N90845.AR.001573
NWIRP BETHPAGE
5090.3a

LETTER AND U S DEPARTMENT OF THE INTERIOR COMMENTS ON WORKPLAN FOR NAVY VERTICLE PROFILE BORING 133 NWIRP BETHPAGE NY

10/24/2011
U S DEPARTMENT OF THE INTERIOR

United States Department of the Interior

U. S. GEOLOGICAL SURVEY

NEW YORK WATER SCIENCE CENTER
2045 Route 112, Building 4
Coram, NY 11727-3085
(631) 736-0783
(631) 736-4283 Fax

October 24, 2011

Mr. Robert Alvey, P.G.
Technical Support Team
U.S. Environmental Protection Agency, Region II
Emergency and Remedial Response Division
290 Broadway, 18th Floor
New York, New York 10007-1866

Re: Comments on Workplan for Navy Vertical Profile Boring 133

Dear Mr. Alvey,

The U.S. Geological Survey (USGS) was requested by U.S. Environmental Protection Agency (USEPA) to review the workplan for Navy vertical profile boring (VPB) 133 at Bethpage, N.Y. (fig. 1), and to offer recommendations that would optimize the results anticipated through the VPB. The VPB133 workplan proposes collection of data that would increase confidence in approaches to anticipated future public water supply impacts from VOC plume migration, particularly in the northwest of Massapequa Water district including supply wells N 6442/ N 6443 (fig. 1). In addition to N 6442/N 6443, other supply wells at nearby upgradient wellfields in the AquaNY (N 9338) and South Farmingdale (N 8664) water districts may be expected to influence groundwater levels and flows at VPB133.

The completed and proposed VPB work is a helpful step and this letter will present a few suggestions for improved data collection and analysis, and to re-iterate recent suggestions given in the "Remedy Optimization Team Report for the Bethpage Groundwater Plume Remedy" (Hare and others, 2011), and "Simulation of Groundwater Flow in a VOC-Contaminated Area near Bethpage, Nassau County New York – A discussion of Modeling Considerations" (Misut, 2011).

Comment on Purpose of Boring

The main purpose of the current boring program is summarized by the following introduction statement (pg. 1of VPB133 workplan): *"These investigations are being conducted to better define the extent of solvent-contaminated groundwater offsite of the Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, Long Island, New York (Figure 1)."* Given this purpose, it is likely useful to collect information types including the following: VOC concentrations, inorganic chemical concentrations, vertical and horizontal variations in geology and head values; and to conduct analyses such as aquifer tests and modeling. Better information on vertical and horizontal variations in water chemistry, geology and head values may be used to better delineate

and understand how the plumes are migrating. These ideas are described in more detail in (Hare, 2011).

