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Archaeology and Climate Change: Sites at Risk of Sea Level Rise in The Puget Sound

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Archaeology and Climate Change: Sites at Risk of Sea Level Rise in The Puget Sound



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Abstract

The Puget Sound Watershed, located along Washington's Northwest coast, contains 5,467 recorded archaeological sites, 1,290 of which are listed on the National Register of Historic Places. The majority of these sites are located along the coastline and associated waterways making them highly susceptible to climate change induced sea level rise. This research uses data provided from The Washington State Department of Archaeology and Historic Preservation and a geographic information system (GIS) to determine the susceptibility of thousands of sites to rising sea-levels. A mosaic of 10m resolution digital elevation models (DEMs) was created for the Puget Sound Watershed and elevation for each site was then extracted. The data are then compared to predicted sea level rise measurements to generate an inundation vulnerability assessment. Once complete, this research can inform potential management strategies for sites that are currently vulnerable to inundation in the State of Washington.

Objectives

This research answers two main questions:

- 1) What are the impacts of sea level rise on archaeological sites?
- 2) What archaeological sites within the Puget Sound Watershed are at risk of inundation?

Study Area

The Puget Sound Watershed is located in the north-western corner of Washington state (Figure 1). Puget Sound contains more than 3,000 kilometers of diverse shoreline, including rocky coasts, sand and gravel beaches, coastal bluffs, small estuaries and lagoons, and river deltas (Shipman, 2008). Washington's archaeological heritage spans over 12,000 years dating back to the arrival of the first humans who crossed the land bridge in the Bering Sea (Washington State Department of Archaeology & Historic Preservation, 2019). Since then, the coastal areas in Washington have been inhabited by native peoples, leaving it with a rich history and a wealth of archaeological sites.

