

# The Nature of Sediment in the Toutle and Cowlitz Rivers after the Eruption of Mt. St. Helens

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ES 406: Aerial Photo Interpretation

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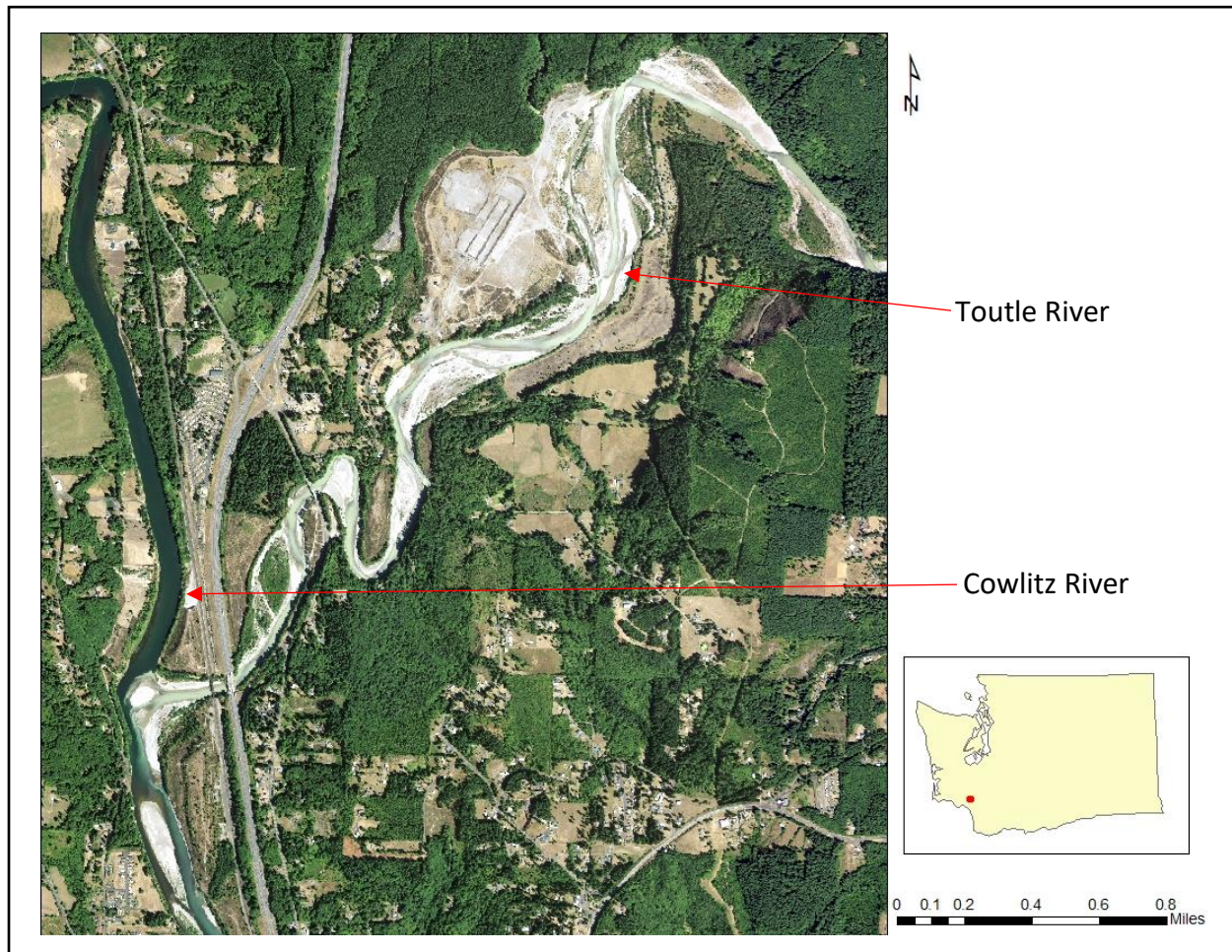
## Introduction

40 years ago, on March 27<sup>th</sup> 1980, Mt. St. Helens erupted, letting loose a flow of extremely hot and fast moving sediment known as a lahar. Although the eruption and landslide of the mountain was directed towards the Northeast, most of this sediment followed the Toutle river and then into the Cowlitz river. After the eruption, once the Toutle river began to flow again, sediment from this eruption continued to flow downstream.



