DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, PORTLAND DISTRICT
PO BOX 2946
PORTLAND OR 97208-2946

REPLY TO
ATTENTION OF

CENWP-EC-HD (1110a) 28 October 2012

MEMORANDUM FOR RECORD

SUBJECT: John Day (JDA) North Fish Ladder - Trip Report for field water velocity measurements – October 18 and 19, 2012.

Participants: Schlenker, Steve EC-HD
Hansen, Martin, EC-HD
Henrie, Gary, EC-HD

Field Trip Objectives:

1. The objective of this trip was to conduct water velocity measurements in the JDA North Fish Ladder. Total entrance discharge was determined for rating curve data at low tailwater, and average channel velocity was measured near Weir 155 and in the Auxiliary Water Supply (AWS) well. The general vicinity is noted in Appendix A. The USACE team consisted of Steve Schlenker, Martin Hansen and Gary Henrie. The USACE Price meter equipment was used to obtain water velocities in the various locations. Access for the work was coordinated with Miroslaw A Zyndol – resident JDA fish biologist.

Background:

2. Concern over problems of adult salmon migrating upstream through the North Fish Ladder has been noted by Miro Zyndol. Such delay at Columbia and Snake River dams is unacceptable to fishery agencies and has prompted the U.S. Army Corps of Engineers to gather field data to address the situation recently noted. An additional purpose of the site visit was to calibrate the 1-D Model for low tailwater conditions including entrance head; AWS head losses, channel velocities, and pump curves. A summary is provided in Appendix B.

3. After Miro alerted FPOM on the poor fish passage numbers in September, discussion between him and EC-HD lead to a diagnosis of probable low velocities in the fish way channel between the approximate middle of Diffuser 2 and the base of the ladder, Weir 155. EC-HD provided to FPOM results from

their numerical 1-D model indicating varying degrees of low velocities under different operations and also future operations after the Season 2 construction is completed this spring. In early October, Miro & other Project Biologists collected surface velocities that were significantly higher than the 1-D Model results.

4. In past years, the adult fish ladder on the north side of JDA has struggled to meet current fish passage criteria for fish ladders, and past problems have been reviewed. The current situation has relatively slow velocities in the lower channel (Diffuser 2) just downstream of the last weir. Miro (with EC-HD concurrence) suggested the low velocities could be improved by an interim operation that increased the Auxiliary Water Supply (AWS) flow (using the three pumps in manual mode) to a level so that the entrance head would exceed NMFS criteria (> 2.0 feet). Also the flow from the Exit section could be increased by raising depth over the control ladder weir, from 1.0 to 1.3 feet. The excessively high entrance head operation was later moderated to between 1.7 – 1.9 feet in early October, as request by NMFS due to concerns for Lamprey passage. All three operations were tested during the EC-HD site visit.

5. The low velocity problems should be largely or entirely mitigated by the Season 2 construction improvements (lowing Stover Pipe weir crests for the ladder diffusers 3 -15 and sluices gates that can limit the discharge from diffuser 2).

Data Collection:

6. The members of the data collection team arrived at the project on Oct. 18th and organized at the JDSFL (185 deck) at approximately 15:12. Per the staff personnel in the 'Smolt' Building, The forebay elevation at that time was recorded as 265.16 feet with the N. shore tailwater being 159.3 feet. The Exit Control Section Weir was observed to be overtopped by 1.3 feet (i.e. Ladder head). This did not change during the site visit. On 10-19-12 AM, the forebay was 265.16 feet and south & north tailwater were 159.5 and 159.1 feet respectively.
7. Data was collected at two locations in the ladder: total AWS discharge from the AWS conduit vent, (east of Weir 174) and channel velocities at a location some six feet downstream of the former Weir 155 and nine feet downstream of the monolith joint. Appendix A shows the areas where data was taken. Appendix C contains copies of the field data sheets. Appendix D shows photographs of the collection points and associated equipment. The data collection took place under generally fixed forebay and tailrace conditions. Water levels in the Tailwater stillwell were recorded by an 'OnSet' data logger, to supplement water levels

taken using the 'Solinst' water level meter 'e-tape'. The measurements of the e-tape are good to about 0.1 foot or so. The data logger confirmed well water levels did not change much during testing.

Flow Conditions in the Ladder and Lower Ladder Auxiliary Water System (AWS) and Fish Ladder Entrance:

8. **Ladder Flow:** The total flow in the Entrance was computed by the summation of the measured AWS discharge and the upper ladder flow from the Exit and Ladder Control Section. The Auxiliary Water Supply (AWS) conduit feeds the downstream end and entrance section from the afterbay NavLock exit channel by pumping, to provide the majority of the entrance flow. The flow at the counting station was 113 cfs, based on previous model measurements for a ladder head of 1.3 feet. Depending on the ladder and entrance heads, the fish ladder exit provides 85 -113 cfs and the AWS provides 800 - 2200 cfs.

   Auxiliary Water System: The water to the lower section AWS is supplied by recently replaced pumps (driven by electrical power from the turbines). Direct measurement of the flow through the pumps would be impractical, but can be calculated from a rating curve using tailrace elevation and rating curves. For this field trip, AWS flow is estimated by integrating q grid of velocity measurements over the width and depth of the AWS conduit, using the Price meter equipment.

   Entrances: The approximate tailwater elevation was recorded from the staff gage on the concrete wall downstream of the fish ladder entrance. The head differential between the tailwater and water level just upstream of the entrance was determined by measuring upstream water levels from the Elev. 185 deck. The average tailwater elevations and entrance heads for Tests 11, 12, and 13 were the following:

   Ladder Head = 1.3 feet (113 cfs ladder flow) in all test cases below.

   Pump Test 11:
   Conditions under operation on initial day of site visit:
   Tailwater Elevation = 159.15 feet
   Entrance head = 1.71 feet

   Pump Test 12:
   Conditions changed on 2nd day of site visit:
   Tailwater Elevation = 159.15 feet

Entrance head = 1.51 feet

Pump Test 13:
Conditions changed on 2nd day of site visit:
Tailwater Elevation = 159.1 feet
Entrance head = 2.19 feet

Discharge Computations:

9. The measurements were recorded on data sheets in Appendix C.
Three sets of data were taken, designated as 'Pump Tests 11, 12, 13; and consisted of:
   A. Pumping parameters recorded in the pump house, e-tape water levels in the discharge channel well, AWS diffuser "stove pipe" water levels and other water levels. Changes in pumping were affected by Stephanie Lesko CENWP-OD-J.
   B. AWS conduit discharge measurements in the air vent, using Price meter reading to determine average flow and velocities
   C. Fish Ladder Channel velocity measurements – three sections were used, each with recordings at three different depths.

   The total flow through the various sampling transects is determined by first calculating an integrated average velocity across the channel at each depth and then integrating the resultant averages again over all depths. The edge of the flow field was extrapolated from the two outermost measurements at a given depth. The total integrated average velocity was then multiplied by the total cross-sectional area to get a total flow rate.

Table 1 - Summary of Flow Rates, Pump Data, Entrance Head, and Channel Velocities

John Day North Fishladder
Low Tailwater Pump Tests Measurement Data Summary Table

Data Collected:	Ladder head =	**1.3**	feet (for shad)
October 18-19, 2012	Ladder Flow =	113	cfs

Pump Operations

Max Pump RPM = 229
Max Sustained Amperage = 510

Pump Test No	Date	Aver. TW Elev. (ft)	∑ AWS Flow (cfs)	No. of Pumps	Pump RPM	% max RPM	Max Amps	Max VFD HP	Ave Static Lift (ft)	Average Unit Pump Discharge (cfs)
11	10/18	159.2	927	3	175	76%	379	244	4.0	309
12	10/19	159.2	841	2	224	98%	452	379	3.1	420
13	10/19	159.1	1,112	3	205	90%	474	371	5.2	371

Entrance Operations

Channel Velocities

Pump Test No	Date	Ave. TW Elev. (ft)	Δ TW in test (ft)	En-trance Flow (cfs)	Ave. Entrance Head Readings (1) Con-trol Panel	(2) Meas. Fut-ure Loca-tion*	Diff (1) - (2)	Location 2**, near Weir 155 Flow Rate cfs	Average Velocity ft/s	Surface Velocity ft/s
11	10/18	159.15	-0.1	1,040	1.81	1.50	0.3	217	0.8	1.4
12	10/19	159.15	0.1	954	1.61	1.42	0.2	235	0.9	1.5
13	10/19	159.1	0	1,225	2.29	2.18	0.1	304	1.1	1.8
						Average	0.2	Ratio Surf /Ave =		170%

* Future location for u/s stillwell is on right side of channel 50' feet u/s of entrance structure
** 6 ft d/s of u/s end of Diffuser 2 & 9 ft east of Monolith joint

Comparison of Measured Pump Performance with Pump Curves

Pump Test No	No. of Pump	Ave Static Lift (ft)	% Max RPM	Average Pump Discharge Meas. (cfs)	Curves (cfs)	% *** difference Meas. to curves	Pump Horsepower based on Curves Curves HP	Recorded VFD HP
11	3	4.0	76%	309	296	4%	160	244
12	2	3.1	98%	420	411	2%	366	379
13	3	5.2	90%	371	349	6%	331	371
Ave.:	2.7	4.1	0.9	366.7	352.1	4%	285.7	331.3

**** Average of previous percent differences in Tests 1-4, 10 were 8%*

Observations:

10. The measurement of the discharge and channel velocities at different AWS pump settings at the low tailwater generally indicates overall compliance with the previously developed ladder model. This mathematical hydraulic model has been utilized to develop this season's information, the PLC logic, and will be used to develop the PLC logic after the Season 2 Construction upgrades. The velocity measurements taken were to verify/calibrate the ladder model at low tailwater levels and to provide experience for future operations. This data provides important channel velocity verification, to allow proper judgments to be made on how to best operate the fish ladder, in similar circumstances. The low velocity data confirms and helps document the reason why fish did not proceed up the ladder earlier this fall. The data is attached within Appendix B.

