

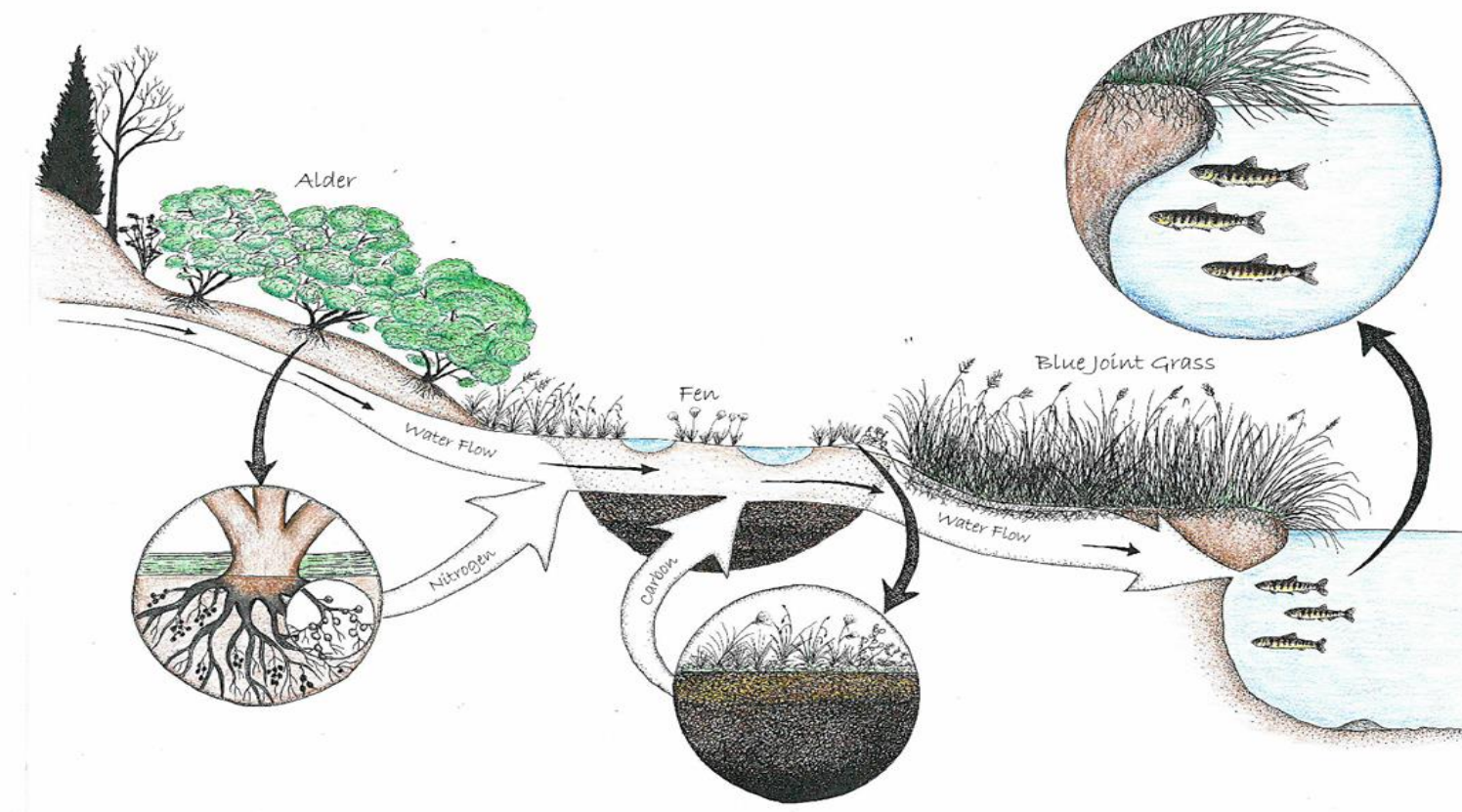
Visualizing Groundwater Resources to Promote Source Water Protection in the Kenai Lowlands

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Introduction

Groundwater is water found beneath the land surface in the cracks and crevices of rocks, soil, and sand. This groundwater is stored in aquifers where groundwater is recharged and from where it is discharged.



