Developing the IWRS Research Agenda:
A Look at Data and Information Gaps

"When it comes to managing water resources, what do we know, what don't we know, and what information do we need?

Materials Prepared for April 14, 2010
Integrated Water Resources Strategy
Policy Advisory Group Meeting

OREGON'S INTEGRATED WATER RESOURCES STRATEGY

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Understanding Instream (Non-Consumptive) Needs

Summary Recommendations:

- Develop consistent methodology/data to define and quantify instream environmental needs (water quantity, water quality, channel morphology, substrate, and fish passage needs).
- Create guidance for prioritizing watersheds/basins for data collection and monitoring, given limited funding and staffing resources.
- Develop a framework for collecting and maintaining “basic” data for priority watersheds/basins. Basic data include: streamflow, precipitation, water quality, and habitat parameters.
- Develop better data to define and quantify navigation, hydropower, and recreational needs.
- Develop better data to define and quantify impacts of run-off and removal-fill impacts.
- Improve capacity to process data that is already available. For instance, develop basin yield estimates, building upon the “water availability basin” [WAB] methodology currently in use by OWRD.
- Create inter-agency (local, state, federal) agreements for leveraging resources, methods, and tools for data sharing.

<u>Instream (Non-Consumptive) Study: the 2008 Oregon Water Supply & Conservation Initiative</u>

Ronan Igloria, P.E., HDR Engineering

What do we know?

- Major non-consumptive uses of water include: hydropower, habitat (fish, instream), water quality, scenic, and recreational.
- Evaluation of instream water needs is typically defined on a reach-by-reach basis. OWRD defines instream flow requirements for streams using existing instream water rights and state scenic water way designations. Instream water rights have been adopted for only a fraction of streams across the state.
- Oregon Water Resources Department (OWRD) completed a statewide water needs assessment under the Oregon Water Supply and Conservation Initiative (OWSCI) that included methodology to calculate "surrogate instream demand" on a volumetric basis for each administrative basin. The methodology was developed in cooperation with state agencies with authority to apply for instream water rights (Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, and Oregon Department of Parks and Recreation).
- OWRD maintains several databases that are useful for evaluating current and future water demands: water rights information system, water use reporting, and water availability reporting system.
- Other state and federal agencies provide useful information, but the information is not centralized (assumptions, planning periods, etc.). Data includes: fish presence, climate data, hydropower licensing, water quality (e.g. 303d, TMDL).

What information do we need?

- Consistent, science-based, technically sound, and understandable methodology to define and quantify instream environmental needs. Strategic prioritization and protection of reaches.
- Data on other habitat limiting factors that may or may not be related to flow quantity (e.g. channel morphology, substrate, fish passage issues). This would inform the strategy and prioritize specific stream reaches for flow management.
- Water availability and basin yield estimates (building on the "water availability basin" [WAB] methodology currently in use by OWRD). Capacity to process data that is already available.
- More robust climate data to account for regional variability and climate change conditions, including downscaling of global and regional scale models.
- Maintain existing and install additional flow monitoring at prioritized stream reaches.
- "Hydropower demand forecast," accounting for external market drivers and prioritizing where hydropower development is likely to occur.

Recommendations for Information Investments / Efforts:

- Create guidance for prioritizing watersheds/basins for data collection and monitoring, given limited funding and staffing resources.
- Develop a framework for collecting and maintaining "basic" data for the priority watersheds/basins. Basic data includes: streamflow, precipitation, water quality parameters, and habitat parameters.
- Develop inter-agency (local, state, federal) agreements for leveraging resources, methods and tools for data sharing.
- *See also – Consumptive Use recommendations.*

Scenic Waterways, Habitat & Species, Water Quality: Interagency Work in Instream Water Rights
Dwight French, Water Rights & Adjudication Administrator, Water Resources Department

Background

Under Oregon's Instream Water Right Act of 1987, three state agencies can apply for new instream water rights—Oregon Parks and Recreation Department (OPRD), Oregon Department of Environmental Quality (DEQ), and Oregon Fish and Wildlife Department (ODFW). The value of an instream right is to provide water for instream functions, and certainty to water users who want to apply for water rights on a particular stream or reach. New instream water rights are assigned priority dates and regulated like any other water right. The Water Resources Department holds these instream water rights in trust. Since July 1987, these agencies have filed 997 instream water right applications, potentially protecting 42,119 river and stream miles, if approved.

OPRD .... 2 applications
ODFW .... 954 applications
Jointly filed by OPRD and ODFW .... 9 applications
DEQ .... 32 applications

Of these applications, 125 were protested. Sixty-nine applications remain under protest.

What information do we use?

The Oregon Parks and Recreation Department can file instream water rights for a number of reasons, including recreation flow requirements, scenic attraction and wildlife viewing, camping, hiking, boating access and picnicking. The methodology for determining flow requirements is described in more detail in Oregon Administrative Rules (OAR) 736-060-0015.

Oregon Department of Fish and Wildlife may apply for instream water rights to address four primary categories: (1) to fulfill fish and wildlife species plans and other plans; (2) to protect sensitive, threatened, endangered species or other important resources; (3) to maintain or enhance habitat or functions of a waterway; or (4) to conserve, maintain, or enhance angling, hunting and other recreational uses. The standards used in these decisions are described in more detail in OAR 635-400-0020.

