FIELD RECONNAISANCE, GPS SURVEY AND DISCHARGE SIMULATIONS OF PUGET COVE PONDS NEAR YAKUTAT, ALASKA

PREPARED FOR THE YAKUTAT REGIONAL AQUACULTURE ASSOCIATION BY ALASKA HYDROSCIENCE, OCTOBER 2015.

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1 INTRODUCTION

In March of 2015 I provided a preliminary hydrologic assessment of the Puget Cove ponds near Yakutat. The objective of the assessment was to examine the feasibility of using runoff from the ponds and associated watershed area for a proposed salmon hatchery. The initial assessment suggested the site was a marginal water source for the proposed hatchery due to the small watershed area. In order to provide an adequate source of continuous discharge the pond complex would likely need to be operated as a reservoir, relying on pond storage during dry or cold periods. Furthermore it would require adequate capacity to store water during periods when runoff would be in excess of hatchery requirements. Preliminary estimates suggested that the ponds would provide insufficient discharge to provide the desired 800 gallon per minute (gpm) discharge for a full scale hatchery operation and would likely be unable to provide a continuous discharge of even 200 gpm for many days during most years. I conducted additional hydrologic reconnaissance survey of the region from April 21-23, 2015 in order to improve estimates of the watershed area, map portions of the pond drainage network, map key features of surface water hydrology, and to evaluate the potential for reservoir development.

2 SETTING

The ponds at the study site were formed at the terminus of the Hubbard/Yakutat Bay Glacier as it retreated about 900 year ago (Trabant and others, 2003). They represent two of the larger ponds on the peninsula of land extending north between Puget Cove and Sawmill Cove to the northeast of Yakutat (Figure 1). This type of kame and kettle topography (Bates and Jackson, 1980) is widely distributed in a southwest to northeast direction along the southeast margin of Yakutat Bay. Topographic maps of the area indicate a head differential of about 50 feet from the pond surfaces to sea level.

The landscape within the surveyed area has been modified through logging and road building activities. Stream channels appear constrained by road beds and in some locations flow adjacent to raised road beds. It appears likely that natural drainage patterns within the watershed may have been modified by road construction. Much of the terrain within the Puget Cove ponds drainage area was exceedingly difficult to traverse. Despite optimum weather conditions and complete lack of snow cover, extremely dense vegetation growth coupled with numerous kettle and beaver ponds limited my ability to provide detailed maps of the entire drainage network in the time allocated.

