

Appendix G

2021 Portland District TDG Report

U.S. Army Corps of Engineers Portland District Quality-Assurance and Quality-Control Evaluation of the 2020-2021 Total Dissolved Gas and Water Temperature Data in the Lower Columbia River

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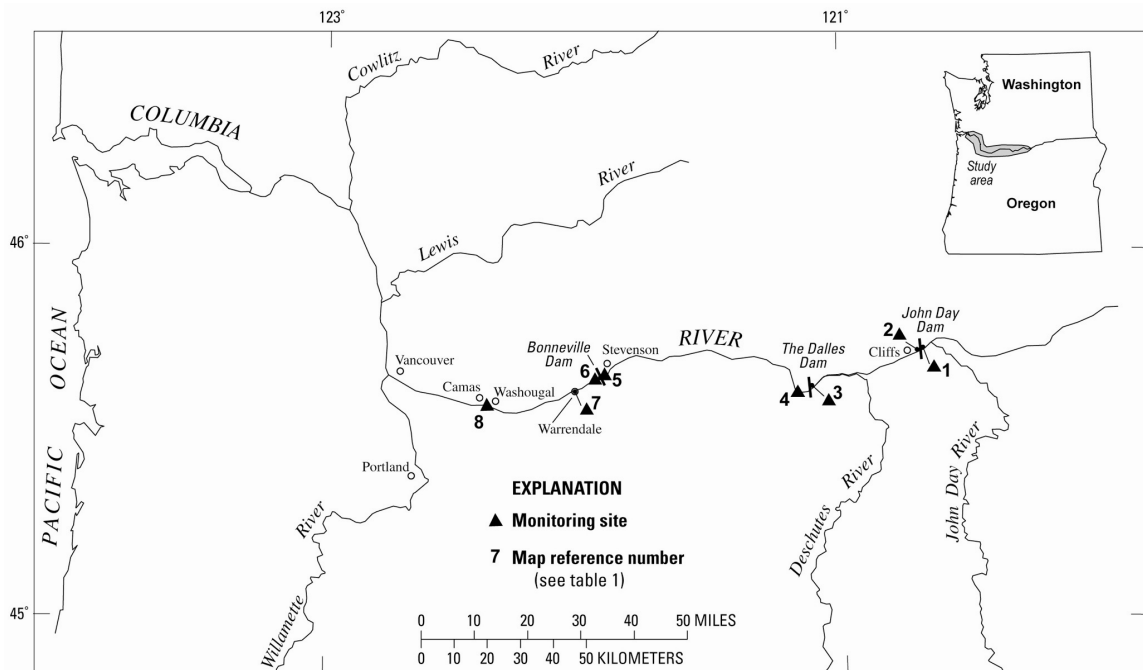
Significant Findings

An analysis of total-dissolved-gas (TDG) pressure, barometric pressure, and water-temperature data collected at seven fixed monitoring stations on the lower Columbia River in Oregon and Washington in water year 2021 indicated the following:

- Data received in real-time from the seven individual monitoring sites ranged from 91.7 percent (at Warrendale) to 99.8 percent complete.
- Criteria for data completeness (95 percent) were met at all monitoring stations, except for Warrendale. Equipment was removed at the site from February 2 to 26, 2021. The shed housing the equipment was damaged beyond repair and shipping of a replacement was delayed due to extreme winter weather. Excluding that period, data completeness was greater than 99 percent at the site.
- After approximately three to four weeks of deployment in the river, 74 of 76 TDG sensor field checks were within ± 1.0 percent saturation of a secondary standard sensor. One of the two field checks that failed the guideline was due to a ruptured TDG membrane. The reason for the other instance (-1.3 percent saturation) was unclear, but it was not due to a ruptured membrane and no data were deleted because of the difference.
- One of 73 barometric pressure field checks was greater than ± 1 mmHg of a primary standard, ranging from -15.7 to +1.0 mmHg. The difference of -15.7 mmHg was due to a malfunctioning barometer that recorded intermittent erroneous values for several days before it was replaced.
- All 73 water-temperature field checks were within ± 0.2 °C of a secondary standard, ranging from -0.13 to + 0.04 °C.
- All 71 TDG sensor laboratory checks that were performed after field deployment were within ± 0.5 percent saturation of a primary standard at ambient air pressure and at ambient air pressure plus 300 mmHg.
- During each scheduled site visit, the TDG sensors were field checked, removed and replaced with recently calibrated sensors, and brought to the lab for calibration checks. The three year-round tailwater sites were visited monthly from October 2020 through March 2021. The Cascade Island (Bonneville Dam tailwater) site was installed in March 2021 and the four operational sites were then visited every three weeks. The installation of the three seasonal forebay sites was deferred until May 2021 when they were added to the three-week visitation schedule.

1.0 Introduction

The U.S. Army Corps of Engineers (USACE) operates several dams in the lower Columbia River Basin in Oregon and Washington (figure G-1), which encompasses 259,000 mi² of the Pacific Northwest. These dams are multipurpose structures that fulfill regional needs for flood control, navigation, irrigation, recreation, hydropower production, fish and wildlife habitat, water-quality maintenance, and municipal and industrial water supply. When water is released through the spillways of these dams (instead of being routed through the turbines to generate electricity), ambient air is entrained in the water. This results in an increase in the concentration of dissolved gases (referred to here as “total dissolved gas,” or “TDG”) in the water downstream of the spillways. The USACE regulates streamflow and spill from its dams on the lower Columbia River to minimize the production of excess TDG downstream of the dams, with the additional goal of providing for fish passage through the spillways.



Real-time TDG, barometric pressure, and water-temperature data are vital to the USACE for dam operation and for monitoring compliance with environmental regulations. The data are used by water managers to maintain water-quality conditions that facilitate fish passage and ensure their survival in the lower Columbia River. The U.S. Geological Survey (USGS), in cooperation with the Portland District of the USACE, has collected TDG and related data in the lower Columbia River each year since 1996. The hourly values were stored in both the USGS database and in a USACE database and are available online within approximately one hour of the time of collection. The current and historical TDG and water-temperature data in the USGS database can be accessed at https://waterdata.usgs.gov/or/nwis/current/?type=usacetdg&group_key=basin_cd

(accessed October 29, 2021). The USACE database also includes hourly river discharge and spill data at http://pweb.crohms.org/ftppub/water_quality/tdg/ (accessed October 29, 2021).

This report presents the TDG, barometric pressure, and water temperature quality-assurance and quality-control data that demonstrate the USACE Portland District compliance with the 2019 TDG monitoring plan. To assure the accuracy and integrity of the data needed for managing and modeling TDG in the lower Columbia River, hourly values were reviewed relative to concurrent field measurements, laboratory sensor calibrations, and inter-site comparisons. All deleted or missing data are explained in detail.

2.0 Data Collection

Seven monitoring stations were operated on the lower Columbia River, from the navigation lock of the John Day Dam (river mile [RM] 215.7) to Dodson, Oregon (RM 140.3) (figure G-1, table G-1). Data for water year 2021 (October 1, 2020 - September 30, 2021) include hourly measurements of TDG pressure, barometric pressure, water temperature, and sensor depth. The John Day tailwater, The Dalles tailwater, and Warrendale stations are operated year-round. Warrendale is used to provide backup data for Cascade Island during the spill season and assists in monitoring TDG levels in relation to chum redds below Bonneville Dam during the winter. One of the seasonal stations (Cascade Island) was operated from mid-March through late-September 2021, encompassing the usual period for dam spill operations (April 1 to August 31). Three of the seasonal stations (John Day navigation lock, The Dalles forebay, and Bonneville forebay) were operated from mid-May through late-September 2021.

In the past, the forebay stations have been deployed in mid-March, but deployment was delayed because these stations are no longer required during the spring spill operations as both Washington and Oregon omitted any spring forebay TDG monitoring or compliance requirements. The Camas station (furthest downriver) is no longer part of the monitoring program as the data was not useful enough to justify the cost during a tight budget.

