Evaluation of Oregon Water Data Portal Project: Phase 2

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Oregon Water Data Portal Phase 2 Evaluation: Executive Summary

The state of Oregon has a diverse and complex landscape of water resources, with many different water interests and challenges including drought, flooding, aging infrastructure, supporting diverse environments and users, and adapting to climate change. Making informed decisions about how to allocate, protect, and plan for water resources in the present and into the future requires a modern data system to serve decision makers, agency staff, and the broader public.

The goal of the Oregon Water Data Portal (OWDP) is to use modern data management practices and technologies to make water data more accessible and usable. The OWDP strives to develop an accessible data system that will better support and inform water management decisions across the state, to improve data-driven decision making and infrastructure planning, save public funds, and meet water-related challenges and opportunities. This report is an evaluation of the OWDP Phase 2, which took place from 2023-2025 (Phase 1 occurred from 2021-2023). The key objectives for this biennium included:

1. Launching a pilot portal to integrate water datasets.
2. Developing a recommended interagency governance plan establishing roles, responsibilities, and decision-making processes.
3. Supporting participating state agencies.
4. Conducting user testing and engaging Tribes and interested parties to inform project development.

Summary of evaluation findings

Overall, the evaluation finds that the above objectives have been successfully met. Further findings of this evaluation include:

Technical evaluation summary

- **Progress** includes the successful launch of a pilot Water Data Portal; the development of guidance on water data standards; and inventorying datasets across state agencies.
- **Challenges** include limited functionality, interoperability, and customizability of the pilot portal in its current format.
- **Recommendations** include developing and implementing a plan for the technical infrastructure of the permanent portal; continuing to incorporate high priority data sets; maintaining sufficient documentation and communication of data standards; hiring staff with deep IT expertise; and continuing to coordinate across agencies to implement common data standards, protocols, and technical frameworks for the OWDP.

Stakeholder engagement evaluation summary

- **Progress** includes proactively conducting outreach, engagement, and beta testing to share and receive feedback on the pilot portal; and including plans for ongoing engagement in the recommended governance plan.
- **Challenges** include a limited time frame for public engagement and the need for more extensive public sharing of the portal; limited outreach and involvement of Tribes; and the need for more iterative and ongoing engagement going forward.
- **Recommendations** include centering ongoing, iterative engagement to inform OWDP in multiple ways; ensuring adequate timeline and budget for user engagement; and engaging closely with Tribal communities, underrepresented communities, and higher education institutions.

Governance evaluation summary

- **Progress** includes successful completion of a detailed recommended governance plan; learning from and working with other states and organizations; and effective collaboration across Oregon state agencies including efforts to identify future leadership.
- **Challenges** include a lack of buy-in and support of executive-level leadership and continued funding and leadership uncertainties.
- **Recommendations** include implementing the recommended governance plan; ensuring leadership is engaged and committed to OWDP success; incentivizing participation by different agencies; establishing a long-term funding structure; incorporating Tribal data sovereignty; and continuing to engage with coalitions and collaborative groups.

Overall recommendations

The OWDP Project Team for Phase 3 (2025-2027) recommends the following:

1. Establish a sustainable governance structure and operational framework for the OWDP project
2. Develop a comprehensive plan for the development and implementation of the permanent portal
3. Collaboratively develop and implement common data standards, protocols, and technical frameworks for Oregon's Water Data Portal
4. Enhance pilot portal functionality and usability through user engagement and iterative development
5. Partner with agencies to advance data readiness and strategic water initiatives
6. Strengthen user engagement, build awareness, and improve pilot portal accessibility

This evaluation concurs with the above recommendations. A modern water data system for the State of Oregon is key to ensuring the state is able to serve its diverse constituency and meet its long-term water and infrastructure planning goals in an efficient and cost-effective way. The OWDP team should follow the above recommendations to continue to develop a data system that is useful, usable, accessible, and used in practice to support informed decision making.

Oregon Water Data Portal Phase 2 Evaluation: Full Report

1. Commentary on the general conduct and operation of the project

The state of Oregon has a diverse and complex landscape of water resources, with many different water users and interests, ranging from agriculture and industry to urban areas to fish and wildlife habitat. The state faces many water-related challenges including drought, flooding, aging infrastructure, balancing diverse and competing interests, protecting habitats and aquatic species, and climate change. Making informed, cost-effective decisions about how to allocate, protect, and plan for water resources in the present and into the future requires a modernized water data system (Cantor et al. 2021; Josset et al. 2019; Fewless et al. 2025). Before the efforts to create an integrated Water Data Portal, data about water, or data impacting water management, has been spread across 17 different Oregon state agencies. The lack of an integrated system to access or synthesize water data from these many different sources has presented a challenge to decision makers, agency staff, and the public.

The goal of the Oregon Water Data Portal (OWDP) is to use modern data management practices and technologies to make water data more accessible and usable. The OWDP is envisioned as an integrated, single point of access data system that will better inform water management decisions across the state, improve data-driven decision making and infrastructure planning, save public funds, and help meet water-related challenges and opportunities.

This report is an evaluation of the OWDP Phase 2, the second of three currently planned phases in the development of the water data portal based on directions from the Oregon Legislature. During Phase 1, from 2021-2023, the Oregon Department of Environmental Quality (DEQ) and other state water agencies began working together to scope and plan for a statewide water data platform with the goal of modernizing Oregon's water data infrastructure. From 2023-2025, DEQ and other state agencies have collaborated on Phase 2 to build a pilot water data portal, develop a recommended interagency governance plan establishing roles, responsibilities, and decision-making processes, and conduct initial user testing with interested parties and Tribes to inform project development.

