IN THE CIRCUIT COURT OF THE STATE OF OREGON

FOR THE COUNTY OF MARION

KLAMATH IRRIGATION DISTRICT, Petitioner, v. **OREGON WATER RESOURCES DEPARTMENT**, *an agency of the state of Oregon,* **THOMAS BYLER,** *in his official capacity as Director of Oregon Water Resources Department,* and **DANETTE WATSON**, *in her official capacity as Watermaster for the Oregon Water Resources Department* Respondent.	Case No. 20CV15606 **DECLARATION OF GENE SOUZA IN SUPPORT OF PETITIONER'S MOTION FOR TEMPORARY RESTRAINING ORDER**

I, Gene Souza, hereby declare as follows:

1. I am Executive Director and Manager of the Klamath Irrigation District ("KID"). I have personal knowledge and am competent to testify to each of the matters discussed below. I am providing this declaration in support of KID's motion for a temporary restraining order.

2. The reason KID is seeking a temporary restraining order is that the morning of June 10, 2020, I became aware that diversions of stored water from Upper Klamath Lake reservoir ("UKL reservoir") had suddenly increased dramatically. Despite having just attended an "operations" meeting with representatives of the United States Bureau of Reclamation ("Reclamation") the day prior, where a substantial increase in diversions by any party would typically be discussed, I was not informed this dramatic increase in diversions would be occurring.

3. In making water management decisions for KID, I regularly rely upon the data reported by the United States Geological Survey ("USGS") on the Klamath Teacup Diagram (Teacup Diagram). This data is a public record and available to anyone with Internet access. The data appearing on the Teacup diagram is derived from gauges located at major inflow points and water

facilities, including the Link River Dam and A-Canal headworks. These gauges electronically report the amount of water being diverted from these locations in near real time. The data reflected in the Teacup Diagram is also made available in spreadsheets and other formats, but the Teacup Diagram is particularly convenient. While gauges occasionally go offline and the real time data reported on the Teacup Diagram is provisional, it is my experience the Teacup Diagram is a reasonably reliable basis for determining, in near real time, how water is being distributed. I know from my regular dealings with officials at the United States Bureau of Reclamation and managers of other irrigation districts that they regularly rely upon the Teacup Diagram in similar fashion as I do. Additionally, I know that OWRD partners with USGS in compiling steam data and relies upon the Teacup diagram much as I do

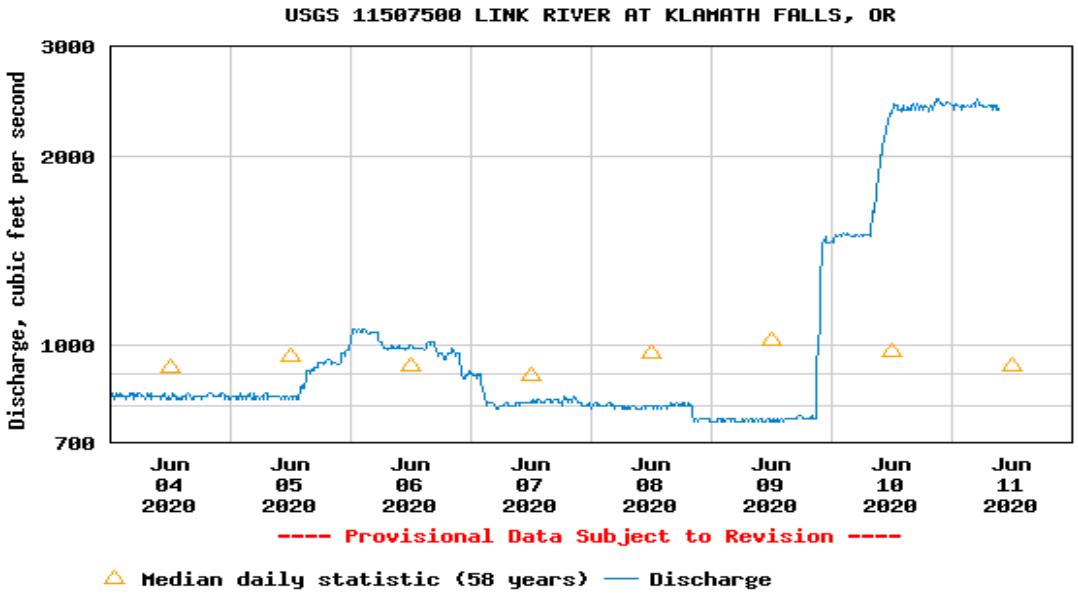
4. For example, attached as **Exhibit 1** is a true and correct copy of an email I received from Karen Morris of OWRD on June 8, 2020, which I forwarded to KID's attorney Nathan Rietmann to mark as an Exhibit. I receive similar emails from OWRD every Monday. Also included in **Exhibit 1**, is a true and correct copy of the attachment to this email, which consists of a hydrology report prepared by OWRD. The data in the report is derived from the USGS data reported on the Teacup Diagram and provides direct links to Teacup Diagram itself. It also contains slides directly copied from the Teacup Diagram very similarly to how I have copied such slides throughout this declaration.

5. Also, for purposes of demonstrating the extent to which OWRD relies on the USGS data reported on the Teacup Diagram, I've attached as **Exhibit 2** a true and correct copy of a document downloaded from OWRD's own website on June 11, 2020, which is authored by OWRD and I understand to be a public record. In this document, OWRD explains its water monitoring strategy and how closely OWRD partners with USGS and other federal agencies in monitoring water.

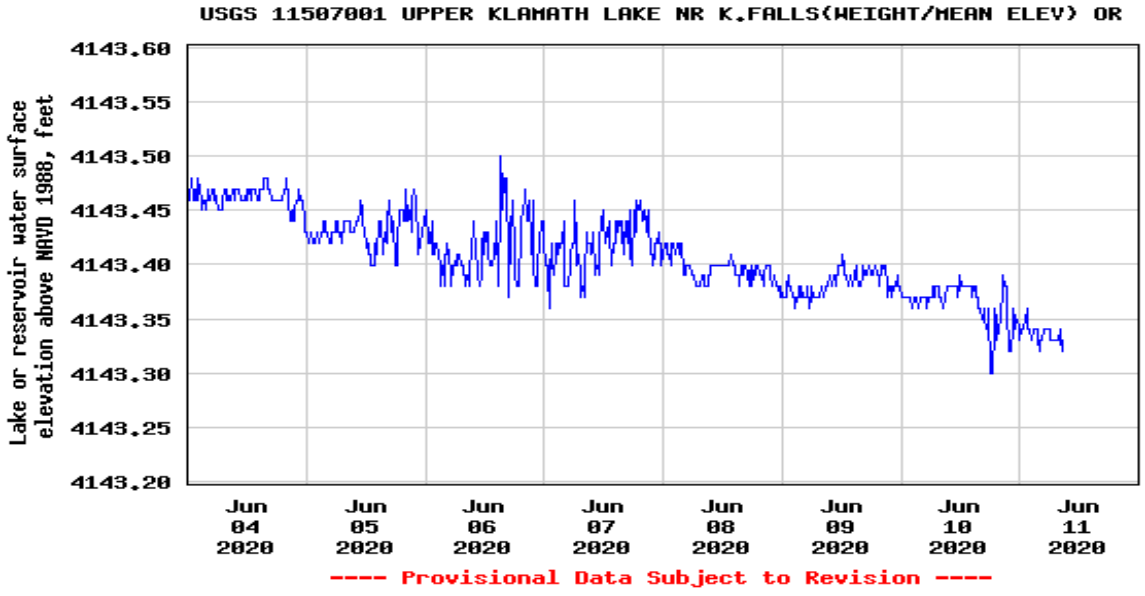
6. The Court and any other member of the public may access the Teacup Diagram on the Internet here: https://waterdata.usgs.gov/nwis/uv/?site_no=11507500&parameter_cd=00060.

7. Below is a true and correct copy of a screenshot from the Teacup Diagram. It was copied and pasted into this document at 9:38am on June 11, 2020. This chart shows how diversions of

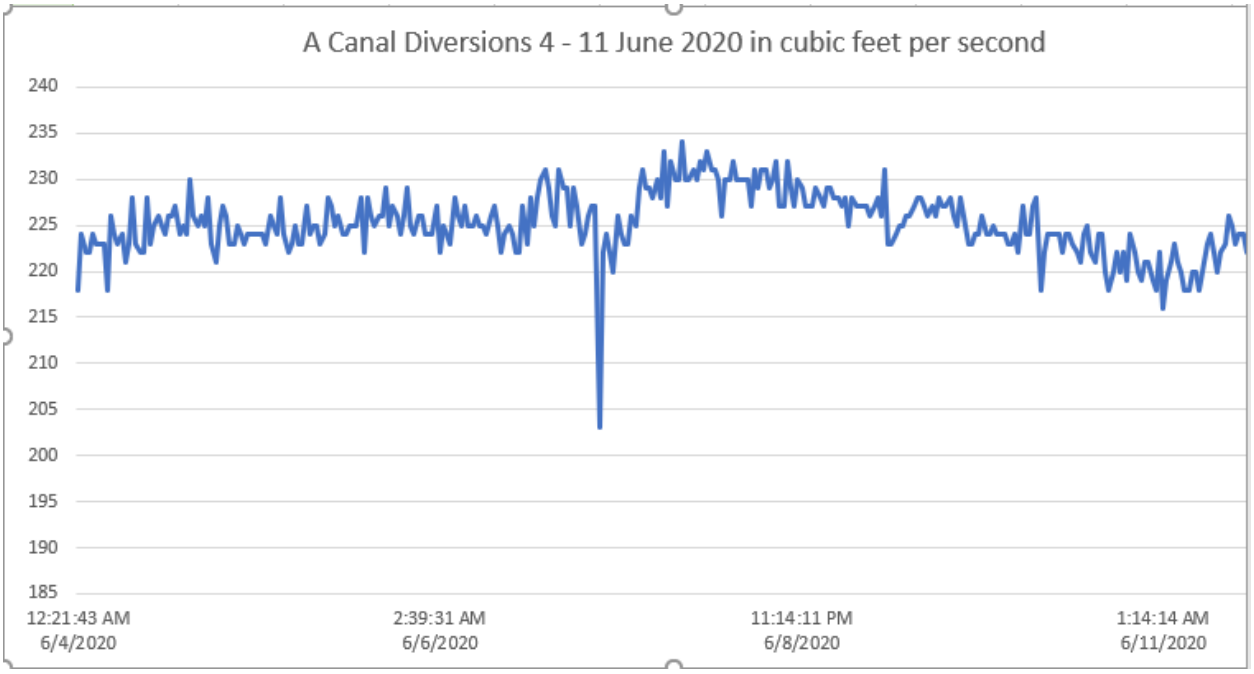
water from UKL reservoir through the Link River Dam have dramatically increased since the evening of June 9, 2020.



8. Below is a true and correct copy of a screenshot from the Teacup Diagram copied. It was copied and pasted into this document at 9:39am on June 11, 2020. This chart shows how the elevation of UKL reservoir has dropped after diversions from Link River Dam ramped up.



9. Although Link River Dam diversions have dramatically increased, KID's diversions from UKL reservoir through the A-Canal have been constant or diminishing during this same period (June 4, 2020 to June 11, 2020). Below is a true and correct extract of the flow meter report monitored in real-time by Reclamation, which informs the Teacup Diagram.



This same information is available on the Teacup Diagram here:
https://www.usbr.gov/pn/hydromet/klamath/kinstant_graph.html?cbtt=ACHO&pcode=qc1

10. Given the declining lake elevation of UKL reservoir, it is evident that a large volume of stored water is being diverted from UKL reservoir through the Link River Dam. It is also evident the declining lake level cannot be attributed to A-Canal diversions or other agricultural diversions because such diversions are less than the inflows reported in the Teacup Diagram.

11. Based on my calculations of inflows and outflows reported on the Teacup Diagram, I very conservatively estimate that *at least* 1,000 cfs of stored water is currently being diverted from UKL reservoir through the Link River Dam. I arrived at this conservative estimate by adding the inflows to UKL reservoir that I am presently seeing reported on the Teacup Diagram from Woodriver

(401cfs inflow), Cherry Creek (19.6cfs inflow), and the Williamson River[1] (551.cfs), which brings the total reported inflow into UKL reservoir to 971.6cfs. I then subtracted KID's current diversion of 223cfs of live flow from the A-Canal headworks from this total inflow calculation, which leaves 748.6cfs of unappropriated inflows. I then subtracted this 746cfs of unappropriated inflows from the 2,380cfs of reported Link River Dam diversions. This calculation indicates Link River Dam outflows exceed unappropriated inflows by 1,634cfs. In other words, 1,635cfs of stored water is presently being diverted from Link River Dam. Thus, even if someone contends the 223cfs KID is diverting through the A-Canal is stored water and not live flow, or contends there are 441cfs of UKL reservoir diversions not being reported on the Teacup, which is not the circumstances, there is still at least 1000cfs of stored water currently being diverted from UKL reservoir through Link River Dam.

12. Since becoming aware of this situation, I have recognized that the increased flows are, at least in substantial part, attributable to an arrangement between PacifiCorp and the United States Bureau of Reclamation to fill water pools behind PacifiCorp's hydroelectric facilities located downstream of UKL reservoir. My understanding based on public records, conversations with Reclamation officials, and participation in various meetings is that PacifiCorp has previously released approximately 15,000 acre-feet of water from its downstream reservoirs to help Reclamation provide enhanced flows below Iron Gate Dam. Now, Reclamation is repaying PacifiCorp for these releases by using stored water in UKL reservoir to refill the pools behind its dams. Filling the pools before the July 4 holiday also facilitates recreation and enables further enhancement of instream flows in California. Attached as **Exhibit 3** is a true and correct copy of the borrowing agreement between Reclamation and PacifiCorp, which is downloaded from the following OWRD webpage and understand to be a public record.

https://www.oregon.gov/OWRD/programs/regulation/KlamathRegulation/Pages/default.aspx.

[1] The Sprague River flows into the Williamson so the flows reported for the Sprague on the Teacup are encompassed in the flows reported for the Williamson.

13. I understand PacifiCorp wanting repaid for the water behind its dams that was released for the flushing flow. Since the rate of water needed for the flushing flow can only be obtained by running water over PacifiCorp's dams, rather than through its turbines, providing the flushing flow cost it money. If Reclamation were repaying PacifiCorp with its own money or water, KID would have no complaint. However, repaying PacifiCorp with stored water in UKL reservoir that KID and others hold the water rights to is extremely objectionable and injurious.

14. I am also struck by the fact that while Reclamation is willing to repay PacifiCorp for the water behind its dams used in the flushing flow, it has refused multiple KID requests that its farmers be compensated for stored water in UKL reservoir used in the flushing flow. And now, to add insult to injury, Reclamation is using KID farmers' water to repay PacifiCorp.

15. Reclamation's current diversion of stored water is depriving KID and the farmers its serves of stored water they desperately need for irrigation. **Because of the short supply of available stored water, many of the lands KID serves are completely shut-off and not receiving *any* water from UKL reservoir to ensure that farmers and ranchers in KID receive at least *some* water from UKL reservoir.** The lands that KID is contractually obligated to serve, which are not receiving *any* UKL water deliveries include 10,342 acres of land in Klamath Basin Improvement District, 3,991 acres of land in Shasta View Irrigation District, 2,981 acres of land within Enterprise Irrigation District, 904 acres of land in Pine Grove Irrigation District, as well as other lands in Poe Valley Improvement District, Sunnyside Irrigation District, and numerous individuals to whom KID owes water delivery obligations. The reason these districts/individuals are completely shut off is the various contractual arrangements are understood to give KID priority to water delivery in times of shortages. However, current circumstances are so dire that even depriving all of these districts and farmers of water delivery will not enable KID to fully satisfy the water rights demands of its own landowners.

16. It has been nearly 2.5 months since KID originally asked OWRD to take charge of UKL pursuant to ORS 540.210 on April 3, 2020. During this time, OWRD has made a few requests for information, much of it extraneous (e.g., KID was asked to provide information on the number of

livestock and houses located the more than 100,000 acres of lands it serve). It has also issued a couple of interim orders that were worded in a matter that ensures they have no practical effect. I am not aware of OWRD doing anything to actually divide and distribute stored water in UKL reservoir to the persons entitled to it. To date, no final order has been issued determining how stored water in UKL reservoir must be distributed through Link River Dam. Nor has OWRD has exercised any physical control over the distribution of water from Link River Dam.

17. The dramatic increase in the diversion of stored water through Link River Dam began shortly before June 10. Hearing on KID's pending injunction motion will not occur until June 18, 2020. If 1,000 cfs to 1,600 of stored water from UKL reservoir continues to be diverted through Link River continues through such date, KID and the farmers it serves will have been deprived of somewhere between 17,847 acre-feet (i.e., 1000cfs x 1.983 x 9 days = 17,847) and 28,555.2 acre-feet of stored water (i.e., 1600cfs x 1.983 x 9 days = 28,555 acre-feet). **This quantity of water is enough to supply one acre foot of water to at least the 10,342 acres of land in Klamath Basin Improvement District, 3,911 acres of land in Shasta View Irrigation District, 2,981 acres of land within Enterprise Irrigation, and 904 acres of land in Pine Grove Irrigation District, which are shut-off and not receiving *any* water from UKL reservoir.**

18. KID's believes that pursuant to ORS 540.210, ORS 540.720, ORS 540.170, and other laws, KID is entitled to have OWRD divide and distribute stored water in UKL reservoir to the persons entitled to it under their water rights, and not otherwise. Once OWRD fails to enforce the law, KID's right to have OWRD prevent injury from this unlawful distribution of water is gone forever, along with the water that is desperately needed by the farmers and ranchers KID serves. Thus, the injury that will occur if OWRD continues to allow water to be distributed from UKL reservoir without a water right between now and next Thursday's scheduled hearing is irreparable.

