WOODY Jennifer L * WRD

From: Haney, Jeremy NFG NG ORARNG (USA) <jeremy.haney2.nfg@army.mil>
Sent: Monday, April 1, 2024 11:45 AM
To: WOODY Jennifer L * WRD
Cc: CLEMENTS Allen * DEQ; FARRIS Ann M * DEQ; Leeper, Mark S CIV USARMY HQDA (USA); Kelly Toynton; Leake, Benjamin
Subject: RE: Review process for Umatilla Depot Artificial Recharge Limited License-1964 application and model

Hi Jen,

OMD has reviewed the *Umatilla County Central Area Artificial Recharge Project* Limited License Application and accompanying *Numerical Groundwater Modeling to Evaluate the Effect of Artificial Recharge on a Groundwater Pump and Treat System, Former Umatilla Army Depot, Umatilla County, Oregon.* While the AR project could benefit to the Ordnance Aquifer and the area, there is insufficient information to fully assess potential negative impacts to the Explosive Washout Lagoon remediation project. OMD has the following questions and comments:

Umatilla Artificial Recharge Application Comments

1) General: the application is over 1,000 pages and the PDF is not properly bookmarked, which makes review unnecessarily difficult.
2) Application / Section 1.2: The application is for 90,000 acre-feet (AF) per year. Assuming this is divided equally over 5 years of the permit, 18,000 AF per is much more infiltration than the modeled 5,000 AF per year. The limited license should be reduced to the maximum modeled infiltration rate of 5,000 AF per year. The "Maximum and instantaneous rate" rate should be reduced accordingly to 12 cubic feet per second (cfs) to prevent infiltration rates exceeding the modeled rates (e.g., infiltration at 45 cfs would reach the annual allotment of 5,000 AF in 56 days rather than 7 months and have a very different effect on the aquifer than infiltrating 5,000 AF over 7 months.). Authorized water withdrawal volume and rate may be increased if initial monitoring and supplemental modeling show there is no adverse effect on the EWL remediation system. "Under the current artificial recharge and groundwater pumping regime, water levels in the Ordnance Gravel aquifer are relatively stable" (OWRD, 2021, Critical Groundwater Area Three Year Review). This means that if the AR project does have a negative effect on the Explosives Washout Lagoon (EWL) Plume, hydraulic containment will be lost until groundwater levels decline to present ones or the EWL remediation system is expanded at great expense to the permit holder.
3) Section 3.2.1/Figure 3 / Figure 4: Many boring logs from wells along cross sections A and B were not used to create Figures 4. Please include summaries of why boring logs closer to the cross sections not selected and boring logs further from the cross sections were utilized. Accuracy of the north end of cross section A is suspect due to the lack of data points and distance of wells from the cross section. The term "trough" is a misleading. With vertical exaggeration removed from the cross section, the "trough" is much more akin to a broad low rather than a steep sided trough.
4) Section 3.2.2/Figure 6: It does not seem appropriate to merge depth to groundwater data from February and April for the purpose of groundwater elevation contouring. Figure 7 indicates the greatest change in groundwater elevation in the Ordnance Gravel Aquifer typically occurs between February and April. Merging groundwater elevation data from February and April has a high potential to mix near seasonal low elevations with near seasonal high elevations. Please provide the rationale for blending groundwater elevation data from different seasons or provide evidence groundwater elevation rebound did not occur during between synoptic groundwater level monitoring events. Also, why were more recent data not used? Was data from 2016 determined to be representative of the past 7 years?

5) Section 4.1: The Mounding Analysis indicates groundwater mounding of only 3 feet when 5,000 AF of water recharge of 120 days, however, the numerical groundwater model indicates mounding of over 9 feet in the vicinity of the recharge basin when 5,000 AF of groundwater recharge over seven months (210 days). Groundwater elevation is modeled to rise over 3 feet about 1 mile from AR basins during the 7-month AR period, but it's not clear if this is average in maximum groundwater elevation increase. Please explain the difference between the Mounding Analysis and numerical groundwater model, it seems the hydraulic conductivities assumed in this section are too high.

