N65928.AR.000895
NTC ORLANDO
5090.3a

EMAIL REGARDING U S NAVY RESPONSE TO GEOLOGICAL/HYDROGEOLOGICAL COMMENTS ON THE DRAFT OPERABLE UNIT 2 (OU 2) REMEDIAL INVESTIGATION REPORT WITH ATTACHMENTS NTC ORLANDO FL
6/10/1999
TETRA TECH

03,01,02,0012
00560

McCoy, Steven

From: McCoy, Steven
Sent: Thursday, June 10, 1999 5:18 PM
To: 'Barbara Nwokike'; Alan Aikens; Dave Grabka; Nancy Rodriguez; Rick Allen; Robin Manning; Wayne Hansel
Cc: Campbell, Michael
Subject: Response to OU 2 RI Comments

Y'all:
Attached are responses to the geological/hydrogeological comments on the draft OU 2 RI Report. The second file (Resampling strategy) was transmitted to you last week, but is included again as it is referenced in the responses. If you have further questions, please call me and hopefully we'll be able to resolve remaining issues over the phone. Thanks,
Steve


RI Geo Responses.doc


Resampling strategy.doc

RESPONSE TO FDEP COMMENTS – DRAFT OU 2 RI REPORT NAVAL TRAINING CENTER, ORLANDO

Reference: Letter from Mr. David P. Grabka to Mr. Wayne Hansel, RE: "Draft Remedial Investigation Report for Operable Unit 2", April 1, 1992.

(1) Vertical groundwater flow through the uppermost confining clay layer of the Hawthorn Group should be discussed in more detail in the report. There is an apparent 30 to 35 foot hydraulic head drop through this layer. Also, cone penetrometer testing data located in the Remedial Investigation Technical Report (Brown & Root, 1998) would be useful in this report to identify areas where DNAPLs could pool, thicknesses of the confining clay layer and site lithology.

Response: A more detailed discussion will be added to the text. The cone penetrometer data and a discussion of the results will be added to the report.

(2) The soil organic vapor survey results located in the Remedial Investigation Technical Report (Brown & Root, 1998) would be useful in this report to correlate with soil sample analyticals and to identify potential hot spots or source areas that may be impacting groundwater. Also, the results of the methane gas survey were not located in the report.

Response: The soil organic vapor and methane gas surveys will be added to the report.

(3) In section 5.2.6, it appears that total chromium was inadvertently grouped with calcium, magnesium, potassium and sodium as being abundant in natural soils, having low toxicity and having no residential soil cleanup target level (SCTL). This should be corrected.

Response: This error will be corrected.

(4) The report states that landfill wastes reportedly included low-level radiological waste (from Air Force operations). As this reviewer is not very knowledgeable about what that type of waste would be composed of, I feel it would be useful to describe the specific radioactive elements that might be found in such wastes, their breakdown products and half-lives. It would also be useful to include in the report information on the specific radioactive elements that are naturally occurring and the ratios in which they are found.

Response: Available historical records only indicate "low-level radiological waste (from Air Force operations)." No additional information has been found regarding specific radionuclides. A discussion of naturally occurring radionuclides and their associated ratios will be added to the report.

(5) It appears that geochemical processes within the landfill are leaching metals from waste material and the aquifer matrix to groundwater. A section of the report should be devoted to these processes with reference to field data collected during groundwater sampling (pH, turbidity, dissolved oxygen, oxidation-reduction potential, conductivity, etc.) and laboratory analytical data. It may be useful to conduct a modelling exercise to determine why metals are apparently leaching to groundwater at extremely elevated concentrations and why surface water

in the canals and ponds at the site have greatly reduced metals concentrations in comparison.

Response: It is likely that the turbidity of the groundwater samples was the source for much of the inorganic contamination detected. The wells with inorganic concentrations above FDEP criteria will be resampled using additional techniques to reduce turbidity. If widespread metals contamination is found, a detailed discussion of the groundwater chemistry and the possible effects on leaching will be added to the report.

(6) It was stated in the report that the FDEP's GCTL for gross beta radiation in groundwater is 50 pCi/L. This is incorrect. Florida's primary standard for beta radiation is 4 mrems/year. If there is a conversion from mrems/year to pci/L, the calculations should be provided in the report.

Response: The identification of 50 pCi/L as an FDEP GCTL in Table 5-3D and in Section 5.3.7 was in error. This value is a federal screening level provided in 40CFR141.26, and the report will be changed to cite the correct reference.

