RESPONSE TO COMMENTS FROM THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION – BUREAU OF REMEDIATION AND WASTE MANAGEMENT DRAFT GROUNDWATER MODELING SUMMARY REPORT SITES 1 AND 3 AND THE EASTERN PLUME NAVAL AIR STATION BRUNSWICK, BRUNSWICK, MAINE

Commentor: Claudia Sait, MEDEP - Project Manager-Federal Facilities Bureau of Remediation & Waste Management	
Comment Issue Date: 22 Jan 2009	**Navy Response Date: 17 Mar 2009**

General Comments:

1. The title of the document is misleading since it does not fulfill the workplan objectives. MEDEP suggests the following title: "Groundwater Modeling *Interim* Report …"

Response: Interim suggests that the report will not be finalized. Once there is concurrence, a Final Groundwater Modeling Summary Report will be issued. A Technical Memorandum will be issued that will specifically address the objectives outlined in the Final Groundwater Modeling Work Plan (EA 2006), as well as provide recommendations.

2. If available please provide a spreadsheet or text file version of Table A-1 that details the locations utilized and reference elevations for the associated stratigraphic units.

Response: An electronic version of Table A-1 will be provided to MEDEP.

3. The heterogeneity of the layers targeted by the model (in particular the transition) was a significant concern for development of the model. There are a number of stochastic models that can address parameter heterogeneity (including Stochastic Modflow, Modflow-Sto, etc.) that are well represented in peer-reviewed literature. Were stochastic methods considered to address the heterogeneity issues at the site and, if so, please explain why weren't they used?

Response: Stochastic models were considered during model development. However, the non-stochastic approach was chosen because it met the goals of the Work Plan and appeared more transparent in its development. It was presumed that this approach could adequately simulate groundwater flow to meet the objectives outlined in the Work Plan. The model was developed in accordance with the Final Work Plan to include assumptions agreed to by the stakeholder and once developed will become a useful tool for use by the project stakeholders that will enhance the overall understanding of groundwater flow conditions at the Eastern Plume.

4. To ensure that the information generated by this modeling effort is available in the future, the Navy should obtain the model code from ECC.

Response: The Navy will have the model input files for the final calibrated model, to distribute as needed.

Specific Comments:

5. Page 3, Section 2 Site Conceptual Model:

   a.) The Summary Report for the Direct-Push Investigation at the Southern Boundary of the Eastern Plume was never finalized because the agencies did not agree with some key geologic interpretations, therefore it must be noted both here and in the references that the Summary Report for the Direct-Push Investigation at the Southern Boundary of the Eastern Plume is a draft final version.

Response: The text was revised to correctly state the Draft Final version of this report.

   b.) The conceptual model has been revised, please reference the latest version from 2006 and update the text as needed.

Response: The 2006 version of the conceptual model has been referenced in the Groundwater Model Summary Report.

6. Page 4, Section 2.1, Site Geology and Hydrogeology, bullet 1: This bullet cites the amount of contaminant mass removed by the Ground Water Extraction Treatment System to 2003. Please update.

Response: The total mass removed through 2008 is 453 Kg and this amount will be cited in the text.

7. Page 5, Section 2.2, Existing Pump-and-Treat System, last sentence: "Overall, the groundwater extraction system has not established hydraulic control of the Eastern Plume, although natural geologic conditions appear to have helped contain movement of the groundwater contamination."

   This appears to be true to the south but is not true of the eastward migration. Please revise accordingly.

Response: The referenced sentence has been revised to, "...although natural geologic conditions appear to have helped contain the *eastward* movement of groundwater contamination."

8. Page 8, Section 3.4.1 Aquifer Parameters and Table 1:

   a.) Please reference Table 1 in the text; it presents data relevant to the discussion presented.

Response: Table 1 has been referenced in Section 3.4.1 of the report.

b.) A brief justification for setting the Upper Sand to "convertible" rather than "unconfined" needs to be included in this section.

Response: In the Layer Property Flow Package, there are only two layer types: convertible and confined. Since there is no unconfined option, model layer one representing the Upper Sand was set to convertible. In the second paragraph of Section 3.4.1, the word "unconfined" has been omitted from the first sentence which now reads, "Each model layer was designated as convertible, or confined."

9. Page 9, Section 3.4.1 Hydraulic Conductivity paragraph 3: *"The table below provides the average values of hydraulic conductivity for the lower sand calculated for each well where..."*

   For clarity please revise the text to "...each well group where...".

Response: The text has been revised accordingly.

