GIS tools to incorporate flood risk, infrastructure and natural capital into planning and decision making

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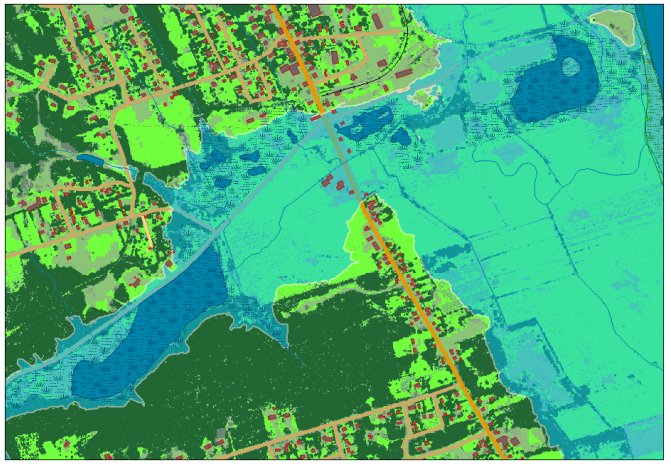
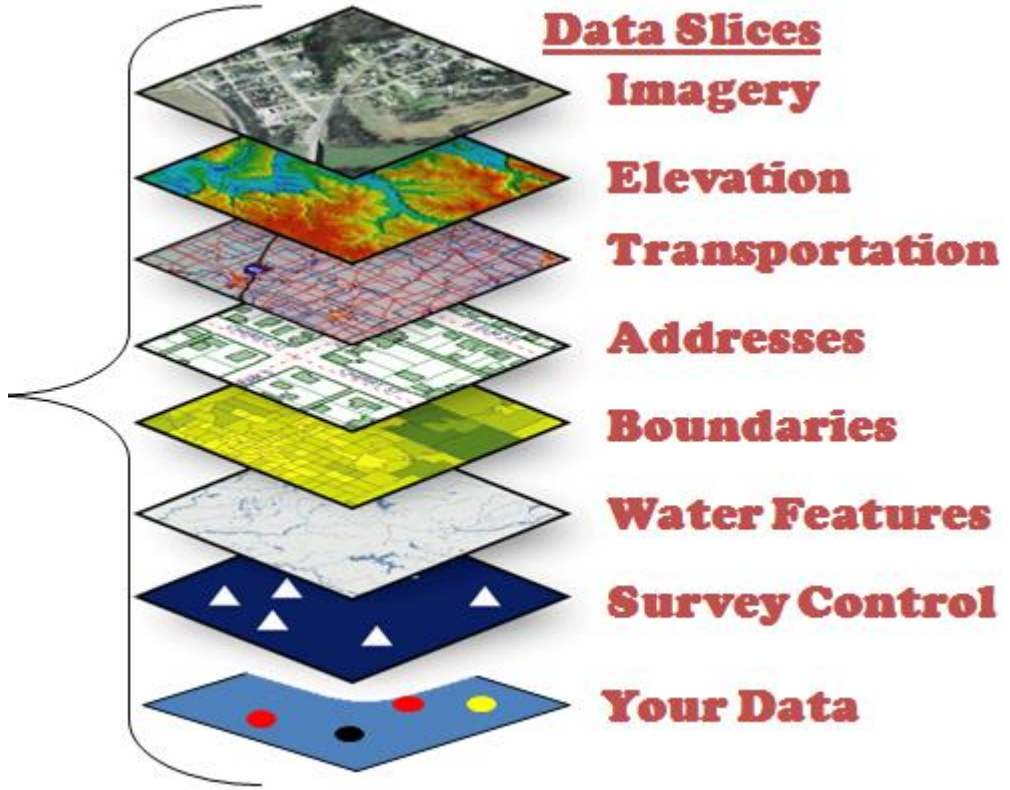
SOUTHEAST Regional Service Commission

Commission de services régionaux SUD-EST



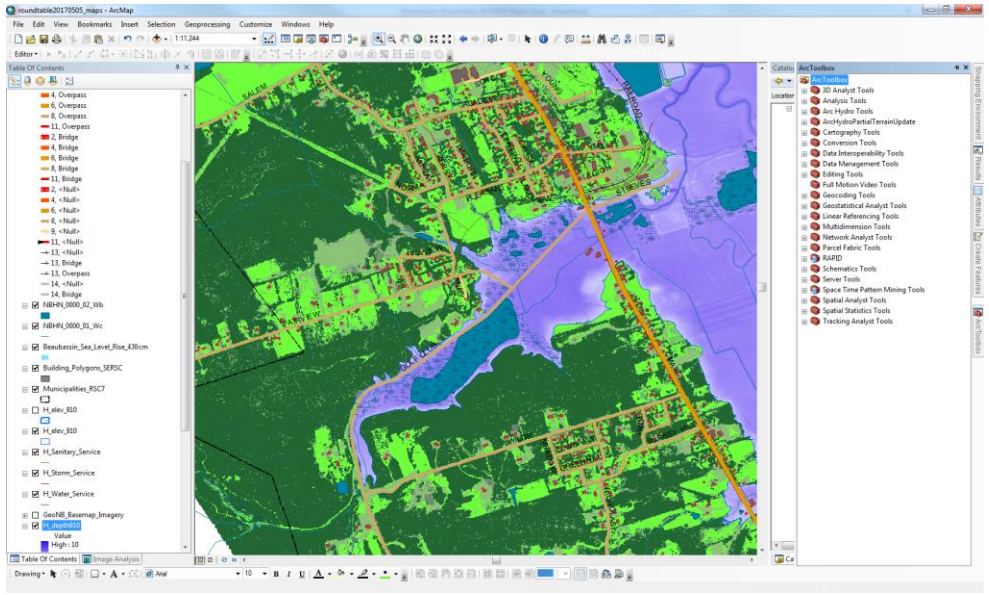
Outline

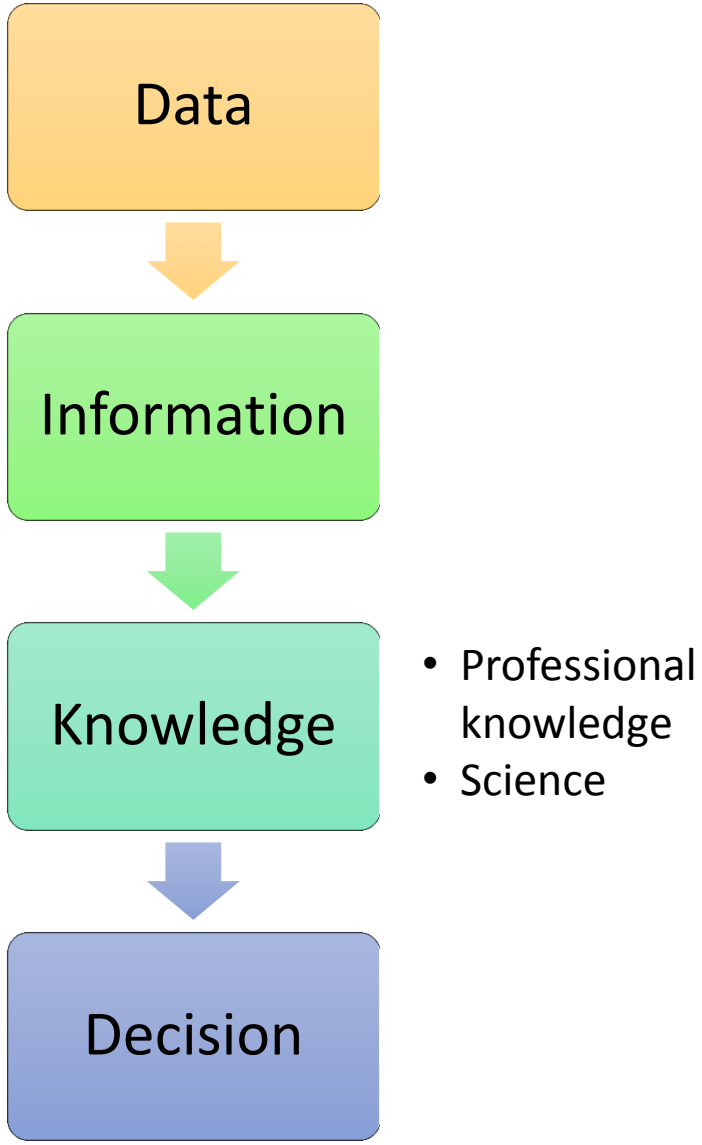
- Inventory – <u>understand & communicate risk</u>
  - Hazard
  - Infrastructure
  - Land use/land cover
- GIS Analysis - <u>to reduce future risk</u>
  - Zoning - minimum height
  - Engineering design
  - Scenario planning & asset management



