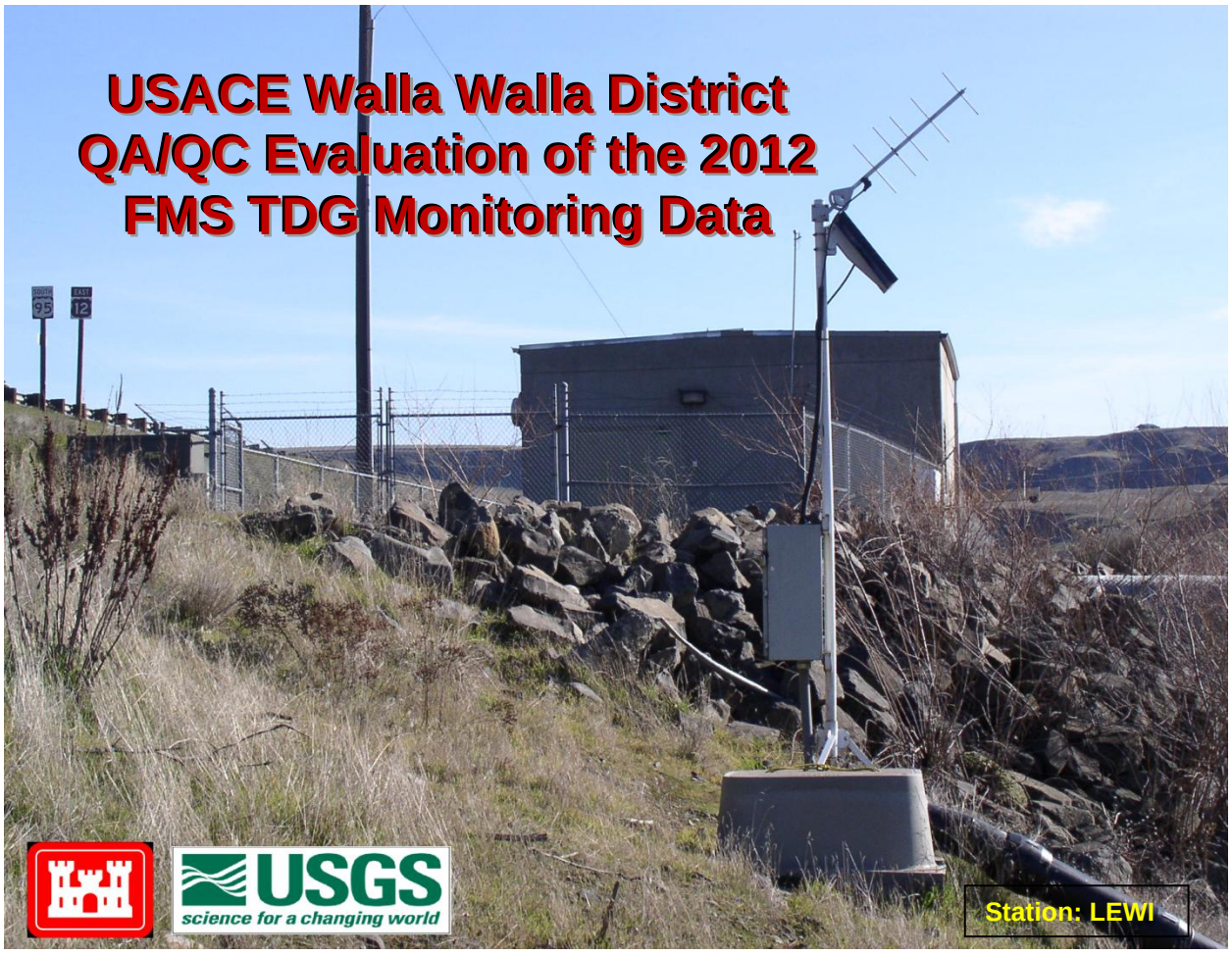
Appendix I



Includes:

McNary, Ice Harbor,
Lower Monumental, Little Goose,
Lower Granite, and Dworshak Projects

USACE Walla Walla District QA/QC Evaluation of the 2012 FMS TDG Monitoring Data

Prepared by:
Hydraulic Design and Water Quality Section
Walla Walla District
U.S. Army Corps of Engineers
Walla Walla, Washington

Prepared for:
Northwestern Division Regional Office
U.S. Army Corps of Engineers
Portland, Oregon

November 2012

TABLE OF CONTENTS

FIGURES

TABLES

TABLES (continued)

ABSTRACT

The U.S. Army Corps of Engineers (USACE), Walla Walla District (CENWW), operated fifteen fixed-monitoring system (FMS) stations (nine seasonal and six year round) for total dissolved gas (TDG), barometric pressure (BP), and temperature as part of their 2012 water-quality program. These stations are located on the Columbia, Lower Snake and Clearwater Rivers. This report provides a summary of the 2012 water-year quality assurance/ quality control (QA/QC) evaluation. Highlights include:

- 99.6, 98.7, and 99.6 percent of the BP, TDG, and water temperature data, respectively, were received in real-time and passed provisional QA/QC review. Percent completeness subsequently increased to 99.7, 98.8, and 99.7 for BP, TDG, and temperature, respectively, after the final data set was considered.
- 34.3 percent of the invalid/missing provisional data and 39.3 percent of the final data was due to low TDG readings at the Pasco (PAQW) Lewiston (LEWI), Peck (PEKI), and Little Goose tailwater (LGSW) stations. The second and third most frequent causes of anomalous data were data spikes and missing DCP data at 18.7 and 15.7 percent, respectively. Defective membranes, defective DCPs, and defective cables were the causes of the balance of erroneous data totaling 26.2 percent. There was no data loss due to defective data sondes in 2012.
- The sensor pre-deployment check had calculated median TDG and temperature differences of -0.10 mm Hg and 0.02 °C, respectively.
- The sensor post-deployment check revealed median TDG and temperature differences of 0.00 percent and 0.01 °C, respectively.
- The deployment pipe at the Dworshak FMS station was capped to prevent future access by muskrats.

.

1.0 INTRODUCTION

Walla Walla District (CENWW) of the U.S. Army Corps of Engineers (USACE) operated six hydropower projects: McNary, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak dams. These six dams are included in the basin-wide fixed-monitoring system (FMS) network. Six of the stations (*i.e.*, the tailwater stations at McNary Dam, Ice Harbor Dam, Lower Monumental Dam, Little Goose Dam, Lower Granite Dam, and Dworshak Dam) are operated throughout the year (Figure I-1; Table I-1). The remaining nine stations record data from 1 April through 31 August.

Three water-quality parameters are monitored at these facilities. One is total dissolved gas (TDG). This parameter is of interest since gas supersaturation results when air is entrained as water flows over the spillways and plunges into the stilling basin where water pressure causes the air to go into solution. The river subsequently becomes shallow beyond the stilling basin and the result is water supersaturated with TDG relative to atmospheric conditions. The U.S. Environmental Protection Agency (USEPA) has established an upper limit of 110 percent TDG for protection of freshwater aquatic life. Greater than 110 percent TDG can cause gas bubble trauma in fish and adversely affect other aquatic organisms. The State of Washington rule adjustment allows the percent TDG to reach 115 percent in the forebays and 120 percent in the tailwaters when water is spilled for fish passage, as well as during high river discharge events (*i.e.*, flows greater than the 7Q10). Washington State TDG standards specify that the maximum TDG measurement cannot exceed 125 percent for one-hour while the Oregon TDG standards limit it to two hours. Two additional parameters that influence the percent TDG are barometric pressure and water temperature. As such, measurements for these two constituents are also recorded and stored in the database.

Measurements were completed hourly at all stations and transmitted via the Geostationary Operational Environmental Satellite Program (GOES) system to USACE and U.S. Geological Survey (USGS) databases. The Corps Water Management System (CWMS) database at the Northwestern Division (CENWD) office in Portland, Oregon can be accessed at http://www.nwd-wc.usace.army.mil/report/total.html. The link to real-time USGS data for Washington is http://waterdata.usgs.gov/wa/nwis/current/ ?type =quality.

2.0 PURPOSE AND SCOPE

The purpose of TDG monitoring is to provide managers, agencies, and interested parties with near real-time data for managing stream flows, spill and the percent TDG downstream from power-producing dams. As with any data collection activity, an important component that cannot be overlooked is the quality of the data. Measurement of data quality allows determination of the usefulness and relevance of the data for current and future decision processes.

This 2012 report:

- Describes the data collection methods.
- Evaluates quality assurance/ quality control (QA/QC) data for the FMS stations at McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite reservoirs. Additionally, this data-collection system provided water quality information for the Clearwater River downstream of Dworshak Dam, the Columbia River near Pasco, and the Snake River near Anatone, Washington (Figure I-1; Table I-1).

- The QA/QC data includes:

    1. Instrument Data: This data was used to evaluate how an instrument performed as a function of the magnitude and direction that individual sensors deviated over time from their respective laboratory standards. These relationships were determined for each sensor before and after each deployment.

    2. Station Data: These data present comparisons between an in-place instrument that was deployed at a given station for a specified cycle and a newly calibrated QA/QC instrument (field standard). The Sutron® barometers at each station were evaluated with a Novalynx® hand-held barometer that served as a portable field standard for barometric pressure. Fifteen stations were visited for routine maintenance once every three weeks between 1 April and 31 August. The six year-round stations were maintained once every four weeks for the remainder of the year.

3.0 METHODS

3.1 DATA COLLECTION

The instrumentation at each FMS station consisted of components provided by CENWW and the USGS Kennewick, Washington, office. A 12-volt battery charged by a solar panel and/or 120-volt alternating-current line powered each station. Thirty-eight Hydrolab® multi-parameter probes (*i.e*., MS4A's and MS5's) were utilized. Twenty-nine of these units were provided by CENWW and the remaining nine belong to the USGS. Each sonde was deployed 4.6 times, on average, during water year 2012.

