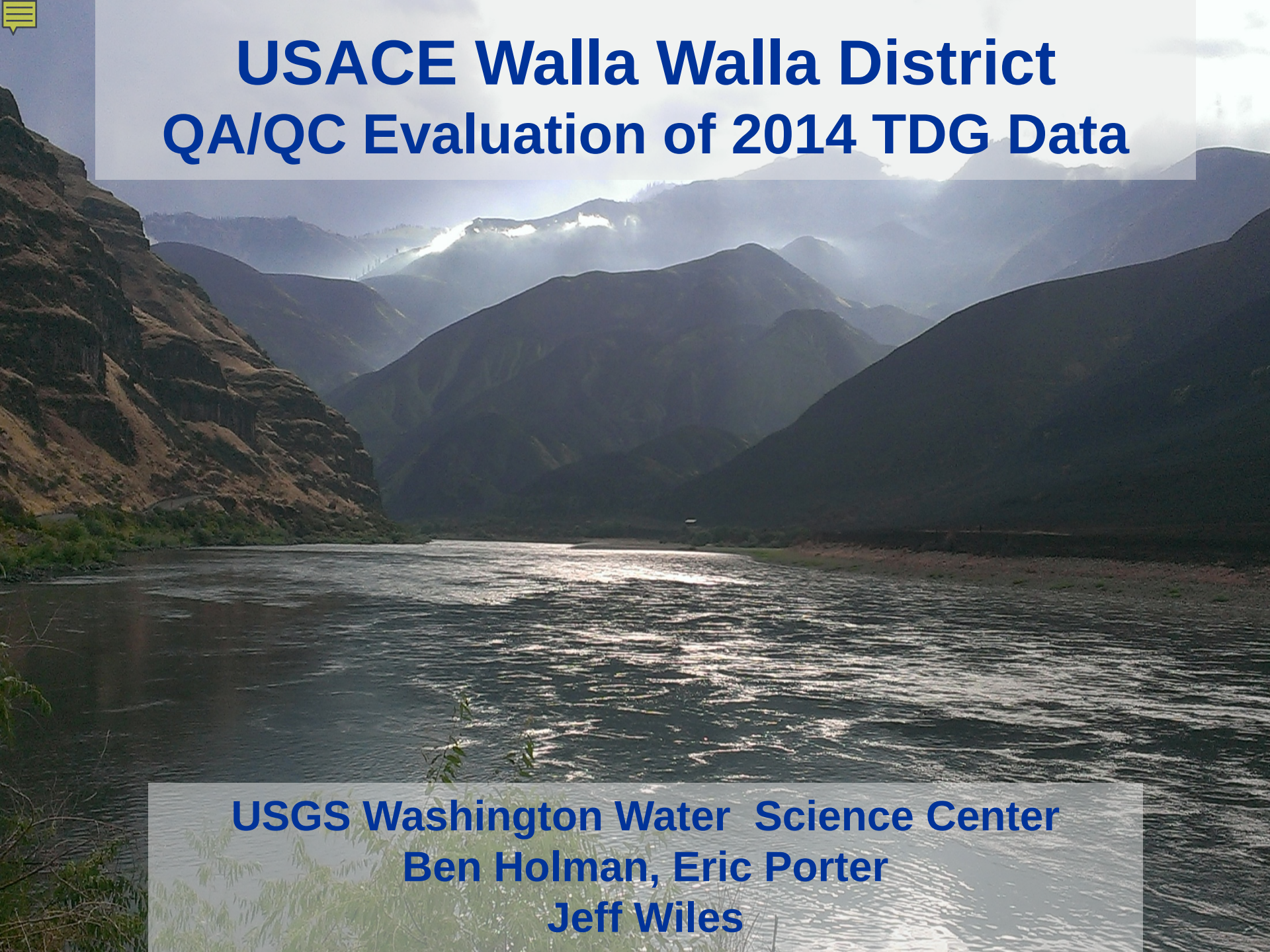
USACE Walla Walla District
QA/QC Evaluation of 2014 TDG Data

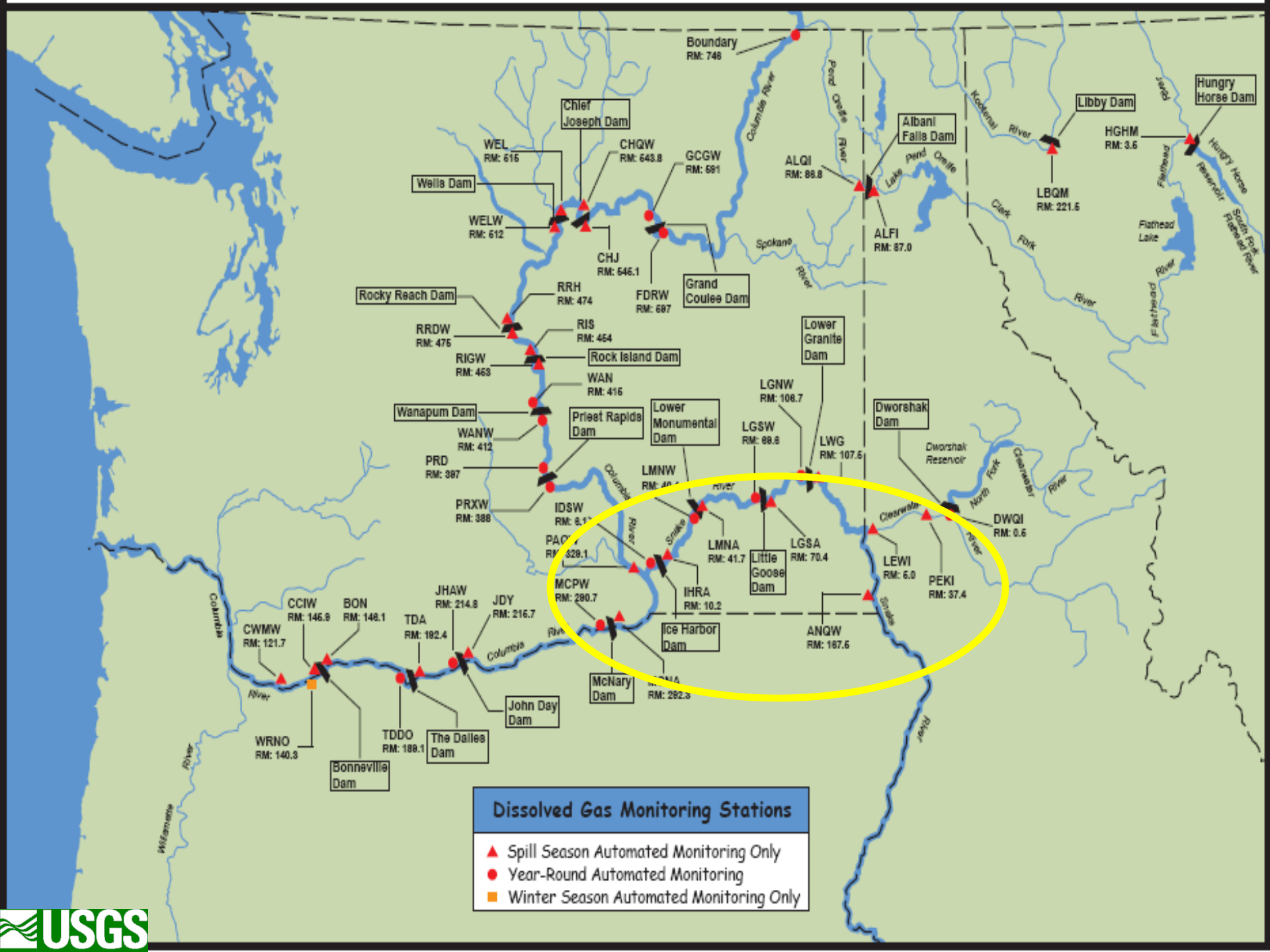


USGS Washington Water Science Center
Ben Holman, Eric Porter
Jeff Wiles

Presentation Outline

- Project location
- Instrumentation
- Data completeness
- Station locations and percent saturation graphs
- QA/QC
  - Pre and post deployment comparisons to primary standards
  - Sensor comparisons to secondary standards
- Summary

USGS


Boundary
RM: 748
Chief Joseph Dam
WEL
RM: 615
CHQW
RM: 643.8
GCGW
RM: 581
Wells Dam
WELW
RM: 612
CHJ
RM: 546.1
FDRW
RM: 687
Grand Coulee Dam
Rocky Reach Dam
RRH
RM: 474
RRDW
RM: 475
RIS
RM: 454
Rock Island Dam
RIGW
RM: 463
WAN
RM: 416
Wanapum Dam
WANW
RM: 412
Priest Rapids Dam
PRD
RM: 387
PRXW
RM: 388
IDSW
PAOW
RM: 328.1
MCPW
RM: 280.7
Lower Monumental Dam
LMNW
LMNA
RM: 41.7
Little Goose Dam
IHRA
RM: 10.2
Ice Harbor Dam
McNary Dam
LGNW
RM: 108.7
LGSW
RM: 88.8
LGSA
RM: 70.4
Lower Granite Dam
LWG
RM: 107.6
LEWI
RM: 6.0
ANQW
RM: 187.6
Dworshak Dam
DWQI
RM: 0.6
PEKI
RM: 37.4
Albeni Falls Dam
ALQI
RM: 88.8
ALFI
RM: 87.0
Libby Dam
LBQM
RM: 221.5
HGHM
RM: 3.6
Hungry Horse Dam
CCIW
RM: 146.9
BON
RM: 148.1
CWMW
RM: 121.7
TDA
RM: 182.4
JHAW
RM: 214.8
JDY
RM: 216.7
John Day Dam
The Dalles Dam
TDDO
RM: 188.1
WRNO
RM: 140.3
Bonneville Dam
Columbia River
Snake River
Pend Oreille River
Spokane River
Kootenai River
Clark Fork River
Flathead River
Flathead Lake
Hungry Horse Reservoir
South Fork Flathead River
Dworshak Reservoir
North Fork Clearwater River
Clearwater River
Willamette River
Dissolved Gas Monitoring Stations
Spill Season Automated Monitoring Only
Year-Round Automated Monitoring
Winter Season Automated Monitoring Only
USGS

Field Monitoring Stations

- Total Cost $356,370
- 15 sites: 6 year-round sites, 9 seasonal sites
- 5 Forebay sites, 6 Tailwater sites, 4 Riverine sites
- All 15 sites visited every three weeks during spill season and 6 tailwater sites every four weeks outside spill season

USGS

Field equipment

- 41 sondes
- Hydrolab Mini 4a, and Mini 5 sondes.
- Purchased 25 new TDG membranes from In-Situ Inc, and 6 new membranes from Hach
- Two Novalynx 230-M202 Handheld Digital Barometers
- Four Surveyor 4 hand-held data displays

USGS

FMS equipment for 2014

- 14 Sutron Satlink 2 HDR DCP's plus one Sutron 8210 HDR DCP with external phone modem
  - (8210 to be replaced with 8310 in early 2015)

- All Sutron SDI-12 digital barometers

USGS

Lab equipment

- Heise calibrated digital pressure gage
- Ashcroft calibrated digital pressure gage
- Two Barnant digital thermometers
  - Being replaced with Oakton digital thermometers
- ParoScientific digital barometric pressure Digiquartz Laboratory Standard. Model 745.

USGS

Data Completeness

- During the Spill Season April 1 to August 31:
  - 99.9% of the BP, 98.5%TDG Data, and 99.9% of the WT data.
- For the whole reporting period:
  - 99.7% of the BP, 97.6% TDG, and 99.7% of the WT data.
- DWQI, LGSW, and PAQW accounted for 90.4% of the bad TDG data.