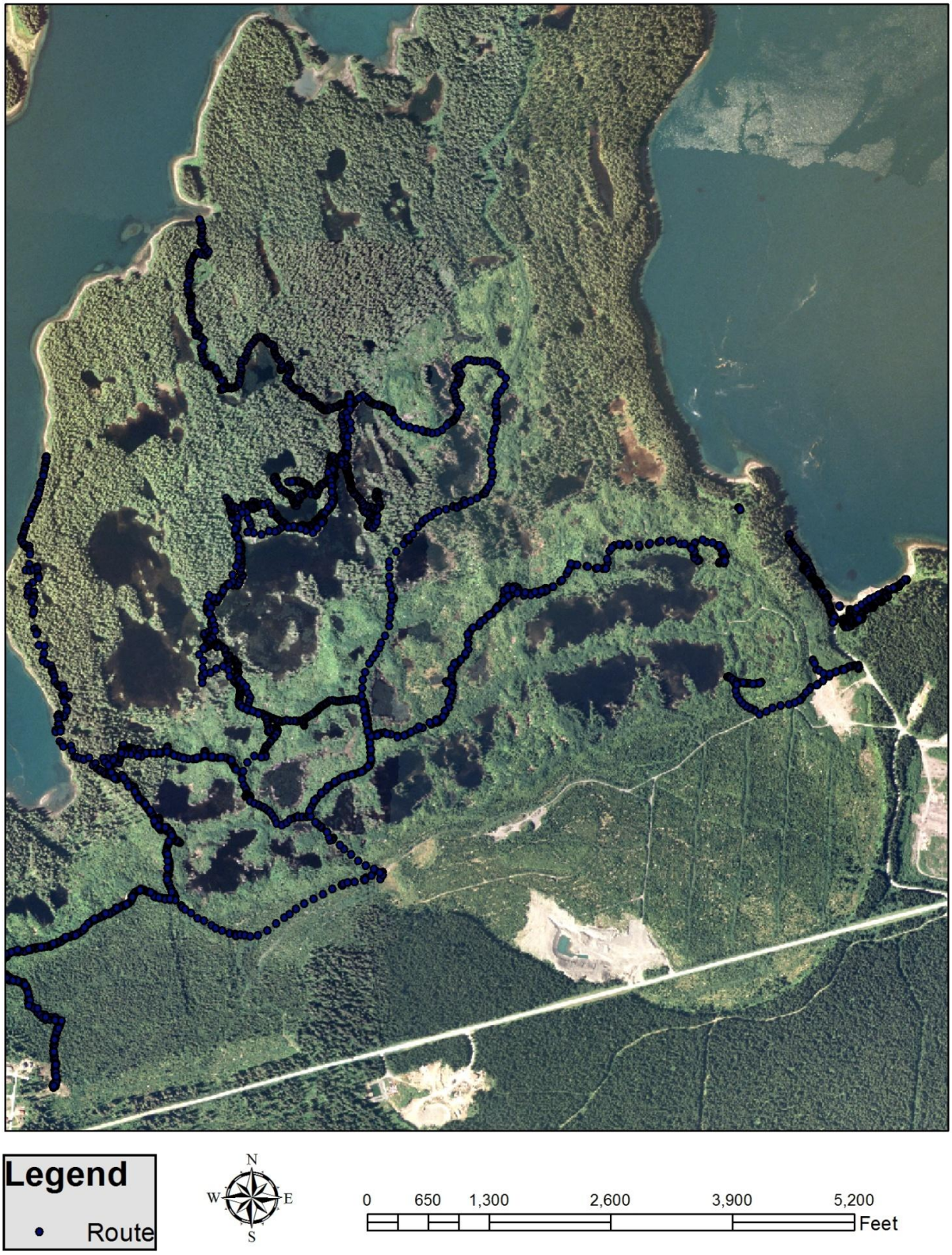

Figure 1. Map showing route traversed during GPS surveys of April, 2015.

3 OBJECTIVES

The preliminary hydrologic assessment of the Puget Cove ponds and associated watershed was conducted with minimal field reconnaissance of the site. Results of the preliminary assessment suggested that in order to fulfill the desired discharge requirements of 800 gpm the following conditions would have to be met:

- A reservoir system could be engineered such that discharge from the ponds can be fully utilized or nearly fully utilized.
- The actual annual discharge from the ponds would have to be greater than discharges simulated using Ophir Creek discharge data.
- The watershed area used in the simulations would need to be greater than or equal to the estimate provided.
- The ponds would likely need to be modified to provide connectivity of all basins as the water levels are drawn down during periods of low flow.

The field survey of April, 2015 was conducted in an attempt to provide an improved estimate of the actual watershed area of the Puget Cove pond complex. It was of further interest to map the Puget Cove ponds outlet stream and determine the feasibility of gaging discharge from the ponds and verify that it was the stream identified in the preliminary hydrologic assessment. I also visually examined the geometric configuration of the pond outlet to determine potential feasibility of modification to provide additional water storage for hatchery operations. The remainder of my mapping efforts in the region involved mapping key hydrologic features such as the stream flowing between the largest ponds and some additional stream segments.

4 OBSERVATIONS

Figure 1 shows a map of the region surveyed. Track lines were generated with a Garmin GPSMAP 60CSx. As I traversed the watershed I made my best attempt at determining flow paths and drainage area delineations. Significant observations are noted below:

- Drainage from the west pond is into the east pond where it discharges from the north end and then flows to the west and north before discharging into Shaw Cove.
- Drainage area of the pond complex is likely considerably larger than the drainage area estimated in the preliminary hydrologic assessment, which relied solely on topographic maps and aerial imagery. The revised estimate of the drainage area is approximately 0.6 mi^2. The complex of ponds and landscape to the south west appears to contribute substantial drainage to the two larger ponds (figure 2).
- Just downstream of the north outlet of the east pond, flow is constrained by a beaver dam approximately 30 feet wide and 3 feet high (figure 3). The current configuration of the pond outlet is likely an obstruction to anadromous fish passage at the observed discharge. This additional ponded water isn't visible in Google Earth imagery or displayed on USGS topographic maps.

- The outlet of the east pond is in a region of low relief and it would be difficult to increase storage without considerable amounts of fill (figure 4).

