

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 37-21297

Exam Date: 6/18/2020

1. Current Owner:
WILLIAM ARKOOSH 2005 US HWY 26 GOODING ID 83330

2. Accompanied by: William Arkoosh
Phone No: 208-539-5443
Address: 2005 US Hwy 26, Gooding, ID 83330
Relationship to permit Holder: Applicant

3. **SOURCE:**
LITTLE WOOD RIVER

Tributary
MALAD RIVER

Method of Determination: Aerial imagery in ArcMap

B. OVERLAP REVIEW

1. Other water rights with the same place of use: NO Overlap

Water Right No.	Source	Purpose of Use	Basis

Comments: There is only one water right/permit (37-21297) for power use at this POU.

2. Other water rights with the same point-of-diversion: YES Overlap

Water Right No.	Source	Purpose of Use	Basis
37-327	Little Wood River	Irrigation	Decreed
37-329	Little Wood River	Irrigation	Decreed
37-59M	*Big Wood River	Irrigation	Decreed

Comments: There are no other water rights for power use at this POD; however, the three irrigation rights listed above share the same POD and have a combined use limit of 5.88 cfs that may be pumped from the feeder canal upstream of the power plant to the irrigation POU. *Note: Water for 37-59M is diverted from the Big Wood River into the Richfield Canal, injected into the Jim Byrns Slough that flows into the Little Wood River, and re-diverted from the Little Wood River.

C. DIVERSION AND DELIVERY SYSTEM1. **LOCATION OF POINT(S) OF DIVERSION:**

LITTLE WOOD RIVER NE¼ NE¼, Sec. 26, Twp 05S, Rge 16E, B.M. LINCOLN County

Method of Determination: Aerial imagery in ArcMap and Google Earth, and field exam

2 **PLACE OF USE: POWER**

Twp	Rng	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
05S	16E	26								X									

Method of Determination: Aerial imagery in ArcMap and Google Earth, and field exam

- 3.
- ☒ Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
- ☒ Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.
- ☒ Aerial Photo Attached (required for irrigation of 10+ acres).
- ☒ Photo of Diversion and System Attached

(Refer to attachments 1, 2, 3, and 4a-4d.)

4.

Generator Make	kW	Generator Type	Turbine Make	Turbine Discharge Size
*See Remark (Type SF1200-24/2600)	1200	Synchronous	*See Remark (Type ZTK305-LJ-160)	Rated for 500 cfs and 34.5 feet of rated head

*One generator and one turbine with a fixed shared shaft. The Turbine-generator set is manufactured by China Chang Jiang Energy Corporation.
The turbine is a vertical shaft Kaplan type (manually adjustable).

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
Open Channel	ADCP - StreamPro	RDI Teledyne	SPADCP-ELEC-UG1 Rev:D	432	31.5" x 45" Boat	*See Remarks Below

2. Measurements:

Power Plant Flow:

Though the power plant was operating on the day of the exam, no open channel measurement was made that day. On 9/16/16, however, IDWR staff made two open channel measurements at the facility using a StreamPro (see equipment specifications above). One measurement was made just downstream of the point of diversion in the feeder canal and one was made downstream of the power plant in the tailrace canal (upstream of where it discharges to the Little Wood River). The upstream measurement was 381.6 cfs, and the downstream measurement was 380.5 cfs. One small diversion (for the three irrigation rights listed above) just upstream of the power plant was simultaneously reading 2.4 cfs. Subtracting the small diversion measurement from the upstream measurement leaves 379.2 cfs for the power plant flow. The tailrace canal measurement also reflects power plant flow.

Summary of power plant flow measurements:

Measurement at the upstream end of feeder canal: 381.6 cfs
 Measurement of irrigation diversion upstream of power plant: 2.4 cfs
 Resulting power plant flow from upstream measurement: $381.6 - 2.4 = 379.2$ cfs

Measurement at the downstream end of tailrace canal: 380.5 cfs
 (also a measure of power plant flow)

Values for power plant flow within 1% of each other: 379.2 cfs and 380.5 cfs

To address condition 12 on the amended permit, the open channel flow measurements made by IDWR staff on 9/16/16 confirmed that no losses were occurring between the upstream end of the feeder canal and the downstream end of the tailrace canal. A report of the measurement results was included by the applicant in the proof of beneficial use statement.

*Note: Regarding calibration of the StreamPro, the accuracy of the StreamPro is periodically tested by doing side by side measurements with StreamPros of the United States Geological Survey (USGS). The date of the most recent such test prior to the 9/16/16 measurement is unknown, but such validation measurements typically happen once per year.

Little Wood River Flow:

a) Irrigation Season Flow: Station 14 on the Little Wood River at Shoshone, Idaho is a part-time station maintained from April 1 – September 30 by Water District 37 personnel. The water master provided Water District 37 (WD37) diversion data for the reach on the Little Wood River between Station 14 and the applicant's project. IDWR water rights in the same reach could account for another approximate 20 cfs of diverted water. The spreadsheets titled, "Little Wood River at Applicant's POD" (Attachments 5a and 5b), represent year 2016 and 2017 daily average flow for Station 14 less the water district diversions for the reach upstream of the permit POD. The spreadsheets indicate that substantial flow is available at the permit POD for the applicant to beneficially use, even with an additional 20 cfs of diversions for IDWR water rights. All Station 14 and WD37 diversion data were published in the Water District 37 2016 & 2017 black books (Water District No. 37, *Water Distribution and Hydrometric Works*).

b) Winter Flow: The applicant verifies he operates the plant in winter to produce a minimum of 20 kW of power, which would require 8.6 cfs of flow through the power plant. The minimum bypass flow in winter months is 13 cfs; therefore, with just under 22 cfs of flow (8.6 + 13 cfs), the applicant can run the power plant. IDWR operates a stream gaging station, called Little Wood #54, about 1.6 miles east of Shoshone city center on the Little Wood River. The winter flow at this stream gaging station approximates the available flow at the permit POD (for non-irrigation months). Peak flow for the Little Wood #54 station during non-irrigation months for 2016 was 143 cfs, which exceeds the minimum required bypass flow, allowing for winter power generation at the applicant's facility. The applicant's power generation records (and IPCO records) confirm that power production is occurring in non-irrigation months, and available data suggest it would be feasible to generate power in winter while still meeting minimum bypass flow requirements.