Groundwater contributes greatly to salmon habit, a priority to the community in the Kenai Peninsula. Studies conducted by the Kachemak Bay Research Reserve and their partners have concluded that groundwater discharge:

- creates overwintering habitats
- maintains stream flows
- modulates stream temperatures by keeping them cool in the summer and warm in the winter
- delivers nutrients that support the stream food webs

Figure 1: Groundwater features illustrated by Conrad Fields.

Population increases

Urbanization increases

Demand for material grows

It is important to know the locations of shallow aquifers so they, and the salmon habitat that aquifers create and support, are protected from the impacts of material extractions on the Kenai Peninsula.



Figure 2: Example of a material extraction site

Materials such as gravel and sand are extracted from the land surface to support the development of roads and more. Currently, material extraction regulations do little to protect aquifers and crucial groundwater sites that contribute to salmon habitat.



Figure 3: Location of area where project was conducted

Objectives

1. Visualize location and depths of shallow water-bearing formations
2. Identify vulnerable water-bearing formations in the vicinity of current and potential proposed activities
3. Create a story map to communicate the importance of source water protection and describe how it ties in with salmon habitats to be used in the development of best management practices to help reduce impacts of different land uses

Methods

Collecting the Data

1. Alaska Department of Natural Resource's Well Log Tracking System
 - Contained locations of wells, and depths to aquifers.
2. Kenai Peninsula Borough website
 - Contained location size and type of material extraction site

Choosing the Study Area

- The study area was chosen because:
1. The concentration of material extraction sites
 2. The amount of available well data logs

Interpreting the Data

- To visualize depths to groundwater resources and vulnerable areas:
- ArcMap Topo to Raster interpolation

Communicating the Science

- To communicate this information:
- ArcGIS Story Maps an interactive tool that can tell a story while incorporating ArcMap products

WATER WELL RECORD

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEY

Drilling Permit No. **49687**

Well Name: **Anchor Point**

Location of Well (Easting, Northing, UTM Zone 18N)

Well Log

Interval	Material	Depth (ft)	Remarks
0-2	Top soil (black)	10.4	
2-5	Shale (gray)	14.4	
5-12	Sand (very fine)	26.4	
12-17	Sand (fine)	38.4	
17-19	Sand (medium)	48.4	
19-25	Sand (coarse)	64.4	
25-34	Gravelly sand	80.4	
34-38	Sand (fine)	90.4	
38-44	Sand (fine)	100.4	

Figure 4: Example of well log data.

