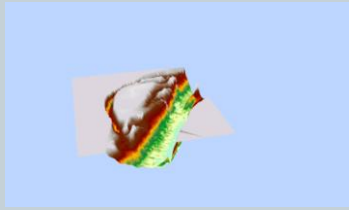


Evaluation of Historic Surface Generation for Pile Dike Analysis

JASON MILLER
DOUGLAS SWANSON
GEOG 593
DIGITAL TERRAIN ANALYSIS
20 NOVEMBER 2012

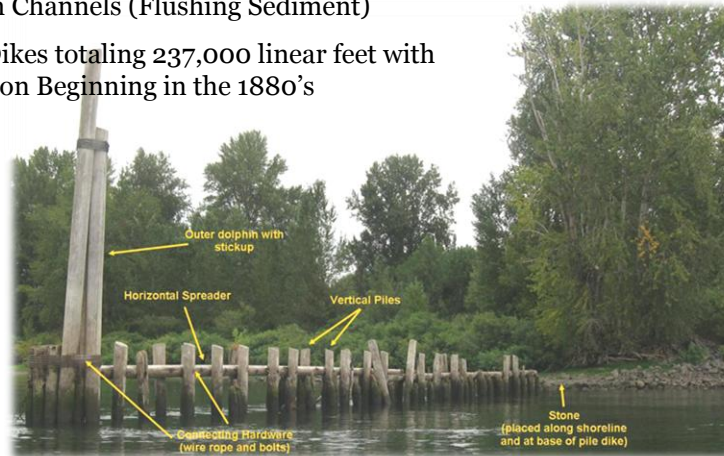


Topics of Discussion

- Pile Dikes Defined
- The Problem: Lack of Information
- The Solution: Building a Scientifically Sound Historical Surface
- Step One – Historical Data Conversion
- Step Two – Generating an Historical Baseline
- Step Three – Interpolating the Baseline
- Step Four – Historical Surface in Analysis
- Summary and Questions & Answers

Pile Dikes Defined

- ❑ Pile Dikes are used to Protect River Banks & Increase Flows in Navigation Channels (Flushing Sediment)
- ❑ 256 Pile Dikes totaling 237,000 linear feet with Construction Beginning in the 1880's



Lower Columbia River (LCR) Studies

- ❑ **2008 Biological Opinion (BiOp)** – Lower Columbia River Estuary Partnership (LCREP) Concluded that Various Operations in the LCR Jeopardize Threatened & Endangered Species:
Pile Dikes were assigned Reasonable and Prudent Alternative (RPA) #38 Directing Agencies to Develop & Implement a Pile Dike Removal Program.

- ❑ **2010 Pile Structure Program Report** (Project Number 2003-011-00)

“The removal or modification of pile structures is an untested restoration technique for ecosystem restoration and salmonid recovery in the lower Columbia River estuary. As a result, the program team believes it is important to establish a strong scientific foundation for this new program.”

- ❑ **2011 - Structural & Hydraulic Analysis of Columbia R. Pile Dikes** (W9127N-10-D-0002)

*Pile Dike Assessment Habitat Impact Findings:
Determination: “Additional Studies Recommended”
“Impact Inconclusive”*

The Problem: Lack of Information



❑ **Detrimental Effects**

- May Limit Large Woody Debris (LWD) Recruitment Behind Pilings
- May Block Access for Fish to High Quality Habitat
- Piscivorous Fish and Birds may Utilize Pile Structures for Foraging



❑ **Beneficial Effects**

- May Provide Valuable Habitat Structure and Trap LWD
- May Help form Shallow Water Habitat
- May Provide Cover from Piscivorous Fish and Birds



Are Pile Dikes beneficial or detrimental?

Little Science Available to Support Any Solid Conclusions

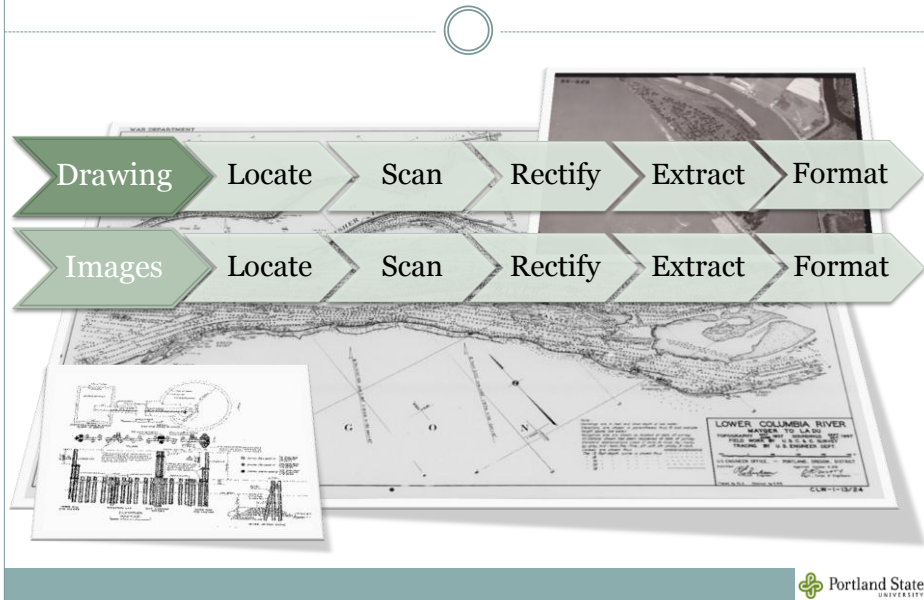
The Solution – More Data



Using Historical Information, Produce Scientifically Sound, Accurate Digital Terrains Around Pile Dikes to Support further Study.

We Believe that Historical Information is Vital to Restoration; Providing a Picture of what it is we are Trying to Achieve.