GIS - enabling good decisions

- Store, manage & display geographic data
- Analysis to inform decisions

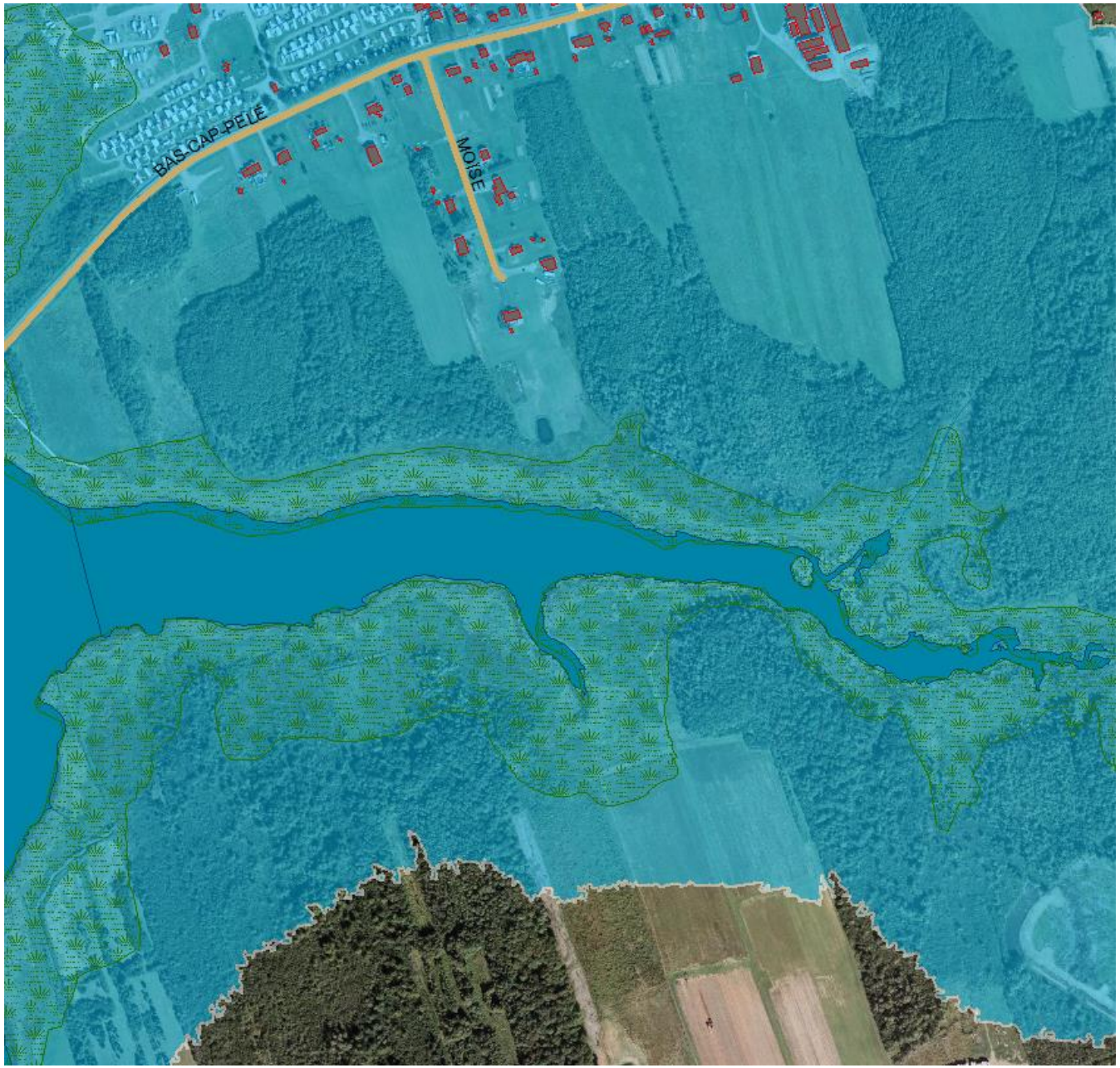




- Professional knowledge
- Science

Flood risk

- Hazard
  - Flood extent
  - Occurrence
- Vulnerability
  - Exposure (buildings, assets, population)
  - Susceptibility
  - Resiliency
    - During
    - After



Flood risk

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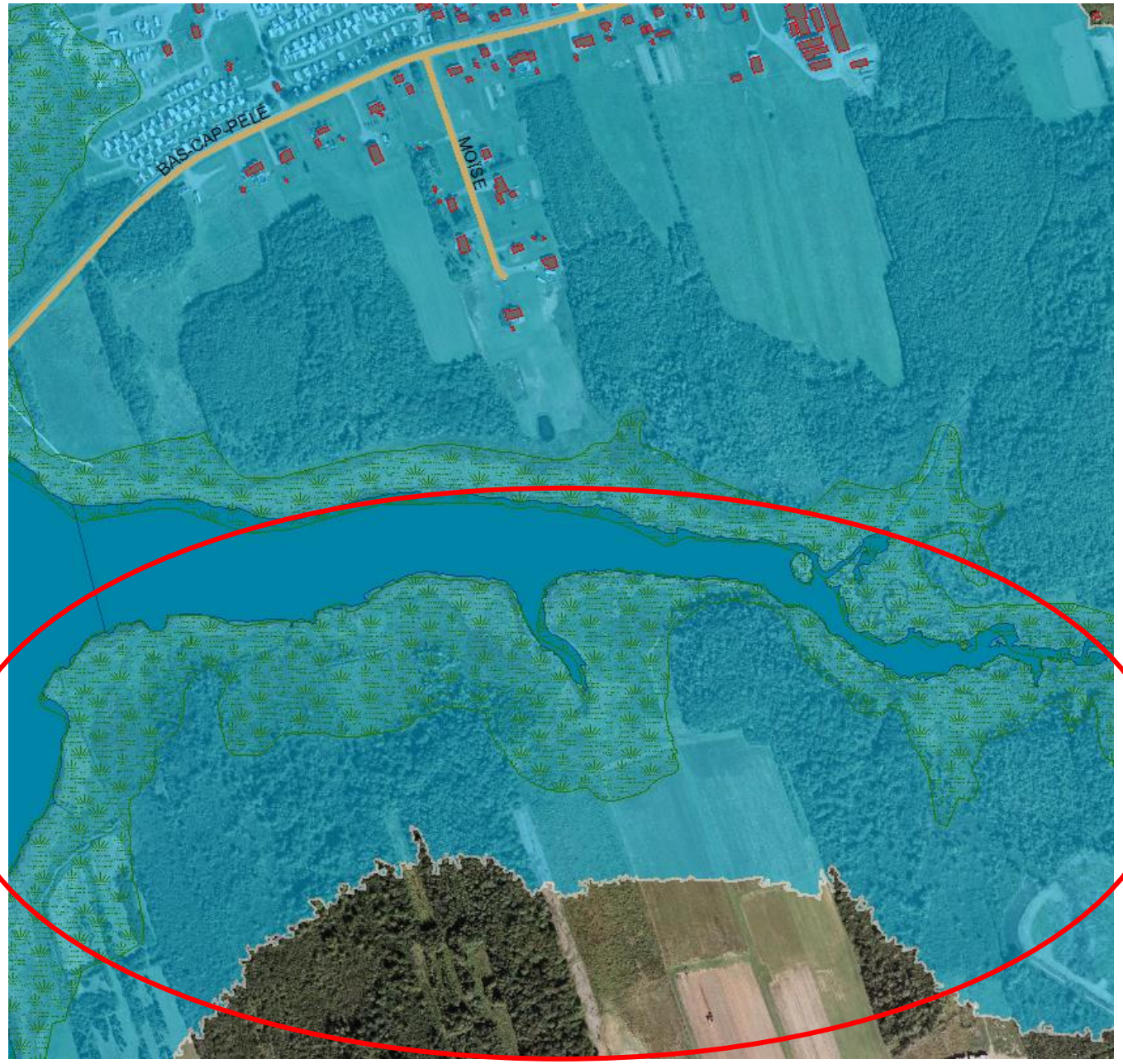
    - After