11. The two of the key improvements planned for Season 2 (FY 13 In-water work period) are designed to improve channel velocities in the lower ladder:

    - Lower Stove Pipe Weirs for Ladder Diffusers 3 – 15
        - This will direct more flow in the ladder diffusers which will in turn raise velocities at the base of the ladder
    - Install eight (8) new sluice gates for diffuser two (2) portals
        - This will limit flow into large Diffuser 2 and raise AWS hydraulic gradeline to help direct more flow into the ladder diffusers

Conclusions:

12. Water velocities in the vicinity of the former weir 155 and base of ladder Weir 158 were confirmed to be too low for acceptable salmon passage in the ladder. This out-of-criteria channel velocity condition will be addressed with the Season 2 construction. While not optimum, the interim operations with the increases in AWS flow and ladder head provided the best interim corrections for Season 1.

13. Also with calibration of the entrance head coefficient (0.694), the 1-D model simulated the field data with an average difference of 0.05 ft/s (higher in the field than model). The only aberration was with Pump Test 12, where the difference was +0.2 ft/s in the field. This shows that the model is a viable tool for simulating Season 2 Operations and PLC refinements.

Recommendations:

14. CENWP-EC-HD will provide a brief memo to FPOM on the Low Tailwater velocities experienced this year (Season 1) and the expected improvements with operations in Season 2.

15. Additionally, the Price meter equipment is in need of attention. Items needing consideration, given limited financial resources, are:
-replacement of the 'Aquacount' output reader
-purchase of a second Sounding Reel crank arm
-replacement of one of the threaded rods which guides the cable guide-wheel
-installation of the geared sprocket near the handle to make the 'catch' functional
-replace/refurbish Price meter that do not pass the 'two minute spin' test

Martin Hansen
Hydraulic Engineer

Encl.

CF:
CENWP-EC-H (Buchholz, Robert)
CENWP-EC-HD (Phillips, Marie)
CENWP-OD-J (Mackintosh, David)
CENWP-OD-J (Zyndol, Miro)

CENWP-EC-TG
CEN/FILES

CENWP-EC-H
CAPLEY

CENWP-EC-H
BUCHHOLZ

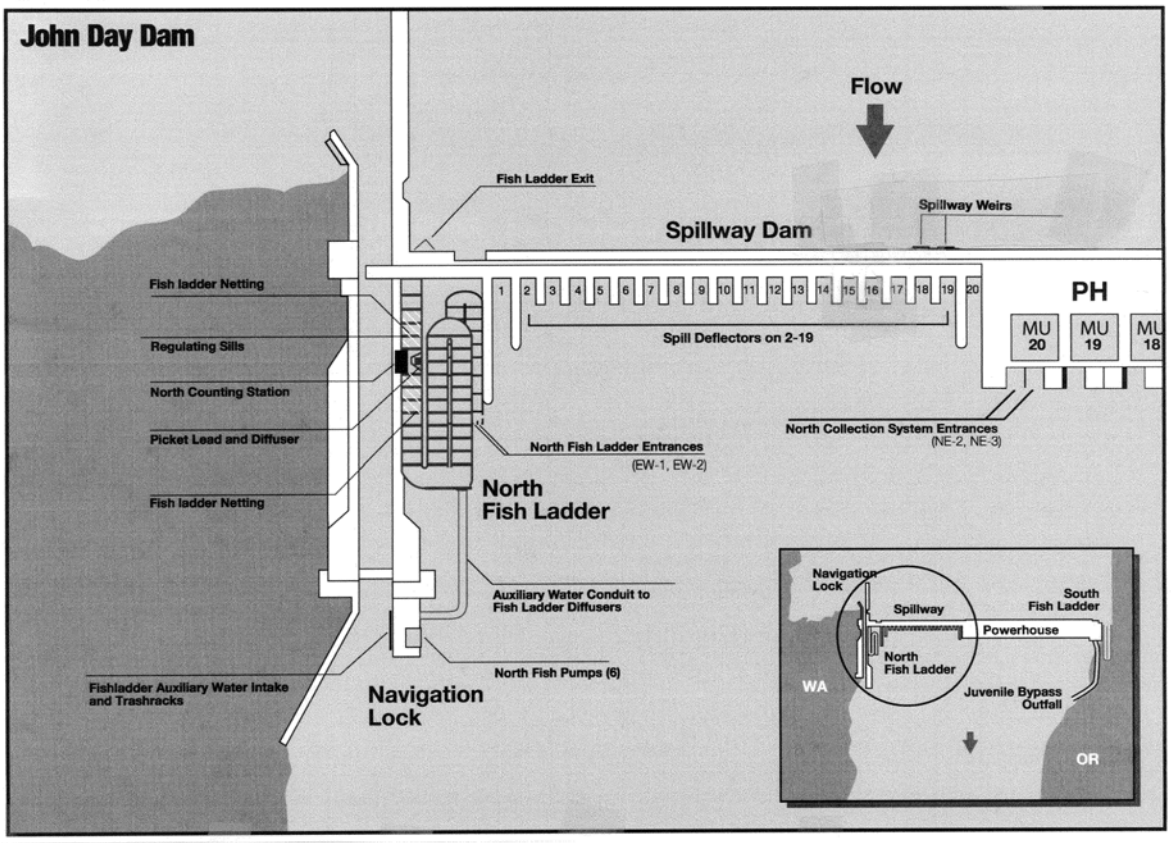
CENWP-EC-HD
PHILLIPS

CENWP-EC-HD
SCHLENKER

CENWP-EC-HD
HANSEN

WAC/4871
28 OCT 2012

APPENDIX A - Vicinity Map sheets with schematic outline of North Fish Ladder



John Day Dam Spillway and North Fish Ladder.

Note: water velocity measurement locations are shown in red on the subsequent, more detailed pages, in **red.** See the photo collage for a visual depiction of the Price meter water velocity measurement locations.

