

CHAPTER 7. CONCLUSIONS

This report represents the first comprehensive water resources data compilation and assessment for WRIA 54. The conclusions of this work are presented below, organized by report chapter.

WATERSHED CHARACTERISTICS

Much water-resource information exists for the main stem Spokane River throughout WRIA 54, but very little exists for most of the tributaries, such as Deep and Coulee Creeks, Spring Creek, and Mill Creek. While the main stem Spokane River is by far the largest surface water body in the WRIA and therefore may warrant much focus, it will be impossible to comprehensively manage the watershed without better data for the tributary subbasins. This need is particularly acute in the Deep Creek, Coulee Creek, Airway and Long Lake North subbasins, where development pressure is rapidly changing the character of the areas.

Based on available data, it appears that the SVRP aquifer is a significant source of flow for the Spokane River in WRIA 54. It follows that the WRIA 54 planning unit will have a keen interest in the quality and quantity of water in the SVRP aquifer that discharges into the Spokane River between Latah (Hangman) Creek and Nine Mile Falls Dam.

A number of groundwater aquifers warrant further investigative studies, as they either hold promise for water supply purposes or appear to be already over utilized in areas. The characteristics of most of these aquifers within the watershed are not currently well-understood. These include the Columbia River Basalt Group aquifers (Wanapum and Grande Ronde) that are present in most of the southern portion of the WRIA (south of the Spokane River), the paleochannel aquifers, and the Lower Chamokane Valley Aquifer.

Groundwater/surface water interaction is a dynamic component of the intra-basin water balance throughout WRIA 54. This exchange of water is not well understood below Lake Spokane (Long Lake) on the Spokane River, and even less well documented in tributary subbasins. Hydraulic continuity between the Upper Chamokane Valley Aquifer and Chamokane Creek, is believed to be significant, based on historical observations of water levels, stream flow and water well pumping.

The subbasin delineations used in this document, drawn from the Washington Department of Natural Resources Watershed Administrative Unit designations, may not be a logical breakdown for planning purposes in all cases. For example, it is likely that groundwater flow in CRBG aquifers does not follow subbasin boundaries. Further groundwater-related investigations should consider alternate study area delineations.

The Airway subbasin is an example of a subbasin delineation that may need to be revised as watershed planning continues in WRIA 54. This subbasin covers a very diverse area, including portions of the City of Spokane (some of the most densely populated portions of the WRIA) as well as rural areas north and west of the City of Airway Heights. This subbasin also includes very distinct regions from a water resources perspective, with the SVRP aquifer and Spokane River dominating the eastern portion of the subbasin and the CRBG aquifers, paleochannel aquifers and Deep Creek drainage dominating the western portion.

The Cities of Spokane, Medical Lake and Reardan lie only partially in WRIA 54. This Level 1 Assessment attempted to accurately portray the water rights and water use for these cities as they pertain to WRIA 54. Inter-WRIA planning would benefit these communities, in order to ensure that consistency and a regional viewpoint are reflected in WRIA 54 Watershed Plan recommendations that affect these jurisdictions.

WATER RIGHTS AND WATER USE

Water right claims dominate the recorded water documents in WRIA 54, and uncertainty about the true quantity of water appropriated through these claims restricts the ability to effectively manage water resources in WRIA 54. The understanding of the probable appropriation could be refined through additional targeted studies, but only an adjudication can actually validate these potential appropriations. The first targeted studies we recommend are the following:

- Investigate the largest claims to evaluate the likelihood that they are actively being used, and if so, the nature of the use.
- Further investigate potential duplicate claims to establish greater confidence that they can be removed from water-rights calculations.
- Because so many of the claims are to groundwater for small quantities, it is likely that many of these serve single domestic needs. The estimates for permit-exempt wells in this document may overlap significantly with this category of claims. A study to evaluate the magnitude of this overlap would help refine the understanding of this potential appropriation.

A very large (25,680 acre-foot per year) irrigation water right is held by the Spokane Tribe for Chamokane Creek and its tributaries and portions of the underlying groundwater. This right was quantified through a federal adjudication, which also granted the tribe rights to a minimum 24 cfs flow for fish habitat in Chamokane Creek.