Bypass Flow measurement:

Condition 14 on the amended permit requires an instantaneous minimum bypass flow in the Little Wood River past the point of diversion and the point of return flow. The amounts vary by month, and 13 cfs is the minimum quantity in winter months with an allowance, upon request, from Idaho Fish and Game to drop the minimum for any month to 10 cfs during state-declared drought emergency conditions. Condition 15 on the amended permit requires a measurement device to ensure the required bypass flow is met, and condition 16 requires the daily average bypass flows to be submitted to the water master. To satisfy these conditions, the applicant installed a staff gage in the bypass channel, and the applicant uses a stage-discharge rating table created by WD37 to determine bypass flows (Attachment 6). The applicant also installed a corrugated metal pipe enclosure that houses a Stevens horizontal drum water-stage shaft encoder. The Stevens shaft encoder produces pen charts showing fluctuations in the water level.

At the time of the field exam, the bypass staff gage reading was 1.64 feet, corresponding to a bypass flow of 67.15 cfs. This exceeds the permitted required minimum bypass flow of 48 cfs for the month of June.

E. FLOW CALCULATIONS

x Additional Computation Sheets Attached

Measured Method:

The nameplate hydraulic capacity of the project is 500 cfs (Attachment photo 4d). The daily flow through the power plant is calculated from power records, not measured.

The power plant went online on October 9, 2015, and the owner-operator spent much of 2016 breaking in the power plant. Relative to 2016, the year 2017 was more representative of typical power plant operations, and water supply was greater in 2017. The applicant provided IDWR with daily hand-written records of instantaneous power generation, typically taken at 9am in the morning (see example, Attachment 7). For the years, 2016 and 2017, the maximum power generation of record of 1165 kW occurred on March 17, 2017 (about two months following submittal of the proof statement).

Sorenson Engineering was the consulting engineering firm for the project. Ted Sorenson of Sorenson Engineering provided a computation sheet in an email (Attachment 8) to calculate the rate of water used for power generation specifically for the applicant's power plant. The equation follows:

$Q = (P * 11.815)/(h * e)$, where P is power in kW, h is net head accounting for entrance losses and velocity head of the draft tube, and e is the paired turbine/generator efficiency in decimal form.

The turbine and generator have a fixed common shaft, and the overall efficiency is the product of each component's efficiency (.87 for the turbine and .96 for the generator). The plant head with losses accounted for is 33 feet. In Ted's email, three factors combine to create the constant of 11.815 in the equation above. They are 550 ft-lb/sec/1 hp, 62.4 lb/ft³ water density, and .746 kW/hp. Applying Sorenson's computation to the applicant's maximum power generation of 1165 kW results in a maximum rate of water used for power generation of 499.4 cfs.

$$Q = (1165 \text{ kW} * 11.815)/(33 \text{ ft} * .87 * .96) = 499.4 \text{ cfs}$$

On 9/16/16, the day IDWR staff made open channel measurements at the facility, the recorded power generation was 880 kW. When applying the equation above, this equates to 377.24 cfs of water flow for the power production. This agrees

within 1% of the power plant flow values of 379.2 cfs and 380.5 cfs measured by IDWR staff on 9/16/16.

On the day of the exam (6/18/20), the power plant generation was 849 kW, equating to 363.95 cfs of calculated water flow through the plant.

F. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{IR} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) =$$

$$V_{DR} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 =$$

$$V = \text{Smaller of } V_{IR} \text{ and } V_{DR} =$$

2. Volume Calculations for Other Uses:

Effective March 29, 2012, the Beneficial Use Examination Rules exempt on-stream, run-of-the-river power generation from the volume reporting requirement. Amended permit condition 13 requires that this project be operated in instantaneous run-of-river mode; however, it is an off-stream project, and by a strict interpretation of the Rule 35 requires a volume on the license.

The following volume calculation quantifies the extent of beneficial use of water for this permit. Because the operator was still breaking the power plant in throughout 2016, the year 2017 is more representative of typical usage, and water supply was more plentiful in 2017. The applicant supplied IDWR with the monthly power generation purchased by Idaho Power Company (IPCO) from this facility for October of 2015 through the present. See spreadsheet titled "Monthly Power Generation for Arkoosh Facility October 2015 through May 2019 and Corresponding Volume Calculation" (Attachment 9). These monthly readings are recorded from an offsite IPCO meter. The readings are corroborated by values reported by IPCO to the Idaho Public Utilities Commission using the FERC Financial Report Form No. 1: Annual Report of Major Electric Utilities, Licensees and Others and Supplemental Form 3-Q: Quarterly Financial Report for the years 2015 to 2017. The highest levels of power generation occurred in the 12 months following the January 2017 filing of the proof statement. For the months of February 2017 through January of 2018, power generation was 5538 MW-hr, which corresponds to 196,191 annual AF of water use for power production.

