Appendix A

2020 Total Dissolved Gas

Fixed Monitoring Stations

Introduction

The Corps fixed monitoring station (FMS) system is composed of 28 gauges that collect hourly readings of total dissolved gas (TDG), barometric pressure, percent TDG saturation, and water temperature. This monitoring system is associated with 19 projects on the Columbia, Lower Snake, Clearwater, Kootenai, and Pend Oreille rivers as shown in Figure 1. Table 1 lists each FMS identifying the station name, station code, dates of operation, river name, project, FMS location, and maintenance and calibration responsibilities. More details, including photos, for each station can be found on pages A-5 through A-32.

Table A- 1: Total Dissolved Gas (TDG) Monitoring Station Summary Data Sheet

Station Name	Station Code	Years of Operation	Dates of Operation	River Name	River Mile	Bank	Latitude[1]	Longitude[1]	Project	Location Description	Maintanence Responsibility	Maintenance Sequence	Calibration Responsibility	Owner
Albeni Falls Forebay	ALFI	2004-Present	April 1-Sept 1	Pend Oreille River	87.0	Right Bank	48° 10' 40.2"	116° 59' 52.3"	Albani Falls Dam	Forebay	Columbia Basin Environmental	Two weeks	Columbia Basin Environmental	USACE, Seattle District
Albeni Falls Tailwater	ALQI	2005-Present	April 1-Sept 1	Pend Oreille River	86.8	Left Bank	48° 10' 40.1"	117° 00' 8.7"	Albeny Falls Dam	Tailwater	Columbia Basin Environmental	Two weeks	Columbia Basin Environmental	USACE, Seattle District
Anatone	ANQW	1999-Present	April 1-Sept 1	Snake River	167.5	Left Bank	46° 05' 50.8"	116° 58' 41.2"	None	River	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Bonneville Forebay	BON	1986-Present	April 1-Sept 1	Columbia River	146.1	Right Bank	45° 38' 44.4"	121° 56' 24.3"	Bonneville Dam	Forebay	USGS, Portland Office	Three weeks	USGS, Portland Office	USACE, Portland District
Camas-Washougal	CWMW	1993-Present	April 1-Sept 1	Columbia River	121.7	Right Bank	45° 34' 38.4"	122° 22' 43.3"	None	River	USGS, Portland Office	Three weeks	USGS, Portland Office	USACE, Portland District
Cascades Island	CCIW	2004-Present	April 1-Sept 1	Columbia River	145.6	Right Bank	45° 38' 44.4"	121° 56' 44.3"	Bonneville Dam	Tailwater	USGS, Portland Office	Three weeks	USGS, Portland Office	USACE, Portland District
Chief Joseph Forebay	CHJ	1985-Present	April 1-Sept 1	Columbia River	545.1	Left Bank	47° 59' 38.7"	119° 38' 42.6"	Chief Joseph Dam	Forebay	Columbia Basin Environmental	Two weeks	Columbia Basin Environmental	USACE, Seattle District
Chief Joseph Tailwater	CHQW	1985-Present	April 1-Sept 1	Columbia River	543.8	Right Bank	48° 00' 17.2"	117° 39' 30.3"	Chief Joseph Dam	Tailwater	Columbia Basin Environmental	Two weeks	Columbia Basin Environmental	USACE, Seattle District
DWR Hatchery Collection Channel	DHCI	2017-Present	Year Round	North Fork, Clearwater River	0.5	Left Bank	46° 30' 55.3"	116° 19' 16.4"	Dworshak Dam	Hatchery Collection Channel	NWW District in an agreement with USFW	Three weeks	NWW District in an agreement with USFW	U.S. Fish and Wildlife
Dworshak Tailwater	DWQI	1993-Present	Year Round	North Fork, Clearwater River	0.5	Left Bank	46° 30' 11.6"	116° 19' 16.4"	Dworshak Dam	Tailwater	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Ice Harbor Forebay	IHRA	2005-Present	April 1-Sept 1	Snake River	10	Right Bank	46° 15' 5.8"	118° 52' 39.0"	Ice Harbor Dam	Forebay	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Ice Harbor Tailwater	IDSW	1994-Present	Year Round	Snake River	6.1	Right Bank	46° 14' 27.6"	118° 57' 13.7"	Ice Harbor Dam	Tailwater	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
John Day Forebay	JDY	2004-Present	April 1-Sept 1	Columbia River	215.7	Right Bank	45° 43' 13.4"	120° 41' 41.2"	John Day Dam	Forebay	USGS, Portland Office	Three weeks	USGS, Portland Office	USACE, Portland District
John Day Tailwater	JHAW	1995-Present	Year Round	Columbia River	214.7	Right Bank	45° 42' 48.4"	120° 42' 39.2"	John Day Dam	Tailwater	USGS, Portland Office	Three weeks	USGS, Portland Office	USACE, Portland District

1. Lat/Long coordinates using NAD-83 datum.
2. The seasonal gauges may be installed several weeks before April 1 and remain in operation several weeks after August 31.

Station Name	Station Code	Years of Operation	Dates of Operation	River Name	River Mile	Bank	Latitude[1]	Longitude[1]	Project	Location Description	Maintenance Responsibility	Maintenance Sequence	Calibration Responsibility	Owner
Libby Tailwater	LBQM	2004-Present	April 1-Sept 1	Kootenai River	221.5	Left Bank	48° 24' 2.4"	115° 19' 7.0"	Libby Dam	Tailwater	USGS, Pasco Office	Two weeks	USGS, Pasco Office	USACE, Walla Walla District
Little Goose Forebay	LGSA	2005-Present	April 1-Sept 1	Snake River	70.4	Left Bank	46° 34' 58.8"	118° 01' 29.2"	Little Goose Dam	Forebay	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Little Goose Tailwater	LGSW	1995-Present	Year Round	Snake River	69.6	Right Bank	46° 35' 00.5"	118° 02' 37.4"	Little Goose Dam	Tailwater	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Lower Granite Forebay	LWG	1985-Present	April 1-Sept 1	Snake River	107.5	Mid-River	46° 39' 34.2"	117° 25' 34.9"	Lower Granite Dam	Forebay	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Lower Granite Tailwater	LGNW	1995-Present	Year Round	Snake River	106.7	Right Bank	46° 39' 58.1"	117° 26' 19.3"	Lower Granite Dam	Tailwater	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Lower Monumental Forebay	LMNA	2005-Present	April 1-Sept 1	Snake River	41.7	Mid-River	46° 33' 45.2"	118° 32' 4.4"	Lower Monumental Dam	Forebay	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Lower Monumental Tailwater	LMNW	1995-Present	Year Round	Snake River	40.4	Left Bank	46° 33' 4.5"	118° 32' 59.0"	Lower Monumental Dam	Tailwater	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
McNary Forebay	MCNA	2005-Present	April 1-Sept 1	Columbia River	292.3	Right Bank	45° 56' 28.8"	119° 17' 35.5"	McNary Dam	Forebay	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
McNary Tailwater	MCPW	1995-Present	Year Round	Columbia River	290.7	Right Bank	45° 56' 2.8"	119° 19' 35.5"	McNary Dam	Tailwater	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Pasco	PAQW	1999-Present	April 1-Sept 1	Columbia River	329.1	Left Bank	46° 13' 26.3"	119° 06' 57.3"	McNary Dam	River	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
Peck	PEKI	1996-Present	April 1-Sept 1	Clearwater River	37.4	Left Bank	46° 30' 0.9"	116° 23' 32.4"	Dworshak Dam	River	USGS, Pasco Office	Three weeks	USGS, Pasco Office	USACE, Walla Walla District
The Dalles Forebay	TDA	1985-Present	April 1-Sept 1	Columbia River	192.4	Left Bank	45° 37' 11.5"	121° 07' 16.5"	The Dalles	Forebay	USGS	Three weeks	USGS	USACE, Portland District
The Dalles Tailwater	TDDO	1996-Present	Year Round	Columbia River	189.1	Left Bank	45° 36' 29.7"	121° 11' 23.8"	The Dalles	Tailwater	USGS	Three weeks	USGS	USACE, Portland District
Warrendale	WRNO	1985-Present	Year Round	Columbia River	140.3	Left Bank	45° 36' 29.1"	122° 02' 19.4"	Bonneville Dam	Tailwater	USGS	Three weeks	USGS	USACE, Portland District

1. Lat/Long coordinates using NAD-83 datum.
2. The seasonal gauges may be installed several weeks before April 1 and remain in operation several weeks after August 31.

