REPORT

Legislative Progress Report

Economic Impacts of Enhanced Aquifer Protection for the Lower Portneuf River Valley Aquifer

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January 4, 2001

A Progress Report to the Idaho Legislature

Economic Impacts of Enhanced Aquifer Protection for the Lower Portneuf River Valley

Prepared for

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EXECUTIVE SUMMARY

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This progress report to the Idaho State Legislature and other interested parties describes an ongoing study of the economic impacts of enhanced groundwater quality protection for the Lower Portneuf River Valley (LPRV) in Bannock County, Idaho. This study was prompted by concerns about future deterioration of the groundwater quality in the aquifer which serves the residents, businesses and farmers in the Pocatello and Chubbuck areas. The primary question is whether a sensitive resource designation under the Idaho Groundwater Rule will create unacceptable economic impacts as compared with the benefits to the region. This sensitive resource designation was adopted for the Coeur d'Alene area in the Rathdrum Prairie in the early 1990s. The full economic impact study will be completed by May 2001.

BASELINE ECONOMIC AND DEMOGRAPHIC CONDITIONS

The study area is defined as the region which relies directly and indirectly upon the LPRV aquifer for its water supply. Exhibit II-1 in the report illustrates the study area location which runs from the Portneuf Gap in the south paralleling Interstate 15 (I-15) and ends at Tyhee to the north. This is an area of about 26 square miles.

The study area's economic base has evolved from a dependence on transportation services to a diversified economy where higher education, manufacturing, business services, high tech and agriculture all contribute. The Bannock County economy has shown considerable growth since the early 1990s, but historical experience suggests a certain vulnerability.

Approximately 68,300 persons reside within the study area, with about 51,900 persons in the City of Pocatello. About 7,200 persons out of the 68,300 study area population have their own groundwater supply. Approximately ten percent of the housing units in the study area are on septic tanks as opposed to a sewer system; the number of households on septic tanks is increasing. The study area also has a host of water-intensive businesses. The cities of Pocatello and Chubbuck water and sewer rates are relatively low by comparison to competing cities in the Rocky Mountain region, such as Evanston, Wyoming or the Wahsatch Front cities in Utah.

BASELINE WATER QUANTITY AND QUALITY CONDITIONS IN THE LPRV

The LPRV aquifer is a highly productive, highly permeable and relatively fast moving groundwater resource. The aquifer recharge is approximately 7.4 billion gallons (23,000 acre-feet) per year, most of which comes in the southern portion of the LPRV from the Bannock Range snowpack and precipitation which becomes lateral groundwater flow.

The considerable permeability of the LPRV geology contributes to its unusual vulnerability. The sands and gravels which compose the bulk of the overlay will readily transmit liquid spills, leaks, discharge run-off and leachate into the groundwater supply.

The LPRV aquifer is the sole source of potable water supply for the cities of Pocatello, Chubbuck, self-supplied industrial operations, agricultural operations and rural households with their own wells. Municipal and domestic water use alone is estimated at about 6.9 billion gallons (21,400 acre-feet) per year in a normal year, with an additional 0.6 to 1.3 billion gallons (2,000 to 4,000 acre-feet) per year for self-supplied industrial and agricultural operations. Hence, the aquifer recharge is in rough balance with withdrawals in the year 2000.

The water quality circumstances in the LPRV aquifer as of year-end 2000 are complex. Municipal water supply is currently good overall and meets water quality standards. However, municipal water is quite hard, with a relatively high total dissolved solids (TDS) content. Water quality monitoring by the IDEQ, IDWR and the cities of Pocatello and Chubbuck indicate certain areas of degraded water quality in the aquifer.

The more prominent, highly publicized water quality issues are better understood than other less publicized water quality concerns. There have been thirteen US EPA Superfund sites identified in the Pocatello area, all except one have been removed from the Superfund list through remediation efforts. The most prominent water quality concerns in recent history have been trichlorethylene (TCE) and perchloroethylene (PCE). The sources of this contamination are believed to have been identified and plans are being devised to eliminate further contamination.

Other constituents of concerns (COCs) include nitrate and sulfate, while rising chloride levels can be an indicator of pathways of potential contamination from surface spills and runoff. Portions of the northern and eastern parts of the LPRV aquifer have been identified as high nitrate areas by the IDEQ. Monitoring data is limited in other areas of the LPRV aquifer, but there are indications of high salts and PCEs in other areas as well as nitrate. Based upon the nature and location of the contaminants, suspected sources of human activity are septic tanks (leachate), road salt, storm run-off and isolated spills, leaks and discharge from business activity.

DEFINITION OF ENHANCED AQUIFER PROTECTION SCENARIO

To examine water quality effects, economic costs and benefits of LPRV protection measures, an enhanced aquifer protection scenario has been devised for the purpose of analysis. This protection scenario is based heavily upon the protection measures adopted in the Rathdrum Prairie case which received a sensitive resource designation for the aquifer in the Coeur d'Alene region.

It is important to remember that this study is the early stages and that the enhanced aquifer protection scenario will be refined over time. While the enhanced protection scenario draws heavily from the aquifer protection experience in the Rathdrum Prairie region, there are important differences between the economy in that region and the economy in the LPRV. As the study proceeds and following its conclusions, it is anticipated that extensive public discussions will lead to a modified protection strategy, if, in fact, this economic study determines that such a strategy has merit.

The enhanced aquifer protection scenario includes separate sets of specific measures which focus upon three potential contaminant sources: septic / sewer discharge, storm water and other non-domestic wastewater management, and critical materials handling. The Study Team will perform its economic cost-benefit study on the basis of this scenario as compared with baseline conditions.

POTENTIAL ECONOMIC COSTS, IMPACTS AND BENEFITS

The Study Team will perform the economic cost and benefit analysis toward the end of this study in Spring 2001. Based upon early research, and in consideration of the enhanced aquifer protection scenario, the Study Team believes it would be instructive to identify types of costs and benefits that will be addressed as the study proceeds.

The final report will explore direct costs and indirect costs as they affect residents, businesses and local government. Existing and new businesses and residents will be addressed. Indirect costs would include increases in taxes and fees, such as water rates, or sewer charges. The cost of doing businesses, its effects on local businesses, and their competitiveness will also be evaluated. The impact on attracting or repelling new businesses to the study area will also be assessed.

On the benefits side, the primary question relates to avoided costs with enhanced aquifer protection. That is, if nothing is done, what sort of economic costs will the region face as water quality continues to degrade? The expense of future remediation and the effects on the attractiveness of the area from a business and a quality of life standpoint will be considered.

This economic benefit cost study will be as definitive as time and resources allow. Certain components will be quantified while others will be qualitative in nature pointing to both the direction and the magnitude of the effect. The balance of benefits vs. costs will be evaluated.

FURTHER AREAS OF INQUIRY AND NEXT STEPS

This economic study will be subject to stated limitations and uncertainties which have been recognized at the outset. In order to more completely address the study issues, further areas of inquiry are identified in this progress report which include an examination of the applicability of the LPRV results for southern Bannock County and surveys of

residents and businesses. Excluding well drilling or similar field work, additional costs might amount to $115,000. The Legislature might consider funding such research for the next fiscal year, although this initial study may be sufficient to lead to decisions about proceeding toward enhanced protection for the LPRV aquifer.

The Study Team will proceed with the next steps in the study according to the original work plan. The report will be available in May 2001.

SECTION I.
BACKGROUND

BACKGROUND ON THE STUDY AND THIS REPORT

In late October 2000, the Idaho Department of Environmental Quality (IDEQ) contracted BBC Research & Consulting to perform an evaluation of the economic impacts of enhanced aquifer protection for the Lower Portneuf River Valley Aquifer (LPRV) in Bannock County, Idaho. A group of concerned citizens, community leaders, and technical advisory staff from the Idaho Geological Survey, District 6 Health, the cities and Bannock County (collectively known as the Aquifer Protection Working Group), is working with and providing guidance to IDEQ on this study.

This study has three principal objectives:

1. Develop and characterize an enhanced aquifer protection scenario designed to protect water quality in the LPRV.

2. Describe a "baseline scenario" without enhanced aquifer protection measures in terms of economic and financial measures and water quality and quantity characteristics.

3. Examine the economic and fiscal impacts, costs and benefits of enhanced protection for the LPRV.

The study focuses on the economic implication of preventing future water quality degradation. BBC and its subconsultant, ERO Resources, will rely on existing data and complete this study in May 2001.

The study will entail considerable secondary data collection throughout Bannock County and elsewhere in Idaho. Meetings with the Aquifer Protection Working Group and the public will launch the study and conclude it.

OVERVIEW OF THIS REPORT

This report summarizes progress during the initial two months of this seven-month study effort. The report is divided into six additional sections following this initial background discussion:

- Baseline Economic and Demographic Conditions – defines the study area and provides a description of economic and demographic conditions at present and recent trends.

