



Executive Summary

Peninsula Drainage District #1 and Peninsula Drainage District #2 US Army Corps of Engineers Authorized Design Surface Water Elevations Report

March 3, 2015

Purpose

Multnomah County Drainage District (MCDD), the agency responsible for managing the Columbia Corridor levee system, received notification that in August of 2013 the United States Army Corps of Engineers' (USACE) certification of the levees in Peninsula Drainage District #1 (PEN 1) and Peninsula Drainage District #2 (PEN 2) would expire. This finding was based on a USACE review of the levees that found insufficient evidence documenting whether the levees were adequate to protect against the 1-percent-annual-chance event on the Columbia River. Loss of this certification by USACE could result in the loss of accreditation with the Federal Emergency Management Agency (FEMA) which means that residents, businesses, and property owners could have an elevated risk of flooding, while also being mandated to purchase flood insurance and comply with floodplain development standards.

In response, more than twenty jurisdictions and other regional partners have come together through a Governor-designated Oregon Solutions process convened by Portland Mayor Charlie Hales and Multnomah County Commissioner Jules Bailey. The Oregon Solutions Project Team is working to ensure that the Columbia Corridor levee system meets federal standards and reduces the risk of damage to lives and property that can result from flooding. The first step in that process was to deliver a collaboratively-sponsored evaluation of the current condition of the levee systems in PEN 1 and PEN 2.

The first evaluation resulted in the Levee Engineering Assessments that were released in October 2014. The Levee Engineering Assessments analyzed how the levees performed against requirements set forth by Title 44 Code of Federal Regulations Section 65.10. Compliance with Title 44 is required by FEMA for levee certification. These analyses only evaluated the levees' performance against a 1-percent-annual-chance event, commonly referred to as a 100-year flood. Following the Levee Engineering Assessments, the Oregon Solutions Technical Advisory Committee recognized the need to do additional modeling to analyze the systems when measured against their original design standards, further explained below. The Technical Advisory Committee also requested modeling to determine at what water height the levees would fail structurally, referred to as the maximum level of protection.

USACE Water Surface Elevations

When USACE designed and constructed the PEN 1 and PEN 2 levee systems, they determined a water surface elevation (the height or depth of the river) for which the systems would be constructed to withstand. The 1936 Flood Control Act authorized both the PEN 1 and PEN 2 systems to withstand an event equivalent to the 1876 flood. Water surface elevations associated with that event were adopted as the design water surface elevations (DWSE) and are approximately 2.5-3 feet above the 1-percent-annual-chance event. The DWSE corresponds to a flood event slightly smaller than the 0.2-percent-annual-chance or 500-year event. The analyses also considered

freeboard (extra height to account for waves and turbulence during a flood) based on USACE design documents. The PEN 1 system has a regulated freeboard of 2 feet above the DWSE while the PEN 2 system has a regulated freeboard of 3 feet.

Summary of Findings

The current phase of studies features the evaluation of the PEN 1 and PEN 2 levees under the USACE Authorized DWSE levels, followed by preparation of summary reports. The USACE Authorized DWSE Reports document the current conditions of each levee system against their authorized constructed design, the 1876 flood. The reports also determine the maximum level of protection provided by the current systems. Engineering firms were contracted in 2013 to conduct a variety of tasks including field work, laboratory tests, and analytic modeling to compare the existing levee systems to federal standards and identify any areas of concern within each system. The USACE Authorized DWSE Reports use this data to evaluate the systems.

Based on the USACE Authorized DWSE Reports, the levee systems in PEN 1 and PEN 2 were found to meet the USACE authorized DWSE in all but four areas:

PEN 1 Cross-Levee: Interstate 5 and North Marine Drive

- As identified in the Levee Engineering Assessments for PEN 1 and PEN 2, there are two sections within the vicinity of the interchange that are not high enough to prevent flood waters from entering PEN 1 or PEN 2.

