

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 63-12305

Exam Date: 8/16/2013

1. Current Owner: MOON LAKE RANCH
C/O JAN ROSE AND JEFF WREEDE
PO BOX 810
STAR ID 83669
(208)286-9666
2. Accompanied by: Jeff Wreeede
Phone No: 860-7234
Address: 653 S Moon Beam Way, Eagle, ID 83616
Relationship to Permit Holder: Homeowner Association Member

3. **SOURCE**

BOISE RIVER

GROUND WATER

WASTE WATER

TRIBUTARY

SNAKE RIVER

SINKS

B. OVERLAP REVIEW

1. Other water rights with the same place of use: 63-22897, 63-183, 63-1, 63-4960, 63-124N, 63-126E, 63-161X, 63-168D, 63-173, 63-370, 63-168B, 63-254, 63-255, 63-125G, and 63-198AC
2. Other water rights with the same point of diversion: 63-22897, 63-183, 63-1, 63-4960, 63-124N, 63-126E, 63-161X, 63-168D, 63-173, 63-370, 63-168B, 63-254, 63-255, 63-125G, and 63-198AC

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

BOISE RIVER	L2 NW1/4NE1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
BOISE RIVER	L1 NE1/4NE1/4	Sec. 13,	Twp 04N,	Rge 01W, B.M.	ADA County
WASTE WATER	L3 NE1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	L4 SE1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	L4 SE1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	L4 SE1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	NW1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	SW1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	L5 NW1/4SW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County
GROUND WATER	L4 SE1/4NW1/4	Sec. 14,	Twp 04N,	Rge 01W, B.M.	ADA County

Method of Determination: Visual Inspection and GPS

2.

PLACE OF USE: IRRIGATION FROM STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>Totals</u>
04N 01W 14					3.0	15.0	16.0	12.0	4.0								50.0
					L 3			L 4	L 5								

Total Acres: 50

PLACE OF USE: AESTHETIC, AESTHETIC STORAGE, AND IRRIGATION STORAGE

Twp Rge Sec	NE				NW				SW				SE				
	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>Totals</u>
04N 01W 14					X	X	X	X	X								
					L 3			L 4	L 5								

DIVERSION TO STORAGE same as **AESTHETIC**

Method of Determination: GIS and Visual Inspection

3. YES Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
- YES Aerial Photo Attached (required for irrigation of 10+ acres).
- YES Photo of Diversion and System Attached

4.

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
Artesian Well #2	None	N/A	N/A	N/A	4" line
Artesian Well #3	None	N/A	N/A	N/A	4" line
Waste Water	None	N/A	N/A	N/A	12" line
Pioneer Canal Diversion	None	N/A	N/A	N/A	Canal
Middle Mill Ditch Diversion and Middleton Irrigation Company Diversion	None	N/A	N/A	N/A	Canal

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

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
Owner's wastewater Meter		Data industrial	Model 2100	Unknown	unknown	UNKNOWN
IDWR's Meter	Polysonic	Fuji	Portflow X	240333	N/A	3/20/2012
Canal Company Records	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Owner's Orifice Plates	Circular	Custom	N/A	N/A	2.25	N/A
Owner's Orifice Plates	Circular	Custom	N/A	N/A	1.5	N/A

2. Measurements: I used the owner's flow meter for the wastewater diversion, since I didn't have equipment that could accurately measure effluent. I used the Canal Company records to determine the flow rate of the canal water. I didn't visit the sites for each point of diversion for the canals. I used the Fuji flow meter to check against the measurements made from the two wells using the orifice plates. Both measurement methods matched reasonably close.

E. FLOW CALCULATIONS X Additional Computation Sheets Attached

Measured Method:

Please See Attached Sheet for measurement calculations.

Calculated maximum flow rate = 2.34 cfs

Permit Allowed = 1.85 cfs

I recommend the Following:

DIVERSION TO STORAGE	11/16 to 03/14	0.490 CFS
DIVERSION TO STORAGE	03/15 to 11/15	1.850 CFS
AESTHETIC	11/16 to 03/14	0.490 CFS
AESTHETIC	03/15 to 11/15	0.850 CFS

F. VOLUME CALCULATIONS**1. Volume Calculations for Irrigation:**

$$V = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = \underline{\hspace{2cm}}$$

I.R.

$$V = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 = \underline{\hspace{2cm}}$$

D.R.

$$V = \text{Smaller of } V \text{ and } V = \underline{\hspace{2cm}}$$

I.R. D.R.

2. Volume Calculations for Other Uses:

Please see the attached analysis for the volume requirements.

I have recommended the following:

IRRIGATION STORAGE	130.8 AF
AESTHETIC STORAGE	130.8 AF
IRRIGATION FROM STORAGE	130.8 AF
TOTAL STORAGE =	130.8 AF

AESTHETIC	11/16 to 03/14	194.5 AF
AESTHETIC	03/15 to 11/15	194.5 AF
TOTAL AESTHETIC USE =		194.5 AF

G. NARRATIVE/REMARKS/COMMENTS

The main water supply for this system comes from the Pioneer Canal. The water in the Pioneer canal comes from shares from the Pioneer Ditch Company whose point of diversion is located in Lot 2 (NWNE) of Section 14, Township 4 North, Range 1 West, and the Middle Mill Ditch Company and Middleton Irrigation Association whose point of diversion is located in Lot 1 (NENE) of Section 13, Township 4 North, Range 1 West. The water is diverted from the canal using the subdivision's canal shares into Pond #2. All of the ponds are interconnected, so the water level is maintained in all 5 ponds.

The diversion from the canal flows through a pipeline to the canal. The sewage effluent water from the subdivision is all run into the Sewage Treatment and Irrigation Building. The water is treated and sent to an underground sump. The water from the sump also flows into Pond #2. A line from Pond #2 flows into a cement box in the west end of the Sewage Treatment and Irrigation Building. The water in this box is pumped into the buried irrigation system by 3 pumps depending on need. There is a 3 Hp, 7.5 Hp and 15 Hp pump diverting water into the irrigation system. Any or all of the three pumps can be used to irrigate this area depending on need. All of the ponds are constructed below the water table, so each pond fills naturally. Therefore, each pond has its own ground water point of diversion. There are two wells that supply water to the ponds. These wells are artesian wells, and provide very little water into the system. These wells are only to be used as a supplemental water system for the irrigation use.

The point of diversion described in the permit for Pioneer Ditch Company was taken directly off of the water rights for Pioneer Ditch Company. Since the permit was applied for and approved, the Department has attained better mapping capabilities. The point of diversion for Pioneer Ditch Company is actually in the Lot 2, (NWNE $\frac{1}{4}$ $\frac{1}{4}$) of Section 14, Township 4 North, Range 1 West instead of Lot 3 (NENW $\frac{1}{4}$ $\frac{1}{4}$) of Section 14 as described in the Pioneer Ditch Company water rights. We cannot correct the Pioneer Ditch Company water rights without the company filing a water right transfer, but we will correct the legal descriptions in this permit with the licensing amendment.

I tried to match conditions from the original permit with standard conditions as much as possible. Many of the conditions were specialized conditions, so they were impossible to match. However, there were several of the conditions that have become standard conditions, and I use the standard language for these conditions. One of the conditions limited diversion of ground water to only the irrigation season. This makes sense for the ground water wells, but it doesn't make sense for the shallow ground water being intercepted by the ponds. Therefore, I re-worded this condition to say ground water wells, instead of just ground water.

Have conditions of permit approval been met? X Yes No

H. RECOMMENDATIONS

1. Recommended Amounts

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>DIVERSION RATE</u>	<u>ANNUAL VOLUME</u>
IRRIGATION STORAGE	03/15 to 11/15		130.80 AF
AESTHETIC STORAGE	01/01 to 12/31		130.80 AF
IRRIGATION FROM STORAGE	03/15 to 11/15		130.80 AF
DIVERSION TO STORAGE	11/16 to 03/14	0.490 CFS	
DIVERSION TO STORAGE	03/15 to 11/15	1.850 CFS	
AESTHETIC	11/16 to 03/14	0.490 CFS	194.50 AF
AESTHETIC	03/15 to 11/15	0.850 CFS	194.50 AF
<u>Totals:</u>		1.850 CFS	325.30 AF

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 ☒ Other

I. AUTHENTICATION Daniel A. Nelson – Staff Hydrologist

Field Examiner's Name Daniel A. Nelson Date 4-21-2014

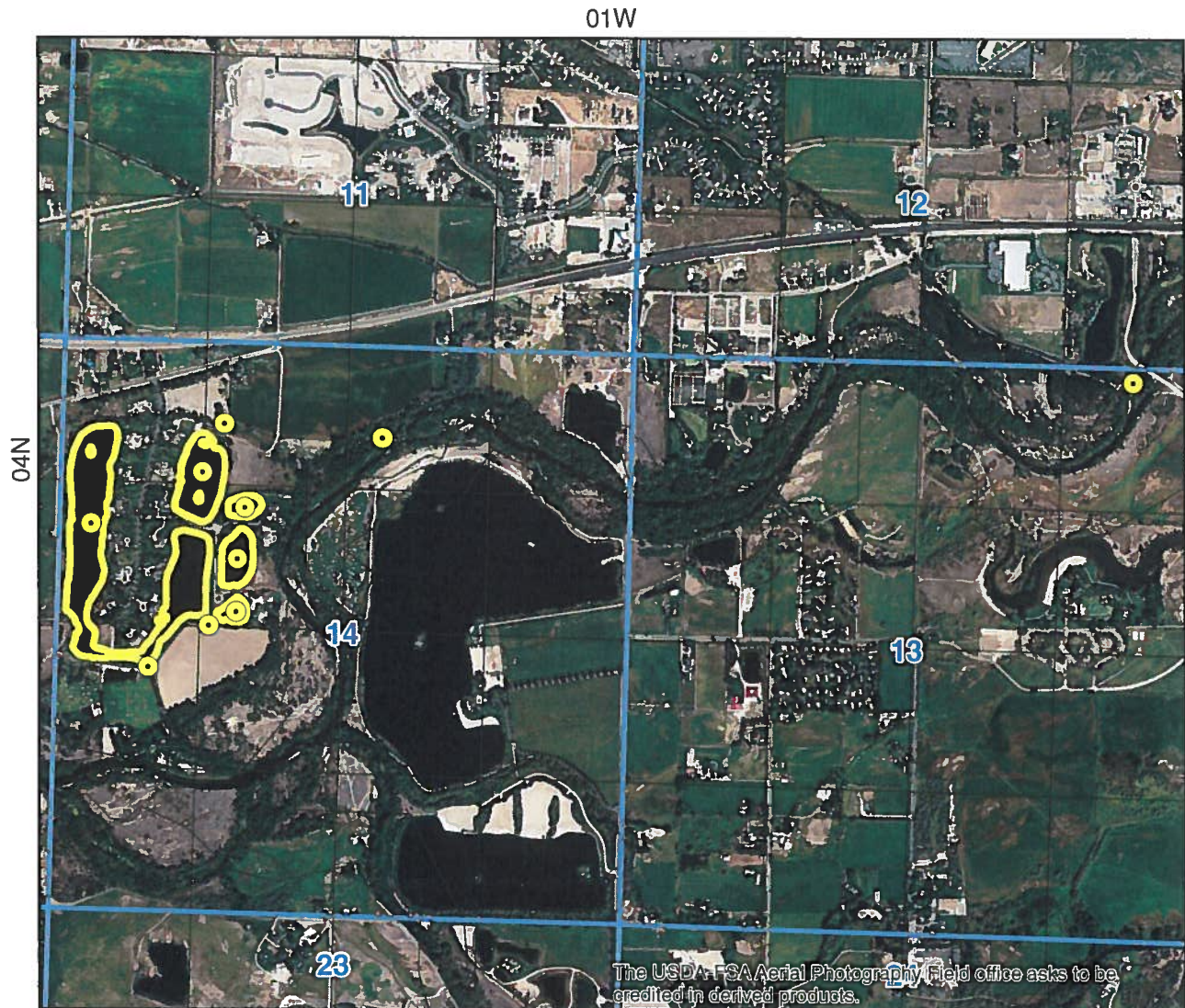
Reviewer _____ Date _____

State of Idaho
Department of Water Resources

Field Exam

63-12305

This map depicts the AESTHETIC, AESTHETIC STORAGE, AND IRRIGATION STORAGE place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.



