REGIONAL WATER SUPPLY PLAN UPDATE

For the

Regional Water Providers Consortium

December 2004

This Plan Update Was Financed and Managed by the Following Consortium Member Participants:

City of Beaverton
Boring Water District #24
Clackamas River Water
City of Fairview*
City of Gladstone
City of Gresham
City of Hillsboro
City of Forest Grove
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Powell Valley Road Water District
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Sunrise Water Authority
South Fork Water Board:
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City of Tigard
City of Tualatin
Tualatin Valley Water District (includes service to City of Sherwood)
West Slope Water District
City of Wilsonville

***Withdrew from the Consortium July 2004**

CONSULTANT TEAM:

Economic And Engineering Services
Quantec, LLC
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Chapter 1. Introduction

Background of the Regional Water Supply Plan Update

From 1994 to1996, many of the municipal water providers in the Portland metropolitan area signed an Intergovernmental Agreement (IGA) to jointly fund and manage the development of a Regional Water Supply Plan (RWSP). By early 1997, the RWSP was developed, and 26 water providers and Metro had endorsed the plan and agreed to join a newly formed Regional Water Providers Consortium (Consortium). The purpose of the RWSP as endorsed by the region's water providers and Metro was to " … Provide a comprehensive, integrated framework of technical information, resource strategies and implementing actions to meet the water supply needs of the Portland metropolitan area to the year 2050." The RWSP was based on more than a dozen background documents; contained several chapters on policy objectives, water demands, existing and future source options, conservation program evaluations and transmission; and formulated a set of resource strategies to meet future needs. Chapter 12 of the RWSP contains a number of recommended strategies on source options, conservation programs and objectives for the formation of the Regional Water Providers Consortium. Both the RWSP (p. 274) and the IGA forming the Consortium (Section 9.C.(7)) state that the RWSP should be reviewed and updated as needed on a five-year interval. The Consortium Board approved a two-year program and special dues assessment to update the RWSP starting in July 2001, with work to begin in January 2002.

The purpose of the RWSP as endorsed by the region's water providers and Metro was to " … Provide a comprehensive, integrated framework of technical information, resource strategies and implementing actions to meet the water supply needs of the Portland metropolitan area to the year 2050."

A work program was developed to update the RWSP based on the following tasks:

1. An assessment of the changes in water supply conditions since adoption of the RWSP, including a review of the policy objectives developed to guide the original RWSP, and an integration of other plans and strategies adopted by the Consortium Board since 1997, including a Transmission and Storage Strategy adopted in 2000, a Source Water Protection Strategy in 1999, and implementation of regional conservation programs by the Consortium starting in 2000.
2. The development of a new water-demand forecast for the water providers that participate in the Consortium.

3. A review of the existing and planned water sources in the region including the effects of water rights and new regulations, a review of transmission linkages and costs, and the status of existing water rights.
4. A new look at conservation programs in the region and a selection of programs to be applied in the region, either collectively, subregionally or locally.
5. The development of a new integrated planning model called *Confluence*® to assess different future water program strategies.
6. The development of an RWSP Update (Update) document, including direct involvement by the Consortium Board and by the public through both regional and local efforts.
7. Endorsement of the RWSP Update by the individual Consortium participant decision-making bodies as called for in the Consortium IGA.

This work program was implemented over a three-year period instead of a two-year period so that coordination with Metro population forecasting and urban growth boundary (UGB) changes could occur. This allowed for more individual provider participation in the development and review of the data necessary to conduct all of the above tasks, and to incorporate the changes included in the Consortium's revised 5-Year Strategic Plan. The special assessment for the funds was still collected over the two-year period, so no additional funds were necessary due to the extension of the process.

The Purpose of the RWSP Update

During the time that the RWSP Update was being conducted in 2003-04, the Consortium Board also reviewed and revised their 5-Year Strategic Plan. As part of revising the Strategic Plan, the Consortium evaluated the functions and purposes of the Consortium during the last seven years. The Board discussed the role of the Consortium in planning for water supplies. The original RWSP was endorsed by most of the region's water providers; however, Section 3 of the Consortium IGA makes it clear that the purpose of the RWSP is to provide guidance for individual supply decisions and as an outline for regional supply coordination. In addition, Section 4 clearly notes that "… no Participant has assigned … to the Consortium ... the power to plan … its water system … ." During the years of operating the Consortium, this purpose has been very important in order for members to continue their membership. During revision of the Strategic Plan, Consortium members evaluated the issues associated with regional water supply planning and adopted changes to the Strategic Plan that clarify the role of the Consortium, including the role of the RWSP. They adopted these revisions in June 2004. The revised Strategic Plan contains new direction in the Meeting Water Needs Strategy. This strategy states, "The primary purpose of the Consortium should be to support local decisions, but not direct the provision of specific water supplies to meet the needs of the region." The revised Strategic Plan contains the following goals regarding the planning functions of the Consortium and specifically about the RWSP:

- To be a collaborative clearinghouse and to provide decision support tools for water supply planning on a consensus-based approach, in keeping with the

Consortium IGA, that leaves water supply development and management to the individual members.

- To review and revise the Regional Water Supply Plan in 2004. Obtain individual provider endorsement for any major plan revisions. Reformat the RWSP to be a document that addresses changes in regional water supplies and programs to reflect the decision making of the individual provider entities. The RWSP will provide a clearinghouse for how water demands can be met over a 20-year period, including conservation programs and a list of opportunities for new source development. The RWSP Update will make it clear that its provisions are not mandatory in any way on individual water providers. The function of the Consortium as a decision support facilitator will be addressed in the RWSP Update.

- To recognize the importance of conservation in meeting regional water needs by continuing to implement regional conservation programs where economies of scale and where regionally consistent conservation messages and benefits can be achieved. Provide a forum for conservation coordination and decision support tools (e.g., modeling and program evaluation) to each of the individual members.

- To provide the necessary clearinghouse and coordination functions to meet Metro's water supply element within their Framework Plan.

The update changes the emphasis of RWSP by reflecting the actions and plans of individual members, as well as presenting options for meeting future needs, but not prioritizing particular source options or transmission linkages.

The RWSP Update work was adjusted in 2003 to reflect the revised role for planning by the Consortium. This document is designed to update the original 1996 RWSP by adding new information on source options, conservation, demands, and to reflect the past adopted policy and strategies of the Consortium. The update changes the emphasis of RWSP by reflecting the actions and plans of individual members, as well as presenting options for meeting future needs, but not prioritizing particular source options or transmission linkages.

One other change in institutional circumstances took place during the update process. The State of Oregon Water Resources Commission adopted new rules (Division 86) requiring Water Management and Conservation Plans for any entity that applies for new water rights, or to utilize extended existing but unutilized water rights. In combination with the regulations to provide the State of Oregon Department of Human Services Drinking Water Program with Water Master Plans, these two requirements have increased the need for individual entities to conduct their own water supply programs and to incorporate conservation programs into their efforts at the local level. Entities are now taking more responsibility on their own to conduct integrated resource planning. Larger scale subregional planning efforts, such as that being conducted through Clean Water Services for the Tualatin Basin Water Feasibility

Study, are further evidence of how coordination of water supply planning is being done locally.

Process for Updating the RWSP

The work process for the RWSP Update was done in modules to cover the work tasks listed in the Background section above. The Consortium utilized its staff and the staff of the entities as represented on the Consortium Technical Committee (CTC) and Subcommittee (CTSC). A work program and schedule was prepared and approved by the CTSC and the Board. The work was completed as follows:

Fall 2001 – Prepared requests for proposals for four separate work modules and conducted consultant selection process; wrote and obtained approval for four contracts to complete the following work:

- ✓ Source-Options Analysis – Economic and Engineering Services, Inc., Portland, Oregon
- ✓ Conservation Program Evaluation and Analysis – Planning and Management Consultants, Ltd., Carbondale, Illinois
- ✓ Integrated Modeling Development and Application – Gary Fiske and Associates/Quantec, LLC, Portland, Oregon
- ✓ Newsletters for Public Information – Strobeck Design, Portland, Oregon

An invited stakeholder panel was invited to the December Board meeting to provide their views on the update of the RWSP.

Winter/Spring 2002 – Work began on collecting individual Master Plans and developing two technical memorandums on policy objectives and source options; data collection on provider customer profiles and conservation program options; beginning to build a model for portraying the "base case" of existing supply sources and their linkages to demand nodes; developing a water-provider map and obtaining consumption/production data from individual providers; and the first newsletter about the project and the development of a Web page section on the Consortium's Web page. Another invited stakeholder panel came to the March 2002 Board meeting to express their views on how the RWSP should be updated.

Summer/Fall 2002 – The Consortium obtained a 2025 base-case population forecast from Metro and meetings were held with Metro to allow providers to understand and ask

questions about these forecasts. Time was spent to determine if new population forecasts should be obtained from Metro based on an officially allocated forecast; however, these data were not available in the timeframe that would allow the RWSP Update to proceed. The Metro base-case forecasts were used to generate individual provider forecasts. Conservation program options were developed, a model called ConEast was used to evaluate the effect of these programs for each provider and a draft matrix of program options was prepared. Source-option alternatives were further developed and a water-rights technical memo was developed. The *Confluence* integration model was populated with data on current source options and transmission, and the hydrology associated with the options was extended and applied in the model. The Consortium Board discussed a set of future supply option strategies that were utilized for modeling work. A second newsletter was developed and a mail-back questionnaire was evaluated. Two public workshops were held.

Winter/Spring 2003 – The work on conservation was completed. A set of conservation programs was developed based on specific assumptions about how conservation would work in this region and a draft report was prepared. After provider comments were incorporated, a final set of conservation programs were ranked against key criteria and providers self selected the programs that would apply to their entities. A common set of programs was applied throughout the region for education and outreach, and workshops. The information on each provider was placed in the integration model. Water-demand forecasts were developed for each provider member and these were given to the entities for their review and comment. This first set of water-demand forecasts was put into the *Confluence* model and beginning runs on the existing source options base case were completed. Based on issues raised about the water-demand forecasts, modeling work was delayed for several months. A draft report on the source options for the future was developed and reviewed by Consortium members.

Summer/Fall 2003 – This time was largely spent resolving issues associated with the water-demand forecasts and working with the specific water providers about operational issues in modeling how water sources should be utilized. Time was spent working with other supply planning efforts that were under way to ensure consistency between these efforts and the RWSP Update. A methodology for evaluating transmission linkages was developed. Modeling of future supply/program options was on hold for some months while the forecasting and operational issues were resolved.

Winter/Spring 2004 - The water-demand forecasts were revised and finalized, and new numbers were placed in the *Confluence* model. In the period that passed while conservation measures were evaluated and demand forecasts were refined, the *Confluence* model was modified. These changes reflected clarification and new decisions about what supplies were viewed as "committed" in the near term. Once the existing and near term base case was finalized, new model runs were conducted to understand the existing situation. During this time the number of future source-option strategies was reduced from seven to four, with a fifth one being the base case. The model was run for all of the future strategies and the results were discussed with the Consortium staff and with the Board. By June 2004 the basic findings of these model runs were shared with

the Board. The decision was made to move the project into a third year to allow the development of a proposed RWSP Update stand-alone document to review in September 2004.

Summer/Fall 2004 – This period was spent developing the proposed RWSP Update document, reviewing it with the CTSC and the Executive Committee of the Board. Public comment was taken during September. A markup version of the Draft Update was created in October and reviewed by the Consortium Technical Committee and the Board Executive Committee. The Board was asked in December 2004 to approve the proposed RWSP Update, which then will be sent to each of the decision-making bodies between December and March 2005. Along with endorsing the RWSP Update, the decision-making bodies also will be asked to approve amendments to the IGA forming the Consortium, including new language about the role of the Consortium in water supply planning.

Organization of the RWSP Update

The RWSP Update is designed as a stand-alone document that supplements and replaces portions of the original 1996 RWSP.

The RWSP Update is designed as a stand-alone document that supplements and replaces portions of the original 1996 RWSP. The update is organized to flow much like the original RWSP but does not contain as many chapters. The first chapter is designed to set the background scene for the update, including the change in the Consortium planning function. The second chapter looks at the water-demand forecasts that were redone for this review, as well as the methodology used for the forecasting and the means by which the forecasting tool can be used in the future for update purposes. The third chapter summarizes the work done to review and evaluate conservation programs as well as how the RWSP Update incorporates programs selected by the individual water providers. The ConEast modeling tool used to evaluate conservation programs is described. The fourth chapter is a description of the policy criteria review, the current status of water supplies, changes in regulatory circumstances, water rights status, transmission linkages, and sections on each of the primary future source options that were evaluated during the update, which include:

- ✓ Bull Run expansion
- ✓ Clackamas River expansion
- ✓ Columbia River diversion
- ✓ Trask/Tualatin River: Hagg Lake/Scoggins Reservoir expansion
- ✓ Aquifer storage and recovery options
- ✓ Columbia South Shore Well Field expansion
- ✓ Willamette River expansion
- ✓ Local sources
- ✓ Non-potable options

The fifth chapter discusses how the information on demands, conservation, sources and transmission was modeled using the *Confluence* model. It also describes the formulation of future strategies and the basic results of the modeling work that integrates the information generated in the work listed above. The sixth and final chapter is designed to basically replace Chapter 12 of the original RWSP. It contains the final recommendations for conservation programs, a list of the source options available to meet future demands, and the ongoing role of the Consortium in decision support for local water provider programs and projects. Other issues associated with past Consortium actions on source protection policy, transmission and emergency preparedness are covered. In addition the respective roles of the Consortium and Metro are addressed. A set of appendices is listed in the Update document, and some will be included in the document while other longer reports will be available as separate documents. Each Consortium member has been given copies of the ConEast conservation spreadsheet model and training has been provided. In addition, each provider will be provided the *Confluence* model, user manual and data from the five strategies evaluated as a part of the Update.

Public Involvement Opportunities

The RWSP Update included opportunities for public involvement as the Plan was reviewed. Two stakeholder panels were invited to provide the Board with their views about how the RWSP should be updated. Three newsletters were sent out during the development of the Update: one in May 2002, a second in August 2002 and a third in February 2003. Two of these newsletters included mail-back questionnaires focusing on policy objectives, source options and conservation. Summaries of the responses are included in the Appendices as well as copies of the newsletters. Public workshops were held in 2002 in Gresham and Tigard. (Public testimony is encouraged at all Consortium Board meetings, which are held four times per year.) The primary means of making newsletters and update documents available to the public during the review process was through the Consortium Web site at www.conserveh2o.org. Individual water-provider Consortium members also have their own opportunities for public involvement through their own events, meetings, Web sites, and printed/mailed information. The update process relied on both regional and local opportunities. A speakers' bureau was established early in the project and presentations were made about the RWSP Update on request from interested parties. Once the Draft Update was available, a notice was sent to the Consortium mailing list offering copies of the Update or directing people to the Consortium Web site where links were provided to the draft and supporting reports. Comments were taken during September and early October. Please see Appendix C for copies of public involvement materials.

The primary means of making newsletters and update documents available to the public during the review process was through the Consortium Web site at www.conserveh2o.org.

Chapter 2. Water Demands for the Portland Metropolitan Area

Introduction

In 1994, Barakat & Chamberlin, Inc., (BCI) as part of the original RWSP study generated water-demand forecasts for the regional water providers in the metropolitan area, which are presented in Chapter 5 of the original RWSP report. The demand forecasts were based on available historical consumption/production data and population forecasts provided by Metro. Metro provided three sets of high, medium and low growth-demand forecasts that extended to the year 2050. As a result, BCI provided three sets of high, medium and low demand forecasts. BCI also provided additional sets of forecasts, which incorporated naturally occurring conservation and effect-of-rate increases by water providers. A set of peak-day forecasts, using the ratios of peak-day demand to average-day demand based on historical data, was generated as well.

As a part of the RWSP Update project, Consortium members decided to update the regional water-demand forecasts as well. Between 1996 and 2002, when the update began, some providers had generated updated forecasts of their own, but Consortium members wanted a single methodology that allowed the creation of individual daily water demand forecasts. The use of an econometric model that had been developed for forecasting daily demand for the City of Portland was determined to be the best fit for more detailed forecasting that could be used in the *Confluence*® integration model. In the original RWSP model there were only three demand nodes representing the three urban counties. The updated *Confluence* model was going to include separate demand nodes for each individual water provider. Therefore, the decision was made to build demand models for as many water providers as had daily water production data and use those models to provide forecasts for all of the demand nodes in the *Confluence* model.

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Regional Water-Demand Forecast Methodology

As an integral part of the RWSP Update project, demand forecasting for all participating water providers and nodes of the *Confluence* model were developed. The demand modeling and

forecasting tasks were implemented according to the following steps:

1) Determining the service area for each provider
2) Collecting historical production and/or consumption data for each provider
3) Collecting demographic and weather data for each provider's service area
4) Collecting other relevant information
5) Building a single-equation econometric demand model for each provider
6) Generating preliminary demand forecasts using the econometric model, based on the forecasts of demographic and economic variables
7) Getting water providers' approval on the demand forecasts
8) Calibrating the demand model and generating the final set of demand forecasts

Service Area

As a first step in demand estimation and forecasting, the service area of each provider had to be determined. Each provider was asked to identify the boundaries of its service area on a map. The water providers were also asked to identify their expected future growth areas. The approved boundary maps were converted to GIS formats and presented to Metro for determining and forecasting population. A sample water provider map is located in Appendix D.

Regional Providers' Historical Production Data

Historical consumption patterns along with demographic and other relevant information were used to estimate the demand models. The resulting demand models were then used for demand forecasting.

Water providers were contacted and availability of data was assessed. Some providers had started collecting data as part of a Demand Tracking project. Some providers that had data available on their SCADA system were provided with assistance in data extraction. A few providers did not have access to this data at all or had only a few years' data available. Among providers that had data, production data were the most accessible.

All available daily production data were collected and put in a usable format for demand analysis. For those providers that had multiple sources of water, total production from all sources was determined. In case data for some sources were not available, the service area was adjusted accordingly. When reservoir data were available, the production data were adjusted for in-town reservoir level fluctuations to more accurately reflect daily demand.

Demographic and Weather Data

Metro provided historical and forecast (only to 2025) population data based on the approved service area map of each provider. Metro also indicated areas of expansion in

the urban growth boundary and appropriated the areas of growth among affected providers. The wholesale territories of some providers were added to their retail service areas. The combined wholesale and retail population was used for the demand-model estimation of those providers. As part of the demand forecast review process, some water providers had more up-to-date population estimates and forecasts for their service territories. For those entities, their population numbers were used for demand forecasting. Staff ensured that the total population cap established by Metro as part of the 2003 adopted Regional Population Forecast was not exceeded.

Providers participating in the RWSP are mainly located in the same climate zone with a mostly uniform weather pattern. For all providers, historic maximum daily temperature and total daily precipitation measured at the Portland Airport weather station were used. Weather data are used for generating weather variables of the demand model as explained in Appendix D.

For all providers, historic maximum daily temperature and total daily precipitation measured at the Portland Airport weather station were used.

Other Relevant Information

The water providers were asked to provide information on events that had short-term or long-term effects on their demand. Events like flood, mandatory curtailment, or addition or loss of sources of supply usually create variations in the data that are not explained by variables in the demand model. That is also the case with sudden jumps in water rates or specific all-out conservation programs. For those providers that had such data anomalies, relevant indicator or dummy variables were added to their demand models.

Demand Model

For each participating water provider that had at least five years of historical production data, a unique demand model was developed. For those water providers that did not have adequate historical data, a demand model for another service area with similar water consumption and customer class characteristics was used as surrogate. The surrogates were chosen based on input from the water provider's management and other regional experts.

Demand estimation and forecasting methodology are explained in detail in Appendix D. Each demand model was validated against the historical data. The demand model provides a set of weather-normalized demands and a set of weather effects, which is based on the historical weather data for the 1940-2002 period. These weather effects provide the opportunity to simulate demand forecasts under historical weather years.

Demand Forecasts

The developed demand models along with population forecasts were used to forecast long-term demand for each water provider. A preliminary set of demand forecasts was presented to participating water providers for their review. Some of the providers had higher growth expectations than indicated by the preliminary forecasts. Those water providers were contacted and their pertinent concerns and expectations were incorporated into the demand forecasting procedure. A final set of demand forecasts was presented to the water providers for their approval.

The final set of demand forecasts to be incorporated into the *Confluence* model consists of a set of weather-normalized demand forecasts extending to the year 2025. Corresponding to each set of weather-normalized demand forecasts, there is a set of weather effects. These weather effects are used in the *Confluence* model to simulate future demand under historical, 1940-2002 weather scenarios.

Regional Water Demands

Among the different tasks included in the RWSP Update project, forecasting demand for water took the most time. This was due to various steps that had to be followed and coordinating these steps with individual water providers. Since a uniform forecasting methodology was used for all providers, a uniform set of data was expected from providers as well. Not all providers, however, had sufficient data readily available. For those providers, surrogate service areas with similar characteristics were used and whatever data they had available were used for calibrating the forecasts. Each provider took time to review their forecasts and compare them to their own forecasting and actual use data. In addition, there was a desire to see if new Metro forecasts were available that reflected the significant amount of new lands that were added to the urban growth boundary in 2002. Despite extending the RWSP Update project into a third year, considering Metro's schedule, the water providers determined that it was not possible to obtain new service area forecasts in a timely manner. Consequently, the RWSP forecasts were modified, as requested by the individual providers, to better match their individually refined population and consumption information. By the latter part of 2003, the water-demand forecasts were completed. Contrary to the original RWSP project, Metro provided only one set of population forecasts (instead of high, medium and low), which extended to the year 2025. The single growth scenario was Metro's base case forecasts developed prior to 2002. The single set of population forecasts resulted in a single set of demand forecasts for each water provider.

In *Confluence* it is possible to use historical weather effects and weather-normalized demands to simulate demand for water in a particular year under different historical

weather scenarios. Adding historical weather effects to weather-normalized demand in a particular year provides this information. The forecasts can be averaged over all weather years or select specific weather years that stress the ability to meet water demands. The modeling can also look at probabilities of being able to meet various demands by matching weather-affected demand with supplies available for that weather year as indicated by historical stream-flow records. Long, hot, rain-free summers produce the highest water demands; whether the demands can be met depends on the hydrology of that particular year throughout the region. For strategic modeling purposes, certain years were selected for matching supply and demand under extreme weather conditions. For illustrative purposes, data presented in this chapter were just a summary of the different levels of water demands that could face the region and its water providers; however, actual demands will vary based on actual growth in population, changes in the customer mix between residential and non-residential uses, and the changes that will be brought about by climate change and actual conservation program savings over time. **It is for this reason that the water demands presented here are not those that each provider may choose to use in its own water master planning.**

Water-demand forecasting normally produces different views of how water demands impact the need for new infrastructure projects and programs. Annual average demands are often shown for the purposes of looking at water revenues that may be generated over longer timeframes. Usually, weather-normalized demand, which is demand in the absence of day-to-day weather variations, is used for financial considerations. The weather-normalized demand is estimated directly by the demand model.

… when the historic record is looked at, one of the highest peak-event years is 1981, which was used to produce the forecast of peak-day demands shown in this chapter

Peak-season forecasts concentrate on water use during the summer season, which is always higher in the Portland area because of our dry summers compared to our wet winters. Peak-season numbers are most important for looking at supply source capacities, such as raw water storage reservoirs, intakes and treatment plant capacities. For the purposes of displaying peak-season average day forecasts in this chapter the peak season is defined as six months from May to October. The year 1967, which produced some of the highest peak-season demands, is used for peak-season considerations. In the actual integration *Confluence* model daily forecasts are used for whatever year or set of years that are selected based on both demand patterns and hydrology throughout the region.

One other primary forecast number is peak day, which is the day or set of days (three to five day period) that produces the highest demands seen in any given year. Peak-day demands are most important when looking at transmission, treatment plant capacities and terminal storage reservoirs. Again, when the historic record is looked at, one of the highest peak-event years is 1981, which was used to produce the forecast of peak-day demands shown in this chapter. In the *Confluence* modeling, the actual peak days of the year selected to modeling the entire region are

analyzed and included. An analysis of the difference between using a high peak-season year over the highest peak-event year shows that it is only a few million gallons per day (mgd) higher in total for the region as a whole.

The forecasts shown below in the various tables are in millions of gallons per day, which is an industry standard measurement. The RWSP Update did not generate a report with water-demand forecast data beyond that presented in this report; however, each water provider was given a set of its own forecasts that can be accessed. The *Confluence* model does not contain a specified set of forecasts either – they are generated through a set of weather-normalized numbers that are changed by adding coefficients from the selected choice of daily weather information, which are then reduced by the amount of conservation savings projected for each demand node.

Annual Average Water Demands

The details of the forecasted weather-normalized annual average water demands are presented in Table 2-1, for all of the members of the Consortium as well as some of the smaller wholesale entities. Chart 2-1 shows the growth of weather-normalized annual average demands over the next 20 years to 2025.

The weather-normalized demand, as computed by the demand model, is the demand without weather effects. It only reflects the seasonal changes in demand, i.e., higher demand in summer than winter, but it does not reflect the daily fluctuations in demand as a result of day-to-day weather changes. Consequently, weather-normalized demand does not depict daily peaking accurately. If we generate a set of demand forecasts for a particular population year with all of the historical weather effects (1940-2002) and then compute the average of the weather-affected demands for each day of the year, the result is very similar to weather-normalized demand.

Peak-Season Water Demands

The details of the forecasted peak-season water demands using 1967 as the representative weather pattern for high use is presented in Table 2-2. Chart 2-2 shows the growth in peak-season use from 2004 to 2025. The region is estimated to use a little more than 265 mgd on an average peak-season day in a hot year starting in 2004 and to rise to a little under 400 mgd in 2025 in a hot year. This is a growth amount of 130 mgd of peak-season average day demand for summer supply (six months) at a 100 percent probability. With climate change, the actual demand in a hot year would likely rise by a couple of percent over what is projected in these tables based on studies of the impacts of climate change that have been done in the Portland area. This means that either more supplies would be necessary to meet increased demands beyond those forecast at this time or that probabilities of being able to meet demand are reduced.

Peak-Day Water Demands

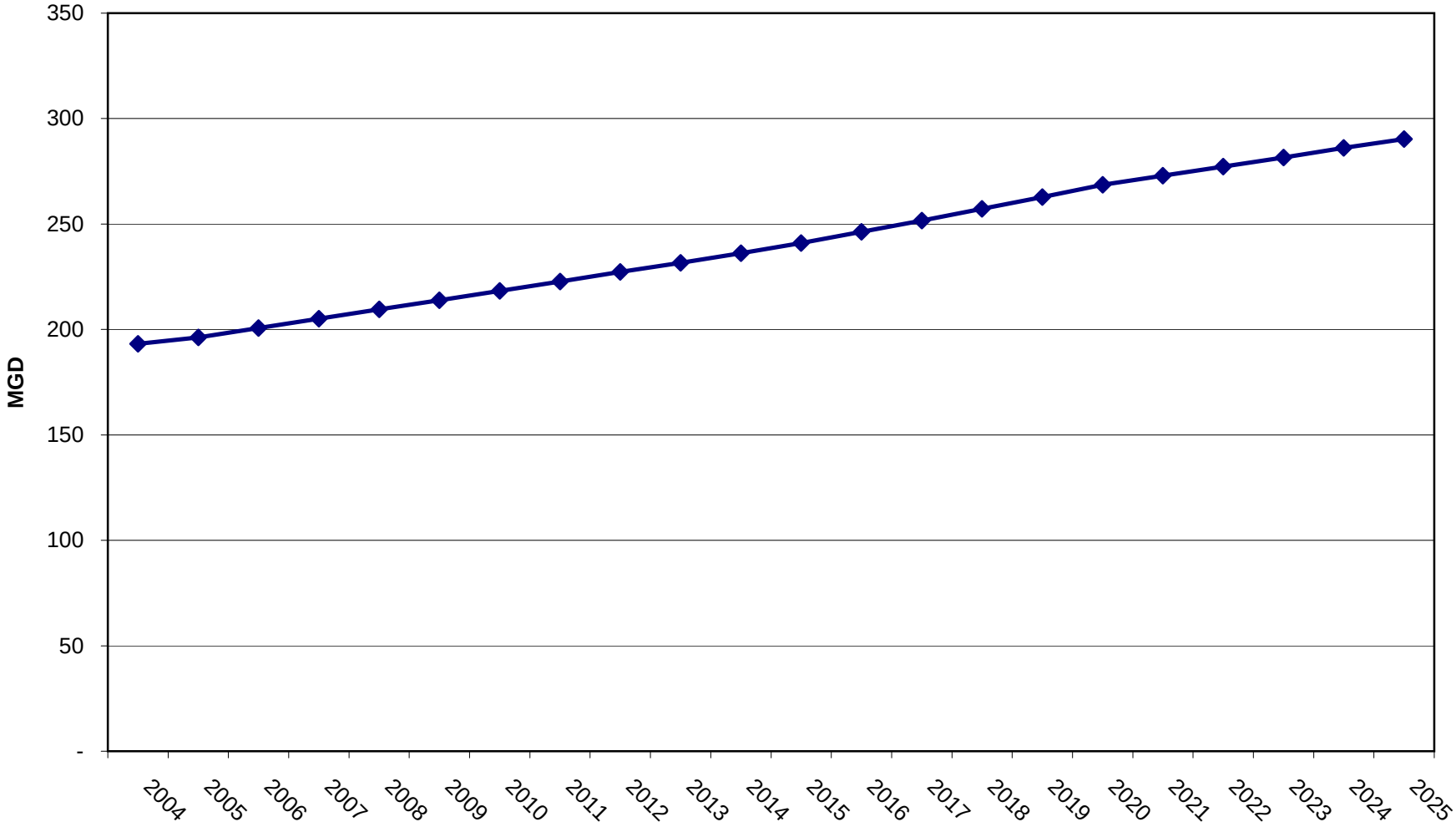
The detail of the forecasted peak-day water demands using 1981 as the representative weather pattern for a high peak-day event is presented in Table 2-3. Chart 2-3 shows the growth in peak-day use from 2004 to 2025. The region is forecasted to use about 403 mgd in 2004 if a very high peak day occurred, rising to 613 mgd in 2025. This is a growth in peak-day use of 210 mgd, or about 34 percent above current conditions.

Historical Perspectives

The demand forecasts presented in this chapter are more refined to the individual provider level than those presented in the original RWSP. The basis for the two forecasts was fairly different, with Metro projecting a more even population growth from 1995-2050. In the Update forecasts, Metro provided a much higher growth rate to 2025 than that of the earlier 2040 planning scenarios. It is for this reason that a comparison of the forecasts indicates that the Update forecasts show a greater increase in water demands by 2025 than those in the original RWSP. Current Metro planning for the urban growth boundary was taken into account according to unofficial population estimates from Metro that recognize more up-to-date, land-use designations and policy which place more growth inside the expanded UGB using more recent economically based population forecasting in their Metroscope model.

Another historical perspective that should be understood is that some water providers in the Portland metropolitan area have been evaluating their water consumption trends over past years. For instance, the Portland retail and wholesale service area has an established pattern of reduced per capita consumption since the late 1980s. In fact, the 2002 version of the aggregate demand model for the entire retail and wholesale service area of the Portland system, attributes a 7 percent drop in consumption to the conservation code changes that went into effect in 1992. The demand model also shows a downward trend in demand that started in the late 1980s that could be attributed to changes in land-use patterns, rate increases and other conservation measures implemented by water providers. By 2002, these effects sum up to an 18 percent reduction in aggregate demand. However, the individual demand models estimated in RWSP updates show that the downward trends in per capita consumption are more pronounced in some areas than others. All of the region's water providers show reductions in per capita use to some extent due to low-flow plumbing requirements implemented in the early 1990s, land-use changes brought about by Metro and local governmental land-use controls on lot sizes and single/multiple-family mix, real-price increases and conservation programs. This pattern is reflected in the water-demand forecasts.

Chart 2-1
Portland Regional Water Providers Consortium
Regional Annual Average Demands Weather Normalized

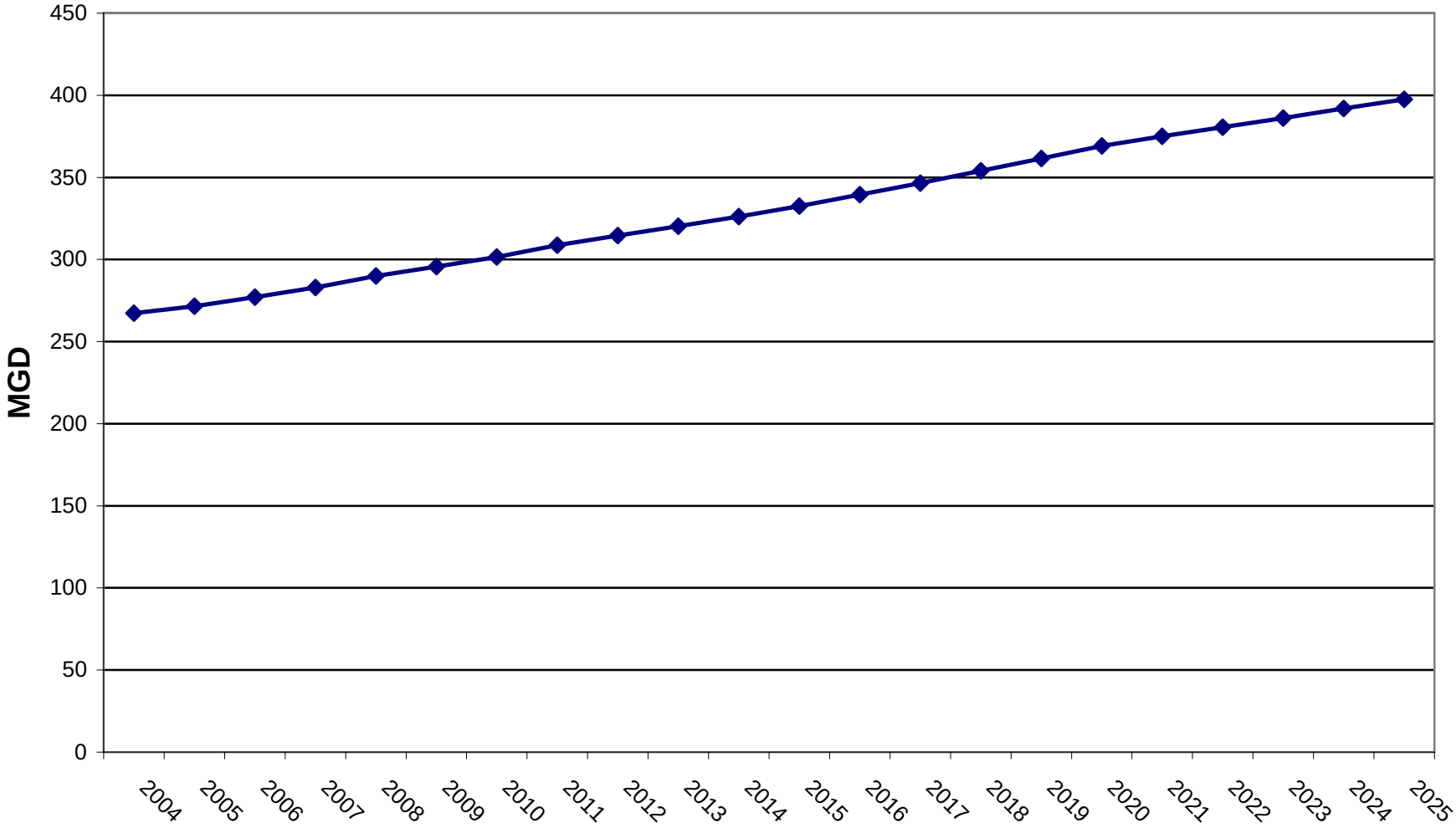


Portland Regional Water Providers Consortium

Table 2-1 RWSP Update Weather Normalized Average Annual Demand Forecasts MGD

Year	Gresham	Tigard	TVWD	Beaverton	CRW	Fairview	Forest Grove	Gladstone	Lake Oswego	Milwaukie	Oak Lodge	Oregon City	Raleigh	Rockwood	Sandy	Sherwood	Sunrise	Tualatin	West Linn	West Slope	Wilsonville	Hillsboro W&R	Portland	Powell Valley	Small PDX East	Small PDX West	**REGIONAL TOTAL**
2004	7.23	6.55	25.31	9.37	6.56	0.92	3.53	1.23	7.03	4.15	3.38	4.25	0.57	7.37	0.80	1.29	4.23	4.08	3.29	1.58	3.06	14.63	67.68	4.02	0.37	0.73	**193.25**
2005	7.37	6.60	26.05	9.67	6.63	0.93	3.67	1.24	7.22	4.23	3.44	4.39	0.58	7.41	0.81	1.31	4.50	4.11	3.35	1.60	3.16	15.69	67.15	3.94	0.38	0.77	**196.22**
2006	7.73	6.74	26.80	9.98	6.73	0.94	3.83	1.24	7.29	4.27	3.47	4.57	0.58	7.45	0.82	1.32	5.34	4.15	3.40	1.61	3.24	15.85	68.08	4.06	0.40	0.78	**200.68**
2007	8.14	6.89	27.56	10.28	6.84	0.95	4.00	1.24	7.33	4.31	3.50	4.75	0.58	7.49	0.83	1.33	6.31	4.18	3.45	1.61	3.31	16.02	68.84	4.18	0.41	0.79	**205.14**
2008	8.54	7.05	28.34	10.42	6.94	0.96	4.18	1.25	7.38	4.34	3.53	4.93	0.59	7.54	0.84	1.35	7.36	4.22	3.51	1.62	3.38	16.20	69.61	4.30	0.42	0.80	**209.58**
2009	8.95	7.19	29.09	10.55	7.04	0.97	4.35	1.25	7.42	4.37	3.56	5.12	0.59	7.57	0.84	1.36	8.45	4.26	3.56	1.62	3.45	16.35	70.33	4.41	0.43	0.81	**213.89**
2010	9.35	7.33	29.86	10.69	7.14	0.98	4.51	1.26	7.46	4.41	3.59	5.30	0.59	7.62	0.85	1.38	9.57	4.29	3.61	1.63	3.52	16.52	71.04	4.53	0.44	0.82	**218.27**
2011	9.68	7.44	30.65	10.83	7.20	1.00	4.61	1.26	7.50	4.42	3.61	5.46	0.59	7.66	0.86	1.44	10.51	4.33	3.67	1.63	3.60	16.67	72.24	4.65	0.45	0.83	**222.77**
2012	10.00	7.55	31.46	10.99	7.26	1.01	4.69	1.26	7.54	4.44	3.64	5.62	0.59	7.70	0.87	1.52	11.45	4.37	3.73	1.63	3.68	16.84	73.43	4.76	0.45	0.84	**227.30**
2013	10.31	7.64	32.24	11.12	7.31	1.03	4.78	1.26	7.57	4.45	3.65	5.77	0.60	7.74	0.88	1.59	12.40	4.40	3.79	1.63	3.75	16.98	74.59	4.88	0.46	0.84	**231.66**
2014	10.63	7.74	33.04	11.27	7.36	1.04	4.87	1.27	7.60	4.46	3.67	5.93	0.60	7.78	0.90	1.66	13.39	4.45	3.86	1.63	3.83	17.13	75.77	5.00	0.46	0.85	**236.19**
2015	10.94	7.84	33.85	11.42	7.41	1.06	4.95	1.27	7.64	4.48	3.69	6.09	0.60	7.82	0.91	1.73	14.45	4.63	3.93	1.64	3.91	17.29	76.98	5.12	0.47	0.85	**240.96**
2016	11.17	7.96	34.18	11.58	7.49	1.07	5.02	1.27	7.69	4.51	3.72	6.26	0.60	7.87	0.92	1.78	15.91	5.13	4.06	1.64	4.02	17.46	78.42	5.24	0.47	0.86	**246.30**
2017	11.37	8.07	34.47	11.73	7.56	1.09	5.08	1.28	7.74	4.55	3.75	6.43	0.61	7.91	0.93	1.82	17.43	5.69	4.20	1.65	4.13	17.59	79.87	5.36	0.48	0.87	**251.64**
2018	11.58	8.18	34.79	11.88	7.64	1.10	5.14	1.28	7.79	4.58	3.78	6.61	0.61	7.95	0.94	1.87	19.02	6.29	4.34	1.65	4.24	17.75	81.37	5.48	0.48	0.87	**257.20**
2019	11.79	8.30	35.11	12.04	7.72	1.10	5.20	1.29	7.84	4.62	3.80	6.78	0.61	8.00	0.95	1.91	20.66	6.91	4.48	1.66	4.34	17.90	82.87	5.60	0.49	0.88	**262.85**
2020	12.00	8.41	35.44	12.20	7.83	1.11	5.27	1.29	7.90	4.65	3.81	6.96	0.61	8.04	0.96	1.96	22.30	7.54	4.62	1.67	4.45	18.06	84.42	5.73	0.50	0.89	**268.59**
2021	12.07	8.48	35.74	12.26	8.18	1.11	5.29	1.29	7.91	4.66	3.82	7.21	0.62	8.08	0.96	2.01	23.25	7.83	4.67	1.67	4.49	18.23	85.87	5.80	0.51	0.89	**272.90**
2022	12.14	8.54	36.05	12.33	8.58	1.11	5.32	1.29	7.93	4.67	3.82	7.47	0.62	8.13	0.96	2.07	24.14	8.08	4.72	1.67	4.53	18.38	87.36	5.87	0.53	0.89	**277.20**
2023	12.21	8.61	36.37	12.40	8.97	1.12	5.35	1.29	7.94	4.67	3.83	7.74	0.62	8.17	0.96	2.12	25.04	8.35	4.77	1.68	4.57	18.54	88.86	5.94	0.55	0.89	**281.54**
2024	12.28	8.68	36.71	12.48	9.35	1.12	5.37	1.29	7.96	4.68	3.83	8.00	0.62	8.22	0.96	2.18	25.98	8.62	4.82	1.68	4.62	18.71	90.42	6.02	0.56	0.89	**286.06**
2025	12.34	8.74	37.00	12.54	9.73	1.13	5.40	1.29	7.97	4.69	3.84	8.26	0.62	8.26	0.96	2.23	26.89	8.88	4.87	1.68	4.65	18.85	91.93	6.09	0.58	0.89	**290.31**

Chart 2-2
Portland Regional Water Providers Consortium
Peak Season Water Demand Forecast RWSP Update 1967 Weather Effect



Portland Regional Water Providers Consortium

Table 2-2 Peak Season Water Demand Forecast RWSP Update 1967 Weather Effect MGD

Year	Beaverton	CRW	Fairview	Forest Grove	Gladstone	Gresham	Hillsboro	Lake Oswego	Milwaukie	Oak Lodge	Oregon City	Other East	Other West	Powell Valley	Portland	Raleigh	Rockwood	Sandy	Sherwood	Sunrise	Tigard	Tualatin	TVWD	West Linn	West Slope	Wilsonville	Region
2004	11.86	7.84	1.10	4.29	1.52	9.99	31.32	9.24	5.05	4.31	9.67	0.39	0.76	4.99	80.49	0.73	16.09	0.95	1.77	5.85	8.93	6.56	33.10	4.50	2.03	3.96	**267.29**
2005	12.25	7.93	1.11	4.46	1.53	10.16	32.83	9.50	5.15	4.38	9.93	0.41	0.81	4.89	79.91	0.74	16.14	0.98	1.79	6.21	9.01	6.61	34.05	4.59	2.06	4.09	**271.49**
2006	12.63	8.04	1.12	4.65	1.53	10.59	33.26	9.60	5.21	4.42	10.21	0.42	0.83	5.00	80.76	0.75	16.19	1.00	1.81	7.26	9.18	6.65	35.03	4.66	2.08	4.19	**277.07**
2007	13.02	8.16	1.13	4.86	1.54	11.10	33.49	9.67	5.25	4.46	10.51	0.43	0.84	5.14	81.69	0.75	16.24	1.00	1.83	8.59	9.38	6.70	36.03	4.73	2.08	4.29	**282.91**
2008	13.23	8.29	1.14	5.07	1.54	12.89	33.75	9.73	5.29	4.50	10.80	0.44	0.85	5.29	82.60	0.75	16.30	1.01	1.85	10.03	9.59	6.75	37.05	4.80	2.09	4.38	**290.03**
2009	13.40	8.41	1.15	5.28	1.55	13.41	33.97	9.78	5.33	4.54	11.09	0.45	0.86	5.44	83.47	0.76	16.35	1.02	1.87	11.53	9.79	6.80	38.04	4.87	2.09	4.47	**295.72**
2010	13.57	8.53	1.17	5.48	1.55	13.92	34.21	9.84	5.37	4.58	11.38	0.46	0.87	5.58	84.31	0.76	16.40	1.03	1.89	13.09	9.99	6.85	39.04	4.94	2.10	4.56	**301.48**
2011	13.75	8.61	1.19	5.61	1.56	15.63	34.43	9.89	5.39	4.61	11.67	0.47	0.88	5.72	85.66	0.76	16.45	1.04	1.97	14.43	10.14	6.90	40.08	5.02	2.10	4.66	**308.62**
2012	13.95	8.68	1.21	5.72	1.56	16.04	34.67	9.94	5.41	4.63	11.95	0.48	0.88	5.87	87.07	0.77	16.51	1.06	2.07	15.74	10.28	6.95	41.14	5.11	2.10	4.77	**314.55**
2013	14.13	8.74	1.22	5.82	1.56	16.44	34.88	9.98	5.43	4.66	12.22	0.48	0.89	6.01	88.45	0.77	16.56	1.07	2.16	17.06	10.42	7.00	42.17	5.19	2.10	4.87	**320.29**
2014	14.31	8.80	1.24	5.93	1.57	16.85	35.10	10.02	5.45	4.68	12.50	0.49	0.89	6.16	89.85	0.77	16.62	1.08	2.26	18.43	10.55	7.06	43.22	5.28	2.11	4.97	**326.19**
2015	14.49	8.86	1.26	6.03	1.57	17.25	35.33	10.07	5.47	4.71	12.79	0.49	0.90	6.30	91.29	0.77	16.67	1.10	2.36	19.90	10.69	7.29	44.27	5.37	2.11	5.08	**332.41**
2016	14.70	8.95	1.28	6.12	1.57	17.55	35.56	10.14	5.50	4.74	13.17	0.50	0.91	6.46	92.96	0.78	16.73	1.11	2.43	21.84	10.85	7.90	44.80	5.55	2.12	5.21	**339.42**
2017	14.89	9.04	1.30	6.19	1.58	17.82	35.77	10.21	5.54	4.78	13.57	0.51	0.91	6.60	94.68	0.78	16.79	1.12	2.49	23.94	11.00	8.66	45.19	5.73	2.12	5.35	**346.56**
2018	15.08	9.13	1.30	6.27	1.59	18.09	35.98	10.27	5.59	4.81	13.97	0.51	0.92	6.75	96.46	0.78	16.84	1.13	2.55	26.14	11.15	9.46	45.60	5.93	2.13	5.49	**353.95**
2019	15.28	9.22	1.31	6.35	1.59	18.36	36.20	10.34	5.63	4.85	14.38	0.52	0.93	6.91	98.24	0.79	16.90	1.15	2.61	28.41	11.31	10.31	46.02	6.12	2.14	5.63	**361.49**
2020	15.49	9.35	1.31	6.42	1.59	18.62	36.44	10.41	5.67	4.86	14.79	0.52	0.94	7.06	100.07	0.79	16.96	1.16	2.68	30.69	11.47	11.17	46.46	6.31	2.15	5.76	**369.14**
2021	15.59	9.73	1.32	6.46	1.59	18.74	36.68	10.44	5.69	4.87	15.17	0.54	0.94	7.16	101.82	0.79	17.01	1.16	2.75	32.15	11.56	11.63	46.85	6.40	2.15	5.83	**375.03**
2022	15.67	10.20	1.32	6.50	1.59	18.83	36.90	10.46	5.70	4.88	15.56	0.56	0.94	7.25	103.57	0.80	17.07	1.16	2.83	33.40	11.65	11.99	47.26	6.47	2.16	5.89	**380.59**
2023	15.76	10.67	1.33	6.53	1.59	18.91	37.12	10.48	5.70	4.88	15.95	0.58	0.94	7.34	105.36	0.80	17.13	1.16	2.90	34.66	11.74	12.34	47.68	6.54	2.16	5.94	**386.18**
2024	15.86	11.13	1.34	6.56	1.59	19.00	37.36	10.50	5.71	4.89	16.35	0.59	0.94	7.43	107.21	0.80	17.19	1.16	2.98	35.96	11.84	12.71	48.12	6.61	2.17	5.99	**392.00**
2025	15.94	11.58	1.34	6.59	1.60	19.08	37.57	10.52	5.72	4.89	16.73	0.61	0.95	7.52	109.01	0.80	17.24	1.16	3.05	37.23	11.93	13.07	48.51	6.67	2.17	6.04	**397.53**

Chart 2-3
Portland Regional Water Providers Consortium
Regional Peak Day Water Demand Forecast 1981 Weather Effect

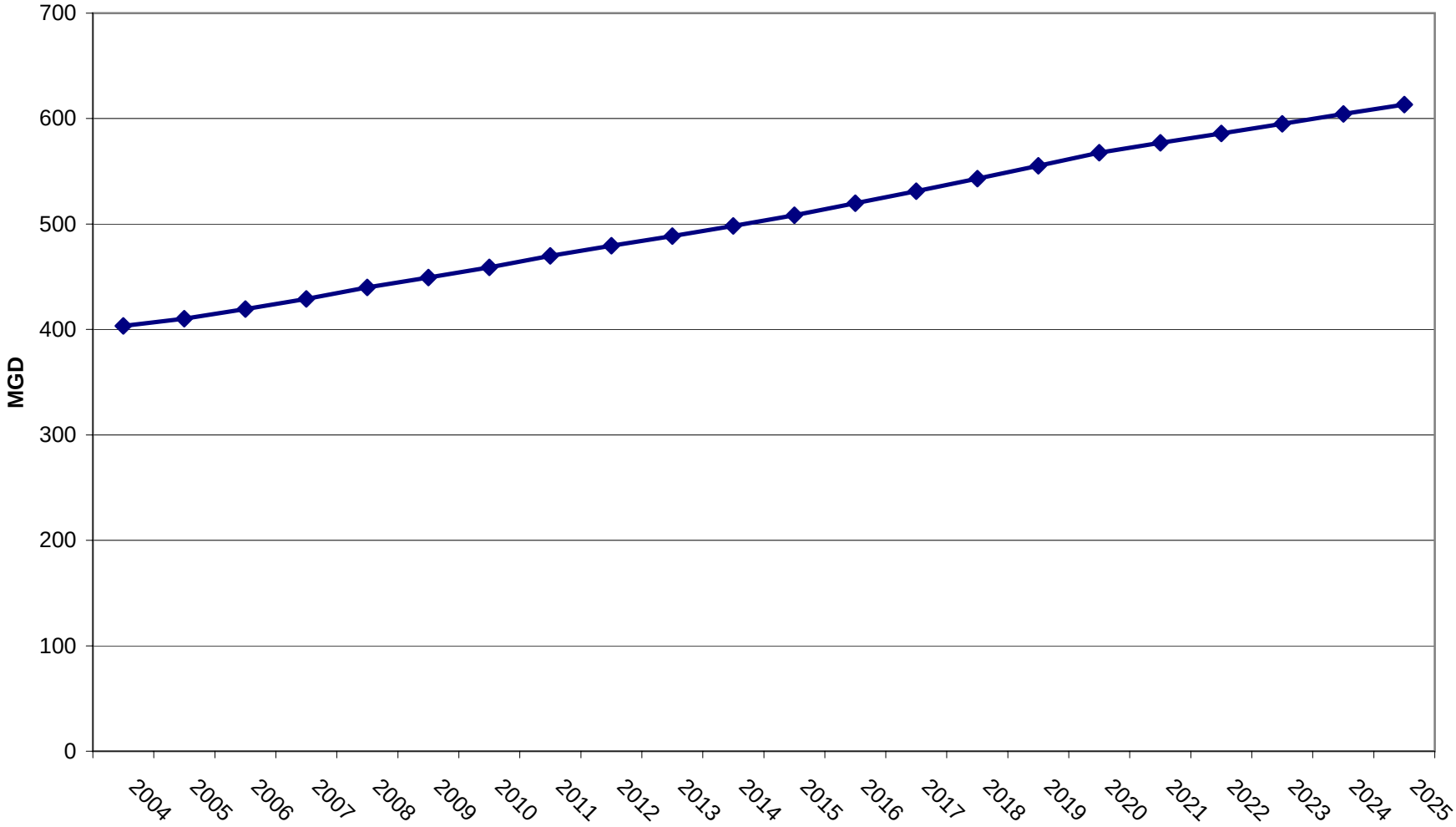


Table 2-3 Peak Day Water Demand Forecast RWSP Update 1981 Weather Year Effect

Year	Beaverton	CRW	Fairview	Forest Grove	Gladstone	Gresham	Hillsboro	Lake Oswego	Milwaukie	Oak Lodge	Oregon City	Other East	Other West	Powell Valley	Portland	Raleigh	Rockwood	Sandy	Sherwood	Sunrise	Tigard	Tualatin	TVWD	West Linn	West Slope	Wilsonville	Region
2004	17.5	13.52	1.69	6.6	2.42	15.81	44.28	15.14	7.78	7.85	7.97	0.71	1.38	7.5	117.59	1.14	21.25	1.5	3.12	10.85	14.5	10.18	58.01	7.91	3.16	5.81	**403.4**
2005	18.06	13.67	1.71	6.86	2.43	16.09	46.75	15.56	7.93	7.97	8.23	0.73	1.46	7.35	116.74	1.16	21.33	1.55	3.15	11.52	14.62	10.25	59.68	8.06	3.22	6	**410.32**
2006	18.63	13.87	1.73	7.17	2.44	16.78	47.44	15.74	8.01	8.06	8.56	0.76	1.49	7.5	117.98	1.17	21.41	1.57	3.18	13.48	14.9	10.33	61.41	8.19	3.24	6.15	**419.4**
2007	19.2	14.08	1.75	7.49	2.45	17.6	47.82	15.84	8.08	8.13	8.9	0.78	1.51	7.72	119.34	1.17	21.49	1.58	3.21	15.94	15.23	10.41	63.17	8.32	3.25	6.29	**428.94**
2008	19.51	14.29	1.76	7.81	2.46	19.82	48.24	15.94	8.15	8.2	9.25	0.8	1.53	7.95	120.67	1.18	21.57	1.6	3.25	18.61	15.57	10.5	64.96	8.44	3.25	6.42	**439.91**
2009	19.76	14.51	1.78	8.13	2.47	20.66	48.6	16.03	8.21	8.27	9.59	0.82	1.55	8.16	121.94	1.18	21.65	1.61	3.28	21.4	15.89	10.57	66.71	8.56	3.26	6.56	**449.31**
2010	20.01	14.71	1.8	8.44	2.48	21.49	48.99	16.12	8.27	8.34	9.93	0.84	1.57	8.38	123.17	1.19	21.74	1.62	3.32	24.3	16.22	10.65	68.49	8.69	3.27	6.69	**458.82**
2011	20.28	14.85	1.83	8.64	2.48	23.57	49.35	16.2	8.3	8.39	10.23	0.85	1.58	8.6	125.13	1.19	21.82	1.64	3.46	26.78	16.46	10.73	70.3	8.83	3.27	6.84	**469.73**
2012	20.57	14.96	1.86	8.81	2.49	24.24	49.74	16.29	8.33	8.44	10.54	0.86	1.6	8.82	127.21	1.19	21.91	1.67	3.64	29.21	16.69	10.82	72.18	8.99	3.28	6.99	**479.35**
2013	20.83	15.06	1.89	8.97	2.49	24.89	50.08	16.35	8.36	8.48	10.83	0.87	1.61	9.03	129.22	1.2	21.99	1.69	3.81	31.66	16.91	10.9	73.99	9.13	3.28	7.14	**488.68**
2014	21.1	15.17	1.91	9.13	2.5	25.55	50.44	16.43	8.39	8.53	11.13	0.88	1.62	9.25	131.26	1.2	22.07	1.71	3.98	34.21	17.13	11.01	75.83	9.28	3.28	7.29	**498.28**
2015	21.37	15.28	1.94	9.29	2.5	26.2	50.81	16.51	8.42	8.58	11.43	0.89	1.63	9.47	133.36	1.2	22.16	1.73	4.15	36.92	17.35	11.38	77.69	9.45	3.29	7.44	**508.4**
2016	21.67	15.43	1.97	9.42	2.51	26.7	51.19	16.62	8.47	8.64	11.75	0.9	1.64	9.7	135.8	1.21	22.25	1.75	4.27	40.53	17.61	12.4	78.62	9.75	3.3	7.64	**519.68**
2017	21.96	15.59	2	9.54	2.52	27.13	51.52	16.72	8.54	8.71	12.07	0.92	1.65	9.92	138.32	1.22	22.33	1.77	4.38	44.43	17.85	13.64	79.31	10.08	3.31	7.84	**531.16**
2018	22.24	15.75	2.01	9.66	2.53	27.56	51.88	16.83	8.6	8.77	12.4	0.93	1.67	10.14	140.91	1.22	22.42	1.79	4.49	48.51	18.1	14.97	80.02	10.42	3.32	8.05	**543.06**
2019	22.54	15.91	2.02	9.78	2.53	28	52.23	16.94	8.67	8.83	12.72	0.94	1.68	10.37	143.52	1.23	22.5	1.81	4.6	52.73	18.35	16.38	80.75	10.76	3.34	8.25	**555.21**
2020	22.84	16.13	2.03	9.89	2.54	28.42	52.62	17.06	8.73	8.86	13.07	0.95	1.69	10.6	146.19	1.23	22.59	1.83	4.71	56.96	18.61	17.79	81.52	11.09	3.35	8.45	**567.55**
2021	22.98	16.78	2.04	9.96	2.54	28.62	53	17.1	8.76	8.87	13.52	0.98	1.7	10.75	148.74	1.24	22.68	1.83	4.84	59.66	18.77	18.55	82.2	11.25	3.36	8.55	**577.04**
2022	23.11	17.59	2.05	10.01	2.54	28.76	53.37	17.14	8.77	8.88	14.01	1.01	1.7	10.89	151.31	1.24	22.77	1.83	4.97	61.99	18.92	19.14	82.92	11.37	3.36	8.63	**585.99**
2023	23.24	18.39	2.05	10.05	2.54	28.9	53.73	17.17	8.78	8.89	14.51	1.04	1.7	11.02	153.93	1.25	22.85	1.83	5.1	64.32	19.06	19.73	83.65	11.49	3.37	8.71	**595**
2024	23.39	19.19	2.06	10.11	2.54	29.05	54.12	17.21	8.8	8.91	15.01	1.07	1.71	11.16	156.62	1.25	22.95	1.83	5.23	66.73	19.22	20.33	84.42	11.62	3.38	8.79	**604.35**
2025	23.51	19.98	2.07	10.15	2.54	29.17	54.46	17.24	8.81	8.92	15.5	1.11	1.71	11.29	159.25	1.25	23.04	1.83	5.36	69.09	19.36	20.93	85.12	11.73	3.38	8.86	**613.26**

Chapter 3. Conservation

The following water conservation programs have been selected by the Consortium for consideration in the RWSP Update. The bolded programs are implemented regionally and the rest are voluntary programs, selected by individual providers, based on customer class and needs, resources and preference.

- **Residential Information, Education and Awareness**
- **Property Manager Workshops**
- **Trade Ally Irrigation and Landscape Workshops**
- Commercial, Institutional and Industrial (CII) Irrigation Evapotranspiration (ET) Controller Retrofit
- Large Landscape Audit
- Nonresidential Irrigation Submetering
- Multifamily Submetering
- CII Indoor Audits
- Toilet Rebate Program
- Residential Indoor Audits
- Residential Irrigation ET Controller Retrofit
- Waterless Urinals (awaiting approval from the Oregon State Plumbing Board)
- CII Outdoor Ordinance
- Elimination of Single-Pass Cooling Systems
- Washing Machine Rebates

The programs and the process used to select the programs are described in this chapter.

A basic premise of the RWSP is that water conservation is a resource that can play a key role in meeting future water supply needs. Conservation has been carefully considered and subjected to the same level of analysis as other supply sources.

Introduction

A basic premise of the RWSP is that water conservation is a resource that can play a key role in meeting future water supply needs. Conservation has been carefully considered and subjected to the same level of analysis as other supply sources. In the original RWSP, a comprehensive framework was used to examine water conservation to assure that all viable conservation technologies and management practices were considered. More than 150 conservation measures were evaluated. Twenty-four programs were selected and further refined to include only outdoor programs. In Chapter 12, *Recommended Plan Concept and Implementation Actions*, in the original RWSP, new conservation programs included the initiation and implementation of a region-wide outdoor conservation effort and exploration/implementation of non-potable source options.

The focus on outdoor conservation was intended to help meet many of the Consortium's objectives. Outdoor conservation programs produce savings when supplies are the most limited (in the summer) and the programs are generally cost-effective. In addition, outdoor conservation programs reduce demand during periods of low stream flow. Conservation can delay the need for new supply capacity. While indoor conservation programs were not recommended in the implementation strategy, there was a recommendation to continue to explore indoor programs and technologies.
The original RWSP strategy included these conservation program concepts:

- Conservation education (focused on outdoor uses)
- Outdoor water audits (residential, commercial, institutional and industrial)
- Incentives to install water-efficient irrigation and landscapes
- Landscape and irrigation ordinances for new developments
- Conservation pricing structures

State of Conservation Programs in the Region

Since the adoption of the RWSP, there has been considerable effort to implement water conservation programs to meet conservation targets. The Consortium initially worked closely with the Columbia Willamette Water Conservation Coalition on program development and implementation until the two organizations merged in 1999. Following endorsement of the RWSP, a scope of work was developed to "operationalize" the conservation element of the RWSP. This scope of work included three elements:

- Element 1. Develop an effective program to track and measure water savings through implementation of water conservation programs
- Element 2. Review and confirm conservation assumptions from the RWSP
- Element 3. Develop a work plan, timeline and budget for program implementation

Work Element 1 was supported by a baseline survey to determine what types of conservation programs were currently being implemented in the region and the data available to monitor and track conservation program savings. A report titled, "Tracking and Measurement of Water Conservation Program Impacts on Water Demand in the Portland Metropolitan Region" was completed in April 1999 by Maddaus Water Management and the Weber Group. As a result of this report, a monitoring and tracking program was developed to encourage individual providers to collect both production and demand data for future analysis of conservation savings. While initial participation was strong, the feasibility of collecting some of this data has been difficult for many providers. However, the Consortium continues to encourage and facilitate data collection by helping providers develop data collection protocols, providing templates and technical support.

Also in 1999 the Board approved a contract with Jennifer Stout of Water and Energy Consulting to review the RWSP conservation program descriptions, costs and savings as well as recommend an implementation strategy. Her report titled, "Portland Metropolitan

Region Water Conservation Program Review and Analysis, November 29, 1999" resulted in a refinement and update of program costs and savings by provider and region and utilized updated population data. Stout's work met the objectives of Work Element 2. Stout also recommended program design changes to incorporate new technologies and approaches. Stout utilized information from focus groups to help guide program modifications for the irrigation industry. Stout's analysis was generated using a modeling tool called Conservation Economic Analysis and Screening Tool (ConEAST), which is described later in this chapter. Based on the work of Maddaus, Weber and Stout, the Consortium and Coalition developed an implementation plan for regional water conservation (Work Element 3).

Element 3: Regional Water Conservation Work Plan

In March 2000 the Consortium Board endorsed a conservation work plan for the Consortium. Until this time, regional conservation implementation was being done by the Columbia Willamette Water Conservation Coalition. It was also recognized that some providers were implementing their own conservation programs. The work plan recognized three levels of programs:

- **Level 1 – Public Education and Workshops**: Programs are applicable to all providers with regional administration being most cost-effective and practical. Programs include:
  - Water Conservation Information, Education and Awareness
  - Residential Landscaping Workshops
  - Commercial, Industrial and Institutional (CII) Trade Ally Irrigation and Landscaping Workshops
  - Property Manager Workshops

- **Level 2 – Technical Assistance and Incentives**: Programs include audits, retrofits and rebates and are applicable to all providers and can be administered either regionally or by individual providers.

- **Level 3 – Regulation Programs**: Targets primarily new construction so applicability depends on growth; administered by individual providers and includes CII outdoor ordinance.

It was recommended that the Consortium focus its efforts on **Level 1** programs. Level 2 and 3 programs were determined to be best implemented voluntarily at a subregional or individual provider level. However, it was noted that the Consortium could help facilitate coordination among providers. The work plan also involved merging the Coalition and Consortium so that all providers in the Consortium were participating and contributing to regional conservation program implementation. In addition, a conservation coordinator and part-time support staff were hired to implement programs. A Consortium Conservation Committee (CCC) was formed to provide direction and guidance to the

conservation coordinator, help develop budget and work plans and make recommendations to the Consortium Technical Subcommittee (CTSC).

Conservation Programs Being Implemented

The Consortium has been actively implementing Level 1 programs. Below is a summary of the programs that have been implemented since the Consortium took over program implementation in 2000. As a reminder, the Columbia Willamette Water Conservation Coalition, established in 1992 and made up of 16 members of the Consortium, was responsible for regional and subregional conservation program implementation prior to 2000. The Coalition's programs were very similar in scope and also included audit and technical assistance programs.

- **Summer Marketing Campaign**: Includes TV and radio ads, on-air interviews, newspaper articles, press releases, billboards and transit sides, and a campaign kick-off event with radio sponsorship.
- **Landscape Workshops**: Designed for the general public in partnership with local nurseries. Topics focus on healthy soil, right plants for the right place, composting, etc. The Consortium also sponsored three Naturescaping for Clean Rivers workshops.
- **Events**: Include the Salmon Festival, Yard Garden and Patio Show, Roar Fair at the Oregon Zoo, and Oregon Garden. The Consortium has a booth, giveaways, activities and staff to answer questions. The Consortium participates in many of these events annually.
- **Youth Education Activities**: These include various stage shows on water conservation (As the Faucet Turns, Where's Rosie) directed toward specific age groups; Clean Water Festival sponsor, Kids Web page at www.conserveh2o.org, and development of a cartoon map of the region's water supplies with related activities.
- **Green Industry Partnerships**: Partnering with green industry trade associations involved in landscaping, nurseries and yard maintenance. A goal is to work more proactively together on issues of water conservation. Initiated grant program to encourage landscape professionals to take classes that focus on water conservation (e.g., sprinkler scheduling, irrigation system auditing and estimating landscape water use). Jointly developed an "Irrigation Bill of Rights" brochure.
- **Distribution of Water Conservation Kits** through Web page, media partners and water providers.
- **Tracking and Measuring Conservation Savings (Demand Tracking)**: Offer technical assistance to providers in collecting and storing production and consumption data for purposes of evaluating conservation program savings.
- **Collateral**: Developed numerous brochures on subjects such as: how to maintain a healthy lawn, indoor water conservation, outdoor water conservation, what to look for when installing an irrigation system, low-water use plants and how to test your soil. Developed event displays for regional and provider use.
- **Web site www.conserveh2o.org**: Contains conservation information, links to member sites, tips, resources, kids' interactive page, RWSP Update information, feedback opportunities, newsletters, meeting information, committee descriptions, meeting summaries and project information.

- **Monitor and track conservation legislation**: Follow federal, state and local legislation regarding water conservation and comment appropriately.
- **Program Evaluation**: The Consortium evaluated the effectiveness of its summer marketing campaign in 2001, and also held teacher focus groups to better define its outreach to schools.

RWSP Conservation Update

An update of the conservation element of the RWSP was needed for many reasons. Conservation technologies have changed and advanced. Customer needs have changed as well as demographics, growth, land-use patterns and economic factors. Our experience in implementing programs has also grown and informed us as to what is most successful and feasible for our region and its water providers.

The conservation update focuses on evaluating both existing and new programs. A policy decision was made by the Water Managers to also evaluate residential and CII indoor programs. Resources were not available to complete as detailed an analysis as was done in the original RWSP. The goal was to ensure that costs and savings projections were updated in line with newer population figures and that the most cost-effective and feasible programs were being considered for implementation. Providers were also given the flexibility to choose which programs, beyond a core group of programs, best suited their needs and were likely to be implemented in the near future. This allowed the Consortium to more realistically predict conservation program costs and savings in the integration model and recognized that individual provider customers and conservation needs are different.

The firm of Planning and Management Consultants, Ltd., (PMCL) was selected by the Consortium to prepare the conservation update. Their report titled, "Update of the Regional Water Supply Plan – Conservation Element" was completed March 31, 2003. A summary of their work is provided below. The conservation program data that they generated was used in the *Confluence*® model to calculate water savings and program costs.

Summary of the Conservation Element of the RWSP Update

The original RWSP evaluated conservation programs on an aggregate level corresponding to the three county areas within the Portland metropolitan region. The evaluation of conservation programs for the RWSP Update was conducted at the utility, or water-provider level. There were 23 provider members of the Consortium at the time of the analysis.

The intent of PMCL's analysis was to calculate the growth rate using updated population and employment projections to determine the projected number of accounts by provider. Updated forecasts by the Metropolitan Service District (Metro) of population and

employment, at the provider level, had not been released (as of January 2003) and thus the analysis described in this report is based on the rate of growth in 1997 population and employment projections as used in the 1999 Jennifer Stout report.

The ConEAST Model

The Conservation update was done using the Conservation Economic Analysis and Screening Tool (ConEAST) model to allow for a more detailed analysis of conservation programs by provider. ConEAST is an Excel spreadsheet model developed by Gary Fiske & Associates that calculates the following elements for either multiple or single agencies:

- Water savings
- Costs
- Economic benefits
- Unit costs
- Benefit-cost ratios

For this evaluation, ConEAST was used to develop these estimates on a provider-by-provider basis. The provider-level estimates of savings, costs and benefits are aggregated to the regional level within the ConEAST model and regional unit-costs and benefit-cost ratios are then calculated.

Inputs into the ConEAST model include:

- Number of conservation program participants per year
- Average gallons saved per day per participant
- Conservation program costs to the utility and participant
- Marginal cost of water and sewer service
- Marginal cost of water supply to the utility
- Other economic factors

Water providers were asked to provide water and sewer rate information, account information and water use information. Where provider information was unavailable, estimates were made based on information from similar providers, industry standards and experience of the consultant. Input data was also taken from previous reports, and then given to providers to review and update as needed.

A Regional Analysis

PMCL's analysis of water conservation programs is conducted at the regional level. Thus, while inputs into the ConEAST model are entered at the provider level, the inputs for this analysis are regional level data that have been allocated among the providers for entry into the ConEAST model. Some of the ConEAST inputs, such as the gallons saved per participant and the marginal price of water and sewer were determined at the provider level to the extent possible within the scope of this study and as available data permitted.

Thus, some effort was made to adjust inputs for variations among provider service area characteristics, especially when provider-specific data were unavailable. Nonetheless, this analysis should not be interpreted as a provider-level analysis of programs. Rather, the analysis assumes a regional implementation of programs by the Consortium. Program participation and program costs are consistently allocated among providers based on the distribution of customer accounts.

Inherent to the Consortium is the core value of managing a shared resource. There are inequities in sharing the cost of managing the resource, as in funding conservation programs that may benefit some members of the Consortium more than others. There are inequities in allocating program costs by size of the provider and there are inequities in the market reached by a program. Some provider service areas have more industrial customers than others, some providers have older residences than others, some providers have more irrigated area than others, etc. However, conducting this analysis at the provider level would not only involve a more extensive analysis beyond the scope of this study, but also undermine the shared resource concept of the Consortium. The regional analysis of programs corresponds with the role of the Consortium in collaborating on water resource management issues and promoting region-wide conservation programs. Regional implementation of conservation programs offers economies of scale and reaches the unified area with consistent programming.

The Integrated Resource Planning Process

Two workshops were conducted during this project with Consortium members and their conservation staff to include stakeholder input into the evaluation process. The first workshop helped provide direction to PMCL by identifying what programs should be evaluated in the update and what criteria should be used. In addition, two draft documents were submitted to the water providers for review. The resulting comments and additional inputs were incorporated into the analysis. The economic analysis of programs is contingent upon the assumed program parameters, which include participation rates, program costs, water use reduction and the baseline water use per account. To the extent possible, values for these parameters are based on findings reported in the literature for similar conservation programs, the opinions of the consultant and opinions of local stakeholders. Actual participation rates and water savings may only be known after a program has been implemented and properly evaluated.

Evaluation Criteria

Evaluation criteria were established by the Consortium and consultant for screening conservation programs for potential implementation and further evaluation. The purpose of the screening process was to select conservation programs that are feasible, acceptable to customers and effective in reducing water use. Criteria identified for screening conservation programs for the RWSP Update were:

- Technical/implementation feasibility

- Administrative feasibility and acceptability
- Customer acceptability
- Potential water savings
- Cost-effectiveness/ benefit-cost analysis
- Meet State requirements for Water Management and Conservation Plans (Oregon Administrative Rule 690-86)
- Externalities, such as environmental benefits, reduced sewer flows, energy savings, public expectations and public relations

The evaluation of the feasibility and acceptability ratings of potential conservation programs is an attempt to quantify subjective opinions and attitudes. The programs were scored for implementation feasibility, stakeholder (utility) acceptability and customer acceptability.

Results of these ratings were used to rank program feasibility and acceptability. The weighted scores for the three criteria were added to provide an overall score for each program. The overall score for each program was then classified as *good, mixed* or *poor*. Subsequent ratings are included in Table 3-1.

The rating process and subsequent ranking of programs can be biased by a number of factors. Bias factors may include:

- Low response rate among those asked to rate potential programs
- Difficulty in rating programs from a regional perspective, rather than from a provider perspective
- Preference or inclination to rate higher those programs already implemented or familiar
- Insufficient information on implementation conditions of programs

The financial indicators for the evaluation of program cost-effectiveness, as calculated by the ConEAST model, include:

- Unit cost of water saved (utility perspective)
- Unit cost of water saved (society perspective)
- Benefit-cost ratio (utility perspective)
- Benefit-cost ratio (society perspective)
- Benefit-cost ratio (customer perspective)

Utility Perspective: Compares the avoided costs of current and future supplies to the administrative, incentive and allocated regional costs borne by the utility and passed through to utility ratepayers and does not reflect revenue losses due to conservation programs.

Society Perspective: Compares the avoided supply costs to the total cost of conservation programs, whether borne by the utility or by the participant. Thus, in addition to the changes in the costs considered in the utility perspective, the societal perspective also considers the portion of conservation equipment costs borne by the participating customer.

Customer Perspective: Compares the typical bill savings experienced by a participating customer to the portion of the conservation equipment or fixture costs (net of utility incentives) that the customer bears.

These financial indicators are calculated at both the provider-level and the regional-level. For this analysis, only the regional indicators are used to select programs for further analysis.

