PRELIMINARY DRAFT

HYDROGEOLOGIC ANALYSIS OF THE WATER SUPPLY FOR THE COMMUNITY OF FRANKLIN, FRANKLIN COUNTY, IDAHO

Preliminary draft

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Technical Assistance for Rural Ground Water Development within Idaho

SUMMARY

Franklin, the oldest incorporated community in Idaho, lies along the west side of Cache Valley in the Bear River drainage (Figure 1). This community of approximately 640 residents acquires its domestic water from springs and wells located along the western front of the Bear River mountain range. Some of the springs contain particulate contaminants, forcing the community to either treat the water or develop a new ground water source. The IWRRI Rural Community Water Project team has completed a hydrogeologic study of the Franklin area and recommends the following options:

- Abandon the contaminated springs or install an adequate treatment system.
- Drill a new well to replace water lost by decommissioning the contaminated springs. A site was defined east of town for a preliminary test well (Plate 1).
- Consider drilling an additional well near the existing city wells.

Paleozoic- and Tertiary-age sedimentary strata form the bedrock under Cache Valley near Franklin. A diverse assemblage of unconsolidated sediments lies above these older rocks. The unconsolidated sediments include gravel deposited from ancient streams and mud deposited from Glacial Lake Bonneville. Lake Bonneville formed in western Utah, eastern Nevada, and southern Idaho approximately 12 to 15 thousand years ago, when the inflow by glacial melt-water exceeded the outflow by evaporation from the internally drained Great Basin.

Extensive deposits of mud and silt that accumulated on the former lake floor impede the flow of ground water in the Franklin area. Well-test data show low yields of ground water from the lacustrine (lake) mud and the older bedrock. Higher yields occur in the gravel deposits that reside above the bedrock and below the Bonneville lakebed sediments. Geological fieldwork and aerial photo interpretation in the project area defined the distribution of these gravels (Plate 1). An analysis of precipitation that falls in nearby drainage basins shows that the Oxkiller drainage, located immediately east of town, may provide adequate recharge into these gravels. The proposed test well is designed to test this sequence of gravel.

Particulates contaminate Crooked Spring, one of Franklin's primary water sources. The contamination results from surface water mixing with subsurface water. Enhanced spring development will not resolve this situation; therefore this source should either be abandoned or the water treated. Dowdell and Kingsford Springs, the communities other spring-water sources, continually provide clean water, so should be maintained. The community uses two wells that penetrate fractured Tertiary bedrock. A new well drilled nearby in the same fractured rock should provide a similar quantity of water as the other wells.

INTRODUCTION

Franklin, a community of 640 residents, lies along the front of the Bear River Mountain Range in Cache Valley Idaho (Figure 1). This report summarizes results of a study undertaken by the IWRRI Technical Assistance for Rural Ground Water Development project to assist Franklin with problems associated with their domestic water supply. The city acquires domestic water from three springs and two wells located in the foothills east of town. One of the primary sources of water for the community, Crooked

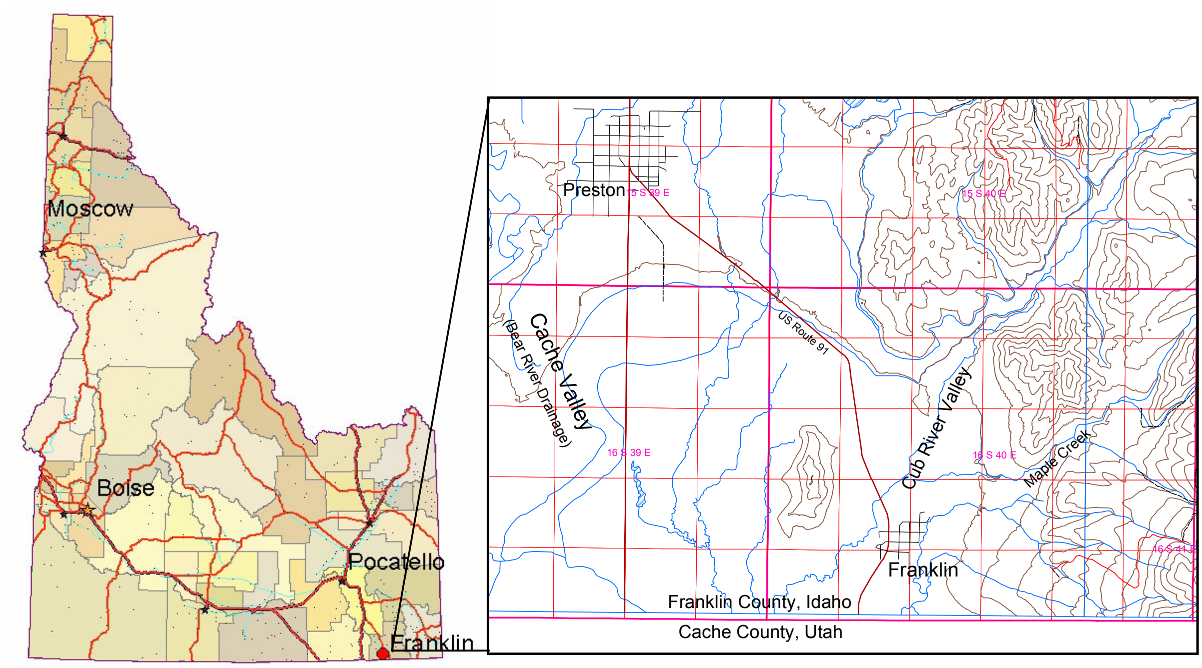

Figure 1, Location map of the Franklin Project area.