- Point of Diversion
- Place Of Use Boundary
- Townships
- PLS Sections
- Quarter Quarters

0 0.2 0.4 0.8 Miles

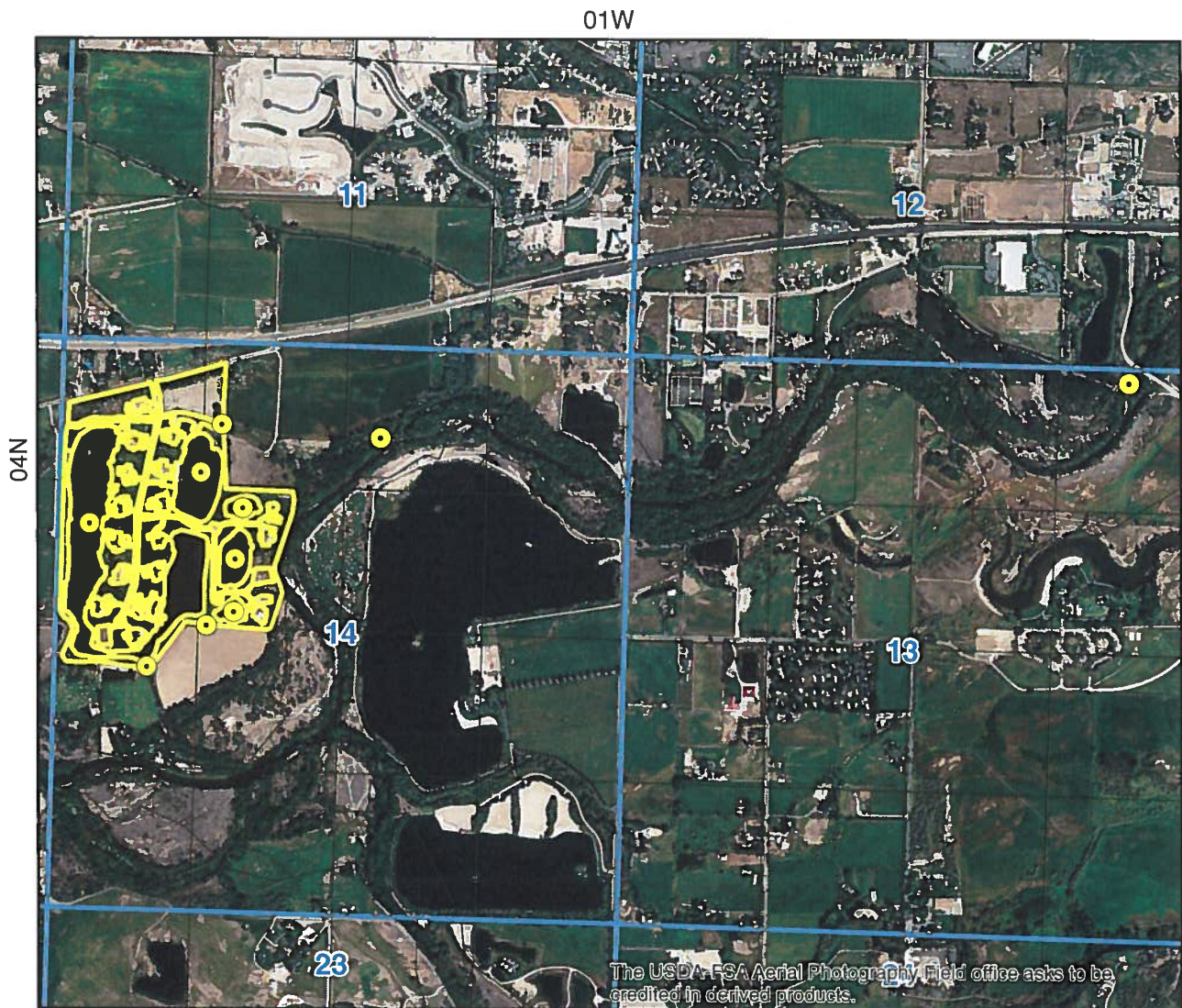


State of Idaho
Department of Water Resources

Field Exam

63-12305

This map depicts the IRRIGATION FROM STORAGE place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.



-  Point of Diversion
-  Place Of Use Boundary
-  Townships
-  PLS Sections
-  Quarter Quarters

0 0.2 0.4 0.8 Miles

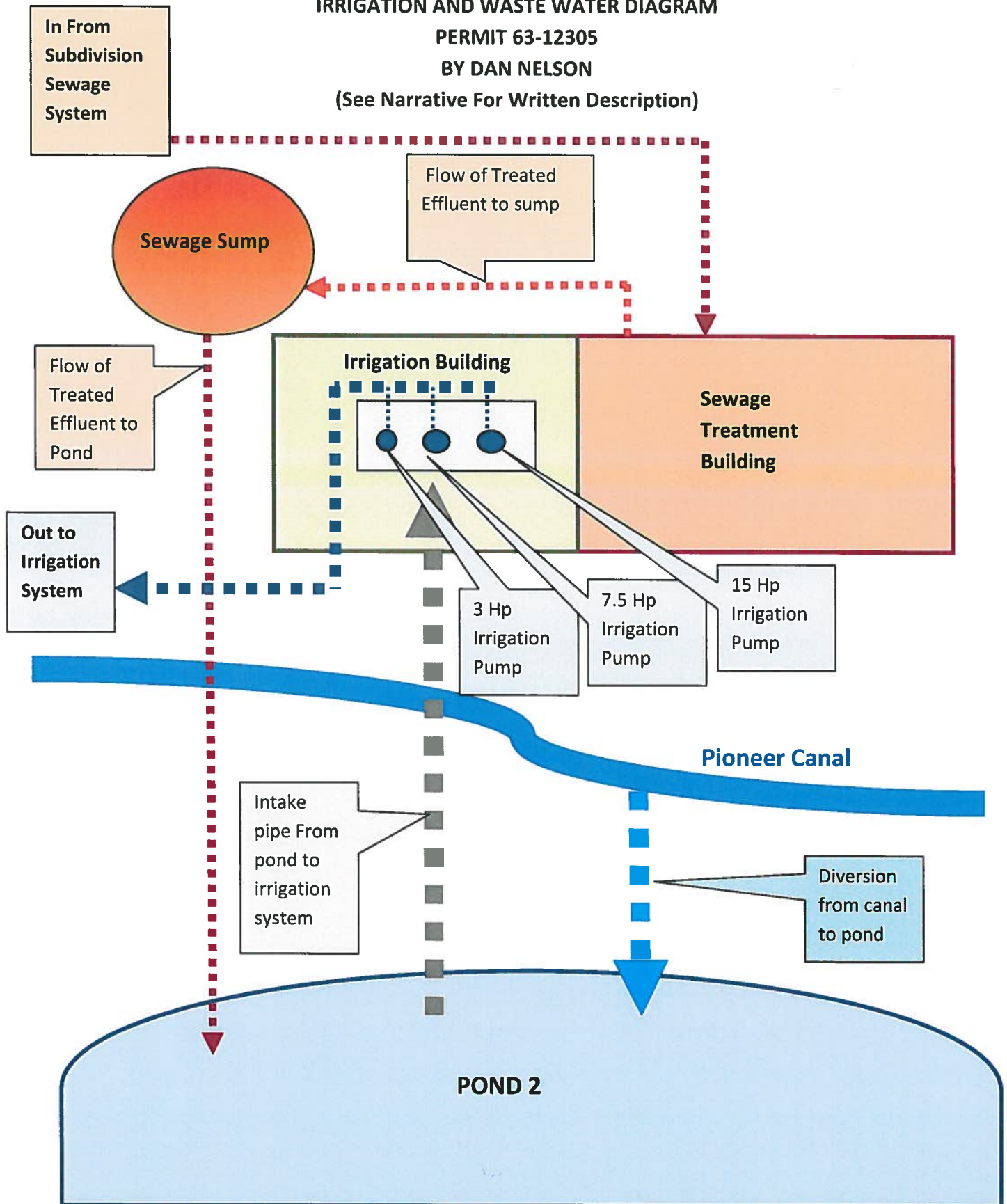


IRRIGATION AND WASTE WATER DIAGRAM

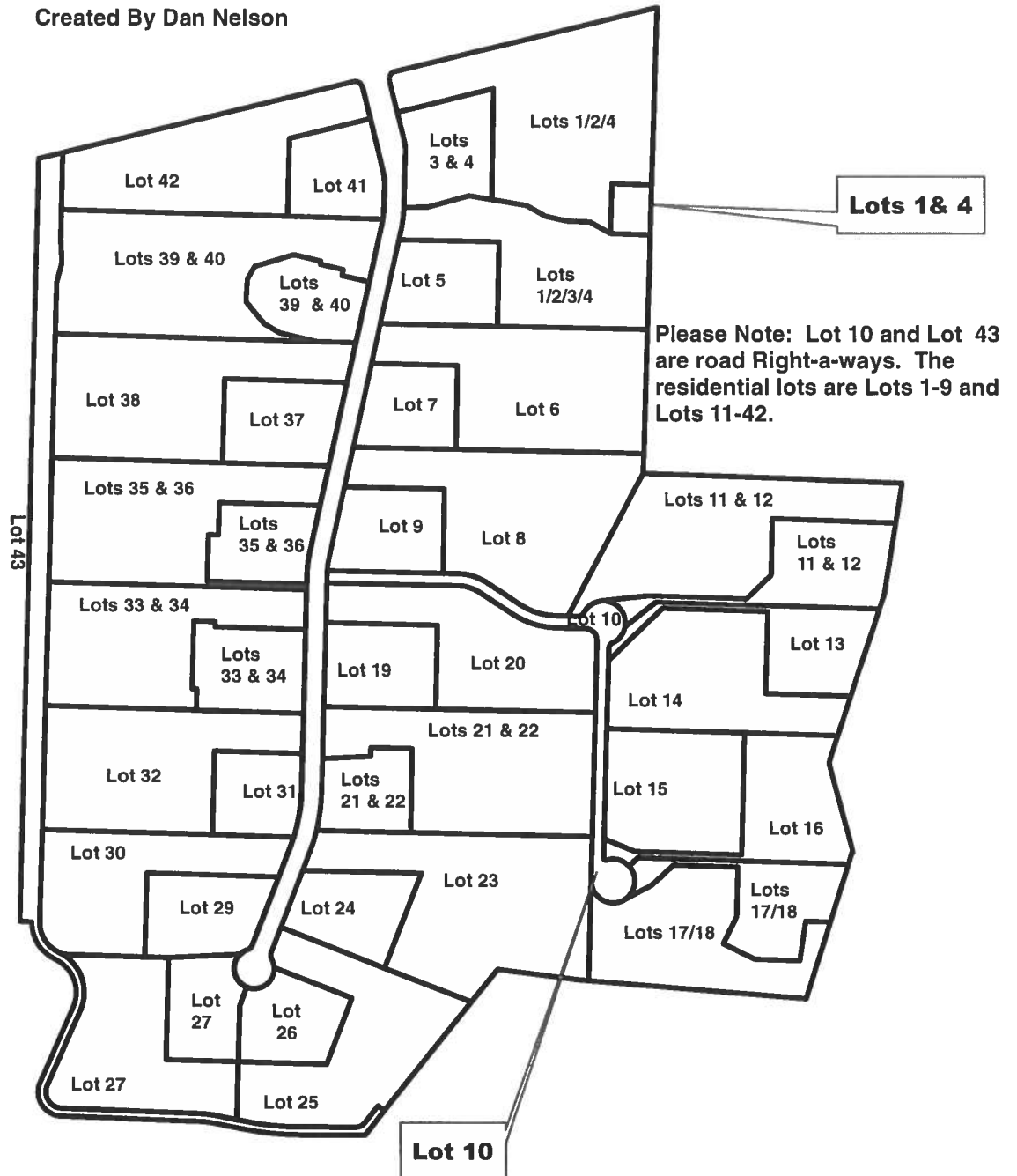
PERMIT 63-12305

BY DAN NELSON

(See Narrative For Written Description)



