Rathdrum Prairie Aquifer

Comprehensive Aquifer Management Plan

Vision: Provide a sustainable source of high-quality groundwater for current and future economic, social, and environmental benefits, and preserve the exceptional quality and reliability of the Rathdrum Prairie Aquifer.

Idaho Water Resource Board

July 2011

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1. Executive Summary

The Rathdrum Prairie Aquifer (RPA) in Northern Idaho is a valuable and significant resource to the region and the state of Idaho. Lying under parts of Kootenai and Bonner counties, the aquifer is a key part of the regional water resources which make the area a magnet for economic growth and an attractive place to live and work. The region produces approximately 8 percent of goods and services in the state of Idaho resulting in an estimated value of $4 billion. Beyond the economic value to the state, the region provides cultural and social benefits throughout the bi-state Spokane Valley-Rathdrum Prairie in Washington and Idaho.

This document presents a Comprehensive Aquifer Management Plan (Plan) for the RPA. The Plan provides a framework for long-range management of the aquifer. The Plan describes the overarching goals and recommended actions which can be implemented to successfully accomplish the stated goals for local residents, the state of Idaho, and to promote productive regional cooperation to benefit the area over the next 50 years.

At the direction of the Idaho Water Resource Board (IWRB) and Idaho Legislature, the Plan was developed collaboratively by the Rathdrum Prairie CAMP Advisory Committee. The Committee submitted a recommended Plan to the Board for their consideration and adoption. Once adopted by the Board, the Plan will be submitted to the Idaho Legislature for final action.

The IWRB developed the following goals for the statewide Comprehensive Aquifer Management Planning effort (CAMP):

- Provide reliable sources of water, projecting 50 years into the future
- Develop strategies to avoid conflicts over water resources
- Prioritize future state investments in water
- Bridge the gaps between future water needs and supply

Based on the four goals, the Advisory Committee developed the following vision for the Plan:

"Provide a sustainable source of high-quality groundwater for current and future economic, social, and environmental benefits, and preserve the exceptional quality and reliability of the Rathdrum Prairie Aquifer."

The Advisory Committee developed the action items in Figure 1 to accomplish their vision.

Meet Future Demand for Water

Projecting future water demand is an integral part of the Rathdrum Prairie CAMP process. The sufficiency of existing water resources cannot be determined without understanding the potential magnitude of future water demand.

The Rathdrum Prairie Aquifer Water Demand Projections study provides projections of Rathdrum Prairie water demand over the next 50 years. The water demand study was conducted for (and funded by) the IWRB as part of the Rathdrum Prairie CAMP process. The study was conducted by SPF Water Engineering, LLC., AMEC Earth and Environmental, Idaho Economics, and Taunton Consulting, with guidance from the IWRB, Idaho Department of Water Resources (IDWR), and the Advisory Committee. The following conclusions were drawn from that study.

Annual water demand by the year 2060 could rise from estimated current withdrawals of approximately 74,000 acre-feet to between 77,000 acre-feet (based on a low population growth rate of 1.6% per year and aggressive water conservation) and 223,000 acre-feet (based on a higher population growth rate

SUMMARY OF KEY ACTION ITEMS

(not ranked or placed in order of priority)

Objective #1: Meet Future Demand for Water

Enact water conservation measures that promote water efficiency and reduced use.

Establish municipal water rights to ensure that they are available for future needs.

Identify local water use improvement strategies and develop partnerships to implement them.

Carefully consider hydrologic and social impacts of exportation of water from the basin.

Update the Rathdrum Prairie Aquifer Water Demand Projections study.

Objective #2: Prevent and Resolve Water Conflicts

Develop a framework for regional discussion and cooperation for SVRPA water issues.

IDWR should develop criteria for artificial recharge projects in Idaho.

Encourage mechanisms that resolve local issues before they become conflicts.

Redefine the IDWR Ground Water Management Area boundaries so they are consistent with the bi-state US Geological Survey hydrologic boundaries.

Objective #3: Protect the Aquifer

Assess all CAMP activities to ensure projects implemented through CAMP protect aquifer water quality.

Support and encourage the Aquifer Protection District to work with Panhandle Health District, Idaho Department of Environmental Quality, and others to address overlapping jurisdictions with the goal of improving efficiency.

Figure 1. Summary of Key Action Items

of approximately 3% per year and no water conservation). The area over the RPA has experienced both of these population growth rates over multi-year periods in past decades.

The most likely 2060 water demand projection ranges from approximately 101,000 to 163,000 acre-feet, depending on the level of water conservation. This projection is based on a moderate level of population growth (averaging approximately 2.3% per year) over the next 50 years.

The RPA is a highly prolific aquifer that fully satisfies the existing water needs, and it is anticipated to meet future needs. However, to ensure that the water resources are put to optimum use to benefit the state of Idaho, this plan identifies actions that will protect the resource for future generations.

Prevent and Resolve Water Conflicts

The Plan addresses the long-term planning and management objectives and actions for the RPA located in Idaho. The RPA is a part of the larger regional aquifer which is shared with the state of Washington. Additionally, the regional hydrological system is a dynamic interrelationship between the aquifer and the Spokane and Little Spokane Rivers in Washington. Although state authorities and planning programs do not cross the state and tribal boundaries, the larger regional interests and needs should be considered. The benefits of cooperation and coordination among the sovereigns in the region far outweigh the potential costs of conflict.

Protect the Aquifer

The RPA is a part of the larger Spokane Valley-Rathdrum Prairie Aquifer (SVRPA). The SVRPA is the sole source of drinking water for the residents living over the aquifer, and many who do not live over the aquifer also receive benefits. The aquifer is vulnerable to water quality degradation which could influence the availability for local communities and residents. The protection of the aquifer from contamination is undertaken through a number of programs and authorities of local, regional and state entities.

The implementation of the Plan and all actions associated with the Plan will be assessed to ensure that water quality is maintained and aquifer protection efforts are coordinated with other responsible agencies and programs.

Plan Implementation

To ensure that the valuable input of stakeholders continues during the implementation of these actions, this Plan should be implemented by IWRB with guidance and advice from the Advisory Committee. The Committee will assist IWRB by providing recommendations and feedback.

Summary

Although the Plan is built upon a substantial base of technical information and stakeholder guidance, it is recognized that present-day solutions may be refined and improved as new information, regional activities, and technologies are developed. Accordingly, the Plan includes an adaptive management component which requires ongoing coordination between the IWRB and Advisory Committee. The Plan provides for continued effort to identify and address all water use needs affected by this Plan, including environmental considerations.

The Plan also recognizes that successful implementation requires sufficient funding. The Committee expects that the preliminary funding recommendations and structure may be refined or modified as further information is developed about funding needs.

2. Glossary

Abbreviations and Terms

acre-foot	A volume of water equivalent to one acre covered in water one foot deep. One acre-foot (af) equals 325,851 gallons
afa	Acre-foot per annum. Rate of water flow equivalent to 1 acre-foot of water flowing in a 1 year period.
aquifer	A water-bearing layer of rock that will yield water in a usable quantity to a well or spring
CAMP	Comprehensive Aquifer Management Plan
cfs	Cubic feet per second. A rate of flow equal to one cubic foot of water passing a point each second. One cfs equals approximately 7.48 gallons per second, or 449 gallons per minute.
consumptive use	Consumptive use is water that is actually consumed and not returned to the immediate water environment. It is the portion of water that evaporates, is used in products or crops, or consumed by humans or livestock.
GWMA	Ground Water Management Area
Plan	Rathdrum Prairie Comprehensive Aquifer Management Plan
RPA	Rathdrum Prairie Aquifer, Idaho
sensitive resource aquifer	A sensitive resource aquifer is considered to have good water quality, is highly vulnerable to contamination and an irreplaceable source. Activities that could degrade the aquifer shall be managed in a manner which maintains or improves existing water quality through the use of best management practices and best available methods. The Rathdrum Prairie Aquifer is Idaho's only sensitive resource aquifer. Sensitive resource aquifers require the strongest level of protection.
SVRPA	Spokane Valley-Rathdrum Prairie Aquifer, Idaho and Washington

Key Agencies

APD	Rathdrum Prairie Aquifer Protection District (jurisdiction by Kootenai County); see Chapter 5 of Title 39 Idaho Code.
IDEQ	Idaho Department of Environmental Quality
WDOE	Washington Department of Ecology
EPA	Environmental Protection Agency
IDWR	Idaho Department of Water Resources (also abbreviated as "Department")
PHD	Panhandle Health District
IWRB	Idaho Water Resource Board (also abbreviated as "Board")
USGS	United States Geological Survey

Conversion table for units of water

1 acre-foot	43,560 cubic feet	325,851 gallons
1 cubic foot per second	7.48 gallons per second	448.8 gallons per minute
1 cfs for 1 year	235,889,280 gallons per year	728 acre-feet per year
1 million gallons	133,689 cubic feet	3.07 acre-feet
1 million gallons per day	3.07 acre-feet per day	1,120 acre-feet per year
1,000 gallons per minute	2.2 cfs	4.4 acre-feet per day

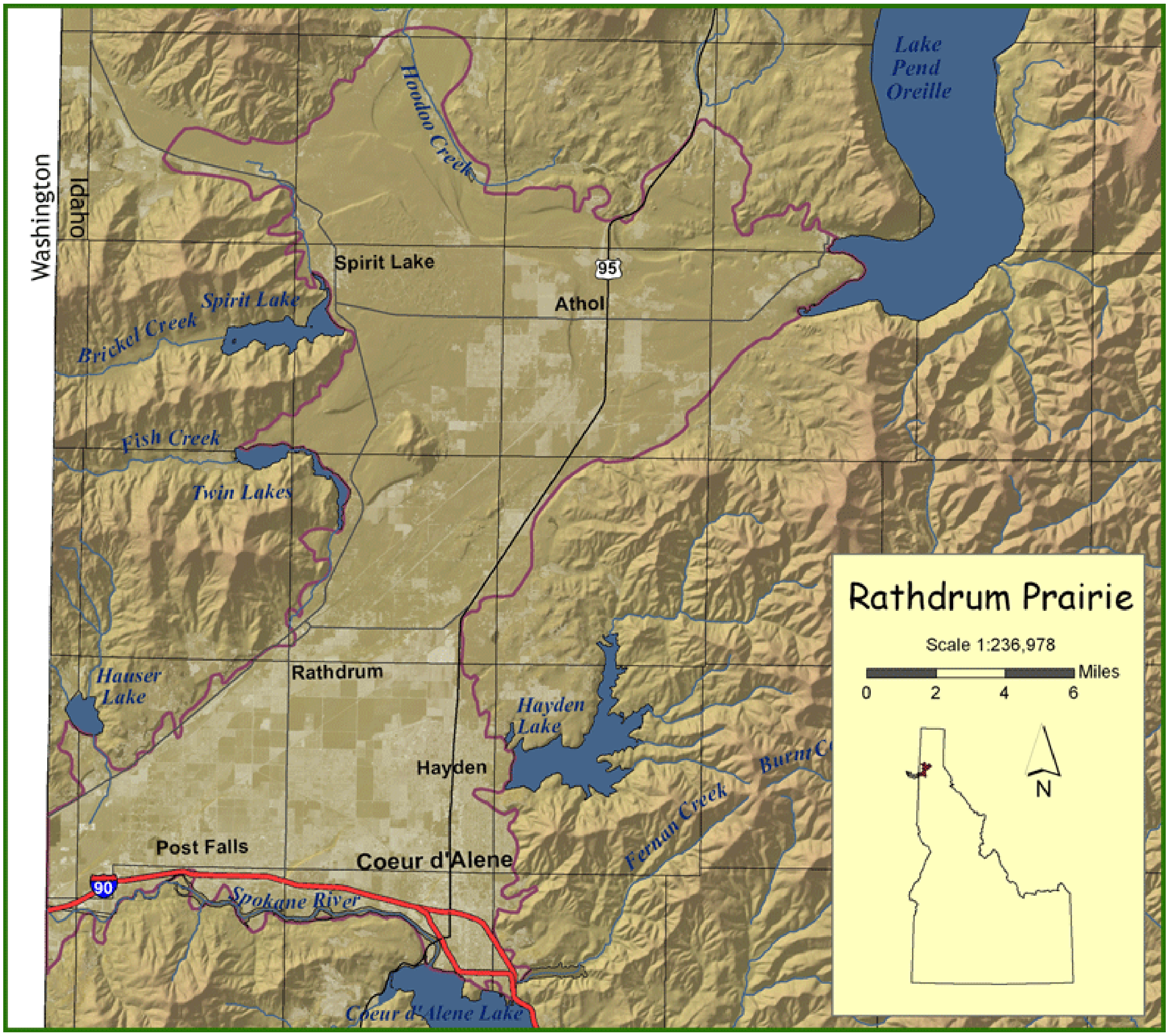

Figure 2. Rathdrum Prairie Aquifer Map

3. Introduction

In 2008, the Idaho Legislature passed House Bills 428 and 644, establishing the statewide comprehensive aquifer planning and management effort and creating a fund to support the effort. The Idaho Water Resource Board (IWRB) and the Idaho Department of Water Resources (IDWR) initiated work in the Rathdrum Prairie to establish a framework and path forward which will lead to sustainable water supplies, optimum use of the aquifer and develop strategies to avoid future conflicts.