10. Page 9, Section 3.4.1 Hydraulic Conductivity last sentence, and Figure B-2: Based on a review of the logs for locations closest to Mere Brook and south of New Gurnett Road, MEDEP is uncertain why the Lower Sand would not have a lower hydraulic conductivity (K) in the area near the brook (as it does to the north). It also seems doubtful that the lower sand extends beyond the east side of the brook to any extent, based on terrain in the area and logs for CP-134 and PL-20 (from the 1,4 Dioxane study) east of the brook near New Gurnett Road. A "zonation" of the hydraulic conductivities must be considered for the southernmost portion of the lower sand, as was applied near EW-2A.

Response: We believe that there is some evidence for this higher 35 ft/day zone south of New Gurnett Road. For instance, the hydraulic conductivity calculated from slug test data for MW-314A is 34 ft/day (Table 8-3, Supplemental Remedial Investigation (E.C. Jordan 1991). This is close to the calibrated value of 35 ft/day for this zone. Therefore, it is believed that the need for an additional zone for the lower sand in this area is not necessary.

Regarding the extent of the lower sand unit, the presence or absence of the lower sand was based on a comparison of the top and bottom interpolated surfaces for the lower sand. Therefore the aerial extent of the lower sand unit is an approximation although it appears to be accurate given the large amount of boring data available. Note that the lower sand is absent in the model at the location of CP-134.

11. Page 10, Section 3.4.1 Aquifer Parameters – Specific Yield: The reference for the values needs to be added to the text.

Response: The text has been revised to include the following reference: (Table 3.5, Anderson and Woessner 1992).

12. Pages 10-11, Section 3.4.2 Recharge, Table 1 and Appendix D Figure D-1:

    a.) Table 1 indicates a 4-month average daily precipitation was applied to calculate the recharge rates for the model, while the text on page 11 indicates a 90-day average. Please revise the text utilizing a 4-month period.

Response: The text has been revised to note the 4-month average daily precipitation was used in the model.

    b.) When future simulations are run recharge values based on longer-term averages need to be evaluated. The 2001 data represent relatively low precipitation while the 2008 data were influenced by a significant precipitation event.

Response: We agree with this comment and future simulations will use recharge rates based on longer-term average precipitation.

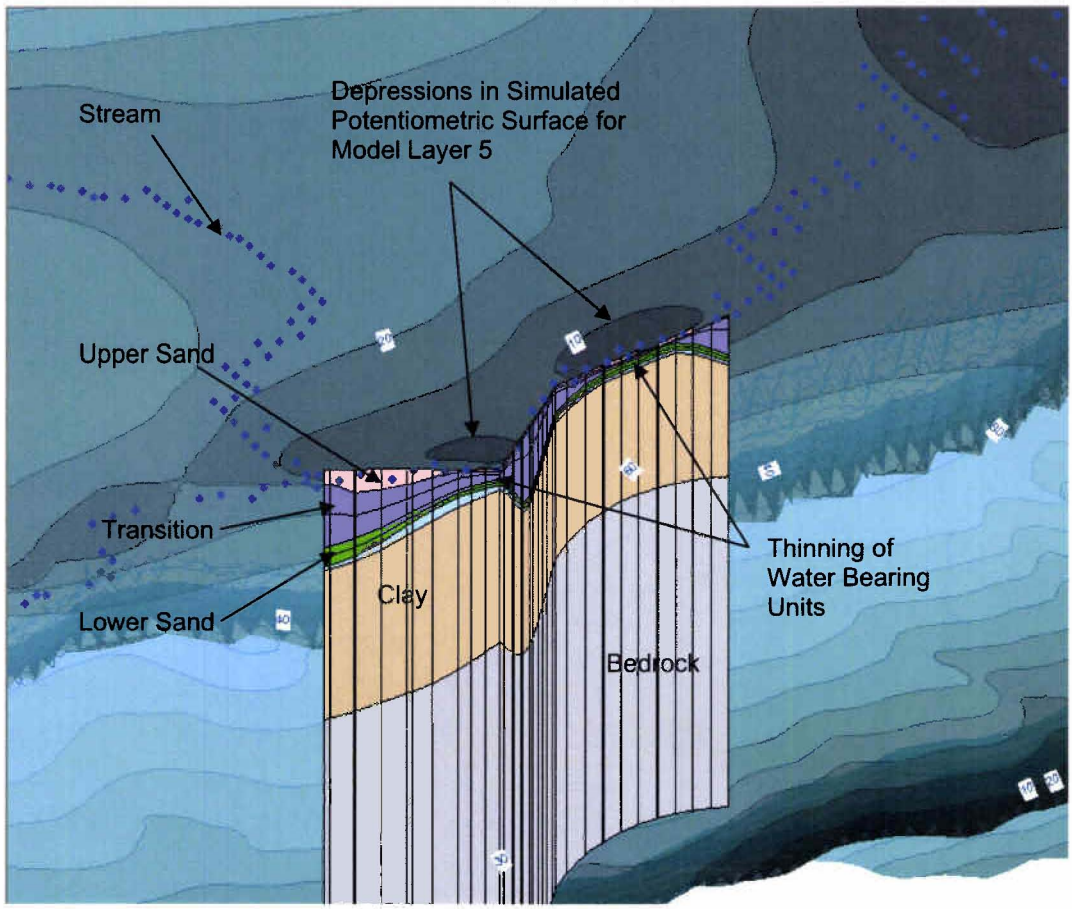
13. Page 13, Section 4.1, Model Calibration (table), Table B-1 and Figure E-5: MW-209 is not screened in the deep lower sand but is instead a shallow water table well. Please revise the hydraulic conductivities and tables as necessary. This incorrect designation may explain the apparent variation in the simulated head depicted on Figure E-5. If this impacts the model significantly the text needs to discuss the changes.

