

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 63-32648

Exam Date: 5/13/2016

1. Current Owner:
RICHARD LINHART
50 YELLOW PINE LN
BOISE ID 83716
2. Accompanied by: Michele Edl (IDWR) and Jutta Linhart (Wife of Permit Holder)
Phone No: 1-208-392-9464
Address: 50 Yellow Pine Lane; Boise, ID 83716
Relationship to Permit Holder: Wife

3. **SOURCE:** MIDDLE FORK THORN CREEK**TRIBUTARY:** THORN CREEK**B. OVERLAP REVIEW**

1. Other water rights with the same place of use: None
2. Other water rights with the same point-of-diversion: None

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

MIDDLE FORK THORN CREEK NW¼NE¼ Sec. 26, Twp 05N, Rge 05E, B.M. BOISE County

Method of Determination: ArcGIS, Visual Inspection, Google Earth GPS points provided by Mrs. Linhart

2. **PLACE OF USE:** POWER

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
05N	05E	26		X															

Method of Determination: ArcGIS, Visual Inspection

3. **MAPS:**

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 Attached4. **POWER GENERATION INFORMATION:**

Turbine Make	Discharge (cfs)	Generator	Size (W or kW)	Nozzle Size
Stream Engine	0.36 cfs	Stream Engine	0.84 kW @ 66 ft	Two 3/4"

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Make	Model No.	Serial No.	Size	Calib. Date
Turbine	Energy Systems & Design	Stream Engine	Delta Series	3/4" nozzle	Unknown

2. Measurements:

Stream Engine Nozzle Flow Chart

Head Feet	Pressure PSI	Nozzle Diameter, inches											Turbine RPM
		1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1.0	
5	2.2					6.18	8.40	11.0	17.1	24.7	33.6	43.9	460
10	4.3			3.88	6.05	8.75	11.6	15.6	24.2	35.0	47.6	62.1	650
15	6.5		2.68	4.76	7.40	10.7	14.6	19.0	29.7	42.8	58.2	76.0	800
20	8.7	1.37	3.09	5.49	8.56	12.4	16.8	22.0	34.3	49.4	67.3	87.8	925
30	13.0	1.68	3.78	6.72	10.5	15.1	20.6	26.9	42.0	60.5	82.4	107	1140
40	17.3	1.94	4.37	7.76	12.1	17.5	23.8	31.1	48.5	69.9	95.1	124	1310
50	21.7	2.17	4.88	8.68	13.6	19.5	26.6	34.7	54.3	78.1	106	139	1470
60	26.0	2.38	5.35	9.51	14.8	21.4	29.1	38.0	59.4	85.6	117	152	1600
80	34.6	2.75	6.18	11.0	17.1	24.7	33.6	43.9	68.6	98.8	135	176	1850
100	43.3	3.07	6.91	12.3	19.2	27.6	37.6	49.1	76.7	111	150	196	2070
120	52.0	3.36	7.56	13.4	21.0	30.3	41.2	53.8	84.1	121	165	215	2270
150	65.0	3.76	8.95	15.0	23.5	33.8	46.0	60.1	93.9	135	184	241	2540
200	86.6	4.34	9.77	17.4	27.1	39.1	53.2	69.4	109	156	213	278	2930
250	108	4.86	10.9	19.9	30.3	43.6	59.4	77.6	121	175	238	311	3270
300	130	5.32	12.0	21.3	33.2	47.8	65.1	85.1	133	191	261	340	3591
400	173	6.14	13.8	24.5	38.3	55.2	75.2	98.2	154	221	301	393	4140

Note: Figures are in US gallons per minute and refer to one nozzle. The standard *Stream Engine* can generate about 500 watts per 1000 rpm. ~~The X-Stream Engine can generate about 1000 watts per 1000 rpm.~~ These figures are theoretical maximums. Actual flow rates will always be somewhat less—usually by five or ten percent.

Measurement based on design head of 66ft: 161.2 gpm or 0.36 cfs

Measurement based on power production of 744 Watts observed: 158.3 gpm or 0.35 cfs

Field Exam Measurement:**E. FLOW CALCULATIONS**

_____ Additional Computation Sheets Attached

Measured Method: The hydropower unit (turbine) can be used as a measurement device itself.