Flood risk

- Hazard
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  - Susceptibility
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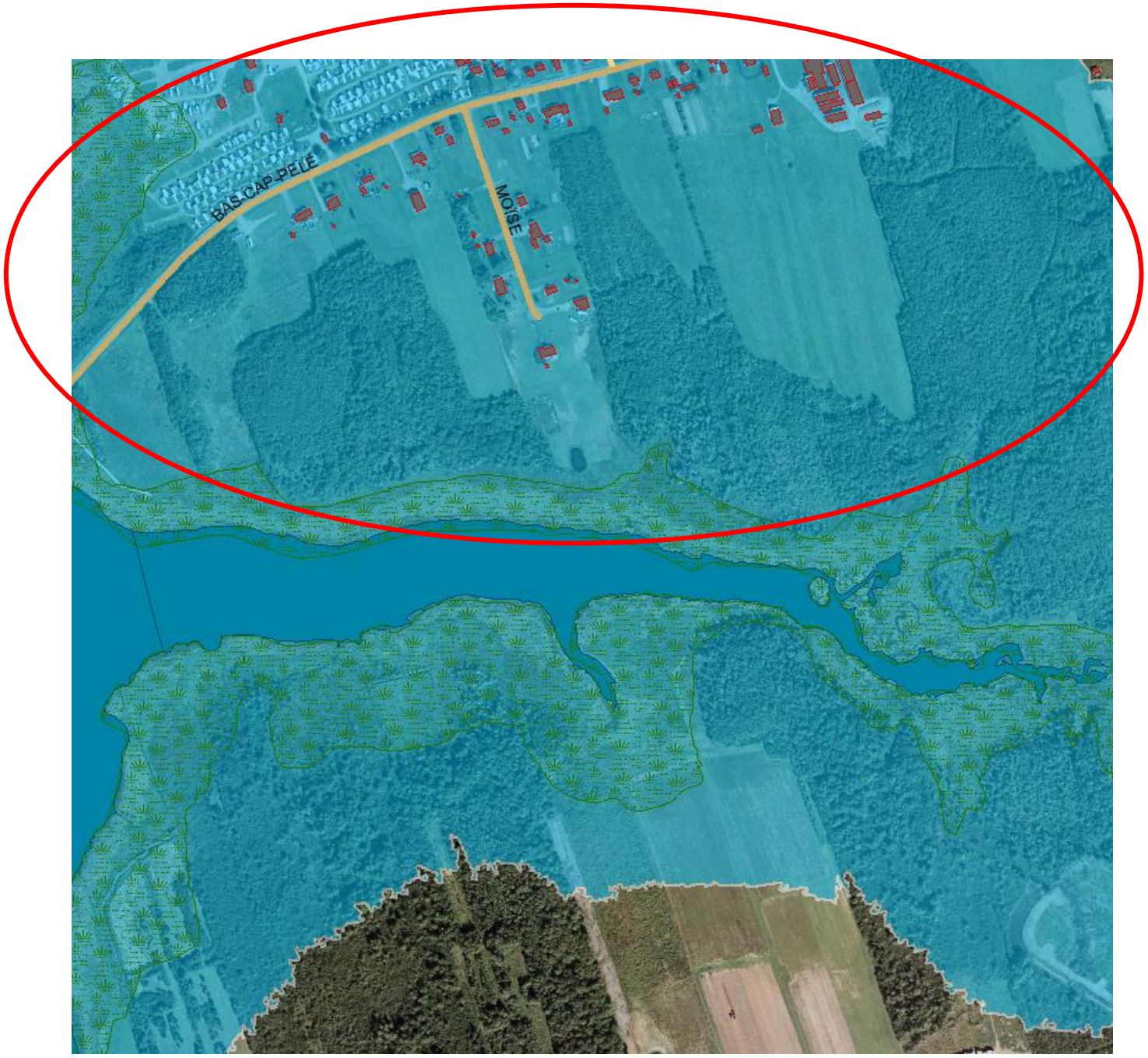
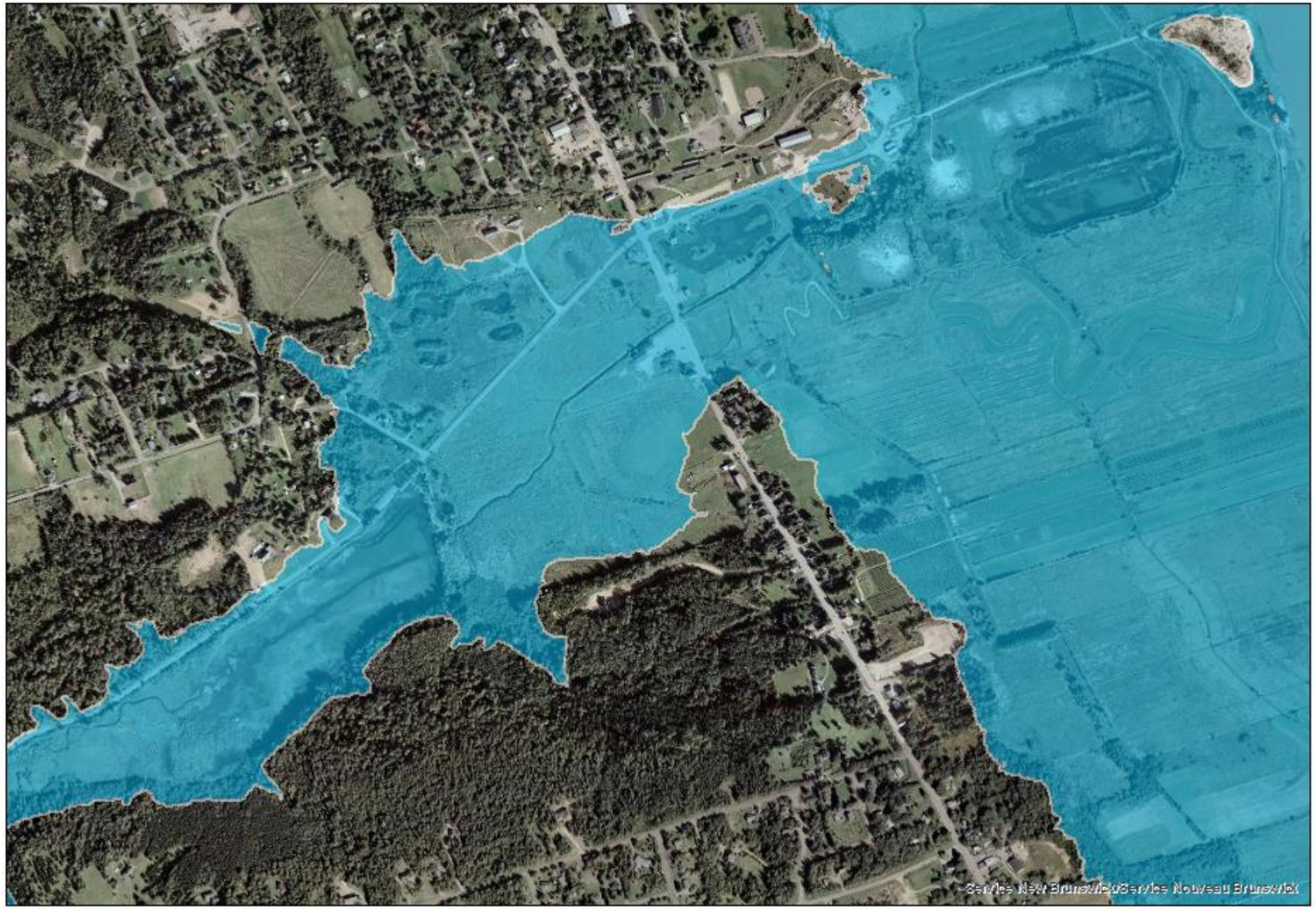


Inventory

- Map hazard
  - Floodway
  - Flood fringe
- Map features that reduce hazard
  - Grey infrastructure (dykes, storm water)
  - Green infrastructure
  - Natural areas (wetlands, forests)
- Map exposure and susceptibility
  - Buildings
  - Infrastructure (roads, culverts)

