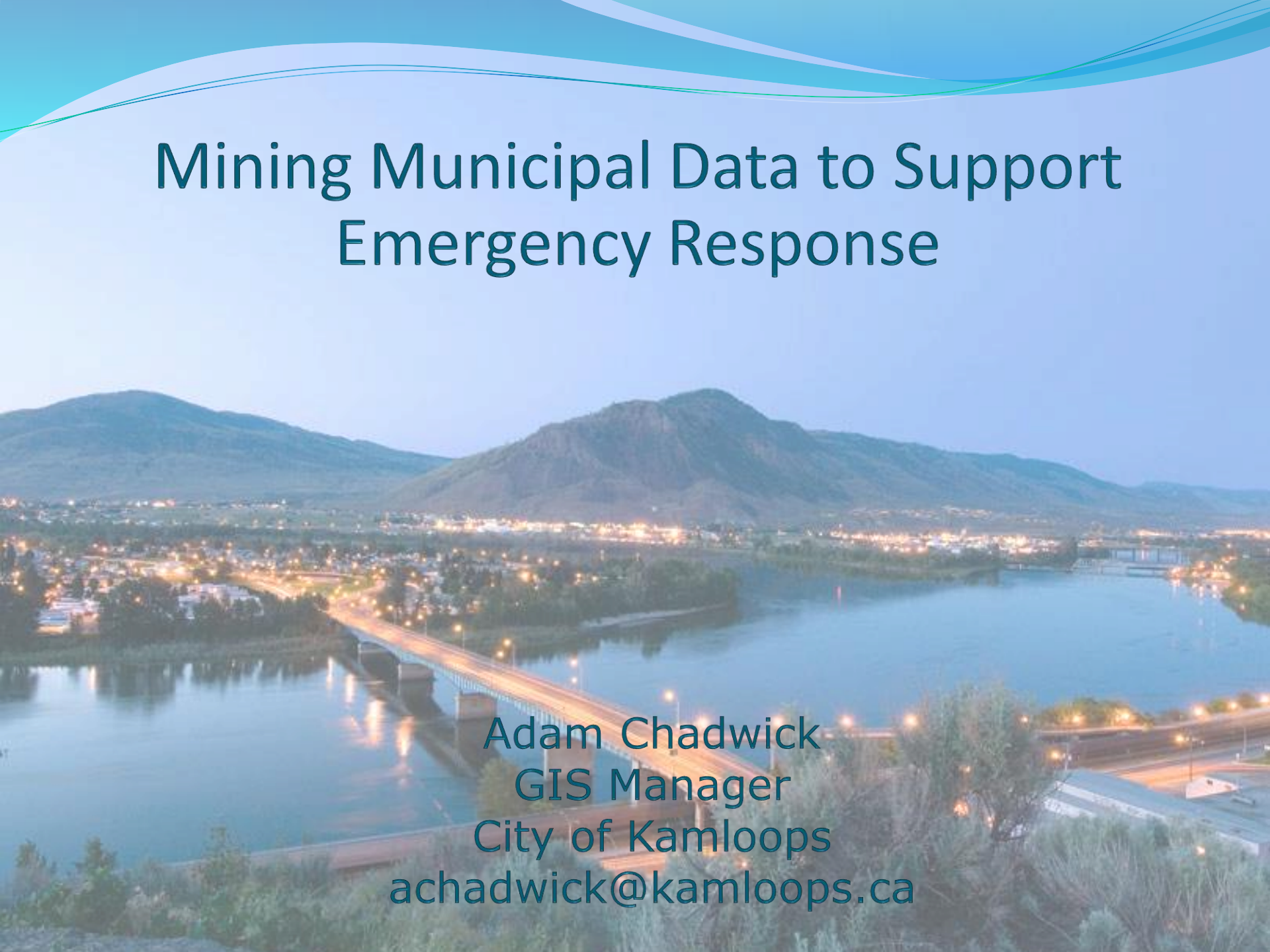
Mining Municipal Data to Support Emergency Response



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Overview

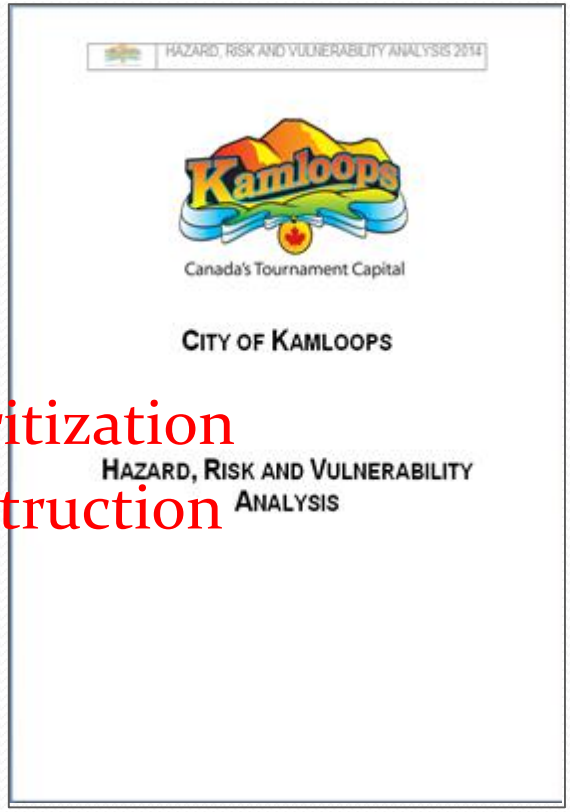
- GIS for Emergency Operations Centre (EOC) Support
  - Flood Mitigation
    - Infrastructure preparation
    - Flood controls
  - Evacuation population prediction

Municipal Emergency Response

- Municipal EOC supports the on-site Incident Commander (Fire & Rescue, RCMP, Environment, Health, etc)
- EOC provides or facilitates provision of:
  - Materiel – provisioning of equipment and supplies
  - Human resources – field staff, specialists, consultants, etc
  - Communications to public/media
  - Planning and predictive services
  - Support to Emergency Support/Social Services (evacuee transportation, housing, food, etc.
- Proactive vs. reactive EOC support

Hazard, Risk and Vulnerability Analysis

- High Likelihood, High Consequence:
- Hazardous Materials Spill
  - Containment and cleanup
  - Evacuation
- Flooding
  - Catch basin seal/unseal list prioritization
  - Temporary river bank berm construction
  - Evacuation
- Wildfire
  - Fire suppression
  - Evacuation

