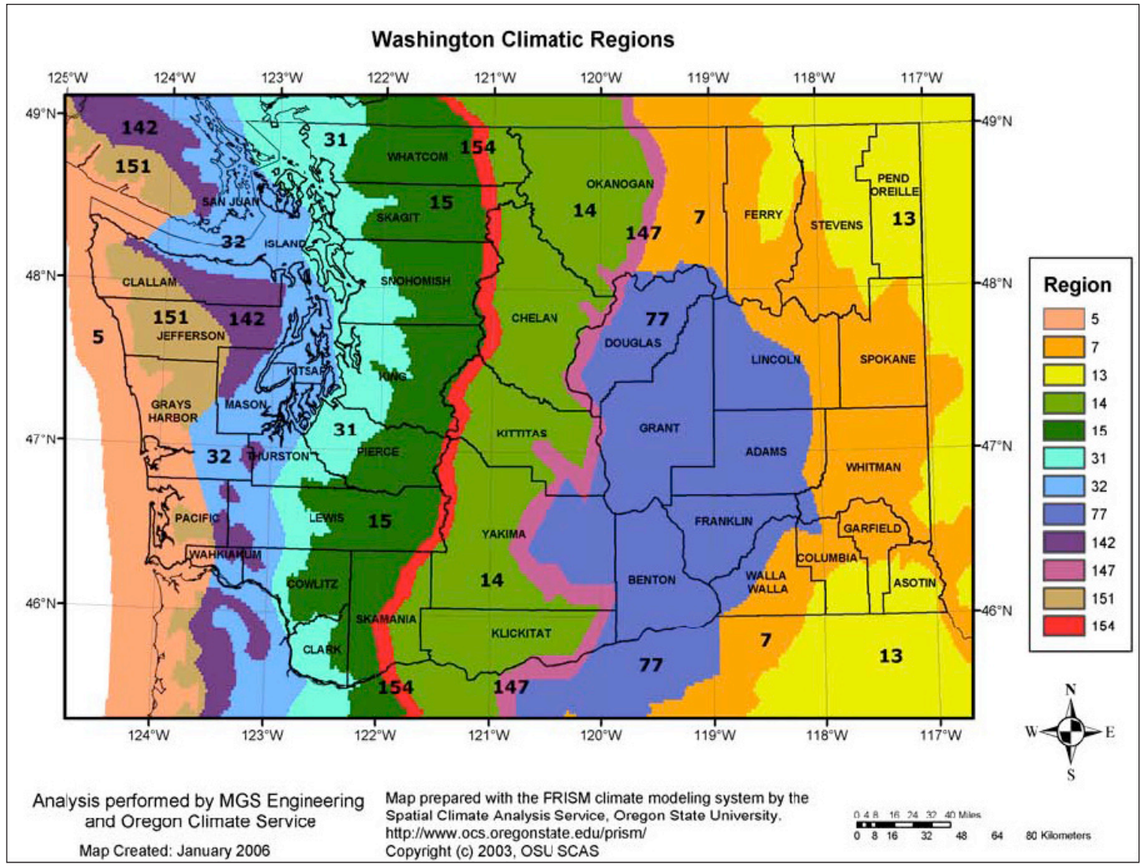

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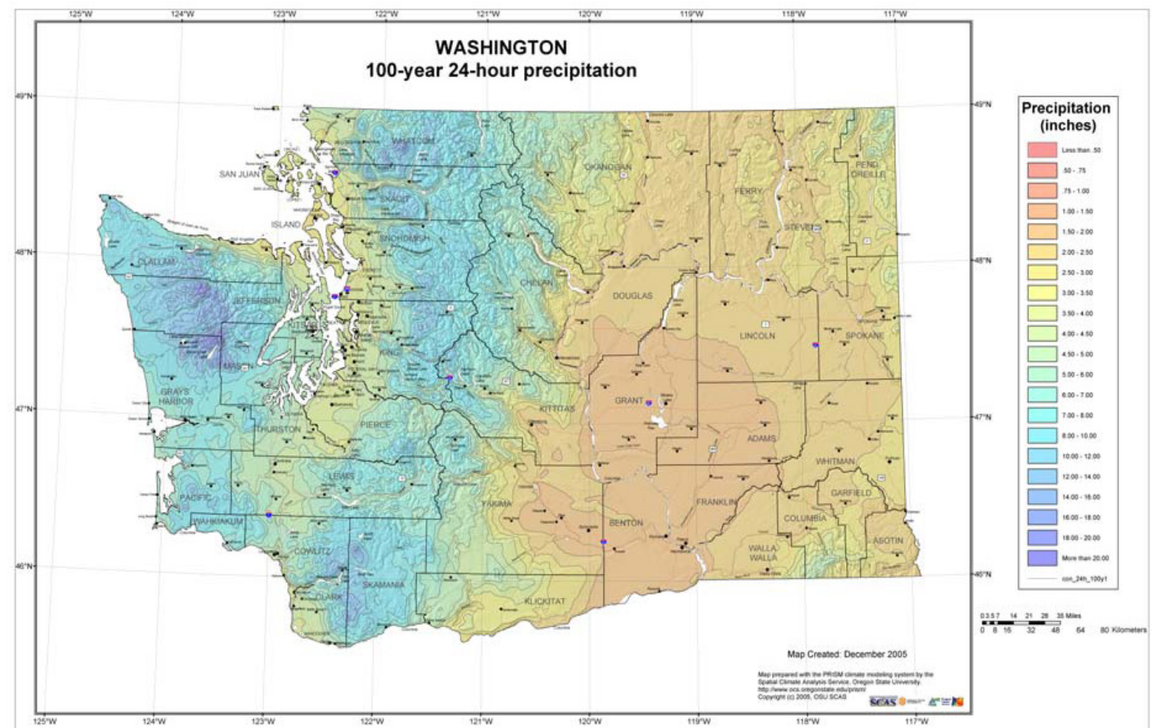
research notes

Regional Precipitation-Frequency Analysis and Spatial Mapping of Precipitation for 24-hour and 2-hour Durations in Eastern Washington

Background

Washington State has very diverse geography and climates. Understanding the history of rain and snowfall allows engineers to more accurately estimate floods for stormwater and hydrology design. This information allows for the design and construction of facilities to be more aligned with actual conditions rather than a "cookie cutter" approach. The completion of precipitation frequency mapping for the 2-hour and 24-hour durations across the state also helps the Washington State Department of Transportation (WSDOT) comply with the new stormwater requirements for Eastern Washington. A similar study was also conducted for Western Washington which produced precipitation frequency maps for guidance in developing stormwater facilities (*Regional Precipitation Frequency Analysis and Spatial Mapping of Precipitator for 24-hour and 2-hour Durations in Western Washington,* WA-RD 544.1, March 2002, by MG Schaefer, MGS Engineering Consultants, et al.).



