

Stream Network Dynamics

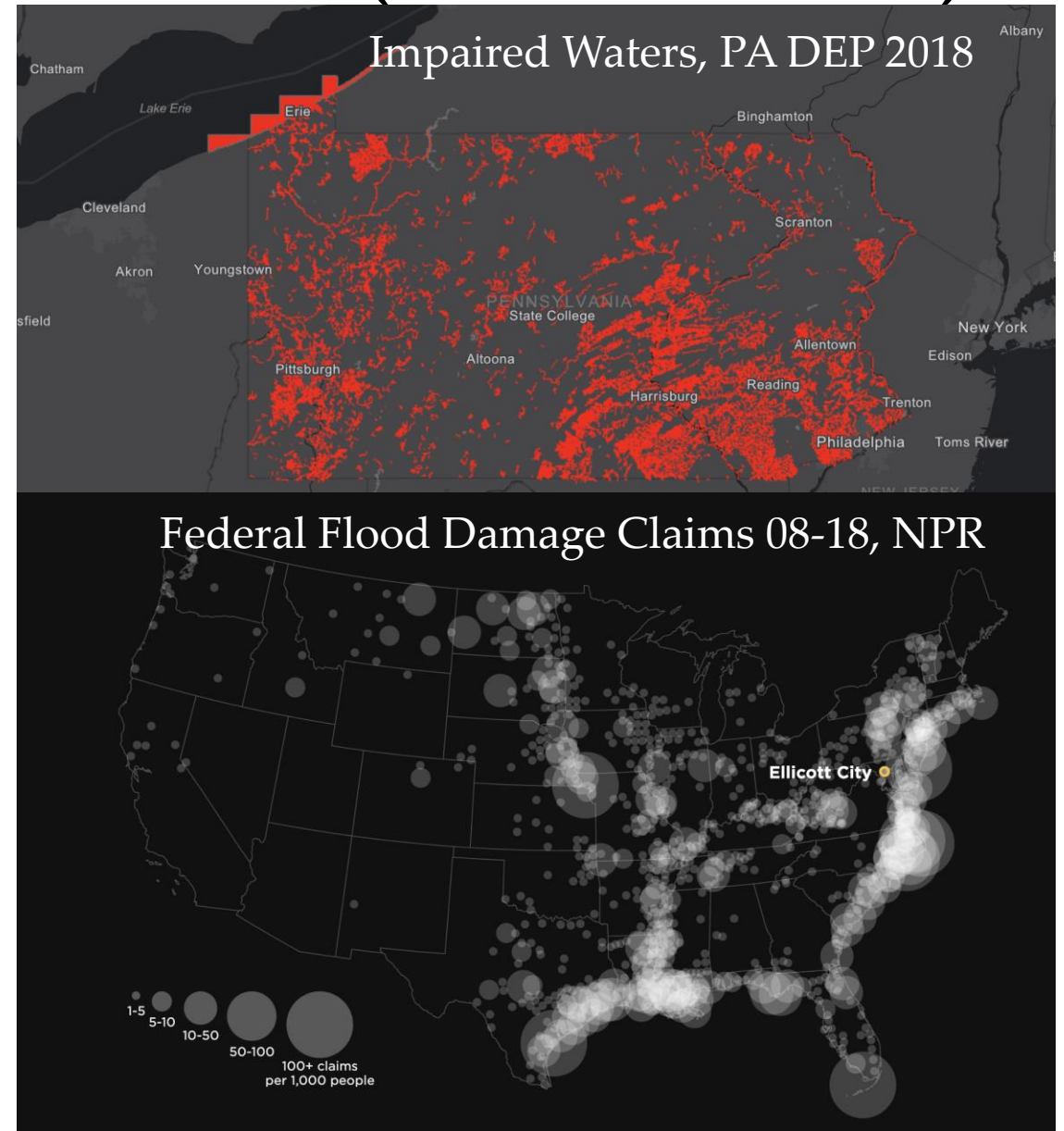
January 28, 2020

Jon Duncan, Emily Kerstetter, Taylor Blackman, and Jonathan Chester

Pennsylvania State University, Department of Ecosystem Science and Management

Pennsylvania: Penn's Woods (and Waters)

- 86,000 miles of streams*
 - 2nd only to Alaska
- 40% of PA streams impaired (2018 DEP Assessment)
 - Abandoned mines
 - Agricultural runoff
 - Stormwater
- Increased flood damage claims



Wither the Clean Water Act?

THE WALL STREET JOURNAL.

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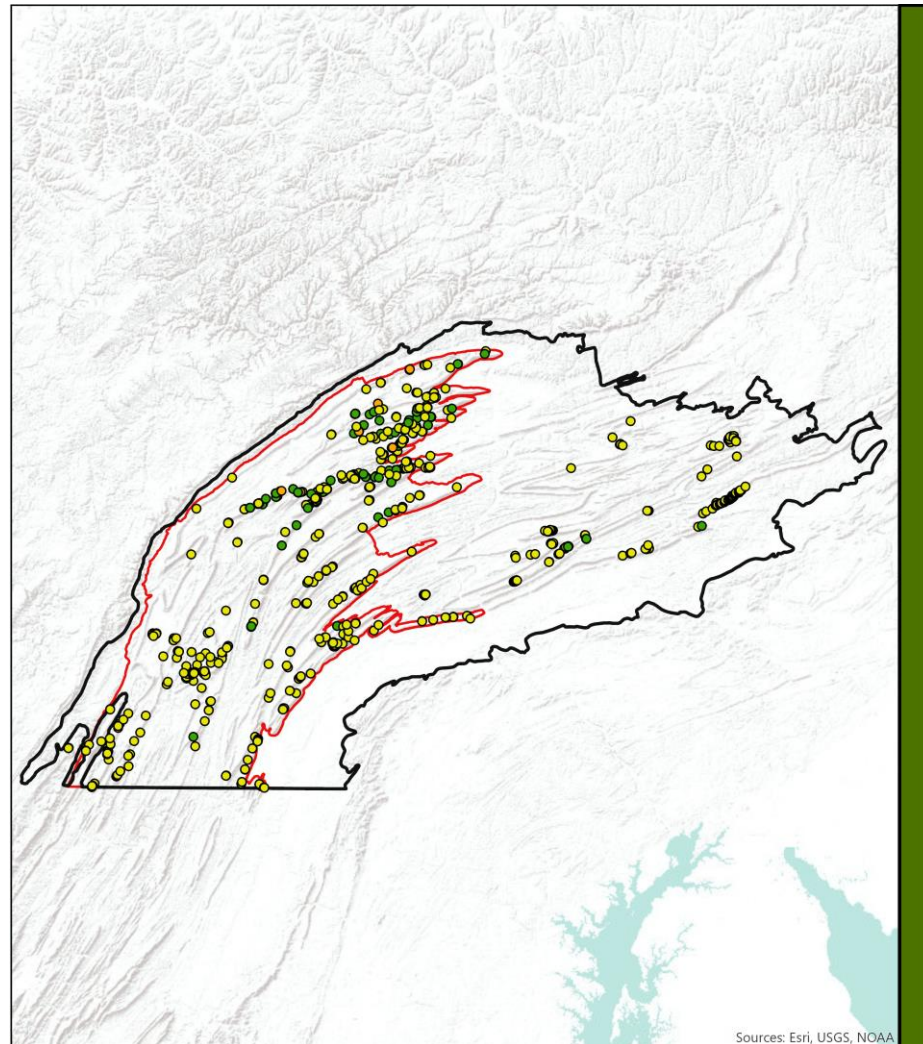
EPA Releases New Clean-Water Rules Scaling Back Federal Oversight

Waters under EPA authority would be limited to four categories, excluding many seasonal streams, small waterways and wetlands

For today- upslope of the NHD

1. Geographically-isolated wetlands
2. Headwater stream network dynamics in the Ridge and Valley
3. Supercomputing applications in PA?

