



February 10, 2014

RMEA Project 14-0010

Board of Directors
Samaria Water and Irrigation Company
c/o David Reel
5176 South 4400 West
Malad, Idaho 83252

Re: Field observation of springs

Dear Directors:

The water rights for Samaria Water and Irrigation Company (District) derive from Illum Spring, a cold-water spring west of Malad, Idaho, and from Warm Springs, located a few miles south of Illum Spring. The District is concerned over declining discharges from the springs and the potential impact of irrigation wells in the area.

On January 28, 2014, I met with Mr. Lynn Wright and Dr. Mark Ipsen to look at the springs and talk about the District's concerns. This letter describes my observations and gives an initial response to several questions:

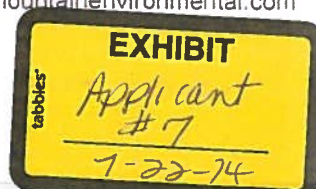
- 1) What are the options and opportunities for cleaning the springs? Will this increase flow? What methods should be used?
- 2) Do the Russian Olive trees surrounding Warm Springs intercept a significant amount of water?
- 3) Does damming the outlet of Warm Springs retard the flow?
- 4) What are the likely effects of wells upon the springs?
- 5) What is the process to make a water call? What kind of data are needed for a call? What are the expected costs?
- 6) What are water tests that might give insight into waters that have common sources?
- 7) What are the options for measuring the discharge of Warm Springs?
- 8) How should the Flow Probe be used that was purchased by the District?

Summary of Observations

Warm Springs

When we looked at Warm Springs, salt stains on the vegetation surrounding the springs indicated that the water levels at times have been persistent at a water level about ten inches higher than we observed. There were boards on the ground near the outlet culvert but at that time the flow was not dammed. Using a velocity head rod, I made

Entire Report to be emailed



springs with the boards in place, and without them. Flow comparisons would need to be made after the pond water level stabilized. The pond covers approximately 1.6 acres. A flow of 50 miners' inches will deliver about two acre feet every 24 hours, so if the boards were pulled, draining the pond could sustain a 50-inch increase in flow for almost a full day, regardless of any change in inflow due to reduced head.

The best time to perform such an experiment would be when irrigation wells are not operating, to avoid confounding influences.

Effect Of Wells Upon the Springs (Question 4)

The reports that Warm Springs are sensitive to pumping in the western wells, while Illum Spring is not, are puzzling and counter to expectations. The warmer, saltier spring would be expected to have a longer flow path and more distant source, while the cooler spring would be expected to be more sensitive to local influence. There are geologic configurations that can explain both situations. These are presented below as possibilities but full investigation of the mechanisms governing the springs could be quite an extensive effort.

I visited with Dr. John Tracy of Idaho Water Resources Research Institute (IWRRI), associated with University of Idaho. There is a USGS funding source for small hydrologic studies, which can fund up to \$15,000 of a \$30,000 study with matching funds from another organization. The next call for proposals is expected in December 2014. This may be an opportunity to gain understanding of the behavior and influences on both springs. RMEA would be glad to perform these investigations, but the state subsidy of IWRRI billing rates and the opportunity for matching funding may be a very good opportunity for the District.

Warm Springs. The reported correlation between pumping the west wells and changes in flow at Warm Springs is a strong indication that those wells affect the springs. The highly variable flows recorded in Table 1, as well as the reported responsiveness to the pumping of cold-water wells to the west, are very puzzling. A deep flow path generally implies an expectation of very small seasonal variations in discharge. It also implies an expectation of muted and delayed response to pumping from shallower, cold-water aquifers. There are at least four possible explanations for these unusual observations:

- 1) Warm Springs flow is highly sensitive to changes in head, and the changes in flow result from changes in the placement of boards in the culvert and/or back pressure from the cold water injection from the canal.
- 2) The apparent variability is an artifact of flow measurement, due to problems with the Flow Probe device.
- 3) Warm Springs is responding to changes in diversion rate from the nearby flowing artesian wells, which also tap a warm-water source.
- 4) Through a very unusual geologic configuration, the deep warm-water source is highly responsive to changes in head of an overlying cold-water aquifer that supplies the springs.

