GROUNDWATER RESOURCES OF IDAHO

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INTRODUCTION

Recent data indicate that Idaho is the largest user of groundwater within the northwestern United States (van der Leeden, et al., 1975). An estimated two million acre-feet (AF) are consumed annually for rural, public, industrial and agricultural uses. Ninety percent of this total, or 1.8 million AF per annum are used for irrigated agriculture. Remaining groundwater appropriations supply an estimated 80 percent of the rural and public water supplies, and 75 percent of the industrial water needs.

One of the tasks within the department's project to develop a state-managed underground injection control program consists of identifying and describing the aquifers of the State. The aquifers are then to be designated, based on current and future use, as underground sources of drinking water, or exempted from the designation.

After reviewing existing data, it was clear that, because of the complex geologic makeup of the state, identifying and describing each and every aquifer was neither practical nor possible. An alternate approach of identifying and describing the major groundwater flow systems was used. Seventy major groundwater systems, many comprising more than one aquifer, are described herein.

METHODS

Identification and description of the major groundwater systems in Idaho was based on the results of numerous geologic and hydrologic studies conducted by this Department, the U.S. Geological Survey, the University of Idaho and other state and federal agencies. Plates illustrating the general lithologies and potentiometric contours of the groundwater systems were modified from Whitehead and Parliman (1979). Arithmetic means and ranges of values for the physical and chemical constituents of groundwater were developed from existing data. The primary and secondary drinking water standards referred to in the text and presented in Table 4 are taken from USEPA (1975), USEPA (1977) and IDHW (1977).

Percentages of populations in each county using groundwater for domestic supplies were developed from municipal and community water use data compiled by the Idaho Department of Health and Welfare and the Idaho Public Utilities Commission. Projected 1980 and 2000 county populations (Meale and Weeks, 1978) were multiplied by these percentages to estimate the number of people in each county relying on groundwater for their domestic supplies. In order to relate the county-wide estimates to individual flow systems, these figures were further broken down as needed into National Bureau of Census county subdivisions using a ratio of subdivision to county population data (NBC, 1970)

DESCRIPTION OF THE MAJOR GROUNDWATER SYSTEMS IN IDAHO

Seventy major groundwater flow systems were identified in Idaho (Plate 1). The general lithologies, which usually represent the shallowest component of the regional system, and potentiometric contours and directions of groundwater movement are illustrated in Plates 2 and 3. Additional hydrogeologic characteristics, ranges and arithmetic means of physical and dissolved chemical constituents of groundwater by flow system, and primary and secondary drinking water standards are presented in Tables 1-4 (Appendix B). Descriptions of the major groundwater systems follow.

1. Kootenai Valley

The Kootenai Valley groundwater system is within the valley fill material comprised of fine-grained stream and lake sediments, and coarse glacial deposits (Dion and Whitehead, 1973; Parliman et al., 1980). Depth of the system is unknown, but probably extends to a basement formation of either Precambrian metamorphosed sediments or granitic rocks related to the Idaho Batholith. The flow system is recharged primarily by leakage from the Kootenai River and its tributaries, runoff from surrounding uplands, and downward percolation of precipitation and snowmelt.

Most wells observed were shallow (less than 200 ft. in depth) and were estimated to yield between 5 and 2 gpm (Table 1). The quality of groundwater was reported as generally suitable for domestic use, but nitrate plus nitrite as nitrogen occasionally exceeded the primary drinking water standard of 10 mg/I and dissolved solids sometimes exceeded the secondary standard of 500 mg/1 (Tables 2-3).

An estimated 3400 people currently utilize the Kootenai Valley groundwater system for their domestic water supply, and this number is projected to increase to 4700 by the year 2000.

2. Priest River

The Priest River groundwater system is within the unconsolidated valley fill material comprised of stream and lake sediments and glacial deposits (Parliman et al., 1980). Major sources of recharge are probably leakage from Priest Lake and Priest River, runoff from surrounding uplands and downward percolation of precipitation and snowmelt.

Wells investigated that penetrated the Priest River groundwater system were between 40 and 230 ft in depth and were estimated to yield between 10 and 60 gpm (Table 1). The quality of groundwater was reported as suitable for domestic use (Tables 2-3).

An estimated 700 people currently use this groundwater system for their domestic water supply, and this number is projected to increase to 950 by the year 2000.

3. Pend Orielle River

The Pend Orielle River groundwater system is within the valley fill material comprised of stream-deposited sands and gravels, clay, silt and fine-grained sands of lake bottoms, and glacial till (Walker, 1964). Recharge is provided by downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the Pend Orielle River, Pend Orielle Lake and tributary streams.

Static water levels in wells investigated were reported to range from 7 to greater than 200 ft below land surface and well yields varied from 6 to 60 gpm (Table 1). The quality of groundwater was reported as generally suitable for domestic use, but pH was occasionally below the lower limit of the secondary drinking water standard, and concentrations of dissolved iron and manganese sometimes exceeded the secondary standards.

Currently, around 7500 people utilize this flow system for their domestic water supply and this number is projected to increase to 10,000 by the year 2000.

4. Rathdrum Prairie

The Rathdrum Prairie groundwater system is primarily within glaciofluvial deposits that extend from Pend Orielle Lake to the Idaho-Washington border (Drost and Seitz, 1978). The deposits primarily consist of fine to coarse sands and gravels and are relatively free of fine-grained materials except near land surface. Thickness of the glacial deposits is reported to be approximately 400 ft at the state line, of which 280 ft is saturated. The flow system is thought to overlie the Latah Formation, comprised of fine grained, semi-consolidated sediments.

Recharge is by percolation of precipitation and irrigation water from surface sources, underflow from adjoining highlands, and leakage from the Spokane River, tributaries and lakes within the region (Drost and Seitz, 1978; Parliman, 1980).

Most wells observed in the Rathdrum Prairie area were between 100 to 500 ft in depth and were reported to yield between 5 to 1500 gpm (Table 1). The quality of groundwater was reported as generally suitable for domestic use, but concentrations of dissolved cadmium occasionally exceeded the primary drinking water standard and levels of dissolved iron sometimes exceeded the secondary standard (Tables 2-3).

Currently, an estimated 35,000 people in Idaho utilize this flow system for their domestic water supply, and this number is projected to increase to 61,000 by the year 2000.

5. Coeur d'Alene River - Silver Valley

The Coeur d'Alene River - Silver Valley flow system is primarily within the valley fill material comprised of fine grained lake deposits, stream-deposited silts, sands and gravels, and glacial deposits (Norbeck, 1974; Parliman, 1980). Basalt of the Columbia River Group intersects the lower end of the Silver Valley.

Within the Silver Valley arm, the sediments grade from poorly sorted gravels mixed with cobbles and boulders near the upper eastern terminus to fine-grained silts, sands and clays within the lower valley. Mine jig tailings have become intermixed with the surficial alluvium over much of the valley (Norbeck, 1974). Thickness of the valley fill material ranges from 30 ft near Wallace, Idaho to over 400 ft at Rose Lake.

The valley flow system is recharged from downward percolation of precipitation and snowmelt, leakage from the Coeur d'Alene River and its tributaries, and underflows from adjoining canyons.

Static water levels in wells investigated ranged from flowing to 199 ft below land surface and yields ranged from 5 to 3000 gpm (Table 1). Concentrations of dissolved cadmium in groundwater from the Silver Valley arm of the flow system were reported to occasionally exceed the primary drinking water standard of 0.01 mg/l (Table 3).

As estimated 12,000 people currently depend on the Coeur d'Alene River - Silver Valley groundwater system for their domestic water supply, and this number is projected to reach 15,000 by the year 2000.

6. Rock Creek

The Rock Creek flow system is within the Columbia River Basalts that flowed from the west into valley lowlands near the southern end of Coeur d'Alene Lake. Although little is known of the specific geologic makeup and hydrologic characteristics of this area, we can assume from studying similar systems that the flow system within the basalts is composed of isolated permeable zones of limited extent. Yields to wells are probably restricted, as indicated in Table 1, and depths to water may be quite variable. The quality of groundwater is apparently suitable for domestic use, but concentrations of dissolved zinc, iron and manganese may occasionally exceed secondary drinking water standards (Tables 2-3).

An estimated 700 people currently rely on this system for domestic water and this number is projected to increase to 1300 by the year 2000.

7. Hangman Creek

The Hangman Creek groundwater system is within the fine-grained sediments and underlying Columbia River Basalts that filled the valley lowlands. Little is known about the specific geologic and hydrologic characteristics of this system, but yields to wells are probably restricted. Recharge is likely from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from Hangman Creek and its tributaries.

Chemical analyses of groundwater are limited (Tables 2-3), but the quality is probably suitable for domestic use. Concentrations of dissolved iron may exceed the secondary drinking water standard of 0.3 mg/l.

An estimated 600 people currently utilize this groundwater system for their domestic water supply and this number is projected to increase to 1100 by the year 2000.

8. Palouse River

The Palouse River groundwater system is within the fine-grained sediments and Columbia River Basalts that filled the valley lowlands. Little is known about the specific geologic and hydrologic characteristics of this system, but yields to wells are apparently restricted (Table 1). Recharge is probably from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the Palouse River and tributaries. The quality of groundwater is apparently suitable for domestic use, but levels of dissolved iron and dissolved solids may exceed the secondary drinking water standards (Tables 2-3).

An estimated 3900 people currently utilize this groundwater system for domestic water and this number is projected to increase to 5400 by the year 2000.

9. St. Maries - St. Joe River

The St. Maries - St. Joe River groundwater system is within the valley fill material comprising fine to coarse-grained stream deposits and Columbia River Basalts, which flowed into the lowlands. Although little is known of the specific geologic makeup and hydrologic characteristics of the area, the stream deposits apparently yield adequate quantities of water to shallow wells for domestic use (Table 1). Yields to wells penetrating the basalts are probably restricted and depths to water may be quite variable. Recharge to the groundwater system is most likely from downward percolation of precipitation and snowmelt, underflows from adjoining canyons, and leakage from the St. Joe and St. Maries Rivers and their tributaries.

Chemical analyses of groundwater indicate that concentrations of dissolved iron and manganese may exceed the secondary drinking water standards.

An estimated 6400 people currently utilize this system for their domestic water supply and this number is projected to increase to 10,000 by the year 2000.

10. Moscow Basin

The Moscow Basin groundwater system is within the fine-grained sediments and underlying Columbia River Basalts that filled the valley lowlands. The fine-grained sediments generally yield only low quantities of groundwater to domestic wells, but the underlying basalts yield quantities under artesian pressure of up to 1500 gpm (Table 1). Water levels in wells penetrating the artesian aquifer have declined for more than 80 years (Stevens, 1960).

Recharge to the shallow sedimentary aquifers is by downward percolation of precipitation and snowmelt. Recharge to the deeper artesian aquifers is limited to water that percolates downward through the weathered mantle of crystalline rocks around the perimeter of the basin.

Chemical analyses of groundwater indicated that concentrations of dissolved cadmium and lead might occasionally exceed primary drinking water standards (Tables 2-3). Levels of pH were reported to occasionally fall outside the desired range of the secondary standards, dissolved solids and concentrations of dissolved sulfate and manganese sometimes exceeded secondary drinking water standards.

An estimated 17,000 people currently rely on this groundwater system for their domestic supply and this number is projected to increase to 24,000 by the year 2000.

11. Clearwater Uplands

The Clearwater uplands flow system is within the Columbia River Basalts that flowed into the valley lowlands forming the Clearwater Embayment. Although little is known of the specific geologic and hydrologic characteristics of the area, the flow system is likely composed of isolated saturated zones of limited extent. Yields to wells are probably low and depths to groundwater may vary considerably. Recharge is probably from downward percolation of precipitation and snowmelt, and leakage from streams that intersect permeable zones within the basalts.

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of mercury occasionally exceeded the primary drinking water standard and levels of dissolved manganese sometimes exceeded the secondary standard.

An estimated 10,000 people currently utilize this groundwater system for their domestic water supply, and this number is projected to increase to 14,000 by the year 2000.

12. Clearwater Plateau

The Clearwater Plateau groundwater system is within the Columbia River Basalts that flowed into the valley lowlands forming the Clearwater Embayment. Within the uppermost flows of basalt, the flow system is comprised of isolated saturated zones of limited extent (Castelin, 1976). These zones usually yield only low quantities of water to wells and depths to groundwater vary considerably (Table 1). Recharge is from downward percolation of precipitation and snowmelt, and from streams and lakes that intersect permeable zones within the basalts.

Older basalt flows within the groundwater system may yield large quantities of water to wells if an adequate source of recharge is present. The high potential for productivity within these flows is attributed to the lack of soil interbeds within the interflow contact zones (Cohen and Ralston, 1980). One such series of flows comprise the Russell Aquifer, which is both a current and potential source of groundwater for the cities of Lewiston, Idaho and Clarkston, Washington. The aquifer is recharged by the Snake and Clearwater Rivers where the permeable basalts are exposed to stream channels (Cohen and Ralston, 1980).

The quality of groundwater within the Clearwater Plateau flow system is reported as generally suitable for domestic use though levels of dissolved cadmium and lead occasionally exceeded primary drinking water standards. Concentrations of dissolved manganese sometimes exceeded the recommended secondary level of .05 mg/l.

An estimated 15,000 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 19,000 by the year 2000.

13. Joseph Plains

The Joseph Plains groundwater system is within that portion of the Clearwater Embayment that lies to the south and west of the Salmon River Canyon. Although little is known of the specific geologic and hydrologic characteristics of the area, the system is likely composed of isolated saturated zones of limited extent. Yields to wells are probably low, and depths to groundwater may vary considerably. Recharge is probably from downward percolation of precipitation and snowmelt, and leakage from streams that intersect permeable zones within the basalts. The quality of groundwater is unknown, but likely similar to that within adjacent basalt systems.

An estimated 240 people currently rely on this system for their domestic water supply, and this number is projected to increase to 300 by the year 2000.

14. Mill Creek

The Mill Creek flow system is probably within unconsolidated stream deposits. Specific data on the quality of groundwater, and hydrologic and geologic characteristics are unavailable. This system is within national forest boundaries and is likely used only as a seasonal domestic supply for forest service facilities.

15. Little Slate Creek

The Little Slate Creek flow system is probably within stream-deposited sediments. Specific data on the quality of groundwater and hydrologic and geologic characteristics are unavailable. This system is within national forest boundaries and is likely used only as a seasonal domestic supply for forest service facilities.