- Baseline Water Quantity and Quality Conditions – provides a physical description of the aquifer, discusses recharge and water use and principal water quality considerations in the LPRV.

- Enhanced Aquifer Protection Scenario – describes the objectives of enhanced aquifer protection and presents an initial description of the scenario of aquifer protection measures assumed for purposes of this study.

- Types of Potential Economic Impacts and Benefits from Enhanced Protection – discusses concerns raised in local interviews and other issues that will be examined during the course of this work.

- Areas of Greatest Uncertainty – describes limitations in available data and analysis.

- Next Steps – provides an outline of work to be completed Spring 2001 and corresponding schedule.

Given the early stage of this study, this progress report is intended primarily to provide background on the study and the issues, rather than answers to the key questions that are the focus of this evaluation.

SECTION II.
BASELINE ECONOMIC AND DEMOGRAPHIC CONDITIONS

ECONOMIC AND DEMOGRAPHIC CONDITIONS-OVERVIEW

Evaluation of the potential economic benefits, costs and impacts of enhanced aquifer protection in the LPRV requires:

- An understanding of current economic and demographic conditions and trends in the study area;
- A projection of future economic and demographic conditions in the absence of enhanced protection measures - termed the "baseline" scenario; and
- A comparative projection of future economic and demographic conditions in the study area with enhanced protection measures.

This section is the foundation for the baseline scenario. We define the study area, describe key economic components of the area and provide an overview of economic and demographic conditions and recent trends. Subsequent work during the next few months will further define the baseline and develop the comparative scenario with enhanced protection measures. Both the examination of recent economic and demographic trends and the baseline scenario closely integrate with the working assumptions, projections and data assembled for the *Our Valley, Our Vision* study.

STUDY AREA DEFINITION

From an economic and demographic standpoint, the study area is defined as the region that relies directly or indirectly upon the LPRV aquifer for its water supply. Certain areas not directly overlying the aquifer, such as portions of the cities of Pocatello and Chubbuck, are included in the study area because of their jurisdictional relationship to areas that do lie directly above the aquifer. The study area and its vicinity are mapped on Exhibit II-1.

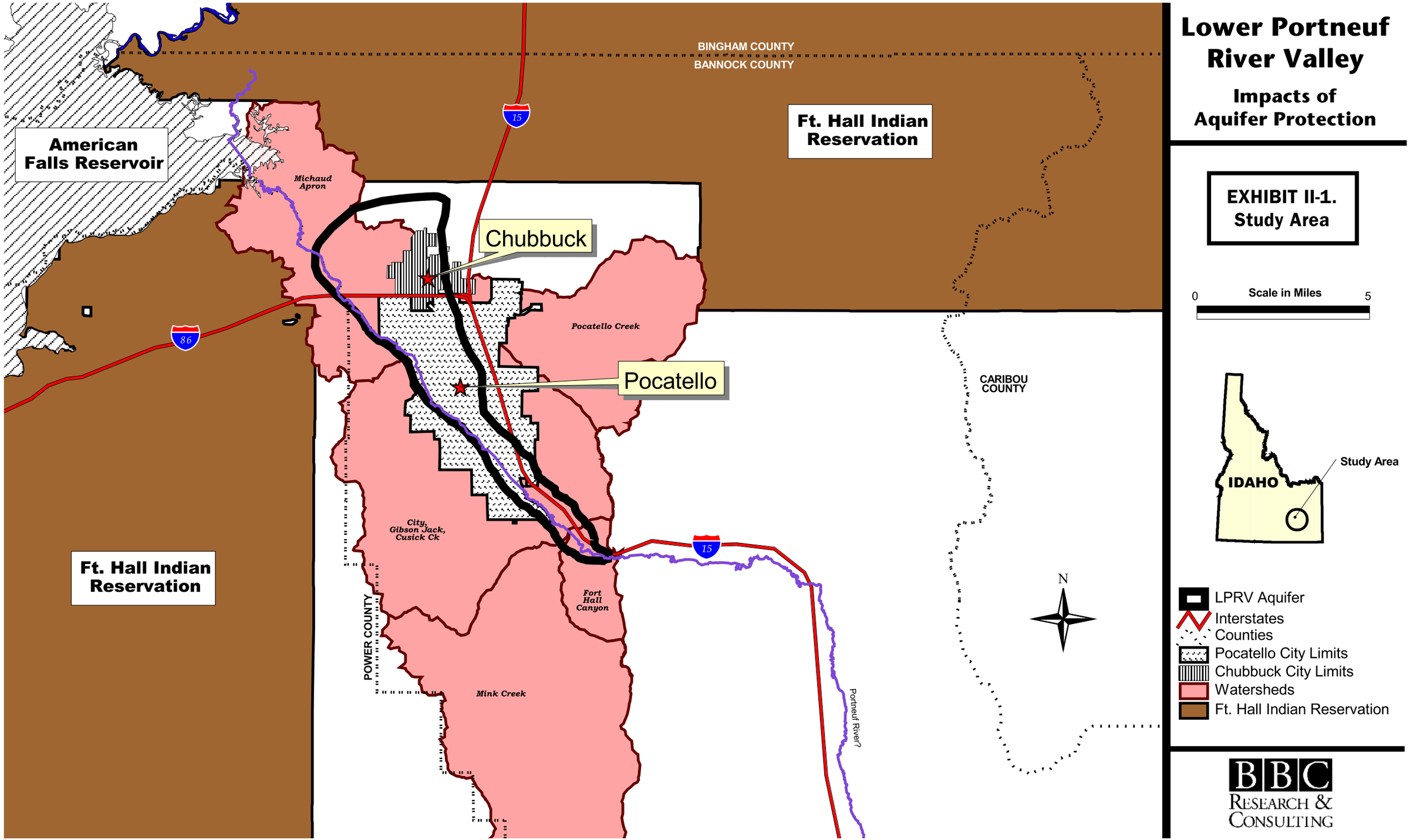
The cities of Pocatello and Chubbuck currently pump all their municipal water from the LPRV aquifer. Other withdrawals from the aquifer consist of private and other wells for domestic, industrial and agricultural self-supply. Non-municipal withdrawals in the study area are mostly within Bannock County.

The LPRV aquifer system itself is composed of two main parts:

1. The southern aquifer system flows northward as a very narrow, strip aquifer from Portneuf Gap to Red Hill. In this area, the aquifer roughly parallels Interstate 15 (I-15) and the lower Portneuf River.

2. The northern aquifer system begins at Red Hill and flows northward to a point where the aquifer widens and merges with the Snake River Plain aquifer and Fort Hall groundwater.

Six portions of surface water basins overlap the aquifer's surface, which covers an area of about 26 square miles.


BINGHAM COUNTY
BANNOCK COUNTY
American Falls Reservoir
Ft. Hall Indian Reservation
Michaud Apron
Chubbuck
Pocatello Creek
Pocatello
CARIBOU COUNTY
City, Gibson Jack, Cusick Ck
Ft. Hall Indian Reservation
Fort Hall Canyon
POWER COUNTY
Mink Creek
Portneuf River?
15
86
N
Lower Portneuf River Valley
Impacts of Aquifer Protection
EXHIBIT II-1. Study Area
0
Scale in Miles
5
IDAHO
Study Area
LPRV Aquifer
Interstates
Counties
Pocatello City Limits
Chubbuck City Limits
Watersheds
Ft. Hall Indian Reservation
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STUDY AREA HISTORY

Long a transportation corridor – first traveled by Native Americans, then by trappers, westward migrants, and fortune seekers in the gold fields – the Portneuf Valley entered a new age with the coming of the railroad in 1876. At Pocatello Junction, Union Pacific created the largest rail center west of the Mississippi. Pocatello incorporated in 1882 and, reflecting its strategic location in southeast Idaho, took the nickname "The Gate City."

During World War II, the United States Naval Ordnance Plant was sited in Pocatello to reline naval guns from warships. The refurbished weapons were shipped to a range at what is now the Idaho National Environmental and Engineering Laboratory for test firing of shells over distances of up to 35 miles.

Today the study area is a community of diverse occupations. The railroad remains a major employer. In Pocatello, Idaho State University increasingly shapes the economy and lifestyle. Diverse industries use the region's natural and human resources: mineral processing, food products, high tech manufacturing, industrial fabrication, telecommunications services, and government research and development. Still a crossroads, Portneuf Valley businesses continue to supply goods and services to travelers who now follow the nation's interstate highways instead of the Oregon Trail.

MAJOR EMPLOYERS & THE ECONOMIC BASE

Chief sources of income in the study area are higher education, manufacturing, transportation, business services, agriculture, high-tech and nuclear research, recreation, and tourism. The study area has an unusually diversified economic base.

The Union Pacific Railroad has a major freight classification yard in Pocatello, plus maintenance and repair facilities for locomotives, cars, and track maintenance equipment. The broad manufacturing base includes integrated circuits, processed foods, and medical products. There is a growing "call center" segment of the business services industry. Agriculture, including farming and potato processing, remains a small but significant export industry. Public employers in the economic base include Idaho State University and the FBI Western Data Center. Other major public sector employers are School District 25, the City of Pocatello and Bannock County.