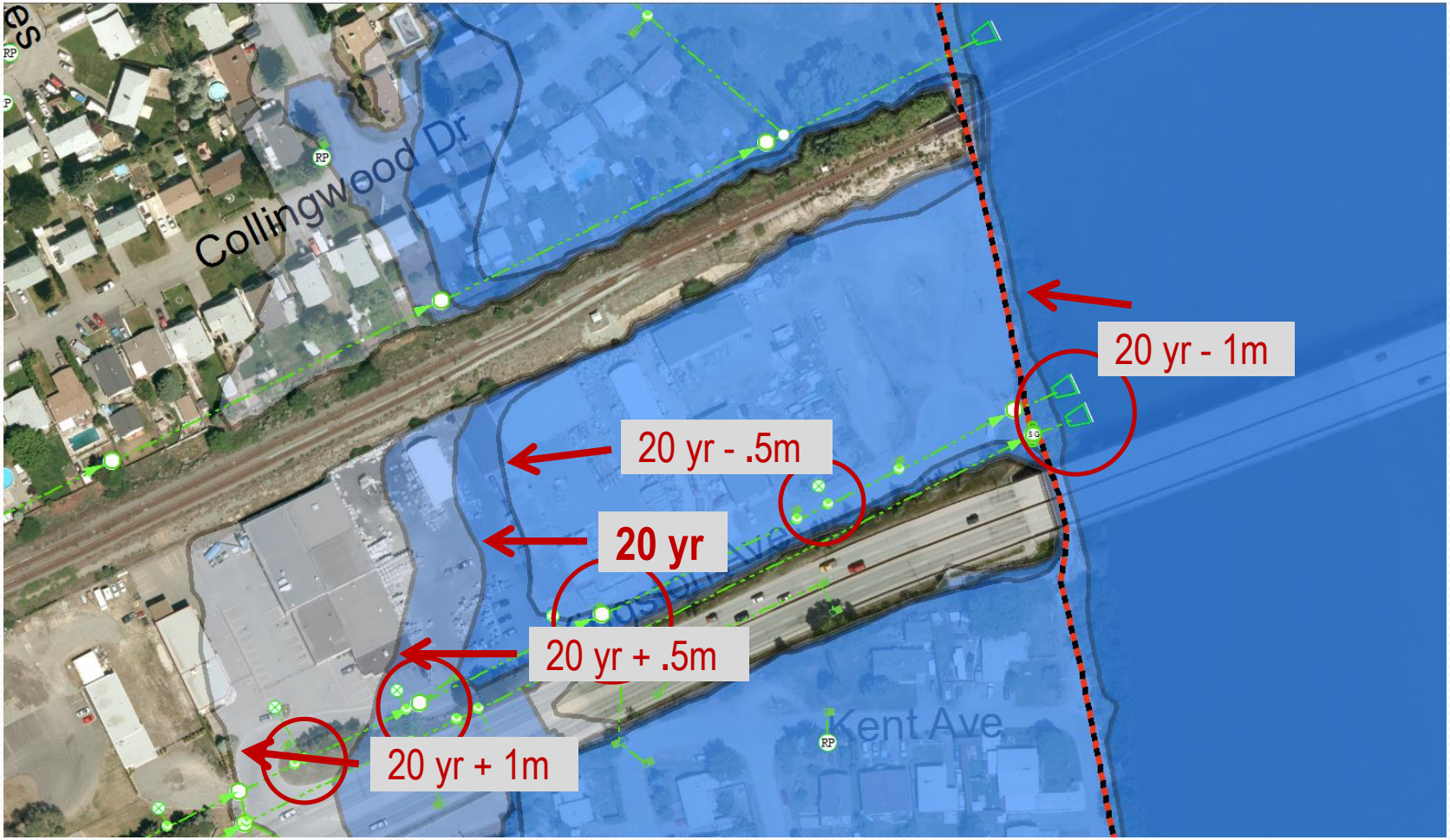


1) Flood Mitigation: Infrastructure Preparation

Catch Basin Seal/Unseal By Elevation Priority

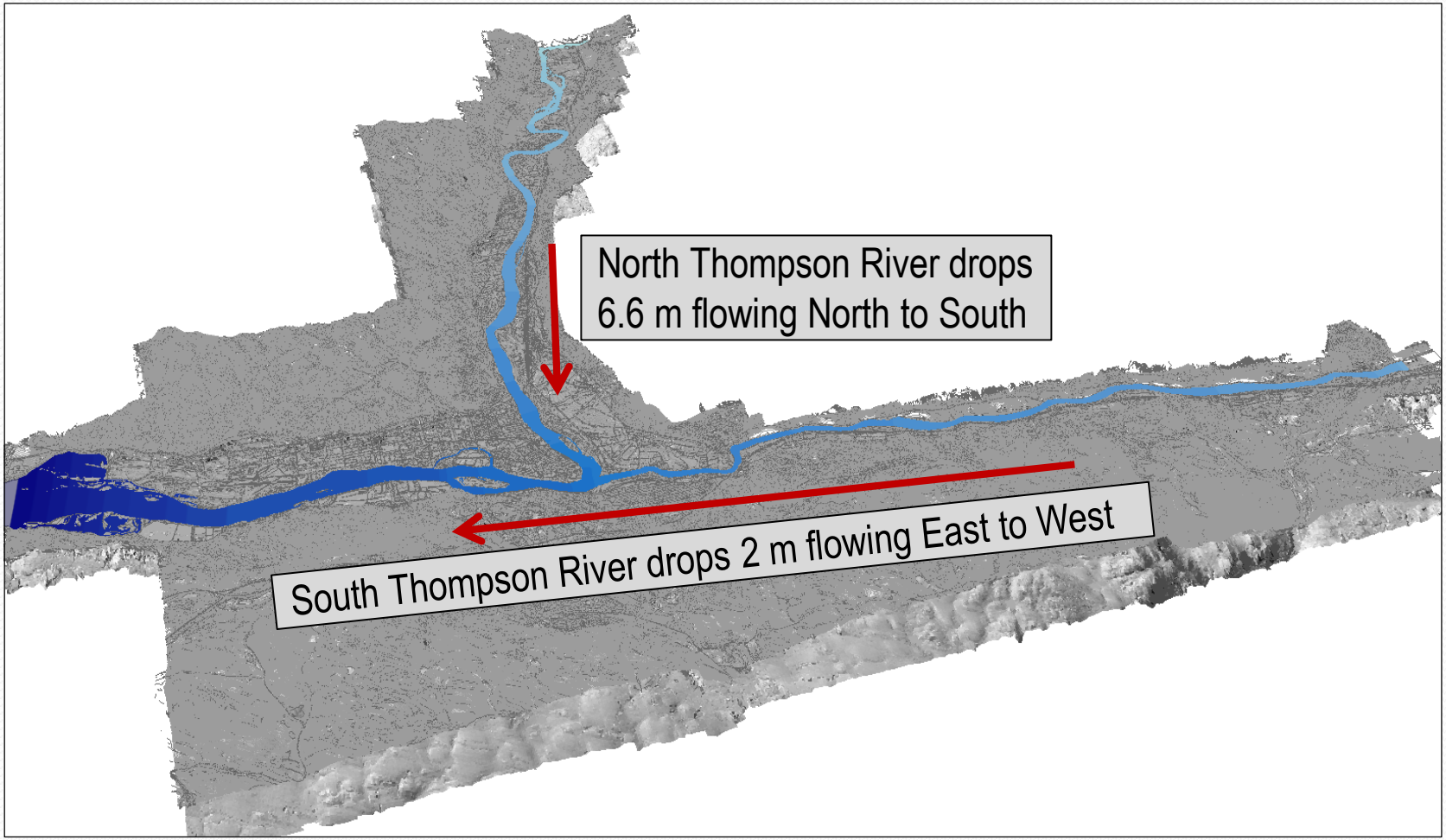
1) Flood Mitigation: Infrastructure Preparation

Catch Basin Seal/Unseal By Elevation Priority



Flood Mitigation: Infrastructure Preparation

Elevation Change Considerations



Flood Mitigation: Infrastructure Preparation

Prioritized Catch Basin Seal Lists

North Shore - 20 Year Floodplain
Catch Basin / Manhole Schedule

Map	Closest Civic Address	FacilityID	Type	CB/MH ID	Rim Elevation	Location Description	Activity
Level Green (340.0m - 342.7m)							
Flood Level Group: 341.50							
TRANQUILLE4							
17	245 CLAPPERTON RD	DCB1651	CB	1677	342.30	In alley behind 245 Clapperton	Seal and Wait
Flood Level Group: 342.00							
TRANQUILLE1							
14	797 POWELL PL	DMH2771	MH	1467	342.72	On corner of Kenora and MacKenzie Ave	Seal and Wait
Flood Level Group: 342.50							
BROCK1							
12	1404 WATERLOO PL	DCB3806	CB	3872	343.40	Waterloo Pl, at start of Cul-de-sac	Seal and Wait
12	1433 WATERLOO PL	DMH1963	MH	1485	343.21	In cul-de-sac	Seal and Wait
12	1447 WATERLOO PL	DCB4213	CB	4284	343.10	Waterloo Pl, In Cul-de-sac	Seal and Wait
MCARTHUR1							
12	1525 ISLAND PKY	DCB12549	CB	12549	343.12	On Grass North of Soccer Clubhouse	Seal and Wait
15	1525 ISLAND PKY	DCB3156	CB	3213	343.20	McArthur Island Park/Norbrook Stadium	Seal and Wait
SCHUBERT3							
20	1316 HAMILTON ST	DCB5281	CB	5141	344.00	Cornwall Street , 1302	Seal and Wait
20	1143 SCHUBERT DR	DCB1999	CB	2032	342.90	Kemano Street/Lane Tideflex Installed	Seal and Wait
WESTMOUNT1							
22	745 WALKEM RD	DCB13910	CB	13910	344.40	Westmount Elementary School Field SE corner	8" Air Plug

