



# Oregon

Tina Kotek, Governor

Department of Environmental Quality

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TTY 711

February 23, 2026

Attn: Vaughn Balzer - DOGAMI

Hello Vaughn,

DEQ lab staff have provided a split field report dated February 5, 2026 for the Knife River/DEQ sampling that occurred on December 8-10, 2025. Forthcoming will be another report, upon sharing and review of the analytical data, providing comparison of those data.

In the split field report, DEQ has identified concerns with the December 2025 sampling event field procedures that must be rectified for future sampling events to ensure quality of the analytical results provided for the ongoing groundwater investigation at the permitted facility. A copy of the DEQ lab field split report is attached.

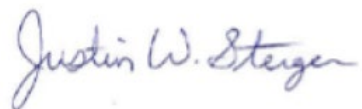
Please provide a copy of the split field report for Knife River to review with their consultant, Hudspeth Land & Water LLC. Some of the issues noted document failure for the sampling procedures to follow those described in the approved Sampling and Analysis Plan (SAP), and some outline improvements that should be made to the SAP in the forthcoming update.

We've placed each of DEQ's comments into the table below and ask that KRC respond in the document how each comment is being addressed and provide written response back to DOGAMI and DEQ as soon as possible but no later than 3/2/2026. **It will be essential for the facility to address concerns noted in the comments and for these concerns to be rectified to the maximum extent possible prior to the next sampling event.**

Regarding the low flow sampling, DEQ understands that site conditions create a turbid water column in wells not designed for low-flow sampling. The proposed sampling protocol allows at least one casing volume of water to be purged with a submersible pump at a rate higher than typical low flow purge rates as described in [EPA \(1996\)](#) prior to sampling the well using low-flow techniques. Based on those site conditions, DEQ approved the SAP proposing the modified low-flow sampling approach and a sampling event designed to compare results of the modified low-flow sampling approach with the traditional approach of purging at least three well volumes prior to sample collection.

Also, if we can attain the dates of Q1, 2026 and Q2, 2026 sampling, DEQ may also send a representative out to observe field sampling collection procedures to ensure these concerns have been addressed.

Thank you.

A handwritten signature in blue ink that reads "Justin W. Sterger". The signature is written in a cursive style with a large initial 'J' and 'S'.

Justin W. Sterger  
Senior WQ Permit Writer

**Table 1 – DEQ Split Event Comments**

DEQ Comment/Observation	Required (Y/N)	Additional DEQ Notes	KRC Response
Fresh gloves should be worn at all times when handling any equipment that will make contact with sample water, including pumps, tubing, and sounders.	Y	This should be included in the SAP update and for all field sampling going forward.	
The sounder was not washed or rinsed and was instead wiped down with the same dry cloth between wells	Y	The Woodward SAP calls for several things that were not sufficiently completed during the observed sampling event. “Decontamination of all multi-use equipment between wells will be performed using an Alconox and distilled water mixture to clean equipment and be rinsed with distilled water”	
The submersible pump was not washed with Liquinox or rinsed with DI on the first two days of sampling. On day three, Liquinox and tap water were used to wash and rinse the pump, but not DI water.	Y	The Woodward SAP calls for several things that were not sufficiently completed during the observed sampling event. “Decontamination of all multi-use equipment between wells will be performed using an Alconox and distilled water mixture to clean equipment and be rinsed with distilled water”	
When using non-dedicated submersible pumps for low level sampling, significant effort should be used to decontaminate equipment between wells. Liquinox and high quality DI water should be used to wash the pump (both inside and out) and several lab-grade DI	Y	The Woodward SAP calls for several things that were not sufficiently completed during the observed sampling event. “Decontamination of all multi-use equipment between wells will be	

rinses should be performed afterwards. If the same “bulk” rinse water is used between wells, then at minimum the last rinse should be a fresh lab-grade DI rinse.		performed using an Alconox and distilled water mixture to clean equipment and be rinsed with distilled water”	
No blank sample was collected by the contractor. The SAP should be amended to include specific language elaborating on the type of blank expected and with what equipment it should be collected with.	Y	The SAP states: “Knife River plans to collect one duplicate sample and one blank per sampling event.”	
No rinseate or equipment blank was collected, and the contractor did not note one having been collected in the past. The SAP should be amended to further explain which of these blank types is required, rinseate or equipment blank, and what the monitoring period is referring to.	Y	The SAP states: “In addition, one rinseate or equipment blank sample will be collected during the monitoring period.”	
Regardless of the decontamination procedures utilized, efforts should be made to keep the non-dedicated pump and its line clean and free from contamination. Storing the pump and line in the same plastic tote between wells will not keep them free from outside or well-to-well contamination.	Y	This should be included in the SAP update and for all field sampling going forward.	
Not storing the pH probe submerged in DI water and instead using a rubber cap with pH probe storage solution (or pH 4 standard).	Y	Samplers should familiarize themselves with proper storage and handling of water quality meters.	
Ensuring dissolved oxygen is in the local DO setting to properly incorporate local barometric pressure readings.	Y	Samplers should familiarize themselves with proper storage and handling of water quality meters.	
Implementing a lab-based calibration routine with daily or twice daily calibration verifications in the field. These field checks provide confidence in daily data but	Y	Samplers should familiarize themselves with proper storage and handling of water quality meters.	