Major Study Area Employers

Employer	Employment
Idaho State University	3,090
School District 25	1,495
American Microsystems, Inc.	1,250
Union Pacific Railroad	950
Bannock Regional Medical Center	884
Convergys	700
J.R. Simplot Minerals & Chemicals	652
Pocatello City Government	600
Pocatello Regional Medical Center	500
Astaris (Power County)	458
Kimberly-Clark Medical Products	405
Bannock County Government	400
Heinz Frozen Foods	360

Source: Bannock Development Corporation, July 2000.

The study area is a retail hub for southeast Idaho and, because of its location on major transportation routes, it supplies goods and services to tourists, business travelers and visitors to the region's recreation areas. However, studies have shown there is considerable retail "leakage," and many local residents apparently travel to Idaho Falls or to the Salt Lake City, Utah area, to make certain purchases. Located 60 miles northwest of Pocatello, the Idaho National Environmental and Engineering Laboratory (INEEL) employs about 7,900 people, a number of who live within the study area. Pocatello houses INEEL suppliers, as well. Examples include the lab's cleanup contractor and a specialty steel fabricator.

EMPLOYMENT GROWTH

Since 1990, employment growth in the study area has rebounded, although total Bannock County job growth is still below the statewide average.

From 1980 to 1990, Bannock County achieved no net job growth, largely because of the shutdown and loss of 3,000 jobs at dragline manufacturer, Bucyrus-Erie. However, from 1990 to 1998 (the most recent data available) total job growth for Bannock County was 3.3 percent per year, just 0.4 percentage points off the statewide pace of 3.7 percent.

Employment Growth Rates in Bannock County and the State of Idaho, 1980-1998

	1980 - 1990		1990-1998	
Sector	Bannock County	State of Idaho	Bannock County	State of Idaho
Farm	-1.1%	-1.8%	1.0%	1.1%
Ag Svc-Forest-Fish	5.6%	6.0%	6.5%	4.3%
Mining	-2.5%	-1.5%	0.0%	-1.7%
Construction	-0.7%	1.5%	7.7%	6.3%
Manufacturing	-4.4%	1.7%	5.4%	2.5%
Transportation/Utilities	-3.4%	0.8%	-1.1%	3.3%
Wholesale Trade	0.9%	0.7%	0.4%	3.4%
Retail Trade	0.8%	2.4%	3.9%	4.5%
FIRE	-1.5%	0.9%	0.5%	3.4%
Services	2.4%	3.7%	4.6%	4.9%
Government	0.9%	1.1%	2.7%	2.1%
Total	0.0%	1.7%	3.3%	3.7%

Source: BEA REIS with BBC estimates of unreported 1998 employment in AG Svc and Mining.

Since 1990 four sectors – manufacturing, construction, agricultural services, and government – have grown faster than the state average. Only the transportation and utilities sector has declined (by 1.1 percent per year) reflecting, in part, significant layoffs by the Union Pacific Railroad. Among the largest sectors, retail trade and services have both grown rapidly, similar to Idaho as a whole.

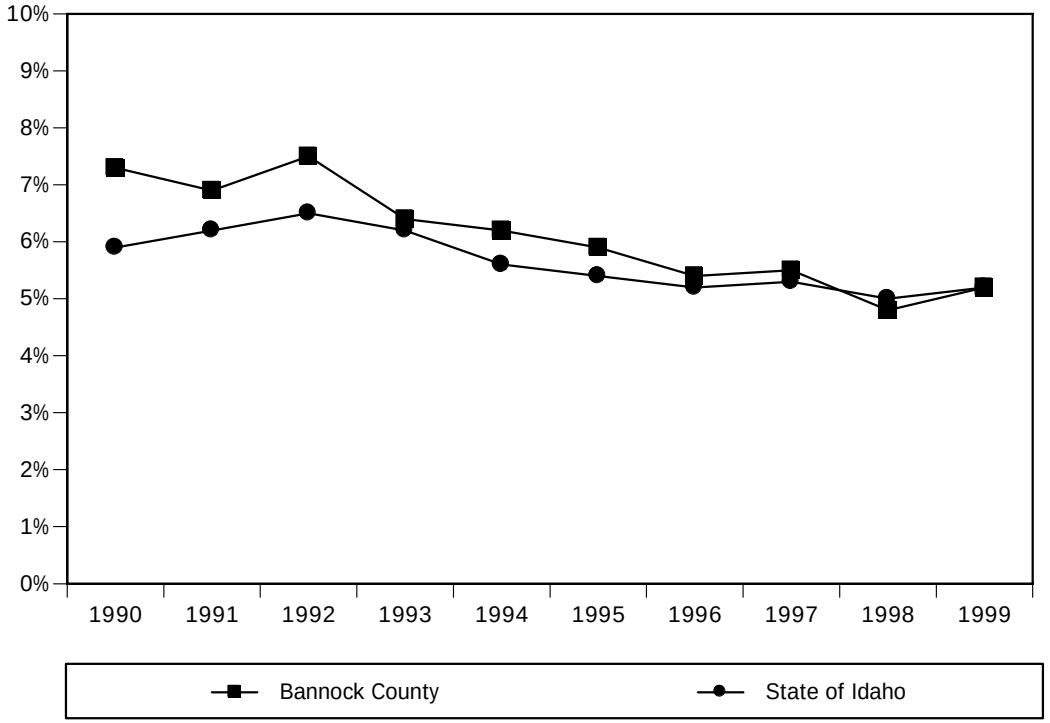
UNEMPLOYMENT RATES

Recent employment growth within the study area has substantially reduced the unemployment rate in Bannock County. The County exceeded the state average in the early 1990s, but currently mirrors Idaho.

Since 1996, unemployment rates for both Bannock County and the state have ranged between 4.8 percent and 5.4 percent.

The present tight labor market has been felt locally. Hiring entry-level employees has been more difficult for retailers, service establishments, fast food restaurants, nursing homes and contractors.

Unemployment Rate
Bannock County and State of Idaho
1990-1998



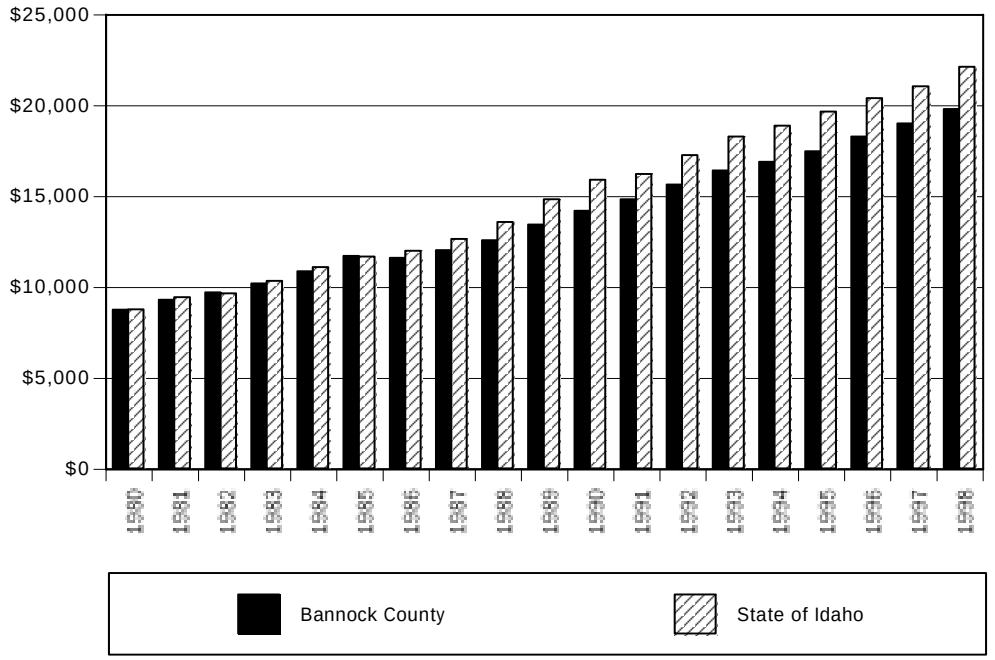
Source: Idaho Department of Labor.

PER CAPITA PERSONAL INCOME

At parity or nearly so with Idaho through 1985, Bannock County per capita personal income went flat during the last half of the 1980s while statewide personal income growth accelerated. By the mid 1990s, Bannock County per capita personal income resumed a healthy growth rate.

Average study area personal income has remained stable at about 90 percent of the state average over the past decade.

