Klamath Basin Monitoring Program – Gap Analysis Project

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Table of Contents

Introduction

The Klamath Basin Monitoring Program (KBMP) strives to provide the most up to date and accurate water quality information within the basin. This data is helpful for many groups, including state and federal agencies. The data helps them understand existing water quality conditions and how they may impact aquatic species, including endangered and threatened species, along with the ways in which aquatic species are benefiting from the conditions. It has been requested by previously noted groups and agencies, that a gap-analysis be conducted on the monitoring locations within the Klamath basin. This project will assess monitoring locations along the Klamath River and its sub basins. Data will be provided in an organized spreadsheet. The goal of this project will be to find spatial gaps and redundancies between monitoring locations that sample for specific water quality parameters including phosphorus, ammonia, and temperatures, along the Klamath River and its sub basins. Figure 1 shows each monitoring location that will be analyzed during this gap analysis.

Methodology

The gap-analysis was conducted by identifying which KBMP member collected data parameters that were associated with selected Total Maximum Daily Loads (TMDL) listed impairments. The TMDL is defined by the Clean Water Act as "a value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards". (EPA,2016). The specific parameters that were assessed in the gap-analysis were total phosphorous (Figure 1), water temperature (from probes), and ammonia (Figure 2). Based on TMDL impairments within the sub basins, an evaluation associated with parameters were assessed to identify the distance in river kilometers between monitoring locations starting at the mouth of the river and moving upstream. Identifying monitoring locations within the mainstem and tributaries of the river will help organizations determine where existing monitoring locations are either redundant or spread too far apart to adequately characterize the river. Another aspect of the gap-analysis project was to identify redundancy of data collection between organizations involved with the KBMP. The analysis looked for locations where data collected by multiple organizations was similar and would help in determining if monitoring locations are too close in proximity. The analysis also helped determine what data will be needed for future monitoring efforts. Data assessed determined whether or not data fields are necessary within the basin monitoring locations.

This determination of data necessary for future monitoring efforts was found by utilizing tools within Microsoft Excel. Through Excel, the data was then filtered by each parameter listed above to determine gaps and redundancies within these data collection sites. To determine whether the data was redundant, guidelines were set to make sure important data collection points were not removed. These important data collection sites were referred to as Legacy Sites. It was important to know whether the site was a "legacy site because legacy site cannot be relocated or removed due to KBMP standards as these are the locations where the best data is collected. Redundant data was defined as: the distance of 0.5 -1.5 km or less between monitoring sites. To determine if there were gaps between data collection sites, it was defined as having greater than 20 kilometers in length between two monitoring locations. Legacy sites were also taken into consideration when finding gaps as previously mentioned, legacy sites cannot be removed or relocated due to KBMP instructions.

Results/Finding

The Gap Analysis has been refined down to only total phosphorus and ammonia shown in Figures 1 and 2. A separate spreadsheet holds data that looks solely at the Klamath River and each of its sub basins where temperature probe data is collected. Also, the data shows which sites being monitored within the basin are Legacy Sites (sites that should persist to ensure continuation of data collection). The next step for the data was to sort through each location within each river and its sub basins to determine if there are redundancies. As shown in Figures 4 and 5, this data was collected from the Williamson and Klamath Strait Drain sub basins identifying where redundancy occurs between monitoring locations. This was determined by looking at the river kilometer starting from the mouth of the river, and seeing that each location lie within the parameter set when defining redundancy 0.5-1.5 km or less. In Figure 5 the data not only provided insight on redundancy while looking at river kilometers, but also with the sampling organization as well. The Bureau of Reclamation can be seen monitoring two locations with the same parameters and the two locations are 0.5 km apart from each other. The data was then highlighted throughout the spread sheet in green, showing these redundancies to determine whether it would be cost efficient to keep or remove these monitoring locations based on the availability of data from nearby locations. The Legacy Sites that could not be moved were set a part by coloring the text red.

When determining where there were gaps between monitoring locations, the data from each sub basin was first broken into a series of worksheets each containing data for only one river and its sub basins. By separating the rivers and their sub basins into separate spreadsheets, I could then determine the distance between the monitoring locations by finding the difference between each location. Gaps between locations were shown in with no highlighting in place.

Again, legacy sites were defined by the text being colored red. As shown in Figure 6, again looking at rive kilometer, it is easy to determine that the distance between two locations is greater than the parameters set when defining a gap within the analysis. Finally, after knowing the distance between each location I was then able to determine whether monitoring locations needed relocated or removed entirely. After finishing this gap analysis, I was able to send the findings to the KMBP in hopes to reduce waste, program dollars, and reduce wasted time within the program.