The Oregon Department of Environmental Quality may apply for instream water rights for water quality purposes, including pollution abatement, protection or maintenance of water quality for beneficial uses, and maintenance of adequate flows. More details regarding the selection of streams for instream water rights applications are found in OAR 340-056-0200.

Recommendation for Information Investments / Efforts:

A gap analysis from OPRD, ODFW, and DEQ would help determine which reaches would benefit most from instream water right applications.

<u>Fish Habitat Needs: Data Needs for Instream Water Flows</u>

Bruce McIntosh, Fish Division Deputy Administrator, Inland Fisheries, Department of Fish and Wildlife

Background

For base flow needs:

- Water instream is required to sustain basic life stage functions.
- There are a number of well-established models used to determine base flow instream needs for fish (most instream flows applied for by ODFW have been established using the Oregon Method).
- About 1,457 instream water right (ISWR) flows have been established in Oregon (about 1,000 as reaches and 500 as points).
- Out of the 2,530 Water Availability Basins (WABs) statewide, 1,194 do not have ISWR (many of these WABs are immediately upstream from ISWRs, so some protection is afforded).
- For most of these, a flow study needs to be completed to apply for an instream water right. Complexity of such a study depends on the specific objective; studies require field measurement.
- Information must be developed for each stream reach.

For channel maintenance needs (peak flows):

- Based on physical attributes of a stream.
- Can be defined by general attributes and type of stream.
- General concepts can be modeled and applied across water basins for same stream type.
- More accurate assessment requires field studies.
- Major need is accurate hydrologic data and stream gaging.
- ODFW has developed basic guidance for determining these types of flows.
- Needed in streams where storage or water withdrawals are contemplated to exceed 50% exceedance values.
- Information either needs to be developed on a project basis (stream) or information can be developed for a basin.
- Currently three project specific analyses have been completed.

For ecologic flows (flows that trigger biological processes):

- Usually are specific to a given species, lifestage, site and/or stream.
- General relationships have been observed between flows and certain processes, but not quantified.
- Few studies have focused on flow needs for any specific process.
- Basic research is needed to get quantitative flow information.
- Most flows currently are identified by timing, season or event, not flow.
- Needed when site specific flows are identified as important for a species of interest.

What information do we use?

- Fish and habitat distribution: The best information is generally on the distribution of salmonids and their habitat in anadromous basins.
- Fish life history information: Information on life history is species- and location-specific.
- Base Flow needs: Specific to salmonids. About half the state's streams have established flows through instream water rights.
- Water availability: ODFW relies on information from the Water Resources Department.
- Relationship of water quality to quantity: ODFW relies on information from DEQ.
- Streamflow records (how often are different flows met): ODFW relies on information from the Water Resources Department and U.S. Geological Survey.

- Barriers to fish distribution: Information comes from ODFW.
- Relationship of flows to population dynamics and recovery of species.
- Relationship of flow magnitudes and frequency to population and lifestage health.

What don't we know?

- Flow needs for species other than the high profile salmonid species (e.g., lamprey, chub, white fish, other native fish species, amphibians, macroinvertebrates, etc.)
- Flow needs beyond base flows (these flows are only now being recognized as significant contributors to maintaining species populations) such as channel maintenance and ecological flows.
- Flow needs to maintain water quality throughout a stream system (DEQ is beginning to work on this with TMDL modeling).
- Relationship of flows to population dynamics and productivity of multiple species.
- Frequency needs (return intervals) of given flows.
- Timing and/or duration of given flows.
- Real time understanding of streamflows. (There are gaps in stream gaging and long-term records. Many gages are unfunded, and/or have been eliminated.)
- The cumulative effect and timing of withdrawals affect fish populations and their habitat.
- Impact of climate change on flows, water availability, and habitat in the next 25 years.

Recommendations for Information Investments / Efforts:

Determine, in the short term:

- Base flow needs for streams without base flow values. Established methodology exists.
- Channel maintenance flows. These have scant information available, but fairly well established methods for determining flows that are important for the long-term health of fish populations.
- Ecological flows. These are less defined, but known to be important for certain life stages. Quantitative information is rare and methodologies are not defined in Oregon.

Determine, in the long term:

- Flow needs for native species other than salmonids.
- Relationship of population dynamics and productivity to flows.
- Relationship of flow to water quality conditions.
- How is water availability going to change with potential climate change?

Useful Links / Resources:

- Data Gap analysis by species from Oregon's Conservation Strategy Document - http://www.dfw.state.or.us/conservationstrategy/document_pdf/b-species_2.pdf
- Fish Habitat Distribution maps - http://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=fishdistmaps
- Fish Life Stage Timing Tables - http://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=timingtables
- Flow Restoration Needs - http://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=streamflowmaps
- ODFW Channel Maintenance Guidance - http://www.dfw.state.or.us/fish/water/docs/ODFW_Guidance_on_Allocating_Peak_Flows.pdf
- Conservation and Recovery Plans - http://www.dfw.state.or.us/fish/CRP/conservation_recovery_plans.asp
- Oregon Native Fish Status Report - http://www.dfw.state.or.us/fish/ONFSR/report.asp
- Oregon Conservation Strategy - http://www.dfw.state.or.us/conservationstrategy

Forest Lands

Jim Paul, Chief, Private Forests Division, Oregon Department of Forestry

Background

The Oregon Board of Forestry, through its *Forestry Program for Oregon*, has established goals (strategies), objectives (actions), and indicators for achieving its mission of leading Oregon in implementing policies and programs that promote environmentally, economically, and socially integrated and sustainable management of Oregon's public and private forests.

