

## **APPENDIX K: OHIO EPA COMMENTS**

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Mike DeWine, Governor  
Jon Husted, Lt. Governor  
Laurie A. Stevenson, Director

July 25, 2019

RE: US Army Ammunition Plt RVAAP  
Remediation Response  
Project Records  
Remedial Response  
Portage County  
ID # 267000859036

Mr. David Connolly  
Army National Guard Directorate  
Environmental Programs Division  
ARNGD-ILE-CR  
111 South George Mason Drive  
Arlington, VA 22204

**Subject: Response to Ohio EPA Comments on the "Draft Facility-wide Groundwater Monitoring Annual Report for 2018"**

Dear Mr. Connolly:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the response to Ohio EPA comments on the "Draft Facility-wide Groundwater Monitoring Annual Report for 2018." This document was received via email at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR), on June 10, 2019. The report was prepared by Leidos for the United States Army Corps of Engineers (USACE) on behalf of the Army National Guard Bureau (ARNG).

Ohio EPA finds that all comments from Ohio EPA's April 25, 2019 comment letter have been adequately addressed and are resolved. Please finalize the document with the changes agreed to according to this correspondence.

If you have questions, please call me at (330) 963-1292.

Sincerely,

Kevin M. Palombo  
Environmental Specialist  
Division of Environmental Response and Revitalization

KP/sc

ec: David Connolly, ARNG  
Kevin Sedlak, ARNG, Camp James A. Garfield  
Katie Tait, OHARNG, Camp James A. Garfield  
Craig Coombs, USACE Louisville  
Nathaniel Peters, USACE Louisville  
Rebecca Shreffler, Chenega Tri-Services, LLC  
Mark S. Johnson, Jr., Ohio EPA, NEDO, DERR  
Bob Princic, Ohio EPA, NEDO, DERR  
Liam McEvoy, Ohio EPA, NEDO, DERR  
Thomas Schneider, Ohio EPA, SWDO, DERR  
Carrie Rasik, Ohio EPA, CO, DERR

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JUL 25 2019



**NATIONAL GUARD BUREAU**  
111 SOUTH GEORGE MASON DRIVE  
ARLINGTON VA 22204-1373

June 10, 2019

Ohio Environmental Protection Agency  
DERR-NEDO  
Attn: Mr. Kevin Palombo  
2110 East Aurora Road  
Twinsburg, OH 44087-1924

Subject: Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, RVAAP-66 Facility-Wide Groundwater, Responses to Comments on the Draft Facility-wide Groundwater Monitoring Annual Report for 2018 (Work Activity No. 267-000-859-036)

Dear Mr. Palombo:

The Army appreciates your time and comments (dated April 25, 2019) on the Draft Facility-wide Groundwater Monitoring Annual Report for 2018. Enclosed for your review are responses to your comments. Upon resolution of these comments, the Army will provide a Final version of the report for Ohio EPA concurrence.

These comment responses were prepared for the Army National Guard in support of the RVAAP restoration program. Please contact the undersigned at (703) 607-7589 or david.m.connolly8.civ@mail.mil if there are issues or concerns with this submission.

Sincerely,

David Connolly  
RVAAP Restoration Program Manager  
Army National Guard Directorate

cc: Bob Princic, Ohio EPA, NEDO, DERR  
Mark Johnson, Ohio EPA, NEDO, DERR  
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Craig Coombs, USACE Louisville  
Jay Trumble, USACE Louisville  
Vasu Peterson, Leidos  
Jed Thomas, Leidos  
Gail Harris, Vista Sciences Corporation

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

## Comments

### **Ohio EPA Comment 1: Figure 3-3 of the Draft FWGWMP Annual Report for 2018**

Figure 3-3 in the report appears to depict inaccurate bedrock geology. Although Figure 3.3 is unattributed to a specific source, it appears to be copied from a faulty 2004 Portage Environmental/USACE map that misinterpreted the bedrock geology beneath the facility from the original United States Geological Survey (USGS) and Ohio Department of Natural Resources (ODNR) source documents (e.g., Geology and Ground Water Resources of Portage County, Ohio [Winslow and White, 1966] and Reconnaissance Bedrock Geology of Newton Falls, Ohio Quadrangle [Slucher and Larsen, 1996]). One source of error is likely that the colors used to map the Sharon Member and the Berea Member on the 1966 Winslow and White map are similar. On several previous occasions, Ohio EPA has commented on similar copies of the aforementioned inaccurate map that has appeared in submissions to the Agency. The bedrock geology shown on Figure 3-3 is inconsistent with the geology shown on geologic cross-sections shown in Figures 3-5 and 3-6 of the submitted report, published USGS, ODNR, and other maps and scholarly/professional literature and what is known of site bedrock geology from facility boring and well logs.

First, the key for the rock column on Figure 3-3 is presented as being out of sequence. It incorrectly suggests that the Devonian aged Berea Sandstone (Note: before the late 1980s the Berea was assigned a Mississippian age) is the youngest bedrock beneath the site and that the Mississippian aged Cuyahoga Group occurs between the Pennsylvanian aged Massillon and Homewood Sandstones. By convention, explanation keys on geologic maps present the units from youngest to oldest. The explanation key on Figure 3-3 is confusing because it is out of sequence and does not convey an understanding of the site geology.

Secondly, Figure 3-3 incorrectly shows Berea Sandstone as the uppermost bedrock in three areas along Paris-Windom Road. The geologic map in Winslow and White (1966), shows the uppermost bedrock in those three aforementioned areas as Pennsylvanian aged Sharon Shale.