Instrumentation at each monitoring station consists of a Hydrolab water-quality sonde, a Vaisala electronic barometer, and a Sutron SatLink2 or SatLink3 data-collection platform (DCP). The instruments at each station are powered by a 12-volt battery that is charged by a solar panel. Measurements are collected, logged, and transmitted every hour. The DCP transmits the four most recent hours of logged data to the Geostationary Operational Environmental Satellite system (GOES). The data are transferred and automatically decoded to the USACE and USGS databases.

Station visits were completed monthly (every 4-5 weeks) at the three year-round stations from September 2020 to March 2021. Cascade Island was installed March 16, 2021 and the four operational stations were then visited every three weeks from March through May 2021. The three forebay stations were installed May 18-20, 2021. All seven sites were then visited every three weeks until October 2021. Cascade Island was removed September 1, 2021 to minimize the period of non-representative TDG data observed after spill from Bonneville Dam ends. The three forebay sites were removed September 21-22, 2021.

The field check procedure was as follows: A reference Hydrolab (which was calibrated before the field trip for use as a secondary standard) was deployed alongside the field-deployed instrument and allowed to equilibrate in order to obtain comparison measurements of TDG and water temperature. The field instrument (which had been deployed for 3 or more weeks) was then removed and replaced with another Hydrolab that had been recently calibrated in the laboratory. After the newly deployed instrument equilibrated, the secondary standard was again used to compare TDG and water temperature values. Any needed adjustment to the water temperature offset was then made within the DCP program. The electronic barometer at the monitoring station was checked against a portable barometer (NovaLynx 230-M202) that is calibrated annually to National Institute of Standards and Technology (NIST) standards. If necessary, the barometric pressure offset was also adjusted.

The Hydrolab that was removed from the field was later checked in the laboratory. The integrity and responsiveness of the TDG membrane was tested, and the membrane was removed and air-dried. The TDG sensor (without the membrane attached) was tested (and recalibrated, if necessary) at a range of pressures spanning the expected range of TDG in the river. The membrane was then installed on the TDG sensor and retested.

Table G-1. Total-dissolved-gas monitoring stations, lower Columbia River, Oregon and Washington, water year 2021.

[Map reference number refers to figure G-1; River mile is distance from the mouth of the Columbia River.]

| Map reference number | USACE station identifier | River mile | USGS station number | USGS station name (and abbreviated station name) | Latitude (NAD27) | Longitude (NAD27) | Period of record in water year 2021 |
|----------------------|--------------------------|------------|---------------------|---|------------------|-------------------|-------------------------------------|
| 1 | JDY | 215.7 | 454314120413701 | Columbia River at John Day navigation lock, Washington (John Day navigation lock) | 45° 43' 14" | 120° 41' 37" | 05/18/21–09/21/21 |
| 2 | JHAW | 214.8 | 454249120423500 | Columbia River, right bank, near Cliffs, Washington (John Day tailwater) | 45° 42' 49" | 120° 42' 35" | 10/01/20–09/30/21 |
| 3 | TDA | 192.4 | 453712121071200 | Columbia River at The Dalles Dam forebay, Washington (The Dalles forebay) | 45° 37' 12" | 121° 07' 12" | 05/19/21–09/22/21 |
| 4 | TDDO | 189.1 | 14105700 | Columbia River at The Dalles, Oregon (The Dalles tailwater) | 45° 36' 27" | 121° 10' 20" | 10/01/20–09/30/21 |
| 5 | BON | 146.1 | 453845121562000 | Columbia River at Bonneville Dam forebay, Washington (Bonneville forebay) | 45° 38' 45" | 121° 56' 20" | 05/20/21–09/22/21 |
| 6 | CCIW | 145.9 | 453845121564001 | Columbia River at Cascade Island, Washington (Cascade Island) | 45° 38' 45" | 121° 56' 40" | 03/16/21–09/01/21 |
| 7 | WRNO | 140.3 | 453630122021400 | Columbia River, left bank, near Dodson, Oregon (Warrendale) | 45° 36' 30" | 122° 02' 14" | 10/01/20–09/30/21 |
| 8 | CWMW | 121.7 | 453439122223900 | Columbia River, right bank, at Washougal, Washington (Camas) | 45° 34' 39" | 122° 22' 39" | N/A |

3.0 Data Completeness

To assure the accuracy and integrity of the TDG data in the lower Columbia River, hourly values were reviewed relative to concurrent field measurements, laboratory instrument calibrations, and daily inter-site comparisons. A summary of the completeness of the TDG percent saturation data is shown in table G-2. Data were based on the total number of hourly TDG and barometric pressure data values that could have been collected during the monitoring season. TDG saturation values were considered to meet quality-assurance standards if they were within ± 1 percent saturation of the expected value.

Table G-2. Completeness and quality of real-time total-dissolved-gas or barometric pressure data, lower Columbia River, Oregon and Washington, water year 2021.

| Abbreviated station name (USACE station identifier) | Planned monitoring (hours) | Number of missing or deleted hourly values | Percent of real-time TDG data passing quality assurance criteria |
|--|----------------------------|--|--|
| John Day navigation lock (JDY) | 3,025 | 15 | 99.5 |
| John Day tailwater (JHAW) | 8,760 | 46 | 99.5 |
| The Dalles forebay (TDA) | 3,023 | 101 | 96.7 |
| The Dalles tailwater (TDDO) | 8,760 | 20 | 99.8 |
| Bonneville forebay (BON) | 3,003 | 10 | 99.7 |
| Cascade Island (CCIW) | 4,054 | 33 | 99.2 |
| Warrendale (WRNO) | 8,730 | 724 | 91.7 ¹ |

¹When excluding the period when equipment was removed after the shed was damaged, completeness is 99.1 percent.

Periods for which substantial amounts of TDG data were missing from the database are listed in table G-3. Deletions associated with the equilibration of newly deployed sensors during site visits are not included in the table.

Table G-3. Periods of missing or deleted real-time total-dissolved-gas (TDG) or barometric pressure data, lower Columbia River, Oregon and Washington, water year 2021.

| Date(s) | USACE station identifier | Reason / Note |
|------------------------|--------------------------|--|
| 10/08/20 to 10/09/20 | JHAW | Erroneous values – Sonde not deployed to pipe bottom after pipe flushing |
| 01/30/2021 to 02/26/21 | WRNO | Missing values – Equipment removed after shed was damaged |
| 07/17/21 to 07/21/21 | TDA | Erroneous values – Barometer malfunctioning |
| 07/21/21 to 07/23/21 | All sites | GOES system outage – Data recovered from DCP logs |
| 08/02/21 | TDDO | Erroneous values - Ruptured membrane |
| 09/15/21 to 09/18/21 | WRNO | Erroneous values – Sonde resting on riverbed |

On January 30, 2021, the shed at WRNO fell over onto the dock (reason unknown). The DCP continued to log data but all transmissions ceased. The site was visited on February 2 and all equipment was removed until a replacement shed could be installed. The new shed did not arrive for several weeks due to shipping delays during nation-wide extreme winter weather. On February 26, the new shed and all equipment were reinstalled in the new location on the dock, approximately 100 ft east (upstream) of the previous location.

The GOES system outage in July 2021 resulted in between 7 and 31 missing transmissions at the sites. All missing data were recovered from the DCP logs.

TDG data from previous years indicate non-spill factors may affect water circulation at the John Day tailwater deployment pipes and consequently, TDG measurements. To reduce stagnant conditions or a buildup of sediment in the deployment pipes during the spill season, both the reference and site sonde pipes were flushed with compressed air on October 8, 2020 and April 7, 2021. After the October flushing, the sonde was not deployed to the bottom of the pipe and recorded erroneous TDG, water temperature, and depth values until the next day when the sonde was re-deployed. No data were deleted during water year 2021 due to stagnation or sediment accumulation at the site.

4.0 Quality-Assurance Data

The collection of accurate data for TDG, barometric pressure, and water temperature involves several quality-assurance procedures, including side-by-side instrument comparisons in the field, sensor calibrations in the laboratory, daily checks of the data, and data review and archiving. The results of the quality-assurance procedures for water year 2021 are presented in this section.

