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DEPARTMENT OF
WATER RESOURCES

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October 30, 2012

Mr. Gary Spackman, Director
Mr. Jeff Peppersack, Chief
Department of Water Resources
322 East Front Street
P.O. Box 83720
Boise, Idaho 83720-0098

Re: Permit No. 37-8205
Our File No. 30587-024

Dear Messrs. Spackman and Peppersack:

Enclosed please find an October 29, 2012 Technical Memorandum ("Memorandum") prepared by Brockway Engineering, LLC ("Brockway") for your consideration as part of the permittee, Sun Valley Land & Minerals, Inc.'s, ("Permittee") plan for mitigation of the evaporative losses on the pond located on its property. As reflected in the Memorandum, the actual evaporative losses due to heating the ponds is not as great as the estimates submitted with the November 23, 2010 mitigation plan. If the Idaho Department of Water Resources ("IDWR") will accept the site specific scientific data then the plan to mitigate the evaporative losses by retiring a portion of decreed right 37-22128 is feasible. Frankly, if the IDWR will not accept the site specific data, and therefore the mitigation plan, there is no alternative available to the Permittee other than challenging the decision. This is because all other avenues for mitigating the evaporative loss have either been rejected by the IDWR, or are not feasible, including the acquisition of water rights from nearby sources all of which efforts have been unsuccessful.

In view of the foregoing the Permittee requests an opportunity to meet with you in person to discuss the mitigation plan as part of your consideration of it. Thank you for your anticipated prompt consideration of this matter.

Sincerely,

LAWSON LASKI CLARK & POGUE, PLLC



Edward A. Lawson

cc: Charles G. Brockway, P.E.
Client



Technical Memorandum

DATE: October 29, 2012
TO: Idaho Department of Water Resources
FROM: Charles G. Brockway, P.E.
SUBJECT: Supplemental Information for Mitigation Plan for Permit 37-8205

Background

Permit 37-8205 is awaiting licensing before the Idaho Department of Water Resources (IDWR). IDWR has required that an acceptable mitigation plan be submitted documenting a consumptive source of water which can compensate for increased evaporation losses in an existing cold-water pond which is proposed to be heated with the geothermal water.

In the last iteration of the various submittals to IDWR (mitigation plan dated November 23, 2010), it was proposed to reduce the pond heat load by maintaining a constant temperature of 66 degrees F, along with maintaining a small "plunge" area at 85 degrees F. The purposes of this technical memo are to 1) recount the mitigation measures previously offered; 2) describe the specific actual consumptive use which will be foregone to provide the required mitigation; and 3) present new site-specific climatological data which forms the basis for the consumptive use calculations.

Mitigation Measures Previously Offered

In the course of the licensing process for permit 37-8205, the permittee has offered a number of sources of consumptive mitigation water, all of which have been rejected by IDWR as insufficient:

- 1. Retirement of a portion of decreed water rights 37-22128 and 37-4368B.** These rights are from the same source as 37-8205 and are unrestricted as to consumptive use. They were decreed on May 2, 2011 and are valid rights. The Department rejected the use of these rights because no showing of actual consumptive use was made. The fact that water usage under the rights *is allowed to be* up to 100% consumptive was not sufficient.
- 2. Filing of a new appropriation under 42-111(b).** This section of Idaho Code allows a water right to be appropriated for "Any other uses, if the total use does not exceed a diversion rate of four one-hundredths (0.04) cubic feet per second and a diversion volume of twenty-five hundred (2,500) gallons per day." The increase in evaporation would be less than these amounts, but the Department rejected the proposal for a reason which is not entirely clear.

3. The use of reduced reservoir water surface evaporative area as consumptive mitigation. The surface area of the Deer Creek reservoir, which is authorized under separate water rights, has been reduced over time as the reservoir has been reconfigured. Ample aerial photo evidence exists to document this hydrologic fact, but the Department rejected the proposal on grounds that the reduced portion of use had been forfeited and was therefore unavailable for mitigation purposes.