Flood Mitigation: Infrastructure Preparation

Data Required:

- Multiple floodplains (20 yr plus 4 additional levels)
- Digital Elevation Model & contours
- Catch basin locations
- Logical location group areas (to group nearby catch basins for field crew efficiencies)

2) Flood Mitigation: Flood Controls

Temporary River Bank Berm Construction

Flood Mitigation: Flood Controls

Optimal Locations for Temporary River Bank Berms

- Objective: To determine the most appropriate location to construct temporary berms
  - Location:
    - City owned land – properties, roads, river banks, rights of way, etc
    - Location is accessible-enough for equipment to build berms
    - Lowest locations where flooding will occur (at a given river level)
    - Allows for berming to high ground at each end of berms

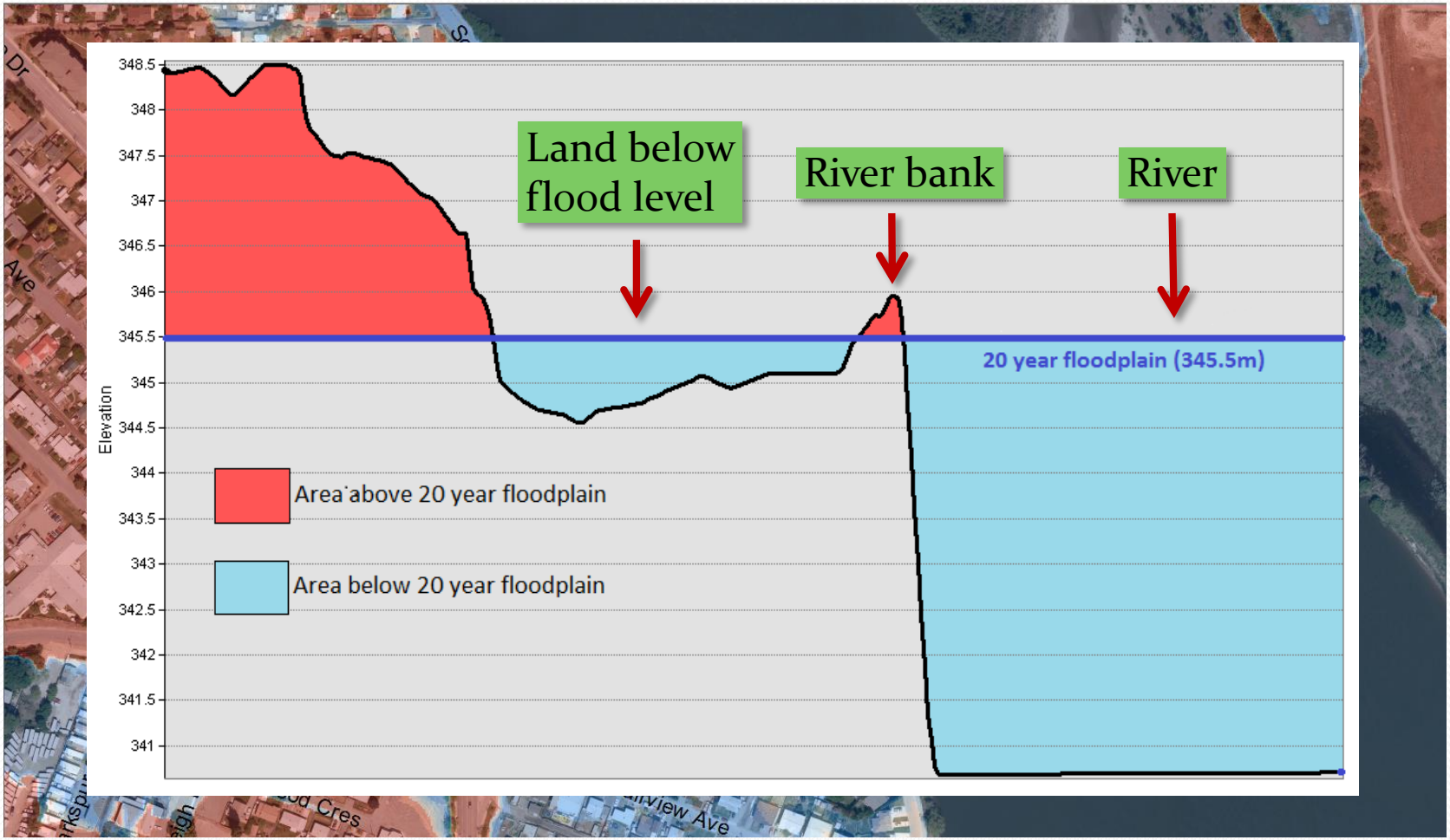
Flood Mitigation: Flood Controls

Merging Berms and Floodplains

- Berm locations and elevations entered into GIS
  - Answers: is a berm above/below 20 yr and by how much?
- Berms then merged into the Digital Elevation Model ground surface and then compared to the 20 yr floodplain
  - Answers: which berms to build given a particular projected flood level?

