Executive Summary

Stakeholders in the Rock-Glade Watershed have taken the initiative to proceed with watershed planning as provided by the State of Washington under the Watershed Management Act (Chapter 90.82 of the Revised Code of Washington [RCW]). RCW 90.82 provides the framework under which government organizations and local citizens representing a range of water resource interests work collaboratively to assess water resources and develop watershed plans. The Rock-Glade Watershed, encompassing portions of Benton, Klickitat, and Yakima counties in south-central Washington, comprises the state's Water Resource Inventory Area (WRIA) 31.

Phase I of the state watershed planning process included the initiating governments that chose to participate in the planning process (i.e., Benton and Klickitat counties and City of Kennewick) establishing the WRIA 31 Planning Unit, which is composed of stakeholders representing a wide range of water resource interests in WRIA 31. The initiating governments chose to include water quantity, water quality, and habitat elements as part of watershed planning for WRIA 31.

Phase II of the watershed planning process is the assessment phase, which provides the technical basis for preparation of a Watershed Management Plan in Phase III of the process. This document represents the Phase II Level 1 technical assessment. This Level 1 Assessment is intended to compile and assimilate available information and describe what is known and unknown (data gaps) regarding water and instream habitat resources in the watershed, and thereby make recommendations for Phase II Level 2 assessment to address the identified data gaps if needed to initiate Phase III planning.

WRIA 31 is divided into four subbasins for the purposes of this Level 1 Assessment. Those subbasins are, from west to east, Rock Creek, Wood/Alder Creeks, Glade/Fourmile Creeks, and Kennewick. The entire watershed is arid with mean annual precipitation decreasing from 16 inches/year in the Rock Creek subbasin on the west to 8 inches/year in the Kennewick subbasin on the east. As of year 2000, the total population of WRIA 31 was approximately 67,600 persons, with more than 65,000 of those residing within the Kennewick subbasin.

The remainder of this Executive Summary includes brief overviews of the Level 1 assessment findings and recommendations for the water quantity, water quality, and habitat elements.

Water Quantity

Very limited streamflow data are available for WRIA 31. Only two flow gages in WRIA 31 (near mouths of Rock and Alder Creeks) have continuous flow data, and the data are limited to the 1960s. This gaging period occurred within a cool/wet climatic cycle (Pacific Decadal Oscillation [PDO]). Therefore, average streamflow conditions calculated from these data may overestimate long-term average conditions spanning both wet/cool and warm/dry PDO cycles.

The available streamflow data indicate that all WRIA 31 streams are ephemeral (lack dry season flow) except in localized spring-fed reaches. Information from General Land Office cadastral surveys (1860s) provides a perspective on historical streamflows based on recorded visual observations. The survey identifies no significant flows and several areas of intermittent flows in Rock Creek which has the highest precipitation and streamflows of any stream in the WRIA. This historical information, coupled with observed ephemeral conditions based on the USGS stream gaging data in the 1960's occurring under minimal water use, suggests that streamflows in Rock Creek is naturally ephemeral rather than a condition created by human development. If Rock Creek is naturally ephemeral, then it is probable that streams to the east of it (lower precipitation) are also naturally ephemeral except in localized spring-fed reaches (e.g., at the mouth of Alder Creek). Under current conditions, irrigation return flows supply dry season flows in some streams (e.g., Glade Creek).

The major aquifer systems in WRIA 31 are sufficiently well understood to proceed with watershed plan development. The primary aquifers are those of the Columbia River Basalt system, which includes from shallowest to deepest (geologically youngest to oldest) the Saddle Mountains, Wanapum, and Grande Ronde Basalts. Unconsolidated overburden (often referred to as alluvium) forms a relatively thin mantle over the basalts in much of the watershed. In addition, gravel deposits along the Columbia River are also utilized as a groundwater supply source for water supplies. Groundwater in these gravels is in close hydraulic connection with surface waters of the Columbia River. The Saddle Mountains Basalt and Wanapum Basalts, and in certain locations the Columbia River gravels, are the primary groundwater sources for larger irrigation withdrawals. The shallow Alluvial Aquifer supplies domestic uses, while the deeper Grande Ronde is largely unexplored in WRIA 31. For WRIA 31 as a whole, Columbia River surface water is a larger supply source than all groundwater sources combined.

Based on regional modeling published in 1990 by the USGS, current groundwater recharge across WRIA 31 as a whole is roughly double that under assumed predevelopment conditions (prior to significant human land use modification or development). The recharge increase is a result of return flows from irrigation water supplied from the Columbia River. Consequently, the recharge increase occurs primarily in the main areas of irrigated agriculture – the Glade/Fourmile and Kennewick subbasins.

