

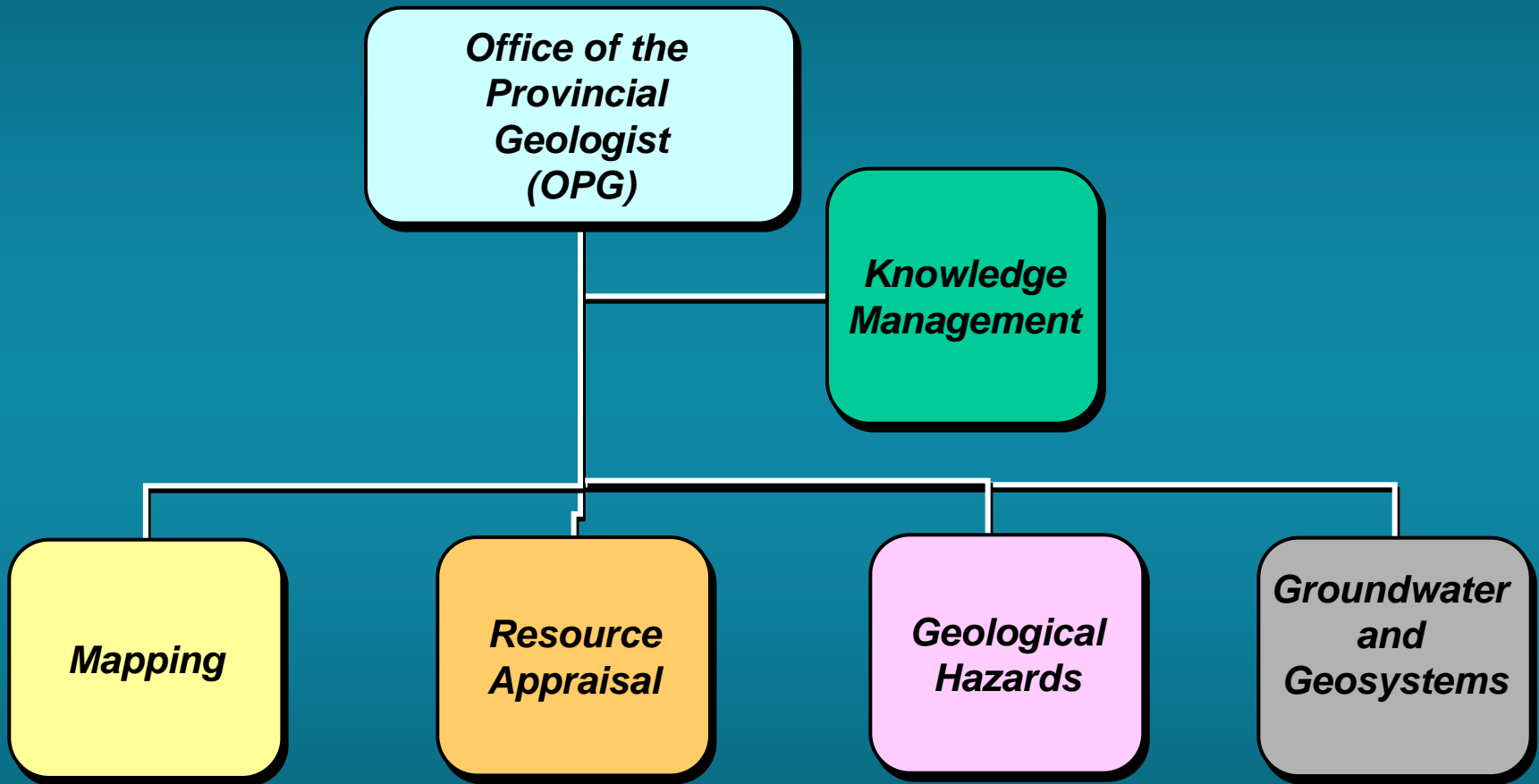
# **Urban Geology and Hazards in Alberta: A Technology Update**

***Corey Froese, P.Eng., P.Geol.  
Section Leader, Geological Hazards***

# The Alberta Geological Survey (AGS):

- Was formed in 1920
- Has been of the Energy and Utilities Board since 1996. ERCB as of January 1, 2008
- The specific mission of the AGS is to provide data, information, knowledge, and advice about the geology of Alberta needed by government, industry, and the public for earth-resource stewardship and sustainable development in Alberta

# Our Structure



# Areas of Focus

## Geological Hazards Program

### Natural Geological Hazards

### Anthropogenic Geological Hazards

#### Urban Geology

Peace River  
Edmonton  
Fort McMurray

#### Shallow Hazards

Landslides  
Subsidence  
Shallow Gas  
Seismicity  
Expansive Soils

#### Formation Integrity

In-Situ Production  
Salt Caverns  
CBM  
Coal Gasification  
Carbon Capture

#### Induced Seismicity

In-Situ Production  
Reservoir  
Impoundment



# Urban Geology

# Benchmark Studies

Bulletin No. 53

## Surficial geology of the Calgary urban area

S.R. Moran



## *URBAN GEOLOGY OF EDMONTON*

*C. P. KATHOL AND R. A. McPHERSON*

*BULLETIN 32*

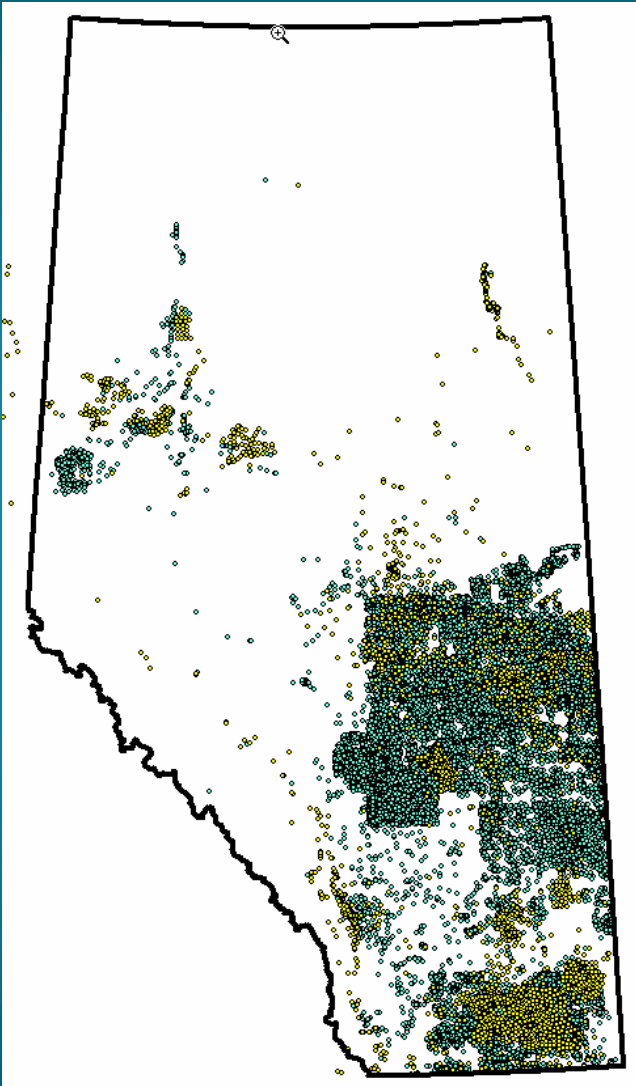
*ALBERTA RESEARCH COUNCIL*

*1975*

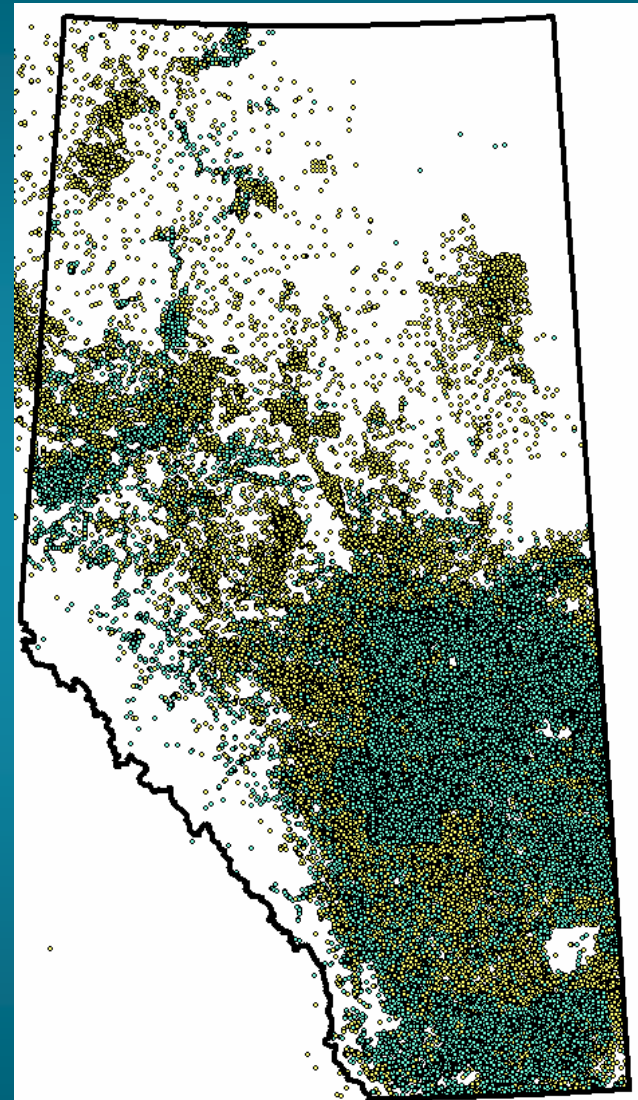
# Advances

- **Data Density**
- **Modeling Tools/Computer Hardware**
- **Remote Sensing Platforms**
- **Web Applications**