The estimates presented for permit-exempt wells are based on standard methods using population, water right, and public water system service area data. These estimates are likely to be fairly accurate, but because there is almost no information to verify the location and use of these wells, it is impossible to evaluate the true impacts of permit-exempt wells. For exempt wells that are simply providing water to one home, the individual impact is not likely to be significant. Significant impacts may be occurring where exempt wells provide significant water for agricultural or industrial purposes, for multiple homes, or where there is a high density of permit exempt wells.

Estimated actual water use exceeded potential water right appropriations in three subbasins: Harker Canyon, Little Chamokane, and Pitney. The reason for this should be evaluated further, and may be the result of transfer of water between subbasins (a water right in one subbasin with actual use in a different subbasin). In some heavily populated subbasins, actual current water use that exceeds current allocated withdrawals may not be identified in this analysis if the estimates of allocated withdrawal include inchoate water rights (currently unused portions of water rights) held by municipal water purveyors in those subbasins.

WATER BALANCE

A frequent objective of incorporating a water balance into watershed planning efforts is to understand the magnitude of each of the water balance components (precipitation, surface water inflow, net demand, etc.) and to identify where surpluses and deficits exist, both spatially throughout the watershed, and seasonally throughout the year. In actual practice, a water balance that spans such a large planning area as WRIA 54

has limited utility for water-resource allocation management, but it does provide useful information for general planning, education, and targeting further detailed work efforts.

In terms of annual water volume, the flow of the Spokane River dominates the WRIA 54 water balance and, because of frequent measurements and a relatively long period of record, is relatively well understood. The other water balance components are smaller in volume than surface water flow, but also are significant with respect to water resource management. For example, water balance components such as groundwater flow and net demand could be critical factors in water resource management at the basin and particularly subbasin level. These components are among the least understood at this time.

The water balance performed for this report allowed for the identification of gaps in the current understanding of hydrologic processes within the watershed. Many of these are summarized in the below *Data Gaps* section.

WATER AVAILABILITY

One of the primary goals of watershed planning is to estimate the amount of water available for future allocation in the watershed. In WRIA 54, gaps in the existing data set limit the understanding of watershed hydrology and make a comprehensive determination of water availability difficult. Water availability considerations for WRIA 54 include the following:

- Surface water could be available for future allocation from the Lower Spokane River. This determination will depend upon, among other factors, the in-stream flow analysis currently being performed for the WRIA 54 Planning Unit.
- Surface water could possibly be available for future allocation from tributaries of the Lower Spokane River if further investigation and analysis show that it could be done with no negative impact. Stream flow data are currently not available for most of the tributaries and would be necessary before allocations are feasible. Though a number of these tributaries are intermittent (do not flow continuously throughout the year), continuous supply could be achieved by implementing water storage projects. This determination also will depend upon, among other factors, the in-stream flow analysis currently being performed for the WRIA 54 Planning Unit.
- The paleochannel aquifers appear to be a relatively promising source for additional groundwater allocation. A review of existing data suggests that these aquifers are relatively transmissive and currently stable with regard to long-term groundwater elevation. Based on the relatively low number of wells currently pumping from paleochannel aquifers and the limited capture zone anticipated, well interference issues likely would be less extensive than in CRBG aquifers.
- The CRBG aquifers in the West Plains area appear to have significant existing groundwater mining and well interference issues, suggesting that these aquifers could be over-allocated in the West Plains area. Additional allocation of this resource should be limited until the impact of future allocation is evaluated by groundwater flow modeling.
- Groundwater elevation data associated with CRBG aquifers in the southwest portion of WRIA 54 are limited. However, based on the current distribution of wells in the basin and aquifer hydraulic characteristics, there could be opportunity for significant additional withdrawal in this area.
- The SVRP Aquifer is highly transmissive and an important source of water throughout the region. Further use of this resource in WRIA 54 will depend on the results of the ongoing

U.S. Geological Survey bi-state investigation, ongoing and planned water right adjudication efforts, and in-stream flow analysis for the Lower Spokane River.

