



United States Department of the Interior

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IN REPLY REFER TO:

L54(2380)
GLAC/General

Memorandum

To: Jerry Burgess, Park Engineer, Glacier National Park

From: Larry Martin, Hydrogeologist, Water Resources Division

Subject: Proposed well at Polebridge Entrance Station

Summary: The Park desires to replace a shallow infiltration gallery at the Polebridge Entrance Station with a water well. This would allow the park to eliminate the filtration portion of the water treatment system, reducing operating costs. I have reviewed geologic reports and results of previous test drilling in the Polebridge area and have determined that it is highly unlikely that a successful water well could be constructed in the immediate vicinity of the Polebridge Entrance Station. The nearest suitable locations for groundwater exploration are on the west side of the North Fork, across the river from the entrance station, or about ½ north of the entrance station where the valley on the east side of the river begins to broaden.

Hydrogeology

Three geologic formations might potentially be sources of potable groundwater in the valley of the North Fork Flathead River. These formations are; Quaternary alluvium, Pleistocene glacial till, and Tertiary Kishenehn Formation sediments.

The Tertiary Kishenehn Formation consists of semi-consolidated sand, silt, and clay (Boettcher, 1973). These sediments were deposited by an ancestor of the North Fork Flathead River about 35-55 million years ago. They have subsequently been compacted, including burial under ice sheets and glaciers. Compaction has reduced the permeability and water-producing capability of the sediments. A well that intersects a sand layer in the Kishenehn Formation might be expected to yield a few gallons per minute. However, there is no way to predict the underground location of these sand deposits from the surface and the odds are low for obtaining more than a few gpm from a well drilled into

the Kishenehn Formation. A well that does not intersect a sand or gravel layer might produce less than one gpm. In some reports, the Kishenehn Formation is referred to as “Old Alluvium” (Ross, 1959).

The Pleistocene glacial till was deposited by glaciers and has not been reworked by streams. Till is a mixture of boulders, gravel, sand, silt, and clay. Because it hasn’t been reworked by moving water, the fine-grained portion remains intermixed with the larger grained sands and gravels. Till is generally a poor source of water for wells. The thickness of the till in the North Fork valley is generally 5-10 feet, but may be 100 feet in places (Carrara, 1990). The till generally occurs as a blanket over the upland areas outside the main river valley.

The Quaternary alluvium consists of gravel, sand, and clay deposited along rivers and streams. Because these sediments have been reworked by water, they are sorted and often the finer-grained portions have been washed downstream. Highly permeable sand and gravel deposits are left behind. Wells constructed in alluvium commonly yield several tens to 100 gpm. The alluvium is generally limited to a maximum thickness of about 50 feet in the main valley of the North Fork. There is only a thin layer of alluvium underlying the Polebridge Entrance Station because it is at the eastern edge of the main valley. Test drilling in 1972 and 1979 showed that the alluvium underlying the entrance station is at an elevation higher than the river, and thus does not function as a reliable source of water.

The Polebridge Ranger Station is at the east end of a bridge across the North Fork Flathead River, near the confluence with Bowman Creek. The area is underlain by a thin mantle of alluvium deposited by the North Fork and the alluvial fan of Bowman Creek. The alluvium overlies Tertiary sediments of the Kishenehn Formation, which is often referred to as “Old Alluvium” (Boettcher, 1973). Several feet of glacial till cover the hillside east of Polebridge.

A schematic west-east geologic cross-section through the Polebridge area is attached to this report to help the reader understand the hydrogeologic conditions.

Previous Test Wells

A test hole was drilled about 100 yards north of the entrance station in 1972 (Boettcher, 1973). The test hole was 20 feet deep and penetrated 14 feet of alluvium. From 14-20 feet the hole was drilled through clay of the Tertiary Kishenehn Formation. The bottom of the alluvium is at an elevation several feet higher than the river and is thus drained (Boettcher, 1973). Therefore, it is unlikely that the alluvium could provide sufficient water for the Ranger Station. Boettcher recommended further exploration in the area including a deep well in the Tertiary sediments and a shallow well to investigate the alluvium along Bowman Creek.

In 1979, HKM Associates constructed and tested wells at several locations in Glacier National Park, including the Polebridge Entrance Station. A 201-foot dry hole was drilled at the Polebridge Entrance Station. A 33-foot dry hole was drilled in the Bowman Creek Campground. Test holes were drilled with an air rotary rig.