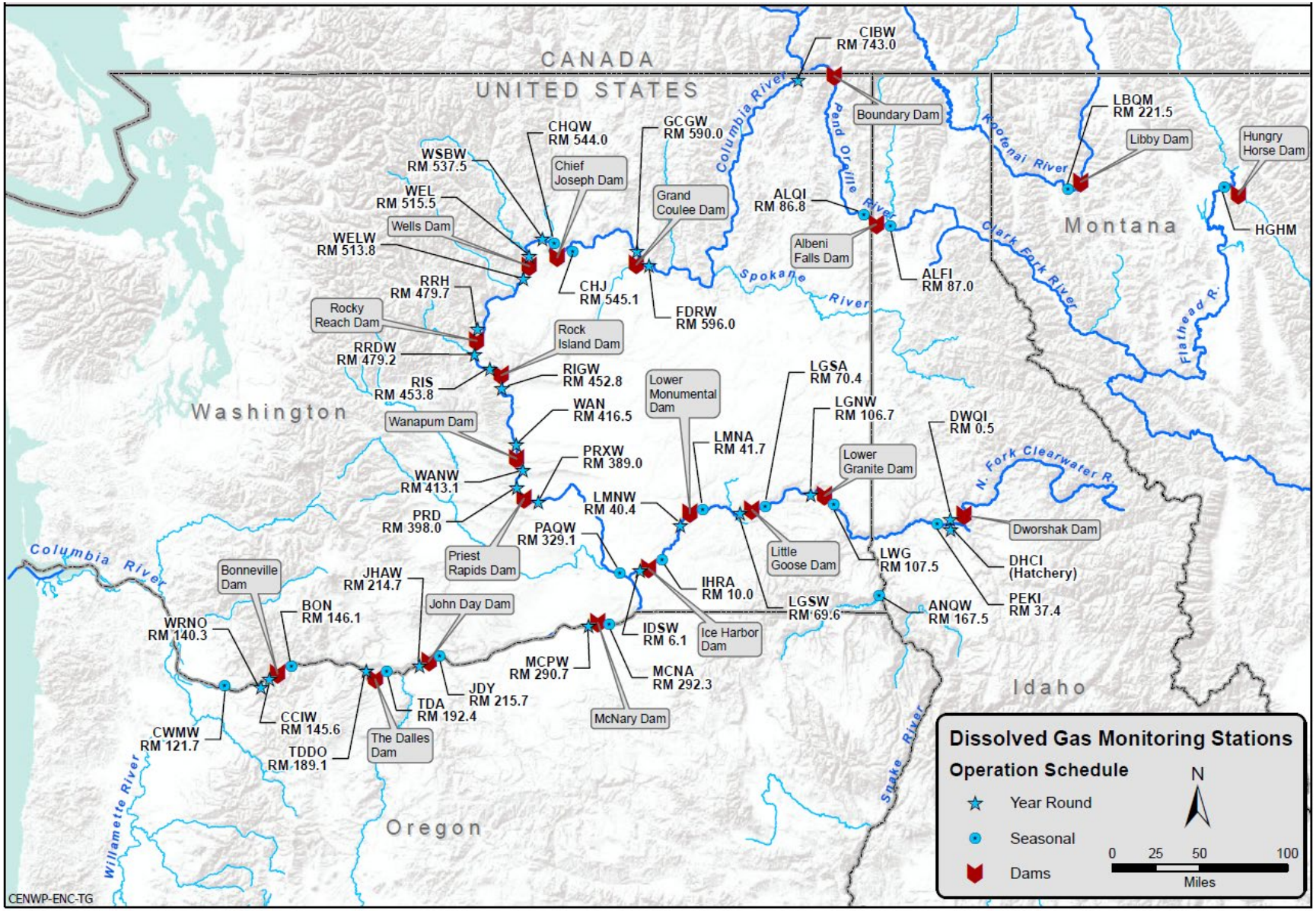
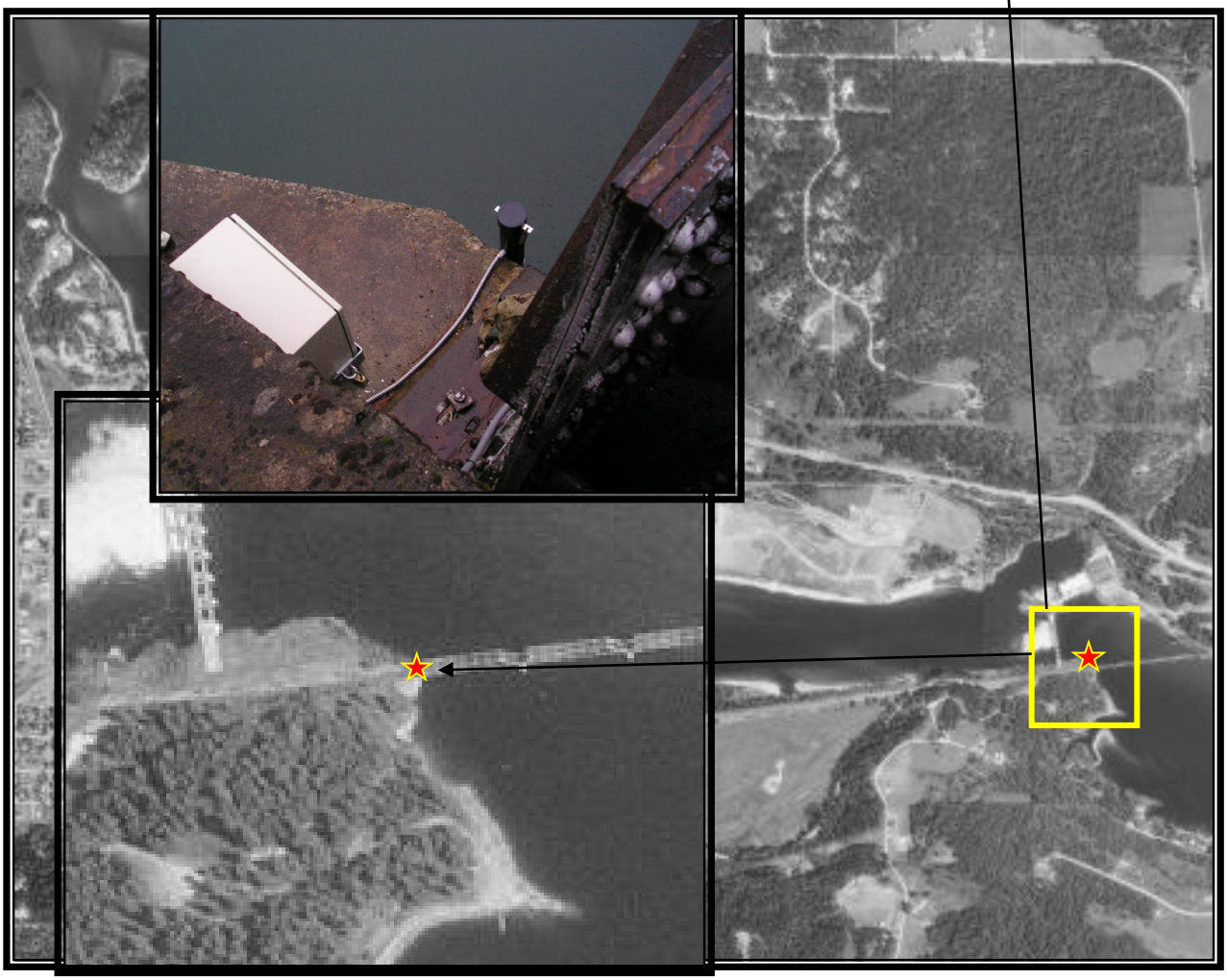