*Figure 1 - United States Geological Survey - Waite, Richard*

This analysis is an attempt to look at the nature of sediment from the eruption of Mt. St. Helens in one specific area of Southwestern Washington. The focus of this paper will be the confluence of the Toutle River with the Cowlitz River. The extent of the analysis is an approximately 4.5 mile stretch of the Toutle river and a 2.5 mile stretch of the Cowlitz river extending downstream from the confluence. Below is an aerial image from 2015 giving a representation of the extent of this analysis.



### **Method**

The primary method of this study was using numerous aerial photographs of the region at specific points in time. The aerial photos were all sourced using the United States Geological Surveys Earth Explorer web application. Four separate points in time were chosen. An aerial photo single frame was chosen as the first point in time which occurred in September of 1975. 1975 would have been five years before the eruption and will serve as a starting point and show a default of what the landscape looked like before. The first image to show the aftermath of the eruption and the resulting lahar is a series of two aerial photo single frames. These two aerial photos took place on September 1<sup>st</sup> of 1980, six months after the eruption. Next, there is another series of two Digital Orthophoto Quadrangle (DOQ) from June 21<sup>st</sup> of 1990, almost exactly 10 years after the event. Finally, a more recent representation

was used to compare how the rivers look now. Two National Agriculture Imagery Program (NAIP) images from the Department of Agriculture's Farm Service Agency dated August 17<sup>th</sup> of 2015.

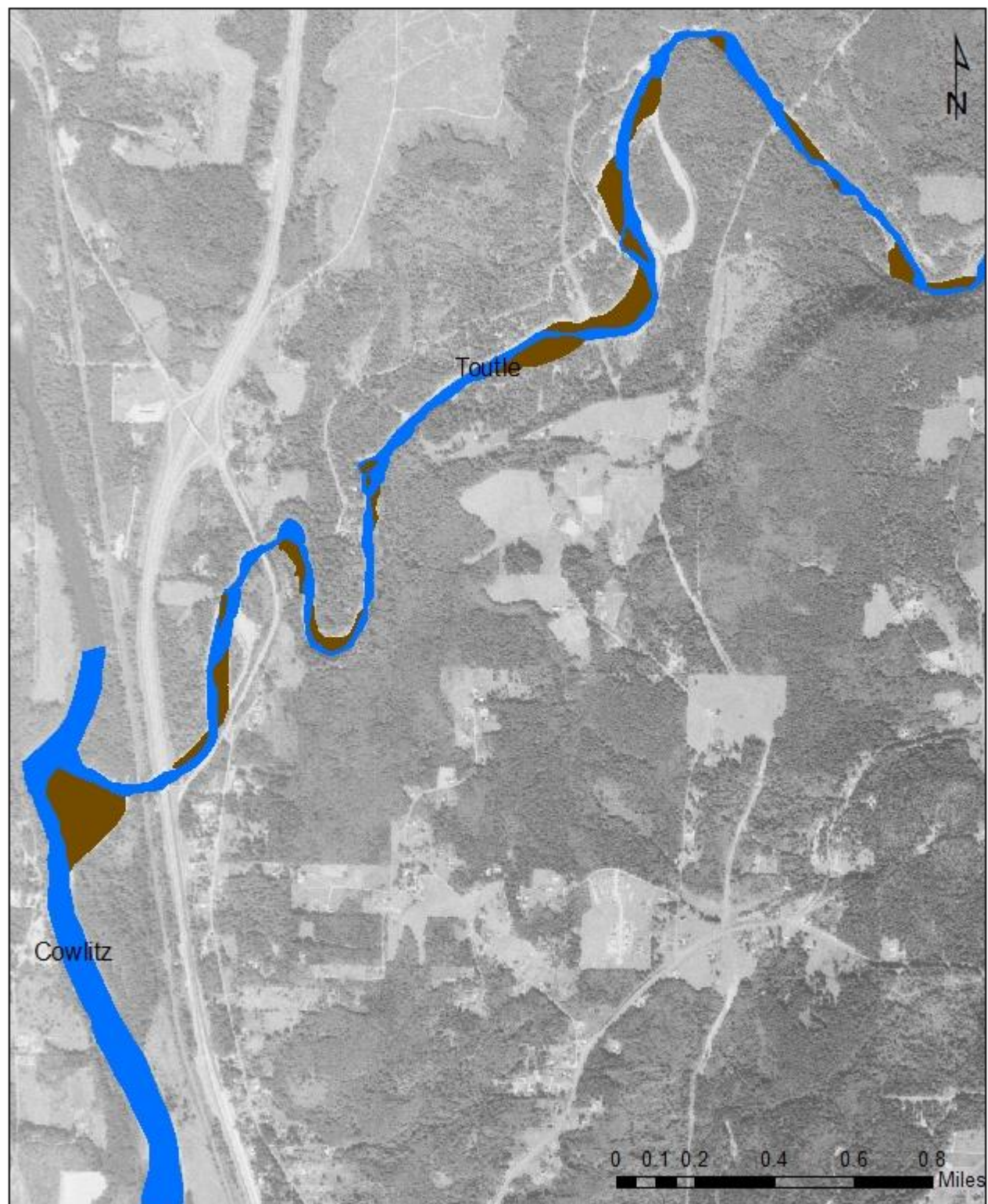
It is important to note that all of the aerial photo single frames sourced from the USGS are not referenced to a geographic location to begin with. Because of this ArcMap 10.7.1 was used to reference the images. This is done by comparing an already referenced image, in this case the USGS DOQs, to the non-referenced image. Using ArcMap's georeferencing tool points are connected between the two images and then a model is produced using a number of different transformation techniques. After all of the aerial image were approximately georeferenced to their physical location, the next step in analyzing the erosion and deposition of the sediment is to digitize the map. Using ArcMap's feature creation tools to create feature polygons for both the path of the rivers and sediment deposits. Finally, using tools like statistics the total area of the sediment deposits can be found.



