PHASE 1 EROSION STUDY 2

Recent Erosion and Deposition Processes

Presented By

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West Valley Demonstration Project
Quarterly Public Meeting
November 15, 2017

OUTLINE

- ***Define the goals of the Study 2 and the tasks assigned***
- ***Present the methodologies employed and the results obtained***
- ***Summarize the broader implications***

STUDY 2 - *Recent Erosion and Deposition Processes*

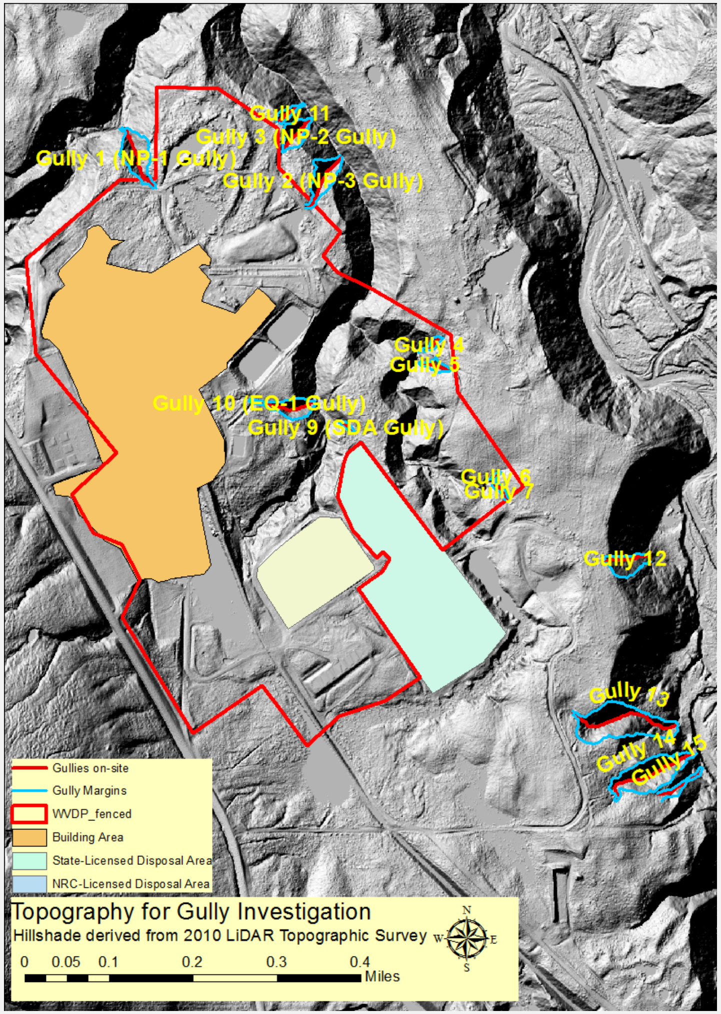
TASKS: Quantify environmental parameters that would reduce the predictive uncertainties in future erosion using a landscape evolution model

- ***Task 2.1b***: *Digital Mapping of Potential Analogue Sites (Gullies)*
  - *Report completed July 2, 2016*
- ***Task 2.1b:*** *Digital Mapping of Potential Analogue Sites, Amendment 1 – Expanded Study of 2010 and 2015 LiDAR Data*
  - *Report completed October 18, 2017*
- ***Task 2.2***: *Quantify Infiltration Capacity*
- ***Task 2.5***: *Quantify Erodibility of Cohesive Sediment*
- ***Task 2.6***: *Quantify Erodibility of Clastic Sediment*
  - *Combined report completed March 1, 2017*

TASK 2.1b: Digital Mapping of Potential Analogue Sites (Gullies)

- ***Objectives:*** *Using the 2010 LiDAR dataset, (1) define the morphologic characteristics of gullies at the WVDP, and (2) identify analogue gullies nearby using the same data and methodologies*

- ***Methods:*** *Using LiDAR data and GIS techniques, topographic information from the gullies were determined including slope, length, orientation, width, depths, and cross-sections*