Bannock County and State of Idaho
Per Capita Income
1980-1998



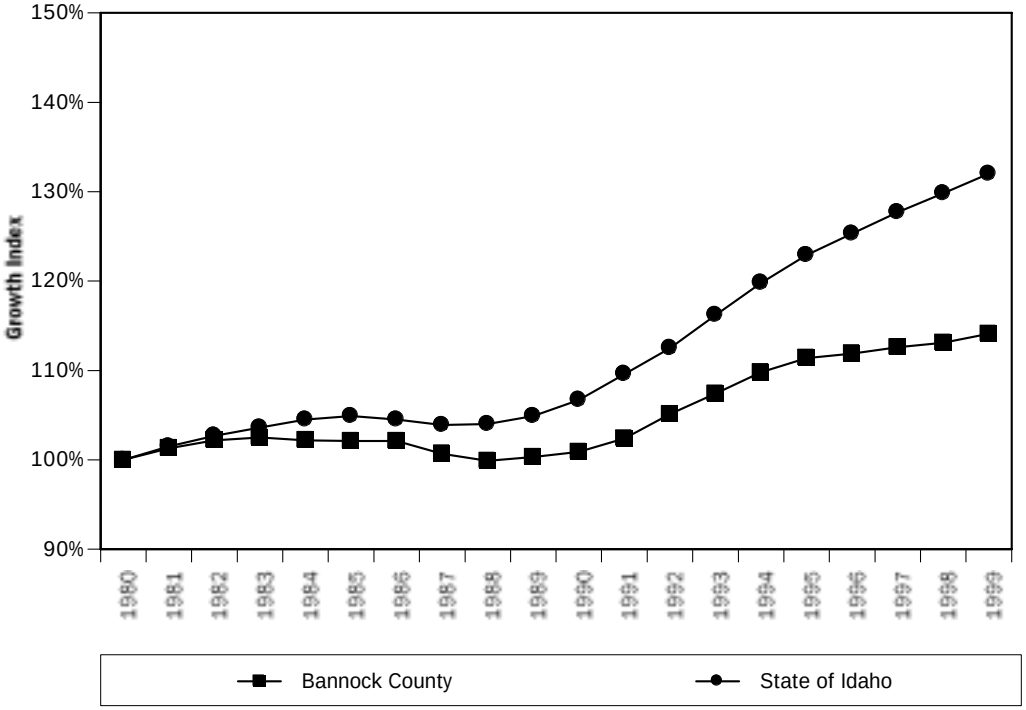
Source: BEA REIS.

COUNTY AND STATE POPULATION

From 1980 to 1999, the U.S. Census Bureau estimated that Bannock County grew by 14.1 percent compared to 32 percent for the state of Idaho as a whole. This equates to an average annual rate of 0.7 percent for Bannock County versus 1.4 percent per year on average statewide.

Net natural change (births minus deaths) accounted for all of Bannock County's growth in the 1980s (net natural change was 9,151, offsetting net out-migration of 8,546) and for 81 percent of growth in the 1990s (natural change was 7,203 and net in-migration was 1,652). Annual estimates were not available specifically for the study area, given its irregular geography.

Population Growth
Bannock County and State of Idaho
1980-1999



Note: Growth Index is defined as 1980 population equal to 100.

Source: U.S. Bureau of the Census.

POPULATION RELYING ON THE LPRV AQUIFER

An estimated 68,300 persons in the cities of Pocatello, Chubbuck, and the surrounding unincorporated area rely on the LPRV aquifer as a water supply.

- Within this area, a population of about 7,200 persons in an estimated 2,200 households have their own groundwater supply.

Estimated Population Relying on LPRV Aquifer

Population	1980	1990	2000
City of Pocatello	46,531	46,080	51,852
City of Chubbuck	7,080	7,791	9,281
Self-Supplied	6,013	6,269	7,181
Total	59,624	60,140	68,314

Source: PCensus for cities; BBC estimate of self-supplied population. Estimates are as of July 1.

- Growth has varied within the study area. While the City of Chubbuck grew 31 percent, the City of Pocatello grew 11 percent from 1980 to 2000. The self-supplied area grew about 19 percent, or 1.8 percent per year.

Sewered housing units predominate within the study area, but households on septic appear to be increasing more rapidly.

- The 1990 Census found approximately 1,400 housing units on septic in the City of Pocatello, 35 in Chubbuck, and about 700 septic tanks in the unincorporated area served by the aquifer.

- Local sources estimate that approximately 50 to 75 new homes on septic have been added to the study area each year since 1996.

WATER USE AND THE ECONOMIC BASE

Based on national averages, key industries within the study area's economic base are moderate to high in water use intensity. Values for the following sectors are expressed in gallons per employee per day: food processing, 469; chemicals processing, 267; hotels and other lodging places, 230; educational services, 117; electronics manufacturing, 95 gallons; business services, 73; railroad transportation, 68 (Table 23.10, Average Rates of Nonresidential Water Use from Establishment Level Data, McGraw-Hill Water Resources Handbook).

The top ten water consumers served by the City of Pocatello Water Utility include several of the study area's base industries: American Microsystems, Inc., Heinz Weight Watchers Foods and the Union Pacific Railroad. Other top consumers are government entities: School District 25 and Idaho State University. The FBI Western Data Center is also a large water customer of the City of Pocatello Utility. Highland Golf Course, leased to an operating company, ranks high in water consumption, too, despite irrigating only five months a year.

Relatively attractive water and wastewater costs play a role in the study area's economic development strategy. In 1998, the City of Pocatello charged $0.85 per thousand gallons for industrial/commercial water, $0.98 per thousand gallons of wastewater for establishments inside the City, $1.29 per thousand gallons of wastewater outside the City, and additional charges of $1.18 and $1.07 per pound per year for suspended solids and BOD respectively for amounts greater than 200 PPM. Wastewater service rates and connection fees are ranked relatively low among comparable site location markets in a six-state, intermountain region, according to Bannock Development Corp.

ECONOMIC DEVELOPMENT STRENGTHS & WEAKNESSES

The study area combines a positive attitude toward growth with numerous economic development strengths – among them relatively low wages, energy costs and cost of living, a skilled industrial work force, and the presence of a technology-oriented university. ISU increasingly is a seedbed for economic development, business incubation and technical training of the work force.

Although the preponderance of total jobs has shifted to retail and services and away from transportation, the traditional leading sector, the study area remains focused on industrial activity as a primary source of higher-wage economic development. Gateway West Industrial Center, the former World War II Naval Ordnance Plant in Pocatello, is a 200-acre complex currently home to more than 20 businesses and about 500 jobs, many in heavy industry. The industrial infrastructure that exists at the facility is unique in the state.

The study area's location within an important transportation corridor is a plus. However, a key economic development issue in the attraction of industrial growth in the future is limited air transportation and high truck freight costs. In addition, the telecommunications infrastructure, though advanced, lacks fiber optic capacity. As a trade center, the study area faces two strong competitors: Idaho Falls and the Salt Lake City, Utah area. In addition, the local economy remains sensitive to the fortunes of the key employers (Union Pacific, Simplot, FMC INEEL, and others). This leads to some volatility in economic performance and the potential for severe economic shocks.

SECTION III.
BASELINE WATER QUANTITY AND QUALITY CONDITIONS

BASELINE WATER QUANTITY AND QUALITY CONDITIONS IN THE LPRV – OVERVIEW

This section characterizes the LPRV aquifer as a basis for later projection tasks in this study. The geography, geology and hydrology of the aquifer are summarized. Water use trends point to an aquifer in rough balance or in a small deficit between withdrawals and recharge. Baseline water quality conditions acknowledge certain well-publicized water quality issues for which certain progress is being made. Other issues such as levels of nitrate, chloride and sulfate are not presently being addressed.