Volume is obtained by first computing an hourly power generation value and then using the power flow equation provided in section E to determine flow rate and then volume as shown below:

$$\text{Power (kW)} = \text{Monthly kW-hr production} / \# \text{ of days in month} / 24 \text{ hours per day}$$

Apply power flow equation from section E to resulting power in kW:

$$\text{Flow} = \text{Power (kW)} \times 11.815 / (33 \text{ ft} \times .87 \times .96)$$

$$\text{Monthly Volume} = \text{Flow} \times 1.9835 \times \# \text{ of days in month}$$

$$\text{Annual Volume} = \text{sum of 12 consecutive months of monthly volume}$$

Refer to the spreadsheet (Attachment 9) for the annual volume calculations.

Note: Monthly values of power generation in Attachment 9 are the same values as those supplied to IPCO and the water master to satisfy condition 11 on the amended permit.

G. NARRATIVE/REMARKS/COMMENTS

Applicant, Project Jurisdiction, and Land Ownership:

The applicant, William Arkoosh, is both the owner and the operator of the hydroelectric facility. Both the Idaho Public Utilities Commission (IPUC) and the Federal Energy Regulatory Commission (FERC) have jurisdiction over this hydroelectric project. The FERC project name is Little Wood River Ranch II Hydropower Project, and the FERC project number is #14154. On April 16, 2013, FERC issued a minor license for this project to William Arkoosh, which has a 50-year term.

IPUC issued an order (order #33103, case #IPC-E-14-06) on 8/21/14 to approve a 20-year energy sales agreement between Idaho Power Company (IPCO) and William Arkoosh.

William Arkoosh owns all of the land encompassing the POU and the POD for Permit 37-21297; however, the project has a small area of overlap onto Bureau of Land Management (BLM) land at two locations along the feeder canal (confirmed by ArcMap aerial imagery and FERC documentation). The applicant has obtained Right-of-way permissions with the BLM for these two locations.

Facility and Diversion Description:

The facility includes: (a) a diversion dam structure consisting of (i) an approximately 20-foot-wide, 8-foot 3-inch high minimum flow bypass release structure, (ii) an approximately 86-foot-long, 8-foot-high rock-rubble dam constructed along the north side of the newly-created impoundment on the Little Wood River; and (iii) an approximately 310-foot-long earthen dike berm with riprap slope protection constructed along the south side of the impoundment; (b) 83 linear feet of weir wall; (c) a 9.1-acre impoundment; (d) a feeder gate intake with a slide gate leading to a 4,000-foot-long, 22-footwide unlined feeder canal, which will convey project flows to a concrete intake structure having one 12-foot 5-inch long 10-foot inner diameter x 7-foot 5 3/4-inch inner diameter steel concentric inlet reducer; (e) a 45-foot-long, 34-foot-wide, 25-foot-high concrete and steel powerhouse containing one manually regulated Kaplan turbine with a total installed capacity of 1.23 MW; (f) a 1,750-foot-long excavated rock tailrace canal; (g) a 2.2-milelong, 4.2-kilovolt, stepping up to a 12.47-kilovolt three-phase transmission line, including a 0.25-mile-long buried section; and (h) appurtenant facilities.

Refer to the attached diagrams of the diversion structure, the power plant, and the facility layout.

Given the components of the diversion structure (control gates, spillway, etc.) range from 8 feet to 8 feet 3 inches in height (less than 10 feet), and the project's 45-acre storage is less than 50 acre-feet, this embankment is not regulated by IDWR's Safety of Dams program.

Priority Date:

The original application for permit was received on 4/22/2004, and approval was granted in late 2007. An Application for Amendment was received from the applicant on 9/17/2009, and the amendment was approved on 11/3/2009, with proof of beneficial use due in 2013. After two extensions, the revised proof of beneficial use due date was 3/1/2017, and the applicant's representative issued a statement of completion for submitting proof of beneficial use on 1/12/2017.

Operation Strategy:

The Little Wood River carries spring runoff from a large upstream drainage basin. The stretch of the Little Wood River near this project serves as a summer conduit for irrigation water distribution by the Big Wood Canal Company. About 400 cfs is diverted from the Snake River near Burley, ID and is carried to the Little Wood River by the Milner – Gooding Canal. The Snake River water is added to the Little Wood River approximately 7 miles upstream from the proposed project site and is re-diverted for irrigation use at the South Gooding Main canal approximately 4 miles downstream from the proposed project site.

The project operates in run-of-the-river mode and utilizes the existing flow regime and natural fall in the Little Wood River by diverting flow into the feeder canal. Water flows through approximately 4,000 feet of feeder canal to an intake structure where it enters a concentric inlet reducer. The inlet reducer feeds water into a powerhouse containing one Kaplan turbine with manually adjustable blades and a synchronous generator and related equipment. Water exits the powerhouse into a 1,750 foot long tailrace canal, which returns water to the Little Wood River approximately 1.3 miles downstream from the point of diversion.

A syphon tube and a manual bypass gate are present in the power plant forebay to serve as power plant bypass spills.

Season of Use:

Power generation records confirm initial production began in October of 2015. The first consecutive 12 months of power production occurred from February of 2017 through January of 2018, confirming year-round use. This is consistent with the permitted season of use from 01/01 through 12/31.

Term Limit:

Both the IPUC and the FERC have authority over this project. FERC issued a 50-year license to William Arkoosh (FERC Project #14154) on April 16, 2013. It expires April 16, 2063.

The power sales agreement is for 20 years and will expire before the FERC license; therefore, the term of the FERC license is appropriate for the term of the water right license.

Storage:

A small pool (45 acre-feet) is impounded by the feeder canal. At the permit-authorized diversion rate, the pool contains less than a day's-worth of stored water for the project. Storage use is not authorized by the permit and is not required. At the time the permit was issued in 2007, any incidental storage would have been considered as falling within the 24-hour rule.

