IMPACTS OF NON-POINT SOURCE POLLUTION ON WATER RESOURCES IN THE PARADISE VALLEY

Prepared for Park County by
The Montana Bureau of Mines and Geology
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Clean Water Act Section 319 Non-point source pollution control program
Final project report DEQ Contract 20091

IMPACTS OF NON-POINT SOURCE POLLUTION ON WATER RESOURCES IN THE PARADISE VALLEY

Final Report

EXECUTIVE SUMMARY

A hydrogeological investigation of Paradise valley was conducted by the Montana Bureau of Mines and Geology in cooperation with Park County between 2000 and 2005. The investigation consisted of inventorying wells and surface-water sites, monitoring ground-water levels and stream flows, collecting water-quality samples, collecting samples for tritium and CFC analyses (ground-water age dating), and performing aquifer tests. This data was used to assess the vulnerability of the water resources to impacts from developments that are occurring in the valley. The following are the key findings of this investigation:

- Surface-water and ground-water systems are interrelated parts of a single hydrologic system. Most of the ground-water recharge comes from stream and ditch infiltration. Also, ground-water discharge accounts for over half of the annual flow contributions to the Yellowstone River from the watershed and ground water from the valley makes up about 8 percent of the river flow at Livingston.

- The primary ground-water units in the valley are the till/fan aquifer and alluvium/outwash aquifer. The till/fan aquifer is made of relatively low permeability materials but can be several hundred feet thick in places. Consequently, this aquifer can be relatively high yielding. However, where the till/fan deposits are thin, they may not be a reliable source of ground-water. The alluvium/outwash aquifer is made of very permeable sand and gravel deposits and is capable of very high yields.

- Ground-water levels in the till/fan aquifer fluctuate 10 to 60 feet in response to the seasonal melt-water runoff. Ground-water levels in the alluvium/outwash fluctuate 1 to 20 feet primarily in response to operation of the Park Bench irrigation ditch. Ground-water levels in both aquifers are sensitive to climatic changes particularly to the quantity of spring melt. Longer term trends in wells seem to correlate with melt-water flows of the past 1 to 2 years.

- Ground-water and surface-water quality in the valley are very good. There were no common ion, trace metal or nutrient concentrations that exceeded drinking water or aquatic standards.

- The current land use of agriculture and residential subdivisions does not appear to have impacted water-quality in the valley. The median nitrate concentration of ground-water in the valley is 0.5 mg/L. The Yellowstone River does gain nitrate concentration (from about 0.03 mg/L to 0.08 mg/L) through the watershed and ground-water discharge accounts for about all of the contribution. However, human activities such as septic drainfield discharges and agriculture appears to account for a minor to negligible part (at most 30 percent) of the ground-water nitrate. Most of the ground-water nitrate is likely from natural sources. Phosphorous concentrations in ground-water are at or below the detection limit and potassium concentrations in ground water are the same or less than the river.

- There are some historical mining activities, but they do no appear to have impacted water quality in the valley.

- Ground-water in both the fan/till and the alluvium/outwash aquifer are likely made up of a mixture of very recent water (less than 10 years old) and older (40-50 year old water). Consequently, the aquifers are susceptible to contamination from surface activities. The aquifers are most vulnerable near recharge areas and near the river where ground-water is relatively shallow.

INTRODUCTION

This report provides a final report for the non-point source impacts to the Paradise Valley project. This project was sponsored by Park County and funded by a Clean-water act, section 319 grant from the U.S. Environmental Protection Agency and the Montana Department of Environmental Quality. Supplemental funds were also provided by the US Bureau of Reclamation and Montana Bureau of Mines and Geology. The final Billing statement is provided in Attachment A.

The Paradise Valley, located along the Yellowstone River south of Livingston Montana (Figure 1), is experiencing rapid development and land use is shifting from primarily ranching and irrigated croplands to 1 to 50 acre residential lots. Much of the development is occurring in the Glastonbury, Emigrant, Pray, and Pine Creek areas (Figure2). All of the population in the valley is dependant on ground water for their source of potable water and on septic drainfields for sanitary disposal. The number of wells and the number of septic systems in the valley doubled between 1990 and 2000 (http://www.parkcountyenvironmentalcouncil.org and well data from GWIC). The increasing number of households in the valley both expand the demand for ground water and pose an increase risk of contamination from the greater density of septic drainfields.

Prior to this project, information as to the potential impacts to water-quality and availability were lacking. Consequently, the growth and land use changes are a matter of concern to area residents. The primary goal of this project was to develop an understanding of the physical hydrogeology of both the surface-water and ground-water systems in Paradise Valley with enough detail to develop scientifically sound predictions of the impacts of future land-use changes and development.

The project was administered by Park County and data collection and interpretation were preformed by the Montana Bureau of Mines and Geology. Data collection occurred primarily between August 2000 and July 2004. Descriptions of the tasks, costs, timeframe, products, responsible parties, and an evaluation of the data are provided in the following text.

OBJECTIVES AND TASKS

Objective 1: Background Data Review
A comprehensive review of available data sources was conducted to identify areas of adequate and inadequate data coverage. The background data review was used to construct a preliminary conceptual understanding of the valley hydrology and was used to better focus data collection tasks.

Task 1: Data Compilation
Description:
Available background information was collected and compiled to build an understanding of the area's ground-water and surface-water systems. A list of the data collected and their source is provided below:

Data	***Source***
Basemap GIS, streams, roads	Montana Bureau of CENSUS
Basemap GIS, land survey	Montana State Library
Basemap, topographic base	USGS
30 M Digital elevation model	USGS
Land parcel ownership	MDA, GIS Bureau
Well, lithologic and geologic data	MBMG-GWIC
Ground-water chemistry data	MBMG-GWIC
Water rights data	DNRC
Satellite imagery	NASA, ASTER and LANDSAT
Climatic station data	NOAA and NRCS
Precipitation distribution modeling	University of Oregon
Soils and irrigation data	NRCS
County agricultural statistics	USDA
Population	US Bureau of CENSUS
Yellowstone River Flow	USGS
Yellowstone water quality	USGS

Additionally, the MBMG conducted an inventory of 130 wells and 69 surface-water sites (Figure 3). The well inventory consisted of verifying the well location, and measuring well depth, static water level, well yield and field water quality parameters (pH, temperature, specific conductance, and nitrate). Surface-water site inventory consisted of measuring the stage, flow, and field water quality parameters (as defined above).

Costs:
$25,887 (GRANT: $15,127; MATCH: $10,760)

Timeframe:
Most of the initial background data collection occurred during the last quarter of 2000. However, additional information was collected throughout the project as it became available or pertinent to the investigation. Most of the well inventory occurred during the summers of 2000 and 2001. Additional wells and surface-water sites were inventoried throughout the project to fill in observed data gaps.

Responsible parties:
All data collection tasks were conducted by the MBMG. Permission to access the sites was provided by area land owners. Project administration was performed by Park County.

Products:

- Appendix B: List of well inventory data
- Appendix C: List of surface-water inventory data
- Figure 1: Paradise Valley is located along the Yellowstone River south of Livingston Montana between Allen's Spur in the north to Yankee Jim Canyon in the South.
- Figure 2: Most of the 1-50 acre residential lots are concentrated in North and South Glastonbury, and near Emigrant, Pray, and Pine Creek.
- Figure 3: Locations of the 130 wells and 69 surface-water sites that were inventoried for this project.

Evaluation/Comments

This information was used to build GIS coverages, form base maps and to guide data collection and interpretation for the project. Data collected in this task forms the basis of evaluation presented later in this document.

Objective 2: Data Collection

In conjunction with voluntary landowner access, a hydrologic monitoring program was undertaken along the Yellowstone River and adjacent alluvial and glacial aquifers between Corwin Springs and Allen's Spur. The monitoring program included water-quality data collection at streams and wells. Data was collected that documented water quality for future TMDL designation. Particular attention was given ground-water and surface-water interaction.

Task 2: Establish monitoring program

Description:

Ground-water level data were collected at 65 sites and surface-water data were collected from 69 sites on a quarterly to monthly basis. Ground-water samples were collected from 13 wells for common ion, trace metals, and nutrients analyses. Surface-water samples were collected from 5 stream sites for the same analyses. Most ground-water monitoring was performed at existing private wells. However, with funding assistance from the US Bureau of Reclamation 9 dedicated test wells were installed.

Cost:

$72,831 (GRANT: $51,312; MATCH: $23,442)

Timeframe:

Monitoring was conducted at well and surface-water sites between August 2000 and July 2003. Test well installation and aquifer tests were performed between July 2003 and May 2004.

Responsible parties:

Monitoring and data collection activities were performed by MBMG staff. Wells were monitored with landowner permission. Test wells were installed with funding from the US Bureau of Reclamation.

Products:

- Appendix D: Surface-water monitoring data

- Appendix E: Time-weighted surface-water flow data for water-year 2002.
- Appendix F: Stream loss and irrigation ditch loss calculations
- Appendix G: Ground-water level monitoring data
- Appendix H: Summary of ground-water elevation data used to construct Plate 1.
- Appendix I: Surface-water sample analytical results
- Appendix J: Ground-water sample analytical results.
- Plate 1 Ground-water elevation and flow map
- Figure 4 Flow contributions to the Yellowstone River from the watershed during the 2002 water-year varied from 270 cfs during winter base-flow conditions and 4,870 cfs during the spring melt.
  water-year 2002
- Figure 5: The Yellowstone River receives or losses flow from ground-water along different reaches in the watershed.
- Figure 6: Ground-water and Spring Creek discharges to the Yellowstone River measured during the 2002 water-year were observed to fluctuate by about 40-percent.
- Figure 7 Map showing irrigated lands and major irrigation ditches.
- Figure 8: There are 36 named streams that drain to the Yellowstone River.
- Figure 9: Flows in the mountain streams increase considerably during the spring melt.
- Figure 10: Bedrock units in the valley include Archean metamorphic rocks, Paleozoic sedimentary rocks, Mesozoic sedimentary rocks and Cenozoic volcanic rocks.
- Figure 11: Quaternary deposits in the valley include alluvium, alluvial fan, glacial till and glacial outwash.
- Figure 12: Well statistics by aquifer
  A) Ranges of specific capacity values by aquifer
  B) Ranges of reported pumping rates by aquifer
  C) Ranges of reported well depths by aquifer
- Figure13: A plot of the arrival date of peak ground-water levels verses distance from the valley confluence in the fan/till aquifer shows that the recharge pulse generally travels about 130 feet per day.
- Figure 14: Ground-water level relationship to annual melt-water (May to July)
  A) Standish well
  B) Erdman well
  C) Ohair well
  D) Nelson well
- Figure 15 Distribution of dissolved constituent concentrations in ground-water

<u>Evaluation/Comments</u>

Surface Water

- Essentially all the surface-water and ground-water flows in Paradise Valley discharge to the Yellowstone River before Livingston. The water contributions from these discharges were evaluated by comparing flow rates on the Yellowstone River at USGS monitoring stations located at Corwin Springs (south) and Livingston (north). During the 2002 water-year the Yellowstone River between these stations gained 270 cfs during the winter and 4,870 cfs during the spring melt (Figure 4)

- Ground-water contributions to the Yellowstone River were evaluated by subtracting measured stream flows from the observed river gain. This data demonstrates that the Yellowstone River overall gains flow from ground water through the watershed, but this is not uniformly true along the entire reach. Between Corwin Springs and the Mill Creek bridge, ground-water discharges to the river about 50 cfs, then the river loses about 60 cfs north to the Pine Creek Bridge and then gains about 330 cfs north to the Carter Bridge (Figure 5).

- The overall ground-water contribution appears to fluctuate from a low of 230 cfs in about March to a high of about 320 cfs in late-August or early September. The average ground-water discharge to the river is about 276 cfs (or about 200,000 acre-feet/year). About 60 percent of the ground-water contribution is accounted for by two large spring fed creeks: Nelson Spring Creek and Armstrong Spring Creek. The flows from these spring creeks fluctuate similar to the overall ground-water contribution rate (Figure 6).

- Near Emigrant 150 to 220 cfs of the Yellowstone River is diverted into the Park Branch Canal and Paradise Canal for irrigation (Figure 7). These canals provide water to about 6,300 acres are unlined. The Park Branch Canal was calculated to lose about 60 percent of its flow to ground-water infiltration and provides about 27,500 acre-feet per year of ground-water recharge. The smaller Paradise Canal only provides about 2,000 acre-feet per year of ground-water recharge based on similar calculations..

- There are 36 named mountain tributary streams that drain directly into the Yellowstone in the watershed (Figure 8). The largest of these are Mill Creek and Big Creek. Flows in these creeks typically increase by an order of magnitude or more during the melt-water period (mid-May to mid-July). All the streams that cross the main valley floor lose flow through infiltration. The rate of loss appears to be a function of stream width and soil permeability (see Appendix D). Unit infiltration rates (flow loss per stream bottom area) range from 1 ft/d to 15 ft/d. Most of the loss occurs at the alluvial fan apex where the streams first drop into the main valley.

Ground water

- The bedrock aquifers of the watershed generally consist of: crystalline metamorphic rock, Paleozoic sedimentary rocks, Mesozoic sedimentary rocks and Cenozoic volcanic rocks. The location and distribution of the bedrock formations are shown on Figure 10. Statistics on well depths, yield, and specific capacity (pumping rate per feet of drawdown) for each aquifer is shown on Figure 11.

- By far most of the wells in the watershed are completed in alluvium, alluvial fan, glacial till and glacial outwash sediments within Paradise Valley. The surficial distribution of these deposits is shown on Figure 12. Based on hydraulic properties these deposits can be divided into the alluvium/outwash aquifer and the till/fan aquifer. The till/fan aquifer consists of poorly sorted clay through boulder sediments. The alluvium/outwash aquifer consists of well-sorted sand and gravel.

- Ground water in the till/fan aquifer flows under a relatively steep gradient of typically 0.03 to 0.05 ft/ft (Plate 1). In places away from stream recharge, the aquifer in the till/fan deposits may become thin and possibly unusable. Ground water in the alluvium/outwash aquifer flows under a much flatter gradient of typically 0.003 to 0.005 ft/ft.

- Near where the tributary streams enter the main valley steep downward vertical ground-water gradients (up to 0.8 ft/ft) have been observed. This is caused by the downward migration of stream infiltration in the till/fan aquifer. Downward vertical gradients of as much as 0.25 ft/ft have also been observed near the Yellowstone River between Mill Creek Bridge and Pine Creek Bridge. This is caused by the downward migration of river infiltration in that reach. Near the spring creeks at the north end of the valley an upward gradient of 0.1 ft/ft was observed. This is the result of ground-water discharge to springs in the area and baseflow discharges to the Yellowstone River.

- Ground water in the till/fan aquifer fluctuates between 10 and 60 feet per year. The fluctuation is tied to the increase in stream infiltration recharge during the melt-water season. The surge in recharge sets off a wave-like ground-water pulse that travels at about 130 feet per day. The motion of the pulse is documented by the peak arrival time in several wells near tributary streams (Figure 13).

- Ground water in the alluvium/outwash aquifer fluctuates from 1 to 20 feet. South of about Mill Creek the fluctuations appear tied to the melt-water surge and peak in about early to mid summer. North of Mill Creek the fluctuations appear to be controlled primarily by seasonal infiltration through the Park Branch Canal.

- Longer term (multi-year) ground-water level changes in both the till/fan and the alluvium/outwash aquifer appear to be linked to the last year or previous to last year melt-water flow rate (average Yellowstone River flow gain, May through July; Figure 14). This data indicates that ground-water levels respond very fast to climatic change. Climatic impacts were greatest (larges water level changes) in the till/fan aquifer and least in the alluvium/outwash aquifer.

Water Quality

- The concentration of dissolved constituents (sum of common ion concentrations) in the tributary streams varies seasonally from 30 mg/L (Pine Creek) to 140 mg/L (Trail Creek) during late-spring to 60 mg/L (Pine Creek) to 290 mg/L (Trail Creek) in late-winter. Dissolved constituent concentrations in the Yellowstone River range from 80 mg/L in late-spring to 260 mg/L in late-winter. The dominant ions are calcium, magnesium and bicarbonate. None of the analyzed common ions, nutrients, or trace metals exceeded drinking water or aquatic standards.

- The concentration of dissolved constituents in ground water in the till/fan and alluvium/outwash aquifers varied from 40 mg/L to 480 mg/L. The distribution of these concentrations demonstrates a pattern of dilution and mixing of fresher recharge water with slightly more mineralized water (Figure 15). The lowest concentrations are near stream and irrigation recharge areas and concentrations increase with distance away from them. None of the ground-water samples collected in the till/fan or alluvium/outwash aquifers exceed drinking water standards.

- Water-quality data of the bedrock wells is more limited. Ground-water dissolved constituent concentrations are generally lowest (about 100 mg/L) in the volcanic rocks in the Big Creek and Eight Mile Creek drainages and highest in the Mesozoic rocks (about 1,400 mg/L). A sample collected from a well completed in the Mesozoic bedrock had sulfate concentrations of 1,320 mg/L that exceeded the secondary standard of 250 mg/L.

Task 3: Collect additional site-specific data

Description:

The MBMG performed aquifer tests at 6 sites and evaluated data from two other tests conducted by others in the valley. Additionally a total of 19 samples were collected for tritium analyses and a total of 17 samples were collected for CFC analyses.

Timeframe:

Aquifer pumping tests were preformed between July 2003 and May 2004. Tritium and CFC sampling were performed between March 2002 and April 2004.

Responsible parties: MBMG staff members performed data collection tasks. The MBMG also performed and/or evaluated additional aquifer tests in cooperation with Octagon Engineering, Wells Consulting, and Fluidyne Inc.

Cost:

$34,202 (GRANT: $23,442; MATCH: $10,760)

Products:

- Appendix K: Summary of aquifer pumping tests
- Appendix L: Summary of tritium and CFC analyses
- Figure 16
    - A) Tritium concentrations in ground water verses CFC-12 concentration.
    - B) Tritium concentrations in ground water verses specific conductance.
    - C) Specific conductance in ground water verses temperature.

Evaluation/Comments

- Aquifer test data (Appendix K) indicate that the horizontal hydraulic conductivity of the till/fan aquifer is relatively low (about 30 ft/day). However, these deposits can be several hundred feet thick and so can still have transmissivities (the product of hydraulic conductivity and saturated thickness) of over 10,000 ft^2/day. These aquifer materials appear to be anisotropic and have vertical hydraulic conductivities of about 2 ft/d. The aquifer storage (specific yield) is also low (about 0.01) and so drawdown and water-level pulses are transmitted rapidly through the material. The horizontal ground-water velocity varies from 90 to 150 ft/d.

- The horizontal hydraulic conductivity in the alluvium/outwash aquifer is much higher than the till/fan aquifer and is about 560 ft/day. The alluvium/outwash aquifer is extremely productive and has transmisivities above 100,000 ft^2/day. These materials are also very anisotropic and have a vertical hydraulic conductivity of about 5 ft/day. The specific yield is about 0.10 which is indicative of a cleaner sand and gravel than found in the till/fan deposits. Although the hydraulic conductivity of the alluvium/outwash aquifer is higher, the horizontal ground-water velocity is actually less than in the till/fan aquifer and ranges from 15 to 25 ft/d. This is because of the flatter gradient and higher specific yield in the alluvium/outwash aquifer than in the till/fan aquifer.

- With only a few exceptions, all the ground-water samples from the till/fan or alluvium/outwash aquifers indicate modern water (less than 50 years old). This indicated by the presence of CFCs and tritium in the sample. Both of these constituents are trace atmospheric contaminants of the modern world (tritium from nuclear testing and CFCs from industrial activities). Because the ground water is relatively young, these aquifers

are potentially susceptible to impacts from surface contamination and land-use changes. Three wells completed in bedrock were found to contain pre-modern water. One well completed in the till/fan deposits had a mixture of modern and pre-modern water (Appendix L)

- More detailed age dating of the ground water is possible using CFC concentrations. However, analyses of the CFC and tritium concentrations show an inverse relationship between these constituents. Such a relationship would not be expected if age were the controlling factor on concentration. Moreover, similar relationships were found to exist with specific conductance, dissolved constituents, percent sulfate and temperature (Figures 16). The most likely explanation for these trends is by mixing young (less than 10 year old), colder, fresher water with older (30 to 50 year old), more mineralize, and warmer water. The mixtures vary from near 0 to 75 percent older water. The overall percentage as indicated by the water composition at the Armstrong and Nelson Spring Creeks is between 20 to 30 percent older water. The older water may be ground water from deeper in the till/fan and alluvium/outwash aquifers and/or ground-water upwelling of underlying bedrock. The composition of the older water is roughly similar to that found at Chico Hot Springs (Leonard and others, 1978) which is believed to be derived from deep ground-water from the Madison Group Limestone (Locke and others, 1995).

Task 4: Evaluate Baseline Data Necessary to Develop TMDL's for the Yellowstone River.

Description:
Surface-water quality and stream-flow data was compiled and evaluated to provide baseline data to help develop future TMDLs for the Yellowstone River.

Costs:
$52,101 (GRANT: $30,582; MATCH: $21,519)

Products:
- Appendix M: Constituent Loading to the Yellowstone River
- Surface-water and ground-water data previously presented

Timeframe:
Surface-water and ground-water data were collected from August 2000 to April 2004.

Responsible parties: MBMG

Evaluation/Comments:
Nutrient loading
- The median nitrate concentration of ground water in the valley is 0.5 mg/L. Using this value and an average ground-water discharge of 275 cfs approximately 135 tons per year of nitrate are added to the Yellowstone River by ground water. Flow weighted averages of nitrate concentrations (1990 to 2003, USGS) indicate that the Yellowstone River gains nitrate from 0.08 mg/L at Corwin Springs to 0.12 mg/L at Livingston. All of the observed nitrate gain is likely from ground water. Nitrate contributions from tributary stream runoff appear to be negligible.

- There were no obvious geographic patterns relating ground-water nitrate concentrations and land use. However, there was a trend of increasing nitrate with dissolved constituent

concentrations. This would indicate that nitrate concentration is influenced similarly to the other constituents by dilution and mixing. Nitrate was present in both the modern and pre-modern waters (identified by tritium) and in fact some of the higher nitrate concentrations were in water containing all or in part pre-modern water.

- Nitrate loading rates from septic drainfields have been estimated to be about 1 pound per person per year (Olson and Reiten 2002). This rate was estimated in alluvial gravels with a shallow water table and so should be conservatively higher than in Paradise Valley where the ground water is typically a hundred feet or more deep. Using this value for the watershed population of 2,740 people; (2000-CENSUS) accounted for less than 2 percent of the annual nitrate contribution to the river.

- Nitrate loading from flood irrigated croplands along the Yellowstone River further downstream (Yellowstone County) has been estimated to be about 5 pounds per acre (Olson and Reiten, 2002). This value is likely conservatively high for Paradise Valley because of the greater depth to ground water, less intensive fertilizer requirements of the crops in the area (hay as opposed to sugar beets and corn), and the use of sprinkler irrigation as opposed to flood irrigation. Never-the-less, using this value accounts for less than 30 percent of the nitrate contribution to the river.

- Most of the nitrate in the ground water of Paradise Valley appears to come from natural sources. These would include precipitation and soil organic matter decomposition. Nitrate concentrations observed near baseflow conditions in the Yellowstone at Corwin Springs are about 0.3 to 0.4 mg/L. This would be representative of average ground-water concentrations in the mostly non-agricultural and uninhabited drainage basin above the project area.

- Phosphorous concentrations in ground water were below or slightly above the analytical detection limit of 0.1 mg/L. Consequently, loading rates could not be calculated for this constituent but are likely negligible. Potassium concentrations in the ground water were the same or less than measured in the river.

Metal loading

- There was historic metal mining up Emigrant, Mill and Six-mile creeks and documented adit discharges (Hargrave and others 2000). However, the impacts are reportedly localized and do not affect the streams beyond the site. There are also historic coal mines up Trail Creek but there are no documented adit discharges. The pH of these streams appear to be similar to other streams in the valley and have iron, manganese, and aluminum concentrations less than the Yellowstone River.

Flow alteration

- Most of the tributary streams in the valley are diverted at least during part of the growing season. Although the total volume of water diverted is small compared to the total annual discharge, during the late summer and fall it can account for most or even all of the available flow. Many of the streams are dry or nearly so after diversion in August and September. Residents along Deep Creek and Six-mile Creek indicate that this is the result of increased irrigation and that in the past the streams would flow year round. There is little historical flow data to evaluate these observations but dead cottonwood trees along the west branch of Six-mile Creek indicate that flow conditions along this drainage has

changed in the recent past. Most, if not all of the flow of this stream, appears to have been diverted into a ditch or pipeline.

- A review of DNRC water rights permits indicate that 462,000 acre-feet of water are allocated for use from the tributary streams. In the 2002 water-year there was only 262,000 acre-feet of water available and only about 30,000 acre-feet were used for irrigation. The water-rights records also show 930,000 acre-feet of Yellowstone River water allocated in the valley. The total irrigation diversion from the river in 2002 was 53,000 acre-feet of which only 20,000 acre-feet were used for irrigation. Most of the water-rights have priority dates from the early 1900's. Clearly, water-rights in the valley are out of sync with actual water availability and use.

Aquifer sensitivity

- The data collected and compiled from this project indicate that regional non-point impacts by the present land-use pattern of agriculture and low-density residential subdivision are negligible to minimal. However, both the fan/till and alluvium/outwash aquifer contain relatively young water and so are vulnerable to contamination. Areas most vulnerable to contamination are near the Yellowstone River where ground water is shallow (less than 50 feet deep) and near alluvial fan apexes where most of the recharge occurs and where there are strong downward vertical gradients. The relatively high ground-water flow rate has the potential to carry contaminants at a rapid rate but also will act to dilute and disperse them.

Objective 3: Interpret data, develop watershed conceptual models
To the extent possible, identify the effects on watersheds of irrigation practices and subdivisions. Results of this project provided a better understanding of the overall stream impacts, and surface-water and ground-water interactions.

Task 5: Plot and analyze data throughout the project.
Interpretations of the hydrogeologic processes and controls involved were developed. A conceptual model of the aquifer and surface-water system was developed. The primary goal of this task was to construct a water balance for the hydrogeologic system.

Products:

- Appendix N: Water balance calculations

Cost
$53,173 (GRANT: $31,654; MATCH: $21,519)

Timeframe:
Data collection and preliminary interpretation occurred throughout the project. The finalized water budge and conceptual model was completed in the spring of 2005.

Responsible parties:
The MBMG collected and interpreted the data. Park County administered the project.

Evaluation/Comments

- The total volume of precipitation for the watershed was calculated using PRISM model data from the University of Oregon (Daly and Taylor, 1998). Precipitation data from nearby weather monitoring stations in the area (Shower Falls and Pray, NRCS) indicated

that in 2002 overall precipitation was about 80 percent of normal and so the PRISM data was decreased accordingly to account for the drier climate that year. The total volume of water entering the watershed during the 2002 water-year was 981,000 acre-feet per year (AFY). The fate of this water was evaluated using data collected from this project and is listed below:

Water in:

o Precipitation	981,000 AFY

Water out:

o Surface-water discharge	180,200 AFY
o Valley ground-water discharge	199,800 AFY
o Irrigation use	49,000 AFY
o Evapotranspiration	533,800 AFY
o Diversion out of area	12,800 AFY
o Ground-water consumptive use	90 AFY

- Roughly 60 percent of the precipitation falling in the valley is lost through plant transpiration and evaporation (evapotranspiration). Most of the remaining water is discharged to the Yellowstone River by either surface water or ground water. Irrigation use is relatively minor compared to the total water budget and ground-water consumptive use is negligible.

- The ground-water recharge budget was calculated from measured stream and ditch infiltration losses and assumed precipitation infiltration of 5 percent (typical of semi-arid climates:). The bedrock contribution was estimated using geochemical and tritium/CFC tracer data (previously presented). The recharge budget for the 2002 water-year is as follows:

Water-year 2002 ground-water recharge budget

o Stream infiltration	109,200 AFY
o Ditch infiltration	29,500 AFY
o Valley precipitation infiltration	4,600 AFY
o Bedrock aquifer recharge	56,500 AFY

- Most of the ground-water recharge is from stream infiltration. Infiltration through the Park Bench canal in the northern part of the valley is also a significant source of recharge. Recharge from the bedrock aquifers occur through upwelling of deeper older water from within the watershed.

Task 6: Write and publish reports.

Product:
This report was prepared and submitted to the DEQ in general accordance with their formatting requirements. A similar report will undergo further MBMG review and publishing procedures and will be available to the public.

Cost:
$35,434 (GRANT: $19,295; MATCH: $16,139)

Timeframe:

Data collection and preliminary interpretation occurred throughout the project. The finalized report was prepared during the spring of 2005.

Responsible parties:
The MBMG collected and interpreted the data. Park County administered the project.

Task 7: Public Meetings
Information collected from the project will be disseminated to the public via public meetings:

Products:
- Project data were presented at a public meeting with the Park County Planning Board on March 21, 2002.
- Project data were presented at a public meeting with the Park County Planning Board on June 18, 2002
- Project data has been presented at the annual meeting of the American Water Resources Association (AWRA) in Livingston on October 3, 2002.
- This presentation was also given to the general public at a Park County Planning Meeting on October 17, 2002.
- Project data was presented at a technical seminar in Butte on February 19th 2004
- Project data were presented at a public meeting in Livingston on March 23, 2005
- Presentation to the Upper Yellowstone River Watershed Group (proposed July 7, 2005)

Cost:
$13,312 (GRANT: $7,933; MATCH: $5,380)

Timeframe:
Public presentations were conducted periodically throughout the project.

Responsible parties:
MBMG/Park County

EVALUATION OF GOAL ACHIEVEMENT

This project was successful in compiling and collecting hydrogeologic data and in interpreting this data to build a conceptual model of the water systems in the valley. This project developed an understanding of these systems and the interrelationships between surface water and ground water. Data from this project provides evaluation of surface-water infiltration, ground-water recharge sources and rates, ground-water flow direction and rates, and water quality analyses. This data will help provide the scientific basis for effective land-use and water-use management planning.

PROJECT PROBLEMS

There were no major problems encountered during the project. However, the project was completed during a severe drought. The affect that the unusual climatic conditions had on the monitor data are not entirely known. Historical data to evaluate ground-water and surface-water trends through the changing land uses and climatic fluctuations were somewhat limited. Additional longer term monitoring in the area would assist in future evaluation.

CITED REFERENCES

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Berg, R.B., Lopez, D.A., Lonn, J.D., 2000, Geologic Map of the Livingston 30'x60' Quadrangle, South-Central Montana, Montana Bureau of Mines and Geology Open File Report MBMG-406, Scale 1:100,000.

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FIGURES

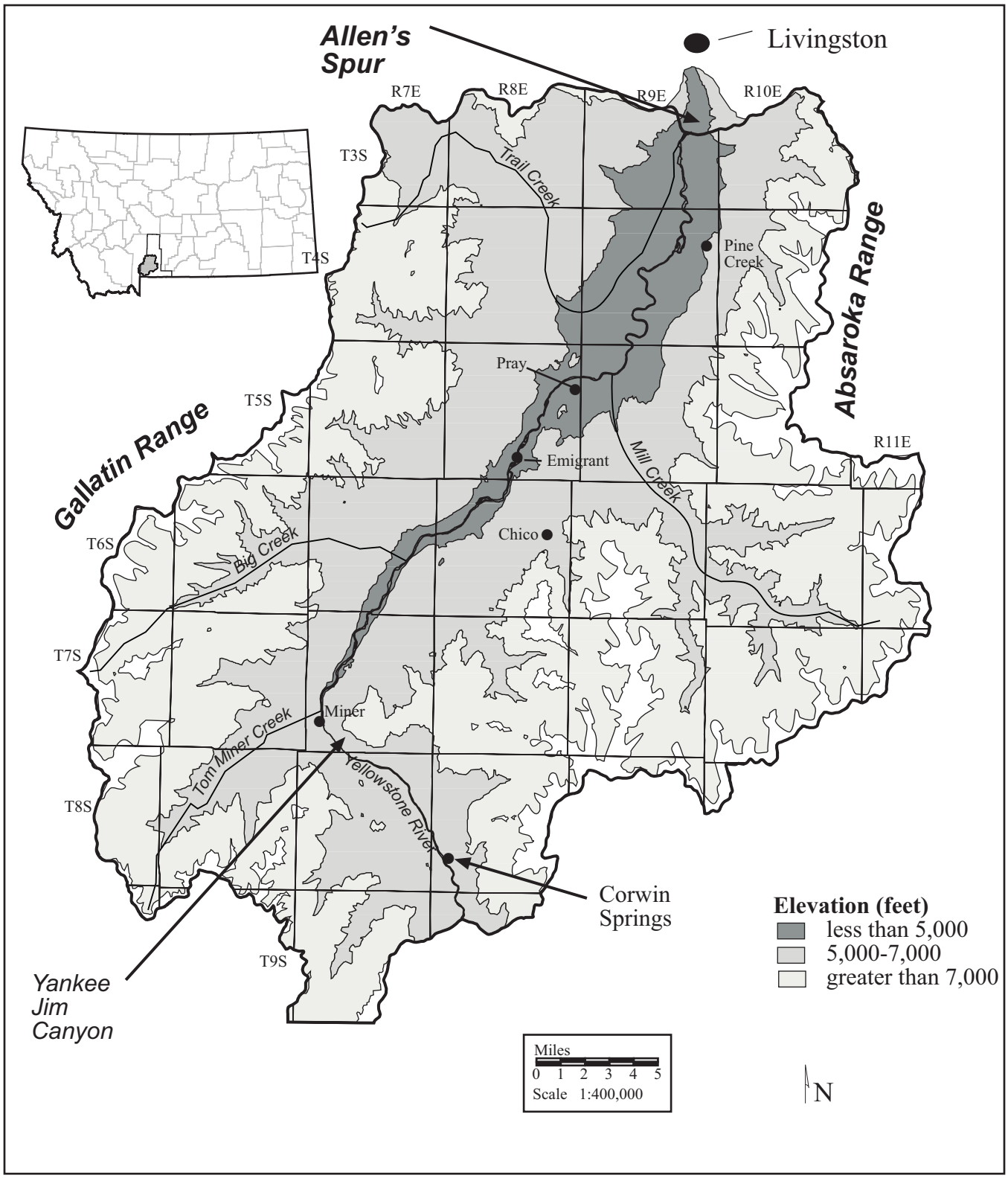


Figure 1: Paradise Valley is located along the Yellowstone River south of Livingston Montana between Allen's Spur in the north to Yankee Jim Canyon in the south. The surrounding Yellowstone River watershed between Corwins Springs and Livingston is bounded by the Absaroka Range on the east and teh Gallatin Range on the west.

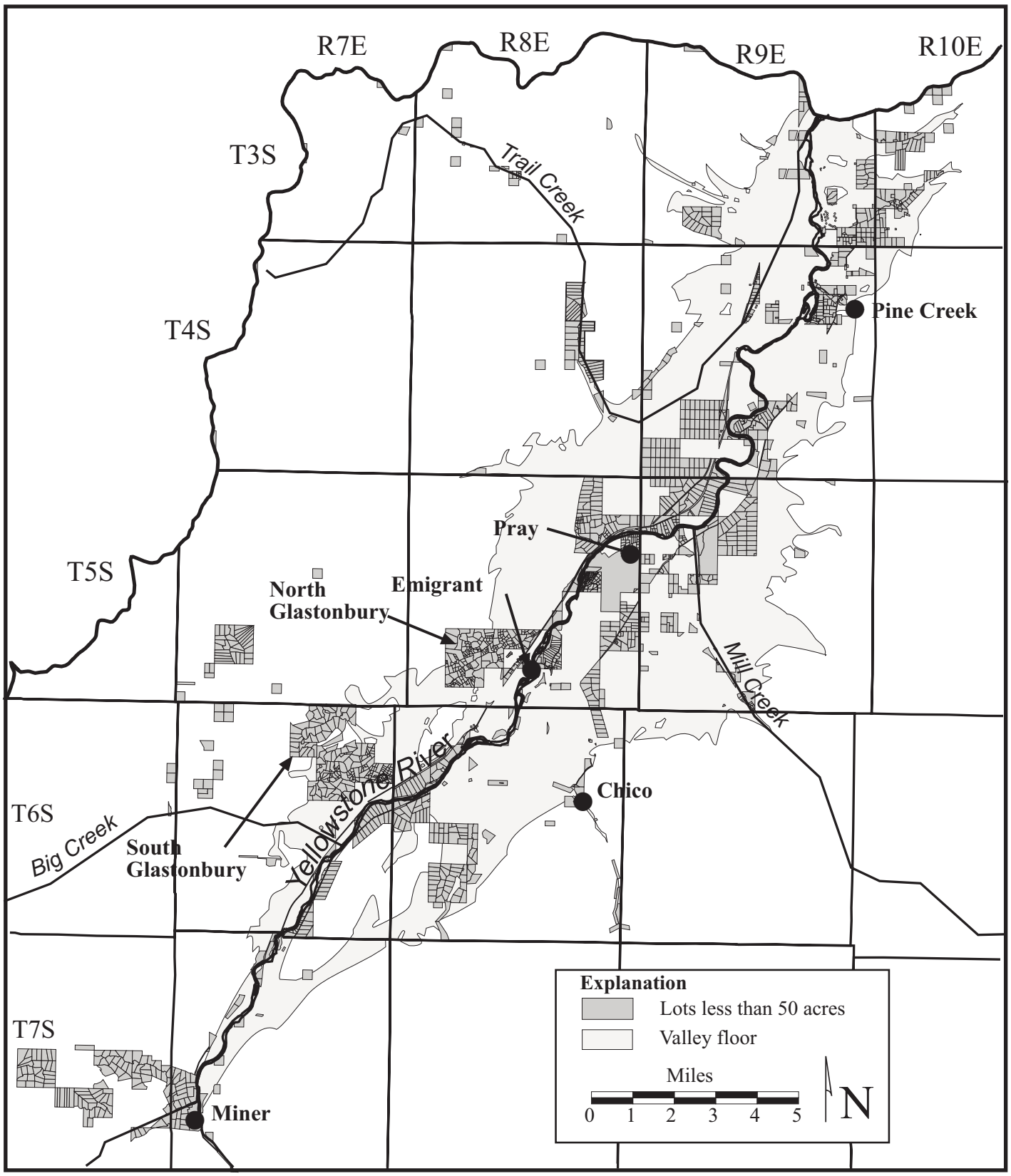


Figure 2: Most of the 1-50 acre residential lots are concentrated in North and South Glastonbury, Emigrant, Pray, and Pine Creek areas.

