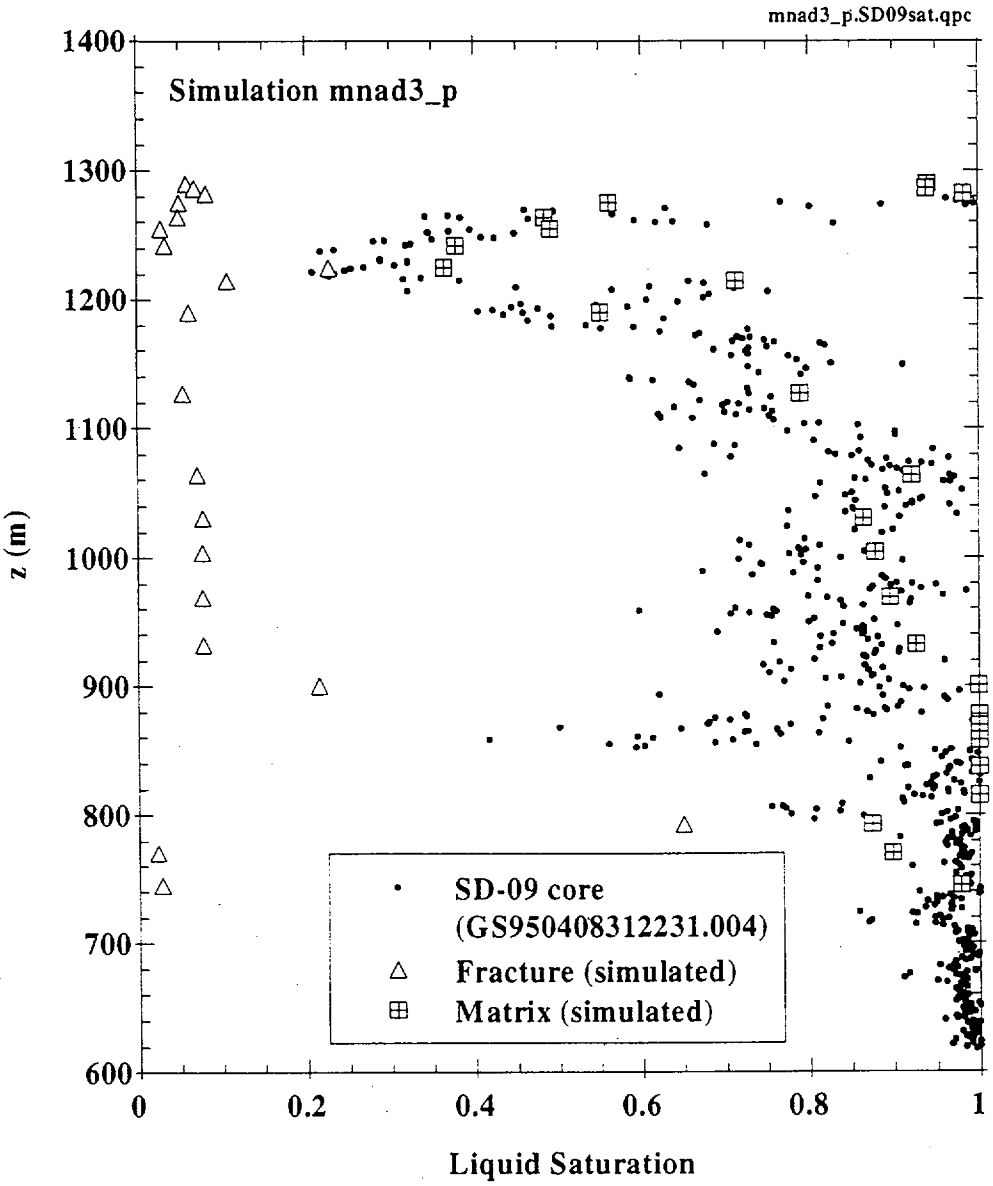


Figure 2-85. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-09, using the results of simulation mnad3_p (minimum fracture alpha, present-day infiltration divided by three).