16. Elk City

The Elk City groundwater system is within the unconsolidated valley fill material. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from overlying streams. The quality of groundwater is reported as suitable for domestic use (Tables 2-3).

An estimated 350 people currently utilize the Elk City and Red River (17) flow systems for their domestic water supply, and this number is expected to increase to 450 by the year 2000.

17. Red River

The Red River groundwater system is likely within the unconsolidated valley fill material. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from overlying streams. The quality of groundwater is unknown, but most likely is suitable for domestic use.

An estimated 350 people currently utilize the Elk City (16) and Red River flow systems for domestic water supplies, and this number is expected to increase to 450 by the year 2000.

18. Meadows Valley

The Meadows Valley flow system is within the stream deposited sediments, glacial deposits and Columbia River Basalts that filled the valley lowlands. Little is known about the specific geologic and hydrologic characteristics of this system. Recharge is probably from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the Little Salmon River and its tributaries. The quality of groundwater is reported as suitable for domestic use (Tables 2-3).

An estimated 1,300 people currently rely on this system for their domestic water supply, and this number is expected to increase to 1,700 by the year 2000.

19. South Fork Salmon River

The South Fork Salmon River groundwater system is likely within the valley fill material composed of glacial and stream deposits. Little is known about the specific geologic and hydrologic characteristics of this system. Recharge is probably from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the South Fork Salmon River and its tributaries. The quality of groundwater is reported as suitable for domestic use (Tables 2-3).

An estimated 20 people currently utilize the South Fork Salmon River, Stibnite (20) and Deadwood River (23) flow systems for domestic water supplies, and this number is projected to increase to 30 by the year 2000.

20. Stibnite

The Stibnite groundwater system is likely within the valley fill material composed of glacial and stream deposits. Little is known about the specific geologic and hydrologic characteristics of this system. Recharge is probably from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the East Fork South Fork Salmon River and its tributaries. The quality of groundwater is unknown, but it is likely suitable for domestic use.

21. Long Valley-Round Valley

The Long Valley-Round Valley groundwater system is primarily within the valley fill material comprised of stream and lake sediments and glacial deposits. Little is known of the specific geologic and hydrologic characteristics of this system. Recharge is likely from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from Payette Lake, Cascade Reservoir and the South Fork Payette River and its tributaries.

Data describing the quality of groundwater are limited. The only sample documented indicates that the quality of groundwater is probably suitable for domestic use, but dissolved iron may exceed the secondary drinking water standard of 0.30 mg/l.

An estimated 2,200 year-round residents currently rely on this system for their domestic water supply, and this number is expected to increase to 3,200 by the year 2000. These population figures do not include seasonal second-home residents, which would probably double the number of people relying on this system for domestic use during the summer months.

22. Weiser River

The Weiser River groundwater system is within the Columbia River Basalts that underlie the valley lowlands throughout the basin, and sedimentary valley fill material. The sediments generally yield restricted quantities of groundwater to domestic and stock watering wells, while the basalt aquifers generally yield quantities suitable for irrigation and municipal supplies (Young et al., 1977).

Recharge to the basalt aquifers is primarily from precipitation and stream leakage that enters fractures and joints in the basalts where exposed in the highlands. The sedimentary aquifers are primarily recharged by downward percolation of precipitation, snowmelt, and irrigation water, and leakage from the Weiser River, its tributaries, and irrigation canals. Some recharge to the sediments may result from upward percolation from the underlying basalts (Young, et al., 1977)

Reported groundwater quality data indicate that levels of dissolved arsenic in water from the sedimentary aquifers may exceed the primary drinking water standard of 0.05 mg/l, and concentrations of dissolved iron may exceed the secondary standard (Tables 2-3). Levels of iron and manganese and values of pH may not be within the desired ranges of the respective secondary drinking water standards in water from the basalt components of the flow system.

An estimated 4, 100 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 5,500 by the year 2000.

23. Deadwood River

The Deadwood River flow system is likely within the unconsolidated valley fill material. Specific data on the quality of groundwater, and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the Deadwood River and its tributaries.

This system is primarily within national forest boundaries, and, combined with groundwater systems 19 and 20, provides domestic water supplies for an estimated 20 people.

24. Sawtooth Valley - Bear Valley

The Sawtooth Valley - Bear Valley groundwater system is likely within the unconsolidated valley fill material. Specific data on the quality of groundwater and the hydrologic and geologic characteristics are unavailable. Major sources of recharge to the flow system are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from Bear Valley Creek, Marsh Creek, Valley Creek, the Salmon River and their tributaries.

An estimated 370 people currently rely on this system for their domestic water supply, and this number is expected to increase to 460 by the year 2000. These population figures do not include seasonal second-home residents, which would increase the number of people relying on the system for domestic water supplies during the summer months.

25. Garden Valley

The Garden Valley flow system is probably within the unconsolidated valley fill material. Specific data on the quality of groundwater, and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the middle and South Forks of the Payette River and their tributaries.

An estimated 530 people currently rely on this groundwater system for their domestic water supply, and this number is expected to increase to 1,000 by the year 2,000. These population figures do not include seasonal second home residents, which would increase the number of people relying on the system for domestic water supplies during the summer months.

26. Scott Creek - Mann Creek

The Scott Creek - Mann Creek groundwater system is primarily within the sedimentary valley fill material comprised of sand, silt and clay (Young et al., 1977). Yields to wells are generally low, but a sand and gravel aquifer near Weiser yields adequate quantities of groundwater for municipal and agricultural production. The groundwater system is recharged by downward percolation of precipitation and snowmelt, leakage from overlying tributaries to the Snake River, and infiltration of imported irrigation water.

The quality of groundwater is generally suitable for domestic use, but dissolved solids and concentrations of dissolved iron and manganese may exceed the secondary drinking water standards.

As estimated 6,500 people currently rely on this groundwater system for their domestic water supply, and this number is expected to increase to 9,000 by the year 2000.

27. Payette Valley

The Payette Valley groundwater system is primarily within the unconsolidated valley fill material comprising of sands, gravels, silts and clays. Sand and gravel aquifers yield quantities of groundwater suitable for agriculture and municipal use (Norvitch, 1966). The groundwater system is recharged primarily by river runoff from the surrounding mountains, leakage from the Payette River and its tributaries, and infiltration of diverted irrigation water.

The quality of groundwater is reported as generally suitable for domestic use, but nitrate plus nitrite as nitrogen and concentrations of dissolved fluoride occasionally exceeded primary drinking water standards (Tables 2-3). Levels of dissolved iron and manganese, and dissolved solids commonly exceeded the secondary standards.

An estimated 27,000 people currently rely on this system for their domestic water supply, and this number is expected to increase to 33,000 by the year 2000.

28. Grimes Creek

The Grimes Creek groundwater system is probably within the unconsolidated valley fill material. Specific data on the quality of groundwater and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation or precipitation and snowmelt, runoff from surrounding uplands, and leakage from Grimes Creek its tributaries.

An estimated 570 people currently rely on the Grimes Creek and Mores Creek (29) groundwater systems for domestic water supplies, and this is expected to increase to 1100 by the year 2000. These population figures do not include seasonal second-home residents, which would increase the number of people relying on the system for domestic water supplies during the summer months.

29. Mores Creek

The Mores Creek groundwater system is probably within the unconsolidated valley fill material. Specific data on the hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from Mores Creek and its tributaries. The quality of groundwater is reported as generally suitable for domestic use (Tables 2-3).

An estimated 570 people currently rely on the Mores Creek and Grimes Creek (28) groundwater systems for domestic water supplies, and this is expected to increase to 1100 by the year 2000. These population figures do not include seasonal second-home residents, which would increase the number of people relying on the system for domestic water supplies during tile summer months.

30. Boise Valley

The Boise Valley groundwater system is primarily within unconsolidated deposits of silt, sand, clay and fine gravel. Total thickness of the sediments is estimated to be 2500 ft in the Boise-Nampa area (Dion, 1972). In places, Snake River Basalts are intercalated with the sedimentary deposits. The flow system is recharged primarily by leakage from the Boise River, drainage from the mountains to the north of the valley, and infiltration of diverted irrigation water. Yields to wells are reported to be sufficient for municipal and agricultural use throughout most of the valley.

The quality of the groundwater is generally suitable for domestic use (Tables 2-3). However, concentrations of nitrate plus nitrite as nitrogen, and dissolved arsenic, cadmium and lead are reported to occasionally exceed primary drinking water standards. Dissolved solids and concentrations of dissolved copper, iron, manganese and zinc may occasionally exceed the secondary standards.

An estimated 240,000 people currently rely on this groundwater system for their domestic water supply, and this number is expected to increase to 400,000 by the year 2000.

3 1. Mountain Home Plateau

The Mountain Home Plateau groundwater system is primarily within unconsolidated deposits of clay, silt, sand and gravel, Snake River Basalts and, at depth, silicic volcanics of the Idavada Formation. Thickness of the formations overlying the granitic basement complex is estimated to be at least 10,000 ft (Young, 1977). The flow system is primarily recharged from the infiltration of imported irrigation water, leakage from the Boise River between Lucky peak and Barber Dams, drainage from mountains to the north of the plateau, and direct infiltration of precipitation into the Idavada Volcanics, where exposed.

All wells investigated were finished in either sedimentary or basalt aquifers. Static water levels in wells penetrating unconsolidated formations ranged from 3 to 355 ft, while water levels in wells finished in basalts ranged from 13 to 425 ft below land surface (Table 1). Yields to wells penetrating unconsolidated formations ranged from 20 to 2700 gpm, while wells finished in basalts yielded from 12 to 3600 gpm.

The quality of groundwater was reported as generally suitable for domestic use, but dissolved solids, pH and concentrations of dissolved iron and manganese were occasionally outside of the desired ranges of the secondary drinking water standards (Tables 2-3).

An estimated 26,000 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 35,000 by the year 2000.

32. Homedale - Murphy

The Homedale - Murphy groundwater system is primarily within sedimentary sequences of unconsolidated to consolidated clay, silt, sand and gravel, basalts of the Banbury and Bruneau Formations and, at depth, silicic volcanics (Mundorff, et al., 1964; Ralston and Chapman, 1969). The system is recharged by drainage from the Owyhee Mountains to the south, and direct infiltration of precipitation into the silicic volcanics, where exposed in the highlands.

All wells investigated were finished in either sedimentary or basalt aquifers. Static water levels ranged from 3 to 425 ft below land surface and yields to wells ranged from 3 to 3600 gpm (Table 1). Levels of dissolved fluoride in the groundwater often exceeded the primary drinking water standards and dissolved solids and concentrations of dissolved iron and manganese occasionally exceeded secondary standards (Tables 2-3).

An estimated 5,700 people currently rely on this system for their domestic water supply, and this number is expected to increase to 6,500 by the year 2000.

33. South Fork Boise River

The South Fork Boise River flow system is likely within the unconsolidated valley fill material. Specific data on the quality of groundwater, and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the South Fork Boise River and its tributaries.

An estimated 200 people currently rely on this ground water system for their domestic water supply, and this number is expected to increase to 280 by year 2000.

34. Bruneau - Grandview

The Bruneau-Grandview groundwater system is primarily within sedimentary sequences of unconsolidated to consolidated clay, silt, sand and gravel, basalts of the Banbury and Bruneau Formations and, at depth, silicic volcanics (Mundorff et al., 1964; Ralston and Chapman, 1969). The system is recharged by drainage from the Owyhee Mountains to the south, and direct infiltration of precipitation into the silicic volcanics, where exposed in the uplands.

All wells investigated were finished in sedimentary aquifers (Table 1). Levels of fluoride and dissolved lead in the groundwater were reported to occasionally exceed the primary drinking water standards, while dissolved solids, pH and dissolved iron were sometimes outside of the desired ranges of the secondary standards (Tables 2-3).

An estimated 1,800 people currently rely on this system for their domestic water supply, and this number is expected to increase to 2, 100 by the year 2000.

The Blue Gulch area, within the eastern portion of this flow system, has been designated as a critical groundwater area in response to recently declining water levels.

35. Juniper Basin

The Juniper Basin groundwater system is probably within the valley fill materials comprised of stream and lake sediments. Specific data on the quality of groundwater, and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from overlying streams.

This system is within a remote area of Idaho and is probably not utilized as a domestic water supply.

36. Duck Valley

The Duck Valley flow system is likely within the valley fill material comprised primarily of stream-deposited sediments. Specific data on the quality of groundwater, and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from the Owyhee River and its tributaries.

An estimated 160 people currently rely on this flow system for their domestic water supply and this number is expected to increase to 180 by the year 2000.

37. Camas Prairie

The Camas Prairie groundwater system is primarily within the valley fill material comprised of stream and lake sediments, and basalts of the Bruneau Formation (Young, 1978). The system is recharged from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from Camas Creek and its tributaries. Static water levels in wells analyzed ranged from flowing to 197 ft below land surface, and reported yields to irrigation wells varied from 400 gpm to greater than 2,000 gpm (Table 1).

The quality of groundwater was reported as generally suitable for domestic used although levels of dissolved fluoride and nitrate plus nitrite as nitrogen occasionally exceeded primary drinking water standards. Concentrations of dissolved iron and manganese in the groundwater usually exceeded the secondary standards (Tables 2-3).

An estimated 950 people currently rely on this flow system for their domestic water supply, and this number is projected to decrease to 750 by the year 2000.

38. Big Wood River - Silver Creek

The Big Wood River - Silver Creek groundwater system is primarily within the sedimentary valley fill materials. Estimated thickness of the sediments ranges from 30 ft to greater than 580 ft (Castelin and Winner, 1975). Basalts of the Snake River Group also contain groundwater in the southeast part of the Silver Creek basin (Moreland, 1977). The system is recharged from downward percolation of precipitation and snowmelt, leakage from the Big Wood river and its tributaries, and infiltration of surface water diverted for irrigation (Castelin and Chapman, 1972).

Wells penetrating the sedimentary aquifers are reported to yield from 4 to approximately 5,000 gpm (Table 1), and the quality of groundwater is reported as generally suitable for domestic use (Tables 2-3).

An estimated 7,000 people currently rely on this groundwater system for their domestic water supply, and this number is expected to increase to 13,000 by the year 2000.

39. Snake Plain

The Snake Plain groundwater system is within the basalts of the Snake River Group, the associated sedimentary and pyroclastic interbeds and the river and lake-deposited sediments that were laid down around the southern, eastern and northern margins of the basalt flows. This flow system is considered one of the most prolific in the world with an estimated total annual recharge of 6,200,000 AF (Mundorff et al., 1964). The system is recharged by downward percolation of precipitation and snowmelt, underflow from tributary basins, leakage from streams entering or crossing the plain and infiltration of surface water diverted for irrigation.

