UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

September 07, 2020

Mr. James Foster
Base Realignment and Closure Division (ACSIM-ODB)
2530 Crystal Drive (Taylor Building), Room 5000
Arlington, VA 22202-3940

Dear Mr. Foster:

The U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Department of the Army's response to EPA comments on the Defense Depot of Memphis, Tennessee Main Installation Conceptual Site Model (CSM) Technical Memorandum, dated March 2018.

EPA appreciates the Army's time and efforts to investigate first steps toward data collection and development of a CSM for the DDMT site and looks forward to additional information collection and further CSM development in the future. EPA agrees with suggested text revisions for this limited scope technical memorandum and anticipates further conversations among the FFA partnering team to discuss CSM development and groundwater modeling efforts to support the ongoing supplemental remedial investigation and the vapor intrusion investigation at the DDMT site and has included 2nd responses to comments for the U. S. Army's consideration for future efforts.

EPA suggests that further discussion among the FFA partnering team is needed in the future at a mutually acceptable time.

Should you have any questions or concerns, please feel free to call me at on my cell number 404-229-9500.

Sincerely,

Diedre Lloyd

Diedre Lloyd
Remedial Project Manager
Restoration & Sustainability Branch
Region 4, Superfund Division

cc: Mr. James Foster, (Signed Original), United Parcel Service, Return Receipt
Mr. Jamie A. Woods, PG, Tennessee, Department of Environment and Conservation, Memphis Environmental Field Office, 8383 Wolf Lake Drive, Bartlett, TN 38133-4119
Ms. Joan Hutton, CALIBRE, 3898 Mountain View Road, Kennesaw, GA 30152
Mr. Thomas Holmes, HDR Environmental, P.O. Box 728, Highlands, NC 28741

Above Letter was also emailed to list below and can be found at the e-file location noted below.

ec: james.c.foster10.civ@mail.mil; jamie.woods@tn.gov; joan.hutton@calibresys.com; thomas.holmes@hdrinc.com;

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CONCEPTUAL SITE MODEL TECHNICAL MEMORANDUM

U.S. ARMY RESPONSE TO COMMENTS
U.S. EPA 2ND RESPONSE TO COMMENTS

MAIN INSTALLATION

SEPTEMBER 07, 2020

DEFENSE DEPOT
MEMPHIS TENNESSEE

EPA COMMENTS:

1. **<u>Section 2.4, Groundwater Flow System, Page 4</u>**
   Section 2.4 states, "There are no naturally flowing streams or creeks on DDMT [Defense Depot Memphis Tennessee]." However, Nonconnah Creek is located approximately 0.75 miles south of the Main Installation (MI) and is not included within the model boundary depicted in Figure A1 located in Appendix A, Model Bound and Cross Sections. For clarity and completeness, revise Section 2.4 to include a discussion as to why Nonconnah Creek is not considered a part of the groundwater flow system although the outer boundary wells of Allen Well Field, located approximately 1.5 miles west of the MI are included.

   U.S. Army Response 1: Nonconnah Creek was not considered part of the groundwater flow system as there is not a known connection to the Fluvial Aquifer south of the DDMT site. The creek is relatively shallow within alluvium which is 80 percent or more silt from loess with fine to medium grained quartz and chert sand, and does not down cut into the sand and gravel fluvial aquifer (Moore and Diehl, 2004). The bottom of Nonconnah Creek is approximately 235 feet NAVD, while water levels within the Fluvial Aquifer are approximately 210 feet NAVD at the southern boundary of the MI.
   The Allen Well Field is considered part of the groundwater flow system as they are completed and pump groundwater from the Memphis Sand Aquifer. The well field is a major source of groundwater supply and impact the water level gradients west of the MI and may influence contaminant flow directions.
   The text will be revised to note the presence of Nonconnah Creek and state that it is not considered to impact water levels on the MI. The reference will be added: Moore, D.W., and Diehl, S.F., 2004. Surficial Geologic Map of the Southeast Memphis Quadrangle, Shelby County, Tennessee. U.S.G.S Scientific Investigations Map 2822, Version 1.0.

   U.S. EPA 2nd Comment Response #1: Before the Nonconnah Creek is dismissed/not considered to part of the groundwater flow system, additional data is needed to support this assertion.

2. **<u>Section 2.5, Groundwater Recharge, Page 6</u>**
   Section 2.5 states, "Although, there are no measurements of groundwater recharge at the MI, previous studies (Robinson, J.L., et. al., 1997) within the area have produced estimates of 0.67 to 1.8 inches per year, which is approximately 1.2% to 3.3% of the monthly average annual precipitation of 54.4 inches (HDR, 2017a). DDMT land use maps will be used to determine permeable (open areas) and impermeable (buildings and pavement) to specify areas that will receive recharge to the underlying aquifer system." However, as stated in Section 2.2.1, Loess, the uppermost deposit at the

MI is a 20-30 feet thick continuous and unsaturated deposit of loess that is considered a semi-confining unit that limits groundwater recharge. It is unclear if the groundwater recharge estimate produced by the previous study referenced was within an area with a similar loess deposit. For clarity and completeness, revise Section 2.5 to include discussion on how the groundwater recharge estimates produced in the previous study specifically relate to the hydrostratigraphic units at the MI.

