ICE HARBOR DAM

INFORMATIONAL OVERVIEW

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SECTION 1: General Information

1.1 Project Description

Stream: Snake River (R.M. 9.7)
Location: Pasco, Washington
Owner: U.S. Army Corps of Engineers, Walla Walla District
Project Authorization: PL 79-14, 1945
Authorized Purpose: Power, Navigation
Other Uses: Fishery, Recreation, Irrigation, Water Quality
Type of Project: Run-of-river
Date established: December 1961

Ice Harbor Lock and Dam is a hydroelectric, concrete, gravity dam on the Snake River in Walla Walla and Franklin counties in the U.S. state of Washington. The dam is located 8 miles (13 km) northeast of the town of Burbank and 12 miles (20 km) east of Pasco, river mile 9.2.

Looking north, Ice Harbor Dam with lock and one fish ladder on the left (north side of the river), spillway in the middle of the dam, and the power generation station and another fish ladder on the south side (right) of the river.

Lake Sacajawea, named for Sacajawea, is formed behind the dam. The lake stretches to the base of Lower Monumental Dam, 32 miles (50 km) upstream. The Wallula Channel, formed from the backup of Snake River entering the Columbia River just southeast of Pasco, runs 10 miles (16 km) downstream from the base of the dam.

1.2 Status - History

Construction began in June 1955. The main structure and three generators (units 1 through 3) were completed in 1961, with an additional three generators (units 4 through 6) finished in 1976. Generating capacity is 603 megawatts, with an overload capacity of 693 MW. The spillway has ten gates and is 590 feet (180 m) long. Ice Harbor Dam is part of the Columbia River Basin system of dams.

SECTION 2: Dam Design

2.1 Normal Operation Range

Normal operating range .....437’-440’

2.2 Water Surface Elevation (ft)

Max. flood pool (Q = 850,000 cfs) .....446.4’
Max. controlled flood pool/ Full pool (Q = 685,000 cfs) .....440.0’[(1)]
Minimum operating pool .....437.0’[(1)]
Max. flood tailwater (Q = 850,000 cfs) .....374.0’
Max. controlled flood tailwater (Q = 685,000 cfs).....370.5’

2.3 Discharge

Minimum
- December-February ..... Zero
- March-July 9,500
- August-November 7,500

Maximum rate of change per hour 20,000

2.4 Storage in Forebay

Maximum Storage …….4.0 KSFD/ 1.0 ft

2.5 Powerhouse

Number of Units 6
Turbine type .....Units 1-3 Kaplan
Units 4-6 Francis
Units 1-3 turbines capacity .....143,000 hp @ 89.0' head
Units 4-6 turbines capacity .....174,000 hp @ 89.0' head
Normal Maximum Head .....100’
Length .....560’
Spacing of units
- Units 1-5 .....90’
- Unit 6 .....96’

Number of hydro-generating units.....3 – 99,723 kva
Number of hydro-generating units.....3 – 122,947 kva
Total rated capacity .....603 MW
Units 1-3 Runner diameters .....280"
Units 4-6 Runner diameters .....300"

2.6 Navigation Lock

Type .....Single lift
Length ……675'
Width .....86'
Minimum water depth over lower sill, feet.....16
Upstream gate:

Type.....Radial
Height, feet.....25
Downstream gate:
Type.....Vertical lift
Height, feet.....91.0
Maximum operating lock lift, feet.....105
Flow through lock …..…….. 1500 cfs
Normal fill time……..11 minutes
Normal emptying time……14 minutes

2.7 Stilling Basin

Type .....Horizontal apron
Width, perpendicular to flow, feet.....590
Length, parallel to flow, feet.....168
Depth, feet…….40.4
Floor elevation, feet msl 304
Height of continuous end sill, feet.....12

2.8 Spillway

Type .....Ogee, concrete, gravity, gate controlled
Length (overall) .....590’
Number of bays……..10 –
Gates types……..tainter gates
Gates size……50' X 52.9’
Gates – method of operation……individual electric hoists, remote and manually controlled
Elevations .....391’
Deck elevation .....453’
Design discharge, (cfs) 850,000