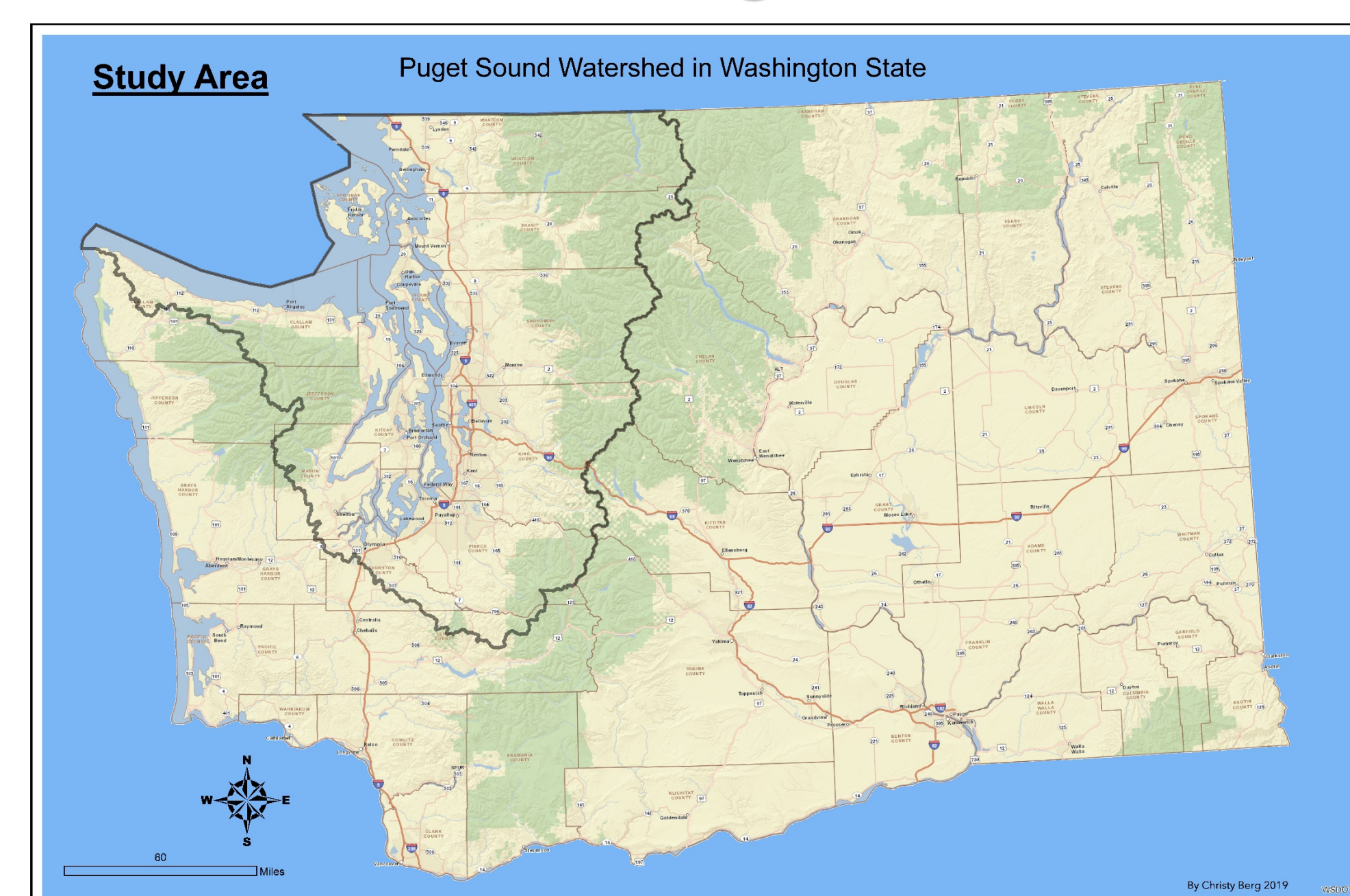


Figure 1. Project Area: The Puget Sound Watershed

Methods

- Archaeological site data were obtained by the Washington State Department of Archaeology and Historic Preservation (DAHP). This data set includes site location, dates, artifact details, elevation and was updated in February 2019, (Figure 2).
- Accurate elevation for each site was determined using 10-meter digital elevation models (DEMs) provided by the USDA Geospatial Data Gateway.
- DEMs were mosaicked together for the study area, and elevation data was then extracted to points.
- Figures from the National Climate Assessment in 2014 were used to provide the general estimates for projected global sea level rise. The three scenarios are 1m, 3m and 5m of sea level rise.
- Site elevations were compared to the sea level rise projections to determine zones of risk from potential inundation.
- All analysis was completed using ArcGIS 10.6