6) Section 5 and Section 5.2.3: What is the extent the AR project "will improve the quality of native groundwater?" Has the groundwater mixing zone been modeled to assess groundwater improvement as dilution or is the improvement assumed for groundwater users in the immediate vicinity of the AR project? Is the improvement limited to dilution near the recharge basins or is there a component of native groundwater displacement by source water? If displacement occurs, how will this affect water quality of wells further from the AR project? Are there contaminants in groundwater, other than the explosives being addressed by the Explosives Washout Lagoon (EWL) remediation project, which could migrate to new areas or water users as a result of the AR project?

7) Section 6.1: Is only one year at the 5,000 AF rate sufficient to determine the effects on the EWL remediation project? What is the basis for this determination? This suggests groundwater elevations will return to pre-AR project elevations during non-AR infiltration months (e.g., starting from the current base elevation every year with no influence from the previous year of AR operation). However, the Mounding Model indicates groundwater elevation near the recharge basin will not return to pre-AR elevations after one year from

8) Section 6: Information regarding infiltration basin maintenance not provided. What is the anticipated Columbia River sediment accumulation rate? How often will the basins be tilled or rejuvenated to maintain infiltration rates? If accumulated sediment needs to be removed from the AR basins, it must me analyzed for PFAS, among other chemicals with potential to be present in source water or sediment, prior to removal to prevent distribution or improper disposal. When not in use, vegetation will grow within the basins and require removal. OMD strongly objects to the use of herbicides and/or pesticides in the basins since residuals will be washed into the aquifer. Although residual amounts will be small and the many gallons of water will help dilute the concentrations, this will be ongoing. It is also important to consider that a little bit here or a little bit there has already caused a basin wide issue for other contaminants such as nitrate.

9) Section 6.2: How was the recharge area initially selected? Are there plans to reassess the infiltration basin location now that the numerical groundwater model indicates the aquifer has much higher conductivity less than one half mile to the south?

10) Section 7.1: Due to the sensitivity of the EWL remediation project, monthly usage/infiltration volumes must be reported quarterly to USACE and OMD to allow the ability to compare groundwater table response in relation to AR infiltration.

11) Table 7: Manual frequency must be updated to quarterly manual measurement (Quarter 2 and 4 to be completed by USACE contractor, Quarters 1 and 3 to be collected by Permit holder) and to add the following EWL (USACE) wells:

4-163	MW-26	MW-29	006	67-1
4-113	WO21	47-3	4-4	4-5
4-6	4-124	4-25	4-119	4-125
4-122	4-123	4-161	4-160	47-2
4-3	008	4-7	MW-28	4-135
TBD – any of the approximately 5 wells to be installed during the upcoming focused feasibility study if any are in preferred locations.				

12) Section 7.3: This section does not include the need to monitor the effects of the AR project on the EWL remediation. There is potential for the AR project to cause migration of explosives at the EWL beyond the EWL groundwater

extraction and treatment system (GETS) capture zone, which would open the AR Permit Holder to CERCLA liability. Groundwater monitoring must include explosives identified at the EWL including:

- 2,4,6-trinitrotoluene (TNT)
- hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
- octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (commonly referred to as high melting explosive, octogen, or HMX)
- 2,4,6-tetranitro-N-methylaniline (tetryl)
- 2,4-dinitrotoluene (2,4-DNT)
- 2,6-dinitrotoluene (2,6-DNT)
- 1,3,5-trinitrobenzene (TNB)
- 1,3-dinitrobenzene (DNB)
- Nitrobenzene (NB) (occurring as either impurities or degradation products of TNT)

Groundwater monitoring for explosives at selected wells must be conducted quarterly to identify potential migration in a timely manner. USACE (EWL) wells are already sampled twice per year, but the permit holder needs to be responsible for sample collection during two additional quarters, quarterly reporting (monthly AR usage/infiltration volumes, and for Q1 and Q3: groundwater sample analytical data, explosives plume maps, groundwater elevation contours, assessment of potential plume migration), and coordinating with USACE and OMD. See comment regarding Table 7 for a tentative list of wells to be sampled. The number and locations of wells to be sampled have not yet been finalized but must be sufficient to identify potential contaminant migration primarily to the west/northwest as well as southwest and north. Groundwater monitoring well locations used to assess potential EWL plume migration during AR project extraction will be selected once the extraction point(s) is identified. Due to the lag time between infiltration and aquifer response, groundwater monitoring is required during all four quarters regardless of AR project operation.