Figure A- 1: 2020 Total Dissolved Gas Fixed Monitoring Stations System

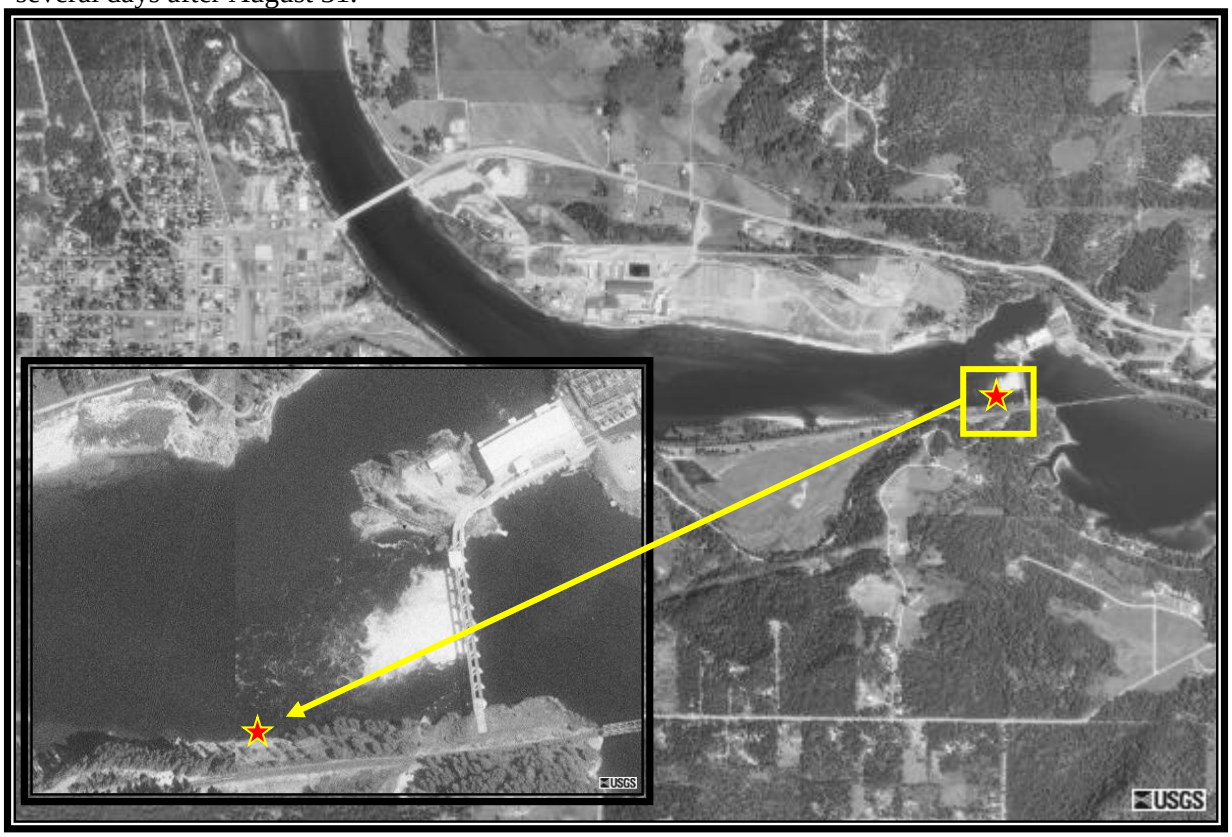
1. Albeni Falls Forebay TDG Monitoring Station (ALFI)

Gage Elevation: Fixed
Latitude: 48° 10' 40.2" N
Longitude: 116° 59' 52.3" W
Distance from Dam: --
Datum: NAD83
River: Pend Oreille
River Mile: 87.0
USGS-ID: --
Owner: U.S. Army Corps of Engineers-NWS
Gauge Type: Hydrosonde
Data Transmission: Radio Transmission
Dates of Operation: April 1– August 31*
Years of Operation: 2004 – Present
Water Conditions: Mixed
Location: Attached to the railroad bridge pier on the southern shoreline of the Pend Oreille River
This gage replaced: N/A
Reasons for replacement: N/A
Comments: * The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



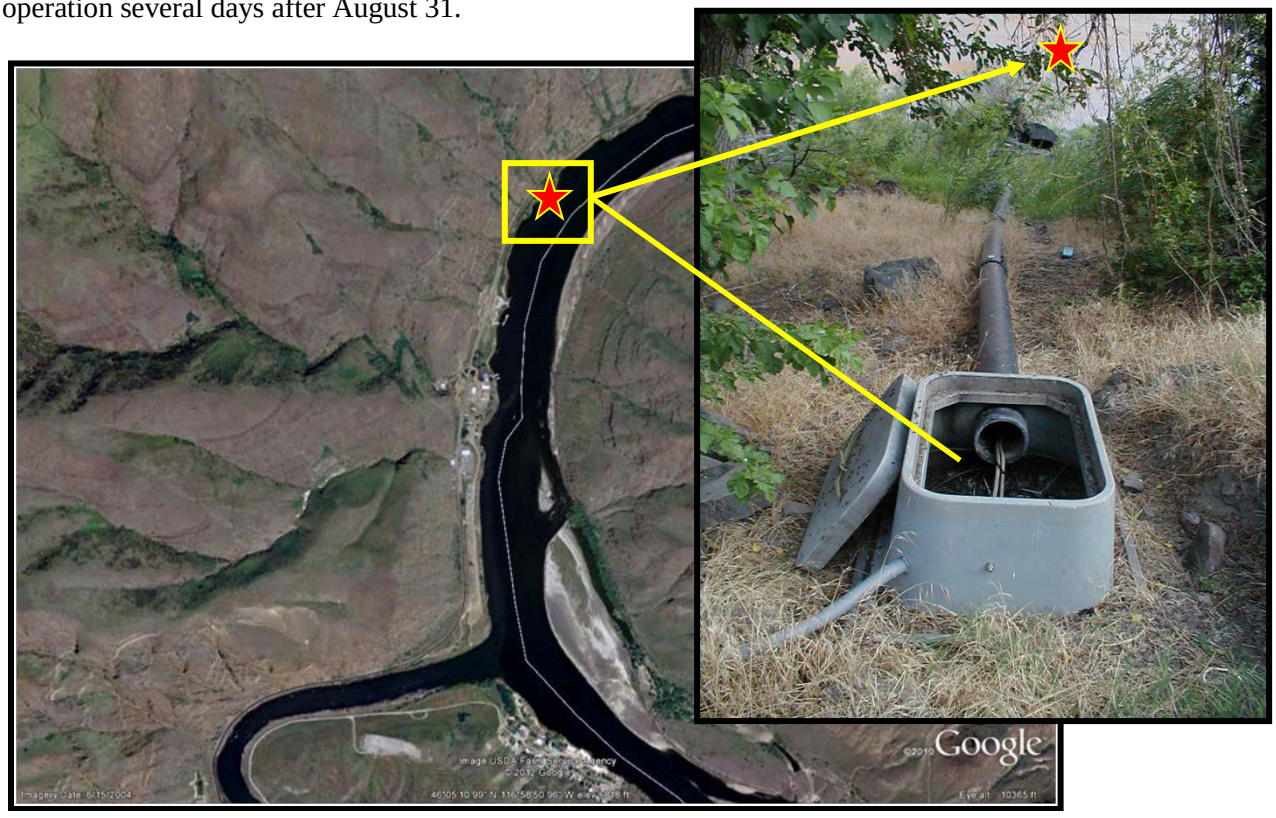
2. Albeni Falls Tailwater TDG Monitoring Station (ALQI)

Gage Elevation: Fixed
Latitude: 48° 10' 40.1" N
Longitude: 117° 00' 8.7" W
Distance from Dam: 700 ft
Datum: NAD83
River: Pend Oreille
River Mile: 86.8
USGS-ID: --
Owner: U.S. Army Corps of Engineers-NWS
Gauge Type: Hydrosonde
Data Transmission: Radio Transmission
Dates of Operation: April 1 – August 31 *
Years of Operation: 2005 - Present
Water Conditions: Tailwater Monitor
Location: On the southern shoreline of the Pend Oreille River.
This gauge replaced: ALFW
Reasons for replacement: This gauge was initiated at this site on July 28, 2005 due to sediment burying the previous site several times. This newer location is immediately below the spillway aerated zone in deeper water which should minimize sedimentation problems.
Comments: * The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



