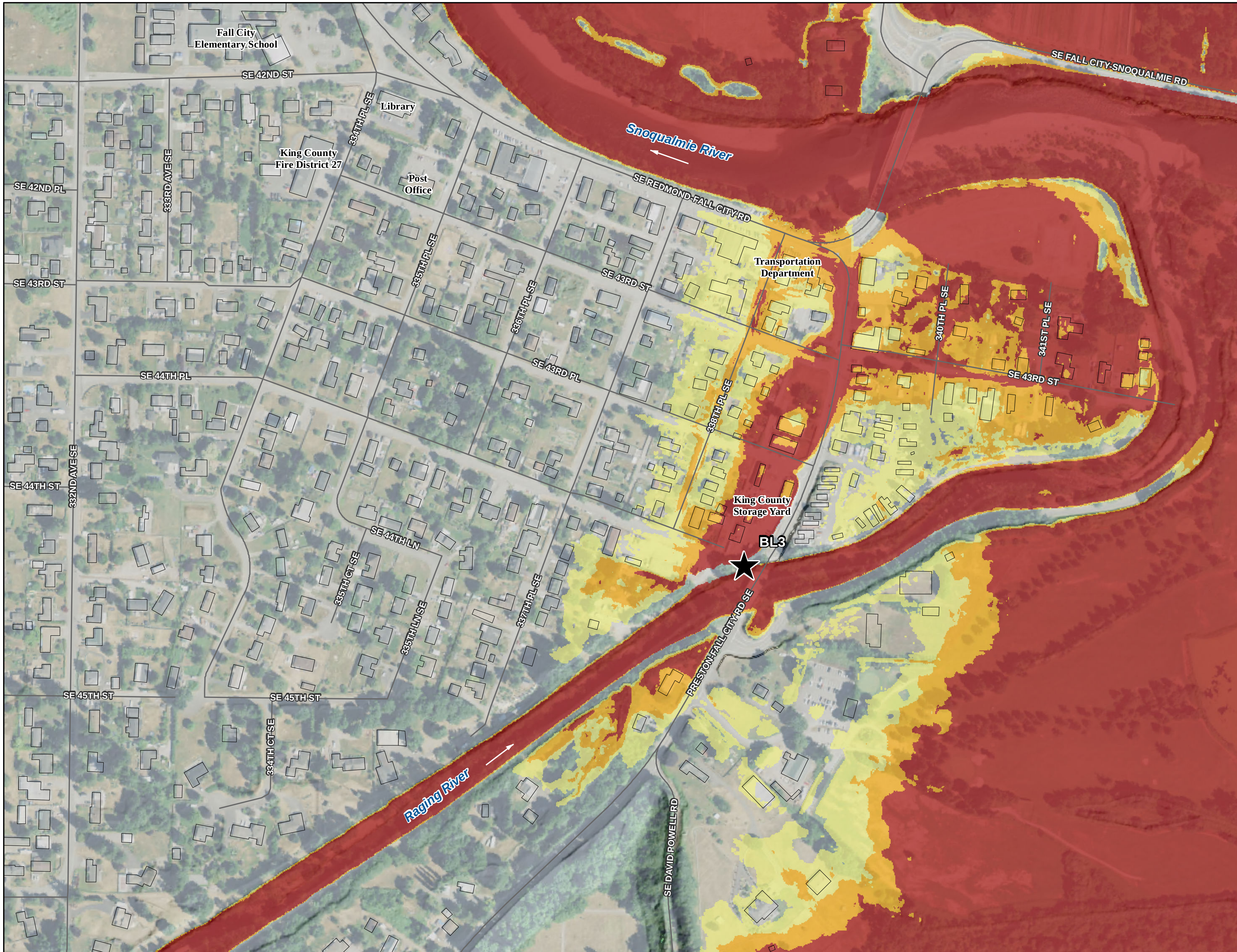
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 50-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

nhc northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously threatened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

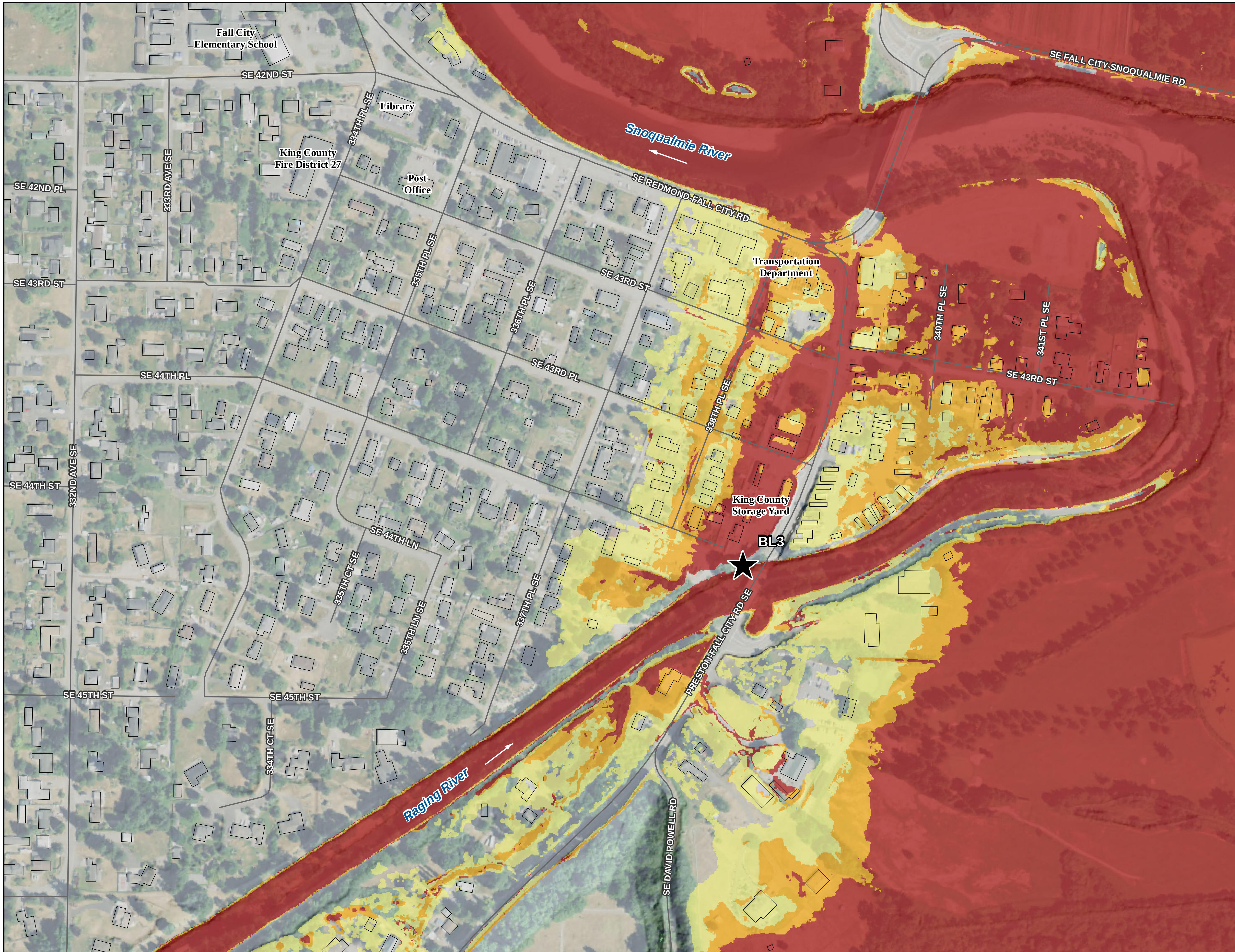
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 100-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

