

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 34-14339
Exam Date: 04/29/2021

1. Current Owner:
GORDON FULTON 5907 N US HIGHWAY 93 MACKAY ID 83251-4404

2. Accompanied by: Gordon Fulton
Phone No: Same as above
Address: Same as above
Relationship to permit Holder: Owner

I was also accompanied by Tyler Smith from our Western Region office for training purposes

3. **SOURCE:** Tributary
ROCK CREEK Sinks

Method of Determination: Visual Inspection and GIS

B. OVERLAP REVIEW

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

Water Right No.	Source	Purpose of Use	Basis
			F

Comments: There are no overlapping water rights for the place of use.

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

Water Right No.	Source	Purpose of Use	Basis
34-57	Rock Creek	Irrigation and Stockwater	Decree
34-58	Rock Creek	Irrigation	Decree
34-836	Rock Creek	Irrigation and Stockwater	Decree
34-10585	Rock Creek	Irrigation	Decree
34-4039	Rock Creek	Irrigation	Decree

Comments: The above rights are all diverted from the same pipeline. Water Rights 34-57 and 34-58 are owned by the permit holder, and remainder of the rights are owned by the Smith family. There are also 2 instream stockwater rights that are in the same 40 acre tract owned by United States Department of Interior, Forest Service (USFS). The point of diversion is on USFS lands.

C. DIVERSION AND DELIVERY SYSTEM

1. **LOCATION OF POINT(S) OF DIVERSION:**

ROCK CREEK SW¼ SE¼, Sec. 34, Twp 10N, Rge 22E, B.M. CUSTER County

Method of Determination: Visual Inspection and GIS

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	
09N	22E	5								X									

Method of Determination: Visual Inspection and GIS

Please Note: The place of use has changed. The new place of use is on BLM ground. The Permit holder has supplied a copy of the permit from the federal government that authorizes the construction and maintenance of the power plant at the new location. Please see the applicant's email dated May 13, 2021. An amendment will be needed to change the place of use from what was shown in the permit.

- 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

4. Power Plant Specifications:**Generator:**

Power Kw – 390
 Voltage – 8
 Phases – 3
 Frequency – 60
 RPM Nominal – 910
 Power Factor (%) – 80
 Serial Number H2718231081

Turbine:

Turbine Type – Two Nozzle Horizontal Pelton
 Turbine Runner Size – 536 mm
 Net Head – 164 m (537.8 ft.)
 Flow – 300 liter/s (4755 US GPM)
 Rated Output – 407 kW (545 Hp)
 Nozzle(s)/Injector(s): 2 – Two 8 Inch Injectors

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
Panametric	Polysonic	Portable	PT878	09044		4/8/2021

2. Measurements: At the point of diversion, I measured 0.24 feet of head of water going over the 4 ft. Cipolletti Weir. Using the University of Idaho Measurement Book, this equaled 1.57 cfs or 703 gpm. The Bureau of Reclamation Water Measurement Manual confirmed the flow rate at 1.58 cfs or 709 gpm. The weir was set right behind the headgate, which is an improper installation for the weir. Since the weir was improperly installed, I performed a flow measurement at the powerhouse. That showed a diversion rate of 644 gpm or 1.43 cfs. I am more confident in the flow meter reading than I am of the weir measurement. I then measured the 1 ft. rectangular weir for the overflow or bypass required in the conditions of permit. I found 0.08 ft. of head of water flowing over the weir. The University of Idaho Measurement Book only shows a minimum of 0.10 ft. of head. At 0.10 ft. of head the flow rate would be limited to 0.106 cfs. The Bureau of Reclamation Water Measurement Manual for 1 foot contracted rectangular weirs only goes down to a minimum head of 0.20 feet. Using the formula supplied in the Bureau of Reclamation Manual for contracted rectangular weirs ($Q=3.33(L-0.2h)h^{1.5}$), I determined the flow rate though the 1 foot rectangular weir was approximately 0.07 cfs. I don't believe the 0.20 cfs required bypass flow was being met at the time of the field examination.

E. FLOW CALCULATIONS

YES Additional Computation Sheets Attached

Measured Method:

The water flow at the time of the field exam wasn't at the highest flows for the year. The high flows in Rock Creek are generally reliant on runoff that happens in approximately June of each year. Therefore, I used the standard power formula to determine the high flow rate based on the power records submitted by the permit holder in his letter received March 26, 2021. Based on the high Kw recorded by Salmon River Electric Cooperative in the spreadsheet the permit holder supplied on March 26, 2021, the highest hourly Kw rating was 363 Kw recorded June 6, 2020. Using this power rating, I determined that the flow rate at this power rating would be approximately 8.94 cfs (see attached power formula spreadsheet). The permit is limited to a diversion rate of 6.50 cfs. It does appear as though the permit holder has exceeded the 6.50 cfs allowed by the permit for approximately 37% of the time in June and 3.3 % of the time for the entire year.

