

MEMORANDUM

TO: Water Right Permit File 61-7712

FROM: Daniel A. Nelson

DATE: July 30, 2021

SUBJECT: Volume Review for Storage and Recreation uses.

The uses developed under this permit are the storage components and the recreation use. No commercial enterprise was actually developed, so the commercial storage component will be changed to recreation use as discussed in the field report.

The permit authorizes irrigation storage, irrigation from storage, stockwater storage, commercial storage, wildlife storage, recreation storage, and diversion to storage, and the commercial storage component will be changed to recreation use. The diversion to storage is addressed in the measurement memo.

Recreation Volume:

The recreation use is the filling and maintenance of the hot tub. The well diverted 3.83 gpm to the hot tub non-stop. So the total daily diversion was $3.83 \text{ gpm} \times 24 \text{ hours} \times 60 \text{ minutes}$ for a total daily diversion of 5,515.2 gallons per day. The annual volume would be to multiply 5,515.2 gallons per day $\times 365 \text{ day}$ and then divide that amount by 325,850 to determine the total acre-feet diverted per year of 6.177 acre-feet rounded to 6.2 acre-feet of total commercial type use.

I feel it is important to determine the volume of the hot tub to ensure that the hot tub could be filled in a reasonable amount of time with the diversion rate supplied. The calculations shown below are determined by Width $\times$ Depth $\times$ Length to determine the cubic feet.

$2 \times 1 \times 7 =$ 14 Cubic Feet	$2 \times 2.25 \times 7 =$ 31.5 Cubic Feet	$2 \times 3.25 \times 7 =$ 45.5 Cubic Feet	$3 \times 4.75 \times 7 = 99.75$ Cubic Feet
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Total volume of Hot Tub = $14 + 31.5 + 45.5 + 99.75 = 190.75$ Cubic Feet

190.75 Cubic Feet $\times 7.48$ gallons/cubic feet = $1,426.81$ gallon hot tub.

$1,426.81$ gallons / 3.83 gpm = 372.54 minutes / $60 = 6.21$ hours to completely fill hot tub.

Due to the fact that the hot tub doesn't really authorize any additional storage, that the volume for the commercial use should be limited to 6.2 acre-feet found of continuous use of the geothermal water to maintain the temperature of the hot tub.

Irrigation Use:

The irrigation volume is based on the number of acres found (47 acres) times the head gate volume authorized in that area of 4.0 af/ac, or the maximum allowable diversion rate allowed for irrigation ($47 \text{ acres} \times 0.02 \text{ cfs/acre} = 0.94 \text{ cfs}$) times the number of days of the irrigation season (246 days) multiplied by the 1.9835 to attain the maximum capacity of the system. The Department is limited to allow the smaller volume of these two calculations. The irrigation use is based on the following calculations:

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = 47 \text{ acres} \times 4 \text{ af/ac} = 188 \text{ acre-feet}$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 =$$

$$0.94 \text{ cfs} \times 246 \text{ days} \times 1.9835 = 458.67 \text{ acre-feet}$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} = 188 \text{ acre-feet}$$

Irrigation Storage, Stockwater Storage, Wildlife Storage, and Recreation Storage:

The On-Stream Pond has a surface area of 6.3 acres with an average depth of 8 feet. This equates to approximately 50.4 af of capacity. The majority of this pond is outside the stream channel, so we need to take into account seepage losses for this pond. Under normal circumstances, we wouldn't include seepage losses for an on-stream pond. The seepage losses are 46 af and the evaporation losses are 20.5 af for a total of 117 af of ponds storage for the On-Stream Pond.

The Reserve Pond is totally off-stream, so seepage losses must be taken into account for this pond. The Reserve Pond has a surface area of 1.3 acres with an average depth of 4 feet. This equates to an approximately 5.2 af for storage capacity. The seepage losses are 9.5 af, and the evaporation losses are 4.2 af.

The combined storage for the two ponds shows a capacity of 55.6 af with seepage losses of 55.5 af and evaporation losses of 24.7 af. The total storage for these two ponds is 135.8 af. According to the LandSat imagery, these ponds seem to fill maybe once every 4 to 8 years. Although the LandSat imagery doesn't have the clarity of NAIP imagery, it does appear the Reserve Pond was filled in 2001, 2002, and 2003, and the On-Stream Pond was filled in 2002 and 2003. The irrigation from storage component will be limited to a single fill of 55.6 af.