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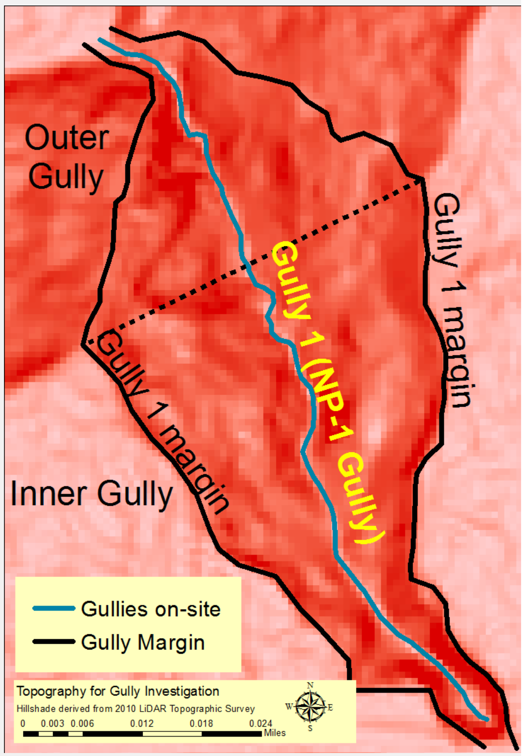
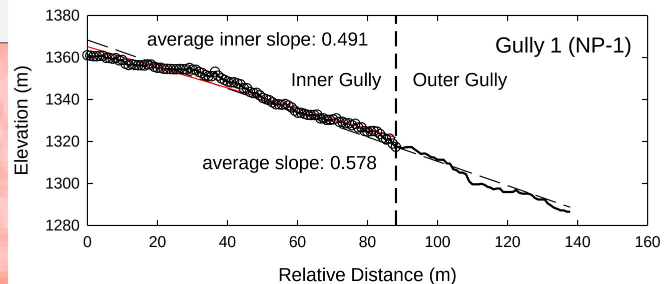
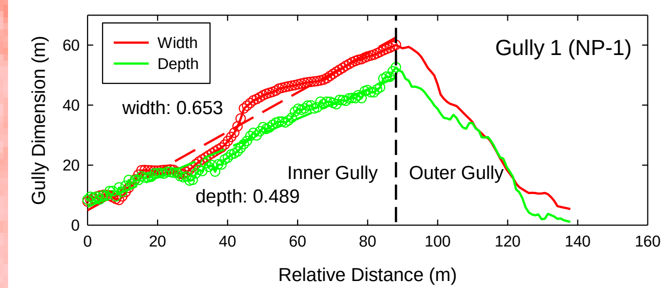
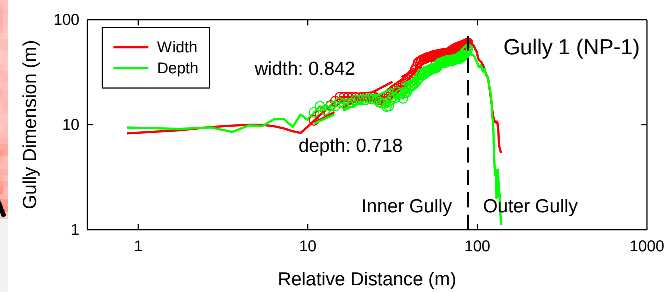
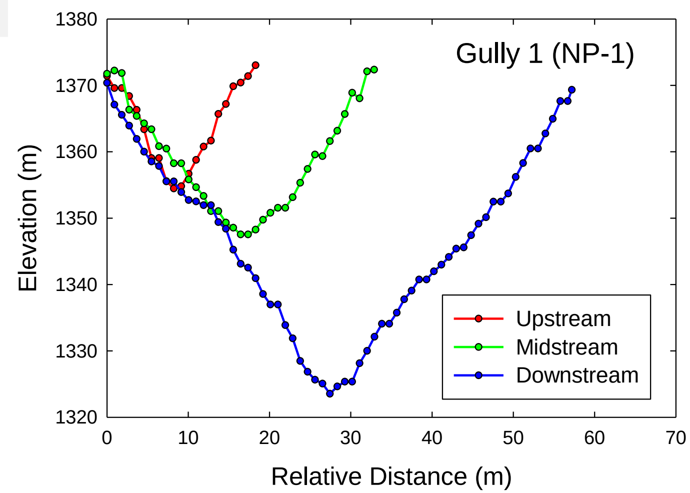
TASK 2.1b: Digital Mapping of Potential Analogue Sites