Conclusion

The purpose of this project was to provide a gap-analysis to the Klamath Basin Monitoring Program members regarding their water quality monitoring efforts. KBMP would like to make their water collection throughout the year efficient, as different entities within the program are currently collecting the same data throughout the year, often at locations very close to where others collect the same data. With the results of this analysis, KBMP members will be able to eliminate redundant monitoring locations or add locations where needed, based on how many kilometers upstream or downstream similar data is collected. KBMP members can then identify whether the findings in this analysis will be suitable to their own data collection efforts throughout the entirety of the Klamath Basin to better spend program dollars.

Figures:

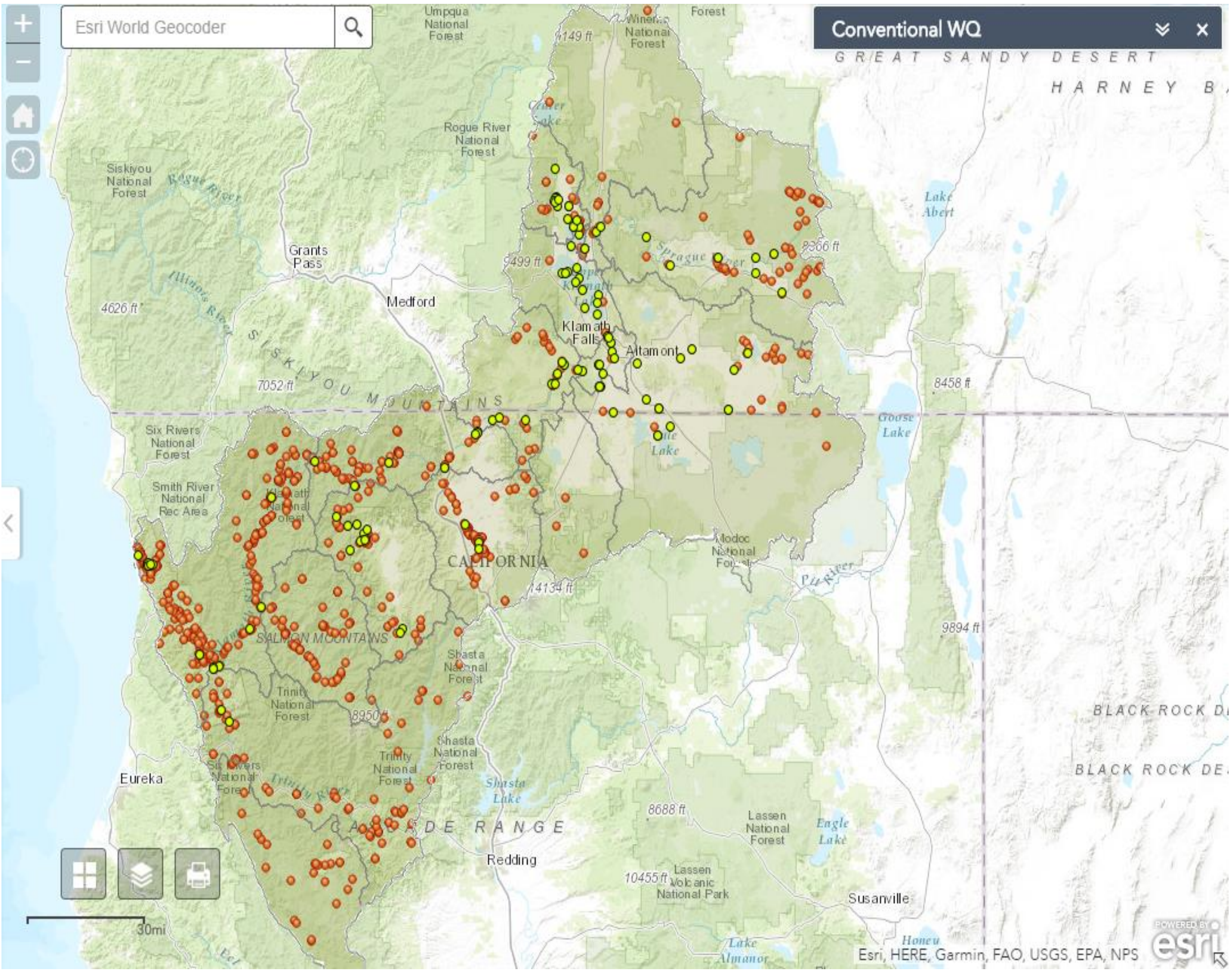

Figure 1. Screenshot of locations that monitor of total phosphorus.