5 RECOMMENDATIONS AND REVISED SIMULATIONS

The reconnaissance survey suggests the watershed area of the ponds in considerably larger (0.6 vs. 0.25 mi^2) than the estimate generated using topographic maps and satellite imagery alone. Despite the increase in estimated drainage area it is likely that this drainage still represents a marginal water source. To illustrate this I recomputed daily mean discharge simulations using daily mean discharges from Ophir Creek and the Lost River for the 2007 and 2011 water years (see Preliminary Hydrologic Assessment of Puget Cove Ponds for details in calculating simulations). Results are shown in figures 5 and 6. These simulations use the revised drainage area estimate of the ponds (0.60 mi^2), and demonstrate discharge deficits at the 200 and 800 gpm levels despite the increase in estimated drainage area. Table 1 shows the number of days simulated discharges where below target discharges of 800, 400, and 200 gpm using flow simulations from Ophir Creek (USGS, 2015) and the Lost River for the 2007 and 2011 water years. These results suggest the need to draw from storage to obtain a continuous discharge of even 200 gpm. It is important to note that these simulations are meant to provide estimates. The storage function of the ponds could provide a discharge hydrograph with more or less volume and variability than the simulations.

The outlet of the east pond is in a broad area of low relief (figure 4) and increasing storage would likely require a significant effort in surveying, engineering, and earth moving in order to effectively increase water storage. Should you decide to conduct further feasibility inquiries into the Puget Cove Ponds as a viable water source for the project I would suggest installing a stream gage near the outlet of the east pond in order to determine actual discharges. Because the volume of water available from the watershed is clearly marginal, it is likely that gaging would be a requirement of the ADF&G permitting process.

Despite the increase in drainage area the concerns related to water chemistry, temperature, and the potential for fish pathogens listed in my preliminary hydrologic assessment remain relevant. I collected samples for environmental DNA analysis, which could indicate the presence of juvenile sockeye within the Puget Cove Ponds watershed. They are frozen and available for analysis should you decide to proceed with further investigations into this site.

Table 1. Showing the number of days simulated discharge from the Puget Cove Ponds watershed area falls below taget discharges using simulations based on discharge data from Ophir Creek and the Lost River for the 2007 and 2011 water years.

Discharge (gal/min)	2007 Water Year		2011 Water Year	
	Ophir Creek Simulations Days	Lost River Simulations Days	Ophir Creek Simulations Days	Lost River Simulations Days
<800	165	171	191	173
<400	111	119	136	105
<200	44	31	67	25