Geographically Isolated Wetlands (GIW)



Vernal Pools of the Ridge and Valley

Field Verified



Time Series Imagery



Third Party



Appalachian Mountain
Section



Ridge & Valley



N



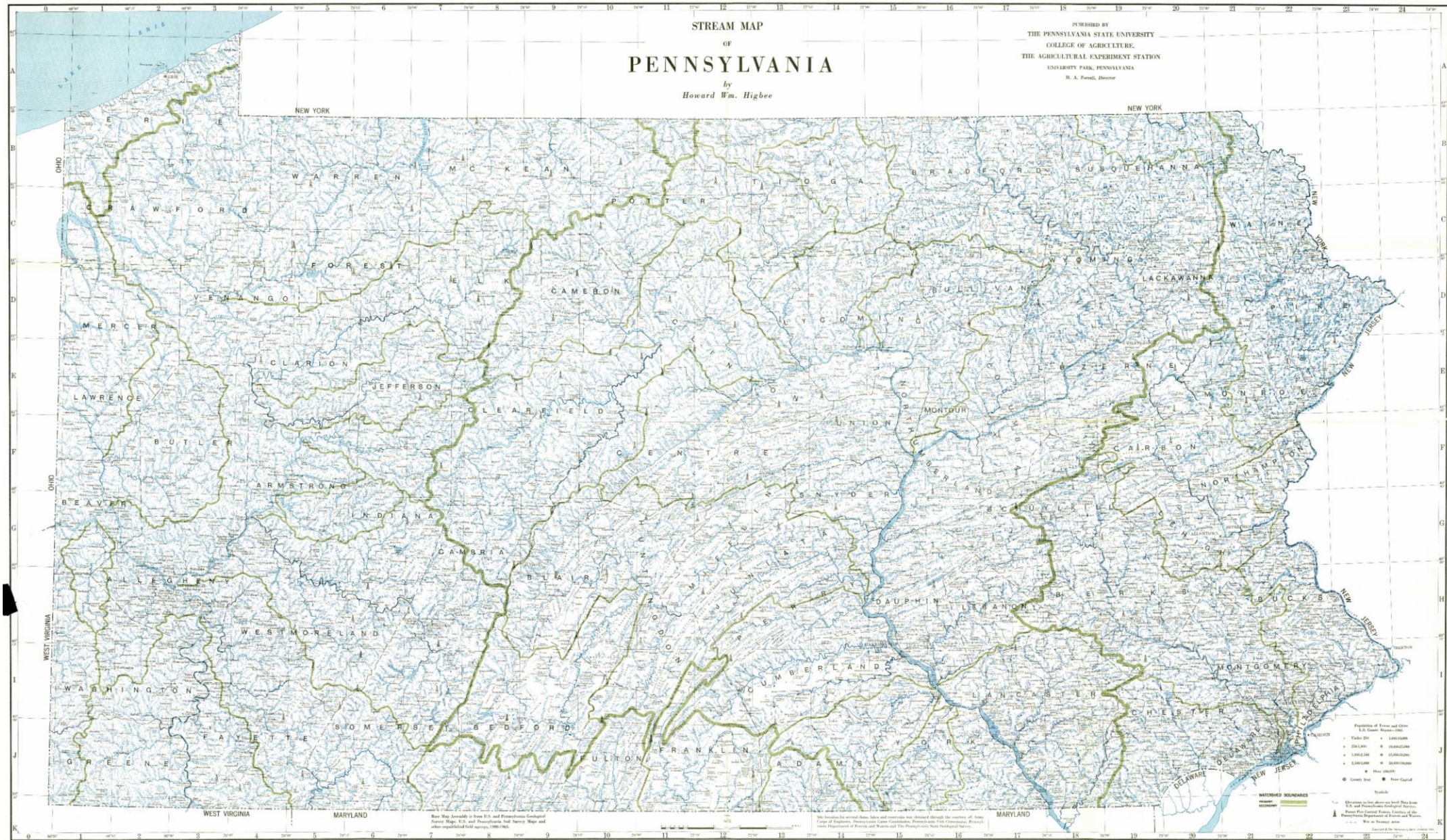
0 25 50 Miles

1,165 in PA

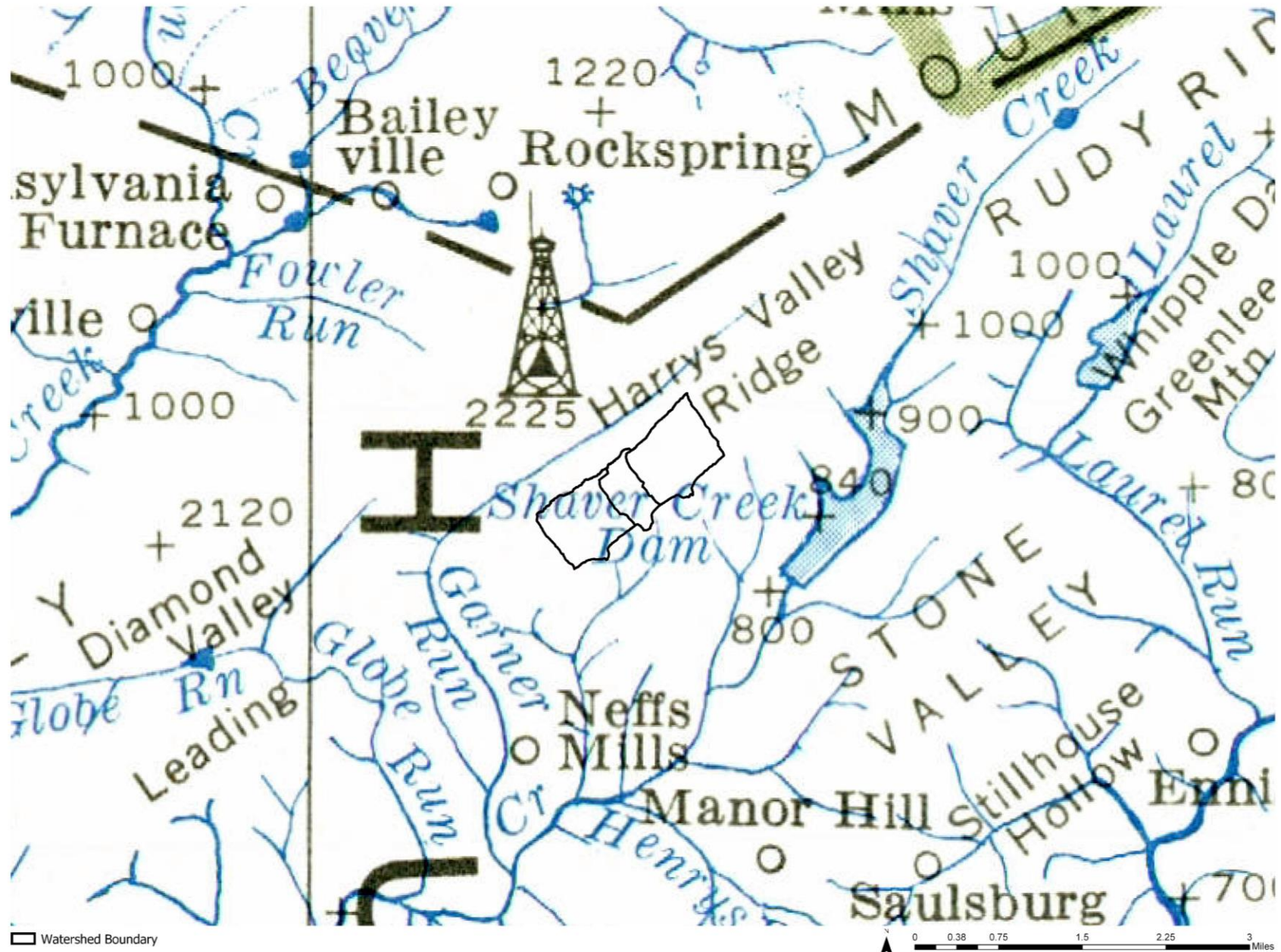
52% mapped in NWI