(7) It is stated in section 8.1 that the southern extension of the canal that runs along the eastern perimeter of the southern, wooded portion of the landfill did not exist when the landfill was in operation. The date this canal was constructed should be provided in the report.

Response: The construction date will be added to the report.

(8) Please note that the Department is in the process of rulemaking for Chapter 62-777, Florida Administrative Code. Some groundwater cleanup target levels (GCTLs), soil cleanup target levels (SCTLs) and surface water cleanup target levels (SWCTLs) may change. The latest cleanup target levels being proposed may be found on the internet at:

http: //www. ifas.ufl.edu/~jkt/index.htm

Response: The final report should cite the criteria (Chapter 62-785 or 62-777) in effect at the time of submittal. However, for preparation of the next draft, which is several months away, we plan to reference the Chapter 62-777 criteria to avoid further revisions when the criteria are finally adopted.

(9) Surface water contaminant concentrations are compared to the federal Ambient Water Quality Criteria in the ecological risk assessement portion of the report. Florida's Surface Water Quality Standards and SWCTLs should also be used for screening level purposes to determine COPCs.

Response: EPA Region 4 surface water screening levels were used in the ecological risk assessment, although Region 4 surface water screening levels are based, in part, on AWQCs. As indicated in the comment, the Eco Risk Assessment will be revised to include Florida's Surface Water Quality Standards (Chapter 62-302) and SWCTLs in developing the COPCs.

(10) Surface soil and groundwater inorganic concentrations are compared to background concentrations. This report should provide details on how these background concentrations were calculated and where the background samples were collected from.

Response: The text (Section 5.2.6) identifies the source of the inorganic background concentrations as *Background Sampling Report, Naval Training Center, Orlando* (ABB-ES, 1995). However, a footnote will be added to Tables 5-2C and 5-3E to indicate the source of these background data. The *Background Sampling Report* provides the method of calculation and the locations where the samples were collected.

RESPONSE TO EPA COMMENTS – DRAFT OU 2 RI REPORT
NAVAL TRAINING CENTER, ORLANDO

Reference: Letter from Ms. Nancy Rodriguez, USEPA Region 4, to Mr. Wayne J. Hansel, Southern Division NAVFACENGCOM, SUBJ: "Comments on the Remedial Investigation, Operable Unit 2, McCoy Annex Landfill", May 5, 1999.

I. Technical Comments:

General Comment:

1. Much data has been collected for this investigation and in many ways the field investigation has been very through. The format of presentation of these data in the graphs and figures of the report is excellent. However, in some aspects, the interpretation of the available data presented in the report is weak or absent. For example, the figures show points where contamination has been sampled, and reports the results of the analyses, but plumes of groundwater contamination are not shown.

Response: In keeping with data collection focused on the presumptive remedy of capping and containment, plume maps of groundwater contamination have not been generated. Data were not collected to define the extent of groundwater contamination beneath the landfill, but rather to characterize the contamination that may be migrating off site to support remedial alternative selection in the FS.

Areas and volumes of contaminated soil which may require remediation are not defined.

Response: Areas of soil contamination are identified on the maps provided in the RI Report. Volumes of contaminated soil will be calculated in the FS if required for alternative evaluation. Please note, however, that the IRA currently underway at OU2 is addressing the contamination and thin areas in the soil cover. As a result, confirmation data showing that the soil contamination has been remediated is expected to be available in the near future.

Some contaminants, such as the gross alpha and gross beta activity reported in groundwater are described as being from to natural sources without a clearly described comparison to levels found in background areas unrelated to the landfill which would support the idea that the observed gross alpha and gross beta activity is natural.

Response: A more in-depth discussion of the gross alpha and gross beta results will be included in the Draft Final report. Additional data from resampling monitoring wells, including offsite background wells on GOAA property to the east, will be considered in the discussion.

Trends in contaminant concentrations over time have not been evaluated. Only one set of monitoring well sample data is presented, so trends in organic contaminant concentrations, an important aspect of monitored natural attenuation, can not be evaluated.

Response: Additional groundwater, surface water, and sediment samples will be obtained in July 1999 (see attached resampling recommendations). The new data should allow limited evaluation of trends in contaminant concentrations. Data on MNA parameters, however, have been obtained and will indicate if conditions favorable to MNA are present at OU 2.