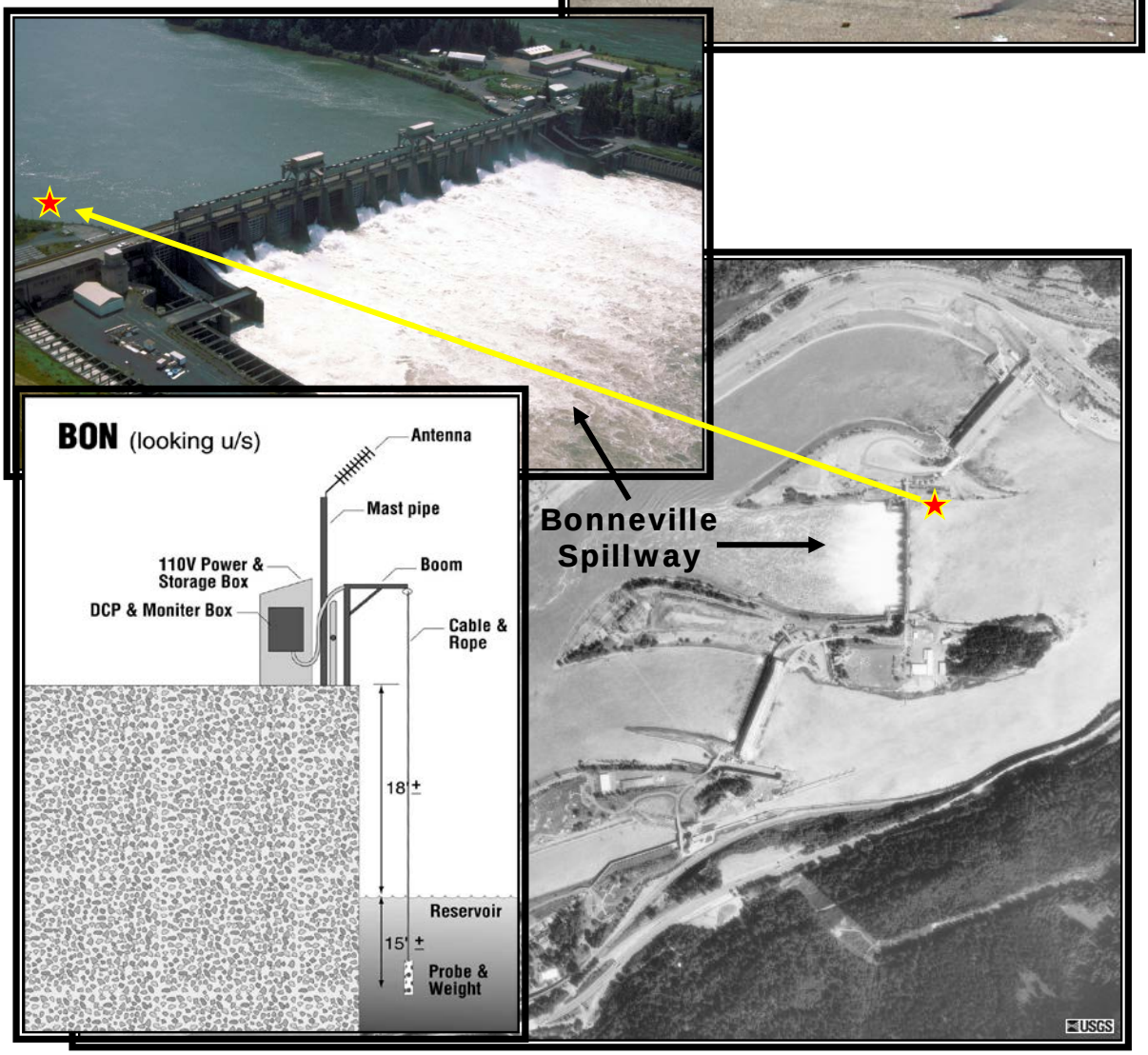
3. Anatone TDG Monitoring Station on the Snake River (ANQW)

Gage Elevation: Fixed
Latitude: 46º 05’ 50.8” N
Longitude: 116º 58’ 41.2382” W
Distance from Dam: N/A
Datum: NAD83
River: Snake
River Mile: 167.5
USGS-ID: 13334300
Owner: U.S. Army Corps of Engineers-NWW
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – Aug 31*
Years of Operation: 1999 - Present
Water Conditions: Open River
Location: This gauge is located on the Washington shoreline of the Snake River approximately 1.3 miles downstream of the Grande Ronde River confluence. It is co-located with the USGS Anatone Stream gauge (ANAW).
This gage replaced: N/A
Reasons for replacement: N/A
Comments: *The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



4. Bonneville Forebay TDG Monitoring Station (BON)

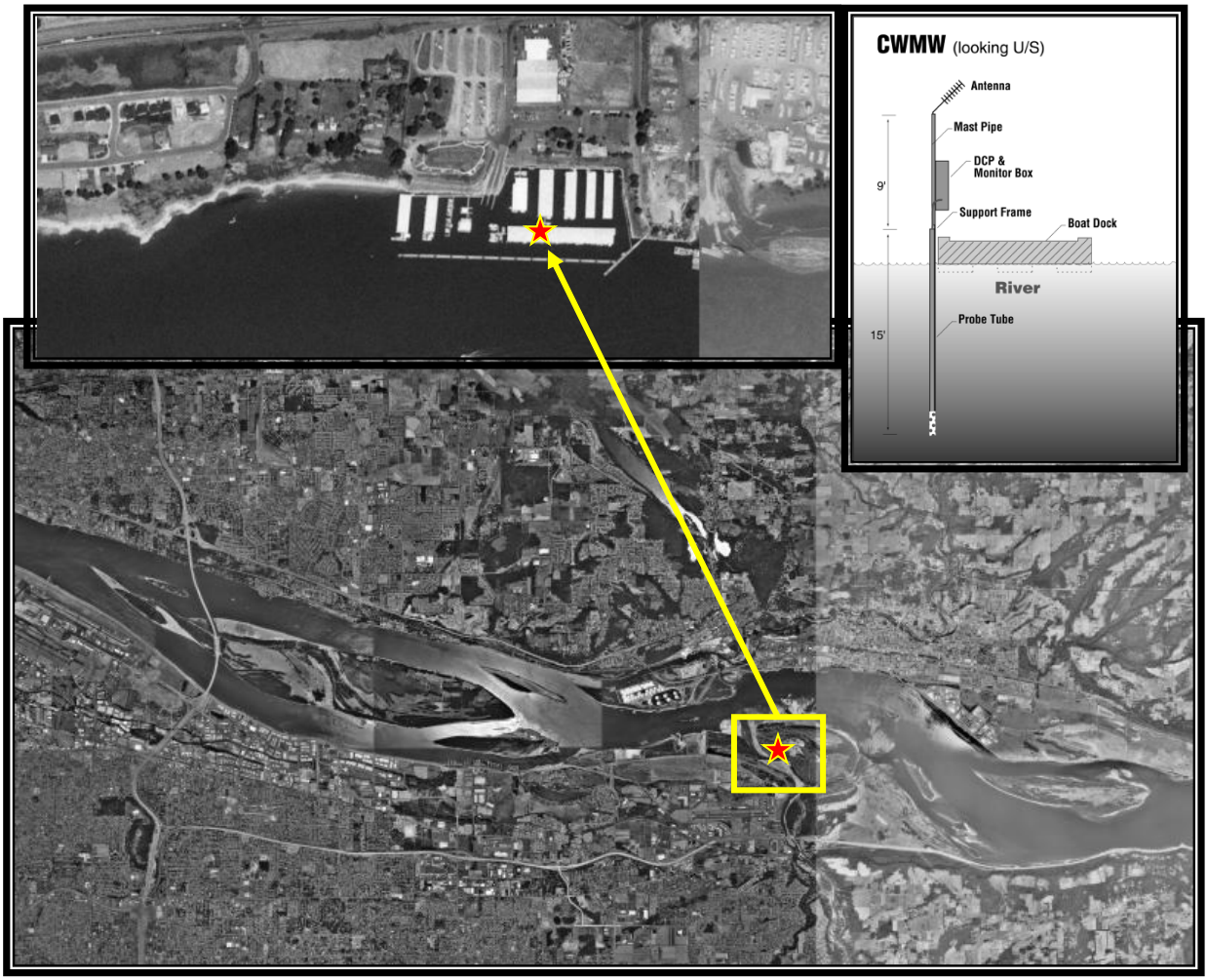
Gage Elevation: Fixed
Latitude: 45º 38' 44.42147" N
Longitude: 121º 56' 24.29279" W
Distance from Dam: On face of dam
Datum: NAD83
River: Columbia
River Mile: 146.1
USGS-ID: 453845121562000
Owner: U.S. Army Corps of Engineers-NWP
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – August 31*
Years of Operation: 1986 – Present
Water Conditions: Mixed
Location: On the northern side of the spillway channel on Cascade Island just upstream of Spillbay #1.
This gage replaced: N/A
Reason for replacement: N/A
Comments: *The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



5. Camas-Washougal TDG Monitoring Station (CWMW)

Gage Elevation: Variable
Latitude: 45° 34' 38.42788" N
Longitude: 122° 22' 43.32961" W
Distance from Dam: 24 miles downstream from Bonneville
Datum: NAD83
River: Columbia
River Mile: 121.7
USGS-ID: 453439122223900
Owner: U.S. Army Corps of Engineers-NWP
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – August 31*
Years of Operation: 1993 – Present
Water Conditions: Mixed
Location: Attached to the boat dock at the outer edge of the harbor at the Port of Camas/Washougal, WA
This gage replaced: N/A
Reason for replacement: N/A
Comments: This gauge is currently being utilized as a surrogate forebay gauge for the management of spill at Bonneville Dam.