Flood hazard - 1% annual chance of flooding, year 2100

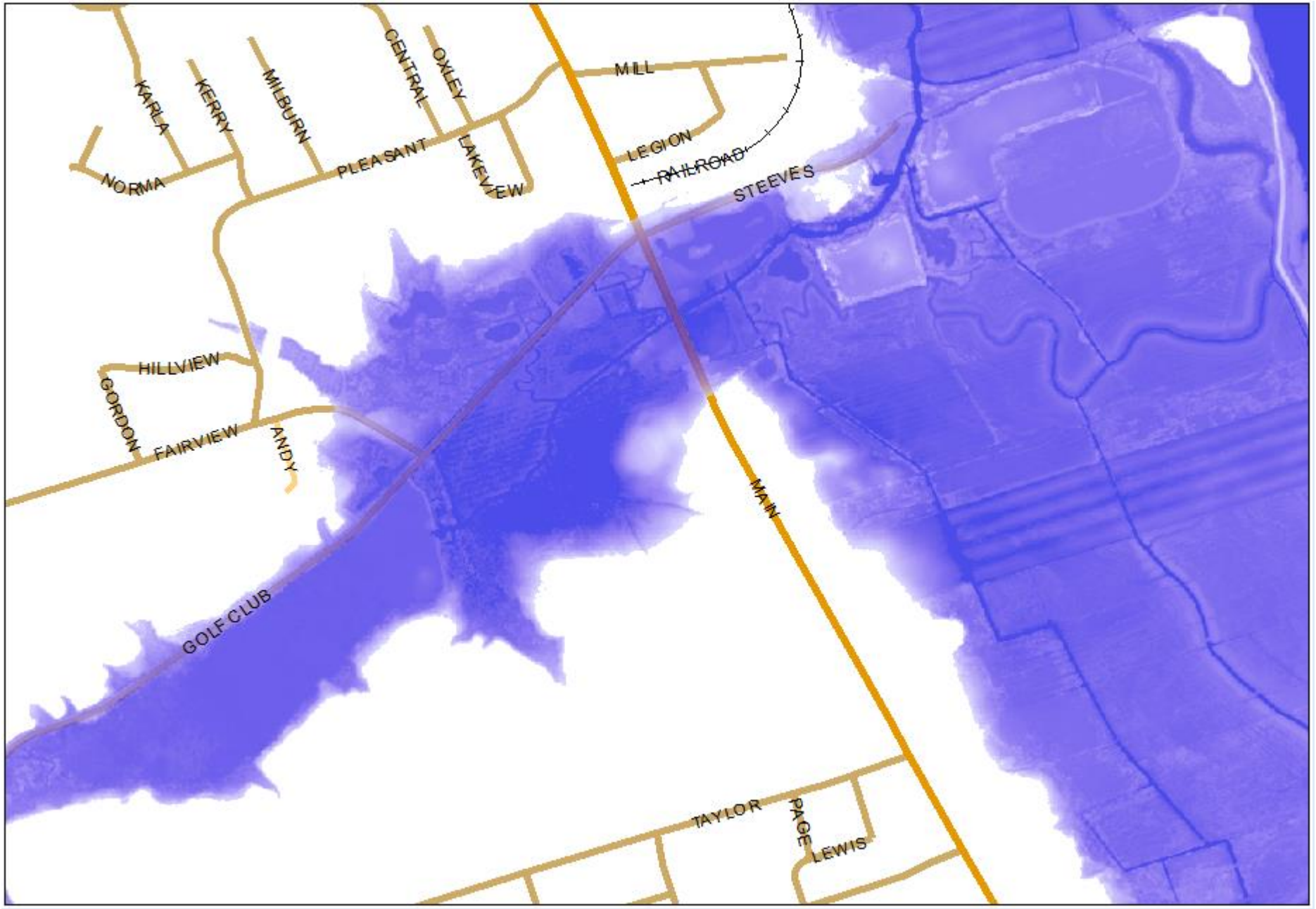


Attributes
Return period
Flood depth

Flood hazard - 1% annual chance of flooding, year 2100

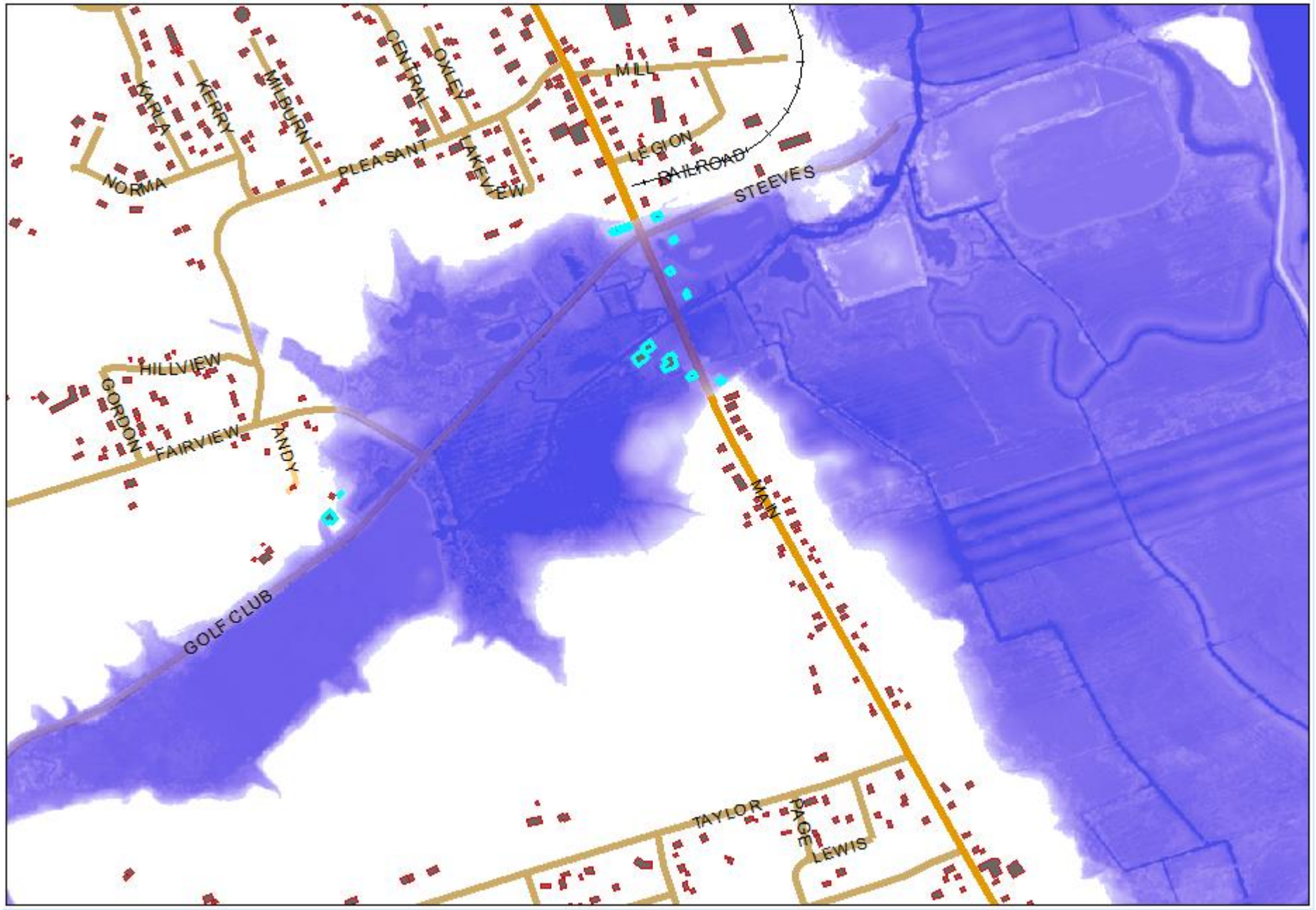
Attributes
Return period
Flood depth

Roads



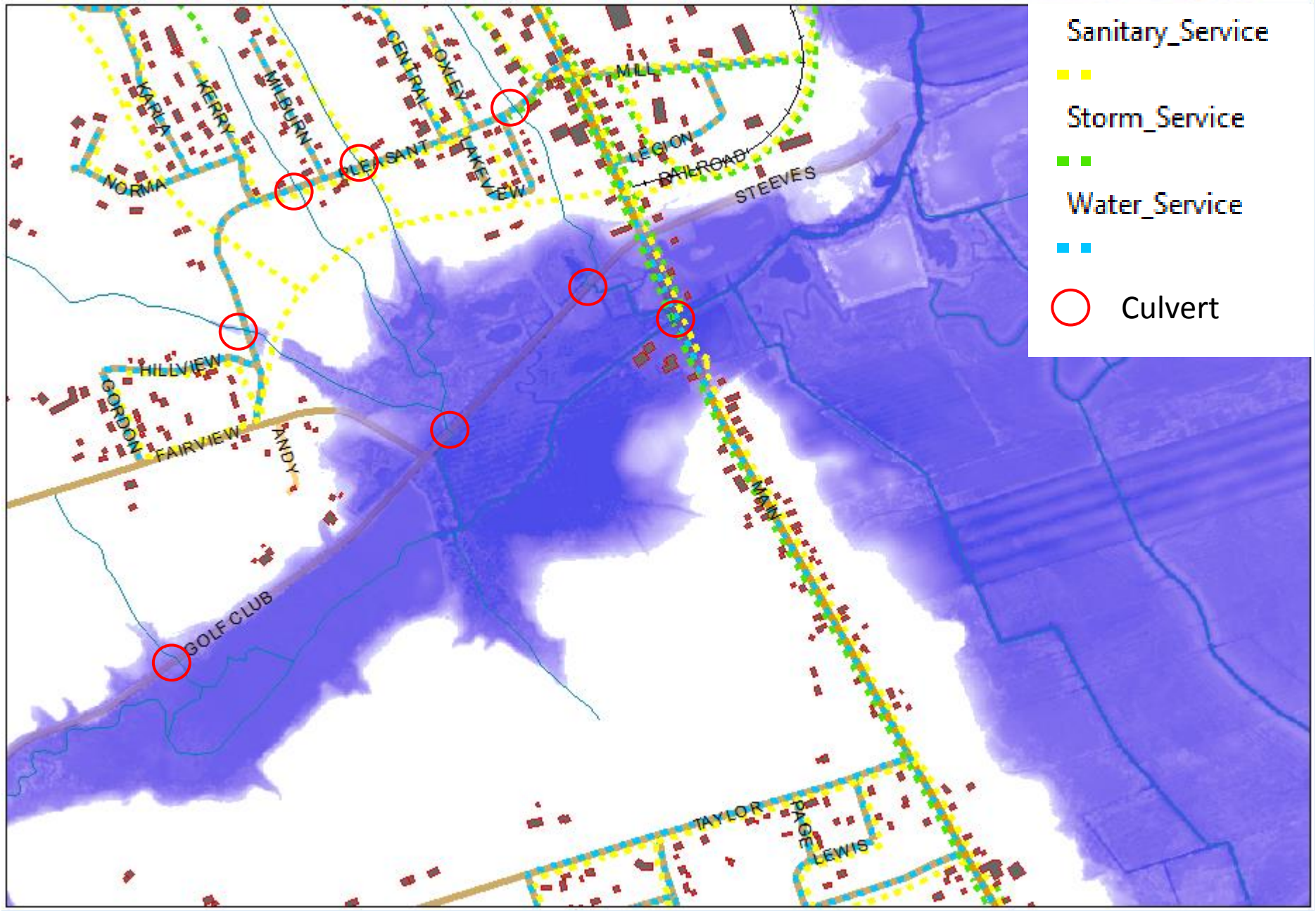
Attributes
Type
Surface
Age
Condition
Maintenance cost
residents serviced
EMO importance

