Oregon Department of Transportation

Research Stage 1 Problem Statement

Number 26-24 – "Development of Eastern Oregon Flood Frequency Equations to Reduce Flooding Risk through Optimized Hydraulic Design"

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs to research.

Regional flood frequency equations are needed to plan, maintain, and protect critical infrastructure against flood risks across Oregon. Currently, these equations are utilized using the USGS StreamStats web tool. However, these equations were developed over 20 years ago, and only for western Oregon. A statewide update of regional flood frequency equations would use more data and modern statistical techniques to reduce uncertainty in regional flood frequency estimates and allow for statewide coverage. This update will allow ODOT to better assess and mitigate flood risks across the state, supporting more resilient infrastructure planning and informed maintenance decisions.

2. What **final product or information** needs to be produced to enable this research to be implemented?

This research will produce a USGS Scientific Investigations Report detailing the development of updated regional flood frequency equations. The report will cover the methodologies, data sources, and statistical techniques applied, ensuring transparency and replicability for future updates. Once finalized, the equations will be integrated into the USGS StreamStats web tool, allowing ODOT and other stakeholders to estimate flood frequency metrics—such as annual exceedance probabilities—for any National Hydrography Dataset (NHD) stream segment across Oregon.

To fully implement the updated equations and streamline their use within ODOT, it may be necessary to revise relevant policies, standards, and procedures related to infrastructure planning and risk assessment, particularly those that involve floodplain management and bridge or roadway design. Updated guidance could focus on incorporating the tool's outputs into design criteria and emergency response planning, enhancing ODOT's capacity for data-driven, statewide flood risk management

3. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.

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Adam Stonewall	Hydrologist	stonewal@usgs.gov	971-500-0739
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Matthew Segrin	Region 5 Hydraulic Engineer	matthew.segrin@odot.oregon.gov	541.786.3135

4. Decision making lenses

Please complete the following three sections. Your answers to these questions will be applied on a programmatic basis to support agency decisions. Answering yes to the questions below is not required.

Resolving a narrowly focused technical research problem may meet agency needs without answering yes to any of the following questions. The ODOT Research Section will seek a balanced portfolio some projects will answer yes to one of the three categories below (e.g. climate, equity, and/ or safety) and other projects in a different category.

We are looking for an overall program balance and no one project is expected to balance all categories. Generally, a research problem statement is expected to be able to answer yes with clear and verifiable information in only one of the three categories below, some projects may be able to answer yes in two or even three categories. Some projects (i.e. needs focused on specific elements of infrastructure design), may have no yes answers but may still be high value research need.

Climate

Oregon recognizes the climate crisis and makes systemic changes to reduce emissions caused by travel. Every mile driven in Oregon is powered by a clean source of fuel. We seek research that supports construction and maintenance operations are carbon neutral and investments in mobility that support travel by low and no emission modes. While every research project may not result in a reduction in emissions, transportation investments overall support emission reductions to achieve state goals. Oregon envisions a transportation system that is resilient in the face of seismic and climate events and impacts to the degradation of the natural environment are reduced. Our vision includes a transportation infrastructure is built in a way that avoids impacts on key habitat and results in better environmental conditions for wildlife and native vegetation. For definitions and details please review the equity vision, goals, and objectives of the ODOT Strategic Action Plan and Oregon Transportation Plan.

4f. Will addressing the **transportation issue** identified as a need in Question 1 develop, or validate methods for the estimation, measurement, or monitoring of transportation generated greenhouse gasses (GHG)?

☐Yes ☒No ☐Unsure

4g. If climate or GHG is not the focus of this **transportation issue** identified in this problem statement, will the research apply a GHG analysis to transportation infrastructure, planning, operations, maintenance, or materials?

☐Yes ☒No ☐Unsure

4h. Will the addressing the **transportation issue** include development or testing of construction practices, methods, or materials to establish potential reductions in greenhouse gas emissions?

☐Yes ☒No ☐Unsure

4i. Will the solving the **transportation issue** in question 1 study or support the reduction of vehicle miles traveled and single occupancy vehicle travel or support transition to electric vehicles (or other types of zero emission vehicles) or low-carbon alternative fuels?

☐Yes ☒No ☐Unsure

4j. Will the solving the **transportation issue** in question 1 lead to work that will support, measure, monitor, transportation system resilience in response to expected climate events, effects, or natural disasters in general?

☒Yes ☐No ☐Unsure

4k. Will the solving the **transportation issue** in question 1 lead to work that may result in better environmental conditions for wildlife and native vegetation?

☒Yes ☐No ☐Unsure

4l. If you answered yes to any of the climate questions above or can provide alternative details related to climate, please provide additional information:

The proposed research will provide more updated regional flood frequency estimations that have been lacking for central and eastern Oregon which will assist in design of resilient infrastructure that can better withstand anticipated climate change induced extreme precipitation, flooding, and high-water events. Correctly designed hydraulic infrastructure supports fish passage even under these anticipated future conditions.