3.2 LABORATORY PROCEDURES

The TDG sensor measures the sum of the partial pressures of gaseous compounds dissolved in the water and reports the result in millimeters of mercury (mm Hg). The TDG sensor requires a two-step calibration procedure (*i.e*., adjustments are made at two points on the calibration curve) that is completed prior to and after deployment. The atmospheric pressure calibration point (Lab BP) is equal to the atmospheric pressure at the time of calibration as measured with a ParoScientific® digiquartz barometric pressure standard that is calibrated yearly at the factory. The differences between Lab BP and the pressure measured by the sensor [Δ(BP-PT)] were recorded before and after deployment. The slope of each sensor response was also evaluated to ensure that measurements were interpolated correctly over the full range of expected field values. To accomplish this task, a Heise™ PTE-1 hand held certified pressure calibrator, calibrated yearly at the factory (primary standard) and an Ashcroft digital test gauge, also calibrated yearly at the factory (primary standard), were used to apply pressure to the TDG sensor. Three hundred mm Hg were added to Lab BP during the pre-deployment check and the differences between Lab BP+300 and the sensors' response were recorded as Δ[(BP+300)-PT]. Similar tests were completed post-deployment when 100 mm Hg was added to Lab BP, and the resulting differences were recorded as Δ[(BP+100)-PT]. Pre-deployment pressure tests were made without a membrane installed. Post-deployment tests were made with a dry membrane in place.

Each sensor also includes a sensor for reporting water temperature in degrees Celsius (°C). Sensor thermometers are factory calibrated and cannot be adjusted. However, temperature sensor performance was evaluated pre- and post-deployment by comparing instrument readings

to two Barnant Model 600 digital thermistors. Both of these instruments were checked quarterly against a National Institute of Standards and Technology (NIST) mercury thermometer standard.

3.3 FIELD PROCEDURES

The differences in barometric pressure, water temperature, and TDG between a secondary standard instrument (*i.e.*, replacement sensor) and the fixed-station monitors after three or four weeks of field deployment were measured and recorded as part of the field inspection and calibration procedure. These differences, defined as the secondary standard value minus the field instrument value, were used to compare and quantify the precision between two independent instruments. The Sutron® barometers were checked using a Novalynx® Model 230-355 hand-held digital barometer that is calibrated yearly at the factory. The water temperature and TDG comparisons were made *in situ* with the secondary standard (*i.e.*, a recently calibrated Hydrolab®) positioned alongside the field Hydrolab®.

3.4 DEFINING INVALID AND MISSING DATA VALUES

The provisional real-time data were examined daily during the workweek by CENWW and/or USGS employees. Missing values and those that appeared to be outside the expected range were flagged. If a reasonable explanation (*e.g.*, routine maintenance, DCP failure, or defective membrane) could be attributed to the incident, then the data point, or points, was not included in the final data set used for this analysis. Outlying data points that could not be attributed to a specific cause were retained.

The final data set was subsequently developed based on a comparison of the data in the CWMS and USGS databases. This final data set is more complete and representative of the TDG and temperature environment than the provisional one.

4.0 RESULTS AND DISCUSSION

4.1 INVENTORY-WIDE SENSOR QA/QC PERFORMANCE

4.1.1 Pre-deployment

The pre-deployment evaluation of the sensors consisted of 181 individual checks for barometric pressure (Table I-2). The evaluation of the pressure sensors to the standard revealed a calculated mean of -0.1 mm Hg, and a range of -0.8 to 0.7 mm Hg (Table I-2; Figure I-3). Three hundred millimeters of mercury (mm Hg) was added to the TDG sensor in the laboratory using the laboratory barometer as the baseline standard. The difference between the barometer with 300 mm Hg of pressure and the instrument was compared against the expected value. The calculated mean was based on the 181 measurements. The sensor pressure differences ranged from -0.1 percent to 0.1 percent (Figure I-4; Tables I-2 and I-3). The calculated mean and median values were both 0.0 percent (Figure I-4; Tables I-2 and I-3).

The dissimilarities between the NIST-traceable thermometer and the sensor thermisters were also quite small. The calculated average and median values for all the instruments were 0.01 ºC and 0.02 °C, respectively. These calculated values were based on 181 measurements, with the medians for individual sensors ranging from -0.14 °C to 0.12 °C (Tables I-2 and I-3; Figure I-5). The instrument manufacturer's specification is ±0.20 °C for all instruments within a sample pool.

4.1.2 Post-deployment

The evaluation of the post-deployment QA/QC data also displayed favorable results. A total of 175 data points were used for the evaluation. The differences between the laboratory barometric pressure and that recorded by the sensors ranged from -1.6 mm Hg to 1.3 mm Hg, with a mean of 0.03 mm Hg (Tables I-2 and I-4; Figure I-3). The results of the post calibration checks using barometric pressure +100 mm Hg showed a calculated mean of 0.0 percent, and a range of -0.2 to 0.1 percent (Table I-2; Figure I-4).

There were 175 post deployment checks available for temperature evaluation. Temperature post calibration checks resulted in a calculated mean of 0.00 °C with a range between -0.15 °C and 0.14 °C (Tables I-2 and I-4; Figure I-5).

4.2 System-wide Station QA/QC Performance

The analysis of the station QA/QC data showed that the in-place barometric air pressure, TDG pressure, and temperature instruments performed well when compared to the secondary standards (Figures I-6 through I-8). A total of 183 readings were used to calculate the mean and median values for barometric pressure (Table I-5). The median of all the differences calculated between the station barometers and the secondary standards was 0.00 mm Hg (Table I-5; Figure I-6). All of the stations medians were within -0.2 to 0.1 mmHg (Table I-6). The published accuracy of the barometers is ±0.7 mm Hg.

A total of 168 readings were used to calculate the mean and median values for TDG instrument pressure (Table I-5). The overall median for the percent TDG differences between the in-place and replacement sensors was 0.0 percent saturation (Table I-5; Figure I-7). Individual median station values ranged from -0.3 percent saturation to 0.3 percent saturation (Table I-6).

A total of 168 readings were used to calculate the temperature differences between the in-place and replacement sondes (Table I-5). The calculated mean and median temperature differentials for the field data were both -0.01 °C (Table I-5; Figure I-8). The stations where the calculated median value departed from the overall median to the greatest extent were the McNary Dam tailwater (MCPW) and Lewiston (LEWI) stations at -0.07 ºC, and the Lower Monumental Dam tailwater (LMNW) at -0.06 °C (Table I-6). The manufacturer's specification for the temperature sensor is ±0.20 °C.

4.3 FMS Data Completeness and Station Statistics

Percent completeness can be examined from two perspectives: real-time data transmission from the DCP and corrected data based on a comparison of the data received in CWMS and the USGS database (referred to as the final). Percent completeness for the real-time TDG, barometric pressure, and temperature data were 98.7, 99.6, and 99.6 percent, respectively (Table I-7). The final data set had fewer missing/anomalous data points resulting in higher percentages for the same three parameters: TDG (98.8 percent), BP (99.7 percent), and temperature (99.7 percent) (Table I-8). The most frequent reason attributed to missing or anomalous in the real-time and final data sets was low TDG pressure (0.7 percent of the combined station performance and 34.3 to 39.3 percent of the anomalous data) (Tables I-9 and I-10). Regardless of the data set considered, all of the fifteen stations exceeded the required 95 percent criterion for both for DCP

and final data. The lowest reporting station was Peck (PEKI) at 96.7 percent complete and accurate (Table I-8).

4.3.1 Barometric Pressure

Barometric pressure data was 100 percent complete at ten of the fifteen FMS stations based on both the provisional real-time DCP data (Table I-7) and the final data (Table I-8) set. The remaining five stations (McNary tailwater [MCPW], Lower Monumental tailwater [LMNW], Little Goose tailwater [LGSW], Lower Granite tailwater [LGNW], and Dworshak [DWQI]) were greater than or equal to 99 percent complete based on the final data set. Spikes, missing data, defective cables, and DCP failure were the primary causes for omitted data (Tables I-10 and I-12).

4.3.2 Total Dissolved Gas

The TDG data from the fifteen stations averaged 98.7 percent complete based on the real-time DCP data and 98.8 percent complete when the final data set is considered (Tables I-9 and I-10). The McNary forebay (MCNA), Ice Harbor tailwater (IDSW), Ice Harbor forebay (IHRA), Lower Monumental forebay (LMNA), Little Goose forebay (LGSA), Lower Granite forebay (LWG) and Anatone (ANQW) stations were all 100 percent complete regardless of the dataset considered (Tables I-7 and I-8). The stations that experienced the greatest amount of data loss were Lewiston (LEWI), Peck (PEKI), and Pasco (PAQW) where the final data set statistics were, 97.4, 90.0, and 97.5 percent complete and correct, respectively (Tables I-7 and I-8). Low TDG pressures, data spikes, and defective membranes accounted for the majority of the data losses at those stations (Tables I-13 and I-14).

4.3.3 Temperature

The temperature data from the fifteen FMS stations averaged 99.6 and 99.7 percent complete based on the real-time DCP and final data sets, respectively. Ten stations (McNary forebay [MCNA], Pasco (PAQW), Ice Harbor tailwater [IDSW], Ice Harbor forebay [IHRA], Lower Monumental forebay [LMNA], Little Goose forebay [LGSA], Lower Granite forebay [LWG], Anatone [ANQW], Lewiston [LEWI], and Peck [PEKI]) attained 100 percent completeness based on the preliminary data (Table I-7) and final data sets (Table I-8). McNary tailwater (MCPW), Lower Monumental tailwater, Little Goose tailwater (LGSW), and Lower Granite tailwater (LGNW) were all greater than 99 percent complete, and the Dworshak (DWQI) station was 98.8 percent complete. Missing data, data spikes, DCP failure, and cable failure were primarily responsible for these five stations failing to achieve 100 percent completeness (Table I-15 and I-16). In spite of these deficiencies, all fifteen FMS stations were above 95 percent complete for temperature. A major contributing factor to this achievement was 100 percent deployed sonde reliability this season.

4.4 Dworshak Deployment Pipe Repair

The Dworshak tailwater (DWQI) FMS station is located on the North Fork of the Clearwater River along the left bank directly adjacent to the Dworshak National Fish Hatchery's water intake pump house near Asahaka, Idaho. The deployment pipe is made of 8-inch diameter SDR 17 black high density polyethylene (HDPE) pipe and was originally installed in 2002 and extended by 30 feet in 2010.