The stockwater found at the time of exam was 60 cow/calf pairs, or 120 head of range cattle. There were no sheep present at the time of the exam, and the owner stated that there wasn't any sheep on the property. Department standards for stockwater for range cattle is 12 gallons per day per animal. The following calculation has been used to determine the total volume of water being used by the cattle:

$$12 \text{ gpd} \times 120 \text{ head of cattle} = 1,440 \text{ gallons per day}$$

$$1,440 \text{ gpd} \times 365 \text{ days} = 525,600 \text{ gallons per year}$$

$$525,600 \text{ gpy} / 325,850 = 1.61 \text{ acre-feet per year for stockwater.}$$

The stockwater storage should be limited to a total of 1.6 acre-feet. The total storage volume should be listed on the license as follows:

The Total volume limitation that are recommended:

Recreation =	6.2 acre-feet
<u>Irrigation =</u>	<u>188 acre-feet</u>
Total Non-Storage Volume =	194 acre-feet

Irrigation Storage =	136 acre-feet
Irrigation From Storage =	55.6 acre-feet
Stockwater Storage =	1.6 acre-feet
Wildlife Storage =	136 acre-feet
<u>Recreation Storage =</u>	<u>136 acre-feet</u>
Total Storage Volume =	136 acre-feet

Right 61-7712 authorizes total annual storage volume of 136 acre-feet, 55.6 acre-feet to be used for the initial filling or carryover storage of the two pond(s) and 80.2 acre-feet for the replacement of losses caused by seepage and evaporation. Due to Idaho Code 42-202(3) the irrigation from storage component can have up to 5 acre-feet per acre. Therefore Condition R70 is needed.

Total Storage Calculations

FILE NUMBER	61-7712 On_Stream,
REVIEWER	Joe Agent
DATE	1/1/2000

This spreadsheet has been designed by Idaho Department of Water Resources to estimate the total seepage, evaporation and fill capacity required for a pond.

User Input
Calculated value
Formula Explanations

Surface Area (AC.)	6.3	"Surface Area" is automatically carried over from the "Seepage Loss" sheet.
Average Pond Depth (FT.)	8	"Average Pond Depth" depicts the actual depth of the pond either measured or estimated. Note: If you know the maximum depth and not the average depth, the Field Examiner's Handbook suggests multiplying the maximum depth by 0.4 to get the average depth, or you can use any method that seems reasonable to attain average depth.
Pond Capacity (AF)	50.4	Pond Capacity is calculated by multiplying the Pond Surface Area by the Average Pond Depth. If you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above. Note: If pond capacity is determined using a method shown on the "Pond Capacity" sheet, the user may need to modify the value of "Pond Capacity" (cell B9) manually. Note that if the value is modified manually, the formula will be altered for future use.
Multiple Fill Volume Above Initial Fill to Fulfill From Storage Needs- "Multiple Fills" (AF)	0	The "Multiple Fill Volume Above Initial Fill" is the acre-feet of water required to meet a <i>from storage</i> component if the <i>from storage</i> component exceeds a one time fill. This section should not include the amount of water needed to fill the pond initially or the amount of water needed to maintain the pond level due to evaporation or seepage. For example: if a pond has a capacity of 5 acre feet and 2.5 acre feet of seepage and evaporation, but the pond is used for irrigation that requires 10 acre feet of from storage for the irrigation use, then you would insert 5 acre feet into this location (10 acre feet needed - 5 acre feet from the initial fill = 5 acre feet of additional storage needed). Note: You must have a "From Storage" component exceeding the initial fill on the permit to include a volume in this space.
Estimated Seepage Loss (AF)	46.0	The "Estimated Seepage Loss" is automatically carried over from the "Seepage Loss" sheet.
Estimated Evaporation Loss (AF)	20.5	The "Estimated Evaporation Loss" is automatically carried over from the "Evaporation Loss" sheet.
Total Volume Required (AF)	116.9	The "Total Volume Required" is calculated by adding the Pond Capacity, Multiple Fills, Seepage Loss, and Evaporation Loss amounts to determine the total amount of storage required.