Spring, has revealed chronic water quality problems during the past few years. The spring was redeveloped recently in order to remedy the problems but this work failed and the spring remains contaminated. This study resulted in an understanding of the hydrogeology of the existing water supplies and delineation of additional sources of ground water for the community.

STATEMENT OF PROBLEM

Water samples from one of the community’s primary water supplies, Crooked Spring, contain particulate contaminants. The chronic nature of the poor water quality has prompted the Idaho Department of Environmental Quality (DEQ) to require the community to either treat this water or take the spring off line. The population of Franklin has grown 34 percent in the last ten years (US Bureau of Census, March, 2001). Regardless of whether or not the community chooses to treat the water or decommission the spring, Franklin will likely need additional water to supply their growing population.

PURPOSE AND OBJECTIVES

This study provides Franklin with a hydrogeologic assessment of the ground water systems from which the community acquires domestic water. The assessment will help Franklin find a source of water to replace Crooked Spring and to supply water required for future growth. It also provides Franklin with technical information that is not generally available, enabling the city to develop a sustainable, alternate source of water.

GROUND WATER DEVELOPMENT CONCEPTS

Ground water occurs and moves between individual grains of sand or gravel or through cracks or fractures in solid rocks. One of the keys to ground water development is locating a zone where the holes between grains or fractures are large and interconnected. In such a saturated zone, called an aquifer, water in these holes moves under the force of gravity from higher elevations (recharge areas) to lower elevations (discharge areas). Typical discharge areas include springs, streams and lakes. Most recharge comes from precipitation (rain or snow) that infiltrates the ground. Some recharge occurs from streams and lakes at elevations higher than the ground water. Ground water moves downward slowly, generally less than 10 feet per day.

Understanding subsurface geology leads to an understanding of ground water systems. Aquifers occur where streams deposited sand or gravel or where an extensive network of fractures cut solid rock. Geologists understand aquifers and ground water flow patterns by mapping surface rock outcrops and reviewing logs of material penetrated by wells. This leads to identifying potential areas for well development and the recharge areas critical for good water quality and sustainability.

Sustainable development requires that ground water use be less than aquifer recharge. Removal of water from wells results in some water level decline in the ground and an associated reduction in natural discharge. Characterizing natural ground water discharge from springs and seeps, knowing the discharge of interconnected streams, and understanding the quantity and location of annual aquifer recharge provides the basis for proper ground water development.

GEOLOGY

The geological architecture, including the type of rocks and the distribution of faults, exercises considerable influence on the distribution quantity and availability of ground water in the Franklin area.

REGIONAL GEOLOGY

Rocks in the Franklin area consist primarily of sedimentary strata deposited in shallow marine water during Precambrian and lower Paleozoic time. The originally flat-lying strata were compressed and transported easterly during Mesozoic time, forming the Idaho-Wyoming overthrust belt. The waning stages of this deformation exposed the section in early Tertiary time to an extensive period of erosion. Modern-day drainage patterns and the distribution of valleys and mountains were largely established during this period of erosion.

Bear River starts in the Uinta Mountains of Utah and flows north into Wyoming, west into Idaho, then south into the Great Salt Lake. This convoluted flow path resulted from bedrock controls imposed by complexly folded and faulted sedimentary strata of the Idaho-Wyoming overthrust belt. Rocks within this belt have regional-scale north south oriented folds. Many types of faults cut the folded strata; some, called thrust faults, place older rocks above younger, and others, called normal faults, place younger strata above older rocks.

Normal faults, the youngest in the area, cut all of the earlier features and help to form the landscape visible in much of southeastern Idaho. These faults formed primarily during development of the Basin and Range, an extensional tectonic province covering much of the central-west and southwest part of North America. Franklin and the Cache Valley lie within the Idaho-Wyoming overthrust belt, in the northern portion of the Basin and Range geologic province.

PROJECT AREA GEOLOGY

Precambrian and Paleozoic-age sedimentary rocks underlie the Franklin area indicated by exposures of these strata in the Bear River Mountains and west of town on Little Mountain. The section consists of the upper Precambrian- and Cambrian-age Brigham Quartzite and lower Paleozoic-age limestone, dolomite and sandstone. Eocene-age sedimentary rocks of the Salt Lake Formation accumulated above the deformed and deeply eroded pre-Tertiary strata in a shallow, inland sea. Following deposition of the Salt Lake Formation, late Tertiary erosion formed a regionally extensive accumulation of gravel. Young faults cut this sequence and formed isolated, gravel-capped benches and terraces. The terrace gravels now occur as erosional remnants along the margins of valleys throughout the area. Unconsolidated sediments, primarily of glacio-lacustrine and fluvial origin, accumulated above the older strata at elevations less than 5100 feet.

STRATIGRAPHY

The geologic map of the study area (Plate 1), constructed from field mapping, interpretations of aerial photographs, and data from Oriel and Platt (1983), shows the distribution of sedimentary units. The following section discusses the sedimentary strata near Franklin that influence ground water flow.

PRECAMBRIAN AND CAMBRIAN BRIGHAM QUARTZITE

The Brigham Quartzite forms the oldest strata exposed in the Bear River Mountain Range and underlies most of the drainage basins east of Franklin. The unit consists primarily of silicified quartz sand with local pebble conglomerate lenses. It forms bold, resistant outcrops though locally shows pervasive, strong fracturing.