# Data Density



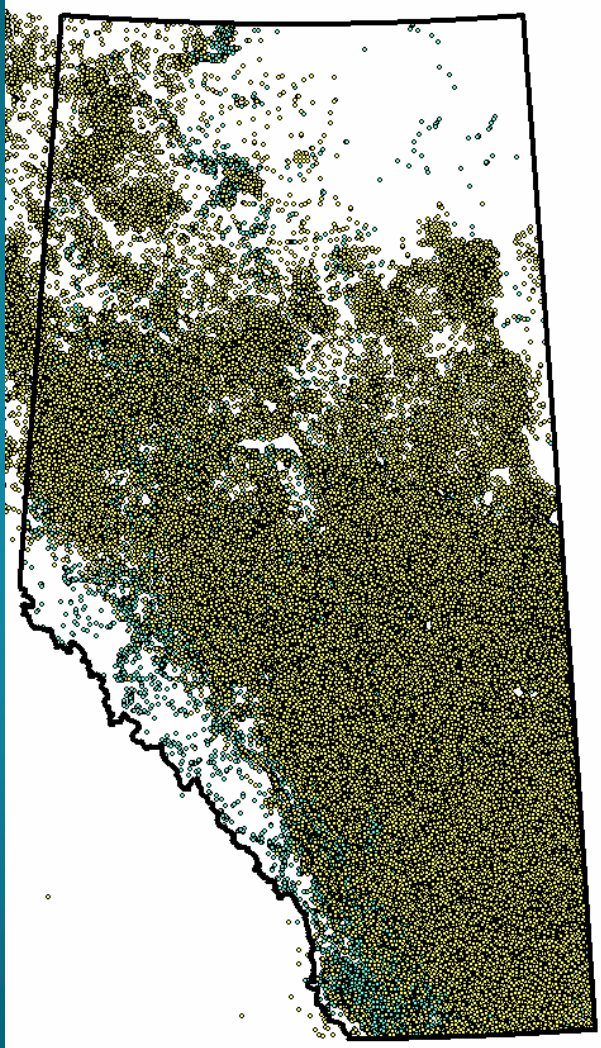
1950



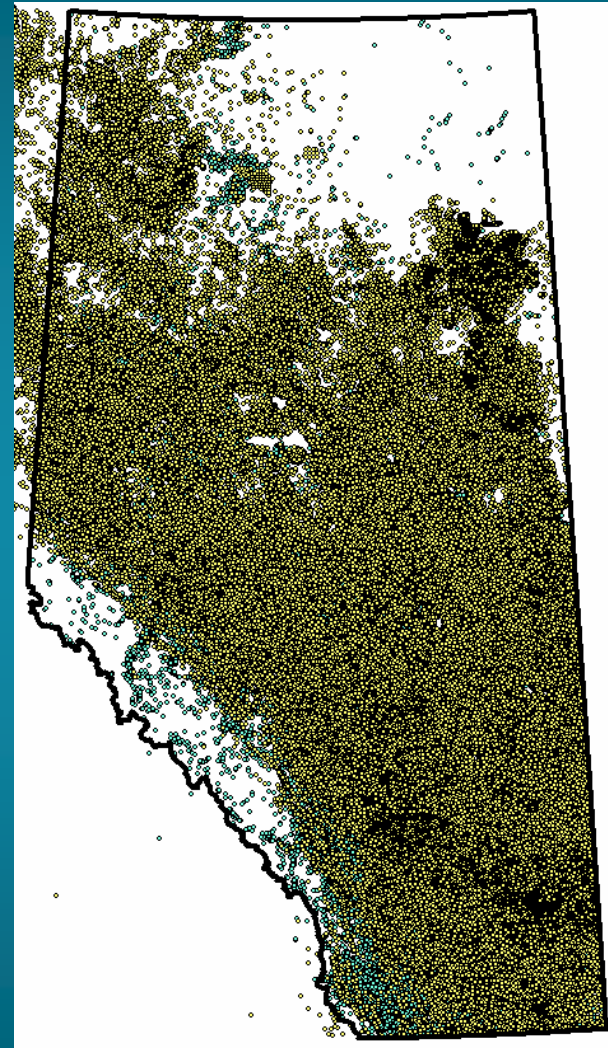
1970



# Data Density

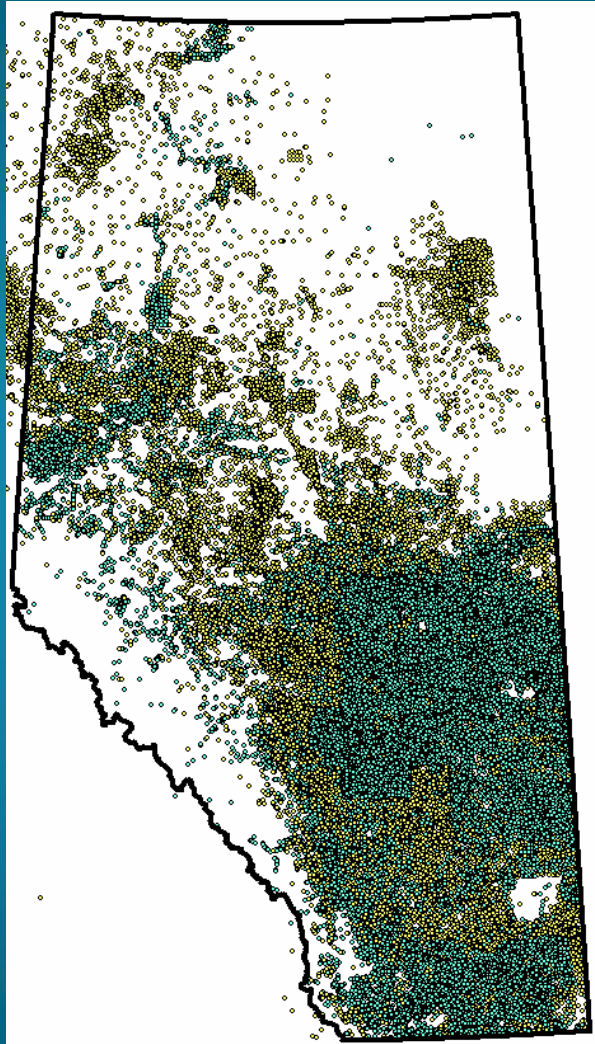


1990

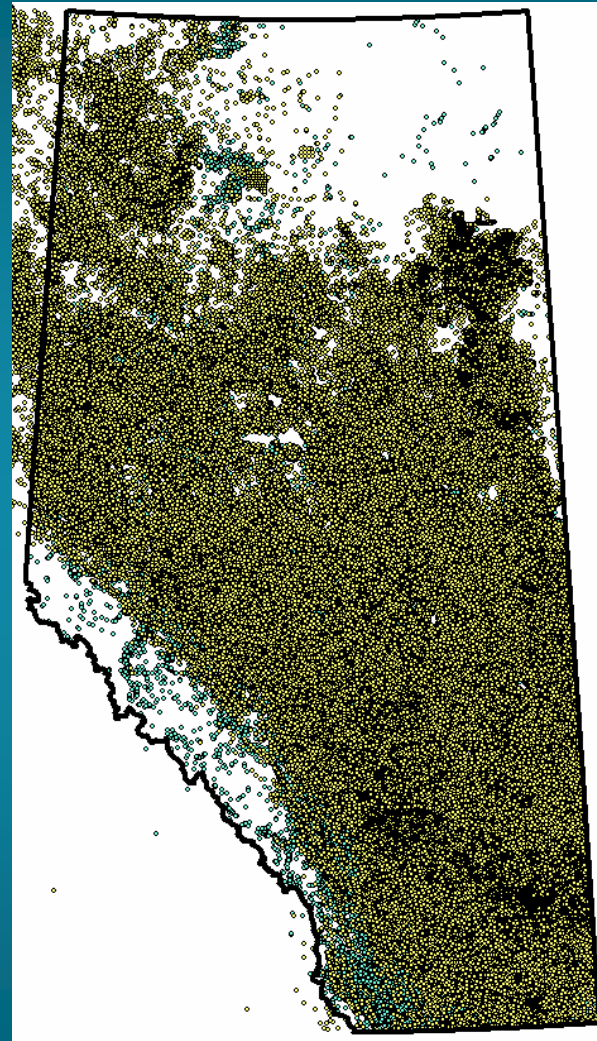


2009

# Data Density



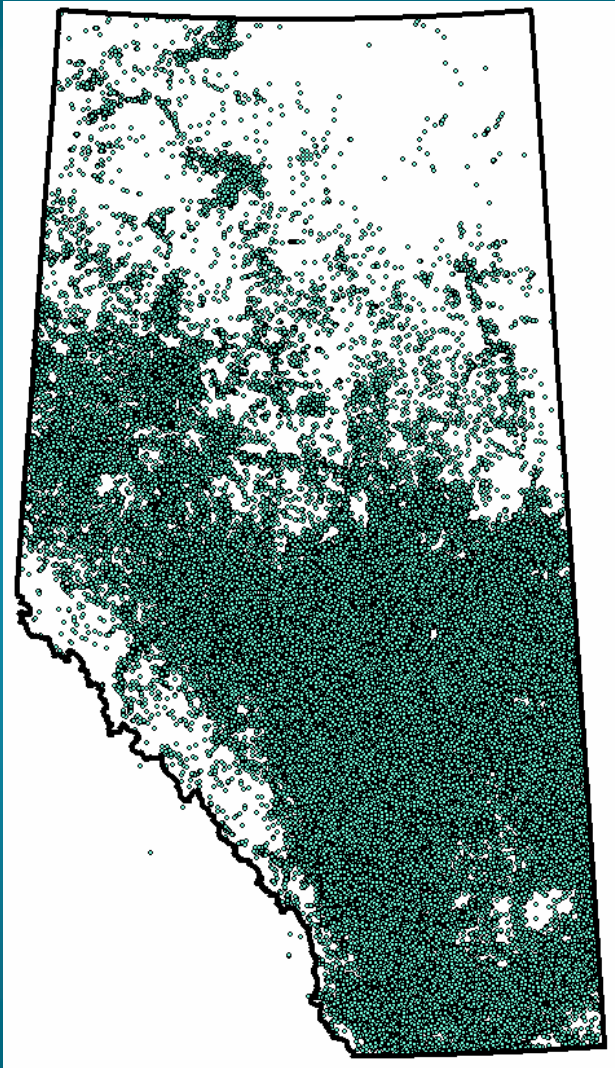
1970



2009



# Data Density



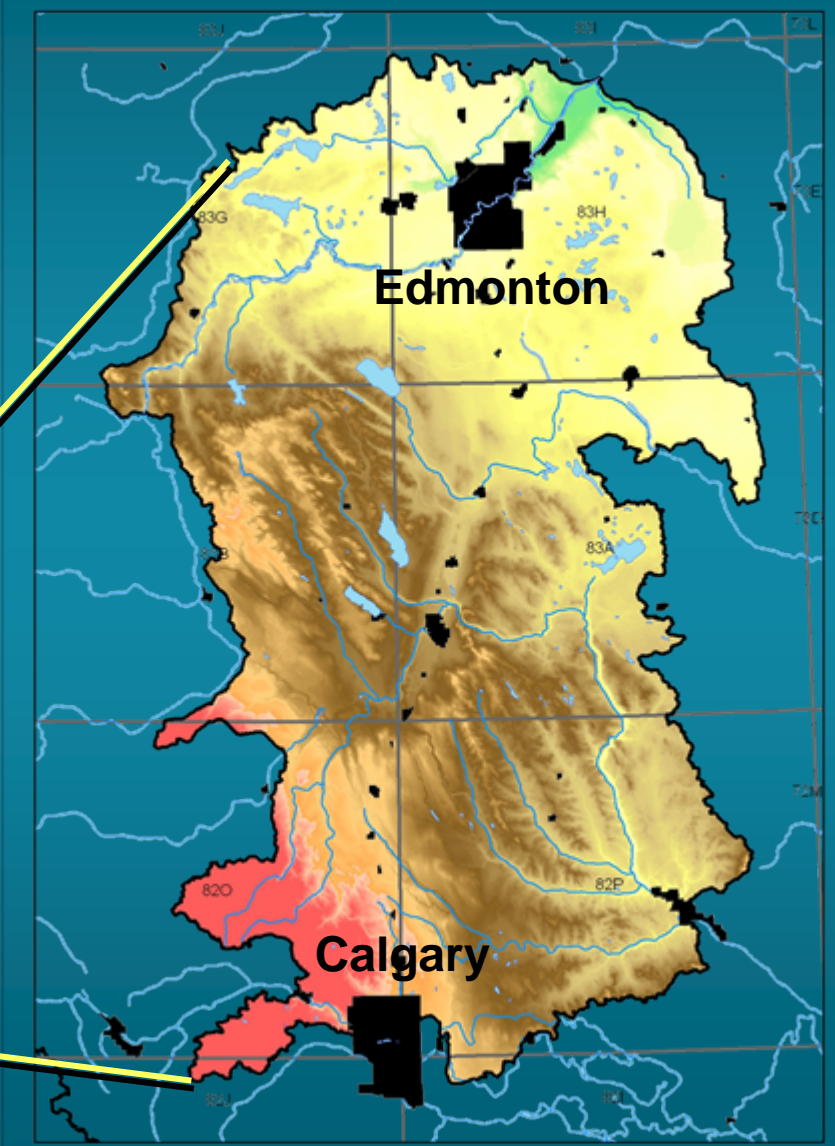
**Water Well**



**Oil and Gas**

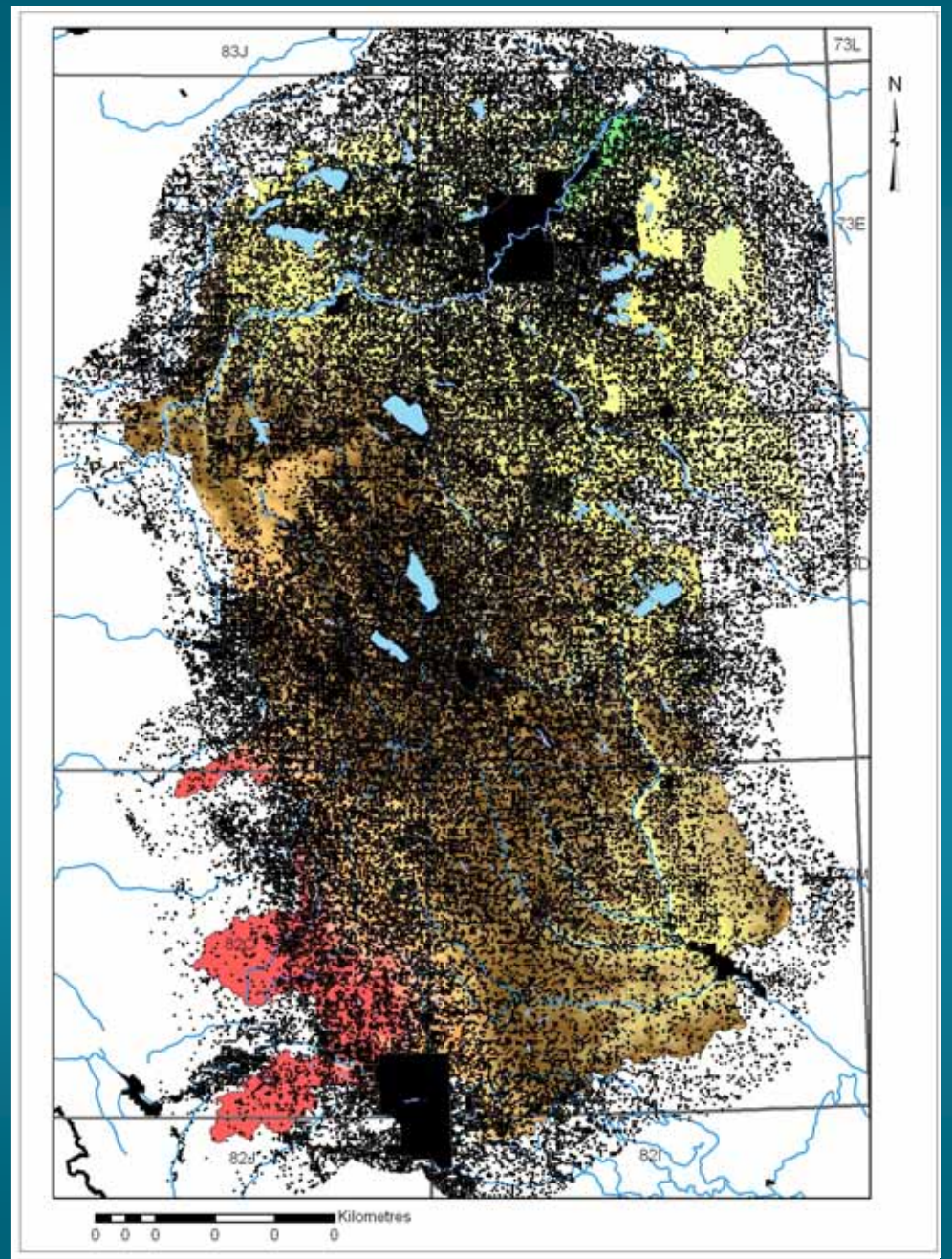
# ECC Groundwater Inventory

Identifying, characterizing, and assessing aquifer complexes in the Edmonton-Calgary Corridor