A 2023 Site Inspection identified two locations within the modeled area and down gradient from the AR infiltration basins where PFAS is present in groundwater. AR project source water analysis (Group A and Group B) must include PFAS using method TBD (likely 1633 but potentially 8327 or both 357.1 and 533 – method to be updated to current accepted PFAS analytical method) to identify the potential PFAS contribution to groundwater from the AR project or ensure the AR project Permit Holder does not get identified as a PFAS source or Responsible Party if a PFAS remediation is required. Source water samples must be collected for analysis during two consecutive quarters during the AR operational period.

13) Table 8: Add the list of nine explosive compounds and 40 PFAS compounds for Method 1633 (or PFAS included with the approved analytical method).

14) Table 9 should be retitled: “Groundwater Quality Monitoring Plan.” Groundwater monitoring will be required for the duration of the AR project or until the EWL plume has been remediated. Groundwater sample collection frequency may be adjusted over the life of the project with approval.

15) Table 9: Because monitoring the effects of the AR project on the EWL remediation was not considered in section 7.3, the selected wells are insufficient to assess potential migration of explosives in groundwater as a result of the AR project. The number and locations of wells to be sampled must be sufficient to identify potential contaminant migration primarily to the west/northwest as well as southwest and north during infiltration. The following list of wells may not be complete, and wells will be added or removed based on aquifer response to the AR project. Table 7 must be updated quarterly manual measurement (Quarter 2 and 4 to be completed by USACE contractor, Quarters 1 and 3 to be collected by Permit Holder) and to add the following EWL (USACE) wells:

006	008	4-111	4-112	4-113
4-114	4-116	1-131	1-135	4-148

4-158	4-160	4-163	4-4	67-1
MW-26	MW-29	WO22	WO23	WO24
TBD – any of the approximately 5 wells to be installed during the upcoming focused feasibility study if any are located where they may aid in detection of potential AR-caused plume migration.				

Groundwater sample collection will likely be required at addition wells after groundwater extraction locations and rates are determined. Additional wells will be selected during the review process after modeling groundwater extraction.

16) Section 8: In addition to the annual report, monthly usage/infiltration volumes must be reported quarterly to USACE and OMD for the duration of the AR project. Quarterly groundwater monitoring results for Quarter 1 and Quarter 3 will be submitted to the USACE and OMD by with 45 days after the end of the quarter. Quarterly reports will include groundwater and source water sample analytical results, explosives plume maps, groundwater elevation contours, and a general assessment of explosives in groundwater migration potential.

Umatilla Artificial Recharge Model Comments

17) General: The model is insufficient to confirm:

- The Artificial Recharge (AR) project will benefit the entire EWL remediation project.
- The AR project will not adversely affect the EWL remediation project during initial AR rate or later planned potential AR rate increases.
- Future groundwater extraction resulting from the AR project will not adversely affect the EWL remediation project. Including future planned or potential groundwater extraction rates and locations, even if only representative rates and locations are modeled.

18) General: Will this model be revised or updated in response to comments?

19) General: A focused feasibility study is underway which could result in selected infiltration fields, installing one or more new infiltration field, installing new extraction wells, or all of the above. If changes are made to the infiltration field locations (or infiltration rates per location) or the extraction wells are installed, additional modeling will be required.

20) Section 1.1: If approved, infiltration rates greater than 5,000 AF per year will require additional modeling, review, and approval.

21) Section 1.2: RDX, TNT, and DNT are not the only explosives of concern at the EWL. As groundwater elevation rises in response to the AR project, any or all of the nine explosive compounds associated with the EWL remediation could dissolve into groundwater if present in the vadose zone. In addition to the two EWL infiltration fields, three other infiltration fields/lagoons are available to the EWL project.

22) Section 2.1: Groundwater elevation data is available for the model simulated years (2018 to 2022) in the vicinity of the EWL. How do the modeled groundwater elevations and elevation contours compare to measured elevations and interpreted groundwater elevation contours?