For this analysis, a marginal supply cost of $47 per acre-foot is assumed for all providers in winter and $374 per acre-foot in summer. These values were selected in consultation with the Consortium staff and other consultants evaluating alternative supply options for the region. A report prepared by Gary Fiske entitled "Evaluation of Marginal Supply Costs for the Portland Metropolitan Region, 1998" was the basis for determining regional marginal cost as there were not resources available for a comprehensive analysis. Inflation was applied to reflect today's dollars. Note that these assumed winter and summer costs per acre-foot are equivalent to $0.11 per 100 cubic feet (ccf) in winter and $0.86 per ccf in summer. For purposes of this analysis, the summer marginal cost was applied to four months and the winter marginal cost was applied to the remaining eight months.

An estimated unit cost of $0.80 per ccf or less was classified as *cost-effective*. Unit costs between $0.80 and $1.00 per ccf were classified as *marginally* cost-effective; and unit costs greater than $1.00 per ccf were classified as *not* cost-effective. The actual marginal cost of water supply may vary significantly by provider depending upon the source, accounting practices and other factors.

The benefit-cost ratios are calculated as discounted benefits divided by discounted costs. A benefit-cost ratio greater than 1.0 indicates that the benefits are greater than costs, and thus the program is cost-effective. Programs with benefit-cost ratios between 0.9 and 1.05 were classified as *marginally* cost-effective. Programs with estimated benefit-cost ratios less than 0.9 were classified as *not* cost-effective.

The classifications of the program unit cost estimates and the benefit-cost ratios were combined into an overall cost-effectiveness score. A *good* cost-effectiveness score required a program unit cost to be cost-effective for both the utility and society perspectives and the benefit-cost ratios to be cost-effective for the utility, society and customer perspectives. A *poor* cost-effectiveness score was given if the unit costs were not cost-effective and all benefit-cost ratios were not cost-effective. Some programs were given a *mixed* cost-effectiveness score indicating that the unit costs and benefit-cost ratios

were in the marginal range, or that there were conflicting scores between the perspectives. The overall cost-effectiveness score of each program that was evaluated is shown in Table 3-1.

The cost-effectiveness ratings may be biased by the assumption that a given program is applicable in all provider service areas. An example is the program to eliminate single-pass cooling systems. As demonstrated by the Portland Business, Industry and Government (BIG) program, elimination of single-pass cooling results in dramatic water savings and can pay for itself in a short time period at selected customer facilities. However, evaluating the program at an aggregate level such as estimating the percent reduction in water use for the Commercial Industrial and Institutional sector region wide reduces the cost-effectiveness of the program. Furthermore, some providers may not have any customers with single-pass cooling within their service area. Assuming implementation of the program among all providers for the regional analysis further masks the cost-effectiveness rating of the program, which may be very cost-effective for a selected facility or utility but does not look favorable as a regional program.

Similarly, the cost-effectiveness ratings are based on the regional assumption of an implementation rate for a given program across all providers. Realistically, participation rates may vary among provider service areas. Variation of assumed water usage rates (the gallons per day per account) and variation in marginal water and sewer rates among providers also affect the cost-effectiveness of a program by provider. Thus, programs that effectively save water when implemented at a given facility, or at the provider level, may not appear cost-effective when evaluated at the regional level.

Other factors are considered in the selection of recommended programs in addition to the acceptability ratings and estimates of cost-effectiveness. These factors include:

- State requirements (Oregon Administrative Rule 690-86)
- Mix of programs targeting residential and nonresidential sectors
- Mix of programs targeting indoor and outdoor water use
- Need to address peak use as well as total demand
- Environmental issues, such as the benefits of reduced sewer flow

As a final component of stakeholder input, Consortium members reviewed a draft list of program evaluations and collectively developed a list of recommendations.
Table 3-1 shows the list of evaluated programs, their ranking, cost/benefit, water savings, cost and acceptability. The data are most useful in ranking programs against each other for further analysis by an individual provider. The data assume that all providers are participating in the program; however, providers selected the programs they are most likely to implement. The programs selected by providers and the projected 2025 peak-season savings is shown in Table 3-2.

Table 3-1

RANKING AND GROUPING OF CONSERVATION PROGRAMS BY CRITERIA

	Program	Overall Acceptability	Meets Division 86 Requirements	Unit Cost Utility ($/ccf)	Unit Cost Society ($/ccf)	B/C Ratio Utility	B/C Ratio Society	B/C Ratio Customer	Average Annual Savings MG	Average Annual Cost	Cost-Effective
Acceptable and Cost-effective	**Residential Information, Education & Awareness**	**Good**	E	$0.28	$0.28	1.76	1.76	n/a	776	$282,591	**Good**
	Property Manager Workshops	**Good**	E, A	$0.33	$0.33	2.63	2.63	n/a	38	$15,401	**Good**
	Trade Ally Irrigation & Landscape Workshops	**Good**	E, A	$0.19	$0.19	4.42	4.42	n/a	78	$18,632	**Good**
Mixed Acceptability and Cost-effective	**Large Landscape Audit B**	**Mixed**	A,R,U	$0.80	$0.80	1.07	1.07	n/a	234	$241,404	**Good**
	CII Irrigation ET Controller Retrofit A	**Mixed**	A, R	$0.19	$0.31	4.55	2.77	13.66	398	$84,916	**Good**
	Nonresidential Irrigation Submetering	**Poor**	O	$0.02	$0.11	57.04	7.51	16.61	605	$9,964	**Good**
	Multifamily Submetering	**Poor**	O	$0.03	$0.03	16.40	16.40	n/a	156	$4,694	**Good**
Mixed Acceptability and Mixed Cost-effectiveness	**CII Indoor Audits A**	**Good**	A, U	$0.48	$0.70	0.88	0.61	22.08	473	$289,125	**Mixed**
	CII Indoor Audits B	**Mixed**	A, R, U	$0.66	$0.66	0.64	0.64	n/a			**Mixed**
	Toilet Rebate or Replacement	**Mixed**	R	$0.44	$0.44	0.95	0.95	n/a	508	$196,296	**Mixed**
	Residential Indoor Audits A	**Poor**	A	$0.39	$0.62	1.09	0.68	19.60	740	$366,795	**Mixed**
	Residential Irrigation ET Controller Retrofit	**Poor**	A, R	$0.49	$2.21	1.76	0.39	0.89	105	$57,643	**Mixed**
	Waterless Urinals	**Poor**	R	$0.49	$0.49	0.87	0.87	n/a	344	$146,165	**Mixed**
	Residential Indoor Audits B	**Poor**	A, R	$0.60	$0.60	0.70	0.70	n/a			**Mixed**
	CII Outdoor Ordinance	**Poor**	A, U	$0.77	$4.43	1.12	0.19	0.44	205	$187,109	**Mixed**
	Eliminate Single-Pass Cooling - No Incentive C	*****	R, U	$0.03	$6.41	15.97	0.07	0.77	479	$11,095	**Mixed**
Mixed Acceptability Poor Acceptability and Not Cost-effective	**Washing Machine Rebate $50**	**Mixed**	R	$0.99	$0.99	0.43	0.43	n/a	216	$251,055	**Mixed**

*** Eliminate single-pass cooling was added after feasibility ranking.**

Div. 86 Requirement Codes: E - education, A - technical assistance, R - rebates and financing retrofits, U - reuse, recycling, and non-potable use, O - Other

Programs not included due to poor acceptability and poor cost effectiveness include: Residential Landscape Workshops, CII Landscaping and Irrigation System Rebate, Residential Landscaping and Irrigation System Rebate, Single Family Outdoor Audit.

$.86/ccf is the marginal cost of new supply (for summer) used for this analysis

Findings and Recommendations

The evaluation of programs by the overall acceptability score and the cost-effectiveness score allows the programs to be grouped into the following categories:

- Feasible, acceptable and cost-effective
- Poor feasibility and acceptability, but cost-effective
- Mixed feasibility and acceptability, and marginally cost-effective
- Mixed feasibility and acceptability, and not cost-effective
- Poor feasibility and acceptability, and not cost-effective

The programs are grouped in Table 3-1 according to these categories. Programs that are feasible, acceptable and cost-effective are recommended for implementation. Programs that are cost-effective but were ranked poorly on perceived feasibility and acceptability may be recommended on the condition that marketing and public education can improve the acceptability of the program. Other programs may be recommended contingent upon a redesign of implementation conditions and assumptions used in the evaluation process.

In situations where multiple implementation scenarios of a given program are evaluated (e.g., Scenario A and B), the highest ranked scenario is selected for recommendation. Thus, there are 14 programs that can be recommended for further analysis with the supply alternatives from the first three groupings. In addition, the washing machine rebate program is included in the set of programs for further analysis on the basis of its marginally effective unit cost, mixed acceptability and the recommendation of the Consortium members.

Conservation managers may modify the implementation specifications of the recommended programs based on individual provider target populations (i.e., their customers), budgets and resources available. ConEAST allows individual providers to calculate their specific costs and savings. For the purpose of this analysis and the RWSP Update, the implementation specifications of the recommended programs are assumed reasonable for the average provider.

The following 15 programs have been recommended for further analysis in the RWSP Update. A description of each program is provided in the full report by PMCL and a brief description follows.

- Residential Information, Education and Awareness
- Property Manager Workshops
- Trade Ally Irrigation and Landscape Workshops
- CII Irrigation ET Controller Retrofit (Option A)
- Large Landscape Audit (Option B)
- Nonresidential Irrigation Submetering
- Multifamily Submetering
- CII Indoor Audits (Option A)

- Toilet Rebate Program
- Residential Indoor Audits (Option A)
- Residential Irrigation ET Controller Retrofit
- Waterless Urinals (awaiting approval from the Oregon State Plumbing Board)
- CII Outdoor Ordinance
- Eliminate Single-Pass Cooling (Option C)
- Washing Machine Rebates

Conservation Program Descriptions

Includes multi-media campaign, Web page, youth education programs, events, brochures and public relations. This program targets all single-family and multifamily accounts.

Regional Programs

Residential Information, Education and Awareness

Includes multi-media campaign, Web page, youth education programs, events, brochures and public relations. This program targets all single-family and multifamily accounts. The analysis assumes a 2 percent reduction of average indoor and outdoor water use, with a one-year savings life. The program continues each year through 2030.

Property Manager Workshops

This program targets multifamily accounts and commercial landscape irrigation through workshops for property managers, landscape maintenance personnel and landscape contractors. It emphasizes inclusion of specific language regarding landscape and irrigation system maintenance in the landscape contract. Workshops will also cover efficient watering practices, including proper system timing and programming, the use of evapotranspiration (ET) rates to estimate turf and plant watering needs and efficient landscaping maintenance. The program assumes two workshops per year with 30 attendees each, who each affect two properties for a total of 120 multifamily or commercial accounts affected per year. Workshops continue through 2030.

Trade Ally Irrigation and Landscape Workshops

This program targets single-family and commercial (CII) accounts through workshops for developers and landscapers. The focus is primarily on water-efficient landscape design and installation, but may also cover water-efficient irrigation equipment. Four workshops will be conducted per year through 2030.

Programs for Individual Provider Selection

Large Landscape Audit

This program targets commercial (CII) accounts with high summer-to-winter water use ratios. The audits may include the following services for customers: help in determining current irrigation efficiency; advising customers of low-cost hardware improvements; providing baseline irrigation schedules; guiding customers on how to modify irrigation schedules according to weather changes; providing irrigation water savings information, and information on new technologies. It is estimated that approximately 100 accounts will participate each year. The program assumes $400 additional (i.e., incremental) cost to customer above routine maintenance costs.

CII Irrigation ET Controller Retrofit A

As with the large landscape audit program, this program targets commercial (CII) accounts with large irrigation use. These accounts are assumed to have high summer-to-winter water use ratios. For this analysis, the accounts with high summer usage are assumed to be the top 15 percent of CII accounts. The program also targets known irrigators such as golf courses, parks and schools. The ET-based controller systems are programmed with historical ET data for a given region. Irrigation schedules are adjusted bi-weekly according to the historical ET data and can be further adjusted on a daily basis with a temperature sensor. These systems are competitively priced with standard irrigation controllers.

It is assumed that one 32-station irrigation controller is installed at each location with protective cabinet and temperature sensor. However, some locations, such as golf courses, may require multiple controllers.

This program assumes a 50 percent ($475) rebate and the customer pays for 50 percent of the cost of ET controller. The program has 5 percent participation each year through 2015. Five percent of 15 percent of CII accounts equals 0.75 percent of CII accounts, or about 200 accounts per year**.**

Toilet Rebate Program

This program targets non-ultra-low-flush (ULF) toilets that use more than 1.6 gallons per flush. The analysis assumes 70 percent of all existing accounts (in the year 2000) have non-ULF toilets. This assumption is based on the age of homes reported in the 2000 U.S.

Census for Clackamas, Multnomah and Washington counties and an assumption that toilets in some pre-1990 homes have already been replaced with ULF toilets. Consortium staff (or subcontractor) would market, administer and track the rebate program. The program would offer $100 rebate for verified installation of a 1.6 gallon per flush toilet. The rebate may be used by the customer to offset the cost of the new fixture and/or installation costs. The program would be offered for 10 years and provide 5,000 rebates per year.

Nonresidential Irrigation Submetering

This program targets irrigation of landscape areas through separate metering and billing for irrigation use. The program will be required of all *new* construction with landscape areas greater than 10,000 square feet and will also target *existing* large landscape areas assumed to be submetered over a 10-year period. The premise behind this program is that studies show that if a customer knows exactly how much water is being applied to landscapes and what their irrigation costs are, it will provide an incentive to make water conserving improvements. The targeted accounts are assumed to be in the top 15 percent of accounts with a high summer-to-winter ratio. Program analysis assumes a 90 percent compliance with targeted accounts or about 430 accounts per year.

Multifamily Submetering

This program targets all *new* multifamily accounts through ordinances or utility regulations that require submeters for individual units. The analysis assumes that the additional cost of submetering is incorporated into building costs. Any billing service fee is assumed to be offset by reduced water bill. The analysis assumes 90 percent compliance with ordinance mandating submetering in new multifamily construction.

CII Indoor Audits B

This program targets those CII accounts in the top 15 percent of annual use, or those with sharp increase in use. Water audits may be performed by a contractor, such as trained staff within the Portland Water Bureau, at an average audit cost of $1,000 per audit. An average cost to customers of $500 is assumed. Participation of 5 percent of targeted accounts is assumed (5 percent of 15 percent is about 200 accounts per year).

Washing Machine Rebates

This program targets all residential customers and offers a $50 rebate for the purchase of water-efficient clothes washers. The incremental cost to customers is assumed to be offset by the rebate, plus the Oregon Energy Tax Credit. The analysis assumes participation by 4,000 residential accounts per year.

Residential Indoor Audits A

This program targets single-family and multifamily accounts with high volumes of water use, or sudden increases in water consumption. Targeted accounts are assumed to be the top 20 percent of accounts. The analysis assumes 5 percent of accounts per year participate and implement recommendations (5 percent of 20 percent, or about 3,800 audits per year). Audits are assumed to cost $75 each and participants are assumed to pay an average of $50 to implement audit recommendations.

Residential Irrigation ET Controller Retrofit

This program targets the top 20 percent of single-family accounts with high summer-to-winter use ratios. The ET-based irrigation controllers are programmed with historical ET data for a given region. Irrigation schedules are adjusted bi-weekly according to the historical ET data and can be further adjusted on a daily basis with a temperature sensor. The analysis assumes that a participant will pay $174 for the controller and that the Consortium will pay $35 for installation. The analysis assumes that 3,000 customers will participate.

Waterless Urinals

This program targets the replacement of watering urinals with waterless urinals in *existing* commercial (CII) accounts, especially those with high volume traffic such as restaurants, schools, dormitories, sports arenas and office buildings. A rebate of $150 per urinal is offered to offset the cost of fixture replacement. The proportion of targeted high-traffic accounts to all CII accounts is unknown. For this analysis, it is assumed that 5 percent of existing (i.e., year 2000) accounts, or about 1,330 accounts will participate with an average of two fixture replacements per account. The program is offered for only 10 years and is contingent on the Oregon State Plumbing Board approving their use. As of July 2004, they are not approved for commercial use, but are being used in a pilot program in some State Parks.

CII Outdoor Ordinance

This program targets *new* CII accounts by requiring submittal and approval of landscape plans for new construction and restricting turf area in landscaped areas. The analysis assumes 90 percent compliance among new CII accounts, or about 500 accounts per year. Plan reviews are assumed to cost $350 each and the customer is assumed to pay an average of $1,800 to comply with the ordinance.

Eliminate Single-Pass Cooling

This program target CII accounts currently using single-pass cooling to cool equipment such as refrigerators, air conditioners and ice machines. This program seeks to eliminate

single-pass cooling systems by 2010 and have participants install water saving technology that has a one-to-five year payback. It is estimated that 39 percent of existing (i.e., year 2000) CII accounts have single-pass cooling. Thus, 300 existing accounts would be converted per year. An average customer cost of $25,650 is assumed.

Provider Selections

The water providers were given the option to select which programs they felt were realistically going to be implemented in the next five years. The providers wanted the ability to select conservation programs best suited to their customer classes and customer needs, and resources available. This also allowed for a more realistic analysis of conservation savings in the integration model. Table 3-2 shows which programs were selected by which provider for inclusion in the integration model and the projected peak-season savings in 2025. Projected peak-season savings from conservation by 2025 is 19.3 million gallons per day.

All providers are participating in the education and awareness programs, property manager workshops, green industry partnerships, and trade ally and irrigation workshops. These programs are currently being implemented by the Consortium and are felt to be the most suited for regional implementation as they apply to all providers and are the most cost-effective to implement regionally. These programs form the basis of the Consortium's regional conservation program. The Consortium's role in the implementation of the remaining programs may be as coordinator, a place for resource sharing and facilitating partnerships.

The net present value of the conservation programs selected by the region's water providers is $23.16 million dollars in utility costs and $92.29 million dollars in customer costs. The utility costs include all costs of direct payments and administration, while the customer costs are those incurred directly by the customer to achieve the water savings listed in Table 3-2. All of the strategies modeled in the RWSP Update include this set of programs with their attendant costs and savings.

Conservation Program Savings by Provider Node **Table 3-2**

PROGRAM BY NODE	CII Elim SPC C	CII ET Controller Retrofit A	CII Indoor Audit B	CII Irrg Submeter	CII Landscape Audit B	CII Outdoor Ordin	CII Waterless Urinals	MF metering	PM Wksp CII*	Res Educ*	Res In Audit	SF Irrg Control Retrofit	Toilet Rebate	Trade Ally Wksp*	Wash Mach Rebate	**2025 Peak Season Savings MGD**
Clackamas																
1 CRW N		0.07	0.146						0.016	0.115			0.073	0.059	0.02	**0.499**
2 CRW S		0.03	0.07						0.008	0.058			0.037	0.029	0.01	**0.242**
3 Gladstone									0.003	0.02				0.005		**0.028**
4 L Oswego		0.086			0.025				0.008	0.08				0.018	0.02	**0.237**
5 Milwaukie									0.006	0.05				0.011		**0.067**
6 Sunrise		0.027			0.011				0.002	0.217		0.098		0.044		**0.399**
7 Wilsonville				0.134					0.01	0.055				0.013		**0.212**
8 Oak Lodge									0.007	0.05				0.011		**0.068**
9 West Linn									0.007	0.065				0.014		**0.086**
10 Oregon City									0.007	0.068				0.015		**0.090**
11 Sandy									0.002	0.024				0.005		**0.031**
Multnomah																
12 Fairview									0.001	0.02				0.004		**0.025**
13 Gresham									0.015	0.2			0.136	0.030		**0.381**
14 Ptldn W	0.23	0.76	0.088	0.58	0.22		1.065		0.016	0.131				0.063		**3.153**
15 Ptldn E	0.868	2.85	0.33	2.18	0.829		0.284		0.06	0.491				0.016		**7.908**
16 Powell Valley	0.105	0.083	0.037	0.06	0.023		0.049		0.009	0.076				0.017		**0.459**
17 Rockwood		0.125							0.01	0.088	0.07		0.11	0.019	0.02	**0.442**
Washington																
18 Beaverton			0.104			0.058		0.024	0.02	0.124	0.101			0.028		**0.459**
19 Forest Grove									0.007	0.04				0.010		**0.057**
20 Hillsboro	0.233	0.307	0.175		0.11				0.02	0.209			0.174	0.048	0.05	**1.326**
21 Raleigh									0.0009	0.006				0.002		**0.008**
22 Sherwood		0.085			0.034				0.001	0.09				0.011	0.02	**0.241**
23 Tigard					0.047		0.077	0.03	0.003	0.123		0.04	0.161	0.009	0.034	**0.524**
24 Tualatin			0.053	0.09	0.034			0.004	0.013	0.04	0.03			0.010		**0.274**
25 TWVD Wolf Cr.	0.19	0.265	0.113		0.088		0.109		0.023	0.425			0.39	0.100	0.1	**1.803**
26 TVWD - Metzger	0.028	0.038	0.016		0.012		0.015		0.003	0.06			0.05	0.015	0.015	**0.252**
27 West Slope									0.005	0.021				0.005		**0.031**
2025 Peak Season Savings MGD	**1.654**	**4.726**	**1.132**	**3.044**	**1.433**	**0.058**	**1.599**	**0.058**	**0.283**	**2.946**	**0.201**	**0.138**	**1.131**	**0.610**	**0.289**	**19.302**

Savings were calculated as part of a regional analysis and not on an individual provider level basis.

*= Programs selected for regional implementation

Chapter 4. Source Options

Part 1. Background and Issues

Source-Option Selection

The update to source options is conducted through a re-examination of the 1996 RWSP recommendations with modifications made, as needed, to reflect noted changes in regulation, resource availability, political change or other factors deemed relevant under present knowledge. In a review of the history of source-option development for the region, a basis of study was originally established in 1992 under Phase 1 of the plan titled, "Water Options Source Study." Under Phase 1, 29 different water supply options were identified as potential sources for serving the Portland/Vancouver metropolitan area within a 50-year planning horizon. These initial options were selected to augment existing supplies in meeting projected planning year needs. Using a predetermined set of 14 technical criteria, five source options were selected for further analysis under Phase 2. These are:

- Bull Run Dam 3
- Clackamas River Diversion
- Willamette River Diversion
- Columbia River Diversion
- Aquifer Storage and Recovery (ASR)

The final recommendations from the 1996 RWSP included near-term committed resources, new conservation programs, exploration and implementation of viable non-potable options, exploration and implementation (after 2024) of viable ASR projects, and up to 50 mgd of additional development (after 2030) on the Clackamas River (over and above the 22.5 mgd being planned by 2005). In Chapter 12 of the RWSP, the Willamette and Columbia rivers were identified as potential larger source increments after 2030; however, on pages 269-271 strategies to continue studying these sources are identified. In the case of the Willamette, a specific strategy notes that it may be developed for smaller local source use in the near term.

In the 2002 update to the RWSP, the available source options for the region have been modified to reflect changes that have occurred in regulation, availability, public perception and other factors. Following lines similar to 1996, possible expansion of the Bull Run through Dam 3, expansion of the Clackamas River, Columbia River, and aquifer storage and recovery (ASR) sources were again included. Expansion of the Clackamas River source was not be considered under

a consolidation of facilities, rather under continued select expansion by the existing purveyors. And although ASR was again considered as a source, its capacity was thought to be much reduced from that anticipated in 1996. In addition, possible expansion of sources for the Trask/Tualatin River system and localized groundwater sources have been added. The addition of the Trask/Tualatin system reflects the potential raise of Hagg Lake.

A special note is made regarding the Willamette River, Columbia River, Columbia South Shore Well Field and local sources options. Although it is included in the source-option review, the CTSC decided not to include the Willamette River in the development of source-option strategies for evaluation with the *Confluence*® resource planning model. Future use of the Willamette River is to be decided by individual jurisdictions. The same decision was made to not include the Columbia River in the supply strategies including the modeling. Future updates to the RWSP may include the Willamette or Columbia rivers as regional sources of supply. Furthermore, the inclusion of the Columbia South Shore Well Field is not intended as a stand-alone primary source, but as an emergency option or as supplement during peak-season supply linked to the Bull Run surface water supply. Limitations also were applied to local groundwater sources to reflect declining source availability, jurisdictional consolidation, annexation and potential regulation that may force abandonment.

Table 4(1)-1 lists the source options included in this review along with a comparison of the source expansion considered in the 1996 RWSP and the expansion assumed under this update. Exhibit 4-1 shows locations of major source options, while Exhibits 4-2 and 4-3 show the ASR and local sources included in the RWSP Update, respectively. *Note: the general locations of the ASR and local sources are represented by symbols within the service area of the purveyor of the local source; however, these locations are not necessarily the exact locations of these projects.*

Table 4(1)-2 shows the "base case" and source expansion or development options that comprise the source options considered for expansion. The base case is defined as those source options that are currently being utilized or are committed for development. Table 4(1)-2 indicates the estimated additional capacity to be made available by each project. From the source options shown in Table 4(1)-2, different strategies may be developed that represent a range of approaches for meeting future water demands.

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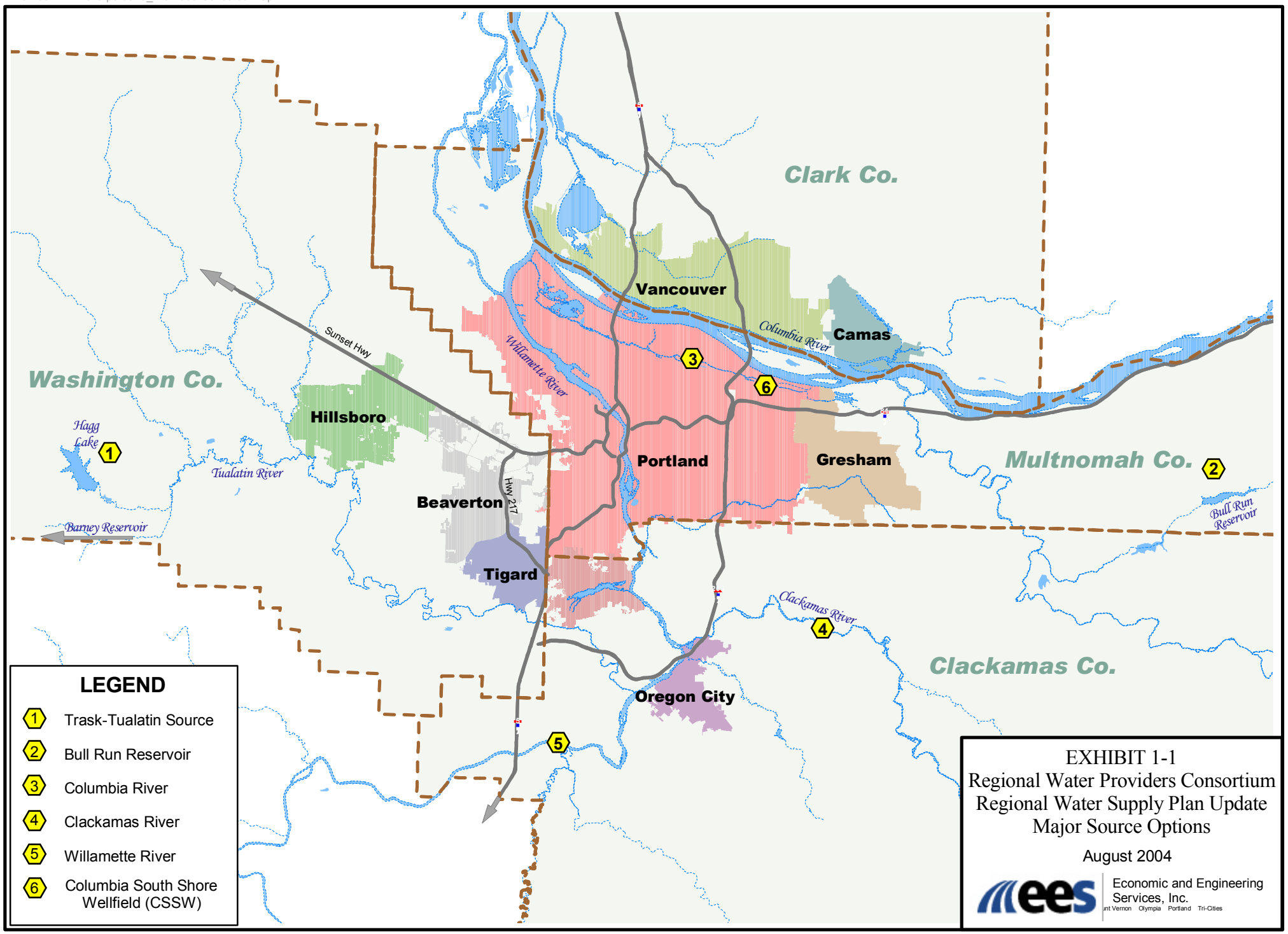

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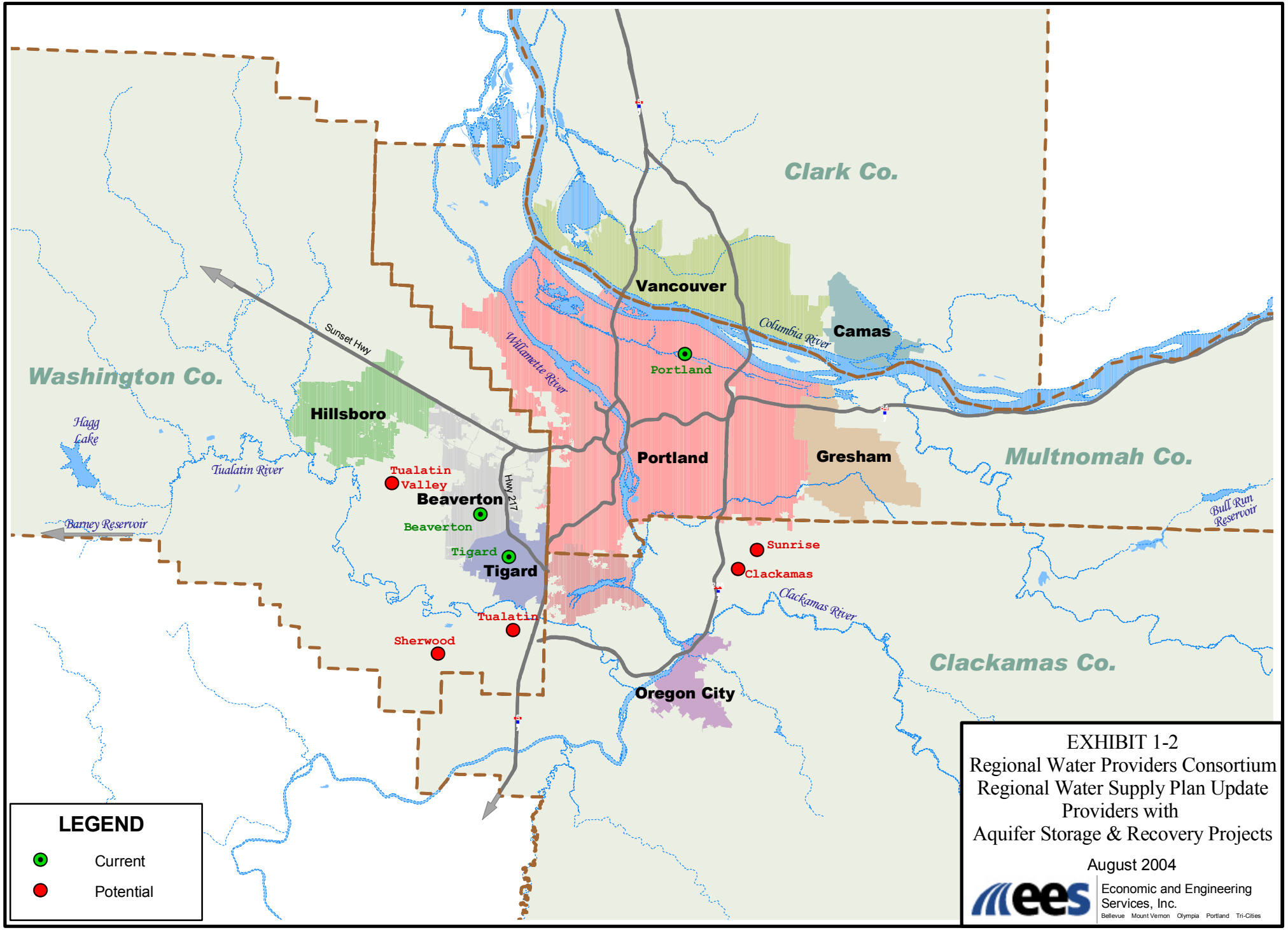

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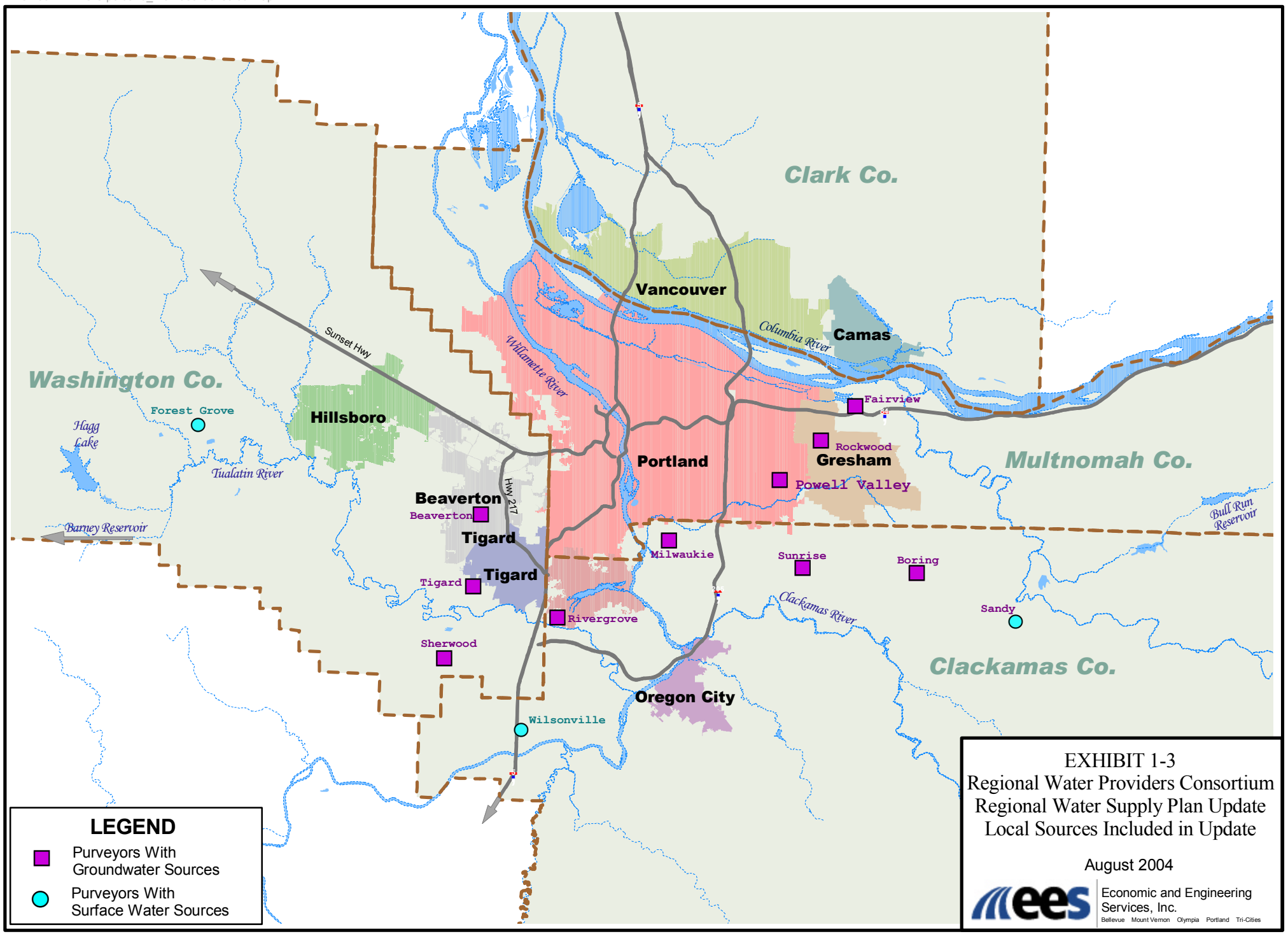

Table 4(1)-1 Source Options Considered in Update Regional Water Providers Consortium		
Source Option	**1996 RWSP Expansion**	**Current Expansion and Application to Source Strategies**
Bull Run Watershed	• Construction of Dam 3 and associated improvements	• Addition of Dam 3 • Raises at Dams 1 and 2 • Potential for groundwater development and ASR
Clackamas River Diversions	• Four alternatives for expansion were considered • Assumed that expansion would occur at a single central facility	• Potential expansion assumed for each of the Clackamas River treatment plants with no new central facility • Potential to utilize hydroelectric storage from Timothy Lake to meet M&I needs
Columbia River	• Intake and treatment facilities site just below mouth of Sandy River	• Same as 1996 RWSP
Trask/Tualatin River	• Not included • Expansion at Barney Reservoir and Joint Water Commission treatment plant was considered a committed resource (base case)	• Scoggins Dam raise and certification of M&I water rights • Water treatment plant expansion at Joint Water Commission Facilities • Raw water pipeline • Sain Creek Tunnel
Regional Aquifer Storage & Recovery	• Two representative sites in Powell Valley and Cooper-Bull Mountain	• Regional ASR projects at Powell Valley and Bull Mountain dropped from consideration • Evaluate smaller more local ASR pilot studies currently being undertaken or planned by agencies
Willamette River	• Intake and treatment plant site located upstream of railroad bridge in Wilsonville	• Used only as local supply source for the City of Wilsonville • Not included as a regional source of supply for this update and not included in final set of source option strategies • Available to meet/offset/supplement local water supply needs if desired by individual jurisdictions in the future
Columbia South Shore Well Field	• Not included • Considered a committed resource ("base case")	• Included in the base case and expansion included as a future local water system source option strategy • To be utilized as a summertime augmentation source and emergency backup
Local Sources	• Not included • Considered a committed resource ("base case")	• Account for overall utilization of local sources and the potential expansion of these sources. • Assess changes in demand from the regional sources resulting from either developing new local sources or restricting existing ones

Table 4(1)-2 Source-Option Expansion and Development Regional Water Providers Consortium				
Trask/Tualatin	**Bull Run**	**Clackamas River**	**ASR/Groundwater**	**Other**
Base Case				
▪ JWC WTP (120 mgd peak capacity) ▪ Assumes raw water pipeline from Scoggins. ▪ Hagg Lake (13,500 ac-ft) ▪ Barney Reservoir (19,600 ac-ft)	▪ Bull Run Dam 1 and 2 (210 mgd) ▪ Bull Run Reservoirs 1 and 2 (30,400 ac-ft) ▪ Water Treatment Plant (8,300 ac-ft)	▪ CRW WTP (30 mgd) ▪ NCCWC WTP (10 mgd) ▪ SFWB (20 mgd) ▪ L. Oswego (16 mgd) ▪ Timothy Lake (2,200 ac-ft[1] and 9,100 ac-ft[2]) ▪ SFWB WTP improvements (10 mgd) ▪ Unspecified Clackamas Improvement (10 mgd)	▪ Brownell (0.13 mgd) ▪ Sunrise (15.0 mgd) ▪ Fairview (5.4 mgd) ▪ Milwaukie (6.1 mgd) ▪ Powell Valley (8 mgd) ▪ Rockwood (6.5 mgd) ▪ Beaverton (1.9 mgd) ▪ Sherwood (1.9 mgd) ▪ Tigard (0.5 mgd) ▪ Beaverton ASR (5 mgd) ▪ CSSWF & ASR (95 mgd for 120 days) ▪ Tigard ASR (5.76 mgd – restricted use)	▪ Alder Creek (2.6 mgd) ▪ Forest Grove (2 mgd) ▪ Wilsonville WTP (15 mgd)
Source Expansion and Development Options				
▪ Sain Creek Tunnel ▪ Scoggins Raise and new WTP (35,600 ac-ft[4] of added M/I storage plus 60[5] to 80 mgd peak capacity) **or** ▪ No Scoggins and expand existing JWC - WTP (20 mgd)	▪ Dam 1 Raise (600 ac-ft / +1.8 mgd) ▪ Dam 2 raise (6,750 ac-ft / +20 mgd) ▪ Bull Run Groundwater (20 mgd) ▪ Bull Run Dam 3 ▪ (58,300 ac-ft / +172 mgd)	▪ NCCWC WTP expansion (10 mgd) ▪ Timothy Lake Raise (3,097 ac-ft[3] / +9 mgd) ▪ Lake Oswego WTP Expansion (6-10 mgd) ▪ Future treatment plant expansion (+20-30 mgd)	▪ JWC (+5 to +10 mgd) ▪ Gresham (+5 mgd – restricted use) ▪ Rockwood (+13 mgd) ▪ Tualatin ASR (5 mgd – restricted use) ▪ CRW –ASR (+2 mgd) ▪ Sherwood –ASR (+3 mgd)	▪ Columbia River WTP (50 mgd) ▪ Columbia River WTP expansion (+50 mgd)

Notes:

Conversion of storage to mgd assumes 110-day peak-season drawdown period

[1] *Between June 15-Labor Day*

[2] *Between Labor Day-June 14*

[3] *No restriction on time*

[4] *Expansion total is 50,600 ac-ft of which 18,600 ac-ft is available to JWC partners and 17,000 ac-ft is available to other cities for municipal purposes*

[5] *Firm capacity of the new JWC WT.*

Review of Policy Objectives and Source-Option Issues

As part of the 1996 RWSP, the Consortium, with substantial input from the public, defined a series of *policy objectives* that "… faithfully reflect the issues important to the region" and which are "… useful to policymakers in distinguishing among alternative resource futures." The policy objectives developed involved the following considerations:

- Efficient use of water
- Water supply reliability
- Water quality
- Impacts of catastrophic events
- Economic cost and cost equity
- Environmental stewardship
- Growth and land-use planning
- Flexibility to deal with future uncertainty
- Ease of implementation
- Operational flexibility

A description of policy objectives is included in Table 4(1)-3. Under their original design, these policy objectives were intended to serve as guiding principles in evaluating various resource supply strategies for the region. These policy objectives complement, compete and/or conflict with one another in such a way as to provide a comparative framework for which various options could be analyzed. For this reason the policy objectives were not prioritized in the original RWSP. Rather, they were used as key guidance for developing resource strategies that account for the uncertainties and tradeoffs that must be made among different, and often competing, objectives and interests. Resource strategies include the components for water conservation, source of supply, transmission and policies to meet the demands over the planning period. In the 1996 RWSP, five different resource strategies were developed that emphasized different policy objectives or combinations of objectives. For example, one strategy emphasized minimizing environmental impacts and maximizing efficient use of water, while another strategy emphasized cost minimization and maximizing raw water quality.

Furthermore, the RWSP considered the following "*source- option issues*":

- Water availability
- Environmental impacts
- Raw water quality
- Vulnerability to catastrophic events
- Ease of implementation
- Treatment requirements
- Capital and operating costs

Description of the source-option issues is included in Table 4(1)-4. Note that several of the source-option issues correspond directly with the policy objectives. The source-option issues were the foundation against which all sources were compared in the 1996 RWSP. The

source-option issues were used primarily to compare and relate the general advantages and disadvantages of the source options relative to one another, thus allowing the appropriate source option(s) to be used with a given resource strategy. In other words, the source-option issues were used to evaluate the source options outside the overall resource strategy.

Exhibit 4-4 provides a graphical overview of the overall assessment that was conducted in the 1996 RWSP in relation to the source-option evaluation. It illustrates that the sources were evaluated using the source-option issues listed in Table 4(1)-4. Key policy objectives or combinations of policy objectives were then selected that were representative of stakeholder concerns. Resource strategies were then developed to address these key policy objectives. Thus, although source-option issues such as water availability (return flows), ease of implementation and treatment requirements were evaluated for each source option, they were not explicitly evaluated for the resource strategies. Instead, policy objectives such as reliability and water use efficiency were evaluated at the resource strategy level. The final assessment was then conducted with respect to the resource strategies as a whole and not just on the source options alone. Resource strategies were then rated against policy objectives.

As part of the update, the Consortium Board decided in December 2003 that all of the policy values were important. However, since only limited funds were available in the update to re-analyze the ratings and no funding was allocated to conduct new studies of these factors, the CTSC decided to utilize in the update as much of the ratings developed in the 1996 RWSP that were still relevant. However, the change in direction for the RWSP Update has meant that ratings were not used in the modeling of potential strategies.

This final report on source options is meant to address the proposed ranking system against the policy objectives for information purposes. The *Confluence* model could provide a quantitative or qualitative summary of rankings that may be applied to any of the source options. A summary of the policy objectives, along with their application to the source-option strategies, is listed in Table 4(1)-3.

Based on CTSC recommendations numeric criteria for the following objectives were assigned to each of the sources:

- Water quality – raw water quality/protectability/aesthetics
- Natural environment – particularly in light of new information on the Endangered Species Act (ESA) and Clean Water Act (CWA) regulations
- Catastrophic events – including system vulnerabilities to both natural and human-caused events
- Ease of implementation – ability to obtain needed permits

The impacts these issues might have on the evaluation of source options are discussed in Part 2 for each source option. The listing of species and the climate change study are particularly important in that they affect several of the source options and need to be addressed in a global manner in any evaluation by individual entities.

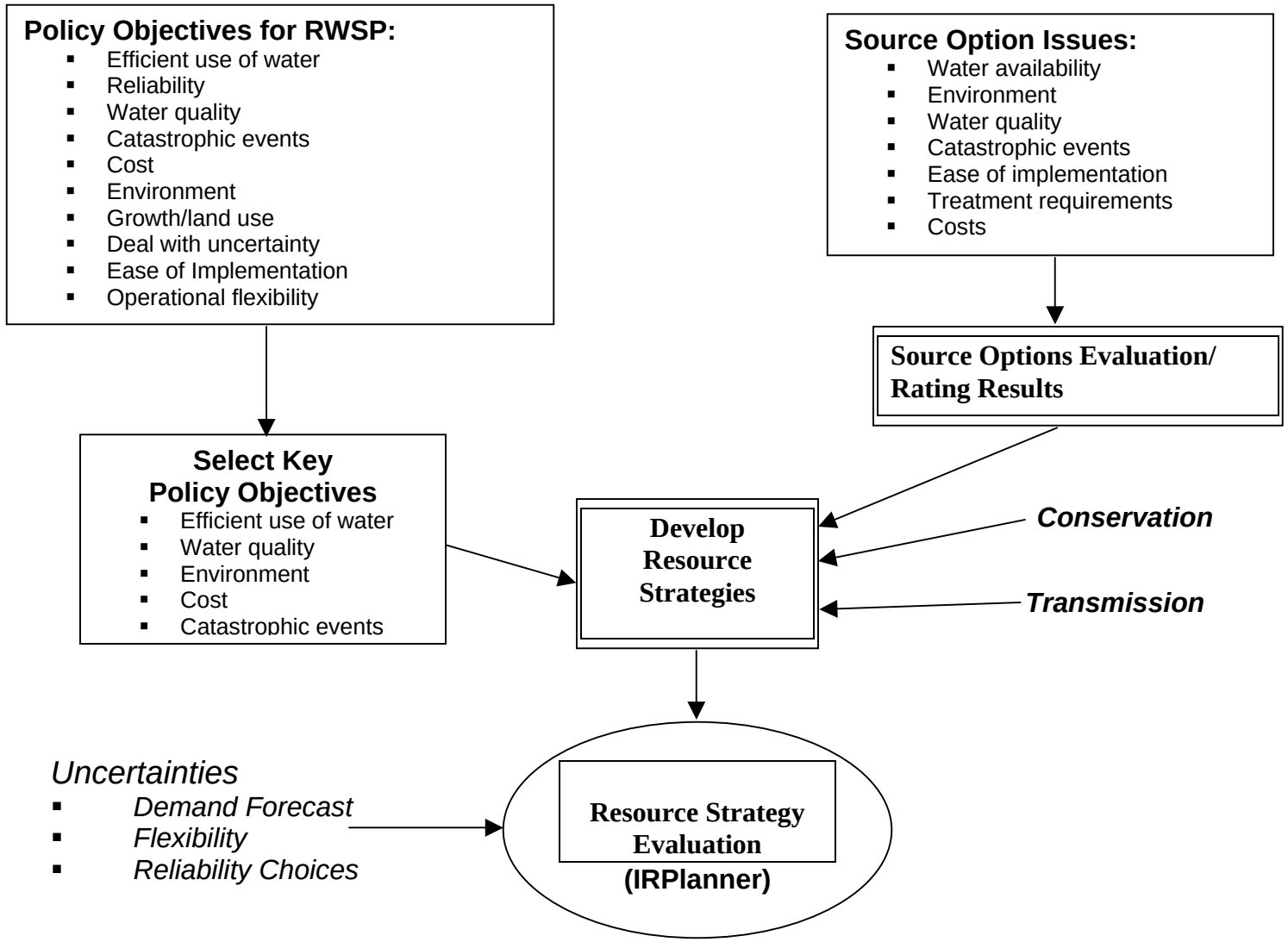

Exhibit 4-4
Application of Policy Objectives in Source Option Evaluation Processes in 1996 RWSP

Table 4(1)-3
Application of Policy Objectives
Regional Water Providers Consortium

Policy Objective	Application of Policy Objective for the Update
Efficient Use of Water	
▪ Maximize the efficient use of water resources, taking into account current and emerging conservation opportunities, availability of supplies, practicality, and relative cost-effectiveness of the options ▪ Make the best use of available supplies before developing new ones	▪ Include a specific set of conservation programs for each water provider that selects them, along with the regionally implemented programs. ▪ Conservation would apply to all of the scenarios, rather than evaluating each scenario with and without conservation. ▪ Based on this approach, efficient use of water is not evaluated here; evaluation can occur under the *Confluence* modeling for a source option strategy rather than each source
Water Supply Reliability	
▪ Minimize the frequency, magnitude and duration of water shortages through a variety of methods including development and operation of efficient water supply systems, watershed protection, and water conservation ▪ Ensure that the frequency, duration and magnitude of shortages can be managed ▪ Ensure that decision makers retain the flexibility to choose appropriate risk of peak event shortages given applicable future conditions, constraints, and customer values	▪ This issue was addressed in the 1996 RWSP, that all needs were shown to be met by the resource strategies modeled; the discussion of different levels of reliability was put off for a future date, but is yet to be addressed ▪ The *Confluence* model (see Chapter 5) was used to determine whether the source option scenarios l met the identified needs over the study period ▪ Different reliability levels will be evaluated at a future date when a longer-range demand forecast is available. ▪ Based on this approach, water supply reliability is not evaluated here; evaluation can occur under the *Confluence* modeling or future assessment
Water Quality	
▪ Meet or surpass all current federal and state water quality standards for finished (tap) water ▪ Utilize sources with high raw water quality ▪ Maximize the ability to protect and enhance water quality in the future, including support and participation in watershed-protection and pollution prevention based approaches ▪ Maximize the ability to deal with aesthetic factors such as taste, color, hardness, and odor	▪ Board assumes that all source options will be treated to meet or exceed federal and state standards; this assumption precludes the need to develop a ranking for water quality ▪ Board changes the use of the term “highest” to “high” raw water quality, which in turn does not preclude any source from being considered or evaluated. ▪ Water quality rating will rely on the 1996 ratings for previous sources, with some additional ratings for other sources not considered in the 1996 RWSP.

Table 4(1)-3
Application of Policy Objectives
Regional Water Providers Consortium

Policy Objective	Application of Policy Objective for the Update
Impacts of Catastrophic Events	
▪ Minimize the magnitude, frequency, and duration of water service interruptions due to natural or human-caused events, such as earthquakes, landslides, volcanic eruptions, floods, spills, fires, sabotage, etc.	▪ Rating for impacts of catastrophic events will rely on the 1996 ratings for previous sources, with some additional ratings for other sources not considered in the 1996 RWSP. ▪ Acts of terrorism is added to this objective; sources ranked in the 1996 RWSP will be adjusted as necessary to account for vulnerability to terrorism ▪ *Confluence* modeling can be used in the future to assess the impacts of events by removing critical sources and evaluating the effects
Economic Cost and Cost Equity	
▪ Minimize the economic impact of capital and operating costs of new water resources on customers ▪ Ensure the ability to allocate capital and operating costs, e.g., rate impacts for new water supply, related infrastructure, and conservation water savings, among existing customers, future customers, and other customer groups, proportional to benefits derived by the respective customer group(s) ▪ Maximize cooperative partnerships to co-sponsor projects and programs that provide multiple benefits	▪ Present value of utility revenue requirements (for capital and operating costs) updated for each source option evaluated in the *Confluence* model ▪ *Confluence* model would generate total cost including transmission and conservation costs
Environmental Stewardship	
▪ Minimize (i.e., avoid, reduce, and/or mitigate) the impact of water resource development on the natural and human environments ▪ Foster protection of environmental values through water source protection and enhancement efforts and conservation	▪ Rating for environmental stewardship will rely on the 1996 ratings for previous sources, with some additional ratings for other sources not considered in the 1996 RWSP; an aggregate rating is used. ▪ Sources rated in the 1996 RWSP will be adjusted as necessary to account for new information regarding presence of ESA species and other new information
Growth and Land-Use Planning	
▪ Be consistent with Metro's regional growth strategy and local land-use plans ▪ Facilitate and promote effective Regional Water Supply Plan implementation through local and regional land-use planning and growth management programs	▪ This policy objective is not directly evaluated under the source option review ▪ A discussion of this issue will be included in the Update by considering how the source option strategies meet demand growth using the *Confluence* model.
Flexibility to Deal with Future Uncertainty	
▪ Maximize the ability to anticipate and respond to unforeseen future events or changes in forecasted trends	▪ This policy objective is not directly evaluated under the source option review. ▪ Board decided not to include this as a policy objective since it is essentially covered under the other objectives on water availability, catastrophic events, and flexibility.

Table 4(1)-3
Application of Policy Objectives
Regional Water Providers Consortium

Policy Objective	Application of Policy Objective for the Update
Ease of Implementation	
▪ Maximize the ability to address existing and future local, state, and federal legislative and regulatory requirements in a timely manner.	▪ Rating for ease of implementation will rely on the 1996 ratings for previous sources, with some additional ratings for other sources not considered in the 1996 RWSP; an aggregate rating is used. ▪ Ease of implementation ratings have not been created for the RWSP Update because actual ease of implementation will depend on individual circumstances at the local level. ▪ Ease of implementation will consider "public acceptance" at the local decision-making level since this factor will vary by source and by community.
Operational Flexibility	
▪ Maximize operational flexibility to best meet needs of region, including the ability to move water around the region and to rely on backup sources as necessary ▪ Ensure that the plan includes flexible strategies for meeting both subregional and regional water demands in the year 2000 and beyond	▪ This policy objective is not directly evaluated under the source option review ▪ A discussion of this issue will be included in the Update by considering how the source option strategies meet demands in different areas of the region using the *Confluence* model.

Table 4(1)-4 Source-Option Issues Regional Water Providers Consortium	
Source-Option Issue	**Description**
Water Availability	Consideration of hydrology, water rights, and storage operation; water availability described in terms of monthly yield exceedance probabilities
Environmental Impacts	Includes impacts to natural and human environments, extensive planning-level subjective analysis of ten environmental factors; an aggregated score was given to each source option; ▪ Natural environment includes: fish, geotechnical and natural hazards, threatened and endangered species, wetlands, wildlife and habitat ▪ Human environment includes: cultural resources, hazardous materials, land use, recreational resources, scenic resources
Raw Water Quality	Physical, inorganic, organic, and microbiological constituents, DO, and nutrients were reviewed; aesthetic aspects considered; assessment of ability to protect watershed and resulting vulnerability of raw water quality
Vulnerability to Catastrophic Events	Vulnerability to volcanic, fire, slide and spill events
Ease of Implementation	Ease of implementation with respect to legal or permitting requirements; subjective assessment
Treatment Requirements	Treatment regime was developed based on raw water quality, used multiple barrier approach to exceed drinking water standards; all of the surface sources can readily be treated to meet or surpass safe drinking water standards
Capital and Operating Costs	Costs included intakes, raw water pipelines, treatment plants, pumping stations, finished water pipelines, and terminal reservoirs

Major Issues Affecting the Source Options

Several major developments have occurred since publication of the 1996 RWSP that affect both the actual sources to be considered and, potentially, the evaluation of source-option issues. In particular, regulatory enhancements involving drinking water treatment requirements and issues associated with the management of threatened and endangered species under the Endangered Species Act (ESA) top the list of recent changes. These changes have direct implications with regard to the evaluation of potential source options against such issues as environmental impacts, ease of implementation and treatment requirements. In addition, the State has adopted new rules for water-right permit extensions for municipalities that require preparation of water management and conservation plans. The products of that work will likely lead to changes that make it more advantageous for cities and special districts to certify all or a portion of their water rights as soon as possible. A ruling of this kind may impact the net available water to both cities and special districts in the region. This issue is potentially complicated by recent research findings from the University of Washington that suggest that global climate change may lead to reduced stream flows in late spring and summer, along with increased summertime demand over the time period considered in the original RWSP. A more detailed evaluation of the major issues affecting source options for the region is discussed in the following subsections.

Regulatory Issues Impacting Sources

There are several major regulatory changes that have occurred since 1996 that may directly affect the viability of a given source, most notably recent changes in the federal Safe Drinking Water Act (SDWA) and the Endangered Species Act. On the drinking water side, promulgation by the U.S. Environmental Protection Agency (USEPA) of the Long-Term Stage 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and Stage 2 Disinfectants and Disinfection By-Products (D/DBP) may result in additional regulation regarding filtration and disinfection.

The LT2ESWTR is targeted at reducing the human health risk associated with *Cryptosporidium* – a protozoan parasite that is relatively resistant to disinfectants like chlorine and has been associated with acute gastrointestinal illness. Under LT2ESWTR, surface water sources are expected to conduct monitoring for *Cryptosporidium*, subject to risk classification based on those results. Filtered systems noted as having higher risk levels will likely be required to provide 3 to 4.5-log reduction in *Cryptosporidium* levels, while unfiltered systems will likely be required to provide at least 2 or 3-log inactivation of *Cryptosporidium,* depending on their monitoring results. The LT2ESWTR is also expected to call for additional requirements concerning disinfection profiling, forcing systems to assess the level of disinfection they provide and determine the impacts associated with a change in those practices on disinfection levels within their systems.

As supplement to these rules changes, the USEPA is also expected to bring forth new guidance regarding disinfectants and disinfection by-products. The new Stage 2 D/DBP rule is targeted at reducing the presence of the potentially carcinogenic compounds often found in systems using chlorine as a disinfectant. The DBPs are formed when chlorine combines with various organic

and inorganic materials in the water, giving rise to such compounds as trihalomethanes (THMs) and haloacectic acids (HAAs). Under the new rules, systems will likely be required to conduct an evaluation to determine the locations with high DBP concentrations and monitor those points for compliance under a locational running annual average. The fall out from this new rule is an anticipated future reduction in DBPs compliance levels, with present proposals targeting a 50 percent reduction in THMs and HAAs over their current standards.

The other major regulatory element of interest is that associated with the federal Endangered Species Act. The ESA is intended to protect *threatened* ("likely to become endangered within the foreseeable future throughout all or a significant portion of its range") or *endangered* ("in danger of extinction throughout all or a significant portion of its range") plant and wildlife species. ESA offers potentially broad protection under its so-called *take* provisions, defined as any action that would "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct," as it relates to protected species. Moreover, it is also illegal under ESA Section 9 to possess, sell, deliver, carry, transport or ship any species that has been lost due to a *take*.

It is important to note that the ESA does not prohibit all take but allows for the permitting of acceptable levels, including a certain amount of take that is "incidental" to otherwise lawful activities. For threatened species, the 4(d) rule allows for potential *take* under an approved permitted process; whereas, for endangered species, governance is covered under ESA Section 10, which prohibits any take with the exception of an approved habitat conservation plan.

Triggering of the ESA at the local level comes under the Act's Section 7 provisions, governing consultation between federal agencies. Section 7 requires that each federal agency consult with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and/or U.S. Fish and Wildlife Service (USFWS) to ensure that any federal action authorized, funded or carried out by a federal agency is not likely to jeopardize the continued existence of any threatened or endangered salmon species or would result in the destruction or adverse modification of critical habitat designated for the species. Section 7 generally applies to such actions (or funded activities) as U.S. Army Corps of Engineers Section 404 permits, Environmental Protection Agency approval of state water quality standards, mortgage and facility development assistance from federal agencies, and licensing and regulation of hydroelectric facilities by the Federal Energy Regulatory Commission. Section 7 also applies to both newly proposed activities and existing actions where the federal agency retains some discretionary control.

In terms of jurisdiction, NOAA Fisheries is charged with protection of federally designated endangered, threatened, proposed for listing and candidate anadromous fish species and marine mammals, while USFWS oversees protection of federally designated endangered, threatened, proposed for listing, and candidate wildlife, plant and resident fish species (including coastal cutthroat trout). Both agencies' involvement is dependent on whether proposed, threatened or endangered species and/or designated critical habitats have been identified within the project vicinity and whether the species or their habitat will be impacted by proposed project activities.

Fundamentally, any government body authorizing an activity that specifically causes *take* may be found to be in violation of the Section 9 take prohibitions. For example, the withdrawal of water from a stream in a manner or time that has the effect of preventing migration or spawning of protected fisheries may constitute a *take*. As a practical matter, the more direct the impact an action has with regard to potential injury to the species, the more likely that action could be held responsible for *take*. In the end, every action conducted by a utility must at some level be examined for its potential regarding *take* under the ESA, especially those that may impact the habitat of or actual species for which a threatened or endangered designation has been assigned. Enforcement is conducted through either direct intervention by one of the consultation agencies, such as NOAA Fisheries or U.S. Fish and Wildlife, or through third-party lawsuit.

Water-Rights Review Summary

As part of the source-options review, a detailed water-rights review was conducted for those water rights that could affect use of the source options. In order to assess the true availability of water for a given source, a comprehensive water balance should be conducted that accounts for natural flow, existing water rights and actual use or demand. Due to scope and resource limitations, such a study was simply not possible. The work completed under the source options review, however, includes a compilation of municipal water rights held by Consortium members, with comparisons being made to existing instream water rights with respect to diversion rate and priority date. In all cases, there are various limitations with these findings that should be kept in mind:

1. Non-members (of the Consortium) with more senior municipal water rights can affect the availability of water for a particular source option. For the most part, this limitation is minor since all of the major water users in the region are part of the Consortium.

2. Water rights for other beneficial uses (e.g., irrigation) can impact the availability of water depending on their priority date relative to the municipal use water rights. This limitation concerns the fact that other beneficial uses may "cut off" a municipal use water right under low flow conditions if the non-municipal right has a more senior water right. This limitation is potentially more of a concern for those sources where irrigation, agricultural and industrial uses are prominent. A review of overall water rights by use indicates that the Tualatin River and Willamette River have significant non-municipal water rights that can impact municipal use availability.

3. Actual present withdrawal or use rate was not determined as part of this task. This limitation, actual water use, is related to determining the true availability of water beyond what is documented on paper.

Notwithstanding, the results of this work indicate that there have not been major changes in the water rights situation for the source options being evaluated as part of this update. No new instream water rights have been adopted by the Oregon Water Resources Department (OWRD) since the 1996 RWSP. Moreover, some of the issues faced by the source options under the 1996 RWSP still remain. Most notably, within the past few years there has been increasing emphasis

on protecting both flow and habitat for fish. Any new or pending water-rights applications will have to undergo greater scrutiny regarding this issue. This not only affects surface water diversions, but also storage applications such as those being proposed for the Trask/Tualatin system (Scoggins Reservoir raise), Bull Run (Dam 3) and Clackamas River basin (Timothy Lake).

Table 4(1)-5 summarizes the available water in terms of water rights for each of the source options evaluated in the 1996 RWSP and the current update. The available water rights include only permitted or certificated rights. In addition, the available water rights that are senior or junior to any instream water rights were not differentiated. The available water for some of the source options is listed in terms of flow rate and/or volume depending on the type of source.

The major recurring water-rights issues are discussed below and summarized for each source in Table 4(1)-6.

1. *Limited new water rights available for use.* Having existing water rights allow providers the flexibility of developing these sources when needed without having to go through the often extended application review process and the uncertainty of whether the application will be permitted. Each of the source options currently have varying quantities of water rights that have yet to be put to beneficial use. In general each of the major source options have significant quantities of water rights available for development. Local sources are also generally limited in the available water rights for future development. The Bull Run option essentially has, in practice, very broad rights to exclusive use of the Bull Run and Little Sandy rivers. Limited new water rights can be balanced by the ability to conjunctively use existing water rights for live stream flows, groundwater, and stored water to minimize environmental impacts on ESA listed or instream water rights. Oregon State water rights law is fairly broad in defining service areas for municipal water rights.

2. *Significant permitted water rights yet to be perfected.* Having existing water rights that have not been utilized can pose potential problems as well. There are certain complex and contentious legal issues regarding permitted but unperfected water rights that are beyond the scope of this RWSP. As water demands increase, there will be increasing pressure for OWRD to seek options to reduce or cancel unused or unperfected portions of existing water rights to meet these demands, as described in the permit extensions discussion in Section 2.0. Most of the major water providers have some plans to increase the capacity of their intakes or water treatment plants to maximize use of their water rights. Although all of the source options have unused water rights, the providers with water rights on the Willamette River have the most significant quantity of unused water rights. The situation with the Bull Run supply is unique in that the entire watershed is dedicated through Oregon statute as water supply for the City of Portland, and therefore is less of an issue from a water rights perspective.

3. *Significant quantity of water rights junior to existing instream rights*. Based on the priority dates, municipal water diversions can be "cut off" during low-flow periods if the dates for their water rights are junior to existing instream rights. The two source options with this

issue include the Clackamas River and Trask/Tualatin system. The Clackamas River providers have yet to be cut off, but the potential is there as demands increase. The Trask/Tualatin system providers are regularly cut off from diverting natural flows during the summer and rely on storage rights. The other sources generally have adequate flows to meet instream needs or do not have actual instream rights that may limit diversions. However, all of the source options have the potential for being impacted by Section 4 rules in place for steelhead and chinook that prohibit the take of these species (see issue No. 7 below).

4. *Significant quantity of unadjudicated claims.* Unadjudicated claims result in uncertainty in the availability of existing water rights owned by water providers. If the pre-1909 claims are granted, they will generally be senior to the existing water rights and could effectively limit available water during low flow conditions. The most significant claims are related to hydropower and other industrial uses on the Clackamas River and Willamette River. However, the hydropower claims on the Clackamas are located upstream of most of the municipal water diversions and will not likely be impacted by downstream diversions.

5. *Significant quantity of non-municipal use water rights.* Although not explicitly quantified in this review, all of the source options have non-municipal uses that affect the availability of water in cases where they are senior to the municipal use water rights. The only exception to this is the Bull Run. This issue is most prominent in the Trask/Tualatin and Willamette River systems where a large fraction of the total water rights is associated with irrigation or agricultural use. The Columbia River, although having a large quantity of flow, has a large fraction of rights associated with industrial use. In these cases, the availability of water is only affected if the non-municipal water rights are senior.

6. *Additional water rights contingent on access to storage options.* Additional water is potentially available to purveyors on the Clackamas River, Willamette River and Trask/Tualatin system pending the outcome of use of water from storage facilities. On the Clackamas River, there is potential to use releases of water from hydroelectric storage at Timothy Lake for municipal and industrial (M&I) use. There are also discussions that have taken place for developing additional storage in Timothy Lake for M&I use. On the Trask/Tualatin system, additional storage is being studied for Scoggins Reservoir/Hagg Lake. There is also a potential to purchase water rights at the Army Corps of Engineers reservoirs on the Willamette River tributaries.

Table 4(1)-5 Summary of Water-Rights Availability Regional Water Providers Consortium					
Source Option	**Water Availability 1996 RWSP**		**Water Availability Current Update**		**Comments**
	Flow (mgd)	**Volume (ac-ft)**	**Flow (mgd)**	**Volume (ac-ft)**	
Bull Run	Full flow of Bull Run and Little Sandy	N/A	Full flow of Bull Run and Little Sandy	N/A	▪ Scope of this right has not been adjudicated ▪ Maintenance of stream flow may be required by ESA
Clackamas River	105	N/A	100	N/A	▪ Based on total water rights of 176 mgd ▪ Change is a result of new installed capacity ▪ Available Timothy Lake storage volume is 11,300 ac-ft based on PGE agreement
Columbia River	None	N/A	50	N/A	▪ Based on total water rights of 50 mgd ▪ Change is a result of Rockwood PUD water right being permitted
Trask/Tualatin	N/A	14,000	N/A	35,600	▪ Estimated available storage volume at Scoggins Reservoir (total project 50,600 ac-ft)
Willamette	168	N/A	153	N/A	▪ Based on total water rights of 168 mgd ▪ Change is a result of Willamette River WTP (operated by Wilsonville)
ASR	40 (projected)	N/A	37.5 (goal)	N/A	▪ No ASR projects were implemented in 1996 ▪ Current value includes estimate of total flow from projects at pilot stage
CSSWF	261	N/A	238	N/A	▪ Based on total water rights of 333 mgd ▪ Assumes CSSWF expansion to 95 mgd long-term capacity
Local Sources	*59.3*	N/A	*47.2*	N/A	▪ *Values shown are current capacity (not water rights)* ▪ Some providers from 1996 are no longer members and are not included in the current total

Note: The values shown (except for local sources) are the available water rights for expansion, i.e., not currently put to beneficial use, but which have been permitted. The values shown for local source are the actual amount being utilized.

Table 4(1)-6 Summary of Water-Rights Issues of Source Options Regional Water Providers Consortium								
Water Rights Issue	**Bull Run**	**Clackamas River**	**Columbia River**	**Trask/ Tualatin**	**Willamette River**	**ASR**	**CSSWF**	**Local Sources**
1. Limited new water rights available for use			●	●				●
2. Significant permitted water rights yet to be perfected		●	●	●	●		●	
3. Significant water rights "junior" to existing instream rights		●		●				
4. Significant quantity of unadjudicated claims		●			●			
5. Significant quantity of non-municipal use water rights			●	●	●			
6. Additional water rights contingent on storage options[1]		●		●	●			
7. Potential ESA restrictions (may include source waters for ASR)	●	●	●	●	●	●		●
8. Non-municipal water rights potentially available for municipal use				●				
9. Only limited license currently being used[2]						●		

[1] *Agreement has been made between Clackamas River Water and PGE for use of late season storage in Timothy Lake for M&I use.*
[2] *Can be made more permanent with availability subject to right of source recharge water*

7. *Additional water rights contingent on access to storage options.* Additional water is potentially available to purveyors on the Clackamas River, Willamette River and Trask/Tualatin system pending the outcome of use of water from storage facilities. On the Clackamas River, there is potential to use releases of water from hydroelectric storage at Timothy Lake for municipal and industrial (M&I) use. There are also discussions that have taken place for developing additional storage in Timothy Lake for M&I use. On the Trask/Tualatin system, additional storage is being studied for Scoggins Reservoir/Hagg Lake. There is also a potential to purchase water rights at the Army Corps of Engineers reservoirs on the Willamette River tributaries.

8. *Potential ESA restrictions.* This issue may have the most impact on the ultimate availability of water from the source options. All of the surface water source options face the potential of having restrictions placed on water rights from ESA enforcement requirements. The potential for enforcement actions may be initiated by the federal government, as well as ESA-related third-party lawsuits. Section 4 rules are now in place for steelhead and chinook, and take prohibition is enforceable. However, enforcement can also come in the form of conditions on an "incidental take permit" issued to individual providers or facilities. Whether or not these rules would be applied "retroactively" to existing rights is also uncertain. In addition, ESA could potentially affect water rights approvals for ASR projects, since winter flows can be important to maintaining suitable habitat. It is apparent that ESA will in some way affect existing rights. The uncertainty is in the magnitude of the effect. The effects can be on pattern of use or actual quantities.

9. *Non-municipal water rights potentially available for municipal use.* There are non-municipal rights that have not been put to beneficial use that may be available for municipal use. This is the case in the Trask/Tualatin system where irrigation rights are not being used and may be available for conversion to municipal use. A transfer application with OWRD is necessary to convert any irrigation rights to municipal use.

10. *Only limited license currently being used.* This issue specifically relates to the ASR option. Those providers considering ASR have been issued limited licenses to conduct pilot studies for ASR. A permanent license must still be obtained if the option is demonstrated to be feasible.

It should be clarified that source options with more issues identified as shown in Table 4(1)-2, does not necessarily imply that it is less attractive as a source option for development. Table 4(1)-2 summarizes the applicable issues, but does not attempt to rate the issues or rank the source options with respect to water-rights issues. The following sections include a discussion of the water-rights issues for each source option in further detail.

Water Availability and Water Management

The regional demand for water continues to increase, not only with respect to consumptive demand but also for expanded protection of the environment and instream needs. Preservation of the resource must address a "balance" between the need for water and the amount actually available. For surface waters, availability can be defined in turn by either "physical" or "legal" quantities. In this case, physical quantities refer to the amount of flow

naturally available in the stream at any given time (absent withdrawals or diversions). By contrast, the term legal availability refers to the accessibility of water under existing water law, as prescribed by various permits, certificates and transfers. Accessibility for the latter is established by "seniority" for a given right based on the date of issuance (or so-called priority date). It is important to note that there is no direct connection between physical and legal quantities other than a finite amount of water that can be withdrawn from a stream at any given time.

The more interesting element lies in the administration of the rights and the complexity of demand for both instream and out-of-stream uses. In order to determine the future availability of water from a given source, a comprehensive review should be conducted that examines both the physical and legal availability of water as they relate to need. In particular, the following questions would be used to determine whether existing water rights for a given source option are adequate:

1. What is the natural flow in the stream or source?
2. How much water has been appropriated for the stream or source?
3. How much of the water rights have been put to beneficial use?
4. What are the actual demands on the source (for all uses)?

Ideally, the amount of water rights appropriated, amount of water put to beneficial use, and the actual (or projected) demands for all uses can be compared against the hydrologically available natural flow to determine whether the water source has any additional water available for future appropriation. However, the ability to provide answers to these four questions requires quantitative definition for each element. Providing answers to the first two questions is relatively straightforward. The first question involves a review of available hydrologic record for the stream or source (e.g., storage) to determine the expected yield. A statistical analysis could also be conducted to determine monthly exceedance flows or annual probability of reservoir fill. The second question involves reviewing the existing water rights associated with the given source, including determination of the points of diversion, rates and priority dates for all uses on the stream (or source). These numbers are generally readily available from the Oregon Water Resources Department (OWRD). The third question is more complicated because many water rights have not been certificated (or fully perfected) and the amount of water rights actually put to beneficial use is generally unknown without conducting an intensive survey of all water users. The fourth question is very difficult to answer because future conditions in most cases must be considered in terms of projected demands and pending regulatory requirements, some of which have yet to fully unveil themselves with regard to impact on demands such as the federal Endangered Species Act and Clean Water Act. It is these unknown legal and political requirements that lead to the uncertainty in determining the actual water availability for a given source.