I am recommending that this permit be licensed for a diversion rate of 6.50 cfs.

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:

The permit holder provided a spreadsheet in his March 26, 2021, letter that he received from Salmon River Electric Cooperative. Using this data and the power equation used as a standard for hydropower facilities, I was able to determine that the highest volume of water diverted within a 12 month period was 1809.3 acre-feet from October 2019 to September 2020.

I recommend that this permit be licensed for a diversion volume of 1810 acre-feet.

G. NARRATIVE/REMARKS/COMMENTS

I met Tyler Smith from the Western Region to perform the field exam on permit 34-14339 in Mackay on April 29, 2021. We then drove out and met Gordon Fulton at his home and discussed the permit. We determined to visit the point of diversion first and then move down to the power plant.

This permit was filed to use the water being delivered for irrigation and stockwater to several farms by the water rights listed in the overlap analysis above. The pipeline used for the hydropower plant has been in place since approximately 1984. Prior to 1984, the water was delivered to the irrigation uses through a cement ditch. According to the owner, the cement ditch was destroyed during the 1983 earthquake in that area. The permit holder felt he could use the pressure and flows in that pipeline to provide hydropower with minimal changes to the system.

The permit holder filed and attained a Federal Energy Regulation Commission (FERC) exemption for the power use. The permit holder is also not regulated by the Public Utility Commission (PUC), because he is selling the power to a local power company, Salmon River Electric Cooperative, Inc. which is not subject to PUC regulation.

The permit was protested by United States Department of Interior, Bureau of Land Management (BLM) and the Idaho Department of Fish and Game (IDFG). The point of diversion is on USFS land, but they did not officially protest the application for permit. The USFS did provide a comment letter stating a concern about the easement that was granted for irrigation use only. The concerns of these protests were that the water delivered for hydropower during the non-irrigation season would decrease the flows in Rock Creek for wildlife below the point of diversion. The permit holder claims that all of the water was being diverted out of Rock Creek all year long for stockwater, and he didn't propose to change any of the historic practices in the creek. The protest was resolved by including conditions that required measurement of Rock Creek not more than 100 ft. below the point of diversion, and to ensure that minimum of 0.20 cfs was flowing in Rock Creek below the diversion dam. The 0.20 cfs was based on a measurement done by the local watermaster on the diversion during permitting to determine the amount of water leaking around the dam in the creek. The measurement was done in March of 2013 over a portable 6 inch rectangular weir.

At the point of diversion, I measured 0.24 feet of head of water going over the 4 ft. Cipolletti Weir. Using the University of Idaho Measurement Book this equaled 1.57 cfs or 703 gpm. The Bureau of Reclamation Water Measurement Manual confirmed the flow rate at 1.58 cfs. The weir was set up directly behind a 2X4 board headgate, so I was concerned about the accuracy of these measurements.

I then measured the 1 ft. rectangular weir for the overflow water requirement according to the conditions. I found 0.08 ft. of head of water flowing over the weir. The University of Idaho Measurement manual only provided a flow rate to a minimum of 0.10 ft. of head. At 0.10 ft. of head the flow rate would be limited to 0.106 cfs. The bureau of Reclamation Water Measurement Manual does not provide a water flows over a 1 ft. weir with less than 0.20 feet of head. Using the formula supplied in the Bureau of Reclamation Manual for Contracted Rectangular Weirs ($Q=3.33(L-0.2h)h^{1.5}$), I determined that the flow rate would be approximately 0.07 cfs through a 1 ft. rectangular weir with 0.08 ft. of head. It doesn't appear as though the 0.20 cfs required bypass was flowing over the weir at the time of my measurement.

The owner has claimed that the diversion has not been changed, and that the same amount of water is bypassing the diversion as there was when the watermaster measured Rock Creek in 2013. When the measurement was made by the watermaster to establish the 0.20 cfs, a different weir (6 inch rectangular weir) was used. I also noted in the photos that plastic was used to ensure all water in Rock Creek was diverted through the weir. It is difficult to tell from the photos how much water was flowing in the Rock Creek during that measurement, but it appears to be more water than was flowing at the time on my measurement. At the time of my measurement, there was no plastic funneling the water to the weir, and a different weir was being used. It also appears as though the watermaster's weir was located slightly closer to the dam. I do have to concede that some of the water in the creek could have been flowing through the rocks and around the weir, but I can't confirm that assumption. In review of the historic power records, this creek varies flows throughout the day, so this flow rate could change depending on the time of day the measurement was done. All I can confirm is that approximately 0.07 cfs was flowing over the weir at the time of my measurement.

