

SVRP Project Work plan - FY04,

October 1, 2003 to September 30, 2004

Version 1.2 (incorporates comments accepted at MAC meeting 1/30/2004)

The Spokane Valley - Rathdrum Prairie (SVRP) aquifer is the sole source of drinking water for over 400,000 residents in Spokane County, Washington, and Kootenai County, Idaho. The area includes the rapidly growing cities of Spokane, Spokane Valley, and Liberty Lake, Washington, and Coeur d'Alene and Post Falls, Idaho. Recent and projected urban, suburban, industrial, and commercial growth has raised concerns about potential future impacts on water availability and water quality in the SVRP aquifer, and Spokane and Little Spokane rivers. Water resource concerns include growing demands on ground water and declining ground water levels, low stream flow in reaches of the Spokane and Little Spokane rivers, and water quality problems associated with changing land use activities. Water resource demands are increasing at a time when aquifer and river dynamics are not well understood. This understanding is essential in making proper management decisions concerning ground water and surface water appropriations in the SVRP area.

Management of the SVRP aquifer is complicated because of the interstate, multi-jurisdictional responsibilities for the aquifer. The states of Washington and Idaho have primary responsibility for water allocation and water quality. However, local governments are increasingly being called upon to consider water supply and quality implications in land use planning. Aquifer management is also complicated by the interconnection between ground water and surface water-ground water exchanges with surface channels influence surface channel flow rates and surface water quality and vice versa.

A numerical ground-water flow model will be developed to simulate the flow in the SVRP aquifer and its relation to surface water. The intended users are the Washington Department of Ecology (WADOE) and the Idaho Department of Water Resources (IDWR). The intended use of the model is to test future management scenarios.

Objectives

The fiscal year 2004 (FY04) objectives are:

- Evaluate existing models and select suitable model or construct a new steady state model.
- Compile and format existing data needed for the Spokane Valley Rathdrum Prairie aquifer system (SVRP) ground-water/surface-water model,
- Identify additional data required to produce a satisfactory model and begin data collection to the extent funding is available;
- Provide a means for communicating SVRP project information and results to stakeholders and the public.

Specific data needed by the model are:

1. Boundaries and hydraulic characteristics of the SVRP aquifer system.
2. Configuration of the potentiometric surface and its variability over time.
3. Water budget for the SVRP, including recharge from surface water, inflow at boundaries, and infiltration of precipitation and discharge to surface water, flow at boundaries, and withdrawals by wells.

Approach

Specific tasks needed to accomplish FY04 objectives are presented below. Initial characterization of the SVRP aquifer will provide the conceptual framework upon which the numerical model will be built. This conceptual framework will be developed from existing information compiled from reports and models, hydrologic databases, geologic maps and cross-sections, well logs, seismic data, streamflow records, and water-use records.

The compilation of existing information will produce updated hydrogeologic and water budget data sets, including digital spatial data sets called coverages, that will be used to compute input data for the numerical model. These data sets and coverages will be reviewed to identify additional data needs. Other data needs may be identified as the model is developed.

SVRP project tasks will be accomplished by personnel from the USGS (WA and ID) and signatory state agencies (WADOE and IDWR). Specific tasks also may be performed by local governments, universities, and the private sector.

Some of the following tasks will be performed concurrently and are not in order of performance. Under each task, estimates of the time (labor in hours) required to complete the task are provided for planning purposes. Actual times to complete the tasks will depend largely on the availability and quality of existing information, as well as the quantity of additional data collection required to meet the objectives of this investigation.

Project progress reviews by the Project Technical Leadership Team, Technical Advisory Committee, and the Peer Review Team will be used to revise this work plan as needed for submission for review and approval by the Management Committee.

A Congressional appropriation to the USGS will support most, but not all, of the proposed work on SVRP study tasks in FY04. Additional support (in-kind services and/or direct funding) provided by the signatory States and stakeholders will be required to accomplish all of the tasks listed below.