The implications are far-reaching and certainly the demands for water will continue to grow, especially with respect to instream needs. As an example, the integrity of unperfected water rights (such as reserved waters for municipal use) is being questioned because of the potential impacts of ESA and other instream requirements that may have to be met in the future. Under current attitudes regarding management of water rights, water providers must be conscious of challenges stemming from regulatory requirements associated with improving water quality and protecting listed species. The result will be a much more

critical review toward: (1) extension of unutilized rights and (2) issuance of new water-rights permits to correspond more closely with demands demonstrated by the user.

In recognition of these and other facts, OWRD recently adopted new rules concerning permit extensions and water management and conservation planning for municipal quasi-municipal purveyors. The rules governing permit extensions, as prescribed under Oregon Administrative Rule (OAR) 690-315, now calls for applicants to submit documentation as to the actions taken since the last extension to develop the right, an estimate of future demand projection showing need for the right, and a schedule for construction completion and/or perfection of the right. Any request for an extension greater than 50 years must include documentation that the demand projection is consistent with the inventory and type of lands and uses proposed to be served by that right. Moreover, the approval of such applications is to be conditioned on the submittal of an approved water management and conservation plan, as prescribed under OAR 690-086, with exceptions for permit holders serving fewer than 1,000 persons (or as required by OWRD) or for those permit holders that can reasonably demonstrate construction and beneficial use (i.e., perfection) within a five-year period. Although the law for permit extensions under the new rules anticipates permit holders will make a single extension request as part of a plan for certification, it does not preclude the permit holder from making multiple applications for extension into the future.

In turn, the preparation and approval of a water management and conservation plan (WMCP) essentially serves as a contract between the state and an individual water-right holder for future use of water under that permit. Once a voluntary action, the preparation of a WMCP has become required in association with formal permit extensions. The process is such that at the time of the permit extension the use of water under a permit subject to extension is frozen to an amount not to exceed the maximum withdrawn (or pumped) during the prior permit period, until such time as an approved WMCP had been granted. In preparing the WMCP, the permit holder has the responsibility of developing a plan that demonstrates the need for water under that permit in excess of the maximum rate used during the prior permit period. The permit holder must take into account all available sources of water in demonstrating the requested future need. Approval of the WMCP provides authority to use the increased quantity of water, also known as “green light” water, for a period of up to 20 years – at which time a new WMCP must be submitted to request continued or additional withdrawals for the extended permit(s). The renewal process includes periodic progress reporting every five years and a formal update of the WMCP after 10 years.

The contents of a WMCP include four major elements: a water supplier description, conservation program, curtailment plan and water supply plan. The key elements of the WMCP are those of the conservation and water supply plans. Water conservation is now viewed as a critical supply strategy in the State’s water supply inventory, including full metering of systems, annual water auditing, rate structures based on quantities metered, meter testing and maintenance and public education. For utilities larger than 7,500 customers, additional measures of consideration include leak detection and repair, retrofit and replacement of inefficient fixtures, reuse, recycling, non-potable use opportunities, and other measures as deemed cost-effective. The WMCP also requires the development of a long-range water supply plan. This plan focuses on the preparation of a forecast that outlines a 10- and 20-year need for water, followed by an analysis of available sources to meet that need. In addition, this plan requires the creation of a schedule for perfecting (in part or full)

any extended permits included as part of the water supply framework. Under the new rules, preparation of WMCPs will require purveyors to more carefully examine their operations with regard to water-use efficiencies and identify potential options for making effective use of available resources.

Climate Change

The final major issue that may affect source selection is that associated with climate change. In a study commissioned by the City of Portland Water Bureau (PWB) and published in January 2002, researchers from the University of Washington developed historical data and models to predict future changes in regional meteorological patterns and behavior. In particular, the study uses a series of linked models to predict future changes in the region's climate and the impacts of those changes on the hydrologic cycle and demand for water.

The study found average temperatures will increase 1.5 °C by year 2020 and 2 °C by year 2040. Average monthly temperatures were predicted to be warmer every month; however, July and August showed the greatest increases in temperature. Similarly, precipitation also was predicted to be affected, with increases in overall wintertime precipitation and lower summertime rainfall. And although wintertime precipitation is expected to increase, it will come in the form of less snow and more rain.

The noted changes in climate described above were found to have significant impact on the region's hydrology. The higher temperatures in the winter months translated into less snow (i.e., less snowpack) and more rain. Therefore, winter stream flows were predicted to increase approximately 15 percent by the year 2040. Similarly, over that same period, late spring flows – typical snowmelt season – decreased by 30 percent. Furthermore, a temporal shift was predicted for snowmelt to earlier in the spring due to increased temperatures, resulting in increased peak flows, especially under conditions of increased warm rain on snow. The increased runoff might also reduce recharge to upland aquifers, thereby reducing base flows to area streams during late spring and summer.

In addition, the reduction in summertime precipitation would tend to directly reduce local stream flow during that same period. So, although the overall amount of precipitation is largely unaffected, its change in timing would tend to increase wintertime flows and the potential for flooding, while reducing summertime flows and the availability of water during the warmest periods of the year.

The impact on demands, however, tends to be less sensitive to climate change than those on hydrology. However, increases in precipitation during the winter and decreases in the summer, coupled with higher overall temperatures, particularly in July and August, were found to impact demand. Peak-season demand was estimated to increase over the next 40 years by 8 percent, while annual average demand was predicted to increase by 4 percent. This increase is largely due to warmer summers, lowering of late spring and summer flows, and the lengthening of the annual period of summer-like conditions.

The most noticeable impact is that related to potential increases in the need for raw water storage, especially for those who now rely on such storage or have relatively junior water rights. In particular, the anticipated period for "drawdown demand" is expected to increase

by as much as 60 days. This stems largely from an expected increase in the number of days without rain during the summer months and reduced stream flows during that same period. Those reliant on surface water storage should anticipate substantial increases in the required volumes of storage to meet consumer demand. In general, municipal water resource planners in the region have predominantly planned storage volumes around a 120-day summertime period – typically running from about mid-May to mid-September. This is a period when many water suppliers, especially those with junior rights, anticipate being shut off from stream flow and turn to surface water storage for their supplies. The impacts of climate change suggest that this period may be extended by as much as 60 days – that translates to a 40 percent to 50 percent increase in raw water storage needs. For many, this is a substantial impact to maintaining adequate future supplies.

The results of the PWB study may have several important implications on the future of the region's water supply. Most notably is the likelihood that summertime flows in the region will be diminished. There will in general be less surface water available to users in the summertime throughout the region. The University of Washington completed a similar climate change study for the Hagg Lake/Barney Reservoir area showing that these reservoirs may be affected by: (a) the change in seasonal precipitation and the timing of runoff in winter and late spring with regard to the filling of the reservoir, and (b) the possible need to increase releases during the summertime to augment lowered stream flows. In particular, the timing of runoff will affect the scheduling and potential for filling the reservoirs and operations at the dams will have to be altered in order to maximize probability of fill while minimizing flood risks. Additionally, the amount of water available for release to preserve instream objectives may be insufficient as the period of lower flows during summer is extended.

With regard to demand, the region should potentially anticipate an increase in summertime (peak) period use of about 8 percent. This is not to say that peak-day demand will increase by that amount, but rather water needs over the summer season may grow by an amount equivalent to that identified in the PWB study. The PWB study does not necessarily indicate that maximum annual temperatures will increase by any amount (i.e., an increase in peak-day demand), rather that the conditions of summer-like weather will be extended over significant portions of the year – resulting in higher demands over an extended summertime period. The Portland study also found that droughts would not be worse than recently experienced, but that we would be seeing them more often.

In terms of implementation, the issues here elicit a need to incorporate these factors into the long-range supply planning for the region. This supports the use of climate and hydrology years from the past record that exhibit similar increased use and lower summer flows for modeling purposes. Using these years allows accounting for reduced late spring and summertime flows in local surface water streams and expansion of demand over an extended summertime period.

Part 2. Water Supply Options

Source-Option Issues Evaluation Summary

Part 2 includes a description of each of the eight source options reviewed, along with a discussion of the new developments and changes that are specifically related to each source option. A discussion of the water rights status and updated costs are also provided for each source option. Appendices in the full EES RWSP Source-Options Update Final Report, August 2004, include the list of water rights associated with each source option, and includes a summary table of updated costs for each source option. Finally, a qualitative evaluation of each source option is conducted against the source-option issues listed.

Recall that some of the source options issues had numerical ratings developed for the source options reviewed in the 1996 RWSP. As discussed in Part 1 of this chapter ratings have been provided for the same issues in this update using the same general basis as used in the 1996 RWSP. Table 4(2)-1 summarizes those ratings. Further discussion is included for each source option in the following subsections.

As alluded to in Part 1 of this chapter, several major changes have occurred that affect the source options (e.g., ESA listing of species, new water-quality regulations, etc.). As a preface to the following discussions in the following subsections, the most significant issues and developments that have occurred since the 1996 RWSP are listed below:

- Listing of several species under ESA for the Lower Columbia and Upper Willamette rivers.
- Anticipated LT2ESWTR and Phase 2 D/DBP Rule.
- Study on climate change impacts on surface water supplies (run of river and reservoirs) in two parts of the region.
- Development of biological opinion for Columbia River by National Marine Fisheries Service.
- Completion of studies to raise Hagg Lake (Scoggins Reservoir) and use water from Timothy Lake to meet M&I needs.
- A number of ASR pilot projects are in progress throughout the region sponsored by various consortium purveyors. Implementation decisions and capacities will depend on site-specific findings from pilot studies.
- Completion of the Willamette River Water Treatment Plant (in Wilsonville) and NCCWC slow-sand filter plant on the Clackamas River.

These and other developments are discussed further for each source option in the following subsections.

Table 4(2)-1
Ratings of Source Options (modified from 1996 RWSP)
Regional Water Providers Consortium

Source Option	Environment		Raw Water Quality			Vulnerability to Catastrophic Events	Ease of Implementation [1]
	Natural Environment	Human Environment	Comparative Rating	Watershed Protection	Aesthetics		
Bull Run Dam 3	4.9	3.6	1.2	1.0	1.0	3.5	NR
Bull Run Dam 1 and 2 Raise	4.5	3.5	1.2	1.0	1.0	3.5	NR
Bull Run Groundwater	1.5	2.0	2.8	NR	3.0	NR	NR
Clackamas River WTPs	3.5	1.0	1.8	2.0	2.0	2.5	NR
Timothy Lake Dam Raise	4.5	3.5	1.8	2.5	NR	3.5	NR
Columbia	2.6	2.5	2.1	5.0	2.5	3.3	NR
Trask-Tualatin	4.5	3.2	2.0	2.5	2.0	3.5	NR
ASR	1.5	2.2	3.0	NR	3.0	NR	NR
CSSWF	1.5	2.0	2.8	NR	3.0	NR	NR
Willamette	1.0	2.5	2.0	4.0	2.0	2.5	NR

Note:
Ratings range from 1 to 5; lower scores are preferred
NR: not rated
[1] Ease of implementation ratings have not been created for the RWSP Update because actual ease of implementation will depend on individual circumstances at the local level

A. Bull Run Option

The 1996 RWSP focused its evaluation on constructing a third reservoir in the Bull Run Watershed. The project, known as Dam No. 3, was to be located just downstream of Log Creek and about one-half mile downstream of the confluence of Blazed Alder Creek and the Bull Run River. At that time the project was anticipated to provide an additional 67,250 acre-feet or about 20 billion gallons of storage. This equated to an increase in average daily peak-season availability of 134.8 mgd. Peak-day capacities from the Bull Run could increase based upon added transmission capacities represented by new conduits being constructed. Under preliminary review, the primary concerns with this option included potential impacts on threatened and endangered species, wildlife habitat and wetlands.

The 1996 RWSP concluded that the Bull Run source provides high raw water quality and the highest degree of source protection of any of the regional supply sources. However, significant costs and environmental impacts made this option difficult to develop. In addition, the evaluation indicated that this option was inflexible in that it was physically located farther away from where supply shortfalls would occur over the planning period, thus necessitating long transmission lines and added cost. Finally, relying on expansion of the Bull Run for future water supply would increase the region's vulnerability to catastrophic events because of the greater dependence on a single source.

The Bull Run source option for this current update is modified to include potential construction of a third reservoir (Dam 3) located upstream of existing Reservoir No. 1. Besides Dam 3, the Bull Run option includes raising Dams 1 and 2, as well as developing groundwater and/or ASR within the basin. Construction of a water filtration plant for the Bull Run water supply could increase the amount of usable storage in the existing Bull Run reservoirs. However, as of 2004, no commitment has been made by the City of Portland regarding changes to current water treatment of this source particularly since the new EPA rules are not final.

The Bull Run source option for this current update is modified to include potential construction of a third reservoir (Dam 3) located upstream of existing Reservoir No. 1. Besides Dam 3, the Bull Run option includes raising Dams 1 and 2, as well as developing groundwater and/or ASR within the basin.

A. 1. New Issues and Developments

Other Bull Run Supply Alternatives. A study conducted by the Portland Water Bureau in 2000 included the evaluation of several supply alternatives within the Bull Run option besides Dam 3. Table 4(2)-2 lists those alternatives, along with the additional storage/capacity and estimated capital costs. Although not all of these options are included in the RWSP Update, the list does point to some flexibility within this option in terms of economic cost, environmental impact and ease of implementation. However, as noted in the 2000 study, none of the alternatives provide significant additional amounts of new water with the exception of construction of a third dam.

Table 4(2)-2 Summary of Bull Run Supply Alternatives Developed by Portland Water Bureau Regional Water Providers Consortium		
Alternative	**Additional Storage/Capacity**	**Capital Cost[2]**
Bull Run Dam 2 Raise	2.2 BG / 20 mgd	$10 M
Bull Run Dam 3 Full Raise	19 BG / 172 mgd	$185 M
Bull Run WTP (more existing storage made available for use)	2.7 BG / 24.5 mgd	$125 M
Additional Storage at Bull Run Lake	2.0 BG / 18 mgd	$5 M
Dam 1 Gate Replacement	0.2 BG / 1.8 mgd	$1.5 M
Off-site Storage at Lusted Hill	2.0 BG / 18 mgd	$129 M - $152 M (with WTP)
Bull Run Dam 3 Low Dam	9.5 BG / 86.4 mgd	$120 M
Bull Run Groundwater[1]	1.2 BG/ 10 mgd	$$5.8M
Bull Run ASR[1]	unknown	

Note 1 – for further discussion of Bull Run Groundwater and ASR , see below.
Note 2 – capital costs based on 1999 dollars; the costs listed in this table are indexed to 2003 dollars for inclusion in the modeling effort as described in Section 2.4.
Information taken from "Supply, Transmission, and Storage Analysis" CH2MHill and MW (July 2000)
Note 3 - for the purposes of evaluating the source options under this regional plan, only construction of Dam No. 3, Dam Nos. 1 and 2 raises, and the Bull Run ground water and ASR development are considered.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and Stage 2 D/DBP Rule. The 1986 and 1996 amendments to the Safe Drinking Water Act (SDWA) have influenced the operation of the Bull Run supply and will continue to do so in the next decade. The U.S. EPA continues to enforce existing rules and create new rules that will help utilities meet the requirements of the SDWA. As described earlier in this chapter, the latest proposed rule(s) if adopted, that may have an impact on the Bull Run Supply is the Long Term 2 Enhanced Surface Water Treatment Rule/Stage 2 Disinfectants and Disinfection Byproducts Rule. This proposed rule establishes guidance for utilizing multiple barriers in the treatment of drinking water to protect finished water supplies from bacteria and viruses while minimizing the creation of disinfection by-products. The proposed rule would have impacts on two separate parts of Portland's water system. First, the rule would require the City to provide additional treatment to its supply to either remove or inactivate *Cryptosporidium*. The treatment options anticipated to be available to the City for this include filtration (either traditional or newer micro-membrane technology to remove the parasites), ozonation (the introduction of ozone to water to destroy the *Cryptosporidium oocysts*) and ultraviolet radiation (ultraviolet lights irradiate the *Cryptosporidium oocysts* to prevent them from reproducing). The City has not selected a preferred treatment approach.

In November 2003, the City submitted comment to the EPA rule-making process, requesting that a waiver provision for the *Cryptosporidium* treatment requirement be included in the forthcoming LT2ESWTR. Such a provision would allow those with protected, low-risk drinking water sources, such as the Bull Run, to avoid substantial expenditures.

A potential benefit of selecting filtration as the treatment method is the secondary benefits of allowing dam operation to access deeper layers of water often too turbid to introduce into the system during drawdown. This could substantially increase storage capacity and available water in the summertime. In addition, the reliability would increase because the watershed would more likely remain online during periods of high turbidity (i.e., when high stream flows are high and bank wash occurs). In addition filtration would facilitate the ability to construct new or expanded storage facilities in the Bull Run watershed for drinking water and fish enhancements.

Study on Climate Change Impacts on Portland's Bull Run Supply. The PWB contracted with the University of Washington to study the effects of climate change on Portland's Bull Run water supply. The focus of this work was to examine: (1) changes in water availability, (2) changes in water demand created by climate change, and (3) changes in water demand created by anticipated regional growth. Results of the study indicated that climate change would alter the basic hydrology of the Bull Run River, ultimately leading to a decrease in the system's peak-season yield assuming there were no changes in the volume of impounded water. The associated modeling indicates that future (2040) average stream flows will increase in the wintertime by approximately 40 percent, while late spring and summer flows will decrease by 30 percent. This result is due to an increase in precipitation in the form of rain rather than snow in the winter months causing a decrease in snowpack and a shift in the period of snowpack melt. The result is less late spring and summer flows.

The study makes it clear that climate change should be a consideration, not only for the Bull Run option, but other options as well, since precipitation and natural flows in the other rivers may also be impacted.

Listed Species Under the Endangered Species Act. Since 1996, newly listed salmon and steelhead species have been identified under the Endangered Species Act (ESA). Although the 1996 RWSP considered this issue under the environmental impacts criteria, several species were only considered as candidates for listing at that time. Since then, the following species have been listed for the Lower Columbia River (which includes the Bull Run watershed tributaries): chinook salmon, chum salmon and steelhead. ESA Section 4 rules have been put in place, which prohibit the take of steelhead trout and chinook. However, project-specific requirements are subject to site-specific analysis and negotiation, which may include the need for enhanced stream flows. As such, this need may impact source availability as part of any future options for regional water supply.

The U.S. Fish and Wildlife Service withdrew the proposed rule to list the southwestern Washington/Columbia River Distinct Population Segment (DPS) of coastal cutthroat trout as a threatened species as stated in the Federal Register, July 5, 2002. If only the anadromous form is listed, then the requirements could be similar to those for steelhead trout. If resident trout are also included, then habitat above the dams and reservoir operations could be significantly affected.

In the Steelhead Supplement to the Oregon Plan, the City of Portland made an interim commitment to keep flows in the lower Bull Run River at 100 cfs prior to June 15 to benefit steelhead spawning. In recent years, Portland has released experimental flows into the lower river during the summer season (June - September). Since water temperature appears to be a

more significant limiting factor for the fish than is flow amount, the release amounts have been driven by temperature objectives. Flow amounts have varied from 10 cfs to 60 cfs. Further studies and negotiation are currently ongoing to determine the flow levels that may be required for long-term ESA and Clean Water Act compliance. For the purposes of the Portland Infrastructure Master Plan an instream amount of 30 cfs was used during the summer drawdown period to model the effect of instream releases. Further studies and negotiation are currently taking place to determine the actual flow levels that may be required in the future.

Plan for Bull Run Water Supply Authority. The City of Portland proposed forming a combined regional water authority to other regional cities and water providers to share resources in managing and operating the major supply sources. After some discussion and debate among the water providers and the public, the focus centered on having the water agency manage and operate the Bull Run/CSSWF supply only. Under "Phase 1" of the discussions, the participants decided that the proposed water agency should focus on developing source options and providing financial backing for the enhancement of the Bull Run supply. Proponents of the agency envisioned a more unified group among participants and individual agencies taking "ownership" of the main water supply as the central advantages. In "Phase 2" the group worked to define how the proposed agency would operate, how costs would be allocated among the participants, and how to deal with ownership issues. After "Phase 2" the proposal was dropped because mutually acceptable financial arrangements could not be agreed upon by all of the parties.

Bull Run Wells. This is a completely new source that was not considered in the 1996 plan. Since 1998, PWB has been investigating the feasibility of this new source involving extensive well drilling, testing modeling, and analysis of long-term yield potentials. The investigation has included seven exploratory wells in the Bull Run watershed near Dam 2, and a full-size pilot production well with a nominal capacity of 2 mgd. Both silica and fluoride were found in the groundwater, and the issues associated with these constituents will need to be resolved before the source is considered for further development. The investigation to date has confirmed that groundwater is a feasible future source for the Portland system in quantities of at least 10 mgd and possibly 20 mgd.

CSSWF and Bull Run ASR. The aquifer system in Bull Run occurs within the basalt rocks that have been developed elsewhere in Oregon for water supply and for ASR, for example Salem and Beaverton. The groundwater system at the site of the Bull Run wells is highly pressurized and these pressures make the feasibility of a gravity-fed ASR recharge system questionable. Since long-term extraction of groundwater from basalt aquifers can result in significant groundwater level decline, ASR may be a long-term option for PWB to consider with a Bull Run well field. Costs and capacity at this time are unknown. ASR in the CSSWF is being piloted and this project does have some promise; however, this project does not appear to provide added quantities of water beyond those already included for the ambient groundwater unless continued development and pumping of the CSSWF deep aquifer (SGA) causes further water level decline.

A. 2. Existing Municipal Water Rights and Applications

The City of Portland has exclusive rights to the waters of the Bull Run watershed granted by State law in 1909 (ORS 538.420). The scope of this right has not been adjudicated. However, the City has generally taken broad interpretation of these rights to use the full flow of the Bull Run and Little Sandy rivers for municipal purposes with a priority date of February 25, 1909. The City also takes the position that no other person may after that date seek to appropriate any water from the Bull Run for any purpose. In addition to this, the City of Portland filed a surface water registration statement with the Oregon Water Resources Department (OWRD) on December 31, 1992, which claims full flow of the Bull Run River or as much as is needed for the future. The claim is based on prior appropriation and reserved municipal rights. The prior appropriation claim is based on the initiation of the appropriation with a priority date of August 6, 1886. The reserved municipal right is based on the fact that the federal government reserved the water of the Bull Run Watershed, then subsequently granted the use of that water to the City. Also, the City of Portland has filed a surface water claim for the full flow of the Little Sandy River with a priority date of 1892. The claims can be certificated if upheld in adjudication of the Sandy River Basin, but there are no such plans to adjudicate in the foreseeable future.

There are no known competing non-federal claims for water on the Bull Run River. However, Portland General Electric has filed a claim with a priority date of 1907 of up to 800 cfs for hydroelectric purposes, which is anticipated to be converted into an instream flow once the PGE power production facilities are abandoned on the Little Sandy. The 800 cfs right applies to a complex of facilities that involve both Little Sandy and the mainstem Sandy River. The allocation of flow rate amounts in the converted PGE right is still in negotiation, but the current plan is to assign 200 cfs to the Little Sandy and 600 cfs to the mainstem Sandy. The Little Sandy is a tributary of the Bull Run River, but flows into the Bull Run below the City of Portland's diversion. The City also owns a water right for the generation of hydroelectric power at Bull Run Dams 1 and 2.

A.3. Water-Rights Issues Affecting Source-Option Development

There is no need to obtain new surface water rights for the Bull Run option since the City has exclusive and prior rights to the waters of the Bull Run Watershed. In addition, because of this exclusive right, the City does not need separate storage and withdrawal rights from constructed reservoirs. However, a water right would be needed if hydropower generation were desired for any new reservoir.

Besides potential instream flow requirements resulting from listing of species under the Endangered Species Act (ESA), other legal or regulatory limitations for developing the Bull Run option include a special use permit, 404 permit and Clean Water Act requirements.

The major issue affecting development of this option is the effect ESA will have on existing and future water rights as a result of listing of species present in the Bull Run tributaries under ESA. It is apparent that ESA will in some way affect existing rights. The uncertainty is in the magnitude of the effect. The effects can be on pattern of use or actual quantities. The potential for enforcement actions may be initiated by the federal government, as well as

ESA-related third-party lawsuits. Section 4 rules are now in place for steelhead and chinook, and the take prohibition is enforceable; however, enforcement can also come in the form of conditions on an "incidental take permit" issued to individual providers or facilities. USFWS withdrew the proposed rule to list the coastal cutthroat as a threatened species as stated in the Federal Register on July 5, 2002. However, Section 4 rules have been put in place for steelhead and chinook that prohibit any take of these species. Project-specific requirements are subject to site-specific analysis, and PWB is conducting a variety of studies in the Bull Run Watershed to respond to these ESA requirements. A habitat conservation plan (HCP) is the desired mechanism to address ESA, but this set of negotiations does not include Dam 3 at this time. The final negotiations will likely include other activities to expand the Bull Run supply.

A. 4. Capital and Operating Costs

Capital and operating costs for the Bull Run source options are based on information in the "Supply, Transmission, and Storage Analysis" report (CH2MHill, 2000) and information provided by Portland Water Bureau (Kessler, 2002). Table 4(2)-2 lists the costs provided in the "Supply, Transmission, and Storage Analysis" report. Cost estimates provided in Table 4(2)-3 only include those Bull Run source options to be used in the source scenario strategies.

A. 5. Summary Evaluation of Bull Run Source-Option Issues

The major developments discussed above have the most significant effect on water availability, environmental impacts, ease of implementation, treatment requirements, and capital and operating costs. The PWB has developed several alternatives within the Bull Run Option besides Dam 3, as noted in Table 4(2)-2. Consideration of these alternatives provides flexibility in evaluating each of the criteria mentioned. However, this does add complexity to the evaluation process.

In particular, the proposed LT2ESWTR may directly impact the treatment requirements and hence costs for this option and may significantly affect the use of the Bull Run option in any overall resource strategy. Additionally, water availability should be reconsidered in light of the potential climate change study, whereas final rules have not been established for the newly listed species under ESA, so its final impact is yet unknown. A summary of other new issues and developments for the Bull Run is listed in Table 4(2)-4. Many of the issues noted have relatively minor effects on the source-option evaluation, but are included for reference and completeness.

Table 4(2)-5 includes a summary of the new issues and developments discussed above that affect the evaluation of the source option issues. Recall from Part 1.4, that numerical ratings for some of the source-option issues have been developed. These ratings are based on the evaluation from the 1996 RWSP in conjunction with the new issues and developments noted in Table 4(2)-5. Changes to the ratings are noted in the table where they have been made. In general, the ratings remained the same or changed only by a fraction.

Table 4(2)-3 Cost Summary for Bull Run Options *Regional Water Providers Consortium*				
Option	**Description**	**Capital Cost**	**Operation and Maintenance**	**Comments**
Bull Run Dam No. 3	• 400 foot high dam with storage capacity of 22 BG, 19 BG of which is usable • Construction in 2020	$200,000,000	$2,000,000	• Capital improvement costs and operations and maintenance costs inflated from PWB's 2001 Infrastructure Master Plan by 3% annually (from PWB)
Dam No. 2 Raise	• Construction of a 16 foot-high labyrinth weir to raise reservoir level by 12 feet • Increases storage supply by 2.2 BG • Construction in 2010	$12,500,000	$55,000	• Capital improvement costs obtained from PWB's 2002 to 2012 CIP • Operations and maintenance costs inflated from PWB's 2001 Infrastructure Master Plan by 3% annually (from PWB)
Dam No. 1 Gate Raise	• Replace lift gates at Dam #1 with higher gates to raise the maximum normal pool elevation by a maximum of 4 feet • Increases storage supply by 200 MG • Construction in 2005	$1,600,000	$16,500	• Capital improvement costs and operations and maintenance costs inflated from PWB's 2001 Infrastructure Master Plan by 3% annually (per PWB)
Bull Run Groundwater	• Well development with an estimated maximum supply of 20 mgd • 10 mgd constructed in 2007; 10 mgd constructed in 2010 (per PWB)	$11,600,000	$1,650,000	• CIP 2003-2013 cites $580,000 per mgd capital costs for aquifer development (from PWB) • Operations and maintenance costs inflated from PWB's 2001 Infrastructure Master Plan by 3% annually (from PWB); IMP provided a range of $1.2-$2.1M; used the average of the O&M costs
Conduit No. 5	• 84" to 96" conduit running from Headworks to Powell Butte • Approximately 250 mgd capacity	$181,000,000	$905,000	• Capital improvement costs inflated from PWB's 2001 Infrastructure Master Plan by 3% annually (from PWB) • Operations and maintenance costs not available from IMP; assumed to be 0.5% of capital costs

Note: Cost is in 2002 dollars

Table 4(2)-4 New Issues Affecting Bull Run Option *Regional Water Providers Consortium*
Major Developments
▪ Other smaller scale supply options related to Bull Run reservoir expansion have been presented, including alternatives for supply conduits and reservoirs, supply conduit (Conduit 5) as a replacement for existing conduits, construction of three new 50 MG reservoirs, plus one 20 MG reservoir ▪ LT2ESWTR and Stage II D/DBP rules requires additional microbial treatment for Bull Run water ▪ Study completed on climate change effects on Bull Run supply and demand patterns of the service area ▪ New species listed under Endangered Species Act and some candidates ▪ PWB's investigation of groundwater development within Bull Run
Other Supply Works Constructed or Committed
▪ 2 mgd pilot production well completed
Other Related Studies
▪ Climate Change study evaluating yield from Bull Run ▪ Development of reservoir operations model providing information about operation of third reservoir ▪ Study and design of under crossing of Sandy River for conduits ▪ STM model development and data sets available on demands, sources, hydrology, and transmission ▪ New studies of ESA fish species and temperature modeling
Other Local/Regional Planning Efforts
▪ Formation of Water Treatment Advisory Panel on evaluating treatment options/locations and Independent Review Panel on open reservoirs

Table 4(2)-5 Summary Evaluation of Source-Option Issues – Bull Run Regional Water Providers Consortium	
Water Availability	
Rating: N/A (not quantified in 1996 RWSP) *To be quantified by Confluence modeling*	• Water rights are not a limitation since the City of Portland has exclusive and prior rights to the waters of the Bull Run watershed, with the exception of potential ESA requirements. PWB is conducting a variety of studies in the Bull Run watershed to respond to these ESA requirements (see environmental impacts) • In the Steelhead Supplement to the Oregon Plan, City of Portland made an interim commitment to keep flows in the lower Bull Run River at 100 cfs prior to June 15 to benefit steelhead spawning. • Further studies and negotiation are currently taking place to determine the actual flow levels that may be required in the future, but at this time no new figure is proposed. • Addition of filtration for the Bull Run source could provide access to additional storage volume and increased water availability if this option were selected to meet SDWA pending rules. • Climate change study indicates that average stream flows will increase in the wintertime by approximately 40 percent, while late spring and summer flows will decrease by 30 percent by 2040. • No other significant changes to issues impacting the Bull Run options' water availability.
Environmental Impacts	
Natural Rating: 4.9 *(4.9)* Human Rating: 3.6 *(3.6)*	• The following species have been listed for the Lower Columbia River (which includes the Bull Run watershed tributaries): chinook salmon, chum salmon, and steelhead • No other significant changes to issues impacting the Bull Run options' environmental impacts.
Raw Water Quality	
Rating: 1.2 *(1.2)*	• LT2ESWTR/Stage 2 D/DBP could have a significant impact on the treatment requirements for all surface water sources, and may require the City of Portland to make substantial capital improvements to its unfiltered system, with options ranging from being granted a potential waiver to Membrane Filtration. • Construction of Dam 1 and Dam 2 raises and developing the ground water and ASR sources will have fewer impacts on water quality. • No other significant changes to issues impacting the Bull Run options' raw water quality.
Vulnerability to Catastrophic Events	
Rating: 3.5 *(3.5)*	• Low probability for terrorist acts for the Bull Run source. The source is isolated which limits ability to secure the source. However, its relative remoteness also limits accessibility. • No other significant changes to issues impacting the Bull Run options' vulnerability to catastrophic events (e.g., earthquakes, large fires, volcanic eruptions).

Table 4(2)-5 Summary Evaluation of Source-Option Issues – Bull Run Regional Water Providers Consortium	
Ease of Implementation	
Rating: N/A *(4.5)* *Ease of implementation will depend on individual circumstances at the local level*	• ESA continues to be a limiting factor for constructing Dam 3 or the dam raises • The groundwater at the site of the Bull Run wells is highly pressurized and makes the feasibility of a gravity-fed ASR recharge system questionable. • Groundwater development project would have less environmental impact. • Silica and fluoride in the Bull Run Groundwater will complicate its future implementation and potentially limit its use. • No significant changes to issues impacting the Bull Run options' ease of implementation.
Treatment Requirements	
Rating: N/A (not quantified in 1996 RWSP)	• No other significant changes to issues impacting the Bull Run options' treatment requirements.
Capital and Operating Costs	
Rating: N/A *Refer to cost table for each source option*	• No other significant changes to issues impacting the Bull Run options' capital and operating costs.

Note:
- Ratings range from 1 to 5 per 1996 RWSP; lower scores are preferred.
- Italicized ratings in parentheses are values from the 1996 RWSP.
- Ratings are for Bull Run Dam 3 and raises for Dams 1 and 2; ratings for Bull Run ground water and ASR would be the same as those for the ASR option (section 2.6)

B. Clackamas River Diversion Option

For the 1996 RWSP, it was assumed that no new intake or treatment facility locations would be developed besides the four existing or planned sites for the Clackamas River option. At the time, the existing facilities were operated by Clackamas River Water, South Fork Water Board and the City of Lake Oswego. The Oak Lodge Water District treatment plant was still in its planning phase. The four source-option alternatives considered in the 1996 RWSP included: (1) utilizing current or planned configurations and capacities; (2) development of a consolidated intake and treatment facility at CRW; (3) expanding all existing and planned facilities (providing a consolidated facility if needed); and (4) expanding all existing facilities as then planned to meet ultimate flows without constructing a consolidated facility. Although four alternatives were considered, only Alternative 1 was evaluated in detail as a representative site with respect to cost and environmental impacts. A total short-term capacity of 86.5 mgd was assumed in the analysis based on a 22.5 mgd expansion of the existing and planned facilities. It was then assumed that up to 50 mgd of additional development (after 2030) would be available on the Clackamas River over the long-term.

The 1996 RWSP concluded that the Clackamas River had been a proven source with high raw water quality and would continue to provide an important source of water in the areas where shortages were anticipated to occur within the region. However, that same anticipated growth was also thought to pose potential detrimental impact to the watershed and water supply. In addition, the source is limited by the available water rights and potentially by instream flow requirements. Any additional junior water rights to the instream flow could be limited because available flows are approaching the instream limits. In addition, the Clackamas River option does not reduce the region's vulnerability to catastrophic events since the supply is already being utilized.

The Clackamas River source option for this current update is modified to include run-of-the-river diversions from the Clackamas River utilizing expansions of existing intakes and treatment facilities or new intake and treatment facilities. Additional withdrawals would be within the maximum amount allowable under various existing water rights as well as new permits subject to water availability. Points of diversions would generally be between river mile 8 and the mouth of the river. Currently, Clackamas River Water (30 mgd), South Fork Water Board (20 mgd), City of Lake Oswego (16 mgd), and North Clackamas County Water Commission (10 mgd) provide a total of 76 mgd through four separate intakes and treatment plants.

B. 1. New Issues and Developments

Construction of NCCWC Slow-Sand Filtration Plant. The most significant change since the 1996 RWSP has been the completion of the North Clackamas County Water Commission (NCCWC) slow sand filtration plant. The NCCWC was formed from Mt. Scott Water District, Damascus Water District and Oak Lodge Water District in 1996 to fund and construct the 10 mgd new slow-sand filtration plant on the Clackamas River (expandable to 20 mgd). The plant became operational in the spring of 1999. Since its start-up, the Mt. Scott and Damascus Water Districts have combined, forming the Sunrise Water Authority,

which together with the Oak Lodge Water District comprises the NCCWC. An expansion to add 10 mgd of additional capacity with membrane filtration are underway in 2004 with completion anticipated in 2005.

Expansion of Other Clackamas River Facilities. Other existing intakes and treatment plants also underwent modifications during this period. In particular, South Fork Water Board is making modifications to its plant to potentially add 10 mgd capacity, although it is not currently rated to provide as such. In addition, Lake Oswego has completed an upgrade to their intake facility in 2002 to a capacity of 25 mgd, this project also included the installation of fish screens and a screen cleaning system to achieve compliance with the ESA. The Lake Oswego screen improvement was sized to ultimately allow diversion of the full water right of 32.32 mgd. Current intake pumping capacity for Lake Oswego is 16.15 mgd (25 cfs), with the installation of larger pumps, pumping capacity could be increased to the full water right. Clackamas River Water has conducted improvements for the intake at their water treatment plant. Each of these plants can add 10 mgd additional capacity through these modifications. The overall effect is that these expansions and improvements provide additional infrastructure to ease further development of the Clackamas River option. Future expansion is, however, limited by the available water rights for diverting raw water to the plants. This issue will be discussed in detail in the technical memorandum addressing water rights.

New Users of Clackamas River Supply. Since the 1996 RWSP, the City of Milwaukie has become a new user of water from the Clackamas River Water WTP. Rockwood Water District has also signed an intergovernmental agreement with Clackamas River Water for 1 mgd with option to expand to 6 mgd by 2005.

Pending Water-Rights Applications. Significant filings for additional water rights have been submitted by Clackamas River Water (CRW) and Sunrise Water Authority. CRW has applications totaling almost 149 cfs and Sunrise has an application for an additional 10 cfs. Instream flow requirements may pose issues for permitting these junior water-rights applications. Although historically the Clackamas River has never been flow regulated because of instream flow requirements, expanding pressure from increased withdrawals and the need for additional flow to support fisheries habitat could force more periodic regulation of users.

Municipal Storage in Timothy Lake. Since the 1996 RWSP, discussions have taken place between Portland General Electric and the various Clackamas River water purveyors to examine potential opportunities to utilize hydroelectric storage as well as potential additional storage at Timothy Lake for M&I use. CRW has an agreement with PGE for use of existing late season storage in Timothy Lake for the benefit of municipal providers on the Clackamas. Any plans to increase the storage at Timothy Lake are complicated by the upcoming Federal Energy Regulatory Commission (FERC) relicensing efforts as well as necessary Federal use permits. If developed, this alternative would provide enhanced flow augmentation for fish and temperature needs, especially during the late summer and early fall, which would enhance the ability to utilize municipal water rights on the lower Clackamas.

Construction of Highland Road Intertie. The Highland Road Intertie was completed in 2001 and provides for a 10 mgd connection between the South Fork Water Board (SFWB) plant and NCCWC's slow-sand filter plant. The intertie is designed to accommodate bi-directional flow and adds significant ability to move water among providers in Clackamas County. During periods of high turbidity, production at the NCCWC's plant can be limited and the pipeline can be used to serve water from South Fork into the Oak Lodge Water District and Sunrise Water Authority. In the summertime, water can be served from the NCCWC plant to South Fork in order to help meet peak demands, including those in Clackamas River Water's south service area.

Listed Species Under the Endangered Species Act. Since 1996, additional species of salmon and steelhead have been listed under the Endangered Species Act. Although the original RWSP considered this issue under the environmental impacts criteria, several species were only considered as candidates for listing at that time. Since then, the following species have been listed for the Lower Columbia River (which includes the Bull Run watershed tributaries): chinook salmon, chum salmon and steelhead. USFWS withdrew the proposed rule to list the coastal cutthroat trout as a threatened species as stated in the Federal Register, July 5, 2002. Since the Clackamas River ultimately feeds into the Willamette River and then into Lower Columbia River, the listing means steps will have to be taken in order to protect these species. Stream flows and habitat along the Clackamas River will likely be considered as part of any final recovery plan. As mentioned in the discussion for the Bull Run option, Section 4 rules are in place for steelhead and chinook and the take prohibition is enforceable, but project specific requirements are subject to site-specific analysis and negotiation.

B. 2. Existing Municipal Water Rights and Applications

The purveyors holding municipal water-use permits and/or certificates on the Clackamas River include City of Lake Oswego, South Fork Water Board, Clackamas River Water, Oak Lodge Water District and the City of Gladstone. A summary of the existing municipal rights in the Clackamas River is shown in Table 4(2)-6. The total municipal rights associated with the Clackamas River are approximately 272 cfs. An OWRD instream right with a priority date of August 26, 1968, is located from Three Lynx to the mouth of the Clackamas River, which applies this right throughout the points-of-diversions of the municipal rights. Of the total municipal rights, 185 cfs is "senior" to the instream right and "junior" municipal rights total approximately 87 cfs. A portion of the water right held by SFWB for use within its municipal service area is located on the South Fork of the Clackamas River and Memaloose Creek. Table 4(2)-6 summarizes the water rights put to beneficial use by the existing water treatment plants on the Clackamas River.

OWRD received several registration filings for pre-1909 water rights on the Clackamas River system. The major filings are all for power generation purposes at PGE's Cazadero/Faraday Project (2,370 cfs), River Mill Project (4,641 cfs) and the Oak Grove Project (602.5 cfs). All of the municipal rights are downstream of these PGE claims except those of the SFWB located on the South Fork of the Clackamas River and Memaloose Creek. If these rights were transferred downstream to the SFWB intake, then they would not impact the PGE filings.

Water-rights applications with significant rates were submitted by Clackamas River Water and Sunrise Water Authority. CRW has applications totaling almost 149 cfs and Sunrise Water Authority has an application for 10 cfs. Historically, the Clackamas River has never been flow regulated because of instream flow requirements. However, instream flow requirements do pose constraints on junior water rights and for future water-right applications. Issues regarding instream rights and minimum flows are discussed further in the following subsection.

B. 3. Water-Rights Issues Affecting Source-Option Development

There are five main water-rights issues regarding the development of the Clackamas River: (1) water rights not put to beneficial use, (2) a significant quantity of water rights are "junior" to instream right, (3) a significant quantity of unadjudicated claims, (4) additional water rights are potentially available from storage options, and (5) impacts of potential ESA rulings.

The OWRD instream right (Cert. 59491) between Three Lynx and the mouth of the Clackamas River impacts all of the Clackamas River purveyors with junior water rights and applies to any new water rights, with the exception of storage. The instream right requires a minimum river flow of 400 cfs in August and September and 640 cfs for the remainder of the year. This right is to be maintained from the Three Lynx gauge to the river's confluence with the Willamette River under an August 26, 1968 priority date. In addition to this instream right, the Clackamas River also has a scenic waterway flow of 890 cfs to be maintained in August and September extending from river mile (RM) 29.3 to RM 8 (near Carver). In terms of affecting the potential availability of water for various users on the river, only the instream water right described above is enforceable with regard to its respective flow requirement and priority date. The scenic waterway flow is not enforced against *existing* water rights and has no "priority date." However, OWRD must ensure that the commissioned scenic flow is maintained within the reach when deciding on allowing *new* water rights.

Table 4(2)-6
Clackamas River Water Rights Put to Municipal Beneficial Use
Regional Water Providers Consortium

Purveyor	Total Water Rights (cfs)	Installed Treatment Capacity (cfs)	Remaining Rights Senior to Instream Right (cfs)	Remaining Rights Junior to Instream Rights (cfs)
CRW	46.5	46.4 cfs (30 mgd)	0	0.1
SFWB	116	30.9 cfs (20 mgd)	85.1	N/A
Lake Oswego	59	24.7 cfs (16 mgd)	25.3	9
NCCWC (OLWD)	62	15.5 cfs (10 mgd)	N/A	46.5
Gladstone	13.73	N/A[1]	4	9.73
Total	**297.23**	**117.5 cfs (76 mgd)**	**114.4**	**65.33**

[1] N/A – Not applicable; Gladstone does not have a water treatment plant their water right is exercised at the CRW Water Treatment Plant

Discussions currently are taking place between purveyors utilizing the Clackamas River and Portland General Electric Co. regarding use of releases from hydroelectric storage at Timothy Lake for municipal and industrial (M&I) use. There are also discussions and studies taking place for developing additional storage in Timothy Lake for M&I use. Studies regarding the feasibility of a dam raise indicate that a 15-feet raise is technically feasible, but a smaller raise is more likely due to environmental issues and other constraints. It is not presently clear how these negotiations will proceed.

The potential for enforcement actions may be initiated by the federal government, as well as ESA-related third-party lawsuits.

It is apparent that ESA will in some way affect existing rights. The uncertainty is in the magnitude of the effect, which can be on pattern of use or actual quantities. It is not presently clear whether the rules will be applied retroactively to existing water rights. Since 1996, additional species of salmon and steelhead have been listed under the ESA, which include the following species for the Lower Columbia River (to which the Clackamas River as a tributary): chinook salmon, chum salmon and steelhead. The USFWS withdrew the proposed rule to list the coastal cutthroat trout as a threatened species. Since the Clackamas River feeds ultimately into the Lower Columbia, the listing means steps may have to be taken to protect these species including possible restrictions on future withdrawals. Section 4 rules are now in place for steelhead and chinook and take prohibition is enforceable; however, enforcement will likely come in the form of conditions on an "incidental take permit" issued to individual providers or facilities. Project-specific requirements are subject to site-specific analysis and negotiation.

Historically, OWRD has not had to suspend any individual water-right holder from their appropriated access to water for the purpose of preserving instream water rights. This is owed to the fact that there has historically on average been sufficient river flow in excess of instream rights. However, OWRD has noted that the authorized withdrawals exceed the instream water right at the 80^{th}-percentile flow level for September. In addition, the authorized withdrawals exceed the scenic waterway flow requirements for both August and September. However, this has not been an issue since the points of diversion with the largest withdrawals are downstream of the reach with designated scenic flow. In either case, as legal requirements grow to protect fisheries and other instream demands, there will be an increased likelihood that various authorized users of the river may be subject to temporary suspension of full access to water and that issuance of new water rights will be limited because of both instream and scenic waterway flow requirements.

B. 4. Capital and Operating Costs

Capital and operating costs for the Clackamas River source options are based on information provided during interview with the individual purveyors along the Clackamas River. Cost estimates provided in Table 4(2)-7 only include those Clackamas River source options to be used in the source scenario strategies.

B. 5. Summary Evaluation of Clackamas Source-Option Issues

The major developments discussed above have the most significant effects on water rights, environmental impacts and ease of implementation. These new developments essentially improve the ease of implementation because there is now more existing infrastructure, new pending water rights and potential for additional water for managing low flow periods. However, the permitting of water-rights applications may be difficult because of potential instream flow limitations on the Clackamas River. Climate change and ESA rules take prohibitions can affect the availability of water from the Clackamas River. A summary of other new issues and developments is listed in Table 4(2)-8.

Table 4(2)-9 includes a summary of the new issues and developments discussed above that affect the evaluation of the source-option issues. Recall from Section 1.4, that numerical ratings for some of the source-option issues have been developed. These ratings are based on the evaluation from the 1996 RWSP in conjunction with the new issues and developments noted in Table 4(2)-9. Changes to the ratings are noted in the table where they have been made. In general, the ratings have remained the same or decreased (improved) slightly because of the flexibility afforded by having incremental capacity increases for individual water treatment plants rather than construction of a new central facility.

Table 4(2)-7 Cost Summary for Clackamas River Options Regional Water Providers Consortium				
Option	**Description**	**Capital Cost**	**Operation and Maintenance**	**Comments**
Clackamas River Water Treatment Plant Expansion	• Plant expands from 30 to 40 mgd (from CRW) • Completion date as early as 2005 assuming additional wholesale demand, otherwise project complete from 2015 to 2020 (from CRW)	$12,000,000	$1,201,000	• Capital improvement costs include $6 million for upgrade and $6 million for expansion (from CRW) • Operations and maintenance costs: Chemicals based on base case cost of $20.67/mg; power based on base case cost of $26.22/mg; sludge disposal. Note: equipment and supplies, labor, and contingency are assumed to be the same as Lake Oswego WTP costs unless other costs are provided by CRW or costs from base case for these items are available. Total O&M cost estimate is equivalent to $0.33 per 1000 gallons
Lake Oswego Water Treatment Plant Expansion	• Expand Lake Oswego's existing supply, treatment and transmission system to develop an additional 6-10 mgd of capacity for ultimate demands within the City's USB and including some level of development within the Stafford area (per City of Lake Oswego) • Completion date in 2020 (per City of Lake Oswego)	$22,500,000	$1,343,000	• All costs obtained from City of Lake Oswego; O&M costs equivalent to $0.37 per 1000 gallons
NCCWC Water Treatment Plant Expansion	• Plant expansion from 10 to 20 mgd (per NCCWC)	$6,000,000	$904,500	• Capital costs estimated at $0.60/gallon (per NCCWC) • Operations and maintenance costs: Chemicals based on base case cost of $15/mg (per Gary Fiske), power based on base case cost of $115/mg (per Gary Fiske), sludge disposal cost assumed same as Lake Oswego, contingency based on base case (per Gary Fiske); total O&M cost estimate is equivalent to $0.25 per 1000 gallons.
Timothy Lake Dam Raise	• Raise Timothy Lake 2 feet for an additional 3,100 a.f.10 mgd constructed in 2007; 10 mgd constructed in 2010 (per PWB)	$4,650,000	$69,750	• Estimates based on $1,500 per acre foot for 3,100 acre feet; annual operation and maintenance assumed to be 1.5% of capital cost

Note: Cost is in 2002 dollars

Table 4(2)-8 New Issues Affecting Clackamas River Option Regional Water Providers Consortium
Major Developments
▪ NCCWC (MSWD, DWD, OLWD) formed in 1996 to fund and construct the 10 mgd (expandable to 20 mgd) slow sand filtration plant on Clackamas River operational in spring 1999 ▪ Total of 149 cfs of water rights applications submitted by CRW and Sunrise WA ▪ Agreement for potential use of water releases from Timothy Lake to meet M&I needs; also considering additional storage in Timothy Lake ▪ CRW agreement with PGE for use of late season storage in Timothy Lake ▪ Construction of interties between Clackamas River suppliers (Lake Oswego-SFWB and SFWB-NCCWC) ▪ City of Milwaukie uses water from Clackamas River Water ▪ IGA between Rockwood and Clackamas River Water to purchase 6 mgd
Other Supply Works Constructed or Committed
▪ Expansion plans exist for NCCWC SSF (intake already designed) ▪ SFWB plans to improve and expand WTP to 30 mgd by around year 2007 through incremental upgrades ▪ CRW has conducted intake improvements on their water treatment plant; can add 10 mgd capacity ▪ Lake Oswego rebuilt their intake facility in 2002 to add fish screening and to seismically upgrade the facility. Any further work to increase the intake capacity or on the transmission line under the Willamette River to their treatment plant in West Linn is not programmed at this time. ▪ Sunrise WA options for additional supply involve construction of transmission lines and/or interties depending on the alternative selected. A new WTP may also be constructed on the Clackamas River as an alternative to meet increased demands (April 1999) ▪ NCCWC utilizes the SSF as their primary source of water instead of CRW; water system plan recommended installing an intertie with PWB as emergency source (May 2000)
Related Studies
▪ Additional data on flows and water quality developed by Metro for Clackamas River basin
Other Local/Regional Planning Efforts
▪ Agreements to build interconnections between Clackamas systems ▪ Significant filings for additional water rights on Clackamas River by CRW and a smaller amount by Sunrise WA not acted upon by OWRD at this time ▪ Entities are attempting to improve the ability to transfer water in the region; projects are on-going ▪ Studies being conducted on effects of releases from Timothy Lake

Table 4(2)-9 Summary Evaluation of Source-Option Issues – Clackamas River Regional Water Providers Consortium	
Water Availability	
Rating: N/A (not quantified in 1996 RWSP) *To be quantified by Confluence modeling*	• Significant filings for additional water rights have been submitted by Clackamas River Water (CRW) and Sunrise Water Authority. • Stream flows and habitat along the Clackamas River will likely be considered as part of any final recovery plan. • Although historically the Clackamas River has never been flow regulated because of instream flow requirements, expanding pressure from increased withdrawals and the need for additional flow to support fisheries habitat could force more periodic regulation of users. • Portland General Electric and the various Clackamas River water purveyors have examined potential opportunities to utilize hydroelectric storage as well as potential additional storage at Timothy Lake for M&I use. • Climate change study indicates that average stream flows will increase in the wintertime, while late spring and summer flows will decrease. • No other significant changes to issues impacting the Clackamas River options' water availability.
Environmental Impacts	
Natural Rating: 3.5 *(2.4)* Human Rating: 1.0 *(1.0)*	• The following species have been listed for the Lower Columbia River (which includes the Bull Run watershed tributaries): chinook salmon, chum salmon, and steelhead • No other significant changes to issues impacting the Clackamas River options' environmental impacts.
Raw Water Quality	
Rating: 1.8 *(1.8)*	• No significant changes to issues impacting the Clackamas River options' raw water quality.
Vulnerability to Catastrophic Events	
Rating: 2.5 *(2.5)*	• Low probability for terrorist acts for the Clackamas River source. • No other significant changes to issues impacting the Clackamas River options' vulnerability to catastrophic events.
Ease of Implementation	
Rating: N/A *(2.0)* *Ease of implementation will depend on individual circumstances at the local level*	• ESA continues to be a limiting factor for treatment plant expansion • No significant changes to issues impacting the Clackamas River options' ease of implementation.
Treatment Requirements	
Rating: N/A (not quantified in 1996 RWSP)	• No other significant changes to issues impacting the Clackamas River options' treatment requirements.
Capital and Operating Costs	
Rating: N/A *Refer to cost table for each source option*	• No other significant changes to issues impacting the Clackamas River options' capital and operating costs.

Note:
- Ratings range from 1 to 5 per 1996 RWSP; lower scores are preferred.
- Italicized ratings in parentheses are values from the 1996 RWSP.

C. Columbia River Diversion Option

The Columbia River is not currently used as a drinking water source in the Portland metropolitan area. However, other cities upstream and downstream of the area do utilize the river for municipal supply. At the time of the 1996 RWSP, the proposed additional supply from this option was evaluated at 105 mgd with the intake located along the river's south shore between the mouth of the Sandy River and the Portland Airport.

The evaluation in the 1996 RWSP concluded that although Columbia River raw water quality was good, it was not as good as the Bull Run or Clackamas River. Although water availability was not identified as an issue as far as hydrology, issues regarding protection of the watershed and addressing protection of fish were considered moderate to significant. In addition, the Columbia River source was considered relatively distant from the location of the anticipated future needs.

The Columbia River source option for this current update remains as a potential run-of-the-river diversion from the Columbia River. An intake would be located near the confluence of the Sandy River. A water-use permit would be required to develop this source option. None of the Consortium members currently hold water rights to divert water from the Columbia River, with the exception of a recent water right granted to Rockwood PUD for 77 cfs. During the update process the Columbia was not modeled due to resource constraints; however, it is a potential option for development.

C. 1. New Issues and Developments

Listed Species Under the Endangered Species Act. Since 1996, additional species of salmon and steelhead have been listed under the Endangered Species Act. The 1996 RWSP considered this issue under the environmental impacts criteria, but at that time several species were only candidates for listing. Since the then, the following species have been listed for the Lower Columbia River: chinook salmon, chum salmon and steelhead. The listing means steps will have to be taken to protect these species. As mentioned in the discussion for the Bull Run option, Section 4 rules are in place for steelhead and chinook and the take prohibition is enforceable, but project-specific requirements are subject to site-specific analysis and negotiation. USFWS withdrew the proposed rule to list the coastal cutthroat trout as a threatened species as stated in the Federal Register, July 5, 2002.

NOAA Fisheries Biological Opinion. Since the 1996 RWSP, the emphasis on protecting threatened and endangered species has increased. NOAA Fisheries published their biological opinion on the operation of the Federal Columbia River Power System (FCRPS) in year 2000. In that report, NOAA Fisheries presented proposed actions that recommended target

flows from 220,000 to 260,000 cfs as measured at McNary Dam during spring (April 20 to June 20) and 200,000 cfs during summer (July 1 to August 1). The flow objectives in any given year would be determined using a sliding scale based on forecasted runoff. For fall chinook and chum salmon spawning below Bonneville Dam, FCRPS would be operated to use storage to augment natural flows in an attempt to provide a flow level of 125,000 cfs during early November to April.

Any suggested municipal demand from this source would be seemingly insignificant compared to the available water under these target flows. However, these target flows are in turn set higher than the historic observed averages during these same times. Hence, the notion of available water may be misleading if any one of the target flows became enforceable. Moreover, all the tributaries feeding the Columbia River may be affected as well.

C. 2. Existing Municipal Water Rights and Applications

None of the Consortium members currently hold water rights to divert water from the Columbia River, with the exception of a recent water right granted to Rockwood PUD for 77 cfs, which has a priority date of April 27, 1992. The Port of Portland has water rights of 51.6 cfs with a priority date of November 18, 1992, lower down towards the mouth of the Willamette.

C. 3. Water-Rights Issues Affecting Source-Option Development

There are two main water-rights issues regarding the development of the Columbia River: (1) there are a significant number of other non-municipal water rights on the Columbia River and (2) potential impacts of ESA rulings and perceived water-quality issues that may affect public acceptance of this source.

No additional water-rights applications are being accepted by OWRD above Bonneville Dam. However, below Bonneville Dam water use permits can be applied for on the Columbia River subject to availability of water as determined by OWRD. Since the minimum discharge from Bonneville Dam is 70,000 cfs or greater, applications for water rights to develop the Columbia River source option would be a small percentage of the minimum discharge from the dam. However, there are a significant number of other non-municipal water rights for the Columbia River related to industrial use that can impact any new water rights issued if ESA rulings place limits on use as discussed below.

Recall, additional species of salmon and steelhead have been listed under the ESA, which include the following species for the Lower Columbia: chinook salmon, chum salmon and steelhead. The USFWS withdrew the proposed rule to list the coastal cutthroat trout as a threatened species. As with the other river sources discussed previously, ESA will likely impact water rights. The uncertainty is in the magnitude of the effect, which can be on pattern of use or actual quantities. The potential for enforcement actions may be initiated by the federal government, as well as ESA-related third-party lawsuits. It is not presently clear whether enforcement will be applied retroactively to existing water rights. Section 4 rules are now in place for steelhead and chinook, and take prohibition is enforceable. However,

enforcement will likely come in the form of conditions on an "incidental take permit" issued to individual providers or facilities. Project-specific requirements are subject to site-specific analysis and negotiation.

NOAA Fisheries has published their biological opinion on the operation of the Federal Columbia River Power System (FCRPS) in year 2000. In that report, NMFS presented proposed actions that recommended flow. The flow objectives in any given year would be determined using a sliding scale based on forecasted runoff. For fall chinook and chum salmon spawning below Bonneville Dam, FCRPS would be operated to use storage to augment natural flows in an attempt to provide a flow level of 125,000 cfs during early November to April. These flows are significant, but the diversions needed are on the order of hundreds of cubic feet per second. On simply a flow quantity basis, this would have insignificant effect on developing the Columbia River source option. However, there are historical flows that are below the minimum target flow set by the report. During these times diversions would be affected. Despite the significant flows released from Bonneville Dam, it is not clear whether final rules will limit the diversion rates or the type of mitigative steps that will be required of the water-rights applicants before a permit is issued.

C. 4. Capital and Operating Costs

Capital and operating costs for the Columbia River source option is based on information from the 1996 RWSP. Cost estimates provided in Table 4(2)-10 assume a water treatment plant capacity of 50 mgd based on the amount of the existing water right held by Rockwood PUD.

C. 5. Summary Evaluation of Columbia Source-Option Issues

The major developments discussed above have the most significant effect on environmental impacts, availability and ease of implementation. The 1996 RWSP recognized the issues posed by anadromous fisheries in developing the Columbia River option. Moreover, regardless of the argument made with regard to flow impact, the more important issue for any new withdrawal may be that in obtaining permits for construction of intakes and the potential for 'take' as defined under the 4(d) rule of the ESA. Because of the uncertainty surrounding the ESA and the future of NMFS target flows, use of the Columbia River as a major source of municipal supply also involves some uncertainty. A summary of other new issues and developments is listed in Table 4(2)-11.

Table 4(2)-12 includes a summary of the new issues and developments discussed above that affect the evaluation of the source-option issues. Recall from Section 1.4, that numerical ratings for some of the source-option issues have been developed. These ratings are based on the evaluation from the 1996 RWSP in conjunction with the new issues and developments noted in Table 4(2)-12. Changes to the ratings are noted in the table where they have been made. In general, the ratings remained the same due to the limited changes in conditions.

Table 4(2)-10 Cost Summary for Columbia River Option Regional Water Providers Consortium				
Option	**Description**	**Capital Cost**	**Operation and Maintenance**	**Comments**
Columbia River Water Treatment Plant Construction	• Assume a plant capacity of 50 million gallons per day	$123,000,000 • Raw Water PS = $4.18M • Raw Water Pipe = $1.04M • WTP = $68.42M • Finish PS = $11.15M • Eng./Adm. = $16.98M • Contingencies = $21.16M	$6,069,000 • Labor = $0.633M • Chemicals = $0.380M • Equipment = $0.90M • Power = $1.9M • Disposal = $0.101M • Contingencies = $2.15M	• Capital costs based on 1996 RWSP data and indexed to 2002 dollars using Construction and Engineering Index.

Note: Cost is in 2002 dollars

Table 4(2)-11 New Issues Affecting Columbia River Option Regional Water Providers Consortium
Major Developments
▪ NOAA Fisheries 2000 Biological Opinion on Operation of Federal Columbia River Power System
Supply Works Constructed or Committed
▪ None
Related Studies
▪ Pilot Treatment Study completed for Rockwood PUD
Other Local/Regional Planning Efforts
▪ Rockwood Water People's Utility District Water Master Plan recommended continued use of Bull Run supply; also investigate use of groundwater as back-up; recommends against pursuing Columbia River unless part of regional effort (December 1998) ▪ There are currently no plans by Clark County or City of Vancouver to develop Columbia River supply.

Table 4(2)-12 Summary Evaluation of Source-Option Issues – Columbia River Regional Water Providers Consortium	
Water Availability	
Rating: N/A (not quantified in 1996 RWSP) *To be quantified by Confluence modeling*	• Water rights currently only available to Rockwood PUD for 77 cfs. • NOAA Fisheries published their biological opinion on the operation of the Federal Columbia River Power System (FCRPS) in year 2000. FCRPS would be operated to use storage to augment natural flows in an attempt to provide a flow level of 125,000 cfs during early November to April. Available water may be affected if any one of the target flows became enforceable • Climate change study indicates that average stream flows will increase in the wintertime, while late spring and summer flows will decrease. • No other significant changes to issues impacting the Columbia River option's water availability.
Environmental Impacts	
Natural Rating: 2.6 *(2.6)* Human Rating: 2.5 *(2.5)*	• The following species have been listed for the Lower Columbia River (which includes the Bull Run watershed tributaries): chinook salmon, chum salmon, and steelhead • No other significant changes to issues impacting the Columbia River option's environmental impacts.
Raw Water Quality	
Rating: 2.1 *(2.1)*	• LT2ESWTR/Stage 2 D/DBP will have a significant impact on the treatment requirements for all surface water sources. • No other significant changes to issues impacting the Columbia River option's raw water quality.
Vulnerability to Catastrophic Events	
Rating: 3.3 *(3.3)*	• Low probability for terrorist acts for the Columbia River source. • No other significant changes to issues impacting the Columbia River option's vulnerability to catastrophic events.
Ease of Implementation	
Rating: N/A *(3.5)* *Ease of implementation will depend on individual circumstances at the local level*	• ESA continues to be a limiting factor for constructing a Columbia River intake and water treatment plant. • No significant changes to issues impacting the Columbia River option's ease of implementation.
Treatment Requirements	
Rating: N/A (not quantified in 1996 RWSP)	• No other significant changes to issues impacting the Columbia River option's treatment requirements.
Capital and Operating Costs	
Rating: N/A *Refer to cost table for each source option*	• No other significant changes to issues impacting the Columbia River option's capital and operating costs.

Note:
- Ratings range from 1 to 5 per 1996 RWSP; lower scores are preferred.
- Italicized ratings in parentheses are values from the 1996 RWSP.

D. Trask/Tualatin River: Hagg Lake/Scoggins Reservoir Option

The Trask/Tualatin River system was included in the base case in the 1996 RWSP, but was not included as one of the potential source options for further expansion and evaluation. The update to the RWSP will include the Trask/Tualatin River system as a new source option, highlighting the potential expansion of Scoggins Reservoir and the completion of the Barney Reservoir Expansion. Waters stored in the Barney and Scoggins Reservoirs are diverted into the Joint Water Commission's (JWC's) treatment plant via the Springhill Pump Station. Currently, water from this source is used to serve customers in the cities of Hillsboro, Forest Grove, Beaverton and Cornelius, as well as the Tualatin Valley Water District. Water from this source also serves the town of Gaston, the LA Water Cooperative and unincorporated portions of western Washington County as part of Hillsboro's service territory. Limitations on the current system center on available summertime raw water, and a firm capacity of the treatment plant of 60 mgd. Under future capital improvements plans, the peak-day capacity of the system may be as large as 160-180 mgd, depending on a proposed raising of the dam at Scoggins Reservoir. Without the dam raise, the ultimate capacity of the system may be as large as 120 mgd.

D. 1. New Issues and Developments

Study to Raise Hagg Lake (Scoggins Reservoir). Clean Water Services and the U.S. Bureau of Reclamation are leading a study to assess the feasibility of raising the dam at Scoggins Reservoir. These agencies are joined by a number of supporting partners including those of the cities of Hillsboro, Beaverton, Forest Grove, Tigard, Tualatin, as well as the Tualatin Valley Water District. Currently, studies are being conducted into the potential expansion of Scoggins reservoir to add as much as 50,600 ac-ft, of which 18,600 ac-ft would become available to JWC partners, as well as an additional 17,000 ac-ft to the cities of Tigard, Tualatin, Sherwood, North Plains, Cornelius and Banks.

In a parallel effort, the group is examining the future potential for construction of a raw water pipeline from Scoggins to the Joint Water Commission's treatment plant and points farther to the east in order to address raw water conveyance restrictions caused by the natural limitations of the Tualatin River channel. This would add significant source to the west side purveyors. The results of the various studies are critical for any further consideration with regard to the future expansion potential for this source. Construction of the Sain Creek tunnel also will improve the reliability of the amount of water stored in Hagg Lake from year to year.

Facilities Expansions. At the time the 1996 RWSP was published, the design phase of the Barney Reservoir expansion was being completed. In addition, the JWC was completing

improvements to its intake and treatment plant. Both of those projects have been completed, leaving that source with a present finished water delivery capacity of 60 mgd. Barney Reservoir expansion was completed in 1996 and now provides 18,000 ac-ft of gross storage for M&I use. Furthermore, the JWC treatment plant was expanded to a peak-day capacity of 70 mgd in 1998. The effect of this development has been to expand the availability of treated water to water purveyors in the western portion of the region. Future expansion of those facilities is dictated by the potential expansion of raw water storage in Scoggins Reservoir. If the Scoggins dam is raised, the JWC could produce as much a 160-180 mgd during peak times. On the other hand, without Scoggins, the JWC has identified an ultimate 2040 peak-day capacity of 120 mgd at the water treatment plant.

Integrated Water Resources Management Group. The IWRM Group was formed in 1999 as a framework in which the water resources stakeholders in the Tualatin River Basin could consider their needs in a watershed-wide perspective. The 1999 report prepared by the group outlined their primary source options to include expanding imports from the City of Portland, development of the Willamette River and expansion of Scoggins Reservoir. As a follow on, the group is developing a Tualatin Basin water supply study. Of these options, only that of imports from the City of Portland and expansion of Scoggins Reservoir now serve as potential options. The Willamette River is being considered to supply agricultural uses and transferring agricultural use in Scoggins Reservoir to M&I use.

Listed Species Under the Endangered Species Act. Since 1996, chinook salmon and steelhead have been listed for the Upper Willamette system under the Endangered Species Act. This listing also affects the Trask/Tualatin River source option. In February 1999, NMFS proposed critical habitat for the recovery of steelhead trout. The proposed critical habitat included tributaries to the Willamette. As mentioned in the discussion for the Bull Run option, Section 4 rules are in place for steelhead and chinook and the take prohibition is enforceable, but project-specific requirements are subject to site-specific analysis and negotiation.

D. 2. Existing Water Rights and Applications

Purveyors holding water use permits in the Trask/Tualatin River system include the cities of Forest Grove, Hillsboro, Beaverton and the Lake Oswego Corporation. These water rights allow for access to both natural flow (i.e., instream) and stored waters. A summary of the existing municipal and instream rights in the Trask/Tualatin River system is shown in Table 4(2)-13.

On paper, natural flow water rights total approximately 165 cfs that allow for diversion at the Springhill Pump Station. However, the actual total is 115 cfs because JWC has agreed to give up 50 cfs from permit S-46423 to develop the 75 cfs under permit S-50879. Access to this water, however, is governed by priority date and many such rights held are junior to the instream flow requirements set by OWRD for the Tualatin River. As such, access during low-flow periods (i.e., summertime) is limited. The total rights available for withdrawal at the Springhill diversion during the summertime is typically restricted during a substantial portion of the period extending from about mid-May 15 to mid-September.

The most senior instream right has a priority date of May 25, 1966, on the Tualatin River and Sain Creek. Table 4(2)-16 summarizes the available water rights relative to this instream right and the current capacity of the JWC water treatment plant. Water rights associated with the Forest Grove and Cherry Grove treatment plant are discussed in the section including local sources.

Permits for Barney and Scoggins reservoirs allows water to be released at a total rate of 226.7 cfs as shown in Table 4(2)-16. There are some issues that need to be resolved with these rates however. A determination has to be made whether the rate of 38.7 cfs from Permit S-32139 can be withdrawn from Barney reservoir since the Middle Fork of the North Fork of the Trask River feeds into Barney reservoir. In addition, the 75 cfs from permit S-50879 is planned for use with a pipeline that is yet to be constructed. Thus, excluding these two water rights, there is currently 113 cfs available for municipal use from storage rights.

Barney Reservoir is permitted to store a total of 20,000 acre-feet, of which 2,000 acre-feet is designated for pollution abatement and flow augmentation in the Tualatin River. There is also a mandatory loss factor applied for evaporation, fish flow and dead pool loss that reduces the gross storage by about 21 percent. Table 4(2)-14 summarizes the storage ownership for Barney Reservoir. Scoggins Reservoir is designed to store a total of 67,900 ac-ft with a loss factor of three percent (3 percent) applied for evaporation losses. Table 4(2)-15 summarizes the storage ownership for Scoggins Reservoir. Note that the water rights owned by the Bureau of Reclamation shown in Table 4(2)-15 is shared among the members of the JWC, Tualatin Valley Irrigation District, Clean Water Services and the Lake Oswego Corporation via a Bureau of Reclamation contract.

D. 3. Water-Rights Issues Affecting Source-Option Development

There are six main water-rights issues regarding the development of the Trask/Tualatin: (1) the quantity of water rights not put to beneficial use, (2) quantity of water rights junior to instream rights, (3) quantity of non-municipal use water rights, (4) water rights contingent on storage option, (5) impacts of potential ESA rulings, and (6) quantity of water rights available from unutilized irrigation rights. The primary water-rights issue with development of the Trask/Tualatin River system is resolving the future use of irrigation rights and the limitations posed by instream rights.

Water providers using the Trask/Tualatin system have several water rights that are not fully utilized. Although unlikely, the unused or unperfected rights can potentially be cancelled by OWRD if needs are not demonstrated. As discussed above, the Trask/Tualatin system is often controlled during the low-flow period by instream rights. This along with other senior non-municipal rights places limits on the reliability of the supply in terms of water rights.

There are also a significant quantity of non-municipal use water rights associated with irrigation and agricultural use that can compete with municipal uses in those cases where the municipal water rights are junior.

To date however, the rate of withdrawal for irrigation demands is typically a lot less than its permitted maximum. Thus, there is potential for utilizing the unused irrigation rights for municipal uses. The control of these releases remains in the hands of the outside entities –

for the Barney Reservoir it is the State's Watermaster and for Scoggins Reservoir it is the Bureau of Reclamation.

In addition, there is the potential for future discharges to the Tualatin River to be further limited in order to improve water quality and protect endangered species. Since 1996, chinook salmon and steelhead have been listed for the Upper Willamette system under the ESA. This listing also affects the Trask/Tualatin River source option. Section 4 rules are now in place for steelhead and chinook, and take prohibition is enforceable; however, enforcement will likely come in the form of conditions on an "incidental take permit" issued to individual providers or facilities. Project-specific requirements are subject to site-specific analysis and negotiation. This would require a greater balance between flow augmentation and protection against habitat degradation and necessarily affect any new and potentially existing water rights.

Table 4(2)-13
Summary of Water Rights with Diversion at Springhill Pump Station
Regional Water Providers Consortium

Purveyor	Total Water Rights (cfs)	Installed Treatment Capacity at JWC-WTP (cfs)	Remaining Rights Senior to Instream Rights (cfs)	Remaining Rights Junior to Instream Rights (cfs)
Springhill Diversion				
Beaverton	25	23.2 cfs (15 mgd)	0	1.8
Forest Grove	33	12.4 cfs (8 mgd)	0	20.6
Hillsboro	57	41.7 cfs (27 mgd)	0	15.3
Tualatin (TVWD)	0	15.5 cfs (10 mgd)		-15.5
Total	**115**	**92.8 cfs (60 mgd)**	**0**	**22.3**

Notes:
The total 92.8 cfs capacity is apportioned to JWC members based on their ownership share in the JWC WTP.
The instream right referenced is the most senior instream rights in the Trask/Tualatin system (priority date of May 25, 1966)
Hillsboro relinquished a total of 50 cfs of their junior rights in trade of additional future rights at Scoggins reservoir.

Table 4(2)-14
Summary of Storage Holdings in Barney Reservoir
Regional Water Providers Consortium

Entity	Storage Allocation	
	Gross Storage (ac-ft)	Net Storage[1] (ac-ft)
Hillsboro	6,200	4,870
Forest Grove	500	393
Beaverton	4,300	3,378
TVWD	7,000	5,498
CWS	2,000	1,571
Totals	20,000	15,710

[1] *loss factor applied for evaporation, fish flow, and dead pool loss that reduces the gross storage by about 21 percent*

Table 4(2)-15 Summary of Storage Holdings in Scoggins Reservoir Regional Water Providers Consortium		
	Storage Allocation	
Entity	**Gross Storage (ac-ft)**	**Net Storage[1] (ac-ft)**
JWC Members		
Hillsboro	5,000	4,850
Beaverton	4,000	3,880
Forest Grove	4,500	4,365
TVWD	0	0
CWS	16,900	16,393
TVID	37,000	35,890
Lake Oswego Corp.	500	485
Totals	67,900	65,863

[1] *Loss factor of three percent (3%) applied for evaporation losses.*

D. 4. Capital and Operating Costs

Capital and operating costs for the Trask-Tualatin River source options are based on information provided during interview with the Joint Water Commission. Cost estimates provided in Table 4(2)-16 only include those Trask-Tualatin River source options determined to be the preferred option by JWC members at the time of the RWSP Update modeling in May 2004.