Three of the Board of Forestry seven goals are closely related to the Integrated Water Resources Strategy. They include:

- Goal C**:** Protect, maintain, and enhance the productive capacity of Oregon's forests to improve the economic well-being of Oregon's communities.
- Goal D: Protect, maintain, and enhance the physical and biological quality of the soil and water resources of Oregon's forests.
- Goal E: Contribute to the conservation of diverse native plant and animal populations and their habitats in Oregon's forests.

What information do we need?

For Goal C: data are available for an indicator evaluating the "area of non-federal forestland and development trends." This information will allow policy makers to determine how much, and where Oregon forestland is being developed and what areas of forestland are likely to be developed next. This indicator information has direct implications for future water quality and quantity policy discussions since forestlands produce the state's highest quality water.

For Goal D: data are available for two of three indicators. The "water quality of forest streams" indicator uses available Department of Environmental Quality (DEQ) data on water quality index sampling of Oregon forest streams. The "biological integrity of forest streams" indicator relies on available DEQ data on index of biological integrity sampling on Oregon forest streams. Together, these two indicators assess how the physical, chemical, and biological properties of forest streams are changing. The "forest road risks to soil and water resources" indicator is designed to assess hydrologic connectivity, fish passage, and land area in non-forest condition on a sample of forest roads throughout the state. This information will be valuable in evaluating the forest road improvements that have taken place through the Oregon Plan for Salmon and Watersheds. The indicator will require field crews to drive the roads, and assess the potential for run-off, water quality and fish habitat impacts, and erosion. If funding is available, the Department of Forestry would like to initiate at least a pilot project for this indicator in 2011 or 2012.

For Goal E, indicator data are available for the "extent of area by forest cover type in protected area categories" and for "forest plant and animal species at risk." Information may become available later in 2010 for a third indicator, "composition, diversity, and structure of forest vegetation."

Recommendations for Information Investments / Efforts:

- Funding is needed for contracted resources to conduct initial statewide field sampling of forest road conditions with potential re-sampling on a five- or ten-year cycle.

- Increased funding and resources are needed for ongoing, intensified, randomized water quality index and index of biological integrity sampling of Oregon forest streams by DEQ.
- More stable funding mechanisms are needed for the Department of Forestry's budget directed at maintaining and increasing public and private investments in forests and in keeping forests in forest use.
- Better integration is needed of adaptive forest management, monitoring, assessments, systematic evidence reviews, and research, particularly research regarding the scientific principles of ecosystem dynamics, into learning, planning and decision-making processes.
- Greater understanding, acceptance, and support across all land uses is needed for relevant evaluations of water quality conditions based on beneficial uses, and the use of these evaluations to develop stream protection policies that result in consistent application of state water quality standards across land uses.
- Continued long-term watershed research is needed to study the effectiveness of the most current forestry best management practices in providing protection for soil and water resources and promote the sharing and application of new knowledge.
- Promoting the maintenance of forestland in forest uses and promote the establishment of new forests are needed as key elements in promoting high quality water and protection of soil productivity.
- Forest management is needed that perpetuates the ecological processes—including disturbance dynamics—that contribute to desired aquatic habitat and water quality using a landscape level approach.
- Continued statewide efforts under the Oregon Plan for Salmon and Watersheds are needed to enhance, restore and protect Oregon's native salmonid populations, watersheds, water quality, and fish and wildlife habitat, while sustaining a healthy economy.
- Development of a coordinated, statewide Oregon native plant and animal conservation policy addressing all land uses and ownership classes is needed. The policy should clearly state public expectations for base-line resources site protection, as well as broader contributions of private land owners to achieve state conservation goals. The policy should also clarify that private forestlands will be held to the same standards as other private land uses.

Useful Links / Resources:

- Oregon Department of Forestry - http://egov.oregon.gov/ODF/index.shtml
- Forestry Program for Oregon - http://egov.oregon.gov/ODF/BOARD/fpfo2003.shtml
- Oregon Indicators of Sustainable Forest Management - http://www.oregon.gov/ODF/indicators/index.shtml
- Forest, Farms, and People: Land Use Change on Non-Federal Land in Oregon 1974-2005 - http://www.oregon.gov/ODF/RESOURCE_PLANNING/docs/Low_Res_Forest_farms_8_9_09.pdf
- High Level Indicators of Oregon's Forested Streams - http://www.oregon.gov/ODF/indicators/docs/High_Level_Indicators_DEQ09_LAB_0041_TR.pdf
- The Future of Oregon's Forests: Choices, Consequences And What's At Stake For Oregon - http://www.oregonforests.org/assets/uploads//Working_Web.pdf
- Oregon's Family Forestlands: Why They Matter To The State's Quality Of Life - http://www.oregonforests.org/assets/uploads//Oregon_Family_Forestland.pdf
- Watershed Science at Work In Oregon's Forests: New Paired Watershed Studies Look at Effects of Contemporary Forest Management on Streams - http://www.oregonforests.org/assets/uploads//watershed_science.pdf
- Drinking Water and Forestry - http://www.oregonforests.org/assets/uploads//Drinking_Water.pdf