Evaporation Loss Calculations

This spreadsheet has been designed by Idaho Department of Water Resources to estimate the annual evaporation losses from a pond.

FILE NUMBER	61-7712 On Str
REVIEWER	Joe Agent
DATE	1/1/2000

User Input
Calculated value
Formula Explanations

The acronyms used on the Kimberly Research Center website are defined below:

P = Precipitation
ET= Evapotranspiration
P _d = Precipitation deficit
P _d =ET-P

USING THIS SPREADSHEET

Use the link below to access the Kimberly Research Center website. This website provides the Precipitation Deficit for a station most representative of the pond under examination. The Precipitation Deficit is the total amount of free water surface evaporation minus the precipitation for a given area, which gives the total amount of evaporative losses incurred by the pond. There are several weather sites that are used throughout the state. IDWR staff can find the nearest site using Arc Map. The shape file containing the sites can be found at <X:/Spatial/Climate/ETIdahostations.shp>.

Instructions:

1. Use the link below to navigate to ET Idaho 2012.
2. Select the station which is most representative to your pond location.
3. Click Submit Query.
4. Under "Land Covers with Evapotranspiration Estimates," select "Open Water - Shallow Systems (ponds, streams)" or "Open Water - small stock ponds" depending on the pond size.
5. Click the link to "Precipitation Deficit."
6. Reference and copy (ctrl + C) the first subheading "Mean" values.
7. Click the "Paste Values from ET Idaho" button. The table will automatically enter a zero (0) for any negative precipitation deficit values.

Found at: <http://data.kimberly.uidaho.edu/ETIdaho/>

Precipitation Deficit

Station: Glens Ferry (NWS--USC00103631)

Month	mm/day ¹	Days per month	mm/Month
Jan	-0.61	31	0.00
Feb	0.36	28	10.08
March	1.63	31	50.53
April	3.39	30	101.70
May	4.32	31	133.92
June	5.49	30	164.70
July	6.15	31	190.65
August	5.21	31	161.51
September	3.64	30	109.20
October	2.07	31	64.17
November	0.14	30	4.20
December	-0.60	31	0.00

PLEASE NOTE:

The seasonal average for precipitation deficit should not be used for calculations because precipitation often exceeds evaporation during wetter months of the year. If the pond is kept full, excess precipitation during wetter months does not serve to refill the pond during drier months.

For example, see Sandpoint KSPT (NWS -- 108137), the annual precipitation deficit is -106 mm. However, April through September have positive precipitation deficit values. To properly estimate the annual volume of water necessary to refill a pond due to evaporation losses, the table will automatically enter a zero (0) for each month that the precipitation value is reported as a negative value.

As described above, precipitation offsets evaporation in winter months, so the net effect is that wintertime precipitation deficit is usually zero.

Total mm/year = 990.66

[(mm/yr) ÷ (convert to feet)] X (Surface area of pond, in acres) = Evaporation Loss in Acre Feet

$$(990.66 \div 304.8) \times 6.30 = 20.5 \text{ AFA}$$

Seepage Loss Calculations

This spreadsheet has been designed by Idaho Department of Water Resources to estimate the total annual seepage losses from a pond.

FILE NUMBER	61-7712 On_Stream/Pond
REVIEWER	Joe Agent
DATE	1/1/2000

User Input
Calculated value
Formula Explanations

INPUTS

Pond Surface Area (AC.)	6.3	AC.
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Pond Surface Area (SQ. FT.)	274428	SQ. FT.
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I used the following method to obtain my Soil Classification information:	NRCS Web Soil Survey	
My Soil Classification is	ML	
Suggested Seepage Rate (FT./DAY)	0.0200	FT./DAY

Formula: (Surface Area X Seepage Rate) X 7.48 = Gallons Per Day Loss
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Convert to GPD	41054	GPD
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Total Seepage Loss (AFA)	46.0	AFA
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Though sand and gravel seepage rates may actually be higher, the maximum allowable rate is 0.2 ft/day, pursuant to Administrative Memo "Seepage Loss Standards for Ponds and Reservoirs."