D. 5. Summary Evaluation of Hagg/Scoggins Source-Option Issues

This source option was not evaluated in the 1996 RWSP. However, because the source option is related to reservoir expansion, the most critical criteria will be related to environmental impacts and ease of implementation regarding permitting issues. The IWRM Group is likely to emphasize Scoggins Reservoir as the primary source for additional supply. Moreover, as with the other source options, the outcomes of the climate change study prepared for the Bull Run supply would also likely apply to the Trask/Tualatin system, leading to reduced yields of the surface water system in the summertime period and potentially extended periods of time requiring service from raw water storage. A summary of other new issues and developments is listed in Table 4(2)-17 below. Many of the issues noted have relatively minor effects on the source-option evaluation but are included for reference and completeness.

Table 4(2)-18 includes a summary of the issues and developments discussed above that affect the evaluation of the source-option issues. Recall from Section 1.4, that numerical ratings for some of the source-option issues have been developed. Ratings are developed for these same source-options issues for the Trask/Tualatin source. These ratings are based on comparison of the ratings from the 1996 RWSP for the other sources in conjunction with the issues and developments noted in Table 4(2)-18.

Table 4(2)-16 Cost Summary for Trask-Tualatin River Options Regional Water Providers Consortium				
Option	**Description**	**Capital Cost**	**Operation and Maintenance**	**Comments**
Scoggins Dam Raise and Sain Creek Tunnel	• Project includes Scoggins dam raise of 40 feet ("40 Year Capital Improvement Plan") • Also included is the project to construct a tunnel and transmission line from Tualatin River to Sain Creek.	$150,000,000 ($106M is M&I Share)	$1,500,000	• Capital costs per Hillsboro estimates (Joe Thompson, 2003); note that Scoggins Dam and Tunnel is estimated at $150M, but $106M is the M&I share of the project. • Annual Dam and Tunnel operations and maintenance calculated by assuming 1% of capital costs.
Water Treatment Plant Upgrade	• WTP expansion of 40 mgd (to total 150 mgd).	$60,000,000	$5,110,000	• Annual WTP operations and maintenance calculated by assuming a $0.35 per 1000 gallons.

Note: Cost is in 2002 dollars

Table 4(2)-17 New Issues Affecting Trask/Tualatin River Option Regional Water Providers Consortium
Major Developments
▪ Study to raise Hagg Lake (Scoggins Dam) being completed through Clean Water Services and BOR ▪ Barney Reservoir project has been completed and is on-line ▪ Integrated Water Resources Management (IWRM) Water Supply Feasibility Study examines water supply alternatives to increase supply within the Tualatin Basin, including Hagg Lake expansion (May 2001 agreement)
Supply Works Constructed or Committed
▪ JWC plans to construct a new 20 MG finished water reservoir at Fern Hill ▪ JWC will complete construction of its North Transmission Line Phase II by end of 2003. Pipeline will increase transmission capacity to over 140 mgd. Raw water pipeline committed and in base case.
Related Studies
▪ Hillsboro, TVWD, Forest Grove, and Tigard have all recently completed updated master plans. In addition, the JWC has also prepared a coordinated draft 40-year capital improvement plan. ▪ JWC members are looking toward an aggressive plan to expand infrastructure and supply capacity. Ultimate capacity will depend on feasibility of Scoggins expansion. JWC plans to expand existing treatment plant to between 120 to 180 mgd, depending on Scoggins expansion
Other Local/Regional Planning Efforts
▪ The City of Tigard has joined the JWC as a new member.

Table 4(2)-18 Summary Evaluation of Source-Option Issues – Trask/Tualatin River Regional Water Providers Consortium	
Water Availability	
Rating: N/A *Modeled by CWS in Phase II Tualatin Basin Feasibility Report.*	• Trask/Tualatin system is often controlled during the low flow period by instream rights. This along with other senior non-municipal rights places limits on the reliability of the supply in terms of water rights. • Potential for utilizing the unused irrigation rights for municipal uses • Facilities expansions (Barney Reservoir and JWC plan expansion) has expanded the availability of treated water to water purveyors in the western portion of the region. Future expansion of those facilities is dictated by the potential expansion of raw water storage in Scoggins Reservoir. • Climate change study indicates that average stream flows will increase in the winter, while late spring and summer flows will decrease. • Modeling done by TBFS shows that expanded reservoir would fill 80% of the time in all years.
Environmental Impacts	
Natural Rating: 4.5 Human Rating: 3.2	• Since 1996, chinook salmon and steelhead have been listed for the Upper Willamette system under the Endangered Species Act • Scoggins Dam raise would affect riparian wetlands adjacent to Hagg Lake • Scoggins Dam raise could also affect terrestrial wildlife and their habitat as well as recreational issues.
Raw Water Quality	
Rating: 2.0	• LT2ESWTR/Stage 2 D/DBP will have a significant impact on the treatment requirements for all surface water sources • There is the potential for future discharges to the Tualatin River to be further limited in order to improve water quality and protect endangered species
Vulnerability to Catastrophic Events	
Rating: 3.5	• Low probability for terrorist acts for Trask/Tualatin source. The source is isolated which limits ability to secure the source. However, its relative remoteness also limits accessibility. • Trask-Tualatin has some vulnerability to upstream spills. • Low to moderate potential for fires and susceptibility to increased sediment and nutrient loads.
Ease of Implementation	
Rating: N/A *Ease of implementation will depend on individual circumstances at the local level*	• ESA is a limiting factor for constructing the Scoggins Dam Raise as well as other associated projects such as the Sain Creek Tunnel and water treatment plant expansion • Community impacts and public acceptance can be an issue
Treatment Requirements	
Rating: N/A (not quantified)	• Existing water treatment plants are effective in properly treating the source water. • No significant changes to issues impacting the Trask/Tualatin option's treatment requirements.
Capital and Operating Costs	
Rating: N/A *Refer to cost table for each source option*	• No other significant changes to issues impacting the Trask/Tualatin option's capital and operating costs.

E. Aquifer Storage and Recovery Option

In 1996, no ASR projects were being undertaken in the Portland regional area. Some planning had been initiated by the cities of Beaverton, Tigard, Tualatin Valley Water District (TVWD) and Mt. Scott Water District. Conceptually, ASR was being considered as a means to assist in meeting peak-season demand, provide emergency backup system benefits, and improve water quality by lowering temperatures in the distribution system during the summer. The two "regionally significant" sites evaluated in the RWSP were to be located in the Powell Valley areas southeast of Gresham and the Cooper-Bull Mountain area southwest of the City of Beaverton. The option was projected to supply an additional 40 mgd seasonal yield (20 mgd at each site). Smaller ASR sites in other locations were not considered.

The 1996 RWSP rated the raw water quality for ASR as significantly below that of the other supply options. However, water quality for this option is highly dependent on the actual site conditions for a given ASR project. The 1996 RWSP concluded that the major advantages of ASR are its low cost and ability to augment summer supplies utilizing winter flows. Although limited site-specific information was available at the time, general knowledge indicated that advantages included relatively minor environmental impacts, good water quality and possible locations near areas where anticipated needs would occur.

This source option consists of injecting treated water into suitable aquifers for underground storage. The water would be injected through wells during low-water system demand periods and then recovered from the aquifer through the wells to meet peak summer period demands. Several ASR studies and pilot projects are now under way or have been completed. The ASR source option for this current update is modified to include sites recently investigated by the cities of Tigard, Tualatin, Sherwood, Beaverton and Portland, as well as TVWD, Sunrise Water Authority and Clackamas River Water.

E. 1. New Issues and Developments

ASR Studies and Ongoing Pilot Projects. Several ASR studies and pilot projects are now under way or have been completed. Sites investigated include those by the cities of Tigard, Tualatin, Sherwood, Beaverton and Portland, as well as TVWD, Sunrise Water Authority and Clackamas River Water. (See Table 4(2)-19)

The City of Beaverton has completed initial pilot testing and is now in the process of testing a full-scale pilot project with a 6 mgd capacity. The City of Tigard has also completed initial screening of sites and is in the process of preliminary pilot testing with the intent of ultimately developing a 6 mgd facility. Similarly, Clackamas River Water has just begun pilot testing and contemplates a future 5 to 6 mgd facility. TVWD also recently began pilot testing on an existing well, but reportedly found the well site to be unsuitable for ASR; however, the test indicated a storage capacity of 11 mg at the site. The cities of Tualatin and Sherwood and the Sunrise Water Authority are all in the initial stages of site development and screening.

Table 4(2)-19 Summary of On-going or Planned ASR Projects Regional Water Providers Consortium				
ASR Site	**Feasibility Study completed (Y/N) / date**	**Number of ASR Wells as of 2004**	**Pilot storage and recovery capacity**	**Future potential storage and recovery capacity (goal)**
Tigard	Yes / 2001	2	250 MG / 2.5 mgd	500 MG / 6 mgd
Tualatin	Yes / 2002	1	1 mgd	TBD
Sherwood	Yes/2001	0	TBD	TBD
TVWD	Yes / 1997	1	TBD	TBD
Portland	Yes / 2000	4	1000 MG/ 12 mgd	>3000 MG / > 20 mgd (TBD)
Beaverton	Yes / 1997	3	500 MG / 4 mgd	500 MG/6 mgd (5 wells)
Sunrise	Yes / 1998	0	TBD	TBD
Clackamas	Yes / 2000	1	100 MG / 1 mgd	5-6 mgd

The City of Portland began ASR pilot testing at CSSWF in May 2002. The Bureau of Water Works holds an ASR Limited License issued by Oregon Water Resources Department that became effective September 2001 and is good through September 2006, and allows testing in two aquifers in the Columbia South Shore Well Field (CSSWF). The license allows testing of up to seven wells in two aquifers. Table 4(2)-20 summarizes the ASR plans for the City of Portland. Total potential storage volume of a full-scale permanent system will be determined following pilot testing.

Table 4(2)-20 Columbia South Shore Well Field ASR Summary Regional Water Providers Consortium				
Aquifer	**Total Potential ASR wells**	**Total Potential Storage Volume (Estimated) (BG)**	**Number of Pilot Test Wells**	**Pilot test schedule**
Sand and Gravel Aquifer (SGA)	12 to 14	4,000 to 5,000	4 – 5	2002-2005
Troutdale Sandstone Aquifer (TSA)	5 to 7	800 to 1,200	2	2004-2006

The various regional ASR projects are for the most part in relatively early pilot phases, so it will be some time before the regional ASR potential capacity and effectiveness are known. If all the regional ASR pilot projects become permanent, it is possible that regional ASR recovery storage volume and recovery capacity will exceed 4 billion gallons and 40 mgd, respectively. However, the decisions to implement these projects may not be made at the same time, so the development of ASR is likely to occur incrementally over the next five to 10 years. Recent (1997 OAR 690-350) regulations are in place to guide the process of pilot

testing ASR and also for expanding ASR pilot systems into a permanent operation. As with other types of water infrastructure, land-use compatibility can be an issue, for example when it is necessary to place ASR facilities such as wells or pipelines outside the urban growth boundary. New regulations regarding ASR have been developed since the 1996 RWSP. In particular, development of ASR infrastructure in rural areas may encounter issues with recent legislation. Due to issues associated with providing infrastructure developments that take place on Exclusive Farm Use (EFU) zoned lands the Legislature enacted ORS 215.213(1)(d) and 215.283(l)(d), which requires that a special alternatives analysis be done of facilities that pass through or are located on EFU zoned lands. Cost alone cannot be the reason why facilities may be located on EFU lands. The likelihood of being able to develop large ASR facilities as selected by the RWSP has been determined to be less than ASR developed in smaller amounts throughout the region.

E. 2. Existing Water Rights and Applications

Limited licenses were approved by OWRD to conduct ASR pilot testing at sites operated by the cities of Tigard, Tualatin, Sherwood, Beaverton, as well as Sunrise Water Authority, Clackamas River Water, TVWD, and the City of Portland. No permanent ASR permits have been issued by OWRD to any municipal water providers within the State.

E. 3. Issues Affecting Source-Option Development

Issues discussed for each of the other source options apply to the ASR option where water rights to winter flows need to be obtained. Other issues specific to ASR include:

- A limited license to store and use water injected into an aquifer for aquifer storage and recovery purposes must be obtained from OWRD.
- After completion of a test program under the limited license, the applicant may apply for a permanent ASR permit. Where existing water rights for the injection source water have been issued, OWRD is required to conduct a public review process for the ASR permit.
- DEQ requires that the receiving aquifer not be degraded. Accordingly, annual reporting and monitoring may be required.

ESA could potentially affect water rights approvals for ASR projects. Even though most critical flows for fish are in the summer months, winter season flows can be important to maintaining suitable habitat (e.g., flushing sediment) and could conceivably be regulated under ESA authorities. Given the relative abundance of winter flows, pattern of use might be a more important factor than total quantity diverted.

E. 4. Capital and Operating Costs

Capital and operating costs for the Aquifer Storage and Recovery source options are based on general assumptions for constructing and operating ASR systems. Cost estimates provided in Table 4(2)-21 only include those ASR source options to be used in the source scenario

strategies. Other ASR systems are considered as "base case" (i.e., pending projects) and are not included in this report.

E. 5. Summary Evaluation of ASR Source-Option Issues

The results of the studies and pilot projects have the most significant effect on water availability and ease of implementation. Further pilot testing results are needed to verify the potential storage volumes, recovered water quality and recovery capacity provided by this alternative. Such results should become available during the next five years as the existing projects progress through several years of pilot testing and subsequent refinements. A summary of other new issues and developments is listed in Table 4(2)-22.

Table 4(2)-23 includes a summary of the new issues and developments discussed above that affect the evaluation of the source-option issues. Recall from Section 1.4, that numerical ratings for some of the source-option issues have been developed. These ratings are based on the evaluation from the 1996 RWSP in conjunction with the new issues and developments noted in Table 4(2)-23. Changes to the ratings are noted in the table where they have been made. In general, the ratings remained the same or changed only by a fraction, although the ASR projects are smaller in scale than the projects defined in the 1996 RWSP.

Table 4(2)-21 Cost Summary for Aquifer Storage and Recovery Options Regional Water Providers Consortium				
Option	**Description**	**Capital Cost**	**Operation and Maintenance**	**Comments**
Clackamas River Water ASR	• Develop 2 million gallon per day (mgd) at existing well (per CRW)	$2,000,000	$54,300	• Capital costs derived by assuming $1 per gallon; 1% of capital costs contingency added for O&M in addition to power costs • Power demand costs were estimated for all ASR and ground water projects based on the following assumptions: lift at 300 feet, 70% efficiency, $0.07/kW, pumps operating 50% of the time
Sherwood ASR	• Develop 3 mgd facility	$3,000,000	$81,300	• Same assumptions
Tualatin ASR	• Develop 5 mgd facility	$5,000,000	$135,900	• Same assumptions

Note: Cost is in 2002 dollars

Table 4(2)-22 New Issues Affecting Regional Aquifer Storage and Recovery Option Regional Water Providers Consortium
Major Developments
▪ Individual purveyors are pursuing ASR more on a local / subregional scale as opposed to the two 20 mgd regional east and west side options considered in the 1996 plan. Future availability of the local ASR for peak season will influence how the major regional sources are managed during peak season.
Supply Works Constructed or Committed
▪ City of Beaverton now in the process of full-scale pilot testing for a 6 mgd facility. ▪ Tigard initial feasibility study in June 2001 and is now in the process of initial pilot testing. Plans are to construct a 5-6 mgd facility. ▪ CRW and TVWD are also conducting pilot testing. Favorable results have been gathered by CRW that would warrant further development, while TVWD found its retrofitted older well was not at a good location for large volume storage. ▪ City of Portland conducted a pilot test in the CSSWF in 2002 and 2003 subsequent years. The pilot-scale facility construction is complete.
Related Studies
▪ Tualatin, Sherwood, and Sunrise have also initiated preliminary site investigations. Tualatin completed a feasibility study in 2002 and is drilled an exploratory test/pilot well in 2002. ▪ Powell Valley area studies have not been initiated
Other Local/Regional Planning Efforts
▪ N/A

Table 4(2)-23 Summary Evaluation of Source-Option Issues – ASR Options Regional Water Providers Consortium	
Water Availability	
Rating: N/A (not quantified in 1996 RWSP)	• Water rights are not a limitation since most entities have access to already permitted water rights in the winter in excess of hat needed to meet actual winter demand. The City of Portland has exclusive and prior rights to the waters of the Bull Run watershed, with the exception of potential ESA requirements. PWB is conducting a variety of studies in the Bull Run watershed to respond to these ESA requirements (see environmental impacts). • OWRD has defined Groundwater limited areas that may impact the areas where ASR can be developed. • No other significant changes to issues impacting the ASR options' water availability.
Environmental Impacts	
Natural Rating: 4.9 *(4.9)* Human Rating: 3.6 *(3.6)*	• The following species have been listed for the Lower Columbia River (which includes the Bull Run watershed tributaries): chinook salmon, chum salmon, and steelhead. • Smaller ASR projects are likely to have less environmental impacts • OWRD has defined Groundwater limited areas that may impact the areas where ASR can be developed. • No other significant changes to issues impacting the ASR options' environmental impacts.
Raw Water Quality	
Rating: 1.2 *(1.2)*	• No other significant changes to issues impacting the ASR options' raw water quality.
Vulnerability to Catastrophic Events	
Rating: 3.5 *(3.5)*	• Concern for terrorist acts is a low for the ASR source. • No other significant changes to issues impacting the ASR options' vulnerability to catastrophic events.
Ease of Implementation	
Rating: N/A *(4.5)* *Ease of implementation will depend on individual circumstances at the local level*	• Infrastructure developments that take place on Exclusive Farm Use (EFU) zoned lands the legislature enacted ORS 215.213 (1)(d) and 215.283 (l) (d), which requires that a special alternatives analysis be done of facilities that pass through or are located on EFU zoned lands. • Groundwater system at the site of the Bull Run wells is highly pressurized and makes the feasibility of a gravity-fed ASR recharge system questionable. • Groundwater development project is currently scheduled to be complete with wells operational by 2006-2007. • Smaller projects are easier to implement.
Treatment Requirements	
Rating: N/A (not quantified in 1996 RWSP)	• No other significant changes to issues impacting the ASR options' treatment requirements.
Capital and Operating Costs	
Rating: N/A *Refer to cost table for each source option*	• No other significant changes to issues impacting the ASR options' capital and operating costs.

F. Columbia South Shore Well Field Option

This source was not evaluated as an additional expansion option in the 1996 RWSP. It was accounted for in the base case of existing supplies. In this update, the CSSWF will be considered a summertime augmentation source and emergency backup. The CSSWF is located near the Columbia River between the Portland Airport and Blue Lake Park. When the well field was constructed, 22 wells were installed totaling about 90 mgd in capacity. However, due to contamination problems discovered in 1986, the useable delivery capacity was assumed to be approximately 35 mgd in the 1996 RWSP discussion and projected to 72 mgd based on expected remediation to occur within 10 years. At that time, CSSWF had been used five times since its construction to augment summer water supply from the Bull Run watershed reservoirs.

F.1. New Issues and Developments

Status of CSSWF. In recent years, PWB began to periodically augment summer supply (up to 25 percent) with CSSWF water, and may possibly use the CSSWF facility to store Bull Run water. The wells have been used to either augment summer supplies or for emergency events in 1996, 1998, 1999, 2000, 2001, 2003 and again in 2004.

PWB improvements in recent years are addressing the overall reliable capacity and water quality of the well system, primarily by developing new (deep) wells and retiring older (shallow) wells with water quality problems. The plan involves minimizing reliance on vulnerable shallow aquifers and developing new wells in deeper, well-protected aquifers that are also considered suitable for ASR. The objective is to develop reliable long-term capacity of 95 mgd for 120 days or more using well supplies from CSSWF and, possibly, Bull Run.

Since 1996, three new CSSWF wells have been drilled and a project is under way to connect two existing wells to the groundwater system (Wells 28 and 34). Table 4(2)-24 summarizes the groundwater development projects at CSSWF. As Table 4(2)-24 indicates, these projects add a peak yield of about 21 mgd to the CSSWF for relatively short-term emergency operation of up to 30 days. The increase in long-term yield is estimated to be on the order of 15 mgd.

Two Parkrose wells were connected to the CSSWF system in the summer of 1999 and will be used until a replacement SGA well is drilled at the same location to retire these 40 year-old shallow wells. The current short-term CSSWF capacity (30 days) is at least 90 mgd and current long-term capacity is 70 to 75 mgd.

Since 1996, one well (32, CRSA, ~4.5 mgd) has been removed from service joining Well 17 (Blue Lake Aquifer) in this category of wells drilled, constructed and operated and then retired due to significantly elevated concentrations of either iron or manganese, or both.

Remediation efforts overseen by Oregon DEQ have enabled the Portland Water Bureau to have unrestricted access to its wells, though decisions to minimize potential risks of moving contaminates in surrounding areas risk are incorporated into yearly summer pumping plans.

Table 4(2)-24
Groundwater Development at Columbia South Shore Well Field
Regional Water Providers Consortium

Wells & Aquifer	Dates Drilled	Yield (Gpm)	Yield (Mgd)	Remarks
35, 36, 37 (SGA)	2000-2001	35: 3000 36: 3000 37: 3600	4.3 4.3 5.2	Currently available for supply
28 (TSA) and 34 (SGA)	1985 (site improvements and pipelines in design)	28: 2000 34: 3000	2.9 4.3	Scheduled for completion February 2005

CSSWF Expansion Alternatives. Given PWB's objective of establishing a reliable long-term groundwater yield of 95 mgd, additional groundwater supply is needed to take the current reliable capacity from 75 to 95 mgd. Current plans are to develop and additional 10 mgd in the western part of the CSSWF on property owned by the Port of Portland. Here, PWB has potential easement rights for up to five wells and approximately 15 mgd from two aquifers. An additional 10 mgd of additional expansion beyond the west well field is also planned in the existing well field including such alternatives as the development of a collector well system in the Blue Lake Aquifer. The expansion alternatives are summarized in Table 4(2)-25. Expansion beyond ~100 mgd in the CSSWF would require expansion of the existing groundwater pump station and a change in the groundwater conveyance system, for example, connection of the well system to a local distribution main.

Table 4(2)-25
Summary of CSSWF Alternatives
Regional Water Providers Consortium

Alternative	Capacity	Capital Cost
West well field 5 wells	15 mgd[1]	$6M
Blue Lake Collector Well System	30 mgd[2]	$18M

NOTE:
1 – Not planned unless Bull Run wells are not developed or reliable capacity > 95 mgd overall is needed.
2 – Future expansion option, or a possible option in place of either Bull Run wells and west well field (capacity and cost figures from 1999 study would need review).

F.2. Existing Water Rights and Applications

All of the water rights associated with the CSSWF are owned by the City of Portland. Five groundwater permits dictate the terms of groundwater appropriation in the CSSWF and none have been certificated. The permits total 338.6 mgd.

F.3. Water-Rights Issues Affecting Source-Option Development

The City of Portland intends to maintain the CSSWF as a backup water supply source with plans to increase the firm production capacity to approximately 100 mgd or annual average of system demands. Based on a desire to achieve annual average capacity, options are being considered to increase well field production by 20 to 30 mgd. Options include increasing well capacity of existing wells, constructing new wells and developing ASR in the CSSWF. Although existing permitted water rights are sufficient to meet the future anticipated demand, the requirement to submit municipal permit extensions could be an issue. Portland submitted their extension in July 2004.

F.4. Capital and Operating Costs

Capital costs for the Columbia South Shore Well Field are shown in Table 4(2)-25 based on information from PWB. The CSSWF is considered a base case option, and some additional groundwater capacity was included for both the CSSWF and the Bull Run groundwater in the *Confluence* modeling.

F.5. Summary Evaluation of Columbia South Shore Well Field Source-Option Issues

This source option was not evaluated in the 1996 RWSP, and although the CSSWF is included as a source option, PWB does not intend to use it as a primary source, but to maintain it as an emergency supply and as a peak-season supply so long as the region must depend on it. The most significant evaluation criteria for this alternative include water availability, raw water quality, treatment requirements and ease of implementation in terms of feasibility. The noticeable difference in aesthetic water quality relative to Bull Run water is also a concern for some customers, for example wafer manufacturers are very sensitive to changes in silica content even though neither of Portland's sources are high in silica. A summary of other new issues and developments is listed in Table 4(2)-26. No summary evaluation table is provided for the CSSWF source options since it is an existing facility and will be considered a base case source used to meet emergency and peak summer demands.

Table 4(2)-26 New Issues Affecting Columbia South Shore Well Field Option Regional Water Providers Consortium
Major Developments
▪ Current approach is to maintain the CSSWF for summertime use when it is needed. ASR may integrate into the peak-season strategy over the long-term. ▪ PWB plan is to maintain reliable capacity of wells 90 to 100 mgd for emergency backup. Future expansion beyond 90 to 100 mgd is possible.
Supply Works Constructed or Committed
▪ Five wells and 20 mgd: Three new wells have been installed in the CSSWF by the City of Portland and two others previously drilled will be brought on line by late 2003. Parkrose wells will be retired and replaced by a new SGA well.
Related Studies
▪ Modeling study of groundwater development and yield and feasibility of ASR ▪ Bull Run wells – a pilot well project has confirmed the feasibility of 10 mgd of well supply near Bull Run headworks for possible future development.
Other Local/Regional Planning Efforts
▪ Use of the well field is accepted and receives scrutiny; overall the region has historically been more comfortable relying on surface water supplies as the primary sources. ▪ Wellhead protection plan has been updated to include areas outside City of Portland (eg. Gresham and Fairview)

G. Willamette River Diversion Option

In 1996, the Willamette River was not being used as a municipal water source for the Portland metropolitan region. Flows in the Willamette River continue to be controlled by 13 upstream reservoir projects operated by the U.S. Army Corps of Engineers. The reservoirs were constructed primarily for flood control, while storage releases from these reservoirs provided more than half the flows from August to October. In addition, the Bureau of Reclamation holds water rights to divert the total usable storage of 1.6 billion ac-ft for irrigation; however, only a very small percentage of this amount had actually been contracted for irrigation use. Hence, at the time of the 1996 RWSP, the State of Oregon and other stakeholders initiated a study to reauthorize how the stored water should be allocated and how the reservoirs should be operated in the future. At that time, substantial quantities of water had been identified for possible M&I use. It was anticipated that the Willamette River option could provide as much as 154 mgd of additional supply using permits held by regional providers, and potentially more if additional applications were pursued.

The evaluation in the 1996 RWSP concluded that although Willamette River raw water quality was good, it was not as good as the Bull Run or Clackamas River. In addition, protection of the watershed would be difficult because of the size of the basin along with the high number of potential contamination sources. Beyond these issues, significant instream water rights and flow targets had also been established for the Willamette River that may limit future access. While the Willamette River option, as it was assessed in the 1996 RWSP, was relatively expensive in terms of meeting regional needs, recent experience shows it may be among the less costly options to address specific local needs. Benefits of the Willamette option include providing a new source that would reduce the vulnerability of the region to catastrophic events, as well as having fewer transmission costs.

For the purposes of forecasting future allocation of regional water supply, the RWSP Update identifies the Willamette River as the City of Wilsonville's primary source, with local wells as Wilsonville's secondary source. While the Willamette is available to meet the needs of other jurisdictions as well, the RWSP Update assumes demand outside of Wilsonville will be met from sources other than the Willamette River. The RWSP Update acknowledges that individual jurisdictions retain the ability to supplement local water supply with water from the Willamette if they choose to do so in accordance with local decision-making processes.

G.1. New Issues and Developments

Wilsonville Water Treatment Plant. At the time the 1996 RWSP was written, the City of Wilsonville faced an imminent need for additional supply. After years of studies and extensive public involvement, Wilsonville selected the Willamette River over the other supply options. TVWD shares ownership of the plant (including much of the land, excess capacity of the yard piping and finished water pipeline) and 5 mgd of the water treatment plant capacity. The Wilsonville Water Treatment Plant was completed April 29, 2002, and has a current capacity of 15 mgd (with an intake capacity of 70 to 120 mgd). The City of Wilsonville Water Master Plan calls for future expansion whose timeframe is dependent on demand changes over the next five or more years.

Position of Water Purveyors on Use of Willamette River for Municipal Use. Water purveyors acknowledge the requirement in several jurisdictions to conduct a vote of the public before making a decision to tap the Willamette for use as a municipal water supply. Some cities (e.g., Tualatin, Tigard and Sherwood) have stated that they maintain the individual right for such a public vote on whether to use the Willamette River as a source of municipal supply because this source could avoid large transmission costs of obtaining water from another more distant source. TVWD has also not taken a final position on use of the Willamette River, but has enacted an ordinance to say that a vote would be held before TVWD would use the Willamette River as a water source. Until such votes are taken, the forecasts regarding water allocation in the RWSP Update assume these jurisdictions will continue to obtain their water from sources other than the Willamette. In the meantime, Wilsonville will continue the ongoing monitoring program documenting raw water quality at the intake to the Willamette water treatment plant. Recent (2003/2004) studies conducted by TVWD on raw and treated water, as well as sediments around the intake, indicate that the quality of the Willamette is very high.

Listed Species Under the Endangered Species Act. Since 1996, chinook salmon and steelhead have been listed for the Upper Willamette system under the Endangered Species Act. This listing directly impacts this source option. In February 1999, NMFS proposed critical habitat for the recovery of steelhead trout. The proposed critical habitat included the Willamette and its tributaries. As mentioned in the discussion for the Bull Run option, Section 4 rules are in place for steelhead and chinook and the take prohibition is enforceable,

but project-specific requirements are subject to site-specific analysis and negotiation. For the Willamette Water Treatment Plant, the City of Wilsonville together with TVWD applied for and received NMFS approval for and has constructed, an intake structure with a capacity of 70 to 120 mgd.

Status of Bureau of Reclamation Contracts from the Willamette Basin Project. As of December of 2002 the US Bureau of Reclamation (BOR) resumed contract activities in the Willamette Basin ending a moratorium on accepting new irrigation contract applications put into place by mutual agreement of the U.S. Army Corps of Engineers (Corps) and BOR following the listing under the Endangered Species Act of Upper Willamette salmon and steelhead in 1999. Several existing applications that had been previously on hold are also in the process for contracts.

The agreements to resume contract activities did not relieve BOR of obligations under National Environmental Protection Act (NEPA). This means that long-term contracts are not instantly available. In the interim, long-term contract applicants asking for less than 1000 acre-feet have been allowed to utilize short-term contracts while the BOR develops an Environmental Assessment (EA) on their behalf. There are two pending contracts larger than 1000 acre-feet for two irrigation districts, these are required to have separate EA. Both districts are working with the same contractor to resolve conflicts and supply the BOR with enough information to develop their individual EA.

The Corps operate and maintain 13 reservoirs in the Willamette Basin total storage (1.6 million acre feet) and contracts for stored water from the Willamette Basin Project are administered by the BOR under secondary water-right permits issued by the Oregon Water Resources Department (WRD). At the request of the WRD and others in the spring of 2002, the Federal action agencies and consulting services revisited the need for the moratorium on new irrigation contracts. Although all actions must be consistent to protect listed species; because of better coordination by State and Federal Agencies; improved flow modeling and contract conditions the federal agencies subsequently determined that it was no longer necessary to delay processing pending contracts and allowed 10,000 additional acre-feet for future applications while the Biological Opinion required because of the ESA listing. BOR and the Corps amended the proposed action under consultation to include the potential release of water from storage to meet pending contract applications and prospective additional applications yet to be received.

At the time of the ESA listing, BOR had 249 contracts for a total of 59,911 acre-feet of storage serving 31,401 acres. Subsequently, BOR has accepted 26 additional applications for water service, for approximately 25,000 acre-feet of storage eventually this will raise the total number of existing irrigation water service contracts to 275 for a total of about 85,000 acre-feet. The interim allowance 10,000 acre-feet (for a total of 95,000 acre-feet) to the total amount of storage immediately available for water service contracts. The existing contracts constitute about 3.8 percent of the total 1.593 million acre-feet of storage in the Willamette System. The 2002 modification the federal agencies have implemented increase the amount of storage currently used for water service contracts to about 5.9 percent of total storage.

G.2. Existing Water Rights and Applications

Purveyors holding water-use permits for the Willamette River include the City of Wilsonville, Tualatin Valley Water District, City of Lake Oswego and Port of Portland. The total municipal rights associated with the Willamette River totals approximately 260 cfs. At present, only the City of Wilsonville's WTP is utilizing 10 mgd (15.5 cfs) of their 30 cfs municipal water right. Wilsonville utilized a portion of its water rights to the Willamette for the WTP and was granted an extension by OWRD for the remainder of its unused municipal water rights. A total of 473.8 cfs of municipal water-rights applications for Willamette River water is pending. The largest application is by Tualatin Valley Water District with a 387 cfs application. In addition, the City of Portland has filed a surface water claim for 28 cfs of Willamette River water with a priority date of 1883.

The OWRD's Willamette Basin Program has established instream flow requirements. The relevant requirements are those downstream of the existing intake site at Wilsonville. The minimum natural flow required at Wilsonville is 1,500 cfs year round with a priority date of June 22, 1964. The minimum flow from storage releases at this point is up to 4,700 cfs. The minimum natural flows at Oregon City to the mouth have the same flow requirements (1,500 cfs natural flow and 4,700 cfs storage release flow) with a priority date of June 22, 1971. These instream flow requirements, which would be senior to the existing municipal rights, have not actually been permitted as instream rights, however. It is not known whether the minimum flow levels will remain the same when they are converted to water rights status.

G. 3. Water-Rights Issues Affecting Source-Option Development

There are five main water-rights issues regarding the development of the Willamette River: (1) extensions needed for water rights not yet put to beneficial use, (2) adjudication of claims, (3) quantity of non-municipal use water rights, (4) potential to purchase storage in Corps of Engineers reservoirs, and (5) impacts of potential ESA rulings.

Water providers along the Willamette River have several water rights that are not being utilized. Although unlikely, the unused or unperfected rights can potentially be cancelled by OWRD if needs are not demonstrated. There is also a significant quantity of non-municipal use water rights associated with irrigation and industrial use that can compete with municipal uses in those cases where the municipal water rights are junior.

As discussed in the 1994 water-rights review memo, several major pre-1909 filings were made jointly and severally by industrial users, particularly for hydropower at Oregon City, resulting in total claims exceeding the total flow of the Willamette River during significant portions of the year. Any permitting of additional water-rights application on the Willamette River requires a potentially complex review by OWRD and the public. To date, the claims have not been adjudicated and it seems unlikely that the process will be resolved in the near future. In any case, the claims by PGE and others at Willamette Falls create uncertainty as to whether they will be enforced against junior upstream users, since this is a non-consumptive use that predates the development of storage on the Willamette.

The Corps of Engineers operate several reservoir projects on the Willamette River for irrigation and flood control. An application to convert irrigation storage for municipal use can be submitted by the Corps of Engineers. The stored water can then be appropriated under individual applications of municipal users. However, the OWRD review process can be complex and there is uncertainty in completing this process, as well. Furthermore, as discussed in the 1994 water-rights review, OWRD is considering modification of its regulation of released uncontracted stored water. It is currently managed as natural flow. The proposed changes would allow OWRD to protect the uncontracted releases to support instream uses. This could pose issues in utilizing storage releases to satisfy existing rights.

Since 1996 additional species of salmon and steelhead have been listed under the Endangered Species Act. The following species have been listed for the Upper Willamette River: chinook salmon and steelhead. In February 1999, NMFS proposed critical habitat for the recovery of steelhead trout, which included the Willamette River and tributaries to the Willamette. Section 4 rules are now in place for steelhead and chinook that prohibit the take of these species. However, enforcement will likely come in the form of conditions on an "incidental take permit" issued to individual providers or facilities. Project-specific requirements are subject to site-specific analysis and negotiation.

G.4. Capital and Operating Costs

Capital and operating costs for the Willamette River are not included in this report because it is not part of the source options being evaluated in the source-option strategies in this RWSP Update.

G.5. Summary Evaluation of Willamette Source-Option Issues

For purposes of forecasting future allocation of regional water supply, the RWSP Update identifies the Willamette River as Wilsonville's primary source, with local wells as Wilsonville's secondary source. While the Willamette is available to meet the needs of other jurisdictions as well, the RWSP Update assumes demand outside of Wilsonville will be met from sources other than the Willamette. The RWSP Update acknowledges that individual jurisdictions retain the ability to meet/offset/supplement local water supply with water from the Willamette if they choose to do so in accordance with local decision-making processes. In this event, regional and subregional forecasts would be adjusted accordingly to account for such a shift in water allocation. A summary of other new issues and developments is listed in Table 4(2)-27.

Table 4(2)-28 includes a summary of the new issues and developments discussed above that affect the evaluation of the source-option issues. Recall from Section 1.4, that numerical ratings for some of the source-option issues have been developed. These ratings are based on the evaluation from the 1996 RWSP in conjunction with the new issues and developments noted in Table 4(2)-28. Changes to the ratings are noted in the table where they have been made. In general, the ratings remained the same or changed only by a fraction.

Table 4(2)-27 New Issues Affecting Willamette River Option *Regional Water Providers Consortium*
Major Developments
▪ Available to meet/offset/supplement local water supply if desired by individual jurisdictions. ▪ Construction of 15 mgd treatment plant by City of Wilsonville and TVWD (intake capacity of 70-120 mgd)
Supply Works Constructed or Committed
▪ N/A
Related Studies
▪ ▪ Non-potable delivery is being examined for commercial/industrial use in Tualatin/Sherwood area ▪ Studies done by City of Wilsonville and other entities (Sherwood, Tualatin, Tigard, TVWD, Canby, CRW) on potential use of Willamette River for supply purposes including treatment locations and costs. ▪ TVWD has completed water quality studies in 2003/2004 of raw and treated water and sediments around the intake. ▪ OSU completed a 2-year study of fish deformities in the Newberg pool indicating that parasites are responsible for the observed deformities and do not pose a threat to human health. ▪ TVWD conducted a study in 2004 to cost out the building of a large pipeline from Wilsonville water treatment plant to the TVWD service area. ▪ Continued monitoring of sediments, "raw water," and finished water at Wilsonville's water treatment plant. These analyses were conducted by contract laboratories and by faculty at Oregon State University.
Other Local/Regional Planning Efforts
▪ Formation of Willamette River Water Coalition to share water rights and facilitate development of the Willamette River ▪ Local vote conducted on the use of the Willamette River by Wilsonville. Local votes required by Sherwood, Tigard, Tualatin, and TVWD prior to their use of the Willamette. ▪ Development of GIS and other data sources as a part of the Willamette Livability Forum and Willamette Restoration Initiative, including information about potential demands on this source basin wide ▪ USCOE study on USCOE projects on the Willamette River including a Stella model; potentially deals with ESA issues and reauthorization of projects for use other than agricultural; has not been active in recent years ▪ USCOE operates 12 dams and impoundment projects on Willamette River, and reallocation of stored water is being considered by USCOE

Table 4(2)-28 Summary Evaluation of Source-Option Issues – Willamette River Regional Water Providers Consortium	
Water Availability	
Rating: N/A (not quantified in 1996 RWSP)	• Substantial quantities of water have been identified for possible M&I use in the 1996 RWSP. It was anticipated that the Willamette River option could provide as much as 154 mgd of additional supply using permits held by regional providers • Significant instream water rights and flow targets had also been established for the Willamette River that may limit future access • Climate change study indicates that average stream flows will increase in the wintertime, while late spring and summer flows will decrease. No other significant changes to issues impacting the Willamette River option's water availability.
Environmental Impacts	
Natural Rating: 1.0 *(1.0)* Human Rating: 2.5 *(2.5)*	• Chinook salmon and steelhead have been listed for the Upper Willamette system under the Endangered Species Act. No other significant changes to issues impacting the Willamette River option's environmental impacts.
Raw Water Quality	
Rating: 2.0 *(2.2)*	• LT2ESWTR/Stage 2 D/DBP will have a significant impact on the treatment requirements for all surface water sources. Recent studies (TVWD and OSU) and experience at Wilsonville water treatment plant indicate that raw water quality is high.
Vulnerability to Catastrophic Events	
Rating: 2.5 *(2.5)*	• Low probability for terrorist acts for the Willamette River source. No other significant changes to issues impacting the Willamette River option's vulnerability to catastrophic events.
Ease of Implementation	
Rating: N/A *(2.5)* *Ease of implementation will depend on individual circumstances at the local level*	• ESA may be a limiting factor if expansion beyond 120 mgd is pursued. • Additional monitoring information and present use of Willamette source likely improves ease of implementation for the future. • Wilsonville Water Treatment Plant was completed April 29, 2002 and has a current capacity of 15 mgd (with an intake capacity of 70 to 120 mgd) • Some cities (e.g., Tualatin, Tigard, and Sherwood) have stated that they maintain the individual right for such a public vote on whether to use the Willamette River as a source of municipal supply • Two recent studies of water quality and fish deformities may improve the implementation of reusing this source. • Extensive database regarding water quality and treatment plant performance.
Treatment Requirements	
Rating: N/A (not quantified in 1996 RWSP)	• No other significant changes to issues impacting the Willamette River option's treatment requirements.

Table 4(2)-28 Summary Evaluation of Source-Option Issues – Willamette River Regional Water Providers Consortium	
Capital and Operating Costs	
Rating: N/A *Updated costs not calculated for Willamette for this update since it is not included as one of the source options strategies*	• No other significant changes to issues impacting the Willamette River option's capital and operating costs. • TVWD study of a pipeline completed in 2004 set preliminary costs at $160 million.

Note:
- Ratings range from 1 to 5 per 1996 RWSP; lower scores are preferred.
- Italicized ratings in parentheses are values from the 1996 RWSP.

H. Local Sources

The 1996 RWSP source-options evaluation focused on those sources that could provide a substantial amount of new supply of water. For this reason, smaller local sources were not evaluated. The evaluation of the local sources in the update to the RWSP is intended to account for the overall utilization of local sources and the potential expansion of these sources. The review is intended to determine whether any significant changes in demand from the regional sources could result from either developing new local sources or losing access to existing ones. Several water purveyors currently rely primarily on groundwater as their source of supply or for emergency backup or to meet peaking needs.

Table 4(2)-30 lists the local sources included in the 1996 plan and their inclusion status for this update. Only members of the Regional Water Providers Consortium will be included in the review of available local sources for this update. The capacity of local sources accounted for in the 1996 RWSP totaled approximately 59.3 mgd. The capacity of local sources based on the current update is 47.2 mgd.

There are a number of smaller local sources utilized by water providers in the region including both groundwater and surface water sources. These local sources are being included in the update to the RWSP to account for the local supplies that serve local projected demands. This includes some additional updates that have been brought online or are committed as part of the base case for modeling purposes. In some instances, the local sources are used by purveyors for emergency supplies only, especially those purveyors utilizing one or more of the major water sources in the region. The local sources will be part of each source strategy developed (refer to Section 3).

H.1. New Issues and Developments

New interties and wells are being planned by several purveyors. However, some new wells developed will be limited by the "groundwater limited areas" established by OWRD. These limited areas have been defined in the northern Willamette Valley including Sandy-Boring,

Damascus, Sherwood and Dammasch-Wilsonville. OWRD has also designated Cooper-Bull Mountain as a Critical Groundwater Area. As a result, water purveyors will likely utilize interties to existing transmission lines connected to the primary regional sources. ASR is also being considered more as a local source. A summary of new issues and developments is listed in Table 4(2)-29.

Table 4(2)-29
Inclusion Status of Local Sources from 1996 RWSP
Regional Water Providers Consortium

Provider	Source Type	Status for Update
Multnomah County		
Fairview	GW	Included *
Interlachen	GW	Not Included
Powell Valley	GW	Included
Troutdale **	GW	Not included
Wood Village **	GW	Not included
Portland (non-potable)	GW	Not included
Washington County		
Beaverton	GW/ASR	Included
Forest Grove	SW	Included
North Plains **	GW	Not Included
Sherwood	GW/ASR	Included
Tigard	GW/ASR	Included
TVWD	GW/ASR	Not Included
Cornelius/Gaston/Hillsboro	SW	Not included
Clackamas County		
Canby **	SW, GW	Not included
Boring ***	GW	Included
Sunrise (Damascus/Mt. Scott)	GW	Included
Lake Oswego	GW	Not Included
Milwaukie	GW	Included
River Grove **	GW	Not Included
Wilsonville	GW	Not Included
Skylands/G. Morie **	GW	Not Included
Estacada **	SW	Not Included

Notes:
SW – Surface water source
GW – Ground water source
N/A – not included as a local source in 1996 RWSP
**- Not a consortium member after July 1, 2004*
*** - Not consortium member*
**** - Joined consortium in 2002/2003*

Table 4(2)-30 New Issues Affecting Other Local Sources *Regional Water Providers Consortium*
Major Developments
▪ Cooper-Bull Mountain groundwater area has been designated as a Critical Groundwater Area by OWRD meaning current groundwater pumpage exceeds natural replenishment ▪ OWRD established 11 "groundwater limited areas" in the northern Willamette Valley including Sandy-Boring, Damascus, Sherwood, and Dammasch-Wilsonville. Boring joined the consortium in 2003 and they have groundwater wells.
Supply Works Constructed or Committed
▪ Fairview, one of the wells is offline due to water quality concerns, requires installation of new wells to meet demand projections or purchase wholesale water; 3 mgd well drilled and tested May 2002 ▪ Rockwood has drilled a new well in 2003. ▪ City of Milwaukie increased water purchase from CRW
Related Studies
▪ Sandy planning for future Salmon River WTP with 4.0 mgd capacity; also considering Bull Run supply ▪ West Slope Water District water system plan recommends installation of intertie with Washington County Supply Line (PWB) ▪ Powell Valley Road Water District completed additional well station at Vivian property well site to be operational in year 2001. These wells will be taken into the Portland Water Bureau Service area in 2005.
Other Local/Regional Planning Efforts
▪ OWRD pressuring communities utilizing groundwater to reduce consumption in groundwater limited or critical groundwater areas

H.2. Existing Water Rights and Applications

Water rights for the local sources of the Consortium members were divided into surface water and groundwater rights. The total permitted or certificated use rate for surface water rights is 46 cfs (29.8 mgd) and the total for groundwater is approximately 157 cfs (101.3 mgd). The water rights used to obtain this total are listed in Appendix A. Table 4(2)-31 summarizes the actual use rate based on conversations with staff from the purveyors and review of available planning documents. Approximately 42.6 mgd is currently being utilized as local source of supply.

H.3. Water-Rights Issues Affecting Local Source-Option Development

New wells developed in some areas will be limited by the "groundwater limited areas" established by OWRD in the northern Willamette Valley including Sandy-Boring, Damascus, Sherwood and Dammasch-Wilsonville. Thus, new ground water rights may be more difficult to obtain in these areas. Any new "local" surface water rights issued will likely be to meet only local demands and would not be considered significant for the region.

Table 4(2)-31 Comparison of Water Rights to Capacity for Local Sources Regional Water Providers Consortium			
Provider	**1996 Capacity (mgd)**	**Current Water Rights (mgd)**	**Current Capacity (mgd)**
Multnomah County			
Fairview	2.7 (GW)	4.1 (GW)	3.7
Powell Valley	1.8 (GW)	9.2 (GW)	8
Rockwood	N/A	41.0 (GW)	* In development
Total	**4.5**	**54.3**	**11.7**
Washington County			
Beaverton	N/A	1.9 (GW)	1.9
Forest Grove	1.3 (SW)	8.2 (SW)	2.0
Sherwood	2.8 (GW)	4.1 (GW)	1.9
Tigard	1.1 (GW)	2.3 (GW)	1.4
Total	**5.2**	**16.5**	**7.2**
Clackamas County			
Sandy	2.5 (SW)	19.5 (SW)	2.6
Boring	*1.0 (GW)*	4.2 (GW)	2.9
Sunrise (Damascus/Mt. Scott)	3.3 (GW)	4.8 (GW)	4.0
Milwaukie	6.7 (GW)	7.3 (GW)	6.1
Total	**13.5**	**35.8**	**15.6**
Grand Total	**23.2**	**106.6**	**34.5**

Notes:
Only current members of the Consortium are included in this list of providers
SW – Surface water source
GW – Ground water source
N/A – Not listed in 1996 RWSP

H.4. Capital and Operating Costs

Although the local sources are included in the source-option strategies that were modeled in *Confluence*, capital and operating costs for the local sources are not included in this report. It was decided to conduct a relative cost comparison among the major new sources in the scenarios, wherein the local sources are included in each of the scenarios.

H. 5. Summary Evaluation of Local Source-Option Issues

No summary evaluation table is provided for the local groundwater source options since it will be considered a common source used to meet local demands in the development of the source-option strategies.

I. Non-Potable Sources

The 1996 RWSP contains a strategy that recommends a period of five years from the endorsement of the Plan for exploration of non-potable water use to meet appropriate municipal needs. After exploration and study it was anticipated that the Plan would include any viable non-potable sources and thereby reduce demands on potable systems. Many municipal water-demand forecasts potentially include uses that could be met through

untreated water systems, this includes such things as landscape watering, industrial uses, and energy production, and heating and cooling systems.

Non-potable uses already occur throughout the metropolitan region, and since the adoption of the RWSP, few new uses have occurred, including the Portland Parks Bureau's use of wells to water larger parks close to the Willamette River. The Port of Portland had worked with the Portland Water Bureau to study the development of a non-potable water system for the Rivergate and Airport area. The Port obtained water rights from the Willamette and Columbia River for development of a non-potable water system(s). Clean Water Services in Washington County has also explored additional development of non-potable water from their water treatment facilities; however, they have determined at this time that the highest use of their treated wastewater is for instream flows in the Tualatin River. The City of Portland has also explored the potential use of treated wastewater from the Columbia Boulevard Treatment Plant. However, other than for wetland purposes the level of treatment and costs have not made this option viable at this time. The Sunrise Water Authority has considered that a portion of the new demand that will occur in the Damascus/Boring area added to the urban growth boundary in 2002 will be met by innovative new potable sources such as groundwater or wastewater reuse; however, a specific plan was not available for this update.

Non-potable source development exploration remains an option within the metropolitan area to reduce demands on potable systems; however, not enough exploration has been done at this time to identify any particular source. All sources within the RWSP would be potentially available to meet municipal needs so long as the basic water rights were compatible and the costs of installing needed infrastructure were feasible. Many non-potable projects are cost-effective if the source of supply is close to the area of demand, which is why groundwater is often utilized, or sport fields and parks close to wastewater facilities are feasible. The cost to transmit untreated water long distances through pipelines may not be feasible if the cost of the product is the same or greater than potable water that may already be available to the areas of demand.

Chapter 5. Modeling Results

Confluence® Model Description[1]

Origins

Confluence® is a tool to simulate the operations of water supply systems. It traces its roots to the *IRPlanner* model, which was developed during the original Regional Water Supply Plan (RWSP), and which enabled the Portland regional water providers to evaluate and compare the merits of several alternative water supply strategies for the tri-county region. The *Confluence* model began to take shape after the completion of the RWSP. While *IRPlanner* was statically configured to accommodate a highly-aggregated schematic of the Portland regional supply and transmission system, *Confluence* was to be a completely generalized model that could simulate the operation of systems of any size and degree of complexity. Moreover, it was critical that the configuration, component attributes, and operating rules could be readily created and edited.

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RWSP Update *Confluence*® Starting Point

Over the intervening years, successive versions of *Confluence* were created, each incorporating additional features and increased levels of sophistication. At the start of the RWSP Update, as a result of the model development activities that had occurred up to that point, *Confluence* was a fully developed water supply planning model with the following key characteristics:

Accurate System Operation. The model could faithfully replicate the individual and joint operation of all regional system components, including such matters as reservoir drawdown, conjunctive use of supplies, hydraulic limitations in the transmission system, constraints in the use of supplies from particular sources, instream flow requirements, pump limitations, etc. The model was able to reproduce the key real-world operating constraints throughout the system and enabled the user to easily test the effects of modifying these constraints.

The model could represent the operational complexity of the supply and delivery system of the entire region, including supplies, infrastructure and the demands of all providers in the region, with due regard for the unique issues associated with each provider.

[1] For a detailed description of the *Confluence*® model features, see Appendix G.

Changes Over Time. The model was able to readily incorporate the addition of new supplies and facilities and the modification of existing supplies and facilities at any time over the planning horizon. This is necessary to enable different sequences and combinations of system changes to be readily evaluated.

User Orientation. The model had an intuitive user interface, which facilitated the definition of system components and the editing of data. The interface also allowed ready creation of useful outputs suitable for presentation to audiences with varying degrees of sophistication.

Flexibility. The model could flexibly adapt to different and changing system configurations, allowing the addition, modification, and deletion of system components and conservation programs in any combinations and with any timing, as well as changes in system operating rules. Moreover, the system simulation parameters could be easily modified to allow the user to quickly assess system performance against any subset of weather and hydrologic conditions over any future period.

Confluence allowed quick and intuitive modification of any of the myriad of assumptions that underlie the simulation including, in particular, changes in how the system is operated. This was accomplished by ensuring, to the greatest possible extent, that the model was data driven rather than depending on "hard-wired" assumptions or model logic. There were many "levers" and "switches" that the user could apply to reflect the range of operating conditions that must be tested.

Speed. The simulation ran extremely quickly and allowed very rapid scenario creation and viewing of output results.

Self-contained. All of the key planning questions regarding supplies, demands, conservation, costs, rates, etc., were addressed in a single modeling environment.

Sensitivity Analysis. The model facilitated "what if" questions and sensitivity analyses. Such questions are the essence of an integrated planning process and must be answered quickly and accurately.

Scenario Comparisons. The model allowed for the direct comparison of the performance of strategy alternatives against key evaluation parameters. This includes the cost and financial characteristics of alternative strategies. *Confluence* included a seamlessly integrated cost and financial module that allowed for easy input of all cost and financial assumptions, accurate computation of all cost and financial parameters, and a variety of easy-to-understand cost and financial outputs.

Diagnostics. The model offered diagnostic tools to help the user achieve a clear understanding of precisely why particular results are being observed. These tools served a number of purposes. For example, it is often the case, particularly in complex systems, that the "pinch points" that are causing particular instances of unserved demand are not obvious. *Confluence* diagnostic tools afforded the ability to quickly identify those points.

In addition, the model enabled more sophisticated users to understand and carefully track the status of all system components at each step of the model simulation.

Water Conservation. Conservation is often a critical component of municipal water supply strategies. The model was therefore designed to enable the user to specify the participation, savings, and cost characteristics of an unlimited number and variety of conservation programs. The model allowed the user to indicate the extent to which the cost of conservation devices will be borne by the water agency in the form of financial incentives. It also permitted different agencies to implement a different mix and/or implementation pace of programs.

Outputs. The *Confluence* model outputs had sufficient breadth and depth to serve the needs of many audiences, ranging from Consortium staff who may wish to conduct detailed diagnostics of simulation results to citizens who wish to offer input to the planning process to elected officials who will make the ultimate decisions. Moreover, the model offered the ability to customize outputs to meet particular needs. Data underlying any *Confluence* output chart could instantly be copied to the Windows clipboard and pasted into any other application.

Model Enhancements

With this as a starting point, it remained to specify and implement the model enhancements that were required to meet the unique needs of the Consortium. This required careful discussions with CTSC members to identify operating features or output requirements that were not incorporated in the then-existing *Confluence* model. Based on those discussions, the following key enhancements were incorporated in the model:

Joint Water Rights. The Clackamas providers wished to pool their water rights so that, subject to transmission and treatment capacity and flow constraints, water governed by these rights would be assumed to be available for diversion by any of the providers. An option for such pooled rights was added to the model.

"Chained" Diversions. With multiple diversions on the Clackamas, the flows available at any diversion point had to be modified to reflect diversions upstream. This logic and associated input parameters were added.

Flow Augmentation Reservoirs. The existing model had no provision for reservoirs, such as Timothy Lake, for which releases were used to augment flows in a designated stream and where those releases were themselves a function of those flows. This logic was added to the model.

Demand-based Water Rights. The existing model allowed the user to define prioritized diversion and instream water rights that varied by month. Based on discussions with the City of Hillsboro, it was determined that spring/early summer diversions of Tualatin River natural flows could only occur up to the time that a running average of Joint Water

Commission (JWC) daily demands exceeded a user-specified level. That logic was incorporated in the model.

Monthly Storage Adjustment. Discussions with JWC staff indicated that, for Barney Reservoir, as of May 1, a specified percentage of the water in storage would allocated to other uses and thereby be unavailable to meet demands. This feature was added to the reservoir logic.

Daily Demand Running Averages. To account for the ability of local storage facilities to "smooth" daily variations in demand, the Consortium requested the ability to run daily simulations against multi-day running averages of demand. This feature was incorporated, allowing the user to specify the number of days over which demand should be averaged.

Conservation Program Control Matrix. Because of the large number of conservation program/demand node combinations, Consortium staff requested a simpler way to activate, de-activate or edit individual conservation programs for particular demand nodes. As a result, a master control matrix for all conservation programs was created.

Fixed-Cost Allocation. The Consortium wanted the ability to allocate the fixed costs of supply and infrastructure additions to individual nodes or node groups, and to display the allocated cost results. That capability was added to the model.

Demand-driven Transmission Capacities. Consortium staff foresaw the need to adjust transmission link capacities as a function of demands in designated node(s). That logic was added to the model.

Description of Strategies

The original intent of the RWSP Update was to use the *Confluence* modeling tool as described above and to predefine strategy packages that would be evaluated. The *Confluence* model is not an optimization model that selects sources placed into it to provide answers under various assumptions. The model was developed to allow the user to determine the mix of conservation programs and source/transmission projects to evaluate against the water demands developed in the forecasts. The Board and technical committees worked over several months to refine the strategies to be modeled to include the following:

1. Base Case – The base case is the floor from which all of the other strategies are built. The base case includes all existing supplies and infrastructure as well as some further improvements to which member agencies have already committed. These added improvements include:
    - Added JWC treatment plant capacity and the Raw Water Pipeline to Hagg Lake

TABLE 5-1
Total Supplies Included in Base Case

Water Provider	Supply Type	Currently Existing Supply Capacity	Included in Base Case As Future Projects	Capacity in MGD or Billions of Gallons (BG)
City of Portland	Groundwater	95		95
CRW	Diversion	30		30
NCCWC	Diversion	10		10
SFWB	Diversion	20	10	30
City of Lake Oswego	Diversion	16		16
Unspecified Clackamas	Diversion		10	10
JWC	Diversion	73.5	46.5	120
Forest Grove	Diversion	2		2
Beaverton	ASR	3	2	5
Beaverton	Groundwater	1.9		1.9
Sherwood	Groundwater	1.9		1.9
Wilsonville	Diversion	15		15
Tigard	ASR	1.44	4.32	5.76
Tigard	Groundwater	.5		0.5
Milwaukie	Groundwater	6.1		6.1
Sunrise	Groundwater	4	11	15
Sandy	Groundwater	.13		0.13
Sandy	Diversion	2.6		2.6
Rockwood	Groundwater		6.5	6.5
Fairview	Groundwater	3.7	1.7	5.4
Powell Valley	Groundwater	8		8
Bull Run Trans	Diversion	210		210
TOTAL PEAK[2]		**505**	**92**	**597**
RESERVOIRS: [3]				
Bull Run 1 & 2	Reservoir	9.9 BG		9.9 billion gallons
Hagg Lake	Reservoir	4.4 BG		4.4 billion gallons
Barney	Reservoir	6.4 BG		6.4 billion gallons

[2] Total peak-day capacities, not available throughout a whole peak season, all facilities at 100 percent

[3] Usable storage capacity

- Added diversion and treatment capacity of 20 mgd in the Clackamas basin
- Increases in ASR for Beaverton and Tigard
- New or added groundwater capacity at Sunrise, Fairview and Rockwood

Base Case supplies were analyzed to see how they would meet future demands, as well as adding significant transmission improvements between demand nodes to assess how well existing supplies could meet all of the needs within the region. However, some base case supplies were constrained to only be available to certain demand nodes. Base case capacities to meet peak-day demands are assumed to be 597 mgd, of which 505 mgd currently exists, another 92 mgd are assumed to be committed. See Table 5-1 for details about the existing and additional committed sources included in the base case.

2. Hagg Lake Source Development Emphasis – This strategy adds the Scoggins 40' Dam Raise, JWC treatment plant capacity and the Sain Creek Tunnel to the base case supplies. Unlike the other strategies, these supplies are assumed not to be available to meet demands across the region. Rather, they serve only those entities that have been participating in the Tualatin Basin Water Feasibility Study (Forest Grove, Beaverton, Hillsboro, TVWD, Tigard, Tualatin and Sherwood).

3. Clackamas River Development Emphasis – This strategy emphasizes development of the Clackamas River supply. Added supplies include an additional 50 mgd of diversion and treatment capacity beyond base case (30 mgd at unspecified diversion point, 10 mgd at North Clackamas Water Commission plant and 10 mgd at Lake Oswego plant).

4. Bull Run Source Development Emphasis – This strategy emphasizes expansion of surface water and groundwater in the Bull Run watershed and the Columbia South Shore Well Field. The source options include raises for Dams 1 and 2, and added groundwater development in both the South Shore Well Field and in the Bull Run Watershed if these supplies are needed to meet demands.

5. Limited Expansion of Local Projects – This strategy focuses on developing a variety of local supply projects contained within existing provider Master Plans. Thus, the supplies are more localized and diverse. The supplies beyond the base case include:

    - Added capacity from the Clackamas at the Lake Oswego (10 mgd) and North Clackamas Water Commission Water Treatment Plants (10 mgd)
    - Groundwater at Gresham (5 mgd), Rockwood (13 mgd) and JWC (10 mgd)
    - Aquifer Storage and Recovery (ASR) at Clackamas River Water (1.8 mgd), Tualatin (4.5 mgd) and Sherwood (2.7 mgd)

As discussed in Chapter 3 on Conservation, the *Confluence* modeling also included a uniform set of conservation programs for each strategy. The savings represented by those programs is shown in Table 5-2 (the total does not exactly equal that in Table 3-2 due to rounding).

Table 5-2

Projected Annual and Peak-Season Conservation in Year 2025 by Subregion

Subregion	Annual Conservation Savings (mg)	Peak-Season Conservation Savings (mgd)
East	2,747	11.5
Clackamas	472	1.7
JWC	539	1.9
TVWD	630	2.1
Other	490	1.7
TOTAL	**4,878**	**18.9**

Constructing Strategies in *Confluence*®

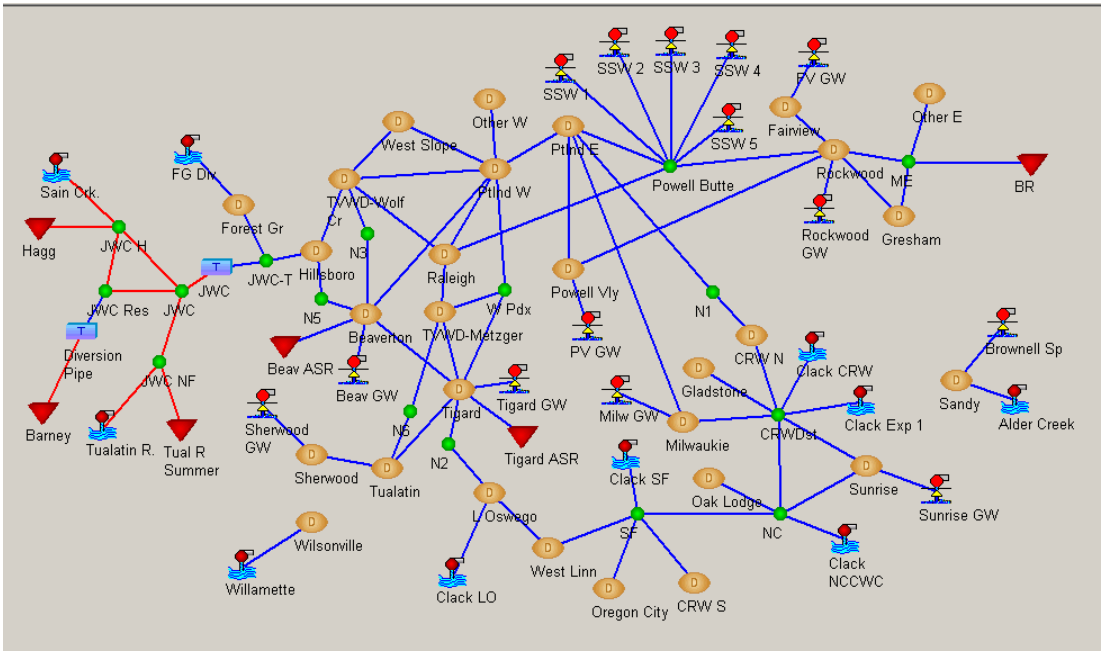
Once the strategies were defined, the next step was to develop a *Confluence* database for each strategy. This required extensive discussions with Consortium staff and member agencies. The base case schematic is shown in Figure 5-1.

This schematic includes demand nodes, river diversions, groundwater supplies, reservoirs, treatment plants and the major transmission links between all of these system components. Each element is described by a set of data that specifies its cost and operating characteristics. As described above, this data can be viewed and edited simply by double-clicking on the appropriate icon in the diagram.

The types of data that are required are described in Appendix G, along with sample data forms. [4]

[4] While the system schematic diagrams for all of the strategies are almost identical to Figure 5-1, the underlying assumptions differ substantially.

Figure 5-1
***Confluence* Schematic for Portland Regional System**



Strategy Evaluation Process

A similar process was used to evaluate the base case and each of the supply strategies using the *Confluence* model. This section begins with a general description of that process and then discusses its application to each of the strategies.

Description of Evaluation Process

The overall goal of the evaluation process was to specify the magnitude and timing of the supply and infrastructure additions that will maximize water supply reliability (i.e., minimize shortages) in all parts of the region over the planning period.
For each strategy, two sub-strategies were examined:

- **Without transmission**. Here, no new transmission links were added. The supply facilities appropriate to the particular strategy, as described above, were added as long as they continued to improve overall system reliability.

- **With transmission**. Prior to adding new supplies, transmission facilities were added as needed, in order to take maximum advantage of existing supplies. With a few exceptions, it was assumed that no new transmission would be operational until at least 2010.

For each sub-strategy, supply and infrastructure were added as needed to maximize supply reliability. The *Confluence* model determined the reliability based on the physical capability of the supply and infrastructure for each strategy, assuming optimal operations, and ignoring political and institutional constraints.[5]

In all cases, the "without-transmission" sub-strategies fell far short of meeting all regional demands through 2025. The "with-transmission" sub-strategies, on the other hand, were always able to achieve this goal, or get very close to it.

Thus, for each "with-transmission" sub-strategy, the end product was a sequence of transmission, treatment, storage and/or supply additions, each of which achieved approximately the same level of service, namely zero shortages under all weather and hydrologic conditions. We were then able to compare the overall costs of these alternative ways of reaching this service level. (As pointed out above, cost is by no means the sole criterion that can be used to compare these strategy alternatives.)

Analytical Approach

All model runs focused on 1977 conditions, since that year's combination of weather and hydrology resulted in the greatest degree of stress on the regional supply system, and therefore the highest overall level of regional shortages. Moreover, to properly account for reservoir fill and drawdown patterns in the years leading up to this critical year, model runs over the planning period examined successive five-year (1973-1977) sequences of weather and hydrology.[6] This is illustrated in Figure 5-2, which shows the without-transmission base case reliability by subregion. In the chart, year 2004 assumes 1973 conditions, year 2005 assumes 1974 conditions, etc. Thus, year 2008 is the critical year (1977 conditions). The sequence then repeats itself, so that critical-year (1977) conditions also occur in 2013, 2018 and 2023.

The most severe shortages are seen in the JWC group, which consists of the Hillsboro, Forest Grove and Beaverton demand nodes. These nodes see critical-year, peak-season shortages which range from 25 percent to 30 percent.

The analytical sequence applied to each strategy was as follows:

- Simulate the operation of the system under without-transmission conditions for the successive 1973-1977 sequences as described above.

- Use *Confluence* model diagnostic tools to identify the magnitude and timing of required transmission additions required to maximally utilize sources and reduce shortages in all parts of the region to as close to zero as

[5] For some smaller local supplies, the modeling did reflect such constraints by limiting the supply source to only serve the demand of selected demand nodes.

[6] For analytical purposes, it is assumed that future hydrological sequences will be identical to historical sequences.

possible. During this process, the operating characteristics of various system components (e.g., reservoirs) are modified to mimic, to the extent possible, the way those components would actually be operated.

- From *Confluence* output charts, estimate costs of the with-transmission strategy, including all capital and operating costs of new supplies, infrastructure and conservation programs.

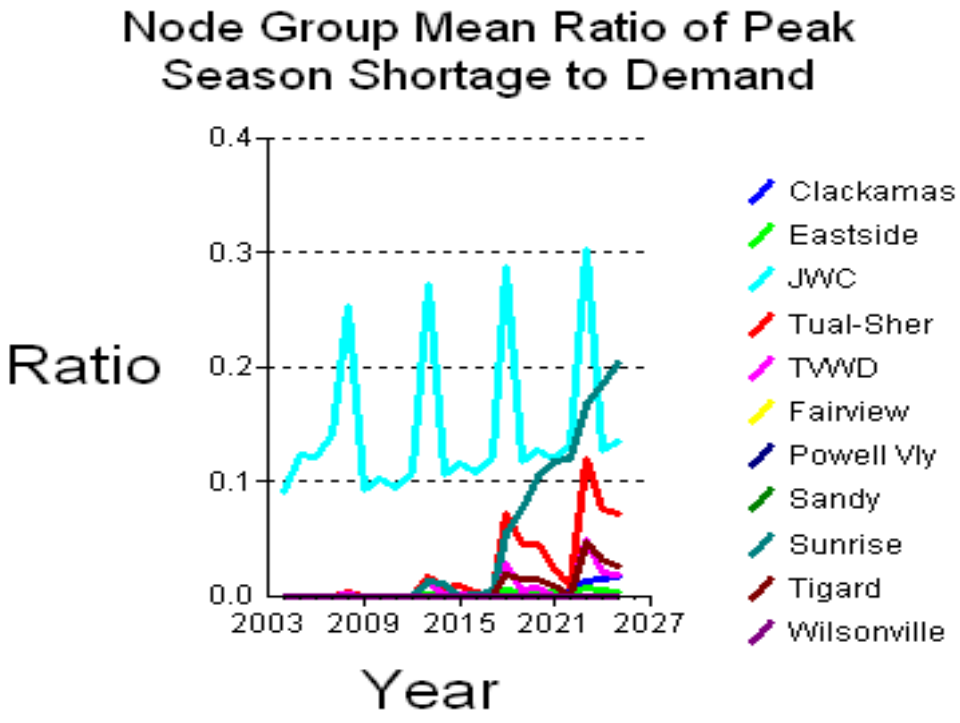
Once all strategies were analyzed, the present values of the capital and operating costs of each strategy were compared.

Following are descriptions of the application of this analytical framework to each strategy, followed by the comparison of with-transmission strategy costs.

The Base Case

By definition, the base case includes no supplies beyond those described above (i.e., those to which regional providers have already committed). As shown in Figure 5-2, by themselves, these base-case supplies cannot serve nearly all demands.

Figure 5-2
Base Case *Without-Transmission* Peak-Season Shortage Ratios



Transmission facilities were then added to more fully utilize these existing and committed supplies. Even in dry years, the current system has considerable supply that remains unused because of an inability to move it to the areas of unserved demand. When all of these transmission bottlenecks are eased, the expected unserved demand is as shown in Figure 5-3.

Figure 5-3
Base-Case *With-Transmission* Peak-Season Shortage Ratios

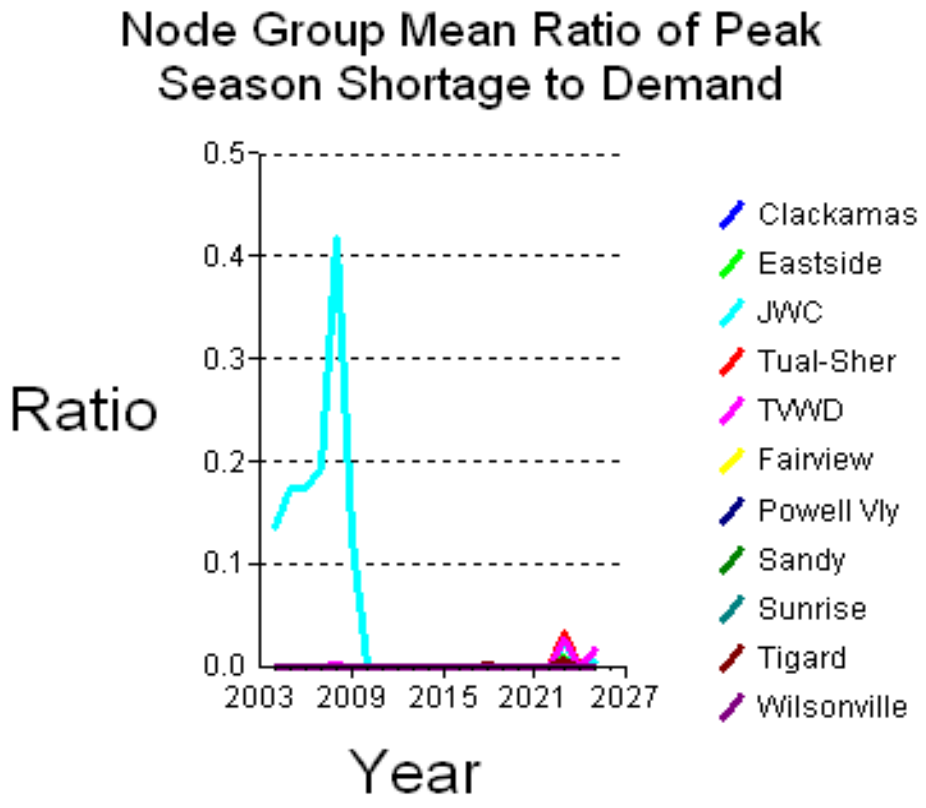


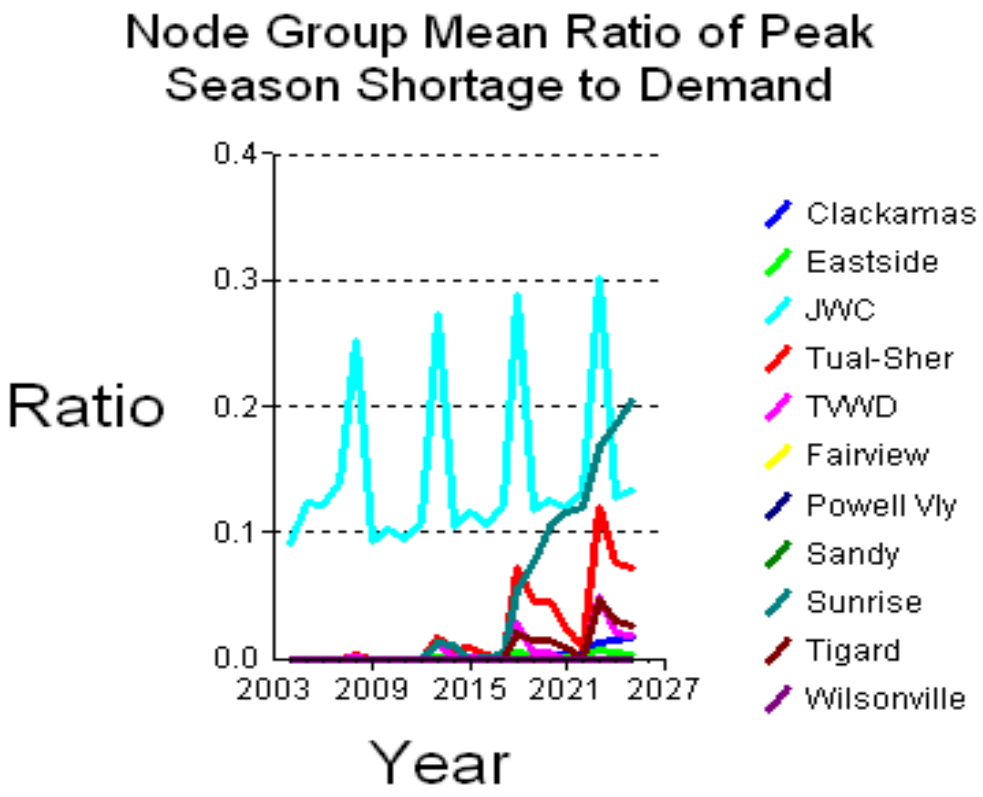
Figure 5-3 illustrates that, even with no supply beyond the base case, the addition of appropriate transmission facilities could reduce shortages virtually to zero, even under worst-year conditions.[7]

[7] The spike in the JWC unserved demand is higher than it actually would be (i.e., higher than in Fig. 5-2) because the reservoir rule curves have been modified to be consistent with added transmission. Since the transmission is not there until after 2008, we see an artificially higher shortage (41 percent vs. 25 percent).