19. Also, Klamath is known for its short growing season and each farmer KID serves has their own individual farming operation. At a certain point, it becomes too late to plant a crop and too late to resuscitate a dying one. When exactly that point is reached varies from farmer to farmer. Therefore, the harm cause by OWRD's unlawful refusal to carry out its mandatory duty to

distribute stored water in UKL reservoir in accordance with law is not remedied by the possibility that OWRD will decide to do so, or may be ordered to do so, at some future time.

20. In view of this situation, KID is asking the Court for a temporary restraining order that compels OWRD to exercise all of its available authorities, as necessary, to prevent water from being distributed through Link River Dam without a water right until at least the time of the hearing on KID's motion for an injunction pursuant to ORS 540.740.

21. The balance of the harms and equities and consideration of the public interest tips heavily in KID's favor. Each and every day I am constantly working to manage the available supply of water in a manner that will stretch it as far as possible. Notably, **KID is not delivering *any* water to thousands and thousands of acres we are obligated to serve to ensure that some farmers in KID will at least receive *some of the* water they need during the 2020 irrigation season**. Given this dismal and heartbreaking reality, it is simply beyond belief that OWRD, which is responsible for distributing water from UKL reservoir in accordance with ORS 540.210 and other law, would argue that the diversion of stored water from UKL reservoir without a water right does not injure KID and the farmers it serves. KID operates the A Canal to remove water from UKL. There is currently water at our head gates for us to divert and it is physically possible from KID to divert more than we are currently using at this moment in time. We have refrained from doing so, despite the desperate need for such water amongst our farmers and ranchers, in the hopes of preserving the availability of *some* stored water for use later in the irrigation season. Obviously, KID is being injured by OWRD's continued refusal to act and tacit approval of the outflows of stored water from UKL without a water right. Were such unlawful releases not occurring, KID would have more water to use, both now and later in the irrigation season. Similarly, the fact that KID is ensuring water is available to some farmers by denying it to other farmers we serve and currently diverting less than we are physically capable of in order to make the very limited supply of stored water last longer does not mean KID is not being injured, as OWRD contends. If OWRD were to restrict these unlawful diversions of water—as it is required to do—KID would be able to honor

more of its commitments and supply more of its farmers and ranchers with adequate amounts of water.

23. A temporary restraining order requiring OWRD to distribute water from UKL reservoir in accordance with law will not harm OWRD and faithful execution and enforcement of the law is in the public interest. Additionally, if a temporary restraining order is granted, but next week the Court finds that OWRD should allow water to be distributed from UKL reservoir without a water right, OWRD will still have the ability to distribute water in such manner. Conversely, if next Thursday the Court determines that OWRD should not allow stored water in UKL reservoir to be distributed from UKL reservoir without a water right, it will be impossible for OWRD to recapture the stored water that was already unlawfully diverted from UKL reservoir and require it to be diverted in accordance with law. Additionally, a temporary restraining order that would require OWRD to prevent stored water from being distributed from UKL reservoir without a water right would not practically prevent stored water in UKL reservoir from being used to refill the pools behind PacifiCorp's reservoirs in advance of the July 4 holiday, if the Court determines that OWRD may allow water to be distributed from UKL reservoir without a water right for such purpose.

24. In considering KID's request for a temporary restraining order, I would encourage the Court to bear in mind that KID has asked OWRD to take exclusive charge of UKL reservoir and distribute water therefrom in accordance with law twice in the last three years. On both occasions, the Court ordered OWRD to take charge of UKL reservoir pursuant to ORS 540.210. However, to date, OWRD has yet to issue any final order dividing and distributing the water of UKL reservoir in accordance with the ACFFOD or exhibited any physical control over the distribution of water from UKL reservoir. OWRD's abdication of its duties and seeming defiance of the Court's orders is contrary to the public interest and extremely injurious to KID and the farmers and ranchers it serves, as well as the larger Klamath Falls community that depends on agriculture as its economic lifeblood. If you drive through KID and the districts its serves, you will see numerous fields where crops are dying and/or the ground is barren as a result of the diminished water deliveries this year.

I also believe there are a good number of farms to whom KID delivers water that may not be able to financially survive the financial losses they will suffer this year, due to a lack of water. As a result, myself and the KID Board have recently relaxed KID's policies on unpaid assessments to the District and are otherwise actively working to accommodate the financial realities our patrons are facing in light of the shortage of water.

25. Additionally, while is a very ancillary point, I would note that a true and correct copy of the declaration of Thomas Paul, which was previously submitted in Marion County Circuit Court Case No. 20CV15606 and is attached as **Exhibit 4,** expressly states that "Once water is legally stored under a storage water right it is considered a new and different source of water and not subject to a call from water right holders who hold rights authorizing diversion of stream flow." Paragraph 12 of the document is highlighted to call out where this statement is made. I would also note that in their recent submittals to appear in this case as amicus curiae, the Yurok Tribe of California acknowledge they do not have a water right in UKL reservoir. Therefore, it is evident any claim the Yurok Tribe may have in the Klamath River in California cannot be fulfilled by calling stored water in UKL reservoir because, as Mr. Paul has explained, stored water is a "new and different source of water and not subject to a call from water right holders who hold rights authorizing diversion of stream flow." Put another way, the extra water flowing down the Klamath River is only able to do so because it is ***stored water*** that exceeds the natural flow of the river.

26. KID is seeking this temporary restraining order to prevent OWRD from unlawfully dividing and distributing the stored waters of UKL reservoir to the detriment of KID farmers and ranchers its serves. Consequently, KID asks that the temporary restraining order issue without requirement for security pursuant to ORS 81A(1)(b)(ii).

I declare under penalty of perjury under the laws of the State of Oregon that the foregoing is true and correct.

Gene R Souza

_____

Gene Souza

Lieutenant Colonel, U.S. Army (Retired)
Executive Director and KID District Mana

From: MORRIS Kara B * WRD <Kara.B.Morris@oregon.gov>
Sent: Monday, June 8, 2020 10:08 AM
Subject: FW: Klamath Basin Outlook

Klamath Basin report for June 8, 2020.

Klamath current conditi...20.pdf

Klamath Basin Hydrology Report
as prepared by
Oregon Water Resources Department
on June 8, 2020

	Most recent (mean daily) conditions		Average (mean daily) for date		Last week Percent of Average	Current Percent of Average
Upper Klamath Lake, elevation (USGS) *	4,141.41	ft	4,142.68	ft		
Upper Klamath Lake, contents (USGS)	359,445	acft	463,933	acft	78%	77%
Williamson River below Sprague River	588	cfs	1177	cfs	47%	50%
Sprague R nr Chiloquin	294	cfs	794	cfs	36%	37%
Klamath River at Iron Gate Dam, CA	1,030	cfs	1710	cfs	70%	60%
Klamath Basin snow water equivalent (snowpack)	-----		-----		**	**
Klamath Basin total precipitation	-----		-----		68%	69%
Precipitation forecast for the next 5 days	0-0.25	in.				

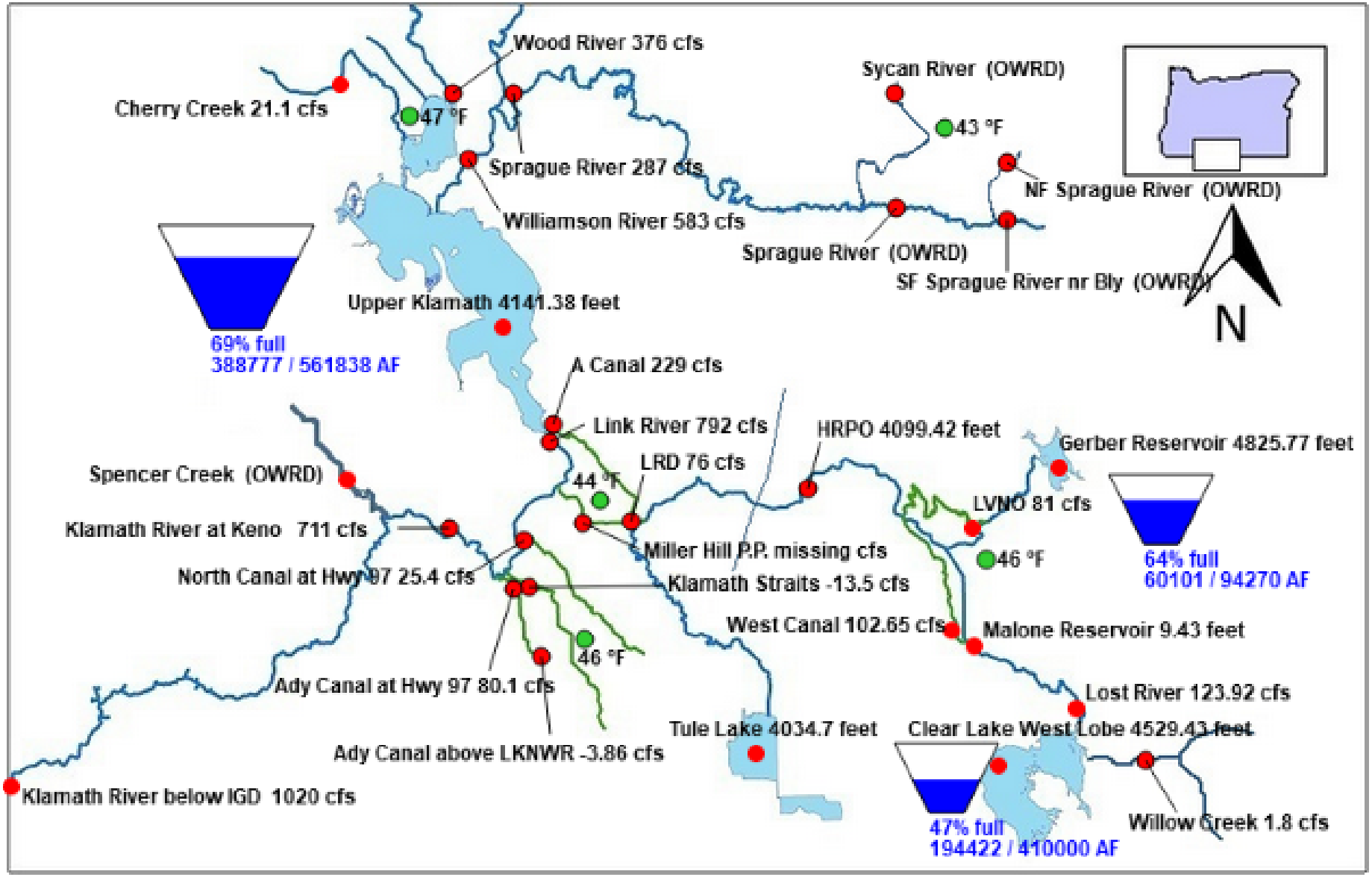
For more detailed information, please refer to the following links:

NRCS Oregon Basin Outlook Report June 2020
Klamath water conditions (USBR)
Water year to date current conditions (NRCS)
Basinwide reservoir summary (NRCS)
3 month temp. and precip. forecast (NOAA)

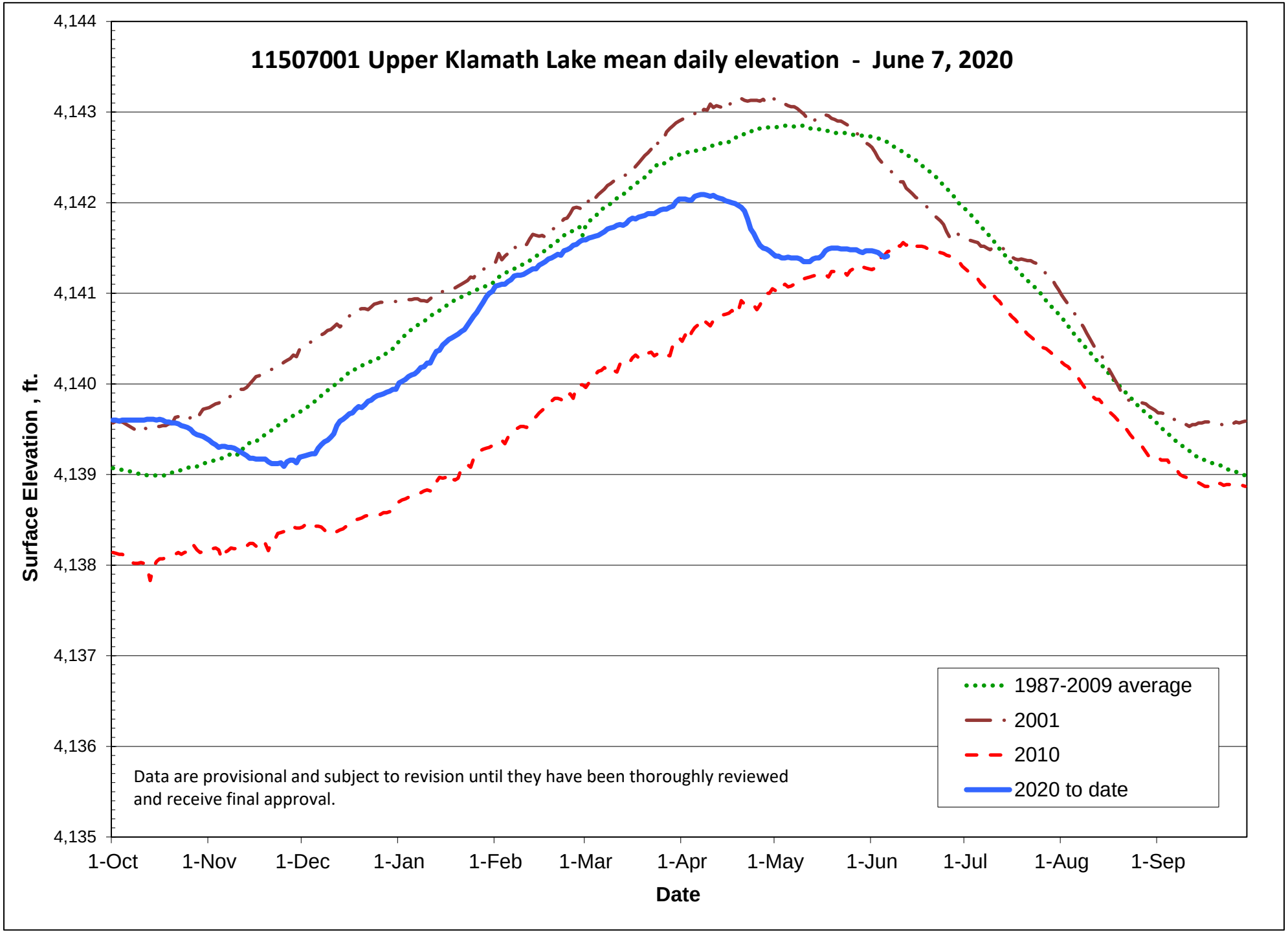
* Lake or reservoir elevation above United States Bureau of Reclamation Klamath Basin (USBRKB) Datum, feet (Mean)
**Data may not provide a valid measure of conditions.
Unless otherwise stated, average lake elevation and streamflow are based on a 30 year period from 1981 to 2010
Data are provisional and subject to revision until they have been thoroughly reviewed and received final approval.

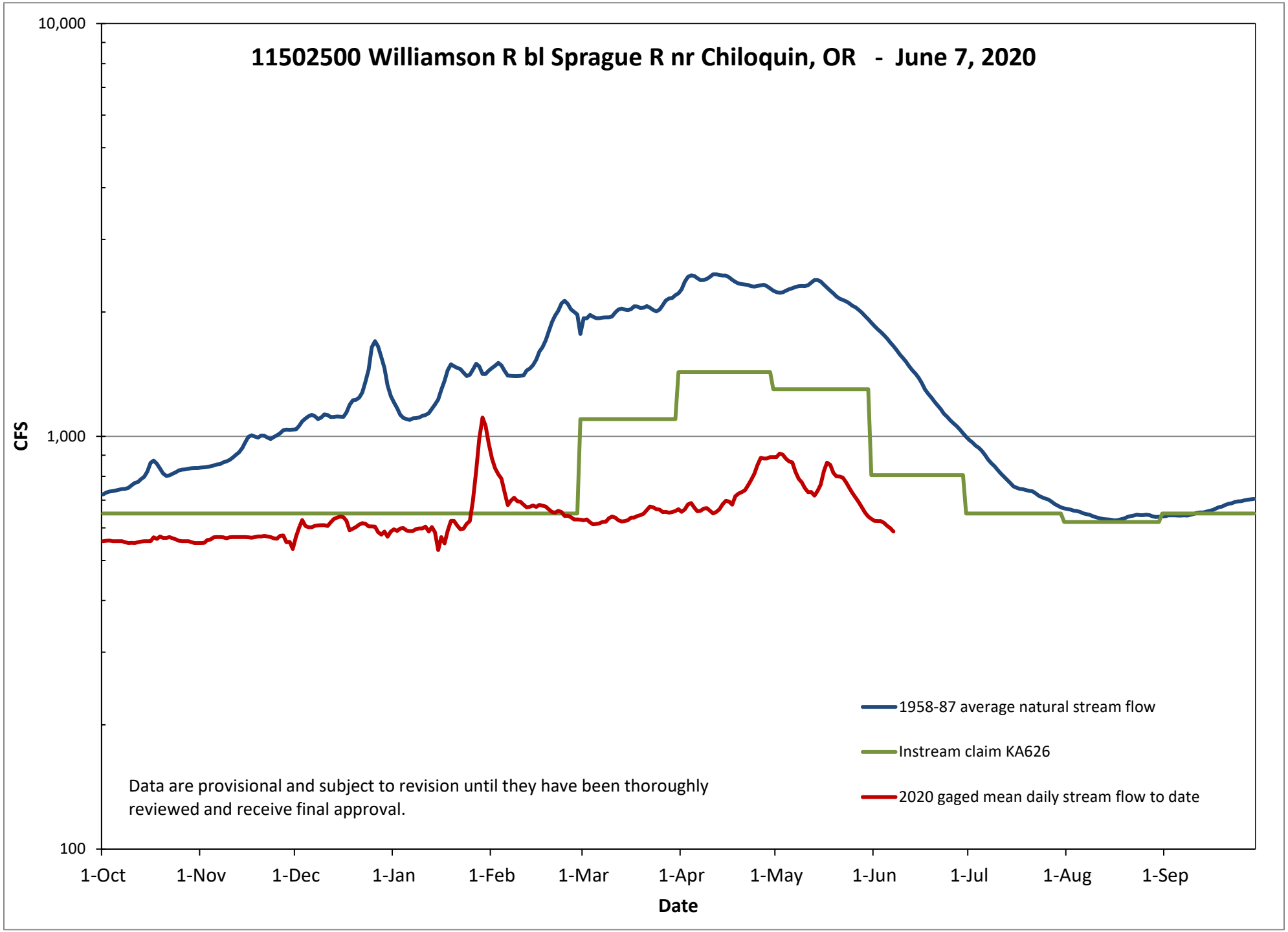
Major Storage Reservoirs in the Klamath River Basin