A. Define purpose, scope, extent, and data collection needs for SVRP ground-water/surface-water model. Review and evaluate in detail existing models.

- 1) PTLT will select model application or applications: Finalize a statement of purpose for the model and define how it will be used. The Peer Review Team and Technical Advisory Committee will be consulted on the merits of various model applications that are available to meet the objectives of the project and the needs of the Idaho Department of Water Resources and the Washington Department of Ecology. The Peer Review Team also will be asked to review and advise on the proposed model scope. *Hydrologist-40 hrs*
- 2) Define model scope.
 - a) Develop a conceptual model(s) that satisfies the intended application/uses of the model.
 - b) What will be the extent of the model vertically (how deep), and spatially (sole-source aquifer area and adjacent alluvium?), and temporally (what time frame(s) will be modeled) *Hydrologist-40 hrs*
 - c) Define the model grid size, layers, orientation, time step length, boundary conditions, and other parameters. These parameters will influence the types and extent of data collection.
 - d) What are the data needs for the model – geology, hydrogeology, aquifer characteristics, water budget, streamflow, etc – and selection of consistent data format(s) *Hydrologist-16 hrs*
- 3) Dependent upon the results of the PTLT modeling recommendations, construct a preliminary steady-state ground water model-450 hrs
 - a) A simple steady state ground water model can be constructed that will help guide the data collection effort. It can be used to test different conceptual models which may indicate where data collection needs to be concentrated. The model may be an extension of an existing model. This would greatly speed up the modeling process and focus data collection for the model.
 - b) Calibrate the preliminary steady state model to available data. Calibration results will also indicate where additional data needs to be collected. New data can be incorporated as it becomes available.
- 4) Review past investigations and develop first version of model input using existing information. Previous models' documentation will be one source of information and may require meeting with the model developers, particularly if the results are unpublished. Information known to be needed by the model includes estimates of aquifer thickness, water-table elevations, ranges of aquifer properties, ranges and distribution of recharge, discharge from the aquifer, historical and seasonal

changes in water-table, and response of the aquifer to changes in recharge or discharge,

- a) Compile and evaluate information describing the areal extent, thickness, and lithologic composition of the SVRP aquifer, aquifer boundary conditions, and the spatial distribution of aquifer hydraulic properties. Compile information describing geologic units beneath and adjacent to the SVRP aquifer, and estimate the exchange of water between the SVRP aquifer and these units. Develop geospatial coverages (extent, thickness, hydraulic properties) of aquifer and adjacent geologic units for use in numerical modeling. Enter/update data in SVRP project database(s). *Hydrologist-520 hrs compile, review, and evaluate data GIS-320 hrs (construct maps, x-sections, coverages), Hydro Tech (STEP)-200 hrs (data entry)*
- b) Compile available aquifer recharge data (precipitation, leakage from surface water features, anthropogenic return flows, and inflows from tributary basins and adjacent uplands) and develop geospatial coverages of recharge for use in numerical modeling. *Hydrologist-240 hrs (compile, review, and evaluate data), GIS-200 hrs (construct coverages)*
- c) Compile available aquifer discharge data (withdrawals from wells, base flow to surface water features, evapotranspiration estimates, and underflow to adjacent units) and develop geospatial coverages for use in numerical modeling. Spokane County, Washington water-use data (ground-water withdrawals and surface-water diversions) have already been migrated into the USGS Site-Specific Water-Use Data System (SWUDS). *Hydrologist-160 hrs (compile, review, and evaluate data), GIS-120 hrs (construct coverages)*
- d) Prepare an annotated bibliography of reference materials used. *Hydrologist-80 hrs*
- e) Compile, review, and evaluate published streamflow records for the Spokane River basin, and perform streamflow analysis to identify possible trends and estimate recharge to and discharge from the aquifer. Streamflow data from all USGS gaging stations within the Spokane River Basin will be retrieved and evaluated for analysis based on length and completeness of record. Those gaging stations with 10 or more years of daily-mean discharge records will be included in statistical analyses. *Hydro Tech or Hydraulic Engineer-40 hrs*
- f) Use selected low-flow statistics (such as the 7-day low flow and Base Flow Index) to identify possible long-term trends in base flows at various river reaches during the period of record that may represent recharge. Preliminary analysis by the USGS indicates increasing losses between Post Falls and Spokane, but needs further analysis. The statistical analysis of low flows in the Spokane River has already been initiated by WADOE. *Hydraulic Engineer-40 hrs*