Bull Run Strategy

The projected reliability of the without-transmission Bull Run strategy is depicted in Figure 5-4.

Figure 5-4
Bull-Run *Without-Transmission* Strategy Peak-Season Shortage Ratios

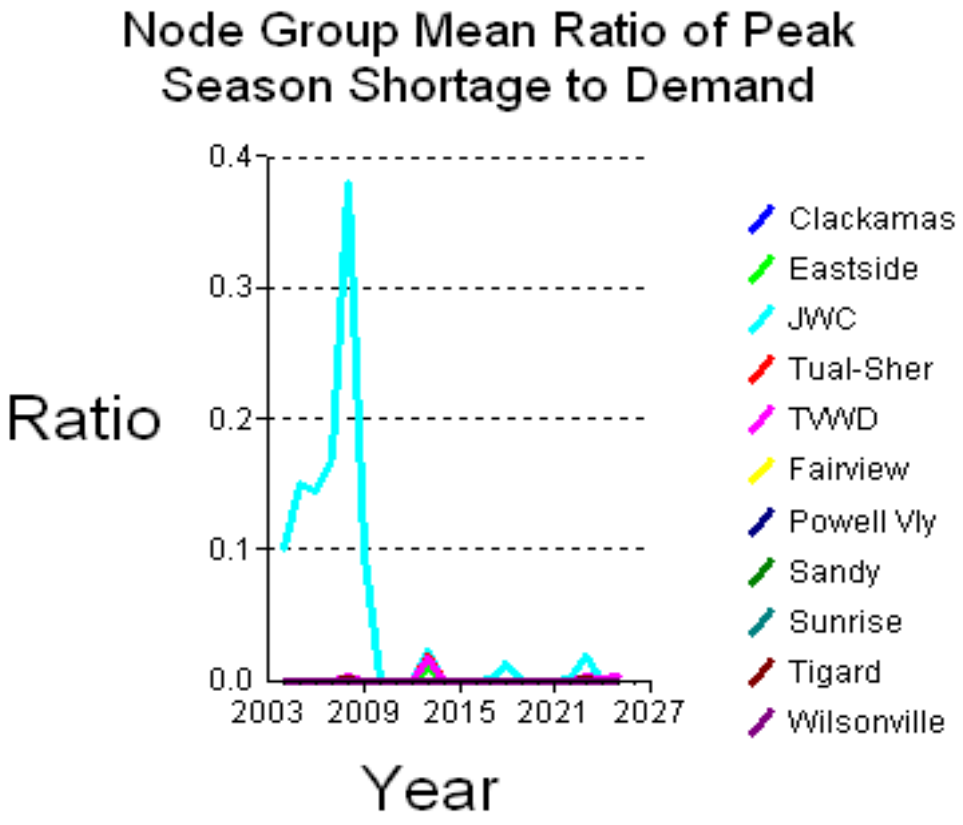


The most striking feature of Figure 5-4 is that it is virtually identical to Figure 5-2, the projected reliability profile for the base case. In other words, adding substantial new supplies in the Bull Run watershed (and some in the South Shore Well Field) has no discernible impact on meeting regional demands. The reason is transmission, or more precisely, a lack of transmission. There is insufficient transmission capacity to move the added supply where it is needed.

Not surprisingly, as shown in Figure 5-5, adding the appropriate transmission to this supply configuration eliminates essentially all regional shortages.

We have now identified two ways to achieve the goal of virtually perfect reliability. We have yet to compare the costs of these two alternatives. The cost comparisons among all the with-transmission strategies will be discussed below.

Figure 5-5
Bull-Run *With-Transmission* Strategy Peak-Season Shortage Ratios



Hagg Lake Strategy

Figure 5-6 shows the projected reliability of the without-transmission Hagg Lake strategy.

Unlike the Bull Run strategy, adding the Hagg Lake strategy supplies, as described above, offers a substantial benefit to system reliability, particularly for agencies on the west side (i.e., JWC and Tualatin-Sherwood node groups). Whereas there is little excess transmission capacity to move the added Bull Run supplies, such capacity does exist on the west side, which results in the ability to utilize some of the new supply to alleviate shortages.

Shortages do, however, remain and these must be addressed through the addition of transmission capacity. The results of adding the necessary transmission and modifying reservoir operations as needed, are shown in Figure 5-7.

Figure 5-6
Hagg Lake *Without-Transmission* Strategy Peak-Season Shortage Ratios

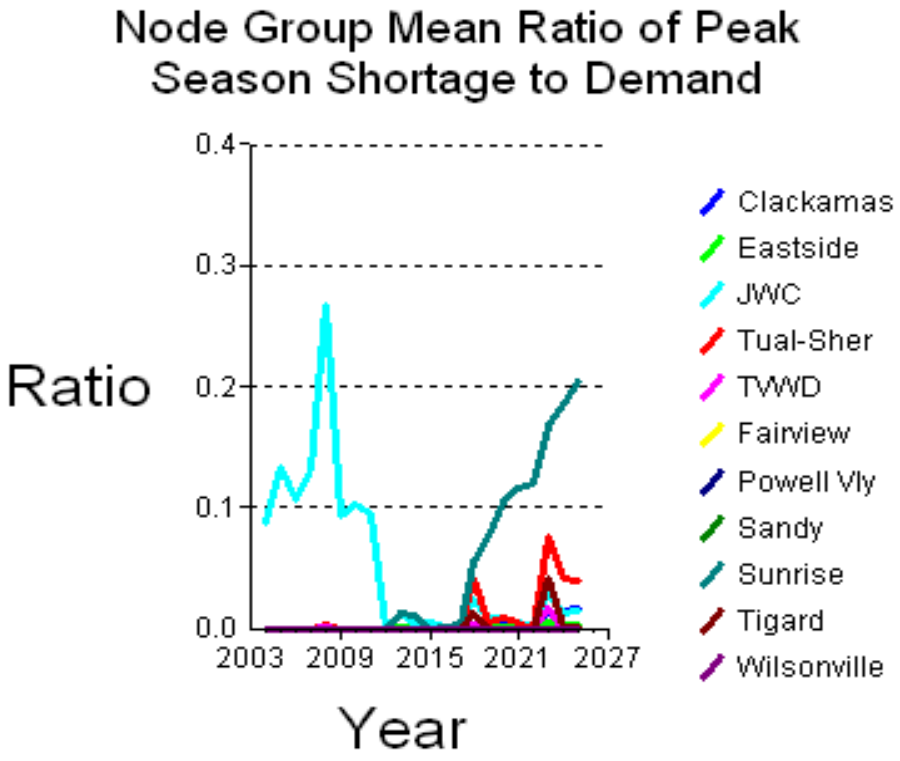
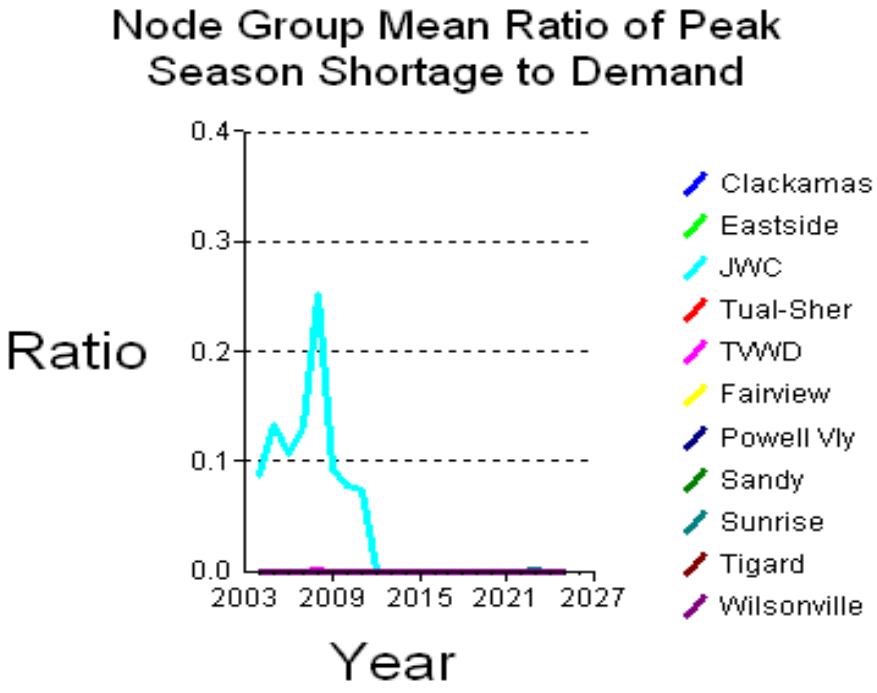


Figure 5-7
Hagg Lake *With-Transmission* Strategy Peak-Season Shortage Ratios



As expected Figure 5-6 demonstrates that the post-2010 shortages are eliminated, after the Hagg Lake expansion project is brought online.

Clackamas Strategy

Figure 5-8 shows the future reliability projection for the Clackamas strategy before adding transmission capacity. By comparing this to Figure 5-2, the differences from the base case with transmission are marginal. This means that, in order to effectively utilize the added Clackamas supply, transmission capacity is required. Figure 5-9 shows the resulting flattening of the unserved demand profiles in all parts of the region.

Figure 5-8
Clackamas *Without-Transmission* Strategy Peak-Season Shortage Ratios

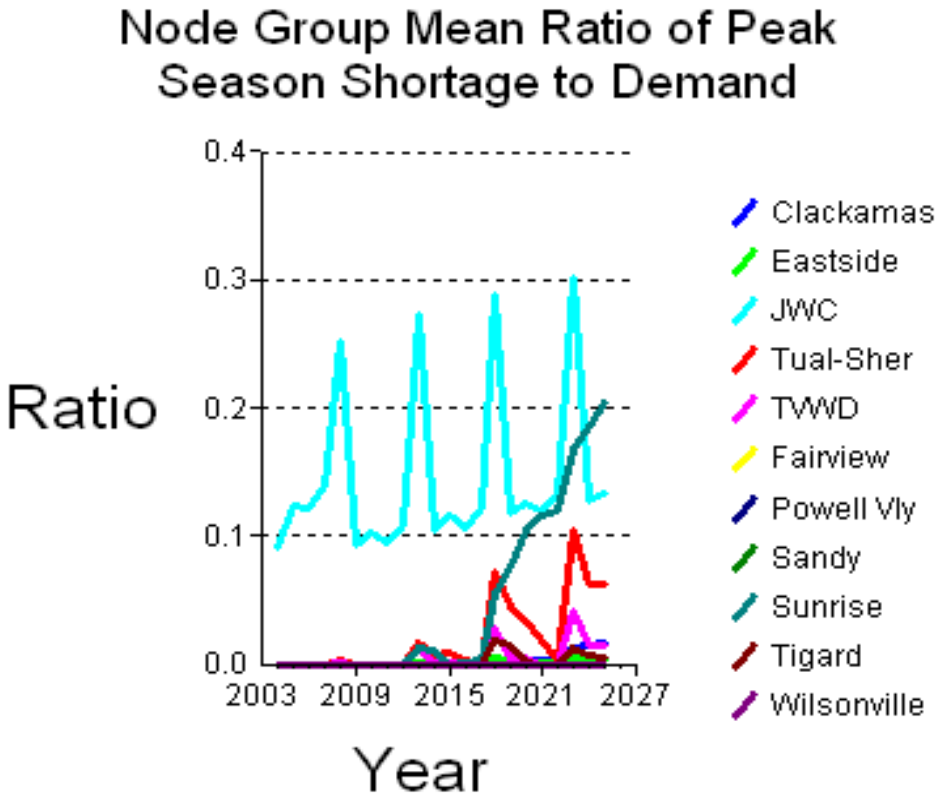
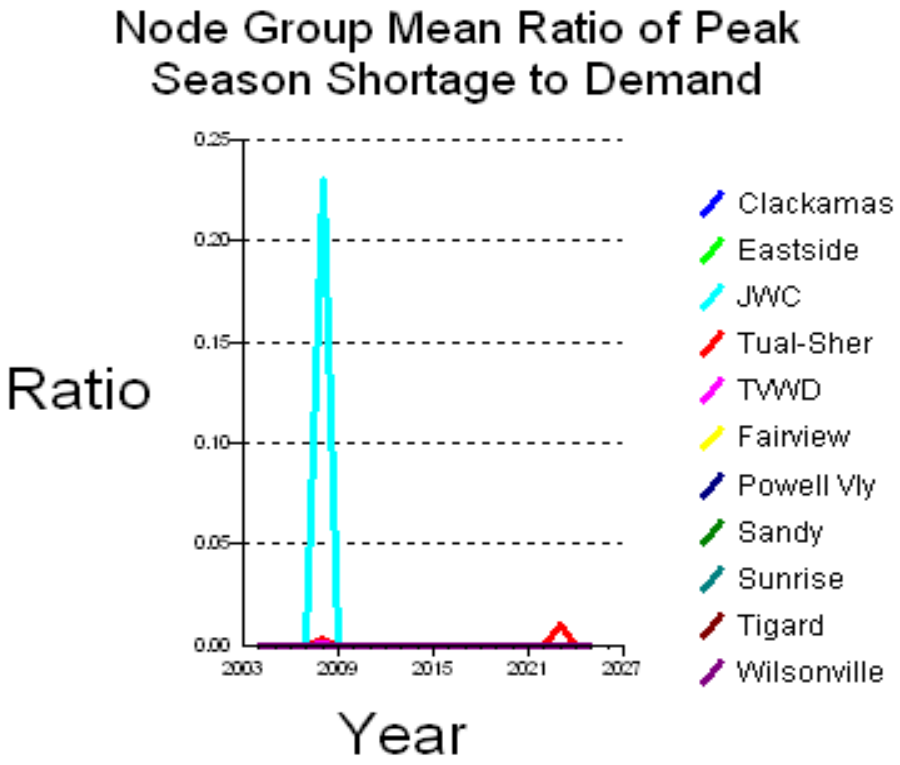


Figure 5-9
Clackamas *With-Transmission* Strategy Peak-Season Shortage Ratios



Local Expansion Strategy

Figure 5-10 shows the reliability for the Local Expansion Strategy before transmission additions. As is the case with the Hagg Lake strategy, the addition of these local supplies noticeably reduces future shortages. Once again, added transmission capacity is needed to eliminate remaining shortages, as shown in Figure 5-11.

Figure 5-10
Local Expansion *Without-Transmission* Strategy Peak-Season Shortage Ratios

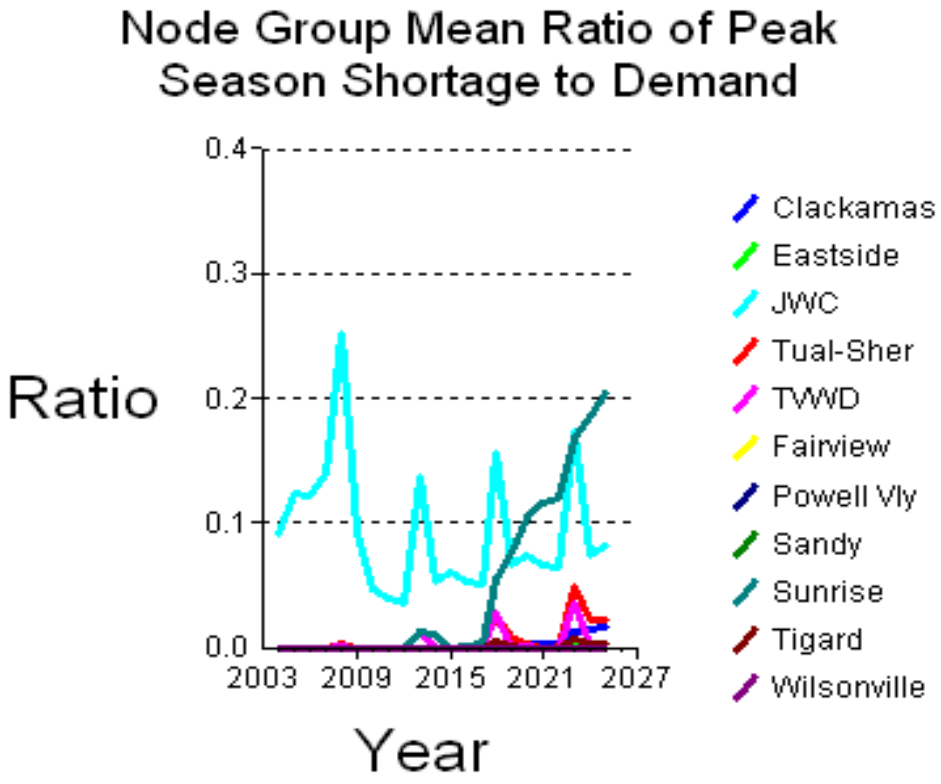
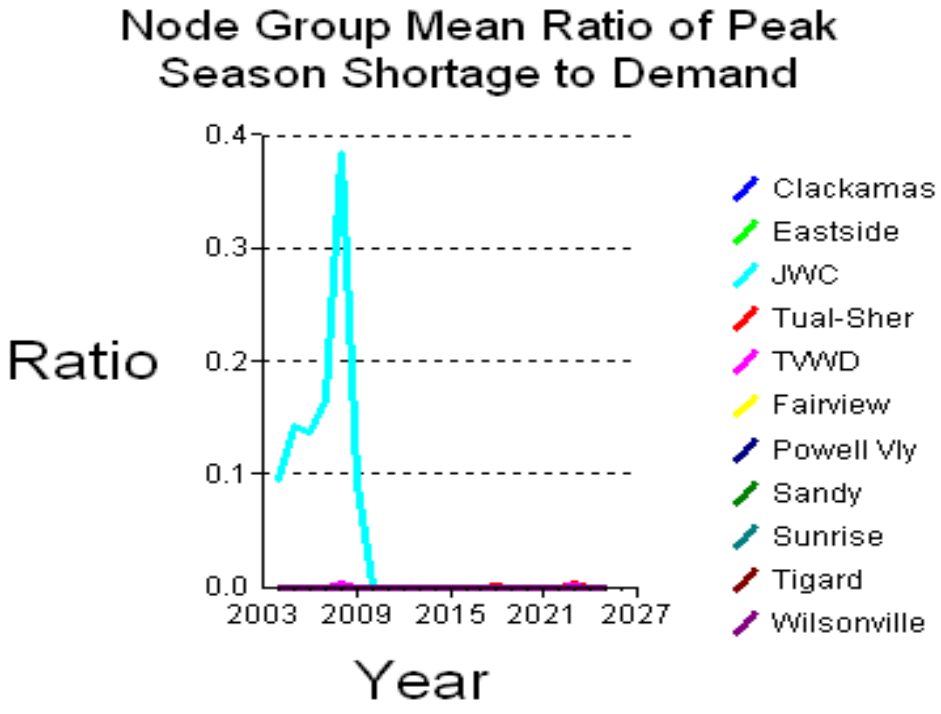


Figure 5-11
Local Expansion *With-Transmission* Strategy Peak-Season Shortage Ratios



Cost Comparisons

The *Confluence* model results described above identify five approaches to achieve virtually perfect water supply reliability through 2025. Each of the with-transmission strategies achieves this end with a different combination of supply and transmission additions. Among other things, it is important to compare the total costs of these alternatives. This cost comparison is presented in Table 5-3, which, for each of the with-transmission strategies, shows the present value of the costs net of those incurred in the base case without transmission, broken into the following three components:

- **Operating costs**. These include both fixed and variable operating costs associated with all system components.

- **Transmission capital**. The annual debt service through 2025 on all transmission investments.[8]

- **Source capital**. The annual debt service through 2025 on all supply investments.

Table 5-4 expresses these costs as percentages of the base case with transmission.

Several important conclusions can be drawn from this chart:

- *The most costly way to eliminate all shortages is the base-case-with-transmission strategy, followed closely by the Hagg Lake strategy*. The high cost of the base case is due primarily to the extensive transmission additions that are required, largely to move Bull Run supplies to other parts of the region. In addition, the limited supply alternatives cause the very expensive South Shore Well Field supply to be used to its maximum limit, resulting in high operating costs. The high cost of the Hagg Lake strategy is due largely to the cost of the dam raise itself.

- *The least-cost alternatives are the Clackamas and Local Expansion strategies*. Both of these alternatives have relatively low operating costs and, because of the location of the supply sources, do not require as extensive a set of additions to the transmission system as do other alternatives.[9]

- *The largest single cost component for all strategies is transmission capital, followed by operating costs*. Other than the Hagg Lake strategy, the capital cost associated with investing in new supply is small.

[8] Capital costs are amortized assuming a 2 percent real rate of interest and a 20-year amortization period.

[9] Water from the Clackamas can be moved to the west side with a much lower transmission investment than can the Bull Run source. The dispersed supplies of the local expansion strategy also require less transmission investment.

Table 5-3

With-Transmission Strategy Net Cost Comparison

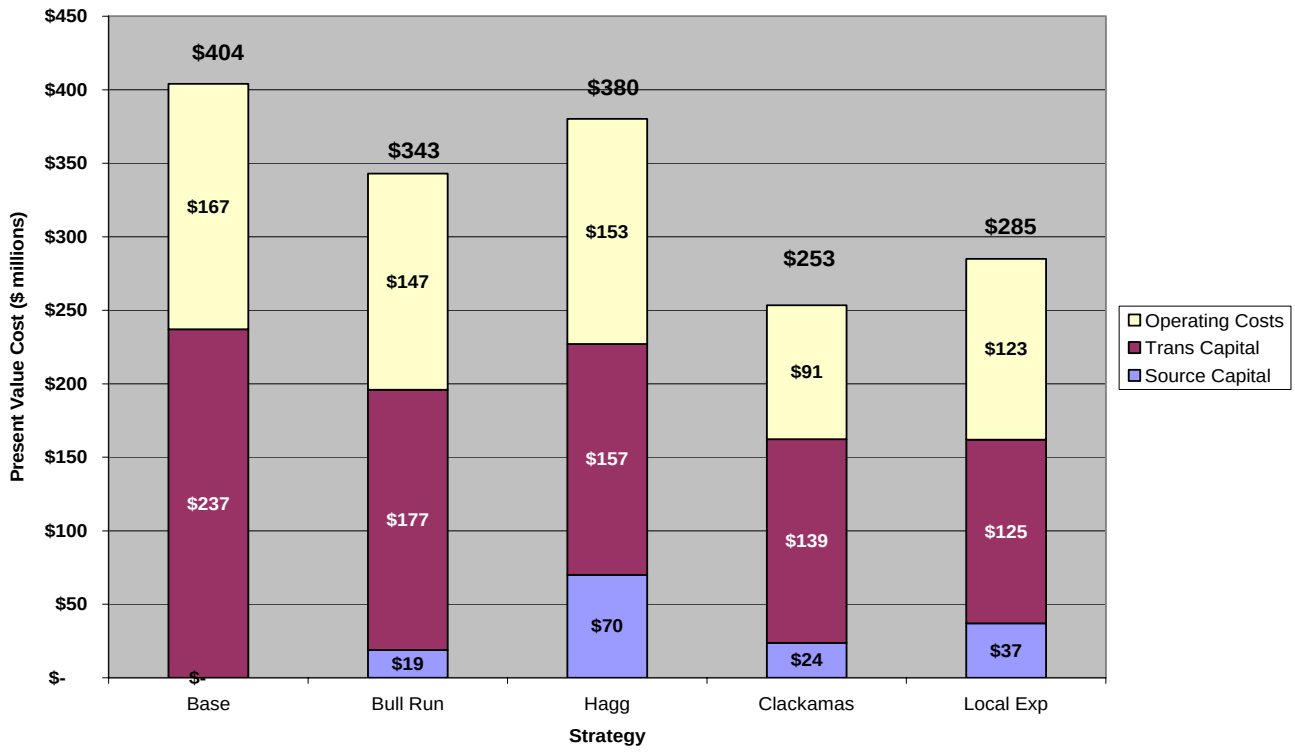


Table 5-4
With-Transmission Net Cost Normalized Comparison

Strategy	Normalized Cost (Base-Case w/Transmission =1.00)
Base Case	1.00
Bull Run	0.85
Hagg Lake	0.94
Clackamas	0.63
Local Expansion	0.71

Conclusions

While it is impossible to eliminate anything close to all unserved demand in the region through 2025 simply by augmenting regional supplies, all of the strategies examined, including the base case, could achieve this goal by also adding to the existing transmission infrastructure. While these five with-transmission alternatives all accomplish this goal, they require different levels of cost to do so. Adding transmission to the base case appears to be the most expensive option, while the Clackamas strategy with transmission is the least expensive. The incremental costs of the latter are about 63 percent of the former. As pointed out above, costs are one of several factors that regional water providers must consider in making ultimate decisions about future enhancements to the region's water supply and infrastructure.

Also as pointed out earlier, these conclusions are based on physical parameters. They address what is physically possible in the region given demand and hydrologic forecasts, water rights, and available supplies from existing and proposed new facilities. The modeling was based on evaluating a specific weather year for peak season (1977). While the model considers each day of the peak season and captures the peak days of that year, the analysis presented in Chapter 2 on forecasted demands notes that a different weather year (1981) produced higher peak days. The analysis presented here does not consider the highest peak events upon which transmission pipeline sizes for various interconnections could be based in the future, or the actual size of peak capacities needed for source production capacities. The work done did compare the peak-event days between the two forecasted years (1977 and 1981) and while the difference is significant on a regional scale, the analysis presented here is close to what would be needed for peak events on a node-by-node basis.

The analysis of these strategies does not consider institutional and contractual barriers to implementing any of these strategies, nor does it evaluate the environmental/land use and other permitting issues associated with actual implementation of any of the projects. As covered in Chapter 1, the Regional Water Providers Consortium has emphasized that this information in the RWSP Update is to inform local decision making and that no specific strategy was to be evaluated for the purposes of selecting specific projects over others. Chapter 6 will outline the conclusions drawn from all of the work done in the Update as well as by individual entities to plan their own water supplies.

Chapter 6. Revised RWSP Strategies

Introduction and Context

In the original 1996 Regional Water Supply Plan, Chapter 12 contains the recommended plan concept and implementation actions. The original RWSP strategies contain a target for conservation program savings to 2050, near-term committed resources (Barney Reservoir expansion, Columbia South Shore Well Field remediation and further development on the Clackamas River). Potential new sources identified included larger scale aquifer storage and recovery on the east and west sides of the region, 50 mgd of additional Clackamas River diversions under existing water rights, and an unidentified source increment of 100 mgd that could come from the Columbia, Bull Run or Willamette rivers. In addition, particular strategies for small local or subregional sources to meet more imminent local needs and a strategy on non-potable water use was included. Chapter 12 also includes a discussion of the policy objectives to inform decision making, the formation of the Regional Water Providers Consortium, and the role of the Consortium and Metro.

Chapter 6 of the RWSP Update is intended to replace Chapter 12 of the 1996 RWSP. In particular, the Update does not address water demands past the year 2025 and it does not recommend specific source options. Over the years since the formation of the Consortium in 1997 several actions have been taken by the Board that are now part of the implementation of the RWSP, some of which were called out as specific strategies in the RWSP. One action in particular has been the adoption and revision (2004) of a 5-Year Strategic Plan by the Consortium, which sets the basic policy direction for the Consortium, and includes specific implementation actions. This document takes the place of some of the action strategies contained in the original RWSP and the process of revising the Strategic Plan will be the place for updating specific action plans and programs over time. The Strategic Plan informs the yearly work program and budget of the Consortium.

This chapter contains a review of the policy actions that have been taken by the Consortium since its formation in 1997, an update of the policy objectives that can be used to guide water supply planning, and an updated set of resource strategies. These strategies address source water protection, transmission and storage, conservation, non-potable water supplies, and source options for the near and longer term. Additional strategies are developed for emergency planning and the role of the Consortium in supporting local decision making, and with Metro.

Chapter 6 of the RWSP Update is intended to replace Chapter 12 of the 1996 RWSP. In particular, the Update does not address water demands past the year 2025 and it does not recommend specific source options.

Consortium Policy and Implementation Actions Taken Since 1997

The following is a list of the activities that have been conducted by the Consortium to implement the RWSP, including some related individual member actions. However, this is not an exhaustive list of all of the actions of individual members actions to develop programs and projects that are mentioned in the 1996 RWSP, but a list of specific Consortium actions.

1. **Source Water Protection Participation Strategy, June 1998**. The Consortium developed and adopted this strategy after a one-year process of forming a Source Water Protection Advisory Committee (SAC) to help formulate a strategy to ensure that drinking water sources were protected from contamination. This strategy contains specific implementation actions whereby the Consortium and its individual members will advocate for and participate in efforts to protect drinking water sources, both surface and groundwater, from activities that degrade them. This strategy has been utilized over the years since its adoption to advocate for specific legislation at the state and federal level. The SAC was convened once more after the policy was adopted to validate the policy and hear what activities the Consortium and its members had been conducting. Since the policy wellhead protection programs have been expanded in the region, federal land-use activities have been monitored and commented upon, letters on legislation have been sent, specifically related to pesticide monitoring and tracking, and on the Federal Energy Bill that sought product liability exemptions for MTBE. This strategy is still in effect and is part of the RWSP Update. See Appendix A for the full report and the strategy language.

2. **Merger of the Columbia/Willamette Conservation Coalition into the Consortium, July 2000.** Regional conservation program implementation was conducted on a regional basis by a subset of the Consortium members and one non-Consortium member since 1993. In 1999 the Consortium and the Coalition developed and managed a review of the RWSP conservation program resulting in a report that reassessed the role of various conservation programs in both a regional and individual context. Very soon after the formation of the Consortium the members decided that two organizations with similar functions were not needed and a process to merge the groups was started in 1999. The actual merger of the groups and an expansion of regional conservation program implementation to all members of the Consortium officially began July 2000 when the budget year began. Since then the conservation program has followed an adopted long-term work program. It has expanded in scope to include full-time dedicated staff during a phase-in period, the formation of a standing Conservation Committee and funding of programs that benefit all members of the Consortium. The budget of the Consortium as of 2004/05 is about 70 percent dedicated to regional conservation program implementation. Conservation implementation has become a major role for the Consortium as initiated by the recommendations of the RWSP

to explore regional and local conservation programs, and to implement specific conservation targets.

3. **Regional Transmission and Storage Strategy, July 2000.** A major infrastructure issue for the region is transmission of water supplies from their sources to customers. In some cases the supplies are located miles from the area of use (e.g., Bull Run, Barney/Hagg Lake) while in other cases the supplies are more proximate to the areas of demand (Willamette, Clackamas, groundwater supplies). However, not all areas that will need water supplies in the near or longer term have adequate transmission to provide existing or future sources to meet demands. In addition, the ability to provide emergency backup supplies is limited in many parts of the region. In 1999 the Consortium began a study to examine the status of transmission facilities. This work examined past planning efforts, water demands and the existing transmission system; evaluation criteria were developed, and four scenarios were evaluated. Some of the institutional and financing issues were discussed, and public and Consortium feedback on the scenarios was presented. The result was a recommended Regional Storage and Transmission Strategy that was adopted by the Board in July 2000. The key strategy statements from the adopted report (see Appendix B) are:

   - ✓ Build interconnections between and among individual water systems within the region to increase the reliability of supply to individual communities and to the region as a whole.
   - ✓ In the long term, develop either a zonal or interconnected subregional transmission and storage system (depending on the sources) that the communities in southern Washington County which currently need water, develop for their primary supply.
   - ✓ Develop these projects though intergovernmental agreements (IGAs) among those agencies that choose to participate in the individual projects.

   Since its adoption, several entities have implemented transmission improvements that accomplish parts of this strategy. Specifically agreements in the Clackamas Basin provide for interconnections between systems. In the Washington County area, the Joint Water Commission has continued to expand their transmission linkages and Wilsonville participated with the Tualatin Valley Water District to upsize the raw water pipeline and intake in the Willamette Water Treatment Plant. Rockwood PUD signed an agreement with Clackamas River Water that contemplates a new transmission interconnection.

4. **Emergency Preparedness Planning (ongoing since 2001).** An Emergency Planning Committee was created and an Emergency Preparedness Manual was developed, which has been updated periodically. The Consortium has been actively involved in Emergency Planning since 1998 when efforts were initiated with an Emergency Preparedness Assessment. This survey helped the Consortium establish priorities for coordinating emergency planning and response activities. An Emergency Preparedness and Planning (strategic planning) workshop

followed in early 2001, which helped identify the steps needed to accomplish strategic goals for Emergency Planning. An Emergency Planning Committee was established in December 2001 to develop and carry out a work plan. The main objectives identified were to improve coordination and communication among providers, offer training, identify funding opportunities, explore ways to improve interconnections between providers and offer relevant resources.

The Emergency Planning Committee has accomplished many tasks including development of a Resource Notebook for water providers that includes an emergency contact list; recommendations for mutual aid agreements among water providers who do not have one in place; and other resources. The EPC monitors relevant legislation; brought together the provider's Public Information Officers; developed a communication survey and set of recommendations; coordinated with the FBI, County Emergency Managers and Health Departments; provided recommendations for data sharing; and developed and facilitated Incident Command System training and Table Top exercises.

Planning Policy Objectives

In the original RWSP, a diverse set of policy objectives was developed to provide a basis for evaluating resource options. These policy objectives captured the range of municipal water service issues that citizens, stakeholders and decision makers valued most. For the RWSP Update it was important to validate the policy objectives to ensure they were still relevant and that others shouldn't be added.

In September 2002, the Board reviewed the policy objectives and provided comments. The public also had an opportunity to weigh-in via a survey in the first RWSP Update Newsletter and on the Consortium Web page.

The Board confirmed that the policy objectives were still relevant and important. However, some changes needed to be made to acknowledge new source vulnerabilities and the potential for terrorism. Changes in local, state and federal regulations also needed to be acknowledged. The Board also felt that some policy objectives could be combined. They concurred that all of the policy objectives were of equal value and should not be prioritized.

In the survey, the Consortium asked the public to choose the most important policy objectives to consider in meeting future water supply needs. The top five answers were: efficient use of water, water quality, economic cost and equity, catastrophic events, and environmental impacts.

Table 6-1 on the following two pages shows the Regional Water Providers policy objectives that will be used to guide and inform decision making by the region's water providers. The original RWSP contains implementation actions and evaluation criteria that are still relevant to the policy objectives in this report.

Table 6-1
Regional Water Supply Plan – Policy Objectives

Efficient Use of Water

- Maximize the efficient use of water resources, taking into account current and emerging conservation opportunities, availability of supplies, practicality, and relative cost-effectiveness options.
- Make the best use of available supplies before developing new ones.

Water Supply Shortages

- Minimize the frequency, magnitude and duration of water shortages through a variety of methods including development and operation of efficient water supply systems, watershed protection, water conservation, security and emergency response coordination.
- Ensure that the frequency, duration and magnitude of shortages can be managed.
- Ensure that decision makers retain the flexibility to choose appropriate risk of peak-event shortages given applicable future conditions, constraints and community values.

Emergency Preparedness

- Minimize the magnitude, frequency and duration of water service interruptions due to natural or human caused events, such as earthquakes, landslides, volcanic eruptions, floods spills, fires, sabotage, terrorism, etc.

Flexibility

- Maximize operational flexibility to best meet the needs of the region, including the ability to move water around the region and to rely on back-up sources as necessary.
- Maximize the ability to anticipate and respond to unforeseen future events and changes in forecasted trends.

Ease of Implementation

- Maximize the ability to address existing and future local, state, and federal legislative and regulatory requirements in a timely manner.

Table 6-1 continued
Regional Water Supply Plan – Policy Objectives

Economic Cost and Cost Equity

- Minimize the economic impact of capital and operating costs of new water resources on customers.
- Ensure the ability to allocate capital and operating costs, e.g., rate impacts for new water supply, related infrastructure, and conservation water savings, among existing customers, future customers, and other customer groups, proportional to benefits derived by the respective customer group(s).
- Maximize cooperative partnerships to co-sponsor projects and programs that provide multiple benefits.

Water Quality

- Meet or surpass all current federal and state water quality standards for finished (tap) water.
- Utilize sources with high water quality.
- Maximize the ability to protect and enhance water quality in the future, including support and participation in watershed protection and pollution prevention based approaches.
- Maximize the ability to deal with aesthetic factors, such as taste, color, hardness and odor.

Environmental Stewardship

- Minimize (i.e., avoid reduce and/or mitigate) the impact of water resource development on the natural and human environments, including Endangered Species Act listings.
- Foster protection of environmental values through water source protection and enhancement efforts, conservation; complying with the Clean Water Act.

Growth and Land-Use Planning

- Be consistent with Metro's regional growth management strategy and local land-use plans.
- Facilitate and promote effective Regional Water Supply Plan implementation through local and regional land-use planning and growth management programs and ensure that water provider planning documents comply with state and local land-use laws.
- Provide coordination role to meet requirements the water supply element of Metro's Regional Framework Plan.

Updated Program and Resource Strategies

As a result of the activities of the Consortium since 1997, including the adopted policies and strategies noted above, and the work done in the RWSP Update as summarized in the preceding chapters, the strategies included in Chapter 12 of the original RWSP are replaced by the strategies in this section. In addition, as noted in Chapter 1, the Consortium Board has adopted a revised 5-Year Strategic Plan that changes the emphasis of the planning role of the Consortium. The original RWSP as endorsed by the original Consortium participants and the IGA that formed the Consortium ensured that the strategies of the RWSP were guidance to the individual water providers for their own decision making and project/program implementation. The Consortium has assumed an implementation role in two areas: conservation and emergency preparedness planning. The planning role of the Consortium in the future is directed at coordination and supporting the decision-making roles of the individual water provider members. The RWSP Update will need to be endorsed by the individual water provider members as well as revisions to the Consortium IGA that make clearer the planning role of the RWSP. The RWSP Update strategies are intended to incorporate already adopted Consortium policy actions, to represent a "clearinghouse" document for local planning and decision-making actions, and to support future decision making by individual entities by presenting options for future water supplies and providing tools that can be used to assess different options for the future such as water-demand forecasting, integrated modeling and conservation program evaluation.

1. Source Water Protection

The Source Water Protection Participation Strategy adopted by the Consortium Board in June of 1998 is incorporated into the RWSP. (See Appendix A.)

2. Transmission and Storage

The Transmission and Storage Strategy adopted by the Consortium Board in July 2000 is incorporated into the RWSP. (See Appendix B.)

3. Conservation

Conservation or efficient use of water supplies is a cornerstone of the region's efforts to meet water supply needs. The targets identified in the 1996 RWSP for the year 2000 (12.5 mgd in the peak season) have already been met in aggregate in the region through conservation-inducing programs at both the regional and individual provider level. The evidence generated in the water-demand forecasts demonstrates that per capita water consumption has been dropping in the region since the early 1990s. The reason for this is attributable to naturally occurring conservation (low flow plumbing fixture regulations and availability of low-flow appliances), economic effects, price-induced effects, conservation programs,

changes in behavior due to water shortages in 1992 and 2001, and in no small measure to land-use changes related to urban growth management that encourages smaller lot sizes and higher single family/multifamily mixes. The effects or rates of some of these changes will be reduced over time (economic, land use, fixture regulation); however, the effects as they have been observed are already incorporated into the water-demand forecasts.

Conservation programs will be required to increase reductions in per capita water use overall throughout the region. The Consortium has implemented regional conservation programs. These program concepts include the following types of programs:

- ✓ Residential Information, Education and Awareness
- ✓ Property Manager Workshops or programs that increase the effectiveness of larger landscape water-use reductions.
- ✓ Trade Ally Irrigation and Landscape Workshops

Individual provider entities have also self-selected the most effective conservation programs for implementation to include the following program concepts:

- ✓ CII Irrigation ET Controller Retrofit
- ✓ Large Landscape Audit
- ✓ Nonresidential Irrigation Submetering
- ✓ Multifamily Submetering
- ✓ CII Indoor Audits
- ✓ Toilet Rebate Program
- ✓ Residential Indoor Audits
- ✓ Residential Irrigation ET Controller Retrofit
- ✓ Waterless Urinals (awaiting approval from the Oregon State Plumbing Board)
- ✓ CII Outdoor Ordinance
- ✓ Eliminate Single-Pass Cooling
- ✓ Washing Machine Rebates

The program concepts apply to almost all customer classes. The projected water savings in 2025 associated with these programs is substantial and are reflected in Table 6-2.

Although these savings are not as high as those in the 1996, RWSP they are in keeping with the original RWSP numbers because the region has already evidenced substantial savings at the time of the RWSP Update in 2004. For reference purposes, when combined together, the observed savings in a major part of the region referenced in Chapter 3 (approximately 12 mgd) and those represented by the new programs selected by the water providers for the RWSP Update (approximately 19 mgd), the total is close to 31 mgd between 1996-2025. These savings are close to the 1996 RWSP projected savings of about 32 mgd in 2025. In addition, the RWSP Update programs emphasize some programs that

are year round in nature as opposed to being only focused on outdoor summer peak-season savings, which tends to reduce overall peak-season savings when only outdoor water programs are selected as was the case in the 1996 RWSP. Water provider members have heard from their customers that they place a high value on being able to conserve both indoors and outdoors.

Table 6-2

Projected Annual and Peak-Season Conservation in Year 2025 by Subregion

Subregion	Annual Conservation Savings (mg)	Peak-Season Conservation Savings (mgd)
East	2747	11.5
Clackamas	472	1.7
JWC	539	1.9
TVWD	630	2.1
Other	490	1.7
TOTAL	**4878**	**18.9**

The programs selected for implementation by the individual water providers will be further detailed in their State of Oregon Water Management and Conservation Plans when they are submitted. The Consortium conservation program provides for all members the mandatory programs as required by State rules.

4. Non-Potable Water Sources


TVWD water reuse system

The 1996 RWSP recognized that there was substantial potential for water reuse, recycling and direct use of non-potable sources in the region. Since the RWSP was written, further exploration of these options has happened in various parts of the region. Direct source switching has taken place for some larger customers, such as the Port of Portland and the Portland Parks Bureau. Clean Water Services in Washington County has explored the options of water reuse for their high level of treated effluent, and in Phase I of the Tualatin Basin Water Feasibility Study a small amount of reuse water is included (1,000 ac/ft per year). There has been increased interest on the part of some members of the Consortium, such as Sunrise Water Authority, to utilize water reuse to meet some portion of the largest new area added to the UGB in Damascus. The RWSP Update, however, did not have enough information for the Consortium to adopt a more specific policy about how much water supply could be developed from

reuse or untreated sources. The Consortium still supports the exploration of non-potable water supplies and will support changes to regulations that protect the public health while allowing more options to use rainwater and waste water. The Consortium supports the exploration of non-potable sources by the individual water providers, but is not proposing specific implementation strategies for the Consortium at this time.

5. Source Options

a. Base Case – Existing and Planned Near-Term Future Supplies

The evaluation of water supplies began with looking at the existing water supplies within the region. Since the 1996 RWSP, a number of water providers have implemented source development projects as contained in the Plan, including:

- ✓ Aquifer storage and recovery facilities by Beaverton
- ✓ Willamette River Water Treatment Plant at Wilsonville – 15 mgd
- ✓ Remediation of the Columbia South Shore Well Field to regain use of the installed capacity of 95 mgd
- ✓ Building Barney Reservoir expansion and expansion of the Joint Water Commission Water Treatment Plant
- ✓ Building a new Water Treatment Plant on the Clackamas River by the North Clackamas Water Commission (Sunrise Water Authority and Oak Lodge Water District) – 10 mgd
- ✓ Local groundwater projects by Fairview and Rockwood PUD

The evaluation of water sources in Chapter 4 and the modeling done for the RWSP Update as depicted in Chapter 5 include the existing water supplies of the region as they exist as well as supplies that have been committed by the individual water providers through their own water Master Plans and Capital Improvement Plans. Added supplies were assumed as follows:

- ✓ Clackamas River – South Fork Water Board (10 mgd) and an unspecified location for an additional 10 mgd
- ✓ Tualatin Basin – Joint Water Commission Water Treatment Plant expansion of 46.5 mgd to take advantage of contemplated improvements to the existing Barney/Hagg/Tualatin River supply system
- ✓ ASR – Beaverton facility expansion (2 mgd), Tigard (4.32 mgd) of planned facilities
- ✓ Groundwater – New wells for Sunrise Water Authority (11 mgd), Rockwood PUD (6.5 mgd), Fairview (1.7 mgd)

These additional amounts of supply meet the strategy for near term expansions contained in the 1996 RWSP, and further address the local deficiencies identified as potentially needing local source improvements and development.

b. New Potential Water Sources

The 1996 RWSP identified new water sources as larger scale ASR (40 mgd), Clackamas River (50 mgd), and an unidentified increment of supply (100 mgd), which could come from the Bull Run, Willamette or Columbia rivers. These same options were reviewed and modeled in the RWSP Update and included more options for smaller source development as contained in water provider Master Plans and the expansion of Hagg Lake. The modeling done for the update did not look at all of the sources that were reviewed in Chapter 4. The modeling shows that the region has a robust amount of existing water supplies when near-term committed resources are added to the base case. Adding transmission to allow water to flow to all of the demand nodes where supplies are not sufficient does meet most needs to 2025. However, as noted in Chapter 5 on the modeling outcomes, adding transmission to the base case supplies is the most expensive option, and it does not address institutional nor technical barriers to allowing all water sources to move throughout the region. Although the Clackamas emphasis option is the least cost option, institutional issues and water-rights issues will need to be resolved.

Modeling for the RWSP Update shows that there are a number of options that can be developed to meet the future needs of the region. Transmission is an important part of how new supplies will be available to meet deficiencies, but the cost of transmission is very high and therefore the decisions of what sources to develop over time must be balanced with the needs for transmission improvements and the financial arrangements that water providers will need to make to develop shared sources. The Portland region is blessed with multiple source options that can be developed, from the very large, to small local increments, such as groundwater and ASR. The strategy on potential new sources of supplies

therefore lists those sources that have been evaluated as being reasonable for future development, but does not recommend any particular ones, leaving those decisions to the individual water providers as a part of their Master Plans and State-required Water Management and Conservation Plans.

The following have been considered as potentially viable sources to meet regional and local water demands:

1) **Clackamas River** – Additional water rights exist on the Clackamas River and more are in the application process with the Water Resources Department. In addition, an agreement with PGE also makes some late summer water available to augment flows in the Clackamas River from Timothy Lake. The Clackamas River has a current installed peak capacity of 76 mgd from four water treatment plants. There was 20 mgd of additional supply included as near-term development. The modeling assumed an additional 50 mgd of capacity from the Clackamas. Depending on the amount and timing of development on the Clackamas River there could be significant permitting and water-right issues associated with this option that would need to be addressed.

2) **Hagg Lake Expansion** - Clean Water Services and the cities and water districts of Washington County have been studying the ability to raise the dam at Hagg Lake by various amounts, or to move the facility farther downstream in order to increase the storage capacity of Scoggins Reservoir. This option would bring online a significant amount of additional municipal water supplies and would involve other related projects, such as the Sain Creek Tunnel, more terminal storage at Fern Hill, and expansion of or building a new water treatment plant south of Forest Grove. There are significant permitting and water-right issues associated with this option that will need to be addressed.

3) **Bull Run** - A large new dam in Bull Run (Dam 3) was evaluated as a part of the 1996 RWSP and no further work has been done on this option since that time. However, the site is still feasible and would allow the development of a 19 billion gallon reservoir and make a significant amount of additional water available, some of which would be devoted to instream flows. Other related projects would be required to develop this option, such as a water treatment

plant, conduit capacity and terminal storage. This option would have significant permitting issues associated with it. In addition to Dam 3, the RWSP Update also included smaller increments of supply coming from Bull Run represented by raises of Dams 1 and 2, which together represent 2.4 billion gallons of additional storage. The Portland Water Bureau conducted a study in 2000 that looked at alternative methods to increase Bull Run supplies, which also included a lower Dam 3, additional storage at Bull Run Lake, off-site storage at Lusted Hill and additional storage from existing reservoirs that would be available if filtration treatment were developed in the future. The smaller projects listed would still have significant permitting issues, but they are likely to be less than Dam 3 options.

4) **Willamette River –** Since the 1996 RWSP, the Willamette has been developed as a municipal water supply source by the City of Wilsonville and Tualatin Valley Water District. The Willamette has significant municipal water rights that are coordinated by water-provider members of the Willamette River Water Coalition. A number of other water providers have considered the use of the Willamette River for municipal supplies; however, in each jurisdiction a public vote will be required to use this supply. The Willamette WTP in Wilsonville has been running for more than two years and the results of the treated water quality monitoring have been exceptional. In addition, studies have been conducted on the raw and treated water, and the sediments around the intake under different flow conditions, which also indicate excellent water quality. A two-year study was completed in 2004 by Oregon State University on the fish deformities in the Newberg pool that concluded that parasites were the cause of the deformities, and that these parasites are not harmful to human health. This option has public acceptance challenges, some unresolved water-right issues, but the permitting issues are likely to be less than for the other larger source projects listed.

5) **Columbia River –** The 1996 RWSP evaluated the use of the Columbia River and included it as a potential source in increments up to 500 mgd. Rockwood PUD did a pilot treatment study of the Columbia in 1994 that found that the water was of high quality and that direct filtration would produce water able to meet federal Safe Drinking Water

Act requirements. No further studies have been conducted on this source since that time. Rockwood PUD was granted a 50 mgd water right on the Columbia with a 1992 priority date. This source of supply is proximate to urban development areas. The public acceptability of this source would present challenges. The permitting issues for this source are likely to be expensive, but manageable, particularly in comparison to other larger sources available for consideration.

6) **Local Sources –** In the 1996 RWSP existing local sources were assumed to be available beyond the service areas where they were developed, but no additional smaller local sources were evaluated. In the RWSP Update the smaller local sources were also included in the modeling, although in some cases they were restricted to only being available to certain demand nodes that represented their current service areas. In aggregate the smaller local sources are a significant portion of existing supplies as can be seen in Table 5-1. Smaller local sources are important and are often lower cost alternatives to larger sources, which must be moved longer distances through transmission pipes. These sources include groundwater, aquifer storage and recovery facilities, and small surface water sources. Increased smaller local sources that have yet to be built were included in the base case as listed in Chapter 5.

Additional smaller local sources include:

- Bull Run groundwater
- Columbia South Shore Well Field additional groundwater development
- East Multnomah County groundwater in the Rockwood, Gresham and Fairview service areas

- North Clackamas County groundwater in the Sunrise service area
- Washington County groundwater in the JWC service area
- Aquifer Storage and Recovery in Clackamas River Water, Tualatin, Tigard, Beaverton and Sherwood service areas

6. Emergency Preparedness

One of the original policy objectives of the RWSP is to "minimize the magnitude, frequency, and duration of service interruptions due to natural or human-caused catastrophes, such as earthquakes, landslides, volcanic eruptions, floods, spills fires, sabotage, etc." The evaluation criteria had mostly to do with being able to meet demand and ensuring back-up supplies from the different sources during an event. Since that time, the climate around emergency preparedness has dramatically changed. September 11, 2001, made real the threat and devastation of terrorism that was not addressed in the original RWSP. Subsequent work with the Consortium also highlighted the need for improved coordination and communication among providers.

As a whole, water providers are better prepared to respond to emergencies. In response to 9/11, Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. This act recognizes the need for drinking water systems to undertake a more comprehensive view of water safety and security. The Act amends the Safe Drinking Water Act and specifies actions community water systems and the U.S. Environmental Protection Agency must take to improve the security of the nation's drinking water infrastructure. All water providers serving populations of more than 3,300 persons must complete a vulnerability assessment and emergency response plan by the end of 2004.

As stated in the Consortium's updated Strategic Plan, continued emergency planning and coordination is critical to minimizing the severity of an event and meeting customer needs. A coordinated emergency response strategy will most likely lessen the duration and severity of an event for individual providers and ease recovery. Each water provider has been provided tools and has the opportunity to evaluate their individual systems, and to take actions or develop programs to reduce vulnerabilities. Complete elimination of all vulnerability is not likely. However, if the region's providers have the ability and framework in place to respond effectively, coordinate on a regional level and rely on each other for assistance during either individual or multiple system emergency events, the emergency can be more efficiently dealt with and there is a greater chance that water service can be maintained with less disruption. Having appropriate plans in place also ensures eligibility for public assistance for repairs after an emergency.

7. Consortium Functions to Support Local Decision Making

The Consortium will support local decision making though continuing to provide a clearinghouse role in revising and updating the RWSP on a timeframe as

directed in the Consortium Intergovernmental Agreement. The Consortium has developed a number of tools that can be used to facilitate future RWSP revisions and for local or subregional water planning. These tools include:

- ✓ ConEast – a conservation program spreadsheet program
- ✓ Water-Demand Forecast Models for each of the individual water providers
- ✓ *Confluence*® – an integrated planning model that represents most of the Portland region's water supplies, conservation programs and demand forecasts, which can be used to evaluate different ways of meeting future demands.

The Consortium will develop updated regional water-demand forecasts when official forecasts are available from Metro. The Consortium encourages each provider member to collect water consumption and production data sufficient to improve the quality of water-demand forecasting.

The decision-making support functions of the Consortium will be directed to provide a regional context for local Water Master Plans, water-right permit extensions of individual provider members, and Water Management and Conservation Plans for members who are required to develop plans to support new or extended water rights.

8. The Consortium and Metro

The Consortium is comprised of the region's water providers and Metro, the area's regional government. The 1996 RWSP contained a specific set of strategies regarding the role of Metro and the Consortium. The region's water providers recognize that Metro establishes and manages the region's urban growth boundary, develops forecasts of population growth, and ensures that local jurisdictions' land-use plans and zoning codes comply with the Regional Framework Plan and Regional Growth Management Functional Plan. Metro endorsed the RWSP in 1996 when it joined the Consortium and referenced the Plan in the Water Management chapter of the Regional Framework Plan. The Consortium continues to have a role in water supply planning coordination and implementation of conservation and other regionally based programs. The strategy for this continuing role includes the following:

- ✓ The region's water providers and Metro should continue their ongoing mutually supportive partnership. The Consortium and its members will participate in Metro policy development and implementation programs to ensure that water supply needs are adequately addressed.
- ✓ The Consortium and the RWSP provide a mechanism to ensure that water supply needs are met in a coordinated and efficient manner that recognizes a broad range of expressed public values.
- ✓ The RWSP will be periodically revised based upon Metro's demographic and employment projections, and on adopted elements of Metro's Regional Framework Plan and the UGB.

- ✓ The region's water providers are responsible for the financing and construction of necessary water supply improvements.
- ✓ Metro's Regional Framework Plan will continue to reference the RWSP in its Water Management chapter.

Conclusion

The development of the RWSP Update has taken three years to accomplish and could not have been done without the leadership and dedication to continued regional cooperation among the region's water providers and Metro. The RWSP Update does present a different perspective on regional planning: one that represents changed requirements for each member to consider integrated water resources planning principles in their Water Master Plans and Water Management and Conservation Plans. This document presents a revised set of policy objectives for water providers to consider in their local decision making, a set of conservation programs for regional and local implementation, and a list of potential water supply options that will be evaluated more fully in local plans. The RWSP Update also recognizes the expanded role of the Consortium in areas of emergency planning, regional conservation program implementation, and continuing to manage and utilize planning decision support tools as directed by the Consortium Board.

Appendix A
Source Water Protection Strategy
June 1998

Regional Water Providers Consortium
for the
Portland Metropolitan Area

Adopted Strategy for
Participation in
Source Water Protection Efforts

June 1998

----- *respectfully submitted by the Regional Water Providers Consortium Technical Committee and the Consortium Source Water Protection Stakeholder Advisory Committee* ------

I. Overview of Source Water Protection Participation Strategy Development Process

In September of 1997 the Consortium began developing a strategy to guide and target future Consortium participation in source water protection activities. For the purposes of this effort, "source water protection" means reducing the risk of impairing the quality and quantity of the Portland metro area's existing and potential future drinking water sources.

The primary purpose of developing a strategy is to determine which of the myriad of source water protection related activities the Consortium should participate in to achieve desired outcomes and meet identified criteria. The strategy will guide Consortium activities in the near-term, and provide a foundation for longer-term activities as well.

The Consortium Board initiated the strategy development process by approving a set of desired outcomes and a work plan. The desired outcomes included:

- The Consortium would become an active advocate for protection of all the sources currently in use, surface water and groundwater, and those selected and considered in the Regional Water Supply Plan for the Portland Metropolitan Area.

- The Consortium's role in achieving source protection would be established in, and fostered by, the strategy.

- The Consortium may adopt some basic policy or influence the policies of others regarding source protection to help guide protection efforts over time.

- The individual water provider entities would be able to take more consistent positions on source water protection as a result of developing such a strategy in a regional context.

- The Consortium could more effectively participate in legislative efforts to forward source protection and perhaps even sponsor some legislation in the future.

- The involvement of the elected officials, through the Consortium Board and the individual provider decision making bodies will bring a more concentrated and effective focus on what needs to be done to foster source protection efforts.

- The strategy will recognize that the region's water sources are quite diverse in geographic location and type, and the existing and potential impacts on those sources may be different. In other words, a "one size fits all strategy" may not be appropriate. Some latitude may need to be included to allow for different types of efforts, programs, policy, or regulation within the various parts of the region.

The work program for this effort has taken about eight-months to complete. A

stakeholder advisory committee (SAC) was established to assist during this period. The SAC is a broad-based group of over twenty individuals representing state and federal public agencies, watershed councils, environmental and civic interests, and private resource user and industry interests.
The SAC held five meetings between late September and mid-February. During this time the committee, with assistance from Consortium staff, completed all requested tasks including identifying key source water protection issues, criteria, and potential activities, evaluating the activities against the criteria, and developing recommendations for CTC consideration. ***The hard work of the SAC is reflected in the quality of these products and is much appreciated.***

The Consortium Technical Subcommittee and Technical Committee were kept apprised of SAC's progress through the distribution of interim products and discussion at regularly scheduled monthly meetings. The SAC, CTSC, and CTC prepared a consensus-based package of recommendations for consideration by the Board at its February 25, 1998 meeting. The Board approved the draft source water protection participation strategy (dated February 18, 1998) in concept, and directed staff to work with the SAC to provide additional specificity and to prioritize the activities outlined in the draft strategy.

The remainder of this report presents the refined strategy for consideration by the Board. Section II. presents the criteria developed and used to evaluate the relative benefits of participating in different types of source water protection related activities. Section III. presents a list and brief discussion of recommended key activities areas (by major activity heading). Section IV. presents an "activity task matrix" that lists specific tasks in each activity area and identifies both the recommended timing for implementation and whether the Consortium and/or individual water providers are proposed to take the lead. Section V. suggests steps for evaluating the effectiveness of the strategy implementation and keeping the strategy up-to-date.

The revised strategy includes a packet of attachments. The attachments include all key products of the SAC (verbatim), along with several other informational items. Attachment 1 is the list of SAC members. Attachment 2 presents the complete, consolidated list of key source water protection issues identified by the SAC. Attachment 3 presents the preliminary full range of activities identified and evaluated by the SAC and CTC prior to developing the February 18 draft strategy. Attachment 4 presents the SAC's proposed refinements to the February 18, 1998 draft strategy "unabridged." Attachment 5 provides an outline and presentation explaining the role of treatment and source water protection in the "multiple barrier" approach to providing safe drinking water. This outline was presented as an informational item to the SAC early in the strategy development process.

Consortium staff also developed two background information papers to facilitate development of the strategy. One paper addresses key source water protection issues and participation opportunities facing the region, and highlight current activities underway at the local, regional, state, and federal level. The other providers an overview of drinking

water standards and current source water protection issues relating to Portland metro area's existing and potential future drinking water sources. Given the length of the these papers, staff proposes not to attach them to the strategy package, but rather to offer them to interested parties on a case by case basis.

Section II. Identifying Key Issues and Evaluation Criteria

The first phase of the source water protection strategy development involved identifying key issues and criteria to be used in evaluating and selecting among potential activities.

The stakeholder advisory committee (SAC) spent considerable time and effort identifying a host of issues which were felt to warrant attention. Issues fell into several general categories including:

- Scope of Analysis/Philosophy/Policy Issues
- Contamination Risks and Water Quality/Quantity Relationships
- Information/Data/Monitoring
- Planning/Land Use/Growth Management
- Education/Coordination/Advocacy

The complete, consolidated list is provided as Attachment 2.

The SAC generated an extensive list of potential activities which the Consortium could implement to address these key issues. The full list of activities is provided as Attachment 3. (Note: This list of activities has been modified or consolidated during the process of developing and refining the strategy.

Consortium staff worked with the SAC to generate an "issue statement" explaining succinctly the challenge, and "criteria" with which to evaluate and select among the broad range of potential activities the Consortium could undertake. The SAC narrowed down the full list of criteria to four key criteria in order to make the evaluation process more manageable. The CTC reviewed and agreed with the SAC's selection of key criteria. The Issue Statement and Evaluation Criteria are provided below.

Issue Statement:
The Regional Water Providers Consortium for the Portland Metropolitan Area has assigned a high priority to the development of a strategy for Consortium participation in efforts to protect existing and potential drinking water sources (surface water and groundwater. Numerous activities underway and planned at the local, state and federal level will affect the quality and quantity of the region's current and future water sources. The Consortium has no regulatory authority but rather is a collaborative, voluntary organization that is funded annually through the voluntary dues of its members. The Consortium is established to promote the voluntary coordination of individual and collective actions of its members, provide a forum for discussion of water supply issues of mutual interest to its members, coordinate member responses, and establish an avenue for public participation in water supply issues of regional concern. The Consortium needs to

establish its role and determine in which of the many source water protection related activities it will participate. The Consortium will work with stakeholders to identify issues and criteria for selection of activities that will comprise a source water protection participation strategy.

Criteria for Evaluating Potential
Source Water Protection Participation Activities
(Key criteria are presented in larger font and bold type.)

- Activities selected to comprise the strategy will have a clear and relatively direct relationship to source water protection.

- **Activities with a regional scale focus or larger (e.g., basin-wide, state, federal) will be preferred. Activities have the potential to affect the region's individual water sources may be undertaken in concert with individual water providers or groups of providers.**

- Selected activities will contribute substantially (e.g., long-term, measurable, widespread) to meeting the Regional Water Supply Plan objectives to maintain and enhance the short- and long-term viability of current and potential water sources.

- **Selected activities must assist the Consortium and its members in providing clean, safe, affordable drinking water. Having met this criterion, activities expected to yield additional benefits (e.g., Clean Water Act compliance, habitat enhancement, water use efficiency, etc.) will be preferred.**

- Selected activities will focus on areas of common ground and consensus, reflecting the coordinative, collaborative role of the Consortium established by inter-governmental agreement. (The Consortium may offer to provide a forum for discussion of controversial source water protection issues if deemed a regional priority.)

- Activities will be preferred if the Consortium's participation, as a collective body, will yield benefits that individual water providers (or groups of providers) can not readily generate, or if the Consortium's participation is requested by individual providers for assistance. (Note: There is a significant role for individual water providers and groups of providers as well as for the Consortium.)

- **Activities which lend themselves to partnerships in which working together can accomplish greater benefits or offer cost-sharing opportunities will be preferred.**

- **Activity selection may reflect a recognition of time-sensitivity or "windows of**

opportunity."

- Selected activities will provide the greatest benefit for the cost, and will make the best use of the available budget (proposed at $10,300 or 250 consortium staff hours + materials for FY 1998-99 - costs for general public information covered under separate budget line item). (Note individual providers or groups of providers may voluntarily contribute additional funds for project or programs on a case-by-case basis.)

- The strategy will evolve over time to reflect changing needs, resources, and priorities.

III. Discussion of Recommended Source Water Protection Activities

The Stakeholder Advisory Committee (SAC) and Consortium Technical Committee (CTC) believe that the following list of activity categories are high priority for achieving source water protection goals for the region. Among the options evaluated, these activity areas seem to offer the most promise toward meeting key criteria outlined in Section II. above. The brief written discussion provided after each category heading reflects some of the key points raised by water providers and stakeholders during the strategy development process. Specific recommended tasks for each category area are presented in Section IV of this report.

Recommended Source Water Protection Activity Categories
(not listed in priority order)

- **Pursue Partnerships and Intergovernmental Agreements for Source Water Protection taking advantage of the range of formal and informal options; explore alternative funding options (e.g., EPA grants for regional programs); seek opportunities to generate "transferrable" information and benefits.**

Discussion: It is recommended that the authority of the Consortium to enter into intergovernmental agreements and other legal issues (e.g., representation) be explored further, along with opportunities for regional support of local or basin-specific efforts led by water providers and others. Recognizing that this is not a"one size fits all" activity and will depend on the issues and sources involved, the activity may be most suitable for pursuit by water providers involved with specific water sources. However, there may be roles for the Consortium including active support of water providers attempting to establish or operate within the constructs of such agreements.

- **Promote and Facilitate Wellhead Protection for Groundwater Systems and ASR - explore mechanisms and potential Consortium Board advocacy role to encourage wellhead protection in the region.**

  Discussion: It would be appropriate for the Consortium to focus on those areas which are not as readily addressed by individual providers. For example, Consortium action may be helpful in promoting wellhead protection for regional ASR sites or in regard to regional or statewide program development. Consortium could also provide political support to those providers that are working on wellhead protection for their systems. Activities should also take advantage of windows of activity associated with near-term land use planning and growth management decisions.

- **Keep the Congressional Delegation, the Oregon Legislature, and State Agency Policy Bodies (e.g., Environmental Quality Commission, Water Resources Commission, Oregon Board of Forestry, etc.) apprised of source water protection issues; participate in or pursue legislation (including agency budgets) and administrative mechanisms to promote source water protection. Participate in agency planning and rulemaking processes in support of source water protection.**

  Discussion: SAC and CTC discussion emphasized the opportunity for the Consortium to be effective in these arenas by speaking with a united voice on key source water protection issues. This activity offers a great deal of potential benefit for a reasonable amount of resource outlay.

- **Promote Water Use Efficiency (e.g., joining/contributing to the Columbia-Willamette Water Conservation Coalition); raise awareness and emphasize the role of conservation in source water protection through increased longevity of existing and potential drinking water sources.**

  Discussion: Promoting water conservation received strong support from the SAC and CTC members. Conservation is a critical component of the long-term resource strategy in the Regional Water Supply Plan and is proposed to be funded as a separate line item in the Consortium's proposed budget work program.

- **Sponsor Education and Awareness/Citizen education on topics such as pollution prevention, groundwater vulnerability, stormwater, household hazardous waste. Seek opportunities for partnerships, coordination, and economies of scale.**

  Analysis: Both water providers and SAC members noted that sponsoring education and awareness for source water protection seems "a natural" for the Consortium given the potential for regional and multiple benefits, along with

partnerships particularly with wastewater agencies and watershed councils. Activities should be carefully targeted and coordinated make the best use of resources and avoid expending too many resources on this one activity.

- **Participate in Oregon Department of Environmental Quality (DEQ) Drinking Water Protection Program and Advisory Committee/Coordinate with Oregon Health Division (OHD) Drinking Water Advisory Committee**.

  Discussion: It will be important for the Consortium to remain"at the table" during the DEQ drinking water protection program development activities scheduled for the upcoming year. The Consortium has a representative on the DEQ advisory committee. Opportunities to coordinate with the OHD Drinking Water Advisory Committee regarding activities such as the State Revolving Fund allocations for source water protection should be explored.

- **Coordinate with Governor's Willamette Basin Task Force and Livability Forum; Participate in legislation and budget items that are expected to emerge from the Task Force and Livability Forum efforts**.

  Discussion: The CTC and SAC agree that the Consortium should monitor the progress of these efforts (including legislation/budgets), and "weigh-in" to help shape those future courses toward the goal of source water protection. Participation in the Willamette Task Force and Livability Forum should be targeted since these efforts will take some time to define their own courses of action.

- **Advocate for Source Water Protection on state and private lands through participation in the rulemaking activities of the Oregon Departments of Forestry and Agriculture**.

  Discussion: There is strong support for working through state agency rulemaking processes to address source water protection issues relating to state and private lands. This issue is also important and timely given opportunities for "synergy" with current salmon recovery efforts.

- **Promote source water protection through coordination with Metro planning and growth management activities (e.g., Title 3, Goal 5 Analysis, upland watershed/stormwater management).**

  Discussion: Water providers and the SAC agree that coordination with Metro on these efforts is a high priority, recognizing that the applicability to source water protection is somewhat limited as most of the source intakes and source

watersheds are outside Metro's jurisdiction. However significant benefits may be gained for groundwater and for Clackamas source given that Metro's jurisdiction is proximate and upstream of current supply intakes. In addition, SAC members point out the Consortium and water providers need to stay involved with Metro resource management activities for reasons relating to both substance (source protection) and consistency (e.g., taking care of one's "own backyard" before asking others to make changes in their practices).

Consortium staff intend to participate in Metro's planning efforts to ensure that regional water infrastructure needs and concerns are addressed. However, participation should be targeted strategically to manage staff resources efficiently. This activity is proposed to be funded under the intergovernmental coordination line item in the Consortium's FY 1998-99 work plan and budget.

- **Coordinate with wastewater agencies regarding impacts of discharges on source waters.**

Discussion: Coordination between water suppliers and wastewater agencies to achieve respective and mutual water quality objectives will be an important piece of the future source water protection picture. A key challenge with be for municipalities to balance their own internal objectives as municipal water and wastewater providers. The Consortium can help be promoting a total water management approach and supporting local water providers in watershed-based planning processes. This activity would also be integrated with TMDL coordination activities summarized below.

- **Participate in DEQ 303 (d) list and TMDL priority setting/implementation; Participate in development of watershed plans and associated DEQ and ODA watershed committees; Participate in DEQ priority-setting for completing TMDLs; This activity should be pursued by individual providers (with Consortium support) and/or by the Consortium as a collective entity, depending on the activity.**

Discussion: The total maximum daily load (TMDL) setting process is critical piece in addressing Oregon's current and future water quality issues (including non-point pollution). Ultimately, TMDLs will be set for most of the region's current and potential future surface water sources.

The SAC expressed strong support for Consortium participation in this activity. The SAC and CTC agreed that the Consortium could potentially be effective in influencing the order in which TMDLs will be established for Oregon's water bodies. Individual providers from the various basins could take on a lead role in the actually TMDL setting process. In particular SAC suggested that the water providers and Consortium should help focus more agency and public attention on the existence of municipal intakes, and on drinking water as a beneficial use on water quality limited streams. Some suggested that water providers need to be more vocal in this arena.

The TMDL setting process is also seen as an opportunity to coordinate with Oregon Department of Agriculture in developing agricultural water quality management plans upstream of municipal supply facilities. This process and related activities should also be linked to the DEQ drinking water protection program and coordination with wastewater agencies.

- **Participate in the establishment of drinking water and water quality standards relating to source water protection (e.g., BMPs, turbidity).**

Discussion: The SAC and CTC agreed that strategic Consortium participation in specific federal and state water standard-setting processes (e.g., drinking water standards - OHD; DEQ triennial review process) could help foster source water protection for the region.

- **Promote Coordinated Water Quality Monitoring; Convene a discussion of coordination needs and partnership opportunities.**

Discussion: The Consortium could provide a forum for collaboration in determining water quality monitoring priorities as they relate to source water protection and other objectives. This is also an activity which could be effective for basin-specific water providers to take the lead with Consortium support.

SAC members highlighted the need to think more about how and why various types of monitoring is needed, and to be attentive as to how monitoring will help achieve objectives. The SAC encouraged the Consortium and water providers to promote "smart monitoring" by focusing on water quality parameters of concern vis-a-vis drinking water source protection. It is also important to characterize monitoring as an activity which is complementary to source water protection but not as one which precludes the timely pursuit of "common sense" protection activities.

- **Monitor, and participate as needed, in the Governor's Right-to-Know Task Force and related legislation or rulemaking to promote improved access to public information, and to maintain local abilities pursue and achieve source water protection.**

Discussion: The Governor's Right to Know Task Force is currently meeting in efforts to meet its charge. This issue warrants monitoring and potential participation in areas that may pertain to source water protection such as information accessibility and local regulatory authority.

IV. Recommended Tasks

In order to refine the February 18, 1998 draft source water protection participation strategy, the SAC spent considerable time and effort discussing the activity categories

and generating a list of specific recommended tasks for the Consortium and/or individual water providers to pursue.

After generating the task list, the SAC requested that Consortium staff identify suggested priorities and time frames for initiating, and in some instances completing, the tasks. Staff has attempted to do so as presented in the following matrix.

Please note that the tasks are prioritized not in terms of importance but rather in terms of timing. This is because staff believes that each of the identified tasks are important to address at some level of effort and at some point in time. The level of effort committed to any particular task will be determined as part of ongoing workload management associated with the Consortium's annual budget and work plan.

V. Keeping the Strategy Up-To-Date

During the strategy refinement, the Stakeholder Advisory Committee (SAC) expressed a strong interest in making sure that the Source Water Protection Participation Strategy be a dynamic process that can be revisited and modified to reflect changing conditions and priorities. The SAC agreed that stakeholder involvement would help keep the strategy current and responsive to changing circumstances. The committee also noted that convening stakeholders periodically would provides opportunities for information sharing that will enhance the effectiveness of our respective source water protection related efforts.

Based on the points raise in this discussion, staff recommends that the Consortium convenes the SAC annually to discuss current source water protection issues and to review the Consortium's and water providers' progress in implementing the Source Water Protection Participation Strategy. One (or perhaps two) meetings would be scheduled in time for stakeholder input can be considered before Consortium prepares its work plan and budget for the following fiscal year.

In addition, it will be important to continue the open, information-sharing process that has occurred through the SAC process. This can be accomplished between meetings through effective use of electronic mail, attendance at monthly CTC meetings and other types of correspondence. It is the CTC's hope that SAC members will take the initiative to keep the lines of communication open regarding current and future source water protection issues and opportunities.