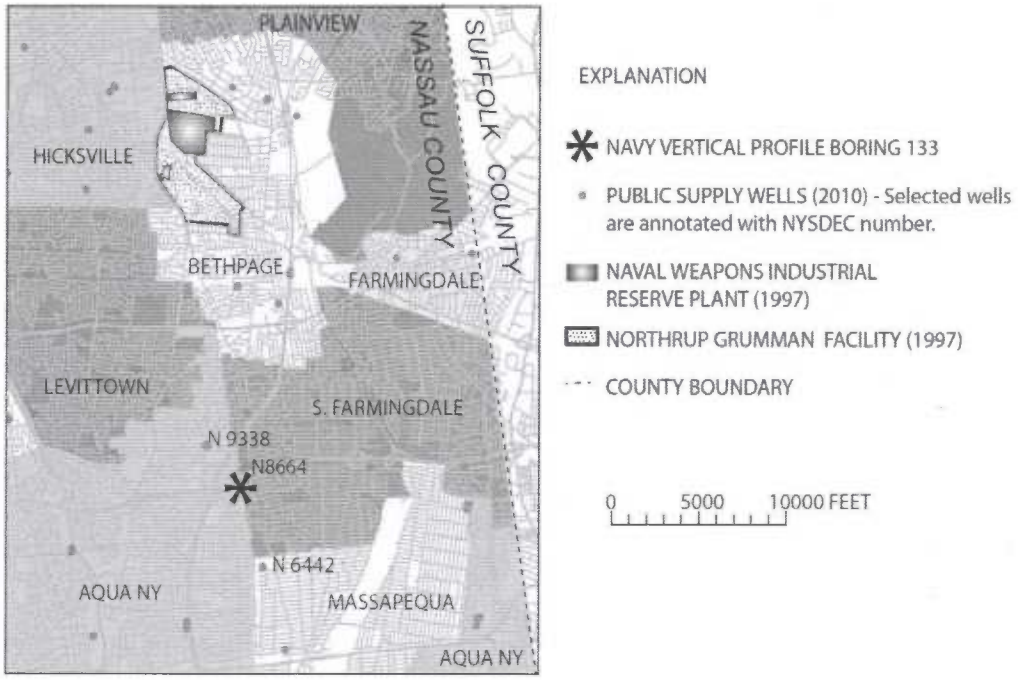

Figure 1. Location of proposed Navy Vertical Profile Boring 133 and Public Water Districts surrounding Naval Weapons Industrial Reserve Plant, Bethpage, New York.

Cooperation with Water Districts

In order to accurately characterize the mechanisms of plume migration that may impact public supply wells, water districts may consider developing aquifer testing networks in conjunction with vertical profile boring sites such as VPB133. Figure 2 shows an example with 5 wellfield and 2 offsite monitors: a recent effort by USGS/Suffolk County Water Authority at Centereach, Long Island (Misut and Busciolano, 2009). Aquifer tests are controlled, transient-state experiments in which pumpage is intentionally varied while water-level dynamics in nearby monitoring wells are observed through continuous water-level recorders, and aquifer hydraulic properties are estimated through model parameter inversion. The inversion process uses least squares minimization to identify parameter values that provide the closest match between simulated and observed water levels. Public-supply well stress generally radiates at least 3,000 feet in the Magothy aquifer during a controlled aquifer test (Misut and Busciolano, 2009). Analysis of longer-term data demonstrating responses to stress variations under typical operating conditions may also be useful.

