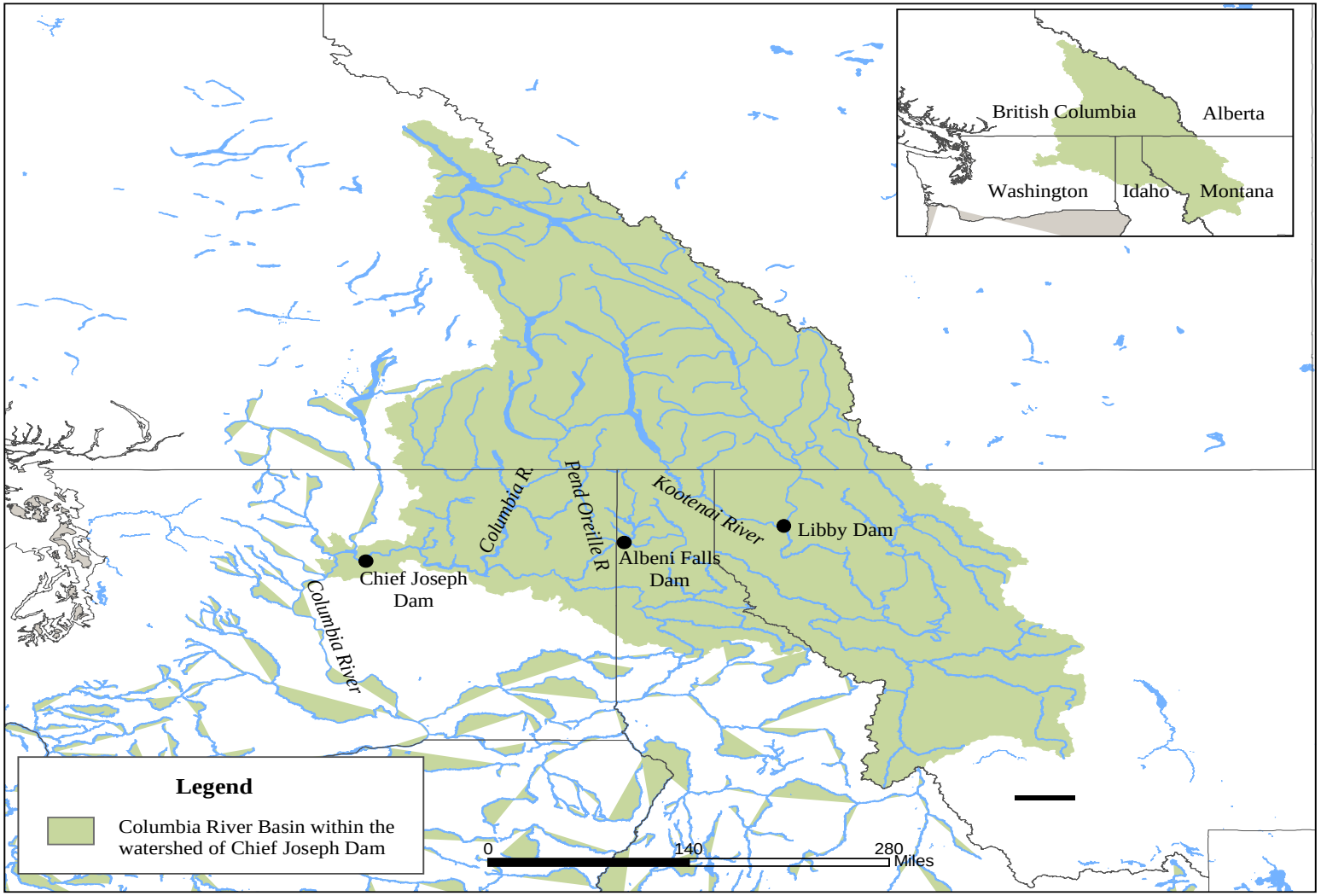
Total Dissolved Gas Monitoring 2012: Chief Joseph Dam, Albeni Falls Dam, and Libby Dam

TDG Monitoring 2012

- Introduction
  - 5 monitoring sites
    - Libby tailwater
    - Chief Joseph forebay and tailwater
    - Albeni Falls forebay and tailwater
  - Seasonal sites (April 1 – September 30)
  - Sites calibrated every two weeks
    - COE data quality criteria
    - Laboratory calibrations
    - Field calibrations
    - Performance checks