98Ø917Ø111 - Part 3

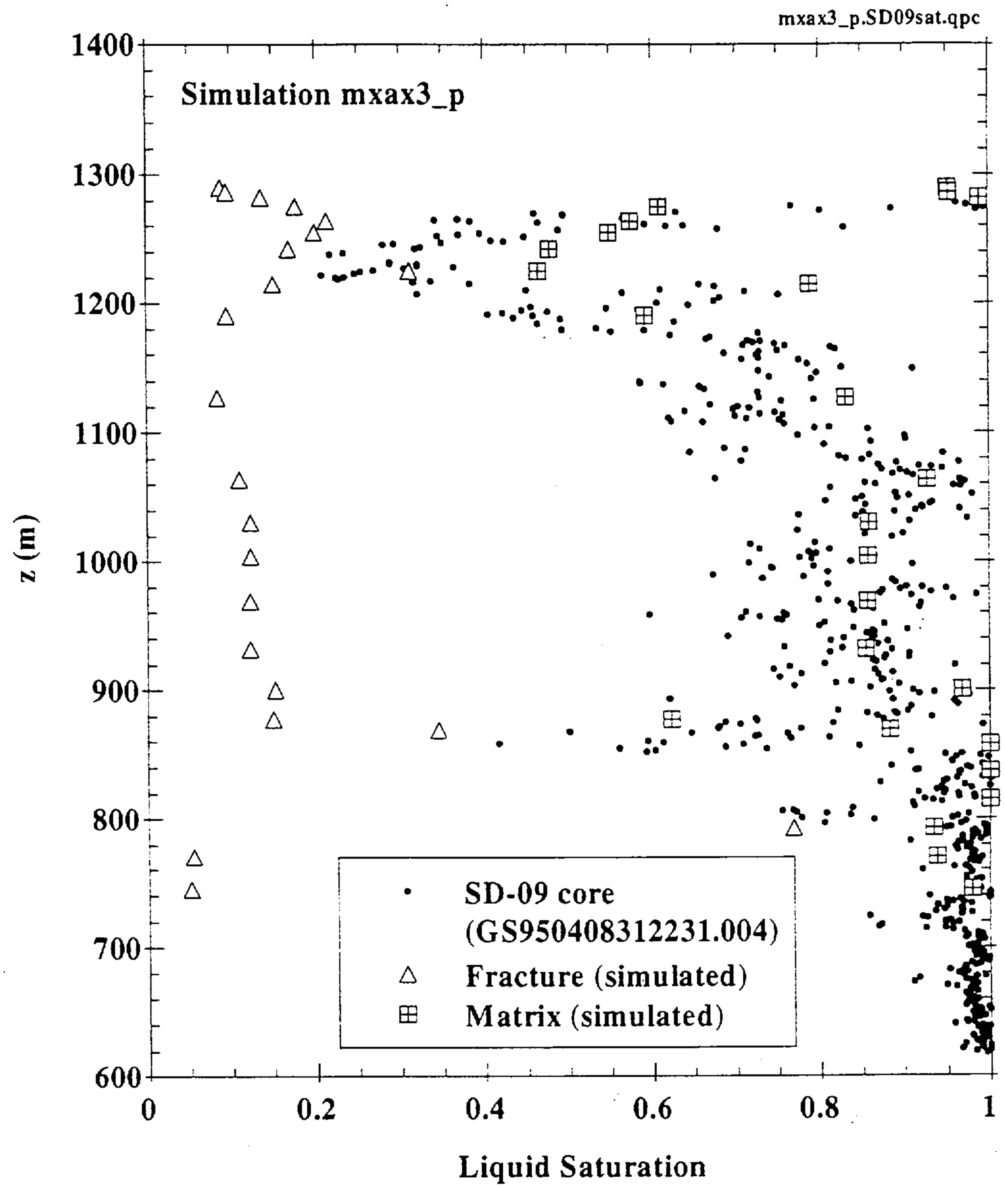


Figure 2-87. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-09, using the results of simulation mxax3_p (maximum fracture alpha, present-day infiltration multiplied by three).

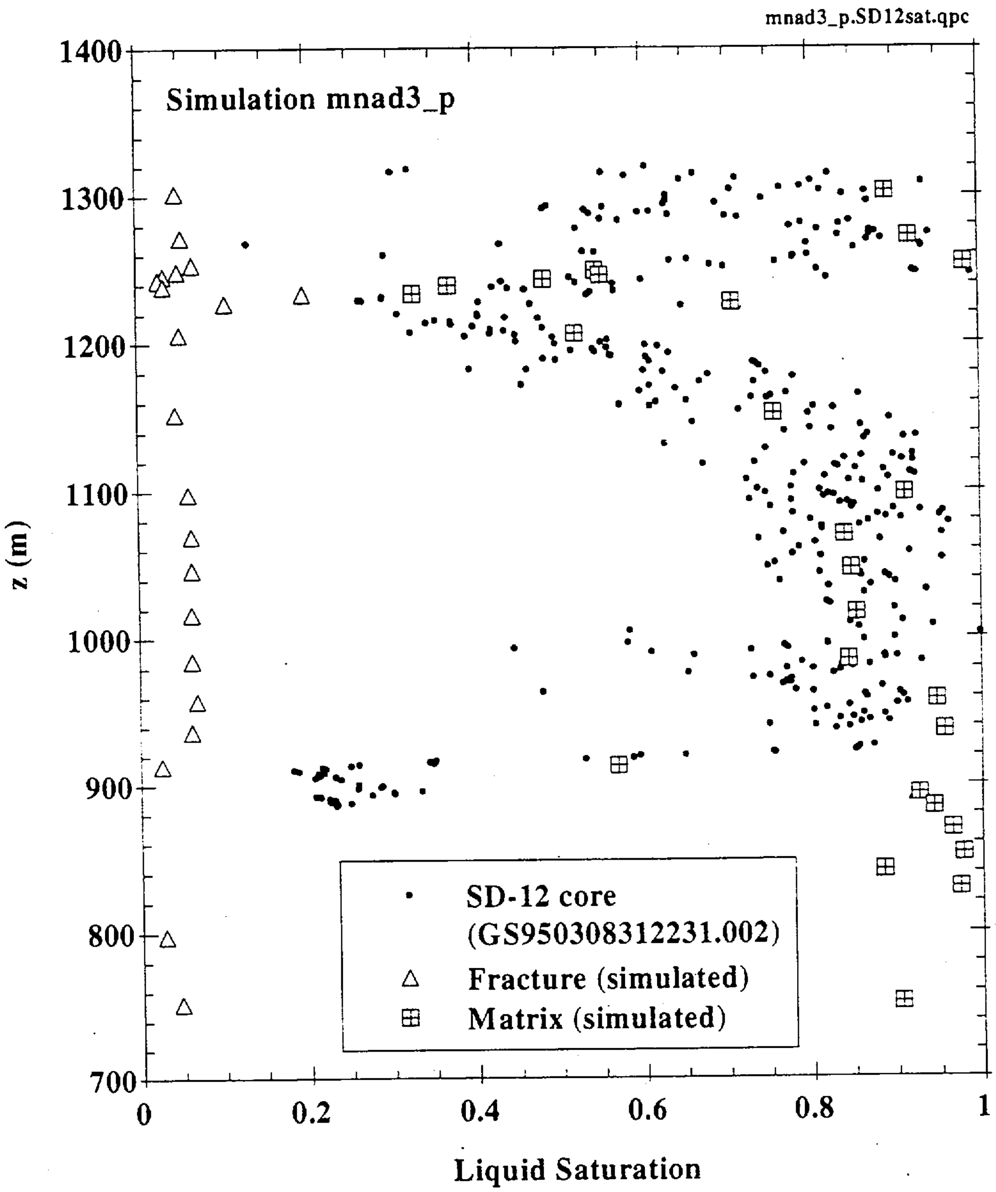


Figure 2-88. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-12, using the results of simulation mnad3_p (minimum fracture alpha, present-day infiltration divided by three).