The existence of flowing wells near Warm Springs and further south indicate a confined aquifer beneath the Malad Valley. It is by no means certain, but it is possible that the flowing wells south and west of Samaria are reducing head in the aquifer sufficiently to affect Warm Springs. It is generally expected that wells would most strongly affect the nearest springs, and this would indicate that the southern flowing wells most strongly affect Samaria Lake west of Samaria. However, it is possible that the confined aquifer works like a single pressure vessel, with the flow to Samaria Lake representing a low-elevation but high-restriction tap, and Warm Spring representing a high-elevation, low-restriction tap. In this case, Warm Spring could conceptually be especially sensitive to reductions in head caused by flowing wells anywhere in the system.

Illum Spring. Illum Spring's colder temperature and lower electrical conductivity indicate shorter residence time and a shallower flow path than Warm Springs. Its lack of responsiveness to pumping in the western wells indicates that it is not strongly connected to the aquifer that serves them. The stable discharge rates over the summer of 2013 suggest that it is supplied by a fairly large recharge area. Its flow may be dominated by higher-elevation recharge in the surrounding hills and on the farmlands to the north.

These factors indicate that Illum Spring is not likely to be too strongly influenced by either the wells west of the springs or the southern flowing artesian wells.

Water Call Opportunities (Question 5)

In visiting with IDWR, I learned that it is very difficult to proceed with a water call outside an organized Water District, and that IDWR will only form a Water District where the water rights have been adjudicated. This has not been done in the Malad Valley. It would be a long and costly political process to commence an adjudication, and long and costly to complete. Once completed, an aquifer call would also be long and costly.

Another option is to petition the State for creation of a Groundwater Management Area or Critical Groundwater Area. These designations would impose limitations on future groundwater development and may also provide some regulation of diversions from existing wells.

The IDWR representative was very interested in the possibility of regulating the flowing wells to the south. In his opinion, discharges far exceed the stockwater uses for which the wells are authorized. He described the possible use of "packers," which are seals installed in the well bore, set six to eight feet below land surface, with a control valve operated by a t-handle. These would allow the wells to be shut off in the wintertime or otherwise when not in use, preserving aquifer head. A Groundwater Management Area

Summary

- 1) The best opportunity for cleaning the springs is to remove vegetation from outlet channels, along with soil that has fallen from channel sides. Great caution is urged against digging too deeply or aggressively in the spring bottoms. Little gain is expected from removing the silt-like material from Warm Springs.
- 2) The Russian Olive trees surrounding Warm Springs likely consume a few miners' inches of water at most.
- 3) Damming the outlet of Warm Springs is very likely to retard the flow.
- 4) The data are puzzling, but from the reported observations, it is very likely that the western wells affect Warm Springs. It is also possible that the southern flowing wells also affect it. Illum Spring may be less influenced by the wells. More precise determination would require significant investigation. The District may want to work with Idaho Water Resources Research Institute to study the interaction between the springs and the wells.
- 5) A water call is not an available option at this time, due to lack of a water district and lack of decreed water rights. A Groundwater Management Area or Critical Groundwater Area may offer some administrative relief. Costs of pursuing this effort are not estimated at this time.
- 6) Common-ion tests cost \$64 per sample and can provide some information on waters from similar sources.
- 7) The discharge from Warm Springs can be measured with an installed submerged orifice or perhaps a ramped flume. The current program of measuring with the Flow Probe could be continued but there are concerns both with the accuracy of the instrument and the defensibility of measurements obtained.
- 8) The attached manual describes use of the Flow Probe.

It has been a pleasure to assist with these questions. Please contact me if there are further questions, or if there is more we can do to be of assistance.

Sincerely,

Bryce A. Contor

Attachments:	Figure 1	Map of Warm Springs
	Figure 2	Map of Illum Spring
	Figure 3	Sketch of Submerged Orifice
	Appendix 1	Photographs
	Appendix 2	Waypoint List
	Appendix 3	Description and Rating of Submerged Orifice