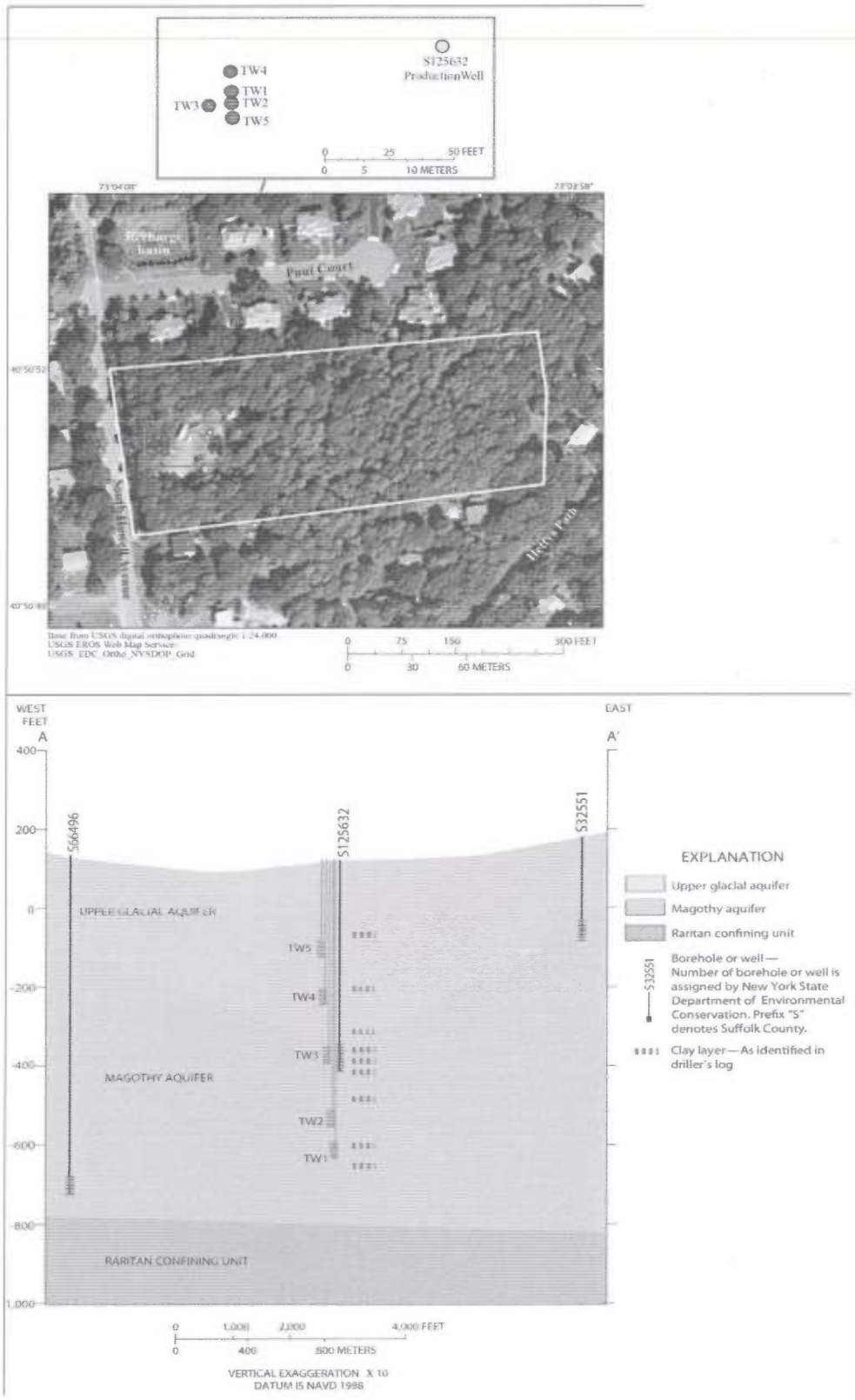

Figure 2. Example of wellfield-scale aquifer testing network in the Magothy aquifer, Suffolk County, New York. (From Misut and Busciolano, 2010)

In addition to affecting water levels, water district pumping rates and schedules may be expected to influence plume migration through both advective and nonadvective mechanisms such as hydrodynamic dispersion (Payne and others, 2008). Temporal variations in pumping rates and other stresses enhance plume spreading and may help explain why solute concentrations increase at public-supply wells that are pumped heavily in summer. Table 1 shows summer peaking in water supply during a representative year (2009) of Massapequa Water District operation (from NYSDEC; written commun., Paul Granger, H2M, 2011). Careful analysis of VPB133 and other site data may yield strategies such as pumping schedule stabilization and regional wellfield rate balancing.

Table 1. NYSDEC 2009 Pumpage Report for Massapequa Water District, Nassau County, New York.

[NYSDEC, New York State Department of Environmental Conservation]

New York State
Department of Environmental Conservation
Water Supply Unit
Pumpage Report for 2009 in Thousands of Gallons

Utility Name: **Massapequa Water District** Address: **84 Grand Avenue Massapequa, NY 11758** Tel No.: **516-798-5226**

Well #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
	N-4602	**N-9173**	**N-5703**	**N-6442**	**N-6443**	**N-6866**	**N-6867**	**N-8214**	**N-13338**	**TOTAL**
MONTH										
JANUARY	2,048	57,419	12	846	16	33,627	753	2	932	95,655
FEBRUAY	8,505	37,313	2	19,750	98	15,697	567	0	38	81,970
MARCH	0	53,225	8	0	4,603	22,594	9,653	0	1,556	91,639
APRIL	10	51,204	4,165	0	0	1,975	36,950	169	10,549	105,022
MAY	24,963	0	3,750	14,175	6,293	30,135	58,913	2,909	21,203	162,341
JUNE	46,721	12,248	5,452	38,442	17,332	20,759	7,879	2,527	21,924	173,284
JULY	18,606	84,420	6,206	23,569	17,216	52,640	14,373	4,687	19,634	241,351
AUGUST	27,014	87,947	1,119	44,671	14,970	53,125	17,356	10,195	19,985	276,382
SEPT	28,034	69,797	3,938	27,381	8,273	38,689	24,504	9,884	15,604	226,104
OCTOBER	51,791	16,526	2,021	9,933	151	7,246	46,766	5,601	11,966	152,001
NOV	283	81,962	2	121	130	1,274	15,855	19	354	100,000
DEC	30,217	13,628	58	4,970	387	26,029	1,012	8	16,810	93,119
						303,79			140,55	1,798,8
TOTAL	**238,192**	**565,689**	**26,733**	**183,858**	**69,469**	**0**	**234,581**	**36,001**	**5**	**68**

Notes:

(1) POPULATION SERVCED IN SERVICE AREA: **43,000**
(2) POPULATION SERVED OUTSIDE OF OWN SERVICE AREA: **0**
(3) PERCENT OF CUSTOMERS METERED: **1**
(4) NUMBER OF SERVICES: **13,750**
(5) PEAK DAY RATE: **39,992**
(6) DATE OF PEAK RATE OCCURENCE: **12**
(7) NUMBER OF ACTIVE WELLS WHICH CAN BE OPERATED BY OTHER THAN ELECTRIC POWER: **4**