<p>prevent poor field conditions from contributing to a bad calibration. This also allows meter performance to be documented over time without frequently calibrating over a bad or failing probe.</p>			
<p>Table 3 of the SAP identifies wells MW-2, WW-2A, MW-5, MW-6, and MW-7 as low flow wells. While not explicitly prohibited in the SAP, it is industry practice to limit purge rates to relative low levels, such as &lt;0.5 liters per minute as recommended by EPA. The incredibly high purge rates of the 4” submersible pump (~5-8 gallons per minute) may have adverse effects on sample quality.</p>	<p>Y</p>	<p>If high flow “bulk” purges are determined to be required to clear the highly-turbid water columns before sampling, then the impact on sample quality of high volume pumping and potential drawdown should be considered.</p> <p>Clarify in Section 2.2 of the SAP that (1) Knife River will conduct the evaluation of potential differences between samples collected using the two different purge and sampling techniques during the first sampling event following SAP approval and (2) samples will be collected at each well first using the modified low-flow techniques followed on a different day within the same quarterly sampling event by the traditional three well casing volume approach.</p> <p>Table 3 of the SAP should be modified to indicate that wells MW-8, MW-9, and MW-10 will be sampled using the modified low-flow procedure as is the case</p>	

		for the other monitoring wells at the site.	
<p>DEQ and the contractor discussed many potential adjustments and improvements to the current sampling plan, including:</p> <p>a. Purchasing dedicated pumps and tubing for each well to eliminate the need for decontamination, or</p> <p>b. Purchasing a single pump to be used with dedicated well tubing for each well, thus limiting decontamination to only the pump and line but not the tubing.</p> <p>c. The inclusion of rinseate and equipment blanks to document the efficacy of any decontamination, or lack thereof, on existing or future equipment.</p> <p>d. Further defining language in the SAP around purge rates (traditional 3x casing volume versus low flow), equipment types, and blank types and frequencies.</p> <p>e. Permanently swap to using disposable cartridge-style 0.45 micron filters for immediate filtering in the field instead of transportation of raw water back to the office which can cause possible sample degradation and introduce more points of contamination.</p>	Y	<p>KRC should review and provide respond on selection of item a or b from these comments. If item b is selected, it is essential that all proper decontamination procedures are followed as per the SAP and the comments provided in this document. Items c-e are required to be addressed prior to the next sampling event.</p> <p>Section 2.4 of the SAP should be modified to be consistent with the recommendation in <a href="#">EPA (1996)</a> to filter groundwater samples in the field using an in-line filter. Specifically, sections titled “Field Parameter Stabilization”, “Final Field Parameter Measurement”, and “Surface Water Sampling” should be modified so that it clarifies that samples collected for dissolved constituents will be filtered in the field using in-line 0.45µm filters.</p> <p>Section 2.4 of the SAP (describing well purging procedures) should be modified to clarify that (1) drawdown will be</p>	

		<p>minimized to the extent practical during the purging of wells to be sampled using the modified low-flow sampling technique and (2) purging will be stopped once the well produces low turbidity water (i.e., less than 15 NTU).</p> <p>Section 2.4 of the SAP should be modified to be consistent with the stabilization recommendations described in EPA (2006). Specifically, the section titled “Field Parameter Stabilization” (the last paragraph on page 8) should be modified to indicate for low-flow sampling three successive readings taken three to five minutes apart should be within <math>\pm 0.1</math> for pH, <math>\pm 10</math> mv for redox potential, <math>\pm 10\%</math> for turbidity, and <math>\pm 10\%</math> for DO. The stabilization requirements of <math>\pm 3\%</math> for conductivity, <math>\pm 0.2^\circ\text{C}</math> for temperature, and 0.3 ft for water level are appropriate. In lieu of measuring all five water quality parameters, a minimum subset would include pH, conductivity, and turbidity or DO.</p>	
<p>It is suggested to upgrade the down well tubing used by peristaltic pumps to 3/8” or larger to reduce the coiling effect that was observed in the 4” wells on the site.</p>	<p>N</p>	<p>Recommended improvement to the SAP.</p>	

<p>Regardless of whether volatile organics are being sampled, care should be taken to orient generators or other sources of wind-transported contamination such that they are down-wind of the sample collection point. If that is not possible, then they should be located as far away from the sample point as possible, or the samplers should consider battery powered equipment.</p>	<p>N</p>	<p>Recommended improvement to the SAP.</p>	
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State of Oregon  
Department of Environmental Quality Memorandum

**To:** Justin Sterger  
**From:** Shane Bennett  
**Subject:** Knife River Woodward Mine Split Field Report  
DEQ Laboratory Work Order 2512080

**Date:** 5 February 2026

**Sampling Date:**

8<sup>th</sup>-10<sup>th</sup> December 2025

**DEQ Representatives:**

Shane Bennett

**Contractor Representatives:**

Amber Hudspeth of Hudspeth Land & Water LLC

**Contractor Lab:**

Neilson Research Corporation based in Medford, Oregon

**Introduction:**

Amber Hudspeth conducts the environmental sampling at Knife River's Woodward Mine in Prineville, Oregon. The purposes of this split sampling event were to:

- Observe and evaluate the groundwater sampling procedures used at the mine.
- Compare field parameter measurements with the contractors.
- Collect split samples for a comparison of laboratory analytical results.

Seven monitoring wells were sampled over the course of three days.

Chronology of Events

Shane Bennett (ODEQ) met Amber (contractor) on December 8th, 2025 at the Woodward Mine in Prineville, Oregon. After a safety briefing from Knife River representatives, the sampling took place over three days as follows:

- 12/8 – MW-2
- 12/9 – WW-2A, MW-9, MW-10
- 12/10 – MW-6, MW-5, MW-7

## Field Evaluation:

### Monitoring Well Construction, Identification, and Security

Table 1. Observations of well construction, identification, and security.