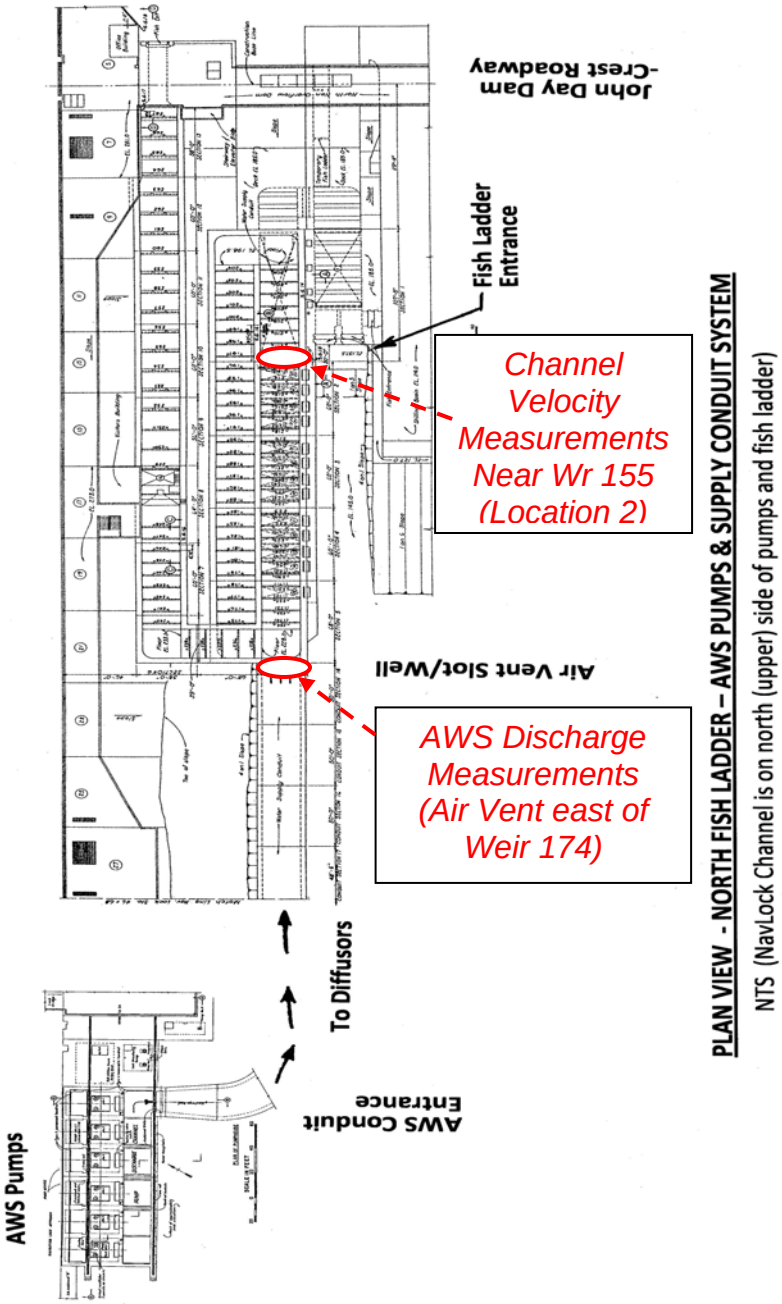


Figure A-1 : Plan View of John Day North Fishladder with Measurment Locations

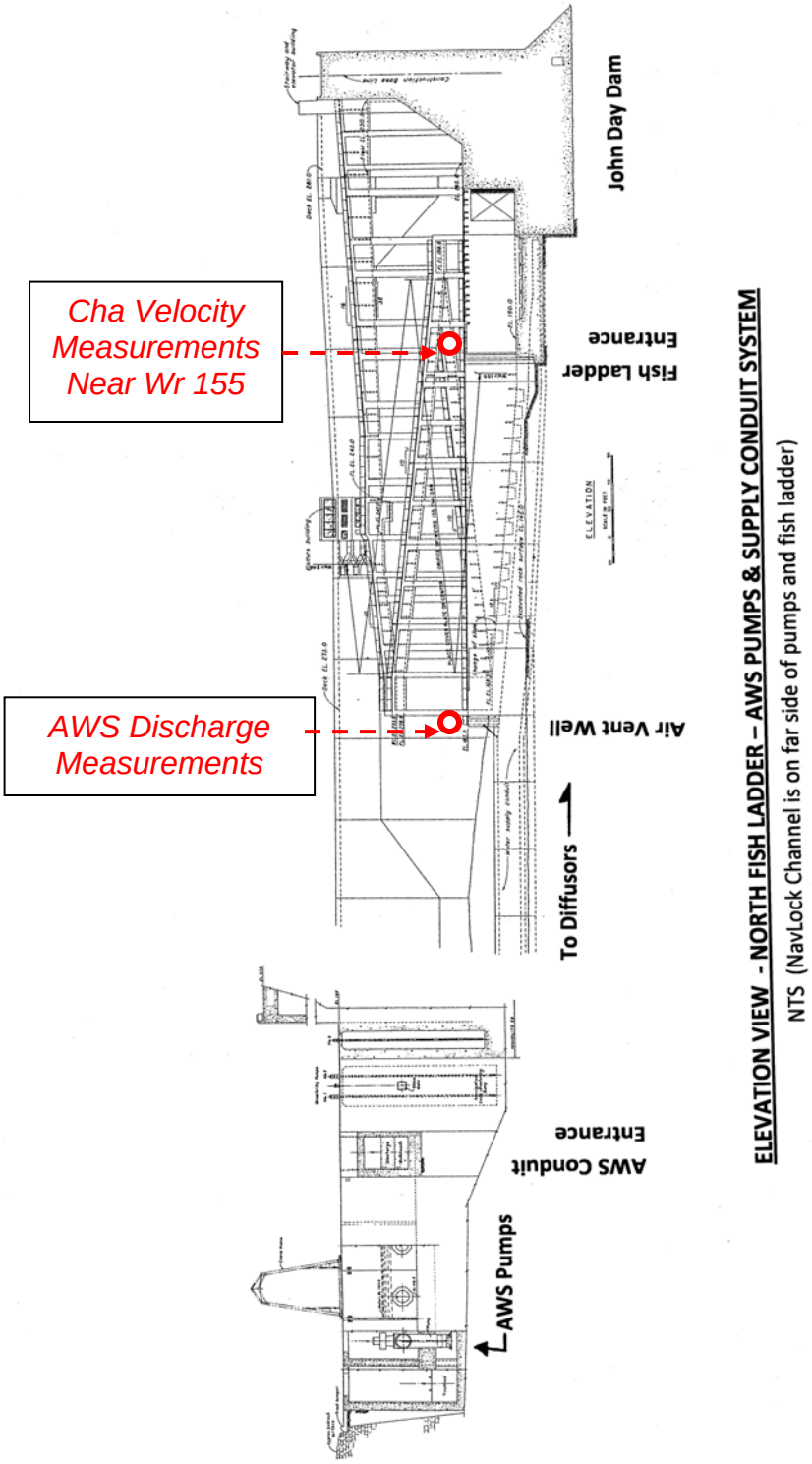


Figure A-1 : Elevation View of John Day North Fishladder with Measurment Locations

APPENDIX B - Outline of Events and Data for JDA Fish Ladder non-performance.

On September 10, 2012, Miro Zyndol, (JDA Project Biologist) reported that the count of adult migrants was unusually low after spill ceased on August 31. Also concurrently plotted is the fish ladder flow, weir elevation (ft above weir crest at North Count Station, the total AWS pump flow, and the entrance head (differential in feet as measured from water surface in the ladder about 40 - 60 feet upstream of the Fish Ladder Entrance minus the Columbia River tailwater elevation).

This incident was noticed when fish were 'holding', that is milling about in the lower North Fish Ladder at the same time that the fish count plummeted. John Day fish biologists responded by increasing flow by two methods:

1. Increase Diffuser 16 grating flow at the North Count Station. The diffusor grating is below the 'Control Section'. This resulted in an increase in water overtopping the weir from 1 ft (for salmon passage) to about 1.3 ft (for shad passage).
2. Pump flow from three units was increased by increasing the RPM's. This resulted in the 'head differential' increasing from 1 foot ('normal', typical condition) to 2.2 to 2.3 feet, starting On September 19, 2012. This was subsequently reduced to about 1.8 feet per request from NMFS. This is within NMFS criteria (but higher than the normal optimum 1.5 feet entrance head) and eases lamprey passage from the excessive head applied earlier.
3. Detailed Pump Operation Log From Miro Zyndol:
   -prior to 9/19 AWS pump[s operated to maintain 1.5 foot entrance criteria and ladder head at 1.0 feet
   -9/19 we increased the AWS output to max (pumps in manual setting) at approximately 1400 hrs.
   -9/26 Due to NOAA concerns for violating flow criteria, we scaled down to below 2.0' differential, at approximately noon.

   Additionally:
   -9/27 one AWS pump tripped AM, and JDN entrance was temporarily at 1.5 'differential
   -9/28 returned to all three AWS pumps operation, at approximately noon

The following figure shows a plot of the percent of total daily adult Chinook salmon passed by the North Fishladder in 2012 versus the average daily percent in 2009-2011 compiled by Miro Zyndol. The data record goes from Aug 06 – Oct 31 for each year. The red solid line represents 2012; the blue dashed line represents 2009-11. The light green line represents the total daily adult salmon passed in 2012 graphed against the secondary axis over the same time period.

The graph shows the poor, post-spill performance of JDAN in 2012 in comparison to previous years, and partial improvement with the interim operations after Sept 19.

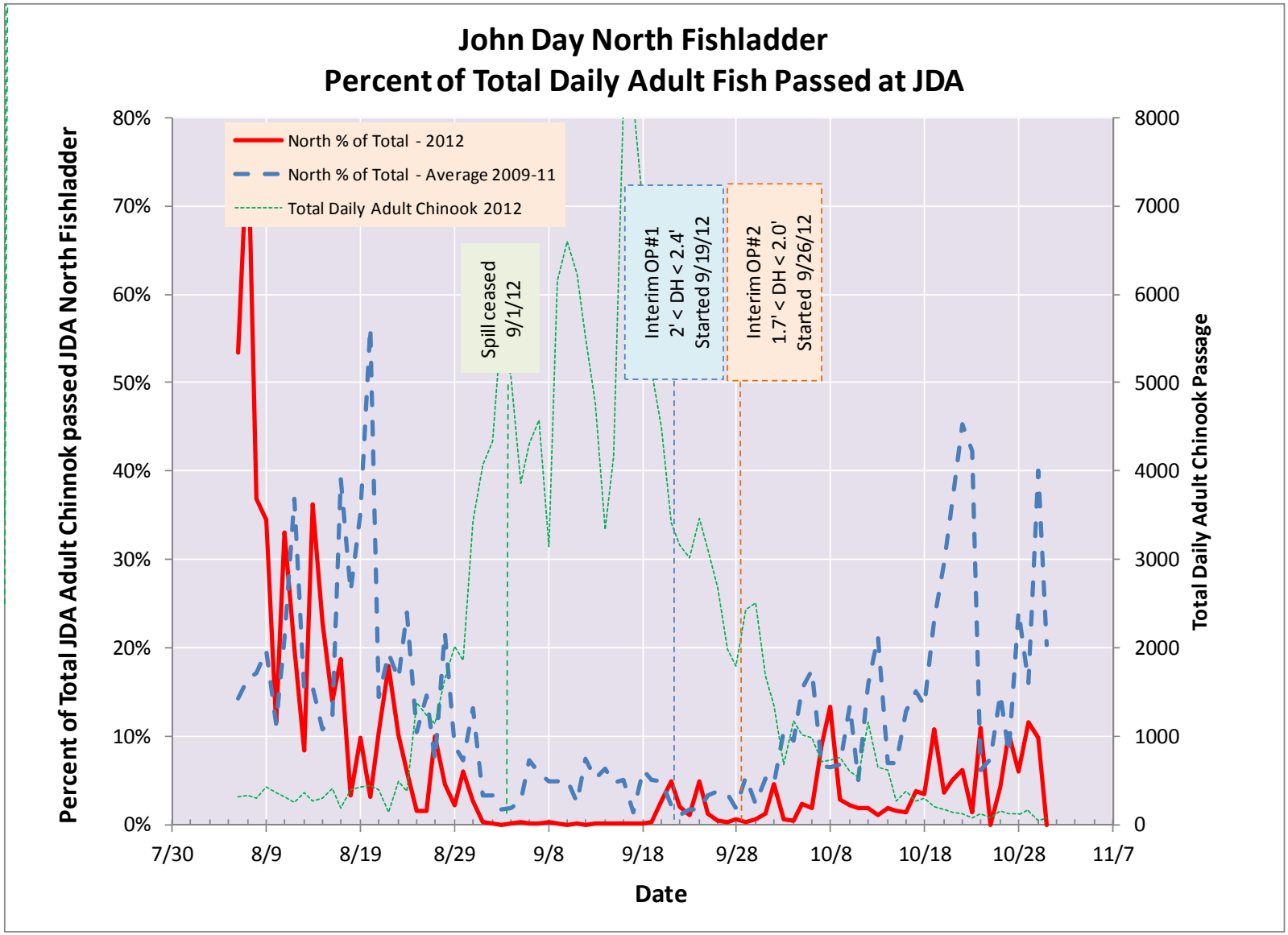


Figure B-1: Percent of Total Adult Chinook Salmon passed at North Fishladder and Total Daily Adult Chinook Count

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APPENDIX C - Detailed field data – Fish Ladder Velocity Data sheets with reductions

Flow Conditions Measured (numbering started from initial tests in spring):
Ladder Head = 1.3 feet (113 cfs ladder flow) in all test cases below.

Pump Test 11:
Conditions under operation on initial day of site visit:
Tailwater Elevation = 159.15 feet Entrance head = 1.7 feet

Pump Test 12:
Conditions changed on 2nd day of site visit:
Tailwater Elevation = 159.15 feet Entrance head = 1.5 feet

Pump Test 13:
Conditions changed on 2nd day of site visit:
Tailwater Elevation = 159.1 feet Entrance head = 2.2 feet

The data for each Pump Test is arranged in the following order:

- Pump Data Sheet 1 – includes pumps used, pumps speeds, pump amperage and VFD horsepower
- Pump Data sheet 2 – includes static lift of pumps (based on difference between water level elevations in pump discharge channel and Navlock Tailwater), hydraulic gradeline in AWS conduit, tailwater and entrance head data from both control panel readouts in electrical building and physical measurements using sounding tapes.