- Breach Location
- Building Footprint

Hazard (Children)

- Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.
- Judgement Zone: Danger level is based upon engineering judgement.
- High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

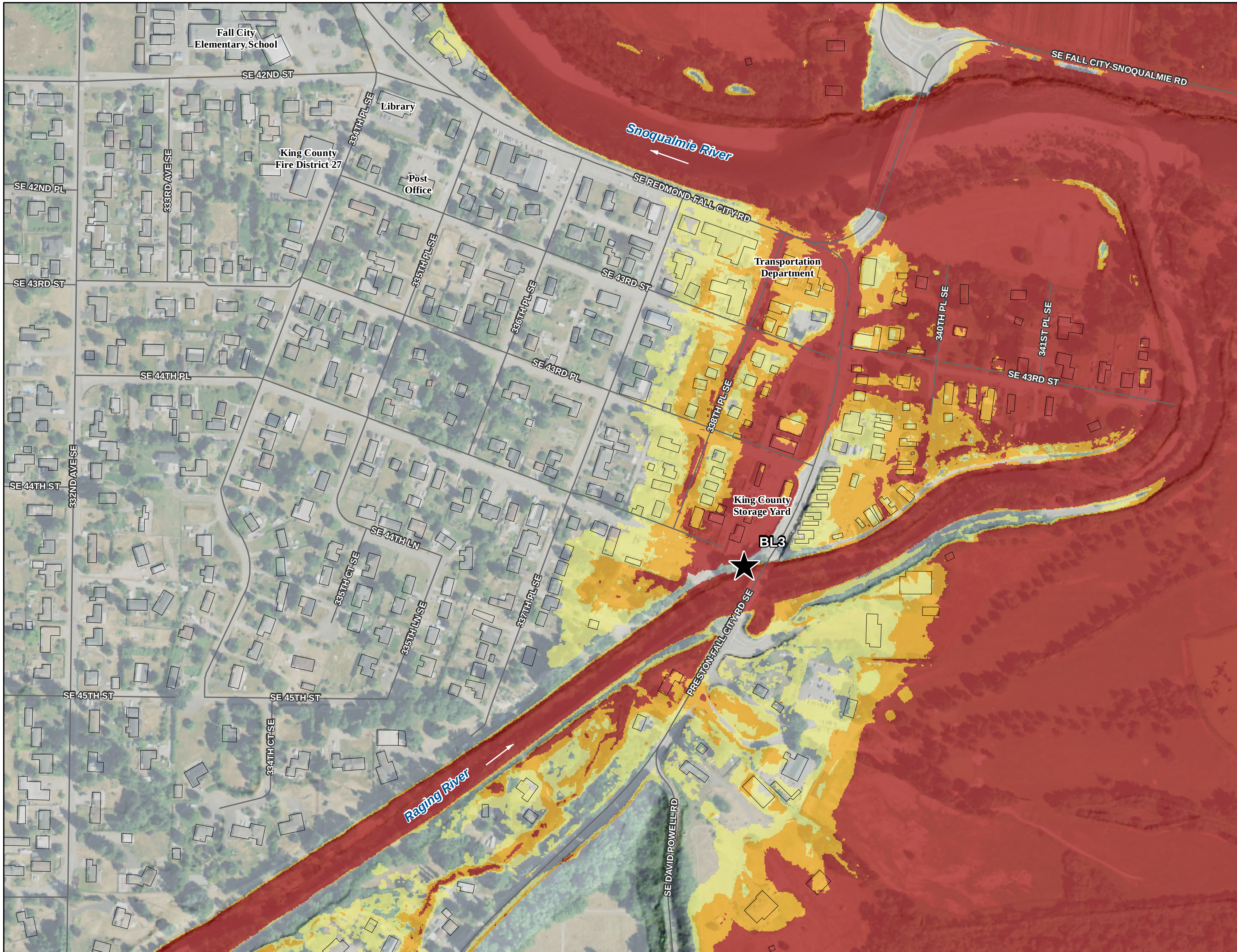
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 250-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

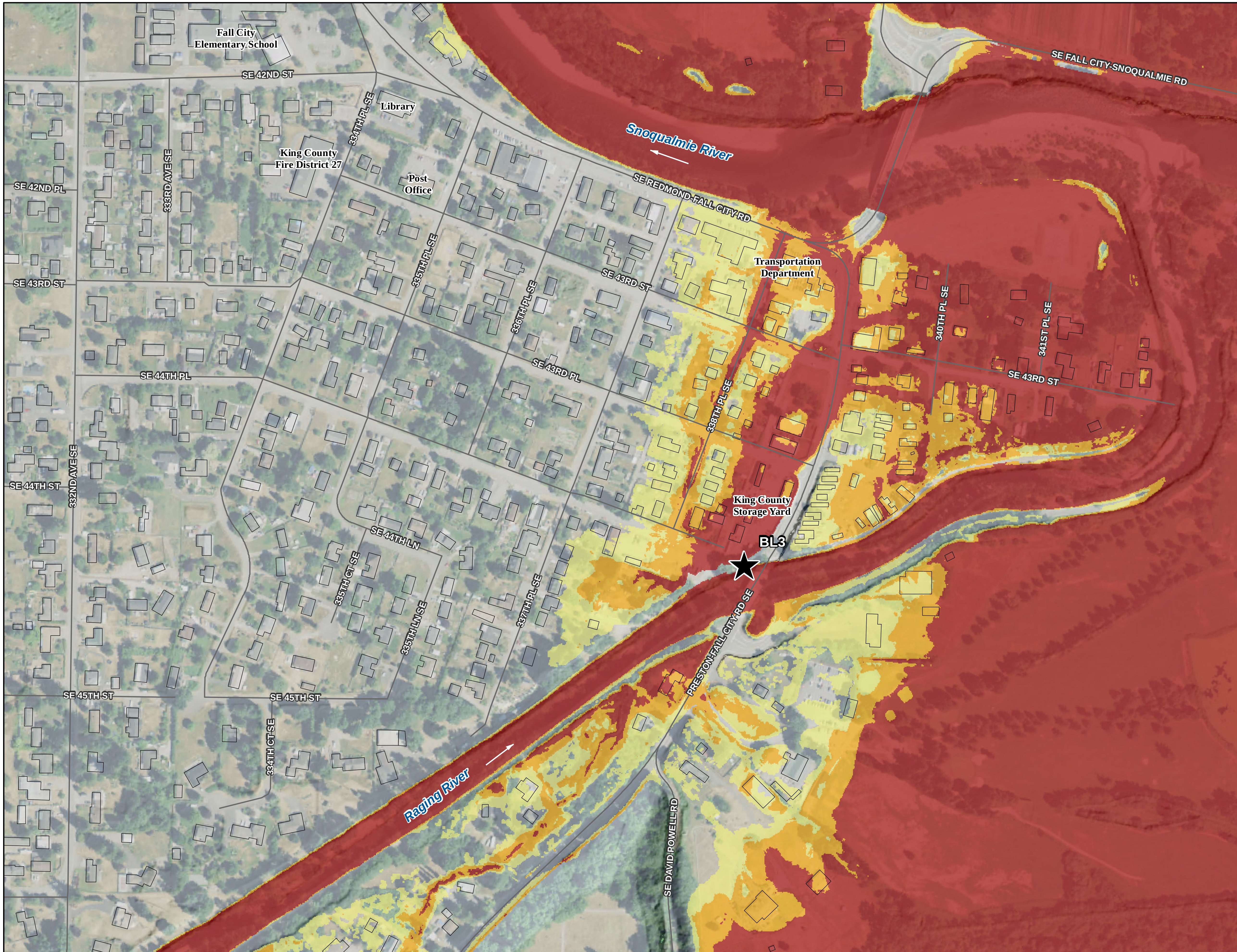
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 500-year EC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