The abundant presence of springs (groundwater discharge) documents hydraulic continuity between shallow groundwater and streams in WRIA 31 – particularly in the Rock and Wood/Alder Creeks subbasins. However, the quantity of spring discharge is generally insufficient to maintain streamflow into the dry season, with the exception of the mouth of Alder Creek. Hydraulic continuity between the basalt aquifers and the Columbia River is inferred based on regional groundwater flow directions.

Long-term water level monitoring completed by the Washington State Department of Ecology (Ecology) and others documents substantial water level declines in the Wanapum Basalt Aquifer in areas of intensive irrigation (Glade/Fourmile and some of Wood/Alder subbasins). In these same areas, water levels in the overlying Saddle Mountains Basalt Aquifer have risen as a result of irrigation return flows.

A total annual volume of approximately 806,000 acre-feet/year is appropriated through water rights in WRIA 31. The 1.27 million acre-feet/year McNary Dam hydroelectric

water right is excluded from the analysis since it is largely non-consumptive. Columbia River diversions and groundwater withdrawals comprise 84 and 16 percent, respectively, of the 806,000 acre-feet/year total annual appropriation. The overwhelming majority (89 percent) of this appropriated water is for irrigation use. Likewise, 85 percent of the new (instantaneous) water right quantities applied for in the WRIA is for irrigation use. The majority of appropriated water is within the Glade/Fourmile and Kennewick subbasins (84 and 13 percent by volume), with the Rock Creek and Wood/Alder Creeks subbasins comprising only 1 and 2 percent of the total volume, respectively.

Estimates of current actual water use on the subbasin scale are considered adequate to support watershed planning. The estimated total annual water use in WRIA 31 is approximately 640,000 acre-feet/year (approximately 79% of the total annual appropriation). Of this total, an estimated 71 percent is supplied from the Columbia River, 18 percent from the Yakima River (Kennewick and Columbia Irrigation Districts), and 11 percent from groundwater sources. Irrigation represents 97 percent of all water use in WRIA 31, with residential and non-residential uses accounting for roughly 1 and 2 percent, respectively. Similar to the distribution of water rights, the majority of estimated water use is within the Glade/Fourmile and Kennewick subbasins (77 and 20 percent by volume), with the Rock Creek and Wood/Alder Creeks subbasins comprising only 1 and 2 percent of the total volume, respectively.

A water balance was developed for each subbasin as a first step in understanding the physical availability of water on the subbasin scale. The water balances made use of the USGS' 1990 modeling to represent predevelopment water balance conditions. The water use estimates developed for this Level 1 Assessment, including non-consumptive return flows, were then added to the USGS' predeveloped water balance to represent the current (developed) water balance.

Although they are subbasin-scale approximations, an important finding from the water balance exercise was estimation of the current net groundwater recharge for each subbasin. The net recharge equals natural groundwater recharge plus return flow recharge minus groundwater pumping, and thus represents a groundwater balance. A positive net recharge indicates greater recharge to the groundwater system than pumping withdrawal from it, and vice versa. Comparing predeveloped and current net recharge values can highlight general trends in sustainable use vs. overdraft of groundwater resources on the subbasin scale. The water balance net groundwater recharge findings are as follow:

- In the Rock Creek subbasin, the current net groundwater recharge is essentially unchanged from the predeveloped condition, consistent with lack of significant groundwater use in the subbasin.
- In the Wood/Alder Creeks subbasin, current net recharge has been reduced to approximately ¼ of the predeveloped condition, consistent with moderate water level declines measured in some subbasin wells.
- In the Glade/Fourmile subbasin, current net recharge is approximately -23,000 acre-feet/year (annual depletion) indicating groundwater use exceeding total recharge, consistent with very large measured water level declines in some subbasin wells.

- In the Kennewick subbasin, current net recharge is more than 13 times greater than the predeveloped condition, as a result of irrigation return flows from the large volume of imported Yakima River water and relatively limited groundwater pumping.

It is important to recognize that these subbasin-scale estimates will not accurately reflect hydrologic conditions at all locations within a subbasin. The characteristics and uses of the different aquifers in a subbasin or smaller area need to be considered in evaluating water availability, and developing water resource management strategies as part of the WRIA 31 watershed management plan.