  (Note that entrance heads reported at the control panel report values 0.1 feet higher than physically measured on average. However, the physical measurements in the approach channel 50 feet upstream of the entrance are not precise due to the high channel velocities that cause difficulty with sounding tapes. The water sensor is located about 3 inches above the above of the bottom of the weighted metal sensor housing that is launched downstream and into a pendulum motion when immersed into fast moving flow.)
- AWS Flow Measurements through air vent east of Weir 174 – Includes depth in conduit and velocities measured over a grid of 5 columns (across the channel) with 5 depths of measurement is each column. The data is numerically integrated for each depth across the width of the channel. The velocities along sidewalls of the channels are estimated by means of modified projection from the outermost two measurements in proximity to the wall. The integrated average velocities for each depth are then integrated over the vertical depth of flow in the same manner. The flow rate is the total integrated velocity x depth x width.
- Channel Velocity Measurements at Location 2 (near former Weir 155) – Includes flow depths and velocities measured over a grid of 3 to 5 columns (across the channel) with 3 depths of measurement is each column. The average velocities and flow rates are computed in the same manner as described in the previous paragraph.

‘Test 11’ sheets, dated 10-18-12

JOHN DAY NORTH FISH LADDER HEAD DATA

Date:	10/18/2012	**Time:**	16:17	18:38		**Name:**	MPH	GSH	SJS
PUMP TEST NUMBER:			**11**			*ENTRANCE DATA READOUT:*			
					16:17	**TW**	159.2	***App Cha***	161.0
NUMBER OF PUMPS OPERATING:				3	*18:38*	**TW**	159.1	***App Cha***	160.9
RPM OF PUMPS OPERATING:				175					
% Max RPM				76%		**ENTRANCE DATA READOUT:**			

	Pump No.	1	2	3	4	5	6
PUMPS IN OPERATION:			X	X	X		

PRESSURE AND WATER SURFACE ELEVATIONS:

	meas.			
COUNTING STATION STAFF GAGE =	1.3	ft	**TIME:**	16:06

PUMP & AWS HEAD MEASUREMENTS: (Deck Elev. = 185 ft)
(datum = NGVD 29/47)

PUMPS FROM U/S END:

CONTROL ROOM READINGS:

PUMP #	1	***TIME:***	16:17	18:38	**PUMP #**	4	
PUMP AMPERAGE					**AMPS**	378	379
HORSE POWER					**HP**	244	243
VOLTAGE to PUMPS					**VOLTS**		
PUMP #	2	3			**PUMP #**	5	
PUMP AMPERAGE			361	363	**AMPS**		
HORSE POWER			233	234	**HP**		
VOLTAGE to PUMPS					**VOLTS**		
PUMP #	3	2			**PUMP #**	6	
PUMP AMPERAGE			366	367	**AMPS**		
HORSE POWER			238	237	**HP**		
VOLTAGE to PUMPS					**VOLTS**		
VOLTAGE TO VFDS							
VFD Frequency				45.4		45.4	Hz

ETAPE MEASUREMENTS IN DISCHARGE CHANNEL:

		meas.	elev.		
WS ELEV. LOCK CHANNEL (etape)		25.5	159.50	**TIME:**	16:33
		25.4	159.60	**TIME:**	18:44

DISCHARGE CHANNEL (etape)			Deck elev.=	**185**	ft		
CHANNEL ENDS:	**U/S END**	21.4	163.6	ft	**D/S END**	21.5	163.5
CHANNEL ENDS:	**U/S END**	21.5	163.5	ft	**D/S END**	21.6	163.4

AVERAGE PUMP STATIC LIFT:					
CHANNEL ENDS:	**U/S END**	4.1	ft	**D/S END**	4.0
CHANNEL ENDS:	**U/S END**	3.9	ft	**D/S END**	3.8

AWS DIFFUSER "STOVE PIPES" (ETAPE W/REF TO EL. 185 DECK)

	meas.	elev.		
#15	22.1	162.9	**TIME:**	16:35

Note: if no overflow in diffuser slot, measure only the downstream slot without overflow in list below; then measure all openings with overflow (downstream of that slot).

	meas.	elev.		meas.	elev.		meas.	elev.
# 10			**# 9**			**# 8**		
# 7			**# 6**			**# 5**	22.50	162.50
# 4			**# 3**	22.60	162.40			

U/S most Diffuser with Flow over weir: **# 5** (lapping over at #6)

READOUTS (Elec Building)

	TIME:	16:16	18:38	
CHANNEL (u/s of Entrance)		161.0 ft	160.9 ft	
TAILWATER @ ENTRANCE =		159.2 ft	159.1 ft	
	Entrance head =	1.80 ft	1.81 ft	

E-Tape Readings		**Distance to Water:**			**WATER LEVEL ELEV:**		
		start	end		start	end	
	Time:	16:45		Ref EL	16:45		
Tailrace Level :		25.6		**185.0**	159.4		**ENTRANCE HEAD:**
		start	end		start	end	start / end
Existing Stillwell :							
Future Stillwell Location		24.1			160.9		1.5
(left side 50' u/s of entrance)							

STAFF GAGE READINGS		elev.		
Tailwater (+/- 1.0 ft)		159.3		ft
Fish Ladder over Diffuser 2 (+/1 0.2 ft)		161.5	161.4	ft

JOHN DAY NORTH FISHLADDER VELOCITY DATA

AWS CONDUIT MEASUREMENTS — *(Air Vent Slot East of Weir 174)*

Data Collectors: MPH | GSH | SJS

Date: 10/18/2012 **Time:** start 16:00 – end 17:30 **Pump Test number** 11

	Distance to Water: start	Distance to Water: end	Ref EL	WATER LEVEL ELEV: start	WATER LEVEL ELEV: end
Time:	16:45	0:00		16:45	0:00
Tailrace Level :	25.6	0.0	**185.0**	159.4	185.0
CONTROL PANEL READOUTS:				159.2	159.1

Datum = NGVD 29/47

	Entrance Head start	Entrance Head end	Ref EL	start	end
Exist U/s Stillwell:	25.6	0.0	**185.0**	185.0	185.0
Future US Stillwell	1.5	0.0		160.9	185.0
CONTROL PANEL READOUTS:	1.80	1.81		161.0	160.9

Staff Gages

location	
TW	159.3
Diff 2	161.5

No. of Pumps Operating: 3

POINT VELOCITY AND FLOW MEASUREMENTS IN AWS:

Z_{15} = Meas. Distance to WS: **22.20** ft (from 185 deck) — **B = Channel Width =** **24.0** ft — **RPM** 175.0

WS = Water Surface Elev: 162.80 (185 - Z_{15}) — **Deck elev =** **185.0** ft — **% Max** 76%

Y = Measured Depth = 12.80 ft (=WS - 2) — **Zi = INVERT =** **150.0** ft — Max RPM 229

		Aprrox internal dimension =	3.5	Div	est TW	26	
X1 = Side Edge width inc=	3	No of Internal X Incr =	5	10	internal Y	-124	(X' if YES) HP
Y1 = Vertical edge height in	2	No of Internal Y Incr. =	4	6		-36.42857143	

AWS CONDUIT MEASUREMENTS: *(Air Vent Slot East of Weir 174)*

Horiz. No.:	Formula for Depth from surface (pm)	Depth from Surface (ft)	Vert. Sect. No. :	1	2	4	6	7	Ave Vel
			Est Dist. from Left Edge (ft)	**1.5**	**5.0**	**12.0**	**19.0**	**22.5**	
			(ft) from Fft side	1.5	5.0	12.0	19.0	22.5	
1	0.5*Y1/2	**1.0**	Counts	46	53	57	60	51	
			duration or angle	40.0	40.2	40.0	40.6	40.1	
			VELOCITY	2.55	2.93	3.16	3.28	2.82	3.00
2	Depth 1 + (Y-Y1)/4	**3.7**	Counts	52	59	58	58	53	
			duration or angle	40.0	40.4	40.1	40.0	40.5	
			VELOCITY	2.88	3.24	3.21	3.22	2.90	3.13
3	Depth 2 + (Y-Y1)/4	**6.4**	Counts	55	58	57	59	52	
			duration or angle	40.1	40.2	40.0	40.5	40.2	
			VELOCITY	3.04	3.20	3.16	3.23	2.87	3.13
4	Depth 3 + (Y-Y1)/4	**9.1**	Counts	49	54	57	56	54	
			duration or angle	40.2	40.6	40.5	40.1	40.4	
			VELOCITY	2.71	2.95	3.12	3.10	2.97	3.00
5	Depth 4 + (Y-Y1)/4 should = Y - 0.5*Y1/2	**11.8**	Counts	46	48	57	53	46	
			duration or angle	40.6	40.2	40.3	40.4	40.1	
			VELOCITY	2.52	2.65	3.14	2.91	2.55	2.81
	Total Average Integrated Velocity =				3.02				
	Total Computed AWS FLOW RATE =				927	(= B * Y * V)			

Pump 1		
Pump 2	X	238
Pump 3	X	234
Pump 4	X	244
Pump 5		
Pump 6		

Price Meter X

Price Meter Rotations per Count: **1**

V = 0.0178 + 2.2048 * (rotations/time)

JOHN DAY NORTH FISHLADDER VELOCITY DATA

LADDER CHANNEL MEASUREMENTS — **Data Collectors:** MPH | GSH | SJS

LOCATION: 2 — *9 feet east of MonolithJoint Sections 1 and 2*

(Approx Former WEIR 155 Location)

Pump Test number 11

		start	end
Date:	10/18/2012	**Time:** 18:08	18:30

	Tailwater start	Tailwater end	Entrance Head start	Entrance Head end
CONTROL PANEL READOUTS:	159.2	159.1	1.80	1.81