Activities and Tasks (Activity categories are shown in bold/italics. Tasks are shown in normal type.)	**Implementation Priority/Timing** 0=ongoing 1=begin now thru FY98-99 2= begin post-FY98-99 a.n.= as needed	**Lead Agency** C=Consortium WP= Water Provider(s) C/WP=Cons. & Provider(s)
Activity: Pursue partnerships and intergovernmental agreements for source water protection, taking advantage of the range of formal and informal options; explore alternative funding options (e.g., EPA grants for regional programs); seek opportunities to generate "transferrable" information and benefits.		
➢ Focus on opportunities for formal and informal interagency agreements by participating in projects that "pull the pieces together" such as the Willamette Province Advisory Committee, Corps/WRD Willamette Basin Reservoir studies.	1	C/WP
➢ Collect copies of intergovernmental agreements pertaining to source water protection and will provide a clearinghouse in which individual water providers and others could obtain copies on request. Help facilitate citizen involvement in source water protection related issues by providing informative progress reports and referrals to other contacts on request.	1	C
➢ Support, as needed, individual water providers in their efforts to establish agreements or partnerships with agencies to protect source waters and address identified problems.	a.n.	C/WP
➢ Offer to serve in a facilitator role if there is disagreement between parties who are working to establish, or are subject to agreements.	a.n.	C/WP
➢ Explore opportunities for partnerships with the US Forest Service and Oregon Department of Forestry to reduce the risk of illegal dumping of chemicals and illegal fires on forest lands.	2	C/WP
➢ Explore opportunities to leverage funds and generate transferrable information by partnering with	2	C

EPA (e.g., sediment studies, work in basins such as Sandy and Willamette) and other agencies.		
Activity: Promote and facilitate wellhead protection for groundwater systems and ASR - explore mechanisms and potential Consortium Board advocacy role to encourage wellhead protection in the region.		
➢ Recommend the development and adoption of plans to protect drinking groundwater sources and groundwater resources in the region.	1	C
➢ Initiate discussions with individual providers, local planning agencies, Metro and WRD regarding ways to ensure proper well abandonment as a part of the development review/land use approval process.	2	C/WP
➢ Gather and provide information regarding the costs and benefits of wellhead and groundwater protection, and seek local spokes people to help "get the word out."	1	C/WP
➢ Work with the DEQ to provide easy access to case examples (e.g., model ordinances) of local wellhead/groundwater protection strategies.	2	C
➢ Provide input to Oregon Water Resources Department Triennial Review to ensure that information developed as part of ASR pilot projects will contribute to development of wellhead protection plans.	a.n.	C
➢ Provide input to the Oregon Water Resources Department to ensure proper well abandonment and to target well inspections.	2	C/WP
Activity: Keep the Congressional Delegation, Oregon Legislature, and state agency policy bodies (e.g., Environmental Quality Commission, Water Resources Commission, Oregon Board of Forestry, etc.) apprised of source water protection issues; participate in or pursue legislation (including agency budgets) and administrative mechanisms to promote source water protection, participate in agency planning and rulemaking processes in support of source water protection.		
➢ Make sure the Governor's office is kept informed about source water protection issues and	1	C

	priorities.		
➢	Coordinate with agency directors regarding development of legislative packages and comments on draft bills.	1	C/WP
➢	Coordinate with and provide information to federal agencies.	1/O	C
➢	Continue participating and representing drinking water source protection issues in the Willamette Province Advisory Committee.	1	C
➢	Seek opportunities for coordinated review and comment federal, state and local land management plans, rules and legislation (e.g., advocacy for selective restrictions on land uses and land management practices such as logging, mining, agriculture and development).	1/O	C/WP
➢	Coordinate in "getting the word out" to individual water providers and watershed councils regarding federal, state, and local planning activities that relate to source water protection.	1/O	C
➢	Work with lobbyists (e.g., AWWA, LOC) to convey important information and collective positions.	a.n.	C
➢	Explore opportunities for participating in presentations to policy boards (e.g., EQC) regarding drinking water issues and source water protection priorities.	2	C
➢	Work with candidates to assess/develop appreciation and support for source water protection,	2	C
➢	Look for opportunities to work with local agencies (e.g., building departments) and others that may not have been involved in source water protection issues so far.	2	WP
Activity: Promote water use efficiency (e.g., joining/contributing to the Columbia-Willamette Water Conservation Coalition); raise awareness and emphasize the role of conservation in source water protection through increased longevity of existing and potential drinking water sources.			
➢	Continue carrying out the conservation implementation project.	1	C

➢ Explore opportunities to fold conservation into SDWA SRF approval criteria for drinking water treatment facilities.	1	C
➢ Explore ways for water providers to capitalize the financing of conservation measures.	2	C/WP
➢ Explore opportunities for system development charges (SDCs) to promote conservation and water use efficiency as part of the water "infrastructure."	2	C/WP
Activity: Sponsor education and awareness/citizen education on topics such as pollution prevention, groundwater vulnerability, stormwater, household hazardous waste. Seek opportunities for partnerships, coordination, and economies of scale.		
➢ Assist in the dissemination of pollution prevention, groundwater vulnerability, stormwater, household hazardous waste. Seek to incorporate the source water protection "link" into information on these topics which is being developed by the Consortium, water providers, or other parties. Seek opportunities for partnerships and economies of scale.	1/O	C
➢ Provide information on existing web-sites, ensure timeliness to keep information current and accurate,	1/O	C
➢ Provide copies of the draft source water protection strategy at upcoming Oregon APA conference on Land Use and Water Quality (April 30) and in other venues to inform citizens and stakeholders of the Consortium's interest in, and commitment to source water protection.	1	C
➢ Explore viability of developing a Consortium web-site in later years.	2	C
Activity: Participate in Oregon Department of Environmental Quality (DEQ) Drinking Water Protection Program and Advisory Committee/Coordinate with Oregon Health Division, Drinking Water Advisory Committee.		
➢ Continue Consortium participation in the DEQ Drinking Water Protection Advisory Committee.	1	C/WP
➢ Explore opportunities for promoting source water protection through coordination with the	1	C

	Oregon Health Division (e.g., participation in Drinking Water Advisory Committee, input re: criteria for allocation of federal funds for implementation of the SDWA).		
Activity: Coordinate with the Governor's Willamette Basin Task Force and Livability Forum; Participate in legislation and budget items that are expected to emerge from the Task Force and Livability Forum efforts.			
➢	Seek opportunities to provide early input on the Willamette Livability Forum's proposed vision statement. Contact Consortium member representatives and Forum staff (Rebecca White) for status and opportunities.	1	C/WP
➢	Track the potential broadening of the Willamette Basin Task Force membership (recommendation to the Governor). Seek water provider and/or Consortium representation on the Task Force to ensure that drinking water issues (including source water protection) are being forwarded by the drinking water community.	1	C/WP
Activity: Advocate for source water protection on state and private lands through participation in the rulemaking activities of the Oregon Departments of Forestry and Agriculture.			
➢	Make sure the Consortium is on the rulemaking notification lists for these agencies.	1	C
➢	Find out about an ODF committee working on issues related to landslides.	1	C
➢	Keep up with ODA implementation of SB 1010 and monitor priority setting for implementation, especially given Steelhead listing as a threatened species in the Lower Columbia Evolutionary Significant Unit. Strive to get and keep drinking water issues, including source water protection, "on the radar screen." (Contact: Peggy Vogue).	1	C
➢	Offer presentations on drinking water issues and source water protection to advisory bodies involved with ODF and ODA rulemaking and program implementation.	1	C
➢	The Joint Water Commission should review and consider providing input on the Tillamook Forest Plan and Habitat Conservation Plan.	1	WP

➢ Support access to pesticide information and support consideration of pesticide use restrictions.	2	C
Activity: Promote source water protection through coordination with Metro planning and growth management activities (e.g., Title 3, Goal 5 Analysis, upland watershed/stormwater management).		
➢ Propose building source water protection (including surface and groundwater/wellhead protection) into Metro's upcoming Goal 5 and uplands/watershed planning efforts.	1	C
➢ Provide input in support of Title 3 as a source water protection tool at the upcoming Metro Council meeting(s).	1	C
➢ Local water providers should stay involved with implementation of Title 3, Goal 5 analysis, upland/watershed planning, and other Metro-sponsored programs that can have source water protection benefits.	1	WP
➢ Explore partnerships with the United States Geological Survey (USGS) for assistance in implementing the SDWA (e.g., delineation of source water protection areas), stream gaging (especially large basins with region-wide implications). Focus on issues in which regional cooperation is important.	2	C/WP
➢ Consider providing presentation(s) to Metro advisory bodies to explain and garner support for source water protection as it relates to long-range planning and growth management.	2	C
Activity: Participate in DEQ 303 (d) list and TMDL priority setting/implementation; Participate in development of watershed plans and associated DEQ and ODA watershed committees; Participate in DEQ priority setting for completing TMDLs. This activity should be pursued by individual providers (with Consortium support) and/or by the Consortium as a collective entity, depending on the activity. ***Activity: Coordinate with wastewater agencies regarding impacts of discharges on source waters.***		

➢	Explore opportunities influence the priority setting process for TMDL implementation.	1	C/WP
➢	Advocate for integrated water resources management to help address internal conflicts within the water provider community (i.e., reliance on ability to divert water, promotion of source water protection, cities acting as both diverters for water supply and dischargers of wastewater). Work with wastewater providers on this issue.	1/O	C/WP
➢	Check status of Three-Basin Rule and its relationship to the TMDL process.	1	C/WP
➢	Promote the inclusion and evaluation of appropriate parameters (e.g., toxics, microbials, sediments), in the context of drinking water as a beneficial use.	1	C/WP
➢	Coordinate with Oregon Department of Agriculture in developing agricultural water quality management plans upstream of municipal supply facilities. Help link to drinking water source protection and coordination with wastewater service providers.	2	WP
Activity: Participate in the establishment of drinking water and water quality standards relating to source water protection (e.g., BMPs, turbidity).			
➢	Participate and work with others involved in EPA and DEQ standard setting, including: Willamette River; SDWA; Clean Water Act; unregulated chemicals; VOCs; pesticides; triennial rule review; setting priorities for establishing standards; funding for setting standards.	2	C
Activity: Promote coordinated monitoring.			
➢	Seek forums for discussion/promotion of coordinated monitoring (e.g., watershed councils, Oregon Plan Team, federal agencies, DEQ, ODF, etc.), and thinking about how and why to monitor - Be attentive to how monitoring will benefit in achieving objectives (e.g., assessment). Explore the merits of convening a stakeholder discussion of coordination needs and partnership opportunities.	1	C/WP
➢	Explore opportunities for sharing technical assistance among Consortium member agencies to facilitate effective coordinated monitoring efforts.	1	C

➢	Recommend types and placement of water quality and quantity monitoring on federal, state, and private lands. Characterize and use monitoring as a complement to source water protection. Need monitoring to establish baseline water quality information and track changes, but do not use lack of data to defer implementation of common sense source protection activities.	1	WP
➢	Promote the use of monitoring to contribute to improved models such as those used to determine "hydrologic recovery" associated with projects on forest lands.	2	WP
➢	Identify and focus on opportunities for data sharing as an incentive for coordinated monitoring.	1	WP
Activity: Monitor, and participate as needed, in the Governor's Right to Know Task Force and related legislation or rulemaking to promote improved access to public information and facilitate water provider drinking water source assessment and protection efforts.			
➢	Monitor in Governor's Right to Know Task Force meetings, and determine whether additional participation is warranted to achieve the above-stated objective.	1	C
➢	Promote access to existing pesticide data.	1	C

<u>Appendix B</u>
Regional Transmission and Storage Supply Strategy – July 2000

Strategy excerpted from Regional Water Providers Consortium Regional Transmission and Storage Strategy, July 2000

REGIONAL TRANSMISSION AND STORAGE STRATEGY

Based on all the above information, the recommended Regional Transmission and Storage Strategy is:

Build interconnections between and among individual water systems within the region to increase the reliability of supply to individual communities and to the region as a whole.

In the long-term, develop either a Zonal or Interconnected Subregional transmission and storage system, depending on the source(s) that the communities in southern Washington County that currently need water, develop for their primary supply.

Develop these projects through intergovernmental agreements (IGA's) among those agencies which choose to participate in the individual projects.

Specific elements of the Strategy should include:

- **Each community in the region should have access to both a primary supply and an adequate emergency source of water.**

- **The primary supply should be one of the six major sources in the region (Bull Run River, Columbia South Shore Wellfield, Clackamas River, Trask/Tualatin River, Willamette River, local groundwater).**

- **The emergency supply should be sized to meet at least the annual average demand of the community and should be a separate source from the primary supply. Preferably, the emergency source would be one of the six major sources in the region (Bull Run River, Columbia South Shore Wellfield, Clackamas River, Trask/Tualatin River, Willamette River, or local groundwater) that is not the community's primary supply.**

- **The sizing of interconnections between water systems should consider future potential peak season and peak day supply needs as well as emergency needs. The level of demand that should be met in an emergency (for example, 85 percent vs. 100 percent of average annual demand) should also be considered when sizing these interconnections. Sizing of each specific project should be reviewed and modified at the time the project is actually designed and constructed. Interconnections should also consider the effects of mixing source**

waters on blended water quality characteristics.

- **If a new east-west transmission connection is made to connect Portland and Washington County, it should be via a route that also connects the Clackamas basin to this transmission line.**

- **While the primary elevation for the transmission connections should be set based on the existing major storage reservoirs in the region (Portland's Powell Butte Reservoir at around 530' elevation and JWC's Fernwood Reservoir at around 520' elevation), not all of the transmission system flow need go to this elevation. Much of the service territory in the region can be served at elevations in the 450' to 490' range. Pumping costs from the river system water treatment plants can be reduced substantially if a portion of the flow goes to the lower elevations. Similarly, there are portions of the region that require higher elevations for service. As specific storage and transmission projects are designed and constructed, both these higher and lower elevation issues should be considered. Pipeline design, should be based upon the pressures of the 530' elevation at a minimum to reduce potential limitations in the utility of the transmission pipelines.**

- **The timing for construction of each project in the Strategy should be determined through negotiations among the project participants that are interested in building the project. Costs should be allocated among participating agencies, and those agencies that do not participate should not be assessed any costs for these projects.**

The benefits of putting this regional transmission strategy into place include:

- Improved protection against loss of any water source for any reason.

- Improved ability to bring available water supplies to communities that may need water.

- Improved flexibility to respond to environment concerns in source waters.

- Ability to utilize lower cost water sources in the winter when water is plentiful and to close higher cost sources during those periods.

- Improved ability to utilize surface sources as part of aquifer storage and recover projects.

The institutional model that is recommended for implementing the elements of the short-term strategy is Intergovernmental Agreements (IGA's) organized under ORS 190. This institutional arrangement offers the greatest array of options for developing detailed system guidelines. It allows relatively easy "evolution" to accommodate future changes in institutional scope or mission. It retains local representation and control while

entering into the regional strategy. For each of the projects under RTSS, IGA's could be developed between the project participants to identify cost allocations, operating responsibilities and other obligations and requirements.

There are several projects that are currently already in the adopted Capital Improvement Programs (CIP's) of various water providers in the region. These projects should be considered as consistent with and as components of, this recommended Regional Transmission and Storage Strategy. These projects are shown in Figure ES-1 and Table ES-4, and include:

- The second transmission line from the Joint Water Commission water treatment plant in Forest Grove that would connect to the Tualatin Valley Water District (TVWD) and the transmission improvements in the TVWD system to bring this water to its storage reservoir.

- The transmission line from the City of Wilsonville's new water treatment plant using the Willamette River as a source, north to its termination point. This termination point is currently assumed to be within the City of Wilsonville, but may extend further north depending on upcoming decisions of other communities.

- An interconnection between the water treatment plants using the Clackamas River as a source.

- The downstream portion of Bull Run Conduit 5.

- A second reservoir on Powell Butte.

Table ES-4
RTSS Projects

Project	Sizing (inches in diameter) or (million gallons)
Projects in Planning	
JWC Supply II	72"
JWC/TVWD Intertie	48"
Willamette Supply	63/54"
Clackamas WTP's Intertie	24"
Conduit 5 – Phase I	84"
Powell Butte Reservoir II	50 MG
Recommended Additional Projects	
Powell Butte / Clackamas Basin Intertie	60"
JWC/WCSL Intertie	60"
JWC/Willamette Intertie	60/54"
Possible Other Projects	
Clackamas / Wash. Co Intertie	60"
Conduit 5 – Phase II	84"
Conduit 5 – Phase III	84"
Cooper Mountain Reservoir	50 MG
Powell Butte Reservoir III	50 MG
Powell Butte 600' Reservoir	20 MG

Several other major projects are recommended for further exploration consistent with this strategy and are also shown in Figure ES-1 and Table ES-4. These are:

- An intertie between the Joint Water Commission and the Portland system.

- An intertie between the Portland system and water sources in the Clackamas basin.

- An intertie between the terminus of the Willamette transmission pipeline and the Joint Water Commission pipeline.

Also shown in Table ES-4 are several possible other projects that depend on future decisions about the regional water supply network.

The routes shown in Figure ES-1 are representative of the general corridor that the transmission pipeline would take. As discussed in Section 5, there are multiple alternative routings for each pipeline. The specific routing for each pipeline should be determined through more detailed study of options and negotiations among those water providers participating in actual project construction.

If the communities in southern Washington County that are currently looking for a long-term source of water (Tigard and Sherwood) decide to use either the Clackamas basin supplies or the Portland system, then a pipeline from the Clackamas basin to those communities should be constructed. If those communities decide to use the Willamette River as their source of supply, then the Willamette transmission pipeline should be sized larger and the connection to the JWC system completed earlier. If those communities decide to use the JWC source as their supply, then the JWC interties to the Portland and Willamette systems should be sized larger and these connections completed earlier.

Other local connections or improvements in connections between individual water providers should also be undertaken as part of the Regional Transmission and Storage Strategy. Examples of these may include:

- Capacity increases of the existing intertie between Clackamas River Water and the Portland system,

- Reactivation of an inactive connection between the Portland system and the Oak Lodge Water District,

- Improved connections between Portland and Lake Oswego, and Portland and Milwaukie, and

- A connection between Fairview, Wood Village and the Portland system.

While these connections may not be of regional significance by themselves, the cumulative effect of the sum total of many of these improvements could be of regional significance.

ASR projects are currently being developed in Portland, Washington County and Clackamas County systems to improve supply reliability. As the capabilities of these ASR systems become better known, they may impact the sizing and timing of some of the transmission and storage facilities recommended in the Strategy.

Appendix C
Public Involvement Materials

What's Inside

Regional Water Supply Plan Update Project
1001 SW 5th Avenue, Suite 450
Portland, Oregon 97204-1124

Regional Water Supply Plan Update Project Continued...

What are the Options to meet future Water Demands?

The Portland region is served by three larger water sources and several smaller ones. The 1996 RWSP anticipated some of these same sources being expanded, while additional supply would be from new sources or conservation programs. The RWSP Update will likely consider the same set of existing sources as well as some new ones that have been proposed since the Plan was adopted.

Existing Sources

- Bull Run and Columbia South Shore Wellfield
- Clackamas River (4 intake and treatment plants)
- Trask/Tualatin River (Barney Reservoir and Hagg Lake)
- Groundwater wells (several cities and districts utilize smaller groundwater sources)
- Regional & Local Conservation Programs
- Non-potable sources (direct use or treated effluent)
- Willamette River Water Treatment Plant in Wilsonville
- Interties of existing water systems

Potential New Sources

- Third Dam and other projects in the Bull Run
- Expanded supplies from the Clackamas River
- Expansion of Hagg Lake
- Groundwater in the Bull Run and selected smaller sites
- Aquifer Storage and Recovery (storing surface water underground)
- Conservation Programs
- Non-Potable projects (direct use or treated effluent)
- More interties of existing and potential new sources

h2Oupdate

A Newsletter by
The Regional Water Providers Consortium
www.conserveh2o.org

Spring 2002

Regional Water Providers Consortium

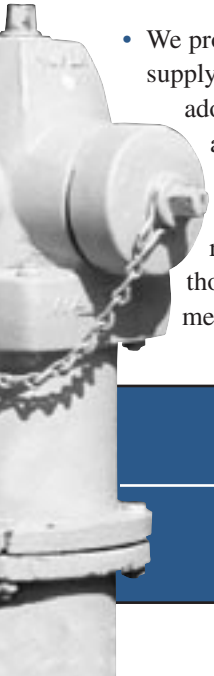
The Regional Water Providers Consortium was formed in 1996 by an Intergovernmental Agreement to coordinate the implementation of the Regional Water Supply Plan (RWSP) for the Portland Metropolitan Area. The RWSP is the region's water supply strategy. The Consortium provides a forum for collaboration on water supply, resource management and conservation issues affecting the region. Currently, there are 22 Water Providers and Metro in the Consortium. The Consortium has many functions, including implementation of the RWSP, intergovernmental coordination, source water protection strategy development and implementation, water conservation program implementation, emergency planning and response coordination, and public education. The Consortium is made up of a Board, Executive Committee, Technical Committee and Subcommittee, and a Conservation Committee.

Strategic Goals

- We take ownership of and coordinate the implementation and revision of the Regional Water Supply Plan as the agencies directly responsible for providing water supplies to customers.

- We provide a forum for study and discussion of water supply issues of mutual interest and we communicate adopted policy and strategies to the public, agencies and stakeholder groups.

- We promote cost efficient use of our water resources and wise stewardship and protection of those resources to meet the values of our collective members and the needs of future generations.



What is the Regional Water Supply Plan?

The Regional Water Supply Plan (RWSP) was adopted in 1996 by most of the region's individual water providers and is coordinated by the Regional Water Providers Consortium. The RWSP provides a comprehensive, integrated framework of technical information, resource strategies and implementing actions to meet the water supply needs of the Portland Metropolitan Area to the year 2050. Twenty-seven of the region's municipal

water providers and Metro collaborated for more than three years to develop the plan. The planning effort and final report reflects extensive input offered by citizens and stakeholders during all phases of the project.

The final resource strategy embraced in the RWSP to meet the water supply needs of the region reflects a weighing and balancing of the policy objectives to meet the multiple goals and

Continued on next page

Mission Statement

The Regional Water Providers Consortium serves as a collaborative and coordinating organization to improve the planning and management of municipal water supplies in the Portland metropolitan region.

(RWSP continued from page 1)

priorities shared by citizens, stakeholders, and participating agencies. The resource strategy includes: naturally occurring conservation (from new efficiency standards for fixtures and appliances), new conservation programs, exploration of non-potable source development, Barney reservoir expansion, Portland wellfield remediation, two increments of Clackamas River expansion, regional transmission linkages, aquifer storage and recovery, and a last source increment that is not named but could be the Willamette River, Columbia River or additional storage in Bull Run. Through July 2003, the Consortium will be working to update the RWSP to reflect work done by the Consortium and other agencies and issues impacting water service as identified below as well as to update current population and demand projections.

Key Issues to consider in the review and update of the RWSP:

1. Integration of adopted Consortium policy and programs.
2. Review and update of conservation programs in the RWSP. What programs should be regionally implemented?
3. What new developments and programs at the local provider level should be incorporated in the regional plan.
4. The need to reflect some of the institutional changes that have occurred in the region as well as the current effort to establish a Bull Run Water Supply Agency.
5. Changes resulting from Federal regulations such as the Endangered Species Act listings and Clean Water Act/Total Maximum Daily Load requirements.
6. Changes in state programs and policies of the Oregon Water Resources Department that affect municipal water suppliers.
7. Citizen initiatives related to water supply choices or resolutions adopted as a part of the approval of the RWSP.
8. Updated demand forecast numbers.
9. Ensuring consistency between local planning and modeling efforts and what is done to update the Regional Water Supply Plan.
10. Affects of local droughts and longer term climate change on water supplies and demands.

How can I get involved?

Newsletter and Questionnaire

Tell us what you think. Use the questionnaire in this newsletter to communicate your questions, concerns and ideas about regional water supply issues. We will also be providing periodic newsletters such as this to keep you up to date on our progress, identify critical issues and to solicit your comments.

www.conserveh2o.org

The About Us section of our web site has up-to-date information on the RWSP Update including milestones, issues and preliminary study results in addition to meeting notices and summaries of our regular meetings of the Technical Committees and Board. The web site also offers an opportunity for you to tell us what you think.

Invited Panels

So far we have had two guest panels at our Board Meeting. Stakeholders, representing Watershed Councils, Environmental Groups, Industry and Special Interests have addressed the Consortium Board with their concerns and thoughts about the update of the RWSP.

Public Workshops

At key times during the RWSP Update the Consortium will host public workshops to share preliminary data, answer questions and to hear your comments.

Speakers Bureau

Staff and other experts are available to speak about the Regional Water Supply Plan to your group or at an event. Please call (503) 823-7528 for access to the speaker bureau members.

Focus Groups and Roundtables

These tools are effective in soliciting feedback on specific issues and work products. Over the course of the update, the Consortium will utilize these venues.

Your own water provider

Individual water providers will be discussing the Regional Water Supply Plan. Attend your local Board, City Council or Commission meetings.

Regional Water Supply Plan Update Project

The Regional Water Supply Plan (RWSP) contains a recommendation that the Plan be reviewed and updated every five years, which is also called for by the Intergovernmental Agreement that water providers adopted when they endorsed the Plan and formed the Regional Water Providers Consortium. In March 2001, the Consortium Board approved a two-year scope of work to review and update the RWSP. The Update officially started in July 2001 and is scheduled to end in June 2003. The work plan for the Update Project contains the following modules or tasks, which will lead to the creation of a preliminary revised plan by February of 2003 and a final revised Plan for local adoption in June 2003. Each Consortium member will hold their own hearings on the adoption of the revised RWSP.

Plan Update Modules:

- Revision of the Plan to reflect past actions of the Consortium and the actions of individual member agencies
- A revised water demand forecast
- A review and update of the conservation programs
- A review and update of the water source strategies contained in the RWSP
- The building of a new regional integration model to assist decision makers and the public in understanding the different ways that future needs can be met
- A public involvement program at the regional and local levels to provide opportunities for the public to interact on the Plan Update proposals

Relationship of the RWSP Update to the Proposed Bull Run Regional Drinking Water Supply Agency

There is an effort underway to evaluate the potential to form a new large drinking water supply agency around the Portland Bull Run/Columbia South Shore Wellfield water supply system. This effort involves many (but not all) of the same water providers that participate in the Regional Water Providers Consortium, but it is focused on the institutional means by which one of the region's largest water supply systems is owned, operated, and managed. This effort is likely to produce a recommended new agency structure in 18-24 months, the same time period for the update of the RWSP. Some have asked why the RWSP Update should proceed in light of this effort. The water providers in the Consortium and those participating in the Bull Run Water Supply Agency effort have stated that at this time they feel both efforts are valid. Any work done in the RWSP Update is likely to deal with the same issues regardless of how the institutions that provide water service change. This is a five year update, and any new agency, if one is formed, will likely play a key role in any future updates.

Continued on back page

RWSP UPDATE

SCHEDULE

Summer/Winter 01 - 02

- Collect water provider plans & programs
- Obtain expert assistance on water sources, modeling, and conservation
- Start collecting water provider data for demand forecasting
- Create water provider map
- Hold stakeholder panels at Board Meetings

Spring/Summer 02

- Evaluate source options
- Review conservation programs
- Develop integration model
- Prepare demand forecasts
- Begin newsletters and hold workshops

Fall/Winter 02-03

- Prepare revision strategies for sources and conservation programs
- Evaluate alternatives for different source/ program options
- Prepare set of Preliminary Recommendations
- More newsletters and workshops

Winter/Spring 03

- Individual provider hearings
- Regional workshops/hearings
- Evaluate changes to Preliminary Plan Update
- Prepare Final Revisions
- More newsletters and workshop/regional hearings
- Provide Final Revisions for entity adoptions in June 2003

Summer/Winter 03

- Individual provider hearings on adoption of Final RWSP Plan Update

Tell Us What You Think About Updating the Regional Water Supply Plan

1. Are you aware of the 1996 Regional Water Supply Plan endorsed by most of the region's water providers? ❑ Yes ❑ No

2. Do you know the source of your drinking water. If yes, what is it?_____

3. What agency provides your drinking water?_____

4. The most important things to consider in meeting future water supply needs are (check all that you think apply):

- ❑ efficient use of water
- ❑ impacts of catastrophic events on the water supply system
- ❑ economic cost and cost equity for customers
- ❑ minimize environmental impacts (eg. fish habitat, wildlife)
- ❑ maximize ability to respond to unforeseen events and trends
- ❑ maximize ability to meet regulatory requirements in a timely manner
- ❑ manage water supply shortages that would affect you
- ❑ operational flexibility for backup and to move water to areas of need
- ❑ maximize water quality of both raw water and treated water
- ❑ be consistent with regional and local land use plans
- ❑ other, please list_____

5. Do you have preferences for supply sources or strategies that your provider should use to meet future demands?
Please see the list contained in this newsletter for ideas, but feel free to list others._____

6. What is your number one concern about how future water supplies are developed?

7. Would you like to be involved as decisions are made about how to update the Regional Water Supply Plan? ❑ Yes ❑ No
If yes, of the different opportunities for involvement listed in this newsletter, which of them work best for you?
Are there others that you think we should consider (please list)?

It is time to update our mailing list!

Please complete this form and return it today.

If we do not receive this form by June 1, 2002 your name will automatically be removed from our mailing list.

Please check preference below:

- ❑ I wish to remain on your mailing list, my address is correct.
- ❑ I wish to remain on your mailing list, my address is incorrect: please update.
- ❑ If available, I would prefer to receive information via e-mail address.*

Name:_____

Address:_____

City:_____ State:_____ Zip Code:_____

Phone:(optional)_____ E-mail:_____

* Information is not currently available by e-mail but may be available in the future.

Please note that future newsletters and Regional Water Providers Consortium information will always be available on our web site: www.conserveh2o.org

Fold ↘

Consortium Members

City of Beaverton
Clackamas River Water
City of Fairview
City of Forest Grove
City of Gladstone
City of Gresham
City of Hillsboro
City of Lake Oswego
Metro
City of Milwaukie
Oak Lodge Water District
City of Portland
Powell Valley Road Water District
Raleigh Water District
Rockwood Water PUD
City of Sandy
City of Sherwood
South Fork Water Board
Sunrise Water Authority
City of Tigard
City of Tualatin
Tualatin Valley Water District
West Slope Water District
City of Wilsonville

Fold ↘

REGIONAL WATER SUPPLY PLAN
UPDATE PROJECT
1001 SW 5th Avenue, Suite 450
Portland, Oregon 97204-1124

Regional Water Supply Plan Update Project
1001 SW 5th Avenue, Suite 450
Portland, Oregon 97204-1124

Printed on recycled paper with soy based ink.

What's Inside

COME AND JOIN US FOR A WORKSHOP

There will be materials, a brief presentation, time for questions, and the opportunity to talk directly to water providers about the Update of the Regional Water Supply Plan.

Tuesday, August 27, 2002
City of Tigard
Tigard Water Department Auditorium
8777 SW Burnham, Tigard OR
Time: 6:00 p.m. to 8:00 p.m.

Thursday, August 29, 2002
City of Gresham
Gresham Conference Center
1333 NW Eastman Parkway, Gresham OR
Time: 6:00 p.m. to 8:00 p.m.

h2Oupdate

A Newsletter by
The Regional Water Providers Consortium
www.conserveh2o.org

Summer 2002, No. 2

Where are we on the Regional Water Supply Plan (RWSP) Update?

The Consortium members have been working on all phases of the RWSP Update project for the last several months. In the first newsletter we covered the update work tasks and the schedule (for copy of the first newsletter please contact us or visit our website). We are on schedule with the efforts for Summer 2002. We have hired some technical experts to help us evaluate source options, conservation programs, and to build an integrated model to put all the complex information together and help us make decisions about revising the RWSP. The model is called Confluence and we will be telling you more about that in a future newsletter. We have also been working on developing new water demand forecasts based on Metro population data, water use patterns, and climate. We also have prepared a report on what we learned from the questionnaires that were sent in from the first newsletter and we have held two interest group panels at Consortium Board meetings. In addition, the Board had a discussion on the role of conservation in the RWSP Update at their June 2002 meeting. As we move into the Fall and Winter we will begin to prepare strategies for sources and conservation programs and we will evaluate those alternative strategies based on the policies and objectives we developed for the RWSP. We will prepare a set of preliminary RWSP revision recommendations after we talk to more people about these different alternatives. In early 2003 each water provider will discuss the set of preliminary recommendations and make suggestions for changes before a final set of revisions will be proposed.

Mission Statement

The Regional Water Providers Consortium serves as a collaborative and coordinating organization to improve the planning and management of municipal water supplies in the Portland metropolitan region.

What did we learn from the survey in the first newsletter?

In Spring 2002 the Regional Water Providers Consortium sent out its first newsletter to inform interested persons about the update of the Regional Water Supply Plan and to solicit comments. The following is a brief summary of the comments we received from you.

We wanted to know if folks were aware of the Regional Water Supply Plan. Most people are aware of the plan, endorsed by a majority of the region's water providers. This high level of awareness is most likely because this is a self-selected mailing list with people familiar with water resource issues. Most people also knew who their water provider was and where their water came from. A majority of our responses came from Portland Water Bureau customers.

We asked what was most important for the Consortium to consider in meeting future water supplies. The top five issues were:

- Efficient Use of Water
- Maximize Water Quality
- Economic Cost and Equity for Customers
- Impacts of Catastrophic Events on the Water Supply System
- Minimize Environmental Impacts

In our last newsletter we listed existing and potential supply sources and asked which sources you preferred. While there was no single theme that came out of the responses for this question, many sources were mentioned, including new developments in the Bull Run, Aquifer Storage and Recovery (ASR), conservation, interties, potable and non-potable uses, and so on.

There were many concerns about how future water supplies are developed. The primary concerns were providing the best water quality at a reasonable cost, and protecting the environment.

Most people expressed an interest in being involved in the decision making process about future water supply decisions. There were many ideas for providing opportunities for public involvement. The most popular involvement opportunities noted were newsletters, the website and questionnaires. In addition workshops, focus groups, roundtables and hearings were mentioned. In this issue we highlight some upcoming public involvement opportunities. We have also updated our website to make information more accessible. Please visit us at www.conserveh2o.org.

RWSP UPDATE SCHEDULE

COMPLETED

Summer/Fall/Winter 01/02
- Collect water provider plans and programs
- Obtain expert assistance on water sources, modeling, and conservation
- Start collecting water provider data for demand forecasting
- Create water provider map
- Hold stakeholder panels at Board Meetings
- Publish first newsletter

IN PROGRESS

Spring/Summer 02
- Evaluate source options
- Review conservation programs
- Develop integration model
- Prepare demand forecasts
- More newsletters and plan workshops
- Public workshops August 27 and 29, 2002

Fall/Winter 02-03
- Prepare revision strategies for sources and conservation programs
- Evaluate alternatives for different source/ program options
- Prepare set of Preliminary Recommendations
- More newsletters and workshops

Winter/Spring 03
- Individual provider hearings
- Regional workshops/hearings
- Evaluate changes to Preliminary Plan Update
- Prepare Final Revisions
- More newsletters and workshop/regional hearings
- Provide Final Revisions for entity adoptions in June 2003

Summer/Fall/Winter 03
- Individual provider hearings on adoption of Final RWSP Update

Setting the Stage for Making Changes to the RWSP

We are preparing to put information together on changes in water demands due to new growth projections, reductions in demand due to conservation savings that have already occurred, existing sources and their capacities and availability, future conservation programs that could be implemented over the next 20 years, new sources that could be expanded or developed, and policy priorities throughout the region. All of this is being done using the existing RWSP as a framework. We aren't starting from scratch, but looking to see how things have changed since 1996 and making adjustments. Let's get started with what we know at this point.

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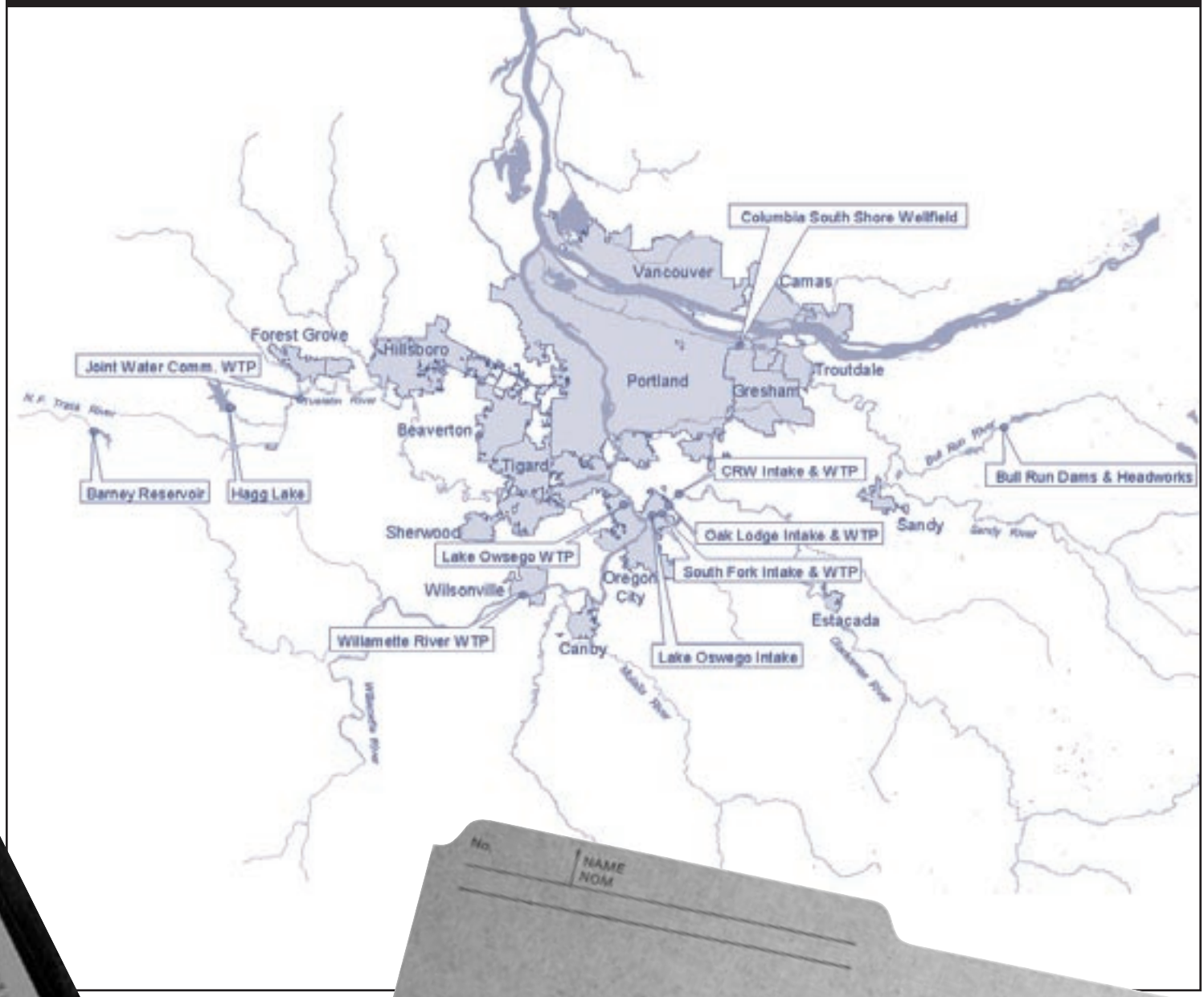
LOCATION OF WATER SOURCES IN THE REGION TODAY



Setting the Stage for Making Changes to the RWSP (continued)

Today the Portland region relies on a select set of sources of potable drinking water that supply the majority of the water used. These include the following:

Name of Source	Installed Capacity	Near Term Expansions	Primary Areas Using Supply
Bull Run **Columbia South Shore Wellfield**	210 MGD - peak day 140 MGD - summer season 90 MGD - summer season or emergencies	None at this time 20-30 MGD	Portland, TVWD, Gresham, Rockwood, Powell Valley, Tualatin, Tigard
Clackamas River	76 MGD - 4 separate intakes and treatment plants in lower 3 miles of river	20 MGD	Clackamas River Water, Sunrise WA, Oak Lodge, Oregon City, West Linn, Lake Oswego, Gladstone
Trask/Tualatin System - Joint Water Commission	60 MGD - average 72 MGD - peak day	None at this time	Hillsboro, Forest Grove, Beaverton, Tualatin Valley Water District
Willamette River	15 MGD, Intake 120 MGD, Screens 70 MGD	None at this time	Wilsonville
Local Water Sources	30-40 MGD - a mixture of groundwater and small surface water diversions/plants	Some additional wells planned	Powell Valley, Fairview, Beaverton, Forest Grove, Sherwood, Tigard, Sandy, Boring, Sunrise WA, Milwaukie and others.

Using What We Have

The regional water providers have an established policy that we should use what sources we have available today as efficiently as possible. This means not only how the customer uses the water (i.e., conservation), but also keeping leaks to a minimum and sharing water supplies that are in excess of those needed by the owning jurisdictions. Since the RWSP was adopted in 1996 a number of interties have been constructed between different water sources while some others are planned in the near term. The Consortium Board adopted a Regional Transmission and Storage Strategy in 1999 which states that each community in the Portland area should have access to a primary water supply and an adequate emergency source of water enough to meet daily average annual water use. The Update will look further at how existing sources of water can be shared amongst providers to meet near term needs as well as whether or not smaller local sources can only supply those providers that own them.

How will Water Demands in the Region Change Over Time?

The region's water providers are not in the business of dictating land use changes, but they do respond to the growth projections of the land use entities that plan for growth. In the Portland area it is Metro that sets the urban growth boundary and they in cooperation with the cities and counties allocate growth to various parts of the region. The water providers use this information to help determine changes in water demands over time. So what does Metro have to say about future growth? Metro is in the process of preparing a 20-year forecast. Their most recent draft regional economic forecast projects that growth will continue in the Portland area, but it will be at a slower rate than over the last 10 years. They estimate we will grow at about 1.4% per year on average over the next 30 years. The five county area (around and including Portland and Vancouver) is expected to reach 3 million people by 2030 which is an increase of approximately 1 million people between 2000 and 2030. If this is a 1/3 increase in population, will we expect water demands to increase by that amount? Not necessarily. The region's water providers have found that water demands have been decreasing per person since the early 1990's. The reasons for this include the following:

- Changes in behavior due to shortages such as occurred in 1992
- Land use changes that have decreased lot sizes and increased multi-family dwellings and therefore reduced outdoor watering demands
- Conservation programs that have been implemented
- Regulations requiring low flow plumbing fixtures

Setting the Stage for Making Changes to the RWSP (continued)

The water demand forecasts that will be developed for the RWSP Update will take into account climate patterns (i.e. temperature and rainfall) that affect water demands from year to year. The water providers have found that summer peak season use is the time when our water demands are the highest, so the longer and hotter the summer season is, the higher the water demands. We will also look to Metro and the cities and counties land use plans to determine which areas of the region will grow more than others. Our modeling will take all of these factors into consideration as we plan what changes we may need for the future. Changes we expect to see are that water demands will increase with growth and with climate change, but probably at a lessor rate of increase on average. All parts of the Portland metropolitan area are expected to grow, but some areas are likely to have higher overall rates of growth than others such as Clackamas and Washington Counties. It is possible that more land will be brought into the urban growth boundary in Clackamas County than in the other two counties.

What Should be the Role of Conservation in Meeting Future Water Demands?

A basic premise of the RWSP is that water conservation is a resource that can play a key role in meeting future water needs. In the RWSP, new conservation programs were anticipated to provide 65 million gallons per day of average peak season savings by 2050 based on full implementation of the recommended conservation programs. These recommended programs include:

- **Conservation Education**
  Currently being implemented by RWPC
- **Outdoor Water Audits (residential, industrial, commercial and institutional)**
  Have been implemented on a pilot basis
- **Incentives to install water efficient irrigation and landscapes**
  Not currently being implemented
- **Landscape and irrigation ordinances for new developments**
  Not currently being implemented
- **Conservation Pricing**
  Eleven providers have conservation rate structures

Currently, as part of its conservation education program, the Consortium implements a summer media campaign aimed at reducing outdoor water use. The Consortium also participates in community events, sponsors landscape workshops, develops educational material and stage shows for schools, and is developing outreach programs for the landscape and irrigation industry. Many individual providers have their own programs that they implement in addition to the regional programs. Entities such as Portland, Tualatin Valley Water District, Hillsboro, Wilsonville and Clackamas River Water and others have programs that complement the regional program and target their customer's needs.

Factors driving conservation program planning and implementation:

There are many factors driving the region to plan and implement conservation programs.

- Regional, State and Federal permitting requirements
- Responsible stewardship of a limited resource, based on adopted policies
- Citizen and customer expectations
- Environmental and Special Interest Group Pressure
- Economics - it can make economic sense to delay demands if conservation savings result in delayed infrastructure investments.

In the RWSP Update, the Consortium is considering broadening its consideration of conservation programs to include indoor programs for residential, industrial, institutional and commercial customers. This would affect base water use and shift our focus from reducing peak season demand to an overall reduction in year-round water use. The Consortium is also considering varying types of programs based on their level of aggressiveness. For example, a voluntary program would have a low level of aggressiveness (e.g. education and awareness programs) and a mandated program, such as an ordinance would have a high level of aggressiveness. Aggressiveness can also indicate the level of participation in a program. Programs with a high level of aggressiveness typically yield higher water savings. Types of programs the Consortium is considering in the Update include:

- Indoor water audits - Residential and Industrial, Commercial and Institutional
- Toilet rebate and replacement program
- High-Efficiency appliance rebate
- Multi-family sub-metering
- Property manager landscape and irrigation maintenance workshops
- Irrigation tools such as moisture sensors and evapo-transpiration controllers (regulates irrigation controllers based on weather data)
- Incentive programs (e.g., rebates, credits, rates)

These programs are in addition to programs already evaluated in the RWSP. Programs must meet certain criteria, such as cost-effectiveness, technical feasibility, customer acceptability, notable water savings, and be easy to implement.

Programs that are selected may be implemented regionally, sub-regionally or by individual water providers. The tools developed in the RWSP Update will allow a water provider to see how much a program will cost to implement and what water savings will be achieved. Data generated in the conservation evaluation will be fed into the integration model to determine options for conservation in meeting supply needs.

What New or Expanded Water Sources Might the Region Consider?

The 1996 Regional Water Supply Plan looked out 50 years to identify new programs and water sources. In that Plan the new or expanded water sources included exploration of non-potable sources, expansion of the Clackamas River diversions, Aquifer Storage and Recovery at two sites in the region, and then left the longer term decisions for later determination (but noted these could include a third dam in the Bull Run, Columbia, or Willamette Rivers). The RWSP also noted that some jurisdictions with near term needs may look to other sources on a sub-regional basis. In addition, the RWSP made some assumptions about sharing the smaller local sources, groundwater and surface water, which were not validated at the time.

Since the Plan's adoption 6 years ago some changes have occurred that need to be incorporated into the Update. These include some new wells, development of a water treatment plant on the Willamette for Wilsonville, expansions on a couple of the Clackamas River water treatment plants at South Fork and the North Clackamas Water Commission, and municipal use of releases from Timothy Lake on the Clackamas. In addition, the City of Beaverton has developed a successful Aquifer Storage and Recovery facility.

Sources that are being evaluated for the review and update include the ones in the Plan as well as some new ones. We are evaluating these sources and have some further information about them.

Bull Run

- Endangered Species Act (ESA) listed fish species need to be considered as well as instream flows to protect fish and temperature.
- Supply can be increased by dam raises, treatment, and groundwater as well as a third dam.
- Results of a study on climate change and impacts to the Bull Run system.
- A regional supply entity may be developed for the Bull Run system.
- More studies have been done on the Bull Run system operations to protect fish and meet Clean Water Act standards.

Columbia South Shore Wellfield

- Remediation for contaminant sources is in place while new contaminants in other areas have been discovered.
- ASR is being studied for this area.
- New wells have been developed to increase capacity.
- Other expansion alternatives exist.

Clackamas River

- ESA listed fish in the Clackamas, new intakes have been permitted on the river.
- There are pending municipal water right applications.
- Timothy Lake could be further expanded to increase releases in late summer.
- Intakes and treatment plants on the river are being improved and could be expanded under existing water rights.
- Monitoring of water quality on the river has been implemented.
- Existing storage in Timothy Lake is available for release.

Columbia River

- ESA listed fish species and target flows for the lower river have been identified.

Hagg Lake Raise

- An Integrated Water Resources Management (IWRM) Water Supply Feasibility Study was conducted in 2000 and raising Hagg Lake was identified as a significant new source that could meet municipal water needs.
- A study that includes the raise of Hagg Lake is underway by most of the municipal providers in the Washington County area, directed by Clean Water Services and the Bureau of Reclamation.
- Hagg Lake raise could be done at two different heights, both of them would provide significant additional storage for municipal supplies.
- ESA fish listings exist in the Tualatin Basin.

Willamette River

- A treatment plant on the Willamette is operating at 15 MGD supplying water to Wilsonville, which has water rights, space, and intake/pipeline sizes to support expansion.
- Public votes in communities considering the Willamette are required before use of this source would be allowed.

Setting the Stage for Making Changes to the RWSP (continued)

- ESA fish listings in the Willamette.
- Willamette River municipal water rights are large and could be used.
- The study of Hagg Lake raise is also looking at a pipeline from the Willamette to replace agricultural water currently being used from Hagg Lake.

Regional Aquifer Storage and Recovery (ASR)

- New legislation has been passed requiring alternatives analysis for water facilities located on Exclusive Farm Use lands, which both of the regional ASR facilities would affect.
- No further studies or pilot work has occurred on either of the regional sites, nor is any planned.
- ASR pilots, studies, and plans by water providers have all been of a smaller scale which may mean that larger scale ASR may not be feasible or desirable at this time.

Smaller Local Sources

- Work is being done to reassess the extent of local sources in the region including some limited expansions that have occurred since 1996.
- Assumptions about smaller local source availability to meet demands are being checked.
- Some local sources may be taken out of production as primary sources.
- Some water providers are evaluating ASR as a local option (Tigard, Tualatin, TVWD, and CRW for example).
- The City of Sandy is evaluating their future supply options on the Salmon River.

What Happens Next?

The Consortium is developing a model called Confluence. This model will be used to evaluate the information talked about in this newsletter. Over the next few months the water providers will use the model to build packages of conservation programs, sources, and transmission interconnections. These packages can be based on meeting different policy outcomes. Along with information about costs, shortages, and other impacts the model will help decision makers and the public understand what the choices mean and which preliminary recommendations will be put together for further comment early in 2003. Stay tuned for more newsletters which will detail these events.

HOW CAN I GET INVOLVED?

- Newsletter and Questionnaire - Read it and tell us what you think!
- www.conserveh2o.org Visit our updated site and give us your comments via the "Contact" Page
- Invited Panels - To date, two interest group panels have presented their ideas, concerns and comments to our Board
- Public Workshops - August 27 and 29, 2002.
- Speaker's Bureau - call 503.823.7528
- Focus Groups and Roundtables
- Contact your Water Provider

What do you Think About Conservation and its Role in Meeting Future Water Supply Needs in the Regional Water Supply Plan?

We would like to know what you think about water conservation and its role in meeting water supply needs in the region. Please answer the questions below and we will share your comments and ideas with our members and report back to you in the next newsletter.

1. Do you do things in your home and garden to conserve water? ❑ Yes ❑ No If so, what are they? (check all that apply)

- ❑ Installed low-flow fixtures e.g., faucet aerators, ultra low-flow toilet, low-flow shower head
- ❑ Own a high-efficiency appliance e.g., washing machine, dishwasher
- ❑ Utilize an efficient Irrigation System e.g., drip hoses
- ❑ Regulate my irrigation controller based on weather and soil moisture
- ❑ Mulch around plants to retain soil moisture
- ❑ Only water my lawn one inch a week
- ❑ Sweep instead of hose off the sidewalk and driveway
- ❑ Direct sprinklers away from sidewalks and street so I am only watering plants
- ❑ Fix leaks
- ❑ Others please list_____

_____

2. Have you seen TV, radio or outdoor ads on water conservation? ❑ Yes ❑ No

Have you visited the Consortium's web site (www.conserveh2o.org)? ❑ Yes ❑ No

3. What motivates you to conserve water?_____

_____

_____

4. How comfortable are you relying on conservation to meet supply needs?_____

_____

_____

5. Should the region or sub parts of the region set water conservation targets? If so, what do you think they should be and/or how do you think the Consortium should set them?_____

_____

6. The Consortium's current water conservation program focuses on reducing peak summer time use, when supplies are most stressed. Should the Consortium also focus on year-round conservation (e.g., residential indoor programs and Commercial, Industrial and Institutional programs)? If so, why?_____

_____

7. Water conservation programs cost money to implement, sometimes more than a new source of water. What would you be willing to pay above the cost of a new source of supply to support more aggressive water conservation programs?

❑ None ❑ 5% - 10% ❑ 10% - 20% ❑ More

Please fold in thirds and seal with tape, do not staple.

WE WOULD LIKE TO KNOW WHO YOU ARE!

❑ Please add me to your mailing list (optional)

Name:_____

Address:_____

City:_____ State:_____ Zip Code:_____

Phone:(optional)_____ *E-mail:_____

* Information is not currently available by e-mail but may be available in the future.

Please note that future newsletters and Regional Water Providers Consortium information will always be available on our web site: www.conserveh2o.org

Fold ↘

Consortium Members

City of Beaverton
Clackamas River Water
City of Fairview
City of Forest Grove
City of Gladstone
City of Gresham
City of Hillsboro
City of Lake Oswego
Metro
City of Milwaukie
Oak Lodge Water District
City of Portland
Powell Valley Road Water District
Raleigh Water District
Rockwood Water PUD
City of Sandy
City of Sherwood
South Fork Water Board
Sunrise Water Authority
City of Tigard
City of Tualatin
Tualatin Valley Water District
West Slope Water District
City of Wilsonville

Fold ↘

Regional Water Supply Plan Update Project
1001 SW 5th Avenue, Suite 450
Portland, Oregon 97204-1124

h2Oupdate
A Newsletter by
The Regional Water Providers Consortium
www.conserveH2o.org
Winter 2003, No. 3

Regional Growth and Water Demands

The Metro regional government is responsible for establishing the regional population and jobs forecast. The Council has approved a regional forecast and will allocate that forecast to specific cities and counties by June of 2003.

The last work task to be completed in the RWSP Update before the decision support modeling can be conducted is to prepare water demand forecasts that reflect the December 12, 2002 Metro Council decision which adds18,700 acres to the Urban Growth Boundary. This decision adds parcels around the region that affect various water providers. The largest addition is in the Damascus area of Clackamas County. This area is approximately 11,000 acres and adds approximately 100,000 new residents and jobs. The water demands of the various water providers reflect their past consumption patterns, but for large new areas the actual water demands are more likely to mirror those of established communities that are similar in nature to the land uses that will be allowed in the future. Water demands in the three Portland metropolitan counties will increase due to infill and redevelopment, so there are very few water providers that won't see growth, however some will see less over time as they become more fully developed. The population increases will be allocated based on the Metro forecast and their framework plan and additions to the Urban Growth Boundary. So although the largest amount of new land has been added in Clackamas County, the actual growth in population will still be significant within Washington and Multnomah Counties.

As the Confluence decision support model is run, it will include new water demand numbers as well as conservation programs. The conservation programs will target changes in demand, which will result in some of the growth in the region being met through more efficient use of existing supplies. Greater efficiency is consistent with new rules recently adopted by the Oregon Water Resources Commission calling for Water Management and Conservation Plans in order to retain unused State water rights. These Plans will address how water efficiency will be part of meeting growing demands. This same scrutiny will be applied to any environmental permits that may be required for new source development. The water demand forecasts already reflect changes in consumption patterns that have been seen in the region over the last 12 years. The Update will treat conservation as a source of supply to be evaluated along with specific source and transmission development projects.

Clackamas River

CONSORTIUM MEMBERS

City of Beaverton
Clackamas River Water
City of Fairview
City of Forest Grove
City of Gladstone
City of Gresham
City of Hillsboro
City of Lake Oswego
Metro
City of Milwaukie
Oak Lodge Water District
City of Portland
Powell Valley Road Water District
Raleigh Water District
Rockwood Water PUD
City of Sandy
City of Sherwood
South Fork Water Board
Sunrise Water Authority
City of Tigard
City of Tualatin
Tualatin Valley Water District
West Slope Water District
City of Wilsonville

What's Up with the Regional Water Supply Plan Update?

The intent of this third newsletter to is to let you know that we are still working on the Regional Water Supply Plan (RWSP) Update and to tell you more about the selected source option packages and the conservation programs. In the first newsletter, we covered the Update work tasks and schedule. In the second newsletter, we talked about water demand, where the region currently obtains supplies, the role of conservation, and what new sources the region might consider for the future. Since the summer, a number of factors have resulted in a delay of the project. We chose to wait until recent Urban Growth Boundary (UGB) decisions at Metro were made to obtain the most up to date population data. We have also allowed more time for the conservation analysis to ensure that information about individual provider systems and future plans are correct and appropriately timed to be included in the Update. The Consortium has almost completed work on the packages of conservation programs. In addition, packages of supply options have been identified. The Confluence decision support model is complete and will be ready to run the programs and supply options once the new water demand numbers are available. The preliminary RWSP Update recommendations will be worked on during the Winter and Spring of 02/03 with a set of preliminary recommendations being given to all of the Consortium water providers by June of 2003.

RWSP UPDATE SCHEDULE

COMPLETED

Summer/Fall/Winter 01/02
- Collect water provider plans and programs
- Obtain expert assistance on water sources, modeling, and conservation
- Start collecting water provider data for demand forecasting
- Create water provider map
- Hold stakeholder panels at Board Meetings
- Publish first newsletter

COMPLETED

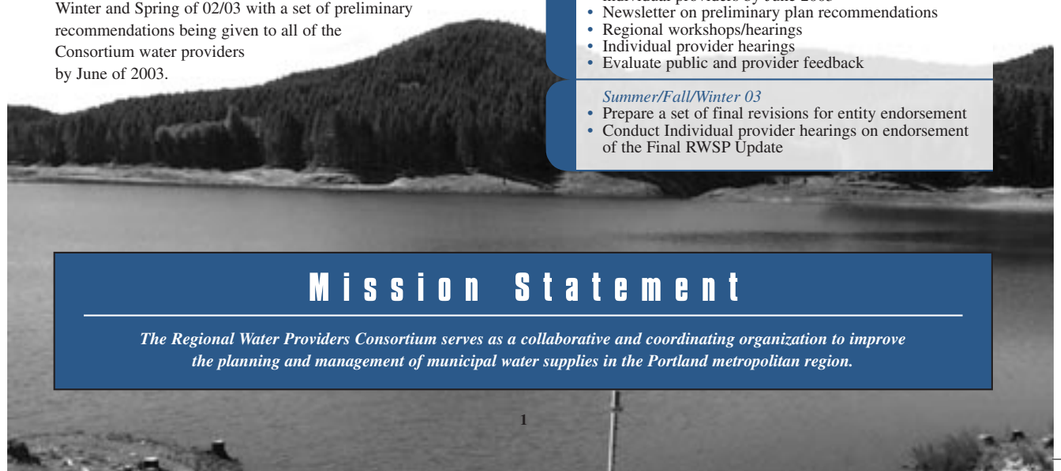
Spring/Summer/Fall 02
- Evaluate source options
- Review conservation programs
- Develop integration model
- Prepare demand forecasts
- More newsletters and plan workshops
- Public workshops August 27 and 29, 2002

IN PROGRESS

Winter 02/Spring 03
- Prepare conservation plan and source option packages
- Newsletter on the Update progress in February 03
- Run the decision support model on packages of supply/program options
- Prepare preliminary plan recommendations

Summer 03
- Provide preliminary plan revisions to public and individual providers by June 2003
- Newsletter on preliminary plan recommendations
- Regional workshops/hearings
- Individual provider hearings
- Evaluate public and provider feedback

Summer/Fall/Winter 03
- Prepare a set of final revisions for entity endorsement
- Conduct Individual provider hearings on endorsement of the Final RWSP Update



Mission Statement

The Regional Water Providers Consortium serves as a collaborative and coordinating organization to improve the planning and management of municipal water supplies in the Portland metropolitan region.

Conservation Survey Feedback

In our last newsletter, we asked our readers what they thought about water conservation and its role in meeting water supply needs in the region. Thirty-nine people responded and here is what they said:

95% of the respondents conserve water in their home and garden. The top five activities are:

- fixing leaks
- installing low-flow fixtures
- using mulch to retain soil moisture
- sweeping instead of hosing down sidewalks and driveways
- directing sprinklers away from hardscapes

Henry Hagg Lake

And while letting your lawn go brown was not a selection, many people noted it in their comments.

The Consortium is always trying to determine if our summer conservation media campaign is reaching the public. Almost half of the respondents had seen or heard water conservation messages on TV, radio or outdoor media. 10% had visited the Consortium's website: www.conserveH2o.org.

- When asked what motivates them to conserve water, most responded that it is the right thing to do. Other responses included environmental benefits, bill reduction, preservation of high quality water sources, delay of infrastructure improvements and reduced sewer flows.

- When asked how comfortable they are with relying on conservation to meet supply needs, most people were o.k. however there were several qualifiers. Notably that conservation is just one component of meeting supply needs.

- When asked about whether or not to set conservation targets, 56% responded that setting conservation targets is a good idea, 15% did not support targets and 28% did not know.

- When asked if the Consortium should include year-round water conservation programs (indoor and commercial, industrial and institutional) in addition to established summer programs, 61% said yes, 23% said no.

When asked what they would be willing to pay on their water bill to support conservation 50% were willing to pay more.

Future Source Option Packages

In order to evaluate the range of options for future supplies in the region, the Consortium and provider staff have developed a set of specific source option packages that have different emphasis. The idea is to compare and contrast different ways that larger and smaller source options might perform in meeting the region's water needs. We want to look at the costs of the source development, transmission, large storage tanks, pumping costs, operating costs (fixed and variable), regulatory/water rights issues, and environmental impacts and potential mitigation costs for each package. The intent of this exercise is to evaluate the options against a set of policy objectives.

The Consortium Board met in September to discuss these policy objectives and decided that all of the policy objectives from the original RWSP were important. Further they decided that the five or six key policy objectives related to costs, water quality, efficient use of water, environmental stewardship, and catastrophic event reliability were all equally important in considering the changes to the RWSP.

The Board was briefed in December about the conservation programs and the future source option packages that would be modeled using the Consortium's Confluence decision support model. The source options packages include the following:

EXISTING MASTER PLANS
- Include all facilities contained in current master plans
- No large scale regional transmission

LIMITED EXPANSION/NO LARGER PROJECTS
- Smaller projects including Aquifer Storage and Recovery (ASR), smaller Water Treatment Plant expansions and dam raises, groundwater development.
- Some regional transmission development as needed

HAGG LAKE SOURCE DEVELOPMENT EMPHASIS
- Focus on the larger raise of Hagg Lake or water exchange
- Water treatment plant expansions or new plants
- Two sub-options with and without Regional Transmission
- Local sources as needed

BULL RUN SOURCE DEVELOPMENT EMPHASIS
- Develop third dam in Bull Run
- Develop groundwater in Bull Run
- Regional Transmission to south and east as needed
- Local sources as needed

CLACKAMAS RIVER DEVELOPMENT EMPHASIS
- One sub-option to develop Clackamas River to level of existing water rights and use of the existing Timothy Lake storage agreement with PGE
- Second sub-option includes existing junior and new water rights along with a Timothy Lake raise
- Water treatment plant expansions or new plants
- Regional transmission to south and east as needed
- Local sources as needed

COLUMBIA RIVER EMPHASIS
- One sub-option includes 50 mgd water treatment plant using existing water rights
- Second sub-option develops larger water treatment plant with new water rights
- Regional transmission as needed
- Local sources as needed

Path to Developing Conservation Programs

A basic premise of the Regional Water Supply Plan (RWSP) is that water conservation is a viable resource that can play a key role in meeting future water demand needs. The original RWSP included a comprehensive analysis of about 150 potential conservation measures. These conservation measures were subjected to qualitative and quantitative screens to narrow the list of conservation programs to the following:

- conservation education
- outdoor water audits
- incentives to install water efficient irrigation and landscapes
- landscape and irrigation ordinances for new developments
- conservation pricing structures

The suite of conservation programs evaluated and selected for the RWSP were designed in 1995. Since then, water conservation efforts, experience, and technologies have advanced. In 1999 a consultant was hired to review the programs in the RWSP to determine if their designs, assumptions and resulting estimates should be revised in addition to updating population and employment forecasts. The consultant recommended some program changes and was able to provide conservation program costs and savings at the individual water provider level.

With the update of the RWSP, the Consortium and its providers have the opportunity to once again look at the role of conservation in the RWSP and reconsider the mix of programs in the RWSP. The programs currently in the RWSP focus on reducing outdoor peak season use. The Consortium Board and stakeholders support broadening our conservation focus to achieve greater savings and to recognize the variations in water use among the providers.

For the conservation analysis, the Consortium is utilizing a modeling tool called ConEAST (Conservation Economic Analysis and Screening Tool) that enables us to calculate water savings, costs, economic benefits, unit costs and benefit/cost ratios of water conservation programs. Our consultant has inputted all of the necessary data into ConEAST, including existing Metro population and employment forecasts and updated individual provider water use, rate and customer account data and other information. The next step was to develop descriptions of potential new programs, aside from those already in the RWSP, and associated costs and savings and input those into ConEAST. The new programs include indoor programs and programs targeted to commercial, industrial and institutional (CII) accounts as well as those aimed at reducing outdoor use. Programs were ranked against a set of criteria and a list of recommended programs was generated. The consultant completed a draft final report and modifications are being made before a final selection of programs for the RWSP Update is made.

One of the main issues with selecting and implementing regional conservation programs is the variability among the individual providers. Some providers serve more residential customers and others have a significant number of commercial, industrial and institutional customers. Our Consortium Board and Managers have discussed this issue in depth and we are working to develop a way to allow our Confluence decision support model to tailor our regional conservation programs by water provider. Our goal is to have a set of regional programs that all providers will participate in. This would be mainly education and outreach programs. Then there will be a subset of programs tailored to specific customer needs that individual providers can choose from and that will be placed in the Confluence model for evaluation with sources of supply. This will make our water savings projections more accurate and realistic. Approximately 10 programs will be selected for inclusion into the RWSP Update.

The programs that were evaluated and that are being considered include the following:

Education and Outreach
- Residential Customer Information, Education and Awareness
- Trade Ally (landscapers, designers and maintenance contractors) Irrigation and Landscape Workshops (Residential and CII)
- Property Manager Workshops
- Residential Landscape Workshops

Commercial, Industrial and Institutional
- Indoor Audits
- Large Landscape Audits (schools, parks, etc.)
- Waterless Urinals
- Submetering
- Elimination of Single Pass Cooling
- CII Outdoor Ordinance
- ET (evapotranspiration) Controller Retrofit
- Landscaping and Irrigation System Rebates

Residential
- Toilet Rebate or Replacement
- Indoor Audits
- ET (evapotranspiration) Controller Retrofit
- Landscaping and Irrigation System Rebates
- Washing Machine Rebate Program
- Outdoor Audit

WE WANT TO HEAR FROM YOU!

To get more information:
- Contact your water provider.
- Speaker's Bureau - call 503-823-7528

Please visit our website at www.conserveH2o.org and send us your comments and questions.

Summary of the Responses to the First RWSP Update Newsletter Questionnaire
June 2002

As of June 7 the Consortium received 154 mail back pieces from the first RWSP Update Newsletter. 17 of these were to just update the mailing list, the remaining 137 contained responses to some or all of the questions. Attached to this summary is a complete tabulation of all of the responses as verbatim as we could make them (handwriting not always decipherable). The newsletter was sent out to a 3,600 mailing list, however, some 400 were returned as undeliverable and no forwarding address reducing the received list to 3,200. This results in about a 4.5% response for the questionnaire.

Question #1. Are you aware fo the 1996 RWSP endorsed by most of the region's water providers? Yes - 95 No - 27 Unanswered or both - 15

Question # 2 Do you know the source of your drinking water, If yes what is it.

Most people felt they did know the source of the drinking water. About 68% answered Bull Run, the rest were spread around the other sources in the region including a couple from out of the area and some individual wells.

Question #3 What agency provides your drinking water?

Again, most people felt they did know the provider with the totals matching the source question.

Question #4 – The most important things to consider in meeting future water supply needs are:

Efficient Use of Water	93
Catestrophic Events	79
Economic Cost and equity	81
Environmental Impacts	76
Unforeseen Event response	55
Meet regulations	42
Manage shortages	57
Operational flexibility	61
Water quality	89
Land use conistency	59

Attached is a chart that shows the relative times an objective was picked, showing that water quality and efficient use of water were the top two objectives for number of times selected. In addition, there were a number of people who noted that they felt all of the objectives were important. Quite a lot of people also listed other objectives, some 40 additional comments in all. These comments can be categorized as dealing with cost/payment issues, quality of water in general, safety of resources, population control

and growth management, conservation, no Willamette, favor certain sources, protect environment, diversity of supply, and education.

Question #5 Do you have preferences for supply source or strategies that you provider should use to meet future demands.

We received some 101 responses to this question. Of these responses some 41 mentioned Bull Run, but a number of these were part of a list of sources which included ASR, Clackamas, and Trask. Other responses were listed for ASR (4), Conservation (14) however a number of these also contained a list of resources such as ASR, Bull Run, Little Sandy, Hagg Lake, Interties (2), No Willamette (2), Yes Willamette (5), Protect sources (2), Use existing sources (5), Clackamas Riv. (2) but this was listed along with others elsewhere, Hagg Lake (2) also listed elsewhere, Groundwater (3), Treated wastewater of other non-potable (5), highest quality sources first (2), a number of mixed comments with a number of ideas from conservation to retaining certain supplies for certain providers, growth control, use of nonpotable supplies for certain uses, etc.(15). See the attached report for a verbatim list. There was really no single theme that came out of the comments on this question.

Question #6 What is your number one concern about how future water supplies are developed?

There were 118 responses provide for this question and again the comments were at times of a mixed nature. An attempt to categorize these comments would include the following:

- ✓ No Willamette (4)
- ✓ Want best water quality (32) a number of comments listed this and at a reasonable cost as well.
- ✓ Cost of new supplies (19)
- ✓ Environment (18) Most of these were to protect the resource, a couple were to use technology work.
- ✓ Population/growth control (7)
- ✓ Conservation (4)
- ✓ Protection of sources and infrastructure (4)
- ✓ Political/institutional issues – usually comments about politics being bad or that certain decisions were made based on politics they didn't like, vote on supplies (8)
- ✓ Other (22) a mixture of comments from support of Bull Run supplies to no more logging in Bull Run, river water and non-potable, sewer fix up, develop all available sources, need diversity, regional cooperation, etc.

Question #7 – Would you like to be involved as decision are made about how to update the RWSP? No – 40 Yes – 75.

If yes, of the different opportunities for involvement listed in this newsletter, which of them work best for you? Are there others you think we should consider?

There were a surprising number of responses to this question with 64 ideas listed including one person who want two other folks added to our lists. The responses included the following ideas:

- ✓ Workshops, focus groups, round tables, hearings (19)
- ✓ Newsletters, websites, questionnaires (23)
- ✓ Other ideas (22) These included such things as: own water provider, already on some committee or group, site visits, public votes, call me. A number of these comments were really related to continuing comments about supplies such as growth control, water quality first, keep out politics, involve Joe Miller and others, conservation.

A number of folks were complimentary of being asked and wanted to continue to get newsletters and to have their opinions sought. No negative comments about newsletter in general.

Summary of Responses to the Second Regional Water Supply Plan (RWSP) Update Newsletter Questionnaire
September 2002

As of September 10, the Consortium received 39 completed questionnaires from the second RWSP Update newsletter. One respondent asked to be added to the mailing list but did not fill out the questionnaire. Not all respondents answered every question. Attached to this summary is a complete tabulation of all the responses verbatim. The newsletter was sent to the 280 persons that are on the RWSP Update mailing list, the 39 responses equates to a 14% response rate, although we do not have a count of how many other newsletters were circulated outside of the mailing itself.

Question #1. Do you do things in your home and garden to conserve water? If so, what are they? (A list of conservation activities was included and the respondent was asked to check all that apply) **Yes- 37** **No- 0** **Unanswered- 2**

- Installed low-flow fixtures e.g. faucet aerators, ultra low flow toilet, low-flow shower head **- 28**
- Own a high-efficiency appliance e.g. washing machine, dishwasher **- 17**
- Utilize an efficient Irrigation System e.g. drip hoses **- 11**
- Regulate my irrigation controller based on weather and soil moisture - **12**
- Mulch around plants to retain soil moisture - **24**
- Only water my lawn one inch a week – **18**
- Sweep instead of hose off the sidewalk and driveway - **23**
- Direct sprinklers away from sidewalks and street so I am only watering plants - **27**
- Fix leaks - **31**
- Others please list – **22** (these response are listed in the survey results section)

Questions #2. Have you seen TV, radio or outdoor ads on water conservation?

Yes- 18 No – 16 Unanswered – 5

Have you visited the Consortium's website (www.conserveh2o.org)**?**

Yes – 4 No – 32 Unanswered – 3

Question #3. What motivates you to conserve water?

There were 36 responses to this question. The categories of responses included that conservation is the right thing to do, easier on the environment, to reduce costs or reduce their own bills, to ensure that higher quality sources will last, to delay improvements, to meet growth needs, and to reduce flows to wastewater systems.

Question #4. How comfortable are you relying on conservation to meet supply needs?

The majority of responses were that folks were comfortable with conservation to meet supply needs, however there were a lot of responses that had qualifiers such as: conservation is not the complete picture to meeting needs which must include source development as well, that incentives for customers to conserve are needed such as in rates and the ability to utilize non-potable sources, and that they don't trust others to conserve. A couple of responses were that conservation would not work to meet future needs particularly with so much water in this region.

Question #5. Should the region or sub parts of the region set water conservation targets? If so, what do you think they should be and/or how do you think the Consortium should set them?

Yes – 22 No – 6 Don't know/Unanswered – 11

A number of respondents said they thought targets were a good idea, but didn't have any suggestions for how to set them. Those that did respond had different ideas, only rates/economic incentives and voluntary/education were mentioned more frequently. Other individual ideas were that targets must be measurable, limit growth to available supply, make growth pay for conservation/supplies, let average use be the guide and then target those using more than the average, target high volume users, reduce irrigation by 10% and winter use by 5%.

Question #6. The Consortium's current water conservation program focuses on reducing peak summer time use, when supplies are most stressed. Should the Consortium also focus on year-round conservation (e.g., residential indoor programs and Commercial, Industrial and Institutional programs)? If so, why?

Yes- 24 No – 9 Don't know/Unanswered – 6

The overwhelming response on this question was that conservation should be an ethic and that year round savings are more reliable, and allow us to be better prepared for drought. Building an efficient use ethic was mentioned many times. A couple of responses noted reducing wastewater costs and that peak season savings were not as reliable. One respondent felt that reducing system vulnerability to terrorist attack should be our highest priority. Another respondent felt that water meters should be read monthly and bills sent out during this peak time would help people monitor usage. There were some folks that felt we should not focus on year round savings and the comments here were impacts on the environment from dust and dead vegetation.