<b>Well Number</b>	<b>Casing</b>	<b>Identification</b>	<b>Security</b>	<b>Concrete Pad/Protection</b>
MW-2	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L149468	Locking outer cap.	Yes, good condition. 4 STD posts.
WW-2A	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L134386	Locking outer cap.	Yes, good condition. 3 STD posts.
MW-9	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L158339	Locking outer cap and bolts.	New well. No pad or posts yet.
MW-10	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L158338	Locking outer cap and bolts.	New well. No pad or posts yet.
MW-6	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L155659	Locking outer cap.	Yes, good condition. 4 STD posts.
MW-5	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L154810	Locking outer cap.	Yes, good condition. 4 STD posts.
MW-7	8" metal outer, 4" PVC well casing	Only a WRD tag on the outer casing body: L155661	Locking outer cap.	Yes, good condition. 4 STD posts.

### Water Level and Well Depth Measurements

The contractor measured depth to water using an electronic sounder with 0.01 ft. accuracy. Depth to bottom measurements were taken from historical records. The sounder was wiped with a microfiber cloth between wells.

### Purging and Sampling Techniques

Purging and sampling was conducted using a combination of methods: A non-dedicated 4" single-speed submersible pump powered by twin generators and/or a peristaltic pump with new 1/4" poly well tubing and new silicone pump tubing. At some wells, the submersible pump was used to complete a "bulk" purge of 3 or more casing volumes in order to clear turbidity from the water column before switching to the peristaltic pump for stability readings, field parameters, and sampling. However, at MW-5, MW-6, and MW-7, the submersible was used to both purge and sample the wells. The submersible pump was single speed and had a very high flow rate at ~5-8 gallons per minute. The purge line was a garden hose and both the line and pump had significant tape on the outside of them.

The contractor's plan was to take samples back to the office to filter at the end of the day. DEQ suggested using in-line cartridge filters so that samples were immediately filtered in the field without

delay. The contractor agreed and samples were filtered with in-line 0.45 micron disposable cartridge filters provided by DEQ.

The contractor measured field parameters with a YSI ProDSS in a flow through cell. The cell's discharge fed into DEQ's flow through cell with a YSI ProDSS. Both the contractor and DEQ measured temperature, pH, specific conductance, dissolved oxygen concentration (DO), turbidity, and oxidation-reduction potential (ORP). After the first site of the sampling event (MW-2), the contractor used their HACH 2100Q turbidimeter due to the unreliable readings from their ProDSS.

Relevant purge and sample details are summarized below:

- **MW-2:** Submersible bulk purge (~90 gallons). Peristaltic pump for stability readings and sampling (~100 gal total). New p-pump and down-well tubing. Purge and sampling depth at ~26 ft. Troubles sending dedicated ¼" down-well tubing into the 4" PVC well so the contractor swapped to new ¼" tubing that was stiffer and easier to use. Contractor's ProDSS turbidity sensor was very unreliable and subject to large changes in readings due to wind or other vibrations from the pump. Used penultimate turbidity readings for this comparison because the last stabilization reading changed rapidly after being bumped. DEQ duplicate site.
- **WW-2A:** Submersible bulk purge (~15 gal). Peristaltic pump for stability readings and sampling (~23 gal total). New p-pump and down-well tubing. More troubles with dedicated down-well tubing so new tubing was used again. Some bubbles in the line, slightly turbid, no aroma. Generators were running close to the sampling point and the fumes were consistently present.
- **MW-9:** Submersible bulk purge (~30 gal). Peristaltic pump for stability readings and sampling (~33 gal total). Target purge and sample depth of 30 ft. New p-pump and down-well tubing. Bubbles in the line, no aroma. Generators were running close to the sampling point and the fumes were consistently present.
- **MW-10:** Submersible bulk purge (~20 gal). Peristaltic pump for stability readings and sampling (~26 gal total). Target purge and sample depth of 25 ft. New p-pump and down-well tubing. Parameters met stability criteria but were still changing slightly as purging continued. The bulk purge rate was ~50% slower than past purges with the same pump for an inexplicable reason. Two possible explanations were a kink in the line, the pump wasn't fully submerged, etc.
- **MW-6:** Submersible bulk purge (~30 gallons) followed by stabilization readings (135 gallons total). Due to the high flow rate, parameters were taken out of a clean bottom-filling 5-gallon bucket per DEQ's suggestion. Sample water to be filtered was collected in clean poly sample bottles and filtered using the p-pump with fresh tubing. Very fast recharge observed after the pump was turned off.
- **MW-5:** Submersible bulk purge (~20 gallons) followed by stabilization readings (180 gallons total). Due to the high flow rate, parameters were taken out of a clean bottom-filling 5-gallon bucket per DEQ's suggestion. Sample water to be filtered was collected in clean poly sample bottles and filtered using the p-pump with fresh tubing. The Woodward Mine SAP designates this well as a low flow well, but the 4" single-speed pump being used could only pump at high flows that resulted in ~7 ft. of drawdown during the purging process. Very fast recharge observed after the pump was turned off.
- **MW-7:** Submersible bulk purge (~20 gallons) followed by stabilization readings (200 gallons total). Target sample depth of 39 ft. Due to the high flow rate, parameters were taken out of a clean bottom-filling 5-gallon bucket per DEQ's suggestion. Sample water to be filtered was collected in clean poly sample bottles and filtered using the p-pump with fresh tubing. Very turbid at the start of purging, but this cleared up. There was initially a large DTW drawdown that slowed significantly by the end of purging. Contractor duplicate site.