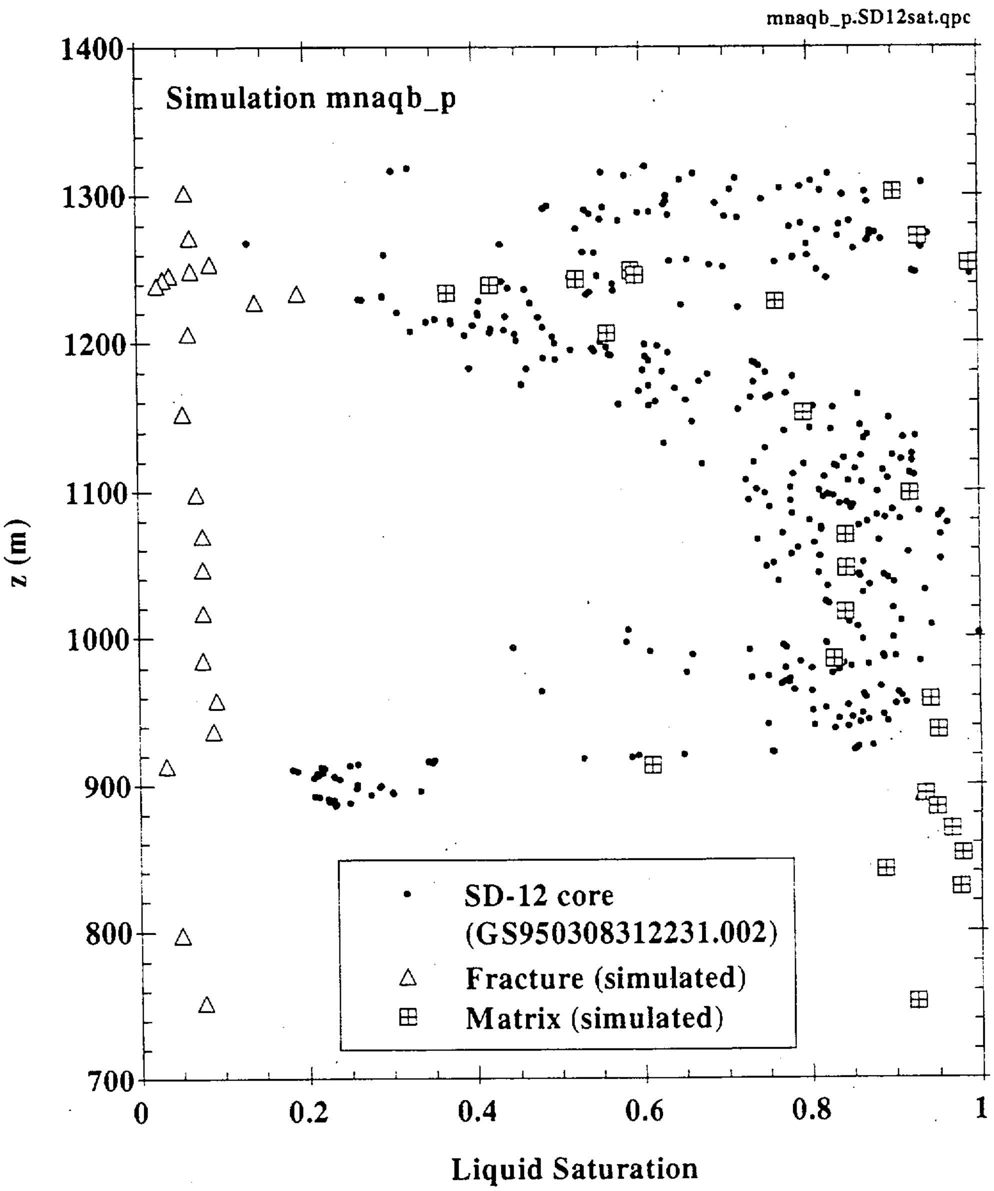


Figure 2-89. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-12, using the results of simulation mnaqb_p. (mean fracture alpha, present-day infiltration).

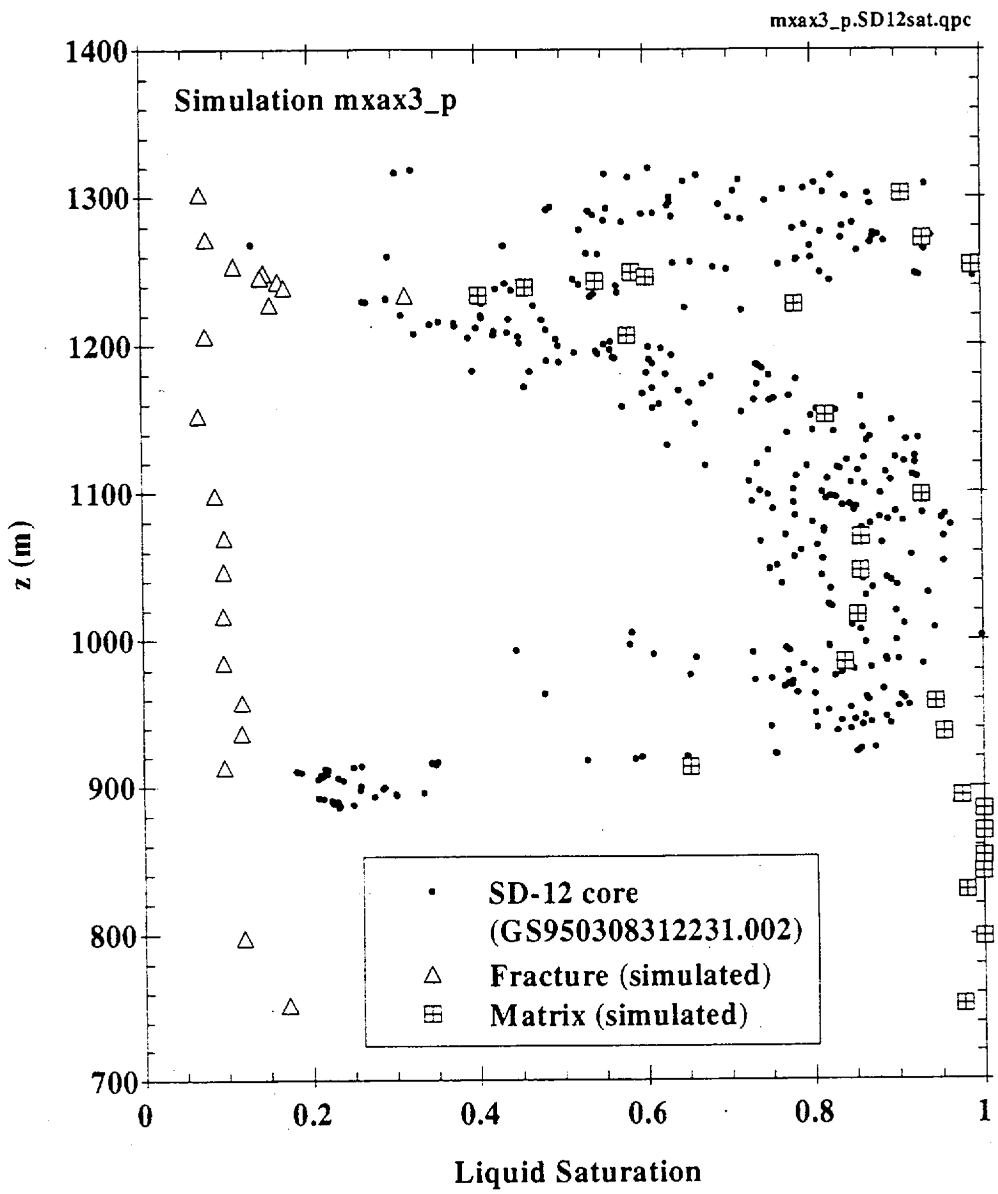


Figure 2-90. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-12, using the results of simulation mxax3_p. (maximum fracture alpha, present-day infiltration multiplied by three).