STORAGE FACILITIES:

1-Elevated Storage Tank -1MG
1- In Ground Storage Tank - 2MG
2- In Ground Storage Tank - 1/2 MG

Site Selection

The VPB133 site is discussed in the Optimization Team Report (Hare and others, 2011, pg. 15) as follows: *"At least three additional multi-level monitoring wells should be installed approximately midway between the Massapequa supply wells and the currently identified leading edge of the plume, to serve as an additional indicator of plume migration. The Southern State Parkway may provide potential access for such wells, which would be installed across a transverse (approximately east-west) cross-section along the potential path of the plume. These wells would supplement other efforts to monitor plume migration towards the next major series of public water supply wells (Massapequa Water District). Given the rough approximation of estimated arrival times*

described in Section 5 (Item #4), the halfway point between the current leading edge of the plume and the Massapequa supply wells would represent a conservative 5-year travel window." The section 5.4 discussion (Hare and others, 2011, pg. 12) follows: *"Arrival time" hand calculations by the Technical Team provided an estimated plume velocity of 275 ft/yr. This estimate is based on the first arrival of the plume in 2009 in the Aqua New York supply well (approximately 3 miles from the suspected source areas and 60 to 70 years after the first reported operations that could have led to VOC releases in the source areas). Assuming that the plume progresses with this same flow rate beyond its current leading edge, the plume could arrive in the Massapequa District wells in approximately 20 years. Assuming that uncertainties (and unknowns) in these rough calculations are of the order of a factor of 2, the plume could be approximated to arrive in Massapequa supply wells, potentially between 10 to 40 years. This calculation contains a large assumption – that the geology, hydraulic gradient, and physical stressors encountered by the plume in its future trajectory are the same (spatially and temporally) as those on the last 3 miles covered by the current plume. This assumption may not hold. The plume would have to bypass capture by Aqua and South Farmingdale Water District supply wells and the plume's VOC content at the current leading edge would have to be strong enough to sustain plume expansion over the next 2 or 3 miles for the plume to reach the next major group of wells."*

According to the Optimization Team Report (Hare and others, 2011) VPB133 would be one of three monitoring sites, each of which would feature multi-level monitoring. The VPB133 workplan calls for two single-level monitoring wells with an optional third single-level monitoring well. Instead of sealing the VPB 133 boring, casing a monitoring well in the boring would help to provide the multi-level information (strings of passive diffusion bag samplers or the Westbay system) recommended by (Hare and others, 2011).

Site History

Various facts are provided in the site history section of the VPB133 workplan. Other relevant topics may include: (1) site history of VOC mass loading/removal; (2) changes in hydrologic stress including droughts, sewer installation, and well pumping; and (3) history of the outpost monitoring and vertical profile boring efforts including the vertical miss (fig. 3) associated with AquaNY. The history of other large VOC sources beside NWIRP/Grumman Northrup that potentially affect VPB133 may warrant description, such as that of American Drive-In Cleaners, about 2 miles upgradient of VPB 133, and the Hooker/Ruco superfund.

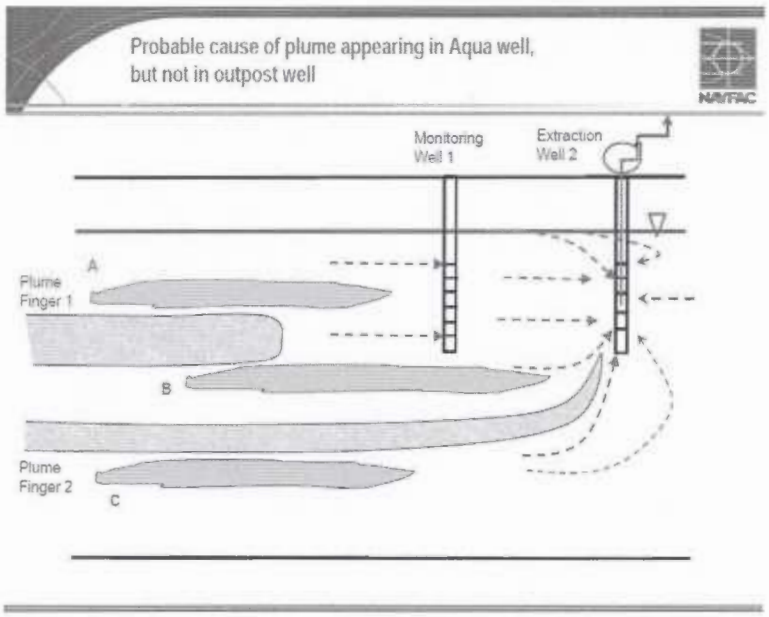

Figure 3. Conceptual diagram of vertical miss (From NAVFAC, 2011)