The evaluation first describes the project history, legislative direction, and evaluation criteria, then evaluates the OWDP's progress from 2023- 2025, focusing on three categories: technical considerations, stakeholder engagement, and governance considerations.

The goals for Phase 2 deliverables included creation of a pilot-level portal; development of a governance plan; supporting participating agencies in data modernization and organization for the portal; and assessment of the pilot portal's performance with interested parties. ***Overall, the evaluation finds that these tasks have been completed successfully.*** In addition to this overall finding, the evaluation outlines specific successes and challenges, and provides suggestions and recommendations for improvements in Phase 3 of the OWDP.

2. History of the project and legislative direction

In 2021, the Oregon Legislature directed DEQ and state water agencies to begin scoping and planning for a statewide water data platform with the goal of modernizing Oregon's water data infrastructure. In response to the legislative mandate, DEQ and partner agencies began development of the Oregon Water Data Portal (OWDP) to support informed decision making around water resources and planning by providing a single point of access for the public to access water and infrastructure data. To accomplish this, DEQ and partners planned a three-stage Project Concept for the OWDP:

- **Phase 1: 2021-2023:** Develop a plan for a state water data portal; set up a framework of standards; inventory water data needs; evaluate existing data sets and information infrastructure; draft a resource request to the Oregon Legislature.
- **Phase 2: 2023-2025 (The focus of this evaluation):** Implement a pilot Data Portal; beta test OWDP with water data users; develop a governance plan; support agencies in participation in OWDP.
- **Phase 3: 2025 and beyond:** Fully implement OWDP; address identified gaps; enable regular maintenance; implement continuous improvement processes.

The evaluation conducted at the end of Phase 1 included the following recommendations:

1. Develop a governance structure for the OWDP.
2. Develop Standard Operating Procedures for submission, curation, and integration of data in the OWDP.
3. Develop a pilot OWDP based on an iterative process.
4. Based on agency- and stakeholder-identified needs, determine short- and long-term priorities for data readiness and integration.
5. Where appropriate and possible, use existing software systems to build on staff knowledge and expertise.
6. Develop an ongoing, meaningful process for incorporating user feedback and ensuring environmental justice and diversity, equity, and inclusion.

The stated goals of Phase Two involved the following key deliverables:

1. A pilot-level portal with enough state tabular and geospatial data to demonstrate its value.
2. A plan to govern and maintain the OWDP and uplift state agency business processes to enable consistent and automated management of interoperable data and improve the effectiveness of OWDP data for water decision-making.
3. Support for participating agencies as they modernize their data and organizational processes and prioritize data for inclusion in the portal in the short and long term.
4. An assessment of the pilot portal's performance with interested parties drawing from insights gained during initial scoping from 2021 to 2023 (phase one).

This evaluation report focuses on the outcomes of Phase 2 of the OWDP, from 2023-2025, including the degree to which Phase 2 has (a) met the above key deliverables and (b) incorporated the Phase 1 recommendations.

3. Sources for standards of evaluation of OWDP

3.1 Evaluation criteria

Previous research on open water data systems has identified criteria for evaluation of success and excellence (Cantor et al. 2018, 2021). These criteria focus on usability of the data system for solving problems and supporting decision making, with success defined as a water data system that is: (1) sufficient, (2) accessible, (3) useful, and (4) actually used in practice. This area of research acknowledges that in order to successfully support decision making, a data system must take into account not only technical considerations, but also governance and stakeholder engagement processes. This report utilizes these criteria to evaluate the Phase 2 OWDP progress and outcomes.

There are four main categories of evaluation criteria, which include:

1. **Technical considerations:** Effectiveness; maintenance; documentation of data; standards for metadata and data quality.
2. **Stakeholder engagement:** Engagement of data users at key points and as an ongoing process; understanding of data user needs and decision-making contexts; legitimacy of data system according to users; use in practice.
3. **Governance considerations:** Institutional commitment and participation by partner agencies; sufficient resources; financial sustainability; plans and resources for system maintenance.
4. **Addressing data limitations:** How well the data system actually functions by addressing data limitations and making data available, accessible, interoperable, and available at appropriate resolution.

These are elaborated upon in Table 1 below, adapted from Cantor et al. (2021). Other related and overlapping data system evaluation criteria exist: for example the “FAIR” (Findable, Accessible, Interoperable, Reusable) Guiding Principles (Wilkinson et al. 2016) focus on ensuring data are usable and accessible. Given that this evaluation focuses on the planning and early implementation stages of a water data portal, the focus of the evaluation is primarily on the aspects of stakeholder engagement, governance, and technical considerations. The category of “addressing data limitations” is more outcome-oriented and thus is not addressed in this evaluation; addressing data limitations should be considered a key overall goal of the OWDP as it is implemented and improved over time and the above criteria could be used for evaluation.

Table 1: Criteria for evaluating success of a water data system.

	Evaluation criteria
Technical considerations	Does the data system effectively support synthesis and analysis? Are systems regularly updated? Is documentation adequate? Are standards for metadata, data quality, and technical requirements clear to data managers?
Stakeholder engagement	Are data users engaged meaningfully at key points in data system development? Is involvement of stakeholders an ongoing process? Is the system based on an understanding of decision-making contexts and user needs? Do users believe the system is useful and usable? Is the system used in practice to inform decision making?
Governance considerations	Is there institutional commitment by key organizations to use and maintain the system? Do incentives exist to ensure participation by data providers and users? Are data providers participating, in practice? Are sufficient resources allocated to long-term maintenance? Is there a plan to ensure financial stability over time?
Addressing data limitations	Are appropriate data readily available? Are data accessible in open, transparent, and usable formats? Are data from multiple sources interoperable? Are data available at appropriate spatial and temporal resolution?

