OWRD STREAM GAGING NETWORK EVALUATION FOR WATER DISTRIBUTION

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Cover Photo: Discontinued stream gage on Big Springs Creek located in Klamath Marsh. Operated by OWRD from 2002–2005 as part of the USGS/OWRD cooperative groundwater study in the Upper Klamath Basin.

ABSTRACT

Oregon's stream gaging network was last formally evaluated in 1970 by the US Geological Survey. Water management and scientific related needs have changed significantly since then, including adoption of instream water rights and the implications of climate change on water resources. Although the gaging network has adapted over time to meet changing local demands, the Oregon Water Resources Department (OWRD) decided to initiate another formal statewide evaluation of the stream gaging network. The OWRD goals (or data needs) for the stream gaging network are interrelated, but can be broadly grouped into those associated with water management and those associated with scientific purposes. This study examines one component of the water management goal for the gage network—to provide discharge data required for timely and effective distribution of water by the state, including conjunctive use distribution needs.

The water distribution component of the gaging evaluation examined over 900 watersheds, storage facilities, diversions and stream reaches using a standardized qualitative approach and the on–the–ground knowledge and experience of OWRD field personnel. Distribution and monitoring activities differ significantly across Oregon's watersheds due to large variations in regulatory and hydrologic setting, and due to local and state resource constraints. The evaluation identified 225 locations that require stream gages to meet the OWRD water distribution goal. Currently, there are active gages at 155 locations, leaving 70 sites where new gages are needed for surface water distribution purposes. Of these locations, 31 were designated as high priority sites due to their regulatory, environmental, and logistical setting. These locations were predominately located in the south central and south eastern regions of the state.

The stream gaging network is currently meeting today's conjunctive–use distribution needs. However, there are 26 identified streamflow sites that may require gages to meet future conjunctive–use needs, pending further hydrologic analysis. Currently, gages are in operating at 19 of these sites for other purposes.

INTRODUCTION

The Oregon stream gaging network was last formally evaluated in 1970 by the US Geological Survey (Lystrom, 1970). Significant changes to both water management and scientific related needs have occurred since this last evaluation. In 2008, the Oregon Water Resources Department (OWRD) decided to undertake a formal evaluation of the gaging network to determine if the network is meeting current OWRD data needs, identify high value stream gages, and describe an optimum network given realistic staff and budget constraints. The stream gaging evaluation consists of the following steps: 1) establish goals of the OWRD stream gaging program; 2) determine appropriate metrics to evaluate these goals; 3) inventory the purpose of the existing gage network; 4) evaluate how information from these gages meets the state's goals; and 5) identify data gaps, redundancies, and current high value gages in the network. In addition to OWRD operated stream gages, the evaluation also considers non–OWRD operated gages (e.g., United States Geological Survey, USGS) as well as monitoring alternatives to stream gaging such as those identified by Fontaine (1994).

Gage network goals were determined through consultation with OWRD personnel, including the Technical Services Division Administrator, Field Services Division Administrator, Hydrographics Section Manager, Groundwater Hydrology Section Manager, Regional Managers, groundwater and surface water hydrologists, hydrographers, and watermasters. The OWRD stream gaging network goals are to provide discharge data for:

- effective regulation and distribution of water by OWRD
- accurate hydrologic regional regression analysis
- define hydrologic systems
- forecasting efforts
- long term trend analysis
- other needs (legal obligations, etc)

This document describes the stream gaging evaluation with respect to the first goal—effective distribution of surface water, including conjunctive–use water management by OWRD.

Background

The primary goal of the State Engineer's office (precursor to the OWRD) in the early 1900s was to issue water rights for the waters of Oregon. The water allocation practice of that time was for all waters of the state to be put to beneficial use[1], predominately for agricultural purposes. Water rights issued in excess of available flow were not considered problematic at that time, as any junior users would either be naturally regulated off when streamflow was no longer available or regulated off by the watermaster when senior users complained about a lack of water. The result of this early allocation policy was that the state issued water rights in excess of available flow in many watersheds; many of which were fully appropriated[2] as early as the 1900s.

The monitoring and regulation scheme of the State's Engineers office and inherited by OWRD was complaint driven. Generally, a water user would complain about insufficient flow (compared to their water right), the watermaster would investigate the complaint, perform necessary flow measurements or estimates, and regulate any upstream junior users accordingly. In many watersheds, this monitoring and regulation system was arguably sufficient to meet historic distribution needs. In other areas (such as highly regulated streams) the watermaster might install stream gage(s), other measurement devices, or flow control devices (e.g., head gates) to aid in timely water distribution.

Over the years, the number of water users has continued to grow[3] and monitoring requirements to effectively distribute water with limited staff resources has necessitated more sophisticated and efficient monitoring techniques. Evolution of the OWRD stream gaging network has been constrained by limited resources. Often network growth has been non–uniform and sometimes sporadic, to meet the ever increasing monitoring

[1] Instream flows were not considered a "beneficial use" by the State until 1987. By that time, most watersheds in Oregon had water rights issued in excess of available flow.

[2] The term "fully appropriated" is used to indicate streams where permitted and certificated water rights exceed natural flow, or where consumptive use exceeds natural flow.

[3] Note, the number of users may still increase in a fully appropriated watershed through the transfers of water rights from a single place of use (i.e., single user) to multiple smaller places of use (i.e., multiple users) of equal area.

needs. Changes to the network were typically at the discretion of the watermaster in each basin. In many basins, the gage network evolution was related to available funding from strategic partners such as the US Bureau of Reclamation (USBR) or the US Geological Survey (USGS). When available monitoring funds decreased, the gage network typically contracted in response. The 1970 USGS evaluation of the streamflow data program in Oregon (Lystrom, 1970) provided a snapshot of the gaging network in Oregon at that time.

In the last three decades, there has been an increase in the complexity of water rights issued by OWRD, including monitoring requirements for many of these rights. The growing awareness of groundwater–surface water (GW–SW) interactions and need for conjunctive use management also represents a new regulatory complexity for OWRD and the stream gaging network. In addition, the recognition of instream flows as a beneficial use and the associated granting of instream water rights (ISWRs) has further complicated the regulatory setting (Pilz, 2006). Adding to this complexity is the transfer and leasing of consumptive water rights to instream water rights (IS_XFRs) with priority dates senior to many consumptive users. All these factors limit the effectiveness of monitoring and regulation by a complaint driven system, and increase the need for accurate real–time (or near real–time) data from stream gages (or other mechanisms). It is under this regulatory environment that the current gaging evaluation for water distribution is undertaken.

Purpose and Scope

The purpose of this study is to analyze and document the ability of the current Oregon stream gaging network (figure 1) to meet OWRD's goal for water distribution. The evaluation inventories general monitoring methods and water management activities (i.e., regulation and distribution) in each watermaster district, and examines how the existing stream gaging network is used. The study identifies data gaps and redundancies in the existing stream gaging network, and helps identify existing high value stream gages.

One component of the distribution goal for the gage network is to provide timely information on the major water uses (out–of–stream, storage, and instream) in each watermaster district that routinely impact water regulation and distribution by OWRD. From a cost and resource perspective, it is not feasible for the gaging network to provide flow information on the thousands of surface water rights throughout Oregon. OWRD recently enacted a strategic measurement plan (OWRD, 2007) that begins to address this larger issue. However, it is feasible for the gage network to provide timely flow data at locations that routinely impact surface water regulation and distribution.

An additional component of the water distribution goal is to provide data for conjunctive–use water management—the integrated management of both surface and groundwater where these resources are hydraulically connected. This integrated approach typically involves water management on a longer time scale than surface–water–only regulation and distribution (e.g., Deschutes Groundwater Mitigation Program, see Oregon Administrative Rules [OAR] 690-505-0000). This part of the OWRD water distribution goal entails operating stream gages in areas of known GW–SW interactions to inform decisions on groundwater withdrawals on a daily, weekly, seasonal, or longer time scale. Examples of this type of gage are those gages that monitor water elevations on the Lost River and Bonanza Springs in the Klamath Basin. The relative water levels between these gages trigger regulation actions in both surface and groundwater management.

The OWRD gaging network also provides data for water managers and projects associated with other agencies and organizations. However, these gages are typically operated by OWRD (or USGS) under contract from the appropriate entity. Providing data to these managers for project operation (e.g., reservoir operations) is not considered an explicit OWRD “distribution” goal of the state gaging network, except when the gages are required for distribution and regulation of water by the state.

This evaluation examines and accounts for stream gages operated by other organizations and used by the state for water distribution; the most significant being

USGS stream gages. Most USGS gages are operated for scientific purposes, for operations of federal water projects, or under contract from various stakeholder groups (e.g., PacifiCorp, Portland Water Bureau, etc.). Many of these gages, including those run by other organizations, also provide significant data pertinent to the water distribution and regulation.

Finally, this evaluation examines alternative mechanisms to stream gaging for monitoring storage, instream flows, and diversions. The most noteworthy alternative is the use of measurement devices such as flow meters, weirs, flumes, and staff gages. Except for flow meters, these alternative monitoring techniques are typically not available in real–time. Nonetheless, in many situations these alternatives still provide an effective, cost efficient management tool for active monitoring, distribution needs, and regulation. As previously mentioned, OWRD recently enacted a strategic measurement plan (OWRD, 2007) which entails the installation of measurement devices on "significant points of diversions" ("SigPODs") in priority watersheds. This evaluation compliments the strategic measurement plan by identifying locations and potential locations that routinely affect water distribution and regulation to determine if additional gages would help water management efforts. These locations include diversions, storage facilities, and streams.

METHODS

Two different approaches for the stream gaging network evaluation as it relates to surface water distribution were used. The first approach was a quantitative method that flagged theoretical gaging sites by comparing water right characteristics (for diversions, storage, or instream rights) to different flow characteristics (e.g., median monthly flow) of the source stream. For example, water rights for diversions that exceed (in terms of diversion rate) a threshold (such as a percentage of natural flow) would be flagged as locations needing stream gages. This method produced inconsistent results in that high regulatory locations were often overlooked for new gages, while low regulatory sites were often flagged for new gages.

The second approach used a qualitative method and the OWRD field offices' local knowledge of stream systems' distribution and regulatory history to flag locations that require gages or changes to existing monitoring methods. These changes could be improved monitoring techniques (e.g., installing a stream gage or flow meter at an unmeasured location) or reduced monitoring techniques (e.g., replacing a real–time canal gage with a flow limiting device and staff gage). Qualitative approaches are often used for stream gage network evaluations (Richard Fontaine, USGS, personal communications 2008).

Conjunctive use stream gaging needs were evaluated separately from the surface–water assessment. OWRD hydrologists and hydrogeologists were questioned about gaging needs in known or suspected areas of GW–SW interactions. Although this evaluation was qualitative, it did include a Geographic Information System (GIS) analysis component to flag potential gages and gaging sites for further analysis. Existing stream gages that assist with conjunctive use decisions were identified. Gaging considerations (both existing and potential gages) for future conjunctive use needs were also considered in the evaluation.

Surface Water Quantitative Approach

Quantitative criteria were initially developed based on gage monitoring and water distribution needs in three highly monitored and regulated watersheds in the upper Deschutes, Hood, and upper Willamette basins. For diversions, these criteria related water right attributes (e.g., diversion rate) to the natural or expected flow of the source stream system. For example, the first draft criterion was to gage diversions that exceeded 5 cfs or 10 percent of the lowest monthly median natural flow. This criterion were then applied to 47 different stream systems of various sizes and hydrologic / regulatory settings across Oregon to flag potential locations where gages would be required for water distribution. The criterion produced significant differences in the number of identified gaging sites between watersheds. For example, this criterion flagged 7 points of diversion (POD) for stream gaging in the Deschutes River above Bend—all locations where stream gages are currently operated by OWRD. However,

the same criteria produced 171 locations for the Powder River above Eagle Creek; an unreasonable starting point for considering the second component of the metric to identify gaging sites (table 1).

Twenty–five different variations of the draft criteria were evaluated for the 47 different streams. Each approach produced widely different results between watersheds. What seemed like reasonable gaging criteria in the three test watersheds represented unrealistic and unhelpful standard in others. The discrepancy in the number of identified potential gaging sites between stream systems arguably makes a state or even region–wide quantitative metric unrealistic. The large variability in results between the stream systems is due to the hydrologic and regulatory setting in each basin. In other words, the difference in results is due to the availability of water (both spatially and temporally, and in terms of natural and storage flow) compared to the nature of the water rights (e.g., location, number, priority date, rate/duty, location and general complexity like permit conditions). For example, in many watersheds the large diversions, which were always flagged for stream gages in the quantitative approach, have no affect on regulation and distribution. This result is due to their location, water right seniority, capacity compared to their permitted rate, and available streamflow (or storage). (Note: There may be reasons, other than distribution and regulation, to monitor some of these diversions; such as determining watershed hydrologic budgets or water–use reporting requirements.)

Surface–Water Qualitative Approach

Resource constraints prohibit a detailed investigation into the regulatory and hydrologic setting in each watermaster district. An alternative approach is to use the institutional knowledge of OWRD field offices to identify the hydrologic and regulatory setting and determine distribution–related stream gaging needs for surface water. The advantage of this approach is that watermasters (WMs) typically have the most experience with water regulation, distribution, and monitoring needs on streams in their districts. Consequently, they are very familiar with water rights for each stream system, and monitoring requirements to effectively manage and distribute water on each stream.

The disadvantage of this approach is that it is subjective and dependent on each WMs' historical experience, which may only be a few years in some districts. In addition, given staffing constraints and the large regulatory burden, regulation and distribution cannot be comprehensive. WMs often must resort to a regulatory scheme set by management and seasonally influenced by water–user complaints, available streamflow and limited resources. Therefore, WMs may be reluctant to comment on regulation and monitoring needs that they perceive to reflect negatively on their current efforts, even though management acknowledges that their efforts cannot be comprehensive.

To counter these inherent drawbacks, a qualitative method was developed to evaluate the gaging network for water distribution by interviewing the watermaster in each of Oregon's 20 watermaster districts using a standardized interview and survey procedure (Appendix A, Section 1). The WMs filled out the surveys and then completed face–to–face interviews to describe the survey results.

During this process, the WMs described their general regulation and monitoring activity, along with their basis for prioritizing work within their district. If any inconsistencies or questions arose during the interview, follow up investigations were made using the OWRD Water Rights Information System (WRIS), discharge data, pertinent reports and historical documents (e.g., court decrees, see "Reference" section for examples). Region managers for each district reviewed the final results. Prior to the interviews, existing gages used for distribution were flagged by the WMs through an initial "gage purpose" survey. These "distribution" gages were then checked by region managers and compared to gage types identified in the OWRD Hydrographics database.

The first part of the survey focused on streams and watersheds that had one of the following attributes: 1) instream transfer and lease activity (IS_XFR)—an indicator of streams which may have instream water rights with a priority date senior to water rights for consumptive uses; 2) zero expected summer flow from the OWRD water availability (Cooper, 2002) analysis—an indicator of fully allocated streams; and 3) high regulation

activity—an indicator of water right complexity and/or full allocation. The list was generated from the OWRD instream transfers/leases database (as of 2007), the OWRD water availability analysis, and the watermaster annual surface water summary reports (2002 through 2007, inclusive). The spatial resolution of the databases are fairly coarse (figure 2), but still represents probable areas of high water management activity for further inquiry. For these identified streams and stream reaches, the WMs were asked to detail how they monitor water for regulation and distribution purposes.

> How is the existing gage network used in this monitoring effort?
> Are less expensive alternatives to these gages feasible while still maintaining regulatory and distribution efficiency?
> For sites without gages, would a stream gage or alternate monitoring techniques improve water regulation and distribution efficiency?

In addition, watermasters were asked to: 1) identify how irrigation districts and other large diversions are monitored, 2) identify how storage is monitored, 3) identify how (or if) the stored and natural components of streamflow are determined below reservoirs for regulation and distribution. These questions were considered for all watersheds within each district (i.e., the areas of consideration were not limited to the “high management activity” areas mentioned earlier).

The survey also asked watermasters to list any instream water rights (ISWRs) affecting regulation in their district. Note that in the context of this review, ISWRs represent the certificated rights held by OWRD that were filed by Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Environmental Quality (ODEQ), or Oregon Parks and Recreation (OPR). ISWRs also include converted minimum flow rights. However, ISWRs in this review are separated from instream rights associated with transfers or leases (IS_XFRs), because the priority date of ISWRs is normally junior to that of IS_XFRs. There is generally little regulation activity associated with ISWRs east of the Cascades due to their relative junior priority compared to consumptive–use water rights. Regulation activities for ISWRs west of the Cascades are more prevalent.

The second part of the survey posed congruent types of questions to the first part, but targeted the identified existing water–distribution gages to see if less expensive (i.e., reduced) monitoring techniques would still allow OWRD to regulate and distribute water effectively (Appendix A, Section 2). A few examples where management related stream gages might not be required for regulation and distribution are as follows: a gage operated on a canal that has a water right senior to all other water rights and whose system capacity (in terms of rate and duty) is equal to or less than the associated water right (e.g., a municipal right where the existing diversion cannot exceed the paper right); diversions on a stream system where the available flow exceeds all demands (including ISWRs); a gage on a diversion that has a junior priority date at the bottom of a stream system (i.e., the user cannot make a call on water). The second part of the survey was developed to identify these types of situations and consisted of five questions answered sequentially (Appendix A, Section 2). Note, there may be other reasons to operate these identified gages (e.g., water use reporting or water budgets), but this is considered in a different evaluation and is not an OWRD "water distribution" goal.

The purpose of the watermaster interview and survey was to identify areas of high management activity and/or need, and to gauge the WMs' knowledge of the water distribution, water rights, and hydrology in each stream system. Watermasters were asked to consider the interview and survey in the context of having unlimited resources to improve water distribution effectiveness (accurate and timely distribution of water based on a stream system's water rights). Nearly all WMs indicated that adding gages to the existing network would be difficult with current staff resources. In addition, staff constraints for processing additional data from an expanded gaging network also exist in the Hydrographics Section of OWRD.

Conjunctive Use Approach

Groundwater distribution also employs the use of stream gages. In Oregon, surface water development and use predates most groundwater development. As a consequence, most surface water rights are senior in priority to groundwater rights.

Consequently, in watersheds where there is a GW–SW connection, there is potential for regulation of junior groundwater users to meet senior surface water demands.

Almost all watersheds in Oregon have some degree of GW–SW connection; the most obvious signs of this connection are springs that are tributary to a stream network. Springs are points of aquifer discharge which support streamflow. However, this does not mean there is conjunctive use management in all watersheds. OWRD conjunctive use management usually involves a finding of "potential for substantial interference" (OAR 690-009-000) between junior groundwater user(s) and senior surface water user(s). The investigation is typically initiated after complaint(s) from surface water user(s) whose demand is not being satisfied. The investigation considers, amongst other things, both the magnitude and timing of the groundwater interference to the surface water resource. The analysis also considers whether groundwater regulation results in timely and effective relief to surface water users.

Another trigger for conjunctive use management by OWRD involves a finding of wide–spread, basin–scale, general groundwater interference with surface water in fully appropriated basins (e.g., Gannett et al., 2001). This type of conjunctive use management generally considers larger spatial and temporal scales than those considered under OAR 690–009, and involves basin wide groundwater management plans (e.g., OAR 690–505–000).

Both of these conjunctive–use–management triggers involve hydrologic findings from OWRD hydrogeologists, which is why the approach for the stream gaging evaluation for conjunctive use management entails a stream gage review by these scientists to identify existing gages and additional sites needed for this purpose. The considerations that the OWRD hydrogeologists were asked to consider were as follows: 1) gages used or needed to regulate groundwater use; 2) gages used or needed to make (or plan) seasonal decisions related to conjunctive use; 3) gages used or needed to determine GW/SW interactions near areas of ongoing and substantial groundwater development; 4) gages used or needed to monitor groundwater management areas

(e.g., Deschutes Mitigation Program); 5) gages used or needed within the next ten years for conjunctive–use management.

To aid in the analysis of gaging needs for future conjunctive use management (item 5 above) a Geographic Information System (GIS) approach was used in conjunction with the qualitative method. The GIS component of the analysis looked at watersheds where summer streamflow was fully appropriated (most watersheds in Oregon), where ISWRs are present and where numerous or large groundwater withdrawals have been permitted after 1987 (the priority date of most of ISWRs in Oregon) near the streams. Gages (or locations) with these attributes were flagged for review for conjunctive use management needs within the next 10 years.

The logic behind the GIS analysis is as follows. Stream networks are typically regional sinks for groundwater discharge from aquifers. Therefore, groundwater withdrawals near the stream network (typically within one mile) have the potential to "substantially interfere" with senior surface water users. Furthermore, ISWRs usually account for the last water appropriated in fully appropriated watersheds and most (over 75 percent of stream miles) have a post 1987 water right priority date. Therefore, any groundwater permits issued after 1987 and near the stream network have the potential to interfere with and be regulated for the ISWRs or senior consumptive rights. Streams in previously designated groundwater management areas were also examined in the analysis, regardless of the attributes mentioned above.

RESULTS

Surface–Water Regulation and Distribution

For each watermaster district, a narrative was written to summarize results from the watermaster standardized interview (Appendix B). These narratives document general surface water hydrologic and regulatory settings in each district. They also describe general monitoring techniques and gaging needs (or upgrades) identified from the surveys. Where a watermaster was new to a district or inconsistencies arose in the

survey and interview, additional information from watershed assessments, basin reports, court decrees, and hydrologic studies was used to augment or confirm testimony from the watermasters. Regional managers then reviewed and commented on the final draft results in each district. Given the resolution of the underlying databases and the general limitations of the approach, the evaluation is considered a broad review of the gaging network for water distribution.

There were a total of **952** water availability basins[4], stream reaches, storage facilities, or major diversions examined in the evaluation for stream gaging (Appendix C). There is some overlap in this total as some locations are identified in multiple databases. For example, a stream reach might be flagged as needing monitoring for an ISWR and also be flagged for monitoring due to a high number of regulations. In this example, both reasons are identified for examination related to stream gaging. In the first case, gaging locations are examined for the stream. In the second case, diversions are being examined (in addition to the stream) for gaging.

Ninety-one locations were originally identified for new stream gages or upgrades to existing gages through this evaluation (figure 3). Non–recording measurement devices or staff gages were ultimately identified as a sufficient alternative at nine locations. At twelve of the identified locations, telemetry upgrades to existing gages are needed. The remaining 70 locations were identified for new stream gages related to water distribution. All gages would require telemetry for real–time monitoring and distribution.

[4] Water availability basins (WABs) are a misnomer as WABs are actually watersheds not “basins” and are described in Cooper 2002

Most watermasters indicated that additional gages would be of low priority, with the exception of District 10. This result is primarily due to limited available resources to run the additional gages. A method was developed to give the identified locations priority ranking should resources become available to expand the network and processing of collected data. The ranking is based on four factors: 1) distance from the field office to the identified gaging location, 2) regulatory setting, 3) environmental setting, and 4) significance of diversions or storage on stream system (i.e., related to size of the diversion or the presence of other SigPODs on the stream system). If the travel distance to the gaging site is more than an hour from the field office, it was given a “flag” for distance. If the gage location is on a stream with high regulations (> 20) or identified as having seasonal regulation, it was given a regulatory “flag”. If a gage is located on a stream with IS_XFRs, ISWRs that routinely affect regulation, or in a priority WAB (OWRD, 2007), it was given an environmental “flag”. Finally, if the identified gaging location is a major diversion or diverted from a stream with more than 10 SigPODs, it was given a “flag” for SigPODs. Locations that had 3 or more flags are generally given a high priority, 2–3 flags a medium priority, and 1–2 flags a low priority. Intangibles about each location from watermaster interviews or from direct feedback from watermasters were used to help identify the final priority of the gaging sites that fell on the overlap of the priority designations. Of the 70 identified new gaging locations, 31 were designated as “high” priority locations (table 2 and figure 3). Gages are being, or have been, installed at seven of these high priority locations.

There were 157 OWRD operated or co–operated stream gages identified for surface water distribution from the initial watermaster survey (table 6, appendix C). Subsequent analysis found that 27 of these gages are not used for water distribution by OWRD (figure 3, table 3). If no other uses are identified, these gages they should be either discontinued or funded by the organization(s) interested in the data. However, before any decision is made regarding operation of these 27 gages, the other OWRD gage network goals need to be evaluated. There are also nine stream gages not currently used for water distribution, that will be used for this purpose in the near future due to pending changes in water rights (e.g., basin adjudication, pending instream transfers,

etc). The narratives derived from the watermaster interviews are presented in appendix B. The narratives describe general monitoring and regulation activity in each district. The results for specific streams and watersheds in terms of instream flows, high regulation streams, fully appropriated streams (where consumptive use exceeds natural flow), major diversions and significant storage are presented in tables in appendix C.

Many of the newly identified high priority stream gage locations are associated with supply and diversions in the Klamath project (figure 3). Installation of many of these gages is already in progress under the guidance of the USGS, with funding by USBR. Coordinated operation of these gages with OWRD will allow use for monitoring, distribution, and regulation by OWRD. Several additional stream gages have been installed above Upper Klamath Lake by OWRD (table 6, appendix C). Upon completion of the Klamath adjudication, all of these gages will be required for water distribution by OWRD.

Other areas in the state with high priority stream gage locations are the Malheur Lake Basin (district 10), where flat terrain coupled with limited supply makes measurement and regulation difficult; the Owyhee Basin, where incomplete operation and maintenance of district–run stream gages has limited their usefulness for water distribution; and the North Coast Region, where additional gaging will help monitoring and regulation associated with ISWRs.

Conjunctive Use Management

Most of the identified conjunctive–use–management stream gages are located in the Klamath and Deschutes Basins, where studies have found a high degree of GW–SW connectivity (Gannett et al., 2001; Gannett et al., 2007). This connectivity is evidenced by the large percentage of streamflow originating from groundwater discharge. Other areas where stream gages are helpful for conjunctive use management are in watersheds that are direct tributaries to the Columbia River and have experienced large groundwater level declines in Columbia River Basalt Group aquifers (e.g., Umatilla Basin, Mosier Creek watershed, etc). There are 25 active stream gages currently used

for conjunctive–use management (figure 4). In addition, the GIS analysis and input from OWRD hydrologists and hydrogeologists indicate another 26 gage locations will probably be needed for conjunctive–use decisions within the next decade. Of these locations, 19 currently have active gages monitoring streamflow. This leaves seven new sites that will probably need streamflow monitoring for conjunctive–use management within the next decade. These locations could initially be equipped with staff gages on an “as needed” basis following appropriate evaluation by OWRD hydrogeologists. Upgrades from staff gages to real–time recording stations would be done on a case–by–case basis as real–time management data needs are evaluated in the field. Results from the analysis are presented in table 4.

DISCUSSION

A primary objective of the OWRD stream gaging program is to provide real–time streamflow data (oral communications Rich Marvin, OWRD). Gages are being upgraded with telemetry as funds and resources become available. However, current budget constraints have slowed this effort. Ultimately, the availability of real–time data, even though this data is technically “raw” (lacking review and quality assurance), would help transition OWRD towards a more proactive, real–time, monitoring and regulation system. Additional monitoring (and implementation of regulation plans) associated with completion of the OWRD Strategic Monitoring Plan (OWRD, 2007) could also be used to assist in this transition. However, there are currently no identified resources or planned regulation and distribution activities associated with the OWRD Strategic Monitoring Plan.

From this evaluation it is apparent that there is a wide difference in monitoring activities between watermaster districts. Much of this disparity can be explained by the differences in regulatory and hydrologic settings documented in the watermaster narratives. Additional factors influencing monitoring methods include external pressures, such as the presence of endangered species in a stream system. However, much of the difference in monitoring activities is tied to available resources. In many districts, which typically encompass thousands of square miles, there is a single watermaster

responsible for monitoring, distribution and regulation. Proactive water distribution requires more resources than water distribution as a complaint driven process. In most districts additional resources are not available.

The Umatilla Basin provides an example where additional resources changed the distribution and monitoring scheme in a basin. The development and implementation of the McKay and Umatilla River Water Management Plan (OWRD, 1991) that detailed accounting, measuring, and reporting requirements associated with water users in the basin accompanied the development of the USBR's Umatilla basin project in the mid 1980s. Water management in the basin was transformed from a predominately complaint driven system to an active, comprehensive, real–time water distribution system. Numerous real–time stream gages were installed on both diversions and other critical points in the stream system. Flow measurement devices were installed on smaller diversions and are routinely monitored by OWRD staff. Funding by USBR enabled this transition by providing funds for maintenance and operation of gages, and funding OWRD staff to monitor and enforce water regulation in the basin in a timely manner.

There is wide variation in resource contributions from water users and strategic partners to the OWRD stream gage network (table 5). In some watermaster districts (e.g., the Deschutes basin) the state largely operates and maintains stream gages without funds from outside resources (e.g., the large irrigation districts). In other districts (e.g., Umatilla Basin), the state is monetarily compensated for both stream gages and personnel to help with regulation and distribution. In yet other districts (upper Rogue and Owyhee Basins), the state provides varying degrees of oversight for operation and maintenance of gages by other entities (with varying degrees of success). A unified policy for compensation of stream gages required for water distribution would help establish an equitable, statewide, stream gaging network and provide for much needed funds to operate, maintain, and publish quality discharge data.

Stream gages are expensive to install and operate. Typical OWRD costs are roughly $14,000 for a gage installation, and $8,500 for the first year of operation and maintenance (O&M) costs ($7,500 O&M costs per year thereafter). The USGS typically charges $16,080 in annual O&M costs (written communications Lloyd VanGordon, OWRD). Because OWRD has historically been resource limited stream gage expenses and staffing limitations represents a significant barrier to transitioning to a more proactive system of monitoring and regulation. For example, the new gaging sites identified in this evaluation would constitute roughly $1,000,000 in capital investments, with yearly expenditures of $530,000 for operation and maintenance costs. OWRD staff continues to evaluate less costly alternatives to stream gaging for monitoring. However, many of these alternatives come with significant limitations.

Flow limiting devices, such as head gates or flow restrictors that limit water users to their allowable rate, provide a good alternative to stream gaging diversions. In many cases, the installation of such devices has already been undertaken on highly regulated streams and identified high priority WABs (OWRD, 2007). However, many of these devices are dependent on hydraulic head (i.e., water depth from the river or other water source) which, depending on site conditions, can vary with time and require continued adjustments and checks by the watermaster. An additional complication with flow limiting devices is that some water rights in Oregon allow varying diversion rates and can be based on how much surface water is present and the month of use. Therefore, this alternative may require additional personnel resources. Nonetheless, in many cases the installation of flow restrictor devices was flagged by watermasters as an effective alternative to stream gaging (appendix C).

A second cost effective approach for transitioning to more proactive monitoring is through the use of diversion measurement devices, such as weirs and flumes, along with routine manual readings of stage (hydraulic heads) using staff gages. Again, installation of these types of devices is already underway on high priority WABs (OWRD, 2007), although additional resources for subsequent monitoring is problematic. Diversion monitoring on Whychus Creek in the Deschutes Basin provides an example of

this method. A City of Sisters employee checks instantaneous diversion rates on multiple ditches through daily stage readings (i.e., hydraulic head readings) on weirs and flumes. The small diversions in the Umatilla Basin also employ this method. Monitoring and regulation to the rate associated with the POD's water right can occur on a daily basis. Nonetheless, this method still takes additional on–the–ground resources to be effective, which in most cases is limited. The method is also of limited value where regulation to water right duty needs to occur. However, it avoids the expense of operating and maintaining stream gages, the expense of processing the data, and allows a quick, accurate, instantaneous evaluation of diversion rates by field staff.

A third approach is to coordinate with local entities for funding and operation of stream gages or other measurement devices (e.g., flow meters, weirs, etc). This method requires close coordination with OWRD hydrographics staff to ensure USGS standards and protocols are followed. Again, this method would add additional workload for the field and hydrographics staff, especially if a stream gage is being operated.

All of these approaches would greatly benefit from modification of the existing "Water Use Reporting" program enabling it to function as a monitoring system for real–time water management, like that implemented by Washington States' Department of Ecology (WSDOE, 2010). Most government entities (e.g., irrigation districts) are already required to report their monthly use to OWRD in an annual report ("Water Use Reporting" program per Oregon Administrative Rules 690-085). There are three problems with this current program for usefulness in proactive water distribution. The first is one of timing. An annual report is too late to be considered useful for active monitoring and regulation of diversions. The second issue relates to precision. The annual reports of monthly use may reveal if users were diverting within their duty (after the fact), but do not reveal if users were within their rate limitations during the regulatory season. The last issue is one of accuracy. Because of budget constraints in the "Water User Reporting" program there are no OWRD staff available to review the record for quality assurance and quality control (QA/QC). Many irrigation districts are simply reporting their water right rate. In addition, there is no explicit regulation enforcement

component to the existing water use reporting program. Consequently, it takes considerable time working with users to get reports, and many of the reports that are provided lack accuracy.

The “Water Use Reporting” program would need modification if it were to be used for real-time monitoring and regulation. Random field checks by OWRD personnel of the measurement devices (or stream gage) for compliance with OWRD standards and for compliance with water rights would be necessary during the regulatory season. Random checks on the submitted records for accuracy and compliance to the water rights duty on a monthly basis would also be required. If flow meters are being used, a municipal–type of automatic reporting system that uses either radio or satellite telemetry to report water use to a central or regional database could be used. As with the other described stream gaging alternatives, this would require additional staff.

CONCLUSION

An evaluation of the Oregon stream gaging network as it pertains to the OWRD water distribution goal has been completed. The evaluation documents current water monitoring and distribution activities in each of Oregon’s 20 watermaster districts. Distribution and monitoring methods differ significantly between each district. This difference in methods is largely due to variation in the regulatory and hydrologic settings, and staff and budget constraints in each district.

The gaging evaluation for water distribution identified 70 new sites for stream gages, on both diversions and streams. Thirty–one sites were deemed high priority for environmental, regulatory, and logistical settings. The estimated installation and O&M costs for stream gages at the high priority sites are estimated to be $434,000 and $232,000, respectively.

Of the 157 OWRD stream gages whose purpose included operation for water distribution, 27 were determined unnecessary for water distribution. These gages will be evaluated (along with all OWRD gages) for the other OWRD goals before any

recommendation is made regarding continued operation. It is highly likely the operation of these gages is related to scientific purposes such as the “Water Availability Analyses” program.

Conjunctive use management needs are currently being met, and most future needs can also be met with the current gaging network. However, an additional seven locations may warrant new stream gages in the next decade for conjunctive use management. Initially, staff gages could be used at these locations to evaluate if more intensive monitoring is required.

The OWRD goal of effective and timely distribution of water by watermasters on a timely basis generally involves proactive monitoring and regulation, as opposed to complaint derived system. Monitoring and regulation via the complaint system arguably penalizes the most junior users (both consumptive use and ISWRs) on a stream system because use by senior is not typically monitored and there is no confirmation that use is within prescribed duty and rate limits. Large regions in many watermaster districts already employ proactive monitoring and distribution (e.g., Deschutes, Tualatin, and Umatilla Basins). However, this proactive scheme requires more resources than water distribution by a complaint driven system. The ability of OWRD to expand the current gaging network is limited by available staff and monetary resources.

RECOMMENDATIONS

Given current resources, any additions to the gaging network should focus on high priority locations— the Malheur Lakes Basin in particular, where the watermaster and ranking system both indicated additional gaging would greatly improve regulation and distribution. As the stream gage network evaluation is completed for the other OWRD goals, locations that fulfill multiple goals should be gaged first, financial and staff resources permitting. It is possible that additional resources will become available by indentifying gage network redundancies.

Developing monitoring and measuring plans for each district similar to the Umatilla Basin (OWRD, 1991) would be useful in determining how other watermaster districts can be transitioned to a more proactive monitoring and regulation scheme. These plans should consider results from this study, compliment the OWRD Strategic Monitoring Plan, and include a timely data collection and regulation scheme. The existing "Water Use Reporting" program could be modified for timely data collection, reporting and subsequent regulation in this endeavor. However, this may require a change in statute (ORS #537.099), and additional staffing resources. Paramount to implementing this method would be inclusion of random quality and compliance checks by OWRD field staff and program staff in Salem.

Finally, a statewide standard should be implemented for gage funding to monitor water–users' storage and diversions. Presently OWRD is compensated to varying degrees by water users for operating, maintaining and processing data from stream gages located on diversions and storage facilities. A uniform funding program would ensure a more equitable distribution of stream gages used for water distribution.

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FIGURES:

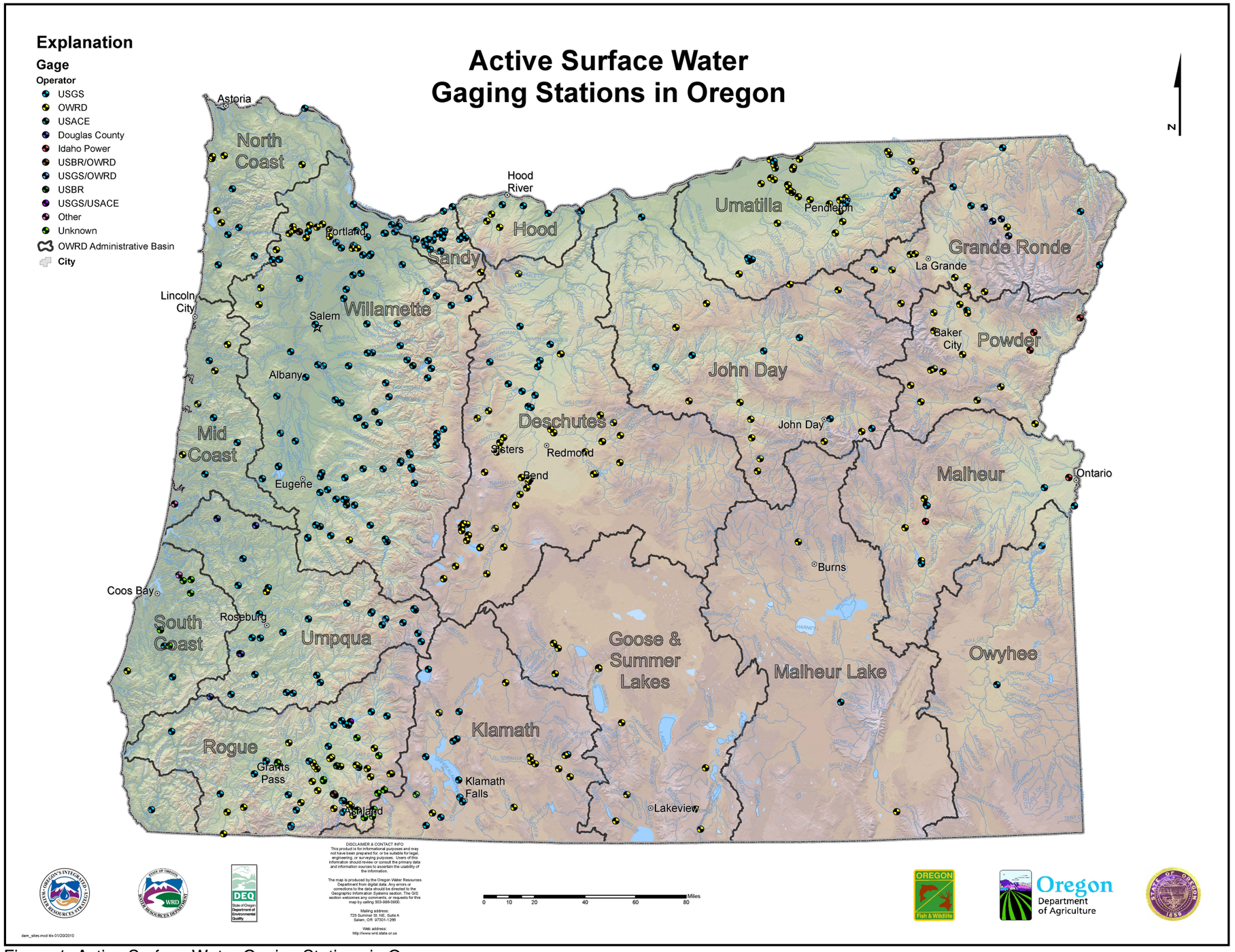


Figure 1: Active Surface Water Gaging Stations in Oregon (source: Oregon's Integrated Water Resource Strategy Project).

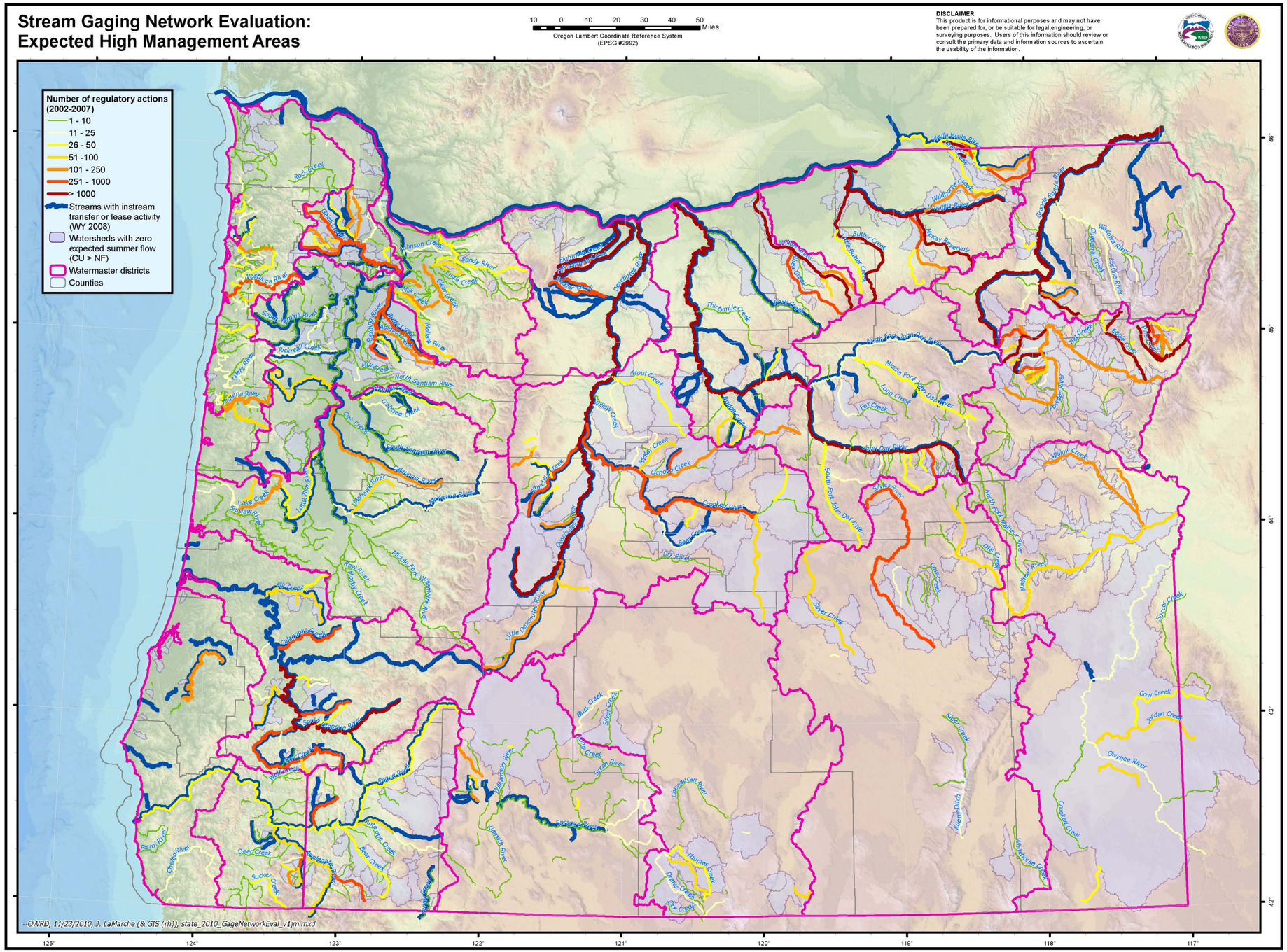


Figure 2: Instream leases and transfers (WY 2008), water availability basins with zero expected summer flow, and OWRD stream regulatory activity (2002–2007).

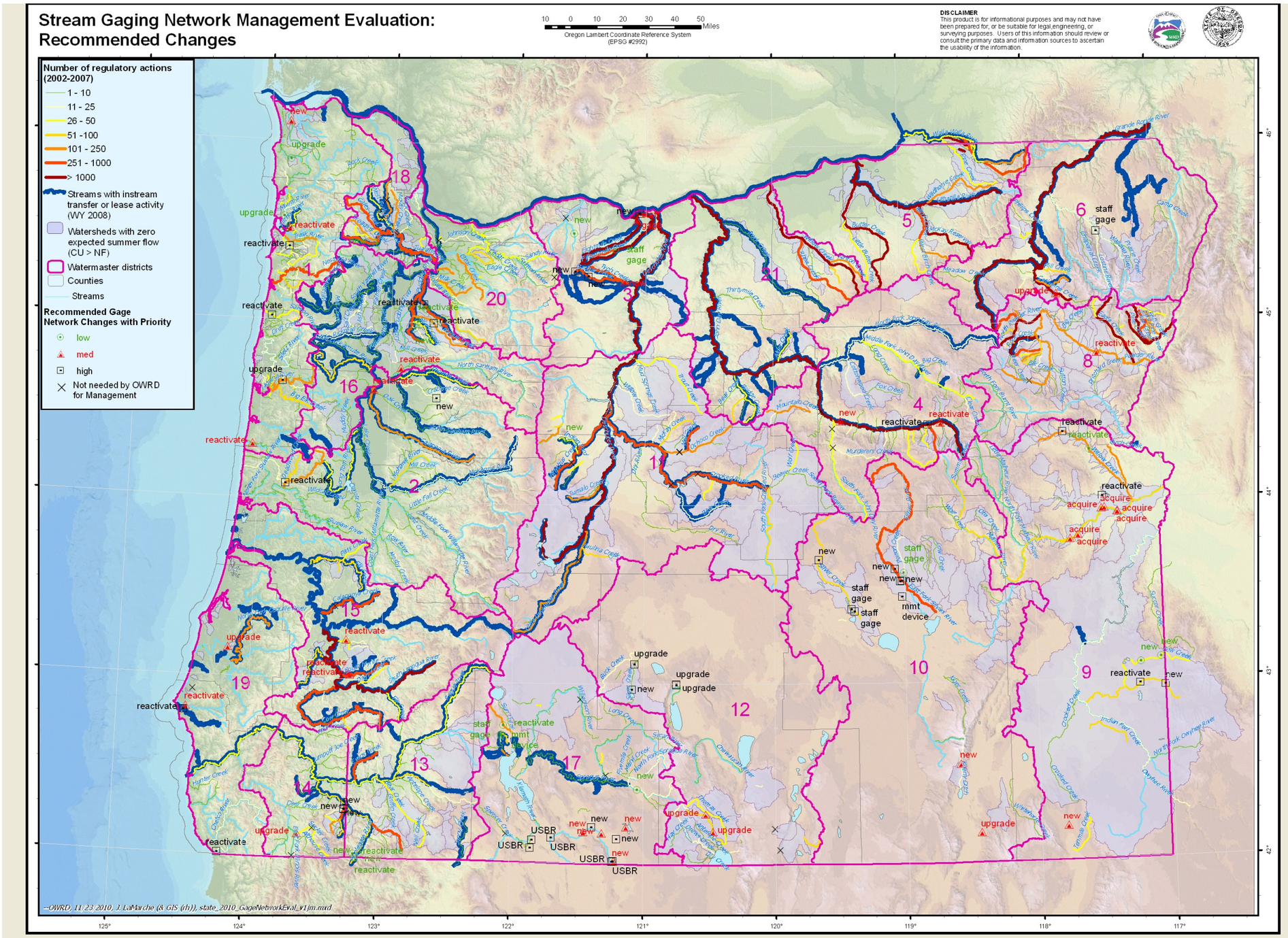


Figure 3: Recommended gage network changes related to OWRD surface water regulation and distribution.

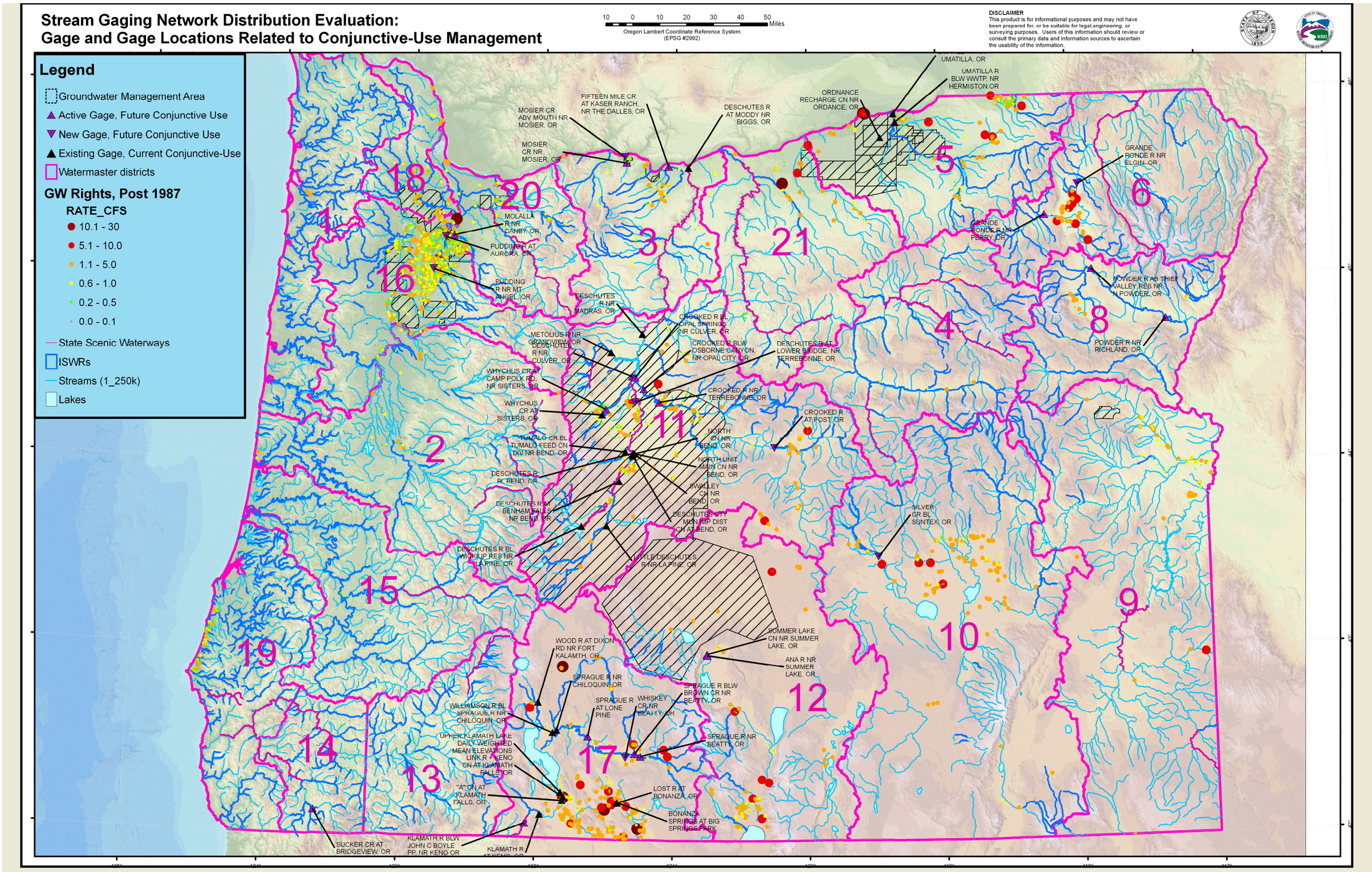


Figure 4: Current and future gaging sites associated with conjunctive-use water management.

