

From: [Burck, Peter](#)
To: [Harden, Tasha](#)
Subject: Re: San Bernardino NWR - Water Update
Date: Thursday, April 23, 2020 12:37:57 PM

Hi Tasha,

Yes, please. That would be very helpful. Much appreciated.

Peter

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From: Harden, Tasha <Tasha_Harden@fws.gov>
Sent: Thursday, April 23, 2020 12:31 PM
To: Burck, Peter <peter_burck@fws.gov>
Subject: Re: San Bernardino NWR - Water Update

Thanks Peter, are you the one tasked with the final report on the refuge's minimum amount of water needed? If would it help at this point if I sent you our document showing pond volume calculations and our recommended/preferred gpm pump size for all the wells?

Tasha Harden
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From: Burck, Peter <peter_burck@fws.gov>

Sent: Thursday, April 23, 2020 9:47 AM

To: Harden, Tasha <Tasha_Harden@fws.gov>

Subject: Fw: San Bernardino NWR - Water Update

Peter Burck

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From: Burck, Peter <peter_burck@fws.gov>

Sent: Thursday, April 23, 2020 9:52 AM

To: Harris, Grant <Grant_Harris@fws.gov>; Broska, James <james_broska@fws.gov>; Reagan, Steve <steve_reagan@fws.gov>; Fernandez, Juliette <juliette_fernandez@fws.gov>; Radke, Bill <bill_radke@fws.gov>; Sesnie, Steven <steven_sesnie@fws.gov>; Stewart, David R <david_stewart@fws.gov>; Kundargi, Darrell <darrell_kundargi@fws.gov>; Baca, Joaquin <Joaquin_Baca@fws.gov>

Subject: Re: San Bernardino NWR - Water Update

Hi Grant,

Thank you for the addition. Done

- 1) Review and adjust agenda
- 2) Overview of Statistical Analysis of Glenn Well Pumping and Mitigation Well water pressures (Randy)
- 3) Any Conclusive Findings we can report so far/Potential Recommendation(s) to Border Patrol regarding Glenn Well pumping rate and timing (Group)
- 4) Summary Overview as to what is being observed for filling ponds & any effects that has had

- on fish management (Bill)
- 5) Summary of Ariel's Water Rights Analysis (Joaquin/Group)
 - 6) Summary Report Status (Joaquin)
 - 7) Status of Ongoing Data Collection Effort (Bill/others)
 - 8) Monitoring Equipment Delivery and Installation Status / Equipment Needs (Darrell)
 - 9) Pond Water Budget Analysis for Selected Ponds for Quantifying Federal Reserved Water Right (Peter)
 - 10) What gaps do we have in any of the above items? (Group)
 - 11) Other
 - 12) Action Items
 - 13) Schedule Next Meeting

Peter

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From: Harris, Grant <Grant_Harris@fws.gov>

Sent: Thursday, April 23, 2020 9:48 AM

To: Burck, Peter <peter_burck@fws.gov>; Broska, James <james_broska@fws.gov>; Reagan, Steve <steve_reagan@fws.gov>; Fernandez, Juliette <juliette_fernandez@fws.gov>; Radke, Bill <bill_radke@fws.gov>; Sesnie, Steven <steven_sesnie@fws.gov>; Stewart, David R <david_stewart@fws.gov>; Kundargi, Darrell <darrell_kundargi@fws.gov>; Baca, Joaquin <Joaquin_Baca@fws.gov>

Subject: Re: San Bernardino NWR - Water Update

Thanks Peter. It's a good agenda. I would like to add, perhaps between #3 and #4, a summary overview from San Bernardino as to what is being observed for filling ponds & any effects that has had on fish management since last group meeting.

Grant

From: Burck, Peter <peter_burck@fws.gov>

Sent: Wednesday, April 22, 2020 3:35 PM

To: Broska, James <james_broska@fws.gov>; Reagan, Steve <steve_reagan@fws.gov>; Harris, Grant <Grant_Harris@fws.gov>; Fernandez, Juliette <juliette_fernandez@fws.gov>; Radke, Bill <bill_radke@fws.gov>; Sesnie, Steven <steven_sesnie@fws.gov>; Stewart, David R <david_stewart@fws.gov>; Kundargi, Darrell <darrell_kundargi@fws.gov>; Baca, Joaquin <Joaquin_Baca@fws.gov>

Subject: San Bernardino NWR - Water Update

Hi Everyone,

For our meeting tomorrow, we'd like to propose the following draft agenda. This list incorporates items Juliette provided in her 4/9 invitation. Please send me any additional items, comments or revisions.