<u>Wetlands and Waterways: Oregon's Removal/Fill Program</u>

Lori Warner-Dickason, Northern Region Manager, Department of State Lands

Background

The Department of State Lands (DSL) administers Oregon's Removal/Fill Law, which requires persons to obtain a permit prior to conducting earthwork in wetlands and waterways ("waters of the state"). In order to issue a permit, the Department must determine that the proposed activity:

- is the practicable alternative with the least adverse impacts on the water resources.
- is consistent with the protection, conservation and best use of the water resources,
- would not unreasonably interfere with preservation of waters for navigation, fishery or public recreation (state-owned submerged and submersible lands).

The Department considers many factors when making these determinations, but there are two that are fundamental in the management of waters of the state: identification of adverse impacts (loss of functions) and mitigation for those impacts on a watershed level. DSL considers functions that are related to flood storage, water quality, fish habitat, wildlife habitat, navigation and public recreation.

What information do we use?

DSL uses information and data related to all of the functions listed above for specific site impacts, but needs to apply that information on a watershed scale to strategically address avoidance and minimization of impacts and mitigation for unavoidable impacts.

What do we know today?

DSL has a <u>wetland</u> functional assessment method and prescriptive method for providing wetland mitigation to address site-specific needs. The Department uses various sources of information including watershed action plans, Total Maximum Daily Load (TMDLs), Salmon Recovery Plans and the ODFW Conservation Strategy to implement a more watershed-based approach in our permit decisions.

What don't we know?

We are currently lacking a <u>stream</u> functional assessment method and standard stream mitigation protocols to offset functional loss to streams.

Recommendations for Information Investments / Efforts:

- Stream functional assessments and protocols for stream mitigation need to be developed.
- Watershed information is not of consistent quality or consolidated in one place to help us answer basic questions about specific impacts and appropriate mitigation citing.
- Develop tools to measure the effectiveness of our current mitigation strategies and specific performance standards that are more directly tied to functions.
- Better access to tools, such as more accurate GIS and other mapping layers to identify limiting factors early on in the planning stages of projects so impacts to waters can be avoided and minimized to the maximum extent practicable.

Understanding Out-of-Stream (Consumptive) Needs

Summary Recommendations:

- Develop better standards/guidance for water use data collection and reporting.
- Utilize and enhance the OWSCI Demand Forecasting Tool for policy discussions and regional-level planning; prioritize data needs and put in place the funding and capacity to regularly update the state-wide demand forecast.
- Conduct statewide coordinated economic studies for: (i) land use-water use; and (ii) infrastructure replacement and renewal ("capital conservation").
- Consider the ties among water planning, land-use planning, and economic development. Where will Oregon grow? What industries will it recruit? How will private and public investments emerge, in relation to community land-use programs and economic development incentives? How will water quantity, quality, and ecosystem issues shape development and vice versa?
- Watershed-level identification of mitigation opportunities.

<u>Out-of-Stream (Consumptive) Study: the 2008 Oregon Water Supply & Conservation Initiative</u>

Ronan Igloria, P.E., HDR Engineering Inc.

What do we know?

- Major consumptive water uses include: municipal, domestic, industrial, agricultural.
- Evaluation of water needs and demand forecasting is generally conducted on a local level (e.g. municipalities, water utilities, irrigation districts). Some regional entities also evaluate demands on a watershed or basin level when planning or developing large or regional sources of water supply. Recently, the Oregon Water Resources Department (OWRD) completed a statewide water needs assessment under the Oregon Water Supply and Conservation Initiative (OWSCI) that created a flexible and transparent *demand forecasting tool* for policy-level discussions and scenario analysis. The tool allows data to be updated.
- Demand forecasting methodologies vary from simple planning models (e.g. "per capita" models), disaggregated numerical models, and more advanced econometric (statistical) methods. The various methods rely on a range of data and level-of-effort. Typically, the available resources (i.e. budget and time) and data are the drivers for choosing a method.
- OWRD maintains several databases that are useful for evaluating current and future water demands, such as a water rights information, water use reporting, and water availability.
- Other state and federal agencies provide useful information, but the information is difficult to access/process and planning criteria are not standardized (assumptions, planning periods, etc.). Data include: population forecasts, land cover, agriculture census, climate, water use, etc.

What information do we need?

- Comprehensive and consistent water-use reporting.
- Consistent and coordinated population forecasting program for the state for water planning purposes, including when and where population will grow.
- Studies on land-use trends for agriculture and urban-rural transition areas. These may be available but need "consolidation" for water planning purposes.
- More robust climate data to account for regional variability and climate change conditions in demand models, including downscaling of global and regional scale models.
- Ability to effectively extrapolate or compare demand forecasts. Water use and water demand forecasting data are generally inconsistent / presented at various geographic scales.
- Understanding of how water demand/need is affected by economic factors (e.g. commodity pricing, water pricing, regulations) especially in agricultural and urban-rural transition areas.
- Assessment of statewide water conservation potential (e.g., volume of water, cost, barriers).
- The condition of water infrastructure and the cost-benefit (economics) of investing in water infrastructure for improved water delivery.
- Quantity of "water demand" not currently met by existing supplies (surface and groundwater).

