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LETTER REGARDING REVIEW OF THE "INTERIM MEASURE SYSTEM INSTALLATION TECHNICAL MEMORANDUM" NSB KINGS BAY GA
4/12/1994
U S DEPARTMENT OF THE INTERIOR

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
Peachtree Business Center, Suite 130
3039 Amwiler Road
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April 12, 1994

Mr. David Driggers
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 190010
North Charleston, SC 29419-9010

Dear David;

Review of the "Interim Measure System Installation Technical Memorandum" by ABB Environmental Services (ABB), dated March 1994, has been completed by the USGS. The review questions/comments are enclosed as two parts: the "General Questions and Comments" regards general statements about the report, and the "Questions and Comments on Specific Pages" regards particular statements made at specific places in the report. Two report sections were only scanned, without comment: the "Conveyance System" section is essentially self-explanatory, and most of the "Ground-water Treatment System" section is outside the fields of expertise of the USGS.

Comments considered as most important are:

(a) lack of water-level response in shallow wells during pumping could be due to differences in storativity with depth, and this could be considered in the analysis of data from the longer duration aquifer tests presently being conducted; if the lack of response is due to differences in aquifer storativity, installation of additional shallow recovery wells may not be necessary because there may not be a confining bed in the upper part of the aquifer,

(b) USGS disagrees with ABB use of aquifer-test data from pumping well RW1 and observation well PS4 because corrections for head losses due to pumping are not included (and perhaps not possible) in data from RW1, and most of the very small water-level changes in PS4 may result from changes in barometric pressure,

(c) USGS disagrees with ABB use of data from the last third of the drawdown at observation wells PS1, PS2, and PS3 because the water-level changes during this period probably result, in part, from changes in barometric pressure,

(d) all values used to compute aquifer-test parameters should be given, including those from computer-generated plots, so that computations can be verified,

(e) discrepancies in elevation data given on boring logs in appendix A, as compared to the data given in tables 2-1 and 2-2, should be resolved.

The USGS hopes that this review is helpful to you. If you have any questions, please feel free to call. A copy of this letter and the review comments will be sent to Lieutenant Commander Patterson and Frank Cater, as you requested during our phone conversation of April 8.

Sincerely

Bud Zehner

Bud Zehner
Hydrologist

Enclosures

cc: √Lieutenant Commander M. J. Patterson
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USGS REVIEW COMMENTS AND QUESTIONS ON REPORT "INTERIM MEASURE PHASE 1 ACTIVITIES: SYSTEM INSTALLATION TECHNICAL MEMORANDUM, SITE 11, OLD CAMDEN COUNTY LANDFILL," WRITTEN BY ABB-ENVIRONMENTAL SERVICES CONSULTING FIRM AND DATED MARCH 1994

General Questions and Comments

The USGS agrees with ABB that storage coefficient, or storativity (S) values obtained from the aquifer-test data are probably too small to represent the unconfined aquifer. As stated in the report, the S values result from interpretation of the "confined-aquifer response" of the drawdown curve because pumping time was insufficient to develop the "unconfined-aquifer response," and that longer duration tests presently underway may better define the S (or the specific yield) that is representative of the unconfined aquifer.

The "confined-aquifer response" from the short pumping test could also cause an incorrect interpretation of a confining bed at shallow depth. The negligible drawdowns in shallow wells, such as in well 11-2, may simply result from increase in S with decrease in depth. That is, the water expansion and aquifer compression reflected during early drawdown in deeper observation wells are expected to be less at shallower depth and may result in negligible drawdown in the shallower wells. Lack of drawdown in the shallower wells could, therefore, be attributed solely to change in S, rather than to a possible confining bed.

The USGS does not agree with ABB interpretations of aquifer-test data from wells RW1 and PS4, and with use of the later (greater than about 600 minutes) drawdown data from wells PS1, PS2, and PS3. The USGS analysis of the ABB aquifer-test data was transmitted to the Navy in a letter dated January 13, 1994. Explanations were made in that letter at to why specific data were used. The explanations, and how they account for the disagreements with ABB interpretations, are as follow:

(a) data from pumping well RW1 were not used by the USGS because of large well loss (USGS-computed well efficiency of RW1 was only 11 percent), and corrections for the well loss could not be made. The unusually small transmissivity (T) values for well RW1 given in table 2-4 of the ABB report, as compared to values from other wells shown in that table, result from the large slope of the solution line fitted to the drawdown data, and the large slope is due to the large well loss.