Reported static water levels in wells penetrating this groundwater system varied from 4 to 450 ft below land surface, and reported discharges from irrigation wells ranged from 269 to 6,820 gpm (Table 1). The quality of groundwater was reported as generally suitable for domestic water supplies, but concentrations of dissolved solids, chloride, and iron occasionally exceeded the secondary drinking water standards (Tables 2-3). Although not included in the data summary of Table 2, levels of nitrate plus nitrite nitrogen have been reported to exceed the primary drinking water standard of 10.0 mg/l in some domestic groundwater supplies from Minidoka County.

An estimated 200,000 people currently utilize the Snake Plain groundwater system for their domestic water supply, and this number is projected to increase to 280,000 by the year 2000.

40. Salmon Falls Creek - Rock Creek

The Salmon Falls Creek - Rock Creek groundwater system is primarily within basalts of the Banbury Formation and, at depth, silicic volcanics (Crosthwaite, 1969a). Alluvial deposits along stream channels may also contain limited quantities of groundwater. The system is recharged from downward percolation of precipitation and snowmelt, runoff from surrounding uplands, leakage from streams crossing the basin, and infiltration of surface water diverted for irrigation. Reported static water levels in wells penetrating the flow system varied from 72 to 512 ft below land surface and reported discharges ranged from 10 to 3000 gpm (Table 1).

Reported levels of dissolved fluoride in groundwater often exceeded the primary drinking water standard, and concentrations of dissolved cadmium occasionally exceeded the primary standard of 0.01 mg/l (Tables 2-3). Dissolved solids, pH and concentrations of dissolved iron and sulfate were reported as occasionally being outside of the desired ranges of the secondary drinking water standards.

An estimated 53,000 people currently rely on this system for their domestic water supply, and this number is expected to increase to 80,000 by the year 2000.

41. Goose Creek - Golden Valley

The Goose Creek - Golden Valley groundwater system is within the unconsolidated alluvial deposits, basalts of the Snake River Group and, at depth, silicic volcanics (Crosthwaite, 1969b). The system is recharged primarily by drainage from the uplands to the south, direct infiltration of precipitation into the silicic volcanics and related rocks, where exposed in the mountains, leakage from streams crossing the basin, and infiltration of surface water diverted for irrigation. Reported static water levels in wells penetrating the flow system ranged from 100 to 500 ft below land surface (Table 1).

The quality of groundwater was reported as generally suitable for domestic water supplies (Tables 2-3). However, levels of dissolved fluoride occasionally exceeded the primary drinking water standard, and pH, dissolved solids and sulfate were reported as occasionally being outside of the desired ranges of the secondary standards.

Three areas within the boundaries of this flow system, Artesian City, Cottonwood and Oakley -Kenyon, have been designated as critical groundwater areas in response to recently declining water levels.

An estimated 16,000 people currently rely on this groundwater system for their domestic groundwater supply, and this number is expected to increase to 28,000 by the year 2000.

42. Marsh Valley

The Marsh Valley groundwater system is likely within the sedimentary valley fill materials. Specific data on the, hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and leakage from Marsh Creek and its tributaries. The quality of groundwater is reported as generally suitable for domestic use (Tables 2-3).

An estimated 4,300 people currently rely on the Marsh Valley and Raft River (43) groundwater systems for domestic use, and this number is projected to increase to 5,300 by the year 2000.

43. Raft River Valley

The Raft River Valley groundwater system is primarily within the poorly indurated volcanic and sedimentary deposits of the Salt Lake Formation, sediments of the Raft lake beds, and the shallow alluvium (Walker et al., 1970). Major sources of recharge are runoff from the surrounding uplands, leakage from Raft River and its tributaries and infiltration of surface water diverted for irrigation. Reported static water levels in wells penetrating the flow system ranged from flowing to 276 ft below land surface, and reported yields to irrigation wells varied from 250 to 4,000 gpm (Table 1).

The quality of groundwater is reported as generally suitable for domestic use, but dissolved solids, and levels of dissolved sulfate and chloride recently exceeded secondary drinking water standards (Tables 2-3). Though not included in the data summary of Table 2, Department records indicated that levels of dissolved fluoride in groundwater may occasionally exceed the primary drinking water standard for that constituent.

A large part of the flow system has been designated as a critical groundwater area in response to recently declining groundwater levels.

An estimated 4,300 people currently rely on the Raft river Valley and Marsh Valley (42) flow systems for their domestic water supply and this number is projected to increase to 5,300 by the year 2000.

44. Black Pine - Curlew Valley

The Black Pine - Curlew Valley groundwater system is primarily within the stream-deposited alluvium comprised of silt, sand and gravel, and the poorly indurated sediments and volcanics of the Salt Lake Formation (Chapman and Young, 1972). Thickness of the water-bearing sediments is estimated to be 4,000 to 5,000 ft. Major sources of recharge are runoff from the surrounding uplands, leakage from overlying streams and infiltration of surface water diverted for irrigation. Reported static water levels in wells penetrating the groundwater system ranged from flowing to 420 ft below land surface and yields to wells varied from 8 to 2700 gpm (Table 1).

The quality of groundwater is reported as adequate for domestic use in that primary drinking water standards were not exceeded within the scope of the measured constituents. However, reported levels of dissolved solids, chloride and sulfate often exceeded the secondary standards (Tables 2-3).

A large part of the flow system has been designated as a critical groundwater area in response to declining groundwater levels.

An estimated 190 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 210 by the year 2000.

45. Rockland Valley

The Rockland Valley groundwater system is primarily within stream and lake-deposited sediments, and the underlying pyroclastic and volcanic rocks (Mundorff, et al., 1964). Specific data on the geologic and hydrologic characteristics are unavailable. Major sources of recharge are runoff from the surrounding uplands and leakage from Rock Creek and its tributaries. The quality of groundwater, based on one sample, is apparently suitable for domestic use (Tables 2-3).

An estimated 4,000 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 5,400 by the year 2000.

46. Arbon Valley

The Arbon Valley groundwater system is primarily within the stream-deposited alluvium that filled the valley lowlands (Chapman and Young, 1972). Near the mouth of the valley, underlying volcanic and pyroclastic rocks may yield substantial quantities of groundwater to deep wells (Mundorff, et al., 1964). Thickness of the water-bearing sediments may exceed 3,000 ft in places. Major sources of recharge are runoff from the surrounding uplands and leakage from Bannock Creek and its tributaries.

Reported static water levels in wells penetrating the flow system ranged from flowing to 28 ft below land surface and reported yields to irrigation wells varied from 450 to 3,400 gpm (Table 1). The quality of groundwater was reported as generally suitable for domestic use. However, concentrations of nitrate plus nitrite as nitrogen may occasionally exceed the primary drinking water standard of 10 mg/l, and dissolved solids may exceed the secondary standard (Table 2). Data describing concentrations of trace constitutes in groundwater were unavailable.

An estimated 680 people currently rely on this flow system for their domestic water supply, and this number is expected to increase to 920 by the year 2000.

47. Pocatello Valley

The Pocatello Valley flow system is primarily within the valley fill materials comprised of fine-grained lake deposits (Chapman and Young, 1972). Specific hydrologic and water quality data are unavailable, but yields to wells are probably low. The major source of recharge is runoff from the surrounding uplands.

An estimated 2,300 people currently utilize the Pocatello Valley and Malad Valley (48) flow systems for their domestic water supply, and this number is projected to increase to 2,400 by the year 2000.

48. Malad Valley

The Malad Valley groundwater system is primarily within the unconsolidated alluvial deposits of clay, silt, sand and gravel (Burnham et al., 1969; Pluhowski, 1970). A shallow 170 to 200 ft thick sand and gravel deposit containing interbedded lenses of clay is considered the principal aquifer of the flow system and, where penetrated, can yield substantial quantities of artesian water to irrigation wells. Static water levels are reported to range from flowing to 20 ft below land surface (Table 1). The groundwater system is primarily recharged by downward percolation of precipitation and snowmelt, infiltration of surface runoff from the surrounding uplands into alluvial fans, leakage from overlying streams and irrigation canals, and infiltration of excess irrigation water.

Data describing the quality of groundwater are unavailable, but it is likely similar to that of the Black Pine - Curlew Valley (44) and Cache Valley (50) systems. Generally, the quality of groundwater is probably suitable for domestic use, but levels of dissolved solids may exceed the secondary standard of 500 mg/l.

An estimated 2,300 people currently utilize the Malad Valley and Pocatello Valley (47) groundwater systems for their domestic groundwater supply, and this number is projected to increase to 2,400 by the year 2000.

49. Marsh Creek - Lower Portneuf River

The Marsh Creek - Lower Portneuf River groundwater system is primarily within the unconsolidated valley fill materials and underlying poorly indurated sediments and volcanics of the Salt Lake Formation (Norvitch and Larsen, 1970). Basalts of the Snake River Group have filled part of the lower Portneuf Valley between the towns of McCammon and Inkom, Idaho, and may also contain substantial quantities of groundwater. The major sources of recharge are downward percolation of precipitation and snowmelt, leakage from tributaries to the Portneuf River and Marsh Creek, and infiltration of surface water diverted for irrigation. Reported yields to wells penetrating the flow system varied from 20 to 2600 gpm (Table 1).

The quality of groundwater is reported as suitable for domestic use, though concentrations of nitrate plus nitrite as nitrogen occasionally exceeded the primary drinking water standard of 10.0 mg/1 (Tables 2-3). Levels of dissolved solids, pH, iron and manganese were reported as sometimes being outside of the desired ranges of the secondary standards.

An estimated 55,000 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 83,000 by the year 2000.

50. Cache Valley

The Cache Valley groundwater system is primarily within the unconsolidated valley fill materials and the underlying poorly indurated sediments and volcanics of the Salt Lake Formation (Dion, 1969). Reported static water levels in wells penetrating the flow system ranged from flowing to 116 ft below land surface, and reported yields to wells varied from 3 to 2500 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, leakage from surface streams along the margins of the valleys, and infiltration of surface water diverted for irrigation.

The quality of groundwater is reported as generally suitable for domestic use, but levels of dissolved cadmium occasionally exceeded the primary drinking water standard of 0.01 mg/l, and dissolved solids and concentrations of dissolved iron frequently exceeded secondary standards (Tables 2-3).

An estimated 8, 100 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 9,300 by the year 2000.

51. Portneuf Valley - Gem Valley

The Portneuf Valley - Gem Valley groundwater system is primarily within the valley fill materials comprised of unconsolidated alluvium, canyon-filling Blackfoot Basalts and, at depth, poorly indurated sediments and volcanics of the Salt Lake Formation (Norvitch and Larson, 1970). Thickness of the valley fill materials may exceed 8,000 ft in places. Reported static water levels in wells penetrating the flow system ranged from flowing to 198 ft below land surface; and reported yields to wells varied from 40 to 3000 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, leakage from surface streams and impoundments overlying the system, infiltration of surface water diverted for irrigation, and possibly, some underflow from the adjoining Gem Valley - Gentle Valley groundwater system (52).

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of dissolved silver at times exceeded the primary drinking water standard of 0.05 mg/l (Tables 2-3). Dissolved solids and iron occasionally exceeded the desired levels of the secondary standards.

An estimated 2,500 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 4,000 by the year 2000.

52. Gem Valley - Gentile Valley

The Gem Valley - Gentile Valley groundwater system is primarily within the valley fill materials comprised of canyon-filling Blackfoot Basalts, unconsolidated alluvium and, at depth, poorly indurated sediments and volcanics of the Salt Lake Formation (Dion, 1970). Reported static water levels ranged from I to 174 ft below land surface, and reported yields to wells varied from 30 to 2700 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, leakage from surface streams along the margins of the valleys, infiltration of surface water diverted for irrigation, and underflow form the Soda Springs groundwater system (53).

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of nitrate plus nitrite as nitrogen occasionally exceeded the primary drinking water standard of 10.0 mg/1 (Tables 2-3). Dissolved solids and pH were reported as occasionally being outside of the desired ranges of the secondary standards.

An estimated 3,900 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 6,000 by the year 2000.

53. Soda Springs

The Soda Springs groundwater system is primarily within the valley fill materials comprised of canyon-filling Blackfoot Basalts, unconsolidated alluvium and, at depth, poorly indurated sediments and volcanics of the Salt Lake Formation (Dion, 1970; Seitz and Norvitch, 1979). Reported static water levels ranged from flowing to 265 ft below land surface and reported yields to wells varied from 10 to 3,400 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, leakage from surface streams along the margins of the basin, seepage from Blackfoot Reservoir and possible underflow from the Bear River-Dingle Swamp groundwater system (54).

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of nitrate plus nitrite as nitrogen occasionally exceeded the primary drinking water standard of 10.0 mg/1 (Tables 2-3). Levels of dissolved solids and dissolved iron, and values of pH were reported as occasionally being outside of the desired ranges of the secondary standards.

An estimated 6,200 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 10,000 by the year 2000.

54. Upper Blackfoot River

The Upper Blackfoot River groundwater system is primarily within the unconsolidated valley fill materials and the underlying Dinwoody and Wells Formations comprised of limestone, sandstone and other marine sediments (Ralston, et al., 1977). Although the structural geology of the area has been studied in great detail, specific hydrologic and water quality data are limited to phosphate mining sites and are of little use in defining the nature and extent of the overall groundwater system.

Major sources of recharge to the flow system are downward percolation of precipitation and snowmelt into the alluvium, infiltration into the Dinwoody and Wells Formations where exposed in the uplands, and leakage from tributaries to the Blackfoot River. The alluvial aquifers are, in places, recharged by the sedimentary rock aquifers, while in other areas the saturated alluvium may lose water to the underlying sedimentary formations. The quality of groundwater in this system is most likely suitable for domestic use.

An estimated 400 people currently rely on the Upper Blackfoot River and Star Valley-Sage Valley (50) groundwater systems for their domestic water supply, and this number is projected to increase to 660 by the year 2000.

55. Bear River - Dingle Swamp

The Bear River - Dingle Swamp groundwater system is primarily within the unconsolidated valley fill materials and the underlying poorly indurated sediments and volcanics of the Salt Lake Formation (Dion, 1969). Reported static water levels in wells penetrating the flow system ranged from flowing to 56 ft below land surface, and reported yields to wells varied from 5 to 1,800 gpm (Table 1). In central Bear Lake Valley, the water table is at or near land surface forming a large marshy area known as Dingle Swamp. Major sources of recharge are downward percolation of precipitation and snowmelt, and leakage from surface streams along the margins of the valleys.