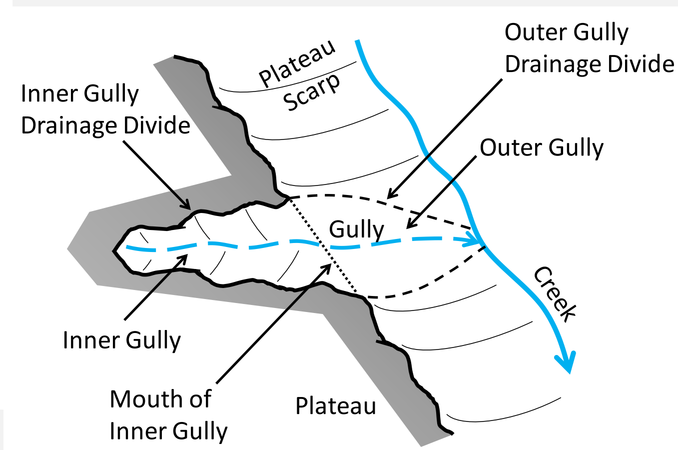












Typical gully at the WVDP (Gully 1, NP-1)

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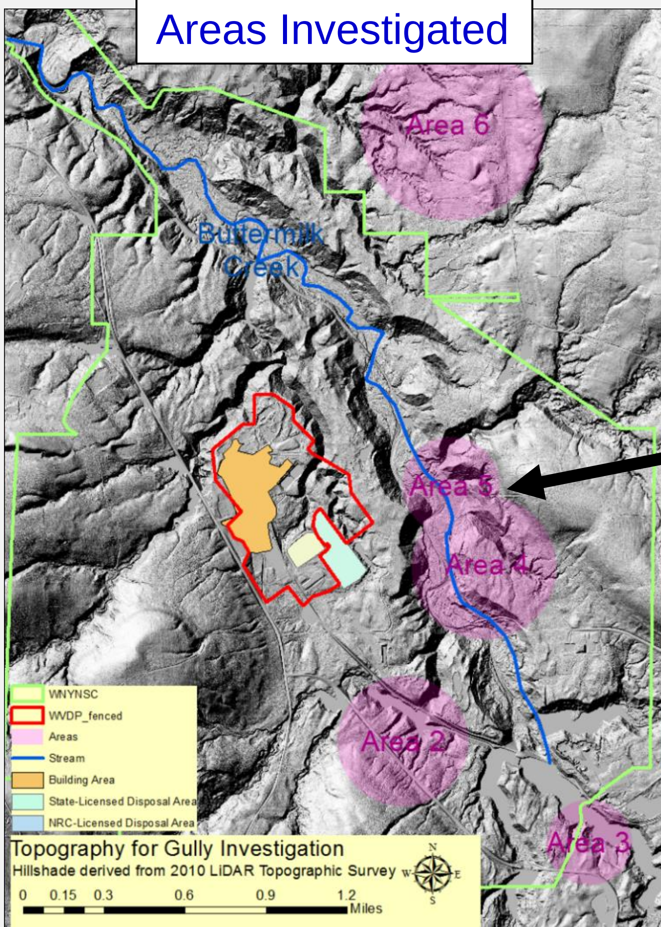
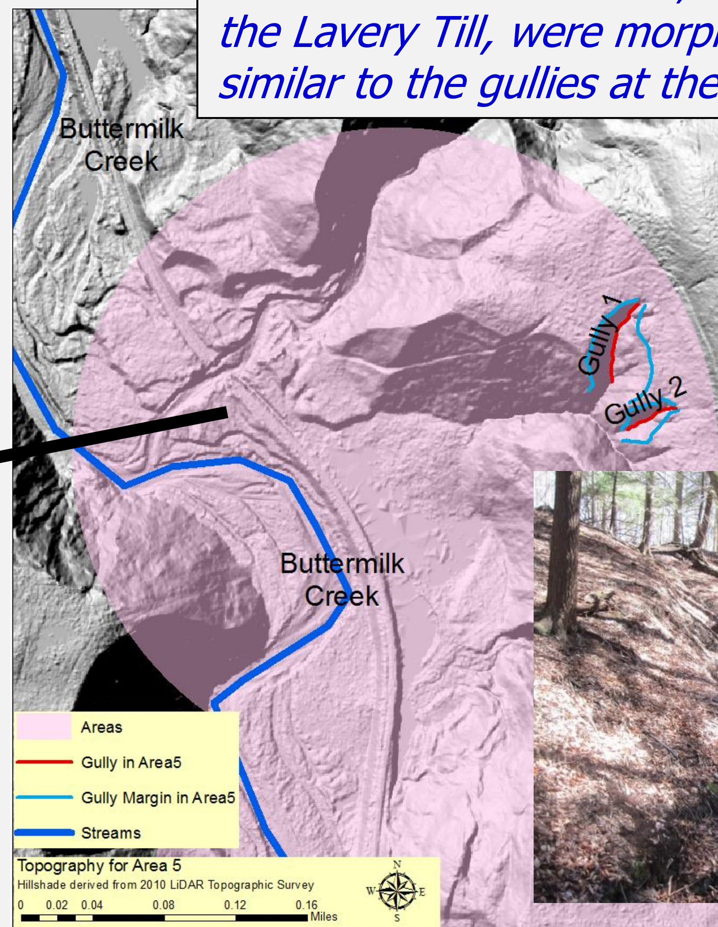
TASK 2.1b: Digital Mapping of Potential Analogue Sites (Gullies)