Based on the Level 1 Assessment findings, the following recommendations regarding water quantity in WRIA 31 are provided:

- **Stream Gaging.** Establishing streamflow gaging stations near the mouths of reported salmonid-bearing streams (Rock, Chapman, and Wood Gulch Creeks) is recommended if the Planning Unit is interested in evaluating opportunities for habitat restoration/enhancement. The streamflow data would provide better understanding of instream habitat limiting factors and thus feasible habitat opportunities. This recommendation need not be implemented prior to initiating Phase III watershed planning.
- **Groundwater Level Monitoring.** It is recommended that the Planning Unit continue on-going coordination with Ecology to ensure that their WRIA-wide water level monitoring program continues. Long-term water level trends from these data and annual pumpage information are fundamental to assessing future sustainability of the groundwater resource. This recommendation need not be implemented prior to initiating Phase III watershed planning.
- **Evaluate Groundwater Development Potential of Grande Ronde Basalt.** The Grande Ronde Basalt has not been extensively explored as a prospective water supply source in WRIA 31. Consequently, the potential yield and water quality of this aquifer is uncertain over most of the WRIA. While this aquifer's depth is a potential constraint in terms of the cost to develop this source, it may be an advantage in terms of hydraulic isolation from senior water right holders in shallower aquifers and surface waters including the Columbia River. This recommendation need not be implemented prior to initiating Phase III watershed planning.
- **Evaluate Water Storage Opportunities.** Given the quantities of water in the Columbia River and in aquifers throughout WRIA 31, there is likely adequate water available on an annual (seasonal) basis to support future growth in WRIA 31 and meet instream resource demands (including Columbia River). However, the water is not available uniformly throughout the year. Water storage is one solution to the timing problem affording the opportunity to store excess water when available in the winter and deliver it during the summer when demand is greatest. The recently initiated WRIA 31 supplemental water storage project focuses on application of aquifer storage and recovery (ASR) in the City of Kennewick and the Glade/Fourmile subbasin. Knowledge gained through that project can be applied as a starting point for evaluating ASR opportunities anywhere in the WRIA. While ASR is likely technically feasible across much of the WRIA, the practicality of its application will likely rely more on legal (water rights) and economic considerations. Development

of surface reservoirs is also a storage option to consider as part of the watershed management plan. The findings and recommendations from the ongoing supplemental water storage project will provide sufficient information to incorporate water storage into Phase III watershed planning.

Water Quality

Based on the available water quality data, the primary water quality concerns in WRIA 31 are:

- Water temperature in Rock Creek, which is likely the most important WRIA 31 stream in terms of instream habitat; and
- Nitrate in shallow groundwater of the Glade/Fourmile subbasin. This is potentially a public health concern for people obtaining their water supply from shallow domestic wells in this subbasin.

The recently initiated WRIA 31 supplemental water quality project includes assessing existing data and collection of new data related to each of these subbasin-specific issues. With the exception of obtaining water quality information for the Grande Ronde aquifer to assess its suitability for water supply, the findings and recommendations from the ongoing supplemental water quality project will provide sufficient information to initiate Phase III watershed planning.

Fish Habitat

Instream habitat is of greatest interest in those WRIA 31 streams where anadromous salmonids have reportedly been observed based on available sources, specifically Rock Creek (steelhead, chinook salmon), Chapman Creek (steelhead, chinook and coho salmon) and Wood Gulch (steelhead). The existing information (published or otherwise publicly available) regarding current fish habitat conditions in those streams is negligible.

In late June 2004, the authors completed a reconnaissance survey of portions of the WRIA 31 streams with emphasis on Rock Creek and Chapman Creek. The current physical conditions (hydrology, channel substrate, riparian vegetation, etc.) can be compared against historical conditions determined from review of GLO cadastral surveys completed in 1867 and 1868 (reflecting average to wet conditions). For example, in terms of presence/absence of riparian vegetation in the Rock Creek subbasin, no differences were noted between today's conditions and the conditions of 1867 and 1868; however, differences in density or width of riparian stands could not be determined from the GLO notes. Rock Creek channel characteristics also appear to be similar to those noted in the 1860s survey (e.g., broad rocky reaches), with the exception that the lowermost reach may be somewhat wider today than historically.

All of the streams in the WRIA become spatially intermittent during summer except for localized spring-fed reaches. Based on the historical information and the small quantity of water currently withdrawn within the Rock Creek subbasin for out of stream use, the current flow regime appears to be the natural hydrologic condition. The natural stream hydrology may therefore be a limiting factor for instream habitat.

All factors considered, Rock Creek is expected to have highest potential for instream habitat. The road density in the Rock Creek subbasin is very low relative to most basins in eastern Washington, and most of the roads are located on ridge tops or a considerable distance from the stream network. Given the low road density and their configuration in the Rock Creek subbasin, and the magnitude of effects from roads found in other studies, it is unlikely that roads have a significant effect on hydrology in this subbasin. However, in localized areas some roads may be affecting habitat through erosion of the road bed.

The renewed streamflow gaging recommended for Rock Creek, coupled with evaluation of the extensive water temperature data collected to date (part of supplemental water quality project for Rock Creek), will help verify hydrologic conditions in Rock Creek. The supplemental water quality project also includes preliminary evaluation of aerial photographs to provide better understanding of changes in riparian vegetation over time, particularly in response to flood events. All of this information can help put in perspective the instream habitat potential of Rock Creek, and thus its prioritization as part of Phase III watershed planning.