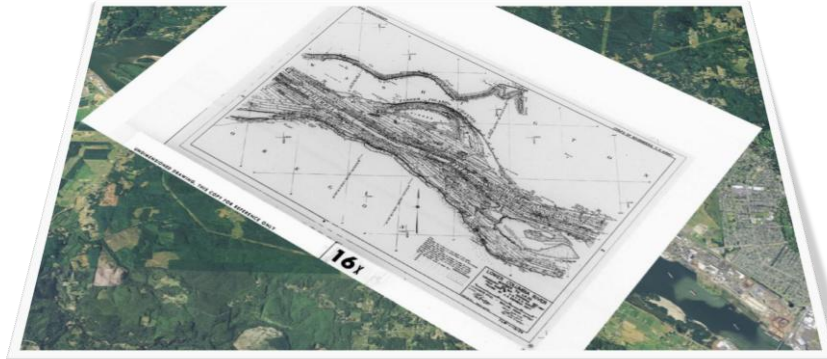
Step 1 – Historical Data Conversion



Step 1 – Historical Data Conversion



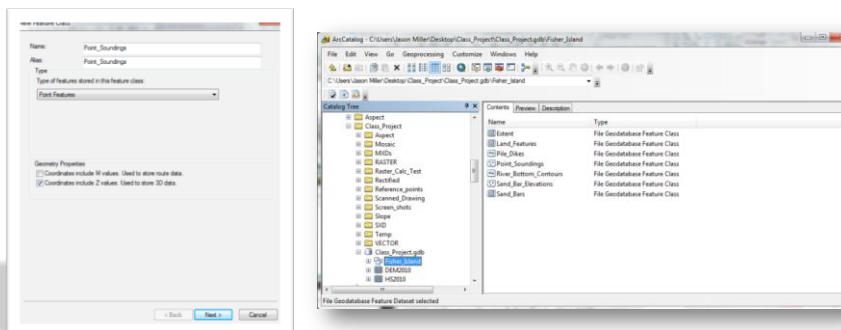
Step 1 – Historical Data Conversion



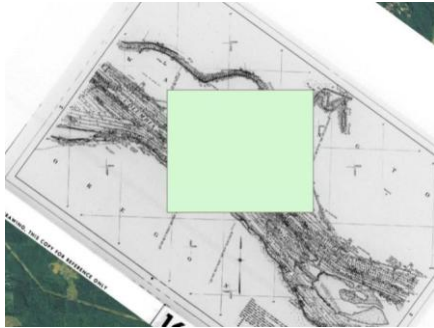
Scanned Drawing in a .Tif format was rectified to a .img format

Step 1 – Historical Data Conversion

Creating File Geodatabase with multiple feature classes:



Step 1 – Historical Data Conversion

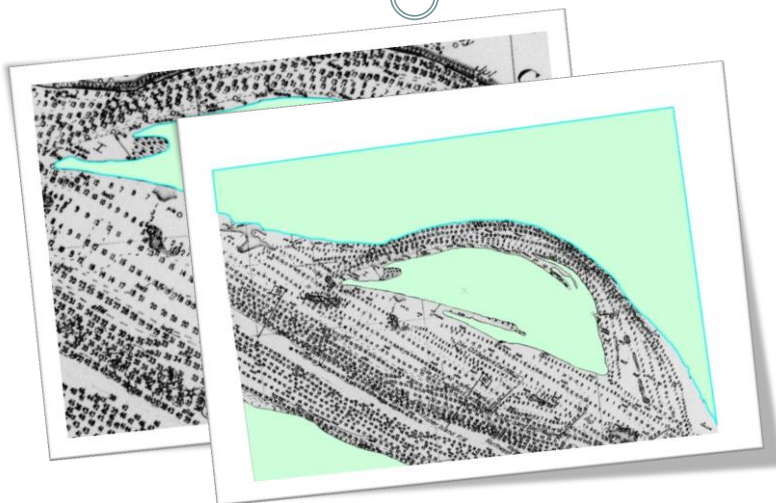


Before

After



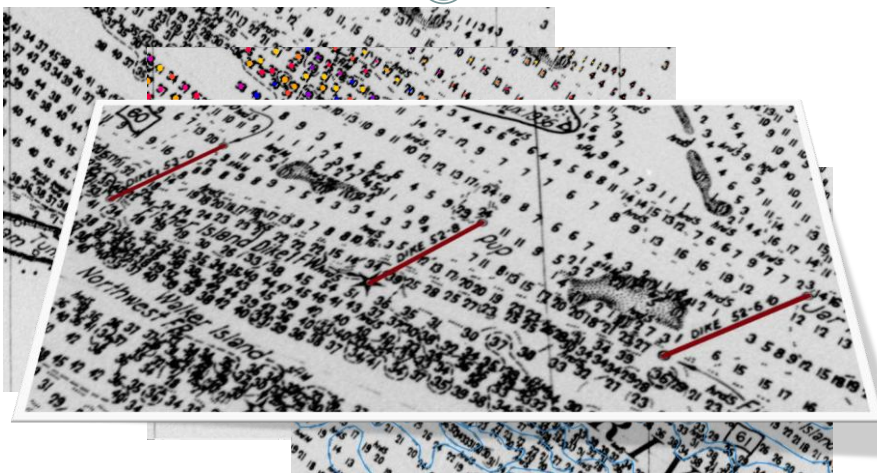
Step 1 – Historical Data Conversion



Step 1 – Historical Data Conversion



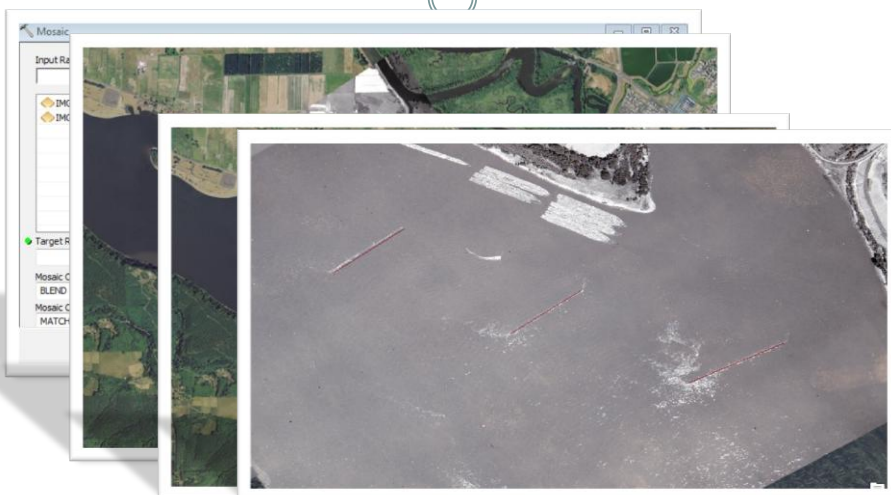
Step 1 – Historical Data Conversion



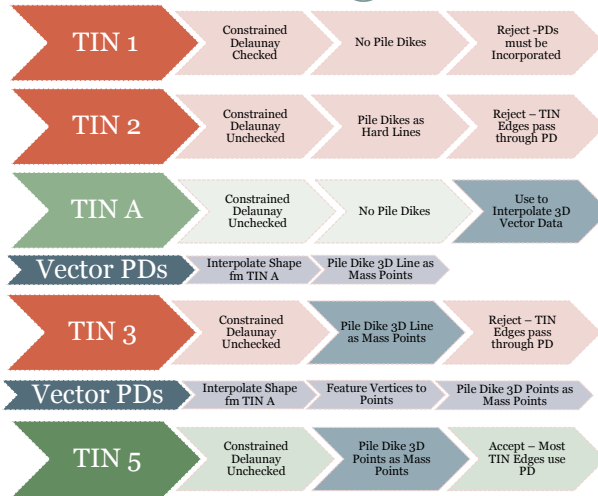
Step 1 – Historical Data Conversion



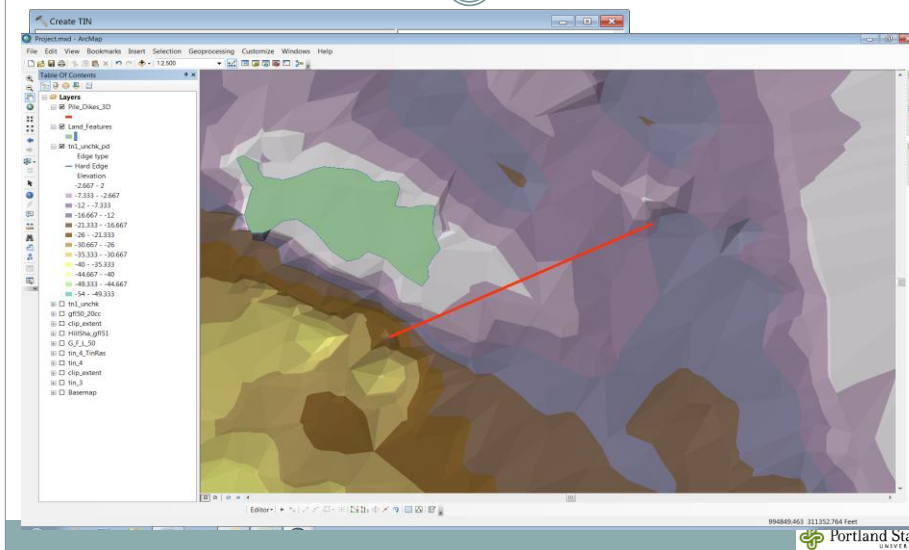
Step 1 – Historical Data Conversion



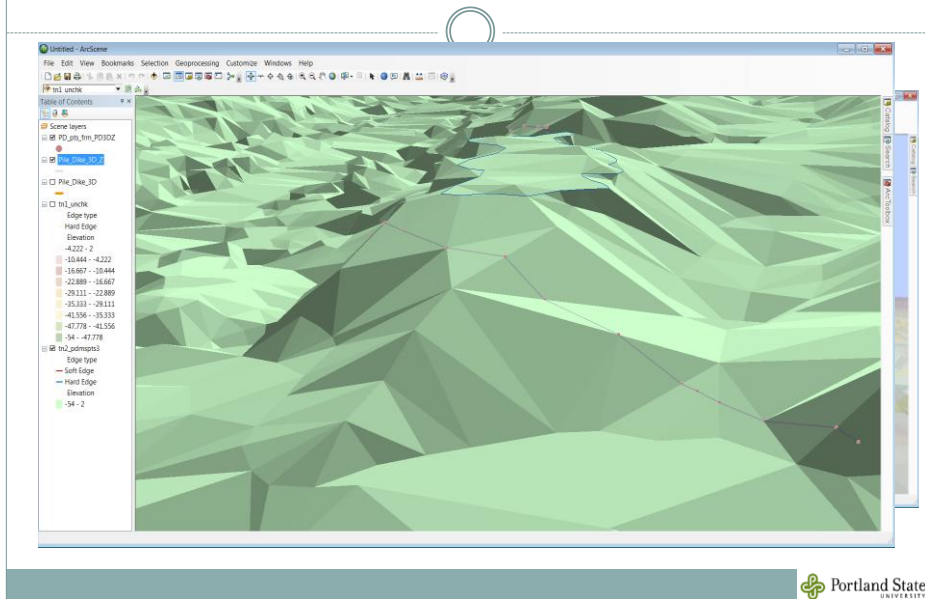
Step 2 – Generating an Historical Baseline