Taylor Blackman, PSU

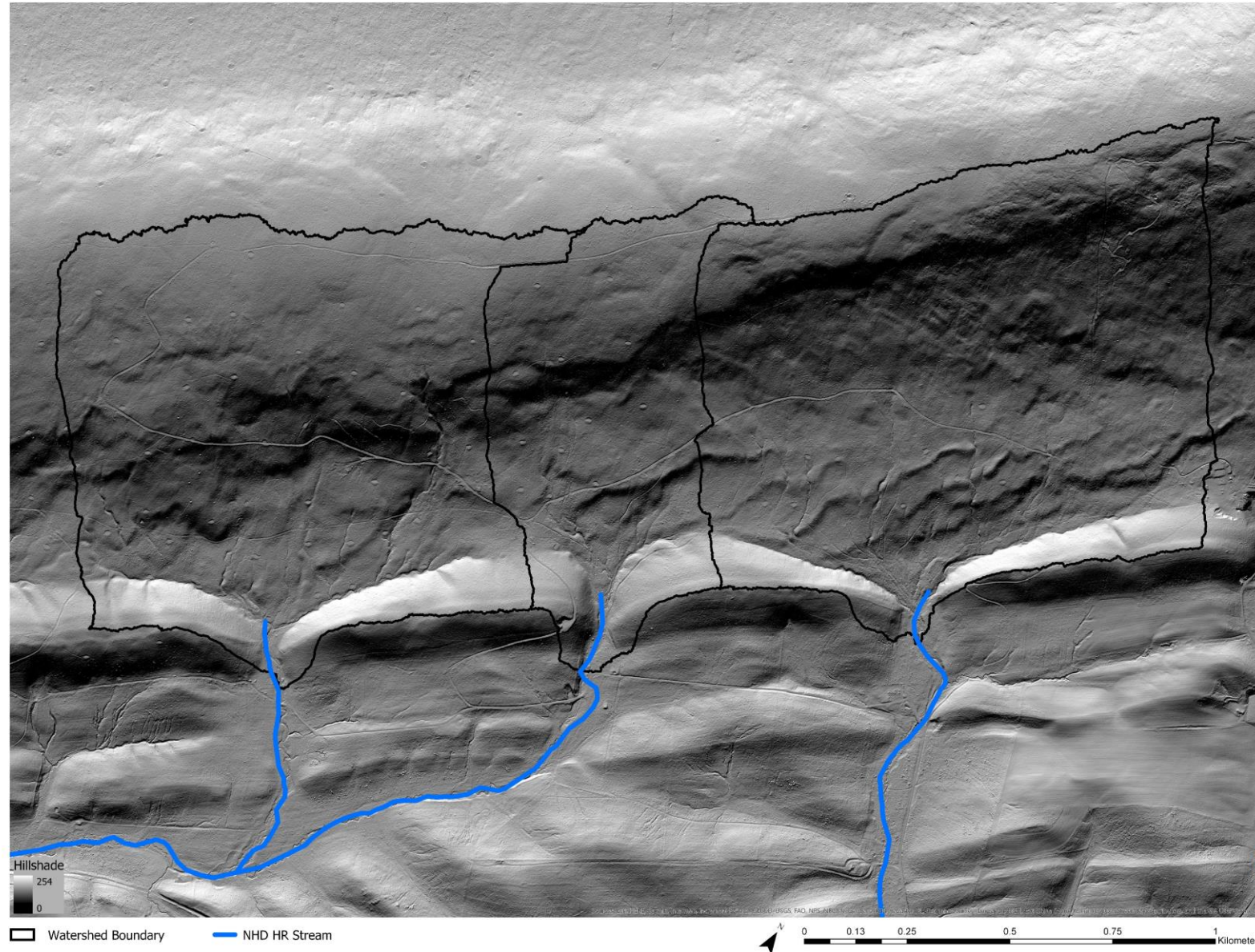
Headwater Streams: Higbee Stream Map



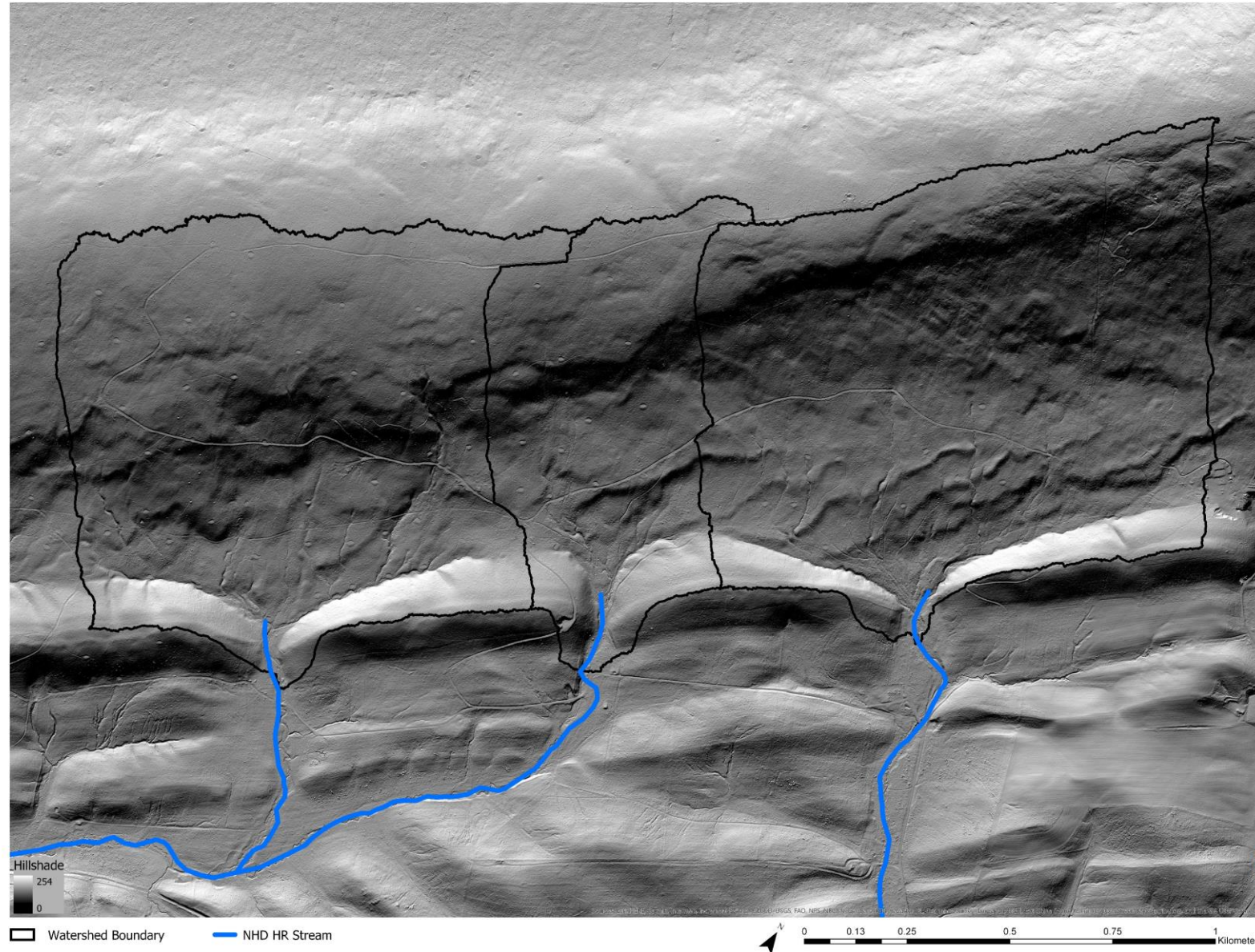
Although the map is detailed, many headwater streams were neglected



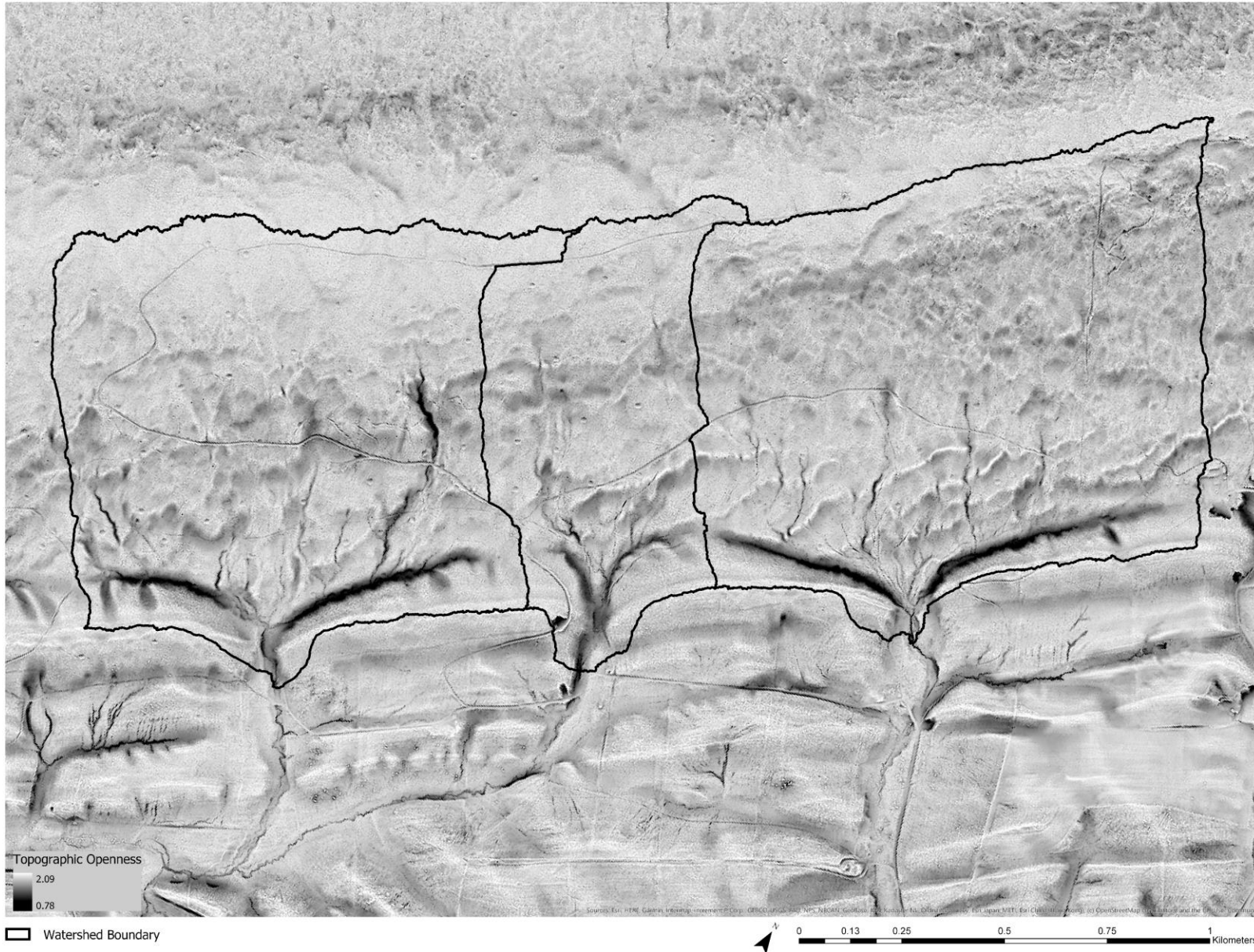
National Hydrography Dataset (NHD) High Resolution (HR)