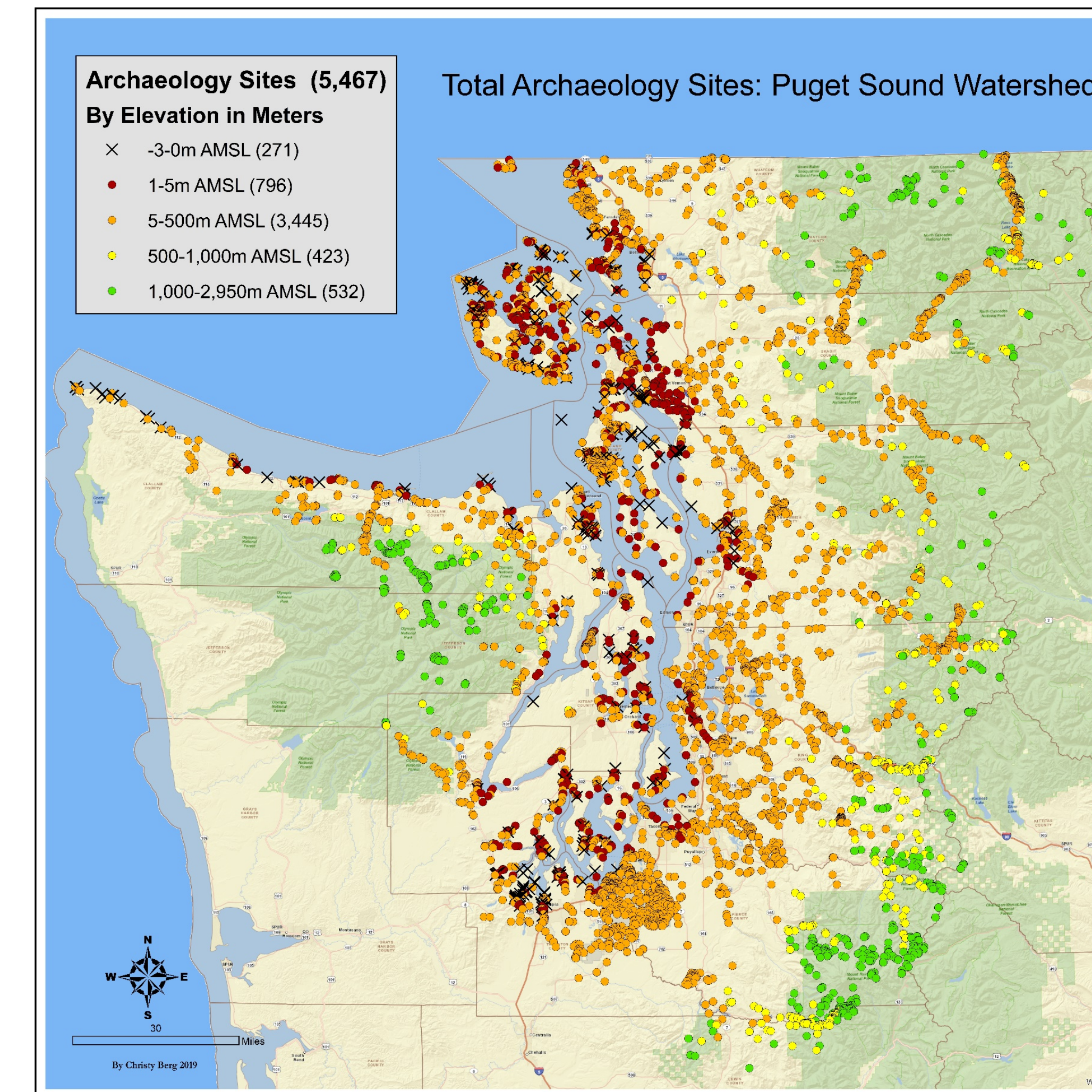


Figure 2. Archaeological Site Data

Results

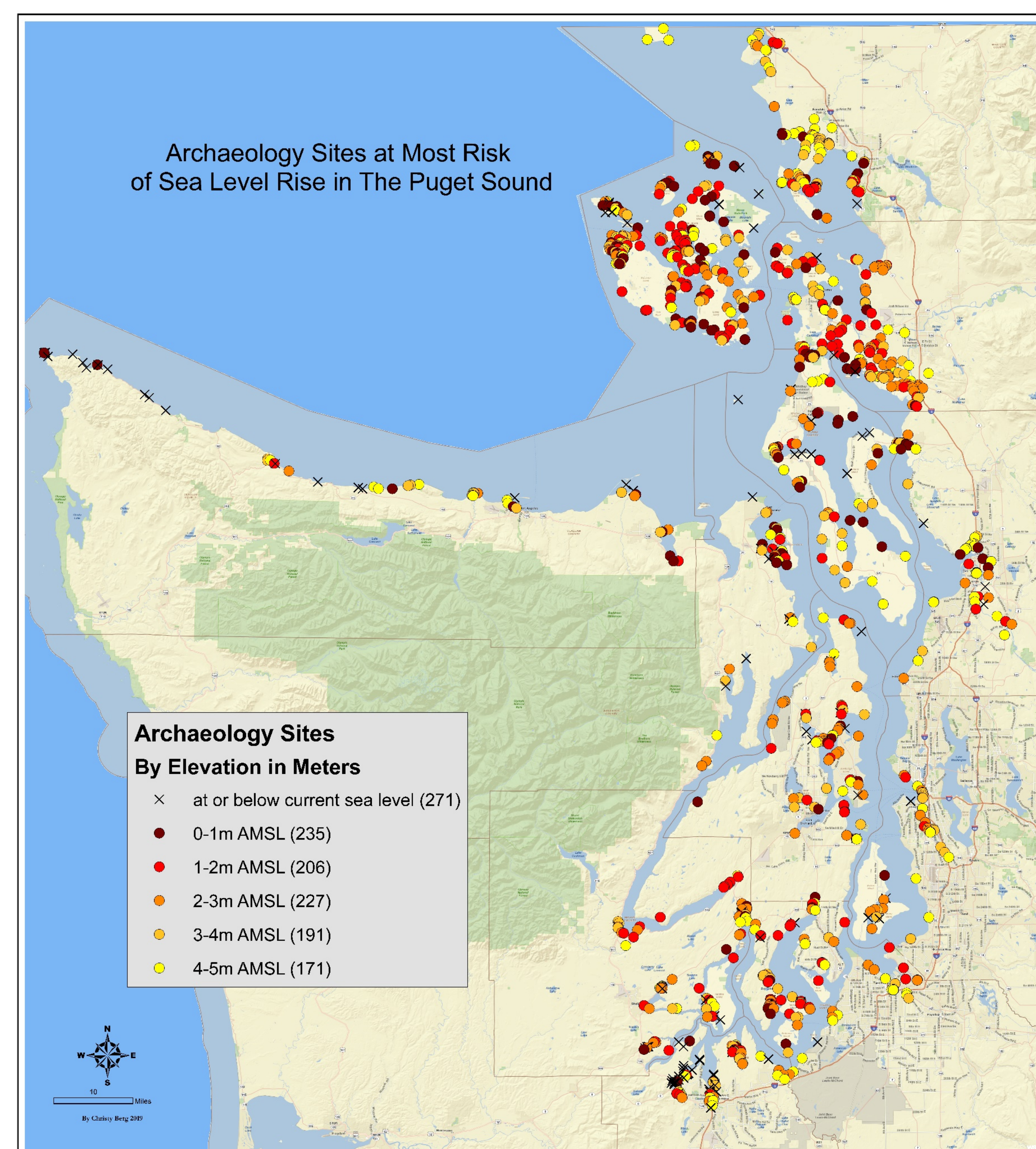


Figure 3. Archaeology Sites Most at Risk in the Puget Sound.

References
Anderson et al., 2017. Sea-Level Rise and Archaeological Site Destruction: An Example from the Southeastern United States Using DINAA (Digital Index of North American Archaeology). *PLoS One* 12(11):12.
Washington State Department of Archaeology & Historic Preservation (DAHP), 2019. *Archaeology*. Accessed 11 March 2019. <https://dahp.wa.gov/archaeology>.
Shipman, Hugh. 2008. A Geomorphic Classification of Puget Sound Nearshore Landforms. *Journal of Island and Coastal Archaeology* 10(3): 436-445.

- 5,467 documented archaeology sites located within the Puget Sound Watershed (Figure 2).
- 271 sites are already at or below current sea level (Figure 3).
- 235 sites are at risk of inundation if there is a 1m rise in sea level.
- An additional 206 sites will be lost if a 2-meter rise in sea-level occurs.

San Juan County

- San Juan County has the most sites that fall within the projected 0-1m zone of inundation in the Puget Sound Watershed (Figure 4).
- 48 sites are below 1 meter of elevation AMSL
- 65 sites will be inundate with a 1-2 meter rise in sea-level.
- These sites included artifacts such as shell middens, fire cracked rock, charcoal, faunal remains, flakes and projectile points.

Discussion

This research supports the evidence that large numbers of cultural resources are threatened by sea level rise. Given these numbers, planning possible protection and mitigation strategies should proceed with an increased sense of urgency. (Anderson, 2017). These sites located along the Pacific coast can provide crucial information for charting past human migration and potentially the first people to enter the Americas. The number of low-elevation sites are especially high in San Juan County. The cluster of sites at 0-1m AMSL make these islands a priority for preservation.