Thirdly, Figure 3-3 shows the uppermost bedrock in the northeast corner of the facility is mapped as Mississippian aged Cuyahoga Group. However, ODNR's 1996 map (Slucher and Larson) shows the aforementioned area mapped as Pennsylvanian aged Pottsville Group (Sharon). Slucher and Larson (1996) show a small area of Camp Garfield South of the East Group 7 Igloos in Trumbull County where the Devonian aged Berea and Mississippian aged Cuyahoga Group are the uppermost bedrock units. Figure 3-3 does not show the Devonian Berea and Mississippian Cuyahoga Group mapped as such. Currently, there are no FWGWMP/RI wells located in northeast portion of RVAAP, currently Camp James A. Garfield, in Trumbull County to provide any additional site-specific bedrock boring data that would refute the 1996 ODNR mapping.

**Comment 1 Action Item:** Ohio EPA recommends utilizing the more accurate geologic map provided in the approved RI Work Plan (Figure 1-3 from the December 2016 RI Work Plan, as approved by Ohio EPA in March 2017). If it is not used, Figure 3-3 needs to be explained or revised.

**Army Response:** Agree. Attached is a revised Figure 3-3 which reflects what was in Figure 1-3 of the RI Work Plan. Please note that the color scheme has been revised to closely mirror what is in the cross sections in Figures 3-4 and 3-5, and the order in the legend has been revised from youngest to oldest.

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

## **Ohio EPA Comment 2: Section 2.2.1 Monitoring Zone Review and Adjustments**

This section of the report indicates that a comprehensive review of all monitoring well logs was conducted to ensure the correct monitoring zones were identified for each monitoring well. Based on this review, the Army identified 33 wells that were found to have different monitoring zones than what was identified in the 2017 Annual Report. These 33 monitoring zone reassignments are summarized in Table 2-1 of the submitted report. The well logs for 32 of these 33 wells are included in Appendix A of the report (Note: No well log for well BKGmw-20 was included in Appendix A; however, the Army later provided a copy of the missing well log to Ohio EPA). Section 5.4 (Variances from Recent Potentiometric Surfaces) discusses how these re-evaluations of monitoring effect changes to potentiometric map/ground water flow interpretations. There is no discussion in the submitted report on how these re-evaluations might affect the presence or absence of ground water data gaps in the RI.

Ohio EPA agrees with 18 of the re-evaluations including wells BKGmw-20, DA2mw-108, DA2mw-111, LL1mw-063, LL2mw-059, LL12mw-113, LL12mw-183, LL 12mw-186, FBQmw-169, LNWmw-027, LL5mw-001, LL5mw-002, LL5mw-004, LLBmw-005, ASYmw-004, ASYmw-005, ASYmw-006, and ASYmw-009.

Ohio EPA disagrees with the reevaluation of LL2mw-269 as an unconsolidated aquifer well from its original interpretation as an Upper Sharon Aquifer well. Most of the screened interval is in fractured shale. The well log for LLwmw-269 indicates that ground water is encountered near the top of bedrock. Both the unconsolidated sediments and fractured shale in this boring log are generally described as "dry". It is Ohio EPA's experience that these fractured shale wells often appear dry when drilled because the heat of drilling often evaporates the limited water resources in such boring when drilled, but they often yield water given time. This well appears to be properly classified as an Upper Sharon well, although there may be some negligible contribution from the unconsolidated aquifer; however, the unconsolidated aquifer appears to be dry.

The remaining 14 of the 33 wells, all either originally determined to be Upper Sharon Aquifer or Homewood Aquifer wells have been re-evaluated by the Army as unconsolidated aquifer wells. However, these 14 wells appear to be screened across two aquifers: The unconsolidated and either one of three possible bedrock aquifers -the upper portion of the Sharon Member, the Homewood Member, or the Mercer Member. These wells are constructed with 10-foot screens which are anywhere from one to almost seven feet into the upper portions of one of the bedrock aquifers. Additional information would be needed to determine if these 14 wells can be assigned to one aquifer or another or represent a composite of two aquifers. Such information would include potentiometric and piper water chemistry comparisons and other hydrogeologic information. These 14 wells include: LL12mw-189, FBQmw-168, FBQmw-177, LL6mw-003, LL6mw-004, LL6mw-005, LL6mw-007, LL5mw-005, LL5mw-006, LL8mw-006, LL9mw-001, ASYmw-001, ASYmw-002, and ASYmw-003. Further, based on limited information on the well log for the four cross-screened wells LL6mw-003, LL6mw-004, LL6mw-007, and LL5mw-001, it is unclear which bedrock unit these wells are screened into because the logs for these wells provide no description other than "bedrock". All these wells are located on erosional bedrock knobs where the uppermost bedrock might be either the Homewood or Mercer Members.

**Comment 2 Action Item:** The Army needs to discuss how the re-evaluation of these wells affects (or causes) data gaps in the RI. Further re-evaluation of the aquifer placement of these wells as indicated in Ohio EPA's comments may affect potentiometric/flow interpretations in areas of Camp James A. Garfield

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

and may result in the need for additional flow direction delineation wells at elevations consistent with evaluation of the proper aquifer.

Army Response: Clarification and agree. Additional information and an extensive, well-specific evaluation are provided below to further assess the appropriate aquifer in which these wells are to be assigned going forward.

Piper diagrams use the concentrations of the major cations and anions (i.e., magnesium, calcium, sodium, potassium, alkalinity, sulfate, chloride, pH, and nitrate). Available data was reviewed from the wells noted in the comment, and all wells are missing alkalinity and anions. As such, a full Piper analysis cannot be conducted with available data.