3.2 Evaluation methodology

The evaluation process included conducting interviews with key personnel involved in the OWDP planning process, as well as examination of documents produced through the OWDP Phase 2 process. A total of twelve participants from Oregon state agencies and other entities involved in the project were interviewed and gave feedback. The interviews focused on the progress of the OWDP so far, successes and challenges, technical performance, governance, external engagement, inter-agency collaboration, and ideas for improvement.

Documents reviewed included the OWDP website, the OWDP 2025 Final Report, the Recommended Governance Plan Draft, documents from the Phase 2 process, and other documents produced as part of this project.

Information from the interviews and analysis of the reports was synthesized and is discussed below in terms of strengths, challenges, and suggestions for improvement on the topics of technical considerations, stakeholder engagement, and governance.

4. Strengths and challenges of OWDP Phase 2

Phase 2 of the OWDP involved the challenging task of designing and implementing a pilot water data portal integrating data from multiple state agencies. Given the limited time frame and the considerable scope of the task, this evaluation concludes that the OWDP project team has done a commendable job of envisioning and carrying out Phase 2 tasks, and also provides some recommendations for the future.

Overall, the goals for Phase 2 were to develop a pilot portal that could demonstrate the value of an integrated water data portal; develop a governance plan; support agencies in participating; and assess the pilot portal's performance by consulting with interested parties. ***These Phase 2 tasks have, overall, been accomplished successfully.*** A pilot portal and governance plan have been developed, with next steps identified. Specific strengths, along with recommendations for Phase 3, are discussed in more detail below.

4.1 Technical aspects

According to evaluation criteria, technical aspects of a successful water data system include adequate documentation, clear standards for metadata, data quality, and technical requirements, effective support of synthesis and analysis for problem solving and decision making, and regular maintenance and updates of systems. Many of these criteria apply to finalized data systems and can only be evaluated in a limited way at this time given that the portal is still in pilot phase.

4.1.1. Technical strengths

- **Successfully launching a pilot Water Data Portal.** During Phase 2, the OWDP team successfully built and shared a public-facing website with a pilot version of an Oregon Water Data Portal. This is an important success and a key outcome of the project. The pilot portal allows users to explore water data across multiple categories, from multiple sources, including groundwater, surface water, water quality, water quantity, and infrastructure. The pilot portal, built by Oregon DEQ, Institute for Natural Resources (INR), and the Internet of Water (IoW) Coalition, enhances public access to data by organizing 37 datasets, 49 tools, and 25 documents into a single platform. While the portal does not fully integrate all of the data into interoperable formats at this time, it does bring multiple datasets from different agencies and sources into one place, making data more publicly accessible. Building a public-facing pilot portal helps to demonstrate the value of an integrated water data system to decision makers, lawmakers, and the public.

- **Developing guidance on water data standards.** Just as important as the pilot portal itself is changing the way that state agencies approach data management, so that water data can be more readily integrated and accessible. The OWDP project team developed guidance materials to assist agencies in modernizing and synchronizing data management practices so that data can be more readily contributed to the portal. The team has developed a Water Data Standards Guidebook with detailed guidance on data and metadata elements, data verification processes, and recommendations to create interoperability. Developing data standardization is an important accomplishment which bridges technical expertise and governance. Agreeing upon standards in order to ensure consistency, normalization, and standardization of data, is a notable accomplishment because bringing water data up to a common standard is key for increasing usability and functionality in the future.

- **Inventorying datasets across state agencies.** During Phase 1 (2021-2023), the OWDP team conducted an inventory of over 500 existing water data sets across 15 state agencies. This work was continued in Phase 2, including standardization of descriptions, improving metadata, and incorporating new dataset entries not previously included. This resulted in a centralized inventory of water data resources, tools, and systems used by agencies statewide.

4.1.2 Technical challenges, obstacles, and limitations

- **Limited functionality of pilot portal.** Participants described the limited functionality of the portal, which was viewed as a result of a compressed development timeline. The compressed timeline occurred because of hurdles in the process of hiring technical staff to build the portal. A key technical staff position, backed by legislative funding, was unable to be successfully filled because of decisions by executive leadership. This created significant delays to the project's progress. Because of these staffing challenges, the OWDP project team shifted their approach and collaborated with IoW and INR in order to release a pilot portal on schedule. Funding and hiring sufficient staff with relevant IT expertise should be a priority for Phase 3.

- **Limited interoperability of data via pilot portal.** While the portal demonstrates the value of integrated water data and provides a public-facing demonstration of what a water data portal can look like, participants noted it is limited in its functionality so far, in particular when it comes to interoperability of data. Many datasets are included on the website but the portal does not yet represent a truly interoperable system that can be used for decision making. Again this was described as a result of the hiring challenges noted above. In the evaluation, participants noted that across Oregon's agencies, some datasets are still in formats that limit operability (e.g., PDFs and Excel spreadsheets). Improving interoperability of data within the portal will be an important priority for Phase 3.

- **Limited customizability of current format.** The pilot portal is currently built as an ESRI ArGIS Hub Site; participants noted that the architecture of this format is limited and in the longer term, a custom solution may be preferable. For Phase 3, the OWDP team will need to plan for the more permanent portal. This may include considering whether the goals of the portal can be met through expansion of the current portal framework, or whether developing a custom data infrastructure is necessary for the portal going forward over the long term. The portal may need to be re-conceptualized in terms of the technical infrastructure and where it is housed.