After field deployment for 3 or more weeks, the TDG instruments were tested and calibrated in the laboratory. First, the sensor was tested, with the gas-permeable membrane in place, for response to supersaturated conditions in soda water. The membrane was then cleaned, removed from the sensor, and allowed to dry for at least 24 hours. Before replacing the membrane, the

TDG sensors were examined independently by comparing the reading of the TDG sensor to barometric pressure (100-percent saturation). Using a certified digital pressure gage (primary standard), comparisons also were made at pressures of 300 mmHg greater than barometric pressure (approximately 139-percent saturation). The accuracy of the TDG sensors was calculated as the difference between the primary standard and the TDG sensor reading (expected minus actual) for the two test conditions divided by the barometric pressure and multiplied by 100 to obtain a percent difference. All 71 TDG sensor laboratory checks performed after field deployment were within ± 0.5 percent saturation of a primary standard at both test conditions and all but one check was within ± 0.3 percent saturation (figure G-2). In that instance, the TDG sensor housing was found to be cracked. The damage apparently occurred after the sonde was removed from the site and no data were deleted due to the difference.

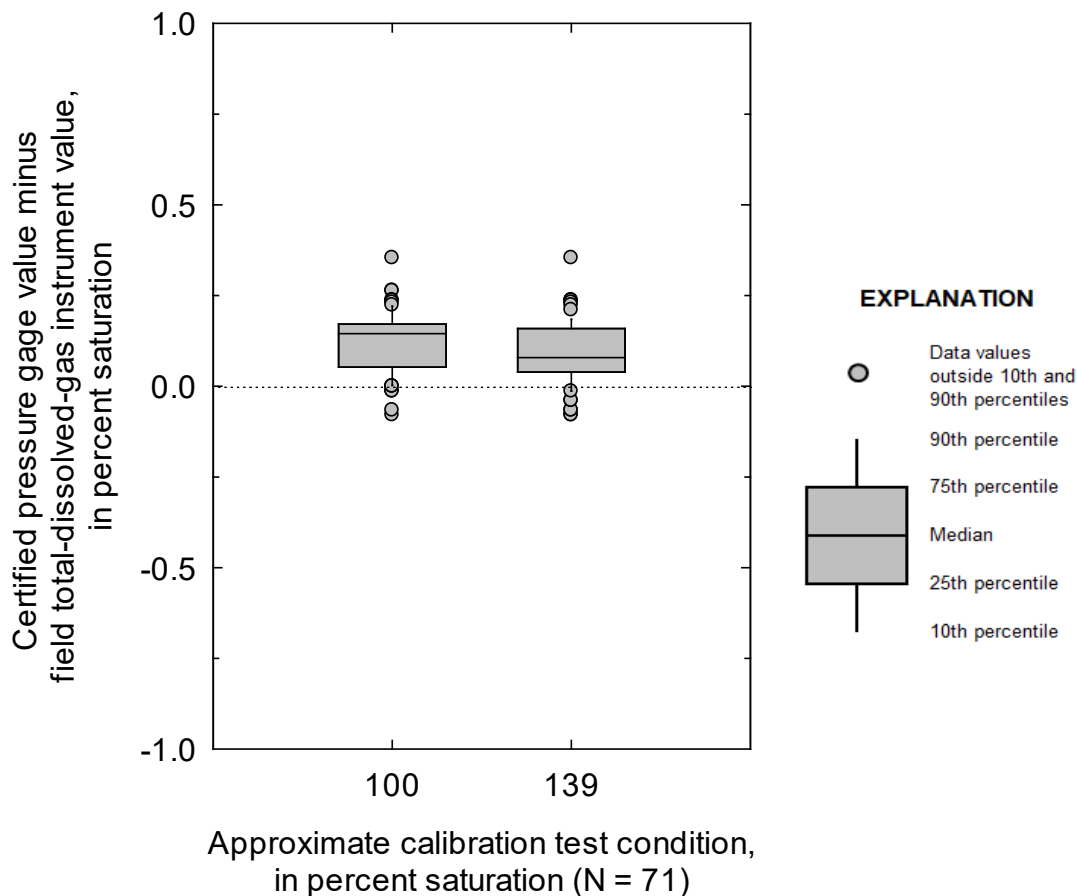


Figure G-2. Accuracy of total-dissolved-gas sensors in the laboratory after 3 or more weeks of field deployment at seven monitoring stations in the lower Columbia River, Oregon and Washington, water year 2021 (number of comparison values = 71).

The differences in barometric pressure, water temperature, and TDG between the reference instruments and the station monitors at the end of their field deployment were measured and recorded as part of every field inspection. These differences, calculated as the standard values

minus the field instrument values, were used to compare and quantify the accuracy and precision between the two instruments. For water temperature and TDG, the measurements were made with the secondary standard (a recently calibrated Hydrolab) positioned alongside the monitor deployed in the river. A digital barometer (NIST certified through January 2022) served as the primary standard for barometric pressure. The distribution of quality-assurance data for each of the three parameters from the seven stations is shown in figures G-3, G-4, and G-5. The data used to generate the boxplots in figures G-2–5 are shown in tables G-4 and G-5.

Comparisons of the digital reference barometer and the field barometers are shown in figure G-3. One of the 73 field check values was greater than ± 1.0 mm Hg of standard values, ranging from -15.7 mmHg to +1.0 mmHg. The difference of -15.7 mmHg was due to an intermittently malfunctioning barometer at The Dalles forebay and resulted in seventy deleted values over 5 days. This comparison reading is not included in the distribution analysis (figure G-3) because it does not represent the barometer's accuracy during normal function.

The comparisons of the secondary standard temperature sensor and the field temperature sensors are presented in figure G-4. The differences of all 73 field checks were within ± 0.20 °C, ranging from -0.13 to +0.04 °C.

Differences between the secondary standard TDG sensor and the field TDG sensors were computed following equilibration of the secondary standard instrument to site conditions before removing the field instrument. The equilibrium was generally considered complete after a minimum of 20 minutes (and a maximum of 2 hours) when the TDG values for the sensors were within 3 mmHg (less than ± 0.5 percent saturation). A total of 76 TDG field checks were done at the seven monitoring sites. Two of the comparisons were greater than 7 mmHg (approximately ± 1.0 percent saturation). One value (-10.4 percent saturation) was due to a ruptured TDG membrane at The Dalles tailwater. This comparison reading is not included in distribution analysis (figure G-5), because these data do not represent the TDG sensor's accuracy during normal function. The other instance (-1.3 percent saturation) occurred at Warrendale. The reason for the difference is unclear but could be explained by a difference in response time of the two sensors during changing TDG conditions. Both TDG sensors and membranes passed subsequent laboratory checks and no data were deleted due to the comparison.

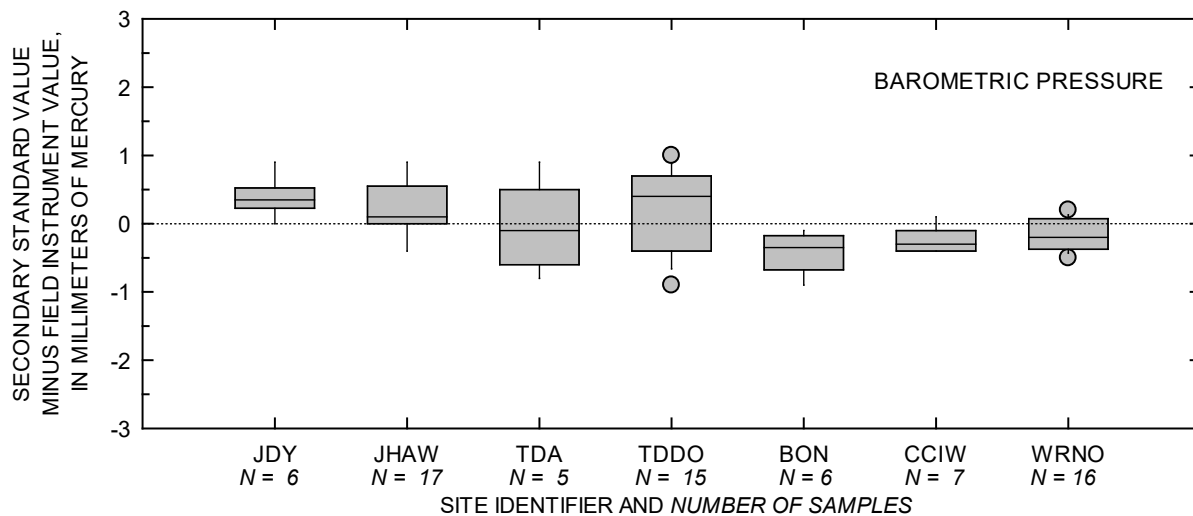


Figure G-3. Difference between the secondary standard and the field barometers in the field after 3 or more weeks of deployment at seven stations in the lower Columbia River, Oregon and Washington, water year 2021. See figure G-2 for explanation of boxplots and table G-1 for definitions of station identifiers.