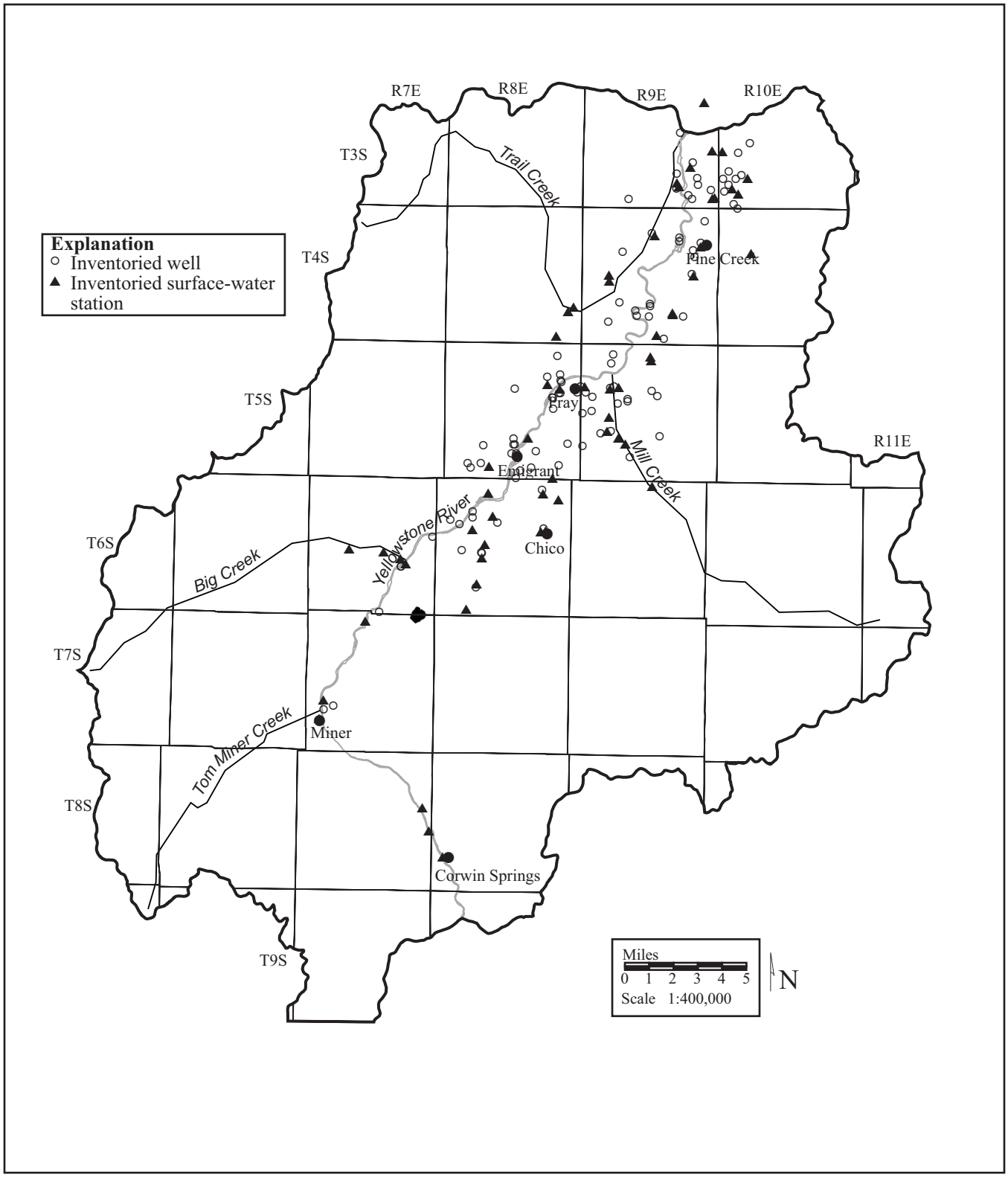


Figure 3: Locations of the 130 wells and 69 surface-water sites that were inventoried for this project.

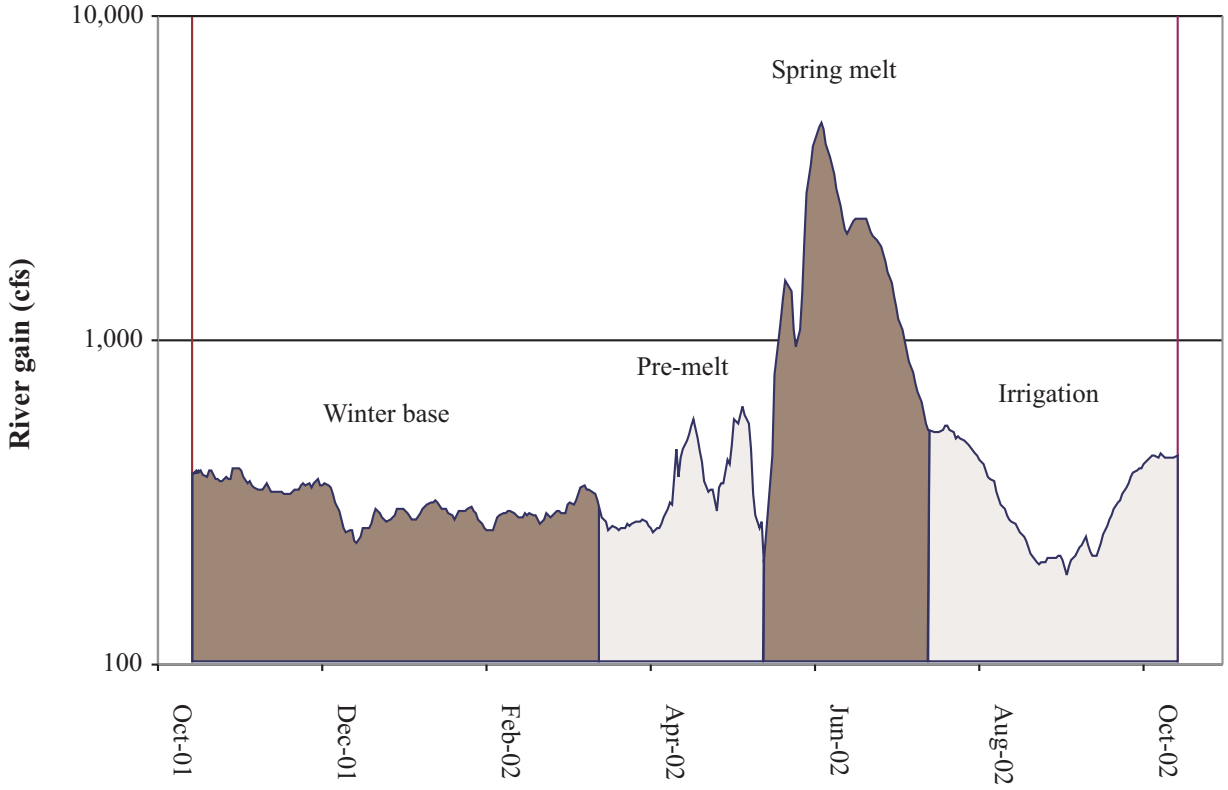


Figure 4: Flow contributions to the Yellowstone River from the watershed during the 2002 water-year ranged between 270 cfs during winter base flow conditions and 4,870 cfs during the spring melt. The flows on this graph are the difference between flows measured by the USGS at the Corwin Springs and Livingston gauging stations.

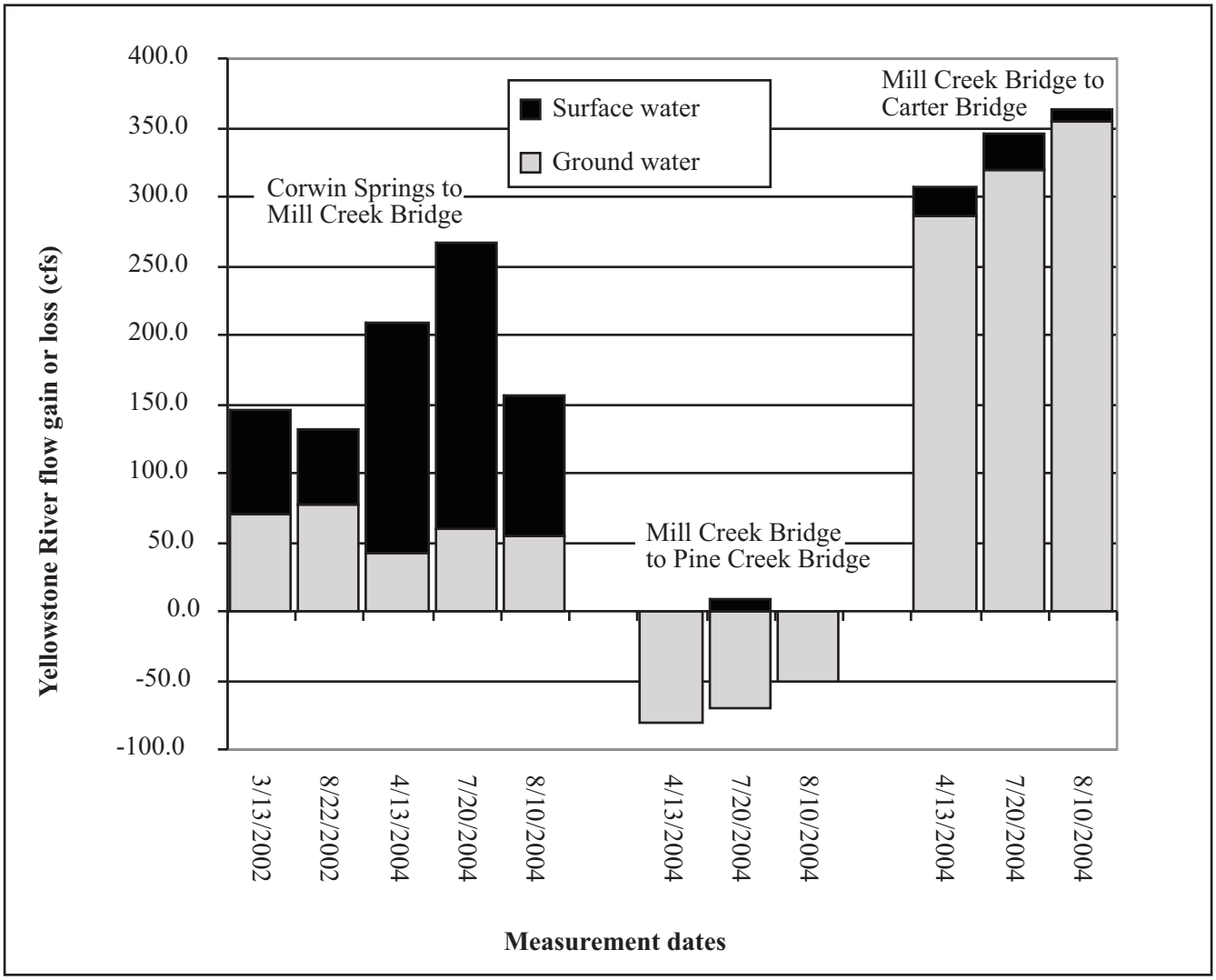


Figure 5: The Yellowstone River receives or losses flow from ground-water along different reaches in the watershed. However, overall the river gains about 276 cfs, most of which discharges north of the Pine Creek Bridge.

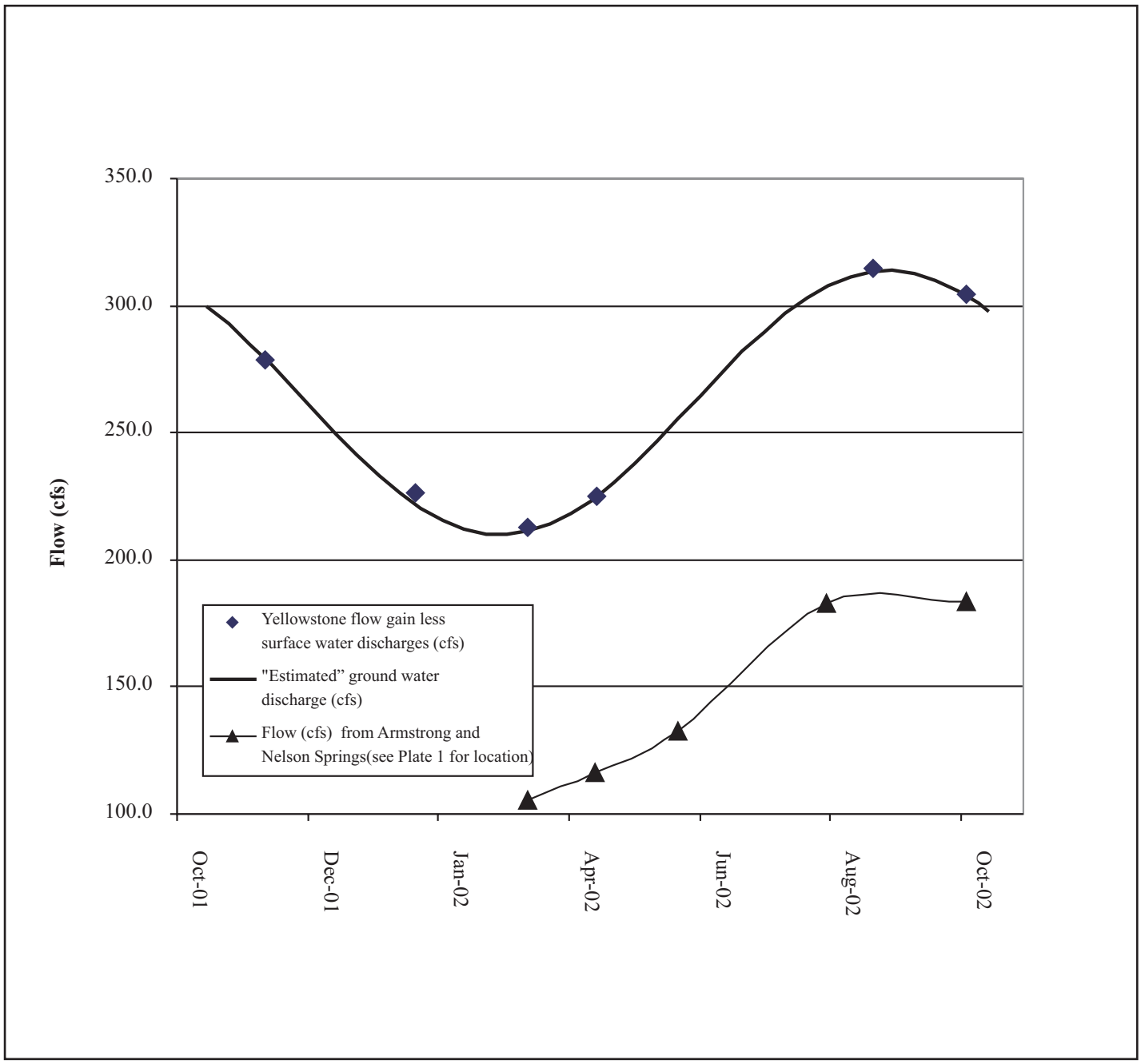


Figure 6: Ground-water and spring creek discharges to the Yellowstone River measured during the 2002 water-year were observed to fluctuate by about 40-percent.

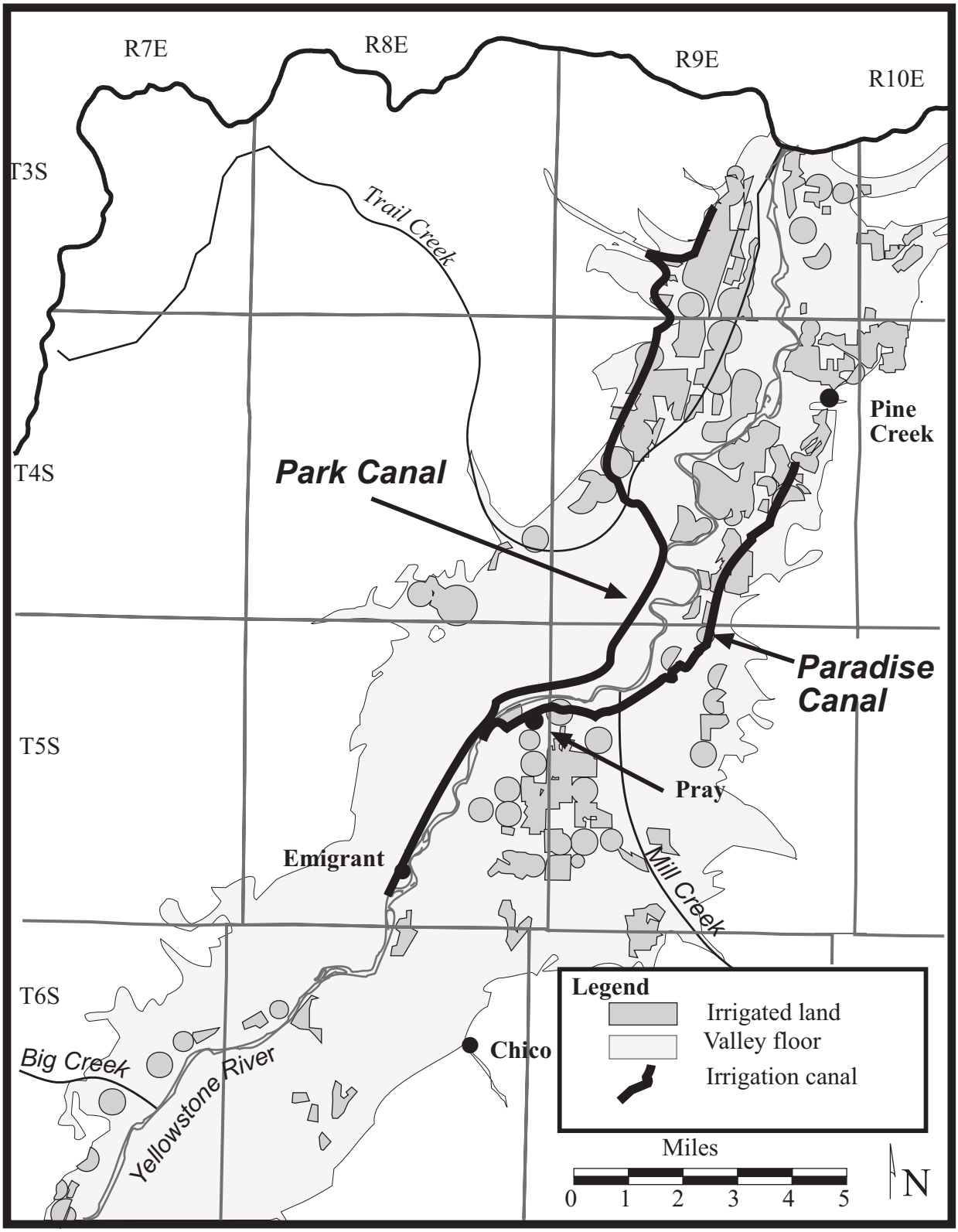


Figure 7: Map showing irrigated lands and major irrigation ditches.

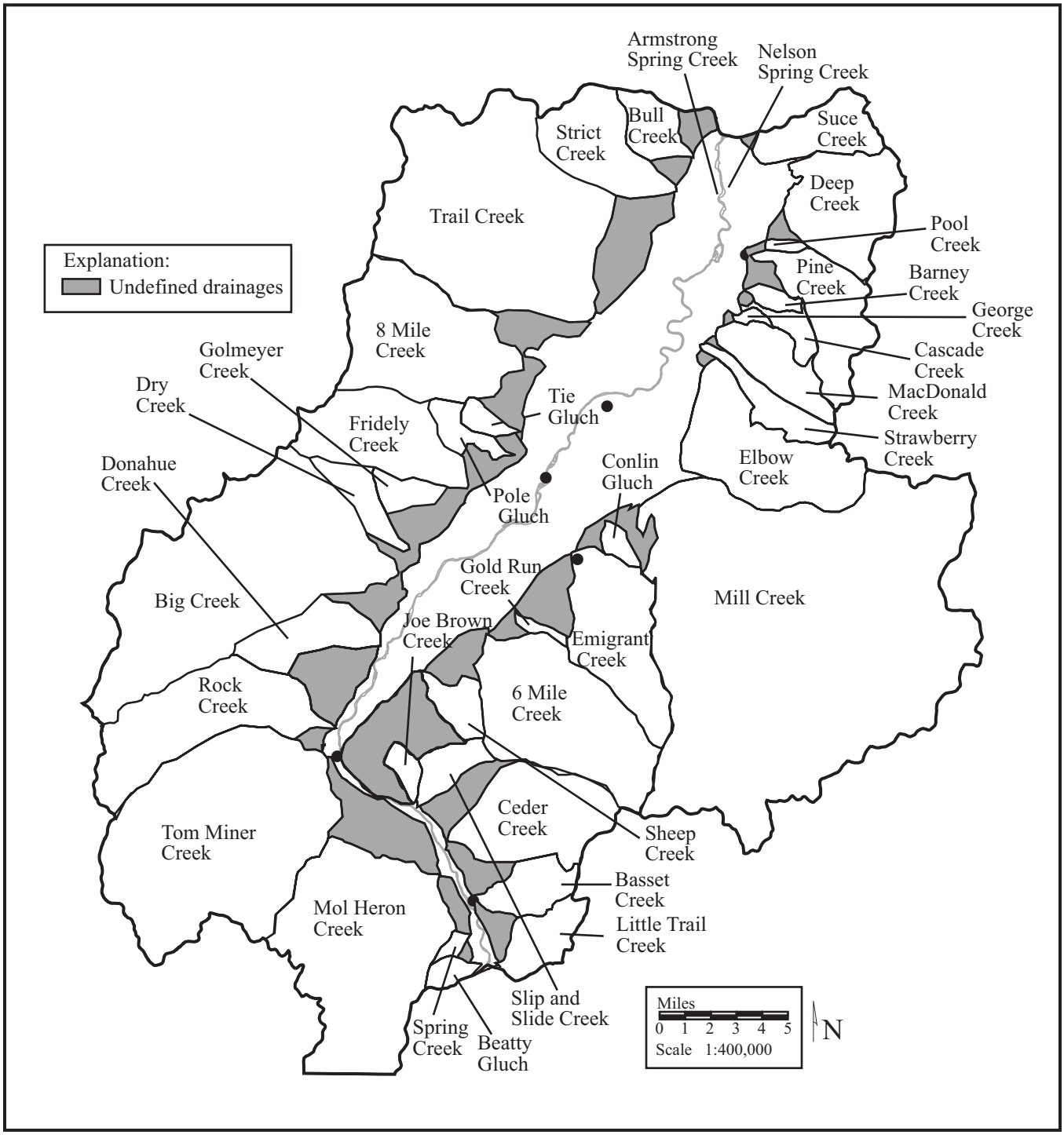


Figure 8: There are 36 named mountain streams that drain to the Yellowstone River. There are also large spring fed creeks in the north end of the valley

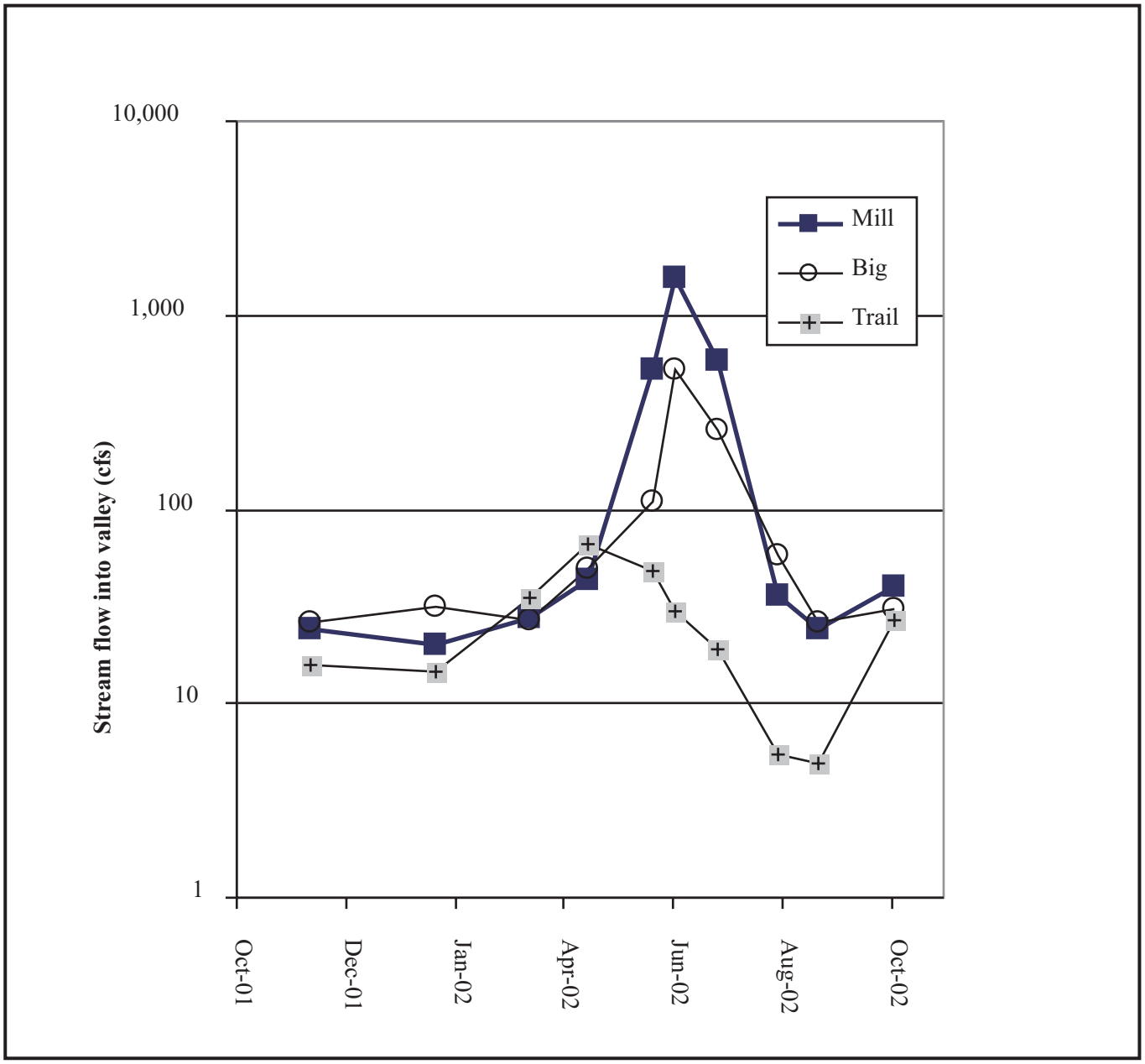


Figure 9: Flows in the mountain streams increase considerably during the spring melt. For most drainages this occurs between mid-May and mid-July. Some streams on the west side of the watershed, such as Trail Creek, peak in mid-March to Mid April.

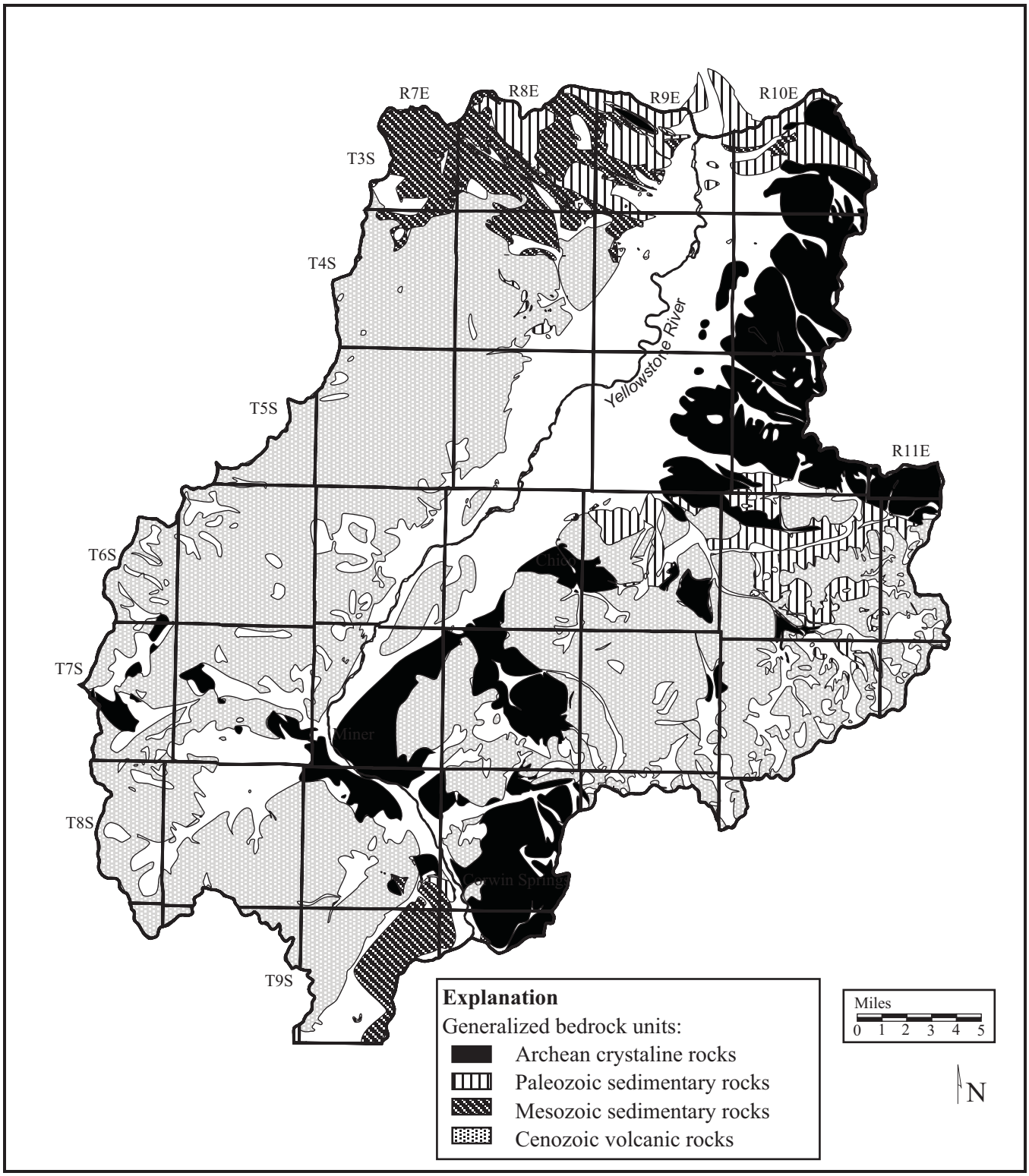


Figure 10: Bedrock units in the watershed include Archean metamorphic rocks, Paleozoic sedimentary rocks, Mesozoic sedimentary rocks and Cenozoic volcanic rocks. This map was generalized from Berg and others 1999, Berg and others 2000, and Lopez and Reiten, 2003.

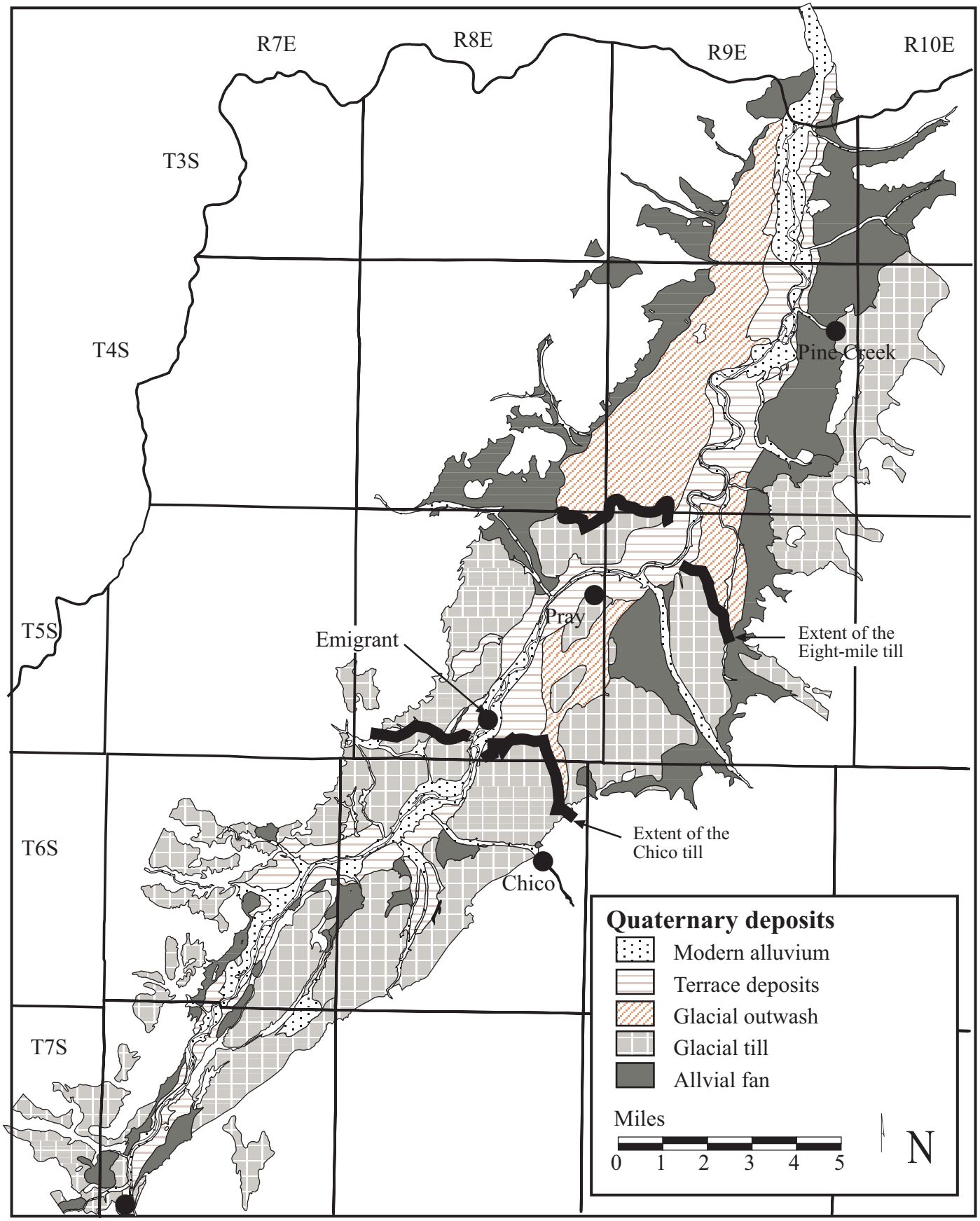


Figure 11: Quaternary deposits in the valley include alluvium, alluvial fan, glacial till and glacial outwash. This map was generalized from Berg and others 1999, Berg and others 2000, and Lopez and Reiten, 2003.

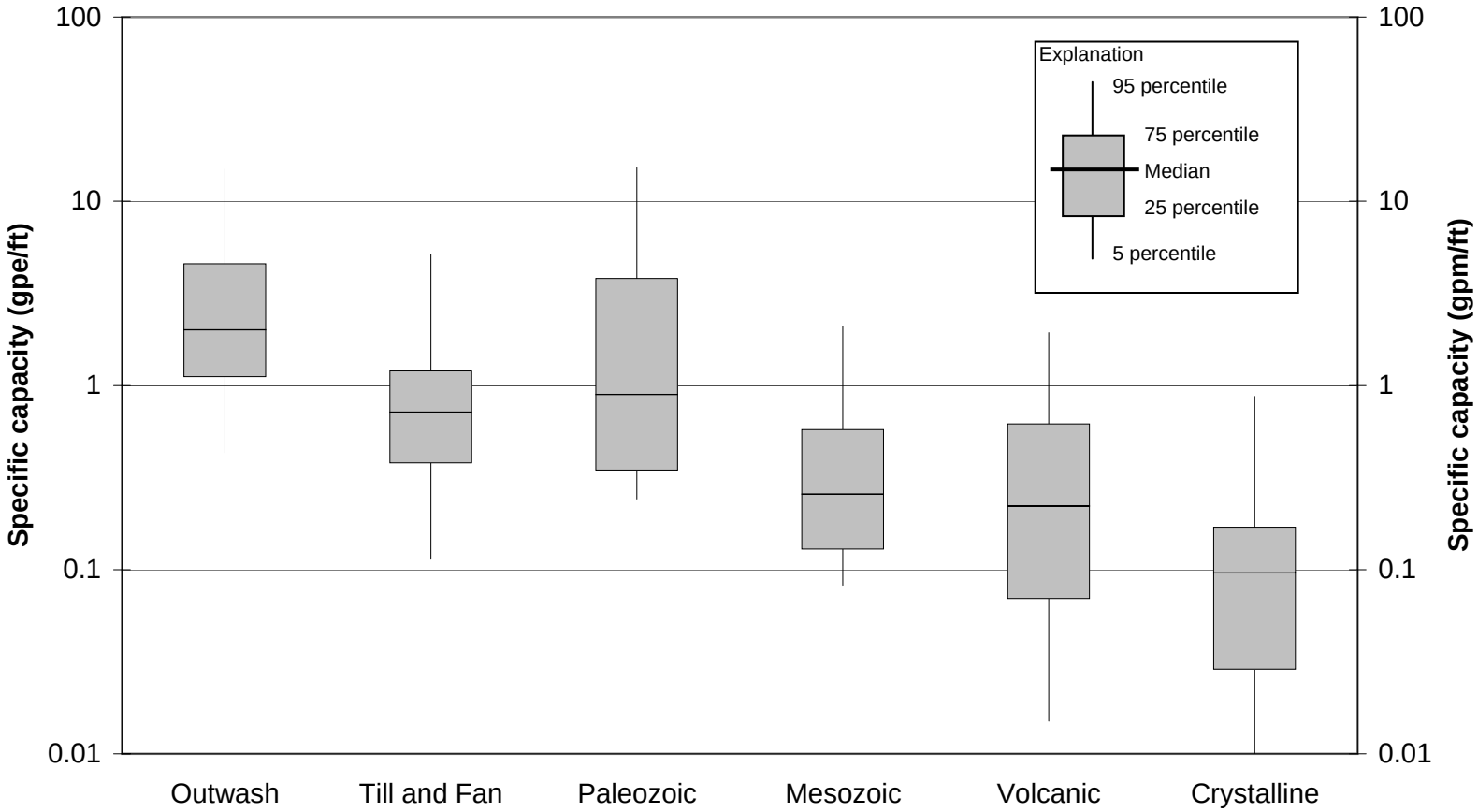


Figure 12A: Well statistics by aquifer showing ranges of specific capacities. Specific capacity is calculated by dividing the pumping rate by the pumping well drawdown.

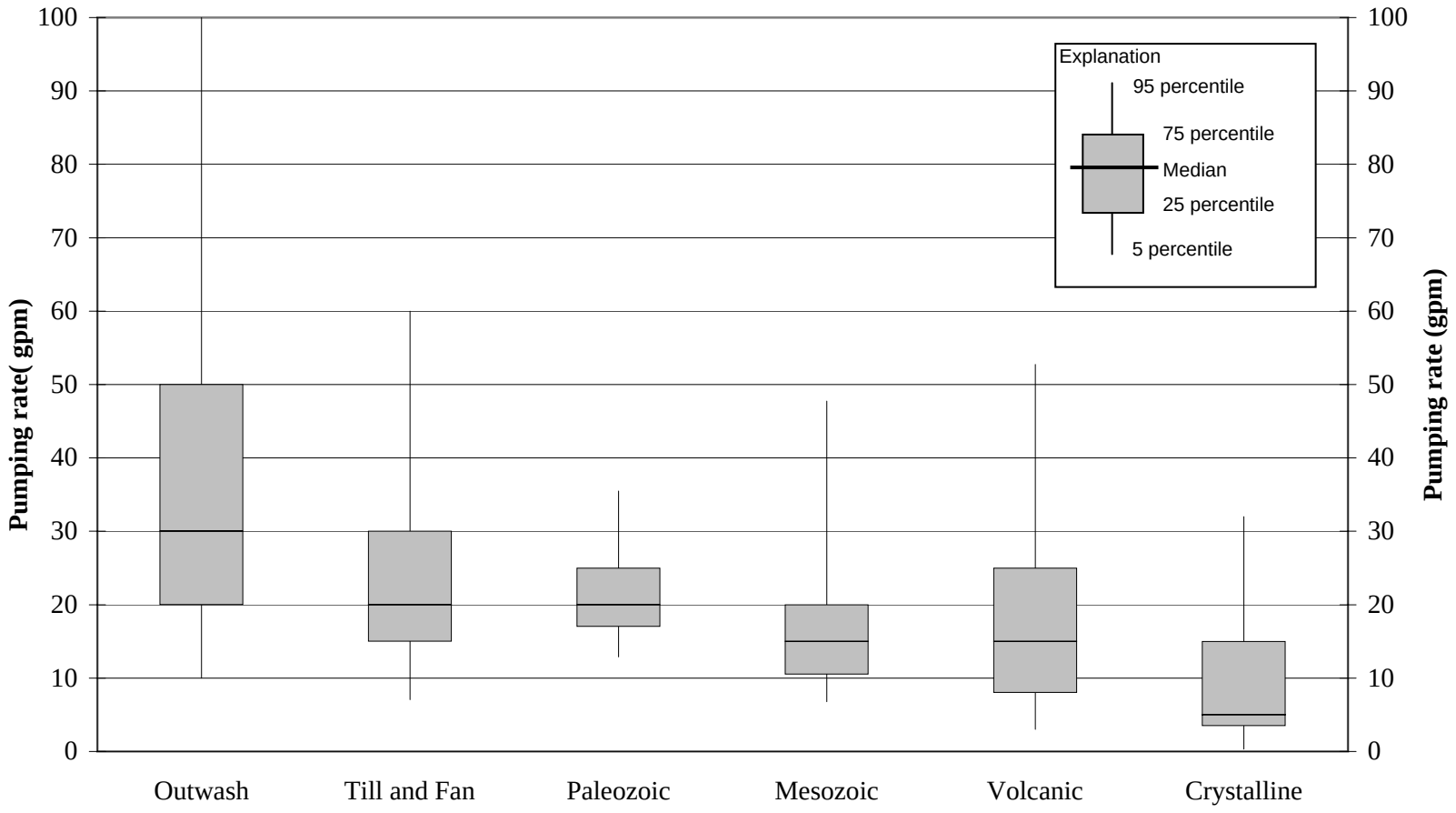


Figure 11B: Well statistics by aquifer showing ranges of reported pumping rates.