Buildings



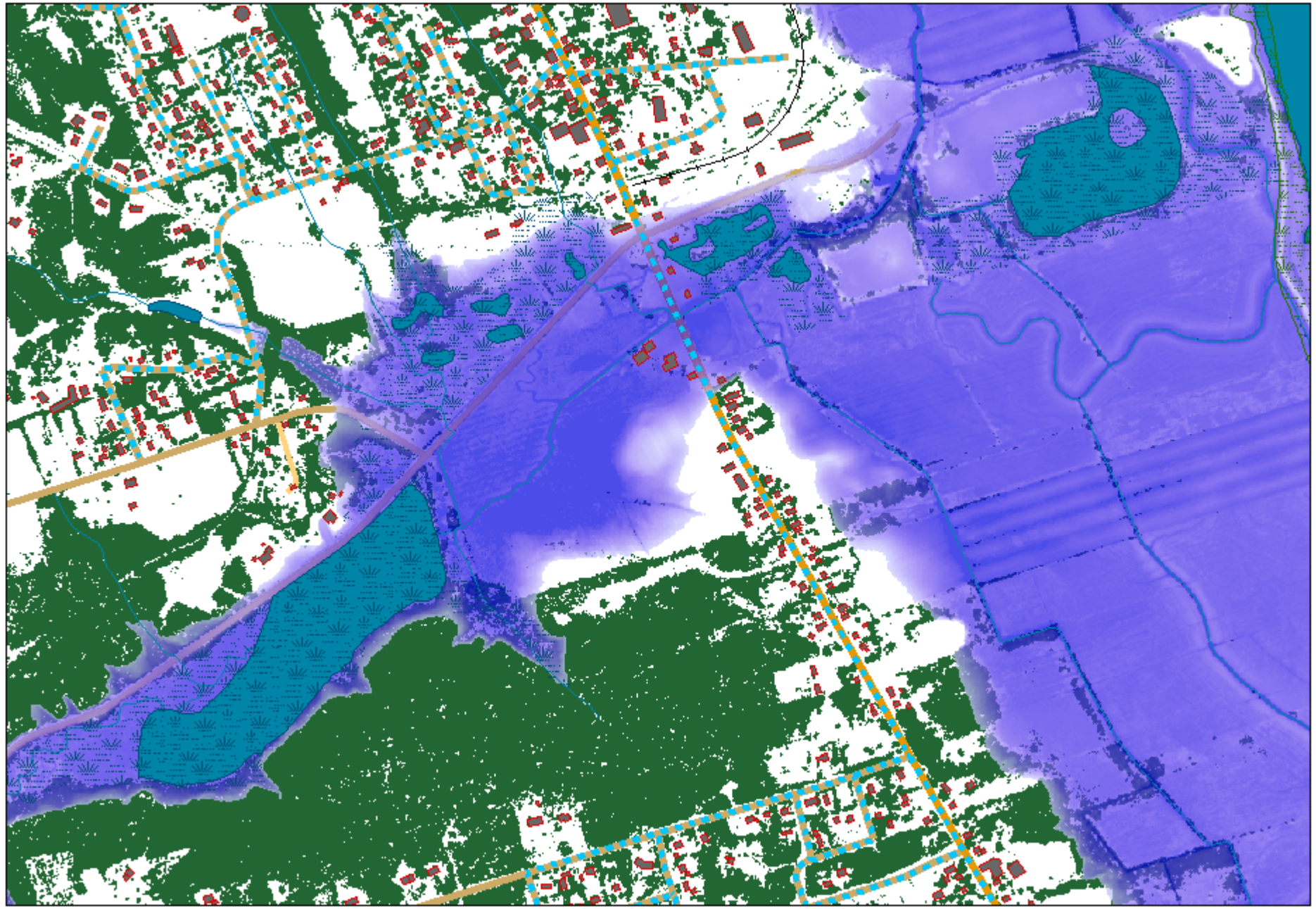
Attributes
Height/# storeys
Age
Adapted to flood?
Units
Land use/zoning
Estimated damage costs

Infrastructure



Attributes
Type (storm, water, sewer)
Material, diameter
Age
Condition
Maintenance cost
residents serviced
Design – return period
Design – capacity

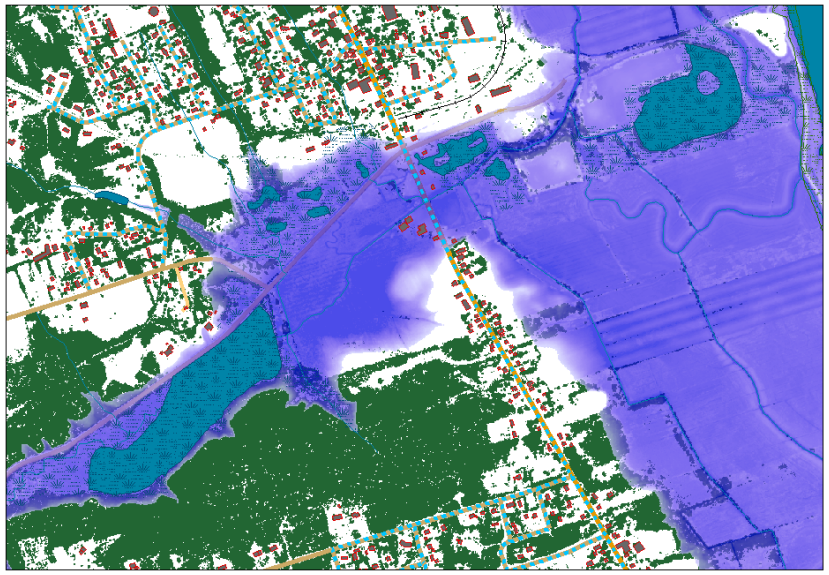
Natural capital – reducing runoff

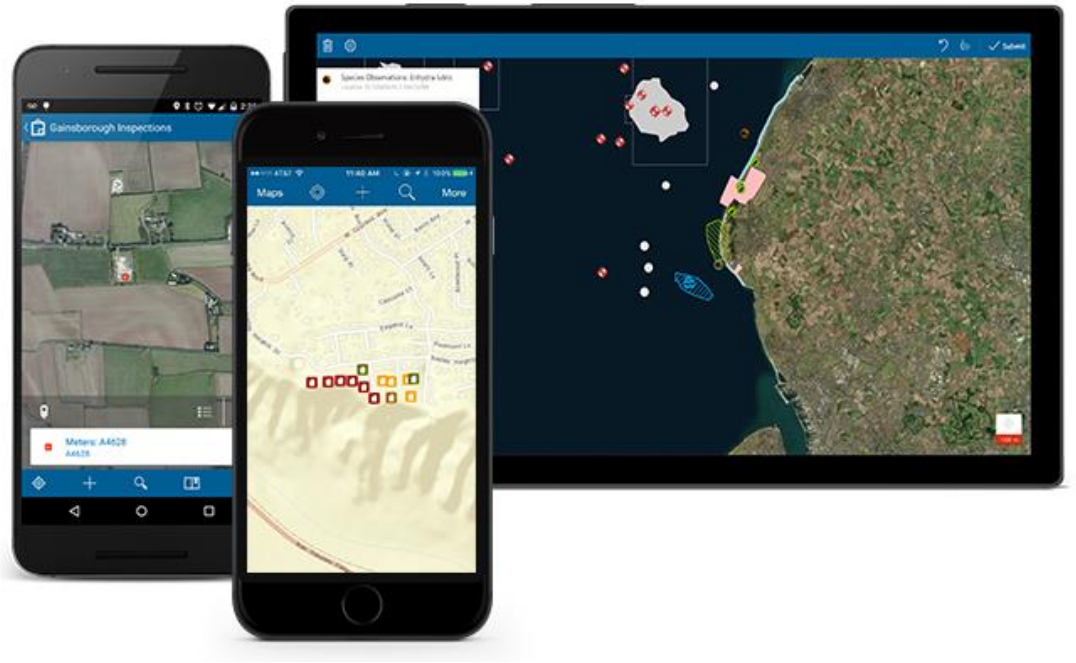


Attributes
Wetland – storage capacity (gauge, cross section, size)
Forest type (run-off coefficient)