4.1.3 Evaluation of technical considerations based on criteria

- *Does the data system effectively support synthesis and analysis?*
    - **SOMEWHAT-** The pilot portal supports synthesis and analysis in a limited way. The portal provides access to a variety of useful datasets, but interoperability is, at this point, still limited.
- *Are systems regularly updated?*
    - **N/A-** Not applicable at this phase.
- *Is documentation adequate?*
    - **YES-** The project has overall been well documented throughout.
- *Are standards for metadata, data quality, and technical requirements clear to data managers?*
    - **YES-** The Water Data Standards Guidebook provides clear standards for metadata, data quality, and technical requirements for data managers.

4.2 Stakeholder engagement

According to evaluation criteria, effective stakeholder engagement involves meaningfully engaging data users at key points in data system development. Engagement should be an ongoing process to ensure a data system based on an understanding of decision-making contexts and user needs.

4.2.1 Stakeholder engagement strengths

- **Proactively conducting outreach and engagement to share and receive feedback on the pilot portal.** The OWDP project team successfully met its goals of engagement with interested parties and Tribes. The project team held an Interested Parties Engagement webinar in November 2024 to share the project and broaden awareness of the portal's capabilities. Over 100 participants attended the webinar. OWDP also held a State and Tribal government engagement session to share the portal and allow for questions and answers in a smaller format. Engagement with interested parties and Tribes was largely described by project participants as positive and going well. OWDP participants described engagement as proactive. The OWDP team has made an effort to conduct meaningful outreach with interested parties and Tribes to ensure the public is aware of

the portal and its capabilities, and has sought external feedback on the portal to inform future iterations.

- **Conducting targeted beta testing of the pilot portal.** There were also two targeted user testing sessions held from January-May 2025, each with 3-4 users, including staff from the Oregon Water Resources Department, Jackson Soil and Water Conservation District, Farmer Conservation Alliance, and the Columbia River Inter-Tribal Fish Commission. Beta testers appreciated the chance to see and try the portal and were impressed by the progress so far.

- **Including engagement in the recommended governance plan looking forward:** The draft recommended governance plan, which establishes roles and responsibilities for sustaining the OWDP, includes a public engagement strategy. This includes annual Tribal and interested party engagements, targeted usability testing, and interagency convenings to ensure ongoing public input and project responsiveness.

4.2.2 Stakeholder engagement challenges and limitations

- **Limited time frame for public engagement and need for more extensive public sharing of pilot portal.** Participants described time limitations for engagement because of the compressed timeline of the pilot portal development, as already described. Beta testing was limited because of the time constraints. Participants also discussed the need for more active communications that go beyond webinars. While there is currently a website for the portal, this was described by participants as a passive format which requires a more extensive push to get information shared publicly. Now that the initial pilot has been presented to the public, future phases should involve soliciting more feedback to ensure it is going in the right direction and represents the vision that members of the public would like to see.

- **Outreach and involvement of Tribes in particular.** Beta testing in May did involve Tribal staff members, which is a strength as noted above, but this engagement was limited. Tribal staff members describe having many competing responsibilities and facing many requests from external agencies and parties. They require sufficient time and advanced notice, perhaps more so than other stakeholders. Future outreach must recognize that it is important to not only consult proactively with Tribal staff members, but in particular to give sufficient lead-up time and advance notice in soliciting that participation. It is also key to involve multiple different Tribal entities and agencies, as there are many diverse Tribal interests, water contexts, and needs across the state of Oregon which cannot be captured by a single Tribal staff member. Ideally, Tribal staff members should be involved in the governance process of the OWDP to inform broader issues of data sovereignty and privacy.

- **Need for iterative and ongoing engagement to ensure equitable outcomes of data portal.** Deliberate, frequent, iterative public engagement going forward will be key in

many ways: for example, prioritization of datasets or development of useful interoperable tools. Research has shown that water data is crucial for attaining environmental justice outcomes, and maximizing data usability through participatory engagement with communities is a key component of environmental justice (Dosemagen & Williams 2022). The planning, timeline, and budget for Phase 3 of OWDP development should make clear that engagement with multiple user communities, including Tribes and minority and/or disadvantaged communities, should be an iterative and ongoing process. Identification of a broad range of potential user communities is key to support this process, given that there is not always a clear "water data coalition." Engagement should be inclusive of a broad range of actors who would benefit from improved water data. This process requires adequate time, support, and resources, and should be done strategically to be effective and efficient.

4.2.3 Evaluation of stakeholder engagement based on criteria

- *Are data users engaged meaningfully at key points in data system development?*
    - **YES** - data users have been involved throughout Phase 1 and 2 in development of use cases, beta testing, and providing feedback.
- *Is involvement of stakeholders an ongoing process?*
    - **YES -** the recommended governance plan provides ongoing mechanisms for engagement.
- *Is the system based on an understanding of decision-making contexts and user needs?*
    - **SOMEWHAT-** the pilot portal's limited functionality likely does not meet many user needs and decision-making contexts yet.
- *Do users believe the system is useful and usable?*
    - **UNKNOWN-** TBD as the portal matures and is used more in practice.
- *Is the system used in practice to inform decision making?*
    - **UNKNOWN-** TBD as the portal matures and is used more in practice.

4.3 Governance

According to evaluation criteria, good governance of a water data system includes institutional commitment by key organizations, along with incentives to participate and sufficient resources for long-term maintenance and financial stability.