(b) water-level data from observation well PS4 show very small change, are erratic in that some changes are in the wrong direction for response to pumping, and probably result from changes in barometric pressure. The unusually large T values for well PS4 given in table 2-4 of the ABB report, as compared to values from other wells shown in that table, result from the small slope of the solution line, and the small slope is probably due to influence of barometric-pressure changes on water-level drawdowns.

(c) water-level drawdowns in observation wells PS1, PS2, and PS3 probably reflect barometric-pressure changes after about 600 to 800 minutes of pumping, so only earlier data were used by the USGS. The larger T values given in table 2-4 of the ABB report for well PS1 data, compared to values from other wells shown in that table, result from ABB use of later data that are influenced by barometric-pressure changes. The T values computed by the USGS from data at wells PS2 and PS3 closely agree with T values obtained by use of the Neuman method in the ABB analyses of these two wells because early drawdown data are emphasized in these analyses by ABB. Conversely, T values computed by the USGS from data of these two wells disagree somewhat (about 30 percent difference) with T values obtained by use of the Cooper-Jacob method in the ABB analyses because later drawdown data are emphasized in these analyses by ABB.

A table of elevation and well-construction data, for all wells completed to date, could be included in the revised version of this report, or in the next ABB report. The table could be similar in format to table 2-2. This suggestion is made because: the USGS is not aware of any report that contains specific elevation and construction data from previously completed wells 11-1 through 11-9, other than that which must be obtained graphically from boring logs, and; information on several wells recently completed by ABB (wells shown in figure 2-1, but not given in table 2-1 or 2-2) is not included in the present report.

Questions and Comments on Specific Pages

Questions and comments regarding table 2-1 on page 2-3 follow:

(a) Why are ground-level elevations in this table so much different (1-2 feet) than those shown on the boring logs in appendix A? The ground-level elevations shown on the boring logs are nearly the same as the values listed as top-of-casing elevations in table 2-1; could headings in the table or appendix be mislabeled?

(b) The explanation for the asterisk that refers to the top-of-casing elevations is confusing. The explanation is that the values are the "computed difference from top of recovery well piezometers." The values listed in this table ARE from the recovery wells, so why would there be a difference? Is this a problem of nomenclature and the "recovery well piezometers" are the "RW-P" wells given in table 2-2? If so, why is the well heading in table 2-2 given as "Observation Wells" rather than "Recovery well piezometers" and why is not table 2-2 referenced in table 2-1? Please clarify -- the explanation is not understandable in the present form.

(c) Nothing in the table is referenced to the footnote "6-inch diameter stainless-steel..."

Page 2-4, last para. The rate of 6.47 gallons per minute is called "constant," but it obviously an average of the ratio (9707 total gallons pumped) to (25 hours * 60 min/hour total pumping time). How does one know that this average rate was a constant rate? Approximately how many pumping-rate measurements were made with the in-line totalizing flow meter, and approximately what range of pumping rates were obtained from these measurements?

Page 2-5, table 2-2. Problems with the ground-level and top-of-casing elevations are similar to those given for table 2-1; they do not match those on boring logs in appendix A. The ground-level elevations shown on the boring logs in appendix A for wells PS7, PS8, PS9, and PS10 are the same as the values listed as top-of-casing elevations in table 2-2; could headings in the table or appendix be mislabeled? Even considering possibly mislabeled headings, one or more of the elevations given for well PS2 is obviously in error; the top-of-casing elevation given in appendix A is 35.59, and does not match the 33.59 top-of-casing or 33.12 ground-level elevation given in table 2-2.

Table 2-3. Does "static water level" refer to the water level immediately before pumping began, and does "water level" refer to the water level immediately before pumping stopped? Please clarify.

Table 2-3. Verification of the "static" (pre-pumping?) water levels given in this table might, theoretically, be done by cross-checking them with water levels given on boring logs in appendix A, and assuming there should be no significant difference between the two. Such a verification cannot actually be done, however, because: (a) the water levels given in appendix A are referenced to ground level, but only the top-of-casing, rather than ground-level, elevations are given in the appendix for several wells, and (b) ground-level elevations in tables are different from those in appendix A, particularly for well PS2.