National Hydrography Dataset (NHD) High Resolution (HR)

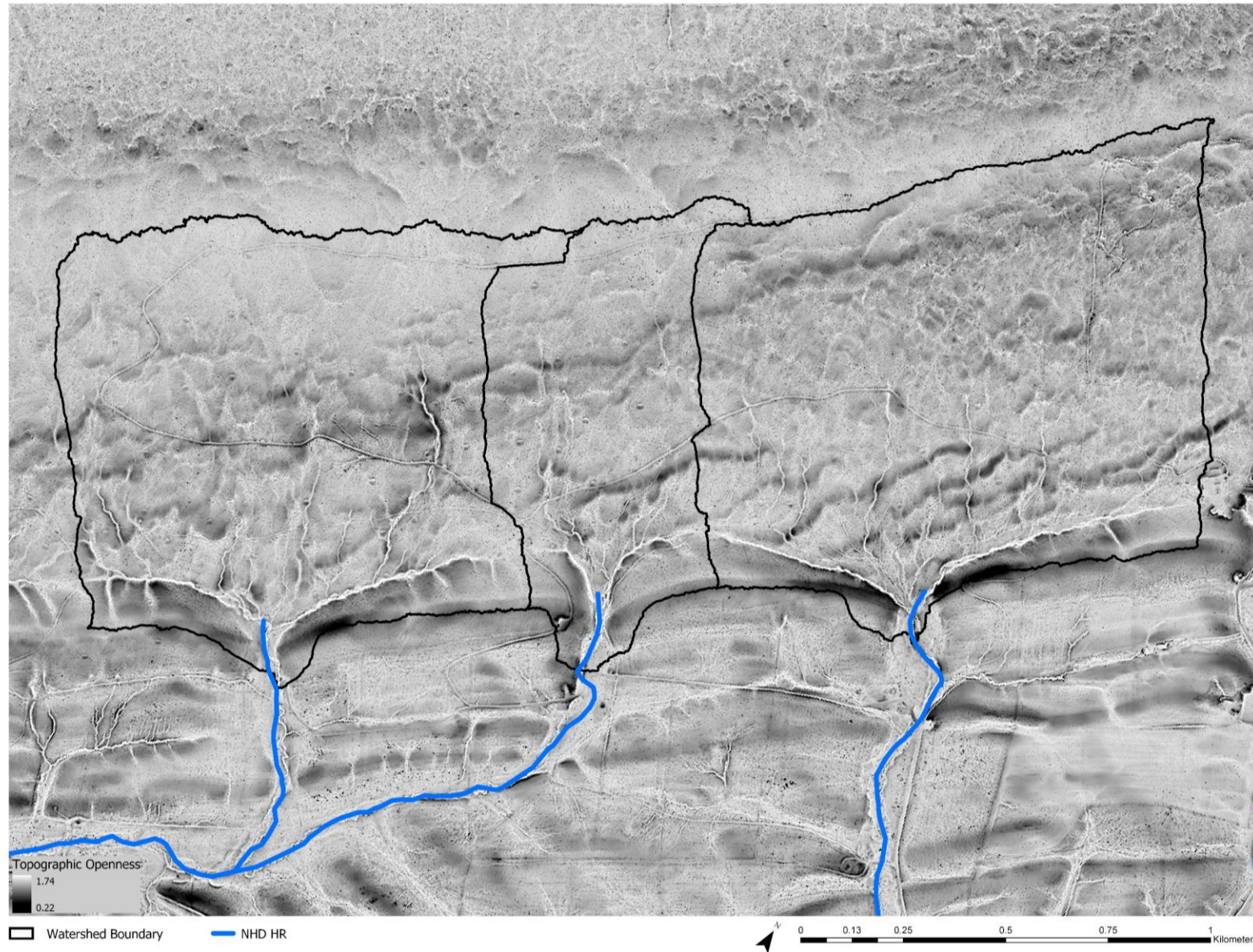


Forest Palimpsest

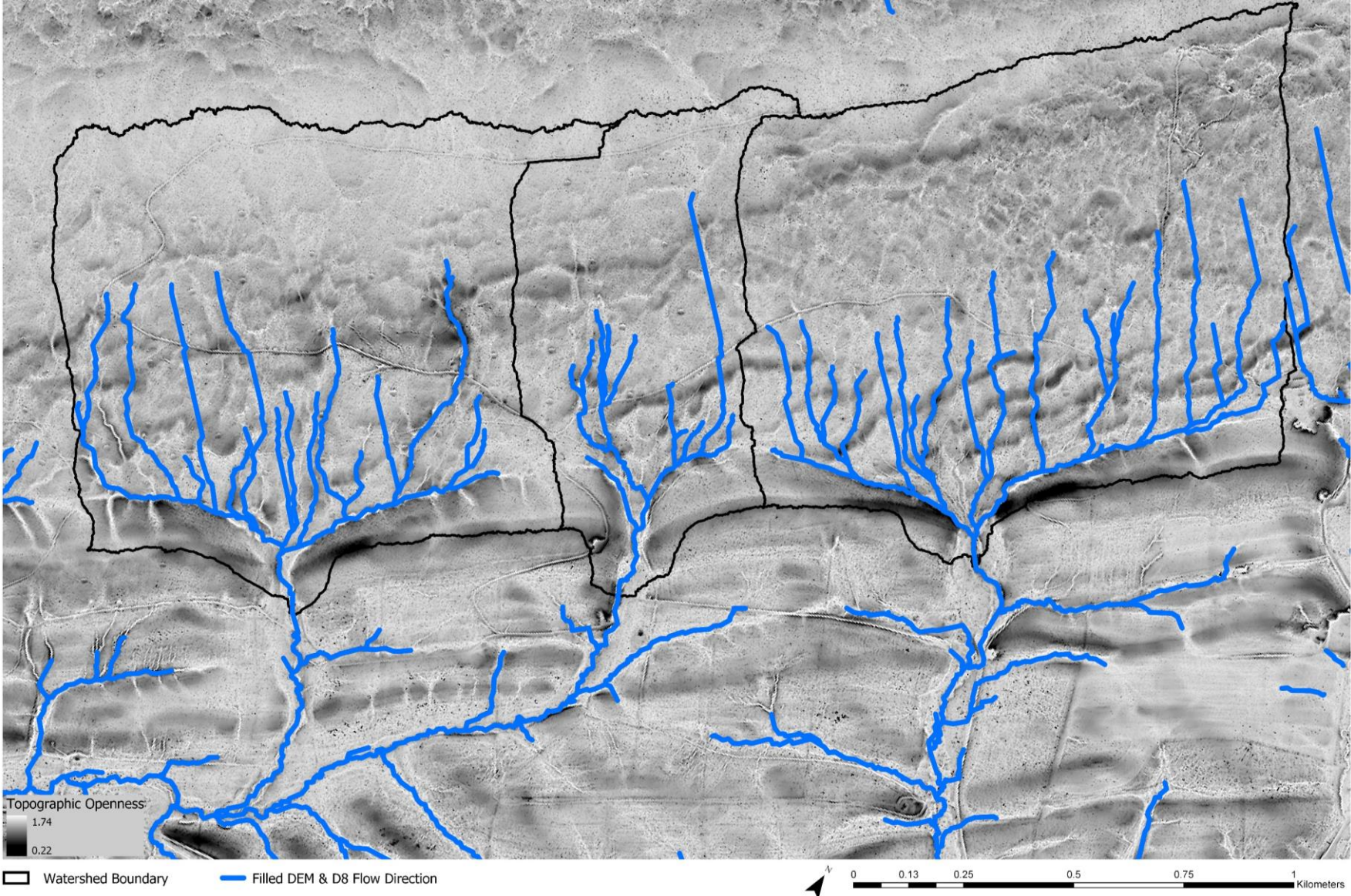


Glacial history
colluvial boulder
Forestry
-Charcoaling
_Logging

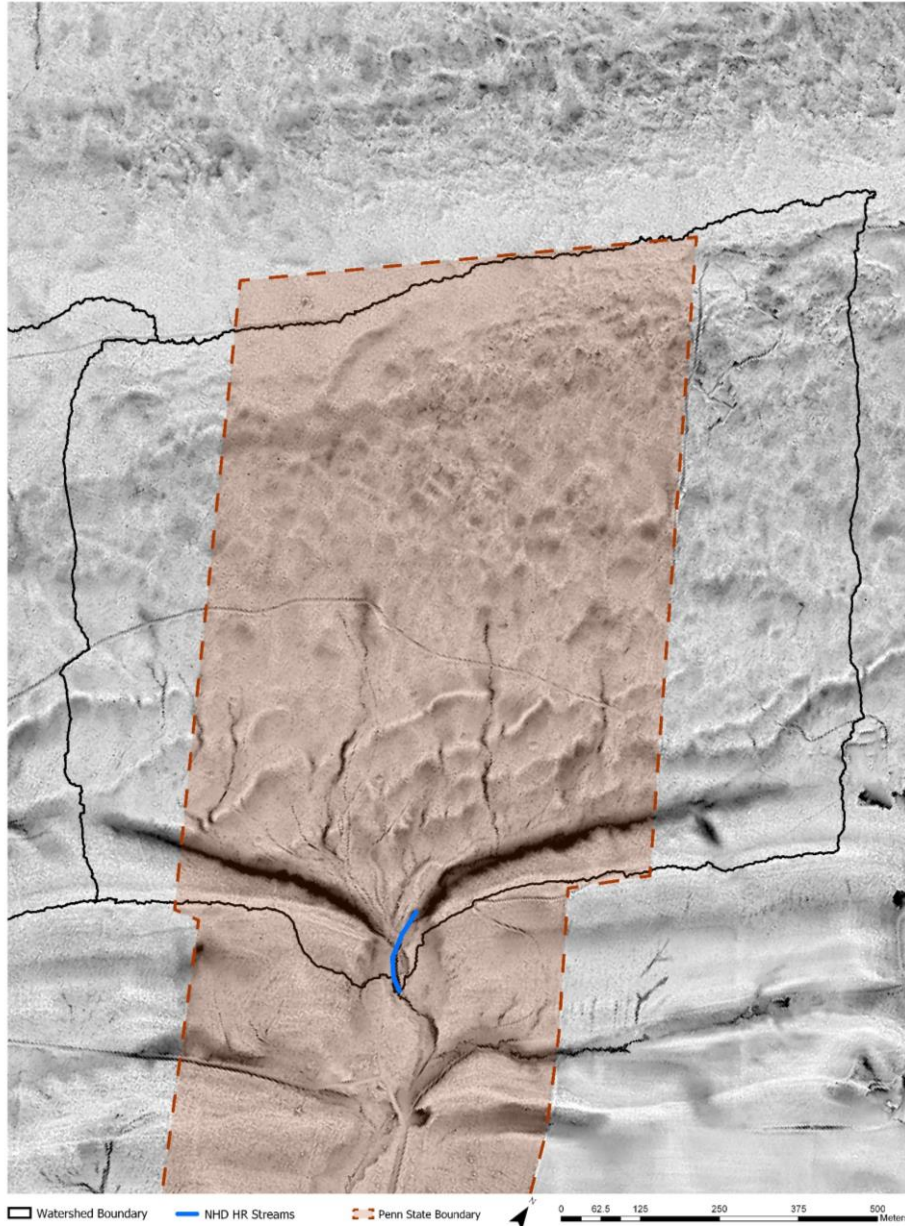
National Hydrography Dataset (NHD) High Resolution (HR)