- g) Delineate gaining and losing reaches of the Spokane and Little Spokane Rivers, and quantify the seasonal exchange of ground water and surface water based on stream discharge measurements. *Hydraulic Engineer-40 hrs*

B. Develop and implement data management process

Efficient data management is needed to ensure data are available for development of model input datasets, to store data for later use, and to provide data to the public. Existing databases and tools will be used to the greatest extent possible and they are expected to meet most of the project needs. Minimizing redundant data entry and diverging data sets will be a goal of the data management process.

- 1) Develop a library of spatial data comprising coverages and metadata needed for the model or for presentation of project results. All data will be formatted for consistency and checked for accuracy. The library will include:
 - a) Land surface information, such as topography, political boundaries, major highways, water purveyor boundaries, and soil information;
 - b) Land cover and use information, such as locations of urban boundaries, rural subdivision boundaries, impermeable areas, drainage and sewer district boundaries, locations of irrigated lands, and water use information;
 - c) Hydrologic and geologic information, including hydrography, precipitation and selected meteorological data, well location and construction, surficial and bedrock geology, ground-water elevations, geophysical surveys, water budget components, and aquifer characteristics.

*Hydrologist-200 hrs (database(s) selection, data manipulation and verification),
GIS-120 hrs (spatial data manipulation and verification),*
- 2) All USGS-collected data or data collected by others for this project and reviewed and accepted by the USGS will be entered into the National Water Information System to provide for public access and long-term preservation. The use of other databases will be evaluated and used as needed for model development. *Hydro Tech (STEP)-120 hrs (data entry)*
- 3) The PTLT will organize a meeting of the agency database and GIS managers to develop a process for data management and sharing.

C. Develop Project Website

Create a project website to provide information about SVRP hydrology, a project description, periodic project updates, a link to an internet map server to provide access to geospatial data, and a directory of all data compiled and collected through the project. The website may house some data, and provide links to various agency

sources for other data. The website will provide a means for communicating SVRP project information and results to stakeholders and the public. *Hydrologist-80 hrs (web site design and content)*, *GIS -40 hrs (web site design and content)*, *IT-120 hrs (web site design and content, create web site)*

D. Additional Data Collection

Additional data collection probably will be needed to calibrate and verify the ground-water model represents the hydrologic system to the level of accuracy needed for management. New data collection will be based on an evaluation of the adequacy of available information to meet modeling needs.

Based on discussions with the local community and previous project scoping by state agencies, it is anticipated that there are significant data needs. Therefore, it is likely that FY04 activities will include: a well inventory to refine the potentiometric map and locate monitoring sites; the establishment of a ground-water monitoring network; ground-water level measurement; and updating/collecting water-use data. Preparations for future data collection activities (such as well drilling, geophysical surveys, or determinations of aquifer properties) also may take place in FY04.