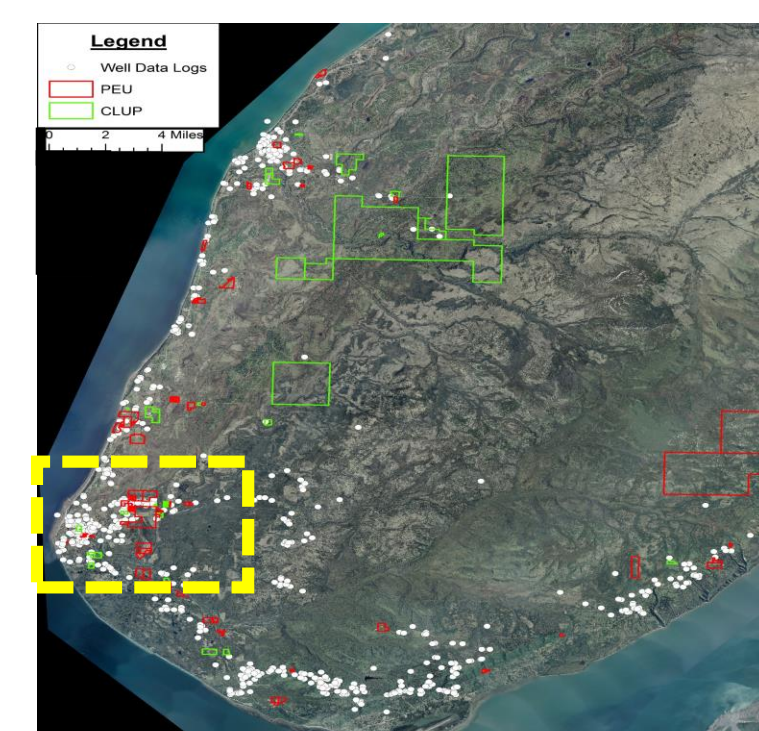


Figure 5: Aerial imagery of Anchor Point.

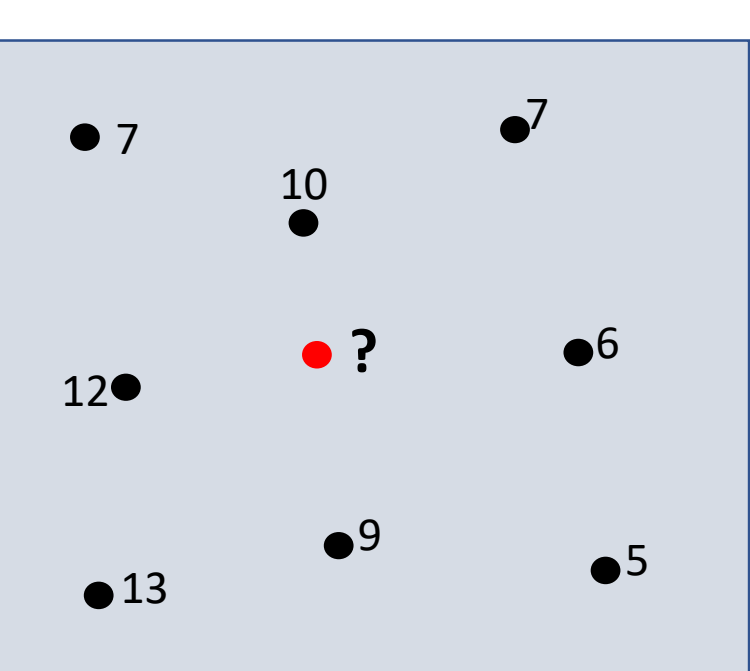


Figure 6: Simplified visual of interpolation.