TABLES:

Table 1: Quantitative Criteria and Results for Gage Locations related to Diversions

INPUT								% of flow	10%
								cfs threshold for %	0.25
								cfs minimum base	5
All values in CFS				Diversion Monitoring Criteria (x threshold cfs or xx% of lowest natural monthly median)							
			Metric >>>>	whichever is less (threshold vs %)				whichever is more (threshold vs %)			
Location	Ref #	District	Natural Median Flow of Lowest Month	base threshold (cfs)	% of median	Resulting Gage Criteria	# Flagged Diversions	base threshold (cfs)	% of median	Resulting Gage Criteria	# Flagged Diversions
BUTTER CR > UMATILLA R > 0725200100	4	5	1.0	5.0	0.3	0.3	94	5.0	0.3	5.0	1
Trout Cr @ Mouth (WAB ID 70247)	5	11	2.0	5.0	0.3	0.3	26	5.0	0.3	5.0	6
LITTLE APPLEGATE R > APPLEGATE R > 1516801540 0530	6	13	2.0	5.0	0.3	0.3	27	5.0	0.3	5.0	1
DEEP CR > CLACKAMAS R > 02114002300130	7	20	3.0	5.0	0.3	0.3	16	5.0	0.3	5.0	0
McKay Cr at Mouth (WAB ID 30710326)	8	11	4.0	5.0	0.4	0.4	14	5.0	0.4	5.0	1
8-Mile Cr @ Mouth (WAB ID 71798)	9	3	5.0	5.0	0.5	0.5	8	5.0	0.5	5.0	0
Lost Cr > M. Fk Willamette (ID #115)	10	2	6.0	5.0	0.6	0.6	1	5.0	0.6	5.0	0
McDowell Cr > S. Santiam (ID #123)	11	2	7.0	5.0	0.7	0.7	1	5.0	0.7	5.0	0
WILLOW CR > MALHEUR R > 1059400080	12	9	7.0	5.0	0.7	0.7	64	5.0	0.7	5.0	5
Hamilton Cr > S. Santiam (ID #106)	13	2	8.0	5.0	0.8	0.8	0	5.0	0.8	5.0	0
15-Mile Cr @ Mouth (WAB ID 30410535)	14	3	10.0	5.0	1.0	1.0	4	5.0	1.0	5.0	1
WINCHUCK R > PACIFIC OCEAN > 172210	15	19	11.0	5.0	1.1	1.1	1	5.0	1.1	5.0	0
THOMAS CR > GOOSE L > #: 31300102	16	12	13.7	5.0	1.4	1.4	66	5.0	1.4	5.0	17
GALES CR > TUALATIN R > 02114003000560	17	18	18.0	5.0	1.8	1.8	0	5.0	1.8	5.0	0
SILVIES R > W FK SILVIES R > 12004001000120	18	10	20.0	5.0	2.0	2.0	61	5.0	2.0	5.0	11
BEAR CR> ROGUE R- AT MOUTH (70993)	19	13	20.3	5.0	2.0	2.0	21	5.0	2.0	5.0	15
W Fk Silvies R> Malheur L- @Mouth	20	10	20.4	5.0	2.0	2.0	71	5.0	2.0	5.0	16
YAQUINA R > YAQUINA BAY > 1808100050	21	1	27.0	5.0	2.7	2.7	0	5.0	2.7	5.0	0
Calapooia R > Willamette R (ID #76)	22	2	35.0	5.0	3.5	3.5	0	5.0	3.5	5.0	0
CHEWAUCAN R > LABERT > 1300100010	23	12	42.0	5.0	4.2	4.2	30	5.0	4.2	5.0	27
N FK COQUILLE R > COQUILLE R > 1715100890	24	19	44.0	5.0	4.4	4.4	0	5.0	4.4	5.0	0
CATHERINE CR> GRANDE RONDE R- AT MOUTH (#: 30810408)	25	6	47.5	5.0	4.8	4.8	25	5.0	4.8	5.0	23
Crooked R abv Osborne	26	11	50.0	5.0	5.0	5.0	30	5.0	5.0	5.0	30
Lake Cr > Siuslaw (WAB ID 71412)	27	2	51.0	5.0	5.1	5.0	0	5.0	5.1	5.1	0
APPLEGATE R > ROGUE R > 1516801540	28	14	61.0	5.0	6.1	5.0	3	5.0	6.1	6.1	3
Tumalo Cr @ Mouth (WAB ID 70752)	29	11	65.0	5.0	6.5	5.0	4	5.0	6.5	6.5	2
Whychus Cr @ Sisters (WAB ID 70754)	30	11	65.0	5.0	6.5	5.0	5	5.0	6.5	6.5	5
Umatilla R @ Mouth (WAB ID 221)	31	5	65.0	5.0	6.5	5.0	18	5.0	6.5	6.5	14
Umatilla R (main stem only) @ Mouth (WAB ID 221)	32	5	65.0	5.0	6.5	5.0	14	5.0	6.5	6.5	12
Little Deschutes (WAB ID 70757)	33	11	74.5	5.0	7.5	5.0	3	5.0	7.5	7.5	2
John Day abv S Fk John Day (WAB ID 212)	34	4	78.0	5.0	7.8	5.0	30	5.0	7.8	7.8	9
PUDDING R> MOLALLA R- AT MOUTH (69998)	35	16	89.0	5.0	8.9	5.0	3	5.0	8.9	8.9	3
TUALATIN R > WILLAMETTE R > 0211400300	36	18	91.0	5.0	9.1	5.0	3	5.0	9.1	9.1	3
Malheur r> Snake R- AT MOUTH (#31011701)	37	9	110.0	5.0	11.0	5.0	115	5.0	11.0	11.0	54
EAGLE CR > POWDER R > 0940600140	38	8	111.0	5.0	11.1	5.0	9	5.0	11.1	11.1	4
S UMPQUA R> UMPQUA R- AT MOUTH (351)	39	15	139.0	5.0	13.9	5.0	1	5.0	13.9	13.9	0
NESTUCCA R> NESTUCCA BAY- AT MOUTH (#71242)	40	1	140.0	5.0	14.0	5.0	0	5.0	14.0	14.0	0
White R @ Mouth	41	3	166.0	5.0	16.6	5.0	14	5.0	16.6	16.6	0
Siuslaw R @ mouth	42	2	205.0	5.0	20.5	5.0	0	5.0	20.5	20.5	0
POWDER R> SNAKE R- AB EAGLE CR (72193)	43	8	214.0	5.0	21.4	5.0	171	5.0	21.4	21.4	27
SPRAGUE R> WILLIAMSON R- AT MOUTH (70806)	44	17	260.0	5.0	26.0	5.0	61	5.0	26.0	26.0	6
JOHN DAY R> COLUMBIA R- AT MOUTH (#: 209)	45	4	271.0	5.0	27.1	5.0	30	5.0	27.1	27.1	1
WOOD R> UPPER KLAMATH L- AT MOUTH (70829)	46	17	398.0	5.0	39.8	5.0	21	5.0	39.8	39.8	2
CLACKAMAS R> WILLAMETTE R- AT MOUTH (#80)	47	20	822.0	5.0	82.2	5.0	0	5.0	82.2	82.2	0
Grande Ronde R> Snake R- @ Mouth (227)	48	6	894.0	5.0	89.4	5.0	48	5.0	89.4	89.4	0
Deschutes nr Bend	49	11	1250.0	5.0	125.0	5.0	7	5.0	125.0	125.0	4
ROGUE R> PACIFIC OCEAN- AB APPLEGATE R (#: 315308(	50	14	1290.0	5.0	129.0	5.0	39	5.0	129.0	129.0	0

Table 2: Identified new high priority gaging locations for surface water distribution

Old Gage #	WM District	Region	Priority	Descriptions	Flags	Gage Type	Notes
14303750	1	NW	high	Salmon R nr Otis, OR	regs, Environ, sigPODs, distance	reactivate	
14302700	1	NW	high	Tillamook R nr Tillamook, OR	regs, Environ, sigPODs	reactivate	
14306030	1	NW	high	Yaquina R nr Chitwood, OR	regs, Environ, distance	upgrade	
	2	NW	high	LaComb ID nr LaComb, OR	regs, Environ, distance, problem P	new	
14307580	2	NW	high	Lake Cr nr Deadwood, OR	regs, Environ, distance	reactivate	
	3	NC	high	Badger Cr blw Badger Lake	regs, Environ, sigPOD, distance	new	
	3	NC	high	Badger Cr ditch	regs, Environ, sigPOD, distance	new	
	3	NC	high	Fifteenmile Cr nr Kaiser OR	regs, Envrion, sigPODs	new	
14038515	4	NC	high	Indian Cr mouth nrPrairie City	regs, Environ, sigPODs	reactivate	
	6	E	high	Cross Country Canal	regs, Environ, sigPODs, distance	staff gage	
13226500	9	E	high	Bully Cr @ Warmsprings nr Vale	regs, Envrion, sigPODs	reactivate	shared supply
	9	E	high	Jordan Cr @ State Line	regs, Environ, distance	new	seasonal gage w/ telemetry
13179000	9	E	high	Jordan Cr nr Jordan Valley	regs, Environ, distance	reactivate	seasonal gage w/ telemetry
13229500	9	E	high	Willow Cr nr Malheur	regs, Environ, sigPODs, distance	reactivate	
	10	E	high	East Fork Silvies at Hwy	regs, sigPODs	new	shared supply
	10	E	high	Foley Slough nr bifurcation	regs, sigPODs	new	shared supply
	10	E	high	Moon Reservoir	regs, sigPODs, distance	staff gage	shared supply
10405800	10	E	high	Silver Cr blw Moon Res,nrRiley	regs, sigPODs, distance	staff gage	shared supply
10403000	10	E	high	Silver Cr near Riley OR	regs, sigPODs, distance	new	
	10	E	high	West Fork Silvies nr bifurcat	regs, sigPODs	new	shared supply
	10	E	high	West Fork Silvies nr hwy205	regs, sigPODs	mmt device	shared supply
10388000	12	SC	high	Ana R nr Summer Lake, OR	Environ, sigPODs, distance	upgrade	telemetry upgrade
	12	SC	high	Silver Cr blw Thompson Res	regs, sigPODs, distance	new	calc nat/storage Q, reduce mmt requirements
10389500	12	SC	high	Silver LakeID Cn nr SilverLake	regs, sigPODs, distance	upgrade	telemetry upgrade
10387500	12	SC	high	Summer Lake Cn nr Summer Lake	Environ, sigPODs, distance,	upgrade	telemetry upgrade
	14	SW	high	Laurel Hill Ditch	regs, Environ, sigPODs	new	problem POD
	14	SW	high	Watts & Topping Ditch	regs, Environ, sigPODs	new	problem POD
	14	SW	high	Williams Cr nr Provolt OR	regs, Environ, sigPODs	new	
14200500	16	NW	high	Abiqua Cr nr Silverton, OR	regs, Environ, sigPODs	reactivate	
14201500	16	NW	high	Butte Cr at Monitor, OR	regs, Environ, sigPODs	reactivate	
	17	SC	high	Ady Canal nr Klamath Project	regs, Environ, sigPOD	USBR	USBR currently working on velocity-index gage
	17	SC	high	East Lateral Langell Valley ID	regs, Environ, sigPODs, distance	USBR	USBR working on velocity-index gage
	17	SC	high	Lost River Diversion Canal	regs, Environ, sigPOD	USBR	USBR working on velocity-index gage, location?
	17	SC	high	North Canal Langell Valley ID	regs, Environ, sigPODs, distance	new	USBR currently uses hydraulic eq'n
	17	SC	high	North Canal nr Klamath Project	regs, Environ, sigPOD	USBR	USBR currently working on velocity-index gage
	17	SC	high	West Canal Langell Valley ID	regs, Environ, sigPODs, distance	USBR	USBR working on velocity-index gage
	17	SC	high	Yonna Ditch, Horsefly ID	regs, Environ, sigPOD	new	need flow meters on pumps too
14327300	19	SW	high	Elk R nr Sixes, OR	Environ, sigPODs, distance	reactivate	
14400200	19	SW	high	Winchuck R nr Brookings, OR	regs, Environ, distance	reactivate	

Table 2 continued: Identified new medium priority gaging locations for surface water management.

Old Gage #	WM District	Region	Priority	Descriptions	Flags	Gage Type	Notes
14301450	1	NW	med	Kilchis R nr Bay City, OR	regs, Environ	reactivate	
	1	NW	med	Lewis&Clark R,nr Lewis&Clark	Environ, distance	new	
14306875	1	NW	med	Yachats R nr Yachats, OR	Environ, distance	reactivate	
14173500	2	NW	med	Calapooia R at Albany, OR	regs, Environ, distance	reactivate	
14105300	3	NC	med	Eightmile Cr nr The Dalles, OR	regs, Environ, sigPODs	staff gage	
14101000	3	NC	med	Tygh Cr @Tygh Valley, OR	regs, Environ	new	
14038530	4	NC	med	John Day nr Dayville OR	regs, Environ, sigPODs	new	might be able to use estimate
14037000	4	NC	med	Power Mill Ditch	regs, Environ	reactivate	problem POD
13320000	6	E	med	Catherine Cr nr Union OR	regs, Environ, sigPODs	upgrade	
13286480	8	E	med	Powder River nr Keating	regs, Envron, sigPODs	reactivate	
13222000	9	E	med	Farmers Canal nr Hope	regs, sigPODs	acquire	shared supply, poorly run district gage
13224000	9	E	med	Gellerman & Frohman D abv Vale	regs, sigPODs	acquire	shared supply
13225000	9	E	med	Hope Mill D @ Vale	regs, sigPODs	acquire	shared supply
	9	E	med	Oregon Canyon Creek	regs, distance	new	seasonal gage w/ telemetry
13219290	9	E	med	Upper Harper Ditch near Harper	regs, sigPODs	acquire	shared supply, poorly run district gage
13219100	9	E	med	Vale Oregon Cn nr Namorf	regs, sigPODs	acquire	shared supply, poorly run district gage
13221000	9	E	med	Vines Cn nr Valye	regs, sigPODs	acquire	shared supply, poorly run district gage
10406500	10	E	med	Trout Cr nr Denio, NV	Environ, distance	upgrade	telemetry upgrade
10406310	10	E	med	Wildhorse Cr nr Andrews, OR	regs, distance	new	
11339995	12	SC	med	Cottonwood Cr ab Cottnwd Res	regs, Environ, sigPODs	upgrade	telemetry upgrade to district gage
11340700	12	SC	med	Cottonwood Cr blw Hwy x-ing	regs, Environ, sigPODs	upgrade	telemetry upgrade to district gage
14375200	14	SW	med	Sucker Cr at Bridgeview, OR	regs, Environ, distance	upgrade	
14312200	15	SW	med	Deer Cr nr Roseburg, OR	regs, Environ, sigPODs	reactivate	
14311000	15	SW	med	N Myrtle Cr nr Myrtle Cr, OR	regs, Environ, sigPODs	reactivate	
14310800	15	SW	med	S Myrtle Cr blw Carson Cr	regs, Environ, sigPODs	reactivate	
14184020	16	NW	med	Sidney Cn, nr Marion, OR	regs, sigPOD	reactivate	shared supply, contract water
11484300	17	SC	med	Lost R blw Harpold Dam	regs, Environ	new	difficult site, probably velocity-index gage
	17	SC	med	Lost R blw Malone Dam	regs, Environ, sigPODs, distance	new	unnecessary if outflow calc is accurate
11484200	17	SC	med	Lost R@Keller Brdg nr Bonanza	regs, Environ	new	difficult site, probably velocity-index gage
11483500	17	SC	med	Miller Cr blw Gerber Res	regs, Environ, sigPODs, distance	new	unnecessary if outflow calc is accurate
14327055	19	SW	med	Coquille River at Coquille, OR	regs, Environ, sigPODs	upgrade	unsure of status
14327150	19	SW	med	Sixes R at Sixes, OR	Environ, sigPODs, distance	reactivate	

Table 2 continued: Identified new low priority gaging locations for surface water distribution.

Old Gage #	WM District	Region	Priority	Descriptions	Flags	Gage Type	Notes
	13	SW	low	Applegate R abv Applegate Lk	regs, Environ	new	only needed durings droughts 2 calc live outflow
14361600	13	SW	low	Elliot Cr abv Applegate Lk	regs, Environ	reactivate	only needed durings droughts 2 calc live outflow
14301300	1	NW	low	Miami R nr Garibaldi, OR	Environ	upgrade	telemetry upgrade
14299000	1	NW	low	S Fk Necanicum R nrSeaside, OR	Environ, distance	upgrade	telemetry upgrade
14114500	3	NC	low	Mt Hood Cn nr Mt Hood, OR	Environ, sigPOD	new	
	3	NC	low	Ramsey Cr nr Dufur, OR	regs, Environ	staff gage	
	9	E	low	Cow Cr nr Downey Canyon	regs, distance	new	seasonal gage w/ telemetry
	9	E	low	Cow Cr nr State Line	regs, distance	new	seasonal gage w/ telemetry
13231500	9	E	low	Willow Cr nr Brogan	regs	reactivate	
10394000	10	E	low	Poison Cr nr Barns, OR	regs, Environ	staff gage	
	11	SC	low	Indian Ford Cr nr Hwy 20	regs, Environ	new	
14361700	13	SW	low	Carberry Cr nr Copper, OR	regs, Environ	reactivate	only needed durings droughts 2 calc live outflow
	13	SW	low	Squaw Cr abv Applegate Lk	regs, Environ	new	only needed durings droughts 2 calc live outflow
	16	NW	low	Drift Cr nr Silverton, OR	regs, Environ	new	
14200300	16	NW	low	Silver Cr at Silverton, OR	regs, Environ	reactivate	
11503500	17	SC	low	Anna Cr nr Fort Klamath, OR	regs, distance	reactivate	seasonal gages
	17	SC	low	S. Fk Sprague blw Fishhole Cr	regs, sigPODs	new	
	17	SC	low	Sevenmile Cr @ Nicholson Rd	regs, distance	staff gage	problem POD
	17	SC	low	Sevenmile Ditch @ NFD32 Rd	regs, distance	mmt device	problem POD
	18	NW	low	Wapato Canal nr Gaston OR	sigPOD	new	need site improvements. current monitored via mmt

Table 3: Gage alternative evaluation for surface water distribution

Field Responses, (1 = Yes, 0 = No), Do not consider water use reporting requirements. Answer each question sequentially. If you answer a question for a gage with a "0" (i.e., "NO" answer), then continue to the next question (i.e., next column). If you answer a question with a "1" (i.e., "YES" answer), then add comment to explain your answer and continue on to the questions for the next gage.

Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
10366000	SC	12	TWENTYMILE CR NR ADEL, OR	OWRD	0	0	0	N/A	0	0	Not a management Gage.	0	1
10371500	SC	12	DEEP CR AB ADEL, OR	OWRD	0	0	0	N/A	0	0	Gage is not used by OWRD for water management. Very important index site for water availability analysis.	0	1
10391050	SC	12	BUCK CR AB PAULINA MARSH NR SILVER LAKE, OR	OWRD	0	0	0	N/A	0	0	Not a management gage.	0	0
11491400	SC	17	WILLIAMSON R BL SHEEP CR NR LENZ, OR	OWRD	0	0	0	N/A	0	0	Not a management gage.	0	1
11499100	SC	17	SYCAN R BL SNAKE CR NR BEATTY, OR	OWRD	0	0	0	0	0	0	Not a management gage.	0	1
11510000	SC	17	SPENCER CR NR KENO, OR	OWRD	0	0	0	N/A	1	1	Pacificorp has a high interest and is part of the interim measures for the Klamath Hydroelectric settlement agreement. A lot of interests in flows by multiple groups for this salmonid stream.	0	1
13275300	E	8	POWDER R NR SUMPTER, OR	OWRD	0	0	0	N/A	0	1	Valuable to irrigation district for water management. Not used by OWRD for water management.	0	1
14039380	NC	4	MURDERERS CR NR DAYVILLE, OR	OWRD	0	0	0	N/A	0	0	Gage monitors ISWR, but has no telemetry and is not used for regulation. ODFW performs periodic measurements which are used to trigger regulation.	0	1
14039500	NC	4	S FK JOHN DAY R NR DAYVILLE, OR	OWRD	0	0	0	N/A	0	1	Gage not used for water management. Resource constraints limit regulation on creek. However, location is though to not be conducive to future regulation needs	0	1
14040500	NC	4	JOHN DAY R AT PICTURE GORGE, NR DAYVILLE, OR	OWRD	0	0	0	N/A	0	0	Theoretically, the gage may be used in conjunction with gage on S Fk to determine flow above Dayville-- an important flow monitoring location for regulation. Reality is gage is not used for regulation - lowest point of regulation of upper JDR is above confluence of SFJDR. If there was a gage available in an appropriate location then it would be used for regulation of Upper JDR system.	0	1
14063000	SC	11	LITTLE DESCHUTES R NR LA PINE, OR	OWRD	0	0	0	N/A	0	0	Not used by OWRD for water management	0	1
14075000	SC	11	WHYCHUS CR NR SISTERS, OR	OWRD	0	0	0	N/A	0	0	Not a management gage. Overappropriated downstream of gage site, but no users upstream of site. Not used by OWRD for water management.	0	1
14079800	SC	11	CROOKED R AB PRINEVILLE RES NR POST, OR	OWRD	0	1	0	N/A	0	0	Stream is overappropriated, but this gage is not used by OWRD for water management. Gage does indicate weather ISWR is being met, but no regulation for the ISWR.	0	1
14080500	SC	11	CROOKED R NR PRINEVILLE, OR	OWRD	0	0	0	N/A	0	0	The gage helps irrigation district manage reservoir releases to irrigation demand. ISWR is protested and demand < supply. Not used by OWRD for water management.	0	1
14080590	SC	11	CROOKED R FEED CN NR PRINEVILLE, OR	OWRD	0	0	0	0	0	0	The gage helps irrigation district manage reservoir releases to irrigation demand. ISWR is protested and demand < supply. Not used by OWRD for water management.	0	1
14085200	SC	11	OCHOCO FEED CN NR PRINEVILLE, OR	OWRD	0	0	0	0	0	0	The gage helps irrigation district manage reservoir releases to irrigation demand. ISWR is protested and demand < supply. Not used by OWRD for water management.	0	1

Table 3, continued[3]

Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
14085300	SC	11	OCHOCO CR BL OCHOCO RES NR PRINEVILLE, OR	OWRD	0	0	0	N/A	0	0	The gage helps irrigation district manage reservoir releases to irrigation demand. ISWR is protested and demand < supply. Not used by OWRD for water management.	0	1
14118500	NC	3	W FK HOOD R NR DEE, OR	OWRD	0	0	0	N/A	0	0	ISWR's are sometimes not met in the summer months, but there is no regulation for the ISWRs. The gage gage is of some interest to other agencies. It is primarily used to monitor instream flows.	0	1
14134000	NW	20	SALMON R NR GOVERNMENT CAMP, OR	OWRD	0	0	0	N/A	0	1	This gage is high in the drainage and has virtually no withdrawls above it. It is an indicator station for water availabiltiy, modeling and is relied upon by OWRD and USFS.	0	1
14205000	NW	18	W FK DAIRY CR AT BANKS, OR	OWRD	0	0	0	N/A	0	0	ISWR but priority date is not regulated for	0	1
14205160	NW	18	W FK DAIRY CR @ EVERS RD	OWRD	0	0	0	N/A	0	0	ISWR but priority date is not regulated for	0	1
14205480	NW	18	E FK DAIRY CR NR MOUNTAINDALE, OR	OWRD	0	0	0	N/A	0	0	ISWR but priority date is not regulated for	0	1
14206241	NW	18	TUALATIN R AT HWY 219 NR HILLSBORO, OR	OWRD	0	0	0	N/A	1	1	This gage is monitored for Clean Water Services water quality purposes only	0	1
14211546	NW	20	CRYSTAL SPRINGS CR AT MOUTH AT PORTLAND, OR	OWRD							Discontinued - severe back-water impact.	0	1
14320700	SW	15	CALAPOOYA CR NR OAKLAND, OR	OWRD	0	0	0	0	1		Data is used for historical long term record and for City of Sutherland Water Treatment Facility	0	1
14372500	SW	14	E FK ILLINOIS R NR TAKILMA, OR	OWRD	0	0	0	0	0	0	Data is used for Historical long term record	0	1
14375100	SW	14	SUCKER CR BL L GRAYBACK CR NR HOLLAND, OR	OWRD	0	0	0	0	1		Data is used for Historical long term record	0	1
11494950	SC	17	S. Fk Sprague R @ Sprague R Park nr Bly	OWRD	0	0	0	N/A	0	1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other gages. Gage is operated under a grant.	0.5	1
11495600	SC	17	S. Fk Sprague R blw Fishhole Cr nr Bly	OWRD	0	0	0	0	0	1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other gages. Gage is operated under a grant.	0.5	1
11495900	SC	17	N FK SPRAGUE R AB SRIC CN NR BLY, OR	OWRD	0	0	0	0	0	1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other measurements and/or gages. Gage is operated under a grant.	0.5	1
11497500	SC	17	SPRAGUE R NR BEATTY, OR	OWRD	0	0	0	0	0	1	Not a management gage at this point. Potential for regulation once adjudication complete. Gage is operated under a grant.	0.5	1
11500500	SC	17	Sprague River @ Lone Pine Road	OWRD	0	0	0	0	0	1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other gages. Gage is operated under a grant.	0.5	1
14038602	NC	4	CANYON CR NR CANYON CITY, OR	OWRD	0	1	0	N/A	0	1	Gage monitors ISWR. Regulation does not occur due to staffing constraints, but should occur in favor of the ISWR. WM Office would like regulate system annually along with other high priority tributaries and the gage would be useful in this endeavor.	0.5	1

[3] Note: Management Designation of 0.5 indicates gage will probably be used for water distribution in the future.

Table 3, continued

Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
14114000	NC	3	E FK I D CN NR MT HOOD, OR	OWRD	0	0	0	0	0	1	Question 2- There is not enough water to satisfy ISWR's during the summer months. However, they are junior so no regulation occurs. Question 3- EFID uses the gage to track how much water EFID are diverting and is used by EFID uses for water management. Not currently used by OWRD for water management, but if hydropower right is transferred instream would be used by OWRD for water management.	0.5	1
14115830	NC	3	GLACIER D NR PARKDALE, OR	OWRD	0	0	0	0	0	1	This gage has been discontinued. MFID planned on piping. Was not used by OWRD for water management, but if hydropower right is transferred instream would be used by OWRD for water management.	0.5	1
14116200	NC	3	DEE IRRIGATION CN NR DEE, OR	OWRD	0	0	0	0	0	1	Dee ID is currently looking at piping the ditch. If they are able to secure the funding, the gage would no longer be operable. They would be installing some sort of flow measurement device such as a totalizing meter. The gage is used primarily by the District's ditch walker. Not currently used by OWRD for water management, but if hydropower right is transferred instream would be used by OWRD for water management.	0.5	1

Table 4: Current and future conjunctive–use stream gaging sites.

GAGE #	DESCRIPTION	Current Conjunctive-Use	Future Conjunctive Use	STATUS	WM DISTRICT	BASIN	OPERATOR	COMMENTS
11484200	LOST R AT BONANZA, OR	1	0	ACTIVE	17	KLA	OWRD	Stage only. Used to manage Horsefly diversion and area GW pumping .
11484201	BONANZA SPRINGS AT BIG SPRINGS PARK	1	0	ACTIVE	17	KLA	OWRD	Stage on spring only. Used to manage Horsefly diversion and area GW pumping .
11501000	SPRAGUE R NR CHILOQUIN, OR	1	0	ACTIVE	17	KLA	USGS	Monitors GW supply to UKL, and likelihood (need) of large seasonal pumping stress in Klamath project area.
11502500	WILLIAMSON R BL SPRAGUE R NR CHILOQUIN, OR	1	0	ACTIVE	17	KLA	USGS	Monitors GW supply to UKL, and likelihood (need) of large seasonal pumping stress in Klamath project area.
11502940	WOOD R AT DIXON RD NR FORT KALAMTH, OR	1	0	ACTIVE	17	KLA	OWRD	Monitors GW supply to UKL, and likelihood (need) of large seasonal pumping stress in Klamath project area.
11507001	UPPER KLAMATH LAKE DAILY WEIGHTED MEAN ELEVATIONS	1	0	ACTIVE	17	KLA	USGS	Monitors supply and storage into UKL, and likelihood (need) of large seasonal pumping stress in Klamath project area.
11507501	LINK R + KENO CN AT KLAMATH FALLS, OR	1	0	ACTIVE	17	KLA	USGS	Monitors outflows from project area, and likelihood (need) of large seasonal pumping stress in Klamath project area.
11507200	"A" CN AT KLAMATH FALLS, OR	1	0	ACTIVE	17	KLA	OTHER	Monitors outflows from project area, and likelihood (need) of large seasonal pumping stress in Klamath project area.
11509500	KLAMATH R AT KENO, OR	1	0	ACTIVE	17	KLA	USGS	Monitors outflows from project area, and likelihood (need) of large seasonal pumping stress in Klamath project area.
14030820	ORDNANCE RECHARGE CN NR ORDANCE, OR	1	0	ACTIVE	5	UMA	OWRD	Monitors recharge in alluvial aquifer in critical groundwater area.
14032400	UMATILLA R BLW WWTP, NR HERMISTON OR	1	0	ACTIVE	5	UMA	OWRD	Monitors streamflow in critical groundwater area and area of GW/SW interactions. Can trigger regulation.
14033500	UMATILLA R NR UMATILLA, OR	1	0	ACTIVE	5	UMA	USGS	Monitors streamflow in critical groundwater area and area of GW/SW interactions. Can trigger regulation.
14056500	DESCHUTES R BL WICKIUP RES NR LA PINE, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14063000	LITTLE DESCHUTES R NR LA PINE, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14064500	DESCHUTES R AT BENHAM FALLS NR BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14068500	DESCHUTES CTY MUN IMP DIST CN AT BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14069000	NORTH UNIT MAIN CN NR BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14069500	NORTH CN NR BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14070000	SWALLEY CN NR BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14070500	DESCHUTES R BL BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage/evaluate Deschtues mitigation program.
14073520	TUMALO CR BL TUMALO FEED CN DIV NR BEND, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage Deschtues mitigation program.
14076050	WHYCHUS CR AT SISTERS, OR	1	0	ACTIVE	11	DES	OWRD	Used to manage Deschtues mitigation program.
14091500	METOLIUS R NR GRANDVIEW, OR	1	0	ACTIVE	11	DES	USGS	Used to manage Deschtues mitigation program.
14092500	DESCHUTES R NR MADRAS, OR	1	0	ACTIVE	11	DES	USGS	Used to manage Deschtues mitigation program.
14103000	DESCHUTES R AT MOODY NR BIGGS, OR	1	0	ACTIVE	3	DES	USGS	Used to evaluate Deschutes Mitigation Program

Table 4: continued

GAGE #	DESCRIPTION	Current Conjunctive-Use	Future Conjunctive Use	STATUS	WM DISTRICT	BASIN	OPERATOR	COMMENTS
10387500	SUMMER LAKE CN NR SUMMER LAKE, OR	0	1	ACTIVE	12	SUM	OWRD	Available flow influenced by pumping in Christmas valley area.
10388000	ANA R NR SUMMER LAKE, OR	0	1	ACTIVE	12	SUM	OWRD	Streamflow influenced by pumping in Christmas valley area.
11497500	SPRAGUE R NR BEATTY, OR	0	1	ACTIVE	17	KLA	OWRD	used w/ Sprague blw Brown Creek to monitor spring inflows in area of GW pumping and known GW/SW interactions. Ongoing water shortages and conflicts in basin.
11497550	SPRAGUE R BLW BROWN CR NR BEATTY, OR	0	1	ACTIVE	17	KLA	OWRD	used w/ Sprague nr Beatty to monitor spring inflows in area of GW pumping and known GW/SW interactions.Ongoing water shortages and conflicts in basin.
11500500	SPRAGUE R AT LONE PINE	0	1	ACTIVE	17	KLA	OWRD	used w/ Sprague @ Chiloquin and Godowa Springs Road to monitor spring inflows in two areas of GW pumping and known GW/SW interactions. Ongoing shorages and conflicts in basin.
11510700	KLAMATH R BLW JOHN C BOYLE PP, NR KENO OR	0	1	ACTIVE	17	KLA	USGS	Large springs between Keno and this location. Pumping stresse in Klamath project area will likely affect these springs.
13284900	POWDER R AB THIEF VALLEY RES NR N POWDER, OR	0	1	ACTIVE	8	POW	OWRD	Possible future analysis and monitoring of gw development impacts on sw discharge higher in Powder basin; influence from stored water though
13286700	POWDER R NR RICHLAND, OR	0	1	ACTIVE	8	POW	OTHER	Monitors outflow from Powder Basin; run by Idaho Power; Possible analysis and monitoring of gw development in basin and its impact on sw discharge
13318960	GRANDE RONDE R NR PERRY, OR	0	1	ACTIVE	6	GRA	OWRD	monitors inflows into Grande Ronde Valley, where large amounts of GW development has occurred abv SWW.
14076500	DESCHUTES R NR CULVER, OR	0	1	ACTIVE	11	DES	USGS	Potential use to manage Deschtues mitigation program.
14076100	WHYCHUS CR AT CAMP POLK RD, NR SISTERS, OR	0	1	ACTIVE	11	DES	OWRD	Future use in management and evaluation of Deschutes mitigation program, monitors upstream GW pumping stresses.
14087300	CROOKED R NR TERREBONNE, OR	0	1	ACTIVE	11	DES	OWRD	GW development post ISWR priority. Zero surface water availablity.
14087380	CROOKED R BLW OSBORNE CANYON, NR OPAL CITY, OR	0	1	ACTIVE	11	DES	USGS	Future use in management and evaluation of Deschutes mitigation program, monitors upstream GW pumping stresses.
14087400	CROOKED R BL OPAL SPRINGS NR CULVER, OR	0	1	ACTIVE	11	DES	USGS	Potential use to manage Deschtues mitigation program.
14104800	FIFTEEN MILE CR AT KASER RANCH, NR THE DALLES, OR	0	1	ACTIVE	2	HOOD	OTHER	Area of potential GW/SW interactions, large pumping stresses (relative to streamflow) and potential well construction issues. Zero surface water availability.
14113200	MOSIER CR NR MOSIER, OR	0	1	ACTIVE	3	HOOD	USGS	Area of GW/SW interactions, large pumping stresses (relative to streamflow) and potential well construction issues. Zero surface water availability. Interests in ASR.
14200000	MOLALLA R NR CANBY, OR	0	1	ACTIVE	16	WIL	USGS	GW development post ISWR priority, No surface water availability.
14202000	PUDDING R AT AURORA, OR	0	1	ACTIVE	16	WIL	USGS	GW development post ISWR priority, No surface water availability.
14375200	SUCKER CR AT BRIDGEVIEW, OR	0	1	ACTIVE	14	ROG	OWRD	Potential good data site in the unlikely event more gw development occurred in the alluvial basin
10405000	SILVER CR BL SUNTEX, OR	0	1	NEW	10	MAL LK	OWRD	Large post-1987 GW development. Zero surface water availability.
11499500	WHISKEY CR NR BEATTY, OR	0	1	NEW	17	KLA	OWRD	AREA OF GW PUMPING, WELL CONSTRUCTION ISSUES, AND GW/SW INTERACTIONS
13323500	GRANDE RONDE R NR ELGIN, OR	0	1	NEW	6	GRA	OWRD	Monitors inflow to Grande Ronde Basin; potential use in analysis of gw developmentand/use in basin and impact on sw discharge.
14074630	DESCHUTES R AT LOWER BRIDGE, NR TERREBONNE, OR	0	1	NEW	11	DES	OWRD	useful to manage and evaluate Deschutes mitigation program, monitor upstream pumping stresses.
14079500	CROOKED R AT POST, OR	0	1	NEW	11	DES	OWRD	GW development post ISWR priority. Zero surface water availablity.
14201000	PUDDING R NR MT ANGEL, OR	0	1	NEW	0	WIL	OWRD	GW development post ISWR priority, No surface water availability.
NEW	MOSIER CR ABV MOUTH NR MOSIER, OR	0	1	NEW	0	HOOD	OWRD	Area of GW/SW interactions, large pumping stresses (relative to streamflow) and potential well construction issues. Zero surface water availability. Interests in ASR.

Table 5: Eastern region gage funding sources[4]

Eastern Region							
Station No.	Station Name	Region	Gage Operator	Gage Funding (*STATE, COOP, or OTHER*)	Funding Source	Funding: Annual Cost Share	Comments
10393500	SILVIES R NR BURNS, OR	E	OWRD	STATE	N/A	$0	
10406500	TROUT CR NR DENIO, NV	E	OWRD	STATE	N/A	$0	
13214000	MALHEUR R NR DREWSEY, OR	E	OWRD	COOP	USBR	$7,020	
13214500	WARMSPRINGS RES NR RIVERSIDE, OR	E	USBR	COOP	N/A	$0	Watermaster reads gage in reservoir and reports to USBR
13216500	N FK MALHEUR R AB BEULAH RES NR BEULAH, OR	E	OWRD	COOP	USBR	$7,020	
13269300	N FK BURNT R NR WHITNEY, OR	E	OWRD	COOP	USFS	$2,400	seasonal
13273000	BURNT R NR HEREFORD, OR	E	OWRD	COOP	USBR	$7,020	
13274020	BURNT R AB CLARKS CR NR BRIDGEPORT, OR	E	OWRD	COOP	BRID	$2,400	seasonal
13274400	BURNT R AB BANKS DIV NR DURKEE, OR	E	OWRD	COOP	BRID	$2,400	seasonal
13275000	BURNT R AT HUNTINGTON, OR	E	OWRD	COOP	BRID	$2,400	seasonal
13275105	POWDER R AT HUDSPETH LANE NR SUMPTER, OR	E	OWRD	STATE	N/A	$0	
13275200	DEER CR AB PHILLIPS LAKE NR SUMPTER, OR	E	OWRD	STATE	N/A	$0	
13275300	POWDER R NR SUMPTER, OR	E	OWRD	COOP	USBR	$7,020	
13277000	POWDER R AT BAKER CITY, OR	E	OWRD	COOP	USBR	$7,020	
13281200	ROCK CR NR HAINES, OR	E	OWRD	STATE	N/A	$0	
13282550	OR	E	OWRD	COOP	PVWCD	$3,600	
13284900	POWDER R AB THIEF VALLEY RES NR N POWDER, OR	E	OWRD	COOP	USBR	$3,510	
13285500	POWDER R BL THIEF VALLEY RES NR N POWDER, OR	E	OWRD	COOP	USBR	$7,020	
13317850	GRANDE RONDE R BL CLEAR CR, NR STARKEY, OR	E	UNION CTY	COOP	GRMW	$7,700	
13318060	MEADOW CR AB BEAR CR NR STARKEY, OR	E	UNION CTY	COOP	GRMW	$7,700	
13318210	MEADOW CR BL DARK CANYON CR NR STARKEY, OR	E	UNION CTY	COOP	GRMW	$7,700	
13318920	FIVE POINTS CR AT HILGARD, OR	E	UNION CTY	COOP	GRMW	$7,700	
13318960	GRANDE RONDE R NR PERRY, OR	E	UNION CTY	COOP	GRMW	$7,700	
13319900	OR	E	UNION CTY	COOP	GRMW	$7,700	
13320000	CATHERINE CR NR UNION, OR	E	OWRD	STATE	N/A	$0	
13320300	CATHERINE CR AT UNION, OR	E	UNION CTY	COOP	GRMW	$7,700	
13329770	WALLOWA R AB CROSS COUNTRY CN NR ENTERPRISE, OR	E	OWRD	COOP	GRMW	$7,700	
13330000	LOSTINE R NR LOSTINE, OR	E	OWRD	COOP	GRMW	$7,700	
13330050	LOSTINE R AT CAUDLE LANE AT LOSTINE, OR	E	OWRD	COOP	NFWF	$2,500	seasonal
13330300	LOSTINE R AT BAKER RD, NR LOSTINE, OR	E	OWRD	COOP	GRMW	$7,700	
13330500	BEAR CR NR WALLOWA, OR	E	OWRD	COOP	GRMW	$7,700	
13331450	WALLOWA R BL WATER CAN, NR WALLOWA,	E	OWRD	COOP	GRMW	$7,700	
10403400	SILVER CR BL NICHOLL CR NR RILEY	E	OWRD	STATE	N/A	$0	
				Eastern Region subtotal >>>		$153,730	

[4] Acronyms– BPA: Bonneville Power Administration; BRID: Burnt River Irrigation District; CTWS: Confederated Tribes of Warm Springs; FWT: Fresh Water Trust; GRMW: Grande Ronde Model Watershed; JC: Jackson County; NFWF: National Fish and Wildlife Foundation; ODFW: Oregon Department of Fish and Wildlife; PVWCD: Powder Valley Water Control District; UBWC: Umatilla Basin Watershed Council; USBR: US Bureau of Reclamation; USFS: US Forest Service; USGS: US Geological Survey

Table 5 continued: North Central region gage funding sources[4]

North-Central Region							
Station No.	Station Name	Region	Gage Operator	Gage Funding (*STATE, COOP, or OTHER*)	Funding Source	Funding: Annual Cost Share	Comments
14010000	S FK WALLA WALLA R NR MILTON, OR	NC	OWRD	STATE	N/A	N/A	
14010800	N FK WALLA WALLA R NR MILTON FREEWATER, OR	NC	OWRD	STATE	N/A	N/A	
14012100	LITTLE WALLA WALLA R NR MILTON, OR	NC	OWRD	STATE	N/A	N/A	
14012300	MILTON-FREEWATER HUDSON BAY D NR FREEWATER, OR	NC	OWRD	STATE	N/A	N/A	
14019098	PHASE II CN AB COLD SPRINGS RES NR HERMISTON, OR	NC	OWRD	COOP	USBR	$2,400	[1] USBR funds equipment, funds county hydro tech position in lieu of paying operation of the co-op gauges. OWRD analyizes, works and web publish discharge record. Hydro tech salary and OPE is pro-rated to each gage (total 24) that we consider under the co-op with USBR.
14019100	PHASE II CN AT COLD SPRINGS RES NR HERMISTON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14020990	WILDHORSE CR AT PENDLETON, OR	NC	OWRD	COOP	UBWC	$7,500	Two year contract. Operated gage, mmts, year end discharge report, annual summary
14021000	UMATILLA R AT PENDLETON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14022500	MCKAY CR NR PILOT ROCK, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14023500	MCKAY CR NR PENDLETON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14024100	W BIRCH CR AT PILOT ROCK, OR	NC	OWRD	COOP	OFWD	$8,000	[2] USBR funds equipment, funds two County positions. OWRD analysis, works and web publish discharge record, no funds. Paul Word's salary and OPE and pro-rate it to each gage (total 24) that we consider under the co-op with USBR. Money goes to pay the salary and OPE for Paul Word who measures and maintains the gages.
14024300	E BIRCH CR AT PILOT ROCK, OR	NC	OWRD	COOP	OFWD	$8,000	[2]
14025000	BIRCH CR AT RIETH, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14026000	UMATILLA R AT YOAKUM, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14026897	FURNISH CN AB CRAYNE-LISLE CN NR ECHO, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14029000	UMATILLA PROJECT FEED CN NR ECHO, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14029550	UMATILLA PROJECT FEED CN AT RES NR HERMISTON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14029780	US "A" LINE CN AT COLD SPGS RES NR HERMISTON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14029800	US "A" LINE CN NR HERMISTON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14029900	UMATILLA R NR ECHO, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14030000	ALLEN CN AT ECHO, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14030500	WESTERN LAND CN NR ECHO, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14030820	ORDNANCE RECHARGE CN NR ORDNANCE, OR	NC	OWRD	STATE	N/A	N/A	
14031000	DILLON CN NR STANFIELD, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14031050	UMATILLA R AT I-84, NR STANFIELD, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14031490	OR	NC	OWRD	COOP	USBR	$2,400	[1]
14031500	MAXWELL CN NR HERMISTON, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14031600	UMATILLA R BL MAXWELL CN NR HERMISTON	NC	OWRD	COOP	USBR	$2,400	[1]
14032000	BUTTER CR NR PINE CITY, OR	NC	OWRD	STATE	N/A	N/A	
14032400	UMATILLA R BL WASTE WATER TREATMENT PLANT NR HERMIS	NC	OWRD	COOP	USBR	$2,400	[1]

Table 5 continued: North Central region gage funding sources[4]

14032500	W DIVISION MAIN CN NR UMATILLA, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14032650	W DIVISION MAIN CN BL POWERLINE RD NR UMATILLA, OR	NC	OWRD	COOP	USBR	$2,400	[1]
14033500	UMATILLA R NR UMATILLA (USGS Gage with OWRD Coop)	NC	USGS	COOP	BPA	N/A	[1]
14034800	RHEA CR NR HEPPNER, OR	NC	OWRD	STATE	N/A	N/A	
14037500	STRAWBERRY CR AB SLIDE CR NR PRAIRIE CITY, OR	NC	OWRD	STATE	N/A	N/A	
14038602	CANYON CR NR CANYON CITY, OR	NC	OWRD	STATE	N/A	N/A	
14039320	OR	NC	OWRD	STATE	N/A	N/A	
14039340	DEER CR NR IZEE, OR	NC	OWRD	STATE	N/A	N/A	
14039380	MURDERERS CR NR DAYVILLE, OR	NC	OWRD	STATE	N/A	N/A	
14039500	S FK JOHN DAY R NR DAYVILLE, OR	NC	OWRD	STATE	N/A	N/A	
14040500	JOHN DAY R AT PICTURE GORGE, NR DAYVILLE, OR	NC	OWRD	STATE	N/A	N/A	
14040600	MOUNTAIN CR NR MITCHELL, OR	NC	OWRD	STATE	N/A	N/A	
14042500	CAMAS CR NR UKIAH, OR	NC	OWRD	STATE	N/A	N/A	
14043700	FIVEMILE CR DIV TO BUTTER CR NR GURDANE, OR (Seasonal)	NC	OWRD	STATE	N/A	N/A	
14047100	BUTTE CR NR FOSSIL, OR	NC	OWRD	STATE	N/A	N/A	
14047380	LONE ROCK CR NR LONEROCK, OR	NC	OWRD	STATE	N/A	N/A	Discontinued 10/4/2010
14100850	BADGER IMPROVEMENT DISTRICT D NR WAMIC, OR	NC	OWRD	STATE	N/A	N/A	
14114000	E FK I D CN NR MT HOOD, OR	NC	OWRD	STATE	N/A	N/A	
14116200	DEE IRRIGATION CN NR DEE, OR	NC	OWRD	STATE	N/A	N/A	
14118500	W FK HOOD R NR DEE, OR	NC	OWRD	STATE	N/A	N/A	
14105550	Fifteenmile Cr nr The Dalles, OR	NC	OWRD	COOP	OWRD, CTWS	$8,341	CTWS is expected to begin funding this gage in 2011. Owrd bid, waiting for tribe three bid process
14104800	Fifteenmile Cr @ Kaser Ranch nr The Dalles, OR	NC	OWRD, FW	COOP	OWRD, FWT	$0	Fresh Water Trust currently operates recorder. OWRD and FWT measure flow.
				North Central Region subtotal >		$87,041	

Table 5 continued: North West region gage funding sources[4]

Northwest Region							
Station No.	Station Name	Region	Gage Operator	Gage Funding (*STATE, COOP, or OTHER*)	Funding Source	Funding: Annual Cost Share	Comments
14134000	SALMON R NR GOVERNMENT CAMP, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14153800	LAYNG CR AB PRATHER CR NR DISSTON, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14192500	S YAMHILL R NR WILLAMINA, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14193000	WILLAMINA CR NR WILLAMINA, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14194300	N YAMHILL R NR FAIRDALE, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14202450	GROVE, OR	NW	OWRD	COOP	COOP	$9,053	OWRD operated gage providing provisional record
14202510	TUALATIN R AT GASTON, OR	NW	OWRD	COOP	COOP	$8,969	OWRD operated gage providing provisional record
14202850	GASTON, OR	NW	OWRD	COOP	COOP	$7,068	OWRD operated gage providing provisional record
14202920	SAIN CR NR GASTON, OR	NW	OWRD	COOP	COOP	$7,068	OWRD operated gage providing provisional record
14202980	GASTON	NW	OWRD	COOP	COOP	$8,216	OWRD operated gage providing provisional record
14204530	OR	NW	OWRD	COOP	COOP	$7,596	OWRD operated gage providing provisional record
14204800	CORNELIUS, OR	NW	OWRD	COOP	COOP	$9,008	OWRD operated gage providing provisional record
14206200	DAIRY CR AT RTE 8 NR HILLSBORO, OR	NW	OWRD	COOP	COOP	$7,605	OWRD operated gage providing provisional record
14206295	OR	NW	OWRD	COOP	COOP	$9,067	OWRD operated gage providing provisional record
14206500	TUALATIN R AT FARMINGTON, OR	NW	OWRD	COOP	COOP	$9,079	OWRD operated gage providing provisional record
14206956	TUALATIN R AT TUALATIN PARK NR TUALATIN	NW	OWRD	COOP	COOP	$3,633	OWRD operated gage providing provisional record
14207000	OSWEGO CN NR LAKE OSWEGO	NW	OWRD	COOP	COOP	$6,969	OWRD operated gage providing provisional record
14299000	S FK NECANICUM R NR SEASIDE, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14299137	W FK ECOLA CR AB CITY DIV, NR CANNON BEACH, OR	NW	OWRD	COOP	Cannon Beach	$6,100	OWRD operated gage providing provisional record
14299150	N FK ECOLA CR (AKA ELK CR) NR CANNON BEACN, OR	NW	OWRD	COOP	Cannon Beach	$6,100	OWRD operated gage providing provisional record
14300100	ROCK CR AT VERNONIA, OR	NW	OWRD	COOP	Vernonia	$5,200	OWRD operated gage providing provisional record
14301300	MIAMI R NR GARIBALDI, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14304350	SUNSHINE CR NR VALSETZ, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14306030	YAQUINA R NR CHITWOOD, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14306820	DRIFT CR NR WALDPORT, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
14306900	BIG CR NR ROOSEVELT BEACH, OR	NW	OWRD	STATE	N/A	N/A	OWRD operated gage
				Northwest Region subtotal >>>>		$110,731	

Table 5 continued: South Central region gage funding sources [4].

South-Central Region							
Station No.	Station Name	Region	Gage Operator	Gage Funding (*STATE, COOP, or OTHER*)	Funding Source	Funding: Annual Cost Share	Comments
10366000	TWENTYMILE CR NR ADEL, OR	SC	OWRD	STATE	N/A	$0	
10371500	DEEP CR AB ADEL, OR	SC	OWRD	STATE	N/A	$0	
10378500	HONEY CR NR PLUSH, OR	SC	OWRD	STATE	N/A	$0	
10384000	CHEWAUCAN R NR PAISLEY, OR	SC	OWRD	STATE	N/A	$0	
10387500	SUMMER LAKE CN NR SUMMER LAKE, OR	SC	OWRD	STATE	N/A	$0	
10388000	ANA R NR SUMMER LAKE, OR	SC	OWRD	STATE	N/A	$0	
10389500	SILVER LAKE I D CN NR SILVER LAKE, OR	SC	OWRD	STATE	N/A	$0	
10390000	SILVER CR NR SILVER LAKE, OR	SC	OWRD	STATE	N/A	$0	
10391050	BUCK CR AB PAULINA MARSH NR SILVER LAKE, OR	SC	OWRD	STATE	N/A	$0	Discontinued 10/4/2010
11338500	DREWS RES NR LAKEVIEW, OR	SC	OWRD	STATE	N/A	$0	
11491400	WILLIAMSON R BL SHEEP CR NR LENZ, OR	SC	OWRD	STATE	N/A	$0	
11494950	BLY	SC	OWRD	STATE	N/A	$0	
11495600	S FK SPRAGUE R BL FISHHOLE CR NR BLY	SC	OWRD	STATE	N/A	$0	
11495900	N FK SPRAGUE R AB SRIC CN NR BLY, OR	SC	OWRD	STATE	N/A	$0	
11497500	SPRAGUE R NR BEATTY, OR	SC	OWRD	STATE	N/A	$0	
11497550	SPRAGUE R BL BROWN CR NR BEATTY	SC	OWRD	STATE	N/A	$0	
11499100	SYCAN R BL SNAKE CR NR BEATTY, OR	SC	OWRD	STATE	N/A	$0	
11500500	SPRAGUE R AT LONE PINE	SC	OWRD	STATE	N/A	$0	
11502940	WOOD R AT DIXON RD NR FORT KLAMATH, OR(CARDWELL RAN	SC	OWRD	STATE	N/A	$0	
11510000	SPENCER CR NR KENO, OR	SC	OWRD	STATE	N/A	$0	High potential to leverage funds from Pacificorp to run this gage
14050000	DESCHUTES R BL SNOW CR NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14050500	CULTUS R AB CULTUS CR NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14051000	CULTUS CR AB CRANE PRAIRIE RES NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14052000	DEER CR AB CRANE PRAIRIE RES NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14052500	QUINN R NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14053000	CHARLTON CR AB CRANE PRAIRIE RES NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14053500	CRANE PRAIRIE RES NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	OWRD does O&M, rating, publish records, irrigation districts pay USBR for telemetry and associated O&M.
14054000	DESCHUTES R BL CRANE PRAIRIE RES NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	OWRD does O&M, rating, publish records, irrigation districts pay USBR for telemetry and associated O&M.
14054500	BROWN CR NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14055600	ODELL CR NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14056000	WICKIUP RES NR LA PINE, OR	SC	OWRD	COOP	USBR	$0	OWRD does O&M, rating, publish records, irrigation districts pay USBR for telemetry and associated O&M.
14056500	DESCHUTES R BL WICKIUP RES NR LA PINE, OR	SC	USBR	STATE	N/A	$0	OWRD does O&M, rating, publish records, irrigation districts pay USBR for telemetry and associated O&M.
14057500	FALL R NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14059500	CRESCENT LAKE NR CRESCENT, OR	SC	OWRD	STATE	N/A	$0	

Table 5 continued: South Central region gage funding sources[4].

South-Central Region							
Station No.	Station Name	Region	Gage Operator	Gage Funding (*STATE, COOP, or OTHER*)	Funding Source	Funding: Annual Cost Share	Comments
14060000	CRESCENT CR AT CRESCENT LAKE NR CRESCENT, OR	SC	OWRD	STATE	N/A	$0	
14062500	WALKER BASIN CN NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14063000	LITTLE DESCHUTES R NR LA PINE, OR	SC	OWRD	STATE	N/A	$0	
14064500	OR	SC	OWRD	STATE	N/A	$0	
14065500	ARNOLD CN NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14066500	CENTRAL OREGON CN AB PILOT BUTTE NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14068500	OR	SC	OWRD	STATE	N/A	$0	
14069000	NORTH UNIT MAIN CN NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14069500	NORTH CN NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14069699	CENTRAL OREGON IRRIGATION SPILL WEIR NR TERREBONNE,	SC	OWRD	STATE	N/A	$0	
14069700	LONE PINE CN NR TERREBONNE, OR	SC	OWRD	STATE	N/A	$0	
14070000	SWALLEY CN NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14070500	DESCHUTES R BL BEND, OR	SC	OWRD	STATE	N/A	$0	
14073500	TUMALO FEED CN NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14073520	TUMALO CR BL TUMALO FEED CN DIV NR BEND, OR	SC	OWRD	STATE	N/A	$0	
14074900	SNOW CR NR SISTERS, OR	SC	OWRD	STATE	N/A	$0	
14075000	WHYCHUS CR NR SISTERS, OR	SC	OWRD	STATE	N/A	$0	
14076000	WHYCHUS CR CN NR SISTERS, OR	SC	OWRD	STATE	N/A	$0	
14076050	WHYCHUS CR AT SISTERS, OR	SC	OWRD	STATE	N/A	$0	
14076100	WHYCHUS CR AT CAMP POLK RD NR SISTERS,OR	SC	OWRD	STATE	N/A	$0	
14079800	CROOKED R AB PRINEVILLE RES NR POST, OR	SC	OWRD	COOP	USBR	$7,020	Contract gage with USBR
14080400	PRINEVILLE RES NR PRINEVILLE, OR	SC	OWRD	COOP	USBR	$3,510	Contract gage with USBR
14080500	CROOKED R NR PRINEVILLE, OR	SC	OWRD	COOP	USBR	$7,020	Contract gage with USBR
14080590	CROOKED R FEED CN NR PRINEVILLE, OR	SC	OWRD	STATE	N/A	$0	
14082550	OCHOCO CR BL MARKS CR NR PRINEVILLE, OR	SC	OWRD	COOP	USBR	$7,020	Contract gage with USBR
14083400	MILL CR BL SCHOOLHOUSE CR NR PRINEVILLE, OR	SC	OWRD	COOP	USBR	$7,020	Contract gage with USBR
14085200	OCHOCO FEED CN NR PRINEVILLE, OR	SC	OWRD	STATE	N/A	$0	
14085300	OCHOCO CR BL OCHOCO RES NR PRINEVILLE, OR	SC	OWRD	COOP	USBR	$7,020	Contract gage with USBR
14085700	OR	SC	OWRD	STATE	N/A	$0	
14087300	CROOKED R NR TERREBONNE, OR	SC	OWRD	STATE	N/A	$0	
14088000	LAKE CR NR SISTERS, OR	SC	OWRD	STATE	N/A	$0	
14088500	OR	SC	OWRD	STATE	N/A	$0	
14095250	MUD SPRINGS CR NR GATEWAY, OR	SC	OWRD	STATE	N/A	$0	
14095255	TROUT CR AT CLEMENS DR NR GATEWAY, OR	SC	OWRD	STATE	N/A	$0	
				South Central Region subtota		$38,610	

Table 5 continued: South West region gage funding sources[4].

Southwest Region							
Station No.	Station Name	Region	Gage Operator	Gage Funding (*STATE, COOP, or OTHER*)	Funding Source	Funding: Annual Cost Share	Comments
14320700	CALAPOOYA CR NR OAKLAND, OR	SW	State	State	N/A	N/A	State Gage
14327137	FLORAS CR NR LANGLOIS, OR	SW	State	State	N/A	N/A	State Gage
14335200	OR	SW	State/Jacks	State	N/A	N/A	State Gage
14340800	S FK LITTLE BUTTE CR AB SODA CR NR LAKECREEK, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1] JC owns equipement in gage, provides O&M and works preliminary data.State provides ratings, JC pays USBR for GOES
14341610	S FK LITTLE BUTTE CR AT MOUTH NR LAKECREEK, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14342500	N FK LITTLE BUTTE CR AT FISH LAKE NR LAKECREEK, OR	SW	State/JC	COOP	JC	$0	[1]
14343000	N FK LITTLE BUTTE CR NR LAKECREEK, OR	SW	State/JC	COOP	JC	$0	[1]
14346700	LITTLE BUTTE CR AT LAKECREEK, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14348000	LITTLE BUTTE CR BL EAGLE POINT, OR	SW	State/JC	COOP	JC	$0	[1]
14348080	ANTELOPE CR BL RRVID DIV NR WHITE CITY	SW	JC/USBR/St	COOP	JC /USBR	$6,263	JC provides O&M and works preliminary data. State provides ratings. USBR owns equipment and provides GOES
14348150	ANTELOPE CR NR EAGLE POINT, OR	SW	State/JC	COOP	JC	$0	[1]
14348400	EMIGRANT CR AB GREEN SPRINGS POWERPLANT NR ASHLAND	SW	JC/USBR/St	COOP	USBR/JC	$6,263	USBR owns equipement in gage and provides GOES. JC provides O&M and works preliminary data. State provides ratings.
14350900	NEIL CR AB DUNN DITCH NR ASHLAND	SW	State/JC	COOP	JC	$0	[1]
14352000	NEIL CR AT MOUTH NR ASHLAND	SW	State/JC	COOP	JC /USBR	$6,263	[1]
14352001	BEAR CR BL NEAL CR NR ASHLAND, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14354100	ASHLAND CR BL TREATMENT PLANT AT ASHLAND, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14355875	WAGNER CR AT TALENT	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14357000	BEAR CR BL PHOENIX CN NR TALENT, OR	SW	JC/USBR/St	COOP	USBR/JC	$6,263	USBR owns equipement in gage and provides GOES. JC provides O&M and works preliminary data. State provides ratings.
14357503	BEAR CR AT JACKSON ST BRIDGE AT MEDFORD, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14358680	GRIFFIN CR AT CENTRAL POINT, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14358750	JACKSON CR AT CENTRAL POINT	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14358800	BEAR CR AB MOUTH AT RM1 NR CENTRAL POINT, OR	SW	State/JC	COOP	USBR/JC	$6,263	[1]
14360500	EVANS CR AT WIMER	SW	State/JC	COOP	JC	$0	JC owns equipment, provides O&M and works preliminary data. State provides GOES.
14365500	LITTLE APPLEGATE R NR RUCH	SW	State/JC	COOP	JC/FWT	$0	JC owns equipment, provides O&M and works preliminary data. State provides GOES. Fresh Water Trust payed a portion for equipment
14372500	E FK ILLINOIS R NR TAKILMA, OR	SW	State	State	N/A	N/A	State Operated Gage
14375100	SUCKER CR BL L GRAYBACK CR NR HOLLAND, OR	SW	State/USGS	Coop	USGS	$0	State and USGS work equally on O&M. USGS works final record. OWRD works preliminary record and provides GOES.
14375200	SUCKER CR AT BRIDGEVIEW, OR	SW	State	State	N/A	N/A	State Operated Gage
14358610	GRIFFIN CR BLW MURPHY CREEK NR MEDFORD, OR	SW	State/JC	COOP	JC	$0	JC owns equipment, provides O&M and works preliminary data. State provides GOES.
14358725	JACKSON CR AT JACKSONVILLE, OR	SW	State/JC	COOP	JC	$0	JC owns equipment, provides O&M and works preliminary data. State provides GOES.
14354950	WAGNER CR BL GOOSE CR NR TALENT, OR	SW	State/JC	COOP	JC	$0	JC owns equipment, provides O&M and works preliminary data. State provides GOES.
				South West Region subtotal >>>		$87,686	

APPENDIX A—Watermaster Surface Water Distribution Surveys

Section 1:

For streams identified with instream leases/transfers (IS_XFR) or ISWR that affect distribution, please answer the following questions.

1. How are instream flows monitored?

Real–time monitoring via
a. Telemetry equipped stream gage.