USGS

Missing/ Anomalous BP and TDG Data

1429 Hours or 1.36% of Total for WY2014

Hours	Percent	Reason
959	67.13	Too Low
318	22.24	DCP Failure
108	7.55	Bad Membrane
26	1.82	Inspection
7	0.49	Spike
5	0.35	Missing
4	0.28	Bad Sonde
2	0.14	Missed Transmission
0	0	Cable Failure

USGS

Unusable BP/TDG data

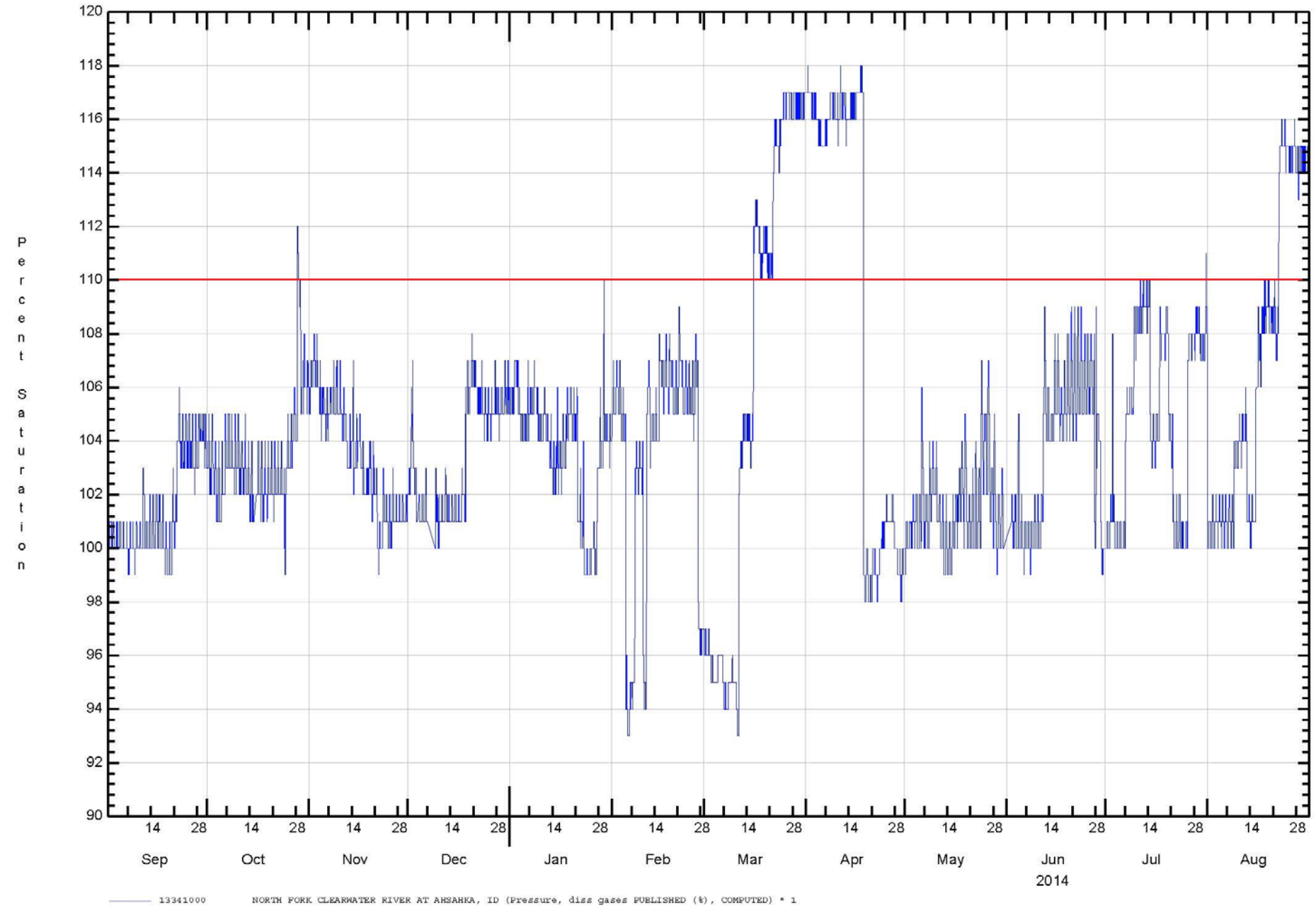
- Worst Sites:
  - DWQI: 286 hours
  - LGSW: 597 hours
  - PAQW: 373 hours

- Mostly due to Too Low of readings, Membrane failures, and DCP failures.

- Best sites:
  - LGSA, LMNA, IDSW, LWG, LGNW, and MCNA
    - 0 unusable hours

USGS

DWQI - NF Clearwater River NR Ahsahka, ID


Percent Saturation
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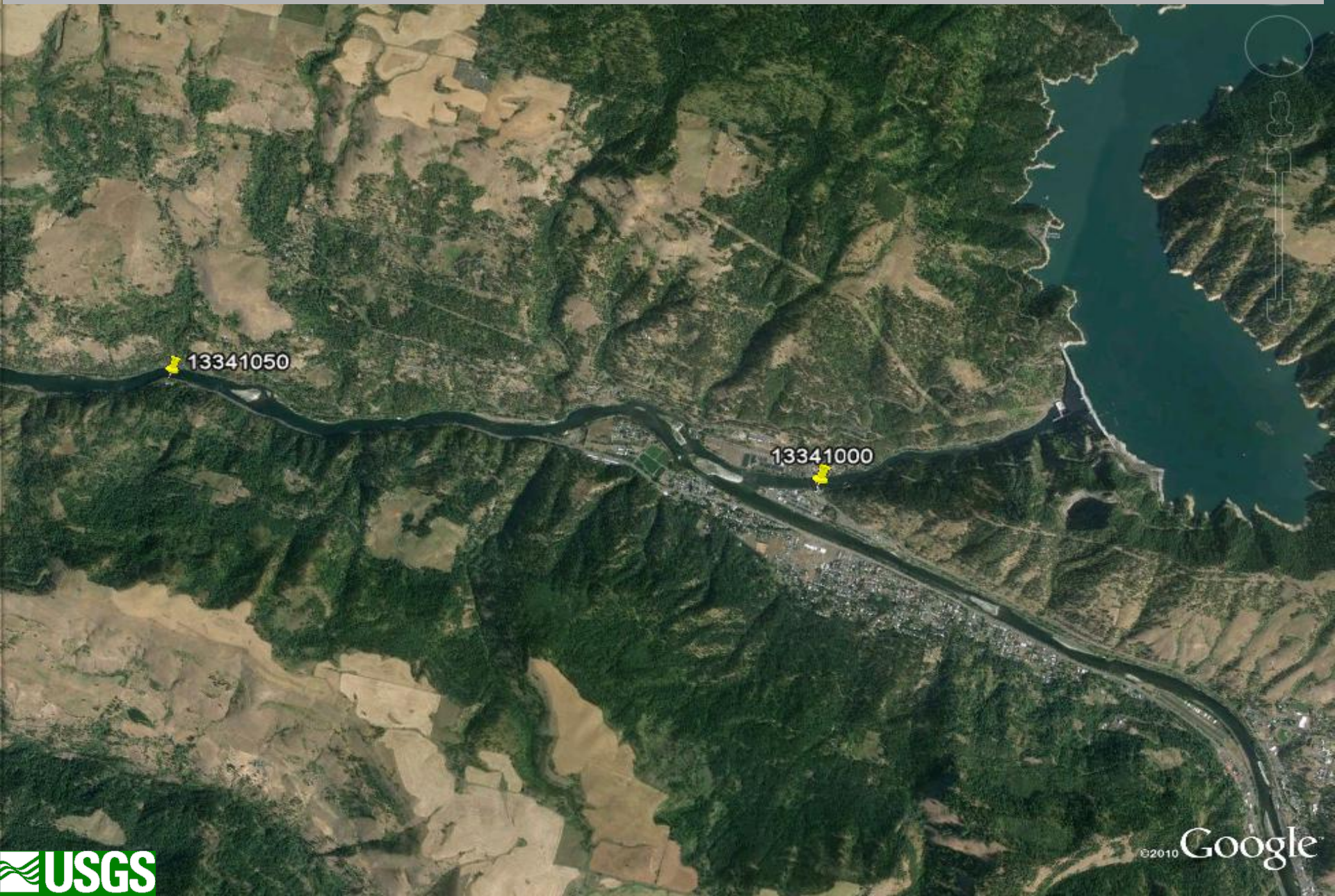
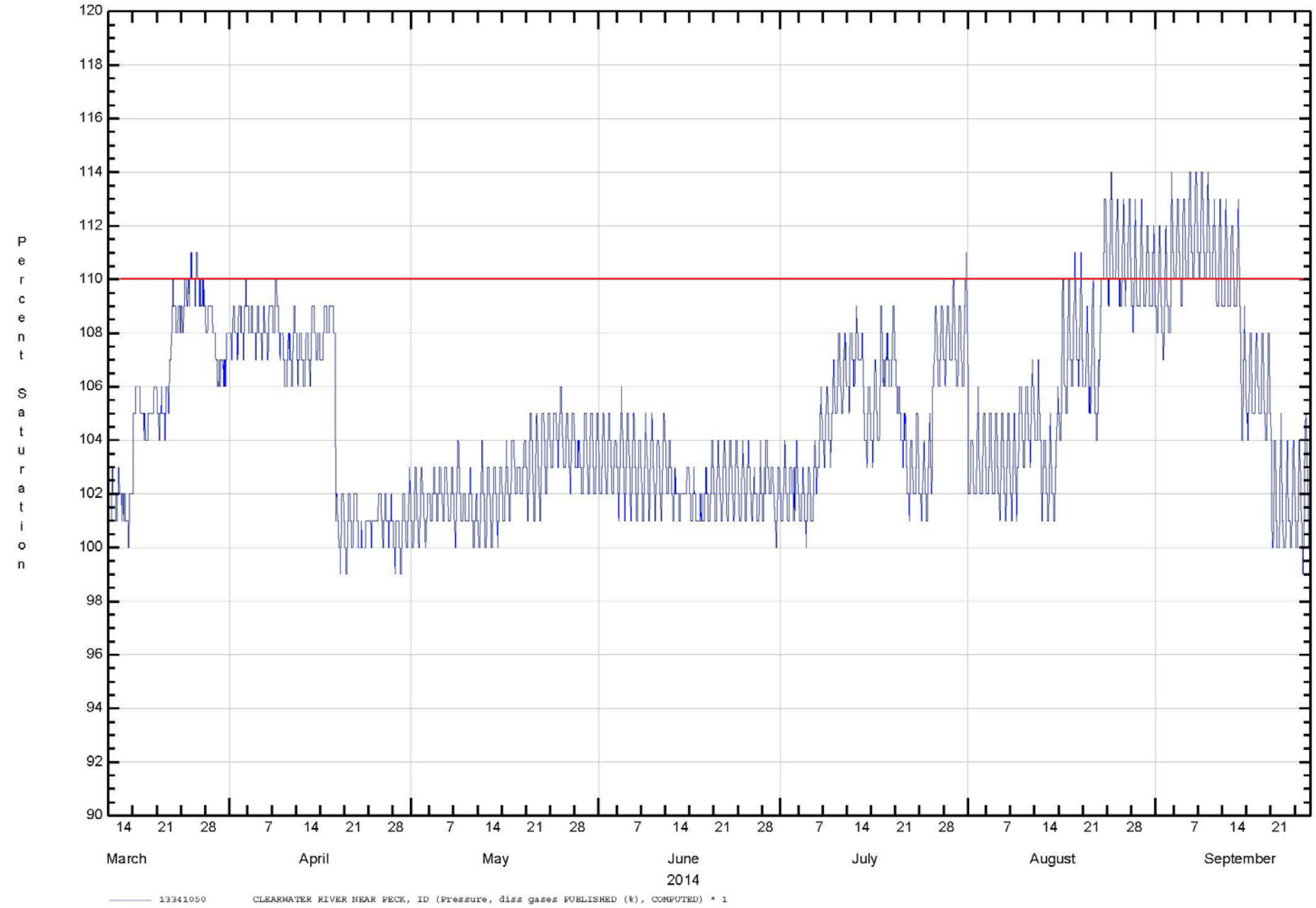
2014
13341000 NORTH FORK CLEARWATER RIVER AT AHSAHKA, ID (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

