

**Linking Great Lakes Professional and Geospatial Networks  
to Promote Resilient Coastal Communities**

**Wisconsin Coastal Management Program  
Wisconsin Department of Administration**

**Proposal for the  
NOAA Coastal Management Fellowship  
NOAA Office for Coastal Management**

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## **Background and Introduction:**

Building on a current NOAA Project of Special Merit and Regional Coastal Resilience Grant Project, along with recently completed NOAA and state coastal management fellowships, Wisconsin Coastal Management Program is proposing a new fellowship opportunity that will offer unique experiences to engage and support professional and geospatial networks in the Great Lake region. The results of these networking experiences will strengthen the ability of coastal communities to adapt to and mitigate coastal hazards. The value to the Fellow includes direct experiences bringing innovative geospatial technologies to other coastal professionals, coastal communities and coastal programs.

## 2018 NOAA Project of Special Merit

In 2018, the Wisconsin Coastal Management Program (WCMP) was awarded a NOAA Project of Special Merit for their proposal entitled, *“Combining a mapping community of practice with an innovative collaborative environment to improve coastal hazard planning and policy development.”* The PSM was a direct outgrowth of a “Lake Superior Coastal Mapping Mini-summit” held in Ashland, WI in September 2017, which in turn was an outgrowth of a NOAA Office of Coast Survey “Great Lakes Coastal Mapping Summit” held in Chicago the previous April. Both events gathered mapping professionals from various state, local, university and federal agencies in order to better understand each other’s work, data needs, and potential future collaborations. At the Ashland event, presentations of current mapping and planning projects revealed a surprising amount of redundant efforts occurring on similar issues (e.g. mapping of road culverts). Due to this, the second day of the summit was dedicated to devising specific ways that this group of motivated individuals could effectively coordinate efforts in the future. Improved flood risk data tools and planning rose to the top of topics based on the amount of work currently being applied to this issue and also the backdrop of the recent wind and flooding event that occurred in the region in July 2016. At the conclusion of the meetings, all members vocally expressed an eagerness to continue to meet and further the conversation about how to tackle a more organized and integrated floodplain management team for the region. To take advantage of this enthusiasm, WCMP submitted a proposal for the 2018 PSM grant cycle.

The primary goal of the PSM is to organize the mini-summit attendees, particularly those with an interest in ongoing local flood risk management into a community of practice (COP). Several participants indicated they were already mapping culverts in their watersheds, some were cooperating, most were not. An online survey last spring indicated at least 21 different culvert mapping projects both in the regional and other parts of the state. Using adaptive management techniques, the COP, organized by WCMP, the DOA GIO and project staff from State Cartographer’s Office will inventory the various efforts, look for best practices and attempt to develop a working model for cooperation among the COP participants. **To aid in this effort, the project will develop a cloud-based “collaboration support environment” or CSE that will allow mappers to share data, try new tools, and view results in real time.** The new Fellow, when they arrive in the late summer of 2019 would assist with the development of methods to evaluate the vulnerability of culverts using hydrological modeling techniques. This will help meet the project goal of providing technical assistance to local governments, particularly road departments in charge of culvert maintenance, identifying infrastructure assets that might be at future risk. In the second half of the project, the Fellow will further expand the capabilities of the COP and CSE through exploration of NOAA resources (Digital Coast, CCAP and others).

**Goals and Objectives: The Primary Goal of the Wisconsin Coastal Management Fellowship Experience is to apply geospatial technologies developed by state, federal and university programs to hazard issues identified by coastal stakeholders and communities:**

Objective 1: Participate in activities supporting the Wisconsin Project of Special Merit:

- A) Enhancement of the 2018 NOAA PSM culvert inventory products through development of hazard vulnerability assessment methods.
- B) Development of methods for inventory, public access and long-term management of geospatial products, studies and reports produced by WCMP grantees and Coastal Hazards Workgroup, Coastal Resiliency Project and others. Research availability of historical hazard geospatial products, maps, studies and reports for inclusion in archive.
- C) Investigate hazard vulnerability models developed by others for Wisconsin coastal areas.

Objective 2: Demonstrate and integrate NOAA geospatial resources into state and local coastal hazard education activities

- A) Investigate geospatial resources available through NOAA Digital Coast, Coastal Change Analysis Program (CCAP) and National Water Model (NWM). Develop educational presentation for state, local and tribal organizations.
- B) Develop a self-directed project that incorporates elements of the PSM, Coastal Resiliency Project, Digital Coast, CCAP or NWM into a multi-hazard vulnerability viewer for property, infrastructure and natural features in Great Lakes coastal areas.
- C) Present results to local, state and tribal coastal managers.