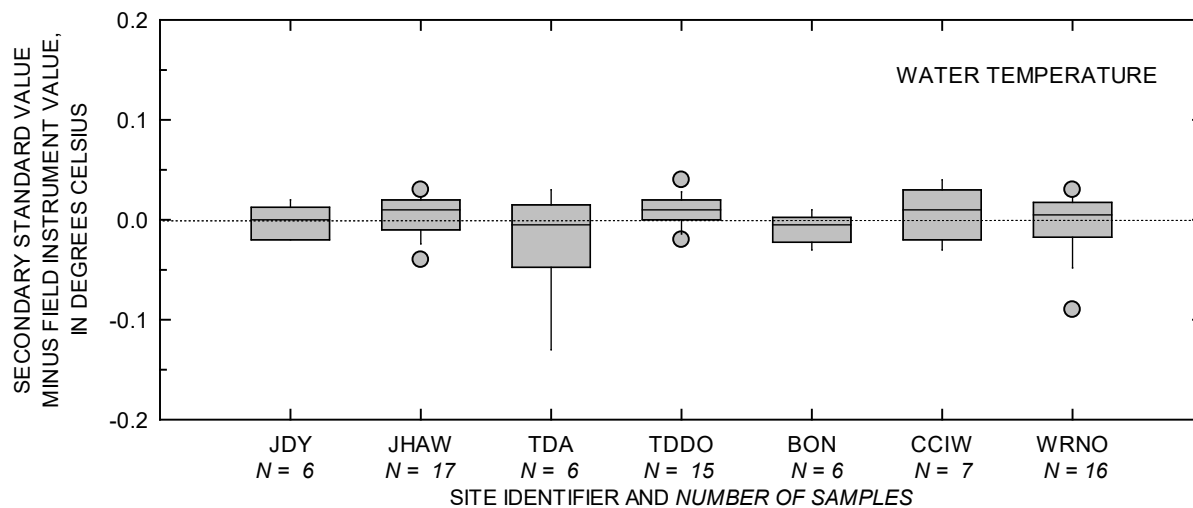


Figure G-4. Difference between the secondary standard and the field temperature instruments in the field after 3 or more weeks of deployment at seven stations in the lower Columbia River, Oregon and Washington, water year 2021. See figure G-2 for explanation of boxplots and table G-1 for definitions of station identifiers.

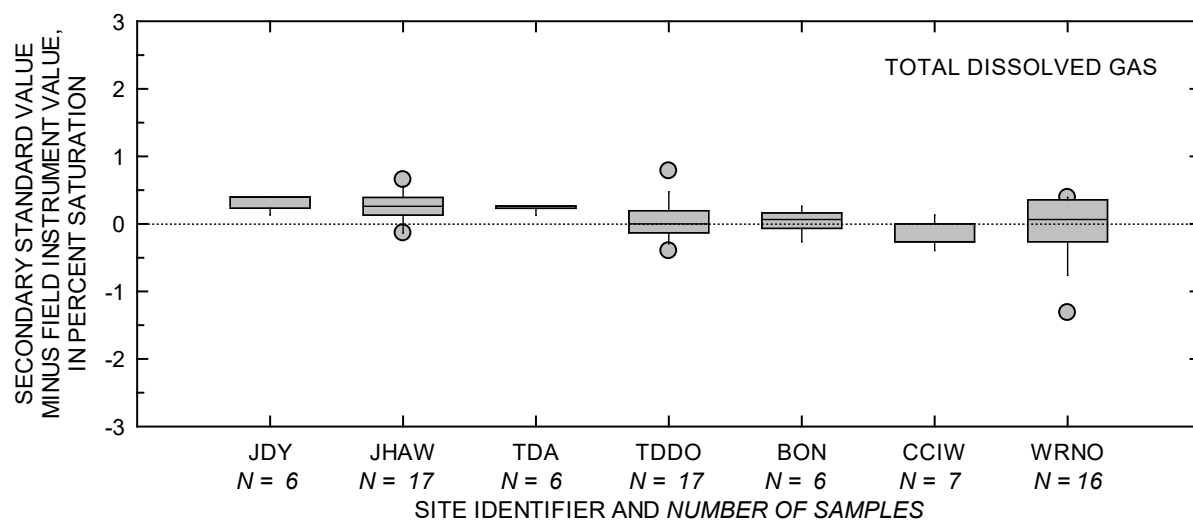


Figure G-5. Difference between the secondary standard and the field total-dissolved-gas instruments in the field after 3 or more weeks of deployment at seven stations in the lower Columbia River, Oregon and Washington, water year 2021. See figure G-2 for explanation of boxplots and table G-1 for definitions of station identifiers.

Table G-4. Summary of total-dissolved-gas side-by-side reference and field instrument comparisons, water year 2021.