Gullies 1 and 2 in Area 5, underlain by the Lavery Till, were morphologically similar to the gullies at the WVDP



Gully 2, Area 5

TASK 2.1b: Expanded Study of 2010 and 2015 LiDAR Data

- ***Objectives:*** *To determine geomorphic changes in topography using the 2010 and 2015 LiDAR datasets, focusing on: (1) gullies, and (2) bed elevation for selected stream channels*
- ***Methods:*** *Morphologic analysis of gullies on the WVDP (13), and analogue gullies located within the WNYNSC (Areas 5 and 6)*
  - *Spatially-averaged parameters (length, slope, width, depth)*
  - *At-a-point changes (elevation, width, depth)*
- *Longitudinal profiles of stream channels: Buttermilk, Franks, Quarry, Heinz, and Gooseneck Creeks*

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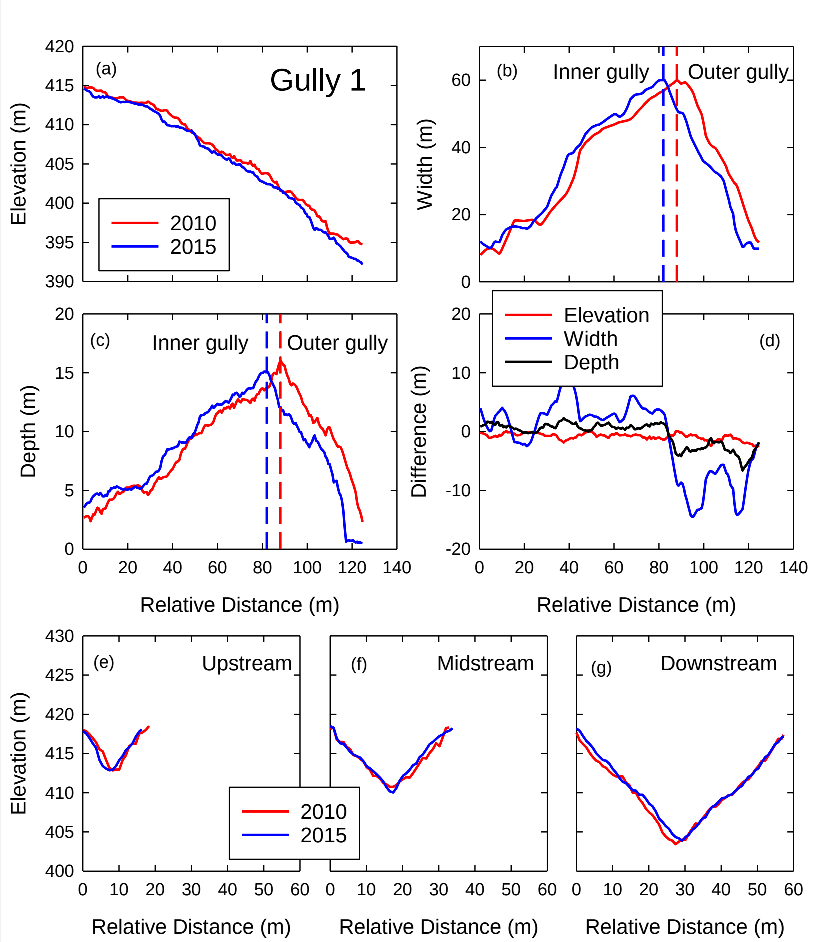
TASK 2.1b: Expanded Study of 2010 and 2015 LiDAR Data