Geochemical analyses of water samples (Table 1) collected from springs in the Brigham Quartzite along the east side of the Bear River Range suggest ground water in this unit results principally from locally derived precipitation, not from a regional ground water flow system. If applicable at Franklin, this interpretationsuggests that the Brigham is not a good target for well development. Much of the precipitation that accumulates in drainage basins east of Franklin probably runs off as surface water rather than infiltrating. The runoff will flow down gradient and recharge unconsolidated-sediment aquifers at lower elevations. Clearly, the larger drainage basins will provide the greatest amount of recharge. Plate 2 shows the outline of these basins and the quantity of annual precipitation (modified from Daly and Taylor, 2001), and indicates that Deep Creek and Oxkiller canyon accumulate the largest volume of precipitation.

Table 1 - Chemistry of water from springs in the Brigham Quartzite.

Sample number	Easting (NAD27-12)	Northing (NAD27-12)	Water Temp F	Alkalinity (as CaCO3)	Ca	Mg	K	Si	Na	Sulfate
BRO 08-20-02-1	462417	4673497	60							
BRO 08-21-02-1	461221	4678364	65	29	7	1.7	2	1.1	3	<2.00
BRO 08-21-02-2	460738	4678447	50	14	5	1.2	1	6.7	2	2.52
BRO 08-21-02-3	460588	4679088	65	16	6	1.2	1	6.7	2	2.46
BRO 08-21-02-7	460527	4673341	55	18	5	1	1	6.2	2	<2.00
BRO 08-22-02-1	462309	4673536	58	37	10	2.4	1	11	3	3.09

Paleozoic carbonate strata

Strata younger than the Brigham Quartzite that occur on Little Mountain west of Franklin include Paleozoic-age limestone and quartzite (Plate 1). These strata do not occur in the Bear River Range near Franklin, so are not important with respect to ground water systems utilized by the community.

Tertiary Salt Lake Formation

Tertiary-age sedimentary rocks of the Salt Lake Formation overlie the Brigham Quartzite. These strata include a diverse assemblage of siltstone, sandstone, limestone, and conglomerate that lie above an erosional surface on the older rocks. They occur along the lower part of the Bear River Range front, and underlie the Cache Valley near Franklin. A north-south normal fault juxtaposes Salt Lake strata near Franklin against the Brigham Quartzite along Bear River range front (Plate 1).

Most of the wells developed in bedrock near Franklin penetrate siltstone and claystone of the Salt Lake Formation. Water yield from these wells varies over a wide range. Most show yields of 5 to 20 gpm though a few produce over 200 gpm. Generally, the higher yielding wells are located along or near faults, suggesting that fault-induced fractures play a critical role in the higher flow rates. Conversely, this suggests that wells developed in unfractured Salt Lake strata will typically yield low flow rates.

Tertiary and Quaternary unconsolidated sediments

Several different types and ages of unconsolidated sediments occur above rocks of the Salt Lake Formation and provide water to many of the wells in the Franklin area. Most wells in the Cache Valley near Franklin derive water from the unconsolidated material, whereas wells within and near the mountains derive water from strata of the Salt Lake Formation (Plate 1).

TERRACE GRAVEL

Deposits of coarse-grained gravel accumulated during an extensive period of erosion that followed deposition of the Salt Lake Formation. This once regionally extensive unit has been eroded away in many areas due to uplift and faulting. Remnants of the gravel unit now cap ridges near Franklin and form a large dissected alluvial fan at the base of Oxkiller Canyon (Plate 1). The gravel deposits formed earlier than the Glacial Lake Bonneville sediments, so underlie these extensive clay-rich strata. As such, a hole drilled in the Cub River Valley near Franklin would penetrate the glacial lake sediments, and then intersect the gravel before penetrating the Salt Lake Formation.

Wells developed in the gravel section can show yields greater than 350 gpm. Table 2 shows two examples of such wells. Regionally, numerous springs emanate from the terrace gravels. These data indicate that the gravels carry abundant ground water where hydrologically connected to a recharge area. The large gravel fan located in the lower Oxkiller drainage immediately east of Franklin represents such an occurrence. Surface runoff from precipitation in upper Oxkiller Creek recharges this fan (Plate 1).

Table 2 - Examples of water yields from wells developed in terrace gravels.

Owner	Location	Well Depth	Yield (gpm)
Fairview Water District	T16N R40E SENE 8	354	350
Hanson, Boyd	T1S6 R40E SWSE 27	200	365

BONNEVILLE AND PROVO FORMATIONS

The predecessor to the Great Salt Lake, ancient Lake Bonneville, occupied much of the Great Basin during Pleistocene time. It formed because glacial melt water and precipitation accumulated faster than what could evaporate from the internally drained area. Lake Bonneville reached a maximum elevation of about 5,100 feet before it breached Red Rock Pass and flowed into the Snake River Plain. The breach drained the lake to an elevation of about 4,800 feet, where it resided for an extended period. The 5,100-foot-elevation high-water stand is referred to as the Bonneville level, while the 4,800-foot-elevation is called the Provo level. Geologic features such as shorelines and sediments deposited from the lake use these same names. Unlithified sediments deposited during the Bonneville level high-water stand are named the Bonneville Formation, and similarly for the Provo Formation (Plate 1). Both formations consist primarily of clay rich sediment, though sand- and gravel-bearing deltas, fed by mountain streams, propagate into the clay-rich sediments.