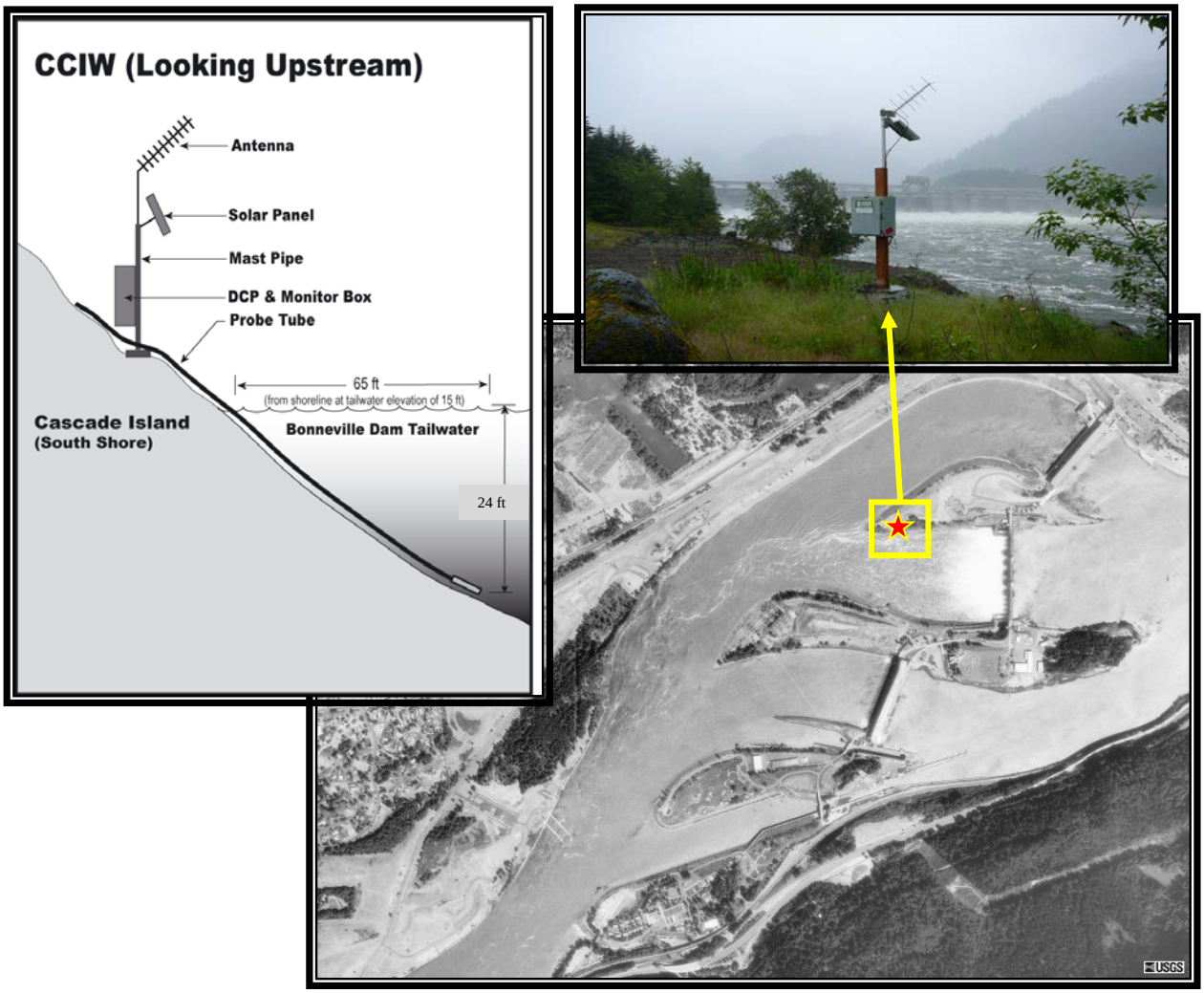
*The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



6. Cascades Island TDG Monitoring Station (CCIW)

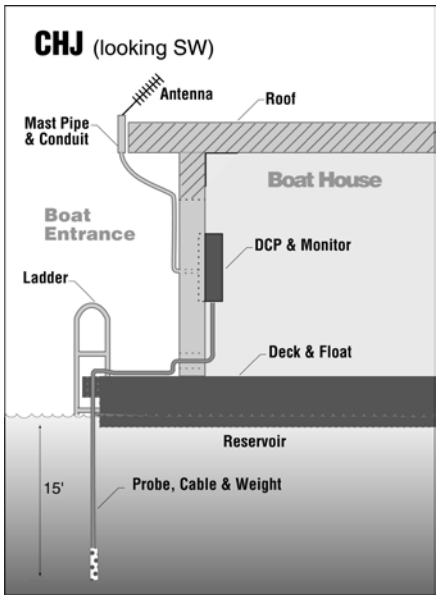
Gage Elevation: Fixed
Latitude: 45° 38' 44.42143" N
Longitude: 121° 56' 44.29340" W
Distance from Dam: 0.27 miles (1400 ft)
Datum: NAD83
River: Columbia
River Mile: 145.6
USGS-ID: 453845121564001
Owner: U.S. Army Corps of Engineers-NWP
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – August 31*
Years of Operation: 2004 – Present
Water Conditions: Spillway
Location: Within the Bonneville Dam spillway channel on Cascade Island.
This gage replaced: September 2011; **Probe pipes replaced**: March 2014.
Reason for replacement: Old gage destroyed due to high velocity flows.
Comments: Became the spill management gauge as of 2004. Location of station moved to higher elevation.

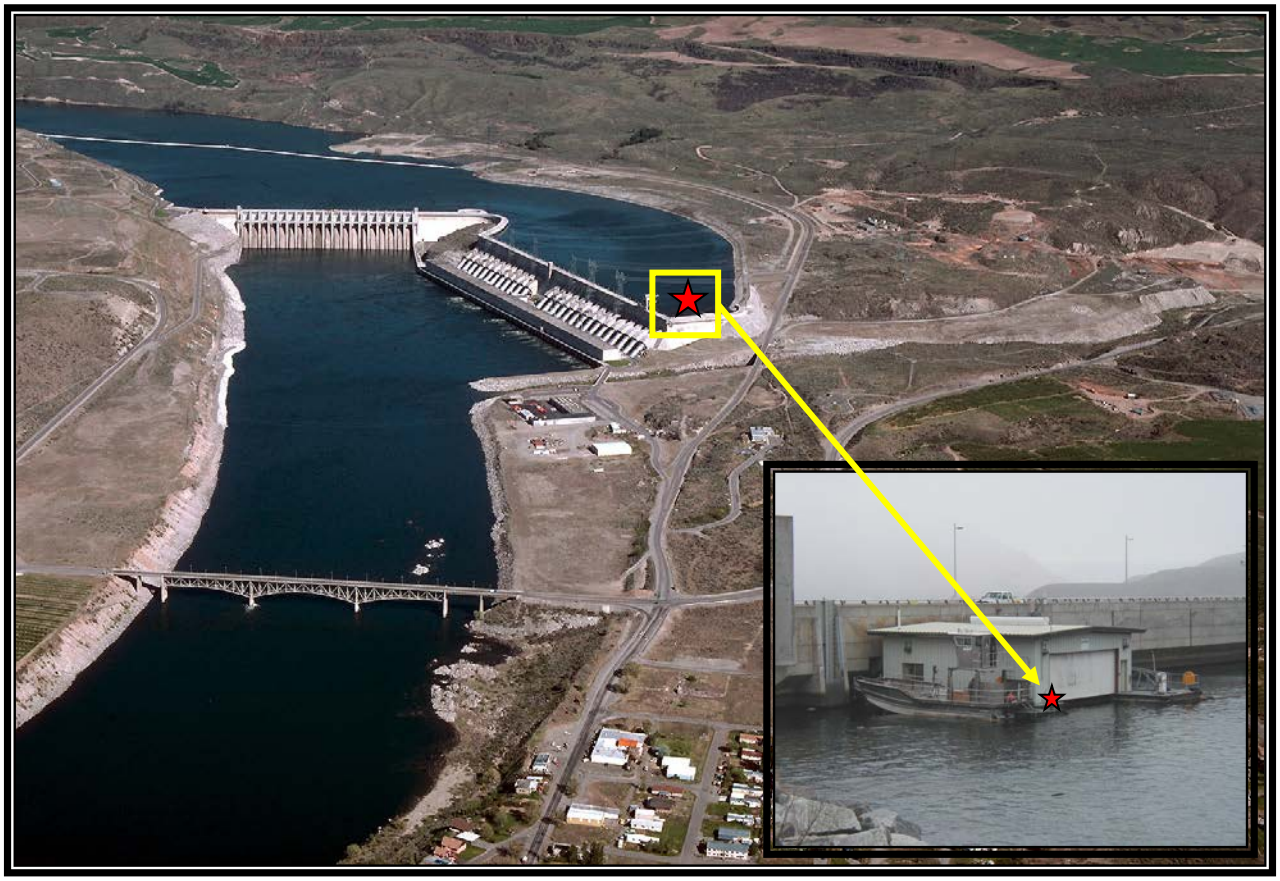
* The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



