Idaho Department of Water Resources

Open File Report

ADDENDUM TO FLUORESCENT DYE TRACER TESTS AT THE MALAD GORGE STATE PARK

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Purpose and Objectives

In preparation for larger scale tests, a third tracer test using 3 times more dye than the previous two RWT tests was implemented in late September 2009 with the main goal to evaluate what the resurgent concentration of dye would be at site MG-7 given more mass. RWT tests #1 and #2 resulted in a peak dye concentration of about 0.4 ppb and so the question was posed if the mass of dye injected is 3 times more, will that result in a resurgent concentration 3 times higher. The methods and equipment were identical as the previous two RWT tests and the depth to water in the well was 190.28 feet. Three gallons of 2.5% active ingredient Rhodamine WT was released at the same level in the well at 2:30 pm on September 22, 2009. The Malad River was flowing at a high rate as well as the W-canal spilling water over the edge of the canyon. The SCUFA was calibrated at 1.0 ppb with a sampling frequency of 10 minute intervals and deployed in the same manner as before at site MG-7.

Results and Conclusions

Results of the test are shown in the Figure 18 concentration breakthrough curve that has the same response pattern as the two previous tests with a maximum concentration of approximately 0.9 ppb or just over twice the previous concentration. This suggests a non-linear function between injected mass and resultant spring water concentration. There is a data shift noted in the graph which is attributed to the instrument detection limit of 0.04 ppb in combination with an introduction of some turbidity. The turbidity channel started to record effects starting on September 25th which apparently created some 'noise' in the fluorescence data but the recession limb trend is still clear. Figure 19 shows all three RWT tests shifted to match the starting injection time zero. This test provides valuable data for gauging the amount of dye injected to obtain desirable concentrations in springs.

Hydrogeologic Note

There appears to be an association of talus boulder size and spring discharge. The larger boulders are located in the areas with the higher discharge springs from about site MG-4 to MG-10. The talus boulders upstream and downstream, as well as the opposite side of the canyon are generally smaller elsewhere, as is the spring discharge. Also based on visual observation, most but not all groundwater is discharging from the south side of the river. A possible explanation for area geology, springs, groundwater tracer test results, and other features like talus boulder size, is that a paleo-canyon existed in this area with a more southeast/northwest orientation, at least locally, than the present day gorge, which is east/west. As noted in the original report, this paleo-canyon filled with lava flows from nearby shield volcanoes.

Attempt to Determine Flow Rate

An attempt was made to determine the flow rate for the spring discharge located at site MG-7. The USGS equation #3 from page 6 USGS 1985 by Kilpatrick was used with data from the second RWT test. A calculation of approximately 58 cfs was determined with the caveat that this equation may not be completely applicable for this type of flow regime through and from a talus slope. Therefore this value may not be completely valid.

General Observations to Note

1. It's best to have two people while hiking into the gorge.
2. Cell phones seem to work in the gorge.

3. GPS receives signals but at a reduced capacity.
4. Poison ivy is abundant but not a major barrier.
5. No ticks or snakes were encountered during at least a dozen trips into the gorge by two people each time.
6. Grass and vegetation actually posed the greatest trip hazard. Only 3 falls occurred from all of the hikes and none were serious; but all 3 happened near the edge of the river where grass and vegetation grows thicker. In one case, the person thought that under the grass there would be a rock or ground instead of a hole. Another case the grass 'rolled' or caused a slip between the rock and sole.
7. A walking stick and leather gloves are recommended.
8. Timing is important regarding access into the gorge and the tracer test. It is optimal to test when the W-canal is not spilling water over the edge of the gorge and when irrigation return flows into the Malad River are low. Also, in the early morning during cool weather the talus rocks are still moist and more slippery. During the spring and fall the sun angle is low enough that the talus rocks receive little direct sunlight to dry the surfaces so entry is best later in the day.
9. After rain storms the mosses and lichens grow and become more slippery.
10. Based on a visual judgment, site MG-5 has the greatest discharge rate of the springs.