Routine (weekly or semi-weekly) monitoring via
b. Stream gage with recorder, but no telemetry.
c. Staff gage with rating curve.
d. Manual streamflow measurements, no staff gage.
e. Other (e.g., visual estimate)

Occasional (monthly or as needed) monitoring via
b. Stream gage with recorder, but no telemetry.
c. Staff gage with rating curve.
d. Manual streamflow measurements, no staff gage.
e. Other (e.g., visual estimate)

Complaint Driven
f. Who usually makes the complaint? (e.g., irrigation district, conservation group, state agency, other user, etc).

None
g. There is nothing to regulate in favor of the ISWR
h. Lease/Transfer amount is much less than typical (i.e., expected) flow or too small to manage.
i. Stream system (including instream flows) is self regulating.
j. Lease has expired
k. Other

2. Recommend upgrade to (use designation from above, and specify where).

For High Regulatory Streams (> 20 reported regulatory actions to date).

3. What is the cause of the high number of regulations?

a. Regulation due to an ISWR? (If so, respond to question #1)?
b. Regulation due to re-occurring problem PODs (e.g., diversions that exceed water right duty or rate)?
c. Regulation related to reoccurring dispute (e.g., dispute between feuding neighbors)?
d. Regulation due to water rights exceeding available flow?
e. Regulation due to other causes (e.g., large # of diversions)?

4. Is there a stream or POD location where an additional stream gage (or upgrade) would greatly aid in regulation efficiency?

5. Is there an alternative to stream gaging (e.g., staff gage with rating curve, measurement device, etc) that would accomplish the same regulatory benefit?

For watersheds (i.e., WABs) with zero expected summer streamflow (CU > NF):

6. Is there seasonal regulation?

YES
a. Yes, due to an ISWR? (If so, please fill out question #1 as well)?
b. Yes, due to problem PODs (e.g., diversions that exceed water right duty or rate)?
c. Yes, due to reoccurring dispute (e.g., dispute between feuding neighbors)?
d. Yes, due to water rights exceeding available flow?
e. Yes, due to other causes?

NO
f. No, users self regulate.
g. No, there are no complaints.
h. No, typically flow is > 0 due to storage release or error in WAA.
i. No, there is nothing to regulate (e.g., single user).

7. Would additional stream gaging help with the seasonal regulation?

8. Is there an alternative to gaging that would accomplish the same regulatory benefit?

For the major water users (add any large diversions left out), please answer the following questions.

9. How are diversions monitored?

Real-time monitoring via
a. Telemetry equipped stream gage or flow meter.

Routine (weekly or semi-weekly) monitoring via
b. Stream gage or flow meter with recorder, but no telemetry.
c. Staff gage reading coupled with rating curve, weir, flume, or reading flow meter.
d. Manual streamflow measurements, no measurement device
e. Other (e.g., visual estimate)

Occasional (monthly or as needed) monitoring via
b. Stream gage or flow meter with recorder, but no telemetry.
c. Staff gage reading coupled with rating curve, weir, flume, or reading flow meter.
d. Manual streamflow measurements, no measurement device
e. Other (e.g., visual estimate)

Complaint Driven
f. Who usually makes the complaint? (e.g., irrigation district, conservation group, state agency, other user, etc).

None
g. There is nothing to regulate.
h. Typically flow is in excess of cumulative water rights (including ISWR).
i. Diversion is too small to manage.
j. Stream system (and diversion) is self regulating
k. There are no complaints for regulation.

10. Recommend any upgrades to monitoring methods (use designation from above, and specify where)?

11. Generally speaking, how do you monitor for water right compliance to rate and duty?

For the storage sites listed (add any reservoirs left out), please answer the following questions.

12. How is storage and releases monitored?

Real-time monitoring via
a. Telemetry equipped stream or reservoir gage.

Routine (weekly or semi-weekly) monitoring via
b. Stream/reservoir gage with recorder, but no telemetry.
c. Staff gage reading coupled with: measurement device (or rating curve) for releases or capacity curve for storage
d. Manual streamflow measurements with no measurement device (valid for releases only)
e. Other (e.g., visual estimate)

Occasional (monthly or as needed) monitoring via
b. Stream/reservoir gage with recorder, but no telemetry.
c. Staff gage reading coupled with: measurement device (or rating curve) for releases or capacity curve for storage
d. Manual streamflow measurements with no measurement device (valid for releases only)
e. Other (e.g., visual estimate)

Complaint Driven
f. Who usually makes the complaint? (e.g., irrigation district, conservation group, state agency, other user, etc).

None
g. There is nothing to regulate.
h. Typically flow is in excess of cumulative water rights (including ISWR).
i. Storage/Release is too small to manage.
j. Stream system (storage and diversion) is self regulating (e.g., single user)
k. There are no complaints for regulation.

13. Recommend any upgrades to monitoring methods (use designation from above, and specify where)?

14. How is the determination of storage and live flow determined?

Section 2:

For the list of OWRD–operated management gages in your district, please answer the following questions sequentially with a "1" (YES) or "0" (NO).

1. Do you regularly and actively distribute water on this stream system were the gage is located? That is, do you have to constantly monitor flows and diversions to ensure proper distribution of water (in terms of rate and duty) on the stream system where the "management" gage is operated? Likewise, do you typically have to regulate junior users off on the stream network?
    1. If you answer “yes”, please move on to the next identified gage in your district.
    2. If you answer “no”, continue to the next question.

2. Does the cumulative demand on the stream system (including ISWRs) exceed the available flow? Do not use water the water availability analysis (which was considered earlier in “Part 1”. Answer from your on–the–ground experience?

3. If the gage in question is discontinued, would other users be negatively affected (i.e., injured)? In other words, if the level of monitoring were reduced at the gage site would either senior or junior downstream users (e.g., ISWRs) be negatively impacted?

    1. If you answer “yes”, please move on to the next identified gage in your district.
    2. If you answer “no”, continue to the next question.

4. Are there typically high interests or complaints from entities about the gaged diversion, storage, or in–stream flows from other users? Are users constantly asking for information from the gage?
    1. If you answer “yes”, please move on to the next identified gage in your district.
    2. If you answer “no”, continue to the next question.

5. Are there other any management reasons, (do not consider water–use reporting requirements), to operate the gage? If so, please explain in the "comment" section.

APPENDIX B— Watermaster Interview and Survey Results Narrative

District One—North and Middle Coast Basin

Summary:
Watermaster District One consists of several large (100-600 square miles) and numerous, small, individual watersheds in the north and mid–coast region (i.e., coast drainages from the Columbia River to Yachats watershed). Most of these watersheds drain to the Pacific Ocean, but a few smaller streams drain to the mouth of the Columbia River. Rainfall–runoff processes dominate stream flow generation in these watersheds. Stream flows are very high throughout the winter/spring in response to continuous seasonal storms and associated rainfall. The decline in stream flow follows that of rainfall, and usually tapers off by the end of June. Base flows are significant in most watersheds, but typically insufficient to meet all water rights by mid to late summer.

Water management and monitoring in Watermaster District One is partly proactive and partly complaint driven. Most regulation is triggered by ISWRs which are actively monitored by stream gages and manual measurements. Once stream flow has declined below the major streams' ISWRs, regulation of the numerous junior consumptive users begins in earnest. This also triggers additional monitoring of other ISWRs in the district by manual measurements.

Diversions are monitored predominately by visual estimates, as regulation typically results in a shut off of users. Manual flow measurements are also used when necessary. Complaints can also trigger regulation in the district, but upwards of 90 percent of regulations result from ISWRs. The major water users in the district, municipalities, are senior to all other users and are not typically involved in regulation or active monitoring.

The only significant reservoirs in the district are Barney Reservoir and McGuire Lake. Reservoir gages monitor storage, while user–operated stream gages monitor releases. Summer inflows to the reservoirs are minimal, so determining storage and live flow below the reservoirs is simple. The reservoirs are not actively monitored because summer release requirements exceed natural flow and the reservoirs are not involved with regulation in the district.

USGS operates gages on the large streams in the district: Nestucca, Alsea, Nehalem, Trask, and Wilson Rivers. However, channel stability is an issue and rating shifts are so common as to limit these gages usefulness for actively monitoring ISWRs or for water management. OWRD operates eight gages in the district, six of which are used in water management activities. Given the driving distance from the field office, telemetry upgrades to three of these gages would help regulation efficiency. In addition, several additional stream gages would also help in monitoring ISWRs and the corresponding regulation. IS_XFR are small, much less than the typical flow in the associated stream reaches, and therefore are not actively monitored.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
Municipalities are the major water users in Watermaster District One, and have the most senior water rights. These water rights exceed the actual amount diverted. Therefore, most of these diversions are not associated with regulation and routine monitoring. Nonetheless, all municipal diversions have flow meters and submit monthly water use reports to OWRD annually. The City of Vernonia, Upper Nehalem Watershed Council and OWRD operate a gage on Rock Creek and Yachats River near Yachats Oregon for water management. There are also gages on the West and North Forks of the Ecola Creek to help manage the City of Canon Beach's effluent discharge.

There are no irrigation districts in the region and no other organized users. The water users generally consist of individual land owners with small acres and single PODs (usually pumps). However, some large dairies divert water near Tillamook. Most diversions are monitored by visual estimates (e.g., counting sprinkler heads, reading electric meters on pumps, etc) or through manual discharge measurements on ditches. Most regulation and associated diversion monitoring is triggered by ISWRs and results in junior users being shut off. Regulation activity is very high for a couple of weeks following the seasonal decline in stream flow with rainfall, and then tapers off due to compliance and a lack of additional users to regulate for the ISWRs.

Stored Flow and Natural Flow:
There are only two large reservoirs in the North Central Coast Basin—Barney Reservoir and McGuire Reservoir. Barney Reservoir is located on the Middle Fork of the North Fork Trask River. A trans–basin aqueduct carries water across the Coast divide into the Tualatin River. The Joint Water Commission (see District 18 review) operates and manages the reservoir, including monitoring contents and releases into the Tualatin River. Storage monitoring occurs from daily reading of reservoir elevations. Monitoring of releases is done by a non–OWRD/USGS stream gage.

McGuire Reservoir is located on the Nestucca River and serves the City of McMinnville. Reservoir levels and outflows are monitored by non–telemetry USGS gages.

Both reservoirs are located in the headwaters of their respective drainages and store water for municipal use on the east side of the Coast Range (i.e., for trans-basin diversions). Summer inflows to the reservoirs are minimal. As a condition of the storage permit, the reservoirs have summer release requirements that exceed the natural flow downstream of the reservoir. Outflows are not routinely monitored by OWRD. Determining the storage and natural flow component of stream flow is not required for regulation and distribution (oral communications Greg Beaman, District One Watermaster).

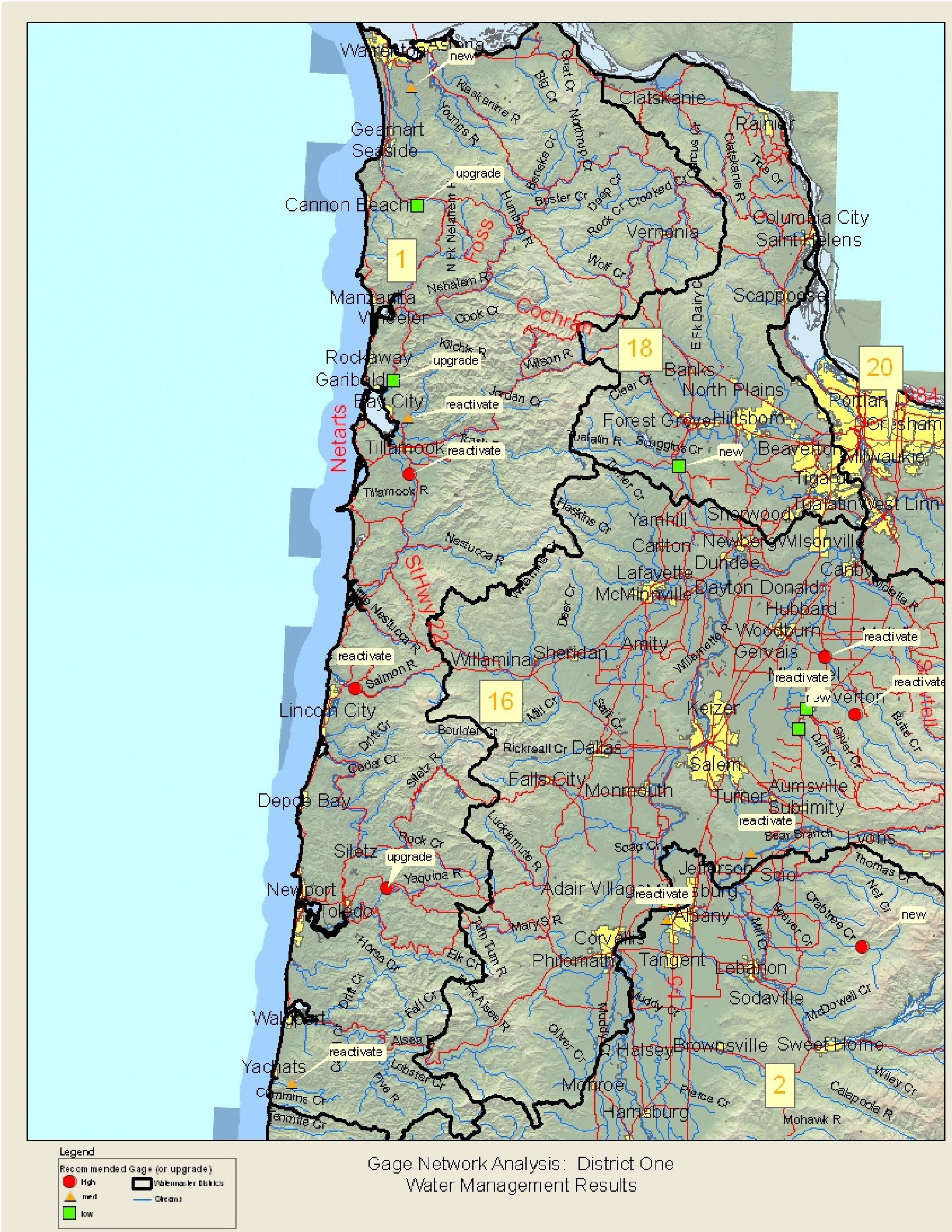
Instream Transfers and Leases (IS_XFR):
IS_XFRs are small, much less than the typical flow in the associated stream reaches, and are not monitored. ISWRs, however, do affect regulation and are monitored throughout the basin by a system of stream gages and manual measurements at the lowest point in the watersheds, just above tidal influence. ISWRs on the Necanicum, Nehalem, Miami, Kilchis, Wilson, Trask, Tillamook, Nestucca, Salmon, Siletz, Yaquina, Alsea and Yachats are all monitored. When stream flow at the monitoring location fall below the ISWRs, all junior water rights upstream of the monitoring location are regulated in the main stem and tributaries. This event also triggers additional monitoring by manual measurements further upstream and on tributary sites.

Most stream channels in the district are very dynamic, such that generation of rating curves at staff gages is problematic. Indeed, because of unstable channels, monthly measurements for current shifts on the USGS gages on the Nestucca, Alsea, Nehalem, Trask, and Wilson are required for these gages to be useful for real–time regulation and water management. Current staffing resources restrict OWRD's ability to measure discharge at these gages.

Upgrades to telemetry at the following sites would greatly improve regulation efficiency: Miami, S. Fk Necanicum and Yaquina Rivers. In addition, the reactivation of gages on the Salmon (near Otis OR), Yachats (near Yachats OR), Kilchis (near Bay City OR), and Tillamook (near Tillamook OR) Rivers is also recommended (given sufficient support resources). Finally, a new gage on the Lewis and Clark River would also be helpful for water management.

High Regulation Streams:
Twenty-five streams (or stream reaches) were identified with a high number of reported regulations (> 20). Regulations for all identified streams were due to ISWRs triggering regulation of junior out–of–stream users. Adding gages to help monitoring of these ISWRs and regulation was previously discussed.

Zero Expected Flow Streams:
Twenty–two watersheds were identified with zero expected flow during the summer by the OWRD Water Availability Analysis. Only two of these streams (Tillamook River and Killam Creek) were reported with routine regulation activity (due to full appropriation). Users on the other streams self-regulate and share water (per communication Greg Beaman, Watermaster District 1). However, there is some regulatory activity associated with those streams that have ISWRs.



Gaging for water distribution evaluation results. Watermaster District One

District Two—Upper Willamette Basin

Summary:
Most streams in the upper Willamette Basin experience high runoff in winter and spring in response to rainfall from seasonal storms, which tapers off to base flow conditions by the end of May or June; depending on watershed size and spring rainfall. Snowmelt runoff processes and large groundwater discharge also occurs in some watersheds of the Cascadian uplands, resulting in consistent high summer base flows. Superimposed on these natural hydrologic responses are the effects of numerous USACOE reservoirs on the major streams. These reservoirs capture spring runoff in the upland, forested canyons of the basin for summer release. Thus, summer flow in the major streams commonly exceed natural flow and are sufficient to meet all water use demands from these streams, including ISWRs. In contrast, summer flows in the smaller tributaries with no reservoirs are often insufficient to meet demands, causing regulation.

Water management and monitoring in the basin is predominately driven by the ISWRs on the smaller tributaries. Here, regulation of small individual users for senior ISWRs occurs after the seasonal decline in stream flow. ISWRs are proactively monitored via stream gages and routine manual measurements at a multitude of locations, coupled with local hydrologic knowledge of the streams. In addition, two IS_XFRs affect regulation and are monitored by routine manual measurements.

The large diversions in the basin are associated with municipalities, irrigation entities, and five off–channel hydropower facilities. Most of these diversions have stream gages, flow meters, or measurement devices present for monitoring flow. However, these users are not typically involved with regulation and active monitoring due to their location and the adequate water supply (or seasonal restrictions) to meet all needs, including ISWRs. All large users measure and report water use annually to OWRD.

Storage and releases in the basin are tracked by USGS operated reservoir and stream gages. Releases from most reservoirs, which are set to meet flow targets in the Willamette River, exceed natural flow and all user demands (including ISWRs) on the major streams. Storage contracts and associated releases for users are coordinated by USACOE. Storage and releases do not impact regulation and are not actively monitored by OWRD due to the abundant water supply.

There are 41 official stream gages operated in the basin. Most are located on the major tributaries and are used for operation and management of the USACOE reservoir projects. The USGS operates 39 of these gages, and several are used by OWRD for monitoring ISWRs.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
The major surface water diversions in the basin are municipalities, irrigation entities, and the hydropower facilities. The municipal users consist of the City of Eugene, Sweet Home, Albany, Lebanon, Cottage Grove, and Oakridge. The irrigation entities include the Lacomb Irrigation District (LID), Junction City Water Control District (JCWCD), Muddy Creek Irrigation Association (MCIA), and the Creswell Irrigation Association (CIA). The five hydropower projects are the Eugene Water and Electric Board (EWEB) facilities on the McKenzie River, the Albany hydroelectric facility (Albany/Santiam Canal or ASC) on the South Santiam, and the Lacomb Irrigation District power plant on Crabtree Creek.

User operated flow meters or stream gages are operated on all municipal surface diversions, but this information is not required for distribution or regulation by the watermaster. The municipalities' water rights are very senior (with respect to other water rights) and stream flows in the pertinent streams (i.e., those with municipal PODs) are always sufficient to meet all water needs, including the ISWRs. Nonetheless, municipal users do report monthly water use to OWRD annually.

Most of the irrigation entities do not affect regulation and are not actively monitored for the same reasons as the municipalities—the water rights are senior to the ISWRs, and the ISWRs are always met. Nonetheless, a user–operated stream gage monitors JCWCD diversions from the Long Tom River. In addition, real–time USGS gages are located above and below the diversion. JCWCD has senior live flow rights, plus storage rights (in Fern Ridge Reservoir) and has never been found to be out of compliance. Likewise, MCIA diversion from the McKenzie River has never been found to be out of compliance and, given the seniority of its water rights, is also not actively monitored at present. LID's diversion from Crabtree Creek is occasionally monitored by manual measurements. This monitoring is required because, even though the district is senior to the ISWR, stream flow does not exceed demand and the district sometimes diverts in excess of its water right. The district does operate a gage on its canal. On occasion, this knowledge does not get transferred to new operators after internal management changes, so watermaster involvement is often necessary. An OWRD stream gage at this location may be needed for regulation or distribution.

User–operated stream gages are operated on diversions into two of the hydropower facilities: ASC (South Santiam River) and EWEB (McKenzie River). The diversions are senior to the ISWR and, like the other major diversions, the ISWR is always met. The diversions have never been found to exceed the water rights and, therefore, are not actively monitored by OWRD. For the EWEB project, there are multiple gages on the McKenzie River to monitor instream flows associated with minimum flows requirements from FERC licensing. ODFW actively works with EWEB to make sure these minimum flows (associated with the FERC license) are met in the two river reaches with hydropower bypass channels. For the hydropower facility associated with LIDs diversions, monitoring is conducted as previously described.

A seasonal real–time gage on the lower Calapooia (near Albany) could help with more timely regulation to protect the ISWR. OWRD recently installed a staff gage which will provide some interim help with monitoring.

The diversions in the district that are actively regulated and monitored are the small individual users who pump water directly from the small streams that do not have storage in the basin. These pumps are monitored by visual estimates (i.e., either off or on) when regulation occurs, which is usually for an ISWR. Stream flow elsewhere in the district generally exceeds all demands and there are seldom calls for regulation and no associated regulation monitoring for diversions.

Stored Flow and Natural Flow:
There are numerous USACOE reservoirs on the major streams in the basin that store significant winter and spring runoff for summer release. Most of these reservoirs are located in the forested canyons above the Willamette Valley (except for Fern Ridge Reservoir). Storage releases from these reservoirs typically exceed natural flow and all user demands (including ISWRs) on the major streams. Therefore, determining the live and storage component of flow is not required. Storage contracts can be obtained by users in the district, with roughly 4-6 percent of storage releases being for irrigation use. The USACOE coordinates releases with the contract holders to match these contracts. Contract holders are required to report use to USACOE. USACOE facilities operate under flow targets at numerous locations on the Willamette. The contract releases are very small compared to these flow targets. Nonetheless, real–time USGS gages monitor storage and releases from all these reservoirs, but this monitoring is not required for OWRD water management and regulation.

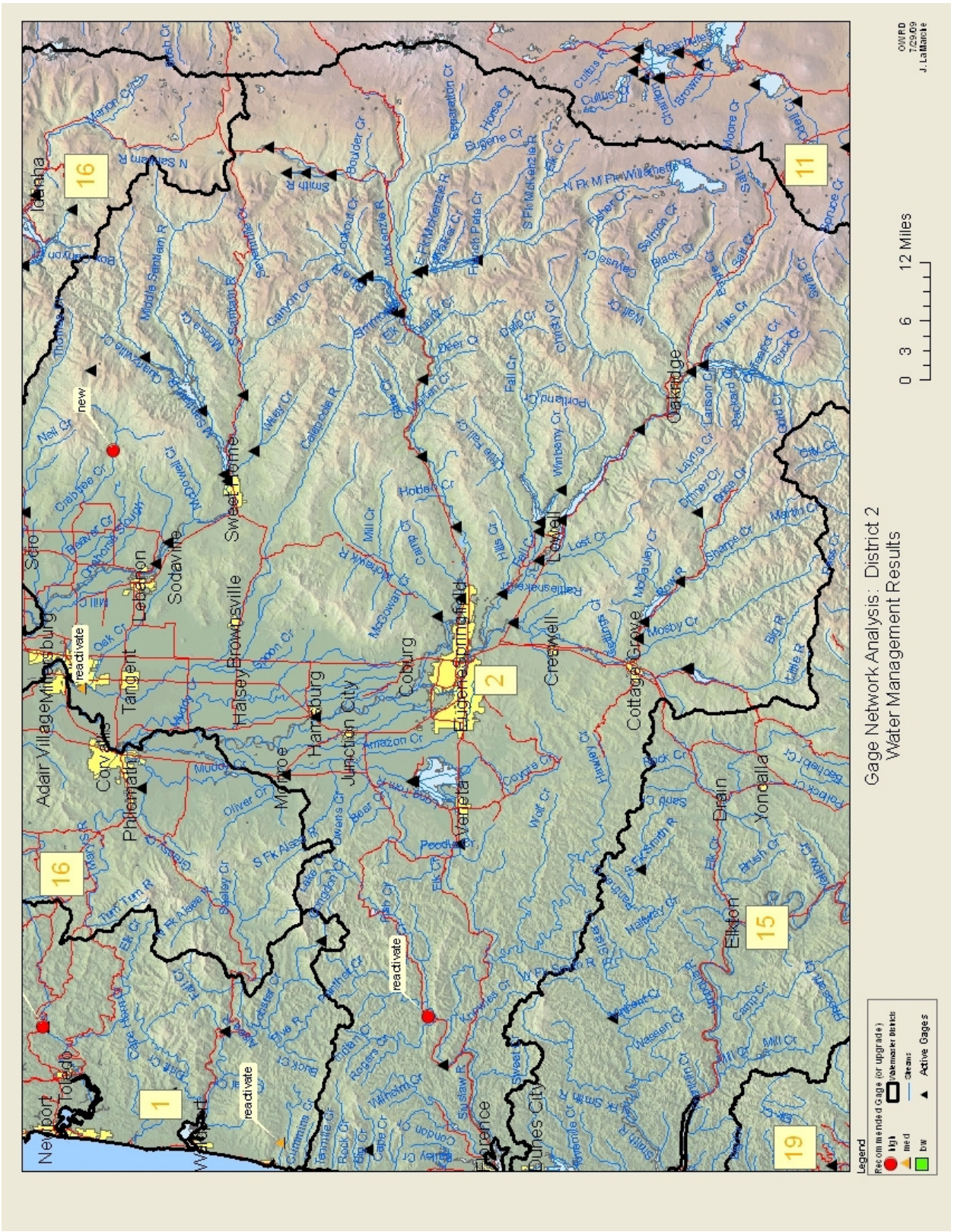
Instream Transfers and Leases (IS_XFR):
Most IS_XFRs are associated with small individual users temporarily leasing their water instream to preserve their water right from non–use cancellation. As such, the flows are usually very small compared to typical flow and generally do not impact regulation activities, except for Thomas Creek and the Calapooia River. For these streams, the IS_XFRs are of sufficient magnitude to warrant active monitoring. After the spring runoff, routine manual measurements are used on both streams to monitor instream flows. In addition, the Freshwater Trust operates a real–time stream gage on the Calapooia River that is checked periodically by the watermaster, who also performs manual measurements at the gage to check accuracy.

Instream water rights (ISWR) impact water distribution in the district; therefore, stream flow on nine streams are routinely monitored by manual measurements for compliance with the ISWR and regulation of junior rights. The monitoring of these streams occurs seasonally and begins with the decline in rainfall and stream flow. In addition to manual measurements, a USGS real–time stream gage on the Mohawk River and the Freshwater Trust real–time stream gage on the Calapooia are also used to monitor ISWR flows. Because of travel time to these locations, reactivating the USGS stream gages on Lake Creek near Deadwood (#14307580), and the Calapooia at Albany (#14173500) would improve water management and monitoring of the ISWRs

associated with those streams.

High Regulation Streams:
There are six streams classified as high regulatory streams: Upper Siuslaw River, Lake Creek (and its tributaries), Deadwood and Indian Creeks, Calapooia River, Mohawk River, and Thomas and Crabtree Creeks. The cause of all of these was regulation for the ISWR. As previously mentioned, due to the distance from the field office a seasonal, telemetry–equipped stream gage on the Calapooia River and Lake Creek would make water management more efficient. The Lake Creek gage could also be used as an indicator site on when regulation on Deadwood Creek and Indian Creek should begin. No other additional stream gages were identified as helping with regulation on these streams.

Zero Expected Flow Streams:
There were no streams listed as having zero expected flow. This finding matches with the watermaster testimony that regulation is driven by the ISWRs, and consumptive use is less than available stream flow.



Gaging for water management evaluation results. Watermaster District Two

District Three—Hood Basin

Summary:
There are three large watersheds associated with water management in the Hood Basin: Hood River (HR), Fifteenmile Creek (FC), and White River (WR). Each of these streams generates significant winter/spring flows from rainfall/snowmelt runoff processes that commonly last through mid June, except in dry years. Base flows are significant, but less so in FC due to the watershed's geology and smaller attributes (area, precipitation, etc). Summer base flow in tributaries to FC and WR are commonly less than demand.

Regulation and monitoring in the basin is both proactive (related to IS_XFRs) and complaint driven (related to full–appropriation), and associated with the seasonal decline in stream flow in Badger, Tygh and Fifteenmile Creeks. Regulation involves small individual irrigators and two water user associations in response to routine monitoring of stream flow. Real–time monitoring occurs in the HR watershed, but with little regulation as water supply typically exceeds demand.

The major water users in the basin are the organized users (e.g., irrigation districts) in the HR and WR watersheds. Most of these users are monitored through OWRD (or district operated) stream gages, flow meters, or measurement devices. Routine monitoring due to complaints is more common in the WR watershed than the HR watershed, for water supply reasons previously mentioned. In contrast to the HR and WR watersheds, most users in FC watershed are small, individual, irrigators with single PODs. For these users, diversions are monitored by measurement devices, manual measurements or visual estimates. To help with regulation, the gage on the Badger District Ditch needs to be moved near the head gate and upgraded to a real–time gage.

A few small reservoirs exist in the Hood Basin, and storage/releases are typically monitored by reservoir/stream gages or staff gages. Badger Lake and Pine Hollow Reservoir (in the WR watershed) are the only reservoirs that routinely affect distribution and are regularly monitored by manual methods. A real–time stream gage on Badger Lake releases would aid water management.

ISWRs do not affect regulation in the basin. IS_XFRs, however, do affect regulation and are proactively monitored by routine manual measurements and staff gages on streams of high interests, or by visual estimates on the smaller streams due to resource constraints. A telemetry–equipped gage on Fifteenmile Creek and Tygh Creek would help with monitoring instream flows and regulation on those drainages. There are three real–time USGS gages on major streams in the Hood watershed, but no active OWRD/USGS gages in the WR and FC watersheds.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
The main diversions in the Hood Basin are associated with irrigation district (ID) or water use association (WUA) diversions located in the Hood River and White River watersheds. In the Hood River watershed, water availability is generally adequate to meet all needs (except in dry years), which reduces the need for active management. In contrast, water use in Fifteenmile and Eightmile Creeks, and Badger and Tygh Creeks (tributaries to the White River) commonly exceed available flow. This results in active regulation and routine monitoring of both stream flow and diversions by measurement devices, manual measurements and visual estimates.

In the Hood River watershed, the large diversions consist of the Farmers (FID), East Fork (EFHID), Middle Fork (MFHID), Mount Hood (MHID), and Dee irrigation districts. Most of these IDs are highly efficient because of piped distribution systems, coupled with irrigation almost exclusively by sprinklers or micro–sprinklers. Given the typical stream flow of the Hood River and its tributaries, competition for water between the districts (which hold the senior water rights in the basin) is very limited. Because of the adequate water supply, IDs irrigation efficiency, and the seniority of the IDs water rights, regulation and routine monitoring of these diversions is generally not required for water management. Nonetheless, most ID diversions have OWRD telemetry–equipped stream gages or non–telemetry, user–operated, flow meters. These diversions are periodically checked by the watermaster for water right compliance. The one exception is MHID, which presently does not have a monitoring device. Discussions are underway on how to effectively monitor this district's diversions either through stream gaging or measurement devices.

In addition to the irrigation districts in the HR watershed, there is a large diversion for a PacifiCorp hydroelectric facility. A flood in 2006 damaged the diversion dam (Powerdale Dam) and was removed in 2010. Plans are currently underway to convert the associated hydropower water right to an instream right. Because of the seniority of this right, this may affect the regulatory environment and associated monitoring needs in the watershed.

The hydrologic and regulatory setting in the White River watershed, specifically Badger and Tygh Creeks, contrasts with that of the HR watershed, as previously mentioned. In response, the watermaster actively monitors stream flow to proactively facilitate regulation. In the White River watershed, the large users consist of Badger District Improvement Company (BDIC), Pine Hollow Cooperative (PHC), Round Prairie Ditch Company (RPDC), Rock Creek District Improvement Company (RCDIC), and Juniper Flat Irrigation District (JFID). BDIC and PHC share a common diversion from Badger Creek, which is monitored through an OWRD stream gage (#14100850). Installing telemetry at this site would greatly aid water management efficiency. The gage needs to be moved closer to the actual POD to prevent vandalism. The Threemile Creek (a White River tributary) diversions to RPDC, PHC, and RCDIC are not regularly monitored as there are no regulation calls from senior downstream users. A formal rotation agreement exists between RPDC, PHC, and RCDIC.

The Juniper Flat Irrigation District's water supply is from Clear Creek (a White River tributary) and Clear Lake (storage releases). User–operated gages are located on JFID's diversions, but these diversions do not affect regulation in the White River watershed and are not routinely monitored by OWRD. This regulatory setting results from JFID's separate water supply (from the other large water users), its location (i.e., no junior upstream users), the adequate stream flow in the main stem White River to meet all down stream demands, and the priority of JFIDs water rights. In addition, there are no ISWRs on Clear Creek.

Water users in Fifteenmile Creek watershed are predominately small, individual farmers with single PODs. Monitoring these small users is usually done by visual estimates and in response to regulation for IS_XFRs, which is triggered by the decline in flows after spring runoff. However, there are two large ditches in the watershed: Orchard Ridge Ditch and Wolf Run Ditch. Both are routinely monitored by measurement devices, coupled with manual measurements. In addition, there are two other two small ditches on Fifteenmile: "Little Ditch" and Airstream Ditch. Both are slated for installation of measurement devices next year. Measurement devices are also planned for the other small, but significant diversions in the watershed.

Stored Flow and Natural Flow:
There are five main storage facilities in the Hood Basin: Laurence Lake in the Hood River watershed, and Rock Creek Reservoir, Badger, and Pine Hollow and Clear Lakes in the White River watershed. Laurence and Clear Lakes are located in the headwaters of their watersheds, and storage is monitored by reservoir gages by MFHID and JFID/USBR, respectively. Rock Creek Reservoir is also located high in its watershed and storage is visually monitored by RCDIC. Badger Lake is also located high in its watershed and storage is visually monitored by BDIC. Generally speaking, when these three reservoirs are filling, there are not any competing water rights, so monitoring reservoir levels for regulation is not necessary. Pine Hollow Reservoir, however, is located midway in the watershed and is monitored by OWRD due to a user agreement between ODFW and Pine Hollow Coop regarding filling the reservoir. This reservoir is monitored by an inclined staff gage which is checked every four to six weeks by the watermaster.

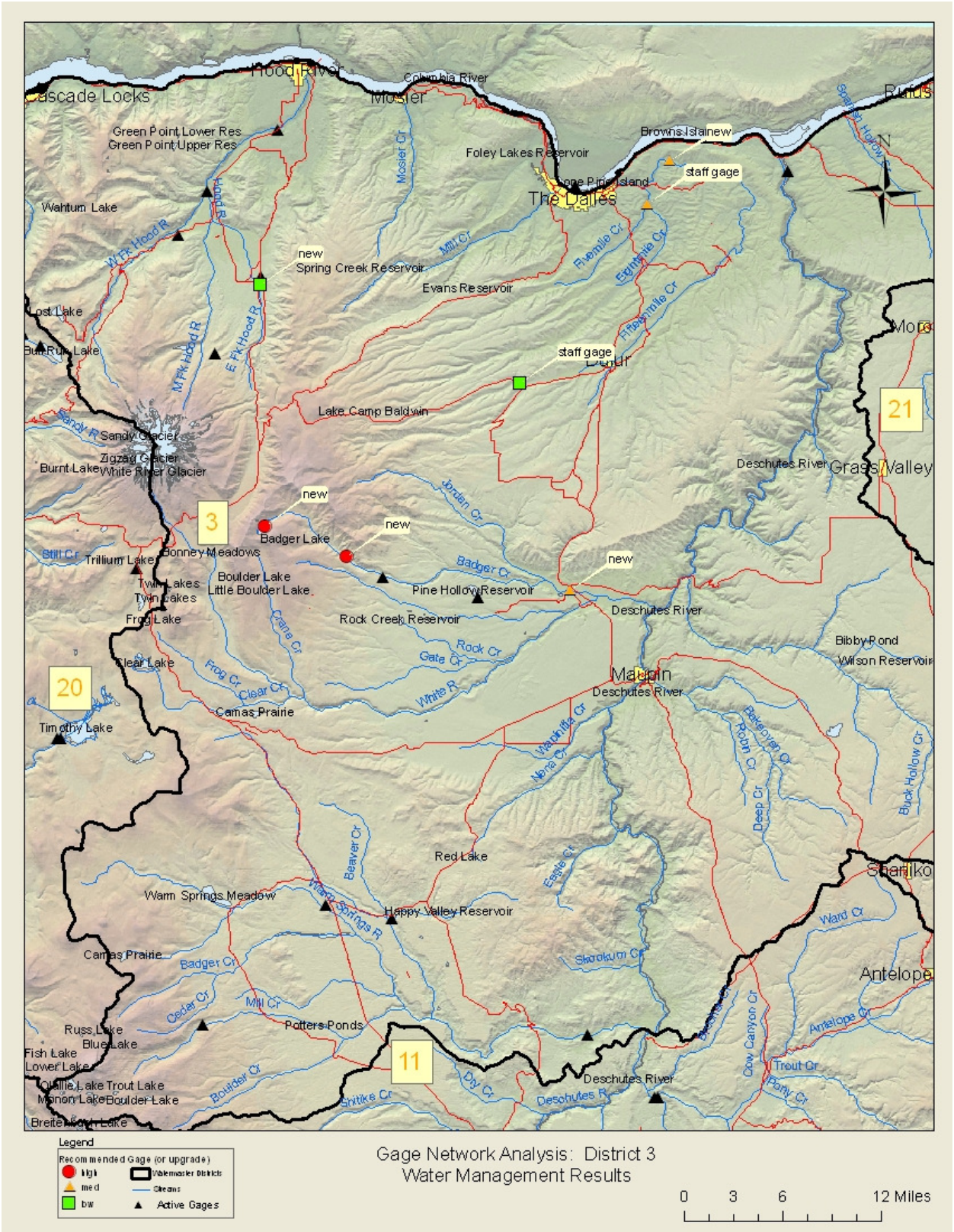
Determination of the live and storage component of stream flow is only required for distribution on Badger Creek. Consequently, reservoir outflows from Badger Lake are routinely monitored by the watermaster by Parshall flume and a staff gage. An upgrade to a recorder with telemetry would help with regulation here and at the head gate of Badger Ditch, as the watermaster has to routinely check releases against the downstream diversion. For Laurence (MFID) and Clear Lakes (JFID/USBR), measurement of reservoir outflows is accomplished by district–run stream gages. The location and priority of the district water rights negates this need for distribution/regulation by the watermaster. Outflows from Pine Hollow Reservoir (an off channel reservoir) go directly to the irrigation districts (i.e., not instream) and monitoring these flows is not currently required.

Instream Transfers and Leases:
There are thirteen streams in the Hood Basin with instream transfer and lease (IS_XFR) activity. Resource constraints limit the ability of OWRD to monitor stream flow in all of these streams related to IS_XFRs. Thus far, the focus of monitoring thus far has been on streams where the IS_XFR causes significant and routine regulation of junior water rights on streams of significant importance —Badger, Tygh, Fifteenmile, and Eightmile Creeks. These streams (except for Eightmile Creek) are monitored through routine manual readings of staff gages at sites where rating curves have been developed from periodic stream flow measurements. A staff gage would be helpful for Eightmile Creek, but is not necessary for Fivemile Creek, Threemile Creek (tributary to the White River) or White River. Fivemile Creek is usually dry by July / August. Threemile Creek has only one small lease which is met. White River has very few out of stream users and instream rights are generally met. However, telemetry equipped real time gages on Fifteenmile and Tygh Creeks are recommended to both help monitor IS_XFRs and to aid in regulation efficiency.

ISWRs (the certificated rights held by OWRD) do not affect regulation and distribution of water in the watershed. There are no summer out–of–stream users that are junior to the ISWRs. Nonetheless, many ISWRs are monitored by stream gages, staff gages, or routine measurements.

High Regulation Streams:
The cause of all five streams with a high number of regulations (> 20) is full appropriation. In addition, all of these streams also have IS_XFRs that drive regulation activity. Problem PODs and reoccurring disputes also factor into regulator activity on Tygh and Badger Creeks. Aside from the monitoring improvements already mentioned for these streams, a staff gage on Ramsey Creek would help with regulation.

Zero Expected Flow Streams:
There were eight water availability basins (WABs) identified as having zero expected flow in the basin. However, water is generally available for all users in these watersheds (except for Dry Creek) and regulation activity is generally minimal. No additional gages were identified for management needs in these WABs.



Gaging for water management evaluation results. Watermaster District Three

District Four—Upper John Day Basin

Summary:
Water management and monitoring activity in the upper John Day Basin (John Day Basin at the main stem/North Fork confluence) is partly proactive and partly complaint driven. Regulation and monitoring are associated with the seasonal decline in stream flow after the spring freshet, and primarily occur on the main stem river above the confluence with the South Fork (near Dayville, Oregon). The majority of irrigation use occurs in the valley above Dayville, where summer base flows are limited and irrigation demand is high. Stream gages in this area are used to anticipate regulation and initiate manual monitoring of diversions.

Below the South Fork confluence, flows are generally sufficient to meet existing irrigation needs on the main stem. Likewise, stream flow on the North and Middle Fork John Day are usually sufficient to meet the small number of water users on those rivers. However, regulation exists on the smaller tributaries in the basin; some of which are fully appropriated. For these watersheds, regulation is largely complaint driven. Complaints also drive regulation and monitoring on the main stem South, North and Middle Forks.

There are no large irrigation organizations (e.g., irrigation districts) in the basin, but multiple irrigators share a few large ditches on the John Day above Dayville. In addition to these large ditches, there are estimated 30-40 diversions that can take between 1–5 cfs of flow in this reach. Stream gages were historically operated on many of the large ditches in the late 1920s, and as recently as 1988 for the Enterprise and Panama Ditches. Presently, monitoring occurs by routine manual checks of measurements devices (present on most of these diversions) during the regulatory season, which typically starts in June. Measurement devices are not as ubiquitous for diversions elsewhere in the basin (e.g., tributaries). In lieu of measurement devices, manual measurements or flow estimates are used to check diversions related to complaints.

There are no large reservoirs in the basin, but several small reservoirs store water for single users in the Mountain Creek watershed. Typically, monitoring of these reservoirs is by manual means and complaint driven.

Real–time stream gages exist on all forks of the John Day River and on many tributaries. Many of these gages are used for real–time water management or to monitor stream flow for ISWRs. ISWRs that affect distribution are actively monitored and junior users regulated accordingly. Almost all IS_XFRs are small compared to the typical flow in the affected reach, or are too small to manage (except for the Middle Fork John Day River, which is monitored by a stream gage).

Below is a detailed description of how water is monitored, the current stream gaging system and identified gaging needs.

Diversions:
The main water users in the upper John Day Basin are ditch companies, which consist of either loosely organized groups of users or non–profit corporations that share diversions from a common canal or ditch. All of these diversions are located on the main stem John Day River (JDR) above Dayville. Old Settler Ditch, Luce Long Ditch, Enterprise Ditch, Panama Ditch, Power Mill Ditch and Eddington Ditch comprise the largest of these diversions. Power Mill Ditch also diverts water from Strawberry Creek. All of these diversions are monitored by staff gages, coupled with measurement devices and occasional manual measurements, when required. In addition, there are roughly 30-40 diversions that can divert between 1–5 cfs. Most of these diversions have measurement devices, or are identified to have measurement devices installed.

When the JDR (John Day River near John Day, #14038530) drops below a specified threshold, active monitoring and regulation of the diversions by manual readings of the staff gages begins. This seasonal decline in flows occurs relatively quickly after the spring freshet. Once regulation on the JDR begins, it is a continual management activity throughout the irrigation season. Diversions are typically visited at least once. Most users above Prairie City are accustomed to regulation and compliance is very high. This is not the case in other parts of the river. A telemetry–equipped stream gage on the Power Mill Ditch would help with regulation in the JDR.

For the other forks of the John Day, regulation is complaint driven and monitoring occurs by manual measurements from watermaster investigations. Regulation activity is high in Indian, Mountain, Canyon, Little Pine and Pine Creeks—all tributaries to the John Day, near or above Dayville. To a lesser degree, regulation also occurs on the Middle and South Forks of the John Day River. On the North Fork John Day River (NFJDR), there is very little irrigation above Monument, but there is some water use associated with mining. Most agricultural use on the NFJDR occurs between Monument and Kimberly.

Stored Flow and Natural Flow:
There are no large storage facilities in the basin. The three significant reservoirs that store water for irrigation are all located in the Mountain Creek watershed. These reservoirs are all associated with individual users and determining the natural and storage component of stream flow is usually not required. The reservoirs fill during the spring runoff, when water is available for all uses and water is released during the dry summer, when natural flow is minimal. There are no regulatory calls associated with storage in Mountain Creek.

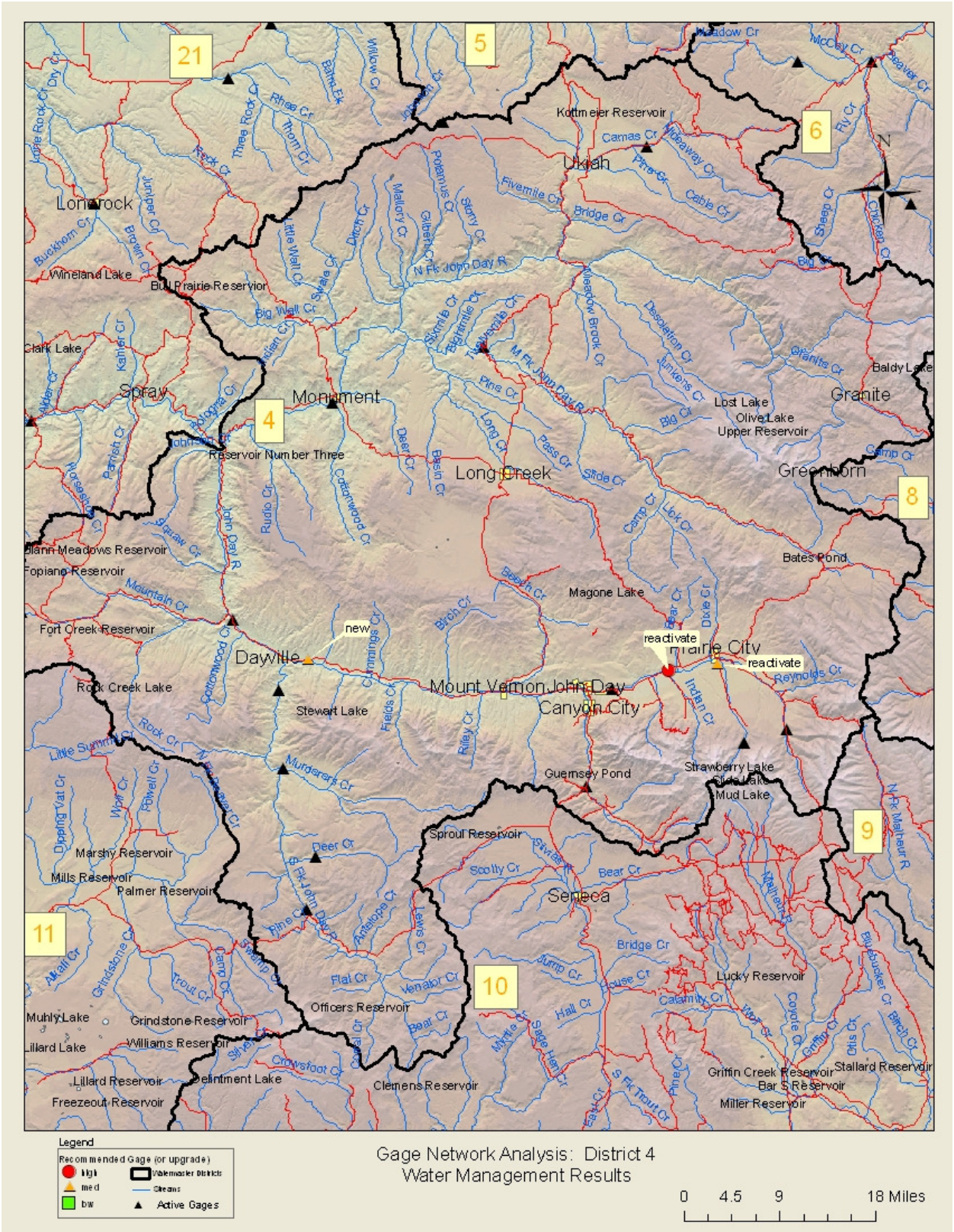
Instream Transfers and Leases (IS_XFR):
Almost all IS_XFRs are small compared to the typical flow in the affected reach or too small to manage (< .1 cfs). There is little monitoring activity for these IS_XFRs. However, there is some transfer activity in the Middle Fork John Day River (MFJDR) that is significant. A real–time USGS stream gage (#14044000) is used to monitor streamflow related to this IS_XFR activity. In addition, the Fresh Water Trust (formerly Oregon Water Trust) operates numerous gages on the MFJDR to monitor flow.

Most irrigation rights are senior to the ISWRs in the basin. However, there are some irrigation users junior to the ISWRs. For the JDR above Mountain Creek (just downstream of the South Fork confluence), the timeframe for regulating these junior irrigation rights in favor of the ISWR is very short; typically from a few days to a couple of weeks. This short regulation window occurs because senior irrigation user (senior to the ISWR) needs are not met soon after spring runoff because stream flow declines very rapidly. Therefore, users senior to the ISWR are regulated off soon after the spring freshet to provide water to the most senior users in the JDR. In other words, regulation quickly becomes in favor of these senior irrigation users, as opposed to the ISWR, which has junior priority to these senior users. After the JDR stream flow drops to this level (and the ISWR becomes junior to the other irrigation users), the watermaster objective then becomes to distribute all streamflow to the senior users above Dayville. Because of this objective, reactivating the stream gage on the JDR near Dayville (#14039000) would be helpful. The flow above Dayville may be estimated by subtracting the flow monitored at the SFJDR gage (#14039500) from the John Day River at Picture Gorge gage (#14040500). However, the watermaster believes this estimate would be of insufficient accuracy to be useful due to tributary inflows between Dayville and the Picture Gorge gage. The accuracy of this estimate is being evaluated.

For the South Fork John Day River (SFJDR), the ISWR is actively monitored by telemetry–equipped stream gage on the river near Dayville. However, there is minimal water use to regulate in favor of the ISWR on the South Fork. Similarly for the NFJDR, there is little to regulate in favor of the ISWR. Nonetheless, a USGS telemetry equipped stream gage is present to monitor instream flows real–time. Between Monument and Kimberly, water rights are generally senior to the NFJDR 1980 ISWR, but junior to the 1960 water right.

High Regulation Streams:
There were eight streams with a high number of regulations (>20). Most of this regulation activity is caused by full–appropriation. The upper JDR (above Dayville) and SFJDR both have ISWRs that also cause regulation. Additional stream gaging would help with regulation at the discontinued gage sites of John Day River nr Dayville (#14039000, discussed earlier), which is above Dayville, and Indian Creek near Prairie City (#14038515). Regulation of upstream users (senior to the ISWR) is driven by the objective described earlier of the John Day River at Dayville.

Zero Expected Flow Streams:
There were 12 water availability basins (WABs) identified with zero expected flow in the basin during the summer. Many of these WABs had no regulation due to a lack of complaints. Some of the other WABs (Indian, Cottonwood, Strawberry, Mountain and Dixie Creeks) have seasonal regulation activity when flows drop in early summer. No additional gages were identified to help with regulation other than those already specified. However, measurement devices installed on the diversions in Cottonwood Creek would help with regulation in that watershed.



Gaging for water management evaluation results. Watermaster District Four

District Five—Umatilla Basin

Summary:
Watermaster District Five consists of two major rivers and associated watersheds: the Umatilla and the Walla Walla. The hydrology of both watersheds can be described as predominately runoff driven from winter/spring rains and spring snowmelt. Base flows are relatively insignificant, although springs in the lower reaches of both rivers provide flows critical to users in those reaches. The Walla Walla River bifurcates near the town of Walla Walla and many of the distributaries' stream flow are derived from springs, probably of local origin. Two reservoirs augment water supply in the Umatilla River, but there are no significant reservoirs in the Walla Walla watershed. Demand in the tributaries of both rivers often exceeds supply resulting in regulation and monitoring activity.

Water management and accounting for most of the Umatilla Basin is described in the "McKay and Umatilla River Water Management Plan" (OWRD, 1991). The plan was created in response to: irrigation district requests to track distribution of McKay storage, development of the Umatilla Basin project (i.e., Columbia River/Umatilla River water exchange), restoration efforts of anadromous fish runs, and the general complexities of water management in the basin. The management issues in the Umatilla watershed differ from those in the Walla Walla watershed, thus a similar plan was not developed for the Walla Walla.

In the Umatilla watershed, real–time stream and reservoir gages exist on all major tributaries, irrigation district diversions, and reservoirs, including inflows and outflows. This gaging system allows for real–time monitoring and water management, and a detailed accounting of live and storage diversions. In addition to the stream gaging network, there are measurement devices and reporting requirements for the smaller non–district irrigators (detailed later).

In the Walla Walla watershed, stream gages and flow meters exist on irrigation district diversions and tributaries. Most devices are equipped with telemetry, but currently do not report real–time flow. Real–time monitoring is reportedly not as critical to water management in this watershed. Water management in the Walla Walla watershed generally follows a water use monitoring system where OWRD personnel periodically read and check measurement devices and gages for compliance with water rights.

There are IS_XFRs on the main stem Umatilla River and Walla Walla Rivers. Monitoring is accomplished by stream gages, although the lease/transfer amount is considerably less than typical stream flow in the stream reaches of interest. ISWRs do not affect regulation in the basin. However, there are instream flow requirements associated with federal programs that do impact regulation in the basin (e.g., Umatilla River Exchange).

Below is a description of the current monitoring system and gaging needs.

Diversions:
Real–time stream gages operated by OWRD exist on all four irrigation districts of the Umatilla River below the City of Pendleton, which is where the majority of water use occurs. In addition, non–recording measurement devices (weirs, flumes, etc) or flow–meters are required on all diversions for lands exceeding 2 acres. OWRD personnel read these devices once a month. For lands less than 2 acres, users are required to submit monthly water use reports to the watermaster's office.

Two irrigation districts are present in the Walla Walla River sub-basin. OWRD–operated stream gages equipped with telemetry monitor these diversions, but currently do not report real–time data. Only the east side diversion of the Walla Walla River Irrigation District has a measuring device that is not equipped with telemetry. In the existing regulatory environment, real–time monitoring is not necessary for distribution and regulation because there is no duty limit and diversion rates are typically not exceeded (per communication, Tony Justus Watermaster District 5). Nonetheless, for all users in the Walla Walla watershed, head gates and measurement devices have been installed to ensure compliance to water rights as part of an OWRD/WWWC cooperative project. OWRD personnel periodically check these devices to ensure compliance with water rights.

The Hudson Bay Improvement Company and Walla Walla Watershed Council (WWWC) operate one stream gage on the mainstream river below all diversions (near the Oregon/Washington state line). This gage is operated to meet ESA flow requirements in the main stem Walla Walls River below the two irrigation districts' diversions.

Users on the major tributaries (McKay, Birch, and Butter Creeks) are non–centralized (i.e., non–irrigation district) diversions, and typically generate significant amount of regulation due to the diffuse nature of the diversions in combination with low water availability after the spring freshet. Low head differentials on some of these diversions makes monitoring by measurement devices difficult, and manual discharge measurements are the typical method used during the seasonal regulation activities.

USGS–operated stream gages on Meacham Creek and the Umatilla River above Meacham Creek serve as an early warning signal for distribution and water management below Pendleton.

Additional information is available at:
http://www.cbfwa.org/FWProgram/ReviewCycle/fy2002cp/projects/25066resp.doc

Stored Flow and Natural Flow:
In the Umatilla watershed, USBR operates the reservoir gages on Cold Springs and McKay Reservoirs, while OWRD/USBR operated stream gages exist on all major streams, including the main stem river and inflows and outflows from the reservoirs. From this data, the live and storage component of stream flow is determined. Irrigation district use is tracked real–time by OWRD stream gages. As described earlier, non–

district use is also monitored. The result of this gaging and monitoring activity is a detailed monthly water use report with remaining storage balances, which is distributed to the irrigation districts and other water rights holders.

There are no storage facilities in the Walla Walla watershed, and thus no need to determine live and natural flow (and use) in the Walla Walla River.