GIS inventory in the field

- Data collection
- Municipal Public Works
- EMO

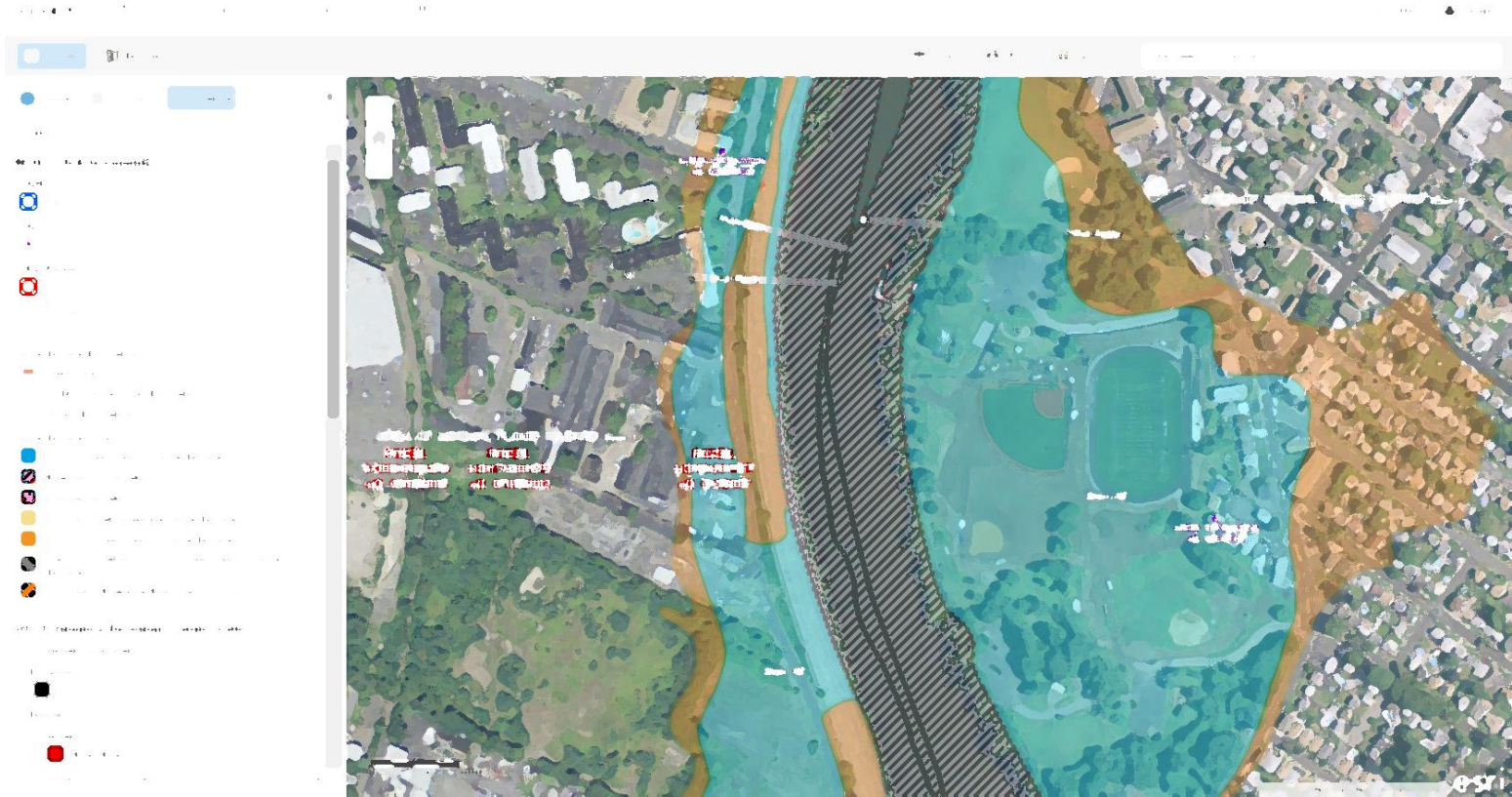




GIS to support Adaption #1

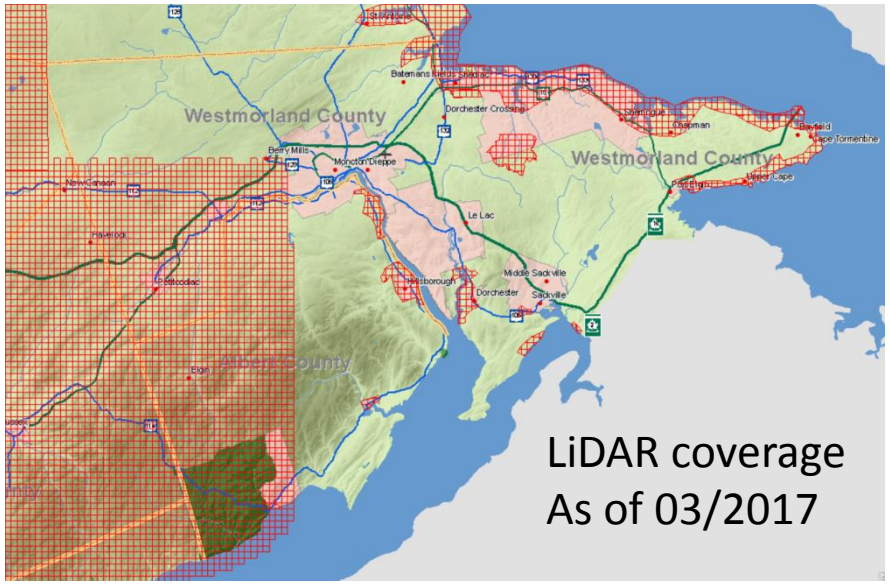
Zoning by-law

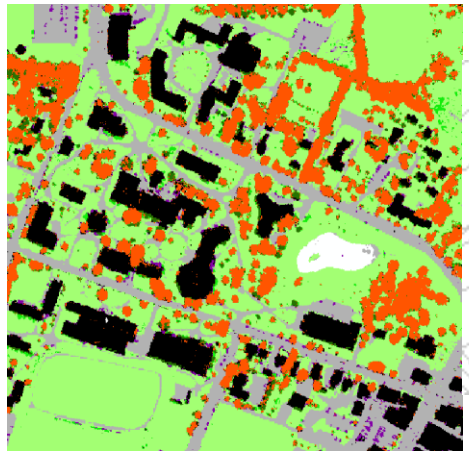
Minimum elevation habitable portion of residence

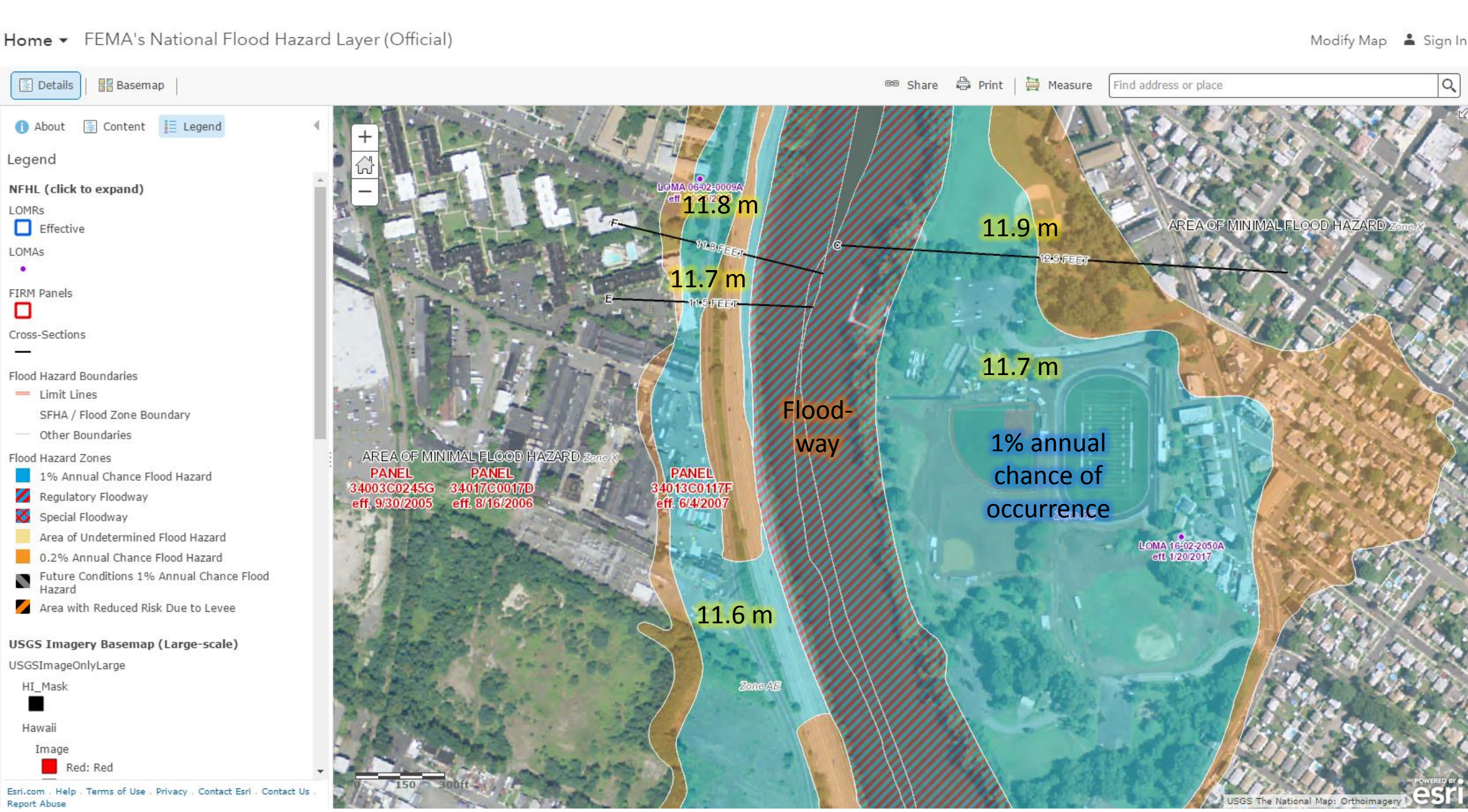


Mapping Inland Flood Risk for Region

- Collaboration with Dr. Laroche, U de Moncton
- Data in support of mapping
  - LiDAR
  - land use and land cover