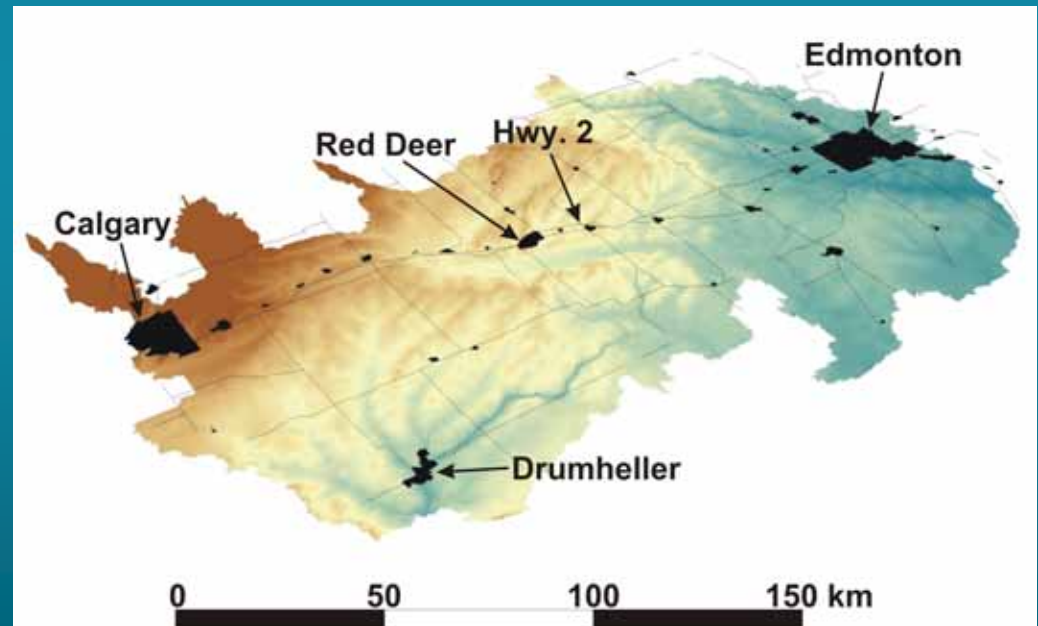


**~188,000 Water-wells**



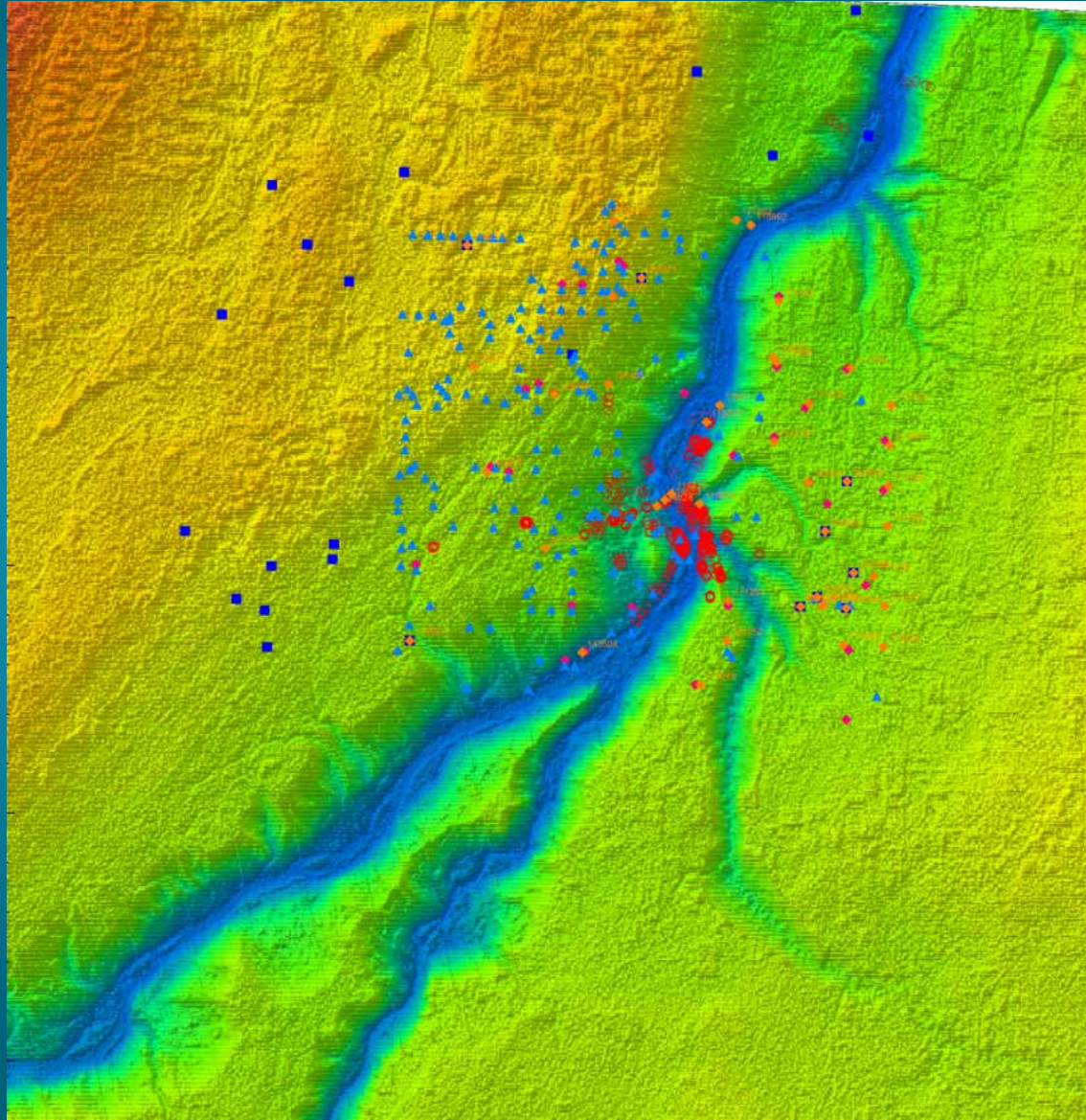
# Edmonton-Calgary Corridor

Drift (sediment) thickness map of the ECC

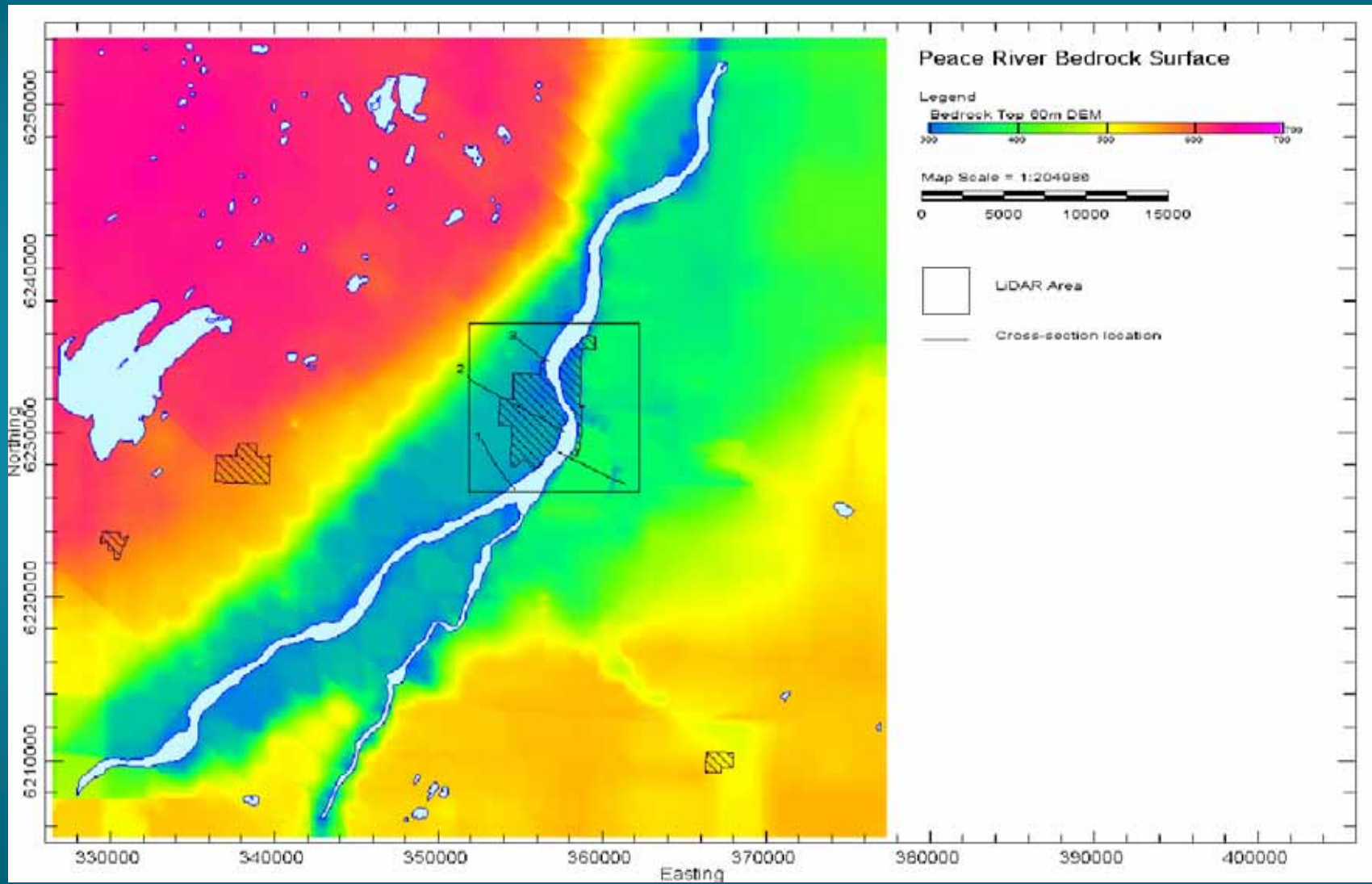




# Geological Model: Peace River

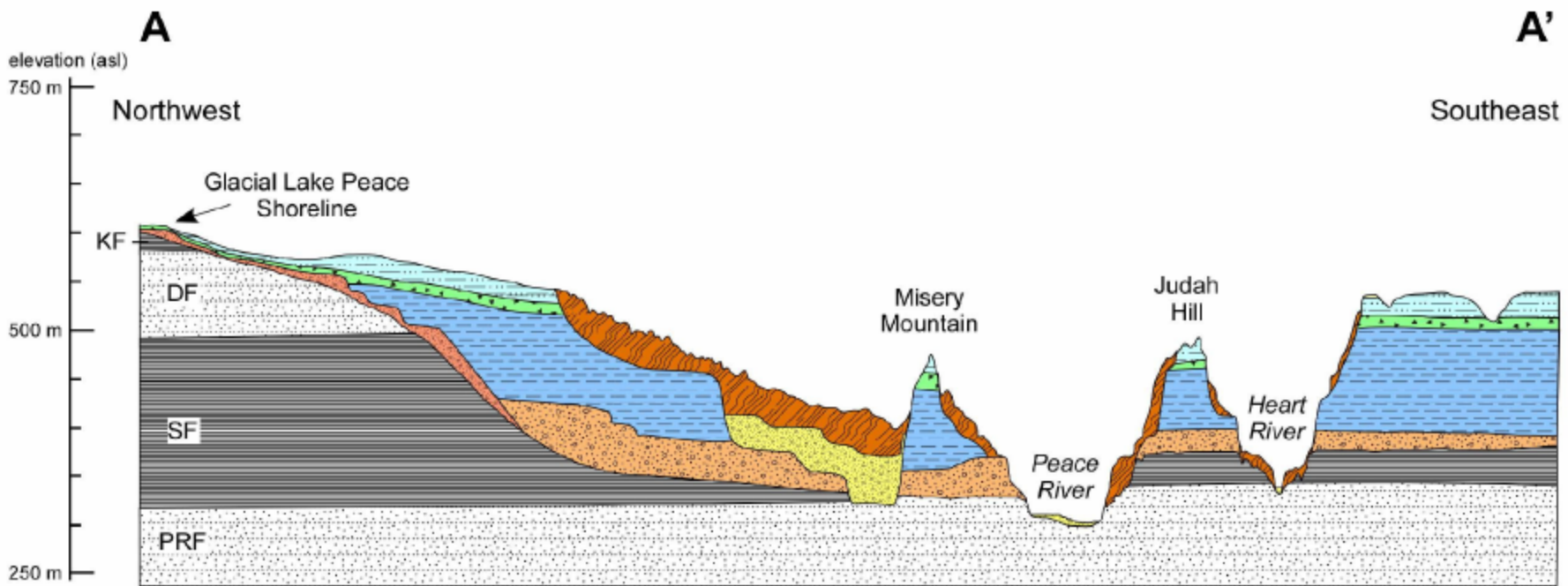


# Geological Model: Peace River





# Geological Model: Peace River



### Quaternary

- |  |  |  |   |
|--|--|--|---|
|  | Eolian sediments (Holocene)                              |  | Glacial sediments (Late Wisconsin)                        |
|  | Colluvial sediments (Holocene)                           |  | Advance-phase glaciolacustrine sediments (Late Wisconsin) |
|  | Fluvial sediments (Holocene)                             |  | Fluvial sediments (Middle Wisconsin)                      |
|  | Glacial Lake Peace sediments (Late Wisconsin - Holocene) |  | Grimshaw sediments (Sangamon)                             |

### Bedrock

- |  |                                 |
|--|---------------------------------|
|  | Kaskapau Formation shale        |
|  | Dunvegan Formation sandstone    |
|  | Shaftesbury Formation shale     |
|  | Peace River Formation sandstone |

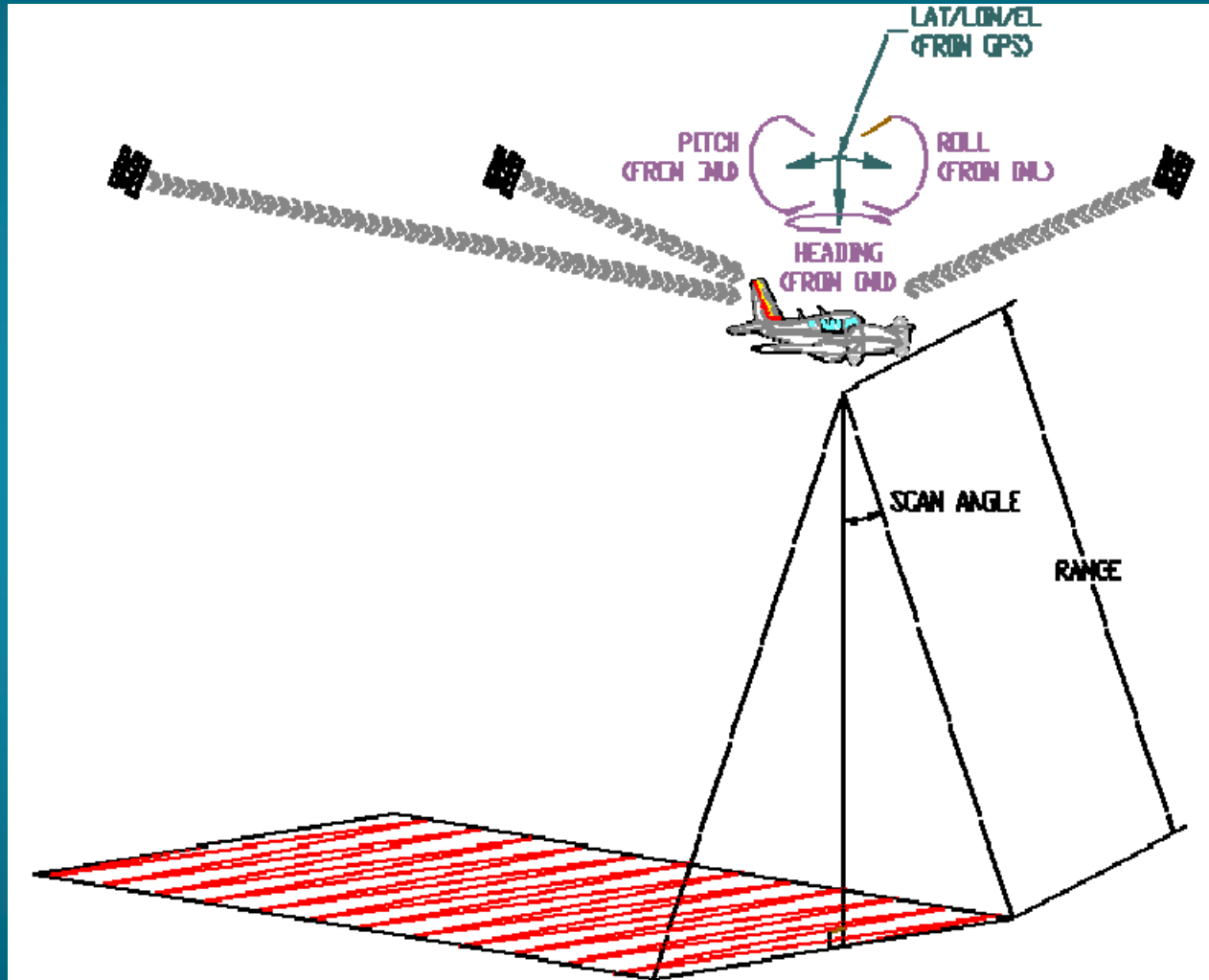
# Remote Sensing

# Airborne Data

- Light Detection And Ranging (LiDAR)
- Airborne Electromagnetic (Airborne EM)



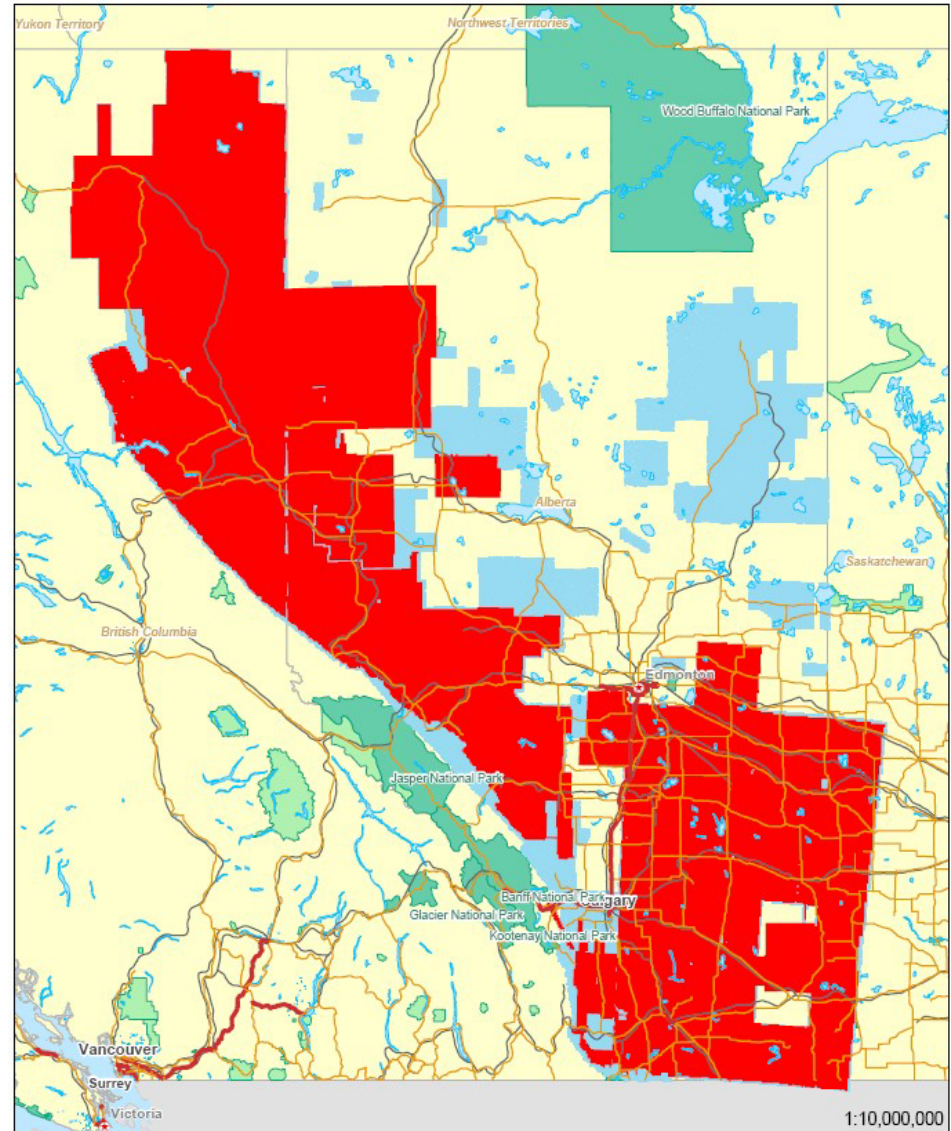
# Airborne LiDAR





# Available LiDAR Coverage

[www.valtus.com](http://www.valtus.com)