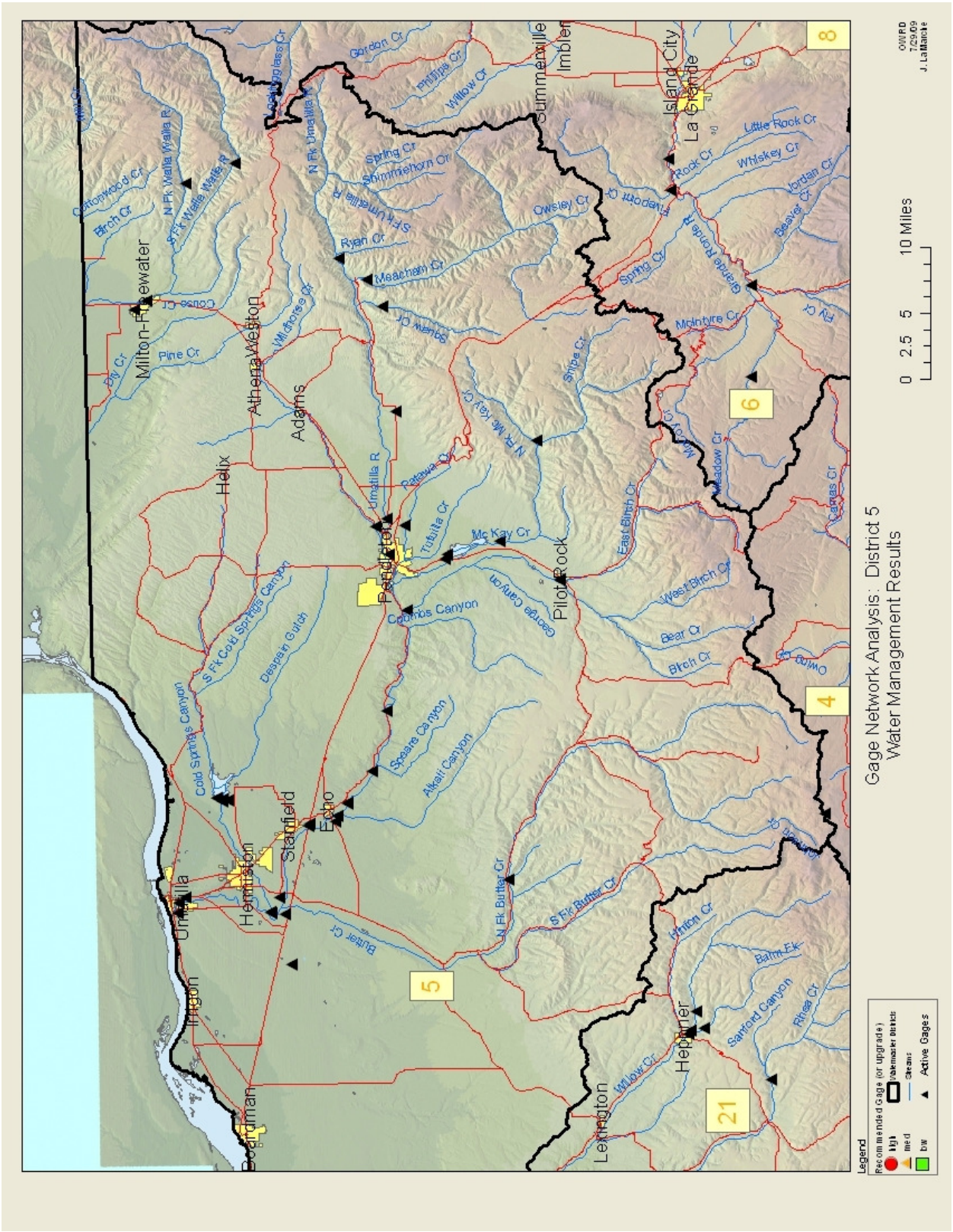
Instream Transfers and Leases:
There were four streams identified as having IS_XFR activity. These IS_XFR normally result in an instream flow requirement with a priority date that affects water management. Of these four streams with IS_XFR, two have expired, leaving only the main–stem Umatilla and Walla Walla Rivers with IS_XFRs. Although stream gages exist on these rivers to monitor the resulting instream flow requirement, the IS_XFRs are less than the typical flow seen in these reaches.

There is an ESA required minimum flow on the main stem Walla Wall River, near the Oregon border. Currently, the Hudson Bay Irrigation District and Watershed Council operate the gage to monitor these required flows. In addition, there are instream flow requirements on the main stem Umatilla River associated with the Umatilla River water exchange program. The numerous main stem gages on the Umatilla below Echo are used to monitor and manage distribution for these flow requirements.

High Regulation Streams:
The cause of regulations for all 23 streams (or stream reaches) with high regulations (> 20), is full appropriation in combination with a large number of points of diversion (POD) to regulate. Measurement devices are installed or are being installed for most users of these streams. However, some ditches have minimal head drop and rely on manual measurements from the watermaster for regulation. These streams have seasonal regulation that is largely complaint driven. However, no additional gaging needs were identified as being helpful for water management in these streams.

Zero Expected Flow Streams:
There were 15 WABs identified with zero expected flow in the summer. Many of these WABs had no regulation because of a lack of complaints. Most of the other streams had some seasonal regulation activity that is complaint driven. No additional gaging needs were identified in these WABs.

No new gaging sites or upgrades were identified in this survey for watermaster District Five.



Gaging for water management evaluation results. Watermaster District Five

District Six—Grande Ronde Basin

Summary:
Regulation and monitoring activity in the Grande Ronde Basin is typically complaint driven and associated with the seasonal stream flow decline after the spring freshet. Most of this activity occurs in the Grande Ronde valley due to the high water demand, coupled with a lack of significant summer base flows in the valley. Regulation is anticipated by the watermaster based on telemetry–equipped stream gages that monitor stream flow into the valley and current crop types being cultivated. Water use in the valley is mostly associated with individual users (i.e., non–organized irrigators) and typically by late June, regulation and monitoring has begun in earnest because of declining flows. Diversion monitoring occurs by measurement devices, manual measurements, or visual estimation of irrigation systems.

In the Wallowa River, base flows are much higher and demands significantly smaller compared to the Grande Ronde valley. This hydrologic setting, coupled with constrained OWRD staff resources limits regulation and monitoring activity in the Wallowa watershed, which is almost entirely complaint driven. There are several organized water users in the Wallowa watershed as well as many large individual diversions. Diversion monitoring in the Wallowa watershed occurs (when necessary) by measurement devices, manual measurements, or estimation techniques.

There are few storage facilities in the Grande Ronde Basin, and only Wallowa Lake (in the Wallowa watershed) has the potential to affect water distribution. However, under the current regulatory environment, minimal monitoring of storage and storage releases occurs in the basin.

Numerous gages are operated by the USGS or OWRD on all of the major streams in the Grande Ronde Basin: Wallowa River, Lostine River, Bear Creek, Minam River, Catherine Creek, and the Imnaha River. In addition, gages are operated at multiple locations on the Grande Ronde River and upper basin tributaries. Many of these gages help with regulation activity in the basin.

Instream transfers and leases (IS_XFR) generally do not affect regulation in the basin. Monitoring, where required, occurs by visual estimates due to the small size of the leases. The instream water right (ISWR) on the Grande Ronde River at Troy is the only place where an ISWR causes regulation, and is monitored by a telemetry–equipped stream gage. There is a voluntary conservation program on the Lostine River which causes monitoring activity on that stream system.

Recommended changes to the current gaging network (related to water management) includes a telemetry upgrade to Catherine Creek, near Union (gage # 13320000) and installation of a staff gage on the Cross Country canal on the Wallowa River. Monitoring and regulation could change if the regulatory environment changes or additional staff resources become available.

Diversions:
Wallowa watershed—
For the Wallowa watershed, the Wallowa court decree divides the watershed into three valleys. Users in each valley are not allowed to make a call for water from users in upstream valley(s), regardless of water right priority date. In addition, there is no rate limit set for users in the Wallowa decree. Nonetheless, many diversions (open ditches) have measurement devices. Routine diversion monitoring, however, is generally not carried out given the regulatory and hydrologic setting (i.e., general abundance of water in most years to meet all demands), limited OWRD staff resources, and general lack of complaints from water users in the watershed.

At the head of the Wallowa Valley near Wallowa Lake, are two organized irrigation entities; the Wallowa Valley Improvement District (WVID) is located at the head of the valley in the Prairie Creek system just east of Wallow Lake, while the Associated Ditch Company (ADC) is located primarily in the lower Prairie Creek system below (i.e., North and East of) Wallowa Lake. Most of the WVID's water supply comes from a trans–basin diversion from Sheep Creek, Little Sheep Creek and McCully Creek in the Imnaha watershed, and from Prairie Creek, tributary to the Wallowa River. Measurement devices are thought to be generally absent on the diversions, although there is a water use reporting requirement for WVID (oral communications Shad Hattan, District Six watermaster). In contrast, ADC is thought to have measurement devices on the main diversions (except at the Wallowa Lake Dam). ADC relies on both storage and natural flow for its water supply. Additional monitoring of natural and storage flow use may be warranted in a different regulatory setting (e.g., multiple storage users). However, presently diversions for both entities are not routinely monitored due to the hydrologic setting (i.e., adequate water supply) and lack of regulatory complaints.

The next downstream, semi–organized users are the large ditches in valley of the Lostine River and Bear Creek; tributaries to the Wallowa River. All the ditches on the Lostine River and most on Bear Creek have measurement devices. Some of the ditches on the Wallowa River have measuring devices. Additional measuring devices on the Wallowa River are under consideration for water management needs. Again, diversion monitoring does not routinely occur (see regulatory conditions detailed earlier). However, there are two stream gages that monitor flows below diversions at critical locations on the Lostine River to help with water management. In addition, measurements are occasionally required at Cross Country Canal for regulation for downstream rights. Installation of a measurement device or staff gage here would help with regulation.

The Lower Valley Improvement District (LVID) is the most downstream organized user on the Wallowa River. LVID diversions have measurement devices installed, but are not actively monitored. LVID does report monthly water use to OWRD through annual reports.

In addition to these organized irrigators, there are roughly 30–40 diversions from the Wallowa River that can divert between 5–20 cfs of flow. Presently, these diversions are

not monitored, but some are equipped with measurement devices.

Grande Ronde Valley—
The regulatory and hydrologic setting in the Grande Ronde Valley differs significantly from the Wallowa watershed. Stream flow is severely limited after spring runoff, and generally by mid–July demand far exceeds available water. During spring runoff, the Grande Ronde River Decree allows water right holders to beneficially use “excess” water without penalty. The senior water rights exist along the fringes of the valley, with junior rights generally located in the valley center. Most diversions from the Grande Ronde River and lower end of tributaries consist of pumps for individual land owners. Diversions on most of the upper tributaries (e.g., Catherine Creek, Willow Creek, Mill Creek, etc.) occur by ditches. Regulation activity in the Grande Ronde Valley is generally complaint driven, but proactive regulation of unauthorized water use is initiated by the watermaster. Inflows into the valley are monitored by the watermaster to predict when regulation should begin.

On Catherine Creek, two stream gages are used to help with regulation: Catherine Creek at Union (#13320300) and Catherine Creek near Union (#13320000). These gages effectively bracket much of the water diverted from Catherine Creek. The gage at Union is equipped with modem and phone line, while a telemetry upgrade is recommended for the gage near Union. This upgrade would allow for real–time flow monitoring and identify when regulation should occur. The diversions from Catherine Creek are scheduled to have measurement devices installed to aid in regulation. Current diversion monitoring consists of performing manual stream measurements, using empirical hydraulic equations for submerged orifices or other flow estimation techniques. There is an inter–basin diversion from South Catherine Creek to Big Creek in the Powder Basin. This diversion is not monitored, but is regulated off seasonally with the decline in Catherine Creek stream flow.

Other tributaries with significant regulation activity are Willow Creek and Mill Creek. Springs feed several tributaries to Willow creek at the contact between the valley floor and the base of the Blue Mountains. Regulation and monitoring is complaint driven. A staff gage was installed on Willow Creek and a rough rating curve was established to assist with regulation. Mill Creek has a separate court decree. Major diversions from Mill Creek that are routinely regulated and monitored have measuring devices. Mill Creek does not have a stream gage.

Regulation for diversions from the Grande Ronde River proper is triggered by complaints. Real–time flow monitoring at the Grande Ronde gage near Perry helps predict the timing of initial complaints and in determining water availability for regulation. There is only one irrigation district in the Grande Ronde Valley, but there are numerous (~40) other non–organized, large–capacity diversions (> 5 cfs) in the watersheds. Regulation consists of shutting off the pumps used to divert water from the river, and adjusting and monitoring the diversion ditches in the upper valley. Many of the diversion pumps serve multiple water rights spanning a broad range of priority dates. Diversion monitoring consists of making sure junior lands are not being watered and that

diversions for senior rights are within the allowable rate limits.

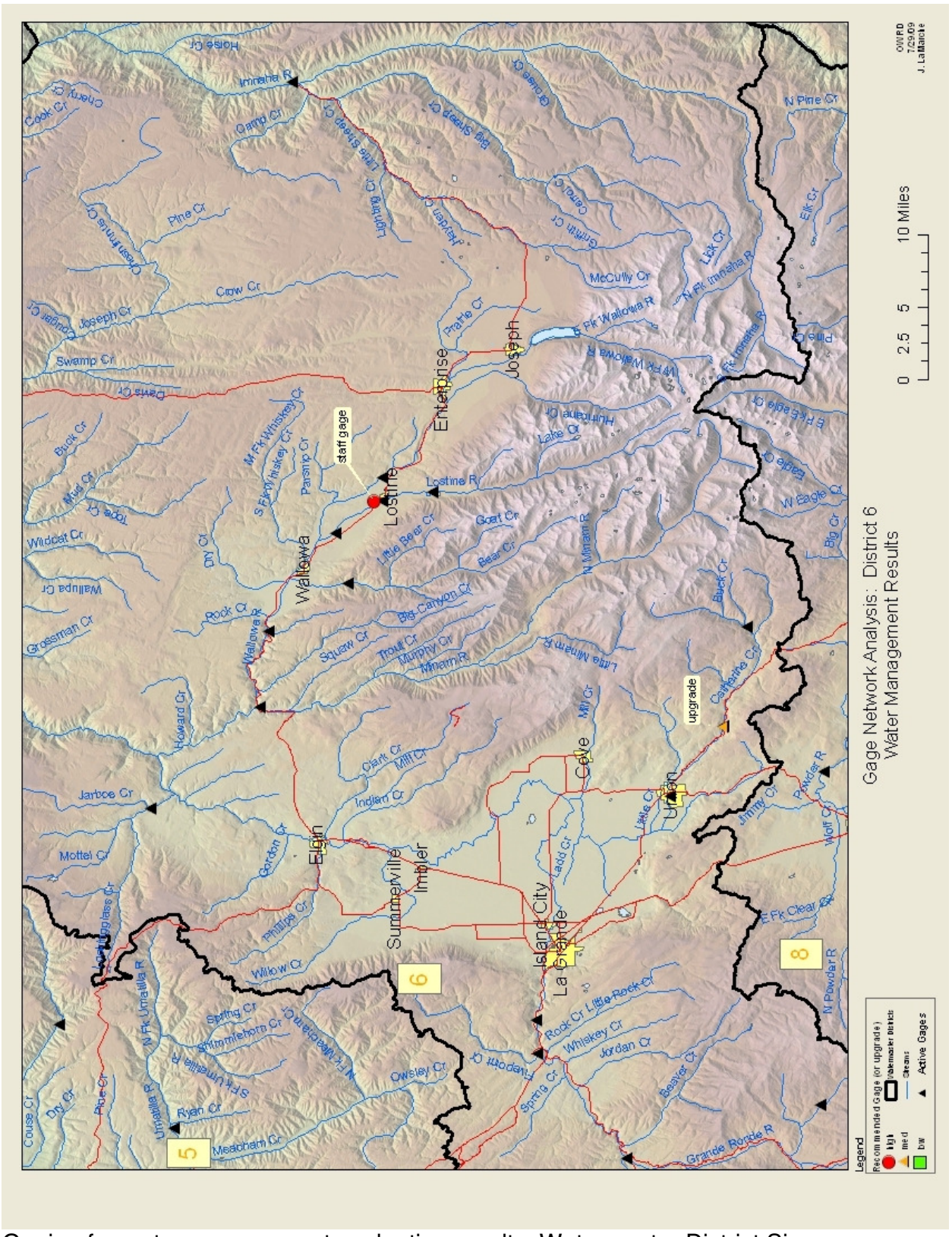
Stored Flow and Natural Flow:
There are only two significant storage facilities in the Grande Ronde Basin: Wallowa Lake and Minam Lake. Storage in Minam Lake is for users in the Lostine River, while storage in Wallowa Lake is currently for the Associated Ditch Company only.

Storage and releases from either storage facility are not routinely monitored. Releases from Minam Lake generally last only a couple of weeks and usually do not impact distribution in the Lostine River. Releases from Minam Lake can be monitored from the Lostine River gage near Lostine #13330000. Storage in Wallowa Lake is more significant, but the sole user of the storage is just downstream of the lake. If there were multiple users, storage and releases from Wallowa Lake (and the associated diversions) would need more intensive monitoring.

Instream Transfers and Leases (IS_XFR):
There are eight streams in the Grand Ronde Basin with instream lease or transfer (IS_XFR) activity. Most IS_XFRs are of insufficient quantity or priority to warrant intensive monitoring. IS_XFR associated lands are monitored to ensure that they are not being irrigated. None of the IS_XFR causes regulation activity. However, there is one instream water right that causes regulation in the Grande Ronde Basin—Grande Ronde River at Troy. A stream gage with telemetry exists at this location and is routinely monitored at low flows by the watermaster for regulation of junior upstream rights. Under present conditions, no additional gages are required to monitor instream flows.

High Regulation Streams:
Seven high regulation streams were identified (> 20). All are located in the Grande Ronde Valley, where water is scarce during the summer due to the watersheds hydrology and the amount of use in the valley. High demand, combined with seasonal flow decline in water results in disputes among users and the need for regular water management on the tributaries and valley.

Zero Expected Flow Streams:
There were fourteen water availability basins (WABs) with zero expected flow during the summer. Regulation activity only occurs in six of these for the same reasons stated in the high regulation streams. There generally are no complaints on the other WABs.



Gaging for water management evaluation results. Watermaster District Six

District Eight—Burnt and Powder Basin

Summary:
There are two major river systems in Watermaster District Eight: the Burnt and Powder Rivers. These rivers, including the major tributaries, exhibit stream flow derived from snowmelt runoff processes, with very little base flow in the summer through winter. As a consequence, reservoirs provide an important source of water for summer demand.

Water management in the district is complaint driven and predominately associated with the seasonal stream flow decline after the spring freshet. This complaint driven management generally entails regulating the myriad of users on tributaries and the main stem Powder River with no access to stored water. Irrigation districts are usually not associated with direct monitoring or regulation.

Irrigation district diversions are not monitored real–time because they are described as "self regulating," due to the independent sources of water for each district. Several other factors contribute to this description: geographic separation between districts, lack of senior users to make a call on district diversions and the adequate supply of water for these demands. The irrigation districts may have as few as half a dozen or greater than eighty diversions. Therefore, there are no stream gages on diversions. However, water use reporting is required of the districts and is generally accomplished through daily readings of measurement devices (e.g., weirs, flumes, etc) by district staff. The exception is in the Burnt River watershed, where stream gages on the main–stem river are used in a block monitoring approach to water use.

Storage is monitored by real–time reservoir gages operated by USBR on the main reservoirs (Phillips Lake, Thief Valley, and Unity) in the basin. Other reservoirs, Wolf Creek and Pilcher Creek Reservoirs are operated by irrigation districts. Smaller reservoirs on tributaries are generally not gaged for reasons discussed later. Real–time stream gages operated by OWRD (or OWRD for USBR) are present below the main reservoirs and along the main–stem Powder and Burnt Rivers. The gaging stations are useful for water management but are generally not needed for regulation.

Instream flow requirements associated with transfer and/or leases of irrigation rights to instream uses (IS_XFR) are only located on Rock Creek. The location and priority of the IS_XFR obviates monitoring requirements. Most instream water rights filed by ODFW have been protested.

One location was identified where an additional stream gage would help with water management—Powder River near Keating. In addition, several non– USGS/OWRD operated gages are very useful to water management in Eagle and Pine Creeks. Below is a detailed description of the current stream gaging system and identified gaging needs.

Diversions:
There are four irrigation districts (or water control districts) in the Powder watershed:

Baker Valley Irrigation District (BVID), Lower Powder Irrigation District (LPRID), Powder Valley Water Control (PVWCD), and Phillips Ingle Ditch Improvement Company (PID). PVWCD is located on tributaries to the Powder River: Wolf Creek and Pilcher Creek. PID diverts water from Goose Creek and West Eagle Creek, tributaries to the Powder River. BVID is the upper–most district and located on the main stem Powder River; while Lower Powder ID (also on the main stem river) is below Thief Valley Reservoir, and PVWCD and BVID. Each district has its own storage reservoir.

Past watermasters have determined a futile call usually exists for LPRID to call on live flow from junior users above Thief Valley Reservoir (e.g., BVID and PVWCD). Thus, the source of water for each district is considered independent from each other, which negates regulation activity by the watermaster between major users in the basin. In addition, there is a general lack of junior users to the districts (including instream water rights, which have been protested). Therefore, there is no monitoring for rate and duty. Given an adequate supply of water to the districts in most years, there is little active monitoring of district diversions in this regulatory environment. Although district diversions are not gaged, end–of–year water use reporting is required by the districts and is generally accomplished by manual readings of non–recording measurement devices by district staff. District diversions are coordinated with reservoir releases and available stream flow.

There is only one irrigation district in the Burnt River watershed: Burnt River Irrigation District (BRID). Storage is allocated solely for BRID and typically there is no shortage of water in the watershed. Given the supply of water and lack of any instream flow requirement, the watermaster does not monitor the BRID diversions in real–time. However, as in the case of the Powder River, district water use reporting is required. Water use is estimated by comparing the flow of stream gages at the top and bottom of three reaches: Unity Reservoir to Clarks Creek, Clarks Creek to above Banks diversion, and Banks diversion to the mouth near Huntington. The difference in flow between the upstream and downstream gage provides an estimate for consumptive use, a surrogate for the amount diverted. OWRD operates the Burnt River gages in cooperation with USBR and BRID. The gages, however, are not used for regulation or distribution.

Stored Flow and Natural Flow:
As indicated earlier, there are separate storage facilities for each irrigation district. This fact, along with the futile call determination between users on the upper and lower Powder River (delineated by Thief Valley Reservoir) means the watermaster does not determine the stored and live flow component of stream flow for distribution. The existing gages, however, are sufficient to operate the reservoirs, determine net inflows, and set releases to meet irrigation demands by district staff.

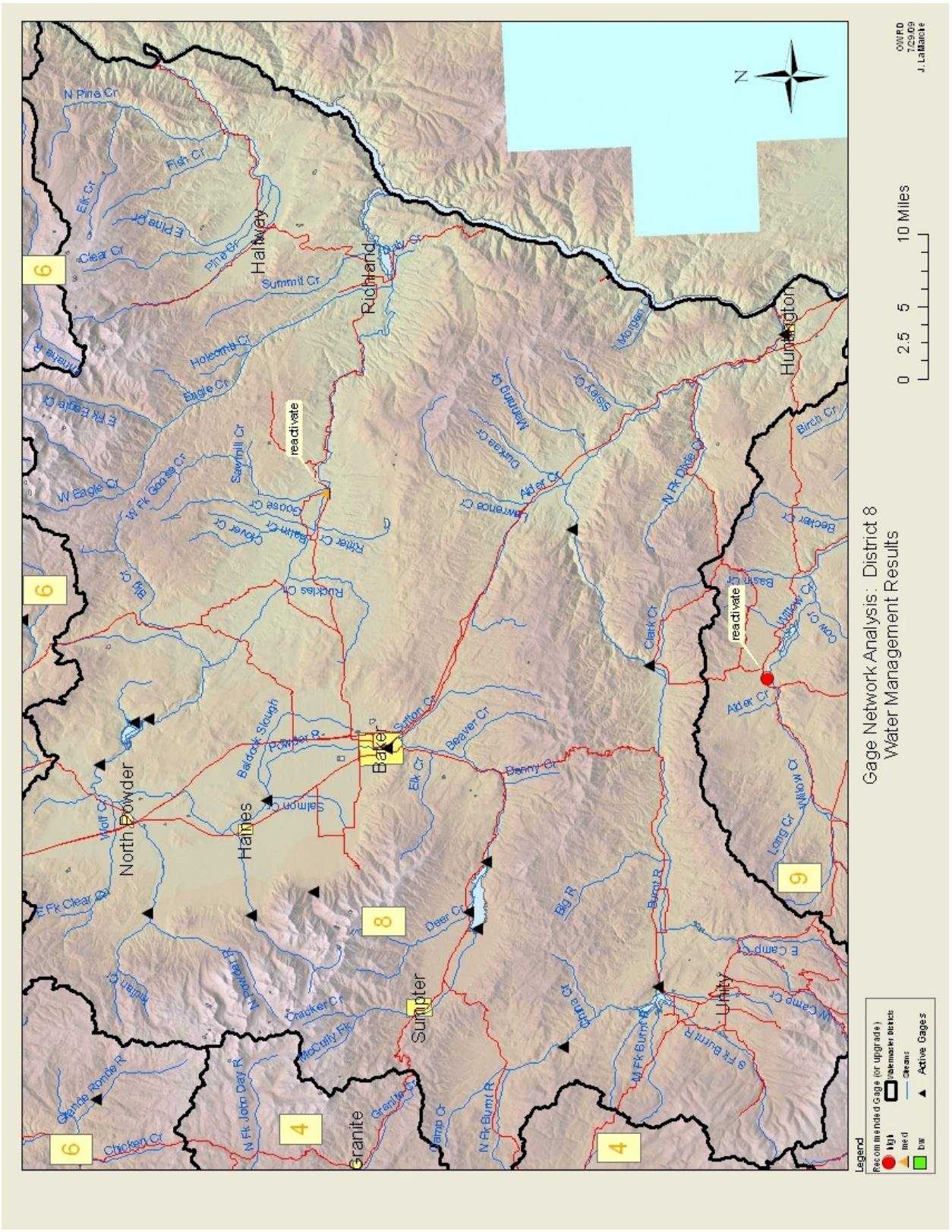
There are no active gages for storage and releases from Wolf Creek Reservoir and Pilcher Creek Reservoir. Storage in these smaller reservoirs (during winter/spring) generally does not compete with other users. These facilities are operated, monitored and managed by Powder Valley Water Control District.

Instream Transfers and Leases:
Rock Creek is the only stream where instream transfer and/or leases (IS_XFR) have occurred. However, the location of the IS_XFR is above any junior users, which obviates monitoring requirements. Instream water rights filed by ODFW have been protested.

High Regulation Streams:
The cause of all 25 streams listed as having a high number of reported regulations (> 20), is due to full appropriation, in combination with the high number of points of diversion (POD) to regulate in these runoff dominated streams. These streams have seasonal regulations that are largely complaint driven. The installation of measurement devices has been given high priority in the areas of Pine Valley, West Hills (west of Baker), Eagle Creek and the lower Powder River. An additional gage to help with water management was identified for the Powder River near Keating. In addition, new Idaho Power stream gages on Eagle Creek (near Skull Cr and above the mouth) will help with management on that system. Finally, several new Idaho Power gages are slated for Pine Creek and East Pine Creek, which is expected to help with water management in that watershed.

Zero Expected Flow Streams:
There were 42 water availability basins (WABs) identified as having zero expected flow in the basin (Table 1b). Fourteen of these WABs were also associated with streams having a high number of regulations (discussed previously). Of the remaining 28 WABs, most are self regulating due to the runoff nature of the streams and reoccurring late season shortages. There is occasional regulatory activity by OWRD in some of these WABs. No additional gages were identified for management needs in these WABs, aside from those already specified.

Other Information:
The gage network was evaluated for management needs as they exist in the current regulatory environment. As is the case for the rest of the state, if this environment changes, then it is probable that the gaging needs for management will likely change and will require reevaluation.



Gaging for water management evaluation results. Watermaster District Eight

District 9—Owyhee and Malheur Basin

Summary:
Water management and monitoring in Watermaster District Nine (consisting of the Owyhee and Malheur Basins) is impacted by the USBR's Vale and Owyhee Projects. Information about these two projects can be found at:

http://www.usbr.gov/projects/FacilitiesByState.jsp?StateID=OR#list

In addition to these two projects, OWRD regulation and monitoring activities are affected by the large size of District Nine (9,600 square miles), limited staff resources (a single watermaster), and the hydrologic setting—runoff driven streams with little summer base flow. The irrigation districts (IDs) rely heavily on storage for their summer water supply due to this hydrologic setting. There is no rate limit for storage diversions and the IDs work together to manage common water supplies, which limits most complaints from the major water users. Due to these factors, OWRD regulation and monitoring activity is complaint driven and usually associated with the individual users along the small tributaries in the basin, where water supply (i.e., storage) is limited.

None of the ID diversions are actively monitored by OWRD. Diversions are checked by manual measurements when there are complaints for regulation (by senior water right holders). Presently, there is minimal conflict or regulation of the IDs, but this could change under a different regulatory environment (e.g., ESA concerns, reduced or constrained supply, etc.). OWRD historically operated stream gages on many ID diversions which are now operated by the IDs. Most of these gages, however, are no longer of sufficient quality to be of use to the watermaster and improvements need to be made in their operation and maintenance.

Reservoir storage and releases are measured by telemetry equipped USGS gages on the four USBR reservoirs, except for Bully Creek Reservoir where releases are monitored by hydraulic equations and manual readings by the Vale Oregon Irrigation District. The live and storage component of stream flow below the reservoirs is determined, when required, by the relevant irrigation districts. OWRD is not involved in this process and does not monitor storage or releases. For the private reservoirs, OWRD checks storage and releases on an as needed basis by manual methods.

There is minimal instream transfer and leasing activity (IS_XFR) in the basin. Instream water rights (ISWR) are junior to the irrigation rights (which greatly exceed natural flow). Hence there is no monitoring for instream flow requirements for water distribution purposes.

Below is a detailed description of how water is monitored, the current stream gaging system and identified gaging needs.

Diversions:
The main diversions in the basin are related to the irrigation districts: Owyhee Irrigation District (OID), South Border Control (SBC), Old Owyhee Ditch Improvement Company

(OODIC), and Jordan Valley Irrigation District (JVID) in the Owyhee Basin; and Vale Oregon Irrigation District (VOID), Warm Springs Irrigation District (WSID), Orchard Irrigation District (OCID) and Harper South Side Irrigation District (HSSID) in the Malheur Basin. Most of the districts diversions were at one time monitored by stream gages operated by OWRD, but are now operated by the irrigation districts (IDs). The IDs are required to report monthly water use to OWRD annually. Presently, reporting is intermittent and gage maintenance and operation is in need of improvement for many of the districts. Nonetheless, irrigation districts work cooperatively together for the most point and complaints/regulation activity associated with ID diversions are minimal.

The main users from the Owyhee River are OID, SBC, and OODIC. OID and SBC take water directly from Owyhee Reservoir by a common intake and tunnel. Both entities have very junior live flow rights and rely almost entirely on storage for their water supply. OID operates and maintains Owyhee Reservoir in cooperation with SBC. There is a duty limit, but no rate limit for diversions from storage. OID operates a gage with telemetry on the main diversion from the reservoir, but the watermaster does not monitor this data as there are no complaints for regulation. OID also operates gages on the North Canal for OID and the South Canal for SBC.

OODIC has the most senior water right from the Owyhee River. The ditch company works with OID to set releases below Owyhee reservoir to meet its demands. There are no measurement devices on OODIC diversions, but the watermaster can check the diversion by manual measurements if required. Presently OODIC does not report its monthly water use to OWRD.

JVID is located on Jordan Creek, a tributary to the Owyhee River upstream of Owyhee Reservoir. The district relies almost exclusively on off channel storage in Antelope Reservoir (capacity 70,000 ac-ft). There are senior live flow users on Jordan Creek that cause regulation of JVID. Presently there are no measurement devices on diversions into the district. Regulation and monitoring is complaint driven (by the senior live flow users) and may involve manual measurements by the watermaster on either reservoir storage or the diversion into the reservoir. Two stream gages on Jordan Creek would help with reoccurring regulation. The first would be near the state line above the JVID diversion, while the second would be located at the discontinued gage site: Jordan Creek, near Jordan Valley (# 13179000).

In the Malheur watershed, WSID is located near the bottom of the watershed and VOID is just upstream (VOID also occupies land in the Willow Creek watershed). Both VOID and WSID have storage rights in Warm Springs Reservoir as well as natural flow rights from the Malheur River. WSID operates and maintains the reservoir and the districts cooperate to coordinate reservoir releases and diversions. Stream gages operated by the districts are present on the diversions. However, they are not properly maintained and are not used by the watermaster for monitoring or regulation. Monitoring is done by manual measurements in response to complaints. Given additional resources, the watermaster would like to take over these gages and equip them with telemetry.

VOID also has storage rights in Beulah Reservoir (located on the North Fork Malheur) and Bully Creek Reservoir (located on Bully Creek). VOID operates and maintains both reservoirs. In addition, VOID has natural flow rights from Willow Creek. Again the district operates gages on diversions, but they are not maintained well enough to be of use to the watermaster. Monitoring by the watermaster is complaint driven and occurs by manual stream flow measurement.

Orchard Irrigation District (OCID) gets it water supply from Willow Creek (tributary to Malheur River) and Pole Creek Reservoir. Monitoring is done by manual measurements and is complaint driven. There are no measurement devices on OCIDs diversion and the district does not report its water use.

Harper South Side Irrigation District has live flow rights from the Malheur River. Under the Malheur Decree, downstream users can not call on water diverted by HSSID. There are no measurement devices on HSSID diversions, but occasional monitoring is performed by manual measurements.

Improvements or, given additional resources, reacquisition to the stream gages on diversions to Warms Springs, Vale, and Harper South Side Irrigation District would be helpful for water management purposes. Specifically the following gages: Vale–Oregon Canal near Namorf (#13219100), Upper Harper Ditch near Harper (#13219290), Vines Canal near Vale (#13221000), Farmers Canal near Hope (#13222000), Gellerman and Frohman Ditch above Vale (#13224000), and Hope Mill Ditch at Vale (#13225000).

Stored Flow and Natural Flow:
Storage is monitored by USGS reservoir gages on the four USBR reservoirs. Outflow from three of these reservoirs (Warmsprings, Owyhee, and Beulah) are monitored by USGS stream gages, while releases from Bully Creek Reservoir are monitored by hydraulic equations and manual readings by VOID. Typically outflows from these reservoirs are set to zero during the fill season, except for Owyhee Reservoir which typically releases at least 10 cfs during the winter. Determination of the live and storage component of stream flow below the reservoirs is made, when required, by the associated irrigation districts. There is generally no regulation or monitoring by OWRD associated with stored water in the USBR reservoirs. Likewise, storage and releases from these reservoirs are not monitored by OWRD.

For the other significant reservoirs in the basin (Upper Cow Creek Lake, Lower Cow Creek Lake, Antelope Reservoir, and Malheur Reservoir), storage and live flow below the reservoir is determined by the watermaster on an as needed basis and is complaint driven. Routine monitoring does not occur.

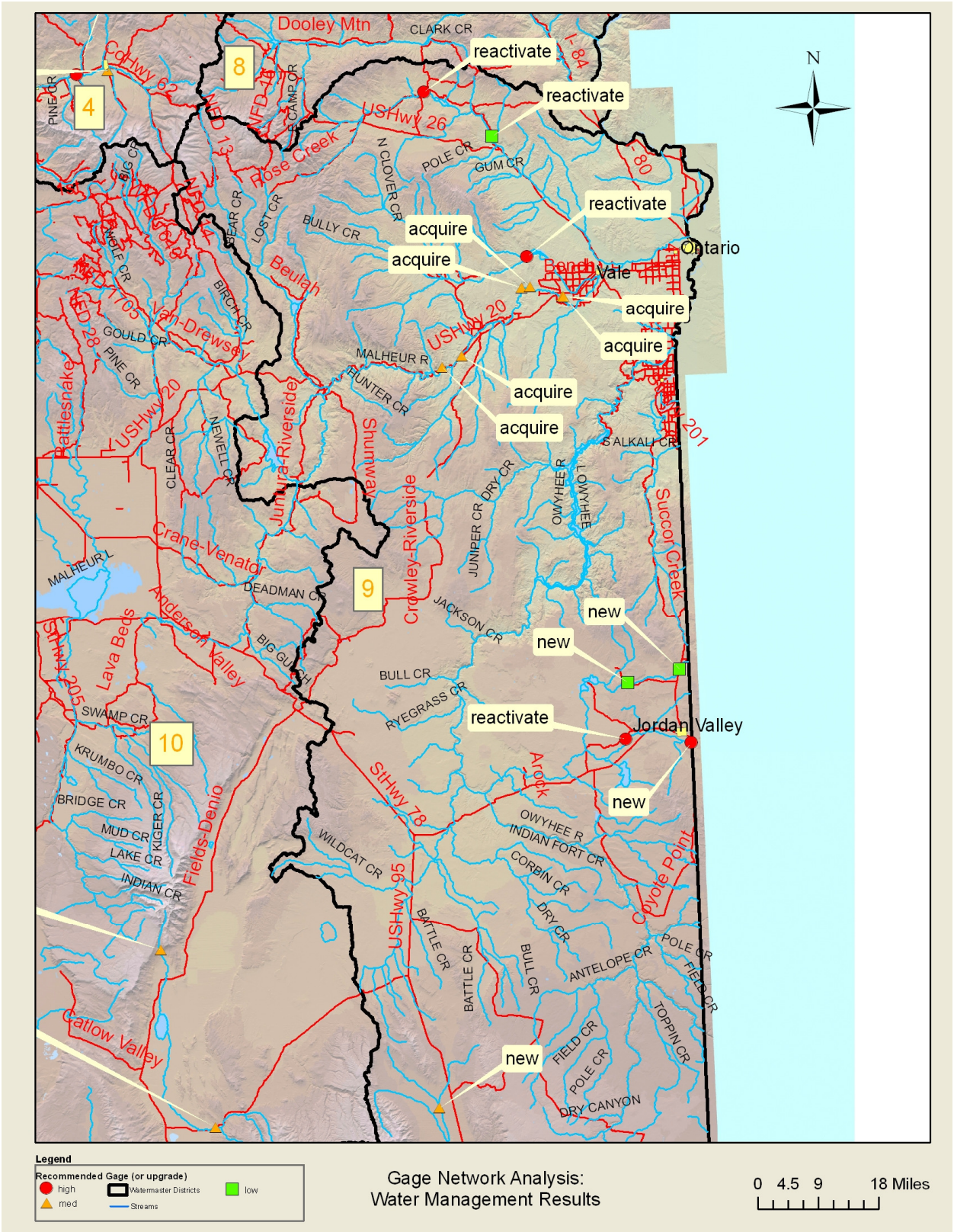
Instream Transfers and Leases (IS_XFR):
Rinehart Creek was the only stream in the district that had IS_XFRs. The stream had only one user, who was responsible for the IS_XFR. There are instream water rights (ISWRs) in the basin, but none affect distribution. This is due to the basin being highly full–appropriated (irrigators rely heavily on storage flows for the summer supply) and the

natural absence of live flows in the summer for any type of use.

High Regulation Streams:
There were six streams with high regulations (>20): Willow Creek, Malheur River, Jordan Creek, Indian Fort Creek, Cow Creek, and Oregon Canyon Creek. Full–appropriation was the cause of all of these regulations, except for Oregon Canyon Creek. For this creek, reoccurring disputes are the cause of high regulations.

For Willow Creek, telemetry equipped stream gages above and below the reservoir (historic gage sites: Willow Creek near Malheur (#13229500), Willow Creek near Brogan (#13231500) would help with regulation in the upper and lower watershed. The gages on Jordan Creek have already been discussed. Regulation on Cow Creek would also benefit from a gage located near the state line. Finally, regulation on Oregon Canyon Creek (located several hours away from the field office) occurs regularly for anywhere between two weeks to two months. A telemetry equipped gage on this creek would greatly enhance regulation efficiency for this creek. All of these gages could be seasonally operated.

Zero Expected Flow Streams:
There were 22 water availability basins (WABs) identified as having zero expected flow in the basin. Most of these WABs had seasonal regulation activity due to full–appropriation. There were no complaints for three of the WABs. A stream gage at the historic Bully Creek at Warmsprings near Vale (#13226500) site would help with regulations. They other gaging needs for these WABs have already been discussed.



Gaging for water management evaluation results. Watermaster District Nine

District 10—Malheur Lakes Basin

Summary:
Three major watersheds produce significant stream flow in the Malheur Lakes Basin (aka Harney Basin): Silvies River, Silver Creek, and Donner und Blitzen. These streams generate significant stream flow from snowmelt–runoff in the spring, which rapidly diminishes during summer. The lower valleys typically flood (both naturally and assisted by small dams) during spring runoff. However, in the Silvies River and Silver Creek watershed, summer base flows are small and irrigation demand far exceeds supply after the spring freshet. Base flows in the Donner und Blitzen River are higher and irrigation demand much smaller than the other watersheds. Therefore, most regulation and monitoring activity occurs in the Silvies and, to a lesser extent, Silver Creek watersheds. This activity is predominately complaint driven after spring runoff. However, regulation can occur during the winter and early spring of dry years as irrigators typically irrigate prior to the growing season to increase soil moisture content.

The main diversions in the basin are associated with non–organized large irrigators that share supply from a common canal, slough, or ditch. Most of the diversions are from the Silvies River and, to a lesser degree, Silver Creek. Both streams naturally bifurcate as they enter their respective valleys, resulting in various sloughs and forks of the main streams. These channels divert water to numerous individual irrigators by check or push–up dams. Due to the low gradient channels in both valleys, it is difficult to use measuring devices or stream gages as backwater conditions (either natural or due to check dams) are typical. As a result, complaint driven monitoring by manual discharge measurements is the norm. Complaints are numerous because the basin is highly fully appropriated and the users unorganized.

There are four active stream gages in the district. One of the gages (Malheur River near Drewsey) is in a different drainage basin. Of these gages, the Silvies River near Burns gage (#10393500) is the most important for water management purposes. This gage, plus the Donner und Blitzen near Frenchglen gage, measure most of the inflows to the valley floor. A gage in a similar location on Silver Creek would essentially measure all major inflows to the valley.

There are a few small storage facilities in the Malheur Lake Basin, but only one routinely affects distribution— Moon Reservoir. Monitoring of storage and releases are done manually. Installing measurement devices here would be beneficial for water management.

There are no instream transfers or leases (IS_XFR) in the basin. Instream water rights (ISWR) are junior to the irrigation rights, which greatly exceed natural flow. There is no ISWR monitoring related to regulation and distribution.

Below is a detailed description of how water is monitored, the current stream gaging system and identified gaging needs.

Main Diversions:
Silvies River–
The Silvies River naturally bifurcates as it enters Harney Valley. Numerous sloughs carry water to individual or groups of irrigators, the largest being Foley Slough. Legally, stream flow is to be divided between the main stem Silvies and Foley Slough at a ratio of approximately 10 to 1, based on the water rights on each system (This ratio actually varies somewhat based on the priority date and acreage of the rights being fulfilled from each channel, which in turn depends on the available flow above the bifurcation point). Historically, this division in flow occurred somewhat naturally due to the channel configuration and associated hydraulic properties in each channel. This is no longer true due to either natural or anthropogenic changes in the Silvies channel and some controversy exists on how to remedy this issue. There is no head gate on the Foley Slough as it is legally consider a distributary of the Silvies River. There are designs for two small dams to be constructed in each channel in order to manage the required division of water. Currently, the division of flows is routinely checked manually without benefit of a staff gage or rating curve. Given the site conditions it may be difficult to develop a stage discharge relationship at this location in either channel. Nonetheless, there is a need for a telemetry equipped stream gage on the Foley Slough in order to closely monitor and manage flows at this critical location in real–time. The gage would probably be a velocity–index gage, given the site conditions. In addition, as mentioned previously, some type of control structure needs to be installed to manage the division of flow.

The other large bifurcation on the Silvies River critical for water management is the East Fork/West Fork split. At most flows, stream flow is to be almost equally divided between the two forks based on the water rights priority date and acres associated with each branch. However, most of the very senior water rights receive water from the West Fork, which means that at low flows upwards of roughly 70% of the water should be sent down the West Fork channel. Dams are present on both the East and West Forks and are used to manage the distribution of flows between the two branches. Again, flows in each fork are routinely checked manually, without benefit of a staff gage. The site conditions may make it difficult to develop a stage–discharge relationship. There is a need for a telemetry equipped stream gage on each fork, in order to closely monitor and manage flows and this critical location in real–time. The gages may have to be a velocity–index gage, given the site conditions.

The main water users in the Silvies watershed are the Blue Mountain Cattle Company, Island Ranch, and the Bell–A Grazing Cooperative. Diversions to these users are monitored through routine manual discharge measurements of the diversions during the summer due to the scarcity of available flow. Measurement devices need to be installed on the diversions (where hydraulically possible) to aid in water management. In addition to a new gage on the West Fork Silvies near the bifurcation, a weir on the West Fork Silvies at the Highway 205 crossing (near Island Ranch) would greatly aid in monitoring and water management for these users.

There is water use in the Silvies Valley (upstream of Harney Valley), but it is comparatively small and confined to the alluvial filled valley next to the river. There are few complaints for regulation in this valley, and the valley has always been regulated separately from the lower valley.

Silver Creek–
Silver Creek is smaller than the Silvies River in terms of watershed size, stream flow, and irrigation use. Typical of the major streams in the basin, Silver Creek also bifurcates in its' valleys: Silver Creek Valley (west of Burns) and the Warms Springs Valley just upstream of Harney Lake— the ultimate terminus for all three major watersheds in the basin. The Silver Creek decree puts most users in the upper valley on par, and there are better irrigation rotation agreements and landowner cooperation in the Silver Creek watershed than the Silvies River. As a result, there are fewer complaints for regulation and monitoring in the Silver Creek watershed compared to the Silvies watershed.

For the Silver Creek Valley, monitoring and regulation are complaint driven. Most of the users have established irrigation rotations and diversions are checked by occasional manual discharge measurements when there are complaints. A stream gage with telemetry above the valley near the historic "Silver Creek near Riley, Oregon" gage site (near the road crossing at the bottom of the "upper valley") would help with regulation efficiency and distribution in the valley. The installation of measurement devices on the main channels/diversions in the Silver Creek valley would also help with regulation.

For the Warm Springs Valley (downstream of Silver Creek Valley), regulation activity and monitoring are also complaint driven and more routine due to higher frequency of complaints, plus storage in Moon Reservoir. The channel gradient is much lower in this valley and as a consequence diversions are monitored by manual stream flow measurements. The presence and hydraulic configuration of Moon reservoir also causes some regulation complexity. Senior live flow users are located below the reservoir, which should pass live flow to these users when required. The outlet of the dam, however, is of insufficient size to pass runoff at higher flows. Routine monitoring of outflows and storage by manual measurements are typical regulatory activities in the valley. A staff plate on the reservoir plus and stage/capacity curve are needed to better manage the storage and distribution of water below the reservoir. In addition a measuring device downstream of the dam (to measure outflows) would also be very beneficial to distribution and regulation in the valley.

Hotchkiss Cattle Company is the largest water user in the upper Silver Creek watershed. The installation of measurement devices on the associated diversions would help with regulation.

There is regulation of junior irrigation users on Silver Creek in favor of the refuge. Monitoring of inflows to the refuge from the Silver Creek distributaries is very difficult due to channel gradients, presence of springs near the refuge which comingle water with the Silver distributaries, water control dikes on the refuge, and the numerous channels which drain into the refuge.

Donner und Blitzen–
There is very little regulation and monitoring in the Donner und Blitzen watershed due to the late season runoff and the small amount of irrigation use. There are some large diversions related to water distribution in the Malheur National Wildlife Refuge, which encompasses most of the Blitzen Valley as well as Harney and Malheur Lakes. There is a stream gage just upstream of the refuge which records the inflows to the refuge from the Donner und Blitzen River.

Other watersheds–
There is some regulation and related flow monitoring that takes places outside of the three main watersheds in the Harney Basin. One of these locations is the Pueblo Valley, located about 2 hours south of Burns on the east side of the Steen Mountains and south of the Alvord desert. Some reoccurring regulation occurs on Trout Creek due to limited flow in the creek compared to the water use. Due to the distance from the field office, the existing gage on Trout Creek (#10406500) needs to be upgraded with telemetry. This upgrade would greatly improve regulation efficiency in the basin.

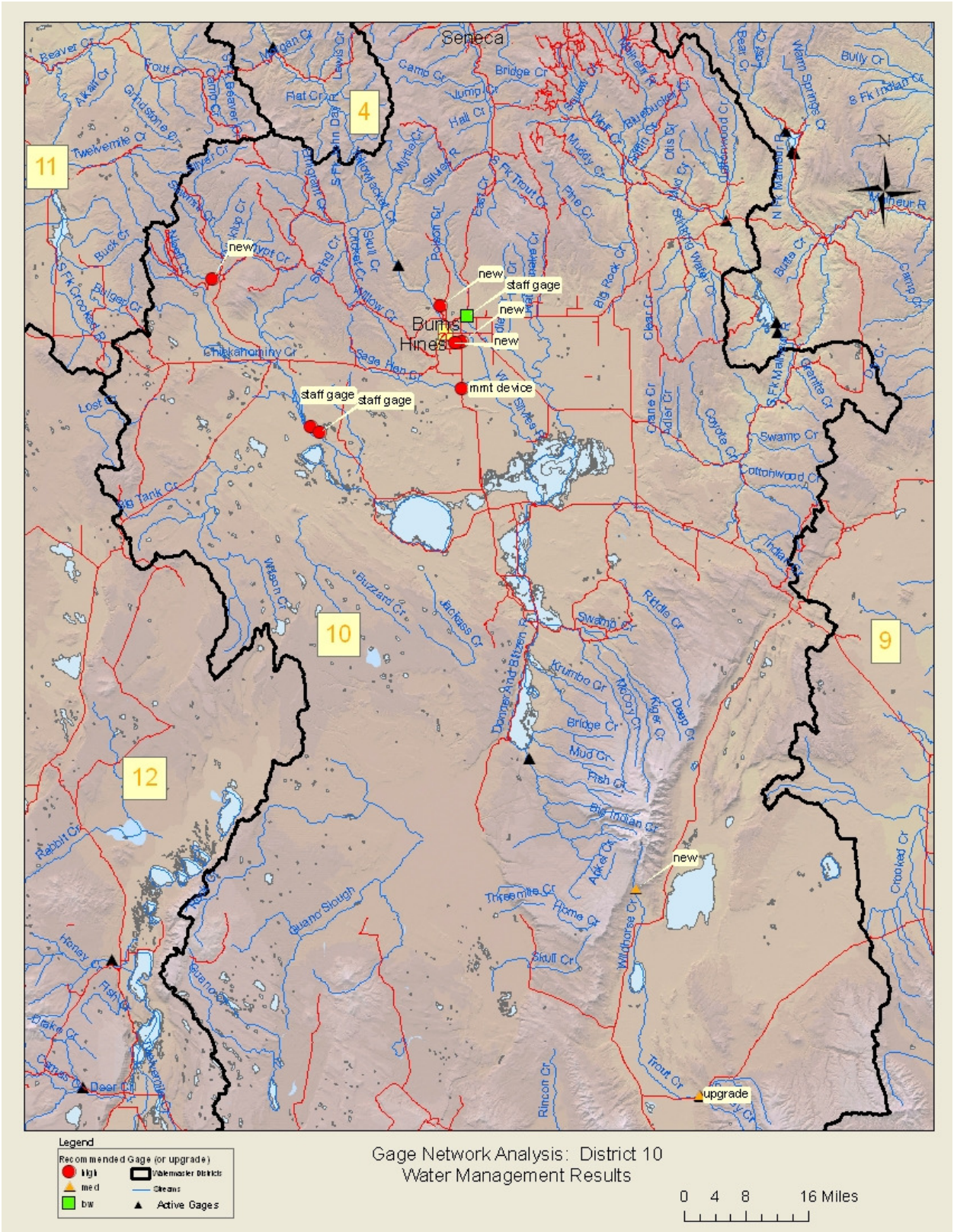
Stored Flow and Natural Flow:
Most of the reservoirs in the Malheur Lake Basin are small and do not affect regulation. The exception is Moon Reservoir on Silver Creek and Cottonwood Reservoir on Cottonwood Creek. Moon Reservoir storage and outflow is routinely monitored by a staff gage and manual measurements, respectively. Calculation of the storage and live flow component of stream flow downstream of the reservoir occurs on an as needed basis. The management of the reservoir was discussed previously. Cottonwood Reservoir is managed and monitored by Otis Valley Irrigation Company. Complaints associated with distribution of storage are rare, and associated monitoring and regulation occur on an as needed basis.

Instream Transfers and Leases (IS_XFR):
There are no streams in Watermaster District Ten that have IS_XFR activity on them. There are instream water rights (ISWRs) in the basin, but none affect distribution. This is due to the basin being fully appropriated and very little if any flow is available for instream use.

High Regulation Streams:
The high regulation streams in the basin in order of activity are the Silvies River, West & East Fork Silvies River, Silver Creek, Poison Creek, Kueny Ditch and Malheur River. Regulations reported on the Malheur River included activities in watermaster District Nine, where most of the diversions take place. The reason for all of the high regulation activity is full–appropriation (i.e., water rights exceed available flow). New stream gages that would help with this regulation have already been described previously. Gages on Silvies River, East Fork Silvies River, and Silver Creek would dramatically improve regulation and water management efficiency. A staff gage on Poison Creek where the creek enters the valley would also be beneficial for regulation. Finally, Kueny Ditch is a great distance from the watermasters office. A seasonal telemetry equipped stream

gage on Wildhorse Creek would help with regulation of this ditch, but would be a lower priority to the other gaging needs discussed.

Zero Expected Flow Streams:
There were 26 water availability basins (WABs) identified as having zero expected flow in the District Ten. All of the WABs associated with the lower tributaries to the Silvies River and Silver Creek have seasonal regulation due to full appropriation. The institutional knowledge of the regulatory environment is insufficient to determine if there is seasonal regulation in the other WABs.



Gaging for water management evaluation results. Watermaster District Ten

District 11—Deschutes Basin

Summary:
There are six watersheds in District 11 where most water management and water distribution occurs: upper Deschutes River (above Bend), Tumalo Creek, Whychus Creek, lower Crooked River (Bowman Dam to Smith Rocks), upper Crooked River (above Bowman Dam), and Trout Creek. The hydrologic setting of these watersheds varies dramatically. Trout Creek, upper Crooked River, and lower Crooked Rivers (including the tributaries) exhibit snowmelt–runoff processes, with very high flows during the spring freshet and minute summer baseflows (i.e., groundwater contributions). In contrast, the upper Deschutes watershed exhibits stream flow predominately derived from groundwater discharge, with some snowmelt–runoff contributions, mostly from the Little Deschutes River, a major tributary in the upper Deschutes River. Stream flow in Tumalo and Whychus Creeks originates from both groundwater and snowmelt–runoff processes. Superimposed over these hydrologic regimes, several reservoirs augment summer water supply in the upper Deschutes and lower Crooked watersheds by storing water in the winter/early spring.

Despite the differences in hydrologic settings, all of these watersheds have one commonality: full–appropriation in the summer. Telemetry–equipped gages provide real–time monitoring and management for the majority of water that is stored and distributed. The major water users in the basin are the organized irrigation districts in the upper Deschutes, Tumalo, Whychus and lower Crooked watersheds; all of which are monitored through real–time stream gages. In addition, most large non–irrigation district diversions in Whychus and the lower Crooked watersheds have measurement devices. For Trout Creek, upper Crooked River, and smaller tributaries through out the district, diversions are diffused and associated with individual irrigators. Monitoring these users is predominately complaint driven, followed by watermaster investigation.

Stream gages are present on all major streams in District 11, including the Metolius River. In addition, reservoir gages exist on all major storage facilities. The majority of stream flow and reservoir storage information is available in real time. In the upper Deschutes watershed, storage and natural flow components of stream flow are routinely calculated for distribution purposes. In the lower Crooked, this calculation is only required during drought years due to releases from Prineville Reservoir that exceed downstream consumptive demand.

ISWRs do not affect regulation in the basin due to their junior priority. IS_XFRs, however, do affect regulation and most are proactively monitored by telemetry–equipped stream gages. An additional gage on Indian Ford Creek (near or below Highway 20) would help with monitoring instream flow requirements.

Below is a detailed description of how water is monitored, the current stream gaging system and identified gaging needs.

Diversions:
There are six irrigation districts (IDs) in the upper Deschutes watershed: Arnold (AID), Central Oregon (COID), North Unit (NUID), Tumalo (TID), Swalley (SID), and Lone Pine (LPID). In addition, there is one ID each in the Whychus (Three Sisters ID), Tumalo (TID), and lower Crooked (Ochoco ID) watersheds. All of the diversions associated with the IDs are monitored by OWRD operated, real–time stream gages.

In addition to these irrigation districts, there are numerous sizeable diversions associated with groups of users in the Little Deschutes, Whychus, and lower Crooked River watersheds. The Walker Basin Canal, which diverts water from the Little Deschutes River, is the largest diverter, and is monitored by a stream gage. On Whychus Creek, measurement devices are present on most large diversions and are read daily by a deputy watermaster. For Tumalo Creek, there are municipal diversions that are regulated in times of drought, and periodically monitored during the summer of normal years. Measurement devices have been installed on most of the large ditches in the lower Crooked River watershed. Monitoring these diversions occurs by manual measurements in response to complaints, as opposed to active monitoring. This regulatory environment results from Prineville Reservoir summer releases, which typically exceeds downstream demand. However, this may change in the future with the allocation of un-allocated storage in the reservoir.