Response: We agree with this comment. Well MW-209 is not screened in the lower sand. Table B-1 and relevant sections of the text have been revised accordingly. While its designation is incorrect, its vertical location in the model was correct. Therefore, this error will not impact the model construction or model calibration.

14. Page 17, Section 4.1.1, Discussion of Model Calibration and Figures E-4 and E-5: The elevations within the stream channel indicate, as depicted, several areas with depressions or "undulations" along the flowpath. If possible, the river package data needs to be revised to improve the depiction of flow to the channel. Improving the model calibration is warranted based on the importance of the surface waters as discharge points for the Eastern Plume.

Response: The presence of depressions in the simulated flow field for model layers 3 and 5 is not necessarily an indication that something is "wrong" with the way surface water bodies are represented in the model, but is associated with the changing thickness of the model layers. The graphic below shows an oblique view from a view point below the potentiometric surface (i.e., looking up), of a cross-section taken from the model showing stratigraphy along a reach of Mere Brook just below the confluence with Merriconeag Stream and the simulated potentiometric surface for model layer 5. As can be seen in the graphic, the depressions in the flow field coincide with a thinning of the water bearing units above the clay layer. Note that the simulated potentiometric surface for model layer

5 represents the aquifer under confined conditions and therefore do not simulate the interaction of the water table with surface water bodies.



15. Page 19, Section 4.3, Sensitivity Analysis and Page 9, Section 3.4.1 Hydraulic Conductivity paragraph 2: MEDEP accepts the relative variation in vertical anisotropy (20:1 vs 10:1) proposed for the transition. However, as the value was set without direct measurements referenced some assessment of this parameter in the sensitivity analysis might improve the model.

Response: An additional sensitivity analysis for the vertical anisotropy of the transition unit was completed. An additional bullet will be added to Section 4.3 that reads, "The model appears to be moderately to highly sensitive to changes in Layers 2 and 3 (transition) vertical anisotropy. Vertical anisotropy affects model output in a nonlinear fashion, a 50 percent decrease (vertical to horizontal K ratio is 1:10) in transition hydraulic conductivity resulted a one-ft elevation change while a 50 percent increase (vertical to horizontal K ratio is 1:30) resulted in a 0.7-ft elevation change. This indicates that the vertical anisotropy in Layers 2 and 3 is an important controlling factor to model results." Figure H-1 and applicable portions of the text of Section 4.3 have been revised accordingly to reflect that vertical anisotropy was assessed as part of the sensitivity analysis.

16. Page 25, Section 6.2, Conclusions, bullet 4: "The model input parameters are considered to be a realistic simplification of the natural conditions at the site."

    Please clarify in the text which site (Sites 1 & 3 and/or the Eastern Plume) is being discussed.

Response: Both sites are being discussed. The text has been clarified.

17. Appendix A Figures A-1 to A-6: If it is possible to adjust the shading or the stream color so the location of the surface waters is more visible that would help improve the figures.

Response: The shading of surface waters have been adjusted to improve visibility as suggested.

18. Appendix C Page 3 of 3, first paragraph: *"Recovery data was corrected for the increase in water levels due to the large precipitation event ..."*

    A brief explanation of how the correction was applied to the data needs to be included in the text.

Response: It was assumed that water level trends increased linearly over the course of the recovery-drawdown test. The correction for recovery-drawdown data can therefore be stated as shown below:

$$WL_c = WL_m - (t/T \times \Delta WL)$$

Where,

WL_c	=	Corrected water level
WL_m	=	Measured water level
t	=	time at which measurement was logged as measured from the cessation of pumping
T	=	Total time of logged period, from cessation of pumping to end of logging period after resumption of pumping
ΔWL	=	Total change in water elevation over logging period, factoring out changes due to pumping

This description has been included in the text in Appendix C – Recovery-Drawdown Test.