Further, I am unable to conclude that the reported exceedances for inorganic contaminants are real or as extensive as indicated from the data presented. I do not believe that the available data is suitable for evaluating the need for remedial measures or selecting the appropriate remedial measure for inorganic contamination in groundwater.

Response: Steps will be taken to ensure that the new groundwater samples to be obtained will have minimum turbidity, and thereby provide confidence that the forthcoming inorganic data are valid (see attached resampling recommendations). In addition, surface water samples for mercury analysis will be obtained with special sampling procedures and analyzed by a mercury-clean certified lab to avoid the possibility of false positives.

Specific Comments:

1. The text on page 2-13 and Figures 2-4 & 2-6 describe the large water level difference between Shallow Aquifer & Hawthorn Formation caused by a clay layer (Figure 2-3). The clay layer is effective barrier to downward movement of groundwater and probably limits the downward migration of contamination. The text notes (page 2-13) absence of contamination in the Hawthorn Formation below the top of the clay layer, but this good news demonstrating the vertical extent of contamination is not stressed in the text of the report before Chapter 8, and not mentioned in Executive Summary description of Investigation Results.

Response: This information will be stressed in Section 5.3 and added to the Executive Summary description of Investigation Results.

2. Section 5.2 describes contamination in surface soils, but does not include a map showing the extent of soil contamination. The volume of contaminated soil in excess of Florida SCTLs is not estimated. Estimates of the volume of contaminated soil which may require remediation should be part of a site characterization.

Response: In keeping with data collection focused to evaluate the presumptive remedy of capping and containment, Figure 5-2 shows the locations where contaminated soil was encountered and indicates the extent of contamination. The IRA currently underway at OU 2 is addressing the contamination and thin areas in the soil cover. Estimates of contaminated soil volume will not be calculated in the RI (refer to the response to General Comment #1.)

3. The RI should include the elements necessary to evaluate the transport and fate of the COCs and the elements necessary to evaluate the risk associated with the concentrations of COCs. "The ability to estimate future exposure concentrations depends on the extent

to which hydrogeologic properties needed to evaluate contaminant migration are quantified. Repetitive sampling of wells is necessary to obtain samples that are unaffected by drilling and well development and that accurately reflect hydrogeologic properties of the aquifer(s)." (EPA Risk Assessment Guidelines, CHAPTER 4, p. 4-12, http://www.epa.gov/oerrpage/superfund/programs/risk/ragsa/index.htm).

Response: A discussion of the properties of the surficial aquifer will be added to Section 2.2.3.2 (Aquifer Properties). MWs that contained concentrations of contaminants at levels exceeding GTCLs will be resampled, thus the samples should be more representative of the aquifer conditions for the reasons stated in the comment.

Important physical and chemical characteristics of the soil and groundwater flow system which are important for evaluating fate and transport are not presented in the report. These hydrogeologic properties, including porosity, bulk density, fraction organic carbon, retardation factors for the COCs, etc. may have a significant effect on the risk assessment.

Response: A discussion of the properties of the surficial aquifer including bulk density and fraction organic carbon will be added to Section 2.2.3.2 (Aquifer Properties). In-place porosity was not determined due to an inability to obtain Shelby tube samples from the sands of the surficial aquifer. As indicated in Section 8, an estimated porosity of 0.2 was used based on literature values. Retardation factors for the chemicals of concern (COCs) will be included in Section 8.

4. Figure 5-3A through 5-3E shows the locations of groundwater samples which exceeded Florida GWCTLs. None of these figures show plumes of contaminated groundwater or show the extent of groundwater contamination which could be used to estimate the volume of contaminated water which may require remediation.

Response: In keeping with data collection focused to evaluate the presumptive remedy of capping and containment, Figures 5-3A through 5-3E show the locations where contaminated groundwater was encountered. Groundwater discharges to the drainage canals as discussed in Section 2.2.3.1. A discussion of the downgradient extent of contamination will be added to Section 5.3.8, (Groundwater) Summary.

Estimates of the volume of contaminated groundwater which may require remediation should be part of a site characterization.

Response: Because volume estimates are not required to evaluate the presumptive remedy of groundwater containment, data were not collected to make this determination.

Estimates of the rate of groundwater flow and rates of contaminant migration within the plumes should be part of a site characterization.