Diversions from Trout Creek, the upper Crooked River, and the smaller tributaries (e.g., McKay, Mill, Ochoco, Bear Creeks, etc) in District 11 are monitored and managed by a complaint driven system. Most of this activity entails regulating off junior users following the seasonal stream flow decline in late spring. Trout Creek users tend to be self–regulating, due to informal rotational agreements. In the upper Crooked watershed, most junior users are downstream of senior users, which reduce regulation calls.

There are very few water users in the Metolius watershed. Those that exist are located on the tributaries and divert relatively small amounts of water. Most regulation and monitoring in the Metolius is associated with a single tributary— Lake Creek. Monitoring in Lake Creek typically results from watermaster investigation following disputes between neighbors or complaints by environmental organizations.

Stored Flow and Natural Flow:
There are three large reservoirs in the upper Deschutes watershed: Crescent Lake, Wickiup, and Crane Prairie. Determining the live (i.e., natural) and storage component of stream flow occurs for distribution and water accounting purposes on a regular basis in the watershed. OWRD operates gages on all storage, reservoir outflows, and irrigation diversions; which allows for this computation. The calculation is necessary because there are multiple large users that share a common water supply—the upper Deschutes River. In addition, five of the six irrigation districts in the watershed also have rights for stored water: TID (Crescent Lake), NUID (Wickiup Reservoir), COID, AID, and LPID (Crane Prairie Reservoir). Releases from these reservoirs are comingled with natural flow in the Deschutes River above Bend. This fact, coupled with high demand makes accurate water accounting a requirement in the watershed.

There are two storage facilities in the lower Crooked watershed: Ochoco and Prineville Reservoir. Storage in Ochoco Reservoir is solely for OID, while storage in Prineville Reservoir is for OID and more than a dozen other small users (oral communications Kyle Gorman, South Central Region Manager). In the lower Crooked River watershed, determining the live and storage component of stream flow only occurs in drought years because storage releases typically exceed all consumptive demand.

The Pelton–Round Butte hydropower complex is located at the confluence of the Crooked, Metolius, and Deschutes Rivers; in the northern most part of District 11. The three reservoirs (Billy Chinook, Simtustus, and Pelton Re-regulation) are operated for power production and are predominately "run of the river" reservoirs, with minimal seasonal changes in storage. However, approximately 35,000 acre-feet of storage for flood control are usually evacuated from Lake Billy Chinook for four months, beginning in November (PGE 1999). According to the 1999 re–licensing application, the re–regulating reservoir is operated to maintain relatively even flows in the lower Deschutes and to approximate the inflows into the project. The hydropower complex is junior to all other users, except the ISWRs above and below the reservoir. OWRD does not actively monitor storage and releases from the reservoirs.

Instream Transfers and Leases:
Most instream leases and transfers (IS_XFR) are monitored real–time by stream gages with telemetry if they generally meet the following criteria: 1) the stream is of high importance to third parties; 2) there is a potential to meet IS_XFR (i.e., there are junior users to regulate and stream flow has potential to meet the IS_XFR); 3) monitoring the IS_XFR is on a high management stream (i.e., high regulatory stream).

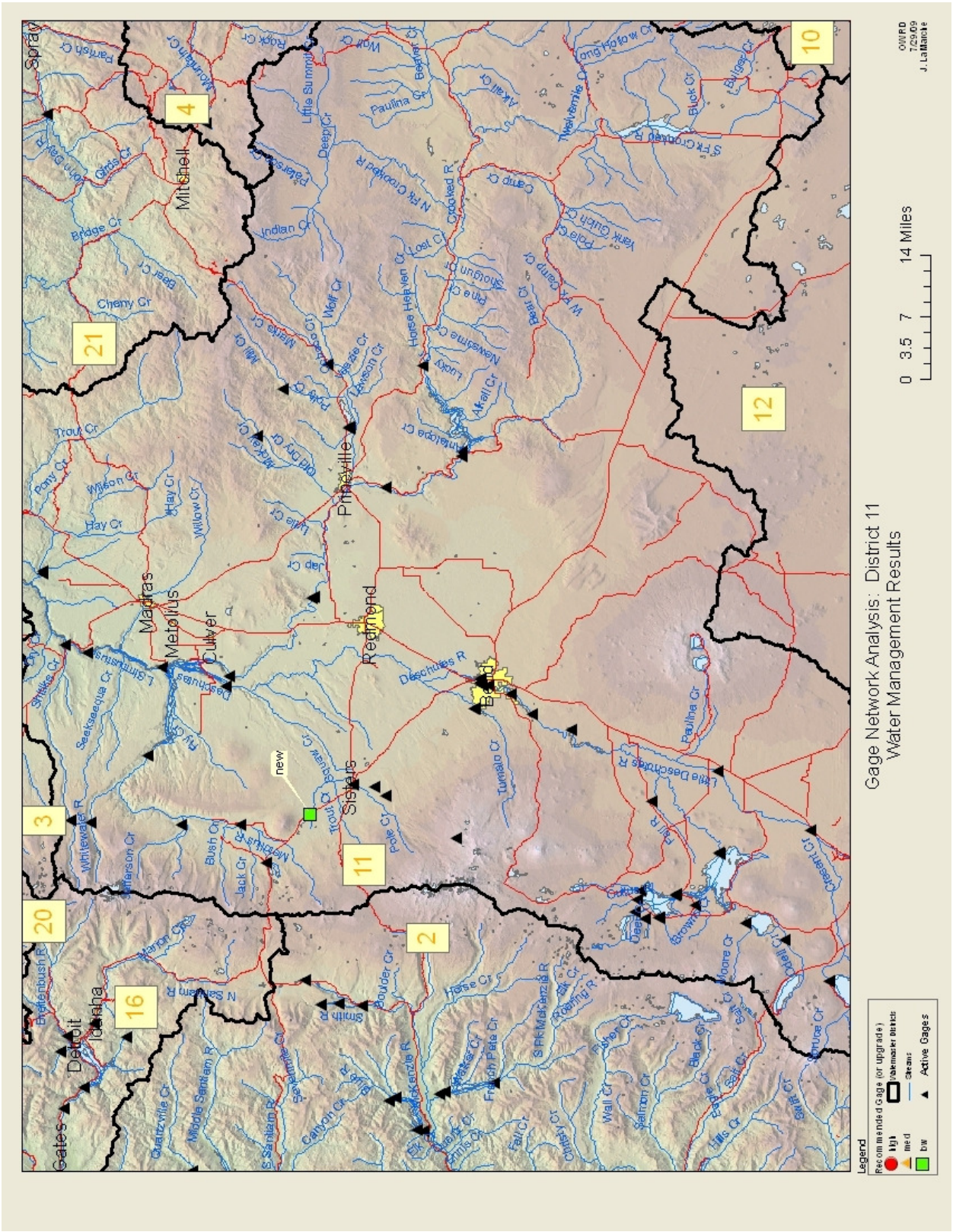
Of the 15 streams identified as having IS_XFR, eight are monitored by stream gages. Most of the remaining six streams are either too small to manage or there is nothing to regulate in favor of the IS_XFR. A gage on Indian Ford Creek was identified as being helpful for monitoring, although it was given relatively low priority.

ISWRs are junior in priority to all other water rights and have no effect on regulation or water distribution. Monitoring ISWR for water management and distribution purposes, therefore, is minimal.

High Regulation Streams:
Nineteen streams were identified having a high number of regulations (> 20). The primary reason for the high regulations was the cumulative out–of–stream rights exceeding available flow (i.e., full appropriation). Several streams had either problem PODs or reoccurring neighbor disputes generating regulatory action. Measurement devices on diversions in the Prineville valley were identified as helpful for management on the lower Crooked River. The Peoples Irrigation ditch diversion is sometimes problematic, and management could be improved with a stream gage. Finally, IS_XFRs cause regulation on some of the streams. Most of these streams have gages to monitor

flows. However, a gage on Indian Ford Creek (discussed previously), would help with regulation.

Zero Expected Flow Streams:
Twenty–five watersheds were identified as having zero expected flow during the summer from the OWRD Water Availability Analysis. Storage releases augment water supply in the main stem Deschutes and the lower Crooked Rivers. Ten of these watersheds had seasonal regulation. Measurement devices on the lowest diversion on Bear Creek and the diversions in the lower Crooked (previously mentioned) are identified as being helpful for management. Regulation activity on the other 14 stream watersheds does not occur because there are no complaints or no users to regulate.



Gaging for water management evaluation results. Watermaster District Eleven

District 12—Goose and Summer Lakes Basin

Summary:
There are five valleys in the 8,000 square mile Goose and Summer Lake Basin where most water distribution, management and monitoring occurs. The hydrologic setting and associated water supply varies dramatically in each valley. A single watermaster is responsible for regulation and monitoring in the basin, which is complaint driven and predominately associated with seasonal stream flow decline after the spring freshet. In normal years, water supply is generally sufficient to meet demand from the main users in the basin: irrigation districts (IDs) and water user associations (WUA).

There is little regulation associated with most large (i.e., organized) diverters in the basin because of the: 1) independent sources of water for each ID and WUA (i.e., geographic separation), 2) senior priority date for most of the main diverters, and 3) adequate supply of water in most years. Nonetheless, there are OWRD and user–operated stream gages on most of the main diversions. The watermaster routinely checks and verifies gages for accuracy, and before any regulation activity occurs. Monitoring of Adel and Hart Lake Water User Association diversions is accomplished by manual measurements, as opposed to stream gaging, due to the diffused nature of the diversions (in response to complaints).

Reservoir monitoring is performed by OWRD and/or the water users associated with the reservoirs, depending on the regulatory environment in each watershed. However, management of these facilities is usually performed by the water users. Currently, OWRD does not typically calculate the live and storage component of stream flow anywhere in the basin, aside from Warner Valley in March. However, the districts perform this calculation for distribution purposes. Gages on the reservoirs and outflows are used to monitor storage and releases, except for the Warner Valley, where OWRD monitors storage using manual methods.

Real–time stream gages are operated by OWRD on the Chewaucan River, Deep Creek and Silver Creek. Stream gages are also present on Ana River, Twentymile Creek, and Honey Creek. The stream gages on Honey, Deep, and Twentymile Creeks basically capture all surface inflows into the Warner Valley. Similarly, the gage on the Chewaucan River near Paisley and Ana Creek measures the major surface inflow into the Chewaucan Valley and Summer Lake Valley, respectively.

There are no instream transfers or leases (IS_XFR) in the basin. Instream water rights (ISWR) are junior to the irrigation rights (which greatly exceed natural flow). Hence, there is no monitoring for ISWR requirements related to water management.

Below is a detailed description of how water is monitored, the current stream gaging system and identified gaging needs.

Diversions:
The large water users in the basin consist of: Adel Water Users (AWU), Hart Lake Water Users (HLWU), Lakeview Water Users (LWU), Bagley Ditch Company (BDC), Summer Lake Irrigation District (SMLID), and Silver Lake Irrigation District (SLID). All these users are located in separate valleys with distinct water supplies, except for Hart Lake and Adel Water User Associations, which are both located in Warner Valley. Diversion monitoring varies based on the regulatory setting and water supply for each entity. All main users, except for AWU and HLWU (described below), have stream gages or measurement devices to monitor the main diversions.

In the Warner Valley, snowmelt–generated runoff typically lasts through the month of June. Hart Lake Water Users are located down gradient of Adel Water Users, which leads to competition for water between the two users—especially during dry years. This competition has been largely ameliorated due to an agreement to pass live flow through Greaser Reservoir (supply for AWU) to HLWU, between March 1st and April 1st. Monitoring of AWU and HLWU diversions is based on complaints followed by manual stream flow measurements by the watermaster. The water right for AWU far exceeds the available flow, which along with the reservoir storage agreement, reduces the amount of active monitoring by OWRD. HLWU has multiple PODs and its diversions are typically only checked with manual measurements when there is a complaint or a call for water is made by HLWU. There are no senior users down gradient from HLWU. For Honey Creek, an important tributary to Hart Lake, the watermaster sets up an annual rotation agreement among the water right holders whose diversions emanate from that stream. The gaging station on Honey Creek is vital to distribution.

Lakeview Water Users (located in the Goose Lake Valley) rely predominately on storage in Drews and Cottonwood reservoirs for supply during the summer. The district operates gages on its diversions, as well as releases from the two reservoirs. Monitoring these diversions is required for water use reporting and is checked periodically by the watermaster. The district self regulates (for rate and duty) for patrons within the district to conserve its storage supply. There are senior live flow users in the valley outside of LWU, which does cause some regulation activity associated with LWU diversions.

Further to the north (near Paisley), with diversions from the Chewaucan River, is the Bagley Ditch Company. The Chewaucan River has substantial runoff through June, but base flows typically fall below 50 cfs by mid–July. However, there are typically few complaints for regulation, and diversion monitoring is generally minimal. The BDC consists of two main users and a flow meter is operated by the users on its main diversion because of the users permit condition. This meter is routinely checked by the watermaster. Monitoring of other diversions from the Chewaucan River is complaint driven.

Further to the northwest is the Summer Lake Irrigation District, which diverts water from the spring–fed Ana River tributary to Summer Lake (Summer Lake valley). Here, there is competition for water by fishery and wildlife needs for the wildlife refuge managed by

ODFW, which are junior to the irrigation district. Because of the consistent flow in the Ana River and the low duty limit on the district, there is typically regulation for duty associated with the district. An OWRD operated stream gage monitors flow in the creek, as well as the diversion. Given the distance from the field office, an upgrade to telemetry may be warranted for both of these sites.

The last organized large diversion lies about 15 miles to the north, in the Silver Lake sub–basin. Again, snowmelt runoff process dominates stream flow generation in the spring and into early summer. Summer base flows, plus storage in Thompson Reservoir are typically sufficient to meet irrigation demands, except in dry years. OWRD operates a gage on the diversion to the Silver Lake Irrigation District (SLID) and on Silver Creek, below the SLID diversions. These gages are located several hours from the watermaster office and, although telemetry has been added to the Silver Creek gage, an upgrade to telemetry on the SLID diversion gage would help with regulation efficiency.

Stored Flow and Natural Flow:
In the Warner Valley (eastern part of the basin), water flows from south to north through Greaser Reservoir, Crump and Hart Lakes. Monitoring of water levels in these three water bodies are important for regulation and distribution in the valley. Greaser Reservoir supplies water to Adel Water Users, while Crump and Hart Lakes are up gradient from Hart Lake Water Users. Currently, Greaser reservoir is monitored through a staff plate, while Crump and Hart Lake are monitored by manual surveying the lake surface from reference points. Monitoring of Greaser is sufficient due to an agreement between Adel and Hart Water Users that specifies live flow be passed through Greaser, between March 1st and April 1st. However, telemetry–equipped reservoir gages on Crump and Hart Lakes would be helpful in monitoring and distributing water between the Hart and Adel Water Users. Determining the exact natural and storage component of flows from the reservoirs is generally not done, other than what was previously described. The main tributaries (Honey, Deep and Twentymile Creeks) are gaged, and in conjunction with lake levels monitoring, the live and storage outflows could be determined, if needed.

In the Goose Lake Valley (southwest part of the basin), two reservoirs supply water to the Lakeview Water Users. The district monitors reservoir outflows for internal distribution. OWRD monitors reservoir levels in Drews Reservoir due to regulation and complaints from LWU associated with numerous upstream users. LWU monitors storage in Cottonwood Reservoir. Determining the natural and storage component of flow through Drews Reservoirs is not required, except for internal distribution in the district, because there are no senior users from Drews Creek. However, there are some senior live–flow users outside the district on Cottonwood Creek. The watermaster uses district–run gages above Cottonwood Reservoir and at highway 140, to determine live and storage component flow for distribution purposes. Telemetry and facility upgrades to these sites would greatly aid regulation efficiency.

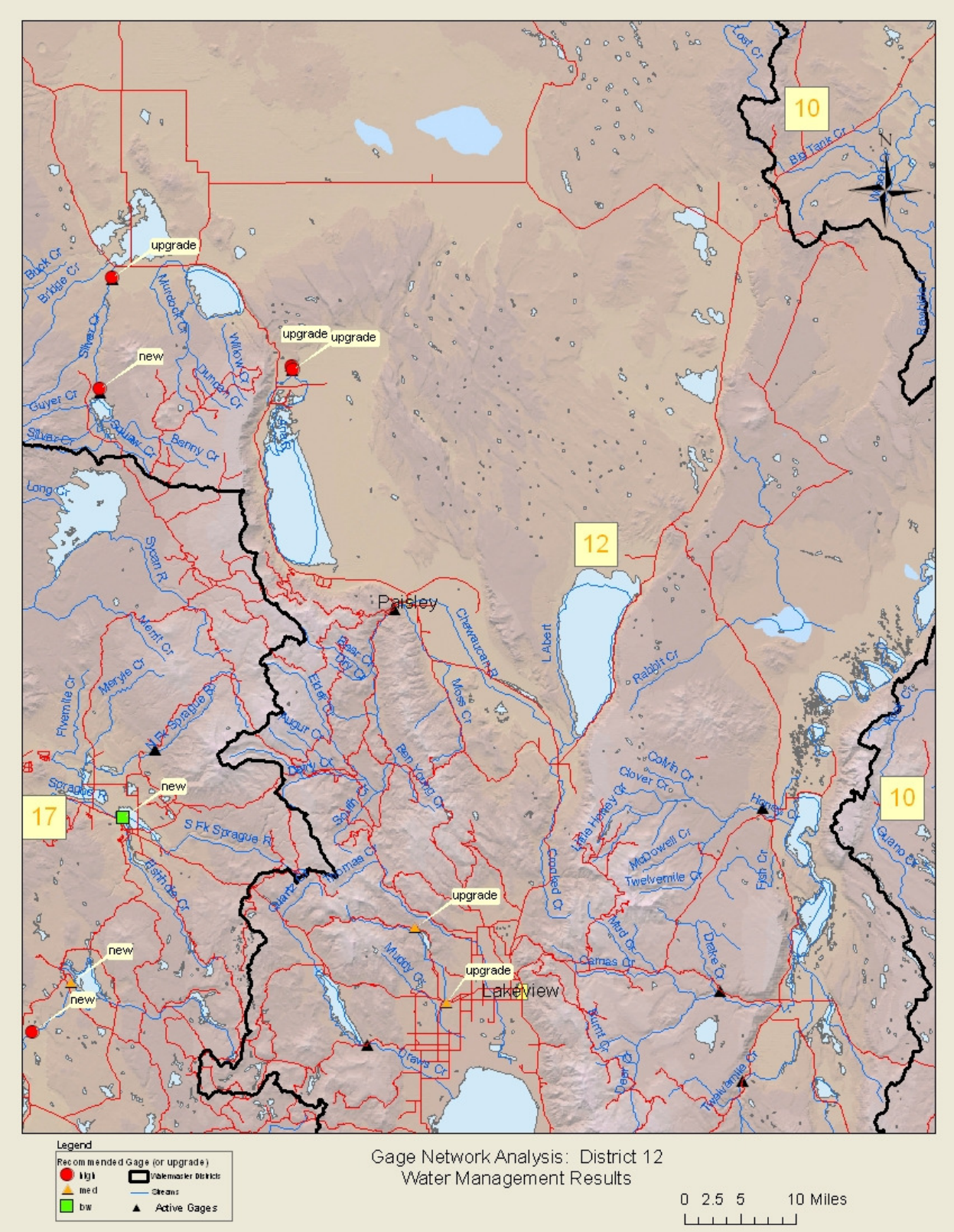
Thompson Reservoir is the only other significant reservoir in the basin. It stores water for SLID and other users in the Silver Lake Valley. The district determines the live and storage component of flow by reading staff plates (with rating curves) on tributaries below Thompson Reservoir and by using stream gages on the SLID diversion and Silver Creek, below the diversion. The watermaster periodically measures at the staff gage sites to keep the ratings current. During drought years, the watermaster takes over estimating live and natural flow.

A more efficient system would be to install a gage below Thompson Reservoir to monitor releases. This information, coupled with reservoir levels would allow for determination of storage releases from the reservoir. The storage release data could then be combined with the flow data at the canal and gage below the canal to determine total tributary inflow. This would reduce the measurements required by the watermaster. Given the distance from these gages to the watermaster office, telemetry–equipped gages are recommended for all locations.

Instream Transfers and Leases (IS_XFR):
There were no stream reaches identified as having IS_XFR activity. Furthermore, the ISWRs are so junior and the basin is fully appropriated, it has no effect on regulation or water distribution. Therefore, there is no flow monitoring with respect to ISWR for water distribution purposes.

High Regulation Streams:
There were four streams (Silver Creek, Greaser Canyon, Cottonwood Creek, and Thomas Creek) identified as having a high volume of regulations (> 20). The causes of all of these were reoccurring disputes between neighbors. No additional stream gages were identified as helping with regulation on these streams. However, given the distance to Silver Creek watershed from the field office in Lakeview, telemetry upgrades are recommended for the stream and reservoir gages.

Zero Expected Flow Streams:
There were ten streams listed as having zero expected flow. Seasonal regulation occurs in five of these (Drews, Thomas, Cottonwood, Honey, and Camp Creeks) due to full appropriation. The remaining five are self–regulating due to the limited availability of water after the spring freshet.



Gaging for water management evaluation results. Watermaster District Twelve

District 13—Upper Rogue Basin

Summary:
There are six large watersheds in Watermaster District 13 where most water management and monitoring occurs: Applegate River, Bear Creek, Evans Creek, Little Butte Creek, Big Butte Creek, and the upper Rogue River (above Gold hill). Stream flows in these watersheds are high in the winter/spring, in response to a combination of rainfall/snowmelt runoff processes and, in the case of Big Butte Creek and Rogue River watersheds, significant amounts of groundwater discharge. In these last two watersheds, the groundwater contribution produces significant summer base flows, which is lacking in the other watersheds. Reservoirs have been constructed in all the watersheds, except in Evans Creek, to augment summer water supply.

For streams lacking a significant summer base flow component (Applegate River, Bear Creek, Evans Creek, and Little Butte Creek), regulation does occur due to full–appropriation. For the Applegate and Evans Creek watershed, regulation is mostly associated with the small individual users and occurs regularly. Regulation occurs in the other watersheds due to comingled water supply; both between the irrigation districts, and between the districts and individual senior live flow rights.

Stream and reservoir gages are present on all irrigation district diversions and storage facilities in the district. In addition, stream flow is monitored at numerous locations on major tributaries, including gages operated to monitor senior instream water rights. The majority of this stream flow and reservoir storage information is available real time. The result of this gaging system is a real–time, ability to monitor and manage water in the basin.

Most of the gages operated on and below storage facilities (Fish Lake, Fourmile Lake, Emigrant Lake, Hyatt Lake, Howard Prairie Reservoir, and Agate Reservoir) are operated cooperatively by the USBR and the five major irrigation districts (IDs) in the area. This joint ownership is also responsible for running stream gages that monitor trans–basin diversions and the irrigation districts' canals. OWRD routinely measures discharge at, and checks the operation of, gages on the canals (oral communications Larry Menteer, Watermaster Dist 13).

The USGS monitors reservoir levels at two storage facilities (Lost Creek and Applegate Lakes), as well as stream flow along the Rogue River above Grants Pass at multiple locations. OWRD operates numerous stream gages at critical locations on major streams for management and distribution, including monitoring to ensure instream water rights are met.

Below is the description of the current stream gaging system and needs (if any) for water management by category. As instream transfers and leases continue to occur, additional stream gaging to monitor instream flows may be necessary.

Diversions:
There are five major irrigation districts (IDs) in watermaster district 13— Talent, Medford, Rogue River Valley, Eagle Point and Gold Hill. All major PODs into the districts are monitored by telemetry equipped stream gages that are operated by the IDs. The gages, originally operated by OWRD, were cooperatively run by OWRD with the IDs for five years before they were completely turned over to the IDs. Personnel from the OWRD regional and district office routinely check gage operation and perform measurements at these PODs. From this oversight, the accuracy of these gages is deemed sufficient by the watermaster for water management and distribution. The IDs diversion record, however, is not reviewed nor published by OWRD. Consequently, although the "status" of these gages is listed as "active" in the accompanied gage survey for district 13, the record is not reviewed or published.

Stored Flow and Natural Flow:
The determination of the live (i.e., natural) and storage component of stream flow occurs on an as needed basis for distribution during the irrigation season by the watermaster. USBR and the irrigation districts cooperatively operate gages on all of the storage facilities and outflows from these facilities, including the trans–basin diversions between the Klamath and Rogue Basins. In addition, OWRD and the USGS operate stream gages on streams above some of the reservoirs.

For the Little Butte drainage, the watermaster has determined spring inflows into the stream network from multiple sets of stream flow measurements and has determined that these flows are relatively constant (per communication Larry Menteer, district 13 watermaster). This data, in conjunction with the cooperatively run USBR gages, is used (when necessary) to determine the live and storage component of stream flow above the irrigation district PODs in the watershed.

For the Bear Creek drainage, OWRD monitors stream flow into Emigrant Lake. This data is then used with the lake and outflow information from the USBR gages to distinguish the natural flow component of the lake's outflows.

Most of the inflows into Lost Creek Lake are measured by the USGS and thus natural outflows from the reservoir can be calculated directly.

Applegate Lake (reservoir) was the only location where additional gages would help with water distribution of natural and storage water, and this is only critical during dry years. The required stream gages would be located on Squaw Creek, Elliot Creek, Carberry Creek, and the Applegate River above the reservoir.

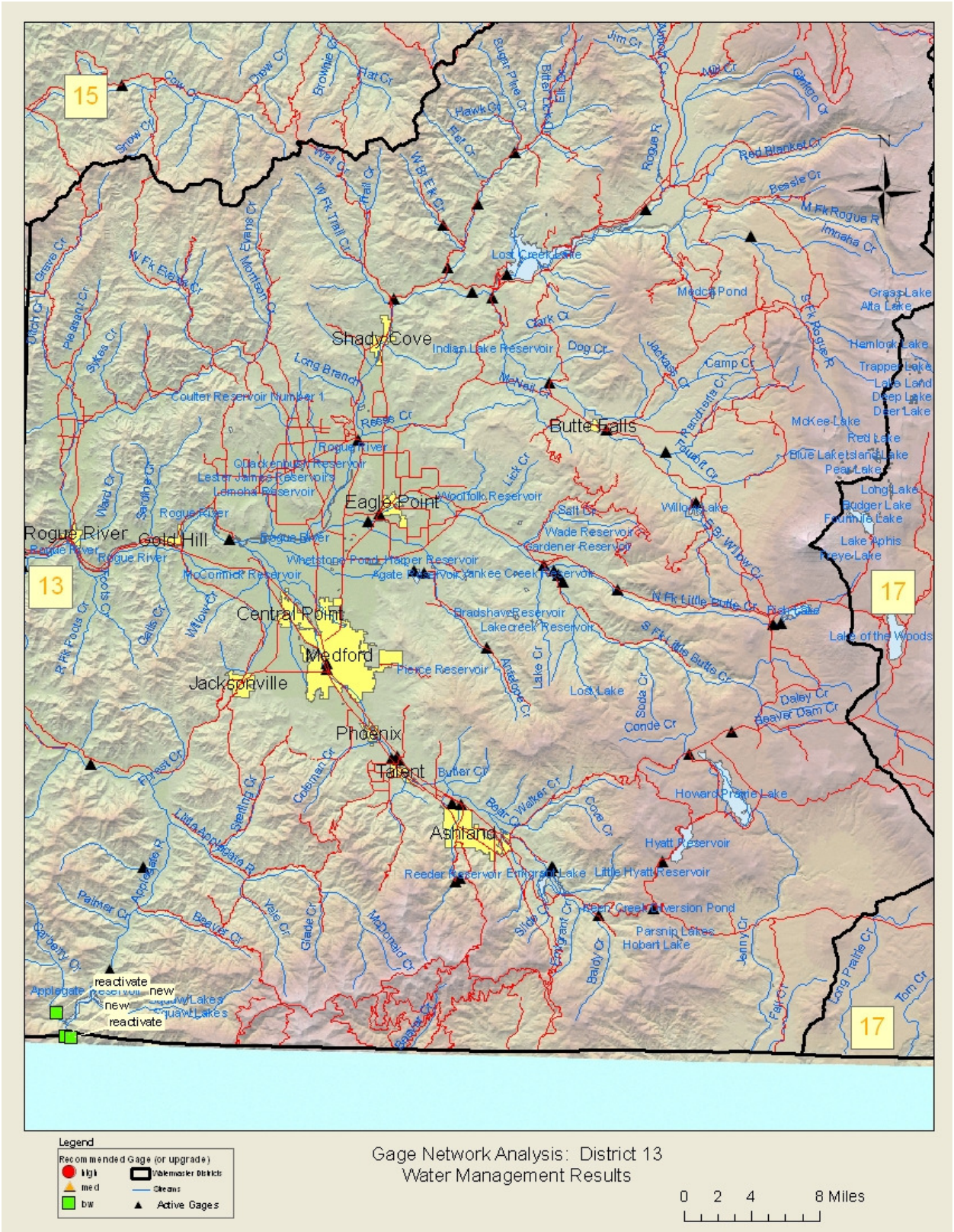
Instream Transfers and Leases:
Most instream leases and transfers (IS_XFR) are monitored real time by stream gages with telemetry if they generally meet the following criteria: 1) the collective IS_XFR is large enough to monitor (typically > 0.5 cfs), 2) the IS_XFR is larger than the expected stream flow (without the IS_XFR), and 3) the IS_XFR is large enough that the resulting change in stream flow can be physically managed and tracked downstream. Some of

the new stream gages identified in the survey are slated for installation in the spring of 2009.

Of the eleven streams identified as having IS_XFR (Appendix A), six have stream gaging to monitor stream flow as they relate to IS_XFR. Three of the streams (Pleasant Cr, Neathammer Cr, and Rogue River above National Forest Boundary) are identified as self regulating or being located where there are no junior users to regulate. One of the streams (West Fork Trail Creek) is monitored through periodic measurements. Two of the streams are having stream gages installed to monitor the IS_XFR.

High Regulation Streams:
Seven streams were identified (Appendix A) as having a high number of reported regulations (> 20). The reason for the high regulations was the cumulative out–of–stream rights exceeding available flow (i.e., full appropriation). Two of the streams (Evans Cr and Little Applegate R) are slated for additional gaging to monitor IS_XFR, which will also help with regulation. There were no additional gages (or gaging alternatives) identified that would help with regulation in these streams.

Zero Expected Flow Streams:
Nineteen watersheds were identified as having zero expected flow during the summer from the OWRD Water Availability Analysis. Ten of these watersheds had no reported seasonal regulation or no available user to regulate (e.g., a single senior diversion within a watershed). Seven of the watersheds are identified as being full–appropriation and four of these watersheds have or will have newly installed stream gages that will help with water management.



Gaging for water management evaluation results. Watermaster District Thirteen

District 14—Lower Rogue Basin

Summary:
The major rivers in watermaster (WM) District 14 consist of the lower half of the Rogue River, lower third of the Applegate River, and most of the Illinois River. Each of these streams has significant winter/spring flows predominately derived from rainfall and/or snowmelt–runoff process. Summer base flows are significant in all three rivers and usually sufficient to satisfy consumptive demands from the main stem rivers. However, this is not the case for many of the tributary streams.

Water management and monitoring in the district is complaint driven, associated with the many, individual, small users located on tributaries, and largely related to seasonal stream flow decline in these tributaries in late spring. In addition, regulation related to illegal use, problem PODs and neighbor disputes also occur on these small tributaries and the Applegate River. Measurement devices or, more commonly, manual measurements are the main mechanism used to monitor diversions on these high regulation streams.

The large water users in the basin consist of irrigation districts, water use associations, and municipalities. Since most of these users divert water from the major rivers, they are usually not involved with regulation because of adequate water supply. Nonetheless, many of these diversions have either user operated stream gages or measurement devices. In the highly regulated Williams Creek watershed, new gages on two large diversions and a gage on Williams Creek near the mouth would greatly aid management and monitoring.

There are no significant reservoirs in the district that affect water distribution and management. However, reservoirs near the headwaters of the Applegate and the Rogue Rivers (in WM District 13) store significant amounts of water in both watersheds. Monitoring of these reservoirs is discussed in the WM District 13 review. Storage contract releases from these reservoirs can be obtained by users in District 14.

USGS operated real–time stream gages are present on all the major rivers in District 14. In addition OWRD operates four gages on tributaries. A telemetry upgrade to the Sucker Creek at Bridgeview gage would help regulation.

The IS_XFRs in the district are either of insufficient quantity to warrant monitoring or are monitored by routine manual measurements. ISWRs are usually junior to all other users, except on the Illinois River, Sucker Creek and Graves Creek. Here the ISWRs affect distribution and are monitored by a stream gage, and manual measurements, respectively.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
The major users in the lower Rogue Basin are irrigation districts, water user associations, and municipalities. Diversions for these users are predominately located on the large streams in the basin: Rogue, Applegate, and the Illinois Rivers. Generally speaking, there are few regulation and monitoring activities associated with the large users because available stream flow generally exceeds consumptive demands from these rivers.

The major diversions from the Rogue River consist of the Grants Pass Irrigation District (GPID), Fort Vanoy Irrigation District (FVID), Applegate/Rogue Irrigation District (ARID), and the city of Grants Pass. GPID and the City of Grants Pass diversions have flow meters that can be used for monitoring purposes. FVIDs diversions have measurement devices and are occasionally checked. In contrast, ARID diversions have no measurement devices and are not monitored. ARID does have a water use reporting requirement, but the district reports its water right rate, not the actual diversion amount. A measurement device should be installed on this diversion. However, as previously stated none of the diversions from the Rogue River are involved with regulation and there is no active monitoring of these diversions.

The City of Cave Junction water supply is from the East Fork of the Illinois River. Flow meters are present on the City's diversion(s), but are not used for active monitoring. There is no regulation activity associated with the City's diversion.

All of the remaining large diversions are located in the Applegate watershed. Monitoring of these diversions is by periodic manual flow measurements coupled with measurement devices. Only the Wilderville Water Users (WWU), which diverts water from the main stem Applegate, has no diversion monitoring. There are no calls for regulation of WWU diversions by other users because the water supply from the main stem Applegate River is adequate to meet all users, including ISWRs (oral communications, Kathy Smith watermaster District 14). In contrast, Williams Creek (tributary to the Applegate River) is fully appropriated and heavily regulated. The Laurel Hill and Watts Topping Ditches both divert water from this creek and are actively monitored with measurement devices. In addition, the watermaster is implementing a program to install measurement devices and head gates on most of the Williams Creek users to help with regulations. Telemetry equipped stream gages on the Laurel Hill Ditch, Watts Topping Ditch, and Williams Creek near the mouth would significantly improve management and regulation on this stream.

Most of the regulation and associated monitoring in the district is associated with the large number of diffused, individual, pumps related to the numerous small users on the tributaries to the main three rivers. In addition to full–appropriation, regulation in these tributaries is also caused by illegal use, problem PODs (i.e., diversion exceeding its water right) and neighbor disputes. These regulation triggers occur in the tributaries and also on the Applegate River.

Stored Flow and Natural Flow:
There are no significant reservoirs in the district that affect water distribution or regulation. However, there are reservoirs near the headwaters of the Applegate and the Rogue Rivers in WM District 13 (upper Rogue Basin). These reservoirs store significant amounts of water and affect stream flow in these two rivers in District 14. Storage contracts can be obtained by users in District 14. USBR and USCOE coordinate releases to match these contracts. Regulation and monitoring associated with storage and natural flow users only occurs during drought years.

Reservoir management and monitoring of these reservoirs are described in the WM District 13 management and gaging review.

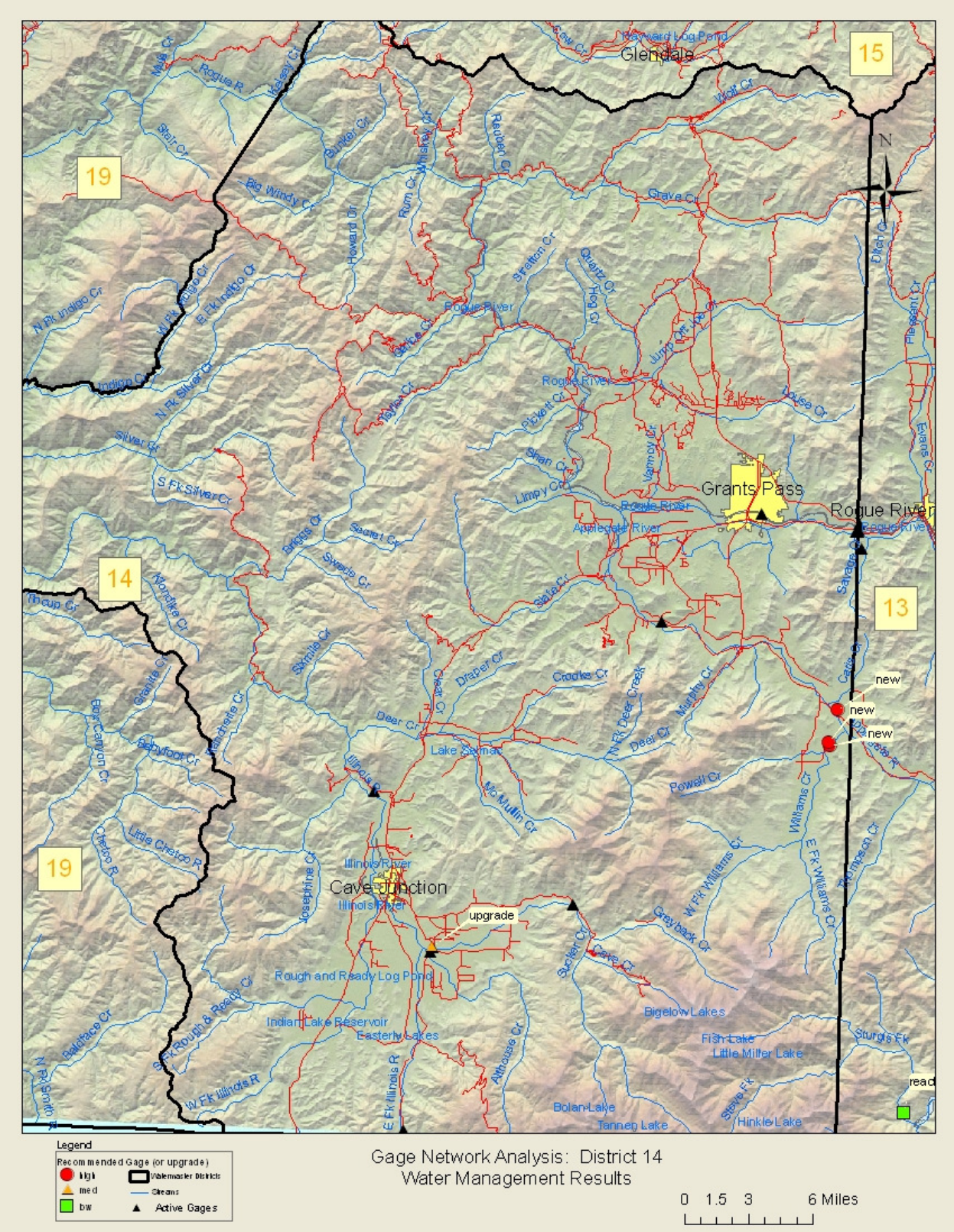
Instream Transfers and Leases (IS_XFR):
There were seven streams listed with IS_XFR activity, three of which (Williams Creek, E. Fk Williams Creek, and Cheney Creek) are monitored by manual discharge measurements. For the other IS_XFRs, the quantity is too small to manage (Slate and Chapin Creek) or small in comparison to the typical flows (Applegate and Rogue Rivers). Two creeks (Graves and Sucker Creeks) and the Illinois River have ISWRs that cause regulation activity of junior irrigation uses and, therefore, warrant monitoring. There are stream gages used to monitor instream flows on Sucker Creek and the Illinois River, while flows in Graves Creek are monitored by occasional manual discharge measurements. No additional gaging needs were identified to monitor instream flows related to IS_XFR or ISWRs.

High Regulation Streams:
Most of the high regulatory streams are in the Applegate River watershed and are due to myriad of issues including: regulation to meet an ISWR, reoccurring problem PODs, illegal water users, reoccurring neighbor disputes, and full–appropriation. In addition, the unorganized and diffused nature of the irrigators in combination to the archaic nature of the PODs further complicates regulation activity in the Applegate system. Williams Creek and its tributaries in particular generate a lot of regulatory activity. As previously discussed, the installation of three telemetry equipped stream gages in Williams Creek watershed would greatly aid regulation and water management. Measurement devices and head gates are also being installed on Williams Creek to help with regulations.

The other high regulation streams are associated with Draper Creek (tributary to Deer Creek and, ultimately, to the Illinois River) and Coyote Creek in the Graves Creek watershed (tributary to the Rogue River). The cause of this high regulation in both streams is full–appropriation. No additional stream gages were identified as being helpful for regulation in these high regulation streams.

Zero Expected Flow Streams:
Four water availability basins (WABs or sub-watersheds) were identified as having zero expected flow during the summer from the OWRD Water Availability Analysis. Three of these are in the previously discussed Williams Creek and have seasonal regulation

activity. The other WAB is Slate Creek, tributary to the Applegate River, and had no seasonal regulation identified. No additional gaging or monitoring was identified for these watersheds other than what was previously mentioned.



Gaging for water management evaluation results. Watermaster District Fourteen

District 15—Umpqua Basin

Summary:
In the Umpqua Basin, stream flow is high during the winter and spring in response to rainfall from seasonal storms, then declines (with rainfall)—typically tapering off to base flow conditions by the end of spring. Summer base flows can vary from a few cfs to over a 1000 cfs, depending mostly on watershed size and water year precipitation. Usually these summer flows are not sufficient to meet all water use demands, which triggers regulation and monitoring. The notable exception to this hydrologic/regulatory setting is the North Umpqua River. Due to the geology (and elevation), base flows in this river are high; commonly in excess of 1000 cfs, which represents almost the entire flow of the main Umpqua River during summer. Stream flows in the North and main stem Umpqua are typically sufficient to meet all demands.

Water management in the basin is predominately driven by regulation of irrigation and municipal users for senior ISWRs following the seasonal decline in flows. ISWRs are monitored via periodic manual stream measurements at a multitude of locations coupled with local hydrologic knowledge of the streams and real time observations of key gages. Regulation activity also occurs on the smaller tributaries due to complaints between the many small consumptive users.

The large diversions in the basin are associated with municipal and irrigation use, and an extensive hydropower project on the North Umpqua River. Most of these users have monitoring devices, which are routinely checked by the watermaster. The hydropower use is monitored real–time due to variability in power production and compliance with licensing requirements. There is a high degree of compliance by users in the basin to regulation activity.

Storage and releases in the basin are tracked by USGS, OWRD, Douglas County or user operated stream and reservoir gages. Reservoir releases are monitored by OWRD for compliance with storage and live flow water rights.

There are 28 stream gages operated by OWRD, USGS, and Douglas County on the major streams in the basin. All of these gages are used in some manner for regulatory purposes. One of these gages is used to monitor the only IS_XFR that affects regulation in the basin on Calapooya Creek. In addition, (as previously mentioned), ISWRs routinely cause regulation activity and are monitored via routine manual stream flow measurements and stream gages. The close proximity of the streams to the watermaster office negates the need for additional stream gages for monitoring ISWR. However, due to the frequent need for regulation, new stream gages with telemetry on North and South Myrtle Creeks, and on Deer Creek would make water management more efficient.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
All major diversions in the basin can be monitored near real–time, and most are actively and routinely monitored by OWRD. Nearly all of the major diversions in the basin are associated with municipal or quasi-municipal use. However, there are two large irrigation users (water control districts), two large industrial users, and one hydropower user in the basin.

All of the listed municipal diversions have flow meters and are required to report monthly water use to OWRD annually. In addition, municipal users are subject to regulation for senior ISWR. If regulation occurs, the municipalities are required to report their daily use to the watermaster. There is a high degree of compliance with regulation of these municipalities.

There are two water control districts (WCD) (Lookingglass/Ollala and Sutherlin) that store and deliver water in the basin. The Lookingglass-Olalla Water Control District delivers stored water from Ben Irving Reservoir to irrigation and quasi-municipal users. Storage from Ben Irving is also released for instream flow augmentation. Downstream diversions are monitored by flow meters, which are routinely read by Douglas County staff under contract with the district. The Sutherlin Water Control District delivers stored water from Plat I Reservoir to irrigation water users and from Cooper Creek Reservoir to the City of Sutherlin for municipal use. In both instances, the secondary use is measured using flow meters.

Several industrial users also have significant diversions in the basin. These include Roseburg Forest Products and the Swanson Group. Most of the users have flow meters to monitor water use. Some of these users have senior water rights. The junior rights may be regulated off. Active monitoring is to ensure regulated rights remain off.

Douglas County manages Galesville Reservoir on upper Cow Creek in the South Umpqua basin. USACOE monitors the reservoir and set's the rule curves. Stored water from this reservoir is delivered under contract to downstream municipal, industrial and irrigation users. Storage releases are monitored using gages on Cow Creek and the South Umpqua River. Individual diversions are measured using flow meters. The Galesville project also generates hydroelectric power using two turbines.

Finally, PacifiCorp operates a complex hydropower project in the North Umpqua and Clearwater Rivers. The project consists of two diversions on the Clearwater River, one on Fish Creek and five on the North Umpqua. All of the diversions and associated bypass reaches are gaged to insure compliance with licensing requirements. Flow data is examined by watermaster staff on a daily basis. Water year data is submitted to OWRD annually. PacifiCorp has been very responsive to any needed regulation (oral communications, David Williams District 15 watermaster).

Stored Flow and Natural Flow:
There are four storage reservoirs in the basin (Galesville, Ben Irving, Plat I, and Cooper Creek) that are used for municipal, industrial, irrigation, and recreational purposes.

Storage from Galesville and Ben Irving is also used for stream flow augmentation to enhance salmonid migration and habitat. Stream gages on Cow Creek, South Umpqua River, Umpqua River, Olalla Creek, and Lookingglass Creek are used to determine the natural and storage component flow and for the regulation of Galesville and Ben Irving releases.

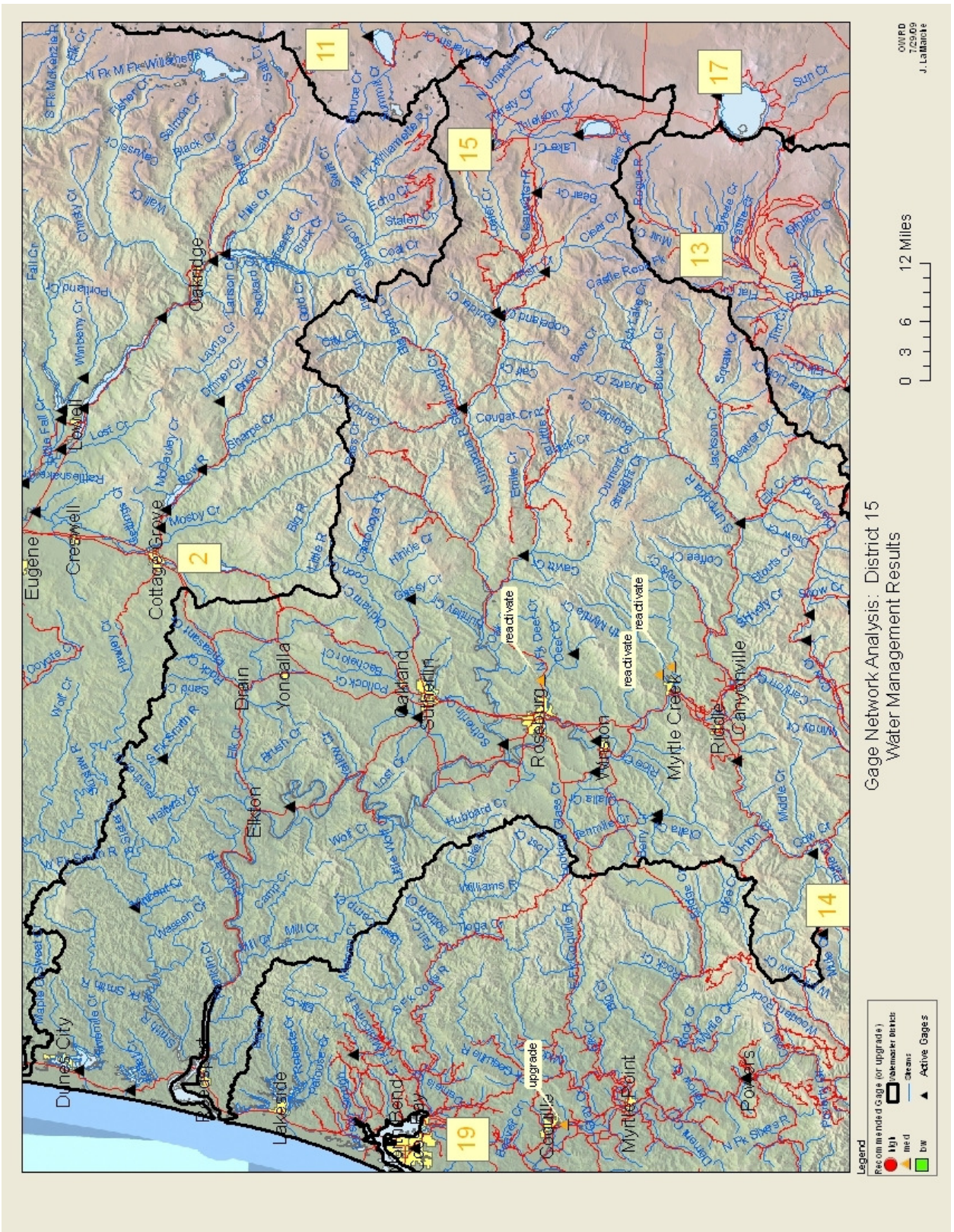
There are three large reservoirs in the upper North Umpqua watershed. Lemolo and Toketee Lakes are part of PacifiCorp's hydropower project. ODFW holds a storage right on Diamond Lake to provide water for the Rock Creek fish hatchery. In the event the hatchery is regulated off its North Umpqua live flow right, release from Diamond Lake are monitored by a USGS gage on Lake Creek. Lemolo and Toketee storage and releases are monitored via USGS and PacifiCorp operated reservoir and stream gages.

Instream Transfers and Leases (IS_XFR):
Most IS_XFRs are associated with small individual users temporarily leasing their water instream in order to preserve their water rights. As such, the IS_XFRs are generally very small compared to typical flow and normally do not affect regulation, except for Calapooya Creek. The Freshwater Trust has been actively leasing water rights on Calapooya Creek and monitoring of the resulting instream flows in accomplished via manual stream flow measurements.

Instream water rights (ISWRs) significantly affect water distribution in the basin. ISWRs are monitored using stream gages and manual flow measurements. The monitoring of these streams occurs seasonally and begins when flows start to decline after spring runoff. Regulatory activity for ISWRs may occur on as many as twenty streams in the basin annually.

High Regulation Streams:
There were fourteen streams flagged with a high number of regulatory actions (> 20). The cause of all of these actions was insufficient stream flow to meet the ISWR and/or consumptive demand. Due to the high level of regulatory activity, new stream gages with telemetry on North and South Myrtle Creek as well as Deer Creek would make water management more efficient. No additional stream gages were identified as helping with regulation on these streams.

Zero Expected Flow Streams:
There were ten streams with an estimated zero expected flow during the summer (i.e., Consumptive Use > Stream flow). Seasonal regulation for the ISWRs or consumptive uses occurs on all of these streams due to full–appropriation.



Gaging for water management evaluation results. Watermaster District Fifteen

District 16—Mid Willamette Basin

Summary:
Watershed assessments describing water use and hydrologic characteristics for most of Watermaster District 16 are available at:

http://www.oregon.gov/OWEB/MONITOR/watershedassessments_linked.shtml#Willamette

There are two major rivers and many smaller, but significant, streams in the middle Willamette Basin. The smaller watersheds produce high runoff in winter and spring in response to rainfall from seasonal storms, which tapers off to base flow conditions in late spring or early summer; depending on watershed size and spring rainfall. For the large rivers (Willamette and North Santiam), rainfall / snowmelt runoff generates high winter/spring flows, while groundwater discharge sustains large summer base flows. USACOE reservoirs capture significant spring runoff in the main Willamette tributaries for summer and fall release. As a result, summer flows in the North Santiam and Willamette Rivers generally exceed natural flow; sufficient to meet all demands including instream flow requirements (ISWR + minimum storage release) in typical years. However, in the smaller tributaries summer flows are often insufficient to meet all demands.

Water management and monitoring in the basin is predominately driven by the ISWRs and full–allocation in these smaller watersheds. Here, regulation of small, individual, users for senior ISWRs occurs after the seasonal decline in stream flows. ISWRs are proactively monitored through stream gages and routine manual stream measurements at a multitude of locations.

The large diversions in the basin are associated with municipal and irrigation use. Most of these diversions have stream gages or flow meters, and report monthly water use to OWRD annually. Flow meters are typically checked at the beginning and end of the irrigation season for commonly regulated users. However, most large diversions are from large rivers and are not involved with active monitoring due to adequate water supply to meet all needs, including ISWRs.

Reservoir storage and releases in the basin are tracked by USGS operated reservoir and stream gages. Releases for instream flow targets and for contract water are coordinated by USACOE. Due to the sufficient water supply, storage and releases do not impact regulation and are not actively monitored by OWRD.

There are 26 OWRD/USGS stream gages operated in the basin. Most are located on major tributaries and are used for operation and management of the USACOE reservoirs. The USGS operates 23 of these gages, and several are used by OWRD for monitoring ISWRs and associated regulation. Only one IS_XFR affects regulation and it is monitored by a real–time stream gage.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
The large diversions in the basin are associated with the irrigation entities (e.g., irrigation districts, cooperatives, water control districts, etc.) and municipalities. Most large users divert water from the North Santiam and Willamette Rivers, where natural stream flows are typically sufficient to satisfy consumptive uses and minimum stream flow requirements (ISWRs + storage release requirements), except in below normal years (North Santiam Watershed Assessment, 2002). Summer stream flows for the North Santiam and Willamette River in watermaster District 16 are elevated over natural conditions due to storage releases from the USACOE Willamette project reservoirs. Storage releases are made for irrigation contracts, but are also made to meet flow targets at certain locations on the major tributaries and main stem of the Willamette River. OWRD does not regulate diversions to meet these USACOE instream flow targets, other than for permit conditions. The result is that available stream flow exceeds consumptive demand and ISWRs on the North Santiam and Willamette Rivers. (Note: ISWRs are based on natural flows and do not include minimum storage releases).

All municipal diversions are monitored through flow meters or stream gages, and report monthly water use to OWRD annually. Most of the municipal water rights are senior to the ISWRs and divert less than the allowable rate for these senior rights. Flow meters are checked on all of these diversions before and after the irrigation season by OWRD personnel (oral communications Mike McCord, District 16 watermaster), but are not routinely monitored because municipal diversions typically do not affect regulation.

Most municipal users divert water from either the North Santiam or Willamette Rivers. The communities of Salem, Stayton, Turner, Jefferson, Idanha, Detroit, Gates, and Mill City all divert water from the North Santiam River. With the exception of dry years, stream flow is sufficient to meet all demands from the North Santiam River. Corvallis diverts water from both the Willamette River and Rock Creek. None of these municipalities routinely affect water distribution or regulation in the basin.

The City of Silverton diverts water from Silver and Abiqua Creeks, while the City of Dallas diverts water from Rickreall Creek and its tributaries. In contrast to the larger rivers, these small streams are over allocated and regulation occurs for ISWRs. Nonetheless, the cities' water rights are senior to the ISWR and have never been found to be out of compliance. Because of this regulatory setting and adequate water supply, none of the municipal diversions are actively monitored.

McGuire reservoir is located on the Nestucca River in WM District #1 and serves the City of McMinnville. Reservoir levels and outflows are monitored by non–telemetry USGS gages. Like the other municipalities, the city reports its monthly water use to OWRD and does not affect regulation in the basin. Most other municipal users in the district use groundwater.