7. Chief Joseph Forebay TDG Monitoring Station (CHJ)

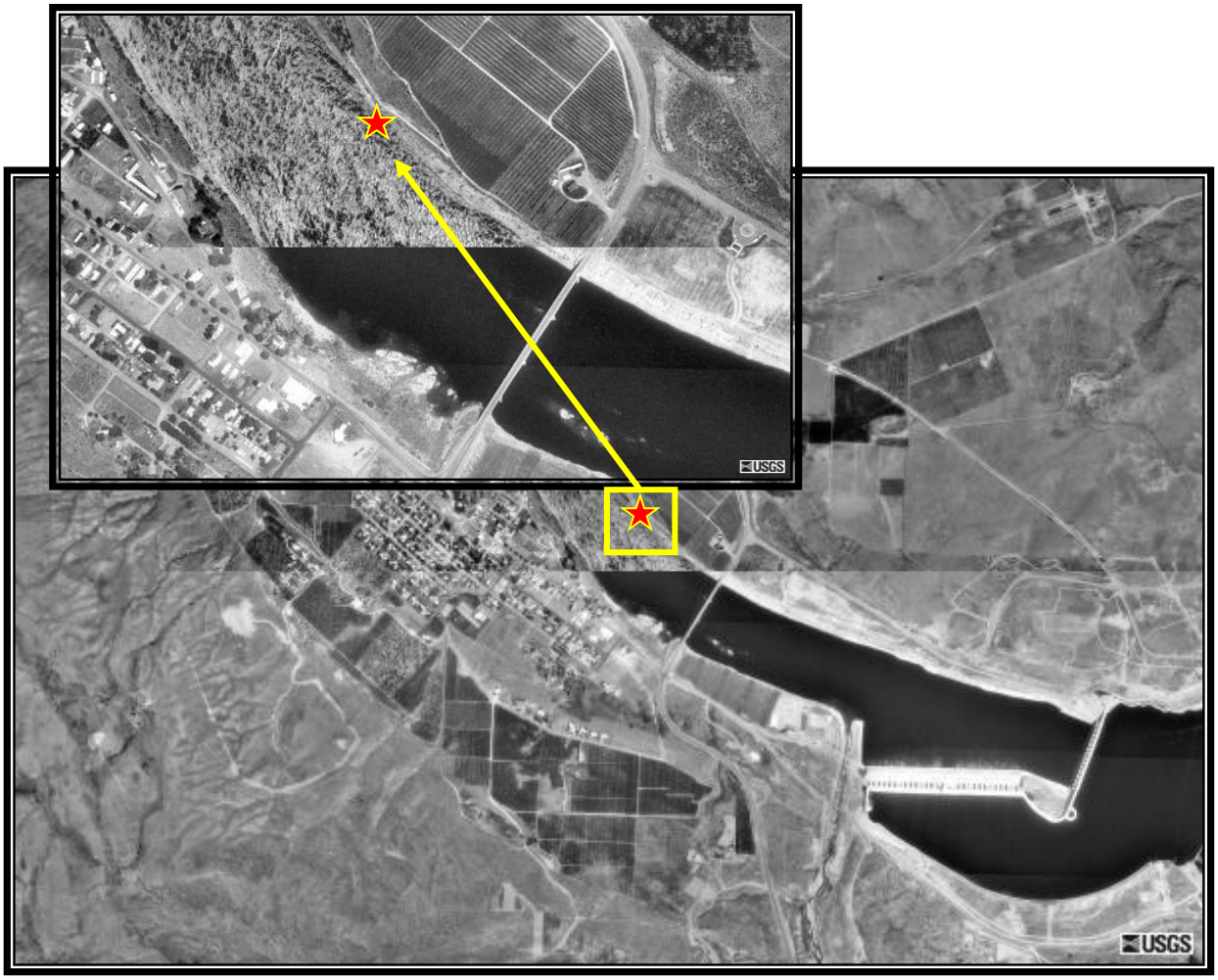
Gage Elevation: Fixed
Latitude: 47º 59' 38.7" N
Longitude: 119º 38' 42.6" W
Distance from Dam: At Dam
Datum: NAD83
River: Columbia
River Mile: 545.1
USGS-ID:
Owner: U.S. Army Corps of Engineers-NWS
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – Aug. 31*
Years of Operation: 1985 - Present
Water Conditions: Mixed
Location: Along the southern edge of Lake Rufus Woods (inside the boat house).
This gage replaced: N/A
Reason for replacement: N/A
Comments: * The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.





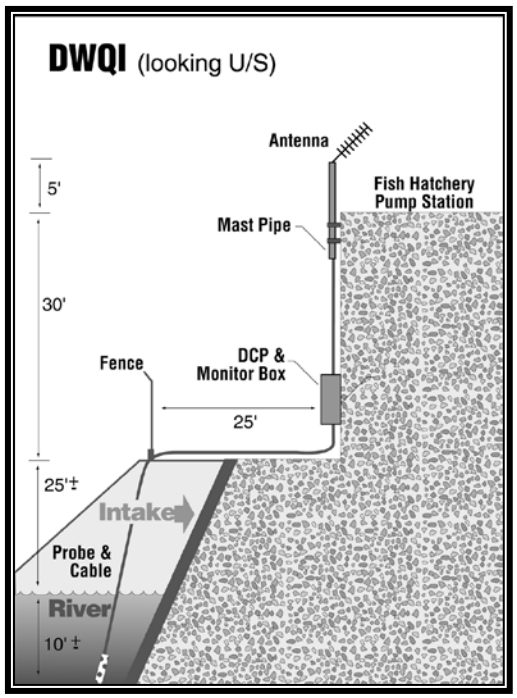
8. Chief Joseph Tailwater TDG Monitoring Station (CHQW)