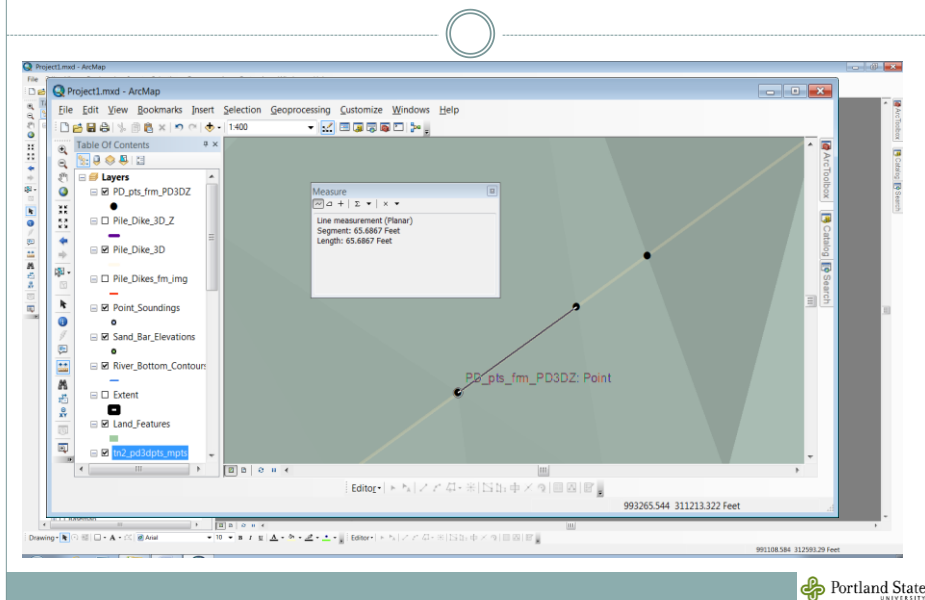
Step 2 – Generating an Historical Baseline



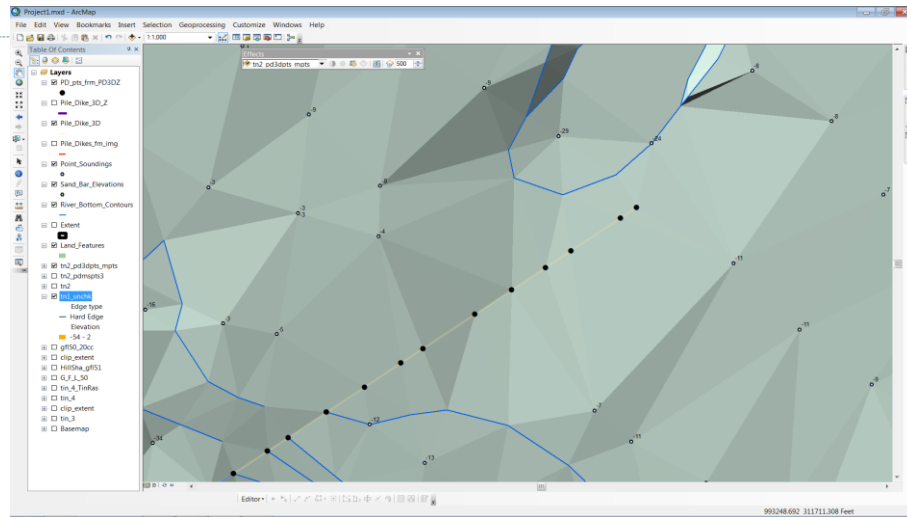
Step 2 – Generating an Historical Baseline



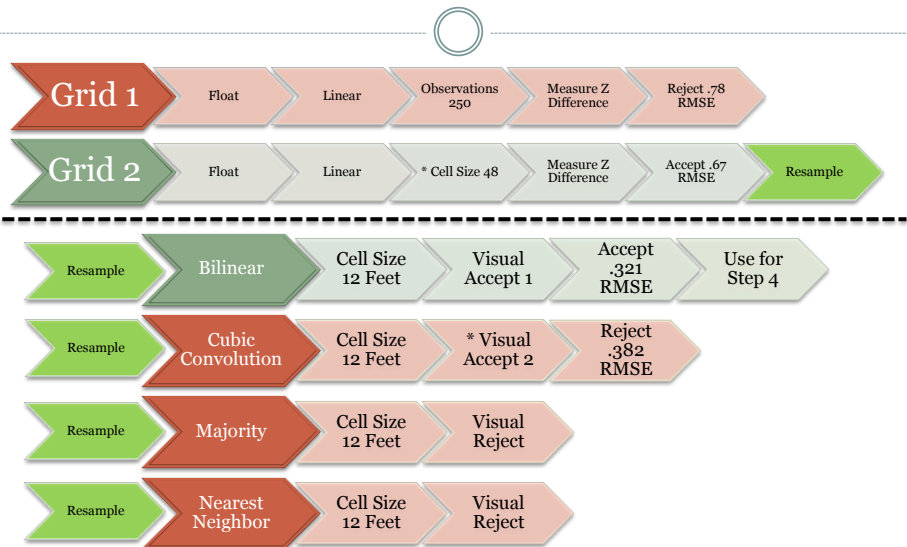
Step 2 – Generating an Historical Baseline



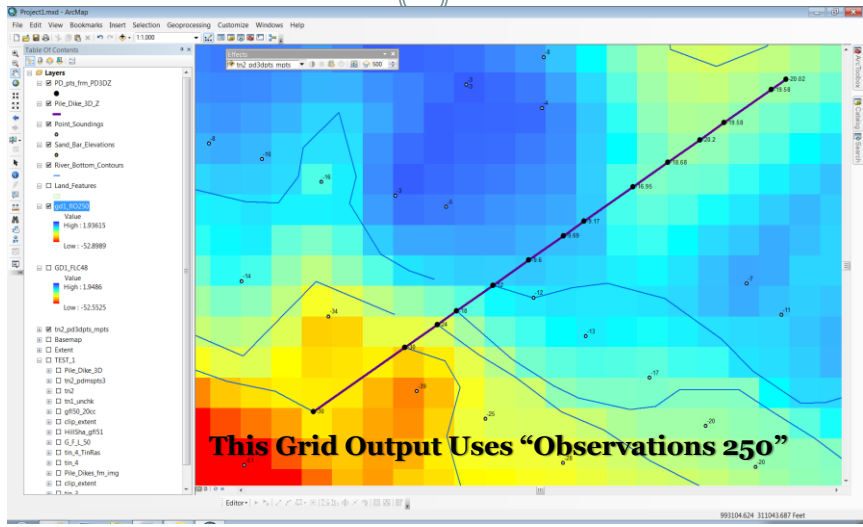
Step 2 – Generating an Historical Baseline