Price Meter X

No. of Pumps Operating: 3

Price Meter Rotations per Count = 1

V = 0.0178 + 2.2048 * (rotations/time)

POINT VELOCITY AND FLOW MEASUREMENTS IN AWS:

Z_{15} = Meas. Distance to WS		ft (from 185 deck)	**B = Channel Width =**	**24.0** ft
WS = Water Surface Elev	161.40	(185 - Z_{15})	**Deck elev =**	**185.0** ft
Y = Measured Depth =	11.40	ft (=WS - 2)	**Zi = INVERT =**	**150.0** ft

		Aprrox internal dimension =	5.0	Div	est TW	26.0
X1 = Side Edge width inc=	4	No. of Internal X Incr. =	3	6	internal Y	-124.0
Y1 = Vertical edge height in	2	No.of Internal Y Incr. =	2	4		-25.8

AWS CONDUIT MEASUREMENTS:

(Former Weir 155 Location)

Horiz. No.:	Formula for Depth from surface (pm)	Depth from Surface (ft)	Vert. Sect. No. :	1	2	4	6	7	Ave Vel
			Est Dist. from Left Edge (ft)	**4.0**		**12.0**		**20.0**	
			(ft) from Fft side	4.0		12.0		20.0	
1	0.5*Y1/2	**1.0**	Counts	23		26		25	
			duration or angle	41.2		40.6		40.1	
			VELOCITY	1.25		1.43		1.39	1.35
Observed Angle of Flow (range)		*Degrees from longitudinal*		-20 to 10		-10 to 20		-20 to 20	South is - North is +
4	Depth 3 + (Y-Y1)/2	**5.7**	Counts	10		12		12	
			duration or angle	42.4		42.9		42.4	
			VELOCITY	0.54		0.63		0.64	0.60
5	Depth 4 + (Y-Y1)/4 should = Y - 0.5*Y1/2	**10.4**	Counts	10		8		9	
			duration or angle	42.4		40.4		41.5	
			VELOCITY	0.54		0.45		0.50	0.50

Total Average Integrated Velocity = 0.79

Total Computed AWS FLOW RATE = 217 (= B * Y * V)

'Test 12' sheets, dated 10-19-2012

JOHN DAY NORTH FISH LADDER HEAD DATA

Date:	10/19/2012	Time:	9:41	10:50		Name:	MPH	GSH	SJS
PUMP TEST NUMBER:			12			*ENTRANCE DATA READOUT:*			
					9:41	TW	159.1	*App Cha*	160.7
NUMBER OF PUMPS OPERATING:				2	*10:50*	TW	159.2	*App Cha*	160.8
RPM OF PUMPS OPERATING:				224					
% Max RPM				98%					

Pump No.	1	2	3	4	5	6
PUMPS IN OPERATION:			X	X		

PRESSURE AND WATER SURFACE ELEVATIONS:

	meas.			
COUNTING STATION STAFF GAGE =	1.3	ft	**TIME:**	

PUMP & AWS HEAD MEASUREMENTS: (Deck Elev. = 185 ft)
(datum = NGVD 29/47)

PUMPS FROM U/S END:

CONTROL ROOM READINGS:

PUMP # 1	*TIME:*	9:41	10:50	**PUMP #** 4		
PUMP AMPERAGE				**AMPS**	452	448
HORSE POWER				**HP**	379	375
VOLTAGE to PUMPS				**VOLTS**		
PUMP # 2	3			**PUMP #** 5		
PUMP AMPERAGE				**AMPS**		
HORSE POWER				**HP**		
VOLTAGE to PUMPS				**VOLTS**		
PUMP # 3	2			**PUMP #** 6		
PUMP AMPERAGE		434	428	**AMPS**		
HORSE POWER		364	364	**HP**		
VOLTAGE to PUMPS				**VOLTS**		
VOLTAGE TO VFDS						
VFD Frequency		58.1		58.1	Hz	

ETAPE MEASUREMENTS IN DISCHARGE CHANNEL:

		meas.	elev.		
WS ELEV. LOCK CHANNEL (etape)		25.4	159.60	**TIME:**	9:48
		25.2	159.80	**TIME:**	10:53

DISCHARGE CHANNEL (etape)			Deck elev.=	**185**	ft			
CHANNEL ENDS:	**U/S END**	22.1	162.9	ft		**D/S END**	22.2	162.8
CHANNEL ENDS:	**U/S END**	22.2	162.8	ft		**D/S END**	22.2	162.8
AVERAGE PUMP STATIC LIFT:								
CHANNEL ENDS:	**U/S END**		3.3	ft		**D/S END**		3.2
CHANNEL ENDS:	**U/S END**		3.0	ft		**D/S END**		3.0

AWS DIFFUSER "STOVE PIPES" (ETAPE W/REF TO EL. 185 DECK)

	meas.	elev.		
#15	22.6	162.4	**TIME:**	10:10

Note: if no overflow in diffuser slot, measure only the downstream slot without overflow in list below; then measure all openings with overflow (downstream of that slot).

	meas.	elev.		meas.	elev.		meas.	elev.
# 10			**# 9**			**# 8**		
# 7			**# 6**			**# 5**	22.80	162.20
# 4			**# 3**	23.00	162.00			

U/S most Diffuser with Flow over weir: **# 5** (barely lapping over)

READOUTS (Elec Building)

	TIME:	10:00		10:48	
CHANNEL (u/s of Entrance)		160.7	ft	160.80	ft
TAILWATER @ ENTRANCE =		159.1	ft	159.2	ft
	Entrance head =	1.61	ft	1.60	ft

E-Tape Readings		**Distance to Water:**			**WATER LEVEL ELEV:**		
		start	end		start	end	
	Time:	10:00	11:04	Ref EL	10:00	11:04	
Tailrace Level :		25.8	25.7	**185.0**	159.3	159.3	**ENTRANCE HEAD:**
		start	end		start	end	start / end
Existing Stillwell :							
Future Stillwell Location		24.3	24.3		160.7	160.7	1.4 / 1.4
(left side 50' u/s of entrance)							

STAFF GAGE READINGS	elev.		
Tailwater (+/- 1.0 ft)	?		ft
Fish Ladder over Diffuser 2 (+/1 0.2 ft)	161.2		ft

JOHN DAY NORTH FISHLADDER VELOCITY DATA

AWS CONDUIT MEASUREMENTS — *(Air Vent Slot East of Weir 174)*

Data Collectors: MPH | GSH | SJS

Date: 10/19/2012 **Time:** start 9:30 – end 10:40 **Pump Test number** 12

	Distance to Water: start	Distance to Water: end		WATER LEVEL ELEV: start	WATER LEVEL ELEV: end	Entrance Head start	Entrance Head end
Time:	10:00	11:04	Ref EL	10:00	11:04		
Tailrace Level :	25.8	25.7	**185.0**	159.3	159.3		
CONTROL PANEL READOUTS:				159.1	159.2		
Exist U/s Stillwell:	0.0	0.0	**185.0**	185.0	185.0	25.8	25.7
Future US Stillwell	24.3	24.3		160.7	160.7	1.4	1.4
CONTROL PANEL READOUTS:				160.7	160.8	1.61	1.60

Datum = NGVD 29/47

Staff Gages

location		
TW	?	
Diff 2	161.2	

No. of Pumps Operating: 2

POINT VELOCITY AND FLOW MEASUREMENTS IN AWS:

Z_{15} = Meas. Distance to WS	22.70 ft (from 185 deck)	**B = Channel Width =**	**24.0** ft	**RPM**	224.0
WS = Water Surface Elev	162.30 (185 - Z_{15})	**Deck elev =**	**185.0** ft	**% Max**	98%
Y = Measured Depth =	12.30 ft (=WS - 2)	**Zi = INVERT =**	**150.0** ft	Max RPM	229

		Aprrox internal dimension =	3.5	Div	est TW	26	
X1 = Side Edge width inc=	3	No of Internal X Incr =	5	10	internal Y	-124	(X' if YES) HP
Y1 = Vertical edge height in	2	No of Internal Y Incr. =	4	6		-36.42857143	

AWS CONDUIT MEASUREMENTS: *(Air Vent Slot East of Weir 174)*

Horiz. No.:	Formula for Depth from surface (pm)	Depth from Surface (ft)	Vert. Sect. No. :	1	2	4	6	7	Ave Vel
			Est Dist. from Left Edge (ft)	**1.5**	**5.0**	**12.0**	**19.0**	**22.5**	
			(ft) from Fft side	1.5	5.0	12.0	19.0	22.5	
1	0.5*Y1/2	**1.0**	Counts	51	54	55	57	47	
			duration or angle	40.0	40.4	40.3	40.7	40.4	
			VELOCITY	2.83	2.97	3.03	3.11	2.58	2.94
2	Depth 1 + (Y-Y1)/4	**3.7**	Counts	48	54	55	57	49	
			duration or angle	40.1	40.5	40.3	40.0	40.4	
			VELOCITY	2.66	2.96	3.03	3.16	2.69	2.94
3	Depth 2 + (Y-Y1)/4	**6.4**	Counts	52	56	55	54	50	
			duration or angle	40.3	40.5	40.0	40.6	40.6	
			VELOCITY	2.86	3.07	3.05	2.95	2.73	2.96
4	Depth 3 + (Y-Y1)/4	**9.1**	Counts	47	54	55	52	50	
			duration or angle	40.4	40.4	40.7	40.7	40.1	
			VELOCITY	2.58	2.97	3.00	2.84	2.77	2.86
5	Depth 4 + (Y-Y1)/4 should = Y - 0.5*Y1/2	**11.7**	Counts	40	37	49	49	43	
			duration or angle	40.7	40.1	40.6	40.2	40.7	
			VELOCITY	2.19	2.05	2.68	2.71	2.35	2.43

Total Average Integrated Velocity = 2.85

Total Computed AWS FLOW RATE = 841 (= B * Y * V)

Pump 1		
Pump 2		
Pump 3	X	364
Pump 4	X	379
Pump 5		
Pump 6		

Price Meter X

Price Meter Rotations per Count: **1**

V = 0.0178 + 2.2048 * (rotations/time)

