1. INTRODUCTION

This section presents the objective and purpose of this study, the location of the study area, an outline of the watershed issues and the scope of work for this project. A list of acronyms used within the text is presented as Table 1.1.

1.1 Objective

The objective of this report is to compile, characterize and provide a preliminary assessment of existing information for Water Resource Inventory Area #55 (WRIA 55) and Water Resource Inventory Area #57 (WRIA 57). The area encompassed by WRIA 55 (Figure 1.1) includes all the land within the Little Spokane River watershed and comprises of lands in Spokane (62%), Stevens (13%) and Pend Oreille (25%) Counties. The area encompassed by WRIA 57 (Figure 1.1) includes all the land within the Spokane River watershed, from the Washington-Idaho state line westwards to the Hangman Creek confluence and small adjacent areas in Washington State that flow into Idaho. WRIA 57 lies within Spokane (92.6%) and Pend Oreille Counties (7.4%). A summary of the approximate areas within the WRIAs and Counties are provided in the table below.

	Acres	**Square Miles**
Total WRIA 55	**433,000**	**675**
Spokane County in WRIA 55	267,000	415
Pend Oreille County in WRIA 55	108,000	170
Stevens County in WRIA 55	58,000	90
Total WRIA 57	**183,000**	**285**
Spokane County in WRIA 57	170,000	265
Pend Oreille County in WRIA 57	14,000	21

This report is designed to accomplish the following:

- Provide an inventory of existing information relevant to watershed planning in WRIAs 55 and 57;
- Organize the existing information into categories based on major technical disciplines (e.g., climate, hydrology, land use etc.);
- Interpret the existing information and describe the major characteristics of the watersheds;
- Provide a preliminary assessment of information gaps;
- Partially fulfill the requirements of the Phase II, Level I Assessment of the 1998 Watershed Planning Act (RCW 90.82);

- Provide a foundation for Level 2 Assessment of Phase II; and,
- Provide data to support development of a Watershed Plan under Phase III.

1.2 Purpose

Watershed planning is funded by the State of Washington under the direction of the Department of Ecology (Ecology). Watershed planning is a tool for developing water resources management strategies in the context of current laws and policies. As the human population increases and land use activities change, so may the demands for water. Watershed planning incorporates the knowledge of those who live within a watershed with science to develop an inventory of water inflows into and outflows from the watershed. A wide variety of local interest groups have an opportunity to voice their needs and concerns. For WRIAs 55 and 57, the interest groups involved in the watershed planning process are listed in Section 2.2 of this report. Watershed planning attempts to incorporate the perspectives of these groups into a framework for water resource allocation within the watersheds.

1.3 Location and Background

WRIAs 55 and 57 are located on the eastern boundary of Washington State, where the climate is affected by both the Cascade and Rocky mountain ranges (Figure 1.1). The Washington State Department of Natural Resources (DNR) has defined sub-basins within the two WRIAs known as Watershed Administrative Units (WAUs; Figure 1.2). Precipitation is relatively low in both WRIAs, particularly during the summer months. The WRIAs rely on snowmelt from the upland areas and groundwater recharge to the rivers to maintain river flows throughout the drier months. Groundwater and surface water are used to supply water to a growing population, for domestic water supply, agriculture, industry, power generation, wildlife and recreation. Given that water resources in the basins are limited by climate, watershed planning offers a tool for citizens, businesses, local governments as well as state and federal agencies to come together to make water resource management decisions.

1.4 Watershed Planning Issues

The following sections describe watershed planning issues within WRIA 55 and WRIA 57. The information presented is based on a review of existing information and on communication with the WRIAs 55 and 57 Planning Unit.

1.4.1 WRIA 55 – The Little Spokane River Basin

The first basin-wide study of WRIA 55 was completed by Ecology to assess the availability of water for further appropriation (Chung, 1975). As a result of this study, an instream flow rule (WAC 173-555) was adopted in 1978 for the Little Spokane River (see Section 5.1 and Appendix C4 for more detail). In addition, eleven cubic feet per second (cfs) was identified as available for further appropriation for specified uses along some

reaches of the main stem of the Little Spokane River. The tributaries to the Little Spokane River were closed to further appropriation.