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of nitrate plus nitrate as nitrogen sometimes exceeded the primary drinking water standard of 10.0 mg/1 (Tables 2-3). Dissolved solids and sulfate were also reported to occasionally exceed the desired levels of the secondary drinking water standards.

An estimated 5,200 people currently rely on this system for their domestic water supply, and this number is projected to increase to 6, 100 by the year 2000.

56. Blackfoot Reservoir

The Blackfoot Reservoir groundwater system is likely within the valley-fill materials comprised of unconsolidated alluvium and the canyon filling Blackfoot Basalts. Sedimentary deposits of pre-Tertiary origin may also yield groundwater in limited quantities where fractured or weathered. Major sources of recharge are probably downward percolation of precipitation and snowmelt, runoff from the adjacent uplands and leakage from the Blackfoot reservoir and overlying streams.

Hydrologic and water quality data were available for only one well, which penetrates the pre-Tertiary sediments. The static water level was reported at 15 ft below land surface and the quality was reported as generally suitable for domestic use (Tables I3).

The number of people utilizing this system for domestic water supplies is known, but probably less than 50.

57. Willow Creek - Grays Lake

The Willow Creek - Grays Lake groundwater system is primarily within the valley-filling sediments and volcanics, and sedimentary rocks of the Wayan and related preTertiary formations (Parliman, personal communication). Reported static water levels in wells ranged from flowing to 120 ft below land surface (Table 1). Major sources of recharge are likely downward percolation of precipitation and snowmelt, direct infiltration into permeable sedimentary rock formations, where exposed, and runoff from surrounding uplands.

With the exception of total dissolved solids, the quality of groundwater is reported as generally suitable for domestic use, but data describing trace constituents are lacking (Tables 2-3).

An estimated 500 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 800 by the year 2000.

58. South Fork Snake River

The South Fork Snake River groundwater system is within the valley-filling sediments and volcanics, and sedimentary rocks of the Wayan and related pre-Tertiary formations (Parliman, personal communication). Reported static water levels in wells ranged from flowing to 500 ft below land surface, and reported yields to wells varied from 3 to 75 gpm (Table 1). The flow system is recharged primarily by downward percolation of precipitation and snowmelt, direct infiltration into sedimentary rock formations, where exposed, and runoff from the surrounding uplands.

The quality of groundwater is reported as generally suitable for domestic use. However, water obtained from the unconsolidated to poorly indurated sediments may occasionally contain dissolved fluoride levels in excess of the primary drinking water standard, and dissolved solids and concentrations of sulfate and chloride frequently exceeded the recommended levels of the secondary standards (Table 2). Water obtained from the basalts occasionally was reported to contain dissolved solids in excess of the secondary drinking water standard of 500 mg/l. Data describing concentrations of trace elements in groundwater were unavailable.

An estimated 1,000 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 1,300 by the year 2000.

59. Star Valley - Sage Valley

The Star Valley - Sage Valley groundwater system is likely within the unconsolidated valley fill material and the underlying pre-Tertiary sedimentary rocks. This flow system is probably recharged by downward percolation of precipitation and snowmelt, direct infiltration into permeable sedimentary rock formations, where exposed, and runoff from the surrounding uplands.

Specific hydrogeologic characteristics and water quality data are limited to one well (Tables 1-3). The reported static water level was 20 ft, the discharge was 15 gpm and the quality was suitable for domestic use.

An estimated 400 people currently rely on the Star Valley - Sage Valley and Upper Blackfoot River (54) groundwater systems for their domestic water supply, and this number is expected to increase to 660 by the year 2000.

60. Teton Valley

The Teton Valley groundwater system is primarily within stream and glacial deposited sediments, silicic volcanics and pre-Tertiary sedimentary rocks (Kilburn, 1964). Major sources of recharge are downward percolation of precipitation and snowmelt, runoff from the surrounding uplands, direct infiltration into permeable sedimentary rock formations, where exposed, and downward migration of surface water diverted for irrigation. Static water levels in wells were reported to range from flowing to 375 ft below land surface, and reported yields varied from 2 to 1400 gpm (Table 1).

The quality of groundwater is reported generally suitable for domestic use, but pH and levels of dissolved iron were occasionally outside of the desired ranges of the secondary drinking water standards (Tables 2-3).

An estimated 5,500 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 7,500 by the year 2000.

61. Island Park

The Island Park groundwater system is primarily within the valley-filling stream and glacial deposits, rhyolitic ash flows and basalt (Whitehead, 1978). Thickness of the alluvium near Henrys Lake is reported to exceed 3,6000 ft. Reported static water levels in wells penetrating the flow system varied from I to 225 ft, and reported specific capacities ranged from 1.7 to 113 gpm/ft (Table 1). The flow system is recharged primarily by downward percolation of precipitation and snowmelt that falls within the basin.

The quality of groundwater is reported as generally suitable for domestic use (Table 2). However, levels of dissolved fluoride occasionally exceeded the primary drinking water standard, and pH and dissolved solids were sometimes outside of the desired ranges of the secondary standards. Concentrations of trace constituents in the groundwater are unknown.

An estimated 420 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 520 by the year 2000. These population figures do not include seasonal second home residents, which would increase the number of people relying on the system for domestic water during the summer months.

62. Birch Creek Valley

The Birch Creek Valley groundwater system is primarily within the valley fill materials comprised of stream, lake and glacial deposits (Parliman, unpublished data). Specific hydrologic and water quality data are unavailable due to a lack of development in the valley. The flow system is likely recharged by downward percolation of precipitation and snowmelt, and infiltration of runoff from the surrounding uplands.

The number of people relying on this groundwater system for domestic water supplies is unknown, but probably less than 50.

63. Lemhi Valley

The Lemhi Valley groundwater system is primarily within the valley fill materials comprised of stream, lake and glacial deposits (Parliman, in prep.). Marine sediments may also yield limited quantities of groundwater to wells along the eastern flank of the valley. Reported static water levels in wells penetrating the flow system ranged from 2 to 78 ft below land surface and reported yields varied from 1 to 2240 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, runoff from the surrounding uplands, and infiltration of surface water diverted for irrigation.

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of dissolved fluoride occasionally exceeded the primary drinking water standard (Table 2). Levels of dissolved sulfate, chloride, iron and dissolved solids sometimes exceeded the secondary drinking water standards (Table 3).

An estimated 1,800 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 2,200 by the year 2000.

64. Little Lost River Valley

The Little Lost River Valley groundwater system is primarily within the valley fill materials comprised of stream, lake and glacial deposits (Parliman, unpublished data). Basalts of the Snake River Group underlay the sediments in the southern part of the valley near Howe and yield substantial quantities of groundwater to irrigation wells (Clebsch et al., 1974). Reported static water levels in wells penetrating the flow system ranged from 46 to 278 ft below land surface and reported yields to wells varied from 10 to 2,475 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, runoff from surrounding uplands, and infiltration of surface water diverted for irrigation.

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of dissolved iron occasionally exceeded the desired limit of the secondary drinking water standards (Tables 2-3).

An estimated 280 people currently rely on this groundwater system for their domestic water supply, and this number is projected to remain constant over the next 20 years.

65. Pahsimeroi Valley

The Pahsimeroi Valley groundwater system is primarily within the valley fill materials comprised of stream, lake and glacial deposits (Parliman, unpublished data). Reported static water levels in wells penetrating the flow system ranged from flowing to 165 ft below land surface, and reported yields to wells varied from 50 to 3850 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, runoff from the surrounding uplands, and infiltration of surface water diverted for irrigation.

The quality of groundwater is reported as generally suitable for domestic use, but concentrations of trace elements are unknown (Tables 2-3).

An estimated 150 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 200 by the year 2000.

66. Big Lost River Valley

The Big Lost River Valley groundwater system is primarily within the valley fill materials comprised of stream, lake and glacial deposits (Parliman, unpublished data). Thickness of the valley fill is reported to range from 150 ft at the northern end near Chilly to over 2,5000 ft at the southern end near Arco. Basalts of the Snake River Group, interbedded in the alluvium within the lower end of the valley, and carbonate rocks along the northeast flank, may also transmit large quantities of groundwater (Crosthwaite et al., 1970). Reported static water levels in wells penetrating the flow system ranged from 4 to 600 ft below land surface, and reported yields to wells varied from 10 to 4,000 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, underflow from the Copper Basin flow system, runoff from surrounding uplands and infiltration of surface water diverted for irrigation.

The quality of groundwater is reported as generally suitable for domestic use (Tables 2-3). However, concentrations of nitrate plus nitrite as nitrogen may exceed the primary drinking water standard, and levels of dissolved iron may exceed the desired limit of the secondary standards.

An estimated 4,400 people currently rely on this groundwater system for their domestic water supply, and this number is projected to increase to 4,800 by the year 2000.

67. Copper Basin

The Copper Basin groundwater system is primarily within unconsolidated glacial deposits (Crosthwaite et al., 1970). Specific data on the quality of groundwater and hydrologic and geologic characteristics are unavailable. Sources of recharge are likely runoff from the surrounding mountains and leakage from overlying streams. This groundwater system is within national forest boundaries and is likely used only as a seasonal domestic supply for forest service facilities.

68. Round Valley

The Round Valley groundwater system is primarily within the valley fill materials comprised of stream and glacial deposits (Parliman, unpublished data). Reported static water levels in wells penetrating the flow system ranged from 6 to t20 ft below land surface, and reported yields to wells varied from 1 to 200 gpm (Table 1). Major sources of recharge are downward percolation of precipitation and snowmelt, runoff from the surrounding uplands and possibly leakage from overlying streams.

The quality of groundwater is reported as generally suitable for domestic use (Tables 2-3).

An estimated 970 people currently rely on this flow system for their domestic water supply, and this number is projected to increase to 1,200 by the year 2000.

69. Upper Salmon River

The Upper Salmon River groundwater system is primarily within the valley fill materials comprised of stream and glacial deposits (Parliman, unpublished data). Reported static water levels in wells penetrating the flow system ranged from 10 to 65 ft below land surface, and reported yields varied from 1 to 22 gpm (Table 1). Major sources of recharge are underflow from adjoining groundwater systems, downward percolation of precipitation and snowmelt, runoff from surrounding uplands and possible leakage from overlying streams.

The quality of groundwater is reported as generally suitable for domestic use (Tables 2-3).

An estimated 1,600 people currently rely on the Upper Salmon River and North Fork Salmon River (70) groundwater systems for their domestic water supply, and this number is projected to increase to 2,000 by the year 2000.

70. North Fork Salmon River

The North Fork Salmon River groundwater system is primarily within the valley fill materials comprised of stream and glacial deposits (Parliman, unpublished data). Specific data on the quality of groundwater and hydrologic characteristics are unavailable. Sources of recharge are likely downward percolation of precipitation and snowmelt, runoff from surrounding uplands and leakage from overlying streams.

An estimated 1,600 people currently rely on the North Fork River and Upper Salmon River (69) groundwater systems for their domestic groundwater supply, and this number is projected to increase to 2,000 by the year 2000.

SUMMARY

The quality of groundwater available to wells within a given flow system is dependent on:

1. precipitation within the basin of the groundwater system,

2. groundwater underflow from one flow system into another,

3. the capacity of exposed or shallow unsaturated formations to conduct infiltrating surface water into the groundwater system, and

4. the lithology and continuity of the saturated zones.

Within North and Central Idaho (flow systems 1-17), precipitation is adequate to maintain most groundwater systems at or near maximum capacity. However, because of either limited infiltration, or restricted permeability, flow systems within fine-grained lake deposits or the Columbia River basalts generally yield only limited quantities of groundwater to wells. The most productive groundwater systems, such as Rathdrum Prairie (4) or Coeur d'Alene River - Silver Valley (5), are within the coarse stream and glacial deposited materials. Older basalt components, which lack soil buildup within the interflow zones, may also yield large quantities of groundwater when adequate recharge to the system is available.

Capacities of several major groundwater systems in Southwest and South Central Idaho are limited by a lack of water available as recharge, in addition to unfavorable geologic characteristics. Large areas within the Bruneau - Grandview (34), Goose Creek - Golden Valley (41) and Raft River Valley (43) flow systems have been designated as critical groundwater areas in response to declining groundwater surface elevations. These systems are all located south of the Snake River (Plate 1).

Generally, the most productive groundwater systems in these regions of the state are within basalts, silicic volcanics and coarse-grained sediments. Adequate water for recharge is supplied from precipitation in nearby mountains, primarily to the north of the Snake River Plain, and infiltration of surface water, often diverted for irrigation. One of these systems, the Snake Plain (39), underlies a large part of South Central and Southeast Idaho, and is considered one of the most prolific groundwater systems in the world.

Within Southeast Idaho (systems 44-61, plus the eastern half of 39), several groundwater systems contain large areas where yields to wells are low, or static water levels are declining. A large part of the Black Pine - Curlew Valley (44) flow system has been designated as a critical groundwater area, and the Pocatello Valley (47) and parts of the Malad Valley (48) groundwater systems yield only limited quantities to wells.

Adequate water for recharge combined with suitable aquifer formations have resulted in generally productive flow systems along the eastern margin of the State *systems 49-61). The most productive lithologic zones are comprised of coarse-grained alluvium and stream sediments, poorly indurated sediments and volcanics, fractured or porous sedimentary rocks of marine origin, basalts, and silicic volcanics.

Groundwater systems underlying the mountain valleys of East Central Idaho (systems 62-70) are primarily within valley-filling stream, lake and glacial sediments, and, near the northern boundary of the Snake River Plain, basalts of the Snake River Group. Recharge, primarily from precipitation falling within the respective basins, is adequate and yields to wells are generally suitable to meet agricultural and domestic needs.

The quality of groundwater is primarily dependent upon sources of recharge, physical and chemical interactions within the geologic environment, time of retention within the subsurface settings, and the effects of man's activities. Current groundwater conditions in Idaho are primarily attributed to influence of the natural phenomena.

Generally, the quality of groundwater in Idaho is reported as suitable for domestic use. The only constituent observed to consistently exceed primary drinking water standards within a major flow system was fluoride. Levels in excess of 4 mg/I were usually observed in samples collected from the Homedale - Murphy (32) and Salmon Falls Creek - Rock Creek (40) groundwater systems. Concentrations of fluoride were reported to occasionally exceed the primary standard in groundwater from seven additional systems in Southwest, South Central, Southeast, and East Central Idaho. The high-fluoride groundwaters are thought to be of natural origin.