- The basement rock aquifers are of limited permeability, and associated well yields generally will be low. The aquifers generally are reliable only for low-volume domestic use.

FUTURE WATER NEEDS

Future consumptive water needs, which are anticipated to be primarily for domestic supply (this includes associated commercial/industrial uses), are expected to increase by approximately 57 percent by 2025, based on WRIA 54 growth projections. This increase will likely be focused in two areas—the West Plains region of Spokane County and near the Spokane River downstream from the City of Spokane—making the likely actual increase in water demand more in those two areas. Some of these areas are in established water service areas, but existing purveyor systems may not be fully built at this point. Other parts of these growth areas are not in established water service areas (see Figure 7-1).

Municipal purveyors hold inchoate water rights that will help meet this future demand. The magnitude of inchoate rights differs among purveyors, however, and may not be matched to where actual growth in water demand will occur. This should be approached as a regional issue through a coordinated planning effort.

Water conservation is an important component in meeting current and future water supply needs. All municipal purveyors currently have conservation programs described in their water system plans; implementation of these programs, as well as additional conservation activities, will produce significant water savings. Because outdoor water use (residential, commercial, and agricultural irrigation) is such a large component of water use in WRIA 54, conservation efforts targeted to reducing outdoor water use will be most fruitful. For example, outdoor water use accounts for approximately three-quarters of the water consumed by the Group A and Group B systems alone in WRIA 54.

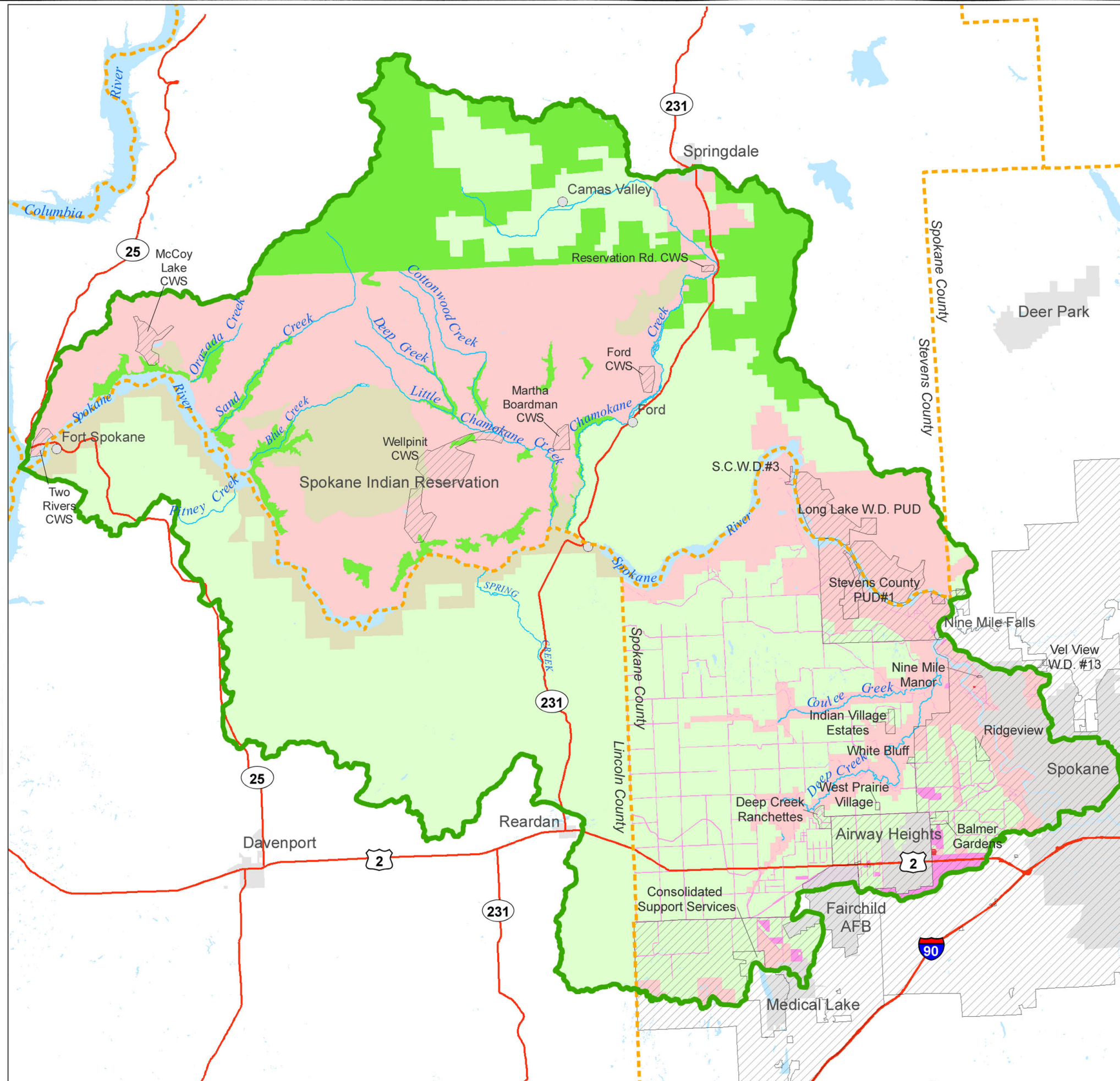
Water needs for in-stream flow are being evaluated through the WRIA 54/57 Instream Flow Study currently being conducted by the Tetra Tech project team. Results of the instream flow study will help quantify stream flow requirements for fish in the main stem Spokane River, Deep Creek, Coulee Creek, Little Chamokane Creek, and Lower Spring Creek. These results will be integrated with other in-stream flow needs and technical assessment results by the planning unit as they develop the WRIA 54 Watershed Plan.