23) Table 2: Is the Columbia River stage elevation = surface elevation? If so, is a River Bottom Elevation of 257 feet correct? This seems like the Columbia River is only 9 feet deep.

24) Table 3: Pumping and infiltration rates should be balanced (all extracted, treated groundwater discharges to the infiltration fields), but the infiltration rate is roughly 50% of pumping. How does the missing infiltration volume affect the model in the vicinity of the plume?

25) Section 2.4. The model is not well calibrated in the vicinity of the EWL where there is potential for westward plume migration resulting from the AR project. The average calibration error of 15.1% is 50% greater than the "rule of thumb" of 10%, which seems to be more than "slightly" over. Calibration errors less than 5%, or even less than 1%, are usually attainable. While the model is well calibrated at some off-property wells, such as MORR51990 (Figure A-

9), seasonal variation is averaged out at all EWL wells in the area of interest (Figures A-1 and A-3 through A-8) with the possible exception of 4-116 (Figure A-2). If the average calibration relative error is 15.1%, which includes good calibration at off-property wells, then the relative error within the area of interest, at EWL wells, is greater than 15.1%.

26) Figure 2: What do the Recharge Scenario modeled groundwater elevation contours represent? Are they the maximum elevation after 7 months of infiltration or the average groundwater elevation during the AR infiltration window? What is the lag time for AR infiltration to reach the western extent of the EWL plume (e.g., for how many days/months after recharge ends will the groundwater elevation continue to rise / gradient continue to increase at the western edged of the EWL plume?). Is IF-3 no longer within the capture zone or does the Recharge Scenario not include infiltration at IF-3?

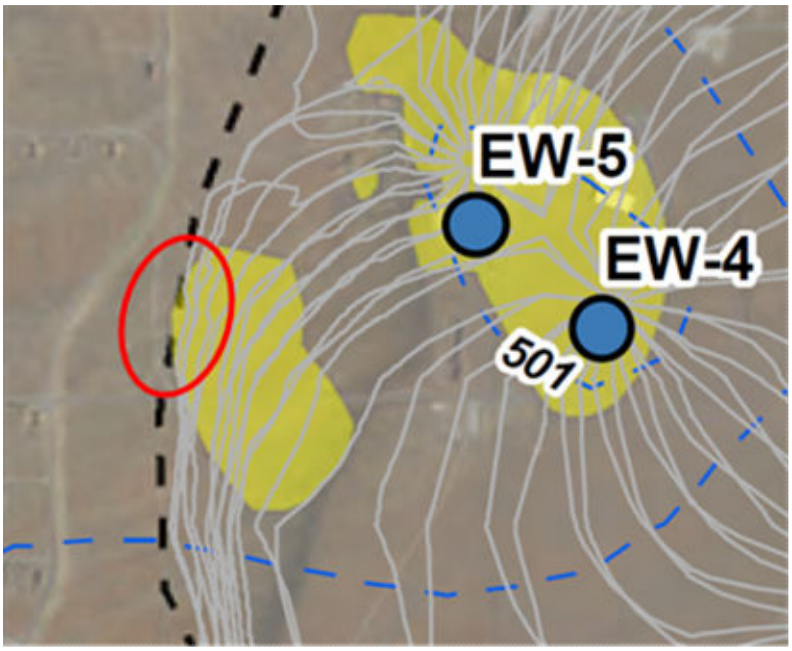
27) Figure 3: Figure 3 indicates the hydraulic conductivity at in the vicinity of the EWL wells is in the 7,000 feet/day to 10,000 feet/day range, which is considerably greater than hydraulic conductivities documented in the EWL area during the 1992 RI, which ranged from approximately 500 feet/day to 2,700 feet/day. Where does the high (+9,000 feet/day) hydraulic conductivity come from? Is that from the model or is it supported by well/log data? Where was Task 1 field investigation conducted and are those locations representative of the EWL area?

28) Figure 3: While helpful for the project as a whole, a figure telescoping into the area around the EWL plume, associated extraction wells, and AR infiltration pond using smaller cells to increase resolution would be helpful to determine if the plume remains within the modeled capture zone during AR. This could reduce some uncertainty in Figure 2 introduced by large cell size, e.g., the western plume boundary and modeled capture zone are coincident, but smaller cell size could confirm the plume boundary is within the modeled capture zone.