Recommendations for Information Investments / Efforts:

- Develop better standards/guidance for water use data collection and reporting. Some of the information needs listed above are available, but data accessibility or transferability is limited.
- Conduct statewide coordinated economic studies for: (i) land use-water use; and (ii) infrastructure replacement and renewal ("capital conservation").
- Utilize and enhance the OWSCI Demand Forecasting Tool for policy discussions and regional-level planning; prioritize data needs and regularly update the state-wide demand forecast.
- *See also – Non-consumptive Use recommendations*

Oregon's Economic Development Needs

Based on staff interviews and workshop with the Oregon Business Development Department

Background

Water needs (quantity/quality/discharges) vary by industry – from a minimal concern to a potentially major factor in siting, operations, and expansions. To date, water availability has not generally been a top tier deciding factor in business decisions, but there are some indications of growing concern about what the future holds in store.

Recommendations for Information Investment / Efforts:

As part of the background/issue papers developed for the Integrated Water Resources Strategy, several questions emerged, related to water planning for future out-of-stream (consumptive) needs in our growing population and industrial centers. Staff at the Oregon Business Development Department / Business Oregon echoed these same informational needs during interviews and a workshop with the IWRS Project Team.

1. If Oregon wants to promote water conservation or water re-use/recycling and make recommendations about technical assistance and grant/loan programs for these purposes, the state could learn from industries that are already working on this.

2. The IWRS needs to consider the ties between water use/demands and land use, such as: (1) Where will Oregon grow? (2) How will private and public investments emerge, in relation to community land use programs? (3) How will water quantity, quality, and ecosystem issues shape development and vice versa?

3. In addition, the Oregon Business Development Department's Infrastructure Finance Administration has recently formed and is looking at the state's infrastructure needs, including water and wastewater systems. A better understanding of the status and future needs of the state's water and wastewater infrastructure should emerge from the IFA's efforts.

Transportation and Construction

William Fletcher, Water Quality / Resources Program Coordinator, Dept of Transportation (ODOT)

Background

Although present throughout the state, ODOT has a minor role in Oregon's water resources. Its management of water is largely related to stormwater and the need to keep highways safe and stable, and to prevent erosion at its construction sites. ODOT uses water for construction activities, maintenance, landscaping, and facilities and in that sense, is representative of public and private entities who manage infrastructure and construction projects. As ODOT designs stream crossings and mitigation projects as well as stormwater drainage, it is important to have a better understanding of the effects of climate change.

Recommendations for Information Investments / Efforts:

ODOT's data needs are many, as the agency must design and maintain highway drainage and stream crossings, ensure safe drinking water and sanitary conditions at rest stops, and develop projects that comply with wetland, fish habitat, hazmat, water right, and other state and federal regulations.

One primary water-related issue for ODOT is how to treat and where to put excess water, generated as run-off. The management of such water could be more strategic and supportive of State goals if the Department had more information about where it was most needed (and the policy tools to support such management).

Example of data needs include:

- Watershed-level identification of critical water resources issues and needs
    - Instream flow requirements and shortfalls
    - Groundwater requirements and shortfalls
    - Habitat requirements and shortfalls
    - Water quality issues
    - Flooding issues
- Watershed level identification of mitigation opportunities that address identified issues and needs

Understanding Oregon's Water Resources

Summary Recommendations:

- Maintain existing and install additional flow monitoring at prioritized stream reaches.
- Leverage data/sample collection between agencies. A Statewide Monitoring Council would be needed to ensure data quality needs are met.
- Conduct effectiveness monitoring of treatment techniques to point future projects to those areas with the greatest potential to improve water quality.
- Define a structure (perhaps through the Integrated Water Resources Strategy) that lists assumptions so all agencies are using the same assumptions in planning/decision-making and can use adaptive management.
- Monitor and assess pollutants for which we have no comprehensive data, but which the U.S. Environmental Protection Agency has flagged for future work.
- Resources to conduct (and cost-share) basin-wide studies.

<u>Surface Water Supply: Oregon's Stream Gaging Network</u>

Jonathan LaMarche, P.E., Water Resources Department Hydrologist

Background

Stream gages provide the backbone of the Oregon Water Resources Department (OWRD's) hydrologic investigations and water management efforts. For example, the OWRD's water availability analysis, which determines the availability of water for further appropriation, is primarily based on data collected by OWRD and U.S. Geological Survey (USGS) stream gages. Groundwater studies designed to understand sustainable yield and groundwater/surface water interactions also rely heavily on data from stream gages. In addition, watermasters rely on gages operated on both diversions and streams to effectively distribute water according to Oregon water law.

What information do we use?