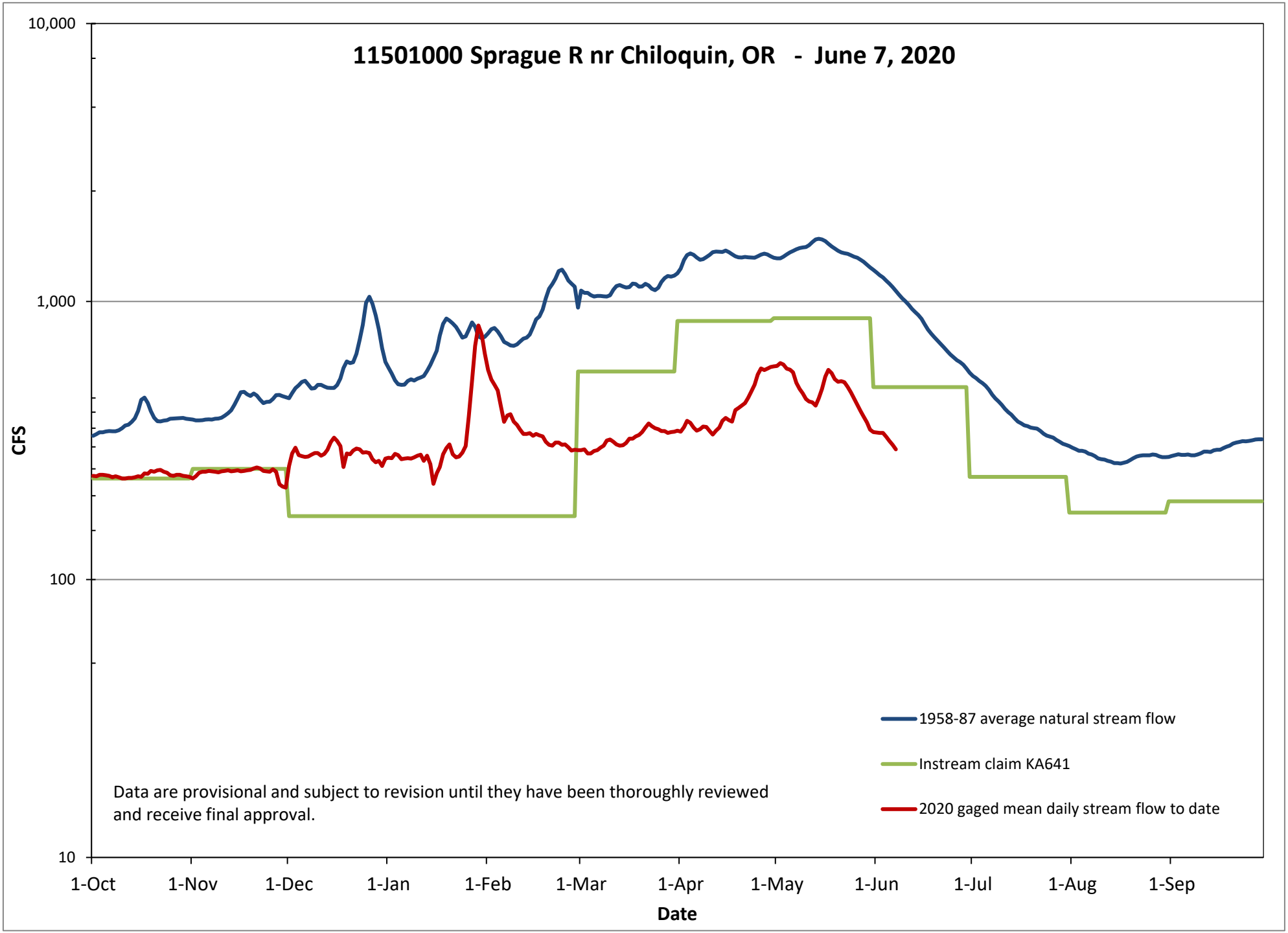
Mon Jun 08 2020 09:38:23 GMT-0700 (Pacific Daylight Time)

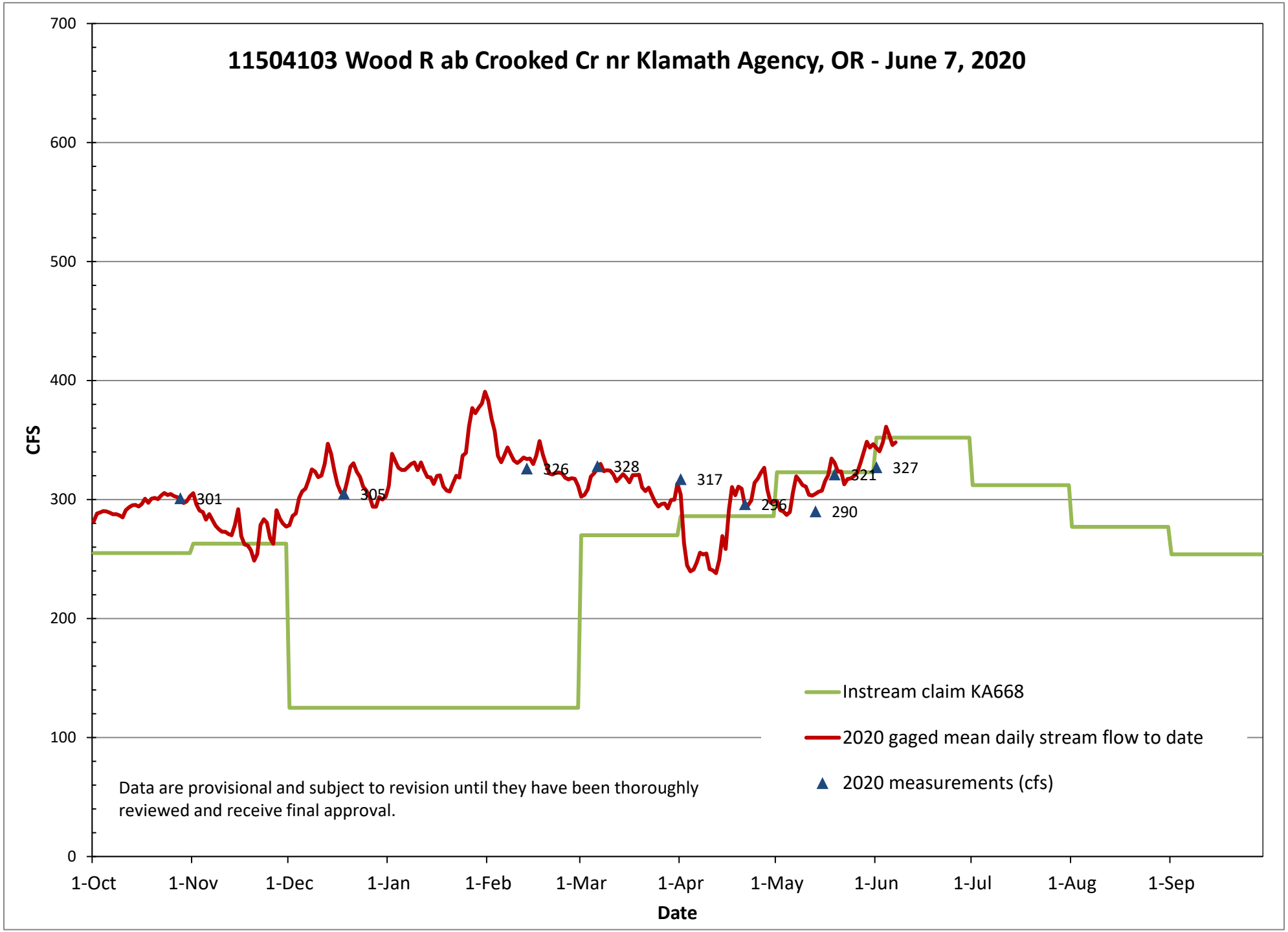


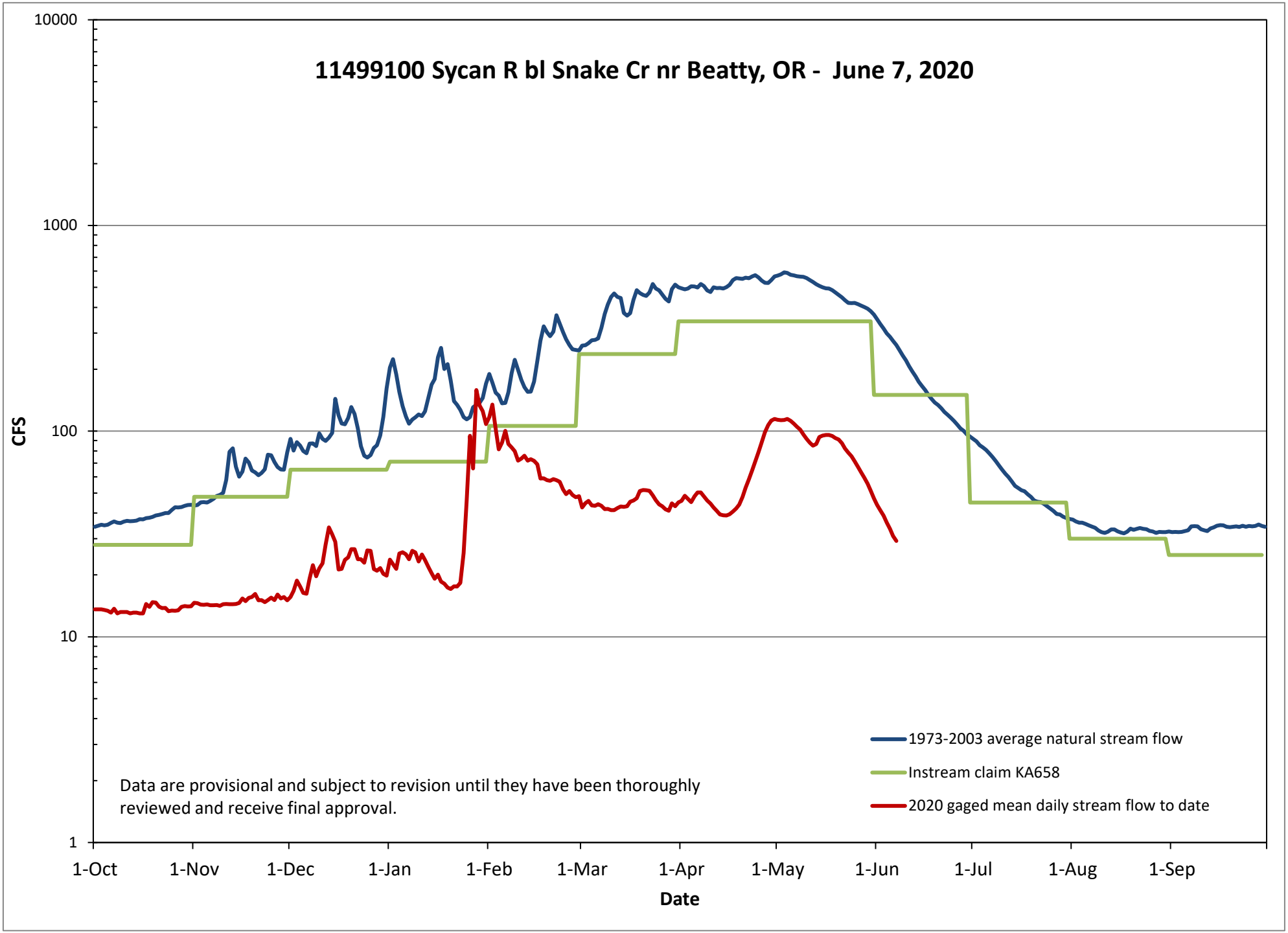
PROVISIONAL DATA - SUBJECT TO CHANGE!

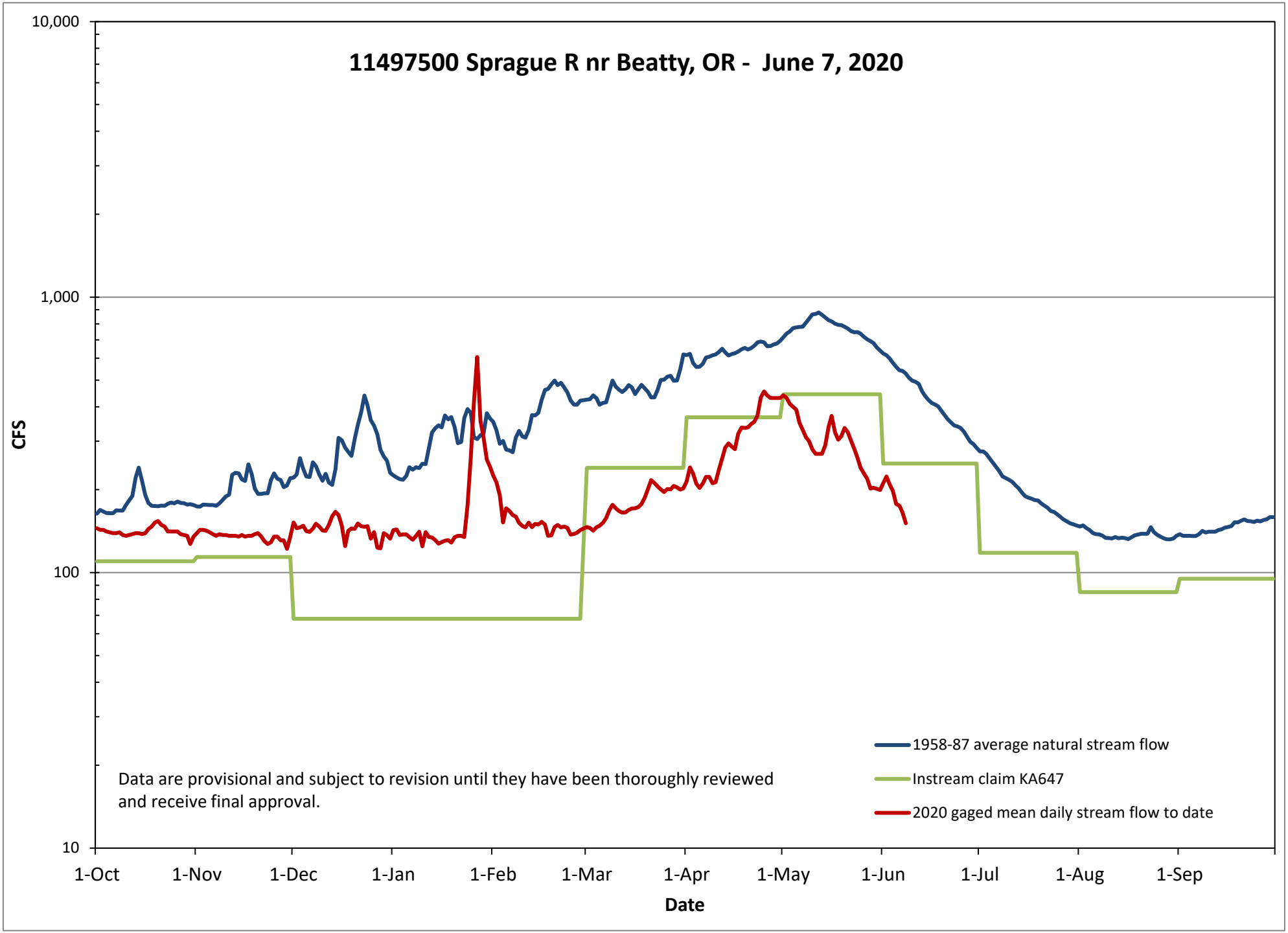

11507001 Upper Klamath Lake mean daily elevation - June 7, 2020
Surface Elevation , ft.
4,144
4,143
4,142
4,141
4,140
4,139
4,138
4,137
4,136
4,135
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Date
1987-2009 average
2001
2010
2020 to date
Data are provisional and subject to revision until they have been thoroughly reviewed and receive final approval.