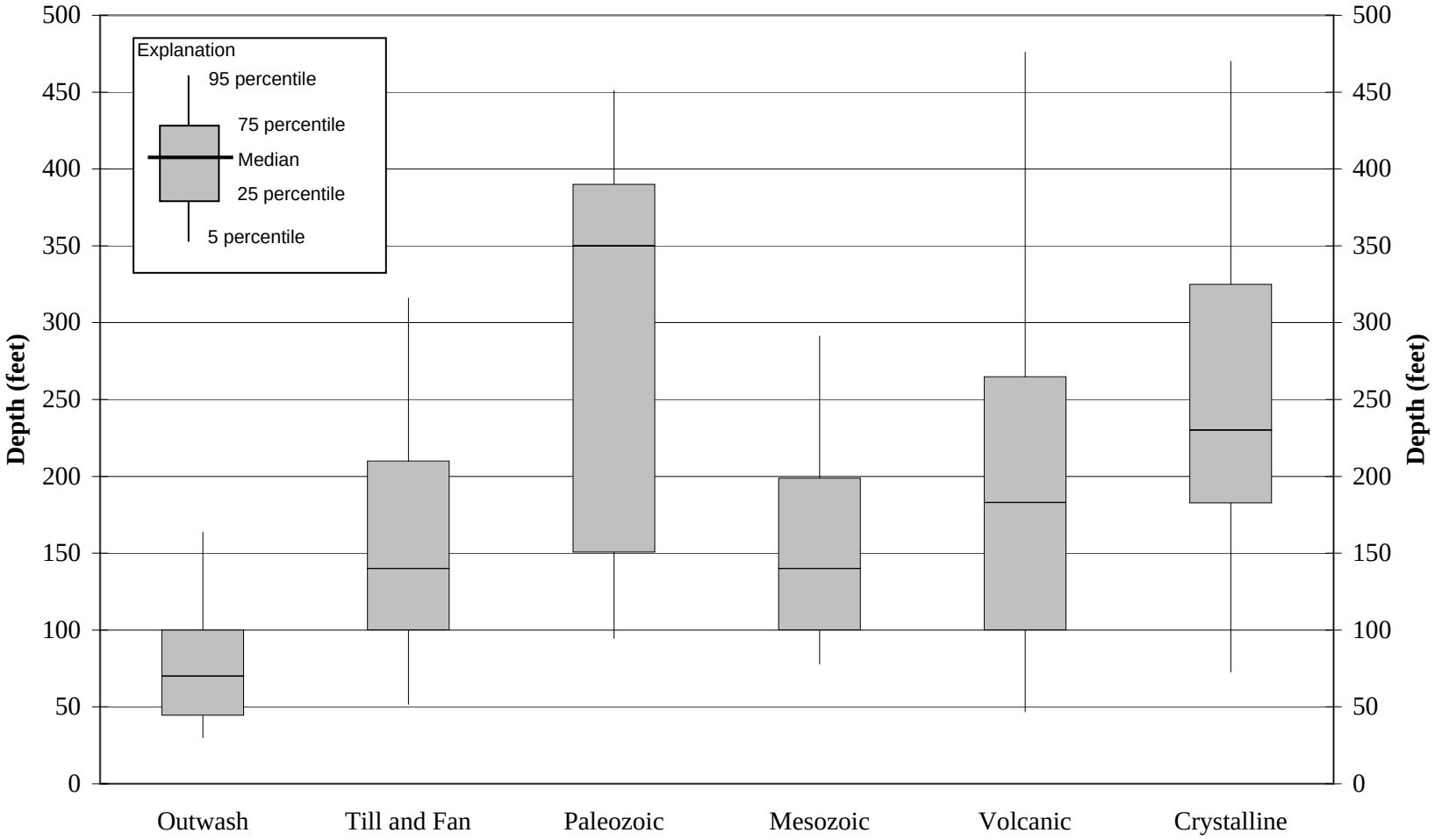


Figure 11C: Well statistics by aquifer showing reported well depths.

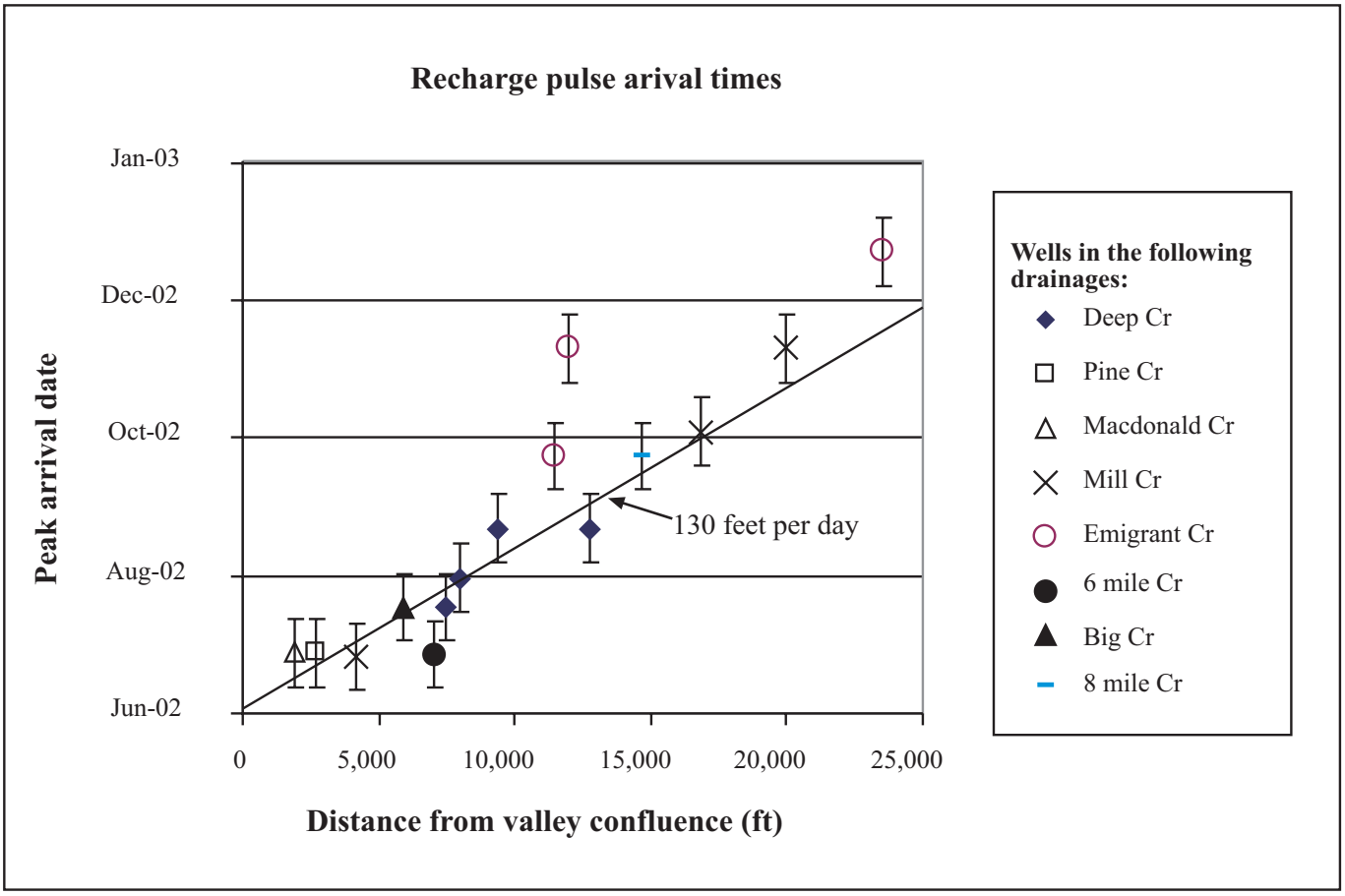
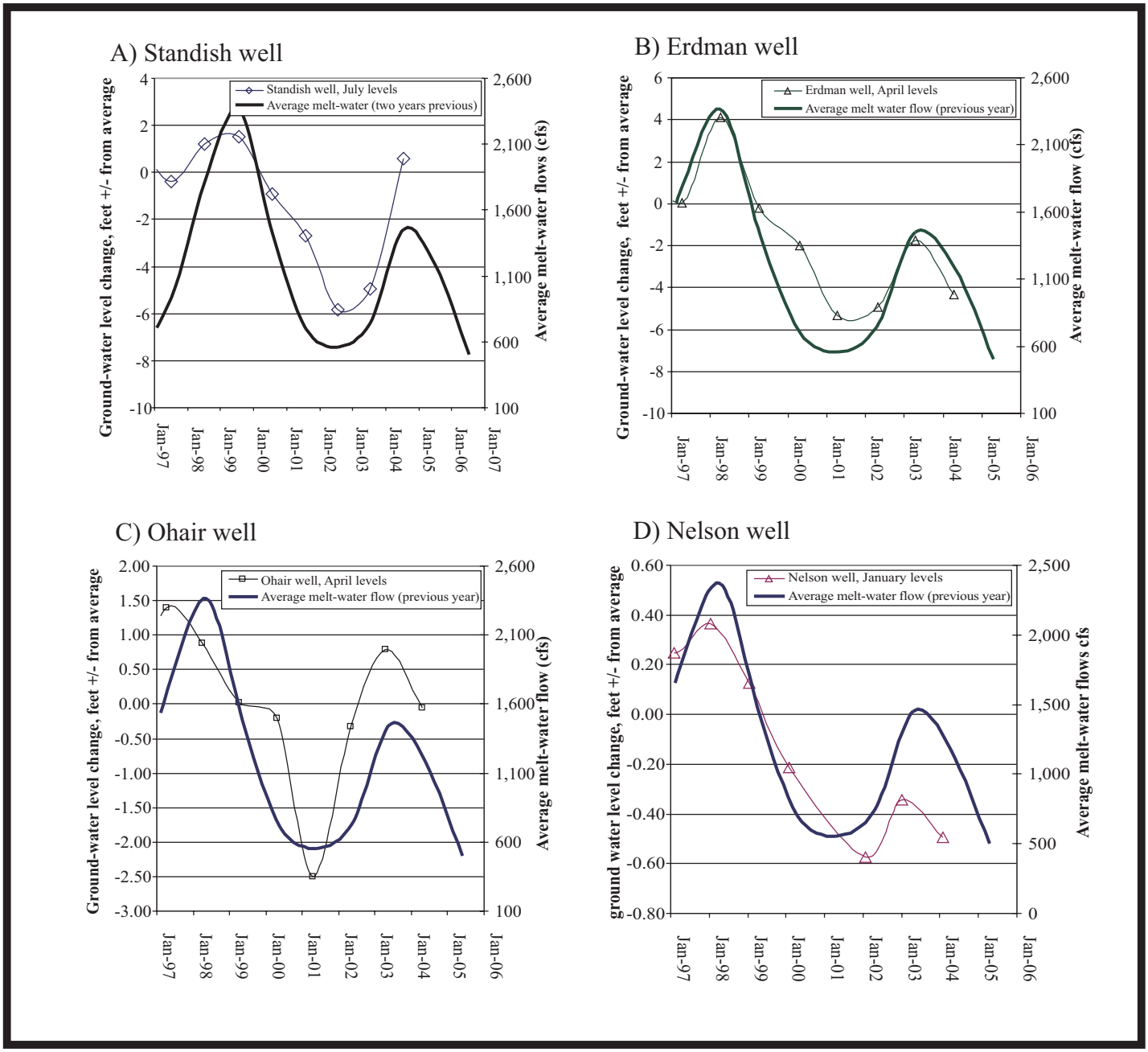


Figure13: A plot of the arrival date of peak ground-water levels verses distance from the valley confluence in the fan/till aquifer shows that the recharge pulse generally travels about 130 feet per day.



Figures 14 A,B,C,D, Ground-water level relationship to annual melt-water (May to July) flows. The four longer-term hydrographs shown above demonstrate a relationship between annual changes in ground-water levels and melt-water flow in the Yellowstone River from either the previous year or the second-year. The annual ground-water level change compares levels taken at the same time each year (ussually the low point) against the seasonal average level for the period of record. The melt-water flow is the average flow gain between Corwin Springs and Livingston during the period of May through July from iether one or two years past (as listed).

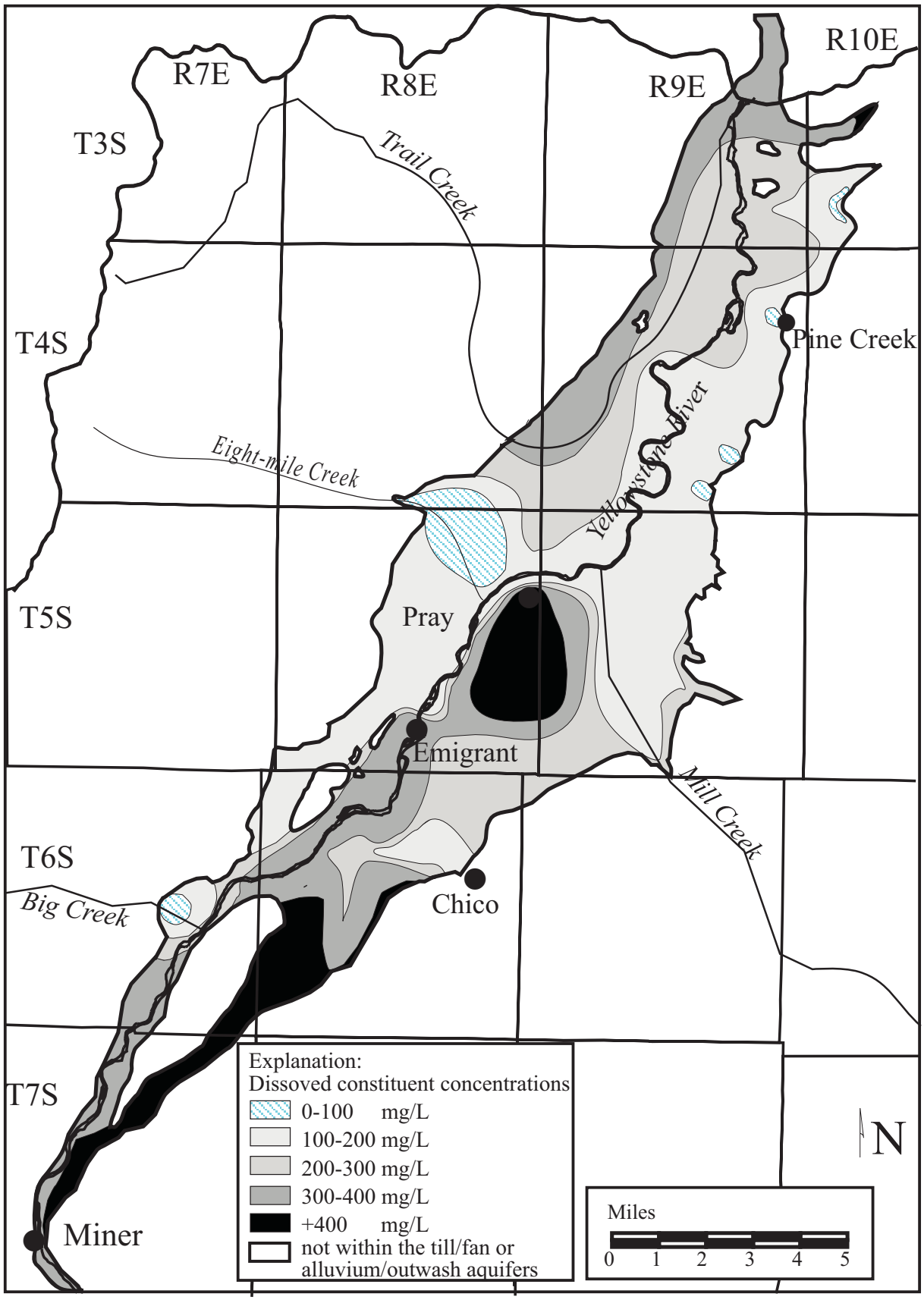


Figure 15: Dissolved constituent concentrations in ground water vary from 40 mg/L to 480 mg/L. The concentration pattern shows that relatively fresh recharge water dilutes slightly more mineralized ground water.

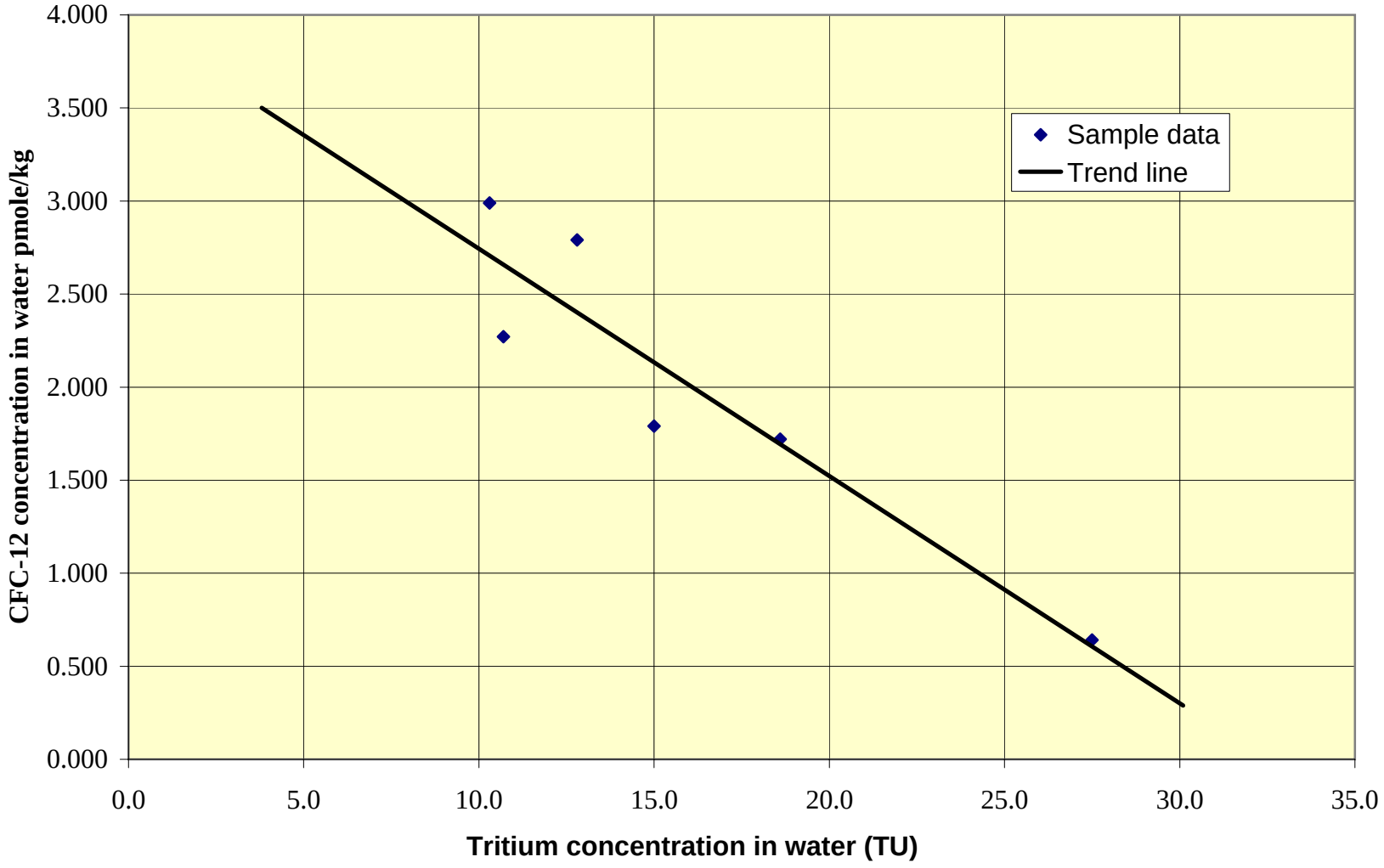


Figure 16A: Trend between Tritium and CFC concentrations.

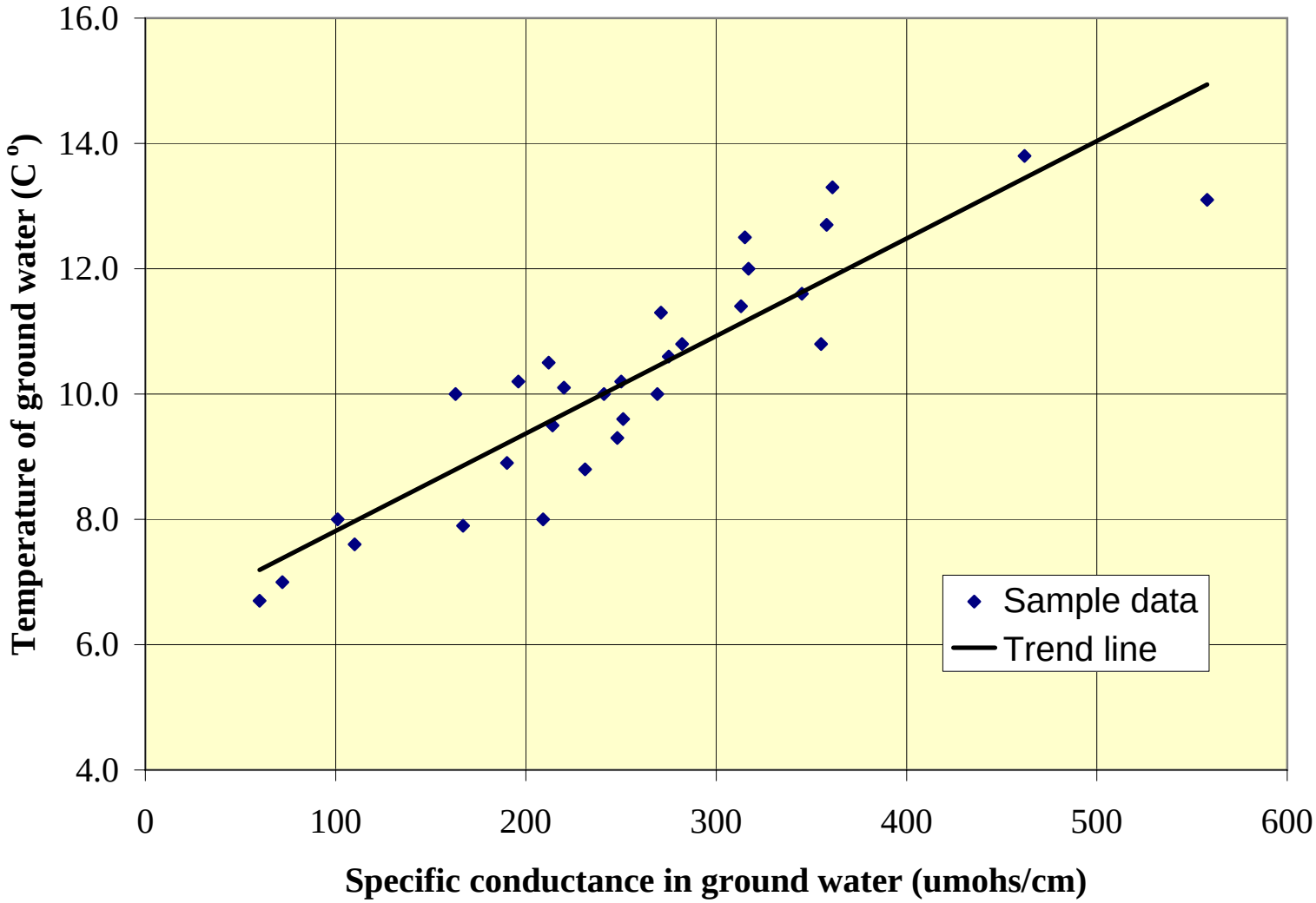


Figure 16C: Trend between specific conductance and temperature.

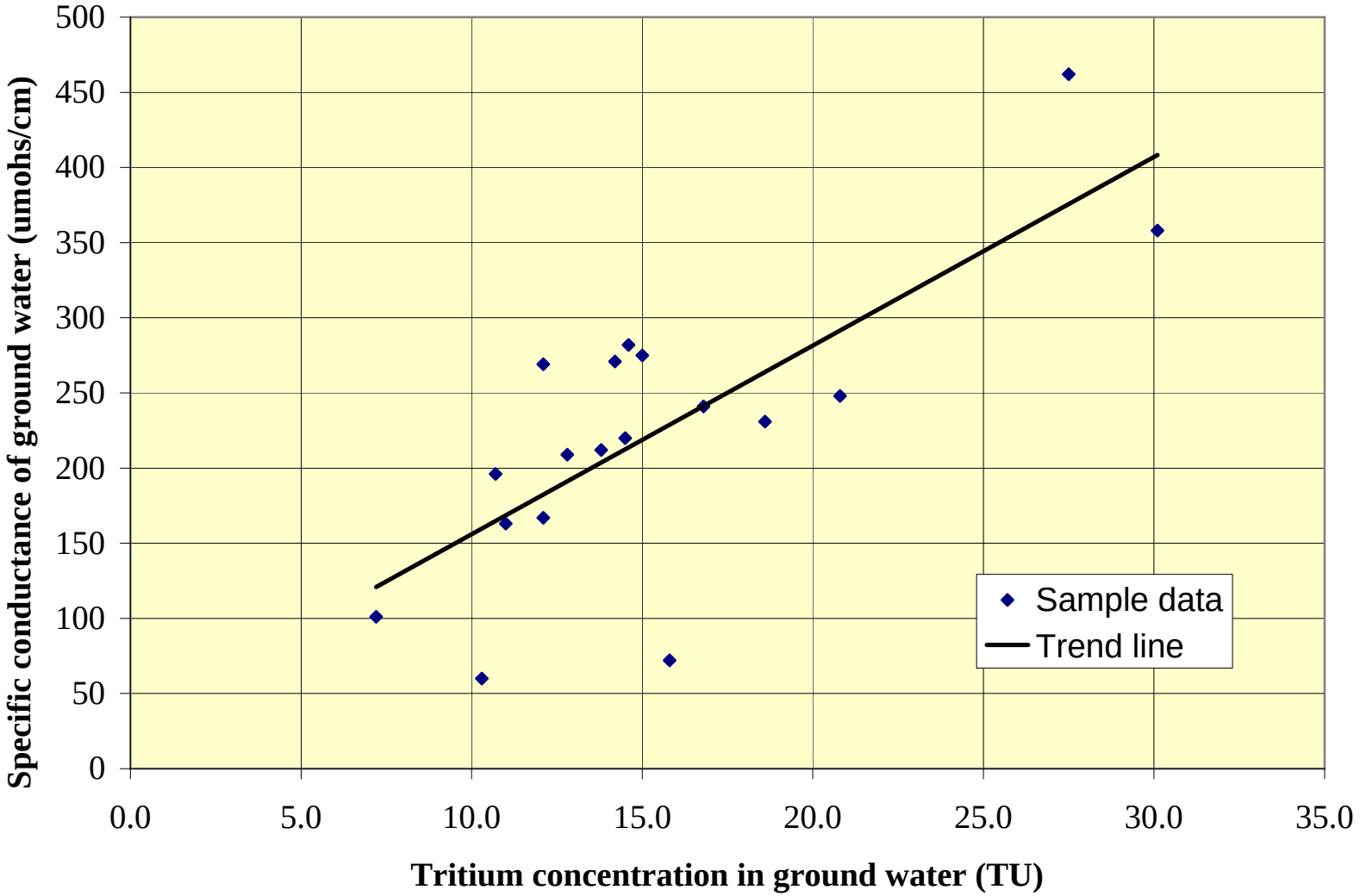


Figure 16B: Trend between Tritium concentrations and specific conductance

Appendix A:
Final billing statement

BILLING STATEMENT **Attachment B**

Project: **Impacts of NPS Pollution to Water Resources in the Paradiese Valley**

DEQ Contract No. 200091

Billing Period **January-March 2005** **Statement Date:** 6/3/2005

Goal/Objective/Task (as listed in Attachment A)	*DEQ Grant	Currect Billing	To-date Expended	Balance Remaing
OBJECTIVE 1 CHARACTERIZE HYDROGEOLOGY				
OBJECTIVE 1: (Organization and Background)				
TASK 1 (Data Compilation)	12,721.66	-	12,721.66	-
OBJECTIVE 2: (Data Collection)				
TASK 2: (Estabolish Monitoring)	43,122.39	-	43,122.39	-
TASK 3: (Collect Additional Data)	19,690.81	-	19,690.82	-
OBJECTIVE 3 (Interpret Data...)				
TASK 4 (Evaluate Baseling Data...)	25,714.05	-	25,714.05	-
TASK 5 (Plot and Analyze Data...)	16,202.42	-	16,202.42	-
TASK 6 (Write and Publish Report)	26,585.60	1,311.95	26,585.60	-
TASK 7 (Public Meetings)	6,673.07	3,668.43	6,673.07	-
ADMINISTRATION **Park County**	6,285.00	670.34	6,285.00	-
MBMG-Indirect Costs	22,349.00	2,586.80	22,349.00	-
TOTAL	$179,344.00	$8,237.52	$179,344.00	$0.00

*List total DEQ grant amount for that goal/objective/task and the DEQ grant amount for the current State Fiscal year

Comments Section: _____

I certify the above costs are actual, necessary and allowable for the performance of the agreement. There are no duplicate costs and the statement is mathematically correct. All progress reports required under this contract are current.

Date: _____ Signed: _____

If you need a copy of this revised billing statement sent to you on computer disk, please call

Vicky VanSwearingen @ (406) 444-1842

Match Report **Attachment B (2)**

Project: **Impacts of NPS Pollution to Water Resources in the Paradiese Valley**

DEQ Contract No. 200091

Billing Period **January-March 2005** **Jan-00** **Statement Date:** 6/3/2005

Goal/Objective/Task (as listed in Attachment A)	Non-Fed Match State, Private, Local	Non-Fed Match In-Kind	Fed Match	Description
OBJECTIVE 1: (Organization and Background)				
TASK 1 (Data Compilation)	-	-	-	-
OBJECTIVE 2: (Data Collection)				
TASK 2: (Estabolish Monitoring)	-	-	-	-
TASK 3: (Collect Additional Data)	-	-	-	
OBJECTIVE 3 (Interpret Data...)				
TASK 4 (Evaluate Baseling Data...)	-	-	-	
TASK 5 (Plot and Analyze Data...)	-	-	-	
TASK 6 (Write and Publish Report)	-	-	-	
TASK 7 (Public Meetings)	-	-	-	
ADMINISTRATION	670.34 -	-	-	Park County
TOTAL	**670.34**	$0.00	$0.00	

Total to date: *106,296.84*

Appendix B:
Well inventory data

Appendix B Well inventory data

m number	Site name	Latitude	Longitude	Township	Range	Section	Tract	Ground elevation	Measureing piont elevation (ft)	Total Depth	Date (dd/mm/yy)	Static water level from mp	Pumping water level (ft)	Yield (gpm)	Water temperature (C)	Field SC (umhos/cm)	Field pH	Field test nitrate mg/L N)
135257	NORDIN MARK OR SHARON	45.4316	-110.6952	05S	08E	2	ADCD	5,037	5,039.0	--	08/28/00	223.6	226.5	--	10	115	7.56	<1
148027	JOHNSON VAUGHN	45.4328	-110.6445	05S	09E	5	BDCB	4,835	4,837.8	100	09/09/00	65.43	65.5	10	10.9	278	7.81	<1
152007	MILL CREEK HEADWATERS OFFICE - JOHNSON VAUGHN	45.4272	-110.6462	05S	09E	5	CCAA	4,836	4,839.0	100	09/09/00	54.6	54.72	12	13.1	292	7.66	<1
102623	NEIL & STEFFESEN	45.3824	-110.655	05S	09E	19	DDBC	5,040	5,041.0	300	09/12/00	229.1	--	6	10.5	388	8.04	1
102608	HANS NORDBLOM	45.4014	-110.6398	05S	09E	17	CAAA	4,912	4,911.5	117	09/12/00	94.23	95.15	--	9.9	260	7.82	1
160127	PARADISE VALLEY FIRE SVC. AREA	45.3599	-110.7174	05S	08E	34	ACDA	4,968	4,969.3	164	08/05/00	41.61	--	--	10.4	280	8.04	<1
169850	BLAIR STEVEN T. AND JENNIFER J	45.418	-110.7042	05S	08E	11	BDDB	4,970	4,971.4	195	08/04/00	162.69	--	10	8	101	7.64	<1
175964	MCCULLEY MARK	45.3612	-110.6925	05S	08E	35	ADAD	5,115	5,116.5	240	08/05/00	196.83	198.73	5	13.9	348	7.68	<1
73357	GAMBLE DAVID	45.4657	-110.6118	04S	09E	28	AACA	4,742	4,743.7	80	08/28/00	30.17	--	12	9.6	237	7.96	<1
159909	O'HAIR RANCH CO.	45.5493	-110.589	03S	09E	27	ADDA	4,617	4,619.3	58	08/28/00	16.77	16.96	12	9.6	267	7.81	<1
143982	USDA FOREST SERVICE	45.5275	-110.5333	04S	10E	5	BBCC	5,290	5,287.0	--	07/26/00	158.49	--	4.5	9.4	173	7.5	<1
163650	TOMLIN JOHN & MARCELLA	45.4432	-110.5986	04S	09E	34	DBDC	4,955	4,956.5	280	08/04/00	175.21	--	15	14.3	112	6.49	<1
121836	JORDAN CHRISTOPHER	45.4576	-110.6126	04S	09E	28	DACC	4,761	4,761.9	63	08/05/00	25.53	--	15	12.1	239	7.88	<1
131520	DOUGLAS DICK	45.4611	-110.6249	04S	09E	28	CBDB	4,830	4,832.8	140	08/05/00	101.43	101.45	--	17.9	226	8.36	<1
101038	LOCH LEVEN FAS	45.4576	-110.6236	04S	09E	28	CACC	4,750	4,750.0	41	08/04/00	14.1	--	--	--	--	--	--
153940	JORDAN LARRY	45.4852	-110.5739	04S	09E	14	DCAA	4,790	4,791.3	117	08/06/00	70.04	75.31	20	9.5	207	7.57	<1
121213	CHRISTIAN ELLERY C	45.4958	-110.5717	04S	09E	14	AACB	4,870	4,871.4	230	08/06/00	152.62	154.8	4	16.8	195	--	<1
101004	PINE CREEK CHURCH	45.5053	-110.5662	04S	09E	12	BCCB	4,865	4,866.4	147	08/04/00	92.66	96.7	12	7.5	111	7.1	<1
100941	PINE CREEK SCHOOL DISTRICT 19	45.5188	-110.563	04S	09E	1	BCDD	4,817	4,819.5	110	07/26/00	63.3	--	10	8.9	258	7.5	<1
155222	JUMPING RAINBOW RANCH	45.5356	-110.5781	03S	09E	35	ACBB	4,641	4,643.1	45	08/07/00	11.06	14.2	10	--	218	--	<1
149227	HEDRICK GEORGE E. OR JOAN N.	45.2027	-110.9019	07S	07E	30	AACD	4,996	4,997.6	56	07/26/00	27.28	--	4	11.3	271	7.5	<1
103661	WARNICK VICTOR	45.3254	-110.79	06S	08E	7	DCBB	4,950	4,952.9	69.8	08/18/00	48.78	49.15	10	12	305	7.56	<1
165070	HARTER LINN	45.5518	-110.7411	03S	08E	28	BABD	5,511	5,513.3	75	08/14/00	27.19	--	20	--	1114	--	<1
99832	FONDA PETER	45.5508	-110.5416	03S	10E	30	BDBB	5,077	5,079.0	280	08/14/00	143.42	--	10	--	203	--	<1
144463	PIPOLO ANTHONY & JOHN	45.5632	-110.5332	03S	10E	19	ADCB	5,032	5,033.6	360	08/13/00	243.67	--	--	--	376	--	<1
99795	ROSE ROY	45.5323	-110.6325	03S	09E	32	DAAB	4,839	4,835.5	140	08/05/00	60.49	63.91	10	63.9	2140	7.07	<1
99790	SPRING CK.HILLS PROF	45.5542	-110.6279	03S	09E	28	BBBD	5,038	5,041.0	205	08/13/00	41.2	--	--	--	525	--	<1
100991	MITCHELLS MILE HIGH RANCH	45.5084	-110.5858	04S	09E	11	BBCA	4,700	4,701.3	60	08/12/00	31.26	--	15	--	200	--	<1
99794	WARREN MACKEY L	45.5375	-110.6312	03S	09E	32	ADAB	4,838	4,839.8	325	08/11/00	195.1	198.9	12	--	1350	--	<1
143002	HACKER LLOYD & BEVERLY	45.5057	-110.7066	04S	08E	11	BDCB	5,272	5,273.7	155	08/14/00	62.71	--	8	--	3470	--	<1
170537	TECCA JOHN	45.5467	-110.5703	03S	09E	26	DAAC	4,882	4,884.5	238	08/14/00	179.55	186	15	10.8	270	7.92	<1
100962	WEBER ROBERT L.	45.4985	-110.6372	04S	09E	8	DCDB	4,780	4,783.0	200	08/25/00	81.61	--	--	--	446	--	<1
102516	JENSEN ROBERT	45.3783	-110.734	05S	08E	28	AADB	5,071	5,072.5	250	08/26/00	177.69	--	--	15.1	152	8.14	<1
175962	DUNN SHERMAN	45.3744	-110.7338	05S	08E	28	ADDB	5,002	5,002.9	230	09/11/00	102.92	104.4	--	21	160	8.11	1
175963	OLSON JOHN	45.3621	-110.7751	05S	08E	31	AADC	5,155	5,157.5	305	09/10/00	137.15	--	3	13	301	8.07	1
102536	HARTH PATRICIA	45.3734	-110.7612	05S	08E	29	ACCD	5,229	5,229.0	585	08/27/00	180.34	--	--	14.1	163	8.18	<1
102605	ELBOW CREEK RANCH	45.4065	-110.6038	05S	09E	15	BACC	5,069	5,069.0	340	09/11/00	236	243.17	5.5	13.5	200	7.47	<1
138756	ELBOW CREEK RANCH	45.4097	-110.6091	05S	09E	9	DDDD	4,957	4,957.0	200	09/11/00	144.45	--	12	10	241	7.46	1
169858	JACKSON WILLIAM L & SANDRA	45.3674	-110.6281	05S	09E	28	CCBC	5,160	5,161.9	485	10/07/00	313.6	324	17	9.7	358	7.65	<1
169854	LLOYD SHIRLEY	45.3744	-110.7326	05S	08E	28	ADDA	5,010	5,013.0	207	09/11/00	105.65	106.65	8.5	20.4	159	20.4	<1
183899	SMITH BETTY	45.5756	-110.5863	03S	09E	14	CACA	4,589	4,589.0	8.8	08/25/00	5.5	--	15	11.5	399	7.33	<1
183896	COLL AUDREY	45.3226	-110.7818	06S	08E	7	DDCD	4,920	4,921.9	81.4	08/16/00	37.71	38.17	7.5	13.1	418	7.65	<1
183898	BRANDIS JACK JR	45.3531	-110.7312	05S	08E	34	CCBD	5,000	5,002.9	295	08/09/00	78.2	--	--	--	--	--	--
183895	BRANDES JACK	45.3578	-110.7274	05S	08E	34	CABC	4,920	4,921.2	59.8	08/09/00	17.68	17.68	7.5	12.4	402	7.77	<1
183902	BRANDIS JACK	45.3142	-110.806	06S	07E	13	DBAA	4,917	4,918.8	32	08/10/00	8.67	12	9	11.6	339	7.76	<1
183900	LOOMIS	45.5969	-110.5633	03S	09E	12	BABC	4,550	4,552.1	--	08/26/00	10	12	9	11.6	345	7.58	<1
183901	BALLANTYNE DOROTHY	45.3309	-110.7699	06S	08E	8	ACCB	4,900	4,901.3	28.9	08/17/00	19.08	19.15	10	11.4	487	7.77	<1