This effort was conducted under the leadership of the IWRB. The IWRB is the constitutionally established agency responsible for formulating and implementing the State Water Plan for optimum development of the water resources in the public interest. This document is a component of the State Water Plan, which guides the development, use, conservation and management of water resources in Idaho.

The specific goals of the statewide Comprehensive Aquifer Management Planning effort (CAMP) are to:

- Provide reliable sources of water, projecting 50 years into the future
- Develop strategies to avoid conflicts over water resources
- Prioritize future state investments in water
- Bridge the gaps between future water needs and supply

The IWRB recognizes that the long-term management of the water resources of the Rathdrum Prairie must be acceptable to the local community and take into account the social and economic interests of the residents and public interest. The long-range plan must also be consistent with the legal constraints and laws of Idaho. The Idaho Water Resource Board appointed an Advisory Committee to consider these interests and develop recommendations for a Ratherum Prairie Comprehensive Aquifer Management Plan (Plan). For a list of Advisory Committee members, see Appendix 1.

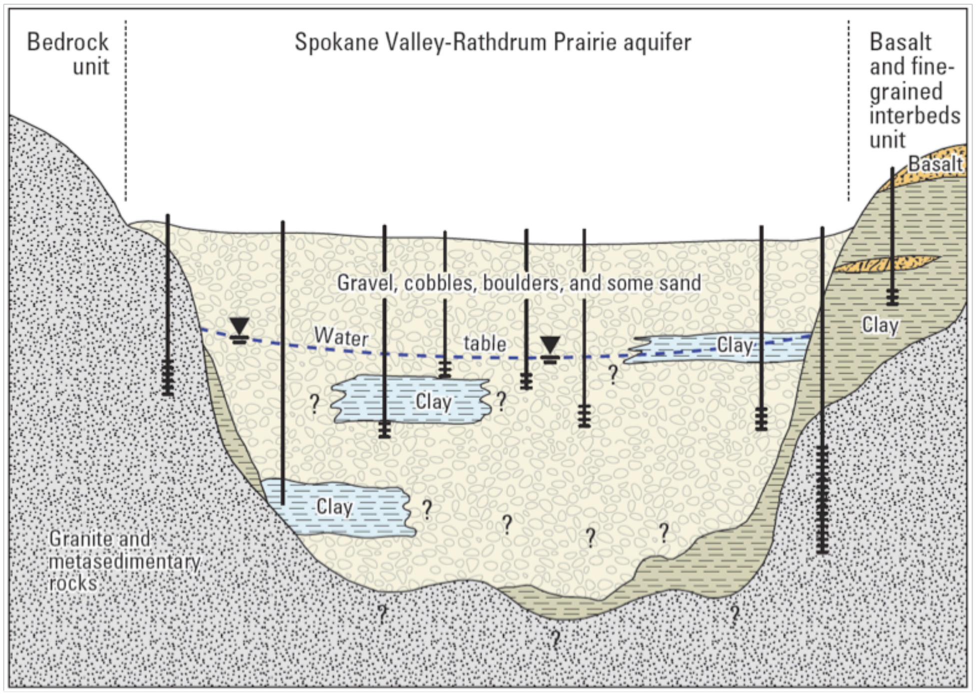

Figure 3. Simplified conceptual model of hydrologic conditions in the Spokane Valley-Rathdrum Prairie aquifer and surrounding hydrogeologic units.

Source: Hydrogeologic Framework and Groundwater Budget of the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho. Scientific Investigations Report 2007-5041.

4. Background

Regional Setting and Hydrological System

The RPA (RPA) is the Idaho portion of the regional Spokane Valley-Rathdrum Prairie Aquifer (SVRPA) in Northern Idaho and Eastern Washington (Figure 1). The RPA underlies approximately 250 square miles in Kootenai and Bonner Counties. Approximately two-thirds of the entire aquifer lies under Idaho. A population of over 500,000 live above the SVRPA, with the Idaho population accounting for approximately 128,000 or about 25%. Approximately 8% of Idaho's economy is generated within the Rathdrum Prairie area.

The RPA consists primarily of thick layers of coarse-grained sediments deposited during a series of massive floods from ancient Glacial Lake Missoula. These floods deposited sands, gravels, cobbles, and boulders across the landscape. The nature of the RPA has created one of the most productive and transmissive aquifers in the world. See Figure 3 for a simplified conceptual model of hydrologic conditions found throughout the SVRPA.

Studies

This plan references several studies and reports on the RPA, and various planning processes which precede the work conducted for this Plan. See Appendix 2 for a Chronology of Studies and Events relevant to the RPA.

RPA – By the Numbers

The Spokane Valley-Rathdrum Prairie Hydrologic Project completed in 2007 developed a region-wide water budget for the hydrologic system. The average annual inflow to the aquifer is approximately 1,470 cubic feet per second (cfs), of which approximately 900 cfs flows from Idaho, based on the 10-year average (1995-2005).

In recent years, approximately 99 cfs of water was annually withdrawn from the RPA. Community water systems used 47 cfs (47.7%); agricultural irrigation accounted for 34 cfs (34.3%); individual domestic wells used 12 cfs (12.2%); and commercial/industrial (self-supplied) totaled 6 cfs (5.8%). The estimated aggregate consumptive use (water lost from the local hydrologic system) was approximately 53 cfs.

Groundwater/Surface Water Interaction

There is a strong relationship between the Spokane River and the SVRPA. From the outlet of Coeur d'Alene Lake to its confluence with the Little Spokane River, the Spokane River alternatively transitions between reaches that lose to the SVRPA and reaches that gain from the SVRPA. The Spokane River is perched above the aquifer through its entire reach in Idaho from the outlet of Coeur d'Alene Lake to beyond the border between Idaho and Washington. In Idaho, there is no direct connection between groundwater pumping in Idaho and the Spokane River flows due to the perched condition of the river over the aquifer. In Washington, however, there is a direct connection with several gaining and losing reaches of the river that result in water seeping from the river into the aquifer (losing reaches) or water discharging from the SVRPA into the river.

Water Quality

The overall quality of the RPA is very good. The highly permeable soils and gravels over the RPA make it susceptible to contamination. In 1978, the RPA was designated by the Environmental Protection Agency (EPA) as a Sole Source Aquifer under the Safe Drinking Water Act. This designation subjects all federally funded projects that have the potential to contaminate the aquifer to EPA review. In 1997, the RPA received additional protection from the state of Idaho and is now designated a Sensitive Resource Aquifer.

Due to the vulnerability of the aquifer to contamination, ongoing protection programs have been implemented by local and state agencies. These programs have resulted in protecting or improving the groundwater quality despite a significant increase in population over the RPA.

Future Demand for Water

Critical to the development of the RP CAMP is estimation of future water demands. Water demand overlying the RPA was projected for a 50-year time horizon (2060). This study included consideration of the potential impacts of climate variability during this time frame on water supply and demand in the area. A qualitative estimate of conservation and water demand was also included in the study. A basic assumption in the calculation is that the service area remains centered over the aquifer without additional exportation of water to outlying areas. See Appendix 3 for the Executive Summary of this study.

The primary conclusions from this analysis include the following:

The RPA area population is projected to grow from approximately 128,000 people to approximately 400,000 people by the year 2060, reflecting an average growth rate of approximately 2.3% per year. If population growth for the next 50 years is at the same 1.6% annual rate experienced between 1980 and 1990, the 2060 population overlying the aquifer will be approximately 286,000 people. If the population grows at a rate of 3% per year (which is less than the 3.7% annual growth between 1970 and 2007), the 2060 population overlying the RPA will be approximately 581,000 people.

Water demand by the year 2060 could rise from estimated current withdrawals of approximately 74,000 acre-feet to between 77,000 acre-feet (based on a low population growth rate of 1.6% per year and aggressive water conservation) and 223,000 acre-feet (based on a higher population growth rate of approximately 3% per year and no water conservation). The RPA area has experienced both of these population growth rates over multi-year periods in past decades.

The most likely 2060 water demand projection ranges from approximately 101,000 and 163,000 acre-feet, depending on the level of water conservation. This projection is based on a moderate level of population growth (averaging approximately 2.3% per year) over the next 50 years (see Figure 4).

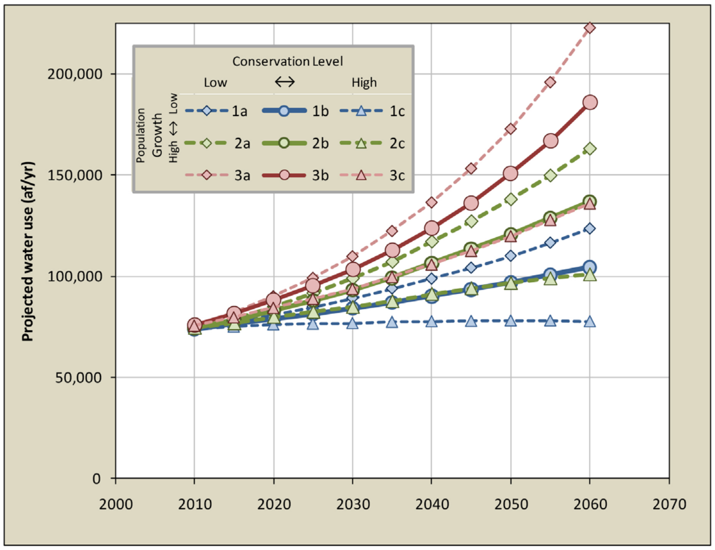

Figure 4. Future demand projections

The consumptive use is water that is actually consumed and not returned to the immediate water environment (i.e., aquifer and Spokane River) which occurs mostly through evapotranspiration. The consumptive use is projected to increase from approximately 40,000 acre-feet in 2010 to between 59,000 and 76,000 acre-feet in the year 2060 under moderate population and employment growth rates (See Figure 5). This range reflects the effects of different water conservation levels.