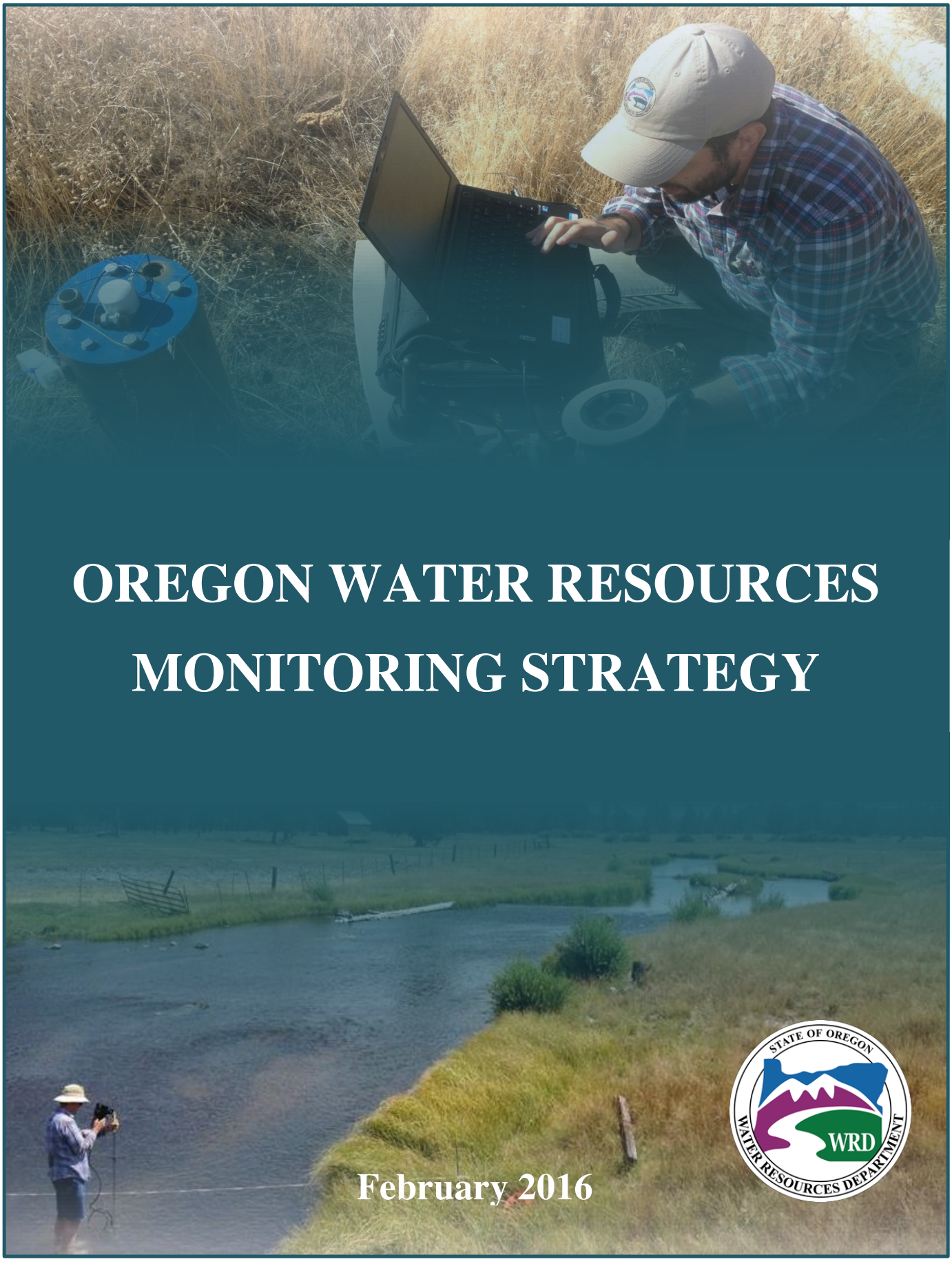

11502500 Williamson R bl Sprague R nr Chiloquin, OR - June 7, 2020
10,000
1,000
100
CFS
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Date
1958-87 average natural stream flow
Instream claim KA626
2020 gaged mean daily stream flow to date
Data are provisional and subject to revision until they have been thoroughly reviewed and receive final approval.


11501000 Sprague R nr Chiloquin, OR - June 7, 2020
10,000
1,000
100
10
CFS
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Date
1958-87 average natural stream flow
Instream claim KA641
2020 gaged mean daily stream flow to date
Data are provisional and subject to revision until they have been thoroughly reviewed and receive final approval.


11504103 Wood R ab Crooked Cr nr Klamath Agency, OR - June 7, 2020
CFS
700
600
500
400
300
200
100
0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Date
301
305
326
328
317
296
290
321
327
Instream claim KA668
2020 gaged mean daily stream flow to date
2020 measurements (cfs)
Data are provisional and subject to revision until they have been thoroughly reviewed and receive final approval.


11499100 Sycan R bl Snake Cr nr Beatty, OR - June 7, 2020
10000
1000
100
10
1
CFS
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Date
1973-2003 average natural stream flow
Instream claim KA658
2020 gaged mean daily stream flow to date
Data are provisional and subject to revision until they have been thoroughly reviewed and receive final approval.


11497500 Sprague R nr Beatty, OR - June 7, 2020
10,000
1,000
100
10
CFS
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Date
1958-87 average natural stream flow
Instream claim KA647
2020 gaged mean daily stream flow to date
Data are provisional and subject to revision until they have been thoroughly reviewed and receive final approval.



OREGON WATER RESOURCES MONITORING STRATEGY

February 2016

This page intentionally left blank.

TABLE OF CONTENTS

LIST OF ACRONYMS

ASR/AR	Aquifer Storage and Recovery/Aquifer Recharge
DEQ	Oregon Department of Environmental Quality
Department	Oregon Water Resources Department
IWRS	Integrated Water Resources Strategy
NRCS	Natural Resources Conservation Service
ODFW	Oregon Department of Fish and Wildlife
OWEB	Oregon Watershed Enhancement Board
RAFT	Rapid Assessment of Flooding Tool
STREAM Team	STRategic Enterprise Approach to Monitoring Team
USGS	U.S. Geological Survey

ACKNOWLEDGEMENTS

The development of this Monitoring Strategy was a cooperative effort among various staff at the Water Resources Department. In particular, the following people are gratefully acknowledged for their significant contributions in leading this effort and completing the Department's first Monitoring Strategy.

Mellony Hoskinson, Rachel LovellFord, and Ken Stahr led its development.

In addition, Brenda Bateman, Technical Services Division Administrator; Jonathan LaMarche, South Central Region Office; Rich Marvin, Surface Water Hydrology Section; Ivan Gall, Karl Wozniak, and Ken Lite, Groundwater Hydrology Section; and Alyssa Mucken from the Director's Office participated and contributed to the development of this strategy.

INTRODUCTION

The vision of the Water Resources Department is to assure sufficient and sustainable water supplies are available to meet current and future needs. In order to properly manage Oregon's water resources to meet these needs, the Department must have a strategy in place and have the means for measuring both surface water and groundwater resources. A network of strategically placed stream gages and observation wells enable Department staff to collect valuable data about water resource conditions across the state at any given time. The challenge is to have a monitoring network design that adequately, efficiently, and effectively captures water resource data essential for proper management of the state's water resources. This strategy identifies the Department's monitoring priorities and recommends monitoring actions that will ensure the vision of the Department is being met.

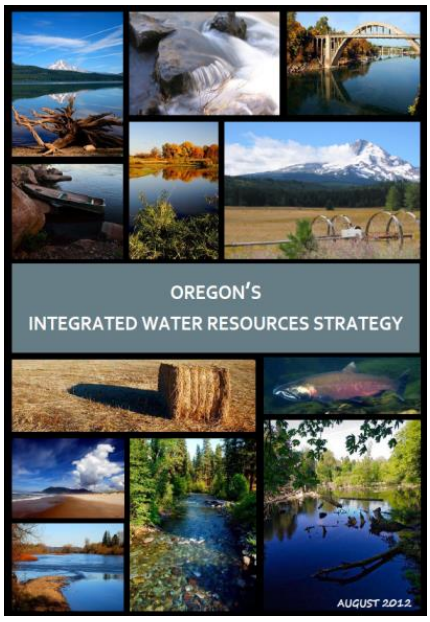
Background

In 1988, the Department's groundwater section developed a framework as part of its Observation Well Network Review (Miller and Lite, 1988). The framework helped determine whether a proposed well was suitable for the state's observation well network and whether the resulting data would be valuable. A review form was developed and instructions and flow diagrams were provided to determine how to rank each proposed well in the network.

In 2008, the Department undertook a similar evaluation of its stream gage network. The purpose of this effort was to determine if the network met the needs of the Department, to identify "high value" stream gages, and to describe an optimum network, given staffing and budget constraints. As an initial step, the evaluation focused solely on distribution and regulation needs. The Department published its findings and recommendations in an open file report titled, *OWRD Stream Gaging Network Evaluation for Water Distribution* (LaMarche, 2011).

Integrated Water Resources Strategy

Oregon's Integrated Water Resources Strategy (IWRS), adopted by the Water Resources Commission in 2012, describes numerous coming pressures that may affect Oregon's water needs and supplies in the future. These include climate change, population growth, economic development, and changes in land use, among others.



Oregon's IWRS also calls on the Department to improve water resources data collection and monitoring methods (Recommended Action 1B). This Monitoring Strategy is a response to the IWRS, further strengthening the state's monitoring and data collection network.

Another IWRS action addressed by this Monitoring Strategy is Recommended Action 1C, "coordinate inter-agency data collection, processing, and use in decision-making." The Department's data collection standards were developed in coordination with the U.S. Geological Survey (USGS). The Department shares groundwater and streamflow data with several federal agencies, including the USGS, the Natural Resources Conservation Service (NRCS), the U.S. Army Corps of Engineers, and the U.S Bureau of Reclamation. The Department is also a member of

Oregon's STREAM Team (see inset), which is made up of several state agencies that monitor Oregon's waters, both quantity and quality.

Efficient Use of Resources

This Monitoring Strategy is designed to ensure that the Department is making the most efficient and effective use of funding and resources to build its monitoring network. The Department is designing its network around the monitoring needs of the state and providing staff and partners with much needed information to anticipate and adapt to coming pressures.

Monitoring Priorities

The Department has identified the following priorities for monitoring:

- Climate Change
- Extreme Events
- Groundwater
- Water Management
- Instream Needs
- Water Supply
- Partnering with Other Agencies (see STREAM Team box)

For each priority, the Department has identified recommended monitoring actions to meet the related data needs. These are described in further detail in the following pages.

STREAM Team

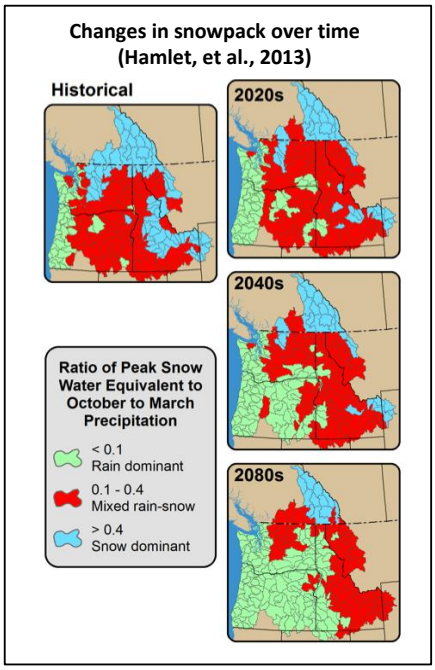
Oregon's STREAM Team is made up of many of the state's natural resource agencies which all monitor Oregon's water for various public purposes. 'STREAM' stands for *STRategic Enterprise Approach to Monitoring.* State agencies that make up this team include:

- Oregon Department of Agriculture
- Oregon Department of Environmental Quality
- Oregon Department of Fish and Wildlife
- Oregon Department of Forestry
- Oregon Department of State Lands
- Oregon Health Authority
- Oregon Water Resources Department
- Oregon Watershed Enhancement Board
- Oregon State University's Institute of Natural Resources

The STREAM Team facilitates collaborative decision making to support a healthy environment through coordinated planning, monitoring, and communication of water-related data and information among Oregon's natural resources agencies. One of the main goals of the STREAM Team is for each agency to develop an interactive monitoring strategy in support of collaborative decision making for water quality, water quantity, and ecosystem services. These strategies are designed to be used as communication tools among the agencies in managing the state's water resources.

MONITORING PRIORITIES

To fully understand and address each of the following priorities, the Department relies on monitoring data. Below, the Department has identified and recommended specific monitoring actions that should be taken in order to address each priority.



CLIMATE CHANGE

World renowned climate change research is taking place within Oregon's university system, and is helping the state prepare for a changing hydrologic regime. With a predicted increase in regional mean temperature of 3.3 to 9.7 degrees Fahrenheit by the end of this century, Oregon can expect to see the percentage of precipitation that falls as rain instead of snow to increase significantly (Mote, et al., 2014). Precipitation arriving as rain instead of snow may contribute to increased frequency and magnitude of high flow events, decreased summertime snowmelt run-off, and reduced recharge to groundwater aquifers.

The state needs a monitoring network that is designed to capture data necessary to observe and quantify these shifts and changes. These data can provide water users and planners with the information needed to adapt and build resiliency within our water management systems.

Recommended Monitoring Actions

- Identify basins susceptible to changing flow regimes (e.g., basins that receive a significant percentage of precipitation as snow) and establish gages to quantify the rate of change in the magnitude, frequency, duration, and timing of streamflow.
- Identify groundwater systems with areas of recharge within the rain-snow transition zone; monitor groundwater level responses to climatic impacts.
- Work with the USGS and other partners to support long-term, natural streamflow monitoring stations that have previously been used to assess climate impacts on water supplies (e.g., USGS Hydro-Climatic Data Network stations, Geospatial Attributes of Gages for Evaluating Streamflow stations).

Watermaster Travis Kelly at Mt. Ashland Ski Bowl Road Snow Course Site (April 1, 2015)

EXTREME EVENTS

FLOODS

Floods are common and widespread natural hazards in Oregon and increasing occurrences of floods are anticipated due to a changing climate (Mote, 2013). Changing land-use patterns, a growing population, and the occurrence of wildfires also contribute to the increasing impacts of floods. In Oregon, flooding generally occurs due to extreme precipitation events, rapid snowmelt, or rain-on-snow precipitation events. In the next few decades, extreme precipitation events may increase, but exact locations cannot be predicted with certainty.

Oregon Christmas flood of 1964

Gages that accurately capture high flow events help planners and engineers effectively plan for floods. However, not all stream gages accurately capture flood data. In some cases, the stream comes out of bank and the flow by-passes the gage. In other cases, there is not suitable cross-section in which to measure high flows. The Department needs more gages that effectively monitor floods and accurately capture high flow data. Such gages are used in the Department's Peak Flow Estimation Program and in real-time emergency response tools such as the Rapid Assessment of Flooding Tool (RAFT). RAFT is an interactive, near real-time tool developed by the Oregon Silver Jackets team that characterizes the severity of forecast flooding. Gages used for monitoring floods also play a key role in statistical flood frequency analysis (i.e., the frequency and impact of 10-year, 100-year, or 1,000-year floods). Combined with the Federal Emergency Management Agency (FEMA) floodplain maps, these gages can help communities respond to flood events in real time.

Recommended Monitoring Actions

- Identify gages that measure natural peak flows contained within channel and can be measured. Increase the number of high flow measurements or relocate these gages.
- Upgrade gages in flood-prone areas to transmit data in real-time for flood forecasting and early warning systems. Work with other state agencies and municipalities to identify at-risk areas.
- Identify watersheds within the RAFT program that would benefit from additional gages and/or additional measurements.
- Deploy temporary gages for real-time monitoring of high flow events.

DROUGHT

Drought conditions can result from low winter snowpack, a lack of precipitation, and warm temperatures. Oregon has a history of frequent, single-year droughts, particularly on the east side of the state. In 2015, some parts of Oregon were in year four of a multi-year drought, breaking historic records for the lowest observed snowpack and high summer temperatures. This provided water managers a glimpse into potential future water conditions in Oregon. Improved monitoring for low streamflows and groundwater levels is critical for both drought management and resiliency planning.

Stream gage on Fifteenmile Creek measuring 0.00 cfs. August 24, 2015

Water supply forecasts, such as those developed by the NRCS and the Northwest River Forecast Center, rely on stream gage data from rivers throughout the state. However, not all gages accurately capture low-flow events. In some cases, the stream should have an engineered control structure in place, such as a v-notch weir to focus flow so that it can be measured. Accurate low-flow measurements help to track water supplies for real-time distribution and allow for trend analysis and prediction of future low-flow events. Gages useful for tracking drought include those used to distribute water during low-flow periods (e.g., summer and fall), gages with high-quality records associated with the lower end of the rating curves, and gages used by other regulatory agencies that compute low-flow statistics.

Recommended Monitoring Actions

- Establish streamflow gages in locations that are vulnerable to low-flow conditions, to help with water supply forecasting.
- Establish water-level gages or inflow and outflow gages on reservoirs that provide water supplies or instream releases and that are also susceptible to short-term drought.
- Identify gages currently used for low-flow distribution and drought statistics; upgrade to near real-time, as needed.

WILDFIRE CONDITIONS

With recent fires in the Pacific Northwest, especially those of intense severity, expect to see extreme flash flooding conditions and debris flows during the fall and winter months following these fires. Other potential effects from wildfires include erosion and rapid run-off of precipitation due to decreased soil porosity. Watersheds under burned conditions may see the rate of streamflow increase by 10-100 times or more, compared to previously recorded high flows (Neary, 2003).

Recommended Monitoring Action

- Place traditional streamflow gages or rapid deployment gages in recently burned watersheds to track and send alerts regarding potential flash flooding and debris flows.

GROUNDWATER PROTECTION

GROUNDWATER LEVEL TRENDS

Monitoring groundwater levels provides valuable scientific data for hydrogeologic studies and informs the Department's decision-making with regard to permitting and conjunctive water management. The Department has a need for additional groundwater data and basin studies to better understand the capacity, location, and extent of Oregon's aquifers. These studies are also useful for assessing groundwater availability and quantifying surface water/ groundwater interactions.

Karl Wozniak and Aurora Bouchier, OWRD staff, near City of Sublimity, 2014

Recommended Monitoring Actions

- Construct dedicated observation wells in key aquifers around Oregon to expand and improve long-term groundwater level data collection; locate wells in areas of high groundwater demand, hydraulic connection between aquifers and streams, and groundwater recharge locations.
- Install data logging equipment in key observation wells to expand the continuous groundwater level data collection network.
- Estimate annual aquifer recharge rates for basins in Oregon, and compare aquifer recharge to aquifer discharge (via pumping wells, or discharge to streams and springs).