At the point of diversion there is an earthen dam that some leakage that continues down Rock Creek. The headgate for the pipeline is on the north side of the dam and has a 2X4 headgate located a few inches ahead of the dam. If the headgate was regulated, the weir would no longer be usable. As it is, the measurements from the weir are suspect with the headgate located so close to the weir. This shouldn't be an issue as far as the water flowing to the powerhouse is concerned, since all outflows from the powerhouse go directly to headgates that are used to distribute the water to two separate farms.

The water flowing through the point of diversion headgate flows out onto a screen to remove the debris in the creek water. The water flows through the screen into a vault that distributes the water into a 24 inch pipeline. The permit holder stated that the 24 inch pipeline necks down to a 20 inch pipeline shortly after it leaves the point of diversion.

We then went to the powerhouse. A 20 inch pipeline comes out of the ground and splits into two 20 inch pipelines. One split has a valve to a pipeline that runs along the north side of the power house and into a vault with the irrigation headgates. The headgates supply the ditches associated with the overlapping water rights discussed in the overlap analysis. The headgates both have lockable controlling devices and can be measure using an orifice equation. The second 20 inch pipeline flows directly into the power house. All of the water at the time of the field exam was going into the power house.

Inside the power house the 20 inch line then splits into 2 – 8 inch pipelines that flows into the turbine. You can clearly see the power rams used for the pin point or adjustable nozzles used on the turbine. At the split there is a pressure gauge that showed a pressure of 250 psi or 577.5 feet of head on the turbine. During the field exam, the pressure did not vary at all.

Tyler gathered information on the generator and turbine, which matched the specification sheet submitted by the permit holder in his March 26, 2021, letter.

I reviewed the power panel and found the generator was producing between 51 to 53 Kw at the time of the field exam. The permit holder went through the power panel, and provided me with an understanding of the gauges on the panel. When we first reviewed the power panel, the permit holder told me that the water flowing into the turbine was only going through one of the 8 inch pipelines and nozzles. I felt the pipelines and noticed that both pipes appeared to be cold, and I asked if he was sure if water wasn't flowing through both pipes. He was convinced that water was only flowing through the upper 8 inch pipeline. I set up our flow meter on the upper 8 inch pipeline and measured a flow rate of 230 gpm. Which was less than ½ of the amount measured at the upper diversion.

I then set up my flow meter on the 20 inch pipeline. The measurement on the 20 inch pipeline provided a flow rate of 630 to 660 gpm, which is reasonably close to the weir measurement taken at the point of diversion. I then took a 10 minute reading. During the reading, I compared the Kw readings and the instantaneous flow readings from the flow meter. The readings were as follows:

At 620 gpm – 50 Kw

At 645 gpm – 53 Kw

At 647 gpm – 51 Kw

At 655 gpm – 51 Kw

The average flow rate for the 10 minute test was 643 gpm or 1.43 cfs, and the average power output was approximately 51 Kw $\{ (50 + 53 + 51 + 51) / 4 = 51.25 \text{ Kw} \}$. This seems reasonable considering the instantaneous readings taken. Using the standard power equation of $e = P(11.8)/QH$, I determined that the efficiency of this system at this diversion rate was approximately 70.9 %. According to the efficiency chart supplied by the permit holder in his March 26, 2021, letter, this efficiency does seem a bit high. However, the system is designed to increase the efficiency of the system at the lower flows by using the two pin point or adjustable nozzles to maintain a constant head pressure on the Pelton wheel. Taking this information into account, I feel the efficiency chart showing an efficiency of 80% to 83% for flow rates ranging from 4.00 cfs to 10 cfs is reasonable.

The outflow from the power house goes through a cement channel to the vault where the headgates are located to separate the water for the irrigation and stockwater uses discussed in the overlap analysis. None of the water ever gets back to the original Rock Creek channel once it leaves the point of diversion. Historically, it appears as though the majority of Rock Creek water spread out and seeped into the ground long before it reached the farms. Rock Creek is part of Water District 34, but it is considered an unconnected source, and is only regulated when there is a dispute between the two ranchers using this water for irrigation and stockwater.

The powerhouse is a non-consumptive use that was placed on the existing pipeline, so the powerhouse is basically at the mercy of the irrigation users downstream of the powerhouse. Any measurements or distribution of water for the ranches below the power house transpires at the head gates below the powerhouse. All of the water flowing through the power house can be measured and regulated at the head gates below the power house, so there is really no need for measurement requirements at the point of diversion for the hydropower use.

Condition Review:

Conditions X35, 01P, 027, 025, and 004 will be carried forward to licensing. This license should also include the F06 condition that shows all of the rights in the overlap section are diverted through this same point of diversion.