The water use for agricultural irrigation will likely decrease in time as irrigated agricultural land is replaced by more urban and suburban land uses. However, development of new residential and municipal irrigation on land

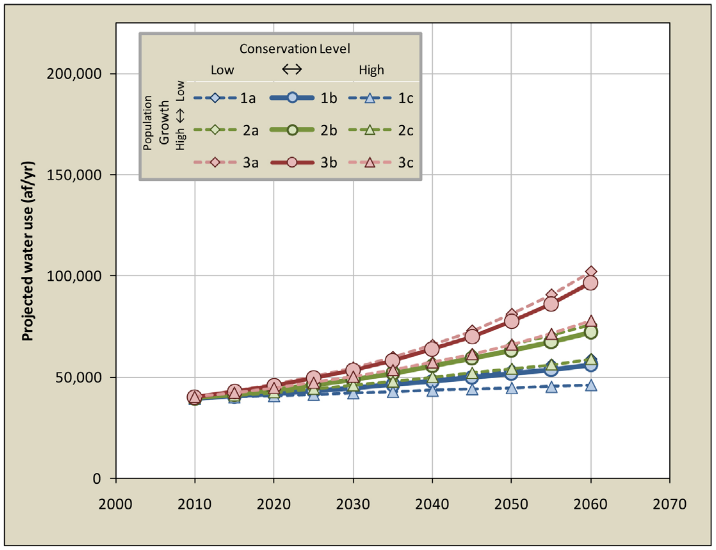

Figure 5. Consumptive use projections

(i.e. lawns) that is currently non-irrigated will likely lead to an overall increase in total irrigation demand.

The IDWR conducted a modeling exercise to assess the potential impact on the Spokane River from additional water use in Idaho. Using the medium growth prediction from the Water Demand Projections study, the model estimated a maximum flow reduction of 31 cfs in late summer and early fall. Additionally, the model showed an impact on Coeur d'Alene Lake, which would result in an indirect impact on the Spokane River. A summary memo is attached in Appendix 4.

Climate Variability

The IWRB contracted with Boise State University to evaluate potential changes to water supply and demand which might result from climate variability on a watershed scale. The executive summary of this report is in Appendix 5. Additionally, SPF Water Engineering, LLC (SPF) includes a discussion of regional impacts from climate variability in their Water Demand Projections study. These two studies, which were both seriously considered by the Advisory Committee, suggest the following observations.

Climate variability adds another element of uncertainty to planning for future water needs. Studies based on climate models and emission scenarios indicate that the overall temperature in the RPA region may increase over the next 50 years. The precipitation forecast is less certain. The northwest United States is expected to see some increase in annual precipitation; the expected change over the Rathdrum Prairie is inconclusive. Increased temperatures may mean that more winter precipitation may fall as rain instead of snow.

Temperature increases may also alter the timing of snowmelt, potentially shifting peak runoff from May to April. Any additional precipitation is expected to occur during the fall, winter and spring, rather than the summer months. Increases in temperature would lead to increased evapotranspiration. This could translate into increased irrigation demands during the summer months when there may also be less precipitation. Earlier runoff, combined with decreased precipitation during the summer, may also result in decreased flows in the Spokane River. Another likely impact of climate change is an increase in extreme events such as droughts and floods.

Water Conservation Potential

The Water Demand Projections study evaluated the potential of water conservation to reduce future demand. Based on a review of literature and other information, the study reflected three future conservation scenarios:

- No conservation – no new measures or programs would be implemented during

- the 50-year period, though ongoing adoption of newer appliances is assumed
- Intermediate conservation – voluntary water conservation measures would be implemented throughout the period
- Aggressive conservation – government-mandated measures require conservation measures above and beyond current codes

These scenarios covered indoor and outdoor residential use, commercial use, and agricultural use. They were applied to the three primary water demand projection scenarios to estimate the potential impact of conservation over the study period. Figure 6 illustrates the impacts conservation scenarios are projected to have on water demand and consumptive use, respectively.

The Water Demand Projections study found that water conservation can help mitigate projected future water use. The study described a range of conservation measures and projected assumed conservation outcomes that could be achieved by a combination of various potential water conservation measures and programs.

Water conservation will be an important part of managing future demand and ensuring the viability of the aquifer. While all conservation measures are important, reduced outdoor irrigation, both residential and agricultural, presents the largest conservation opportunity. Water reuse has the potential to reduce groundwater pumping and meet other goals, but does not bear directly on future aquifer demands.

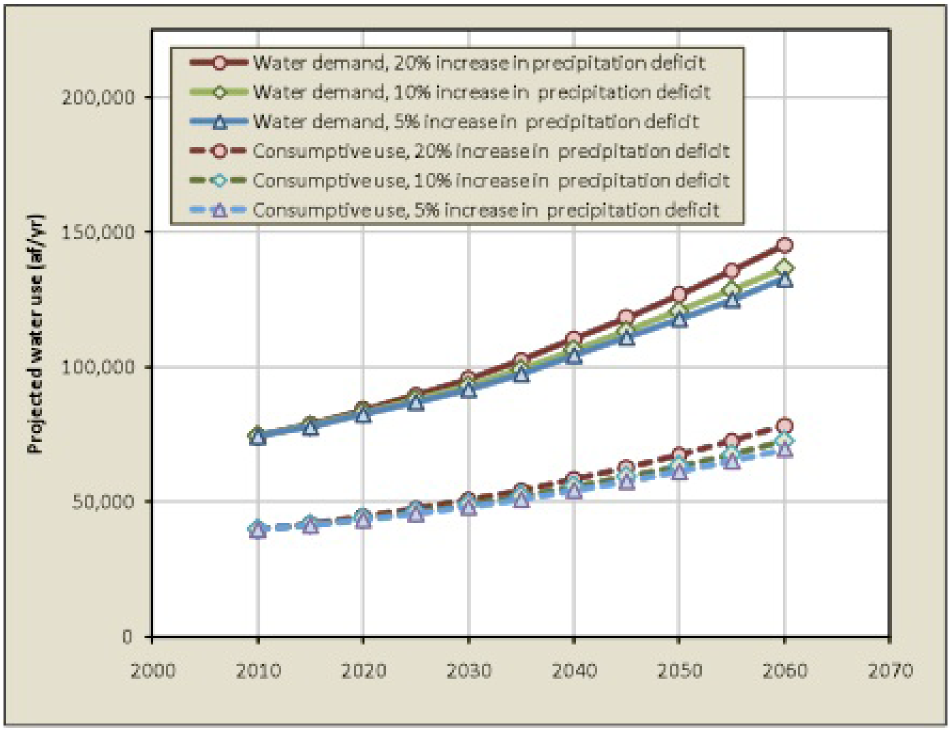

Figure 6. Future demand and consumptive use comparison chart

5. Recommendations

The specific goals of the statewide CAMP effort, and this specific Plan, are to:

- Provide reliable sources of water, projecting 50 years into the future
- Develop strategies to avoid conflicts over water resources
- Prioritize future state investments in water
- Bridge the gaps between future water needs and supply

Based on the four CAMP goals adopted by the IWRB, the Advisory Committee developed the following vision for the Rathdrum Prairie Plan:

> *"Provide a sustainable source of high-quality groundwater for current and future economic, social, and environmental benefit, and preserve the exceptional quality and reliability of the RPA."*

Using the four CAMP goals and this vision, the Advisory Committee developed three main objectives and several recommendations for achieving the goals and vision. Figure 7 illustrates how the Committee moved from CAMP goals to Vision to Objectives to Recommendations.

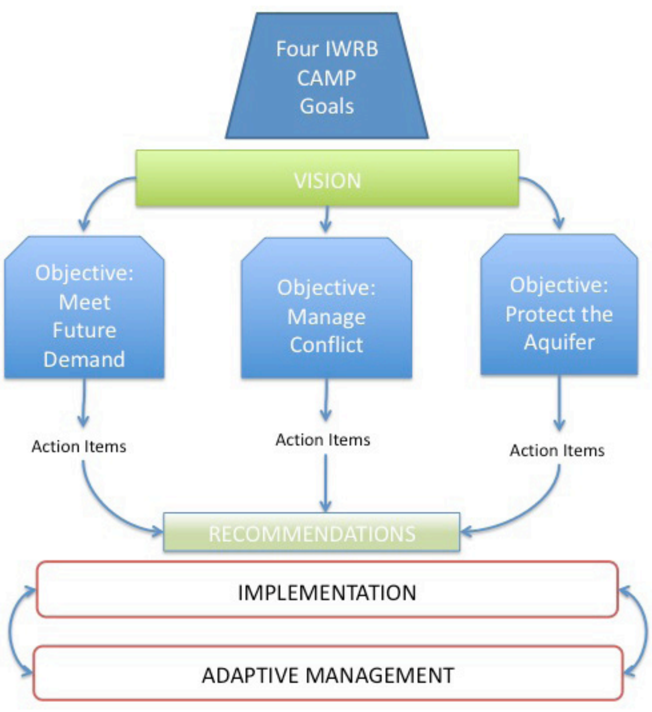

Figure 7. Moving from CAMP goals to adaptive management

The following recommendations are not ranked or placed in order of priority.

Objective # 1: Meet Future Demand for Water

The Water Demand Projections study completed in 2010 shows that projected growth over the RPA is not expected to exceed the aquifer's annual recharge rate. However, as the aquifer supplies communities in Idaho and Washington, meeting this objective should reflect regional implications.

In the face of all of the uncertainties relative to future water demand (for example, growth and climate change) the Board recognizes that water conservation is one approach that the region can control. Conservation is an important strategy to make more efficient use of groundwater and reduce the need for future water supplies. The CAMP includes a broad-based, voluntary, incentive-based approach to enacting a water conservation program designed to meet a part of the projected future water needs.

The CAMP also includes a strategy of moving ahead with Reasonably Anticipated Future Needs (RAFN) water right applications for municipal water providers.

The Board adopts the water demand projections of moderate population growth and moderate level of conservation, Water Demand Projections study scenario 2b, as the target on which to evaluate CAMP performance and to meet the goal established by the Board of having a sustainable aquifer. At least once every five years, annual consumptive use will be calculated, water demand projections updated, and progress evaluated against this target. The level of effort in each of the action items should be reviewed and modified as necessary to meet the overall objective of a sustainable aquifer. The Board believes that if Idaho demand meets the established target, the jurisdictional conflicts with Washington will be minimized.

The Board recognizes the variability in growth and future water needs predictions and recommends periodic reviews and updates to the Rathdrum Prairie Water Demand Projections study.

Action Item #1: Enact water conservation measures that promote water efficiency and reduced use.

Conservation should be an ongoing goal to improve wise use of water. IWRB should encourage water conservation through incentive programs to achieve conservation today and in the future. Voluntary programs and actions can be implemented that focus on reducing current water consumption by use of best practices. Programs should also be developed that target new and changing uses. For example, the following steps could be taken, cooperatively with funding partners:

- Develop partnerships to establish demonstration conservation projects.
- Establish incentive programs directed at targeted water use categories (residential, commercial, agricultural, etc.).
- Enhance water conservation education programs through partnerships with governmental and private interests.

In compliance with Idaho water law, water conservation should be a consideration in the IDWR review processes for new and transferred water appropriations. In the event additional measures are found necessary to maintain a sustainable Rathdrum Prairie Aquifer, it may be necessary for municipal water providers and/or other water users to consider regulatory measures.

Action Item #2: Establish municipal water rights to ensure that they are available for future needs.

In partnership with the municipal water providers in the Rathdrum Prairie area, studies necessary to support Reasonably Anticipated Future Needs (RAFN) water right applications should be undertaken.

This action item applies to the first goal of providing a reliable source of water in the future as well as preventing conflict over water resources.

Action Item #3: Identify local water use improvement strategies and develop partnerships to implement them.

To accomplish Action Item #3:

Assess local ordinances and land use plans that may have an effect on water resources. Examples of strategies are:

- Use the city and county comprehensive land use plans, GWMA, conservation plans, agency education and aquifer studies as tools to encourage growth in areas to minimize impacts.
- Encourage all land use policies to retain topsoil where possible over the RPA. This will enhance the conservation of water use, as well as provide additional buffer for contaminant travel.

Action Item #4: Carefully consider hydrologic and social impacts of exportation of water from the basin.

Idaho Code Section 42-203A(5) describes the elements the director of IDWR must consider for all new appropriations of water within the state, including those appropriations when the proposed place of use is outside of the water shed or local area where the source water originates.

