

OWRD - Erik Thomasser Delivered to Zollman's
First part of September 2016

State of Oregon

Water Resources Department

Memorandum

April 20, 2016

To: File T-11689 and G-15198 (Permit G-17360)
CC: Justin Iverson, Groundwater Section Manager
Joel Jeffery, Well Construction and Compliance Program Coordinator
From: Josh Hackett, Hydrogeologist, Groundwater Section
Subject: Borehole Flowmeter Review MORR 52027, John Vandenberg

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Background:

MORR 52027 was completed as a test hole for John Vandenberg by Zollman's Larry Burd Well Drilling on December 17, 2012. According to the driller's well report, the well was drilled 8-inch open hole from 18 feet below land surface (bls) to a total depth of 1393 feet bls with 8-inch steel casing and cement and bentonite seal installed in a 12-inch borehole from land surface to a depth of 18 feet bls.

MORR 52027 was one of three wells listed as proposed additional points of appropriation on Groundwater Transfer Application T-11689 (received by the Department on November 19, 2013). Due to the large open interval in the well, Groundwater Section staff was concerned it may be drilled through multiple aquifers and allowing water to flow between aquifers. This mixing (or mingling) of waters from different aquifers is commonly referred to as commingling. To investigate the possibility of commingling in MORR 52027, Groundwater Section staff conducted a downhole video survey on April 17, 2014. The video survey recorded particles moving up the borehole between depths of 788 feet and 1305 feet bls, indicating commingling was occurring. Based on observations from the video survey, two potential aquifers were identified; a shallow aquifer from 880-975 feet bls and a deep aquifer from 1275-1339 feet bls (see Attachment 1 for a complete review of the video log survey).

Most recently, a borehole flowmeter log survey was conducted by Groundwater Section staff on January 7, 2016 to measure the upward flow rate in the well and determine where the water was exiting the well. Findings from the flowmeter survey are presented in this document. Recommendations to meet permit conditions are presented at the conclusion of this memo.

Equipment/Methods:

Fluid movement in the borehole was measured using a Century Geophysical Corp. Model 9722 Electromagnetic (EM) Flowmeter Tool. The instrument measures flow rates using the principle of Faraday's Law of Induction; the voltage induced by a conductor (water) moving through a magnetic field (generated by the electromagnet in the EM flowmeter) is proportional to the velocity of the conductor through the field. The Model 9722 EM Flowmeter has a full range of 50 milliliters per minute (0.01 gallons/min (gpm)) to 40 liters per minute (10.6 gpm) and is accurate to ± 5 milliliters per minute (0.001 gpm). An 8.5 inch

diameter flow diverter skirt was installed on the EM flowmeter to minimize flow around the tool and direct flow through the meter.

Measurements of vertical flow in the borehole were obtained under static (non-pumping) conditions at ten "stations" below the static water level (605 feet bls), between depths of 629 feet and 1205 feet bls. The flowmeter was allowed to equilibrate for at least two minutes or until flow rates stabilized at each station before flow rates were recorded.

Results:

Maximum upward flow ranging from 2.81 gpm to 3.57 gpm was measured in the interval from 1205 feet to 784 feet bls (Table 1, Figure 1). Above 784 feet bls, a decrease in upward flow was observed at successive stations (1.41 gpm at 759 feet bls, 0.22 gpm at 667 feet bls) until flow ultimately decreased to nearly zero (0.04 gpm) at 629 feet bls (Table 1, Figure 1). The consistency of upward flow rates between 1205 feet and 784 feet bls indicates that vertical flow is entering the well below this interval and is exiting the well above it. Decreasing upward flow rates between 784 feet and 629 feet bls indicates that flow is exiting the well in this interval. The abrupt decrease in flow between 784 feet and 759 feet bls suggests that a significant portion of flow exits the well in this short interval while the remainder exits in the longer interval from 759 feet to 629 feet bls.