Amended Permit Condition Review:

Condition #10 on the amended permit reads: "Prior to diverting water under this right, the right holder shall install a meter and data logger to record fluctuations in the diversion rate. The data logger does not need to record actual flow rates in cfs, but shall indicate relative diversion rates. The meter and data logger must be acceptable to the Department and the water master." The intent of this condition is to reduce sudden fluctuations at the point of diversion and in the feeder canal. There is similar language in condition #13 to minimize fluctuation by requiring the project to operate in run-of-river mode. Given the overlapping language between the two conditions, and the lack of such a measurement device on the project, the water

master finds my recommendation to eliminate condition #10 acceptable.

Condition #11 of the amended permit reads: "The right holder shall install and maintain standard meters and data loggers to measure and record the amount of electric energy generated by the project works and the effective head on the turbines. The right holder shall also rate the turbine output in kilowatts compared to flow in a manner acceptable to the Department and the water master and shall report monthly kilowatt output and other information as directed by the Department and/or water master." Good records are being kept for power production but not head on the turbines. The power flow equation relates the facility power generation in kilowatts to flow. The head remains fairly constant at this facility, and I therefore recommend dropping the phrase "and the effective head on the turbines" from the condition. The water master finds this change acceptable.

Condition # 15 on the amended permit reads: "Prior to diversion of water under this right, the right holder shall provide a means of measurement acceptable to the Department for measuring the flow in the Little Wood River to ensure the bypass flow required by the right. The measuring device(s) shall be available for inspection by the Department, the water master, and/or Idaho Department of Fish and Game officials at all times. The right holder shall pay the costs of installing and maintaining the measuring device(s) or other means of measurement."

Condition #16 on the amended permit reads: "The right holder shall report daily average bypass flows for the prior calendar year to the water master by January 15 each year. The Department reserves jurisdiction to require reporting on a more frequent basis, not to exceed four reports annually."

At the time of the exam, the permit holder had been reporting the data for condition 16 to Idaho Fish and Game rather than to the water master. Given condition #15 will remain on the license, and the bypass measurement will be maintained, I recommend elimination of condition #16, and the water master finds this change acceptable.

Water master approval of the recommended condition changes is provided in emails (Attachments 10a, 10b, & 11).

In addition, I recommend adding the following two conditions to the license:

162 – to provide the name of the project, and

004 – to indicate the license does not grant any right-of-way easements.

Recommendations:

To date, the maximum rate of water used for power generation was 499.4 cfs. That use occurred on March 17, 2017. I recommend a license rate of 500 cfs.

I recommend a volume of 196,191 AF based on actual power generation records for the twelve consecutive months from February 2017 to January 2018.

Have conditions of permit approval been met? ☒ Yes ☐ No

H. RECOMMENDATIONS

1. Recommended Amounts

<u>Beneficial Use</u>	<u>Period of Use</u>	<u>Rate of Diversion</u>	<u>Annual Volume</u>
POWER	01/01 to 12/31	500.00 CFS	196,191 AF
Totals:		500.00 CFS	196,191 AF

2. Recommended Amendments

Change P.D. as reflected above	Add P.D. as reflected above	x	None
Change P.U. as reflected above	Add P.U. as reflected above	x	None