In 1995, a draft initial watershed assessment of the Little Spokane River Basin was completed for Ecology (Dames and Moore and Cosmopolitan, 1995). The primary purpose of the assessment was to evaluate the status of surface and groundwater resources within WRIA 55 to help Ecology make appropriate water resource management decisions. The issues identified in the 1995 initial assessment of WRIA 55 included:

- Water flows in the Little Spokane River and its tributaries did not meet instream flow requirements, established by rule in 1978 in WAC 173-555, 53 days per year on average between 1970 and 1991, and went below the MISF at least one day in 16 of 21 years between 1970 and 1991;
- Declines in stream flows and groundwater levels are due in part to the consumptive water uses in the basin and below average precipitation in recent years;
- Non-point pollution is increasingly affecting water quality in the watershed;
- The lower eight-mile reach of the Little Spokane River is a state-designated Scenic River Corridor; and,
- Development and population growth in the lower part of the watershed are steadily increasing the demand for water.

Activities in the basin since the 1995 assessment have resulted in identification of additional issues. These issues are briefly described in the points below.

- As a result of better understanding and acknowledgement of surface water – groundwater continuity between the Little Spokane River and adjacent aquifers, Ecology started denying applications for groundwater rights as of 1996. Although the 11 cfs of surface water defined as available in 1975 (Chung, 1975) had not been allocated, 20 cfs of groundwater rights had been granted by Ecology between 1975 and 1996.
- Recent developments located in close proximity to the river are serviced by septic systems that have the potential to impact the water quality of groundwater and surface water.
- The upper portion of the watershed does not meet Washington State's fresh water temperature criteria for the protection of aquatic life.
- Recent geologic information suggests that there may be a deeper aquifer zone within the Spokane Valley Rathdrum Prairie aquifer within WRIA 55 that is separated from the upper zone by a semi-continuous clay and silt layer.

1.4.2 WRIA 57 – The Middle Spokane River Basin

In contrast to WRIA 55, this study represents the first integrated study of the Middle Spokane WRIA. The movement and availability of water within WRIA 57 is dominated by the Spokane Valley Rathdrum Prairie (SVRP) Aquifer and the interactions between the Spokane River and the SVRP Aquifer. Most of the studies completed to date within WRIA 57 have focused on understanding and protection of the SVRP Aquifer. Sources of recharge to the aquifer include infiltration of precipitation and irrigation, seepage from perimeter lakes and hillside subbasins and recharge from the Spokane River.

To date, an instream flow rule has not been set for the Spokane River. However, a recommended minimum flow target for the Spokane River was set by Ecology at 2,000 cfs in 1999 at the United States Geologic Survey (USGS) gage 12422500 (Spokane River at Spokane). The 2,000 cfs target was recommended by the Washington Department of Fish and Wildlife (WDFW) and represents the 50% exceedance flow for the period of record pre-installation of the Post Falls Dam (i.e., 1891 to 1906). The letter from the WDFW to Ecology recommending the 2,000 cfs target is included within Appendix C4.

The issues described in brief below for WRIA 57 are based on review of a number of study reports and on discussions with the WRIA 55 and WRIA 57 Planning Unit (PU) members.

- Across the period of record for the Spokane River at Spokane gage (1891 to 1999), the 2,000 cfs target flow is met only 86% of the time and the flow did not fall below the target in only five years in the period of record. Analysis of summer (June to October) flows, indicate that 45% of the flow record is below 2,000 cfs.
- The SVRP Aquifer is highly vulnerable to contamination from activities on the ground surface because it is an unconfined, coarse-grained aquifer.
- Interactions between the SVRP Aquifer and the Spokane River are important seasonally and spatially to maintain flows and good water quality in the Spokane River.
- If water demands continue to increase, the average daily withdrawal of water from the SVRP Aquifer may exceed the inflow to the aquifer from sources other than the Spokane River. This may result in increased leakage from the Spokane River to the SVRP Aquifer, thereby reducing flows in the Spokane River.
- Lower Spokane River flows may compromise the ability of the river to dilute contaminants.
- Discharge from the SVRP Aquifer to the Little Spokane River is important to maintain flows in the lower reaches of the Little Spokane River.
- The impacts on water flow and quality of the Spokane River from changes in water use and application (e.g., if treated wastewater is applied to crops in the summer rather than directly discharged to the Spokane River) are not well understood nor quantified.

- A better understanding of how river flows are impacted by human activities (e.g., land use changes, pumping wells, and dam operations) is required to plan future water management in the Spokane River Valley; and,
- A better understanding of the quantity of water flowing through the Trinity and Hillyard Troughs is needed.

1.5 Report Organization

This report is organized into two main sections: the main text, tables and figures that are organized by chapter and the appendices that follow the main text.