WATER QUALITY

The water quality information provided with this Level 1 assessment is limited to a brief summary of water quality information primarily related to the Spokane River Dissolved Oxygen TMDL. The planning unit intends to undertake additional water quality assessment work under a separate project, funded through a supplemental grant from the Department of Ecology.

Water quality impairments caused by excess nutrients (contributing to low dissolved oxygen levels), metals, and PCBs have been identified in WRIA 54, and Ecology is currently addressing these impairments through development and implementation of Total Maximum Daily Load (TMDL), or Water Cleanup Plans. The excess nutrients and low dissolved oxygen may be related to stream flow levels.

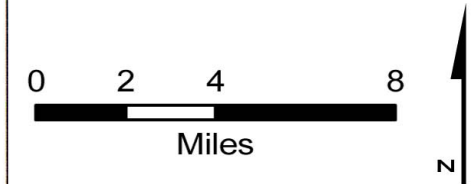
Figure 7-1
WRIA 54
Public Water
System Service and
Future Land Use



Legend

- Major Road
- County Boundary
- Stream
- Public Water Service Area
- WRIA54 Boundary
- Waterbody
- Jurisdiction/Tribal
- Future Land Use**
- Agriculture
- Barren (Exposed rock/soil, mining)
- Commercial/Industrial/Transportation
- Forest
- High Intensity Residential
- Low Intensity Residential
- Openland (Recreation, grasslands, shrublands)
- Wetland

Data Sources:
 Streets, Waterbodies, Streams,
 County Boundary, Spokane Indian
 Reservation - Washington DNR
 Juristictions - County Data
 WRIA Boundary - Washington DOE
 Water Distribution - Stevens/Spokane County
 Future Land Use - County Zoning Data



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 Map Produced 01/16/2007

DATA GAPS

Data gaps that were identified during the technical assessment limit our understanding of hydrologic processes within WRIA 54 and could hinder future water resource management efforts. These include the following:

- Stream Flow
 - With the exception of the Little Spokane River, Latah (Hangman) Creek, and Blue Creek, stream flow data for tributaries to the Spokane River are limited. This limits the understanding of hydrologic processes on a subbasin scale.
 - The amount of surface water entering WRIA 54 from the Little Spokane River is poorly defined because a stream gauge is not located near the Spokane River confluence.
 - The amount of surface water exiting the watershed in the Spokane River cannot be accurately estimated because a backwater portion of the river varies with Lake Roosevelt pool elevation that extends a significant distance into the watershed.
 - Groundwater/surface water interaction is not well defined downstream of Lake Spokane (Long Lake); it could have a significant impact on the watershed-scale water balance.
- Groundwater
 - Previous estimates regarding SVRP discharge to the Spokane River in WRIA 54 are conflicting in the literature and should be reevaluated when the USGS bi-state study is completed.
 - The amount of groundwater entering and exiting the watershed through various aquifers was estimated from existing information and is of limited precision. Accurately delineating groundwater flow on a watershed scale is a massive undertaking. Targeted groundwater studies should be considered by prioritizing aquifers with significant water resource management challenges.
 - Previous hydrogeologic studies in WRIA 54 have focused primarily on the SVRP aquifer and CRBG and paleochannel aquifers within the West Plains area. In the rest of the watershed, the hydrogeology is largely undefined. Data used to estimate aquifer thickness and extent, hydraulic conductivity, and hydraulic gradient for the bedrock and sedimentary aquifer were limited to information provided in a relatively small number of domestic water well reports, boring logs, and regional and local studies.
- Climate
 - Precipitation inputs should be reevaluated with 800-meter resolution PRISM data that were published near the completion of this technical assessment.
 - The coarse scale and the general nature of descriptions for non-agricultural land use data could lead to errors in evapotranspiration estimates and an overestimate for total evapotranspiration.
- Net Demand
 - Population estimates were derived by including all census blocks completely or partially located within the watershed, likely resulting in overestimation.
 - The calculation of total commercial or industrial water right allocations did not incorporate values for water right certificates, permits or claims that did not have a quantity associated with them in the source databases.

Addressing all of these data gaps would be a time-consuming and expensive task that may not be necessary to achieve the water management goals of the WRIA 54 Planning Unit. Targeted investigations that increase understanding of specific subbasins or components of the watershed water balance could provide more short- and long-term benefit.

MODELING CONSIDERATIONS

The construction of a comprehensive hydrologic model (such as the model developed for WRIA 55/57) that encompasses all of the WRIA 54 basin would be a major undertaking and should be initiated only after careful examination of the potential benefits and probable cost. This type of model can be a planning tool to determine the potential impact of future water resource allocations on existing water rights, stream flow, etc. Because of the data gaps identified in the water balance analysis, a significant data acquisition effort would be required before a comprehensive hydrologic model could be constructed for WRIA 54. Significant data collection would be required in portions of the watershed that have relatively limited water resource allocation issues at this time.

It is our opinion that modeling resources would be better spent concentrating investigative efforts in key areas within the watershed that are not addressed by previous and ongoing modeling efforts. A targeted model that likely would provide significant water resource planning benefit for the cost would be a groundwater flow model that encompasses the West Plains area. Such a model could achieve the following objectives:

- Characterization of the extent of groundwater mining in CRBG aquifers under existing conditions and various future scenarios
- Estimation of the groundwater resource potential of the paleochannel aquifers
- Evaluation of the hydraulic connection between the CRBG and paleochannel aquifers
- Estimation of the diminishment or augmentation of groundwater discharge (to the Spokane River and/or its tributaries) as a function of well discharge and development scenarios
- Evaluation of the potential for successful aquifer storage and recovery projects within CRBG and/or paleochannel aquifers.

Alternatively, a larger model grid could be developed to evaluate the groundwater resource potential within the CRBG that includes the southwest portion of WRIA 54 in addition to the West Plains area.

The Spokane Tribe has obtained funding to potentially run the CEQUAL water quality model for the Spokane Arm of Lake Roosevelt, in order to understand the impacts of flow on water quality. This work could be used to further address in-stream flow needs in the non-free-flowing reaches of the Lower Spokane River.