

**DATE:** September 29, 2017

**TO:** Jean-Paul Zagarola  
Project Manager, Luckiamute Watershed Council

**FROM:** Pete Gruendike  
Fisheries Biologist, River Design Group, Inc.

**SUBJECT:** Additional Opportunities at Luckiamute State Natural Area

---

## **1 Introduction**

Since 2011, River Design Group, Inc. (RDG) has been working with the Luckiamute Watershed Council (LWC) to provide technical assistance for hydrologic analysis, conceptual designs, and cost analysis for floodplain enhancement projects at the Luckiamute State Natural Area (LSNA). As a recent task, RDG completed a remote sensing data review and a site visit to identify potential additional opportunities aimed at increasing the connectivity between the Willamette and Luckiamute rivers and adjacent floodplain in order to enhance habitat for native fish and wildlife at LSNA. This memo describes the additional opportunities identified during that effort and recommendations for further actions to determine the benefits and consequences of those opportunities. Previous memos (May 20, 2013 and September 6, 2017) provide more comprehensive reviews of LSNA site characteristics, existing hydrologic conditions, and project goals.

### **1.1 Remote Sensing Effort**

Remote sensing data were reviewed to identify and prioritize locations for additional field investigation. RDG examined 2009 DOGAMI LiDAR, 2017 and 2016 NAIP aerial imagery, historical imagery, inundation extents and depths associated with varying flows (RDG 2013), and other pertinent GIS layers. RDG also examined unmanned aerial vehicle (UAV) imagery captured for select areas of LSNA during a high water event on February 22, 2017, and fixed wing aerial imagery taken by Eagle Digital Imaging, Inc. on January 28, 2012 during flood conditions. The discharge at the Luckiamute at Suver gage was 4,900 cfs, and 45,000 cfs at the Willamette River at Albany gage during the 2017 UAV imagery acquisition, and 2,700 cfs at the Luckiamute River at Suver gage and 75,000 cfs at the Willamette River at Albany gage during the 2012 event.

The remote sensing effort identified a multitude of potential project locations. Potential project opportunities were typically associated with crossings or existing high ground topography that limits broader floodplain inundation. Fill material in floodplain channels typically limits the frequency and duration of inundation of the habitats located on the upstream side of the fill. Blockages can also create potential fish stranding issues when the blockage is overtopped during high flows and surface water

connection is subsequently broken as flows recede, leaving water and aquatic organisms isolated on the upstream side of the blockage.

Areas of lower elevation topography adjacent to the lower Luckiamute and Willamette rivers were also assessed using LiDAR data to investigate potential cold water habitat enhancement and refugia development opportunities.

## **1.2 Site Reconnaissance**

RDG staff conducted a site visit to LSNA on October 10, 2017, to evaluate the potential project site opportunities identified during the remote sensing effort. Site conditions were noted and ground photographs were taken to document the conditions of those sites. Other opportunities were also identified by assessing the habitat characteristics of floodplain features at LSNA such as the slough located at the confluence of the Luckiamute and Willamette rivers and the gravel pond located in the South Tract.

Additional opportunities identified during the site visit include adding large wood habitat structures for cover in the slough at the confluence area, and enhancing western pond turtle nesting and basking habitat in the gravel pond in the South Tract.

## **2 Potential Opportunities and Recommendations**

Potential opportunity locations or site investigation areas (SIAs) that were identified at LSNA during the remote sensing and field reconnaissance efforts are shown in Figure 2-1. Descriptions of the existing features and recommendations for future actions at the SIAs are provided in Table 2-1.

Additional opportunities aimed at enhancing connectivity and function of floodplain habitats at LSNA are typically associated with anthropogenic fills for agricultural purposes, or for road or trail access. SIAs #24 and #25 are floodplain fills for agricultural or maintenance access roads. The crossings do not have adequate culverts to convey moderate flood flows. The crossings as limit fish passage and potentially create fish stranding issues when they the crossings are overtopped and then flows subsequently recede. We recommended that the necessity of these access roads be evaluated and the road crossings are either removed or modified to improve site conditions and floodplain connectivity.

SIAs #17-20 are associated with the trail network that connects the interior floodplain with the Willamette River access and camping area. The trail has multiple locations that cross low floodplain topography, creating berms that disconnect low elevation floodplain areas south of the trail, from Luckiamute River backwater channels to the north. In addition, a several hundred foot section of the trail (SIA #21) is located in a Willamette River flood channel and degrades the condition of the bed and vegetation in that portion of the channel. We recommended the current trail alignment be evaluated and the trail potentially relocated in areas where the trail bisects floodplain channels.