Tax Lot Map
Permit 63-12305
Created By Dan Nelson



Flow Measurements Made
Permit 63-12305
By Dan Nelson

Attaining flow measurements for this system took some doing and I did not perform all of the measurements. I am not totally confident on some of the measurements, but there are others that I feel are reasonable. I will discuss each measurement below by their source:

Boise River/Canal Company:

The water diverted from the Boise River is delivered through the existing canal system for the Middle Mill Ditch Company, Middleton Irrigation Association, and Pioneer Ditch Company. There are two points of diversion from the Boise River for these three companies. This permit limits the amount of water that is delivered to place of use to shares owned by the subdivision in these three companies. Basically the irrigation water and the Boise River water under this permit is the same water. I was not able to measure the actual water being delivered to the property, and the three companies were not able to provide records of their water delivery. Therefore, I can only assume that the full amount allowed under the shares of 91.75 shares is the amount delivered. The shares are limited to an inch or 0.02 cfs per share for a total of 1.835 cfs.

Wastewater:

The wastewater for this permit is the treated effluent from the subdivision's sewage treatment facility. At the time of the field exam, the facility was treating 220.319 gpm of effluent or 0.49 cfs of effluent water. This amount varies a great deal throughout the day. We were in the facility in the morning hours, when the flows would be the highest. The flows at night would be next to nothing and the high flows would only be for a few hours in the morning. There is a large storage tank/cistern used to treat the water that evens out the average flow of wastewater into the pond. Therefore, it is difficult to tell that actual rate of water being diverted to the ponds. The maximum that could be diverted is the 0.49 cfs, so that is a reasonable estimate of the flow rate of wastewater to the ponds.

The permit states that waste water will be diverted to the pond at a rate of 5 gpm. At 5 gpm, the total daily diversion would be 7200 gpd ($5\text{ gpm} \times 60\text{ minutes} \times 24\text{ Hours} = 7200\text{ gpd}$). At a maximum diversion rate of 220 gpm, the waste water could be totally delivered within 33 minutes ($7200\text{ gallons} / 220\text{ gpm} = 32.7\text{ minutes}$). The system wasn't designed to deliver more than the 7200 gpd, but it also wasn't designed to treat water at an average flow of 5 gpm all day long. Therefore, I feel the 220 gpm is a reasonable rate for the maximum capacity of this system, even though it rarely meets this rate of diversion for a minimum amount of time per day. A test of the system done in August of 2006 showed an average daily flow of water through the treatment plant of 2,227 gallons with a range of 1,827 to 3,690 gallons per day with a peak of 6,026 gpd. The limit of 5 gpm was just an average flow, so we should consider the amount that was actually measured of 0.49 cfs or the maximum flow.

Ground Water:

The ponds intercept shallow ground water, so it is impossible to determine the flow rate of the ground water into the ponds from the water table. The flow rate from ground water through the ponds would be limited by the rate of evaporation when irrigation or wastewater is not being diverted into the ponds.

However, there are two wells (Well #3 and Well #2) that do divert into the ponds. There were originally 4 wells that could have diverted into the ponds, but 2 of the wells were decommissioned by the owners. The owner's installed orifice plates on the wells, and I did use the Department's Fuji Flow Meter to calibrate the orifice plates. We ended up with readings between the flow meter and the orifice plates that matched. The owner used two orifice plates, one for each well. He attempted to use the same coefficient for each plate, but the orifice plates were different sizes and were used on the same size pipe. Therefore, the coefficient needed to be adjusted to have it match design of the two systems.

Well #3 was measured through the orifice plate at 52.9 gpm and the Fuji flow meter at 53 gpm. The Fuji flow meter stayed very consistent during the measurement. There was hardly any variation in flows. I neglected to take a long term (10 minute) reading on this well, since we were specifically attempting to compare our meter with the orifice plate. The measurements did match up on this well exactly with the orifice plate used. This orifice plate was the larger of the two orifice plates, so it was properly sized for the pipe being used. No adjustments to the owner's spreadsheet for these measurements were needed.

Well #2 was measured through the orifice plate at 37 gpm and the Fuji flow meter at 38 gpm after the coefficient for the orifice plate was adjusted. The Fuji flow meter stayed very consistent during the measurement. There was hardly any variation in flows. I neglected to take a long term (10 minute) reading on this well, since we were specifically attempting to compare our meter with the orifice plate. This orifice plate was the smaller of the two orifice plates, so it was not sized correctly for the pipe being used. Adjustments to the coefficient in the owner's spreadsheet was needed to attain the proper flow rate for this orifice plate. After checking two different flow ranges, the spreadsheet match the Fuji flow meter.

The wells produced a total of 91 gpm or 0.20 cfs (53 gpm Well #3 + 38 gpm Well #2 = 91 gpm). The wells for this permit are only allowed to supply supplemental irrigation water for this permit. Therefore, they are only allowed to operate when the canal water is not being delivered. Since these wells produce less than the canal shares, they do not any water to the total rate of diversion.

Conclusion:

The diversion rate of this permit is limited to the rate of the waste water and the rate of the canal shares entering the ponds. The permit allowed a maximum diversion rate of 1.85 cfs. The maximum that can be diverted into the pond is 2.34 cfs (1.853 cfs canal water + 0.49 cfs waste water = 2.343 gpm). The wells and the waste water supply a total of 0.69 cfs (0.49 cfs waste water + 0.20 cfs well water = 0.69 cfs). Since the wells can only be operated during the irrigation season when the canal water is not available then the maximum total rate of diversion that is used in 2.34 cfs. The permit would limit the diversion to storage and the total diversion rate to 1.85 cfs. This seems reasonable, since the waste water is so sporadic in the rate of water is can supply to the system.

The diversion to storage rate of 1.85 cfs should only be allowed during the irrigation season of 3/15 to 11/15. During the non-irrigation season, the only water being diverted to the ponds is the 0.49 cfs. Therefore, from 11/16 to 3/14 the diversion to storage rate should be limited to 0.49 cfs or the maximum flow from the wastewater system.

The aesthetic use for this water right was included to cover the evaporation and seepage losses for this permit. The permit calculated the aesthetic flows by adding all of the rates together and subtracting the losses from the ponds. The permit holder called these losses seepage losses. However, by intercepting the shallow ground water table the seepage flows would non-existent, and the only losses would be the irrigation losses. I determined that there was approximately 50 acres of ground being irrigated. At a diversion rate of 0.02 cfs per acre, the maximum rate of irrigation would be 1.00 cfs. This would leave approximately 0.85 cfs of the total allowable diversion rate to cover the evaporation losses of the pond during the irrigation season.

The highest 3-Day moving average for daily precipitation deficit from the ET site is 6.75 mm. When calculated into the size of the 5 ponds, this is equal to 0.7 acre feet of water $[(6.75 \text{ mm} / 304.8 \text{ conversion to feet}) \times 32.7 \text{ all 5 ponds total surface area} = 0.7 \text{ af}]$. The average rate of diversion required to replace the 0.7 af of water per day would be 0.35 cfs during the most extreme part of the year $(0.7 \text{ af} / 1.0835 = 0.3529 \text{ cfs})$. The total evaporation loss for these ponds is 71.3 af. The aesthetic use diversion rate and the diversion to storage diversion rate for the Boise River/Canal Company water is only allowed during the irrigation seasons, so the only water that can be diverted during the non-irrigation season is the wastewater or 0.49 cfs. Both diversion rates exceed the maximum diversion rate required to cover the evaporation from the pond, so there shouldn't be an issue with limiting the diversion to storage or the aesthetic storage rates.

Therefore, I am recommending that the difference between the land being irrigated and the maximum rate allowed by the permit be considered as the aesthetic flow for the permit during the irrigation season of 0.85 cfs from 3/15 to 11/15. During the non-irrigation season, the only flow into the ponds is from the waste water and the influence from the water table. The evaporation rate during the non-irrigation season is almost non-existent, so the waste water diversion would be more than adequate to cover the flow rate. Therefore the aesthetic flows during the non-irrigation season from 11/16 to 3/14 would be limited to 0.49 cfs. The diversion to storage diversion rates will be limited to 1.85 cfs during the irrigation season from 3/15 to 11/15 and 0.49 cfs from 11/16 to 3/14 during the non irrigation season.

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM



U.S. Environmental
Protection Agency



NSF International

ETV Joint Verification Statement

TECHNOLOGY TYPE:	DECENTRALIZED WASTEWATER TREATMENT – BIOLOGICAL, SAND FILTRATION, AND ULTRAVIOLET TREATMENT	
APPLICATION:	DOMESTIC WASTEWATER TREATMENT FOR A RESIDENTIAL DEVELOPMENT	
TECHNOLOGY NAME:	MODEL 6000 SEQUENCING BATCH REACTOR SYSTEM	
COMPANY:	INTERNATIONAL WASTEWATER SYSTEMS	
ADDRESS:	2020 Charlotte Street BOZEMAN, MT 59718	PHONE: (406) 582 1115 FAX: (406) 582 1116
EMAIL:	claudes1985@yahoo.com	

NSF International (NSF) operates the Water Quality Protection Center (WQPC) under the U.S. Environmental Protection Agency's (EPA) Environmental Technology Verification (ETV) Program. The WQPC evaluated the performance of a sequencing batch reactor biological treatment system, with media filtration and ultraviolet disinfection, for treatment of residential wastewater in a decentralized application. This verification statement provides a summary of the test results for the International Wastewater Systems Model 6000 Sequencing Batch Reactor (SBR) System. The Eagle Sewer District acted as the Testing Organization (TO) for the verification testing, which was performed near Boise, Idaho.

EPA created the ETV Program to facilitate deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV program is to further environmental protection by accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer reviewed data on technology performance to those involved in the design, distribution, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations; stakeholder groups consisting of buyers, vendor organizations, and permittees; and the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and verifiable quality are generated, and that the results are defensible.

TECHNOLOGY DESCRIPTION

The following technology description is provided by the vendor and does not represent verified information.

The International Wastewater Systems' (IWS) Model 6000 SBR includes a 6,000 gallon (gal) equalization tank, a 6,000 gal modified SBR, a 3,000 gal holding tank, a coagulation injection system, a gravity sand filtration system, and an ultraviolet (UV) disinfection system. The IWS SBR is designed to provide treatment by optimizing the treatment conditions using a computer controlled and monitored system of pumps, floats, and probes to measure, monitor, and adjust the treatment parameters within the unit. The computer control system uses a programmable logic controller (PLC) and a software program, written by IWS, for the master control of the SBR and for communication outside the facility by modem and phone line installed with the unit.