DWQI

PEKI - Clearwater River NR Peck, ID

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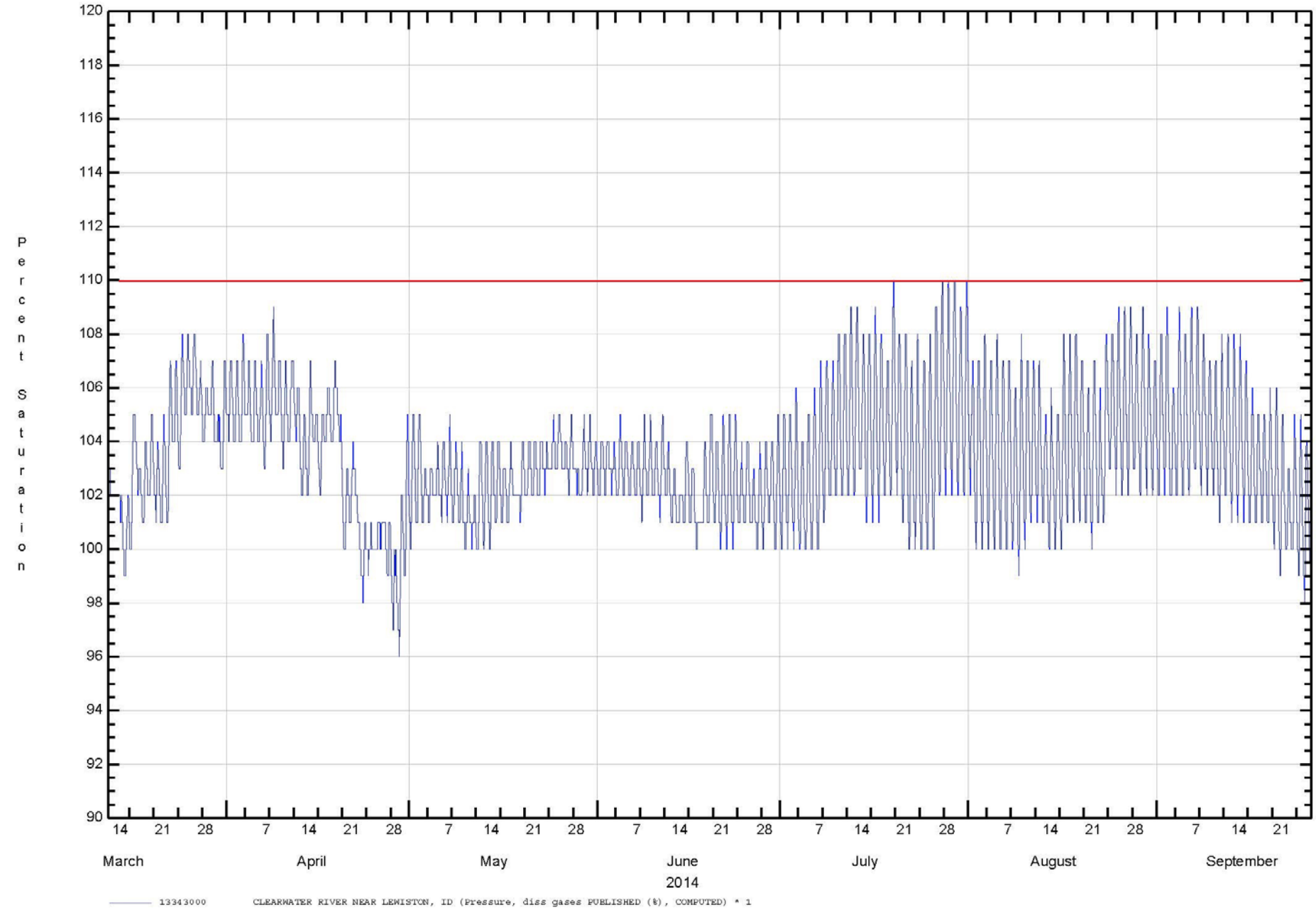
13341050 CLEARWATER RIVER NEAR PECK, ID (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

PEKI

LEWI – Clearwater River NR Lewiston, ID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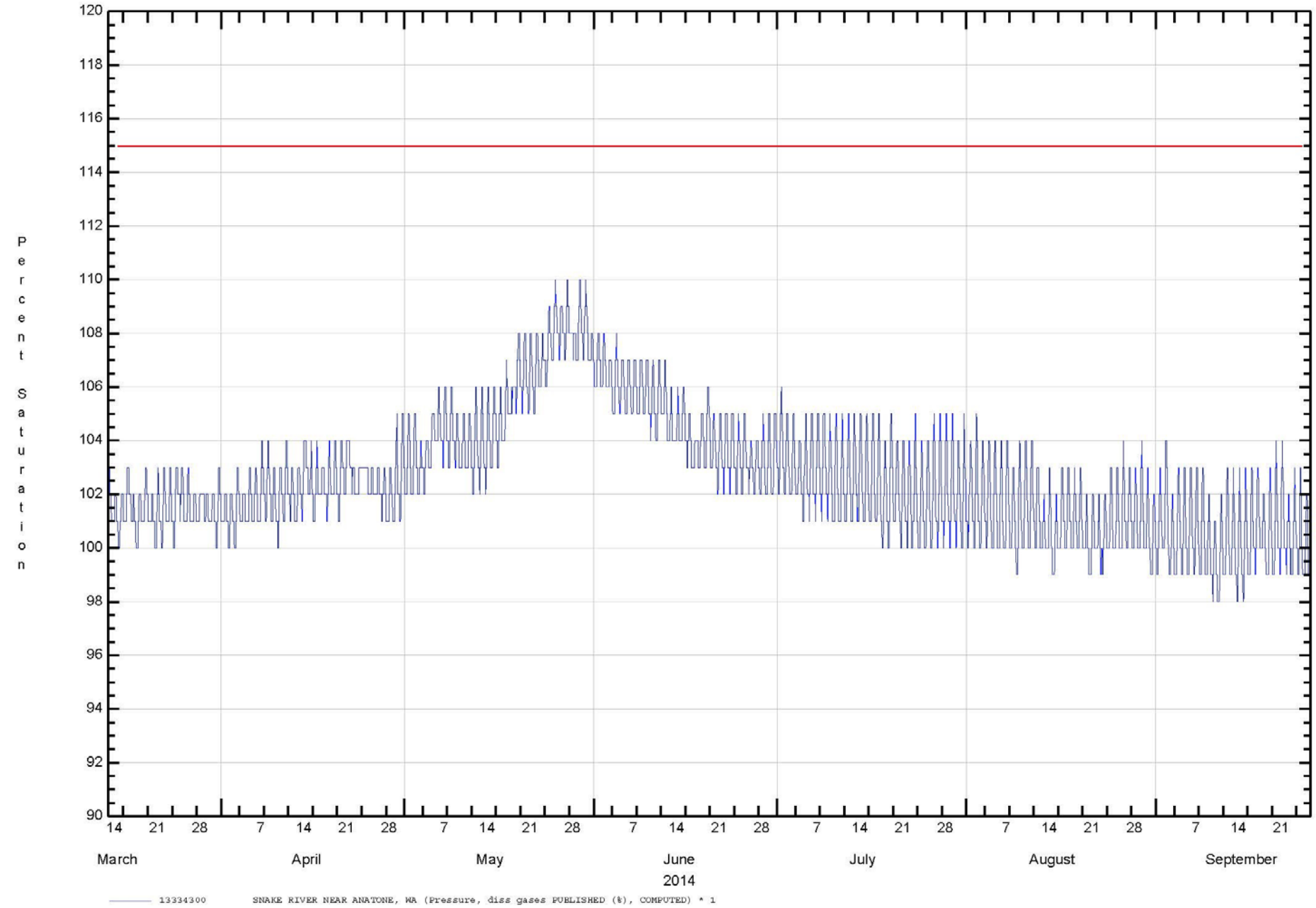
13343000 CLEARWATER RIVER NEAR LEWISTON, ID (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

LEWI

ANQW – Snake River NR Anatone, WA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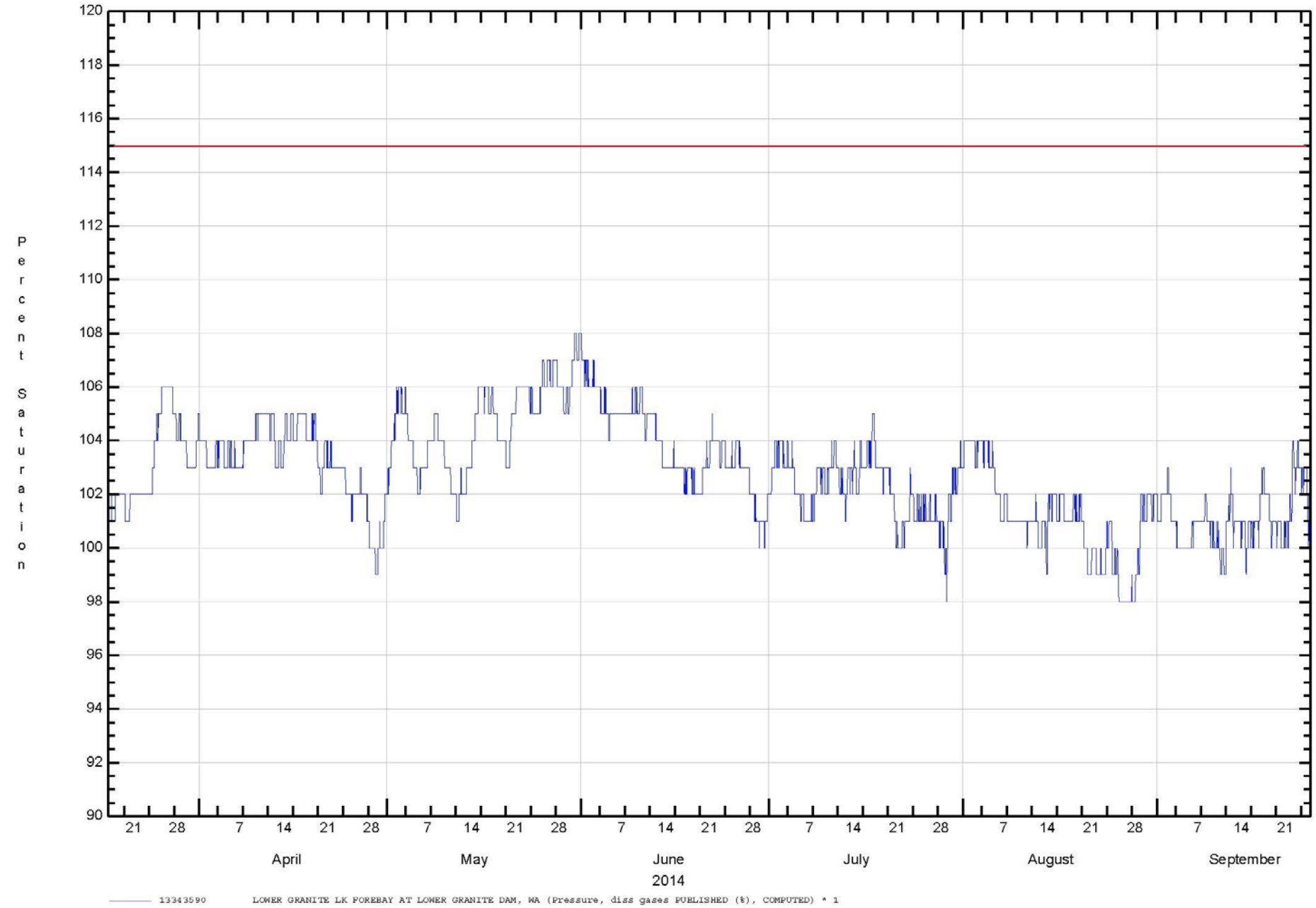
13334300 SNAKE RIVER NEAR ANATONE, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