**Milestones and Outcomes:**

Activities	Duration
<ul style="list-style-type: none"> <li>• Orientation to the Wisconsin Coastal Management Program, Wisconsin Land Information Program, and the Division of Intergovernmental Relations at the Wisconsin Department of Administration.</li> <li>• Orientation to the University of Wisconsin Sea Grant Institute and the University of Wisconsin-Madison.</li> <li>• Introduction to project partners at the Wisconsin Emergency Management, Wisconsin State Cartographer’s Office, and the Robinson Map Library.</li> <li>• Tour the Lake Michigan and Lake Superior coasts of Wisconsin.</li> <li>• Attend the September meeting of the Wisconsin Coastal Management Council.</li> <li>• Review information on the statewide parcel mapping initiative, WisconsinView lidar inventory, Coastal Resiliency Project and Project of Special Merit.</li> </ul>	<p>Aug. 1, 2019 to Sept. 30, 2019</p>
<ul style="list-style-type: none"> <li>• Obj. 1A – research modeling options to assess culvert vulnerability measures.</li> </ul>	<p>Oct. 1, 2019 to Dec. 31, 2019</p>

<ul style="list-style-type: none"> <li>Obj. 1A - attend the fall meeting of the Wisconsin Land Information Association or Wisconsin chapter of Association of Floodplain, Stormwater and Coastal Management.</li> </ul>	
<ul style="list-style-type: none"> <li>Obj. 1A - preliminary modeling of culvert vulnerability measures and demonstration to COPs and coastal hazards work group.</li> <li>Obj. 1B - develop pilot for WCMP funded data inventory process.</li> <li>Obj. 1C – continue investigating hazard vulnerability models.</li> <li>Obj. 2A - attend Coastal GeoTools conference, begin research on NOAA geospatial resources.</li> </ul>	Jan. 1, 2020 to Mar. 31, 2020
<ul style="list-style-type: none"> <li>Obj. 1B – continue WCMP coastal data inventory for Lake Superior, develop archival process for data and reports with Robinson Map Library.</li> <li>Obj. 1C – continue investigating hazard vulnerability models.</li> </ul>	Apr. 1, 2020 to Jun 30, 2020
<ul style="list-style-type: none"> <li>Obj. 1B - continue WCMP coastal data inventory for Lake Michigan coast.</li> <li>Obj. 2B - with both COPs and coastal hazards work group members, discuss multi-hazard viewer.</li> </ul>	Jul. 1, 2020 to Sept. 30, 2020
<ul style="list-style-type: none"> <li>Obj. 2B - build first prototype for multi-hazard vulnerability viewer.</li> <li>Obj. 2A – Present at WAFSCM.</li> </ul>	Oct. 1, 2020 to Dec. 31, 2020
<ul style="list-style-type: none"> <li>Obj. 2B - complete prototype multi-hazard vulnerability viewer and demonstrate to PSM and Coastal Resiliency COPs, and incorporating tools and data into Sea Grant’s Coastal Atlas.</li> <li>Obj. 2C - present prototype viewer at the Wisconsin Land Information Association annual conference or Wisconsin Emergency Management Conference.</li> <li>Obj. 2C - present at the NOAA Social Coast Forum.</li> </ul>	Jan. 1, 2021 to Mar. 31, 2021
<ul style="list-style-type: none"> <li>Obj. 2C - complete multi-hazard vulnerability viewer and demonstrate at Wisconsin Coastal Management Council.</li> </ul>	Apr. 1, 2021 to Jun. 30, 2021
<ul style="list-style-type: none"> <li>Project wrap-up and evaluation.</li> </ul>	Jul. 1, 2021 to Jul. 31, 2021

Specific outcomes anticipated from this project include:

- Review of methods to assess vulnerability of culverts to flood damage. This is of interest to the local, tribal, state and federal road and asset managers.
- Review of methods to inventory, collect and archive WCMP funded data and reports. This will be of interest to the WCMP, NOAA Office of Coastal Management, Sea Grant’s Coastal Atlas and other state’s coastal management programs.
- Completion of a comprehensive inventory of WCMP funded data and studies with metadata made available through Robinson Map Libraries Geodata system. Electronic copies of significant works stored online. This will be of interest to WCMP, NOAA OCM, Sea Grant’s Coastal Atlas and coastal communities.
- Review and inventory of NOAA Digital Coast, CCAP and NWS capabilities and data resources relevant to Wisconsin and Great Lakes. This will be of interest to WCMP, WEM and other state coastal programs.

- Working prototype of multi-hazard vulnerability viewer. This will be of interest to WCMP, WEM, NOAA OCM, Sea Grant's Coastal Atlas local emergency and planning/zoning offices.