**ASYmw001, ASYmw002, ASYmw003:** Groundwater elevations are within ~1 ft of each other and are similar to nearby unconsolidated wells ASYmw-004, -005, and -009. Based on local topography, the variations observed between the cluster of wells is consistent with variations to be expected based on the change in topography and is indicative of wells screened within a similar aquifer zone. Drilling logs for ASYmw-001, -002, and -003 indicate saturated soils above the bedrock, but do not indicate water bearing fractures in the bedrock. It is inferred that the groundwater elevations at ASYmw-001, -002, and -003 represent the potentiometric surface for the unconsolidated zone. *Consistent with the recommendations of the 2018 Annual Report, it is recommended that these wells change designation from Sharon to Unconsolidated.*

**FBQmw-168 and FBQmw-177:** Both wells are located in an area with a cluster of wells; however, there is a topographic relief near the cluster of wells. There are a total of 11 FBQ wells, 5 of which are currently considered in the Homewood. Overall there is little difference between the groundwater elevations at the 11 FBQ wells, which suggests the Homewood and Unconsolidated zones are unconfined and in direct hydraulic communication. Drilling logs for FBQmw-168 and FBQmw-177 indicate saturation in the unconsolidated zones and no water bearing zones identified in the bedrock, supporting the designation as Unconsolidated zone wells. Groundwater elevations at FBQmw-168 are consistent with nearby Unconsolidated wells (FBQmw-176, FBQmw-167, and FBQmw-169). The topographic elevation at FBQmw-168 is similar to FBQmw-176, and the observed groundwater elevations are similar. FBQmw-167 and FBQmw-169 are situated at lower topographic elevations than FBQmw-168, but observed groundwater elevations among the wells are consistent with elevations from an unconfined water table aquifer, particularly considering the topographic setting. FBQmw-177 is adjacent to FBQmw-176, with a lower topographic position (~3.3 ft) but has a 7 ft lower groundwater elevation. The difference in groundwater elevation over a short distance appears anomalous and may be due to geologic constraints or measurement error. The groundwater elevation at FBQmw-177 is more consistent with those observed at FBQmw-166 and FBQmw-167 (both screening in the Unconsolidated), than that observed at FBQmw-176. In general the 'bedrock' and unconsolidated aquifers appear to have the same potentiometric surface, indicative of an unconfined/water table aquifer. There may be geochemical differences in the 'aquifers' but the hydraulic connection is relatively unimpeded. Classification as Homewood or Unconsolidated may be helpful for evaluating geochemistry, but in terms of groundwater gradient and flow direction, there is little value in distinguishing the 2 zones for the purposes of determining hydraulic gradient. That said, based on drilling logs, both FBQmw-168 and FBQmw-177 appear to receive groundwater primarily from the Unconsolidated zone. *Consistent with the recommendations of the 2018 Annual Report, it is recommended that these wells change designation from Homewood to Unconsolidated.*

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

**LL2mw-269:** This well should be classified as Upper Sharon. Although the screen straddles the overburden/shale, the logs indicate the borehole was dry to TD, but the water level later equilibrated to near the top of the screen. The observed GW elevation is more similar to the elevations observed at nearby Upper Sharon wells. *The recommendation in the Draft 2018 Annual Report for LL2mw-269 is recommended to be retracted, and groundwater samples from well LL2mw-269 will be considered from the Upper Sharon aquifer.*

**LL5mw-005 and LL5mw-006:** LL5mw-005 drilling logs indicate groundwater was encountered at approximately 19 ft bgs in material logged as ML and SM. Weathered bedrock was encountered at approximately 26 ft bgs and the borehole was terminated at approximately 27.8 ft bgs. No water bearing zones were noted in the bedrock. Static groundwater was later measured at approximately 19.1 ft bgs, indicative of unconfined/water table aquifer within the Unconsolidated zone. LL5mw-006 drilling logs indicate groundwater was encountered at approximately 18 ft bgs in material logged as ML. Weathered bedrock was encountered at approximately 22 ft bgs and the borehole was terminated at approximately 24.5 ft bgs. No water bearing zones were noted in the bedrock. Static groundwater was later measured at approximately 17.5 ft bgs, indicative of unconfined/water table aquifer within the Unconsolidated zone. There are 6 wells present at LL5, and each display similar groundwater elevations indicative of an unconfined/water table aquifer within the Unconsolidated zone. *Consistent with the recommendations of the 2018 Annual Report, it is recommended that these wells change designation from Homewood to Unconsolidated.*

**LL6mw-003, LL6mw-004, LL6mw-005, LL6mw-007:** Drilling logs for each of these wells indicate groundwater was encountered in unconsolidated sediments several feet above weathered bedrock. Drilling logs do not indicate the presence of water bearing zones within the fractured bedrock. The observed groundwater levels appear consistent with those observed in other Unconsolidated zone wells in the general vicinity. In addition, it is noted that nearby wells LL6mw-008 and LL6mw-009 are located in close proximity to each other, but LL6mw-009 is approximately 20 ft deeper and screened within the Homewood aquifer. The observed water levels at LL6mw-008 and LL6mw-009 are very similar to each other, as well as LL6mw-003, LL6mw-004, LL6mw-005, and LL6mw-007. This observation supports the conclusion that the Unconsolidated zone and Homewood aquifer are in direct hydraulic communication and share the same piezometric surface and may be classified as unconfined/water table aquifers. *Consistent with the recommendations of the 2018 Annual Report, it is recommended that these wells change designation from Homewood to Unconsolidated.*