Flood Mitigation: Flood Controls

Berms and Flood Boundaries



Flood Mitigation: Flood Controls

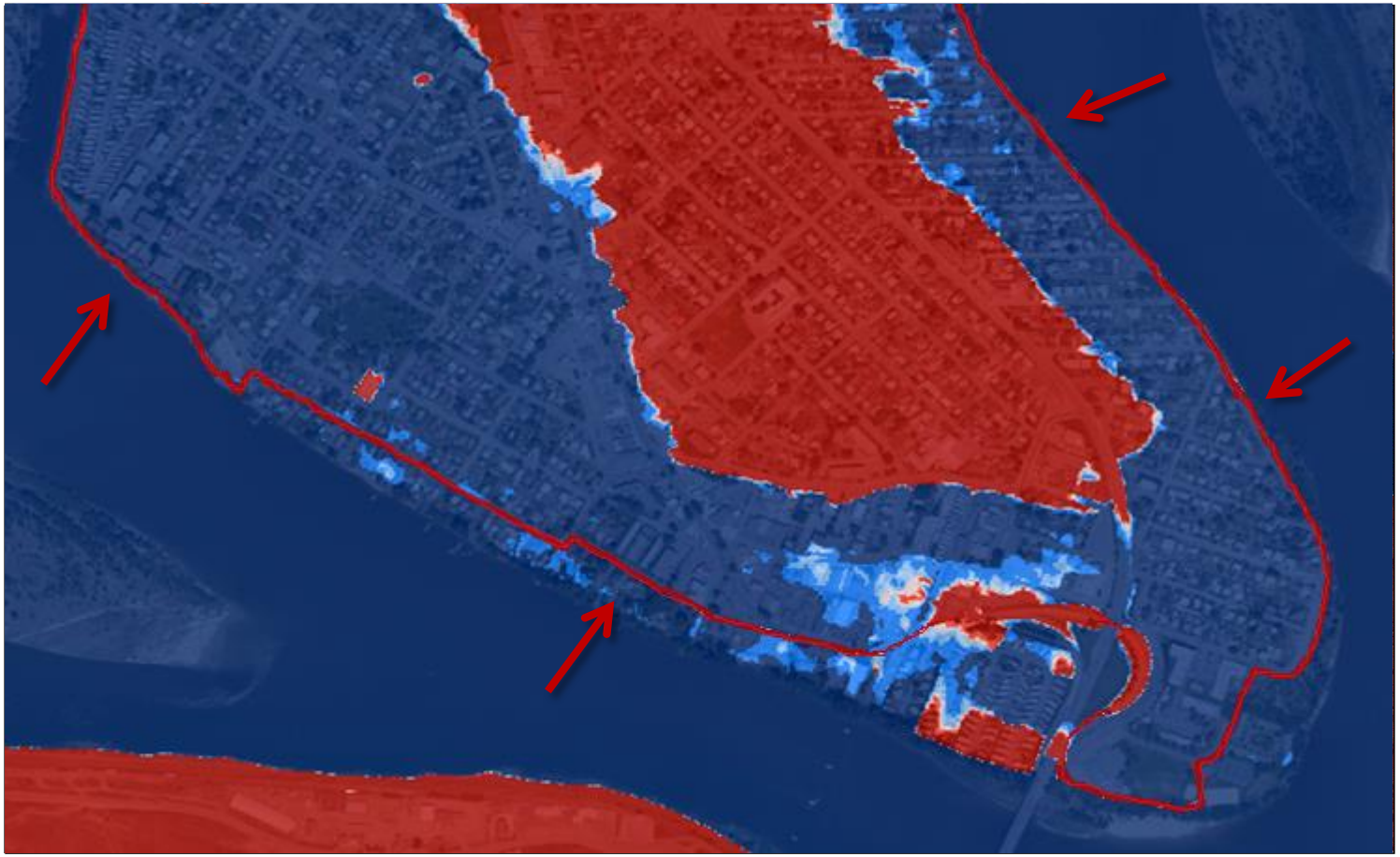
Berms and Flood Boundaries

Flood Mitigation: Flood Controls

10cm Increment Floodplains to 200 yr Level

Flood Mitigation: Flood Controls

10cm Increment Floodplains to 200 yr Level



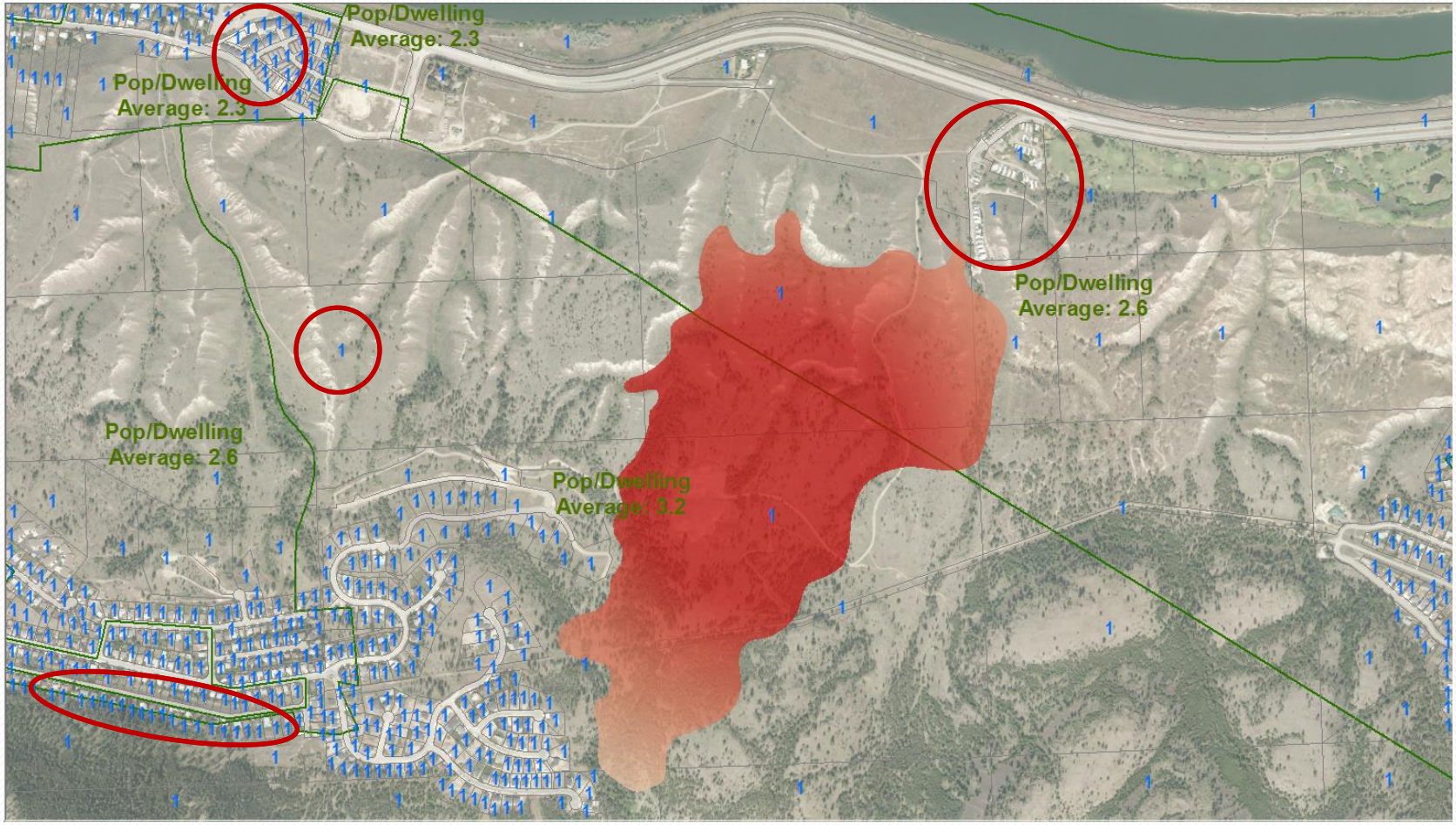
Flood Mitigation: Flood Controls

Data Required:

- Multiple floodplains (20 yr plus 4 additional levels) - for initial berm locating
- River bank berms (projected)
- Digital Elevation Model surface
- 20 yr floodplain surface
- Flood surface (result of subtracting DEM surface from 20 yr floodplain surface)

3) Evacuation: Population Prediction

Property-Based Population Calculation: Basic Calculation



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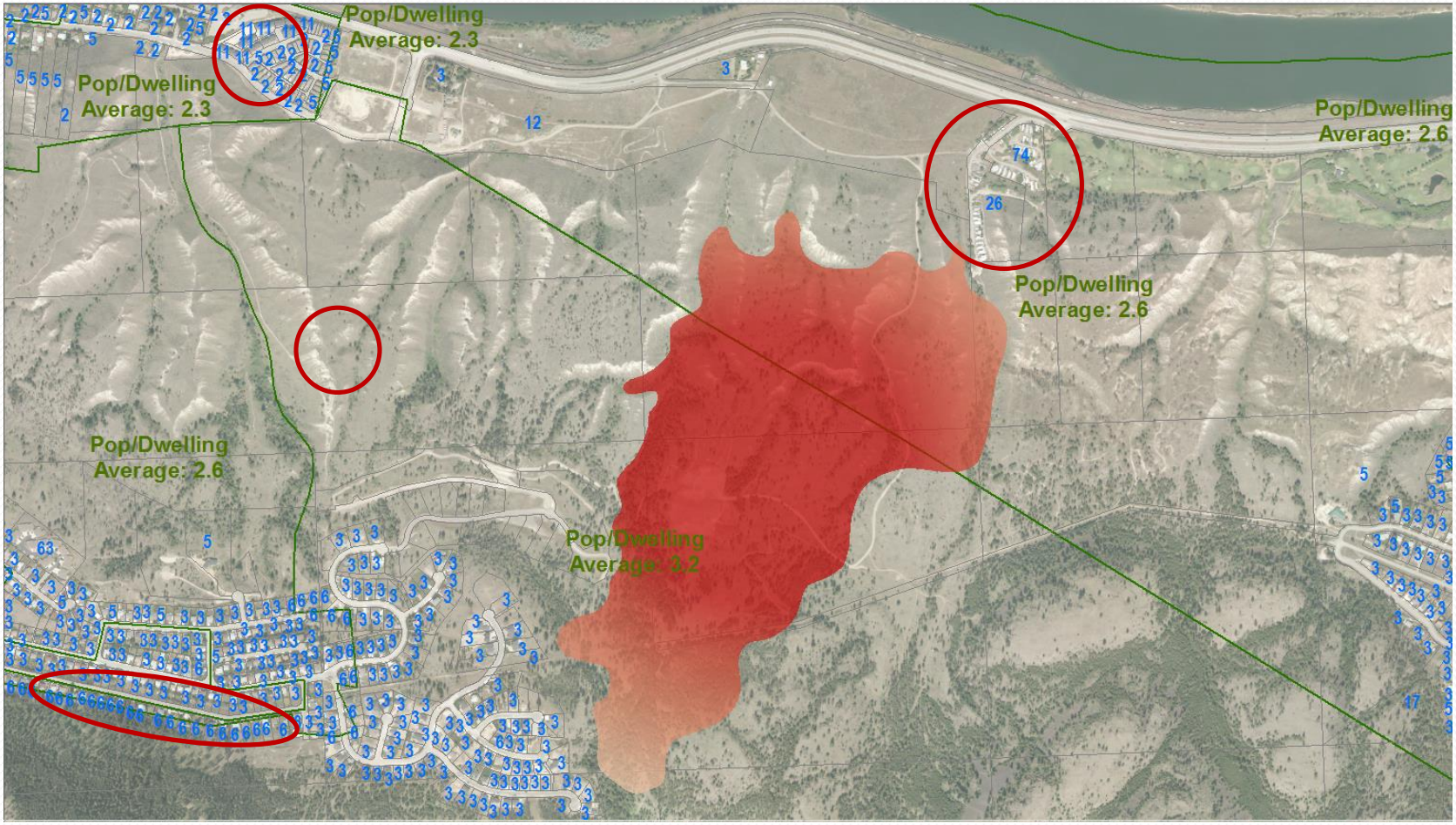