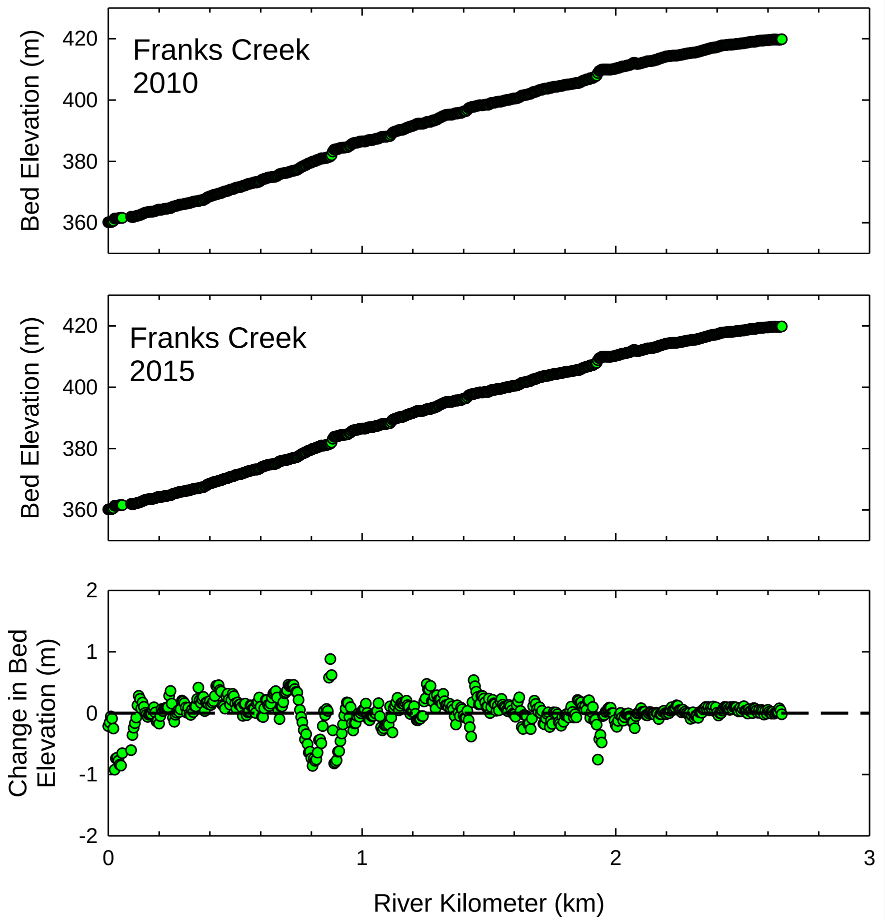
Results: Similar to values reported in the FEIS (lower advance rates)

- *Spatially-averaged rates*
  - *Length: 0.1±2.7%/yr*
  - *Slope: –0.6±1.5%/yr*
  - *Width (near head): 2.9±6.4%/yr*
  - *Depth near head: 2.9±7.9%/yr*
- *Average rates at-a-point*
  - *Width: 0.028±0.042 m/ha-yr*
  - *Depth: 0.002±0.014 m/ha-yr*
  - *Slope: –0.006±0.012 m/ha-yr*