UNDERSTANDING SURFACE WATER / GROUNDWATER INTERACTIONS

Groundwater discharges to streams, springs, and rivers throughout the year, providing critical surface water flows during the dry months of the year. Groundwater and surface water are hydraulically connected at multiple scales, with the interaction controlled primarily by the geologic framework of the basin. Streams often gain flow from groundwater, but in some cases streams lose water into the aquifer. These exchanges can reverse seasonally or more frequently depending on the basin. Both groundwater level and stream discharge monitoring help Department scientists understand and quantify the stream-aquifer interaction. Oregon manages surface water and groundwater conjunctively, so a clear understanding of stream-aquifer interaction is key to protecting senior water rights. By coupling stream and aquifer monitoring in key basins, Department scientists will have a better understanding of these interactions.

Recommended Monitoring Actions

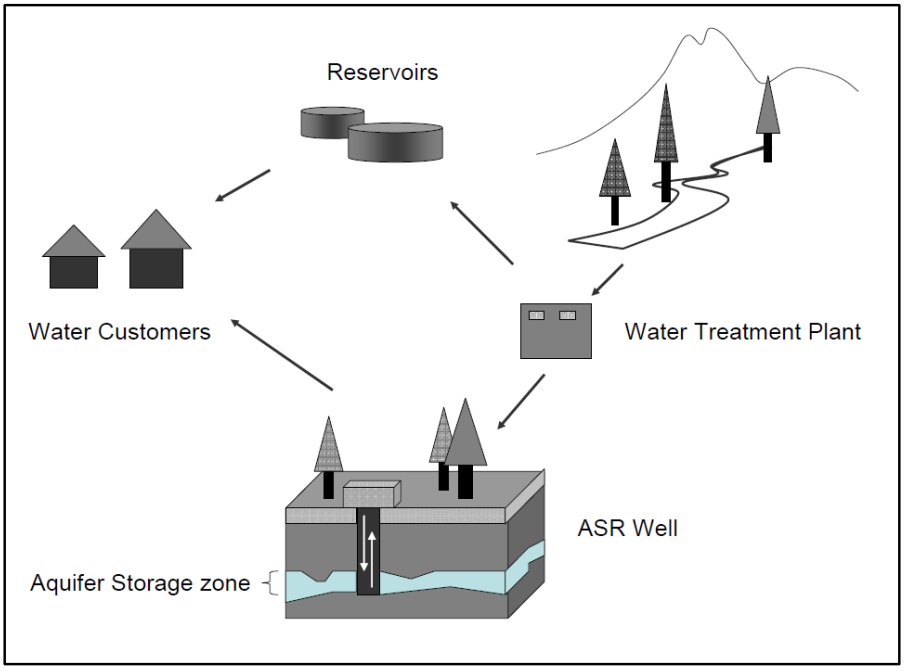
- Pair stream gages with observation wells in areas of stream-aquifer interactions.
- Target key basins for dedicated observation well installations to be monitored in conjunction with stream gages.
- Rank streams in Oregon based on the percent of annual yield contributed by groundwater. This ranking would provide a way to structure and prioritize long-term monitoring activities.

AQUIFER STORAGE AND RECOVERY & AQUIFER RECHARGE

In Oregon, the relatively wet climate during the winter months makes Aquifer Storage and Recovery (ASR) and Aquifer Recharge (AR) viable water storage techniques. During the summer dry season, water use typically peaks due to increased irrigation and municipal demand, while surface water supply is at its lowest. Many communities have surface water rights in the high flow winter months that are not fully utilized. ASR and AR can capture some of this flow and store it in aquifers to supplement dry season water supplies (Woody, 2007).

Recommended Monitoring Actions

- Construct dedicated observation wells in key basalt aquifers around Oregon to expand and improve long-term groundwater level data collection. Target wells in areas of potential ASR and AR projects with nearby surface water supplies.
- Expand continuous groundwater level data collection in key observation wells.
- Work with local water users to conduct ASR and AR feasibility studies for specific projects and water needs.



ASR system illustration. (Woody, 2007)

WATER MANAGEMENT

IMPROVE EFFECTIVENESS OF DISTRIBUTION AND REGULATION

The Department's watermaster corps is responsible for enforcing Oregon water laws in the field. In order to make effective and timely decisions, including calls for regulation of water, field staff need access to data that are accurate and up-to-date.

Recommended Monitoring Action

- Place gages in locations that will help distribute water and validate regulation calls quickly. In particular, select reaches where regulation takes place frequently. Optimal sites may include areas near large water withdrawals or at specific locations named in water rights.

OWRD Watermaster Nikki Hendricks

PREDICTING THE RESPONSE OF THE HYDROLOGIC SYSTEM TO DIVERSION / APPROPRIATION

Effective modeling can help determine the response of the hydrologic system to groundwater pumping and surface water diversions. The Deschutes Basin model, for example, developed in partnership with the USGS, demonstrates the effects of groundwater pumping on other wells in the system and also on streamflows. The sophisticated models used by the Department and its partners show how varying well depths and distances can affect other water users, while also affecting groundwater travel time and water quality.

Recommended Monitoring Actions

- Establish observation wells and stream gages in areas where groundwater basin studies will take place.
- Establish observation wells where the volume of requests for groundwater permits is high, and the number of recent groundwater-level measurements is low.

WATER AVAILABILITY

During the 1989 – 1991 biennium, the Department began to develop a Water Availability Program. The program uses computerized hydrologic models that include streamflow and run-off measurements to characterize the timing and volume of streamflow throughout the basin. This model is used by Department staff to determine the availability of water when conducting evaluations of new water use applications.

Recommended Monitoring Actions

- Establish natural flow stream gages in areas likely to see an increase in water development in the near future to adequately capture before and after conditions.
- Establish gages above diversions and impoundments in major streams (i.e., measure natural streamflow) throughout the state.
- Establish evapotranspiration measurements to improve water availability consumptive use estimates.

- Improve the resolution of the water availability model by establishing gages in regions of the state where stream gage density needs to be increased.

WATER USE DATA

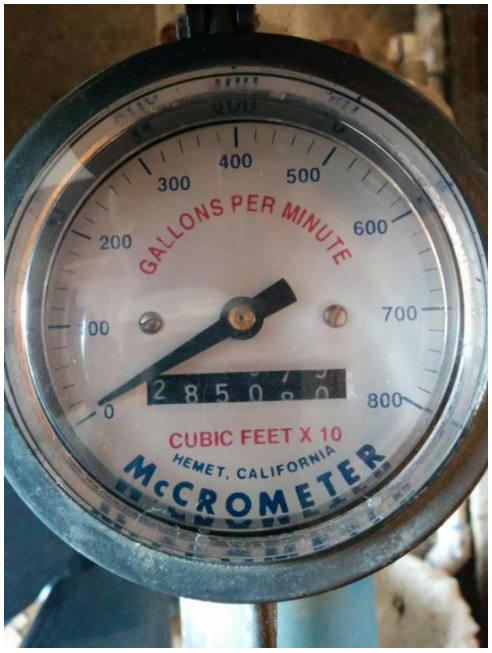
Water use information is critical for timely water management decisions, water resources planning, and hydrologic analyses. These data are often used to determine sustainable groundwater withdrawals or basin water budgets. Water use data differ from stream gage data collected at diversions in that they are self-reported by water users on a monthly basis. Totalizing flowmeters are typically installed to capture water use information at diversions or wells.

Water use reporting is required for approximately 23 percent of water rights in Oregon. Governmental entities, such as municipalities and irrigation districts, are required to track and report water use data. Since the late 1980's, some water permits have been conditioned to report monthly water use information annually to the Department. This Monitoring Strategy seeks to build upon already existing investments in the Water Use Reporting Program.

In 2000, the Water Resources Commission approved a strategic plan for improving water management statewide. The Plan focuses on measurement of diversions with the greatest impact on streamflows in areas with the greatest needs for fish. The Water Resources Department developed a statewide inventory of approximately 2,300 "significant diversions" within 300 high priority watersheds across the state. This represents about 10 percent of all the diversions in these watersheds, but accounts for about 50 percent of all water diverted in the state.

Recommended Monitoring Actions

- Coordinate the Water Use Reporting and Significant Points of Diversion programs.
- Establish quality assurance procedures to verify the accuracy of water use data.
- Monitor and report surface water diversions in high priority watersheds.
- Establish a water use reporting requirement for irrigation wells in declining or critical groundwater areas.
- Integrate the Water Use Reporting program with quasi-real-time water management.
- Utilize satellite-based remote sensing imagery to estimate consumptive use on irrigated lands.
- Collect groundwater use data from observation wells that are actively pumped.



Inline Totalizing Flow Meter

DAM SAFETY

Willow Creek Dam above the City of Heppner

Oregon's dam safety program pertains to dams that are taller than 10 feet and that hold more than 9.2 acre-feet of water. The program assigns hazard ratings, based on the density of population and property located below the dam. The program also assesses whether each dam is in satisfactory, fair, poor, or unsatisfactory condition. Water managers monitor the condition of local dams to guard against dam failures and downstream loss of life and property. Dam designs must include methods for determining if the dam is operating properly, and may include monitoring reservoir water levels to ensure the safe operation of a storage project. Regular inspections, coupled with monitoring capability and early warning systems, are critical to public safety and the success of Oregon's Dam Safety Program.

Recommended Monitoring Action

- Place gages to appropriately serve as early warning systems for high flow events that could indicate dam failures. Prioritize high hazard dams that have been evaluated as unsafe.

INSTREAM NEEDS

CHARACTERIZING INSTREAM NEEDS

In 1987, the Oregon Legislature recognized the protection of water instream as a beneficial use. The Water Resources Commission and the Department were directed to hold water in trust for recreation, pollution abatement, navigation, and the maintenance and enhancement of fish and wildlife populations and their habitats. To meet this directive, Department hydrologists must quantify the amount of instream flows needed to meet each beneficial use. Quantifying instream flow needs requires an understanding of the magnitude, frequency, duration, timing, and rate of change of streamflow.

Recommended Monitoring Actions

- Identify basins with sensitive, threatened, and endangered species (e.g., coastal tributaries) and install monitoring equipment to help characterize the suite of flows through these basins.
- Collaborate with other state agencies and watershed councils to monitor streamflow in order to support restoration and conservation activities.

Coho Salmon, Eagle Creek

PROTECTING A SUITE OF INSTREAM FLOWS

Instream water rights are enforced based upon priority date similar to consumptive water rights. There are a variety of tools available to protect water instream, from issuing instream water rights and designating scenic waterways, to authorizing instream transfers, and conditioning new permits. New instream protections often include some type of monitoring requirement.

Recommended Monitoring Actions

- Increase the number of stream gages with telemetry (real-time monitoring) in reaches with instream water rights.
- Increase the number of gages in streams where water has been transferred to instream water rights.
- Ensure there is a stream gage located at the mouth of each state scenic waterway.

WATER SUPPLY

MEETING FUTURE WATER DEMANDS

Oregon's water challenges are expected to intensify over time, driven by increases in population, changes in climate, and shifts in land use, and economic conditions. These drivers will affect water demands and water management practices across the state. In 2015, Oregon updated its water demand projections, which show a potential increase in total consumptive water demand by up to 15 percent before the year 2050 (OWRD, 2015). Both surface water and groundwater supplies will need to be monitored carefully to prevent further depletion of limited water supplies.

Irrigation in Central Oregon

In areas where surface water is fully allocated, groundwater is becoming a commonly used new source of supply. In a natural groundwater system, recharge is equal to discharge, with the net recharge equal to zero. In a groundwater system with pumping, understanding the balance between recharge and discharge is important for responsible management of the resource.

Recommended Monitoring Actions

- Establish stream gages and monitoring wells in watersheds with projected increased demand in locations that allow for tracking of the entire water distribution network.
- Employ the Department's Water Use Reporting Program to track demand over time.
- Use telemetry in wells to monitor actual groundwater use in each basin.

FORECASTING SEASONAL WATER SUPPLY

Gages that provide key information about streamflow patterns are crucial for accurately characterizing water supplies. Spring and summer forecasts utilize stream gage data from earlier in the year to predict the likely median streamflow at a site. These forecasts are based on historic streamflows, snowpack amounts, groundwater levels, and climate data. Gages that can be used to provide information for water supply forecasting include gages with a minimum of 20 to 30 years of record and gages that monitor natural streamflow.

Recommended Monitoring Actions

- Ensure communities in every basin have access to natural streamflow data from long-term, high-elevation gages, mid-level snow survey sites, and baseline groundwater levels.
- Participate with federal partners in the Jet Propulsion Laboratory's "Airborne Snow Observatory" (ASO) Program. ASO is a LiDAR-based system used to quantify snowpack conditions which will provide complete, accurate real-time water supply data for water management.

PARTNERING WITH OTHER AGENCIES

The Department partners with public and private sector entities to monitor and share data about Oregon's streams and aquifers. These partnerships help leverage limited state resources and serve as conduits for communication. Cooperative gages and wells have been identified by state and federal partners as useful for meeting various legal obligations and institutional needs.

DEVELOPING FLOW PRESCRIPTIONS

The state of science on instream flow needs has evolved greatly since the establishment of Oregon's Instream Water Rights Act in 1987. Although establishing new instream water rights is an effective strategy for protecting water instream, the state has other tools and options at its disposal as well. Under legislation passed in 2013, some storage projects funded through Oregon's newly created Water Supply Development Fund will be required to operate in a manner that protects diverse ecological needs. In order for both the users and the stream system to benefit, such projects will require thoughtful flow prescriptions, monitoring, and response programs.

Recommended Monitoring Action

- Work with Oregon Department of Fish and Wildlife, Department of Environmental Quality, and tribes to develop monitoring protocols in support of water supply development projects and requirements to protect seasonally varying flows.

MONITORING WATER QUALITY

Water quantity and water quality are inextricably linked. Decreased water quantity (streamflow and groundwater levels) impairs water quality; impaired water quality can have an effect on the accessibility and reliability of water supplies.

Water quality information, although generally outside of the regulatory responsibilities of the Department, plays a crucial role in water management decisions. The Department currently collects temperature data for partners who are monitoring watershed or stream health. The Department recently partnered with the Oregon Department of Environmental Quality (DEQ) to install water quality monitoring (temperature) devices at several stream gages and monitoring wells. These data are collected according to USGS standards and are publicly available through the Department's website.

Recommended Monitoring Actions

- Continue to work with DEQ to develop instrumentation deployment protocols at Department monitoring sites to support water quality monitoring programs.
- Increase the number of stream gages with reportable water temperature data to support DEQ, Oregon Department of Fish and Wildlife (ODFW), and other entities that might use the data. This includes linking the telemetered data sets with agency databases.

RESTORING AND CONSERVING HABITAT

The Oregon Watershed Enhancement Board (OWEB) funds millions of dollars of watershed restoration and conservation projects every year. Monitoring is a central component of OWEB-funded projects for project development reasons and for tracking effectiveness over time. Many local restoration and conservation partners operate long-term water quality and habitat monitoring networks in order to better understand baseline conditions and track trends in their watersheds. Baseline data, when compared to water quality or habitat standards, may trigger restoration or conservation activities. More recently, these groups have an increased interest in watershed characteristics that require continuous water quantity information. Essentially, monitoring streamflow conditions helps the state and its partners identify the most pressing restoration and conservation needs, ensures the effective use of funding, and confirms whether funding recipients have met their commitments.

Recommended Monitoring Action

- Work with OWEB to develop monitoring protocols for collecting and managing water quality and water quantity monitoring data.

Whychus Creek Watershed Restoration Project, 2011

EVALUATING THE MONITORING NETWORK

A well designed monitoring network provides accurate and reliable streamflow and groundwater level data for decision makers inside and outside the Department. This Monitoring Strategy provides a framework for evaluating the effectiveness of the Water Resources Department's current monitoring network of stream gages and observation wells.

In addition, this Monitoring Strategy identifies monitoring priorities and offers recommended actions to guide the design of the monitoring network in the future. It identifies desired site characteristics for effective monitoring of each priority and summarizes them into a succinct table format (see Table 1). This document also outlines next steps for evaluating the monitoring network. Included are a set of appendices identifying additional resources and tools that will be used for implementation.

The Department plans to evaluate current and potential monitoring sites for their effectiveness in meeting each of the priorities outlined in this Monitoring Strategy. In order to do this, however, the Department has additional work ahead. Evaluating current and potential monitoring sites starts by updating and adding site characteristics for each monitoring site in the database. Evaluating the network also means determining where there are gaps in the data and where the Department should place new monitoring sites[1].

Next steps for evaluating the monitoring network are:

1) Update and add new attributes for each monitoring site in a centralized database
2) Identify and rectify problematic sites
3) Solicit input from external partners on future monitoring locations
4) Evaluate current and potential monitoring sites
5) Determine gaps in monitoring data based on network evaluations

1) Update and add new attributes for each monitoring site in the Department's database. The Department has a list of about 40 different types of attributes for each of its stream gages and observation wells. Approximately 70% of these data have been filled in thus far. Department staff are working to update and populate 100% of these attributes. These attributes are primarily location related, such as latitude and longitude, county, and basin.

One goal of the Monitoring Strategy is to capture even more precise information about Oregon's network of monitoring stations. For example, each gage record should reflect if the streamflow is natural or if there are diversions or impoundments upstream. In addition, we should note whether the site helps to characterize surface water/groundwater interactions. Refer to Table 1 to see the set of attributes associated with each monitoring priority. The Department is updating and adding these attributes to each monitoring station record in the database, improving its ability to query information.

2) Identify and rectify problematic sites. A number of monitoring sites have issues related to poor data quality, difficult access, or serious safety concerns. As Department staff update attributes

[1] One full-time staff member could coordinate and perform these network evaluations.

in the database, these sites will be flagged as requiring relocation, service, replacement, or removal.