Measurement based on design head of 66ft:

Linear interpolation:

$$(66 \text{ ft} - 60 \text{ ft}) / (80 \text{ ft} - 60 \text{ ft}) = X / (98.8 \text{ ft} - 85.6 \text{ ft}) \quad X = 3.96 \text{ gpm}$$

$$66 \text{ ft head @ } \frac{3}{4}'' \text{ nozzle} = 85.6 + 3.96 = 89.56 \text{ gpm}$$

$$Q = [2 - \frac{3}{4}''\text{-inch nozzles flowing with 66 ft head}] \times [89.56 \text{ gpm}] \times [\text{approx } 90\% \text{ efficiency}] = 161.2 \text{ gpm or } 0.36 \text{ cfs}$$

$$(66 \text{ ft} - 60 \text{ ft}) / (80 \text{ ft} - 60 \text{ ft}) = X / (1850 \text{ rpm} - 1600 \text{ rpm}) \quad X = 75 \text{ rpm}$$

$$66 \text{ ft head @ } \frac{3}{4}'' \text{ nozzle} = 1600 + 75 = 1675 \text{ rpm}$$

$$P = [1 \text{ turbine}] \times [1675 \text{ rpm}] \times [500 \text{ watts}/1000 \text{ rpm}] = 837.5 \text{ watts or } 0.84 \text{ kW}$$

Measurement based on power production of 744 Watts observed:

$$12 \text{ Amps} \times 62 \text{ Volts} = 744 \text{ Watts} \times [1000 \text{ rpm}/500 \text{ watts}] = 1488 \text{ rpm}$$

Linear interpolation:

$$(1488 \text{ rpm} - 1470 \text{ rpm}) / (1600 \text{ rpm} - 1470 \text{ rpm}) = X / (85.6 \text{ gpm} - 78.1 \text{ gpm}) \quad X = 1.04 \text{ gpm}$$

$$744 \text{ Watts @ } 2\text{-}\frac{3}{4}\text{" nozzle} = 2 \times (78.1 \text{ gpm} + 1.04 \text{ gpm}) = 158.3 \text{ gpm or } 0.35 \text{ cfs}$$

Permitted flow rate 1.00 cfs.

Recommend license for design flow rate of 0.36 cfs.

At the time of the field exam, the cabin was also operating off of some battery and solar power. During the winter, the cabin is heated with a wood-burning stove. Nearly all of the winter power use is hydroelectric. The amount of winter solar energy produced is almost negligible, according to Mrs. Linhart.

F. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation: N/A
2. Volume Calculations for Other Uses: Power

$$V = [0.36 \text{ cfs}] \times (365 \text{ Days}) \times 1.9835 = 260 \text{ AF}$$

G. NARRATIVE/REMARKS/COMMENTS

On Friday, May 13, 2016, Michele Edl and I conducted a field exam for permit 63-32648. A little while after we arrived at the property, we found Mrs. Jutta Linhart down at the Creek (Middle Fork Thorn Creek) with her two dogs. After our meet and greet, she explained how they had developed their power use over time.

The Linharts are the original owners/builders of the cabin, stable, and hydropower system which exist today. They moved to Idaho from Kentucky. When they first arrived at their new Idaho property, they constructed the stables and the overlying studio apartment. They lived in the apartment while the cabin was under construction. Initially, the apartment was powered using solar panels, which are still in place today. The Linharts soon learned that the solar panels alone would not be sufficient to make it through the higher elevation winters in Idaho. Soon after that, they realized that, "hydropower is the way to go!" They applied for and received their permit, then installed the system.

Mrs. Linhart demonstrated the Coanda screen intake, embedded in the stream at a drop of about 3 feet. The screen was difficult to see because of the stream flow rate at the time of the exam. At the edge of the stream closest to the road, a penstock vent pipe was easily visible. Mrs. Linhart explained that the penstock runs down the center of Yellow Pine Lane, nearly the full length of their property. We walked westward, the length of the penstock, to the hydropower unit. The Stream Engine unit was operating with two $\frac{3}{4}$ " nozzles. From here, we followed the turbine discharge to confirm that it returned to Thorn Creek. Next, we walked up the hill to the stables, in nearly a straight line, tracing the path of the buried power service line from the turbine to the stables, where the "power room" was located. On the path up to the power room, we noticed and photographed the domestic well, buried cistern, and buried propane tank. The domestic well bore two well tags (D 0055831 and D0052111) because it was drilled, then deepened.