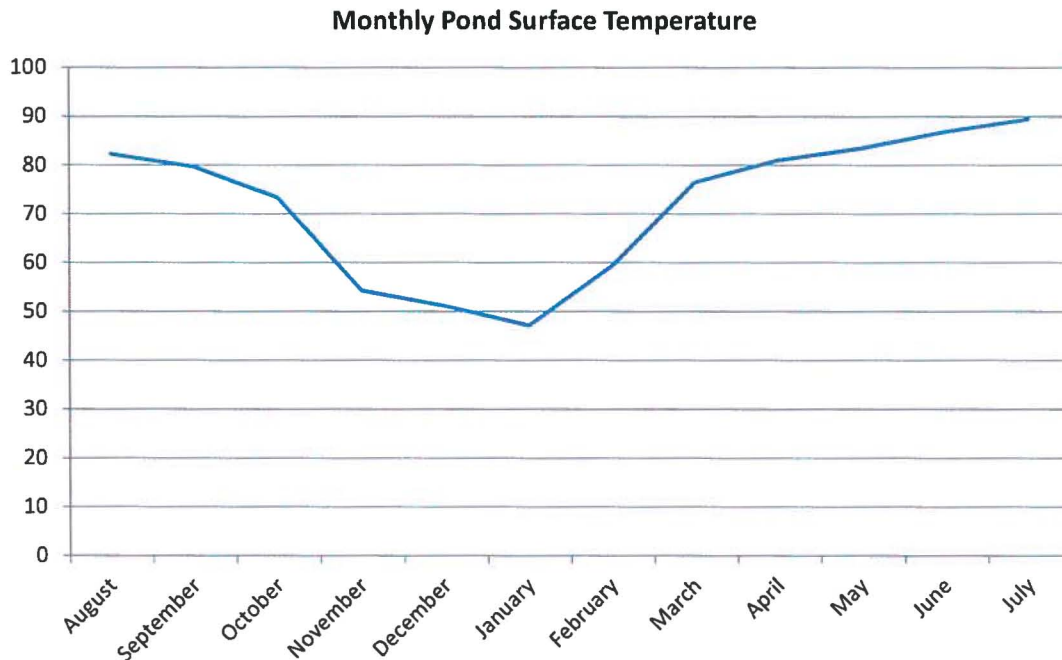
Proposed Mitigation

The mitigation being offered by the permittee involves retirement of a portion of decreed right 37-22128. Consumptive use under this right has now been established by the utilization of the geothermal water to heat a small recreational pond. The pond was constructed in July 2011, and artesian flow under this right has been flowing to the pond on August 5, 2011. Water is delivered to the pond via a 6-inch mainline constructed in 2010 as the trunk line of the geothermal distribution system. The source of water is the artesian flow at the springhead, collected in the distribution system and delivered by gravity flow to the pond. Water flows from the small pond to the adjacent larger pond, and thence returns to Deer Creek as it has done for eons. The surface area of the pond is 0.33 acres. Refer to the attached aerial map showing the system.

Flow data and climatological data was collected using a weather station and datalogger situated on the bank of the pond. The purpose of the data collection effort was to establish parameters affecting evaporation which were more specific to the actual pond site, in lieu of using average parameters at various weather stations at Hailey. This data collection effort was initiated because the topographic differences between Hailey and the project site were expected to significantly affect certain parameters such as wind speed and temperature.

Inflow to the pond was measured using a Seametrics WMP-101 magnetic-induction flow meter. Inflow ranged from 20 to 35 gpm from August 5, 2011 to February 3, 2012, and was nearly constant at 93 gpm thereafter. The increase in flow was made possible by an elimination of a restriction in the supply pipeline, and essentially resulted in all of the spring flow entering the pond.

The water surface temperature in the pond was measured using a floating temperature probe set approximately 20 feet from the bank and penetrating about 6 inches into the water. Surface temperature ranged from 48 to 82 degrees F over the measurement period, with the lowest and highest temperatures occurring during January and July, respectively. The following graph illustrates the monthly water temperature pattern.



In addition to the pond temperature, the relevant climatological parameters measured were air temperature, relative humidity, dew point, wind speed, and precipitation. The equipment used to collect the data was supplied by the Onset Corporation. The station included all of the above sensors, plus a tripod and supporting equipment to house the sensors and datalogger. The tripod was configured on the south bank of the pond so that wind speed was measured at the standard 2 m height. A sun shield was included to eliminate solar radiation effects on air temperature readings. The water temperature probe was set in the pond on a float with the end of the sensor approximately 6 inches below water surface. Additional information on the station may be found at <http://www.onsetcomp.com/products/kits/u30-nrc-sys-b>.

