Technical Memorandum #20

700 Washington Street
Suite 401
Vancouver, WA 98660
Phone (360) 737-9613
Fax (360) 737-9651

To:	Robin Krause, PE
From:	Tim Kraft, PE; Scott Ferré, EIT
Copies:	File
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Subject:	Large Waterbody Exemption: Vancouver Lake/Lake River
Project No.:	14505

Introduction

This memo describes the hydrology and hydraulics of Vancouver Lake and Lake River for use in the listing of these waterbodies on the Washington Department of Ecology's Flow Control Exempt Waterbody List found in Volume I, Appendix E of Ecology's 2005 Stormwater Management Manual for Western Washington. Waterbodies included on the Flow Control Exempt List are shown to remain stable and not incur greater than natural erosion due to increased flows resulting from development. These waterbodies are typically large, tidally influenced, and function so that flow additions from new development draining directly to the waterbodies are insignificant compared to the natural flow of the waterbody.

Vancouver Lake

Vancouver Lake is located in Clark County, Washington on the Columbia River west of Vancouver, Washington. The lake is tidally influenced and has a surface area of approximately 2600 acres and an average depth of three-feet (US Army Corps of Engineers [USACE] 2). Vancouver Lake receives flows from direct runoff, groundwater, and Burnt Bridge Creek. Vancouver Lake is connected to the Columbia River naturally by Lake River and by a manmade flushing channel. During periods of flood tide the lake receives flows from Lake River and during ebb tides the lake drains through Lake River. The average annual flow which during flood tide flows into Vancouver Lake and during ebb tide flows out of Vancouver Lake is estimated to be 300 cubic feet per second (WSU). This results in a small net flow out of Vancouver Lake.

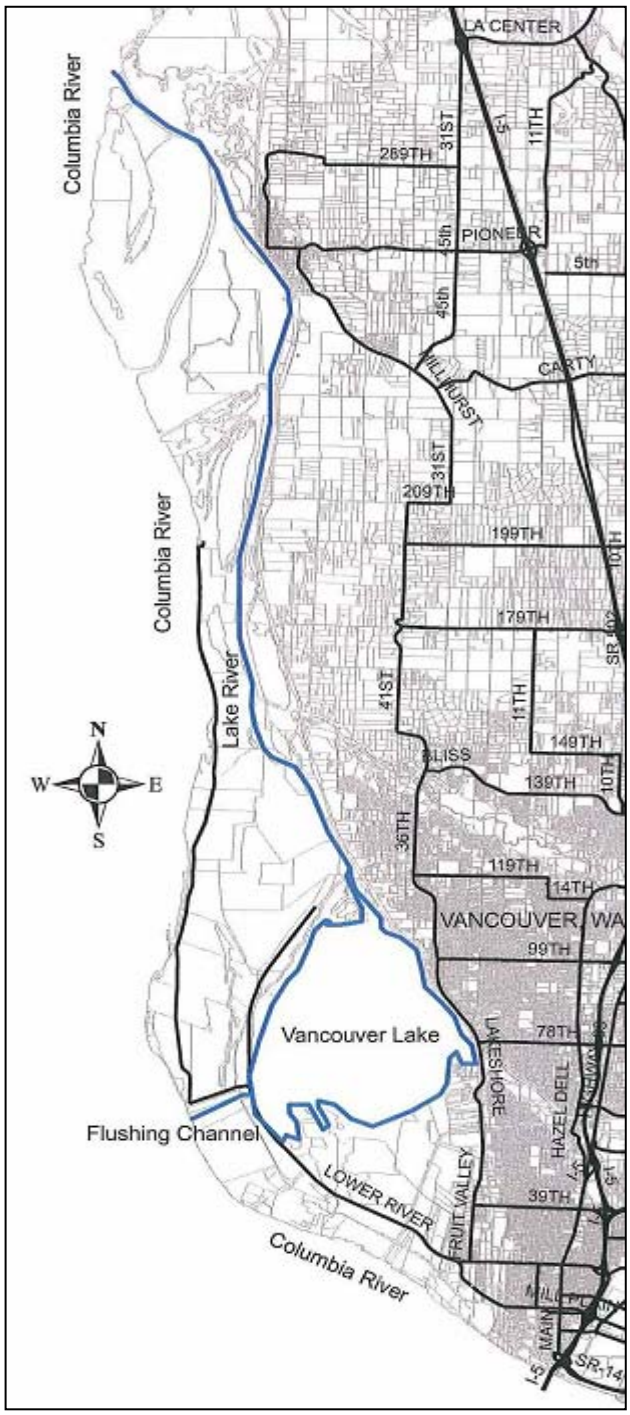
The manmade flushing channel was constructed in the late 1970s with a tide gate to help flush the lake with Columbia River water. The tide gate prevents the lake from draining to the Columbia River through the flushing channel when the river level drops below the Lake level. Vancouver Lake was dredged shortly after the flushing channel was constructed however, dredging has not been done since.