| Date | Reference sonde number | Site sonde number | Barometric pressure (mmHg) | | | | Water temperature (°C) | | | | Pressure, total dissolved gas (mmHg) | | | | Difference, in percent saturation |
|---------------------------------------|------------------------|-------------------|----------------------------|----------------|------------|---------------------|------------------------|-------------|------------|---------------------|--------------------------------------|-------------|------------|---------------------|-----------------------------------|
| | | | Reference barometer | Site barometer | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | |
| John Day navigation lock (JDY) | | | | | | | | | | | | | | | |
| 6/8/2021 | 66363 | 65426 | 752.4 | 752 | 0.4 | 0.40 | 15.61 | 15.61 | 0.00 | 0.00 | 811 | 810 | 1 | 1 | 0.13 |
| 6/30/2021 | 66363 | 65425 | 746.9 | 746 | 0.9 | 0.90 | 20.05 | 20.07 | -0.02 | 0.02 | 849 | 846 | 3 | 3 | 0.40 |
| 7/22/2021 | 66363 | 65426 | 757.3 | 757 | 0.3 | 0.30 | 21.86 | 21.84 | 0.02 | 0.02 | 769 | 766 | 3 | 3 | 0.40 |
| 8/10/2021 | 66363 | 65425 | 754.3 | 754 | 0.3 | 0.30 | 22.65 | 22.67 | -0.02 | 0.02 | 782 | 779 | 3 | 3 | 0.40 |
| 8/31/2021 | 66363 | 65426 | 750.4 | 750 | 0.4 | 0.40 | 20.59 | 20.58 | 0.01 | 0.01 | 760 | 758 | 2 | 2 | 0.27 |
| 9/21/2021 | 66363 | 65425 | 761.0 | 761 | 0.0 | 0.00 | 19.95 | 19.95 | 0.00 | 0.00 | 751 | 748 | 3 | 3 | 0.39 |
| Mean | | | | | 0.38 | 0.38 | | | 0.00 | 0.01 | | | 2.5 | 2.5 | 0.33 |
| Median | | | | | 0.35 | 0.35 | | | 0.00 | 0.02 | | | 3.0 | 3.0 | 0.40 |
| John Day tailwater (JHAW) | | | | | | | | | | | | | | | |
| 10/5/2020 | 66361 | 67838 | 761.7 | 762 | -0.3 | 0.30 | 18.40 | 18.42 | -0.02 | 0.02 | 760 | 757 | 3 | 3 | 0.39 |
| 11/2/2020 | 66363 | 67837 | 761.0 | 761 | 0.0 | 0.00 | 12.89 | 12.88 | 0.01 | 0.01 | 751 | 749 | 2 | 2 | 0.26 |
| 12/2/2020 | 66363 | 67838 | 771.1 | 771 | 0.1 | 0.10 | 8.84 | 8.82 | 0.02 | 0.02 | 752 | 751 | 1 | 1 | 0.13 |
| 12/28/2020 | 66363 | 67837 | 761.6 | 762 | -0.4 | 0.40 | 6.48 | 6.46 | 0.02 | 0.02 | 746 | 745 | 1 | 1 | 0.13 |
| 1/25/2021 | 66363 | 67838 | 754.0 | 754 | 0.0 | 0.00 | 4.89 | 4.88 | 0.01 | 0.01 | 757 | 758 | -1 | 1 | -0.13 |
| 2/22/2021 | 66363 | 67837 | 763.1 | 763 | 0.1 | 0.10 | 2.86 | 2.84 | 0.02 | 0.02 | 767 | 765 | 2 | 2 | 0.26 |
| 3/18/2021 | 66363 | 67838 | 754.2 | 754 | 0.2 | 0.20 | 6.36 | 6.34 | 0.02 | 0.02 | 792 | 788 | 4 | 4 | 0.53 |
| 4/5/2021 | 66363 | 67837 | 759.3 | 759 | 0.3 | 0.30 | 8.27 | 8.25 | 0.02 | 0.02 | 790 | 788 | 2 | 2 | 0.26 |
| 4/28/2021 | 66363 | 67838 | 763.9 | 763 | 0.9 | 0.90 | 11.75 | 11.73 | 0.02 | 0.02 | 900 | 895 | 5 | 5 | 0.65 |
| 5/18/2021 | 66363 | 67837 | 759.9 | 759 | 0.9 | 0.90 | 13.97 | 13.96 | 0.01 | 0.01 | 896 | 895 | 1 | 1 | 0.13 |
| 6/8/2021 | 66363 | 67838 | 754.7 | 754 | 0.7 | 0.70 | 15.69 | 15.67 | 0.02 | 0.02 | 927 | 928 | -1 | 1 | -0.13 |
| 6/30/2021 | 66363 | 67837 | 749.4 | 749 | 0.4 | 0.40 | 19.97 | 19.94 | 0.03 | 0.03 | 864 | 865 | -1 | 1 | -0.13 |
| 7/22/2021 | 66363 | 67838 | 759.1 | 759 | 0.1 | 0.10 | 21.95 | 21.95 | 0.00 | 0.00 | 865 | 864 | 1 | 1 | 0.13 |
| 8/10/2021 | 66363 | 67837 | 756.0 | 756 | 0.0 | 0.00 | 22.73 | 22.73 | 0.00 | 0.00 | 873 | 871 | 2 | 2 | 0.26 |
| 8/31/2021 | 66363 | 67838 | 752.7 | 752 | 0.7 | 0.70 | 20.61 | 20.63 | -0.02 | 0.02 | 825 | 824 | 1 | 1 | 0.13 |
| 9/21/2021 | 66363 | 67837 | 764.6 | 765 | -0.4 | 0.40 | 19.96 | 19.98 | -0.02 | 0.02 | 767 | 764 | 3 | 3 | 0.39 |
| 10/13/2021 | 66363 | 67838 | 758.4 | 758 | 0.4 | 0.40 | 16.79 | 16.83 | -0.04 | 0.04 | 768 | 765 | 3 | 3 | 0.40 |
| Mean | | | | | 0.22 | 0.35 | | | 0.01 | 0.02 | | | 1.6 | 2.0 | 0.22 |
| Median | | | | | 0.10 | 0.30 | | | 0.01 | 0.02 | | | 2.0 | 2.0 | 0.26 |

| Date | Reference sonde number | Site sonde number | Barometric pressure (mmHg) | | | | Water temperature (°C) | | | | Pressure, total dissolved gas (mmHg) | | | | Difference, in percent saturation |
|------------------------------------|------------------------|-------------------|----------------------------|----------------|------------|---------------------|------------------------|-------------|------------|---------------------|--------------------------------------|-------------|------------|---------------------|-----------------------------------|
| | | | Reference barometer | Site barometer | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | |
| The Dalles forebay (TDA) | | | | | | | | | | | | | | | |
| 6/9/2021 | 66363 | 66624 | 759.9 | 759 | 0.9 | 0.90 | 15.60 | 15.73 | -0.13 | 0.13 | 851 | 850 | 1 | 1 | 0.13 |
| 6/30/2021 | 66363 | 65427 | 750.1 | 750 | 0.1 | 0.10 | 20.34 | 20.35 | -0.01 | 0.01 | 837 | 835 | 2 | 2 | 0.27 |
| 7/21/2021 | 66363 | 66624 | 758.3 | 774 | -15.7 | 15.70 | 21.85 | 21.84 | 0.01 | 0.01 | 795 | 793 | 2 | 2 | 0.26 |
| 8/11/2021 | 66363 | 65427 | 756.9 | 757 | -0.1 | 0.10 | 22.74 | 22.74 | 0.00 | 0.00 | 829 | 827 | 2 | 2 | 0.26 |
| 8/31/2021 | 66363 | 66624 | 754.6 | 755 | -0.4 | 0.40 | 20.34 | 20.36 | -0.02 | 0.02 | 776 | 774 | 2 | 2 | 0.27 |
| 9/22/2021 | 66363 | 65427 | 759.2 | 760 | -0.8 | 0.80 | 19.69 | 19.66 | 0.03 | 0.03 | 754 | 752 | 2 | 2 | 0.26 |
| Mean | | | | | -2.67 | 3.00 | | | -0.02 | 0.03 | | | 1.8 | 1.8 | 0.24 |
| Median | | | | | -0.25 | 0.60 | | | -0.01 | 0.02 | | | 2.0 | 2.0 | 0.26 |
| The Dalles tailwater (TDDO) | | | | | | | | | | | | | | | |
| 10/5/2020 | 66361 | 64596 | 762.7 | 763 | -0.3 | 0.30 | 18.45 | 18.46 | -0.01 | 0.01 | 772 | 774 | -2 | 2 | -0.26 |
| 11/2/2020 | 66363 | 67481 | 765.4 | 765 | 0.4 | 0.40 | 12.99 | 12.99 | 0.00 | 0.00 | 758 | 756 | 2 | 2 | 0.26 |
| 12/2/2020 | 66363 | 64596 | 771.4 | 771 | 0.4 | 0.40 | 8.71 | 8.70 | 0.01 | 0.01 | 764 | 763 | 1 | 1 | 0.13 |
| 12/28/2020 | 66363 | 67481 | 763.6 | 764 | -0.4 | 0.40 | 6.43 | 6.42 | 0.01 | 0.01 | 750 | 749 | 1 | 1 | 0.13 |
| 1/25/2021 | 66363 | 64596 | 755.2 | 755 | 0.2 | 0.20 | 5.07 | 5.06 | 0.01 | 0.01 | 756 | 758 | -2 | 2 | -0.26 |
| 2/22/2021 | 66363 | 67481 | 763.6 | 763 | 0.6 | 0.60 | 3.32 | 3.30 | 0.02 | 0.02 | 771 | 772 | -1 | 1 | -0.13 |
| 3/18/2021 | 66363 | 64596 | 754.8 | 755 | -0.2 | 0.20 | 6.45 | 6.44 | 0.01 | 0.01 | 792 | 795 | -3 | 3 | -0.40 |
| 4/5/2021 | 66363 | 64598 | 762.5 | 762 | 0.5 | 0.50 | 8.53 | 8.49 | 0.04 | 0.04 | 790 | 791 | -1 | 1 | -0.13 |
| 4/28/2021 | 66363 | 64596 | 764.0 | 763 | 1.0 | 1.00 | 12.00 | 11.99 | 0.01 | 0.01 | 907 | 901 | 6 | 6 | 0.79 |
| 5/19/2021 | 66363 | 64598 | 759.7 | 759 | 0.7 | 0.70 | 14.13 | 14.15 | -0.02 | 0.02 | 898 | 899 | -1 | 1 | -0.13 |
| 6/8/2021 | 66363 | 64596 | 756.8 | 756 | 0.8 | 0.80 | 15.75 | 15.75 | 0.00 | 0.00 | 893 | 890 | 3 | 3 | 0.40 |
| 6/30/2021 | 66363 | 64598 | 751.8 | 751 | 0.8 | 0.80 | 20.50 | 20.48 | 0.02 | 0.02 | 871 | 871 | 0 | 0 | 0.00 |
| 7/21/2021 | 66363 | 64596 | 760.6 | 760 | 0.6 | 0.60 | 21.75 | 21.73 | 0.02 | 0.02 | 851 | 850 | 1 | 1 | 0.13 |
| 8/2/2021 | - | 64598 | - | 760 | - | - | - | - | - | - | 869 | 948 | -79 | 79 | -10.39 |
| 8/10/2021 | 66363 | 64596 | 756.5 | 756 | 0.5 | 0.50 | 22.84 | 22.82 | 0.02 | 0.02 | 871 | 871 | 0 | 0 | 0.00 |
| 8/31/2021 | 66363 | 64596 | 757.5 | 758 | -0.5 | 0.50 | 20.41 | 20.41 | 0.00 | 0.00 | 814 | 814 | 0 | 0 | 0.00 |
| 9/22/2021 | 66363 | 64598 | 761.5 | 762 | -0.5 | 0.50 | 19.68 | 19.66 | 0.02 | 0.02 | 773 | 772 | 1 | 1 | 0.13 |
| 10/13/2021 | 66363 | 64596 | 761.1 | 762 | -0.9 | 0.90 | 16.26 | 16.27 | -0.01 | 0.01 | 765 | 762 | 3 | 3 | 0.39 |
| Mean | | | | | 0.22 | 0.55 | | | 0.01 | 0.01 | | | 0 | 2 | 0.06 |
| Median | | | | | 0.40 | 0.50 | | | 0.01 | 0.01 | | | 0.0 | 1.0 | 0.00 |