The deep test hole at Polebridge was drilled on October 1-2, 1979. The well penetrated about 6 feet of alluvial deposits from 17-23 feet below ground surface. Drilling continued through 178 feet of dry, semi-consolidated Tertiary sediments consisting of mainly clay. Estimated production from the test hole was less than one gpm. The hole was backfilled, capped, and abandoned.

A 33-foot test hole was drilled near the east end of the Bowman Creek Campground on October 3, 1979. The test hole penetrated 9 feet of damp alluvium. The underlying Tertiary sediments consisted of the same dry, semi-consolidated clay material as encountered at the Polebridge Ranger Station. The hole was backfilled, capped and abandoned due to lack of water.

The existing infiltration gallery at Polebridge was tested by HKM (1979). The test holes drilled at Polebridge were dry, indicating that the only sources of water at Polebridge are surface water from the North Fork or Bowman Creek or groundwater from the infiltration gallery. The existing gallery system is located about 35-40 feet northwest of the Polebridge administrative site and approximately 11-12 feet lower than the site. The system consists of a 24-inch diameter CMP pipe with an open bottom extending to 7 feet below ground surface. The collector system reportedly consists of 12-inch collector pipe buried under Bowman Creek with a 4-inch transmission pipe leading to the 24-inch CMP pipe. A limited pumping test was conducted on the system (HKM, 1979). The system was pumped at an average rate of 15 gpm for 2½ hours. Drawdown in the 24-inch CMP pipe was 3 feet. Inspection of the system during the test indicated that no water was flowing through the horizontal collector from Bowman Creek. All the water was coming through the bottom of the 24-inch CMP pipe, indicating that the system was essentially functioning as a shallow well.

Nearby Wells

Copies of well logs for adjacent areas in the North Fork valley were retrieved from the Montana Bureau of Mines and Geology Ground Water Information Center website (<http://mbmggwic.mtech.edu>). Wells within 3 miles upstream or downstream from Polebridge in the main valley of the North Fork generally range from 20-50 feet deep and obtain water from the alluvium. These wells yield 10-50 gpm.

Discussion

Successful water supply wells in the North Fork valley generally obtain water from the alluvial deposits in the river valley. These wells are shallow, generally 20-50 feet deep

and produce 10-50 gpm. Wells drilled into underlying bedrock formations have very little chance of producing water at more than one gpm.

At Polebridge, the river flows along the eastern side of the valley, greatly limiting the areal extent of alluvial deposits. Previous drilling and investigations at Polebridge have shown that the alluvial deposits will not provide significant quantities of water. The exception to this is the infiltration gallery constructed immediately adjacent to Bowman Creek. Infiltration from Bowman Creek provides a constant source of water to the alluvium in this area, keeping it saturated.

Test holes drilled into Tertiary sediments at Polebridge Entrance Station and Bowman Creek Campground were dry. There is no reason to think that additional drilling into the Tertiary sediments in this area would yield any different results.

The alternatives for providing water for the Polebridge Entrance Station include; 1) continuing to use the present infiltration gallery, 2) constructing a new, more secure infiltration gallery, 3) constructing a well in the alluvium on the west side of the river, and 4) constructing a well in the alluvium on the east side of the river about ½ mile north of the entrance station.

The existing infiltration gallery and treatment system meet the requirements of Montana DEQ for a public water supply (personal communication with Max Lauder, Montana DEQ, Feb. 15, 2001). Water from the system meets chemical and bacteriological standards for drinking water. Water from the infiltration gallery is pumped to a treatment building, where it passes through a series of filters and is chlorinated. The smallest filter removes all particles larger than 1 micron and is designed to remove giardia cysts. I have not seen the existing system and cannot comment on its state of repair or integrity of surface seals.

From available information in WRD files, it appears that the existing infiltration system has been in place for at least 30 years. It may be necessary to reconstruct the infiltration gallery to provide a more secure surface seal to prevent contaminants from getting into the collection system. If sufficient quantities of water can be obtained from a shallow “well”, similar to the existing 24-inch CMP pipe, then it might be better to forgo disturbing the creekbed and constructing a new system without an infiltration gallery.