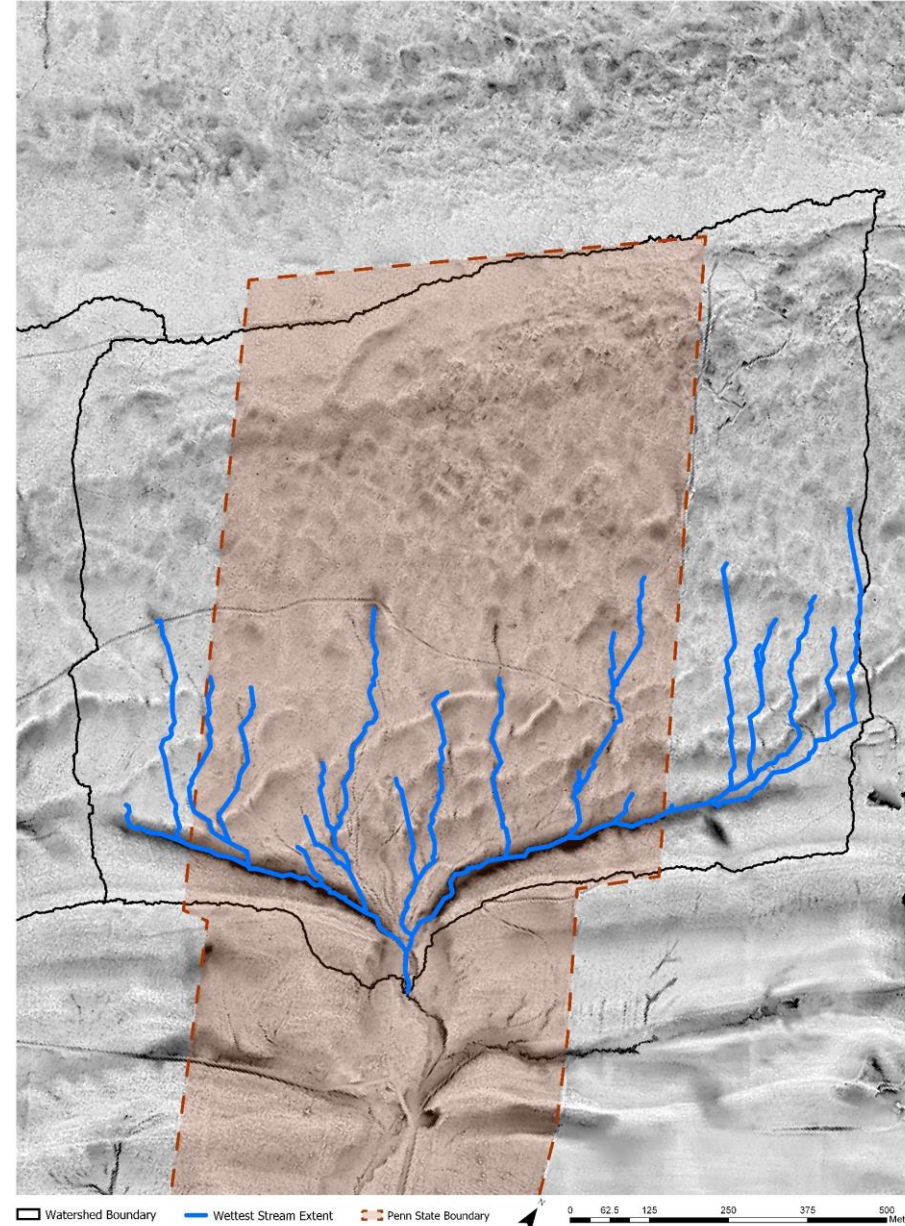
Filled 3m DEM and D8 Flow Direction



NHD High Resolution Streams



2018 Wetter Conditions

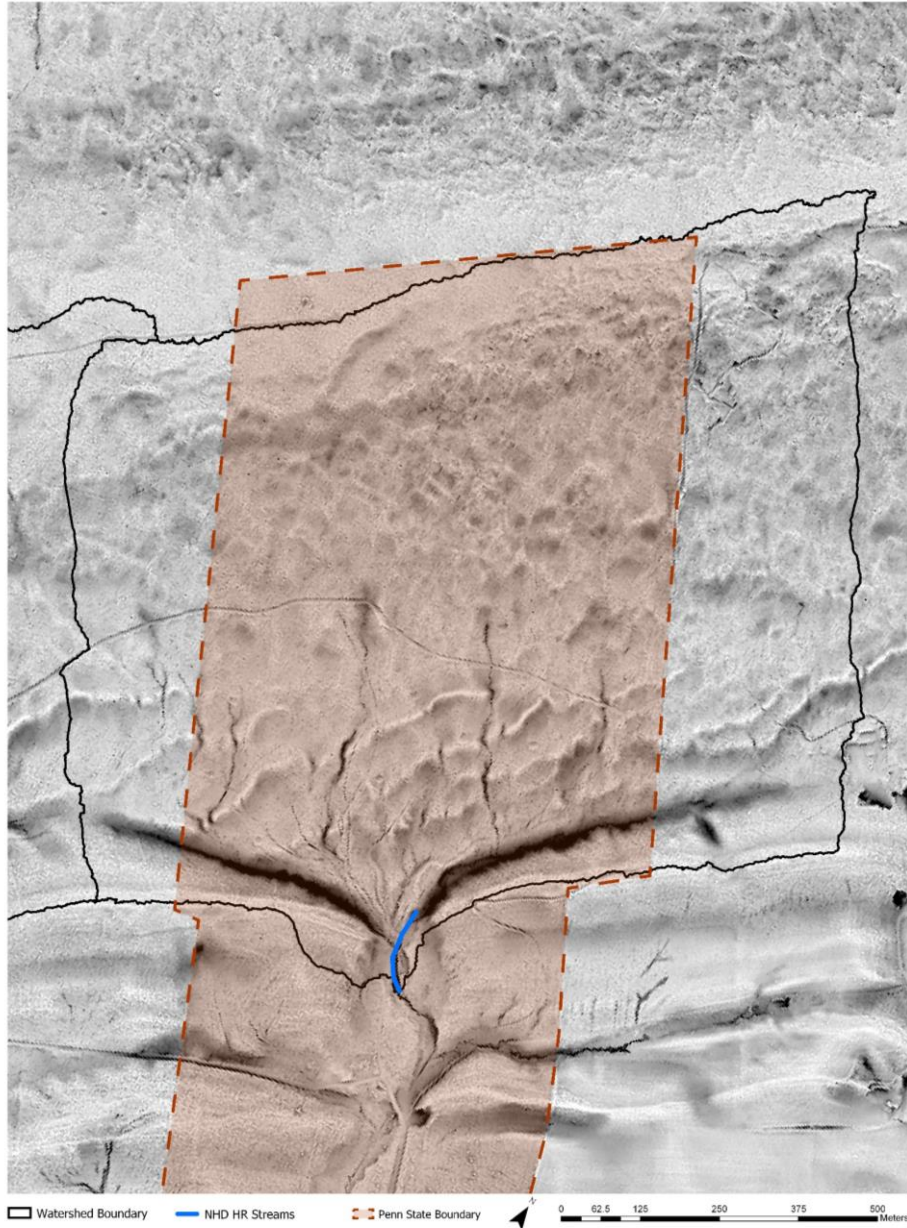


NHD HR
Stream
Length:
0.14 km

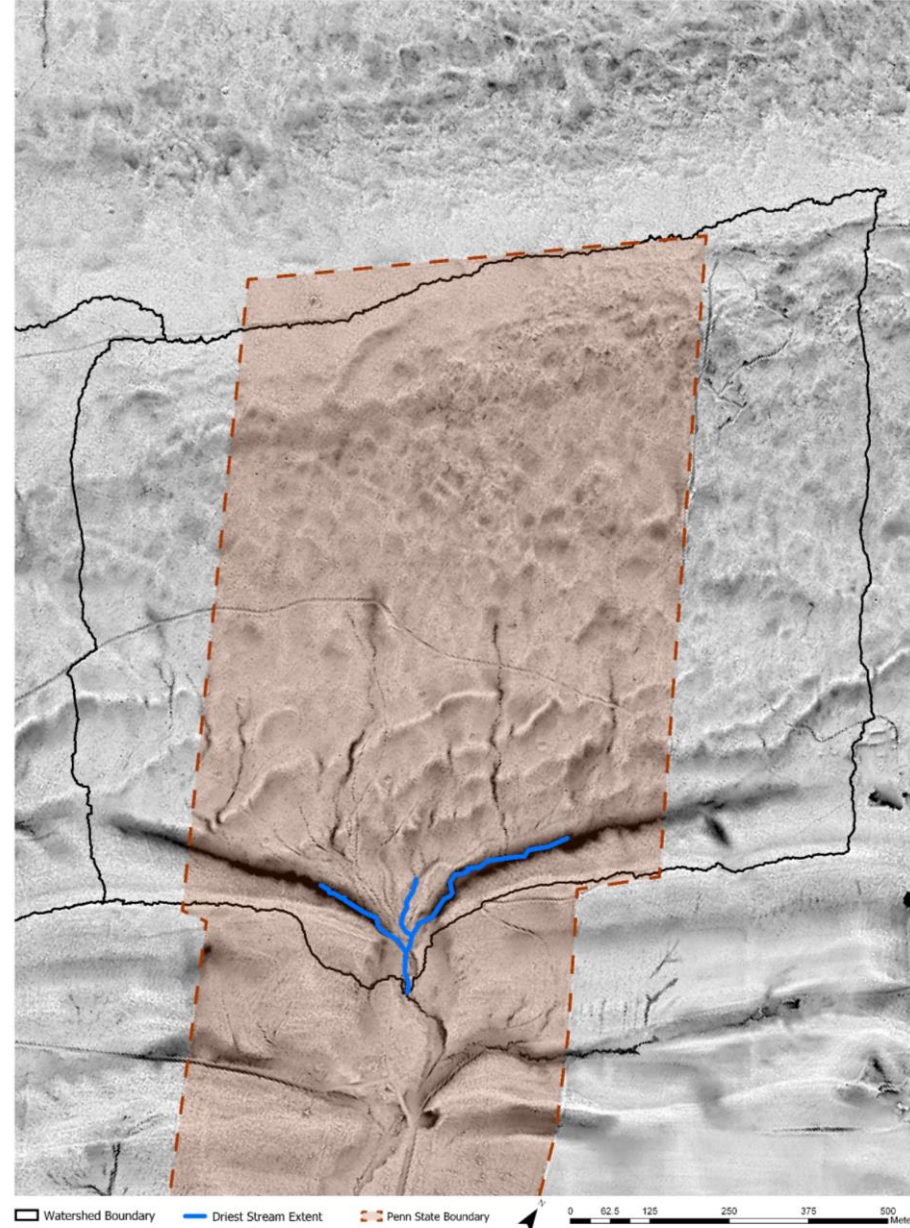
Wettest
Stream
Extent
Observed:
4.13 km

NHD HR
Streams
only
represent
3% of total
observed
stream
length
under
wettest
conditions.