Clay-rich sediments of the Bonneville and Provo Formations severely impede or preclude ground water flow. Wells that cut these sediments generally derive water from gravel below the clay-rich sediments or from interlayered deltaic sand and gravel beds. Many of the wells in Cache Valley show an artesian head, suggesting that the aquifer underlying the lacustrine clay beds is confined.

STRUCTURE

Faults help to form the landscape visible from Franklin and influence the elevation of the bedrock surface below unconsolidated valley-filling sediments. Two primary fault orientations occur in the study area: north-northeast faults and west-northwest faults. Both sets cut all strata except those deposited from Glacial Lake Bonneville. Fault displacement has exposed the older terrace gravel deposits to increased erosion, greatly modifying their distribution and thickness. This relationship indicates that the last movement occurred prior to Lake Bonneville sedimentation, approximately 12,000 to 15,000 years ago.

NORTH-NORTHEAST FAULTS

North northeast faults form the eastern side of Cache Valley by displacing strata down to the west. The largest of this fault set, located approximately 3.5 miles east of Franklin, separates Brigham Quartzite within the Bear River Range from strata of the Salt Lake Formation exposed along the range front (Plate 1). A parallel structure lies between Franklin and the Oxkiller fan. This structure, inferred from differential depths to bedrock in drillholes, separates relatively thick accumulations of unconsolidated sediments below the valley floor from thinner accumulations along the range front.

WEST-NORTHWEST FAULTS

The west-northwest set of faults drops strata down to the south (Plate 1). Outcrops of these faults exposed east of Franklin show extensive fracturing, particularly in the Brigham quartzite. A west-northwest fault in Oxkiller Canyon, herein named the Oxkiller fault (Plate 1) cuts through the terrace gravels located east of Elk Meadows subdivision and places gravels south of the fault against strata of the Salt Lake Formation on the north.

HYDROGEOLOGY

The rocks and unconsolidated sediments discussed above and the structural controls imposed by faulting provide the framework in which ground water occurs in the Franklin area.

REGIONAL HYDROGEOLOGY

Contours of ground water in Cache Valley show two sources that contribute to water to the area near Franklin. Some ground water flows south along the axes of the valleys of Cub and Bear rivers. Ground water also results from infiltration of precipitation in the Bear River Mountains to the east. The relative proportion of water from each source depends on the location in the valley; Franklin probably derives its water primarily from the easterly mountainous source area. The generalized water table map constructed from static water level in wells (Plate 3) shows that ground water along the range front generally flows from east to west.

PROJECT AREA HYDROGEOLOGY

Two types of material provide ground water to wells in the Franklin area; sedimentary strata of the Salt Lake Formation, and overlying unconsolidated material. Lacustrine clay beds deposited from Lake Bonneville and Lake Provo generally produce little water.

GROUND WATER FLOW SYSTEMS IN CONSOLIDATED ROCKS

All of the wells in the Franklin area that intersect bedrock penetrate strata of the Tertiary Salt Lake Formation. Well tests from these strata generally show low to moderate yields of 5 to 20 gpm, which probably results from low permeability through the clay-rich strata. Isolated wells, however, have flow rates over 200 gpm. These wells are generally located near fault traces, suggesting that fractures concentrated along faults may foster increased water flow.

GROUND WATER FLOW SYSTEMS IN UNCONSOLIDATED SEDIMENTS

Clay-rich strata deposited from glacial Lake Bonneville and Lake Provo dominate the unconsolidated sediments in the Cache Valley near Franklin. Wells developed in the lake sediments show very low yields, and are probably inadequate for most water uses. Wells that penetrate the base of the clay beds commonly show artesian heads, suggesting that the clay-rich strata confine the underlying aquifer. Isolated gravelly and sandy lenses within the clay-rich lakebeds show higher flow rates and probably represent the best potential strata within the lacustrine sediments that have the potential to host a productive aquifer. Locating such strata, however, could only be accomplished by trial and error.

The terrace gravel unit is older than the Lake Bonneville sediments so probably underlies the clays throughout much of the Cub River Valley. Wells developed in this gravel sequence generally show yields of greater than 200 gpm (Table 3). One well near the mouth of Cub River Canyon developed in these gravels yields 350 gpm. These data suggest that this unit can produce high yields where the gravels are connected to a recharge zone. The following discussion pertains to a uniquely large accumulation of terrace gravel east of Franklin, in the lower Oxkiller drainage basin.

OXKILLER FAN GROUND WATER SYSTEM

The terrace-gravel fan at the mouth of Oxkiller Creek likely contains a ground water system that can be developed (Plate 1). A west-northwest trending fault cuts the gravel fan and places gravel on the fault's south side against strata of the Salt Lake Formation on the north. The bedrock floor beneath the down-dropped gravel is deepest near the fault. Viewed in cross section (Plate 1, Section BB'), the bedrock profile creates an asymmetric "V" shape, with the bottom of the V nearest the fault. Water enters the gravel fan from the upper part of the drainage basin then may preferentially flow through the deeper gravels along the south side of the fault. Water following this path will continue down gradient into the Cub River basin under the clay beds of Lake Bonneville. A hole drilled into the fan gravels south of the fault should intersect this flow path.

HYDROTHERMAL WATER SYSTEMS

Several wells in the Cub River Valley reportedly contain sulfurous or strongly ferruginous water. Some, like the Franklin-City old well, contain geothermal water. The geothermal water probably emanates from faults that cut the sedimentary rock units then mixes with the cold ground water below Lake Bonneville sediments.