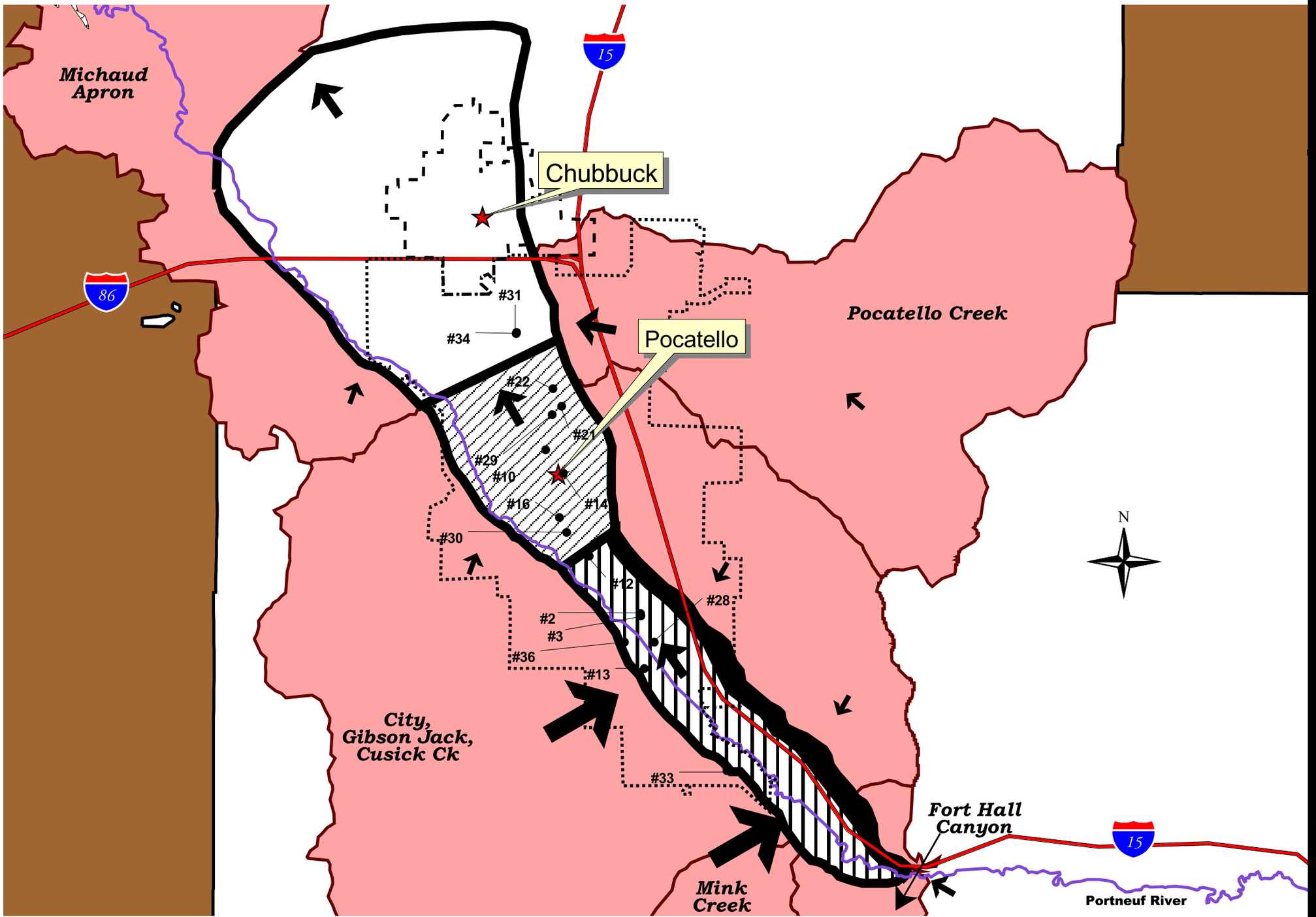
DESCRIPTION OF THE LPRV AQUIFER

The LPRV aquifer is a highly prolific, alluvial valley-fill aquifer, situated in the Portneuf Valley beginning at the Portneuf Gap and grading into the Eastern Snake Plain aquifer northwest to Tyhee. The contributing watershed includes portions of the Bannock Range and the Pocatello Range, as well as the Upper Portneuf River Valley. The LPRV aquifer is the source of supply for all human needs in the study area.

The general flow path of groundwater in the LPRV system is from the Portneuf Gap toward Pocatello (from southeast to the northwest) (see Exhibit III-1). Northwest of Pocatello, toward American Falls Reservoir, groundwater in the LPRV aquifer converges with groundwater flowing from the north out of the Fort Hall Reservation and groundwater from the Eastern Snake Plain Aquifer.

Much of the current understanding of LPRV aquifer hydrogeology is based on the work of John Welhan and Chris Meehan, who divide the LPRV aquifer into four hydrologic subdivisions for purposes of analysis. These hydrologic subdivisions are shown on Exhibit III-1 and discussed below:

- The Southern Aquifer is the principal source of water supply for Pocatello and Chubbuck.
- The Eastern Aquifer, smaller than the other hydrologic subdivisions, roughly parallels the southern aquifer, but is distinguished based on a different water quality.
- The Central Aquifer acts as a transition from the southern aquifer to the northern aquifer.
- The Northern Aquifer extends from the bedrock high located about mid way down the lower Portneuf Valley to the northwest. This portion includes the Pocatello Creek tributary.



Lower Portneuf River Valley

Impacts of Aquifer Protection

EXHIBIT III-1.
Aquifer Subdivisons, Groundwater Flow and Select Well Locations

Scale in Miles
0 1 2

- Municipal Water Wells (#10)
- Groundwater Flow
- Chubbuck City Limits
- Pocatello City Limits
- Interstates
- Northern Aquifer
- Central Aquifer
- Southern Aquifer
- Eastern Aquifer
- Watersheds
- Ft. Hall Indian Reservation

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GEOLOGY OF THE LPRV AQUIFER

The high productivity and the vulnerability to contamination from surface and near surface sources are rooted in the LPRV aquifer's geology. The following is a greatly simplified overview of that geology.

- The geology of the LPRV aquifer is comprised of sands and gravels ranging in thickness from approximately 100 to more than 500 feet and blanketed in areas by 5 to 20 feet of silt and loess. Interbedded units of clay are common toward the northern end of the system.

- Changes in sand and gravel composition, depth to bedrock, and bedrock type are evident along the aquifer system. The subdivision of the aquifer into four smaller areas, described on the previous page, helps account for the geologic variability along the river valley.

- The Southern Aquifer has a history of excellent water yields, which are derived from coarse, gravels at depths less than 100 to 150 feet below surface. Very permeable, unconfined gravels overlying a section of low-permeability, basin fill sediments dominate this portion of the LPRV aquifer.

- The Eastern Aquifer is unconfined and is composed of silty gravels of low permeability.

- The Central Aquifer is also unconfined and is comprised of a thin sedimentary layer overlying shallow bedrock.

- The Northern Aquifer is comprised of multiple confined silty gravel and sand aquifers hosted in stratified, but poorly sorted, sedimentary basin fill more than 2,000 feet thick.

LPRV AQUIFER RECHARGE

The recharge characteristics of the LPRV aquifer provide both information about its sustainability as the sole water source for the study area and about the areas that may be particularly susceptible to contamination from surface or near surface sources.

- Annual recharge of the LPRV aquifer is estimated at approximately 7.4 billion gallons (23,000 acre-feet) per year. The following discussion focuses primarily on the southern division of the aquifer, which initially receives the bulk of the recharge. The other aquifer hydrologic subdivisions are recharged principally through intra-basin flows from south to north.

- An estimated 70 percent of primary recharge to the southern portion of the LPRV aquifer is lateral groundwater flow from the Bannock Range. This recharge area includes the Mink Creek and the Gibson-Jack Creek sub-basins (see Exhibit III-1). The recharge originates from the snowpack and precipitation in the southern Bannock Range.

- Approximately 15 percent of southern LPRV aquifer recharge is derived from the upper Portneuf River basin through the Portneuf Gap, and over ten percent is derived from the other drainages, principally the Eastern Aquifer and Pocatello Creek. The evidence suggests that the Portneuf River does not significantly recharge the aquifer.

- Other recharge sources include the Pocatello Creek drainage, Pocatello Range, direct precipitation and intra-basin flow. Groundwater flowing into the LPRV watershed from areas outside of the boundaries (intra-basin flow) is unknown, but is potentially a source of recharge.

LPRV AQUIFER WATER USE

The LPRV aquifer provides the sole source of potable water supply for the cities of Pocatello and Chubbuck, as well as supplies for self-supplied industrial operations, rural households with their own wells and agricultural operations in the valley. Current annual water use is rapidly approaching the annual recharge estimate described previously. If water demands continue to rise at the rates experienced over the past decade, groundwater mining resulting in declining aquifer levels may begin to occur.

- Published statistics on LPRV aquifer water use are available only for the Pocatello and Chubbuck municipal water utilities. The Study Team has estimated household water use in rural areas based on a local per capita water use factor and an estimate of the self-supplied population served. Total withdrawals for municipal system and household self-supply in the year 2000 are estimated to be about 6.9 billion gallons (21,400 acre-feet).

Year 2000 Water Withdrawals for Potable Use in the LPRV Aquifer

	Billions of Gallons	Acre-Feet
Pocatello Municipal System	5.64	17,576
Chubbuck Municipal System	0.64	2,000
Unincorporated Domestic	0.60	1,784
Total	6.88	21,360

Note: Year 2000 municipal use data, annualized amounts, are based on 11 months through the end of November.

Source: Cities of Pocatello and Chubbuck and BBC estimates.

- The LPRV aquifer also supports self-supplied industrial and agricultural operations. The study team estimates that 0.6 to 1.3 billion gallons (2,000 to 4,000 acre-feet) per year are withdrawn from the aquifer for these non-potable purposes.

WATER USE TRENDS

In the past decade, there has been modest growth in the amount of LPRV aquifer water withdrawn by municipal water utilities and by self-supplied households in aquifer-served rural areas.

