

Memo

To: Jen Woody (OWRD)
From: Phil Richerson
Date: 04/19/2024
Subject: Limited License Application AR LL-1964



State of Oregon
Department of
Environmental
Quality

Water Quality Program
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DEQ has reviewed the limited license application AR LL-1964 and offers the following comments. Please let me know if you have any questions about DEQ's comments.

Summary - DEQ supports the concepts of Aquifer Storage and Recovery (ASR) and Artificial Groundwater Recharge (AR) to help address groundwater quantity issues and possibly groundwater quality issues under the right circumstances. The proposed location appears to be a good location for a recharge project based on the permeable surficial sediments and nearby infrastructure. DEQ's concern is that the proposed location may not be the right location for a recharge project given the potential for water quality issues. In addition to potential water quality concerns, the interpretation of the site's hydrogeology is unorthodox, and the digital groundwater model submitted as part of the limited license application does not adequately represent observed groundwater levels and flow directions.

A primary water quality concern is the project's location adjacent to the Umatilla Army Depot Lagoons National Pollutant List (NPL) site and the associated groundwater contamination operable unit and the ongoing investigations of emerging contaminants of interest. It is important to ensure that a recharge project does not interfere with the NPL site because the Department of Defense along with state and federal agencies have spent significant money and effort to control and remove contamination in the groundwater.

The interpretation of the site's hydrogeology highlights another water quality concern. Specifically, the possible connection of the alluvial aquifer and the deeper basalt aquifer(s) through an "erosional window", where the Missoula Floods eroded down through the Alkali Canyon Formation and the uppermost basalt flow into deeper basalt flows then filled the scoured hole with sediment. The direct connection of sediments with basalt interflow zones provides the potential for hydraulic connection between the aquifers. A monitoring well installed approximately 0.6 miles east of the proposed recharge site (cited in the Limited License Application) documents an erosional window. Well RMW-3 (located at the proposed recharge site) also appears to be located in the erosional window.

In addition to water quality concerns, DEQ finds the groundwater model provided does not accurately represent observed alluvial aquifer water levels and flow directions. Finally, the proposed analyte list and sampling frequency is inadequate.

Given these concerns, it is still possible that with enough planning, monitoring, oversight, and active control the project could be implemented without causing detrimental water quality issues. DEQ's specific comments on the conceptual model, groundwater model, and water quality monitoring are provided below.

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CONCEPTUAL MODEL COMMENTS – Several statements in the application, along with differences between the geologic cross section A-A’ presented in the pre-application meeting (i.e., the first cross section) and the one included in the limited license application (i.e., second cross section) affect the conceptual model of the site. Please describe the new information and/or rationale for these changes to the cross section and conceptual model.

1. *Elimination of Rattlesnake Ridge member* - The Rattlesnake Ridge member is the interbed between the Elephant Mountain Basalt and the Pomona Basalt. The first cross section includes the Rattlesnake Ridge member as a mapped unit, but the second cross section includes a stippled pattern labeled “Interflow Zone” in its place. The stippled pattern is also used in two locations identified as “Flood Deposit Clay Lenses” on the first cross section.
2. *Delineation of Alkali Canyon Formation* – The application describes the Alkali Canyon Formation as consisting of indurated gravels and tuffaceous silts and sands. However, the specific criteria used by the applicant to identify Alkali Canyon Formation is not specified and appears inconsistent. Well UMAT 1545 (located south of the proposed recharge area) showed no Alkali Canyon Formation in the first cross section but was not included in the second cross section. Approximately 25 feet of Alkali Canyon Formation is depicted in its place on the second cross section.

The well log for UMAT 57007 (further south than UMAT 1545) indicates sand and gravel from land surface to 91 feet followed by 39 feet of reddish-brown clay to 130 feet followed by 4 feet of basalt to 134 feet. In the second cross section, the Alkali Canyon Formation at UMAT 57007 was thickened from about 25 feet to about 75 feet to include the entire thickness of the “reddish brown clay” identified on the well log, which also deepens the top of basalt surface at that location by about 30 feet.

3. *Documentation of Erosional Window into Basalt Aquifer* - During the December 13, 2022 pre-application meeting, a slide was shown depicting cross section A-A’ going through the proposed recharge area. It was noted during the meeting that well UMAT 57006 in the cross section depicted an erosional window through the Alkali Canyon Formation, the Elephant Mountain Basalt Formation, the Rattlesnake Ridge member, and into the Pomona Basalt. A copy of the meeting slides provided later that week included a note on the cross section saying “Note that basalt may be locally in hydraulic communication with catastrophic flood deposits (particularly Elephant Mountain member)”.

The second cross section A-A’ shows a similar trough beneath the proposed recharge area but includes well RMW-3 rather than UMAT 57006, and includes a thin layer of Alkali Canyon Formation draped over the erosional window.