- a. Conduct well inventory, collect ground-water level measurements, and construct potentiometric surface map
 - i. The well inventory will be conducted by participating agency personnel using consistent methods. The USGS will provide training for all personnel prior to the start of the inventory, and will monitor progress of the inventory until its completion. Wells incorporated into the ground-water level monitoring network will be surveyed (both location and altitude) or tied into a consistent coordinate system. All data will be stored in the USGS National Water Information System and other appropriate State databases.
 1. Conduct a well inventory of a subset of existing wells in the study area Conduct records inventory - Identify wells (SVRP aquifer and adjacent geologic units) already in the databases of SVRP project participants and plot locations to determine existing well coverage. Compile well data from Northern Rocky Mountains National Water Quality Assessment and enter into the appropriate database; *Hydrologist or Hydro Tech-80 hrs (data manipulation)*, *GIS-40 hrs (construct well coverage map(s))*
 2. Determine which wells in the database are suitable for inclusion in the ground-water level monitoring network and select a subset of these wells (200-250) for field inventory. Well selection will be based on the availability of lithologic logs, well construction information, owner permission to visit the site, and geographic coverage. Verify/update/enter well information into database; *Hydrologist-200 hrs (well*

- selection, information verification), Hydro Tech (STEP)-80 hrs (update/enter well info)*
3. Determine which areas need additional wells to fill in data gaps. Locate additional wells (30-50); obtain owner permission and well information; enter well information into the database; *Hydrologist-80 hrs (identify data gaps and potential locations for additional wells), Hydro Tech-160 hrs (field reconnaissance to locate additional wells, obtain owner permission, collect well information), Hydro Tech (STEP)-80 hrs (data entry)*
 4. Conduct field inventory – Measure water levels in all inventory wells over a short as possible period (2-3 weeks) during the late summer-fall of 2004. Water levels will be measured as depth below land surface using either a graduated steel tape or a calibrated electric tape accurate to the nearest 0.01 ft. Water levels will be measured at least twice, several minutes apart, to verify the measurement and determine if the water level reflects static conditions or the influence of recent pumping. Verify/update/collect ancillary data (well construction, drillers' logs, water use, owner info) for all wells. GPS units will be used during the field inventory to determine the latitude and longitude of each site along with any metadata that may be required; *Hydrologist-40 hrs (plan field work), SupvHydro Tech-60 hrs (supervise field work), Hydro Tech-400 hrs (conduct field work)*
 5. Land-surface altitude at each site will be determined by plotting the well location (GPS) on 1:24000-scale topographic maps and interpolating the altitudes from contours (generally to within one-half of a contour interval). Higher accuracy land-surface altitudes (NAVD88) will be determined, if needed, at selected sites (30-40) using differential GPS (to within 1 ft); *SupvHydro Tech-16 hrs (plan and supervise field work), Hydro Tech-160 hrs (conduct field work)*
 6. Enter all field inventory data into the SVRP project database(s) for input to model; *Hydrologist or Hydro Tech-200 hrs (data verification/entry), Hydro Tech (STEP)-160 hrs (data entry)*
- b. Construct preliminary potentiometric surface map. *Hydrologist-40 hrs (data interpretation-potentiometric surface), GIS-40 hrs (map construction)*

- c. Information on the fluctuation of the potentiometric surface is needed for model development, calibration, and verification therefore additional water-level measurements will be needed.
 - i. Selected wells (8-10) will be instrumented with continuous water-level recorders. The selection of wells to be instrumented will be based on geographic coverage, and the identification of areas where water levels may change rapidly due to natural or anthropogenic influences such as ground-water pumpage or recharge from stream infiltration. Data collection installations will be structured to allow for continuing, long-term monitoring. Several wells in the SVRP study area are currently being monitored (some instrumented with continuous water-level recorders) by Spokane County and the USGS/IDWR cooperative program. Continuous water-level recorder data will be periodically downloaded and entered into the SVRP projects database. *Hydrologist-40 hrs (select wells to be instrumented and plan field work), Hydro Tech-120 hrs (conduct field work, download/enter data)*
 - ii. In addition, monthly ground-water level measurements will be conducted in selected wells (40-50) to define seasonal ground water-level changes, define ground-water inflow from tributary basins and adjacent lakes, and to define stream-aquifer interactions with the Spokane River and lower reach of the Little Spokane River. Monthly ground-water level measurements will be entered into the SVRP projects database. *Hydro Tech-480 hrs (conduct field work), Hydro Tech (STEP)-60 hrs (enter data)*

- d. Compile water-use data.