Question #7. Water conservation programs cost money to implement, sometimes more than a new source of water. What would you be willing to pay above the cost of a new source of supply to support more aggressive water conservation programs?

None – 11 5%-10% - 12 10%-20% - 7 More – 1 Unanswered – 8

This question got a variety of responses with half (19) responders agreeing to give conservation programs a premium in cost above new supply development. A number of comments were given on this question including some who said they did not accept the premise of this question, and that all the costs of developing new supplies were often not included in comparisons. One person noted that water rates don't reflect the true costs of supplying it anyway. Help for low income was mentioned, as well as using federal funds, and that if people were going to asked to pay more for conservation that measurement of the savings would be necessary.

Regional Water Supply Plan Survey Detail Results
Newsletter #2

Question #1. Do you do things in your home and garden to conserve water? If so, what are they? (A list of conservation activities was included and the respondent was asked to check all that apply) **Yes- 37 No- 0 Unanswered- 2**

- Installed low-flow fixtures e.g. faucet aerators, ultra low flow toilet, low-flow shower head **- 28**
- Own a high-efficiency appliance e.g. washing machine, dishwasher **- 17**
- Utilize an efficient Irrigation System e.g. drip hoses **-11**
- Regulate my irrigation controller based on weather and soil moisture **- 12**
- Mulch around plants to retain soil moisture **- 24**
- Only water my lawn one inch a week – **18**
- Sweep instead of hose off the sidewalk and driveway **- 23**
- Direct sprinklers away from sidewalks and street so I am only watering plants **- 27**
- Fix leaks **- 31**
- Others please list – **22**

Others Responses:

- Installed subsurface drip system for lawn area, take "Navy" showers, plant low water tolerant shrubs.
- Am trying to locate a supplier of plastic rain barrels to collect rainwater during the rainy season.
- Keep the tap on only when actually using water.
- Living in an apartment, I am limited as to what I can do.
- Irrigate when possible in the early morning.
- Do not water lawn during the summer.
- Rain barrels and underground cisterns to better utilize rain water.
- Do not water lawn, never wash vehicles.
- Short showers, fill laundry loads, always many small things daily to conserve and save money.
- Bathroom common sense.
- Multiple use of toilet before flushing.
- Don't water lawn at all- only plants that flower.
- Turn on water in shower only for initial soaking and final rinse (turn h2o off for lathering up)
- Water garden by hand, don't water lawn, wash dishes by hand.
- Use a suds saver on washing machine, do laundry only when a full load, use dishwasher only when full, don't water lawn.
- Population stabilization must be included in the picture.
- Eliminate lawns – emphasize drought resistant shrubs.

- Capture rainwater from my garage roof in 20-gallon tank and use it to water my vegetable garden. I don't water the lawn in the summer. I let Mother Nature take its course.
- Keep gutters cleaned; direct downspouts onto lawn.
- Make use of gray water.
- Have over 20 trees to provide shade and reduce evaporation.
- Only run dishwater when full.
- Thinking of rain barrels!
- Landscape with low-use plantings and remove most of lawn.
- Redirect downspouts to irrigate yard.
- Avoid long showers and "image" use of water (green lawns, clean car etc.)

Questions #2. Have you seen TV, radio or outdoor ads on water conservation?

Yes- 18 No – 16 Unanswered – 5

Have you visited the Consortium's website (www.conserveh2o.org**)?**

Yes – 4 No – 32 Unanswered – 3

Question #3. What motivates you to conserve water?

Responses:

- Knowledge of local water resource issues.
- Ingrained desire not to waste any resource. Also, basically I'm a cheapskate.
- Cost to me. Desire to continue getting pure Bull Run water and having to mix it with lesser-quality water.
- It is a key resource. Note: We should be actively monitoring water research to see if scientific developments can be a help.
- To, at least, know that quality and quantity will be no less than what have been normal in the past.
- Increase in population.
- Knowledge of limited resources.
- It is the right thing to do. Water is scarce.
- If we conserved more there might not be a need for a 3rd Bull Run reservoir in the 25 years. Less to storm water and sewage treatment so less frequent CSO. Volume band charges on water bill (they should be increased).
- Money.
- Save resources & money.
- Growing up in North Dakota. Also the rising cost of water.
- It's best for the environment.
- Recognition of the effects of population growth on demands for water in contrast to the limited ability to increase supply.
- Social conscience, care for the earth.

- Continued population growth, drought, misuse by others.
- Cost. I consider it a waste of an environmental resource. If I conserve, then when I really want to use a little extra I don't feel wasteful.
- I think water is a precious resource. As a citizen of this country, I already take up many resources in electricity, gas, metals, and paper that others don't have. I feel the little I accomplish in not worth the resources I use; therefore I want to minimize my use.
- The less water I use, the more water there is for fish and other aquatic life and other humans.
- The cost.
- Costs.
- Thirst and cost.
- Wanting to keep Bull Run water and not wanting to have to pay for the development of a new sources.
- Logic.
- Cost of sewage and run off fees.
- Makes sense- why waste?
- Community participation.
- Minimum cost, but primarily because I recognize that clean water is too precious.
- Responsibility.
- It's everybody's responsibility.
- An interest in conservation of natural resources and concern for adequate water for farmers and new development.
- Poor planning in past and present has forced us into water supply crises!
- Price.
- Civic responsibility; don't like to waste; save money if I can.
- I work in the field and need to set an example and use earth's resources wisely.
- Conserve natural resources.
- Minimize dependency on inexpensive supply of water.
- Optimize usage of a precious resource.
- Saves water and money.
- Common sense and desire to protect economic investment (maximize available resources).

Question #4. How comfortable are you relying on conservation to meet supply needs?

Responses:

- Fine, brown yards turn green in the fall.
- Not very, everyone needs to help. Water agencies don't seem willing- they need the money.
- Conservation is not the complete solution but it will help. Conservation extends the time when we will need additional sources.

- Very.
- Personally very much- but have little faith in the efforts of the general population.
- Not very- it's part of the answer.
- Conservation is important but should only be part of a total effort. The RWSP seems to be heading in the right direction. (*)
- Very comfortable.
- Not comfortable at all. Low water rates and the mindset of Oregonian like me who think they have unlimited h2o forever make voluntary conservation unfeasible.
- Very. This option should be implemented fully before new sources are tapped. Incentives for water conservation should be developed.
- Pretty comfortable. We have not yet begun to tap rainwater effectively and gray water. Regional Water Supply Plan needs to aggressively find turnkey systems for households coupled with financial incentives.
- Very.
- It is a start but a larger Hagg Lake would be nice.
- Comfortable.
- Pretty comfortable. There should also be a greater economic incentive to use less water. People should pay a lot more for the water they use and thus benefit by conserving more.
- Somewhat as an easily implemented method to extend the time period in which present sources are adequate.
- Not likely without a more enlightened population.
- Not very. I don't trust the users to do their share to conserve.
- I think it would be great to rely on conservation for supply needs. If people could be educated t use water collected from rain barrels to use in toilets or something, it would make a difference perhaps. (Also, if businesses were given incentives not to water the sidewalks or water plants in the rain, that would be nice).
- Very.
- Not comfortable.
- I'm not because people- homeowners and businesses- still keep wasting water.
- Very.
- No opinion.
- Very.
- Not at all – we need to develop all available sources ASAP
- Can meet some but not all needs.
- Not. As population grows, demand keeps growing, regardless of reductions in household use.
- Comfortable in the next 5 years; however, weary afterwards about water supply needs relying on conservation only.
- OK
- Not a question of comfortable. Conservation is forces on the public business. Sell more water!
- More comfortable if we had dual water systems in place – one for potable water and one for other uses!
- Very.
- Somewhat. I think we should "store" more water.

- Very.
- Somewhat comfortable.

Question #5. Should the region or sub parts of the region set water conservation targets? If so, what do you think they should be and/or how do you think the Consortium should set them?

Yes – 22 No – 6 Don't know/Unanswered – 11

Responses:

- Suggestions of what to do to conserve water and ask people to volunteer constraints.
- Depends on how much water needs to be saved.
- Realistic targets that are "measurable" can be set.
- Yes. Set up a trial to see what is possible/likely for an average consumer.
- Yes. But I'm not wise enough to know how to go about it.
- Yes. But I have no idea how to measure results.
- Yes. I think my statement above #3 applies. Land use population growth and distribution are of prime importance. Water is a finite commodity. (*)
- Make people aware of wasting water on car washing, sweep the driveway clean. Caution neighbors in a nice way about wasting water on auto washing, etc.
- Increase fees for greater use per capita.
- Yes. I do not know what they should be though. The should be set at the household level.
- Absolutely should have regional targets. If we halve our water consumption, we could accommodate population growth. However, I am not sure we should have unlimited population growth. We should figure out what is a sustainable population given water consumption and water runoff. Additional population should bear new costs of additional development , not just marginal costs.
- Yes. Set average for residential, business and industrial use. Price those using 10% above out of the market.
- Yes.
- As one item- bathrooms- possibly subsidizing 1 ½ to 3-gallon toilets- shower heads- sink faucets that allow only so much water- I am sure there are others.
- Yes. The standard should become more stringent (e.g., people should have to install more efficient appliances and use water more efficiently over time).
- Yes. As current sources are mixed out by users, raise water cost using progressively higher rates to discourage wasteful or careless consumption.
- Yes. Reduce irrigation consumers water use 10%. Reduce winter use 5%.
- Don't know. But I would carefully watch usage and volumes used. Target excesses, high volumes, most efficient impact areas.
- I think conservation targets would be a headache for regional agencies unless they are funded to provide education to consumers regarding the importance of conservation. For this education, I ask for (please) no offensive ads that treat me like an idiot.
- No.

- No.
- Conservation targets will only hurt the people who are conserving water. People who waste water are the ones who can afford to pay for it.
- Economic reward for conservation- Better measurement of water use and steeper rates for higher use.
- No targets. I don't know.
- Good question.
- Yes. Should be based on maximum possible per household, discouraging green lawns and encouraging greywater and rainwater.
- Yes, they should, by focusing on non-essential or critical usage.
- Mandatory water conservation by prioritizing the needs.
- I'm more concerned about crisis management.
- It's not my call; store more water for summer demands!
- No opinion.
- Yes, soon. Should be based on lots, family size for residents. For business, allocations will be much harder to enforce.
- Targets should be set for sub parts for the region.
- Education/awareness of situation and potential threat should be first target.
- No.
- Don't know.

Question #6. The Consortium's current water conservation program focuses on reducing peak summer time use, when supplies are most stressed. Should the Consortium also focus on year-round conservation (e.g., residential indoor programs and Commercial, Industrial and Institutional programs)? If so, why?

Yes- 24 No – 9 Don't know/Unanswered – 6

Responses:

- Suggest but not require we have enough regulations.
- Yes. Every bit would help.
- Yes. We should have as small an impact on water sources as possible in order to protect the nautical hydrologic cycle.
- Yes. A gallon saved is a gallon saved, no matter what time of year.
- Yes. Waste occurs at all times and being conscious in winter renders a person more likely to be conscious in (critical) summer.
- Absolutely. It sets a tone and gets us in the habit and precludes capital spending to provide wasted water when it is available.
- Conservation anytime should result in savings for the future. All users cannot be relied on to act in unison. Conservation at peak times is not reliable as a strategy for significant results.
- Yes. To conserve water supply.
- Mind set. Think conservation year round.

- Yes. Why wait until the supply is limiting. The goal should be to have excess supply/
- Absolutely. Conservation needs to be a consistent yearlong strategy for households and businesses.
- Yes. Most conservation improvements would carry over to all seasons.
- Yes. Having regular conservation on people's mind is a good thing.
- If the need for water conservation is needed lets "conserve".
- Yes. Because this will accustom users to always be thinking about conservation and the need to use water efficiently.
- Yes. To make conservation habitual.
- Yes. The good habits will carryover into summer. Also figure ways for individuals to capture winter rainfall too. Perhaps gray water plumbing.
- Periods of drought can not always be predicted, thus year round conservation helps support the need in times of drought.
- Yes. Because year-round usage is a constant: it gives a base usage value. Base vs. Peak demand.
- I believe they should focus on conservation year-round because of the expense of treatment (both in/out of consumers' systems) and to help people practice conservation (to get them in the habit of doing it).
- No.
- No.
- No. I think conservation has a negative affect on the environment. Dust, brown lawns interfere with vegetation that produces oxygen and cleans the soil.
- No year-round conservation.
- Consortium should focus on around- the- clock covering and monitoring (where possible) our water storage and supplies against terrorist acts. That is in any areas. #1 focus should be area of vulnerability, all else is secondary**.**
- I don't know.
- Eventually all will be necessary.
- For the long run, yes, for water will get scarcer.
- Yes. Water use now way over-exceeds pure, fresh water supplies.
- Yes because population and growth will increase the non-essential demand.
- If year-round conservation is implemented, everybody wins.
- I think education on water conservation should and must be part of the program.
- No!
- How about having water meters read monthly in the summer and bills sent out monthly? This would help people monitor and adjust in time to make a difference.
- We should use natural resources as wisely as possible irrespective of what we need or not. We don't know what the future holds.
- If individuals conserve at home level then they may be apt to influence corporate conservation as well.
- It has to be a year round focus (like recycling) with peak periods of special focus.
- No.
- Only during drought conditions if reservoirs are inadequate.

Question #7. Water conservation programs cost money to implement, sometimes more than a new source of water. What would you be willing to pay above the cost of a new source of supply to support more aggressive water conservation programs?

None – 11 5%-10% - 12 10%-20% - 7 More – 1 Unanswered – 8

Responses: (information in ( ) indicates which box respondent checked.)

- Community service announcements and the various communities have communication systems to each of their own folks. Utilize those channels. (unanswered)
- Depends on how much needs to be saved. (unanswered)
- I am not sure I accept the premise of this question. (unanswered)
- I don't believe this statement about "costing more sometimes". Doubt all cost of a new source is considered in the calculation. (5-10%)
- Again people should be paying for a lot more for the water they use both residential and commercial. It is a precious resource. (5-10%)
- With real measurements. (5-10%)
- Build another Bull Run Dam/holding facility. (none)
- With more help for low income, and an increasing definition of "low income". (10-20%)
- I think our public officials should go the Feds for more money. After all they are the ones who make all the water regulation laws. (none)
- Would depend on how short we are.
- Whatever it takes – new sources will cost more in the long run.
- More Bull Run storage (3 dams) are needed1
- Not sure we really need to pay more; there's lots of conservation out there that doesn't cost more.
- Don't know.

Water Source Map
Members
Meeting Schedule
Programs and Projects
Regional Water Supply Plan
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Plans and Reports

Regional Water Supply Plan

The Regional Water Supply Plan (RWSP) was adopted in 1996 by most of the region's individual water providers and is coordinated by the Regional Water Providers Consortium. The RWSP provides a comprehensive, integrated framework of technical information, resource strategies and implementing actions to meet the water supply needs of the Portland Metropolitan Area to the year 2050. Twenty-seven of the region's municipal water providers and Metro collaborated for more than three years to develop the plan. The planning effort and final report reflects extensive input offered by citizens and stakeholders during all phases of the project.

Phase 1 of the development of the RWSP was a water source options study. Phase 2 took a deeper look at how to meet the regional water demands of the region to 2050. Integrated Resource Planning (IRP) techniques were used to develop the RWSP. IRP is a more inclusive approach to long-term water resource issues. Its premise is that a wide range of traditional and innovative supply-side and demand-side (conservation) resources be considered.

The RWSP distinguishes itself not only as one of the most comprehensive applications of the IRP model, but also as a unique attempt to develop a truly regional water supply plan.

The final resource strategy embraced in the RWSP to meet the water supply needs of the region, reflects a weighing and balancing of the policy objectives to meet the multiple goals and priorities shared by citizens, stakeholders, and participating agencies. The resource strategy includes: naturally occurring conservation (from new efficiency standards for fixtures and appliances), new conservation programs, exploration of non-potable source development, Barney reservoir expansion, Portland wellfield remediation, Clackamas expansion, regional transmission linkages, aquifer storage and recovery, and source increment, i.e. Willamette River, Columbia River or additional storage on Bull Run.

Over the last three years, the Consortium has been working to update the Regional Water Supply Plan to reflect work done by the Consortium and other agencies and issues impacting water service as well as to update current population and demand projections. See the Regional Water Supply Plan Update in Programs and Projects. For more information and to access documents. We welcome your questions and comments.

Newsletter

"h2o Update" is a newsletter about the Regional Water Supply Plan Update. The newsletters are available to download in PDF* format.

h2o Update Newsletter

» Spring (PDF)
» Summer (PDF)
» Winter (PDF)

* To view a PDF file, you will need the Acrobat Reader.

For more information call 503-823-7528 or e-mail RWPCinfo@water.ci.portland.or.us.

Water Source Map
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Programs and Projects

The Consortium provides a forum for collaboration on water supply and resource management issues affecting the region. Some of the specific programs and projects the Consortium is currently involved in are detailed below.

- **Water Conservation**
- **Emergency Planning and Preparedness**
- **Source Protection Strategy**
- **Regional Transmission and Storage Strategy**
- **Regional Water Supply Plan Update**

Water Conservation

A basic premise of the Regional Water Supply Plan is that water conservation is a resource that can play a key role in meeting future water needs. The Consortium is currently implementing water conservation programs to reduce peak summer use in the region. The Consortium website is primarily dedicated to promoting water conservation.

- Conservation Committee Members

Emergency Planning and Preparedness

One of the main policy objectives of the Consortium is to minimize the impacts from catastrophic events that could affect delivery of water to the region. Members of the Consortium are working together to improve communication and coordination and develop a regional emergency coordination plan for water utilities, building on existing partnerships and plans.

Source Protection Strategy

In 1998 the Consortium adopted a Source Water Protection Participation Strategy to guide the Consortium and its individual members in activities to protect the quality and quantity of existing and potential drinking water sources and their watersheds.

- Source Water Protection Strategy
- Activities and Tasks
- Status Report - November 1999

Regional Transmission and Storage Strategy

In June 2000 the Consortium adopted a Regional Transmission and Storage Strategy (RTSS). The purpose of the Strategy is to develop short and long-term visions for regional transmission and storage, and to identify the institutional arrangements that can facilitate these visions. The RTSS uses the Regional Water Supply Plan as its foundation and identifies ways that complements and integrates water supply improvements in the region.

- RTSS Executive Summary

Regional Water Supply Plan Update

Since July 2001, the Consortium has been working to update the Regional Water Supply Plan. The Update serves to respond to changing conditions, priorities and public values and reflects work done to date by the Consortium, water provider members, and general events that impact water service (e.g. ESA listings, Metro projections and growth rate changes, and Clean Water Act changes). Elements of the Update include: an update of the water demand forecast; update of conservation element; additional analysis of source options; and Integrated Resource Planning modeling. Public participation and input at the Consortium and local water provider level is a critical component of the success of the update. Comments and questions can be directed to the Consortium or to your specific water provider member. The Consortium Board will consider recommending the RWSP Update for individual water provider endorsement in December 2004.

- DRAFT Regional Water Supply Plan Update - Sept 2004

Newsletter

"h2o Update" is a newsletter about the Regional Water Supply Plan Update. The newsletters are available to download in PDF format.

h2o Update Newsletter

» Spring (PDF)
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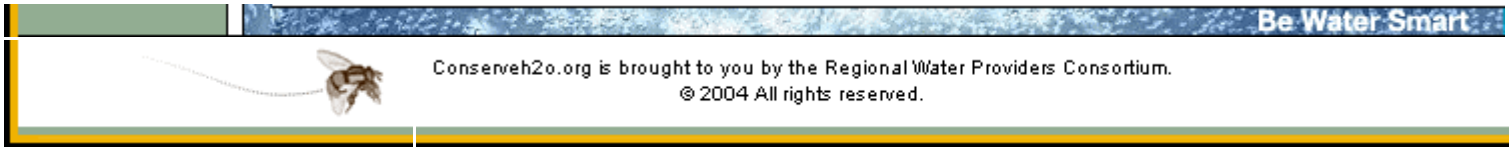


To view the Draft RWSP Update and its Appendices, please click on the links below:

DRAFT Regional Water Supply Plan Update – September 2004

Appendix A – Source Water Protection Strategy

Appendix B – Transmission and Storage Strategy

Appendix C – Public Involvement Materials

Appendix D – Water Demand Forecasting Background Documents

Appendix E – Conservation Report

Appendix F – EES Source Options Report

Appendix G – Confluence Modeling Background Documents

(**COPY OF NOTICE MAILED TO THE CONSORTIUM MAILING LIST ON SEPTEMBER 15, 2004)**

Regional Water Providers Consortium
1120 SW FIFTH AVENUE, SUITE 600
PORTLAND, OR 97204

We would like to hear from you…

The Regional Water Providers Consortium has completed the DRAFT Regional Water Supply Plan (RWSP) Update and it is now available for review.

You can find the DRAFT RWSP Update in the ***About Us*** section of the Consortium's website at www.conserveh2o.org.

To request a hard copy of the DRAFT RWSP Update, please call 503-823-7528.

Our comment period will run until October 8, 2004. You can mail written comments to our address, e-mail comments to us at RWPCinfo@water.ci.portland.or.us, fax comments to attention: Patty Burk at 503-823-4500 or call us at 503-823-7528. You are also encouraged to contact your local water provider.

Appendix D
Water Demand Forecasting Background Pieces

Regional Water Demand Forecasting
Portland Regional Water Providers Consortium

RWSP Update Project - September 2004

Prepared by Dr. Hossein Parandvash

As an integral part of the Regional Water Supply Planning (RWSP) updates demand forecasting for all participating water providers and nodes of the Confluence model was developed. The demand modeling and forecasting tasks were implemented according to the following steps.

1) Determining the service area for each provider
2) Collecting historical production and or consumption data for each provider.
3) Collecting demographic and weather data for each provider's service area
4) Collecting other relevant information.
5) Building single equation econometric demand model for each provider.
6) Generating preliminary demand forecasts using the econometric model, based on the forecasts of the demographic and economic variables.
7) Getting water providers' approval on the demand forecasts.
8) Calibrating the demand model and generating the final set of demand forecasts.

Service Area

As a first step in the demand estimation and forecasting, the service area of each provider had to be determined. Each provider was asked to identify the boundaries of its service area on a map. The water providers were also asked to identify the expected future growth areas. The approved boundary maps were converted to GIS formats and presented to Metro for determining and forecasting population.

Regional Providers' Historical production Data

Historical consumption pattern along with demographic and other relevant information were used to estimate a demand model. The resulting demand model was then used for demand forecasting.

Water providers were contacted and their data availability was assessed. Some providers had started collecting data as part of Demand Tracking project. Some providers that had data available on their SCADA system were provided with assistance in data extraction. Few did not have access to their data at all or had only couple of years of data available. Among the providers that had data, production was the most accessible data.

All available daily production data were collected and put in a usable format for demand analysis. For those providers that had multiple sources of water, total production

from all sources was determined. In case if data for some sources were not available the service area was adjusted accordingly. The production data were adjusted for in-town reservoir level fluctuations to more accurately reflect daily demand, when reservoir data were available.

Demographic and Weather Data

Metro provided the historical and forecast population data based on the approved service area map of each provider. Metro also indicated the areas of expansion in the urban growth boundary and appropriated the growth area to affected providers. The wholesale territories of some providers were added to their retail service area. The combined wholesale and retail population was used for demand model estimation of those providers.

The participating providers in RWSP are mainly located in the climate zone with mostly uniform weather pattern. For all providers historic maximum daily temperature and total daily precipitation measured at the Portland Airport weather station were used. The weather data are used for generating the weather variables of the demand model as explained in the appendix.

Other Relevant Information

The water providers were asked to provide information on events that had short-term or long-term effect on their demand. Events like flood, mandatory curtailment, or addition or loss of sources of supply usually create variations in the data that are not explained by variables in the demand model. That is also the case with sudden jumps in the rates or specific all out conservation programs. For those providers that had such data anomalies, relevant indicator or dummy variables were added to their demand model.

Demand Model

For each participating water provider, which had at least five years of historical production data a unique demand model was developed. For those water providers that did not have adequate historical data demand model for another service area with similar water consumption and customer class characteristics was used as surrogate. The surrogates were chosen based on the input from the water provider's management and other regional experts.

Demand estimation and forecasting methodology is explained in detail in the appendix. Each demand model was validated against the historical data. The demand model provides a set of weather-normalized demands and a set of weather effects, which is based on the historical weather data for the 1940-2002 period. These weather effects provide the opportunity to simulate demand forecasts under historical weather years.

Demand Forecasts

The developed demand models along with population forecasts were used to forecast long-term demand for each water provider. A preliminary set of demand forecasts was presented to the participating water providers for their review. Some of the water providers had higher growth expectations than indicated by the preliminary forecasts. Those water providers were contacted and their legitimate concerns and expectations were incorporated into the demand forecasting procedure. A final set of demand forecasts were presented to the water providers for their approval.

The final set of demand forecasts to be incorporated into the Confluence model consists of a set of weather normalized demand forecasts extending to year 2025. Corresponding to each set of weather-normalized demand forecasts, there is a set of weather effects. These weather effects are used in the Confluence model to simulate future demand under historical, 1940-2002, weather scenarios.

DEMAND MODEL ESTIMATION AND FORECASTING METHODOLOGY

For each water provider, which had at least five years of historical data, a unique demand model was developed. The demand model is a single equation regression model in double log format. The structure and the methodology of the model are discussed in this appendix.

The Data

In order to strongly reflect the effect of weather variations on demand, daily production data for each water provider is used. Some water providers, as part of the Demand Tracking project have been collecting production data in a uniform format, which was developed by the Portland Water Bureau staff. Others, which had data available on their SCADA system, were assisted in data extraction. In order to more accurately reflect daily water use, data are adjusted for changes in the in-town reservoir levels.

Total daily precipitation and maximum daily temperature, measured at the Portland Airport weather station, are available online by Oregon Climate Service for the 1940-2002 period. The weather data are used to generate the weather variables, which are used as explanatory variables in the demand model.

Demographic data are provided by Metro, a regional planning government agency that oversees Portland metropolitan area population growth and urban growth boundaries. In order to get both historical and future population forecasts, Metro is provided with service area maps for each participating water provider. Metro uses Metroscope, a multifaceted planning model, which incorporates economic, demographic, land-use, and transportation data and assumptions to forecast future population growth. Metro also provides regional employment and other economics forecasts as well.

The Model

Various studies, Hannan [1963], Jorgenson [1964 and 1967], Harvey and Shephard [1993], show that a time series data can be decomposed into trend, cyclical, seasonal, and irregular components. Chesnutt and McSpadden [1995] show that part of the daily water demand variations can also be decomposed into variables that describe weather effect.

A structural time series model is adopted to represent the demand for water by the participating water providers in the RWSP. The approach is similar to the one used by Chesnutt and McSpadden [1995]. The general specification of the demand model is represented by (1).

$$D = f(S, W, Pop, I) \qquad (1)$$

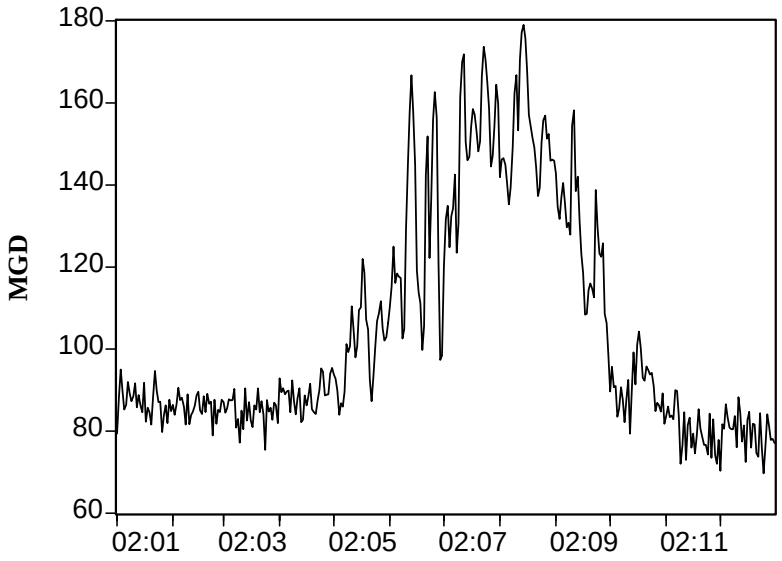
where

D = total daily demand by retail and wholesale customers (MGD),
S = variables depicting seasonal demand variations,
W = weather variables generated via a regression model as explained below,
Pop = population, and
I = indicator or dummy variables.

Seasonal Variables

There is a distinct bell-shape seasonal pattern in demand for water by the water providers in the region. Figure 1 shows aggregate demand in the Bull Run service area. Demand during the winter months is very flat, it starts picking up mid-spring, it peaks in July-August period, and declines mid-fall. Granger and Watson [1984] suggest the use of a series of 11 dummy variables to represent 11 months of the year to depict seasonal variations. In this approach the 12th month dummy is dropped to avoid singularity.

Figure 1. Retail and Wholesale Daily Water Demand in Bull Run Service Area, 2002



Hannan [1963], Jorgenson [1964 and 1967], Harvey and Sheparrd, [1993], and Dziegielewski and Opitz [2002] also recommend use of Fourier series of sine and cosine terms as a continuous function of time to express these seasonal patterns.

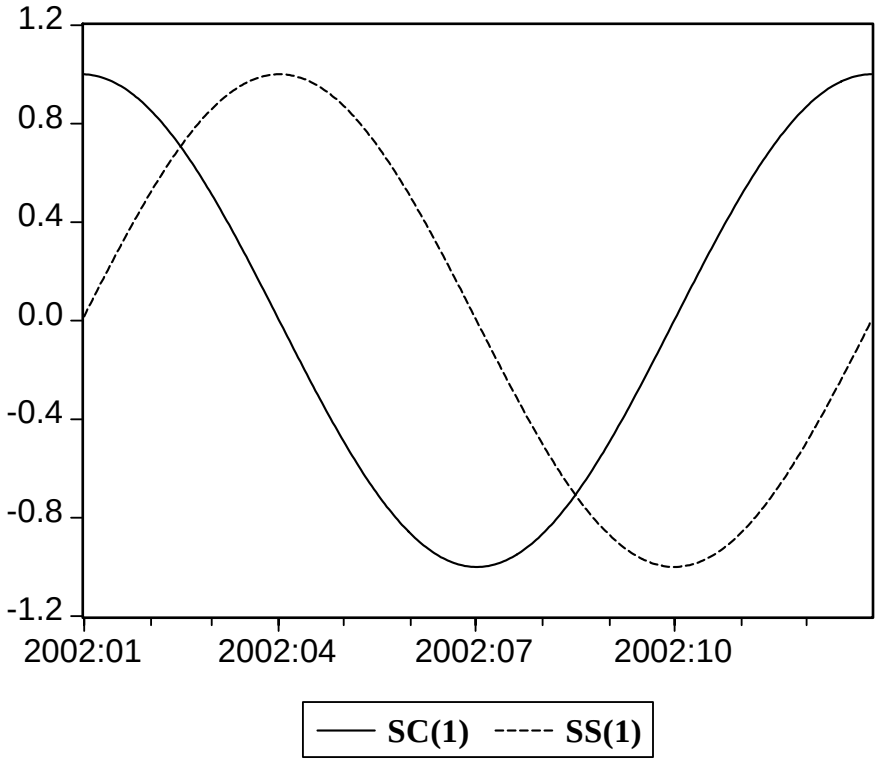
For daily demand data these variables can be constructed as

$$SS_{it} = \sin\left(\frac{2\pi it}{DIY}\right) \text{and } SC_{it} = \cos\left(\frac{2\pi it}{DIY}\right) \quad \textbf{(2)}$$

where *i* is the number of cycles within each year, *t* is the day of the year, and *DIY* is the number of days in the year, i.e., 365 days and 366 for leap years.

For instance SS1 and SC1 (t subscript is dropped to avoid clutter) complete one full Sine and Cosine cycle and SS2 and SC2 complete two full cycles within a year. Figure 2 shows SS1 and SC1 cycles during a period of one year

Figure 2. Sine and Cosine Wave Seasonal Variables



Weather Variables

Weather is the most important driving factor in daily demand. Air temperature and precipitation determine the level of water use, especially during the peak season. Obviously, weather is governed by a seasonal pattern, which is reflected in demand as well. Using air temperature and precipitation directly as explanatory variables would entangle the seasonal demand pattern with the weather effect. In order to resolve such problem, seasonal effect should be removed from both air temperature and precipitation. Furthermore, air temperature is affected by precipitation as well. Regression models are

used to generate seasonally adjusted weather variables. For precipitation variables first natural log of the scaled daily precipitation is computed as

$$P = \ln(DP + 1), \tag{3}$$

where DP is Daily Precipitation in inches. Since precipitation data include zeros, scaling is needed prior to logarithmic transformation. Various lags and various moving averages of the transformed scaled precipitation data, *P*, are generated to be used in the weather variable models. In each model *P* or its various transformation, is regressed on a Fourier series with six sine and six cosine harmonics. The seasonally adjusted variables are computed as the residuals of these regression models.

$$Pdl0 = P_0 - \left(\hat{\alpha} + \sum_{i=1}^{6} \hat{\beta}_i SS_i + \sum_{j=1}^{6} \hat{\gamma}_j SC_j \right) \tag{4}$$

For example, (4) shows a contemporaneous seasonally adjusted precipitation variable in scaled natural log format. Using the same technique precipitation variables with various lags and moving averages are generated.

The temperature variables are generated by taking the residual of the regression of natural log of maximum daily temperature on the same Fourier series plus P_t and P_{t-1}. The contemporaneous temperature variable is depicted by (5)

$$Tdl0 = T_0 - \left(\hat{\alpha} + \sum_{i=1}^{6} \hat{\beta}_i SS_i + \sum_{j=1}^{6} \hat{\gamma}_j SC_j + \hat{\delta} P_0 + \hat{\lambda} P_{-1} \right) \tag{5}$$

where P_0 and P_{-1} are the natural log of scaled contemporaneous and one day lag daily precipitation.

Indicator Variables

In order to depict anomalies or sudden changes in the consumption that are not explained by demographic, seasonal, or weather variables, indicator or dummy variables are introduced.

Halvorsen and Palmquist [1980], suggest that by taking the antilog to base e of the estimated dummy coefficient and subtracting 1 from it, one can obtain the relative change in the mean of the dependent variable as the dummy variable switches from zero to one in semi logarithmic functional forms.

Demographic Variables

Population, employment, household income, and price were initially considered as variables that reflect the effects of demographic and economic trend on demand. The initial results of the regression model showed coefficient estimates with inconsistent signs, magnitudes, and low level of statistical significance. This was a clear sign of high degrees of multicollinearity among these variables.

Economic variables tend to move together. Economic boom in a region leads to higher employment, income, and population and eventually higher prices. The multicollinearity problem is also rooted in the procedures according to which the economic estimates are generated. For instance, the models that generate population forecast have employment and other economic factors as explanatory variables.

Since the models are used for forecasting purposes, having too many variables that require forecasting, would increase the error of the demand forecasts. Due to these concerns only population variable for the service area of each water provider is retained.

Functional Form

Natural logarithms of daily demand are regressed against the log of explanatory variables. The seasonal and indicator variables are all in raw scale. Since the weather variables are the residuals of the regression of natural logs of temperature and scaled precipitation against seasonal variable, they are in natural log format. The population numbers are also converted to natural log. Equation (6) shows the compact representation of the functional form as

$$\ln D = \alpha + \beta S + \gamma W + \delta \ln(Pop) + \theta I + u \qquad \textbf{(6)}$$

where D is the daily demand in millions of gallons per day (MGD). S and W are Seasonal and Weather variables as explained in the above. Variables I are the indicator variables. Pop is the population of the retail and wholesale service area, which are served by the water sold by the Bureau.

RESULTS

The results of the regression model estimation for aggregate demand for Bull Run service area are presented in Table 1 as an example. The model shows a strong relationship between daily demand and the explanatory variables. The adjusted R2 is 0.89, which is rather high for daily demand models. Moreover, all coefficients have proper signs. The population coefficient is 0.97, which indicates that a 1 percent increase in population results in almost 1 percent increase in daily demand for water. A population coefficient, which is greater than one usually, indicates expansion in water intensive economic activities and land use patterns. Conversely, successful conservation

programs and increase in multifamily dwelling land use pattern result in population coefficient that is less than one. In this particular model there are long-term cyclical and the conservation variables which capture the corresponding variations in demand.

As in the case of most time series models, the error term shows strong evidence of autocorrelation. An AR(2) procedure is used to deal with the autocorrelation problem. Furthermore, White's Test shows evidence of heteroskedasticity. As a result, White Heteroskedasticity Consistent Covariance was used to correct the standard errors of the estimates.

Table 1. Results of the Daily Water Demand Regression Model for the Bull Run Service Area

Dependent Variable: ln(DMD)
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SS(1)	-0.091693	0.002655	-34.53168	0.0000
SC(1)	-0.199829	0.002881	-69.36426	0.0000
SS(2)	0.082066	0.002723	30.13342	0.0000
SC(2)	0.064252	0.002774	23.16573	0.0000
SS(3)	-0.035928	0.002711	-13.25498	0.0000
SS(4)	0.015026	0.002654	5.662090	0.0000
SC(4)	-0.006858	0.002724	-2.517574	0.0118
SS(5)	-0.004908	0.002634	-1.863505	0.0624
SC(5)	0.009680	0.002668	3.628596	0.0003
SC(6)	-0.008925	0.002591	-3.445228	0.0006
WKND	-0.037708	0.001323	-28.50431	0.0000
PDL(0)	-0.066588	0.005122	-13.00140	0.0000
PDL(1)	-0.105442	0.005104	-20.66010	0.0000
PDL(2)	-0.088197	0.005046	-17.47745	0.0000
PDL(3)	-0.066659	0.005364	-12.42609	0.0000
PDL(4)	-0.053234	0.005083	-10.47394	0.0000
PDL(5)	-0.054355	0.005213	-10.42777	0.0000
PDL(6)	-0.049591	0.004899	-10.12188	0.0000
PMA7S(1)	0.249880	0.029456	8.483086	0.0000
PMA7C(1)	0.580732	0.038287	15.16782	0.0000
PMA7S(2)	-0.185628	0.027210	-6.822011	0.0000
PMA7C(2)	-0.219728	0.027959	-7.858833	0.0000
TDL(0)	0.302730	0.008667	34.92833	0.0000
TDL(1)	0.088465	0.008529	10.37167	0.0000
TDL(2)	0.043499	0.008013	5.428507	0.0000
TDL0S(1)	-0.138292	0.011328	-12.20782	0.0000
TDL0C(1)	-0.458385	0.012542	-36.54665	0.0000
TDL0S(2)	0.090837	0.011756	7.726871	0.0000
TDL0C(2)	0.121099	0.011396	10.62632	0.0000
TMAWK(1)	0.058407	0.018087	3.229191	0.0012
TMAWK(2)	0.043278	0.017127	2.526843	0.0115
ln(POP)	0.972279	0.037875	25.67044	0.0000
CONS92	-0.072708	0.010445	-6.960928	0.0000
Y92JUL	-0.249190	0.067638	-3.684174	0.0002
Y92AUG	-0.276685	0.031789	-8.703813	0.0000
Y92SEP	-0.164540	0.031811	-5.172492	0.0000
EC2001	-0.045794	0.010022	-4.569496	0.0000
EC2002	-0.074176	0.011165	-6.643821	0.0000
LCTC(1)	-0.086196	0.004087	-21.09123	0.0000
LCTC(2)	-0.025048	0.002958	-8.467476	0.0000
C	-8.369591	0.506342	-16.52952	0.0000
AR(1)	0.440744	0.012805	34.41923	0.0000
AR(2)	0.215083	0.011503	18.69823	0.0000

R-squared	0.888373	Mean dependent var	4.657053
Adjusted R-squared	0.888073	S.D. dependent var	0.249875
Durbin-Watson stat	2.049272	Prob(F-statistic)	0.000000

The variables are defined as follows:

SS(i) and SC(i) are continuous sine and cosine wave variables that explain seasonal variations in water demand. The number (i) indicates the frequency of oscillation with in a year.

WKND is the weekend indicator variable which takes the value of one for Saturdays and Sundays and zero otherwise.

PDL(i) are the daily precipitation variables with lag of (i) days generated via the procedure explained in the above.

PMA7S(i) are seven-day moving averages of daily precipitation interacted with the seasonal sine variables with (i) frequency of oscillation.

PMA7C(i) are seven-day moving averages of daily precipitation interacted with the seasonal cosine variables with (i) frequency of oscillation.

TDL(i) is the maximum daily temperature variable with lag of (i) days generated via the procedure explained in the above.

TDL0S(i) are the contemporaneous daily maximum temperature interacted with the seasonal sine variables with (i) frequency of oscillation.

TDL0C(i) are the contemporaneous daily maximum temperature interacted with the seasonal cosine variables with (i) frequency of oscillation.

TMAWK(i) are weekly moving averages of daily maximum temperatures with lag of (i) weeks.

ln(POP) is the natural log of the retail and wholesale service area population.

LCTC(i) are the long-term cyclical trend cosine wave variables with (i) frequency of oscillation during the 1960-2002 time period.

CONS92 is the conservation dummy variable that captures effect building code changes since 1992.

Y92JUL, Y92AUG, and Y92SEP are dummy variables that show he mandatory curtailments in the summer of 1992.

EC2001 and EC2002 are dummy variables that show the effect of recent economic downturns on demand.

AR(1) and AR(2) are the first and second order autoregressive error correction variables.

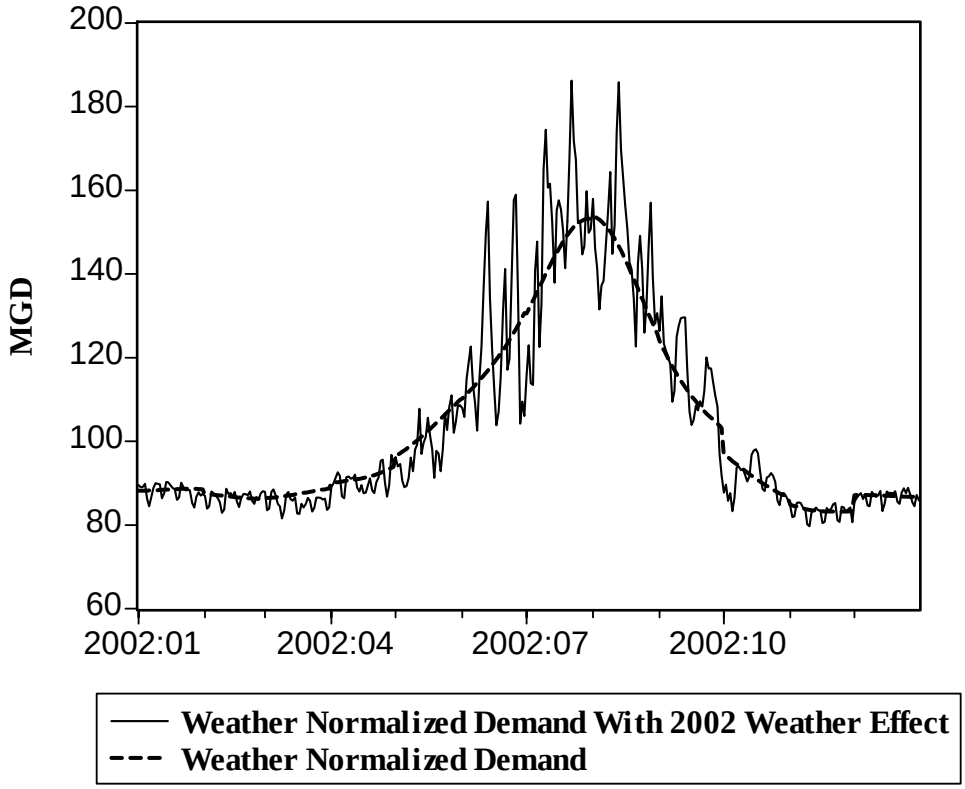
Coefficients of the seasonal variables SC(3) and SS(6) turned out to be highly insignificant and therefore are not included in the model. The weather variables, although all are significant, they have different levels of influence on demand. In general, the model results indicate that temperature has a higher effect on demand than precipitation. The weather variables that are interacted with the sine and cosine waves make the effect of unseasonable rain and temperature less pronounce. Coefficients of all indicator variables are significant and show the percentage change in demand when the variable is in effect.

Decomposition of the Effects

One of the advantages of the model is that the variations in demand can be decomposed into the effects of different variables. For instance, the antilog of the linear combination of all seasonal variables shows the seasonal variations in demand. Also, the antilog of the linear combination of weather variables added to that of the seasonal variables shows the peaking behavior or the load profile of daily demand. The resulting magnitudes show the peaking factors of weather normalized and weather affected demand relative to average demand.

The other useful feature of the model is that if we take the antilog of the linear combination of all variables except for the weather variables, we end up with the weather-normalized demand with seasonal variation. For simulation purposes also, weather effect from any weather year can be added to the weather normalized demand of any specific year. This would make it possible to observe demand for a specific year with a historical sample of weather effects and explore the best and worst case weather scenarios. Figure 3 shows the 2002 weather normalized demand along with demand with 2002 weather effect.

Figure 3. Weather Normalized and Weather Affected 2002 Demand Forecasts



Forecasting

In order to use the demand model as a forecasting tool, data on the future values of the explanatory variables are required. The seasonal and weekend variables are predetermined. Some of the indicator variables like conservation can be judgmentally determined as well. One can also decide about the effect of the long-term cyclical trend variables. However, the model needs population forecast for the service area.

Plugging in the population forecasts along with the predetermined seasonal and indicator variables, using the estimated coefficients, one can estimate a set weather-normalized demand forecasts. Subsequently, weather effects of any particular weather year can be applied to the weather-normalized demand for weather effect simulations.

Forecast Evaluation

The usual statistics that are resulted from running the regression equation normally report the fit of the model and how significant the coefficients of the explanatory

variables are. However, to evaluate the quality of forecast Mean Absolute Percentage Error (MAPE) of the forecast is used. The advantage of this statistics is that it is scale indifferent and easy to explain. It is defined as

$$MAPE = \frac{1}{h}\sum_{t=T+1}^{T+h}\left|\frac{\hat{D}_t - D_t}{D_t}\right| \quad \textbf{(7)}$$

where $\hat{D}_t$ and D_t are Forecast and Actual demands respectively. It shows on the average by what percentage the forecast deviates from the actual.

The Bull Run service area demand model shows a higher degree of forecast accuracy from 1980 onward. For instance MAPE for 1960-2002, 1980-2002, and 1990-2002 periods are 7.6%, 7.0% and 5.6% respectively. Furthermore, the accuracy is increased even more when MAPE is computed for the monthly and annual average demand figures. Daily variations in demand are explained by weather variables in the demand model, therefore, any daily demand pattern that is not weather related adds to the inaccuracy of the forecast. For instance, some wholesale customers start filling their reservoirs in advance when they predict hot days ahead. Since the data on reservoir level for the wholesale customers are not available, the demand data cannot be adjusted accordingly. These kinds of operation practices were more commonplace in the earlier decades of the 1960-2002 period that the demand data covers.

CONCLUSIONS

In this study structural time-series model are used for long-term water demand forecasting purposes. The model allows for decomposing the daily variations in demand in long-term cyclical, trend, seasonal, and daily weather related components. Population and weather forecast are important pieces of information that are needed for demand forecasting. Using the demand model one can generate a set of weather-normalized demand forecasts along with the weather effects based on the historical weather data. This process simulates demand under an available historical weather sample, which can be used to identify a demand range for planning purposes.

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Confluence Nodes Population Forecasts 2004-2025

	Provider Nodes																									PDX	Portland Other East							Portland Other West				
Year	Beaverton	CRW North	CRW South	Fairview	Forest Grove	Gladstone	Lake Oswego	Milwaukie	Oak Lodge	Oregon City	Raleigh	Rockwood	Sandy	Sherwood	Sunrise	Tualatin	West Linn	West Slope	Wilsonville	Gresham	Tigard	TVWD-M	TVWD-W	Hillsboro	Powell Valley	Portland	GNR	Green Valley	Hide-away	Lorna	Lusted	Pleasant Home	Sky-view	Palatine	Valley View	Burling-ton	Lake Grove	Totals
2004	59,064	27,821	18,958	6,780	22,185	11,654	44,492	26,089	31,081	26,724	5,214	50,734	6,007	12,795	38,265	23,649	24,642	14,502	17,627	59,336	51,331	21,363	161,802	79,667	39,240	561,789	8	10	6	234	983	1,533	42	2,349	1,257	463	2,915	1,452,612
2005	59,218	28,253	19,252	6,848	23,046	11,789	46,186	26,633	31,680	27,588	5,347	50,886	6,149	12,917	39,406	23,743	25,116	14,841	18,220	59,970	51,712	21,448	166,300	85,017	39,883	579,593	8	10	6	234	1,019	1,583	42	2,531	1,310	492	2,987	1,491,263
2006	59,372	28,866	19,670	6,916	24,133	11,854	46,535	26,860	32,019	28,750	5,371	51,039	6,203	13,040	44,136	23,838	25,466	14,886	18,627	62,914	52,809	21,533	170,798	85,833	41,069	585,745	9	10	6	237	1,052	1,632	43	2,557	1,334	506	3,017	1,518,683
2007	59,526	29,480	20,088	6,985	25,219	11,920	46,884	27,088	32,359	29,913	5,394	51,192	6,256	13,163	48,865	23,934	25,816	14,931	19,034	65,858	53,906	21,617	175,296	86,652	42,255	591,897	9	10	6	240	1,084	1,681	43	2,583	1,358	520	3,046	1,546,108
2008	59,681	30,093	20,506	7,055	26,306	11,985	47,233	27,315	32,698	31,075	5,418	51,346	6,310	13,289	53,595	24,029	26,165	14,976	19,441	68,802	55,004	21,702	179,794	87,474	43,442	598,048	9	10	6	243	1,116	1,730	43	2,610	1,382	534	3,075	1,573,540
2009	59,836	30,706	20,924	7,126	27,393	12,051	47,582	27,542	33,038	32,238	5,441	51,500	6,364	13,415	58,325	24,126	26,515	15,021	19,848	71,746	56,101	21,787	184,292	88,299	44,628	604,200	9	10	6	246	1,149	1,779	44	2,636	1,406	548	3,104	1,600,978
2010	59,992	31,320	21,342	7,220	28,479	12,116	47,932	27,770	33,378	33,400	5,465	51,688	6,418	13,531	63,054	24,222	26,864	15,066	20,254	74,689	57,198	21,871	188,790	89,124	45,814	610,352	9	10	6	249	1,181	1,828	44	2,663	1,430	562	3,133	1,628,464
2011	60,148	31,696	21,598	7,329	29,031	12,151	48,216	27,863	33,591	34,401	5,485	51,976	6,507	14,219	66,590	24,319	27,292	15,090	20,710	76,858	57,928	22,097	193,288	89,886	46,416	613,005	9	10	6	251	1,205	1,844	44	2,679	1,443	568	3,152	1,648,899
2012	60,304	32,072	21,855	7,438	29,583	12,186	48,501	27,957	33,804	35,401	5,504	52,264	6,597	14,907	70,125	24,416	27,719	15,114	21,165	79,027	58,657	22,307	197,786	90,650	47,017	615,658	9	10	6	253	1,228	1,860	44	2,696	1,457	573	3,171	1,669,321
2013	60,461	32,448	22,111	7,547	30,134	12,221	48,786	28,050	34,017	36,402	5,524	52,553	6,687	15,595	73,661	24,514	28,146	15,138	21,620	81,196	59,386	22,517	202,284	91,417	47,618	618,310	9	10	6	255	1,252	1,876	44	2,713	1,470	579	3,190	1,689,747
2014	60,618	32,823	22,367	7,656	30,686	12,256	49,070	28,144	34,231	37,402	5,544	52,841	6,777	16,283	77,197	24,612	28,574	15,162	22,075	83,365	60,116	22,727	206,781	92,187	48,220	620,963	9	10	6	257	1,276	1,892	45	2,730	1,483	584	3,208	1,710,176
2015	60,906	33,199	22,623	7,765	31,237	12,291	49,355	28,237	34,444	38,403	5,563	53,130	6,867	16,971	80,732	25,039	29,001	15,186	22,530	85,534	60,845	22,937	211,279	92,961	48,821	623,616	9	10	6	259	1,299	1,908	45	2,746	1,497	590	3,227	1,731,068
2016	61,371	33,672	22,945	7,854	31,639	12,353	49,778	28,462	34,765	39,500	5,597	53,497	6,942	17,384	85,678	26,368	29,958	15,257	23,152	87,052	61,677	23,279	212,825	93,706	49,407	628,314	9	10	6	260	1,319	1,931	45	2,759	1,510	599	3,261	1,754,140
2017	61,837	34,144	23,267	7,996	32,041	12,414	50,201	28,688	35,085	40,597	5,630	53,865	7,018	17,796	90,623	27,697	30,915	15,329	23,775	88,570	62,509	23,621	214,370	94,454	49,993	633,013	9	11	6	261	1,340	1,953	45	2,771	1,524	609	3,296	1,777,270
2018	62,302	34,616	23,588	8,024	32,442	12,517	50,623	28,913	35,406	41,694	5,663	54,233	7,093	18,209	95,569	29,026	31,873	15,400	24,397	90,088	63,342	23,964	215,915	95,204	50,579	637,711	9	11	6	262	1,360	1,975	45	2,783	1,537	618	3,330	1,800,329
2019	62,768	35,088	23,910	8,053	32,844	12,531	51,046	29,139	35,726	42,791	5,697	54,601	7,169	18,622	100,514	30,355	32,830	15,471	25,019	91,606	64,174	24,306	217,460	95,956	51,165	642,410	9	11	6	264	1,380	1,997	45	2,795	1,550	627	3,364	1,823,300
2020	63,233	35,561	24,232	8,081	33,246	12,545	51,469	29,364	35,779	43,888	5,730	54,662	7,244	19,035	105,460	31,684	33,787	15,543	25,641	93,124	65,006	24,648	219,006	96,710	51,751	647,108	9	11	6	265	1,400	2,019	45	2,808	1,564	637	3,399	1,845,699
2021	63,489	37,625	25,639	8,110	33,409	12,559	51,594	29,409	35,833	45,548	5,749	54,724	7,246	19,552	107,961	32,176	34,119	15,582	25,873	93,509	65,484	24,998	220,546	97,583	51,840	651,479	9	11	6	265	1,443	2,105	45	2,808	1,570	637	3,410	1,863,942
2022	63,744	39,689	27,045	8,138	33,572	12,574	51,718	29,454	35,886	47,209	5,768	54,785	7,247	20,069	110,463	32,668	34,451	15,622	26,105	93,894	65,962	25,348	222,086	98,343	51,929	655,849	9	11	6	265	1,486	2,191	45	2,809	1,577	638	3,421	1,882,073
2023	63,999	41,753	28,452	8,167	33,735	12,588	51,842	29,499	35,940	48,869	5,787	54,846	7,248	20,586	112,965	33,160	34,783	15,661	26,337	94,278	66,440	25,698	223,626	99,102	52,017	660,220	9	11	6	265	1,530	2,276	45	2,809	1,584	638	3,432	1,900,203
2024	64,254	43,818	29,859	8,196	33,899	12,602	51,967	29,544	35,993	50,529	5,806	54,908	7,250	21,103	115,466	33,652	35,115	15,701	26,568	94,663	66,919	26,048	225,166	99,860	52,106	664,591	9	11	6	265	1,573	2,362	45	2,810	1,591	639	3,444	1,918,332
2025	64,509	45,882	31,265	8,225	34,062	12,616	52,091	29,589	36,047	52,189	5,824	54,969	7,251	21,620	117,968	34,144	35,447	15,740	26,800	95,048	67,397	26,400	226,700	100,619	52,195	668,961	9	11	6	265	1,616	2,448	45	2,810	1,598	639	3,455	1,936,458
Growth Increment	**5,445**	**18,061**	**12,307**	**1,445**	**11,877**	**962**	**7,599**	**3,500**	**4,966**	**25,465**	**610**	**4,235**	**1,244**	**8,825**	**79,703**	**10,495**	**10,805**	**1,239**	**9,173**	**35,711**	**16,066**	**5,037**	**64,898**	**20,952**	**12,954**	**107,172**	**1**	**1**	**-**	**31**	**633**	**914**	**3**	**462**	**341**	**177**	**540**	**483,846**

Primary Water Sources for the Portland Metro Area

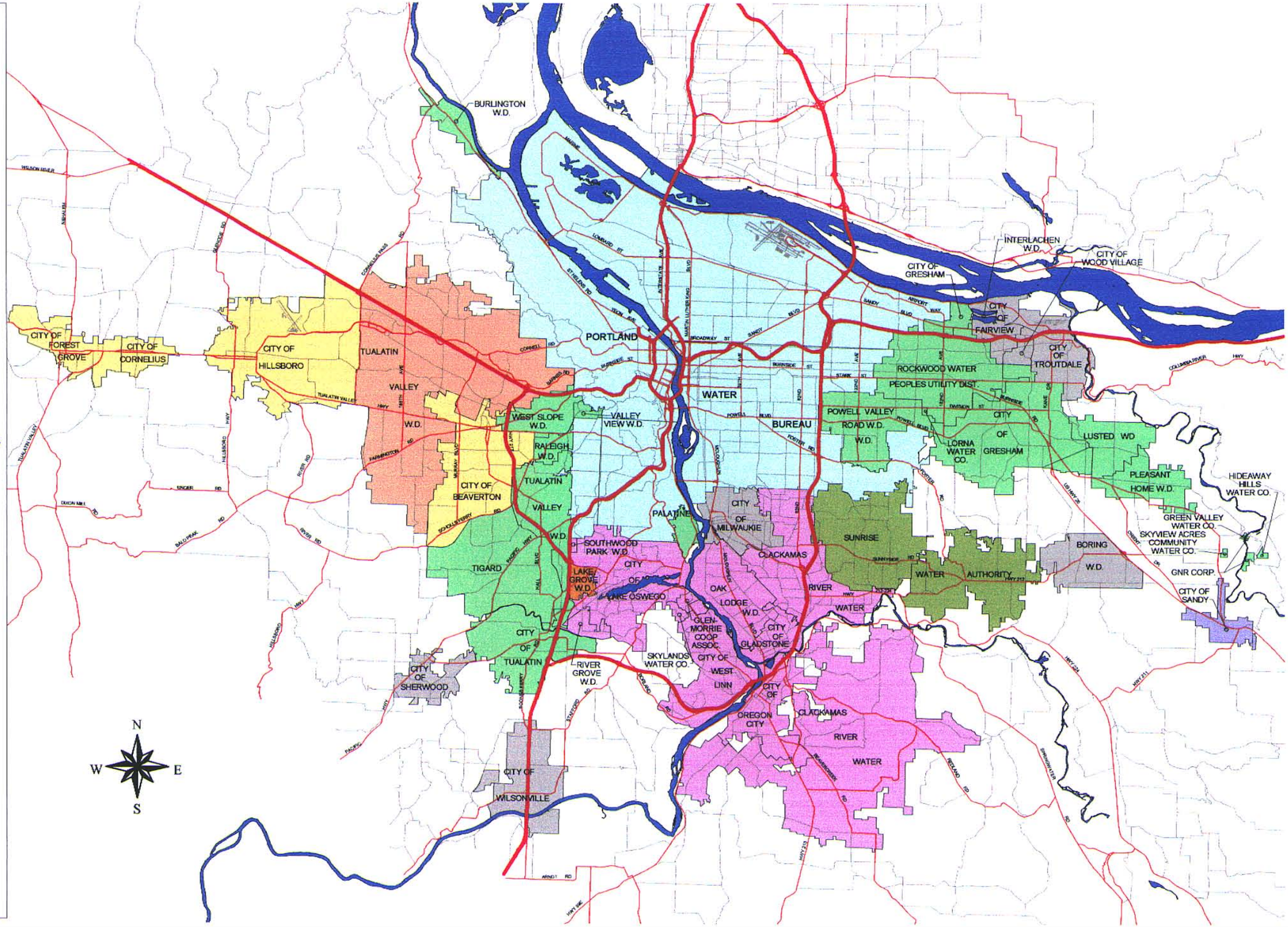
Water Sources

- Alder Creek
- Bull Run Retail
- Bull Run Wholesale
- Bull Run/Clackamas
- Bull Run/Trask-Tualatin
- Clackamas
- Groundwater
- Groundwater/Clackamas
- Trask-Tualatin

2 0 2 4 Miles

Note: Map shows primary municipal water source for each service area. Actual water supplies for some service areas include one or more other supplemental sources not listed in the key.

PORTLAND WATER BUREAU



Appendix E
Planning and Management Consultants, Ltd. (PMCL) Report

Update of the Regional Water Supply Plan
Conservation Element

March 31, 2003

Prepared by:
PMCL@CDM
A CDM Company

Copies of this report can be found on the Consortium Website
www.conserveh2o.org

or by contacting the Consortium at (503) 823-7528

Regional Water Providers Consortium
1120 S.W. 5th, Room 600
Portland, Oregon 97204

Appendix F
Economic and Engineering Services, Inc. (EES) Report

RWSP Source Options Update
Final Report

August 2004

Prepared by:
Economic and Engineering Services, Inc.

Please note: This report was a background product for the RWSP Update, materials from this report were incorporated in Chapter 4. Inconsistencies between the information in this report and the RWSP Update are due to newer revised information since the Source Option Update materials were first collected. Chapter 4 of the RWSP Update is the official final version of the source options review.

Copies of this report can be found on the Consortium Website
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or by contacting the Consortium at (503) 823-7528

Regional Water Providers Consortium
1120 S.W. 5th, Room 600
Portland, Oregon 97204

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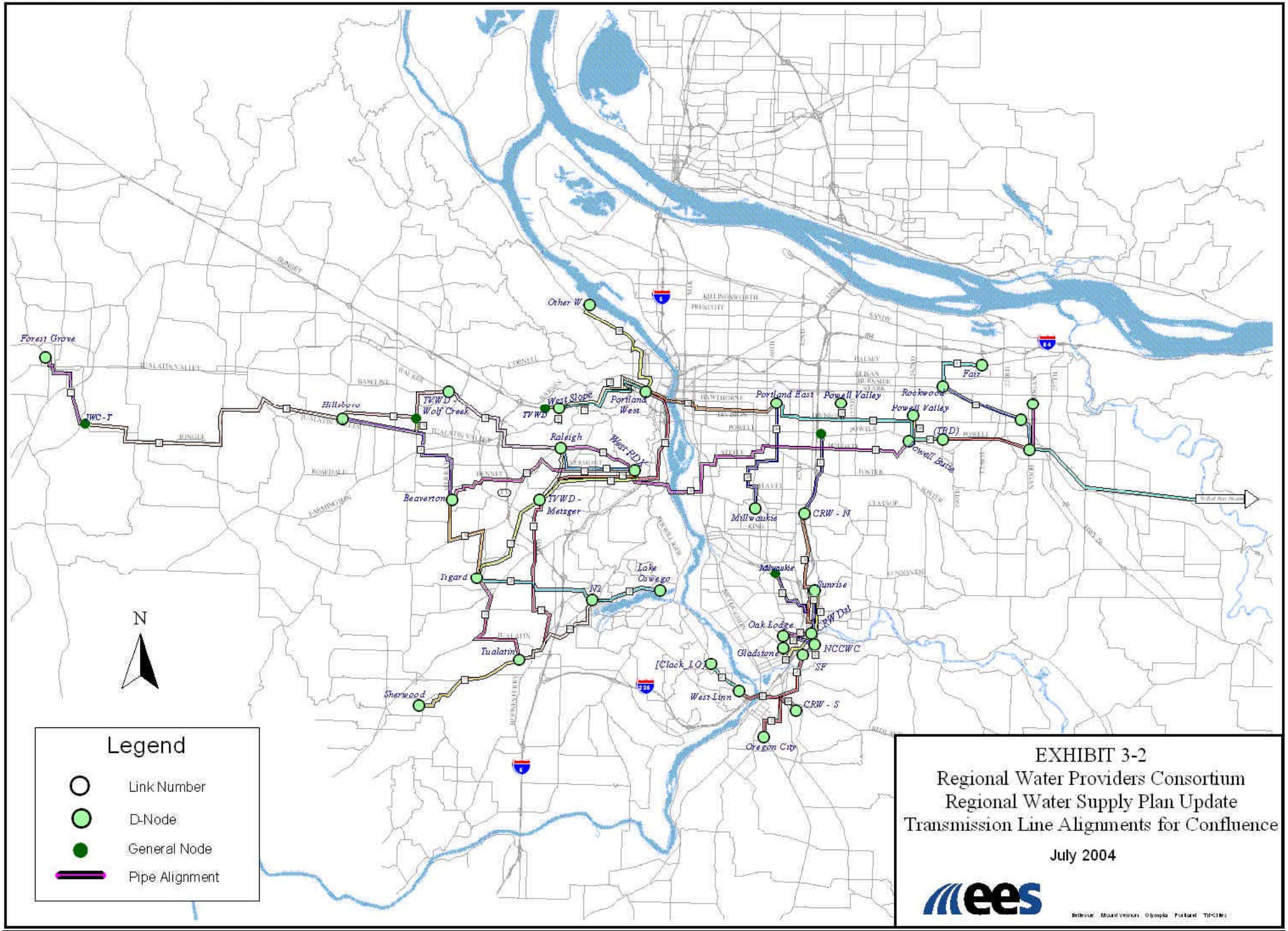

Appendix G
Confluence Model

Present Value Net Cost Comparison: Scenarios with Transmission ($ million)					
	Base	**Bull Run[1]**	**Hagg[2]**	**Clackamas[3]**	**Local Exp[4]**
Source Capital	$ -	$ 19	$ 70	$ 24	$ 37
Trans Capital	$ 237	$ 177	$ 157	$ 139	$ 125
Operating Costs	$ 167	$ 147	$ 153	$ 91	$ 123
Conservation[5]	$ -	$ -	$ -	$ -	$ -
Total	**$ 404**	**$ 343**	**$ 380**	**$ 253**	**$ 285**

NOTE: All figures are present values of revenue requirements through 2025, *net of base case without transmission.*

1. Includes dam raises for reservoirs 1 and 2.
2. Includes Scoggins dam raise, added treatment capacity, and Sain Tunnel.
3. Includes Clackamas basin supply additions beyond those in base case.
4. Includes following local supply additions beyond those in base case:
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   Gresham Groundwater: 5 mgd
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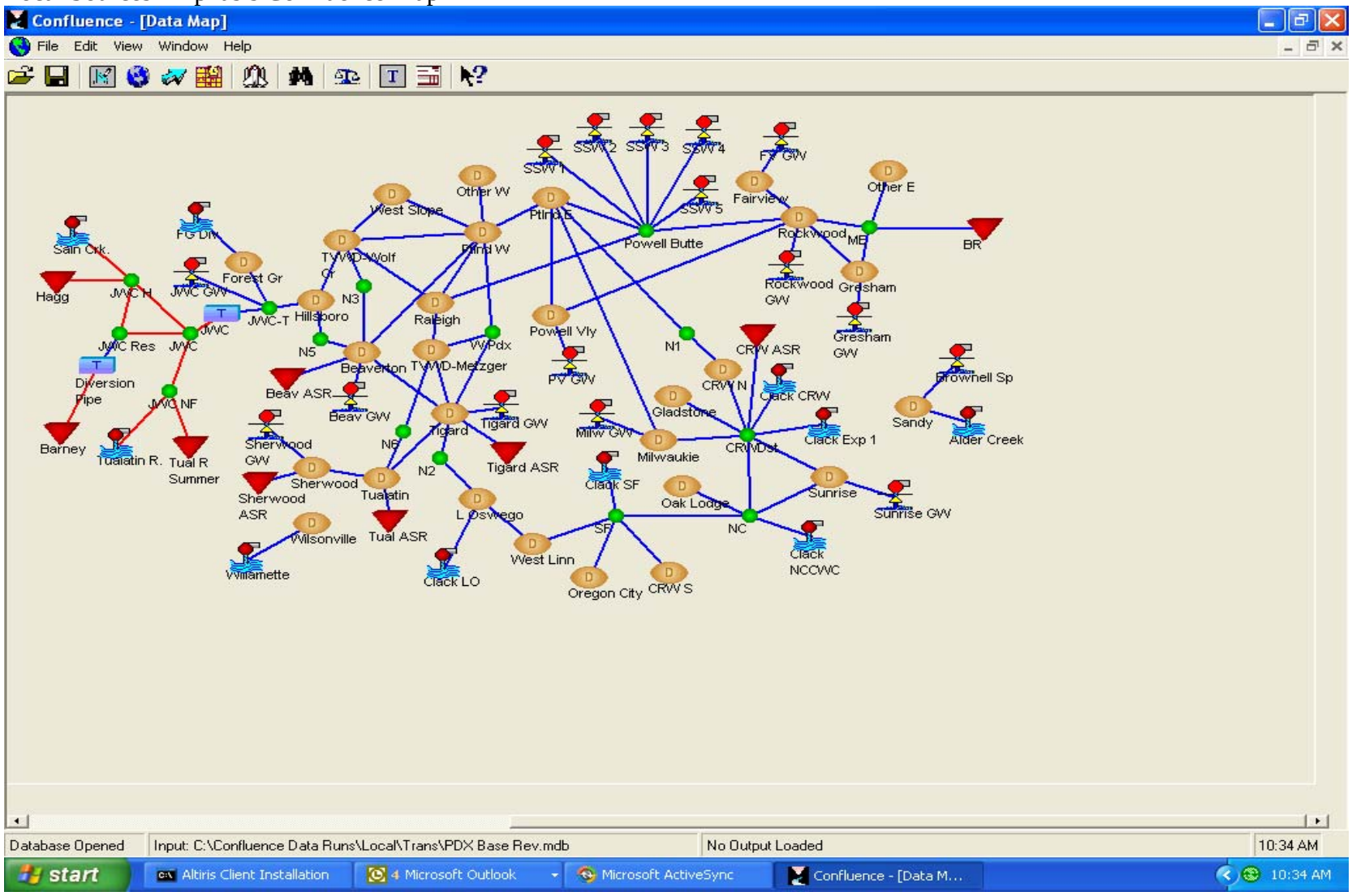
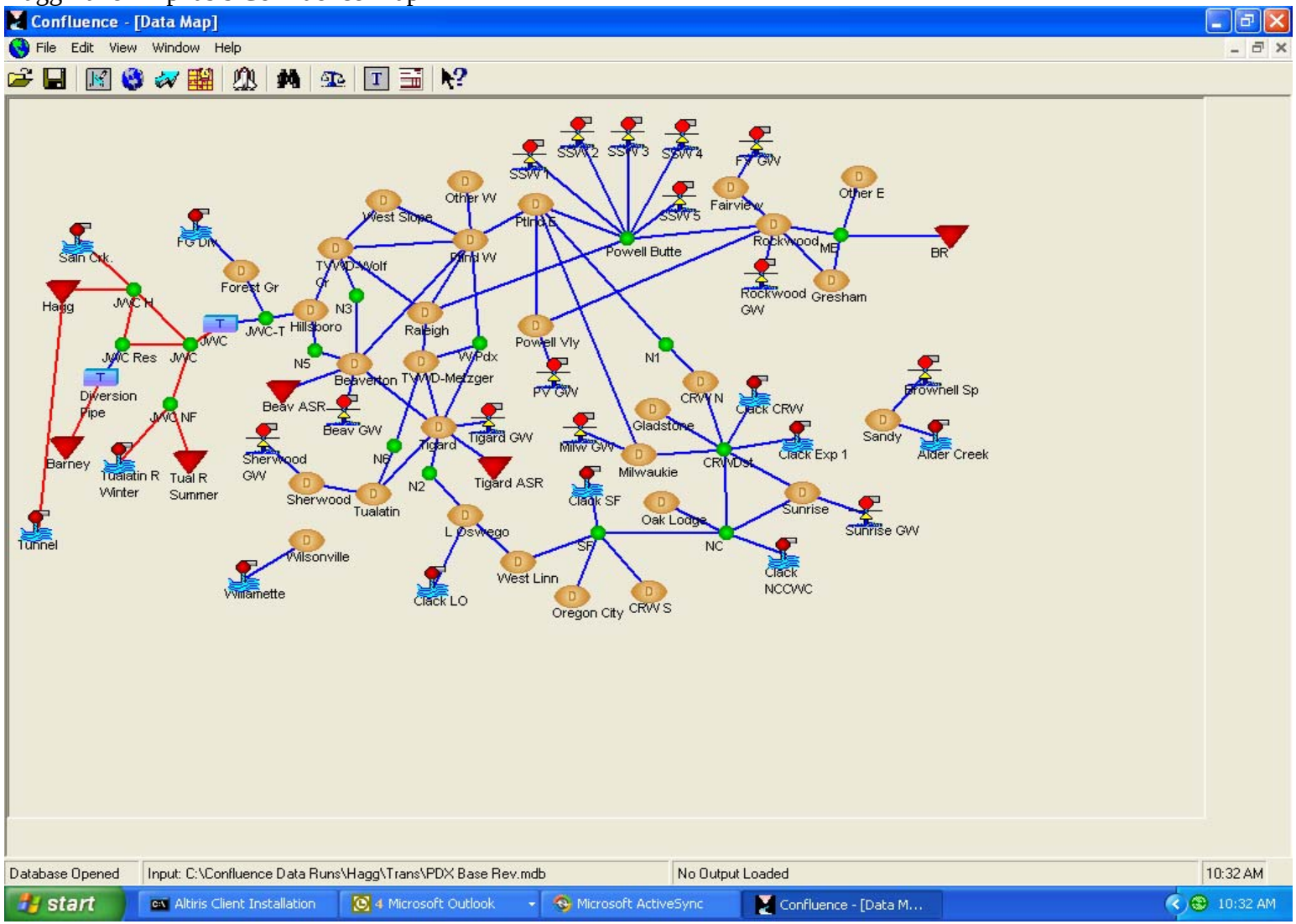
   Rockwood Groundwater: 13 mgd
5. Note that the conservation included in base case and all strategies is identical.
   The utility net present value for the programs is $23.16 Million (the customer cost is $92.29 million).