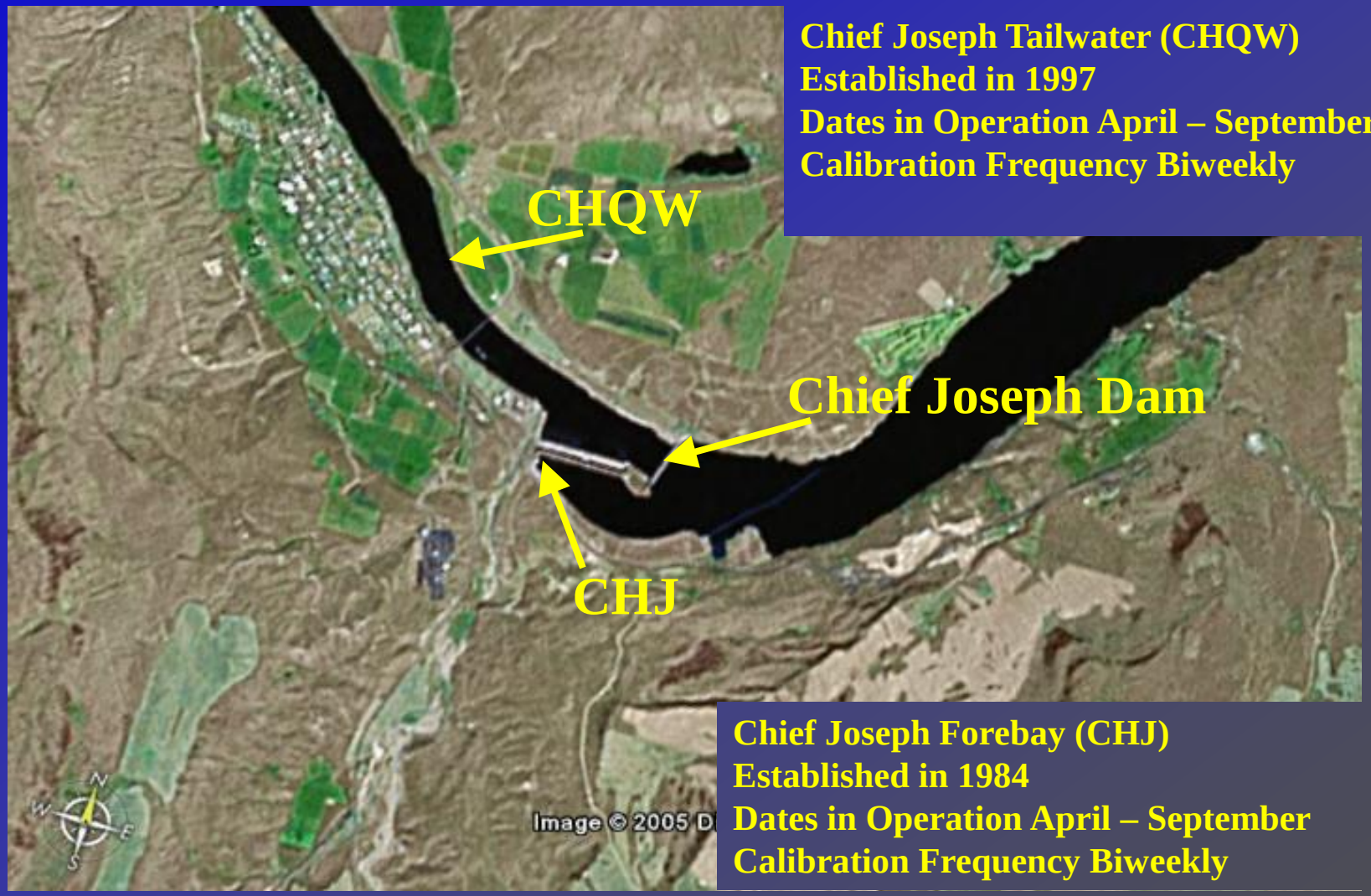


Location of the Seattle District's projects in the Upper Columbia River Basin.

TDG Monitoring 2012

- Chief Joseph
  - Equipment
    - Hydrolab MiniSonde 4a TDG sensor/Sutron barometer
    - Sutron 9210 XLite DCP, AC Power
    - Radio transmission and GOES station
- Albeni Falls
  - Equipment
    - Hydrolab MiniSonde 4a TDG sensor/Sutron barometer
    - Sutron 9210 XLite DCP, AC and Solar Power
    - Radio transmission station
- Libby
  - Equipment
    - Hydrolab MiniSonde 4a TDG sensor/Sutron barometer
    - Sutron 9210 XLite DCP, Solar Power
    - Radio transmission station

TDG Monitoring 2012

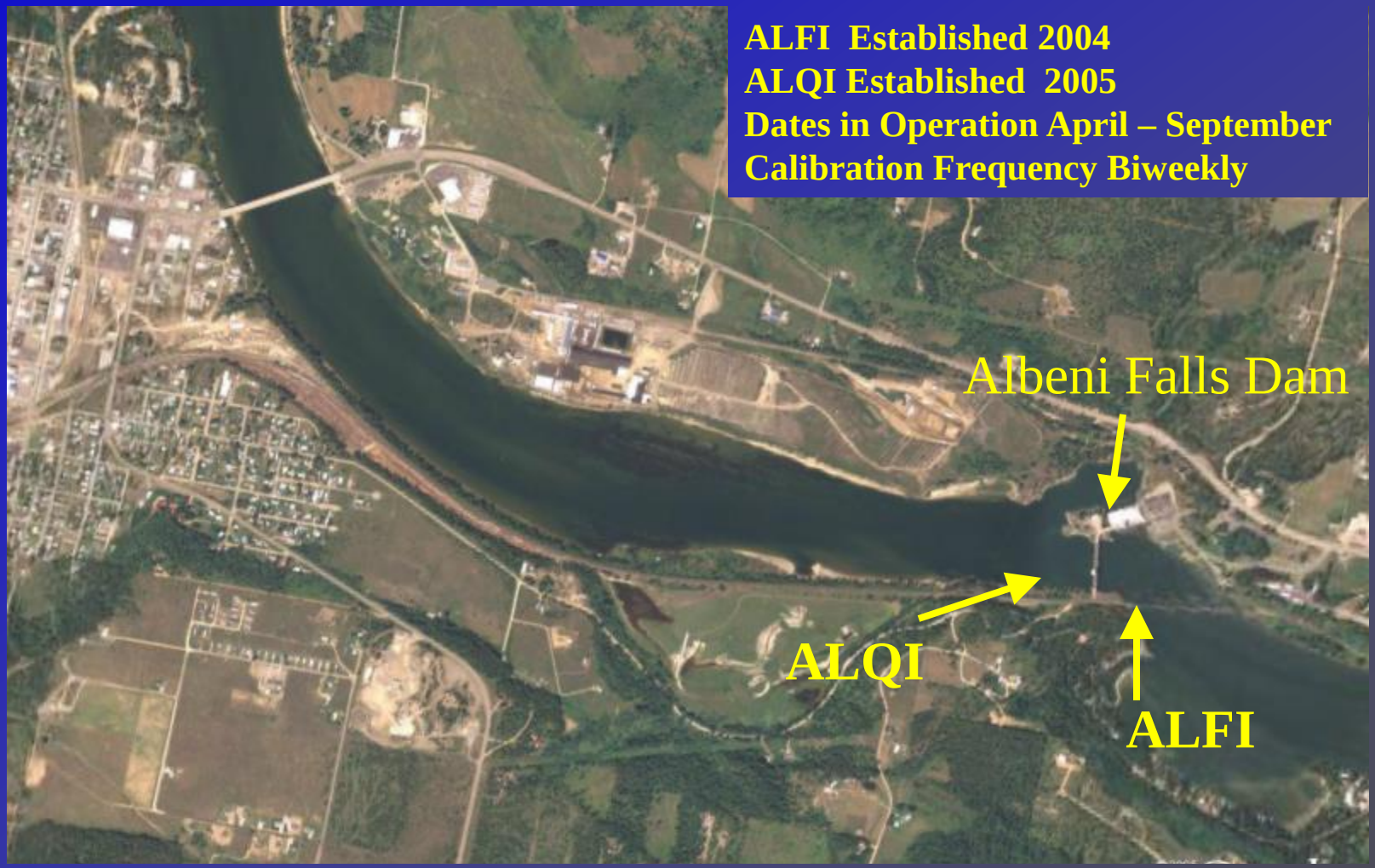


Chief Joseph Tailwater (CHQW)
Established in 1997
Dates in Operation April – September
Calibration Frequency Biweekly