Step 3 – Interpolating the Baseline



Step 3 – Interpolating the Baseline

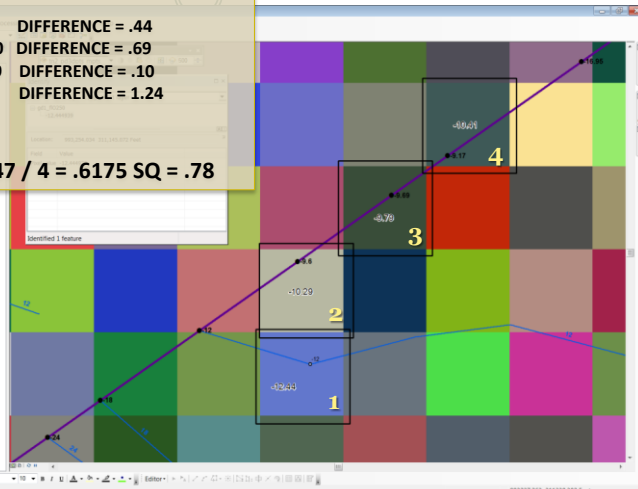


Step 3 – Interpolating the Baseline

Observations 250

CELL 1 = -12.44	S POINT = -12	DIFFERENCE = .44
CELL 2 = -10.29	P POINT = -9.60	DIFFERENCE = .69
CELL 3 = -9.79	P POINT = -9.69	DIFFERENCE = .10
CELL 4 = -10.41	P POINT = 9.17	DIFFERENCE = 1.24

Totals
 $.44 + .69 + .10 + 1.24 = 2.47 / 4 = .6175 \text{ SQ} = .78$



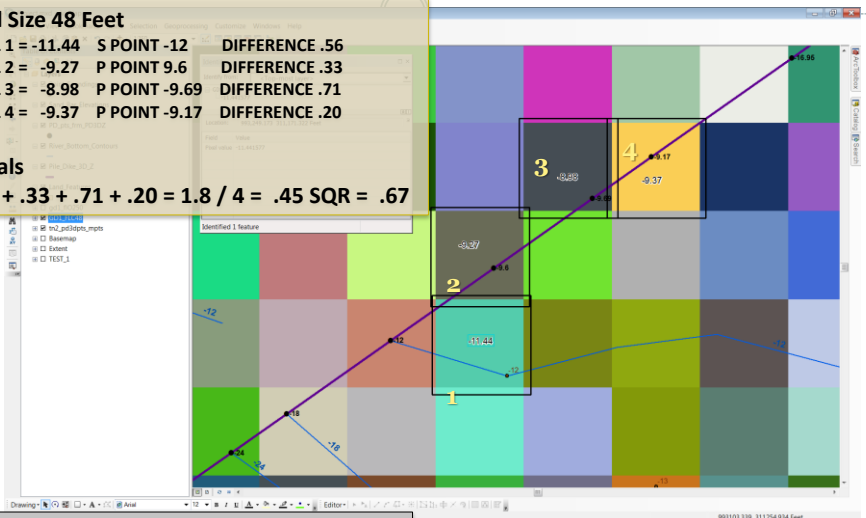
Comparing Sampling Distance Approach

Step 3 – Interpolating the Baseline

Cell Size 48 Feet

CELL 1 = -11.44	S POINT -12	DIFFERENCE .56
CELL 2 = -9.27	P POINT 9.6	DIFFERENCE .33
CELL 3 = -8.98	P POINT -9.69	DIFFERENCE .71
CELL 4 = -9.37	P POINT -9.17	DIFFERENCE .20