TASK 2.1b: Expanded Study of 2010 and 2015 LiDAR Data

- ***Results:*** *Buttermilk, Franks, Heinz, and Gooseneck Creeks display a net increase (aggradation) in bed elevation with time (Heinz Creek: 0.003±0.009 m/km^2-yr)*
- *Quarry Creek shows a net decrease (incision) in bed elevation with time, –0.005±0.009 m/km^2-yr*
- *Changes conditioned by geospatial uncertainties and hydrologic and geomorphic variability during the study period*



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TASK 2.2: Quantify Infiltration Capacity

- ***Objectives:*** *Field activities sought to quantify infiltration rate for selected surficial geological materials (in particular, the Lavery Till) using a double ring infiltrometer*
- ***Methods:*** *A standard double ring infiltrometer (ASTM D-3385) consisting of two steel rings was used*
- *37 tests performed in trenches dug in support of Study 1*

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TASK 2.2: Quantify Infiltration Capacity

Results: Similar to the values used in the FEIS

- *Spatial average:*

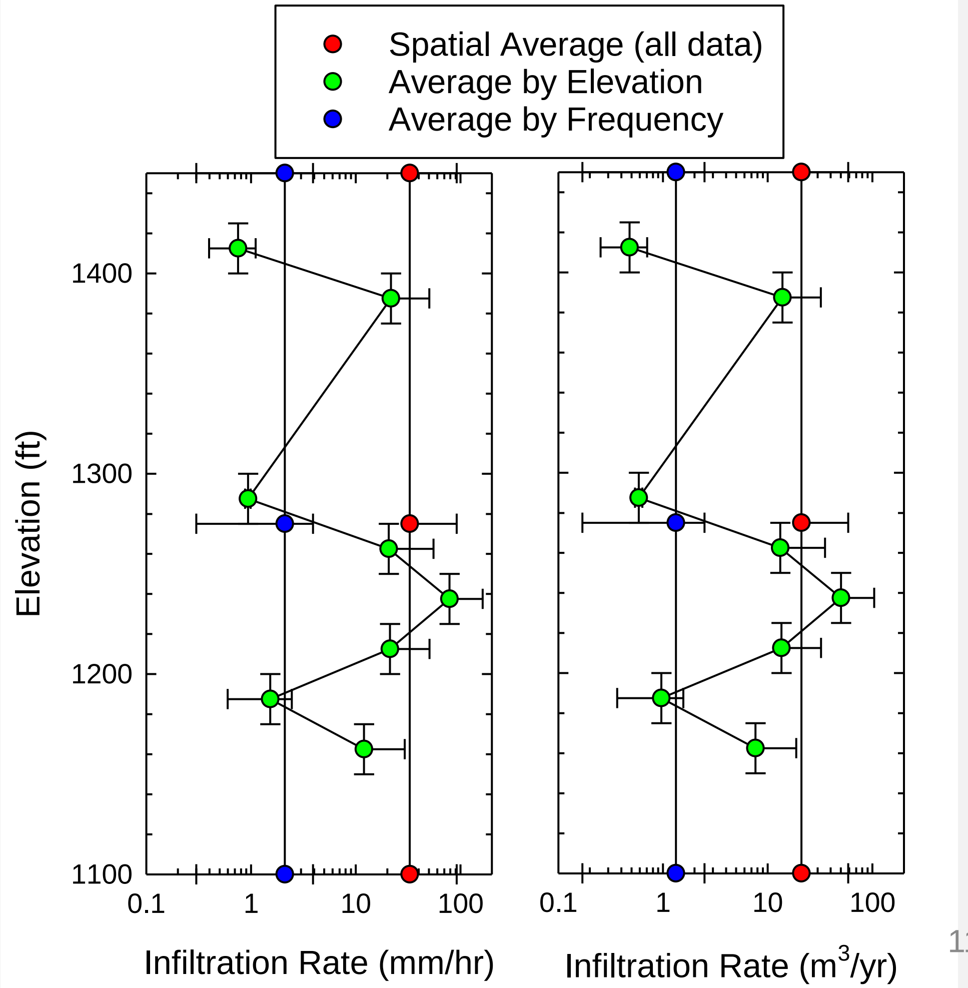
  33±59 mm/hr

  20.98±37.8 m^3/yr

- *Average by elevation (shown)*
- *Average by frequency (for the tills):*

  2±2 mm/hr

  1.33±1.37 m^3/yr



TASK 2.5: Quantify Erodibility of Cohesive Sediment

- ***Objectives:*** *Field activities sought to quantify the erodibility of selected surficial geological materials (in particular, the Lavery Till) using the jet erosion test (JET)*
- ***Methods:*** *The JET forces water to impinge the material's surface forming a scour hole, and the rate of erosion can be used to estimate the material's critical shear stress τ_c and erodibility coefficient k_d*
- *37 tests performed in trenches dug in support of Study 1*