The following EPA criteria for field parameter stabilization are referenced in the 2025 Revised SAP. However, the exact language for stabilization in the SAP points to the sampler's professional judgement in determination of representative conditions.

- pH: +/- 0.5 standard units (SU)
- Temperature: +/- 0.2 C
- Specific conductivity: +/- 3%
- Dissolved oxygen: no standard
- Redox potential: no standard
- Water level: 0.3 feet

All monitoring wells met the stabilization criteria during the last three readings for all parameters except for the following:

- MW-6: Depth to water
- MW-5: Depth to water

The depth to water changes are listed below in Table 2 and show changes over time during purging. For low flow technique there should be minimal change in DTW over the last 3 stabilization readings.

Table 2. Depth to Water readings and changes while purging and sampling.

Sample Point	DTB (ft)	Static DTW (ft)	DTW at 1st stabilization reading (ft)	DTW at final stabilization reading (ft)	Change in DTW over last 3 stabilization readings (ft)	Total Drawdown before sampling (ft)
MW-2	36	11.72	NR	11.74	NA	0.02
WW-2A	25	20.96	20.98	20.98	0	0.02
MW-9	40	24.74	24.74	24.74	0	0
MW-10	30	22.45	22.5	22.49	-0.01	0.04
MW-6	62	32.6	36.5	36.19	-0.31	3.59
MW-5	71	20.11	26.89	27.29	0.4	7.18
MW-7	55	21.85	25.63	25.69	0.06	3.84

### Quality Assurance and Preservation

The contractors stated that they collect one field duplicate per event for all parameters and no equipment blanks. For this event, the contractor collected a duplicate at MW-7. DEQ collected a field duplicate at MW-2 for all parameters and a full field blank using lab DI water.

The contractors wore gloves during purging and sampling, however they did not use gloves for handling the sounder. Samples were placed in coolers with icepacks in the field, transferred to sample refrigerators at the office for overnight storage, and picked up by a lab courier with block ice the following morning. Bottles from Neilson Research Corporation came pre-acidified and there was no pH check in the field.

## Field Decontamination

DEQ did not observe any significant decontamination of the sounder between wells besides the same dry microfiber cloth that was used for all wells.

When used, the peristaltic pump had new pump tubing and down-well tubing and therefore did not warrant any decontamination.

The submersible 4" pump had varying amounts of decontamination. On days one and two, the contractor stated that they dunked the pump and ~1-2 ft of line in a rinse barrel of tap water after each well. On day 3, DEQ observed the contractor dunk the fully coiled line in a wash barrel of Liquinox and tap water, then dunk the line in a rinse barrel of tap water only. The pump was then placed in the Liquinox barrel and turned on to circulate the soap through the system. The same process was repeated in the tap water rinse barrel. There was no DI rinse of any sampling equipment and no equipment or rinseate blanks were collected.

## Sample Documentation and Delivery

The samples were picked up by a lab courier the following morning after sampling. The laboratory supplied bottles and labels. Acid preservative was already added in the bottles where applicable. Field notes and chains of custody were present and filled out on site.

Table 3. Analyte and container list.

Analytes	Volume	Container	Preservative	Filtered
Total metals	500 mL	Poly	HNO3	N
Dissolved metals	500 mL	Poly	HNO3	Y
TOC	40 mL	Glass	Not recorded	N
Nitrate/Nitrite, TDS, Alk., SO4, Cl2, Fluoride	1000 mL	Poly	None	N
Bacteria	100	Poly (IDEXX)	None	N

## Field Parameter Measurement

Table 4 shows the instruments used by the contractors during the sampling event.

Table 4. Meter and calibration information.

Parameter	Meter	Calibration
Water Level	electronic sounder	Manufacturer calibration.
Temperature	YSI ProDSS	Contractor stated that they calibrate their meters once before each event. However, documentation and details were not present in the field and were not provided to DEQ afterwards despite multiple requests.
pH		
Conductivity		
Oxidation-reduction potential		
Dissolved Oxygen		
Turbidity	MW-2: YSI ProDSS. All other wells: Hach 2100Q	NA
Purging	- 4" single-speed high-flow submersible pump - Geotech Geopump Peristaltic Pump with silicone pump tubing	

## Discussion:

DEQ and contractor field data results are reported in Table 6 at the end of this report. Table 5 summarizes differences in the field parameter readings between the contractor and DEQ, the number of contractor readings that exceeded the comparison limit, and the total number of readings taken. There are no comparison limits for ORP or turbidity readings. However, a discussion of those results is still included in the next section.

Table 5. Field Parameter Comparison Summary.