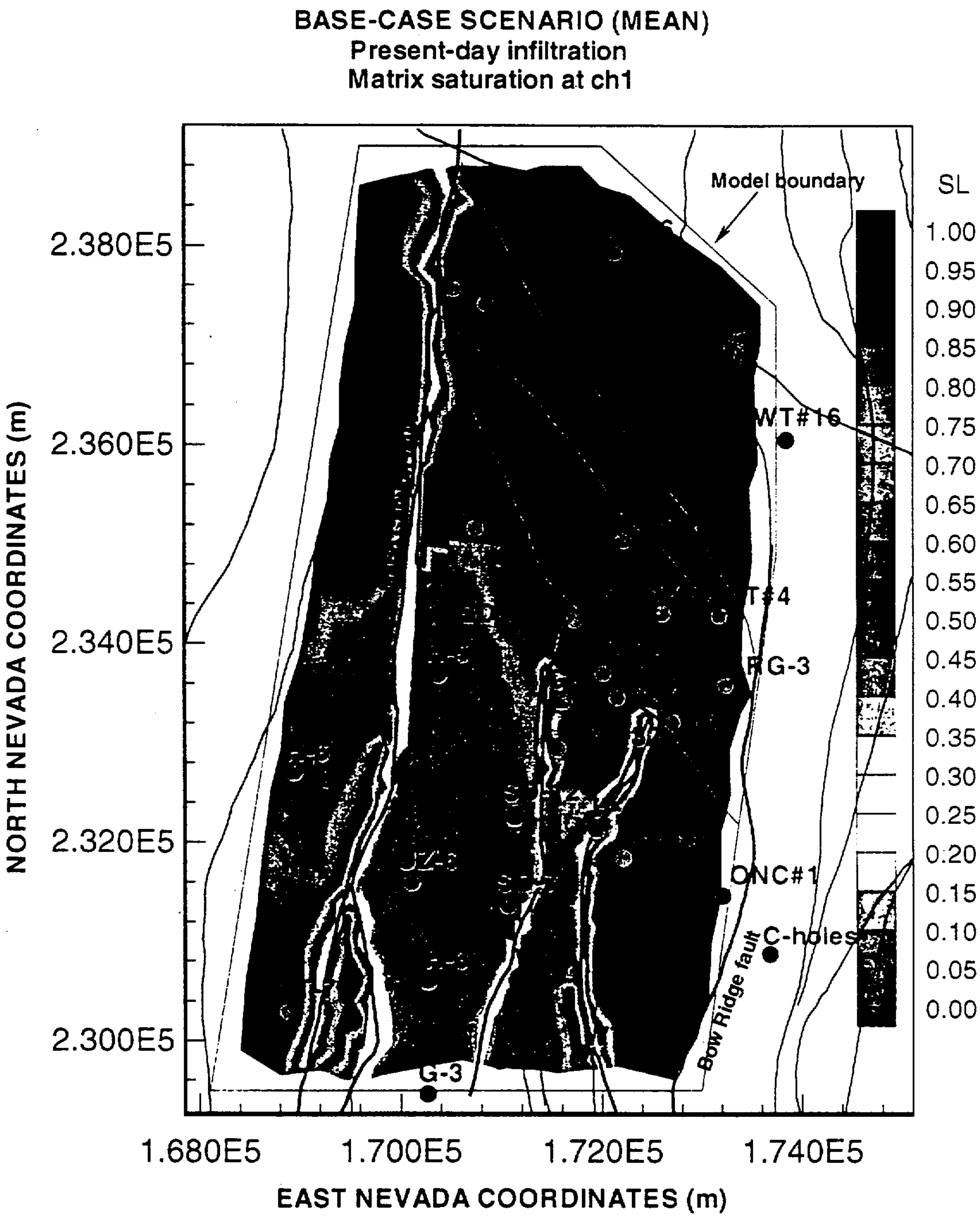
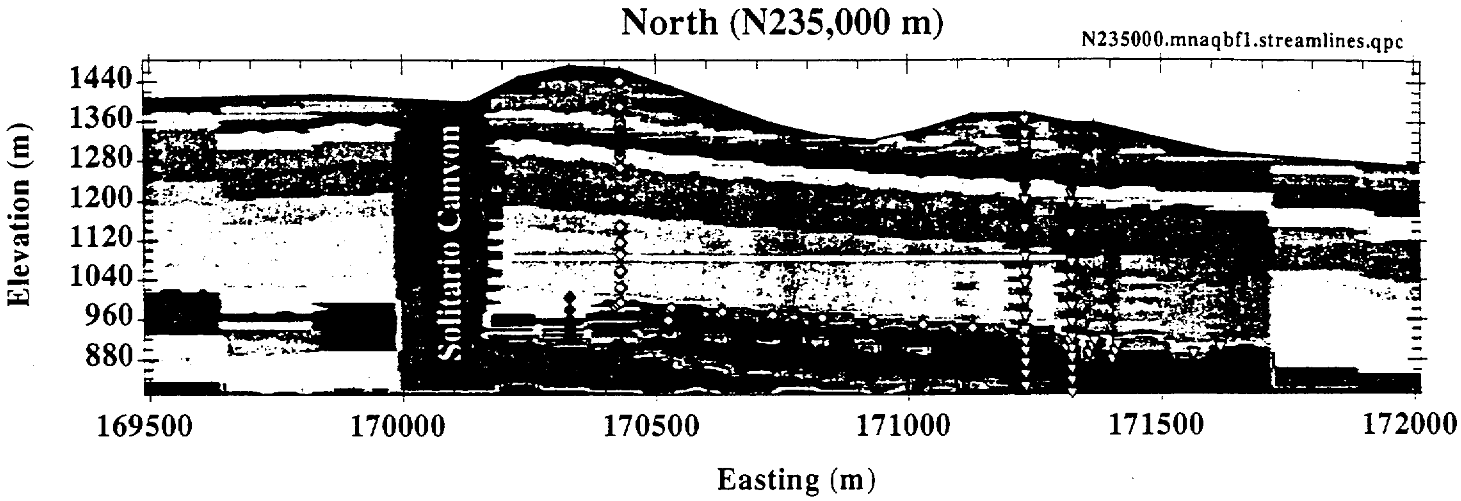


Figure 2-91. A plan view of saturation contours, showing the perched-water body surrounding UZ-14, SD-9, NRG-7a, and G-2 using the results of base-case simulation mnaqb_p (mean fracture alpha, present-day infiltration).