Residential wastewater is discharged to an equalization tank and is pumped to the SBR for aerobic/anoxic biological treatment. In the treatment process, the wastewater/biological solids mixture (mixed liquor) is alternately mixed with, then deprived of, oxygen and is then periodically pumped to the clarification chamber, where quiescent conditions allow the solids to settle. A pump transfers the settled solids back to the aeration chamber and clarified effluent is pumped to the 3,000 gal holding tank. A portion of the mixed liquor is periodically wasted to a sludge holding tank to maintain optimal operating conditions in the treatment process.

A high-level switch in the effluent holding tank starts the coagulation-filtration system by injecting a coagulant, poly aluminum chloride (PAC) or aluminum sulfate (alum), ahead of a sand filter. The sand filter is a Centra-Flow dynamic sand bed filter that provides for continuous sand cleaning by using an airlift pump to extract the sand and solids from the filter, and lifting the mixture to a separation box. Cleaned sand is returned to the top of the filter and waste solids are piped to the equalization tank. A turbidity meter, used with an electronically actuated valve, monitors the effectiveness of the sand filter and reroutes the filtrate to the 3,000 gal holding tank for further treatment if the turbidity exceeds 5 Nephelometric Turbidity Unit(s) (NTU). Filtered water flows by gravity to the disinfection process.

The disinfection system consists of two UV disinfection units operating in parallel, with electronically actuated solenoid valves for each unit to prevent untreated water from reaching the post equalization tank. Each unit is designed to handle 20 gpm and achieve total coliform levels of <2.2 MPN/100 mL for water having suspended solids <10 mg/L and turbidity of <5 NTU.

IWS expects the system to require operator attention on a two to three visits per week basis, with additional time needed if special maintenance activities are required.

VERIFICATION TESTING DESCRIPTION

This verification was completed following the procedures described in the Verification Test Plan, which was prepared in accordance with the *Protocol for Verification of Wastewater Treatment Technologies*, dated April 2001.

Test Site

The verification test was performed at the Moon Lake Ranch Subdivision, located a few miles west of Boise, Idaho, which consists of 18 homes in an area not served by a centralized wastewater collection system. Each home has a holding tank and grinder pump system that is connected to a force main that delivers wastewater to the IWS Model 6000 SBR. The system, owned by the Moon Lake Ranch Homeowners Association, discharges treated effluent to a lake on the subdivision property and is permitted by the State of Idaho for surface water discharge.

Methods and Procedures

The system startup evaluation was made by shutting down one SBR and keeping the second unit on line while the out-of-service SBR was cleaned and prepared for startup. The startup time and conditions were documented. The verification test included sixteen sampling and analysis events over the one-year test period, and included monthly four-day sampling events, and one special four-day sampling event each season of the year. Sampling locations included the untreated wastewater, treated effluent from the SBR, and final effluent from the system after filtration

and UV disinfection. Flow-weighted composite and grab samples were collected during sampling events, depending on the requirements and holding time for each analysis. Grab samples were collected each sample day for pH, temperature, turbidity, and total coliform. The samples for total coliform were collected and placed directly into sterile bottles provided by the laboratory. Flow-weighted, 24-hr composite samples were collected each sampling day for total suspended solids (TSS), five-day biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), and alkalinity. Four-day composite samples were collected for total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH₃-N), nitrite plus nitrate (NO₂+NO₃-N), and total and soluble phosphorus (TP and SP, respectively) by taking an aliquot of each 24-hr composite sample and combining them to make the 96-hr composite. All of the 96-hr composites were prepared in the laboratory to ensure proper preservation and cooling was maintained.

When the sludge holding tank was nearly full, arrangements were made to have the sludge removed by a licensed hauler. The volume of sludge pumped from the tank was recorded each time the tank was emptied and a sample of the sludge was taken for analysis of percent solids and metals (As, Ba, Cd, Cr, Hg, Pb, Ni, Zn).

All analyses were completed in accordance with EPA approved methods or *Standard Methods for the Examination of Waster and Wastewater*, 20th Edition. An established quality assurance/quality control (QA/QC) program was used to monitor sampling and laboratory procedures. Details on all analytical methods and QA/QC procedures are provided in the full verification report.

PERFORMANCE VERIFICATION

Overview

Evaluation of the IWS Model 6000 SBR began in April 2004 when one SBR was taken off line and cleaned. The verification testing started July 1, 2004 and proceeded without interruption through June 30, 2005. All sixteen four-day sampling events were completed as scheduled, yielding 64 sets of analytical data for daily composite and grab sample parameters, and 16 sets of data for the 96-hr composite parameters.

One major change was made to the test system approximately two and one half months after the start of the verification test. The original system included two 6,000 gal SBR units, with no equalization or distribution tank ahead of the SBR units. One of the SBR units was converted to an equalization tank, while the second SBR unit continued to operate as an SBR. IWS made this same change to all of their systems to provide better flow control to the SBR unit and to reduce the potential for upsets in the SBR during very high inlet flow rates.

Startup

The SBR startup proceeded without difficulty. Startup and acclimation procedures were easy to follow and the SBR system established a viable biomass that would provide treatment of the wastewater within two to three weeks.

Verification Test Results

The average daily flow based on daily averages calculated for each month in the twelve-month verification period, was 2,277 gal and ranged from 1,827 to 3,690 gal. The peak single day flow of 6,026 gal occurred in November 2004 and the lowest single day flow of 259 gal occurred in October 2004.

Table 1 presents the results for BOD₅ and TSS. The SBR effluent achieved a mean reduction of 95% for BOD₅. The final treated effluent had a mean value of 4 mg/L giving a mean reduction of 98% for BOD₅. Most of the BOD₅ results in the final effluent were below the detection limit of either 3 or 4 mg/L.

The mean influent COD was 480 mg/L, with a range of 120 to 1,440 mg/L. The SBR effluent mean COD concentration was 49 mg/L, ranging from <20 to 240 mg/L, and the COD concentration in the treated effluent had a mean of 22 mg/L with a range of <20 to 45 mg/L. The mean value was very close to the detection limit for the COD test (20 mg/L), as most of the test results were below the detection limit.

Table 2 presents the results for TKN, NH₃-N, NO₂+NO₃-N and total nitrogen (TN). TN was determined by adding the concentrations of the TKN (organic plus ammonia nitrogen), and NO₂+NO₃-N in the effluent. The SBR demonstrated a mean reduction of 83% in TN for the verification test period. The final treated effluent nitrogen concentrations were similar to the SBR effluent except for a somewhat lower mean concentration of TKN. The overall system removal efficiency for TN was 88%.

Table 1. BOD₅ and TSS Data Summary

	BOD ₅ (mg/L)			TSS (mg/L)		
	Influent	SBR Effluent	Final Effluent	Influent	SBR Effluent	Final Effluent
Mean	230	12	4	170	26	6
Maximum	580	39	8	440	160	23
Minimum	86	<4	2	15	3	3
Std. Dev.	99	8.3	1.4	90	28	4

Note: Data are based on 64 samples.

Table 2. Nitrogen Data Summary

	TKN (mg/L)			NH ₃ -N (mg/L)		
	Influent	SBR Effluent	Final Effluent	Influent	SBR Effluent	Final Effluent
Mean	37.6	3.23	1.23	29.8	0.44	0.33
Maximum	50.2	6.40	3.54	40.0	2.99	2.53
Minimum	17.9	1.17	0.40	11.9	<0.04	<0.04
Std. Dev.	9.95	1.86	0.90	8.65	0.94	0.76

	NO ₂ +NO ₃ -N (mg/L)			TN (mg/L)		
	Influent	SBR Effluent	Final Effluent	Influent	SBR Effluent	Final Effluent
Mean	0.08	3.1	3.1	38	6.3	4.4
Maximum	0.232	9.9	8.8	50	15	9.8
Minimum	<0.02	0.50	0.6	18	2.0	1.0
Std. Dev.	0.06	2.4	2.2	9.9	3.3	2.3

Table 3 presents data for TP and SP. The SBR demonstrated a mean reduction of 56% of the TP and 59% of the SP present in the influent. The trends are very similar with SP representing approximately 65-75% of the TP concentration in both the influent and SBR effluent for the verification test period. The final treated effluent showed a small additional decrease in SP (mean of 1.1 mg/L versus 1.6 mg/L), while the TP concentration decreased from a mean of 2.4 mg/L to 1.3 mg/L. Overall the full treatment system achieved a 76% reduction in TP concentration and 72% reduction in SP concentration.

Table 3. Phosphorus Data

	Total Phosphorus (mg/L)			Soluble Phosphorus (mg/L)		
	Influent	SBR Effluent	Final Effluent	Influent	SBR Effluent	Final Effluent
Mean	5.4	2.4	1.3	3.9	1.6	1.1
Maximum	7.4	4.7	2.7	5.7	3.5	2.5
Minimum	2.9	0.37	0.08	1.5	0.12	<0.05
Std. Dev.	1.5	1.1	0.75	1.2	0.89	0.76

Note: The data in Tables 2 and 3 are based on 16 samples.

Total coliform results are presented in Table 4. The UV system reduced total coliform levels to below the detection limit on most sample days. Only one day exceeded 100 MPN/100 mL and two additional days exceeded 10 MPN/100 mL.

Table 4. Total Coliform Data Summary

	Total Coliform (MPN/ 100 mL)		
	Influent	SBR Effluent	Final Effluent
Geometric Mean	7.1×10^6	1.2×10^5	4
Maximum	1.6×10^9	5.0×10^6	120
Minimum	2.3×10^5	2.4×10^3	2

Note: Data are based on 63 samples of influent and SBR effluent, and 53 samples of final effluent.

Verification Test Discussion

High influent volumes in November (several days above 4,000 gal and two days over 5,000 gal) resulted in high water alarms in the system. During this time, the filter was not meeting turbidity requirements, resulting in reject water from the filtration system going to the SBR in addition to the high influent volume. Five truckloads (15,500 gal) of raw wastewater from the equalization tank were hauled away to stabilize the system. In response, the process cycle time was also changed from four hours to six hours and the aeration cycle was lengthened from two 45-minute periods to two 90-minute periods. Following this change, the maximum daily flow during the test (6,026 gal) occurred three days later, followed by continued high flows for several more days, but the high flows did not significantly impact system performance.

SBR effluent BOD₅ exceeded 20 mg/L on eight of the 64 monitoring days, and exceeded 30 mg/L on three of those days. While there was no distinct pattern or cause identified for the days with higher BOD₅, the higher BOD₅ concentrations did tend to correspond with higher TSS concentrations. The highest BOD₅ concentration of 39 mg/L corresponded to the maximum TSS concentration of 160 mg/L. TSS varied considerably in the SBR effluent with eight of the 63 monitoring days exceeding 50 mg/L. Clarification of the biomass was generally successful, but poorer settling did at times challenge the coagulation/filtration system. The filtration system and the on-line turbidity monitor worked as designed, rejecting filtrate with higher turbidity and TSS. On days when TSS was elevated in the SBR effluent, the final effluent was typically 5 mg/L or less.

Operation and Maintenance Results

In December, a total of 10,500 gal of wastewater was removed from the equalization tank and trucked to the local municipal wastewater treatment plant. The high water condition was most likely due to a faulty low level UV intensity reading on the UV unit, based on system pumping records, UV readings, filter turbidity and effluent coliform data collected when UV readings were properly acquired by the PLC. Once the problem was resolved, the unit returned to normal operation and no additional high water alarms were encountered.