Condition R05 will need to be added, since this water use is within Water District 34. Conditions 01P will be carried forward to licensing to address the possible need for a lockable controllable head gate in the future. I am also going to add condition 01M to allow for the possible future need for a properly installed measurement device at the point of diversion. Typically, we require a lockable controllable head gate and measurement device to be installed on the point of diversion when a water right is in a water district. However, this stream is considered to be an unconnected water source to the Big Lost River, and is not actively measured or regulated by the watermaster. If there is ever a need to regulate the water use, it is regulated at the head gates below the power house, so there is really no need for the watermaster to go up to the point of diversion unless he needs to address the bypass flow. The bypass flow has a measurement device available if needed. The overlapping water rights all have a 01M condition, and a condition confirming that Rock Creek has been historically administered separately. Therefore, I think the condition on the overlapping rights that state this fact should be included on this permit at licensing. The condition state the following:

Rights diverted from Rock Creek have historically been administered independently from Big Lost River and its other tributaries.

Condition 17H will be changed to condition R22. Conditions 914 and 917 will be replaced with condition 916, since FERC has exempted this use, and PUC approval is not needed to sell the power to private power company. The term limit for condition 916 is generally considered to be equal to the life of the equipment, but condition 916 is also not generally used when the permit holder is selling the power. Although this permit is not regulated by the PUC, it is still reasonable to limit the term in this condition to the standards generally used by this organization instead of the life of the equipment. I am recommending a 20 year term instead of the life of the equipment to allow the Department to monitor whether or not the power being generated by this system is still being sold to Salmon River Electric Cooperative, or if the purchaser of the power will change in the future. It would be unreasonable to limit the term to the annual agreements signed between the permit holder and Salmon River Electric Cooperative, so extending the term out to 20 years seems to be a reasonable compromise.

The conditions have not been met, because less than 0.20 cfs is flowing in Rock Creek below the diversion dam. However, as mentioned above, it doesn't appear from the photos in the permit review, and the site visit as though any changes have been made to the dam. I cannot determine at this time if the measurements made by the watermaster or my measurements correctly depict the water flow bypassing the dam throughout an entire day. The two flows do seem somewhat similar, and the system doesn't appear to have been changed since the measurement in 2013. There is currently no way to adjust the flows of the water flowing by the dam, except to completely shut down the point of diversion or breach the dam. Shutting down the flows could also result in the failure of the dam, since there is no spillway on the dam. There are no conditions requiring a bypass flow past the dam on the irrigation and stockwater rights, so to reduce the flow to the irrigation and stockwater rights would injure their water use. The field exam was performed the day before the beginning of the season of use for the irrigation rights of May 1st, so I am concerned that if we require this bypass flow during the irrigation season it could result in injury to the irrigation uses.

I have presented this issue to other Department staff, and it was determined that we cannot allow the condition to go unaddressed. Therefore, a Notice of Intent to void the permit will need to be sent to ensure that the 0.20 cfs is being diverted through the dam. In order to do this, the permit holder will need to provide some type of device or assurance that this condition can be met.

Have conditions of permit approval been met? ____ Yes X 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	6.50 CFS	1,810.0 AF
<u>Totals:</u>		6.50 CFS	1,810.0 AF

2. Recommended Amendments

____ Change P.D. as reflected above ____ Add P.D. as reflected above ____ None

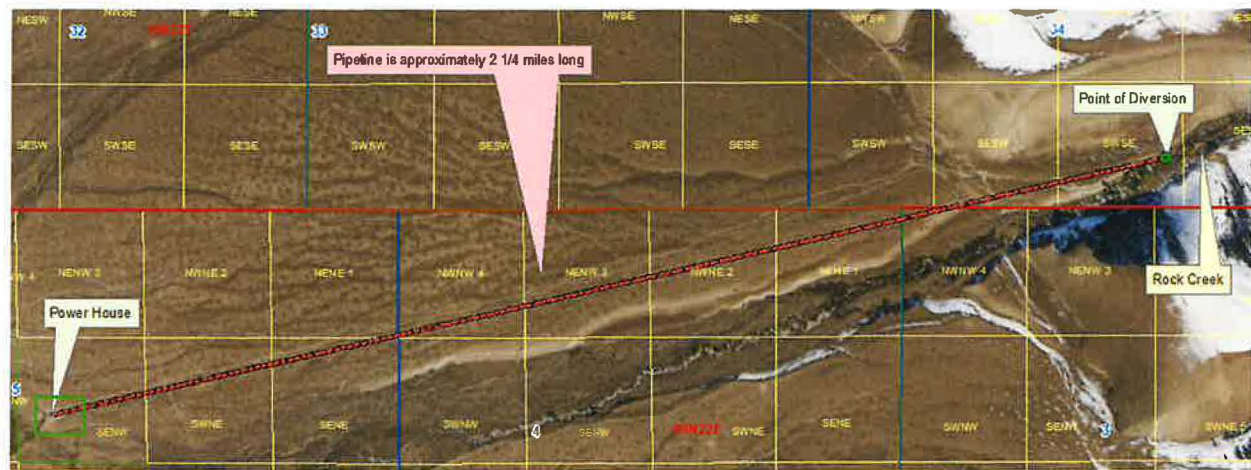
X Change P.U. as reflected above ____ Add P.U. as reflected above ____ None