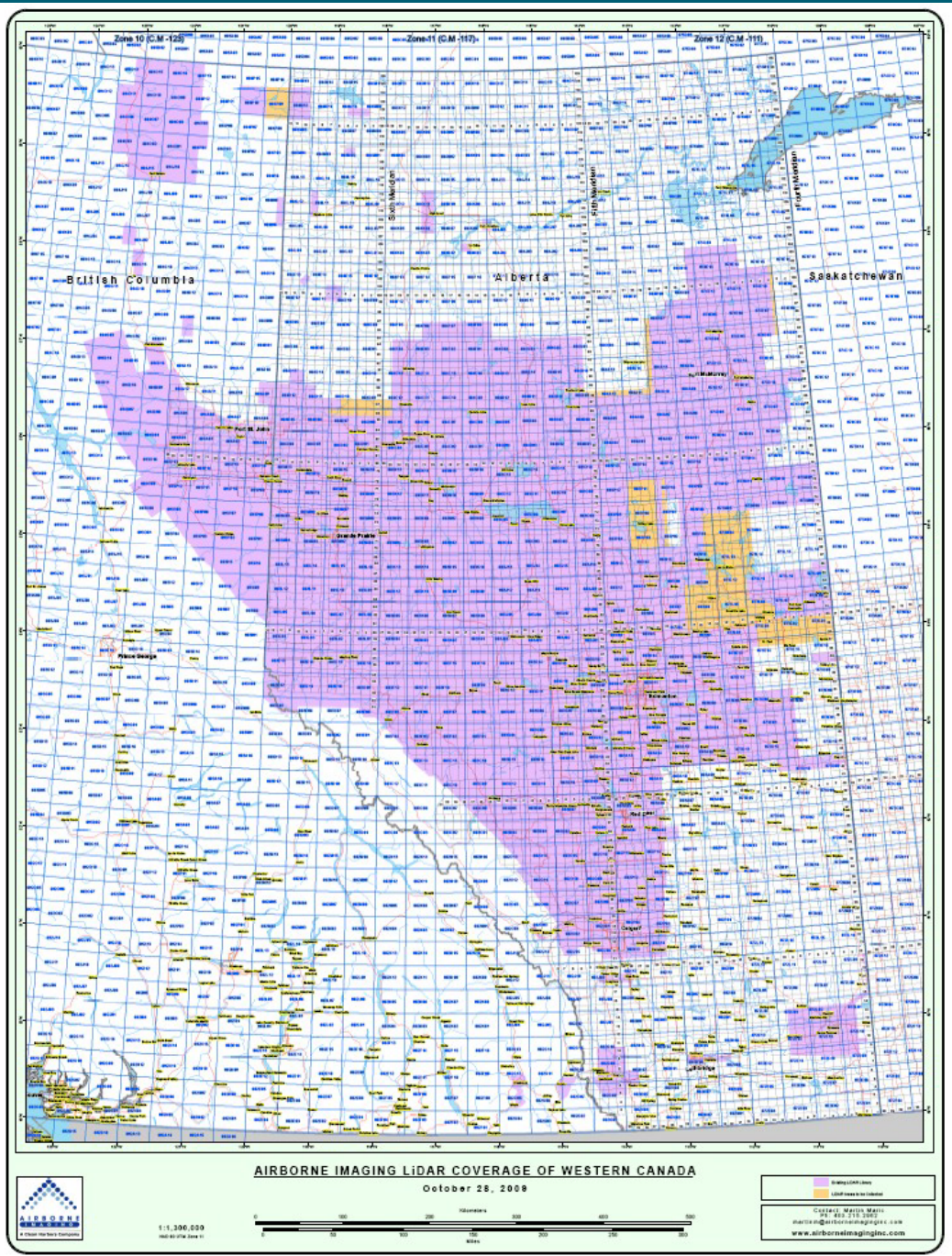


**Legend**  
■ LiDAR Onfile  
■ LiDAR Collected

Valtus Imagery Services | Suite 212, 5435-11 Street NE | Calgary, Alberta T2E 7E9 Canada | 403-295-0694  
E-mail: [info@valtus.com](mailto:info@valtus.com) | Web: [www.valtus.com](http://www.valtus.com)

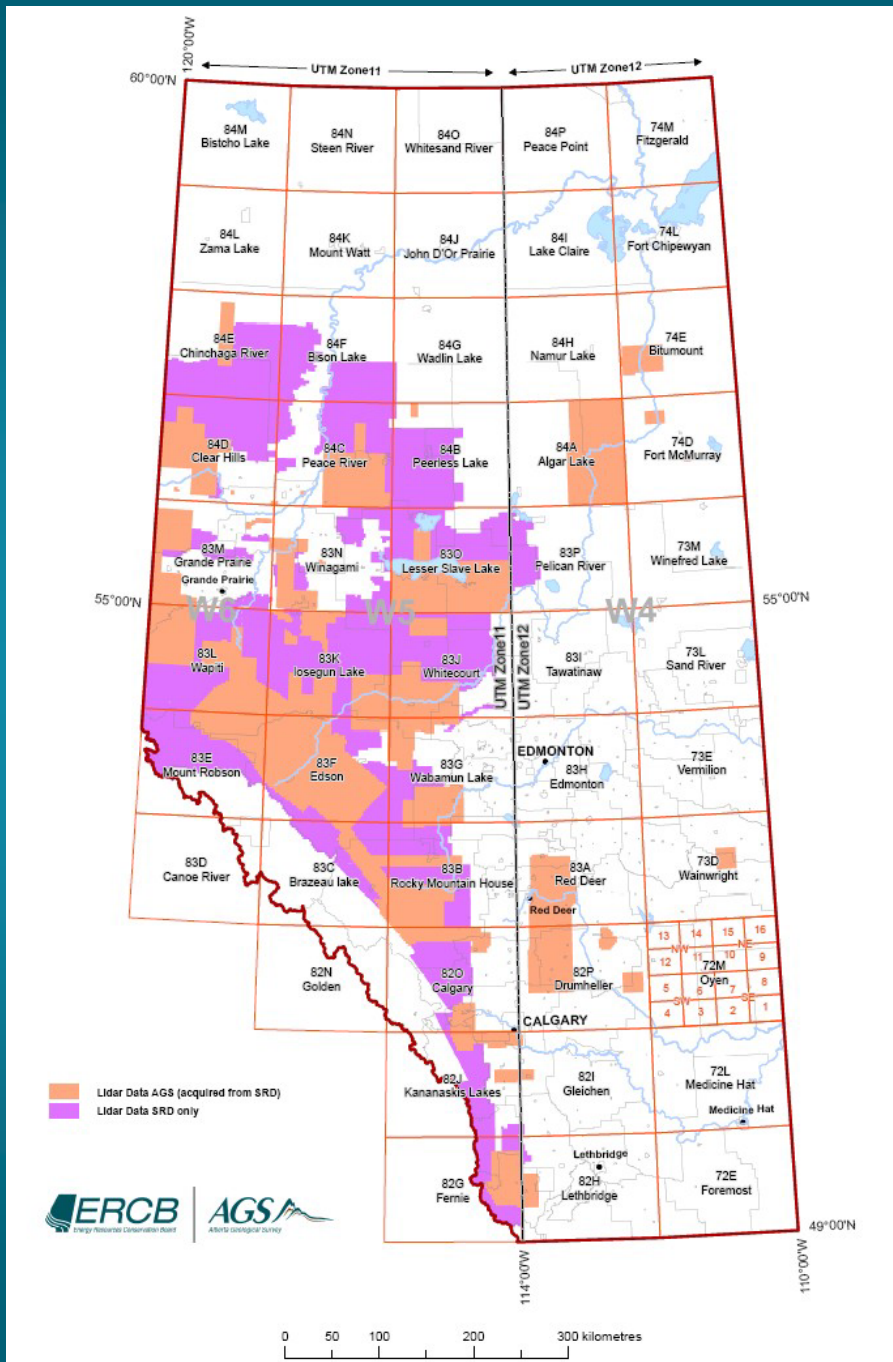
# Available LiDAR Coverage

Airborne Imaging

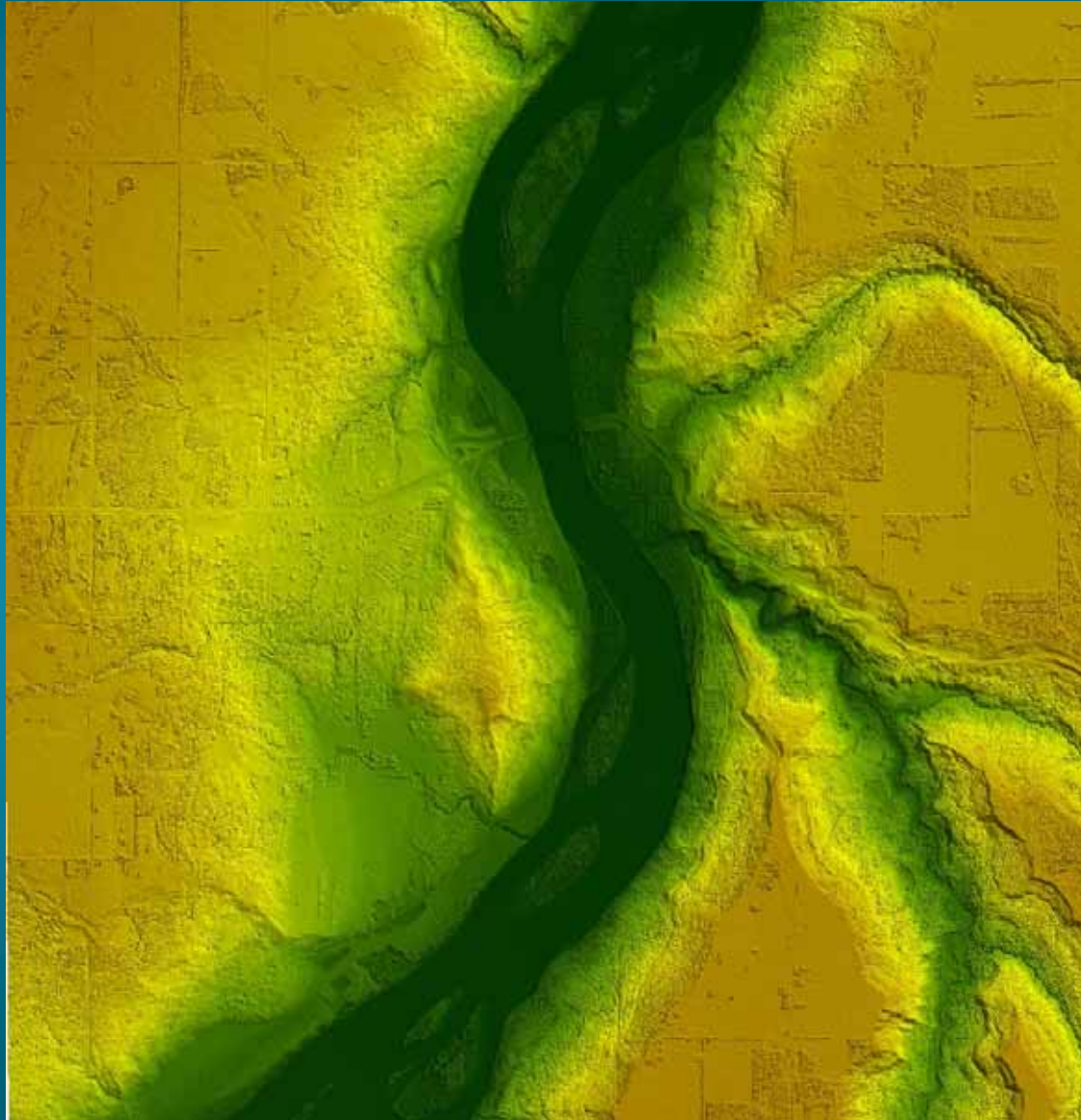




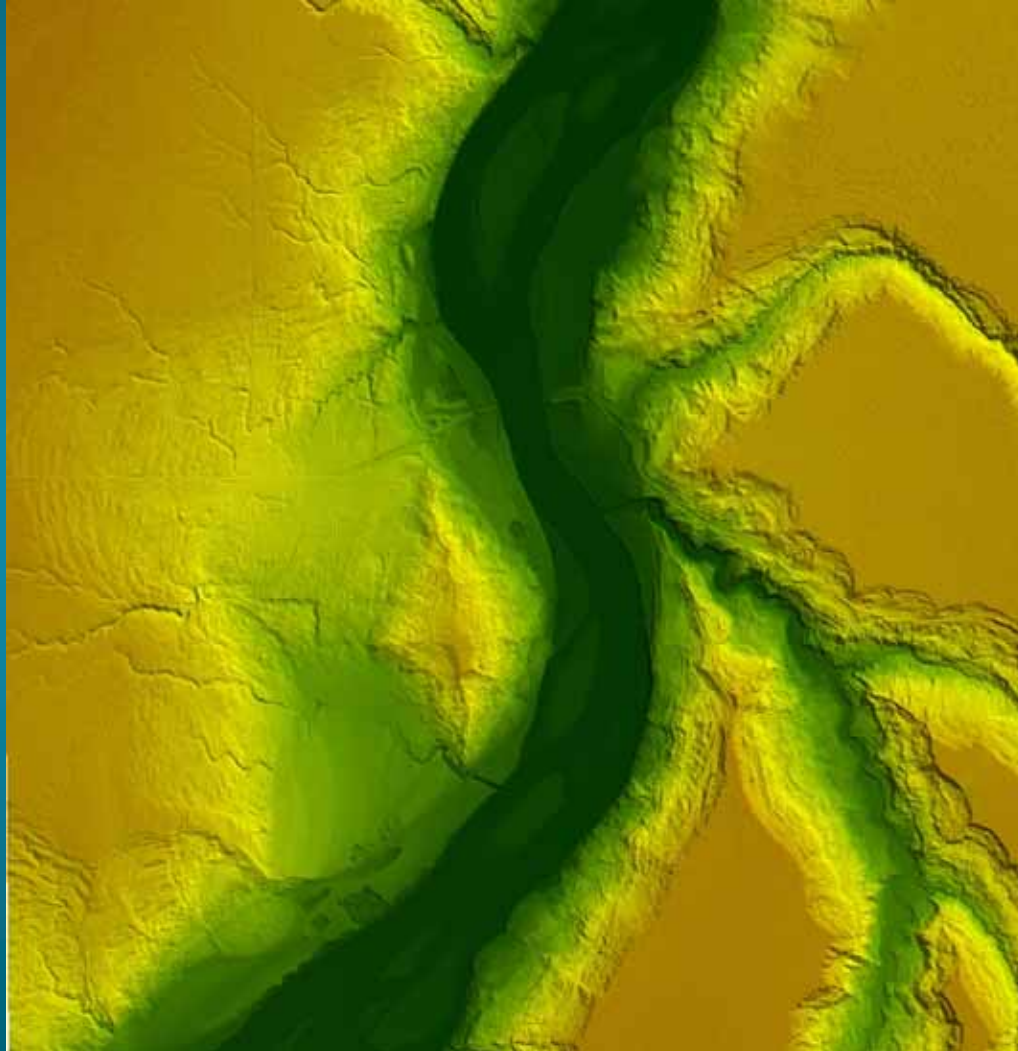
# GOA-Licensed LiDAR Coverage (Current)



