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TECHNICAL MEMORANDUM

Date: September 25, 2013
To: Project File
From: Jim Good
Subject: Project Completion Report Addendum: July 2013 DO and pH Monitoring
Project Number: 573-6327-001
Project Name: Rio Ruidoso Monitoring

INTRODUCTION

The purpose of this Project Completion Report Addendum is to update the Rio Ruidoso nutrient assessment contained in the Project Completion Report (Parametrix 2013) with additional DO and pH monitoring data collected in July 2013. The Project Completion Report concluded that while the large DO and pH data sets indicated improvement and diel fluctuations were greatly reduced since the new treatment plant became operational, 19 days with DO concentrations below 6.0 mg/L and DO saturation less than 90 percent for at least four consecutive hours in 2012 indicated that the Rio Ruidoso may still have been impaired by nutrients. Two pH readings greater than 8.8 were determined to be invalid results. **In contrast, other response variables such as periphyton chlorophyll *a* indicated non-impairment when compared to nutrient assessment thresholds.** The additional monitoring in July 2013 was undertaken to see if further improvement in DO conditions and confirmation of pH readings within the thresholds would support an overall nutrient assessment conclusion of non-impairment. *

Sondes were calibrated and deployed at the three Rio Ruidoso monitoring sites on the evening of July 8, 2013, following the procedures described in the Quality Assurance Project Plan (Parametrix 2009) and employed during the previous monitoring years. River flows were generally low but not quantified during the monitoring period, until a local thunderstorm on the night of July 11 produced high flows. Provisional data from the USGS gauge at Hollywood were erroneously reported as 0.00 cfs throughout the period, evidenced by a flow of approximately 5 to 10 cfs that was observed at the gauging station on July 9 (USGS 2013).

RESULTS

Results are presented graphically at the end of this technical memorandum. The first three figures show the DO (mg/L) and pH results together on graphs similar to those included in Appendix B of the Project Completion Report. The final three figures show the DO in both mg/L and percent saturation, for comparison to nutrient assessment thresholds.

AWWTP Site

Upriver from the treatment plant effluent outfall the Rio Ruidoso pH and DO levels exhibited diel fluctuations at the AWWTP site that were typical through previous years of monitoring, and consistent with the observation of abundant periphyton and macrophyte biomass in this river reach. The pH varied between 7.6 and 8.1, well within the nutrient assessment protocol threshold range of 6.6 to 8.8. DO concentrations ranged from 5.4 to 7.6 mg/L, less than the 3.0 mg/L fluctuation that is used in the nutrient assessment protocol as an indicator of excessive algae. However, from 1635 on July 10 through 0635 on July 11, and again from 1635 through 1935 on July 11, the DO was below 6.0 mg/L and also less than 90% saturation. These two periods of at least four consecutive hours of low DO constituted excursions from the nutrient assessment protocol thresholds and indicated nutrient impairment in the river that is not attributable to the wastewater treatment plant.

Vigil Site

Downriver from the treatment plant effluent outfall the Rio Ruidoso pH and DO levels exhibited greater diel fluctuations than those at the AWWTP site and were consistent with the observation of robust filamentous algae growth. Large mats of periphyton were present over most of the riffle areas and algae filaments were commonly more than one foot in length. These conditions of abundant periphyton growth at the Vigil site had not been observed since June 2012. Similar to the AWWTP site, the pH varied between 7.3 and 7.9, well within the nutrient assessment protocol threshold range of 6.6 to 8.8. DO concentrations ranged from 5.1 to 10.4 mg/L and the diel fluctuation was more than 3.0 mg/L on all three full days of monitoring, thus indicating excessive algae. These were the largest diel fluctuations in DO that had been measured since June 2011. There were four periods of at least four and up to 16 consecutive hours when DO was below 6.0 mg/L and also less than 90% saturation. These low DO conditions were excursions from the nutrient assessment protocol thresholds and indicated nutrient impairment.

Tully Site

Although the graph for DO and pH at the Tully site includes all of the data recorded, it is obvious that some of those data are not valid due to problems with performance of the DO sensor on the sonde. The first 18 hours of DO readings that were less than 0.3 mg/L are not valid measurements, with the problem diagnosed as faulty batteries. The sharp drop in DO that started at 1345 on July 10 and the low DO readings that continued for the next 5 hours are suspect and may have been caused by temporary fouling of the sensor. It is also possible that a major irrigation return flow affected the water chemistry during this period. Runoff from a brief thunderstorm caused a substantial increase in flows that likely caused the sharp drop in pH measured at 1045 on July 11. The pH continued to gradually drop, leveled out, and then gradually increased over the next 15 hours as the storm flows peaked and then receded. Fouling of the DO sensor likely occurred during the peak flows and the sharply declining DO readings starting at 0245 on July 12 are considered invalid measurements.