Suggested Seepage Rates for Different Soil Types:
GW, GP, GM, GC, SW, SP and SM (silty sand, sand silt mixtures and gravel mixtures) = 0.2 ft per day
OL and ML (inorganic silts - very fine sands, silty, or clayey fine sands) = 0.02 ft per day
SC (clayey sands, sand clay mixtures) = 0.007 ft per day
CL (Low to medium plasticity clays) = 0.003 ft per day
MH, OH, PT and CH (high plasticity clays) = 0.0003 ft per day
LINED PONDS (liners can be chemical, fabric, or bentonite) = 0 ft per day
Ponds Intercepting Groundwater (excavated ponds filled by ground water) = 0 ft per day
PLEASE NOTE: The initial basis for the Suggested Seepage Rates in the table above is found on Page 16 of Seepage from Fish Ponds, Bulletin 599, August 1989 Alabama Agricultural experiment Station, Auburn University, Auburn University Alabama. If you don't know the soil type, please refer to the map provided at the NRCS Web Soil Survey (Tab #1), an ArcMap Soil Classification Map (Tab #1.1), or published NRCS Soil Survey (Tab #1.2). Use "0" if the pond fill relies on the water table.

PLEASE NOTE: We typically don't include seepage losses for onstream ponds, but in this case, the area of the pond is much larger than the stream. With the large foot print of the pond, a majority of the pond is outside the stream channel, so seepage losses must be accounted for in this circumstance.



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ETIdaho 2017

Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho

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Glenns Ferry (NWS -- USC00103631)

Statistics based on thirty year normal spans 1973 to 2006 years

For a different land cover or crop click on the above link.

You can highlight this table and copy via the clipboard to a Microsoft Excel or OpenOffice spreadsheet to plot or otherwise work with this data.

Open water - small stock ponds															
Precipitation Deficit (Click here for a graph)															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Growing Season ^a	Non Growing Season ^b	Annual
Mean ^j	mm/day												mm		
Monthly ^c	-0.61	0.36	1.63	3.39	4.32	5.49	6.15	5.21	3.64	2.07	0.14	-0.60	952	0	952
15-Day Moving Average ^d	-0.69	0.15	1.64	3.41	4.24	5.50	6.22	5.16	3.58	2.11	0.11	-0.40			
7-Day Moving Average ^e	-0.66	0.26	1.63	3.40	4.27	5.51	6.21	5.19	3.59	2.07	0.08	-0.52			
3-Day Moving Average ^f	-0.62	0.33	1.62	3.41	4.31	5.49	6.16	5.21	3.63	2.06	0.13	-0.59			

Total Storage Calculations

FILE NUMBER	61-7712 RES/Pond
REVIEWER	Joe Agent
DATE	1/1/2000

This spreadsheet has been designed by Idaho Department of Water Resources to estimate the total seepage, evaporation and fill capacity required for a pond.

User Input
Calculated value
Formula Explanations

Surface Area (AC.)	1.3	"Surface Area" is automatically carried over from the "Seepage Loss" sheet.
Average Pond Depth (FT.)	4	"Average Pond Depth" depicts the actual depth of the pond either measured or estimated. Note: If you know the maximum depth and not the average depth, the Field Examiner's Handbook suggests multiplying the maximum depth by 0.4 to get the average depth, or you can use any method that seems reasonable to attain average depth.
Pond Capacity (AF)	5.2	Pond Capacity is calculated by multiplying the Pond Surface Area by the Average Pond Depth. If you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above. Note: If pond capacity is determined using a method shown on the "Pond Capacity" sheet, the user may need to modify the value of "Pond Capacity" (cell B9) manually. Note that if the value is modified manually, the formula will be altered for future use.
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Estimated Seepage Loss (AF)	9.5	The "Estimated Seepage Loss" is automatically carried over from the "Seepage Loss" sheet.
Estimated Evaporation Loss (AF)	4.2	The "Estimated Evaporation Loss" is automatically carried over from the "Evaporation Loss" sheet.
Total Volume Required (AF)	18.9	The "Total Volume Required" is calculated by adding the Pond Capacity, Multiple Fills, Seepage Loss, and Evaporation Loss amounts to determine the total amount of storage required.