The large irrigation users consist of Greenberry Irrigation District, Queener Irrigation and Improvement District, Sidney Irrigation Cooperative, and Palmer Creek Water District. Total amount of irrigated lands in these districts is about 37,000 acres. These users

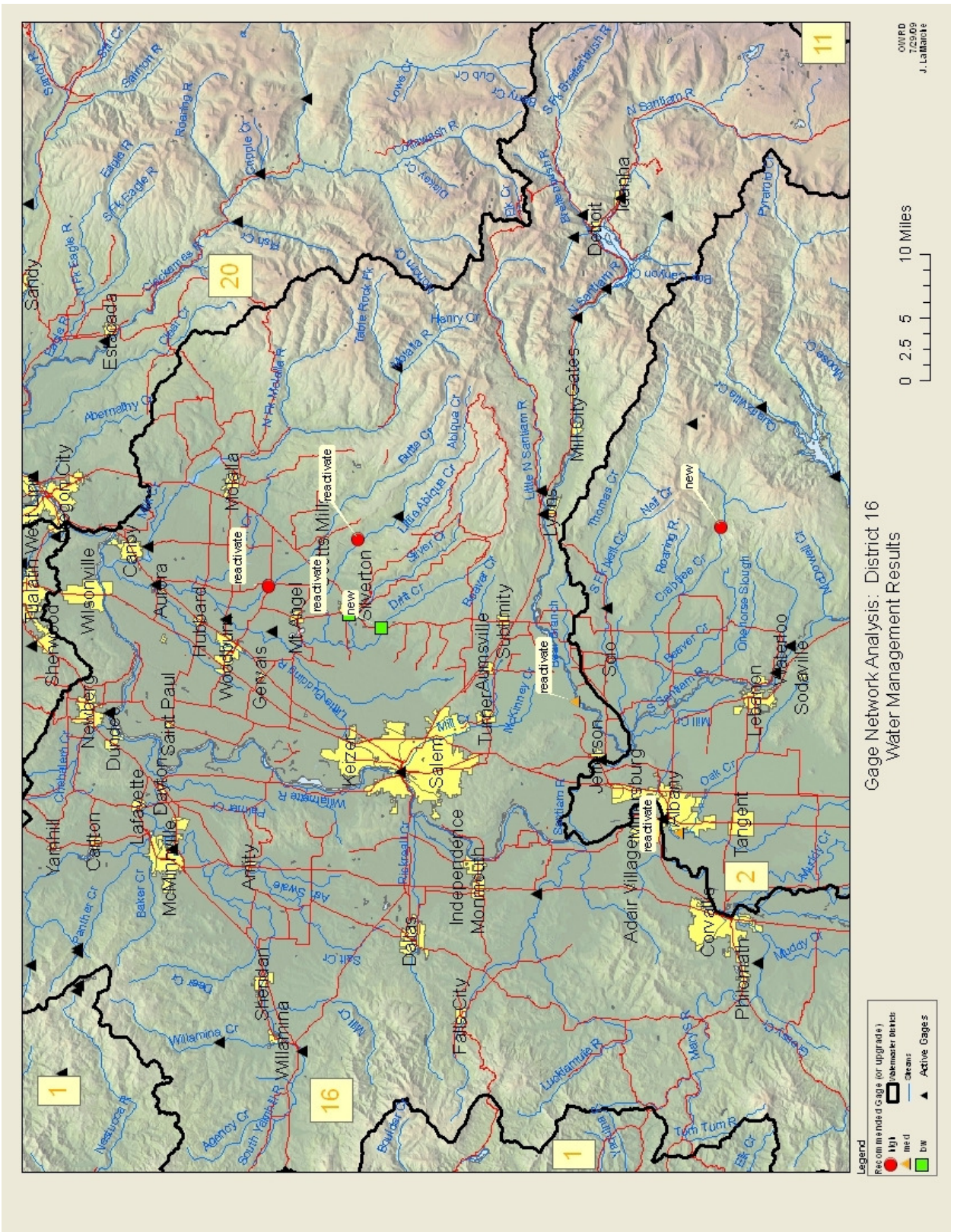
divert water from either the North Santiam or Willamette Rivers. Some of these users contract storage releases from the USACOE reservoirs. All of these users except, the Sidney Irrigation Cooperative (SIC), have flow meters or gages that monitor diversions. None are actively monitored. Given that SIC diverts storage contract water, a measurement device may be warranted—especially in dry years.

Stored Flow and Natural Flow:
There is one significant reservoir in the mid Willamette Basin: Detroit Lake. However, storage facilities on the main forks of the Willamette River in the upper Willamette Basin also store significant water for use in the mid Willamette Basin. These storage facilities are operated by the USACOE. Contract storage releases are available for irrigation use and are administered by the USBR. However, operations and monitoring of storage and releases are coordinated by the USACOE. Currently, storage releases from reservoirs far exceed the contract water and, under the basin plan (OWRD Administrative Rules 690-502), most of the more recent large users in the basin rely on contract water only. Other users, such as Palmer Creek Water District, have senior live flow rights. Under the current regulator environment the natural and storage component of stream flow diverted by these users is not monitored. Monitoring of other smaller reservoirs (generally less than 100 ac-ft) are monitored via complaint driven system.

Instream Transfers and Leases:
There were numerous stream reaches identified as having IS_XFR activity on them. Most of these transfer amounts are temporary (i.e., short duration leases) and small relative to the typical flow in the river and do not cause regulation and monitoring activity. However, there are numerous stream reaches were the ISWR has a senior priority relative to other users, which results in regulation. Most of these ISWR are monitored through real–time stream gages, staff gages and/or periodic manual measurements. Butte Creek, Drift Creek, Abiqua Creek, and Silver Creek were all identified as locations where telemetry equipped stream gages would help monitor ISWR. Butte Creek in typical years is regulated past ISWR for consumptive rights.

High Regulation Streams:
ISWRs are the cause of the high regulations (> 20 reported regulations) on six streams (Butte, Abiqua, Silver and Rickreall Creeks, and the Pudding and Luckiamute Rivers) in the district. Butte, Silver, and Rickreall Creeks, and the Pudding River are also fully allocated. These streams have seasonal regulation that is largely triggered when stream flow drops below the ISWR. Additional gages identified in this evaluation match those identified in the previous section for Abiqua and Silver Creeks.

Zero Expected Flow Streams:
There were 14 water availability basins (WABs) identified as having zero expected flow in the basin. Most of these WABs had regulatory and monitoring activity for various reasons; the most common being regulation for an ISWR. Full appropriation is another cause for highly regulated streams. Aside from the previously mentioned added gages, no new gages were determined to be necessary for water management in these WABs.



Gaging for water management evaluation results. Watermaster District Sixteen

District 17—Upper Klamath Basin

Summary:
Watermaster District 17 consists of the upper Klamath Basin—the Klamath drainage above Iron Gate Dam. Significant rivers in the district include the Lost, upper Klamath, Wood, Sprague, and Williamson. Snowmelt runoff increases stream flow considerably in the spring, especially in the Sprague watershed and smaller tributaries throughout the basin. Groundwater discharge is significant in the major rivers, which results in relatively high summer base flows. Nonetheless, water demand by agricultural (e.g., USBR's Klamath Project) and environmental needs (e.g., ESA mandated) often exceeds available supply. This competition for water usually centers on water levels in Upper Klamath Lake, flows in the Klamath River below Keno, and diversions into the Klamath Project and associated wildlife refuges.

Water monitoring and management in the district is complicated because the basin is not entirely adjudicated. Since the adjudication will ultimately determine priority dates and flow for the myriad of water claims in the basin, it is uncertain where stream gaging is required for effective water management of the resulting water rights. For example, a dramatic change in water management in the basin may occur from the priority granted (or negotiated) for instream tribal claims. A pronounced increase in stream gages to monitor instream flows would be required for time immemorial instream water rights. In contrast, a subordinate tribal instream right may require little if any changes to the existing stream gaging network. Currently most monitoring and regulation is complaint driven.

OWRD or USGS operates stream gages on all major rivers of the basin. The Williamson, Sprague and Klamath Rivers (including Link River) all have real–time stream gages (i.e., gages with telemetry) at multiple locations. Sycan and Wood Rivers also have stream gages with telemetry, but only at one location each.

Reservoir levels are monitored by real–time USGS gages on Upper Klamath Lake (UKL) and USBR gages on Gerber and Clear Lake Reservoirs. Smaller lakes and reservoirs along the east side of the Cascade Crest (in the westernmost part of the basin) are used by irrigation districts in the upper Rogue Basin and are discussed in the watermaster District 13 gaging review. There are several smaller reservoirs in the upper Sprague and Lost River. However, the impact of these reservoirs on water management and distribution has not yet been established.

Diversions into the irrigation districts are monitored by USBR, mostly via hydraulic formulas at spill ways, head gates, pumping plants, etc. Monitoring upgrades to velocity index stream gages are underway at most locations in order to improve monitoring accuracy on diversions. These new gages will be owned and operated by USBR and should be equipped with telemetry.

Currently, there are no continuous gages on diversions outside of the irrigation districts. However, most of these diversions are slated for installation of non-recording measuring devices (oral communications Vern Church, district 17 watermaster).

Senior instream water rights (i.e., those associated with transfer and leases of irrigation rights) are predominately located in the Wood River Valley and monitoring of these rights is by the Klamath Basin Rangeland Trust (KBRT) via their stream gaging network. Thus water management of the associated instream flows is accomplished by a complaint driven system, with subsequent checks via manual stream measurements by the watermaster. If instream transfers and longer term leases occur in this area, new OWRD stream gages may be necessary to monitor instream flows.

The identified sites where stream gaging would help with water management are as follows: Annie Creek near National Park Boundary, South Fork Sprague River below Fishhole Creek, Lost River at Harpold Dam, and the Lost River at Keller Bridge. In addition, stream gages may be needed for the Lost River below Malone Dam and Miller Creek below Gerber Reservoir, depending on an investigation of the accuracy of the hydraulic equations used to determine reservoir outflows on the two streams. Flow meters or stream gages on all main canals into the Klamath Project will be needed for water management. USBR should install and operate these gages in cooperation with the district 17 watermaster.

When the adjudication is completed, changes to the existing gaging network (including the recommendation for new gages) are likely to occur. A detailed description of the current stream gaging network for water management along with additional gaging needs is presented below.

Diversions:
There are thousands of irrigated acres above UKL. However, there is only one irrigation district— Modoc Point Irrigation District (MPID). Due in part to the inherent sprawling nature of the non–organized individual irrigators above UKL, there are currently no stream gages on these diversions. There is, however, non real–time monitoring by other mechanisms (e.g., head gates, weirs, flow meters, etc). In addition, MPID is slated to install continuous flow meters on their diversion. It is not known if real–time monitoring of these flow meters will be required for regulation purposes.

In contrast to diversions above UKL, diversions below UKL are mostly associated with the Klamath Project and the associated irrigation districts. There are four major PODs from the Klamath River (including UKL) into the project. Except for the “A” Canal gage (operated by the USGS), the diversions are estimated by USBR using hydraulic formulas at head gates, pumping plants, spill ways etc. The accuracy of these estimates is questionable at many locations (Burt and Freeman, 2003). As a consequence, there is a USBR program to replace the hydraulic monitoring with velocity–index gages (oral communications, John Hicks USBR) to improve diversion monitoring accuracy. The District 17 watermaster intends to closely monitor and check these gages once they are installed to ensure accuracy and operations. If operated in cooperation with the

watermaster, these gages should be sufficient to monitor and managed Klamath River diversions into the Klamath Project. These gages should be equipped with telemetry for real–time monitoring.

Diversions from the Lost River also supply water to the Klamath Project and are monitored by USBR. Again, most of the diversions are estimated using hydraulic equations. Horsefly irrigation district uses large pumps and one ditch to divert water from the Lost River. Upgrades to real–time flow meters are recommended for the pumps and some type of real–time gage is needed for the ditch. In addition, real–time stream gages should be installed on the main canals (East Lateral, West Canal, and North Canal) into the Langell Valley Irrigation District. Velocity index gages are slated for installation on the East lateral and West canal (oral communications, Vern Church District 17 water manager). A ramp flume and recorder is being installed on the North Canal (oral communications, Jason Cameron USBR).

Stored Flow and Natural Flow:
The determination of live (i.e., natural) and storage components of stream flow generally has not been necessary in the basin due to the ongoing adjudication. However, it may be required once the adjudication is completed, especially with respect to Upper Klamath Lake.

For the Klamath River basin (excluding the Lost River), UKL is the main source of stored water. The USGS operates three lake level (i.e., reservoir) gages as well as stream gages monitoring the lake outflow. Since there are several thousand acres of irrigated lands above UKL, these gages by themselves can only determine net inflow into UKL. The *natural* inflow into UKL may be estimated from two approaches.

The first approach is to estimate consumptive use above UKL, then add back the consumptive use (CU) value into the net inflow calculation. Consumptive use can be estimated through published data, real–time Agrimet data (or other climate ET models), or direct measuring of ET at selected sites. The resulting equation for natural inflows into UKL using the first approach is as follows:

EQ 1: Natural Inflow = Change in Storage + Outflows + UKL Evaporation + CU

Note this approach inherently assumes return flows come back to the stream network fairly quickly.

The second approach is to measure all surface inflows into the UKL using stream gages and estimate the direct groundwater (GW) contribution to the lake. In this case the resulting equation would be:

EQ 2: Natural Inflow = $\sum$ surface inflows + GW

The GW estimate may be provided from a calibrated transient groundwater model, such as the current USGS/OWRD groundwater model under development for the basin. If

results from the USGS/OWRD model indicate a large variability in GW inputs to the lake (from climate variability), then the model may need to be run each year with continuously updated climate data to estimate the GW inputs for the natural inflow calculation. If the model indicates low variability in GW inputs to UKL, then a constant average contribution for each month may be sufficient for the natural inflow estimate. Another alternative is to use a statistical regression model based on historic GW estimates (e.g., Hubbard 1970) and stream flow in one of the spring dominated rivers (or GW levels in wells). For the second method to be used, gages would need to be installed (at the very minimum) on the following streams: Fort Creek, Crooked Creek, Annie Creek, Sun Creek, Sevenmile Creek, and Fourmile Creek. Most of these streams have significant groundwater inputs via springs in the valley floor. Unfortunately the valley is where the myriad of diversions also occur. Therefore, the exact location of these gages should be chosen carefully. Gages would need to be placed below the majority of spring inputs, but above most major diversions. It is highly likely that stream gages will need to be installed on diversions in the valley as well.

Until results from the USGS/OWRD groundwater model can be examined, the most accurate approach (EQ 1 or EQ 2) cannot be determined. However, it should be noted that measuring all surface inflows into UKL (the approach shown in EQ 2) would still require some estimates of consumptive use, as many of the gages (e.g., Williamson River below Sprague River) are located downstream of a substantial amount of irrigated acres. Likewise in the Wood River Valley, many of the gages would have to be located below diversions in order to capture all of the spring inflow to the stream network. In this case, the upstream diversions would also have to be monitored.

Given that consumptive use would have to be estimated in both approaches and the substantial capital and resource requirements for gage installation and operation in the second method, the current view is that the first method is the most cost effective means of determining natural inflow into the lake. In this case, the current stream gaging is sufficient for determining the natural and stored component of stream flow for distribution below UKL.

There are additional smaller storage facilities (~79,000 ac-ft) on the western margin of the basin along the Cascade Crest (e.g., Howard Prairie Reservoir, Hyatt Reservoir, etc) used by irrigation districts in the upper Rogue Basin. Monitoring of storage and outflows in these reservoirs is discussed in the watermaster District 13 gaging review.

Releases from Gerber and Clear Lake reservoirs are estimated via hydraulic equations developed for the reservoir outlets. The accuracy of this data is thought to be good (Burt and Freeman, 2003), but has not been verified by OWRD. This data along with the USBR reservoir gages are sufficient to determine natural and live flow below the reservoirs. However, traditional stream gages may be needed on Miller Creek (below Gerber reservoir) and the Lost River (below Malone Dam) if accuracy of the hydraulic equations are suspect.

Instream Transfers and Leases (IS_XFR):
Efforts by conservation groups to put water back instream consist predominately of leasing irrigation rights in the Wood River sub-basin. Nine of the twelve streams listed with IS_XFR are located in the Wood River sub-basin. Since protection of instream flows is based on temporary leasing in these nine streams, no permanent stream gages are planned for monitoring at this time. Klamath Basin Rangeland Trust (KBRT), however, currently monitors instream flows via their own stream gages. Thus management of the IS_XFR is complaint driven, with subsequent manual stream measurements to check the complaint by the watermaster.

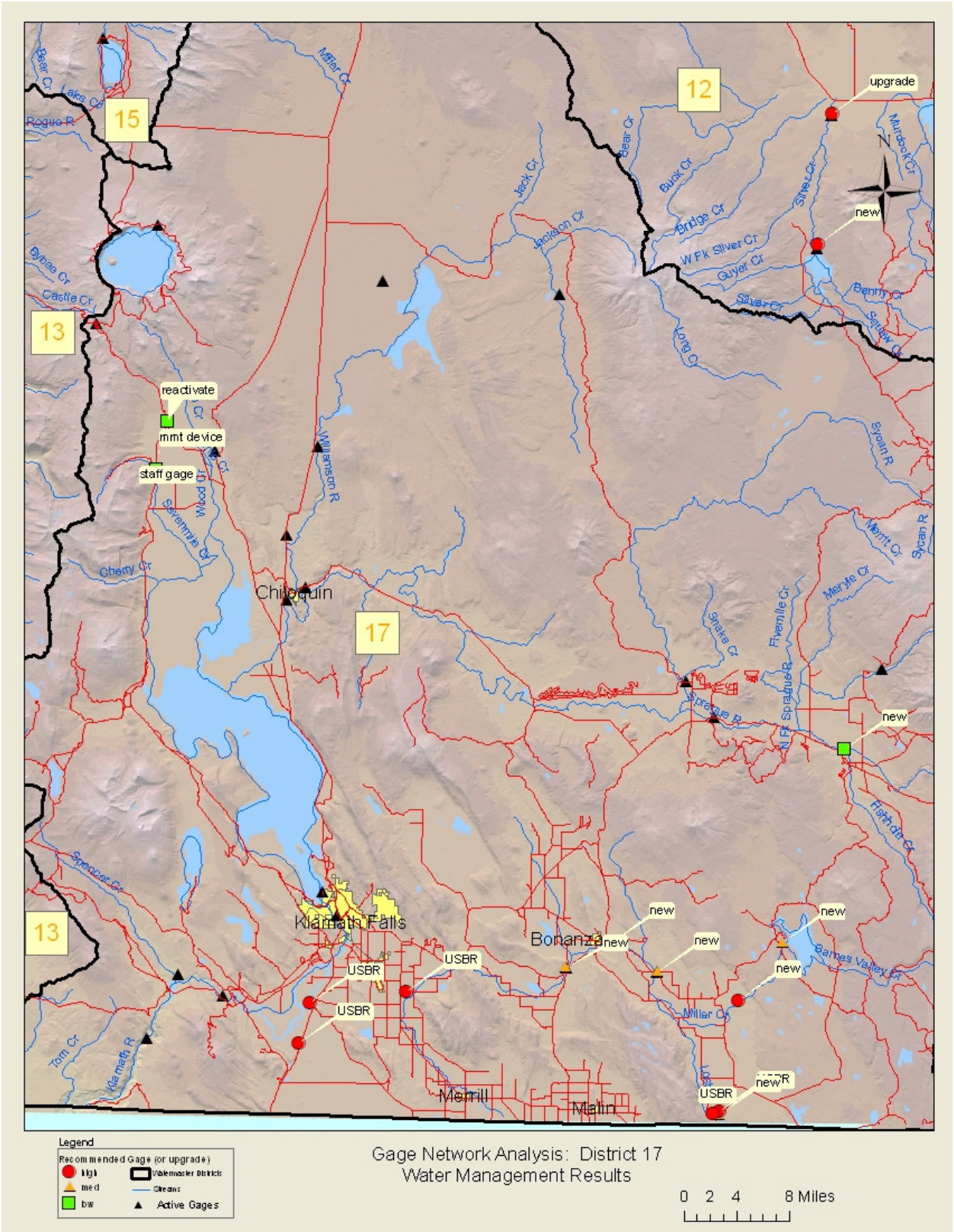
For Fort Creek, Crooked Creek, Agency Creek, and the Sprague River, the lease amount is much less than the expected stream flow and, as a consequence, monitoring is limited. Sevenmile Creek is the only location where a stream gage might be needed to monitor the instream lease. At this time a staff plate in conjunction with periodic measurements is thought to be sufficient for monitoring. A measuring device on the most upstream diversion would help water management on this stream. If longer duration leases or permanent instream transfers occur, stream gaging would be warranted.

For Jenny Creek, the adjudication needs to be completed before a monitoring plan can be defined for the IS_XFR. The need for monitoring IS_XFR on Whisky and Nannie Creek has not been determined at this time and may also depend on results from the adjudication.

High Regulation Streams:
Annie, Blue, Fourmile, and Sevenmile Creeks had high regulations (> 20) in the surface water summary reports. Measuring devices on diversions would be an adequate alternative to stream gaging to help with water management in these systems. However for Annie Creek, a seasonal gage with telemetry near the forest boundary is recommended to help with water distribution and regulation.

There was also high regulatory activity on the North and South Forks of the Sprague River. For the North Fork, measuring devices (weir, flume, etc) on the two main diversions would help with water management and distribution. The South Fork of the Sprague River is typically dry near the mouth and a gage installed below Fish Hole Creek would aid in water management. By using this gage and the gage located upstream near the forest boundary, the rate and duty of the collective diversions between the gages can be monitored and regulated.

Zero Expected Flow Streams:
The Williamson River at Kirk and above Spring Creek, and Keene, and Jenny Creeks are streams with zero expected summer flows (i.e., CU > NF). For all of the streams, except Jenny Creek, there is limited regulation due to lack of complaints. For Jenny Creek the installation of restrictor nozzles may be a good alternative to stream gaging at this time. Gaging to monitor IS_XFR on Jenny Creek may be necessary once the adjudication is finalized.



Gaging for water management evaluation results. Watermaster District Seventeen

District 18—Tualatin Basin

Summary:
Rainfall–runoff processes dominate stream flow generation in the Tualatin Basin, resulting in high flows during the winter and spring in response to seasonal storms. Limited summer base flow in the major streams of the basin means that storage and releases from the districts' two significant reservoirs is critical for the summer water supply. A good description of water management, accounting, storage, stream gaging, and diversions for the Tualatin Basin is described in the annual "Tualatin River Flow Management Reports" available at:

http://www.co.washington.or.us/Watermaster/SurfaceWater/tualatin-river-flow-technical-committee-annual-report.cfm

Water in the Tualatin Basin is managed and monitored through real–time gages on streams, and flow meters on diversions and waste water discharge. Stream gages are present along the main stem Tualatin River and all major tributaries affecting water distribution. One large diversion, the Lake Oswego Canal (near the mouth) is monitored, but no flow record is produced due to voluntary reduction of the diversion rate substantially below the water right, and lack of downstream users. Only one small canal into the Wapato Irrigation District, currently monitored by weekly measurements due to poor site conditions, was identified for a possible upgrade to a stream gage (or other monitoring device).

Storage is monitored in Henry Hagg Lake by a reservoir gage operated by USBR. The inflows and outflows are monitored by a combination of stream gages and manual stream measurements. Barney Reservoir, (a private reservoir) is monitored by manual reservoir level readings by the Joint Water Commission. Trans–basin deliveries from this private reservoir into the Tualatin River are monitored by a non OWRD/USGS stream gage.

The end result of this monitoring effort is that storage, instream flows, diversions and effluent discharge is proactively managed to meet minimum flow requirements and general compliance with water rights and storage agreements. Weekly, monthly, and annual reports on water use are created, distributed, and reviewed by the major stakeholders at regular meetings. In addition, daily operations are also monitored.

Instream flow requirements associated with transfer and/or leases of irrigation rights to instream uses (IS_XFR) are generally of insufficient quantity in relation to typical flows to be a monitoring issue in the Tualatin Basin. However, some traditional instream water rights (ISWR) are of sufficient magnitude and priority to cause regulation activity and warrant monitoring. Staff plates coupled with routine weekly manual measurements are used to monitor these ISWRs.

Below is a detailed description of how water is monitored in the district, the current stream gaging system and identified gaging needs.

Diversions:
The main diversions in the Tualatin Basin are the Tualatin Valley Irrigation District (TVID), and the municipalities of Beaverton, Hillsboro, and Forest Grove—which collectively form the Joint Water Commission (JWC). Withdrawals for both TVID and the municipalities are taken at a joint pumping plant (Spring Hill Pumping Plant) on the Tualatin River (below Gales Creek) and are monitored by telemetry equipped flow meters. Total capacity of the TVID pumps is 120 cfs, while capacity of the JWC pumps is 100 cfs. Additional monitoring is accomplished by real-time stream gages on the Tualatin River, located above (USGS) and below (OWRD) the pumping plant, and on Gales Creek (OWRD).

The next largest diversion is the Lake Oswego Canal located about 7 miles above the mouth of the river. The canal can divert up to 57.5 cfs of natural flow from the Tualatin River into Lake Oswego for power generation at the lake outlet. From the lake outlet, water flows through Oswego Creek before entering the Willamette River several miles downstream from the mouth of the Tualatin River. The entire diversion, therefore, is considered “consumptive” from the Tualatin River. There was a stream gage in operation on the canal, but the continuous record is no longer processed, nor published. However, since 2000 the canal has never taken more than 10 cfs of flow (oral communications Darrell Hedin, District 18 watermaster). In addition, a real–time USGS gage is located below the diversion to monitor instream flows in the Tualatin River.

The Wapato Improvement District (WID) diverts water from Tualatin River near river mile (RM) 62, at the Wapato canal diversion. Current site conditions are not conducive to gaging, so monitoring is accomplished by manual weekly flow measurements. At this time an upgrade to the diversion is considered cost prohibitive for WID. However, regulation of the district typically does not occur because of its location (above other users) and relative seniority of its water right. There is interest by USFWS to purchase WID for conversion to a wildlife refuge. Should this transaction occur, the watermaster will work with USFWS to develop some type of real–time monitoring at this diversion.

The City of Hillsboro also diverts a small amount of water for municipal use above Cherry Grove. The diversion is typically about 3 cfs and is monitored by flow meters.

Clean Water Services (CWS) augments Tualatin River stream flow by releasing stored water from Barney and/or Scoggins Reservoirs in order to meet certain flow thresholds (Bonn 2007) that are required for effluent discharge from different waste water treatment plants. CWS, TVID, and JWC all provide financial support to the watermaster to operate the stream gaging network.

Finally, there are individual water users associated with TVID that pump water directly from the Tualatin River (about 5 percent of the total district acres). These users are regulated by the watermaster, using mass mailings when natural flows decline to a certain level. These users may then order storage releases from Scoggins Reservoir to continue to irrigate. By comparing the storage release orders against the regulation list, non–compliant users are identified and regulated.

Aside from a possible monitoring upgrade to the WID diversion, no changes to the stream gaging network were identified for monitoring diversions.

Stored Flow and Natural Flow:
The main storage facility in the Tualatin Basin is Scoggins Reservoir (aka Henry Hagg Lake) and is monitored by an elevation gage operated by USBR. The two significant tributaries to Scoggins Reservoir (Scoggins Creek and Sain Creek) are monitored by OWRD real–time gages. Another small tributary, Tanner Creek, is monitored by daily readings of a staff plate by the dam tender, coupled with a rating curve maintained by OWRD. Outflows are monitored by a USBR stream gage coupled with a rating curve generated by OWRD. This combination of gaging allows for the determination of live and storage releases from the reservoir. An alternative way to determine reservoir inflow, using change in storage and reservoir outflow, is considered insufficient in accuracy (on a daily basis) to warrant discontinuing the stream gages monitoring inflows into the reservoir.

The other storage facility is Barney Reservoir—a private reservoir located on the Middle Fork of the North Fork of the Trask River, on the west side of the Coast Range divide and outside of the Tualatin Basin. A trans–basin aqueduct carries water across the Coast divide into the Tualatin River. JWC operates and manages the reservoir, including monitoring contents and releases into the Tualatin River. Monitoring storage occurs from daily reading of reservoir elevations. Monitoring of releases is done by a non–OWRD/USGS stream gage located on the aqueduct and is the only information needed to determine storage releases into the Tualatin River.

In addition to the gaging associated with reservoir operation, several OWRD and USGS stream gages operate on the main–stem Tualatin River and its major tributaries. These gages are all equipped with telemetry. This information, coupled with data collection on diversions and effluent discharge, allows for weekly and monthly water use and storage reports generated by the cooperators in the Tualatin Basin.

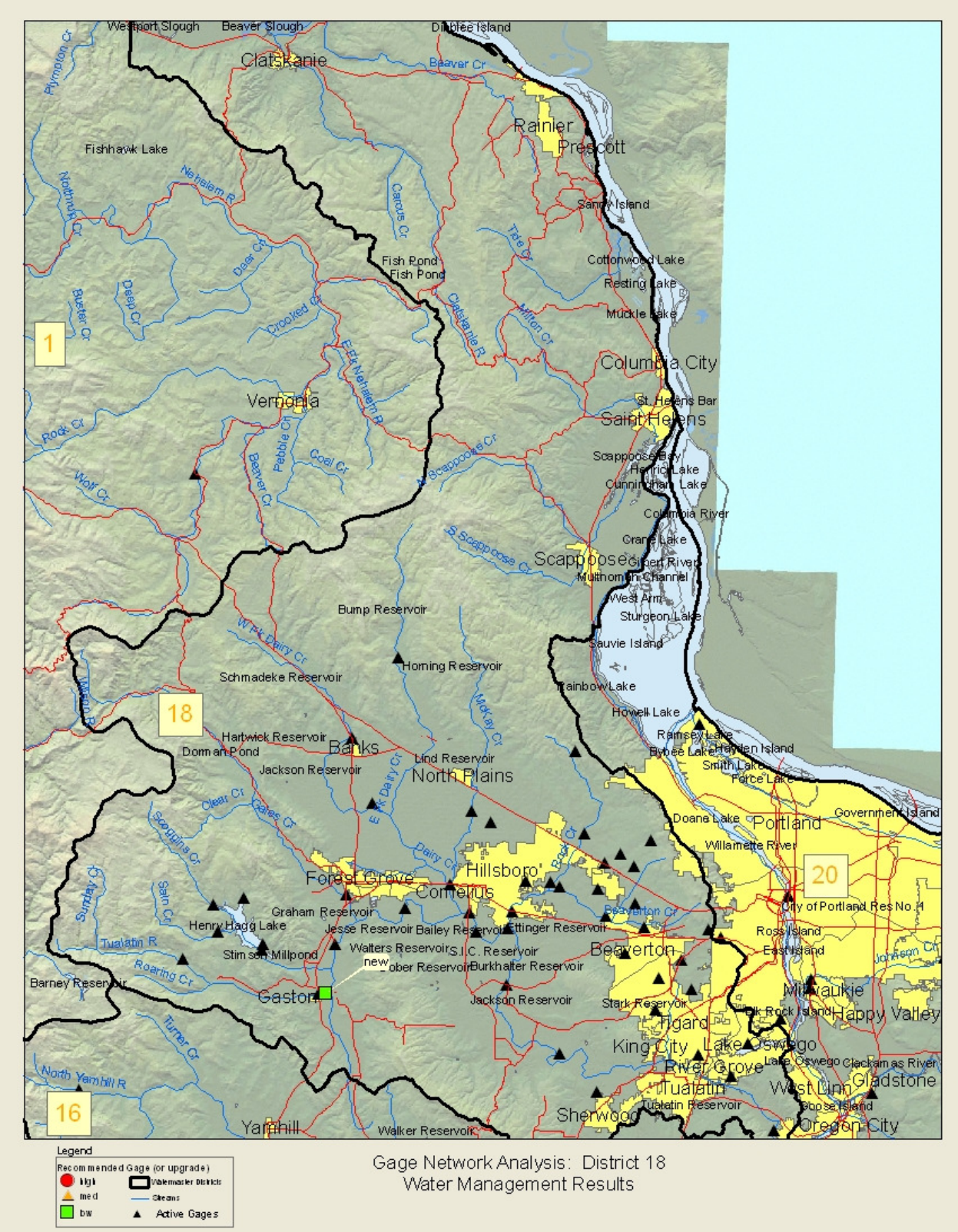
Recently, gages near the mouth of Rock and Fanno Creeks were discontinued. For regulatory purposes and to determine live and storage components of stream flow, information from these gages were not required. This fact is due, in part, to the major diversions all being located above these two tributaries. In addition, Tualatin River stream flow below Dairy Creek is sufficient to meet both instream and the small amount of diversion needs.

Instream Transfers and Leases:
There were ten stream reaches with IS_XFR activity. Most of these transfers are temporary (i.e., short duration leases), small relative to the typical flow in the river, and are not monitored. The current stream gage network is able to track instream flows related to IS_XFR on the west, east and main–stem of Dairy Creek, Gales Creek, and the Tualatin River if the transfer amounts ever exceed typical flows. Dairy and Gales Creeks are listed as high priority watersheds for flow restoration by Oregon Water Trust.

There are ISWRs on some streams with sufficient priority to cause regulation activity of junior consumptive users. On these streams (McKay at Northrup, E. Fk. Dairy Cr at Dairy Cr Rd, W. Fk. Dairy Cr at Banks), instream flows are monitored through routine reading of staff gages coupled with manual measurement and rating curves.

High Regulation Streams:
Full appropriation is the cause for all 11 streams (or stream reaches) listed with high number of reported regulations (> 20). These streams have seasonal regulation that is largely triggered when stream flow, monitored by the existing gaging network, drops below a threshold. No additional gaging needs were identified through the survey as helping with regulation on these streams.

Zero Expected Flow Streams:
There were 16 water availability basins (WABs) with zero expected flow in the basin. Many of these WABs had no regulation due to lack of complaints. Some of the other streams have seasonal regulation activity that occurs when flows drop below a specified level. The availability of storage for TVID users greatly decreases the regulatory burden in the basin.



Gaging for water management evaluation results. Watermaster District Eighteen

District 19—South Coast Basin

Summary:
The South Coast Basin (Watermaster District 19) consists of seven separate watersheds greater than 50 square miles that drain directly to the Pacific Ocean. In addition, numerous smaller watersheds, some critical to municipal water supply, also drain directly to the Pacific Ocean. Stream flow generation is predominately from rainfall–runoff processes and are very high from late fall to late spring in response to seasonal storms. For the Coquille River (the largest watershed), peak flows commonly exceed 20,000 cfs, but drop to only 100 cfs by August. This significant variation in flow is common for all streams in the basin. In normal years, summer base flows in the main rivers are generally sufficient to meet all consumptive needs. However, this is not always the case in below average years or on smaller streams.

There are no organized users with centralized diversions, aside from municipalities. Municipal users generally have the most senior rights and are typically not involved with regulation, except on the Chetco River. There are several relatively large (> 0.5 cfs) diversions in the district for agricultural use. Many of the agricultural water rights are complex and difficult to regulate (e.g., Cranberry bogs). In some watersheds (from the City of Bandon south to the California border), agricultural users have worked on rotation agreements to share water and self regulate. Generally, diversions are not actively monitored and most regulation consists of shutting off small junior users or illegal use in response to complaints from other users. This regulation commonly occurs in August, September and October due to the seasonal rain and stream flow decline.

All reservoirs in the basin are small (< 500 ac-ft), except for one: upper Pony Creek Reservoir (6200 ac-ft). This reservoir is for the sole user on Pony Creek— the City of Coos Bay. Reservoirs in the district are not typically associated with regulation or active monitoring.

There are ten stream gages operated in the basin. However, only one is used for water management—Floras Creek near Langlois (oral communications Mitch Lewis, District 19 watermaster). This stream is of high interests due to restoration interests and the presence of salmonids. A telemetry upgrade to this gage is recommended.

Most IS_XFR are associated with individual users who have temporarily leased water instream in order to preserve the water right and do not warrant stream gages for monitoring. ISWRs are junior to many users and, with a few exceptions, are not routinely monitored.

Below is a detailed description of how water is monitored in the district and the current stream gaging system.

Diversions:
The large diversions in the basin are associated with municipal use. There are no other organized water users with central diversion and distribution systems. Domestic and small farms are the most numerous water users in the basin. However, there are a few farms where irrigated lands exceed 1000 acres according to the NRCS hydrologic unit profile of the area (NRCS 2006). In addition, there are water rights in excess of 0.5 cfs in the district.

Municipalities all have water use reporting requirements and operate flow meters on diversions. Many municipalities routinely experience water shortages during the dry season and conservation is encourages by high water rates (per communication Mitch Lewis, District 19 watermaster). The municipal rights are senior to most water rights in the basin, and the legal diversion rates exceed the actual quantity diverted (per communication Lloyd VanGordon, former District 19 watermaster). Municipal diversions are not actively monitored by OWRD.

Most other diversions in District 19 are associated with the numerous, small, agricultural and domestic users with single PODs. Agricultural users in fully allocated watersheds (e.g., Sixes River, Johnson Creek, etc) have worked out rotational agreements to limit complaints and regulation activities. This is especially true of Cranberry bogs where water use during harvest greatly exceeds available flow.

Many of the irrigation rights in the district are complex, especially with respect to Cranberry bogs, which makes monitoring difficult. Regulation is typically in response to complaints from consumptive users and consists of shutting off junior users, as opposed to monitoring diversions for rate or duty compliance. Additional regulation is associated with illegal use. Diversion monitoring after regulation is done visually (e.g., regulated diversions and/or sprinklers remain off).

The current watermaster concluded that regulation of small users on minor tributaries and springs for senior rights on the main–stem rivers generally results in a “futile call” (Administrative Rule 690-250-020 {1}). Therefore, the users located on these tributaries are typically not regulated. Regulation of these small users is further limited by language in most of the district’s pre–1987 ISWRs that state: “The instream water right shall not have priority over appropriations of water for human consumption, livestock consumption and irrigation of non–commercial gardens not to exceed one–half in area and water legally released from storage.” (WRIS database, accessed 5/4/2009)

The diversions, regulatory and hydrologic setting in each of the major watersheds in District 19 is discussed in detail below. Information was taken from available watershed assessments, the OWRD water availability analysis (available on line), the OWRD WRIS database (available on line), and interviews with the present and the once–removed former watermaster.

The regulatory setting (i.e., relative priorities and quantities of the ISWRs and consumptive uses compared to water availability) and diversion descriptions for the

major streams and watersheds are given below. Analysis at the tributary scale was outside the scope of this study. In addition, the most junior ISWRs were not considered in the analysis given that consumptive use available for regulation for the senior ISWRs was limited.

Winchuck watershed—
Diversions in the Winchuck watershed consist of a few small individual domestic and irrigation users. A 1964 ISWR for 20 cfs (all year long) exists on the main–stem river. The1964 ISWR is typically not met in dry years or in September of normal years. The OWRD WRIS database indicated that a total of 0.8 cfs of consumptive users (excluding 1/6 cfs of domestic uses, which are not subject to regulation for the 1964 ISWR) are junior to the1964 ISWR. One of these diversions is almost 0.5 cfs, but all others are less than 0.1 cfs.

The 1980 ISWR rate is tiered and is typically met in normal years, but is not met in the summer of dry years. There are 0.6 cfs of junior water rights to this ISWR, including the 0.5 cfs diversion mentioned earlier.

According to the watermaster, there some complaints and regulation associated with consumptive users in the watershed due to full appropriation. Given this regulatory setting, some type of stream flow monitoring is warranted on the Winchuck River.

Chetco Watershed—
The Chetco River is the one exception where municipal use is not senior to other uses. Part of the City of Brooking's water right is junior to the 1964 ISWR, which is for 80 cfs in all months. This ISWR is not met during the summer of dry years and September of most years according to the water availability analysis. There are roughly 26 cfs of junior rights (excluding domestic rights) to the 1964 ISWR, including 20.5 cfs of municipal rights. The City of Brookings reports its monthly water use to OWRD on an annual basis, but is not actively monitored by OWRD. Regulation and monitoring of consumptive uses is complaint driven.

A 1980 ISWR is also present on the Chetco River. It is usually not met in the summer of dry years and September of typical years. There is 1.35 cfs of junior consumptive rights to the 1980 right, including a single water right for 1.0 cfs.

Given this regulatory setting, the existing active gage on the Chetco River should be used to actively monitor flows for the ISWR. Active monitoring for the City of Brookings diversion is also recommended during dry years and late summer of all years.

Pistol Watershed—
The water availability analysis for the Pistol River indicates that the most senior ISWR (1964) for 15 cfs (year around) is usually met, even in dry years. There are few consumptive rights in the watershed, of which approximately 1.3 cfs are junior to the ISWR. Furthermore, the ISWR specifies that no domestic users will be regulated in favor of the ISWR.

The next senior ISWR has a priority of 1980. This ISWR is also typically met. There is only 0.15 cfs of junior rights to this ISWR.

Elk Watershed—
The largest water use in the Elk watershed is for agriculture, with the largest portion of that use being for Cranberry production. The most senior ISWR is a 1980 right, which is for 45 cfs between mid June and the end of September. There are approximately 4.5 cfs of junior rights to the 1980 ISWR. However, according to the OWRD water availability analysis, the 1980 ISWR should be met in typical and dry years

There is also a 1990 ISWRs on the main–stem Elk River that is met in typical years, but is not met in June and July of dry years according to the OWRD water availability analysis. Junior users to the 1990 ISWR also total about 4.5 cfs.

Given this regulatory setting, some type of stream flow monitoring (e.g., staff gage) is warranted on the Elk River.

Sixes Watershed—
Similar to the Elk watershed, the largest water user in the Sixes watershed is agriculture; with Cranberry production being the largest part of agriculture use. There are also 426 acre-ft of storage rights and 75 cfs of mining rights according to the Sixes watershed assessment (Maguire, 2001). The mining rights are non–consumptive.

The most senior ISWR is a 1964 right for 30 cfs between October through July, and 25 cfs from August through September. The water availability analysis shows that this ISWR is met in typical years, except in September and October. In dry years, the 1964 ISWR is not met between Julys through October. According to the WRIS data base, there are roughly 33 cfs of junior users to the 1964 ISWR. Most of these users are associated with Cranberry use, and 10.5 cfs of this total is associated with a single water right.

The 1980 ISWR is for 40 cfs mid June through July and 25 cfs from August through September. The water availability analysis shows that during dry years these rights typically won't be met, but should be met during normal years. There are 24 cfs of junior rights to the 1980 ISWR.

Given this regulatory setting, some type of stream flow monitoring, (probably a stream gage), is warranted on the Sixes River.

Floras Watershed—
Most of the diversions in the Floras watershed are associated with agriculture, specifically cranberry bogs. A 1964 ISWR specifies a year round flow requirement of 5 cfs. This instream flow is typically met in most years, including dry years according to the OWRD water availability analysis. In addition, the estimate expected flows are also typically sufficient to meet the 1980 ISWR, even in dry years. Nonetheless, there are 18

cfs of consumptive uses junior to the 1964 ISWR and 13 cfs of consumptive uses junior to the 1980 ISWR.

Coquille Watershed—
According to the NRCS hydrologic unit profile of the Coquille watershed (NRCS, 2006), there are roughly 9,900 acres of irrigated lands in the watershed, but 17,000 acres of adjudicated irrigated water rights. In addition to Cranberry bogs, irrigation for pasture, hay, and dairies constitute the other main uses of water in the watershed. The ISWR priority on the main–stem Coquille River is 1983, with flow requirements of 200 cfs (or higher) until mid–June, transitioning to 95 cfs to the end of June, and 71 cfs for the rest of the summer. The ISWR flow requirements in October start at 300 cfs, and transition to 380 cfs by mid October. According to the OWRD water availability analysis, stream flow is typically sufficient to meet all needs (including the ISWR), except for August and September of dry years, and October of normal and dry years. There are roughly 30.5 cfs of consumptive uses junior to the 1983 ISWR.

The existing active stream gage (#14327055) on the Coquille River should be used to monitor flows during dry years.

Coos Watershed—
The main stem Coos River is fairly short, with only four river miles from the mouth to the confluence with the South Fork Coos and Millicoma Rivers; the two main tributaries to the main stem. There are no ISWR associated with the main stem Coos River. In addition, the Millicoma River has no ISWRs and the estimated stream flow is sufficient to meet all needs in the Millicoma and Coos River watersheds, even during dry years.

There are ISWRs, however, for the S. Fork Coos River. A 1964 ISWR exists for 30 cfs of flow all year long. Stream flow is sufficient to meet these 1964 ISWR in normal years, but not in August and September of dry years. There are about 15 cfs of consumptive rights junior to the 1964 ISWR.

There is also a 1980 ISWR on the S. Fork Coos River with flow requirements of 40 cfs from mid June through July, 30 cfs from August to mid September, and 40 cfs to the end of September. In normal years the 1980 ISWR is met, but during dry years the August and September instream rights are not met. There are 3.3 cfs of consumptive rights junior to the 1980 ISWR.

Stored Flow and Natural Flow:
There is only one reservoir in the district that exceeds 1000 ac-ft in storage— Upper Pony Creek Reservoir on Pony Creek. The reservoir is located adjacent to the City of Coos Bay and captures runoff from a very small watershed. Nonetheless, the copious amounts of rainfall are sufficient to fill this 6200 ac-ft reservoir. Inflow to the reservoirs are very small during the summer and, given the municipality is the only user on Pony Creek, determination of storage and natural flow from the reservoirs is not made.

There are other small reservoirs throughout the basin (< 500 ac-ft). Given the rainfall–runoff processes that dominate stream flow generation throughout the basin, coupled with the significant amounts of winter/spring precipitation (> 5 feet in most areas), the reservoirs easily fill and usually do not affect regulation. Most of the reservoirs capture runoff for agriculture use, including Cranberry production.

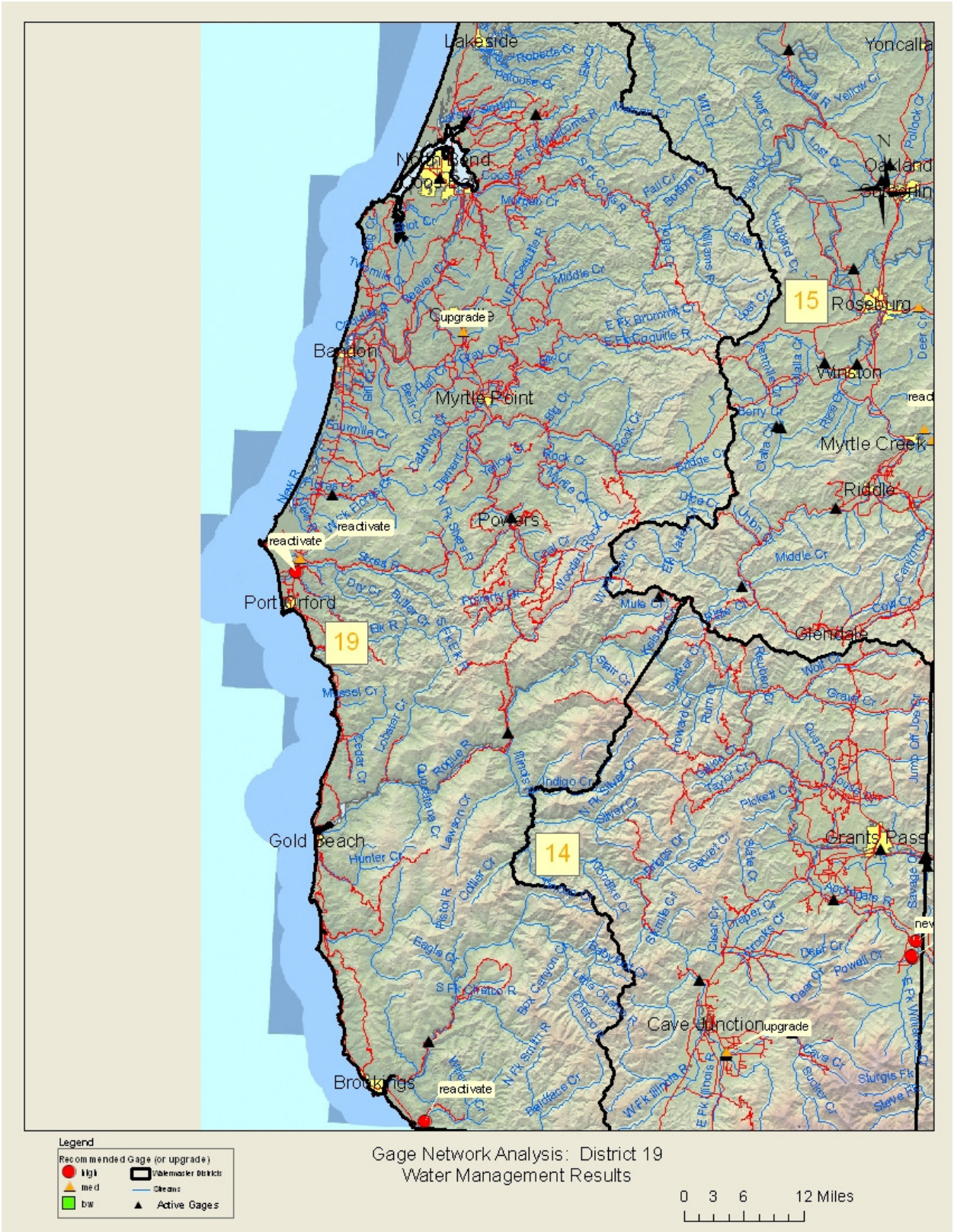
Instream Transfers and Leases (IS_XFR):
IS_XFRs in District 19 are associated with individual users temporarily leasing their water instream in order to preserve the water right. As such, the flows are typically very small and occur where there are other users with the same priority date. The end result is that the IS_XFRs are considered too small by the watermaster to manage and are not monitored.

The ISWRs are junior to most other users in the basin. However, as detailed previously, there are significant amounts of junior users to the most senior ISWRs. For example, the Sixes, Coquille, Chetco, Floras, and South Fork Coos Rivers have 33, 30.5, 26, 18, and 15 cfs of junior consumptive water rights, respectively. These numbers do not include domestic uses which are usually not subject to regulation to the most senior ISWRs. In most of these watersheds the ISWRs are usually met in normal years, except for September and October. However in some watersheds (Chetco, Elk, Sixes, Coquille, and S. Fk Coos) the ISWRs are typically not met in the summer and early fall of below average years.

Historically, about 20 OWRD gages were operating to monitor ISWRs and to collect additional data for the OWRD water availability analysis (Cooper, 2002). In the past, regulation for ISWRs generally involved small junior irrigators for these ISWRs. Because of the small quantities of water involved with these users, the current watermaster judged that regulation of these users would result in a futile call. Thus, the gages have been discontinued and the ISWRs are no longer actively monitored.

High Regulation Streams:
There were three streams (North Fork Coquille, Winchuck and Chetco Rivers) flagged with high regulations (> 20). The cause of these was full appropriation and illegal use. No additional stream gages or upgrades were identified as helping with regulation on these streams, other than what was discussed in the previous section.

Zero Expected Flow Streams:
There were nine streams listed with zero expected flow. However, there are no complaints for regulation in these streams. The reason for this fact is that municipal rights have not been fully developed, although the accounting in the water availability analysis treats them as fully developed. Therefore, the actual stream flow is higher in these watersheds than expected and there are no complaints due to shortages.



Gaging for water management evaluation results. Watermaster District Nineteen

District 20—Sandy Basin

Summary:
Although District 20 includes reaches of the Columbia and Willamette Rivers, the two main rivers and watersheds associated with water management and monitoring in the basin are the Sandy and the Clackamas. Stream flow in these rivers are high in the winter/spring due to combined rainfall and snow–melt runoff processes, commonly exceeding several thousand cubic feet per second. Low flows occur in summer, but are significant (several hundred cfs). Base flows are sufficient to meet current demands from the main–stem Clackamas (including ISWRs), but insufficient to meet demands (including the ISWRs) on the main–stem Sandy River. Likewise, summer stream flow in numerous tributaries to both rivers are often insufficient to meet all needs.

Water management and monitoring in the basin is proactive and predominately associated with regulation for ISWRs on the numerous tributaries in both watersheds. Regulation and related monitoring is usually associated with small individual irrigators, as opposed to the large water users (due to water right seniority). Numerous real–time stream gages, staff gages and frequent manual measurements are used to monitor instream flows, which triggers regulation.

The major diversions in the basin are related to the numerous municipal users and hydroelectric projects. All of these diversions have user–operated stream gages, flow meters or measurement devices. However, the diversions are not currently involved with regulation or active monitoring due to the water right seniority. There is increasing concern that the water supply from the Clackamas watershed is insufficient to meet future consumptive use and instream rights. Given the numerous municipal users diverting water in the Clackamas watershed, OWRD monitoring efforts in the watershed may change.

Several reservoirs operated for municipal use and hydropower are present in the district. Most of these are located in the Bull Run (tributary to the Sandy River) and upper Clackamas watersheds, and are monitored through USGS operated real–time stream and reservoir gages. Storage and releases are not presently involved with regulation and are not routinely monitored by OWRD.

There are 39 USGS/OWRD stream gages operated in the basin, 11 of which are used by OWRD for water management purposes. The USGS operates 36 of these gages, many of which are used to by reservoir operators for management. There are no IS_XFRs in the basin. However, ISWRs are present and do affect regulation in the basin. As previously mentioned, routine manual measurements, staff gages, and stream gages are used to proactively monitor the ISWRs and to trigger regulation of junior consumptive users.

Below is a detailed description of how water is monitored in the district and the current stream gaging system. No additional gages were needed in the district.

Diversions:
Most of the main water use in District 20 is associated with municipalities and hydroelectric projects. These uses are senior to all other water rights and have not historically been associated with regulation and water distribution activities in the district. Nonetheless, all municipal diversions have flow meters or stream gages and report monthly water use in an annual report to OWRD. The Molalla Irrigation District and several large individual nurseries in the basin are the largest agricultural users in the district. These users (as well as others), classified as "significant", are routinely monitored through flow meters and also report water use annually to OWRD.

Clackamas watershed—
The main diversions in the Clackamas watershed are associated with the Clackamas River Water Providers (CRWP) and the PGE hydroelectric facilities. CRWP consists of representatives from the City of Lake Oswego, Clackamas River Water (county), the North Clackamas County Water Commission, the South Fork Water Board (Oregon City& West Linn), and Sunrise Water Authority. In addition, the Cities of Estacada, Gladstone, and Milwaukie; plus Clackamas County's Water Environment Services rely on flows in the Clackamas watershed.

There is concern that if the municipal users fully develop their water rights, the water supply from the Clackamas watershed would be insufficient to meet competing consumptive municipal uses, let alone the junior ISWRs (LWVCC, 2002). As these cities continue to grow, OWRD monitoring and regulation of the municipal diversion may change as competition for water increases between the various users.

The hydroelectric diversions are non–consumptive and are located upstream of the municipal diversions. As such, they do not affect the municipal diversions. However, the hydroelectric diversions do have a dramatic impact on instream flows; roughly 70 river miles are affected by these diversions. Storage releases from Timothy Lake into the Oak Grove Fork (major tributary to the Clackamas River) occur in the fall for power production. Downstream of Harriet Lake Dam, the Oak Grove Fork is typically dewatered. In addition, on the main–stem Clackamas River between RM 47.8 (Oak Grove Powerhouse) and 33.5 (North Fork Reservoir), stream flows fluctuate in response to power production. Finally, below North Fork reservoir the river is diverted off channel (except for 100 cfs) into the Faraday powerhouses, then back into the channel (Carpenter, 2003). OWRD does not actively monitor the off channel hydroelectric diversions due to the seniority of the water rights and the diversions have never been found to be out of compliance.

The "Clackamas River at Estacada, Oregon" gage is routinely checked for minimum flow requirements and to monitor PGE, Clackamas River Water Providers, and Water Environment Services management activities.

Sandy watershed—
The large diversions in the Sandy watershed are associated with the Portland Water Bureau and, until recently, PGE hydroelectric facilities. PGE recently decommissioned

its hydroelectric projects and associated diversions. There is a plan to convert the hydropower related rights to instream use. If this occurs, it could possibly change regulatory and monitoring activity in the Sandy watershed. Other municipal water suppliers in the watershed are the Corbett Water District (from Gordon Creek) and the City of Sandy (from Alder Creek). Neither of these municipalities have been regulated and neither are actively monitored.

The largest diversions are in the Bull Run watershed, where the City of Portland operates two reservoirs and a lake (providing approximately 69,500 ac-ft of storage), a hydroelectric facility, and diversions to the city. The Bull Run watershed was proclaimed as a reserve for the City of Portland's domestic water supply in 1892, by President Benjamin Harrison. In addition, the state legislature enacted ORS 538.420 in 1909, which granted the City of Portland exclusive rights to use waters from the Bull Run and lower Sandy Rivers. The city's water right does not define volume or diversion rate limits (Sandy River Basin Partners, 2005). Given this regulatory setting, the city's diversions are not actively monitored by OWRD.

Stored Flow and Natural Flow:
There are five significant storage facilities identified in watermaster district 20: Bull Run Reservoir #1, Bull Run Reservoir #2, Bull Run Lake, Timothy Lake, and North Fork Reservoir on the Clackamas River. The first three reservoirs are associated with the Portland Water Bureau in the Sandy watershed, while the last two are located on the Clackamas watershed. Given the significant rainfall and associated runoff in both watersheds, filling the reservoirs occurs without difficulty in the winter when demand from other users is limited.

In the Bull Run watershed, the USGS operates real–time gages on the reservoirs, inflows and outflows from the reservoirs (Reservoirs #1 and #2, and Bull Run Lake). These gages are used for planning and operation of the Portland Water Bureau's water supply by the city. Typically, the reservoirs are filled during the late fall and winter months, after which surplus water is spilled. During late summer, most water entering these impoundments is diverted through Portland's water supply conduits. As previously stated, stream gages are not required for monitoring for regulation purposes by OWRD. Storage releases and natural flows are not determined by OWRD in the Bull Run watershed due to the regulatory setting.