Appendix B Well inventory data

m number	Site name	Latitude	Longitude	Township	Range	Section	Tract	Ground elevation	Measureing piont elevation (ft)	Total Depth	Date (dd/mm/yy)	Static water level from mp	Pumping water level (ft)	Yield (gpm)	Water temperature (C)	Field SC (umhos/cm)	Field pH	Field test nitrate mg/L N)
183904	USFS * PINE CREEK CAMPGROUND	45.4985	-110.5238	04S	10E	8	CCDB	5,597	5,599.0	38	07/26/00	19.87	--	7	5.6	87	7	<1
101037	GAMBLE DAVE	45.4642	-110.6115	04S	09E	28	ADAB	4,735	4,730.6	23.3	08/28/00	10.76	--	8	11.9	240	7.69	<1
100984	PITMAN SCOTT	45.5002	-110.5732	04S	09E	11	DCAB	4,825	4,827.3	--	08/12/00	130.17	--	--	--	153	--	<1
99843	PEACOCK DOUG	45.53	-110.5367	03S	10E	31	CAD	5,224	5,225.6	--	08/12/00	71.57	--	8	--	150	--	<1
101021	MCLAIN BERNARD	45.4576	-110.5814	04S	09E	26	CACB	5,015	5,015.5	--	08/13/00	27.02	--	10	--	72	--	<1
99828	MOONEYHAM DAVE	45.5691	-110.5228	03S	10E	20	BBB	5,158	5,161.8	--	08/12/00	31.71	37.45	15	--	515	--	<1
168006	BURNS LAURA	45.5423	-110.5695	03S	09E	26	DDAC	4,762	4,763.6	--	08/11/00	127.52	127.9	8	--	267	--	<1
155008	GEG PARKS	45.5034	-110.7084	04S	08E	11	CBDC	5,277	5,279.5	195	08/14/00	45.07	--	--	--	743	--	<1
170555	DENTON JOHN	45.3043	-110.7611	06S	08E	20	AAAA	5,086	5,087.3	80.4	08/10/00	39.7	39.67	20	9.3	3.65	7.65	<1
103645	BROWNE MAXMILLION	45.2658	-110.8533	06S	07E	28	CAC	--	4,985.0	43.9	07/26/00	27.31	27.99	12	11.4	11.4	7.59	--
155014	MEYERS NICK	45.4147	-110.6912	05S	08E	11	DADA	4,850	4,850.2	83	08/28/00	39.75	39.95	9	12.4	227	7.34	<1
151258	KNOLL PAT & AMY	45.412	-110.6737	05S	08E	12	CDD	4,856	4,857.5	111	08/06/00	61.2	61.2	--	14.9	555	7.82	<1
162941	ARROWHEAD SCHOOL DISTRICT 75	45.3948	-110.6716	05S	08E	13	DDDD	4,963	4,965.0	248	08/07/00	161.07	--	10	13.5	464	7.72	<1
148585	ROBB LINDSAY C. & KRAFT SUSAN V	45.3703	-110.7135	05S	08E	27	DDB	5,012	5,012.0	166	08/06/00	133.99	136.33	4	12.4	321	8.03	<1
133369	ROBEY PATRICIA	45.3976	-110.6982	05S	08E	14	DCAD	4,899	4,900.6	136	08/06/00	84.04	86.7	7.5	10.9	319	7.9	<1
102464	INVERNESS LAND & CATTLE MANAGEMENT INC	45.4102	-110.7334	05S	08E	9	DA	5,061	5,061.5	171	08/28/00	162.2	--	10	16.4	168	8.15	<1
148813	WARFIELD WILLIAM S	45.4116	-110.6467	05S	09E	8	CCA	4,840	4,841.9	--	10/07/00	45.85	46	--	9.9	239	7.07	<1
175612	WARFIELD WILLIAM	45.4123	-110.6433	05S	09E	8	CDBD	4,850	4,851.4	100	10/07/00	52.5	54.35	--	7.7	237	7.47	<1
184344	SCHNEIDER GARY	45.381	-110.6012	05S	09E	22	CDCD	5,454	5,456.0	223	09/11/00	207.27	--	8.5	10.4	261	8.2	<1
184346	MCMAN BILL	45.3528	-110.6014	05S	09E	33	DDBD	5,914	5,916.1	48	09/12/00	17.79	17.96	--	8	251	7.98	1
184345	WAID JOHN	45.3685	-110.7355	05S	08E	28	DDBD	4,883	4,885.8	111	08/25/00	5.73	--	8.5	12.6	388	8.13	<1
182639	TRIPLE R RANCH	45.4989	-110.7058	04S	08E	11	CDBD	5,203	5,203.5	--	08/14/00	85.5	--	--	--	1000	--	<1
182638	WISE JOHN	45.3207	-110.7054	06S	08E	14	ABAA	5,420	5,422.7	--	09/10/00	20.22	--	12	4.5	153	7.6	<1
182637	BRYANT ROSEMARRY	45.4054	-110.6629	05S	09E	18	BDBA	4,940	4,939.5	180	10/07/00	138.3	138.6	9	11.6	385	7.46	1
149841	WALSH PETE	45.4404	-110.7326	04S	08E	34	CCCC	5,257	5,259.0	--	09/30/00	6.49	10.25	15	8	63	6.73	<1
124069	BRUTGER ALAN	45.3099	-110.9172	06S	07E	18	C	5,698	5,999.5	305	10/08/00	165.26	--	5	6.9	162	7.5	<1
103692	PERKINS CHARLES	45.2823	-110.766	06S	08E	29	DBDA	5,370	5,371.5	--	10/07/00	10.78	--	--	10.8	509	8.06	<1
166428	MT DEPT OF HWYS	45.295	-110.8342	07S	07E	23	CDAB	4,925	1,926.3	57.8	07/27/00	10.25	--	--	--	--	--	--
183893	KANT BRAD & CRYSTAL	45.4538	-110.6494	04S	09E	29	CCCC	4,890	4,892.5	--	09/09/00	152.87	--	10	10.6	338	8.02	<1
183894	CHEKOWSKI PETER	45.4159	-110.6919	05S	08E	11	DAAD	4,855	4,857.3	70	09/09/00	43.76	45.15	10	10.2	196	7.73	<1
183891	TAYLOR JACK	45.3741	-110.6711	05S	08E	25	ADDA	5,040	5,041.5	287	10/08/00	218.1	219.9	10	13.8	462	7.7	1
100935	MONTANA LAND AND CATTLE	45.4553	-110.6932	04S	08E	26	DDAD	4,975	4,977.0	299	08/28/00	--	--	--	11.7	273	8.14	<1
169853	ROACH MARAGRET	45.3747	-110.7338	05S	08E	28	ADAB	5,060	--	225	11/29/00	--	--	--	19.1	126	--	<1
102557	GOLDEN AGE VILLAGE - WELL 2	45.362	-110.7633	05S	08E	32	ABCC	5,081	5,082.9	132	08/25/00	43.95	--	10	--	229	8.04	<1
176295	MORTON DAVE	45.3059	-110.7793	06S	08E	20	BBAA	5,169	5,171.0	179	09/30/00	122.3	--	15	15.1	558	7.79	<1
183892	FAIR BARBARA	45.3241	-110.7473	06S	08E	9	DCAC	5,034	5,036.4	30.5	08/19/00	21.35	25.14	15	8.8	231	7.31	<1
183897	HINKIE RICHARD	45.327	-110.7699	06S	08E	8	DBCD	4,900	4,900.9	18	08/16/00	13	13.1	6	13	305	7.4	<1
183903	USFS * SNOWBANK CAMPGROUND	45.2893	-110.5465	06S	10E	30	BACB	5,729	5,731.2	45	07/26/00	5	--	6	5.3	253	8.1	<1
184342	TECCA ALFRED	45.6023	-110.572	03S	09E	2	DDBA	4,550	4,551.0	--	08/28/00	11.68	--	--	11.4	360	7.68	1
21567	NELSON SPRING CREEK RANCH	45.5563	-110.5744	03S	09E	23	ADDA	4,659	4,660.5	60.5	07/25/00	32.17	--	6.5	14.3	357	7.63	<1
104586	STATE HIGHWAY DEPARTMENT - MINER SECTION HOUSE	45.2051	-110.8933	07S	07E	20	CDDA	5,083	5,085.0	87.2	07/27/00	68.37	65.7	7.5	13.9	589	7.6	<1
175955	MURRAY WILLIAM	45.4195	-110.6924	05S	08E	11	ADAD	4,970	4,971.4	217	03/15/01	183.54	184.45	15	7.6	110	8.68	<1
185218	ALGER BARBARA & BELZ DAVE	45.5461	-110.5467	03S	10E	30	CBBD	4,993	4,994.8	174	11/10/02	122.06	123.22	10	10.1	220	7.62	<1
182640	OTIS BERT	45.3688	-110.7313	05S	08E	27	CCBC	4,890	4,890.5	80	08/05/00	11.28	--	--	13.3	361	7.39	<1
201443	PEAVEYHOUSE JOEL	45.5461	-110.5352	03N	10E	30	DBCD	5,140	5,141.7	--	11/10/01	222.15	234.6	--	9	292	7.75	<1
201444	BRAWNER QUENTIN	45.539	-110.5577	03S	10E	31	BBCC	4,857	4,858.0	44	11/10/01	24.49	26.6	--	9	212	7.81	<1
201445	GESKO SAM	45.5471	-110.544	03N	10E	30	CABA	5,080	5,081.3	--	11/10/01	166.88	--	--	10.1	258	7.87	1

Appendix B Well inventory data

m number	Site name	Latitude	Longitude	Township	Range	Section	Tract	Ground elevation	Measureing piont elevation (ft)	Total Depth	Date (dd/mm/yy)	Static water level from mp	Pumping water level (ft)	Yield (gpm)	Water temperature (C)	Field SC (umhos/cm)	Field pH	Field test nitrate mg/L N)
201446	LAWRIE K	45.5424	-110.5416	03S	10E	30	CDCA	5,010	5,005.2	--	11/10/02	113.77	--	--	--	--	--	--
138754	DOAK BRIAN J	45.538	-110.5454	03S	10E	30	CA	5,020	5,017.6	252	11/10/01	191.75	--	--	9.5	277	7.45	<1
175960	KNOOP MARY L	45.3749	-110.7348	05S	08E	28	AD	5,020	2,023.6	230	09/09/00	113.07	--	--	--	--	--	--
99841	SCHLEICHER EARL	45.5431	-110.5375	03S	10E	30	DCBC	5,080	5,081.3	80	11/10/01	65	--	--	--	--	--	--
99840	SCHLEICHER EARL	45.5457	-110.528	03S	10E	30	DAA	5,080	5,082.6	103	11/10/01	89.62	--	--	--	--	--	--
182357	BASINI ALBERT	45.5391	-110.5541	03S	09E	36	ACA	4,885	4,886.9	--	11/10/01	46.4	--	--	--	--	--	--
206290	SACKETTES	45.4045	-110.6992	05S	08E	14	ACBA	4,843	4,841.4	45.8	07/08/03	24.33	--	--	--	--	--	--
102486	STANDISH CHAD AND MORLEY PAT	45.3752	-110.6847	05S	08E	25	BDBD	5,011	5,011.8	--	07/10/03	168.72	--	--	--	419	7.86	--
179428	WESTGEEST BOB	45.3839	-110.6456	05S	09E	20	CCB	5,058	5,059.0	--	07/09/03	266.5	--	--	--	--	--	--
201776	ADKINS MIKE	45.4084	-110.669	05S	09E	18	BBBA	4,893	4,895.5	--	07/10/03	101.53	--	--	--	--	--	--
159750	SACKETT GARY AND SHANNON	45.4045	-110.6992	05S	08E	14	ACB	4,850	4,851.6	--	07/11/03	24.33	--	--	--	--	--	--
192475	SHIMMIN RILEY	45.3967	-110.6634	05S	09E	18	CD	4,972	4,974.3	--	07/09/03	194.43	--	--	--	--	--	--
192235	LAY BRUCE	45.5333	-110.5747	03S	09E	35	ACD	4,720	4,721.5	--	04/17/03	113.35	--	--	--	--	--	--
211605	HAYNES WILLIAM	45.5107	-110.6109	04S	09E	9	AAAA	4,710	4,711.6	79	06/30/04	60.25	61.83	6.8	10.2	261	6.99	<1
102566	HOAG M/M PHILLIP	45.3593	-110.7724	05S	08E	32	BCC	5,150	5,151.0	--	04/18/03	8.74	--	--	--	--	--	--
211602	JACKSON RAY	45.4662	-110.6396	04S	09E	29	ABBC	4,850	4,853.0	160	06/30/04	136.15	136.2	10	10.5	300	8.16	<1
159719	TECCA TONY	45.5487	-110.53	03S	10E	30	ADB	5,225	5,221.0	--	11/10/01	285.18	--	--	--	--	--	--
151257	PEAVYBOUSE JOEL & HERMA	45.5461	-110.5352	03S	10E	30	DBD	5,147	5,148.7	--	11/10/01	222.15	--	--	--	--	--	--
211652	GESCO SAM	45.5471	-110.5439	03N	10E	30	CBAD	5,032	--	--	11/10/01	--	--	--	--	--	--	--
205557	AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL	45.4084	-110.6766	05S	08E	13	ABAD	4,958	4,960.2	--	07/08/03	170	--	--	--	--	--	--
205550	AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE	45.4075	-110.6919	05S	08E	14	AADA	4,852	4,854.2	--	07/08/03	51.49	--	--	--	--	--	--
205551	AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL	45.4075	-110.6932	05S	08E	14	AADB	4,848	4,850.2	--	07/08/03	51.49	--	--	--	--	--	--
211706	MILL CREEK RIDGE TEST WELL #1	45.4029	-110.6308	05S	09E	17	ADDC	4,999	5,000.0	344	05/27/04	230.52	249.56	140	--	--	--	--
211709	MILL CREEK RIDGE TEST WELL #2	45.4046	-110.6308	05S	09E	17	ADAB	4,994	4,995.0	264	05/27/04	213.88	--	--	--	--	--	--
211241	DENTON JOHN SHALLOW	45.3048	-110.7616	06S	08E	20	AACA	5,085	5,087.0	82	03/24/04	67.78	--	--		--	--	--
211242	DENTON JOHN DEEP	45.3048	-110.7616	06S	08E	20	AACA	5,085	5,086.9	102	03/24/04	67.9	--	--		--	--	--
211240	DENTON JOHN PUMPING WELL	45.3048	-110.7616	06S	08E	20	AACA	5,085	5,086.9	92	03/24/04	67.72	--	--		--	--	--
211235	MITCHELLS MILE HIGH RANCH SHALLOW	45.506	-110.5859	04S	09E	11	BCAC	4,700	4,701.5	61	03/24/04	35.7	--	--		--	--	--
209229	MITCHELLS MILE HIGH RANCH DEEP	45.506	-110.5859	04S	09E	11	BCAC	4,700	4,701.7	102	03/24/04	35.65	--	--		--	--	--
211236	MITCHELLS MILE HIGH RANCH PUMPING WELL	45.506	-110.5859	04S	09E	11	BCAC	4,700	4,702.3	70	03/24/04	36.19	--	--		--	--	--
211238	OHAIR SHALLOW	45.5398	-110.5398	03S	09E	26	CCCC	4,630	4,632.0	41	03/24/04	5.09	--	--		--	--	--
211239	OHAIR DEEP	45.5398	-110.5398	03S	09E	26	CCCC	4,630	4,632.0	103	03/24/04	1.1	--	--		--	--	--
211237	OHAIR PUMPING WELL	45.5398	-110.5398	03S	09E	26	CCCC	4,630	4,631.7	52	03/24/04	6.49	--	--		--	--	--

Appendix C:
List of surface-water inventory data

Surface-water site inventory summary

Stream/Ditch	Site	Measuring point	Location			Inventory date
			Township, Range, Section, tract	Latitude (dd)	Longitude (dd)	
Big Creek	Upper	marked on bridge rail	6S-7E-17DCDD	45.3111	110.8971	4/18/03
Big Creek	Diversion	Cement diversion	6S-7E-22DCDD	45.3063	110.8516	11/11/01
Big Creek	Highway	marked on bridge rail	6S-7E-23DBBB	45.2991	110.8314	9/20/00
Big Creek Ditch	Grate	none	6S-7E-22DCDD	45.3063	110.8516	8/23/02
Chico Ditch	Old Chico	none	6S-8E-14ABAA	45.3211	110.7057	9/20/00
Chico Ditch	New Chico	none	6S-8E-1CACB	45.3416	110.6935	7/9/03
Chico Ditch	Golf Course	none	6S-8E2 ACCA	45.3450	110.7079	7/9/03
Chico Ditch	Emigrant Road	none	5S-8E35 DBDB	45.3560	110.6993	7/9/03
Ceder Creek	Highway	none	8S-7E-13ADBB	45.1431	110.8123	11/11/01
Deep Creek	North upper	mark on culvert	3S-10E-29BCCD	45-5488	110.5254	11/11/01
Deep Creek	South upper	none	3S-10E-31ABBD	45.5392	110.5345	11/11/01
Deep Creek	Pool	mark on culvert	3S-10E-30CDCA	45.5418	110.5405	6/29/01
Deep Creek	Tree	stake	3S-9E-36ACAB	45.5368	110.5546	11/12/01
Deep Creek	Highway	marked on bridge rail	3S-9E-36ACBC	45.5358	110.5580	9/18/00
Deep Creek Ditch	Diversion	none	3S-10E-29BCCA	45.5511	110.5213	4/12/02
Donahue Creek	Old Yellowstone Trail	stake	7S-7E-4AADD	45.2618	110.8667	3/12/02
Elbow Creek	Bridge	none	5S-9E-10CBBB	45.4165	110.6092	06/03/02
Emigrant Creek	Scary Bridge	marked on bridge rail	6S-8E-14BAAA	45.3205	110.7085	9/20/00
Emigrant Creek	Highway	marked on bridge rail	6S-8E-9BDBD	45.3306	110.7535	5/30/01
Fridley Creek	Glastonbury	mark on culvert	5S-8E-32CCCB	45.3618	110.7572	5/22/02
Fridley Creek	Highway	none	6S-8E-4CACC	45.3445	110.7574	5/22/02
Gold Run Creek	Conlin Rd	none	6S-8E-17ADAA	45.3163	110.7595	7/9/03
McDonald Creek	McDonald Rd	mark on culvert	4S-9E-27ADCB	45.4616	110.5937	9/22/01
Mill Creek	Second Bridge	marked on bridge rail	6S-9E-3BAAB	45.3505	110.6094	9/20/00
Mill Creek	First Bridge	marked on bridge rail	5S-9E-29AACC	45.3775	110.6334	10/04/02
Mill Creek	Highway	marked on bridge rail	5S-9E-8CCBA	45.4195	110.6423	9/20/00
Mill Flat Ditch	South of Mill Cr Rd	none	5S-9E-33DBBD	45.3546	110.6140	7/9/03
Mill Flat Ditch	Clark	none	5S-9E-20DCCB	45.3546	110.6140	7/9/03
Mill Flat Ditch	Lower	none	5S-9E-20BBBA	45.3945	110.6490	7/9/03
Mol Heron	Old Hyw	none	8S-7E-24ACAA	45.1276	110.8062	11/11/01
Nelson Spring Creek	Old bridge	none	3S-9E-23DCDC	45.5555	110.5763	5/23/02
Ohair Spring Creek	Culvert	none	3S-9E-26CCBA	45.5429	110.5885	3/14/02
Paradise Canal	Cascade	none	5S-8E-12DADA	45.4136	110.6713	7/9/2003
Paradise Canal	Mill Creek Road	mark on cement lip	5S-9E-8CADA	45.4140	110.6413	9/20/00
Paradise Canal	Elbow Creek	none	5S-9E-4DAAB	45.4325	110.6081	7/10/2003
Paradise Canal	Mcdonald Road	mark on culvert	4S-9E-27ADCA	45.4613	110.5925	9/20/00
Paradise Canal	Barney Creek	none	4S-9E-14DCAA	45.4854	110.5734	7/9/2003
Park Branch Canal	Checowski	none	5S-8E-11DADA	45.4126	110.6942	7/10/03
Park Branch Canal	Old Yellowstone Trail	marked on bridge rail	5S-8E-22DABA	45.3702	110.7320	9/20/00
Park Branch Canal	Darrel	mark on culvert	4S-9E-20BBBC	45.4815	110.6513	9/20/00
Park Branch Canal	Trail Creek Divide Rd	none	4S-9E-20BCBB	45.5222	110.6304	7/10/03
Pine Creek	Campground	stake	4S-10E-8CDBB	45.4981	110.5195	9/20/00
Pine Creek	Highway	marked on bridge rail	4S-9E-12BCCC	45.5044	110.5672	9/21/00
Rock Creek	Old Yellowstone Trail	none	7S-7E-19CAAA	45.2106	110.9033	11/11/01
Strawberry Creek	Highway	none	4S-9E-34BCDC	45.4476	110.6661	11/11/01
Suce Creek	First Bridge	mark on culvert	3S-9E-24ADAA	45.5669	110.5593	9/18/00
Suce Creek	Highway	marked on bridge rail	3S-9E-24ABCC	45.5655	110.5493	9/18/00
Tom Miner Creek	Old Yellowstone Trail	marked on bridge rail	7S-7E-30ACDB	45.1988	110.9082	9/20/00
Trail (East branch)	Old Yellowstone Trail	mark on bridge deck	4S-8E-25BADA	45.4650	110.6527	9/20/00
Trail (East branch)	Darrel	mark on culvert	4S-9E-17CCBC	45.4842	110.6511	9/20/00
Trail Creek (west branch)	Tin Shed	mark on culvert	4S-8E-25BCDA	45.4618	110.6878	6/30/01
Trail Creek (west branch)	Pine Cr Rd	mark on culvert	4S-9E-3CCDC	45.5113	110.6081	11/11/01
Trail Creek (west branch)	Ohair	none	3S-9E-27DADA	45.5453	110.6081	11/11/01
Yellowstone River	Corwin Springs	USGS	8S-8E-30BDCC	45.1119	110.7934	03/13/02
Yellowstone River	Mill Creek Bridge	marked on bridge rail	05S-9E-8BADD	45.4195	110.6423	03/13/02
Yellowstone River	Pine Creek Bridge	marked on bridge rail	4S-9E-11BABB	45.5109	110.5819	04/13/04
Yellowstone River	Carter Bridge	USGS	3S-9E-12ABBB	45.5969	110.5661	03/13/02
6 Mile Creek (east fork)	First Bridge	mark on bridge deck	6S-8E-16CBCB	45.3163	110.7600	11/11/01
6 Mile Creek (east fork)	South of split	none	6S-8E-29ACAD	45.2893	110.7641	10/4/02
6 Mile Creek (west fork)	Muledeer	stake	6S-8E-20AAAC	45.2868	110.7669	3/14/01
6 Mile Creek (west fork)	Q Bridge	marked on bridge deck	6S-8E-29 ACAD	45.2868	110.7669	9/20/00
6 Mile Creek	Mountain	marked on bridge rail	6S-8E-32BDCC	45.2706	110.7760	8/7/01
6 Mile Ditch	North of Q Bridge	mark on culvert	6S-8E-29ACAD	45.2860,	110.7675	5/30/01
6 Mile Ditch	Mule Deer	none	6S-8E-20AACC	45.3026,	110.7653	7/9/03
8 Mile Creek	Old Yellowstone Trail	mark on culvert	5S-8E-11CABD	45.4149	110.7056	9/20/00
8 Mile Ditch	Old Yellowstone Trail	mark on culvert	4S-8E-35ACDC	45.4457	110.6989	9/20/00