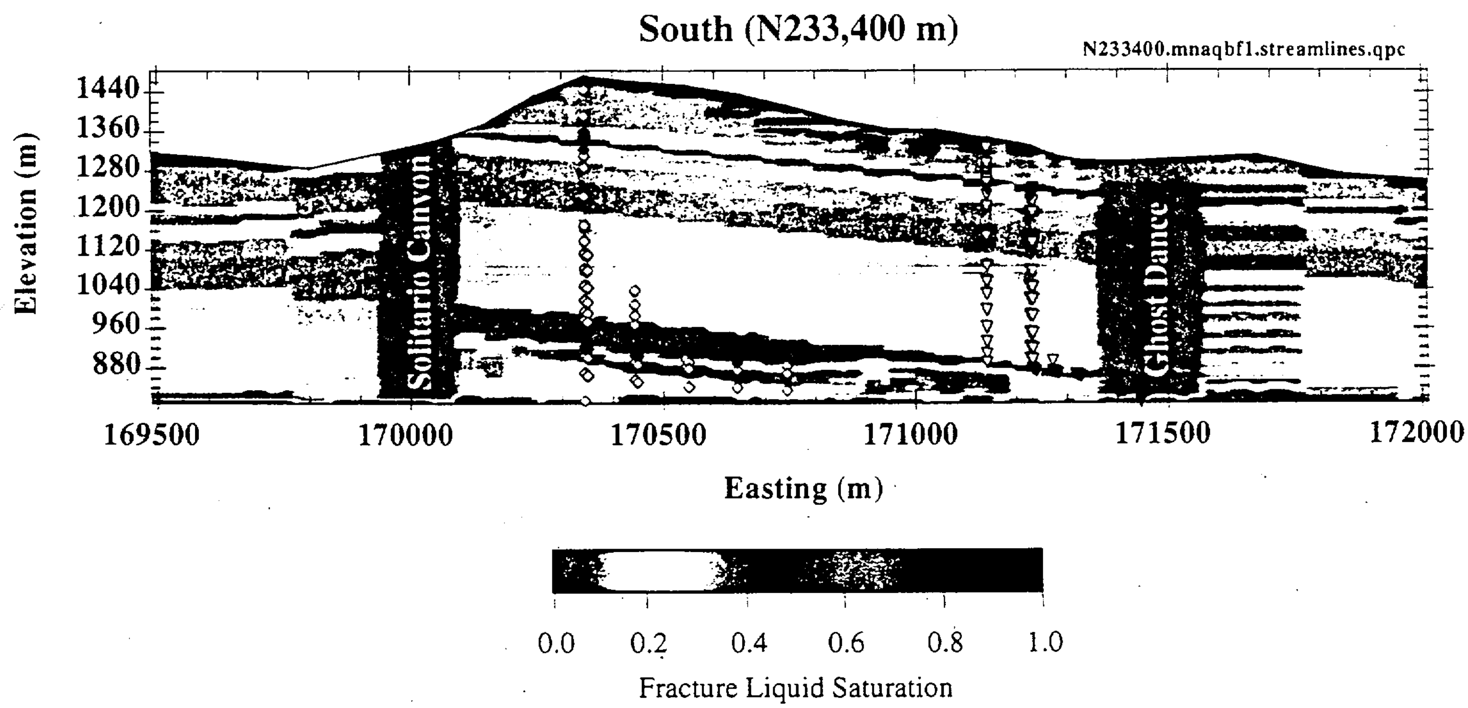


Figure 2-92. Fracture saturation profiles and paths of conservative tracers (non-sorbing, no matrix diffusion) along two east-west vertical cross-sections for the long-term-average base-case simulation (mnaqbf1). The white symbols denote a higher concentration in the fractures, and the black symbols denote a higher concentration in the matrix. Significant lateral diversion exists in the north beneath the repository (denoted by the white line) where perched water is present.

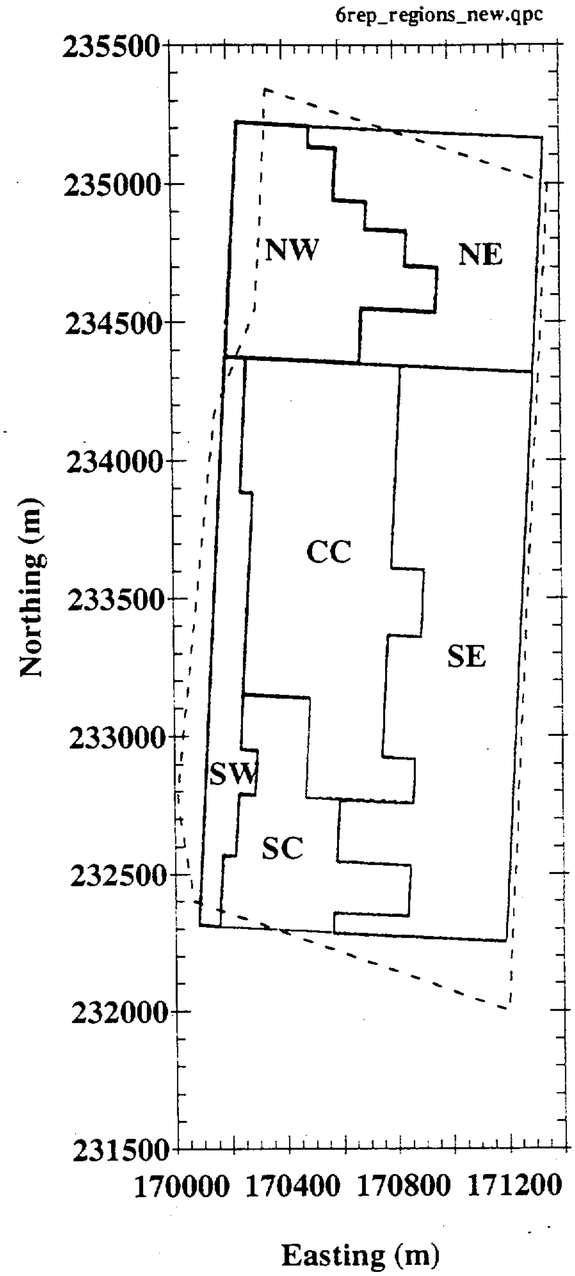


Figure 2-93. Six repository sub-regions used in TSPA-VA. The dashed line indicates the outline of the actual emplacement drifts.