# Peace River



# Peace River





# Landslide Hazard: West Side

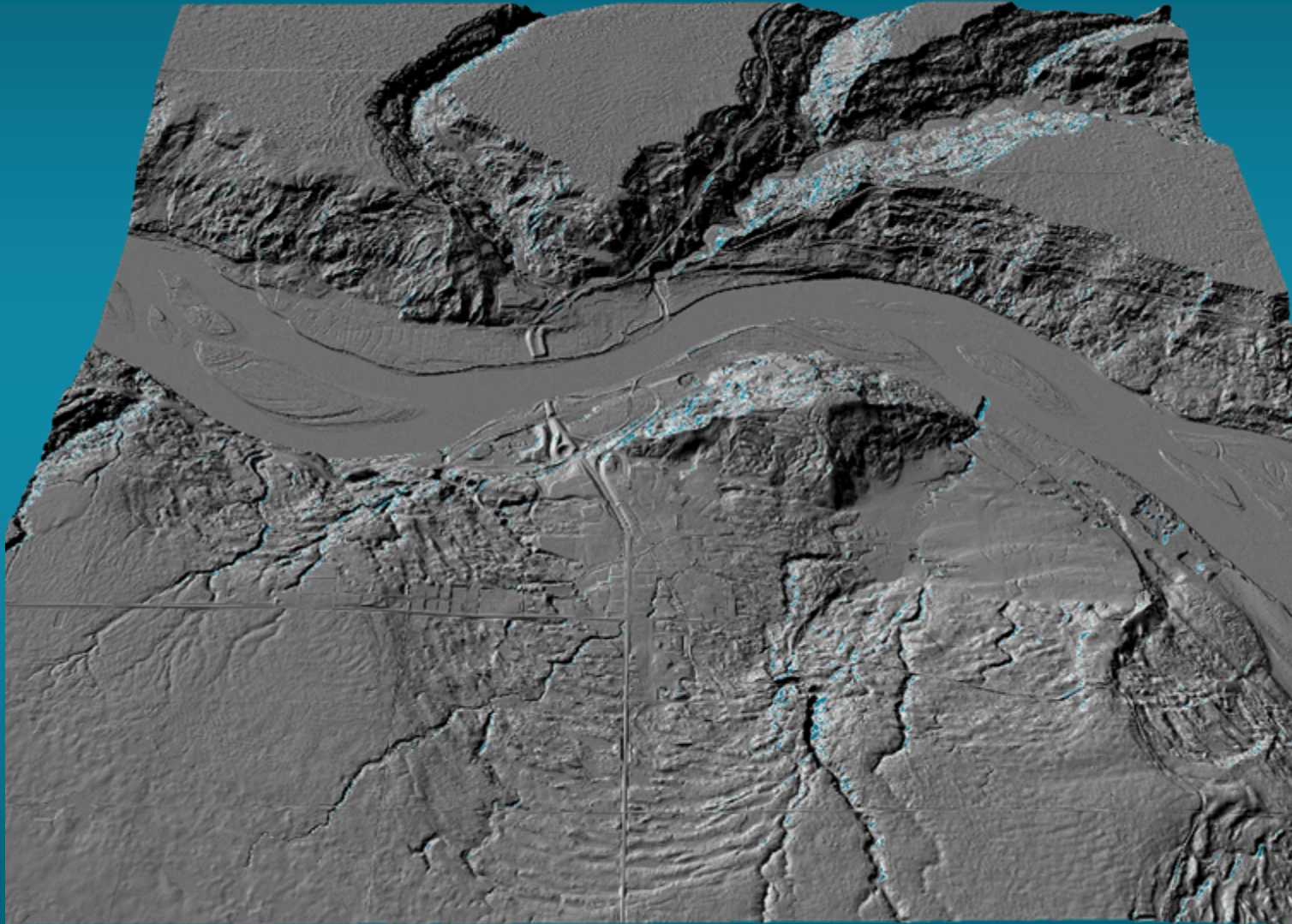


# West Side

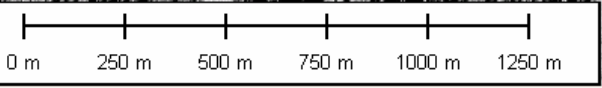
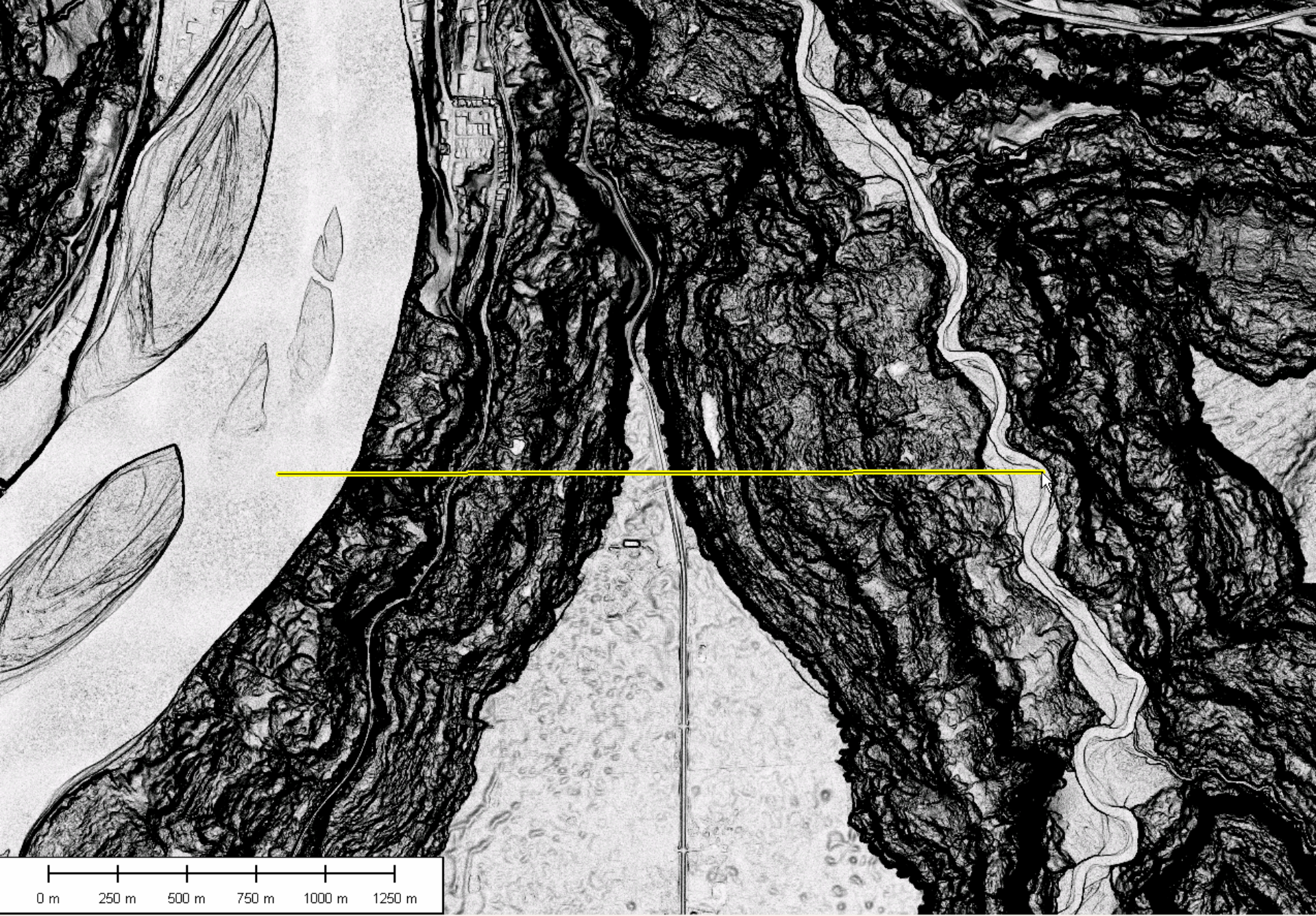