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TASK 2.5: Quantify Erodibility of Cohesive Sediment

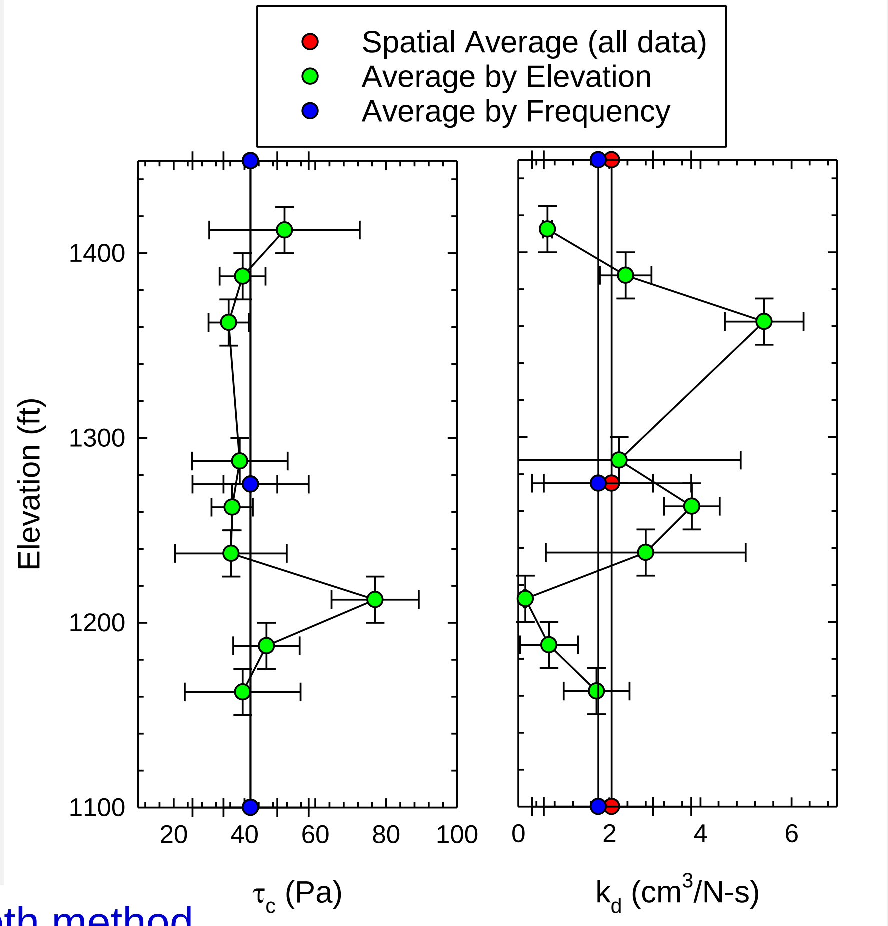
- ***Results: Similar to values used in the FEIS***
- *Spatial average:*

  $\tau_c = 42.7 \pm 16.4$ Pa

  $k_d = 2.05 \pm 1.75$ $cm^3/N\text{-}s$
- *Average by elevation (shown)*
- *Average by frequency (for the tills):*

  $\tau_c = 41.7 \pm 7.6$ Pa

  $k_d = 1.76 \pm 1.20$ $cm^3/N\text{-}s$



Scour depth method

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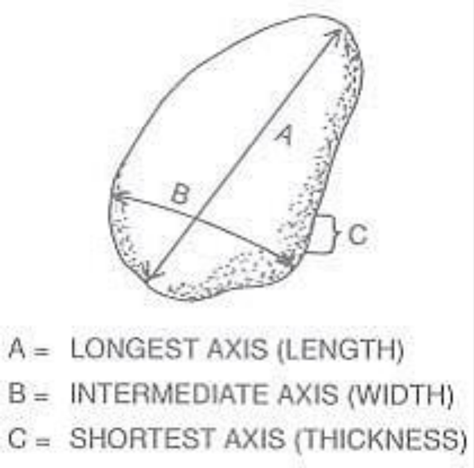
TASK 2.6: Quantify Erodibility of Clastic Sediment