Chief Joseph Forebay (CHJ)
Established in 1984
Dates in Operation April – September
Calibration Frequency Biweekly

Chief Joseph Total Dissolved Gas Monitoring System

TDG Monitoring 2012



Albeni Falls Total Dissolved Gas Monitoring System

TDG Monitoring 2012

Established 2003
Dates in Operation
April – September
Calibration Frequency Biweekly

Libby Dam Total Dissolved Gas Monitoring System

TDG Data Completeness 2012

Station Name	Station Abbreviation	Planned monitoring in hours	Number of missing hourly values	Number of hourly values not passing QA	Percentage of real-time TDG monitoring data received	Percentage of real-time TDG data received and passing quality assurance
Chief Joseph Forebay	CHJ	4392	24	2	99.5	99.4
Chief Joseph Tailwater	CHQW	4392	26	4	99.4	99.3
Albeni Falls Forebay	ALFI	4392	9	10	99.8	99.6
Albeni Falls Tailwater	ALQI	4392	140	2	96.8	96.8
Libby Tailwater	LBQM	4392	32	4	99.3	99.2

Temperature Data Completeness 2012

Station Name	Station Abbreviation	Planned monitoring in hours	Number of missing hourly values	Number of hourly values not passing QA	Percentage of real-time Temperature monitoring data received	Percentage of real-time Temperature data received and passing quality assurance
Chief Joseph Forebay	CHJ	4392	24	0	99.5	99.5
Chief Joseph Tailwater	CHQW	4392	26	0	99.4	99.4
Albeni Falls Forebay	ALFI	4392	13	0	99.7	99.7
Albeni Falls Tailwater	ALQI	4392	140	0	96.8	96.8
Libby Tailwater	LBQM	4392	28	0	99.4	99.4

TDG Monitoring 2012

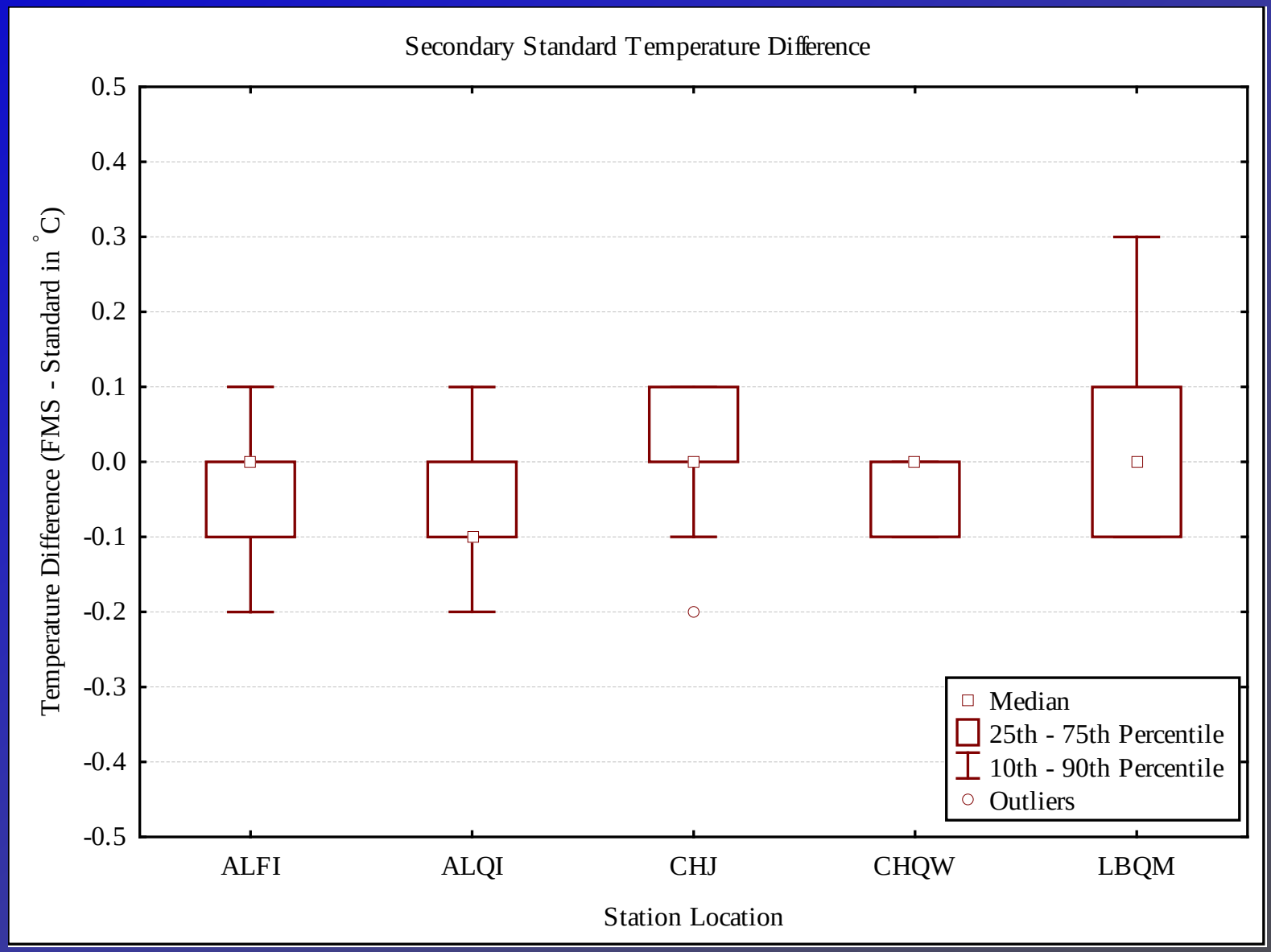
- Overview of 2012 TDG and Temperature Data
  - Data completeness
    - Chief Joseph Forebay (CHJ) and Tailwater (CHQW)
      - DCP malfunctions and programming problems
      - Calibration visits
    - Albeni Falls Forebay (ALFI) and Tailwater (ALQI)
      - Barometer problems
      - DCP malfunctions and programming problems
      - TDG probe problems
      - Calibration visits
    - Libby Tailwater (LBQM)
      - DCP malfunctions and programming problems
      - Calibration visits