I. AUTHENTICATION

Michelle Richman - Engineer, Technical 1




Field Examiner's Name Michelle Richman Date 7/13/20

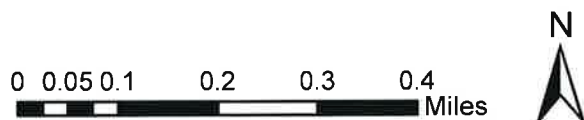
Reviewer [Signature] Date 7/13/2020

37-21297 Beneficial Use Field Report: System Diagram & Map



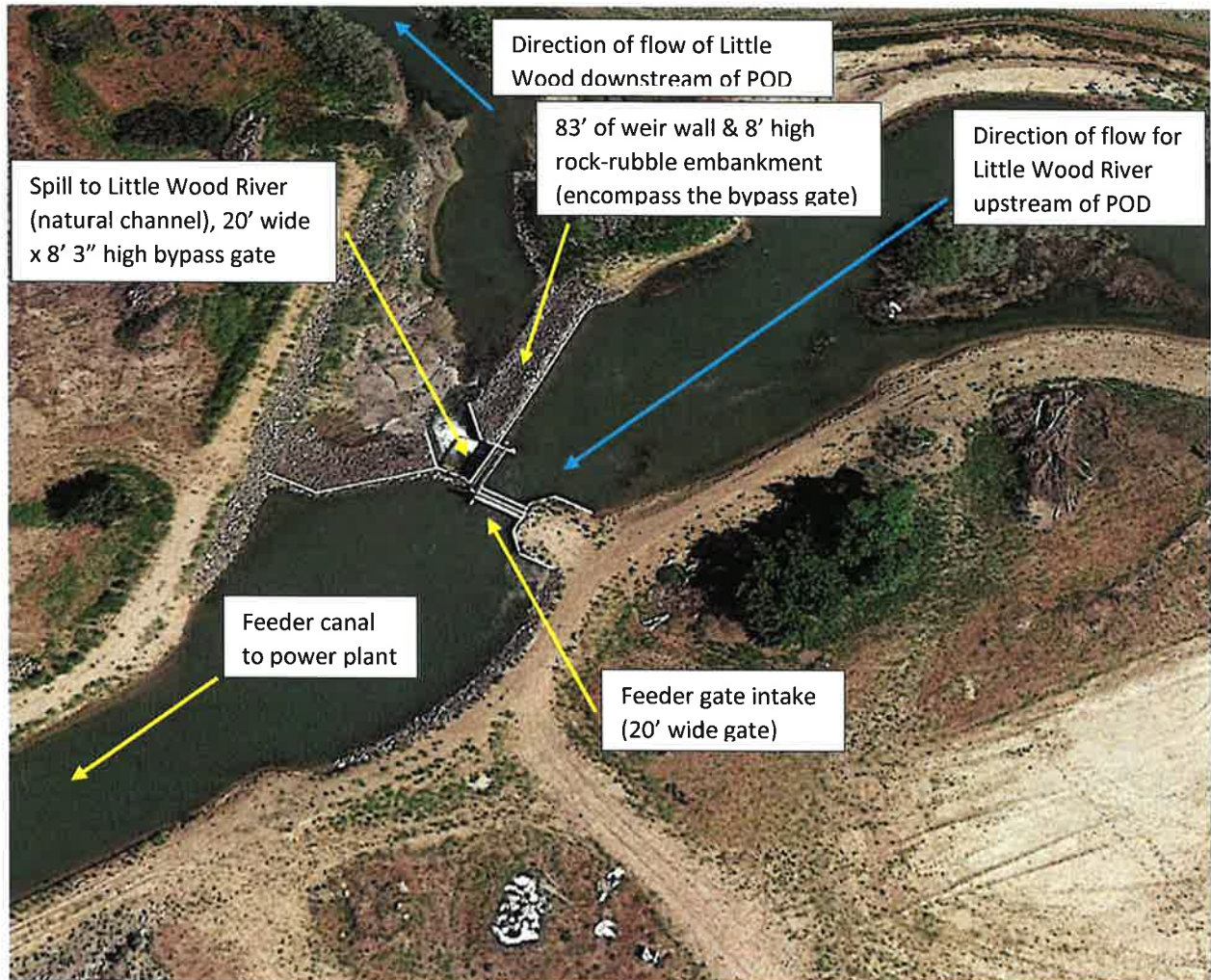
Legend

-  Township/Range
-  Sections
-  QQ



Attachment: Beneficial Use Field Report 37-21297

Diversion Structure

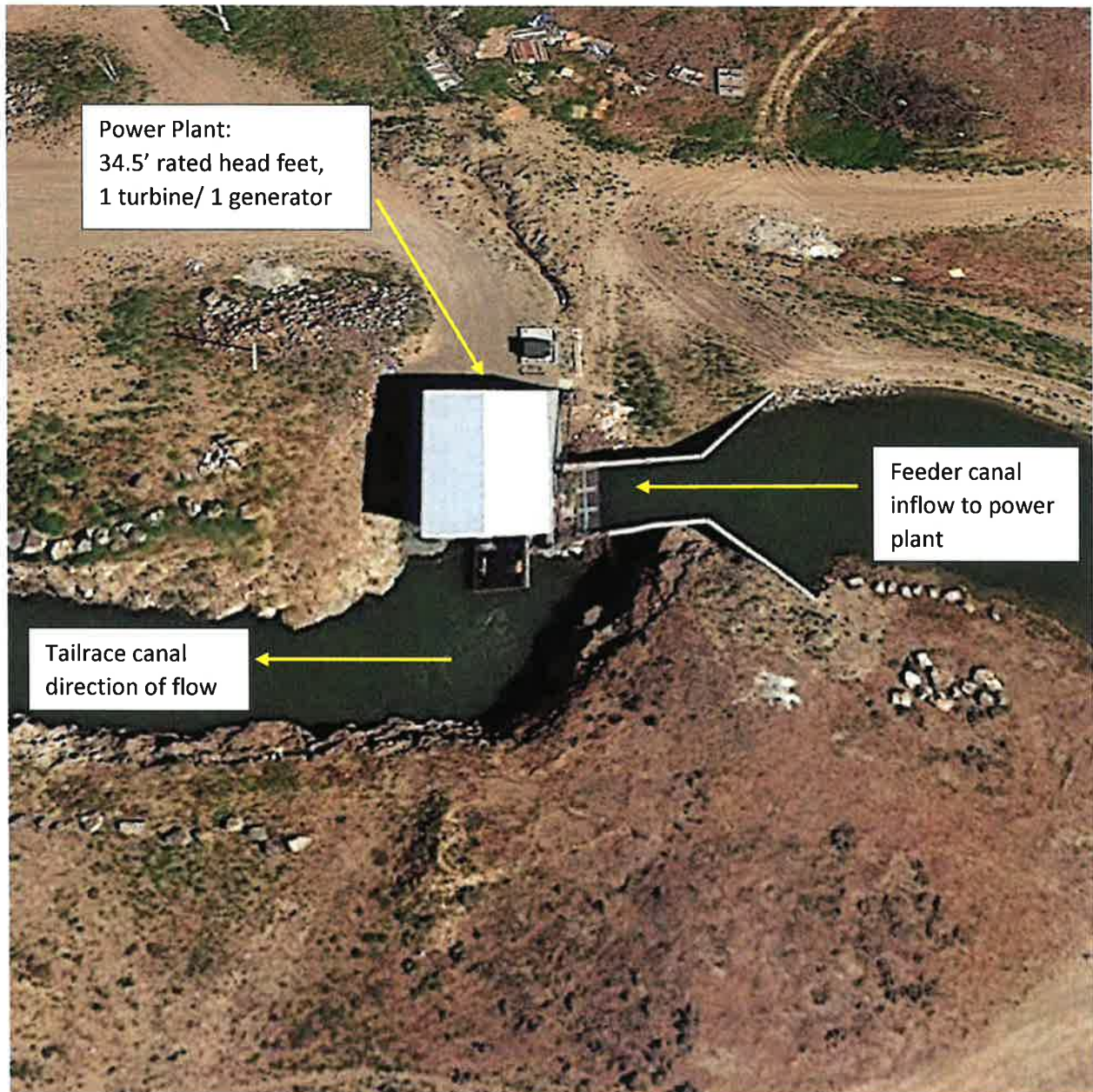


Source imagery: Google Earth



Attachment: Beneficial Use Field Report 37-21297

Power Plant



Source imagery: Google Earth





Photo 4a ABOVE: Point of Diversion for Permit 37-21297, and spill to bypass (Little Wood River).