Cross section A-A’ contains two wells (UMAT 1542 and UMAT 1547) that are also on cross section D-D’ of Grondin et. al., (1995). Cross Section D-D’ does not depict Alkali Canyon Formation but does depict an erosional window through the Elephant Mountain member into the Rattlesnake Ridge interbed beneath UMAT 1542.

Section 3.2.1 of the LL application acknowledges “an east-west trending erosional and/or structural trough” beneath the study area, and that “the trough appears to have eroded into the Elephant Mountain member of the CRBG, potentially cutting



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down into the underlying Pomona member of the CRBG". That interpretation is consistent with the commonly accepted idea that, where these erosional windows occur, the Missoula Floods scoured out troughs that removed the Alkali Canyon Formation along with the underlying basalt layer(s).

OWRD conducted geochemical analysis of drill cuttings from UMAT 57006 that confirm the erosional window removed the Alkali Canyon Formation, the Elephant Mountain basalt, the Rattlesnake Ridge member, and reached the Pomona basalt.

Please explain the new information or rationale for depicting a thin layer of Alkali Canyon Formation at the bottom of the erosional window in contact with the Pomona basalt.

4. Potential Hydraulic Connection Between Aquifers – The application concludes hydraulic communication between the alluvial aquifer and basalt aquifer is unlikely, and postulates that could be due to a low-permeability Alkali Canyon Formation or the basalt interflow zone locally not being permeable.

The criteria used to identify Alkali Canyon Formation at RMW-3 is not specified or clear. The description of materials encountered from 133.4 to 134 feet below land surface (fbls) and identified as Missoula Flood Deposits is very similar to the description of materials encountered from 140 to 144 fbls but identified as Alkali Canyon Formation:

- Material identified as Missoula Flood Deposits was described as Medium dense, wet, brown, silty GRAVEL (GM), little very fine to fine subrounded to subangular sand, gravel is subrounded to rounded.
- Material identified as Alkali Canyon Formation was described as Medium dense, wet, dark brown to brown, silty GRAVEL (GM), some silt, few fine to coarse subround to subangular sand, gravel is well graded subround to round.

The well log for RMW-3 identifies four feet of silty gravel as the Alkali Canyon Formation, and indicates the well log for UMAT 57531 shows the basalt interflow zone produces 15 gallons per minute. Silty gravel is likely to be permeable. Fifteen gallons per minute is a rate capable of supplying a medium-sized home.

In summary, based on the documentation of an erosional window, the gravelly nature of the sediment in the bottom of the erosional window, and productive interflow zone documented at the proposed site, it is DEQ's opinion that hydraulic communication between the alluvial aquifer and the basalt aquifer is possible and should be assessed.

COMMENTS ON GROUNDWATER MODEL - DEQ offers the following specific comments regarding the construction and potential use of the groundwater model.

1. Appropriate Source Code - DEQ is encouraged to see the use of open-source models in the development of this project (MODFLOW/MODPATH/ModelMuse).
2. Extent of Hydraulic Conductivity in Layer 1 – Figure 3 of the Modeling memo provides discretized hydraulic conductivity values but no landmarks for reference. Please provide a modified figure with appropriate landmarks for reference.



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3. Recharge and Discharge Could Be Better Simulated – The modeling memorandum indicates recharge rates were based on Grondin et al., (1995) and a nearby recharge project. It seems appropriate to build in changes in recharge and discharge to the model such as leaky canals, expected increases in precipitation due to climate change, and potentially increased water use through pumping.
4. Need to Better Address Potential Effects on Nearby Groundwater Extraction and Treatment System – The applicant should consider the use of MODPATH and/or particle tracking to ensure the RDX plume doesn't migrate during operation of the recharge project. RDX has low retardation as compared to other explosives in groundwater (e.g. TNT) and is frequently the primary contaminant of concern with respect to the groundwater plume operable unit.



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A recharge limited license should include conditions specifying required actions if the recharge project affects the groundwater extraction and treatment system (GWET) including specifying the parties responsible for paying for any increased operation and maintenance of the GWET system.

There have been times in the past in which pump failure, filter changeouts, and other issues have resulted in the GWET system being shut down and not operated for a time. A recharge limited license should include a plan for this type of event, including the potential to suspend recharge operations until the GWET system is operational.

Moving forward, the Oregon Military Department (OMD) is responsible for operation and maintenance of the GWET system. State and federal agencies are updating the 1989 federal facility agreement between DoD, EPA, and DEQ to include OMD to the agreement.

The Depot NPL site has a low cleanup value for RDX and aquifer restoration. There have been many discussions of re-evaluating this value and it could be updated or mitigated in the future with a change to the Record of Decision. These discussions have included GWET system shutdown to allow rebounding in source areas, and natural attenuation. A recharge limited license should address these considerations.

5. Inaccurate Baseline Scenario – Figure 6 of the Application shows groundwater elevations from February 2016 (from an OWRD monitoring event) and April 2016 (from an USACE monitoring event) and depicts a regional groundwater flow direction to the northeast in the vicinity of the Lamb-Weston North Farm located adjacent to the northeast corner of the Depot.