**LL8mw-006:** The drilling log indicates groundwater was encountered at approximately 17.5 ft bgs and that weathered bedrock was encountered at approximately 18.25 ft bgs. The borehole was terminated at approximately 24.2 ft bgs. No water bearing zones in the bedrock were noted on the drilling logs. Subsequent measurements indicated the static groundwater level was at/near the overburden/weathered bedrock interface. Groundwater elevation observed at LL8mw-006 is lower than the elevations observed at the 5 other LL8 wells; however, there is a small drainage/ephemeral stream near LL8mw-006, and this feature may be hydraulically connected with bedrock fractures and/or preferential subsurface flow paths. When the groundwater elevations from the six LL8 wells are viewed together, they depict a general gradient towards nearby drainage features and appear to be consistent with an unconfined/water table aquifer. It is therefore concluded that the groundwater elevation of LL8mw-006 is representative of the piezometric head in the Unconsolidated zone. *Consistent with the recommendations of the 2018 Annual Report, it is recommended that these wells change designation from Homewood to Unconsolidated.*



Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

**LL9mw-001**: The drilling log indicates groundwater was encountered at approximately 13.5 ft bgs and that weathered bedrock was encountered at approximately 15.5. The borehole was terminated at approximately 22 ft bgs. No water bearing zones were reported in the bedrock, and the competent bedrock was described as having ‘very few fractures’. However, the observed groundwater elevation at LL9mw-001 is consistent with the elevations noted at the 6 other LL9 wells, all of which are classified as Homewood wells. *The recommendation in the Draft 2018 Annual Report for LL9mw-001 is recommended to be retracted, and groundwater samples from well LL9mw-001 will be considered from the Homewood aquifer.*

**LL12mw-189**: The drilling log indicates groundwater was encountered at approximately 8.2 ft bgs in material described as ML and that weathered bedrock was encountered at approximately 17. The borehole was terminated at approximately 18.5 ft bgs. Subsequent measurements indicated static water level at 6.18 ft btoc. No water bearing zones were reported in the bedrock. LL12mw-189 is located near several Unconsolidated zone wells and the observed groundwater elevation at LL12mw-189 is consistent with Unconsolidated zone groundwater elevations in that area. While the borehole may extend into the bedrock, it is inferred that the groundwater elevation is representative of the Unconsolidated zone. *Consistent with the recommendations of the 2018 Annual Report, it is recommended that this well change designation from Homewood to Unconsolidated.*

### **Ohio EPA Comment 3: Section 3.2.7 Cuyahoga Shale**

This section of the report correctly indicates that bedrock incorrectly mapped on the 2004 Portage County Environmental Map as "Cuyahoga Formation" has been mapped by ODNR (Slucher and Larsen, 1996) as Pottsville (likely Sharon). To clarify, the 1996 ODNR Reconnaissance Bedrock Geology of Newton Falls (Slucher and Larsen) shows a small area of Mississippian-aged Cuyahoga Group and Devonian-aged Berea Sandstone mapped in the northeast portion of Camp James A. Garfield located in Trumbull County. There are no FWGWMP/RI bedrock or unconsolidated monitoring wells in that portion of the facility.

**Comment 3 Action Item**: The geologic map (Figure 1-3) in the December 2016 RI Plan (approved by Ohio EPA March 2017) will need further refinement in the northern portion of Camp Ravenna located in Trumbull County in future documents to accurately reflect the bedrock geology beneath the facility.

Army Response: Comment noted. As presented in revised Figure 3-1, this area in the northeastern portion of the facility has been revised to indicate that that upper unit is Sharon Member-Shale. This is consistent with Figure 1-3 of the RI Work Plan. Further evaluation of the geology in that area under the FWGWMP would be conducted if potential risk was identified in that area and wells are required to be installed to evaluate the CERCLA risk.

### **Ohio EPA Comment 4: Section 5.4 Variances from Recent Potentiometric Surfaces**

Since 33 wells were identified as having different monitoring zones than previously identified in the 2017 Annual Report, some changes were noted in potentiometric surface contours of the affected aquifers from 2017 to 2018 mapping, but generally contours were similar to past years (Section 5.4).

**Comment 4 Action Item**: Provide some discussion regarding the need for additional wells in certain areas to confirm ground water flow direction where monitoring zone well designations have changed.

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

Army Response: Clarification. The potentiometric surfaces presented in the 2018 Annual Report was done with the reclassification of wells/aquifers, as discussed in Section 2.2.1. The 2018 potentiometric surfaces were compared to the 2017 potentiometric surfaces. As indicated, there were minimal changes to the potentiometric surfaces. As such, it is believed there are enough current wells in the monitoring network to establish solid potentiometric surfaces, even if some of the wells are re-categorized. It is not believed that data gaps exist to confirm groundwater flow direction to support the CERLCA evaluation under the FWGWMP.

Please note that during the CERCLA process to identify COCs and evaluate the extent of risk, it will be evaluated if additional wells are needed to further refine extent of risk and contamination.

**Ohio EPA Risk Comment 1: Section 6.4.2, Page 6-9, Lines 27-30**

The text in the section discusses how the detection of RDX in Upper Sharon ground water monitoring well RQLmw-008 was detected above the background concentration measured from Upper Sharon ground water monitoring RQLmw-014. A site-specific background screening level for RDX has not been developed or approved at Ravenna. Also, RQLmw-014 is a ground water monitoring well that has historically been sampled as part of the facility-wide ground water monitoring program due to the presence of chemicals of potential concern (COPCs); the 2016 FWGWMP noted RQLmw-014 for criteria 1 and 2 (figure C-3; 1= one or more non-metal COPCs above screening level (SL) and 2= one or more site COPC maximum results). Therefore, RQLmw-014 is not an appropriate well for a background well since COPCs were detected in the well.

**Risk Comment 1 Action Item:** Change the terminology in Section 6.4.2 to state RDX in RQLmw-008 exceeded the screening criteria and remove language regarding a background concentration for RDX.

Army Response: Agree. The last paragraph in Section 6.4.2 has been revised as follows:

“The only constituent that exceeded the **screening criteria** in the sample collected from well RQLmw-008 was RDX, at a concentration of 0.00085J mg/L in October 2018. The only constituent that exceeded the **screening criteria** in the sample collected from well RQLmw-014 was RDX, at a concentration of 0.00082J mg/L in October 2018. These results are presented in Figure 6-6.”