Authorizing an appropriation to export water to an area outside the watershed it originates should be carefully evaluated. In addition to the other elements identified in Idaho Code Section 42-203A(5), when considering appropriations that describe the place of use outside the watershed, the director of IDWR will examine an appropriation to determine if it will adversely affect the local economy of the watershed or local area where the source of the water originates.

Action Item #5: Assess the Rathdrum Prairie Aquifer Water Demand Projections study on a regular basis.

The Board recognizes the uncertainty in predicting future growth and water needs and recommends periodic reviews and updates to the RPA Water Demand Projections study.

Action Item #6: Fully fund implementation of the Ground Water Management Plan.

In 2005, the IDWR Director adopted the Rathdrum Prairie Ground Water Management Plan. This Plan was developed by a collaborative advisory group and reflects locally supported actions. The Plan sets forth goals and actions that guide the water resource management "to balance the protection of existing ground water uses and water quality with the opportunity for future development while encouraging water conservation." The plan has not been fully implemented. The following actions must be implemented to complement the implementation of the RP CAMP:

- Implement monitoring protocols for all water users
- Collect and analyze data to refine knowledge of water supply and water use
- Establish a water district upon completion of the Northern Idaho Adjudication
- Finalize Water Conservation Measures and Guidelines document

A summary of the status of the Ground Water Management Plan is attached in Appendix 6.

Objective # 2: Prevent and Resolve Water Conflicts

The Rathdrum Prairie Aquifer is part of the Spokane Valley-Rathdrum Prairie Aquifer, a regional water resource shared with the state of Washington. While studies show there is adequate water for Idaho needs for the duration of the current planning horizon, Idaho recognizes that cooperation by stakeholders and governments from both states and tribes on water issues is necessary to avoid future conflict that may compromise or complicate water management.

A hydrologic analysis by IDWR determined that the most likely Idaho future water need projection could potentially reduce flow in the Spokane River at the Spokane gage by approximately 31 cfs by 2060 due to reduction of aquifer discharge to the river. This could result in additional attention and scrutiny from downstream interests. See Allan Wylie's hydrologic analysis in Appendix 4.

One of the prominent features of the SVRPA is the connectivity to surface water. The interaction between the ground and surface water dictate that long-term management and planning must integrate both sources of water. Any surface water conflict issues that arise in the future will also relate to groundwater. As communities over the SVRPA grow, so will the potential for these conflicts. Figure 8 shows a map of the SVRPA.

Action Item #1: Develop a framework for regional discussion and cooperation for

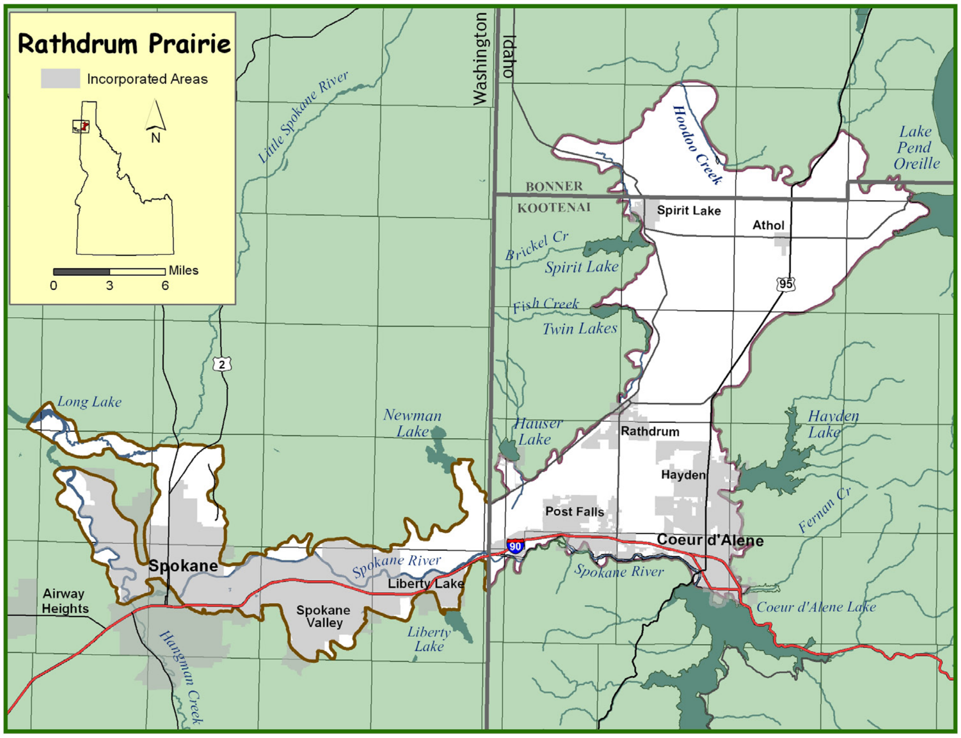

Figure 8. SVRP Aquifer Map

SVRPA water issues.

Building on the history of bi-state relationships, studies, and efforts to work together, the IWRB, in cooperation with the state of Washington and tribal governments, should convene an official bi-state Advisory Committee to develop a bi-state regional cooperative forum for the SVRPA.

The framework should respect the sovereignty of Idaho, Washington, and the Coeur d'Alene and Spokane Tribes.

The Idaho contingent of the Bi-State Advisory Committee should include local interests along with tribal, local, state government and others. It should report periodically to the appropriate state agencies and implement the framework within two years of the adoption of this Plan.

The particular type of legal or institutional instrument to initiate the Advisory Committee, and to implement the framework itself, should be determined through a collaboration among the states and the tribal governments.

For more details on how this framework might be developed, see Appendix 7.

Action Item #2: IDWR should develop criteria to evaluate artificial recharge projects in Idaho.

Idaho should anticipate future requests or applications for artificial recharge projects and determine what values need to be considered in the application review process. Criteria or guidelines for future projects will protect Idaho's interests and may provide a more predictable process for those wishing to implement artificial recharge projects.

Action Item #3: Encourage mechanisms that resolve local issues before they become conflicts. For example, by assembling local water purveyors, tribes, municipalities, and state agencies on a regular basis.

Support a venue for local jurisdictions to discuss and coordinate local water needs, as well as articulate local needs to IDWR and other relevant agencies.

This group should:

1. Provide a forum to consider whether local jurisdictions should coordinate and apply for a Reasonably Anticipated Future Needs water right.
2. Assess the effectiveness of recharge options to increase aquifer beneficial use to support aquifer sustainability while meeting non-degradation standards
3. Maintain communication with IDWR so that all entities stay current on issues at the local and state level.

Action Item #4: Redefine the IDWR GWMA boundaries so they are consistent with the bi-state USGS hydrologic boundaries.

The director of IDWR should redefine the RPA boundaries in the GWMA so that they are consistent with the bi-state USGS hydrologic boundaries in Idaho. This will promote cohesive management, which should reduce future conflict over water resources.

Objective # 3: Protect the Aquifer Quality

The RPA can be characterized as having sufficient quantity for Idaho's needs and as having good water quality. However, the aquifer is vulnerable to water contamination and the region must be vigilant in protecting this valuable resource. There are many threats to the water quality of the aquifer, and a number of agencies and authorities exist to protect and improve the water quality.

The aquifer provides high quality water to all of its users. The health of the aquifer is of paramount importance to the region.

Working within existing authorities and programs to protect and enhance the water quality of the RPA is the appropriate and cost-effective way to protect the water resources to meet future water needs.

Action Item #1: The Board should assess all CAMP activities to ensure projects implemented through CAMP protect aquifer water quality.

Action Item #2: The Board should support and encourage the Aquifer Protection District to work with Panhandle Health District, Idaho Department of Environmental Quality, tribal governments and others to address overlapping jurisdictions with the goal of improving efficiency.

The Aquifer Protection District (APD) may consider funding the following strategies to address current water quality protection:

1. Mitigate the impacts of stormwater runoff.
2. Promote practices that prevent accidental or incidental releases of contaminants over the RPA.
3. Encourage accounting of wellheads over RPA and proper abandonment of unused wellheads.
4. Support continued monitoring and management of potential water quality issues contained in RPA source lakes and rivers.
5. Encourage wastewater disposal methods that benefit the RPA.
6. Prepare for emerging or unknown threats.

See Appendix 8 for a list of supported strategies.

Figure 9 is a summary of the key action items.

SUMMARY OF KEY ACTION ITEMS

(not ranked or placed in order of priority)

Objective #1: Meet Future Demand for Water

Enact water conservation measures that promote water efficiency and reduced use.

Establish municipal water rights to ensure that they are available for future needs.

Identify local water use improvement strategies and develop partnerships to implement them.

Carefully consider hydrologic and social impacts of exportation of water from the basin.

Update the Rathdrum Prairie Aquifer Water Demand Projections study.

Objective #2: Prevent and Resolve Water Conflicts

Develop a framework for regional discussion and cooperation for SVRPA water issues.

IDWR should develop criteria for artificial recharge projects in Idaho.

Encourage mechanisms that resolve local issues before they become conflicts.

Redefine the IDWR Ground Water Management Area boundaries so they are consistent with the bi-state US Geological Survey hydrologic boundaries.

Objective #3: Protect the Aquifer

Assess all CAMP activities to ensure projects implemented through CAMP protect aquifer water quality.

Support and encourage the Aquifer Protection District to work with Panhandle Health District, Idaho Department of Environmental Quality, and others to address overlapping jurisdictions with the goal of improving efficiency.

Figure 9. Summary of Key Action Items

6. Additional Plan Components

In addition to the objectives and action items listed in the Plan, additional actions are included to enhance coordination, decision-making, and aquifer management.

Plan Implementation

Management of the RPA affects numerous stakeholders, tribal nations, and the states of Idaho and Washington. Effective implementation of the Plan will require the participation and cooperation of stakeholders and governmental entities with jurisdictional authorities and responsibilities.

The Board will provide leadership and coordinate activities for the implementation of this Plan.

The Board will continue to convene the Advisory Committee to guide and make recommendations concerning the implementation of management strategies and review of goals and objectives. The Advisory Committee will provide a forum for discussing implementation, establishing benchmarks for evaluating the effectiveness of actions, coordinating with water users and managers, evaluating and addressing environmental issues and identifying and pursuing funding opportunities.

The Advisory Committee will continue to include interest groups currently represented, and may expand to include other interested people, per the Board's direction. In addition, the Board will appoint at least one of its members to serve as a liaison between the Committee and the Board. The Advisory Committee will serve at the pleasure of the Board and provide a forum for public participation. The Board will facilitate the work of the Advisory Committee and provide the technical information needed for its deliberations. The Board will make all final decisions concerning Plan project priorities, implementation, and funding.

As various programs are implemented, additional monitoring or modifications will likely be needed. Specific projects may require site-specific measurement and analysis that are not currently available. Additional analysis will likely be required to assist the Board and the Advisory Committee.

Outreach and Education

During implementation of RP CAMP, the Advisory Committee will help develop and recommend funding mechanisms for a broad water education and outreach effort, building on existing outreach efforts and programs. Emphasis will be placed on education efforts that promote conservation and a reduction in consumptive use.

Implementation Plan and Funding

Implementation of new CAMP actions will be a partnership among the state, local and federal governments, tribes, stakeholders, water users and non-governmental organizations. The costs of implementation are anticipated to be shared among partners. As the implementation plan is developed, the funding needs for the Plan components will be evaluated and potential funding sources, including federal grants, will be identified.

The many existing activities for protecting the RPA reflect the value and importance the aquifer and water resources have to the region. These existing activities are undertaken by a variety of governments, agencies, and others. These activities are funded through various sources and through various programs. The Board supports existing programs that protect and enhance the water resources of the area. Opportunities to combine resources and leverage existing programs with CAMP implementation will be encouraged and supported.

7. Adaptive Management

This section sets forth an adaptive management strategy for implementation of the Plan. The goal of adaptive management is to support improved decision making and performance of water management actions over time.