During the January 2012 maintenance trip the USGS field technician was not able to retrieve the sonde. Consequently, the replacement sonde was placed in the previously used deployment pipe located closer to shore at the fish hatchery water intake. Subsequent examination of the deployment pipe with a pipe camera showed that the rope used to retrieve the sonde, as well as the communication cable, was severed. There also was what appeared to be a muskrat nest in the pipe. Pipe repair was not completed until late September when Dworshak project releases were back to low-flow conditions and boat access was considered safe. The repair consisted of removing the pipe from the anchors, replacing the internal rope, attaching a stainless steel screen at the end of the pipe (Figure I-10), and then re-anchoring.

5.0 SUMMARY

Hourly TDG, temperature, and barometric data recorded during the 2012 water year at fifteen FMS stations were evaluated. Six tailwater sites were maintained throughout the year and nine were monitored from 1 April through 31 August.

The combined data from all stations except Dworshak exceeded the 95 percent criterion. The final data set had a higher percent rating than the real-time DCP data for all parameters.

The USGS Kennewick field office performed routine station maintenance under a cooperative agreement; completed emergency repairs; and operated the DCPs. Their pre-deployment QA/QC checks showed a mean difference of -0.07 mm Hg when the TDG sensors were compared to barometric pressure and -0.01 percent when 300 mm Hg of pressure was added. The post-deployment evaluations had mean differences of -0.03 mm Hg and 0.00 percent when the TDG sensors were compared to barometric pressure and barometric pressure plus 100 mm Hg, respectively. The calculated mean temperature difference was 0.01 °C for pre-deployment and 0.00 °C for post-calibration.

The 38 instruments used to perform this years monitoring met the manufacturers' specifications. Field checks during routine maintenance demonstrated that the air barometric pressure, percent TDG, and temperature averaged -0.02 mm Hg, 0.0 percent, and -0.01 °C, respectively, when compared to the secondary standards.

The preventative maintenance schedule provided for calibration and routine maintenance at three week intervals during the fish spill season and once every four weeks during the rest of the year. Station performance was hampered primarily by low TDG values, data spikes, missing data, DCP malfunction, cable failure, and defective membranes.

The deployment pipe downstream from the Dworshak project was capped with stainless steel mesh to prevent future access by muskrats.

FIGURES

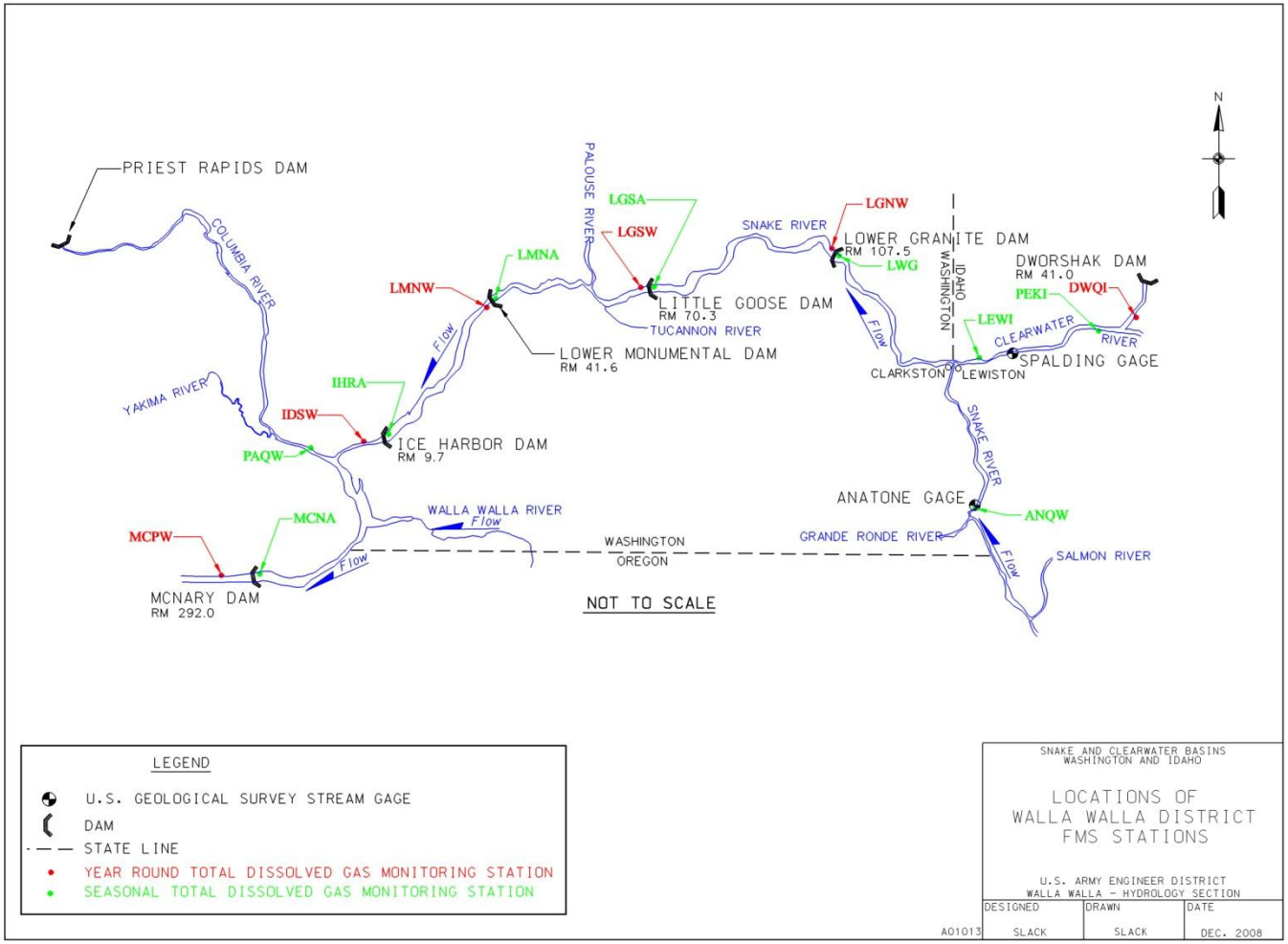


Figure I-1. Locations of Walla Walla District's FMS stations.

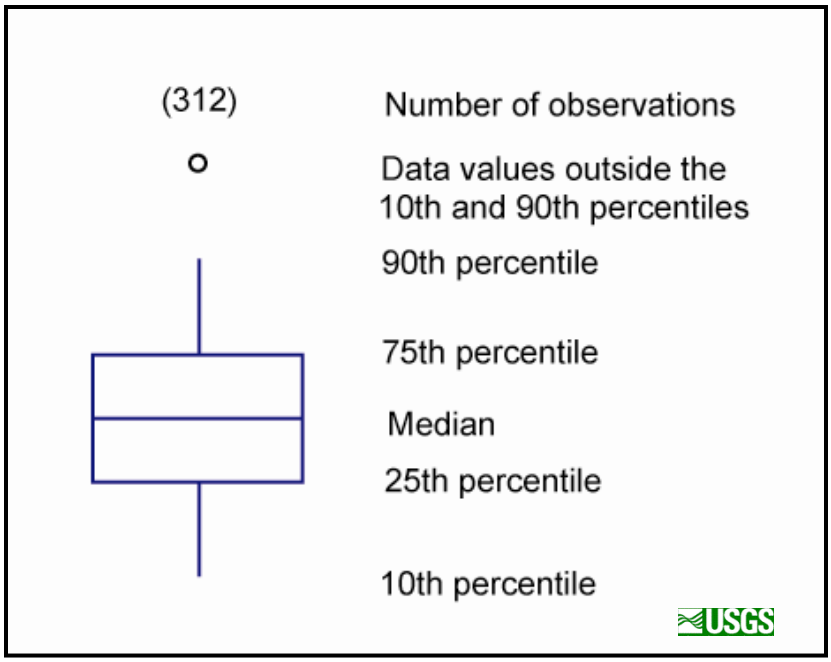


Figure I-2. Explanation key for the box plot information.

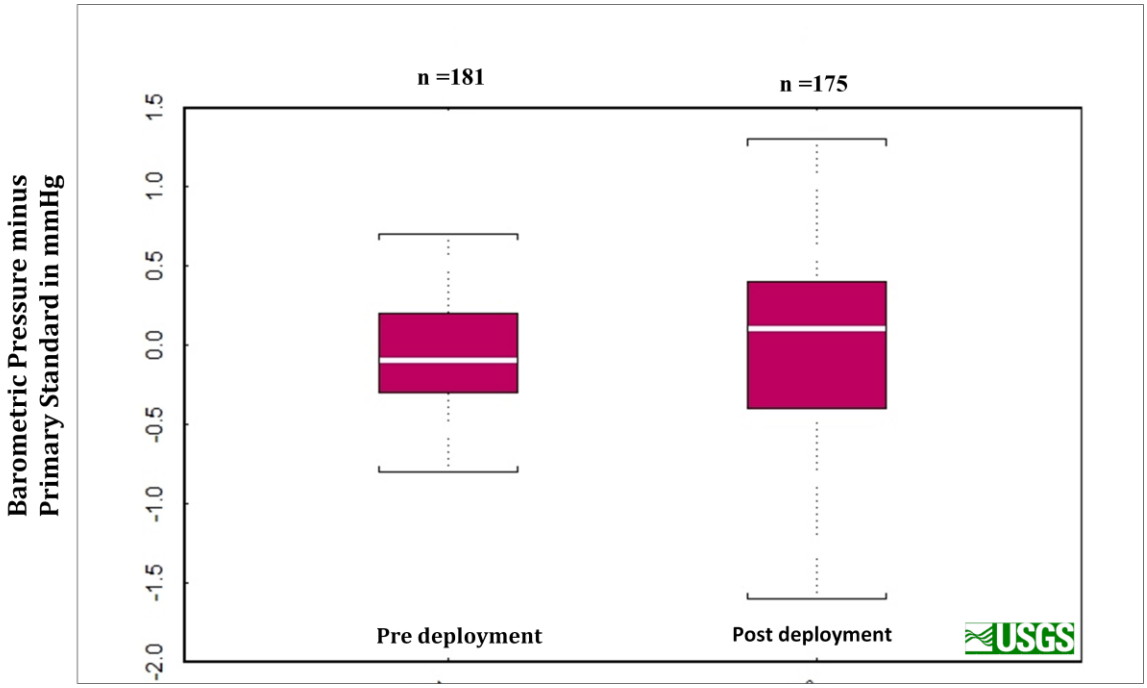


Figure I-3. Summary box plots of the pre-and post-deployment check of the barometric pressure versus the primary standard during the 2012 monitoring season.