**Ohio EPA Risk Comment 2: Section 8.2.3.1 FWGWMP Sampling 2019, Page 8-2, Lines 37 and 38**

Section 8.2.3.1 states, "The proposed FWGWMP groundwater sampling for 2019 to support the RI is provided in the 2019 Addendum." In comparing the FWGWMP Annual Report for 2018 and the FWGWMP Addendum for 2019 an inconsistency with the conclusions presented for ground water monitoring well CBLmw-003 was noticed. The FWGWMP Addendum for 2019 reported that sampling at all C Block Quarry wells in the Homewood Sandstone Aquifer would be discontinued starting in 2019, which contrasts with the results presented in Section 6.3.6 of the FWGWMP Annual Report for 2018 which reports, "In June 2018, the wells in which cyanide exceeded the screening criteria (0.00015 mg/L) [included] CBLmw-

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

003 (0.0037 J mg/L)." It appears from the data presented in this annual report that sampling should continue at 2019 at ground water monitoring well CBLmw-003.

**Risk Comment 2 Action Item:** Clarify why sampling can discontinue for well CBLmw-003 or continue sampling in 2019.

Army Response: Clarification. During the course of the Facility-wide Groundwater Monitoring Addendum for 2018 (TEC-Weston, June 21, 2018), the purpose of the 2018 sampling of C Block Quarry wells was established to support the Revised Draft RI/FS for Soil, Sediment, and Surface water at RVAAP-06 C Block Quarry. While the target COC in soil was hexavalent chromium, the Army also agreed to have SVOCs; metals, including hexavalent chromium; PCBs; explosives; nitrate/nitrite; sulfate/sulfide; cyanide; and pH analyzed.

As summarized in Table 8-1, cyanide was detected at CBLmw-003 at an estimated concentration of 0.0037J mg/L, above the screening criteria of 0.00015 mg/L but below the MCL of 0.2 mg/L. It is also noteworthy that five of six samples analyzed for cyanide from this well did not have detectable concentrations of cyanide. Accordingly, the Army does not recommend further evaluation of cyanide within this well.

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Facility-Wide Groundwater Annual Report for 2018 (Work Activity No. 267-000-859-036)

Reference Ohio EPA Comment 1, revised Figure 3-3

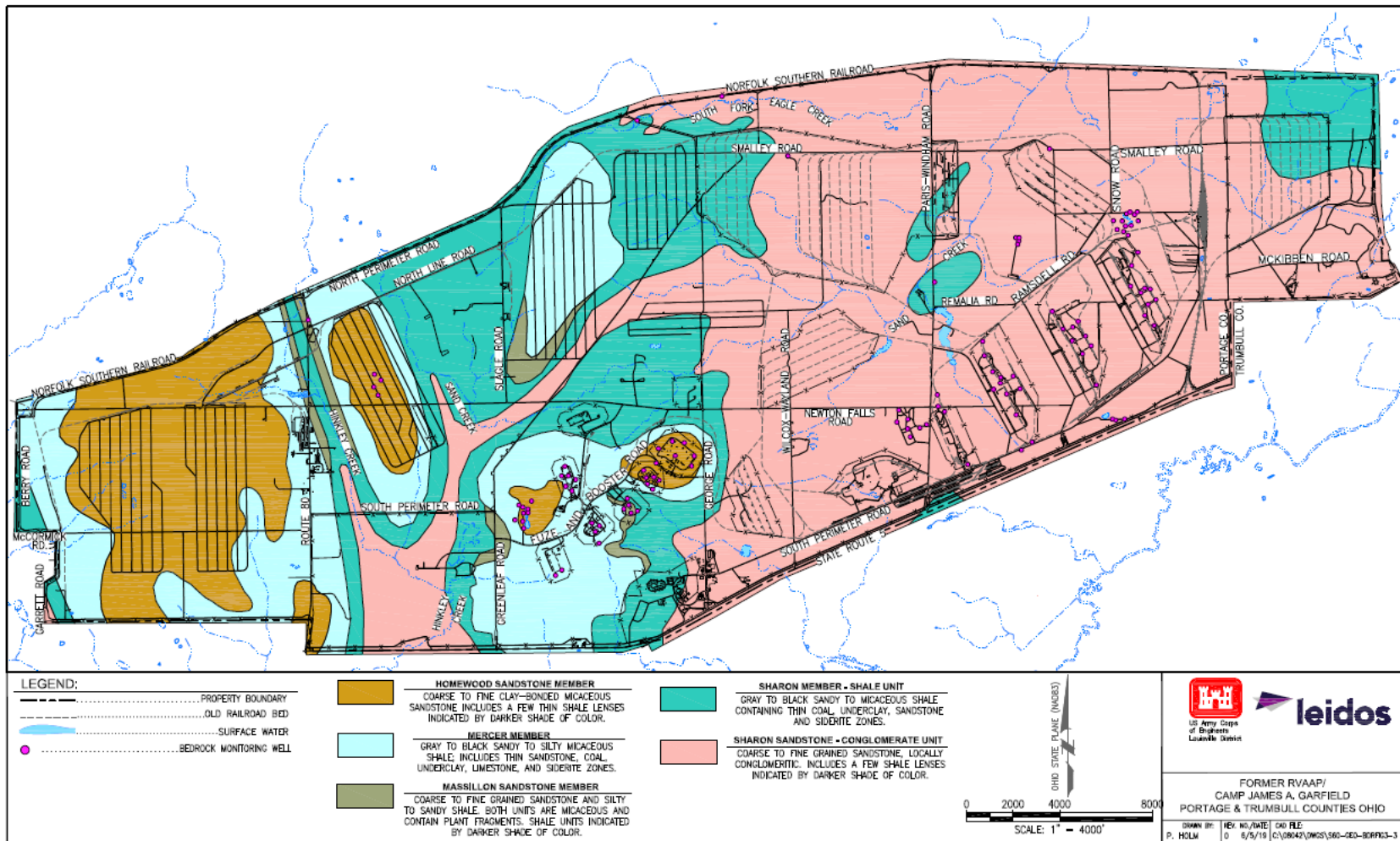


Figure 3-3. Geologic Bedrock Map and Stratigraphic Description of Units at Camp James A. Garfield