NHD High Resolution Streams



2019 Drier Conditions

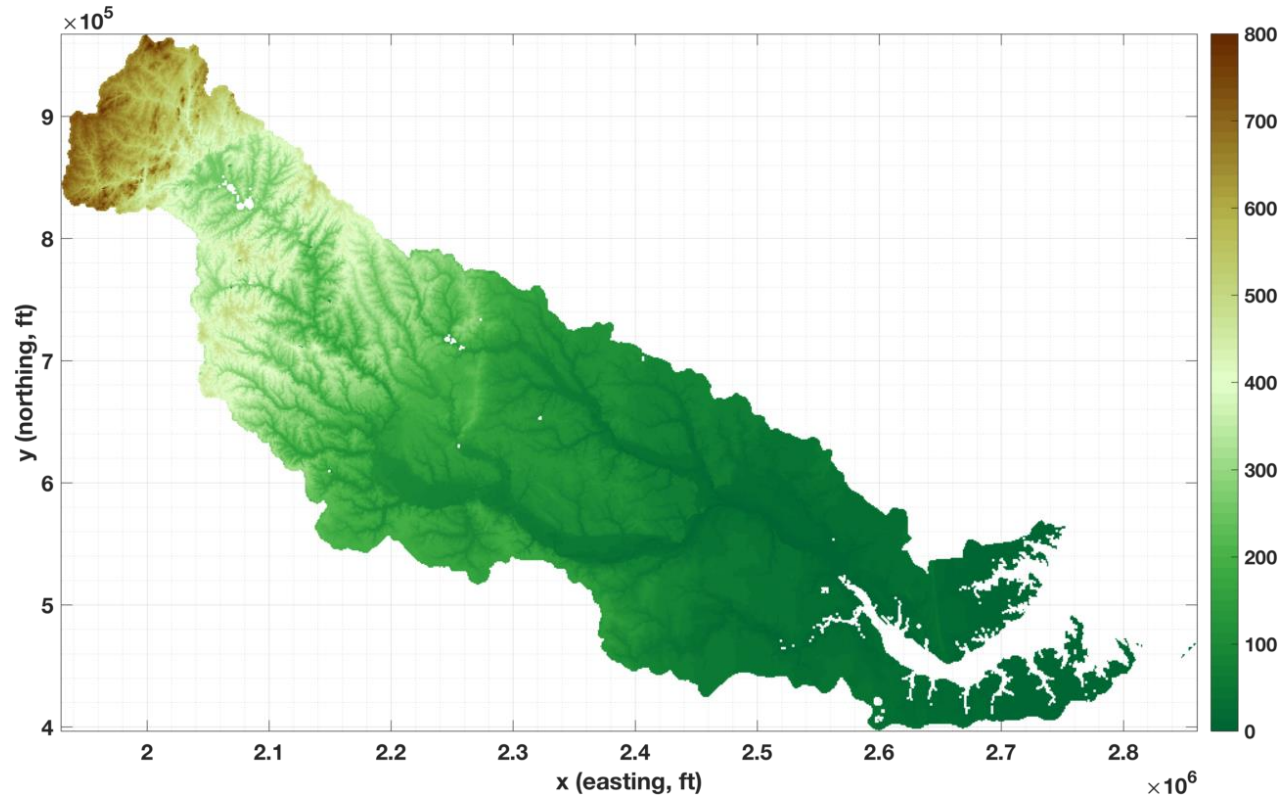


NHD HR
Stream
Length:
0.14 km

Wettest
Stream
Extent
Observed:
0.67 km

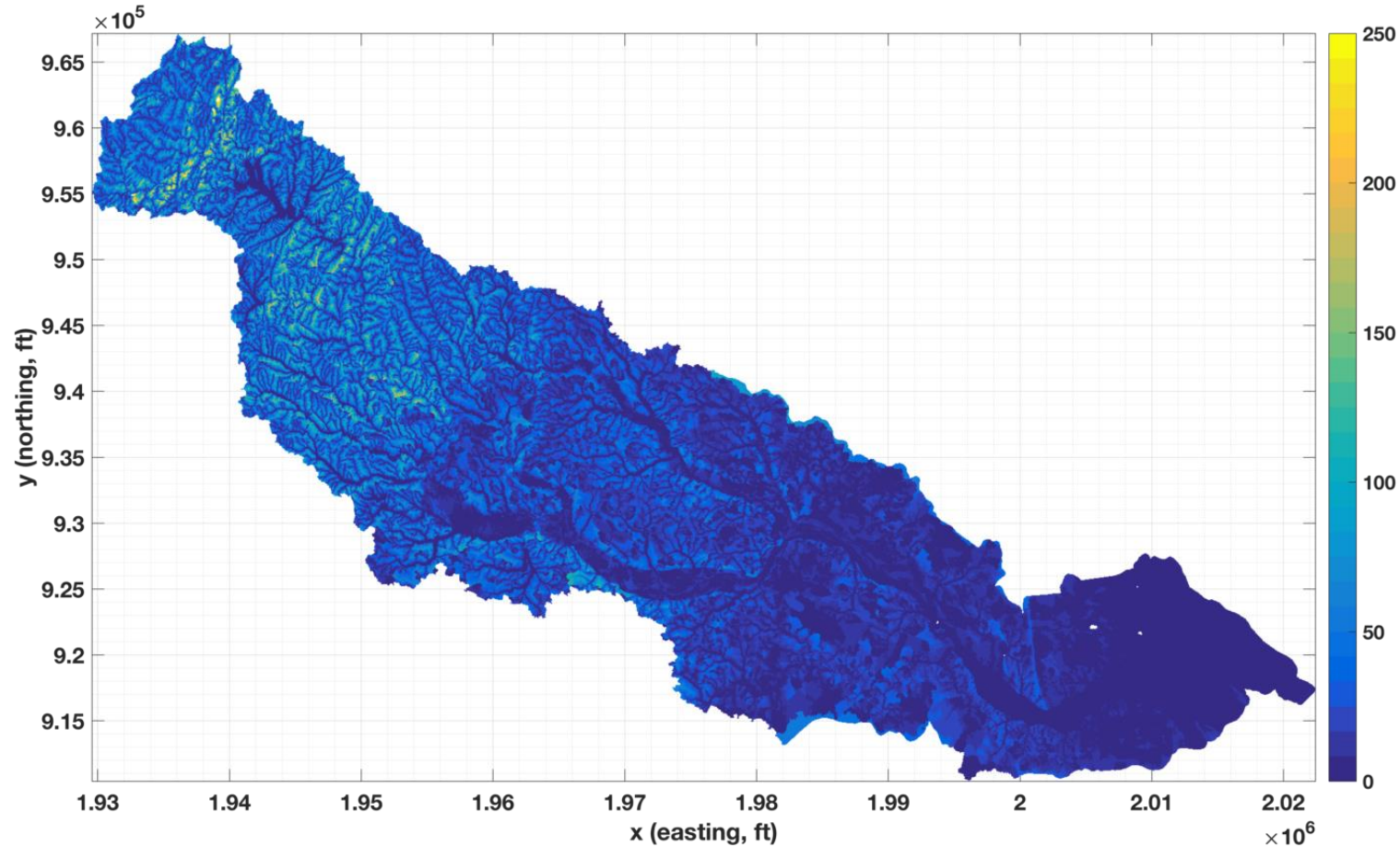
NHD HR
Streams
only
represent
21% of total
observed
stream
length
under
driest
conditions.

NC RENCI Supercomputing Initiative for Drainage Basin scale tiling & terrain analysis