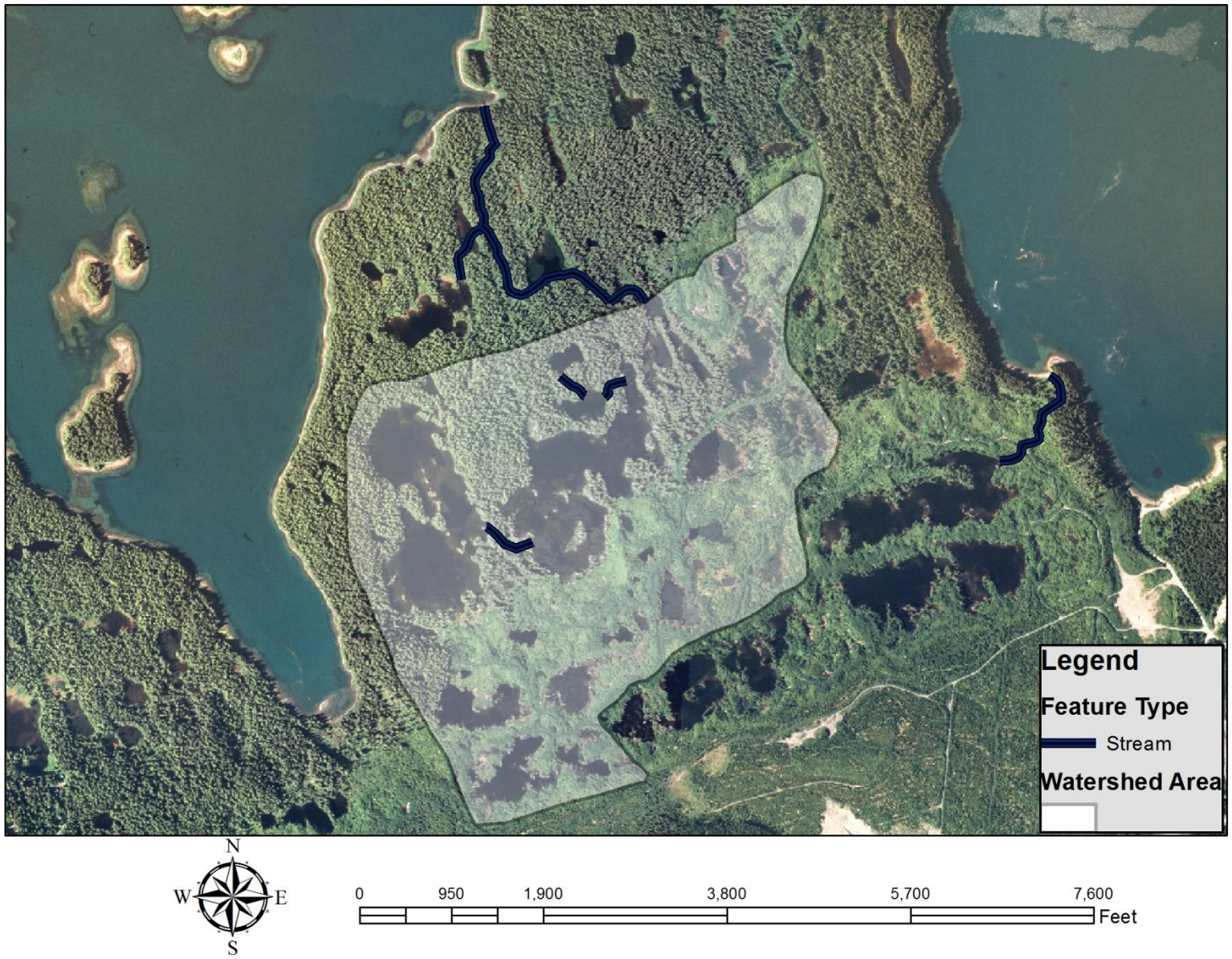

Figure 2. Map of Puget Cove Ponds, estimated watershed area, and surveyed stream channels.

Figure 3. Beaver dam located downstream of the north outlet of East Puget Cove Pond

Figure 4. Showing the north outlet of East Puget Cove Pond draining across a broad area of low relief.

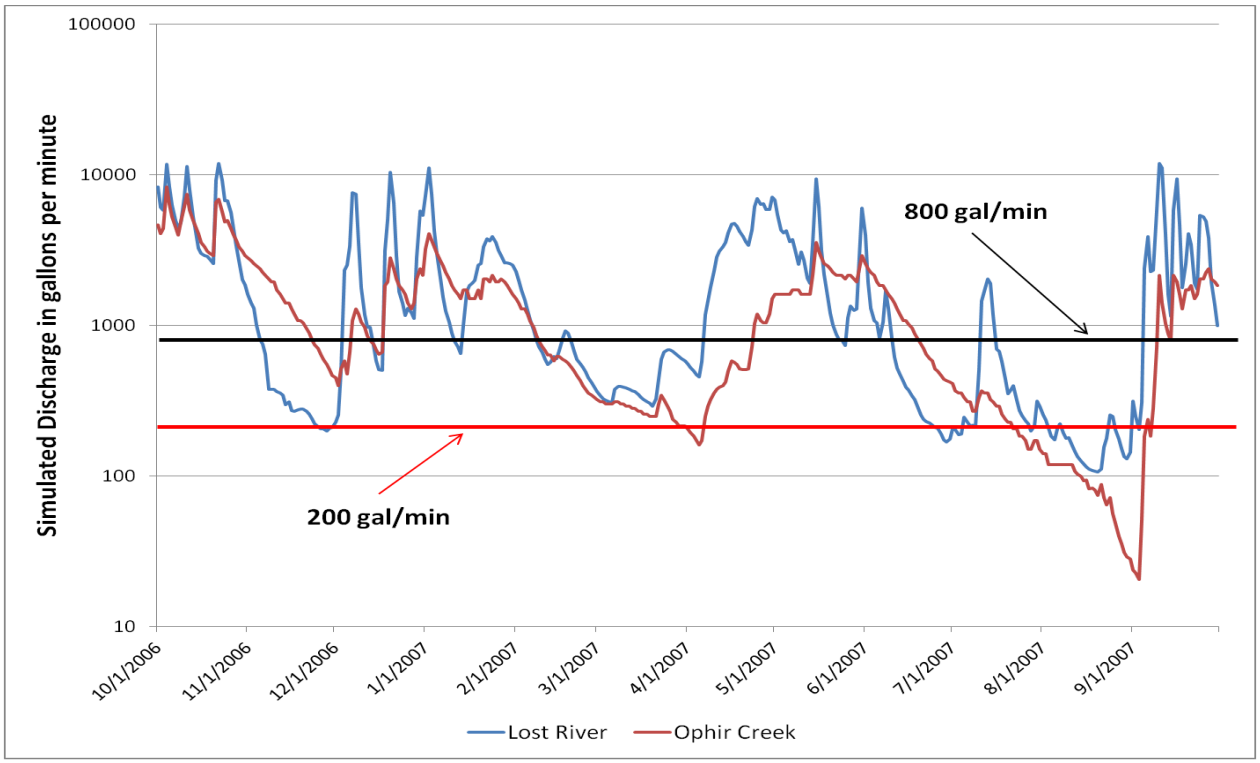

Figure 5. Daily mean discharge simulation of the Puget Cove Pond watershed area using hydrologic data from Ophir Creek (red) and the Lost River (blue) for the 2007 water year.