Key principles fundamental to this approach include:

1. Anticipating possible future uncertainties and contingencies during planning.
2. Employing science-based approaches to build knowledge over time.
3. Designing projects that can be adapted to uncertain or changing future conditions.

Adaptive management involves taking actions, testing assumptions, and monitoring and adapting/adjusting the management approach as necessary. It is a way of taking action in a complex system with many variables and constant change. Developing perfect knowledge concerning any system, including the RPA, is impossible. Therefore an adaptive management approach is critical to the successful attainment of the qualitative and quantitative goals set forth in the Plan. Successful adaptive management requires patience and long-term commitment, just as acquiring enough data to make decisions about program changes takes time.

The adaptive management strategy will allow the Board to:

- Develop protocols for revising management actions and/or quantitative targets as necessary.
- Compare costs and impacts of different actions in the RPA.
- Adjust funding allocation between projects to get the most "bang for the buck."
- Concentrate funding on management actions that show results.
- Make adjustments and revisions to the Plan as new information becomes available or in response to changing water supply and demand needs.
- Proceed with flexibility depending on results and analysis of monitoring and measurement data.

Coordination and Implementation

Management of the RPA affects numerous stakeholders within Idaho and requires coordination with other interests including the state of Washington and tribes. The Advisory Committee will be charged with providing guidance and recommendations concerning the implementation of management strategies and review of objectives. The Advisory Committee will provide a forum for discussing implementation, establishing benchmarks for evaluating the effectiveness of actions, coordinating with water users and managers, evaluating and addressing environmental issues and identifying and pursuing funding opportunities.

Monitoring and Data Gathering

With data gathered through the monitoring process, the Advisory Committee and the Board will be able to assess the impacts of each management activity. In some cases, it may take a number of years to obtain sufficient data to achieve a comprehensive understanding of the effects of particular actions. Regardless, the success of the Plan depends upon the development and maintenance of state-of-the-art monitoring and evaluation tools that provide the information necessary to make sound planning decisions for the future.

Legislative Reporting and Plan Revision

The Board will provide periodic reports to the legislature documenting the progress made on the implementation of the Plan. The Board will evaluate the Plan after five years of implementation and make planning recommendations to the legislature and Governor's office. The 50-year horizon will be considered at each revision so that the Plan will remain a relevant planning document without expiration.

Appendices

Appendix 1: Advisory Committee Members

Chris Beck, AllWest Testing and Engineering (resigned)

Phil Cernera, Coeur D'Alene Tribe

Mike Clary, Hecla Mining

Bruce Cyr, Jacklin Land Company

Andy Dunau, Spokane River Forum

Mike Galante, North Kootenai Water District

Bruce Howard, Avista Utilities

Allen Isaacson, Kootenai Environmental Alliance

Hal Keever, Stimson Lumber Co.

Kermit Kiebert, North Idaho Chamber of Commerce

Paul Klatt, JUB Engineers

Kevin Lewis, Idaho Rivers United (resigned)

Jim Markley, City of Coeur d'Alene

Alan Miller, Hayden Lake Irrigation District

Jonathan Mueller, Landmark/Architects West

Michael Neher, City of Post Falls

Dale Peck, Panhandle Health District

Todd Tondee, Kootenai County

Ron Wilson, East Greenacres Irrigation District

Ken Windram, Hayden Area Regional Sewer Board

Appendix 2: Chronology of Studies and Events Relevant to the Rathdrum Prairie Aquifer

1908 City of Spokane switches water source from the Spokane River to the Aquifer due to typhoid concern from sewage in river and private wells near cesspools

1900s There were few water wells on the Rathdrum Prairie until drilling and pumping technology improved in the 1930's. A history of Prairie water use can be found at: http://www.deq.idaho.gov/water/prog_issues/ground_water/rathdrum_prairie_aquifer/index.cfm#history

1976 Washington Department of Ecology adopts instream flows standards for the Little Spokane River

1976 The Federal Clean Water Act §208 spawned completion of local studies to identify sources of pollution for the Rathdrum Prairie region

1977 Panhandle Health District adopts enhanced septic system regulations for the RPA, creating the "5-acre rule" limiting development to one residential septic system per five acres without connection to a public sewer system. This rule led directly to Sewage Management Agreements with surrounding communities and the sewering of Coeur d'Alene, Fernan, Hayden, Hayden Lake, Post Falls, and Rathdrum.

1978 EPA sole source aquifer designation

SVRP Aquifer was the first aquifer in Idaho and the second in the nation to receive this designation. http://yosemite.epa.gov/r10/water.NSF/Sole+Source+Aquifers/SSA

1978 USGS publishes Spokane Valley-Rathdrum Prairie Aquifer, Washington and Idaho by Drost and Seitz

1978 IDEQ adopts Water Quality Management Plan for Rathdrum Prairie. This plan was developed under CWA §208.

1979 Spokane County and the City of Spokane adopt Water Quality Management Plan consistent with Section 208, Clean Water Act and begin septic tank elimination program

1980 IDEQ "special resource water" designation

1980 Spokane County and Panhandle Health District initiate a groundwater monitoring program

1986-1988 PHD's Sewer Management Agreements result in sewering of the Cities of Hayden, Hayden Lake, Post Falls and Rathdrum with the construction of the regional treatment plants in Post Falls and HARSB.

1988 IDEQ publishes Rathdrum Prairie Aquifer Technical Report

http://www.deq.state.id.us/water/data_reports/ground_water/rathdrum_prairie_aquifer_beg_thru_chap2.pdf

1997 Sensitive Resource Aquifer designation for the RPA in Idaho creates non-degradation standard

2000 Original Spokane Valley-Rathdrum Prairie (SVRP) Atlas published as an educational and outreach tool.

2001 Newport Generation, Cogentrix Energy, and Avista Utilities apply for water rights to drill wells to extract about 18 million gallons per day of cooling water for natural gas turbine power plants

2001 CDA Basin Environmental Improvement Project Commission was created by Idaho Legislature under the Basin Environmental Improvement Act of 2001 (Idaho Code Title 39, Chapter 81 to provide a system for environmental remediation, natural resource restoration and related measures to address heavy metal contamination in the Coeur d'Alene Basin.

2002 Idaho Department of Water Resources denies moratorium on permits from the aquifer and designates the Rathdrum Prairie Groundwater Management Area.

2003 Spokane Valley-Rathdrum Prairie Aquifer Study began. The major product of the study is a numerical groundwater model that Washington and Idaho can use to cooperatively manage the SVRP aquifer and adjacent rivers and lakes. Information gathered by partner agency scientists and contractors has expanded and refined our understanding of the aquifer and its interaction with local lakes and the Spokane and Little Spokane rivers, and water use region wide.

The three main agencies involved in this project/study has references listed here along with the way that each agency refers to the project:

IDWR – Spokane-Valley Hydrological Project http://www.idwr.idaho.gov/WaterInformation/projects/svrp/

DOE – Spokane Valley-Rathdrum Prairie Aquifer Study http://www.ecy.wa.gov/programs/wr/ero/svrp_summit.html

USGS – Spokane Valley-Rathdrum Prairie Aquifer Study http://wa.water.usgs.gov/projects/svrp/

2004 SVRP Aquifer Atlas updated

http://www.spokaneaquifer.org/aq.htm#atlas

2005 IDWR adopts Groundwater Management Plan

http://www.idwr.idaho.gov/WaterInformation/GroundWaterManagement/RathdrumPrairie/rp_gwma.htm

2005 Avista files application to FERC to relicense their Spokane River hydroelectric projects, including Post Falls Dam.

2006 Aquifer Protection District legislation approved in Idaho and Kootenai County voters overwhelmingly approve its formation to fund aquifer protection efforts overseen by the Kootenai County Commission http://www.phd1.idaho.gov/environmental/rathdrum/protectionprogram.cfm

2007 USGS publishes "Hydrogeologic Framework and Water Budget of the SVRP Aquifer" and "Groundwater flow model for SPVRP Aquifer"

2007 Spokane River Forum is a non-profit organization created with WDOE seed funding to facilitate informed and non-partisan dialogue on important water issues in the region. http://www.spokaneriver.net/

2007 Idaho Department of Water Resources and Washington Department of Ecology sign a Memorandum of Agreement to preserve and maintain the SVRP Aquifer and Groundwater Flow Model created by the US Geological Survey.

2008 Legislature approves House Bill 428 and 644

This legislation establishes CAMP program and funding for aquifer management plan development by the IWRB. The legislation authorizes and funds characterization and planning efforts for priority aquifers, including the Rathdrum Prairie and the Treasure Valley Aquifers. http://www.idwr.idaho.gov/waterboard/WaterPlanning/CAMP/CAMP.htm

2008 Rathdrum Prairie Wastewater Master Plan (JUB Engineers)

http://www.postfallsidaho.org/pzdept/RathPrairieMasterPln/RPWWMP08/TM3_Final_Draft.pdf

2008 North Idaho Adjudication begins. The purpose of the general adjudication of water rights is to make a complete and accurate determination of all existing water rights.

http://www.idwr.idaho.gov/WaterManagement/NorthIdAdju/

2009 Idaho Water Resources Board starts the process to development the RP CAMP

2009 Based on settlement agreements with Coeur d'Alene Tribe and State of Idaho, among others, FERC issues new 50-year license for Avista's Spokane River hydro project, including the Post Falls dam.

2009 Coeur d'Alene Lake Management Plan. The Coeur d'Alene Tribe and the Idaho Department of Environmental Quality collaboratively developed the 2009 Lake Management Plan to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments. http://www.deq.state.id.us/WATER/data_reports/surface_water/water_bodies/cda_lake_mgmt_plan.cfm

2010 Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load Water Quality Improvement Report approved by WDOE and EPA but disputed by Idaho communities.

http://www.ecy.wa.gov/programs/wq/tmdl/spokaneriver/dissolved_oxygen/status.html.

2010 Kootenai County Comprehensive Land Use Plan - Prior update was in 1994. 'The final plan was adopted by the County Commissioners in December of 2010. It was signed on 12-30-10

Appendix 3: Rathdrum Prairie Aquifer Water Demand Projections, SPF Water Engineering, LLC, July 2010.

Water demand overlying the RPA (the Idaho portion of the Spokane Valley-Rathdrum Prairie Aquifer) was projected for 5-year increments between 2010 and 2060. The projections were made for the Idaho Water Resource Board (IWRB) and the Idaho Department of Water Resources (IDWR) as part of the Idaho Statewide Comprehensive Aquifer Planning and Management Program (CAMP).

Approach

The approach for projecting future water demand consisted of

1. Reviewing historic population growth trends and growth rates;
2. Estimating existing water demand based on community water system data, water right information, USDA crop data, and other information;
3. Reviewing climate projections from the University of Washington Climate Impacts Group relative to the northern Idaho area;
4. Quantifying water conservation potential;
5. Evaluating selected potential water demand constraints;
6. Projecting future population and employment growth;
7. Projecting future water demand for indoor domestic, municipal, commercial, industrial, and irrigation uses; and
8. Developing "water demand scenarios" to evaluate possible future water demand outcomes that take into account various population growth rates, levels of water conservation, and the potential impact of climate variability.

There are two general categories of factors that will shape future water demand: (1) exogenous factors over which local policies have limited influence and (2) local factors over which public policy and private incentives can have substantial influence. Exogenous factors include the strength of the national or global economy and national demographic trends that strongly influence regional population and job growth. Although local governmental policy can have some influence over these factors, the local economy is largely driven by national or global factors. One needs to look only at the recent economic recession to see that some of these national or global factors are difficult to control at the local level. Exogenous factors also include potential effects of climate variability, over which local policy-making will have very little direct influence.

In contrast, regional land-use policies, building codes, governmental policies, water delivery pricing, and other local measures can have substantial influence on future water demand. Local and state government, local water purveyors, and area residents have substantial influence over these factors.