I. AUTHENTICATION Dan Nelson - Analyst 3

Field Examiner's Name _____ Date _____

Reviewer _____ Date _____

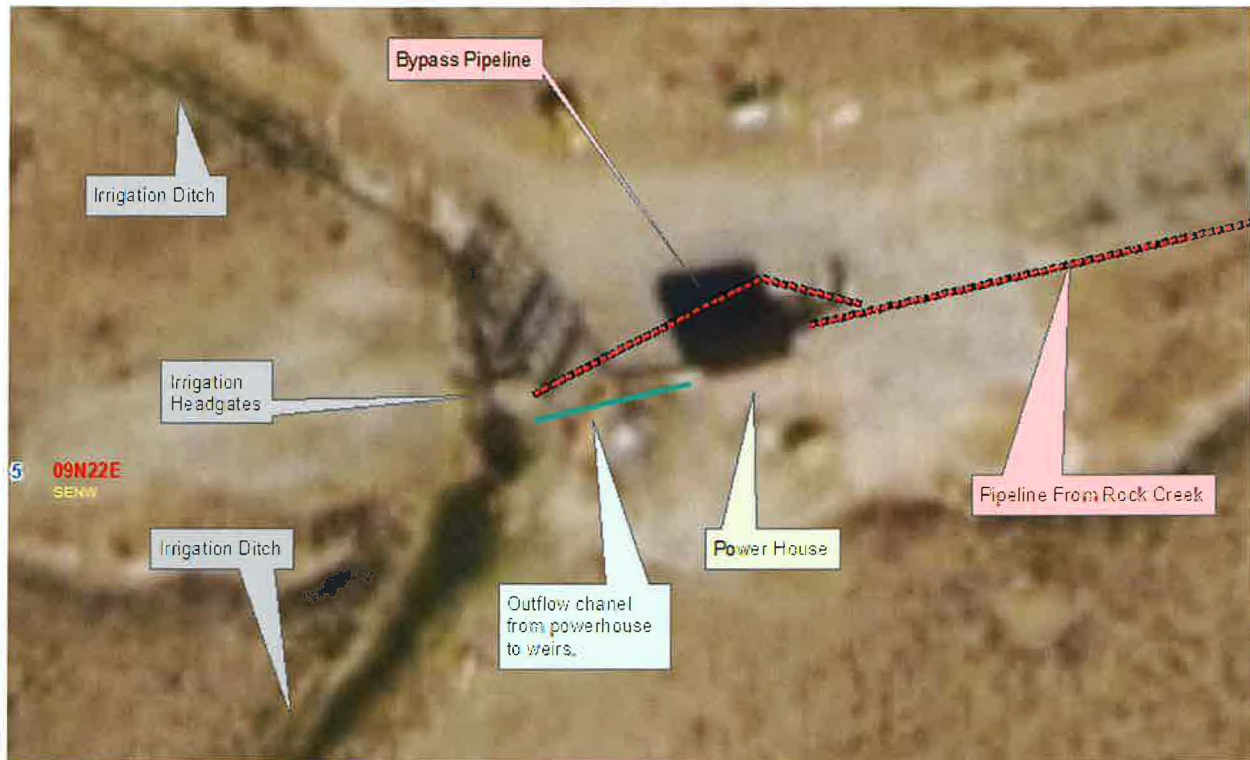
The aerial image below shows the point of diversion diverting water from Rock Creek and transporting that water through approximately 2 ¼ miles of 20 inch pipeline to the powerhouse. As you can see, the Rock Creek seems to totally disappear in the SWNW of Section 4 Township 9 North, Range 22 East.



The image below is a close up of the point of diversion. The water is diverted out a small pool backed up by a dam in Rock Creek. The water flows through a 2X4 headgate and then directly across a 4 ft. Cipolletti Weir onto a screen. The water flows through the screen into a 24 inch pipeline, which necks down to 20 inch pipeline that delivers water to the power plant. The 1 ft. rectangular weir in the creek is approximately 30 to 40 feet below the dam. Rock Creek ran approximately 100 ft. below the dam before it sank into the streambed. There doesn't appear to be any vegetation usually found around a creek more than 1,000 feet below the dam.