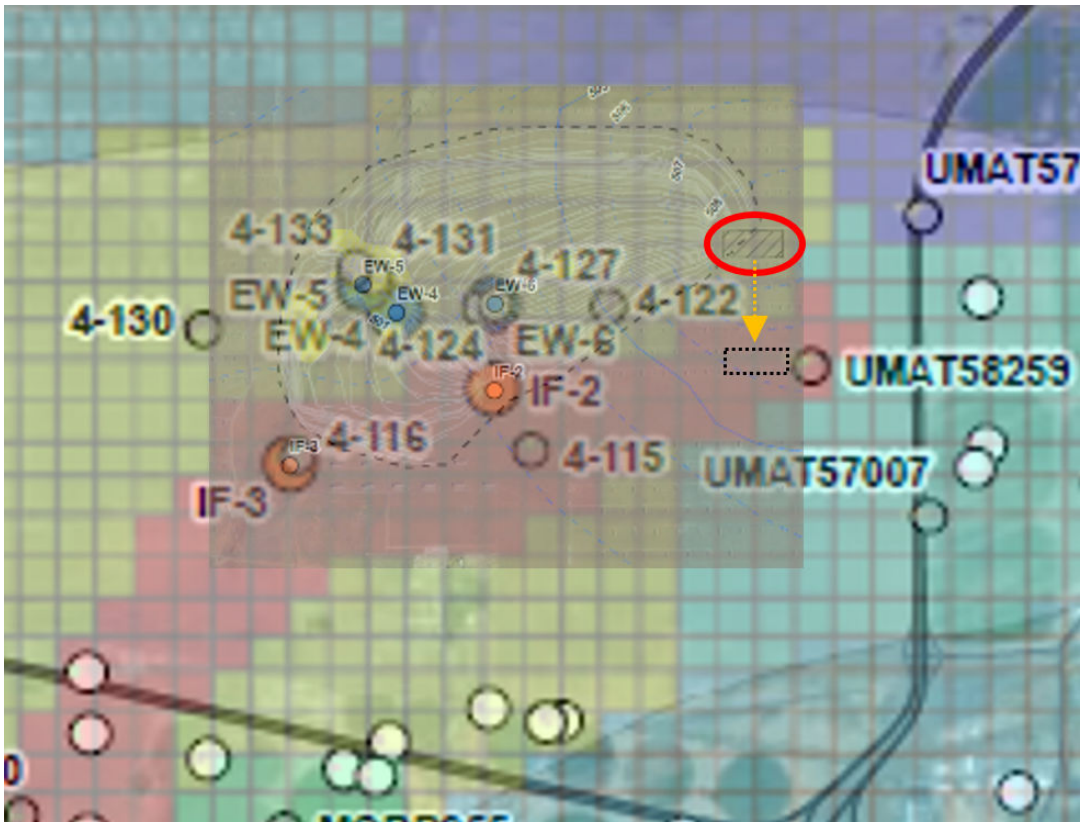
29) Section 2.5: The artificial recharge period does not match the “in water work” months. Does the Model assume a constant artificial recharge rate (714.3 AF per month or 12 cfs)? If the artificial recharge period is reduced to match the “in water work” period, the model must be rerun if the artificial recharge monthly/daily rate increases to maintain 5,000 AF per year over a shorter artificial recharge period or the total infiltration volume must be reduced so the modeled monthly AR rate is not exceeded (e.g., if artificial recharge period is reduced to five months and the annual artificial recharge volume is reduced to 3,571 AF per year (12 cfs), the model would not require an update.).

30) Section 3: The results do not indicate if existing EWL groundwater monitoring well screen will be submerged as groundwater elevation rises. Based on the current model and recent plume boundary interpretation, the modeled capture zone during artificial recharge of 5,000 AF over 7 months is coincident with, if not inside, the interpreted plume boundary. The EWL extraction treatment system (GETS) was designed for operation where groundwater gradient is essentially flat and is operating at maximum capacity. An increase in groundwater flow gradient could overwhelm the GETS. Given coarse cell size in the EWL area, high modeled hydraulic conductivities, and relatively high calibration error in the EWL wells, the current model cannot state with confidence the AR project will not push the western-most plume further west beyond the capture zone when injecting 5,000 AF over 7 months.