Figures:

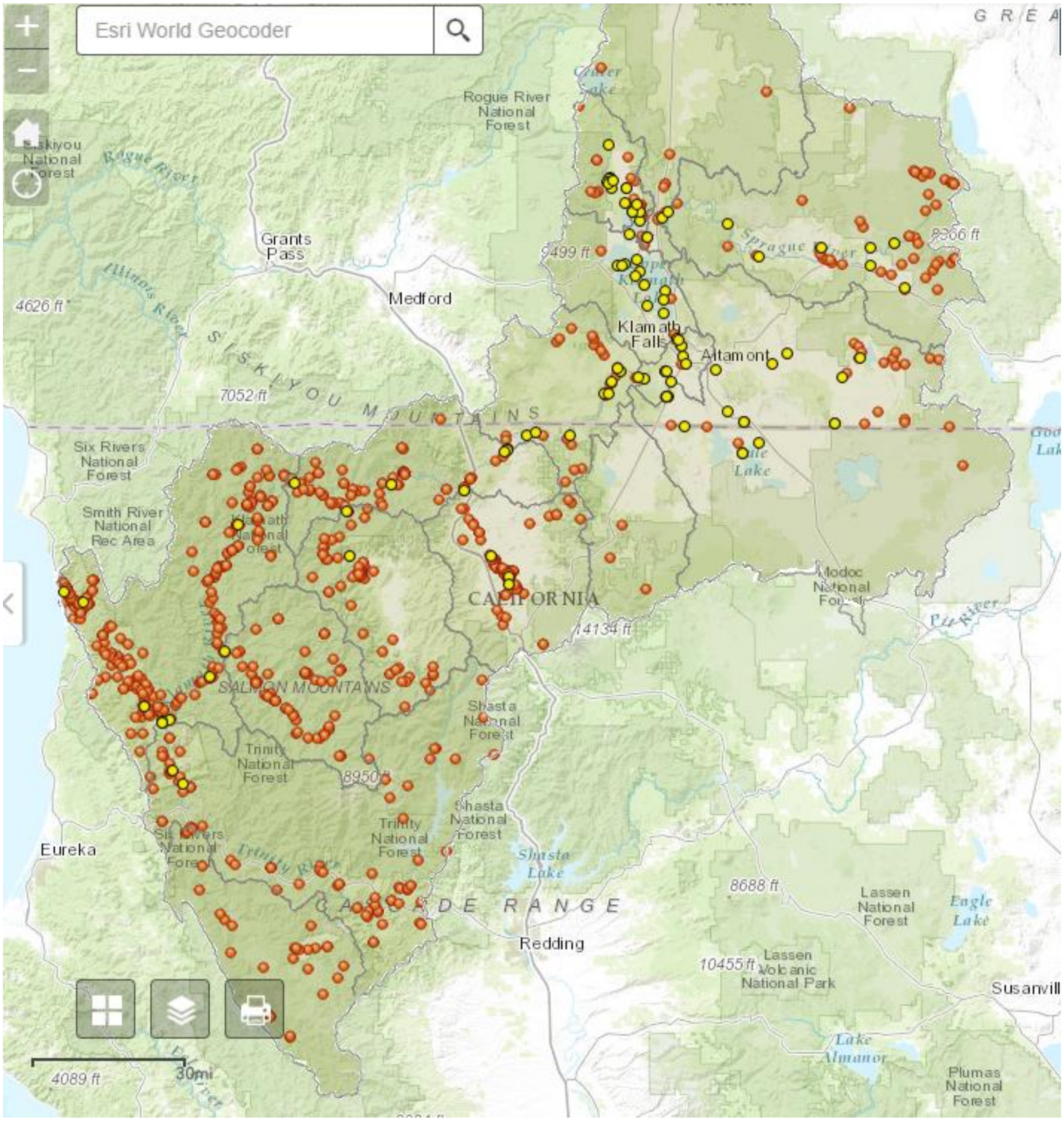

Figure 2. Screenshot of locations that monitor Ammonia with the Klamath Basin.