The main text is organized in to ten sections as follows:

- Section 1 outlines the report objectives, scope and organization.
- Section 2 provides background information on the Watershed Management Act including past and present planning activities.
- Section 3 explains the hydrologic cycle and its important components at the watershed scale.
- Section 4 describes the regional setting of the WRIAs including physiography, climate, geologic setting, soils, land cover and land use.
- Section 5 describes the surface water flows and groundwater of the Little Spokane and Middle Spokane Basins.
- Section 6 characterizes and describes water quality issues that relate to stream flow.
- Section 7 compiles and characterizes the existing water rights and water use.
- Section 8 describes the approach to computer simulation modeling the water resources of the Little Spokane and Middle Spokane Basins
- Section 9 identifies data gaps that need to be filled to adequately quantify the surface water and groundwater resources of the Little Spokane and Middle Spokane Basins.
- Section 10 summarizes the key findings of the data compilation and characterization for both WRIAs 55 and 57 and presents an overview of resource management considerations.

1.6 Scope, Authorization, Limitations and Acknowledgements

This report is prepared in fulfillment of Task 1000 of the November 7, 2000 scope of work entitled “Phase II – Data Compilation and Assessment, WRIA 55-57: The Middle Spokane and Little Spokane Rivers”. This scope of work was agreed to in a contract signed between Spokane County and Golder Associates Inc. (Golder) in December 2000 under Spokane County contract #P2960, funded by a Washington Department of Ecology grant (number 9800300). This report is designed to compile information relevant to

watershed planning for WRIAs 55 and 57. It is not designed to address all the WRIA 55 and WRIA 57 issues outlined in Section 1.4.

The following main elements are included in the scope of work:

- Task 1100: Existing Data Collection and Compilation
- Task 1200: Preliminary Assessment of Data Gaps
- Task 1300: Model Options
- Task 1400: Estimation of Recharge/Discharge of Used Water
- Task 1500: Estimation of Water Conservation Impacts on Water Use
- Task 1600: Model Discretization
- Task 1700: Characterization Report

Several individuals contributed significantly to the preparation of this report. Stan Miller, Water Quality Section Manager for the Utilities Division of Spokane County Public Works, is the project manager on behalf of Spokane County. Reanette Boese, Bea Lackaff, and Erin Cunningham of Spokane County participated in the data collection and review of the report. Susan McGeorge of Whitworth Water District provided staff time for collection of water use data. Spokane County staff provided significant insights into the dynamics of the natural hydrologic system.

Chris Pitre, senior project manager, water resources, is the project manager on behalf of Golder Associates Inc. Bryony Stasney was the local project coordinator and with Sara Marxen, Michael Klisch and Philip Beetlestone of Golder participated in data collection, analysis and report preparation.

This work has been completed in accordance with generally accepted professional practices at the time of preparation within the limitations of available data and budget.

TABLE 1.1
Acronym List

°F	Degrees Fahrenheit
7Q10	7-day low flow with a recurrence interval of 10 years
7Q20	7 day low flow with a recurrence interval of 20 years
abv	above
af/yr, AF/yr	acre-feet per year
amsl	above mean sea level
ASCII	American Standard Code for Information Interchange
AVISTA	Power company
blw	below
CBOD	Carbonaceous Oxygen Demand
CD	Cumulative Departure
CE-QUAL-W2	Surface water quality model developed by the US Army Corps of Engineers
cfs	cubic feet per second
cfs/af/yr	cubic feet per second per acre-feet per year
CID	Consolidated Irrigation District
CIR	Crop Irrigation Requirement
CORPS	United States Army Corps of Engineers
CRB	Columbia River Basin
CU	Consumptive Use
degrees C	Degrees Celsius
DEM	Digital Elevation Model
DEQ	Department of Environmental Quality
DNR	Department of Natural Resources
DO	Dissolved Oxygen
DOE, WaDOE, Ecology	Washington Department of Ecology
DP	Deer Park
e.g.	For example
EES	Economic and Engineering Services (a company name)
EIS	Environmental Impact Statement
EMCON	Company name
EPA	United States Environmental Protection Agency
ESA	Federal Endangered Species Act
ESHB	Engrossed Substitute House Bill
ET	Evapotranspiration
ET_{rc}	evapotranspiration for refrence crop
FERC	Federal Energy Regulatory Commission
ft	feet
ft/gpm	feet per gallons per minute
FSA	Farm Service Agency

