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December 6, 2011

U.S. Environmental Protection Agency
Region 2
290 Broadway-22nd Floor
New York, NY 10007-1866
Attn: Mr. Timothy Gordon

Subject: Contract N62470-08-D-1000
Navy CLEAN 1000 Program
Groundwater Usability Assessment
Naval Activity Puerto Rico, Puerto Rico

Dear Mr. Gordon:

In accordance with the September 29, 2011 scoping session, enclosed please find the Groundwater Usability Assessment prepared for Naval Activity Puerto Rico.

If you have any questions or comments, please feel free to contact me at brett.doerr@ch2m.com or by phone at 757-671-6219.

Sincerely,

CH2M HILL

for
Brett Doerr
Activity Manager

Enclosures

cc: (e-mail)

BRAC PMO SE (Mark Davidson)
USEPA (Dale Carpenter, Tim Gordon)
USEPA Caribbean Environmental Protection Division (Carl Soderberg)
US Fish & Wildlife Service (Mr. Felix Lopez)
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TECHNICAL MEMORANDUM

Groundwater Usability Assessment, Naval Activity Puerto Rico Ceiba, Puerto Rico

PREPARED FOR: NAPR Project Team

PREPARED BY: Naval Facilities Command, Atlantic

DATE: December 2, 2011

Purpose

The primary purpose of this assessment is to summarize the groundwater characteristics beneath Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico in order to demonstrate that potable-use considerations are not warranted when making corrective-action determinations for Resource Conservation and Recovery Act (RCRA) solid waste management units (SWMUs) and areas of concern (AOC). This assessment includes previous regulatory determinations for potential groundwater use as a drinking water supply under current and potential future land use at NAPR.

Current and Future Groundwater Resource Uses

Potable water at NAPR is currently supplied by an existing water treatment system located within NAPR on Langley Drive, which obtains its water from surface intakes on the Rio Blanco River approximately ten miles upgradient of NAPR. The existing water treatment system meets all applicable regulations for finished water quality as mandated by the Puerto Rico Department of Health (U.S. Navy, 2011).

Groundwater beneath Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico has been deemed unsuitable as a drinking water or commercial resource by the Environmental Protection Agency (EPA) due to the low yield of the aquifer. (U.S. EPA, 2007).The Environmental Assessment (EA) performed on the NAPR property in support of Land Reuse Plan (LRA, 2010) states: “Therefore, it is unlikely that aquifers at NAPR would provide an adequate quantity for use as a water supply (U.S. Navy, 2011).” The EA identifies future use of the NAPR property to be dependent on the existing water treatment system that obtains its water from surface intakes on the Rio Blanco River. Thus, the water use approach will likely remain the same into the foreseeable future, and there are no known plans for change.

Aquifer Characteristics

Regional Aquifer Characteristics and Regional Water Use

Information regarding the groundwater resources of Puerto Rico is provided in the United States Geological Survey’s *Atlas of Ground-Water Resources in Puerto Rico and the U.S. Virgin Islands* (USGS, 1996). The report indicates the northeast section of Puerto Rico, including NAPR, and the cities of Ceiba and Fajardo have very limited groundwater availability because the area is underlain by low permeability volcanoclastic, igneous, and sedimentary rocks.

The USGS reports that pumping rates are less than 10 gallons per minute (gpm) for wells completed in the bedrock aquifer within this region of Puerto Rico. Given the low aquifer yield, drinking water is obtained primarily from surface water sources (rivers and streams) and secondly from unconsolidated alluvial deposits of the Yabucco alluvial valley located near the city of Humacao (USGS, 1996). Although many industrial wells have been constructed, the well yields are often inadequate and industries continue to depend largely on public supply systems for water (USGS, 2002).

Site Specific Aquifer Characteristics

Flowrate

In a 1999 study performed on wells located on NAPR at SWMUs 7/8 (Tow Way Fuel Farm), researchers determined maximum pumping rates of 0.009 and 0.13 gallons per minute (gpm) at extraction wells PW-3 and RW-4 (McLaren and Hart, 1999). Similar aquifer yields were obtained during the 2010 groundwater extraction pilot test performed at SWMUs 7/8, where pumping rates between 0.2 and 0.9 gpm were measured (Agviq and CH2M HILL, 2010). The 1999 study was cited in EPA's Consent Order for NAPR: "…pump tests conducted in 1999 on two wells in the aquifers underlying the Facility indicated an aggregate yield of approximately 99 gallons per day, which is below the yield of aquifers considered usable for potable water supply" (U.S. EPA, 2007).