Poor data quality can result when field conditions, equipment, methods, or lack of staff resources do not produce accurate or usable data. Equipment may not be properly calibrated, cleaned, or functioning, or methods may not meet Department and USGS standards. Access to monitoring sites may be physically hampered by items blocking the way such as wires, tree limbs, etc.

Some monitoring sites are in locations where new landowners may deny staff access to the site. Other sites are in remote locations surrounded by steep, slippery, or difficult terrain. Some of these sites can be accessed by all-terrain vehicles, while others can only be accessed by foot. Even locations close to urban areas can present safety concerns, with heavy traffic, dogs, vandalism, or unhealthy conditions posing serious threats.

Monitoring sites that are a cause for health or safety concerns and those yielding sub-standard data should be considered for removal or relocation within the network. Alternately, these problematic sites could be rectified by implementing different types of instrumentation and/or access.

3) **Solicit input from external partners on future monitoring locations.** The Department has a modest budget to establish additional monitoring sites. These new sites will be established first and foremost, in support of the Department's mission. However, the Department seeks input from other agencies and stakeholder groups, in areas of mutual interest. If a partner has specific monitoring needs, the Department would like to learn more. Department staff have developed a form for soliciting input on stream gage needs for outside agencies or groups (see Appendix B). This form has been used by members of the STREAM Team to provide recommendations for stream gage locations. As the Department moves forward in assessing its monitoring network, these needs will be incorporated into the process.

4) **Evaluate current and potential monitoring sites.** The Department will conduct evaluations of its monitoring network to determine whether or not monitoring sites are individually and collectively providing the data needed to support the monitoring priorities of the Department. For each monitoring site, the evaluations will determine the value of the information being collected at a particular location. In addition, the evaluations will determine the effectiveness of the network as a whole and identify areas for improvement.

5) **Determine gaps in monitoring data based on network evaluations.** Once the network evaluations and scientific studies for each monitoring priority are completed, the Department can determine where any data gaps and redundancies exist. These results will also show where there are high value monitoring sites and sites that need to be decommissioned.

TABLE 1. MONITORING PRIORITIES - SITE CHARACTERISTICS

OWRD's Surface Water and Groundwater Monitoring Priorities	Sample Monitoring Site Characteristics
Climate Change	
Tracking the immediate hydrologic effects of climate change	• Measures natural streamflow • Record is long term, year round • Data are transmitted in real-time • Located in snow-rain transition zone • Located in snow dominated or snow-and-rain dominated basin • Paired with snow level monitoring sites (i.e.; SNOTEL stations)
Tracking the long-term hydrologic effects of climate change	• Differentiates climate effects from land use trends • Record is long term, year round • Located in snow-rain transition zone • Located in snow or snow-and-rain dominated basin
Extreme Events	
Predicting and memorializing floods, debris flows, and inundation	• Serves as early warning indicator of high flows and debris • Gage rating curves provide accurate measurement of high flows • Contributes to statewide flood warning response (e.g., RAFT)
Predicting and memorializing short-term drought	• Measures flow in rain and snow dominated streams, reservoirs, and aquifers • Quantifies water supplies in drought susceptible streams and aquifers • Gage rating curves provide accurate definition of low flows
Predicting and memorializing long-term drought	• Record is long term, year round • Quantifies water supplies in in drought susceptible streams and aquifers • Measures natural streamflow and water levels
Monitoring post-wildfire conditions	• Tracks real-time streamflow in recently burned watersheds
Groundwater Protection	
Ensuring sustainable groundwater levels	• Record is long term, year round • Data are transmitted in real-time • Tracks water level in areas of groundwater recharge • Monitors water level in declining areas • Monitors water level in high demand areas without many records
Gaining a better understanding of surface water/groundwater interactions	• Installation of well is in conjunction with related stream gages • Monitors water level in basins with large annual surface water yield from groundwater
Supporting Aquifer Recharge & Aquifer Storage and Recovery	• Tracks water level in areas of current or potential ASR and AR projects, especially key basalt aquifers

Water Management	
Improving effectiveness of distribution and regulation	• Picks up timely and effective signals • Tracks points of diversion/appropriation, storage, outflows • Tracks significant points of diversion
Predicting response of the hydrologic system to diversion/appropriation	• Provides data to an existing or potential model • Fills in a geographic gap in a model • Monitors water level or streamflow in groundwater study basins
Determining water availability	• Fills in a geographic gap in the Water Availability Model • Measures natural streamflow • Measures return flow • Record is long term, year round
Supporting dam safety	• Provides early warning system for high flow events
Providing water use data	• Monitors use from surface water or groundwater diversions
Instream Needs	
Characterizing instream needs	• Identifies stream type (e.g., perennial, intermittent) • Record is long term, year round • Characterizes flow regime in stream with STE species
Protecting a suite of instream flows	• Monitors stream reach with instream water rights or instream transfer • Characterizes streamflow regime in basin with storage potential
Water Supply	
Forecasting water supply	• Measures run-off from high elevation watersheds • Measures snowpack and run-off at mid-level elevations • Measures baseline groundwater levels
Meeting future water demands	• Measures actual surface water and/or groundwater use • Tracks water use in basins with projected increased demand
Partnering with Other Agencies	
Developing flow prescriptions	• Measures streamflow variability
Monitoring water quality	• Measures water quality, in addition to temperature
Restoring and conserving habitat	• Measures floodplain connectivity and stream complexity • Documents relationship between sediment transport and streamflow • Documents relationship between habitat features and streamflow

REFERENCES

Hickel, W.J., Pecora, W.T., Hendricks, E.L., and Kapustka, S.F. 1970. *Evaluation of the Streamflow-Data Program in Oregon.* United States Geological Survey.

LaMarche, J. 2011. *OWRD Stream Gaging Network Evaluation for Water Distribution*. Oregon Water Resources Department.

Mote, P., A. K. Snover, S. Capalbo, S. D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder. 2014. *Ch. 21: Northwest. Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 487-513.

Miller, D. and Lite, K. 1988. *Observation Well Network Review*. Oregon Water Resources Department.

Neary, D. G., Gottfried, G.J., and Folliott, P.F. 2003. *Post Wildfire Watershed Flood Responses.* Proceedings of the 2nd International Fire Ecology Conference, American Meteorological Society. Volume 65982.

Netherlands Organization for Applied Scientific Research, 1986. *Design Aspects of Hydrological Networks.* World Meteorological Organization.

Oregon State Engineer. 1913 – 1974. *Biennial Reports of the State Engineer to the Governor of Oregon.* Oregon State Engineer Office.

Oregon Water Resources Department. 1974 – 2000. *Biennial Reports of the Oregon Water Resources Department.* Oregon Water Resources Department.

Oregon Water Resources Department. 2012. *Oregon's Integrated Water Resources Strategy*. Oregon Water Resources Department.

Oregon Water Resources Department. 2001 – 2014. *Water Resources Department Annual Performance Progress Reports.* Oregon Water Resources Department.

Oregon Water Resources Department. 2015. *Oregon's 2015 Statewide Long-Term Water Demand Forecast*. Oregon Water Resources Department.

Searcy, J. K. 1959. *Flow-Duration Curves* (Report No. 1542A). U.S. Geological Survey.

Wagner, R.J., Bolger, R.W., Jr., Obringer, C.J., and Smith, B.A. 2006. Guidelines and Standard Procedures for Continuous Water-Quality Monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; accessed April 10, 2006, at http://pubs.water.usgs.gov/tm1d3. U.S. Geological Survey

Woody, J. 2008. *A Preliminary Assessment of Hydrogeologic Suitability for Aquifer Storage and Recovery (ASR) in Oregon.* Oregon State University.

APPENDIX A

PROTOCOLS & PROCEDURES FOR ESTABLISHING SITES

The Department has policies and procedures in place for establishing new monitoring sites to protect archaeological and cultural resources and public and private property. These procedures include direction for obtaining property access and developing cooperative agreements. Protocols are being developed to outline specific steps the Department's staff will take in order to meet these requirements. In addition to these items, the protocols will also include agency guidelines for requesting a new gage installation or updating an existing one, equipment purchase agreements, and safety considerations for field-related work.

Archaeological and Cultural Resources Policy

The Department acknowledges the significance of archaeological, historic, and cultural resources and is committed to the protection and preservation of these resources. Oregon's State Historic Preservation Office (SHPO) within the Oregon Parks and Recreation Department (OPRD) is responsible for safeguarding and managing the state's archaeological and cultural resources. In coordination with SHPO and Oregon's federally recognized tribes, the Department established protocols for installing or maintaining gaging stations and monitoring wells. The Department has also established procedures for any inadvertent discoveries.

Property Access Agreements

Private Landowner: The Department has in place a process for obtaining Property Access Agreements, which must be signed by the property holder, and allow personnel access to private property. Activities covered include installation, operation, and maintenance, including site access for taking water level measurements. The agreement also ensures the security of the state's property, including gates and locks.

Public Landowner: The Department also has agreements with other governmental agencies for accessing public properties to establish and maintain stream gages, including taking periodic water level measurements. Such agencies include, but are not limited to, the Oregon Department of State Lands, Oregon Department of Fish and Wildlife, the U.S. Bureau of Land Management, and the U.S. Forest Service. The Department also has agreements with DSL on removal-fill permits and counties and Oregon Department of Transportation on right-of-way permits.

Gaging Station Cooperative Agreements

The Department's procedure is to establish cooperative agreements with entities interested in sharing gaging operation and maintenance responsibilities, including funding. These types of agreements outline the conditions for easements, maintenance, financial obligations, and operation of the stream gage. Sharing and use of the monitoring data is also outlined in the agreement.

APPENDIX B
SOLICITATION FOR INPUT ON STREAM GAGE NEEDS

Water Resources Department – Stream Monitoring Needs

The Department has a modest budget to establish additional streamflow measurement sites (gages). These new gages will be established first and foremost, in support of the Department's mission. However, the Department is also interested in seeking input from other agencies or stakeholder groups to potentially focus on areas of mutual interest.

If your agency or group has specific water monitoring needs in Oregon, the Department would like to know more about them. As the Department moves forward in assessing its stream monitoring network, these place-based needs will be considered as part of its decision-making process.

Contact Information	
Agency/Program	
Name/Title	
Address	
Phone Number	
Email	
Website	

1) Does your project focus on monitoring streamflow or water quality or both?

2) Is this a current monitoring project or a planned project for the future? (If a future project, please provide a date for when monitoring data would be needed.)

3) Please provide a description of the project/program and how the data would be used.

4) Describe the geographic area(s) of interest that your agency would like to monitor.

5) In addition to streamflow data, what other parameters are you interested in collecting?

6) Please provide us with any other pertinent information.

APPENDIX C
HISTORY OF WATER QUANTITY MONITORING IN OREGON

Monitoring streamflow and groundwater has always been critical to the management of the state's water resources. Although policy priorities for monitoring change over time, Oregon continues to rely on consistent monitoring to provide an accurate characterization of surface and groundwater. The Department's ability to conduct monitoring has largely been driven by the availability of resources. The extent to which the Department has met its monitoring objectives appears to be driven by four major factors: historical events driving the availability of resources; changes in agency statutes, policies, and approaches; state-wide budget availability; and local interest and financial participation.

The following narrative describes monitoring efforts by the Department over time including key events that shaped agency monitoring priorities and resources.

1900s. The initial priorities for monitoring for the state were to quantify surface water supplies, to support allocation, adjudication, and regulation. These three priorities remain fundamental to the Department's monitoring needs. In 1909, the Oregon Office of the State Engineer officially began registering water use. The State Engineer's office worked in partnership with the U.S. Geological Survey (USGS) to monitor water resources for municipalities, irrigation, and water-power works. During this decade there were 48 stream gages operating cooperatively by the state and the USGS, although the USGS exclusively performed the hydrographic work.

1910s. World War I (1914-1918) was the first time in history where a decrease in federal water resources monitoring occurred in response to international events. At the completion of the war, the USGS officially began using the State Engineer's office to conduct hydrographic work. During this time, state-level staff increased substantially. By the end of 1920, the State Engineer's office operated 85 gages cooperatively with the USGS.

1920s-30s. Severe droughts during the 1920s and 1930s focused national attention on water resources. Federal and state planning agencies recognized the need for additional hydrologic data, including climatic records, snow surveys, evaporation records, groundwater studies, and streamflow records. The federal government responded with an infusion of funding. By 1928, the State Engineer's Office was conducting snow surveys, while employing a new method of forecasting. This new forecasting approach quantified the status of water supplies for the upcoming season, allowing farmers to plant accordingly and manage stored water to supplement potential shortages.

During the 1920s and 1930s, the State Engineer's office also called for prudent use of groundwater, considering it essential to avoid aquifer depletion, unsustainable withdrawals, or excessive costs. This required accurate data to calculate estimates of sustainable yields. In 1927, the code for appropriation of underground water east of the Cascade Mountains was adopted, and by 1935, the USGS and the State Engineer's office were running a program to collect groundwater water-level measurements. A statewide, cooperative program was later born to inventory groundwater basins and to measure water levels in dedicated observation wells. State and federal agencies provided initial funding.

1940s. Although groundwater funding was diverted to the war effort during World War II, by 1946, cooperative investigations for both surface water and groundwater had resumed. A public information service began in response to 100 public inquiries on groundwater resources of the state. In response, the Department's watermaster corps was strengthened.

1950s. In the 1950s, the number of observation wells in the network rapidly increased. The Oregon Groundwater Act was passed in 1955, paving the way for the public appropriation of groundwater west of the Cascades. By 1958, 140 observation wells were being monitored and two critical groundwater areas had been designated, Cow Valley and The Dalles. Also in the 1950s, the State Water Resources Board was established to oversee water distribution across the state. By 1958, the state was monitoring streamflows at 308 gaging stations.

1960s. The year 1964 marked the beginning of state funding for assistant watermasters, who still play an important role in managing the state's stream gage network. Also in the 1960s, the observation well network had grown to around 150 wells and funds were made available to establish and maintain an observation well program. By the end of 1962, the well net had been expanded to 593 wells, a significant increase in such a short time. During the remainder of the decade, the number of wells had expanded to more than 800 and requests for additional staff were made to meet the increased workload.

Basic data collection must be expanded if a sound factual basis for groundwater controls is to be obtained. Increased uses of groundwater will continue to strain the capacity of our aquifers. The state must face the need for increased funding and immediate expansion of the investigation of surface and groundwater resources. The southwestern United States is already in need of outside water supplies and is looking to the Pacific Northwest. An expanded groundwater program must be initiated by the State Engineer soon, if we are to effectively answer our total water needs in the future.

(1966-1968 State Engineer Report)

1970s. By 1970, five critical groundwater areas had been designated due to groundwater development pressures. During this time, there was a significant increase in the number of public inquiries regarding groundwater. In 1975, the Oregon Legislature created the Water Policy Review Board and merged the State Engineer's Office with the State Water Resources Board to create the Water Resources Department. The national recession of the late 1970s drove agency budgets down, resulting in the start of a long-running stream gage record processing backlog. Record low flows of 1977 and 1978 were captured by gages around the state and resulted in the 1984 nomination of 75 streams for minimum flows by the State Fish and Game Board (now Oregon Department of Fish and Wildlife).

1980s. In 1985, the Water Resources Commission was established to take over the role of the Water Policy Review Board. The Instream Water Rights Act was enacted in 1987, granting authority to the Oregon Department of Fish and Wildlife (ODFW), Department of Environmental Quality (DEQ), and Oregon Parks and Recreation Department (OPRD) to apply for instream water rights. By the 1980'stream gaging station numbers had dipped and rebounded to around 275 gaging stations.

In 1988, the Commission adopted administrative rules governing groundwater interference with surface water, known commonly as the Division 9 rules. These rules guide the Department in making

determinations regarding whether existing or proposed groundwater wells have the potential to cause substantial interference with a surface water supply and provides authority for controlling such interference. The Governor's Watershed Enhancement Board, established in 1989, granted funds to watershed restoration and enhancement activities across the state and was operated out of the Water Resources Department.

In the 1980s, the observation well net was reduced by 50 percent to eliminate unnecessary duplication of data and provide adequate time for the geophysical well logging program. Data from this program were used for groundwater management. Data sheets were completed and entered for the roughly 400 observation wells.

1990s. By 1990, overhaul of the statewide observation well network was about halfway complete. The existing wells on the net had been thoroughly screened to ensure the adequacy of each well for this purpose. The next step was to add monitoring sites where coverage was inadequate. Approximately 335 wells across the state were included as part of the state observation well network. That number gradually increased to about 350 observation wells by the year 2001. It was during this time that the Department developed key performance measures to track the network's growth.

Starting in 1990, the Department initiated the Water Availability program, developing an analytical tool for use in surface water allocation. In 1993, the Department discontinued many of its co-operative gage agreements with the USGS due to budget restrictions, bringing the total number of state-run gages to approximately 200 statewide.

Also in the 1990s, the Field Services Division organized in to five regions in order to better serve local water issues. These regions have largely determined the need and location of stream gages throughout Oregon. This also ushered in a new era of regulation with the Commission being permitted to issue civil penalties for violation of Oregon's water law. Stream gages and the careful tracking of water use became crucial to this new regulatory tool.

Significant improvements in computer systems allowed more timely tracking and comparison of stream gage data. Prior to this, all stream gage records had to be maintained on paper with computations later performed by hand. This was also the beginning of remotely accessed stream gage data.

ODFW applied for multiple instream water rights as well. During this time period many of the previously established minimum perennial streamflows were converted to instream water rights. The Department, which holds instream water rights in trust, continues to use the stream gage network to protect instream water rights today.

In 1997, the Oregon Plan for Salmon and Watersheds was adopted by the Oregon Legislature, in large part, to initiate a home-grown response to the listings of Coho and other salmon species under the federal Endangered Species Act. The Oregon Watershed Enhancement Board (OWEB) was established around this time and took over the funding role of the Governor's Watershed Enhancement Board for watershed restoration projects. Funds for monitoring to support such efforts also fall within OWEB's purview.