The Model 6000 SBR used an aluminum salt (alum or poly aluminum chloride) as a coagulant to treat the SBR effluent prior to filtration and used methanol as a supplemental carbon source for the denitrification process. These chemicals were added from 55 gal storage tanks by chemical metering pumps activated by the PLC during flow to the filter (aluminum) and during the anoxic cycle in the SBR (methanol). The chemical dose for aluminum was approximately 2.5 mg/L as Al. The average coagulant use, based on an average daily flow of 2,280 gal, was approximately 0.5 lbs/day as Al. This translates to approximately 1.1 pounds of PAC per 1,000 gal treated or 2.8 lbs of alum per 1,000 gal treated. The average methanol solution feed rate was 1.7 gal (2.8 lbs) per day, which translates to approximately 50 mg/L as carbon or 1.2 lbs of methanol per 1,000 gal treated.

The IWS Model 6000 SBR, while complex, is highly automated and PLC controlled so that operator intervention is not required on a daily basis. The operator can access the PLC via the Internet and the PLC can send various alarms to an operator when there is a potential problem. Based on the records maintained during the verification test, four to five hr/week are needed to handle routine operation and maintenance activities, with additional time needed for

mechanical problems or upset conditions. There were no major operational upsets in the SBR during the verification test, only adjustments in the SBR master cycle (aeration, anoxic, transfer, clarification). The most significant change was the November adjustment mentioned in the previous section.

There were no major mechanical component failures or major downtime periods during the verification test. When the process was changed in September to switch one SBR to an equalization tank, the switch was completed in two days, with flow to the one SBR maintained throughout the period. There was one structural failure during the test, when the baffle in the SBR between the aeration chamber and the clarifier chamber separated from the tank wall.

Quality Assurance/Quality Control

During testing, NSF completed a QA/QC audit of the Moon Lake Ranch site and Analytical Laboratories Inc. (ALI), the analytical laboratory. This audit included: (a) a technical systems audit to assure the testing was in compliance with the test plan, (b) a performance evaluation audit to assure that the measurement systems employed at the test site and by ALI were adequate to produce reliable data, and (c) a data quality audit of at least 10 percent of the test data to assure that the reported data represented the data generated during the testing. The audit determined that procedures being used in the field and the laboratory were in accordance with the established QAPP. EPA QA personnel also conducted a quality systems audit of NSF's QA Management Program.

Original Signed by
Clyde R. Dempsey for
Sally Gutierrez

September 27, 2006

Sally Gutierrez
Director
National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency

Original Signed by
Robert Ferguson

October 2, 2006

Robert Ferguson
Vice President
Water Programs
NSF International

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and NSF make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of corporate names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products. This report in no way constitutes an NSF Certification of the specific product mentioned herein.

Availability of Supporting Documents

Copies of *The Protocol for Verification of Wastewater Treatment Technologies*, dated April 2001, the Verification Test Plan, Verification Statement, and the Verification Report are available from the following sources:

1. ETV Water Quality Protection Center Manager (order hard copy)
NSF International
P.O. Box 130140
Ann Arbor, Michigan 48113-0140

2. NSF web site: <http://www.nsf.org/etv> (electronic copy)

3. EPA web site: <http://www.epa.gov/etv> (electronic copy)

(NOTE: Appendices are not included in the Verification Report. Appendices are available from NSF upon request.)

EPA's Office of Wastewater Management has published a number of documents to assist purchasers, community planners and regulators in the proper selection, operation and management of onsite wastewater treatment systems. Two relevant documents and their sources are:

1. *Handbook for Management of Onsite and Clustered Decentralized Wastewater Treatment Systems*
<http://www.epa.gov/owm/onsite>
2. *Onsite Wastewater Treatment Systems Manual* <http://www.epa.gov/owm/mtb/decent/toolbox.htm>

VOLUME CALCULATIONS
PERMIT 63-12305
BY DAN NELSON

This system was permitted for various storage uses and aesthetic use. The storage components were for the one time fill of the pond. The aesthetic use was for the evaporation of the pond to maintain the pond level year round. The wells are not allowed to operated except during the irrigation season, but the ponds were constructed and permitted with concept of intercepting the shallow ground water table. Therefore, the pond would naturally maintain a certain water level equal to the distance of the water table below ground. In this case, the pond depth ranges from 3 feet to 10 feet in depth with an average of 4 feet. The volumes calculated for these ponds are as follows:

Pond # 1 = 86.8 af capacity + 47.3 af evaporation = 134.1 ac of total storage

Pond # 2 = 24 af capacity + 13.1 af evaporation = 37.1 ac of total storage

Pond # 3 = 4.4 af capacity + 2.4 af evaporation = 6.8 ac of total storage

Pond # 4 = 11.6 af capacity + 6.3 af evaporation = 17.9 ac of total storage

Pond # 5 = 4 af capacity + 2.2 af evaporation = 6.2 ac of total storage

TOTALS = 130.8 af capacity + 71.3 af evaporation = 202.1 af of total storage

The permit allowed a storage component for a one time fill. The evaporation is included on the aesthetic portion of the water right. Therefore, the storage components should be licensed as follows:

Irrigation Storage = 138 af

Irrigation From Storage = 138 af

Aesthetic storage = 138 af

Total storage = 138 af

The aesthetic use is a little more difficult to determine, because we need to consider the total amount of water supplied by each water source.

Boise River/Canal Company Water:

The Boise River/ Canal Company water is limited to 91.75 shares, which is equal to 91.75 acres. Therefore the Boise River/Canal Company water is limited to 413 af (4.5 af allowable per acre X 91.75 acres = 413 af). Of the 413 acre feet, a portion of that water is designated for the irrigation portion of this right and the Canal Company water rights. The volume designated for the irrigation portion is for 50 acres or 225 af (50 acres X 4.5 af per acre = 225 af). Therefore, only 188 af of Boise River/Canal Company water can be applied to aesthetic and aesthetic storage components.

Wastewater:

In a report compiled on the waste treatment facility by International Wastewater Systems in 2006, they state the average daily flow of was 2,277 gallons per day with a peak of 6,026 gallons per day. At 2,277 gallons per day the annual volume would be 2.6 af of wastewater being delivered to this pond $[(2,277 \text{ gpd} \times 365 \text{ days}) / 325850 = 2.55 \text{ af}]$. All of the 2.6 af of wastewater is being delivered under the aesthetic portion of this water right.

Ground Water:

The ground water is more difficult to determine. The wells associated with this permit are not allowed to operate during the non-irrigation season. However, the ponds are constructed in a manner to intercept the ground water table. Therefore, we need to determine how much storage water the ponds would consume without the influence of the other water sources. The subdivision representative stated that the pond drops between 1.5 to 3 feet. I used average water level of 2 feet which would be half of the completely full average of 4 feet to calculate the non-irrigation season pond volume, so the total amount of the pond volume would be less. I have recalculated to the total pond volume based on the reduced capacity.

Pond # 1 = 21.7 surface area X 2.0 ft ave. depth = 43.4 capacity

Pond # 2 = 6.0 surface area X 2.0 ft ave. depth = 12.0 capacity

Pond # 3 = 1.1 surface area X 2.0 ft ave. depth = 2.2 capacity

Pond # 4 = 2.9 surface area X 2.0 ft ave. depth = 5.8 capacity

Pond # 5 = 1.0 surface area X 2.0 ft ave. depth = 2.0 capacity

TOTALS = 65.4 af capacity can be supplied totally from ground water

With the evaporation loss would not change with the reduction in water level, therefore, the total amount of the storage component that can be supplied by the ground water would be 136.7 af (65.4 af capacity supplied by ground water + 71.3 af evaporation = 136.7 af).

The aesthetic use volume would be the amount of water that flows through the pond plus the amount of water that is evaporated in the pond. The following shows how the aesthetic volume was calculated:

	413.0 af of water supplied by Boise River/Canal Company
Plus	2.6 af of water supplied by Wastewater
Plus	<u>136.7 af of water that can be supplied by ground water</u>
Equals	552.3 af of water that is available for the system.

	552.3 af of water that is available for the system
Minus	227.0 af for irrigation, irrigation storage, and irrigation from storage
Minus	<u>202.1 af for storage and evaporation</u>
Equals	123.2 af for flow through the pond.

The total aesthetic use would be the 123.2 af of water for flow through plus the 71.3 af of evaporation for a total of 194.5 af. The total storage component would be 130.8 af and the total Aesthetic use would be 194.5 af for a total maximum volume of 325.3 af.

TOTAL STORAGE

FILE NUMBER	63-12305 Pond 1
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

Surface Area (in Acres)	21.7	"Surface Area" is automatically carried over from the "Seepage Loss Sheet"
Average Pond Depth (in feet)	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 you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above.
Pond Capacity (in acre feet)	86.8	

Volume Needed Above Initial Fill to Fulfill From Storage Needs- "Multiple Fills" (in acre feet)	0	The "Volume Needed Above Initial Fill" is the acre-feet of water required to meet <i>afrom 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). PLEASE 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 (in acre feet)	0.0	The "Estimated Seepage Loss" is automatically carried over from the Seepage Loss Sheet
Estimated Evaporation Loss (in acre feet)	47.3	The "Estimated Evaporation Loss" is automatically carried over from the Evaporation Loss Sheet
Total Volume Required (in acre feet)	134.1	"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.

Flow Rate Into Pond (in cfs)	1.00	The "Flow Rate" Into the Pond depicts the actual flow either measured or estimated into the pond.
Highest Daily Evaporation Rate From Evaporation Tab. (in mm/day)	5.21	This number is automatically selected by picking the highest recorded number in the "Precipitation Deficit Table".
Maximum Required Daily Maintenance Volume (in acre feet per day)	0.37	"Maximum Required Daily Maintenance Volume" is the maximum volume of water needed on any given day during the year, and is calculated by adding the highest daily evaporation loss to the average daily seepage loss in acre feet. The average daily seepage loss is calculated by dividing the "Estimated Seepage Loss" by 365 days. This is acceptable, since the seepage rate shouldn't vary throughout the season unless the pond completely freezes over during the winter months. The highest daily evaporation loss is calculated by dividing the Highest Daily Evaporation Rate by the 304.8 conversion factor and multiplying this number by the pond surface area to attain a combined daily acre feet requirement.
Minimum Maintenance Flow (in cfs)	0.19	The "Minimum Maintenance Flow" is the minimum amount of flow required to maintain the level of the pond. This number is determine by dividing the "Maximum Required Daily Maintenance Volume" by 1.9835. This flow can be used to determine if the flow rate into the pond is adequate to maintain the pond level.
Days Required to Fill the Pond	54	The "Days Required to Fill the Pond" is calculated by dividing the "Pond Capacity" by the "Flow Rate" minus "Minimum Maintenance Flow" multiplied by 1.9835. This section will assist you in determining if the flow rate being diverted to the pond is adequate to fill the pond while maintaining the pond level. The length of time to fill the pond will help determine if the flow rate is adequate for the size of pond being proposed. This number should be between 1 and 365 days for a project to be sucessful.
Days Required to Fill the Pond at 13,000 gallons per day	-262	The "Days Required to Fill the Pond at 13,000 gallons per day" is calculated converting the "Pond Capacity" and the "Maximum Daily Maintenance Volume" to gallons. The "Pond Capacity" is then divided by 13,000 gallons minus the "Maximum Daily Maintenance Volume" in gallons to determine the number of days to fill pond. This number should be between 1 and 365 if this pond is to described as a domestic use.