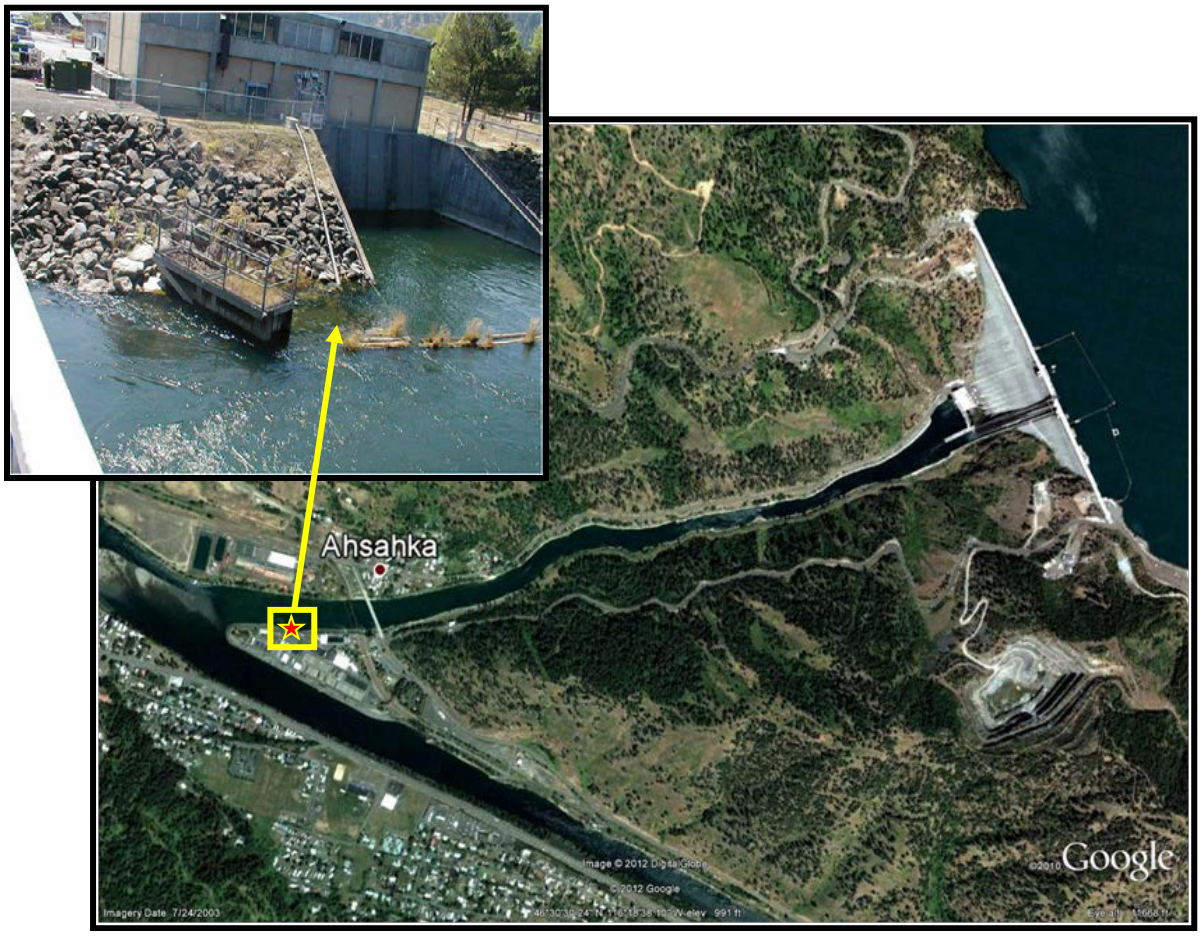
Gage Elevation: Fixed
Latitude: 48° 00' 17.2" N
Longitude: 119° 39' 30.3" W
Distance from Dam: 1 mile
Datum: NAD83
River: Columbia
River Mile: 543.8
USGS-ID: --
Owner: U.S. Army Corps of Engineers-NWS
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – Aug 31*
Years of Operation: 1985 – Present
Water Conditions: Spillway
Location: North bank of the river, just downstream of the Highway 17 Bridge.
This gage replaced: N/A
Reason for gage replacement: N/A
Comments: *The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.



9. Dworshak TDG Monitoring Station (DWQI)

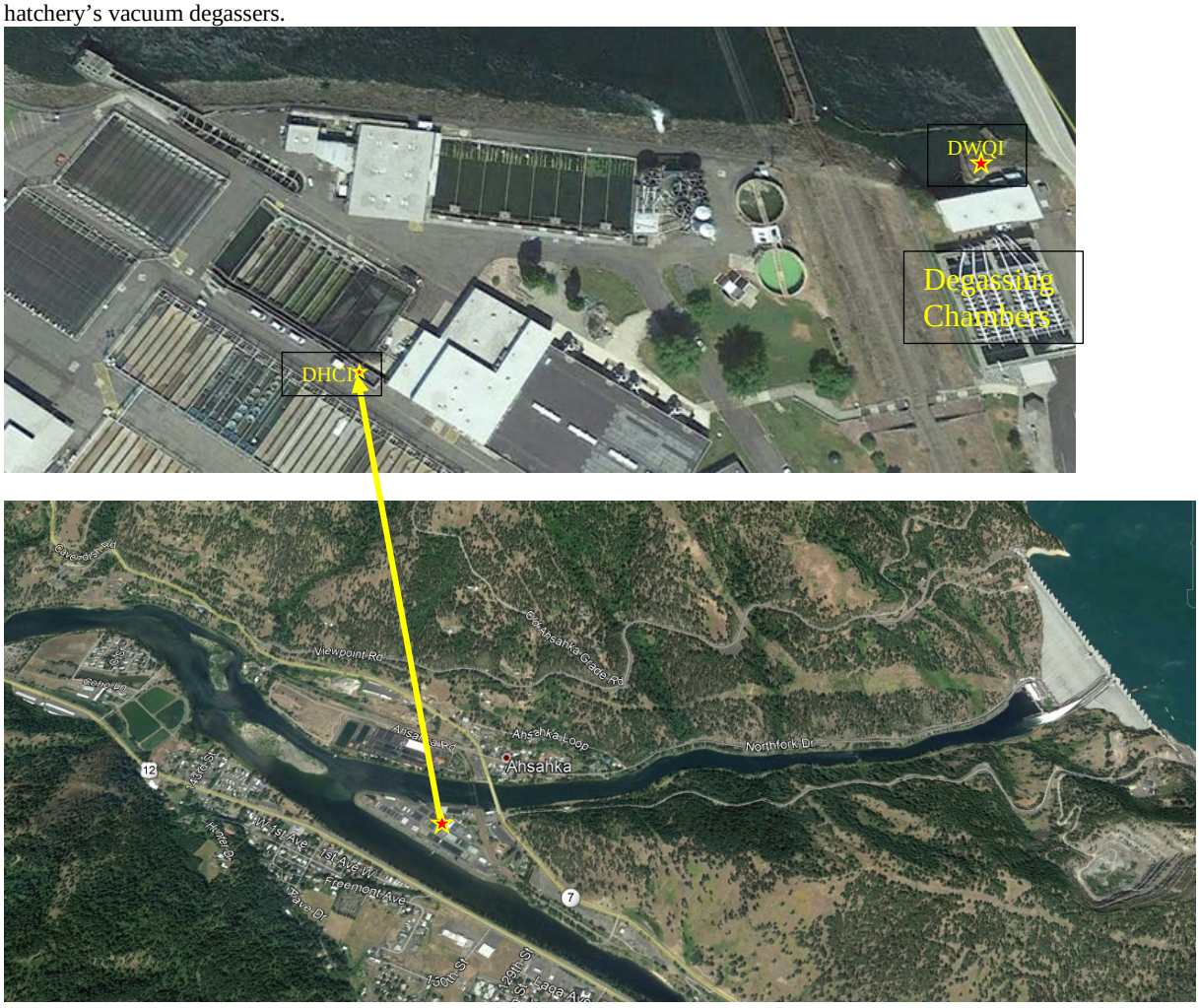
Gage Elevation: Fixed
Latitude: 46° 30’ 11.6464” N
Longitude: 116° 19’ 16.4090” W
Distance from Dam: 1.5 miles
Datum: NAD83
River: North Fork, Clearwater River
River Mile: 0.5
USGS-ID: 13341000
Owner: U.S. Army Corps of Engineers-NWW
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Year round
Years of Operation: 1993 - Present
Water Conditions: Mixed
Location: On the southern bank of the North Fork, Clearwater River between the bridge and the U.S. Fish and Wildlife Service Fish Hatchery outflow pipe.
This gage replaced: N/A
Reason for replacement: N/A
Comments: --





10. Dworshak Hatchery Collection Channel TDG Monitoring Station (DHCI)

Gage Elevation: Fixed
Latitude: 46° 30' 55.332" N
Longitude: 116° 19' 16.392" W
Distance from Dam: 1.5 miles downstream from Dworshak Dam, and 325 feet inland from the river.
Datum: NAD83
River: North Fork, Clearwater River
River Mile: 0.5
USGS-ID: None
Owner: U.S. Fish and Wildlife Service
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Year round
Years of Operation: 2017 – Present
Water Conditions: Mixed, treated.
Location: Gauge is located in a collection channel of the U.S. Fish and Wildlife Service Dworshak National Fish Hatchery.
This gage replaced: N/A
Reason for replacement: N/A
Comments: This gauge is used to assess the TDG levels at Dworshak National Fish Hatchery during Dworshak Dam spill. The water being measured has been treated by the hatchery's vacuum degassers.