ANQW

LGW & LGNW

Snake River at Lower Granite Dam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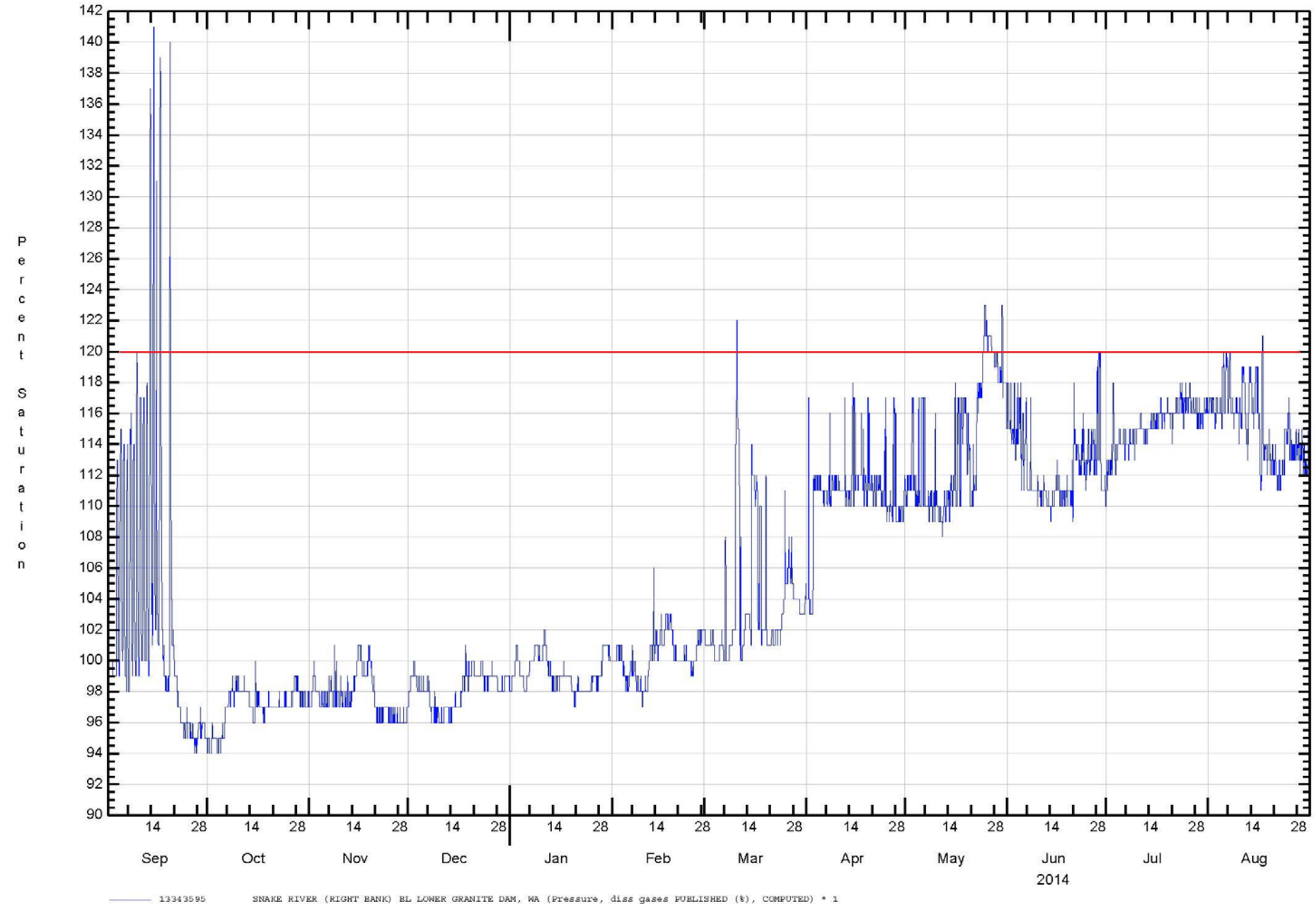
13343590 LOWER GRANITE LK FOREBAY AT LOWER GRANITE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

LWG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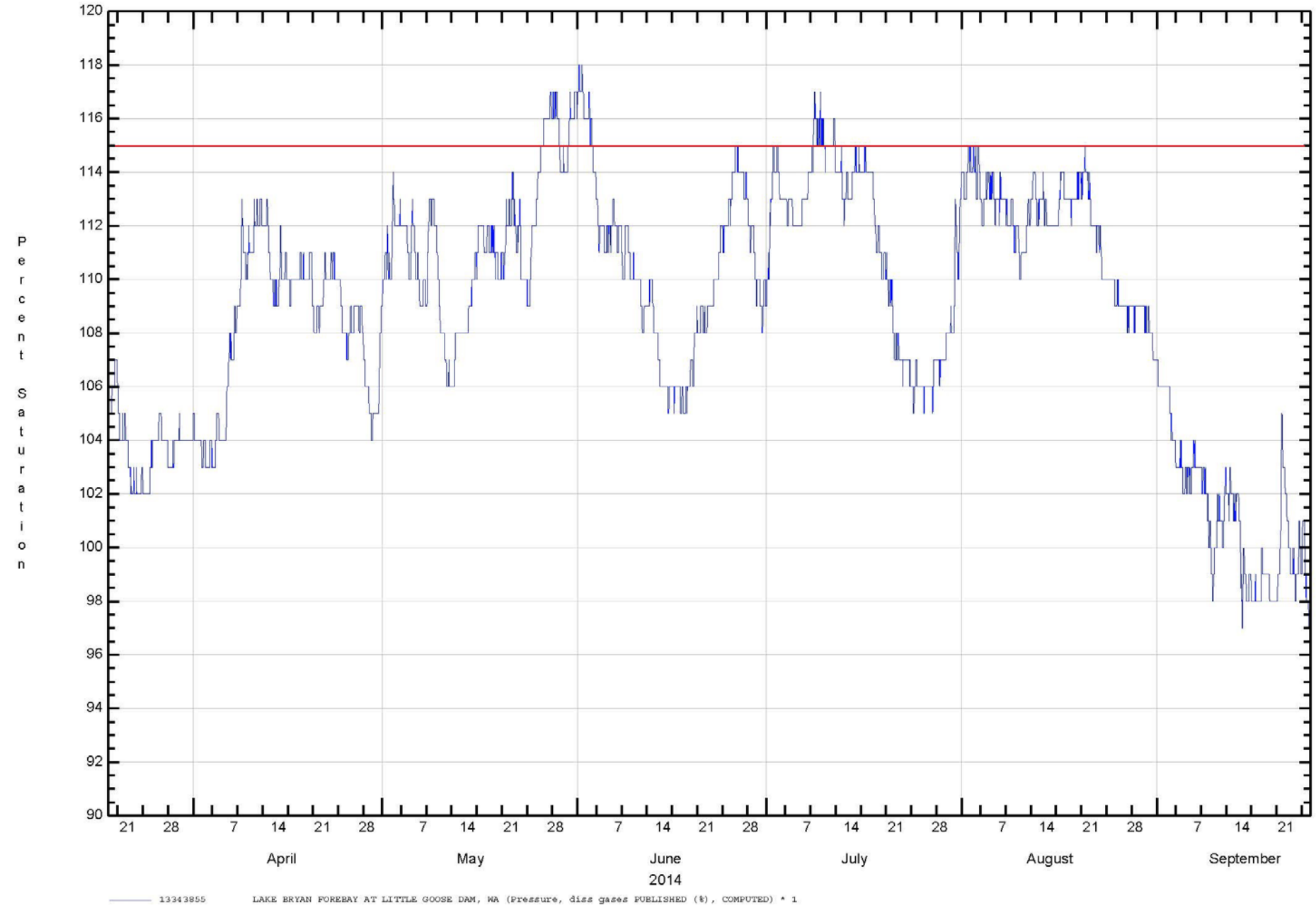
13343595 SNAKE RIVER (RIGHT BANK) BL LOWER GRANITE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

LGNW

LGSA & LGSW

Snake River at Little Goose Dam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13343855 LAKE BRYAN FOREBAY AT LITTLE GOOSE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

LGSA


Percent Saturation
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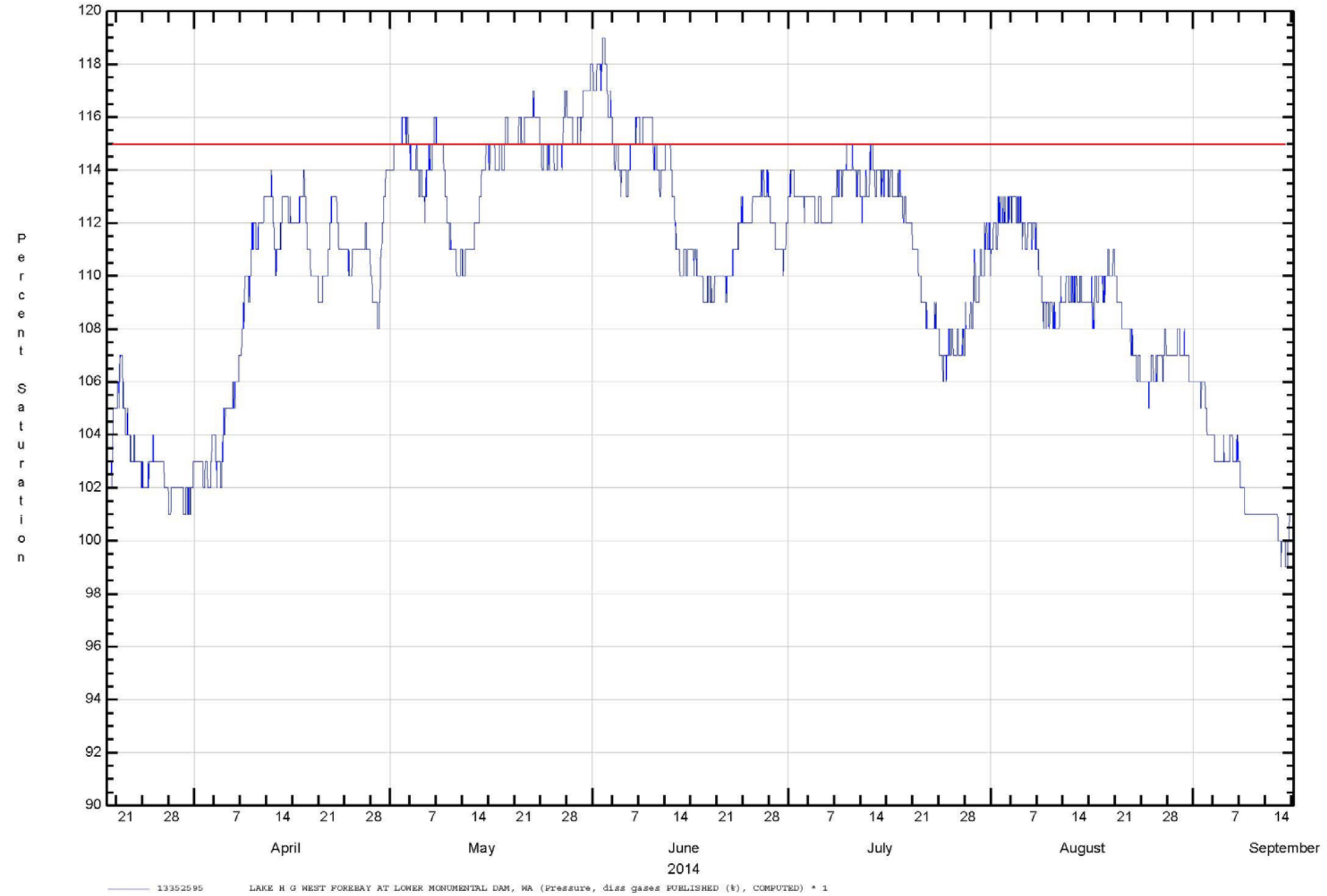
13343860 SNAKE RIVER BELOW LITTLE GOOSE DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