4.3.1 Governance strengths

- **Successful completion of a detailed recommended governance plan.** OWDP project team members worked closely with staff from the Internet of Water Coalition (IoW), a knowledgeable and reputable organization with expertise on this topic, to develop a recommended governance plan. The governance plan contains specific details about roles, responsibilities, and decision-making processes to sustain the OWDP over the long term. The plan contains recommendations for staffing, team structures, task forces, and decision making processes, as well as an engagement strategy including usability testing,

interagency convenings, and engagement of Tribes and interested parties. Development of the governance plan included regular meetings, which were inclusive of different agencies, to determine governance structures. Participants expressed support for the governance plan, which is based on lessons learned from other states and was developed collaboratively. Participants described the governance plan as a strong one that should set the project up for future success. Participants also noted that the governance group has worked well together and has put significant effort into figuring out how to move forward given constraints and hurdles, maintaining positive working relationships.

- **Learning from and working with other states and organizations.** Numerous states across the US are working to improve their water data systems (Josset et al. 2019, Rosen & Mace 2019). Working with the Internet of Water Coalition was a helpful way to understand best practices and learn from other states who have embarked upon similar projects. The OWDP project team also worked with Oregon State University's Applied Systems and Software (CASS) and Oregon State University's Institute for Natural Resources (INR), drawing from the strengths of these organizations which bring expertise in public data, information technology, and geospatial data in the Oregon context.

- **Collaboration across Oregon state agencies.** The development of interagency working groups to guide different aspects of the project was an effective way to make progress on the OWDP while also building relationships across agencies. The OWDP has involved all Oregon state agencies with water-related data or functions. Staff from multiple agencies have directly contributed to the project, which increases shared knowledge of each agency's processes, and increases institutional buy-in and commitment from different agencies.

- **Collaborative efforts to identify future leadership.** While DEQ has led the project to date, DEQ has the drawback of being a regulatory agency; multiple water data contributors and users believe that it is preferable to have a different type of agency in the leadership role. As of the writing of this report, DOGAMI has been tentatively identified as willing to take on leadership of the OWDP (though this is not certain to occur). Participants believe that DOGAMI is a good fit for the OWDP because they have expertise, enthusiasm, strong leadership, and are willing to take on the responsibility and challenges of this project.

4.3.2 Governance challenges and limitations

- **Buy-in and support of executive-level leadership.** Many participants emphasized the need for increased buy-in and support of the OWDP at the executive leadership level of whatever agency it is housed within. Plans for the OWDP can only be supportive if executive leaders across multiple agencies are on board. Participants described an engaged coalition of staff members who are very actively engaged and supportive of the project, but described challenges with decisions at the executive level that hampered progress of the project. In particular, plans to hire a key position with technical expertise

were unsuccessful. This lack of support was cited by participants as the reason for some of the challenges and delays in technical development. The reluctance to hire a key position, and ultimately the decision to not hire this position, required project staff to pivot to outside contractors to develop the portal. These delays had consequences such as limited portal functionality, rushed deadlines for reviewing the portal website, and limited opportunities for external engagement.

- **Need for a full-time project manager and a funded cross-agency staffing plan.** Many participants described the need, going forward, for a full-time project manager and a clear staffing plan with funding resources for state agencies to participate. Multiple participants noted the importance of having a dedicated project manager who can keep track of the many meetings, status reports, take a lead on documentation and communication, and facilitate collaboration across agencies. Given the importance of interagency engagement and collaboration, there is a need for clear roles and resources in the form of FTE put toward those roles, so that participation in the OWDP is not simply another project added into staff members' time. Every organization expected to contribute data needs to have the capacity to engage, and needs to see it as important; a funded staffing plan would be key to meeting these goals. Each agency must not only be able to see their role with water data, but also must be able to put resources towards participation. In particular, participants described the need for involvement of staff who are experts at managing data and IT projects within their respective agencies.

- **Barriers to participation and collaboration across agencies.** Participants described some challenges related to collaboration across agencies. While some agencies were highly involved, this was not universal. Not all agencies participated at equal levels: one participant estimated that about ⅓ of agencies participated fully, ⅓ somewhat participated, and ⅓ did not participate. Some agencies did not prioritize OWDP and the staff time needed to support the data portal project. Agencies face resource and staffing constraints and may not view water data as a priority. Consideration needs to be given to how to incentivize full participation of all agencies with water data. Additionally, participants described challenges related to data sharing processes between organizations. For example, file sharing was difficult across agencies and between agencies and external contractors such as IoW, INR, and universities, creating institutional barriers that prevented effective and efficient work together. Participants expressed concern around how to keep state agencies invested and involved, and again discussed the importance of leadership buy-in and active engagement at the executive level.

- **Funding and leadership uncertainties make it difficult to plan for the future.** A key challenge described by participants was the uncertainty of funding on short 2 year legislative budget cycles, given the long-term nature of the project. For example, developing a governance plan was described as difficult when future funding, resources, and leadership are uncertain. It has been hard to make committed plans without knowing

the future of funding. Momentum is difficult to maintain in this situation. Maintaining continuity is key with a long-term project like this one, and long-term resources are essential for sustainability over time. Participants described the crucial need for state investment, and the need to make the case to legislators, decision makers, agencies, and the public that water data is worthy of prioritization and investment. Another uncertainty described by participants was the future of leadership of the OWDP going forward. Again it is difficult to make concrete plans when leadership roles are uncertain. The tentative identification of DOGAMI as a possible new leader of the project was supported by participants.