Results

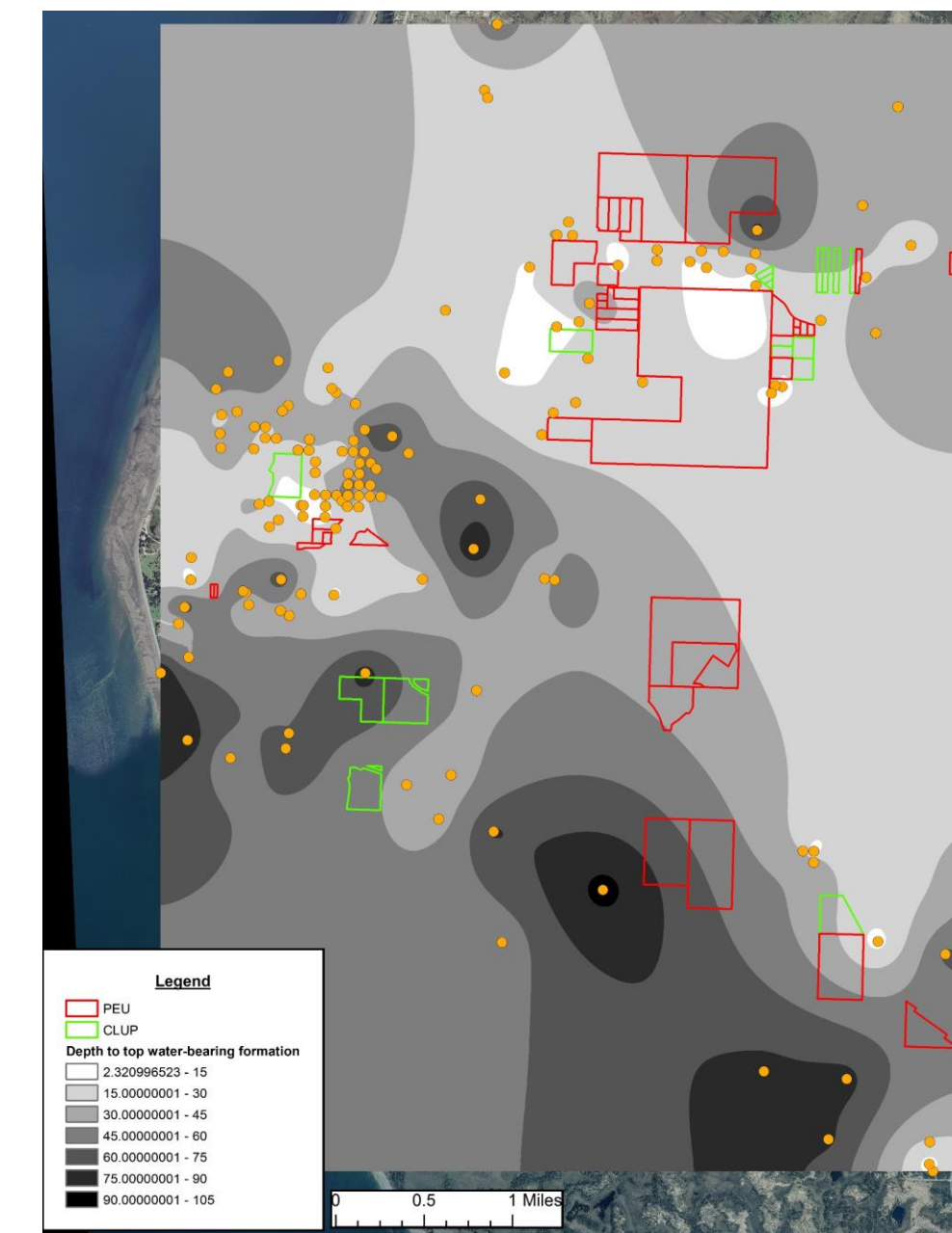


Figure 7: Interpolation performed across the study area with well log locations.

Areas that have the shallowest aquifers near material extraction sites are the **most concerning** areas due to the lack of regulations protecting aquifers.