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FEMA's National Flood Hazard Layer (Official)
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Legend
NFHL (click to expand)
LOMRs
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LOMAs
FIRM Panels
Cross-Sections
Flood Hazard Boundaries
Limit Lines
SFHA / Flood Zone Boundary
Other Boundaries
Flood Hazard Zones
1% Annual Chance Flood Hazard
Regulatory Floodway
Special Floodway
Area of Undetermined Flood Hazard
0.2% Annual Chance Flood Hazard
Future Conditions 1% Annual Chance Flood Hazard
Area with Reduced Risk Due to Levee
USGS Imagery Basemap (Large-scale)
USGSImageOnlyLarge
HI_Mask
Hawaii
Image
Red: Red
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LOMA 06-02-0009A
11.8 m
11.7 m
11.9 m
11.7 m
11.6 m
F
11.8 FEET
E
11.5 FEET
C
12.5 FEET
AREA OF MINIMAL FLOOD HAZARD Zone X
AREA OF MINIMAL FLOOD HAZARD Zone X
PANEL 34003C0245G eff. 9/30/2005
PANEL 34017C0017D eff. 8/16/2006
PANEL 34013C0117F eff. 6/4/2007
Flood-way
1% annual chance of occurrence
LOMA 16-02-2050A eff. 1/20/2017
Zone AE
0 150 300ft
USGS The National Map: Orthoimagery
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Home ▾ FEMA's National Flood Hazard Layer (Official)

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Legend

NFHL (click to expand)

LOMRs
- Effective

LOMAs

FIRM Panels

Cross-Sections

Flood Hazard Boundaries
- Limit Lines
- SFHA / Flood Zone Boundary
- Other Boundaries

Flood Hazard Zones
- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee

USGS Imagery Basemap (Large-scale)

USGSImageOnlyLarge

HI_Mask

Hawaii

Image
- Red: Red

LOMA 06-02-0009A

11.8 m

11.8 m

AREA OF MINIMAL FLOOD HAZARD Zone X

11.7 m

F — 11.8 FEET

C — 12.5 FEET

E — 11.5 FEET

AREA OF MINIMAL FLOOD HAZARD Zone X

PANEL 34003C0245G eff. 9/30/2005

PANEL 34017C0017D eff. 8/16/2006

PANEL 34013C0117F eff. 6/4/2007

11.7 m (CGVD28)

11.6 m

Zone AE

0 150 300ft

USGS The National Map: Orthoimagery

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Adaptation #2 – GIS for Engineering design

- Design standards
  - By province/local government
  - Engineers Canada
- Provide best available GIS data
  - Flood hazard
  - Elevation (LiDAR by 2018)
  - Land cover

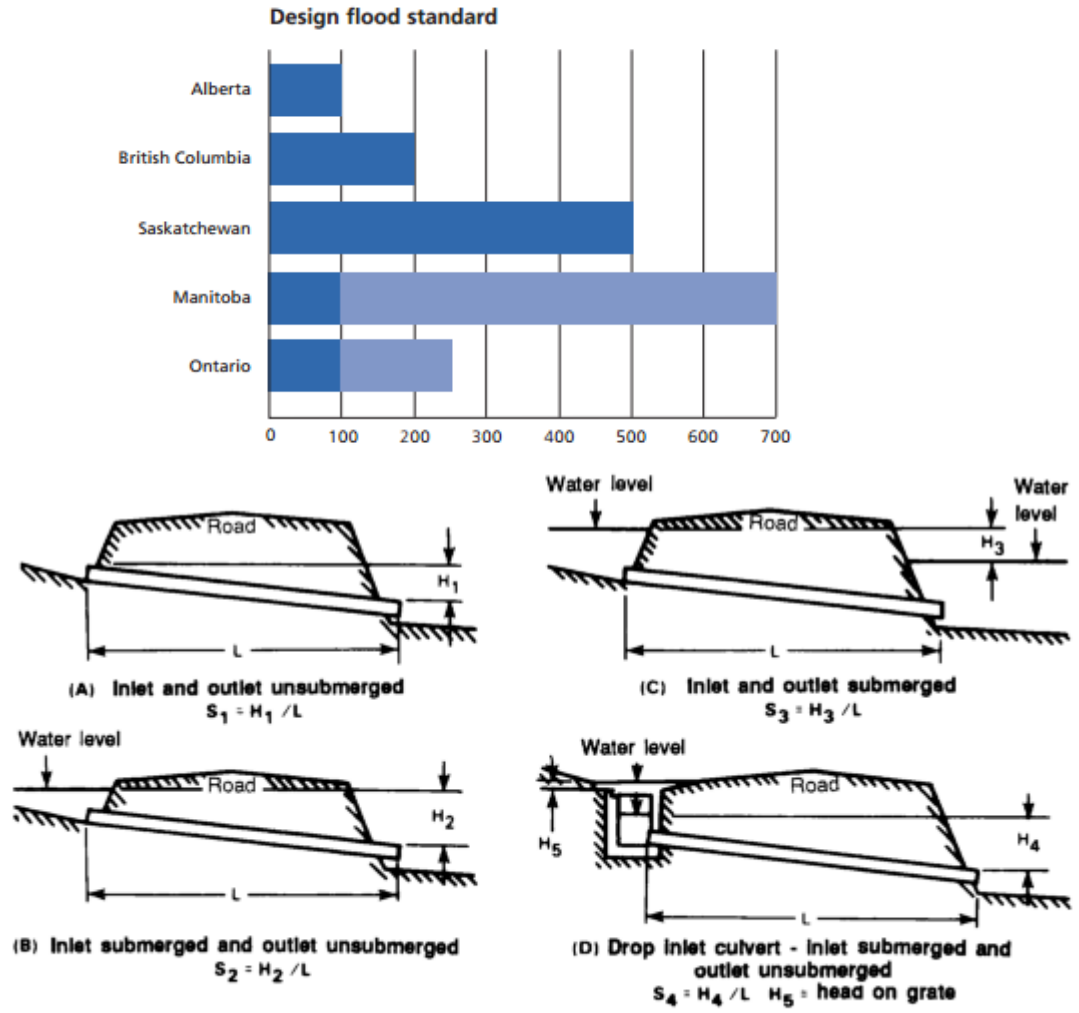
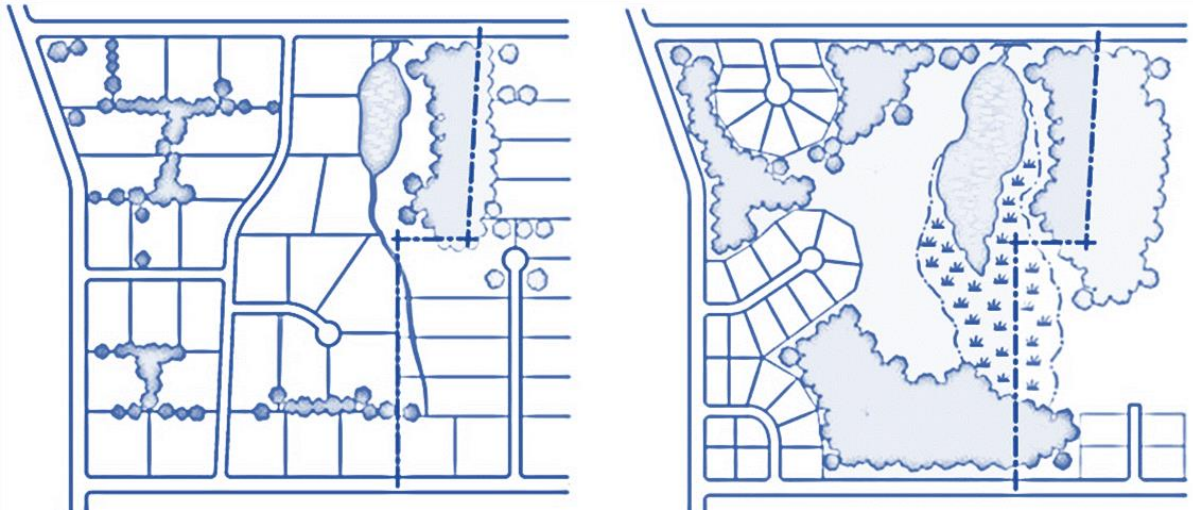