Parameter	Comparison Limit	Readings exceeding limit	Total Readings
Temperature	$\pm 1.0^{\circ}\text{C}$ .	0	7
Specific Conductance	$\pm 10.0\%$	0	7
pH	$\pm 0.3$ pH units	0	7
Dissolved Oxygen	$\pm 0.6$ mg/L	0	7

## Individual Parameter Comparisons

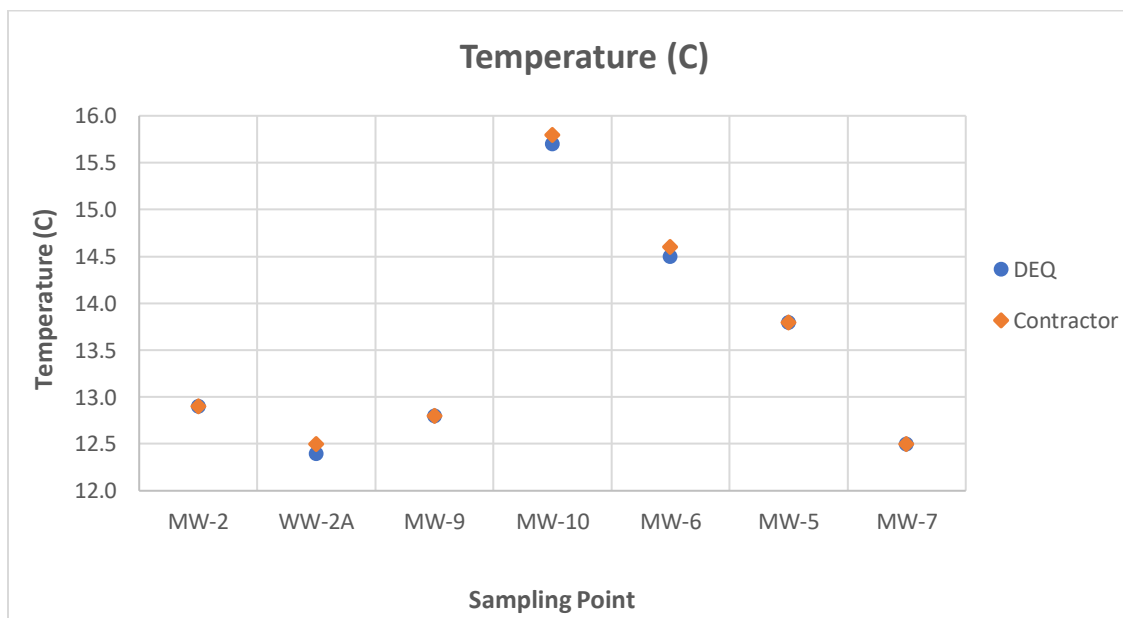


Figure 1. Temperature comparison between DEQ and the Contractor.

Temperature readings had good agreement, with an average different of  $\pm 0.1$  C occurring at WW-2A, MW-10, and MW-6. Three of the seven measurements were biased high.

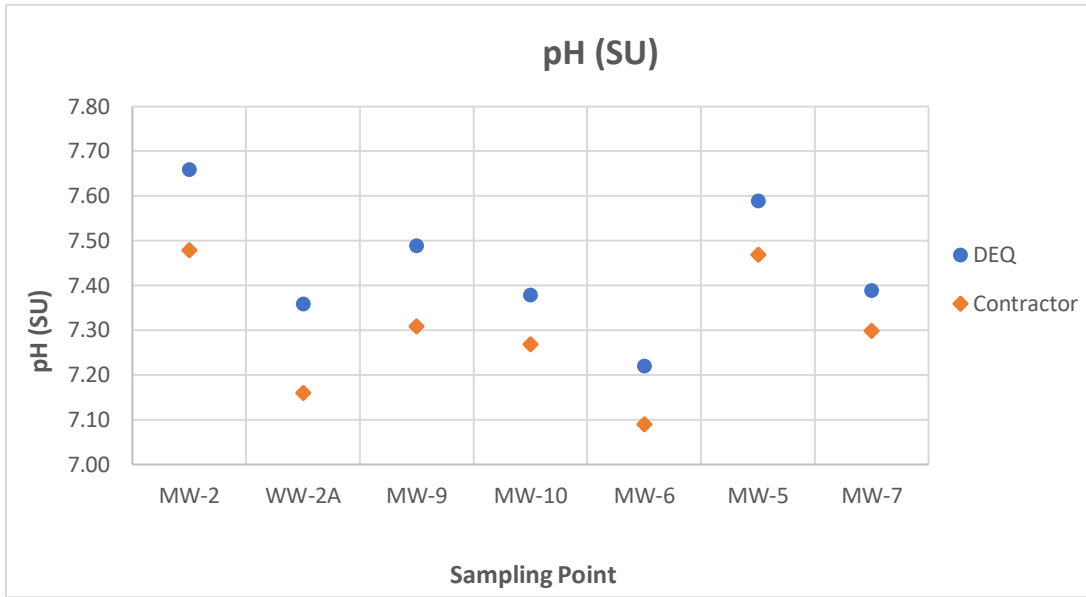


Figure 2. pH comparison between DEQ and the Contractor.

The pH readings generally had good agreement, with an average difference of 0.14 SU and the largest difference of 0.2 SU occurring at WW-2A. All seven readings were biased low.

