UNBC GIS LAB
GIS & Remote Sensing

Flood Extent Should the Kenney Dam Fail

Malyssa Maurer

November, 2007

- Abstract
- Introduction / background
- Data Source
- Data Manipulation
- Method/process
- Results
- Conclusions/Discussion
- Future works / developments
- References

Abstract

This project is designed to show the flood extent of water released into the 50 000 metres of the Nechako River below the Kenney Dam should the dam fail. This was done a guess and check method with the assumption that the dam would be fixed with in two weeks. This method included raster calculations of water level rises that would be equal to the volume that would be released in the 14 days. A six metre water level rise was found to be equivalent to this volume.

Introduction

- Alcan Aluminum built the Kenney Dam in 1952 on the Nechako River which created the Nechako Reservoir. The dam was built to divert two thirds of the flow west through a tunnel in the Coast Mountains to provide power for aluminum production in Kitimat.
- If the Kenney Dam failed massive amounts of water would be released in to the Nechako River below the dam causing flooding and extensive damage to the area.
- study area
- The objective of this study was to see what the extent of flooding would be after 14 days of water release at a rate five times greater than normal.

Study Area and Data Source

- The area of study is the Nechako Reservoir behind the Kenney Dam on the Nechako River. This area is located in west-central British Columbia near the town of Vanderhoof.
- The Kenney Dam is located on the eastern most end of the reservoir.

- The data sheet 93F from TRIM 1 was used for this study with data analysis on the sheets of 93F056, 93F057, 93F058, 93F066, 93F067, 93F068, 93F076, 93F077, 93F078.
- All TRIM 1 data was provided by Ping in the Ninkasi home directory in the form of WinRaR zip files (.saf).
- DEM data for the map sheet 93F was also used and was in the form of WinRaR zip files (.asc).

Data Manipulation

- The TRIM 1 .saf data was unzipped and converted to ESRI ArcInfo Coverage using the FME Translator.
- The Dem .asc data was unzipped and converted to raster using the conversion tool in ArcToolbox. This raster was then used to create hillshade with the Spatial Analyst â€“ Surface Analysis Tool.
- The water, lakes, rivers and roads coverage files from the TRIM 1 data was then clipped to a digitized flood extent shape file. This included the map sheets: 93F056, 93F057, 93F058, 93F066, 93F067, 93F068, 93F076, 93F077, 93F078.
- Data preparation

This was done to give an elevation value to each pixel of the river according to the elevation of the pixels that are closes to it. _

1. A new shape file as a line feature was created
2. The line feature was made into a 3D line
3. The 3D line was converted to a raster
4. A simplified flow path was digitized
5. With 3D Analyst tool a z-coordinate was given to the new simplified flow path
6. Shape file x,y,z table was exported to a point file
7. A new integer field was created with a calculated integer value for the z value
8. With Spatial Analyst â€“ distance tool allocation with z integer field was created

---

Methods / Procedure

Assumptions:

- The reservoir has a volume of 22 000 000 000m^3
- The maximum safe release rate is 650m^3/s
- A dam failure release rate would be about 5 times greater than maximum safe release rate â†' 2600m^3/s due to 650m^3/s natural dissipation by river.
- A dam failure would be detected and fixed with in two weeks (14 days)
- In 14 days approximately 131 000 000m^3 would be released.