31) Section 4: The groundwater model calibration is greater than 15.1% in the vicinity of the EWL extraction wells and is not sufficiently calibrated to meet objective 4 of this groundwater modeling evaluation. Model resolution within the EWL area is low (each cell is 14.7 acres). The model in its current iteration is not sufficient to evaluate potential the AR project could negatively affect the EWL plume by pushing the plume west beyond the modeled capture zone. Figure 2 suggest the modeled capture zone no longer encompasses the EWL plume during AR (see screenshot below).



32) Relocating the AR project recharge site could reduce the potential for the AR project to cause EWL plume migration beyond the modeled GETS capture zone and potentially allow for higher AR rates after the initial assessment. For example, moving the AR project recharge site approximately 2,000 to feet (roughly 3 model cells) south would allow infiltration into the area of highest hydraulic conductivity, as modeled. Are there plans reevaluate the model with the AR project recharge site at alternate location(s) with higher modeled hydraulic conductivity to assess effects on the EWL? (see screenshots below, for illustrative purposes only. NOTE: because more comprehensive figures were not present in the report, I had to layer screenshots of figures, so positions are approximate. Figure 1 and 3 boundaries matched up as did well locations on Figures 1, 2, and 3).



33) If a permit is issued for the AR project, will OWRD to include "if/then" restrictions into the permit which would trigger pausing the recharge, recalibrating the model, and reducing flow accordingly? The following example restrictions could help provide comfort with the uncertainties in the model:

- Many monitoring wells are screened from approximately 500 ft elevation and may be submerged, based on the modeled 2 to 6-foot rise of the water table during artificial recharge of 5,000 AF over 7 months. IF groundwater rises above (predetermined elevations TBD) at selected wells (TBD), THEN artificial recharge must be halted to recalibrate the model and reassess allowable AR rates.
- IF the artificial recharge period decreases to less than 7 months, THEN the infiltration volume and rate must be scaled back to maintain the modeled monthly artificial recharge rate. Assuming 5,000 AF over 7 months, the monthly artificial recharge is 714.3 AF per month (23.8 AF per day).

Modeled Volume (acre-feet)	Months Operating	Modeled Volume/Month (acre-feet)	Annual Infiltration (acre-feet)	Infiltration Rate/day (cubic feet per second)
5,000	7	714.29	5,000	12
5,000	**5**	714.29	**3,571**	12

-
- The EWL GETS was designed for operation where groundwater gradient is essentially flat. A substantial increase in groundwater flow gradient could overwhelm the system, which is already operating at maximum capacity. IF the flow gradient at monitoring wells in the vicinity of EW-4 increase by an order of magnitude, THEN artificial recharge must be halted to recalibrate the model and reassess allowable AR rates.
- IF explosives are detected in EWL groundwater monitoring wells to the southwest, west, or northwest of current western plume extent where concentrations have been ND, particularly along the modeled capture zone boundary or outside the capture zone to the west/northwest, THEN artificial recharge must be halted to recalibrate the model and reassess allowable AR rates.

- The EWL GETS is operating at capacity, and the extent of explosives in groundwater at the EWL has been stable within the GETS capture zone for over 20 years. IF the artificial recharge project causes the explosives in groundwater at the EWL to migrate to monitoring wells outside the capture zone, THEN the Permit Holder will be liable under CERCLA to cover all costs associated with expanding the EWL capture zones. Costs may include but are not limited to additional environmental investigation to achieve groundwater delineation, extraction well(s) installation (drilling, pump(s), piping, electrical, telemetry, vaults, etc.), management, any regulator review/oversite costs (DEQ/EPA), engineering and design costs, project management, and any and all design/installation/upgrades to the current GETS potentially necessary to increase capacity to maintain adequate capture zone at the EWL.
- IF new extraction wells and/or infiltration fields are installed OR significant changes are proposed/made to extraction and/or infiltration rates and locations, THEN the groundwater model must be updated to ensure the AR project does not adversely affect EWL plume capture.
- IF the eastern plume is sufficiently remediated and EW-6 operation is no long necessary, which allows higher pumping rates at wells west of EW-6, THEN the model can be reevaluated using the new extraction rates to determine if AR annual rates can be increased.