JOHN DAY NORTH FISHLADDER VELOCITY DATA

LADDER CHANNEL MEASUREMENTS — **Data Collectors:** MPH, GSH, SJS

LOCATION: 2 — *9 feet east of MonolithJoint Sections 1 and 2*

(Approx Former WEIR 155 Location)

Pump Test number 12

Date: 10/19/2012 **Time:** start 11:10 – end 11:49

	Tailwater start	Tailwater end	Entrance Head start	Entrance Head end
CONTROL PANEL READOUTS:	159.1	159.2	1.61	1.60
Time of Readings:	10:00	10:48		

Price Meter X

No. of Pumps Operating: 2

Price Meter Rotations per Count = 1

V = 0.0178 + 2.2048 * (rotations/time)

POINT VELOCITY AND FLOW MEASUREMENTS IN AWS:

Z_{15} = Meas. Distance to WS	**23.80** ft (from 185 deck)	**B = Channel Width =**	**24.0** ft	
WS = Water Surface Elev	161.20 (185 - Z_{15})	**Deck elev =**	**185.0** ft	
Y = Measured Depth =	11.20 ft (=WS - 2)	**Zi = INVERT =**	**150.0** ft	

		Aprrox internal dimension =	5.0	Div	est TW	26.0
X1 = Side Edge width inc=	4	No. of Internal X Incr. =	3	6	internal Y	-124.0
Y1 = Vertical edge height ir	2	No.of Internal Y Incr. =	2	4		-25.8

AWS CONDUIT MEASUREMENTS: *(Former Weir 155 Location)*

Horiz. No.:	Formula for Depth from surface (pm)	Depth from Surface (ft)	Vert. Sect. No. :	1	2	4	6	7	Ave Vel
			Est Dist. from Left Edge (ft)	2.0	7.0	12.0	17.0	22.0	
			(ft) from Fft side	2.0	7.0	12.0	17.0	22.0	
1	0.5*Y1/2	1.0	Counts	31	21	27	27	32	
			duration or angle	42.6	41.4	40.3	40.8	40.9	
			VELOCITY	1.62	1.14	1.50	1.48	1.74	1.49
Observed Angle of Flow (range)		*Degrees from longitudinal*		-20 to 10	-25 to 10	-20 to 10	-20 to 20	-10 to 10	South is - North is +
4	Depth 3 + (Y-Y1)/2	5.6	Counts	9	9	18	13	15	
			duration or angle	41.6	45.5	40.2	41.4	41.2	
			VELOCITY	0.50	0.45	1.01	0.71	0.82	0.70
5	Depth 4 + (Y-Y1)/4 should = Y - 0.5*Y1/2	10.2	Counts	13	7	7	7	13	
			duration or angle	41.0	44.5	42.7	44.2	41.0	
			VELOCITY	0.72	0.37	0.38	0.37	0.72	0.51

Total Average Integrated Velocity = 0.88

Total Computed AWS FLOW RATE = 235 (= B * Y * V)

‘Test 13’ sheets, dated 10-19-2012

JOHN DAY NORTH FISH LADDER HEAD DATA									
Date:	10/19/2012	Time:	13:20	14:10	15:15	Name:	MPH	GSH	SJS
PUMP TEST NUMBER:			13			ENTRANCE DATA READOUT:			
					13:20	TW	159.1	App Cha	161.4
NUMBER OF PUMPS OPERATING:				3	14:10	TW	159.1	App Cha	161.4
RPM OF PUMPS OPERATING:				205	15:15	TW	159.1	App Cha	161.4
% Max RPM				90%		ENTRANCE DATA READOUT:			
		Pump No.	1	2	3	4	5	6	
PUMPS IN OPERATION:				X	X	X			
PRESSURE AND WATER SURFACE ELEVATIONS:									
					meas.				
COUNTING STATION STAFF GAGE =					1.3	ft	TIME:		
PUMP & AWS HEAD MEASUREMENTS:						(Deck Elev. =		185	ft)
						(datum = NGVD 29/47)			
PUMPS FROM U/S END:									
CONTROL ROOM READINGS:									
PUMP #	1	TIME:	13:20	14:10	15:15	PUMP #	4		
PUMP AMPERAGE						AMPS	473	474	475
HORSE POWER						HP	371	369	370
VOLTAGE to PUMPS						VOLTS			
PUMP #	2	3				PUMP #	5		
PUMP AMPERAGE			459	459	458	AMPS			
HORSE POWER			351	355	356	HP			
VOLTAGE to PUMPS						VOLTS			
PUMP #	3	2				PUMP #	6		
PUMP AMPERAGE			461	464	462	AMPS			
HORSE POWER			361	361	356	HP			
VOLTAGE to PUMPS						VOLTS			
VOLTAGE TO VFDS									
VFD Frequency				53.2		53.3	Hz		

ETAPE MEASUREMENTS IN DISCHARGE CHANNEL:

	meas.	elev.		
WS ELEV. LOCK CHANNEL (etape)	25.7	159.30	**TIME:**	13:26
	25.4	159.60	**TIME:**	14:15

DISCHARGE CHANNEL (etape)			Deck elev.=	**185**	ft			
CHANNEL ENDS:	**U/S END**	20.4	164.6	ft		**D/S END**	20.4	164.6
CHANNEL ENDS:	**U/S END**	20.3	164.7	ft		**D/S END**	20.4	164.6

AVERAGE PUMP STATIC LIFT:						
CHANNEL ENDS:	**U/S END**	5.3	ft		**D/S END**	5.3
CHANNEL ENDS:	**U/S END**	5.1	ft		**D/S END**	5.0

AWS DIFFUSER "STOVE PIPES" (ETAPE W/REF TO EL. 185 DECK)

	meas.	elev.		
#15	21.1	163.9	**TIME:**	13:45

Note: if no overflow in diffuser slot, measure only the downstream slot without overflow in list below; then measure all openings with overflow (downstream of that slot).

	meas.	elev.		meas.	elev.		meas.	elev.
# 10			**# 9**			**# 8**		
# 7	21.5	163.5	**# 6**	21.5	163.5	**# 5**	21.9	163.1
# 4	21.9	163.1	**# 3**	21.8	163.2			

U/S most Diffuser with Flow over weir: **# 6**

READOUTS (Elec Building)

			TIME:	13:20		14:10		15:13	
CHANNEL (u/s of Entrance)				161.4	ft	161.40	ft	161.40	ft
TAILWATER @ ENTRANCE =				159.1	ft	159.1	ft	159.1	ft
			Entrance head =	2.29	ft	2.29	ft	2.27	ft

E-Tape Readings		**Distance to Water:**			**WATER LEVEL ELEV:**		
		start	end		start	end	
	Time:	13:39	14:28	Ref EL	13:39	14:28	
Tailrace Level :		25.8	25.8	**185.0**	159.2	159.3	**ENTRANCE HEAD:**
		start	end		start	end	start / end
Existing Stillwell :							
Future Stillwell Location		23.6	23.6		161.4	161.4	2.2 / 2.2
(left side 50' u/s of entrance)		*23.6*	*23.6*	(right side)	*161.4*	*161.4*	

STAFF GAGE READINGS		elev.		
Tailwater (+/- 1.0 ft)		?		ft
Fish Ladder over Diffuser 2 (+/1 0.2 ft)		162.0		ft

JOHN DAY NORTH FISHLADDER VELOCITY DATA

AWS CONDUIT MEASUREMENTS — *(Air Vent Slot East of Weir 174)*

Data Collectors: MPH | GSH | SJS

		start	end
Date:	10/19/2012 **Time:**	13:10	14:07

Pump Test number 13

	Distance to Water: start	Distance to Water: end	Ref EL	WATER LEVEL ELEV: start	WATER LEVEL ELEV: end
Time:	13:39	14:28		13:39	14:28
Tailrace Level :	25.8	25.8	**185.0**	159.2	159.3
CONTROL PANEL READOUTS:				159.1	159.1

Datum = NGVD 29/47

	Entrance Head start	Entrance Head end	Ref EL	start	end
Exist U/s Stillwell:	25.8	25.8	**185.0**	185.0	185.0
Future US Stillwell	2.2	2.2		161.4	161.4
CONTROL PANEL READOUTS:	2.29	2.29		161.4	161.4

Staff Gages

location	
TW	?
Diff 2	162.0

No. of Pumps Operating 3

POINT VELOCITY AND FLOW MEASUREMENTS IN AWS:

Z_{15} = Meas. Distance to WS	**21.10** ft (from 185 deck)	**B = Channel Width =**	**24.0** ft	**RPM**	205.0
WS = Water Surface Elev	163.90 (185 - Z_{15})	**Deck elev =**	**185.0** ft	**% Max**	90%
Y = Measured Depth =	13.90 ft (=WS - 2)	**Zi = INVERT =**	**150.0** ft	Max RPM	229

		Aprrox internal dimension =	3.5	Div	est TW	26	
X1 = Side Edge width inc=	3	No of Internal X Incr =	5	10	internal Y	-124	(X' if YES) HP
Y1 = Vertical edge height ir	2	No of Internal Y Incr. =	4	6		-36.42857143	

AWS CONDUIT MEASUREMENTS: *(Air Vent Slot East of Weir 174)*

Horiz. No.:	Formula for Depth from surface (pm)	Depth from Surface (ft)	Vert. Sect. No. :	1	2	4	6	7	Ave Vel
			Est Dist. from Left Edge (ft)	**1.5**	**5.0**	**12.0**	**19.0**	**22.5**	
			(ft) from Fft side	1.5	5.0	12.0	19.0	22.5	
1	0.5*Y1/2	**1.0**	Counts	55	57	58	60	61	
			duration or angle	40.3	40.7	40.3	40.3	40.5	
			VELOCITY	3.03	3.11	3.19	3.30	3.34	3.19
2	Depth 1 + (Y-Y1)/4	**3.5**	Counts	55	61	61	64	66	
			duration or angle	40.7	40.0	40.4	40.5	40.3	
			VELOCITY	3.00	3.38	3.35	3.50	3.63	3.38
3	Depth 2 + (Y-Y1)/4	**6.4**	Counts	61	62	62	66	64	
			duration or angle	40.6	40.3	40.3	40.0	40.2	
			VELOCITY	3.33	3.41	3.41	3.66	3.53	3.47
4	Depth 3 + (Y-Y1)/4	**10.5**	Counts	58	58	65	63	64	
			duration or angle	40.2	40.3	40.2	40.1	40.4	
			VELOCITY	3.20	3.19	3.58	3.48	3.51	3.41
5	Depth 4 + (Y-Y1)/4 should = Y - 0.5*Y1/2	**12.9**	Counts	53	58	60	60	47	
			duration or angle	40.4	40.6	40.4	40.6	40.0	
			VELOCITY	2.91	3.17	3.29	3.28	2.61	3.11
	Total Average Integrated Velocity =				3.33				
	Total Computed AWS FLOW RATE =				1112	(= B * Y * V)			