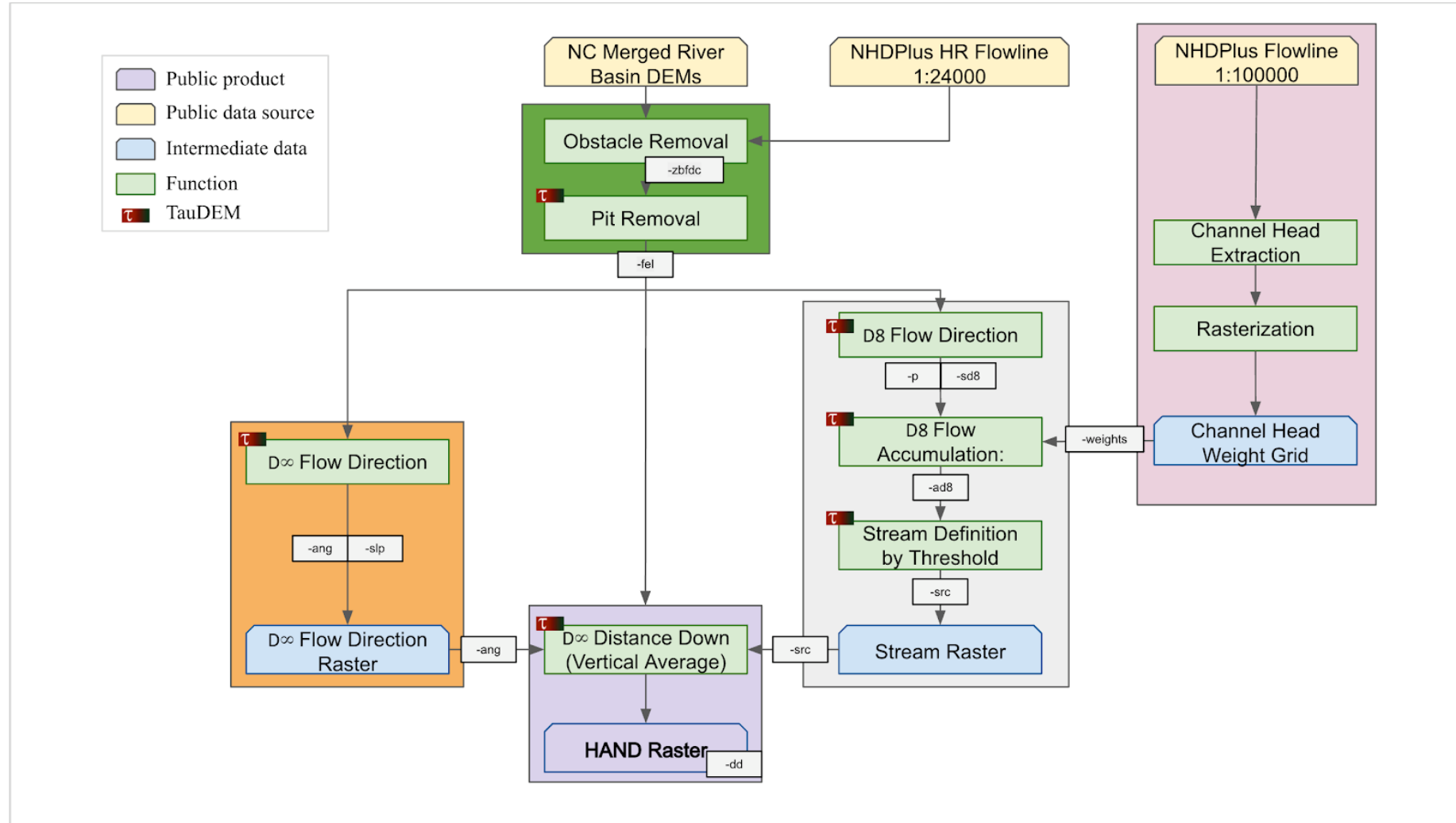


- Issues with tiles
- Issues with HUC12
- (issues with different flights/contracts in NC)

NC RENCI Supercomputing Initiative Height Above Nearest Drainage (HAND product)



GRASS GIS workflow on cluster Height Above Nearest Drainage (HAND)



Worth trying in PA?