| Date | Reference sonde number | Site sonde number | Barometric pressure (mmHg) | | | | Water temperature (°C) | | | | Pressure, total dissolved gas (mmHg) | | | | Difference, in percent saturation |
|---------------------------------|------------------------|-------------------|----------------------------|----------------|------------|---------------------|------------------------|-------------|------------|---------------------|--------------------------------------|-------------|------------|---------------------|-----------------------------------|
| | | | Reference barometer | Site barometer | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | |
| Bonneville forebay (BON) | | | | | | | | | | | | | | | |
| 6/10/2021 | 66363 | 67857 | 764.6 | 765 | -0.4 | 0.40 | 15.76 | 15.77 | -0.01 | 0.01 | 862 | 862 | 0 | 0 | 0.00 |
| 6/29/2021 | 66363 | 66623 | 752.1 | 753 | -0.9 | 0.90 | 20.82 | 20.85 | -0.03 | 0.03 | 866 | 866 | 0 | 0 | 0.00 |
| 7/21/2021 | 66363 | 67857 | 763.4 | 764 | -0.6 | 0.60 | 21.63 | 21.63 | 0.00 | 0.00 | 795 | 793 | 2 | 2 | 0.26 |
| 8/12/2021 | 66363 | 64961 | 757.7 | 758 | -0.3 | 0.30 | 22.86 | 22.86 | 0.00 | 0.00 | 839 | 841 | -2 | 2 | -0.26 |
| 8/30/2021 | 66363 | 67857 | 758.9 | 759 | -0.1 | 0.10 | 20.57 | 20.56 | 0.01 | 0.01 | 795 | 794 | 1 | 1 | 0.13 |
| 9/22/2021 | 66363/64961 | 66623 | 763.8 | 764 | -0.2 | 0.20 | 19.06 | 19.08 | -0.02 | 0.02 | 766 | 765 | 1 | 1 | 0.13 |
| Mean | | | | | -0.42 | 0.42 | | | -0.01 | 0.01 | | | 0.3 | 1.0 | 0.04 |
| Median | | | | | -0.35 | 0.35 | | | 0.00 | 0.01 | | | 0.5 | 1.0 | 0.07 |
| Cascade Island (CCIW) | | | | | | | | | | | | | | | |
| 4/29/2021 | 66363 | 67858 | 765.6 | 766 | -0.4 | 0.40 | 11.97 | 11.96 | 0.01 | 0.01 | 905 | 908 | -3 | 3 | -0.39 |
| 5/20/2021 | 66363 | 64597 | 764.9 | 765 | -0.1 | 0.10 | 13.84 | 13.87 | -0.03 | 0.03 | 893 | 895 | -2 | 2 | -0.26 |
| 6/10/2021 | 66363 | 67858 | 765.7 | 766 | -0.3 | 0.30 | 15.72 | 15.71 | 0.01 | 0.01 | 916 | 915 | 1 | 1 | 0.13 |
| 6/29/2021 | 66363 | 64597 | 752.6 | 753 | -0.4 | 0.40 | 20.95 | 20.94 | 0.01 | 0.01 | 885 | 887 | -2 | 2 | -0.27 |
| 7/21/2021 | 66363 | 67858 | 764.1 | 764 | 0.1 | 0.10 | 21.65 | 21.61 | 0.04 | 0.04 | 888 | 890 | -2 | 2 | -0.26 |
| 8/12/2021 | 66363 | 64597 | 759.6 | 760 | -0.4 | 0.40 | 22.81 | 22.78 | 0.03 | 0.03 | 887 | 888 | -1 | 1 | -0.13 |
| 9/1/2021 | 66363 | 67858 | 758.7 | 759 | -0.3 | 0.30 | 20.16 | 20.18 | -0.02 | 0.02 | 808 | 808 | 0 | 0 | 0.00 |
| Mean | | | | | -0.26 | 0.29 | | | 0.01 | 0.02 | | | -1.3 | 1.6 | -0.17 |
| Median | | | | | -0.30 | 0.30 | | | 0.01 | 0.02 | | | -2.0 | 2.0 | -0.26 |