Response: The groundwater flow rate is provided in Section 8.3. The value in determining the rate of contaminant migration at this site is not clear. No material

has been added to the landfill for >20 years, and it is unlikely that concentrations will increase significantly in the future. Over most of the site, the groundwater discharges directly to the canals a few feet from the site boundary, and in the south-southwest flow direction the extent of contamination has been bounded by MW-20A and –20B. (The data in the draft RI report indicate an exceedance for two organic compounds at this location, but resampling data which will be provided in the final draft report indicated no exceedances.) From an engineering standpoint, the groundwater flowrate is an important parameter for the remedial design but without the likelihood that concentrations will increase, the rate of contaminant migration will not factor into the design.

The discharge areas at this site (the canals) are well defined, therefore the maximum down gradient extent of contamination is known, but the up gradient areas are not monitored. It may not be desirable to install wells through the landfill cover and source material to get samples up gradient from the discharge area, but without up gradient monitoring wells, we don't know the volume of contaminated water or, more importantly, whether contaminant concentrations are increasing or decreasing with time.

The extent of groundwater contamination probably can be estimated from Figures 2-4 and 5-3A, so the area and volume of contaminated groundwater can be approximated.

Response: It is unnecessary to determine the volume of contaminated groundwater to meet the objectives of the presumptive remedy, i.e., containment.

While the resampling at OU 2 should lessen concerns regarding disturbance of the aquifer, it is impractical and unnecessary to sample periodically for several years before initiating the FS. While the additional data could be helpful in lessening uncertainty, "The objective of the RI/FS process is not the unobtainable goal of removing all uncertainty, but rather to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site." (EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, p. 1-3)

However, without monitoring wells up gradient from the canals, it is difficult to determine whether the number of monitoring wells with exceedences will increase In the future or whether the concentrations in the wells which already have exceedances will increase In the future. The wells have been sampled only once, and no data to evaluate trends in metals concentrations is presented.

Response: As indicated in the response to General Comment #1, MWs that contained concentrations of contaminants at levels exceeding GTCLs will be resampled in July 1999. The new data should allow limited evaluation of concentration trends.

The future impact of contaminated groundwater on surface water in the canals has not been evaluated.

Response: Due to the length of time since material has been added to the landfill, it is unlikely that surface water will be further impacted. An evaluation of the future impact to surface water will be added to Section 5.4, Surface Water.

5. The average turbidity of 48 groundwater samples collected from monitoring wells for this investigation (Appendix A) was approximately 900 NTU (see the table attached to this memo), more than 90 times the turbidity level recommended in the EPA Region 4 SOP. The average purging time was only 60 minutes and the average purge rate was approximately 0.5 gpm. The purging time was relatively short and the average pumping rate was higher than the rate which might be considered to be a low flow purge rate.

   It seems strange that so many samples which failed the turbidity criteria of the SOP were collected and submitted for analysis without an action by the consultant to resolve the problem.

   - Perhaps the sample collection methods could have been changed to purge the wells longer and more slowly to obtain samples which met the sample quality requirements of the SOP.

   - Perhaps the wells were developed inadequately prior to purging and more development was needed.

   - Perhaps the wells were installed with screen slots too big for the grain size of the formation material.

   The slot size used is the smallest commonly available for PVC screens, but smaller slot sizes are available in stainless steel. If smaller slot sizes were needed to produce samples of suitable quality for analysis, smaller slot sizes should have been recommended before all 48 wells were installed. If the slot size is OK but the wells were not adequately developed, they should have been developed before the expense of sample collection and analysis was incurred. Stainless steel well screens are much more expensive than PVC, and additional development and purging time costs money, but as noted in the report, the validity of these sample results for assessing the extent of metals contamination in groundwater is questionable.

   The report states (p. 5-91) that "... there were significant differences in the concentrations of some inorganics between the unfiltered and filtered samples." The report also states (p. 5-91) that the results indicate "... that suspended particles or colloids in the shallow and intermediate well samples may have been adversely affected in the concentrations if some inorganic species."

   It is important to know if the results of the metals analyses were due to metals dissolved in groundwater, metals suspended on particles and dissolved by the acid preservative, or metals on colloidal particles. Clearly, an exceedance caused by dissolved metals or colloidal transport is cause for concern, but an exceedance caused by metals leached by the acid preservative from suspended particles is likely to be a transient occurrence and not the basis for assessing the risk of drinking this water for a life time.