Figures:

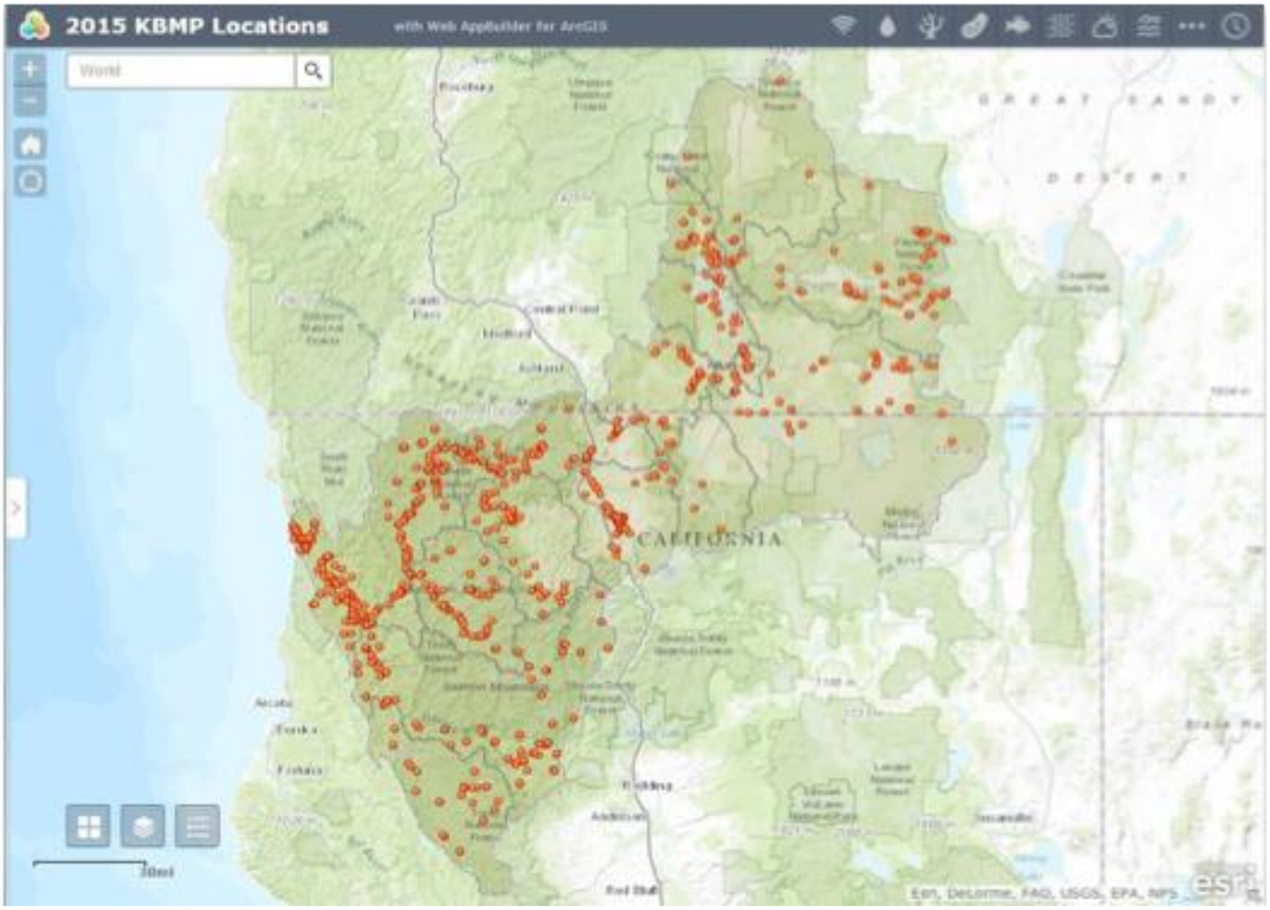

Figure 3. Screenshot of the monitoring locations within the Klamath Basin.

Figures:

	A	B	C	D	E	F	G
1	River Name	subbasin	Site Description (location monitered)	Parameter	Total Length (km)	km (from the mouth)	sampling organization
2	Williamson River	Williamson	Williamson River at Williamson River Store	Ammonia	159.14	10.46	Oregon Department of Environmental Quality
3	Williamson River	Williamson	Williamson River at Williamson River Store	Total Phosphorous	159.14	10.46	Oregon Department of Environmental Quality
4	Williamson River	Williamson	WOOD R. @ WILLIAMSON	Total Phosphorous	159.14	10.47	Klamath Tribes
5	Williamson River	Williamson	WOOD R. @ WILLIAMSON	Ammonia	159.14	10.47	Klamath Tribes

Figure 4. Screenshot of the Williamson sub basin identifying redundant locations.