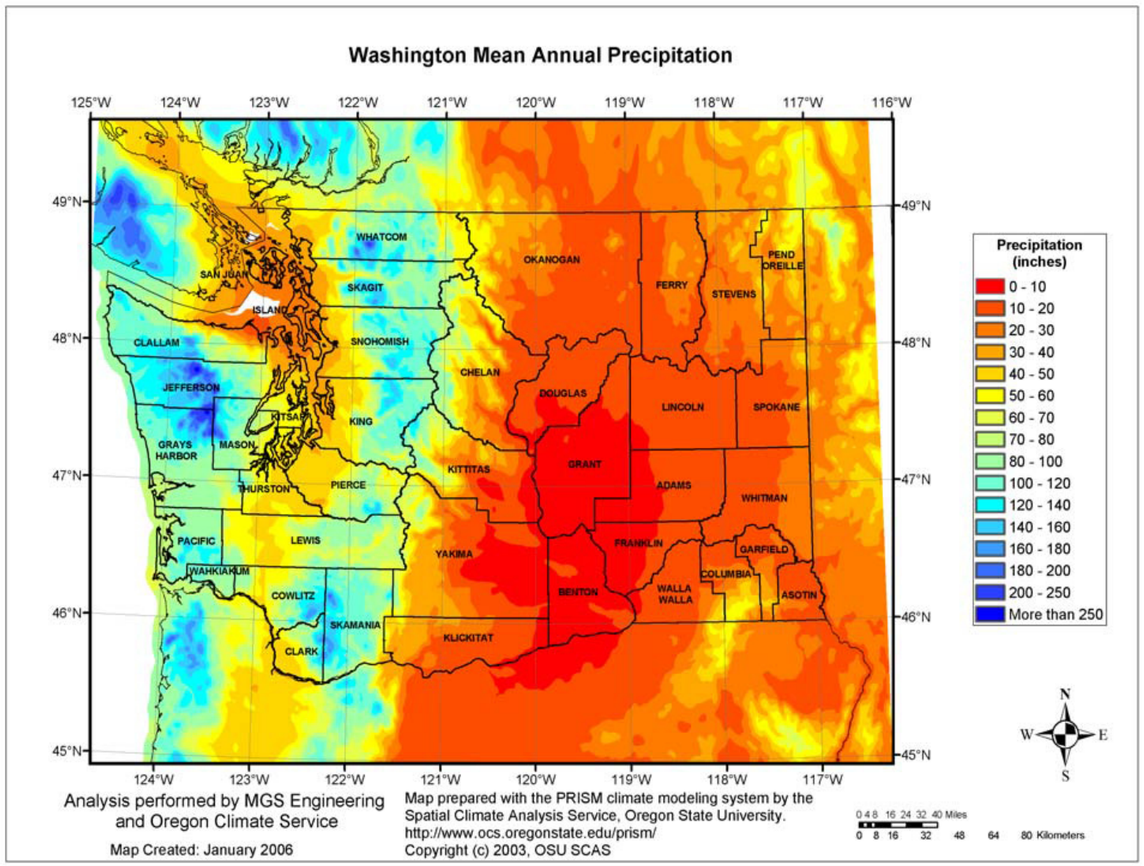
Years of recording precipitation frequencies provided the basis for a statistical frequency analysis displayed as an isopluvial map.