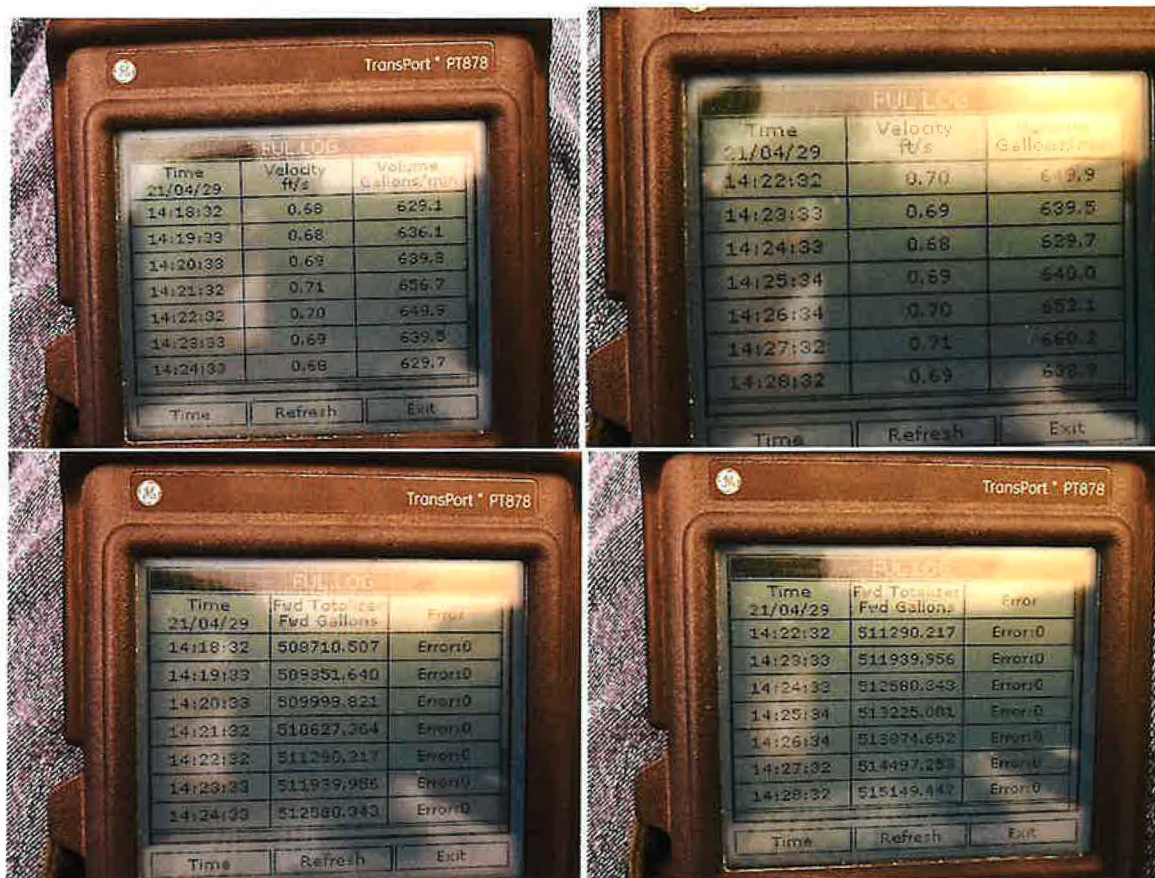
The image below shows the area around the powerhouse. There is a pipeline that bypasses the powerhouse goes into the head gates used to distribute the irrigation and stockwater rights. Water flowing through the powerhouse goes out a cement channel to the same vault as the bypass pipeline to be distributed to the two irrigation ditches. There is no channel that delivers the water back to the Rock Creek in this system.



The 1992 aerial image below shows the same location. You can clearly see that Rock Creek gets smaller and begins to braid long before it reaches the farms. There almost isn't any channel by the time it reaches the farms downstream. The green dot is the point of diversion and the green box is the current location of the powerhouse.



Permit 34-14339 – Pictures of flow measurements due to the inability to get the flow meter to download using Windows 10. Please see attached spreadsheet for calculations.



Flow Measurement for permit 34-14339

Time 21/04/29	Velocity ft/s	Volume Gallons/min	Fwd Totalizer Fwd Gallons	Error
14:18:32	0.68	629.1	508710.507	Error:0
14:19:33	0.68	636.1	509351.640	Error:0
14:20:33	0.69	639.8	509999.821	Error:0
14:21:32	0.71	656.7	510627.364	Error:0
14:22:33	0.70	649.9	511290.217	Error:0
14:23:33	0.69	639.5	511939.956	Error:0
14:24:33	0.68	629.7	512580.343	Error:0
14:25:34	0.69	640.0	513225.081	Error:0
14:26:34	0.7	652.1	513874.652	Error:0
14:27:32	0.71	660.2	514497.253	Error:0
14:28:32	0.69	638.9	515149.447	Error:0

Average Velocity	0.69
Max Velocity	0.71
Min Velocity	0.68

Average GPM	642.9
Max GPM	660.2
Min GPM	629.1

Beginning Reading	508710.507
Ending Reading	515149.447
Difference in Readings	6438.940
Difference / 10 readings	643.894

Permit 34-14339 Annual Volume Calculations.