Despite the problems with the DO sensor, several observations can be made with monitoring data from the Tully site. Diel fluctuation of pH and DO was much less than observed at the AWWTP and Vigil sites, and that was consistent with observations of a general lack of macrophytic algae at the Tully site compared to the other two sites. The pH varied between 7.6 and 8.3, similar to the other two sites and also well within the nutrient assessment protocol threshold range of 6.6 to 8.8. DO concentrations were generally between 6.4 and 8.0 mg/L, with diel fluctuations much less than the 3.0 mg/L threshold that indicates excessive algae. It is uncertain whether the 4-hour period on the afternoon of July 10 with DO less than 6.0 mg/L and also less than 90% saturation was the result of sensor fouling and therefore invalid, or whether they were valid measurements and the sharp drop in DO levels may have been due to a brief but major irrigation return flow. Overall, there was no clear indication of

nutrient impairment at the Tully site, but there was not a full 72 hours of valid DO data obtained for a conclusive assessment.

CONCLUSIONS

The nutrient assessment protocol states that a stream reach is fully supporting with respect to New Mexico's narrative nutrient standard if 1) one or none of the indicators exceed their threshold value, or 2) both TN and TP exceed their threshold values, but there is no indication of a biological response to elevated nutrients in the response variables (NMED 2011). Based on the history of nutrient concentrations reported in the Project Completion Report, it is assumed that the nutrient assessment thresholds of 0.25 mg/L TN and 0.02 mg/L TP continue to be exceeded at all Rio Ruidoso monitoring sites (Parametrix 2013). While pH data collected in July 2013 continued to be well within the assessment thresholds at all three sites, DO monitoring results did not meet thresholds at the AWWTP and Vigil sites. At the Vigil site, DO was below both 6.0 mg/L and 90% saturation for more than four consecutive hours and the diel fluctuation was greater than 3.0 mg/L, on each monitoring day. Conditions were somewhat better at the AWWTP site where the diel fluctuation was less than 3.0 mg/L; however, there were two periods with at least four consecutive hours of DO below both 6.0 mg/L and 90% saturation. These results indicate that, even if there were no nutrient contributions from the new wastewater treatment plant effluent, the July 2013 DO monitoring data from the AWWTP site would continue to indicate that this assessment unit of the Rio Ruidoso is not supporting with respect to New Mexico's narrative nutrient standard. Although the DO results were not conclusive downstream at the Tully site, macro-algae was generally not present and there was no clear indication of nutrient impairment at the site.

It is difficult to predict when the reductions in nutrients achieved with the new wastewater treatment plant will be fully reflected in reduced periphyton productivity in the Rio Ruidoso. It can take up to five years after treatment plant upgrades before the receiving stream is stabilized and ready for a new nutrient assessment. In streams where macro-algae or macrophytes dominate photosynthetic biomass, recovery of the biomass may take one or more growing seasons following a major high-flow event (USEPA 2000). The encouraging trend in reduced periphyton growth that appeared in 2011 and 2012 may have been masked by more frequent scouring events that caused sloughing of the algae and limited re-growth. Conditions at the Vigil site indicate that the substantial reductions in effluent nutrient concentrations have not yet eliminated nuisance periphyton growth in the Rio Ruidoso, and more time may be needed before the stream has stabilized and is ready for a new nutrient assessment. The AWWTP results also indicate that this assessment unit of the Rio Ruidoso may not be fully supporting with respect to New Mexico's narrative nutrient standard until other nutrient loading sources are controlled upriver from the treatment plant.

REFERENCES

- NMED. 2011. Procedures for assessing water quality standards attainment for the State of New Mexico CWA §303(d)/§305(b) integrated report, Appendix D: Nutrient assessment protocol for wadeable, perennial streams. New Mexico Environment Department Surface Water Quality Bureau. May 31, 2011, Revision One. Accessed at: <http://www.nmenv.state.nm.us/swqb/protocols/>.
- Parametrix. 2009. Rio Ruidoso Monitoring Program: Quality Assurance Project Plan. Prepared by Parametrix, Albuquerque, New Mexico. May 8, 2009.
- Parametrix. 2013. Rio Ruidoso Monitoring Program Project Completion Report. Prepared by Parametrix, Albuquerque, New Mexico. February 2013.
- USEPA. 2000. Nutrient criteria technical guidance manual: Rivers and streams. United States Environmental Protection Agency, Office of Water, Office of Science and Technology. Washington, D.C. EPA-822-B-00-002. July 2000. Accessed at: http://www2.epa.gov/sites/production/files/documents/guidance_rivers.pdf.
- USGS (U.S. Geological Survey). 2013. USGS 08387000 Rio Ruidoso at Hollywood, NM. National water information system: web interface. United States Geological Survey. Accessed at: http://waterdata.usgs.gov/usa/nwis/nwisman/?site_no=08387000&agency_cd=USGS.