Levels of nitrate-nitrogen were reported to exceed primary drinking water standards in samples collected from eleven major groundwater systems. However, the high nitrate groundwaters were found only in small areas or individual wells, and were usually associated with relatively shallow alluvial flow systems underlying agricultural or residential areas. Principal sources of nitrate contamination of groundwater are nitrogen fertilizer applications and septic tank effluent.

Trace elements in concentrations exceeding primary drinking water standards were occasionally observed in groundwater from eleven major flow systems. The principal sources of trace element contamination in the Coeur d'Alene River - Silver Valley groundwater system (5) are thought to be related to nearby mining and smelting activities. Most other cases where concentrations of trace elements were reported to exceed the primary standards are attributed to natural sources.

Level of iron and/or manganese were reported to commonly exceed secondary drinking water standards in three major groundwater systems in southern Idaho, and excessive concentrations were occasionally observed in 24 additional systems. In most areas, the high levels of iron and manganese can be attributed to natural sources.

Levels of dissolved solids were reported to commonly exceed the secondary drinking water standard of 500 mg/I in five major groundwater systems in Southwest, South Central and Southeast Idaho. Levels occasionally exceeded the secondary standard in samples from 19 additional flow systems.

Concentrations of chloride, sulfate, zinc and copper in samples of groundwater were occasionally reported to exceed the secondary drinking water standards, and pH levels were sometimes reported as outside of the desired range of the secondary standard.

Groundwater systems with known water shortages, or that contain water that does not meet the primary drinking water standards on a widespread basis are primarily situated in Southern Idaho, south of the Snake River. The quality and quantity of groundwater throughout the rest of the State is generally adequate to meet current domestic, industrial and agricultural needs. However, careful management is imperative to insure sufficient supplies of good-quality groundwater to meet future demands.

APPENDIX A
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APPENDIX B

Hydrogeologic Characteristics and Physical and Chemical Quality of Groundwater for the Major Flow Systems in Idaho.

TABLE 1. HYDROGEOLOGIC CHARACTERISTICS OF THE MAJOR GROUNDWATER FLOW SYSTEMS IN IDAHO

Flow System	Number of Wells Analyzed	Lithology of Production Zone	Groundwater Surface Elev. (ft. above msl) Range of Values	Depths to Standing Water (ft. below LSD) Range of Values	Discharge (gpm) Range of Values	Specific Capacity (gpm/ft. of drawdown) Range of Values
1	84	Qs	1742-1772	15-59	5-20	
2	6	Qs	2057-2496	24-203	10-60	
3	20	Qs	2066-2341	7-214	6-60	
3	1	pCm	2184	16		15
4	50	Qs	1950-2295	70-515	5-1500	
4	1	pCm	2291	124		5
5	12	Qs	1971-2451	Flowing-199	5-3000	
5		Tcr				
6	2	Tcr	1582-2748	28-52	10-15	
7	1	Tcr		2560	Flowing	15
8	2	Qs	2532-2624		16-68	10
8	3	Tcr	2471-2498		22-149	10-20
9	4	Qs	2143-2815		15-67	5-15
10	40	Tcr		669-716		2-240
11		Tcr				
12	152	Tcr		766-4351	Flowing-399	1-110
13	ND					
14	ND					
15	ND					
16		Qs				

Flow System	Number of Wells Analyzed	Lithology of Production Zone	Groundwater Surface Elev. (ft. above msl) Range of Values	Depths to Standing Water (ft. below LSD) Range of Values	Discharge (gpm) Range of Values	Specific Capacity (gpm/ft. of drawdown) Range of Values
17	ND					
18		Qs				
18		Tcr				
19		Qs				
20	ND					
21		Qs				
22	21	Tcr		10-164	3-2200	
22	11	Qs		14-55	1-200	.06-59.4
23		QTs				
24	ND					
25	ND					
26	10	QTs	<1-38	8-24	.01-61.2	
27		QTs				
28	ND					
29		Qs				
30	86	QTs	2215-2807	2-159		
31	42	QTs		3-355	20-2700	1-1050
31	34	Qsr		13-425	12-3600	2-325
32	63	QTs	2235-2807			
33	ND					

TABLE 1. HYDROGEOLOGIC CHARACTERISTICS OF THE MAJOR GROUNDWATER FLOW SYSTEMS IN IDAHO

Flow System	Number of Wells Analyzed	Lithology of Production Zone	Groundwater Surface Elev. (ft. above msl) Range of Values	Depths to Standing Water (ft. below LSD) Range of Values	Discharge (gpm) Range of Values	Specific Capacity (gpm/ft. of drawdown) Range of Values
34	139	QTs	2320-3256			
34		Qs				
35	ND					
36	ND					
37	146	Qs	4810-5102	Flowing-197		
37	48	Qsr	4747-5131	Flowing-119		
37	36	QTsv	5072-5412	Flowing-143		
37	43	TKi	5056-5310	Flowing-33		
38		Qs			4-5000	0.3-200
39	270	Qsr		4-450		259-6820
39	31	Qs		39-323		580-4600
40	42	Qsr	320-5100	72-512	10-3000	1.2-420
41		Qsr	3700-4450	100-500		
42		Qs				
43	193	Qs	4150-5700	Flowing-276	250-4000	72
44	11	Qs	4546-4792	Flowing-420	8-2700	1.6-100
45		QTs				
46	3	QTs	5025-5136	Flowing-28	450-3400	5.6-26.2
47		Qs				
48	3	QTs			Flowing-20	
49	21	QTs	450B-4998		20-2500	

Flow System	Number of Wells Analyzed	Lithology of Production Zone	Groundwater Surface Elev. (ft. above msl) Range of Values	Depths to Standing Water (ft. below LSD) Range of Values	Discharge (gpm) Range of Values	Specific Capacity (gpm/ft. of drawdown) Range of Values
49		QTb				
50	37	QTs	4473-5033	Flowing-104	90-1350	
50	75	TsI	4464-5040	Flowing-116	3-2500	
51	1	QTs	5504	21.0	20	4
51	5	QTb	5303-5433	17.1-186.8	20-1350	150-1760
52	2	QTs	5260-5425	9.8-65.0	10-?	
52	4	QTb	5116-5400	77.0-166.0	17-1680	8-?
52	1	pTs		5242	38.0	15
53	1	Qs		5791.5	33.5	20
53	12	QTb	5116-6081	17.0-175.5		
53	1	TsI	5816	34.0	9-100	<1
53	2	pTs	5779.5-6215	45.5-360.0	10	1-?
54	ND					
55	16	Qs	5912-6120	1.7-98*5	15-1300	0-43
55	3	Tsl	5950-6139.5	Flowinq-40.5	20-30	<1:
55	3	pTs	5999-6256	11-34	15-20	I-2
56	1	pTs	6415	15.0		
57	9	Qs	6160-6560	Flowing-120		
57	1	Tsl	5750	25		
57		Qsr				
57	2	QTb			30	
58	22	Qs	5231-6402	5-380	3-75	
58	3	QTb	5263-5630	7-20		
58	2	pTs	5220-5230	470-500		
58	1	QTs	5221	12D		
58	2	Tsl	5530-5640	Flowing-80		

Flow System	Number of Wells Analyzed	Lithology of Production Zone	Groundwater Surface Elev. (ft. above msl) Range of Values	Depths to Standing Water (ft. below LSD) Range of Values	Discharge (gpm) Range of Values	Specific Capacity (gpm/ft. of drawdown) Range of Values
59	1	pTs	622D	20.0	5	1
60	26	QTsv	5794-6297	Flowing-375	2-100	
60	113	Qs	5951-6373	Flowing-242	3-1400	
60	1	pTs	6110	130		
61	35	QTsv	5939-6397	2-205		1.7-50
61	87	Qs	6203-7699	1-225		3.2-113
62	ND					
63	1	pTs		2	20	
63	22	QTas		6-78	1-2240	1-29
64		pTs				
64	14	QTas		46-278	10-2475	12-236
65	54	QTas	4618-6234	Flowing-165	50-3850	15-203
66		pTs				
66	47	QTas		4-600	10-4000	1.2-663
67	ND					
68	10	QTas		6-120	1-200	2-22
69	19	QTas		10-65	1-22	1-15
70	ND					

ND: No Data Available

TABLE 2. ARITHMETIC MEANS AND RANGES OF PHYSICAL AND DISSOLVED CHEMICAL CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Numbers	Aquifer	Number of Samples	pH (range)	Dissolved Solids (mg/l)	Specific Conductance (μmhos/cm)	Sodium (Na, mg/l)	Potassium (K, mg/l)	Calcium (Ca, mg/l)	Magnesium (Mg, mg/l)	Bicarbonate (HCO_3, mg/l)	Carbonate (CO_3, mg/l)	Sulfate (SO_4, mg/l)	Chloride (Cl, mg/l)	Fluoride (F, mg/l)	Nitrate plus Nitrite (as N, mg/l)
1	Qs	10	6.9-7.6	309	472	21.1	2.6	63.4	17.0	272	0	33.0	8.3	.26	2.6
				35-773	43-1050	1.9-58.0	.8-4.1	4.9-180.0	.8-38.0	19-530	*	1.0-100.0	.8-60.0	.10-.60	.01-5.0
2	Qs	6	6.2-7.4	106	145	4.6	1.5	18.3	5.3	91	0	10.6	.57	.13	.13
				47-206	41-312	1.5-12.0	.8-2.8	4.4-41.0	.8-12.0	24-190	*	2.1-28.0	.10-.90	.00-.30	.01-.41
3	Qs	21	6.1-8.2	133	210	4.6	1.3	27.2	8.4	124	0	9.1	.9	.15	.18
				128-361	32-639	1.2-17.0	.4-2.3	4.5-81.0	.7-39.0	16-430	*	.7-29.0	.2-3.9	.1-.5	.01-1.60
4	Qs	50	6.5-8.2	152	241	3.7	1.7	31.1	12.1	153	0	9.9	1.1	.1	.74
				42-220	43-495	1.8-15.0	.5-4.0	5.0-54.0	.8-22.0	29-350	*	2.1-41.0	.3-8.8	.0-.5	.01-2.90
5	Qs	19	6.0-8.2	98	150	5.3	1.2	14.3	6.1	59	0	18.8	2.9	.09	.39
				55-199	46-968	1.1-24.0	.5-2.9	4.5-27.0	1.2-26.0	11-220	*	2.2-73.0	.2-40.0	.0-.40	.01-1.30
6	Tcr	6	7.4-7.5	200	240	21.0	2.0	23.8	11.8			5.3	4.7	.39	.17
				165-245	*	8.0-30.0	1.2-3.1	22.0-27.0	7.0-17.0			1.0-10.0	2.0-7.0	.32-.47	.002-.49
7	Tcr	1	7.7	143	191	13	2.3	14	9.6	120	0	2.7	1.6	.3	0
8	Tcr	5	7.1-8.1	273	431	45.5	2.7	34.8	7.9	172	0	33.7	24.9	.44	.03
				106-565	129-968	5.6-110.0	1.7-4.9	14.0-78.0	4.6-16.0	79-220	*	2.1-140.0	1.4-100.0	1-1.4	.002-.04
9	Qs	4	6.9-7.6	172	241	8.9	3.9	26.8	11.0	158	0	4.6	1.2	.23	.06
				103-208	133-313	6.2-11.0	1.3-10.0	12.0-36.0	4.5-15.0	70-200	*	2.8-8.5	1.0-1.3	.10-.40	.00-.09
10	Qs	31	6.0-8.2	333		30.8	2.8	24.0	11.2			65.6	13.8	.72	.06
				70-680		*	*	*	*			8.0-260.0	2.0-82.0	.06-1.41	.002-.44
11	Tcr	14	7.0-8.4	125		10.7	1.6	9.7	9.2			14.4	2.9	.14	.06
				51-224		1.0-26.0	.2-4.0	2.0-21.0	1.0-31.0			.2-35.5	1.0-9.0	.01-.34	.002-.18
12	Tcr	18	6.5-8.1	283		30.4	2.7	29.5	12.0			9.7	9.2	.59	1.04
				144-460		6.0-76.0	.4-4.8	11.0-58.0	5.0-19.0			1.0-62.0	1.0-26.0	.24-1.24	.02-9.40
13	NO DATA AVAILABLE														
14	NO DATA AVAILABLE														
15	NO DATA AVAILABLE														
16	Qs	5	7.1-7.9	107		5.1	1.0	14.2	2.9			16.8	11.2	.29	2.8
				58-213		1.9-14.0	.5-1.2	8.0-29.0	.9-8.0			2.0-48.0	4.0-38.0	.05-.42	<.02-.64
17	NO DATA AVAILABLE														