User Input
Calculated value
Formula Explanations

Evaporation Loss Calculation

FILE NUMBER	63-12305 Pond 1
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

The acronyms used on the Kimberly Research Center website are defined below:
P = Precipitation
ET= Evapotranspiration
P _d = Precipitation deficit
P _d =ET-P

User Input
Calculated value
Formula Explanations

USING THIS SPREADSHEET

To ascertain the evaporation from a pond, you will need to go to the Kimberley Research Center website. The link is found below. This web site provides the Precipitation Deficit for the area where the pond is located. The Precipitation Deficit is the total amount of free pan 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, and the entire state is pretty much covered. 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.

Found at: <http://www.kimberly.uidaho.edu/ETIdaho/online.php>

Precipitation Deficit

Station: Twin Falls 2 NNE (NWS -- 109294)

Month	mm/day ¹	Days per month	mm/Month
Jan	0.00	31	0.00
Feb	0.00	28	0.00
March	0.00	31	0.00
April	1.55	30	46.50
May	2.38	31	73.78
June	4.06	30	121.80
July	5.21	31	161.51
August	4.49	31	139.19
September	2.79	30	83.70
October	1.21	31	37.51
November	0.00	30	0.00
December	0.00	31	0.00

PLEASE NOTE: We cannot use the season average, because there are several areas in Northern Idaho with a negative Precipitation Deficit. Therefore, we must enter each monthly deficit, and enter in a zero (0) for each negative month. The reason for this is that precipitation can only offset evaporation to the extent of the evaporation.

Please enter the daily average Precipitation Deficit as shown in the example below.

Although it has sometimes been useful to consider wintertime evaporation to be zero, Allen and Robison (2007, p. 169) noted, "Evaporation during nongrowing (wintertime) periods varies widely"

¹Negative monthly mean values should be entered in the above table as "0".

Total mm/year = 663.99

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

(663.99) ÷ (304.8) X 21.70 = 47.3 AFA

Surface Area of Pond is automatically Carried over from the Seepage Loss Sheet.

SEEPAGE CALCULATIONS

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

FILE NUMBER	63-12305 Pond 1
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

User Input
Calculated value
Formula Explanations

INPUTS

SQ. FT. Calculator Pond Surface area in acres
21.7

POND SURFACE AREA (SQ. FT.)	945252
-----------------------------	--------

SUGGESTED SEEPAGE RATE (FT/DAY)	0.0000
---------------------------------	--------

Use the table below to find the "SUGGESTED SEEPAGE RATES".

FORMULA: (Surface Area X Seepage Rate) / 7.48 = Gallons Per Day loss

CONVERT TO GPD	0	GPD
----------------	---	-----

TOTAL SEEPAGE LOSS (AFA)	0.0	AFA
--------------------------	-----	-----

SUGGESTED SEEPAGE RATES FOR DIFFERENT SOIL TYPES:
GW, GP, GM, GC, SW, SP and SM (silty sand, sand silt mixtures and gravel mixtures) = 0.20 ft per day
OL and ML (inorganic silts - very fine sands, silty, or clayey fine sands) = 0.016 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 with shallow 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 <X:\Spatial\Soils\USCS\PondSoils.lyr>. Use "0" if the ponds intersect the water table.

TOTAL STORAGE

FILE NUMBER	63-12305 Pond 2
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

Surface Area (In Acres)	6	"Surface Area" is automatically carried over from the "Seepage Loss Sheet"
Average Pond Depth (In feet)	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 you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above.
Pond Capacity (in acre feet)	24	

Volume Needed Above Initial Fill to Fulfill From Storage Needs- "Multiple Fills" (in acre feet)	0	The "Volume Needed Above Initial Fill" is the acre-feet of water required to meet <i>afrom 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). PLEASE 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 (in acre feet)	0.0	The "Estimated Seepage Loss" is automatically carried over from the Seepage Loss Sheet
Estimated Evaporation Loss (in acre feet)	13.1	The "Estimated Evaporation Loss" is automatically carried over from the Evaporation Loss Sheet
Total Volume Required (in acre feet)	37.1	"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.

Flow Rate Into Pond (in cfs)	1.00	The "Flow Rate" Into the Pond depicts the actual flow either measured or estimated into the pond.
Highest Daily Evaporation Rate From Evaporation Tab. (in mm/day)	5.21	This number is automatically selected by picking the highest recorded number in the "Precipitation Deficit Table".
Maximum Required Daily Maintenance Volume (in acre feet per day)	0.10	"Maximum Required Daily Maintenance Volume" is the maximum volume of water needed on any given day during the year, and is calculated by adding the highest daily evaporation loss to the average daily seepage loss in acre feet. The average daily seepage loss is calculated by dividing the "Estimated Seepage Loss" by 365 days. This is acceptable, since the seepage rate shouldn't vary throughout the season unless the pond completely freezes over during the winter months. The highest daily evaporation loss is calculated by dividing the Highest Daily Evaporation Rate by the 304.8 conversion factor and multiplying this number by the pond surface area to attain a combined daily acre feet requirement.
Minimum Maintenance Flow (in cfs)	0.05	The "Minimum Maintenance Flow" is the minimum amount of flow required to maintain the level of the pond. This number is determine by dividing the "Maximum Required Daily Maintenance Volume" by 1.9835. This flow can be used to determine if the flow rate into the pond is adequate to maintain the pond level.
Days Required to Fill the Pond	13	The "Days Required to Fill the Pond" is calculated by dividing the "Pond Capacity" by the "Flow Rate" minus "Minimum Maintenance Flow" multiplied by 1.9835. This section will assist you in determining if the flow rate being diverted to the pond is adequate to fill the pond while maintaining the pond level. The length of time to fill the pond will help determine if the flow rate is adequate for the size of pond being proposed. This number should be between 1 and 365 days for a project to be successful.
Days Required to Fill the Pond at 13,000 gallons per day	-383	The "Days Required to Fill the Pond at 13,000 gallons per day" is calculated converting the "Pond Capacity" and the "Maximum Daily Maintenance Volume" to gallons. The "Pond Capacity" is then divided by 13,000 gallons minus the "Maximum Daily Maintenance Volume" in gallons to determine the number of days to fill pond. This number should be between 1 and 365 if this pond is to described as a domestic use.

User Input
Calculated value
Formula Explanations

Evaporation Loss Calculation

FILE NUMBER	63-12305 Pond 2
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

The acronyms used on the Kimberly Research Center website are defined below:
P = Precipitation
ET= Evapotranspiration
P _d = Precipitation deficit
P _d = ET-P

User Input
Calculated value
Formula Explanations

USING THIS SPREADSHEET

To ascertain the evaporation from a pond, you will need to go to the Kimberley Research Center website. The link is found below. This web site provides the Precipitation Deficit for the area where the pond is located. The Precipitation Deficit is the total amount of free pan 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, and the entire state is pretty much covered. 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.

Found at: <http://www.kimberly.uidaho.edu/ETIdaho/online.php>

Precipitation Deficit

Station: Twin Falls 2 NNE (NWS -- 109294)

Month	mm/day ¹	Days per month	mm/Month
Jan	0.00	31	0.00
Feb	0.00	28	0.00
March	0.00	31	0.00
April	1.55	30	46.50
May	2.38	31	73.78
June	4.06	30	121.80
July	5.21	31	161.51
August	4.49	31	139.19
September	2.79	30	83.70
October	1.21	31	37.51
November	0.00	30	0.00
December	0.00	31	0.00

PLEASE NOTE: We cannot use the season average, because there are several areas in Northern Idaho with a negative Precipitation Deficit. Therefore, we must enter each monthly deficit, and enter in a zero (0) for each negative month. The reason for this is that precipitation can only offset evaporation to the extent of the evaporation.

Please enter the daily average Precipitation Deficit as shown in the example below.

Although it has sometimes been useful to consider wintertime evaporation to be zero, Allen and Robison (2007, p. 169) noted, "Evaporation during nongrowing (wintertime) periods varies widely"

¹Negative monthly mean values should be entered in the above table as "0".

Total mm/year = 663.99

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

$$(663.99 \div 304.8) \times 6.00 = 13.1 \text{ AFA}$$

Surface Area of Pond is automatically Carried over from the Seepage Loss Sheet.

SEEPAGE CALCULATIONS

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

FILE NUMBER	63-12305 Pond 2
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

User Input
Calculated value
Formula Explanations

INPUTS

SQ. FT. Calculator Pond Surface area in acres
6

POND SURFACE AREA (SQ. FT.)	261360
-----------------------------	--------

SUGGESTED SEEPAGE RATE (FT/DAY)	0.0000
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Use the table below to find the "SUGGESTED SEEPAGE RATES".

FORMULA: (Surface Area X Seepage Rate) / 7.48 = Gallons Per Day loss

CONVERT TO GPD	0	GPD
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TOTAL SEEPAGE LOSS (AFA)	0.0	AFA
--------------------------	-----	-----

SUGGESTED SEEPAGE RATES FOR DIFFERENT SOIL TYPES:
GW, GP, GM, GC, SW, SP and SM (silty sand, sand silt mixtures and gravel mixtures) = 0.20 ft per day
OL and ML (inorganic silts - very fine sands, silty, or clayey fine sands) = 0.016 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 with shallow 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 <X:\Spatial\Soils\USCS\PondSoils.lyr>. Use "0" if the ponds intersect the water table.

TOTAL STORAGE

FILE NUMBER	63-12305 Pond 3
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

Surface Area (in Acres)	1.1	"Surface Area" is automatically carried over from the "Seepage Loss Sheet"
Average Pond Depth (in feet)	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 you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above.
Pond Capacity (in acre feet)	4.4	

Volume Needed Above Initial Fill to Fulfill From Storage Needs- "Multiple Fills" (in acre feet)	0	The "Volume Needed Above Initial Fill" is the acre-feet of water required to meet <i>afrom 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). PLEASE NOTE: You must have a " <u>From Storage</u> " component exceeding the initial fill on the permit to include a volume in this space.
Estimated Seepage Loss (in acre feet)	0.0	The "Estimated Seepage Loss" is automatically carried over from the Seepage Loss Sheet
Estimated Evaporation Loss (in acre feet)	2.4	The "Estimated Evaporation Loss" is automatically carried over from the Evaporation Loss Sheet
Total Volume Required (in acre feet)	6.8	"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.

Flow Rate Into Pond (in cfs)	1.00	The "Flow Rate" Into the Pond depicts the actual flow either measured or estimated into the pond
Highest Daily Evaporation Rate From Evaporation Tab. (in mm/day)	5.21	This number is automatically selected by picking the highest recorded number in the "Precipitation Deficit Table".
Maximum Required Daily Maintenance Volume (in acre feet per day)	0.02	"Maximum Required Daily Maintenance Volume" is the maximum volume of water needed on any given day during the year, and is calculated by adding the highest daily evaporation loss to the average daily seepage loss in acre feet. The average daily seepage loss is calculated by dividing the "Estimated Seepage Loss" by 365 days. This is acceptable, since the seepage rate shouldn't vary throughout the season unless the pond completely freezes over during the winter months. The highest daily evaporation loss is calculated by dividing the Highest Daily Evaporation Rate by the 304.8 conversion factor and multiplying this number by the pond surface area to attain a combined daily acre feet requirement.
Minimum Maintenance Flow (in cfs)	0.01	The "Minimum Maintenance Flow" is the minimum amount of flow required to maintain the level of the pond. This number is determine by dividing the "Maximum Required Daily Maintenance Volume" by 1.9835. This flow can be used to determine if the flow rate into the pond is adequate to maintain the pond level.
Days Required to Fill the Pond	2	The "Days Required to Fill the Pond" is calculated by dividing the "Pond Capacity" by the "Flow Rate" minus "Minimum Maintenance Flow" multiplied by 1.9835. This section will assist you in determining if the flow rate being diverted to the pond is adequate to fill the pond while maintaining the pond level. The length of time to fill the pond will help determine if the flow rate is adequate for the size of pond being proposed. This number should be between 1 and 365 days for a project to be successful.
Days Required to Fill the Pond at 13,000 gallons per day	209	The "Days Required to Fill the Pond at 13,000 gallons per day" is calculated converting the "Pond Capacity" and the "Maximum Daily Maintenance Volume" to gallons. The "Pond Capacity" is then divided by 13,000 gallons minus the "Maximum Daily Maintenance Volume" in gallons to determine the number of days to fill pond. This number should be between 1 and 365 if this pond is to described as a domestic use.