4.3.3 Evaluation of governance based on criteria

- *Is there institutional commitment by key organizations to use and maintain the system?*
  - **YES, SOMEWHAT-** pending future funding.
- *Are data providers participating, in practice?*
  - **SOMEWHAT-** some agencies are participating fully and actively, while others are participating to a lesser degree.
- *Do incentives exist to ensure participation by data providers and users?*
  - **YES, SOMEWHAT**- governance plan outlines structures for participation, but actual incentives are pending future funding.
- *Are sufficient resources allocated to long-term maintenance?*
  - **UNKNOWN**- pending future funding.
- *Is there a plan to ensure financial stability over time?*
  - **UNKNOWN**- pending future funding.

5. Recommendations, suggestions for improvement, and next steps for OWDP Phase 3

All of these recommendations have relevance for OWDP Phase 3. Some of the recommendations are specific to Phase 2, while others have been carried over from the prior evaluation of Phase 1, but are re-stated here because they remain relevant.

5.1 Technical aspects

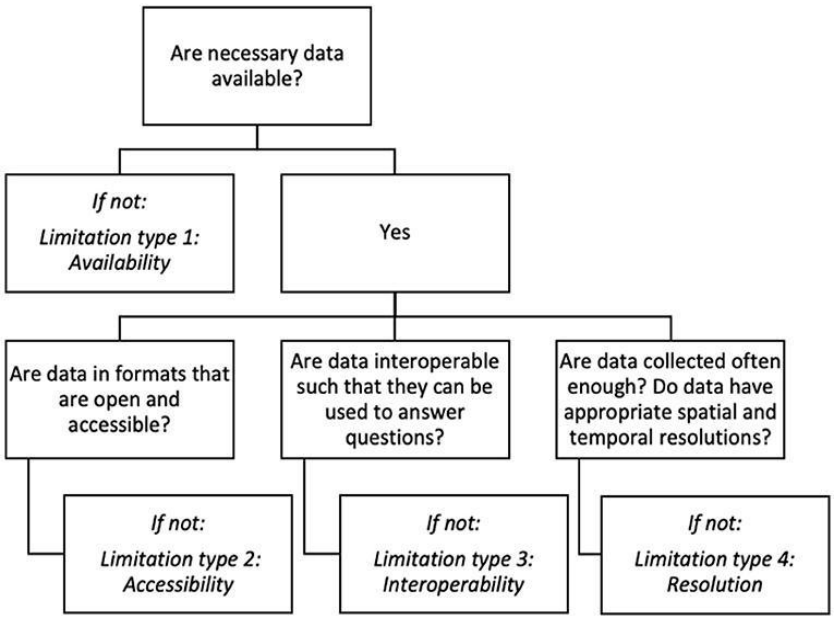
A successful water data system should effectively support synthesis and analysis of data to support decision-making by ensuring adequate documentation and providing clear standards for metadata, data quality, and technical requirements. Here, the evaluation recognizes that the OWDP is still in a pilot phase, and more of these aspects will be developed during Phase 3. The OWDP should consider the following recommendations regarding technical aspects of the project.

- **Maintain sufficient documentation, communication of data standards, and regular updates.** Ensuring continuity and basic functionality of the OWDP is key to making sure that the investments to date will not be wasted.
- **Hire staff with sufficient IT experience.** This phase of the OWDP suffered from the lack of ability to hire a key staff member with deep technical expertise. In the future, hiring key personnel with deep experience in IT will be key to success.
- **Consider the degree to which the architecture of the pilot portal will be able to serve long-term needs.** The pilot portal is currently built as an ESRI ArGIS Hub Site; participants noted that the architecture of this format is limited and in the longer term, a custom solution may be preferable. For Phase 3, the OWDP team will need to consider whether the goals of the portal can be met through expansion of the current portal framework, or whether developing a custom data infrastructure is ultimately necessary for the portal going forward over the long term. This is important when it comes to interoperability of data.
- **Continue identifying and incorporating high priority data sets.** High priority data sets are those that are both "low hanging fruit"- data sets that do not require huge amounts of effort to make publishable- and that are important for meeting real world needs of decision makers. The pilot portal already includes many of these data sets, and can continue to add more in Phase 3. While prioritizing development of "low hanging fruit" makes sense, it is also important to develop the data sets and tools identified as highly important for public use and decision making. In prioritizing development of data sets and decision support tools, it is important to engage with decision makers and target users (Stoltz et al., 2023).
- **Balance accessibility and usability with depth.** One challenge of a data portal is that it must, on the one hand, be easily accessible to members of the public seeking to find information they are interested in; and on the other hand, should make data accessible for those seeking access to full data sets to conduct their own analysis. User-friendly apps and web portals are needed, as is access to full raw data sets.
- **Continue to coordinate with information services staff across agencies.** Including data in the portal, and refining standards for metadata and data quality across all the different agencies, will be an ongoing process that will require working with data specialists at each agency and Department of Administrative Services (DAS).
- **Wherever possible, harmonize metadata and formatting requirements.** Agencies encounter many different reporting requirements, requests, and expectations to serve data to many different data portals and brokers (for example, AWQMS, the Oregon Open Data Portal, the Western States WADE system, USGS, CUAHSI, etc.). There is potential for the cumulative impact of expectations of many different organizations and data

brokers to be a strain on agency resources. Harmonizing and aligning metadata and formatting requirements wherever possible could help alleviate this burden.

- **Continue addressing multiple types of data limitations in order to make important data sets, decision support tools, and models available.** There are multiple types of data limitations: For example, some data may not be available at all, while other data might be available but limited in its accessibility, interoperability, or not collected at a useful resolution (Figure 1). Identifying what type of limitation is at play is useful in determining next steps for any given data set.

Figure 1: Types of data limitations: Availability, accessibility, interoperability, resolution.