TDG and Temperature QA/QC 2012

	Temperature	Total Dissolved Gas Percent			
	°C	100	113	126	140
Num	70	70	70	70	70
min	-0.10	-0.69	-0.69	-0.83	-0.98
max	0.20	0.49	0.63	0.63	0.49
median	0.10	0.01	0.03	0.01	0.00
avg	0.06	0.03	0.05	0.03	-0.01
sd	0.07	0.15	0.15	0.16	0.16

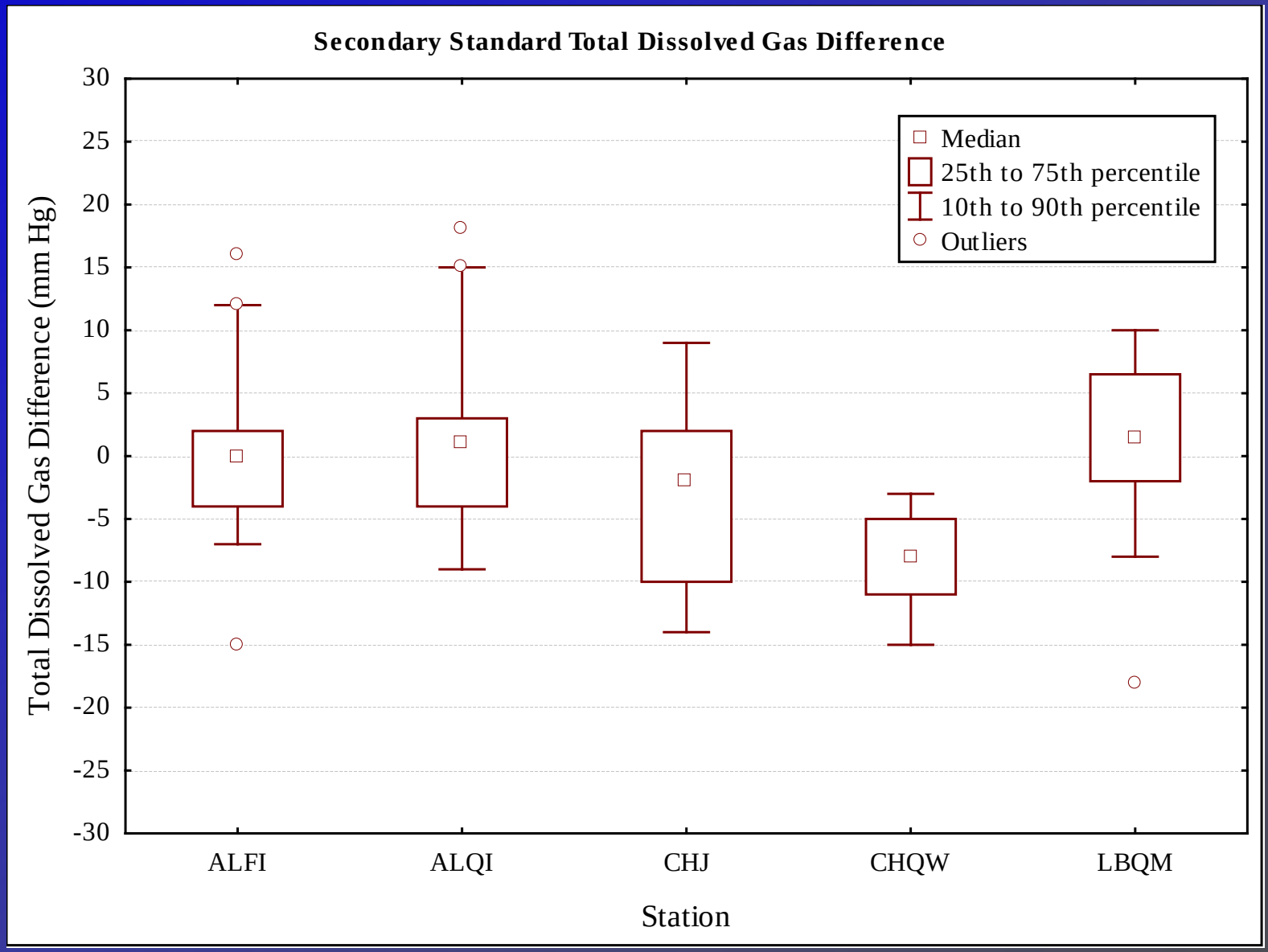
Difference between the primary standard and total dissolved gas instrument.