TABLE 1.1
Acronym List

ftp	File Transfer Protocol
gcd	gallons per capita per day
GIS	Geographic Information Systems
GMA	Growth Management Act
gpd/ft	gallons per day per foot
gpm/af/yr	gallons per minute per acre-feet per year
gpm/ft	gallons per minute per foot
HUC	Hydrologic Units Codes
ID	Idaho
IDEQ	Idaho Department of Environmental Quality
IFIM	Instream Flow Incremental Methodology
ISFs	Instream Flows
JISAO and SMA	Joint Institute for the Study of the Atmosphere and Ocean and School of Marine Affairs
K	Hydraulic Conductivity
Kh	Horizontal Hydraulic Conductivity
Kv	Vertical Hydraulic Conductivity
LSR	Little Spokane River
LSRA	Little Spokane River Aquifer Area
LULC	Land Use and Land Cover
m.y.	million years
m/s	meters per second
max	Maximum
mg/L	milligrams per liter
mi^2	square miles
MIKE	Group of Software Products developed by DHI Water and Environment. MIKE refers to the suite of software modeling packages selected for use in this Watershed Inventory Assessment
mL	Milliliters
mm/h	millimeters per hour
MSL	Mean Sea Level
MSR	Middle Spokane River
n	Porosity
NAM	Acronym for how rainfall/run-off is simulated by MIKE software. A lumped, conceptual rainfall-runoff model simulating overland flow, interflow and baseflow as a function of the moisture content in four mutually interrelated storages.
NASA	National Aeronautics & Space Administration
NAWQA	National Water-Quality Assessment Program
NE	North East
NEPA	National Environmental Policy Act

TABLE 1.1
Acronym List

NGVD	National Geodetic Vertical Datum
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
nr	Near
NRCS	National Resource Conservation Service (formerly the Soil Conservation Service)
NROK	Northern Rockies Intermontain Basins (NAWQA study area)
NTU	Nephelometric Turbudity Units
NW	North West
OWD	on-site waste-disposal
OWDS	on-site waste-disposal systems
PDO	Pacific Decadal Oscillations
P_{ET}	Potential Evapotranspiration
PHD	Panhandle Health District
PNRBC	Pacific Northwest River Basins Commission
POCD	Pend Oreille Conservation District
POD	Point of Discharge
ppb	parts per billion
ppt	Precipitation
PRISM	**P**arameter-elevation **R**egressions on **I**ndependent **S**lopes **M**odel
PU	Planning Unit
Qa	Permitted Annual Water Use
Qa/Qi	ratio for non-irrigation groundwater and surface water rights
Qal	Recent Deposits of Alluvium
Qfs/Qfg/Qfcg	Lower Sand and Gravel Unit, Flood Sand and Gravel Units
Qgl	Glacial Deposits
Qi	Instantaneous Water Use
Ql	Loess
Qmw	Mass Wasting Deposits
Qp/Qla	Recent Deposits of Lacustrine
R	Runoff
RCD	Rescaled Cumulative Departure
RCW	Revised Code of Washington
SAJB	Spokane Aquifer Joint Board
SCCD	Spokane County Conservation District
SCS	Soil Conservation Service (now the Natural Resource Conservation Service)
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
SNOTEL	**SNO**wpack **TEL**emetry, snowpack and related climatic data collected in the Western United States by the NRCS through an automated system.

TABLE 1.1
Acronym List

SR	Spokane River
S_s	Specific Storage
SSA	Sole Source Aquifer
stn	Station
SVA	Spokane Valley Aquifer
SVRP	Spokane Valley – Rathdrum Prairie
SVRPA	Spokane Valley - Rathdrum Prairie Aquifer
SW/GW	Surface Water-Groundwater
SWE	Snow Water Equivalent
S_y	Specific Yield
T	Transmissivity
TCE	Trichloroethlyene
TEM	Transient electro-magnetics
TIR	Total Irrigation Requirement
Tl	Lacustrine silts and clays, Latah Formation
TMDL	Total Maximum Daily Load – a part of the federal Clean Water Act
TRS	Township, Range, Section
Tw/Tgr	Columbia River Basalts WRIA 55/57
UofW	University of Washington
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UTM	Universal Transvere Mercator
v	Linear Velocity
w/o	without
WA, Wa, Wash.	Washington
WAC	Washington Administrative Code
WAUs	Watershed Administrative Units
WMA	Watershed Management Act
WQMP	Water Quality Management Program
WRATS	Water Rights Application Tracking System
WRIA	Water Resource Inventory Area
WRIA 54	Lower Spokane River Watershed
WRIA 55	Little Spokane Watershed
WRIA 57	Middle Spokane River Watershed
WRIA 62	Pend Oreille River Watershed
WRIS	Water Resources Information System