TABLE 2. ARITHMETIC MEANS AND RANGES OF PHYSICAL AND DISSOLVED CHEMICAL CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Numbers	Aquifer	Number of Samples	pH (range)	Dissolved Solids (mg/l)	Specific Conductance (μmhos/cm)	Sodium (Na, mg/l)	Potassium (K, mg/l)	Calcium (Ca, mg/l)	Magnesium (Mg, mg/l)	Bicarbonate (HC0$_3$, mg/l)	Carbonate (C0$_3$, mg/l)	Sulfate (S0$_4$, mg/l)	Chloride (Cl, mg/l)	Fluoride (F, mg/l)	Nitrate plus Nitrite (as N, mg/l)
18	Qs	6	7.1-8.2	253		47.5	4.1	16.4	6.9			76.5	17.2	.60	.01
				148-368		7.1-68.0	1.6-5.5	14.0-20.0	2.8-18.0			10.0-116.0	<2.0-52.0	<.0 1-1.25	.002-.02
19	Qs	3	6.8-7.0	48		2.2	.43	5.7	.53			9.3	3.3	.07	.008
				32-70		2.0-2.5	.4-.5	5.0-6.0	.40-.80			8.0-10. 0	<2.0-6.0	<.01-.14	.002-.01
20	NO DATA AVAILABLE														
21	Qs	1		52		6.5	1.1	6.0	1.0			<10.0	2.0	<.01	.04
22	Tcr	21	6.8-8.7	197	240	25.4	6.2	15.2	6.6	149	1.2	8.2	2.1	.3	.74
				136-323	145-440	5.6-75.0	1.5-13.0	4.1-31.0	.2-19.0	83-283	0.0-16.0	.6-19.0	.5-4.5	.1-1.0	.01-4.90
22	QTs	10	6.6-8.2	235	316	29.4	6.0	20.4	9.1	154	0	29.6	5.2	.25	2.1
				165-499	168-700	9.7-89.0	1.1-9.0	2.6-66.0	1.1-26.0	59-266	*	4.3-240.0	.6-17.0	.10-.30	.01-9.0
23	NO DATA AVAILABLE														
24	NO DATA AVAILABLE														
25	NO DATA AVAILABLE														
26	QTs	10	6.3-8.3	523	649	67.6	8.01	52.5	13.9	301	0	70.6	17.7	.63	2.40
				216-1150	271-1810	13.0-250.0	3.90-14.00	20.0-110.0	3.6-34.0	129 -910	*	13.0-180.0	3.3-45.0	.40-1.80	.02-6.30
27	QTs	46	6.5-8.3	432	223	45.5	3.9	35.4	13.9			25.5	5.3	.7	1.9
				54-719	166-280	5.0-109.0	.7-11.2	10.0-86.0	1.0-37.2			.1-82.0	2.0-20.0	.2-3.0	.002-18.2
28	NO DATA AVAILABLE														
29	Qs	2		56		3.5	.75	10.5	1.3			<10.0	<2.0	<.01	.03
				54-58		3.4-3.6	.70-.80	10.0-11.0	*			*	*	*	.002-.050
30	QTs	86	6.7-8.4	323	596	43.8	3.1	47.0	9.7	195		67.2	16.0	.34	2.7
				98-667	104-1210	6.6-96.0	1.0-5.5	17.0-93.0	2.5-28.0	83-275		2.0-148.0	0.0-63.0	.30-.50	0.0-12.9
31	Qsr	34	7.0-8.1	209	288	26.6	3.9	22.2	7.4	134		22.6	8.5	.43	1.7
				52-571	40-844	2.9-130.0	1.2-7.3	2.5-77.0	.3-31.0	14-398		1.9-100.0	.8-43.0	.10-1.00	.08-8.6
31	QTs	13	5.9-8.4	309	467	45.0	4.1	36.2	10.8	171		58.5	18.4	.52	2.78
				136-904	193-1428	12.0-190.0	1.1-9.1	15.0-67.0	1.0-37.0	75-381		7.6-200.0	4.6-67.0	.20-1.20	.15-8.90
32	QTs	48	6.7-8.3	299	430	72.0		18.1	3.9	145		42.7	9.6	7.87	.35
				132-920	426-437	8.0-278.0	* *	1.0-69.0	.2-23.0	61-258	* * *	1.9-230.0	2.0-21.0	.01-24.0	.01-2.20
33	NO DATA AVAILABLE														
34	QTs	16	8.1-8.9	315	390	58.6	7.4	31.2	17.1			48.6	52.4	1.4	1.9

Flow System Index Numbers	Aquifer	Number of Samples	pH (range)	Dissolved Solids (mg/l)	Specific Conductance (μmhos/cm)	Sodium (Na, mg/l)	Potassium (K, mg/l)	Calcium (Ca, mg/l)	Magnesium (Mg, mg/l)	Bicarbonate ($HC0_3$, mg/l)	Carbonate ($C0_3$, mg/l)	Sulfate ($S0_4$, mg/l)	Chloride (Cl, mg/l)	Fluoride (F, mg/l)	Nitrate plus Nitrite (as N, mg/l)
				270-544	270-950	20.0-106.0	2.5-12.2	16.0-66.0	1.0-51.0			17.0-210.0	40.0-67.0	.6-6.4	.6-3.5
35	NO DATA AVAILABLE														
36	NO DATA AVAILABLE														
37	Qs	29	6.8-8.5	156	217	24.4	2.3	13.6	4.4	112	.14	4.4	3.7	.92	1.5
				82-284	107-416	7.2-78.0	.5-8.0	3.0-33.0	.0-10.0	44-240	.00-3.00	.60-36.0	.9-10.0	.10-4.60	0.0-18.0
38	Qs	36	7.5-7.7	232	388	7.7	1.2	41.9	13.6	199		14.3	3.0	.24	.87
				162-368	247-605	4.0-23.0	.0-3.1	16.0-77.0	2.8-34.0	52-355		4.0-26.0	1.0-15.0	.00-1.00	.00-2.90
39	Qsr	301	7.2-8.0	359	595	33.1	5.3	57.1	21.0	225	0	57.3	41.6	.53	1.3
				172-679	260-1560	13.0-87.0	3.0-10.0	21.0-118.0	8.0-43.0	144-394	*	7.0-171.0	7.0-325.0	.20-1.00	.44-7.1
40	Qsr	42	7.7-8.2	486	556	96.7	4.8	78.6	22.2	204		142.6	73.7	4.8	1.8
				121-804	416-780	66.0-128.0	1.0-8.6	36.8-104.0	4.8-36.0	135-300		49.8-252.0	39.0-92.0	.8-6.9	.02-5.7
41	Qsr	31	6.2-9.4	319	495	38.1	6.2	42.1	10.5	148		44.6	33.5	.81	.76
				81-854	39-1230	2.5-137.0	1.5-12.0	1.8-149.0	6.0-36.0	15-426		.6-270.0	1.0-144.0	.10-6.80	.00-4.40
42	Qs	4	7.2-7.5	266		17.0	4.8	37.0	20.7			24.9	11.0	.52	.03
				254-280		15.0-21.3	4.7-5.6	30.0-41.0	13.9-24.0			24.0-25.7	2.0-29.0	.43-.69	.01-.08
43	Qs	19	7.1-7.9		1017	77.4	8.5	91.3	18.8	208		59.7	188.9	.52	.64
					*	17.0-271.0	4.0-12.0	40.0-423.0	9.0-49.0	133-282		16.0-347.0	32.0-988.0	.20-1.60	.00-9.80
44	QTs	14	7.1-7.9	1090	1668	146.7	12.7	96.7	72.3	270		175.4	296.4	.34	1.62
				308-3352	587-4392	17.0-454.0	3.0-36.7	29.0-255.0	18.0-154.0	203-391	* * *	21.0-994.0	54.0-1029.0	.10-.97	.14-2.89
45	QTs	1	7.0	318		23.0	9.6	48.0	18.6			16.0	2.0	.16	.73
46	QTs	3	7.4-7.8	559	861	47.7	4.9	95.7	22.0	315		29.0	86.7	.20	6.8
				316-744	483-1197	14.0-90.0	1.6-10.9	67.0-119.0	10.0-41.0	200-455	* * *	10.0-43.0	43.0-128.0	.07-.35	.4-13.9
47	NO DATA AVAILABLE														
48	NO DATA AVAILABLE														
49	QTb	49	6.8-8.5	392	708	39.6	6.7	89.7	43.7	515	2	47.0	34.7	.2	.69
				232-489	756-1200	24.0-47.0	1.2-9.7	48.0-120.0	13.0-84.0	332-820	0-10	10.0-75.0	13.0-59.0	.0-.7	.02-1.50
49	QTs	39		452	745	42.8	6.1	72.5	26.6	309	0	44.6	61.7	.25	2.53
				193-1440	334-2300	7.1-200.0	.7-41.0	34.0-200.0	6.1-60.0	143-833	*	1.6-230.0	16.0-360.0	.10-.80	.02-29.00
50	QTs	14	7.4-7.9	430	709	45.3	6.4	61.6	32.4	351		29.6	43.9	.53	1.3
				286-632	472-1020	9.2-110.0	1.9-19.0	27.0-95.0	14.0-59.0	277 -496		5.0-91.0	13.0-95.0	.20-1.30	.11-3.8
51	QTs	2	7.4-7.5	294	518	14.0	2.3	57.5	18.0	260	0	15.5	20.0	.35	1.18
				291-297	513-522	*	1.2-3.4	54.0-61.0	17.0-19.0	258-262	*	13.0-18.0	18.0-22.0	.30-.40	.35-2.00

TABLE 2. ARITHMETIC MEANS AND RANGES OF PHYSICAL AND DISSOLVED CHEMICAL CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Numbers	Aquifer	Number of Samples	pH (range)	Dissolved Solids (mg/l)	Specific Conductance (μmhos/cm)	Sodium (Na, mg/l)	Potassium (K, mg/l)	Calcium (Ca, mg/l)	Magnesium (Mg, mg/l)	Bicarbonate ($HC0_3$, mg/l)	Carbonate ($C0_3$, mg/l)	Sulfate ($S0_4$, mg/l)	Chloride (Cl, mg/l)	Fluoride (F, mg/l)	Nitrate plus Nitrite (as N, mg/l)
51	QTb	5	7.1-7.5	623	1033	40.4	8.2	97.6	59.4	523	0	78.2	39.8	.3	1.60
				475-823	777-1350	27.0-68.0	3.4-13.0	79.0-120.0	26.0-94.0	369-781	*	55.0-120.0	23.0-54.0	.2-.3	.04-3.10
52	QTs	2	7.5	417	668	28.2	1.9	89.0	22.5	365	0	43.1	22.5	.15	1.79
			*	301-533	482-854	5.3-51.0	1.2-2.5	80.0-98.0	17.0-28.0	337-392	*	8.1-78.0	3.0-42.0	.1-.2	.17-3.40
52	QTb	4	7.2-7.6	679	1117	58.3	11.4	70.8	75.3	549	0	81.5	51.3	.33	8.8
				559-909	927-1440	52.0-68.0	6.8-21.0	66.0-76.0	49.0-130.0	359-855	*	71.0-90.0	45.0-56.0	.20-.40	2.4-15.0
52	pTs	1	5.4	190	338	1.8	.4	56.0	12.0	217	0	5.4	1.9	.1	.03
53	Qs	1	7.4	272	489	6.7	2.3	88.0	20.0	254	0	11.0	8.8	.1	.92
53	QTb	12	6.4-7.8	599	985	21.7	4.2	82.3	78.2	586	0	59.3	21.9	.4	3.80
				237-1690	404-2730	6.1-49.0	2.6-9.5	13.0-150.0	15.0-320.0	210-1930	*	8.8-150.0	5.3-63.0	.1-2.0	.04-19.00
53	Tsl	1	7.1	458	769	9.2	3.5	80.0	22.0	312	0	28.0	38.0	.2	5.4
53	pTs	2	7.3-7.5	365	597	10.9	3.4	85.5	22.0	359	0	21.5	13.5	.45	.37
				362-368	564-630	5.8-16.0	1.1-5.7	76.0-95.0	19.0-25.0	305-412	*	16.0-27.0	6.0-21.0	.20-.70	.21-.53
54	NO DATA AVAILABLE														
55	Qs	16	7.2-7.8	409	703	33.7	3.2	72.1	29.3	303	0	70.2	29.2	.24	1.9
				260-592	409-1040	6.8-110.0	1.0-8.9	38.0-110.0	17.0-53.0	209-594	*	1.6-300.0	3.1-110.0	.10-.80	.0-7.9
55	Tsl	3	7.2-7.6	405	671	28.0	9.0	72.7	26.0	307	0	62.7	25.9	.5	1.55
				356-475	561-754	10.0-59.0	.7-25.0	34.0-110.0	23.0-31.0	273-329	*	14.0-140.0	8.0-60.0	.2-.8	.08-4.00
55	pTs	3	7.2-7.5	439	744	27.3	2.0	84.0	29.7	262	0	108.0	32.4	.3	6.7
				320-518	536-867	15.0-47.0	.8-3.3	76.0-95.0	15.0-38.0	224-314	*	24.0-180.0	9.1-45.0	.1-.5	.25-19.00
56	pTs	1	7.7	345	597	53.0	2.7	52.0	19.0	371	0	10.0	15.0	.2	.02
57	Qs	18	7.1-8.3	307	547	27.7	2.5	58.9	17.3	322	0	18.2	15.5	.3	.88
				125-545	230-1150	4.2-110.0	.5-11.0	13.0-110.0	3.6-44.0	130-570	*	4.3-90.0	.9-79.0	.1-.7	0.00-5.10
57	Tsl	1	7.6	349	497	12.0	4.6	70.0	16.0	250	0	57.0	10.0	.6	0.02
57	Qsr	3	7.8	340	570	26.0	4.1	65.5	17.0	266	0	44.5	25.7	.3	1.5
			*	321-359	526-598	22.0-30.0	3.8-4.4	64.0-67.0	15.0-19.0	242-290	*	40.0-49.0	18.0-57.0	.2-.4	*
57	QTb	2	7.6-8.1	235	415	14.8	2.1	43.5	13.0	250	0	14.9	8.3	.4	
				210-259	349-480	9.5-20.0	1.4-2.7	42.0-45.0	12.0-14.0	210-290	*	6.9-23.0	5.5-11.0	*	
58	Qs	16	6.3-8.3	1059	1656	185.6	21.8	133.4	34.8	411	0	125.3	305.7	.57	1.1
				119-6620	206-10500	.9-1500.0	.4-180.0	12.0-560.0	14.0-100.0	200-1200	*	2.2-1000.0	1.2-2800.0	.10-2.70	.05-4.90