Boring Depth

The bottom of the boring will be installed to *"the top of the Raritan Clay Layer (approximately 860 feet bgs)"* (pg. 2 of VPB133 workplan). USGS typically refers to this upward-fining formation in regional framework studies as the "Raritan confining unit" because it can contain significant proportions of fine sand and silt in its upper part. The Raritan Clay dips to the southeast and varies in depth over the study area. This unit and the overlying Magothy aquifer are both heterogeneous mixtures of high- and low-permeability materials through which groundwater may be expected to flow preferentially within the more permeable materials. Core samples may be increased with a shorter interval near the bottom to verify the Raritan Clay has been reached, and to characterize the highly-permeable basal Magothy zone. Casing the VPB boring in the basal Magothy would lead to collection of important hydraulic data.

Waste

Waste handling procedures appear to be conservative given the isolated fingers of low (parts per billion) levels of VOCs expected to be encountered. It may not be necessary to remediate extremely low or non-detected levels of contamination; thus, it may be cost effective to downscale waste handling procedures to what would be typical for a supply well drilling operation in this area. It may be greener to eliminate procedures which generate an unnecessary carbon footprint and introduce low levels of VOC contamination themselves.

Geophysical Logging and Split Spoon Samples

Borehole geophysical logging of open boreholes provides high resolution information on the hydrogeology and water quality at a site. Gamma logging through the drill stem will produce a log that is reduced in it's gamma signatures due to the inverse-square law and the density of the materials the gamma rays must pass through before being measured by the scintillation counters in a gamma probe. While gamma logs alone will provide some lithologic information, the addition of a full suite of electric and electromagnetic logs will add significant information on clay content, hydraulic property estimates, stratigraphic correlations, and water quality changes. The USGS plans to collect gamma, spontaneous potential, single-point resistance, long-medium-short normal resistivity, and electromagnetic induction at deep open boreholes.

Water Sampling

Although the contaminants of concern from the historic operations of the Navy and Northrop-Grumman facilities are VOCs, additional constituents and parameters are recommended for sample collection and analysis. These additional parameters can be used to help describe the plume conditions in relation to the hydrogeological characteristics and provide information for considering additional or alternate remedial actions. The effectiveness of monitored natural attenuation at this site may be better understood through analysis of relatively easily measured parameters, including total organic carbon, and redox conditions. Other inorganic chemical data is useful in interpreting geophysical logs.

Electric logs from VPB 129 indicate a conductivity contrasts with depth in the formation that do not appear to be caused by differences in hydrogeology, and may be related to elevated

concentrations of dissolved metals. Investigation into the nature of these conductive anomalies at the proposed VPB would benefit the outpost well objective.

Dedicated monitoring well pumps need equipment blanks to ensure adequate QA/QC.

Screen Intervals

The selection of screen zones for monitoring well construction purposes needs to be conducted in an optimized manner. More detail concerning questions about the assignment of monitoring well screen zones and their relative priority may be useful. Currently there is uncertainty by the USGS about how screen intervals are chosen. Appendix A provides some data concerning adjacent public supply wells.

Water-Level Data Collection

The use of pressure transducers in multi-level monitoring wells located near public water supply wells should be implemented to collect water level time series that adequately characterize pumping stresses on the screened aquifer zones (Hare and others, 2011, pg. 14). It is important to collect water-level time series because it documents and quantifies the transient nature of aquifer heads. Monitoring well screens may be ideally located in layers demonstrating the maximum response to water supply pumping stress.

Summary

Collection of VPB133 data will likely increase confidence in approaches to anticipated future public water supply impacts. This letter presented a few suggestions for improved data collection and analysis, and re-iterated other recent suggestions. The references mentioned in this letter are given in the accompanying Appendix document. If you have any questions or comments, please do not hesitate to telephone me at the above number or email me at pemisut@usgs.gov.

Sincerely,

Paul Misut */signed/*

Hydrologist

Cc: Lora Fly, Remedial Program Manager, NAVFAC Mid-Atlantic