Southeast Corner of PEN 1: Columbia Slough Levee

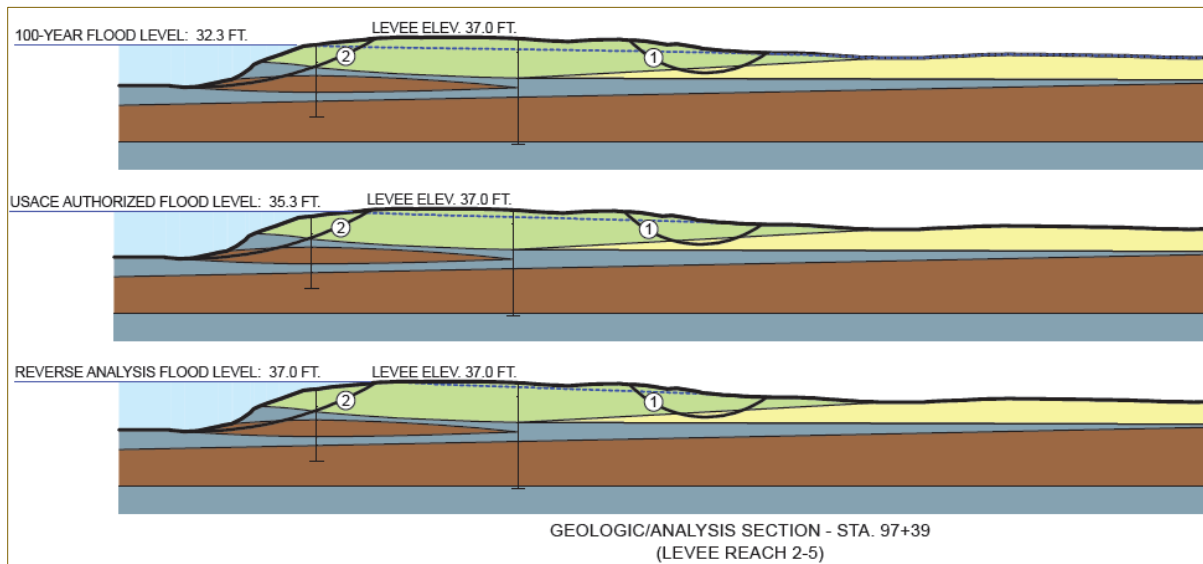
- This reach has a calculated Factor of Safety (FS) of 1.3, slightly below the USACE's minimum FS of 1.4. Thus, the structural capacity of the levee does not meet USACE standards.
- This risk will need to be communicated to property owners and this area is to be identified in PEN 1's operations and maintenance manual and emergency response plan as a "watch area" during flood events.
- This area was not identified as an area of concern in the PEN 1 Levee Engineering Assessment, and no structural fixes to the systems will be necessary to remediate this deficiency.

PEN 2 Cross-Levee: Peninsula Drainage Canal

- As identified in the PEN 2 Levee Engineering Assessment, this area of the system continued to be found structurally deficient under the additional modeling conditions.

PEN 2 North: Columbia River Levee

- There are reaches of levee along the Columbia River that have insufficient freeboard to meet the USACE authorized design standard.
- This risk will need to be communicated to property owners and this area is to be identified in PEN 2's operations and maintenance manual and emergency response plan as a "watch area" during flood events.
- This area was not identified as an area of concern in the PEN 2 Levee Engineering Assessment, and no structural fixes to the systems will be necessary to remediate this deficiency.

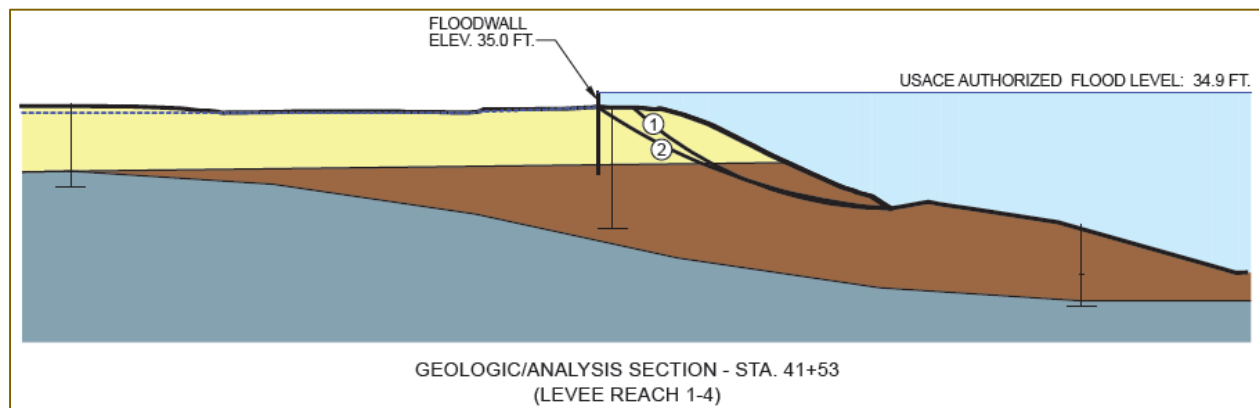


Seepage and stability modeling at multiple water elevations – Northeast end of PEN 2 along Marine Drive

Comments on PEN 1 Engineering Analyses

The railroad embankment, identified as problematic in the PEN 1 Levee Engineering Assessment, and which makes up the western edge of the system, was not considered in this analysis as its USACE authorized DWSE (the 1-percent-annual-chance event) had already been evaluated during the prior Levee Engineering Assessment.