5.2 Stakeholder engagement

A successful water data system should engage water data users meaningfully on an ongoing basis in order to ensure a water data system that is useful and usable to inform decision making in practice. Processes such as user-centered design, which center user needs in software and IT development, are increasingly being used in relation to environmental data systems (Houtkamp et al. 2025). This approach argues that deliberate and frequent user engagement can ensure that funds are spent in ways that most directly benefit the public. The OWDP should consider the following recommendation around deliberate, iterative, inclusive engagement.

- **Engagement can and should inform OWDP in multiple different ways.** There are several different types of engagement of interested parties, stakeholders, and Tribes that

each serve different functions. It is important to consider the goals of engagement so that the appropriate format can be chosen. These include (but may not be limited to):

1. Development of use cases to inform what the data portal should be able to do, what types of questions should be answerable, what functionalities and what types of interoperability are important to include, and to help prioritize datasets and development of tools.
2. User testing of workflows to see if questions are answerable and tasks are possible to accomplish based on the data and the tools that exist in the portal; testing if users can find the information they need.
3. Broader information sessions (such as public webinars) or targeted informational meetings with smaller groups of specific data users to inform the public about available tools and data sets.
4. Formation of an advisory board of a range of different types of data users to inform system development.

- **Center ongoing, iterative stakeholder engagement processes within project governance, budget, and timelines.** Engagement should be considered as an ongoing process. Recognizing that public engagement is itself an area of expertise that requires experience, expertise, and skill, it is important that the project staff have the expertise to lead public engagement efforts, including engagement with Tribal and underrepresented communities. OWDP may also consider forming an advisory group made of members of the public who would use a data system, including members of underrepresented communities. It is important to remember that public engagement takes time and funding. Specific resources should be budgeted for ongoing engagement, including at multiple project stages.

- **Identify and incorporate different types of data needs and perspectives.** Different audiences may have different data needs. For example, previous researchers have identified five types of data users, including public sector water resource managers; public sector water resource data analysts; industry and private companies; Tribal Nations; and nonprofit organizations (Restrepo-Osorio et al. 2022). Working with different community groups on an ongoing basis, including underrepresented groups, is crucial to ensuring full representation. OWDP should identify which specific communities have already been represented in the OWDP engagement process, and which perspectives are missing. When the team has identified which perspectives or communities are not represented, reach out directly to those communities or stakeholder groups in particular, and work with them directly to ensure that their data needs are represented. This has the benefit of encouraging community engagement and investment in the OWDP process, while also ensuring more equitable representation.

- **Engage closely with Tribal communities.** Oregon is home to a wide diversity of Tribes whose members care deeply about water. However, only a few people representing Tribal

governments participated in the engagement efforts. Tribal staff members describe having many competing responsibilities and facing many requests from external agencies and parties. They require sufficient time and advanced notice. Future outreach must recognize that it is important to not only consult proactively with Tribal staff members, but in particular to give sufficient lead-up time and advance notice in soliciting that participation. It is also key to involve multiple different Tribal entities and agencies, as there are many diverse Tribal interests, water contexts, and needs across the state of Oregon which cannot be captured by a single Tribal staff member. Movements of Indigenous Data Sovereignty and Indigenous Data Governance strive to center Indigenous control over collection and use of data, addressing issues such as privacy and sovereignty (Carroll et al. 2019; Lovett et al. 2019). Ideally, Tribal staff members should be involved in the governance process of the OWDP to inform broader issues of data sovereignty and privacy. The OWDP team should work closely with Tribal Relations staff members within agencies to develop outreach strategies that will be effective and appropriate, and may consider partnering with an organization and/or hiring a consultant who is experienced and knowledgeable, and who has specific expertise in engaging with Tribal communities. Budget resources should be set aside for this purpose.

- **Strengthen outreach to underrepresented environmental justice (EJ) communities in particular.** Communities impacted by EJ issues are an important set of data users who could benefit from better access to and use of water data. For example, communities experiencing EJ issues could benefit from knowing more about their local water quality, including groundwater contaminants, contaminants in fish, and drinking water quality. The knowledge of communities impacted by EJ issues is important to include in data systems and processes. The team should consider partnering with existing EJ organizations and/or hiring a consultant with well-developed existing connections to underrepresented communities impacted by EJ issues. Existing research on Oregon environmental justice issues can be referenced to learn more about water data needs of underrepresented communities such as renters, farmworkers, and mobile home park tenants (e.g. Brown et al. 2022; Dalgaard 2022). Budget resources should be set aside for this purpose.

- **Make materials available in different languages where it is most relevant.** Recognizing that Oregon is a diverse and multilingual state with many different communities who may have different priorities and needs around water, engaging with different language speakers would be an area to improve upon in future iterations. This could involve identifying a limited set of high priority use cases that would best serve target communities, then ensuring those are accessible in different languages. This would require targeted outreach and funding.

- **Strengthen engagement with higher education institutions.** Oregon's higher education system has potential to be a valuable collaborator and key partner. Working with

universities, including research universities and community colleges, could provide valuable opportunities for strengthening the portal, reaching community partners who do not currently work closely with state agencies, and training a data-literate water workforce. Participants envisioned many opportunities including classes (for example, data curation, data science, visualization, data security, etc), continuing education credits, the use of the OWDP as a living laboratory, a student fellowship program, community engagement, partnering with researchers, workforce development, and applying for grants to support this work.