The datalogger was set to collect data at 5-minute intervals. The station was visited at least twice each month to verify its operation and download data. A battery malfunction resulted in a loss of data from 10/21 to 11/15. All other data was retrieved and quality-checked. Raw data can be provided upon request.

The following photos illustrate the station setup.



Small pond just after construction, looking south-southeast – 8/5/11



Weather station setup looking northwest – 8/10/2011



Pond and inflow looking east, weather station visible on south bank
(cinder blocks were placed around the station for protection) – 5/25/2012



Temperature sensor and float – 10/29/2012



Pond in winter – 2/24/2012



Inflow meter – 1/13/2012

Comparison of Site-Specific Parameters with Hailey Stations

IDWR has requested a comparison of the data collected with the weather station described above with the monthly average parameters utilized in previously submissions to the Department and a justification for utilizing site-specific data in lieu of Hailey averages. The previous data were based on various existing data records at the Hailey NWS and/or Hailey airport stations as described in previous submittals. The attached plots illustrate the comparison. Site temperature was nearly identical to the Hailey averages. Relative humidity was also comparable, with somewhat higher humidity conditions occurring at the site during the wintertime. The greatest variation is seen in wind speed, as expected based on topographical considerations. Monthly wind speed was generally about twice as high at the site than in Hailey. This significant variation provides a good justification for using the site-specific data to compute evaporation, since wind speed is a major factor in the evaporation equations. The graph showing the comparison between computed evaporation illustrates this fact.