SECTION 3: Water Quality

3.1 Flow Deflectors

Total number of Bays.....10
Total number of deflectors.....10
Elevation of deflector (ft).....338
Depth of deflector (ft) 6.4
Length of deflector (ft).....12.5
Toe of deflector (ft).....15

3.2 Water Quality Monitoring Stations

A) Active Gauges

A1. Ice Harbor Forebay TDG Monitoring Station (IHRA)

Gage Elevation: Fixed
Latitude: 46° 15’ 5.8” N
Longitude: 118° 52’ 39.0” W
Datum: NAD-83
River: Snake
River Mile: 10.2
USGS-ID: 13352950
Owner: U.S. Army Corps of Engineers
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Year-round
Years of Operation: 2005 – Present.
River Conditions: Forebay Monitor.
Location: This gauge is located in the forebay of Ice Harbor Dam at the upstream end of the navigation lock guidewall.

Comments: This gauge was established in April 2005 to replace the previous Ice Harbor Forebay gauge (IHR) that was located on the face of the dam at a depth of about 5 meters.

Figure 1: TDG monitoring station IHRA

A2. Ice Harbor Tailwater (IDSW)

Gage Elevation: Fixed
Latitude: 46° 14’ 27.6” N
Longitude: 118° 57’ 13.7” W
Datum: NAD-83
River: Snake
River Mile: 6.1
USGS-ID: 13353010
Owner: U.S. Army Corps of Engineers
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Year-round
Years of Operation: 1994 – Present.
River Conditions: Mixed River, Tailwater.
Location: Washington, USA
This gauge is located on the northern shore of the Snake River approximately 3.6 miles downstream of Ice Harbor Dam, in the tailwater.