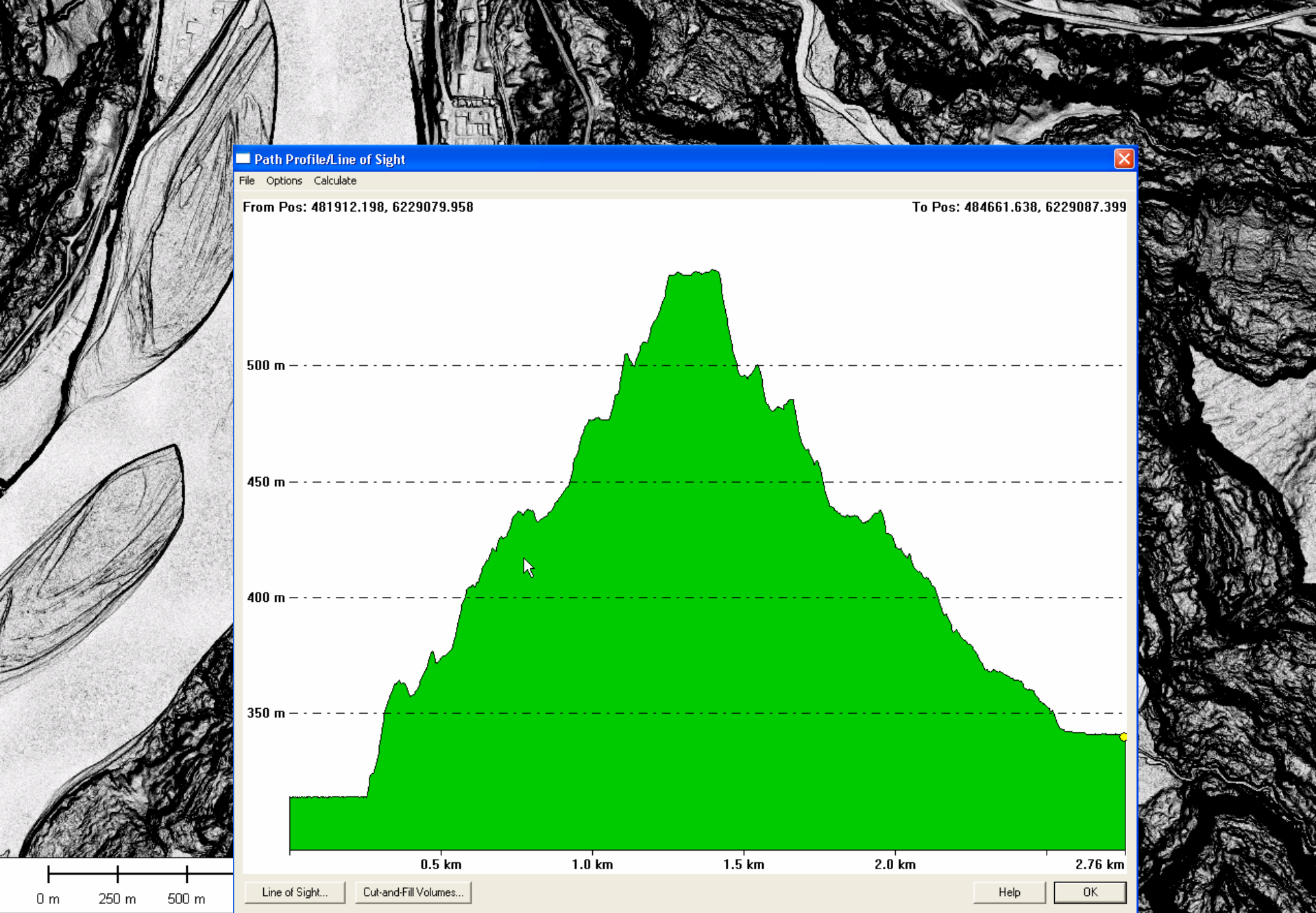
# West Side



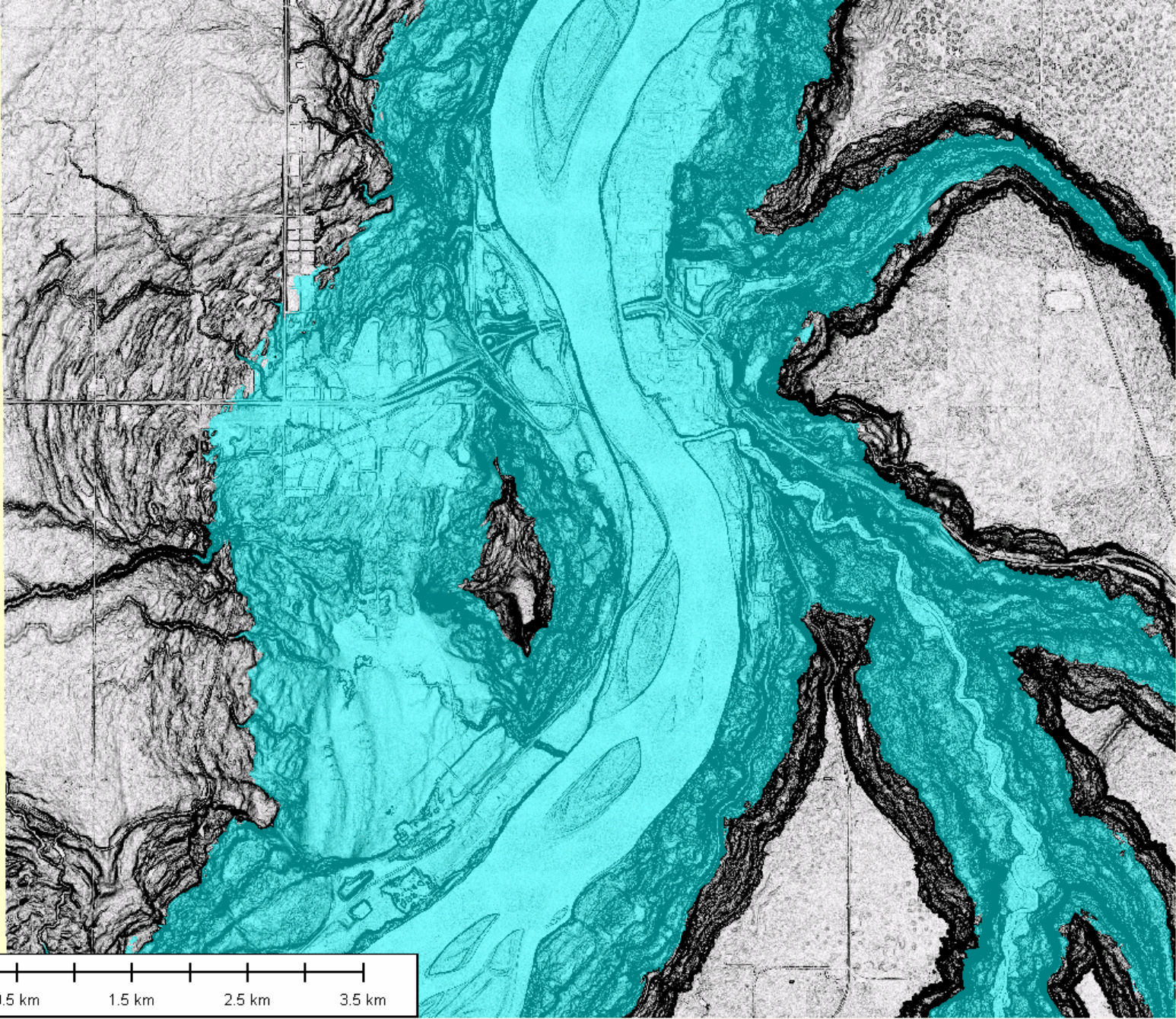




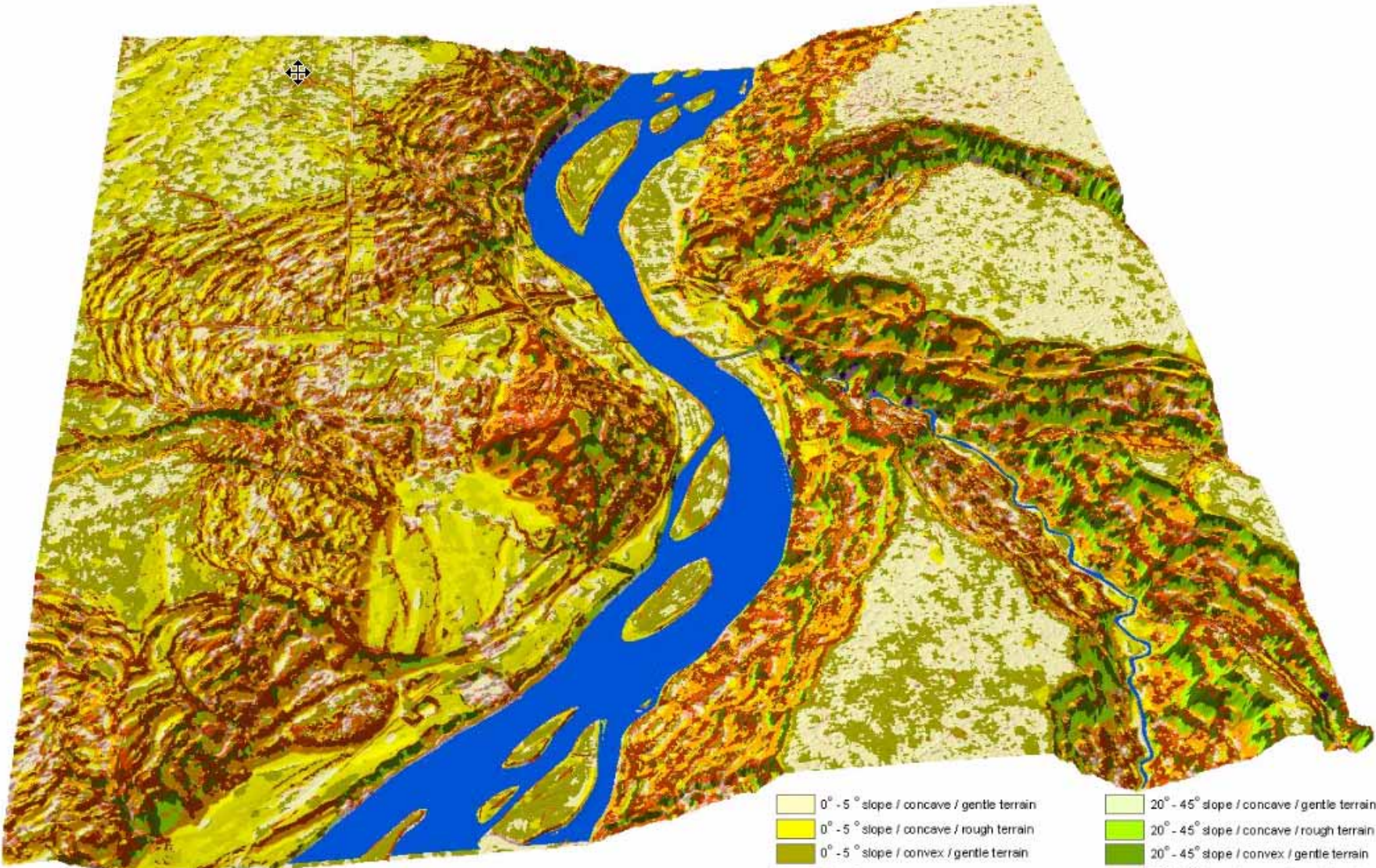





















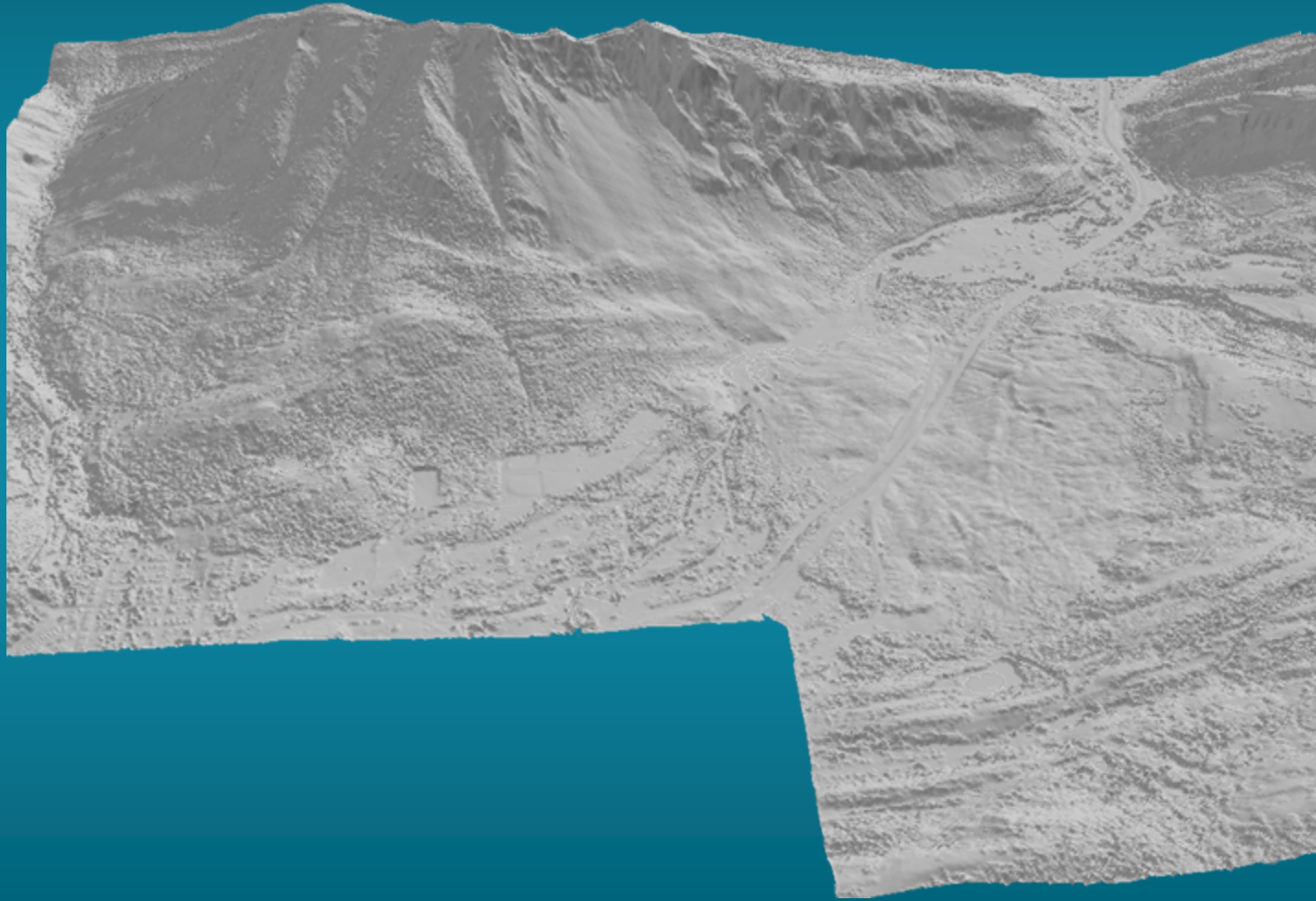






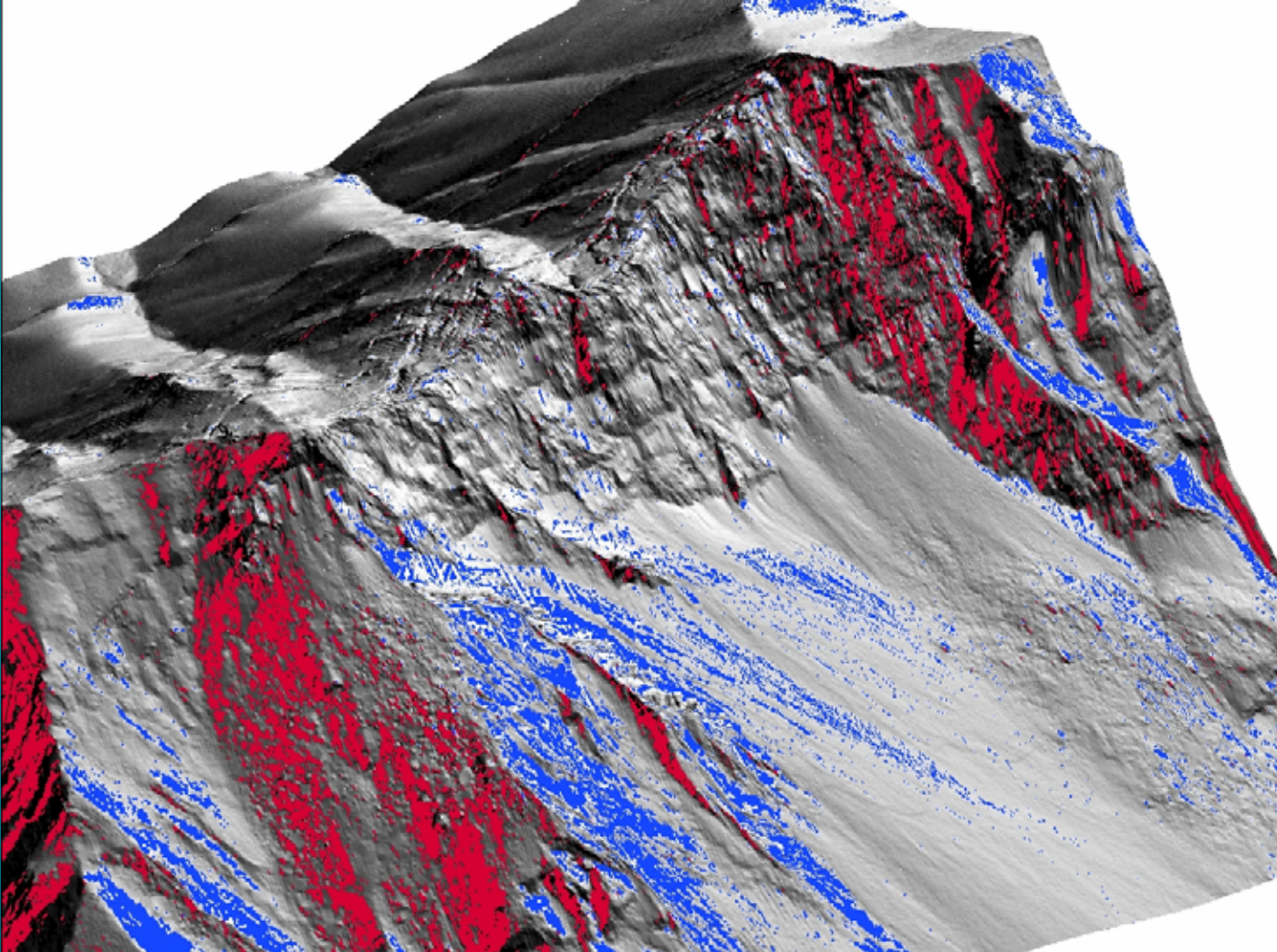
 0° - 5° slope / concave / gentle terrain	 20° - 45° slope / concave / gentle terrain
 0° - 5° slope / concave / rough terrain	 20° - 45° slope / concave / rough terrain
 0° - 5° slope / convex / gentle terrain	 20° - 45° slope / convex / gentle terrain
 0° - 5° slope / convex / rough terrain	 20° - 45° slope / convex / rough terrain
 5° - 20° slope / concave / gentle terrain	 +45° slope / concave / gentle terrain
 5° - 20° slope / concave / rough terrain	 +45° slope / concave / rough terrain
 5° - 20° slope / convex / gentle terrain	 +45° slope / convex / gentle terrain
 5° - 20° slope / convex / rough terrain	 +45° slope / convex / rough terrain

# Turtle Mountain LiDAR



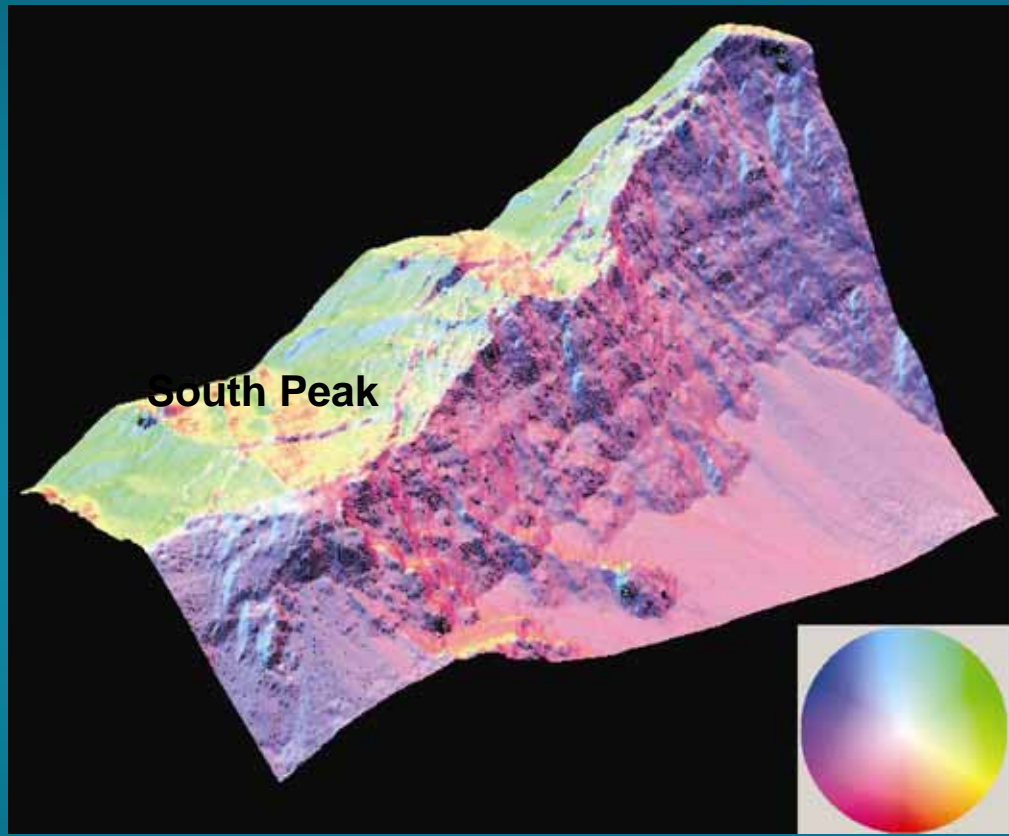
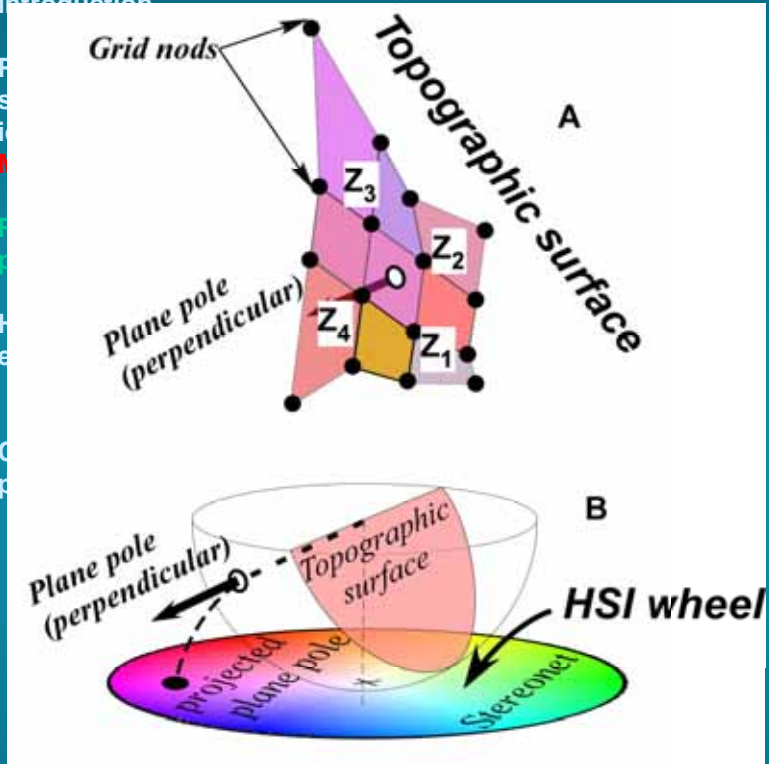