TABLE 2. ARITHMETIC MEANS AND RANGES OF PHYSICAL AND DISSOLVED CHEMICAL CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Numbers	Aquifer	Number of Samples	pH (range)	Dissolved Solids (mg/l)	Specific Conductance (μmhos/cm)	Sodium (Na, mg/l)	Potassium (K, mg/l)	Calcium (Ca, mg/l)	Magnesium (Mg, mg/l)	Bicarbonate ($HC0_3$, mg/l)	Carbonate ($C0_3$, mg/l)	Sulfate ($S0_4$, mg/l)	Chloride (Cl, mg/l)	Fluoride (F, mg/l)	Nitrate plus Nitrite (as N, mg/l)
58	QTb	3	7.2-7.7	334	640	4.0	3.2	92.0	23.3	327	0	79.3	15.3	.77	.34
				219-485	345-1113	2.9-5.5	.9-7.3	59.0-140.0	13.0-39.0	220-430	*	14.0-200.0	1.6-79.0	.10-.50	. 29-.37
58	pTs	3	7.2-7.6	390	616	23.0	3.5	71.3	25.3	293	0	64.0	30.6	.2	.94
				266-585	447-898	7.0-41.0	2.2-5.3	46.0-100.0	11.0-37.0	240-390	*	11.0-140.0	6.7-52.0	.1-.3	.32-1.40
58	QTs	1	7.2	615	1010	68.0	7.8	98.0	35.0			46.0	120.0	.3	.42
58	Tsl	2	7.4	226	315	8.7	3.5	39.5	11.0	165	0	12.0	14.5	.2	
			*	213-238	280-350	8.4-8.9	3.5-3.6	36.0-43.0	9.9-12.0	150-180	*	11.0-13.0	13.0-16.0	*	
59	pTs	1	7.4	328	587	39.0	2.1	55.0	20.0	290	0	13.0	39.0	.2	1.1
60	Qs	36	7.1-8.9	225	371	6.0	1.1	52.5	14.8	220	0	22.6	4.3	.2	.72
				47-352	48-604	0.0-76.0	0.0-3.3	5.4-85.0	0.1-28.0	21-390	*	1.0-159.0	.0-45.0	.0-.4	.03-2.20
60	QTsv	7	7.1-8.9	122	204	4.9	.53	24.4	7.6	121	2	5.9	4.7	.23	.80
				69-221	111-384	2.9-6.9	0.00-1.30	12.0-52.0	2.3-16.0	63-243	0-12	1.4-7.7	1.9-11.0	.10-.40	.03-2.20
60	pTs	1	7.0	103	164	2.1	.8	19.0	6.4	100	0	9.0	1.4	.1	.46
61	QTsv	46	6.3-8.3	183	187	7.5	2.5	23.8	8.5	121	0	5.2	3.5	.62	1.7
				14-506	19-830	.5-36.0	.2-4.0	1.1-95.0	.1-39.0	*	*	.8-34.0	.1-36.0	.0-4.60	.0-2.4
62	NO DATA AVAILABLE														
63	QTas	26	6.8-8.9	624	1065	114.3	6.5	76.2	18.2	310		155.3	73.1	.75	.89
				124-2660	137-4068	5.2-390.0	.7-37.0	1.7-480.0	.0-96.0	73-990		3.8-1000.0	3.0-730.0	.0-3.70	.0-6.90
64	QTas	15	7.2-8.0	240	407	15.1	1.5	45.2	17.8	209		22.3	14.1	.11	1.2
				151-446	243-733	2.7-62.0	.9-3.4	24.0-70.0	11.0-27.0	130-330		9.6-61.0	3.3-41.0	.1-.2	.11-4.50
65	QTas	7	7.1-8.0	219	369	17.3	2.2	38.9	13.8	211	0	18.4	6.2	.3	.47
				92-345	159-562	5.5-64.0	.9-6.3	12.0-68.0	8.9-20.0	88-317	*	8.8-31.0	1.6-8.9	.0-.9	.17-.79
66	QTas	47	7.3-8.0	195	396	8.0		48.6	11.8	221	0	17.9	7.9	.27	2.6
				110-288	183-738	3.2-14.5	* *	25.0-67.0	5.3-18.0	98-422	*	11.0-29.0	.5-22.0	.20-.40	.0-11.0
67	NO DATA AVAILABLE														
68	QTas	3	6.9-8.9	278	447	74.0	.5	16.3	3.7			50.9	10.0	.56	1.0
				267-289	432-461	70.5-78.5	.3-.8	15.2-17.6	3.0-4.3			46.0-54.2	2.0-17.0	.51-.59	.002-.24
69	QTas	20		251	408	32.1	3.3	37.9	14.0	179		48.0	9.9	1.1	1.5
				58-665	76-1092	4.3-120.0	.4-12.0	3.8-110.0	.9-44.0	50-350		2.5-200.0	1.0-40.0	.1-11.0	.03-3.8
70	NO DATA AVAILABLE														

* No Range

* * Potassium Combined with Sodium
* * * C03 Combined with HC03

TABLE 3. ARITHMETIC MEANS AND RANGES OF DISSOLVED TRACE CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Number	Aquifer	Number of Samples	Arsenic (As, mg/l)	Barium (Ba, mg/l)	Cadmium (Cd, mg/l)	Chromium (Cr, mg/l)	Copper (Cu, mg/l)	Iron (Fe, mg/l)	Lead (Pb, mg/l)	Manganese (Mn, mg/l)	Mercury (Hg, mg/l)	Silver (Ag, mg/l)	Zinc (Zn, mg/l)
1	Qs	2			<.001		.011 *	.04 .02-.05	<.01 *	.01 <.01-.02	<.005 *		<.001
2	Qs												
3	Qs	4			<.001 *		.003 <.001-.009	.97 .06-2.18	<.01 *	.08 <.01-.15	<.005 *		.50 .081-1.29
4	Qs	39	<.01 *	<.1 *	.001 <.001-.022	.01 *	.007 .010-.090	.06 .01-.31	<.01 *	.01 <.01-.04	<.005 *	<.001 *	.040 .001-.580
5	Qs	7	.001 .000-.008		.006 .002-.023	0 *	.03 .03-.08	.08 .00-.13	.008 .005-.015		0 *		.81 .11-3.60
6	Tcr	4			.01 *		.008 <.001-.016	.19 .06-.42	.01 *	.04 <.01-.08	<.001 *		1.79 .175-5.14
7	Tcr	1								3.5			
8	Qs	6	.01 <.01-.01	<.1 *	.002 .001-.005	<.01 *	.03 .001-.06	3.1 .0-14.0	.01 <.0l-.01	.03 <.0l-.05	<.005 *	<.001 *	.05 .001-.149
9	Qs	8	<.01 *	<.1 *	.003 <.001-.018	<.01 *	.006 <.001-.017	1.20 .03-5.75	<.01 *	.06 <.0l-.16	<.005 *	.001 *	.35 .03-1.19
10	Tcr	16	<.01 *	<.1 *	.006 <.001-.02	<.01 *	.06 *	4.5 *	.01 <.01-.08	.72 *	<.005 *	<.001 *	.4 *
11	Tcr	14	<.01 *	<.1 *	<.005 *	<. 01 *	.03 .001-.18	.30 <.0l-1.70	.01 <.01-.01	.03 .01-.08	.02 .0005-.16	<.001 *	.040 <.001-.081
12	Tcr	18	<.01 *	<.1 *	.008 .001-.019	<.01 *	.003 .001-.010	.13 .01- .27	.025 .010-.120	.02 .01-.06	<.005 *	<.001 *	.08 .002-.109
13	NO DATA AVAILABLE												
14	NO DATA AVAILABLE												
15	NO DATA AVAILABLE												
16	Qs	1	<.01	<.1	<.001	<.01	.016	.03	<.01	<.01	<.0005	<.001	.63
17	NO DATA AVAILABLE												
18	Qs	4	<.01 *	<.1 *	<.001 *	<.01 *	.006 <.001-.013	.10 .01-.30	.01 <.0l-.01	.01 <.01-.01	<.005 *	<.001 *	.20 .001-.583
19	Qs	1	<.01	<.1	<.001	<.01	<.001	<.01	<.01	.01	<.005	<.001	.28

TABLE 3. ARITHMETIC MEANS AND RANGES OF DISSOLVED TRACE CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Number	Aquifer	Number of Samples	Arsenic (As, mg/l)	Barium (Ba, mg/l)	Cadmium (Cd, mg/l)	Chromium (Cr, mg/l)	Copper (Cu, mg/l)	Iron (Fe, mg/l)	Lead (Pb, mg/l)	Manganese (Mn, mg/l)	Mercury (Hg, mg/l)	Silver (Ag, mg/l)	Zinc (Zn, mg/l)
20	NO DATA AVAILABLE												
21	Qs	1	<.01	<.1	<.001	<.01	<.01	.44	<.01	.04	<.005	<.001	.04
22	Tcr	8	.003	.07	<.001	<.01	.003	.90	.012	.02	<.005	.001	.04
			.001-.006	.05-.10	*	*	.001-.005	.00-1.2	.010-.016	.00-.06	*	*	.002-.13
22	QTs	7	.09	.07	.002	<.01	.006	.30	.014	0	<.005	.001	.009
			.003-.17	.05-.10	.001-.004	*	.001-.013	.01-2.80	.010-.017	*	*	.001-.002	.003-.029
23	NO DATA AVAILABLE												
24	NO DATA AVAILABLE												
25	NO DATA AVAILABLE												
26	QTs	4	.017	<.1	<.001	<.01	.033	.26	.03	.03	<.005	.001	.012
			.004-.041	*	*	*	.001-.072	.00-1.50	.01-.05	.00-.09	*	*	.001-.029
27	QTs	33	.009	<.1	<.005	<.01	.006	.30	<.01	.09	<.005	<.001	.07
			.010-.027	*	*	*	<.001-.034	.01-6.43	*	.01-.69	*	*	.001-2.46
28	NO DATA AVAILABLE												
29	Qs	3	<.01	<.1	<.001	<.01	<.001	.11	<.01	.01	<.005	<.001	.006
			*	*	*	*	*	.09-.12	*	<.01-.02	*	*	.004-.007
30	QTs	116	.01	.10	.001	.01	.03	.42	.01	.04	<.005	<.001	.19
			.005-.052	.05-.80	<.001-.130	<.01-.04	.001-1.28	.20-.76	.01-.18	.01-.63		<.001-.005	<.001-5.96
31	Qsr												
31	QTs	17	<.01	<.1	<.005	<.01	.010	.14	<.01	.05	<.005	<.001	.22
			*	*	*	*	.001-.055	.01-1.05	*	.01-.56	*	*	.001-2.24
32	QTs	48	.01	<.1	<.001	<.01	.020	.89	<.01	.10	<.005	<.001	.03
			.005-.01	*	*	*	.001-.046	.01-2.70	*	.02-.30	*	*	.002-.086
33	NO DATA AVAILABLE												
34	QTs	5	.02	.15	<.001	<.01	.003	.23	.02	.01	<.005	<.001	.29
			.01-.02	.10-.20	*	*	.001-.005	.14-.58	.01-.19	.01-.03	*	*	.04-.53
35	NO DATA AVAILABLE												
36	NO DATA AVAILABLE												
37	Qs	4	<.01	<.1	<.001	<.01	.009	1.56	<.01	.14	<.005	<.001	.05

TABLE 3. ARITHMETIC MEANS AND RANGES OF DISSOLVED TRACE CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Number	Aquifer	Number of Samples	Arsenic (As, mg/l)	Barium (Ba, mg/l)	Cadmium (Cd, mg/l)	Chromium (Cr, mg/l)	Copper (Cu, mg/l)	Iron (Fe, mg/l)	Lead (Pb, mg/l)	Manganese (Mn, mg/l)	Mercury (Hg, mg/l)	Silver (Ag, mg/l)	Zinc (Zn, mg/l)
			*	*	*	*	< 001-.014	.01-18.00	*	.00-.70	*	*	.01-.14
38	Qs	4	<.01	<.1	<.001	<.01	<.001	.12	<.01	<.01	<.005	<.001	.060
			*	*	*	*	*	<.01-.27	*	*	*	*	017-.134
39	Qsr	200	.01	<.1	.001	<.01	.03	.48	<.01	.01	<.005	<.001	.06
			<.01-.025	*	<.001-.002	*	.001-.22	.01-3.82	*	<. 001-.03	*	*	.001-.58
40	Qsr	19	.01	.1	.001	.01	.01	.07	.01	.01	<.005	<.001	.03
			<.01-.02	<.1-.4	.001-.023	<.01-.01	.01-.12	.01-.90	<.01-.02	<.001-.03	*	<.001-.010	.001-.15
41	Qsr	12	<.01	<.1	.001	<.01	.001	.04	<.01	.01	<.001	<.001	.084
			*	*	<.001-.003	*	<.001-.006	.01-.15	*	*	*	*	.001-.296
42	Qs	4	<.01	<.1	<.001	<.01	.003	.02	<.01	<.01	<.005	<.001	.07
			*	*	*	*	*	*	*	*	*	*	*
43	Qs	1						.03					
44	QTs	14	.002										
			.000-.020										
45	QTs	1	<.01	<.1	.003	<.01	.005	.01	<.01	<.01	<.005	<.001	.05
46	QTs	3	0										
			*										
47	NO DATA AVAILABLE												
48	NO DATA AVAILABLE												
49	QTb	35	<.01	.1	<.001	<.01	.22	.07	.01	.02	<.005	<.001	.20
			*	<.1-.2	<.001-.003	*	.00-.44	<.01-2.24	<.01-.03	.01-.12	*	.001-.01	.003-1.17
49	QTs												
50	Qs	10	<.01	.1	.001	<.01	.02	.8	<.01	<.01	<.005	<.001	.07
			*	.I-1.0	<.001-.03	*	.001-.25	<.01-10.0	*	*	*	*	.007-.25
51	QTs												
51	QTb												
52	QTs												
52	QTb	2	<.01	<.1	<.001	<.01	.011	.08	<.01	<.01	<.005	<.001	2.9
			*	*	*	*	*	*	*	*	*	*	*
52	pTs												

TABLE 3. ARITHMETIC MEANS AND RANGES OF DISSOLVED TRACE CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Number	Aquifer	Number of Samples	Arsenic (As, mg/l)	Barium (Ba, mg/l)	Cadmium (Cd, mg/l)	Chromium (Cr, mg/l)	Copper (Cu, mg/l)	Iron (Fe, mg/l)	Lead (Pb, mg/l)	Manganese (Mn, mg/l)	Mercury (Hg, mg/l)	Silver (Ag, mg/l)	Zinc (Zn, mg/l)
53	Qs												
53	QTb	8	<.01 *	<.1 *	<.01 *	<.01 *	.007 <.001-.031	.07 <.01-.33	<.01 *	.01 <.01-.03	<.005 *	<.001 *	.16 .001-.89
53	Tsl												
53	pTs												
54		NO DATA AVAILABLE											
55	Qs	3	<.01 *	<.1 *	.003 *	<.01 *	<.001 *	.02 .01-.02	<.01 *	<.01 *	<.0002 *	<.001 *	.118 *
55	Tsl												
55	pTs												
56	pTs												
57	Qs												
57	Qsr												
57	Tsl												
57	QTb												
58	Qs												
58	QTb												
58	pTs												
58	QTs												
58	Tsl												
59	pTs												
60	Qs	5	.0004 0.000-0.002	.016 0.00-0.05	.005 .002-.01								
60	QTsv		<.01 *	<.1 *	<.001 *	<.01 *	.005 .0005-.007	.79 .03-2.70	<.01 *	<.01 *	<.005 *	<.001 *	.26 .08-.69
60	pTs												
61	QTsv												