OWRD has undertaken an evaluation of the Oregon stream gaging network. The evaluation consists of the following steps: 1) establish the goals of the OWRD stream gaging program, 2) determine appropriate metrics to evaluate these goals, 3) document the purpose of each gage (e.g., forecasting, management, etc) for both active and discontinued gages, 4) evaluate how information from these gages (including discontinued sites) meets the State's goals, and 5) identify data gaps, redundancies, and current high value gages in the network. The evaluation will determine if the gaging network is meeting current OWRD needs and help describe an optimum network given staff and budget constraints. The evaluation also considers non-OWRD operated gages as well as monitoring alternatives to stream gaging.

The goals of the gaging network have been established. These goals are to provide data: A) for effective management and distribution of water; B) for accurate regional hydrologic analysis (e.g., water availability analysis); C) to define hydrologic systems (e.g., basin water budgets); D) necessary for forecasting efforts; E) for long term trend analysis; F) for other needs (legal obligations, etc).

Some of the evaluation criteria have been established, while others are under development and internal peer review. Most active gages (541) in Oregon have been inventoried as to their purpose of operation. In addition, many discontinued gages have also been inventoried as to their historic purpose. Evaluation of the forecasting goal (item D) has been completed with cooperation from related federal agencies such as US Bureau of Reclamation, National Oceanic and Atmospheric Administration, National Weather Service, US Army Corps of Engineers. Most forecasting needs are currently being met by the existing stream gaging network. The evaluation for water management (item A) has been completed and is under internal peer review. This part of the evaluation compliments the department's strategic measurement plan in that it also examines how OWRD monitors water in the context of the active stream gaging network. Numerous locations were identified for potential gaging to improve water management and given a general priority ranking. However, current resources limit the expansion of the existing network.

Recommendations for Information Investments / Efforts:

The remaining goals need to be evaluated. After all goals have been evaluated, additions to the existing gage network will be identified. To create the most efficient gaging network given resource constraints, it maybe necessary to shift resources from existing gages (that provide limited benefit) to those new locations that fulfill multiple goals.

<u>Water Quality</u>
Gene Foster, Ph.D., Department of Environmental Quality

What information do we use?
There are various types of data that DEQ uses including:

- Surface water quality monitoring data collected by DEQ, other state and federal agencies, watershed councils, municipalities, permitees and universities. This data typically is for conventional water quality pollutants such as temperature, dissolved oxygen, bacteria, and pH. Recently, more monitoring for toxic pollutants is available, including at DEQ.
- Groundwater Assessments that were conducted around Oregon during the 1980s and early 1990's.
- Groundwater quality data for the three Groundwater Management Areas around the state for nitrate, nitrogen and some pesticides.
- Real Estate Transaction Data that is collected when real estate that includes a domestic well is sold. Arsenic, nitrate and total coliform bacteria are measured and reported to the Department of Human Services' Drinking Water Program.
- Socio-economic data, land use information, and flow data.
- Results from the Clean Watershed Needs Survey (conducted every four years, next survey will be in 2012). This is an assessment of Oregon's capital needs required to meet the water quality goals set forth in the Clean Water Act.

This information is used to:

- Develop the biannual assessment of water quality in Oregon and identify the list of impaired waterbodies as required by the Clean Water Act
- Develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies (clean water plans) and work with communities and other designated management agencies to implement the plans.
- Develop permit limits.
- Support Clean Water Act Section 401 water quality certification decisions.
- Work with municipalities on drinking water protection efforts.
- Work with local Groundwater Management Committees to implement action plans in Groundwater Management Areas.
- Work with others to implement nonpoint source pollution best management practices.
- Prioritize work at DEQ and funding decisions (for grants and loans) to leverage other state and federal funding.

What do we know today?
We know a lot about water quality in Oregon, particularly about conventional pollutants such as temperature, bacteria, and dissolved oxygen:

- To date, there are almost 15,000 miles of streams in Oregon that exceed water quality standards for one or more pollutant [note that number will change by the end of 2010].
- To date, DEQ has completed 1,013 TMDLs, which means we have plans in place to get the river or stream back to meeting standards.
- Oregon has a capital need of at least $6 billion in projects to improve water quality.
- Toxic pollutants are found in Oregon's rivers that exceed water quality standards and others that do not have standards, are also present. Legacy pesticides and other toxic pollutants are found at unacceptably high levels in resident or non-migratory fish tissues, which are harmful to human and ecosystem health.

- Nitrate levels in groundwater exceed drinking water criteria (maximum contaminant levels) in several areas of the state including the Willamette Valley, Rogue and Deschutes basins, lower Umatilla basin and northern Malheur County.
- Water quality conditions on agricultural and urban landscapes are significantly more impaired than forest lands in the Willamette basin, generally because of the condition of streamside vegetation.
- Healthy trees, shrubs and ground cover provide shade to keep water temperatures cool, and a stable stream bank keeps sediment and nutrients from running off the land.
- In general, the water on Oregon beaches is safe for contact recreational activities. However, certain locations on the coast are susceptible to high bacteria levels that are unsafe when contacted during wet weather.
- Water quality steadily improved around Oregon from 1990-2000. Wastewater facility upgrades that included improved streamside vegetation protection measures likely played an important role in the water quality improvements. However, there has been a downward water quality trend at many of our long term monitoring sites over the last ten years. This may be related to the rapidly increasing population in Oregon over the last decade, increasing sources of diffuse pollution from runoff, and other reasons.
- Lower river flows often result in poorer water quality. Lower flows result in changes in natural processes such as more solar heating of shallow, slower-flowing streams, more algal growth, and depleted oxygen levels.