TDG and Temperature QA/QC 2012



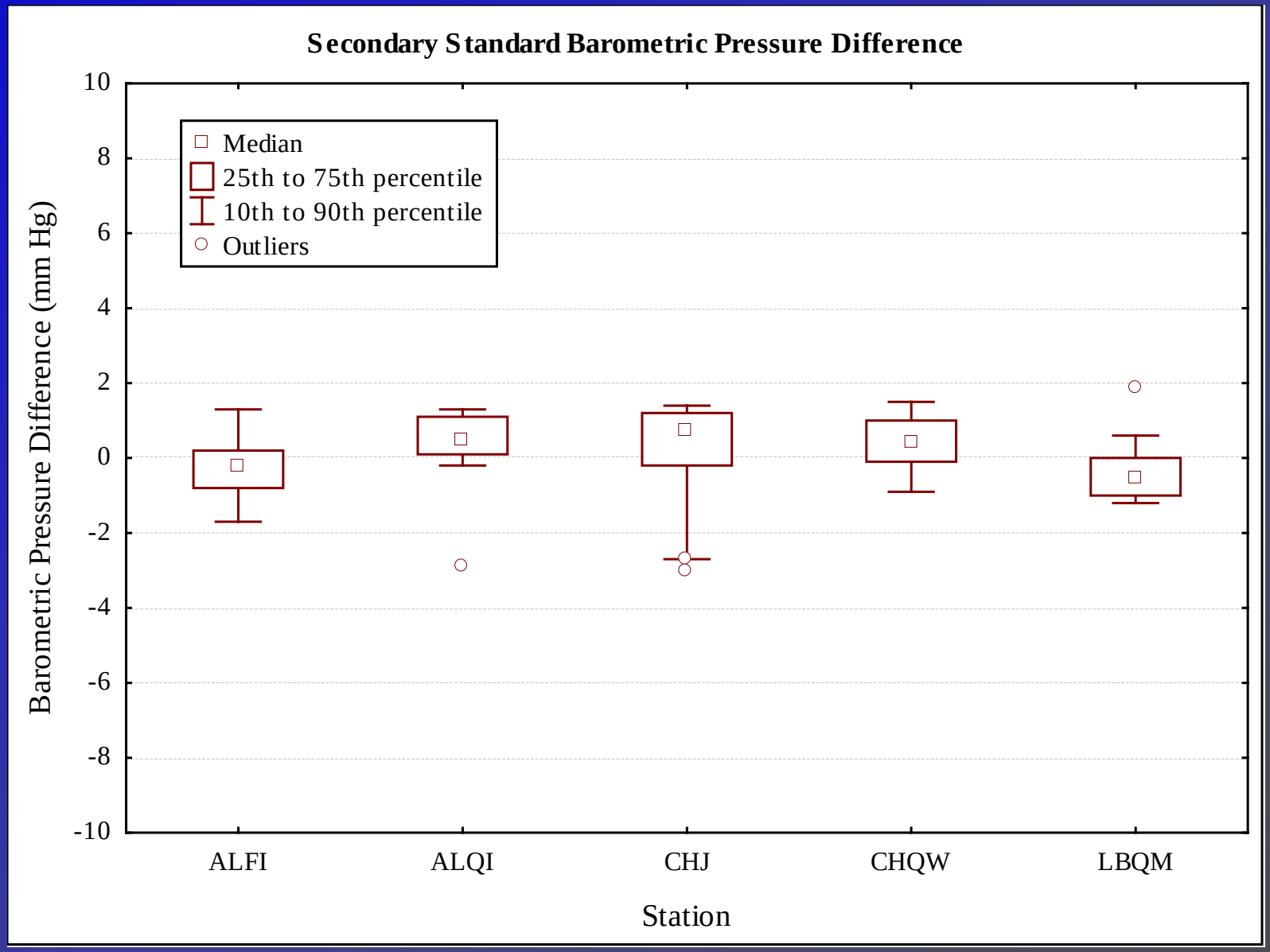
Difference between the secondary standard and the field thermometer