ANALYSIS OF WELLS AND SPRINGS

FRANKLIN CITY WELLS

The city of Franklin operates two wells located in the Maple Creek drainage. Well-1 is 244 feet deep and cased to 39 feet. It collars in glacial gravel deposits and then penetrates strata of the Salt Lake Formation. This well yields 136 gpm. Well-2 is 285 feet deep and cased to 285 feet. It penetrates similar rocks to Well-1 and pump tested at 185 gpm (IIDWR records; Sunrise, 1999a). These two wells provide water to the municipality, a third well located nearby remains undeveloped. Well-3 is 305 feet deep and cased to 305 feet. A pump test when drilled yielded 225 gpm. Measured yields from these wells are abnormally high relative to others completed in correlative strata. The well logs indicate that water-producing zones are strongly fractured. The fractures may have resulted from movement along the west-northwest fault that follows Deep Creek. The pump test of Well-3 showed a yield higher than test results from the two adjacent wells. Perhaps Well-3 should have been developed rather than Wells 1 and 2.

The Franklin City "old well" is located along lower Maple Creek, approximately one mile northeast of town. This well was drilled to 377 feet and cased to 366 feet. The pump test indicates the well can produce approximately 100 gpm (Sunrise, 1999b). It is not used because it produces geothermal water; A 1978 pump test records a temperature of 74 Degrees F from a depth of 120 feet.

DOWDELL SPRING GROUND WATER SYSTEM

Dowdell Spring emanates from a thick sequence of terrace gravel located northwest of High Creek, in Cache County, Utah. It maintains a constant flow rate of approximately 70 gpm throughout the year (Sunrise, 1999c). The recharge area for the ground water system feeding Dowdell Spring appears to be from an irrigated area rather than from the Bear River Mountains. Irrigation water is diverted from High Creek and flows in a canal constructed on the terrace gravel approximately 1000 feet upslope from Dowdell Spring. The historically constant flow rate from this spring suggests that it will likely remain a dependable source of water. Shortened irrigation seasons due to drought, however, could adversely impact the volume of water that flows through the spring.

KINGSFORD SPRING GROUND WATER SYSTEM

Kingsford Spring emanates from unconsolidated gravel in the South Canyon drainage and flows at approximately 20 gpm. The gravel, originally deposited by a glacier, consists of a mixture of fine- and coarse-grained material. A dye test completed in 1971 (Haws, 1971) indicates that High Creek, 6,000 feet to the south, is the source of water for Kingsford Spring. Test records show that dye placed in High Creek at an elevation of approximately 5200 feet appeared in Kingsford Spring at an elevation of 5050 feet 11 days after introduction. Results from this test were likely misinterpreted; it is unreasonable to think that ground water can travel this distance through bedrock in 11 days while dropping relatively little in elevation. Recharge for the ground water system feeding the spring probably occurs higher in the South Creek drainage. Historical water tests show that agricultural use in South Canyon does not influence the quality of Kingsford spring water. Further development such as road construction may impact the water quality of the spring, so should be monitored.

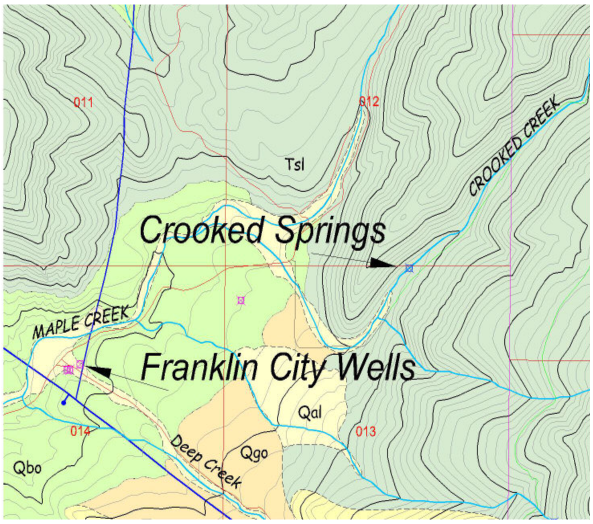

Figure 2, Location of Crooked Spring relative to the Franklin City Wells.

CROOKED SPRING GROUND WATER SYSTEM

Crooked Creek, a high-gradient mountain stream, flows into Maple Creek up stream from the municipal wells *(Figure 2).* A thin mantle of gravel overlies bedrock along the deeply incised stream channel along most of its length. Surface and ground water are closely interconnected within the drainage. As gravels thicken in the drainage, surface water infiltrates and mixes with the ground water. When gravels thin, ground water reemerges as surface water and mixes with the stream. Crooked Spring is an example of this condition. The close interconnection of the springs with ground water and surface water make using the spring as a municipal supply source essentially the same as using water directly from the creek. There is no way to develop the spring in a different way to improve this site as a water supply source.

DISCUSSION OF RESULTS

The city of Franklin derives its water supply from two wells and three springs. A combination of particulate contamination in some of the springs, inefficient production from the wells, and population growth will require the community to consider developing alternative water sources. Available water exploration targets include aquifers in bedrock and in overlying, unconsolidated sediments. When choosing a new target, two primary factors require consideration:

- Availability of a suitable supply of good quality water, and
- Proximity to the existing infrastructure.