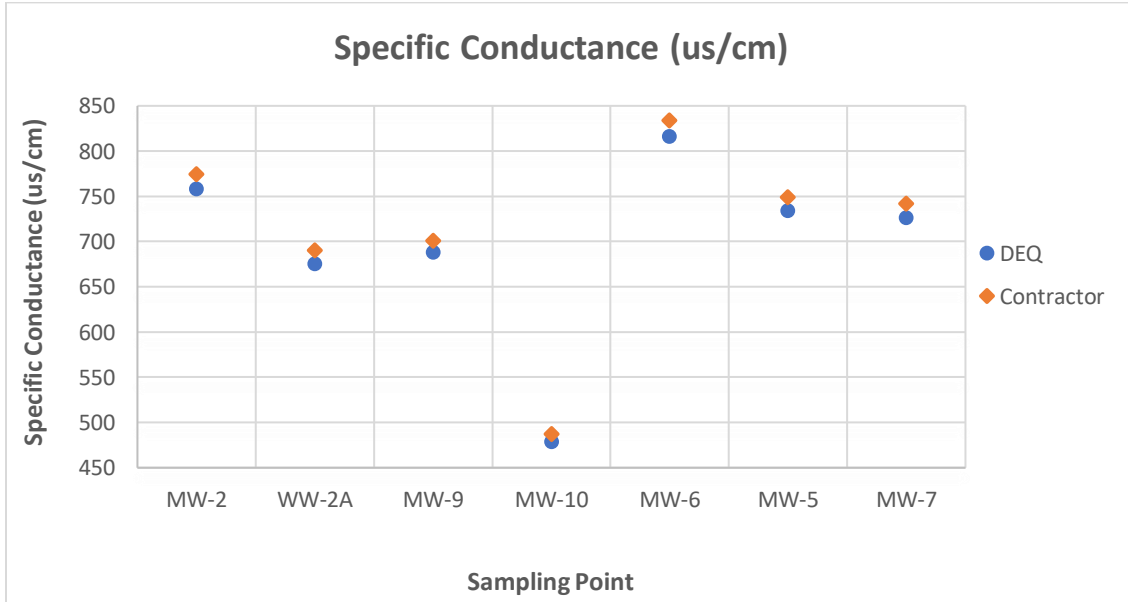


Figure 3. Specific conductance comparison between DEQ and the Contractor.

The specific conductance readings had good agreement, with an average difference of 2.0%. All seven readings were biased high.

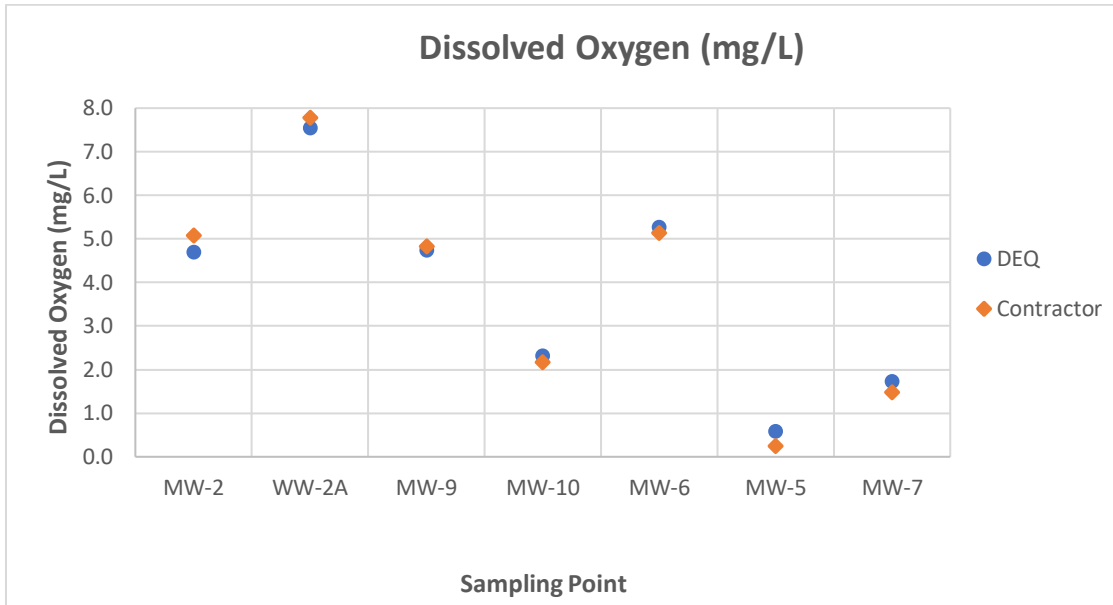


Figure 4. Dissolved oxygen comparison between DEQ and the Contractor.

Dissolved oxygen readings generally had good agreement. The average difference was 0.22 mg/L and the largest difference was 0.38 mg/L at MW-2. Four of the seven readings were biased low.

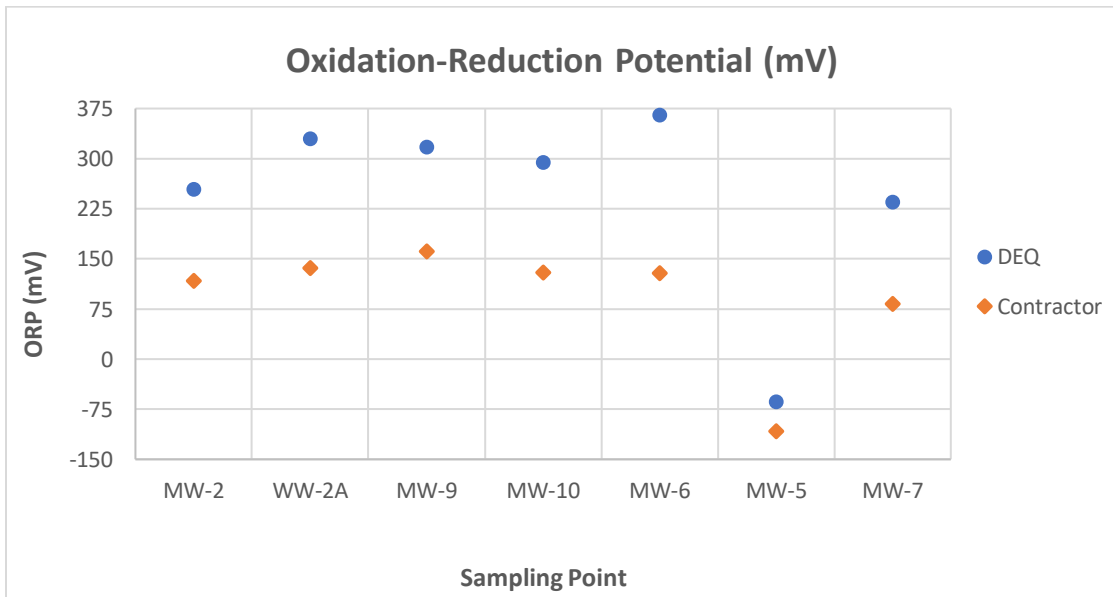


Figure 5. Oxidation-reduction potential comparison between DEQ and the Contractor.