LGSW

LMNA & LMNW

Snake River at Lower Monumental Dam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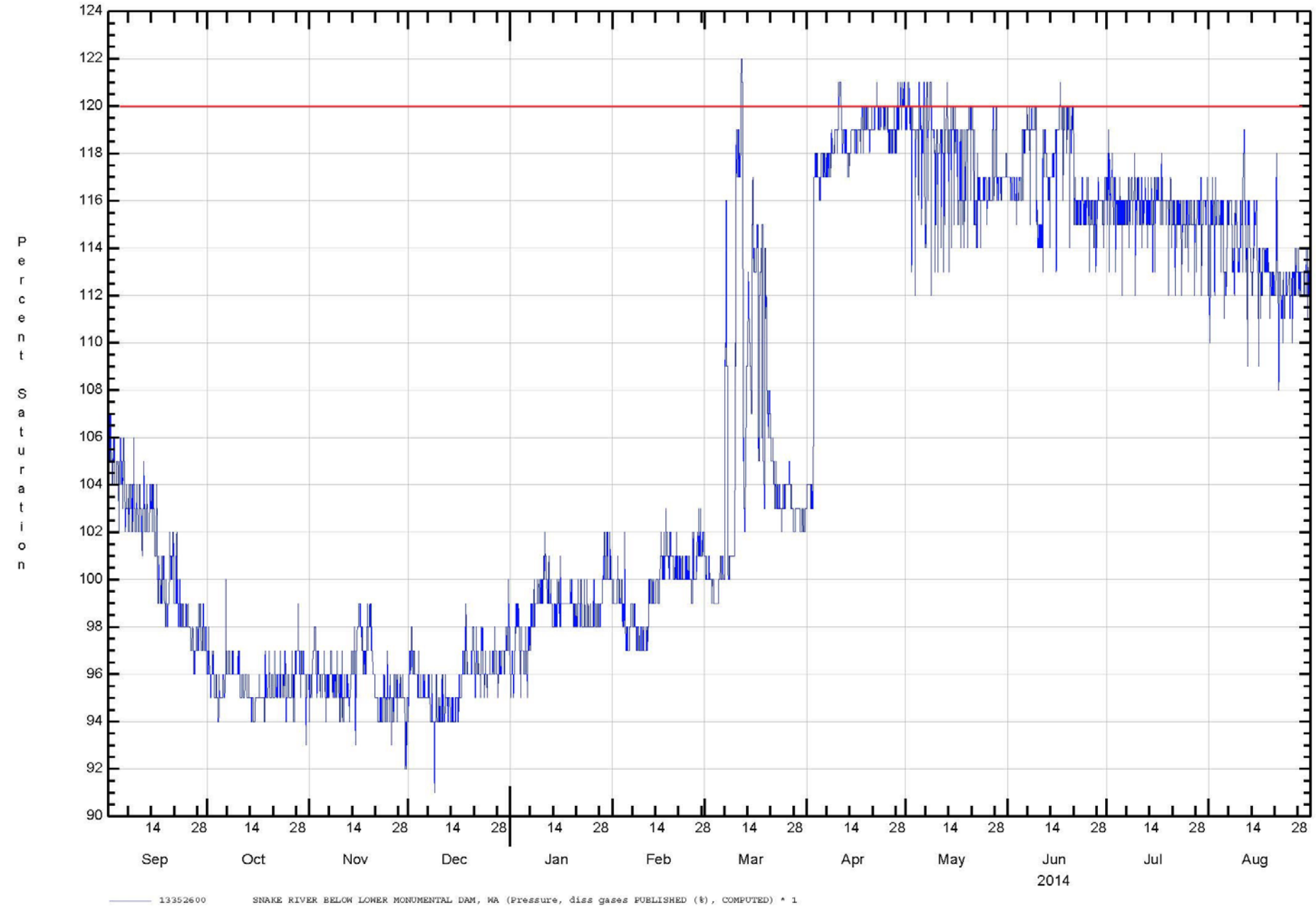
13352595 LAKE H G WEST FOREBAY AT LOWER MONUMENTAL DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

LMNA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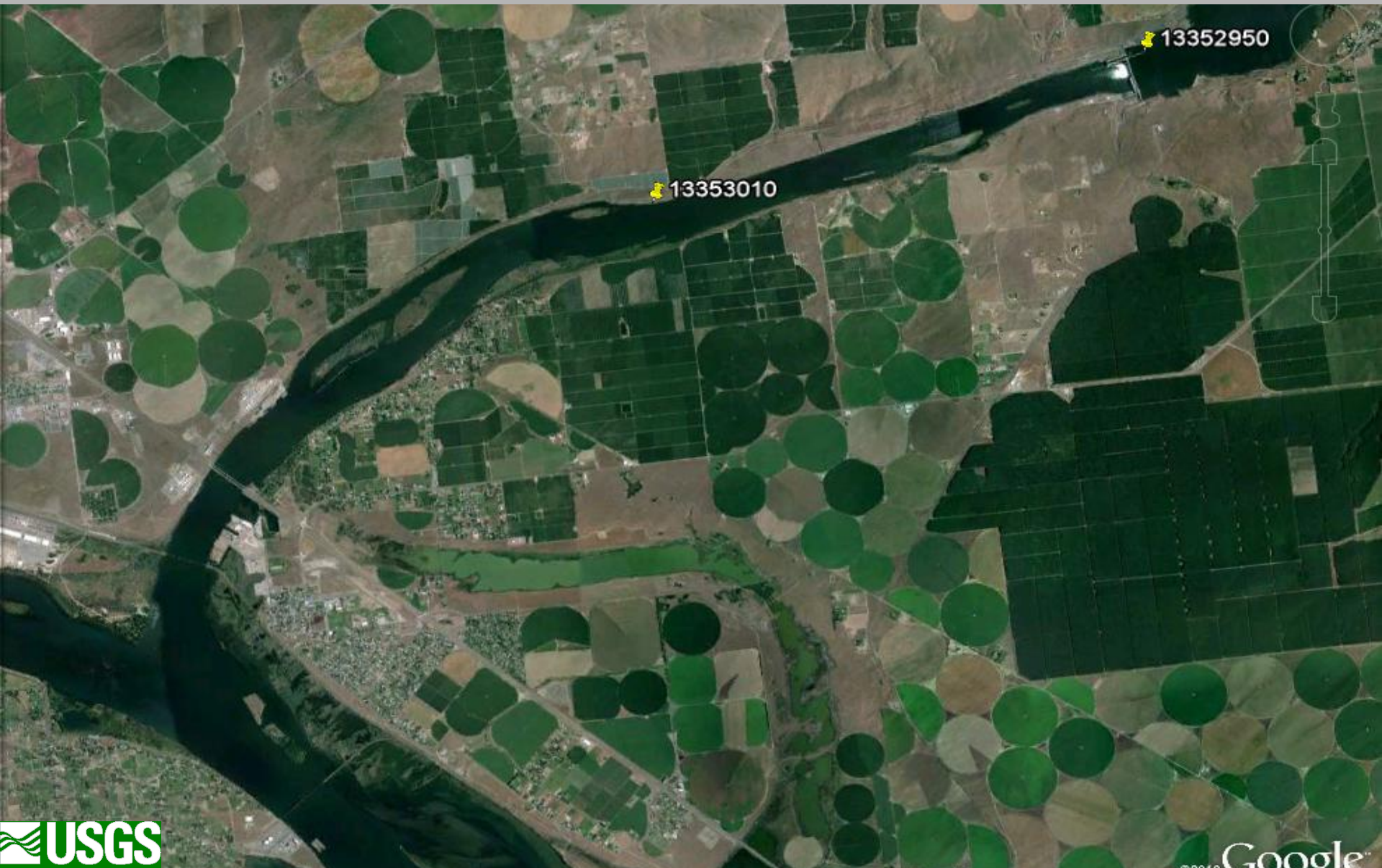
13352600 SNAKE RIVER BELOW LOWER MONUMENTAL DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

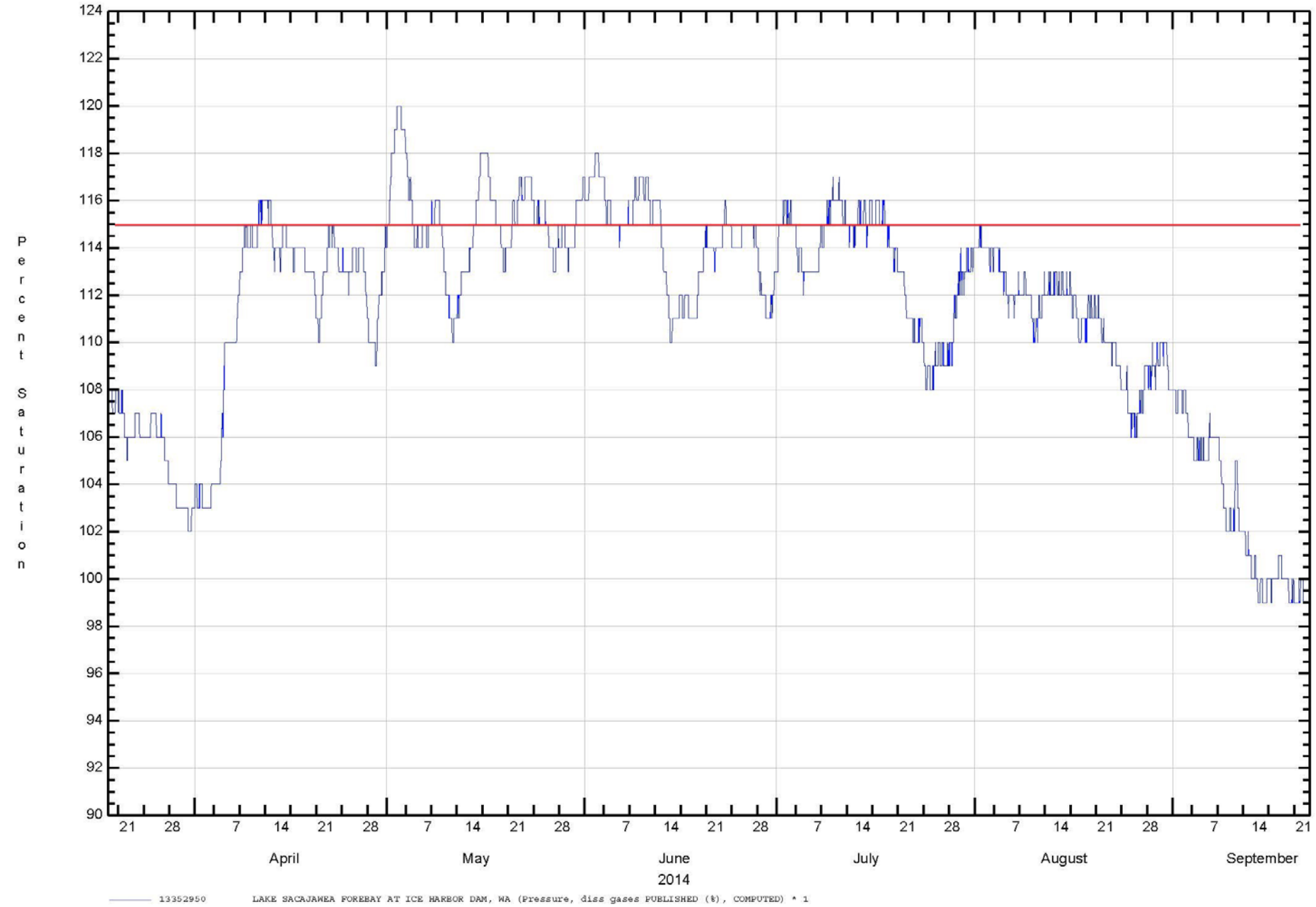
USGS

LMNW

IHRA & IDSW

Snake River at Ice Harbor Dam

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13352950
LAKE SACAJAWEA FOREBAY AT ICE HARBOR DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

