2.3 Hydraulic Properties

A summary of field and laboratory measurements of hydraulic conductivity for ash, alluvial soils, and shallow bedrock derived from previous site investigations is presented in Table 2-1. References for the laboratory or field methods are also given in the table. Vertical hydraulic conductivities (K_v) for nine fly ash samples range from 3.6×10^{-6} to 8.3×10^{-5} cm/s and exhibit a median value of 2.0×10^{-5} cm/s. The two field measurements of fly ash horizontal conductivity (K_h) generally fall within the range of data reported for K_v. Laboratory-derived K_h and K_v data for alluvial clay-silt samples show little difference and average about 5×10^{-7} cm/s. Field measures of K_h for this unit are about an order of magnitude higher, averaging approximately 7×10^{-6} cm/s. The difference reflects the larger measurement scale associated with field tests as well as the tendency for higher K values in the horizontal direction. Field testing performed in three wells completed in the upper Conasauga shale yielded K_h values averaging 2×10^{-5} cm/s.

The "natural" geologic buffer material below the proposed CCB disposal area would largely consist of fly ash (see hydrogeologic sections on Figures 2-3 and 2-4). As indicated in Table 2-1, hydraulic conductivity measurements of fly ash are limited to laboratory analysis of seven samples and two Boutwell field tests. Although the number of hydraulic conductivity measurements is below the recommended requirements of the DSWM Hydrogeologic Guidance Document, these data are considered sufficient in view of the high-degree of homogeneity of fly ash.

The hydraulic conductivity data presented in Table 2-1 do not include data for remolded samples of landfill cap and geologic buffer materials. The source of the cap and buffer materials has not been identified. Prior to construction of either the cap or buffer, TVA will solicit bids for cap/buffer materials having specified geotechnical properties. These specifications will include a requirement that the cap/buffer materials are compacted in accordance with ASTM D-698 or D-1557, and that hydraulic conductivity be measured according to ASTM D-5084. Hydraulic conductivities equal to or less than 10^{-6} cm/s (at design compaction) will be required of buffer materials.

Clay cap material will require hydraulic conductivities equal to or less than 10^{-7} cm/s. Test results will be presented to the State for approval prior to construction of the cap or buffer.

Table 2-1. Summary of Site Hydraulic Conductivity Data

Media	Location	K_h (cm/s)	K_v (cm/s)	Test Method	Reference
Fly Ash	Ash Dredge Cell 1	--	8.3E-05	ASTM D-5084	Law, 1995
Fly Ash	Ash Dredge Cell 3	--	3.4E-05	ASTM D-5084	Law, 1995
Fly Ash	B-1	1.4E-05	5.1E-06	ASTM D-6391	Mactec, 2004
Fly Ash	B-2	3.7E-06	3.6E-06	ASTM D-6391	Mactec, 2004
Fly Ash	B-2A	--	1.67E-05	ASTM D-5084	Mactec, 2004
Fly Ash	B-1A, 1B	--	1.87E-05	ASTM D-5084	Mactec, 2004
Fly Ash	--	--	2.0E-05	ASTM D-2434-68	EPRI, 1993
Fly Ash	--	--	2.1E-05	ASTM D-2434-68	EPRI, 1993
Fly Ash	--	--	2.2E-05	ASTM D-2434-68	EPRI, 1993
Bottom Ash	(?)	--	9.3E-03	ASTM D-5084	Law, 1995
Alluvial Clay-Silt	Well 2	7.4E-08	6.3E-08	(note 1)	Milligan & Ruane, 1980
Alluvial Clay-Silt	Well 4	6.6E-08	2.8E-07	(note 1)	Milligan & Ruane, 1980
Alluvial Clay-Silt	Well 5	2.8E-07	4.0E-07	(note 1)	Milligan & Ruane, 1980
Alluvial Clay-Silt	Well 6	2.5E-06	4.4E-07	(note 2)	Milligan & Ruane, 1980
Alluvial Clay-Silt	Well 2	9.1E-06	--	(note 2)	Velasco&Bohac, 1991
Alluvial Clay-Silt	Well 4B	6.1E-06	--	(note 2)	Velasco&Bohac, 1991
Alluvial Clay-Silt	Well 5	9.1E-06	--	(note 2)	Velasco&Bohac, 1991
Alluvial Clay-Silt	Well 13A	3.0E-06	--	(note 2)	Velasco&Bohac, 1991
Conasauga Shale	Well 9B	6.1E-06	--	(note 2)	Velasco&Bohac, 1991
Conasauga Shale	Well 13B	2.1E-05	--	(note 2)	Velasco&Bohac, 1991
Conasauga Shale	Well 15A	3.0E-05	--	(note 2)	Velasco&Bohac, 1991

Notes:

1. *Laboratory constant-head test of undisturbed sample in triaxial cell; exact method unknown.*
2. *Field constant-rate pumping test in single well.*

2.4 Precipitation

In the absence of long-term precipitation records for the KIF site, precipitation data were obtained for the National Oceanic and Atmospheric Administration (NOAA) station in Oak Ridge, Tennessee, located some 20 miles northwest of the site. A continuous 20-year period (1968-87) of daily precipitation data was selected. Annual precipitation for the period ranged from 38.8 to 76.3 inches and averaged approximately 52.9 inches.

3. LOCAL GROUNDWATER USE

A survey of local groundwater use within an approximate two-mile radius of the center of the ash pond area was conducted in March 1995 (Boggs et al., 1995). The survey included interviews with local residents and utility district managers. Water well records maintained by the State of Tennessee were also examined for wells within the survey region. This survey identified a total of 22 residential wells. A listing of these wells and their coordinate locations is given in Table 3-1. Note that wells were numbered 1 through 23 with no well 15. One spring (Spring 1) was identified which provides untreated water for 10 to 12 residences along Swan Pond Road and for several residents of the Kingston Heights subdivision. The spring emanates from aquifers of the Knox Group. This spring appeared to be the only spring in the survey region used for water supply. Other residents within the survey region were served by one of the four local water utilities listed in Table 3-1. These utilities provide treated water from intakes on Watts Bar Lake or the Emory River.

This area was re-surveyed in May 2004 to determine whether changes in local water use had occurred. The survey relied on interviews with local utility district managers, a drive-by inspection to identify new residences, and examination of current State well records. Six new residential wells identified, i.e., wells 24 through 29 (Figure 3-1) located east of the proposed disposal area on the opposite side of the Emory River. There was no change in public water supplies in the site vicinity.