In 1998, the Hydrographics Section began working on a backlog reduction project to support the recently established water availability program, which required processing of approximately 500 water years of raw data.

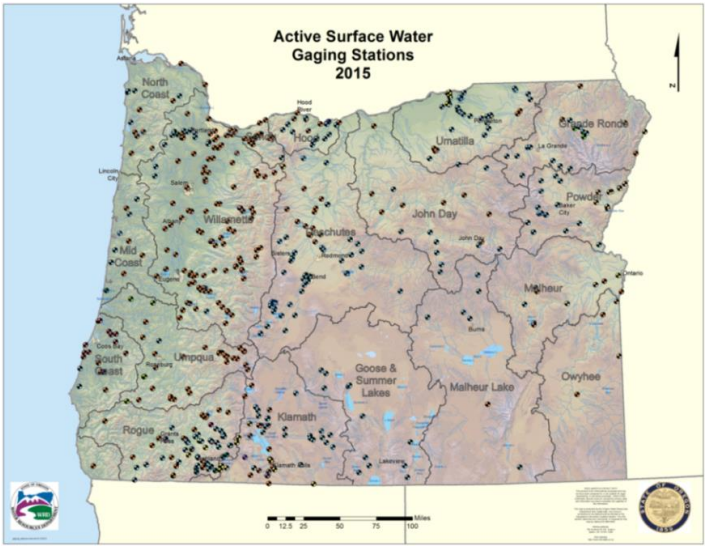
2000s. In 2002 and 2003, the Department worked with staff from the Oregon Progress Board to revise and update its key performance measures. The goal was to build a stronger link to the Department's mission. It was recognized that measuring streamflow and groundwater levels is essential to effectively managing these water resources. However, maintaining streamflow gaging stations and groundwater measurement sites is dependent on sufficient funding to operate stations and analyze and publish the data. Related key performance measures in existence today include:

> *Key Performance Measure #4* – Focused on streamflow gaging, this measure tracks the Department's progress toward increasing the number of state-operated or assisted gaging stations from the baseline year 2001. The baseline number of gaging stations is 215.
>
> *Key Performance Measure #5* – Focused on assessing groundwater resources, this measure tracks the Department's progress toward increasing the number of wells routinely monitored to assess groundwater resources from the baseline year 2001. The baseline number of wells is 350. There are challenges in maintaining the number of monitoring wells. Wells monitored by the Department are privately owned and access is commonly an issue. As property changes hands or other conditions change, some well owners have discontinued their participation in the State Observation Well Net.

The Department needs to ensure adequate budget and staff to maintain, collect, and analyze data from these important monitoring sites, and to continue providing publicly accessible data. Key to this success is an expanded network that includes dedicated sites with a long-term record.

Despite fluctuating budgets and the deep national recession of the 2000s, the number of monitoring stations has rebounded. An infusion of funding from the 2013 and 2015 Oregon Legislatures, discussed below, will help the state expand its programs and make significant progress on these key performance measures.

Present-Day Stream Gages. The Department operates more than 250 stream gages, of which about 80 percent are near real-time. The entire network shown on the accompanying map includes an additional 345 gages operated by cooperators, such as the USGS. The Department includes cooperators' gages as part of our network and utilizes the data collected at those sites in day-to-day operations and scientific studies.

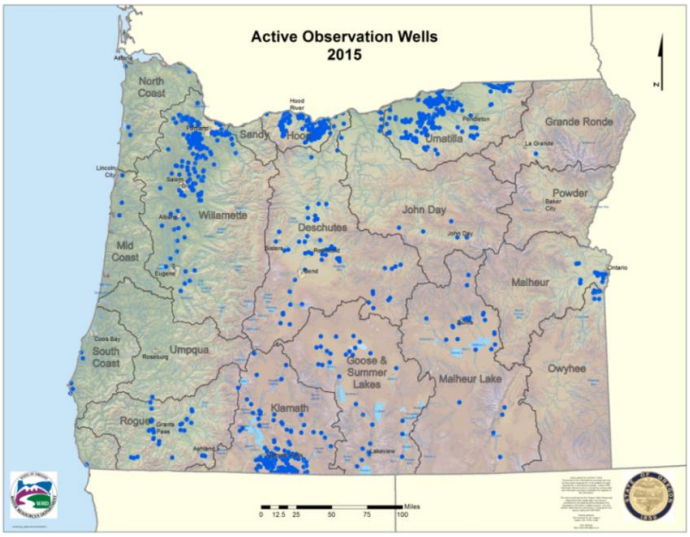


As part of the Upper Klamath Basin Comprehensive Agreement signed in 2014, the Department partnered with the

Klamath Tribes and the U.S. Fish and Wildlife Service to install several gaging stations within the Klamath River Basin. The gages will be used to monitor and assess streamflow conditions on a real-time basis in support of Tribal water rights. As of September 2015, six new gages had been installed in support of this effort.

The 2013 Oregon Legislature provided the Department with resources to install 16 new gages each biennium. This Monitoring Strategy will help ensure that will be installed in areas that provide the most benefit and data in support of our monitoring network objectives.

Present-Day Observation Wells. The Department currently has 370 state observation wells, 60 of which have continuous recorders installed. A well is considered part of the state observation well network if data are collected on a quarterly basis. However, the Department currently measures water levels in a total of about 1,100 observation wells across the state, some of which are project based wells.



The Department is actively installing new observation wells. The 2013 Oregon Legislature provided funding for new monitoring wells, groundwater studies, and staff. With this new funding, the Department has installed new monitoring wells in the Umatilla Basin, near The Dalles, Harney Valley in the Malheur Basin, and the Deschutes/Metolius area.

APPENDIX D
HYDROLOGY OF THE STATE OF OREGON

When designing a hydrological observation network, it is necessary to have as much knowledge as possible about the physical properties and the processes in the system involved (Netherlands Organization for Applied Scientific Research, 1986). Climate, hydrology, topography, and geology play a key role in understanding the interconnected water cycle of Oregon.

Precipitation. Oregon receives a majority of its precipitation in the winter. In general, Oregon has a rather mild, winter climate. The climate of the western third of Oregon is characterized by moderate temperatures, wet winters, and dry summers; about 78 percent of the annual precipitation occurs in the period October to March. The eastern two-thirds of the state, on the other hand, have greater extremes of temperature but somewhat less seasonal variation in precipitation. On the east side, about 65 percent of the precipitation occurs in the period October to March. (Phillips, 1969).

The Cascade Range, about 90 miles inland from the Pacific Ocean, lies parallel to the coastline and acts as a natural barrier to marine air masses and the prevailing westerly winds. This causes a significant statewide variation in annual rainfall. Average annual precipitation ranges from 200 inches in places in the Coast Range to less than 40 inches on the Willamette Valley floor in western Oregon and less than 10 inches in parts of north-central and south-eastern Oregon. Much of the precipitation falls as snow at altitudes above 3,500 feet, which is the approximate mean altitude of Oregon.

Precipitation does not all arrive at once, but in a series of storms or events. Each event elicits a unique combination of responses from the effected watersheds, including plant uptake, surface water runoff, and groundwater recharge.

Run-Off. Surface water runoff is relatively abundant in Oregon, but it is unevenly distributed with respect to location and timing. Major river systems drain the Coast Range, the Cascades, Klamath, John Day and Wallowa Mountains, and the terminal lake basins of the Great Basin. Each of these areas has a distinct topography and plant community, which interact with climate and geology to produce unique runoff patterns. Floods may occur every few years in the humid, western part of the state; although less frequent, floods are not unknown in the semiarid eastern region. Water shortages common to eastern Oregon can also occur in the humid western section, especially during typical dry summers. Some streams that lie almost side by side can differ markedly in their patterns of flow. Snow, and the period during which it melts, plays a major role in shaping annual hydrographs.

Recharge and Groundwater. In Oregon, most of the groundwater recharge occurs in the winter and spring months. This seasonal distribution of groundwater recharge results in a seasonal fluctuation of the water table. The magnitude of fluctuation is greatly dependent on the permeability of the underlying geologic formations. The occurrence of permeable rocks capable of absorbing and transmitting groundwater varies greatly from place to place in the state. Many of the geologic features of Oregon are of volcanic origin, but parts of the state have marine and continental sediments, metamorphic rocks, or unconsolidated deposits laid down by water, wind, or ice. The most permeable rock formations occur in the Cascade Mountains and are composed chiefly of young volcanic rocks.

They lie in a belt that receives relatively large quantities of recharge. The groundwater discharge from these rock formations create the many large springs that occur on both sides of the Cascade Mountains.

Coarse alluvial sediments were deposited along the eastern part of the Willamette River Valley by the swift streams flowing off the Cascade Mountains. These coarse-grained sediments form the high-production water bearing zones in the Willamette Valley. Slower moving streams flowing off the Coast Range deposited relatively fine-grained deposits along the western margin of the Willamette Valley. This difference in character of the alluvial sediments from one side of the Willamette Valley to the other accounts for the great difference in the availability of groundwater in these two areas.

In general, the Coast Range and Klamath Mountains are composed of extremely low-permeable rock units. Even though these areas receive large amounts of precipitation, the aquifers yield small supplies of groundwater.

Along the coast, there are many areas underlain by recent sand dune deposits. These areas absorb large quantities of water and are capable of producing large amounts of groundwater. Other parts of the coast are underlain by less-permeable marine terrace deposits which are composed of older beach deposits and which make up many of the aquifers along the southern coast.

In eastern Oregon, the central mountains are composed chiefly of relatively impermeable rock formations that are capable of yielding only small supplies of groundwater. Intermountain basins such as the Baker, Wallowa, and Grande Ronde Valleys often contain permeable rock formations and moderate natural supplies of groundwater. Much of the north-central part of the state is underlain by the Columbia River Basalt Group. These formations are of wide areal extent in both Oregon and Washington and are generally capable of yielding moderate to large supplies of groundwater. The deeper basalt aquifers do not recharge rapidly; mining this resource has led to significant declines in groundwater levels. Much of the basin and plateau areas of southeastern Oregon contain permeable rock formations, and where these formations contain water, they generally produce moderate to large amounts of groundwater.

Groundwater/Surface Water Interactions. Along with controlling rates of recharge to aquifers, the diverse geology of Oregon produce other variations in surface-water hydrology as well. For instance, the broad areas of pumice and young lava flows in the southern part of the Cascade Range (the Upper Metolius basin) have poorly developed stream systems because the highly permeable rocks at the surface readily absorb and retain rainfall. As a result, peak flows from rainstorm and snowmelt runoff are relatively low, but the discharge of groundwater through springs and seeps produces relatively large and sustained annual flows in Oregon's rivers and streams. By contrast, altered volcanic and marine rocks in parts of the Coast Range and some of the older rock formations in the Klamath and Blue Mountains have low permeability, allowing little infiltration of precipitation. Streams draining such areas respond rapidly to intense precipitation, and may recede to nearly zero during the drier months.

Between these two extremes are varying degrees of gradation. In places, surficial deposits allow a sizable amount of infiltration from moderate rates of precipitation, but reject a large part of precipitation from intense storms. This interaction among geography, geology, and climate is most evident in places where streams and groundwater directly exchange water. Groundwater/surface water interaction occurs in three basic ways: 1) streams gain water from inflow of groundwater via springs or seepage through the streambed; 2) streams lose water to groundwater by outflow through the

streambed; or 3) they do both, gaining in some reaches and losing in others. Gaining streams represent locations where cooler groundwater emerges and contributes to a stable base flow, helping to sustain surface water during the summer months. Losing streams can act as a potential route of groundwater contamination, as polluted runoff enters streams that eventually percolate back into the ground. Stream reaches may seasonally shift between gaining and losing depending on the local water table and the rate and volume of precipitation and infiltration.

Vegetation. Evapotranspiration makes up a major part of the water cycle. During the rainy season, tree canopies intercept substantial amounts of water and slow the rate at which water seeps into the ground or runs off into streams. As the precipitation rates decrease and plants increase their rate of water use each summer, they can significantly influence surface and groundwater levels.

Conclusion. Together, the geology, topography, vegetation, and climate of Oregon produce a diverse system of water movement. Understanding this diversity is key to effectively managing Oregon's water resources.

PACIFICORP

Pacific Power |
Rocky Mountain Power
825 NE Multnomah, Suite 1800
Portland, Oregon 97232

Submitted Electronically

March 18, 2020

Jeff Nettleton, Area Manager
Klamath Basin Area Office
U.S. Bureau of Reclamation
6600 Washburn Way
Klamath Falls, OR 97603

Subject: U.S. Bureau of Reclamation and PacifiCorp Water Borrowing Agreement
(KO-500, 2.2.4.21 (PRJ-23.00))

Dear Mr. Nettleton:

This letter is submitted in response to the U.S. Bureau of Reclamation's (Reclamation) formal request of March 17, 2020 (see Enclosure 1) which outlines the expectations, responsibilities, and communication protocols that Reclamation and PacifiCorp will follow when considering to use water stored in PacifiCorp's Klamath Hydroelectric Project reservoirs. The intent of using stored water is to support flows in the Klamath River downstream of Iron Gate Dam for Coho Salmon while simultaneously preserving adequate elevations in Upper Klamath Lake to protect endangered Lost River and Shortnose suckers. PacifiCorp understands that even though Reclamation anticipates these operations will not be frequently requested, water borrowing operations are included in Reclamation's Interim Operation's Plan anticipated to be in effect through September 2022. These water borrowing activities provide important assurances that Upper Klamath Lake elevations will not drop below those deemed important for spawning suckers in Upper Klamath Lake.

As PacifiCorp communicated to Reclamation verbally on February 21, 2020, and via email on February 26, 2020, we are happy to assist Reclamation, the water users, Tribal stakeholders, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service with this request, when practicable. This remains the case.

Modifying operations of the Klamath Hydroelectric Project and being prepared to make those modifications, requires planning, affects our operations, and can impact recreational uses and other natural resources. Because of this, PacifiCorp's February 26 email stressed that successful implementation of these modified operations will require advanced coordination and notification. PacifiCorp appreciates the coordination process described in Reclamation's letter and agrees that this process will assist our operations staff in coordinating project operations to benefit Upper Klamath Lake elevations and support flow releases downstream of Iron Gate Dam.

Under this arrangement, the water available from PacifiCorp's reservoirs is limited to about 5,000 acre-feet, with this amount of water to be returned to PacifiCorp's reservoirs in June each

year so that reservoir levels can return to normal operating levels (water surface elevation of up to 2,607.5 feet in Copco Reservoir and 2,327.5 feet in Iron Gate Reservoir). If conditions indicate that more than 5,000 acre-feet would be necessary to maintain adequate Upper Klamath Lake elevations during March, April, or May, PacifiCorp understands that Reclamation will provide additional advance notice to PacifiCorp and discuss the feasibility of additional releases given operational and other constraints associated with accessing more than 5,000 acre-feet from Project reservoirs.

PacifiCorp understands the actions outlined above are required to assist Reclamation in meeting the requirements of the Endangered Species Act, while also meeting the Reclamation's water supply obligations. Similarly, PacifiCorp's ability to undertake the actions outlined above is contingent on PacifiCorp's compliance with the Endangered Species Act and other legal obligations. PacifiCorp will continue close coordination with Reclamation, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service regarding these matters to ensure existing Biological Opinions and Incidental Take Permits cover PacifiCorp's actions in parallel with Reclamation's actions.

PacifiCorp appreciates the continued close collaboration between our organizations regarding the implementation of Klamath River flow releases in support of our respective obligations and operational objectives. If you have any questions, please contact Demian Ebert (503-813-6625; demian.ebert@pacificorp.com).

Sincerely,

Mark Sturtevant

Digitally signed by Mark Sturtevant
Date: 2020.03.18 10:45:22 -07'00'

Mark Sturtevant
Vice President, Renewable Resources

Enclosure 1: Reclamation Letter to PacifiCorp dated March 17, 2020

cc: Jim Simondet, National Marine Fisheries Service
Laurie Sada, U.S. Fish and Wildlife Service

Enclosure 1

United States Department of the Interior

BUREAU OF RECLAMATION
Mid-Pacific Region
Klamath Basin Area Office
6600 Washburn Way
Klamath Falls, OR 97603-9365

MAR 17 2020

IN REPLY REFER TO:
KO-500
2.2.4.21 (PRJ-23.00)

VIA ELECTRONIC MAIL AND USPS

Mr. Mark Sturtevant
PacifiCorp
825 NE Multnomah Suite 1800
Portland, Oregon 97232

Subject: U.S. Bureau of Reclamation (Klamath Basin Area Office) and PacifiCorp Water Borrowing Agreement

Dear Mr Sturtevant:

This letter outlines the expectations, responsibilities, and communication protocols that Burearu of Reclamation (Reclamation) and PacifiCorp will follow before utilizing water from PacifiCorp's Klamath Hydroelectric Project (PacifiCorp's Project) while Reclamation implements its Interim Operations Plan. The intent of utilizing stored water in PacifiCorp's Project is to support Klamath River flows to benefit coho salmon downstream of Iron Gate Dam (IGD) while preserving elevations in Upper Klamath Lake (UKL) for endangered suckers. Reclamation anticipates these operations will be requested relatively infrequently; however, the water borrowing operations are included in Reclamation's Interim Operations Plan and provide important assurances that UKL elevations will not fall below those deemed important for spawning suckers in UKL.
Conditions which may generate a request to borrow water from PacifiCorp's Project are generally IGD releases in conjunction with other operations that would lower UKL elevations below 4,142.0 feet (Reclamation datum) during March, April, or May, including:

- Providing augmented releases from IGD to increase available habitat and reduce disease risk for juvenile coho salmon.
- Meeting formulaic IGD flow targets during extremely dry years.