34) Additional permit conditions:

- EWL groundwater monitoring for explosives is currently conducted during the second and fourth quarters. The permit holder is required to collected groundwater samples from wells (to be determined with input from USACE and their contractor, but likely to the southwest, west, northwest, and north of the current explosives plumes) for laboratory analysis for explosives associated with the EWL:
    - 2,4,6-trinitrotoluene (TNT)
    - hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
    - octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (ococtogen / HMX)
    - 2,4,6-tetranitro-N-methylaniline (tetryl)
    - 2,4-dinitrotoluene (2,4-DNT)
    - 2,6-dinitrotoluene (2,6-DNT)
    - 1,3,5-trinitrobenzene (TNB)
    - 1,3-dinitrobenzene (DNB)
    - Nitrobenzene (NB)
- The artificial recharge rate is expected to start at 5,000 AF over a 7-month period (714.3 AF per month) but may potentially increase up to 18,000 AF over a 7-month period. Artificial recharge rates cannot exceed the modeled monthly rate without written authorization from OWRD. Any increase of artificial recharge rates exceeding the modeled monthly rate (currently 714.3 AF per month) must be requested in writing and must be accompanied by an updated numerical groundwater model. At least two rounds of EWL groundwater data collected after the most recent artificial recharge rate increase must be incorporated into / compared to the update numerical model. The updated model will be reviewed by relevant agencies (OWRD, DEQ, USACE, OMD, EPA, Tribes, etc.) prior to potential approval.
- At least two rounds of EWL groundwater monitoring data collected after the prior AR infiltration rate increase (or initiation) must be available for review prior infiltration rate increase approval.
- Prior to allowing groundwater extraction in the vicinity of the AR project and EWL remediation project, the groundwater model must be updated and reviewed and an as part of the groundwater extraction permit application process.

Jeremy Haney, R.G

(He / Him)
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Subject: Review process for Umatilla Depot Artificial Recharge Limited License-1964 application and model

Hi all,
After consulting with OWRD managers, I propose the following review and process timeline:

1. WRD is seeking written comments from agencies by March 31, 2024. Provide comments, if you choose to do so, to myself in whatever format is convenient. Feel free to include technical comments and recommendations about action on the application. We have the ability to approve the application, issue with conditions, or deny the application. Please let me know if this timeline is not feasible.
2. In early April I will set up a meeting with agency commenters to discuss the applications and comments.
3. We will provide feedback to the applicant and request additional information as needed. This will be in writing and likely a meeting with the applicant and/or their agent to go through the comments and discuss.
4. We may need to iterate through these steps to get the application, monitoring plan, etc to a version agencies consider complete and can make a decision upon.
5. We plan to act on the application by December 2024, as described in our pre-application meeting; anticipating a year to get through the steps to approval or denial.

There was a proposal from the County and GSI to convene a technical advisory committee. OWRD does not plan to do that, rather we will follow the usual AR LL application review process as outlined above. Let me know if you have any questions, or you are aware of another agency staff person who has not received the application materials and needs them.

Application materials and model report are available here under scanned documents: https://apps.wrd.state.or.us/apps/wr/wrinfo/wr_details.aspx?snp_id=223823
The GW model files will require separate access, contact me if you need them.

Thanks very much,
Jen

Jen Woody, RG
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From: WOODY Jennifer L * WRD
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Subject: GW Model and Model report for Umatilla Depot AR LL-1964

Hi all,
We received addendums to application AR LL-1964 and they are now available for your review. You will find the numerical groundwater model report and a separate folder of files containing the numerical model and associated files. The application itself is available here: https://apps.wrd.state.or.us/apps/wr/wrinfo/wr_details.aspx?snp_id=223823

I've had a hard time wrangling these files, so let me know if you are unable to access them or are otherwise foiled in you attempt to download them.

Once you've gotten the files, think about your workload and a feasible timeline for review and comment. Then let me know when you are shooting to get comments back to me on this application. I'm seeking advice in my agency re capacity to review and timelines, and will keep you posted as I know more.
Thanks very much.
Jen

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