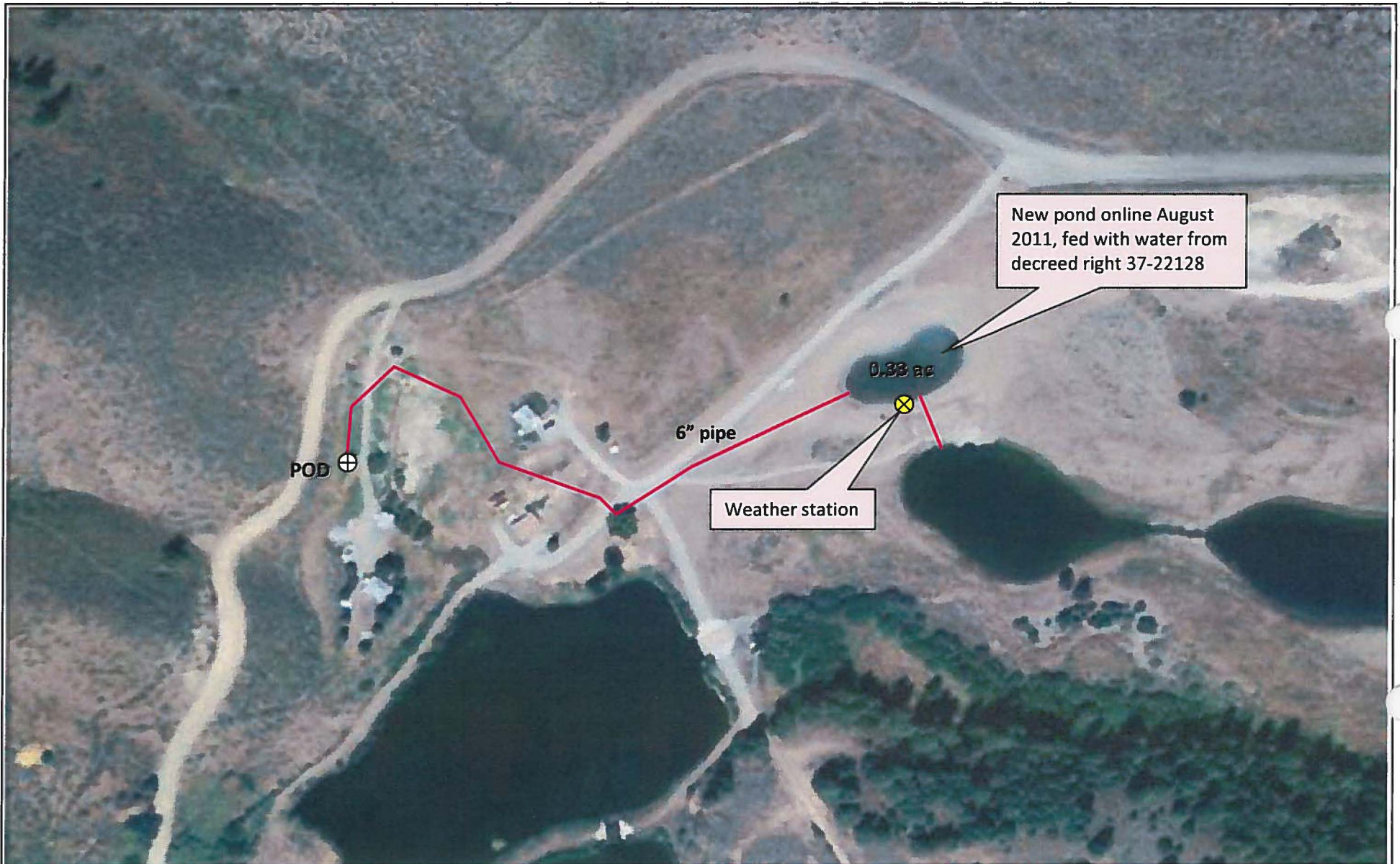
Results

The attached spreadsheet illustrates the details of evaporation calculations for the small pond on a monthly basis using the site-specific climatological parameters described above. The four evaporation methods previously evaluated by IDWR and apparently accepted as sound were utilized. The computed annual evaporation for the small pond is 2.5 acre-feet.

By comparison, the annual increase in evaporation for the 66-degree pond and heated plunge (as described in the November 23, 2010 mitigation plan), relative to the evaporation from the same pond with unheated water, is 2.4 acre-feet (see attached spreadsheet).

These calculations indicate that retiring the consumptive use associated with the pond served by water under 37-22128 will adequately mitigate for the increase in consumptive use caused by heating the large pond to a temperature of 66 deg F. Water right 37-22128 allows a diversion volume of 40 ac-ft, all of which could be consumed since the right is unrestricted as to consumptive use. Actual consumptive use under this right is 2.5 ac-ft / 40 ac-ft or 6.25% of the right. This amount will be retired and dedicated to mitigation for increased evaporation occurring under permit 37-8205.