Equity

Equity can have many dimensions and impacts relating to communities, and transportation. It is important that problem statement proposals clearly explain in what capacities are equity dimensions or impacts being examined within problem statements. It is a goal of the OTP to "Improve access to safe and affordable transportation for all, recognizing the unmet mobility needs of people who have been systemically excluded and underserved. Create an equitable and transparent engagement and communications decision-making structure that builds public trust". Proposed research may have the intent of studying elements of this goal or apply analysis to specific transportation topics to ensure the resulting research recommendations is consistent with our equity goals. For definitions and details please review the equity vision, goals, and objectives of the ODOT Strategic Action Plan and Oregon Transportation Plan.

4a Is the **transportation issue** identified as a need in Question 1 specifically focused on transportation equity?

☐Yes ☒No ☐Unsure

4b If the **transportation issue** is not focused on transportation equity, will the primary topic be assessed for equity benefits or impacts within the research project?

☐Yes ☐No ☒Unsure

4c Is the implementation of potential findings from this research likely to directly involve participation from an identified group that would benefit from an equitable process or outcome?

☐Yes ☐No ☒Unsure

4d Is the intended final product or information expected to support ODOT's equity efforts (Including but not limited to supporting one of the equity related objectives of the ODOT's Strategic Action Plan or Oregon Transportation Plan) ?

☒Yes ☐No ☐Unsure

4e If you answered yes to any of the equity questions above or can provide alternative details related to equity, please provide additional information:

*While Equity is not the main focus of the proposal, this proposal aligns with the Strategy Action Plan's Goal for **Climate Equity** to invest in the protection of marginalized communities from environmental*

hazards. Specifically, the expanded USGS tool for use in central and eastern Oregon will enable design of more resilient and reliable infrastructure and emergency planning (regarding high intensity flooding and flooding post-wildfire) for multiple high disparity communities including those along highways:

- *Kimberly-Long Creek*
- *Pendleton John-Day*
- *The Dalles*
- *Sherman*
- *Antelope*
- *Shaniko-Fossil*
- *Warm Springs*
- *Lake of the Woods*
- *Green Springs*
- *Klamath Falls*
- *Umatilla Mission*
- *Central Oregon*

Safety

Research outcomes may include interventions and countermeasures to prevent or reduce the frequency of crashes or other causes of transportation-related injury or death; or may include measures to reduce severity of injury (including prevention of death) after a crash or other injurious event. For definitions and details please review the equity vision, goals, and objectives of the ODOT Strategic Action Plan, Oregon Transportation Safety Action Plan and Oregon Transportation Plan.

4m. Will solving the **transportation issue** in question 1 support improving **safety culture** for either transportation workers or the traveling public?

☐Yes ☒No ☐Unsure

4n. Will the solving the **transportation issue** support improving safety through **healthy and livable communities**?

☒Yes ☐No ☐Unsure

4o. Will solving the **transportation issue** support improving safety through using **best available technologies**?

☒Yes ☐No ☐Unsure

4p. Will solving the **transportation issue** support improving safety through **communication and collaboration**?

☐Yes ☐No ☒Unsure

4q. Will the solving the **transportation issue** support improving safety through **investing strategically**?

☒Yes ☐No ☐Unsure

4r. If you answered yes to any of the safety questions above or can provide alternative details related to safety, please provide additional information:

Correctly designed hydraulic infrastructure that can withstand current and future flooding scenarios provides safety for the travelling public and ensures resilient public investment in safety. If successful, this research will improve hydraulic engineering design for the traditionally underserved geographic areas of central and eastern Oregon and thus improve safety for these rural and tribal partner communities. Correctly designed hydraulic infrastructure also helps ensure healthy and livable communities under the community value of environmental stewardship through viable fish passage design, investment of which can ensure aquatic biological diversity and continued longevity even under climatic stress.

5. Other comments:

The USGS has a long history of developing regional regression equations to estimate streamflow statistics, and publishing those findings in USGS Scientific Investigations Repots and the USGS web-based tool StreamStats[1]. Current western Oregon flood frequency regional regression equations were developed by Cooper (2005)[2], and are available to users with minimal training using StreamStats. USGS StreamStats web tool documentation and relevant links[3], and a recent example of a USGS peak flow report can be found online.

The USGS proposes using a combination of established methods and novel approaches to develop a statewide update to Oregon peak flow stream statistics, to implement those equations in StreamStats. Tasks associated with this study will include:

- Compile catalog of peak streamflow data from stream gauging stations across the State of Oregon and neighboring states.
- A quality check for all peak streamflow data.
- Compiling basin characteristics for all sites to be used in analysis.
- Evaluating datasets for trends or other forms of nonstationarity.
- Estimate peak flow statistics at all individual station.
- Machine-learning approach to develop hydrologic regions.
- Development of regional regression equations and associated uncertainties.
- Publication of USGS Scientific Investigations Report detailing methods and findings.
- Implementation of regional regression equations in USGS StreamStats web tool.

Citations:

1- https://www.usgs.gov/centers/new-england-water-science-center/news/streamstats-highlighting-a-25-year-web-tool-developed
2- https://pubs.usgs.gov/sir/2005/5116/
3- https://www.usgs.gov/streamstats
4- Magnitude, frequency, and trends of floods at gaged and ungaged sites in Washington, based on data through water year 2014

6. Corresponding Submitter's Contact Information:

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