Month / Year	Total Monthly Kwh	Total Hours	Average Kw	Feet of Head Constant at 577.5	Average Efficiency (Assume 80%)	Average Flow Rate in CFS (using $Q=(P11.8)/H_e$)	Total Volume in Acre Feet. [using CFS X 1.9835) X (Hours / 24)]	
Oct-19	57,166	730	78.31	577.5	0.80	2.00	120.67	
Nov-19	52,815	713	74.07	577.5	0.80	1.89	111.49	
Dec-19	50,245	744	67.53	577.5	0.80	1.72	106.06	
Jan-20	47,485	734	64.69	577.5	0.80	1.65	100.23	
Feb-20	41,630	696	59.81	577.5	0.80	1.53	87.88	
Mar-20	43,813	744	58.89	577.5	0.80	1.50	92.48	
Apr-20	47,015	720	65.30	577.5	0.80	1.67	99.24	
May-20	69,208	744	93.02	577.5	0.80	2.38	146.09	
Jun-20	169,927	720	236.01	577.5	0.80	6.03	358.69	
Jul-20	138,861	744	186.64	577.5	0.80	4.77	293.12	
Aug-20	82,022	744	110.24	577.5	0.80	2.82	173.14	
Sep-20	57,249	720	79.51	577.5	0.80	2.03	120.85	1809.93
Oct-20	53,896	744	72.44	577.5	0.80	1.85	113.77	1803.03
Nov-20	48,932	720	67.96	577.5	0.80	1.74	103.29	1794.83
Dec-20	48,144	744	64.71	577.5	0.80	1.65	101.63	1790.40
Jan-21	43,698	744	58.73	577.5	0.80	1.50	92.24	1782.41

Permit 34-14339 Monthly Total KW and Hours

Month	High Load Kwh	Low Load Kwh	Total Kwh	High Hours	Low Hours	Total Hours
19-Oct	24,558	32,608	57,166	304	426	730
19-Nov	24,368	28,447	52,815	320	393	713
19-Dec	23,240	27,005	50,245	344	400	744
20-Jan	20,989	26,496	47,485	324	410	734
20-Feb	17,770	23,860	41,630	296	400	696
20-Mar	19,249	24,564	43,813	328	416	744
20-Apr	19,721	27,294	47,015	304	416	720
20-May	30,859	38,349	69,208	344	400	744
20-Jun	75,931	93,996	169,927	304	416	720
20-Jul	67,918	70,943	138,861	328	416	744
20-Aug	36,100	45,922	82,022	328	416	744
20-Sep	25,502	31,747	57,249	320	400	720
20-Oct	22,689	31,207	53,896	312	432	744
20-Nov	22,820	26,112	48,932	336	384	720
20-Dec	21,830	26,314	48,144	328	416	744
21-Jan	20,226	23,472	43,698	344	400	744

Head	Power	Efficiency	Discharge			
577.5	53	0.737	1.47	$P=Qhe/11.8$	P=	53.022
577.5	363	0.83	8.936	$P=Qhe/11.9$	P=	362.987
577.5	363	0.737	10.064	$P=Qhe/11.9$	P=	363.001
577.5	363	0.83	6.5	$P=Qhe/11.9$	P=	264.035

577.5	53	0.737	1.47	$Q=(P11.8)/He$	Q=	1.469
577.5	363	0.83	8.936	$Q=(P11.8)/He$	Q=	8.936
577.5	363	0.737	10.064	$Q=(P11.8)/He$	Q=	10.064

577.5	53	0.737	1.47	$H=P(11.8)/QH$	H=	577.262
577.5	363	0.83	8.936	$H=P(11.8)/QH$	H=	577.520
577.5	363	0.737	10.064	$H=P(11.8)/QH$	H=	577.498

577.5	53	0.737	1.47	$e=P(11.8)/QH$	E=	0.737
577.5	363	0.83	8.936	$e=P(11.8)/QH$	E=	0.830
577.5	363	0.737	10.064	$e=P(11.8)/QH$	E=	0.737
577.5	363	0.737	6.50	$e=P(11.8)/QH$	E=	1.141

Please Note:

Using the efficiency provided in the chart provided by the permit holder, the head measured at the time of the field exam, and the power records provided by the permit holder, this system should produce 363 Kw at 83% efficiency with a flow rate of 8.94 cfs. This is in line with the information provided by the permit holder.

During the field exam, we were able to measure 1.47 cfs of water being used to produce an average of 53 Kw at 577.5 feet of head. This would reduce the efficiency of the system to approximately 74%. This efficiency is slightly above the efficiency provided in the system chart supplied by the permit holder. This could be a product of the double pin nozzles used on this system used to maintain the head on the turbine.

The permit limited the water use to 6.50 cfs. In order to attain the 363 Kw found in the records, the system would need to have an efficiency of 114% which seems unreasonable (see green row). The information provided suggests that this system has exceeded the 6.50 cfs amount authorized by this permit. Based on the calculations shown above in green, this system should produce approximately 264 Kw at 6.50 cfs. According to my count, this rate was only exceed approximately 1/2 the time during the month of June or during high runoff, and was never met before or after June.