Pumping removes fine particles near the well screen, causing a natural develop a filter pack to develop near the well. The result is a water supply of low turbidity without suspended particles on which metals may be present. Unfiltered samples from a properly developed monitoring well simulate the quality of water which might be consumed by someone using the aquifer over a long period. Metals may enter a water supply via colloidal transport in some aquifers even with a well developed natural filter pack, but the distinction between metals concentrations by dissolved, suspended and colloidal transport can not be made from these data. Suspended solids sometimes enter filtered samples by breaking through the filter when the source water is turbid and the pressure on the filter is high, so the results from the filtered samples may not be conclusive. Further, it is EPA Region 4 policy to base risk assessment calculations on unfiltered samples only. Samples can be collected by low flow purge methods from properly developed wells which have turbidity levels suitable for water supply purposes. The results of metals analysis from unfiltered samples with low turbidity will be indicative of metals concentrations in the groundwater which should be considered for risk assessment purposes.

In summary, there may be a problem with inorganic substances in groundwater at this site. However, the quality of the samples submitted for analysis did not meet the recommended requirements in the Region 4 SOP, which makes it difficult to determine if the exceedances are real. It is impossible to use the existing data to determine if metals are dissolved in groundwater, transported on colloidal particles, or dissolved from suspended solids by the sample preservative. The report acknowledges that inorganic substances probably were dissolved from suspended sediments in the samples.

Response: Additional samples will be obtained in July 1999 from all wells with exceedances and background wells on GOAA property. The attached sampling recommendations summarize the steps to be taken to minimize turbidity and meet the EPA guidance criterion of 10 NTU.

6. The source of gross alpha and gross beta radiation detected in water and sediment samples has not been evaluated. Have background samples been collected from other areas which show similar gross alpha and gross beta activity?

Response: Gross alpha and gross beta background data are presented in the *Background Sampling Report* (ABB-ES 1995) for groundwater. No background data are available for sediment or surface water at this time; however, additional upstream samples will be collected and analyzed to evaluate the contribution from offsite sources. Two sediment samples have been submitted for isotopic analyses. The analytical data are expected to indicate that the source of the alpha and beta activity is naturally occuring, as is qualitatively indicated by isotopic data from two surface soil samples. A discussion of the isotopic data will be added to the text.

7. The RI does not contain the elements necessary for an evaluation of monitored natural attenuation (MNA). Guidelines for evaluation of MNA have been available from EPA Region 4 since 1997. These guidelines strongly resemble MNA guidelines from other sources which have been available since 1995 (Air Force Center for Environmental Excellence, AFCEE). National guidelines for implementation of MNA, which evolved from the AFCEE guidelines, were finalized by EPA in November, 1998 (http://www.epa.gov/ada/report.html or http://www.clu-in.org/). The national guidelines are relatively recent, but the requirements and methods for evaluation of MNA are not substantially different than the earlier Region 4 or AFCEE guidelines. The COCs in Area 2/3 groundwater (p.6-12) include a number of fuel related and chlorinated organic compounds which may be suitable for remediation by MNA at this site. MNA probably should be evaluated in the FS, but the site characterization factors which would be used in the FS to evaluate MNA are not presented in this RI.

Response: Data for evaluating MNA were obtained during the RI, but presentation of these data will be improved for clarity. Most of these data are provided in Appendix B, including alkalinity, BOD, COD, chloride, nitrate, phosphate, sulfate, pH, microbial plate count, redox potential, total organic carbon, TSS, TDS, and dissolved methane. Additional parameters, including dissolved oxygen, dissolved carbon dioxide, Fe+2, temperature, conductivity, and sulfide, are reported on the groundwater sampling log sheets. These data will be entered into the database and provided in Appendix B. In addition, a table listing the MNA data will be inserted into Section 5.3.

RECOMMENDATIONS FOR RESAMPLING AT OU 2
McCOY ANNEX LANDFILL

SURFACE WATER AND SEDIMENT

Locations to Resample [a]	Analytical Parameters	Rationale
All locations in canals or ditches adjoining OU 2 (SW1, SW5, SW8, SW10, SW12, SW14, SW15, SW18 SW19, SW20, and SW21)	Surface water: gross alpha, gross beta, metals (mercury to ultra clean lab), SVOCs Sediment: gross alpha, gross beta, metals, pesticides	Determine current conditions in sediment (conditions may have changed due to dredging after RI samples were collected) and additional data for trend analysis
Six new upstream locations (two north of 8th Express St., two west of Hole No. 5, and two northwest of Hole No. 5)	VOCs, SVOCs, pesticides, herbicides, PCBs, metals, gross alpha, gross beta, TDS, TSS, hardness, alkalinity, and TPH	Evaluate potential upstream contributions to contamination found adjacent to OU 2

[a] Surface water and sediment collected at each location.