Evaporation Loss Calculations

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FILE NUMBER	61-7712 RES/Pd
REVIEWER	Joe Agent
DATE	1/1/2000

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Calculated value
Formula Explanations

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December	-0.60	31	0.00

Total mm/year = 990.66

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For example, see Sandpoint KSPT (NWS -- 108137), the annual precipitation deficit is -106 mm. However, April through September have positive precipitation deficit values. To properly estimate the annual volume of water necessary to refill a pond due to evaporation losses, the table will automatically enter a zero (0) for each month that the precipitation value is reported as a negative value.

As described above, precipitation offsets evaporation in winter months, so the net effect is that wintertime precipitation deficit is usually zero.

$[(\text{mm/yr}) \div (\text{convert to feet})] \times (\text{Surface area of pond, in acres}) = \text{Evaporation Loss in Acre Feet}$

$$\left(\frac{990.66}{304.8} \right) \times 1.30 = 4.2 \text{ AFA}$$

Seepage Loss Calculations

This spreadsheet has been designed by Idaho Department of Water Resources to estimate the total annual seepage losses from a pond.

FILE NUMBER	61-7712 RES/Pond
REVIEWER	Joe Agent
DATE	1/1/2000

User Input
Calculated value
Formula Explanations

INPUTS

Pond Surface Area (AC.)	1.3	AC.
-------------------------	-----	-----

Pond Surface Area (SQ. FT.)	56628	SQ. FT.
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I used the following method to obtain my Soil Classification information:	NRCS Web Soil Survey	
My Soil Classification is	ML	
Suggested Seepage Rate (FT./DAY)	0.0200	FT./DAY

Formula: (Surface Area X Seepage Rate) X 7.48 = Gallons Per Day Loss
--

Convert to GPD	8472	GPD
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Total Seepage Loss (AFA)	9.5	AFA
--------------------------	-----	-----

Though sand and gravel seepage rates may actually be higher, the maximum allowable rate is 0.2 ft/day, pursuant to Administrative Memo "Seepage Loss Standards for Ponds and Reservoirs."

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MH, OH, PT and CH (high plasticity clays) = 0.0003 ft per day
LINED PONDS (liners can be chemical, fabric, or bentonite) = 0 ft per day
Ponds Intercepting Groundwater (excavated ponds filled by ground water) = 0 ft per day

PLEASE NOTE: The initial basis for the Suggested Seepage Rates in the table above is found on Page 16 of Seepage from Fish Ponds, Bulletin 599, August 1989 Alabama Agricultural experiment Station, Auburn University, Auburn University Alabama. If you don't know the soil type, please refer to the map provided at the NRCS Web Soil Survey (Tab #1), an ArcMap Soil Classification Map (Tab #1.1), or published NRCS Soil Survey (Tab #1.2). Use "0" if the pond fill relies on the water table.



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Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho

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7-Day Moving Average ^e	-0.66	0.26	1.63	3.40	4.27	5.51	6.21	5.19	3.59	2.07	0.08	-0.52			
3-Day Moving Average ^f	-0.62	0.33	1.62	3.41	4.31	5.49	6.16	5.21	3.63	2.06	0.13	-0.59			

PHOTOGRAPHER AND DATE OF PHOTOS Dan Nelson 5/26/2021

FILE NUMBER 61-7712

The photos below show the pump and the pumping station at Point of diversion A.



The photo on the left below shows the point where water from the hot tub flows back into the On-Stream Pond, and the pipeline flowing out of the pond at Point of Diversion B. Unfortunately, there isn't a specific location for the pump at PDB, and we didn't get a photo of this pumping system. The photo on the right shows the spillway of the dam and the pipeline from well going across it.



The photo below left is looking down at the On-Stream pond area from the dam spillway. The photo on the right shows the well.



PHOTOGRAPHER AND DATE OF PHOTOS Dan Nelson 5/26/2021

FILE NUMBER 61-7712



The photos below show the Reserve Pond. The first photo shows the outflow pipeline.



PHOTOGRAPHER AND DATE OF PHOTOS Dan Nelson 5/26/2021

FILE NUMBER 61-7712

These photos are of the 12 acre field on the east side of Bennett Creek.



The photos below are of the 35 acre field on the west side of Bennett Creek.



The photo below shows the hot tub.