Appendix D:
Surface-water monitoring data

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
Big Creek											
	Upper	TRSt: 6S-7E-17DCDD	4/18/03	7.40	46.6	--	4.5	7.9	68	56	<1
		LL: 45.3111, 110.8971	7/10/03	--	49.5	--	--	--	--	--	--
	Diversion	TRSt: 6S-7E-22DCDD	11/11/01	6.01	25.0	35.0	--	--	--	--	--
		LL: 45.3063, 110.8516	1/20/02	6.25	21.5	34.0	--	--	--	--	--
			3/13/02	6.19	22.4 e	34.0	--	--	--	--	--
			4/15/02	5.04	49.3 e	41.0	--	--	--	--	--
			5/22/02	4.02	117.7 e	49.0	--	--	--	--	--
			6/3/02	2.93	397.5 e	64.0	--	--	--	--	--
			6/27/02	3.79	147.6	52.0	--	--	--	--	--
			8/1/02	5.21	43.4 e	39.0	--	--	--	--	--
			8/23/02	6.00	24.8	35.0	--	--	--	--	--
			10/4/02	6.01	25.0 e	35.0	--	--	--	--	--
			4/18/03	5.20	43.2	39.0	--	--	--	--	--
			7/11/03	--	48.3	40.0	--	--	--	--	--
	Highway	TRSt: 6S-7E-23DBBB	9/20/00	--	10.7	25.0	11.2	8.21	88	72	<1
		LL: 45.2991, 110.8314	3/14/01	15.60	9.2	25.0	2.7	7.8	82	67	<1
			4/15/01	15.64	8.2 e	25.0	--	--	--	--	--
			5/30/01	15.00	41.9	29.0	11.4	7.32	48	39	<1
			6/30/01	15.61	8.8 e	25.0	--	--	--	--	--
			8/7/01	15.87	3.9	23.0	--	--	--	--	--
			9/22/01	15.85	4.9 e	24.0	--	--	--	--	--
			11/11/01	15.57	9.7 e	25.0	--	--	--	--	--
			1/20/02	15.78	5.8 e	24.0	--	--	--	--	--
			3/13/02	15.64	8.2 e	25.0	--	--	--	--	--
			4/15/02	15.18	26.0 e	27.0	--	--	--	--	--
			5/22/02	14.67	97.1	31.0	6.4	7.62	57	47	<1
			6/3/02	14.17	370.6 e	35.0	--	--	--	--	--
			6/27/02	14.59	120.0 e	31.0	--	--	--	--	--
			8/1/02	15.25	21.7 e	27.0	--	--	--	--	--
			8/23/02	15.71	7.9	22.0	10.5	7.96	77	63	--
			10/4/02	15.52	11.0 e	25.0	--	--	--	--	--
			4/18/03	15.24	22.3 e	27.0	--	--	--	--	--
			7/10/03	15.50	11.6 e	25.0	--	--	--	--	--
Big Creek Ditch											
	Grate	TRSt: 6S-7E-22DCDD	8/23/02	--	15.5	--	--	--	--	--	--
		LL: 45.3063, 110.8516	7/11/03	--	18.4	--	--	--	--	--	--
Chico Ditch											
	Old Chico	TRSt: 6S-8E-14ABAA	9/20/00	2.25	3.9	--	--	--	--	--	--
		LL: 45.3211, 110.7057	7/9/03	--	14.4	--	--	--	--	--	--
	New Chico	TRSt: 6S-8E-1CACB	7/9/03	--	3.1	--	--	--	--	--	--
		LL: 45.3416, 110.6935									
	Golf Course	6S8E2 ACCA	7/9/03	--	1.5	--	--	--	--	--	--
		LL: 45.3450, 110.7079									
	Emigrant Road	5S8E35 DBDB	7/9/03	--	0.2	--	--	--	--	--	--
		LL: 45.3560, 110.6993									
Ceder Creek	Hyw		11/11/01	--	3.4	--	--	--	--	--	--
Deep Creek											
	North upper	TRSt: 3S-10E-29BCCD	11/11/01	7.55	1.6	9.0	4.9	8.08	121	99	--
		LL: 45-5488, 110.5254	3/12/02	7.26	1.8 e	5.4	--	--	--	--	--
			4/16/02	7.07	3.2	--	--	--	--	--	--
			5/21/02	6.16	54.5	22.2	6.6	7.3	84	69	--
			6/3/02	5.96	107.7 e	29.6	--	--	--	--	--
			6/26/02	6.41	24.0 e	15.8	9.9	6.63	49	40	--
			7/15/02	6.70	9.6 e	10.7	--	--	--	--	--
			7/31/02	6.80	7.1	9.4	--	--	--	--	--
			8/22/02	DRY	0.0	0.0	--	--	--	--	--
			10/4/02	DRY	0.0	0.0	--	--	--	--	--
			4/17/03	7.78	0.2	2.2	5.2	8.94	129	106	--
			7/10/03	7.10	2.9 e	6.5	--	--	--	--	--
	South upper	TRSt: 3S-10E-31ABBD	11/11/01	--	3.3	7.0	--	--	--	--	--
		LL: 45.5392, 110.5345	7/10/03	--	5.3	9.0	--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
	Pool	TRSt: 3S-10E-30CDCA	6/29/01	--							
		LL: 45.5418, 110.5405	8/7/01	Dry	0.0	--	--	--	--	--	--
			9/22/01	Dry	0.0	--	--	--	--	--	--
			11/11/01	5.38	0.3	3.0	3.4	7.74	120	98	--
			1/20/02	Dry	0.0	--	--	--	--	--	--
			4/16/02	Dry	0.0	--	--	--	--	--	--
			5/21/02	4.60	69.7	26.0	7.1	7.25	79	65	--
			6/3/02	4.23	162.6	24.0	--	--	--	--	--
			6/26/02	4.78	24.9	16.0	9.9	6.63	49	40	--
			7/31/02	--	2.9	--	--	--	--	--	--
			8/22/02	Dry	0.0	--	--	--	--	--	--
			10/4/02	Dry	0.0	--	--	--	--	--	--
			4/17/03	Dry	0.0	--	--	--	--	--	--
			7/10/03	5.12	3.1	7.0	--	--	--	--	--
	Tree	TRSt: 3S-9E-36ACAB	11/12/01	1.87	0.2	2.0	2	--	--	--	--
		LL: 45.5368, 110.5546	1/20/02	Dry	0.0	0.0	--	--	--	--	--
			3/14/02	--	0.1	0.0	--	--	--	--	--
			4/16/02	--	4.8	7.5	--	--	--	--	--
			5/21/02	--	65.2	22.0	8	7	63	52	--
			6/3/02	--	156.2	31.5	--	--	--	--	--
			6/26/02	--	23.1	25.0	9.9	6.63	49	40	--
			7/31/02	--	3.1	6.0	--	--	--	--	--
			8/22/02	Dry	0.0	0.0	--	--	--	--	--
			10/4/02	Dry	0.0	0.0	--	--	--	--	--
			4/17/03	Dry	0.0	0.0	--	--	--	--	--
			7/10/03	--	2.4	5.0	--	--	--	--	--
** includes input from a spr	Highway	TRSt: 3S-9E-36ACBC	9/18/00	8.25	0.3	--	11.7	7.47	192	157	0.5
		LL: 45.5358, 110.5580	1/10/01	8.46	0.0	--	4.8	7.6	167	137	--
			3/13/01	8.45	0.1 e	--	5.9	7.2	170	139	--
			4/12/01	8.29	0.2 e	--	--	--	--	--	--
			5/29/01	7.90	10.5	--	9.6	6.4	53	43	--
			6/29/01	8.02	3.6 e	--	--	--	--	--	--
			8/7/01	8.42	0.1 e	--	--	--	--	--	--
			9/22/01	8.43	0.1 e	--	--	--	--	--	--
Deep Creek Ditch											
	Diversion	TRSt: 3S-10E-29BCCA	4/12/02	--	2.6	--	--	--	--	--	--
		LL: 45.5511, 110.5213	6/26/2002	--	5.8	--	--	--	--	--	--
			7/31/02	--	5.9	--	--	--	--	--	--
			8/22/02	--	3.4	--	--	--	--	--	--
			10/4/02	--	2.5	--	--	--	--	--	--
Donahue Creek											
	Old Yellowstone Trail	TRSt: 7S-7E-4AADD	3/12/02	2.45	3.7	--	--	--	--	--	--
		LL: 45.2618, 110.8667	5/22/02	2.10	41.1	--	7.20	8	64	52	--
			6/3/02	--	68.0	--	--	--	--	--	--
Elbow Creek											
	Bridge	TRSt: 5S-9E-10CBBB	06/03/02	--	119.4	--	--	--	--	--	--
		LL: 45.4165, 110.6092	06/27/02	--	52.0	--	--	--	--	--	--
			07/31/02	--	0.0	--	--	--	--	--	--
Emigrant Creek											
	Scary Bridge	TRS: 6S-8E-14BAAA	9/20/00	6.54	1.4	11.0	10.30	7.93	165	135	0.5
		LL: 45.3205, 110.7085	1/10/01	6.33	7.0	18.0	3.40	7.99	145	119	--
			3/14/01	--	8.1	18.0	2.90	7.38	147	121	--
			4/12/01	6.39	3.5 e	15.0	--	--	--	--	--
			5/30/01	5.91	46.3	29.0	8.50	6.85	91	74	--
			6/29/01	5.94	34.0 e	27.0	--	--	--	--	--
			8/7/01	6.54	1.7 e	12.0	--	--	--	--	--
			9/22/01	6.47	2.3 e	13.0	--	--	--	--	--
			11/11/01	6.32	4.8 e	16.0	--	--	--	--	--
			1/20/02	6.32	4.9 e	16.0	--	--	--	--	--
			3/14/02	6.33	5.0 e	16.0	--	--	--	--	--
			4/15/02	6.28	5.9	--	--	--	--	--	--
			5/22/02	5.90	65.6	32.0	5.30	7.73	92	75	--
			6/3/02	5.62	192.2	43.0	--	--	--	--	--
			6/27/02	5.80	71.6 e	33.0	--	--	--	--	--
			7/31/02	6.21	8.4 e	19.0	--	--	--	--	--
			8/23/02	6.65	1.0 e	10.0	--	--	--	--	--
			10/4/02	6.31	5.1 e	16.0	--	--	--	--	--
			4/17/03	6.18	9.8 e	19.0	10.10	8.21	127	104	--
			7/9/03	6.70	0.8 e	10.0	--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
	Highway	TRS: 6S-8E-9BDBD	5/30/01	11.10	6.5	10.0	12.7	7.11	102	84	--
		LL: 45.3306, 110.7535	8/7/01	Dry	0.0	0.0	--	--	--	--	--
			5/22/02	10.91	12.3	14.0	6.4	7.82	85	70	--
			6/3/02	10.18	122.1 e	17.0	--	--	--	--	--
			6/27/02	10.76	18.7	10.0	--	--	--	--	--
			8/1/02	Dry	0.0	0.0	--	--	--	--	--
			8/23/02	Dry	0.0	0.0	--	--	--	--	--
			10/4/02	Dry	0.0	0.0	--	--	--	--	--
			7/9/03	Dry	0.0	0.0	--	--	--	--	--
Fridley Creek											
	Glastonbury	TRSt: 5S-8E-32CCCB	5/22/02	2.96	7.2	--	7.2	7.77	47	39	--
		LL: 45.3618, 110.7572	6/27/02	3.30	2.4	--	--	--	--	--	--
			8/1/02	3.32	2.3	--	--	--	--	--	--
			8/23/02	3.32	2.3	--	12.2	7.65	59	48	--
			10/4/02	3.29	2.5	--	--	--	--	--	--
			4/18/03	2.90	7.3	--	5.7	7.78	53	43	--
	Hyw	TRSt: 6S-8E-4CACC	5/22/02	--	6.8	--	--	--	--	--	--
		LL: 45.3445, 110.7574	6/27/02	--	1.8	--	--	--	--	--	--
			8/23/02	--	1.7	--	--	--	--	--	--
			10/4/02	--	2.2	--	--	--	--	--	--
Gold Run Creek	Conlin Rd	TRSt: 6S-8E-17ADAA	7/9/03	--	8.2	--	--	--	--	--	--
		LL: 45.3163, 110.7595									
McDonald Creek											
	McDonald Rd	TRSt: 4S-9E-27ADCB	9/22/01	5.84	0.6	--	--	--	--	--	--
		LL: 45.4616, 110.5937	6/30/01	5.57	12.5	--	--	--	--	--	--
			9/22/01	5.84	0.6	--	--	--	--	--	--
			5/22/02	5.64	5.5	--	4.5	7.31	44	36	--
			6/26/02	5.48	38.4	--	--	--	--	--	--
			7/31/02	Dry	0.0	--	--	--	--	--	--
			8/23/02	6.26	0.0	--	--	--	--	--	--
			10/4/02	Dry	0.0	--	--	--	--	--	--
			7/10/03	6.18	0.0	--	--	--	--	--	--
Mill Creek											
	Second Bridge	TRSt: 6S-9E-3BAAB	9/20/00	15.25	24.0	34.0	10.6	8.31	183	150	--
		LL: 45.3505, 110.6094	3/14/01	14.86	46.2	41.0	1.9	8.04	177	145	--
			4/12/01	14.80	52.9 e	43.0	--	--	--	--	--
			5/30/01	13.30	445.0	82.0	7.6	7.17	77	63	--
			6/29/01	13.70	321.3 e	74.0	--	--	--	--	--
			8/7/01	15.35	22.6 e	33.0	--	--	--	--	--
			9/22/01	15.39	21.2 e	33.0	--	--	--	--	--
			11/11/01	15.20	28.4 e	36.0	--	--	--	--	--
			1/20/02	15.15	30.6 e	37.0	--	--	--	--	--
			3/14/02	15.22	27.5	35.0	--	--	--	--	--
			4/15/02	14.99	39.3	39.0	--	--	--	--	--
			5/23/02	13.45	494.0	84.0	6.1	8	97	80	--
			6/3/02	13.07	964.9	103.0	--	--	--	--	--
			6/26/02	13.59	387.9 e	78.0	--	--	--	--	--
			7/31/02	15.05	35.8	38.0	--	--	--	--	--
			8/23/02	15.30	24.3	34.0	13.1	8.27	153	125	--
			10/4/02	14.93	43.1 e	41.0	--	--	--	--	--
			4/17/03	14.59	73.9 e	48.0	5.8	8.17	161	132	--
			7/9/03	14.36	107.0 e	53.0	--	--	--	--	--
	First Bridge	TRSt:5S-9E-29AACC	10/04/02	--	22.3	20.0	--	--	--	--	--
		LL: 45.3775, 110.6334	04/17/03	--	39.6	26.0	--	--	--	--	--
	Highway	TRSt: 5S-9E-8CCBA	9/20/00	9.74	4.8	18.0	13.1	8.53	200	164	0.5
		LL: 45.4195, 110.6423	3/14/01	9.44	25.1	25.0	2	7.75	189	155	--
			4/12/01	9.35	28.4 e	25.0	--	--	--	--	--
			5/31/01	8.69	363.2 e	43.0	--	--	--	--	--
			6/29/01	8.78	253.8 e	40.0	--	--	--	--	--
			8/7/01	Dry	0.0	0.0	--	--	--	--	--
			9/22/01	Dry	0.0	0.0	--	--	--	--	--
			11/11/01	9.65	9.5 e	20.0	--	--	--	--	--
			1/20/02	9.70	7.9 e	19.0	--	--	--	--	--
			3/14/02	9.60	11.4 e	21.0	--	--	--	--	--
			4/15/02	9.39	24.5 e	25.0	--	--	--	--	--
			5/23/02	8.63	462.2	46.0	5.5	7.68	111.2	91	--
			6/3/02	8.47	886.6 e	52.0	--	--	--	--	--
			6/26/02	8.70	349.0 e	43.0	--	--	--	--	--
			7/31/02	9.49	17.0 e	23.0	--	--	--	--	--
			8/23/02	Dry	0.0	0.0	17.2	8.41	170	139	--
			10/4/02	9.45	19.6 e	18.0	--	--	--	--	--
			4/17/03	9.29	35.6 e	27.0	--	--	--	--	--
			7/8/03	--	2.9	16.0	--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
Mill Flat Ditch											
	South of Mill Cr Rd	TRSt: 5S-9E-33DBBD	7/9/03	--	5.9	--	--	--	--	--	--
		LL: 45.3546, 110.6140									
	Clark	TRSt: 5S-9E-20DCCB	7/9/03	--	3.5	--	--	--	--	--	--
		LL: 45.3546, 110.6140									
	Lower	TRSt: 5S-9E-20BBBA	7/9/03	--	3.3	--	--	--	--	--	--
		LL: 45.3945, 110.6490									
Mol Heron	Old Hyw	TRSt: 8S-7E-24ACAA	11/11/01	--	8.3	--	--	--	--	--	--
		LL: 45.1276, 110.8062									
Nelson Spring Creek											
	Old bridge	TRSt: 3S-9E-23DCDC	5/23/02	--	51.1	--	--	--	--	--	--
		LL: 45.5555, 110.5763	7/31/02	--	75.3	--	--	--	--	--	--
			4/17/03	6.10	48.1	--	11.1	8.48	262	215	--
Ohair Spring Creek	Culvert	TRSt: 3S-9E-26CCBA	3/14/02	--	61.9	--	--	--	--	--	--
		LL: 45.5429, 110.5885	4/14/02	--	68.3	--	12.6	8.32	259	212	--
			5/23/02	--	81.2	--	--	--	--	--	--
			7/31/02	--	108.8	--	--	--	--	--	--
			10/4/02	--	107.9	--	--	--	--	--	--
			4/17/03	--	69.5	--	--	--	--	--	--
Paradise Canal											
	Cascade	TRSt: 5S-8E-12DADA	7/9/2003	--	32.0	--	--	--	--	--	--
		LL: 45.4136, 110.6713									
	Mill Creek Road	TRSt: 5S-9E-8CADA	9/20/00	1.88	21.0	--	15.1	8.26	273	224	--
		LL: 45.4140, 110.6413	5/29/01	1.15	29.0	--	15.4	7	100	82	--
			6/30/01	1.10	29.9 e	--	--	--	--	--	--
			8/7/01	1.10	29.9 e	--	--	--	--	--	--
			9/22/01	1.09	30.1 e	--	--	--	--	--	--
			5/23/02	2.35	17.8	--	--	--	--	--	--
			6/26/02	1.33	26.3 e	--	--	--	--	--	--
			8/23/02	0.95	33.0 e	--	--	--	--	--	--
			7/9/03	1.58	23.4 e	--	--	--	--	--	--
	Elbow Creek	TRSt: 5S-9E-4DAAB	7/10/2003	--	17.3	--	--	--	--	--	--
		LL: 45.4325, 110.6081									
	Mcdonald Road	TRSt: 4S-9E-27ADCA	9/20/00	2.46	7.7	--	14.1	8.07	254	208	<.5
		LL: 45.4613, 110.5925	6/30/01	2.88	2.8	--	15.1	8.26	273	224	--
			8/7/01	0.76	20.8	--	--	--	--	--	--
			9/22/01	1.98		--	--	--	--	--	--
			5/23/02	0.72	27.3	--	--	--	--	--	--
			6/26/02	2.28		--	20.1	--	80	66	--
			7/31/02	1.73		--	--	--	--	--	--
			8/23/02	1.71		--	--	--	--	--	--
			10/4/02	Dry		--	--	--	--	--	--
			7/10/03	1.92		--	--	--	--	--	--
	Barney Creek	TRS: 4S-9E-14DCAA	7/9/2003	--	1.7	--	--	--	--	--	--
		LL: 45.4854, 110.5734									
Park Branch Canal											
	Checowski	TRSt: 5S-8E-11DADA	7/10/03	--	130.8		--	--	--	--	--
		LL: 45.4126, 110.6942									
	Old Yellowstone Trail	TRSt: 5S-8E-22DABA	9/20/00	6.67	113.4		13.9	8.59	268	220	--
		LL: 45.3702, 110.7320	6/30/01	5.40	195.0 e		--	--	--	--	--
			8/8/01	4.91	240.0		--	--	--	--	--
			9/22/01	5.84	161.0 e		--	--	--	--	--
			5/23/02	6.35	132.0 e		--	--	--	--	--
			6/27/02	6.06	147.0 e		--	--	99	81	--
			8/1/02	5.19	214.0 e		--	--	--	--	--
			8/22/02	5.03	219.6		17.5	8.5	159	130	--
			7/10/03	5.43	209.2	27.8	--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
	Darrel	TRSt: 4S-9E-20BBBC	9/20/00	3.38	67.1		13.5	8.41	259	212	0.5
		LL: 45.4815, 110.6513	5/31/01	3.17	68.9		12.2	6.87	93	76	--
			6/30/01	3.14	69.0		--	--	--	--	--
			8/7/01	3.38	69.2		--	--	--	--	--
			9/23/01	3.23	68.7		--	--	--	--	--
			5/23/02	--	30.6		9.3	7.68	87	71	--
			6/27/02	2.25	72.5	--	--	--	99	81	--
			8/1/02	2.00	73.8		--	--	--	--	--
			8/22/02	0.78	85.0	14.5	18.2	8.33	164	134	--
			7/10/03	2.54	71.2		--	--	--	--	--
	Trail Creek Divide Rd	4S9E4 BCBB LL: 45.5222, 110.6304	7/10/03	--	17.2	3.6	--	--	--	--	--
Pine Creek											
	Campground	TRS: 4S-10E-8CDBB	9/20/00	--	4.0	18.0	10.1	7.89	73	60	--
		LL: 45.4981, 110.5195	1/9/01	--			1.9	7.5	--	--	--
			5/29/01	--	134.1	66.0	7.9	6.8	40	33	--
			7/16/01	1.65	56.5	48.0	--	--	--	--	--
			8/7/01	2.07	11.0	27.0	--	--	--	--	--
			9/22/01	2.30	4.8	20.0	5.1	--	61	50	--
			11/11/01	2.21	3.5	18.0	5.1	8.15	61	50	--
			5/21/02	1.08	164.1	71.0	6	6.95	40	33	--
			5/23/02	1.31	54.5	47.0	--	--	--	--	--
			6/3/02	1.15	95.4	58.0	--	--	--	--	--
			6/26/02	1.28	60.2	49.0	--	--	--	--	--
			7/31/02	1.89	11.3	27.0	--	--	--	--	--
			8/22/02	1.95	9.1	25.0	11	7.48	59	48	--
			10/4/02	2.09	11.5	27.0	--	--	--	--	--
			4/17/03	1.79	41.0	43.0	5.2	7.99	63	52	--
			7/10/03	1.74	52.9	47.0	--	--	--	--	--
	Highway	TRS: 4S-9E-12BCCC	9/21/00	Dry	0.0	0.0	--	--	--	--	--
		LL: 45.5044, 110.5672	1/9/01	15.79	1.6	6.0	1.9	7.5	--	--	--
			3/13/01	14.95	2.3	7.0	2.5	7.41	67	55	--
			4/12/01	15.30	2.0	6.0	--	--	--	--	--
			5/29/01	13.43	107.7	23.0	9.3	6.7	41	34	--
			6/29/01	13.72	56.0	19.0	--	--	--	--	--
			8/7/01	Dry	0.0	0.0	--	--	--	--	--
			9/22/01	Dry	0.0	0.0	--	--	--	--	--
			11/11/01	Dry	0.0	0.0	--	--	--	--	--
			1/20/02	Dry	0.0	0.0	--	--	--	--	--
			3/14/02	Dry	0.0	0.0	--	--	--	--	--
			4/11/02	15.40	1.6	6.0	--	--	--	--	--
			5/23/02	13.92	38.2	17.0	--	--	--	--	--
			6/3/02	13.59	75.0	21.0	--	--	--	--	--
			6/26/02	13.83	43.9	17.0	3.8	7.75	53	43	--
			7/31/02	Dry	0.0	0.0	--	--	--	--	--
			8/22/02	Dry	0.0	0.0	--	--	--	--	--
			10/4/02	Dry	0.0	0.0	--	--	--	--	--
			4/17/03	14.09	24.8	15.0	--	--	--	--	--
			7/10/03	14.01	29.5	15.0	--	--	--	--	--
Rock Creek											
	Old Yellowstone Trail	TRSt: 7S-7E-19CAAA	11/11/01	--	8.8		--	--	--	--	--
		LL: 45.2106, 110.9033	3/14/02	--	7.8		--	--	--	--	--
			4/15/02	--	17.3		--	--	--	--	--
Strawberry Creek											
	Hyw	TRSt: 4S-9E-34BCDC	11/11/01	--	1.5		--	--	--	--	--
		LL: 45.4476, 110.6661	4/17/03	--	3.9		--	--	--	--	--
			7/10/03	--	6.5		--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
Suce Creek											
	First Bridge	TRSt: 3S-9E-24ADAA	9/18/00	6.13	1.0	4.0	9.3	8.31	359	294	0.5
		LL: 45.5669, 110.5593	1/10/01	5.83	1.3	4.0	6.2	8.17	304	249	--
			3/13/01	5.95	1.5	4.0	6.2	8.17	298	244	--
			4/12/01	5.83	1.8	4.0	--	--	--	--	--
			5/29/01	5.18	9.1	5.0	10.7	7.38	250	205	--
			6/29/01	5.20	8.0	5.0	--	--	--	--	--
			8/7/01	5.20	8.0	5.0	--	--	--	--	--
			9/22/01	5.85	1.7	4.0	--	--	--	--	--
			11/11/01	5.85	1.7	4.0	--	--	--	--	--
			1/20/02	5.89	1.6	4.0	--	--	--	--	--
			3/11/02	5.88	1.6	4.0	--	--	--	--	--
			5/21/02	4.92	16.4	6.0	8.7	8.22	161	132	--
			6/26/02	5.10	10.3	5.0	11.6	8	236	194	--
			6/3/02	4.41	68.6	7.0	--	--	--	--	--
			6/27/02	4.70	29.9	6.0	--	--	--	--	--
			7/31/02	5.63	2.8	4.0	--	--	--	--	--
			8/22/02	6.20	0.8	3.0	18.2	8.33	164	134	--
			10/4/02	5.92	1.5	4.0	--	--	--	--	--
			4/17/03	5.73	2.2	4.0	4.9	8.54	226	185	--
			7/10/03	5.16	8.8	5.0	--	--	--	--	--
	Highway	TRSt: 3S-9E-24ABCC	9/18/00	7.67	1.2	4.5	--	--	--	--	--
		LL: 45.5655, 110.5493	1/10/01	Frozen			--	--	--	--	--
			3/13/01	7.62	1.0	4.2	6.2	8.28	296	243	--
			4/12/01	7.63	1.3	4.7	--	--	--	--	--
			5/29/01	7.45	2.4	6.0	11.9	7.54	247	203	--
			6/29/01	7.53	1.8	5.3	--	--	--	--	--
			8/7/01	Dry	0.0	0.0	--	--	--	--	--
			9/22/01	7.66	1.2	4.5	--	--	--	--	--
			11/11/01	7.66	1.2	4.5	--	--	--	--	--
			1/20/02	7.70	1.1	4.3	--	--	--	--	--
			5/21/02	7.13	7.6	9.4	9.4	8.1	175	144	--
			6/3/02	6.52	62.0	21.9	--	--	--	--	--
			6/26/02	7.67	1.2	4.5	11.6	8	236	194	--
			7/31/02	7.57	1.6	5.1	--	--	--	--	--
			8/22/02	7.98	0.4	3.0	0.07	--	-- --		--
			10/4/02	7.72	1.0	4.2	--	--	--	--	--
			4/17/03	7.58	1.5	5.0	--	--	--	--	--
			7/10/03	Dry	0.0	0.0	--	--	--	--	--
Tom Miner Creek											
	Old Yellowstone Trail	TRSt: 7S-7E-30ACDB	9/20/00	9.81	4.2		10.2	8.28	168	138	0.5
		LL: 45.1988, 110.9082	3/14/01	9.57	14.2		2.7	7.82	147	121	--
			4/12/01	9.40	18.1		--	--	--	--	--
			5/30/01	9.20	35.3		13.2	7.3	95	78	--
			6/30/01	9.59	11.2		--	--	--	--	--
			8/9/01	9.91	5.1		--	--	--	--	--
			9/22/01	10.07	3.5		--	--	--	--	--
			11/11/01	9.40	18.1		--	--	--	--	--
			1/20/02	9.65	9.7		--	--	--	--	--
			3/12/02	9.50	14.1		--	--	--	--	--
			4/15/02	9.41	17.7		--	--	--	--	--
			5/22/02	8.94	49.2		6.1	7.71	98	80	--
			6/3/02	8.51	195.2		--	--	--	--	--
			6/27/02	8.68	121.7	--	--	--	86	71	--
			8/1/02	9.30	23.4		--	--	--	--	--
			8/23/02	9.81	9.1		10	8.31	129	106	--
			10/4/02	9.48	14.8		--	--	--	--	--
			4/17/03	9.15	34.5		4.9	8.4	137	112	--
			7/9/03	9.50	14.1		--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
Trail Creek											
	Combined Trail		6/30/01	--	15.6 e		--	--	--	--	--
	**estimaed by combining east and west branch		8/7/01	--	3.6 e		--	--	--	--	--
			9/23/01	--	3.2 e		--	--	--	--	--
			11/11/01	--	20.0 e		--	--	--	--	--
			1/20/02	--	14.4 e		--	--	--	--	--
			3/12/02	--	35.0 e		--	--	--	--	--
			4/15/02	--	69.7 e		--	--	--	--	--
			5/22/02	--	47.6 e		--	--	--	--	--
			6/3/02	--	29.6 e		--	--	--	--	--
			6/27/02	--	19.0 e		--	--	--	--	--
			7/16/02	--	13.4 e		--	--	--	--	--
			8/1/02	--	5.5 e		--	--	--	--	--
			8/22/02	--	4.9 e		--	--	--	--	--
			10/4/02	--	26.9 e		--	--	--	--	--
			4/17/03	--	70.2 e		--	--	--	--	--
			7/10/03	--	13.6 e		--	--	--	--	--
Trail (East branch)											
	Old Yellowstone Trail	TRSt: 4S-8E-25BADA	9/20/00	4.57	4.4	4.0	8.2	8.39	347	285	0.5
		LL: 45.4650, 110.6527	4/12/01	3.75	26.3	9.0	--	--	--	--	--
			5/31/01	4.12	11.2	6.0	12.7	7.1	220	180	--
			6/30/01	4.10	11.7	7.0	--	--	--	--	--
			8/7/01	4.42	3.6	4.0	--	--	--	--	--
			9/23/01	4.73	3.2	4.0	--	--	--	--	--
			11/11/01	4.50	5.0	5.0	6.1	7.62	330	271	--
			1/20/02	4.20	9.4	6.0	2	7.9	341	280	--
			3/12/02	3.80	23.3	9.0	--	--	--	--	--
			4/15/02	3.47	53.4	12.0	--	--	--	--	--
			5/22/02	3.64	34.5	10.0	6.6	7.96	167	137	--
			6/3/02	3.87	19.7	8.0	--	--	--	--	--
			6/27/02	4.09	11.9	7.0	--	--	164	134	--
			7/16/02	4.27	8.0	6.0	8	--	--	--	--
			8/1/02	4.45	5.5	5.0	--	--	--	--	--
			8/22/02	4.50	4.9	5.0	19	8.48	144	118	--
			10/4/02	4.20	9.4	6.0	--	--	--	--	--
			4/17/03	3.37	53.5	14.0	6.8	8.2	156	128	--
			7/10/03	4.20	9.4	6.0	--	--	--	--	--
	Darrel	TRSt: 4S-9E-17CCBC	9/20/00	3.42	4.7	5.0	13.6	8.45	272	223	--
		LL: 45.4842, 110.6511	5/31/01	3.18	10.8	7.0	12.4	6.94	98	80	--
			6/30/01	2.98	13.8	8.0	--	--	--	--	--
			8/7/01	3.03	21.7	9.0	3.38	--	-- --		--
			9/23/01	3.84	5.2	6.0	--	--	--	--	--
			11/11/01	4.10	4.1	5.0	--	--	--	--	--
			3/12/02	2.80	17.6	8.0	--	--	--	--	--
			4/14/02	2.25	40.6	11.0	--	--	--	--	--
			5/22/02	2.88	15.8	8.0	--	--	--	--	--
			6/3/02	2.90	15.4	--	--	--	--	--	--
			6/27/02	3.01	13.3	8.0	--	--	--	--	--
			8/1/02	3.15	11.2	7.0	--	--	--	--	--
			8/22/02	3.12	12.0	7.0	--	--	--	--	--
			10/4/02	3.83	5.3	6.0	--	--	--	--	--
			4/17/03	2.30	42.6	12.0	--	--	--	--	--
			7/10/03	3.33	9.0	7.0	--	--	--	--	--
Trail Creek (west branch)											
	Tin Shed	TRSt: 4S-8E-25BCDA	6/30/01	6.02	3.9	5.0	--	--	--	--	--
		LL: 45.4618, 110.6878	11/11/01	5.28	15.0	7.0	--	--	--	--	--
			1/20/02	5.87	5.0 e	--	--	--	--	--	--
			3/12/02	5.41	11.7 e	7.0	--	--	--	--	--
			4/15/02	5.24	16.3 e	8.0	--	--	--	--	--
			5/22/02	5.35	13.1	7.0	--	--	--	--	--
			6/3/02	5.50	9.9	7.0	--	--	--	--	--
			6/27/02	5.68	7.1 e	6.0	--	--	159	130	--
			7/16/02	5.84	5.3 e	5.0	--	--	--	--	--
			8/1/02	Dry	0.0	0.0	--	--	--	--	--
			8/22/02	Dry	0.0	0.0	--	--	--	--	--
			10/4/02	5.20	17.6 e	8.0	--	--	--	--	--
			4/17/03	5.25	16.7	8.0	8.8	8.08	152	125	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
			7/10/03	5.97	4.2	5.0	--	--	--	--	--
Trail+8 mile ditch			11/11/2001	--	15.7 e	9.0	--	--	--	--	--
			3/15/02	--	15.0 e	9.0	--	--	--	--	--
**estimated by combining Trail ditch and 8 mile ditch flows			4/15/02	--	27.6 e	11.0	--	--	--	--	--
			5/22/02	--	17.7 e	10.0	--	--	--	--	--
			6/27/02	--	8.9 e	8.0	--	--	--	--	--
			7/16/02	--	6.2 e	7.0	--	--	--	--	--
			8/1/02	--	0.8 e	4.0	--	--	--	--	--
			8/22/02	--	0.9 e	4.0	--	--	--	--	--
			10/4/02	--	18.5 e	10.0	--	--	--	--	--
			4/17/03	--	26.5 e	11.0	--	--	--	--	--
			7/10/03	--	5.0 e	7.0	--	--	--	--	--
	Pine Cr Rd	TRSt: 4S-9E-3CCDC	11/11/01	--	4.0	5.0	--	--	--	--	--
		LL: 45.5113, 110.6081	03/15/02	--	8.2	6.0	--	--	--	--	--
			04/15/02	--	13.9	7.0	--	--	--	--	--
			10/04/02	--	6.2	5.0	--	--	--	--	--
	Ohair	TRSt: 3S-9E-27DADA	11/11/01	--	0.7	2.0	--	--	--	--	--
		LL: 45.5453, 110.6081	3/15/02	--	1.3	3.0	--	--	--	--	--
			4/14/02	--	4.0	4.0	--	--	--	--	--
			5/22/02	--	8.1	5.0	includes ditch retur		--	--	--
			6/3/02	--	7.2	5.0	includes ditch retur		--	--	--
			6/27/02	--	6.8	5.0	includes ditch retur		--	--	--
			8/1/02	--	5.9	5.0	includes ditch retur		--	--	--
			10/4/02	--	2.8	4.0	--	--	--	--	--
			4/17/03	--	4.5	4.0	--	--	--	--	--
			7/10/03	--	8.8	5.0	--	--	--	--	--
Yellowstone River											
	Corwin Springs	TRSt: 8S-8E-30BDCC	03/13/02	--	786.0 U		--	--	--	--	--
	****USGS data*	LL: 45.1119, 110.7934	08/22/02	--	1,913.0 U		--	--	--	--	--
			04/13/04	--	2,140.0 U		--	--	--	--	--
			07/20/04	--	4,210.0 U		--	--	--	--	--
			08/10/04	--	2,310.0 U		--	--	--	--	--
	Mill Creek Bridge	TRSt:05S-9E-8BADD	03/13/02	23.10	932.0	233	--	--	--	--	--
		LL: 45.4195, 110.6423	08/22/02	22.65	1,824.0	241	--	--	--	--	--
			04/13/04	22.36	2,349.0	258	--	--	--	--	--
			07/20/04	21.05	4,246.0	275	--	--	--	--	--
			08/10/04	22.35	2,247.0	261	--	--	--	--	--
	Pine Creek Bridge	TRSt: 4S-9E-11BABB	04/13/04	--	2,268.0	283	--	--	--	--	--
		LL: 45.5109, 110.5819	07/20/04	--	4,164.0	304	--	--	--	--	--
			08/10/04	--	2,196.0	285	--	--	--	--	--
	Carter Bridge	TRSt: 3S-9E-12ABBB	03/13/02	--	1,110.0 U		--	--	--	--	--
	****USGS data*	LL: 45.5969, 110.5661	08/22/02	--	2,130.0 U		--	--	--	--	--
			04/13/04	--	2,575.0 U		--	--	--	--	--
			07/20/04	--	4,520.0 U		--	--	--	--	--
			08/10/04	--	2,510.0 U		--	--	--	--	--
6 Mile Creek											
	East Fork @First Bridge	TRSt: 6S-8E-16CBCB	11/11/01	3.50	2.9	8.0	5.7	8.43	191	157	--
		LL: 45.3163, 110.7600	5/22/02	2.66	34.6	11.0	--	--	--	--	--
			6/3/02	2.34	115.4 e	12.0	--	--	--	--	--
			6/27/02	2.53	55.4 e	11.0	--	--	109	89	--
			7/31/02	3.27	5.0	9.0	--	--	--	--	--
			8/23/02	Dry	0.0	0.0	--	--	--	--	--
			10/4/02	3.21	5.9 e	9.0	--	8.14	8.44	7.00	--
			7/9/03	3.08	8.7 e	9.0	18.7	17.14	--	--	--
			4/18/03	3.65	1.9	8.0	8.0	8.24	181	148	--
			7/9/03	3.08	9.9	9.0	--	--	--	--	--
	East Fork south of split	TRSt: 6S-8E-29ACAD	10/4/02	--	2.1	9.0	--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
		LL: 45.2893, 110.7641	7/9/03	--	8.9	10.0	--	--	--	--	--

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
	West Fork @ Muledeer	TRSt: 6S-8E-20AAAC	3/14/01	4.02	1.4	6.0	2.8	8.17	196	161	--
		LL: 45.2868, 110.7669	4/12/01	4.37	1.0 e	6.0	--	--	--	--	--
			5/30/01	3.95	1.5	7.0	13.9	7.31	248	203	--
			6/29/01	4.30	1.1 e	6.0	--	--	--	--	--
			8/7/01	Dry	0.0	0.0	--	--	--	--	--
			9/22/01	Dry	0.0	0.0	--	--	--	--	--
			11/11/01	5.60	0.3	5.0	--	--	--	--	--
			1/20/02	Frozen			--	--	--	--	--
			5/22/02	3.00	6.3	8.0	--	--	--	--	--
			6/3/02	1.95	53.5	13.0	--	--	--	--	--
			6/27/02	2.70	10.6 e	9.0	--	--	158	130	--
			7/31/02	4.80	0.6 e	6.0	--	--	--	--	--
			8/23/02	4.74	0.7	6.0	--	--	--	--	--
			10/4/02	Dry	0.0	0.0	--	--	--	--	--
			4/18/03	3.63	3.8	7.0	--	--	--	--	--
			7/9/03	Dry	0.0	0.0	--	--	--	--	--
	West Fork @ Q Bridge	TRSt: 6S-8E-29 ACAD	9/20/00	6.61	0.1	4.0	12.7	8.11	223	183	--
		LL: 45.2868, 110.7669	1/10/01	6.00	4.3	10.0	3.2	8	197	162	--
			3/14/01	6.05	3.9	10.0	3.1	7.87	198	162	--
			4/12/01	6.01	4.8	10.0	--	--	--	--	--
			5/30/01	6.10	2.8	9.0	10.6	7.14	125	103	--
			6/29/01	6.31	0.5	7.0	--	--	--	--	--
			8/7/01	6.33	0.4	7.0	--	--	--	--	--
			9/22/01	6.28	0.6	7.0	--	--	--	--	--
			11/11/01	6.03	4.1	10.0	--	--	--	--	--
			1/20/02	Frozen			--	--	--	--	--
			5/22/02	6.34	0.4	7.0	8.2	7.65	208	171	--
			6/3/02	--							
			6/27/02	6.09	2.6	9.0	--	--	100	82	--
			7/31/02	6.14	1.8	9.0	--	--	--	--	--
			8/23/02	6.24	0.9	8.0	--	--	--	--	--
			10/4/02	6.60	0.1	5.0	--	--	--	--	--
			4/18/03	6.63	0.1	5.0	--	--	--	--	--
			7/9/03	6.62	0.1	5.0	--	--	--	--	--
	Mountain	TRSt: 6S-8E-32BDCC	8/7/01	7.43	14.7	16.0	--	--	--	--	--
		LL: 45.2706, 110.7760	9/22/01	7.48	14.2 e	16.0	--	--	--	--	--
			11/11/01	7.58	9.8	14.0	5.4	8.33	187	153	--
			5/22/02	6.60	63.4	24.0	5	7.65	127	104	--
			6/3/02	5.98	206.5	38.0	--	--	--	--	--
			6/27/02	6.40	91.6 e	25.0	--	--	--	--	--
			7/31/02	7.33	18.1 e	17.0	--	--	--	--	--
			8/23/02	7.61	13.6	15.0	9.9	8.2	176	144	--
			10/4/02	7.49	13.9 e	15.0	--	--	--	--	--
			7/9/03	6.90	35.9	20.0	--	--	--	--	--
6 Mile Ditch											
	Q Bridge	TRSt: 6S-8E-29ACAD	5/30/01	--	19.3		--	--	--	--	--
		LL:45.2860, 110.7675	5/22/02	0.40	12.6	14.6	--	--	--	--	--
			6/3/02	0.00	24.0		--	--	--	--	--
			6/27/02	0.30	15.0	--	--	--	102.00	84.00	--
			7/31/02	1.10	3.8 e		--	--	--	--	--
			8/23/02	1.27	2.8		--	--	--	--	--
			10/4/02	1.93	0.9 e		--	--	--	--	--
			7/9/03	0.70	8.4		--	--	--	--	--
	Mule Deer	TRSt: 6S-8E-20AACC	7/9/03	--	0.6		--	--	--	--	--
		LL:45.3026, 110.7653									

Surface-water Flows

Stream	Station	Location Legal= TRSt, Geographic = LL	Date	Depth to Water (feet)	Flow (cfs)	Width (ft)	Temp (Co)	pH	Specific conductance (umhos/cm)	Dissolved constituents (mg/L)*	NO3 (mg/L)
8 Mile Creek											
	Old Yellowstone Trail	TRSt: 5S-8E-11CABD	9/20/00	2.70	6.1		10.2	8.57	75	62	--
		LL: 45.4149, 110.7056	1/9/01	2.58	8.0		3.1	7.3	59	48	--
			3/15/01	2.50	12.6		4.3	7.04	58	48	--
			4/12/01	2.81	3.5		--	--	--	--	--
			5/30/01	--	1.8		21.2	7.36	65.3	54	--
			8/7/01	3.06	1.5		--	--	--	--	--
			9/23/01	3.00	1.9		--	--	--	--	--
			11/11/01	2.61	7.3		--	--	--	--	--
			1/20/02	2.70	5.2		--	--	--	--	--
			3/15/02	2.48	12.0		--	--	--	--	--
			4/16/02	2.27	28.5		--	--	--	--	--
			5/31/02	2.35	20.3		--	--	--	--	--
			6/3/02	2.52	10.3		--	--	--	--	--
			6/27/02	2.58	8.1	--	--	--	72	59	--
			8/1/02	3.12	1.3		--	--	--	--	--
			8/22/02	3.14	2.0		24.6	8.6	64	52	--
			10/4/02	2.69	5.4		--	--	--	--	--
			4/17/03	2.25	31.1		10.6	7.91	62	51	--
			7/10/03	3.08	1.4	--	--	--	--	--	--
8 Mile Ditch											--
	Old Yellowstone Trail	TRSt: 4S-8E-35ACDC	9/20/00	3.00	1.0		8.1	7.84	77	63	--
		LL: 45.4457, 110.6989	1/9/01	-- ice			--	--	--	--	--
			3/15/01	2.63	3.5		1.5	6.78	56	46	--
			4/12/01	2.48	7.0		--	--	--	--	--
			5/31/01	2.40	10.7		12.2	6.98	61	50	--
			8/8/01	2.67	2.3		--	--	--	--	--
			9/23/01	3.00	1.0		--	--	--	--	--
			11/11/01	2.97	0.7		--	--	--	--	--
			1/21/02	3.30	0.2		--	--	--	--	--
			3/15/02	2.63	3.3		--	--	--	--	--
			4/16/02	2.39	11.3		--	--	--	--	--
			5/22/02	2.56	4.6		8.3	7.98	60	49	--
			6/3/02	2.70	2.3		--	--	--	--	--
			6/27/02	2.75	1.8	--	--	--	75	62	--
			8/1/02	2.90	0.9		--	--	--	--	--
			8/22/02	2.92	0.8		17.1	7.95	56	46	--
			10/4/02	2.90	0.9		--	--	--	--	--
			4/17/03	2.41	9.8		11.3	9.05	66	54	--
			7/10/03	2.95	0.7		--	--	--	--	--

Appendix E:
Time-weighted stream flow data for water-year 2002.

Wieghted average stream discharges to the Yellowstone River (water year 2002), Page 3, CFS Summary

days		Base flow season 10/15/01 to 3/15/02 cfs	Pre-melt season 3/15/02 to 5/15/02 cfs	Melt-water season 5/15/02 to 7/15/02 cfs	Irrigation season 7/15/02 to 10/15/02 cfs	Surface water runnoff Average (cfs) cfs	Ground-water recharge Average (Mcfd) cfs
Barney	input	**0.3**	**1.1**	**5.1**	**0.5**	1.29	
	discharge	**0.0**	**0.6**	**4.7**	**0.3**	0.95	
	infiltration	0.3	0.6	0.4	0.2	0.34	**0.03**
Big	input	**23.8**	**48.1**	**256.6**	**48.8**	73.05	
	discharge	**5.8**	**25.2**	**217.2**	**25.5**	49.34	
	infiltration	18.0	22.8	39.4	23.3	23.70	**1.78**
Bullis	input	**0.0**	**0.0**	0.0	**0.0**	0.00	
	discharge	**0.0**	**0.0**	0.0	**0.0**	0.00	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
Casc	input	**0.6**	**1.9**	**9.8**	**1.1**	2.48	
	discharge	**0.0**	**0.1**	**1.8**	**0.0**	0.31	
	infiltration	0.6	1.8	8.0	1.1	2.17	**0.19**
Ceder	input	**6.1**	**12.3**	**65.1**	**12.4**	18.57	
	discharge	**6.1**	**12.3**	**65.1**	**12.4**	18.57	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
Conlin	input	**0.3**	**1.0**	**4.6**	**0.5**	1.16	
	discharge	**0.0**	**0.0**	**-0.1**	**0.0**	-0.02	
	infiltration	0.3	1.0	4.7	0.5	1.18	**0.10**
Deep	input	**2.6**	**19.2**	**77.3**	**7.0**	18.97	
	discharge	**0.1**	**11.3**	**59.3**	**2.4**	12.43	
	infiltration	2.5	8.0	18.1	4.6	6.55	**0.57**
Don	input	**2.8**	**5.4**	**29.1**	**4.8**	8.14	
	discharge	**0.0**	**0.4**	**14.6**	**0.4**	2.60	
	infiltration	2.8	5.1	14.5	4.4	5.54	**0.48**
Dry	input	**1.4**	**3.6**	**1.8**	**1.3**	1.80	
	discharge	**0.0**	**0.0**	**0.0**	**0.0**	0.00	
	infiltration	1.4	3.6	1.8	1.3	1.80	**0.16**
Elbow	input	**4.0**	**13.7**	**67.1**	**1.4**	15.53	
	discharge	**0.0**	**4.1**	**40.3**	**0.8**	7.64	
	infiltration	4.0	9.6	26.8	0.6	7.90	**0.68**
Emigrant	input	**5.0**	**13.5**	**83.4**	**6.7**	19.96	
	discharge	**0.0**	**1.7**	**41.3**	**0.5**	7.30	
	infiltration	5.0	11.8	42.1	6.3	12.66	**1.09**
Fridley	input	**6.9**	**18.1**	**9.1**	**6.8**	9.14	
North and South	discharge	**1.1**	**10.2**	**1.9**	**1.2**	2.78	
	infiltration	5.8	7.9	7.2	5.6	6.35	**0.55**
Goldrun	input	**0.2**	**0.6**	**2.6**	**0.3**	0.65	
	discharge	**0.0**	**0.0**	**0.0**	**0.0**	0.00	
	infiltration	0.2	0.6	2.6	0.3	0.65	**0.06**
Golmeyer	input	**2.9**	**7.6**	**3.9**	**2.9**	3.85	
	discharge	**0.0**	**0.0**	**0.0**	**0.0**	0.00	
	infiltration	2.9	7.6	3.9	2.9	3.85	**0.33**
Mac	input	**2.0**	**7.3**	**32.9**	**3.2**	8.33	
	discharge	**0.0**	**1.7**	**15.5**	**0.3**	2.94	
	infiltration	2.0	5.6	17.4	2.9	5.39	**0.47**
Mill	input	**30.5**	**114.0**	**513.7**	**50.1**	130.15	
	discharge	**6.8**	**84.8**	**459.6**	**26.6**	100.48	
	infiltration	23.7	29.1	54.2	23.5	29.67	**2.56**
Mulheron	input	**14.0**	**28.4**	**150.5**	**28.8**	42.95	
	discharge	**14.0**	**28.4**	**150.5**	**28.8**	42.95	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
Pine	input	**3.8**	**10.8**	**61.3**	**12.8**	16.86	
	discharge	**0.0**	**6.0**	**46.0**	**1.1**	8.98	
	infiltration	3.8	4.8	15.3	11.7	7.88	**0.68**
Pool	input	**0.1**	**0.5**	**2.2**	**0.4**	0.61	
	discharge	**0.0**	**0.0**	**0.0**	**0.0**	0.00	
	infiltration	0.1	0.5	2.2	0.4	0.61	**0.05**
Rock	input	**8.3**	**16.8**	**89.3**	**17.1**	25.48	
	discharge	**8.3**	**16.8**	**89.3**	**17.1**	25.48	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
Sheep	input	**1.1**	**2.3**	**12.3**	**2.8**	3.60	
	discharge	**0.0**	**0.2**	**6.2**	**0.2**	1.11	
	infiltration	1.1	2.1	6.1	2.6	2.49	**0.21**
Slip and Slide	input	1.4	2.7	14.5	2.8	4.15	
plus Joe Brown	discharge	**1.4**	**2.7**	**14.5**	**2.8**	4.15	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
						0.00	
Straw	input	**1.9**	**7.1**	**31.9**	**3.1**	8.07	
	discharge	**0.1**	**4.5**	**34.0**	**2.7**	7.14	
	infiltration	1.8	2.6	-2.1	0.4	0.93	**0.08**
Strict	input	**0.0**	**0.0**	**0.0**	**0.0**	0.00	
	discharge	**0.0**	**0.0**	**0.0**	**0.0**	0.00	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
Suce	input	**1.5**	**2.7**	**19.1**	**2.2**	4.81	
	discharge	**0.9**	**1.9**	**16.9**	**1.5**	3.90	
	infiltration	0.6	0.7	2.2	0.7	0.91	**0.08**
TomMiner	input	**10.4**	**17.2**	**116.6**	**25.9**	33.19	
	discharge	**10.4**	**17.2**	**116.6**	**25.9**	33.19	
	infiltration	0.0	0.0	0.0	0.0	0.00	**0.00**
Trail	input	**18.3**	**47.6**	**24.1**	**17.9**	24.04	
	discharge	**2.0**	**11.1**	**3.9**	**1.8**	3.79	
	infiltration	16.3	36.4	20.2	16.0	20.25	**1.75**
6MI	input	**11.1**	**14.0**	**107.3**	**55.5**	38.87	
east+west	discharge	**1.4**	**4.0**	**96.3**	**45.2**	28.73	
	infiltration	9.7	10.0	11.0	10.3	10.14	**0.88**
8mi	input	**10.8**	**31.9**	**21.3**	**9.8**	15.81	
	discharge	**6.0**	**24.3**	**15.2**	**5.1**	10.37	
	infiltration	4.8	7.6	6.1	4.7	5.43	**0.47**