- ★ Breach Location
- Building Footprint

Hazard (Children)

- Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.
- Judgement Zone: Danger level is based upon engineering judgement.
- High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600
Feet

N

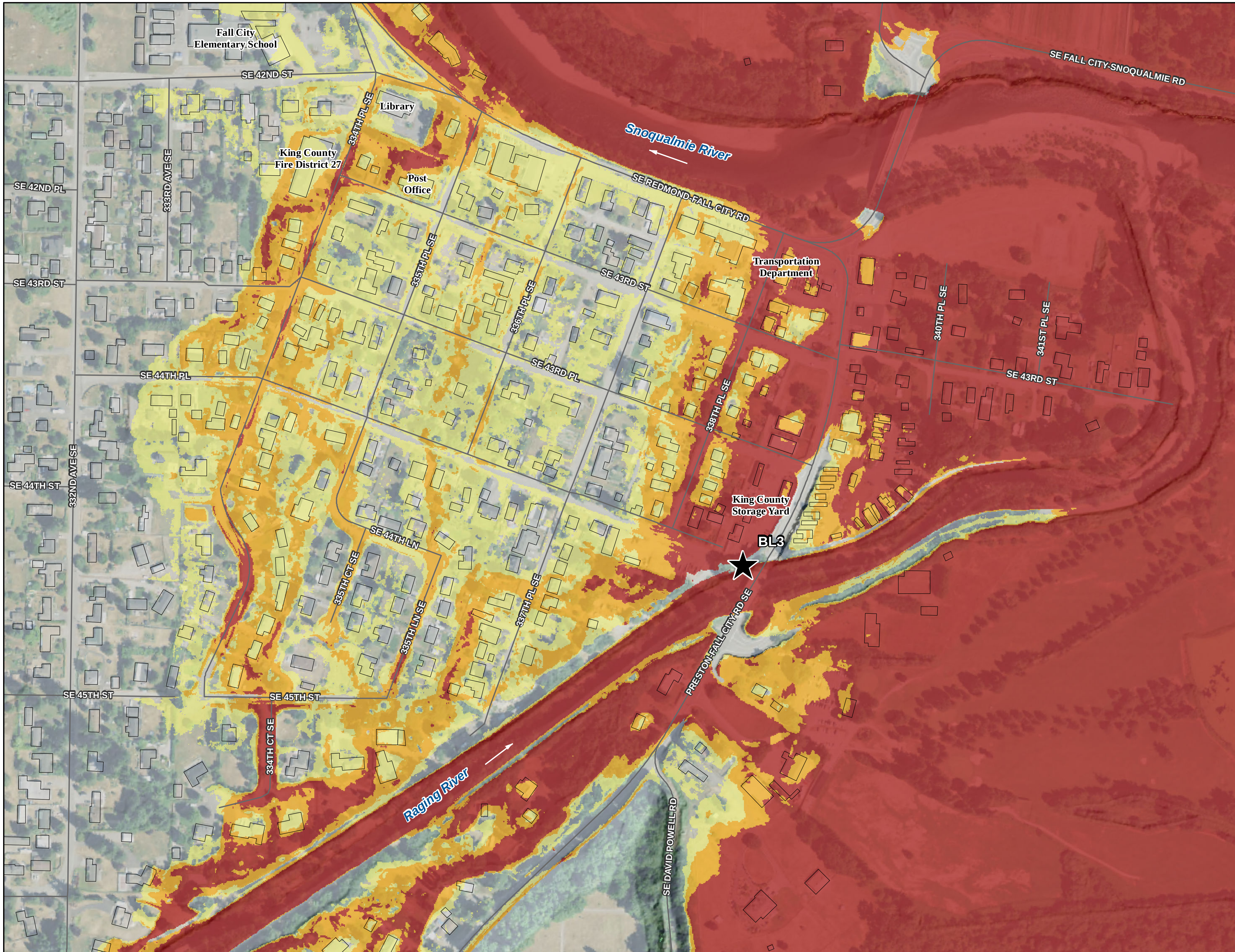
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 100-year FC flood at BL3

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600
Feet

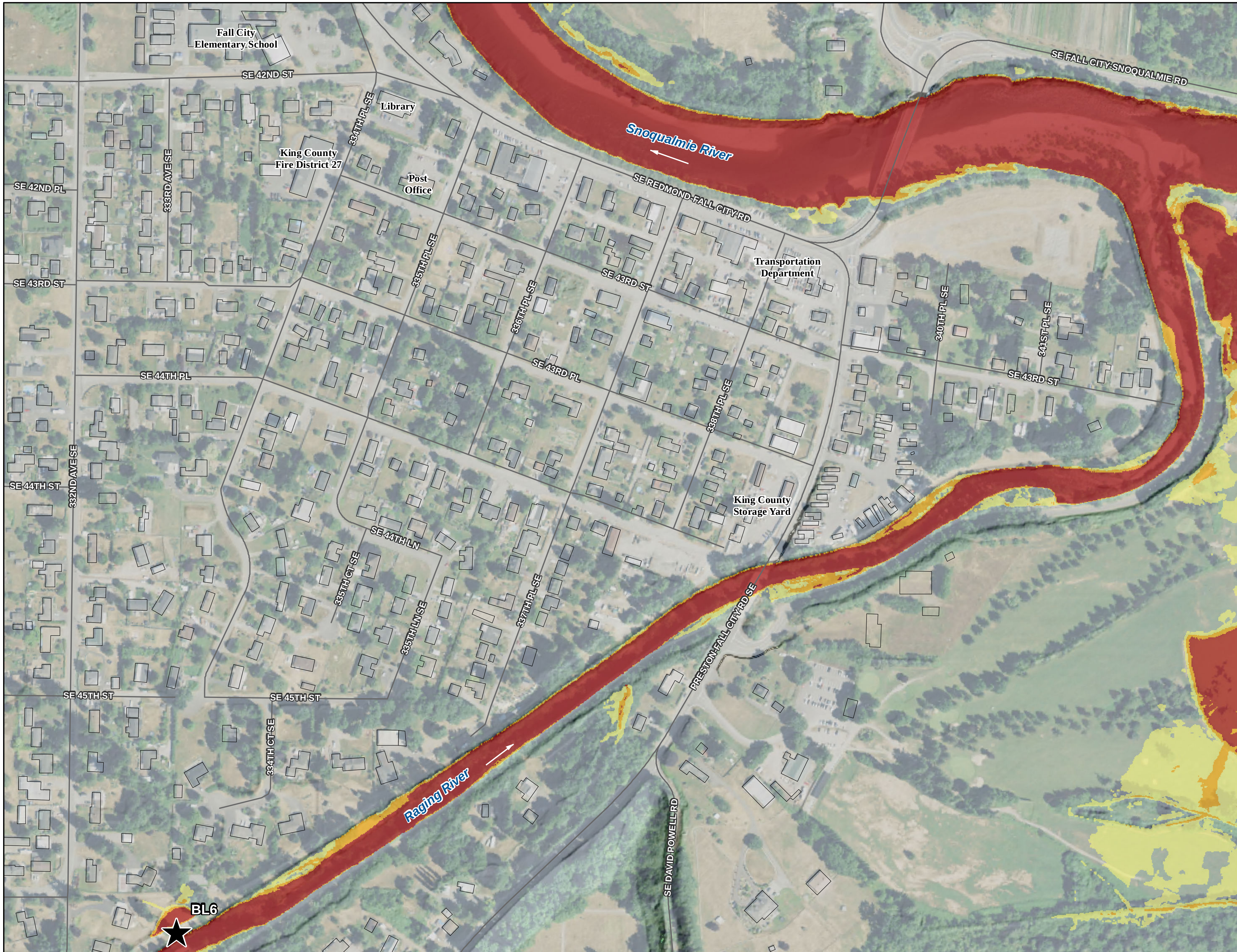
N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 500-year FC flood at BL3