| Date | Reference sonde number | Site sonde number | Barometric pressure (mmHg) | | | | Water temperature (°C) | | | | Pressure, total dissolved gas (mmHg) | | | | Difference, in percent saturation |
|--------------------------|------------------------|-------------------|----------------------------|----------------|------------|---------------------|------------------------|-------------|------------|---------------------|--------------------------------------|-------------|------------|---------------------|-----------------------------------|
| | | | Reference barometer | Site barometer | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | Reference sensor | Site sensor | Difference | Absolute difference | |
| Warrendale (WRNO) | | | | | | | | | | | | | | | |
| 10/5/2020 | 66361 | 67856 | 765.1 | 765 | 0.1 | 0.10 | 18.54 | 18.55 | -0.01 | 0.01 | 783 | 781 | 2 | 2 | 0.26 |
| 11/2/2020 | 66363 | 67855 | 767.1 | 767 | 0.1 | 0.10 | 12.85 | 12.86 | -0.01 | 0.01 | 766 | 764 | 2 | 2 | 0.26 |
| 12/2/2020 | 66363 | 67856 | 769.1 | 769 | 0.1 | 0.10 | 8.16 | 8.18 | -0.02 | 0.02 | 765 | 765 | 0 | 0 | 0.00 |
| 12/28/2020 | 66363 | 67855 | 764.9 | 765 | -0.1 | 0.10 | 5.85 | 5.83 | 0.02 | 0.02 | 758 | 755 | 3 | 3 | 0.39 |
| 1/25/2021 | 66363 | 67856 | 758.6 | 759 | -0.4 | 0.40 | 5.25 | 5.27 | -0.02 | 0.02 | 763 | 761 | 2 | 2 | 0.26 |
| 3/16/2021 | 66363 | 67856 | 764.8 | 765 | -0.2 | 0.20 | 6.25 | 6.23 | 0.02 | 0.02 | 805 | 802 | 3 | 3 | 0.39 |
| 4/5/2021 | 66363 | 67855 | 768.8 | 769 | -0.2 | 0.20 | 8.79 | 8.78 | 0.01 | 0.01 | 825 | 825 | 0 | 0 | 0.00 |
| 4/29/2021 | 66363 | 67856 | 767.8 | 768 | -0.2 | 0.20 | 11.83 | 11.84 | -0.01 | 0.01 | 895 | 899 | -4 | 4 | -0.52 |
| 5/19/2021 | 66363 | 67855 | 762.7 | 763 | -0.3 | 0.30 | 14.23 | 14.23 | 0.00 | 0.00 | 887 | 889 | -2 | 2 | -0.26 |
| 6/9/2021 | 66363 | 67856 | 765.2 | 765 | 0.2 | 0.20 | 15.99 | 16.02 | -0.03 | 0.03 | 920 | 923 | -3 | 3 | -0.39 |
| 6/29/2021 | 66363 | 67855 | 755.0 | 755 | 0.0 | 0.00 | 20.79 | 20.78 | 0.01 | 0.01 | 882 | 884 | -2 | 2 | -0.26 |
| 7/22/2021 | 66363 | 67856 | 764.0 | 764 | 0.0 | 0.00 | 21.59 | 21.56 | 0.03 | 0.03 | 886 | 885 | 1 | 1 | 0.13 |
| 8/11/2021 | 66363 | 67855 | 760.6 | 761 | -0.4 | 0.40 | 22.63 | 22.62 | 0.01 | 0.01 | 888 | 898 | -10 | 10 | -1.31 |
| 8/30/2021 | 66363 | 67856 | 760.7 | 761 | -0.3 | 0.30 | 20.61 | 20.70 | -0.09 | 0.09 | 863 | 864 | -1 | 1 | -0.13 |
| 9/21/2021 | 66363 | 67855 | 763.6 | 764 | -0.4 | 0.40 | 19.22 | 19.21 | 0.01 | 0.01 | 781 | 778 | 3 | 3 | 0.39 |
| 10/14/2021 | 66363 | 67856 | 768.5 | 769 | -0.5 | 0.50 | 15.62 | 15.60 | 0.02 | 0.02 | 765 | 762 | 3 | 3 | 0.39 |
| Mean | | | | | -0.16 | 0.22 | | | 0.00 | 0.02 | | | -0.2 | 2.6 | -0.03 |
| Median | | | | | -0.20 | 0.20 | | | 0.00 | 0.02 | | | 0.5 | 2.0 | 0.07 |

Table G-5. Summary of reference and site TDG sensor comparisons measured during lab calibrations, water year 2021.

| USACE Station identifier | Site sonde number | Date checked | Soda test (Pass/Fail/N/A) | Reference Barometric pressure (mmHg) | | Site sensor Total pressure (mmHg) | | Difference between reference and site sensor total pressures (percent saturation) | | Calibrated (Y/N) | Pressure test (Pass/Fail/N/A) |
|--------------------------|-------------------|--------------|---------------------------|--------------------------------------|--------|-----------------------------------|------|---|-------|------------------|-------------------------------|
| | | | | +0 | +300 | +0 | +300 | +0 | +300 | | |
| JDY | 65426 | 6/24/2021 | P | 759.4 | 1059.4 | 758 | 1058 | 0.18 | 0.18 | N | P |
| JDY | 65425 | 7/11/2021 | P | 761.7 | 1061.7 | 760 | 1060 | 0.22 | 0.22 | N | P |
| JDY | 65426 | 7/30/2021 | P | 755.3 | 1055.3 | 754 | 1054 | 0.17 | 0.17 | N | P |
| JDY | 65425 | 8/26/2021 | P | 758.8 | 1058.8 | 757 | 1057 | 0.24 | 0.24 | N | P |
| JDY | 65426 | 10/4/2021 | P | 754.2 | 1054.2 | 753 | 1053 | 0.16 | 0.16 | N | N/A |
| JDY | 67481 | 10/24/2021 | P | 736.9 | 1036.9 | 737 | 1037 | -0.01 | -0.01 | N | N/A |
| JHAW | 67838 | 10/16/2020 | P | 765.6 | 1065.6 | 765 | 1065 | 0.08 | 0.08 | N | P |
| JHAW | 67837 | 11/18/2020 | P | 749.1 | 1049.1 | 749 | 1049 | 0.01 | 0.01 | N | P |
| JHAW | 67838 | 12/16/2020 | P | 755.3 | 1055.3 | 755 | 1055 | 0.04 | 0.04 | N | P |
| JHAW | 67837 | 1/6/2021 | P | 758.1 | 1058.1 | 757 | 1057 | 0.15 | 0.15 | N | P |
| JHAW | 67838 | 1/29/2021 | P | 753.1 | 1053.1 | 752 | 1052 | 0.15 | 0.15 | N | P |
| JHAW | 67837 | 3/15/2021 | P | 762.8 | 1062.8 | 762 | 1062 | 0.10 | 0.10 | N | P |
| JHAW | 67838 | 3/23/2021 | P | 770.3 | 1070.3 | 769 | 1069 | 0.17 | 0.17 | N | P |
| JHAW | 67837 | 4/16/2021 | P | 761.0 | 1061.0 | 759 | 1060 | 0.26 | 0.13 | N | P |
| JHAW | 67838 | 5/17/2021 | P | - | - | - | - | - | - | - | - |
| JHAW | 67837 | 5/28/2021 | P | 765.3 | 1065.3 | 764 | 1064 | 0.17 | 0.17 | N | P |
| JHAW | 67838 | 6/24/2021 | F | 759.4 | 1059.4 | 758 | 1058 | 0.18 | 0.18 | N | P |
| JHAW | 67837 | 7/11/2021 | P | 761.6 | 1061.6 | 760 | 1060 | 0.21 | 0.21 | N | P |
| JHAW | 67838 | 7/30/2021 | P | 755.2 | 1055.2 | 754 | 1054 | 0.16 | 0.16 | N | P |
| JHAW | 67837 | 8/26/2021 | P | 758.9 | 1058.9 | 759 | 1058 | -0.01 | 0.12 | N | P |
| JHAW | 67838 | 9/10/2021 | P | 759.4 | 1059.4 | 758 | 1058 | 0.18 | 0.18 | N | P |
| JHAW | 67837 | 10/1/2021 | P | - | - | - | - | - | - | - | - |
| JHAW | 67838 | 10/24/2021 | P | 736.7 | 1036.7 | 735 | 1035 | 0.23 | 0.23 | N | P |
| TDA | 66624 | 6/24/2021 | P | 759.3 | 1059.3 | 758 | 1058 | 0.17 | 0.17 | N | P |
| TDA | 65427 | 7/11/2021 | P | 761.6 | 1061.6 | 760 | 1061 | 0.21 | 0.08 | N | P |
| TDA | 66624 | 7/30/2021 | P | 755.2 | 1055.2 | 754 | 1054 | 0.16 | 0.16 | N | P |
| TDA | 65427 | 8/26/2021 | P | 758.9 | 1058.9 | 758 | 1058 | 0.12 | 0.12 | N | P |
| TDA | 66624 | 9/9/2021 | P | 759.0 | 1059.0 | 757 | 1058 | 0.26 | 0.13 | N | N/A |
| TDA | 65427 | 9/30/2021 | P | 759.0 | 1059.0 | 758 | 1058 | 0.13 | 0.13 | N | N/A |