TDG and Temperature QA/QC 2012



Difference between the secondary standard and the TDG instrument

TDG and Temperature QA/QC 2012



Difference between the secondary standard and the Barometer

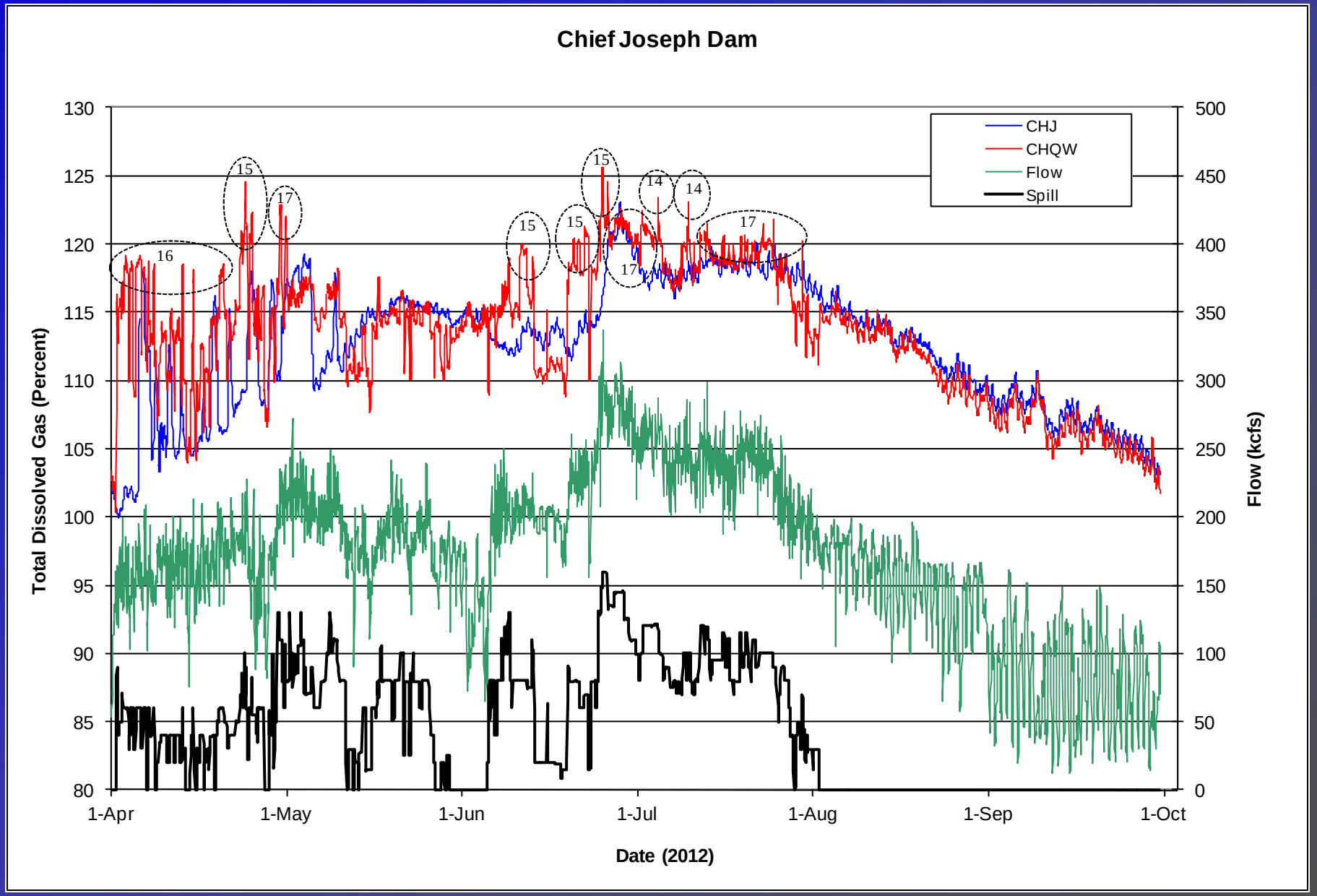
TDG Monitoring 2012

- Overview of 2012 Data QA/QC
  - Laboratory calibration data were good and within 0.1 º C for temperature and 1% saturation for TDG
  - Field calibration data for temperature were good and generally within 0.2ºC of the secondary standard thermometer
  - Field calibration data for TDG were generally within 10 mm Hg of the secondary standard TDG instrument
  - Field calibration data for barometric pressure were generally within 2 mm Hg of the secondary standard

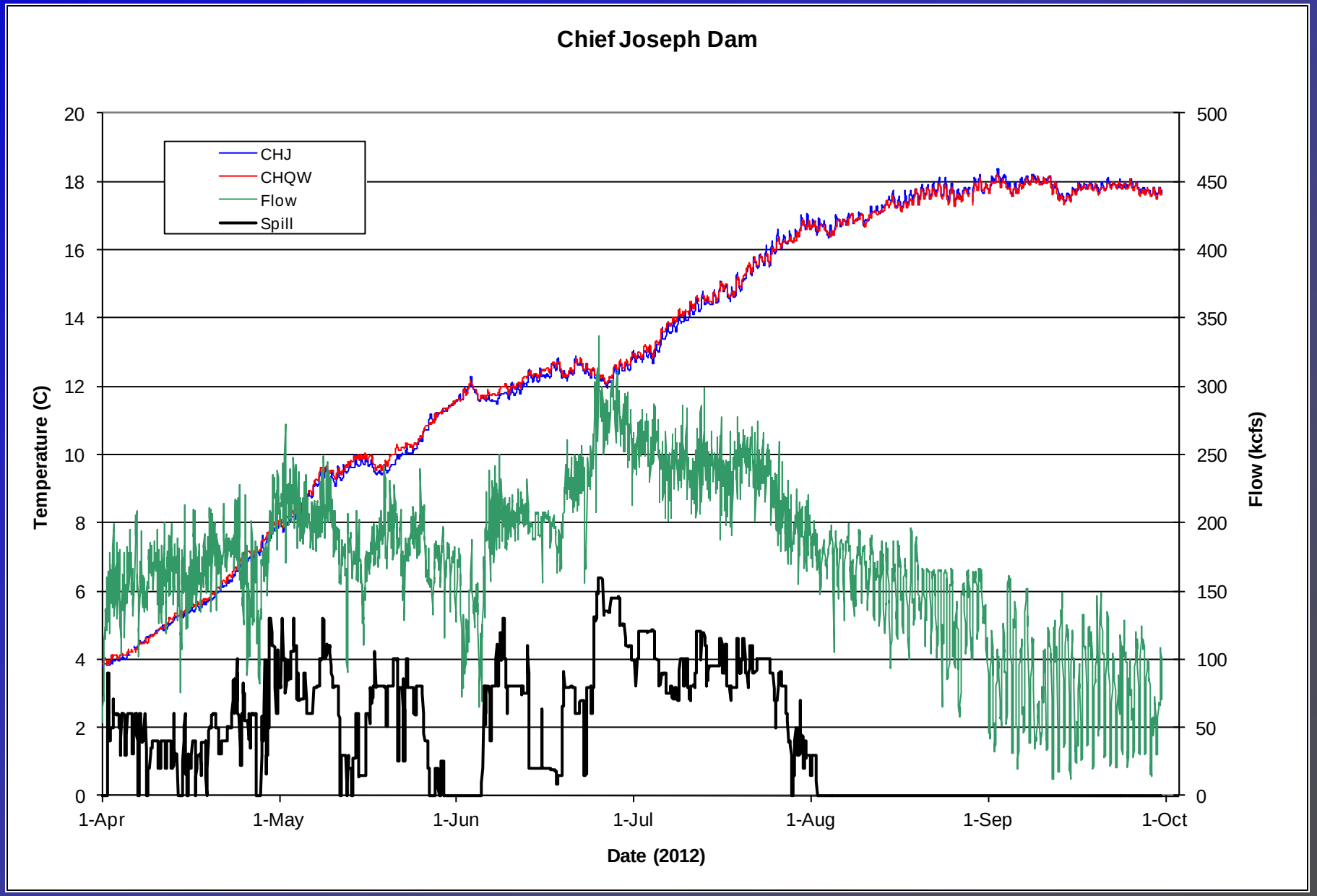
TDG Monitoring 2012

- 2012Spill Season Results for Chief Joseph Dam
  - TDG-Forebay (CHJ)
    - Forebay TDG levels a function of Grand Coulee tailwater TDG
    - Maximum forebay TDG about 122%
  - TDG-Tailwater (CHQW)
    - Several spill bays periodically out of service during season
    - Station located in undiluted spillway flow, not mixed river
    - Max TDG about 126% during 160kcfs spill over 15 of 19 bays
    - Greatest TDG reduction when spill over 18 to 19 bays
    - TDG dependent on:
      - Number of spillbays operational
      - Tailwater elevation
  - Temperature-Forebay/Tailwater
    - Little difference between forebay and tailwater temperatures
    - Forebay temperatures exceeded 16ºC from about late July through Sept 30 and 18 ºC periodically in Sept
    - Tailwater temperatures exceeded 18ºC periodically in Sept