King County

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Legend

★ Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously threatened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

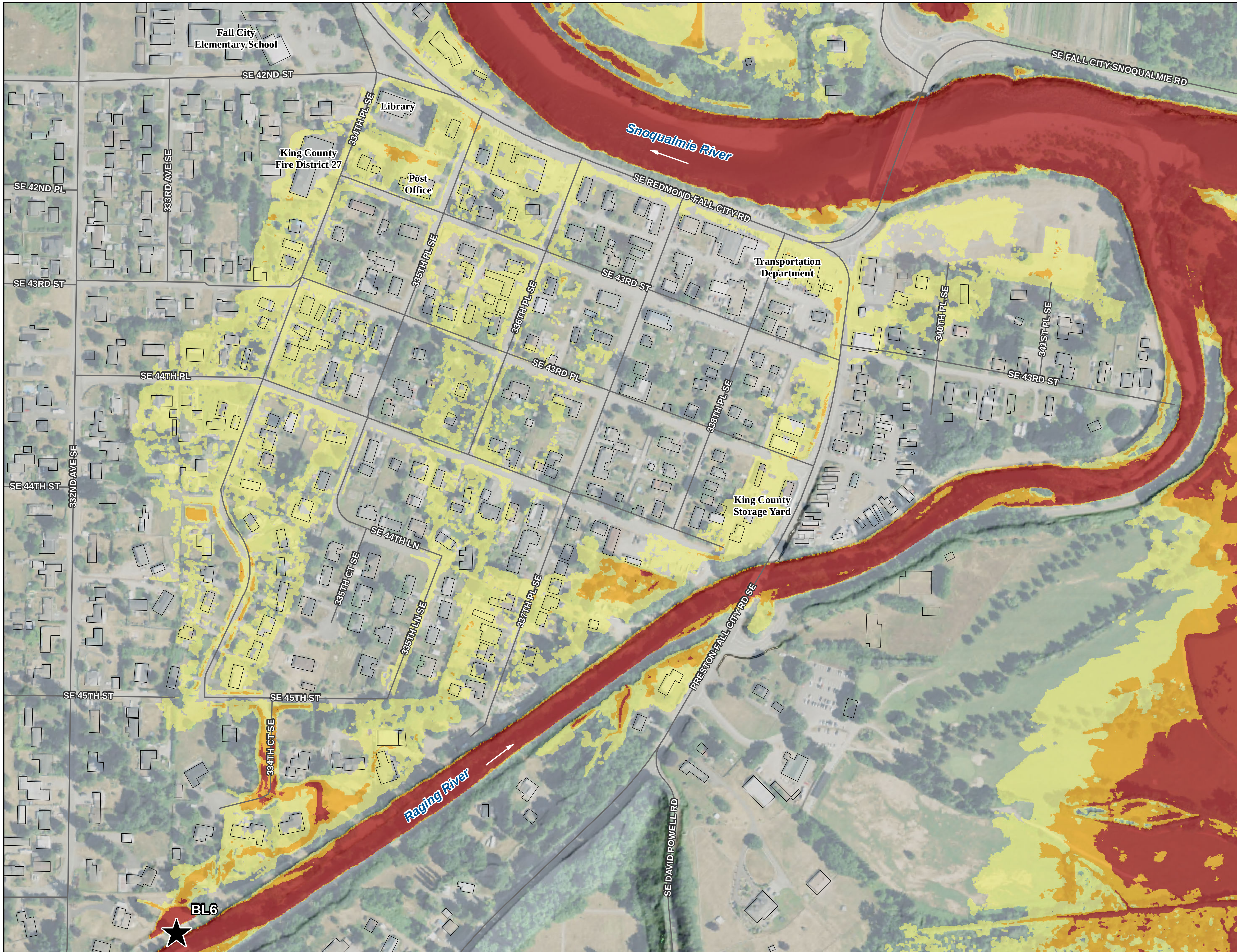
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 2-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

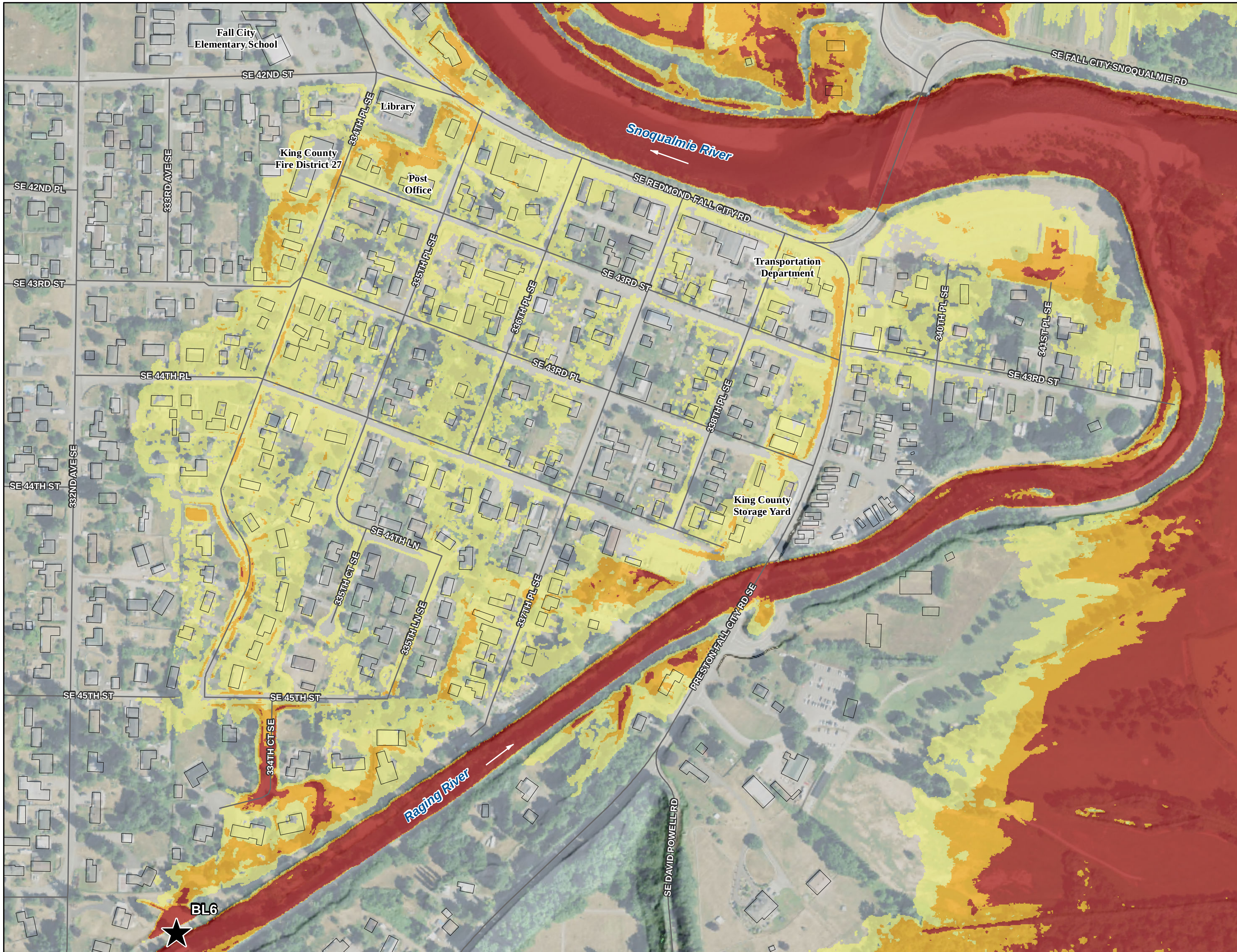
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 5-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

★ Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600

Feet

N

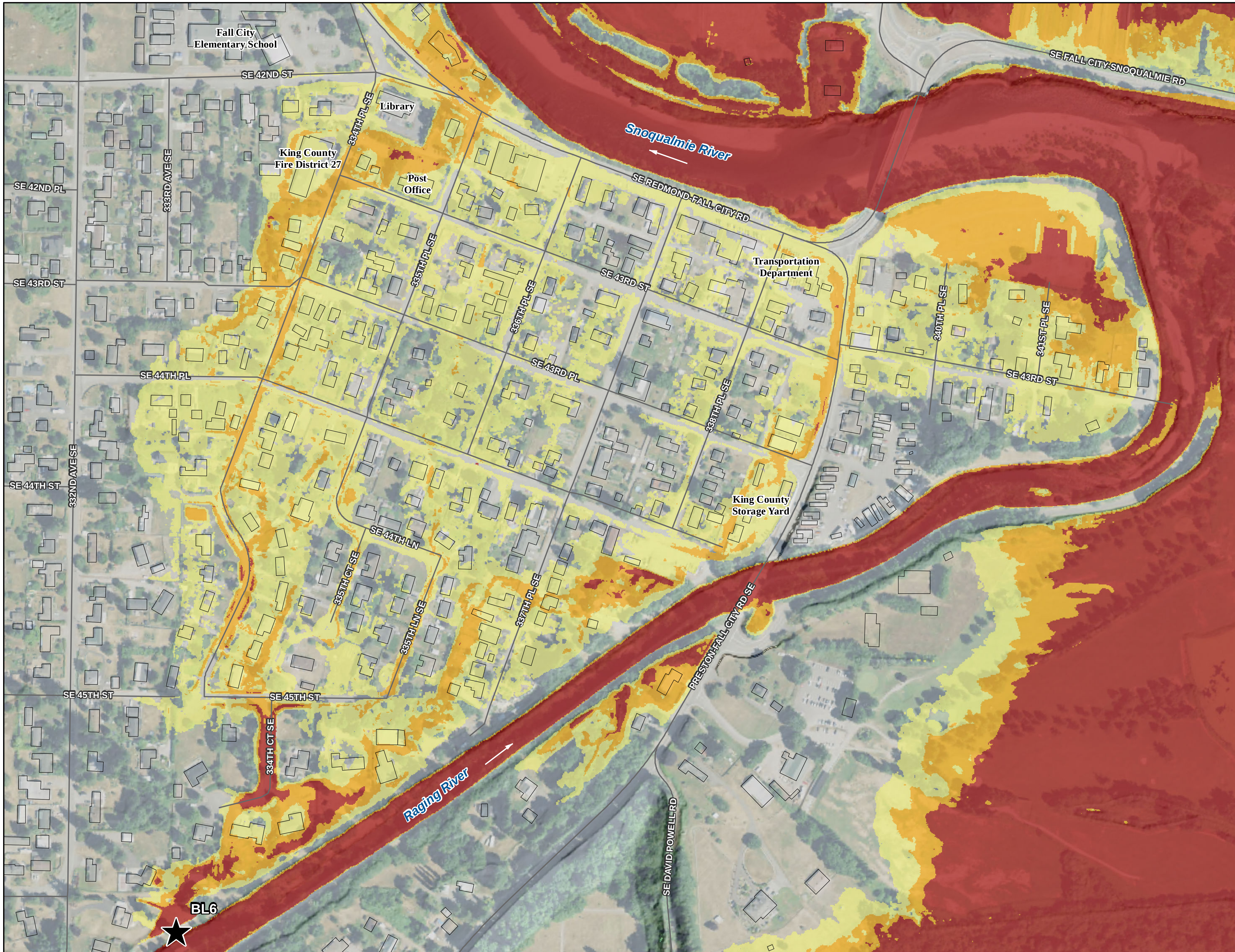
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 10-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



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Legend

- ★ Breach Location
- Building Footprint

Hazard (Children)

- Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.
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- High Danger Zone: Almost any size child is in danger from flood water.

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SCALE - 1:3,600

0 150 300 600
Feet

N

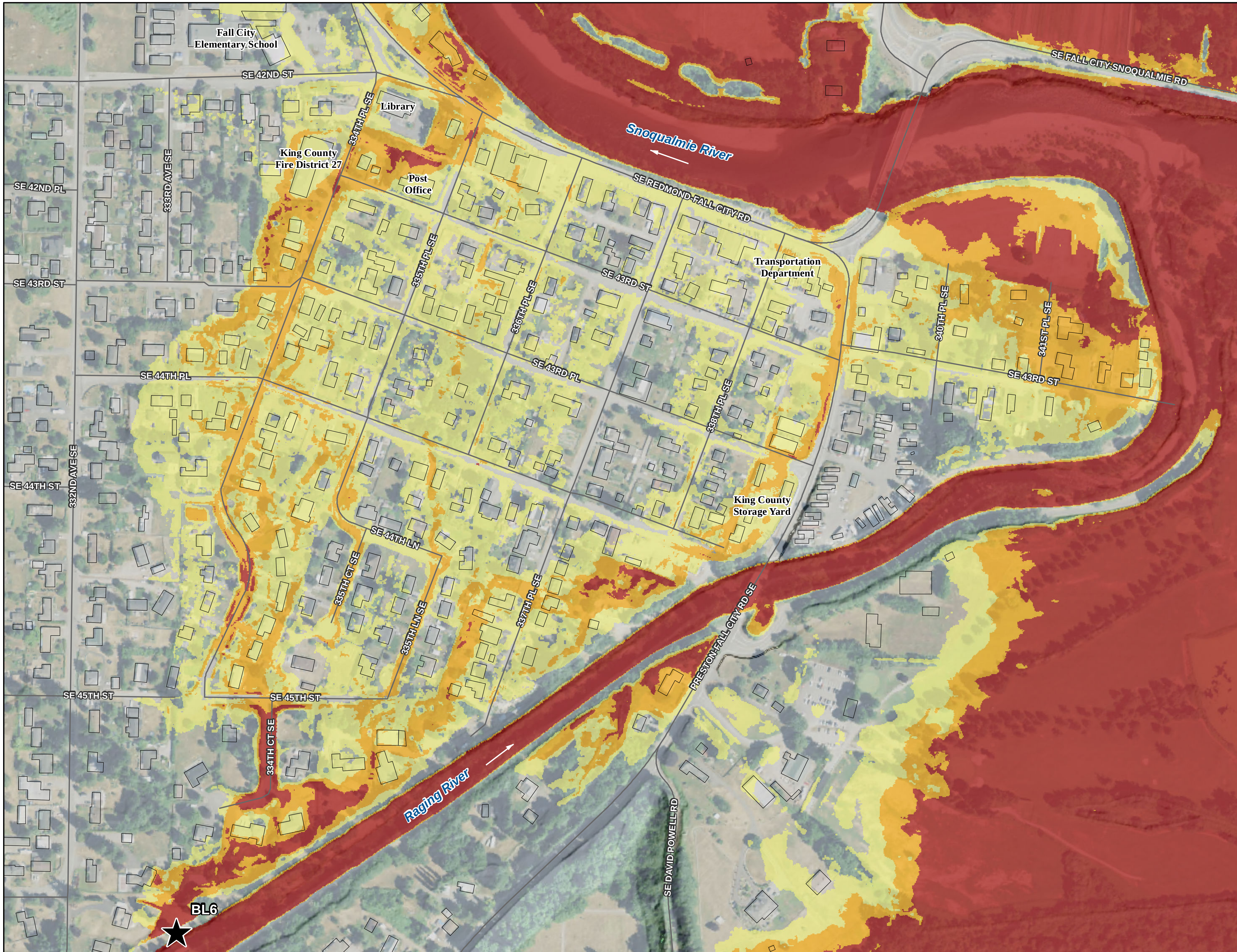
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 25-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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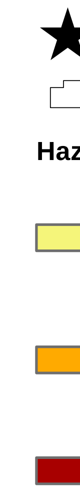
Legend