# LiDAR Structural Studies



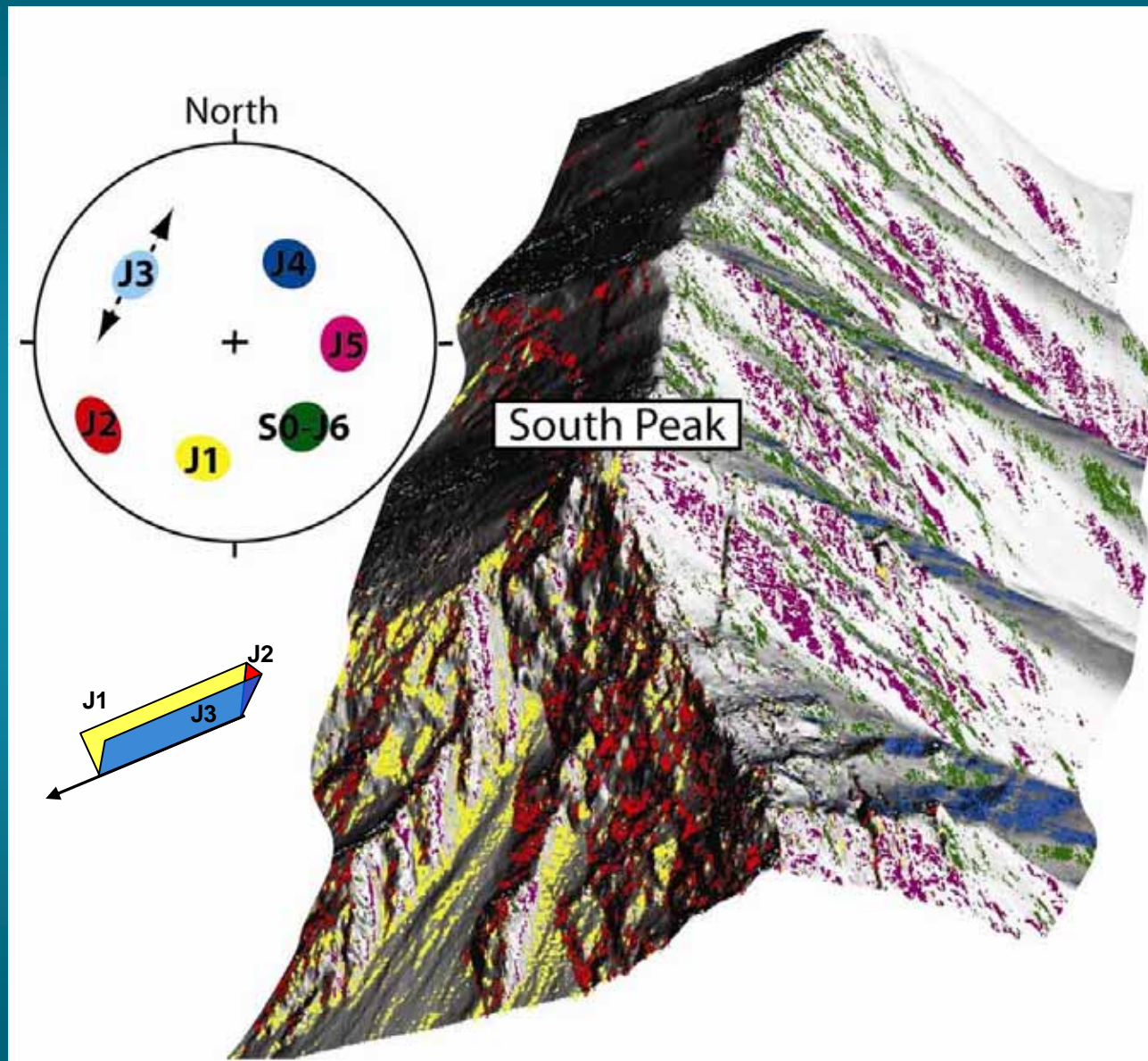
# LiDAR Structural Studies

Introduction



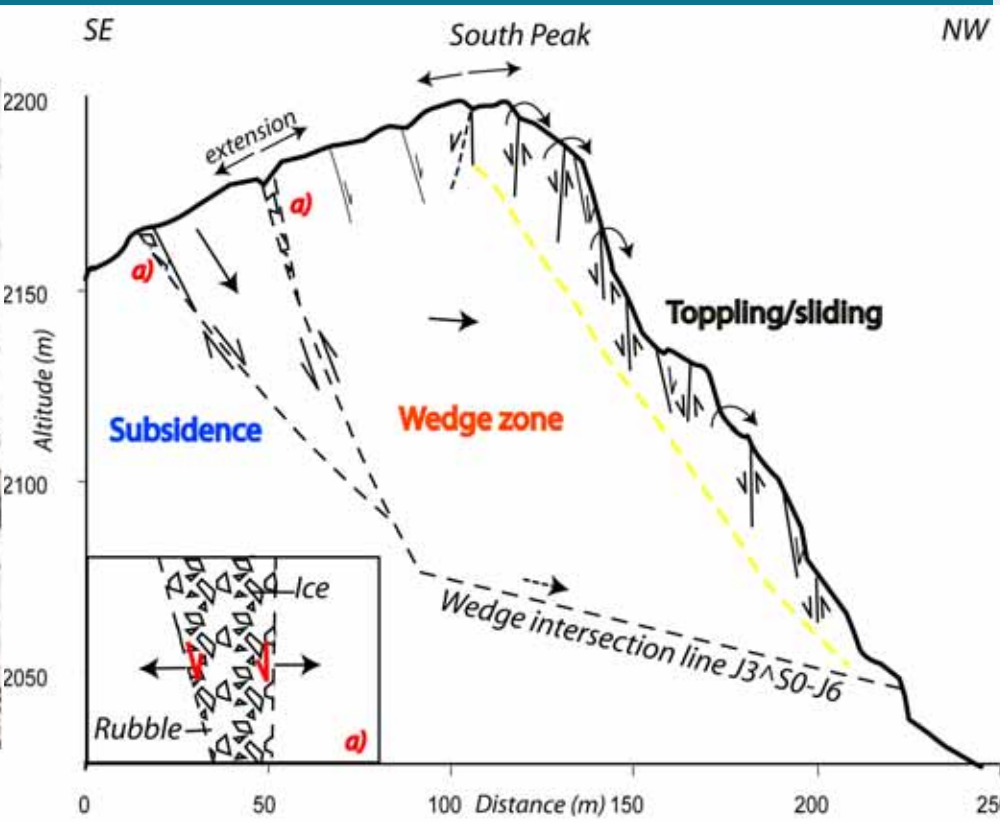
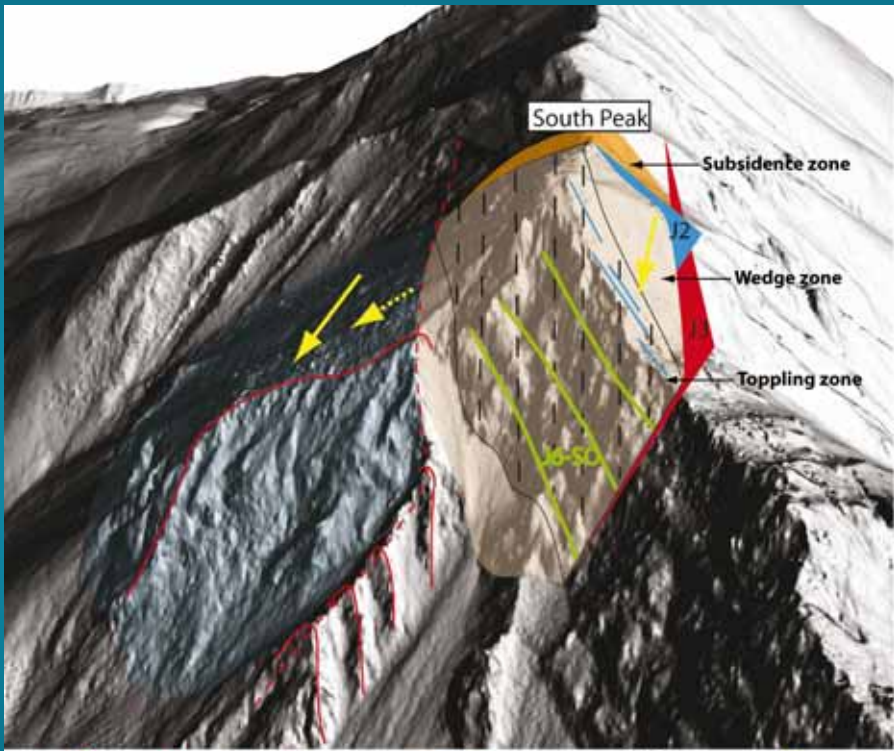