Standard wells could be constructed in the alluvium of the North Fork. The nearest locations to construct wells are across the bridge on the west side of the river or about ½ mile north of the entrance station where the valley broadens on the east side of the river. A well in either of these locations would need to be drilled to about 50 feet and could be expected to yield 20-50 gpm. Well locations could be picked to insure that the wells would be considered to be true groundwater sources by Montana DEQ (rather than groundwater under the direct influence of surface water). Such a determination would preclude the necessity for filtration. A map showing these locations is attached.

References

Boettcher, Arnold J., 1973, Evaluation of the Ground-Water supply at Eight Sites in Glacier National Park, Northwestern Montana, USGS Open-File Report, 30 pp.

Carrara, Paul E., 1990, Surficial Geologic Map of Glacier National Park, Montana, USGS Miscellaneous Investigations Map I-1508-D

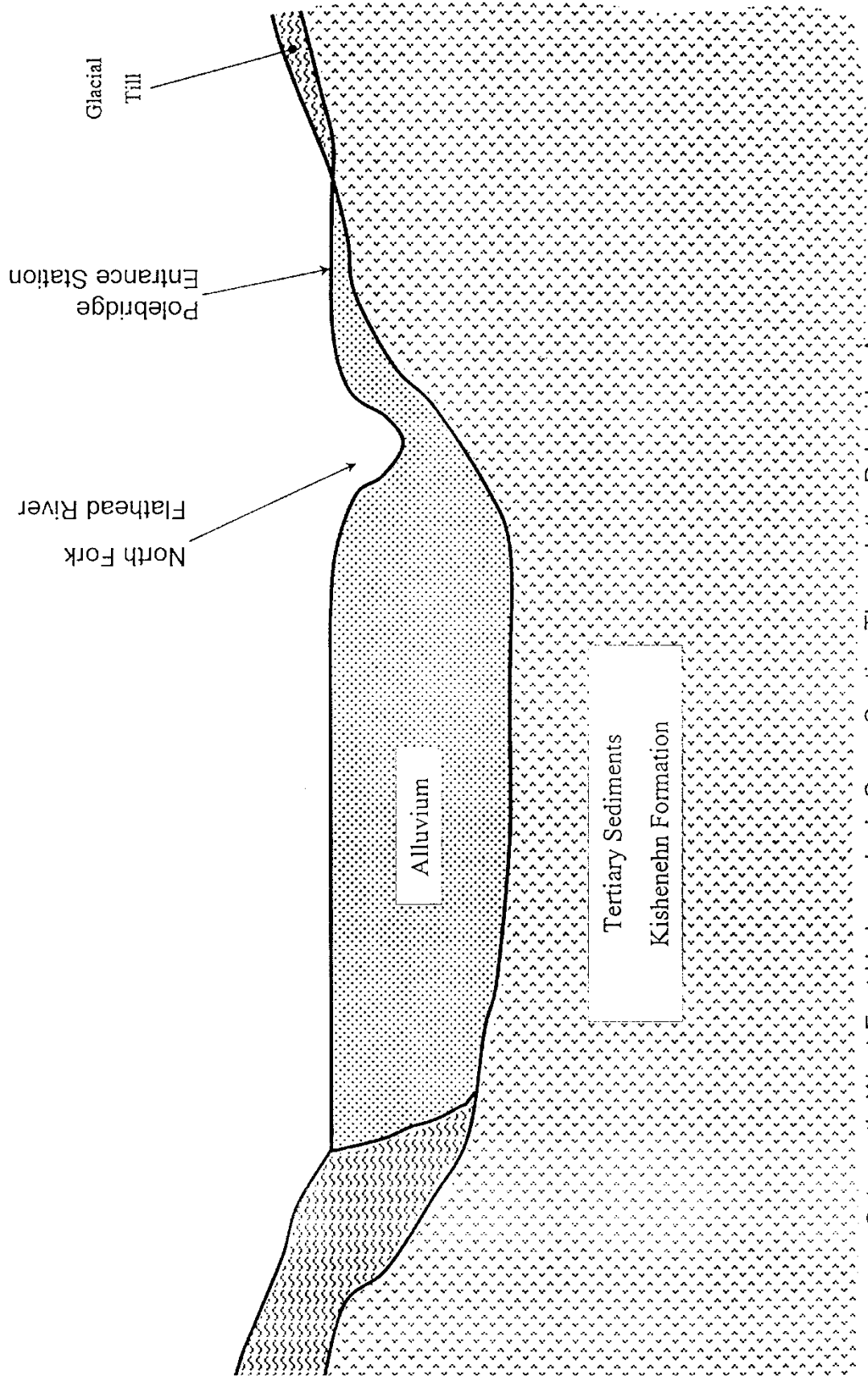
HKM Associates, 1979, Report on Well Construction Program at Glacier National Park, Montana, August 21, 1979 – October 5, 1979, Submitted to National Park Service, Denver Service Center, Lakewood, Colorado 8215, Project No. 6M099.108, 12 pp. plus Appendices

Ross, Clyde P., 1959, Geology of Glacier National Park and the Flathead Region, Northwestern Montana, USGS Professional Paper 296, 125 pp.