Photo 4b BELOW: Power plant looking upstream from bridge over tailrace canal.





Photo 4c LEFT: Turbine & generator set with fixed shaft.

Photo 4d BELOW: Turbine & generator nameplate.

TURBINE & GENERATOR SET					
TURBINE			GENERATOR		
TYPE	ZTK305-LJ-160	TYPE	SF1200-24/2600	RATED EXCITING VOLTAGE	80 V
RATED OUTPUT	1326 kW	RATED POWER	1200 kW	RATED EXCITING CURRENT	208 A
RATED HEAD	34.5 ft	RATED VOLTAGE	480 V	PHASE	3
RATED FLOW	500 cfs	RATED CURRENT	1604 A	STATOR CONNECTION	Y
RATED SPEED	300 r/min	RATED FREQUENCY	60 Hz	INSULATION CLASS	F/B
MAX. HEAD	38.0 ft	RUNAWAY SPEED	680 r/min	TOTAL WEIGHT	kg
MAX. OUTPUT	1475 kW	POWER FACTOR	0.9	PRODUCED DATE	
PRODUCT NO.	120S/1	PRODUCT NO.	290FA/1		
CHINA CHANG JIANG ENERGY CORPORATION					

LITTLE WOOD RIVER at APPLICANT'S POD*

2016

Flow at Arkoosh POD calculated by subtracting all WD37 diversions from Station 14 @ Shoshone

DATE	APRIL	MAY	JUNE	JULY	AUG	SEPT	DATE
1	0	0	464	473	491	447	1
2	0	0	382	500	503	436	2
3	0	0	501	511	480	414	3
4	0	0	509	493	465	430	4
5	0	0	524	475	492	446	5
6	0	0	538	471	468	443	6
7	0	0	529	468	469	353	7
8	0	0	442	477	470	346	8
9	0	0	444	455	476	370	9
10	0	452	432	462	457	381	10
11	0	386	443	468	463	383	11
12	0	373	475	492	459	384	12
13	0	343	507	517	467	439	13
14	0	355	502	490	487	465	14
15	0	367	509	463	507	553	15
16	0	380	508	466	501	424	16
17	0	407	484	487	475	289	17
18	0	436	481	507	469	296	18
19	0	420	445	525	484	302	19
20	0	441	409	501	474	280	20
21	0	496	431	498	478	270	21
22	0	456	420	535	482	286	22
23	0	416	437	478	458	320	23
24	0	421	452	502	505	374	24
25	0	416	451	526	502	364	25
26	0	363	475	537	460	353	26
27	0	492	500	528	450	356	27
28	0	391	495	537	450	326	28
29	0	409	474	518	450	314	29
30	0	427	473	539	490		30
31		421		565	486		31
TOTAL	0	9066	14137	15465	14763	10845	
MEAN	0	292	471	499	476	374	
ACRE	0	17951	27991	30621	29231	21473	

YEARLY C F S 64277
 YEARLY ACRE FEET 127268
 TOTAL NO OF DAYS 182
 YEARLY MEAN 353

* Created from data supplied by the water master of Water District 37.

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Attachment 5a

LITTLE WOOD RIVER at APPLICANT'S POD*

2017

Flow at Arkoosh POD calculated by subtracting all WD37 diversions from Station 14 @ Shoshone

DATE	APRIL	MAY	JUNE	JULY	AUG	SEPT	DATE
1	664	592	514	414	544	514	1
2	668	569	534	433	515	386	2
3	672	545	687	452	497	396	3
4	668	505	711	418	505	406	4
5	608	466	734	406	499	421	5
6	482	485	731	388	523	439	6
7	446	582	725	417	546	465	7
8	443	678	674	459	539	470	8
9	462	784	647	505	529	454	9
10	480	701	665	551	546	448	10
11	454	656	700	576	530	441	11
12	446	600	734	566	519	446	12
13	441	596	673	545	527	406	13
14	435	627	602	497	535	404	14
15	439	657	468	476	531	434	15
16	527	620	427	510	505	488	16
17	615	670	400	543	447	508	17
18	611	689	473	572	447	528	18
19	620	753	545	574	428	488	19
20	620	776	570	556	448	388	20
21	599	676	553	518	468	376	21
22	624	575	545	490	453	506	22
23	619	518	566	525	453	438	23
24	613	487	532	554	460	434	24
25	622	352	501	552	490	429	25
26	632	473	469	602	457	458	26
27	625	630	473	576	448	366	27
28	625	683	411	547	440	323	28
29	610	735	426	557	480	314	29
30	601	694	437	547	478		30
31		598		540	456		31
TOTAL	16971	18969	17123	15862	15241	12572	
MEAN	566	612	571	512	492	434	
ACRE	33603	37559	33904	31408	30178	24893	

YEARLY C F S 96739
 YEARLY ACRE FEET 191544
 TOTAL NO OF DAYS 182
 YEARLY MEAN 532

* Created from data supplied by the water master of Water District 37.