- 1) Review and adjust agenda
- 2) Overview of Statistical Analysis of Glenn Well Pumping and Mitigation Well water pressures (Randy)
- 3) Any Conclusive Findings we can report so far/Potential Recommendation(s) to Border Patrol regarding Glenn Well pumping rate and timing (Group)
- 4) Summary of Ariel's Water Rights Analysis (Joaquin/Group)
- 5) Summary Report Status (Joaquin)
- 6) Status of Ongoing Data Collection Effort (Bill/others)
- 7) Monitoring Equipment Delivery and Installation Status / Equipment Needs (Darrell)
- 8) Pond Water Budget Analysis for Selected Ponds for Quantifying Federal Reserved Water Right (Peter)
- 9) What gaps do we have in any of the above items? (Group)
- 10) Other
- 11) Action Items
- 12) Schedule Next Meeting

On the topic of the pond water budget analysis for the purpose of quantifying the refuge's federal reserved water right, please review the attached draft analysis for selected ponds. The analysis includes numerous assumptions, so I am requesting feedback on the validity and reasonableness of these assumptions. I intend to include the remaining ponds soon.

If you have questions or comments, please let me know. Thank you.

Peter

San Bernardino National Wildlife Refuge

Draft Pond Water Budget Analysis for Selected Ponds

April 22, 2020

The purpose of this analysis is to quantify the refuge's federal reserved water right by estimating the water budget associated with each pond in the absence of influence from off-refuge pumping.

Draft Results for Selected Ponds(These are the ponds I was asked to address first)

Table 1: Draft Pond Water Budgets for Selected Ponds. All values are in gallons per minute (gpm).

	Inflow		Outflow		
Pond Name	Inflow from Well	Precipitation	Infiltration	Evaporation	Overflow
Bunting/North	20	0.19	6.3	1.2	13
Hay Hollow	10	0.28	4.7	1.7	3.9
Mitigation	-	-	-	-	-
Twin	80	0.28	6.7	1.7	72
Hackberry	70	1.4	46	8.6	17

Assumptions

1. The primary assumption is that **pond inflows generally balance and equal pond outflows**.
2. Pond inflows consist of two components: inflow from the supply well and a small amount of precipitation falling on the pond.
3. Pond outflows consist of three components: infiltration, evaporation and overflow from the pond.
4. The equation, then, is: Inflow from Well + Precipitation = Infiltration + Evaporation + Overflow
5. I solved for overflow because I have estimates for the remaining elements.
6. Values used are averages that do not take seasonality into consideration.
7. In the absence of evapotranspiration (ET) data, the calculation includes only evaporation for now (any thoughts on appropriate ET data sources?)
8. Infiltration is estimated from a range of values reported in the Yaqui Pond Memo (Tashjian 2017)

9. Precipitation is estimated based on pond size and 30-year Parameter-elevation Regressions on Independent Slopes Model (PRISM) normals (800 m 1981-2010)
<http://www.prism.oregonstate.edu/>
10. This analysis does not explicitly consider larger amounts of water that would likely be required during initial pond filling or refilling.
11. Evaporation is estimated from Tashjian (2017).
12. In general, overflow is an amount of water needed to provide flow downstream of the pond outlet works.
13. Generally, the amount of water needed for the federal reserved water right may be less than or equal to the amount of flow supplied by the well. For example, in the case of Bunting Well/North Pond, I'm assuming that the overflow is used to keep the 300 foot by 15 foot *surface water flow at Bunting wet* (Pond Dimensions and Depth spreadsheet). The depth of this surface water is not given. I assume it's fairly shallow (in the 1-3 foot depth range). The 13 gpm overflow may be fully consumed or it may represent some excess. Assuming these values are all reasonable, the minimum amount of water needed for the federal reserved water right at this location is somewhere in the 15 gpm to 20 gpm range.

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