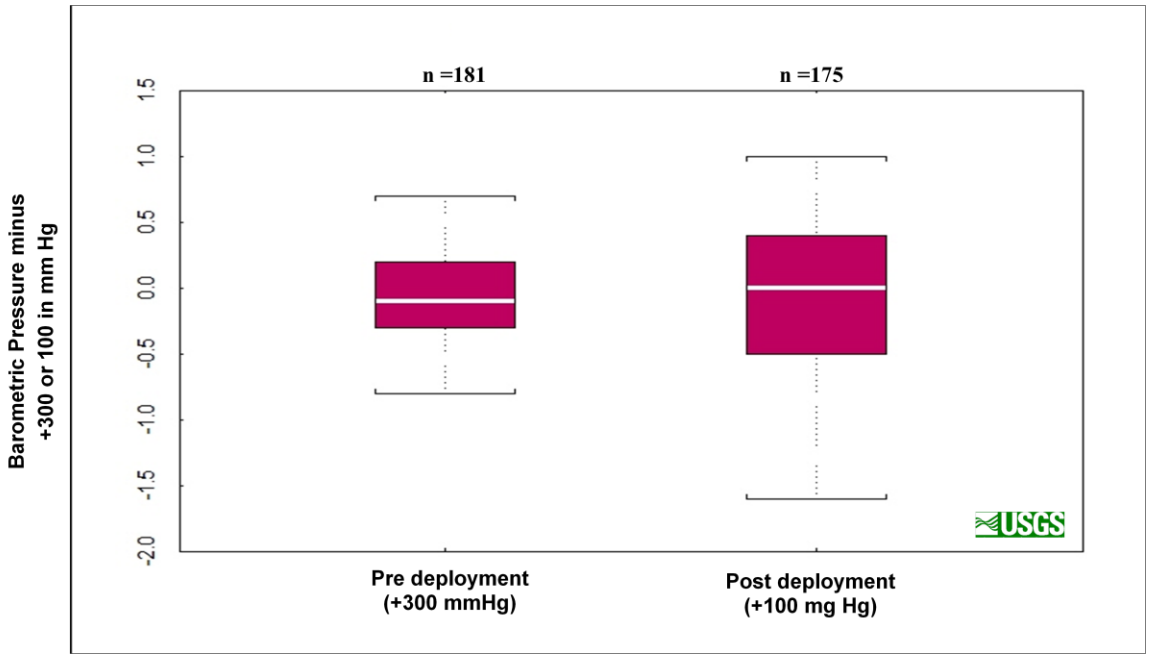


Figure I-4. Summary box plots of the pre-and post-deployment check of the Hydrolab® TDG sensors with the addition of 100 and 300 mmHg during the 2012 monitoring season.

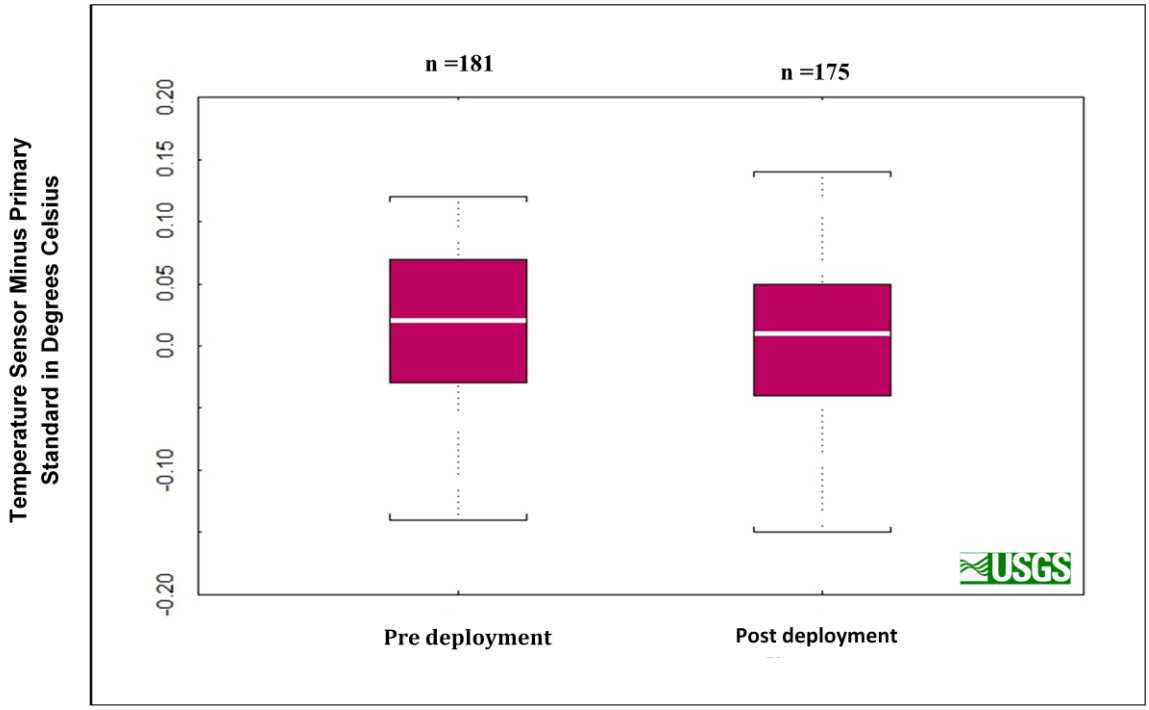


Figure I-5. Summary box plots of the pre- and post-deployment check of the Hydrolab® temperature sensors during the 2012 monitoring season.

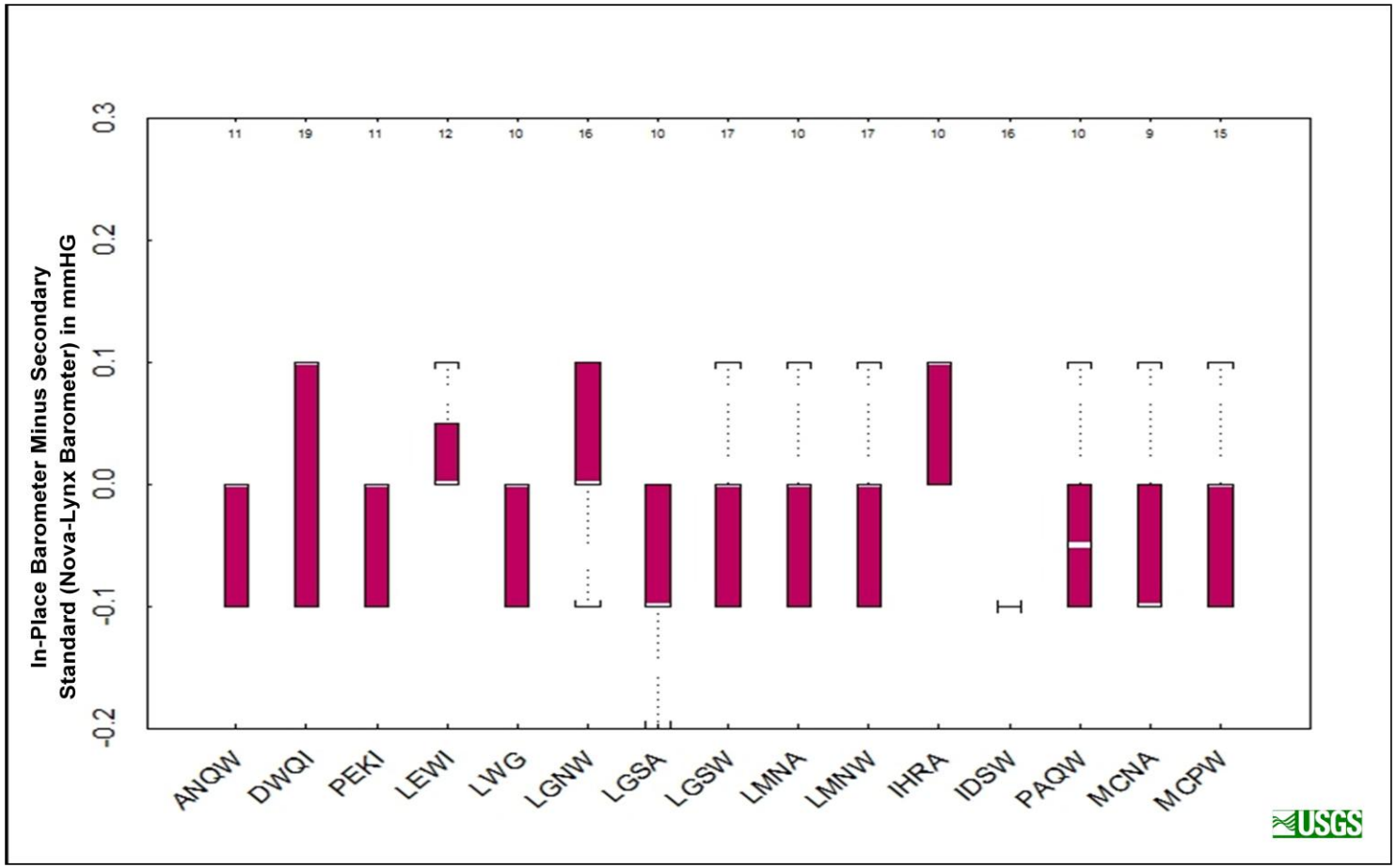


Figure I-6. Box plots of the field barometric pressure sensors check in mm Hg by site during the 2012 monitoring season.