## **Results**

The conclusion of this analysis has found that in total, from the area examined, that sediment from the lahars initially clouded the Toutle and Cowlitz rivers. Over the period of 40 years the sediment continued to either clear, or become inhabited by foliage. Using the methods described above, the area had an approximate land cover of 80.41 Acres Sq. After the eruption the sediment deposits area was equal to approximately 348.73 Acres Sq. In the following years sediment began to clear out with a total of 185.11 Acres Sq. in 1990 and 107.27 Acres Sq. in 2015. The pages following are visualizations of the data produced from this study.



# Sediment Deposits on the Toutle and Cowlitz Rivers in September of 1975



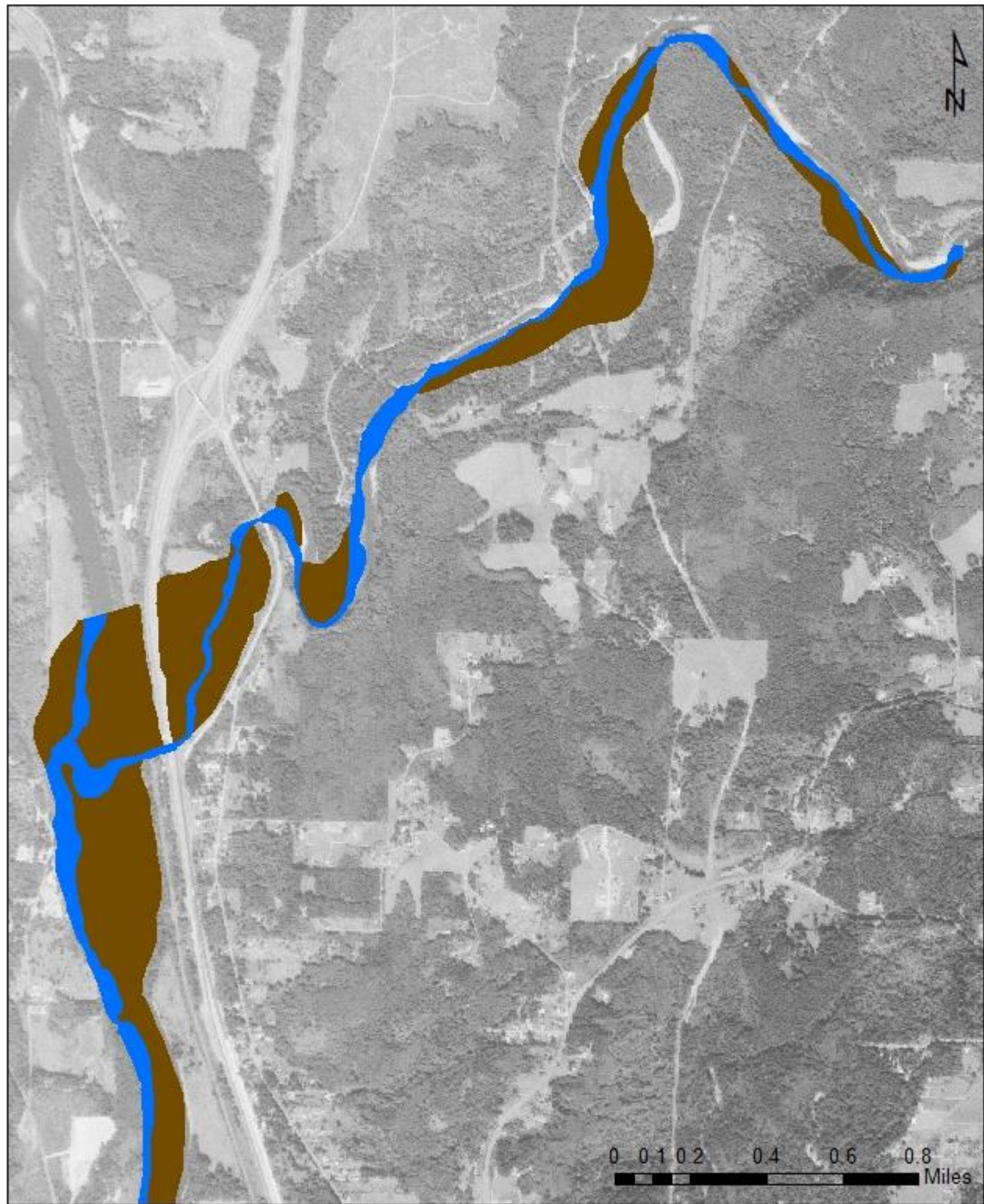
-  Sediment Deposits
-  River Boundry



Total sediment along the Cowlitz and Toutle rivers in the study area in 1975: 80.41 Acres Sq.