Pump 1		
Pump 2	X	355
Pump 3	X	361
Pump 4	X	371
Pump 5		
Pump 6		

Price Meter X

Price Meter Rotations per Count: **1**

V = 0.0178 + 2.2048 * (rotations/time)

JOHN DAY NORTH FISHLADDER VELOCITY DATA

LADDER CHANNEL MEASUREMENTS — **Data Collectors:** MPH, GSH, SJS

LOCATION: 2 — *9 feet east of MonolithJoint Sections 1 and 2*

(Approx Former WEIR 155 Location)

Pump Test number 13

Date: 10/19/2012 **Time:** start 14:35 end 17:05

	Tailwater start	Tailwater end	Entrance Head start	Entrance Head end
CONTROL PANEL READOUTS:	159.1	159.1	2.29	2.29
Time of Readings:	14:10	15:13		

Price Meter X

No. of Pumps Operating: 3

Price Meter Rotations per Count = 1

V = 0.0178 + 2.2048 * (rotations/time)

POINT VELOCITY AND FLOW MEASUREMENTS IN AWS:

Z_{15} = Meas. Distance to WS — ft (from 185 deck) — **B = Channel Width =** **24.0** ft

WS = Water Surface Elev 162.00 (185 - Z_{15}) - staff gage — **Deck elev =** **185.0** ft

Y = Measured Depth = 12.00 ft (=WS - 2) — **Zi = INVERT =** **150.0** ft

		Aprrox internal dimension =	5.0	Div	est TW	26.0
X1 = Side Edge width inc=	4	No. of Internal X Incr. =	3	6	internal Y	-124.0
Y1 = Vertical edge height ir	2	No.of Internal Y Incr. =	2	4		-25.8

AWS CONDUIT MEASUREMENTS: *(Former Weir 155 Location)*

Horiz. No.:	Formula for Depth from surface (pm)	Depth from Surface (ft)	Vert. Sect. No. :	1	2	4	6	7	Ave Vel
			Est Dist. from Left Edge (ft)	2.0	7.0	12.0	17.0	22.0	
			(ft) from Fft side	2.0	7.0	12.0	17.0	22.0	
1	0.5*Y1/2	1.0	Counts	36	30	30	32	36	
			duration or angle	41.4	39.9	41.0	40.9	40.9	
			VELOCITY	1.94	1.68	1.63	1.74	1.96	1.79
Observed Angle of Flow (range)		*Degrees from longitudinal*		-10 to 10	-30 to 30	-20 to 20	-20 to 20	-5 to 5	South is - North is +
4	Depth 3 + (Y-Y1)/2	6.0	Counts	16	13	16	15	20	
			duration or angle	43.1	46.2	40.6	41.4	41.6	
			VELOCITY	0.84	0.64	0.89	0.82	1.08	0.85
5	Depth 4 + (Y-Y1)/4 should = Y - 0.5*Y1/2	11.0	Counts	19	9	9	6	14	
			duration or angle	42.1	42.1	41.5	43.1	40.0	
			VELOCITY	1.01	0.49	0.50	0.33	0.79	0.62

Total Average Integrated Velocity = 1.05

Total Computed AWS FLOW RATE = 304 (= B * Y * V)

APPENDIX D - Photo collage of field data gathering showing equipment. (See following pages.)

Photo-stream of John Day Dam N. Fish Ladder, Oct. 18 & 19, 2012 data collection and associated equipment:
(Overall Images Nos. 1 to 9, on pages 1 to 4:)

Photo 1. Aerial View of North Fish Ladder from NavLock gate lifting tower – looking upstream towards dam, with Navlock on the left. The Fish Counting Station is in center of upper-most level of the fish ladder.

Photo 2. End view of North Fish Ladder – the AWS vent-well is shown in the lower right corner, as a projection from the end turn of the fish ladder channel, per the arrow. Three struts are at the base of the AWS vent-well wall.

Photo 3. N. Fish Ladder – looking downstream from AWS vent-well towards dam and former Weir 155, the other transect location where the fish ladder channel cross-sectional velocities were measured.

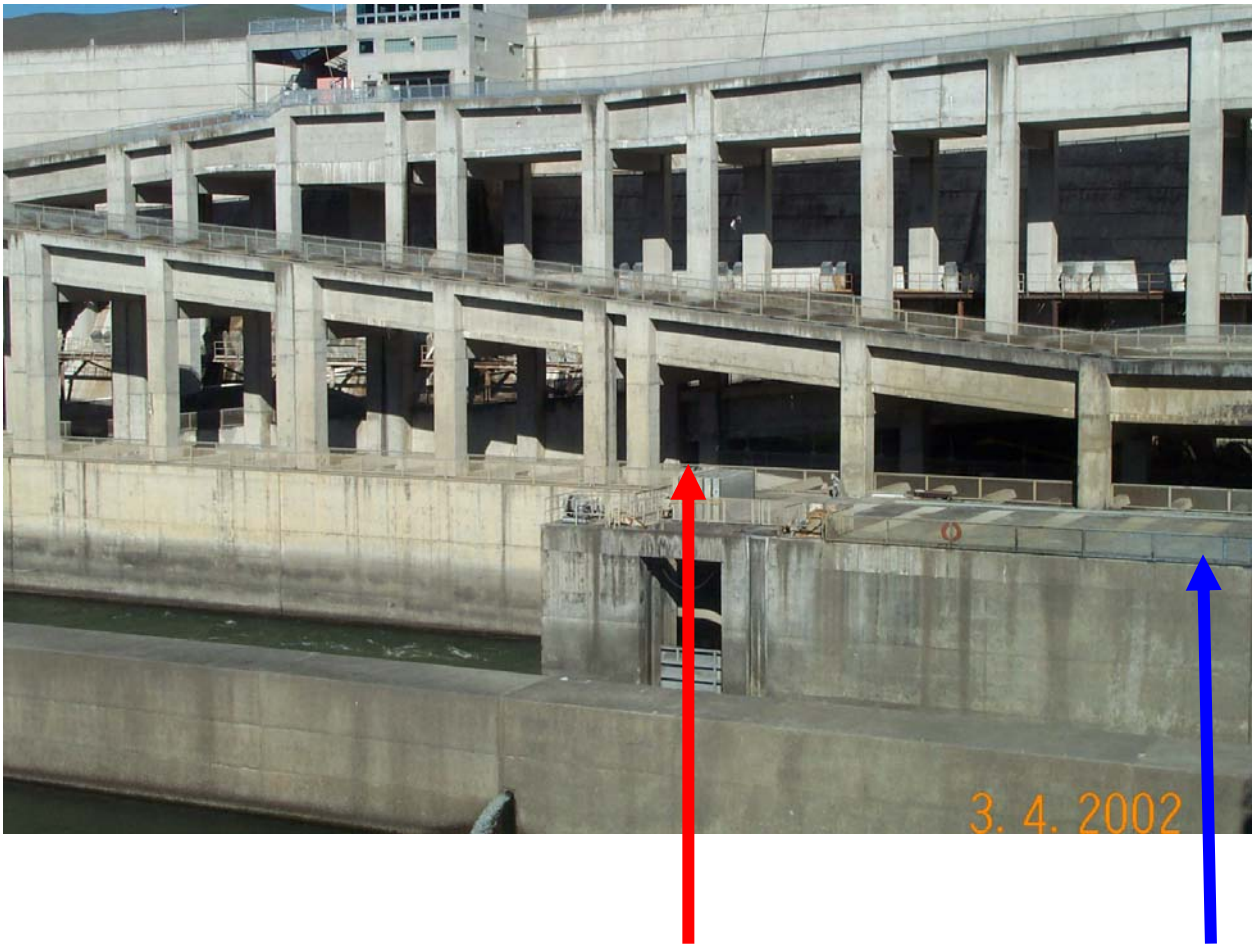

Photo 4. Elevation view of N Fish Ladder – the fish channel transect is located just right of the closely spaced dual concrete columns in line-sight with the entrance end of the fish ladder. The monolith joint runs between the two closely-spaced columns. The fish channel transect is nine feet to the right of the monolith joint, lying just to the right of right column as noted by the red arrow. The blue arrow pointing to the Elev. 185 deck is where e-tape water-surface level indicators are used to determine the water surface, just within the fish ladder entrance.

Photo 5. Water velocity measurement system – sounding reel on folding frame, plus 30# lead fish-weight, with Price meter. Price meter is lowered by stainless steel cable down into the AWS vent-well from the end pulley, via a hand-operated crank-arm mounted on the sounding reel.

Photo 6. Close-up of water velocity measurement system – sounding reel on folding frame, showing hand crank and electrical leads for measuring Price meter cup rotations, and hence water velocity. An adjustable cable-payout dial indicator is on the left upper end of the sounding reel chassis, directly above the reel axle.

Photo 7. Close-up of Price meter setup next to the AWS vent-well with 30# fish weight to maintain stability in turbulent flow. The upper wire connection lead ("one-count") is normally used, not the lower wire connection lead as shown ("five-count"). The cups of the Price meter are given a 'two minute spin' test before immersion to insure proper functioning. Concurrently the spin reading on the 'Aquacount' output reader (not shown) is also checked.