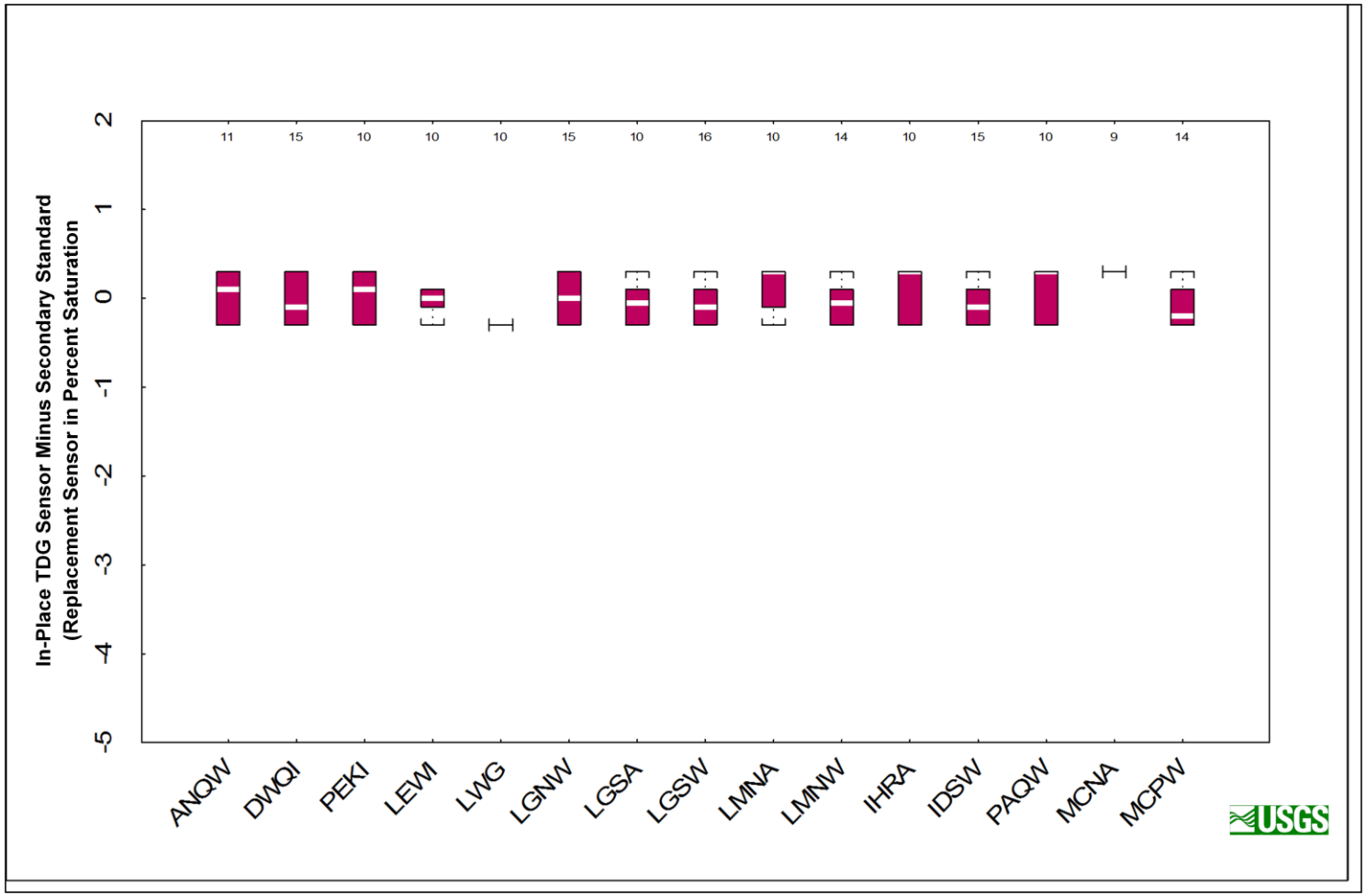


Figure I-7. Box plots of the field total dissolved gas sensor check verses secondary standard in percent saturation by site during the 2012 monitoring season.

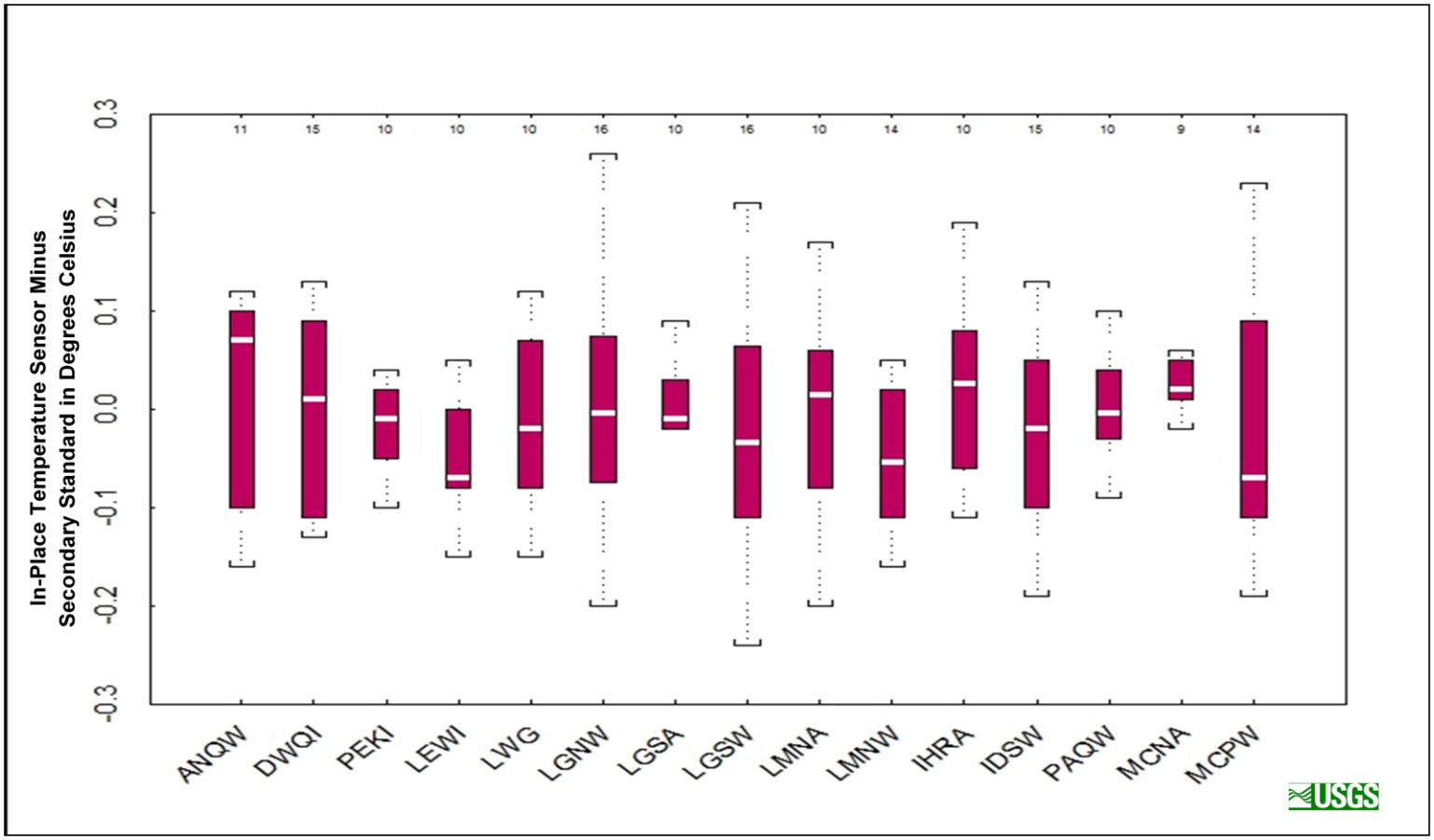


Figure I-8. Box plots of the field temperature sensors check verses secondary standard in degrees Celcius by site during the 2012 monitoring season.

Figure I-9. United States Geological Survey personnel from the Kennewick Field Office setting new anchors for the Dworshak FMS Station (DWQI), 20 September 2012.