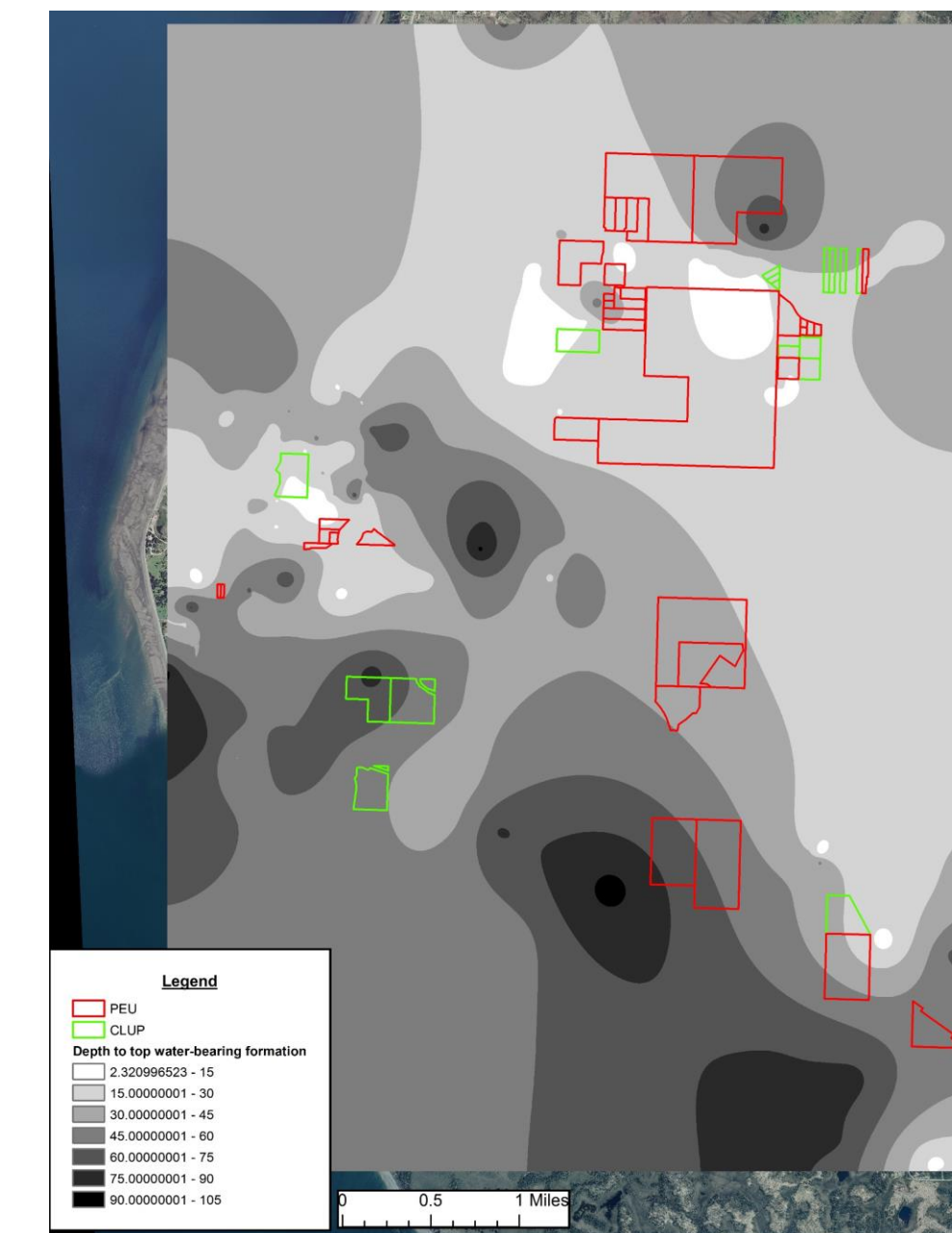
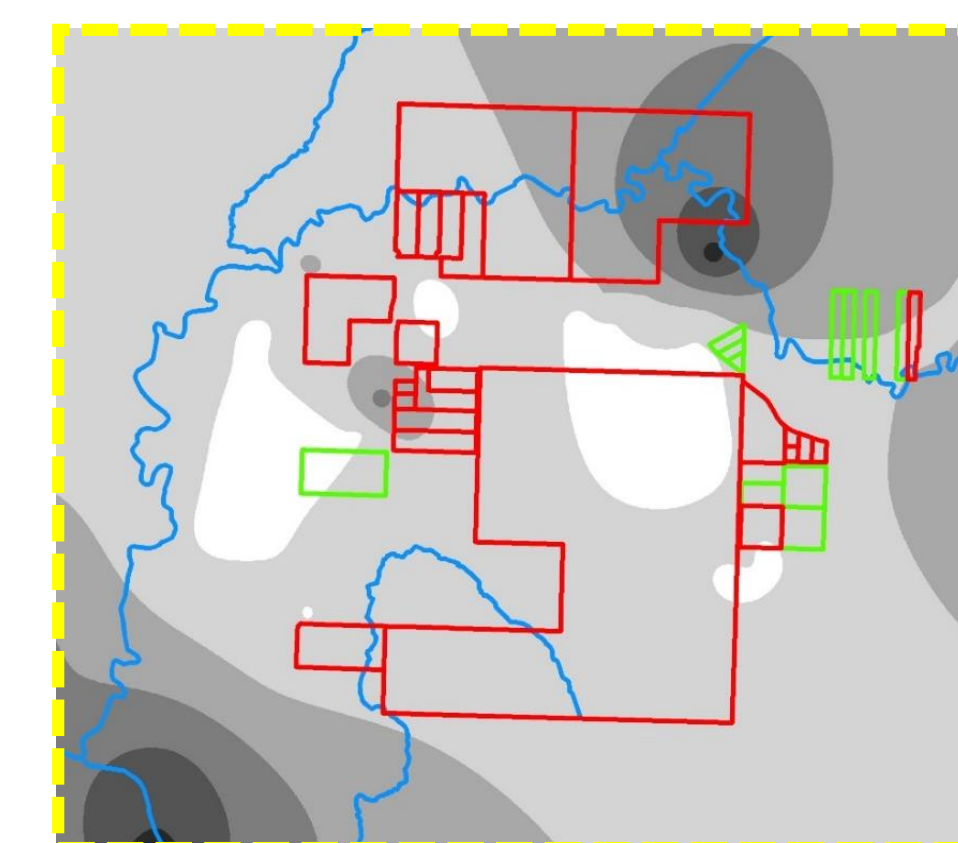