U. S. Army Response 2: The model completed by Robinson, J.L., et. al., 1997, in the area of the Naval Support Activity (NSA) facility, is approximately 5 miles north of Memphis, TN. The loess within that area is 15 to 45 feet thick and the recharge estimate accounts for groundwater recharge through the loess deposits. The text will be revised to note the study is within the Memphis area and has similar stratigraphy.

U.S. EPA 2nd Comment Response #2: Acceptable

3. **Section 2.9, Contaminant Transport Parameters, Table 1, Initial PCE and TCE Transport Parameters, Pages 7-8**

Table 1 proposes a bulk density value of 1.8 g/cm^3 to be used as an initial value specific to PCE and TCE transport. However, the (5) notes on page 8 state, "The bulk density value is of the sandy aquifer at the Savannah River Site (Riley, et. al., 2006)." For clarity, provide an explanation as to why a bulk density value from a sandy aquifer at the Savannah River Site is proposed for this parameter.

U. S. Army Response 3: Installation of a Memphis Aquifer (MAQ) well is no longer planned. If model development proceeds, additional review will be conducted to locate bulk density values in the Memphis area.

U.S. EPA 2nd Comment Response #3: Acceptable

4. **Section 3.3, Data Limitations, Pages 8-9**

Section 3.3 states, "Individual well pumping and water level data at Allen Well Field is not known and it will not be possible to determine the correct water level drawdown within the well field and the vicinity or calibrate to those water levels." However, it is unclear if the level of accuracy will be sufficient to determine contaminant travel times to the Allen Well Field wells. As stated in Section 2.2, Hydrostratigraphic Units, only two (2) Memphis Aquifer (MAQ) wells are currently installed on the MI. Therefore, due to the lack of information regarding the Allen Well Field wells and insufficient number of wells installed within the MAQ on the MI, it is unclear with what level of accuracy the revised conceptual site model (CSM) will accurately depict and estimate contaminant travel times within the MAQ from the MI. Revise Section 3.3 to discuss the data limitations regarding the lack of wells and well related data within the MAQ and if any wells should be installed and screened within the MAQ to address this limitation and manage the uncertainty in the adequacy of MAQ monitoring well network.

   a. EPA is aware that the Army has attempted to reach personnel associated with the Allen Well Field, please provide additional information regarding the status of these requests and a future path forward since this data is crucial with regard to developing an accurate

U. S. Army Response 4: Request EPA indicate what additional information regarding the lack of wells and well related data within the MAQ is needed in Section 3.3.

U. S. Army Response 4a: Army has made multiple requests for Allen Well Field data to MLGW, University of Memphis Groundwater Institute and the USGS. The data have not been provided and are not expected in the near-term.

U.S. EPA 2nd Comment Response #4/4a: EPA renews request for Allen Well Field Pumping Data and would like to discuss additional efforts for data collection. EPA understands that the Army has attempted to collect this information from outside sources and appreciates the Army's efforts.

5. **Appendix A, Figure A-1, Model Boundary and Cross Section Locations**
The figure depicts MAQ, Intermediate/Upper Claiborne (IAQ), and Fluvial Aquifer well locations; however, based on the scale of the map and the symbols used for the well locations, it is difficult to determine which well locations are installed in the three (3) separate aquifers. For clarity, revise the symbols used for the well locations on Figure A-1 so that it is clear which well location is installed within each aquifer.

U. S. Army Response 5: Symbols used for wells installed by Army have different shapes and, at full scale, can be distinguished to identify the aquifer (circle for Fluvial, square for Intermediate/Upper Claiborne and triangle for Memphis). Army will add different colors for each aquifer to aid in identifying the aquifer. Due to the scale of the map and the spacing of the wells in some areas, overlap of well symbols cannot be avoided. Well maps for the Main Installation and Dunn Field are included in LTM reports submitted to EPA and should be reviewed if additional detail is required.

U.S. EPA 2nd Comment Response #5: Please ensure that figures in future submittals are readable on paper copies and not just on computer screens.

EPA Scientific Support Section Comments:

6. It is important to select a model domain much larger than the selected model area. The boundary conditions along the periphery of the domain should also be carefully selected so that it does not influence the groundwater flow field within the selected model area. The CSM memo did not explain the model domain and the boundary conditions in details. This information should be provided.