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**Project Description:**

Starting in early 2019, WCMP and project staff at UW State Cartographer's Office will begin working with local, tribal, state and federal GIS professionals in the Lake Superior Region to organize the coastal hazards mapping community of practice. Using culvert mapping as the COP case study, participants and project staff will inventory current culvert mapping projects, methods, field surveying techniques and data models. Using an adaptive management approach, the COP will try different techniques and data models developed by the various groups, and work towards a common model, and best practices for field data collection and distributed maintenance of the culvert database. With additional participants from other parts of the state and other Great Lakes states, it is hoped that the best practices can be extended to a wider area. If successful with a relatively simple data layer like culverts, the COP adaptive management model should be extendable to other issues and/or databases.

By the time the Fellow arrives in later summer 2019, the COP, CSE and culvert database should be well established and working together. In order to take the additional step of identifying culverts at risk from flooding, various vulnerability models may be applied to the culvert database. This will require some modeling skills (or interest) by the Fellow, either hydrologic or GIS watershed parametric models. Modeling assistance will be provided by engineering staff from WDNR, NRCS and UW Sea Grant.

To further development of the COP adaptive management model and cloud-based CSE technology, the Fellow with assistance from WCMP staff, Wisconsin Sea Grant, the GIO, SCO and the Robinson Map Library will investigate new ways to inventory and archive orphaned coastal data and integrate the resulting collections into new tools for technical assistance to communities. The Fellow in the second year of the fellowship will help develop a process to inventory and collect these resources, which may come from past WCMP grant funded projects, from the Coastal Hazards Work Group, or other sources geospatial information, such as NOAA itself. We'll look at NOAA Digital Coast with collections of elevation, bathymetric, land cover and other data sets.

Finally, the Fellow will use the CSE for a self-directed project using knowledge and data elements collected from the previous year, loosely based around a viewer for multi-hazard vulnerabilities. WCMP has funded projects to collect data and study hazards including storm surge inundation, riverine flooding, and bluff erosion. Combined with GIS data collected by WLIP for land ownership parcels, buildings and other infrastructure a multi-hazard vulnerability viewer (MHVV) can be constructed and demonstrated using the CSE cloud-based tools. Working with the COP participants in the Lake Superior and SE Wisconsin Coastal Resiliency Project, the MHVV can be demonstrated to coastal communities and other decision makers and form the basis for further development through WCMP and Wisconsin Emergency Management.

**Fellow Mentoring:**

The Coastal Management Fellow will be considered part of the Resource Policy Team within the Division of Intergovernmental Relations at the Wisconsin Department of Administration, and primarily housed with RPT staff. This will allow the Fellow the opportunity to learn about all aspects of coastal management as applied to the Great Lakes. The Fellow will be mentored by Jim Giglierano, WDOA geographic information officer at the Wisconsin Land Information Program (also part of RPT and 2018 PSM Co-PI), with assistance from WCMP staff Todd Breiby, Kate Angel (PSM PI), and Dr. David Hart, Assistant Director for Extension at Wisconsin Sea Grant.

The Fellow will participate in staff meetings and will be provided opportunities to participate in site visits, intra- and inter-agency meetings, regional events such as the Great Lakes Regional Meeting of Coastal Management Programs, meetings of the Wisconsin Coastal Management Council and the Coastal Hazards Workgroup. The Coastal Management Fellow will be expected to work closely with the WCMP and land information program staff.

The Fellow will also have access to the staff and facilities of the University of Wisconsin Sea Grant Institute on the University of Wisconsin-Madison campus. This includes office space with a computer that includes a wide variety of GIS software. This arrangement allows the Fellow all the resources of state government, in addition to the resources available on campus (technical expertise, lectures, libraries, computer software training, etc.). By assisting with the culvert inventory project, the Fellow will have regular contact with PSM project staff at the UW's State Cartographer's Office.

### **Project Partners:**

The project will require coordination with various state, regional, and local communities. In addition to working closely with the Wisconsin Coastal Management Program, the Wisconsin Land Information Program, the Wisconsin Geographic Information Officer, and the University of Wisconsin Sea Grant Institute, the Fellow and mentors will coordinate with the following agencies and organizations:

- Wisconsin Department of Natural Resources - hydrologic modeling, wetland and floodplain mapping, GIS data management
- Wisconsin Emergency Management - hazard mitigation and emergency response
- University of Wisconsin State Cartographer's Office, WisconsinView and Robinson Map Library - PSM prime contractor and state GIS data archives
- Wisconsin Land Information Association - main GIS professional organization in the state
- Northwest Wisconsin Regional Planning Commission - Lake Superior regional planners, HAZUS modeling of entire region
- Coastal county, municipal and tribal governments - GIS data stewards and culvert mappers participating in the PSM and Coastal Resiliency COPs
- USDA Natural Resources and Conservation Service - engineering models, GIS data for conservation and watershed planning