Mike DeWine, Governor  
Jon Husted, Lt. Governor  
Laurie A. Stevenson, Director

April 25, 2019

RE: US Army Ammunition Plt RVAAP  
Remediation Response  
Project Records  
Remedial Response  
Portage County  
ID # 267000859036

Mr. David Connolly  
Army National Guard Directorate  
Environmental Programs Division  
ARNGD-ILE-CR  
111 South George Mason Drive  
Arlington, VA 22204

**Subject: Ohio EPA Comments on the "Draft Facility-Wide Groundwater Monitoring Annual Report for 2018," Dated February 14, 2019**

Dear Mr. Connolly:

The Ohio Environmental Protection Agency (Ohio EPA) has received and reviewed the "Draft Facility-Wide Groundwater Monitoring Annual Report for 2018" at the Former Ravenna Army Ammunition Plant (RVAAP), Portage and Trumbull Counties, Ohio. This document was received at Ohio EPA's Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) on February 14, 2019. The report was prepared for the U.S. Army Corps of Engineers (USACE) on behalf of the National Guard Bureau by Leidos under Contract Number W912QR-16-D-0003.

Comments on the document based on Ohio EPA review are provided below. Please provide responses to the enclosed comments in accordance with the Directors Findings and Orders.

The "Draft Facility-wide Groundwater Monitoring Program (FWGWMP) Annual Report for 2018" summarizes ground water monitoring results for the two major sampling events conducted for the year. The highlights of these annual events include the following:

#### **Highlights from the 2018 Sampling Events**

Seventy-nine wells in June of 2018 and 81 wells in October of 2018 were sampled compared to the 76 wells sampled in 2017. Seventy-two of the 81 wells (including five Resource Conservation and Recovery Act (RCRA) wells) from the 2018 sampling event will be sampled semi-annually (January and July) in 2019 to evaluate potential off-site migration, potential source area attenuation, temporal fluctuations and to support the Facility-Wide Ground Water Remedial Investigation (RI).

MR. DAVID CONNOLLY  
U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP  
APRIL 25, 2019  
PAGE 2

In December 2018, the Army abandoned FWGmw-017 based on six rounds of sampling data being non-detect (ND).

Three new permanent wells and four new temporary wells were installed and sampled in 2018 to support the Facility-Wide Ground Water RI:

- Open Demolition Area #1 temporary well DA1tw-001 (explosives were ND; no further sampling).
- Sand Creek Disposal Road Landfill (SCL) permanent wells SCLmw-001, SCLmw-002, and SCLmw-003 (volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), explosives, polychlorinated biphenyls (PCBs), pesticides and metals; sampled three times in 2019).
- Electric Substation No. 3 temporary wells ES3tw-001, ES3tw-002, and EStw-003 (naphthalene, ND; no further sampling).

Per the 2019 Addendum to the 2018 FWAGWMP, sampling is to be discontinued starting in 2019 at the following wells (see Table 3-1 of Addendum for rationale):

- C Block Quarry (CBL) wells CBLmw-001, CBLmw-002, CBLmw-003, and CBLmw-004 all in the Homewood zone (Sampled June 2018 only; no detections of compounds of concern (COCs)).
- Load Line 2 well FWGmw-017 in the Basal Sharon Conglomerate (COCs ND in 2017 and 2018; well abandoned December 2018).
- Load Line 4 well LL4mw-193 in the unconsolidated zone (cyanide (CN) below maximum contaminant level (MCL) in 2017 and 2018).
- Northeast of Load Line 1 well FWGmw-010 in the unconsolidated zone (CN below MCL in 2017 and 2018).
- Facility-Wide well FWGmw-013 in the Upper Sharon zone (CN below MCL in 2017 and 2018).
- NACA Test Area wells NTAmw-117 and NTAmw-118 in the unconsolidated zone (CN below MCL in 2017 and 2018).
- Ramsdell Quarry (RQL) well RQLmw-014 in the Upper Sharon zone (COCs ND in 2018).

Based on USACE/Leidos review of the sampling results, one well sampled as part of the 2018 FWGWMP for pH (RQLmw-014) will no longer be monitored for pH conditions based on consistent normal range readings (mean pH of 5.75).

MR. DAVID CONNOLLY  
U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP  
APRIL 25, 2019  
PAGE 3

**Notable Compounds of Potential Concern (COPCs)  
Detections in the Aquifers Sampled**

Unconsolidated Aquifer:

- Manganese in 16 various wells.
- RDX at Winklepeck Burning Grounds (WBG) and Open Demolition Area #2 (DA2) had an increasing trend at both areas of concern (AOCs).
- Cyanide in nine wells at various Load Lines (LLs), Central Burn Pits (CBP), Erie Burning Grounds (EBG), Fuse and Booster Quarry Landfill (FBQ) and SCL.
- SVOCs exceeded screening criteria in SCLmw-003.

Homewood Sandstone Aquifer:

- Manganese at LL10 and LL7.
- Explosives at FBQ had detections trending downward.
- Carbon tetrachloride at LL10 exceeding screening criteria and had an increasing trend.
- Cyanide at CBL, FBQ and LL7.
- pH at CBL and FBQ.