Water-use data is used to determine recharge and discharge from the system. Retaining site-specific water use data as well as spatially interpolated or model grid cell data allows the model developer to modify the model grid resolution or model simulation time step to determine the best representation of the system.

The PTLT will recommend a process to manage and share water-use data. The USGS water-use database (SWUDS) consists of programs that are used to manage water-use data collected by category of use at the site-specific or aggregate level. These programs and data enable a spatial and temporal depiction of volumes and locations of water withdrawals, transfers and returns, and will provide useful data for the SVRP ground-water/surface-water model. Both the States of Washington and Idaho also have comparable databases which will supply additional data.

Withdrawals were previously collected or estimated in Spokane County for 1998. These data were provided to the USGS and compiled into SWUDS using funds and personnel that were committed in FY03 by WADOE and USGS through the USGS Federal

Matching Funds program. Withdrawal data in Idaho have not been fully inventoried or compiled.

Initial work elements will include the further synthesis and integration of available site locations and water use data into the appropriate databases. Secondary work elements will focus on field inventory of water-use data at wells identified for other components of the study, and data entry. Additionally, information on ground water withdrawals for irrigation, small-scale public supply and commercial use, and an average domestic-use rate exists. Specific water-use tasks are given below. Project technical teams will further define the scope and suggested implementation of each task.

- i. Continue to collect and integrate water-use data into the appropriate databases and update as necessary the data already in the databases
 1. Determine what types of water-use data will be collected, and how the data will be entered into data bases;
Hydrologist-16 hrs
 2. Determine time lines and strategy for water-use data collection activities in FY04; *Hydrologist-16 hrs*
 3. Define the water use data needs for the ground-water flow model; *Hydrologist-24 hrs*
 - Time period needs for different users, i.e. large public supply wells; actual monthly data, domestic wells; estimated average annual.
 - Need for site specific information
 - Methods to estimate unreported water use: irrigation, private public supply etc.
 4. In office data collection and database input; *Hydrologist-320 hrs*
 - Update data to current conditions where necessary.
 - Integrate public-supply site-specific data into the appropriate databases
 - Collect site-specific data for industrial and irrigation withdrawals using non-field collection methods
 - Specific tasks – Spokane County, Washington: compile monthly measurements for 241 wells (94-99), and update measurements through 2004
 5. Field data collection (Field work will be coordinated with other data-collection tasks to maximize efficiency);
Hydrologist-80 hrs (plan and supervise field work), Hydro Tech-320 hrs (conduct field work), GIS-40 hrs (provide

geospatial coverages for planning and conducting field work)

- Design water-use field form for well inventory
 - Collect site-specific data for industrial and irrigation withdrawals using field collection methods
 - Field check public supply wells locations with GPS
 - Determine the location of irrigation wells
 - Specific tasks – Kootenai County, Idaho: inventory a subset of private public supply wells; inventory a subset of large public supply wells; assess and collect data for domestic wells using an aggregate approach (water use in a geographic area); collect, calculate, or estimate withdrawals for public supply, irrigation and domestic wells (1994-2003)
6. Populate database with water-use data collected or estimated for Spokane and Kootenai Counties; *Hydrologist-300 hrs*
- Subtask; associate sites with USGS sites, or build new NWIS Site file for sites not in NWIS
 - Design database coding model for withdrawals, conveyances, losses and returns
 - Enter all water-use data into database using appropriate units and coding to differentiate estimates from actual measurements

Anticipated Products FY2004

- Preliminary steady state ground water model for use of PTLT.
- Initial data-sets needed for model, including the potentiometric surface, aquifer boundaries, estimated aquifer hydraulic characteristics, recharge estimates, surface-water and water-use discharge estimates.
- Project database and website
- Monitoring well network

Peer Review Process

The Peer Review Team appointed by the Management Committee will meet with the Project Technical Leadership Team at least twice during the fiscal year to discuss and review plans and progress.