I recommend that this permit be licensed for 6.50 cfs.

PHOTOGRAPHER AND DATE OF PHOTOS Dan Nelson 4/29/2021

FILE NUMBER 34-14339



The photos above and below show the point of diversion. The water comes through a headgate and then directly through a 4 foot Cipolletti weir. There was 0.24 feet of head going over the weir providing a measurement of approximately 1.57 cfs or 705 gpm. It should be noted that weir was not properly installed with the headgate directly in front of it, so there was some concern about that flow reading. I did measure the pipeline at the power house, and found a diversion rate of 644 gpm or 1.43 cfs. I feel the measurement at the power house was more accurate than the improperly installed weir.



The photo below shows the bypass flow. There was a 1 foot rectangular weir there to measure the water. This weir had a bit better installation. I measured 0.08 feet of water going over the weir. Using the formula $Q=3.33(L-0.2h)h^{1.5}$, the diversion rate would be approximately 0.07 cfs. The conditions of the permit require that a minimum of 0.20 cfs is required to bypass the power house. I informed the permit holder that he needed to address this issue.



PHOTOGRAPHER AND DATE OF PHOTOS Dan Nelson 4/29/2021

FILE NUMBER 34-14339



These photos show the 20 inch pipeline entering the power house. The 20 inch pipeline then splits into 2 6 inch pipelines.



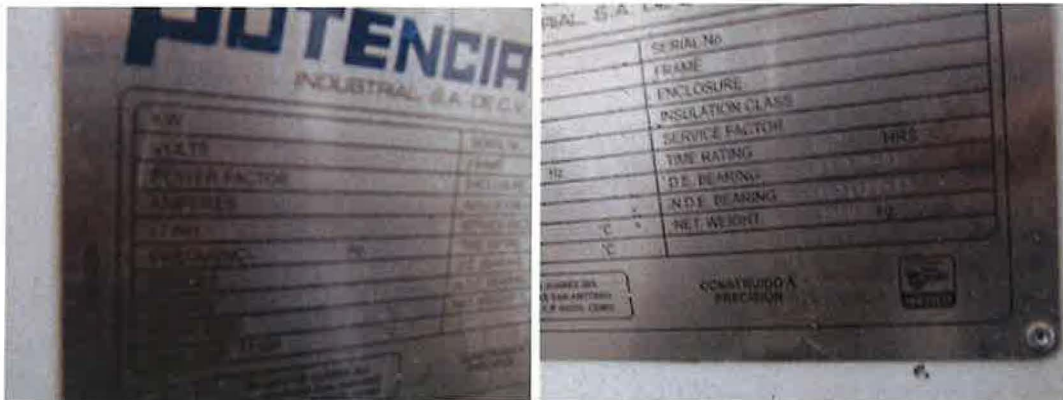
The two 8 inch pipelines discharge into the turbine. Both pipelines use an 8 inch pin nozzle. The pin nozzle is adjusts the size of the opening going into the turbine to maintain a constant head pressure regardless of the flow. This provides a better efficiency at lower flow rates.

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The above gauge shows that the turbine was producing 51 Kw at this time. The nameplate photos are a bit fussy, but they do show the turbine is designed to operate at 390 Kw, 480 Volts and 60 Hz. The Serial number was H2718231081.



The pressure gauge below shows a pressure of 250 psi, which equates to 577.5 feet of head against the turbine ($250 \times 2.31 = 577.5$ ft)



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FILE NUMBER 34-14339



The photos above show the valve and the bypass pipelines. The pipeline in the foreground of the photo goes to the power house and the other lines goes to the headgates shown below for irrigation.



The photos above show the exit channel from the power house. Water is flowing out of the power house from the left through a channel that goes into a pipeline that transports the water to the head gates shown below for irrigation.



The photo above shows the head box and the headgates that distributes the water coming out of the bypass or power house to the farmers who use this same water for irrigation and stockwater.



DEPENDABLE TURBINES LTD.



Rock Creek Hydroelectric Project

Mackay, Idaho, USA

Statistics:

- ◆ Turbine: double nozzle Pelton
- ◆ Generator: 390kW Potencia @ 900 RPM
- ◆ Rated head: 164m
- ◆ Rated flow: 0.3m³/sec
- ◆ Commissioned: 2019

Water in Rock Creek is diverted into a 20-inch diameter buried pipeline for about 3740m with a drop of about 186m. At the end of the pipeline the flow is diverted to irrigated farmland. The existing water intake facility and the existing pipeline were modified for power generation (USDA subsidies for hydro power on existing irrigation systems). The generated power is being sold to a local utility company.



Two Nozzle Pelton Hydro Turbine Generator



Wall Mounted Hydro Turbine Switchgear and Control Panels



Powerhouse



Switchyard

[Back to Projects page.](#)