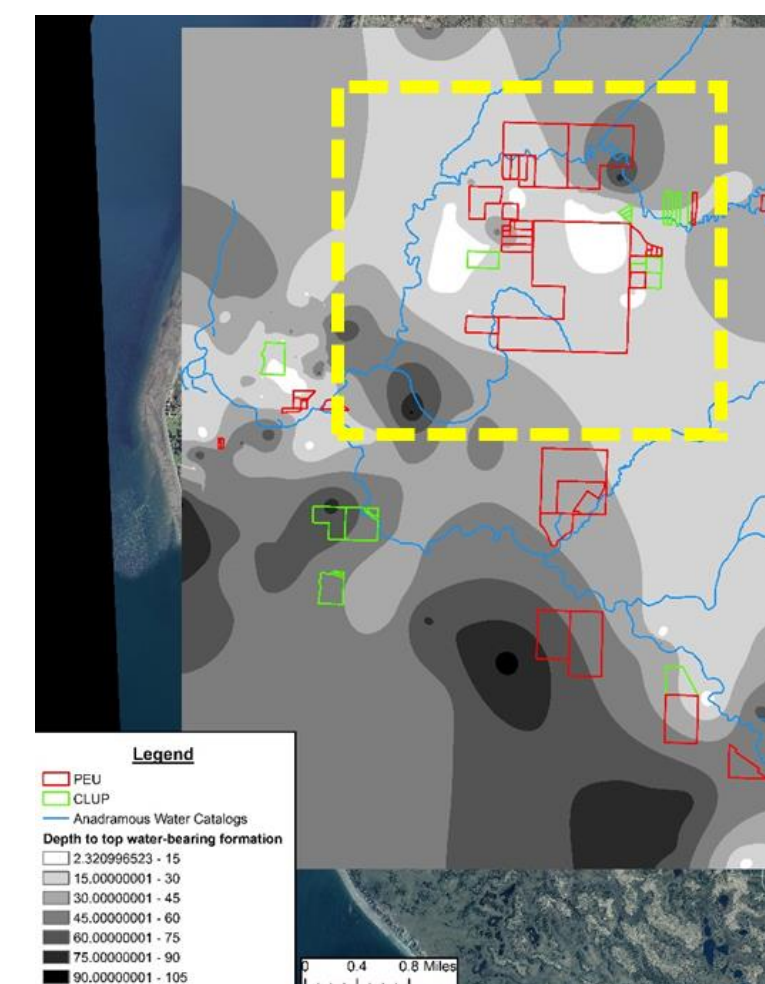