Appendix F:
Stream loss and irrigation ditch loss calculations

Stream loss calculation

Stream

	Date	Start Site	Start flow (cfs)	End site	End flow (cfs)	Distance (mi)	Flow loss (cfs)	Loss Rate			Average stream width	Unit infiltration rate	Mid-point distance from the valley confluence
Big Creek	**after irrigation diversion							cfs/mi	ft^2/d	ft		ft/d	mi
		Diversion		Highway		1.10							
	11/11/01		25.0		8.2		16.8	15.3		250	30	8	**0.55**
	05/22/02		117.7		97.1		20.6	18.7		306	40	8	
	06/03/02		397.5		370.6		26.9	24.5		401	50	8	
	06/27/02		147.6		120.0		27.7	25.2		412	42	10	
	08/01/02		43.4		21.7		21.7	19.7		322	33	10	
	08/23/02		24.8		7.9		16.9	15.3		250	29	9	
	10/04/02		25.0		11.0		13.9	12.7		208	30	7	
	04/18/03		43.2		22.3		20.9	19.0		311	33	9	
											average:	**9**	
Deep Creek	**after irrigation diversion												
	11/11/01	N+South upper**	4.9	Pool	0.3	0.91	4.5	5.0		82	9	9	**0.75**
	05/21/02		92.6 e		69.7		22.9	25.2		412	35	12	
	06/03/02		183.1 e		162.6		20.5	22.5		369	38	10	
	06/26/02		40.7 e		24.9	19.72	15.8	17.4		284	28	10	
	07/10/03		8.2		3.1		5.1	5.6		91	10	9	
											average:	**10**	
		e) combined = 1.7xN upper											
Deep Creek	11/11/01	Pool	0.3	Tree	0.1	0.77	0.2	0.3		5	2	2	**1.31**
	05/21/02		69.7		65.2		4.5	5.8		96	24	4	
	06/03/02		162.6	0.5	156.2	0.00	6.4	8.3		135	24		
	06/26/02		24.9		23.1		1.8	2.3		38	14	3	
	07/10/03		3.1		2.4		0.7	0.9		15	8	2	
											average:	**3**	
		N+South upper**		Tree									
Deep Creek	11/11/01		4.9		0.1		4.8	6.2		101	4	26	
	05/21/02		92.6		65.2	66.30	27.4	35.6		582	33	18	
	06/03/02		183.1		156.2		26.9	34.9		571	45	13	
	06/26/02		40.7		23.1		17.6	22.9		374	28	13	
	07/10/03		8.2		2.4	2.64	5.8	9.0		147	14	11	
Emigrant Creek											average:	**16**	
	**after irrigation diversion												
	05/30/01	Scary bridge	46.3	Hyw	6.5	2.56	39.8	15.5		254	20	13	
	05/22/02		65.6		12.3		53.3	20.8		341	23	15	
	06/03/02		192.2		122.1		70.1	27.4		448	30	15	
	06/27/02		71.6		18.7		53.0	20.7		339	22	16	
											average:	**15**	
Mill Creek													
	10/04/02	2nd Bridge	43.1	1st Bridge	22.3	2.19	20.8	9.5		156	31	5.1	**1.095**
	04/17/03		73.9		39.6		34.3	15.6		256	37	6.9	
											average:	6.0	
	10/04/02	1st Bridge	22.3	Hwy	19.6	2.58	2.7	1.0		17	19	0.9	**2.385**
	04/17/03		39.6		35.6		4.0	1.6		25	27	0.9	
											average:	**0.9**	
		2nd Bridge		Hwy									
	03/14/01		46.2		25.1	4.77	21.1	4.4		72	33	2	
	04/12/01		52.9		28.4		24.5	5.1		84	34	2	
	05/30/01		445.0		363.2		81.8	17.1		281	63	4	
	06/29/01		321.3		253.8		67.5	14.2		232	57	4	
	11/11/01		28.4		9.5		18.9	4.0		65	28	2	
	01/20/02		30.6		7.9		22.7	4.8		78	28	3	
	03/14/02		27.5		11.4		16.2	3.4		55	28	2	
	04/15/02		39.3		24.5		14.8	3.1		51	32	2	
	05/23/02		494.0		462.2		31.8	6.7		109	65	2	
	06/03/02		964.9		886.6		78.4	16.4		269	78	3	
	06/26/02		387.9		349.0		38.9	8.2		133	61	2	
	10/04/02		43.1		19.6		23.5	4.9		81	30	3	
	04/17/03		73.9		35.6		38.3	8.0		131	38	3	
Pine Creek											average:	**3**	
		Campground											
	05/29/01		132.1	Hyw	107.7	0.80	24.4	30.5		498	45	11	**0.4**
	11/11/01		9.6		0.0		9.6	12.0		196	9	22	
	05/23/02		54.5		38.2		16.3	20.4		333	32	10	
	06/03/02		95.4		75.0		20.4	25.5		418	40	11	
	06/26/02		60.2		43.9		16.3	20.4		334	33	10	
	04/17/03		41.0		24.8		16.2	20.2		331	29	11	
	07/10/03		52.9		29.5		23.4	29.2		478	31	15	
Suce Creek											average:	**13**	

Stream loss calculation

Stream	Date	Start Site	Start flow (cfs)	End site	End flow (cfs)	Distance (mi)	Flow loss (cfs)	Loss Rate		Average stream width	Unit infiltration rate	Mid-point distance from the valley confluence
		1st Bridge		Hwy		0.49						
	03/13/01		1.5		1.1		0.4	0.92	15	4	3.7	**1.25**
	04/12/01		1.8		1.3		0.5	0.97	16	4	3.7	
	11/11/01		1.7		1.2		0.5	1.06	17	4	4.0	
	01/20/02		1.6		1.1		0.5	1.05	17	4	4.1	
	03/11/02		1.6		1.0		0.6	1.23	20	7	3.0	
	10/04/02		1.5		1.0		0.5	0.98	16	4	3.9	
	04/17/03		2.2		1.5		0.7	1.43	23	5	5.1	
										average:	**3.9**	
Trail												
		OYT		Darel								
	11/11/01		6.3	10.5	4.1	2.15	2.2	1.0	17	5	3	1.08
	03/12/02		23.3		17.6		5.7	2.7	44	9	5	
	04/15/02		53.4		40.6	42.54	12.8	6.0	97	12	8	
	10/04/02		8.4		5.3		3.1	1.4	24	6	4	
	04/17/03		53.5		42.6		10.9	5.1	83	13	6	
										average:	**5.3**	
	11/11/01	TrailD+8miD	15.7	Pine Cr Dr	4.0	5.68	11.7	2.1	34	7	5	**2.84**
	03/15/02		15.0		8.2		6.8	1.2	20	8	3	
	04/15/02		27.6		9.8		17.8	3.1	51	9	6	
	10/04/02		18.5		6.2		12.3	2.2	35	8	5	
										average:	**4.5**	**4.3**
	11/11/01	Pine Cr Dr	4.0	Ohair	0.7	2.84	3.3	1.2	19	4	5.4	
	03/15/02		8.2		1.3		6.9	2.4	40	5	8.9	
	04/15/02		9.8		4.0		5.8	2.0	33	6	6.0	
	10/04/02		6.2		2.8		3.4	1.2	20	7	2.9	
											5.8	
	11/11/01		15.7		0.7	8.52	15.0	1.8	29	6	5.3	
	03/15/02	TrailD+8miD	15.0	Ohair	1.3		13.7	1.6	26	6	4.3	
	04/15/02		27.6		4.0		23.6	2.8	45	8	6.0	
	10/04/02		18.5		2.8		15.7	1.8	30	7	4.3	
	04/17/03		26.5		4.5		22.0	2.6	42	8	5.6	
										average:	**5.1**	
6 Mile Creek												
	11/11/01	MT	9.8		4.4	1.40	5.4	4.1	68	14	5.0	**0.7**
	05/22/02	MT-D	50.8	72.0	40.9		9.9	7.6	125	20	6.4	
	06/03/02	MT-D	182.5	338.0	168.9	153.48	13.6	10.5	171	30	5.7	
	06/27/02	MT-D	76.6	139.0	66.0	58.94	10.6	8.2	134	22	6.2	
	07/31/02	MT-D	14.2		5.6	7.46	8.7	6.7	109	16	6.8	
	10/04/02		12.9		5.9		7.0	5.4	88	12	7.3	
										average:	**6**	
	03/14/01	Q	3.9	Mule	1.4	1.27	2.4	1.9	32	8	4	
	04/12/01		4.8		1.0		3.9	3.0	50	8	6	
	11/11/01		4.1		0.3		3.9	3.0	50	8	7	
										average:	**6**	

Calculations for ditch loss

Paradise Canal

Total diversion	22	cfs	acre-feet/yr	7,855				
Return	2	cfs	acre-feet/yr	714				
Difference				7,140				
Method 1: Unit infiltration loss								
Distance along canal	Width (ft)	area (ft2)				unit loss rate		
0	7				1 cfd/ft2	3 cfd/ft3		
8300	6.4	55610	32					
13600	5.8	32330	25	18.71				
23700	5.3	56055	17	12.33				
48800	3.4	109185	2	11.87				
	Recharge = area x unit infiltration			**14.30**				
	total area	253,180			253180	759540	cfd	
					2.93	8.79	cfs	
		Ground-water recharge			1,046.2	3,138.6	AFY	
Method 2: Irrigation use								
			typical application		+20%	-20%		
Irrigated acres	1808	acres	(inches)	35	42	28		
			acre feet/yr		6,328	4,219		
		Recharge=diversion-return-irrigation						
		Ground-water recharge			812	2,922		
		Average of both methods			**900**	**3,000**		
PARK BENCH CANAL			percent of total		11.5%	38.2%		
Total average diversion	129	cfs	acre-feet/yr	46,056				
Return	15	cfs	acre-feet/yr	5,355				
Difference				40,701				
L	W	Area (ft2)		Unit infiltration				
0				3 cfsd/ft2	5 cfd/ft2			
10000	28	280000	209					
18000			177	diversion to Paradise Canal				
28500	21	453250	131	5.42				
67500	14	682500	77	6.84				
78000	4	94500	17					
		1,510,250			4,530,750	7,551,250	cfd	
					52.4	87.4	cfs	
		Ground-water recharge			**18,722.1**	**31,203.5**	**AFY**	
Method 2: Irrigation use								
			typical application		+20%	-20%		
Irrigated acres	4487	acres	(inches)	35	42	28		
			acre feet/yr		15,705	10,470		
		Recharge=diversion-return-irrigation						
		Ground-water recharge			**24,996**	**30,231**		
		Average of both methods			**21,900**	**30,700**		
			percent of total		47.6%	66.7%		
		TOTAL of both canals			**22,800**	**33,700**		

Appendix G:
Ground-water level monitoring data

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
165070	HARTER LINN	03S-08E-28-BABD	5522.3	5520	8/14/2000 12:53	27.19	5495.11
184342	TECCA ALFRED	03S-09E-2-DDBA	4551	4550	8/28/2000 19:30	11.68	4539.32
183900	LOOMIS	03S-09E-12-BABC	4552.1	4550	8/26/2000 11:50	10	4542.1
					1/11/2001 16:30	12	4540.1
					3/13/2001 12:08	11.72	4540.38
					4/12/2001 12:30	11.83	4540.27
					5/29/2001 12:07	7.29	4544.81
					7/1/2001 16:25	8.92	4543.18
					8/7/2001 12:10	10.37	4541.73
					9/22/2001 10:08	11.4	4540.7
					11/10/2001 10:00	11.9	4540.2
					1/20/2002 10:45	12.62	4539.48
					3/12/2002 10:25	12.59	4539.51
					5/22/2002 13:15	6.46	4545.64
					6/28/2002 11:30	6.49	4545.61
					7/30/2002 12:00	9.26	4542.84
					8/22/2002 11:50	10.02	4542.08
					10/4/2002 10:00	11.1	4541
					1/2/2003 11:10	12.14	4539.96
					4/17/2003 10:45	10.99	4541.11
					7/11/2003 12:11	8.26	4543.84
183899	SMITH BETTY	03S-09E-14-CACA	4580	4580	8/25/2000 11:00	5.5	4574.5
21567	NELSON SPRING CREEK RANCH	03S-09E-23-ADDA	4660.5	4659	4/15/1993 7:32	32.17	4628.33
					7/7/1993 17:43	29.13	4631.37
					9/22/1993 10:27	31	4629.5
					12/30/1993 10:30	31.86	4628.64
					7/1/1994 8:53	28.75	4631.75
					9/30/1994 9:45	29.67	4630.83
					12/23/1994 10:30	31.72	4628.78
					3/31/1995 10:38	32.75	4627.75
					7/6/1995 8:00	26.95	4633.55
					10/16/1995 15:16	29.97	4630.53
					1/10/1996 11:11	31.67	4628.83
					4/12/1996 14:15	31.7	4628.8
					7/6/1996 8:50	27.69	4632.81
					10/10/1996 14:05	36.2	4624.3
					2/1/1997 13:44	31.83	4628.67
					4/4/1997 12:04	32.24	4628.26
					7/1/1997 11:25	28.93	4631.57
					10/7/1997 13:27	28.48	4632.02
					1/13/1998 12:00	31.71	4628.79
					4/3/1998 12:35	31.77	4628.73
					7/8/1998 13:30	28.58	4631.92
					1/18/1999 0:00	31.95	4628.55
					4/3/1999 12:35	30.74	4629.76
					7/25/1999 13:55	29.92	4630.58
					10/27/1999 13:38	31.32	4629.18
					1/29/2000 13:13	32.29	4628.21
					4/24/2000 14:45	31.45	4629.05
					7/25/2000 15:00	28.91	4631.59
					7/31/2000 11:40	29.07	4631.43
					11/18/2000 15:02	32.03	4628.47
					4/14/2001 13:26	32	4628.5
					7/26/2001 15:15	29.41	4631.09
					10/6/2001 12:38	31.4	4629.1
					1/21/2002 13:35	32.65	4627.85
					4/29/2002 13:33	32.65	4627.85
					7/23/2002 11:32	30.22	4630.28
					8/22/2002 0:00	30.02	4630.48
					10/17/2002 15:31	31.6	4628.9
					1/7/2003 13:53	32.42	4628.08
					4/19/2003 13:54	32.33	4628.17
					7/18/2003 13:40	30.34	4630.16
					10/11/2003 15:50	31.57	4628.93
					1/24/2004 12:30	32.57	4627.93
					4/17/2004 11:00	32.6	4627.9
					7/20/2004 13:20	29.14	4631.36
					10/16/2004 12:35	30.74	4629.76
					1/10/2005 13:15	32.18	4628.32

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
168006	BURNS LAURA	03S-09E-26-DDAC	4763.6	4762	8/11/2000 10:23	127.52	4636.08
170537	TECCA JOHN	03S-09E-26-DAAC	4802.5	4800	8/14/2000 19:00	179.55	4622.95
					11/28/2000 13:55	181.85	4620.65
					3/15/2001 11:26	183.81	4618.69
211237	O'HAIR RANCH CO PW	03S-09E-26-CCCC	4631.73	4630	3/24/2004 13:00	6.49	4625.24
					6/30/2004 10:45	5	4626.73
211238	O'HAIR RANCH CO OBS-S	03S-09E-26-CCCC	4632	4630	3/24/2004 13:00	5.09	4626.91
					6/30/2004 10:45	3.75	4628.25
					8/10/2004 10:20	3.45	4628.55
					8/27/2004 17:00	3.1	4628.9
211239	O'HAIR RANCH CO OBS-D	03S-09E-26-CCCC	4632	4630	3/24/2004 13:00	1.1	4630.9
159909	O'HAIR RANCH CO.	03S-09E-27-ADDA	4627.25	4625	8/28/2000 12:10	16.77	4610.48
					1/11/2001 16:15	18.41	4608.84
					3/14/2001 11:15	18.54	4608.71
					4/13/2001 17:37	18.55	4608.7
					5/31/2001 9:30	17.56	4609.69
					7/1/2001 16:00	16.62	4610.63
					8/8/2001 14:00	16.73	4610.52
					9/23/2001 10:40	16.51	4610.74
					11/10/2001 16:33	17.63	4609.62
					1/21/2002 9:45	18.31	4608.94
					3/11/2002 15:07	18.35	4608.9
					5/23/2002 17:00	17.77	4609.48
					6/27/2002 15:30	17.11	4610.14
					8/1/2002 14:00	17.14	4610.11
					8/22/2002 16:45	16.89	4610.36
					10/4/2002 16:30	17.39	4609.86
					1/2/2003 17:00	18.28	4608.97
					4/17/2003 15:00	18.12	4609.13
					7/10/2003 17:13	17.26	4609.99
99787	OHAIR RANCH COMPANY	03S-09E-27-BBBA	4656.45	4655	1/20/1993 10:43	40.43	4616.02
					4/14/1993 14:26	41.51	4614.94
					7/7/1993 18:02	33.38	4623.07
					9/22/1993 7:24	35.37	4621.08
					12/30/1993 10:47	40.28	4616.17
					3/29/1994 12:04	41.18	4615.27
					6/30/1994 7:35	35.09	4621.36
					9/30/1994 7:20	33.1	4623.35
					12/23/1994 10:54	39.5	4616.95
					3/31/1995 11:01	43.1	4613.35
					7/6/1995 8:40	33.16	4623.29
					10/16/1995 16:05	38.91	4617.54
					1/10/1996 11:34	44	4612.45
					4/12/1996 11:15	41.8	4614.65
					7/6/1996 7:15	33.5	4622.95
					10/10/1996 11:25	35.7	4620.75
					2/1/1997 8:59	40.75	4615.7
					4/4/1997 12:30	40.49	4615.96
					7/1/1997 9:02	32.05	4624.4
					10/7/1997 11:04	36.33	4620.12
					1/13/1998 9:30	40.26	4616.19
					4/3/1998 10:18	41	4615.45
					7/8/1998 10:10	30.84	4625.61
					1/18/1999 0:00	40.8	4615.65
					4/3/1999 9:30	41.86	4614.59
					7/25/1999 10:32	32.29	4624.16
					10/27/1999 11:00	38.01	4618.44
					1/29/2000 9:49	41.36	4615.09
					4/24/2000 12:00	42.09	4614.36
					7/31/2000 8:57	35.1	4621.35
					11/18/2000 12:00	39.8	4616.65
					4/14/2001 11:00	44.39	4612.06
					7/26/2001 10:20	36.08	4620.37
					10/6/2001 9:50	36.65	4619.8
					1/21/2002 11:21	43.13	4613.32
					4/29/2002 11:25	42.21	4614.24
					5/16/2002 14:41	41.42	4615.03
					7/23/2002 8:50	37.73	4618.72
					10/17/2002 12:52	39.27	4617.18
					1/7/2003 11:49	46.41	4610.04
					4/19/2003 11:20	41.09	4615.36
					7/18/2003 10:39	31.01	4625.44
					10/11/2003 12:10	38.96	4617.49
					1/23/2004 15:25	43.14	4613.31
					4/17/2004 8:50	41.94	4614.51
					7/20/2004 10:45	36.12	4620.33
					10/16/2004 9:32	37.78	4618.67
					1/10/2005 10:49	41.11	4615.34

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
99790	SPRING CK.HILLS PROP	03S-09E-28-BBBD	5041	5038	8/13/2000 17:57	41.2	4999.8
99794	WARREN MACKEY L	03S-09E-32-ADAB	4851.8	4850	8/11/2000 13:54	195.1	4656.7
99795	ROSE ROY	03S-09E-32-DAAB	4835.5	4860	8/5/2000 16:00	60.49	4775.01
					11/30/2000 16:00	60.3	4775.2
155222	JUMPING RAINBOW RANCH	03S-09E-35-ACBB	4643.1	4641	8/7/2000 13:37	11.06	4632.04
192235	LAY BRUCE	03S-09E-35-ACD	4721.5	4720	4/17/2003 11:10	113.35	4608.15
182357	BASINI ALBERT	03S-09E-36-ABAA	4991.8	4990	11/10/2001 12:00	46.4	4945.4
					1/20/2002 11:14	49.41	4942.39
					3/12/2002 10:59	51.54	4940.26
					5/22/2002 13:45	53.54	4938.26
					7/31/2002 12:50	42.44	4949.36
					8/23/2002 11:00	30.51	4961.29
					10/4/2002 10:20	44.33	4947.47
					1/2/2003 11:30	49.29	4942.51
					4/17/2003 11:25	53.49	4938.31
					7/9/2003 13:50	44.12	4947.68
144463	PIPOLO ANTHONY & JOHN	03S-10E-19-ADCB	5033.6	5032	8/13/2000 13:09	243.67	4789.93
99828	MOONEYHAM DAVE	03S-10E-20-BBBB	5161.8	5158	8/12/2000 15:36	31.71	5130.09
138754	DOAK BRIAN J	03S-10E-30-DBCC	5097.9	5100	11/10/2001 13:00	191.75	4825.85
					8/23/2002 12:10	174.88	4923.02
185218	ALGER BARBARA & BELZ DAVE	03S-10E-30-CBBD	4994.8	4993	11/10/2001 11:15	122.06	4872.74
					1/20/2002 11:05	126.43	4868.37
					3/12/2002 10:25	131.77	4863.03
					5/22/2002 13:40	135.95	4858.85
					7/31/2002 12:40	118	4876.8
					8/22/2002 12:00	113.04	4881.76
					11/10/2002 11:15	122.06	4872.74
					11/10/2002 12:00	122.06	4872.74
					1/2/2003 11:23	128.54	4866.26
					7/9/2003 14:20	124.96	4869.84
201446	LAWRIE K	03S-10E-30-CDCA	5005.2	5010	11/10/2002 13:00	113.77	4891.43
					8/22/2002 12:17	92.87	4912.33
99832	FONDA PETER	03S-10E-30-BDBB	5062	5050	8/14/2000 18:00	143.42	4918.58
99837	LUDER A.ERDMAN	03S-10E-30-CDCD	5041.45	5040	1/21/1993 8:51	128.26	4913.19
					4/14/1993 12:35	137.26	4904.19
					7/7/1993 17:29	107.95	4933.5
					9/21/1993 17:24	109.04	4932.41
					12/30/1993 10:13	127.1	4914.35
					3/29/1994 11:32	138.27	4903.18
					7/1/1994 8:39	109.93	4931.52
					9/30/1994 9:26	116.58	4924.87
					12/23/1994 10:13	129.45	4912
					3/31/1995 10:20	139.69	4901.76
					7/6/1995 7:15	115.55	4925.9
					10/16/1995 15:00	115	4926.45
					1/10/1996 10:47	129.66	4911.79
					4/12/1996 13:55	140.35	4901.1
					7/6/1996 8:33	107.43	4934.02
					10/10/1996 13:45	121.63	4919.82
					2/1/1997 12:15	136.5	4904.95
					4/4/1997 11:45	142.46	4898.99
					7/1/1997 11:10	105.45	4936
					10/7/1997 13:06	113.33	4928.12
					1/13/1998 11:38	128.08	4913.37
					4/3/1998 12:13	138.4	4903.05
					7/8/1998 13:10	108.98	4932.47
					1/18/1999 0:00	135.46	4905.99
					4/3/1999 12:15	142.71	4898.74
					7/25/1999 13:38	103.33	4938.12
					10/27/1999 13:18	120.23	4921.22
					1/29/2000 12:52	137.72	4903.73
					4/24/2000 14:15	144.5	4896.95
					7/31/2000 11:12	100.12	4941.33
					11/18/2000 14:46	128.13	4913.32
					4/14/2001 13:10	147.8	4893.65
					7/26/2001 15:00	100.54	4940.91
					10/6/2001 12:10	122.61	4918.84
					1/21/2002 13:16	136.85	4904.6
					4/29/2002 13:20	147.4	4894.05
					7/23/2002 11:18	100.73	4940.72
					10/17/2002 15:15	127.11	4914.34
					1/7/2003 13:42	163.36	4878.09
					4/19/2003 13:38	158.24	4883.21
					7/18/2003 13:10	109.86	4931.59
					10/11/2003 15:20	133.1	4908.35
					1/24/2004 12:50	135.79	4905.66
					4/17/2004 10:40	146.83	4894.62
					7/20/2004 13:00	104.07	4937.38
					10/16/2004 12:10	113.66	4927.79
					1/10/2005 13:03	125.38	4916.07

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
99840	SCHLEICHER EARL	03S-10E-30-DCBC	5082.55	5080	11/10/2001 15:05	89.62	4992.93
					1/20/2002 11:55	87.5	4995.05
					3/12/2002 11:28	89.77	4992.78
					5/22/2002 14:10	91.43	4991.12
					6/28/2002 13:15	75.78	5006.77
					7/31/2002 13:00	49.67	5032.88
					8/23/2002 10:50	79.82	5002.73
					10/4/2002 10:30	91	4991.55
					1/2/2003 11:45	87.6	4994.95
					4/17/2003 11:30	86.02	4996.53
					7/9/2003 13:42	71.63	5010.92
					11/10/2001 15:00	65	5016.25
151257	PEAVYHOUSE JOEL & HERMA	03S-10E-30-DBCA	5148.7	5147	11/10/2001 0:00	222.15	5016.25
					8/22/2002 11:50	205.3	4943.4
201444	BRAWNER QUENTIN	03S-10E-31-BBCC	4952	4951	11/10/2001 13:00	24.49	4927.51
					8/22/2002 11:30	18.23	4933.77
99843	PEACOCK DOUG	03S-10E-31-DCBB	5201.6	5200	8/12/2000 13:51	71.57	5130.03
182357	BASINI ALBERT	03S-09E-36-ACBC	4886.89	4885	11/10/2001 12:00	46.4	4840.49
					1/20/2002 11:14	49.41	4837.48
					3/12/2002 10:59	51.54	4835.35
					5/22/2002 13:45	53.54	4833.35
					7/31/2002 12:50	42.44	4844.45
					8/23/2002 11:00	30.51	4856.38
					10/4/2002 10:20	44.33	4842.56
					1/2/2003 11:30	49.29	4837.6
					4/17/2003 11:25	53.49	4833.4
					7/9/2003 13:50	44.12	4842.77
143002	HACKER LLOYD & BEVERLY	04S-08E-11-BDCB	5286.7	5285	8/14/2000 14:47	62.71	5223.99
155008	GEG PARKS	04S-08E-11-CBDC	5279.5	5277	8/14/2000 15:36	45.07	5234.43
182639	TRIPLE R RANCH	04S-08E-11-CDBD	5203.5	5220	8/14/2000 16:23	85.5	5118
149841	WALSH PETE	04S-08E-34-CCCC	5259	5257	9/30/2000 14:30	6.49	5252.51
					3/14/2001 12:44	6.58	5252.42
					4/13/2001 15:43	6.42	5252.58
					5/30/2001 16:06	6.46	5252.54
					6/30/2001 11:21	6.5	5252.5
					8/8/2001 12:50	6.62	5252.38
					9/23/2001 16:25	7.15	5251.85
					11/10/2001 14:59	6.8	5252.2
					1/21/2002 11:50	6.79	5252.21
					3/12/2002 16:16	6.8	5252.2
					5/23/2002 15:15	6.4	5252.6
					6/27/2002 14:40	6.52	5252.48
					8/1/2002 11:30	9.06	5249.94
					8/22/2002 16:00	7.52	5251.48
					10/4/2002 14:55	6.72	5252.28
					1/2/2003 15:55	6.56	5252.44
					4/17/2003 16:35	6.54	5252.46
					7/10/2003 16:26	6.82	5252.18
100941	PINE CREEK SCHOOL DISTRICT 19	04S-09E-1-BCDD	4819.5	4817	7/26/2000 16:22	63.3	4756.2
					3/13/2001 12:49	113.05	4706.45
					4/12/2001 13:05	117.53	4701.97
					5/29/2001 12:25	107.2	4712.3
					6/29/2001 12:34	76.44	4743.06
					8/7/2001 12:25	63.37	4756.13
					9/22/2001 10:40	73.46	4746.04
					11/10/2001 10:17	86.03	4733.47
					1/20/2002 12:15	101.28	4718.22
					3/12/2002 10:59	110.22	4709.28
					6/28/2002 13:20	91.86	4727.64
					7/31/2002 13:40	81.82	4737.68
					8/23/2002 10:35	75.97	4743.53
					1/2/2003 11:55	103.81	4715.69
					7/9/2003 13:20	96.87	4722.63
100962	WEBER ROBERT L.	04S-09E-8-DCDB	4763	4760	8/25/2000 14:50	81.61	4681.39
					3/14/2001 12:16	120.16	4642.84
					4/12/2001 14:15	121.21	4641.79
					5/30/2001 16:25	110.84	4652.16
					6/30/2001 12:18	97.98	4665.02
					8/8/2001 13:20	91.78	4671.22
					9/23/2001 17:24	87.91	4675.09
					11/10/2001 15:26	91.54	4671.46
					1/21/2002 12:16	114.93	4648.07
					3/12/2002 16:43	119.53	4643.47
					5/23/2002 15:30	121.71	4641.29
					6/27/2002 15:15	105.78	4657.22
					8/1/2002 12:15	93.94	4669.06
					8/22/2002 16:30	92.73	4670.27
					10/4/2002 15:15	91.53	4671.47
					1/2/2003 16:10	114.5	4648.5
					4/18/2003 12:35	123.65	4639.35
					7/10/2003 16:53	108.62	4654.38

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
211605	HAYNES WILLIAM	04S-09E-9-AAAB	4711.6	4710	6/30/2004 11:35	60.25	4651.35
100984	PITMAN SCOTT	04S-09E-11-DCAB	4827.3	4825	8/12/2000 13:26	130.17	4697.13
100991	MITCHELLS MILE HIGH RANCH	04S-09E-11-BBCA	4701.3	4700	8/12/2000 11:25	31.26	4670.04
209229	MITCHELLS MILEHIGH RANCH INC OB	04S-09E-11-BCAC	4701.65	4700	3/24/2004 12:30	35.65	4666
		04S-09E-11-BCAC	4701.65	4700	6/30/2004 11:10	30.85	4670.8
209229	MITCHELLS MILEHIGH RANCH INC OB	04S-09E-11-BCAC	4701.65	4700	8/10/2004 10:45	31.96	4669.69
211235	MICHELL'S MILEHIGH RANCH INC OBS	04S-09E-11-BCAC	4701.5	4700	3/24/2004 12:30	35.7	4665.8
					6/30/2004 11:10	31.3	4670.2
					8/10/2004 10:45	32.76	4668.74
211236	MITCHELL'S MILEHIGH RANCH INC PV	04S-09E-11-BCAC	4702.25	4700	3/24/2004 12:30	36.19	4666.06
					6/30/2004 11:10	31.85	4670.4
101004	PINE CREEK CHURCH	04S-09E-12-BCCB	4851.4	4850	8/4/2000 13:00	92.66	4758.74
					11/28/2000 15:15	92	4759.4
					3/13/2001 13:13	136.91	4714.49
					4/12/2001 13:13	137.39	4714.01
					5/29/2001 12:34	113.75	4737.65
					7/1/2001 15:00	82.55	4768.85
					8/7/2001 12:55	93.26	4758.14
					9/22/2001 11:07	109.5	4741.9
					11/10/2001 10:28	114.31	4737.09
					1/20/2002 12:22	125.96	4725.44
					3/12/2002 11:41	134.54	4716.86
					5/22/2002 14:55	110.01	4741.39
					6/28/2002 13:40	89.85	4761.55
					7/31/2002 13:40	96.31	4755.09
					8/23/2002 10:25	109.11	4742.29
					10/4/2002 11:00	142.81	4708.59
					1/2/2003 12:00	129.2	4722.2
					4/17/2003 12:25	104.03	4747.37
					7/9/2003 13:08	89.27	4762.13
121213	CHRISTIAN ELLERY C.	04S-09E-14-AACB	4856.4	4855	8/6/2000 12:26	152.62	4703.78
153940	JORDAN LARRY	04S-09E-14-DCAA	4791.3	4790	8/6/2000 11:20	70.04	4721.26
198713	HERITAGE REMBRANDT - AA RANCH	04S-09E-14-BDCC	4726.5	4725	10/16/1995 14:20	28.95	4697.55
					1/10/1996 10:26	34.35	4692.15
					4/12/1996 13:20	36.5	4690
					7/6/1996 8:13	26.03	4700.47
					10/10/1996 13:30	31.1	4695.4
					2/1/1997 11:50	35.54	4690.96
					4/4/1997 11:24	37.9	4688.6
					7/1/1997 10:52	27.05	4699.45
					10/7/1997 12:47	30.48	4696.02
					1/13/1998 11:15	34.28	4692.22
					4/3/1998 11:52	36.21	4690.29
					7/8/1998 12:50	26.24	4700.26
					1/18/1999 0:00	33.95	4692.55
					4/3/1999 11:55	36.38	4690.12
					7/25/1999 12:27	26.99	4699.51
					10/27/1999 12:52	34.16	4692.34
					1/29/2000 12:31	35.96	4690.54
					4/24/2000 13:45	37.52	4688.98
					7/31/2000 10:50	27.58	4698.92
					11/18/2000 14:15	34.04	4692.46
					4/14/2001 12:45	30.22	4696.28
					7/26/2001 14:35	29.59	4696.91
					10/6/2001 11:52	30.62	4695.88
					1/21/2002 12:57	36.1	4690.4
					4/29/2002 12:58	38.44	4688.06
					5/15/2002 16:00	37.78	4688.72
					7/23/2002 10:57	29.9	4696.6
					10/17/2002 14:48	32.75	4693.75
					1/7/2003 13:16	37.31	4689.19
					4/19/2003 13:11	38.76	4687.74
					7/18/2003 12:40	29.92	4696.58
					10/11/2003 14:45	32.99	4693.51
101021	MCLAIN BERNARD	04S-09E-26-CACB	5015.5	5015	8/13/2000 11:29	27.02	4988.48
					1/11/2001 16:00	29.87	4985.63
					3/13/2001 13:34	29.01	4986.49
					4/17/2001 13:31	27.02	4988.48
					5/29/2001 12:52	10.99	5004.51
					6/29/2001 13:22	13.56	5001.94
					8/7/2001 14:15	23.89	4991.61
					9/22/2001 11:55	26.51	4988.99
					11/10/2001 10:51	26.78	4988.72
					1/20/2002 12:35	27.7	4987.8
					3/12/2002 11:50	27.8	4987.7
					6/28/2002 15:10	13.08	5002.42
					8/23/2002 10:10	26.59	4988.91
					10/4/2002 11:15	24.99	4990.51
					4/17/2003 12:30	25.29	4990.21
					7/9/2003 14:55	16.4	4999.1

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
101037	GAMBLE DAVE	04S-09E-28-ADAB	4734.4	4740	8/28/2000 14:45	10.76	4723.64
101038	LOCH LEVEN FAS	04S-09E-28-CACC	4750	4750	8/4/2000 11:30	14.1	4735.9
					1/11/2001 13:30	24.69	4725.31
					3/13/2001 14:20	25.74	4724.26
					4/12/2001 13:44	26.71	4723.29
					5/29/2001 13:16	23.23	4726.77
					6/29/2001 13:34	17.3	4732.7
					8/7/2001 14:30	14.76	4735.24
					11/1/2001 10:55	17.13	4732.87
121836	JORDAN CHRISTOPHER	04S-09E-28-DACC	4761.9	4761	8/5/2000 10:28	25.53	4736.37
131520	DOUGLAS DICK	04S-09E-28-CBDB	4832.8	4830	8/5/2000 12:54	101.43	4731.37
73357	GAMBLE DAVID	04S-09E-28-AACA	4746.7	4745	8/28/2000 13:45	30.17	4716.53
183893	KANT BRAD & CRYSTAL	04S-09E-29-CCCC	4892.5	4890	9/9/2000 16:55	152.87	4739.63
					11/30/2000 14:50	157.7	4734.8
					3/15/2001 9:58	161.72	4730.78
					4/13/2001 17:18	162.92	4729.58
					5/31/2001 9:55	162.52	4729.98
					7/1/2001 13:30	158.6	4733.9
					8/8/2001 14:20	154.92	4737.58
					9/23/2001 11:25	153.14	4739.36
					11/10/2001 16:33	154.12	4738.38
					1/21/2002 10:09	158.69	4733.81
					3/11/2002 15:26	161.52	4730.98
					5/23/2002 16:45	164.05	4728.45
					6/27/2002 16:00	161.56	4730.94
					8/1/2002 13:15	157.76	4734.74
					8/22/2002 17:00	156.35	4736.15
					10/4/2002 15:40	154.74	4737.76
					4/18/2003 12:10	165.51	4726.99
211602	JACKSON RAY	04S-09E-29-ABBC	4853	4850	6/30/2004 14:56	136.15	4716.85
					8/10/2002 13:35	129.89	4723.11
163650	TOMLIN JOHN & MARCELLA	04S-09E-34-DBDC	4956.5	4955	8/4/2000 14:02	175.21	4781.29
143982	USDA FOREST SERVICE	04S-10E-5-BBCC	5287	5550	7/26/2000 15:11	158.49	5128.51
183904	USFS * PINE CREEK CAMPGROUND	04S-10E-8-CCDB	5599	5597	7/26/2000 13:47	19.87	5579.13
135257	NORDIN MARK OR SHARON	05S-08E-2-ADCD	5039	5037	8/28/2000 15:38	223.6	4815.4
102464	INVERNESS LAND & CATTLE MANAGE	05S-08E-9-DDDD	5061.5	5061	8/28/2000 18:15	162.2	4899.3
					5/29/2001 15:28	162.71	4898.79
					6/30/2001 10:43	162.76	4898.74
					8/8/2001 12:30	162.72	4898.78
					11/10/2001 14:34	162.24	4899.26
					5/23/2002 14:50	162.76	4898.74
155014	MEYERS NICK	05S-08E-11-DADA	4850.2	4850	8/28/2000 13:19	39.75	4810.45
					7/10/2003 17:45	47.46	4802.74
169850	BLAIR STEVEN T. AND JENNIFER J.	05S-08E-11-BDDB	4971.4	4970	8/4/2000 15:48	162.69	4808.71
175955	MURRAY WILLIAM	05S-08E-11-ADAD	4971.42	4970	3/15/2001 10:39	183.54	4787.88
		---			6/30/2001 16:34	180.69	4790.73
					8/8/2001 15:30	177.03	4794.39
					9/23/2001 11:38	174.17	4797.25
					1/21/2002 10:45	180.1	4791.32
					3/11/2002 16:07	182.89	4788.53
					5/23/2002 16:15	185.15	4786.27
					6/27/2002 16:10	184.44	4786.98
					8/1/2002 13:30	181.04	4790.38
					8/22/2002 17:30	179.6	4791.82
					10/4/2002 16:00	178.31	4793.11
					1/2/2003 16:35	182.64	4788.78
					4/18/2003 11:30	187.29	4784.13
					7/10/2003 18:25	184.52	4786.9
183894	CHEKOWSKI PETER	05S-08E-11-DAAD	4857.3	4855	9/9/2000 11:05	43.76	4813.54
					11/30/2000 13:45	47.73	4809.57
					3/15/2001 12:15	52.68	4804.62
					4/13/2001 16:55	53.91	4803.39
					5/31/2001 10:27	50.72	4806.58
					8/8/2001 16:05	44.78	4812.52
					9/23/2001 13:42	42.61	4814.69
					11/10/2001 15:53	48.05	4809.25
					1/21/2002 10:25	49.62	4807.68
					3/11/2002 16:07	52.37	4804.93
					5/23/2002 16:25	53.31	4803.99
					8/1/2002 13:45	48.56	4808.74
					8/22/2002 17:40	47.25	4810.05
					10/4/2002 16:10	47.63	4809.67
					1/2/2003 16:45	52.16	4805.14
					4/18/2003 11:50	56.3	4801
					7/10/2003 18:00	50.96	4806.34
151258	KNOLL PAT & AMY	05S-08E-12-DDBD	4857.5	4856	8/6/2000 16:59	61.2	4796.3
					7/10/2003 12:27	70.63	4786.87
162941	ARROWHEAD SCHOOL DISTRICT 75	05S-08E-13-DDDD	4965	4963	8/7/2000 13:08	161.07	4803.93
					7/8/2003 17:15	173.78	4791.22
205557	AINSWORTH B NEAL/GALLATIN VALLE	05S-08E-13-ABAD	4960.2	4958	7/8/2003 12:00	170	4790.2
133369	ROBEY PATRICIA	05S-08E-14-DCAD	4911.6	4910	8/6/2000 15:35	84.04	4827.56