Questions and comments regarding table 2-4 on page 2-10 follow:

(a) the saturated thickness of the aquifer ("b") should be given so that the reader can readily check the values of hydraulic conductivity (ratio of T to "b") without having to examine the text or plots in order to find the "b" value.

(b) third line of values for well RW-01 -- a T of 0.0674 ft2/min is not equal to a T of 24 ft2/day, and a T of 24 ft2/day does not give a hydraulic conductivity of 4.6E-4 cm/sec for the "b" of 75 feet given in the text of the report; the incorrect values on this line are apparently due to arithmetic errors on the hand plot in appendix E.

(c) values obtained from the Cooper-Jacob method cannot be distinguished from those obtained from the Neuman method; that is why it is confusing to have two different values, both determined from computer plots, for each of the wells PS-03 and PS-04. The reader must go through a procedure of first checking the scales of the plots in appendix E to see which method was used, then comparing the values on the plots to the values in the table before a determination can be made as to what value results from which method. Also, values from the Neuman method cannot be verified because match-point values are not given in the table or on the plots.

(d) The excessively large value of T for well PS-04, from the hand-plot, (for which a note is given in the table that the value should not be considered) is too large because the slope of the solution line is erroneously large -- the large slope matches very few of the data points. The second value for well PS-04, from the computer plot, probably should not be considered either because the solution line is matched to data that are probably affected by barometric-pressure changes.

Page 2-12, end of 1st para. The information here that the specific capacity of well RW1 increased from .54 gpm/ft to 1.1 gpm/ft conflicts with the data in appendix C, page C-3, and the footnote on page C-4, which states that no 'well efficiency' (specific capacity?) data were collected prior to the 25-hour aquifer test. Or does this mean that the specific capacity of well RW1 was .54 at the beginning of the pumping test and increased to 1.1 by the end of the pumping test?

Page 5-1, beginning of 4th para. The possibility that a confining bed is located between the shallow and deep wells is conceptual, as is stated in the paragraph. However, the statement that the pumping-test data indicate that the upper part of the aquifer may be more permeable than the lower part is unsubstantiated -- the aquifer-test data do not indicate a permeability difference, and no other data or explanations are given in the report to indicate such a difference. Further explanation should be given here, or the statement deleted.

Appendix A. Why is only ground-level elevation given in headings of some boring logs and only top-of-casing elevation given in headings of other boring logs? Are some headings mislabeled (see previous comments about possible mislabeling of tables 2-1 and 2-2). All information below the headings of the boring logs are apparently referenced to ground level, and no scale is given for the part of the casing above ground level, so elevations given in the headings should be referenced to ground level rather than top of casing.

Appendix A. The style of print used on boring logs is such that it is extremely difficult, sometimes impossible, to tell the difference between the digits 6, 8, and 9. The numbers are so easily confused that they are of limited use to the reader. This comment has been made in previous USGS reviews of ABB reports.

Appendix A. The dates of water-level measurements should be given on the boring logs. Were they measured on the well-development date?

Appendix C, page C-3. Should not this table be called "specific capacity data" or "well development data," rather than "efficiency data"? Well efficiency is the ratio of theoretical to actual drawdown, usually determined from distance-drawdown curves, and is not addressed in the table. Comments -- it is interesting that specific capacity increased little from well development at several wells, and decreased at RW5; perhaps the aquifer tests now underway will show whether or not these wells were essentially developed immediately after completion of drilling.

Appendix E. Why are two computer-generated, semi-log plots given of data from well PS1, and why are the early drawdown data omitted from the second plot? The solution line of the first plot matches very few of the data points, and no values from the first plot are given in table 2-4; is this a rejected plot that was inadvertently left in the report? Also, the later data shown for the second plot may reflect changes in barometric pressure, and are therefore not useful for analysis.

Appendix E. All computer-generated plots should show all values used in the analysis, including the value of the slope of the solution line used in the Cooper-Jacob method, not simply the results of the analysis. Computations for the Neuman method cannot be checked because match-point values are not given on the plots or in tables, so the reader must accept analysis results on faith.

Appendix E. No well name is given on the plot of the Theis recovery method (drawdown and t/t'). To determine which well data were plotted, the reader must find the information either in the text or in table 2-4. Also, some arithmetic errors have been corrected on the plot, but some have not been corrected.