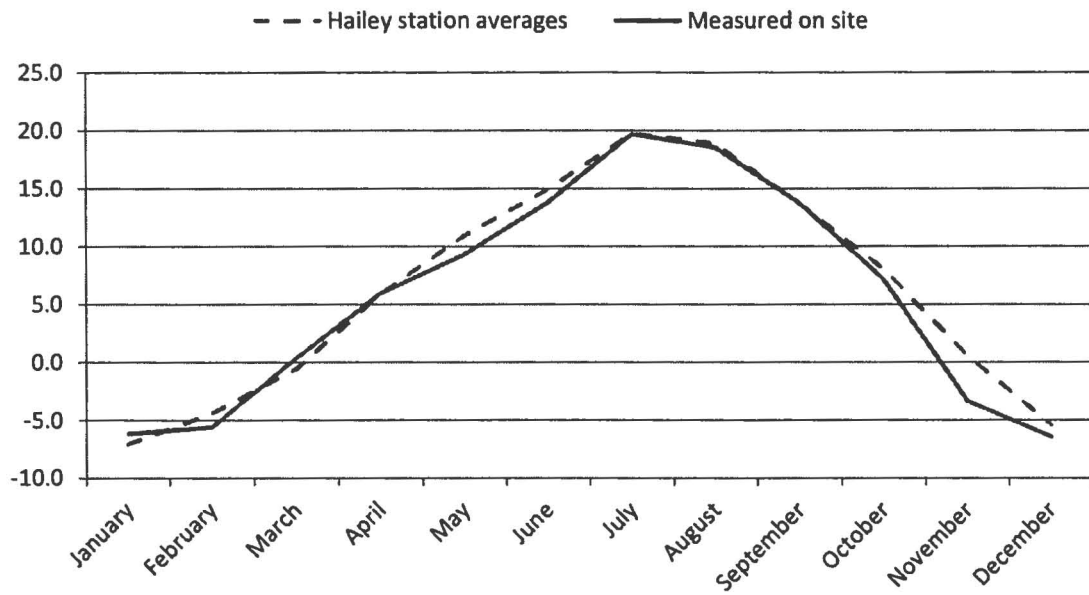
**SUN VALLEY LAND AND MINERALS
MITIGATION PLAN FOR WATER RIGHT PERMIT 37-8205**

Brockway Engineering, PLLC
October 29, 2012

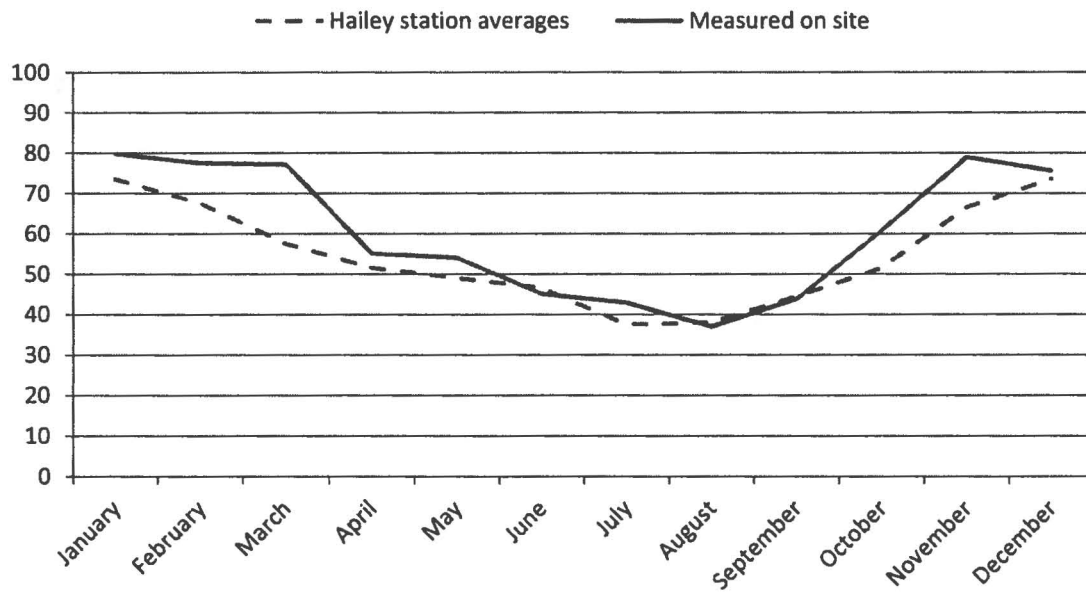
Comparison of climatological parameters from Hailey station(s) with on-site measured values
Monthly average values