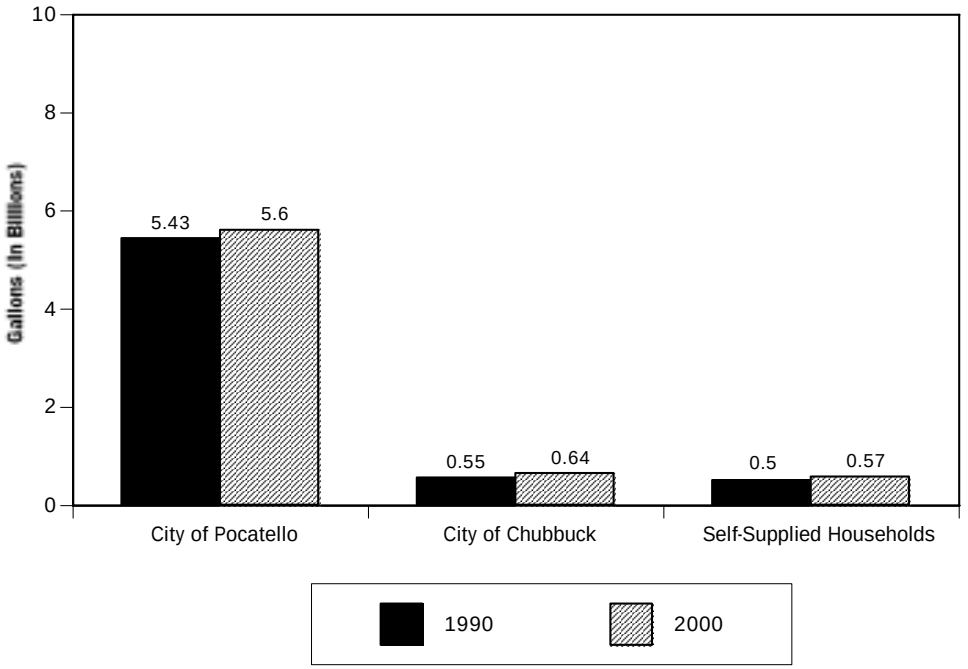
The accompanying chart illustrates the following water use trends:

- Pocatello used 5.6 billion gallons (17,580 acre-feet) per year in 2000, up from 5.43 billion gallons (16,920 acre-feet) in 1990, an increase of about 4 percent. Current Pocatello water use is about 300 gallons per capita per day.

- Chubbuck used 0.64 billion gallons (2,000 acre-feet) per year in 2000, up from 0.55 billion gallons (1,720 acre-feet) in 1990, an increase of about 16 percent. Chubbuck water use is about 190 gallons per capita per day.

- Self-supplied households in rural areas used 0.57 billion gallons (1,780 acre-feet) per year in 2000, up from 0.50 billion gallons (1,560 acre-feet) in 1990, an increase of about 15 percent.

Water Use, Lower Portneuf River Valley Aquifer
1990 and 2000



Source: Cities of Pocatello and Chubbuck; BBC estimate for unincorporated domestic.

LPRV AQUIFER WATER QUALITY – OVERVIEW

Historically, the study area has had numerous commercial or industrial sites that have at one time caused water quality degradation. There have been 13 U.S. EPA Superfund sites identified in the study area but, through remediation and other efforts, all except one of these sites have been removed from the Superfund list.

LPRV water quality concerns became highly publicized with the discovery of Trichloroethylene (TCE) in a number of Pocatello municipal wells in 1991 and Perchloroethylene (PCE) in Chubbuck municipal wells. The source of the TCE is generally believed to be from older areas in the Fort Hall Mine Landfill and work is currently underway to pinpoint the source and develop a plan to limit further contamination. The source of PCE is still unknown and being investigated by EPA and its consultants.

The cities of Pocatello and Chubbuck water quality records show that the overall quality of the LPRV aquifer is good, although the water is very hard and has a relatively high total dissolved solids (TDS) content. However, more recent water quality monitoring by the IDEQ, Idaho Department of Water Resources, and the City of Pocatello indicate several areas of the LPRV aquifer system have degraded water quality. TCE, PCE, nitrate and sulfate are the primary constituents of concern (COCs) that have been identified to date, while rising chloride levels indicate potential pathways for contamination by surface spills or runoff. The COCs vary with each portion of the aquifer, as discussed on the following page.

LPRV AQUIFER WATER QUALITY – BY LOCATION

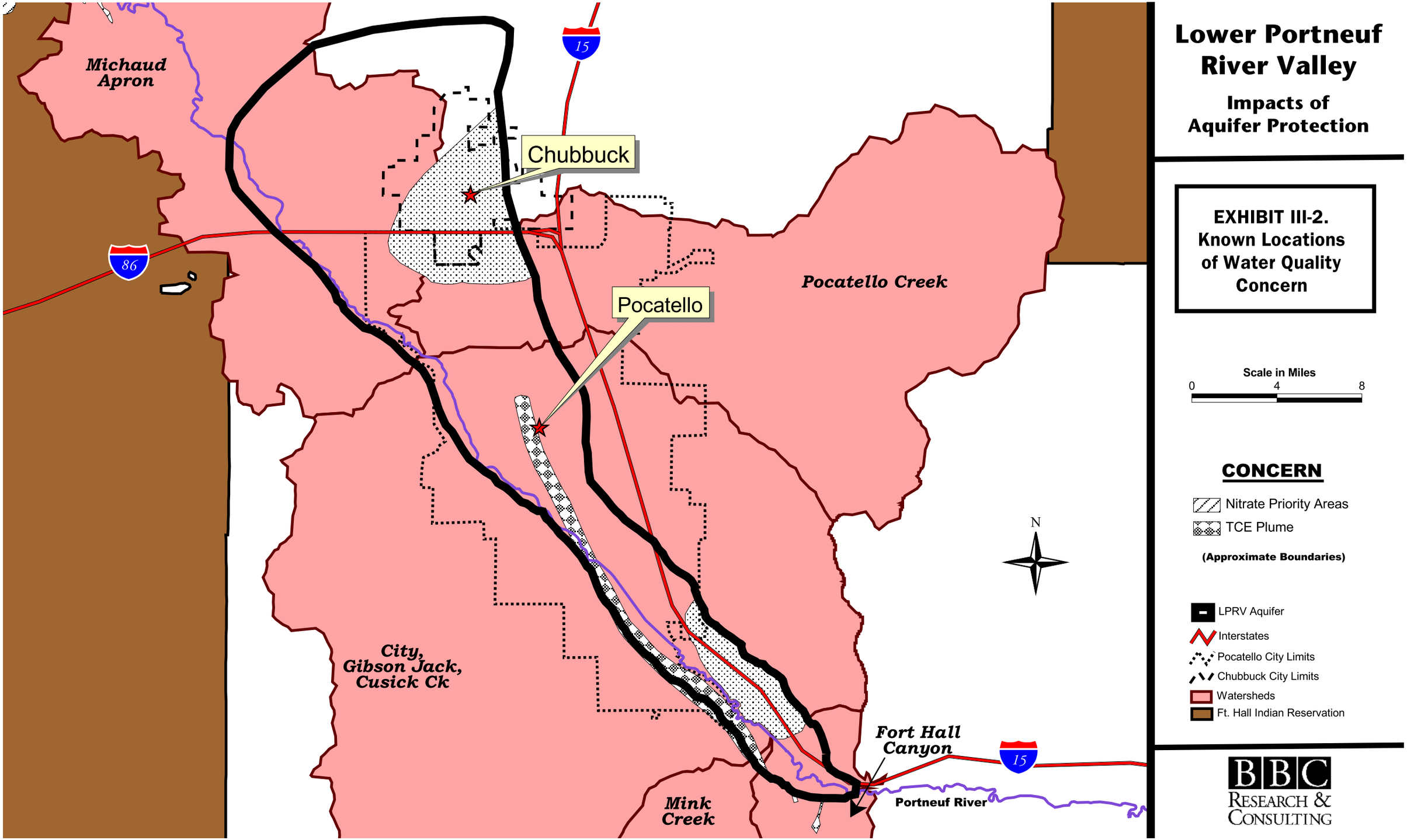
Principal locations of water quality concern are shown on Exhibit III-2. The observations regarding LPRV water quality are based upon the Idaho Statewide Groundwater Monitoring Program, IDEQ studies and various reports by John Welhan and Chris Meehan.

- Southern Aquifer – The greatest concern in the Southern Aquifer has been the TCE plume, discovered in 1991, discussed earlier. Nitrate levels in five of the six monitoring wells used in the Idaho Statewide Groundwater Quality Monitoring Program appear fairly constant. The sixth well indicates a substantial increase in concentration between 1993 and 1997, although only two data points are available. An area near the northern end of the hydrologic subdivision is experiencing increasing salt concentrations, likely due to drawing water from the Eastern Aquifer as a result of cones of depression from municipal drinking wells in this area. Several localized, high-chloride anomalies have been observed in this aquifer and may stem from surface, or near surface, sources such as salt runoff from road de-icing, septic field leaching and/or agricultural/animal waste.