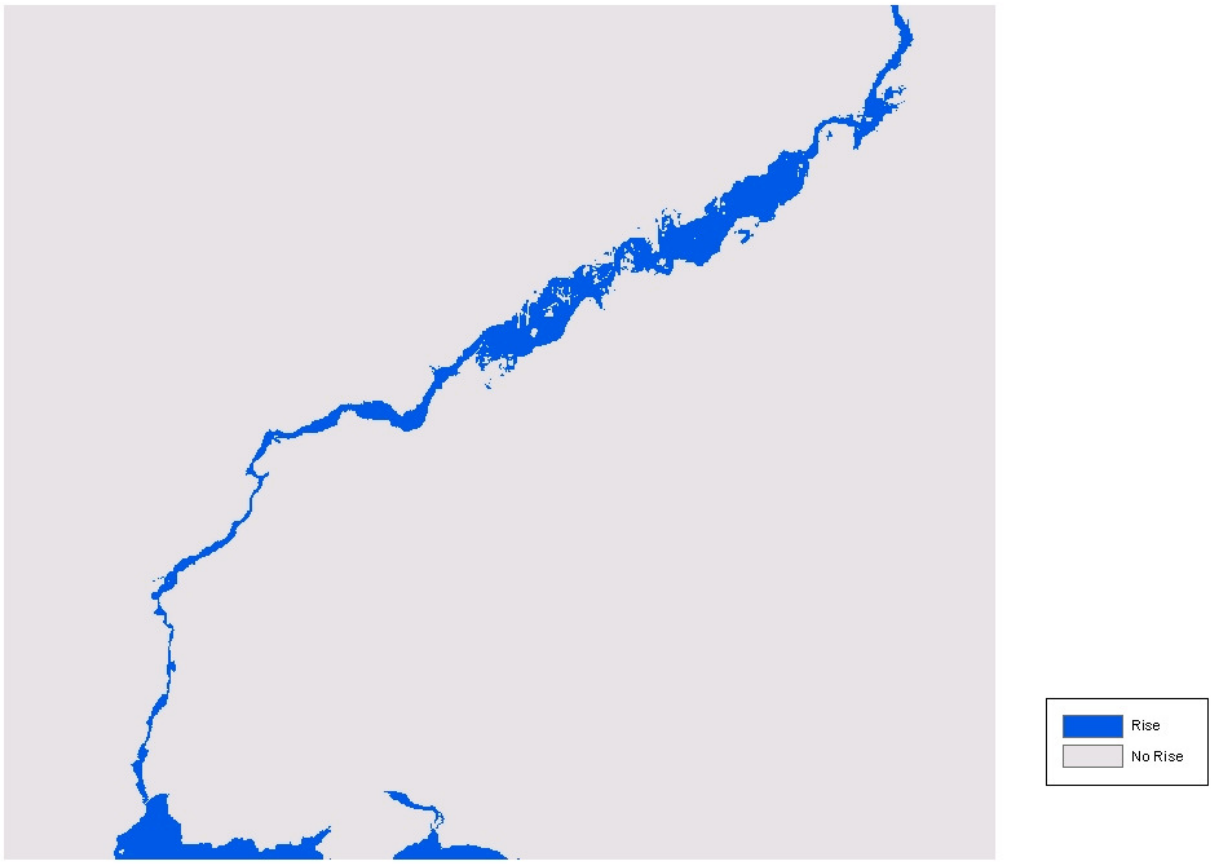
A guess and check procedure was used to find a flood volume that was close to the volume that would be released should the dam fail. This was done by determining the volume of water above the ground elevation for each pixel as follows:

1. Spatial Analyst â€“ Raster Calculator Tool : add X metre rise to allocation rater

Perpendicular Extrusion of River Elevation

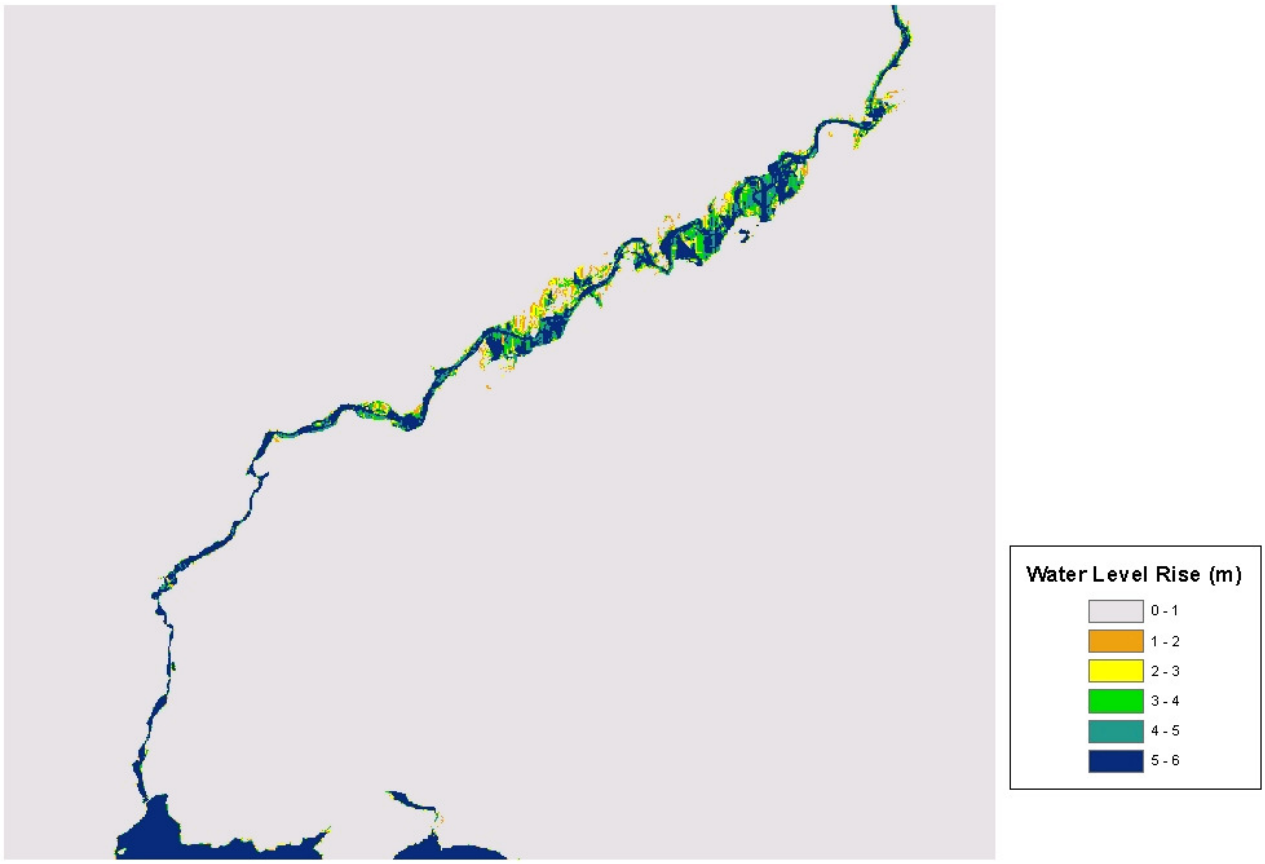
2. Spatial Analyst â€“ Raster Calculator Tool : minus step 1 from DEM rater
3. Spatial Analyst â€“ Reclassify Tool : reclassify step 2 into two values â† 0 â€“ 99999 = 0 and -99999 - -1 = -1

Reclassification of Elevation Due to Water Level Rise



4. Spatial Analyst â€“ Raster Calculator Tool : multiply step 3 and 2
5. Spatial Analyst â€“ Reclassify Tool : reclassify into unique values â† 0 â€“ X = 0 â€“ X and >(X+1) = X