Contact Info

Jon Duncan

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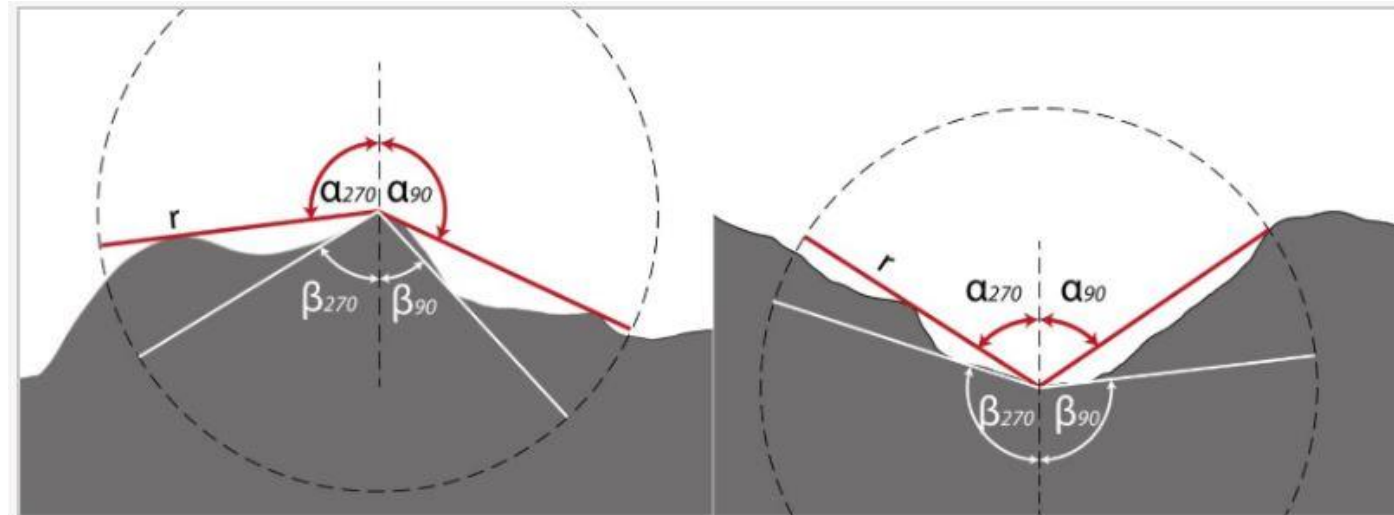
Penn State University

Department of Ecosystem Science & Management

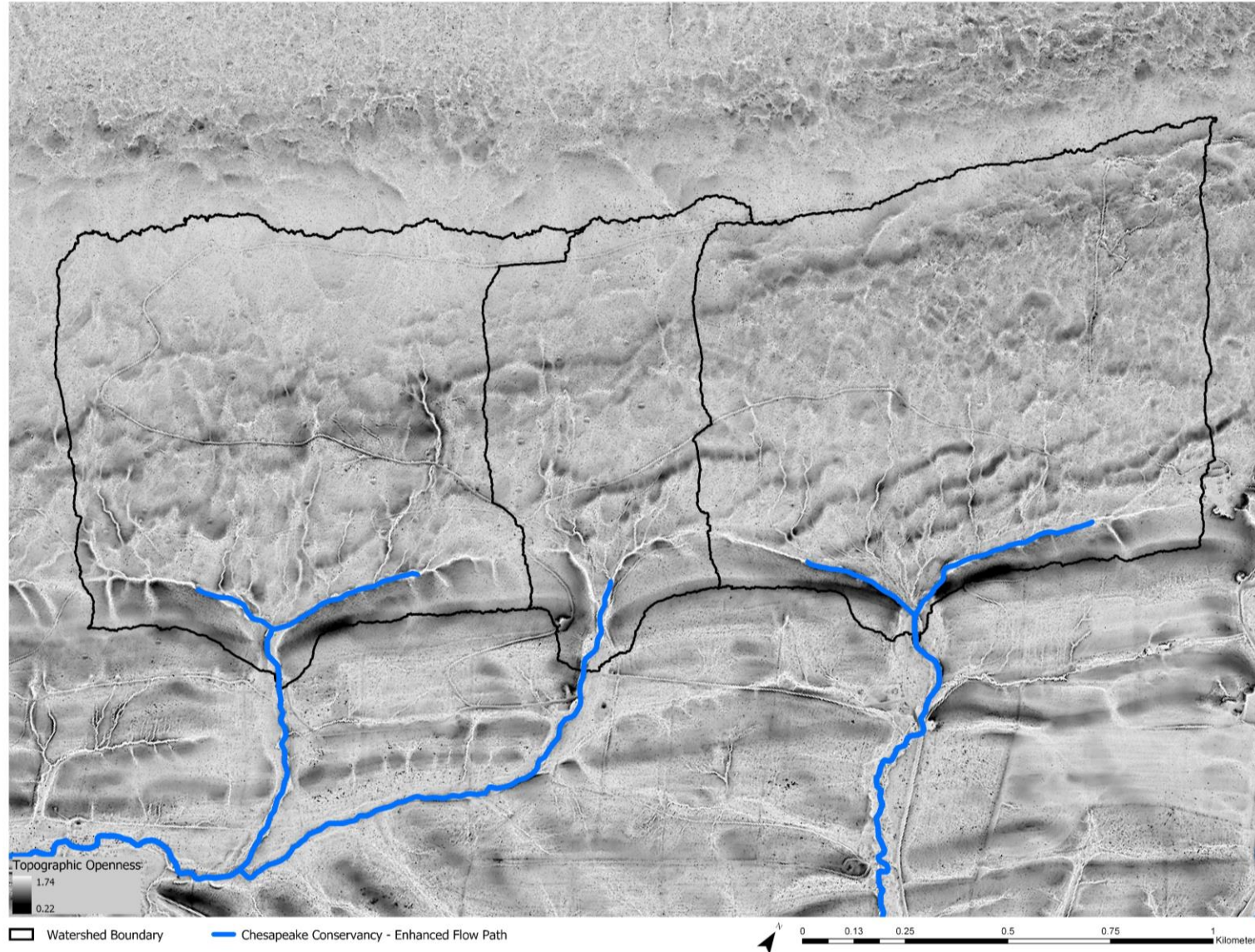
jmduncan@psu.edu

Topographic Openness

Yokoyama, R., Shirasawa, M., and Pike, R. J. (2002) *Visualizing Topography by Openness: A New Application of Image Processing to Digital Elevation Models*. *Photogrammetric Engineering & Remote Sensing* Vol. 68, No. 3 pp. 257-265.



Chesapeake Conservancy Enhanced Flow Path



Resilience to water quality degradation

THE BALTIMORE SUN

Chesapeake Bay's 'dead zone' forecast to be among largest in decades during summer 2019

Lebanon Daily News

\$4 Billion and nothing to show for it

By Ed Schafer, guest columnist 1:51 p.m. EDT July 27, 2016



Pennsylvania Launches Stream Buffer Initiative

Philip Gruber, Staff Writer Apr 1, 2016

Bay Journal

PA's 'reboot' strategy to improve water quality off to slow start

As state tries to come up with money for cleanup, EPA is threatening to take action unless progress is made

By Timothy B. Wheeler on August 07, 2016



Chesapeake Bay Foundation slams Pennsylvania's plan to reduce pollution as 'woefully inadequate'



Photo credit: Swistock

Local scale



Chesapeake Bay scale