Once inside the power room, we viewed the battery, shunt/dump load, inverter, and read outs for power production. We noticed that the shunt load unit was hot, signifying that more electricity was being produced than consumed at the time of the exam.

Finally, Mrs. Linhart invited us into the cabin – the main residence. She gave us a short tour, displaying the kitchen, bathroom, den and one bedroom. We observed that she uses all modern appliances in the kitchen, but she commented that their main heating source is the wood-burning stove in the winter. The hydropower unit has proved to be a very reliable energy source year round.

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

H. RECOMMENDATIONS**1. Recommended Amounts**

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>DIVERSION RATE</u>	<u>ANNUAL VOLUME</u>
POWER	01/01 to 12/31	0.36 CFS	260 AF

Totals: 1.000 CFS

2. Recommended Amendments

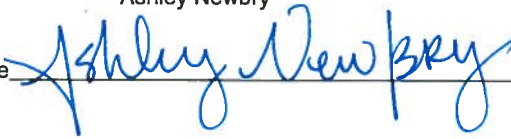
☐ Change P.D. as reflected above ☐ Add P.D. as reflected above ☒ None

☐ Change P.U. as reflected above ☐ Add P.U. as reflected above ☒ None

I. AUTHENTICATION

Ashley Newbry

Field Examiner's Name



Date

5/26/2016

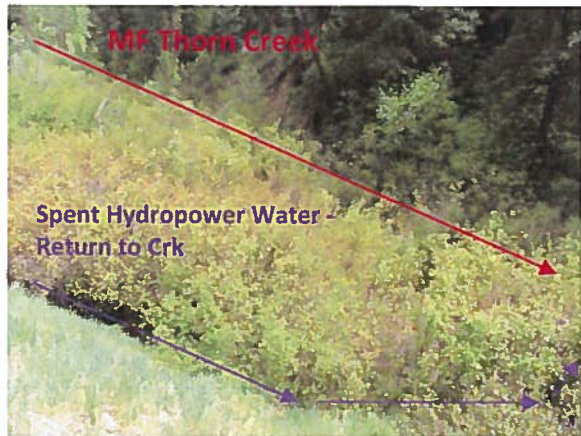
Reviewer

Date

PHOTOGRAPHER AND DATE: ASHLEY NEWBRY • May 13, 2015 • WR FILE: 63-32648



Left: The Coanda screen intake was constructed into a stream drop of approximately 3 feet.
Right: The penstock runs down Yellow Pine Lane to the Stream Engine shelter.



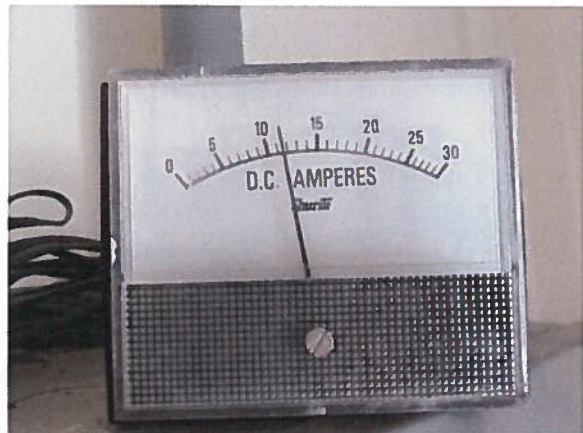
Left: The Stream Engine is a turbine-generator combination unit. It supplies the great majority for the Linharts. Right: We followed the turbine discharge back to Middle Fork Thorn Creek (source).



Left: The power service line from the hydropower unit was buried in a straight path uphill to the "power room."
Right: The domestic well was double tagged (deepened).



Left: We followed Mrs. Linhart along the buried power service, to the power room in the stables barn.
Right: Michele points to the DC Amp meter above the inverter system, instructing me to get a photo.



Left: Mrs. Linhart uncovered the large battery which can hold and supply power from the Stream Engine unit. Right: At the time of the exam, approximately 12 amps were being generated.



Left: The box shown at left demonstrates the dump load. Excess power is released here in the form of heat. It was hot during the exam.