TDS and Salinity

In addition to the low yield of the aquifer, groundwater at NAPR contains high Total Dissolved Solids (TDS) under natural conditions that make groundwater unsuitable as drinking water without treatment. Table 1 lists site-specific TDS and salinity data collected from wells located outside NAPR SWMU plumes (Baker, 2004 and Blasland, Bouck, and Lee, 1994). As noted in the table, TDS levels range from 907 milligram/liter (mg/L) to 45,000 mg/L, significantly above EPA's secondary drinking water standard for TDS of 500 mg/L (U.S. EPA 2011). The terms "TDS" and "salinity" are often used interchangeably because both are measures of the dissolved mineral content in water. Therefore, EPA's secondary drinking water standard for TDS can be applied where salinity measurements are available even though there are no federal standards for salinity. Further, while not an exact, it is generally accepted that freshwater, brackish water, and saline (sea) water are defined as having less than 500 parts per million (ppm[1]), between 500 and 30,000 ppm, and between 30,000 and 50,000 ppm salinity, respectively. Salinity levels in NAPR groundwater range from 660 ppm to 35,500 ppm, all of which indicate the groundwater is brackish to saline and all of which are above EPA's secondary standard of 500 mg/L. Technology exists to treat water containing a high TDS and salinity; however, at an average of $3.50 per thousand gallons of water treated (Water Reuse Association, 2011), it would be a relatively expensive option for drinking water versus the existing source.

TABLE 1
Site-specific TDS and Salinity Data

Site	Well Identification	Average TDS (mg/L)[a]	Average Salinity (ppm)[a]
SWMU 7/8	UGW32	4,887 [a]	3,850
	UGW34	4,433 [a]	3,500
	7MW06	12,157 [a]	10,200
SWMU 9	13GW06	45,000 [b]	35,550
	13GW10	2,600 [b]	2,054
	9MW04	42,000 [b]	33,180
SWMU 30	1983MW1	2,100 [b]	1,659
	1983MW4	2,200 [b]	1,738
SWMU 54	54MW12	973 [a]	710
	54MW13	930 [a]	930
	54MW14	907 [a]	660
SWMU 55	55MW13	13,579 [a]	11,700
NAPR Facility Average		**10,981**	**8,811**
EPA Drinking Water Standard (U.S.EPA, 2011)		Secondary Drinking Water MCL 500 mg/L	See TDS

Notes: mg/L = milligrams per liter

ppm = parts per million

[a] Average of water quality data collected from six separate sampling events performed between May 21, 2010 and August 16, 2011

[b] Average of water quality data collected prior to 2010.

[1] ppm is approximately equal to mg/L

Conclusions and Recommendations

Regional and NAPR data demonstrate and the Consent Order states that groundwater beneath NAPR does not produce sufficient quantities of water to be used as a source of drinking water. Further, the groundwater contains high levels of TDS and salinity (relative to levels acceptable for potable use), characterizing it as brackish or saline. While desalinization could remove solids from groundwater, the high cost (relative to the cost of obtaining water from the currently available water supply system) would limit its implementation even if the aquifer yields beneath NAPR were sufficient for use as a potable source. In addition, the Land Reuse plan developed for the NAPR property anticipates the continued use of the water treatment plant because the aquifers beneath NAPR cannot provide an adequate quantity of water for use as a drinking water supply. Therefore, it is recommended that environmental investigations for NAPR consider the potable use scenario for unrestricted land use (for the potential to avoid land use controls), but that remediation goals not be established based on future groundwater use as drinking water.

References Cited

Agviq/CH2M HILL, 2010. Technical Memorandum, Groundwater Extraction Test at SWMUs 7 and 8, Naval Activity Puerto Rico, Ceiba, Puerto Rico. May 2011.

Baker Environmental, Inc. Revised Draft RCRA Facility Investigation Report for SWMU 9. March 10, 2000.

Blasland, Bouck, and Lee, Inc. Site Characterization – Site 1983(SWMU 30). October 1994.

Local Redevelopment Authority (LRA). 2010. Naval Station Rosevelt Reuse Plan Addendum. April, 2010. Prepared by Chicago Consulting Studio. Prepared for Local Redevelopment Authority and Department of Economic Development and Commerce, Commonwealth of Puerto Rico.

McLaren and Hart, August 31, 1999. Hydraulic Characteristics Evaluation Tow Way Fuel Farm.

U.S.EPA, 2007. RCRA §7000 Administrative Order on Consent. Naval Activity Puerto Rico. January 29, 2007.

U.S. EPA, http://water.epa.gov/drink/ - Accessed October 31, 2011.

USGS, 1996. Atlas of Ground-water Resources in Puerto Rico and the U.S. Virgin Islands, USGS Water-Resources Investigation Report 94-4198, 161p.

USGS, 2002. Groundwater Atlas of the United States, Alaska, Hawaii, Puerto Rico and the U.s. Virgin Islands HA 730-N.

U.S. Navy, 2011. Supplemental Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads). May 2011.

Water Reuse Association, 2011. Seawater Desalination Costs White Paper. www.wateruse.org/sites- Accessed October 24, 2011.