Totals
 $.56 + .33 + .71 + .20 = 1.8 / 4 = .45 \text{ SQR} = .67$

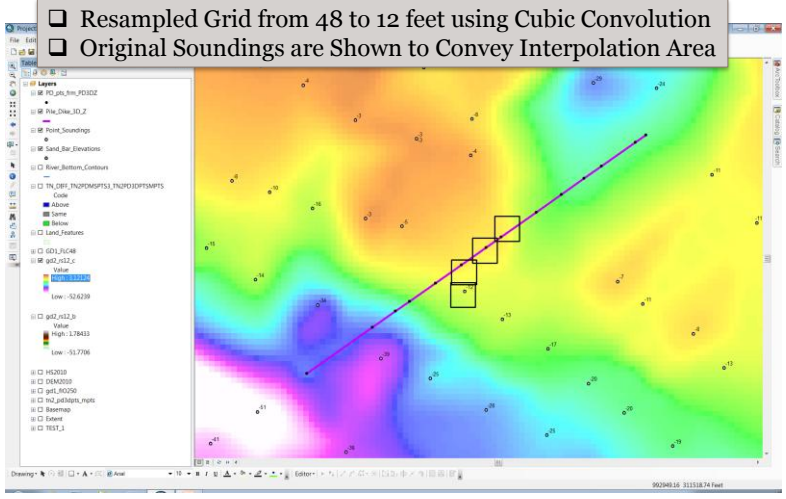


Comparing Sampling Distance Approach

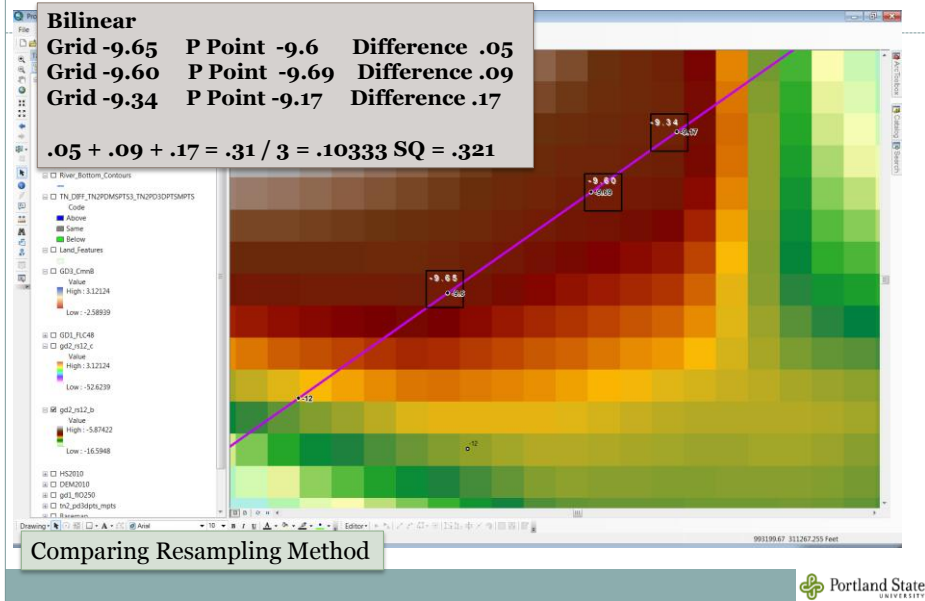


Step 3 – Interpolating the Baseline

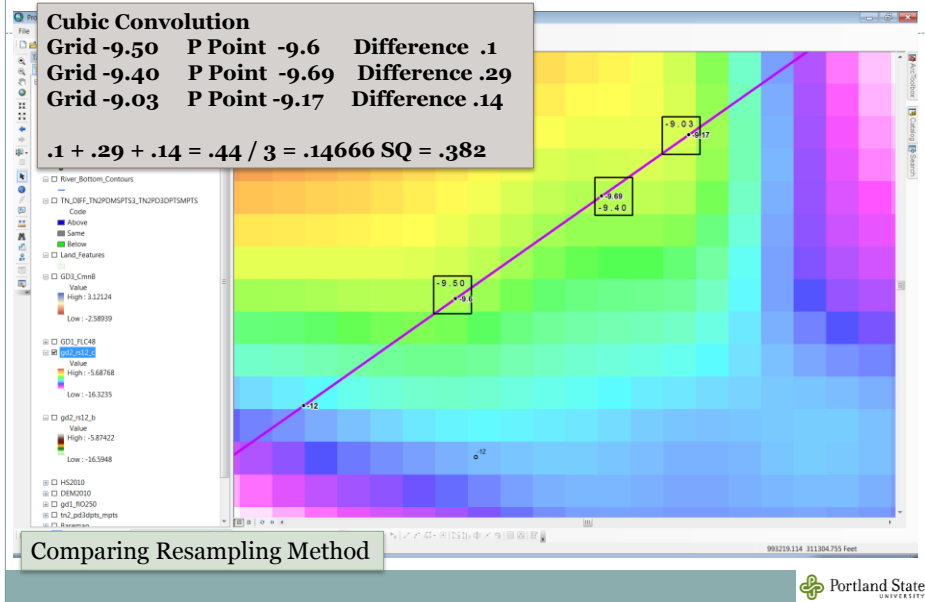
- Resampled Grid from 48 to 12 feet using Cubic Convolution
- Original Soundings are Shown to Convey Interpolation Area