Thus, future water demand scenarios were constructed to reflect the effect of both exogenous (external realm) and local influences (policy realm) on future water use. First, three primary scenarios were developed to reflect three different population growth scenarios: low population growth, medium-level ("baseline") population growth, and high population growth. Then, three sub-scenarios were constructed within each of the population growth scenarios to reflect various water conservation levels. The three primary population growth scenarios, each with three water conservation sub-scenarios, result in nine different projections of potential future water demand. Finally, the effects of potential climate variability were illustrated with a scenario representing baseline population growth and moderate water-conservation.

Conclusions

The primary conclusions from this analysis include the following:

1. Water demand by the year 2060 could rise from estimated current withdrawals of approximately 74,000 acre-feet to between 77,000 acre-feet (based on a low population growth rate of 1.6% per year and aggressive water conservation) and 223,000 acre-feet (based on a higher population growth rate of approximately 3% per year and no water conservation). The RPA area has experienced both of these population growth rates over multi-year periods in past decades.

2. The most likely 2060 water demand projection ranges from approximately 101,000 to 163,000 acre-feet, depending on the level of water conservation. This projection is based on a moderate level of population growth (averaging approximately 2.3% per year) over the next 50 years.

3. The consumptive use is water lost from the local hydrologic system (i.e., aquifer and Spokane River), mostly through evapotranspiration. The consumptive use is projected to increase from approximately 40,000 acre-feet in 2010 to between 59,000 and 76,000 acre-feet in the year 2060 under moderate population- and employment-growth rates. This range reflects the effects of different water conservation levels.

4. The water use for agricultural irrigation will likely decrease in time as irrigated agricultural land is replaced by more urban and suburban land uses. However, development of new residential and municipal irrigation on land that is currently non-irrigated will likely lead to an overall increase in total irrigation demand.

Population and Employment Projections

5. The Kootenai County population grew from approximately 22,300 people in 1940 to 134,400 people in 2007. Bonner County grew from 15,700 people in 1940 to approximately 41,000 people in 2007.

6. Annual population growth rates in Kootenai County (most of which overlies the RPA) have ranged from 1.6% (between 1980 and 1990) to 5.4% (between 1970 and 1980). The average annual growth rate between 1970 and 2007 was 3.7%.

7. The RPA area population growth is projected to grow from approximately 128,000 people to approximately 400,000 people by the year 2060, reflecting an average growth rate of approximately 2.3% per year. If population growth for the next 50 years is at the same 1.6% annual rate experienced between 1980 and 1990, the 2060 population overlying the aquifer will be approximately 286,000 people. If the population grows at a rate of 3% per year (which is less than the 3.7% annual growth between 1970 and 2007), the 2060 population overlying the RPA will be approximately 581,000 people.

8. Employment over the aquifer area is projected to increase from approximately 53,000 employees in the year 2010 to 183,000 employees in the year 2060. The largest employment sector will likely continue to be wholesale and retail trade.

Existing Water Use

9. Existing water use was estimated with data from 20 community water systems ranging in size from approximately 39 to 46,000 people; these 20 community water systems serve approximately 72% of the total Rathdrum Prairie population. Data from the 20 community water systems were used to extrapolate water use to 70 additional community water systems that serve approximately 19% of the study area population. Estimates of self-supplied

domestic water use for the remaining 9% of the population were made based on household domestic use rates estimated from community water system data. Self-supplied industrial water use estimates were based on IDWR water right information. Agricultural water use rates were estimated based on irrigated acreage, USDA crop information, and precipitation-deficit data.

10. Approximately 72,000 acre feet of water were withdrawn annually from the RPA in recent years. Of this, an estimated 34,400 acre-feet were withdrawn by community water systems, 8,800 acre-feet were withdrawn by individual domestic wells, 4,200 acre-feet were withdrawn for self-supplied commercial and industrial uses, and 24,700 acre-feet were used for agricultural irrigation. The estimated aggregate consumptive use (water that is lost from the local hydrologic system) was approximately 38,400 AFA.

11. Approximately 67% of the projected 2010 groundwater withdrawals are used for the irrigation of residential, commercial, institutional, and agricultural lands. Other residential uses (14%), commercial, industrial, and institutional uses (14%), and unaccounted water (5%) constitute the balance.

Water Supply Characteristics

12. The RPA, part of the larger Spokane Valley-Rathdrum Prairie Aquifer, consists of unconsolidated sediments that are primarily course-grained sand, gravel, cobbles, and boulders deposited by immense floods.

13. The highly transmissive nature of the RPA means that the impact of water use in one portion of the aquifer will rapidly propagate throughout the entire aquifer.

14. Recharge to the entire Spokane Valley-Rathdrum Prairie Aquifer is approximately 1,000,000 acre feet per year.

15. The existing RPA consumptive water use (consumptive use is a measure of aquifer impact) is approximately 38,000 AFA, or approximately 3.8% of the 1,000,000 acre feet of aggregate Spokane Valley-Rathdrum Prairie Aquifer recharge.

16. It is unlikely that groundwater availability in most portions of the RPA will limit future water demand over the next 50 years. A projected consumptive use of approximately 71,000 AFA in the year 2060 (based on medium population and employment growth and medium levels of water conservation) represents only about 7% of the Spokane Valley-Rathdrum Prairie Aquifer recharge (although, recharge rates are not equivalent to water available for use). Given the transmissive nature of the RPA sediments, it is likely that this amount of water could be withdrawn from the aquifer (except for, perhaps, along the basin margins where the aquifer is less thick than in central portions of the Rathdrum Prairie).

Potential Environmental Constraints

17. Aquifer water quality is good in most areas and does not presently pose a constraint on future groundwater demand.

18. Future water demand may, however, be limited by the ability to discharge treated municipal effluent.

19. A portion of the Rathdrum Prairie agricultural land will almost certainly be maintained for the land application of treated municipal effluent. Residential or municipal irrigation, to the extent that it occurs on currently non-irrigated land, will contribute to a likely increase in overall irrigation demand.

Climate Variability

20. Annual average temperatures are projected to increase by approximately 3.2°F by 2040 and about 5.3°F by 2080.

21. Evapotranspiration may increase by

approximately 6% per degree centigrade over 2010 values. This could lead to potential evapotranspiration increases of between 12% and 19% by the years 2040 and 2080, respectively. Another study suggests possible potential evapotranspiration increases of 5% to 9% by the year's 2040 and 2080, respectively. Based on these predictions, irrigation demand could increase by 5% to 20% in the next 50 years.

22. For most of the projections in this study, we assumed a 10% increase in future irrigation demand as a result of increased evapotranspiration. However, the effects of a 5% increase and a 20% increase in future irrigation demand were also evaluated for a moderate population growth and conservation-level, scenario. A 5% increase in irrigation demand would result in an overall water demand that is approximately 3% less than the demand projected based on a 10% increase in irrigation demand. A 20% increase in future irrigation demand would result in an overall aquifer demand that is approximately 6% greater than the demand projected based on a 10% increase in irrigation demand.

23. Annual precipitation may increase by approximately 2.3% by the year 2040, and by approximately 3.8% by the year 2080. The RPA area is expected to become wetter in the fall and winter and dryer in the spring and summer. Additional precipitation, to the extent it occurs in the fall, winter, and spring, will not reduce irrigation demand during summer months.

24. Extreme temperature and precipitation events will likely increase in frequency. Extreme and/or extended drought periods will increase annual irrigation demands.

Water Conservation Potential

25. Aggressive water conservation can help mitigate some of the projected future water use. Aggressive conservation can result in aggregate water demand that is approximately 60% of the non-conservation demand for a given population growth outcome in 2060.

26. Aggressive water conservation could lead to a 52% reduction in per-household domestic water demand by the year 2060 (from 2010 levels).

27. Per-household outdoor residential irrigation use could be reduced by up to approximately 33% from 2010 levels.

28. Commercial and industrial use could likely be reduced by up to approximately 40% over the next 50 years compared to 2010 per-employee use rates.

29. Specific water conservation measures are outlined in the report.

30. Water reuse is a potential method to extend water supply, but does not bear directly on future Rathdrum Prairie water demands or aquifer withdrawals.

The full Water Demand Projections study can be found at http://www.idwr.idaho.gov/waterboard/WaterPlanning/CAMP/RP_CAMP/RathdrumCAMP.htm.

Appendix 4: Impact of Projected 2060 Demand on Spokane River

MEMO

State of Idaho
Department of Water Resources
322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098
Phone: (208) 287-4800 Fax: (208) 287-6700

Date: 22 June 2011
To: Helen Harrington
From: Allan Wylie
cc: Rick Raymondi and Sean Vincent
Subject: Impact of projected 2060 demand on Spokane River

The Rathdrum Prairie CAMP Committee asked me to conduct a transient analysis of the impact of the SPF 2b population growth and consumptive use prediction (medium growth with moderate conservation efforts) on the Spokane River and present my findings at the June 4, 2010, meeting.

Method

The SPF scenarios provide average projected consumptive use for 2060, not monthly projections, so I needed to shape the steady state scenario I presented at the April 16 meeting into a monthly transient file for use in the Spokane Valley Rathdrum Prairie (SVRP) Model. To accomplish this, I apportioned the 2060 steady state file to match the Idaho portion of the 2005 consumptive use for the SVRP Model. Table 1 shows the Idaho portion of the 2005 consumptive use from the SVRP aquifer model along with the shaped SPF 2060 consumptive use estimate and the difference between the two files.

Table 1. 2005 water budget for SVRP model and the 2060 monthly water budget.

Month	2005 (ac-f)	Projected 2060 (ac-f)	Difference (ac-f)
January	1,161	1,638	476
February	975	1,337	363
March	1,180	1,641	461
April	4,318	6,762	2,445
May	4,189	6,518	2,328
June	7,119	11,365	4,246
July	11,829	18,985	7,156
August	7,658	12,222	4,564
September	3,316	5,216	1,900
October	1,512	2,228	716
November	981	1,370	389
December	943	1,284	341
SUM	45,181	70,566	25,385

The impacts of the projected growth on the Spokane River can be simulated either by running the model with the 2005 consumptive use and again with the 2060 consumptive use and then differencing the outputs, or by running the model with the difference between the 2005 and 2060 consumptive use. I chose to work with the difference.

Results

Figure 1 shows the direct impact on the river. The direct impact is a result of the change between the 2005 aquifer model consumptive use and the SPF estimate for year 2060. The additional water use lowers the water table causing either increased seepage from or decreased gains to the Spokane River. The maximum change in impact is about 31 cfs in late summer and early fall. Late summer or early fall is when the seven day low flow typically occurs in the Spokane River.