Bedrock targets near existing infrastructure are restricted to the Tertiary Salt Lake Formation based on surface rock exposures and drill logs. Test data from existing wells that penetrate these strata show a range of production levels, though most produce less than 20 gallons per minute. Surface rock exposures indicate that these strata are composed primarily of clay-rich siltstone, which likely explains the low flow rates. Higher flow rates may occur locally due to interbedded sandy lenses, or to areas of increased fracture density along faults. Franklin City wells 1 and 2 provide examples of this; exposures of a fault that follows Deep Creek show extensive fracturing along the trace of the structure. Though unexposed at the wellheads, drill logs indicate increased fracturing in the water-bearing zones. An exploration target in these strata near wells that show higher flow rates, such as the Franklin city wells would increase the odds of developing a better well. Concentrated zones of fracturing or the distribution of sandy lenses in the Salt Lake Formation elsewhere would be difficult to locate due to the extensive cover of Lake Bonneville sediments.

Potential ground-water targets occur in unconsolidated gravel as well. Considerations for such a target include 1) an adequate thickness of gravel to host the ground water, and 2) adequate, continuous recharge. The springs utilized by Franklin define three types of gravel occurrences available in the Franklin area. Crooked Spring occurs in a thin mantle of young gravels that line the deeply incised stream drainage. Kingsford spring emanates from gravel deposited directly by a glacier. Dowdell spring occurs in a thick accumulation of old terrace gravel.

Terrace gravels, such as those that host Dowdell Spring, show the greatest possibility of hosting a quality aquifer. Relevant factors include adequate thickness, good recharge, and evidence of good transmissivity. A large accumulation of terrace gravel occurs east of Franklin, in the lower Oxkiller drainage basin, and represents the best possible target in this type of strata. These gravels appear to be hydrologically connected to the upper part of the drainage, which would probably furnish continuous recharge. A west-northwest fault that follows Oxkiller creek may funnel ground water through the thickest section of gravel, along the trace of the structure.

Two other types of gravel occurrences represent subordinate targets: glacial gravels would likely provide low flow rates, and Crooked Spring shows that ground water traveling in shallow stream gravels is prone to interact with surface water.

CONCLUSIONS AND RECOMMENDATIONS

The city of Franklin should abandon Crooked Spring or install an adequate treatment system. This source cannot supply a consistent contaminant free supply of water, regardless of the type and quality of spring development without a treatment system.

If Crooked Spring is abandoned, Franklin will need a new well to replace water lost from decommissioning the spring. Plate 1 shows the location of a proposed new well designed to test unconsolidated terrace gravels in the lower Oxkiller drainage basin. If the test well proves successful, a new production well should be drilled deep enough to intersect rocks of the Salt Lake Formation, and be completed with an engineered screen. The community should exercise great care in selecting a qualified driller with experience in difficult drilling conditions and installing well screens.

Franklin should consider drilling another well southeast of wells 1 and 2, along the Deep Creek fault. Plate 1 shows a proposed location for a test well, Additional geologic mapping will refine this target by placing the hole within rock fractured by the fault.

Dowdell and Kingsford springs should be maintained as primary sources of water. The community should recognize, however, that shortened irrigation seasons due to drought might impact the volume of water that flows through Dowdell Spring. Land use up stream from Kingsford should be monitored because changes in land use may adversely affect the quality water that recharges the spring.

ACKNOWLEDGEMENTS

The authors accept responsibility for the interpretations expressed in this document. These views do not necessarily reflect those of the University of Idaho, IWRRI, the United States Environmental Protection Agency (USEPA), or any other institution. Rather, they reflect our opinions as shaped by our observations and experiences in the field, interpretation of the scientific and technical literature and our understanding of input provided by our colleagues and representatives from the community of Franklin, Idaho. We, the authors, accept full responsibility for any omissions or misinterpretations of facts.