Evacuation: Population Prediction

Property-Based Population Calculation: Basic Calculation

1) Census based population assignment:

- Spatial intersection of properties with residential zones
- Spatial intersection of properties with buildings
  - Retain only those with assessed improvements > $25,000
- Calculate dwelling units/property
  - Dwelling count set to 1 (single family dwellings, bare land stratas), 2 if dwelling has a basement suite
  - Dwelling count set to sum of folios/property (stratas, mobile home parks)
  - Dwelling count set to # of units from business licences (apartment buildings, duplex/triplex/fourplex)
    - Reduce dwelling count by vacancy rate
- Spatial intersection of property with census dissemination areas
- Calculate population = dwelling units * census population/dwelling avg

Evacuation: Population Prediction

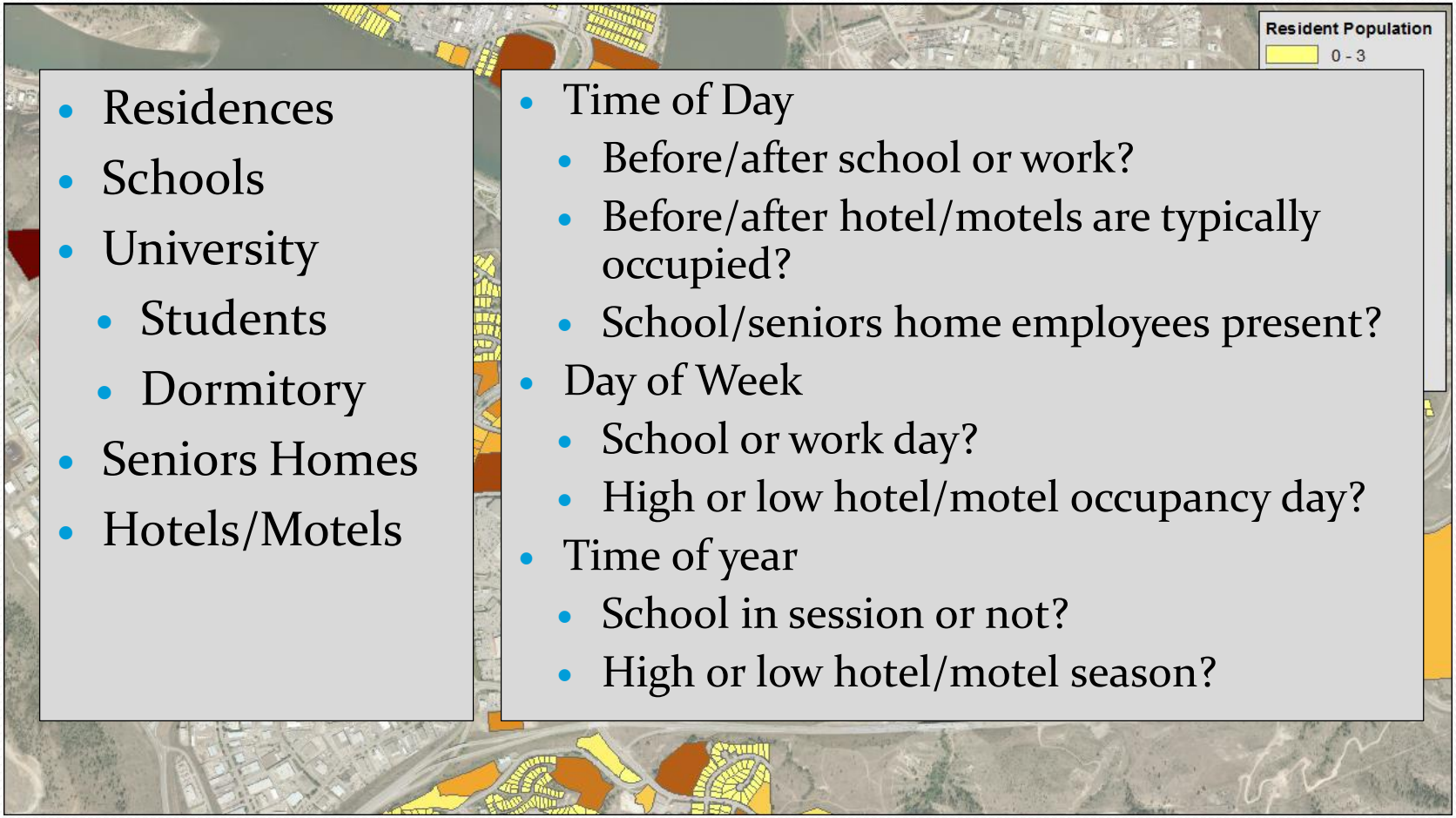
Property-Based Population Calculation: Basic Calculation

2) Site specific population assignment:

- Sites
  - Schools
  - University
  - Seniors homes
  - Hotels/Motels
  - ~~Businesses~~
- Spatial intersection with properties to assign population
- Assign population type to properties (school, seniors home, etc)