Figure 6-49. Hydraulic gradient, S, and heads, H, for culverts

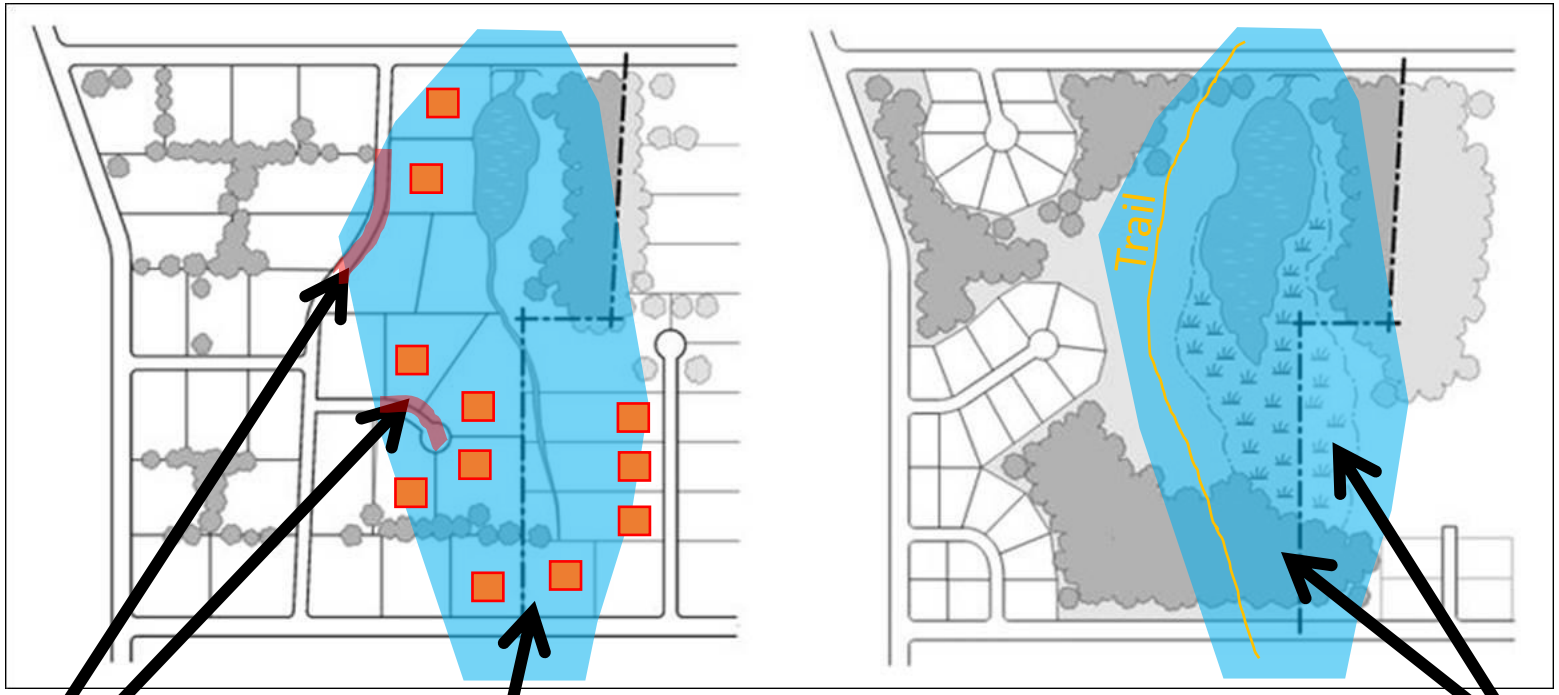
Adaption #3

Scenario planning &

Asset Management



How does future land use change affect flood risk?



1 **Buildings outside of flood prone areas**
Avoided flood damage

2 **Infrastructure outside of flood prone areas**
Less infrastructure to maintain

3 **Maintain natural capital:**
-reduces flood risk
-recreation opportunities
-Reduced cost for storm water infrastructure

Scenario planning tools

Asset Management

Mnai
Making Nature Count

BRITISH COLUMBIA

CLIC COMMUNITY LIFECYCLE INFRASTRUCTURE COSTING TOOL

Modelling Flood Hazard

US Army Corps of Engineers
Hydrologic Engineering Center

HEC-HMS
HEC-RAS
HEC-GeoRAS

Future Land Use

SCENARIO HUB

EPA United States Environmental Protection Agency

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Storm Water Management Model (SWMM)

Version 5.1.006 with Low Impact Development (LID) Controls

- Description
- Capabilities
- Applications
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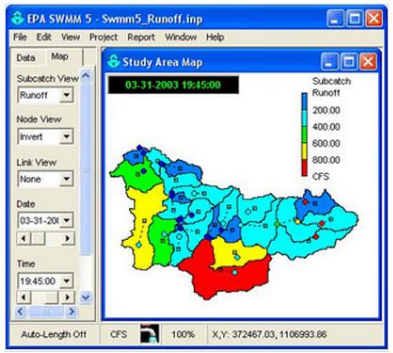

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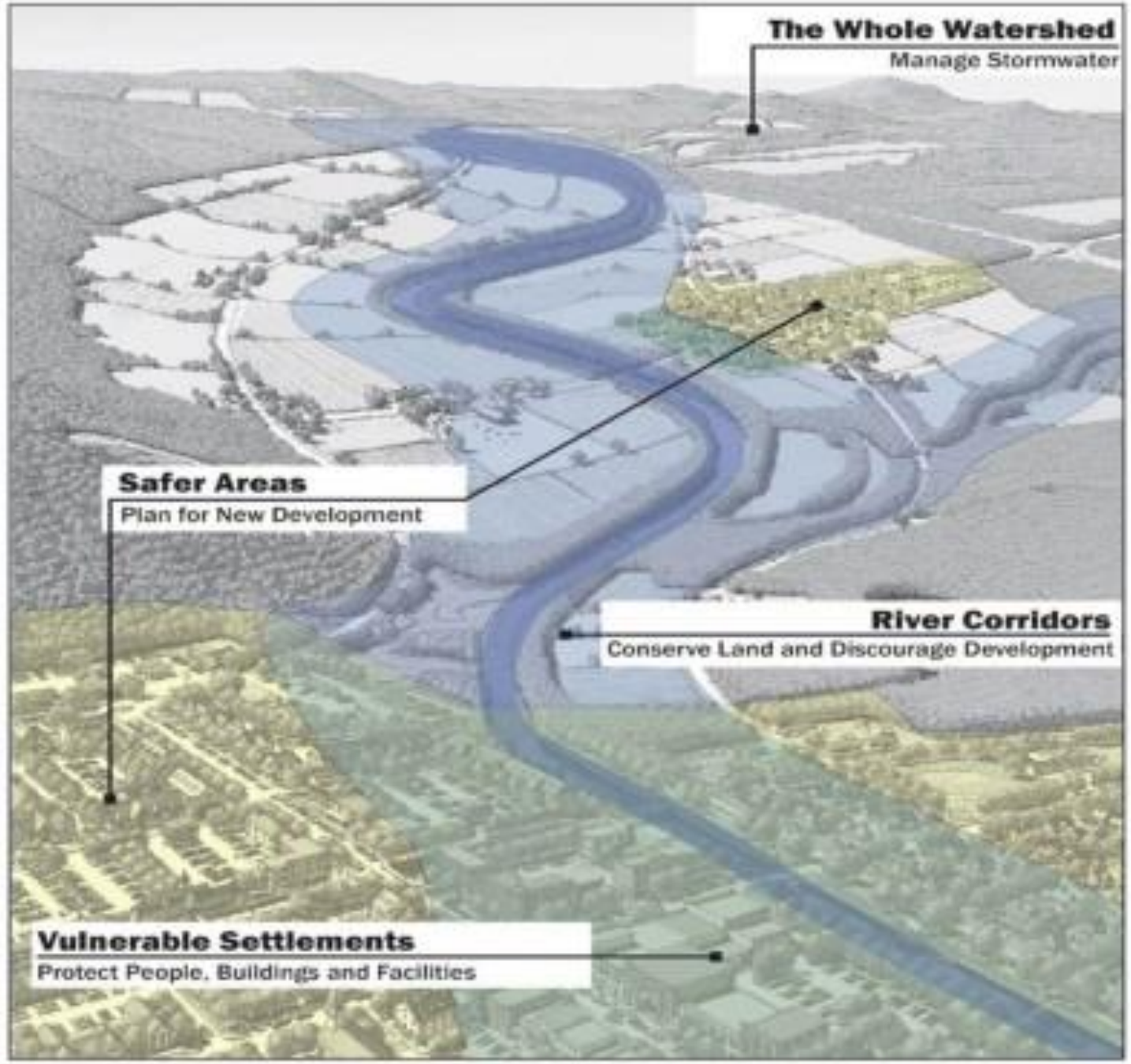
The Whole Watershed
Manage Stormwater
Safer Areas
Plan for New Development
River Corridors
Conserve Land and Discourage Development
Vulnerable Settlements
Protect People, Buildings and Facilities