What don't we know?

- There is a great deal of data available at DEQ and externally that has been collected but not analyzed in a way to help Oregon target pollution reduction strategies or to help set priorities.
- The levels of some nonconventional pollutants that may be causing water quality problems, such as nutrients and sediment.
- What the negative impacts are (if any) on water quality and beneficial uses from toxic pollutants for which we do not have water quality standards for or have not studied (such as pollutants on the Priority Persistent Pollutant List). What the cumulative or synergistic effects are on water quality and beneficial uses from many toxic pollutants.
- Pollutant levels in groundwater, other than pollutants monitored for as listed above.
- Effectiveness (on a large scale) of the restoration efforts that DEQ and others have supported to improve water quality.
- Future instream flow levels that should be used by DEQ to take into consideration results of climate change when making permitting, 401 certification, and TMDL decisions.

Recommendations for Information Investments / Efforts:

- Assess the existing data (surface water and groundwater) that has not been analyzed to determine where the data gaps are in Oregon and make recommendations/decisions based on that information.
- Leverage data/sample collection between agencies. A Statewide Monitoring Council would be needed to ensure data quality needs are met.
- Conduct effectiveness monitoring to point future projects to those with the greatest potential to improve water quality.
- Define a structure (perhaps through the Integrated Water Resources Strategy) that lists assumptions so all agencies are using the same assumptions in planning/decision-making and can use adaptive management.

- Monitor and assess for pollutants that we do not have comprehensive date for, but for which we know (from EPA) we need to do something about in the near future (nutrients and sediment).
- Flow data for all waters in Oregon.

Useful Links / Resources:

- Water Quality Assessment (required by the Environmental Protection Agency) - http://www.deq.state.or.us/wq/assessment/assessment.htm
- Toxics monitoring - http://www.deq.state.or.us/lab/wqm/toxics.htm
- Willamette Assessment - http://www.deq.state.or.us/lab/wqm/assessment.htm
- Total Maximum Daily Loads - http://www.deq.state.or.us/WQ/TMDLs/TMDLs.htm
- Implementation of Senate Bill 737 - http://www.deq.state.or.us/wq/SB737/index.htm

Groundwater Supply

Douglas Woodcock, Groundwater Manager, Water Resources Department

What information do we use?

Groundwater is not only a source for water supply; it also provides baseflow to streams and supports ecosystems reliant upon near-surface water tables. Management decisions addressing groundwater have the potential to affect the entire groundwater flow path from recharge area to discharge area. Effective management of a groundwater resource requires an understanding of:

- the geometry of the aquifer system (geologic framework, lateral extent, changes in aquifer properties, nature of boundaries);
- the source of recharge (rainfall, snowmelt, canal losses, etc);
- the nature of discharge (to surface waters, evapotranspiration, wells, etc);
- stability of the resource (does the system appear to be in equilibrium or displaying signs of overdraft?).

Oregon Water Resources Department is pursuing a strategy of evaluating groundwater supplies at the basin scale through a cooperative science program with the U.S. Geological Survey (USGS). This allows OWRD to develop a broad understanding of a groundwater budget and be able to quantify important relationships, such as the groundwater contribution to surface water. The basin studies to date have been geared toward the data collection necessary for development of numerical flow models, which provide a flexible management tool.

What do we know?

OWRD and the USGS have completed (or nearly completed) three basin-wide investigations in Oregon: Deschutes Basin (completed), Willamette Basin (awaiting final modeling report), and the Upper Klamath Basin (concluding modeling, modeling report).

Where are the information gaps?

Future basin work needs to focus on: Umatilla Basin, Walla Walla Sub-Basin, Hood Basin, Eastern Deschutes, Harney Basin, Willamette Basin, Sandy Basin, Grande Ronde Basin, Powder Basin, Goose and Summer Lakes Basin.

These investigations are dependant on an available groundwater science budget to conduct these projects through the USGS Cooperative Program (a money-match program).

Groundwater Reports from Basin Groundwater Investigations:

Deschutes Basin Study: http://or.water.usgs.gov/projs_dir/deschutes_gw/index.html
Willamette Basin Study: http://or.water.usgs.gov/projs_dir/willgw/willpage.html
Upper Klamath Basin Study: http://or.water.usgs.gov/projs_dir/or180/

Useful Links / Resources:

Aquifer Sustainability: http://pubs.usgs.gov/circ/circ1186/
Groundwater and Surface Water Interaction: http://pubs.usgs.gov/circ/circ1139/
USGS Groundwater Information Page: http://water.usgs.gov/ogw/

Understanding Coming Pressures

Summary Recommendations:

- More robust climate data to account for regional variability and climate change conditions in demand models, including downscaling of global and regional scale models.
- Better information on groundwater supply to help land-use planners assess carrying capacity.
- Better information on the cumulative impacts of groundwater use on drinking water supplies and instream flows.
- Quantify the impacts from development, so that information related to affects on water supply and quality can be integrated into individual land-use decisions.
- Develop better information on the cumulative impacts of septic systems on groundwater quality, including consequences for community and individual wells.
- Assess source areas for drinking water systems, including the location of land uses that generate contaminants.