TDG Monitoring 2012



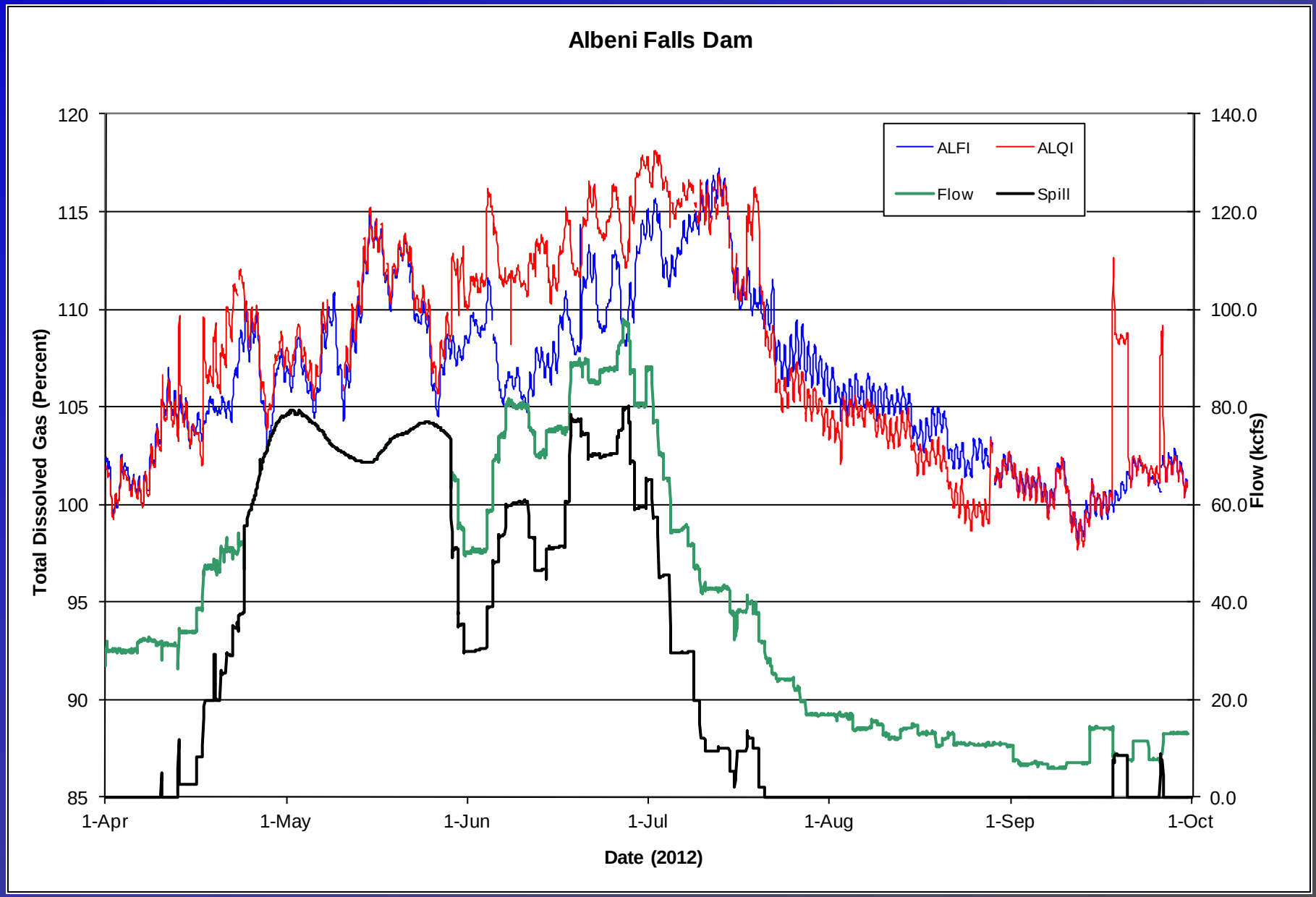
TDG Monitoring 2012



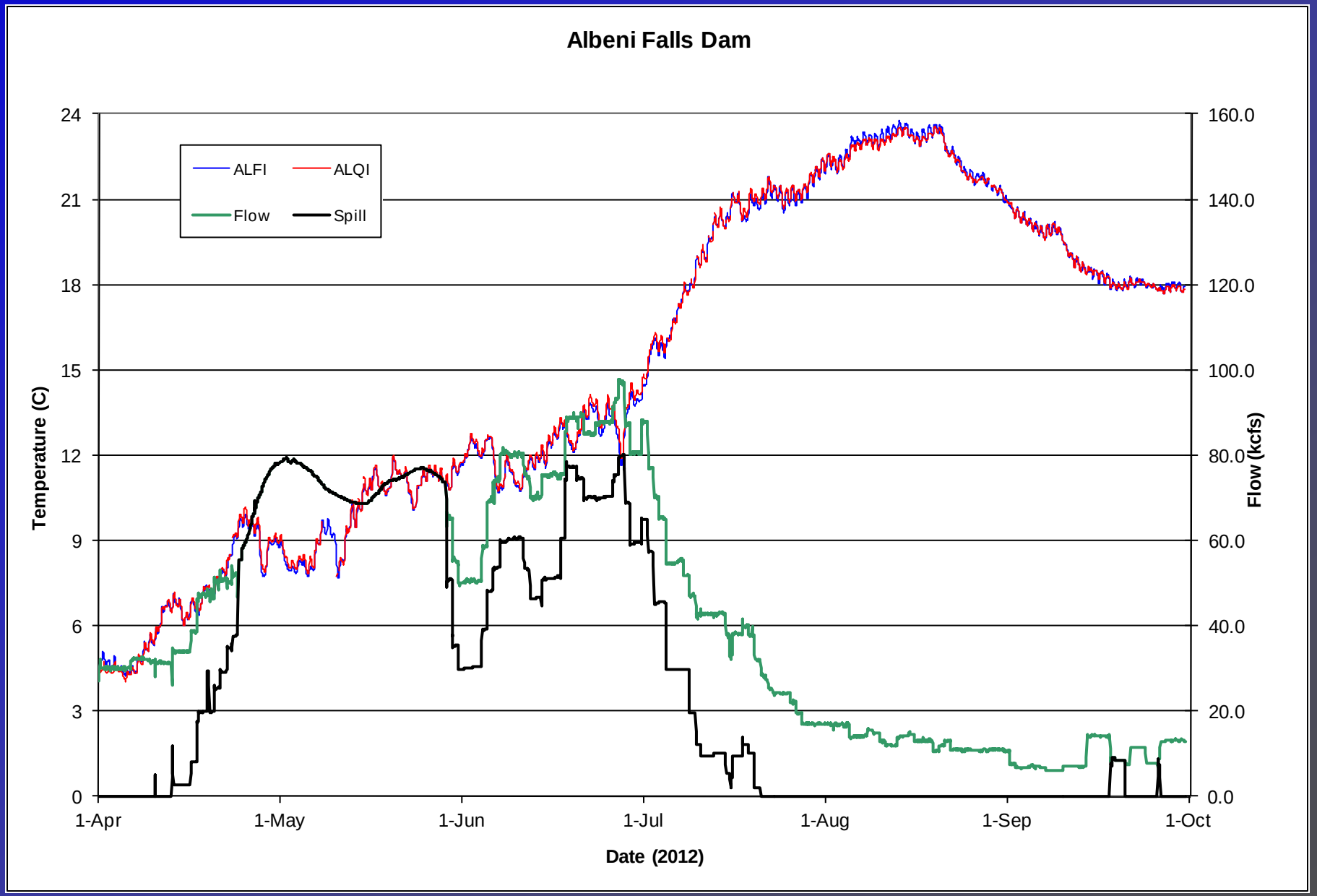
TDG Monitoring 2012

- 2012Spill Season Results for Albeni Falls Dam
  - TDG-Forebay (ALFI)
    - Forebay TDG a function of upstream TDG saturations
    - Highest TDG value was about 117%
  - TDG-Tailwater (ALQI)
    - Highest TDG value was about 118% during 58 kcfs spill
    - Higher spill volumes did not produce higher TDG saturations
    - Free flow conditions did not increase downstream TDG
    - Increase in tailwater TDG saturations largely a function of forebay TDG, head, and number of spillbays used
    - Max TDG increase (12%) in Sept during 8kcfs spill over 4 of 10 bays