IHRA


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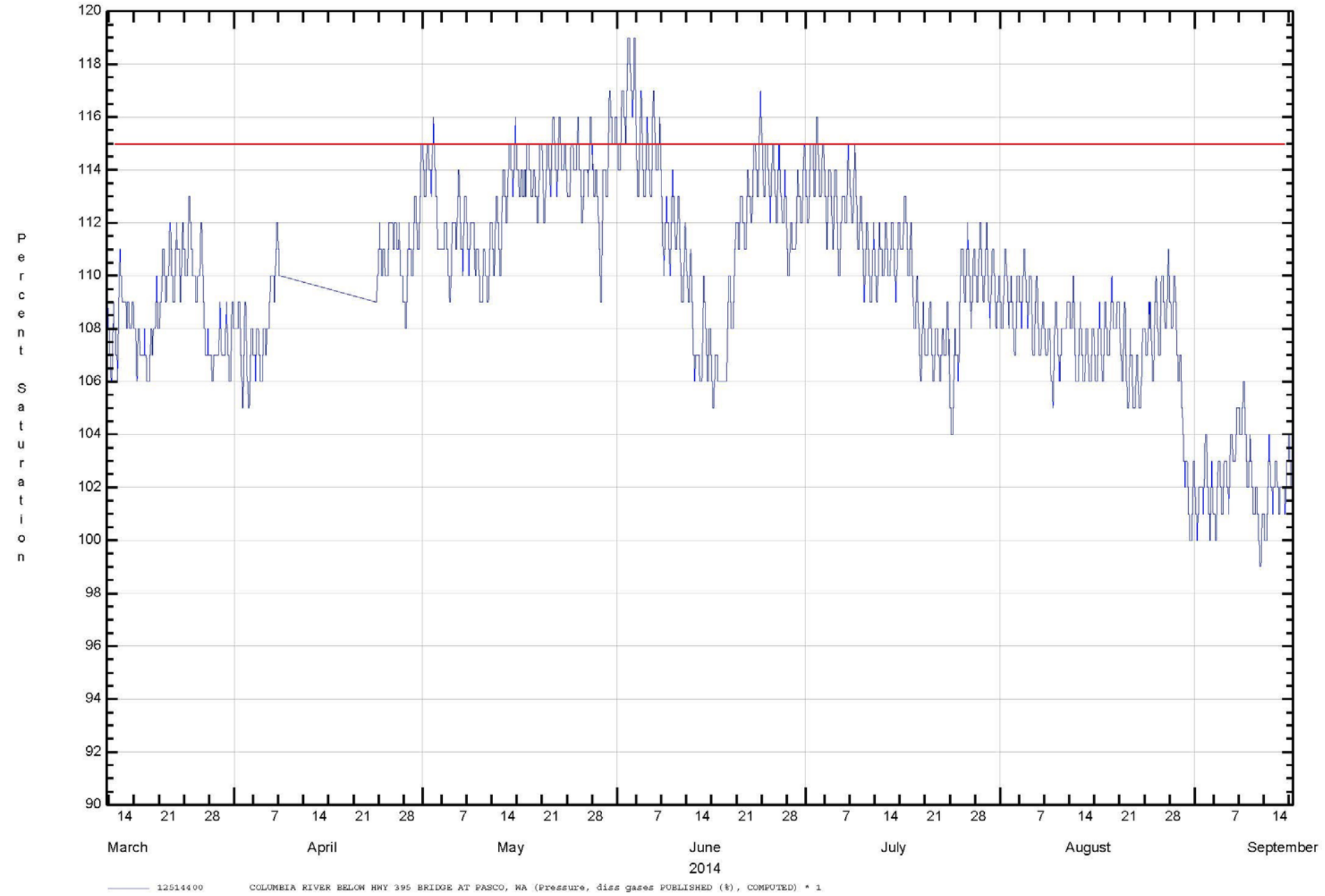
13353010 SNAKE RIVER BL GOOSE ISLAND BL ICE HARBOR DAM, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

IDSW

PAQW – Columbia River at Pasco, WA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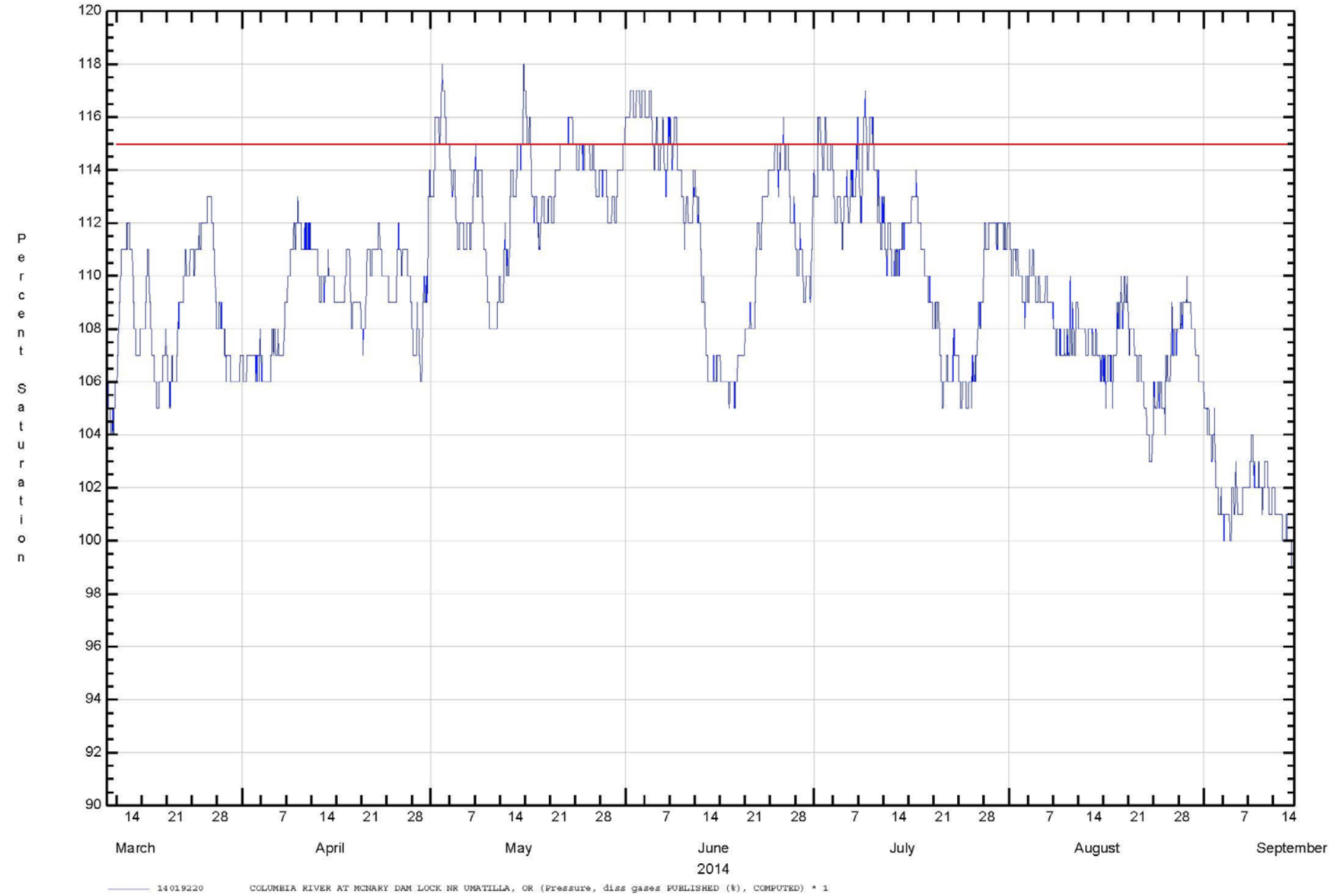
12514400 COLUMBIA RIVER BELOW HWY 395 BRIDGE AT PASCO, WA (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

PAQW

MCNA & MCPW

Columbia River at McNary Dam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14019220 COLUMBIA RIVER AT MCNARY DAM LOCK NR UMATILLA, OR (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

MCNA


Percent Saturation
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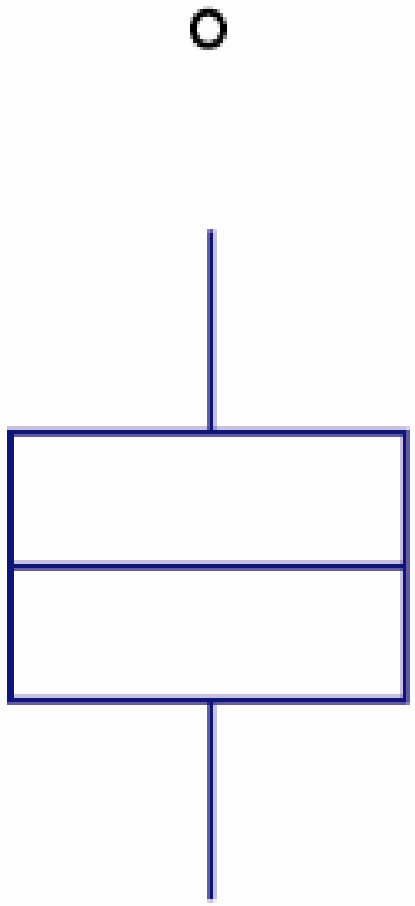
14019240 COLUMBIA RIVER BELOW MCNARY DAM NEAR UMATILLA, OR (Pressure, diss gases PUBLISHED (%), COMPUTED) * 1