Figure 8: Interpolation performed across the study area without well log locations.

If a shallow aquifer is penetrated:

- Introduce contaminants to water source
- Introduce contaminants into salmon-bearing streams
- Interrupt the flow of groundwater into streams
- If exposed, raise temperatures of water



Shallowest depth (2-15ft)

Deepest depth (90-105ft)

Interpolation takeaways:

1. The more data in an area, the better the interpolation
2. Areas with little to no data, interpolation is too generalized

Therefore more well log data is needed for better results.

Inform different audiences:

1. Landowners
2. Policy makers
3. Stakeholders

Conclusion

The goal of this case study was to:

Raise awareness of the location and vulnerability of shallow aquifers to assist in improving regulatory protections for groundwater on the Kenai Peninsula.

This information will help inform landowners and guide them towards making their own decisions about protecting groundwater or inform policy that requires tighter regulations or reclamation plans for groundwater.

A Story of Groundwater for the Protection of Salmon in the Kenai Lowlands is **currently** being used by KBNERR.

A Story of Groundwater for the Protection of Salmon in the Kenai Lowlands can be found using the QR Code to the right.



Future Work

- Expand spatial analysis to the entirety of the Kenai Peninsula
- Incorporate research with the tool that predicts high probability groundwater recharge and discharge sites
- Additional groundwater research can be added to the story map

References

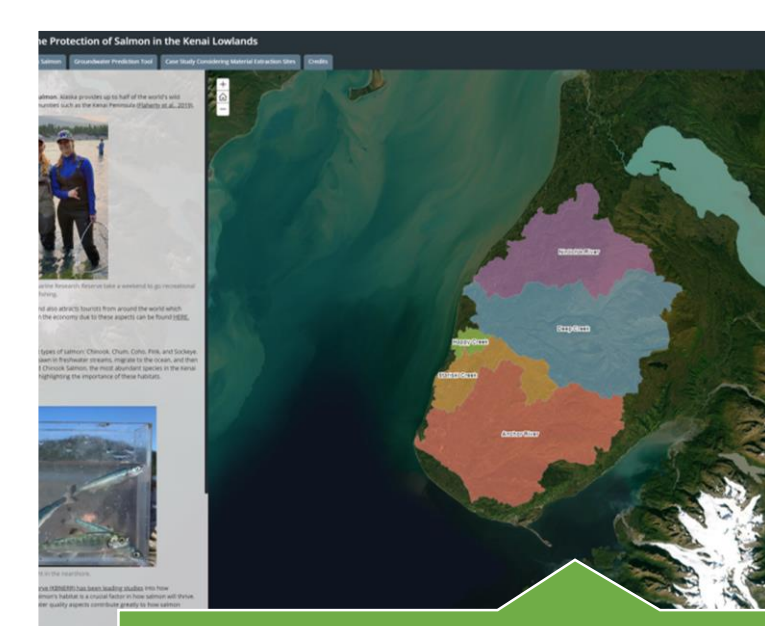
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Acknowledgements