- ***Objectives:*** *Field activities sought to quantify the surface grain size statistics of selected stream channels near the WVDP*
- ***Methods:*** *Wolman (1954) pebble count method, and grain size percentiles determined:* D_{10}, D_{16}, D_{50}, D_{84}, D_{90}, *and* D_{95}
- *A total of 49 pebble counts were conducted in and near the WNYNSC along streams as well as Cattaraugus Creek*



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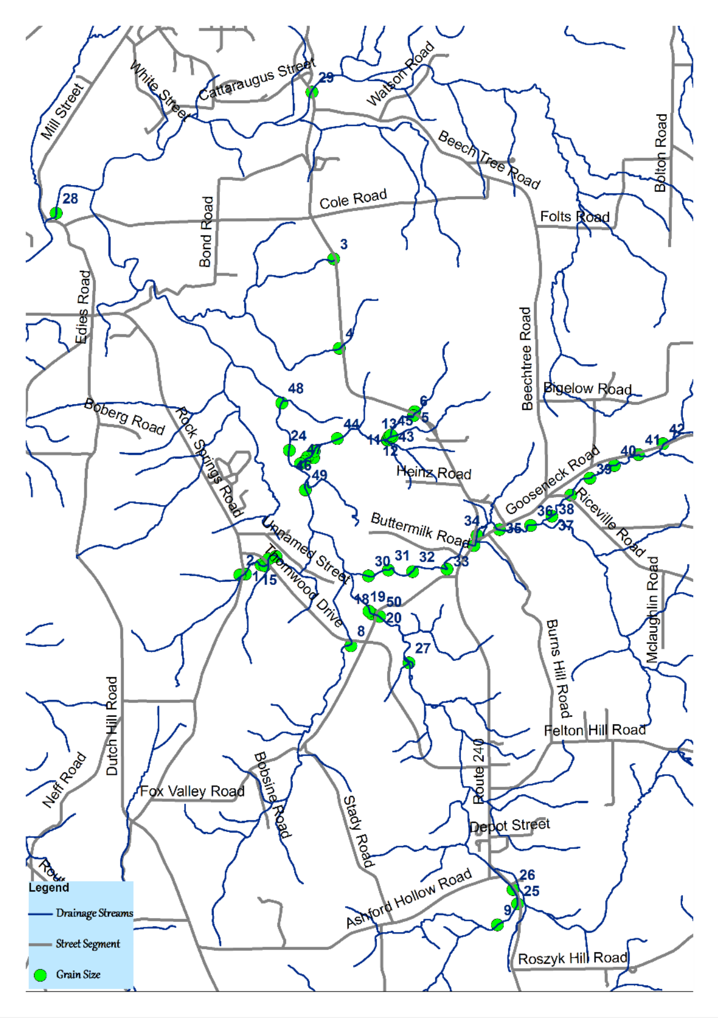
TASK 2.6: Quantify Erodibility of Clastic Sediment

Results: Similar to values used in the FEIS

- *No spatial variation in sediment texture was observed along streams*
- *Excluding a few statistical outliers, grain size data can be aggregated:*

$D_{10} = 11$ mm	$D_{16} = 17$ mm
$D_{50} = 47$ mm	$D_{84} = 117$ mm
$D_{90} = 154$ mm	$D_{95} = 225$ mm



Broader Implications

- *Analogue gullies can be used for a variety of purposes (site visits, analysis of landscape evolution, and field-based monitoring programs)*
- *Observations of gully erosion, infiltration rate, erodibility of glacial materials, and stream bed grain size distributions agree well with previous work and are aligned with those analyses presented in the FEIS (2010)*
- *These newly collected data will further constrain the input parameters required to numerically simulate landscape evolution at the WVDP and to reduce the predictive uncertainty of future erosion at the site*

QUESTIONS?