FHWA-HEP-14-017

Considering Climate Change in the Portland-Milwaukie Light Rail Environmental Study

Summary

The regional government for the Portland metro area (Metro), and the Tri-county Metropolitan Transportation District of Oregon (TriMet) proposed to construct an extension of the regional light rail system to serve southern Portland, including a bridge across the Willamette River (see Figure 1). The Supplemental Draft EIS (SDEIS) was published in May 2010, and the Final EIS (FEIS) was published in October 2010. The Record of Decision (ROD) was published by the Federal Transit Administration (FTA) in November 2010.

There was stakeholder concern that the cumulative impact of the new bridge over the Willamette River and projected river level rise associated with global climate change on navigation were not addressed in the DEIS. TriMet, FTA, the United States Coast Guard (USCG) and their consultant, Parametrix, worked collaboratively to determine how this issue could be addressed in the FEIS. The best available science was used to develop a range of projected river level rise values for the Willamette River. River level rise projections were used to determine whether the planned height of the bridge over the Willamette River would provide the vertical clearance needed to meet navigational needs.

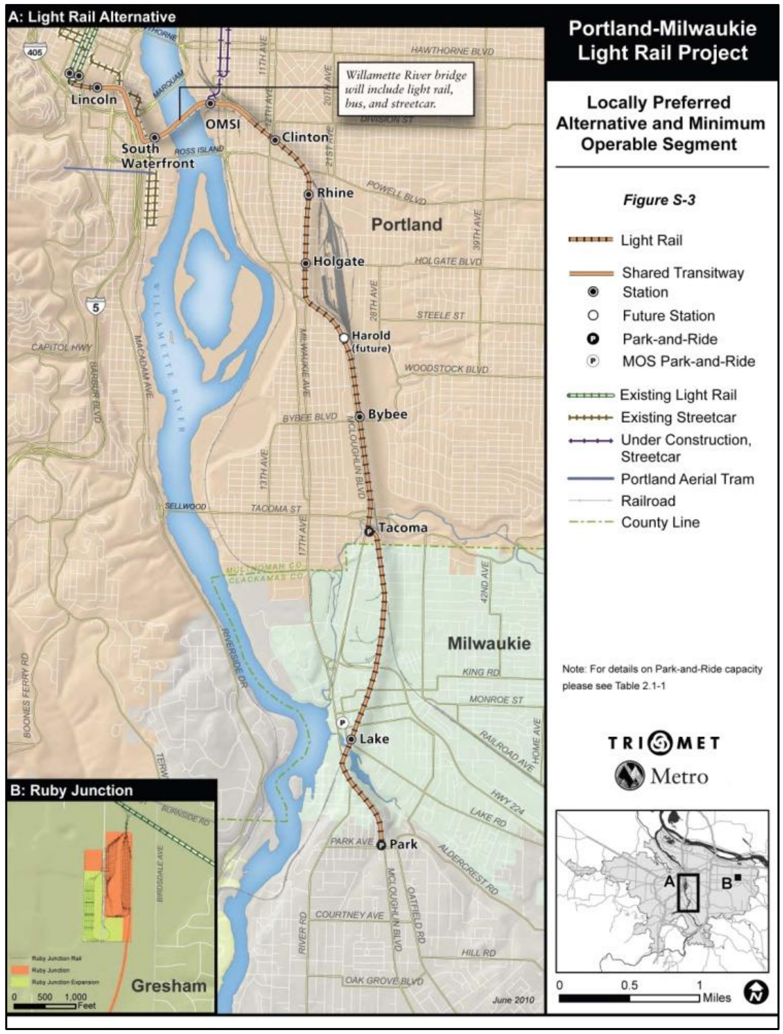

Figure 1: [Locally Preferred Alternative for the Portland-Milwaukie Light Rail Project]

Description of the Action

Metro, in cooperation with TriMet, proposed to construct and operate 7.3 miles of light rail transit and related facilities between downtown Portland, the City of Milwaukie, and north Clackamas County in Oregon (see Figure 2). This extension of the regional light rail system would serve the southern portion of the Portland metropolitan area, connecting urban centers in Multnomah and Clackamas counties. The FTA was the lead agency for the environmental study. The Portland District of the U.S. Army Corps of Engineers (USACE), the USCG, and the Federal Highway Administration (FHWA) were cooperating agencies.