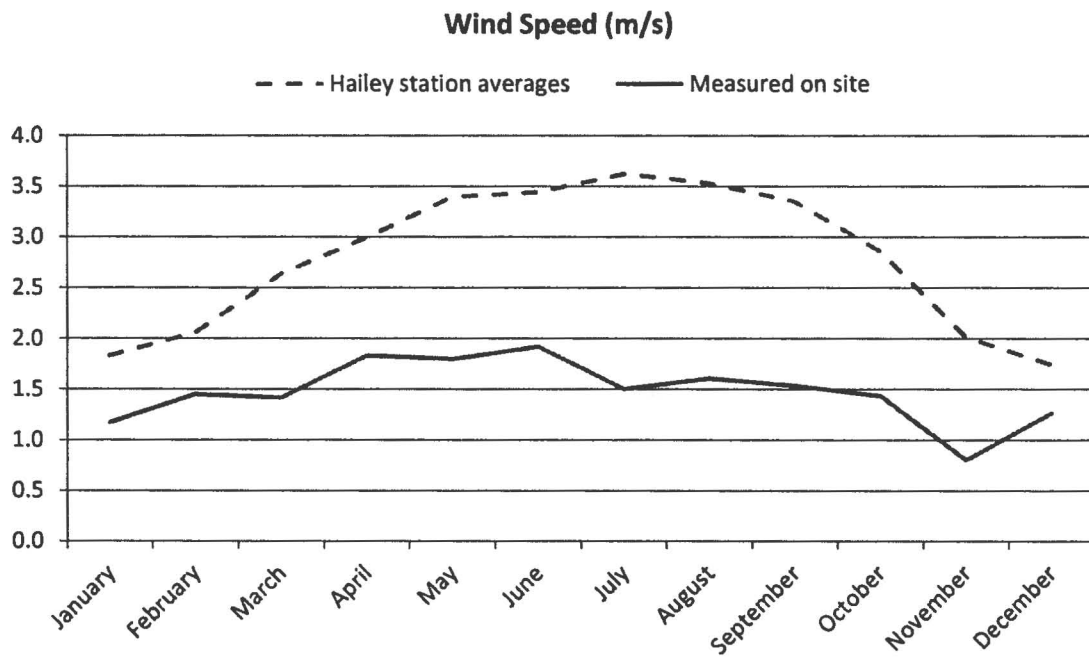
Month	Days	Hailey Station Values			On-Site Measured Values		
		Air temp [C]	RH (%)	Wind (m/s)	Air temp [C]	RH (%)	Wind (m/s)
January	31	-7.1	74	1.8	-6.2	79.8	1.17
February	29	-4.4	68	2.1	-5.6	77.5	1.45
March	31	-0.6	58	2.6	0.4	77.2	1.42
April	30	5.9	52	3.0	5.9	55.1	1.83
May	31	10.9	49	3.4	9.3	54.0	1.80
June	30	14.9	47	3.4	13.8	45.0	1.92
July	31	19.7	38	3.6	19.7	42.9	1.50
August	31	18.9	38	3.5	18.5	36.9	1.61
September	30	13.7	45	3.4	13.7	43.9	1.53
October	31	8.1	52	2.9	7.2	60.7	1.43
November	30	0.6	67	2.0	-3.4	78.9	0.80
December	31	-5.4	74	1.7	-6.4	75.5	1.27

Air Temperature (deg C)



Relative Humidity (%)





EVAPORATIVE LOSS IN HEATED OUTDOOR POND USING WATER FROM DECREED RIGHT 37-22128

Pond temperature and climatological data measured Aug-11 through Oct-12 using weather station on bank

Four applicable evaporation methods as compiled by Helfrich et al. (1982), reported and discussed in Bras (1990)

CGB 10/29/12

Pond temperature
a
b
rho

Varies deg F =
2500 J/g
2.386 J/g-C
1.00E+06 g/m^3

Varies deg C (9999 = same as air)
a,b are coeffs in Le equation:
Le = a - bT
rho = density of water

es = saturation vapor pressure at pond surface temperature
ea = vapor pressure of ambient air

Month	Days	Avg air temp [C]	Avg RH (%)	Avg Wind (m/s)	Pond sfc temp [C]	Le [J/g]	es (mb)	ea (mb)
January	31	-6.2	79.8	1.17	8.4	2480	11.1	3.1
February	29	-5.6	77.5	1.45	15.2	2464	17.3	3.1
March	31	0.4	77.2	1.42	24.7	2441	31.1	4.9
April	30	5.9	55.1	1.83	27.2	2435	36.1	5.1
May	31	9.3	54.0	1.80	28.6	2432	39.1	6.4
June	30	13.8	45.0	1.92	30.5	2427	43.5	7.1
July	31	19.7	42.9	1.50	31.9	2424	47.3	9.8
August	31	18.5	36.9	1.61	27.9	2433	37.6	7.9
September	30	13.7	43.9	1.53	26.5	2437	34.5	6.9
October	31	7.2	60.7	1.43	23.0	2445	28.0	6.2
November	30	-3.4	78.9	0.80	12.4	2470	14.4	3.8
December	31	-6.4	75.5	1.27	10.6	2475	12.8	2.9