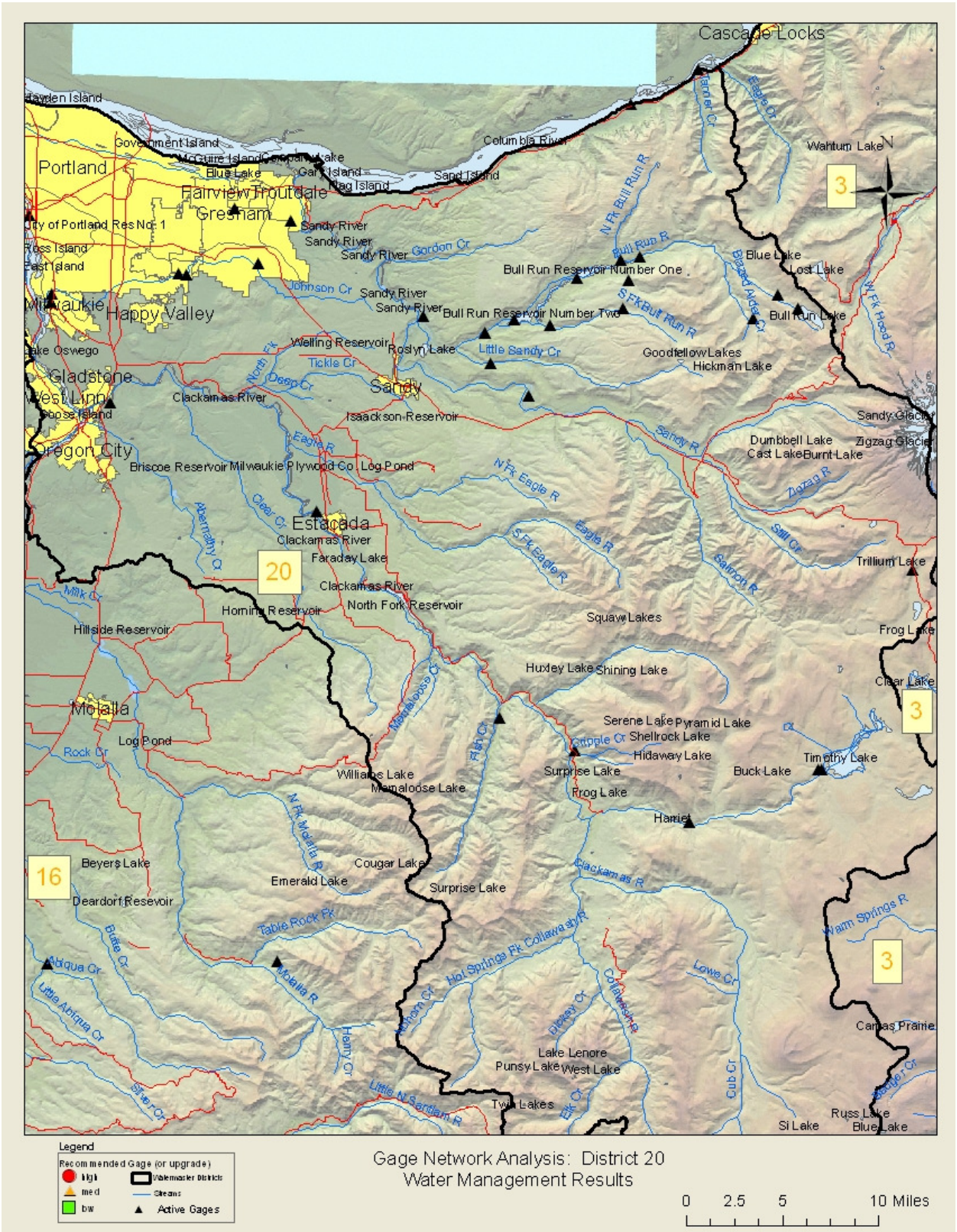
In the Clackamas watershed, the USGS operates numerous gages on the main-stem Clackamas and its tributaries. Timothy Lake (81,000 ac-ft) is the main storage facility in the watershed (Oak Groove Fork) and both storage and releases are monitored by real–time gages. Timothy Lake stores water for PGE hydroelectric facilities. Typically, lake levels are held constant through the summer, and then released in fall for power production and storage capacity. There is interest for contracting storage releases from the lake to increase instream flows during the summer. Presently, no stored water is allocated for municipal use. Should this occur, additional monitoring by OWRD may be needed.

The other large reservoir in the Clackamas watershed is the North Fork Reservoir (21,000 ac-ft) on the main–stem Clackamas River. This reservoir is associated with the off channel hydroelectric facility at Faraday described previously. OWRD does not actively monitor the off channel hydro–diversions because of the water rights' seniority and the diversions have never been found to be out of compliance.

Instream Transfers and Leases (IS_XFRs):
There are no instream transfers and leases identified in the Sandy Basin. However, ISWRs do affect regulation in the district. ISWRs on Clear Creek, Crystal Springs, Deep Creek, and Milk Creek are all monitored through staff gages with rating curves generated by periodic manual measurements. Gordon, N Fk Deep and Tickle Creeks are all monitored by manual measurements. Beaver Creek (tributary to the Willamette River) and the Molalla River (near Canby, tributary to the Willamette River) are monitored by USGS real–time stream gages. In addition, the "Sandy River below Bull Run River, near Bull Run, Oregon" is used to routinely check flows for ISWR purposes. The other ISWRs in the district do not affect regulation.

High Regulation Streams:
The predominant cause for streams with a high number of regulations (> 20 regulations) is ISWRs. Regulation activity generally consists of proactively monitoring flows until they drop below the ISWR, then regulating off all junior users. The high regulation activity on the Clackamas and Sandy Rivers is often due to illegal use.

Zero Expected Flow Streams:
There was only three water availability basins (WABs) identified as having zero expected flow in the basin. Tickle Creek is the only stream where regulation activity, as previously mentioned, is due to the ISWR. For Bull Run River, there are no complaints and no regulation activity due to the nature of the City of Portland's water rights.



Gaging for water management evaluation results. Watermaster District Twenty

District 21—Lower John Day Basin

Summary:
Watermaster District 21 consists of the lower John Day River (LJDR) watershed (below the North Fork confluence) and the Willow Creek watershed (tributary to the Columbia River). Aside from the LJDR, most streams in the district are ephemeral or have extremely low summer base flows (<1-2 cfs). However, summer storm events and seasonal snow–melt can generate very high flows throughout the district.

Water management and monitoring in the LJDR watershed is complaint driven, associated with the many small users located on tributaries to the LJDR, and brought about by seasonal stream flow decline after the spring freshet. Regulation activity is very high for a couple of weeks following this decline in flow, then tapers off due to general lack of water in the basin (i.e., ephemeral streams). In contrast, management and monitoring in the Willow Creek watershed is more proactive due to the distribution requirements of storage releases from Willow Creek Lake. As elsewhere in the basin, most of the users in the Willow Creek watershed are small and have single PODs.

There is only one significant reservoir in the basin: Willow Creek Lake. Inflows, storage, and releases are monitored by USGS operated real–time gages for USACOE. This information is used by OWRD to determine the live and storage component (i.e., contract water) of stream flow below the reservoir.

There are two real–time and one recording stream gages operated by OWRD in the basin. The stream gage on Butte Creek helps with water management (i.e., monitoring ISWR), but the others do not. The USGS operates seven gages in the basin. Five of these gages are associated with management and operation of Willow Creek Lake by USACOE. The other two gages are on the John Day River and are used during dry years for monitoring ISWRs. A new gage on Pine Creek was installed by the USGS for the Confederated Tribes of Warm Springs and is used to monitor instream flows associated with a recent IS_XFR.

Most IS_XFR are associated with individual users temporarily leasing their water instream to preserve the water right and do not warrant stream gages for monitoring. However, three streams are being monitored for instream flow requirements related to IS_XFR by either stream gaging or by manual methods. ISWRs do not typically affect regulation in the basin.

No new stream gages or upgrades to existing gages were identified necessary for water management in the basin. However, staff gages would help with the seasonal, short–lived regulation on the identified high regulation streams.

Below is a detailed description of how water is monitored and the current stream gaging system.

Diversions:
There are no large diversions in the lower John Day Basin, including the Willow Creek watershed. The water users generally consist of individual land owners, with small acres and single PODs (usually pumps). Most diversions in the LJDR watershed (lower John Day Basin excluding Willow Creek watershed), are monitored by visual estimates (e.g., counting sprinkler heads, reading electric meters on pumps, etc) or through manual discharge measurements. Regulation activity is very high for a couple of weeks following the spring runoff, and then tapers off due to the ephemeral nature of most streams (i.e., there is no water to distribute). There is little regulation or monitoring associated with diversions from the main stem John Day River because of the large base flow compared to the small diversions from the river. Most regulation and associated monitoring in the LJDR watershed occurs because of disputes between individual users.

In the Willow Creek watershed, all irrigators with storage contracts are required to have measurement devices on their diversions. In addition, over 36 measuring devices have recently been installed on diversions throughout Willow Creek. The watermaster routinely uses the measurement devices along with manual stream flow measurement to regulate and distribute flows on Willow Creek. The watermaster actively distributes this flow according to the contracts and water rights of the different irrigators.

Stored Flow and Natural Flow:
The USACOE operates one storage/flood control reservoir above Heppner on Willow Creek, and contracts stored water for irrigation to individual users. Stream gages on inflows and outflows from the reservoir, coupled with the reservoir gage are sufficient for the watermaster to determine the live and storage component of stream flow below the reservoir. The watermaster distributes water according to the contracts and water rights water of the different irrigators on Willow Creek.

Instream Transfers and Leases (IS_XFR):
Most IS_XFR are associated with individual users temporarily leasing their water instream to preserve the water right from non–use cancellation. As such, the flows are typically very small and occur on stream that are ephemeral (i.e., self–regulating streams), where there are other users with the same priority date.

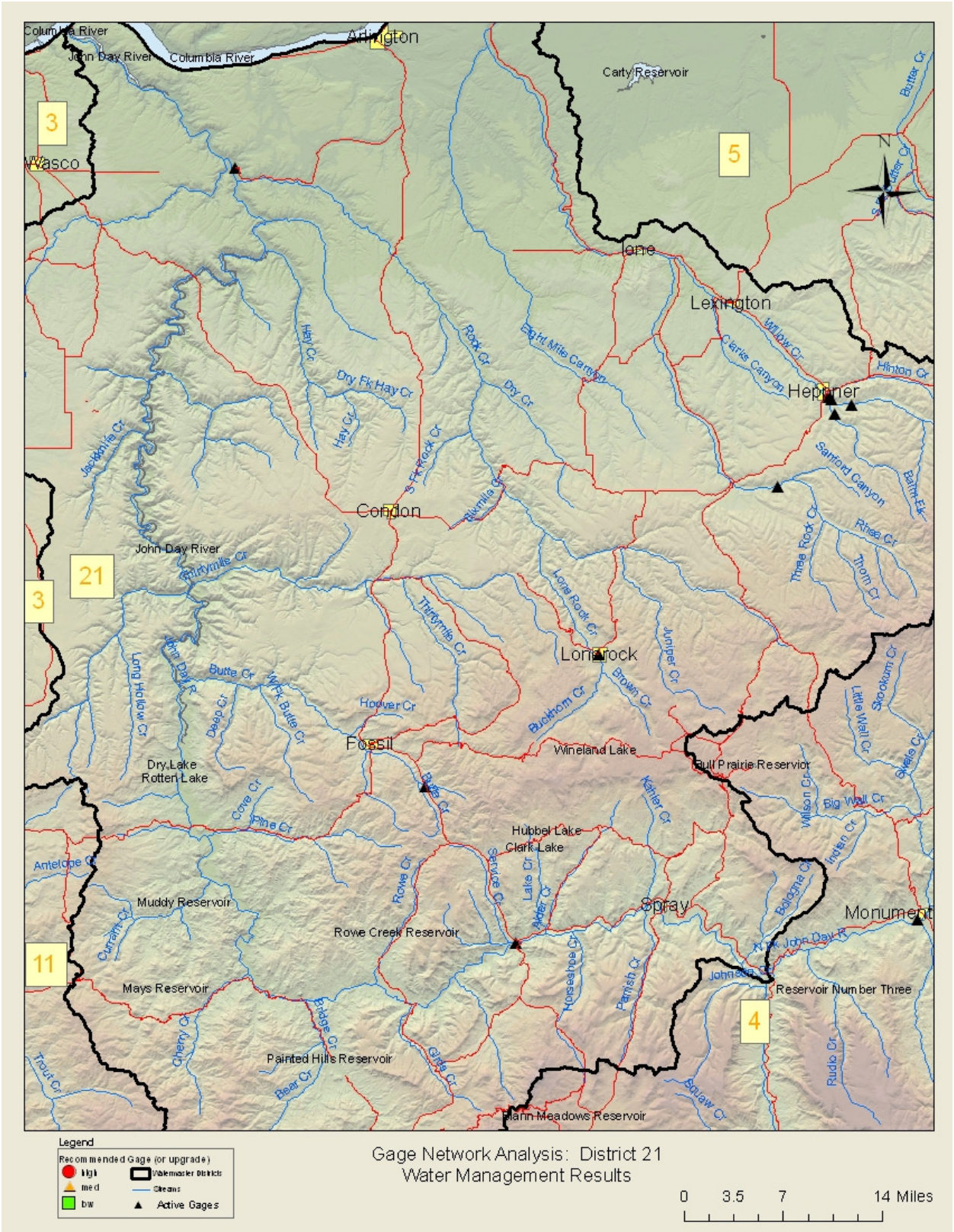
There are, however, several creeks where IS_XFRs do warrant monitoring. Instream flows on Butte Creek and Pine Creek are monitored by real–time USGS stream gages. Butte Creek is also monitored lower in the reach through visual estimates. Bridge Creek is seasonally monitored by manual measurements until the creek goes dry.

Instream water rights (ISWR) are junior to the irrigation rights (which greatly exceed natural flow) and do not typically affect regulation or water distribution in the district.

High Regulation Streams:
There were seven streams (Willow, Rhea, Hinton, Balm Fork, West Branch Bridge, Alder and Bridge Creeks) with significant regulations (> 20). The cause of regulations

was full appropriation and the seasonal decline in stream flow after spring runoff. Willow Creek had the highest number of regulation due to the large number of individual users on Willow Creek. For Rhea, West Branch Bridge and Bridge Creeks, staff gages would help with regulation. No additional stream gages or upgrades were identified as helping with regulation on these streams under the current regulatory environment. However, additional stream gages or other monitoring devices may be necessary on Willow Creek, depending on the distance stored contract water is delivered.

Zero Expected Flow Streams:
There were eight streams listed with zero expected flow. Seasonal regulation occurs in five of these due to full appropriation and reoccurring disputes between neighbors. Users on the remaining three streams self regulate their use. No additional monitoring was identified in these streams during the summer.



Gaging for water management evaluation results. Watermaster District Twenty-one

APPENDIX C—Summary of Results: Survey Tables (see Appendix A for key to table codes)

Table I: Instream Leases or Transfers (IS_XFR), or Instream Water Rights (ISWR) that Affect Regulation

	ISXF or ISWR			1. Monitoring					
District	Name		Type	Real Time	Routine	Periodic	Complaint Driven	None	2. Upgrade or notes?
1	Little Creek	Tributary to Columbia R	IS_XFR					G, H	
1	Kilchis River	Tributary to Tilamook bay	IS_XFR					H	
1	Lobster Creek	Tributary to Alsea River	IS_XFR					G	
1	ALSEA RIVER	ALSEA BAY	ISWR	A		D			Has USGS stream gage, but needs regular mmt to be used for mngmt due to frequent rating shifts from unstable channel
1	KILCHIS RIVER	TILLAMOOK BAY	ISWR			D			(A) re-activate
1	LEWIS & CLARK RIVER	YOUNGS BAY	ISWR			D			(A) new
1	MIAMI RIVER	TILLAMOOK BAY	ISWR		B				(A) Telemetry upgrade
1	NECANICUM RIVER	PACIFIC OCEAN	ISWR			D			
1	NEHALEM RIVER	NEHALEM BAY	ISWR	A		D			Has USGS stream gage, but needs regular mmt to be used for mngmt due to frequent rating shifts from unstable channel
1	NESTUCCA RIVER	NESTUCCA BAY	ISWR	A		D			Has USGS stream gage, but needs regular mmt to be used for mngmt due to frequent rating shifts from unstable channel
1	SOUTH FORK NECANICUM RIVER	NECANICUM RIVER	ISWR		B				(A) Telemetry upgrade
1	SALMON RIVER	PACIFIC OCEAN	ISWR			D			(A) re-activate
1	SILETZ RIVER	SILETZ BAY	ISWR			D			
1	TILLAMOOK RIVER	TILLAMOOK BAY	ISWR			D			(A) re-activate
1	TRASK RIVER	TILLAMOOK BAY	ISWR	A		D			Has USGS stream gage, but needs regular mmt to be used for mngmt due to frequent rating shifts from unstable channel
1	WILSON RIVER	TILLAMOOK BAY	ISWR	A		D			Has USGS stream gage, but needs regular mmt to be used for mngmt due to frequent rating shifts from unstable channel
1	YACHATS RIVER	PACIFIC OCEAN	ISWR			D			(A) re-activate
1	YAQUINA RIVER	YAQUINA BAY	ISWR		B				(A) Telemetry upgrade
2	Noti Creek		IS_XFR					H	
2	McKenzie River		IS_XFR					H	
2	Willamette River		IS_XFR					H	
2	McKenzie River		IS_XFR					H	
2	Long Tom River		IS_XFR					H	
2	South Santiam River		IS_XFR					H	
2	South Fork Neal Creek		IS_XFR			E			Look at the single user associated with transfer
2	Bilyeu Creek		IS_XFR			E			Look at the single user associated with transfer
2	Thomas Creek		IS_XFR		D				
2	Calapooia River		IS_XFR		D				OWT runs real-time gage. WM checks
2	South Fork Neal Creek		IS_XFR						
2	Willamette River		IS_XFR						
2	Thomas Creek		ISWR		D				
2	Crabtree Cr	> S. Santiam	ISWR		C				
2	Calapooia River	> Willamette	ISWR		C				(A) Add Gage @ Calapooia. OWT runs real-time gage upstream.
2	Mohawk	> Willamette	ISWR	A					USGS. Checks w/ manual mmt
2	Upper Siuslaw		ISWR			C			One right to shut off
2	Lake Cr		ISWR		C				(A) new seasonal gage. after shut off, nothing more to monitor
2	Indian Cr		ISWR		C				after shut off, nothing more to monitor
2	Deadwood Cr		ISWR		C				
2	Lost Cr		ISWR			D			One user to regulate
3	Deschutes River	@ Mouth, tributary to Columbia R	IS_XFR	A					
3	Eightmile Creek	@ Mouth, tributary to Fifteenmile Cr	IS_XFR			E			(C) to increase accuracy
3	Fifteenmile Creek	@ Mouth, tributary to Columbia R	IS_XFR		C				(A) Seasonal gage
3	Kerr Creek	@ Mouth, tributary to Deschutes	IS_XFR					I, G	
3	Tygh Creek	@ Mouth, tributary to White River	IS_XFR		C				(A) Seasonal gage
3	Buck Hollow Creek	@ Mouth, tributary to Deschutes	IS_XFR					I, G	
3	Sherar Spring Creek	@ Mouth, tributary to Badget Cr	IS_XFR					I, G	
3	Crane Creek	@ Mouth, tributary to White River	IS_XFR					I, G	
3	White River	@ Mouth, tributary to Deschutes	IS_XFR				F		

	ISXF or ISWR			1. Monitoring					
District	Name		Type	Real Time	Routine	Periodic	Complaint Driven	None	2. Upgrade or notes?
3	Threemile Creek	@ Mouth, tributary to White River	IS_XFR				F		
3	Badger Creek	@ Mouth, tributary to White River	IS_XFR		C				
3	Fivemile Creek	@ Mouth, tributary to Eightmile Cr	IS_XFR				F		
4	North Fork John Day River		IS_XFR	A				H	
4	Cochran Creek		IS_XFR					H	
4	Beaver Creek		IS_XFR					H	
4	Deer Creek		IS_XFR					H	
4	John Day River		IS_XFR					H	
4	Hawkins Creek		IS_XFR					H	
4	John Day River abv Beech CR		ISWR	A					
4	John Day R abv S Fk		ISWR					GI	A. ISWR junior to most other users
4	M Fk John Day River		IS_XFR	A					TNC/TRIBES/OWT
4	S Fk John Day River		ISWR	A					
4	N Fk John Day River		ISWR	A					
5	UMATILLA RIVER		ISXFR	A				F	
5	WEST LITTLE WALLA WALLA RIVER		ISXFR					J	
5	NORTH FORK WALLA WALLA RIVER		ISXFR					J	
5	WALLA WALLA RIVER		ISXFR	A(OTHER)				H	
6	Grande Ronde River	above Wallowa River	IS_XFR			E			Are leased lands dry?
6	Little Creek	@ Mouth, Tributary to Catherine Creek	IS_XFR			E			Are leased lands dry?
6	Indian Creek	@ Mouth, Tribtary to Grande Ronde R	IS_XFR			E			Are leased lands dry?
6	Grande Ronde River	@ Mouth	IS_XFR					H	
6	Chesnimnus Creek	@ Mouth, Tribtary to Joseph Cr	IS_XFR					G	
6	Crow Creek	@ Mouth, Tribtary to Joseph Cr	IS_XFR					G	
6	Elk Creek	@ Mouth, Tribtary to Joseph Cr	IS_XFR					G	
6	Joseph Creek	@ Mouth, Tributary to Grande Ronde R	IS_XFR					G	
6	Grande Ronde @ Troy		ISWR	A					
8	ROCK CR AT MOUTH	POWDER R	IS_XFR					F	
9	Rinehart Creek		ISXFR					G	Single user leased water instream
10	Silver Cr		ISWR					G	
10	Silvies R		ISWR					G	
10	Trout Cr		ISWR					G	
10	Willow Cr		ISWR					G	
11	Little Deschutes River	> Deschutes R	ISXFR	A				H	lease amount is much less than typical flow
11	Deschutes River	to LBC	ISXFR	A					
11	Tumalo Creek	> Deschutes R	ISXFR	A					
11	Three Creek	nr Sisters	ISXFR					G	Creek infiltrates before joining any perennial streams
11	Crooked River	Bowman to mouth; > Deschutes R	ISXFR	A					
11	Little Bear Creek	> Bear Cr	ISXFR			E			all lands leased instream. Periodic check to see if lands dry
11	Bear Creek	> Crooked R	ISXFR					G	
11	Mill Creek	> Crooked R	ISXFR					G	
11	Indian Ford	> Whychus Cr	ISXFR				F		(A). Low priority, by gage would help with monitoring of ISWR.
11	Whychus Creek	> Deschutes R	ISXFR	A					
11	Pole Creek	> Whychus Cr	ISXFR					H	
11	Deschutes River	to mouth	ISXFR	A					
11	Trout Creek	> Deschutes R	ISXFR	A					
11	Mud Springs Cr	> Trout Cr	ISXFR	A					
11	Crescent Lake	> Crescent Creek	ISXFR	A					
12	There are no IS_XFR or ISWR that affect regulation in dsitrict 12.								

	ISXF or ISWR			1. Monitoring					
District	Name		Type	Real Time	Routine	Periodic	Complaint Driven	None	2. Upgrade or notes?
13	EVANS CREEK		ISXFR	A					gage install in process
13	APPLEGATE RIVER		ISXFR	A				G	
13	LITTLE BUTTE CREEK		ISXFR	A					
13	ROGUE RIVER		ISXFR	A				G	
13	PLEASANT AT MOUTH	EVANS CR	ISXFR					I	
13	NEATHAMMER CREEK		ISXFR					I	
13	N. FORK LITTLE BUTTE CR		ISXFR	A					
13	WEST FORK TRAIL CREEK		ISXFR			D			
13	LITTLE AP AB YALE C	APPLEGATE	ISXFR	A					gage install in process
13	LITTLE AP AT MOUTH	APPLEGATE	ISXFR	A					
13	BEAR CR AT MOUTH	ROGUE R	ISXFR	A					
14	Williams Creek	> Applegate R	IS_XFR		D				(A) Very Important Cr
14	East Fork Williams Creek	> Williams Cr	IS_XFR		D				
14	Cheney Creek	> Applegate R	IS_XFR			D, E			
14	Slate Creek	> Applegate R	IS_XFR					G	
14	Chapin Creek	> Slate Creek	IS_XFR					G	
14	Applegate River	> Rogue R	IS_XFR					H	
14	Rogue River	> Ocean	IS_XFR					H	
14	Grave Creek	> Rogue R	ISWR			D			
14	Sucker Creek	> EF Illinois R	ISWR		B				(A)
14	Illinois River		ISWR	A					
15	Elk Creek		IS_XFR			D			
15	Umpqua River		IS_XFR					H	
15	North Umpqua River		IS_XFR					H	
15	Calapooya Creek		IS_XFR		B, D				OWT transfer
15	Rock Creek		IS_XFR					H	
15	Lookingglass Creek		IS_XFR		D				
15	Fate Creek		IS_XFR					H	
15	Louis Creek		IS_XFR					H	
15	Siltcoos River		IS_XFR					H	
15	Frozen Creek		IS_XFR					H	
15	South Myrtle Creek		IS_XFR		D				
15	Cow Creek		IS_XFR					H	
15	South Umpqua River		IS_XFR					H	
15	Wood Creek		IS_XFR		D				
15	Windy Creek		IS_XFR					H	
15	Mill Creek		IS_XFR					H	
15	McGinnis Creek		IS_XFR					H	
15	Billy Cr	tirb to Elk Cr > Umpqua R	ISWR		D				
15	Calapooya Creek		ISWR		B, D				
15	Days Cr		ISWR		D				
15	Deer Cr		ISWR		D				
15	Elk Cr	> Umpqua R	ISWR		D				
15	North Myrtle Cr		ISWR		D				
15	Olalla Cr		ISWR		D				
15	Pass Cr		ISWR		D				
15	Quines Cr		ISWR		D				
15	South Myrtle Creek		ISWR		D				
15	S. Umpqua R		ISWR	A	D				
15	Starveout Cr		ISWR		D				
15	Tenmile Cr		ISWR		D				

	ISXF or ISWR			1. Monitoring					
District	Name		Type	Real Time	Routine	Periodic	Complaint Driven	None	2. Upgrade or notes?
15	Cow Creek		ISWR	A	D				
15	Lookingglass Creek		ISWR		D				
15	Elk Creek		ISWR		D				
15	Windy Creek		ISWR		D				
15	North Umpqua River		ISWR	A					
16	Willamette River		IS_XFR					H	
16	Spring Brook	@ mouth, tributary to Willamette River	IS_XFR					J	
16	South Yamhill River	@ mouth, tributary to Yamhill River	IS_XFR					H	
16	Willamina Creek	@ mouth, tributary to S. Yamhill River	IS_XFR					H	
16	Cosper Creek	@ mouth, tributary to S. Yamhill River	IS_XFR					H	
16	Pudding River	@ mouth, tributary to Willamette River	IS_XFR	A					Large lease. Pudding R @ Aurora is very important
16	Butte Creek	@ mouth, tributary to Pudding River	IS_XFR					H	
16	Silver Creek	@ mouth, tributary to Pudding River	IS_XFR					H	
16	Claggett Creek	@ mouth, tributary to Willamette R	IS_XFR					H	
16	Pedee Creek	@ mouth, tributary to Luckiamute R	IS_XFR					H	
16	Rickreall Creek	@ mouth, tributary to Willamette R	IS_XFR					H	
16	Mill Creek	@ mouth, tributary to S. Yamhill River	IS_XFR					H	
16	Luckiamute River	@ mouth, tributary to Willamette R	IS_XFR					H	
16	Little Luckiamute River	@ mouth, tributary to Luckiamute R	IS_XFR					H	
16	South Fork Alsea River	@ mouth, tributary to Alsea	IS_XFR					H	
16	Pudding River	@ mouth, tributary to Willamette River	ISWR	A					
16	Butte Creek	@ mouth, tributary to Pudding River	ISWR		D				(A) new gage w/ telemetry. Marion SWCD oeprates a gage
16	Pedee Creek	@ mouth, tributary to Luckiamute R	ISWR		C				
16	Rickreall Creek	@ RM 19.1, tributary to Willamette R	ISWR		D				
16	Drift Creek		ISWR		C				(A) new gage w/ telemetry
16	Abiqua Creek		ISWR		C				(A) Given added resources. Marion SWCD operates gage.
16	Luckiamute River		ISWR	A	C				
16	Silver Creek		ISWR		C				(A) Given added resources. Marion SWCD operates gage.
17	Fourmile Creek	> UKL	ISXFR				F (KBRT)		KBRT operates gage
17	Sevenmile Ditch	> UKL	ISXFR				F (KBRT)		KBRT operates gage. [C] OWRD staff gage would help.
17	Short Creek	> Sevenmile Cr	ISXFR				F (KBRT)		KBRT operates gage
17	Jenny Creek	> Upper Klamath River	ISXFR					X	to be determined
17	Crane Creek	> Fourmile Cr	ISXFR				F (KBRT)		KBRT operates gage
17	Sprague River	> Williamson R	ISXFR					H	
17	Fort Creek	> Wood R	ISXFR				F (KBRT)		KBRT operates gage
17	Whisky Creek	> Sprague R	ISXFR				F		
17	Nannie Creek	> Fourmile Cr	ISXFR				F		
17	Crooked Creek	> Wood R	ISXFR				H		
17	Cherry Creek	> Fourmile Cr	ISXFR				G		
17	Agency Creek	> Wood R	ISXFR				G		
18	ROCK CREEK		ISXFR	A				H	
18	MCFEE CREEK AB GULF C	TUALATIN	ISXFR					H	
18	MCFEE CR AT MOUTH	TUALATIN	ISXFR					H	
18	DAIRY CREEK	TUALATIN	ISXFR	A				G	
18	WEST FORK DAIRY CREEK	DAIRY CR	ISXFR	A				G	
18	EAST FORK DAIRY CREEK	DAIRY CR	ISXFR	A				G	
18	TUALATIN NR BUTTERNUT CR	WILLAMETT	ISXFR	A				G	
18	TUALATIN AT MOUTH	WILLAMETT	ISXFR	A				G	
18	McKay Cr	@ Northrup	ISWR		C				
18	E Fk Dairy Cr	@ Dairy Cr Rd	ISWR		C				
18	W Fk Dairy Cr	@ Banks	ISWR		C				

	ISXF or ISWR			1. Monitoring					
District	Name		Type	Real Time	Routine	Periodic	Complaint Driven	None	2. Upgrade or notes?
19	South Fork Coos River		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	North Fork Coquille River		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	Fishtrap Creek		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	Cedar Creek		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	Elk River		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	Twomile Creek		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	Rogue River		IS_XFR					H	temporary leases for very small acres, amount is very small compared to flow
19	ISWR	None listed that affect regulation.							ISWR are so junior that they don't affect regulation. Only affects domestic use and this use is so small that it's a futile call. ODFW doesn't complain about flows.
19	Chetcto	blw N Fk to Tidewater…80 cfs….1964 priority. Usually met, except in dry years	ISWR	A					
20	Lower Clackamas River		ISWR					G	Clackamas River from the boundary of the Olallie Lake Scenic Area downstream to the North Fork Reservoir, and from immediately below the River Mill Dam downstream to the bridge at Carver
20	Beaver Creek	nr Troutdale	ISWR	A					USGS gage
20	Clear Creek	tributary to Clackamas	ISWR		C				
20	Crystal Springs		ISWR	A					
20	Deep Creek	tributary to Clackamas	ISWR		C				
20	Gordon Creek		ISWR			D		G	
20	Milk Creek		ISWR		C			G	
20	N Fk Deep Cr.	tributary to Deep Cr	ISWR			D			
20	Tickle Cr.	tributary to Deep Cr	ISWR			D			C
20	Mollala River	nr Canby		A					

Table II:High Regulation Streams. Total Regulations from the Watermaster's Surface Water Summary Report

	High Regulatory Streams					
District	Name	Description	# of Regs	Q3 Cause ?	Q4 Additional monitoring?	Q5 alternate?
1	Nestucca River		299	A	NO	
1	Trask River		168	A	NO	
1	Yaquina River		131	A	Telemetry Upgrade	
1	Three Rivers		84	A	NO	
1	Olalla Creek		73	A	NO	
1	Big Elk Creek		70	A	NO	
1	Tillamook River		50	A	Reactivate Gage	
1	Beaver Creek		46	A	NO	
1	Foley Creek		42	A	NO	
1	Farmer Creek		40	A	NO	
1	Salmon River		39	A	NO	
1	East Beaver Creek		39	A	NO	
1	South Fork Trask River		35	A	NO	
1	Whiskey Creek		31	A	NO	
1	Depot Creek		29	A	NO	
1	Kilchis River		28	A	Reactivate Gage	
1	Simpson Creek		25	A	NO	
1	Siletz River		25	A	NO	
1	Gold Creek		25	A	NO	
1	Hughey Creek		24	A	NO	
1	Bewley Creek		23	A	NO	
1	Boulder Creek		22	A	NO	
1	Beaver Creek		22	A	NO	
1	Thornton Creek		20	A	NO	
2	Calapooia River		124	A		
2	Lake Creek		112	A	(A) sesaonal real-time gage for Lake Cr nrear Deadwood site. Trigger when to regulate. Station @ historic USGS gage (slope gage) above Indian Creek	
2	Deadwood Creek	> Lake Cr	74	A		Use Lake Cr gage as indicator when to regulate
2	Mohawk River		66	A	No. Use existing USGS gage	
2	Long Tom River		41	A	No. One year lease only	
2	Thomas Creek		38	A		
2	Indian Creek	> Lake Cr	25	A		Use Lake Cr gage as indicator when to regulate
3	Fifteenmile Creek		6246	A,D	need to upgrade 4 staff gage sites to recorders	No
3	Eightmile Creek		2556	A,D	Staff gage needed	No
3	Tygh Creek		982	A,B,C,D	Currently Parshall flumes and occasional q mmts	No
3	Badger Creek		627	A,B,C,D	Currently Parshall flumes and occasional q mmts	No
3	Ramsey Creek		276	A,D	staff gage site would help but not essential.	No
4	John Day River	John Day abv N Fk confluence	1451	A,D	Yes, Gage on upper John Day above Dayville	
4	Indian Creek	Tributary to upper John Day River	561	D,E	Yes, @ mouth (nr Prairie City)	
4	Mountain Creek	Tributary to John Day blw S. Fk	104	C,D		
4	Little Pine Creek	Tributary to upper John Day River	49	D,E		
4	Canyon Creek	Tributary to upper John Day River	47	D		
4	Pine Creek	Tributary to upper John Day River	41	D		
4	Middle Fork John Day River		38	E	Regulation first due to ISWR. Then monitor leasing, txfr's etc. to verify compliance - this is due to high interest from OWT, CTWS, TNC	
4	South Fork John Day River		32	A,C	No	
5	BUTTER CREEK		3155	D		
5	MCKAY RESERVOIR		1633	D		
5	UMATILLA DRAIN		1494	D		
5	DUGGER CREEK		1086	C, D		

	High Regulatory Streams					
District	Name	Description	# of Regs	Q3 Cause ?	Q4 Additional monitoring?	Q5 alternate?
5	BIRCH CREEK		931	D		
5	SOUTH FORK WALLA WALLA RIVER		421	D		
5	EAST BIRCH CREEK		149	D		
5	WILDHORSE AT MOUTH	UMATILLA	115	D		
5	MIDDLE MUD CREEK		54	D		
5	BIG SPRING BRANCH		40	D		
5	LITTLE BUTTER CREEK		38	D		
5	WEST BIRCH CREEK		34	D		
5	PINE CR AT MOUTH	WALLA WAL	34	D		
5	PINE CR AB DRY CR	WALLA WAL	34	D		
5	EAST LITTLE WALLA WALLA RIVER		34	D		
5	LITTLE MUD CREEK		28	D		
5	LITTLE WALLA WALLA RIVER		26	D		
6	Grande Ronde River		1517	D	No	
6	Catherine Creek	> Grand Ronde (valley)	1006	D	YES	Upgrde to telemetry upstream (nr Union) gage.
6	Little Creek	> Catherine Cr	190	D	No	
6	Mill Creek	> Willow Creek	97	D	No	
6	Willow Creek	> Grand Ronde (valley)	34	C, D	No	
6	Lostine River	> Wallowa River	24	B, C, E	No	
6	Ladd Creek Pickup Ditch	> Grand Ronde (valley)	23	C	No	
8	N POWDER AT MOUTH	POWDER R	1551	D, E		
8	ROCK CR AT MOUTH	POWDER R	1490	D,E,F		
8	CLEAR CREEK		1162	D, K		
8	EAGLE CREEK		1116	D, E		
8	PINE CREEK	SNAKE R	1019	D, E	Yes, non OWRD stream gage	No
8	EAST PINE CREEK	PINE CR	706	D,E	Yes, non OWRD stream gage	No
8	PINE CREEK	SALMON CR	412	D,E		
8	ANTHONY CREEK		320	D, E		
8	PILCHER CREEK		238	D, E		
8	MILL CREEK		199	D, E		
8	SAND CREEK		167	D, E		
8	POWDER R AT MOUTH	SNAKE R	155	D	Stream Gage nr Keating	
8	FISH CREEK		142	C,D		
8	DRY CR AT MOUTH	E PINE CR	113	C,D		
8	MARBLE CREEK		99	D,E		
8	SALMON CR AT MOUTH	POWDER R	97	D,E		
8	KILLAMACUE CREEK		85	D,F		
8	DUTCH FLAT CREEK		57	D,F		
8	LAKE FK C AB ELK CR	N PINE CR	34	D,F		
8	SPRING CREEK	LITTLE EAGLE CR	33	D,E		
8	WEST EAGLE CREEK		32	D		
8	GOODRICH CREEK		31			
8	WILLOW CR AT MOUTH	POWDER R	23			
8	SPRING CREEK	SALMON CR	22	D,E		
8	WASHINGTON GULCH	SALMON CR	21			
9	Willow Creek		235	D	Yes, Willow Cr above reservoir and nr Brogan.	
9	Malheur River		97	D	Yes, on diversions to WSID, VOID, and HSSID.	
9	Jordan Creek		65	D	Yes. Stream gage near state line.	
9	Indian Fort Creek		56	C	No	
9	Cow Creek		42	D	Yes. Stream gage near state line and near Downey Canyon	
9	Oregon Canyon Creek		30	C	Yes. Seasonal stream gage	

	High Regulatory Streams					
District	Name	Description	# of Regs	Q3 Cause ?	Q4 Additional monitoring?	Q5 alternate?
10	Silvies River	(including West Fork)	483	D	Yes. Telemetry equipped stream gage	
10	East Fork Silvies River		317	D	Yes. Telemetry equipped stream gage	
10	Silver Creek		69	D	Yes. Telemetry equipped stream gage	
10	Poison Creek		25	D	Yes. Staff gage with rating curve development	
10	Kueny Ditch		24	C	No	
11	Deschutes River		1691	A, D	No	
11	Whychus Creek	> Deschutes R	702	A, D	No	
11	Crooked River	> Deschutes R	371	D	Yes	measurement devices
11	Mill Creek	> Crooked R	268	D	No	
11	Ochoco Creek	> Crooked R	228	D	No	
11	Lake Creek	> Metolius	206	C	No	
11	Tumalo Creek	> Deschutes R	135	A,D	No	
11	Little Deschutes River	> Deschutes R	101	B,D	No	
11	Paulina Creek	> Little Deschutes R	95	A,B	No	
11	South Fork Lake Creek	> Metolius	79	C	No	
11	McKay Creek	> Crooked R	64	D	No	
11	South Fork Crooked River	> Crooked R	56	C	No	End of summer, numerous calls
11	Newsome Creek	> Crooked R	35	C	No	
11	Melvin Creek		32	E	No	
11	Wolf Creek	> Beaver Cr > Crooked R	31	C,D	No	
11	Indian Ford	> Whychus	30	A,E	Yes	gage btwn Hwy 20 and Knapp Diversion
11	Jack Creek	> Metolius	29	B,D	No	
11	Trout Creek	> Deschutes R	28	A,D	No	
11	Mud Springs Creek	> Trout Cr	22	A,E	No	
12	Silver Creek		69	C		
12	Greaser Canyon		58	C		
12	Cottonwood Creek		55	C		
12	Thomas Creek		36	C		
13	EVANS CREEK		432	D	nr mouth (in process)	
13	LITTLE AP AT MOUTH	APPLEGATE	324	D	nr mouth (in process)	
13	APPLEGATE RIVER		81	D	none	
13	LITTLE BUTTE CREEK		62	D	none	
13	BEAR CR AT MOUTH	ROGUE R	48	D	none	
13	NEIL CREEK		39	D	none	
13	ROGUE RIVER		34	D	none	
14	Williams Creek	> Applegate R	256	A, D	Yes, stream gage	mmt devices/head gates
14	West Fork Williams Creek	> Williams Cr	113	C, D, E (illegal use)		mmt devices/head gates
14	East Fork Williams Creek	> Williams Cr	97	C, D, E		mmt devices/head gates
14	Applegate River	> Rogue R	81	B		
14	Sucker Creek	> EF Illinois R	45	D	Yes, telemetry upgrade to gage	
14	Munger Creek	> WF Williams Cr> Williams Cr >	37	B	Yes	Weir (intalled)
14	Draper Cr	> Deer Cr > Illinois R		D		
14	Coyote Cr	> Wolf Cr > Graves Cr		D		
15	South Umpqua River		1161	A		
15	South Myrtle Creek		424	A,D	Yes, additional gage.	
15	Calapooya Creek		335	A,D		
15	Cow Creek		253	A		
15	Billy Creek		93	A		
15	Elk Creek		72	A		
15	Quines Creek		60	A,D		
15	Lookingglass Creek		59	A,D		

	High Regulatory Streams					
District	Name	Description	# of Regs	Q3 Cause ?	Q4 Additional monitoring?	Q5 alternate?
15	Pass Creek		45	A		
15	South Fork Deer Creek		36	A	ISWR regulation	
15	Days Creek		34	A		
15	Elk Creek		28	A		
15	North Fork Deer Creek		21	A	ISWR regulation	
15	North Myrtle Creek			A	Add - Yes, additional gage.	
16	Butte Creek		325	A, D		
16	Pudding River		313	A, D		
16	Abiqua Creek		175	A	(A) Given added resources. SWCD operates gage.	
16	Luckiamute River		77	A		
16	Silver Creek		40	A, D	(A) Given added resources. SWCD operates gage.	
16	Rickreall Creek		25	A, D		
17	Annie Creek	> Wood River	168	D	stream gage @ NP boundary	measuring devices onPODs.
17	Fourmile Creek	> UKL	106	C	no	
17	Sevenmile Ditch	> UKL	64	B		measuring devices on problem PODs. Staff gage
17	Blue Creek	> Sevenmile	44	C	no	
17	North Fork Sprague River	> Sprague	20	B		mmt devices on two main diversions
17	South Fork Sprague River	> Sprague	14	D	stream gage ~ 3mile abv mouth	
18	GALES CREEK	TUALATIN	949	D		
18	TUALATIN AT MOUTH	WILLAMETT	606	D		
18	SCOGGINS AT MOUTH	TUALATIN	146	D		
18	EAST FORK DAIRY CREEK	DAIRY CR	145	D		
18	MCKAY CR AT MOUTH	DAIRY CR	122	D		
18	CARPENTER CREEK		91	D		
18	SAIN CREEK		44	D		
18	FANNO CREEK	TUALATIN	34	D		
18	WEST FORK DAIRY CREEK	DAIRY CR	29	D		
18	DAIRY CREEK	TUALATIN	28	D		
19	North Fork Coquille River		122	D	No	
19	Winchuck River		24	D	No	
19	Chetco River		20	D	No	
20	Milk Creek		186	A,C,E		
20	Clear Creek		113	A		
20	Beaver Creek		106	D		
20	Deep Creek		100	A		
20	Tickle Creek		65	A		
20	Molalla River		53	A,E	complaint driven	
20	North Fork Deep Creek		48	A		
20	Clackamas		37	E		
20	Sandy River		26	E		
20	Woodcock Creek		20	C,E		

Table III: Water Availability Analysis. Streams with Zero Expected Flow in Summer (Consumptive Use > Natural Flow)

Zero Expected Flow (Natural Flow - Consumptive Use)								
					Q6 Seasonal			
District	Stream Name	Description	Tributary to	EXP_Q	Yes	No	Q7 Additional monitoring ?	Q8 Alternate?
1	BEAR CR AT MOUTH		COLUMBIA	-6		F, G	No	
1	BIG CR AT MOUTH		PACIFIC O	-6		F, G	No	
1	CRESCENT AT MOUTH		PACIFIC O	0		F, G	No	
1	FALL CR AT MOUTH		PACIFIC O	0		F, G	No	
1	FAWCETT C AT MOUTH		TILLAMOOK	-23		F, G	No	
1	JETTY CR AB MOUTH		NEHALEM B	0		F, G	No	
1	JOHNSON C AT MOUTH		PACIFIC O	-3		F, G	No	
1	KILLAM CR AT MOUTH		TILLAMOOK	-3	A		No	
1	LEWIS AND AB HECKAR		YOUNGS BA	-11	A		New Gage nr town of Lewis and Clark	No
1	LEWIS AND AT MOUTH		YOUNGS BA	-10	A		New Gage nr town of Lewis and Clark	No
1	ROCKY CR AT MOUTH		PACIFIC O	-6		F, G	No	
1	S FK NECA AT MOUTH		NECANICUM	-1		F, G	No	
1	SHORT CR AT MOUTH		PACIFIC O	-2		F, G	No	
1	SIMMONS C AT MOUTH		TILLAMOOK	0		F, G	No	
1	SPRING L AT MOUTH		PACIFIC O	0		F, G	No	
1	TILLAMOOK AB BEAVER		TILLAMOOK	-16	A		New Gage near Tillamook	No
1	TILLAMOOK AB BEWLEY		TILLAMOOK	-19	A		New Gage near Tillamook	No
1	TILLAMOOK AT MOUTH		TILLAMOOK	-18	A	F, G	New Gage near Tillamook	No
1	YOUNGS R AB KLASKA		YOUNGS BA	-44		F, G	No	
1	YOUNGS R AB MOOSMO		YOUNGS BA	-44		F, G	No	
1	YOUNGS R AT MOUTH		YOUNGS BA	-23		F, G	No	
2	None Found w/ Zero Expected Flow							
3	HOOD R AT RM 0.7		COLUMBIA	-179		f,g,h	No	
3	DEAD POIN AT MOUTH		W FK HOOD	-23		f, g, h	No	
3	DRY CR AT MOUTH		COLUMBIA	-11		f, g, h	No	
3	LAKE BR AT MOUTH		W FK HOOD	-4		f, g, h	No	
3	DITCH CR AT MOUTH		HOOD R	-3		f, g, h	No	
3	BUCK HOL AT MOUTH		DESCHUTES	-2		f, g, h	No	
3	N FK MILL AT MOUTH		MILL CR	0		f, g, h	No	
3	NEAL CR AT MOUTH		HOOD R	1		f, g, h	No	
4	INDIAN CR	AB LITTLE	JOHN DAY	-25	D, E		Yes, gage at mouth	
4	INDIAN CR	AT MOUTH	JOHN DAY	-22	D,E		Yes, gage at mouth	
4	COTTONWOO	AT MOUTH	N FK JOHN	-11	B			mmt devices
4	FOX CR	AT MOUTH	COTTONWOC	-11		G		
4	STRAWBERR	AT MOUTH	JOHN DAY	-4	D			
4	ROBERTS C	AT MOUTH	JOHN DAY	-3		G		
4	MOUNTAIN	AT MOUTH	ROCK CR	-2	C,D			
4	GRAHAM CR	AT MOUTH	JOHN DAY	-2		G		
4	BEECH CR	AT MOUTH	JOHN DAY	-1		F		
4	DIXIE CR	AT MOUTH	JOHN DAY	-1	C,D			
4	RILEY CR	AT MOUTH	JOHN DAY	0		G		
4	OWENS CR	AT MOUTH	CAMAS CR	0		G		
5	UMATILLA AB MCKAY		COLUMBIA	-435		H		
5	WALLA WAL AB LITTLE		COLUMBIA	-104		G,H		
5	UMATILLA RIVER		COLUMBIA	-92	D			
5	UMATILLA AB UNN ST		COLUMBIA	-60		H		
5	WALLA WAL AB BIRCH		COLUMBIA	-52		G		

Zero Expected Flow (Natural Flow - Consumptive Use)								
					Q6 Seasonal			
District	Stream Name	Description	Tributary to	EXP_Q	Yes	No	Q7 Additional monitoring ?	Q8 Alternate?
5	N FK UMAT AT MOUTH		UMATILLA	-34		G,H		
5	PINE CR AB DRY CR		WALLA WAL	-25	D			
5	WILDHORSE AT MOUTH		UMATILLA	-20	D			
5	BIRCH CREEK		UMATILLA	-14	D			
5	PINE CR AT MOUTH		WALLA WAL	-11	D			
5	COUSE CR AT MOUTH		WALLA WAL	-5	D			
5	BUTTER CREEK		UMATILLA	-3	D			
5	DRY CR AT MOUTH		PINE CR	-3	D			
5	MCKAY CR AT MOUTH		UMATILLA	-3	D			
6	WALLOWA R AB PRAIRI		GRANDE RO	-25		G		
6	LITTLE SH AB THREEB		BIG SHEEP	-18		G		
6	PRAIRIE C AT MOUTH		WALLOWA R	-18	C		No	
6	LITTLE SH AT MOUTH		BIG SHEEP	-17		G		
6	HURRICANE AT MOUTH		WALLOWA R	-17		G		
6	WALLOWA R AB LOSTIN		GRANDE RO	-7	C		No	
6	BEAVER CR AT MOUTH		GRANDE RO	-2		G		
6	WILLOW CR AT MOUTH		GRANDE RO	-1	C,D		No	
6	WILLOW CR AB MILL C		GRANDE RO	-1	C,D		No	
6	BEAR CR AT MOUTH		WALLOWA R	0	C		No	
6	LITTLE CR AT MOUTH		CATHERINE	0	D		No	
6	PYLES CR AT MOUTH		CATHERINE	0		G		
6	CROW CR AT MOUTH		JOSEPH CR	0		G		
6	CROW CR AB ELK CR		JOSEPH CR	0		G		
8	WILLOW CR AT MOUTH		POWDER R					
8	SALMON CR AT MOUTH		POWDER R		D			
8	ROCK CR AT MOUTH		POWDER R		D			
8	POWDER R AT MOUTH		SNAKE R		D			
8	POWDER R AB ROCK C		SNAKE R		D			
8	POWDER R AB GOOSE		SNAKE R		D		Stream Gage	
8	POWDER R AB EAGLE		SNAKE R		D			
8	POWDER R AB CLEAR		SNAKE R		D			
8	POWDER R AB BEAVER		SNAKE R		D			
8	N POWDER AT MOUTH		POWDER R		D			
8	N POWDER AB ANTHON		POWDER R		D			
8	LAKE FK C AB ELK CR		N PINE CR		D			
8	EAST PINE CREEK		PINE CR		D			
8	DRY CR AT MOUTH		E PINE CR		C,D			
9	OWYHEE R	AT MOUTH	SNAKE R	-1060		H		
9	MALHEUR R	AT MOUTH	SNAKE R	-420	D		Yes, on diversions to WSID, VOID, and HSSID.	
9	MALHEUR R	AB HOG CR	SNAKE R	-375	D		Yes, on diversions to WSID, VOID, and HSSID.	
9	WILLOW CR	AT MOUTH	MALHEUR R	-52	D			
9	BULLY CR	AT MOUTH	MALHEUR R	-36	D			
9	WILLOW CR	AB GUM CR	MALHEUR R	-35	D		Yes, Willow Cr nr Brogan.	
9	WILLOW CR	AB COW CR	MALHEUR R	-13	D		Yes, Willow Cr near Malheur (above reservoir)	
9	BULLY CR	AB UNN ST	MALHEUR R	-3	D		Yes, Bully Cr nr Westfall	
9	BULLY CR	AB CLOVER	MALHEUR R	-1	D		Yes, Bully Cr nr Westfall	
9	INDIAN CR	AT MOUTH	BULLY CR	-1	D			
9	WARM SPRI	AB BENDIR	N FK MALH	0		G		
9	BENDIRE C	AT MOUTH	WARM SPRI	0		G		
9	NEGRO ROC	AT MOUTH	SAND HOL	0		G		

Zero Expected Flow (Natural Flow - Consumptive Use)								
					Q6 Seasonal			
District	Stream Name	Description	Tributary to	EXP_Q	Yes	No	Q7 Additional monitoring ?	Q8 Alternate?
9	DRY CR	AT MOUTH	BULLY CR	0	D			
9	CLOVER CR	AT MOUTH	BULLY CR	0	D		Yes, Bully Cr nr Westfall	
9	N CLOVER	AT MOUTH	CLOVER CR	0	D		Yes, Bully Cr nr Westfall	
9	S FK INDI	AT MOUTH	INDIAN CR	0	D			
9	BASIN CR	AT MOUTH	WILLOW CR	0	D			
9	GROUSE CR	AT MOUTH	WILLOW CR	0	D			
9	WILLOW CR	AB LONG C	MALHEUR R	0	D		Yes, Willow Cr above reservoir.	
9	JOHNSON B	AT MOUTH	WILLOW CR	0	D			
9	WILLOW CR	AB S WILL	MALHEUR R	0	D			
10	W FK SILV	AT MOUTH	MALHEUR L	-34	D		Yes. Telemetry equipped stream gage	
10	SILVER CR	AB UNN ST	HARNEY L	-10	D		Yes. Telemetry equipped stream gage	
10	SOLDIER C	AT MOUTH	POISON CR	-7	D			
10	NINEMILE	AT MOUTH	MALHEUR S	-6	D			
10	MALHEUR S	AB NINEMI	MALHEUR L	-3	D			
10	CHICKAHOM	AT MOUTH	SILVER CR	-1		G		
10	GRANITE C	AT MOUTH	S FK MALH	-1		G		
10	INDIAN CR	AT MOUTH	S FK MALH	-1		G		
10	LITTLE MU	AT MOUTH	MALHEUR R	-1		G		
10	POISON CR	AT MOUTH	NINEMILE	-1	D		Yes. Staff gage w/ rating curve	
10	STINKINGW	AT MOUTH	MALHEUR R	-1		G		
10	WILLOW CR	AT MOUTH	ALVORD DE	-1				
10	CRANE CR	AT MOUTH	S FK MALH	0				
10	DRY KRUMB	AT MOUTH	KRUMBO CR	0		G		
10	DUCK CR	AT MOUTH	WOLF CR	0				
10	GRIFFIN C	AT MOUTH	MALHEUR R	0				
10	HOT SPRIN	AT MOUTH	MALHEUR S	0	D			
10	LITTLE CR	AT MOUTH	CRANE CR	0				
10	LITTLE ST	AT MOUTH	STINKINGW	0				
10	OTIS CR	AB COTTON	MALHEUR R	0				
10	S FK MALH	AB SWAMP	MALHEUR R	0				
10	S FK MALH	AB GRANIT	MALHEUR R	0				
10	SCOTTY CR	AT MOUTH	SILVIES R	0				
10	SILVER CR	AB MILLER	HARNEY L	0	D		Yes. Telemetry equipped stream gage	
10	VIRGINIA	AT MOUTH	SILVER CR	0		?		
10	WILDHORSE	AT MOUTH	ALVORD L	0	D		Yes. Telemetry equipped stream gage	
11	DESCHUTES	AB TUMALO	COLUMBIA	-827	D		NO	Storage releases augment flow
11	CROOKED R	AB OSBORN	DESCHUTES	-368	D		NO	Storage releases augment flow
11	DESCHUTES	AB LITTLE	COLUMBIA	-272		H	NO	Storage releases augment flow
11	CROOKED R	AB DRY R	DESCHUTES	-266	D		YES	measurement devices
11	DESCHUTES	AB SPRING	COLUMBIA	-202		H	NO	Storage releases augment flow
11	OCHOCO CR	ABV RESERVOIR	CROOKED R	-89	D		NO	
11	TUMALO CR	AT MOUTH	DESCHUTES	-39	D		NO	
11	TROUT CR	AT MOUTH	DESCHUTES	-19	D		NO	
11	HAY CR	AT MOUTH	TROUT CR	-9		G	NO	
11	DRY R	AT MOUTH	CROOKED R	-7	C		NO	
11	JOHNSON C	AT MOUTH	N FK CROO	-6		G	NO	
11	N FK CROO	AB DEEP C	CROOKED R	-4		G	NO	
11	MCKAY CR	AT MOUTH	CROOKED R	-4	B,C,D		NO	regulation occurs abv Ochoco Feed Cn
11	TROUT CR	AB ANTELO	DESCHUTES	-3		G	NO	regulation is managed by landowners
11	MUD SPRIN	AT MOUTH	TROUT CR	-3		G	NO	