MONITORING WELLS

Wells to Resample	Analytical Parameters	Rationale
All wells with organic compound concentrations above GCTLs (3A, 3B, 11B, 12B, 15B, 18B, 20A, 21B, and 26C)	VOCs (and SVOCs for 15B and 21B)	Additional data for trend analysis
All wells on GOAA property (4A, 4B, 10A, 10B, 13A, 13B, 15A, 15B, 16A, 16B, 17A, 17B, 19A, 19B, and 24C) plus wells 9A and 9B on Navy property but across the canal from the landfill area	Metals, gross alpha, gross beta	Determine local background values for metals and gross alpha/gross beta
All wells on Navy property with non-organic concentrations above screening criteria and background values (1A, 1B, 2A, 2B, 3A, 3B, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 11A, 11B, 12B, 14A, 14B, 18A, 18B, 20A, 20B, 21A, 21B, 22A, 22B, 23C, 25C, and 26C)	Metals, gross alpha, gross beta (on a well-by-well basis; only analyze for fractions exceeded)	Additional data for trend analysis and obtain samples with turbidity less than 10 NTU

Reducing turbidity in groundwater samples

Three possible approaches to reducing the turbidity of the samples have been identified and are listed below.

- Extended low-flow purging and sampling at 100 ml/min.
- High-energy redevelopment (approximately 3 gpm) followed by low-flow (100-ml/min) purge and sample.
- Low-energy redevelopment (approximately 0.5 gpm) followed by low-flow (100-ml/min) purge and sample.

In order to collect groundwater samples with minimum turbidity, the purging and sampling rate will be limited to 100 ml/min. If turbidity is greater than 10 NTU when field parameters have stabilized (±5%), purging will continue until one of the conditions listed below occurs.

- Turbidity is less than 10 NTU
- No significant or consistent decrease in turbidity occurs over a 60-min period (approximately 6 measurements)
- 6 hr has elapsed

All wells, in which turbidity can not be reduced below 10 NTU after purging as indicated above, will be redeveloped. In at least two wells (one shallow and one intermediate), a submersible pump will be used to pump water out of the well at a rate of approximately 3 gpm. This approach is based on the results of the pump test conducted in a 4-in. diameter well. Visual observations indicate that the discharge water from the pump test was fairly clear (the pumping rate was about 9 gpm and turbidity was estimated in the 20-30 NTU range). Approximately the same water velocity at the borehole wall of a 2-in. well will result from about a 5 gpm pumping rate. In order to minimize development water the 3 gpm rate is recommended. This rate is still expected to maintain turbulent flow conditions to enhance development.

The pumping rate will be reduced during development when necessary to ensure that drawdown in the well does not exceed ¼ of the saturated screened interval (for wells with at least 4 ft of saturated screen). Limiting the drawdown will maintain water flow across the screened interval of the saturated formation and promote complete development. For wells with less than 4 ft of saturated screened interval, the maximum allowable drawdown will be 0.5 ft above the midpoint of the saturated interval. The wells will be developed until all parameters including turbidity stabilize. Subsequently the wells will be purged (and sampled if turbidity is less than 10NTU) as indicated in the previous paragraph (100 ml/min). The four deep wells (completed in the upper sand of the Hawthorn Group) are not expected to supply enough water for the high-energy redevelopment.

If the turbidity in a given well can not be reduced below 10 NTU using the high-energy redevelopment, a low-energy redevelopment will be performed. A flow rate of approximately 0.7 gpm represents the approximate velocity separating turbulent flow from laminar flow for the well construction used in this aquifer. The wells will be redeveloped at a flow rate of 0.5 gpm to ensure that the redevelopment stays in the laminar flow regime. The same criteria for acceptable drawdown apply to both high- and low-energy redevelopment.

If turbidity can not be reduced below 10 NTU using any of the above procedures, an alternate approach will be to construct smaller diameter wells (using finer sand packs) inside the existing wells.