Month	Kohler (1954)				Meyer (1942)				Brady et al. (1969)				Ryan and Harleman (1973)				Increase fr natural	
	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Average [in]	
January	35.0	1.41E-08	0.05	1.49	83.6	3.37E-08	0.11	3.55	60.4	2.44E-08	0.08	2.57	29.0	1.17E-08	0.04	1.23	2.21	0.20
February	77.0	3.12E-08	0.11	3.08	157.0	6.37E-08	0.22	6.29	112.3	4.56E-08	0.16	4.50	63.6	2.58E-08	0.09	2.55	4.10	2.26
March	139.5	5.71E-08	0.19	6.02	289.2	1.18E-07	0.40	12.49	206.9	8.48E-08	0.29	8.94	115.3	4.72E-08	0.16	4.98	8.11	5.87
April	212.8	8.74E-08	0.30	8.92	369.7	1.52E-07	0.52	15.50	264.8	1.09E-07	0.37	11.10	175.9	7.22E-08	0.25	7.37	10.72	8.15
May	220.6	9.07E-08	0.31	9.56	387.9	1.60E-07	0.54	16.82	277.6	1.14E-07	0.39	12.04	182.3	7.50E-08	0.26	7.91	11.58	8.38
June	262.3	1.08E-07	0.37	11.03	441.9	1.82E-07	0.62	18.58	317.3	1.31E-07	0.44	13.34	216.9	8.93E-08	0.30	9.12	13.02	9.33
July	210.8	8.70E-08	0.30	9.17	419.5	1.73E-07	0.59	18.25	299.8	1.24E-07	0.42	13.04	174.3	7.19E-08	0.24	7.58	12.01	6.77
August	179.1	7.36E-08	0.25	7.76	339.9	1.40E-07	0.48	14.73	242.7	9.97E-08	0.34	10.52	148.0	6.08E-08	0.21	6.41	9.86	4.54
September	158.8	6.51E-08	0.22	6.65	311.2	1.28E-07	0.43	13.03	222.3	9.12E-08	0.31	9.31	131.2	5.39E-08	0.18	5.50	8.62	4.55
October	117.5	4.80E-08	0.16	5.07	241.5	9.88E-08	0.34	10.42	172.8	7.07E-08	0.24	7.45	97.1	3.97E-08	0.14	4.19	6.78	4.58
November	32.0	1.30E-08	0.04	1.32	102.8	4.16E-08	0.14	4.25	76.7	3.11E-08	0.11	3.17	26.5	1.07E-08	0.04	1.09	2.46	
December	47.3	1.91E-08	0.07	2.02	106.5	4.30E-08	0.15	4.54	76.6	3.10E-08	0.11	3.26	39.1	1.58E-08	0.05	1.67	2.87	
	Total			72.09	Total			138.44	Total			99.23	Total			59.59	92.34	54.64

Average evaporation from the four methods:

92.34 inches

7.69 feet

Small pond surface area

0.33 acres

Total annual evaporation

2.54 acre-feet

EVAPORATIVE LOSS IN HEATED OUTDOOR POOL - PROPOSED CONDITIONS, 66 DEGREES F

Using actual, observed climatological data at the site Aug-11 through Oct-12

Four applicable methods as compiled by Helfrich et al. (1982), reported and discussed in Bras (1990)

CGB 10/29/12

Pond temperature

66 deg F =

18.89 deg C (9999 = same as air)

a 2500 J/g

a,b are coeffs in Le equation:

es = saturation vapor pressure at pond surface temperature

b 2.386 J/g-C

Le = a - bT

ea = vapor pressure of ambient air

rho 1.00E+06 g/m^3

rho = density of water

Month	Days	Avg air temp [C]	Avg RH (%)	Avg Wind (m/s)	Pond sfc temp [C]	Le [J/g]	es (mb)	ea (mb)
January	31	-6.2	79.8	1.17	18.9	2455	21.8	3.1
February	28	-5.6	77.5	1.45	18.9	2455	21.8	3.1
March	31	0.4	77.2	1.42	18.9	2455	21.8	4.9
April	30	5.9	55.1	1.83	18.9	2455	21.8	5.1
May	31	9.3	54.0	1.80	18.9	2455	21.8	6.4
June	30	13.8	45.0	1.92	18.9	2455	21.8	7.1
July	31	19.7	42.9	1.50	18.9	2455	21.8	9.8
August	31	18.5	36.9	1.61	18.9	2455	21.8	7.9
September	30	13.7	43.9	1.53	18.9	2455	21.8	6.9
October	31	7.2	60.7	1.43	18.9	2455	21.8	6.2
November	30	-3.4	78.9	0.80	18.9	2455	21.8	3.8
December	31	-6.4	75.5	1.27	18.9	2455	21.8	2.9