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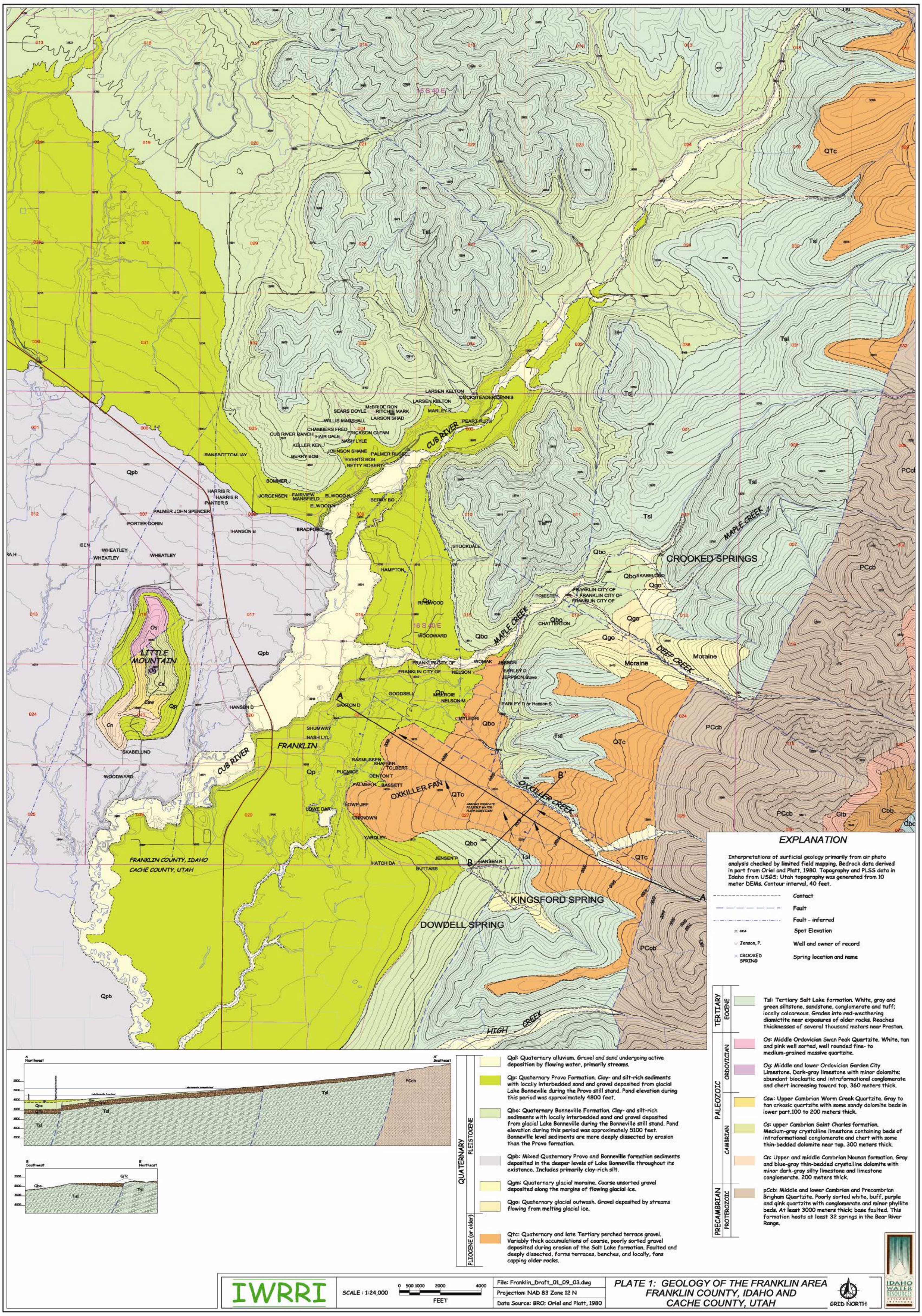
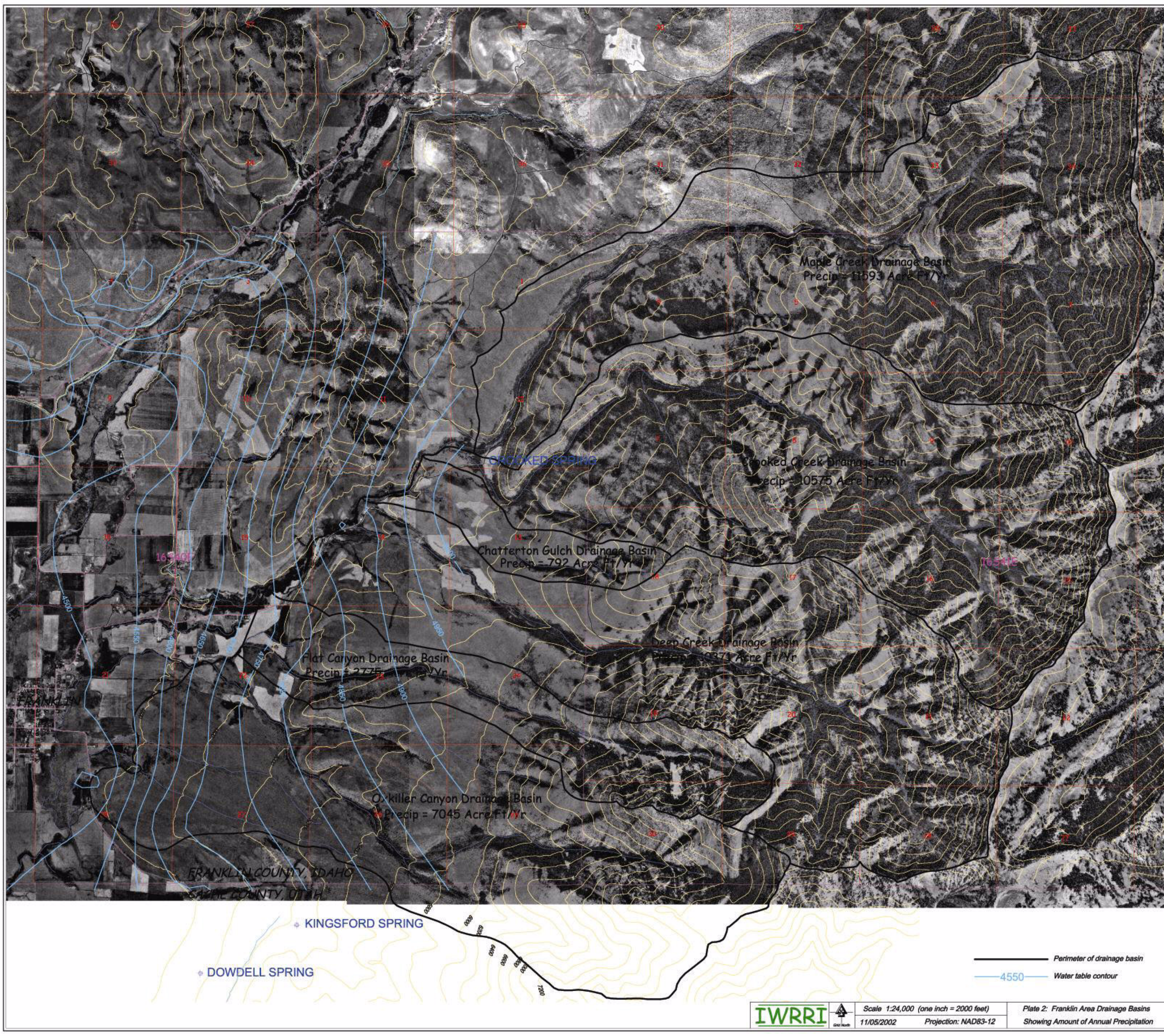