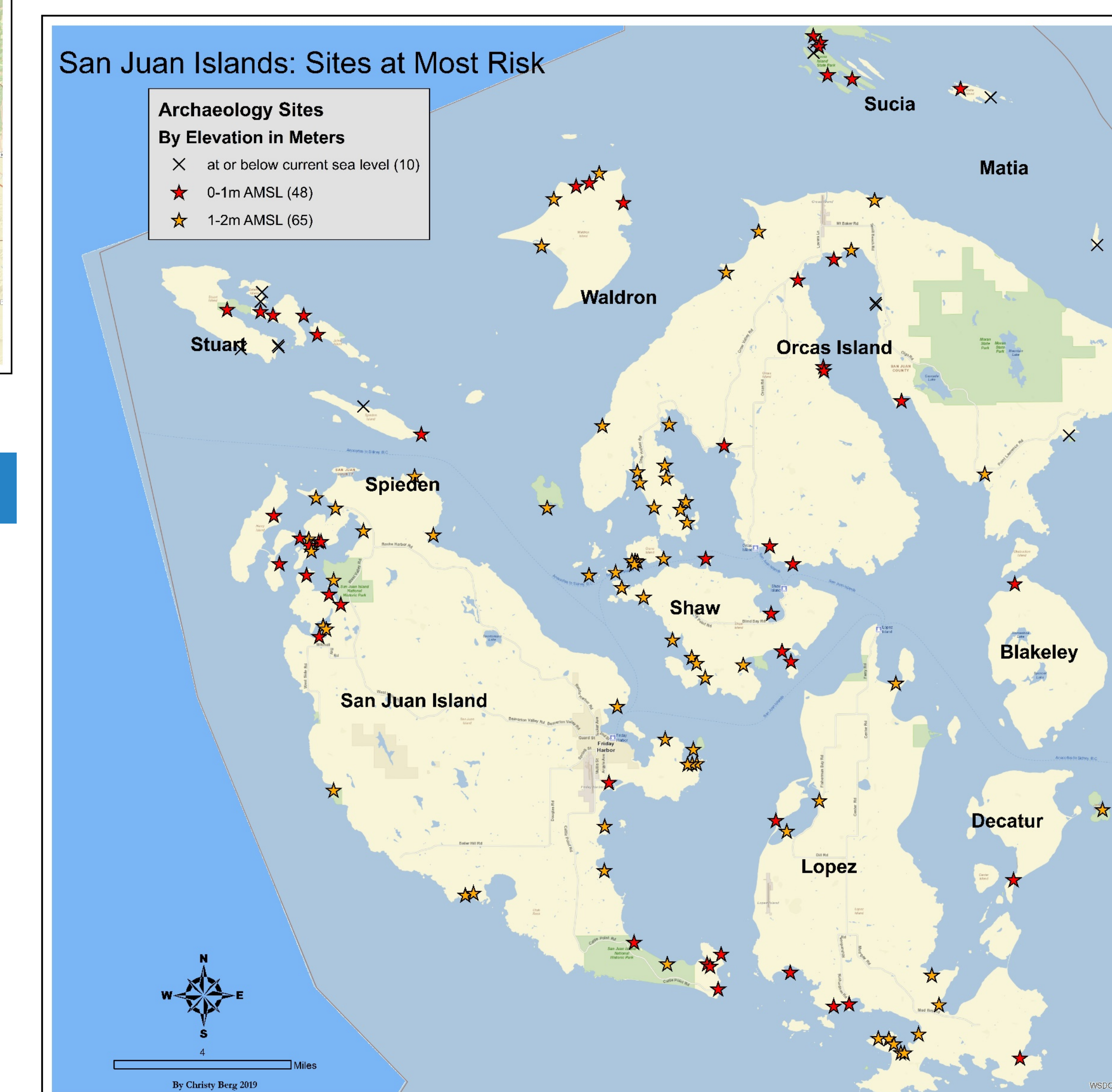


Figure 4. Sites at Risk in San Juan County

Future Research

The results of this research will generate management suggestions for future preservation and conservation research. It will also be used to promote public archaeology through a user-friendly website, and ESRI Story Map.

Acknowledgments

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