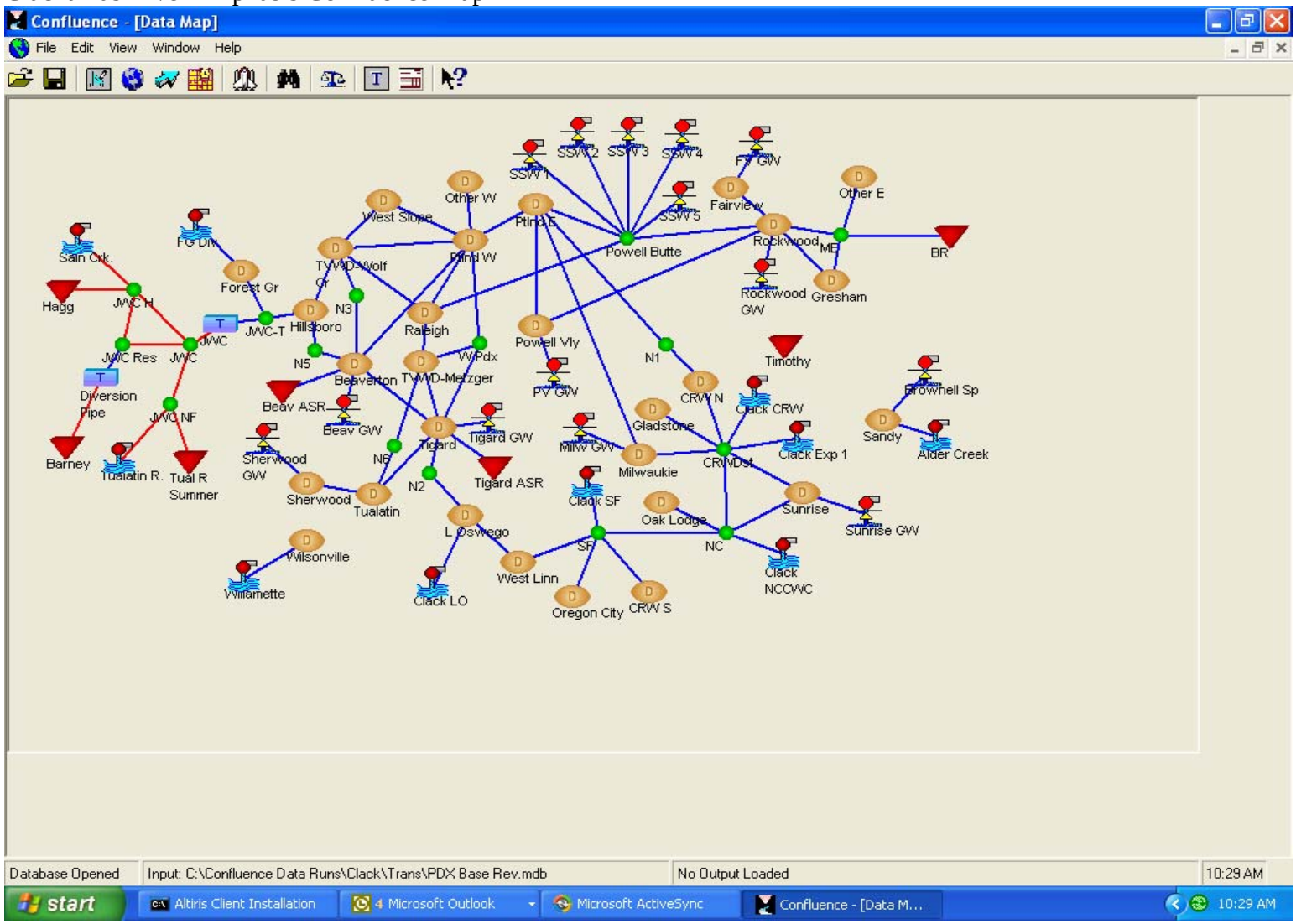
Local Sources Emphasis Confluence Map



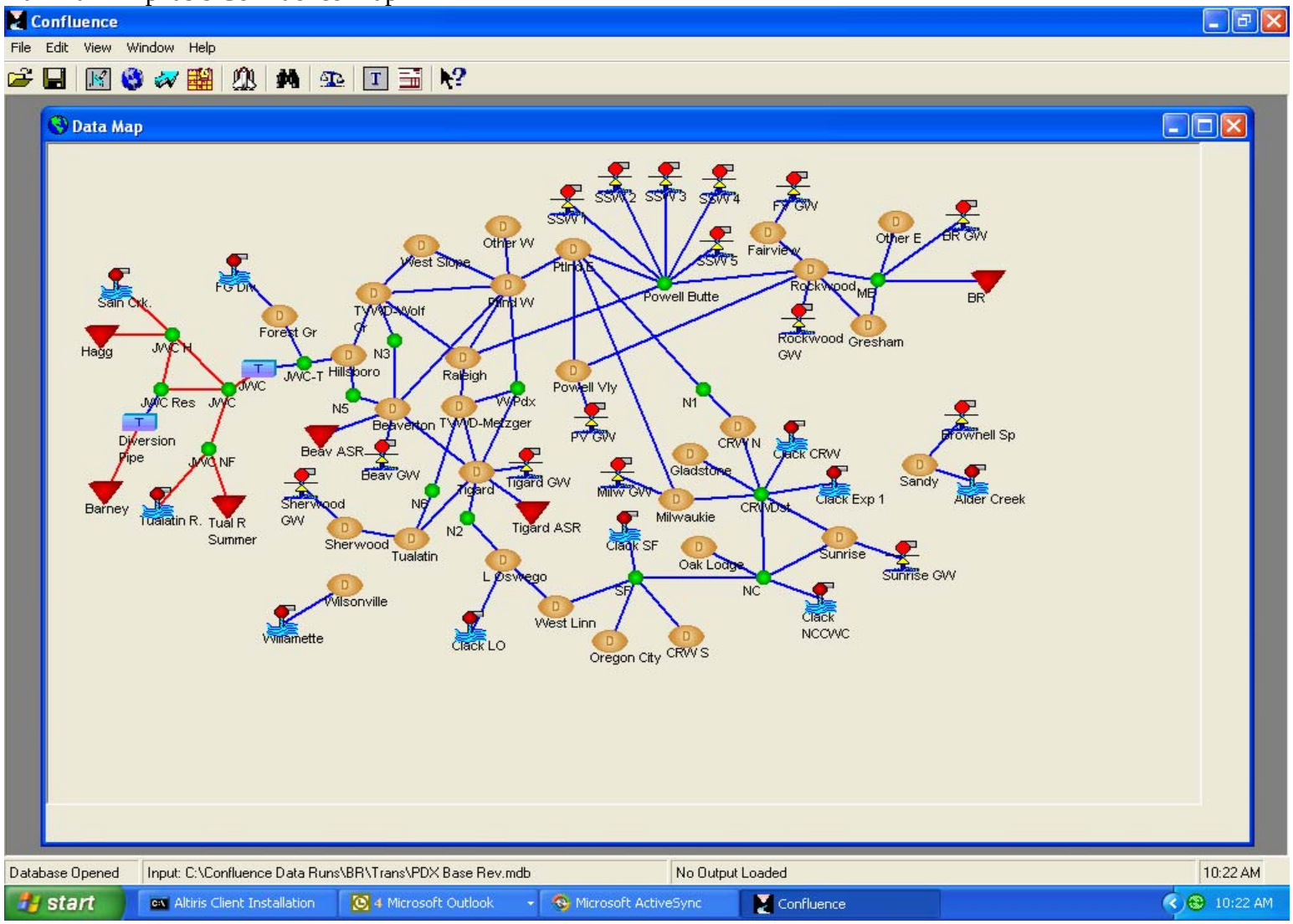
Hagg Lake Emphasis Confluence Map



Clackamas River Emphasis Confluence Map



Bull Run Emphasis Confluence Map



The *Confluence*® Water Resource Planning Modeling System
Key Features

Water supply planning is becoming more complex. In the face of growing demands, escalating regulatory requirements, an increasingly scarce resource, environmental concerns, financial constraints, institutional challenges, and customer scrutiny, water providers must carefully evaluate future supply and infrastructure strategies. Not only must different types of supply and facility options be assessed, but a variety of "non-structural" options such as conservation, re-use, and operational changes must also be considered. All of these alternatives must be evaluated against a range of criteria about which there is often disagreement among key stakeholders. A potentially large number of alternatives must be analyzed and compared quickly, and the results must be presented to and meaningful to a variety of audiences.

Confluence® was specifically developed to meet these diverse requirements. It is a unique water resource planning tool that:

- accurately simulates the real-world operations of a water system;
- flexibly adapts to the unique features of each system;
- runs quickly and efficiently to allow the evaluation and comparison of many strategy alternatives;
- is accessible and understandable to a wide audience;
- facilitates detailed analyses and diagnostics;
- evaluates and compares strategies against a variety of quantitative and qualitative criteria; and
- allows the user to select the level of detail appropriate to the question at hand.

Confluence captures the operating characteristics that are important to particular systems and gives users maximum flexibility in testing alternative operating regimes. At the same time, the model avoids getting buried in the operational details. Many water utilities have their own hydraulic, demand forecasting, environmental and/or financial models. While each of these is valuable in and of itself, none considers all the factors that comprise a successful supply or master plan, all may be cumbersome to use and difficult to

communicate, and they probably don't "talk to" one another very well. *Confluence* brings together all these dimensions, and can link directly with existing models. It is truly a tool for integrated planning.

The model is completely generalized and can be applied to water systems of any degree of complexity. Examples of key model features include:

- Intuitive user interface which permits the user to easily add to or modify water system components, edit data, choose simulation type, and tailor chart or tabular outputs.

- Unlimited number and variety of surface water and groundwater supply alternatives, storage facilities, transmission links, treatment plants, and demand nodes.

- Broad flexibility in specifying system operating rules and testing alternative operating approaches. System operation controlled by user-specified capacity, water rights, volumetric, hydraulic, turbidity, and other constraints.

- Choice of time step, varying from monthly to sub-daily.

- Inclusion of unlimited number of conservation options with costs and savings that change over time and space.

- Probabilistic specification of future growth patterns, which may be independently specified for each demand node.

- Simulation of system operation against historical daily hydrologic and weather conditions.

- Complete financial and cost accounting module.

- An unlimited variety of chart and tabular outputs describing system operations, reliability, costs, demands, etc.

Input and output is simple and intuitive. Output charts and tables are readily customized. Data is easily exported to spreadsheet or database programs.

Confluence uses state of the art development tools. The user interface is written in *Visual Basic®* and makes extensive use of pull down menus, tabbed dialog boxes, and *Visual Basic's* many data-aware features. All input data for any study, while edited through the interface, is stored in a *Microsoft Access®* database. As the model is upgraded, databases from older versions are automatically upgraded as well, providing maximum flexibility and convenience.

The computational engine is written in *Digital Visual Fortran 90*® and is extremely fast. It uses Monte-Carlo simulation techniques to represent uncertainty in growth, streamflow, and weather driven demand. Operation of supply and storage resources is simulated through a multi-area transmission- constrained dispatch algorithm.

The following pages discuss key model features in more detail. For more information on *Confluence*, please contact:

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Portland, OR 97202
Phone: 503-228-2992
Fax: 503-228-3696
Email: garyf@quantecllc.com

Constructing the Water Supply and Delivery System

The *Confluence* interface permits a water supply system schematic of any complexity to easily be created and/or modified. Supply sources of various types, storage reservoirs, treatment plants, transmission links, and demand nodes can be added, named, and located through simple "point, click, and drag" techniques. Double clicking on any system component will allow the user to view and edit the data underlying that component. The appearance (e.g. colors, font sizes, icons) of the schematic can also be easily modified.

Figure 1 is an example of a *Confluence* system schematic.

Defining System Components

The characteristics of each supply source, reservoir, treatment plant, and transmission link can be readily specified through the user interface.

Supply and Treatment Plant Characteristics

The model allows the user to define each supply or treatment plant at the start of the study period in terms of its delivery capacity, costs, operating characteristics, and qualitative values (water quality, environmental impacts, ease of implementation etc.). The user can then add incremental supply or treatment capacity during the study period. The user specifies all capacity, cost, financing, cash flow, and qualitative characteristics for each stage, as well as the year in which each stage becomes operational.

Constraints on the operation of any supply are set by the user and are intended to mimic real-world operating conditions. Examples of such constraints include annual production limits, daily rainfall-driven turbidity limits, discrete pumping capacities, and hydraulic relationships with the production of other supplies. The delivery of water produced by any supply source can also be constrained to a user-specified group of demand nodes.

The available supply for each river diversion is constrained by a historical record of monthly average or daily streamflows and by user-defined water rights, including, where applicable, instream rights.

Figure 2 shows a typical input form for a river diversion.

Reservoir Characteristics

Confluence allows the user to easily specify a wide variety of operating parameters for storage reservoirs, including delivery capacity, total (spillway) storage volume, dead storage volume, preferred minimum storage volume, and the downstream reservoir, if

any, which receives spills. Reservoirs can provide water to the transmission grid or can augment stream flows.

As is the case for supplies and treatment plants, the user can specify staged additions to the base reservoir.

Reservoir operation is completely generalized and is governed through a set of user-specified rule curves, which define multiple zonal boundaries, which vary monthly. User-specified shadow prices for each zone determines the rate at which the reservoir is drawn down (and, if applicable, refilled from other supply sources). This permits recognition of the value of maintaining water in storage over the course of a summer season and allows regulation of carryover storage from one year to the next.

The level of each reservoir at the end of any time step depends on natural inflows, refills from other supplies or reservoirs, rain-on-surface gains, and evaporative losses. Drawdowns can be constrained by downstream flow requirements.

The user can define reservoir groups for coordinated operation. The model will permit transfers among the reservoirs within any of these user-defined groups, subject to transmission availability and rule-curve economics.

Figure 3 is a typical reservoir input form.

Transmission Characteristics

For each node-to-node transmission link, the user specifies the on-line year and operating life, and the bi-directional capacities, losses, and pumping costs. Capital costs and financing parameters are also specified. The line capacities can vary due to a number of user-defined hydraulic constraints.

Demand Characteristics

Demand growth can be either deterministic or stochastic. In either case, growth rates can differ among demand nodes as well as seasonally. If desired, separate demand growth functions can be defined for each class of service within each node. In addition, the user can specify the daily variation of demand as a function of historical temperature and precipitation, thereby exposing any system capacity bottlenecks which limit the ability to serve demand on high-demand days.

The user can also define fixed demands to be added to designated nodes, as well as a set of blocked unserved demand shadow prices which are used in the simulation to regulate the manner in which unserved demand is allocated to nodes and, if desired, the manner in which stored volumes will be preserved for carryover storage.

Conservation Programs

The user can define an unlimited number and variety of water conservation programs. For each program, the user specifies the savings, cost, and participation characteristics, including parameters which define the manner in which savings are distributed over time and space and the manner in which costs are divided between the utility and the participating customer. Free-ridership and natural replacement concerns are also captured by the conservation module.

Figure 4 illustrates a typical conservation program input form.

The Simulation

Once all system components are defined, the simulation can be run. *Confluence* simulates the operation of the system for each time step in the study period. The simulation logic consists primarily of a network configuration module, a supply availability module, and a system dispatch module. The network configuration module determines the available transmission paths for all potential node-to-node transactions, and allows the user to control priorities for use when multiple paths between a set of nodes are available. The supply module determines the supply availability and price for each potential supply resource available to the system. The dispatch module uses the transmission network and supply information, along with demand data, in an attempt to meet demand in each demand node as inexpensively as possible, taking into account actual variable operating costs or user-assigned shadow prices of system components. The model permits the recognition of real-world institutional, policy, or environmental constraints, which may not allow for true cost minimization.

The user must specify the parameters that govern the simulation, including:

- The study start and end dates;
- The number of simulations;
- The manner in which the distributions of historical streamflow and weather will be sampled;
- If applicable, the manner in which the distribution of future demand growth paths will be sampled;
- The time-step resolution (monthly, daily, or sub-daily) for each month of the year;
- The months included in the “peak season”; and

- A variety of underlying financial data.

A portion of the simulation definition form is shown as Figure 5.

Model Outputs

After the simulation is run, the output results can be viewed. The current version of *Confluence* offers about 50 chart options for individual studies as well as a series of chart options that provide comparisons of user-selected study pairs. These charts can be modified or added to as dictated by the needs of the user. In addition, the data from any chart can be easily viewed, copied to the Windows clipboard, and pasted into any other application for additional analysis. The user can easily make changes in chart format, titling, units, etc.

These charts are designed to serve not only as valuable analytical tools, but also to be used to convey results to different types of audiences with differing levels of expertise. In particular, the chart results are very appropriate for presentations to policymakers and lay citizen and stakeholder groups.

In addition, *Confluence* has a dynamic charting capability which permits the viewing of the changes in a variety of demand, supply, transmission, and storage parameters in real time as the simulation is running. This capability facilitates diagnostics and enables a visual understanding on the part of audiences of the manner in which the system operates.

The model can also produce a myriad of complex diagnostic reports which allow the analyst to gain a deeper comprehension of the simulation results. These reports are particularly useful to achieve an understanding of the reasons for particular results, and to guide the assessment of alternative system additions or modifications.

Charts of Individual Study Results

Following are brief descriptions of sample charts of individual study results.

Reliability. *Confluence* produces several charts that permit a thorough understanding of the multiple dimensions of supply reliability. Parameters displayed include:

- Seasonal and monthly expected unserved demand by demand node.
- Expected seasonal shortage ratios for user-specified peaking events.
- Seasonal and daily unserved demand duration curves.
- Unserved demand exceedance curves and probabilities of user-designated shortages.

Economics

- Mean cost time series by category and by resource
- Utility and societal present value cost components
- Capital expenditures
- Costs of individual sources
- Costs incurred at each demand node

Demand. *Confluence* outputs allow the user to easily track the demand characteristics associated with any simulation. These outputs include:

- A series of charts showing expected nodal gross and net monthly demands, the variation of demands along the different sampled demand growth paths, and duration curves of daily demands by node.
- Charts of expected local supplies and duration curves illustrating the distribution of those supplies.

Supply. *Confluence* chart outputs display key supply parameters, including:

- Daily traces of overall production, storage levels, demands, and shortages for user-specified years and months.
- Expected monthly production of user-designated supplies.
- Duration curves for daily and annual production of user-designated supplies.
- Duration curves for daily instream flows.
- Charts of annual and monthly conservation savings by program and by node.

Reservoirs. Charts of the following reservoir parameters are available:

- Duration curves for daily and end-of-month reservoir storage content.
- Traces of end-of-month storage levels and monthly reservoir inflows and outflows.
- Use of storage below user-specified preferred minimum levels.

Treatment and Transmission

- Mean daily treatment plant production or transmission link flow.
- Duration curves for daily plant production or transmission flow.

Qualitative Factors. Various charts of the values over the planning period of user-specified qualitative indices.

Figures 6-10 show a few of the chart options available in *Confluence*.

Figure 1
Sample Confluence System Schematic

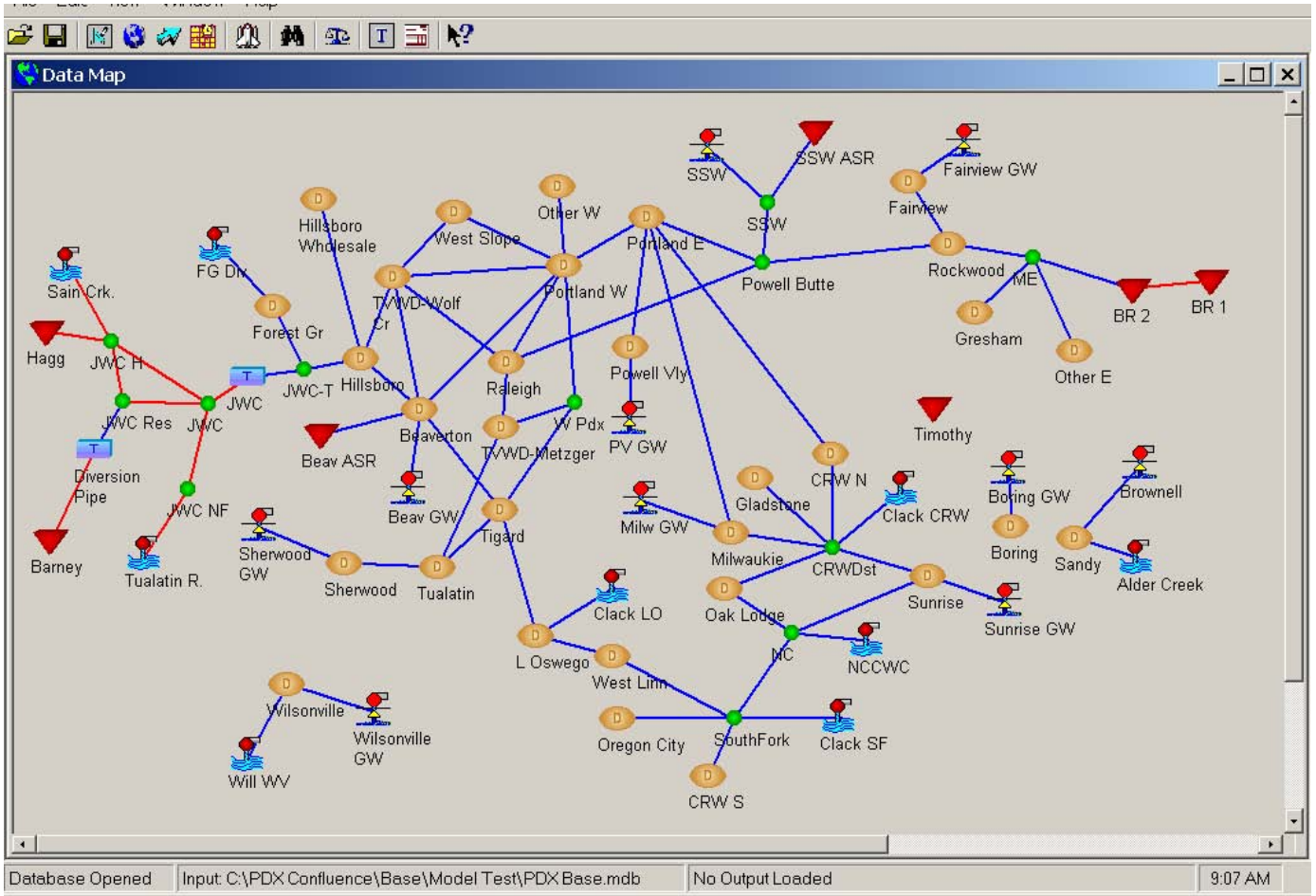


Figure 2
Sample River Diversion Input Form

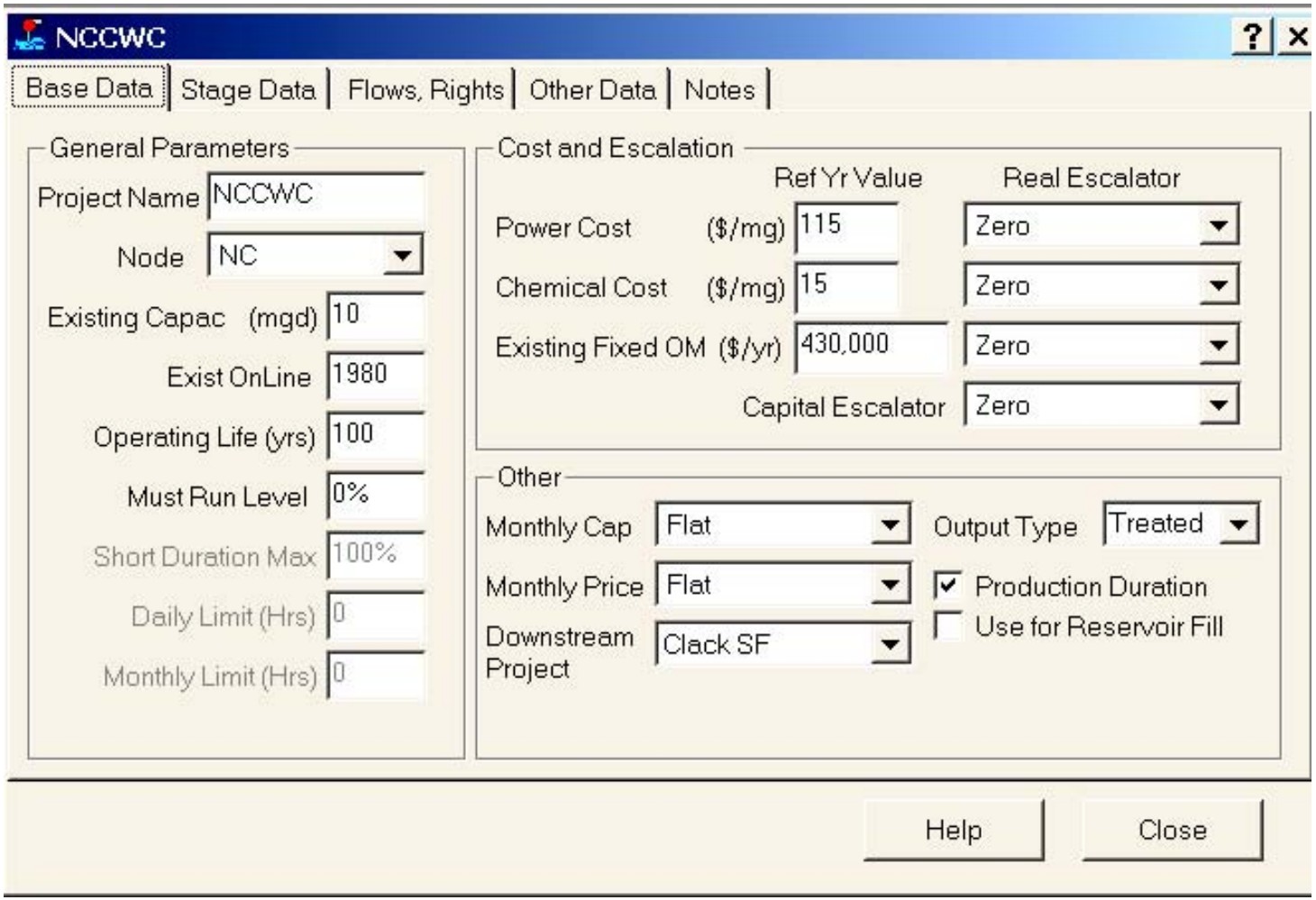


Figure 3
Sample Reservoir Input Form

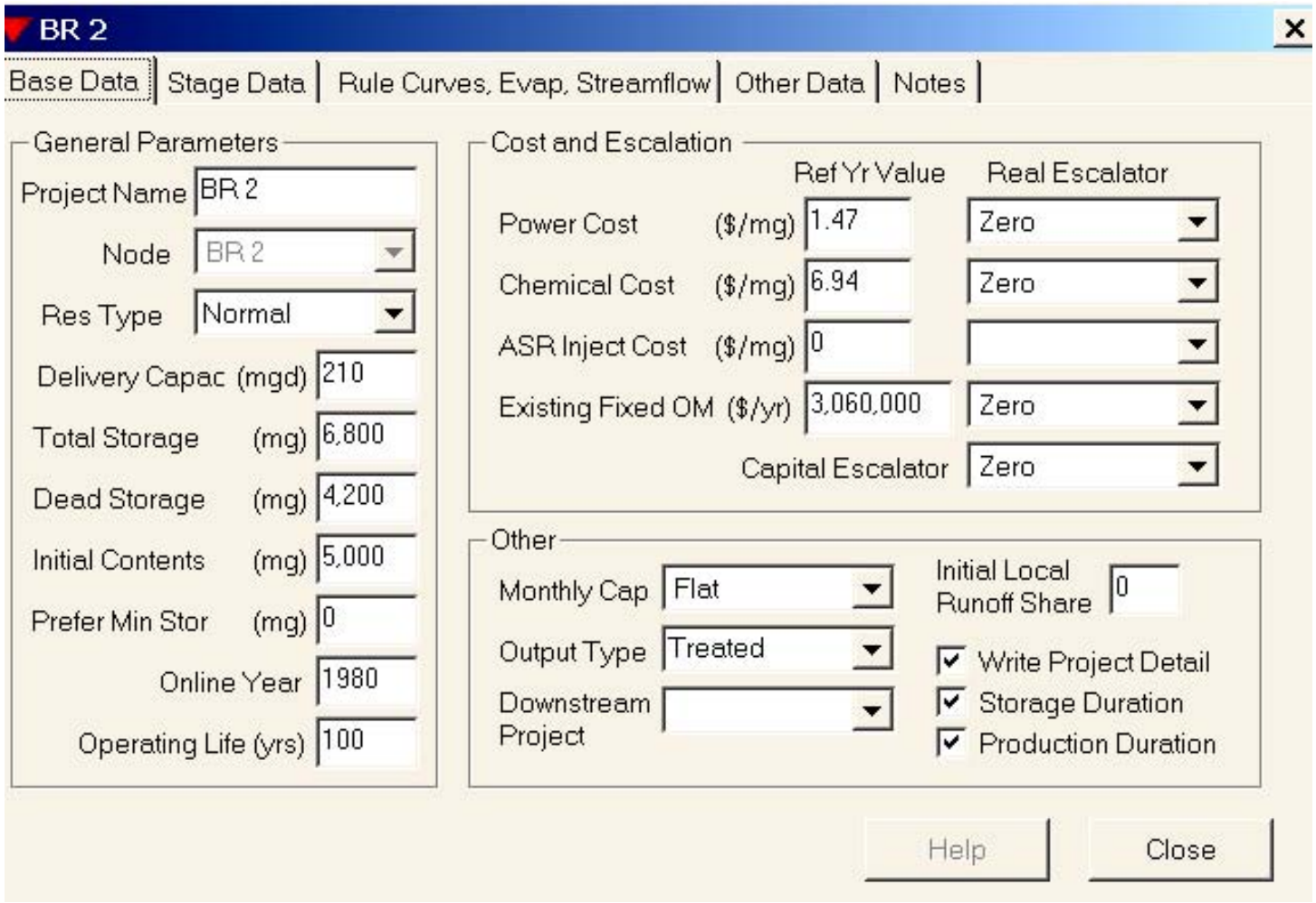


Figure 4
Sample Conservation Program Input Form

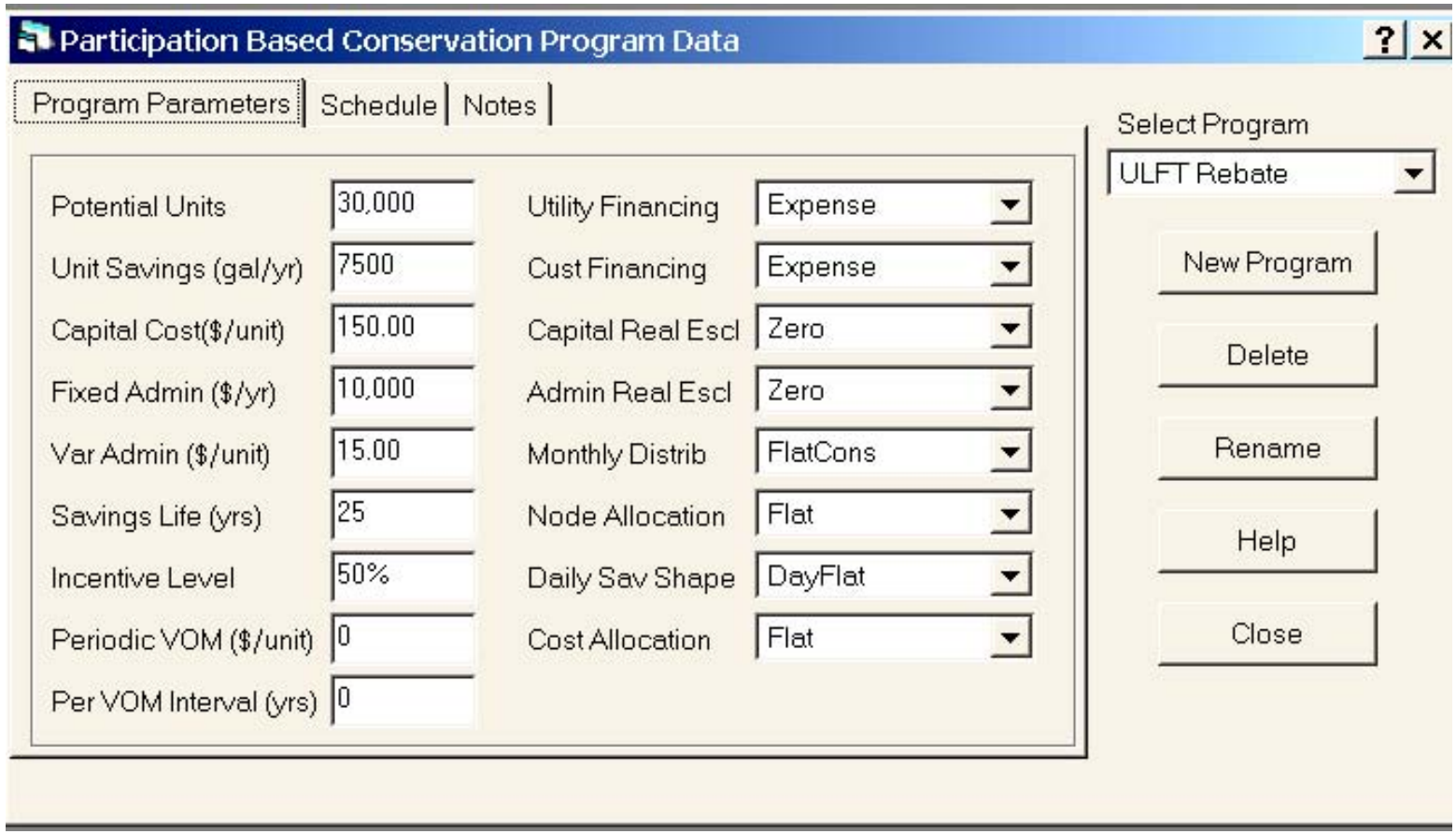


Figure 5
Study Definition Form (Partial)

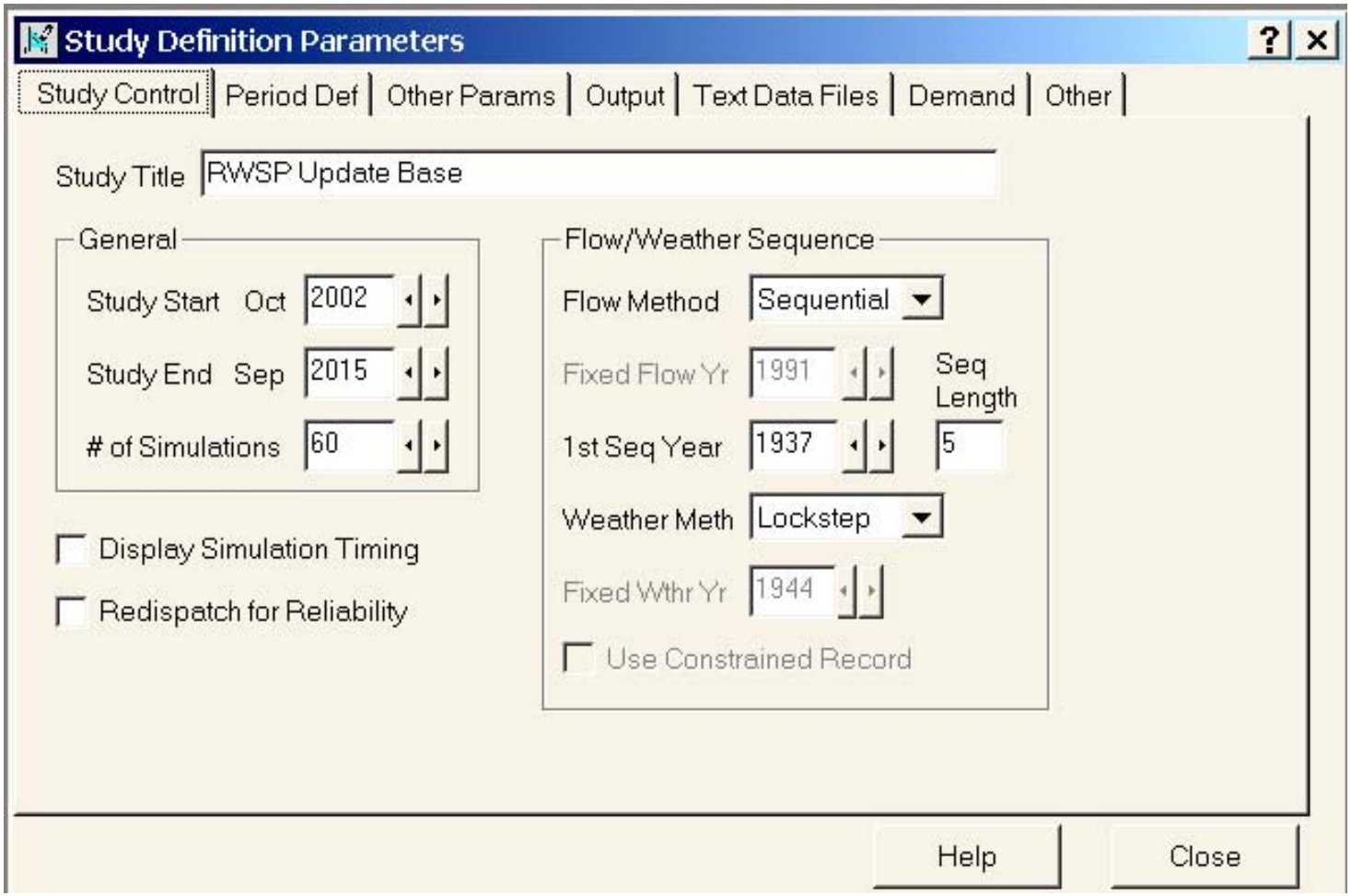


Figure 6
Sample Supply Reliability Chart

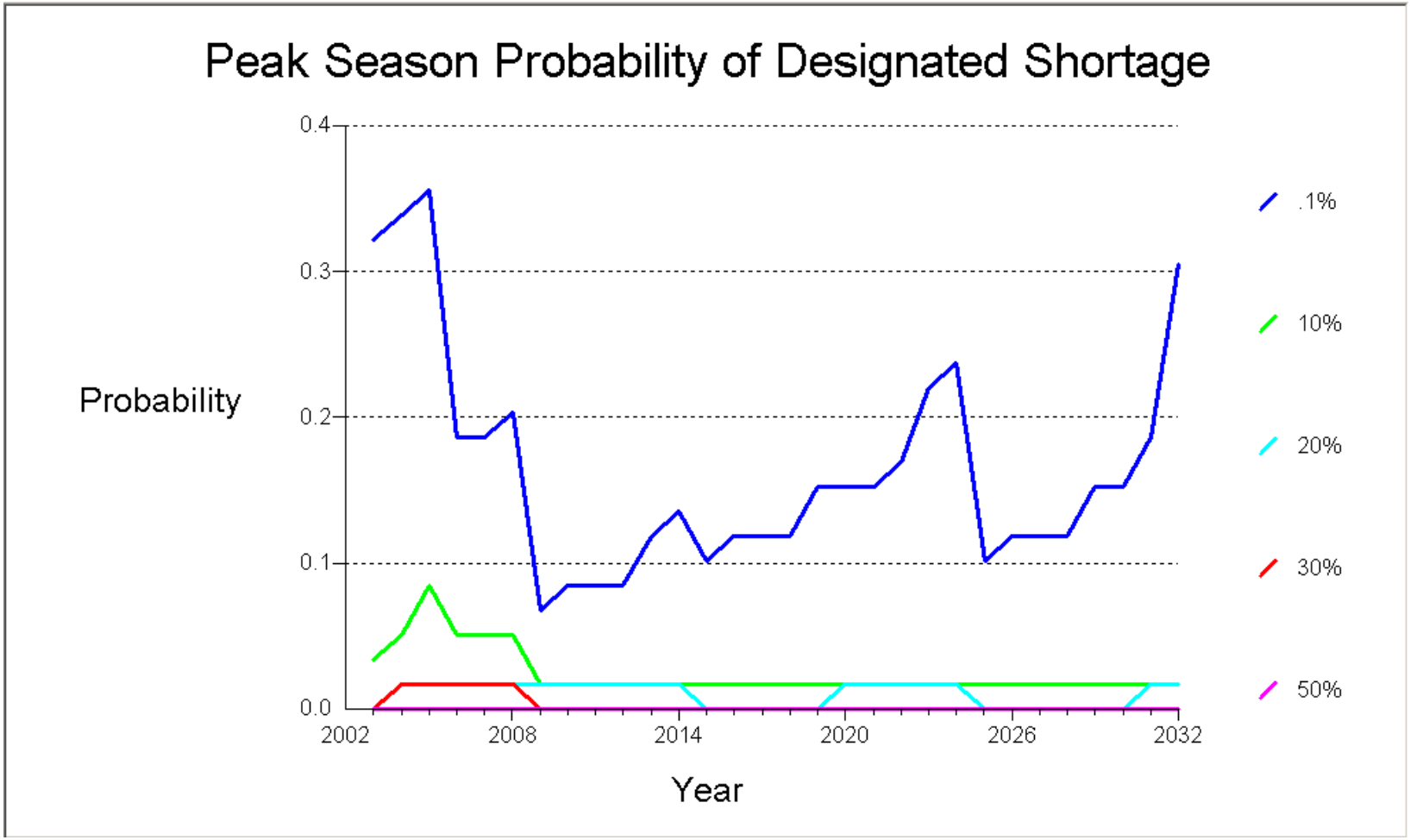


Figure 7
Sample Cost Chart

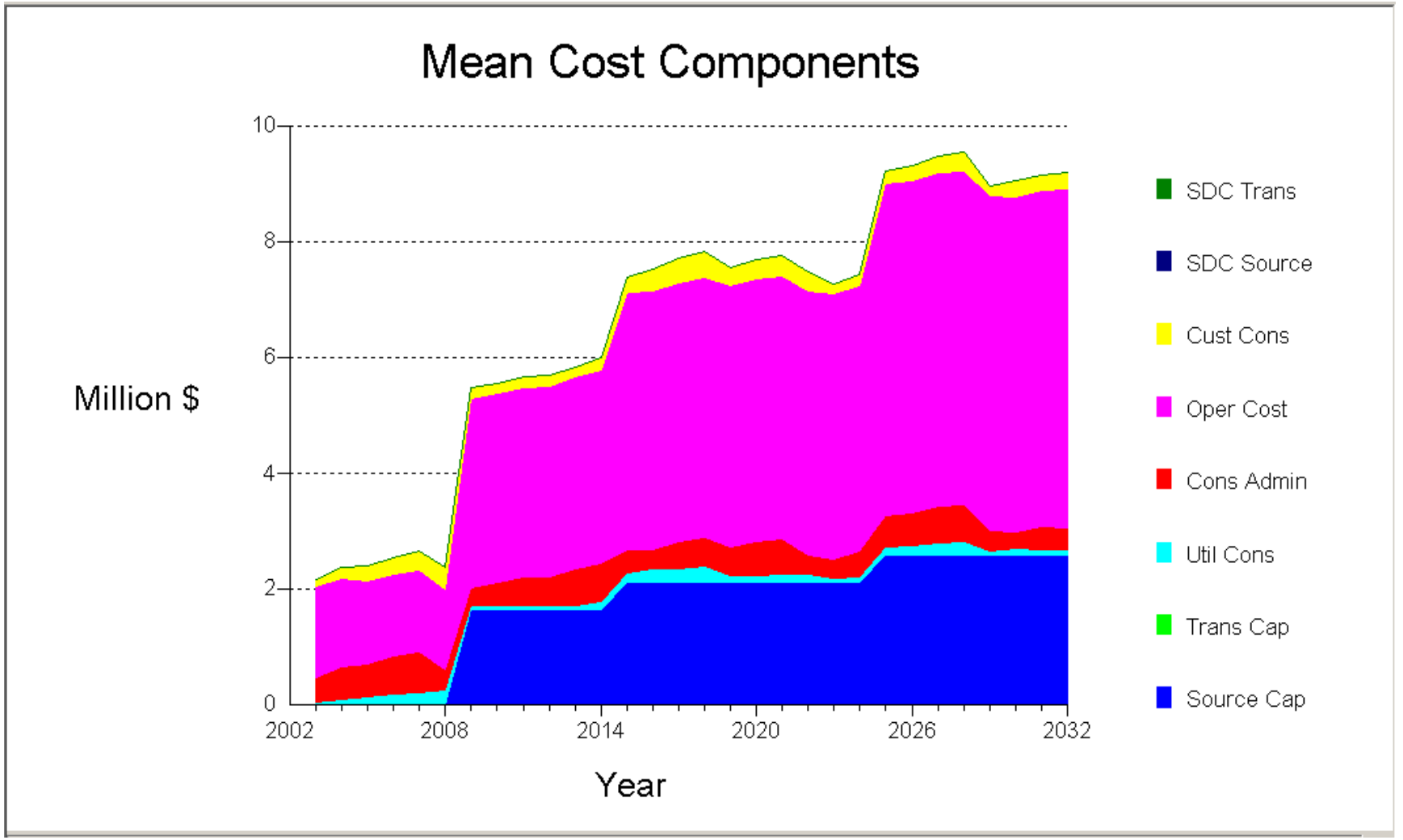


Figure 8
Sample Operations Summary Chart

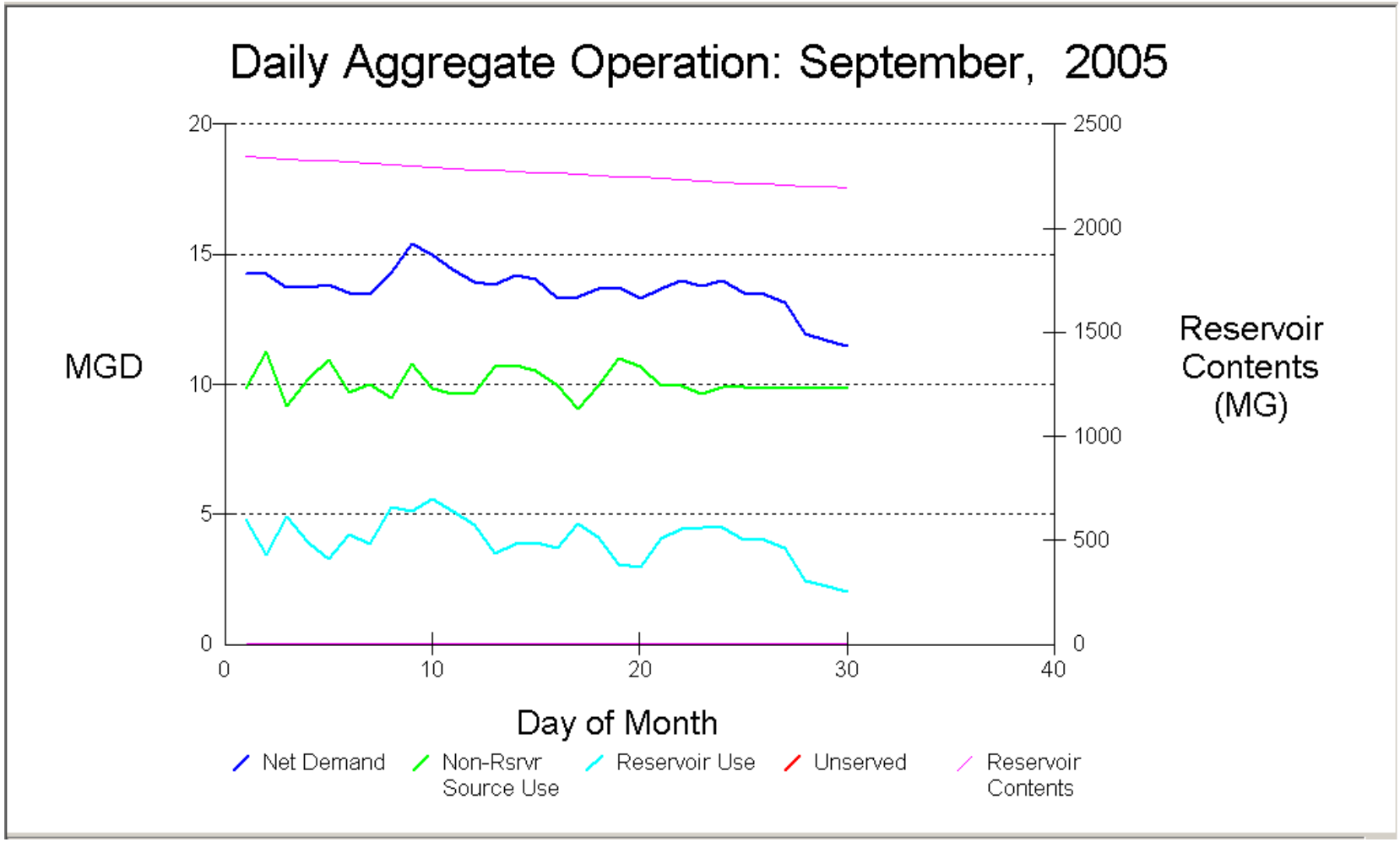


Figure 9
Sample chart of Reservoir End-of-Month Storage Levels

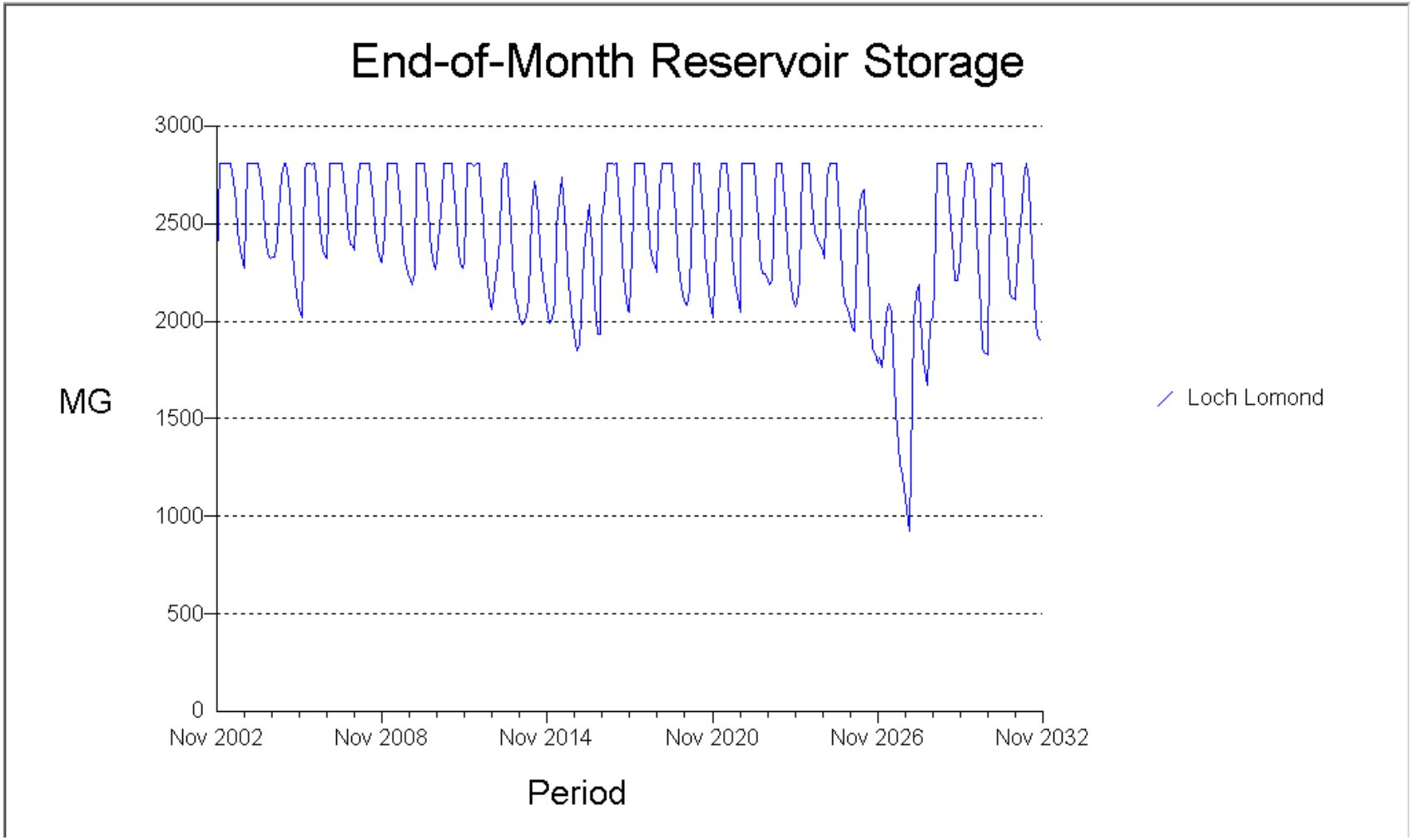
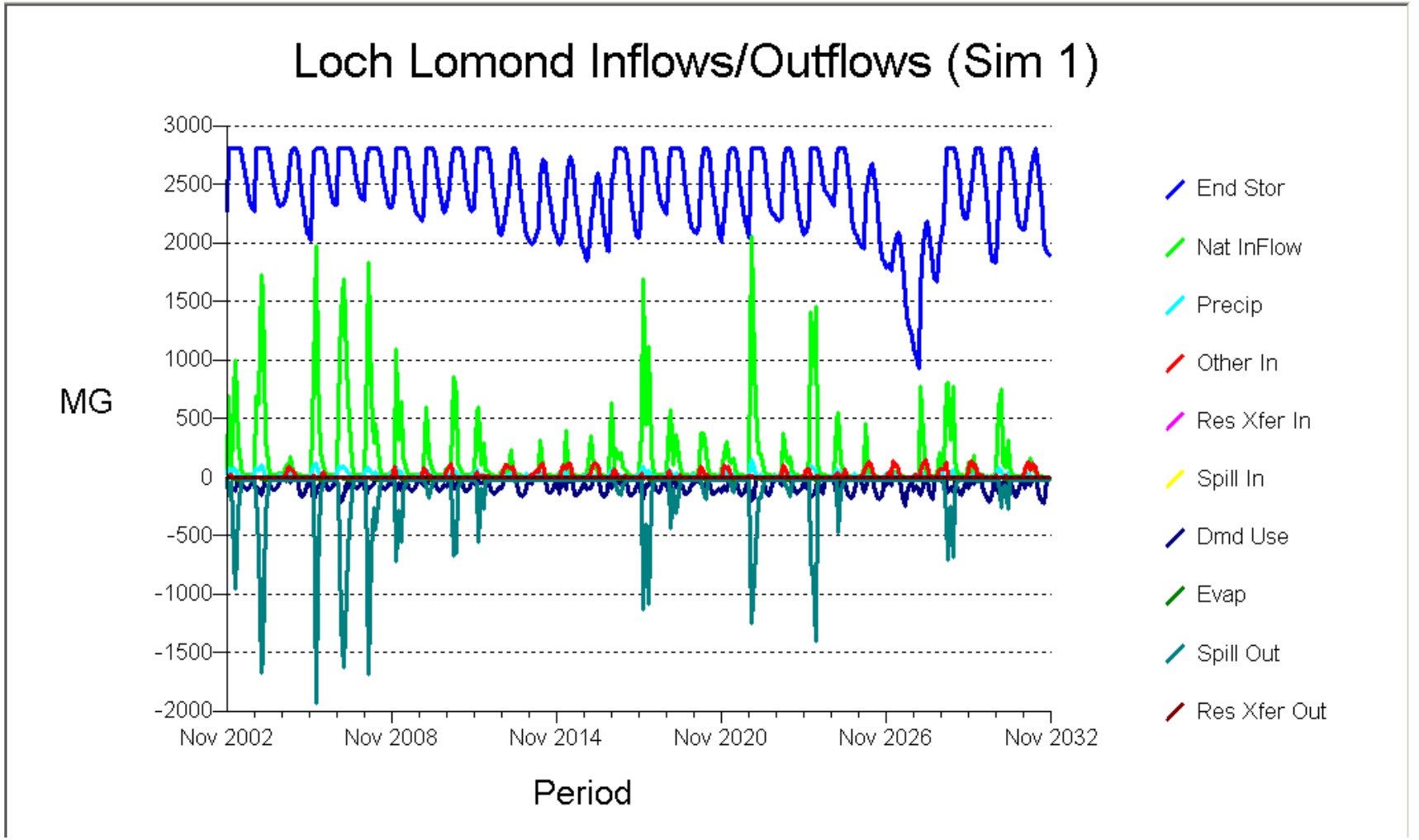
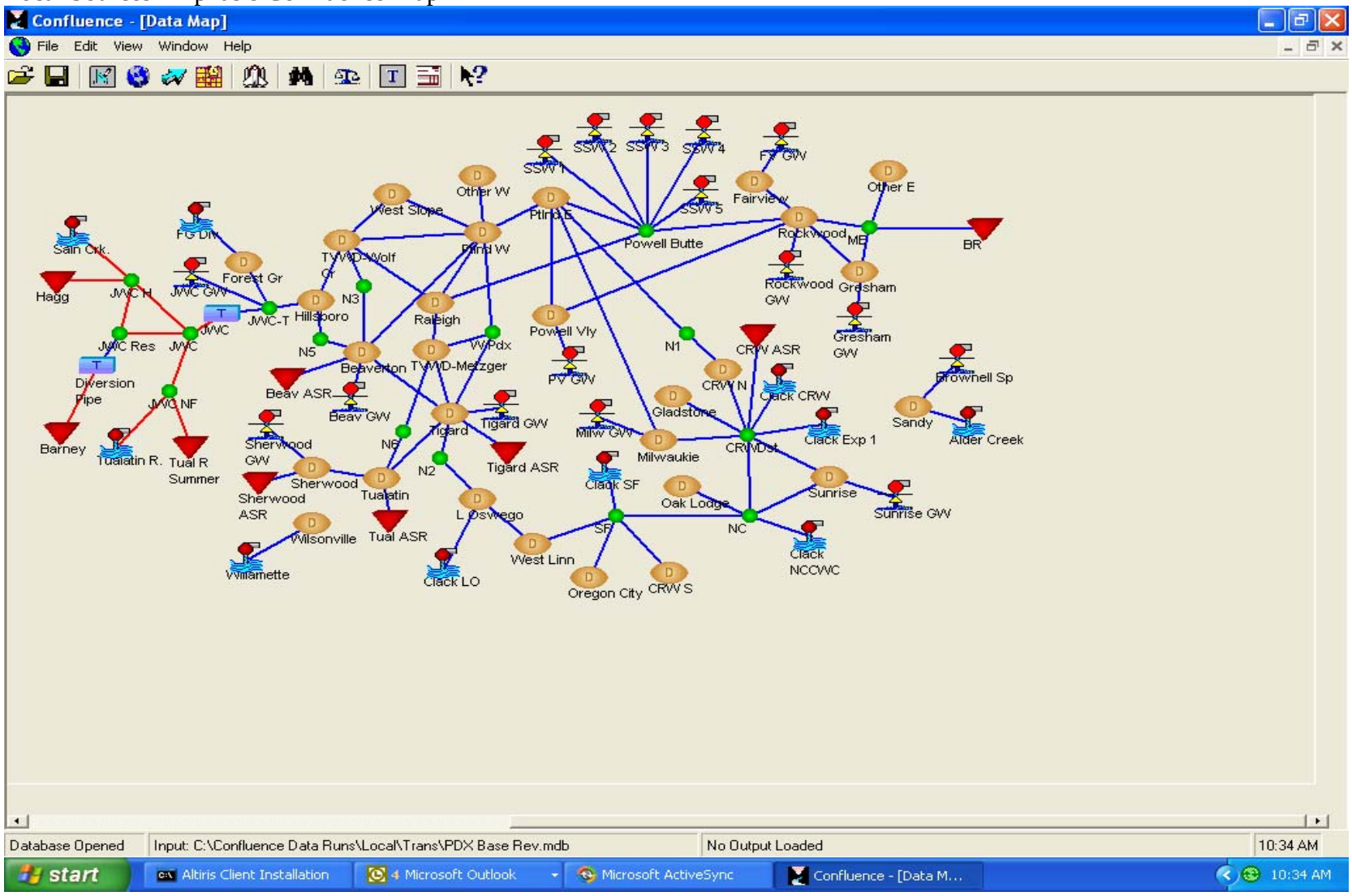


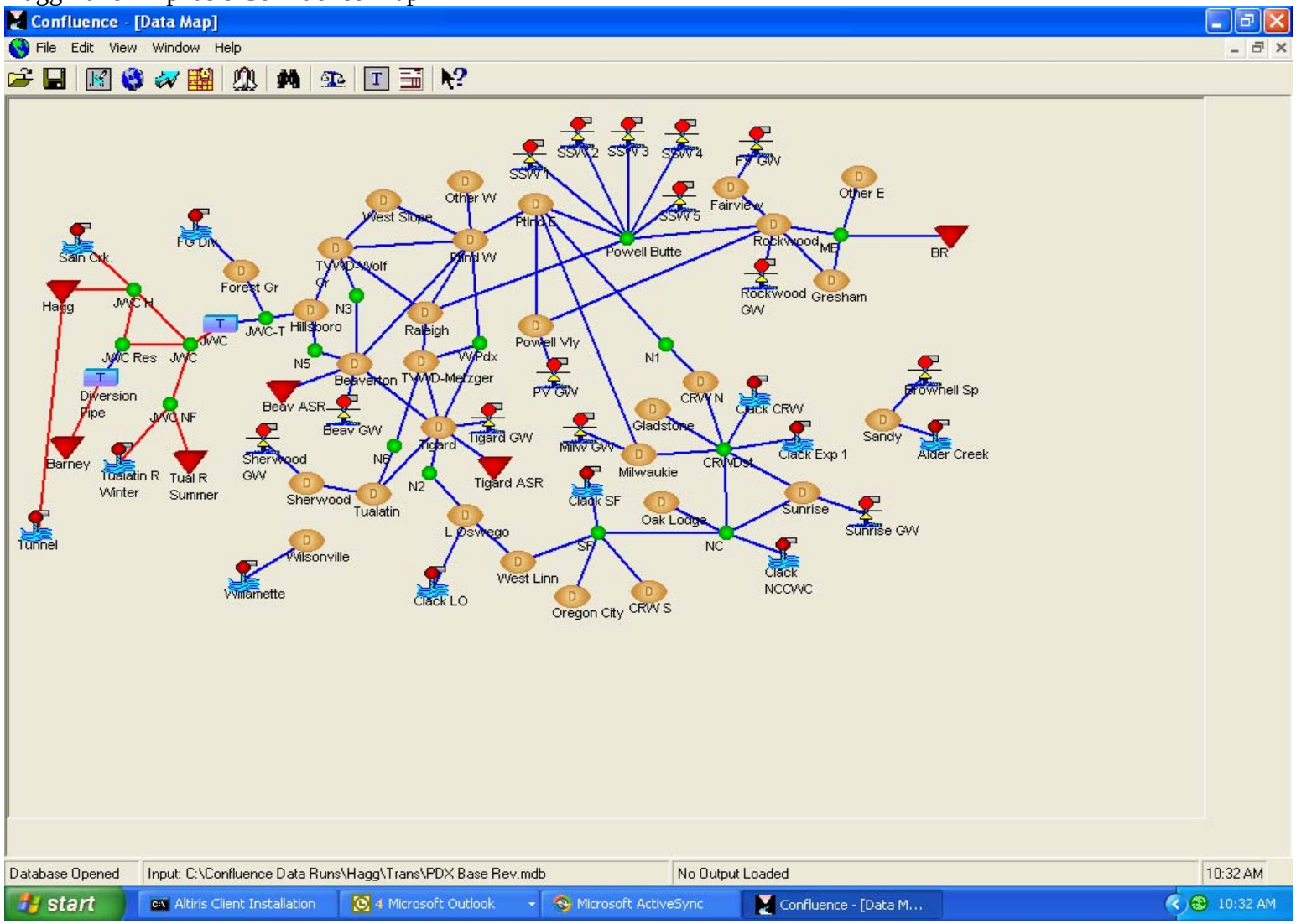
Figure 10
Sample Chart of Reservoir Inflows and Outflows



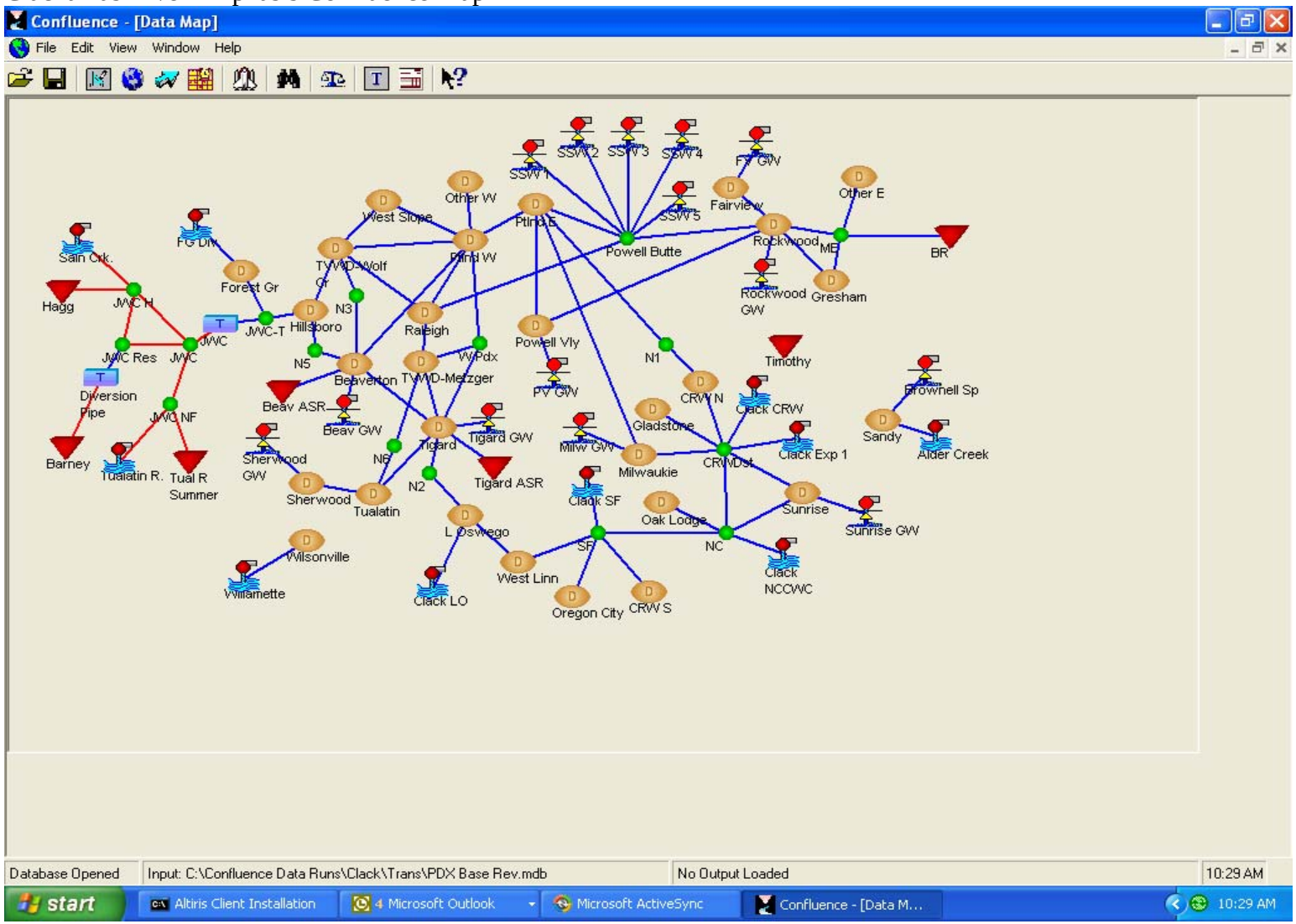
Local Sources Emphasis Confluence Map



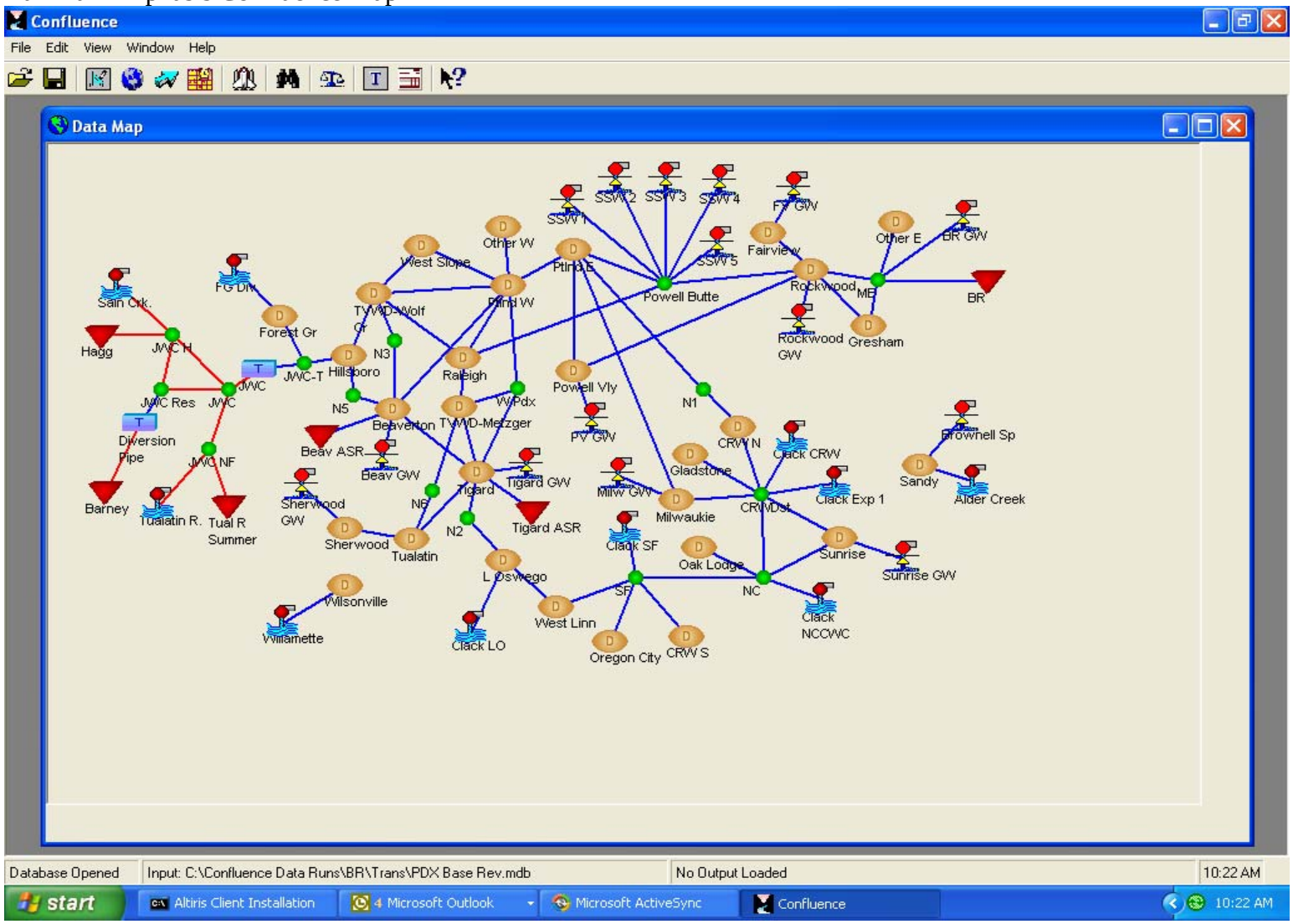
Hagg Lake Emphasis Confluence Map



Clackamas River Emphasis Confluence Map



Bull Run Emphasis Confluence Map



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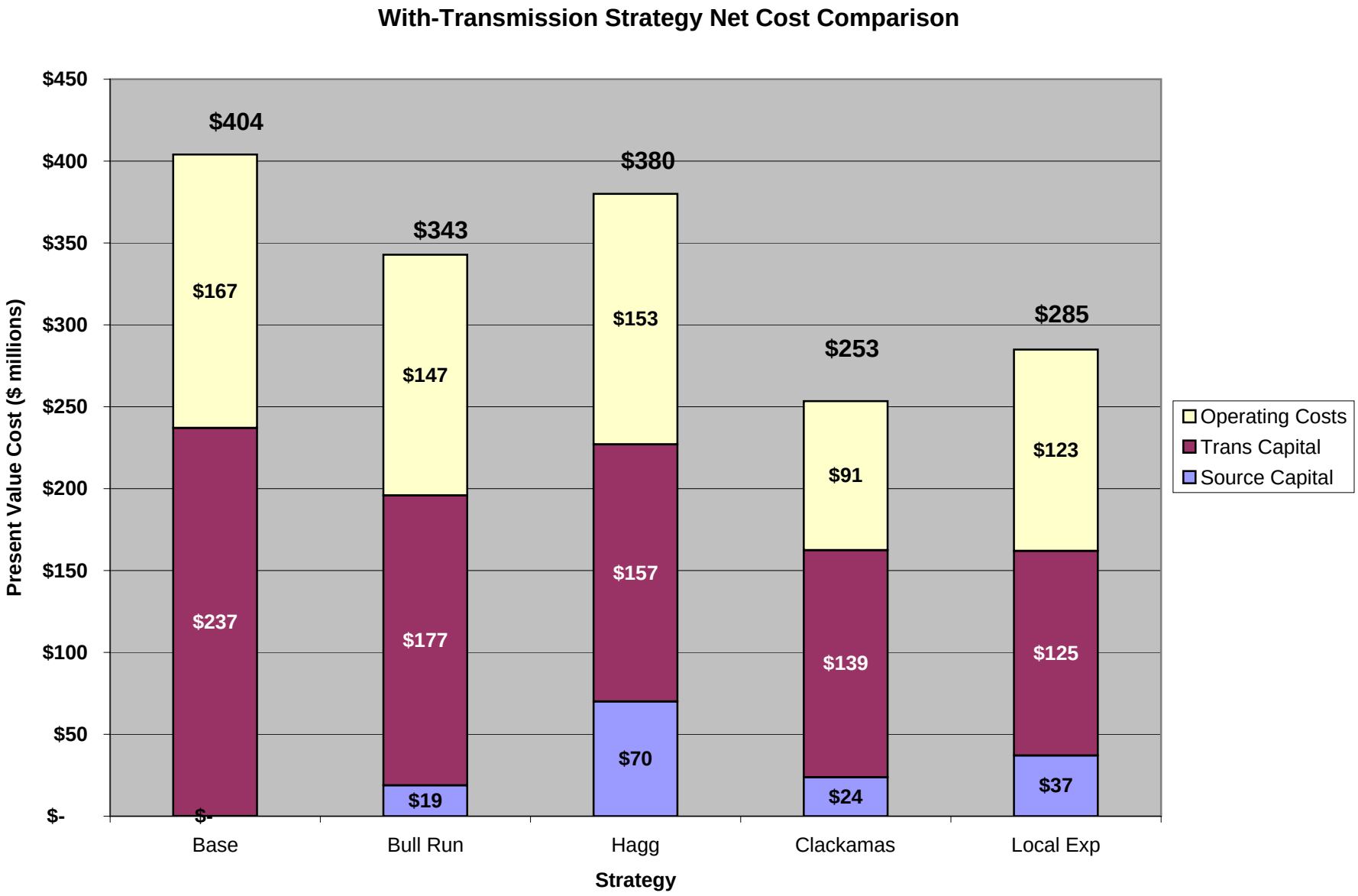
With-Transmission Strategy Net Cost Comparison
Present Value Cost ($ millions)
$450
$400
$350
$300
$250
$200
$150
$100
$50
$-
$404
$167
$237
$-
$343
$147
$177
$19
$380
$153
$157
$70
$253
$91
$139
$24
$285
$123
$125
$37
Base
Bull Run
Hagg
Clackamas
Local Exp
Strategy
Operating Costs
Trans Capital
Source Capital