Coordinate Sys: NAD 1983 StatePlane Washington South



# Sediment Deposits on the Toutle and Cowlitz Rivers in September of 1980



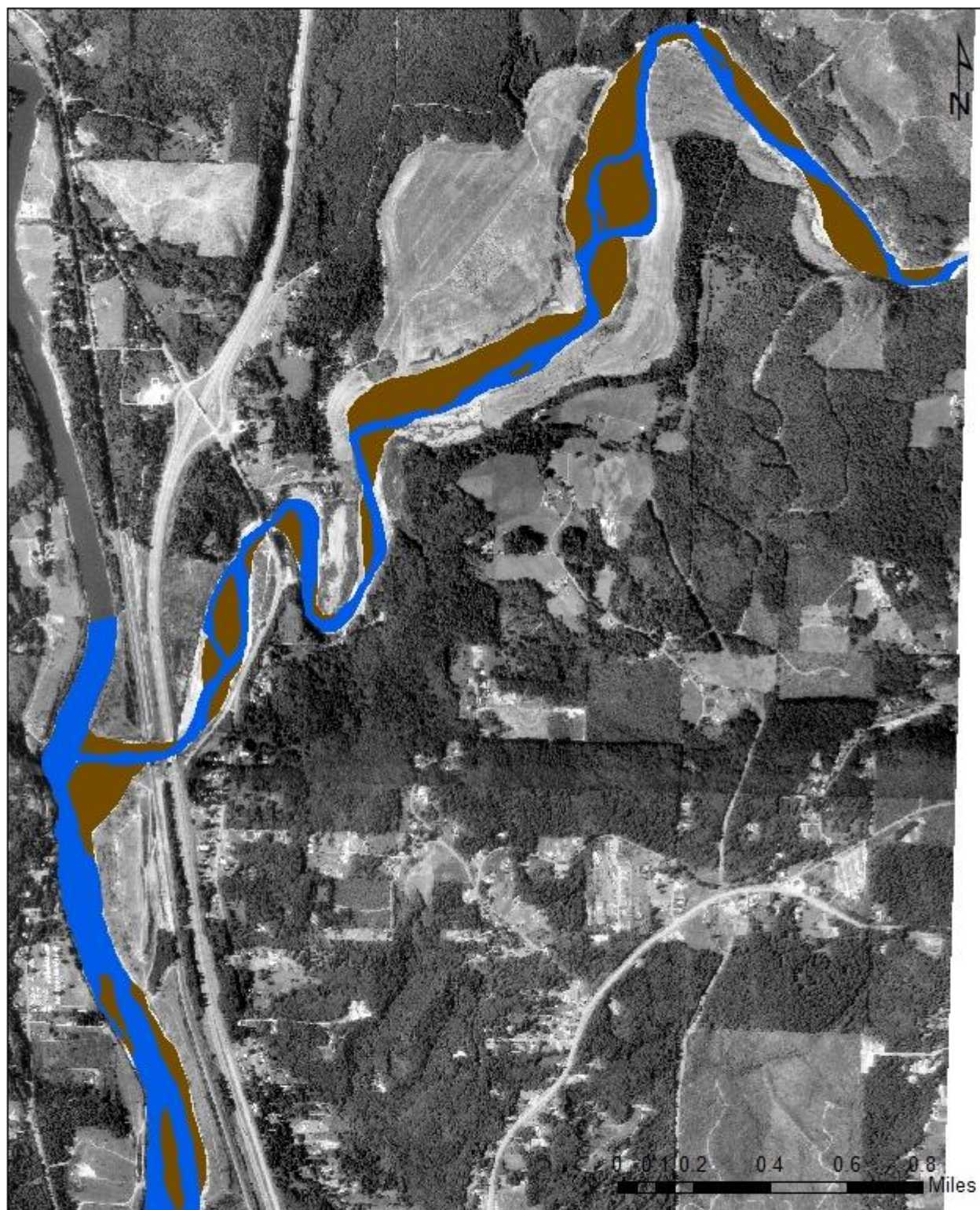
-  River Boundry
-  Sediment Deposits



Total sediment along the Cowlitz and Toutle rivers in the study area in 1980: 348.73 Acres Sq.

Coordinate Sys: NAD 1983 StatePlane Washington South



# Sediment Deposits on the Toutle and Cowlitz Rivers in March of 1990



-  River Boundry
-  Sediment Deposits

Total sediment along the Cowlitz and Toutle rivers in the study area in 1990: 185.11 Acres Sq.

Coordinate Sys: NAD 1983 StatePlane Washington South



# Sediment Deposits on the Toutle and Cowlitz Rivers in August of 2015



River Boundy

Sediment Deposit

Total sediment along the Cowlitz and Toutle rivers in the study area in 2015: 107.27 Acres Sq.

Coordinate Sys: NAD 1983 StatePlane Washington South



### **Works Cited**

Earth Explorer. United States Geological Survey. <https://earthexplorer.usgs.gov/>

“Lahars move rapidly down valleys like rivers of concrete.” United States Geological Survey.  
<https://volcanoes.usgs.gov/vhp/lahars.html>