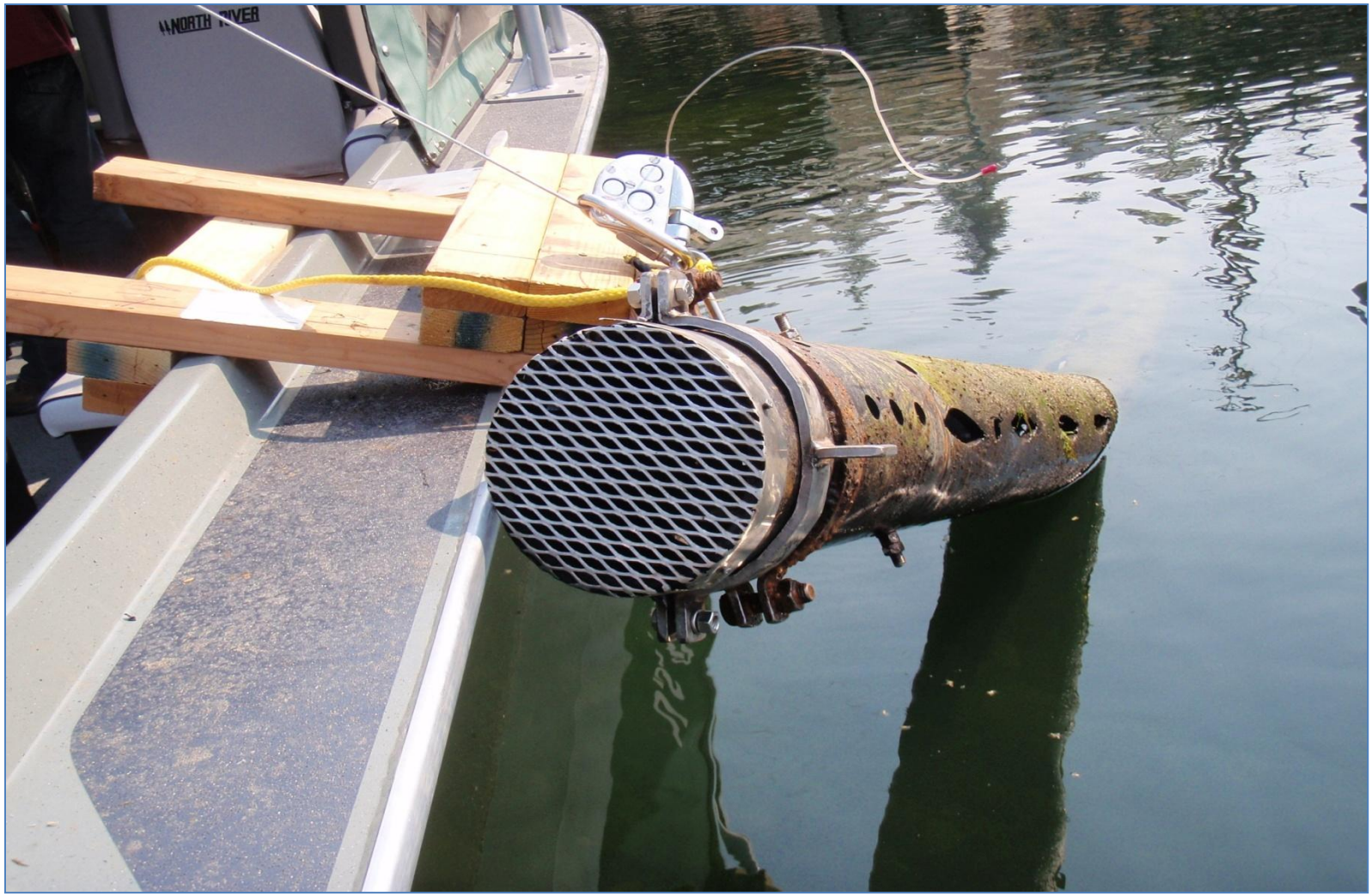


Figure I-10. Installed stainless steel screen at the end of the DWQI deployment pipe intended to prevent further access by muskrats.

TABLES

Table I-1. CENWW FMS station identification and location information.

Station Number	Station Name	Station ID	Latitude (NAD 83)	Longitude (NAD 83)	Elevation (NGVD 29)	River Mile	DCP ID	XMIT Time
12514400	Columbia River at Pasco, WA	PAQW	46 13 26.2851 N	119 06 57.3388 W	345	329.1	17D6E32C	0:27:10
13334300	Snake River Near Anatone, WA	ANQW	46 05 50.7579 N	116 58 41.2382 W	807	167.5	17D63544	0:16:10
13341000	N.F. Clearwater River at Dworshak Hatchery, ID	DWQI	46 30 11.6464 N	116 19 16.4090 W	1,150	0.5	17D600DE	0:13:10
13341050	Clearwater River Near Peck, ID	PEKI	46 30 00.9396 N	116 23 32.4163 W	930	37.4	17D613A8	0:14:10
13343000	Clearwater River Near Lewiston, ID	LEWI	46 25 52.0867 N	116 56 43.9589 W	750	5.0	17D62632	0:15:10
13343590	Lower Granite Dam Forebay, WA	LWG	46 39 34.1727 N	117 25 34.8564 W	738	107.5	17D643D4	0:17:10
13343595	Lower Granite Dam Tailwater, WA	LGNW	46 39 58.0726 N	117 26 19.2595 W	645	106.7	17D650A2	0:18:10
13343855	Little Goose Dam Forebay, WA	LGSA	46 34 58.3188 N	118 01 32.9831 W	638	70.3	17D66538	0:19:10
13343860	Little Goose Dam Tailwater, WA	LGSW	46 35 00.5280 N	118 02 37.4186 W	560	69.6	17D6764E	0:20:10
13352595	Lower Monumental Dam Forebay, WA	LMNA	46 33 44.6559 N	118 32 08.3477 W	540	41.6	17D686CA	0:21:10
13352600	Lower Monumental Dam Tailwater, WA	LMNW	46 33 04.5051 N	118 32 58.9500 W	445	40.4	17D695BC	0:22:10
13352950	Ice Harbor Dam Forebay, WA	IHRA	46 15 05.2792 N	118 52 43.0096 W	440	10.0	17D6A026	0:23:10
13353010	Ice Harbor Dam Tailwater, WA	IDSW	46 14 27.5868 N	118 57 13.7130 W	340	6.1	17D6B350	0:24:10
14019220	McNary Dam Forebay, WA	MCNA	45 56 28.9200 N	119 17 35.4400 W	340	292.0	17D6D6B6	0:26:10
14019240	McNary Dam Tailwater, WA	MCPW	45 56 02.7775 N	119 19 35.4628 W	240	290.7	17D5F754	0:12:10

Table I-2. Summary of the laboratory results evaluating the overall differences between laboratory standards and the sensors pre- and post-deployment during the 2012 water year.

Deployment	Statistic	Δ (BP) (mm Hg)	Δ [(BP+300)-PT] (%)	Δ [(BP+100)-PT] (%)	Δ T (°C)
Pre	Number	181	181	----	181
	Minimum	-0.8	-0.1	----	-0.14
	25 percentile	-0.3	0.0	----	-0.03
	Median	-0.1	0.0	----	0.02
	75 percentile	0.2	0.0	----	0.07
	Maximum	0.7	0.1	----	0.12
	Mean	-0.1	0.0	----	0.01
Post	Number	175	----	175	175
	Minimum	-1.6	----	-0.2	-0.15
	25 percentile	-0.4	----	-0.1	-0.04
	Median	0.1	----	-0.0	0.01
	75 percentile	0.4	----	0.1	0.05
	Maximum	1.3	----	0.1	0.14
	Mean	0.0	----	0.0	0.00

Table I-3. Pre-deployment quality assurance data for the individual sensors utilized at the FMS stations during the 2012 water year.

	Δ (PT – BP)			Δ [(BP+300) – PT]			Δ (Water Temperature)		
Sensor ID	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (^{o}C)**	**Median (^{o}C)**
26	5	-0.4 to 0.5	0.00	5	-0.4 to 0.5	0.00	5	-0.03 to 0.03	0.01
27	7	-0.4 to 0.3	-0.04	7	-0.4 to 0.3	-0.04	7	-0.04 to -0.05	-0.01
29	4	-0.4 to 0.5	-0.05	4	-0.4 to 0.5	-0.05	4	-0.06 to -0.04	-0.06
30	5	-0.6 to 0.0	-0.36	5	-0.5 to 0.0	-0.36	5	-0.11 to -0.08	-0.09
32	8	-0.5 to 0.5	0.03	8	-0.5 to 0.5	0.03	8	-0.06 to -0.01	-0.04
33	7	-0.7 to 0.6	-0.10	7	-0.7 to 0.6	-0.10	7	-0.11 to -0.02	-0.07
34	7	-0.8 to 0.4	-0.06	7	-0.8 to 0.4	-0.06	7	-0.11 to -0.04	-0.08
35	6	-0.2 to 0.5	0.20	6	-0.2 to 0.5	0.20	6	-0.01 to 0.09	0.05
36	7	-0.5 to 0.5	-0.01	7	-0.5 to 0.5	0.01	7	0.02 to 0.09	0.05
37	6	-0.2 to 0.6	0.27	6	0.2 to 0.6	0.27	6	0.00 to 0.05	0.02
39	8	-0.3 to 0.4	0.10	8	-0.3 to 0.4	0.10	8	-0.01 to 0.04	0.01
40	9	-0.7 to 0.7	0.14	9	-0.7 to 0.7	0.14	9	-0.14 to -0.04	-0.08
41	7	-0.8 to 0.3	-0.21	7	-0.7 to 0.3	-0.07	7	-0.02 to 0.04	0.00
42	3	-0.5 to 0.1	-0.27	3	-0.5 to 0.1	-0.27	3	0.03 to 0.04	0.04
43	3	-0.6 to -0.4	-0.47	3	-0.6 to -0.4	-0.47	3	0.01 to 0.04	0.03
44	3	-0.7 to -0.3	-0.50	3	-0.7 to -0.3	-0.50	3	0.08 to 0.11	0.09
45	3	-0.7 to 0.2	-0.37	3	-0.7 to 0.2	-0.37	3	0.07 to 0.08	0.07
46	3	-0.3 to -0.2	-0.23	3	-0.3 to -0.2	-0.23	3	0.08 to 0.10	0.09
47	3	-0.2 to 0.0	-0.13	3	-0.2 to 0.0	-0.13	3	0.08 to 0.09	0.09
48	2	-0.1 to -0.1	-0.10	2	-0.1 to -0.1	-0.10	2	0.06 to 0.09	0.07
49	3	-0.5 to -0.2	-0.27	3	-0.5 to 0.2	-0.27	3	0.07 to 0.09	0.08
51	2	-0.5 to -0.4	-0.45	2	-0.5 to -0.4	-0.45	2	0.08 to 0.09	0.08
52	5	-0.7 to 0.0	-0.48	5	-0.7 to 0.0	-0.48	5	0.08 to 0.11	0.10
53	3	-0.5 to 0.0	-0.27	3	-0.5 to -0.0	-0.27	3	0.03 to 0.05	0.04
54	3	-0.7 to 0.3	-0.23	3	-0.7 to 0.3	-0.23	3	0.06 to 0.07	0.07
55	4	-0.4 to 0.30	-0.10	4	-0.4 to 0.30	-0.10	4	0.05 to 0.07	0.06
56	4	-0.3 to 0.2	-0.12	4	-0.3 to 0.2	-0.12	4	0.06 to 0.07	0.06
57	4	-0.5 to 0.3	-0.08	4	-0.5 to 0.3	-0.08	4	0.09 to 0.10	0.10
58	3	-0.1 to 0.2	0.00	3	-0.1 to 0.2	0.00	3	0.04 to 0.08	0.06
USGS 1	7	-0.2 to 0.5	-0.19	7	-0.2 to 0.5	-0.19	7	0.01 to 0.07	0.04
USGS 2	7	-0.6 to 0.5	-0.06	7	-0.6 to 0.5	-0.06	7	-0.05 to -0.02	-0.03
USGS 3	7	-0.4 to 0.1	-0.09	7	-0.4 to 0.1	-0.09	7	0.01 to 0.04	0.03
USGS 4	8	-0.5 to 0.4	-0.09	8	-0.5 to 0.4	-0.09	8	0.07 to 0.12	0.10
USGS 5	3	-0.3 to 0.5	0.17	3	-0.3 to 0.5	0.17	3	-0.03 to 0.07	0.03
USGS 6	3	-0.8 to 0.3	--0.20	3	-0.8 to 0.3	-0.20	3	-0.03 to -0.02	-0.02
USGS 7	2	-0.3 to -0.1	-0.20	2	-0.3 to -0.1	-0.20	2	-0.02 to -0.02	-0.02
USGS 8	2	-0.8 to 0.1	-0.35	2	-0.8 to 0.1	-0.35	2	0.01 to 0.04	0.02
USGS 9	3	-0.4 to 0.2	-0.07	3	-0.4 to 0.2	-0.07	3	-0.05 to -0.02	-0.03

Table I-4. Post-deployment quality assurance data for the individual sensors utilized at the FMS stations during the 2012 water year.

