APPENDIX E. NOTATION

1/K  double layer thickness in Gouy-Chapman theory

\( \alpha \)  Bjerrum et al. (1972) parameter (see Eq. 5-19), or dimensionless parameter
used in Cooper et al. (1967) method (see Eq. 6-3), or level of significance
(Section 7.3), or \( P_e / 2 \) (Section 7.4)

\( \beta \)  Bjerrum et al. (1972) parameter (see Eq. 5-20) or dimensionless time
parameter used in Cooper et al. (1967) method (see Eq. 6-2)

\( \varepsilon_0 \)  permittivity of vacuum

\( \phi' \)  effective friction angle

\( \gamma \)  unit weight of soil

\( \gamma_d \)  dry unit weight of soil

\( \gamma_m \)  moist unit weight of soil

\( \gamma_w \)  unit weight of water

\( \varphi_{fc} \)  permittivity of filter cakes in cutoff wall

\( \varphi_{sb} \)  permittivity of soil-bentonite in cutoff wall

\( \mu \)  average of negative logarithm of \( k \) values

\( \nu \)  ionic valence or Poisson's ratio

\( \nu' \)  Poisson's ratio of soil skeleton

\( \sigma \)  standard deviation of negative logarithm of \( k \) values

\( \sigma_{c'} \)  circumferential effective stress

\( \sigma_{h'} \)  horizontal effective stress

\( \sigma_{h0'} \)  initial horizontal effective stress (e.g., prior to piezometer installation)