In some cases, natural topographic obstructions combined with lower contemporary Willamette River flows due to river regulation, also limit the connectivity of the river with the LSNA floodplain. SIAs #12-14 are existing floodplain swales that are inundated during elevated flows on the Luckiamute and Willamette rivers. The frequency and duration of hydrologic connection of portions of these swales is limited due to the relative elevation of swales and the interior floodplain. We recommended evaluating

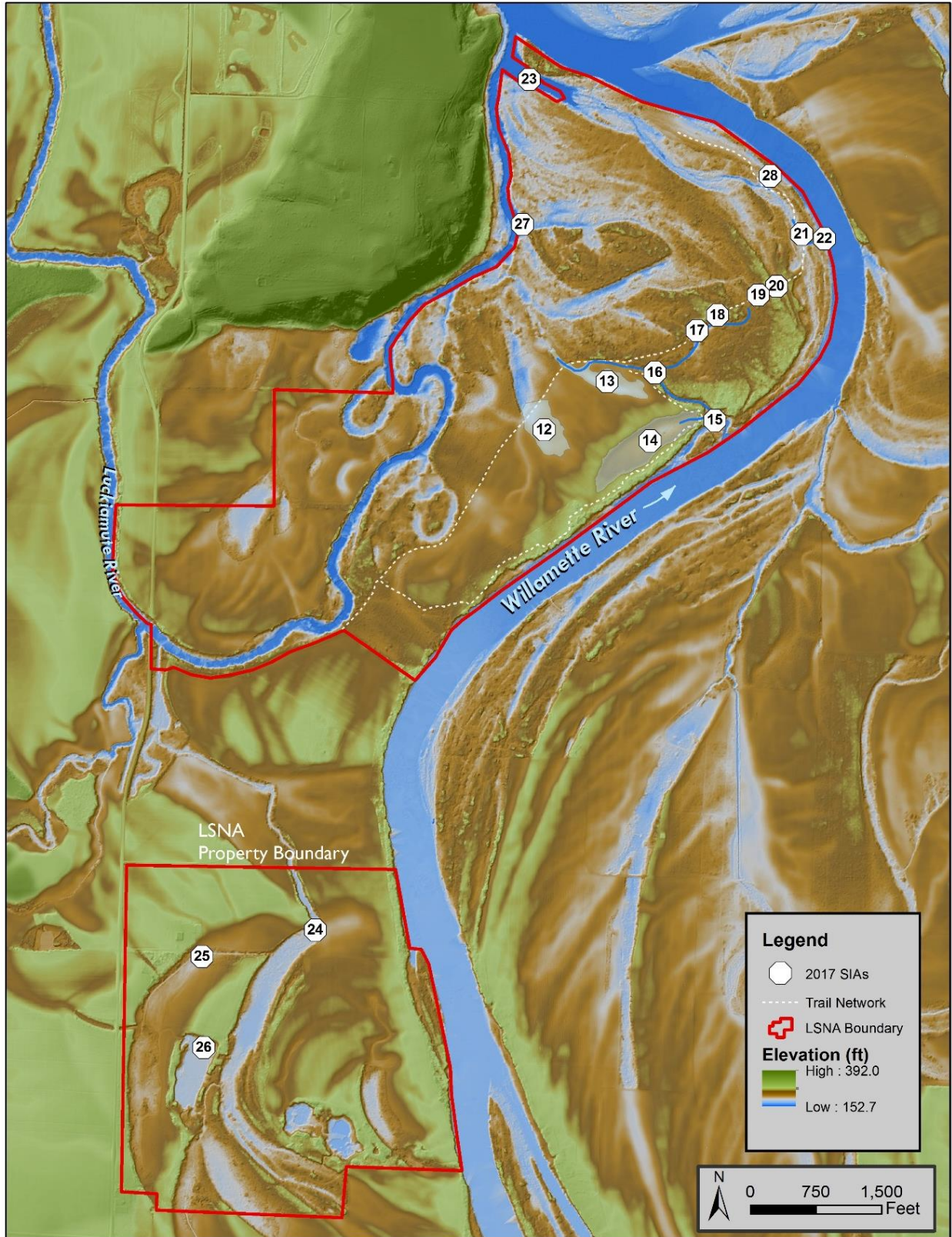
the costs and resulting ecological benefits of grading portions of these swales to match the lower existing swale elevations in closer proximity to the Luckiamute or Willamette rivers.

SIA #15-16 are existing flood channels and low elevation floodplain features that currently have limited connection to the Willamette River due to existing high topographic features. We recommend evaluating the cost and resulting ecological benefits of re-grading the existing topography to improve the frequency and duration of the connection of overbank flows from the Willamette River into the interior LSNA floodplain.

The opportunities identified to improve the connectivity between the floodplain and the Willamette and Luckiamute rivers pose little threat to surrounding properties or infrastructure, but may restrict site access during winter and spring high water periods. These potential projects should be evaluated in relation to other management goals maintained by Oregon Parks and Recreation Department (OPRD) and other stakeholders.

Additional opportunities to enhance or develop cold water refugia along the lower Luckiamute River (SIA #27) and the margins of the Willamette River (SIA #28) were evaluated during the remote sensing effort using LiDAR data and aerial imagery to identify low topographic areas and site conditions that may support the development of cold water features such as alcoves. We recommend that these areas are monitored for summer time water temperatures and are further assessed for hydraulic conditions, substrate composition, and hyporheic exchange.