Breach Location

Building Footprint

Hazard (Children)

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Judgement Zone: Danger level is based upon engineering judgement.

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SCALE - 1:3,600

0 150 300 600

Feet

N

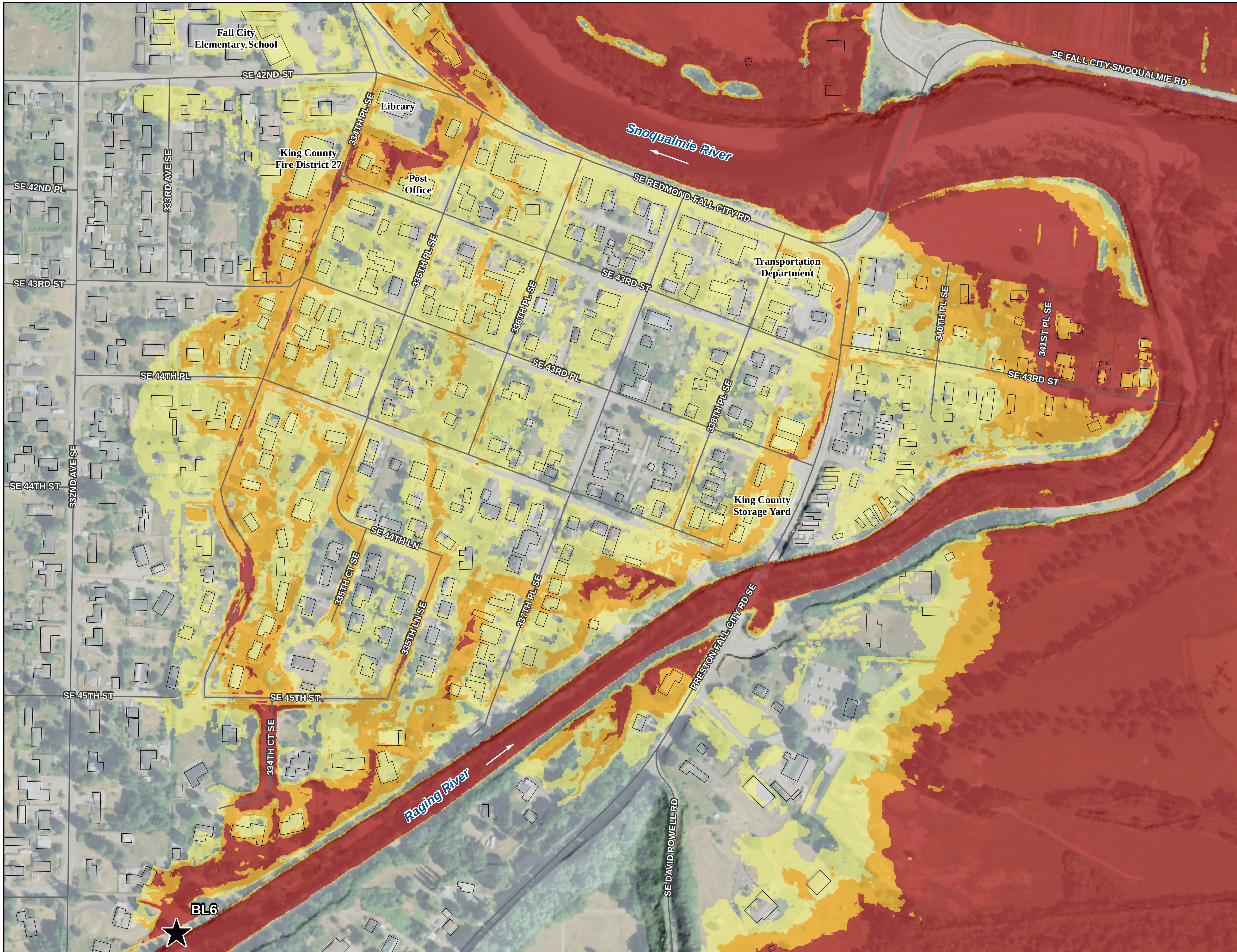
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 50-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

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SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 100-year EC flood at BL6