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Attachment 5b

STATION Arkoosh Upper River bypass

STAGE-DISCHARGE TABLE
LOCATION ON

ARKOOSH Upper HYDRO

7/3/2018

GH FT	DATE	GAGE HT	Q	CORR	DISCHARGE CFS					STATION # KOYLE				
					0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	
0.6	2.12	2.39	2.67	2.95	3.24	3.54	3.84	4.15	4.47	4.79				
0.7	5.12	5.46	5.81	6.16	6.52	6.88	7.26	7.64	8.02	8.42				
0.8	8.82	9.22	9.64	10.06	10.49	10.92	11.36	11.81	12.27	12.73				
0.9	13.20	13.68	14.16	14.65	15.15	15.65	16.16	16.68	17.21	17.74				
1	18.28	18.82	19.38	19.93	20.50	21.07	21.65	22.24	22.84	23.44				
1.1	24.05	24.66	25.28	25.91	26.55	27.19	27.84	28.50	29.16	29.83				
1.2	30.51	31.19	31.88	32.58	33.28	34.00	34.71	35.44	36.17	36.91				
1.3	37.66	38.41	39.17	39.94	40.71	41.49	42.28	43.08	43.88	44.69				
1.4	45.50	46.33	47.16	47.99	48.83	49.68	50.54	51.41	52.28	53.16				
1.5	54.04	54.93	55.83	56.74	57.65	58.57	59.49	60.43	61.37	62.31				
1.6	63.27	64.23	65.20	66.17	67.15	68.14	69.14	70.14	71.15	72.17				
1.7	73.19	74.22	75.26	76.30	77.35	78.41	79.47	80.55	81.62	82.71				
1.8	83.80	84.90	86.01	87.12	88.24	89.37	90.50	91.64	92.79	93.95				
1.9	95.11	96.28	97.45	98.63	99.82	101.02	102.22	103.43	104.65	105.87				
2	107.10	108.34	109.59	110.84	112.10	113.36	114.63	115.91	117.20	118.49				

Mar 11	25 MM	67.3%	687 KW
Mar 13	33 MM	79.4	830 KW
Mar 14	39 MM		
Mar 14	35 MM	82.5%	863 KW
Mar 16	41 MM	89.7%	958 KW
Mar 17	51 MM	95.9%	1075 KW
Mar 17	51 MM	89%	1065 KW
Mar 23	59 MM	88.5%	1099 KW
Mar 23	55 MM	98%	1135 KW
Mar 28	51 MM	79.3%	1007 KW
Mar 29	46 MM	82.8%	1003 KW
Apr 1	46 MM	99.9%	1023 KW
Apr 1	54 MM	100.0%	1118 KW
Apr 1	58.5 MM	91.8%	1124 KW
Apr 3	55.9 MM	99.1%	1160 KW
Apr 6	46 MM	80.5%	980 KW
Apr 9	46 MM	84.6%	1001 KW
Apr 13	46 MM	92.2%	965 KW
Apr 14	46 MM	99.0%	1026 KW
Apr 15	56 MM	100%	1150 KW
Apr 28	58 MM	93.3%	1135 KW
May 1	56 MM	87.6%	1005
May 3	53 MM		
May 9	58 MM	99.2%	1155 KW
May 12	54 MM	96%	1135 KW
May 13	52 MM	99%	1100 KW
May 13	55 MM	99.6%	1190 KW
May 14	58 MM	99.3%	1160 KW
May 15	54 MM	99.7	1135 KW
May 18	57 MM	99.3	1155 KW
May 21	54 MM	88.3	1108 KW
May 22	52 MM	85%	1078 KW
May 24	46 MM	65%	730 KW
May 24	37 MM	85%	907 KW

ABOVE: Example of hand-written daily power generation records supplied by the applicant.

From: [Ted S. Sorenson](#)
To: [Richman, Michelle](#)
Cc: [Bill Arkoosh \(tunupabill@yahoo.com\)](mailto:Bill.Arkoosh@tunupabill@yahoo.com)
Subject: RE: Bill Arkoosh New Hydro
Date: Monday, June 22, 2020 9:36:43 AM

Michelle

$KW = (\text{Head} \times \text{Flow} \times 62.4 / 550) \times 0.746 \times \text{turbine efficiency} \times \text{generator efficiency}$

KW = 1165

Head = Net Head = Static – entrance losses – Velocity head of draft tube = 34 - 0.5 - .5 = 33 feet

Turbine efficiency = 87 %

Generator Efficiency = 96%

Therefore Flow = $(1165)(550) / 33 / 62.4 / 0.746 / .87 / .96 = 499.4 = 500 \text{CFS}$

Ted S. Sorenson, PE

cell: (208) 589-6908

email: ted@tsorenson.net



***Monthly Power Generation for Arkoosh Facility October 2015 through May 2019
and Corresponding Volume Calculation**

Month/Year of Production	kW-hr for Month	Days in Month	Power (kW)	Flow (cfs)	Monthly Volume (AF)	**Annual Volume (AFA)	**Annual MW-hr
Oct-15	78400	31	105	45	2778		
Nov-15	-2800	30	-4	-2	-99		
Dec-15	-5600	31	-8	-3	-198		
Jan-16	-5600	31	-8	-3	-198		
Feb-16	-2800	28	-4	-2	-99		
Mar-16	-700	31	-1	0	-25		
Apr-16	193200	30	268	115	6845		
May-16	588000	31	790	339	20832		
Jun-16	650300	30	903	387	23039		
Jul-16	713300	31	959	411	25271		
Aug-16	69930	31	94	40	2478		
Sep-16	546700	30	759	325	19369	99990	2822
Oct-16	107100	31	144	62	3794	101007	2851
Nov-16	-2800	30	-4	-2	-99	101007	2851
Dec-16	-4900	31	-7	-3	-174	101032	2852
Jan-17	-7700	31	-10	-4	-273	100958	2850
Feb-17	165900	28	247	106	5878	106934	3018
Mar-17	594300	31	799	342	21055	128014	3613
Apr-17	777000	30	1079	463	27528	148697	4197
May-17	654500	31	880	377	23188	151053	4264
Jun-17	746900	30	1037	445	26461	154476	4360
Jul-17	746200	31	1003	430	26437	155641	4393
Aug-17	754600	31	1014	435	26734	179898	5078
Sep-17	640500	30	890	381	22692	183221	5172
Oct-17	217700	31	293	125	7713	187139	5282
Nov-17	100800	30	140	60	3571	190810	5386
Dec-17	57400	31	77	33	2034	193017	5448
Jan-18	81900	31	110	47	2902	196191***	5538
Feb-18	123200	28	183	79	4365	194678	5495
Mar-18	256200	31	344	148	9077	182700	5157
Apr-18	352100	30	489	210	12474	167647	4732
May-18	655900	31	882	378	23237	167696	4733
Jun-18	667100	30	927	397	23634	164869	4654
Jul-18	669200	31	899	386	23709	162141	4577
Aug-18	677600	31	911	390	24006	159413	4500
Sep-18	522200	30	725	311	18501	155222	4381
Oct-18	257600	31	346	148	9126	156636	4421
Nov-18	-2800	30	-4	-2	-99	152965	4318
Dec-18	-2800	31	-4	-2	-99	150832	4257
Jan-19	16800	31	23	10	595	148526	4192
Feb-19	65800	28	98	42	2331	146492	4135
Mar-19	233100	31	313	134	8258	145674	4112
Apr-19	571200	30	793	340	20237	153436	4331
May-19	738500	31	993	426	26164	156363	4414