5.3 Governance

A successful water data system should have institutional commitment by key organizations, incentivize participation by data providers and users, and ensure sufficient resources for financial stability over time. Ensuring that the data system is trusted by the public and perceived as useful and legitimate is also key to ensuring a data system that is used in practice. In order to do so, the OWDP should consider the following recommendations.

- **Implement the recommended governance plan.** Significant effort has gone into the creation of a detailed governance plan which outlines roles, responsibilities, and decision-making processes to sustain the OWDP over the long term. The plan contains recommendations for staffing, team structures, task forces, and decision making processes, as well as an engagement strategy including usability testing, interagency convenings, and engagement of Tribes and interested parties. Implementing this plan will be important going forward into Phase 3.
- **Ensure leadership is engaged and fully committed to OWDP success.** This evaluation identified the need for increased buy-in and support of the OWDP at the executive leadership level of whatever agency it is housed within. Plans for the OWDP can only be supportive if executive leaders of the lead agency and other agencies are on board. Executive leadership should take into consideration that a lack of data standardization and alignment is expensive; while the data portal seems resource intensive, it is also expensive to *not* have integrated data systems. Agency leaders at the executive level should acknowledge the importance of water data and be responsive to the concerns and perspectives of staff and managers who are deeply involved and knowledgeable about the project.
- **Incentivize participation by different agencies.** The OWDP project team identified 17 different state agencies that hold at least some data relevant to water decision making and infrastructure planning. Of these agencies, the OWDP is core to the mission of a few agencies, while water issues are likely perceived as more tangential to others. Moreover, the agencies are different sizes, with different capacities and different existing systems

and standards for data management. All of this presents a challenge for engaging all 17 state agencies. It can be difficult for agency staff members to commit time to the OWDP if it is not recognized and considered as an integral part of their job by their own agency. Formal MOUs from agencies committing staff time and other needed resources may be a useful mechanism to ensure involvement. Budget requests may need to include funding for all participating agencies to fund staff time. The recommended governance plan lays out structures for involving staff from different agencies.

- **Develop a sustainable long-term funding structure.** The funding structure should keep in mind that a data system requires significant up-front costs as well as long-term funding for maintenance, upkeep, improvements, and incorporating new data. Data and information are important public services that deserve public investment and should be accessible to all. A funding structure should focus on securing long-term, public funding to ensure that the data system is accessible, open, transparent, and useful for the public.

- **Lead agency should strive to maximize trust and positive public perception.** DEQ's role as a regulatory agency has been identified as a barrier to hosting the project at DEQ long term, as some members of the public may be reluctant to engage with or trust the OWDP if it is perceived as a regulatory project. The OWDP may need to move to another agency. DOGAMI has been discussed as a potential home for the project.

- **Balance a long-term project with small, actionable steps.** A water data portal will require many years of effort. It is thus important to plan for smaller, achievable goals to demonstrate effectiveness and prevent inertia or collapse of the project. Inclusivity and broad-based participation must be balanced with the need to make decisions and move forward. A clear decision-making process, such as that outlined in the governance plan, can help address these challenges.

- **Incorporate Tribal data governance and sovereignty.** OWDP should be attentive to concerns around Tribal data sovereignty. OWDP data governance plans must be respectful and inclusive of Tribal data sovereignty and governance methods. The OWDP should engage Tribal communities fully and on an ongoing basis, including in governance processes. Tribal engagement and data sovereignty should be formalized, in collaboration with Tribal staff members who regularly engage with water data.

- **Continue to engage with coalitions and collaborative groups.** Groups such as Internet of Water can help ensure that best practices and lessons learned from other places are implemented in Oregon (for example, see Moran et al. 2020 on California and others; Shukla et al. 2020 on Florida; Hobbs et al. 2024 on New Mexico; Rosen & Mace 2019 on Texas; and Cantor et al. 2018 and 2021 on California). Continuing participation with the IoW Technology Adoption Program and other IoW educational, networking, and training programs would be a helpful way to ensure Oregon continues to follow national best practices and continues to learn from other states.

6. Conclusions and next steps

In conclusion, the evaluation finds that the OWDP has done a commendable job of meeting the legislative direction to create a pilot water data portal that will ultimately serve as a useful, usable, and accessible water and infrastructure database. Continuing the OWDP in Phase 3 will be essential in bringing this project to fruition and ensuring continued use of the resources invested so far.

The OWDP Project Team has developed the following recommendations for OWDP Phase 3 (2025 onward), noting that upcoming legislative decisions will shape the project's scope and resources moving forward:

1. Establish a sustainable governance structure and operational framework for the OWDP project
2. Develop a comprehensive plan for the development and implementation of the permanent portal
3. Collaboratively develop and implement common data standards, protocols, and technical frameworks for Oregon's Water Data Portal
4. Enhance pilot portal functionality and usability through user engagement and iterative development
5. Partner with agencies to advance data readiness and strategic water initiatives
6. Strengthen user engagement, build awareness, and improve pilot portal accessibility

This evaluation supports all of the above recommendations, which address the technical, stakeholder engagement, and governance challenges and recommendations discussed in this evaluation. Many of the specific findings of this evaluation can be addressed through these OWDP-developed recommendations.

Incorporating these recommendations will help ensure that a data system is useful, accessible, and used in practice. These recommendations will also help ensure that the data portal serves the diverse communities within Oregon.

To conclude, a modern water data system for the State of Oregon continues to be key to ensuring the state is able to serve its diverse constituency and meet its long-term water and infrastructure planning goals in a cost-effective way. The OWDP project team has taken significant steps in the process of developing a data system that will be useful, usable, accessible, and used in practice to support informed decision making. Continuing to invest in a modern water data system should be a priority for the State of Oregon moving forward.

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