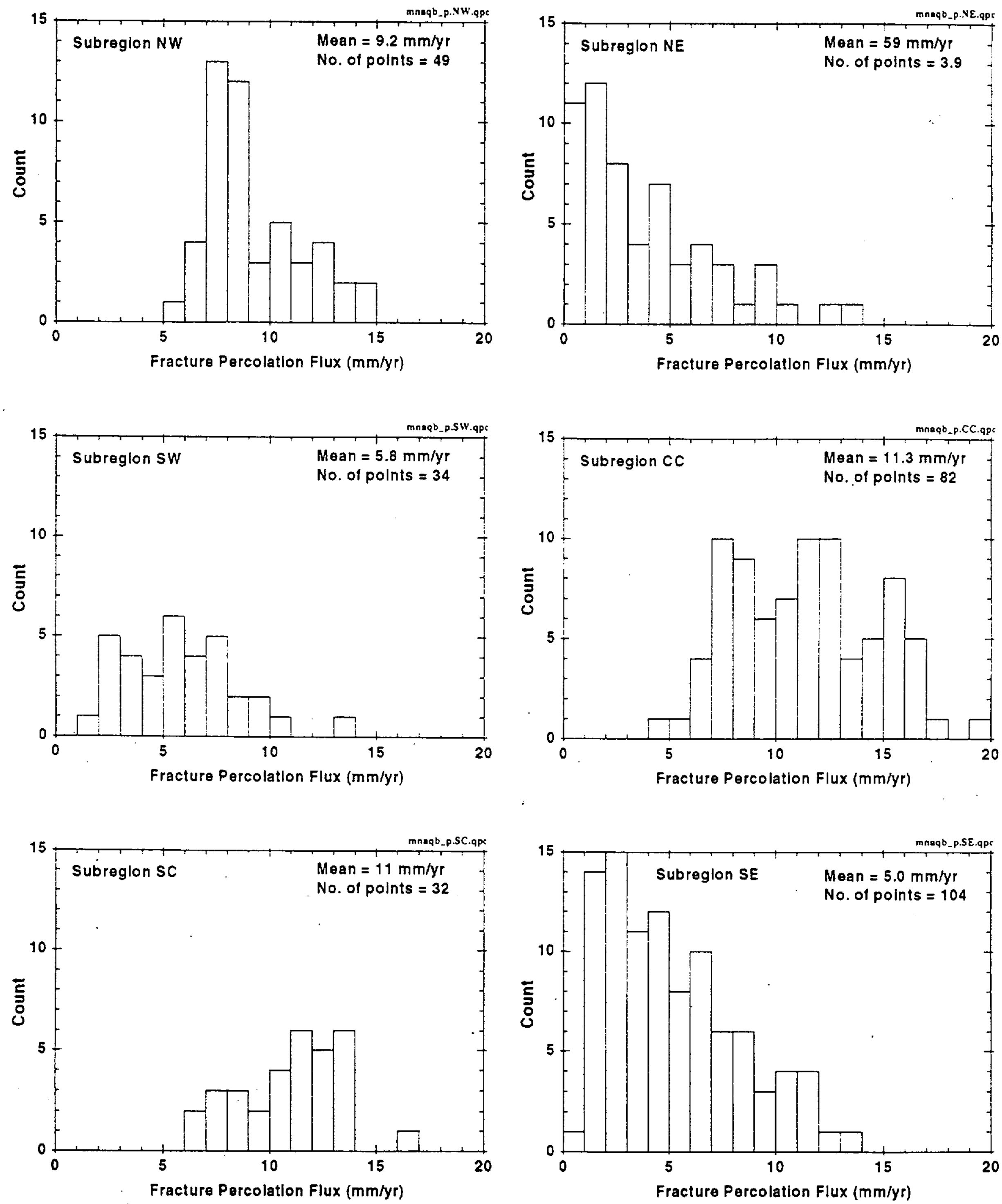


Figure 2-94. Histograms of simulated fracture percolation flux over six sub-domains for base-case simulation with present-day infiltration (mnaqb_p). (MO98606SPAHGRAM.001)

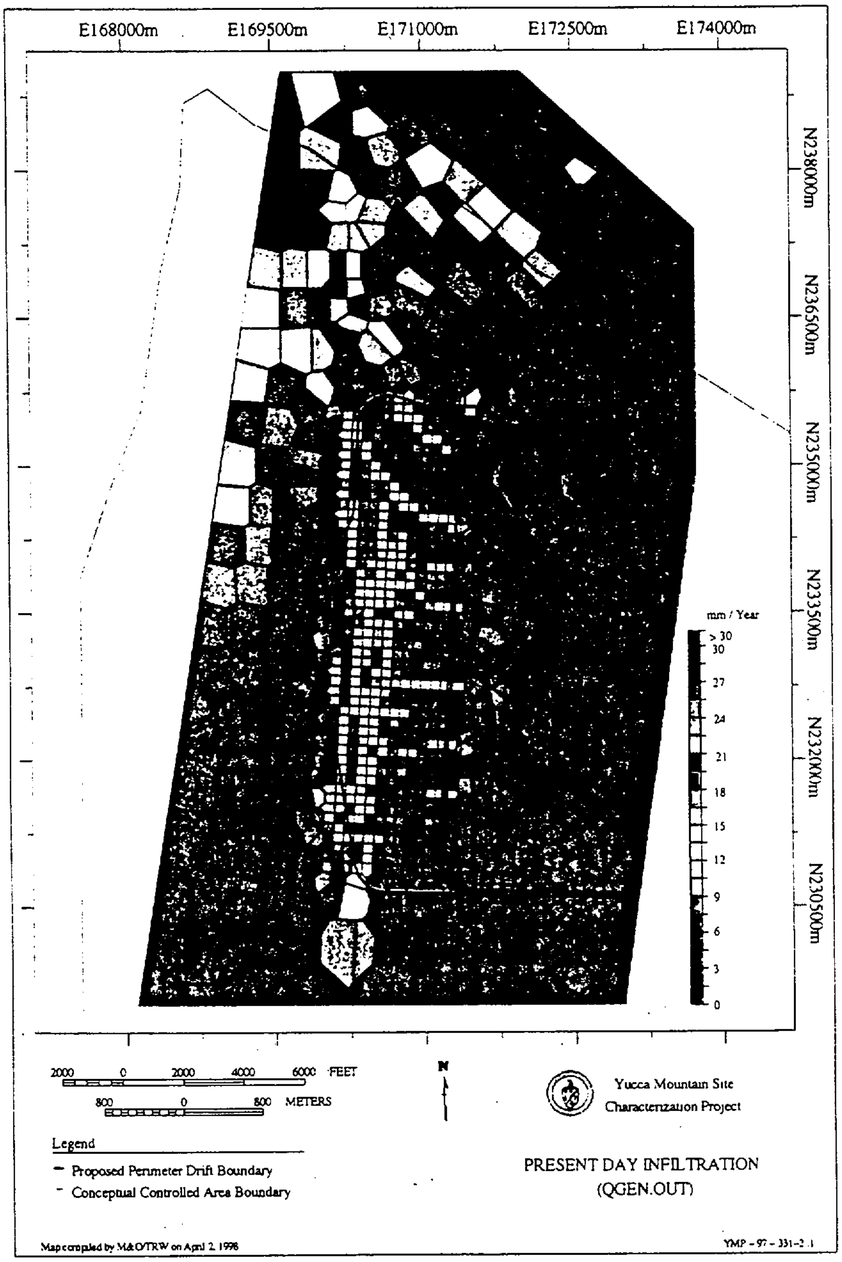


Figure 2-95. A plan view of the infiltrating-percolation flux (present-day mean infiltration) in the fractures at the surface of the model domain.