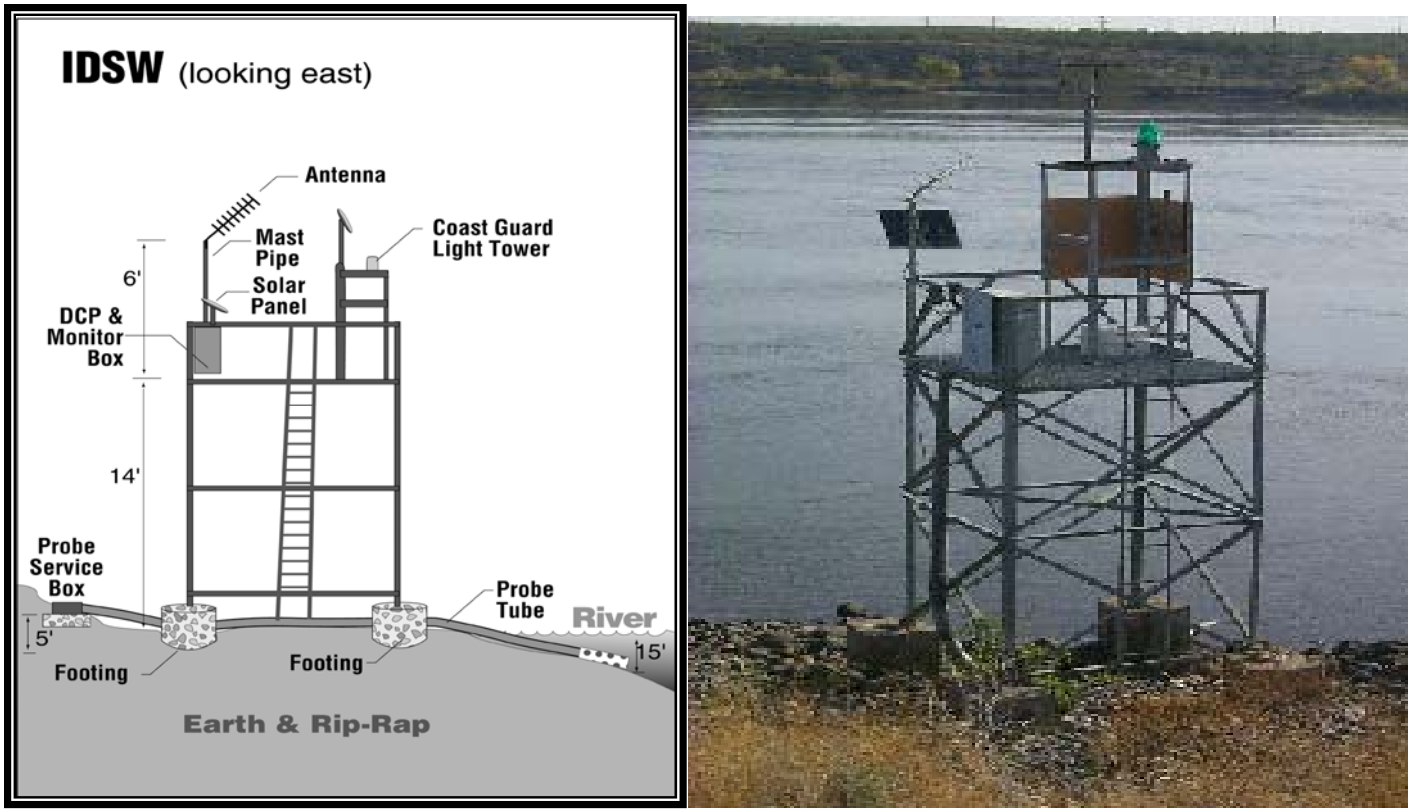

Figure 2: Tailwater monitoring station IDSW

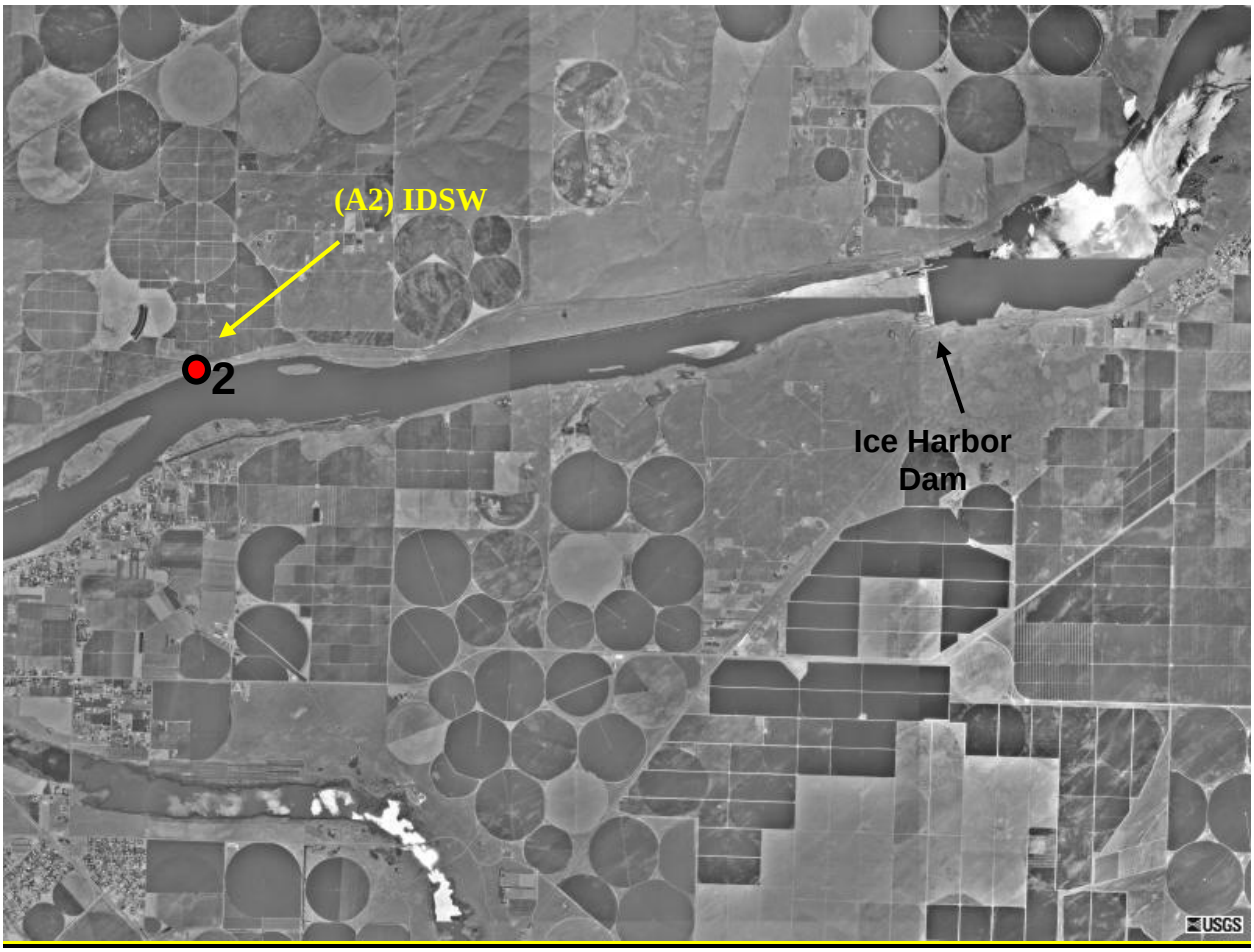

Figure 3: Location of the Ice Harbor tailwater TDG monitoring site, IDSW.

B) Obsolete Gauges

B1. Ice Harbor Forebay (IHR)

Gage Elevation: Fixed
Latitude: 46° 15' 5.3" N
Longitude: 118° 52' 43.0" W
Datum: NAD-83
River: Snake
River Mile: 10.0
USGS-ID: 13352950
Owner: U.S. Army Corps of Engineers
Gauge Type: Hydrosonde
Data Transmission: GOES Satellite
Dates of Operation: Year-round
Years of Operation: 1994 – 2005.
River Conditions: Forebay Monitor.
Location: This gauge was located on the face of the Ice harbor dam between spill bay #1 and generating unit #6.
Parameters Measured: Barometric Pressure, Total Gas Pressure, Temperature
Comments: This gauge was retired in March 2005 and relocated to the end of the navigation guidewall (IHRA).

Figure 4: Obsolete TDG Fixed Monitoring Station at the Ice Harbor forebay

Figure 5: Obsolete TDG monitoring site, IHR.

B2. Hood Park Below Ice Harbor (HPKW)

Gage Elevation: Fixed
Latitude: 46° 15' 0"
Longitude: 118° 52' 12" W
Datum:
River: Snake
River Mile:
USGS-ID: Owner:
Gauge Type:
Data Transmission: May 1994 – June 1996
Dates of Operation: May 1994 – June 1996
Years of Operation: 1994 – 1996.
River Conditions:
Location:

Parameters Measured: Barometric Pressure, Percent Total Dissolved Gas, Temperature, Dissolved Nitrogen and Oxygen Pressure
Comments: This gauge was retired in 1996

SECTION 4: Fish Facilities

4.1 Fish Passage

A) Juvenile Fish Passage

The juvenile fish passage facilities at Ice Harbor consist of standard length submersible traveling screens, vertical barrier screens, 12" orifices, collection channel and dewatering structure, sampling facilities, transportation flume/pipe to the tailrace below the project, and a full-flow PIT tag detection system.

B) Adult Fish Passage

The adult fish passage facilities at Ice Harbor are made up of separate north and south shore facilities. The north shore facilities include a fish ladder with counting station, a small collection system, and a pumped auxiliary water supply system. The collection system includes two downstream entrances and one side entrance into the spillway basin. In normal operation one downstream entrance is used and the other two entrances are closed. The auxiliary water is supplied by two electric pumps with a third pump as a backup. The south shore facilities are comprised of a fish ladder with counting station, two south shore entrances, a powerhouse collection system, and a pumped auxiliary water supply system. The powerhouse collection system includes two downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, four operating floating orifices, and a common transportation channel. One of the downstream north powerhouse entrances and four of the floating orifices are used during normal operation. At the south shore entrances, one entrance is normally used. The auxiliary water is supplied by eight electric pumps of which from six to eight are normally used to provide the required flows. The excess water from the juvenile fish passage facilities is routed into the fish pump discharge chamber to provide additional attraction flow. The upper ends of both ladders have PIT tag detectors. Additional water is supplied to the auxiliary water supply system from the juvenile fish facilities primary dewatering structure.