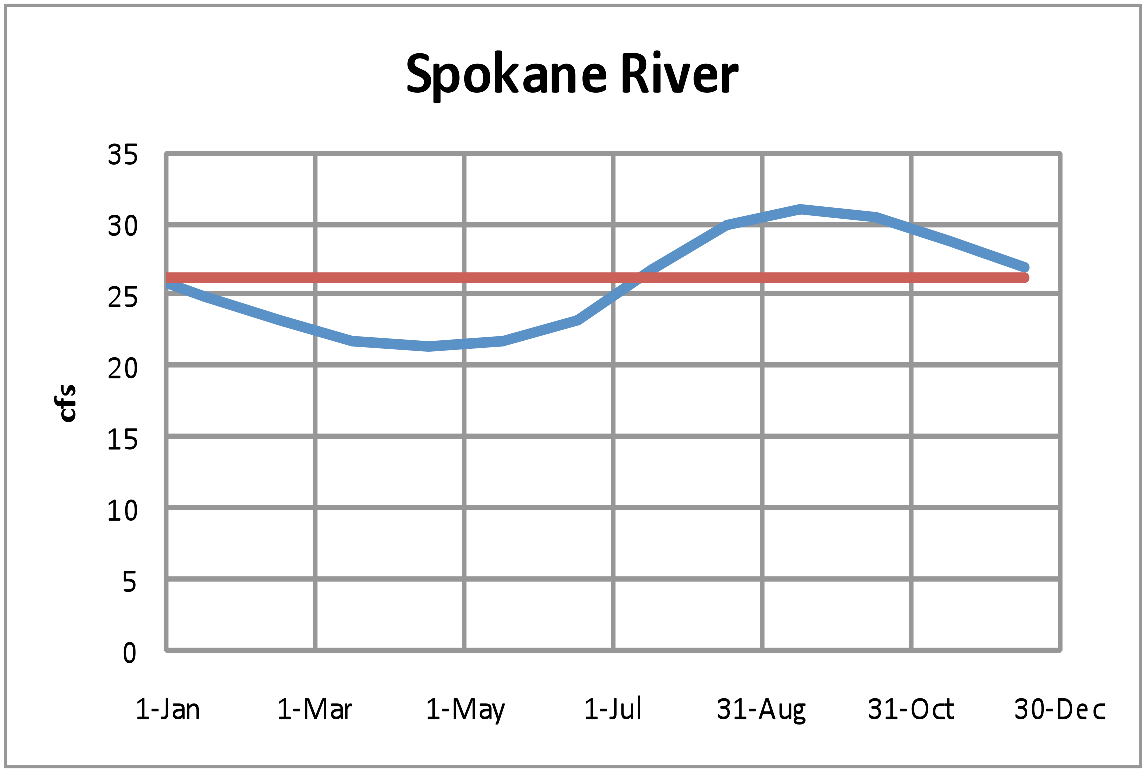

Figure 1. Direct impact on the Spokane River; red=steady state, blue=transient.

Figure 2 presents an impact on Lake Coeur D' Alene that results in an indirect impact on the Spokane River. This is where increased water use in Idaho lowers the water table resulting in increased seepage from Lake Coeur D' Alene. This water leaks from the lake into the aquifer to replace water than has been consumptively used, the water that leaked out of the lake can't be discharged through Post Falls Dam into the Spokane River. Because discharge from the lake is controlled at Post Falls Dam, the timing of this impact does not appear to be critical. Although the magnitude of the impact is small and would be difficult to quantify, it does represent a decrease in the supply of water that can be released to mitigate downstream impacts.

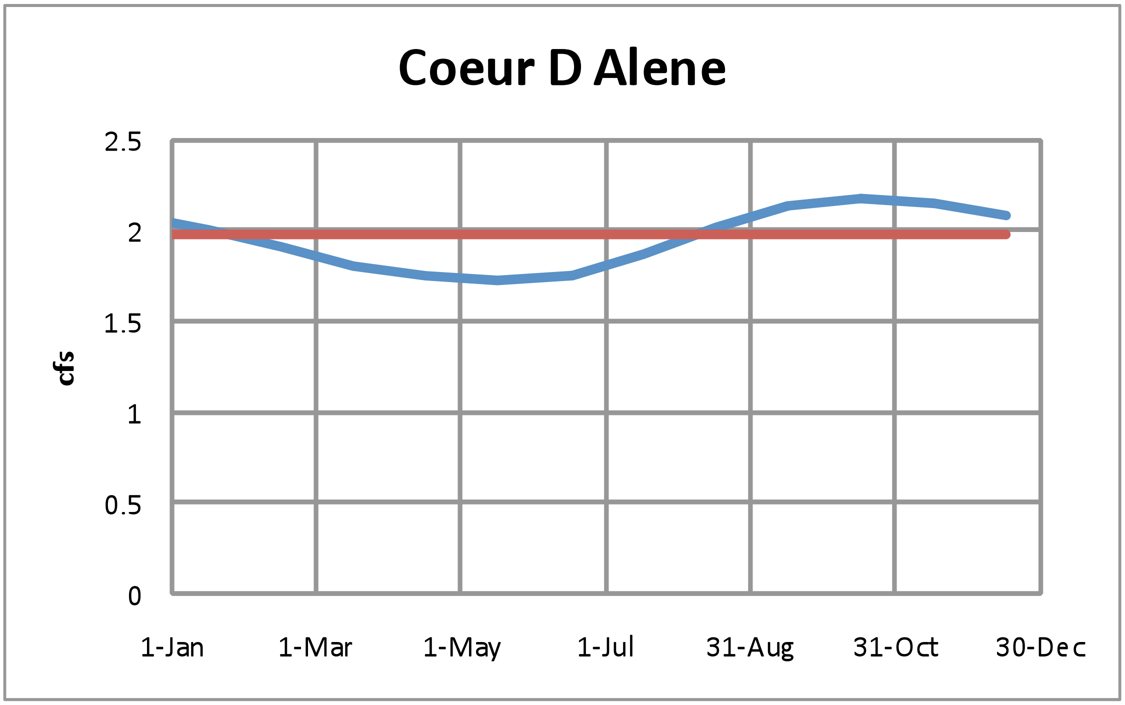

Figure 2. Impact on Lake Coeur D' Alene that results in an indirect impact on the Spokane River; red=steady state, blue=transient.

Conclusion

The transient impacts of SPF scenario 2b were estimated by shaping the 2060 annual consumptive use similar to the consumptive use for 2005 used in the SVRP aquifer model. The difference between the 2005 consumptive use in the SVRP aquifer model and shaped scenario 2b was input into the ground water model. The resulting simulation indicates that the maximum direct impact on the Spokane River would be about 31 cfs and should occur during late August and early September.

The model indicates that Lake Coeur D' Alene will also be impacted by growth in Idaho. Although the impact is small and on a large lake, it does represent a decrease in water than can be released to mitigate downstream impacts.

Appendix 5 Climate Variability Impact Studies in the Rathdrum Prairie and Treasure Valley Regions, Venkat Sridhar and Zin Jin, October 2010.

(This executive summary contains information on the Rathdrum Prairie and Treasure Valley Basins.)

This project covered many tasks including the evaluation of climate models, climate model output downscaling, SWAT model calibration and validation, simulation of climate change in the basin's hydrology and assessment.

We identified five climate models that are relevant to capturing the future trends in precipitation and temperature. The models include CCSM3 (warmer and dry summer through 2020), HADCM3 (warmer and dry summer through 2040), IPSL CM4 (wetter winter), MIROC 3.2 (warmer and wetter winter) and PCM (cooler and dry summer). They represented a wide range of conditions and also change by time.

After identifying the models, we downloaded the spatially downscaled climate model data from CMIP3 source developed by Bureau of Reclamation and other collaborators and subsequently temporally disaggregated them from monthly to daily to run the hydrology model.

The precipitation forecast is less certain. In other words, some models predicted a slightly increased precipitation between 2010 and 2060 while other models predicted a decrease in precipitation. However, the temperature increase is found to be consistent.

For the Treasure Valley region, changes in precipitation ranged between -3.8 % and 36%. Changes in temperature are expected to be between 0.02 and 3.9 °C. In the Rathdrum Prairie region, changes in precipitation are expected to be between -6.7% and 17.9 %.

Changes in temperature will likely be ranging between 0.1 and 3.5 °C. Overall, the chosen climate models showed a rise in temperature (0.31 °C to 0.42 °C/decade for Rathdrum Prairie and 0.34 °C to 0.46 °C/decade) and an increase in annual precipitation (4.7% to 5.8% for Rathdrum Prairie and 5.3% to 8.5% for Treasure Valley) over a period of next five decades between 2010-2060.

In order to study the response of the hydrology model due to changes in precipitation, we implemented the Soil Water Assessment Tool (SWAT) hydrology model to simulate the basin scale hydrologic response to changing climate. However, it is critical to calibrate the model based on the observed flow for multiple sub-basins in each basin. Therefore, we first calibrated the SWAT model for the Spokane River basin using the flows from Post Falls and Spokane. Similarly, we calibrated the model for the Boise River basin using the flows from Parma, Lucky Peak, Arrowrock, Twin Springs and Anderson Ranch. This calibration exercise resulted in 16 parameters adjusted for various processes within the basin including snowmelt, vegetation, groundwater and surface runoff. In both basins the model performance was evaluated using the R2 values and we obtained a value of 0.6 or higher and that is considered to be good in the modeling environment for extending the simulation framework with selected parameters to another period.

The SWAT hydrology model was implemented under future climate conditions using the newly calibrated parameters. Considering a wide range of precipitation and temperature outlook, we expected that predictions on the basin hydrology to express a broad range in streamflows, evapotranspiration and recharge during the simulation period of the entire 50 year period between 2010 and 2050. This was observed for the three emission scenarios

(A1B, A2 and B1).

We calculated the increase or decrease in flows from historic average flow. Therefore, when we state a decrease or an increase by certain flow rate, it is the difference in flows when compared with historic flows. Based on the average of eight sites (Twin Springs, Anderson Ranch, Arrowrock, Lucky Peak, Glenwood, Middleton, Caldwell and Parma) in the Boise River basin, the peak flows (March through June) appear to increase by 4117 cfs (A2), 3285 cfs (A1B) and 3917 cfs (B1). An eight site average of decrease in peak flows for the Boise River basin revealed the flows as 1223 cfs (A2), 1693 cfs (A1B) and 1366 cfs (B1) due to some scenarios where precipitation is predicted to be decreasing. Overall, the peak flow averages expected to increase by 621 cfs (A2), 300 cfs (A1B) and 436 cfs (B1). Thus, the high flows in the future will probably be higher than historic high flows.

We averaged the two site predictions (Post Falls and Spokane) in the Rathdrum Prairie basin to understand the peak flow trends. It was found that increases are expected to be about 2525 cfs (A2), 610 cfs (A1B) and 1899 cfs (B1) based on the two site average flows predicted by the model. The decreases in peakflows were higher than the flows predicted in the Boise River Basin. For example, a decrease in peak flows by 7303 cfs (A2), 7590 cfs (A1B) and 6029 cfs (B1) are also simulated by some scenarios that predict a decrease in precipitation. Again, the high flows in the future will probably be higher than historic high flows.

The low flows (July-Oct) predicted by the model have projected an average increase in the summertime flows by 195 cfs (A2), 77 cfs (A1B) and 336 cfs (B1) scenarios. Minimum low flows predicted by the model have projected decreasing flows by 622 cfs (A2), 662 cfs (A1B) and 607 cfs (B1).Overall, the low flow averages declined in the future by 281 cfs (A2), 303 cfs (A1B) and 328 cfs (B1). In the Rathdrum Prairie basin, for instance, a decrease in flow by 1037 cfs (A2), 903 cfs (A1B) and 6029 cfs (B1) is predicted. The maximum low flows are increasing by 1848 cfs (A2), 954 cfs (A1B) and 1635 cfs (B1). A minimal increase in the average low flows, rather than a decrease as in the Treasure Valley region, by 98 cfs (A2), 56 cfs (A1B) and 95cfs (B2) is simulated by these models. For both basins, the low flows are lower than (Treasure Valley) or about the same as that of the historic low flows.

We computed the volume of flow changes in the Boise River basin at Lucky Peak by integrating the area under the hydrograph. The expected increase in flow volumes are 201896 ac-ft (A2), 120547 ac-ft (A1B) and 265384 ac-ft (B1). The overall average when combining all of these flow volumes results in the flow volume increase by 195942 ac-ft.

We also anticipate a shift in the timing of snowmelt and this shift is advancing from the current peak melt period of May to April, by about 3-4 weeks. This has been consistent for both the basins. This is pretty typical of many regions in the Western U.S. which is expected to cause some management problems related to the water resources in the region. An earlier melt, if not stored, might cause some shortages in the system thereby possibly impacting various sectors including irrigated agriculture, hydro power and domestic as well as municipal water supply.

In the Boise River basin, depending on the climate scenario, a range in precipitation between 23 and 35 inches is probable and it has the cascading effect on the hydrological water balance components. This precipitation is subsequently partitioned into different water balance components, such as streamflow, evapotranspiration, soil moisture and recharge.