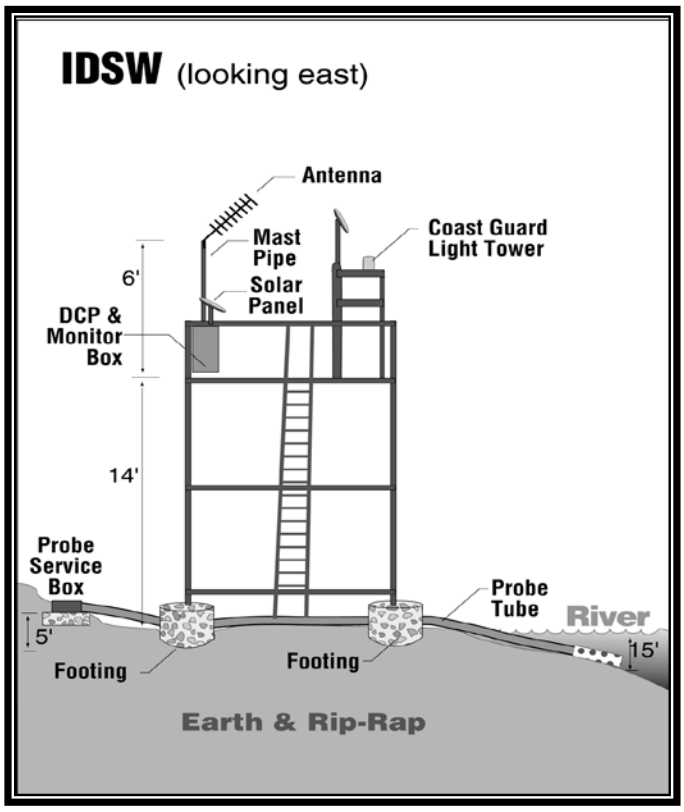


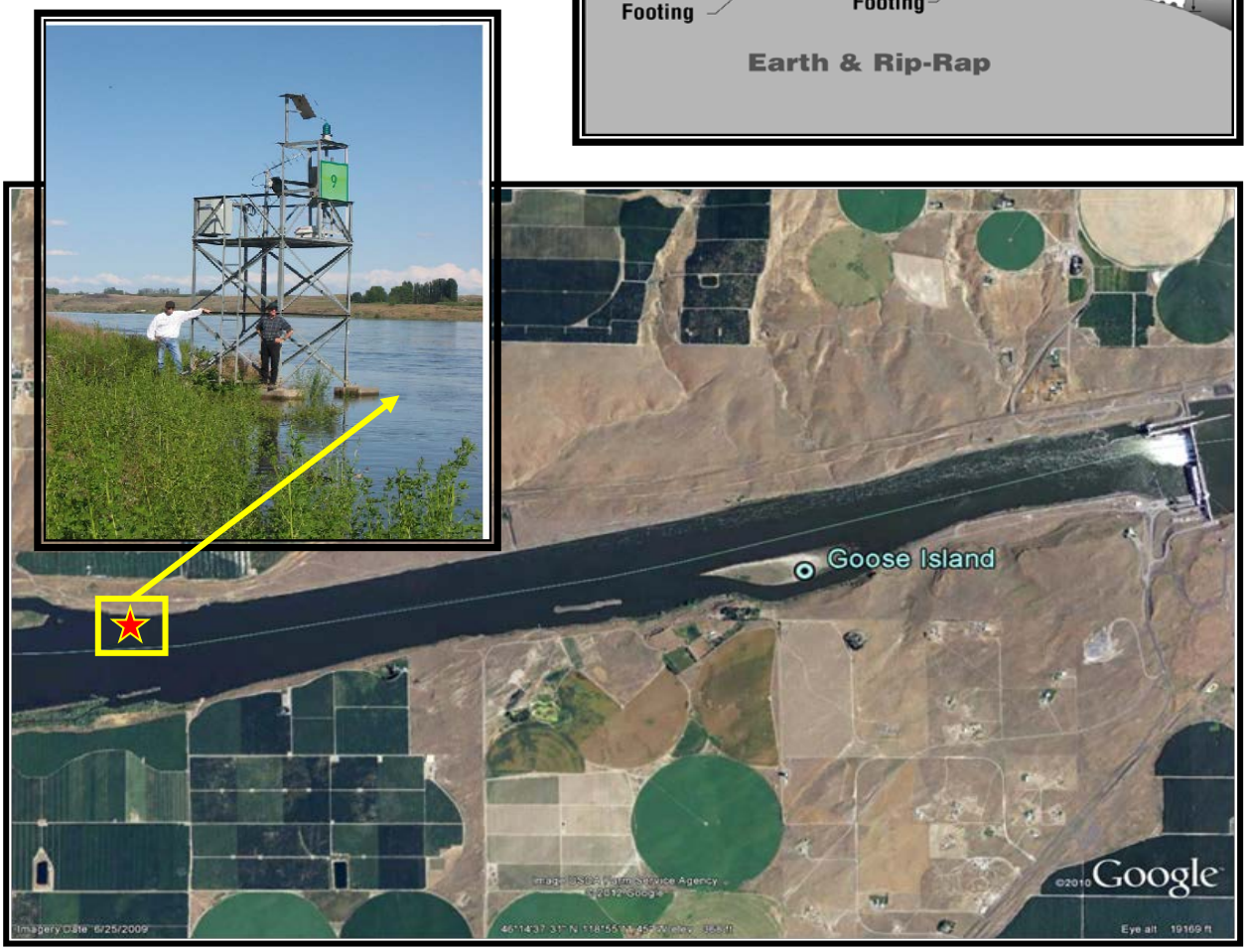
11. Ice Harbor Forebay TDG Monitoring Station (IHRA)

Gage Elevation: Fixed
Latitude: 46º 15’ 5.2792” N
Longitude: 118º 52’ 43.0096” W
Distance from Dam: 695 ft
Datum: NAD83
River: Snake
River Mile: 10.0
USGS-ID: 13352950
Owner: U.S. Army Corps of Engineers-NWW
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Was year round prior to 2006, now seasonal (April 1 – Aug. 31*).
Years of Operation: 2005 – Present.
Water Conditions: Mixed
Location: At the upstream end of the navigation lock guidewall.
This gage replaced: IHR
Reason for replacement: Moved due to thermal influences and lowered from 15 ft to 45 ft.
Comments: *The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.

12. Ice Harbor Tailwater TDG Monitoring Station (IDSW)

Gage Elevation: Fixed
Latitude: 46º 14’ 27.5868” N
Longitude: 118º 57’ 13.7130” W
Distance from Dam: 3.6 miles
Datum: NAD83
River: Snake
River Mile: 6.1
USGS-ID: 13353010
Owner: U.S. Army Corps of Engineers-NWW
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Was seasonal prior to 2006, now year round.
Years of Operation: 1994 – Present.
Water Conditions: Mixed & spillway
Location: On the northern shore of the Snake River
This gage replaced: N/A
Reason for replacement: N/A
Comments: --





13. John Day Forebay TDG Monitoring Station (JDY)

Gage Elevation: Variable
Latitude: 45° 43' 13.44908" N
Longitude: 120° 41' 41.21307" W
Distance from Dam: On extended guidewall from dam
Datum: NAD83
River: Columbia
River Mile: 215.7
USGS-ID: 453439122223900
Owner: U.S. Army Corps of Engineers-NWP
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: April 1 – August 31*
Years of Operation: 2004 – Present
Water Conditions: Mixed
Location: At upstream end of the navigation lock guidewall.
This gage replaced: JDA
Reason for replacement: Moved due to thermal influences and lowered from 15 ft to 45 ft.
Comments: *The seasonal gauges may go in several days before April 1 and remain in operation several days after August 31.

14. John Day Tailwater TDG Monitoring Station (JHAW)

Gage Elevation: Fixed
Latitude: 45° 42' 48.44859" N
Longitude: 120° 42' 39.21477" W
Distance from Dam: 0.8 miles
Datum: NAD83
River: Columbia
River Mile: 214.7
USGS-ID: 454249120423500
Owner: U.S. Army Corps of Engineers-NWP
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Was seasonal prior to 2006, now year round.
Years of Operation: 1995 – Present
Water Conditions: Spillway
Location: Other Washington shore.
This gage replaced: N/A
Reason for replacement: Rising flows
Comments: Location of station moved about 12 feet higher elevation from shore, further up the hill.