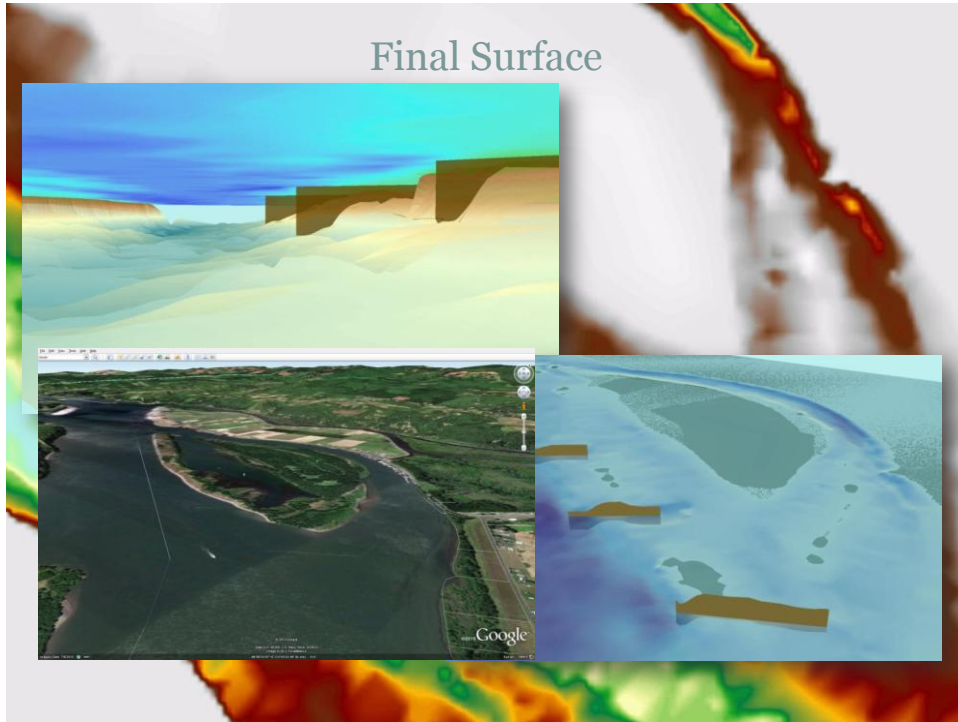


Step 3 – Interpolating the Baseline



Step 3 – Interpolating the Baseline



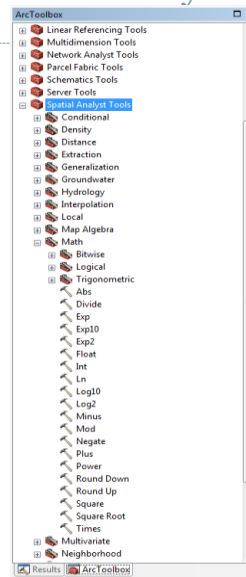


Step Four – Historical Surface in Analysis

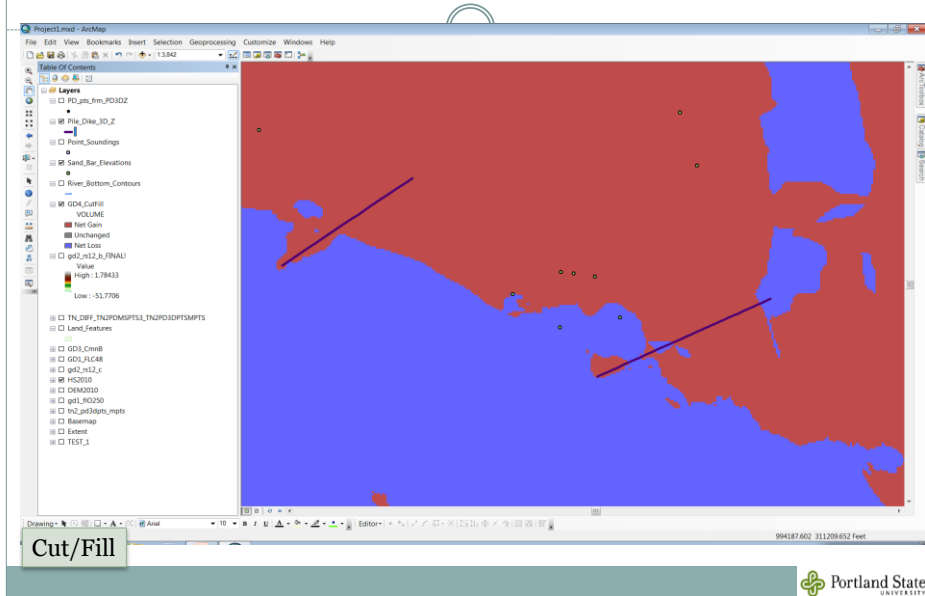


Analysis Tools with Final Historical Surface

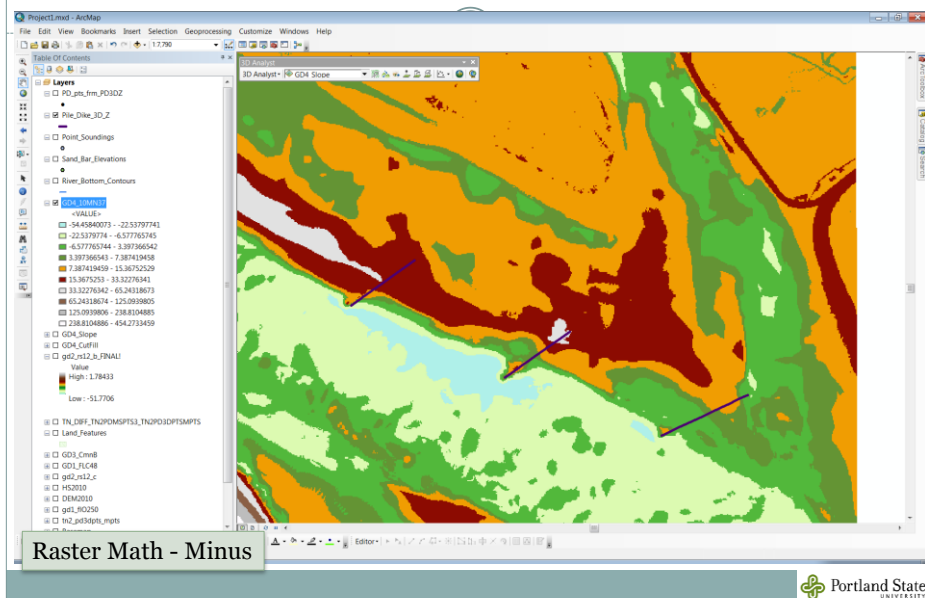
- Cut/Fill with 2010 Surface
- Raster Math, Minus with 2010 Surface
- Slope of Historical Surface
- Generating Profiles of Historical Surface



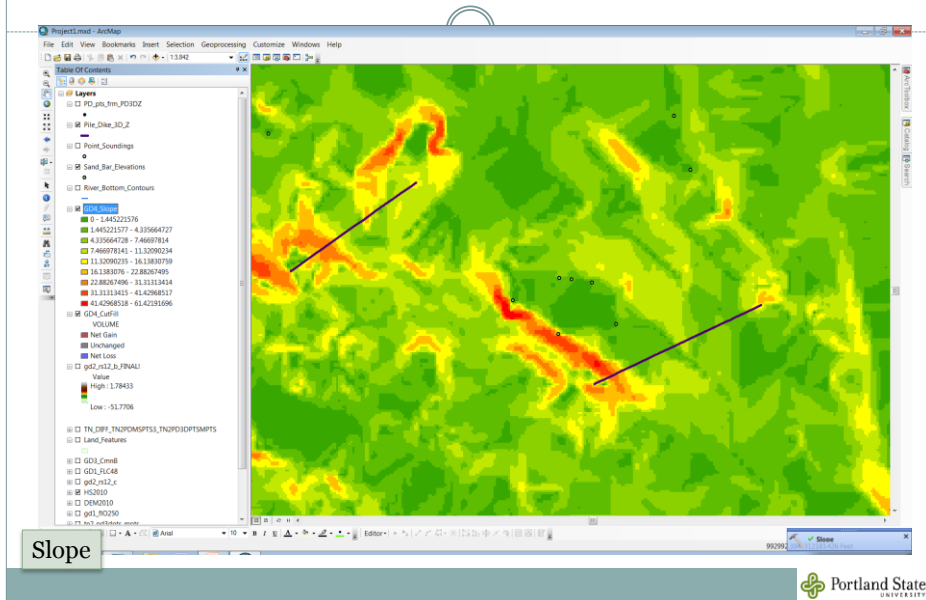
Step Four – Historical Surface in Analysis