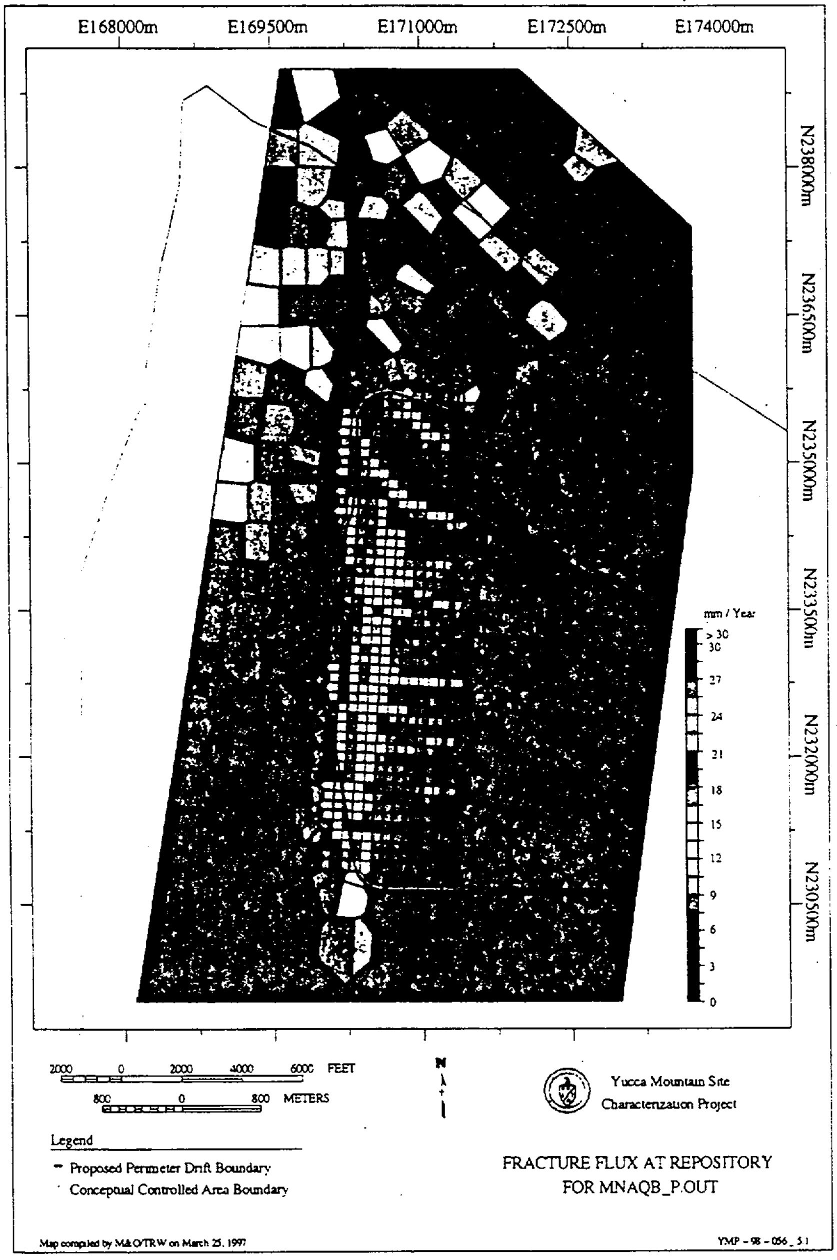


Figure 2-96. A plan view of the downward, fracture-percolation flux at the repository horizon (present-day mean infiltration, base case mnaqb_p).

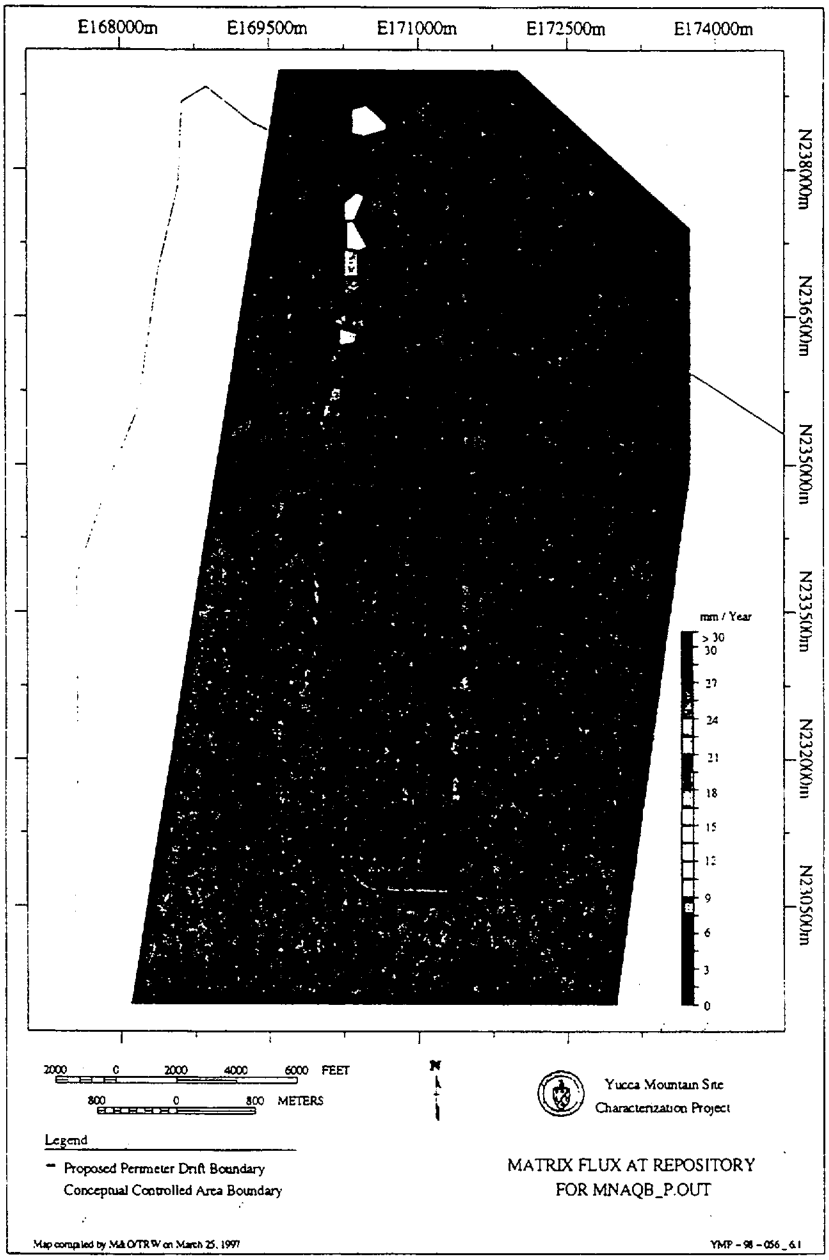


Figure 2-97. A plan view of the downward, matrix-percolation flux at the repository horizon (present-day mean infiltration, base case mnaqb_p).