CUB RIVER
FRANKLIN
LITTLE MOUNTAIN
CROOKED SPRINGS
MAPLE CREEK
DEEP CREEK
OXKILLER FAN
OXKILLER CREEK
KINGSFORD SPRING
DOWDELL SPRING
HIGH CREEK
FRANKLIN COUNTY, IDAHO
CACHE COUNTY, UTAH
EXPLANATION
Interpretations of surficial geology primarily from air photo analysis checked by limited field mapping. Bedrock data derived in part from Oriel and Platt, 1980. Topography and PLSS data in Idaho from USGS; Utah topography was generated from 10 meter DEMs. Contour interval, 40 feet.
Contact
Fault
Fault - inferred
Spot Elevation
Jenson, P.
Well and owner of record
CROOKED SPRING
Spring location and name
QUATERNARY
PLEISTOCENE
Qal: Quaternary alluvium. Gravel and sand undergoing active deposition by flowing water, primarily streams.
Qp: Quaternary Provo Formation. Clay- and silt-rich sediments with locally interbedded sand and gravel deposited from glacial Lake Bonneville during the Provo still stand. Pond elevation during this period was approximately 4800 feet.
Qbo: Quaternary Bonneville Formation. Clay- and silt-rich sediments with locally interbedded sand and gravel deposited from glacial Lake Bonneville during the Bonneville still stand. Pond elevation during this period was approximately 5100 feet. Bonneville level sediments are more deeply dissected by erosion than the Provo formation.
Qpb: Mixed Quaternary Provo and Bonneville formation sediments deposited in the deeper levels of Lake Bonneville throughout its existence. Includes primarily clay-rich silt.
Qgm: Quaternary glacial moraine. Coarse unsorted gravel deposited along the margins of flowing glacial ice.
Qgo: Quaternary glacial outwash. Gravel deposited by streams flowing from melting glacial ice.
PLIOCENE (or older)
Qtc: Quaternary and late Tertiary perched terrace gravel. Variably thick accumulations of coarse, poorly sorted gravel deposited during erosion of the Salt Lake formation. Faulted and deeply dissected, forms terraces, benches, and locally, fans capping older rocks.
TERTIARY
EOCENE
Tsl: Tertiary Salt Lake formation. White, gray and green siltstone, sandstone, conglomerate and tuff; locally calcareous. Grades into red-weathering diamictite near exposures of older rocks. Reaches thicknesses of several thousand meters near Preston.
PALEOZOIC
ORDOVICIAN
Os: Middle Ordovician Swan Peak Quartzite. White, tan and pink well sorted, well rounded fine- to medium-grained massive quartzite.
Og: Middle and lower Ordovician Garden City Limestone. Dark-gray limestone with minor dolomite; abundant bioclastic and intraformational conglomerate and chert increasing toward top. 360 meters thick.
CAMBRIAN
Csw: Upper Cambrian Worm Creek Quartzite. Gray to tan arkosic quartzite with some sandy dolomite beds in lower part.100 to 200 meters thick.
Cs: upper Cambrian Saint Charles formation. Medium-gray crystalline limestone containing beds of intraformational conglomerate and chert with some thin-bedded dolomite near top. 300 meters thick.
Cn: Upper and middle Cambrian Nounan formation. Gray and blue-gray thin-bedded crystalline dolomite with minor dark-gray silty limestone and limestone conglomerate. 200 meters thick.
PRECAMBRIAN
PROTEROZOIC
pCcb: Middle and lower Cambrian and Precambrian Brigham Quartzite. Poorly sorted white, buff, purple and qink quartzite with conglomerate and minor phyllite beds. At least 3000 meters thick; base faulted. This formation hosts at least 32 springs in the Bear River Range.
IWRRI
SCALE : 1:24,000
0 500 1000 2000 4000
FEET
File: Franklin_Draft_01_09_03.dwg
Projection: NAD 83 Zone 12 N
Data Source: BRO; Oriel and Platt, 1980
PLATE 1: GEOLOGY OF THE FRANKLIN AREA FRANKLIN COUNTY, IDAHO AND CACHE COUNTY, UTAH
GRID NORTH


Maple Creek Drainage Basin
Precip = 11593 Acre Ft/Yr
CROOKED SPRING
Chatterton Gulch Drainage Basin
Flat Canyon Drainage Basin
Deep Creek Drainage Basin
Precip = 7045 Acre Ft/Yr
FRANKLIN COUNTY, IDAHO
CACHE COUNTY, UTAH
KINGSFORD SPRING
DOWDELL SPRING
Perimeter of drainage basin
4550 Water table contour
IWRRI
Grid North
Scale 1:24,000 (one inch = 2000 feet)
11/05/2002
Projection: NAD83-12
Plate 2: Franklin Area Drainage Basins
Showing Amount of Annual Precipitation