U. S. Army Response 6: Additional details for the model domain and the boundary condition will not be added at present. The need for additional information can be discussed if model development proceeds. The model domain is described in Section 3.1 and is shown on Figure A-1. General head boundaries will be used along the model domain to allow for the inflow/outflow of water from the model domain. The closest distance from the model boundaries to the MI is 1,500 feet on the southern boundary, with the northern and western boundary further away. The grid cells within the model domain will be 30 ft by 30 ft or 40 ft by 40 ft. The distance to the model boundary, small grid cell size, and the use of general head boundaries, should negate any influence on groundwater flow resultant from the boundaries.

U.S. EPA 2nd Comment Response #6: EPA expects to see development of DDMT Site CSM and groundwater modeling which are both necessary to support the ongoing investigations (SRI and VI) at the DDMT site.

7. Target wells for model calibration should have been included in the memo. Each modeled aquifer should have sufficient target wells for model calibration. It is reported in the model limitation section that the MAQ aquifer has a sparse well dataset. Since MAQ is an important aquifer for this modeling objective, a data gap analysis for the MAQ aquifer should be conducted prior to modeling.

U. S. Army Response 7: If model development proceeds, the target wells for calibration in each aquifer will be identified.

U.S. EPA 2nd Comment Response #7: Target wells for calibration in each aquifer are needed to support model development.

8. Calibration for the groundwater flow model will be matched against the April 2017 water level data. Is that dataset representative of the average flow condition at the site? Is there any seasonal variation in the groundwater flow? This information should be provided.

U. S. Army Response 8: Section 3.1 has been revised to state "Model calibration will involve matching simulated water levels to the most recently measured water levels." If model development proceeds, current information on seasonal variation will be added. Additional information can be added from the review of water level data in recent annual LTM reports. There is little seasonal variation observed in the Fluvial aquifer but there is variability in the IAQ and MAQ, which is believed to result from seasonal differences in recharge and groundwater extraction.

U.S. EPA 2nd Comment Response #8: Acceptable

9. EPA does not consider a 10% normalized root mean squared error (NRMSE) value for the entire model domain acceptable. A 10% NRMSE is acceptable for a smaller selected model area, for example, the MI area. For the entire model domain, EPA expects to reach close to a 5% NRMSE value.

U. S. Army Response 9: A calibration goal of 10% NRMSE for the MI and 5% NRMSE for the entire model domain is acceptable.

U.S. EPA 2nd Comment Response #9: Acceptable

10. Hydraulic conductivity is typically the most sensitive parameter in groundwater modeling. Lack of aquifer testing, as stated in the report, could result in major uncertainty in the modeling results. The memo did not present the extent of the hydraulic conductivity values available from aquifer testing. In the case of limited availability of aquifer test data, new aquifer testing should be considered to fill the data gap.

U. S. Army Response 10: If model development proceeds, additional analysis for hydraulic conductivity values will be considered.

U.S. EPA 2nd Comment Response #10: EPA considers hydraulic conductivity values of great importance to future CSM and groundwater modeling efforts.

11. A site-specific soil-water partitioning coefficient (Kd) value should be collected by conducting a column test. In transport modeling, Kd could become highly sensitive to modeling results, therefore, a site-specific Kd value could be significant in reducing model uncertainty.

U. S. Army Response 11: If model development proceeds, a column test to determine site-specific soil-water partitioning coefficient (Kd) value will be considered on samples taken from existing MAQ wells.

U.S. EPA 2nd Comment Response #11: EPA looks forward to additional discussions of Kd values.

12. Dispersivity is usually a calibration parameter in the transport model, while biodegradation rate and soil-water partitioning coefficient (Kd) could be estimated from data analysis. Initial estimates of biodegradation rates, for example, could be conducted from well-by-well trend analysis.

U. S. Army Response 12: Data analysis of trends between wells and also the values used for the 2009 MI model will be considered when determining the biodegradation rate.

U.S. EPA 2nd Comment Response #12: EPA considers data analysis of trends between wells is of value for future CSM and groundwater modeling efforts.

13. Individual pumping rates at the Allen Well Field will be important boundary conditions in the model. Therefore, effort should be given to collect the pumping schedule from the well field. Public well fields generally have the pumping schedule and the drawdown data available. *This comment can be addressed along with comment #4 above and was included for clarity and completeness.*

U. S. Army Response 13: Army has made multiple requests for Allen Well Field data to MLGW, University of Memphis Groundwater Institute and the USGS. The data have not been provided and are not expected in the near-term.

U.S. EPA 2nd Comment Response #13: See above comment

14. The locations of the extraction wells in the model domain are not visible in Figure A-1. Please present extraction wells in a more visible color, in future submittals.

U. S. Army Response 14: The extraction wells are clearly visible as blue triangles in the eastern portion of the model domain. It may be necessary to expand the scale on your computer screen for the well symbols and identification to be clear.

U.S. EPA 2nd Comment Response #14: See above comment