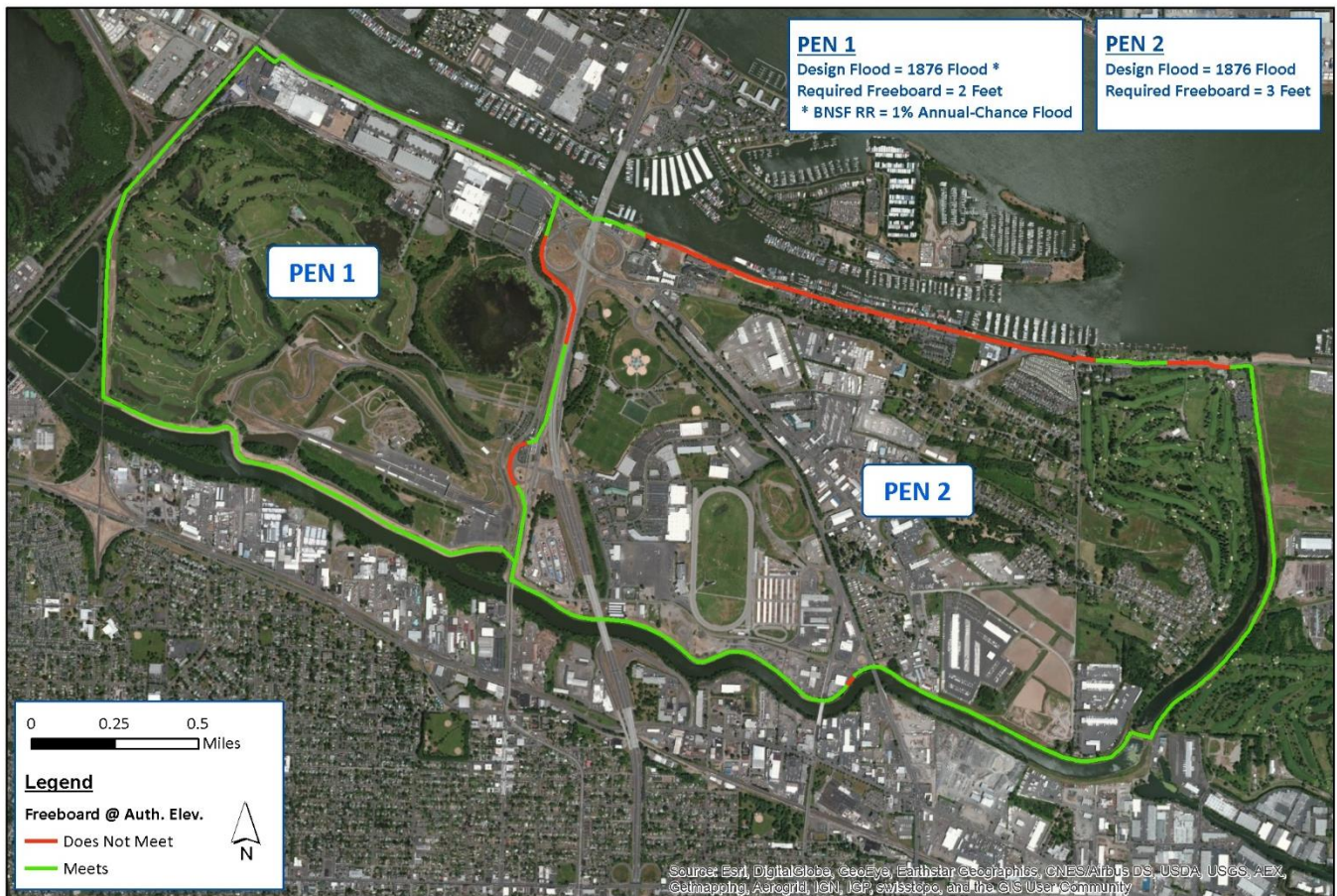
The structural analysis also found that the PEN 1 floodwall along the north edge of the district met USACE stability standards when loaded to the USACE authorized DWSE. The structural analysis demonstrated that the majority of reaches were sufficiently stable even when the water elevation exceeded the USACE authorized DWSE.



North Marine Drive Floodwall modeled for seepage and stability against the USACE authorized DWSE in PEN 1

Conclusions

Both systems continue to have targeted areas with deficiencies, however, the majority of the systems perform well even as water elevations near the 0.2-percent-annual-chance event. This information will be useful when determining the appropriate level of protection for the system, evaluating structural encroachments, and for planning for improvements needed to address the deficiencies. It will also be useful when applying to FEMA for accreditation, as it will demonstrate that the systems protect to a higher standard than the 1-percent-annual-chance event.



USACE Authorized Design Water Surface Elevation Freeboard Analysis Map for PEN 1 and PEN 2

Study Limitations

- Neither climate change nor potential Columbia River Treaty scenarios were evaluated.
- The model does not include a seismic assessment of the levees.
- The assessment does not assign costs to address the areas found to be deficient because costs are dependent on the strategies selected through the Oregon Solutions process.

Next Steps

USACE Authorized DWSE Reports will provide the Oregon Solutions Project Team with a structural understanding of the threshold of the PEN 1 and PEN 2 levee systems. Oregon Solutions will use the findings, along with the Levee Engineering Assessments findings, as a starting point to determine the community's flood risk tolerance, begin the discussion regarding setting a level of protection for the system, and identifying flood risk reduction strategies. The assessment does not identify strategies for improving levee performance or reducing flood risk, nor does it estimate the costs to address the areas of concern. Oregon Solutions will work to engage all communities with current or historical ties to the levee system in a collaborative discussion about how to address the technical and community based implications of levee maintenance and improvements.

For more information, visit Oregon Solutions at <http://orsolutions.org/osproject/MCDD> or contact Steve Greenwood at sgreenw@pdx.edu, or (503) 725-9092.