Similarly, Figure 2 in the modeling memo shows a baseline scenario model result of a larger area that includes a N-NE trending groundwater divide passing west of the Depot landfill with groundwater flowing generally northeast in the area from the landfill southeast to I-84.

However, these maps are not consistent with observed water levels. Details can be provided upon request but in summary, modeled water levels beneath the Lamb-Weston North Farm and the Depot landfill are as much as 98 feet lower than observed water levels, and modeled groundwater flow direction is opposite of that observed. As such, the baseline scenario used as a reference condition for

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evaluation of the effects of the proposed recharge project is not an appropriate starting point.

WATER QUALITY MONITORING COMMENTS - DEQ offers the following specific comments regarding the proposed groundwater quality monitoring plan.

1. **Analyte List** – In January 2023, DEQ was asked to comment on a proposed analyte list for the project. That list included metals, VOCs, SVOCs, general chemistry analytes, radionuclides, explosives (groundwater only), and general pesticide screen. DEQ agreed with the list and provided rationale for adding the following analytes: total coliform and fecal coliform (commonly found in surface water), sulfate (to allow cation-anion balance calculations and evaluation of general water quality using piper diagrams), and PFAS by EPA Method 1633 (PFAS has been detected at the Depot and elsewhere, and it is essential to have results comparable to EPA's new maximum contaminant levels and other health/risk levels).

Subsequent conversations with the applicant's representative lead to the request being modified so that only the source water be tested for PFAS. The proposed analyte list (Table 8) divides analytes into two groups (Group A and Group B) to be sampled at different frequencies. Table 8 does not include testing for PFAS or explosives.

DEQ continues to have concerns regarding PFAS and other emerging chemicals at the proposed location. On April 10, 2024, EPA announced the final National Primary Drinking Water Regulation for six PFAS. DEQ expects PFAS and explosives monitoring to be a part of the water quality monitoring program of the recharge project.

In addition, DEQ expects a limited license to address how the system would be operated if there are issues with contaminant concentrations in the source water or impacts to groundwater at or near the Depot.

2. **Sampling Frequency** – Table 9 proposes a sampling frequency for the first year of operation. The limited license should include a water quality monitoring plan applicable for the duration of the limited license. It is possible that the analyte list and/or sampling frequency could be trimmed over time, but multiple samples over time are required to adequately characterize source water and receiving water quality.

DEQ has the following comments on Table 9:

- The baseline sampling event should include the full analyte list (i.e., Group B).
- A review of the baseline sampling event results could result in additional analytes being added to Group A.
- TDS should be included in Group A.

3. **Proposed Sampling Locations** – The application proposes sampling occur at three wells (RMW-1, RMW-2, and 4-166) and at the pipe where source water enters the recharge project. Those locations appear appropriate. The application acknowledges multiple groundwater flow directions during the year. Well 4-166 would represent conditions southwest of the recharge site. RMW-1 and RMW-2



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would represent conditions at the recharge site. Due to the fluctuating groundwater flow direction, a well located northeast of the recharge site should be included in the proposed water level and water quality monitoring plan.

Due to the potential for hydraulic connection between the aquifers at the erosional window discussed in the application and documented by well UMAT 57006 (approximately 0.6 miles east of the recharge site) and potentially at RMW-3 (at the recharge site), DEQ requests another monitoring well be installed adjacent to RMW-3 that is open to the Rattlesnake Ridge interbed (i.e., between the Elephant Mountain basalt and Pomona basalt) and the upper few feet of the Pomona basalt, and that both wells be used for both water level and water quality monitoring.

4. DEQ Water Quality Permit - Page 3 of the Application states a DEQ Water Quality Permit is “Not Applicable – Source water does not require a water quality permit from DEQ”. This statement is not correct. OAR 690-350-0120(3)(b) says “The applicant shall attach a copy of the necessary water quality permits from Oregon Department of Environmental Quality, show that the application for necessary permits has been filed, or show that permits are not necessary”.

DEQ has the ability to require a water quality permit if deemed necessary. That decision is made on a case-by-case basis. In the past, DEQ’s water quality concerns have been adequately addressed by the applicant and incorporated into OWRD’s Limited License. DEQ’s recommendations for water quality sampling for this project have not been fully incorporated into the limited license application. DEQ may determine a water quality permit is required for this project.

When issuing water quality permits for existing facilities, concentration limits are based on OAR 340-40 Tables 1 through 3 values (largely mirroring federal drinking water standards). When permitting new facilities (i.e., those permitted after October 1989), concentration limits are based on background concentrations. The proposed recharge project would qualify as a new facility with concentration limits based on background concentrations.

Reference:

Grondin, Gerald H., K.C. Wozniak, D.O. Nelson, I. Camacho. 1995. *Hydrogeology, Groundwater Chemistry and Land Uses in the Lower Umatilla Basin Groundwater Management Area*.



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