- Eastern Aquifer – This area is known to have degraded water quality and a portion of the hydrologic subdivision has been identified by IDEQ as a nitrate priority area. One municipal well was drilled in this area, but was never used regularly and was eventually abandoned because of chronically high nitrate levels. Flow of contaminated groundwater into the Southern Aquifer is a potential concern.

- Central Aquifer – This area is not well researched, but, as in parts of the Southern Aquifer, there is concern over migration of high salt concentrations from the Eastern Aquifer.

- Northern Aquifer – IDEQ has identified a high nitrate concentration area near the Pocatello Creek mouth as a nitrate priority area. Corresponding increases in chloride, sulfate, sodium, calcium and magnesium in the same area suggest that septic leachate may be the cause. The City of Chubbuck and the EPA have contracted for a groundwater monitoring program in this area, largely due to concerns about the nearby PCE plume affecting the Fort Hall Reservation and municipal wells in Chubbuck.



Lower Portneuf River Valley

Impacts of Aquifer Protection

EXHIBIT III-2. Known Locations of Water Quality Concern

Scale in Miles
0 4 8

CONCERN

- Nitrate Priority Areas
- TCE Plume

(Approximate Boundaries)

- LPRV Aquifer
- Interstates
- Pocatello City Limits
- Chubbuck City Limits
- Watersheds
- Ft. Hall Indian Reservation

BBC Research & Consulting

CURRENT EFFORTS TO ADDRESS WATER QUALITY CONCERNS

Efforts are being made by Bannock County and the cities of Pocatello and Chubbuck to address several of the water quality issues mentioned above. For example, the TCE contamination in the Southern Aquifer is currently being studied. The PCE contamination in the Chubbuck area has also been monitored for several years and work is in progress to address the contamination.

In contrast, proactive programs have not been implemented to address the concentration, distribution, and sources of other COCs -- such as sulfate and nitrate -- and indicators of potential problems such as increased chloride levels. Rising chloride levels are an indicator of potential pathways for contamination from surface spills or contaminated runoff. These contaminants are likely the result of non-point sources such as septic leachate, road salting, stormwater runoff and runoff from agriculture and ranching operations. Without proactive measures, these contaminants are likely to continue to degrade LPRV groundwater quality.

AVAILABLE DATA SOURCES

Much of the core knowledge of the LPRV hydrogeology is based on extensive research conducted through Idaho State University by John Welhan and Chris Meehan. Additional data is available from the following sources:

- Idaho DEQ Regional and Local Monitoring Data – IDEQ maintains several databases that house data about various potential contaminant sources. These include: 1) Primary Contaminant Inventory; 2) Drinking Water Management System; and 3) Wastewater Application Permit Database.

- Idaho Department of Water Resources Ambient Monitoring Data – Idaho Department of Water Resources (DWR) in cooperation with the Idaho Department of Environmental Quality (DEQ) and the Idaho Department of Agriculture (IDA) designed and maintains a statewide groundwater quality monitoring network. The objectives of the statewide program are to: 1) characterize the groundwater quality, 2) analyze for trends, and 3) identify areas where concentrations of constituents are anomalous.

- EPA Regional Geographic Initiatives Database – - A geographic information systems (GIS) database of wells, water quality data, soils, geology, land use, etc.

- Other Research in the Area – Several research projects have been conducted in the vicinity of the LPRV, but are focused on specific areas and issues.

SECTION IV.
DEFINITION OF ENHANCED AQUIFER PROTECTION SCENARIO

ENHANCED AQUIFER PROTECTION SCENARIO – OVERVIEW

To assess the economic costs, benefits and impacts of additional measures to protect LPRV water quality, assumptions must be made concerning the types of measures that would be implemented and how they would work. These assumptions are collectively termed the "Enhanced Aquifer Protection Scenario."

If the citizens of the LPRV ultimately decide to implement a strategy to provide additional protection for their aquifer, extensive public discussions will likely occur and additional refinements or modifications may be made to the protection strategy(ies). In fact, certain elements of the protection scenario are already in place in some form or under consideration by local governmental entities, but are not applied and enforced across the LPRV in a coordinated fashion. The scenario described herein is intended to reflect reasonable assumptions for purposes of analysis, not to proscribe the strategies that may ultimately be chosen.

As defined for this study, the Enhanced Aquifer Protection Scenario is based on the following considerations:

- Per direction from the local Aquifer Protection Work Group (APWG) the focus should be on measures to reduce the *future* introduction of contaminants to the aquifer, not on measures to clean up *existing* contaminant sources.

- The scenario should focus on three principal categories of potential contaminant sources: septic/sewer discharge, stormwater and other non-domestic wastewater management and critical materials handling.

- The scenario should be based upon measures similar to those that have been adopted and implemented to protect the Rathdrum Prairie Aquifer, amended as needed to reflect LPRV circumstances.

BACKGROUND ON RATHDRUM PRAIRIE AQUIFER PROTECTION MEASURES

The Rathdrum Prairie Aquifer is the sole source of potable water for the residents and businesses of Coeur d'Alene, nearby communities and unincorporated residents in Kootenai County. Across the state border in Washington, the aquifer (termed "Spokane Valley") also provides the sole source of potable water for the City of Spokane and its environs. Since the late 1970s – and spurred further by $1 million annual Congressional appropriations to Spokane County, Idaho DEQ and Panhandle Health District from 1988-1994 – the aquifer has been the subject of extensive monitoring and analysis and considerable effort to develop and implement water quality protection measures.

The work accomplished, and the experience gained in protecting the Rathdrum Prairie aquifer provides relevant and important information for this study for several reasons:

- The Rathdrum Prairie Aquifer is the only aquifer in Idaho currently designated in the Sensitive Resource category. Re-designation of the LPRV Aquifer to this category is the assumed mechanism for enhanced protection for purposes of this study.

- Certain key physical characteristics of the Rathdrum Prairie Aquifer are similar to the LPRV aquifer. Both have a high potential vulnerability to contamination from surface and near surface contaminants due to thin and porous overlying surface material. Both also have a potential for relatively rapid contaminant spreading due to the aquifers' fast moving natures.

- The Rathdrum Prairie area has considerable experience in developing specific measures to protect their aquifer; it offers an example of the potential costs and effectiveness of protection approaches.

ENHANCED PROTECTION SCENARIO - SEPTIC/SEWER DISCHARGE

To address the first of the three protection scenario objectives, reducing future potential contamination from septic and sewer discharge to the aquifer, the following measures are assumed:

- limiting the density of future home development relying on septic discharge to one home per five acres, unless the location of the future development is within a Sewage Management Area (SMA).

- SMA's created under local ordinance or through state regulation. These would be areas, presumably proximate to existing sewerage service, that are contractually committed to future sewer system development under specified development progress conditions. Contracts would be between the developer, an existing sewage disposal entity and the local health district or other regulatory authority.

- Higher densities could also be permitted if the homeowner and developer agree to install a septic pretreatment system, approved by the health district or other regulatory authority, and to submit to periodic monitoring of pretreatment system maintenance by the health district or other regulatory authority.

- Any sewage effluent discharge over the aquifer must either be discharged into the Lower Portneuf River or must employ the "slow-rate application" to crop lands best management practices (BMP) developed in the Hayden Land Application Pilot Study. The BMP is reflected in the Special Supplemental Guidelines to the Idaho Wastewater Land Application Guidelines published in 1995.

These measures are drawn largely from the Rathdrum Prairie list, adapted to more closely fit the nitrate and chloride issues in the LPRV.

ENHANCED PROTECTION SCENARIO - STORMWATER AND OTHER NON-DOMESTIC WASTEWATER MANAGEMENT

To address the second of the three protection scenario objectives, avoiding contamination from stormwater runoff and non-domestic wastewater disposal, the following measures are assumed:

- New developments larger than a single family home must develop and implement a stormwater management plan, consistent with the BMP discussed below. The local health district or other regulatory authority would register and review all new stormwater disposal systems.

- Stormwater management plans would reflect BMPs, such as the recommendations in the *Handbook of Best Management Practices for Stormwater Management and Erosion and Sedimentation Control (1992)*. For example, for isolated systems this generally means the development of grassy swale areas at the lowest point on the property with an appropriately designed dry well (with a raised casing) in the midst of the swale to capture extraordinary runoff events.

- Non-domestic wastewater discharge to the aquifer (such as wastewater streams associated with production, cleaning and vehicle washwater) would be prohibited and these types of wastewater would be required to be sent to a local wastewater treatment plant. In some cases, as required by the wastewater treatment operator, this may require pre-treatment of the waste stream by the commercial facility.

This list of measures is drawn entirely from the Rathdrum Prairie experience.