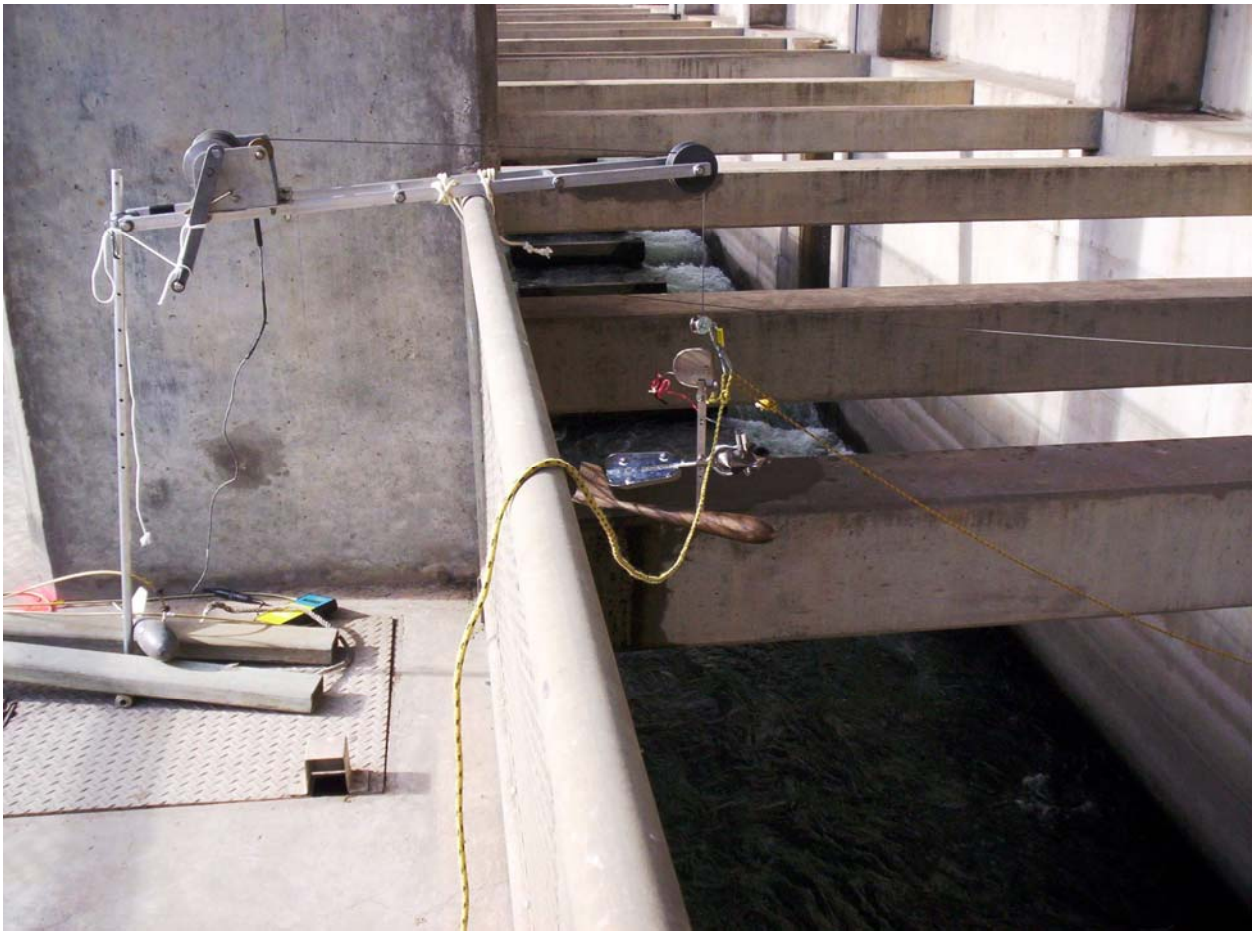

Photo 8. Close-up of Price meter setup next to the fish channel, near the former Weir 155. The fish weight and Price meter are drawn across the channel into position by the ropes attached to the metal links and metal cable-pulley. The position was checked using a marked-up light-weight white two inch plastic pipe. Note the connected blue and yellow 'Aquacount' output reader placed temporarily on the Elev. 185 deck. The operator normally stands on the folding frame where it rests on the deck, instead of the steel tubing sections shown.

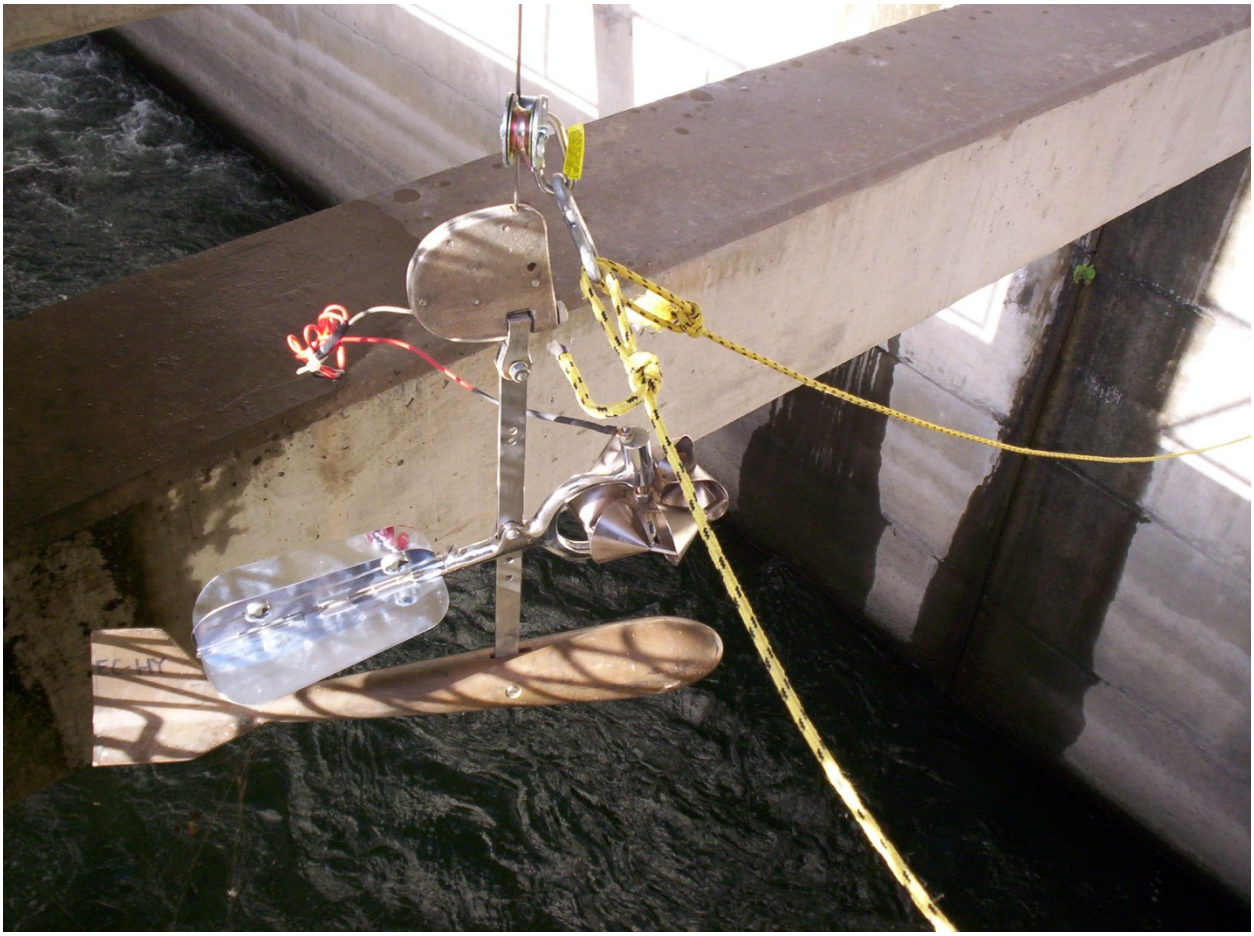

Photo 9. Close-up of Price meter setup next to the fish channel with the metal pulley positioning system. The cups of the Price meter are given a ‘two minute spin’ test before immersion to insure proper functioning. This test consists of seeing if the cups, once manually spun, remain in motion for at least two minutes. Concurrently the spin reading on the ‘Aquacount’ output reader is also checked.

References:

JD reference drawings –

JDF-1-3-4/5 N. Shore Fish Ladder - Pumphouse
JDF-1-3-4/8 N. Shore Fish Facilities - Section of Pump & Pump Discharge Chute (Shows under-sized radius of interior concrete corner, leading to discharge duct)
JDF-1-4-2/1 N. Shore Fish Ladder – Concrete Outline (Shows diffusers and stove-pipe wells & fish ladder entrance X-Section)
JDF-1-4-2/17 N. Shore Fish Ladder – Section Views No. 2 (shows stove-pipe shaft & overflow weir)
JDF-1-4-2/18 N. Shore Fish Ladder – Section Views No. 3
JDF-1-4-2/52 N. Shore Fish Ladder – Weir 155 to 263
JDF-1-4-2/57 N. Shore Fish Ladder – Staff Gage Locations (incl. inside & outside of fish ladder entrance), (shows 'water supply conduit' from pumps)
JDF-1-4-2/58 N. Shore Fish Ladder – Elevation View (shows orifice covers and Stove-pipe shafts leading to diffusers. Also vent well in auxiliary water supply (AWS) conduit where velocities are taken to compute AWS discharge rates.
JDF-1-4-2/104 N. Shore Fish Ladder – Temporary Fish Ladder
JDF-1-5-2/1 N. Shore Fish Ladder – Fish Entrance
JDF-1-5-2/12 N. Shore Fish Ladder – Existing General Layout (shows water Supply conduit, 'observation well', and NavLock discharge conduits routed Beneath water supply conduit)
JDF-1-5-2/19 N. Shore Fish Ladder – Modified Sections at Counting Station

JD misc. ref. -
2007 correspondence on North Fish Ladder evaluations – S. Schlenker, Cy Cook, Karen Kuhn, et al.