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
159750	SACKETT GARY AND SHANNON	05S-08E-14-ACBD	4851.63	4852	7/8/2003 13:30	24.33	4827.3
					7/10/2003 8:45	24.51	4827.12
205550	AINSWORTH B NEAL/GALLATIN VALLE	05S-08E-14-AADA	4854.2	4852	7/8/2003 12:00	51.49	4802.71
206290	SACKETTES	05S-08E-14-ACBA	4851.37	4850	7/8/2003 13:00	24.33	4827.04
102486	STANDISH CHAD AND MORLEY PAT	05S-08E-25-BDBD	5011.82	5011	1/19/1993 16:04	168.72	4843.1
					4/14/1993 12:41	175.07	4836.75
					7/7/1993 16:46	179.02	4832.8
					9/21/1993 16:27	174.58	4837.24
					12/30/1993 9:36	169.97	4841.85
					3/29/1994 10:55	172.02	4839.8
					6/30/1994 20:44	176.39	4835.43
					9/30/1994 8:50	169.08	4842.74
					12/23/1994 9:28	165.71	4846.11
					3/31/1995 9:40	171.83	4839.99
					7/6/1995 6:20	178.44	4833.38
					10/16/1995 13:19	174.94	4836.88
					4/12/1996 12:50	173.85	4837.97
					7/6/1996 7:46	180.06	4831.76
					2/1/1997 11:07	177.8	4834.02
					4/4/1997 11:00	179.89	4831.93
					7/1/1997 10:30	181.69	4830.13
					10/7/1997 12:19	180.75	4831.07
					1/13/1998 10:50	174.71	4837.11
					4/3/1998 11:30	175.94	4835.88
					7/8/1998 12:28	180.1	4831.72
					1/18/1999 0:00	169.59	4842.23
					4/3/1999 10:55	172.69	4839.13
					7/25/1999 12:00	179.78	4832.04
					10/27/1999 12:27	173.33	4838.49
					1/29/2000 12:08	173.34	4838.48
					4/24/2000 13:15	177.92	4833.9
					7/31/2000 10:20	182.25	4829.57
					11/18/2000 13:46	177.21	4834.61
					4/14/2001 12:20	181.77	4830.05
					7/26/2001 14:15	184	4827.82
					10/6/2001 11:35	179.64	4832.18
					1/21/2002 12:36	178.69	4833.13
					4/29/2002 12:35	183.18	4828.64
					7/23/2002 10:16	187.14	4824.68
					10/17/2002 14:40	181.65	4830.17
					1/7/2003 13:02	182.93	4828.89
					4/19/2003 12:37	186.33	4825.49
					7/10/2003 12:45	188.26	4823.56
					10/11/2003 14:25	183.47	4828.35
					1/24/2004 13:45	183.18	4828.64
					4/17/2004 10:05	184.89	4826.93
					7/20/2004 12:10	179.72	4832.1
					10/16/2004 10:42	177.23	4834.59
					1/10/2005 12:20	181.09	4830.73
183891	TAYLOR JACK	05S-08E-25-ADDA	5041.5	5040	10/8/2000 13:55	218.1	4823.4
					11/29/2000 9:30	215.25	4826.25
					6/29/2001 14:56	227.37	4814.13
					8/7/2001 15:40	224.79	4816.71
					9/22/2001 14:33	218.36	4823.14
					11/10/2001 11:45	215.35	4826.15
					1/20/2002 14:00	218.35	4823.15
					5/22/2002 16:40	229.38	4812.12
					6/28/2002 17:00	230.31	4811.19
					7/31/2002 16:10	232.81	4808.69
					10/4/2002 12:35	222.58	4818.92
					1/2/2003 13:08	220.81	4820.69
					7/9/2003 16:01	234.2	4807.3
148585	ROBB LINDSAY C. & KRAFT SUSAN V.	05S-08E-27-DADC	5012	5012	8/6/2000 13:20	133.99	4878.01
					7/9/2003 9:42	134.84	4877.16
182640	OTIS BERT	05S-08E-27-CCBC	4890.5	4890	8/5/2000 13:13	11.28	4879.22
					4/13/2001 13:35	11.43	4879.07
					5/31/2001 10:16	11.22	4879.28
					6/30/2001 15:18	10.33	4880.17
					8/7/2001 16:57	11.4	4879.1
					9/23/2001 15:18	11.32	4879.18
					11/10/2001 13:30	11.42	4879.08
					1/20/2002 16:55	11.51	4878.99
					3/11/2002 16:15	11.21	4879.29
					5/23/2002 13:45	10.95	4879.55
					6/27/2002 10:30	11.25	4879.25
					8/22/2002 15:00	11.11	4879.39
					10/4/2002 14:00	10.89	4879.61
					1/2/2003 15:20	11.61	4878.89
					4/17/2003 15:30	11.89	4878.61
					7/9/2003 9:25	11.56	4878.94

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
102516	JENSEN ROBERT	05S-08E-28-AADB	5072.5	5071	8/26/2000 12:10	177.69	4894.81
					11/30/2000 10:45	179.24	4893.26
					4/13/2001 14:35	179.21	4893.29
					5/30/2001 14:40	179.28	4893.22
					6/29/2001 17:45	179.22	4893.28
					8/8/2001 11:55	179.69	4892.81
					9/23/2001 15:33	179.38	4893.12
					11/10/2001 14:01	179.27	4893.23
					1/21/2002 11:15	179.18	4893.32
					3/11/2002 16:44	179.53	4892.97
					5/23/2002 14:15	179.17	4893.33
					6/27/2002 14:05	179.05	4893.45
					8/1/2002 11:00	179.4	4893.1
					4/17/2003 15:49	179.43	4893.07
					7/10/2003 16:00	179.57	4892.93
169854	LLOYD SHIRLEY	05S-08E-28-ADDA	5013	5010	9/1/2000 18:52	105.65	4907.35
175962	DUNN SHERMAN	05S-08E-28-ADDB	5010.9	5010	9/11/2000 18:12	102.92	4907.98
					11/29/2000 15:45	102.81	4908.09
					3/14/2001 17:15	103.89	4907.01
					4/13/2001 14:48	102.89	4908.01
					5/30/2001 14:52	103.93	4906.97
					6/29/2001 17:50	103	4907.9
					8/8/2001 12:00	102.97	4907.93
					9/23/2001 15:46	102.92	4907.98
					11/10/2001 14:34	102.81	4908.09
					1/21/2002 11:20	102.82	4908.08
					3/11/2002 16:52	102.88	4908.02
					5/23/2002 0:00	102.88	4908.02
					6/27/2002 14:10	102.85	4908.05
					8/1/2002 11:10	103.08	4907.82
					8/22/2002 15:40	103.09	4907.81
					10/4/2002 14:35	103.08	4907.82
					1/2/2003 15:45	103.01	4907.89
					4/17/2003 16:05	103.09	4907.81
					7/10/2003 15:57	103.24	4907.66
184345	WAID JOHN	05S-08E-28-DDBD	4885.8	4883	8/25/2000 12:07	5.73	4880.07
102536	HARTH PATRICIA	05S-08E-29-ACCD	5240	5240	8/27/2000 18:25	180.34	5059.66
175963	OLSON JOHN	05S-08E-31-AADC	5157.5	5155	9/10/2000 18:08	137.15	5020.35
					1/11/2001 14:15	138.22	5019.28
					3/14/2001 16:22	139.05	5018.45
					4/13/2001 14:18	138.93	5018.57
					5/30/2001 14:18	139.31	5018.19
					6/29/2001 17:30	139.08	5018.42
					8/8/2001 11:40	139.24	5018.26
					11/10/2001 13:48	138.2	5019.3
					1/21/2002 11:05	138.34	5019.16
					3/11/2002 16:35	138.71	5018.79
					8/22/2002 15:20	138.58	5018.92
					10/4/2002 14:20	138.68	5018.82
					1/2/2003 15:35	140.73	5016.77
					7/10/2003 15:47	141.32	5016.18
102557	GOLDEN AGE VILLAGE - WELL 2	05S-08E-32-ABCC	5082.9	5081	8/25/2000 14:40	43.95	5038.95
					4/18/2003 9:30	46.92	5035.98
102560	GOLDEN AGE VILLAGE - WELL 1	05S-08E-32-ABCC	5131.5	5130	8/25/2000 15:15	59.45	5072.05
					4/18/2003 9:30	63.71	5067.79
102566	HOAG M/M PHILLIP	05S-08E-32-BCC	5151	5150	4/18/2003 10:00	8.74	5142.26
160127	PARADISE VALLEY FIRE SVC. AREA	05S-08E-34-ACDA	4969.3	4968	8/5/2000 14:33	41.61	4927.69
					4/17/2003 15:15	48.59	4920.71
					7/9/2003 9:33	48.98	4920.32
183895	BRANDES JACK	05S-08E-34-CABC	4921.17	4920	8/9/2000 14:45	17.68	4903.49
183898	BRANDIS JACK JR	05S-08E-34-CCBD	5002.9	5000	8/9/2000 13:45	78.2	4924.7
175964	MCCULLEY MARK	05S-08E-35-ADAD	5101.5	5100	8/5/2000 15:29	196.83	4904.67
148027	JOHNSON VAUGHN	05S-09E-5-BDCB	4837.8	4835	9/9/2000 17:35	65.43	4772.37
152007	MILL CREEK HEADWATERS OFFICE - .	05S-09E-5-CCAA	4839	4836	9/9/2000 18:45	54.6	4784.4
148813	WARFIELD WILLIAM S	05S-09E-8-CCAC	4841.85	4840	10/7/2000 13:25	45.85	4796
					4/18/2003 11:00	64.41	4777.44
175612	WARFIELD WILLIAM	05S-09E-8-CDBD	4851.4	4850	10/7/2000 12:15	52.5	4798.9
					4/18/2003 11:25	70.76	4780.64
					7/9/2003 10:45	57.77	4793.63

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
138756	ELBOW CREEK RANCH	05S-09E-9-DDDD	4957	4957	9/11/2000 13:01	144.45	4812.55
					5/29/2001 13:34	178.63	4778.37
					6/29/2001 13:54	166.65	4790.35
					8/7/2001 14:50	149.71	4807.29
					9/22/2001 13:15	150.11	4806.89
					11/10/2001 11:05	156.34	4800.66
					1/20/2002 13:00	167.73	4789.27
					3/12/2002 12:35	174.36	4782.64
					5/22/2002 15:10	180.74	4776.26
					6/28/2002 15:45	175.77	4781.23
					7/31/2002 14:45	162.32	4794.68
					8/23/2002 9:50	157.04	4799.96
					10/4/2002 11:45	156.13	4800.87
					1/2/2003 12:23	168.92	4788.08
					4/17/2003 13:15	182.05	4774.95
					7/9/2003 12:10	167.67	4789.33
					9/11/2000 14:23	236	4816.6
					7/9/2003 12:35	253.14	4799.46
102608	HANS NORDBLOM	05S-09E-17-CAAA	4911.45	4912	9/12/2000 12:15	94.23	4817.22
					11/29/2000 8:50	100.25	4811.2
					3/13/2001 16:04	113.81	4797.64
					4/12/2001 15:30	116.29	4795.16
					5/29/2001 14:33	113.95	4797.5
					11/10/2001 11:21	98.4	4813.05
					1/20/2002 13:15	107.02	4804.43
					3/12/2002 12:58	113.94	4797.51
					5/22/2002 15:10	118	4793.45
					6/28/2002 16:45	112.85	4798.6
					8/22/2002 13:00	99.26	4812.19
					10/4/2002 12:00	97.11	4814.34
					1/2/2003 12:39	108.33	4803.12
					7/9/2003 10:40	108.6	4802.85
211706	MILL CREEK RIDGE TEST WELL #1	05S-09E-17-ADDC	5000	4999	5/27/2004 11:00	230.52	4769.48
182637	BRYANT ROSEMARRY	05S-09E-18-BDBA	4939.5	4940	10/7/2000 15:00	138.3	4801.2
					7/9/2003 16:54	151.85	4787.65
192475	SHIMMIN RILEY	05S-09E-18-CDDC	4974.3	4972	7/9/2003 10:00	194.43	4779.87
201776	ADKINS MIKE	05S-09E-18-BBBA	4895.5	4893	7/8/2003 13:20	101.53	4793.97
					7/9/2003 13:19	101.14	4794.36
					7/10/2003 8:30	101.25	4794.25
102623	NEIL & STEFFESEN	05S-09E-19-DDBC	5041	5040	9/12/2000 14:48	229.1	4811.9
179428	WESTGEEST BOB	05S-09E-20-CACC	5059	5058	7/9/2003 15:40	266.5	4792.5
					8/22/2002 13:15	252.88	4806.12
184344	SCHNEIDER GARY	05S-09E-22-CDCD	5437	5435	9/11/2000 16:11	207.27	5229.73
169858	JACKSON WILLIAM L & SANDRA	05S-09E-28-CCBC	5161.9	5160	10/7/2000 16:20	313.6	4848.3
					4/12/2001 15:10	331.22	4830.68
					6/29/2001 14:34	333.42	4828.48
					9/22/2001 14:04	314.87	4847.03
					1/20/2002 13:42	322.77	4839.13
					3/12/2002 13:11	329.4	4832.5
					10/4/2002 12:20	320.3	4841.6
					4/17/2003 13:40	334.55	4827.35
					7/9/2003 11:10	341.4	4820.5
	JACKSON WILLIAM L & SANDRA	05S-09E-28-CCBC	5161	5160	4/12/2001 15:10	112.41	5048.59
					5/29/2001 14:15	104.85	5056.15
					6/29/2001 14:34	97.41	5063.59
					9/22/2001 14:05	104.86	5056.14
					11/10/2001 0:00	108.03	5052.97
					1/20/2002 13:42	111.99	5049.01
					3/12/2002 13:11	112.55	5048.45
					5/22/2002 16:18	112.24	5048.76
					6/26/2002 16:20	89.89	5071.11
					7/31/2002 15:40	98.46	5062.54
					8/22/2002 13:10	100.43	5060.57
					10/4/2002 12:20	104.38	5056.62
					1/2/2003 12:49	110.44	5050.56
					4/17/2003 14:04	113.22	5047.78
					7/9/2003 11:00	98.69	5062.31
184346	MCMAN BILL	05S-09E-33-DDBD	5242.1	5240	9/12/2000 16:12	17.79	5224.31
183902	BRANDIS JACK	06S-07E-13-DBAA	4918.77	4917	8/10/2000 16:00	8.67	4910.1
124069	BRUTGER ALAN	06S-07E-18-DACB	5999.45	5698	10/8/2000 15:02	165.26	5834.19

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
103644	MONTANA HIGHWAY DEPT (EMIGRAN	06S-07E-23-CDAB	4926.32	4925	1/19/1993 14:42	10.31	4916.01
					4/14/1993 12:10	12.44	4913.88
					9/21/1993 15:12	9.27	4917.05
					12/30/1993 9:14	11.03	4915.29
					3/29/1994 10:36	12.89	4913.43
					6/30/1994 20:25	7.03	4919.29
					9/30/1994 8:00	9.4	4916.92
					3/31/1995 9:10	12.55	4913.77
					7/6/1995 5:51	5.95	4920.37
					10/16/1995 12:42	8.9	4917.42
					1/10/1996 9:02	11.16	4915.16
					4/12/1996 12:05	11.82	4914.5
					7/7/1996 17:40	5.9	4920.42
					10/10/1996 12:45	8.37	4917.95
					2/1/1997 9:32	9.65	4916.67
					4/4/1997 10:00	11.39	4914.93
					7/1/1997 9:38	16.78	4909.54
					10/7/1997 11:34	10.23	4916.09
					1/13/1998 10:00	11.25	4915.07
					4/3/1998 10:45	12.28	4914.04
					7/8/1998 11:40	5.62	4920.7
					1/18/1999 0:00	11.51	4914.81
					4/3/1999 10:00	12.56	4913.76
					7/25/1999 11:05	16.86	4909.46
					10/27/1999 11:50	11.35	4914.97
					1/29/2000 10:16	12.36	4913.96
					4/24/2000 12:30	11.85	4914.47
					7/27/2000 8:32	9.4	4916.92
					7/31/2000 9:53	10.32	4916
					11/18/2000 13:27	12.25	4914.07
					4/14/2001 11:50	13.6	4912.72
					7/26/2001 11:15	9.94	4916.38
					1/21/2002 12:08	13.11	4913.21
					4/29/2002 12:14	13.72	4912.6
					5/16/2002 11:46	11.18	4915.14
					7/23/2002 9:31	12.95	4913.37
					10/17/2002 13:37	13.14	4913.18
					1/7/2003 12:21	19.67	4906.65
					4/19/2003 11:54	13.8	4912.52
					7/18/2003 11:12	10.91	4915.41
					10/11/2003 13:00	17.73	4908.59
					1/23/2004 15:00	13.44	4912.88
					4/17/2004 9:20	12.99	4913.33
					7/20/2004 11:20	9.9	4916.42
					10/16/2004 10:00	11.97	4914.35
					1/10/2005 11:30	12.7	4913.62
103645	BROWNE MAXMILLION	06S-07E-34-CDDB	4985	4980	7/26/2000 16:22	27.31	4957.69
170553	BRANDIS JACK	06S-08E-2-ACCC	5237.37	5235	8/10/2000 10:30	166.83	5070.54
					3/15/2001 9:58	170.79	5066.58
					4/12/2001 16:28	171.8	5065.57
					5/30/2001 13:30	172.53	5064.84
					9/9/2000 13:45	156.45	5081.55
					3/15/2001 9:58	170.79	5067.21
					4/12/2001 16:28	171.8	5066.2
					5/30/2001 13:30	172.53	5065.47
					6/29/2001 15:10	168.94	5069.06
					8/8/2001 10:00	164.98	5073.02
					9/23/2001 10:26	164.83	5073.17
					11/11/2001 11:30	166.02	5071.98
					1/20/2002 14:34	168.32	5069.68
					3/13/2002 13:00	170.23	5067.77
					5/23/2002 12:30	171.96	5066.04
					6/26/2002 17:35	171.39	5066.61
					7/31/2002 16:30	168.67	5069.33
					8/23/2002 9:00	167.3	5070.7
					10/4/2002 12:50	166.33	5071.67
					7/10/2003 13:06	170.24	5067.76
103661	WARNICK VICTOR	06S-08E-7-DCBB	4952.9	4950	8/18/2000 8:40	48.78	4904.12
183896	COLL AUDREY	06S-08E-7-DDCD	4921.85	4920	8/16/2000 13:00	37.71	4884.14
183897	HINKIE RICHARD	06S-08E-8-DBCD	4900.9	4900	8/16/2000 11:35	13	4887.9
183901	BALLANTYNE DOROTHY	06S-08E-8-ACCB	4901.25	4900	8/17/2000 13:42	19.08	4882.17

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
183892	FAIR BARBARA	06S-08E-9-DCAC	5036.4	5034	8/19/2000 11:55	21.35	5015.05
					11/29/2000 11:00	19.94	5016.46
					3/14/2001 14:38	20.8	5015.6
					4/13/2001 10:50	20.96	5015.44
					5/29/2001 15:04	14.94	5021.46
					7/1/2001 9:53	18.23	5018.17
					9/22/2001 17:34	21.05	5015.35
					11/10/2001 12:13	18.38	5018.02
					1/20/2002 16:04	19.59	5016.81
					3/12/2002 14:20	20.29	5016.11
					5/23/2002 12:55	17.69	5018.71
					6/27/2002 10:45	18.26	5018.14
					8/22/2002 14:20	21.56	5014.84
					10/4/2002 13:10	20.76	5015.64
					4/17/2003 14:25	16.45	5019.95
182638	WISE JOHN	06S-08E-14-ABAA	5422.7	5420	9/10/2000 12:25	20.22	5402.48
170555	DENTON JOHN	06S-08E-20-AAAA	5087.25	5086	8/10/2000 14:28	39.7	5047.55
					4/13/2001 11:10	64.47	5022.78
					5/29/2001 15:21	60.75	5026.5
					6/29/2001 16:52	37.08	5050.17
					8/7/2001 16:25	45.51	5041.74
					9/22/2001 17:09	58.89	5028.36
					11/10/2001 12:28	66.39	5020.86
					1/20/2002 15:15	55.87	5031.38
					3/12/2002 14:35	61.1	5026.15
					5/2/2002 17:00	67.07	5020.18
					6/27/2002 11:10	35.3	5051.95
					7/31/2002 17:10	36.32	5050.93
					8/22/2002 14:30	43.23	5044.02
					10/4/2002 13:25	55.86	5031.39
					1/2/2003 13:45	57.18	5030.07
					4/17/2003 14:35	67.24	5020.01
					7/10/2003 14:25	36.55	5050.7
211240	DENTON JOHN PW	06S-08E-20-AACA	5086.9	5085	3/24/2004 12:00	67.72	5019.18
					6/30/2004 12:45	39.45	5047.45
211241	DENTON JOHN OBS-S	06S-08E-20-AACA	5087	5085	3/24/2004 12:00	67.78	5019.22
					6/30/2004 12:45	39.45	5047.55
					8/10/2004 11:00	43.87	5043.13
211242	DENTON JOHN OBS-D	06S-08E-20-AACA	5086.85	5085	3/24/2004 12:00	67.9	5018.95
					6/30/2004 12:45	39.25	5047.6
176295	MORTON DAVE	06S-08E-20-BBAA	5171	5169	9/30/2000 17:24	122.3	5048.7
					11/29/2000 14:30	122.35	5048.65
					3/13/2001 17:21	123.28	5047.72
					4/13/2001 11:20	123.73	5047.27
					5/29/2001 15:38	124.14	5046.86
					6/29/2001 16:40	124.02	5046.98
					8/7/2001 16:10	123.32	5047.68
					9/22/2001 16:48	122.91	5048.09
					11/10/2001 12:39	122.83	5048.17
					1/20/2002 15:25	123.31	5047.69
					3/12/2002 15:02	123.81	5047.19
					5/22/2002 17:12	124.55	5046.45
					6/27/2002 11:15	124.25	5046.75
					7/31/2002 17:20	124.08	5046.92
					8/22/2002 14:45	123.76	5047.24
					10/4/2002 13:40	123.3	5047.7
					1/2/2003 13:55	123.78	5047.22
					4/17/2003 15:00	124.4	5046.6
					7/10/2003 14:43	124.97	5046.03
103692	PERKINS CHARLES	06S-08E-29-DBDA	5371.5	5370	10/7/2000 12:47	10.78	5360.72
183903	USFS * SNOWBANK CAMPGROUND	06S-10E-30-BACB	5731.2	5729	7/26/2000 10:49	5	5726.2
135284	TRAUCHT SCOTT	07S-06E-27-DDD	5361.5	5360	9/26/1995 16:29	69.49	5292.01
104578	HUBBARD JIM	07S-06E-35-CCDD	5861	5860	9/26/1995 13:01	133.32	5727.68
140286	DICUOLLO AL	07S-06E-35-A	5611	5610	9/26/1995 13:30	64.71	5546.29
152662	PARENT HERSCHELL	07S-06E-36-BBDC	5645	5645	11/21/1995 11:30	73.56	5571.44

Ground-water level monitoring data

mnumber	site_name		Measured point elevation (ft)	Ground surface elevation (ft)	Date and time	Static water level (ft)	Ground-water elevation (ft)
104586	STATE HIGHWAY DEPARTMENT - MIN	07S-07E-20-CDDA	5085	5083	1/19/1993 14:15	68.37	5016.63
					4/14/1993 11:54	69.08	5015.92
					7/7/1993 16:08	62.68	5022.32
					9/21/1993 14:24	66.54	5018.46
					12/30/1993 8:10	68.91	5016.09
					3/29/1994 10:22	69.34	5015.66
					6/30/1994 19:52	74.61	5010.39
					9/30/1994 8:20	67.51	5017.49
					12/23/1994 8:50	69.07	5015.93
					3/31/1995 8:53	69.4	5015.6
					7/6/1995 5:31	65.84	5019.16
					10/16/1995 12:24	67.15	5017.85
					1/10/1996 8:43	68.56	5016.44
					4/12/1996 11:50	68.72	5016.28
					7/7/1996 17:23	61.02	5023.98
					10/10/1996 12:05	66.5	5018.5
					2/1/1997 10:11	68.25	5016.75
					4/4/1997 10:20	68.56	5016.44
					7/1/1997 9:54	60.56	5024.44
					10/7/1997 11:45	65.98	5019.02
					1/13/1998 10:20	68.39	5016.61
					4/3/1998 11:05	68.83	5016.17
					7/8/1998 11:55	62.32	5022.68
					1/18/1999 0:00	68.6	5016.4
					4/3/1999 10:20	69.01	5015.99
					7/25/1999 11:30	63.3	5021.7
					10/27/1999 11:35	67.05	5017.95
					1/29/2000 11:25	69.01	5015.99
					4/24/2000 12:50	68.12	5016.88
					7/27/2000 15:45	65.28	5019.72
					7/31/2000 9:35	67.1	5017.9
					11/18/2000 13:00	70.73	5014.27
					4/14/2001 11:41	72.39	5012.61
					7/26/2001 10:57	65.64	5019.36
					10/6/2001 10:35	67.76	5017.24
					1/21/2002 11:55	69.42	5015.58
					4/29/2002 11:58	68.91	5016.09
					7/23/2002 9:44	64.54	5020.46
					10/17/2002 13:53	66.68	5018.32
					1/7/2003 12:36	72.82	5012.18
					4/19/2003 12:11	69.75	5015.25
					7/18/2003 11:27	64.32	5020.68
					10/11/2003 13:40	66.67	5018.33
					1/23/2004 14:45	68.13	5016.87
					4/17/2004 9:35	68.42	5016.58
					7/20/2004 11:40	66.64	5018.36
					10/16/2004 10:12	67.19	5017.81
					1/10/2005 11:50	69.5	5015.5
166428	MT DEPT OF HWYS	07S-07E-23-CDAB	1926.27	4925	7/27/2000 8:20	10.25	1916.02
149227	HEDRICK GEORGE E. OR JOAN N.	07S-07E-30-ACAB	4997.6	4996	7/26/2000 13:19	27.28	4970.32
					11/30/2000 9:30	31.2	4966.4
					3/14/2001 15:40	32.52	4965.08
					4/13/2001 12:15	32.52	4965.08
					5/29/2001 14:17	24.86	4972.74
					6/30/2001 9:30	25.87	4971.73
					8/9/2001 9:30	27.97	4969.63
					9/23/2001 14:43	29.56	4968.04
					11/10/2001 13:09	30.9	4966.7
					1/20/2002 16:27	32.35	4965.25
					3/12/2002 15:31	32.78	4964.82
					5/23/2002 13:20	26.68	4970.92
					6/27/2002 9:40	24.04	4973.56
					8/1/2002 9:15	26.59	4971.01
					8/22/2002 18:15	27.73	4969.87
					10/4/2002 14:00	28.37	4969.23
					1/2/2003 14:20	31.58	4966.02
					4/17/2003 17:00	31.73	4965.87
					7/8/2003 18:00	25.92	4971.68

Appendix H:
Ground-water elevation data to construct the map on Plate 1

Ground-water level data used to make Plate 1

mnumber	Site name	Location (TRSt)	Measured point elevation (ft)	Ground surface elevation (ft)	Measurement date and time	Static water level (ft)	Ground-water elevation (ft)
165070	HARTER LINN	03S-08E-28-BABD	5522.3	5520	8/14/2000 12:53	27.19	5495.11
183900	LOOMIS	03S-09E-12-BABC	4552.1	4550	8/22/2002 11:50	10.02	4542.08
183899	SMITH BETTY	03S-09E-14-CACA	4580	4580	8/25/2000 11:00	5.5	4574.5
21567	NELSON SPRING CREEK RANCH	03S-09E-23-ADDA	4660.5	4659	8/22/2002 0:00	30.02	4630.48
211238	O'HAIR RANCH CO OBS-S	03S-09E-26-CCCC	4632	4630	8/27/2004 17:00	3.1	4628.9
170537	TECCA JOHN	03S-09E-26-DAAC	4802.5	4800	8/14/2000 19:00	179.55	4622.95
168006	BURNS LAURA	03S-09E-26-DDAC	4763.6	4762	8/11/2000 10:23	127.52	4636.08
159909	O'HAIR RANCH CO.	03S-09E-27-ADDA	4627.25	4625	8/22/2002 16:45	16.89	4610.36
99787	OHAIR RANCH COMPANY	03S-09E-27-BBBA	4656.45	4655	7/23/2002 8:50	37.73	4618.72
99790	SPRING CK.HILLS PROP	03S-09E-28-BBBD	5041	5038	8/13/2000 17:57	41.2	4999.8
184342	TECCA ALFRED	03S-09E-2-DDBA	4551	4550	8/28/2000 19:30	11.68	4539.32
99794	WARREN MACKEY L	03S-09E-32-ADAB	4851.8	4850	8/11/2000 13:54	195.1	4656.7
99795	ROSE ROY	03S-09E-32-DAAB	4835.5	4860	8/5/2000 16:00	60.49	4775.01
155222	JUMPING RAINBOW RANCH	03S-09E-35-ACBB	4643.1	4641	8/7/2000 13:37	11.06	4632.04
182357	BASINI ALBERT	03S-09E-36-ABAA	4886.89	4885	8/23/2002 11:00	30.51	4856.38
144463	PIPOLO ANTHONY & JOHN	03S-10E-19-ADCB	5033.6	5032	8/13/2000 13:09	243.67	4789.93
99828	MOONEYHAM DAVE	03S-10E-20-BBBB	5161.8	5158	8/12/2000 15:36	31.71	5130.09
99832	FONDA PETER	03S-10E-30-BDBB	5062	5050	8/14/2000 18:00	143.42	4918.58
185218	ALGER BARBARA & BELZ DAVE	03S-10E-30-CBBD	4994.8	4993	8/22/2002 12:00	113.04	4881.76
201446	LAWRIE K	03S-10E-30-CDCA	5005.2	5010	8/22/2002 12:17	92.87	4912.33
99837	LUDER A.ERDMAN	03S-10E-30-CDCD	5041.45	5040	7/23/2002 11:18	100.73	4940.72
151257	PEAVYHOUSE JOEL & HERMA	03S-10E-30-DBCA	5148.7	5147	8/22/2002 11:50	205.3	4943.4
138754	DOAK BRIAN J	03S-10E-30-DBCC	5097.9	5100	8/23/2002 12:10	174.88	4923.02
99840	SCHLEICHER EARL	03S-10E-30-DCBC	5082.55	5080	8/23/2002 10:50	79.82	5002.73
201444	BRAWNER QUENTIN	03S-10E-31-BBCC	4952	4951	8/22/2002 11:30	18.23	4933.77
99843	PEACOCK DOUG	03S-10E-31-DCBB	5201.6	5200	8/12/2000 13:51	71.57	5130.03
143002	HACKER LLOYD & BEVERLY	04S-08E-11-BDCB	5286.7	5285	8/14/2000 14:47	62.71	5223.99
155008	GEG PARKS	04S-08E-11-CBDC	5279.5	5277	8/14/2000 15:36	45.07	5234.43
182639	TRIPLE R RANCH	04S-08E-11-CDBD	5203.5	5220	8/14/2000 16:23	85.5	5118
149841	WALSH PETE	04S-08E-34-CCCC	5259	5257	8/22/2002 16:00	7.52	5251.48
100991	MITCHELLS MILE HIGH RANCH	04S-09E-11-BBCA	4701.3	4700	8/12/2000 11:25	31.26	4670.04
209229	MITCHELLS MILEHIGH RANCH OBS-D	04S-09E-11-BCAC	4701.65	4700	8/10/2004 10:45	31.96	4669.69
101004	PINE CREEK CHURCH	04S-09E-12-BCCB	4851.4	4850	8/23/2002 10:25	109.11	4742.29
121213	CHRISTIAN ELLERY C.	04S-09E-14-AACB	4856.4	4855	8/6/2000 12:26	152.62	4703.78
198713	HERITAGE REMBRANDT - AA RANCH	04S-09E-14-BDCC	4726.5	4725	7/23/2002 10:57	29.9	4696.6
153940	JORDAN LARRY	04S-09E-14-DCAA	4791.3	4790	8/6/2000 11:20	70.04	4721.26
100941	PINE CREEK SCHOOL DISTRICT 19	04S-09E-1-BCDD	4819.5	4817	8/23/2002 10:35	75.97	4743.53
101021	MCLAIN BERNARD	04S-09E-26-CACB	5015.5	5015	8/23/2002 10:10	26.59	4988.91
73357	GAMBLE DAVID	04S-09E-28-AACA	4746.7	4745	8/28/2000 13:45	30.17	4716.53
101037	GAMBLE DAVE	04S-09E-28-ADAB	4734.4	4740	8/28/2000 14:45	10.76	4723.64
101038	LOCH LEVEN FAS	04S-09E-28-CACC	4750	4750	8/7/2001 14:30	14.76	4735.24
131520	DOUGLAS DICK	04S-09E-28-CBDB	4832.8	4830	8/5/2000 12:54	101.43	4731.37
121836	JORDAN CHRISTOPHER	04S-09E-28-DACC	4761.9	4761	8/5/2000 10:28	25.53	4736.37
211602	JACKSON RAY	04S-09E-29-ABBC	4853	4850	8/10/2002 13:35	129.89	4723.11
183893	KANT BRAD & CRYSTAL	04S-09E-29-CCCC	4892.5	4890	8/22/2002 17:00	156.35	4736.15
163650	TOMLIN JOHN & MARCELLA	04S-09E-34-DBDC	4956.5	4955	8/4/2000 14:02	175.21	4781.29
100962	WEBER ROBERT L.	04S-09E-8-DCDB	4783	4780	8/22/2002 16:30	92.73	4690.27
175955	MURRAY WILLIAM	05S-08E-11-ADAD	4971.42	4970	8/22/2002 17:30	179.6	4791.82
169850	BLAIR STEVEN T. AND JENNIFER J.	05S-08E-11-BDDB	4971.4	4970	8/4/2000 15:48	162.69	4808.71
183894	CHEKOWSKI PETER	05S-08E-11-DAAD	4857.3	4855	8/22/2002 17:40	47.25	4810.05
155014	MEYERS NICK	05S-08E-11-DADA	4850.2	4850	8/28/2000 13:19	39.75	4810.45
151258	KNOLL PAT & AMY	05S-08E-12-DDBD	4857.5	4856	8/6/2000 16:59	61.2	4796.3
205557	AINSWORTH B NEAL/GALLATIN VALLEY \	05S-08E-13-ABAD	4960.2	4958	7/8/2003 12:00	170	4790.2
162941	ARROWHEAD SCHOOL DISTRICT 75	05S-08E-13-DDDD	4965	4963	8/7/2000 13:08	161.07	4803.93
205550	AINSWORTH B NEAL/GALLATIN VALLEY	05S-08E-14-AADA	4854.2	4852	7/8/2003 12:00	51.49	4802.71
206290	SACKETTES	05S-08E-14-ACBA	4851.37	4850	7/8/2003 13:00	24.33	4827.04
159750	SACKETT GARY AND SHANNON	05S-08E-14-ACBD	4851.63	4852	7/8/2003 13:30	24.33	4827.3
133369	ROBEY PATRICIA	05S-08E-14-DCAD	4911.6	4910	8/6/2000 15:35	84.04	4827.56
183891	TAYLOR JACK	05S-08E-25-ADDA	5041.5	5040	7/31/2002 16:10	232.81	4808.69
102486	STANDISH CHAD AND MORLEY PAT	05S-08E-25-BDBD	5011.82	5011	7/23/2002 10:16	187.14	4824.68
182640	OTIS BERT	05S-08E-27-CCBC	4890.5	4890	8/22/2002 15:00	11.11	4879.39
148585	ROBB LINDSAY C. & KRAFT SUSAN V.	05S-08E-27-DADC	5012	5012	8/6/2000 13:20	133.99	4878.01
102516	JENSEN ROBERT	05S-08E-28-AADB	5072.5	5071	8/1/2002 11:00	179.4	4893.1
169854	LLOYD SHIRLEY	05S-08E-28-ADDA	5013	5010	9/1/2000 18:52	105.65	4907.35
175962	DUNN SHERMAN	05S-08E-28-ADDB	5010.9	5010	8/22/2002 15:40	103.09	4907.81

Ground-water level data used to make Plate 1

mnumber	Site name	Location (TRSt)	Measured point elevation (ft)	Ground surface elevation (ft)	Measurement date and time	Static water level (ft)	Ground-water elevation (ft)
184345	WAID JOHN	05S-08E-28-DDBD	4885.8	4883	8/25/2000 12:07	5.73	4880.07
102536	HARTH PATRICIA	05S-08E-29-ACCD	5240	5240	8/27/2000 18:25	180.34	5059.66
135257	NORDIN MARK OR SHARON	05S-08E-2-ADCD	5039	5037	8/28/2000 15:38	223.6	4815.4
175963	OLSON JOHN	05S-08E-31-AADC	5157.5	5155	8/22/2002 15:20	138.58	5018.92
102557	GOLDEN AGE VILLAGE - WELL 2	05S-08E-32-ABCC	5082.9	5081	8/25/2000 14:40	43.95	5038.95
102560	GOLDEN AGE VILLAGE - WELL 1	05S-08E-32-ABCC	5131.5	5130	8/25/2000 15:15	59.45	5072.05
102566	HOAG M/M PHILLIP	05S-08E-32-BCC	5151	5150	4/18/2003 10:00	8.74	5142.26
160127	PARADISE VALLEY FIRE SVC. AREA	05S-08E-34-ACDA	4969.3	4968	8/5/2000 14:33	41.61	4927.69
183895	BRANDES JACK	05S-08E-34-CABC	4921.17	4920	8/9/2000 14:45	17.68	4903.49
183898	BRANDIS JACK JR	05S-08E-34-CCBD	5002.9	5000	8/9/2000 13:45	78.2	4924.7
175964	MCCULLEY MARK	05S-08E-35-ADAD	5101.5	5100	8/5/2000 15:29	196.83	4904.67
102464	INVERNESS LAND & CATTLE	05S-08E-9-DDDD	5061.5	5061	8/8/2001 12:30	162.72	4898.78
102608	HANS NORDBLOM	05S-09E-17-CAAA	4911.45	4912	8/22/2002 13:00	99.26	4812.19
201776	ADKINS MIKE	05S-09E-18-BBBA	4895.5	4893	7/8/2003 13:20	101.53	4793.97
192475	SHIMMIN RILEY	05S-09E-18-CDDC	4974.3	4972	7/9/2003 10:00	194.43	4779.87
102623	NEIL & STEFFESEN	05S-09E-19-DDBC	5041	5040	9/12/2000 14:48	229.1	4811.9
179428	WESTGEEST BOB	05S-09E-20-CACC	5059	5058	8/22/2002 13:15	252.88	4806.12
184344	SCHNEIDER GARY	05S-09E-22-CDCD	5437	5435	9/11/2000 16:11	207.27	5229.73
169858	JACKSON WILLIAM L & SANDRA	05S-09E-28-CCBC	5161.9	5160	10/4/2002 12:20	320.3	4841.6
196426	JACKSON WILLIAM L & SANDRA	05S-09E-28-CCBC	5161	5160	8/22/2002 13:10	100.43	5060.57
184346	MCMAN BILL	05S-09E-33-DDBD	5242.1	5240	9/12/2000 16:12	17.79	5224.31
148027	JOHNSON VAUGHN	05S-09E-5-BDCB	4837.8	4835	9/9/2000 17:35	65.43	4772.37
152007	MILL CREEK HEADWATERS OFFICE - JOH	05S-09E-5-CCAA	4839	4836	9/9/2000 18:45	54.6	4784.4
148813	WARFIELD WILLIAM S	05S-09E-8-CCAC	4841.85	4840	10/7/2000 13:25	45.85	4796
175612	WARFIELD WILLIAM	05S-09E-8-CDBD	4851.4	4850	10/7/2000 12:15	52.5	4798.9
138756	ELBOW CREEK RANCH	05S-09E-9-DDDD	4957	4957	8/23/2002 9:50	157.04	4799.96
183902	BRANDIS JACK	06S-07E-13-DBAA	4918.77	4917	8/10/2000 16:00	8.67	4910.1
124069	BRUTGER ALAN	06S-07E-18-DACB	5999.45	5698	10/8/2000 15:02	165.26	5834.19
103644	MDOT (EMIGRANT REST)	06S-07E-23-CDAB	4926.32	4925	7/23/2002 9:31	12.95	4913.37
103645	BROWNE MAXMILLION	06S-07E-34-CDDB	4985	4980	7/26/2000 16:22	27.31	4957.69
182638	WISE JOHN	06S-08E-14-ABAA	5422.7	5420	9/10/2000 12:25	20.22	5402.48
170555	DENTON JOHN	06S-08E-20-AAAA	5087.25	5086	8/22/2002 14:30	43.23	5044.02
176295	MORTON DAVE	06S-08E-20-BBAA	5171	5169	8/22/2002 14:45	123.76	5047.24
103692	PERKINS CHARLES	06S-08E-29-DBDA	5371.5	5370	10/7/2000 12:47	10.78	5360.72
170553	BRANDIS JACK	06S-08E-2-ACCC	5237.37	5235	8/23/2002 9:00	167.3	5070.7
103661	WARNICK VICTOR	06S-08E-7-DCBB	4952.9	4950	8/18/2000 8:40	48.78	4904.12
183896	COLL AUDREY	06S-08E-7-DDCD	4921.85	4920	8/16/2000 13:00	37.71	4884.14
183901	BALLANTYNE DOROTHY	06S-08E-8-ACCB	4901.25	4900	8/17/2000 13:42	19.08	4882.17
183897	HINKIE RICHARD	06S-08E-8-DBCD	4900.9	4900	8/16/2000 11:35	13	4887.9
183892	FAIR BARBARA	06S-08E-9-DCAC	5036.4	5034	8/22/2002 14:20	21.56	5014.84
135284	TRAUCHT SCOTT	07S-06E-27-DDD	5361.5	5360	9/26/1995 16:29	69.49	5292.01
140286	DICUOLLO AL	07S-06E-35-A	5611	5610	9/26/1995 13:30	64.71	5546.29
104578	HUBBARD JIM	07S-06E-35-CCDD	5861	5860	9/26/1995 13:01	133.32	5727.68
152662	PARENT HERSCHELL	07S-06E-36-BBDC	5645	5645	11/21/1995 11:30	73.56	5571.44
104586	MDOT- MINER SECTION HOUSE	07S-07E-20-CDDA	5085	5083	7/23/2002 9:44	64.54	5020.46
166428	MT DEPT OF HWYS	07S-07E-23-CDAB	1926.27	4925	7/27/2000 8:20	10.25	1916.02
149227	HEDRICK GEORGE E. OR JOAN N.	07S-07E-30-ACAB	4997.6	4996	8/22/2002 18:15	27.73	4969.87