User Input
Calculated value
Formula Explanations

Evaporation Loss Calculation

FILE NUMBER	63-12305 Pond 3
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

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

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

User Input

Calculated value

Formula Explanations

USING THIS SPREADSHEET

To ascertain the evaporation from a pond, you will need to go to the Kimberley Research Center website. The link is found below. This web site provides the Precipitation Deficit for the area where the pond is located. The Precipitation Deficit is the total amount of free pan 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, and the entire state is pretty much covered. 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.

Found at: <http://www.kimberly.uidaho.edu/ETIdaho/online.php>

Precipitation Deficit

Station: Twin Falls 2 NNE (NWS -- 109294)

Month	mm/day ¹	Days per month	mm/Month
Jan	0.00	31	0.00
Feb	0.00	28	0.00
March	0.00	31	0.00
April	1.55	30	46.50
May	2.38	31	73.78
June	4.06	30	121.80
July	5.21	31	161.51
August	4.49	31	139.19
September	2.79	30	83.70
October	1.21	31	37.51
November	0.00	30	0.00
December	0.00	31	0.00

PLEASE NOTE: We cannot use the season average, because there are several areas in Northern Idaho with a negative Precipitation Deficit. Therefore, we must enter each monthly deficit, and enter in a zero (0) for each negative month. The reason for this is that precipitation can only offset evaporation to the extent of the evaporation.

Please enter the daily average Precipitation Deficit as shown in the example below.

Although it has sometimes been useful to consider wintertime evaporation to be zero, Allen and Robison (2007, p. 169) noted, "Evaporation during nongrowing (wintertime) periods varies widely"

¹Negative monthly mean values should be entered in the above table as "0".

Total mm/year = 663.99

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

$$(663.99 \div 304.8) \times 1.10 = 2.4 \text{ AFA}$$

Surface Area of Pond is automatically Carried over from the Seepage Loss Sheet.

SEEPAGE CALCULATIONS

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

FILE NUMBER	63-12305 Pond 3
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

User Input
Calculated value
Formula Explanations

INPUTS

SQ. FT. Calculator Pond Surface area in acres
1.1

POND SURFACE AREA (SQ. FT.)	47916
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SUGGESTED SEEPAGE RATE (FT/DAY)	0.0000
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Use the table below to find the "SUGGESTED SEEPAGE RATES".

FORMULA: (Surface Area X Seepage Rate) / 7.48 = Gallons Per Day loss

CONVERT TO GPD	0	GPD
----------------	---	-----

TOTAL SEEPAGE LOSS (AFA)	0.0	AFA
--------------------------	-----	-----

SUGGESTED SEEPAGE RATES FOR DIFFERENT SOIL TYPES:
GW, GP, GM, GC, SW, SP and SM (silty sand, sand silt mixtures and gravel mixtures) = 0.20 ft per day
OL and ML (inorganic silts - very fine sands, silty, or clayey fine sands) = 0.016 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 with shallow 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 <X:\Spatial\Soils\USCS\PondSoils.lyr>. Use "0" if the ponds intersect the water table.

TOTAL STORAGE

FILE NUMBER	63-12305 Pond 4
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

Surface Area (in Acres)	2.9	"Surface Area" is automatically carried over from the "Seepage Loss Sheet"
Average Pond Depth (in feet)	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 you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above.
Pond Capacity (in acre feet)	11.6	

Volume Needed Above Initial Fill to Fulfill From Storage Needs- "Multiple Fills" (in acre feet)	0	The "Volume Needed Above Initial Fill" is the acre-feet of water required to meet <i>afrom 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). PLEASE 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 (in acre feet)	0.0	The "Estimated Seepage Loss" is automatically carried over from the Seepage Loss Sheet
Estimated Evaporation Loss (in acre feet)	6.3	The "Estimated Evaporation Loss" is automatically carried over from the Evaporation Loss Sheet
Total Volume Required (in acre feet)	17.9	"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.

Flow Rate Into Pond (in cfs)	1.00	The "Flow Rate" into the Pond depicts the actual flow either measured or estimated into the pond.
Highest Daily Evaporation Rate From Evaporation Tab. (in mm/day)	5.21	This number is automatically selected by picking the highest recorded number in the "Precipitation Deficit Table".
Maximum Required Daily Maintenance Volume (in acre feet per day)	0.05	"Maximum Required Daily Maintenance Volume" is the maximum volume of water needed on any given day during the year, and is calculated by adding the highest daily evaporation loss to the average daily seepage loss in acre feet. The average daily seepage loss is calculated by dividing the "Estimated Seepage Loss" by 365 days. This is acceptable, since the seepage rate shouldn't vary throughout the season unless the pond completely freezes over during the winter months. The highest daily evaporation loss is calculated by dividing the Highest Daily Evaporation Rate by the 304.8 conversion factor and multiplying this number by the pond surface area to attain a combined daily acre feet requirement.
Minimum Maintenance Flow (in cfs)	0.02	The "Minimum Maintenance Flow" is the minimum amount of flow required to maintain the level of the pond. This number is determine by dividing the "Maximum Required Daily Maintenance Volume" by 1.9835. This flow can be used to determine if the flow rate into the pond is adequate to maintain the pond level.
Days Required to Fill the Pond	6	The "Days Required to Fill the Pond" is calculated by dividing the "Pond Capacity" by the "Flow Rate" minus "Minimum Maintenance Flow" multiplied by 1.9835. This section will assist you in determining if the flow rate being diverted to the pond is adequate to fill the pond while maintaining the pond level. The length of time to fill the pond will help determine if the flow rate is adequate for the size of pond being proposed. This number should be between 1 and 365 days for a project to be successful.
Days Required to Fill the Pond at 13,000 gallons per day	-1199	The "Days Required to Fill the Pond at 13,000 gallons per day" is calculated converting the "Pond Capacity" and the "Maximum Daily Maintenance Volume" to gallons. The "Pond Capacity" is then divided by 13,000 gallons minus the "Maximum Daily Maintenance Volume" in gallons to determine the number of days to fill pond. This number should be between 1 and 365 if this pond is to be described as a domestic use.

User Input
Calculated value
Formula Explanations

Evaporation Loss Calculation

FILE NUMBER	63-12305 Pond 4
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

The acronyms used on the Kimberly Research Center website are defined below:
P = Precipitation
ET= Evapotranspiration
P _d = Precipitation deficit
P _d = ET-P

User Input
Calculated value
Formula Explanations

USING THIS SPREADSHEET

To ascertain the evaporation from a pond, you will need to go to the Kimberley Research Center website. The link is found below. This web site provides the Precipitation Deficit for the area where the pond is located. The Precipitation Deficit is the total amount of free pan 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, and the entire state is pretty much covered. 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.

Found at: <http://www.kimberly.uidaho.edu/ETIdaho/online.php>

Precipitation Deficit

Station: Twin Falls 2 NNE (NWS -- 109294)

Month	mm/day ¹	Days per month	mm/Month
Jan	0.00	31	0.00
Feb	0.00	28	0.00
March	0.00	31	0.00
April	1.55	30	46.50
May	2.38	31	73.78
June	4.06	30	121.80
July	5.21	31	161.51
August	4.49	31	139.19
September	2.79	30	83.70
October	1.21	31	37.51
November	0.00	30	0.00
December	0.00	31	0.00

PLEASE NOTE: We cannot use the season average, because there are several areas in Northern Idaho with a negative Precipitation Deficit. Therefore, we must enter each monthly deficit, and enter in a zero (0) for each negative month. The reason for this is that precipitation can only offset evaporation to the extent of the evaporation.

Please enter the daily average Precipitation Deficit as shown in the example below.

Although it has sometimes been useful to consider wintertime evaporation to be zero, Allen and Robison (2007, p. 169) noted, "Evaporation during nongrowing (wintertime) periods varies widely"

¹Negative monthly mean values should be entered in the above table as "0".

Total mm/year = 663.99

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

$$(663.99 \div 304.8) \times 2.90 = 6.3 \text{ AFA}$$

Surface Area of Pond is automatically Carried over from the Seepage Loss Sheet.

SEEPAGE CALCULATIONS

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

FILE NUMBER	63-12305 Pond 4
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

User Input
Calculated value
Formula Explanations

INPUTS

SQ. FT. Calculator Pond Surface area in acres
2.9

POND SURFACE AREA (SQ. FT.)	126324
-----------------------------	--------

SUGGESTED SEEPAGE RATE (FT/DAY)	0.0000
---------------------------------	--------

Use the table below to find the "SUGGESTED SEEPAGE RATES".

FORMULA: (Surface Area X Seepage Rate) / 7.48 = Gallons Per Day loss

CONVERT TO GPD	0	GPD
----------------	---	-----

TOTAL SEEPAGE LOSS (AFA)	0.0	AFA
--------------------------	-----	-----

SUGGESTED SEEPAGE RATES FOR DIFFERENT SOIL TYPES:
GW, GP, GM, GC, SW, SP and SM (silty sand, sand silt mixtures and gravel mixtures) = 0.20 ft per day
OL and ML (inorganic silts - very fine sands, silty, or clayey fine sands) = 0.016 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 with shallow 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 <X:\Spatial\Soils\USCS\PondSoils.lyr>. Use "0" if the ponds intersect the water table.

TOTAL STORAGE

FILE NUMBER	63-12305 Pond 5
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

Surface Area (in Acres)	1	"Surface Area" is automatically carried over from the "Seepage Loss Sheet"
Average Pond Depth (in feet)	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 you know the capacity, divide the capacity by surface area and enter the average pond depth in the space above.
Pond Capacity (in acre feet)	4	

Volume Needed Above Initial Fill to Fulfill From Storage Needs- "Multiple Fills" (in acre feet)	0	The "Volume Needed Above Initial Fill" is the acre-feet of water required to meet <i>afrom 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). PLEASE NOTE: You must have a " <u>From Storage</u> " component exceeding the initial fill on the permit to include a volume in this space.
Estimated Seepage Loss (in acre feet)	0.0	The "Estimated Seepage Loss" is automatically carried over from the Seepage Loss Sheet
Estimated Evaporation Loss (in acre feet)	2.2	The "Estimated Evaporation Loss" is automatically carried over from the Evaporation Loss Sheet
Total Volume Required (in acre feet)	6.2	"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.