  - Temperature-Forebay/Tailwater
    - Forebay and tailwater temperatures are similar, no stratification
    - Forebay and tailwater exceeded IDEQ daily average temperature standard (19ºC) from about early July through mid September
    - Forebay and tailwater exceeded I DEQ maximum daily temperature standard (22ºC) from about early August through late August

TDG Monitoring 2012



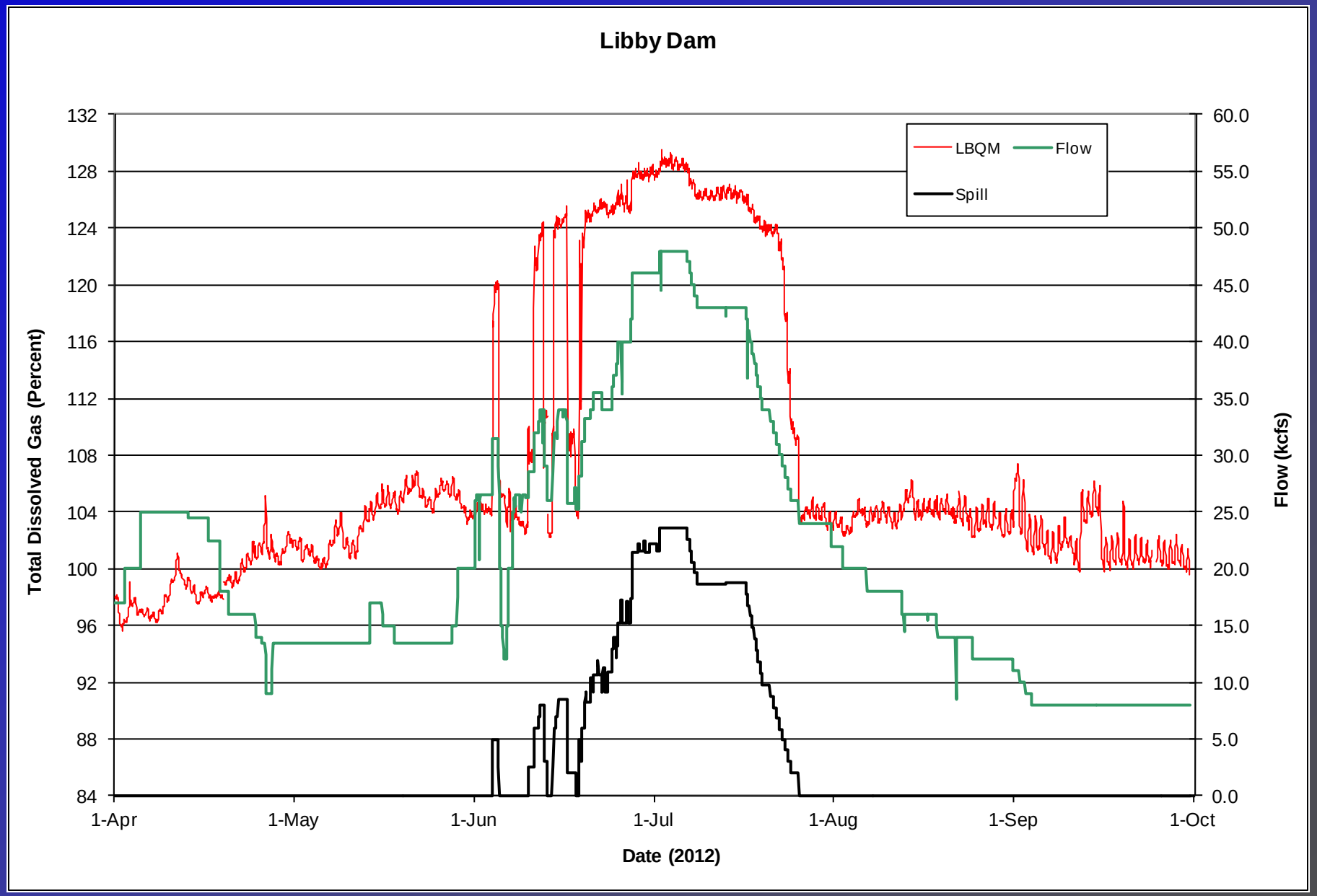
TDG Monitoring 2012



TDG Monitoring 2012

- 2012 Spill Season Results for Libby Dam
  - Record rainfall in watershed in May/June
  - Spillway used during 2012
  - Max TDG of 129% during 23.6 kcfs spill
  - Temperature did not exceed 18ºC

TDG Monitoring 2012



TDG Monitoring 2012