USGS

MCPW

Explanation of a Boxplot



Data values outside the 10th and 90th percentiles

90th percentile

75th percentile

Median

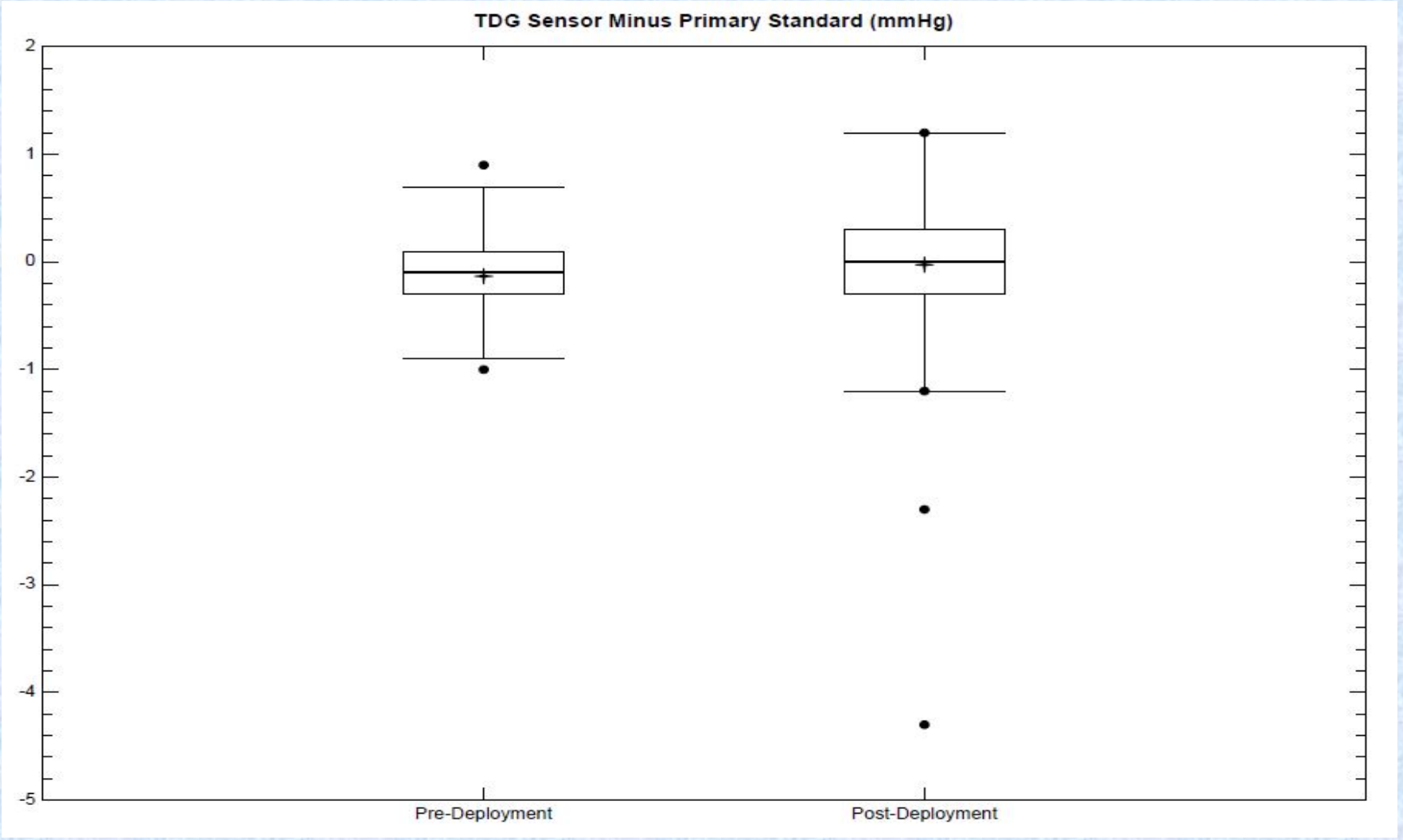
25th percentile

10th percentile

USGS

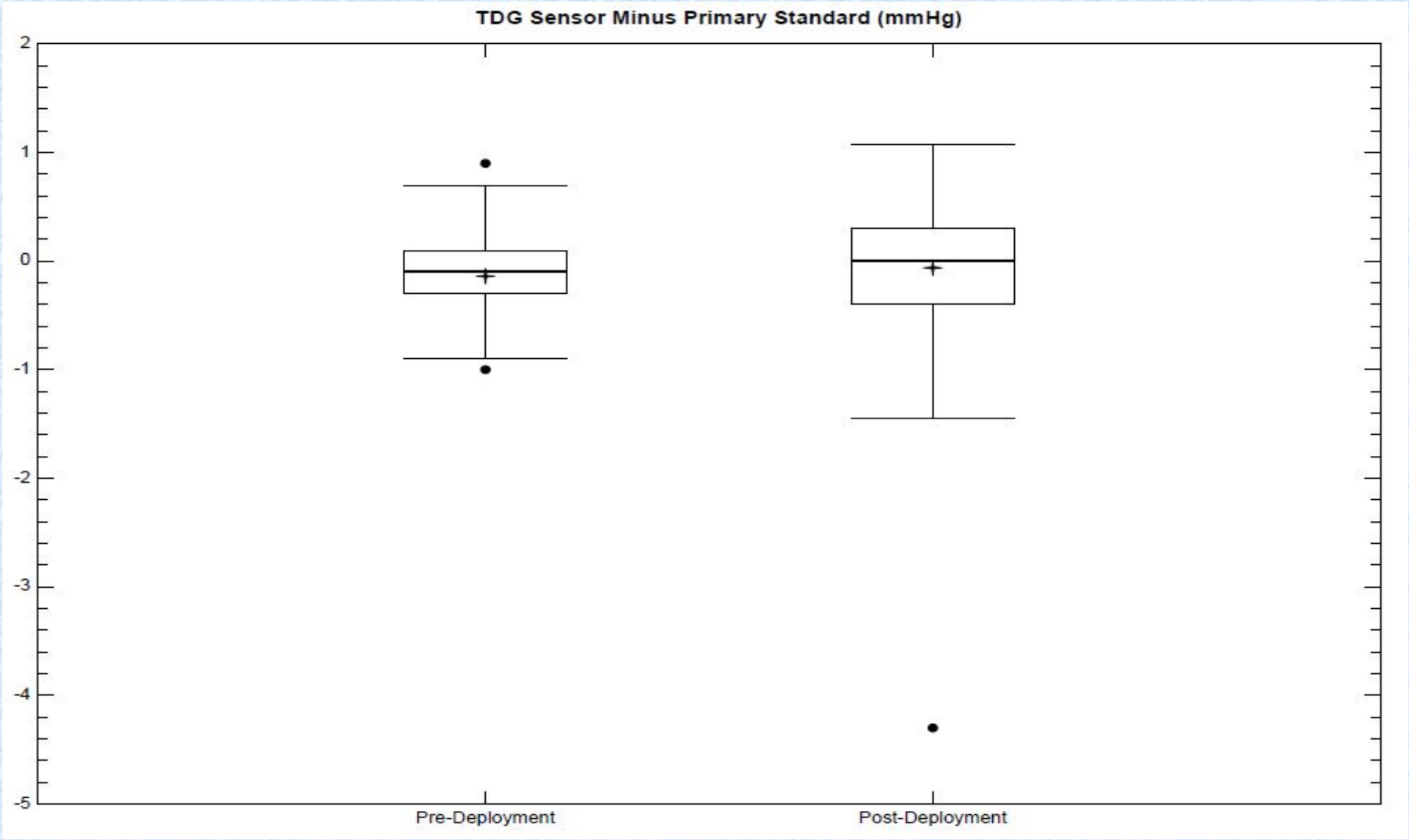
TDG Sensor vs Primary Standard

Barometric Pressure



TDG Sensor vs Primary Standard

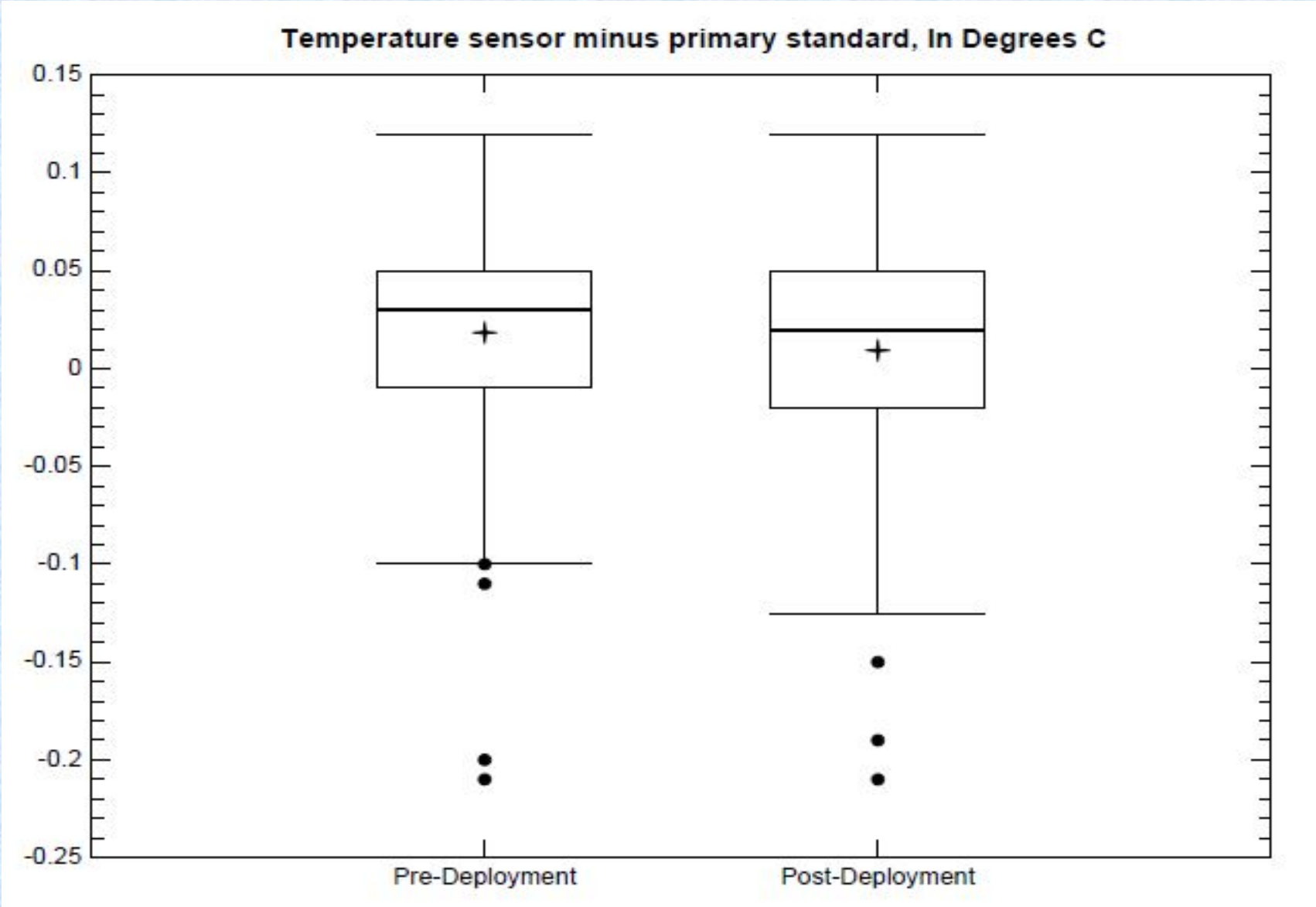
Barometric Pressure +300 or +100 mmHg



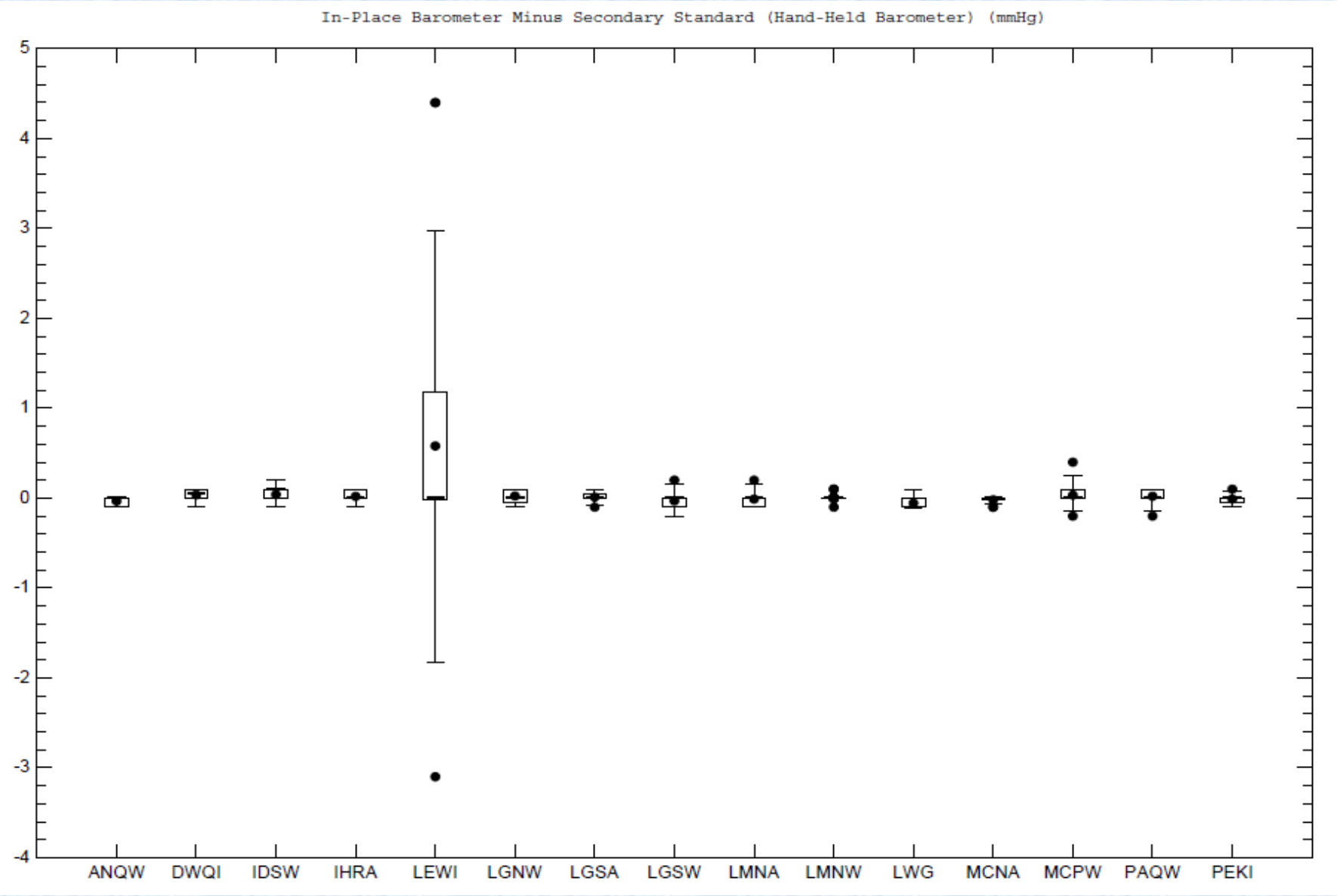
+300

+100

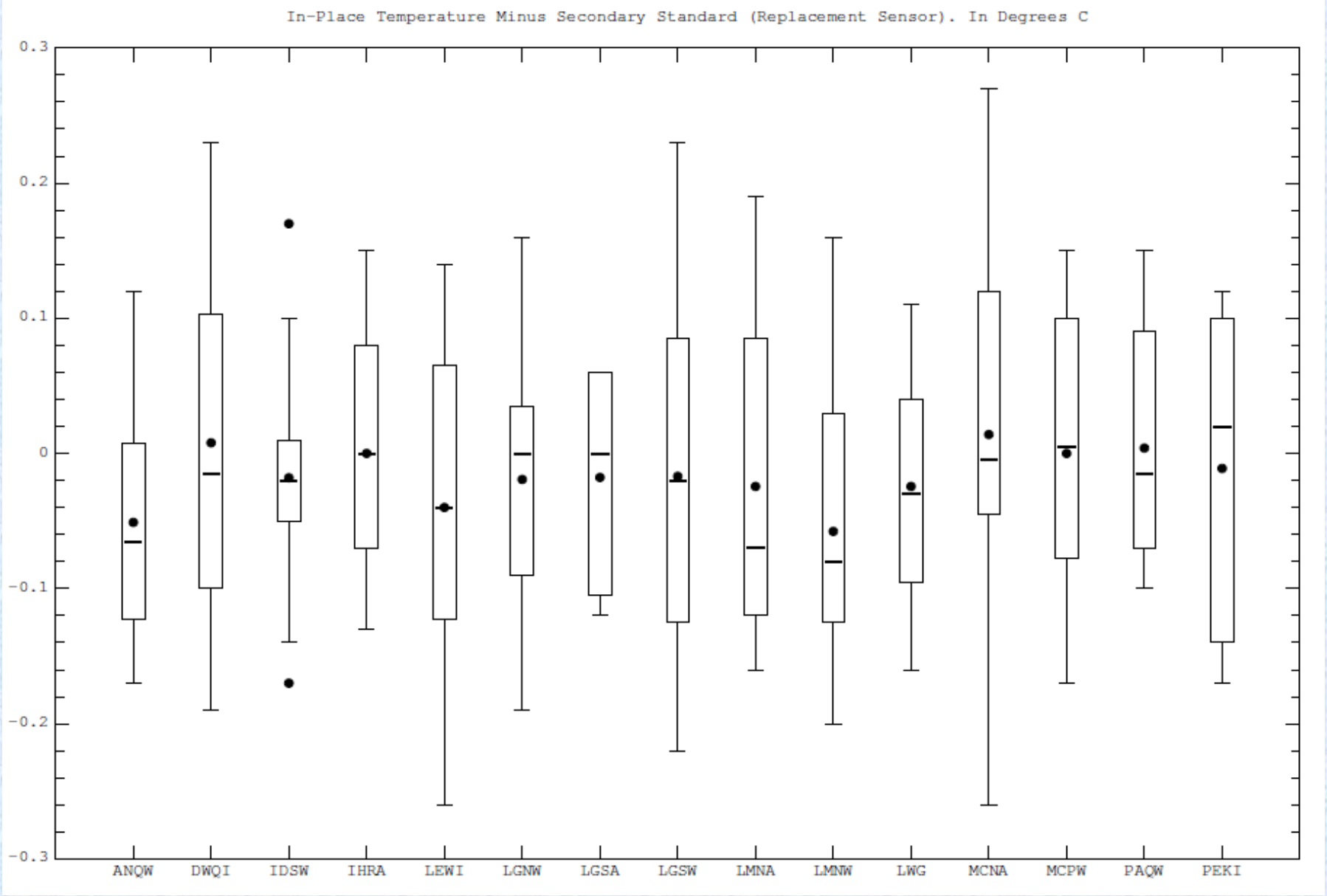
Temperature Sensor vs Primary Standard



In-Place Barometer vs Secondary Standard

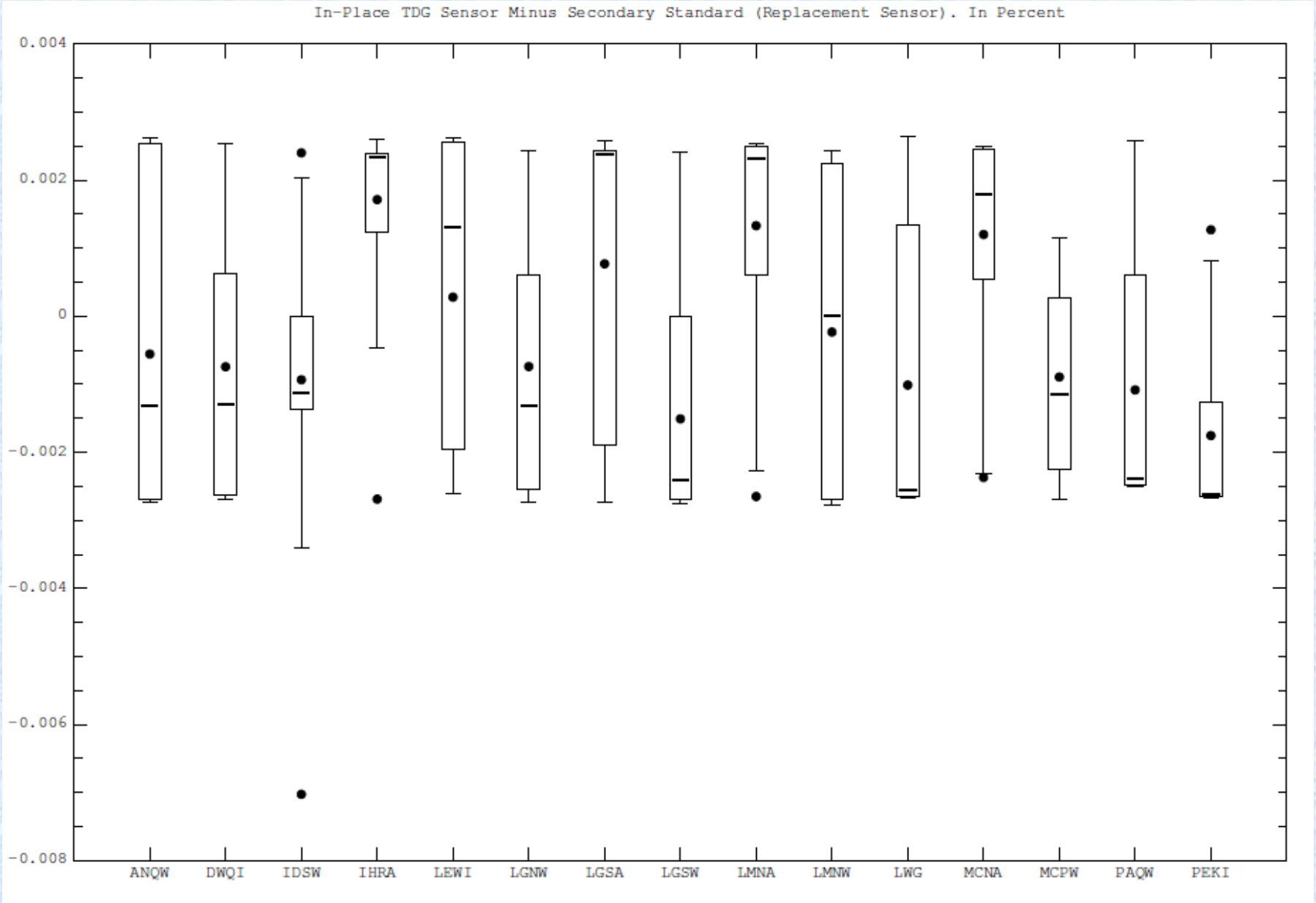


Temperature Sensor vs Secondary Standard



USGS

TDG Sensor vs Secondary Standard



Summary

- 15 sites: 6 year-round and 9 seasonal stations
- 1.36% missing/anomalous data

USGS

Summary

Median differences between TDG Sensors vs. Primary Standards (performed in lab)

- **Barometric pressure**
  - Pre deployment: -0.02 mmHg
  - Post deployment: 0.0 mmHg

- **Water temperature**
  - Pre deployment: 0.02 ^{o}C
  - Post deployment: 0.01 ^{o}C

Summary

Median differences between TDG Sensors vs. Secondary Standards (performed in field)

- **Barometric pressure: 0.0 mm Hg**
- **Water temperature: -.02 ^{o}C**
- **TDG, in percent saturation: -0.1%**

QUESTIONS or COMMENTS?