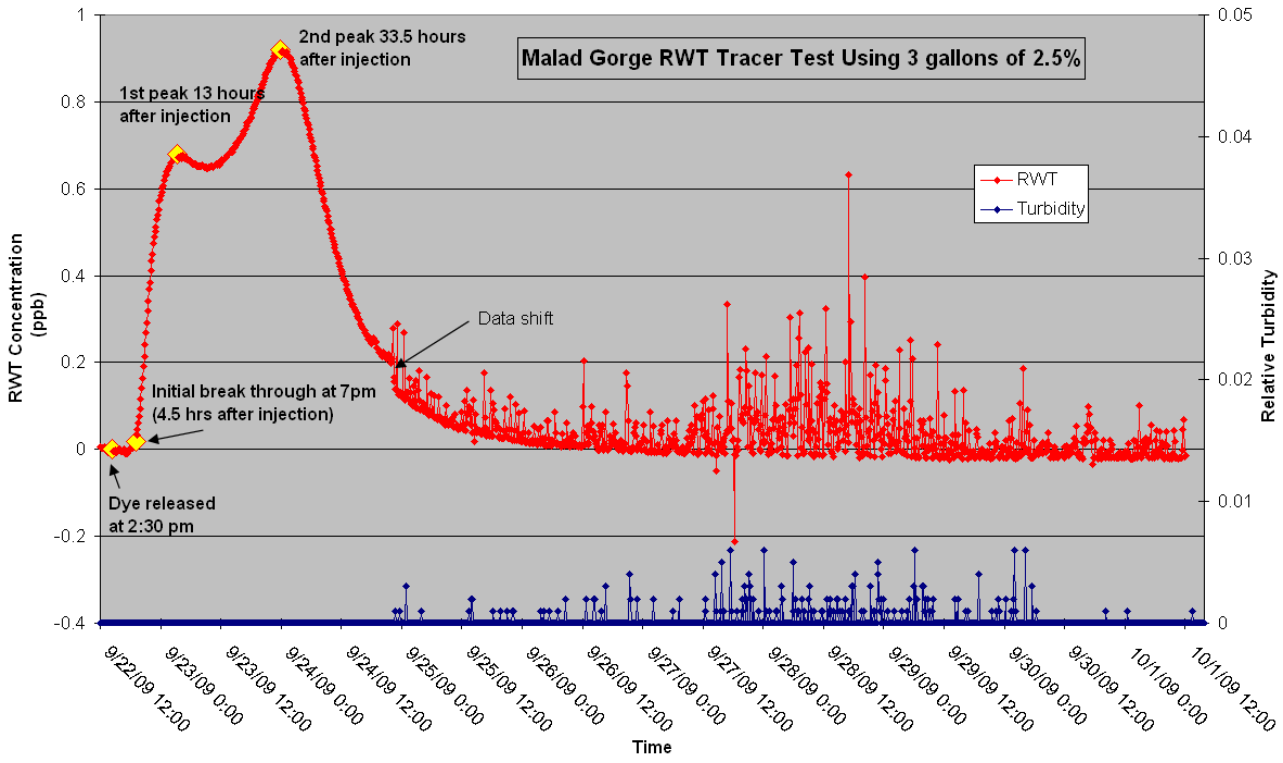

Figure 18. RWT tracer test #3 concentration breakthrough curve from injecting 3 gallons or 3 times the mass of previous tests.

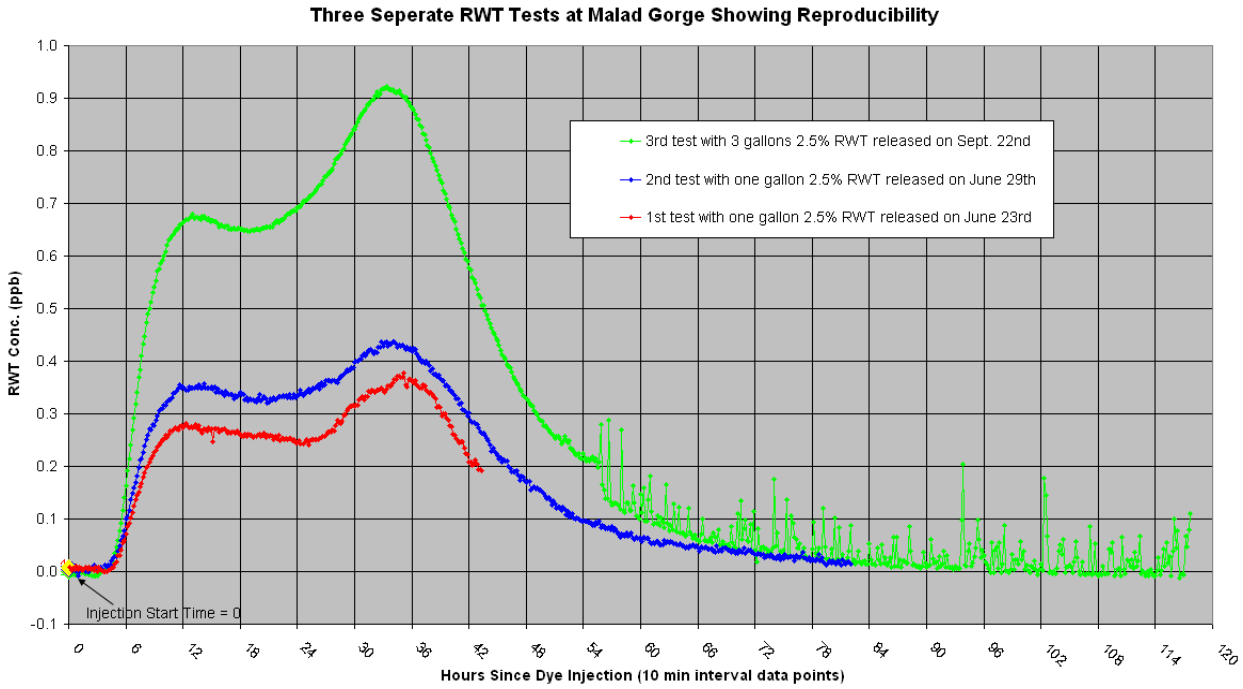

Figure 19. All three RWT tracer test breakthrough curves.

Comment	Easting	Northing	GPS_Height
mg1	2429484.496	1296372.763	922.686
mg2	2429548.44	1296388.977	923.501
mg3	2429613.782	1296423.173	923.127
mg4	2429667.721	1296443.529	924.418
mg5	2429686.761	1296455.227	925.536
mg6	2429698.411	1296463.584	924.524
mg7	2429713.947	1296477.491	924.614
mg8	2429738.205	1296493.738	924.69
mg9	2429755.053	1296504.051	924.731
mg10	2429786.712	1296537.75	924.815
mg11	2429821.976	1296559.821	924.627

Table 1. Coordinates of sample sites in meter units and IDTM NAD83.