Flow Rate Into Pond (in cfs)	1.00	The "Flow Rate" Into the Pond depicts the actual flow either measured or estimated into the pond.
Highest Daily Evaporation Rate From Evaporation Tab. (in mm/day)	5.21	This number is automatically selected by picking the highest recorded number in the "Precipitation Deficit Table".
Maximum Required Daily Maintenance Volume (in acre feet per day)	0.02	"Maximum Required Daily Maintenance Volume" is the maximum volume of water needed on any given day during the year, and is calculated by adding the highest daily evaporation loss to the average daily seepage loss in acre feet. The average daily seepage loss is calculated by dividing the "Estimated Seepage Loss" by 365 days. This is acceptable, since the seepage rate shouldn't vary throughout the season unless the pond completely freezes over during the winter months. The highest daily evaporation loss is calculated by dividing the Highest Daily Evaporation Rate by the 304.8 conversion factor and multiplying this number by the pond surface area to attain a combined daily acre feet requirement.
Minimum Maintenance Flow (in cfs)	0.01	The "Minimum Maintenance Flow" is the minimum amount of flow required to maintain the level of the pond. This number is determine by dividing the "Maximum Required Daily Maintenance Volume" by 1.9835. This flow can be used to determine if the flow rate into the pond is adequate to maintain the pond level.
Days Required to Fill the Pond	2	The "Days Required to Fill the Pond" is calculated by dividing the "Pond Capacity" by the "Flow Rate" minus "Minimum Maintenance Flow" multiplied by 1.9835. This section will assist you in determining if the flow rate being diverted to the pond is adequate to fill the pond while maintaining the pond level. The length of time to fill the pond will help determine if the flow rate is adequate for the size of pond being proposed. This number should be between 1 and 365 days for a project to be successful.
Days Required to Fill the Pond at 13,000 gallons per day	175	The "Days Required to Fill the Pond at 13,000 gallons per day" is calculated converting the "Pond Capacity" and the "Maximum Daily Maintenance Volume" to gallons. The "Pond Capacity" is then divided by 13,000 gallons minus the "Maximum Daily Maintenance Volume" in gallons to determine the number of days to fill pond. This number should be between 1 and 365 if this pond is to described as a domestic use.

User Input
Calculated value
Formula Explanations

Evaporation Loss Calculation

FILE NUMBER	63-12305 Pond 5
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

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

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

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

User Input
Calculated value
Formula Explanations

USING THIS SPREADSHEET

To ascertain the evaporation from a pond, you will need to go to the Kimberley Research Center website. The link is found below. This web site provides the Precipitation Deficit for the area where the pond is located. The Precipitation Deficit is the total amount of free pan 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, and the entire state is pretty much covered. 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.

Found at: <http://www.kimberly.uidaho.edu/ETIdaho/online.php>

Precipitation Deficit

Station: Twin Falls 2 NNE (NWS -- 109294)

Month	mm/day ¹	Days per month	mm/Month
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Please enter the daily average Precipitation Deficit as shown in the example below.

Although it has sometimes been useful to consider wintertime evaporation to be zero, Allen and Robison (2007, p. 169) noted, "Evaporation during nongrowing (wintertime) periods varies widely"

¹Negative monthly mean values should be entered in the above table as "0".

Total mm/year = 663.99

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

(663.99 ÷ 304.8) X 1.00 = 2.2 AFA

Surface Area of Pond is automatically Carried over from the Seepage Loss Sheet.

SEEPAGE CALCULATIONS

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

FILE NUMBER	63-12305 Pond 5
REVIEWER	Daniel A. Nelson
DATE	4/11/2014

User Input
Calculated value
Formula Explanations

INPUTS

SQ. FT. Calculator Pond Surface area in acres
1

POND SURFACE AREA (SQ. FT.)	43560
-----------------------------	-------

SUGGESTED SEEPAGE RATE (FT/DAY)	0.0000
---------------------------------	--------

Use the table below to find the "SUGGESTED SEEPAGE RATES".

FORMULA: (Surface Area X Seepage Rate) / 7.48 = Gallons Per Day loss

CONVERT TO GPD	0	GPD
----------------	---	-----

TOTAL SEEPAGE LOSS (AFA)	0.0	AFA
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SUGGESTED SEEPAGE RATES FOR DIFFERENT SOIL TYPES:
GW, GP, GM, GC, SW, SP and SM (silty sand, sand silt mixtures and gravel mixtures) = 0.20 ft per day
OL and ML (inorganic silts - very fine sands, silty, or clayey fine sands) = 0.016 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 with shallow 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 <X:\Spatial\Soils\USCS\PondSoils.lyr>. Use "0" if the ponds intersect the water table.

ET_{Idaho} 2012 -- Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho

Please send suggestions for improving this site to robison@kimberly.uidaho.edu Copyright 2012, University of Idaho.

Boise 7 N (NWS -- 101017)

Statistics based on thirty year normal spans 1980 to 2010 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	1.28	0.58	-0.01	1.55	2.38	4.06	5.21	4.49	2.79	1.21	1.15	-1.70	520	0	520
15-Day Moving Average ^d	1.28	0.90	-0.05	1.57	2.39	4.24	5.30	4.48	2.66	1.31	1.12	-1.59			
7-Day Moving Average ^e	1.30	0.78	-0.02	1.52	2.39	4.22	5.27	4.49	2.68	1.24	1.18	-1.66			
3-Day Moving Average ^f	1.29	0.64	-0.02	1.54	2.37	4.12	5.21	4.50	2.75	1.21	1.14	-1.70			
Standard Deviation ^k	mm/day												mm		
Monthly ^c	1.19	1.13	1.79	0.97	2.36	1.20	0.68	0.78	1.16	1.36	0.96	1.87	146	0	146
15-Day Moving Average ^d	1.26	1.57	1.62	1.37	2.33	1.46	0.66	0.75	1.54	1.30	1.25	1.58			
7-Day Moving Average ^e	1.71	2.02	2.09	2.09	2.98	2.00	0.95	1.06	1.99	1.91	1.76	2.28			
3-Day Moving Average ^f	2.25	2.48	2.90	3.05	3.93	2.77	1.56	1.47	2.63	2.58	2.49	3.16			
20% Exceedance ^l	mm/day												mm		
Monthly ^c	0.56	0.40	0.89	2.39	3.47	5.26	5.55	4.94	3.54	2.01	0.26	-0.66	667	0	667
15-Day Moving Average ^d	0.23	0.80	2.19	3.56	5.31	6.07	6.08	5.28	4.04	2.73	0.65	0.33			
7-Day Moving															

Average ^e	0.61	1.52	2.79	4.52	6.03	6.48	6.49	5.82	4.57	3.28	1.15	0.59			
3-Day Moving Average ^f	0.78	1.81	3.65	5.40	6.80	7.22	6.99	6.22	5.18	3.70	1.66	0.77			
80% Exceedance ^m	mm/day												mm		
Monthly ^c	1.94	1.49	-1.35	0.72	1.09	2.92	4.82	4.06	2.52	0.55	1.87	-2.87	368	0	368
15-Day Moving Average ^d	3.58	2.78	-3.09	0.81	-1.65	1.12	3.97	3.34	1.53	1.13	3.67	-4.61			
7-Day Moving Average ^e	5.93	4.43	-5.64	3.77	-5.36	1.64	2.70	2.45	0.08	5.14	5.24	-7.43			
3-Day Moving Average ^f	8.97	8.20	-9.18	8.95	11.47	7.04	0.75	0.05	3.18	9.02	9.78	12.68			
Ave Highest P _{def}	mm/day												--		
15-Day Moving Average ^g	0.11	0.39	1.28	2.82	4.14	5.37	5.77	5.06	3.58	2.22	0.35	0.12			
7-Day Moving Average ^h	0.44	1.05	2.30	3.99	5.20	6.11	6.18	5.52	4.25	2.91	0.79	0.36			
3-Day Moving Average ⁱ	0.67	1.56	3.07	4.84	6.13	6.75	6.68	5.97	4.91	3.36	1.35	0.57			
Ave Lowest P _{def}	mm/day												--		
15-Day Moving Average ^g	2.26	1.52	-1.17	0.38	0.53	2.89	4.67	3.89	1.83	0.27	2.14	-2.90			
7-Day Moving Average ^h	3.73	3.09	-3.03	1.59	-1.94	1.16	3.80	3.19	0.60	1.43	3.69	-4.81			
3-Day Moving Average ⁱ	6.18	5.32	-6.24	5.63	-6.45	2.01	1.82	1.64	2.10	4.13	6.74	-8.81			
Special normal distribution parameters for monthly, seasonal, and annual intervals															
Skew ^m	0.06	1.69	-0.07	0.18	-0.33	0.66	0.10	0.31	1.97	0.23	0.81	-0.29	-0.02	0.00	-0.02
Kurtosis ^o	0.61	6.83	0.69	2.63	1.17	2.75	0.68	1.09	6.26	0.84	3.40	0.89	2.65	0.00	2.65

^a Growing Season: This is usually the time from green up or planting in the spring to a killing frost or harvest in the fall. It is not applicable for entries without a growing season and will be blank.

^b Nongrowing Season: This is usually the time from a killing frost or harvest in the fall to the of green up in the spring. It is not applicable for entries without a growing season.

^c Mean of the average daily value for month

^d Mean of the fourteen 15-day period averages contained in the month

PHOTOGRAPHER AND DATE OF PHOTOS DANIEL A NELSON 8/16/2013

FILE NUMBER 63-12305



The photos above show the Well #2 (Site Tag # A0011933). This well is found in a swampy area on the southeast side of the subdivision. It is the eastern most well that is still in use.



The photos above and below show Well #3 (Site Tag # A002446). This well is on the very south end of Pond #1, and is western most well still in use. This well flows into a short channel that flows into Pond #1.



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FILE NUMBER 63-12305



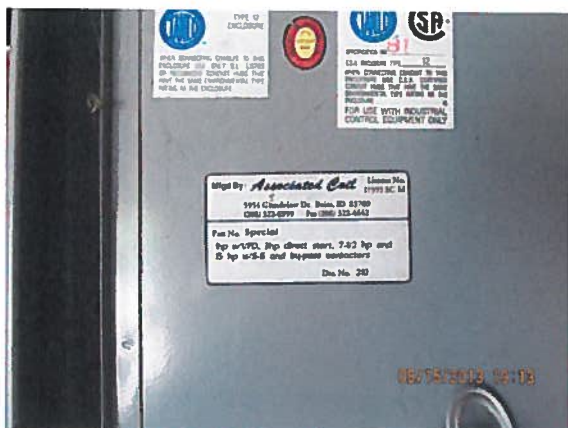
The photo above shows Well #1. This well was decommissioned and is no longer connected to the system. It was too close to the sewage system to be used.



The photo above is the photo of a well that was located inside the irrigation/sewage building. The pump was removed from this well and the casing sealed. The well is only about 10 feet deep and was not used except to flush the sewage system.

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FILE NUMBER 63-12305



These photos show the irrigation pump house. The power panel above shows the Hp of the three pumps (3 Hp, 7 1/2 Hp, and 15 Hp). The display shown above shows the irrigation system was operating at 169.1 gpm at the time of the exam. The pressure gauge show the pressure of the system at 74 psi.

The photos below show the irrigation pumps and the piping. The metal lid covers the vault that collects water from a pipeline from the lake. The pumps divert the water in the vault to the irrigation system.

3 Hp Pump

7.5 Hp Pump

15 Hp Pump



Vault lid and vault.

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The picture above left shows the point of diversion from the Pioneer Canal into the the pond. The diversion goes through the screened headgate and into a coragated black pipe. In the photo above right, you can see a picture of the outflow of the canal diversion. The wing wall in this photo shows the location of the intake pipe shown in the picture below.



Please Note: We could take a picture of the waste water outflow pipeline. It was further out in the pond, and the pictures of the pipeline did not turn out. You couldn't see the pipe, just water.

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These photos show the waste water treatment facility. The blue tank is the solid waste separator and the tubes against the wall are different types of clarification screens and systems. The picture on the bottom right shows the readout of the rate of flow of water that was being treated at the time we were in the facility.