Evacuation: Population Prediction

Property-Based Population Calculation: Time-Based Calculation

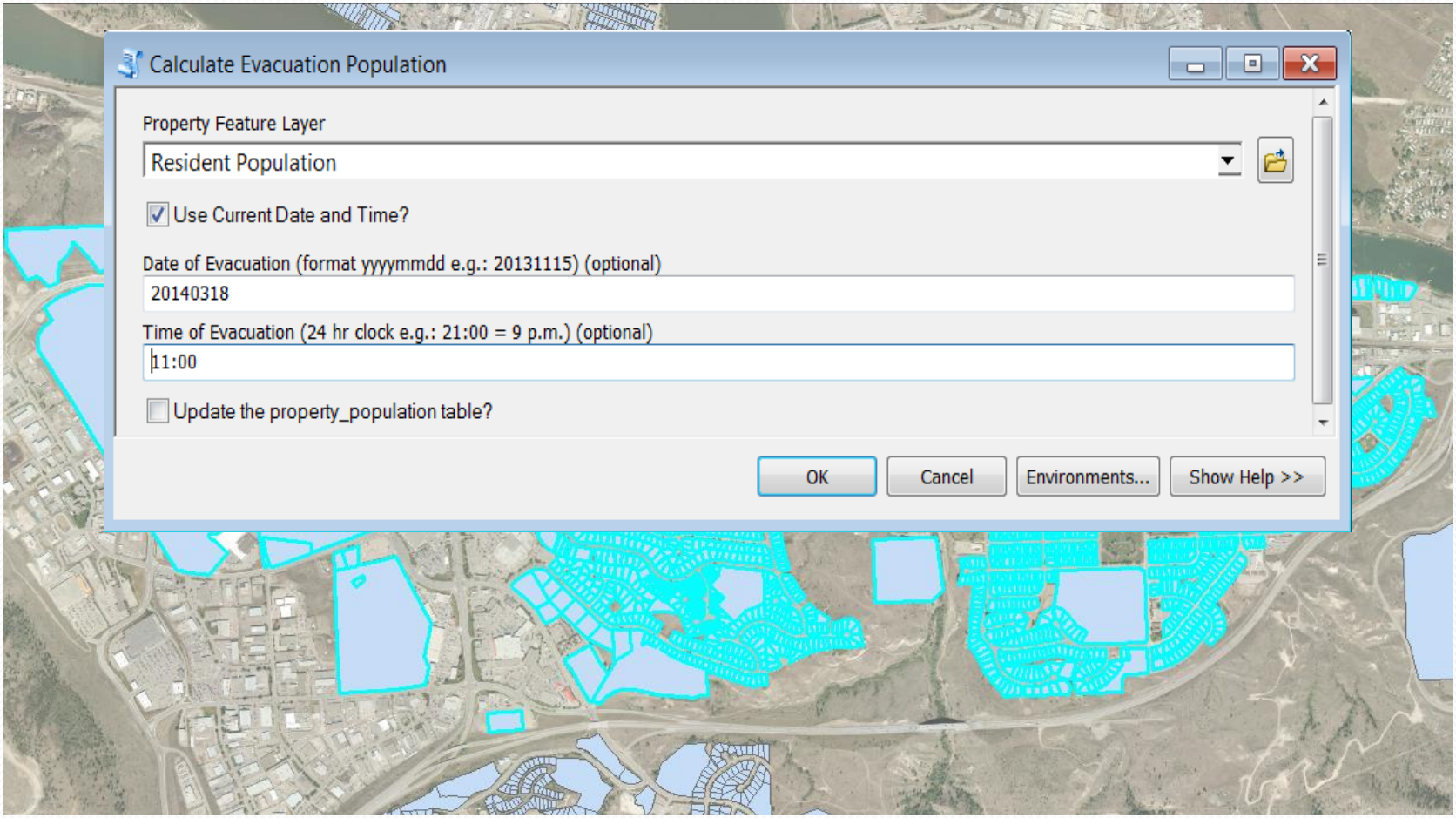


- Residences
- Schools
- University
  - Students
  - Dormitory
- Seniors Homes
- Hotels/Motels

- Time of Day
  - Before/after school or work?
  - Before/after hotel/motels are typically occupied?
  - School/seniors home employees present?
- Day of Week
  - School or work day?
  - High or low hotel/motel occupancy day?
- Time of year
  - School in session or not?
  - High or low hotel/motel season?