The results of the EM Flowmeter log survey generally agree with the findings of the video log survey, with both surveys identifying two aquifers (shallow and deep). However, results from the flowmeter survey indicate that the shallow aquifer occurs from approximately 670-800 feet bls, not 880-975 feet bls as was identified in the video survey. It is evident from the flowmeter survey that the deep aquifer is losing at least 3 gpm to the shallow aquifer. As an average rate, 3 gpm equates to a loss of 4320 gallons per day, 1.57 million gallons per year, and a total of 4.73 million gallons in the three years since the well was drilled.

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Recommendations:

The EM flowmeter log of MORR 52027 indicates the well commingles two aquifers in the Columbia River Basalt Group. Measured vertical flow was approximately 3 gpm from the deep aquifer to the shallow aquifer. The well must be constructed to meet the minimum construction standards for Water Supply Wells described in OARs 690-200 and 690-210. Specifically, the well must not allow commingling of waters from multiple aquifers (690-200-0043) and must be cased and sealed at least five feet into solid, unrecrystallized, consolidated rock overlying the water-bearing rock formation (690-210-0150). To avoid commingling in the well, either the deep or shallow aquifer must be sealed off. According to the drillers' log, most of the production is from the deep aquifer; the following recommendation assumes the shallow aquifer will be sealed off. In addition to sealing off the upper aquifer, the well must be cased and sealed into solid, dense rock overlying the productive aquifer. While the base of the upper aquifer occurs at a depth of 800 feet bls, the borehole does not appear to be solid or unrecrystallized until 815 feet bls. Accordingly, the well should be cased and sealed to a minimum of 820 feet below land surface. This case and seal depth shall supersede Condition 3 of permit G-17360 (case and seal to 1055 feet bls).

Table 1. Measured vertical flow rates at depth stations in MORR 52027. Negative values represent upward vertical flow.

Depth (feet)	Rate (Liters/minute)	Rate (gallons/minute)
629	-0.17	-0.04
667	-0.83	-0.22
759	-5.35	-1.41
784	-10.63	-2.81
814	-10.05	-2.66
834	-11.17	-2.95
854	-13.07	-3.45
858	-11.94	-3.15
1104	-12.25	-3.24
1154	-13.50	-3.57
1205	-12.21	-3.23

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Site Name: Vandenbrink Test Well

MORR 52027 L 109714 01S 24E 22 Lone South
 45 464, -119.804 Morrow 1730
 Umatilla 1393 J. Hackett