4.2 Removable Spillway Weir (RSW)

Year of Installation …….2005
Location (Fig 2)……..……..Spill Bay 2
Height …….105’
Width ……...70’
Weight …….1.7 x 10^6 lb
Depth of entrance (Fig. 3)...……..…12’-15’
Width of entrance (Fig. 3)……48’
RSW flow ……7, 500 – 10,400 cfs
Training Flow .....flows through bays 3-10;
..... See Table IHR-10 in FPP

Figure 1: Location of RSW on spillway - on spill bay 2

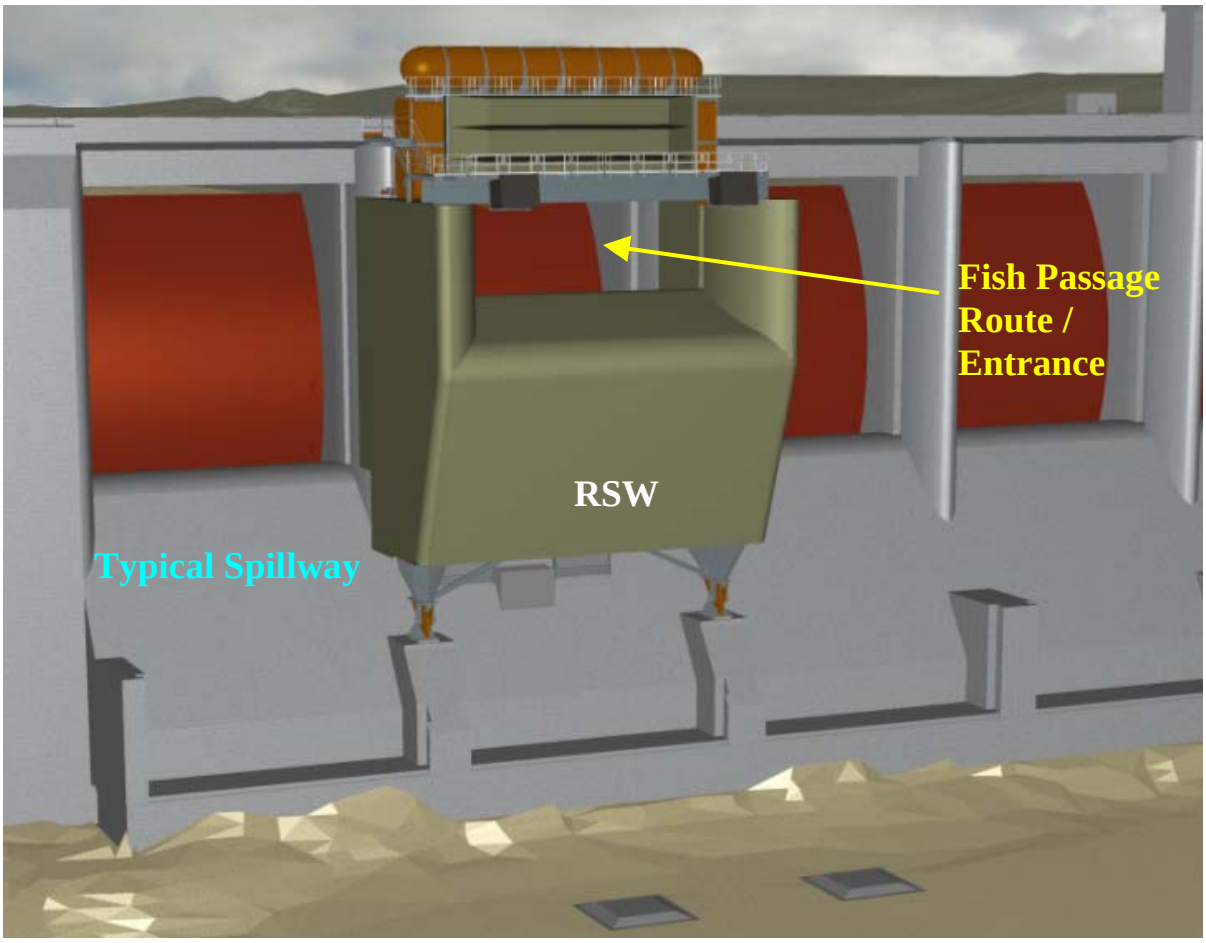

Figure 2: Ice Harbor Dam RSW schematic

4.3 General Fish Facilities Information

Number of fish ladders..... 2
Slope:
North Shore……1V on 10H
South Shore……1V on 16H

Number of weirs
(including orifice-control section).....103
Overflow weirs:
Number 97
Height .....6 feet
Orifice size:
North Shore…….18 x 18 inches
South Shore…….21 x 23 inches

Exit of ladders, invert elevation, feet msl 431

Entrance of ladder, invert elevation, feet msl 332
Normal fishway flow, forebay to each ladder:
North Shore, cfs.....74
South Shore, cfs.....142
Ladder, clear width:
North Shore, feet 16
South Shore, feet 24
Pumps for fish attraction water:
Number:
North Shore……3
South Shore……8
Type .....Turbine
Discharge:
North Shore, cfs 250
South Shore, cfs 300
Fishway entrances:
North shore.....2
South shore.....3
Non-overflow.....3
Powerhouse collection system:
Number of orifice entrances.....12
Length of channel, feet 661
Width of channel, feet.....17.5
Downstream Migrants Bypass System:
Ice-and-trash sluiceway 1
Hydrualic capacity (1% Max), cfs 2,700