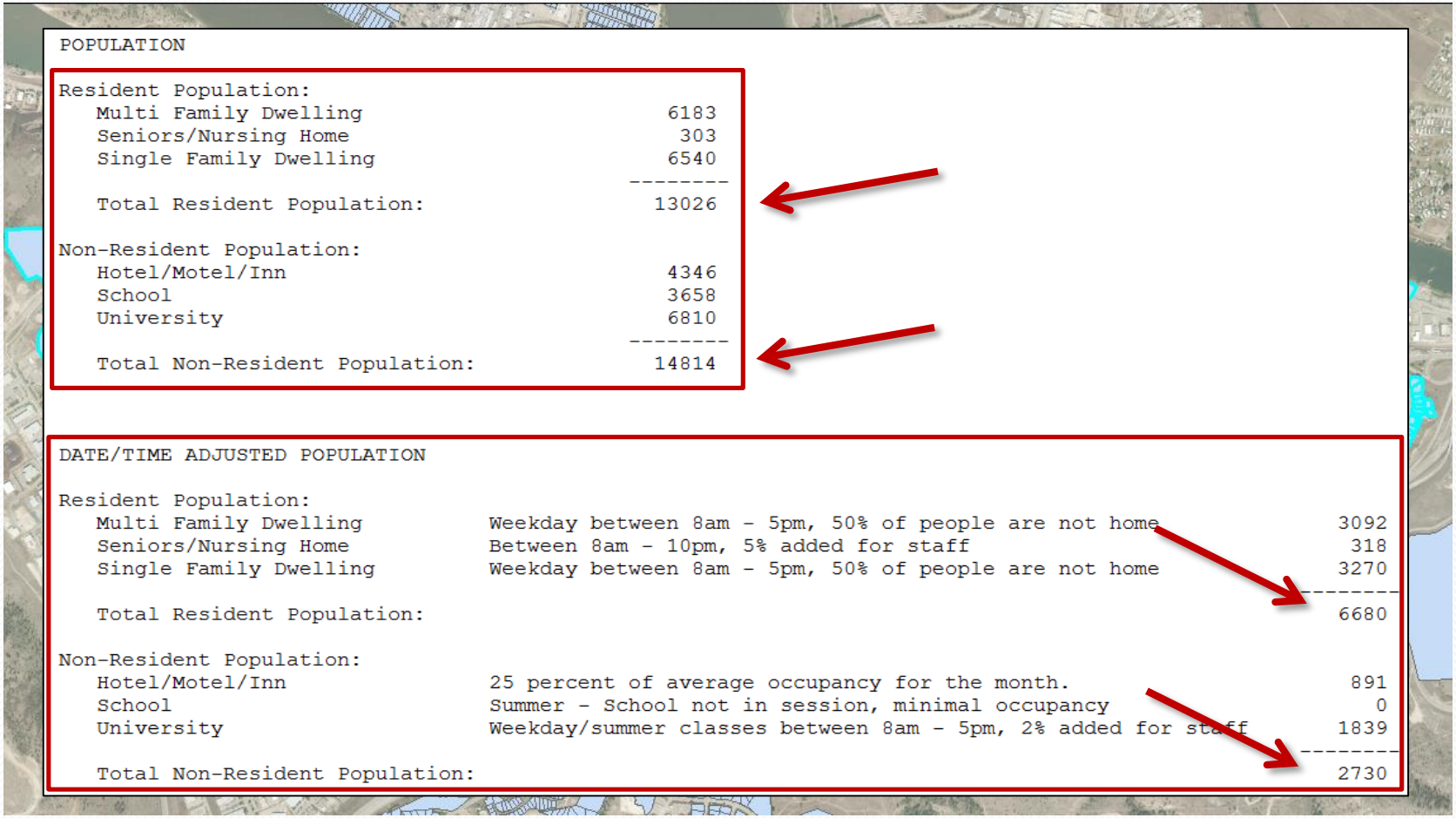
Evacuation: Population Prediction

Property-Based Population Calculation: Time-Based Calculation



Evacuation: Population Prediction

Property-Based Population Calculation: Time-Based Calculation



POPULATION

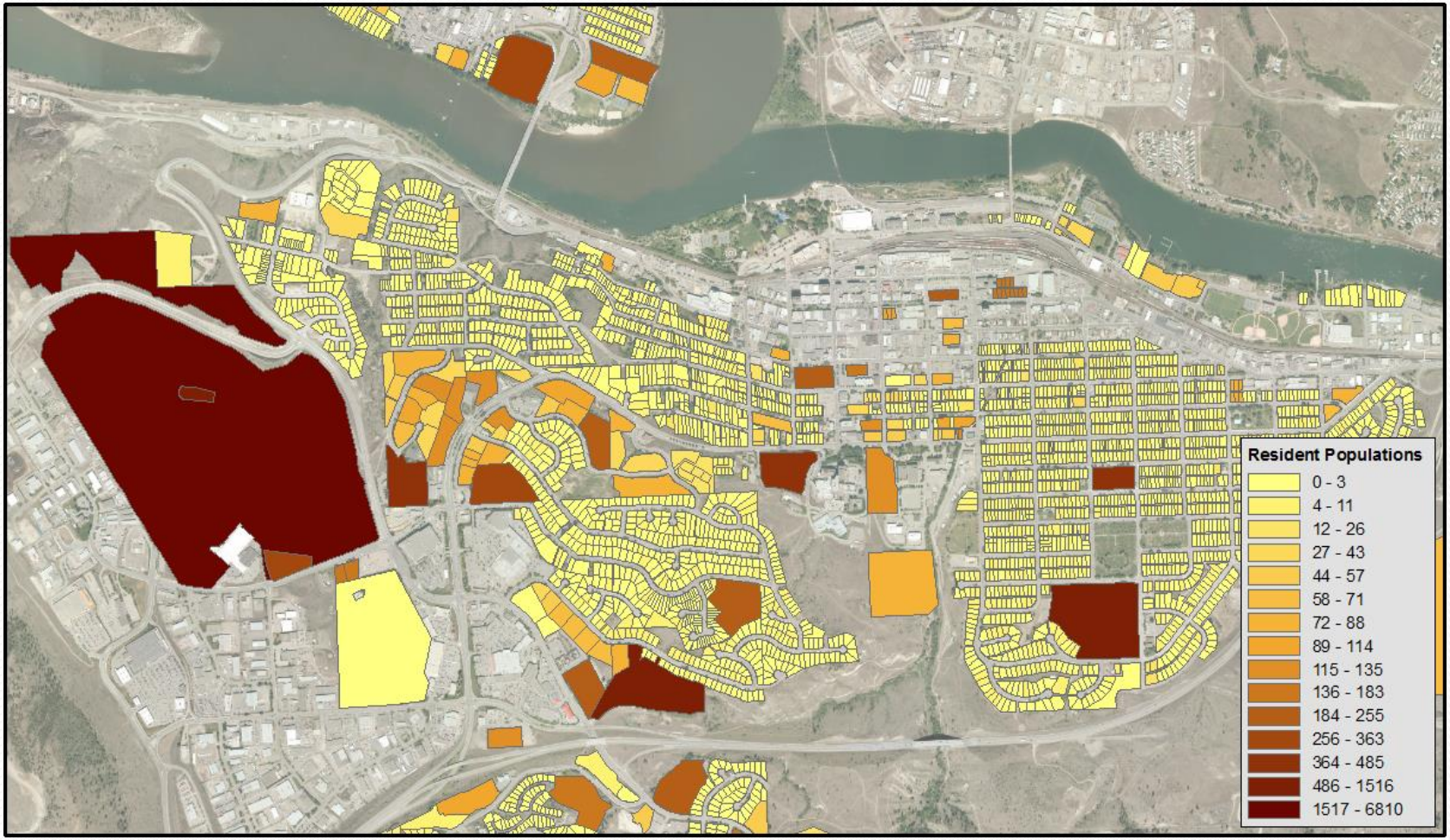
Resident Population:	
Multi Family Dwelling	6183
Seniors/Nursing Home	303
Single Family Dwelling	6540
Total Resident Population:	13026
Non-Resident Population:	
Hotel/Motel/Inn	4346
School	3658
University	6810
Total Non-Resident Population:	14814

DATE/TIME ADJUSTED POPULATION

Resident Population:		
Multi Family Dwelling	Weekday between 8am - 5pm, 50% of people are not home	3092
Seniors/Nursing Home	Between 8am - 10pm, 5% added for staff	318
Single Family Dwelling	Weekday between 8am - 5pm, 50% of people are not home	3270
Total Resident Population:		6680
Non-Resident Population:		
Hotel/Motel/Inn	25 percent of average occupancy for the month.	891
School	Summer - School not in session, minimal occupancy	0
University	Weekday/summer classes between 8am - 5pm, 2% added for staff	1839
Total Non-Resident Population:		2730