	Kohier (1954)				Meyer (1942)				Brady et al. (1969)				Ryan and Harleman (1973)				Average	Increase from natural			
Month	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	Qe [W/m^2]	E [m/s]	[cm/d]	[in]	[in]	[in]			
January	82.4	3.36E-08	0.11	3.54	196.4	8.00E-08	0.27	8.44	142.0	5.78E-08	0.20	6.10	68.1	2.77E-08	0.09	2.93	5.25	3.24			
February	101.6	4.14E-08	0.14	3.94	207.3	8.44E-08	0.29	8.04	148.2	6.04E-08	0.21	5.75	84.0	3.42E-08	0.12	3.26	5.25	3.41			
March	90.2	3.67E-08	0.12	3.87	187.0	7.62E-08	0.26	8.03	133.8	5.45E-08	0.19	5.75	74.5	3.04E-08	0.10	3.20	5.21	2.97			
April	114.5	4.67E-08	0.16	4.76	199.0	8.11E-08	0.28	8.27	142.5	5.81E-08	0.20	5.92	94.7	3.86E-08	0.13	3.94	5.72	3.15			
May	104.3	4.25E-08	0.14	4.48	183.4	7.47E-08	0.25	7.88	131.2	5.35E-08	0.18	5.64	86.2	3.51E-08	0.12	3.70	5.42	2.22			
June	106.0	4.32E-08	0.15	4.41	178.6	7.27E-08	0.25	7.42	128.2	5.22E-08	0.18	5.33	87.6	3.57E-08	0.12	3.64	5.20	1.51			
July	67.5	2.75E-08	0.09	2.90	134.4	5.48E-08	0.19	5.77	96.0	3.91E-08	0.13	4.13	55.8	2.27E-08	0.08	2.40	3.80	-1.44			
August	83.9	3.42E-08	0.12	3.60	159.3	6.49E-08	0.22	6.84	113.7	4.63E-08	0.16	4.89	69.4	2.83E-08	0.10	2.98	4.58	-0.73			
September	85.8	3.49E-08	0.12	3.57	168.2	6.85E-08	0.23	6.99	120.1	4.89E-08	0.17	4.99	70.9	2.89E-08	0.10	2.95	4.62	0.55			
October	84.1	3.43E-08	0.12	3.61	173.0	7.05E-08	0.24	7.43	123.8	5.04E-08	0.17	5.32	69.5	2.83E-08	0.10	2.99	4.84	2.64			
November	54.3	2.21E-08	0.08	2.26	174.5	7.11E-08	0.24	7.25	130.3	5.31E-08	0.18	5.42	44.9	1.83E-08	0.06	1.87	4.20	2.70			
December	90.0	3.67E-08	0.12	3.87	202.7	8.26E-08	0.28	8.71	145.8	5.94E-08	0.20	6.26	74.4	3.03E-08	0.10	3.20	5.51	3.68			
Total				44.81	Total				91.08	Total				65.48	Total				37.04	59.61	23.91

Average evaporation from the four methods: 59.61 inches

April - October 34.19 7.91
November - March 25.42 16.00

SUN VALLEY LAND & MINERALS**PERMIT 37-8295 MITIGATION PLAN - SUMMARY OF POND EVAPORATION CALCULATIONS**

Brockway Engineering 10/29/2012

HEATED POND

	Area [acres]	Evap [in/yr]	Evap [ac-ft/yr]
Heated plunge area 25'x25' at 85 deg F	0.01	92.3	0.11
Main pond at 66 deg F	1.16	59.6	5.76
Total evaporation - heated pond			5.87

NATURAL COLD WATER POND

Natural cold water evaporation	35.70 in/year
Area of pond	1.17 acres
Total evaporation - cold water pond	3.48 ac-ft/yr

Increase in evaporation **2.39 ac-ft/yr**