Currently the lake is estimated to take one and a half months to turn over its entire volume

(USACE2). Figure 1 is a vicinity map of Vancouver Lake and Lake River.

Lake River

Lake River is approximately eleven miles long between Vancouver Lake and where it joins the Columbia River near Ridgefield, Washington. Lake River receives flows from direct runoff, Salmon Creek, Whipple Creek, Flume Creek, and during ebb tide, Vancouver Lake. Lake River is tidally influenced, has a low-gradient, and its flow direction is controlled by tidal fluctuations and the stage of the Columbia River.



Impacts from Future Development

Developable Land

Many of the areas that would have naturally drained directly to Vancouver Lake and Lake River are separated from these waterbodies by a railroad embankment with limited or no culvert crossings. Most of the area on the other side of the railroad that currently drains directly to Lake River and Vancouver Lake consist of steep hillsides that are likely un-developable with limited access to get a pipe directly to Lake River. For these reasons very few developments will be able to drain directly to Vancouver Lake or Lake River. This small area of developable land would not generate significant amounts of runoff.

Impacts to Stability

Vancouver Lake is primarily silted in and is continuing to fill with sediment. Increased development since the mid 1940s has resulted in decreased water quality and an increase of sediment depositing into the lake through Burnt Bridge Creek and Lake River. Sources of sediment to Vancouver Lake include Burnt Bridge

Creek, Lake River during flood tide, **Figure 1: Vicinity Map**
and existing local development around the lake. Development that resulted in increased runoff to, and the erosion of, Burnt Bridge, Salmon, and Whipple Creeks as well as a former gravel quarry on Salmon Creek have resulted in great amounts of sediment being introduced into Lake River (WSU). Historic floods have also resulted in the Columbia River depositing sediment in Vancouver Lake and Lake River.

Tidal fluctuations, the low gradient, and Columbia River stage all affect flow in Lake River and result in low velocity, sluggish flows that allow sediment to settle in Lake River and to be drawn into Vancouver Lake. This is indicated by excessive sedimentation that has been observed along the entire reach of Lake River (US Environmental Protection Agency [EPA]) and gravel deposits from the former gravel quarry in Salmon Creek that have been found along the northern shoreline of Vancouver Lake (WSU).

Stormwater flow velocities at outfalls into Lake River and Vancouver Lake from future development along the shoreline would be quickly dissipated and attenuated by the sluggish receiving water and result in very little, if any, increased erosion in these waterbodies. These waterbodies have similar characteristics as other waterbodies currently listed by Ecology as being flow control exempt including tidal influence, insignificant flow contributions from future development, and low velocities that contribute little to no erosion.

Conclusion

Vancouver Lake and Lake River are hydraulically controlled by the Columbia River's stage and tidal fluctuations. Low flow velocities are evident by the large amounts of sediment observed in Lake River and Vancouver Lake. There is a limited area with potential for future development that can drain directly to Vancouver Lake and Lake River and runoff from these areas would be insignificant compared to existing flows into the system. Flow velocities resulting from future outfalls into Vancouver Lake and Lake River would be quickly attenuated by the sluggish receiving water and would not increase erosion. These characteristics are similar to the characteristics of other waterbodies listed by Ecology as being flow control exempt.

References

US Army Corps of Engineers (USACE). Review of Biological Research on Juvenile and Adult Salmonid use of Vancouver Lake. Portland, OR: USACE, Nov. 2007.

US Environmental Protection Agency (EPA). *Environmental Impact Statement for Vancouver Lake Reclamation Study of Port of Vancouver.* Clark County, WA: EPA, 1978.

Washington State University, Engineering Extension Service, College of Engineering (WSU). *A Summary Report on Water Quantity and Quality Studies of Vancouver Lake, Washington.* Pullman, WA: WSU, Jul. 1971.
-Note: the available copy of this report does not contain page numbers, therefore the parenthetical reference is listed as (WSU).

Wierenga, Ron – Clark County Public Works Water Resources Program. "Vancouver Lake and Lake River Watersheds: Salmon Creek and Lakeshore." Presentation. Vancouver Lake Watershed Partnership, 16 Mar 2005.