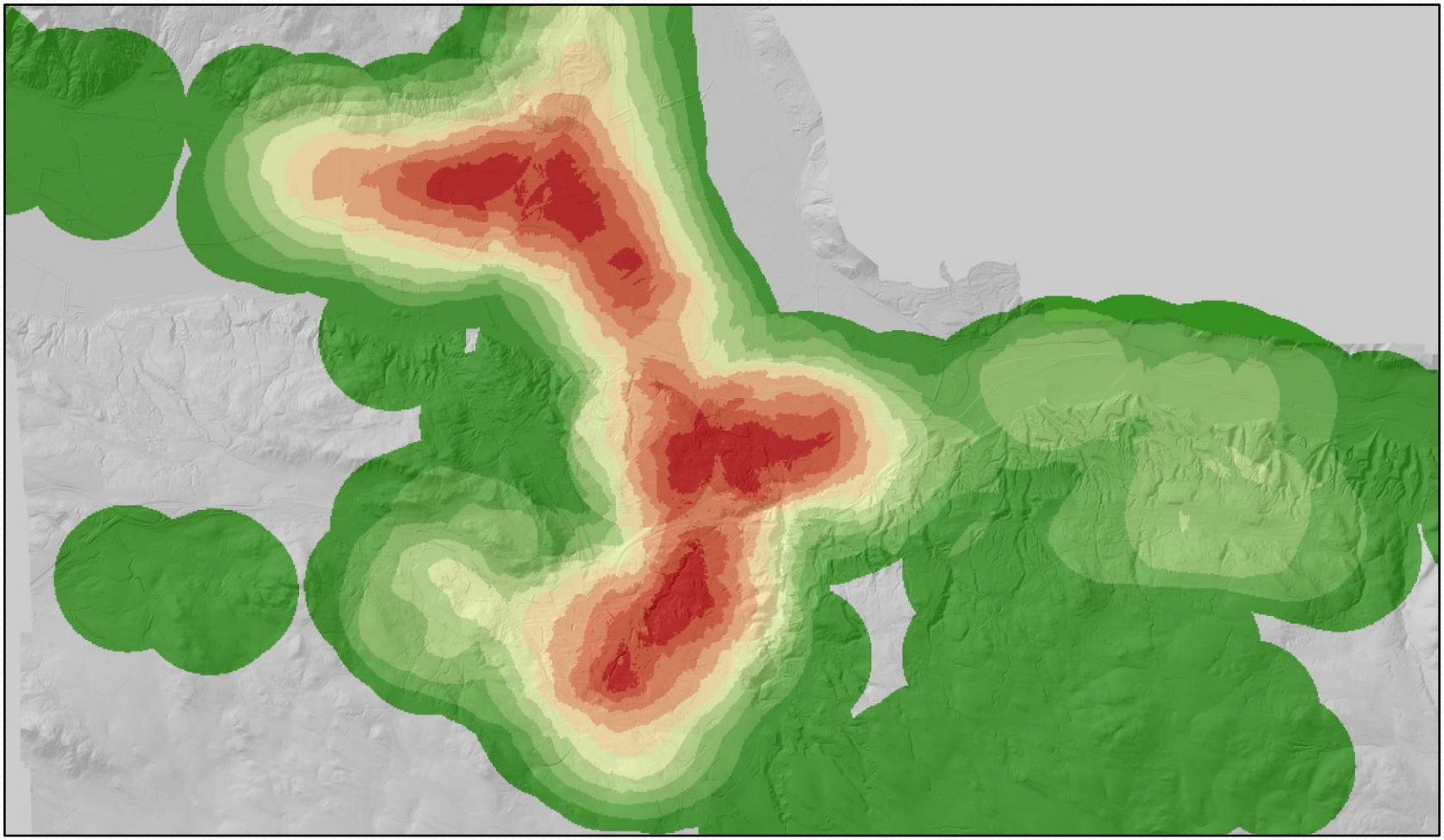
Evacuation: Population Prediction

Population Visualization: Thematic



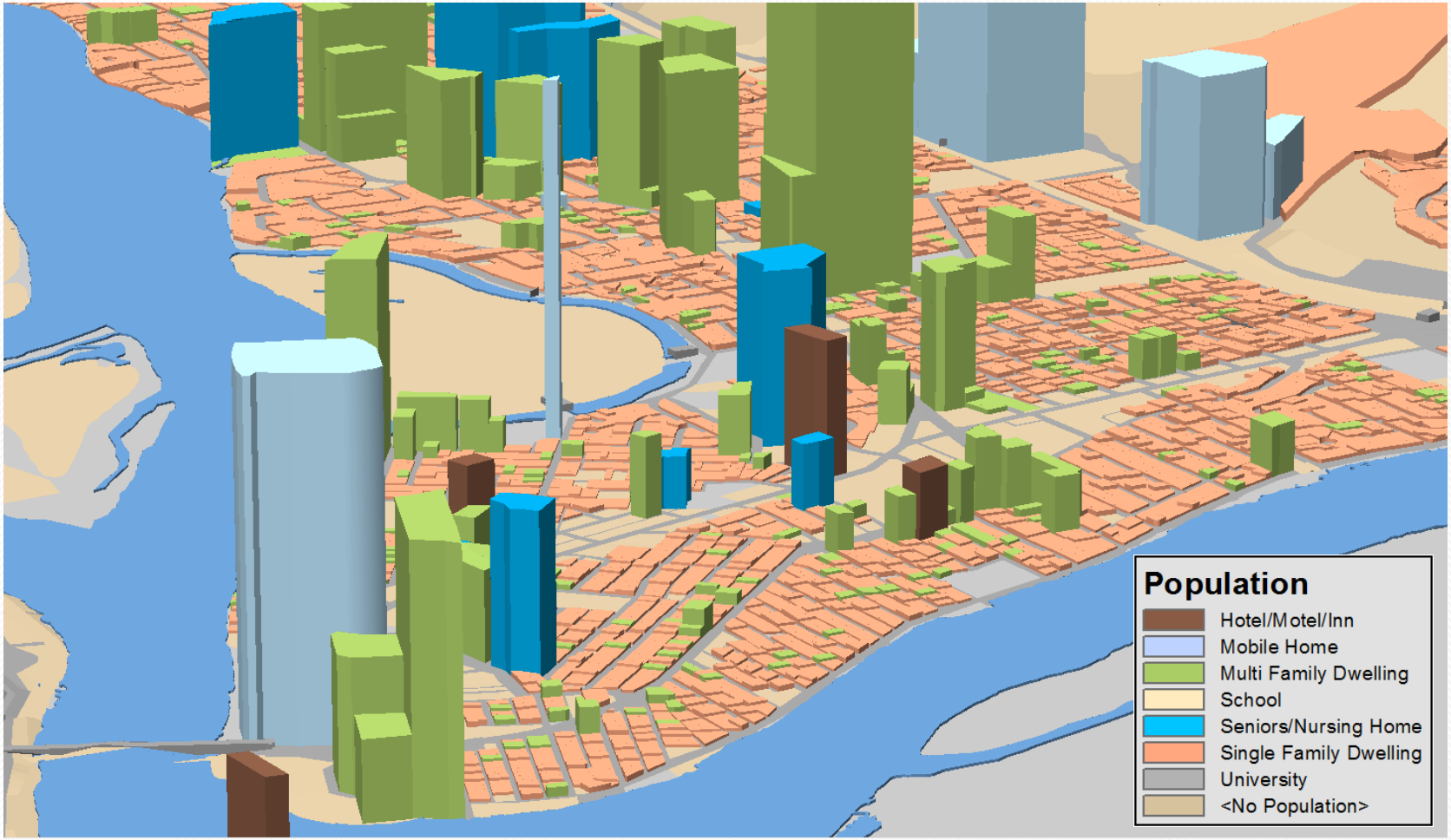
Evacuation: Population Prediction

Population Visualization: Density



Evacuation: Population Prediction

Population Visualization: Extruded Height Surface



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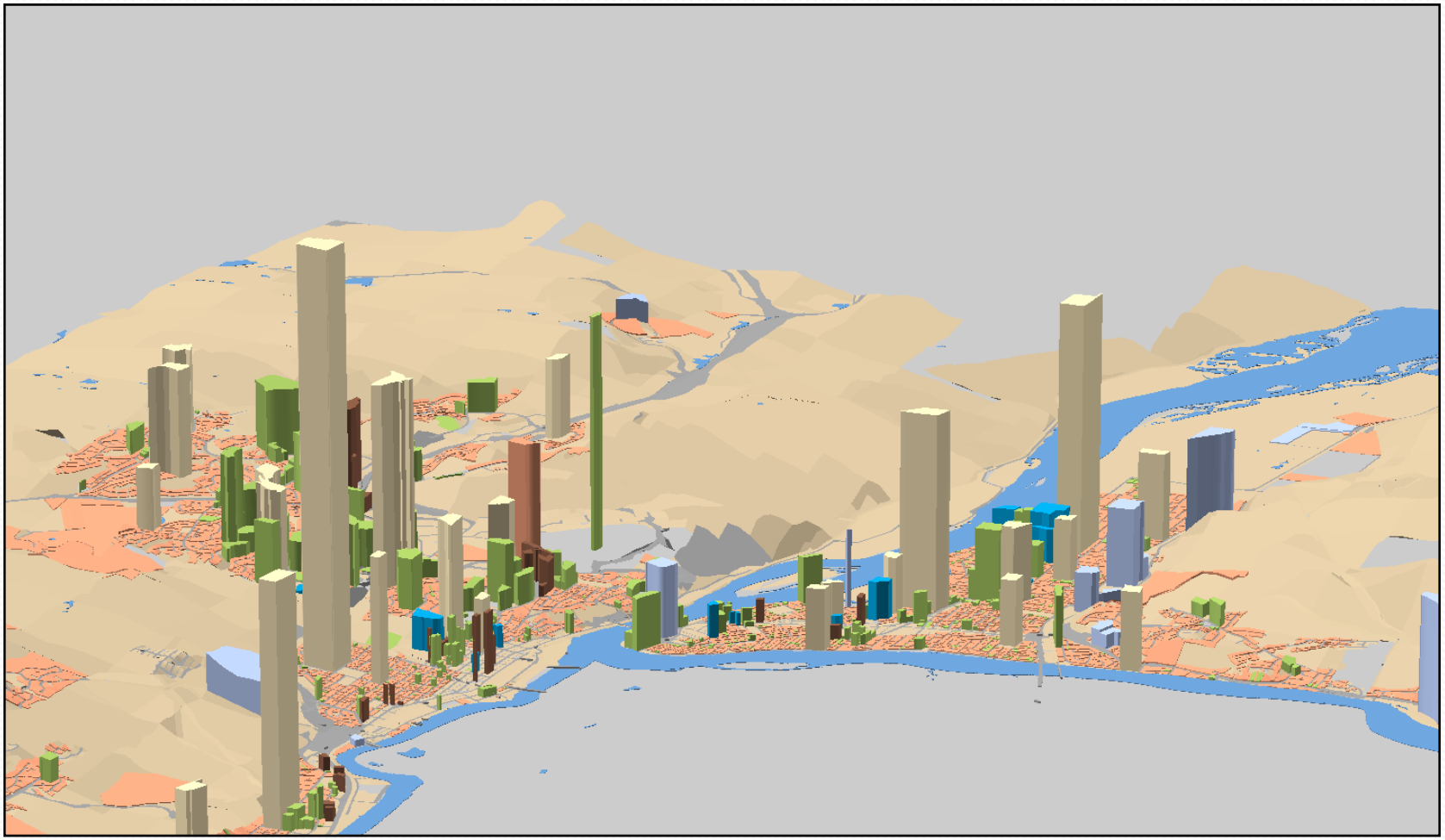
Population Visualization: Extruded Height Surface



Evacuation: Population Prediction

Population Visualization: Extruded Height Surface

Evacuation: Population Prediction

Data Required:

- Properties with:
  - Assessment details (dwelling improvements and their value)
  - Basement suites
  - Apartment building dwelling counts
- Specific site locations (schools, seniors homes, hotels/motels, etc.) and their populations
- Census dissemination areas with:
  - Population
  - Dwelling counts
- Zoning areas
- Building outlines
- Residential vacancy rate
- Hotel/motel daily & monthly average occupancies

Mining Municipal Data to Support Emergency Response

Questions?

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