- US Geological Survey Water Science Center - hydrologic modelers and web mapping experts
- NOAA Digital Coast - coastal geospatial data archive, remote sensing program
- NOAA Coastal Change Analysis Program - coastal land cover analysis data
- NOAA National Water Model Program - real time water cycle model for US
- Wisconsin Coastal Hazards Working Group – chaired by WCMP, meets quarterly

### **Cost Share Description:**

The funding for cost sharing (\$7,500 per year for two years) will be provided by the Wisconsin Department of Administration, Wisconsin Land Information Program which has state funding allocated through the fellowship period.

### **Thematic Areas:**

This proposal addresses one element of strategic focus areas identified by the NOAA Office for Coastal Management for the 2019-21 coastal management fellowship program, including:

- *Resilient Coastal Communities: 1) Foster user-driven science and assessment efforts to enhance understanding of natural, social, and economic impacts of coastal hazards and climate change, and the approaches needed to adapt to and communicate about these threats, 2) Increase public awareness of coastal hazards and actions that can be taken to reduce the loss of life and property, 3) Build capacity to pursue strategies such as hazard preparedness, mitigation, and post-hazard redevelopment planning by providing an integrated suite of data, information, training, technical assistance, cooperative funding, and policy tools to coastal communities, 4) Identify and engage partners in maximizing the understanding, visualization, and application of risk-wise strategies.*

The project will develop flooding vulnerability measures through geospatial modeling of coastal watershed attributes. Results will be incorporated into the region wide culvert inventory allowing PSM project staff to discuss with local government road departments their infrastructure maintenance priorities and address identified issues.

The project will create the geospatial infrastructure needed to support a multi-hazard vulnerability viewer for coastal properties, infrastructure and natural features. The infrastructure will support the integration and management of geospatial data, studies and reports needed to identify and monitor issues that impact coastal areas long-term.

### **Relationship to the WCMP 309 Strategy (Benefits to Coastal Management)**

Through participation in the Project of Special Merit, the Fellowship program will assist the WCMP and its local stakeholders to identify the specific aspects of the Needs Assessment and Strategy 2016 to 2020 (Needs Assessment) that will be addressed through specific PSM activities.

The Needs Assessment includes a description of activities that will lead to the following two program changes:

1. **New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;**
2. **New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.**

The following priority needs, or gaps were identified in the Strategy document:

1. Research/Modeling/GIS – the strategy will address modeling needs by expanding GIS and mapping tools where they will be useful to local decision-makers (the Fellow will help identify and test culvert vulnerability assessment tools)
2. Decision-support tools – the strategy will support development and expansion of decision-support tools to help communities understand, evaluate, and explain coastal hazards (the Fellow’s data inventory project and multi-hazard viewer will support this need)
3. Training/Capacity Building – WCMP will work with its networked agencies and local communities to provide information on evaluating hazards (the Fellow will present project results at professional conferences and stakeholder meetings).
4. Communication and Outreach – WCMP will work with the Wisconsin Coastal Hazards Work Group to identify opportunities to promote best management practices, educate new landowners, and promote guidance and case studies for addressing coastal natural hazards (the Fellow will participate in the Work Group meetings and interact with members).

### **Relationship to NOAA Regional Coastal Resilience Grant Project in Southeastern Wisconsin**

The proposed Wisconsin Fellowship will also interact with WCMP’s NOAA Regional Coastal Resilience Grant project entitled “Improving Resilience and Economic Security in Coastal Wisconsin.” This project will provide resources and assistance to communities in Southeastern Wisconsin to plan and prepare for coastal hazards. To provide needed information on coastal hazards, the project team’s scientists and outreach specialists will evaluate and map shoreline recession rates in the region and develop educational resources on options to protect coastal assets. Using these resources, the project team will work with municipalities to assess their vulnerabilities to coastal hazards, prioritize potential actions to address coastal hazards, and begin to implement some of these actions with project funds. This effort will be organized as a “Community of Practice” with semi-annual meetings to connect local officials, scientists, and outreach specialists to learn about, share experiences with, and develop approaches to plan and prepare for coastal hazards.

This project will provide the Fellow with additional exposure to a different community of practice, on Lake Michigan in a more urban setting. The bluffs, beaches, and harbor infrastructure of Southeastern Wisconsin are vulnerable to coastal hazards including *erosion, coastal storms, & fluctuating water levels*. The data inventory (including available Digital Coast data) and multi-hazard viewer projects will have good applicability in this area, and give the Fellow opportunities to engage the resilience COP and perhaps provide some cross-fertilization of ideas between the two COPs.