Other opportunities to improve habitat conditions for native fish and wildlife include improving habitat in the backwater slough at the confluence of the Luckiamute River and Willamette River (SIA #23) through the addition of large wood habitat structures, and by enhancing western pond turtle habitat at the South Tract gravel pond (SIA #26) through the addition of basking logs and by improving nesting habitat conditions.



**Figure 2-1.** Map of Site Investigation Areas (SIAs) identified during the 2017 remote sensing and site reconnaissance effort.



**Table 2-1.** Additional LSNA site investigation areas (SIAs) identified during the 2017 remote sensing and field reconnaissance efforts.

Site	Existing Site Characteristics	Recommendation
SIA12	Existing floodplain swale has limited connectivity to the Luckiamute River and low elevation areas north and west of the access road/trail due to the swale elevation relative to the adjacent floodplain.	Grade the portion of the swale southeast of the access road/trail to approximately 166 ft NAVD88 to increase the frequency and duration of the connection.
SIA13	Existing floodplain swale has limited connectivity to the Luckiamute River and low elevation areas north and west of the access road/trail due to the swale elevation relative to the adjacent floodplain.	Grade the portion of the swale southeast of the access road/trail to approximately 167 ft NAVD88 to increase the frequency and duration of the connection.
SIA14	Existing floodplain swale has limited connectivity to the Willamette River due to the swale elevation relative to the adjacent floodplain.	Grade a portion of the swale and the connection point to the Willamette River to approximately 172 ft NAVD88 to increase the frequency and duration of the connection.
SIA15	Existing flood channel conveys overbank flows from the Willamette River into interior LSNA floodplain. Mature floodplain forest with multi-level canopy.	Lower the flood channel bed elevation to convey flow at a lower stage on the Willamette River.
SIA16	Existing low floodplain features located south of the access/road trail are isolated from Willamette River flood channel and Luckiamute River backwater floodplain channels by high ground.	Grade a floodplain channel that connects the low elevation features to the Willamette River flood channel.
SIA17	Low elevation portions of the floodplain are isolated at certain flows from Luckiamute River backwater channels due to floodplain fills on the access road/trail.	Remove or modify the access trail floodplain fill to improve connectivity between Luckiamute River backwater channels and the adjacent floodplain.
SIA18	Low elevation portions of the floodplain are isolated at certain flows from Luckiamute River backwater channels due to floodplain fills on the access road/trail.	Remove or modify the access trail floodplain fill to improve connectivity between Luckiamute River backwater channels and the adjacent floodplain.
SIA19	Low elevation portions of the floodplain are isolated at certain flows from Luckiamute River backwater channels due to floodplain fills on the access road/trail.	Remove or modify the access trail floodplain fill to improve connectivity between Luckiamute River backwater channels and the adjacent floodplain.
SIA20	Low elevation portions of the floodplain are isolated at certain flows from Luckiamute River backwater channels due to floodplain fills on the access road/trail.	Remove or modify the access trail floodplain fill to improve connectivity between Luckiamute River backwater channels and the adjacent floodplain.

SIA21	A portion of the access road/trail is located in the Willamette River flood channel.	Realign the road/trail network outside of the Willamette River flood channel.
SIA22	Existing flood channel conveys overbank flows from the Willamette River into interior LSNA floodplain. Mature floodplain forest with multi-level canopy.	Lower the flood channel bed elevation to convey flow at a lower Willamette River stage.
SIA23	A connected backwater slough at the confluence of the Luckiamute and Willamette rivers provides high flow refugia and rearing habitat for juvenile salmonids during certain periods of the year.	Enhance habitat complexity in the slough through the addition of large wood habitat structures or other features.
SIA24	A floodplain road fill limits the connectivity of a floodplain swale during certain flows.	Increase the connectivity of the floodplain swale by removing or modifying the floodplain road crossing such as installing a culvert or low water crossing.
SIA25	A floodplain road fill limits the connectivity of a floodplain swale during certain flows.	Examine the potential to increase the connectivity of the floodplain swale by removing or modifying the floodplain road such as installing a culvert or low water crossing.
SIA26	The existing gravel pond provides some habitat for native western pond turtles.	Enhance pond turtle habitat through the addition of basking logs and/or by enhancing nesting location through slope grading or by importing proper substrates.
SIA27	Low elevation floodplain areas adjacent to the lower Luckiamute River may be enhanced to provide additional cold water refugia for native fish.	Monitor water temperature and further assess site conditions for the presence and potential for hyporheic exchange along the margins of the lower Luckiamute River.
SIA28	Low elevation floodplain areas adjacent to the Willamette River may be enhanced to provide additional cold water refugia for native fish.	Monitor water temperature and further assess site conditions for the presence and potential for hyporheic exchange along the margins of the Willamette River.