	Δ (BP – PT)			Δ [(BP+100) – PT]			Δ (Water Temperature)		
Sensor ID	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (mm Hg)**	**Median (mm Hg)**	**# Obs**	**Range (°C)**	**Median (°C)**
26	5	-0.3 to 0.9	0.38	5	-0.5 to 0.5	-0.02	5	-0.03 to 0.02	-0.01
27	7	-0.4 to 0.6	0.27	7	-0.8 to 0.6	0.13	7	-0.07 to -0.04	-0.06
29	3	-0.4 to 0.6	-0.03	3	-0.4 to 0.6	-0.03	3	-0.07 to -0.05	-0.06
30	5	-0.5 to 0.4	0.08	5	-0.6 to 0.4	-0.12	5	-0.13 to -0.08	-0.10
32	7	-0.4 to 0.2	-0.03	7	-0.4 to 0.2	-0.03	7	-0.09 to -0.03	-0.06
33	7	-0.2 to 0.5	0.19	7	-0.2 to 0.5	0.19	7	-0.12 to -0.02	-0.07
34	7	-0.6 to 0.6	0.04	7	-0.6 to 0.6	0.04	7	-0.11 to -0.08	-0.09
35	6	-0.0 to 0.6	0.33	6	-0.5 to 0.6	0.17	6	0.03 to 0.08	0.06
36	7	-0.7 to 0.9	-0.03	7	-0.7 to 0.2	-0.26	7	0.00 to 0.07	0.03
37	6	-0.4 to 0.4	-0.02	6	-0.4 to 0.4	-0.02	6	0.00 to 0.06	0.02
39	8	0.0 to 0.7	0.40	8	0.0 to 0.7	0.40	8	-0.01 to 0.04	0.00
40	9	-0.5 to 0.7	0.12	9	-0.8 to 0.7	0.01	9	-0.15 to -0.02	-0.07
41	7	-0.6 to 0.5	-0.01	7	-0.6 to 0.5	-0.01	7	-0.03 to 0.01	-0.01
42	3	-1.5 to -0.7	-1.13	3	-1.2 to -0.5	-0.80	3	0.01 to 0.03	0.02
43	3	-1.5 to -0.8	-1.07	3	-1.5 to -0.8	-1.07	3	0.01 to 0.03	0.02
44	3	-1.0 to -0.5	-0.70	3	-1.0 to -0.5	-0.70	3	0.08 to 0.09	0.08
45	2	-0.5 to -0.2	-0.35	2	-0.5 to -0.2	-0.40	2	0.00 to 0.07	0.05
46	3	-0.4 to -0.2	-0.33	3	-0.4 to -0.2	-0.30	3	0.08 to 0.09	0.08
47	3	-0.7 to 0.1	-0.20	3	-0.74 to 0.1	-0.20	3	0.09 to 0.10	0.09
48	2	-0.4 to 0.1	-0.15	2	-0.9 to -0.4	-0.65	2	0.07 to 0.08	0.08
49	3	-0.5 to -0.1	-0.27	3	-1.1 to -0.2	-0.60	3	0.07 to 0.09	0.08
51	2	-0.3 to 0.1	-0.10	2	-0.3 to 0.1	-0.10	2	0.03 to 0.07	0.05
52	3	-1.3 to -0.7	-1.00	3	-1.3 to -0.7	-1.00	3	0.08 to 0.10	0.09
53	3	-0.3 to 0.4	0.03	3	-0.3 to 0.4	0.03	3	0.05 to 0.05	0.05
54	3	-1.0 to 0.1	-0.37	3	-1.0 to 0.1	-0.37	3	0.05 to 0.06	0.05
55	3	-1.6 to 0.0	-0.73	3	-1.6 to 0.0	-0.73	3	0.05 to 0.06	0.05
56	3	-1.0 to 0.9	0.10	3	-1.0 to 0.4	-0.23	3	0.06 to 0.07	0.06
57	3	-0.2 to 0.4	0.13	3	-0.6 to 0.2	-0.20	3	0.09 to 0.09	0.09
58	2	-0.8 to 0.4	-0.20	2	-0.8 to 0.4	-0.20	2	0.04 to 0.05	0.04
USGS 1	7	-0.1 to 0.8	0.36	7	-0.1 to 0.8	0.36	7	-0.01 to 0.05	0.02
USGS 2	8	-0.5 to 0.7	0.13	8	-0.6 to 0.7	0.00	8	-0.08 to -0.03	-0.05
USGS 3	7	-0.5 to 0.5	0.11	7	-0.5 to 0.5	0.11	7	0.01 to 0.05	0.03
USGS 4	8	-0.6 to 1.3	0.56	8	-0.6 to 1.0	0.31	8	0.09 to 0.14	0.12
USGS 5	7	0.1 to 1.2	0.70	7	0.0 to 0.6	0.27	7	-0.01 to 0.04	0.02
USGS 6	3	-1.1 to 0.1	-0.43	3	-1.1 to -0.3	-0.77	3	-0.07 to -0.04	-0.06
USGS 7	2	-1.6 to -0.2	-0.90	2	-1.6 to -1.2	-1.40	2	-0.03 to -0.01	-0.02
USGS 8	2	-0.7 to -0.5	-0.60	2	-0.7 to -0.5	-0.60	2	-0.01 to 0.02	0.01
USGS 9	3	-0.6 to -0.4	-0.50	3	-0.6 to -0.4	-0.50	3	-0.04 to -0.03	-0.03

Table I-5. Summary of the field results for the differences between the in-place and replacement sensors during 2012 water year.

Statistic	Δ BP[1] (mm Hg)	ΔTDG[2] (% sat)	Δ T[2] (^{o}C)
Number	183	168	168
Minimum	-0.20	-0.3	-0.24
Maximum	0.10	0.3	0.26
Mean	-0.01	0.0	-0.01
Median	0.00	0.0	-0.01

Footnotes:

[1] Field – laboratory sensor

[2] Replacement – In-place sensor

Table I-6. Summary of the field results for the differences between the in-place and replacement sensors by station during 2012 water year.

Station ID	Δ Barometric Air Pressure			Δ Total Dissolved Gas					Δ Water Temperature		
	# Obs	Range (mm Hg)	Median (mm Hg)	# Obs	Range (mm Hg)	Median (mm Hg)	Range (% Sat)	Median (% Sat)	# Obs	Range (^{o}C)	Median (^{o}C)
MCPW	15	-0.1 to 0.1	0.00	14	-2 to 2	-1.5	-0.3 to 0.3	-0.2	14	-0.19 to 0.23	-0.07
MCNA	8	-0.1 to 0.1	-0.10	8	-2 to 2	2.0	-0.3 to 0.3	0.3	8	-0.02 to 0.06	0.02
PAQW	9	-0.1 to 0.1	0.05	9	-2 to 2	2.0	-0.3 to 0.3	0.3	9	-0.09 to 0.10	0.00
IDSW	16	-0.1 to 0.1	-0.10	15	-2 to 2	-1.0	-0.3 to 0.3	-0.1	15	-0.19 to 0.13	-0.02
IHRA	9	0.0 to 0.1	0.10	9	-2 to 2	2.0	-0.3 to 0.3	0.3	9	-0.11 to 0.19	0.03
LMNW	17	-0.1 to 0.1	0.00	14	-2 to 2	-0.5	-0.3 to 0.3	0.1	14	-0.16 to 0.05	-0.06
LMNA	9	-0.1 to 0.1	0.00	9	-2 to 2	2.0	-0.3 to 0.3	0.3	9	-0.20 to 0.17	0.03
LGSW	17	-0.1 to 0.1	0.00	16	-2 to 2	-1.0	-0.3 to 0.3	-0.1	16	-0.24 to 0.21	-0.04
LGSA	9	-0.2 to 0.0	-0.10	9	-2 to 2	-0.0	-0.3 to 0.3	0.0	9	-0.16 to 0.19	-0.01
LGNW	16	-0.1 to 0.1	0.00	15	-2 to 2	0.0	-0.3 to 0.3	0.0	15	-0.20 to 0.26	-0.01
LWG	9	-0.1 to 0.2	0.00	9	-2 to 2	-2.0	-0.3 to 0.3	-0.3	9	-0.15 to 0.12	-0.02
ANQW	10	-0.1 to 0.0	0.00	10	-2 to 2	1.0	-0.3 to 0.3	0.1	10	-0.16 to 0.10	0.04
LEWI	10	-0.1 to 0.1	0.00	7	-2 to 1	0.0	-0.3 to 0.1	0.0	7	-0.15 to 0.05	-0.07
PEKI	10	-0.1 to 0.0	0.00	9	-2 to 2	1.0	-0.3 to 0.3	0.1	9	-0.18 to 0.19	-0.03
DWQI	19	-0.1 to 0.1	0.10	15	-2 to 2	-1.0	-0.3 to 0.3	-0.1	15	-0.13 to 0.13	0.01

Table I-7. Database completeness with the number and percent of all missing or invalid barometric pressure, total dissolved gas, and temperature points for each FMS station during the 2012 water year as reported by the provisional real-time DCP system