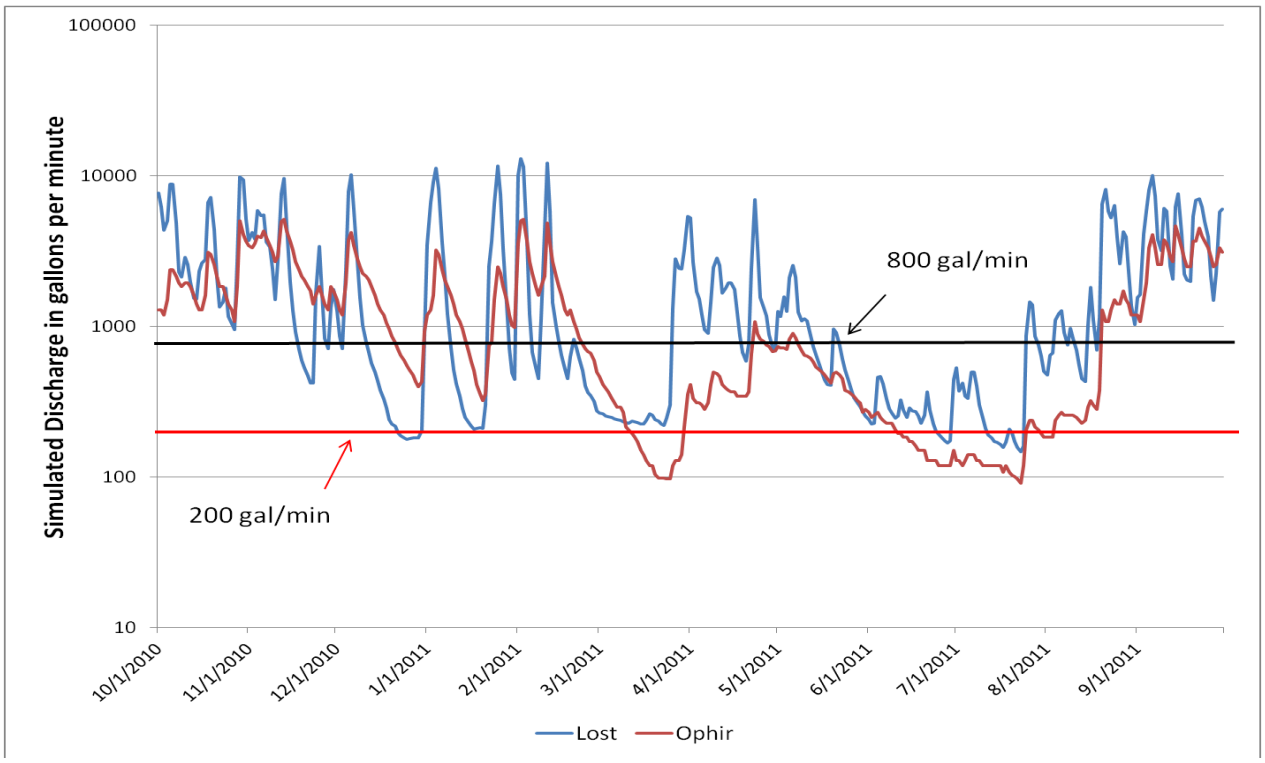

Figure 6. Daily mean discharge simulation of the Puget Cove Pond watershed area using hydrologic data from Ophir Creek (red) and the Lost River (blue) for the 2011 water year.

6 REFERENCES

Bates, R.L., and Jackson, J.A., Editors, 1980, Glossary of Geology, American Geological Institute, Falls Church, Va, 749 p.

Trabant, D.C., March, R.S., and Thomas, D.S., 2003, Hubbard Glacier, Alaska. Growing and Advancing in Spite of Global Climate Change and the 1986 and 2002 Russell Lake Outburst Floods: U.S. Geological Survey Fact Sheet 001-03, 4 p.

U.S. Geological Survey, NWISweb, USGS Water Data for the Nation: http://usgs.waterdata.gov/nwis, Accessed various dates Feb. 16-Mar. 4, 2015.