Reclamation will regularly coordinate with PacifiCorp about conditions that may affect the need to utilize water from PacifiCorp's Project and the following steps outline Reclamation's proposed communication process prior to implementing these special operations.

- Reclamation will provide weekly email updates to designated PacifiCorp personnel beginning in January as to the likelihood that operations will require access to water stored in PacifiCorp reservoirs. (Note: Natural Resources Conservation Service inflow forecasts, which determine water supply, are released every two weeks beginning in early January.) The email updates will include information pertaining to current UKL elevations and tributary inflows, Upper Klamath Lake inflow forecasts, projected spring

lake elevations, anticipated UKL Supply volumes, and relevant assumptions used in hydrologic models/forecasts. Weekly email updates will occur between the first week in January and the last week in May.

- PacifiCorp will continue to participate in the weekly FASTA calls and information sharing, which help determine whether variances from normal operations are desired (e.g., deviations from the formulaic approach to Environmental Water Account (EWA) distribution, utilization of EWA augmentation volumes available under the Interim Operations Plan, etc.). Please note that redistribution of EWA or utilization of the 40,000 acre-feet of EWA augmentation does not automatically trigger the need to utilize water from PacifiCorp's reservoirs.
- If borrowing of water from PacifiCorp's Project becomes increasingly likely, the communication frequency (whether email, phone calls, or more formal communications) will increase, just as it has in the past for flood control, flushing flows, operation and maintenance activities, utilization of stored water in PacifiCorp's Project, or other variations from normal procedures that affect PacifiCorp operations.
- Once a decision has been made to utilize stored reservoir water, Reclamation will provide PacifiCorp with a formal written request. Reclamation will strive to provide PacifiCorp with as much advance notice as possible, ideally 10 working days' notice. The formal written request will include details of the required volumes and timing of anticipated reservoir withdrawals to the best of Reclamation's knowledge. As with previous deviations from normal operational procedures in recent years, there is the possibility that some variance on short notice may be necessary due to rapidly changing hydrologic conditions or other unexpected events.
- Upon receipt of a request for water, PacifiCorp will review and notify Reclamation as soon as possible, ideally within three business days, if revisions to the proposed operations are necessary or if there are operational reasons that prevent the request from being satisfied.
- Reclamation will continue to coordinate weekly with PacifiCorp during the implementation phase of any water borrowing operation. This coordination will include details of total volume used, current and projected UKL elevations, flow targets downstream of IGD, and changes in inflows or other conditions that would change the borrowing pattern.

Based on hydrologic modeling conducted to evaluate the Interim Operations Plan, Reclamation anticipates that water utilized from PacifiCorp's reservoirs would generally be limited to about 5,000 acre-feet, though hydrologic circumstances in any given year will dictate the volumes requested for utilization. If hydrologic projections demonstrate that volumes greater than 5,000 acre-feet are necessary to maintain UKL elevations above 4,142.0 feet during March, April and May, Reclamation will provide additional advance notice to PacifiCorp (more than two weeks) and discuss the feasibility and any operational constraints associated with utilizing volumes greater than 5,000 acre-feet (as was done in 2018).

In all instances that Reclamation utilizes stored water from PacifiCorp's Project, Reclamation will return the volume utilized in June of each year that borrowing occurred so that reservoir elevations can return to normal operational levels (water surface elevation of up to 2,607.5 feet in Copco Reservoir and 2,327.5 feet in Iron Gate Reservoir) before the July 4th holiday weekend. Reclamation will work out more detailed schedules for payback at the time of borrowing, based

on actual volumes borrowed and existing hydrologic conditions. Reclamation believes that payback of the entire volume utilized in the month of June is achievable under the Interim Operations Plan.

Please confirm PacifiCorp's understanding and agreement to the communications protocols outlined above and please provide further clarification if the proposed approach does not reflect PacifiCorp's understanding and willingness to proceed with the arrangement.

Reclamation appreciates in advance the close coordination and partnership in this very difficult year. If you have any questions, please contact Jared Bottcher of my staff by email at (541) 883-6935 or by email at jbottcher@usbr.gov.

Sincerely,

Jeffrey Nettleton
Area Manager

IN THE CIRCUIT COURT OF THE STATE OF OREGON

FOR THE COUNTY OF MARION

KLAMATH IRRIGATION DISTRICT, Relator, v. **OREGON WATER RESOURCES DEPARTMENT**, an agency of the state of Oregon, **THOMAS BYLER**, in his official capacity as Director of Oregon Water Resources Department, and **DANETTE WATSON**, in her official capacity as Watermaster for the Oregon Water Resources Department, Respondents.	Case No. 20CV15606 DECLARATION OF THOMAS J. PAUL IN SUPPORT OF MOTION TO DISMISS PETITION FOR WRIT OF MANDAMUS **ORS 20.140 - State fees deferred at filing**

I, Thomas J. Paul, declare:

1. I am the Special Assistant to the Director of the Oregon Water Resources Department ("WRD"). I have worked on Klamath Basin issues since 1986 and am familiar with the Klamath Basin Adjudication. I participated in the WRD's evaluation and response to the Notice of Dispute submitted to Watermaster Danette Watson which can be found at pages 10-100 of Exhibit 1 to the Petition. I make this declaration based on my personal knowledge and in support of respondents' Motion to Dismiss the Petition for Writ of Mandamus. I understand that respondents may file the Motion as soon as Monday, April 20, 2020.

2. I am familiar with the state law processes governing distribution of water in accordance with the respective and relative rights of users under state law. My knowledge derives from my 50 years of experience working at the WRD as a watermaster, as a member of a "final proof survey crew" determining the extent of beneficial use of water under permits and

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

transfer prior to the issuance of certificates, as a Manager of the Enforcement Section, as Administrator for the Field Services Division, from my experience as Deputy Director of the WRD and as an Interim Director for the WRD.

Brief Overview of the Klamath Reclamation Project

3. The Klamath Reclamation Project ("Project") is a water storage and irrigation project in Southern Oregon and Northern California. The Project was authorized in 1905 pursuant to the Reclamation Act of 1902. (43 USC §371 et seq.) In accordance with state law and the Reclamation Act, the United States Bureau of Reclamation ("BOR") appropriated all available water in the Klamath River and Lost River and their tributaries in Oregon and began constructing a series of water diversion projects. Water for the Project is stored primarily in Upper Klamath Lake ("UKL") in the Klamath River Basin.

4. The Link River Dam, constructed near the mouth of the UKL, regulates flows in the Lower Klamath River. The Link River Dam is owned by the BOR but operated and maintained by PacifiCorp, a power company. PacifiCorp also owns and operates two canals that carry water from UKL for two hydroelectric generation facilities (the East Side and West Side projects) pursuant to a license issued by the Federal Energy Regulatory Commission ("FERC"). The federal ownership and FERC licensing will influence the WRD's determination of the manner and extent to which it may "take exclusive charge" of the Link River Dam in order to distribute water in accord with ORS 540.210(3).

5. The WRD understands that the BOR must deliver water to Project irrigators in accordance with storage rights held by the United States and with the Project irrigators' individual repayment contracts, which are subject to the availability of water, and to the extent authorized by the United States' and Project irrigator's secondary water rights. The Klamath Irrigation District ("KID") among other irrigation districts that use Project water have rights to receive appropriated water pursuant to their contracts with BOR. Two national wildlife refuges, the Lower Klamath and Tule Lake National Wildlife Refuges, also depend on the Project for

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

water and receive large quantities of irrigation flows and other Project waters. In addition to Project water users, there are many individual appropriators who have rights to direct flow from the UKL and the Klamath River below the Link River Dam.

6. In addition to delivery to Project irrigators, the WRD understands that the BOR manages the Project so as not to jeopardize the continued existence of endangered or threatened species under the federal Endangered Species Act ("ESA"). Within the UKL, the WRD understands that the BOR manages lake elevation levels under a Biological Opinion to protect the Lost River and Shortnose sucker, which have both been listed as "endangered" due to a precipitous decline in species population. The sucker live in UKL and nearby tributaries.

7. In addition to managing UKL levels for sucker, the WRD understands that the BOR must also manage flows in the Klamath River below Iron Gate dam (in California) consistent with a Biological Opinion for the protection of various species of fish including coho salmon that have been listed as "threatened" under the ESA.

8. Finally, the WRD understands that the BOR believes that in its management of Project water it must also consider the rights of Indian tribes including the Klamath Tribes and the Yurok Tribe, who hold tribal treaty rights which include water for fishing in the Klamath River Basin. In short, the WRD recognizes that a significant federal law context governs the BOR's operation of Project water in addition to state law determined claims, including KA 294 and KA 1000, discussed in the next section.

9. On April 9, 2020, the WRD received a letter from attorneys representing the Yurok Tribe and commercial fishing groups, providing information and requesting to be included in the process. A true copy of that letter is attached hereto as Exhibit TP101.

10. On April 19, 2020, the same attorneys sent the WRD a copy of a letter addressed to respondents' attorney at the Department of Justice. A true copy of that letter is attached hereto as Exhibit TP102.

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

State Water Rights in UKL – KA 294 and KA 1000

11. As explained in the WRD's Notification of Dispute and Investigation in Aid of Distribution, pp. 3 - 4, the WRD is in the process of adjudicating all pre-1909 water rights in the Klamath River Basin. A water rights adjudication is an action to determine all respective rights on a stream system. An adjudication results in a decree of the court which conclusively establishes the priority dates and rights of all existing claimants upon the stream at issue in the adjudication – in this case the Klamath River and its tributaries including UKL. On March 7, 2013, the Adjudicator delivered the Findings of Fact and Order of Determination to Klamath County Circuit Court signaling the end of the administrative phase of the adjudication. This was followed by the WRD issuing its Amended and Corrected Findings of Fact and Order of Determination ("ACFFOD") in February 2014 which constitutes the final order of the Director. Since the order was entered in the Klamath County Circuit Court, and until a court order is issued, the WRD is directed by ORS 539.170 to distribute water according to the determined claims as they are provided in the ACFFOD. Two of these determined claims, KA1000 and KA 294 are important for understanding what the KID now demands of the WRD.

12. Determined claim KA 294 authorizes the BOR to store up to 486,828 acre feet ("AF") of water in any given year for irrigation purposes. Once water is legally stored under a storage water right it is considered a new and different source of water and not subject to a call from water right holders who hold rights authorizing diversion of streamflow. KA 294 recognizes the BOR as the owner of the Upper Klamath Lake and the owner of the right (KA 294) to store water. The rights to appropriate and store water are referred to as the "primary water right" under Oregon state law. The primary right authorizes the owner to appropriate and store water for a beneficial use. A "secondary right" is required to use the stored water.

13. KA 1000 is the secondary water right that allows the use of the water stored under KA 294. KA 1000 allows the ***use of natural stream flow and stored water*** to irrigate approximately 200,000 acres of Project lands in Oregon and California. Irrigators may divert up

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

to 3.5 AF/acre of water from water held under KA 294 but ***irrigators are only entitled to that amount of water that can be put to beneficial use*** – this concept is important because a water right is circumscribed by the concept of beneficial use without waste and irrigators may make a call only for that amount of water they are prepared to put to a beneficial use without waste. A water right allows the user to satisfy the needs of the authorized beneficial use stated in the water right and is not a document which conveys ownership of the water.

The Process of Distributing Water and Regulating Rights

14. In Oregon, "first-in-time" is "first-in-right" meaning that in times of shortage, water users with the most senior priority date take water ahead of those with a relatively junior priority date. This is what is referred to in the direction to distribute water "in accordance with the respective and relative rights of the various users" on a reservoir. Whenever a "call" is made for water by a water user or if a water user asserts a dispute among users, the watermaster begins an investigation to determine the merits of the call and to determine next steps to distribute water.

15. Investigation or validation of the call is always the first step a watermaster takes before beginning distribution or upon receiving a complaint of a shortage of water. Investigations are conducted under the WRD's authority in ORS 540.045 as provided in OAR 690-250-0100 which states:

> (1) The watermaster shall investigate and respond to all complaints of water shortages or unlawful use based on a review of appropriate records and performance of field inspections, as judgement may require. The watermaster's response may be oral or written communication to appropriators involved in the complaint or shortages, or by personal visits by the watermaster or assistant watermaster.
>
> (2) The watermaster may begin regulation if investigation reveals a valid complaint of water shortage or unlawful use. Water shall be regulated in accordance with the relative rights or rotation agreements of the appropriators involved in the complaint or shortage.

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

16. When validating a call by an irrigator, the WRD is tasked with determining how much water may be put to beneficial use, which requires an investigation to determine that the irrigator is not seeking water for lands that have since been paved over or converted to other uses. This is because "beneficial use" – rather than the representation of the maximum amount that may be diverted as described on a paper right – "is the basis the measure and the limit of all rights to the use of water in this state." ORS 540.610.[1] The Watermaster must also determine if the quantity of water needed is at the authorized point of diversion. If the water present at the point of diversion meets or exceeds the quantity needed, up to the maximum allowed in the right, the call is not validated, and no regulation of other rights occurs.

17. The WRD's Notice of Dispute and Investigation in Aid of Distribution is the first step in the WRD's process of taking charge of the UKL for the purpose of dividing and distributing the water from the UKL in accordance with the respective and relative rights of the UKL. Exhibit 1 to the Petition. With regard to beginning a distribution under ORS 540.210, the Water Resources Commission is authorized to issue subpoenas and take testimony, hold hearings and receive "such pertinent and relative proof as may be considered necessary or proper" in carrying out its duties. ORS 536.026. An investigation is the necessary first step to assure that water is distributed according to law.

18. In the case of conducting the present investigation, the Watermaster must determine the status of water rights to the source that is called upon to determine what water is currently being diverted from what points of diversion so as to determine what water is available for distribution in the source called upon and whether other water right holders are taking water inconsistent with their water rights and authorizations. In a system as large and complex as the UKL and the Klamath River for a federal project that involves thousands of water users, the task of regulating the rights is complicated. Proceeding without an investigation would be

[1] *Bennett v. City of Salem*, 192 Or 531 (1951)(water "must be devoted to a beneficial use, and [the user] is never entitled to divert more water than is actually put to such use, reasonable transmission losses excepted."; citations omitted).

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

inconsistent with the WRD's policy and practice and would involve a potential to impact other water right holders who also are entitled to divert water from the system. The first step, therefore, in taking charge of the UKL involves an investigation as was initiated on April 16, 2020.

19. In the case of the UKL, the Watermaster will need to know how much natural stream flow is entering the UKL from all sources. Inflows include not only water directly entering the lake, but also a large amount of groundwater discharge from springs under the water surface, which is part of the natural flow.

20. In addition, the Watermaster must determine all withdrawals from the system and presently, the WRD has incomplete information. There are several water rights around the UKL which are authorized to divert water directly from the lake and not all diversion are equipped with headgates or measuring devices to facilitate distribution and determination of the amount of water being diverted. The amount of stored water cannot be determined until all live flow diversions are assessed. Then, evaporative losses from the surface of the lake, which can be hundreds of AF per day, must be subtracted from the storage account.

21. Additionally, there are users whose water rights are below the Link River Dam and authorize the use of natural flow. The Watermaster needs to take into account all diversions entitled to divert from the UKL and the Klamath River, as well as which diversions are entitled to both natural flow and stored water or only natural flow. The watermaster also needs to know the number of acres receiving water, where the acres are located and whether the acres are prepared to accept and apply the water to beneficial use without waste.

22. KID's secondary irrigation water rights derive from a determined claim in the Klamath Basin Adjudication known as KA 1000. KA 1000 permits the United States and Project irrigators to beneficially use both natural flow and water stored in accordance with the United States' sole right to store water (KA 294). This dual source authorization makes the task of distributing water throughout the UKL and the Klamath River technically complex. Water users

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

who have water rights to use both natural flow and stored water generally divert the natural flow water first, when the natural flow is available, to meet the water needs of the authorized beneficial use allowed under their water right. As natural stream flow diminishes through the summer, stored water is released to make up the difference between the available natural flow and what is needed to satisfy the use.

The Teacup Diagram is Insufficient Information to Distribute

23. KID's Notice of Dispute appears to demand that the WRD distribute water based solely on information posted to the BOR's webpage known as the "teacup diagram." The teacup diagram is a high-level overview of the percentage of fill for each of the reservoirs within the management of the Klamath Project. The diagram does not depict nor distinguish the percentage of "live flow" that constitutes the total volume of each reservoir. The information in the teacup diagram is also necessarily incomplete and is not verifiable based on information available to the WRD and the Watermaster.

24. Rather than relying on the teacup diagram, the WRD is moving as quickly as possible to convene the investigation in aid of distribution pursuant to ORS 540.210 and in addition to issuing its Notice of Dispute and Investigation in Aid of Dispute, is convening the Oregon Water Resources Commission as soon as this week.

I hereby declare that the above statement is true to the best of my knowledge and belief, and that I understand it is made for use as evidence in court and is subject to penalty for perjury.

DATED April 20, 2020.

s/ Thomas J. Paul
THOMAS J. PAUL

Department of Justice
100 SW Market Street
Portland, OR 97201
(971) 673-1880 / Fax: (971) 673-5000

CERTIFICATE OF SERVICE

I certify that on this 12th day of June, 2020, I served a true and correct copy of the attached Declaration of Gene Souza on the following using the Court's e-filing system.

Ms. Darsee Staley
Oregon Department of Justice
1162 Court St NE
Salem OR 97301

Peter M.K Frost OSB # 911843 Western Environmental Law Center
120 Shelton McMurphey Blvd., Suite 340 Eugene, Oregon 97401
Tel: 541-359-3238 frost@westernlaw.org.

Patti A. Goldman
Earthjustice
810 Third Avenue, Suite 610 Seattle, WA 98104
Phone (206) 343-7340 pgoldman@earthjustice.org

s/ Nathan R. Rietmann

Nathan R. Rietmann, OSB #053630