Upper Sharon Aquifer:

- Manganese at DA2, WBG, LL1, LL2, RQL, FWGmw-012 and -016;
- LL1, 2, and 3 – various explosives or propellants trending downward at LL1 and LL3 and increasing at LL2;
- Cyanide at CBP, RQL, EBG, LL2, LL1, LL3;
- pH (lower than neutral) at LL1 and RQL; and
- VOCs exceeding screening criteria at RQLmw-007.

Basal Sharon Conglomerate:

- None

### General Comments

**1. Figure 3-3 of the Draft FWGWMP Annual Report for 2018:**

Figure 3-3 in the report appears to depict inaccurate bedrock geology. Although Figure 3.3 is unattributed to a specific source, it appears to be copied from a faulty 2004 Portage Environmental/USACE map that misinterpreted the bedrock geology beneath the facility from the original United States Geological Survey (USGS) and Ohio Department of Natural Resources (ODNR) source documents (e.g., Geology and Ground Water Resources of Portage County, Ohio [Winslow and White, 1966] and Reconnaissance Bedrock Geology of Newton Falls, Ohio Quadrangle [Slucher and Larsen, 1996]). One source of error is likely that the colors used to map the Sharon Member and the Berea Member on the 1966 Winslow and White map are similar. On several previous occasions, Ohio EPA has commented on similar copies of the aforementioned inaccurate map that has appeared in submissions to the Agency. The bedrock geology shown on Figure 3-3 is inconsistent with the geology shown on geologic cross-sections shown in Figures 3-5 and 3-6 of the submitted report, published USGS, ODNR, and other maps and scholarly/professional literature and what is known of site bedrock geology from facility boring and well logs.

First, the key for the rock column on Figure 3-3 is presented as being out of sequence. It incorrectly suggests that the Devonian aged Berea Sandstone (Note: before the late 1980s the Berea was assigned a Mississippian age) is the youngest bedrock beneath the site and that the Mississippian aged Cuyahoga Group occurs between the Pennsylvanian aged Massillon and Homewood Sandstones. By convention, explanation keys on geologic maps present the units from youngest to oldest. The explanation key on Figure 3-3 is confusing because it is out of sequence and does not convey an understanding of the site geology.

Secondly, Figure 3-3 incorrectly shows Berea Sandstone as the uppermost bedrock in three areas along Paris-Windom Road. The geologic map in Winslow and White (1966), shows the uppermost bedrock in those three aforementioned areas as Pennsylvanian aged Sharon Shale.

Thirdly, Figure 3-3 shows the uppermost bedrock in the northeast corner of the facility is mapped as Mississippian aged Cuyahoga Group. However, ODNR's 1996 map (Slucher and Larson) shows the aforementioned area mapped as Pennsylvanian aged Pottsville Group (Sharon). Slucher and Larson (1996) show a small area of Camp Garfield South of the East Group 7 Igloos in Trumbull County where the Devonian aged Berea and Mississippian aged Cuyahoga Group are the uppermost bedrock units. Figure 3-3 does not show the Devonian Berea and Mississippian Cuyahoga Group mapped as such. Currently, there are no



FWGWMP/RI wells located in northeast portion of RVAAP, currently Camp James A. Garfield, in Trumbull County to provide any additional site-specific bedrock boring data that would refute the 1996 ODNR mapping.

**Comment 1 Action Item:** Ohio EPA recommends utilizing the more accurate geologic map provided in the approved RI Work Plan (Figure 1-3 from the December 2016 RI Work Plan, as approved by Ohio EPA in March 2017). If it is not used, Figure 3-3 needs to be explained or revised.

**2. Section 2.2.1 Monitoring Zone Review and Adjustments:**

This section of the report indicates that a comprehensive review of all monitoring well logs was conducted to ensure the correct monitoring zones were identified for each monitoring well. Based on this review, the Army identified 33 wells that were found to have different monitoring zones than what was identified in the 2017 Annual Report. These 33 monitoring zone reassignments are summarized in Table 2-1 of the submitted report. The well logs for 32 of these 33 wells are included in Appendix A of the report (Note: No well log for well BKGmw-20 was included in Appendix A; however, the Army later provided a copy of the missing well log to Ohio EPA). Section 5.4 (Variances from Recent Potentiometric Surfaces) discusses how these re-evaluations of monitoring effect changes to potentiometric map/ground water flow interpretations. There is no discussion in the submitted report on how these re-evaluations might affect the presence or absence of ground water data gaps in the RI.

Ohio EPA agrees with 18 of the re-evaluations including wells BKGmw-20, DA2mw-108, DA2mw-111, LL1mw-063, LL2mw-059, LL12mw-113, LL12mw-183, LL12mw-186, FBQmw-169, LNWmw-027, LL5mw-001, LL5mw-002, LL5mw-004, LL8mw-005, ASYmw-004, ASYmw-005, ASYmw-006, and ASYmw-009.

Ohio EPA disagrees with the reevaluation of LL2mw-269 as an unconsolidated aquifer well from its original interpretation as an Upper Sharon Aquifer well. Most of the screened interval is in fractured shale. The well log for LLwmw-269 indicates that ground water is encountered near the top of bedrock. Both the unconsolidated sediments and fractured shale in this boring log are generally described as "dry". It is Ohio EPA's experience that these fractured shale wells often appear dry when drilled because the heat of drilling often evaporates the limited water resources in such boring when drilled, but they often yield water given time. This well appears to be properly classified as an Upper Sharon well, although there may be some negligible contribution from the unconsolidated aquifer; however, the unconsolidated aquifer appears to be dry.