Reclassification of Unique Water Level Rise



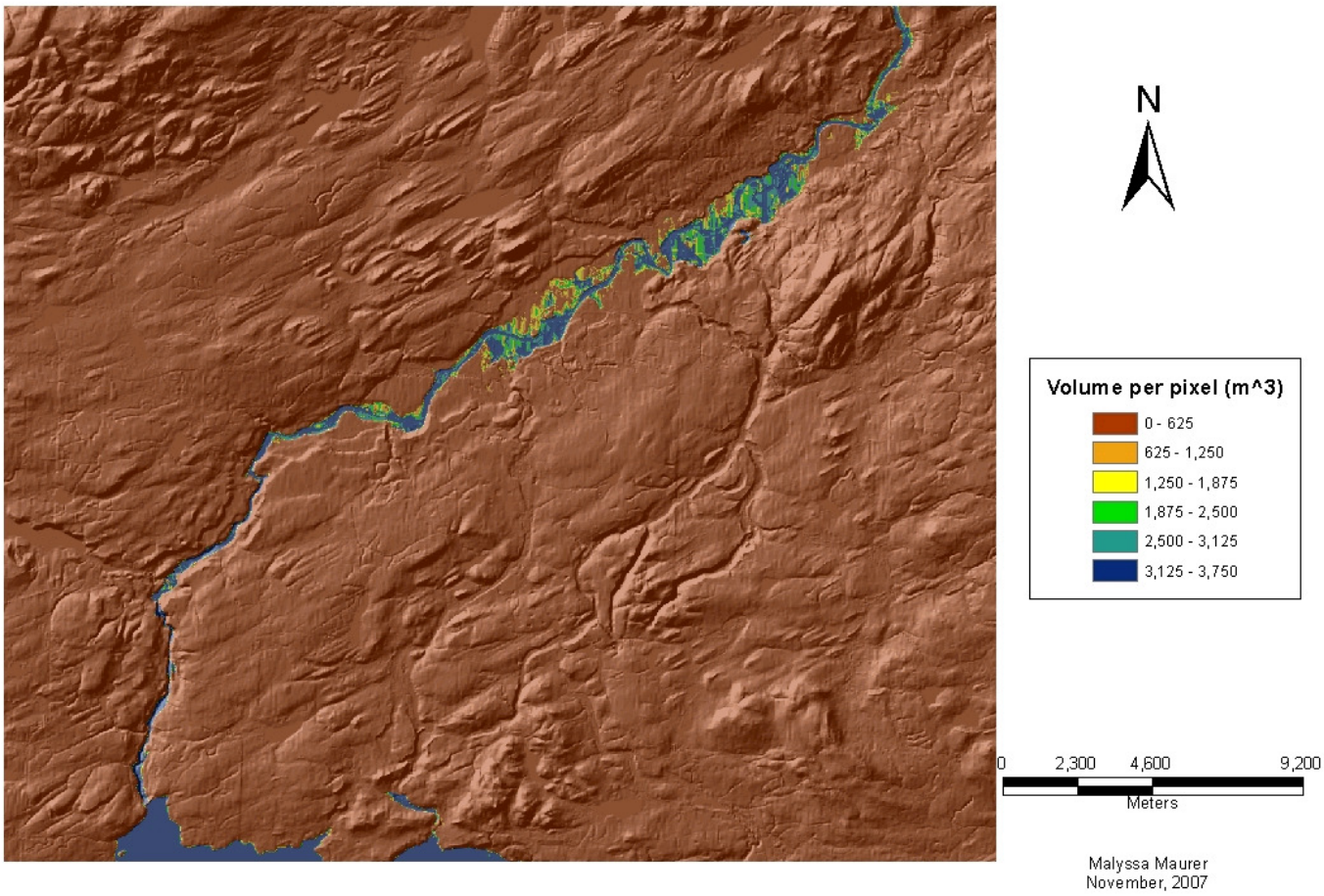
6. Spatial Analyst â€“ Raster Calculator Tool : multiply step 5 by pixel area (625m)
7. Attribute Table : add field called total to step 6
8. Attribute Table : use field calculator to multiply value and count
9. Attribute Table : look at statistics (sum) of step 8 field

---

Results

- In about 14 days the release of 123 000 000m^3 of water from the Nechako Reservoir would cause a 6 metre rise in the water level over the 50 000m long study segment.

Six metre water level rise below Kenney Dam



- If the dam failure was detected and fixed before or after the assumed 14 day period some other water level rises would be:

  10m over a 26 day period â†' releasing 251 000 000m^3
  7m over a 17 day period â†' releasing 157 000 000m^3
  5m over a 11 day period â†' releasing 102 000 000m^3
  4m over a 8 day period â†' releasing 77 000 000m^3

Conclusions / Discussion

- There would be a 6 metre rise in the water level of the Nechako River below the Kenney Dam if there was a dam failure. This failure was assumed to release water at a rate five times greater than the safe release rate and that it would be stopped in about 14days.
- This analysis only looked the first 50 000 metres of the possible flood area after the dam therefore this will only show the flood extent for a specified area. This same method could be used to determine the flood extent of a much larger area if needed.
- Metadata was done for three files: 6_m_rise, reclass6 and 6metres which are located along with all other files in N:\maurer\geog413\project\flood.

Future Works / Developments

- A more detailed study of all the area below the dam not just the first 50 000 metres would give a better understanding of how a dam failure would affect other water systems such as the Fraser River.
- Some things to be interested in would be the soil type and vegetation of the surrounding area and how each type is affected by a flood.
- It would also be interesting to know what would happen if the flow that is now directed through the Coast Mountains to Kitimat was aloud to flow down the Nechako, through the Kenney Dam and into the Fraser River.

References

- http://www.britannica.com/eb/article-9055144/Nechako-River
- http://www.porthardy.com/LakesAndRivers/Rivers/details/?ID=113
- French T. D., Chambers P.A. (1997) Reducing flows in the Nechako River (British Columbia, Canada): potential responses of the macrophyte community. Canadian Journal of Fisheries and Aquatic Science 54:22247-22254

TOP