| USACE Station identifier | Site sonde number | Date checked | Soda test (Pass/Fail/N/A) | Reference Barometric pressure (mmHg) | | Site sensor Total pressure (mmHg) | | Difference between reference and site sensor total pressures (percent saturation) | | Calibrated (Y/N) | Pressure test (pass/Fail/N/A) |
|--------------------------|-------------------|--------------|---------------------------|--------------------------------------|--------|-----------------------------------|------|---|-------|------------------|-------------------------------|
| | | | | +0 | +300 | +0 | +300 | +0 | +300 | | |
| TDDO | 64596 | 10/16/2020 | P | 765.5 | 1065.5 | 765 | 1065 | 0.07 | 0.07 | N | P |
| TDDO | 67481 | 11/18/2020 | P | 749.1 | 1049.1 | 748 | 1048 | 0.15 | 0.15 | N | P |
| TDDO | 64596 | 12/16/2020 | P | 755.2 | 1055.2 | 755 | 1055 | 0.03 | 0.03 | N | P |
| TDDO | 67481 | 1/6/2021 | P | 758.1 | 1058.1 | 757 | 1057 | 0.15 | 0.15 | N | P |
| TDDO | 64596 | 1/28/2021 | P | 753.1 | 1053.1 | 753 | 1053 | 0.01 | 0.01 | N | P |
| TDDO | 67481 | 3/15/2021 | P | 762.7 | 1062.7 | 760 | 1060 | 0.35 | 0.35 | Y | P |
| TDDO | 64596 | 3/23/2021 | P | 770.4 | 1070.4 | 770 | 1069 | 0.05 | 0.18 | N | P |
| TDDO | 64598 | 4/16/2021 | P | 760.9 | 1060.9 | 760 | 1061 | 0.12 | -0.01 | N | P |
| TDDO | 64596 | 5/17/2021 | P | - | - | - | - | - | - | - | - |
| TDDO | 64598 | 5/28/2021 | P | 765.3 | 1065.3 | 764 | 1065 | 0.17 | 0.04 | N | P |
| TDDO | 64596 | 6/24/2021 | P | 759.3 | 1059.3 | 759 | 1059 | 0.04 | 0.04 | N | P |
| TDDO | 64598 | 7/11/2021 | P | 761.5 | 1061.5 | 761 | 1061 | 0.07 | 0.07 | N | P |
| TDDO | 64596 | 7/30/2021 | P | 755.5 | 1055.5 | 755 | 1055 | 0.07 | 0.07 | N | P |
| TDDO | 64598 | 8/26/2021 | F | 760.4 | 1060.4 | 760 | 1060 | 0.05 | 0.05 | N | P |
| TDDO | 64596 | 9/10/2021 | P | 758.4 | 1058.4 | 759 | 1059 | -0.08 | -0.08 | N | P |
| TDDO | 64598 | 10/1/2021 | P | 764.7 | 1064.7 | 764 | 1064 | 0.09 | 0.09 | N | P |
| TDDO | 64596 | 10/24/2021 | P | 736.7 | 1036.7 | 736 | 1036 | 0.10 | 0.10 | N | P |
| BON | 67857 | 6/24/2021 | P | 759.3 | 1059.3 | 758 | 1059 | 0.17 | 0.04 | N | P |
| BON | 66623 | 7/11/2021 | P | 761.5 | 1061.5 | 762 | 1062 | -0.07 | -0.07 | N | P |
| BON | 67857 | 7/30/2021 | P | 755.4 | 1055.4 | 754 | 1055 | 0.19 | 0.05 | N | P |
| BON | 64961 | 8/26/2021 | P | 760.4 | 1060.4 | 760 | 1060 | 0.05 | 0.05 | N | P |
| BON | 67857 | 9/9/2021 | P | 759.0 | 1059.0 | 758 | 1058 | 0.13 | 0.13 | N | N/A |
| BON | 66623 | 9/30/2021 | P | 759.0 | 1059.0 | 759 | 1059 | 0.00 | 0.00 | N | N/A |
| CCIW | 67858 | 5/17/2021 | P | - | - | - | - | - | - | - | - |
| CCIW | 64597 | 5/28/2021 | P | 765.3 | 1065.3 | 764 | 1064 | 0.17 | 0.17 | N | P |
| CCIW | 67858 | 6/24/2021 | P | 759.3 | 1059.3 | 759 | 1059 | 0.04 | 0.04 | N | P |
| CCIW | 64597 | 7/11/2021 | P | 761.5 | 1061.5 | 760 | 1061 | 0.20 | 0.07 | N | P |
| CCIW | 67858 | 7/30/2021 | P | 755.2 | 1055.2 | 755 | 1055 | 0.03 | 0.03 | N | P |
| CCIW | 64597 | 8/26/2021 | P | 760.4 | 1060.4 | 759 | 1060 | 0.18 | 0.05 | N | N/A |
| CCIW | 67858 | 9/9/2021 | P | 759.0 | 1059.0 | 759 | 1059 | 0.00 | 0.00 | N | N/A |

| USACE Station identifier | Site sonde number | Date checked | Soda test (Pass/Fail/N/A) | Reference Barometric pressure (mmHg) | | Site sensor Total pressure (mmHg) | | Difference between reference and site sensor total pressures (percent saturation) | | Calibrated (Y/N) | Pressure test (pass/Fail/N/A) |
|--------------------------|-------------------|--------------|---------------------------|--------------------------------------|--------|-----------------------------------|------|---|-------|------------------|-------------------------------|
| | | | | +0 | +300 | +0 | +300 | +0 | +300 | | |
| WRNO | 67856 | 10/16/2020 | P | 765.3 | 1065.3 | 765 | 1065 | 0.04 | 0.04 | N | P |
| WRNO | 67855 | 11/18/2020 | P | 749.1 | 1049.1 | 748 | 1048 | 0.15 | 0.15 | N | P |
| WRNO | 67856 | 12/16/2020 | P | 755.0 | 1055.0 | 755 | 1055 | 0.00 | 0.00 | N | P |
| WRNO | 67855 | 1/6/2021 | P | 758.1 | 1058.1 | 757 | 1057 | 0.15 | 0.15 | N | P |
| WRNO | 67856 | 1/29/2021 | P | 753.1 | 1053.1 | 752 | 1053 | 0.15 | 0.01 | N | P |
| WRNO | 67855 | 3/15/2021 | P | 762.8 | 1062.8 | 761 | 1061 | 0.24 | 0.24 | Y | P |
| WRNO | 67856 | 3/23/2021 | P | 770.3 | 1070.3 | 769 | 1069 | 0.17 | 0.17 | N | P |
| WRNO | 67855 | 4/16/2021 | P | 760.7 | 1060.7 | 760 | 1061 | 0.09 | -0.04 | N | P |
| WRNO | 67856 | 5/17/2021 | P | - | - | - | - | - | - | - | - |
| WRNO | 67855 | 5/28/2021 | P | 765.3 | 1065.3 | 765 | 1065 | 0.04 | 0.04 | N | P |
| WRNO | 67856 | 6/24/2021 | P | 759.3 | 1059.3 | 758 | 1059 | 0.17 | 0.04 | N | P |
| WRNO | 67855 | 7/11/2021 | P | 761.5 | 1061.5 | 761 | 1062 | 0.07 | -0.07 | N | P |
| WRNO | 67856 | 7/30/2011 | P | 755.2 | 1055.2 | 754 | 1055 | 0.16 | 0.03 | N | P |
| WRNO | 67855 | 8/26/2021 | P | 760.4 | 1060.4 | 760 | 1061 | 0.05 | -0.08 | N | P |
| WRNO | 67856 | 9/10/2021 | P | 759.5 | 1059.5 | 758 | 1059 | 0.20 | 0.07 | N | P |
| WRNO | 67855 | 10/1/2021 | P | 764.7 | 1064.7 | 764 | 1065 | 0.09 | -0.04 | N | P |
| WRNO | 67856 | 10/24/2021 | P | 736.8 | 1036.8 | 736 | 1036 | 0.11 | 0.11 | N | P |