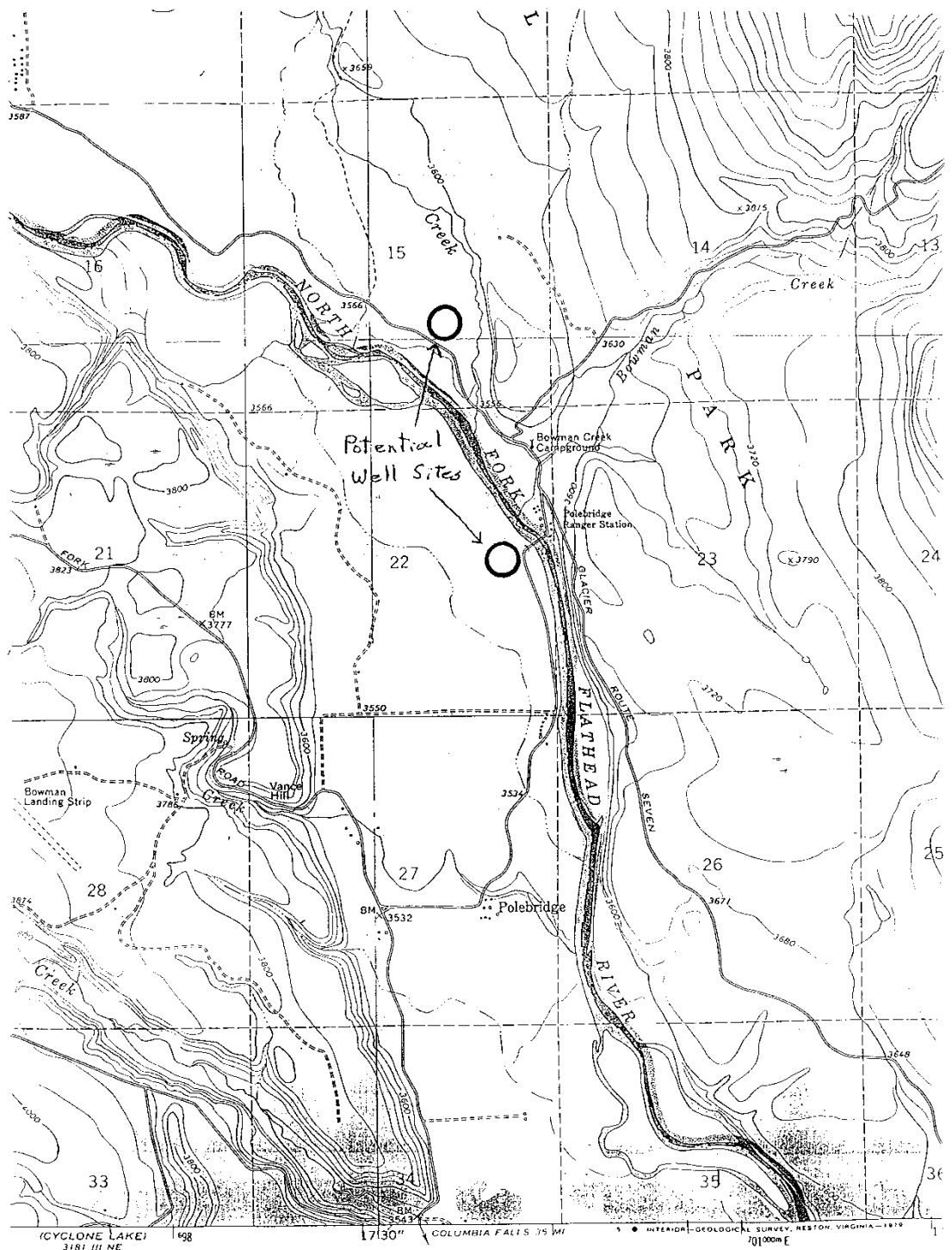
attachments: excerpts from Boettcher (1973) and HKM Associates (1979)