MR. DAVID CONNOLLY  
U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP  
APRIL 25, 2019  
PAGE 6

The remaining 14 of the 33 wells, all either originally determined to be Upper Sharon Aquifer or Homewood Aquifer wells have been re-evaluated by the Army as unconsolidated aquifer wells. However, these 14 wells appear to be screened across two aquifers: The unconsolidated and either one of three possible bedrock aquifers – the upper portion of the Sharon Member, the Homewood Member, or the Mercer Member. These wells are constructed with 10-foot screens which are anywhere from one to almost seven feet into the upper portions of one of the bedrock aquifers. Additional information would be needed to determine if these 14 wells can be assigned to one aquifer or another or represent a composite of two aquifers. Such information would include potentiometric and piper water chemistry comparisons and or other hydrogeologic information. These 14 wells include: LL12mw-189, FBQmw-168, FBQmw-177, LL6mw-003, LL6mw-004, LL6mw-005, LL6mw-007, LL5mw-005, LL5mw-006, LL8mw-006, LL9mw-001, ASYmw-001, ASYmw-002, and ASYmw-003. Further, based on limited information on the well log for the four cross-screened wells LL6mw-003, LL6mw-004, LL6mw-007, and LL5mw-001, it is unclear which bedrock unit these wells are screened into because the logs for these wells provide no description other than “bedrock”. All these wells are located on erosional bedrock knobs where the uppermost bedrock might be either the Homewood or Mercer Members.

**Comment 2 Action Item:** The Army needs to discuss how the re-evaluation of these wells affects (or causes) data gaps in the RI. Further re-evaluation of the aquifer placement of these wells as indicated in Ohio EPA’s comments may affect potentiometric/flow interpretations in areas of Camp James A. Garfield and may result in the need for additional flow direction delineation wells at elevations consistent with evaluation of the proper aquifer.

### 3. Section 3.2.7 Cuyahoga Shale:

This section of the report correctly indicates that bedrock incorrectly mapped on the 2004 Portage County Environmental Map as “Cuyahoga Formation” has been mapped by ODNR (Slucher and Larsen, 1996) as Pottsville (likely Sharon). To clarify, the 1996 ODNR Reconnaissance Bedrock Geology of Newton Falls (Slucher and Larsen) shows a small area of Mississippian-aged Cuyahoga Group and Devonian-aged Berea Sandstone mapped in the northeast portion of Camp James A. Garfield located in Trumbull County. There are no FWGWMP/RI bedrock or unconsolidated monitoring wells in that portion of the facility.

**Comment 3 Action Item:** The geologic map (Figure 1-3) in the December 2016 RI Plan (approved by Ohio EPA March 2017) will need further refinement in the northern portion of Camp Ravenna located in Trumbull County in future documents to accurately reflect the bedrock geology beneath the facility.

**4. Section 5.4 Variances from Recent Potentiometric Surfaces:**

Since 33 wells were identified as having different monitoring zones than previously identified in the 2017 Annual Report, some changes were noted in potentiometric surface contours of the affected aquifers from 2017 to 2018 mapping, but generally contours were similar to past years (Section 5.4).

**Comment 4 Action Item:** Provide some discussion regarding the need for additional wells in certain areas to confirm ground water flow direction where monitoring zone well designations have changed.

**Risk Comments**

**1. Section 6.4.2, Page 6-9, Lines 27-30:**

The text in the section discusses how the detection of RDX in Upper Sharon ground water monitoring well RQLmw-008 was detected above the background concentration measured from Upper Sharon ground water monitoring RQLmw-014. A site-specific background screening level for RDX has not been developed or approved at Ravenna. Also, RQLmw-014 is a ground water monitoring well that has historically been sampled as part of the facility-wide ground water monitoring program due to the presence of chemicals of potential concern (COPCs); the 2016 FWGWMP noted RQLmw-014 for criteria 1 and 2 (figure C-3; 1= one or more non-metal COPCs above screening level (SL) and 2= one or more site COPC maximum results). Therefore, RQLmw-014 is not an appropriate well for a background well since COPCs were detected in the well.

**Comment 1 Action Item:** Change the terminology in Section 6.4.2 to state RDX in RQLmw-008 exceeded the screening criteria and remove language regarding a background concentration for RDX.

**2. Section 8.2.3.1 FWGWMP Sampling 2019, Page 8-2, Lines 37 and 38:**

Section 8.2.3.1 states, "The proposed FWGWMP groundwater sampling for 2019 to support the RI is provided in the 2019 Addendum." In comparing the FWGWMP Annual Report for 2018 and the FWGWMP Addendum for 2019 an inconsistency with the conclusions presented for ground water monitoring well CBLmw-003 was noticed. The FWGWMP Addendum for 2019 reported that sampling at all C Block Quarry wells in the Homewood Sandstone Aquifer would be discontinued starting in 2019, which contrasts with the results presented in Section 6.3.6 of the FWGWMP Annual Report for 2018 which reports, "In June 2018, the wells in which cyanide exceeded the screening criteria (0.00015 mg/L) [included] CBLmw-003 (0.0037J mg/L)." It appears from the data presented in this annual report that sampling should continue at 2019 at ground water monitoring well CBLmw-003.

MR. DAVID CONNOLLY  
U.S. ARMY RAVENNA AMMUNITION PLT. RVAAP  
APRIL 25, 2019  
PAGE 8

**Comment 2 Action Item:** Clarify why sampling can discontinue for well CBLmw-003 or continue sampling in 2019.

This Draft Facility-wide Groundwater Monitoring Addendum for 2019 was reviewed by personnel from Ohio EPA, DERR Risk Assessment and Division of Materials and Waste Management (DMWM). Additional information is necessary to approve the document. If you have questions or would like to set up a meeting to discuss these comments, please call me at (330) 963-1292.

Sincerely,



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