\( \sigma_{r'} \)  radial effective stress

\( \sigma_{v'} \)  vertical effective stress

\( \sigma_{v0'} \)  initial vertical effective stress

API  American Petroleum Institute

\( A \)  material parameter equal to the negative slope of a \( \log k \) vs. \( \log p \) plot, or
inside area of cell in breakthrough experiment (Section 7.2), or total area
under pdf (Section 7.4)
$A_s$ cross-sectional area of soil specimen
$a$ cross-sectional area of burette in falling head tests
$a_i$ incremental area under pdf
$B$ cutoff wall width or material parameter equal to $k_0 p_0 A / [\gamma_w (1 - A)]$
$B_k$ piezocone parameter from Manassero (1994)
CCL Compacted Clay Liner
COV Coefficient Of Variation
cpf cumulative probability function
$C$ dimensionless contaminant concentration, $c/c_0$
$C_B$ NaCl concentration in bottom reservoir in breakthrough experiment
$C_{NaCl}$ NaCl concentration
$C_{0,NaCl}$ initial NaCl concentration
$C_T$ NaCl concentration in top reservoir in breakthrough experiment
$C_{T,initial}$ initial NaCl concentration in top reservoir
$c$ contaminant concentration
$c_0$ constant contaminant concentration inside cutoff wall
$c_h$ coefficient of consolidation in horizontal direction
$D$ diameter of well or piezometer filter element, or Kolmogorov-Smirnov test statistic, or dielectric constant
$D_1$ difference between volumes of water added to/removed from each side of cutoff wall during measurement of background flow rates
$D_2$ difference between volumes of water added to/removed from each side of cutoff wall during measurement of flow rate through wall
$D_\alpha$ critical value of test statistic, $D$
$D^*$ effective diffusion coefficient in soil
$d_1$ difference between background flow rates on each side of cutoff wall
$d_2$ difference between flow rates necessary to maintain water levels on each side of cutoff wall with a hydraulic gradient across the wall
$E$ evaporation rate in height of water per time
$E'$ Young's modulus of soil skeleton
$e$ electronic charge
\( F \) shape factor for single-well test
\( F_{2D} \) two-dimensional single-well shape factor from SEEP2D
\( f_s \) sleeve friction from piezocone
\( G \) shear modulus of soil
\( G_s \) specific gravity of solids
\( H \) applied head, above equilibrium head, in constant head single-well test
\( H_0 \) head at time zero, above equilibrium head, in variable head single-well test
\( H_c \) upgradient height of water above CCL
\( H_t \) head at time \( t \), above equilibrium head, in variable head single-well test
\( h_e \) excess head
\( h_{jc} \) filter cake formation head
\( h_{lt} \) head loss across soil specimen at time \( t \)
\( h \) height of top reservoir in breakthrough experiment
\( h_{lw} \) distance variable defined in Figure 2-1
\( \Delta h \) head drop (across cutoff wall, between piezometer and trench wall, etc.)
\( I_r \) rigidity index
\( i \) hydraulic gradient
\( i_g \) gross hydraulic gradient across API test specimen
\( J \) flux through cutoff wall in mass per area per time
\( J_{D^*} \) flux through cutoff wall due to diffusion only
\( J_{steady \, state} \) steady state flux through cutoff wall
\( j \) flux in mass per time
\( K_0 \) at-rest earth pressure coefficient
\( K_h \) horizontal earth pressure coefficient
\( KR \) ratio of CCL \( k \) to soil-bentonite \( k \)
\( k \) hydraulic conductivity or Boltzmann constant
\( k_0 \) a reference hydraulic conductivity
\( k_{ave} \) average hydraulic conductivity
\( k_{CCL} \) CCL hydraulic conductivity
\( k_{eq} \) equivalent hydraulic conductivity of cutoff wall
$k_{fc}$  filter cake hydraulic conductivity
$k_{formation}$  formation soil hydraulic conductivity
$k_g$  gross hydraulic conductivity of API test specimen
$k_h$  hydraulic conductivity in horizontal direction
$k_{sb}$  soil-bentonite hydraulic conductivity
$k_v$  hydraulic conductivity in vertical direction
LCS  Light Castle Sand
$L$  length of well or piezometer filter element or length of specimen in breakthrough experiment
$L_{fc}$  filter cake thickness
$L_s$  length of soil specimen
$L_w$  length of cutoff wall
$\Delta L_{w,i}$  incremental length of cutoff wall
$m_v$  coefficient of volume compressibility
$N$  number of samples or values in a summation
$n$  soil porosity
$n_d$  number of head drops in a flow net
$n_f$  number of flow channels in a flow net
$n_{fc}$  filter cake porosity
$n_s$  slurry porosity
$n_0$  reference ion concentration
OCR  overconsolidation ratio
PFW  Price's Fork Water
pdf  probability density function
$P_e$  Peclet number = $v_h B / D^*$
$p$  effective major principal stress
$p_0$  a reference effective major principal stress
$p_{air}$  air pressure applied in API tests
$p_b$  effective major principal stress at bottom of API specimen
$p_g$  gross effective major principal stress corresponding to $k_g$
$p_t$  effective major principal stress at top of API specimen
$Q_x$ volume of water added to/removed from $x$, where $x$ is defined in text
$q$ effective surcharge pressure
$q_t$ tip resistance from piezocone
$q_x$ volumetric flow rate at/through $x$, where $x$ is defined in text
$q_{2D}$ two-dimensional flow rate, i.e., volumetric flow rate per incremental length
$R$ retardation factor
$RR$ recompression ratio
$R_e$ equivalent radius in single-well tests
$r$ radius of piezocone
$r_c$ radius of well or piezometer standpipe
$r_w$ radius of well or piezometer filter element
SBTF Subsurface Barrier Test Facility
$S$ shape factor for cutoff wall for given water levels on each side of wall
$S_u$ undrained shear strength
$s$ shape factor for incremental length of cutoff wall
$T$ dimensionless time, $t \, D^* / (R \, B^2)$, or temperature
$T_{0.95}$ dimensionless time to reach 95% of steady state flux through cutoff wall
$T^*$ time factor in Houlsby and Teh (1988) piezocone model
$t$ time variable
$\Delta t$ time interval between two times, $t_1$ and $t_2$
$t_{50}$ time for 50% of excess pore pressure to dissipate
$u_2$ pore pressure measured just above conical tip of piezocone
$u_e$ excess pore water pressure
$V$ top reservoir volume in breakthrough experiment
$v$ discharge velocity
$v_s$ seepage velocity
$\Delta WL$ change in water level in monitoring well in barrier pit
$X$ dimensionless position along width of cutoff wall, $x / B$
$x$ position along width of cutoff wall
$z$ vertical distance variable