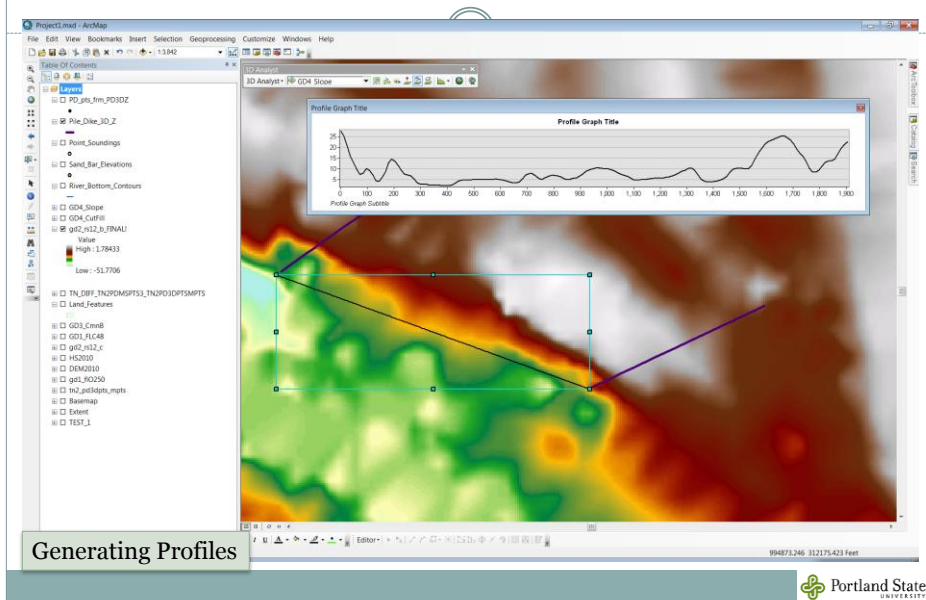
Step Four – Historical Surface in Analysis



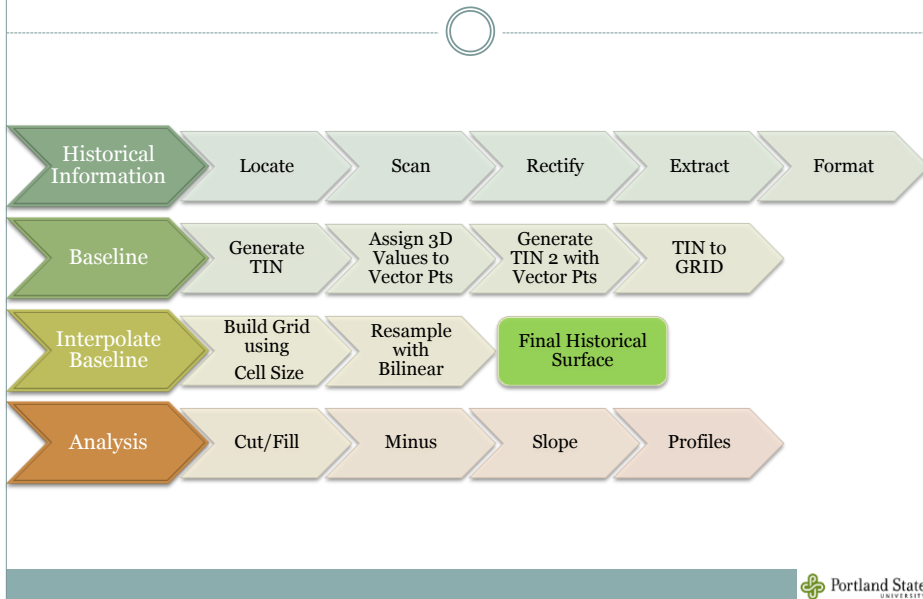
Step Four – Historical Surface in Analysis



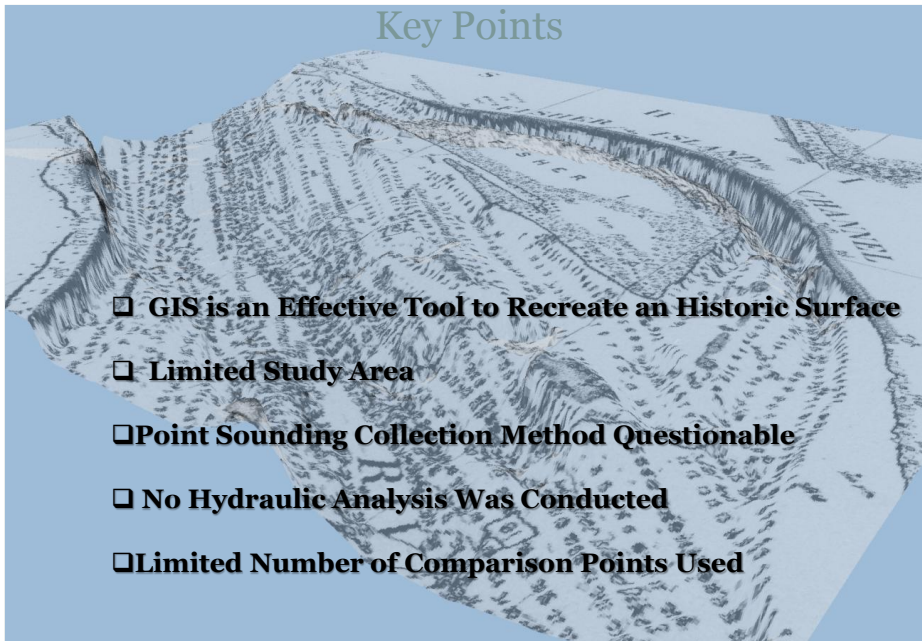
Step Four – Historical Surface in Analysis



Process Summary



Key Points



Sources



- Executive Summary of the Federal Columbia River Power System (FCRPS) 2008 Biological Opinion (BiOp) National Oceanic and Atmospheric Administration (NOAA) 5 May 2008
- Pile Structure Program Project Number 2003-011-00 Chris Collins 2010
- Structural and Hydraulic Analysis of Columbia River Pile Dikes - W9127N-10-D-0002, Task Order 02 AECOM 3 October 2011



Large Woody Debris Recruited by a Pile Structure

Questions