Appendix I:
Surface-water sample analytical summary

Chemical analyses of stream samples

M Number	Site name	Location (TSRt)	Latitude	Longitude	Sample date	Sample ID	Lab pH	Lab SC (umohs/cm)	Common ions (dissolved mg/l)														
									Calcium	Chloride	Carbonate	Flouride	Iron	Bicarbonate	Potasium	Magnesium	Manganse	Sodium	Nitrate (N)	Ortho P	Total P	Silicate	Sulfate
184431	BIG CREEK	06S-07E-23BCBA	45.3033	-110.8375	10/08/00	2001Q0755	7.38	103	9.96	0.727	0.0	<.05	<.005	53.3	1.90	2.82	<.001	3.12	<.05 P	.078	<.05	26.7	<2.5
184427	EIGHT MILE CREEK/ YELLOWSTONE TRAIL	05S-08E-11CABD	45.4154	-110.7050	09/20/00	2001Q0680	7.78	77.9	6.15	<.5	0.0	<.05	.017	38.7	2.40	2.28	.002	2.68	<.5 P	.092	<.05	36.6	<2.50
184427	EIGHT MILE CREEK/ YELLOWSTONE TRAIL	05S-08E-11CABD	45.4154	-110.7050	10/28/76	--	7.7	--	6.7	2.9	0	0.1	0.09	43	2.6	1.8	--	2.6	0.03	--	0.14	29	1.1
184427	EIGHT MILE CREEK/ YELLOWSTONE TRAIL	05S-08E-11CABD	45.4154	-110.7050	04/05/77	--	7.4	68	5.9	0.8	0	0.1	0.05	32	2.8	2	--	2.4	0.01	--	--	36	4.2
184432	EMIGRANT CREEK	06S-08E-14BAAB	45.3208	110.7089	10/08/00	2001Q0756	7.83	155	17.8	<5	0	<.5	0.012	79.2	0.675	4.8	<.001	3.4	0.71	<.5	<.05	10.4	<25
184432	EMIGRANT CREEK	06S-08E-14BAAB	45.3208	110.7089	10/28/76	--	7.5	--	19	0.4	0	0.2	0.14	75	0.7	4.7	--	3	0.08	--	<.01	11	16
184432	EMIGRANT CREEK	06S-08E-14BAAB	45.3208	110.7089	04/05/77	--	7.8	169	21	0.6	0	0.1	--	75	0.9	5.6	--	3.3	0.08	--	--	10	19
184429	MILL CREEK/ 2ND BRIDGE	06S-09E-3BAAB	45.3507	-110.6089	09/20/00	2001Q0683	7.88	93.5	21.0	0.897	0.0	.059	<.005	112.0	1.44	7.69	.001	4.49	<.5 P	<.05	<.05	14.6	6.50
184429	MILL CREEK/ 2ND BRIDGE	06S-09E-3BAAB	45.3507	-110.6089	10/28/76	--	8.1	191	21	1.4	0	0.2	0.07	107	1.3	6.9	0.01	4	0.01	--	0.03	14	8.2
184429	MILL CREEK/ 2ND BRIDGE	06S-09E-3BAAB	45.3507	-110.6089	04/05/77	--	8.2	210	25	1.2	0	0.2	0.13	120	1.5	8.9	--	5.3	0.05	--	--	14	12
183330	PINE CREEK - DOWNSTREAM	09S-09E-4CAAD	45.0783	-110.6256	08/11/00	2001Q0390	7.92	108.1	11.6	<.5	0.0	.071	.012	63.7	1.75	3.47	<.001	4.43	<.05	<.05	<.05	21.3	<2.5
183329	PINE CREEK - UPSTREAM	09S-09E-3CBDA	45.0769	-110.6108	08/11/00	2001Q0389	7.86	103.2	10.4	<.5	0.0	.07	.010	58.6	1.53	3.20	<.001	4.31	<.05	<.05	<.05	21.2	2.51
184426	TRAIL CREEK/ YELLOWSTONE TRAIL	04S-08E-25BADA	45.4654	-110.6818	09/20/00	2001Q0681	7.8	286	28.6	1.45	0.0	.099	.024	146.4	3.38	12.6	.003	16.9	<.5 P	<.05	.098	29.0	40.9
--	SIX-MILE CREEK	06S-08E-16CBCB	45.2692	110.7744	10/28/76	--	8.1	8.1	20	0.8	0	0.1	0.06	124	1.6	11	--	3.8	0.09	--	<0.01	10	12
--	SIX-MILE CREEK	06S-08E-16CBCB	45.2692	110.7744	04/05/77	--	8.1	227	22	1.2	0	0.1	0.16	130	2.1	14	0.1	4.4	0.09	--	<0.01	10	15
--	YELLOWSTONE - CORWIN SPRINGS	08S-08E-30BDCC	45.4195	110.7934	02/10/99	--	7.6	261	17	13	0	1	0.055	78	5.1	5.7	0.021	22	0.22	0.01	0.025	28	39
--	YELLOWSTONE - CORWIN SPRINGS	08S-08E-30BDCC	45.4195	110.7934	05/26/99	--	7.7	82	7.6	1.6	0	0.2	0.035	34	1.1	2.4	0.01	4.2	0.07	0.03	0.43	15	4.4
--	YELLOWSTONE - CORWIN SPRINGS	08S-08E-30BDCC	45.4195	110.7934	08/09/99	--	8.2	138	9.3	4.9	0	0.6	0.025	49	2.4	3.3		12	<.05	<.01	0.028	17	13

***Note: shaded denote pre-existing data

Chemical analyses of stream samples

		Trace constituents (dissolved ug/l)																								
M Number	Site name	Silver	Aluminum	Arsenic	Boron	Barium	Berilium	Bromide	Cadmium	Cobalt	Chromium	Copper	Lithium	Mercury	Molybium	Nickle	Lead	Antimony	Selenum	Strontium	Titanium	Thallium	Uraium	Vandium	Zinc	Zirconium
184431	BIG CREEK	<1	<30	<1	<30	22.7	<2	<50	<2	<2	<2	<2		<1	<10	<2	<2	<2	<1	79.9	<1	<5		<5	<2	<2
184427	EIGHT MILE CREEK/ YELLOWSTONE TRAIL	<1	<30	<1	<30	11.8	<2	<50	<2	<2	<2	38.0		1.09	<10	6.11	<2	4.78	<1	38.8	<1	<5		<5	10.5	<2
184427	EIGHT MILE CREEK/ YELLOWSTONE TRAIL	--	--	--	7	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
184427	EIGHT MILE CREEK/ YELLOWSTONE TRAIL	--	--	--	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
184432	EMIGRANT CREEK	<1	<30	--	<30	42	<2	<500	<2	<2	<2	<2		1.68	<10	<2	<2		<1	159	<1	<5		<5	8.39	<2
184432	EMIGRANT CREEK	--	--	--	7	--	--	--	1	--	--	2	--	10	3	6	18	--	--	90	--			0.9	10	
184432	EMIGRANT CREEK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
184429	MILL CREEK/ 2ND BRIDGE	<1	<30	<1	<30	58.3	<2	<50	<2	<2	<2	<2		3.54	<10	<2	<2	<2	<1	174	<1	<5		<5	<2	<2
184429	MILL CREEK/ 2ND BRIDGE	--	--	--	7	--	--	--	--	--	--	--	--	--	--	6	1			170	--	--	--	1	--	--
184429	MILL CREEK/ 2ND BRIDGE	--	--	--	7	--	--	--	--	--	--	--		10	--	--	--	--	--	200	--	--	--	--	--	--
183330	PINE CREEK - DOWNSTREAM	<1	<30	1.93	<30	56.6	<2	<50	<2	<2	<2	<2	<1	2.22	<10	<2	<2	<2	<1	172	<1	<5		<5	<2	<2
183329	PINE CREEK - UPSTREAM	<1	<30	<1	<30	54.9	<2	<50	<2	<2	<2	<2	<1	2.36	<10	<2	<2	<2	<1	168	<1	<5		<5	<2	<2
184426	TRAIL CREEK/ YELLOWSTONE TRAIL	<1	<30	1.39	30.1	38.1	<2	<50	<2	<2	<2	<2		11.7	<10	<2	<2	<2	<1	272	<1	<5		<5	2.96	<2
--	SIX-MILE CREEK	--	--	--	5	--	--	--	--	--	--	--	--	--	2	6	--	--	--	360		--	--	0.9	--	--
--	SIX-MILE CREEK	--	--	--	2	--	--	--	--	--	--	--	--	10	--	--	--	--	--	350	--	--	--	--	--	--
--	YELLOWSTONE - CORWIN SPRINGS	<1	103	34		24	<1		<1	<1	2	<1		<.1	2	<1	<1	<1	<1			<1			2	
--	YELLOWSTONE - CORWIN SPRINGS																									
--	YELLOWSTONE - CORWIN SPRINGS																									

***Note: shaded denote pre-existing data

Appendix J:
Ground-water sample analytical summary.

Ground-water analytical summary

M Number	Site name	Location (TSRt)	Latitude	Longitude	Sample date	Sample ID	Lab pH	Lab SC	Common ions (dissolved mg/l) Calcium	Chloride	Carbonate	Flouride	Iron	Bicarbonate	Potasium	Magnesium	Manganse	Sodium	Nitrate (N)	Ortho P	Silicate	Sulfate
	Wells																					
7276	SCHNITZLER C/O JUMPING RAINBOW RANCH	03S-09E-35-DBBC	45.5319	110.5769	10/28/87	1987Q1010	7.22	242.1	30.6	0.7	0	0.1	0.014	127.4	2.4	6	0.006	5.4	0.65	<.1	9.5	8.3
7279	BERNTHAL PETER	03S-10E-19-ADCA	45.5638	110.5305	10/25/87	1987Q1005	7.87	352.3	35.7	1.3	0	0.2	<.002	204.9	1.7	20.3	<.001	3.5	0.48	<.1	12.6	9.2
7450	LINDEMAN TIM	04S-09E-4-DADD	45.5155	110.6102	10/27/87	1987Q1007	7.05	288.3	29.2	6.1	0	0.4	0.003	134.6	3.4	9.3	0.001	10.7	0.60	<.1	30.8	17.6
21567	NELSON SPRING CREEK RANCH	03S-09E-23-ADDA	45.5563	110.5744	09/22/93	1994Q0591	7.42	334	39.3	2.4	0	0.04	<.003	197	2.5	17.6	<.002	6.7	0.42	<.15	14.2	20.2
99787	OHAIR RANCH COMPANY	03S-09E-27-BBBA	45.5539	110.6085	05/16/02	2002Q1277	7.36	472	55.2	6.69	0	0.425	0.018	252.1	3.69	21	<.001	18.9	0.66	<.05	24.5	67
99795	ROSE ROY	03S-09E-32-DAAB	45.5323	110.6325	11/30/00	2001Q1034	7.43	2530	312	159	0	<2.5	0.036	161	10.1	178	<.001	86.4	3.25	<2.5	19.4	1323
99810	FORREST RAY	03S-09E-36-BDDC	45.5327	110.5600	10/27/87	1987Q1006	7.45	286.5	35.6	1	0	0.1	<.002	151.8	3	7.3	<.001	7.3	1.02	<.1	11.8	10.3
99837	LUDER A.ERDMAN	03S-10E-30-CDCD	45.5408	110.5402	09/22/93	1994Q0595	6.96	149	18.1	<.2	0	0.06	<.003	78	1.8	4.2	<.002	2.1	0.30	<.15	8.7	3.4
101004	PINE CREEK CHURCH	04S-09E-12BCCB	45.50528	110.5661	03/28/01	2001Q1036	7.17	104	12.8	<.5	0	<.05	<.005	57.3	2.03	3.43	<.001	0.88	<.5	<.05	6.28	5.12
101004	PINE CREEK CHURCH	04S-09E-12BCCB	45.50528	110.5661	07/01/01	2001070012-2	--	--	--	--	--	--	--	--	--	--	--	--	0.26	--	--	--
101038	LOCKLAVEN				07/01/01	2001070012-3	--	--	--	--	--	--	--	--	--	--	--	--	0.51	--	--	--
102486	STANDISH CHAD AND MORLEY PAT	05S-08E-25-BDBD	45.3752	110.6847	09/21/93	1994Q0590	7.33	385	49.2	5.4	0	0.24	0.016	201	3.4	13	<.002	16.1	2.11	<.15	23.4	34.1
102516	JENSEN ROBERT	05S-08E-28-AADB	45.3783	110.7340	11/30/00	2001Q1031	7.75	134	15.1	1.64	0	0.129	0.007	78.8	3.18	2.87	<.001	7.69	0.93	<.05	46.8	<2.5
102608	HANS NORDBLOM	05S-09E-17-CAAA	45.4014	110.6398	11/29/00	2001Q1037	7.62	234	31.1	0.881	0	<.05	<.005	141.5	1.4	8.93	<.001	4.59	<.5	<.05	16.4	5.92
102608	HANS NORDBLOM	05S-09E-17-CAAA	45.4014	110.6398	07/01/01	2001070012-8	--	--	--	--	--	--	--	--	--	--	--	--	0.16	--	--	--
103644	MONTANA HIGHWAY DEPT (EMIGRANT REST)	06S-07E-23-CDAB	45.295	110.8342	05/16/02	2002Q1276	7.76	209	26.1	0.908	0	0.153	0.012	146.4	3.76	8.78	0.001	6.6	<.5	<.05	24.6	5.99
104586	STATE HIGHWAY DEPARTMENT - MINER SECTION HOUSE	07S-07E-20-CDDA	45.2051	110.8933	09/21/93	1994Q0594	7.78	548	50.4	22	0	0.82	0.014	234	7.5	15.1	<.002	50.2	0.35	<.15	22	74.5
149227	HEDRICK GEORGE E. OR JOAN N.	07S-07E-30-AACD	45.2027	110.9019	11/30/00	2001Q1030	7.45	310	38.9	1.6	0	0.075	0.083	190.8	4.58	12	0.005	7.13	0.87	<.05	32.6	6.03
159909	O'HAIR				07/01/01	2001070012-1	--	--	--	--	--	--	--	--	--	--	--	--	0.52	--	--	--
169850	BLAIR STEVEN T. AND JENNIFER J.	05S-08E-11-BDDB	45.418	110.7042	11/30/00	2001Q1033	7.35	95	9.9	0.88	0	0.071	0.009	49.4	2.71	2.77	0.002	3.18	<.5	0.141	36.7	2.9
170537	TECCA JOHN	03S-09E-26-DAAC	45.5467	110.5703	11/28/00	2001Q1039	8.13	271	32.6	1.51	0	0.107	0.01	158.4	3.31	9.57	<.001	7.39	0.54	<.05	14.3	11.4
175962	DUNN SHERMAN	05S-08E-28-ADDB	45.3744	110.7338	11/29/00	2001Q1041	7.87	139	14.6	1.67	0	0.132	0.007	75.6	3.82	2.37	0.003	8.73	<.5	<.05	56.6	<2.5
175955	MURRY				06/30/01	2001070012-4	--	--	--	--	--	--	--	--	--	--	--	--	0.23	--	--	--
176295	MORTON DAVE	06S-08E-20-BBAA	45.3059	110.7793	11/29/00	2001Q1040	7.46	638	50.3	53.4	0	0.184	0.098	209.4	7.66	22.4	0.079	46.2	1.11	<.05	30.1	79.2
183891	LOOMIS				07/01/01	2001070012-11	--	--	--	--	--	--	--	--	--	--	--	--	0.59	--	--	--
182640	OTIS BURT				06/30/01	2001070012-6	--	--	--	--	--	--	--	--	--	--	--	--	0.32	--	--	--
183891	TAYLOR JACK	05S-08E-25-ADDA	45.3741	110.6711	11/29/00	2001Q1038	7.79	392	44.8	5.68	0	0.083	<.005	209.1	4.61	15.1	<.001	17.3	1.89	<.05	26.2	34.7
183891	TAYLOR JACK	05S-08E-25-ADDA	45.3741	110.6711	07/01/01	2001070012-10	--	--	--	--	--	--	--	--	--	--	--	--	2.27	--	--	--
183892	FAIR BARBARA	06S-08E-9-DCAC	45.3241	110.7473	11/29/00	2001Q1042	7	189	26.3	1.45	0	0.108	0.017	99.3	1.15	7.35	0.004	4.27	<.5	<.05	15.5	22
183892	FAIR BARBARA	06S-08E-9-DCAC	45.3241	110.7473	07/01/01	2001070012-9	--	--	--	--	--	--	--	--	--	--	--	--	1.16	--	--	--
183893	KANT BRAD & CRYSTAL	04S-09E-29-CCCC	45.4538	110.6494	11/30/00	2001Q1035	7.72	356	39.8	3.84	0	0.412	0.01	177.6	5.16	11.1	0.008	16.8	1.00	<.05	27.9	29.9
183893	KANT BRAD & CRYSTAL	04S-09E-29-CCCC	45.4538	110.6494	07/01/01	2001070012-5	--	--	--	--	--	--	--	--	--	--	--	--	1.14	--	--	--
183894	CHEKOWSKI PETER	05S-08E-11-DAAD	45.4159	110.6919	11/30/00	2001Q1032	7.43	130	13.3	2.59	0	0.158	0.006	65.1	3.12	3.34	0.002	6.21	<.5	0.085	34	6.77
183894	CHEKOWSKI PETER	05S-08E-11-DAAD	45.4159	110.6919	07/01/01	2001070012-7	--	--	--	--	--	--	--	--	--	--	--	--	0.41	--	--	--
198713	HERITAGE REMBRANDT - AA RANCH	04S-09E-14-BDCC	45.4901	110.5816	05/15/02	2002Q1278	7.3	257	31.5	3.82	0	0.123	0.011	151.5	3.1	8.47	<.001	7.3	0.51	<.05	17.2	11.8
211236	MITCHELLS MILE HIGH RANCH PUMPING WELL	05S-09E-11BCAC	45.5060	110.5859	04/14/04	050132-2	--	--	--	--	--	--	--	--	--	--	--	--	0.31	--	--	--
211237	OHAIR PUMPING WELL	03S-09E-26CCCC	45.5398	110.5398	4/14/2004	050132-1	--	--	--	--	--	--	--	--	--	--	--	--	0.51	--	--	--
	SPRINGS																					
7273	NELSON SPRING CR * JUMPING RAINBOW RANCH	03S-09E-26DCBD	45.5427	110.5769	10/23/87	1987Q1011	7.85	308.2	32.6	4	0	0.3	<.002	142	2.4	9.4	<.001	12	0.77	<.1	25.2	24.2
7274	SPRING * ARMSTRONG SPRING CREEK	03S-09E-35BBBA	45.5397	110.5869	10/26/87	1987Q1008	6.97	317.1	35.9	5.2	0	0.3	<.002	155.2	4	9.7	0.001	10	0.47	<.1	27.3	18.7
7272	ARMSTRONG SPRING CREEK * MASTER SPRINGS	03S-09E-26CCCC	45.5408	110.5886	10/23/87	1987Q1003	7.4	336.1	34	4.6	0	0.4	<.002	153.7	3.8	10.6	<.001	14.1	0.49	<.1	33	28.6
7275	ARMSTRONG SPRING CR * SOUTHERN-MOST SPRING	03S-09E-35CCAD	45.5280	110.5838	10/24/87	1987Q1004	7.21	267.9	27.3	4.6	0	0.3	0.004	123.5	3.5	8.3	<.001	10.3	0.53	<.1	22.1	18.4
7277	PAYNE SPRINGS * AT EAST RIVER RD	03S-09E-36BDAD	45.5352	110.5586	10/26/87	1987Q1012	6.95	221.7	27.6	0.6	0	<.1	<.002	117.6	2.5	6	<.001	4.2	0.61	<.1	10.5	6.9
--	CHICO COLD SPRING	06S-08E-12ACCC	45.3319	110.6856	07/09/76		8.1	200	25	1.5	0	0.4		105	0.6	3.6		6.4	0.11	0.01	15	5
--	CHICO HOT SPRING	06S-08E-01CDCC	45.3536	110.6908	10/28/76		7.2	518	37	12	0	0.9		172	6.6	8		31	0.26		31	42

***Note: shaded denote pre-existing data

Ground-water analytical summary

M Number	Site name	Silver	Aluminum	Arsenic	Boron	Barium	Berilium	Bromide	Cadmium	Cobalt	Chromium	Copper	Lithium	Mercury	Molybium	Nickle	Lead	Antimony	Selenum	Strontium	Titanium	Thallium	Uraium	Vandium	Zinc	Zirconium
		Trace constituents (dissolved ug/l)																								
	Wells																									
7276	SCHNITZLER C/O JUMPING RAINBOW RANCH	--	--	--	--	--	--	<100	--	--	--	--	--	--	--	--	--	--	--	36	--	--	--	--	--	--
7279	BERNTHAL PETER	--	--	--	--	--	--	<100	--	--	--	--	--	--	--	--	--	--	--	75	--	--	--	--	--	--
7450	LINDEMAN TIM	--	--	--	--	--	--	<100	--	--	--	--	--	--	--	--	--	--	--	150	--	--	--	--	--	--
21567	NELSON SPRING CREEK RANCH	<1	<30	<1	35	51.8	<2	<100	<2.	<2.	<2.	2.4	9	<.04	<10	<2	<2	<2	<1	162	<10.		--	<5.	9.6	<20.
99787	OHAIR RANCH COMPANY	<1	<30	2.4	148	64.7	<2	<50	<2	<2	<2	32.1	36.7	--	<10	2.19	<2	<2	<1	943	<1	<5	2.03	<5	12.5	<2
99795	ROSE ROY	<1	<30	5.18	325	18.1	<2	2680	<2	<2	<2	26.2	79.7	--	<10	<2	<2	41.2	19.4	11500	<1	<5	--	17	19.4	<2
99810	FORREST RAY	--	--	--	--	--	--	<100	--	--	--	--	--	--	--	--	--	--	--	43	--	--	--	--	--	--
99837	LUDER A.ERDMAN	<1	<30	<1	<30.	30.5	<2	<100	<2.	<2.	<2.	<2.	<6.	<.04	<10	<2	<2	<2	<1	35	<10		--	<5	17	<20
101004	PINE CREEK CHURCH	<1	<30	<1	<30	22.5	<2	<50	<2	<2	<2	<2	<1	--	<10	<2	<2	<2	<1	46.5	<1	<5	--	<5	13.6	<2
101004	PINE CREEK CHURCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
101038	LOCKLAVEN	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
102486	STANDISH CHAD AND MORLEY PAT	<1	<30	<1	<30.	79	<2	<100	<2.	<2.	<2.	<2.	<6.	<.04	<10	<2	<2	<2	<1	260	<10		--	<5.	<2	<20
102516	JENSEN ROBERT	<1	<30	1.64	<30	<2	<2	<50	<2	<2	<2	<2	5.53	--	<10	<2	<2	<2	<1	88.7	<1	<5	--	8.57	6.4	<2
102608	HANS NORDBLOM	<1	<30	<1	<30	74.1	<2	<50	<2	<2	<2	<2	3.59	--	<10	<2	<2	<2	<1	180	<1	<5	--	<5	12.8	<2
102608	HANS NORDBLOM	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
103644	MONTANA HIGHWAY DEPT (EMIGRANT REST)	<1	<30	10	<30	90.2	<2	<50	<2	<2	<2	<2	6.67	--	<10	<2	<2	<2	<1	152	<1	<5	2.03	<5	12.5	<2
104586	STATE HIGHWAY DEPARTMENT - MINER SECTION HOUSE	<1	<30	4.8	127	43	<2	<100	<2.	<2.	<2.	<2.	44	<.04	<10	<2	<2	<1	1.1	215	<10		--	<5	5.7	<20
149227	HEDRICK GEORGE E. OR JOAN N.	<1	<30	4.61	<30	67.1	<2	<50	<2	<2	<2	9.46	6.5	--	<10	<2	<2	<2	<1	224	<1	<5	--	<5	23.3	<2
159909	O'HAIR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
169850	BLAIR STEVEN T. AND JENNIFER J.	<1	<30	<1	<30	18.2	<2	<50	<2	<2	<2	2.74	1.05	--	<10	<2	<2	<2	<1	47.8	<1	<5	--	<5	15.7	<2
170537	TECCA JOHN	<1	<30	1.17	25.9	56.7	<2	<50	<2	<2	3.79	5.03	10.6	--	<10	<2	<2	<2	<1	116	<1	<5	--	<5	20.8	<2
175962	DUNN SHERMAN	<1	<30	1.68	<30	32.3	<2	<50	<2	<2	<2	<2	6.11	--	<10	<2	<2	<2	<1	107	<1	<5	--	8.18	7.64	<2
175955	MURRY	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
176295	MORTON DAVE	<1	<30	1.21	<30	72.5	<2	301	<2	<2	<2	<2	19.5	--	<10	<2	<2	2.1	3.05	535	<1	<5	--	<5	18.3	<2
183891	LOOMIS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
182640	OTIS BURT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
183891	TAYLOR JACK	<1	<30	1.68	36.5	116	<2	<50	<2	<2	<2	3.73	7.68	--	<10	<2	<2	<2	<1	312	<1	<5	--	<5	18.6	<2
183891	TAYLOR JACK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
183892	FAIR BARBARA	<1	<30	<1	<30	108	<2	<50	<2	<2	<2	<2	2.28	--	<10	<2	<2	<2	<1	243	<1	<5	--	<5	39.3	<2
183892	FAIR BARBARA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
183893	KANT BRAD & CRYSTAL	<1	<30	12	62.4	65.9	<2	<50	<2	<2	<2	<2	66.3	--	<10	<2	<2	<2	<1	216	<1	<5	--	<5	22.4	<2
183893	KANT BRAD & CRYSTAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
183894	CHEKOWSKI PETER	<1	<30	3.33	37.1	13.3	<2	<50	<2	<2	<2	3.59	15	--	<10	<2	<2	<2	<1	60.2	<1	<5	--	<5	17.1	<2
183894	CHEKOWSKI PETER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
198713	HERITAGE REMBRANDT - AA RANCH	<1	<30	<1	68.3	85.7	<2	<50	<2	<2	<2	<2	1.89	--	<10	<2	<2	<2	<1	84.2	<1	<5	1.81	<5	12	<2
211236	MITCHELLS MILE HIGH RANCH PUMPING WELL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
211237	OHAIR PUMPING WELL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	SPRINGS																									
7273	NELSON SPRING CR * JUMPING RAINBOW RANCH	--	--	--	--	--	--	<100.	--	--	--	--	--	--	--	--	--	--	--	160	--	--	--	--	--	--
7274	SPRING * ARMSTRONG SPRING CREEK	--	--	--	--	--	--	<100.	--	--	--	--	--	--	--	--	--	--	--	150	--	--	--	--	--	--
7272	ARMSTRONG SPRING CREEK * MASTER SPRINGS	--	--	--	--	--	--	<100.	--	--	--	--	--	--	--	--	--	--	--	180	--	--	--	--	--	--
7275	ARMSTRONG SPRING CR * SOUTHERN-MOST SPRING	--	--	--	--	--	--	<100.	--	--	--	--	--	--	--	--	--	--	--	120	--	--	--	--	--	--
7277	PAYNE SPRINGS * AT EAST RIVER RD	--	--	--	--	--	--	<100.	--	--	--	--	--	--	--	--	--	--	--	32	--	--	--	--	--	--
--	CHICO COLD SPRING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	CHICO HOT SPRING	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

***Note: shaded denote pre-existing data

Appendix K:
Summary of aquifer tests

Aquifer test summary

Test Location		Yeild (gpm)	Drawdown (ft)	Specific capacity (gpm/ft)	Transmissivity (ft^2/d)	Horizontal hydraulic conductivity (ft/d)	Vertical hydraulic conductivity (ft/d)	Specific yeild	Data Source
Till/Fan deposits									
03S-09E-25-ACAC		78	34.04	2.29	1,940	32	1.6	0.008	Fluidyne
06S-08E-02-ACCC		400	47	8.51	6,270	21	2.0	0.010	Mills
05S-09E-17-ADDC		140	19.04	7.35	12,300	31	1.0	0.012	Octagon/MBMG
Average value						**30**	**2**	**0.010**	
Mixture									
05S-08E-13-ABAD		93	44	2.11	87,800	97	9.7	0.078	Wells/MBMG
06S-08E-20-AACA	Shallow	29	0.94	30.85	5,040	72	7.0	0.110	MBMG
""	Deep	29	0.94	30.85	6,340	91	9.0	0.150	MBMG
Average value						**90**	**9**	**0.094**	
Alluvium/Outwash deposits									
05S-08E-14-ADDB		180	4	45.00	126,000	630	1.9	0.130	Wells/MBMG
03S-09E-26-CCCC	Shallow	88	1.78	49.44	69,100	560	5.5	0.100	MBMG
""	Deep	88	1.78	49.44	70,700	550	5.7	0.110	MBMG
04S-09E-11-BCAC	Shallow	80	1.65	48.48	209,000	600	6.0	0.120	MBMG
""	Deep	80	1.65	48.48	151,000	433	5.1	0.120	MBMG
Average value						**550**	**5**	**0.116**	

Appendix L:
Summary of tritium and CFC analyses

Summary of Tritium and CFC analyses

Sample		Tritium (TU)	error +/-	CFC concentration in water (pmole/Kg) CFC12	CFC11	CFC113	Field water quality parameters SC	T
101004	Pine Creek Church	10.3	1.0	2.990	6.332	0.507	60	6.7
101021	McLain	15.8	1.3	--	--	--	72	7.0
169850	Blair	7.2	0.8	--	--	--	101	8.0
17955	Murry	--	--	2.117	4.688	0.342	110	7.6
--	Yellowstone River	11.0	1.0	--	--	--	163	10.0
196426	Jackson (Shallow)	12.1	1.9	--	--	--	167	7.9
101038	Locklaven	--	--	2.320	4.430	0.331	190	8.9
183894	Chekowski	10.7	1.0	2.271	4.432	0.369	196	10.2
102608	Nordblom	12.8	1.1	2.791	5.715	0.464	209	8.0
7274	Armstrong Springs	13.8	1.1	--	--	--	212	10.5
211241	Denton obs-s	--	--	2.055	4.100	0.346	214	9.5
185218	Belz	14.5	1.2	--	--	--	220	10.1
18392	Fair	18.6	1.5	1.720	3.274	0.212	231	8.8
138756	Elbow Creek Ranch	16.8	1.4	--	--	--	241	10.0
170555	Denton (house well)	20.8	1.6	--	3.753	0.315	248	9.3
211242	Denton obs-d	--	--	1.898	3.753	0.315	250	10.2
159909	Ohair	--	--	1.620	3.091	0.170	251	9.6
7273	Nelson Springs	12.1	1.1	--	--	--	269	10.0
149227	Hedrick	14.2	1.2	--	--	--	271	11.3
183893	Kant	15.0	1.2	1.790	3.501	0.226	275	10.6
170537	Tecca	14.6	1.2	--	--	--	282	10.8
211239	Ohair obs-d	--	--	1.452	2.899	0.203	313	11.4
209228	Mitchel obs-2	--	--	1.358	11.720	0.113	315	12.5
211238	Ohair obs-s	--	--	1.527	7.787	0.404	317	12.0
189854	Loomis	--	--	2.191	3.868	0.358	345	11.6
209229	Mitchel obs-d	--	--	1.099	2.246	0.126	355	10.8
169858	Jackson (Deep)	30.1	2.2	--	--	--	358	12.7
182640	Otis	--	--	0.780	2.938	0.010	361	13.3
183891	Taylor	27.5	2.0	0.641	2.631	0.041	462	13.8
176295	Morton	3.8	0.8	--	--	--	558	13.1
Bedrock Wells								
99795	Rose	1.9	0.6	--	--	--	1660	
102516	Jensen	<0.8	0.5	--	--	--	122	13.6
17962	Dunn	<0.8	0.6	--	--	--	160	21.0

Appendix M:
Constituent loading to the Yellowstone River

Nitrate loading calculations

Ground-water discharge to river					#/Y	T/Y
Median nitrate concentration:			Average discharge		Mass contribution	
	0.5	mg/L	276	cfs	271,139	pounds/Y
	1.10E-06	pounds/L	2.46E+11	L/Y	**136**	Tons/Y
			199,952	afy		

Septic discharge

Population	2739		gpd	afy	Lpy	
septic return	50	gpdpc	136950	154	189,579,543	
Typical nitrate concentrations					#/Y	
	10	mg/L	0.000011	pounds/Y		
	20	mg/L	0.000022	pounds/Y		Percent of total
Loading rate	2,085	pounds/Y	1.04	Tons/Y		0.8%
	4,171		2.09	Tons/Y		1.5%

Agriculutre loading

	pounds/Y	acres	pounds/Y	Tons/Y	Percent of total
Assumned rate	5	17000	85000	42.5	31.3%

Natural contributions

Background concentration (baseflow at Corwin Springs)

	0.35	mg/L	2.46E+11	L/Y	Percent of total
	7.70E-07	pounds/L	189,797	Pounds/Y	
			95	Tons/Y	70.0%

River loading			afy	LPY	pounds/Y	Tons/Y
@ Corwin Springs	2733	cfs	1,437,874	1.77E+12	311,966	156
	0.08	mg/l	(flow wieghted average 1990-2004)			
	1.76E-07	#/L				
@Livingston	3342	cfs	1,758,279	2.17E+12	572,224	286
	0.12	mg/l	(flow wieghted average 1990-2004)			
	2.64E-07	#/L				
Difference						130

Appendix N:
Water balance and recharge budget calculations

Water balance calculations, water year 2002

days

A) Stream runnoff and infiltration

	Discharge to river	Recharge to ground water	Irrigation use	Total Stream	Evapo transpiration	Precipitation	% runoff
Barney	685	249	0	933	800	1,734	53.8%
Big	35,723	14,880	1,790	52,393	42,224	94,618	55.4%
Bullis	0	0	0	0	6,008	6,008	0.0%
Casc	225	1,570	456	2,252	1,522	3,774	59.7%
Ceder	13,440	0	821	14,262	11,401	25,662	55.6%
Conlin	0	852	0	852	725	1,578	54.0%
Deep	8,997	4,740	3,045	16,781	5,885	22,666	74.0%
Don	1,881	1,305	1,167	4,353	7,425	11,778	37.0%
Dry	0	1,477	0	1,477	5,089	6,566	22.5%
Elbow	5,528	5,716	1,601	12,845	10,932	23,777	54.0%
Emigrant	5,285	9,162	947	15,394	11,726	27,120	56.8%
Fridley	2,016	4,598	0	6,614	21,171	27,786	23.8%
Goldrun	0	471	0	471	504	975	48.3%
Golmeyer	0	2,785	0	2,785	11,353	14,138	19.7%
Mac	2,131	3,899	375	6,406	5,166	11,571	55.4%
Mill	72,746	21,478	10,171	104,395	76,315	180,710	57.8%
Mulheron	31,098	0	1,169	32,267	29,156	61,422	52.5%
Pine	6,500	5,704	2,118	14,322	5,807	20,129	71.2%
Pool	0	442	0	442	313	754	58.5%
Pole Gulch	0	120	0	120	394	514	23.4%
Rock	18,448	0	0	18,448	16,727	35,175	52.4%
Sheep	804	1,799	0	2,603	2,174	4,777	54.5%
Slip and Slide	3,004	0	0	3,004	2,716	5720	52.5%
Straw	5,166	676	306	6,148	4,980	11,128	55.3%
Strict	0	0	0	0	17,243	17,243	0.0%
Suce	2,821	660	800	4,281	5,983	10,264	41.7%
TomMiner	24,028	0	417	24,445	51,948	76,393	32.0%
Tie Gulch	0	689	0	689	1,718	2,407	28.6%
Trail	2,744	14,662	1,815	19,222	68,112	87,334	22.0%
6MI	11,048	7,340	991	19,379	23,775	43,154	44.9%
8mi	7,510	3,932	1,681	13,123	33,204	46,327	28.3%
Total	**261,828**	**109,207**	**29,671**	**400,706**	**482,495**	**883,201**	
Total Yellowstone	**241,383**						
error	**-20,445**	-8%					
B) Valley precipitation							
Valley	**0**	4,639	**0**		92,782	92,782	
C) Irrigation use							
Paradise Canal	724	2,000	6,164	7,280	0	0	
Park Canal	4,344	27,500	13,470	46,100	0	0	
	-48,312	**29,500**	**19,634**	**53,380**			
D) Out of area diversion							
Livingston Cnal	-12,844	0	0	0	0	0	
E) Recharge from bedrock aquifers							
Bedrock	0	56,469					
TOTAL	**180,227**	**199,815**	**49,305**	**12,844**	**533,793**	**975,983**	
	18.5%	**14.7%**	**5.1%**		**54.7%**		

Summary

Water balance	AFY	% of precipitation
Stream discharge	180,227	18%
Ground water recharge	199,815	20%
Irrigation	49,305	5%
Evapotranspiration	533,793	55%
Diversion out of area	12,844	1%
Total	975,983	

Recharge	AFY	% of recharge
Stream infiltration	109,207	55%
Ditch infiltration	29,500	15%
Valley precipitation	4,639	2%
Bedrock recharge	56,469	28%
	199,815	