

DRAFT

GROUNDWATER/SURFACE WATER MONITORING PLAN NANTICOKE RIVER DREDGE SPOILS DISPOSAL SITE SEAFORD, DELAWARE

The groundwater monitoring program for the planned dredge spoils disposal site near Seaford, DE will consist of the installation of shallow and deep groundwater monitoring wells, followed by the periodic sampling of the newly-installed monitoring wells and select existing supply wells close to the planned disposal site. Sampling of Turtle Branch near the planned disposal site also will be performed. Work elements of the groundwater/surface water monitoring program include the following:

- Seven groundwater monitoring wells are expected to be installed near the boundary of the planned dredge spoils disposal site. The approximate locations of the monitoring wells are shown in the attached figure, along with the footprint of the planned dredge spoils disposal site and the assumed direction of shallow groundwater flow. Shallow and deep monitoring well pairs will be installed on the northwest, northeast and southeast sides of the planned disposal site. Well pairs to the northwest and northeast are located hydraulically upgradient of the planned disposal site based on the assumed groundwater flow direction shown in the attached figure. These new monitoring wells are also positioned between the planned disposal site and nearby residential supply wells. The remaining well pair will be located downgradient and southeast of the planned disposal site. A shallow well also will be installed downgradient and southwest of the planned disposal site to monitor shallow groundwater conditions between the planned disposal site and Turtle Branch. No groundwater supply wells are known to existing in the area between the planned disposal site and Turtle Branch.
- The groundwater monitoring wells will be installed using rotary or hollow-stem auger drilling techniques. The shallow monitoring wells will be installed immediately above a clay layer (14 to 25 feet thick) that, according to drilling

logs, was first encountered at a depth ranging from approximately 15 and 18 feet below ground surface (ft bgs) at the Sussex County, Community Church and Jones, D. supply well locations (see well locations in the attached figure). Installation of the shallow monitoring well at each location is contingent on encountering a monitorable groundwater zone above the clay during borehole advancement. Depth to the water table on the planned disposal site is expected to be on the order of 10 to 12 ft bgs. The deep monitoring wells will be installed to a total depth of approximately 65 to 70 ft bgs. The Sussex County, Community Church, and Jones, D. supply wells are reportedly completed to total depths ranging from 65 to 80 ft bgs. These supply well depths are comparable to the reported depths of other supply wells in the site area.

- Each groundwater monitoring well will be constructed of 2-inch diameter PVC riser casing and a 0.020-inch slot PVC screen. Well screens will be 5 ft and 10 ft in length for the shallow and deep monitoring wells, respectively. After the aforementioned well components are placed to the desired depth, clean silica sand will be emplaced around the well screen from its base to approximately five feet above the top of the screen. A bentonite seal (approximately 1 to 2 feet thick) will be placed on top of the sand pack. The remaining annular space above the bentonite seal will be backfilled with a cement/bentonite grout mixture from the top of the bentonite seal to ground surface. Each well will be completed at ground surface with a lockable protective steel casing set into a concrete pad. Bollards will be placed around the wells for protection.
- After the site monitoring wells are installed, they will be developed (surged and pumped), and surveyed for horizontal and vertical (top of well casing and ground surface) control.

- Groundwater sampling will occur no sooner than one week after completion of monitoring well development. Groundwater samples for laboratory analysis will be collected from the new-installed monitoring wells and the six supply wells highlighted in the attached figure (i.e., Sussex County, Community Church, Jones, D., Jones, J., Whaley and Bean supply wells), provided permission is granted by the well owner to conduct sampling. Two baseline groundwater sampling events will be performed prior to placement of dredge spoils at the planned disposal site. One round of well sampling will be performed during placement of the dredge spoils. Thereafter, groundwater sampling of the site monitoring wells and designated supply wells will be performed annually for a 5-year period. In addition to well sampling, a surface water sample will be collected for field/laboratory analysis (as described below) from Turtle Creek at a location directly downgradient of the planned disposal site.
- Prior to sample collection, a round of water level measurements will be taken from the site monitoring wells. These measurements will be referenced to a surveyed mark on top of the well casing. This water level information will be used to determine the direction of groundwater flow at the time of sampling.
- Each monitoring well will be purged using a clean variable-flow submersible pump to remove at least three calculated well volumes prior to sample collection with the use of the pump or a clean Teflon bailer. Supply well samples will be taken from the closest sampling point to the well head and after the water has discharged for approximately 5 to 10 minutes. Surface water samples will be collected as grab samples from Turtle Branch.
- Field measurements of pH, temperature, specific conductivity, oxidation reduction potential (ORP), dissolved oxygen (DO) and turbidity will be taken at

the time of sample collection. Groundwater samples and the surface water sample will be collected for laboratory analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, herbicides and metals. Each groundwater and surface water sample will also be laboratory analyzed for nitrate, total dissolved solids (TDS) and chloride (the latter two parameters will be used as general indicators of possible groundwater/surface water quality change). Appropriate quality control (QC) samples (e.g., trip blanks, duplicates) will be collected during the sampling events. Groundwater, surface water and QC samples will be shipped under proper chain-of-custody to a Delaware-certified laboratory for analysis (standard turnaround and deliverables).

- Upon receipt of the laboratory data packages, the field/laboratory analytical results will be summarized and provided to DNREC, along with a summary of the water level measurements and a water level elevation contour map showing the direction of groundwater flow at the time of sampling.