ENHANCED PROTECTION SCENARIO – CRITICAL MATERIALS

The final protection objective, management of critical materials, involves the following measures:

- The health district or other regulatory authority would develop a list of "critical materials" and establish threshold quantities of those materials for purposes of the following procedures. These materials would include potentially significant contaminants to the aquifer if they were accidentally spilled or leaked. Examples of such materials could include certain fuels, industrial solvents and cleaners, etc.

- Facilities that store, handle or use materials included in the list would be required to submit a report on the types and quantities of listed materials used. If quantities exceeded the thresholds established by the health department, the facility would need to submit a plan demonstrating that the material(s) cannot get into the aquifer under either normal operations or in the event of spills.

- The health district or another regulatory authority will have the authority to either approve the plan proposed by the facility or require additional measures.

- The critical materials management regulations would apply to both new facilities and new uses at existing facilities.

The management of critical materials is drawn entirely from the Rathdrum Prairie where it has been effectively utilized.

ENHANCED PROTECTION SCENARIO - OTHER COMPONENTS

In addition to the specific protection measures just identified, important components of aquifer protection include:

- land management of recharge areas;
- enhanced public education; and
- ongoing water quality data collection.

The recharge area for the LPRV, particularly the Bannock Range, is largely undeveloped at this time. Potential water quality impacts arising from future developments may be important for county planning and land use agencies to consider in protecting aquifer water quality. Additional monitoring wells and data collection and analysis would be included under the protection scenario to both enhance understanding of the LPRV aquifer and its water quality and to monitor changes in water quality over time. Additional funding for public education measures is also envisioned.

SECTION V.
TYPES OF POTENTIAL ECONOMIC COSTS AND BENEFITS

ECONOMIC COSTS AND BENEFITS FROM ENHANCED PROTECTION

This study will culminate in Spring 2001 with a discussion of the economic costs, impacts and benefits from the enhanced protection scenario. Based upon the study contract and subsequent input from local interviews in the study area, the following are the types of issues and considerations that will be examined. Subsequent analysis may determine that some issues are significant, while others can be dismissed.

ECONOMIC COSTS AND IMPACTS

Direct Costs

- What would be the administrative cost of the enhanced protection scenario to local governments and agencies such as the health district and the water utilities?
- How significant would the direct costs of compliance be for local businesses and what types of businesses would be most affected?
- How much more would it cost to develop a new home?

Indirect Costs

- How much would taxes or fees have to be increased to pay for enhanced aquifer protection?
- Would some local businesses become less competitive or go out of business or would increases be passed to customers?
- Would local consumers or other businesses have to pay more for products/services from directly impacted firms?
- Would some prospective employers avoid Pocatello and Chubbuck?

TYPES OF BENEFITS FROM ENHANCED PROTECTION

While the costs of enhanced protection measures may be more immediate and easier to estimate, there could be significant economic and non-economic benefits associated with enhanced protection. The following are examples of the types of questions to be considered in the benefits analysis:

BENEFITS

- If nothing is done, what kinds of economic costs may be faced by water users due to degradation under the baseline scenario?
- How expensive might remediation of future water quality problems be if prevention is not implemented?
- Could a proactive stance make the area *more* attractive to some prospective businesses and residents?
- Would LPRV residents experience or perceive an improved quality of life in the future?

SECTION VI.
FURTHER AREAS OF INQUIRY AND NEXT STEPS

FURTHER AREAS OF INQUIRY

The Study Team has conducted a substantial amount of secondary and primary research at this early point in the study of Economic Impacts of Enhanced Aquifer Protection for the LPRV. Our research is by no means complete but we have a clear indication of the information and data which is likely to be available and the data which will not be available for our draft report, set for completion in May 2001. Based upon a mutual understanding at the commencement of this study, primary data collection such as groundwater monitoring or household surveys would not be a part of this initial work. As part of this Phase I effort, however, the Study Team agreed to identify areas of uncertainty where more research or deeper analysis might be worthwhile.

The first area of potential further inquiry would be the linkage of surface activity, be it sewage disposal or storm water drainage, and the quantified effects on groundwater. Preliminary data indicate a definite linkage between the selected surface activities and constituents of concern as described in this report, but a precise quantification of this relationship is unlikely in this Phase I effort. For example, we will not be able to quantify the effects of more septics in a particular square mile of the LPRV as they affect the groundwater in a given area at a given point in time. There are two ways of accomplishing this closer linkage: more analysis of existing groundwater-surface water connection data; and generation of new groundwater data linked to surface activity. In the first instance, individual well data would be further evaluated in terms of direct statistical linkage. In the second instance, new primary geotechnical data would be generated. Additional well data and perhaps additional monitoring would be helpful as part of a later research phase.

Secondly, the quantification of economic benefits associated with the preservation of the aquifer could be improved by a willingness to pay study. This would entail a survey of residents and perhaps businesses regarding their willingness to pay higher water, wastewater or storm water utility bills or a tax levy to preserve the groundwater quality of the LPRV aquifer. The results of the Phase I study might well point to a trade-off of the benefits of a perceived safeguard to water quality by Valley residents and a direct cost in terms of utility bills. The question will then be do the rate payers think this higher level of confidence is worth the out-of-pocket costs? The Study Team has performed such studies in the past and believes this would be useful in this instance, depending on the outcome of our initial work.

FURTHER AREAS OF INQUIRY (CONTINUED)

A third area of potential further inquiry would be the perception itself of a sensitive resource designation for the LPRV. A legitimate question has been raised at to whether the sensitive resource designation would be perceived as a positive demonstration of proactive efforts to improve groundwater quality or, conversely, an official and negative public recognition of a water quality problem. One set of interviews would be conducted with businesses in the LPRV and elsewhere in Idaho or other locations where the possibility for relocating to Pocatello or Chubbuck exists. Another set of interviews, conducted in a focus group setting, would be performed with new LPRV residents and others who might relocate to the region. The attraction of future businesses and residents to an area such as LPRV might hinge on such a perception.

The fourth area of potential further inquiry would be into water use by type of user by self-supplied water users in the LPRV. Customers of the cities of Pocatello or Chubbuck are metered for the amount of use and billed as a category of customer, i.e., residential, commercial, industrial. Similar data is not available for residential and non-residential customers in the LPRV who have their own water supplies through wells or other means. Well counts by size of pope and pump would be derived. Groundwater well volume data would be sought and analyzed. This information would be important both in terms of the groundwater withdrawal-recharge balance and spatial or quality effects. In addition, further knowledge and monitoring of these customers might be important in any aquifer protection system.

It is uncertain whether the Phase I results would apply to southern parts of Bannock County. An additional task would be to look at the characteristics of these areas and compare them to the LPRV based only on available data. A preliminary observation about the applicability of the LPRV findings to adjacent areas would be made. If conditions are fundamentally different, applicability of the LPRV results would be limited.

The cost and time period for these additional areas of inquiry is uncertain since groundwater quality-surface activity linkage might require additional groundwater monitoring, or even a modeling of the groundwater quality circumstance in the LPRV. The Study Team recommends against the commitment of monies for well drilling, monitoring or a major modeling effort at this time. Costs for the proposed Phase II would be less than or equal to $115,000.

Alternatively, the research evaluation envisioned for the May 2001 report will indicate magnitude and direction of effects and point out the benefits and costs in at least a qualitative fashion of enhanced aquifer protection. Depending upon questions raised by the public at that time, such information might be sufficient to make a decision about enhanced aquifer protection for the LPRV.

NEXT STEPS

Extensive work remains to be done on this study over the course of the next few months. The following is a task by task description of upcoming, key work elements:

- *Task 1, Characterization of Enhanced Aquifer Protection Relative to Current Status* -- further detail will be added to this element, as needed to derive costs and to identify key changes required of the entities that would be principally involved in implementing or responding to the enhanced aquifer protection measures.

- *Task 2, Description of Baseline Scenario Without Enhanced Protection* -- projections of key economic, demographic and fiscal measures will be added to the profile of current conditions and recent trends described in this report. The study team will also characterize projected changes in water quality and water quantity.

- *Task 3, Economic and Fiscal Impact Analysis of Enhanced Aquifer Protection* -- the costs, impacts and benefits of enhanced protection will be described, relative to the baseline scenario without additional protective measures. The study team will identify impacts by specifically affected parties (e.g. industries, developers, local government entities, etc.). We will develop quantified dollar impact and benefit estimates wherever possible, although some impacts and benefits will likely have to be characterized in qualitative or non-economic terms.

- *Task 4, Justification and Appropriateness of Projections* -- throughout the subsequent task reports, the study team will describe data sources, analytical approaches, key assumptions and areas of uncertainty in developing projections and estimates.

- *Task 5, Reporting* -- the study team will produce a series of task and final reports, as described on the following page.

SCHEDULE

The following is the schedule of deliverables during Spring 2001:

- Task 1 Working Paper -- preliminary report (subject to subsequent refinement), late December 2000.
- Task 2 Working Paper -- late February 2001.
- Task 3 Working Paper -- April 2001.
- Presentations and final report -- April/May 2001.