	A	B	C	D	E	F	G
1	River Name	subbasin	Site Description (location monitered)	Parameter	Total Length (km)	km (from the mouth)	sampling organization
2	Klamath Strait Drain	Lake Ewanna / Keno	Klamath Straits Drain at Hwy 97	Ammonia	29.44	3.38	U.S. Bureau of Reclamation
3	Klamath Strait Drain	Lake Ewanna / Keno	Klamath Straits Drain at Hwy 97	Total Phosphorous	29.44	3.38	U.S. Bureau of Reclamation
4	Klamath Strait Drain	Lost	ADY Canal @ HWay 97	Ammonia	29.44	3.41	U.S. Bureau of Reclamation
5	Klamath Strait Drain	Lost	ADY Canal @ HWay 97	Total Phosphorous	29.44	3.41	U.S. Bureau of Reclamation
6	Klamath Strait Drain	Lost	Klamath Strait at USBR Pump Station F	Ammonia	29.44	3.82	Oregon Department of Environmental Quality
7	Klamath Strait Drain	Lost	Klamath Strait at USBR Pump Station F	Total Phosphorous	29.44	3.82	Oregon Department of Environmental Quality

Figure 5. Screenshot of the Klamath Strait Drain sub basin identifying redundant locations.

	A	B	C	D	E	F	G
1	River Name	subbasin	Site Description (location monitered)	Parameter	Total Length (km)	km (from the mouth)	sampling organization
2	Lost River	Lost	Lost River @ East-West Road	Ammonia	128.87	1.45	U.S. Bureau of Reclamation
3	Lost River	Lost	Lost River @ East-West Road	Total Phosphorous	128.87	1.45	U.S. Bureau of Reclamation
4	Lost River	Lost	Lost River at Anderson Rose Dam	Ammonia	128.87	12.07	Oregon Department of Environmental Quality
5	Lost River	Lost	Lost River at Anderson Rose Dam	Total Phosphorous	128.87	12.07	Oregon Department of Environmental Quality
6	Lost River	Lost	Lost River at Hwy 39 (Merrill)	Ammonia	128.87	21.33	Oregon Department of Environmental Quality
7	Lost River	Lost	Lost River at Hwy 39 (Merrill)	Total Phosphorous	128.87	21.33	Oregon Department of Environmental Quality
8	Lost River	Lost	Lost River @ Harpold Dam	Ammonia	128.87	66.13	U.S. Bureau of Reclamation-USGS
9	Lost River	Lost	Lost River @ Harpold Dam	Total Phosphorous	128.87	66.13	U.S. Bureau of Reclamation-USGS
10	Lost River	Lost	Lost River above Bonanza	Ammonia	128.87	72.75	Oregon Department of Environmental Quality
11	Lost River	Lost	Lost River above Bonanza	Total Phosphorous	128.87	72.75	Oregon Department of Environmental Quality
12	Lost River	Lost	Lost River @ Malone Dam	Ammonia	128.87	104.60	U.S. Bureau of Reclamation
13	Lost River	Lost	Lost River @ Malone Dam	Total Phosphorous	128.87	104.60	U.S. Bureau of Reclamation
14	Lost River	Lost	Lost River @ Malone Dam	Ammonia	128.87	104.60	U.S. Bureau of Reclamation
15	Lost River	Lost	Lost River @ Malone Dam	Total Phosphorous	128.87	104.60	U.S. Bureau of Reclamation

Figure 6. Screenshot of the Lost river sub basin identifying gaps within the data collected.

Appendix A:

Project Timeline:

Proposal draft

Formal proposal

Formal Outline

Progress Presentation

Written report draft

Final Written Report

Appendix B:

Key Agencies:

Klamath Basin Monitoring Program

(707) – 499-5521 (work cell)

Randy Turner (Coordinator)

San Francisco Estuary Institute

Oregon Department of Environmental Quality

(541) - 273- 7002 (work)

Mike Hiatt

Klamath Basin TMDL Coordinator

Acknowledgement:

A special thanks to Randy turner for mentoring me through this project. Also a special thanks to Mike Hiatt for the suggestions on Parameters to use.

References:

Klamath Basin Monitoring Program 2008, kbmp.net/. Accessed 1 Nov. 2016

*U.S. Environmental Protection Agency*18 Oct. 2016, https://www.epa.gov/tmdl/program-overview-total-maximum-daily-loads-tmdl. Accessed 17 Nov. 2016.