Part of the proposal included the construction of a new multi-use, cable-stayed bridge for light rail across the Willamette River, between the Marquam (I-5) and Ross Island (Hwy 26) bridges. The bridge would accommodate light rail, streetcars, buses, pedestrians, and bicycles, and would be accessible to emergency vehicles. [10, Appendix O, p 1]

The Willamette River is approximately 1,400 feet wide and 45 feet deep. It flows into the Columbia River. The bridge is designed to provide a 77.52 feet vertical clearance for approximately 150 feet in the middle of the center span of the bridge. It would provide 694 feet horizontal clearance between piers. [10, Appendix O, p 26]

Figure 2: [Portland-Milwaukie Light Rail Map]

The NEPA Process and Adaptation to Climate Change

Metro does not typically address climate change in their environmental reviews. However, public comments on the DEIS expressed concern that the environmental study did not address the potential cumulative impact of river level rise associated with global climate change and the new bridge on navigation. Also, following the DEIS, FTA issued guidance suggesting that climate change be considered where bridges or other facilities could be affected due to sea level rise. [13]

Cumulative Impacts on Navigation

For the FEIS, the projected impacts of climate change on the levels of the Willamette River were considered to ensure that the new bridge across the river would be high enough to accommodate vessel passage for the life of the project. The project team used available data from global climate models (GCMs) to determine how water levels might change over the next 100 years (as GCM outputs were available 100 years out). This information was incorporated into TriMet's Navigational Results Report, a detailed assessment of current and future navigational needs, which is summarized in Appendix O "Navigation and Climate Change Summary" of the Final EIS. [8] Three climate-related variables were considered: the hydrology (i.e. flow rate) of the Willamette River, the stage of the Columbia River, and tidal elevation. In addition, the project team studied how the river is used for navigation and received input through extensive public involvement and collaboration with the USCG. [13] A summary of the analysis and how it was used in the environmental study is provided in this section.

A review of the best available science suggested that there are uncertainties inherent in GCM and underlying variables and how those variables intersect to change weather patterns, temperatures, and precipitation. [10, Appendix O, p 23] In the analysis, it is explained that GCMs are used to project the potential changes in the environment associated with climate change and that these projections have large variability and uncertainties. To account for uncertainties, conservative values, defined as: "…the value for a particular variable that (1) is within the predicted range of reasonable values as documented by best available science, and (2) result in a higher predicted river stage [i.e., values that will result in projected river stages at the high end of the expected range] at the project area," were used in the environmental study. [8, p 2]

For this project, there was data available at the regional level, but not specific data about projected changes in the stage of the Willamette River. It was noted in the navigational report that, "Numerous recent studies have evaluated the potential effects of global climate change on water resources in the Pacific Northwest; however, none of these studies specifically looks at river stages in the lower Willamette River or provide specific conclusions about the effects of global climate change on Columbia River stages." [8] Willamette River hydrology, Columbia River stages, and sea level changes were identified as the variables that could affect Willamette River stage. Because there were no known studies that address each of these variables together, the likely magnitude of change in each variable was evaluated individually. The potential combined effect of all three variables on the Willamette River stage was then estimated. The technical memorandum provides details about the methods used for both the analysis of individual variables and the combined estimate.

For Willamette River Hydrology, a relationship was made between available data and increases in stage. A regression equation was used to relate projected increases in flow to changes in stage. In the case of Columbia River stage, it was determined that there was not sufficient data to support a projection: "To date, the best available science does not allow predictions to be made about the potential effect of global climate change on Columbia River stages in Portland, Oregon. As a result, the potential future effect of the Columbia River backwater on river stages in the Willamette River cannot be estimated at this time, and may be positive or negative. Therefore, for the purposes of this analysis, the potential future effect of this variable was assumed to be zero." [8, p 4]

Available data about sea-level projections were scaled down to the local level following a method recommended by U.S. Army Corps of Engineers:

> In July of 2009, the U.S. Army Corps of Engineers (USACE) developed a guidance circular for all projects constructed in tidally influence areas (USACE 2009). The USACE developed a method to account for changes in Mean Sea Level (MSL) on a local level with the consideration of data from the National Research Council (NRC), the Climate Change Science Program (CCSP) and the IPCC. The USACE method incorporates the eustatic MSL trend of 1.7 mm/year (+- 0.5 mm/year, IPCC 2007a), the NRC's predictions for global MSL change, and data from the project site's closest tide station. Based on these values a local MSL prediction can be developed for the project site (Attachment A)." A relationship between projected sea level rise and Willamette River stage was made using current information available about how the tide affects the stage of the Willamette River. The analysis concluded that: "Using best available science, it is not possible to calculate the actual effect of sea level rise on stages in the Willamette River because the probability that maximum tidal elevations would occur during flooding events is unknown. Because of this uncertainty, it was conservatively assumed that sea level rise would likely have an affect on river stage, but that the effect would be within the range of what is currently observed when river stages are high. [8, p 5]

Based on the available data on the potential changes in the hydrology of the Willamette River due to climate change over the next 100 years, and the relationships that were made in this analysis, the following conclusions were reported in the FEIS:

> During winter months (generally November to April):
>
> - The potential increase in Willamette River water level may range from 1.8 to 2.5 feet;
> - The effects of increased sea level may affect the Willamette River by 0.1 to 1.0 foot, with less increase at higher river stages, such as when flooding is expected to occur; and
> - The potential effect of change in the Columbia River elevation could not be quantified.
>
> Based on the data, a conservative estimate of increase in the Willamette River level due to global climate change is 3.9 feet by 2099. The frequency of these increased water levels is not predictable. It is likely that summer flow would be lower than currently measured. [10, Appendix O, p 22-23]

The result of the analysis of how climate change could affect the Willamette River stage in the future was used in the determination of the needed vertical clearance of the project for navigational purposes. The required vertical clearance was determined through extensive public and agency involvement and analysis of existing traffic on the Willamette River. TriMet also conducted an analysis of the potential change in vessel passage rates using the higher river levels that could result because of climate change. The analysis found that passage rates would remain very similar to those predicted without climate change factored in. [10, Appendix O, p 22-23] The project team concluded that the current design would also accommodate climate change-induced water level rise in the Willamette River. A 77.52 foot vertical clearance for approximately 150 feet would allow for the passage of nearly 99 percent of the anticipated bridge traffic. Any restrictions in passage would be primarily in the winter, during high water events, and could be minimized or reduced through existing river management systems, including dams and control devices on the Columbia River and Willamette River.

In Chapter 3, Environmental Analysis and Consequences, the conclusions of the analysis are summarized within the discussion of economic impacts:

> With some exceptions, the current and likely future navigation activities would not be affected by the bridge height (77.52 feet). There is some potential that a combination of high river levels (particularly during flood events), coupled with the long-term effects of climate change, could temporarily restrict passage of the highest vessels north of the Willamette River bridge. These events are expected to occur within a narrow time window each year, mostly in winter. Given the limited activities that would be affected, the economic impacts are expected to remain minor and temporary. Individual private boat owners may be affected, but typically their maximum heights are lower than the industrial river users. Two river cruise excursion operations also could have limited periods when their passage would be restricted. [10, p 3-44]

Biological Opinion

The National Marine Fisheries Service (NMFS) discussed the potential impacts of climate change on protected species and their critical habitat in the Biological Opinion (BO) (Appendix Q of the FEIS). Relying mostly on data from the Independent Scientific Advisory Board and the Unites States Global Change Research Program, NMFS noted that climate change will play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. [10, Appendix Q, p 20 and 24]

While climate change was considered in the context of background information of the changing environmental conditions that protected species and their critical habitat face, NMFS concluded in the BO that the proposed action is not likely to jeopardize the continued existence of endangered species or result in destruction or adverse modification of their habitat. No particular adaptation or mitigation measures regarding climate change were provided.

Lessons Learned

The Willamette River is an extremely complex, highly managed river system. River stages at the proposed bridge site are influenced by sea level, Willamette River hydrology and Columbia River hydrology; which can all be altered due to global climate change. In addition, the ability of the reservoirs and river regulation to dampen or exacerbate the potential effects of global climate change are beyond the ability of any model to predict; particularly at the site scale. While there was an initial expectation that predictions made by GCMs would translate into concrete answers about how the river system would respond to climate change, it was determined that any analysis of potential impacts is reliant on local research and best professional judgment of a very complex issue. For this reason, the project team used the best available science to characterize the range of potential responses to changes in climate. The project team found that considering the effects of climate change in addition to other types of potential effects due to the project required a very collaborative, cross-disciplinary approach. [13]

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