For instance, streamflows predicted by the model were between 10 and 19 inches and recharge from 4 to 8 inches. The other two components, evapotranspiration and soil water storage although are expected to change, under natural condition (without any human influence) as predicted by these models have shown lesser variability.

In the Rathdrum Prairie basin, precipitation is expected to range between 32 and 40 inches over the next decades, which in turn appeared to cause a range in streamflow (14-20 inches) and recharge (2-4 inches) estimates. Evapotranspiration varied between 15 and 19 inches under natural vegetation conditions. Soil water projections are between 6-8 inches.

It is also important to recognize that there are some uncertainties in our estimates and that can be attributed to GCM-produced precipitation and temperature, model parameters and structure (for instance reach gain or loss, residence time of aquifer recharge) and measured regulated flow, computed natural flow and its year-to-year variability.

Appendix 6: Summary of Ground Water Management Plan Status

On September 15, 2005, the Director of the Idaho Department of Water Resources adopted the Rathdrum Prairie Ground Water Management Plan. The plan was based on a recommended plan developed by the Rathdrum Prairie Ground Water Management Advisory Group. The plan set forth goals and actions which were intended to guide water resource management "to balance the protection of existing groundwater uses and water quality with the opportunity for future development, while encouraging water conservation." (A copy of the full plan is available at: http://www.idwr.idaho.gov/WaterInformation/GroundWaterManagement/RathdrumPrairie/PDFs/Final%20Order%20Rathdrum%20GWMA.pdf.)

Since the plan was adopted, some actions have been accomplished, others await implementation. The management plan provides a framework for management actions which would benefit the Rathdrum Prairie Comprehensive Management Plan implementation. The following review of the goals and actions set out in the plan is intended to guide the recommendations for implementing the aquifer Plan.

Goal 1: Technical data and quantification of water availability.

Actions to meet this goal included participation in the SVRP Hydrologic Project; continuing data acquisition; and adaptation of permitting conditions as new data was analyzed. Additionally, IDWR was directed to obtain hydrogeologic data as new wells are completed. All actions have either been accomplished or are in place.

Goal 2: Technical Data and quantification of water use.

Two actions defined under this goal were the establishment of a water measurement district and investigation of starting an adjudication. Since the Northern Idaho Adjudication was initiated successfully, IDWR determined that the establishment of a water measurement district, as an interim measure prior to the adjudication, was not practical. Upon completion of the adjudication, establishment of a permanent area-wide water district will be established.

Goal 3: Manage groundwater resources efficiently and fairly for all users.

Two actions identified included the establishment of a water district and evaluation of transfer applications to ensure consistency with local public interest and conservation of the resource. Both these actions are or will be implemented. As stated above, a permanent area-wide water district will be established once the adjudication is completed.

Goal 4: Encourage water purveyors, regulatory agencies and local and regional governments to plan and incorporate planning principles.

This goal did not lay out actions which IDWR could implement but to show support and encouragement. Elements within this goal included encouragement for municipal water providers to undertake long term plan under the Municipal Water Rights Act of 1996. Local jurisdictions were encouraged to require community water systems over individual wells.

Goal 5: Encourage water conservation efforts by all users of the resource.

Two action items were identified: conservation plans required for municipal purveyors and support for establishment of an aquifer-wide water conservation advisory committee. An additional list of measures was compiled for IDWR encouragement and assistance. This list included economic support for developing conservation plans; water conservation demonstration projects and educational activities; support for price structures to encourage water conservation; and, investigating strategies for using reclaimed wastewater. IDWR has implemented the requirement for conservation plan submission, but a final guidance document has not been completed. Draft Water Conservation Measures and Guidelines for Preparing Water Conservation Plans has been prepared and is available on the IDWR web pages, but has never been finalized. No actions have been taken to implement the other actions or suggestions.

Additional Actions

Seven additional actions were identified:

1. New domestic wells required to be authorized through permit (no Start Card). Implemented.

2. Protection against loss or forfeiture if non-use is due to conservation plan. Implemented, but unused.

3. Proper abandonment of wells, with consideration of use as monitoring well. Implemented.

4. Monitoring required for new wells, if deemed appropriate. Implemented.

5. Investigation of managed recharge. Not implemented.

6. Continued advisory committee activity. Regular meetings not held.

7. Annual review of plan and 5-year report to IDWR Director. Not implemented.

Appendix 7: Full Description of Ideas for the Framework for Regional Discussion

Develop a plan for regional engagement to promote collaborative bi-state SVRP aquifer management. While the specific elements of such a framework would be determined by Idaho and Washington, the study effort has helped highlight some principles that may be useful. Several are noted below, along with specific considerations for the Board.

- The initial effort should be to assemble a manageable-sized regional framework planning group from both states to develop the fuller framework itself (this could include ground rules, process definition, goals, etc.).
- The USGS aquifer study effort provides a possible template, along with strong working relationships, for future collaboration, as well as funding sources.
- A regional framework should be equitable for each state, and be inclusive of tribal governments as well as stakeholders across the region.
- A regional framework should acknowledge the range of economic, environmental and other interests related to the SVRPA and seek to find ways to support that range of interests.
- The focus of a regional framework should begin with issues and efforts that are currently possible with existing governance: working toward common definitions, measurement standards, water use data, mutual conservation and efficiency goals, and further refinement, where needed, of the aquifer as well as groundwater and surface water interactions.
- A regional framework may or may not need to result in formal governance mechanisms; it should be flexible in considering different approaches for collaborative water management. The Moscow-Pullman aquifer effort may provide useful examples in this regard.
- A regional framework should look for ways to constructively integrate with other local and regional efforts, such as water system planning, watershed planning, ongoing adjudication, and similar efforts.

Appendix 8: Aquifer Protection District

The IWRB supports cooperation with the APD to accomplish the following:

Strategy # 1: Encourage the support and development of existing and future applicable programs to monitor, enhance, and model water quality concerns.

- Emphasize continuance and expansion of existing programs and plans, which have been successful in protecting and enhancing the quality of the aquifer. In some cases, we need either to bolster or enforce plans that have not been implemented to their full potential; or develop new plans to fill voids or identify areas that need to be addressed.
- Continue funding for long term monitoring to provide for trend analysis of RPA health.
- Encourage development of fate and transport models to enhance response to contamination events and long term planning to avoid contamination.
- Explore whether there are opportunities to adapt existing models, or develop new models, to determine when and where quality problems will occur. This may require modifying the models so they can be applied at a micro level.
- Develop and expand existing aquifer programs to include basin-wide consideration, such as threats to water quality on a watershed basis.
- Ensure programs relating to water quality and aquifer protection should not be subject to short-term changes in departmental or administrative leadership. Create programs that support long-term vision.

Strategy # 2: Mitigate the impacts of stormwater run off. Stormwater runoff from developed lands can contain a variety of pollutants that can adversely affect water quality. As land development increases, the Advisory Committee recognizes that mitigating the impacts of stormwater run off is essential to protecting the quality of water in the aquifer.

- Promote pretreatment methods for stormwater.
- Encourage permitting agencies to review and improve stormwater permits at regular intervals. Review operations and maintenance overview of systems, and ensure they are maintained as intended.
- Promote the use of best management practices in development design. Although this is not a comprehensive treatment mechanism, the Advisory Committee believes this alternative is more desirable than mere collection in urban areas, which is difficult to deal with.
- Monitor for an increase of chloride or other contaminants in runoff. Develop strategies to address the timing issue of chloride increases following a freeze and use of road salts.
- Consider how to assess and approach the effects of nutrient pollution from both developed and agricultural lands.
- Develop incentives to retrofit non-conforming systems.
- Identify pollutions that create serious problems and identify programs that help reduce and eliminate those pollutants.
- The Advisory Committee encourages utilization of future technologies that enhance the stormwater treatment strategies for the RPA.

Strategy # 3: Promote practices that prevent accidental or incidental releases of contaminants over the RPA.

• Support and expand regular monitoring programs with vigilance to the risk of incidental releases of industrial pollution. Encourage coordination and communication between those regulatory groups to enhance the protection of the aquifer.

• Where applicable, require increased monitoring and reporting of petroleum pipelines by owner and operation entities.

Strategy # 4: Develop a program to account for wellheads over RPA and proper abandonment of unused wellheads. Wellhead contamination is possible if well head construction lacks a seal and allows for contamination.

• Include consideration of wellhead contamination in continued or enhanced regulations and in periodic water quality threat assessments.

• Support proper decommissioning of private wells that should no longer be in use. Support creation of incentives for decommissioning.

• Evaluate unused wells to see if they can and/or should be used for other purposes before sealing against potential contamination (instead of decommissioning).

• Create an educational program to support public awareness of the issue through a coordinated effort with local jurisdictions as a health and safety issue.

Strategy # 5: Support continued monitoring and management of potential water quality issues contained in RPA watershed.

• Determine whether monitoring of lake metals is being completed at the appropriate scale and time intervals (both length and frequency of testing).

• Encourage support or increased resources for monitoring of lake metals.

• Ensure that the prospect of catastrophic events involving the Lake are considered, such as a sudden shift from aerobic to anaerobic conditions.

• Ensure that potential contamination due to dredging is considered in light of potential problems with heavy metal migration.

• Apply for grants to study the potential for mobilization of contaminants in Coeur d'Alene Lake.

• Encourage support or increased resources for monitoring of lake contamination.

Strategy # 6: Encourage wastewater disposal methods that benefit the RPA.

• Develop strategies to maintain standards of nondegradation that can include wastewater reuse such as purple pipe.

• Conduct study to determine cumulative effects of wasterwater disposal methods, including septic systems.

• Determine the permissible land use and density that would not degrade the RPA greater than existing regulations. Account for the aggregate impact of contamination.

• Avoid damaging the water quality with wastewater disposal systems.

• Develop better monitoring or consider study on impacts from septic systems.

Strategy # 7: Prepare for emerging or unknown threats. Traces of personal care products and pharmaceuticals in our water systems are a growing concern, and issues may emerge in the edges of the aquifer where there is less dilution due to the slow movement of water. The Advisory Committee is also concerned about activities beyond the regulatory boundary of the aquifer that may threaten water quality in the future. To address this issue, the Advisory Committee proposes the following:

• Expand regulations beyond aquifer boundaries to maintain water quality at a watershed scale.

• Develop strategy to address overarching federal regulations that may conflict with regional or local needs. (i.e. Pipeline Safety Act)

• Encourage testing for and regulating new compounds that may be proven or suspected of causing potential harm.

• Continue or enhance existing water quality monitoring programs.

• Encourage modification of existing, or development of new models to assist in determining or predicting water quality impacts on the RPA. Continue funding for long-term monitoring to provide trend analysis of RPA health and for the development of fate and transport models to enhance the response to contamination events.

BEFORE THE IDAHO WATER RESOURCE BOARD

IN THE MATTER OF THE RATHDRUM PRAIRIE AQUIFER COMPREHENSIVE AQUIFER MANAGEMENT PLAN ______________________	)))))	RESOLUTION

WHEREAS, the Idaho Water Resource Board (Board), pursuant to its planning authorities in Article XV, Section 7 of the Idaho Constitution, and Idaho Code 42-1779, has completed a Comprehensive Aquifer Management Plan for the Rathdrum Prairie Aquifer as directed by House Bill No. 428 passed and approved by the 2008 Idaho Legislature; and

WHEREAS, the Board is directed to identify goals and objectives, as well as make recommendations for improving, managing, developing or conserving the water resources of the aquifer in the public interest; and

WHEREAS, the Board has sought and received substantial public participation and comment throughout the planning process.

NOW, THEREFORE, BE IT RESOLVED that the Board hereby adopts the attached Rathdrum Prairie Comprehensive Aquifer Management Plan and directs that it be submitted to the Idaho Legislature.

DATED this 29th day of July, 2011.

TERRY T UHLING, Chairman
Idaho Water Resource Board

ATTEST: ______________________

BOB GRAHAM, Secretary

IDAHO WATER RESOURCE BOARD