TABLE 3. ARITHMETIC MEANS AND RANGES OF DISSOLVED TRACE CONSTITUENTS IN GROUNDWATER BY FLOW SYSTEM

Flow System Index Number	Aquifer	Number of Samples	Arsenic (As, mg/l)	Barium (Ba, mg/l)	Cadmium (Cd, mg/l)	Chromium (Cr, mg/l)	Copper (Cu, mg/l)	Iron (Fe, mg/l)	Lead (Pb, mg/l)	Manganese (Mn, mg/l)	Mercury (Hg, mg/l)	Silver (Ag, mg/l)	Zinc (Zn, mg/l)
62	NO DATA AVAILABLE												
63	QTas	2	<.01 *	<.1 *	<.001 *	<.01 *	.017 .015-.019	1.04 *	<.01 *	.01 <.01-.02	<.005 *	<.001 *	.11 .03-.178
64	QTas	1						.95					
65	QTas												
66	QTas	47					.	27 .02-.73	.01 *				
67	NO DATA AVAILABLE												
68	QTas	2	<.01 *	<.1 *	<.001 *	<.01 *	.004 .002-.006	.21 .14-.30	<.01 *	.01 .01-.02	<.005 *	<.001 *	.57 .35-.80
69	QTas	1						.28					
70	NO DATA AVAILABLE												

* No Range

TABLE 4. QUALITY STANDARDS FOR DRINKING WATER

Constituent	Maximum Contaminant Levels for Inorganic Chemicals (USEPA, 1975 & IDHW, 1977)	Secondary Quality Standards (USEPA, 1975 & IDHW,1977)
Iron	--	0.3 mg/L
Manganese	--	0.05 mg/L
Sulfate	--	250 mg/L
Chloride	--	250 mg/L
Fluoride[1]	2.0 mg/L	--
Nitrate	10.0 mg/L	--
Dissolved solids	--	500 mg/L
pH	--	<6.5 or >8.5
Arsenic	0.05 mg/L	--
Barium	1.0 mg/L	--
Cadmium	0.01 mg/L	--
Chromium	0.05 mg/L	--
Copper	--	1.0 mg/L
Lead	0.05 mg/L	--
Mercury	0.002 mg/L	--
Silver	0.05 mg/L	--
Zinc	--	5.0 mg/L

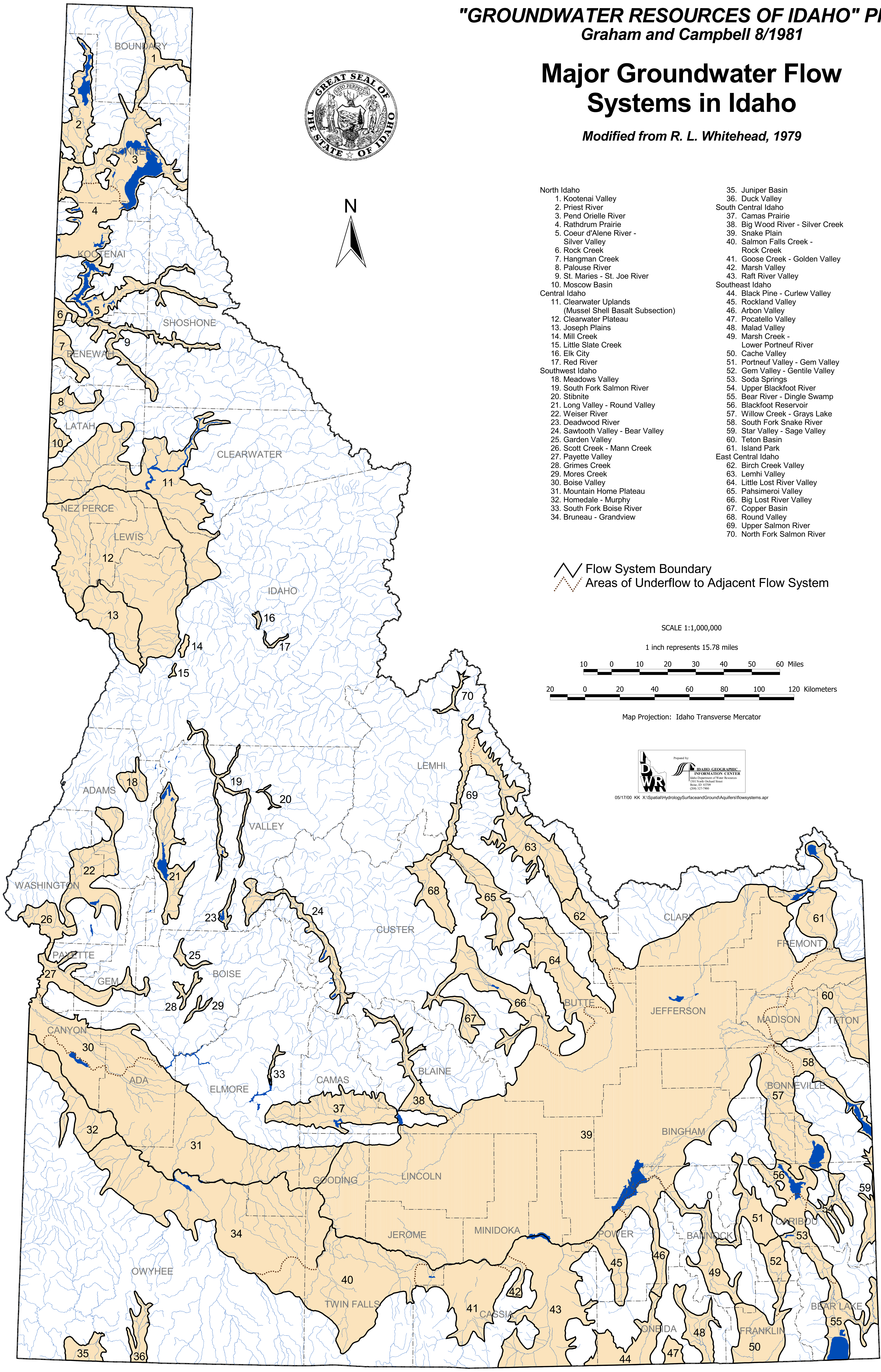
[1] The maximum contaminant level (MCL) for fluoride is dependent upon the annual average of the maximum daily air temperatures for the location in which the water-supply system is situated; from 1.4 mg/l (26.3 to 32.5°C) to 2.4 mg/l (<12.0°C).

"GROUNDWATER RESOURCES OF IDAHO" Plate 1

Graham and Campbell 8/1981

Major Groundwater Flow Systems in Idaho

Modified from R. L. Whitehead, 1979



North Idaho
1. Kootenai Valley
2. Priest River
3. Pend Orielle River
4. Rathdrum Prairie
5. Coeur d'Alene River - Silver Valley
6. Rock Creek
7. Hangman Creek
8. Palouse River
9. St. Maries - St. Joe River
10. Moscow Basin

Central Idaho
11. Clearwater Uplands (Mussel Shell Basalt Subsection)
12. Clearwater Plateau
13. Joseph Plains
14. Mill Creek
15. Little Slate Creek
16. Elk City
17. Red River

Southwest Idaho
18. Meadows Valley
19. South Fork Salmon River
20. Stibnite
21. Long Valley - Round Valley
22. Weiser River
23. Deadwood River
24. Sawtooth Valley - Bear Valley
25. Garden Valley
26. Scott Creek - Mann Creek
27. Payette Valley
28. Grimes Creek
29. Mores Creek
30. Boise Valley
31. Mountain Home Plateau
32. Homedale - Murphy
33. South Fork Boise River
34. Bruneau - Grandview
35. Juniper Basin
36. Duck Valley

South Central Idaho
37. Camas Prairie
38. Big Wood River - Silver Creek
39. Snake Plain
40. Salmon Falls Creek - Rock Creek
41. Goose Creek - Golden Valley
42. Marsh Valley
43. Raft River Valley

Southeast Idaho
44. Black Pine - Curlew Valley
45. Rockland Valley
46. Arbon Valley
47. Pocatello Valley
48. Malad Valley
49. Marsh Creek - Lower Portneuf River
50. Cache Valley
51. Portneuf Valley - Gem Valley
52. Gem Valley - Gentile Valley
53. Soda Springs
54. Upper Blackfoot River
55. Bear River - Dingle Swamp
56. Blackfoot Reservoir
57. Willow Creek - Grays Lake
58. South Fork Snake River
59. Star Valley - Sage Valley
60. Teton Basin
61. Island Park

East Central Idaho
62. Birch Creek Valley
63. Lemhi Valley
64. Little Lost River Valley
65. Pahsimeroi Valley
66. Big Lost River Valley
67. Copper Basin
68. Round Valley
69. Upper Salmon River
70. North Fork Salmon River

Flow System Boundary
Areas of Underflow to Adjacent Flow System

SCALE 1:1,000,000

1 inch represents 15.78 miles

10 0 10 20 30 40 50 60 Miles

20 0 20 40 60 80 100 120 Kilometers

Map Projection: Idaho Transverse Mercator

Prepared by: IDAHO GEOGRAPHIC INFORMATION CENTER, Idaho Department of Water Resources

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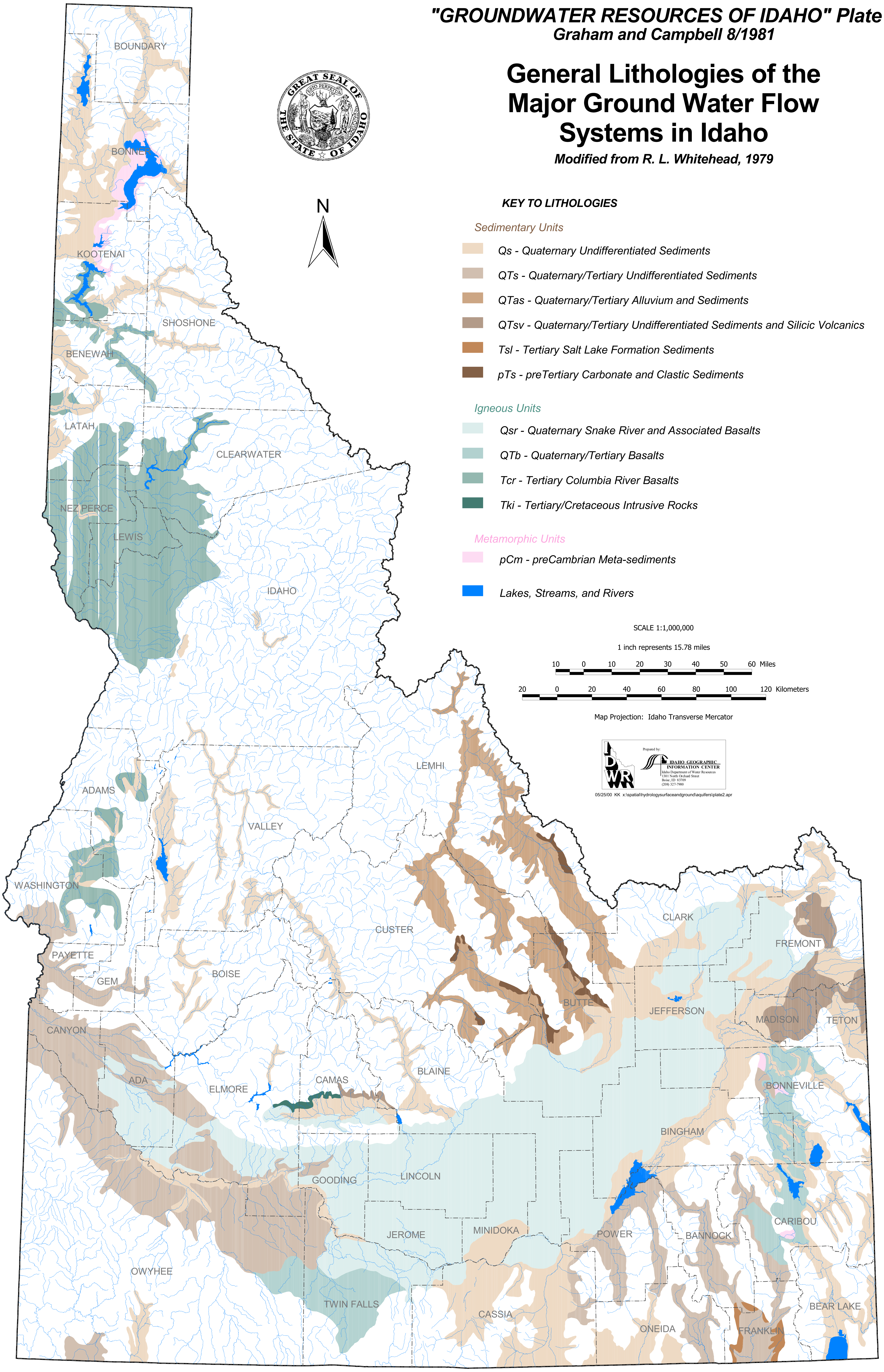
"GROUNDWATER RESOURCES OF IDAHO" Plate 2
Graham and Campbell 8/1981

General Lithologies of the Major Ground Water Flow Systems in Idaho

Modified from R. L. Whitehead, 1979



KEY TO LITHOLOGIES

Sedimentary Units

- *Qs - Quaternary Undifferentiated Sediments*
- *QTs - Quaternary/Tertiary Undifferentiated Sediments*
- *QTas - Quaternary/Tertiary Alluvium and Sediments*
- *QTsv - Quaternary/Tertiary Undifferentiated Sediments and Silicic Volcanics*
- *Tsl - Tertiary Salt Lake Formation Sediments*
- *pTs - preTertiary Carbonate and Clastic Sediments*

Igneous Units

- *Qsr - Quaternary Snake River and Associated Basalts*
- *QTb - Quaternary/Tertiary Basalts*
- *Tcr - Tertiary Columbia River Basalts*
- *Tki - Tertiary/Cretaceous Intrusive Rocks*

Metamorphic Units

- *pCm - preCambrian Meta-sediments*

- *Lakes, Streams, and Rivers*

SCALE 1:1,000,000

1 inch represents 15.78 miles

10 0 10 20 30 40 50 60 Miles

20 0 20 40 60 80 100 120 Kilometers

Map Projection: Idaho Transverse Mercator

Prepared by: IDAHO GEOGRAPHIC INFORMATION CENTER, Idaho Department of Water Resources

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"GROUNDWATER RESOURCES OF IDAHO" Plate 3
Graham and Campbell 8/1981

Potentiometric Contours and Generalized Directions of Groundwater Flow in Idaho

Modified from R. L. Whitehead, 1979