		Barometric Pressure		Total Dissolved Gas		Temperature	
Station ID	**Monitoring Period**	**Number Missing/ Anomalous**	**Percent Complete**	**Number Missing/ Anomalous**	**Percent Complete**	**Number Missing/ Anomalous**	**Percent Complete**
MCPW	1 Oct – 30 Sep	**51**	**99.4**	**57**	**99.3**	**60**	**99.3**
MCNA	1 Apr – 31 Aug	0	100.0	0	100.0	0	100.0
PAQW	1 Apr – 31 Aug	0	100.0	**97**	**97.4**	0	100.0
IDSW	1 Oct – 30 Sep	0	100.0	**1**	**100.0***	0	100.0
IHRA	1 Apr – 31 Aug	0	100.0	0	100.0	**0**	100.0
LMNW	1 Oct – 30 Sep	**31**	**99.6**	**66**	**99.2**	**31**	**99.6**
LMNA	1 Apr – 31 Aug	0	100.0	0	100.0	0	100.0
LGSW	1 Oct – 30 Sep	**38**	**99.6**	**182**	**97.9**	**38**	**99.6**
LGSA	1 Apr – 31 Aug	0	100.0	0	100.0	0	100.0
LGNW	1 Oct – 30 Sep	**45**	**99.5**	**55**	**99.4**	**58**	**99.3**
LWG	1 Apr – 31 Aug	**1**	**100.0***	**1**	**100.0***	**1**	**100.0***
ANQW	1 Apr – 31 Aug	0	100.0	0	100.0	0	100.0
LEWI	1 Apr – 31 Aug	0	100.0	**96**	**97.4**	0	100.0
PEKI	1 Apr – 31 Aug	0	100.0	**369**	**90.0**	0	100.0
DWQI	1 Oct – 30 Sep	**`160**	**98.2**	**178**	**98.0**	**173**	**98.0**

Notes:

* Denotes value that was rounded up to 100 percent

Bold font highlight cases where there were one or more anomalous/missing values

Table I-8. Database completeness with the number and percent of all missing or invalid barometric pressure, total dissolved gas, and temperature points for each FMS station during the 2012 water year based on the final data set.

		Barometric Pressure		Total Dissolved Gas		Temperature	
Station ID	Monitoring Period	Number Missing/ Anomalous	Percent Complete	Number Missing/ Anomalous	Percent Complete	Number Missing/ Anomalous	Percent Complete
MCPW	1 Oct – 30 Sep	**51**	**99.4**	**57**	**99.3**	**57**	**99.3**
MCNA	1 Apr – 31 Aug		100.0		100.0		100.0
PAQW	1 Apr – 31 Aug		100.0	**92**	**97.5**		100.0
IDSW	1 Oct – 30 Sep		100.0		100.0		100.0
IHRA	1 Apr – 31 Aug		100.0		100.0		100.0
LMNW	1 Oct – 30 Sep	**31**	**99.6**	**66**	**99.2**	**31**	**99.6**
LMNA	1 Apr – 31 Aug		100.0		100.0		100.0
LGSW	1 Oct – 30 Sep	**38**	**99.6**	**179**	**98.0**	**38**	**99.6**
LGSA	1 Apr – 31 Aug		100.0		100.0		100.0
LGNW	1 Oct – 30 Sep	**45**	**99.5**	**55**	**99.4**	**58**	**99.3**
LWG	1 Apr – 31 Aug		100.0		100.0		100.0
ANQW	1 Apr – 31 Aug		100.0		100.0		100.0
LEWI	1 Apr – 31 Aug		100.0	**97**	**97.4**		100.0
PEKI	1 Apr – 31 Aug		100.0	**369**	**90.0**		100.0
DWQI	1 Oct – 30 Sep	**91**	**99.0**	**104**	**98.8**	**104**	**98.8**

Note:

Bold font highlight cases where there were one or more anomalous/missing values

Table I-9. Summary of the total hours of barometric pressure, total dissolved gas, and temperature data that were missing or considered invalid in the 2012 water-year provisional real-time DCP data set.

	BP		TDG		BP+TDG			Temperature		All	
Reason	**hours**	**%**	**hours**	**%**	**hours**	**% of hours**	**% of bad data**	**hours**	**%**	**hours**	**%**
Pressure Low	0		613	0.72	613	0.72	42.87	0		613	0.72
Missed transmit	0		0		0			0		0	
Missing data	78	0.09	84	0.10	162	0.19	11.33	84	0.10	246	0.29
Spike	85	0.10	110	0.13	195	0.23	13.64	98	0.11	293	0.34
Inspection	1		18	0.02	18	0.02	1.26	1	0.00	19	0.02
Defective membrane	0		105	0.12	105	0.12	7.34	0		105	0.12
Defective sonde	0		0		0			0		0	
DCP failure	120	0.14	120	0.14	240	0.28	16.78	120	0.14	360	0.42
Cable failure	42	0.05	55	0.06	97	0.11	6.78	55	0.06	152	0.18
Totals	**325**	**0.38**	**1,104**	**1.29**	**1,429**	**1.67**	**100.00**	**358**	**0.42**	**1,787**	**2.09**

Table I-10. Summary of the total hours of barometric pressure, total dissolved gas, and temperature data that were missing or considered invalid in the 2012 water-year final data set.

	BP		TDG		BP+TDG			Temperature		All	
Reason	hours	percent	hours	percent	hours	Percent of hours	Percent of bad data	hours	percent	hours	percent
Pressure Low	0		614	0.72	614	0.72	48.16	0		614	0.72
Missed transmit	0		0		0			0		0	
Missing data	78	0.09	84	0.10	162	0.19	12.71	84	0.10	246	0.29
Spike	85	0.10	110	0.13	195	0.23	15.29	98	0.11	293	0.34
Inspection	0		0		0			0		0	
Defective membrane	0		105	0.12	105	0.12	8.24	0		105	0.12
Defective sonde	0		0		0			0		0	
DCP failure	51	0.06	51	0.06	102	0.12	8.00	51	0.06	153	0.18
Cable failure	42	0.05	55	0.06	97	0.11	7.61	55	0.06	152	0.18
Totals	**256**	**0.30**	**1,018**	**1.19**	**1,274**	**1.49**	**100.00**	**288**	**0.34**	**1,562**	**1.82**

Table I-11. Number and percent of all missing or invalid barometric pressure data for each FMS station during the 2012 water year based on the provisional real-time DCP data set, along with the reasons for those designations.

Station ID	Pressure Too Low		Missed Transmit		Missing DCP Data		Spike		Inspection		Defective Membrane		Defective Sonde		DCP Failure		Cable Failure	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51	0.58	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	31	0.35	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	38	0.43	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	29	0.33	16	0.18	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	11	0.13	38	0.43	-	-	-	-	-	-	69	0.79	42	0.48

Table I-12. Number and percent of all missing or invalid barometric pressure data for each FMS station during the 2012 water year based on the final data set, along with the reasons for those designations.

Station ID	Pressure Too Low		Missed Transmit		Missing DCP Data		Spike		Inspection		Defective Membrane		Defective Sonde		DCP Failure		Cable Failure	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51	0.58	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	31	0.35	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	38	0.43	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	29	0.33	16	0.18	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	11	0.13	38	0.43	-	-	-	-	-	-	-	-	42	0.48

Table I-13. Number and percent of all missing or invalid total dissolved gas data for each FMS station during the 2012 water year based on the provisional real-time DCP data set, along with the reasons for those designations.

Station ID	Pressure Too Low		Missed Transmit		Missing DCP Data		Spike		Inspection		Defective Membrane		Defective Sonde		DCP Failure		Cable Failure	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	6	0.07	-	-	3	0.03	-	-	-	-	51	0.58	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	92	2.50	-	-	-	-	-	-	5	0.14	-	-	-	-	-	-	-	-
IDSW	-	-	-	-	-	-	-	-	1	0.01	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	31	0.35	-	-	35	0.40	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	141	1.61	-	-	38	0.43	-	-	3	0.03	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	29	0.33	26	0.30	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	83	2.26	-	-	-	-	-	-	-	-	13	0.35	-	-	-	-	-	-
PEKI	297	8.08	-	-	-	-	15	0.41	-	-	57	1.55	-	-	-	-	-	-
DWQI	-	-	-	-	11	0.13	38	0.43	5	0.06	-	-	-	-	69	0.79	55	0.63

Table I-14. Number and percent of all missing or invalid total dissolved gas data for each FMS station during the 2012 water year based on the final data set, along with the reasons for those designations.

Station ID	Pressure Too Low		Missed Transmit		Missing DCP Data		Spike		Inspection		Defective Membrane		Defective Sonde		DCP Failure		Cable Failure	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	6	0.07	-	-	-	-	-	-	-	-	51	0.58	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	92	2.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	31	0.35	-	-	35	0.40	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	141	1.61	-	-	38	0.43	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	29	0.33	26	0.30	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	84	2.29	-	-	-	-	-	-	-	-	13	0.35	-	-	-	-	-	-
PEKI	297	8.08	-	-	-	-	15	0.41	-	-	57	1.55	-	-	-	-	-	-
DWQI	-	-	-	-	11	0.13	38	0.43-	-	-	-	-	-	-	-	-	-	-

Table I-15. Number and percent of all missing or invalid temperature data for each FMS station during the 2012 water year based on the provisional real-time DCP data, along with the reasons for those designations.

Station ID	Pressure Too Low		Missed Transmit		Missing DCP Data		Spike		Inspection		Defective Membrane		Defective Sonde		DCP Failure		Cable Failure	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	6	0.07	-	-	-	-	-	-	-	-	51	0.58	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	31	0.35	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	38	0.43	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	29	0.33	29	0.33	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	11	0.13	38	0.43	-	-	-	-	-	-	69	0.79	55	0.63

Table I-16. Number and percent of all missing or invalid temperature data for each FMS station during the 2012 water year based on the final data set, along with the reasons for those designations.

Station ID	Pressure Too Low		Missed Transmit		Missing DCP Data		Spike		Inspection		Defective Membrane		Defective Sonde		DCP Failure		Cable Failure	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MCPW	-	-	-	-	6	0.07	-	-	-	-	-	-	-	-	51	0.58	-	-
MCNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDSW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IHRA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMNW	-	-	-	-	-	-	31	0.35	-	-	-	-	-	-	-	-	-	-
LMNA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGSW	-	-	-	-	38	0.43	-	-	-	-	-	-	-	-	-	-	-	-
LGSA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LGNW	-	-	-	-	29	0.33	29	0.33	-	-	-	-	-	-	-	-	-	-
LWG	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-
ANQW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PEKI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DWQI	-	-	-	-	11	0.13	38	0.43	-	-	-	-	-	-	-	-	55	0.63