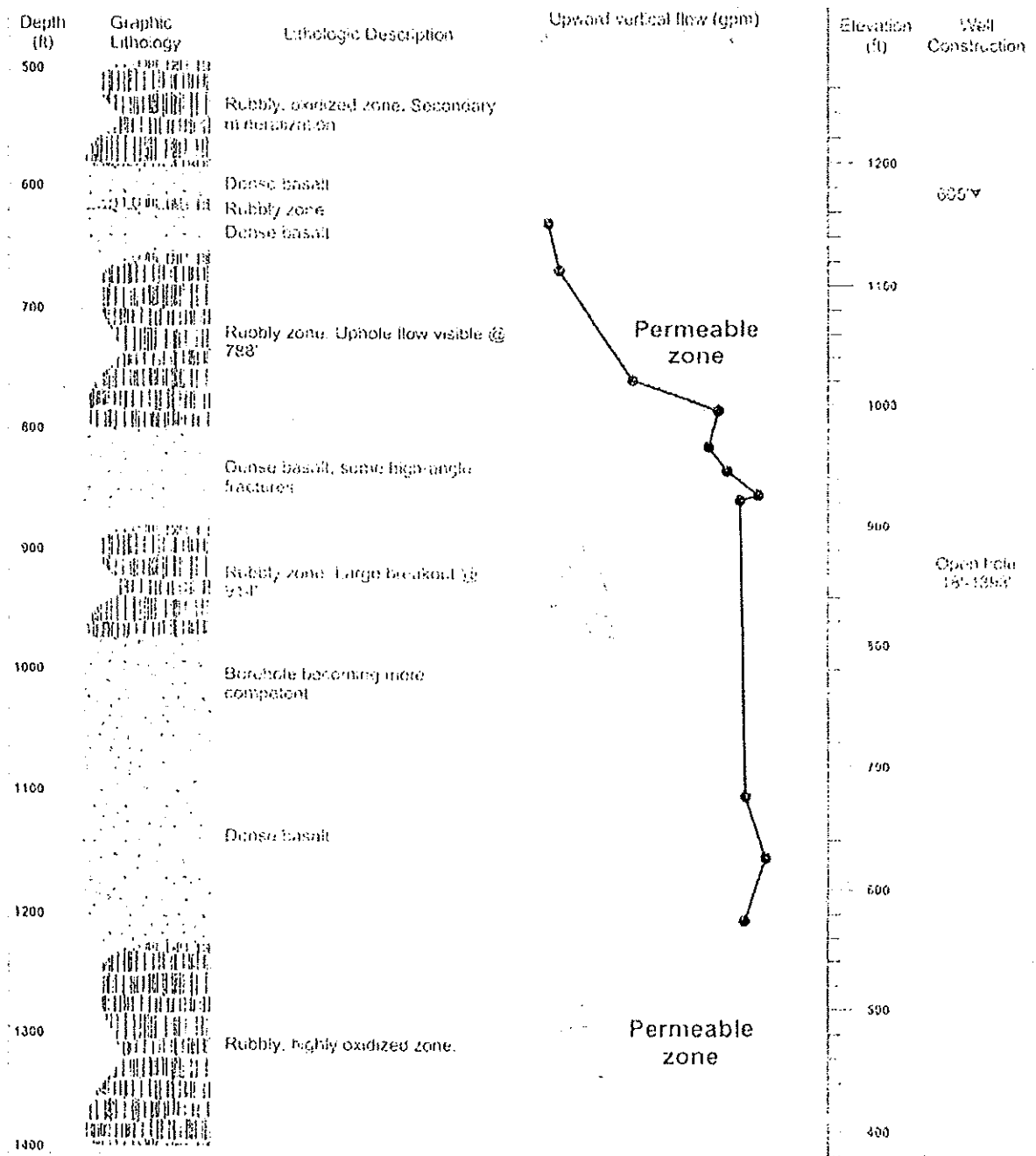


Figure 1. Results of borehole EM flowmeter logging in MORR 52027.

To: John and Janna Vanden Brink
From: Jon Travis, RG, CWRE
Date: June 17, 2022
File: 26115-001-00
Subject: Response to OWRD Draft Preliminary Determination for Transfer Application T-13839

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GeoEngineers is pleased to provide you with this memorandum (memo) which summarizes: (1) Oregon Water Resources Department's draft Preliminary Determination (DPD) for Transfer Application T-13839; and (2) actions needed to bring your wells into compliance with current well construction standards and Certificate 48296 and Certificate 89128.

The DPD states that the following need to be addressed before the transfer can continue to be processed:

- Reconstruct MORR 51114 to meet current well construction standards
- Case and seal MORR 1735 to a minimum depth of 510 feet below ground surface (bgs)

However, because MORR 51114 is the dairy's primary active water source and MORR 1735 is not in use or owned by you and will not be addressed further in this memo, an alternative water supply will be needed to continue dairy operations while MORR 51114 is offline for reconstruction. Based on our previous discussions with you well MORR 52027 could potentially be used as the alternative water source.

With respect to well MORR 52027:

- A flow test was performed on January 7, 2016 by OWRD Groundwater Section staff that showed it, too, was out of compliance with current well construction standards because of up hole flow.
- OWRD recommended, based on their findings, that the well should be cased and sealed to a depth of 820 feet bgs.

As we have discussed with you it is our understanding that you intend to follow OWRD's recommendation as the first step in resolving the issues with well MORR 51114. After MORR 52027 is brought into compliance and becomes operational as an alternative water source the issues with the other well can be addressed, as follows:

- Well MORR 51114 will be cased and sealed to 205 feet bgs as recommended in the DPD, and then brought back online.

This process may take a few years to complete because of driller availability and the need to work on one well at a time.

If you have any questions about this memo, or the results of our work on this project please contact Jon (509.979.0332) at our Kennewick office at your convenience. It has been a pleasure working with you on this project and we look forward to working with you in the future.

LIMITATIONS

We prepared this memorandum for use by John and Janna Vanden Brink to assist in progressing their water right transfer. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of hydrogeology in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood.

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