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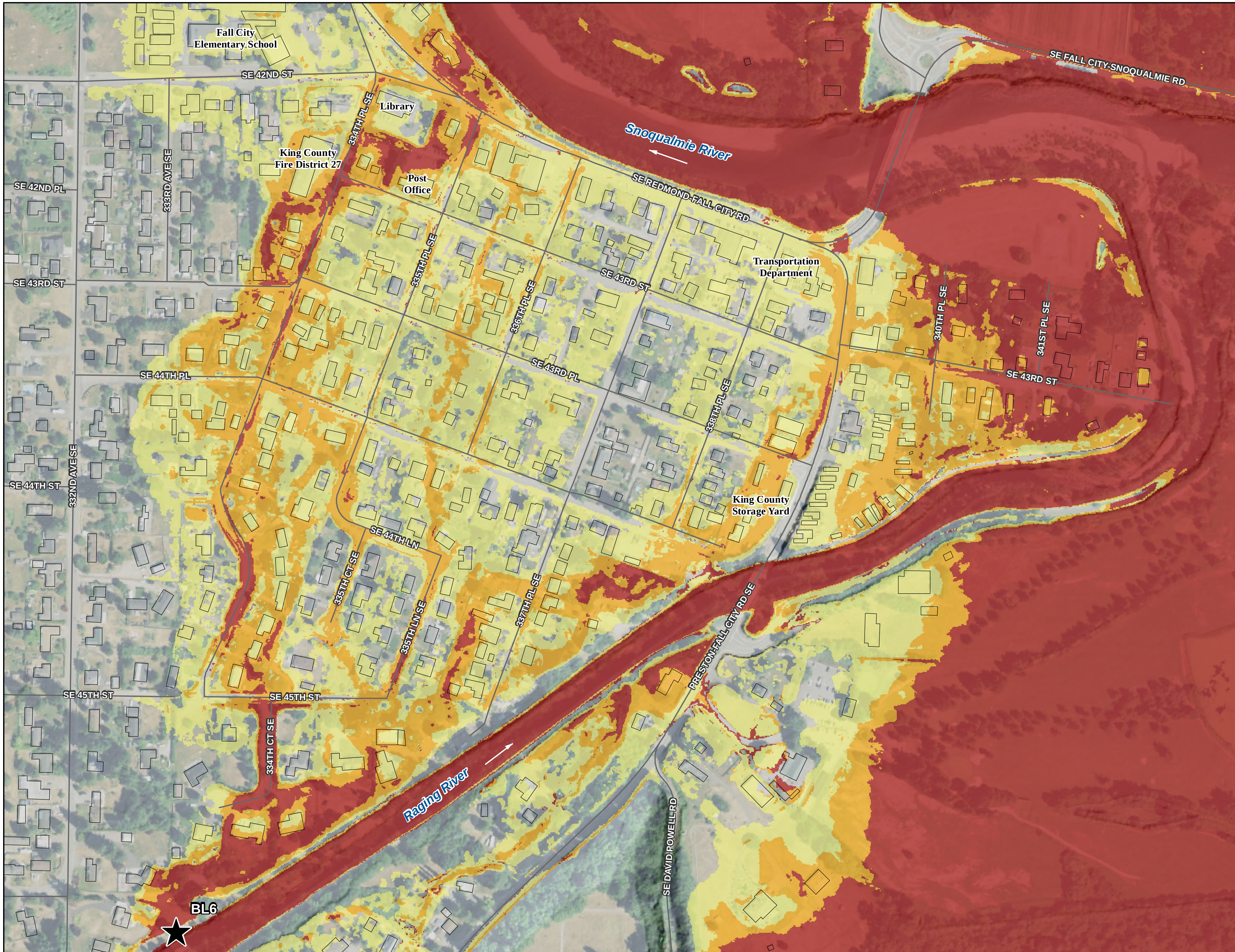

King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

High Danger Zone: Almost any size child is in danger from flood water.

The inundation shown in this figure is a combination of natural flooding and a hypothetical levee breach. This does not imply that a breach at this (or any) location is likely to occur during the flood. Hazard classification determined using U.S. Bureau of Reclamation Downstream Hazard Classification Guidelines.

SCALE - 1:3,600

0 150 300 600
Feet

N

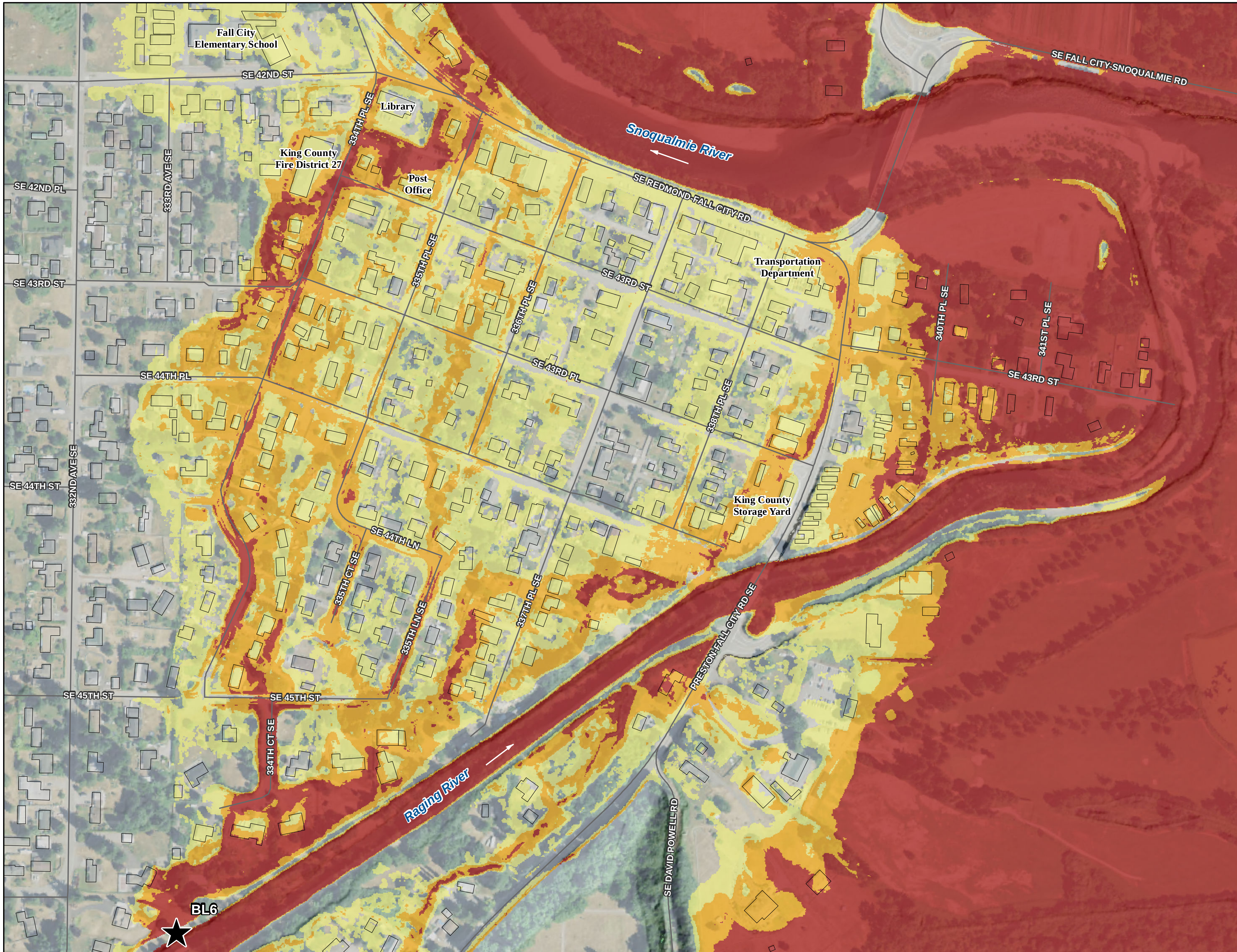
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 250-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