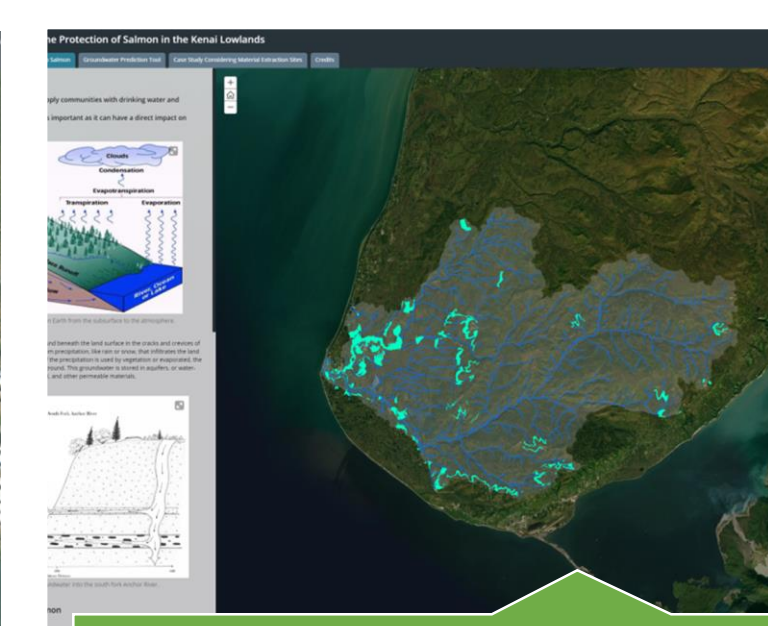
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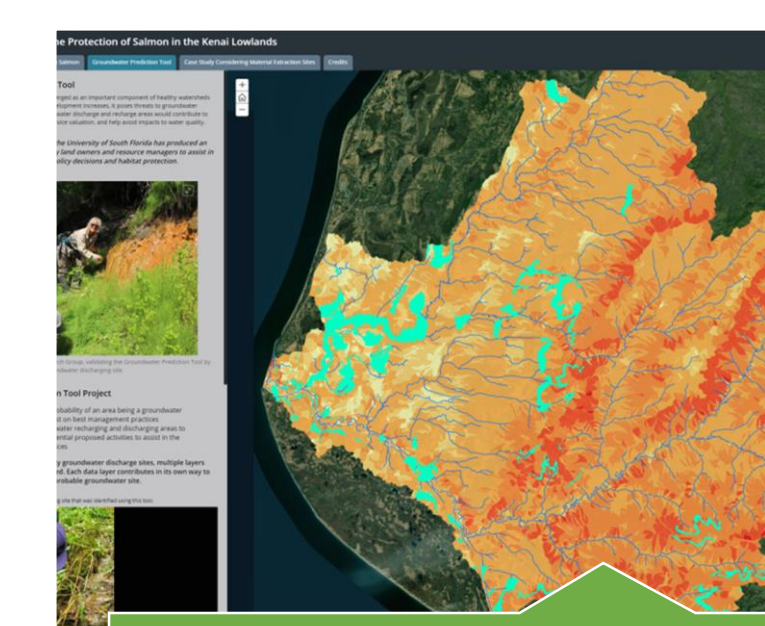
A Story of Groundwater for the Protection of Salmon in the Kenai Lowlands



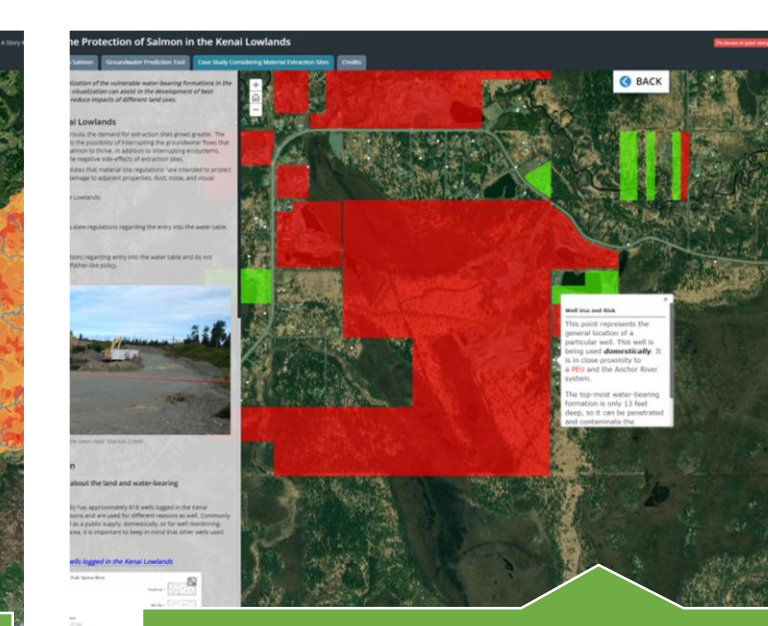
Life of a Salmon
Discusses salmon's importance and life along with how urbanization can affect salmon



Groundwater Contribution to Salmon
Discusses the basics of groundwater and its function to salmon-bearing streams



Groundwater Prediction Tool
Discusses the groundwater prediction tool that the Ecohydrology Research Group from the University of South Florida has created for the Kenai Peninsula.



Case Study considering Material Extraction Sites
Discusses the details about this project dealing with well log data and shallow aquifers.