* Data supplied by William Arkoosh, taken from IPCO meter (showing monthly power generation purchased by IPCO).

** 12-month running total for AFA and MW-hr. *** Indicates highest 12-month volume.

Permit 37-21297

Attachment 9

From: watermanager@cableone.net
To: Richman, Michelle; "Bill Arkoosh"
Subject: RE: Conditions for License 37-21297
Date: Wednesday, July 01, 2020 9:00:49 AM

Michelle,

I spoke with Bill Arkoosh this morning and he will be sending me his Idaho Power hourly reports to verify flows through his power plant. I find it acceptable to eliminate conditions #10 and #16 from License 37-21297 since conditions #13 and #15 describe the same conditions on the license.

Kevin Lakey
Water District 37

From: Richman, Michelle <Michelle.Richman@idwr.idaho.gov>
Sent: Tuesday, June 30, 2020 2:27 PM
To: Kevin Lakey <watermanager@cableone.net>; Bill Arkoosh (tunupabill@msn.com) <tunupabill@msn.com>
Subject: Conditions for License 37-21297

Kevin,

Please consider the following two questions:
(The amendment of permit is attached for your reference.)

1)

Condition #10 on the attached permit reads as follows:

"Prior to diverting water under this right, the right holder shall install a meter and data logger to record fluctuations in the diversion rate. The data logger does not need to record actual flow rates in cfs, but shall indicate relative diversion rates. The meter and data logger must be acceptable to the Department and the water master."

The permit holder currently has no means of measuring or recording relative fluctuations in the diversion rate.

Furthermore, condition #13 has similar language about minimizing fluctuation as follows:

"The right holder shall operate in run-of-river mode only and shall act to minimize the fluctuation of streamflow immediately downstream of the location where water is discharged into the Little Wood River. The director retains jurisdiction to order changes in the operation of the system, up to and including equipment modifications and/or the curtailment of diversions, to minimize the impact to downstream users."

Given we will preserve condition #13, would you find it acceptable to eliminate condition #10?
Please provide comment.

2)

Condition #15 reads, "Prior to diversion of water under this right, the right holder shall provide a

Permit 37-21297

Attachment 10a

means of measurement acceptable to the Department for measuring the flow in the Little Wood River to insure the bypass flow required by the right. The measuring device(s) shall be available for inspection by the Department, the water master, and/or Idaho Department of Fish and Game officials at all times. The right holder shall pay the costs of installing and maintaining the measuring device(s) or other means of measurement."

Condition #16 reads "The right holder shall report daily average bypass flows for the prior calendar year to the water master by January 15 each year. The Department reserves jurisdiction to require reporting on a more frequent basis, not to exceed four reports annually."

Until now, the permit holder has been mistakenly reporting the data for condition 16 to Idaho Fish and Game rather than to the water master. Would the water master prefer that the permit holder begin reporting the bypass data to you, or would you find it acceptable to eliminate condition #16? (Note, condition #15 will remain on the license, and the bypass measurement device will need to be maintained to satisfy condition #15.) Please comment.

Thank you for your input,

Michelle Richman

From: watermanager@cableone.net
To: [Richman, Michelle](#)
Cc: ["Bill Arkoosh"](#)
Subject: RE: Amendment of Permit Condition 11
Date: Wednesday, July 01, 2020 9:51:40 AM

Michelle,

With the other information we talked about in the last email, I am willing to eliminate the phrase "and the effective head on the turbines".

Kevin Lakey
Water District 37

From: Richman, Michelle <Michelle.Richman@idwr.idaho.gov>
Sent: Wednesday, July 01, 2020 8:26 AM
To: Kevin Lakey <watermanager@cableone.net>
Cc: Bill Arkoosh (tunupabill@msn.com) <tunupabill@msn.com>
Subject: Amendment of Permit Condition 11

Kevin,

Here's one more thought. Condition 11 currently reads as follows.

"The right holder shall install and maintain standard meters and data loggers to measure and record the amount of electric energy generated by the project works and the effective head on the turbines.

The right holder shall also rate the turbine output in kilowatts compared to flow in a manner acceptable to the Department and the water master and shall report monthly kilowatt output and other information as directed by the Department and/or water master."

Would you find it acceptable to eliminate the phrase "and the effective head on the turbines" in the first sentence?

If so, you could either add your response to my other email, or you could reply to this one.

Thanks,
Michelle Richman

Permit 37-21297

Attachment 11