Zero Expected Flow (Natural Flow - Consumptive Use)								
					Q6 Seasonal			
District	Stream Name	Description	Tributary to	EXP_Q	Yes	No	Q7 Additional monitoring ?	Q8 Alternate?
11	WILLOW CR	AT MOUTH	DESCHUTES	-2		G	NO	
11	N FK CROO	AB JOHNSO	CROOKED R	-1		G	NO	
11	MCKAY CR	AB ALLEN	CROOKED R	-1		G	NO	
11	ALLEN CR	AT MOUTH	MCKAY CR	-1		G	NO	
11	BEAR CR	AT MOUTH	CROOKED R	-1	D		YES	mmt device on lower diversion
11	ANTELOPE	AT MOUTH	TROUT CR	-1		G	NO	
11	PETERSON	AT MOUTH	N FK CROO	0		G	NO	
11	LITTLE MC	AT MOUTH	MCKAY CR	0		G	NO	
11	BEAVER CR	AT MOUTH	CROOKED R	0	D		NO	
11	CAMP CR	AT MOUTH	CROOKED R	0		G	NO	
12	DEEP CR	DEEP CR AT MOUTH	CRUMP L	-23		F		
12	TWENTYMIL	TWENTYMIL AT MOUTH	CRUMP L	-12		F		
12	DREWS CR	DREWS CR AT MOUTH	GOOSE L	-11	D			
12	THOMAS CR	THOMAS CR AT MOUTH	GOOSE L	-10	D			
12	COTTONWOO	COTTONWOO AT MOUTH	THOMAS CR	-7	D			
12	THOMAS CR	THOMAS CR AB CAMP C	GOOSE L	-1		G		
12	ANTELOPE	ANTELOPE AT MOUTH	GOOSE L	-1		G		
12	DRY CR	DRY CR AT MOUTH	GOOSE L	0		G		
12	HONEY CR	HONEY CR AT MOUTH	HART L	0	D			
12	CAMP CR	CAMP CR AT MOUTH	THOMAS CR	1	D			
13	BIG BUTTE AB MOUTH		ROGUE R	-167		F	none	
13	S FK ROGU AB M FK R		ROGUE R	-73		G, I	none	
13	BEAR CR AT MOUTH		ROGUE R	-56	D		none	
13	EMIGRANT AT MOUTH		BEAR CR	-49	D		none	
13	DEAD INDI AT MOUTH		S FK LITT	-22		G, I	none	
13	LITTLE AP AB YALE C		APPLEGATE	-22	A, D		nr mouth (in process)	
13	LITTLE AP AT MOUTH		APPLEGATE	-20	A, D		nr mouth (in process)	
13	DEAD INDI AB CONDE		S FK LITT	-19		G, I	none	
13	DALEY CR AT MOUTH		BEAVER DA	-17		G, I	none	
13	JACKSON C AT MOUTH		BEAR CR	-5		G, I	none	
13	RED BLANK AT MOUTH		M FK ROGU	-4		G, I	none	
13	WAGNER CR AT MOUTH		BEAR CR	-2	D		Wagner Cr @ Mouth	
13	THOMPSON AT MOUTH		APPLEGATE	-1	D		none	
13	KEENE CR AT MOUTH		JENNY CR	0		G, I	none	
13	PLEASANT AT MOUTH		EVANS CR	0	D		Evans Cr nr mouth	
13	SNIDER CR AT MOUTH		ROGUE R	0		G, I	none	
13	M FK ROGU AT MOUTH		S FK ROGU	3		G, I	none	
13	S FK ROGU AT MOUTH		ROGUE R	23		G, I	none	
14	WILLIAMS AT MOUTH		APPLEGATE	-6	A, D		Yes	mmt devices/head gates
14	E FK WILL AT MOUTH		WILLIAMS	-1	E (illegal use)		Yes	mmt devices/head gates
14	W FK WILL AT MOUTH		WILLIAMS	-1	C, D, E		Yes	mmt devices/head gates
14	SLATE CR AT MOUTH		APPLEGATE	0		G		
15	LOOKINGGL	AB MORGAN	S UMPQUA	-4	A,D			
15	OLALLA CR	AB TENMIL	LOOKINGGL	-3	A, D			
15	ELK CR	AB PASS C	UMPQUA R	-2	A,D			
15	LOOKINGGL	AT MOUTH	S UMPQUA	-2	A,D			
15	BILLY CR	AT MOUTH	ELK CR	-1	A			
15	ELK CR	AB BRUSH	UMPQUA R	-1	A,D			
15	WINDY CR	AT MOUTH	COW CR	-1	A,D			

Zero Expected Flow (Natural Flow - Consumptive Use)								
					Q6 Seasonal			
District	Stream Name	Description	Tributary to	EXP_Q	Yes	No	Q7 Additional monitoring ?	Q8 Alternate?
15	N MYRTLE	AT MOUTH	MYRTLE CR	0	A,D			
15	S FK DEER	AT MOUTH	DEER CR	0	A,D			
15	QUINES CR	AT MOUTH	COW CR	0	A,D			
15	STARVEOUT CR	AT MOUTH	COW CR	0	A,D			
15	MORGAN CR	AT MOUTH	LOOKINGGLA	0	A,D			
15	TENMILE CR	AT MOUTH	LOOKINGGLA	0	A,D			
16	MILL CR AT MOUTH	WILLAMETT		-50	B			
16	YAMHILL R AT MOUTH	WILLAMETT		-14	A,B			
16	HASKINS C AT MOUTH	N YAMHILL		-13		H		
16	PUDDING R AB MILL C	MOLALLA R		-8	A,D			
16	SALT CR AT MOUTH	S YAMHILL		-7	C			
16	PUDDING R AB HOWELL	MOLALLA R		-6	A,D			
16	MILL CR AT MOUTH	PUDDING R		-6		G		
16	ABIQUA CR AT MOUTH	PUDDING R		-5	D		Yes. New gage. (SWCD operates gage, but needs improvements)	
16	GREASY CR AT MOUTH	MARYS R		-5		G		
16	RICKREALL AT MOUTH	WILLAMETT		-5	A, D			
16	YAMHILL R AB PALMER	WILLAMETT		-1	A, E			
16	MUDDY CR AB EVERGR	MARYS R		-1	D			
16	N YAMHILL AT MOUTH	YAMHILL R		0	A			
16	BUTTE CR			-----	A, D		Yes. New gage. (SWCD operates gage, but needs improvements)	
17	Jenny Creek		> upper Klamath R		D			Restrictor nozzles
17	Williamson River @ Kirk		> UKL			G		
17	Williamson River abv Spring Cr		> UKL			G		
17	Keene Cr		> Jenny Cr			G		
18	TUALATIN AT MOUTH		WILLAMETT	-233	D			
18	TUALATIN NR BUTTERNUT CR		WILLAMETT	-221	D			
18	SCOGGINS AT MOUTH		TUALATIN	-138	D			
18	MILTON CR AT MOUTH		SCAPPOOSE	-73		G		
18	MILTON CR AB SALMON		SCAPPOOSE	-44		G		
18	DAIRY CREEK		TUALATIN	-42	D			
18	FANNO CREEK		TUALATIN	-25	D			
18	GALES CREEK		TUALATIN	-20	D			
18	WEST FORK DAIRY CREEK		DAIRY CR	-18	D			
18	S SCAPPOO AT MOUTH		SCAPPOOSE	-5		G		
18	MCKAY CR AT MOUTH		DAIRY CR	-4	A			
18	FOX CR AT MOUTH		COLUMBIA	-4		I		
18	MCFEE CR AT MOUTH		TUALATIN	-2		G		
18	MCFEE CREEK AB GULF C		TUALATIN	-1		G		
18	S SCAPPOO AB RAYMON		SCAPPOOSE	-1		G		
18	GOBLE CR AT MOUTH		COLUMBIA	0		G		
19	PONY CR	PONY CR AT MOUTH	PONY SL	-28		I		Coos/bay N. Bend water board single users. Have storage on
19	FERRY CR	FERRY CR AT MOUTH	COQUILLE	-11		G		Bandon. Junior users upstream
19	WINCHESTE	WINCHESTE AT MOUTH	SOUTH SL	-7		G		Gage on. Coos/Bay N. Bend water board. Unused water right
19	RINK CR	RINK CR AT MOUTH	COQUILLE	-7		G		measure in the summer. Miscellaneous mmt. City of Coquille….takes water out of Coquille R
19	JOE NEY S	JOE NEY S AT MOUTH	SOUTH SL	-7		G		Coos By. N. Bend Res. Pony Cr reservoir

Zero Expected Flow (Natural Flow - Consumptive Use)								
					Q6 Seasonal			
District	Stream Name	Description	Tributary to	EXP_Q	Yes	No	Q7 Additional monitoring ?	Q8 Alternate?
19	WILLOW CR	WILLOW CR AT MOUTH	FLORAS CR	-1		G		measure in the summer. 75 cfs of water rights on Floras Cr…..down to 4-5 cfs in summer time. Oldest right 5 cfs for irrigation.
19	BIG CR	BIG CR AT MOUTH	SUNSET BA	0		G		gage on here Coos/Bay N. Bend unused water rights
19	EEL CR	EEL CR AT MOUTH	TENMILE C	0		G		comes out of EEL lake
19	DAVIS CR	DAVIS CR AT MOUTH	CROFT L	0		G		mmt in summer. Lots of cranberry use.
20	CHENEY CR	@ Mouth	Salmon R	-21		G,I		
20	TICKLE CR	@ Mouth	Deep Cr	0	A			
20	BULL RUN	@ Mouth	Sandy R	0		G,I		

Table IV: Major Diversions. Largest diversions as identified by Watermaster or Water Rights Information System (WRIS)

	Major diversions			Monitoring Method					
District	User	Associated Stream	Acres or CFS	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade or Notes?
1	City of Seaside	Necanicum R			B(OTHER)				
1	City of Astorica	Bear Cr / Cedar Creek			B(OTHER)				
1	City of Cannon Beach	W Fk Elk Cr			B(OTHER)				
1	City of Nehalem	Bobs Cr			B(OTHER)				
1	City of Lincln City	Schooner Cr			B(OTHER)				
1	City of Newport	Siletz R / Big Cr			B(OTHER)				
1	City of Siletz	Siletz R / Big Cr			B(OTHER)				
1	City of Toledo	Siletz R / Mill Cr			B(OTHER)				
1	City of Tillamook	Killiam / Fawcett Cr			B(OTHER)				
1	City of Waldport	Weist Cr			B(OTHER)				
1	City of Yachats	Salmon Cr/ Reedy Cr			B(OTHER)				
1	City of Warrenton	Lewis & Clark River			B(OTHER)				
2	Eugene Water Electric Board	McKenzie		A (Other)				K	ISWR always met
2	Springfield Utility Board	wells							Water Supply from Well Fields
2	Sweet Home	S. Santiam		A (Other)				K	ISWR always met
2	Albany Santiam Canal	S. Santiam	275 cfs	A					City of Albany, part of hydro electric. (85 cfs) transferred to for flow augmentation is 5 small tributaries to Willamette and Calapooia near Albany. 190 cfs reamains for hydro generation in winter and spring; 85 cfs helps with carry fresh water through 11 miles of canal to deliver fresh water to old treatment plant, 50 cfs of municipal rights.
2	LaComb ID	Crabtree Cr	65 cfs hydro, 30 irrig			C	F, ODFW		(A) sesonal gage or staff plate. Senior to ISWR, but sometimes out of compliance. Report annually. Irrig and hydro not additive.
2	Muddy Cr Irrigaiton Association	McKenzie	60 cfs		B			K	Weir. Report water use. Never out of compliance. Senior live flow rights and storage rights and ISWR always met
2	Crewsell Irrigation Association	Coast Fk Willamette	4 cfs				F		Defunct association, but still diverts. No complaints. Monitoring under consideration. ISWR always met
2	Junction Water Improvement District	Long Tom R			B (Other)			K	Weir. Report water use. Never out of compliance. Senior live flow rights and storage rights and no effect ISWR. Real time gaging above and below diversion. Target flows for Long Tom Cr in Monroe and USACOE able to meet. Release is in excess of natural flows (Fern Ridge).
2	Oakridge	M Fk Willamette			B (Other)				
2	Cottage Grove	Layng Cr Row River			B (Other)				
2	Lebanon	S. Santiam			B (Other)				
2	Albany	S. Santiam			B (Other)				
3	Farmers Irrigation District	Hood River	5878			B(OTHER)			
3	East Fk Irrigation District	E Fk Hood R	9610	A					
3	Middle Fk Irrigation District	M Fk Hood R	6112			B(OTHER)			
3	Mt Hood Irrigation District		1018					J	MHID historically has not been monitored although we have had discussions about how to effectively do this.
3	Dee Irrigation District	W Fk Hood R	889	A					
3	The Dalles Irrigation District	Columbia R	6000			B(OTHER)			
3	Juniper Flat Improvement District	White River				B(OTHER)			
3	Badger Improvement District	Tygh Creek			B				A
3	Pine Hollow Cooperative	Tygh Creek			B				
3	Round Prairie Cooperative	Threemile.						J	
3	Orchard Ridge Ditch	Fifteenmile Cr				C			
3	Powerplant	Hood River						X	Diversion structure damaged in flood

	Major diversions			Monitoring Method					
District	User	Associated Stream	Acres or CFS	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade or Notes?
4	Old Settler Ditch	Upper John Day	14			C			
4	Power Mill Ditch	Strawbery Cr	14			C			upgrade to telemetry
4	Luce Long Ditch	Upper John Day	6			C			
4	Enterprise Ditch	Upper John Day	24			C			
4	Panama Ditch	Upper John Day	20			C			
4	Eddington Ditche	Upper John Day	7			C			
4	Blue Mtn. Ditch	Upper John Day	8			C			
4	Home Ranch Ditch	Upper John Day	6			C			
4	Old Thomas Ditch	Upper John Day	6			C			
5	Walla Walla Irrigation District	Walla Walla R			B				
5	Hudson Bay District Improvement	Walla Walla R		A					
5	West Extension Irrigation District	Umatilla R		A					
5	Hermiston Irrigation District	Umatilla R		A					
5	Stanfield Irrigation District	Umatilla R		A					
5	Westland Irrigation District	Umatilla R		A					
6	Wallowa Valley Improvement District	Little Sheep, Big Sheep, Prairie Cr					D		
6	Associated Ditch Companies	Wallowa					C		
6	Lostine Ditches	Lostine					C, D		
6	Diamond Prairies Ditch	Bear					C		
6	Lower Valley Improvement District	Wallowa					C		
6	~40 Wallowa Ditches	Wallowa	(5-20)				D		
6	Beck Irrigation District	Grande Ronde				C			
6	~ 40 others Grande Ronde Ditches	Grande Ronde	(> 5)			C, D			
6	Catherine Users	Catherine Cr				C			Real time gages on Catherine Cr aid in regulation.
6	Swack Hammer Ditch		(20)			C,D,E			
6	Godley One					C,E			
6	Cladwell Ditch	Mill Cr				C			
6	Selders Ditch	Mill Cr				C			
8	Baker Valley Irrigation District	Powder River				C		X	monitored by district staff for water use reporting requirements. Not monitored by OWRD
8	Lower Powder Irrigation District	Powder River				C		X	monitored by district staff for water use reporting requirements. Not monitored by OWRD
8	Powder Valley Water Control District	Wolf&Pilcher Creek, Powder River				C		X	monitored by district staff for water use reporting requirements. Not monitored by OWRD
8	Phillips Ingle Ditch Improvement Company	Goose and West Eagle Creeks				C		X	monitored by district staff for water use reporting requirements. Not monitored by OWRD
8	Burnt River Irrigation District	Burnt River			B*				Gages separate river into reaches for block reporing of water use. Not monitored by OWRD for regulation purposes.
9	Owyhee ID	Owyhee + Owyhee Res		A (OTHER)					All storage use. Very junior live flow right. No rate limit on storage. Duty limit difficult to exceed. WM has access to data, but no reason to examine.
9	South Board of Control	Owyhee + Owyhee Res		A (OTHER)					POD is from the Owyhee ID. Relies mostly on storage
9	Warms Springs ID	Malheur + 1/2 Warmsprings Res			B (OTHER)	D			(A)

	Major diversions			Monitoring Method					
District	User	Associated Stream	Acres or CFS	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade or Notes?
9	Vale Oregon ID	1/2 Warmsprings + Beulah + Bully Creek Res, Malheur and Willow Cr NF			B (OTHER)	D			(A). Mainly relies on storage. Few Senior users. No rate limit on storage. Never over duty. Upgrade to telemetry would help
9	Jordan Valley ID	Jordan Cr				D			relies on storage. Early regulation activity by senior live flow users
9	Orchard (Brogan) ID	Willow Cr + Malhuer Res				D			
9	Old Owyhee Ditch Improvement Di	Owyhee R				D			
9	Harper S. Side ID	Malheur R				D			(A)
10	Otis Valley Ditch Company	Cottonwood Creek & Reservoir							
10	Drewsey Ditch Company	Malhuer			D				Gages on West Fork Silvies
10	Island Ranch	Silver Cr			D				(A) Gage on Silver Cr, Weir on W Fk Silvies
10	Hotchkiss Cattle Company	Silver Cr			D				(A) Gage on Silver Cr
10	Blue Mountain Cattle Company	Silvies			D				(A) Gage on West Fork Silvies
10	Bell-A	Silvies			D				(A) Gage on West Fork Silvies
10	USFWS	Donner Und Blitzen		A					
10	USFWS	Silver Cr							Tail end of drainage
11	WALKER BASIN CN	Little Deschutes			B				
11	ARNOLD ID	Deschutes		A					
11	COID (CO CANAL)	Deschutes		A					
11	COID POWERPLANT	Deschutes			B(OTHER)			X	permit requirement 400 cfs minimum instream flow. Powerplant intermittent during winter depending on flows. Minimum flow always met in summer.
11	TID (BEND FEED CANAL)	Deschutes		A					
11	COID (NORTH CANAL)	Deschutes		A					
11	NORTH UNIT ID	Deschutes		A					
11	SWALLEY ID	Deschutes		A					
11	LONE PINE ID	Deschutes via North Canal			B				
11	TUMALO TOWN DITCH	Deschutes					C		ODFW
11	TID (TUMALO FEED CANAL)	Tumalo Cr		A					
11	CITY OF BEND	Tumalo Cr			B (OTHER)			X	Regulated during dry years by examing gage on Tumalo Cr and TID.
11	THREE SISTERS ID	Whychus Cr		A					
11	LEITHAUSER	Whychus Cr			C				
11	LAZY Z	Whychus Cr			C				
11	BAILEY-HAMMOND (SOKOL)	Whychus Cr			C				
11	EDGINGTON	Whychus Cr			C				
11	RUNCO	Whychus Cr			C				
11	MCCALLISTER	Whychus Cr			C				
11	PLAINVIEW	Whychus Cr						X	Typically ditch is on for a month, then shut-off for rest of year.
11	CITY	Whychus Cr			C				
11	PATTERSON	Whychus Cr			C				
11	CROOKED RIVER CENTRAL	Crooked R					C		mmt device being installed.
11	PEOPLES ID	Crooked R					C		mmt device being installed.
11	CROOKED RIVER FEED CN	Crooked R		A					
11	ELLIOTT (LOWLINE) DITC H	Crooked R					C		mmt device being installed.
11	BALDWIN DITCH	Crooked R					F		headgate present.
11	OCHOCO FEED CN	Ochoco Cr		A					

	Major diversions			Monitoring Method					
District	User	Associated Stream	Acres or CFS	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade or Notes?
12	Adel Water Users	20mile/Deep Cr				D			WR >> available flow
12	Hart Lake Water Users	Hart Lake/HoneyCr						K, J	multiple PODs. See storage monitoring upgrades
12	Lakeview Water Users	Cottonwood/Drews Res			B (Other)				Upgrade to type "A" (telemetry)
12	Bagley Ditch Company	Chewaucan			B (Other)				Upgrade to type "A" (telemetry)
12	Summer Lake ID	Ana R			B				Upgrade to type "A" (telemetry)
12	Silver Cr ID				B				For this gage to be meaningful, need to install gage below reservoir.
13	Eagle Point ID				B(OTHER)				
13	Talent ID				B(OTHER)				
13	Central Point ID				B(OTHER)				
13	Medford ID				B(OTHER)				
13	Wood ID				B(OTHER)				
14	Grants Pass Irrigation District	Rogue			B (OTHER)				Report water use annually
14	Fort Vanoy Irrigation District	Rogue				C			Report water use annually
14	Applegate/Rogue Irrigation District	Rogue						H	Has rprt requirement, but usually just reports rate
14	City of Cave Junction	E Fk Illinois R			B (OTHER)				
14	City of Grants Pass	Rogue			B (OTHER)				
14	Wilderville Water Use Association	Applegate R						H	
14	North Applegate Water Associatio	Applegate R				C			
14	Laurel Hill Ditch	Williams Cr/ Applegate R				C			(A) upgrade to stream gage with telemetry
14	Williams Creek Users	Williams Cr				D			Installing measurement Devices
14	Watts & Topping Ditch	Williams Cr				C			(A) upgrade to stream gage with telemetry
15	Lookingglass Olalla Water Control	Ben Irving Res			B(other)				relies on storage only
15	Sutherlin Water Control District	Plat I Res			B(other)				relies on storage only
15	Winston-Dillard Water District	S. Umpqua			B(other)				
15	Roberts Cr Water District	S. Umpqua			B(other)				
15	City of Riddle	S. Umpqua			B(other)				
15	Tri-City Water District	S. Umpqua			B(other)				
15	Umpqua Basin Water Association	N. Umpqua			B(other)				
15	City of Riddle	Cow Cr			B(other)				
15	City of Sutherlyn	Calaopooya Cr			B(other)				
15	Clarks Branch Water Association	S. Umpqua			B(other)				
15	City of Glendale	Cow Cr			B(other)				
15	City of Roseburg	N. Umpqua			B(other)				
15	S. Umpqua Water Association	Cow Cr			B(other)				
15	Superior Lumber	Windy Cr			B(other)				
15	Roseburge Forest Products	Cow Cr/S. Umpqua			B(other)				
15	Pacific Corp	N. Umpqua		A(other)					
16	City Of Salem	N. Santiam			B(OTHER)				always less than WR. also numerous wells
16	City of Stayton	N. Santiam			B(OTHER)				Includes Gardiner-Bennett Power Canal
16	East Valley Water District	Drift Cr						X	Application pending
16	Greenberry Irrigation District	Willamette	11000		B(OTHER)				storage contract water for about 11,000 acres. Live flow rights as well, staggered season.
16	Norpac Foods Inc.	N. Santiam			B(OTHER)				
16	Queener Irrigation Improvement Dis	N. Santiam	730		B(OTHER)				storage only (Detroit)
16	Santiam Water Control District	N. Santiam	17000	A(OTHER)					includes hydro facility. High visibility
16	Sidney Irrigation Cooperative	N. Santiam	2000					K	upgrade to stream gage or flow meter (1991 priority). No august diversion
16	Stayton Canning Co. Coop								part of City of Stayton diversion
16	Palmer Creek water district	Willamette	6150		B(OTHER)				storage contract as supplemental
16	City of Silverton	Silver Cr/ Abiqua Cr			B(OTHER)				always less than WR

	Major diversions			Monitoring Method					
District	User	Associated Stream	Acres or CFS	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade or Notes?
16	City of Dallas	Rickreal Cr			B(OTHER)				Applegate/Rockhouse/Canyon Creeks
16	City of Corvallis	Rock Cr / Willamette R			B(OTHER)				
17	Modoc ID	Williamson R			B(OTHER)				
17	A Cn (Klamath Project)	UKL		A					
17	North Cn (Klamath Project0	Klamath R		A(OTHER)					needs to be checked by WM
17	Lost River Diversion Cn (Klamath F	Klamath R			B(OTHER)				needs to be checked by WM
17	Ady Cn (Klamath Project)	Klamath R		A(OTHER)					needs to be checked by WM
17	Horsefly Irrigation District	Lost R						X	hydraulic eqn used. [A] needs upgrade to flow meters and stream gage
17	Langell Valley Irrigation District	Lost R						X	hydraulic eqn used. [A] needs upgrade to flow meters and stream gage
18	Tualatin Valley Irrigation District	Tualatin R		A(Other)					
18	Joint Water Commission	Tualatin R		A(Other)					
18	Lake Oswego Canal	Tualatin R			C				
18	Wapato Irrigation District	Tualatin R			D				A
18	City of Hillsboro	Tualatin R		A(Other)					
19	Lakeside	Eel Lake			B (OTHER)				
19	Coosbay/N. Bend Water Board	Winchester Cr/ Pony Cr			B (OTHER)				
19	City of Bandon	Ferry/Geiger Cr			B (OTHER)				
19	City of Port Orford	N Fk Hubbard Cr > Elk Cr > Sixes R			B (OTHER)				less than what they could take
19	Nesika Beach Water District	Greggs Cr. > Pacific Ocean			B (OTHER)				Water supply is mostly from wells.
19	Gold Beach	Rogue River			B (OTHER)				
19	Brookings	Chetco R & Ferry Cr > Chetco R			B (OTHER)				could take 20 cfs, but take abouit 7
19	City of Coquille	Coquille R & Rink Cr			B (OTHER)				
19	Myrtle Point	NF Coquille R			B (OTHER)				
19	Bridge Water District	Unnamed stream > M Fk Coquille			B (OTHER)				
19	Harbor Water Peoples Utility District	Chetco R			B (OTHER)				
20	City of Portland (?)	Bull Run > Sandy R			B (OTHER)			G, K	
20	City of Sandy	Alder Cr >> Sandy R			B (OTHER)			G, K	
20	Corbett Water District	Gordon Cr>> Sandy R			B (OTHER)			G, K	
20	Roslyn Lake Diversion				B (OTHER)			G, K	
20	Clackamas County Service District #1				B (OTHER)			G, K	
20	Clackamas River Water		18		B (OTHER)			G, K	
20	North Clackamas County Water Commission		8		B (OTHER)			G, K	
20	South Fork Water Board		13		B (OTHER)			G, K	
20	Lake Oswego Municipal Water		11		B (OTHER)			G, K	
20	City of Estacada		1		B (OTHER)			G, K	
20	City of Canby				B (OTHER)			G, K	
20	Mollala Water District				B (OTHER)			G, K	
20	Multnomah Water District				B (OTHER)			G, K	
20	Sauvie Island Water District				B (OTHER)			G, K	

Table V: Major Storage. Largest reservoirs as identified by Watermaster or Water Rights Information System (WRIS)

	Storage Facility			Storage Monitoring						Release Monitoring					
District	Storage Facility	Associated Stream	Capacity (if known)	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade?	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade?
1	Barney Reservoir	NF Trask R	20000		B						B				
1	McGuire Reservoir	Nestucca River	9790		B			K			B			K	
1	Bear Cr Reservoir	Bear Creek	2000												
1	Triangle Lake	Siuslaw River													
1	Youngs River Reservoir	Youngs River	12000					K						K	
2	Green Peter Lake	Middle Santiam		A						A					
2	Foster Lake	S. Santiam		A						A					
2	Blue River Lake	Blue R		A						A					
2	Cougar Res	S Fk McKenzie		A						A					
2	Smith Res	Smith R		A						A					
2	Trail Bridge Res	McKenzie						I						I	
2	Carmen Res	McKenzie						I						I	
2	Fall Creek Lake	Fall Cr		A						A					
2	Dexter Reservoir	MF Willamette R		A						A					
2	Hills Cr Lake	MF Willamette R		A						A					
2	Lookout Point Lake	MF Willamette R		A						A					
2	Dorena Lake	Row R		A						A					
2	Cottage Grove Lake	C FK Willamette R		A						A					
2	Fern Ridge Lake	Long Tom R		A						A					
2	Waldo Lake	N Fk M Fk Willamette R		Natural Lake. No active manipulation						Natural Lake. No active manipulation					
2	Triangle Lake	Lake Cr		Natural Lake. No active manipulation						Natural Lake. No active manipulation					
3	Laurance Lake	Clear Branch > M	3550		B(OTHER)						B(OTHER)				
3	Badger Lake	Badger Cr > Tygh	660					G			C				A
3	Pine Hollow Lake	Badger Cr >> Whi	4750					G			B				
3	Clear Lake	Clear Cr >> White	13060		B(OTHER)						B(OTHER)				
4	Rock Cr Lake	Rock Cr						J						J	
4	Fort Cr Res	Fort Cr						J						J	
4	Fupinno Cr Res	Fupinno Cr						J						J	
5	McKay Reservoir	McKay Cr	79000	A						A					
5	Cold Springs Reservoir	Off channel, Columbia/Umatilla R.	52200	A						A					
6	Wallowa Lake		15000					K						K	
6	Kinney Lake		315					K						K	
6	Minam Lake		1000					K						K	
6	La Grande Reservoir		510					K						K	
8	Thief Valley Reservoir	Powder River	13994	A(OTHER)						A					
8	Phillips Reservoir	Powder River	73000	A(OTHER)						A					
8	Wolf Creek Reservoir				B(OTHER)									X	
8	Pilcher Creek Reservoir				B(OTHER)									X	
8	Unity	Burnt River	25200	A(OTHER)						A					
9	Lake Owhyee	Owhyee R	715000	A (OTHER)						A (OTHER)					
9	Upper Cow Cr Lake	Cow Cr						F				D			
9	Lower Cow Cr Lake	Cow Cr						F				D			

	Storage Facility			Storage Monitoring						Release Monitoring					
District	Storage Facility	Associated Stream	Capacity (if known)	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade?	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade?
9	Antelope Reservoir	Jordan Cr	70000				D					D			
9	Warms Springs Reserv	Malhuer R	169639	A (OTHER)						A (OTHER)					
9	Beulah Reservoir	NF Malhuer R	59900	A (OTHER)						A (OTHER)					
9	Bully Cr Reservoir	Bully Cr	23676	A (OTHER)							C (OTHER)				
9	Willow Cr Reservoir	Willow Cr													
9	Malheur Reservoir			A (OTHER)						A (OTHER)					
10	Moon Reservoir	Silver Creek	5650			D					D				
10	Baca Lake	Donner und Blitzen (USFWS refuge)						K						K	
10	Krumbo L	Donner und Blitzen (USFWS refuge)	1660					K						K	
10	Cottonwood Reservoir	Cottonwood Creek	4500												
11	Prineville Res	Crooked	148640	A						A					
11	Wickiup Res	Deschutes	200000	A						A					
11	Crescent Lake Dam	Crescent Creek	86900	A						A					
11	Crane Prairie	Deschutes	55300	A						A					
11	Ochoco Reservoir	Ochoco Cr	44247	A						A					
11	Haystack Res	Deschutes via NUID	5600	A				X	internal to NUID					X	
11	Lake Billy Chinook	Deschutes	535000	A(OTHER)				X			B(OTHER)			X	
11	Lake Simtustus	Deschutes	37300	A(OTHER)				X			B(OTHER)			X	
11	Pelton Re-reg Res	Deschutes	4500	A(OTHER)				X		A				X	
12	Cottonwood Reservoir	Cottonwood Cr				D					B (OTHER)				
12	Drews Reservoir	Drews Cr		A							B (OTHER)				
12	Thompson Reservoir	Silver Cr						G						J	
12	Greaser Reservoir					C								E	
12	Crump Lake					D			A					N/A	
12	Hart Lake					D			A					N/A	
13	Four Mile Reservoir	Fourmile Cr									B				
13	Fish Lake	N Fk Little Butte Cr			B(OTHER)					A					
13	Howard Prairie Reservoir	Jenny Cr > Klamath R									B				
13	Hyatt Reservoir	Keene Cr > Jenny Cr									B				
13	Emigrant Reservoir	Emigrant Cr > Bear Cr > Rogue R			B(OTHER)					A					
13	Agate Reservoir	Off Channel > Antelope Cr			B(OTHER)					A					
14	None Identified														

	Storage Facility			Storage Monitoring						Release Monitoring					
District	Storage Facility	Associated Stream	Capacity (if known)	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade?	Real Time	Routine	Periodic	Complaint Driven	None	Upgrade?
15	Diamond Lake			A						A					
15	Lemolo Lake			A						A					
15	Toketee Lake				B (OTHER)					A					
15	Ben Irving				B (OTHER)						B (OTHER)				
15	Plat I					C					B (OTHER)				
15	Galesville Reservoir			A						A					
16	Detroit Lake	N Fk Santiam		A						A					
16	Silver Cr Reservoir	Silver Creek	2500												
16	Mission Cr Reservoir	Mission Creek	1590												
16	Mercer Reservoir	Rickreall Creek	1550		B(OTHER)						B (OTHER)				
17	Upper Klamath Lake	Link River	500000	A						A					
17	Gerber Reservoir	Miller Cr	123000	A(OTHER)							C				
17	Clear Lake	located in California													
18	Barney Reservoir	M Fk of N FK of Trask (out of basin)			B(OTHER)						C				
18	Henry Hagg Lake	Scoggins Cr		A(OTHER)						A(OTHER)					
19	Pony Cr Res	Pony Cr	6205		B(OTHER)			J			B(OTHER)			J	
20	Bull Run Reservoir #1	Bull Run > Sandy	33760	A				X		A				X	
20	Bull Run Reservoir #2	Bull Run > Sandy	21000	A				X		A				X	
20	Bull Run Lake	Bull Run > Sandy	14500	A				X		A				X	
20	Timothy Lake	Oak Groove Fk > (	81000	A				X		A				X	
20	N Fk Reservoir	Clackamas R	21000					X						X	

Table VI: Responses from second part of survey: Evaluation of “Management” labeled gages (from pre-evaluation “gage purpose” survey).

Field Responses, (1 = Yes, 0 = No), Do not consider water use reporting requirements. Answer each question sequentially. If you answer a question for a gage with a "0" (i.e., "NO" answer), then continue to the next question (i.e., next column). If you answer a question with a "1" (i.e., "YES" answer), then add comment to explain your answer and continue on to the questions for the next gage.																					
Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	v v v v v v v	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	v v v v v v v	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	v v v v v v v	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	v v v v v v v	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	v v v v v v v	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
14085300	SC	11	OCHOCO CR BL OCHOCO RES NR PRINEVILLE, OR	OWRD	0		0		0		N/A		0		0	The gage helps irrigation district manage reservoir releases to irrigation demand. ISWR is protested and demand < supply. Not used by OWRD for water management.	0	1
14118500	NC	3	W FK HOOD R NR DEE, OR	OWRD	0		0		0		N/A		0		0	ISWR's are sometimes not met in the summer months, but there is no regulation for the ISWRs. The gage gage is of some interest to other agencies. It is primarily used to monitor instream flows.	0	1
14134000	NW	20	SALMON R NR GOVERNMENT CAMP, OR	OWRD	0		0		0		N/A		0		1	This gage is high in the drainage and has virtually no withdrawls above it. It is an indicator station for water availabiltiy, modeling and is relied upon by OWRD and USFS.	0	1
14205000	NW	18	W FK DAIRY CR AT BANKS, OR	OWRD	0		0		0		N/A		0		0	ISWR but priority date is not regulated for	0	1
14205160	NW	18	W FK DAIRY CR @ EVERS RD	OWRD	0		0		0		N/A		0		0	ISWR but priority date is not regulated for	0	1
14205480	NW	18	E FK DAIRY CR NR MOUNTAINDALE, OR	OWRD	0		0		0		N/A		0		0	ISWR but priority date is not regulated for	0	1
14206241	NW	18	TUALATIN R AT HWY 219 NR HILLSBORO, OR	OWRD	0		0		0		N/A		1		1	This gage is monitored for Clean Water Services water quality purposes only	0	1
14211546	NW	20	CRYSTAL SPRINGS CR AT MOUTH AT PORTLAND, OR	OWRD												Discontinued - severe back-water impact.	0	1
14320700	SW	15	CALAPOOYA CR NR OAKLAND, OR	OWRD	0		0		0		0		1			Data is used for historical long term record and for City of Sutherland Water Treatment Facility	0	1
14372500	SW	14	E FK ILLINOIS R NR TAKILMA, OR	OWRD	0		0		0		0		0		0	Data is used for Historical long term record	0	1
14375100	SW	14	SUCKER CR BL L GRAYBACK CR NR HOLLAND, OR	OWRD	0		0		0		0		1			Data is used for Historical long term record	0	1
11494950	SC	17	S. Fk Sprague R @ Sprague R Park nr Bly	OWRD	0		0		0		N/A		0		1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other gages. Gage is operated under a grant.	0.5	1
11495600	SC	17	S. Fk Sprague R blw Fishhole Cr nr Bly	OWRD	0		0		0		0		0		1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other gages. Gage is operated under a grant.	0.5	1
11495900	SC	17	N FK SPRAGUE R AB SRIC CN NR BLY, OR	OWRD	0		0		0		0		0		1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other measurements and/or gages. Gage is operated under a grant.	0.5	1
11497500	SC	17	SPRAGUE R NR BEATTY, OR	OWRD	0		0		0		0		0		1	Not a management gage at this point. Potential for regulation once adjudication complete. Gage is operated under a grant.	0.5	1
11500500	SC	17	Sprague River @ Lone Pine Road	OWRD	0		0		0		0		0		1	Not a management gage at this point. Potential for regulation once adjudication complete. Block monitoring of withdrawals with other gages. Gage is operated under a grant.	0.5	1

Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
14038602	NC	4	CANYON CR NR CANYON CITY, OR	OWRD	0	1	0	N/A	0	1	Gage monitors ISWR. Regulation does not occur due to staffing constraints, but should occur in favor of the ISWR. WM Office would like regulate system annually along with other high priority tributaries and the gage would be useful in this endeavor.	0.5	1
14114000	NC	3	E FK I D CN NR MT HOOD, OR	OWRD	0	0	0	0	0	1	Question 2- There is not enough water to satisfy ISWR's during the summer months. However, they are junior so no regulation occurs. Question 3- EFID uses the gage to track how much water EFID are diverting and is used by EFID uses for water management. Not currently used by OWRD for water management, but if hydropower right is transferred instream would be used by OWRD for water management.	0.5	1
14115830	NC	3	GLACIER D NR PARKDALE, OR	OWRD	0	0	0	0	0	1	This gage has been discontinued. MFID planned on piping. Was not used by OWRD for water management, but if hydropower right is transferred instream would be used by OWRD for water management.	0.5	1
14116200	NC	3	DEE IRRIGATION CN NR DEE, OR	OWRD	0	0	0	0	0	1	Dee ID is currently looking at piping the ditch. If they are able to secure the funding, the gage would no longer be operable. They would be installing some sort of flow measurement device such as a totalizing meter. The gage is used primarily by the District's ditch walker. Not currently used by OWRD for water management, but if hydropower right is transferred instream would be used by OWRD for water management.	0.5	1
10378500	SC	12	HONEY CR NR PLUSH, OR	OWRD	1						Gage is vital for distribution purposes.	1	1
10384000	SC	12	CHEWAUCAN R NR PAISLEY, OR	OWRD	0	1	1	N/A	0	0	Gage is used for regulation during disputes for water by downstream users. Very important index site for water availability analysis.	1	1
10387500	SC	12	SUMMER LAKE CN NR SUMMER LAKE, OR	OWRD	1						There are wildlife refuge water needs and Summer Lake Irrigation District is typically regulated for duty.	1	1
10388000	SC	12	ANA R NR SUMMER LAKE, OR	OWRD	1						There are wildlife refuge water needs and Summer Lake Irrigation District is typically regulated for duty.	1	1
10389500	SC	12	SILVER LAKE I D CN NR SILVER LAKE, OR	OWRD	0	0	1	1	0	1	Gage is typically used by irrigation districts to determine the live and natural components of flow and for water distribution by the irrigation districts. OWRD maintains rating curves and takes over regulation during dry years.	1	1
10390000	SC	12	SILVER CR NR SILVER LAKE, OR	OWRD	0	0	1	N/A	0	1	Gage is typically used by irrigation districts to determine the live and natural components of flow and for water distribution by the irrigation districts. OWRD maintains rating curves and takes over regulation during dry years.	1	1
10393500	E	10	SILVIES R NR BURNS, OR	OWRD	1						This gage is used daily during irrigation season for regulation / distribution and montiored daily by most water users.	1	1
10406500	E	10	TROUT CR NR DENIO, NV	OWRD	1						As per the Trout Creek Decree a measuring device must be used to monitor stream flow as the "South Ditch" (altough equal and senior in priority to other downstream users) is not to divert until all other users rates are satisfied.	1	1
13214000	E	10	MALHEUR R NR DREWSEY, OR	OWRD	1						This gage is used by OWRD, VOID and Warmsprings Irri. District. On short water years (about 1 out of 5) OWRD need to know what water is coming into the reservoirs to determine regulations rates for downstream users.	1	1

Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
13216500	E	9	N FK MALHEUR R AB BEULAH RES NR BEULAH, OR	OWRD	1						This gage is used by OWRD, VOID and Warmsprings Irri. District. On short water years (about 1 out of 5) OWRD need to know what water is coming into the reservoirs to determine regulations rates for downstream users.	1	1
13281200	E	8	ROCK CR NR HAINES, OR	OWRD	1	1	0	N/A	0	1	Used by OWRD to distribute water to mulitple users. Need to determine live and storage flow components.	1	1
13282550	E	8	N POWDER R BL ANTHONY FK NR N POWDER, OR	OWRD	1	1	0	N/A	1	1	Used by OWRD to distribute water to mulitple users. Need to determine live and storage flow components.	1	1
13318960	E	6	GRANDE RONDE R NR PERRY, OR	COOP	1	1	1	N/A	1	1	This gage is critical to water management decisions, flood control monitoring, fish monitoring interests, recreational users	1	1
13320000	E	6	CATHERINE CR NR UNION, OR	OWRD	1	1	1	N/A	1	1	This gage is critical to water management decisions, flood control monitoring, fish monitoring interests, recreational users	1	1
13320300	E	6	CATHERINE CR AT UNION, OR	COOP	1	1	1	N/A	1	1	This gage is critical to water management decisions, flood control monitoring, fish monitoring interests, recreational users, and municipal effluent discharge	1	1
13329770	E	6	WALLOWA R AB CROSS COUNTRY CN NR ENTERPRISE, OR	COOP	1	0	0	N/A	1	1	not typically used for direct routine distribution/regulation but valuable for determining the need to regulate for instreams in lower GRR and determining consumption in the mid and lower Wallowa river valley.	1	1
13330000	E	6	LOSTINE R NR LOSTINE, OR	COOP	1	1	1	N/A	1	1	Critical for management and monitoring.	1	1
13330050	E	6	LOSTINE R AT CAUDLE LANE AT LOSTINE, OR	COOP	1	1	0	N/A	1	1	Critical for management and monitoring.	1	1
13330300	E	6	LOSTINE R AT BAKER RD, NR LOSTINE, OR	COOP	1	1	1	N/A	1	1	Critical for management and monitoring.	1	1
13330500	E	6	BEAR CR NR WALLOWA, OR	COOP	1	1	0	N/A	1	1	Critical for management and monitoring.	1	1
13331450	E	6	WALLOWA R BL WATER CAN, NR WALLOWA, OR	COOP	1	0	0	N/A	1	1	Useful for instream monitoring for Wallowa River and Lower Grande Ronde.	1	1
14012100	NC	5	LITTLE WALLA WALLA R NR MILTON, OR	OWRD	0	1					Used for management/ irrigation use.	1	1
14012300	NC	5	MILTON-FREEWATER HUDSON BAY D NR FREEWATER, OR	OWRD	0	1					Used for management/ irrigation use.	1	1
14019098	NC	5	PHASE II CN AB COLD SPRINGS RES NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14019100	NC	5	PHASE II CN AT COLD SPRINGS RES NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14021000	NC	5	UMATILLA R AT PENDLETON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14022500	NC	5	MCKAY CR NR PILOT ROCK, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14023500	NC	5	MCKAY CR NR PENDLETON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14025000	NC	5	BIRCH CR AT RIETH, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14026897	NC	5	FURNISH CN AB CRAYNE-LISLE CN NR ECHO, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14029000	NC	5	UMATILLA PROJECT FEED CN NR ECHO, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1

Gage #	Region	WM District	Official Gage Description	Current Operator	Is the gage used to routinely distribute water and/or regulate users?	Does the gage monitor water where, in your experience, the cumulative demand on the stream typically exceeds available supply?	Would a gaging alternative negatively impact other users by decreasing available water they have a right to?	For gaged diversions or reservoirs, is the physical capacity in excess of the paper right?	Is the gage of high interests to other water users (routinely checked by other users, environ groups,etc)?	Are there any other management reasons to operate the gage?	Comments?	Manage-ment Gage Designation (1 = Yes, 0 = No)	Initial Class-ification from WM Survey
14029550	NC	5	UMATILLA PROJECT FEED CN AT RES NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14029780	NC	5	US "A" LINE CN AT COLD SPGS RES NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14029800	NC	5	US "A" LINE CN NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14029900	NC	5	UMATILLA R NR ECHO, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14030000	NC	5	ALLEN CN AT ECHO, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14030500	NC	5	WESTERN LAND CN NR ECHO, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14030820	NC	5	ORDNANCE RECHARGE CN NR ORDANCE, OR	OWRD	1						Used in accounting County Line Recharge Project.	1	1
14031000	NC	5	DILLON CN NR STANFIELD, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14031050	NC	5	UMATILLA R AT I-84, NR STANFIELD, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14031490	NC	5	UMATILLA R AB BUTTER CR NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14031500	NC	5	MAXWELL CN NR HERMISTON, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14032000	NC	5	BUTTER CR NR PINE CITY, OR	OWRD	1						Used in accounting Butter Creek Management Plan.	1	1
14032500	NC	5	W DIVISION MAIN CN NR UMATILLA, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14032600	NC	5	W DIV MAIN CN BL EXCHANGE PUMPS AT UMATILLA, OR	OWRD	1						Used in accounting Umatilla Basin Project. Exchange.	1	1
14050000	SC	11	DESCHUTES R BL SNOW CR NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14050500	SC	11	CULTUS R AB CULTUS CR NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14051000	SC	11	CULTUS CR AB CRANE PRAIRIE RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14052000	SC	11	DEER CR AB CRANE PRAIRIE RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14052500	SC	11	QUINN R NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14053000	SC	11	CHARLTON CR AB CRANE PRAIRIE RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14053500	SC	11	CRANE PRAIRIE RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14054000	SC	11	DESCHUTES R BL CRANE PRAIRIE RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1

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14056000	SC	11	WICKIUP RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14056500	SC	11	DESCHUTES R BL WICKIUP RES NR LA PINE, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14059500	SC	11	CRESCENT LAKE NR CRESCENT, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14060000	SC	11	CRESCENT CR AT CRESCENT LAKE NR CRESCENT, OR	OWRD	1						Operated to determine multiple user storage accounts, water balance on reservoir, and distribution purposes on mainstem Deschutes.	1	1
14062500	SC	11	WALKER BASIN CN NR LA PINE, OR	OWRD	0	0	1				User can and has exceeded water right on this tributary to the Deschutes, which is an overappropriated system.	1	1
14064500	SC	11	DESCHUTES R AT BENHAM FALLS NR BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14065500	SC	11	ARNOLD CN NR BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14066500	SC	11	CENTRAL OREGON CN AB PILOT BUTTE NR BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14068500	SC	11	DESCHUTES CTY MUN IMP DIST CN AT BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14069000	SC	11	NORTH UNIT MAIN CN NR BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14069500	SC	11	NORTH CN NR BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14069700	SC	11	LONE PINE CN NR TERREBONNE, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14070000	SC	11	SWALLEY CN NR BEND, OR	OWRD	1						Operated to for distribution purposes on mainstem Deschutes and real-time water management.	1	1
14070500	SC	11	DESCHUTES R BL BEND, OR	OWRD	1						Operating for distribution and accounting purposes on mainstem Deschutes. Important site for environmental groups and for mitigation program. Monitors ISWR on overappropriated stream.	1	1
14073500	SC	11	TUMALO FEED CN NR BEND, OR	OWRD	1						Operating for distribution and accounting purposes on mainstem Deschutes and Tumalo Creeks.	1	1
14073520	SC	11	TUMALO CR BL TUMALO FEED CN DIV NR BEND, OR	OWRD	1						Operating for distribution and accounting purposes on mainstem Deschutes and Tumalo Creeks. High interests from environmental groups. Monitors ISWR on overappropriated stream.	1	1
14076000	SC	11	WHYCHUS CR CN NR SISTERS, OR	OWRD	0	1	1				multiple users would be affected if reduced monitoring occurred.	1	1
14076050	SC	11	WHYCHUS CR AT SISTERS, OR	OWRD	1						Important site for environmental groups and for for monitoring ISWR on overappropriated stream.	1	1
14087300	SC	11	CROOKED R NR TERREBONNE, OR	OWRD	1						Used to help managed amount NUID pumps can take out of Crooked Riv	1	1
14100850	NC	3	BADGER IMPROVEMENT DISTRICT D NR WAMIC, OR	OWRD	1	1	1				The Badger/ Tygh Creek System is heavily regulated. This gage is necessary to monitor ditch flows going to the district. Alternate methods could be discussed (ie Parshall Flume or Ramp Flume with recorder instead of gaging station with monthly measurements).	1	1
14100900	NC	3	PINE HOLLOW RES NR WAMIC, OR	OWRD	0	0	1				Question 2- not during the winter months, when water is diverted for storage. Question 3-The "gage" in question is not maintained by WRD. It is an incline staff gage maintained by Badger DIC. I simply get monthly readings for my records.	1	1

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14192500	NW	16	S YAMHILL R NR WILLAMINA, OR	OWRD	1						gage used to monitor ISWR and distribute water	1	1
14193000	NW	16	WILLAMINA CR NR WILLAMINA, OR	OWRD	1						gage used to monitor ISWR and distribute water	1	1
14194300	NW	16	N YAMHILL R NR FAIRDALE, OR	OWRD	1						gage used to monitor ISWR and distribute water	1	1
14202450	NW	18	TUALATIN R BL LEE FALLS NR CHERRY GROVE, OR	OWRD	0	0	0	N/A	1	1	Used by cooperators for distribution and scheduling reservoir releases. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14202510	NW	18	TUALATIN R AT GASTON, OR	OWRD	0	0	0	N/A	1	1	Used by cooperators for distribution and reservoir releases. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14202850	NW	18	SCOGGINS CR AB HENRY HAGG LAKE NR GASTON, OR	OWRD	0	0	0	N/A	1	1	Gage shows incoming flows that are monitored by the Scoggins Dam Supeintendent. Used by cooperators for distribution and reservoir releases. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14202920	NW	18	SAIN CR AB HENRY HAGG LAKE NR GASTON, OR	OWRD	1	1	0	N/A	1	1	Gage shows incoming flows that are monitored by the Scoggins Dam Supeintendent. Used by cooperators for distribution and reservoir releases. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14204530	NW	18	GALES CR AT ROUTE 47 AT FOREST GROVE, OR	OWRD	1	1	0	N/A	1	1	Used for regulation and distribution. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14204800	NW	18	TUALATIN R AT GOLF COURSE RD NR CORNELIUS, OR	OWRD	1	1	0	N/A	1	1	Used for regulation and distribution. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14206200	NW	18	DAIRY CR AT RTE 8 NR HILLSBORO, OR	OWRD	0	0	0	N/A	1	1	Used for regulation and distribution. Local cooperators support this gage which allows for an Assistant Watermaster	1	1
14206295	NW	18	TUALATIN R AT ROOD BRIDGE AT HILLSBORO, OR	OWRD	0	0	0	N/A	1	1	This gage is supported by local cooperators in protecting stored water supplies	1	1
14206500	NW	18	TUALATIN R AT FARMINGTON, OR	OWRD	0	0	0	N/A	1	1	This gage is supported by local cooperators in protecting stored water supplies	1	1
14299000	NW	1	S FK NECANICUM R NR SEASIDE, OR	OWRD	0	1	0	n/a	0	1	OWRD doesn't use for water management on this tream. However, gage is used as an indicator when ISWRs on other coastal streams are not being met and regulation needs to occur on those streams.	1	1
14299137	NW	1	W FK ECOLA CR AB CITY DIV, NR CANNON BEACH, OR	OWRD	0	1	0	n/a	1	1	operated to monitor flows and manage municipal effluent discharge and as an indicator station to monitor ISWRs	1	1
14299150	NW	1	N FK ECOLA CR (AKA ELK CR) NR CANNON BEACN, OR	OWRD	0	1	1	n/a	1	1	operated to monitor flows and manage municipal effluent discharge and as an indicator station to monitor ISWRs	1	1
14300100	NW	1	Rock Cr. NR Vernonia Or	OWRD	1	1	1	n/a	1	1	operated to monitor flows and manage municipal effluent discharge and as an indicator station to monitor ISWRs	1	1
14301300	NW	1	MIAMI R NR GARIBALDI, OR	OWRD	1	1	1	n/a	1	1	operated to monitor flows in coastal basins and as an indicator station to monitor ISWRs	1	1
14301450	NW	1	KILCHIS R NR BAY CITY, OR	OWRD	1	1	0	0	0	0	station used to monitor and regulate for ISWR. Station has been discontinued.	1	1
14306030	NW	1	YAQUINA R NR CHITWOOD, OR	OWRD	1	1	1	n/a	1	1	operated to monitor flows in coastal basins and as an indicator station to monitor ISWRs	1	1
14306820	NW	1	DRIFT CR NR WALDPORT, OR	OWRD	0	1	1	n/a	0	1	operated to monitor flows in coastal basins and as an indicator station to monitor ISWRs	1	1

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14306875	NW	1	YACHATS R NR YACHATS, OR	OWRD	1	1	1	n/a	1	1	operated to monitor flows in coastal basins and as an indicator station to monitor ISWRs	1	1
14327137	SW	19	FLORAS CR NR LANGLOIS, OR	OWRD	0	0	0	0	1		Data is used for Historical long term record	1	1
14335200	SW	13	S FK BIG BUTTE CR AB WILLOW CR NR B FLS, OR	OWRD	1							1	1
14340800	SW	13	S Fork Little Butte CR. Above Soda CR. NR. Lakecreek ,OR	COOP	1						Operated to for distribution purposes on Little Butte system and real-time water management.	1	1
14341610	SW	13	S FK LITTLE BUTTE CR AT MOUTH NR LAKECREEK, OR	COOP	1						Operated to for distribution purposes on Little Butte system and real-time water management.	1	1
14342500	SW	13	N FK LITTLE BUTTE CR AT FISH LAKE NR LAKECREEK, OR	COOP	1						Operated to for distribution purposes on Little Butte system and real-time water management.	1	1
14343000	SW	13	N FK LITTLE BUTTE CR NR LAKECREEK, OR	COOP	1						Operated to for distribution purposes on Little Butte system and real-time water management.	1	1
14346700	SW	13	LITTLE BUTTE CR AT LAKECREEK, OR	COOP	1						Operated to for distribution purposes on Little Butte system and real-time water management.	1	1
14348000	SW	13	LITTLE BUTTE CR BL EAGLE POINT, OR	COOP	1						Operated to for distribution purposes on Little Butte system and real-time water management.	1	1
14348080	SW	13	Antelope Creek below RRVID Diversion White City, OR	COOP	1						Operated to for distribution purposes on Antelope Creek and real-time water management.	1	1
14348150	SW	13	ANTELOPE CR NR EAGLE POINT, OR	COOP	1						Operated to for distribution purposes on Antelope Creek and real-time water management.	1	1
14348400	SW	13	Emigrant CR above Green Springs power plant nr Ashland	COOP	1						Operated to for distribution purposes on the Bear Creek system and real-time water management.	1	1
14350900	SW	13	Neil Creek above Dunn Ditch near Ashland, OR	COOP	1						Operated to for distribution purposes on the Neil Creek and real-time water management.	1	1
14352001	SW	13	Bear Creek below Neal Creek near Ashland Oregon	COOP	1						Operated to for distribution purposes on the Bear Creek system and real-time water management.	1	1
14352001	SW	13	Neil Creek at mouth near Ashland, OR	COOP	1						Operated to for distribution purposes on the Neil Creek and the Bear Creek system and real-time water management.	1	1
14354100	SW	13	Ashland creekbelow Treatment Plant at Ashland Oregon	COOP	1						Operated to for distribution purposes on Ashland Creek and the Bear Creek system and real-time water management.	1	1
14354950	SW	13	Wagener Creek below Goose Creek near Talent, OR	COOP	1						Operated to for distribution purposes on Wagner Creek and the Bear Creek system and real-time water management.	1	1
14355875	SW	13	Wagner Creek at Talent	COOP	1						Operated to for distribution purposes on Wagner Creek and the Bear Creek system and real-time water management.	1	1
14357000	SW	13	BEAR CR BL PHOENIX CN NR TALENT, OR	COOP	1						Operated to for distribution purposes on the Bear Creek system and real-time water management.	1	1
14357503	SW	13	Bear Creek @Jackson Steet Bridge in Medford Oregon	COOP	1						Operated to for distribution purposes on the Bear Creek system and real-time water management.	1	1
14358610	SW	13	Griffin creek below Murphy Creek near Medford, OR	COOP	1						Operated to for distribution purposes on Griffin Creek and the Bear Creek system and real-time water management.	1	1
14358680	SW	13	Griffin Creek at Central Point	COOP	1						Operated to for distribution purposes on Griffin Creek and the Bear Creek system and real-time water management.	1	1
14358725	SW	13	Jackson Creek at Jacksonville, OR	COOP	1						Operated to for distribution purposes on Jackson Creek and the Bear Creek system and real-time water management.	1	1

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14358750	SW	13	Jackson Creek at Central Point	COOP	1						Operated to for distribution purposes on Jackson Creek and the Bear Creek system and real-time water management.	1	1
14358800	SW	13	Bear Creek above mouth @RM1 near central point oregon	COOP	1						Operated to for distribution purposes on the Bear Creek system and real-time water management.	1	1
14360500	SW	13	Evans Creek at Wimer, OR	COOP	1						Operated to for distribution purposes on Evans Creek and real-time water management.	1	1
14365500	SW	14	LITTLE APPLEGATE R NR RUCH	COOP	1						Gage is used in the regulation of ISWR	1	1
14375200	SW	14	SUCKER CR AT BRIDGEVIEW, OR	OWRD	1						Gage is used in the regulation of ISWR	1	1