ORP readings had poor agreement with an average difference of ~155 mV and a maximum difference of 236 mV at MW-6. ORP is generally a qualitative field measurement and subject to interpretation based on the electrode types and environmental water chemistries. Large differences are not unusual. The data trended similarly to DEQ's meters and the differences grew smaller as readings approached 0 mV. The contractor's meter was tested in DEQ's calibration standard of 220 mV and was found to read 179 mV, well below the acceptable levels. All seven readings were biased low.

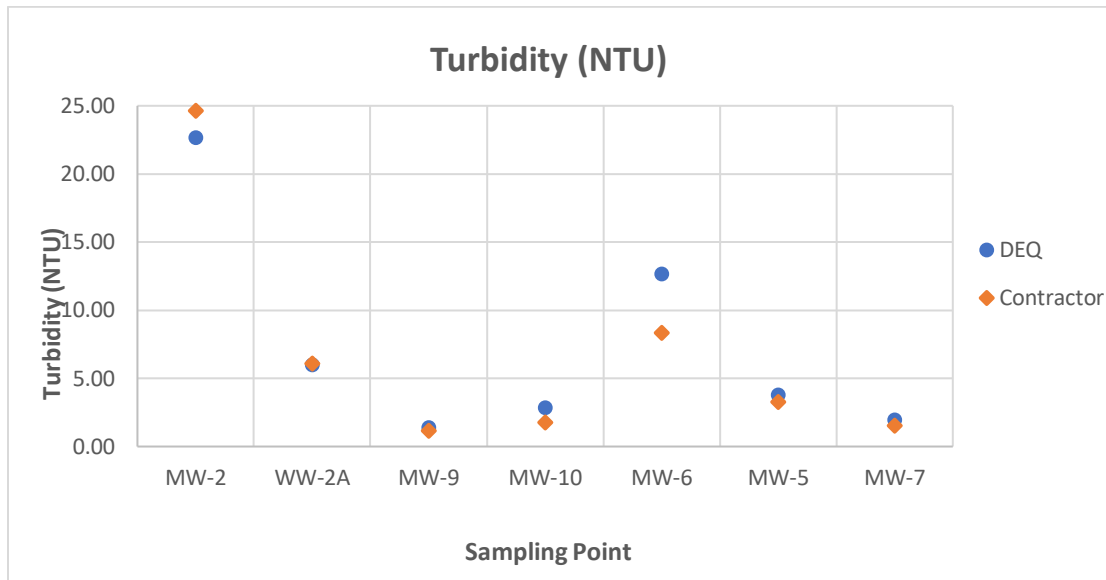


Figure 6. Turbidity comparison between DEQ and the Contractor.

Turbidity readings had moderate agreement with an average difference of 1.24 NTU and a maximum difference of 4.34 at MW-6. The contractor's reading at MW-2 was taken by a ProDSS that did not stabilize reliably and would drastically change values at the slightest disturbance. Subsequent readings were taken by the Hach 2100Q turbidimeter.

#### Comments:

1. Fresh gloves should be worn at all times when handling any equipment that will make contact with sample water, including pumps, tubing, and sounders.
2. The Woodward SAP calls for several things that were not sufficiently completed during the observed sampling event. Exact wording is in quotations, below.
  - a. "Decontamination of all multi-use equipment between wells will be performed using an Alconox and distilled water mixture to clean equipment and be rinsed with distilled water"
    - i. The sounder was not washed or rinsed and was instead wiped down with the same dry cloth between wells
    - ii. The submersible pump was not washed with Liquinox or rinsed with DI on the first two days of sampling. On day three, Liquinox and tap water were used to wash and rinse the pump, but not DI water.
    - iii. When using non-dedicated submersible pumps for low level sampling, significant effort should be used to decontaminate equipment between wells. Liquinox and high quality DI water should be used to wash the pump (both inside and out) and several lab-grade DI rinses should be performed afterwards. If the same "bulk" rinse water is used between wells, then at minimum the last rinse should be a fresh lab-grade DI rinse.
  - b. "Knife River plans to collect one duplicate sample and one blank per sampling event."
    - i. No blank sample was collected by the contractor.
    - ii. The SAP should be amended to include specific language elaborating on the type of blank expected and with what equipment it should be collected with.
  - c. "In addition, one rinseate or equipment blank sample will be collected during the monitoring period."