# LiDAR Structural Studies

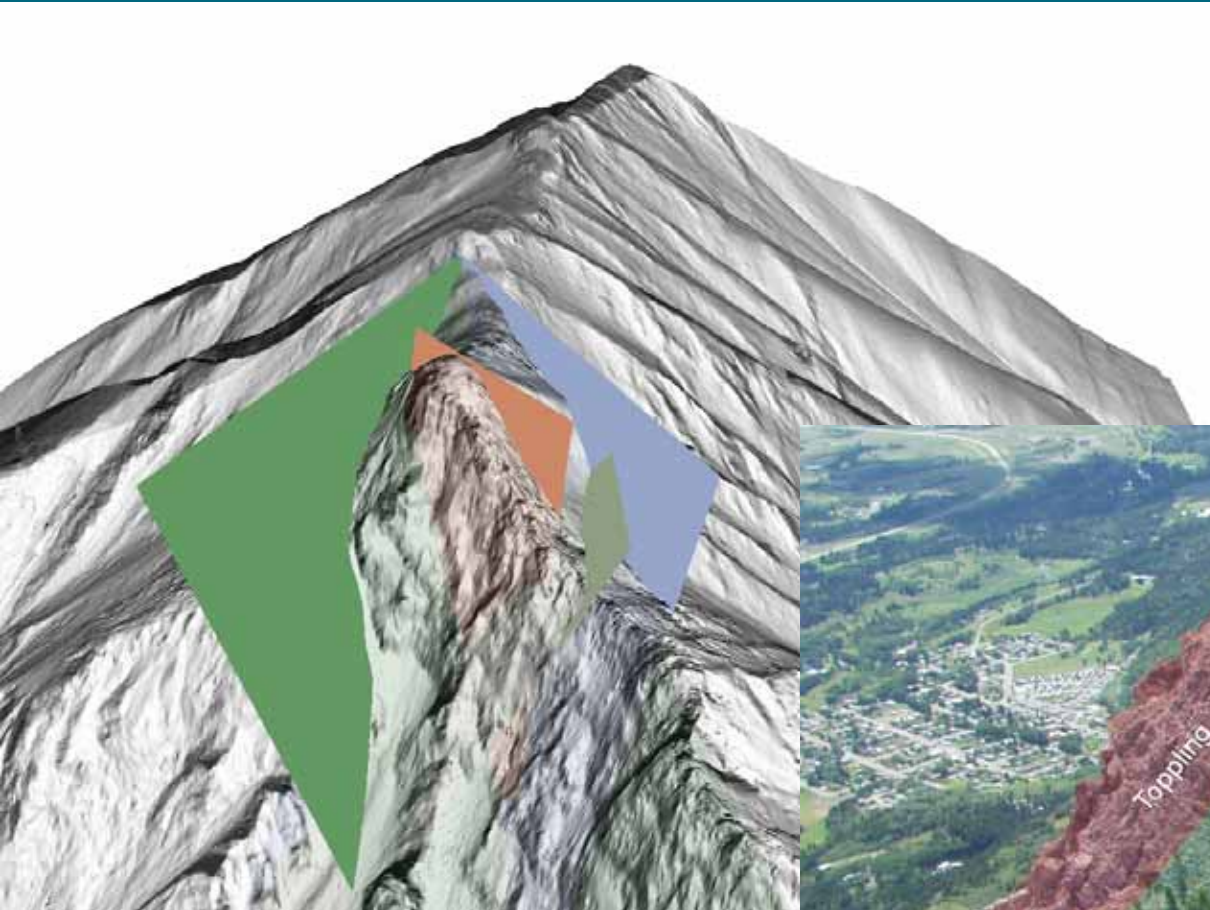




# Upper South Peak

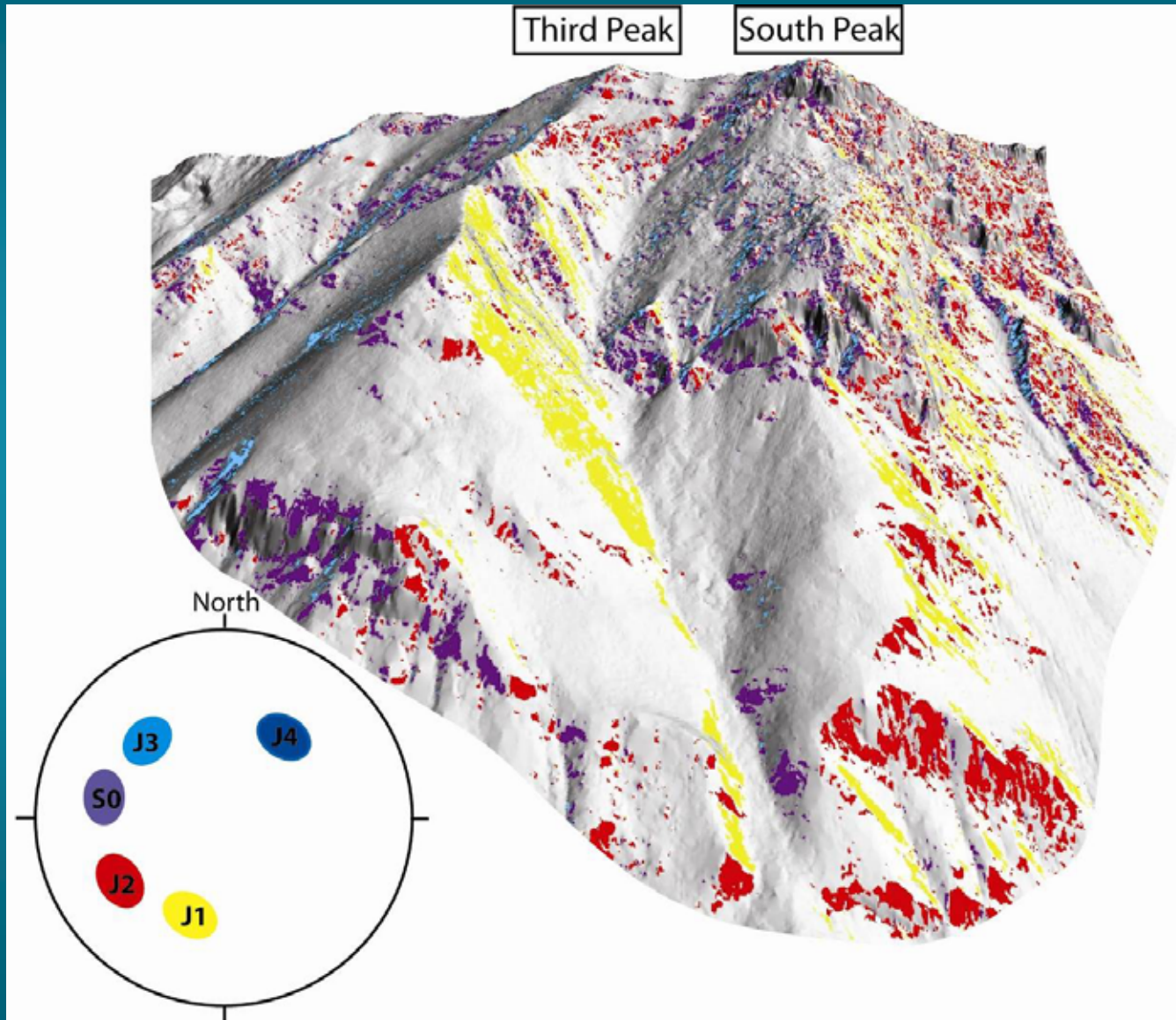


# LiDAR Structural Studies



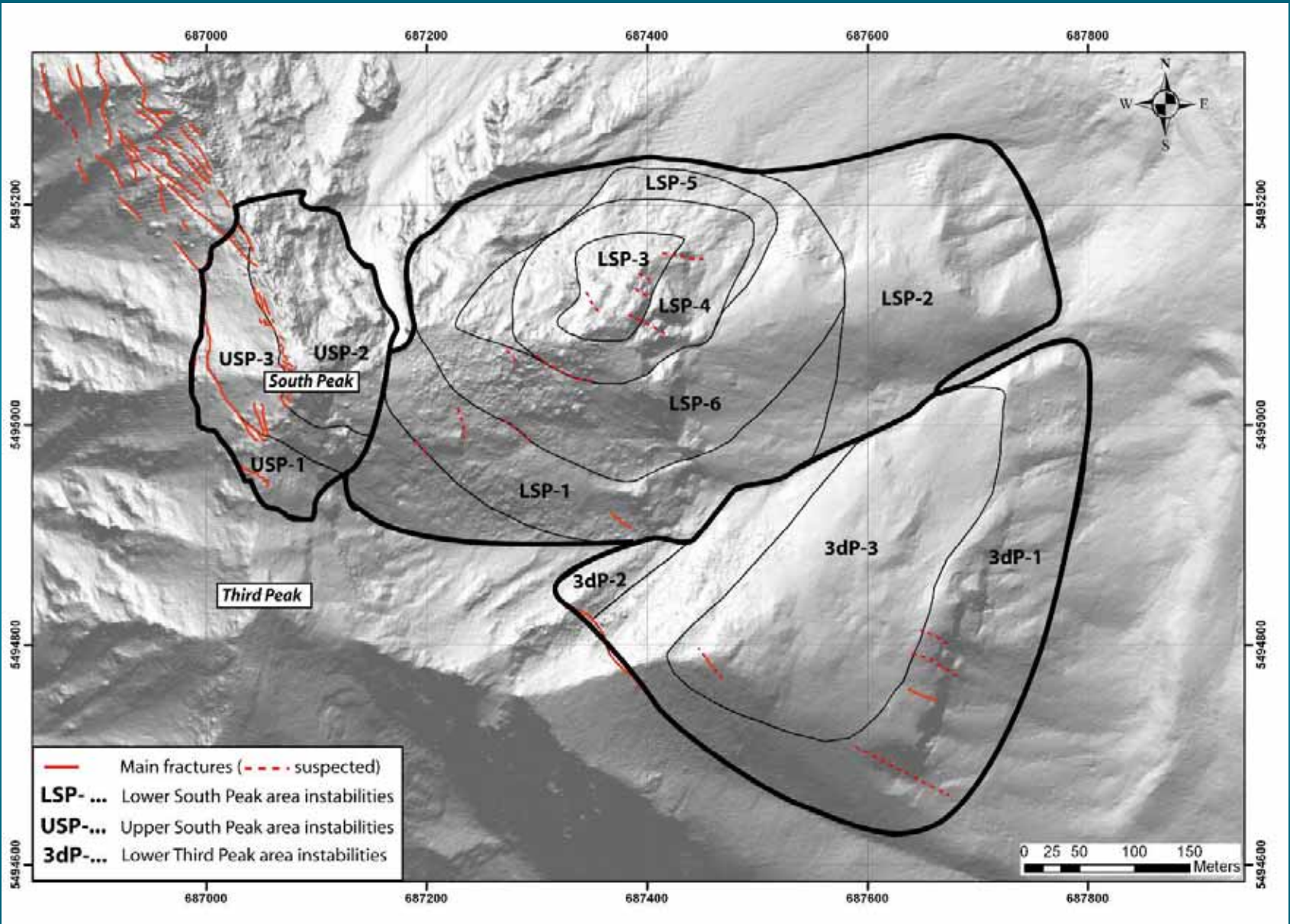


# LiDAR Structural Studies

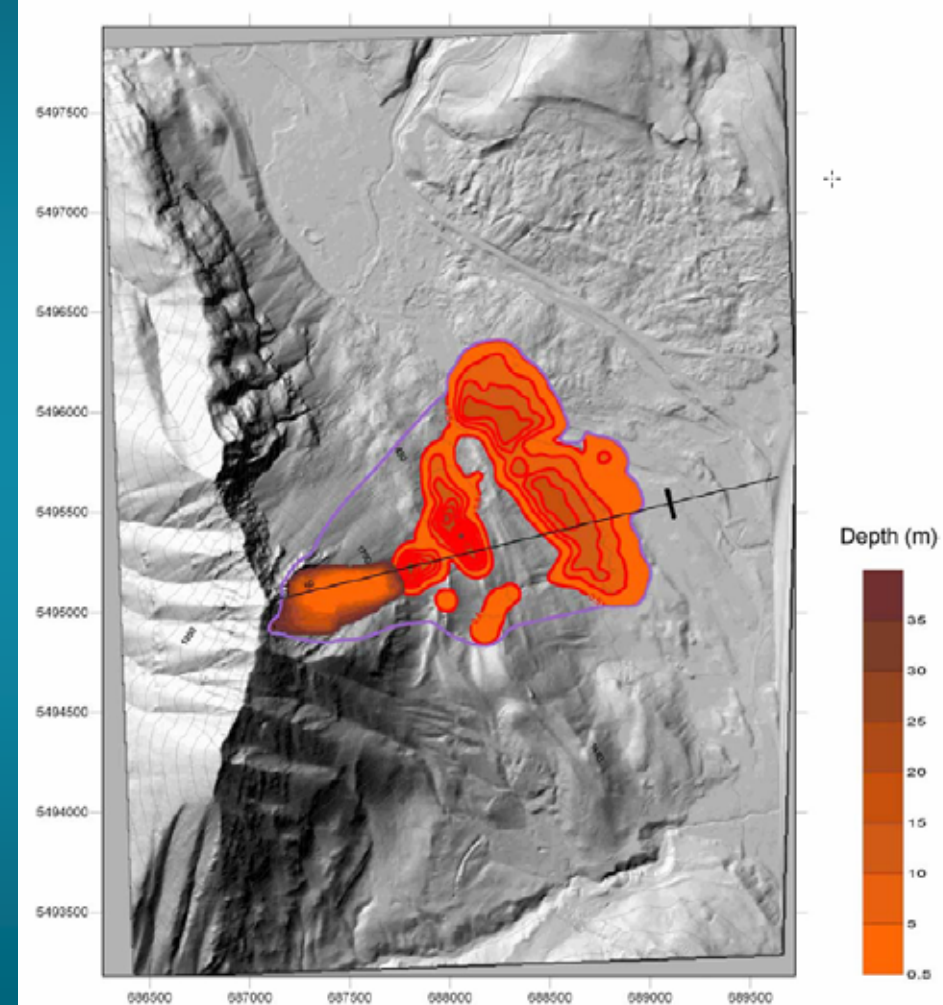
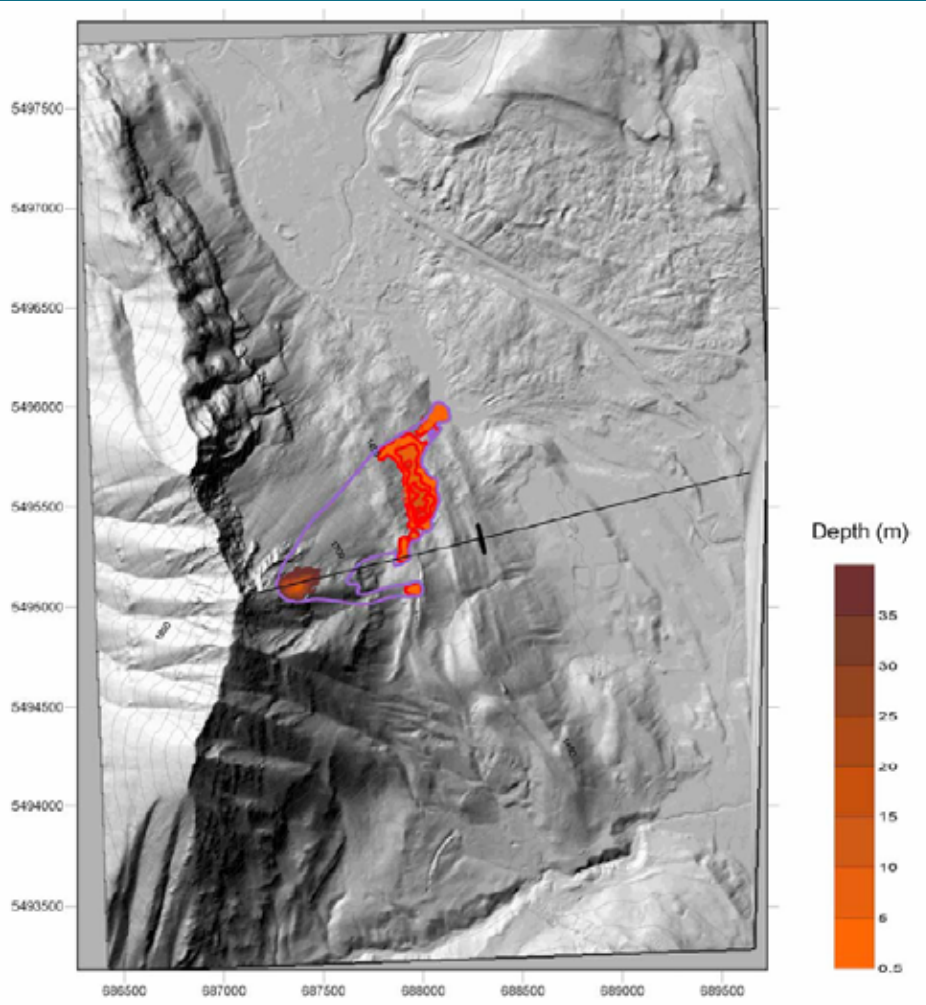




# Hazard Zone Delineation

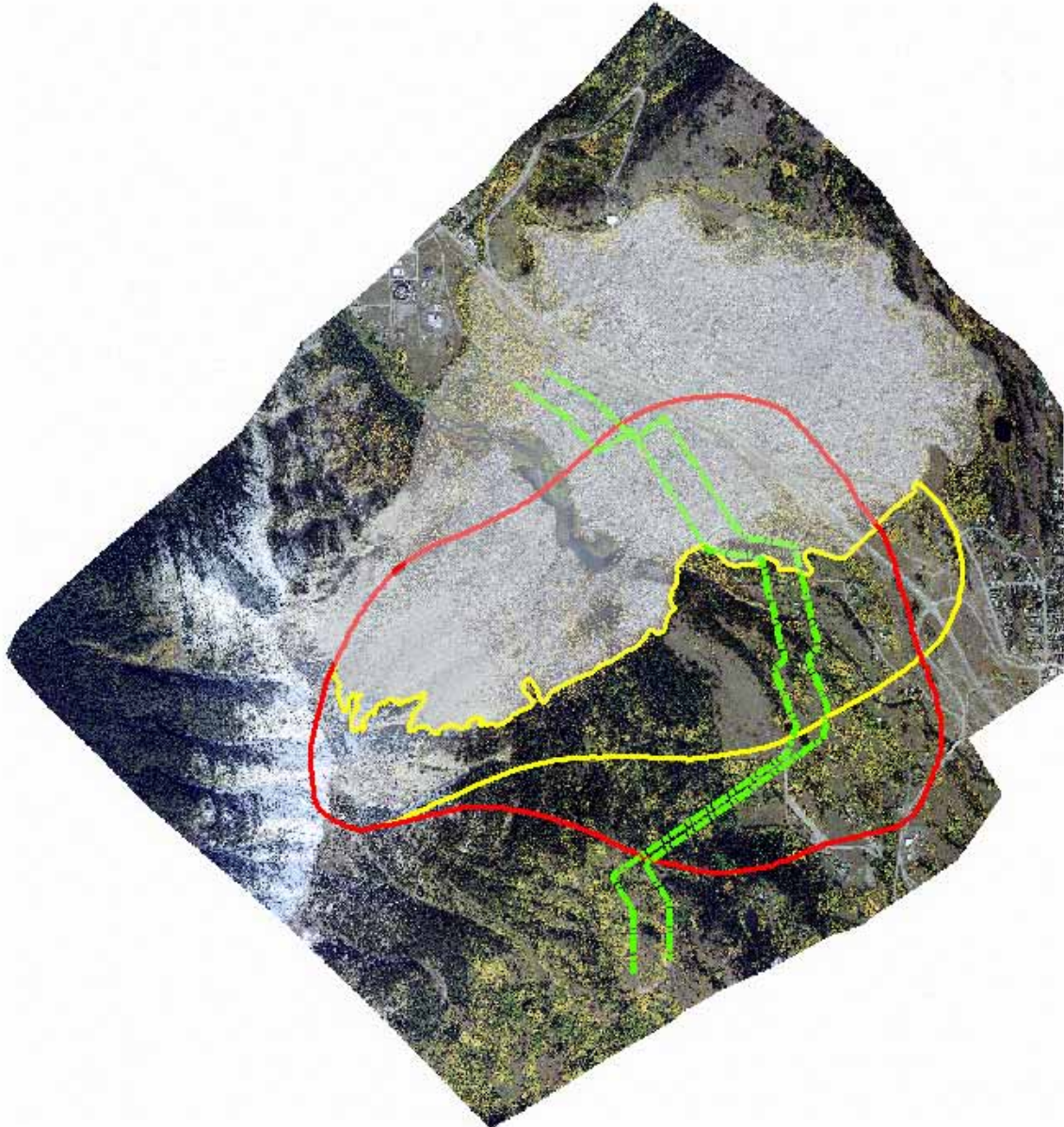


# Lower South Peak





# Results Summary



## Legend

- Allan (1933) 
- BGC (2000) 
- Hungr (2008)  
(Piece-wise failure) 