Appendix A: Project Schematics

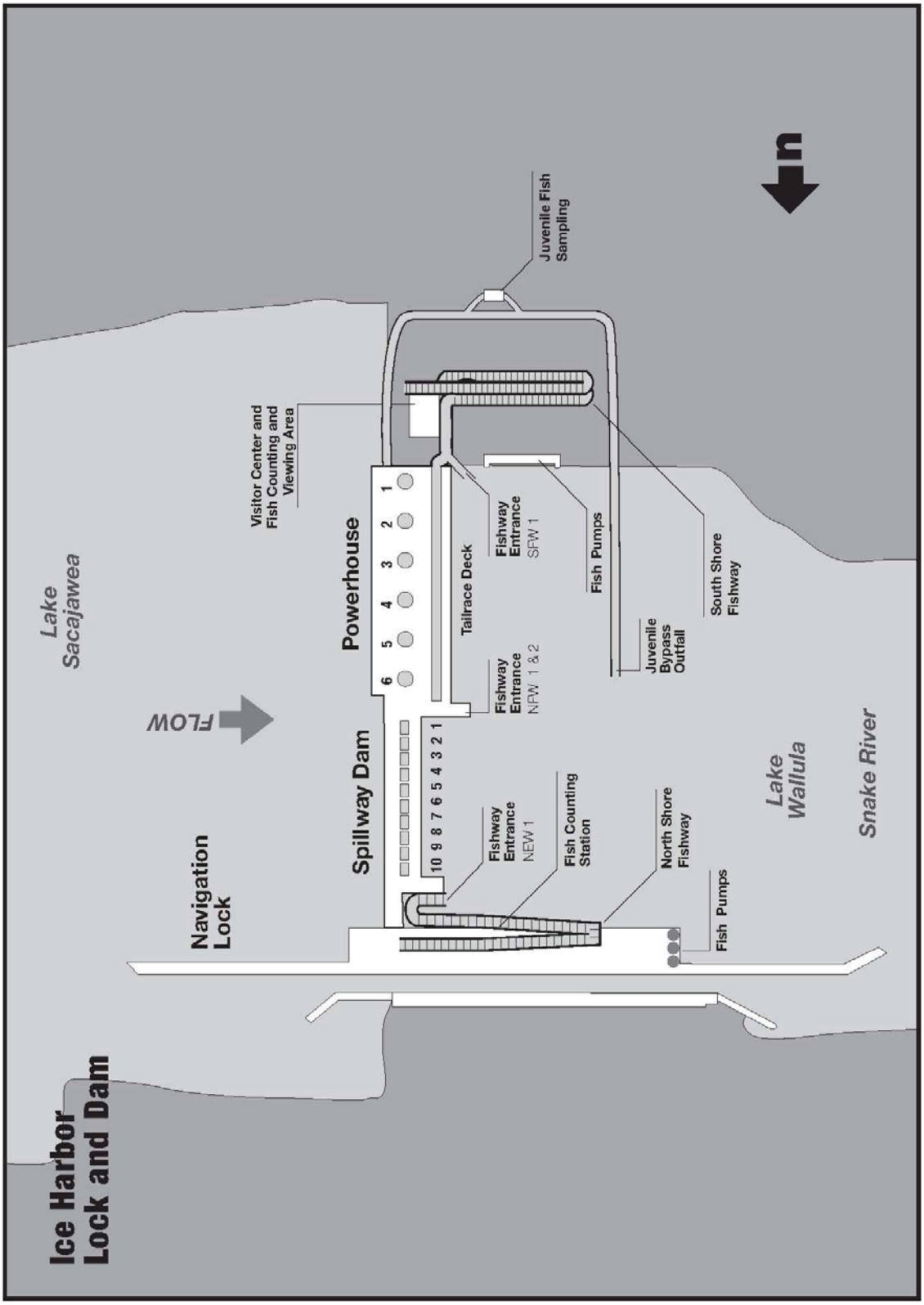

Figure 3: Ice Harbor Lock and Dam general site plan.

Appendix B: Notes

Lake Elevation: Established for power generation and recreation.
House Document 704, 75th Congress 1945.

Discharge: Fisheries consideration.

Rate of Change: Base on 1.5 feet per hour.

Powerhouse: Release for overload plant output with full pool and no spill.

(1) Project Engineer may authorize lake level to fill 0.5 feet above normal full pool or draft 0.5 feet below minimum pool to allow for unexpected events.

Appendix C: Glossary

Forebay - The water upstream of / behind the dam.

Tailwater / Tailraise – It is the water surface immediately downstream from a dam or hydroelectric power plant.

Power Plant – It is a place where electricity is generated.

Powerhouse - The part of a hydroelectric dam where the turbine-generators are housed and where power is produced by the action of the water on the turbine blades.

Navigation Lock - A device used for raising and lowering boats between stretches of water of different levels on river and canal waterways.

Stilling Basin - A basin constructed to dissipate the energy of fast-flowing water, eg, from a spillway or bottom outlet, and to protect the river bed from erosion.

Fish Ladder - Structures on or around artificial barriers (such as dams and weirs) built to facilitate diadromous fishes' natural migration. Most fish ladders enable fish to pass around the barriers by swimming and leaping up a series of relatively low steps (hence the term ladder) into the waters on the other side.

Ice and Trash Sluiceway (IST) – It is a channel through which debris, such as ice and trash, which has collected in the dam forebay, is released into the tailraise. Juvenile fish also use this outlet to travel downstream during the spring and summer seasons.

Removable Spillway Weir (RSW) - A removable steel structure that is attached to the forebay of an existing spill bay, creating a raised overflow weir above and upstream of the existing spillway crest.

Spillway - A structure that allows release of excess water from a dam or other hydraulic structure.

Flow Deflector – It is a structure found below the spillway tiers and above the stilling basin of a dam. Its purpose is to deflect off the flow of the spill water at an angle such that the spilling water skims on the surface of the existing water elevation instead of plunging deep into the tailraise. Spill water plunging into the tailraise will increase Total Dissolved Gas (TDG) levels; the deflector serves to reduce the TDG. The flow deflector will not be as effective during high spill periods as the water will spill clear of the deflector.