Climate Change

Barry Norris, P.E., State Water Resources Engineer, Oregon Water Resources Department

Background

Most climate scientists agree that during the 21st century we will likely experience an increase in average temperature of more than 6 degrees Fahrenheit. Additionally, northwest snow water equivalent (SWE) projections estimate there will be reductions nearing 26% by the 2020's, 44% by the 2040's, and 65% by the 2080's. Snow water equivalent is defined as the amount of water contained within the snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously. The projections are based on specific assumptions inherent in downscaled Global Climate Models and emission scenarios. Additionally, projections indicate that although there will be a severe decrease in SWE, total precipitation will likely remain constant or slightly increase. However, more precipitation will come in the form of rainfall and occur during the winter months, with less precipitation during the warmer summer months.

Oregonians rely on snowpack as a means to naturally store water, accumulating it through the winter months, and enjoying the benefits as runoff through spring and summer months. Snowmelt runoff serves to benefit aquatic life, out of stream users including irrigators and municipalities, and sustainment of wetlands and wildlife. If climate change predictions are correct and there are considerable reductions in snowpack, Oregonians are facing radical changes in ecosystems and the way we manage water. Out–of-stream users such as irrigators and municipalities may see a reduction in the amount of water that is available to them during summer months. Instream water needs will increase as stream flow is diminished and summer months become warmer and drier. Planning for these changes must begin immediately, and it must be based on good science based on quality data.

What information do we use?

Historically, hydrologic analysis has relied on historic data and a belief that history will continue to repeat itself. Taking into account climate change in our projections of future water conditions means we must use historic data in a different manner by relying on trends and projections as to where those trends are taking us. Near real time monitoring, collecting data and tracking changes on a current basis, is more important than ever. Monitoring points that measure hydrologic changes and allow us to plot the trends in climate include surface water gages, ground water measuring points, National Resources Conservation Service (NRCS), Snowpack Telemetry (SNOTEL) sites, rain gages, and soil moisture monitoring sites.

Recommendations for Information Investments / Efforts:

1. Support NRCS' expanding the SNOTEL network
2. Expand groundwater monitoring network
3. Expand surface water gaging network
4. Maintain/improve Oregon's rain gage network
5. Develop statewide soil moisture monitoring network

Investigation needs include downscaling of global climate models and development of hydrologic models that provide projections of various climate-related data through this century. Additionally, it would be helpful to construct climate change scenarios as they relate to water rights and pollution abatement issues.

Useful Links / Resources: Oregon Climate Change Research Institute - http://occri.net/

<u>Land-Use Change</u>

Rob Hallyburton, Planning Services Division Manager, Dept. of Land Conservation and Development

Background

The Department of Land Conservation and Development (DLCD) manages the statewide planning program, which has one basic purpose: "to sustain and advance Oregon's quality of life. That quality of life is derived from our bountiful natural resources, livable communities, affordable housing, a robust economy, clean air and water, and efficient low-cost public services."

What information do we use?

In land-use planning, the emphasis is on *land* management. Land use plans address urban and rural development, preserving productive farm and forest lands and protecting natural resources. The information needs for each are different.

- Municipalities are interested in demand from residential, industrial and other potential users, so population and employment forecasts, along with the potential for new water rights, are important;
- In rural development areas, the carrying capacity of aquifers is a prime concern for groundwater quantity and quality;
- Instream water quantity is a factor in decisions regarding municipal stormwater management;
- Local governments use Drinking Water Source Area maps and Source Water Assessment Reports (available through DHS and DEQ) to voluntarily initiate a process to protect drinking water sources;
- ODF stream classification maps, ODFW fish presence surveys, the National Wetland Inventory, and FEMA floodplain maps are used to develop local riparian corridor and wetland protections;

What do we know today?

We know: where cities plan to grow and by how much; the capacity of municipal systems to withdraw and treat water, and the treatment and discharge of wastewater; historic and current fish distribution.

What don't we know?

- The quantity of groundwater present at a given location, and the long-term ability of the aquifer to yield water, are often not well understood, at least by local land use decision-makers;
- We don't know how to quantify the impacts from development sufficiently so that information related to affects on water supply and quality can be integrated into individual land use decisions that could result in unwanted cumulative impacts;
- Very few public drinking water systems have had the source area mapped, and therefore land uses that could pose a risk to the quality of the system's supply cannot be identified;
- We don't know the effects of climate change on aquifers;
- The carrying capacity of land to absorb sewage through on-site disposal systems over the long term is not well understood for many areas.

Recommendations for Information Investments / Efforts:

From the land use planning perspective:

- Better information on groundwater supply, to help land-use planners assess carrying capacity.

- Better information on the cumulative impacts of exempt private wells and existing water uses on drinking water supplies and instream flows.
- Access to predictive models to assess the impacts of current land use decisions on future ground and surface water supplies.
- Better information on the cumulative impacts of septic systems on groundwater quality and consequences for community and individual wells.
- Source areas for drinking water systems and the location of land uses that generate contaminants.