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SCALE - 1:3,600

0 150 300 600

Feet

N

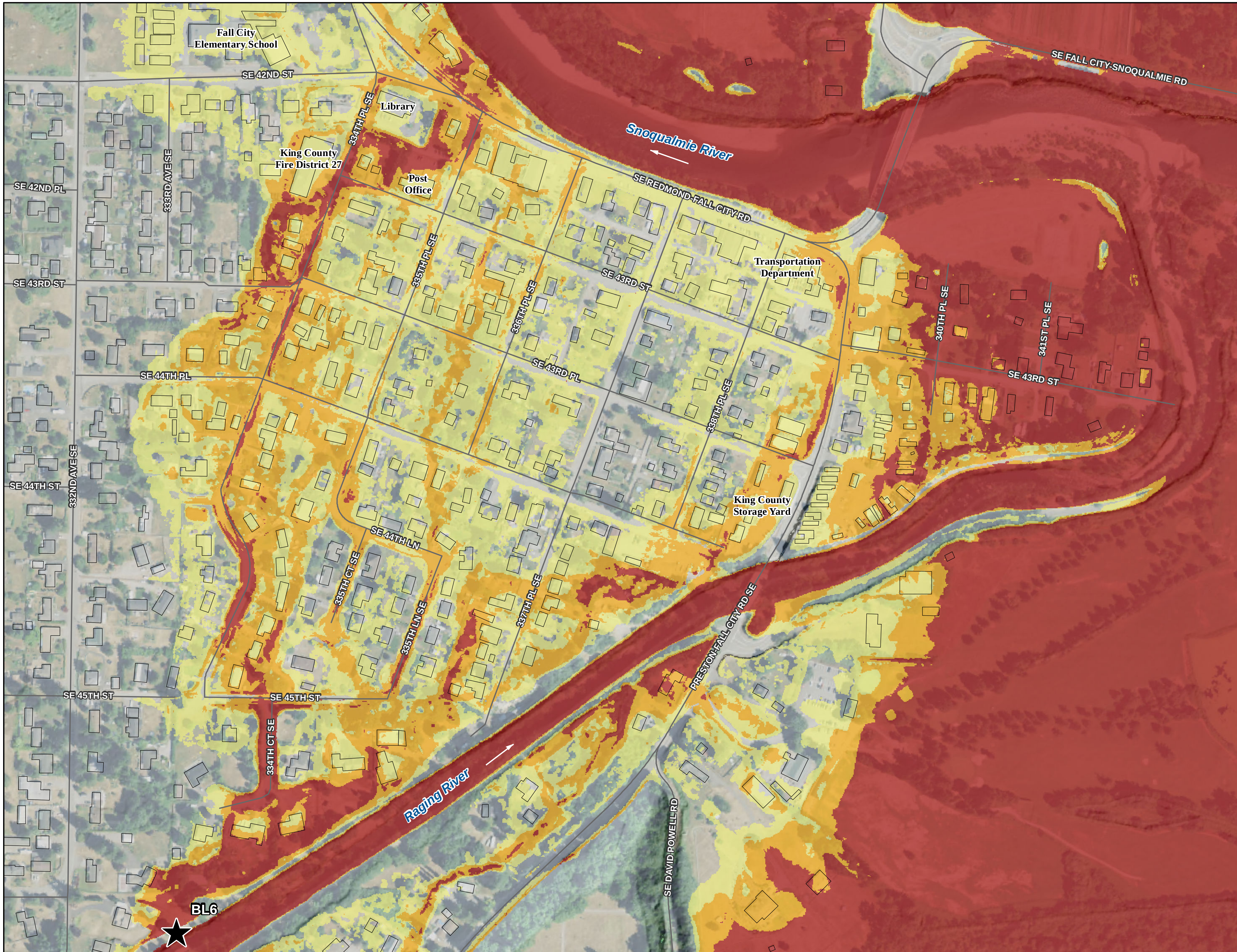
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712 | *Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 500-year EC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

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Legend

- Breach Location
- Building Footprint

Hazard (Children)

- Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.
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SCALE - 1:3,600

0 150 300 600
Feet

N

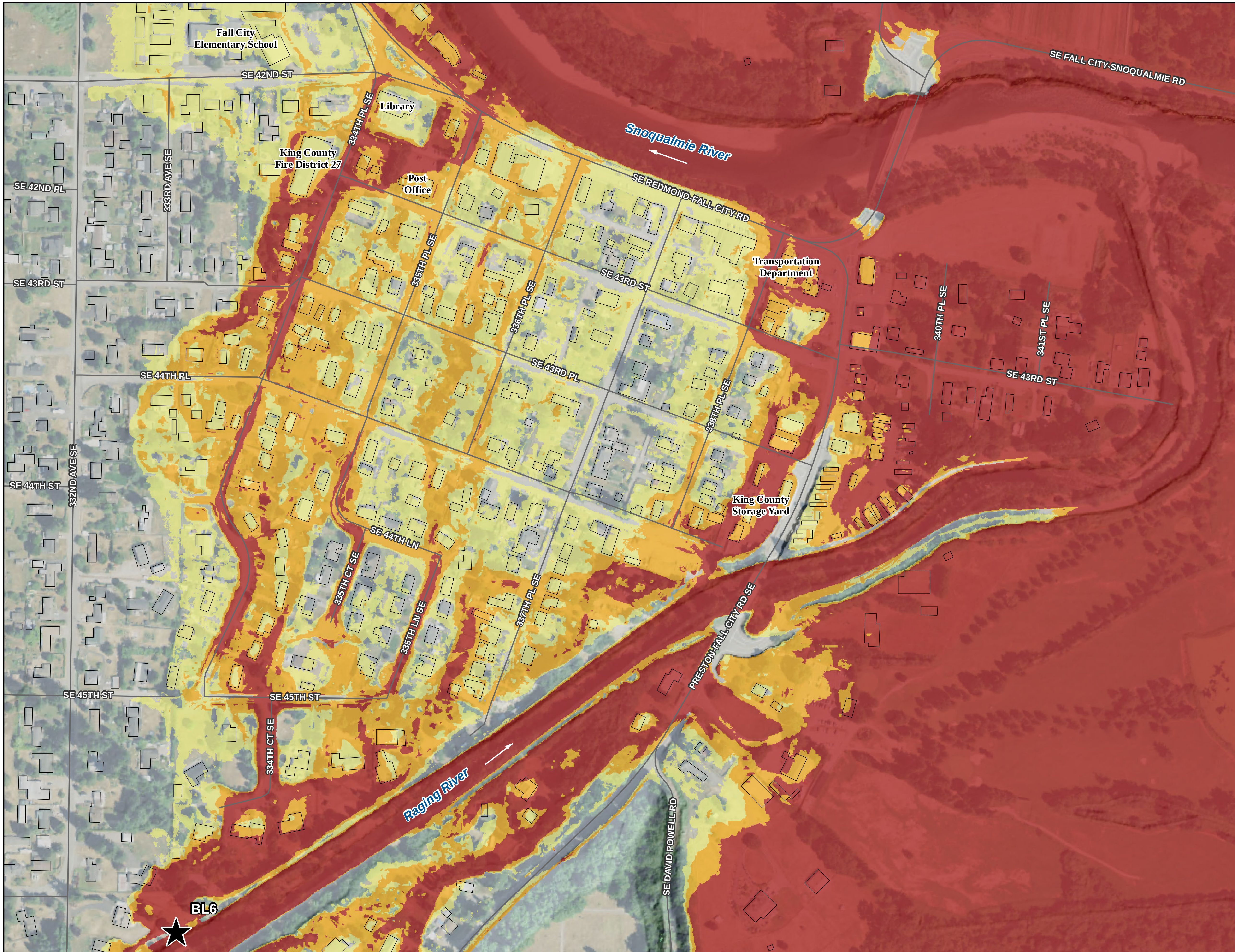
Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	Date: 15-Feb-2023

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 100-year FC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd



King County

nhc northwest hydraulic consultants

Legend

Breach Location

Building Footprint

Hazard (Children)

Low Danger Zone: Almost any size child (excluding infants) is not seriously thretened by flood water.

Judgement Zone: Danger level is based upon engineering judgement.

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SCALE - 1:3,600

0 150 300 600

Feet

N

Coordinate System: NAD 1983 WASHINGTON NORTH FTUS

Job: 2004712	*Date: 15-Feb-2023*

Levee Breach Analysis, Mapping, and Risk Assessment Project

Child hazard resulting from a hypothetical levee breach during a 500-year FC flood at BL6

Q:\2004712_King_County_Levee_Breach_Analysis\95_GIS\MXDs\Figures\Raging\Raging_Hazard.mxd