The Problem

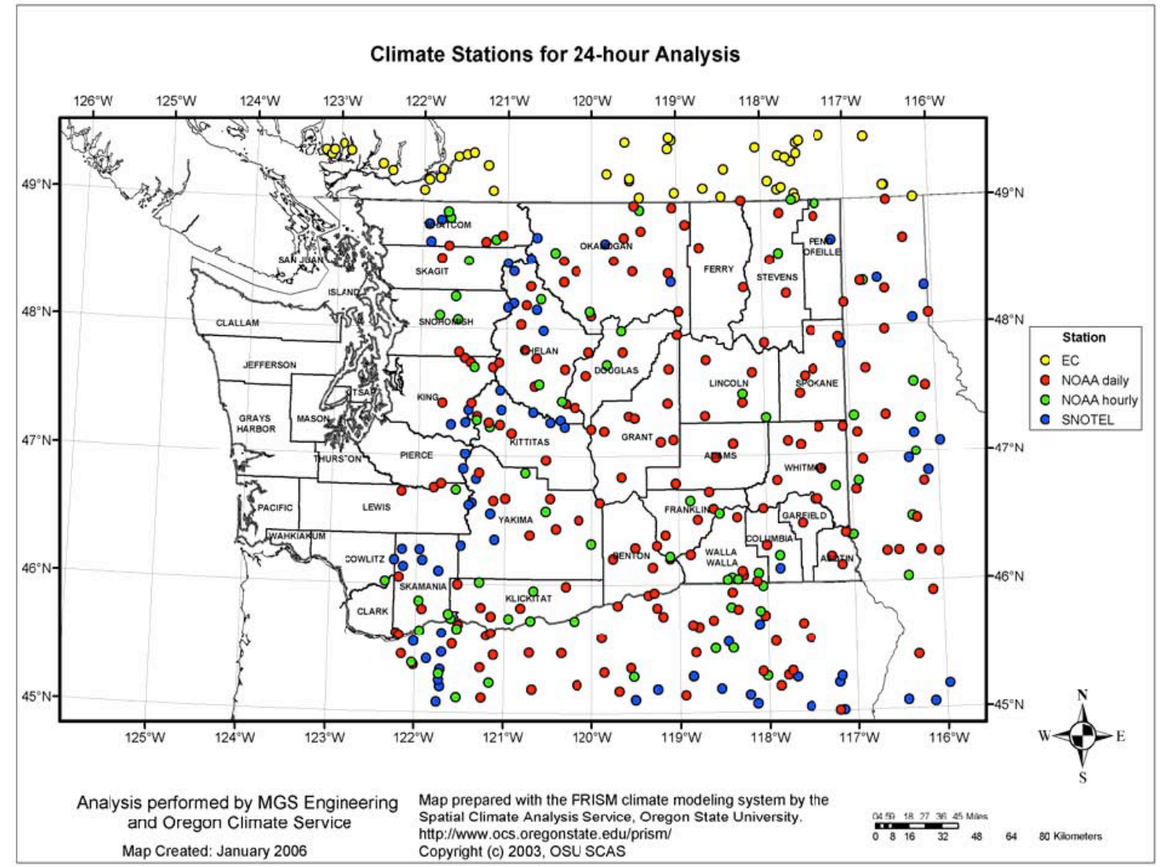
Current WSDOT stormwater design methods utilize precipitation information obtained from studies conducted in the 1960s. Since then, a larger number of data collection sites have been established and the effort to collect historical weather data has increased by the National Weather Service. In 2001, WSDOT commissioned a study by MGS Engineering Consultants, Inc., to analyze historical precipitation frequency for Western Washington. The result was so useful to stormwater facility designers, that a similar effort was undertaken for the eastern part of the state, which has substantially different geography and weather.

What We Did

The purpose of this research was to update and re-analyze precipitation records using modeling technology recently developed for making magnitude-frequency estimates of precipitation. A catalog of extreme storms was assembled that lists precipitation events in Eastern Washington that exceeded a 20-year return period. The information from the storm catalog was used to conduct seasonality analyses. The seasonality analyses were used to identify the frequency of occurrence of extreme storms by month. In particular, the seasonality analyses identified those months that were the most likely and least likely for an extreme event to occur. Color-shaded isopluvial maps were developed to reflect the findings of the study for Eastern Washington and the



updated mapping for Western Washington utilizing the new 1971-2000 base map of mean annual precipitation. This information is useful in rainfall-runoff modeling and can be used by WSDOT staff in conducting hydrologic analyses throughout Eastern Washington.

What We Gained

As this study for Eastern Washington was nearing completion, Oregon Climate Service released a high resolution update of the PRISM map of mean annual precipitation for Washington. This new map of mean annual precipitation was produced for the period from 1971-2000 and incorporated 10 additional years of SNOTEL data in mountain areas, an improved moisture trajectory inflow model, an improved digital terrain model, and higher resolution precipitation mapping. These improvements resulted in significant changes to previously mapped values of mean annual precipitation in some mountain and foothill areas. What we gained from this research is a much more accurate model for Eastern Washington precipitation that will greatly improve the design used to manage stormwater. The PRISM map of mean annual precipitation is the base map from which other spatial mapping is derived for the precipitation-frequency study. These changes necessitated that the spatial mapping that was previously completed for Western Washington be updated to reflect changes to the base map of mean annual precipitation.