- i. Again, no rinseate or equipment blank was collected, and the contractor did not note one having been collected in the past.
  - ii. The SAP should be amended to further explain which of these blank types is required, rinseate or equipment blank, and what the monitoring period is referring to.
3. Given the use of non-dedicated equipment to sample low level metals with largely inadequate or nonexistent decontamination procedures and a lack of equipment blanks, then all analytical data from this event and any other similar event should be considered suspect.
4. Regardless of the decontamination procedures utilized, efforts should be made to keep the non-dedicated pump and its line clean and free from contamination. Storing the pump and line in the same plastic tote between wells will not keep them free from outside or well-to-well contamination.
5. Samplers should familiarize themselves with proper storage and handling of water quality meters. Some examples discussed on site were:
  - a. Not storing the pH probe submerged in DI water and instead using a rubber cap with pH probe storage solution (or pH 4 standard).
  - b. Ensuring dissolved oxygen is in the local DO setting to properly incorporate local barometric pressure readings.
  - c. Implementing a lab-based calibration routine with daily or twice daily calibration verifications in the field. These field checks provide confidence in daily data but prevent poor field conditions from contributing to a bad calibration. This also allows meter performance to be documented over time without frequently calibrating over a bad or failing probe.
6. Table 3 of the SAP identifies wells MW-2, WW-2A, MW-5, MW-6, and MW-7 as low flow wells. While not explicitly prohibited in the SAP, it is industry practice to limit purge rates to relative low levels, such as <0.5 liters per minute as recommended by EPA. The incredibly high purge rates of the 4" submersible pump (~5-8 gallons per minute) may have adverse effects on sample quality.
7. DEQ and the contractor discussed many potential adjustments and improvements to the current sampling plan, including:
  - a. Purchasing dedicated pumps and tubing for each well to eliminate the need for decontamination, or
  - b. Purchasing a single pump to be used with dedicated well tubing for each well, thus limiting decontamination to only the pump and line but not the tubing.
  - c. The inclusion of rinseate and equipment blanks to document the efficacy of any decontamination, or lack thereof, on existing or future equipment.
  - d. Further defining language in the SAP around purge rates (traditional 3x casing volume versus low flow), equipment types, and blank types and frequencies.
  - e. Permanently swap to using disposable cartridge-style 0.45 micron filters for immediate filtering in the field instead of transportation of raw water back to the office which can cause possible sample degradation and introduce more points of contamination.
8. It is suggested to upgrade the down well tubing used by peristaltic pumps to 3/8" or larger to reduce the coiling effect that was observed in the 4" wells on the site.
9. Regardless of whether volatile organics are being sampled, care should be taken to orient generators or other sources of wind-transported contamination such that they are down-wind of the sample collection point. If that is not possible, then they should be located as far away from the sample point as possible, or the samplers should consider battery powered equipment.
10. If high flow "bulk" purges are determined to be required to clear the highly-turbid water columns before sampling, then the impact on sample quality of high volume pumping and potential drawdown should be considered.

Table 6. DEQ and Contractor field data results.

Temperature (c)				
Sample Point	DEQ	Contractor	$\Delta$	$\Delta > 1.0$
MW-2	12.9	12.9	0.00	
WW-2A	12.4	12.5	-0.10	
MW-9	12.8	12.8	0.00	
MW-10	15.7	15.8	-0.10	
MW-6	14.5	14.6	-0.10	
MW-5	13.8	13.8	0.00	
MW-7	12.5	12.5	0.00	
Specific Conductance (us/cm)				
Sample Point	DEQ	Contractor	RPD	RPD > 10%
MW-2	758.00	774.00	2.1%	
WW-2A	675.00	690.00	2.2%	
MW-9	688.00	701.00	1.9%	
MW-10	478.60	487.20	1.8%	
MW-6	816.00	834.00	2.2%	
MW-5	734.00	749.00	2.0%	
MW-7	726.00	742.00	2.2%	
pH				
Sample Point	DEQ	Contractor	$\Delta$	$\Delta > 0.3$
MW-2	7.66	7.48	0.18	
WW-2A	7.36	7.16	0.20	
MW-9	7.49	7.31	0.18	
MW-10	7.38	7.27	0.11	
MW-6	7.22	7.09	0.13	
MW-5	7.59	7.47	0.12	
MW-7	7.39	7.30	0.09	
DO (mg/L)				
Sample Point	DEQ	Contractor	$\Delta$	$\Delta > 0.6$
MW-2	4.70	5.08	-0.38	
WW-2A	7.55	7.78	-0.23	
MW-9	4.74	4.83	-0.09	
MW-10	2.32	2.17	0.15	
MW-6	5.28	5.14	0.14	
MW-5	0.59	0.26	0.33	
MW-7	1.73	1.49	0.24	
ORP (mV)				
Sample Point	DEQ	Contractor	$\Delta$ (mV)	ABS $\Delta$ (mV)
MW-2	254.10	116.90	137.20	137.2
WW-2A	330.10	136.80	193.30	193.3
MW-9	317.30	161.80	155.50	155.5
MW-10	294.30	129.30	165.00	165
MW-6	365.00	128.90	236.10	236.1
MW-5	-64.00	-107.60	43.60	43.6
MW-7	235.40	82.40	153.00	153
Turbidity (NTU)				
Sample Point	DEQ	Contractor	$\Delta$ (NTU)	Note
MW-2	22.70	24.64	1.94	A, B
WW-2A	6.00	6.10	0.10	
MW-9	1.41	1.18	-0.23	C
MW-10	2.87	1.79	-1.08	C
MW-6	12.7	8.36	-4.34	
MW-5	3.83	3.27	-0.56	
MW-7	1.99	1.55	-0.44	
A. Contractor used the ProDSS turbidity probe for this reading. All others were the Hach 2100Q				
B. Used penultimate turbidity readings because the meter was bumped and not stable for the final.				
C. Used penultimate turbidity readings because the contractor did not record a final turbidity.				