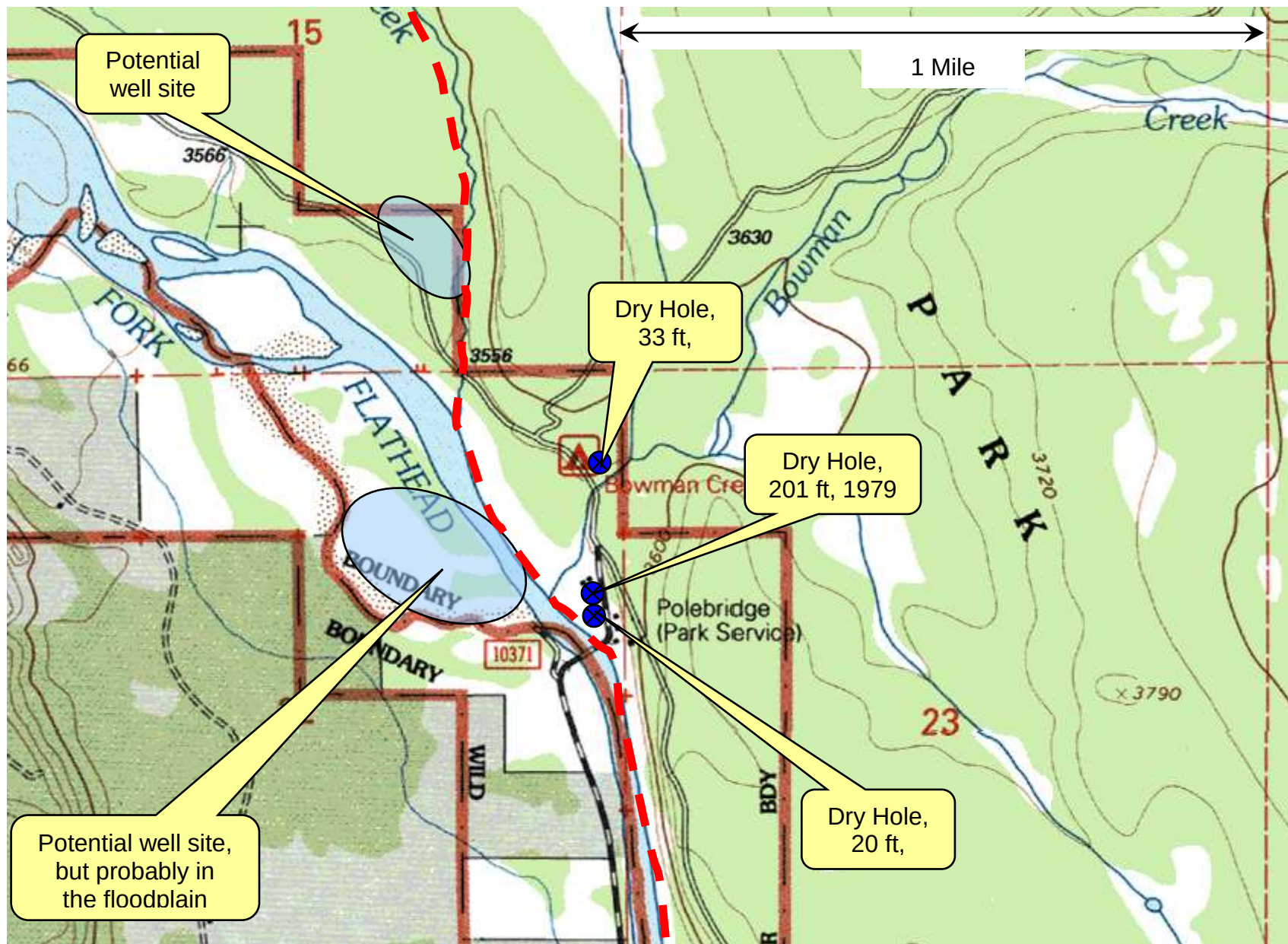
cc: w/o attachments

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Schematic West-East Hydrogeologic Cross-Section Through the Polebridge Area





Locations of previously drilled dry test holes and potential sites for well construction where the hydrogeology is favorable for successful well construction. Locations to the east of the dashed red line are not likely to result in successful well construction.