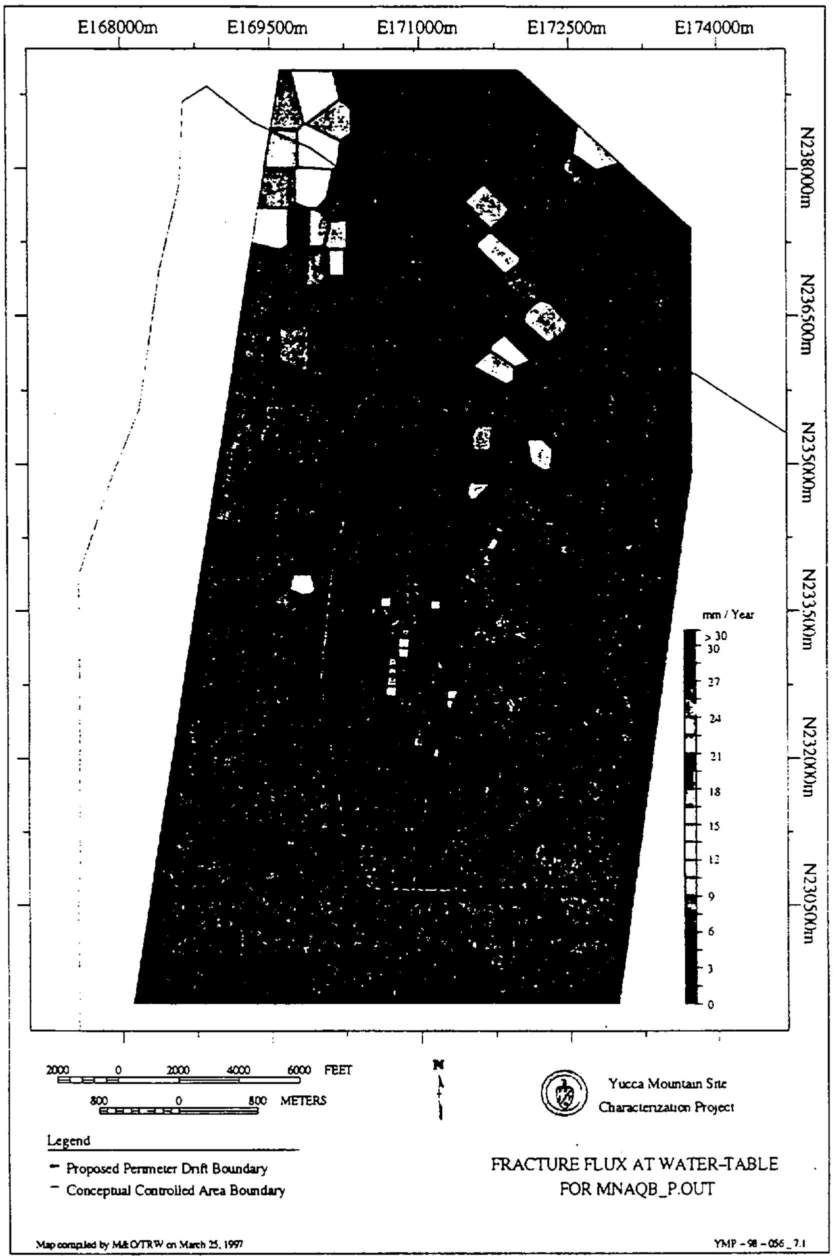


Figure 2-98. A plan view of the downward, fracture-percolation flux at the water table (present-day mean infiltration, base case mnaqb_p).

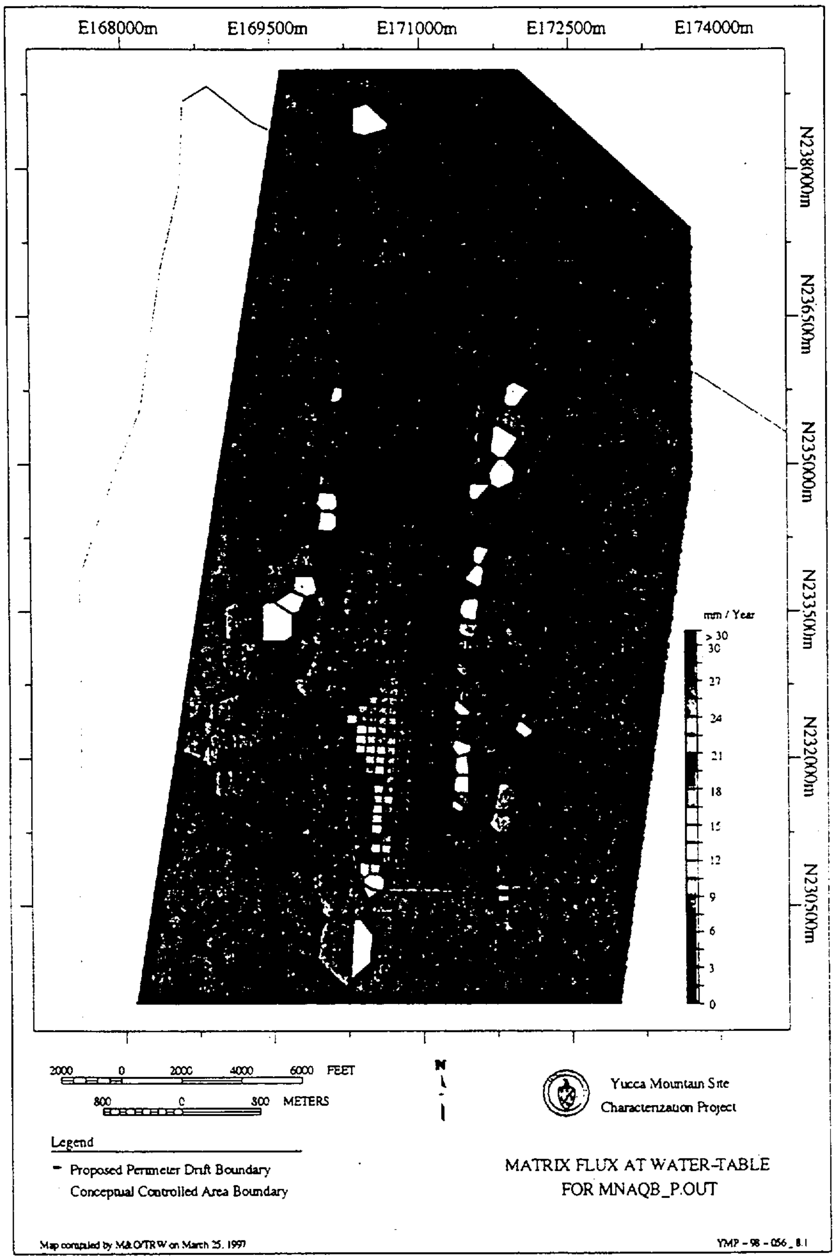


Figure 2-99. A plan view of the downward, matrix-percolation flux at the water table (present-day mean infiltration, base case mnaqb_p).

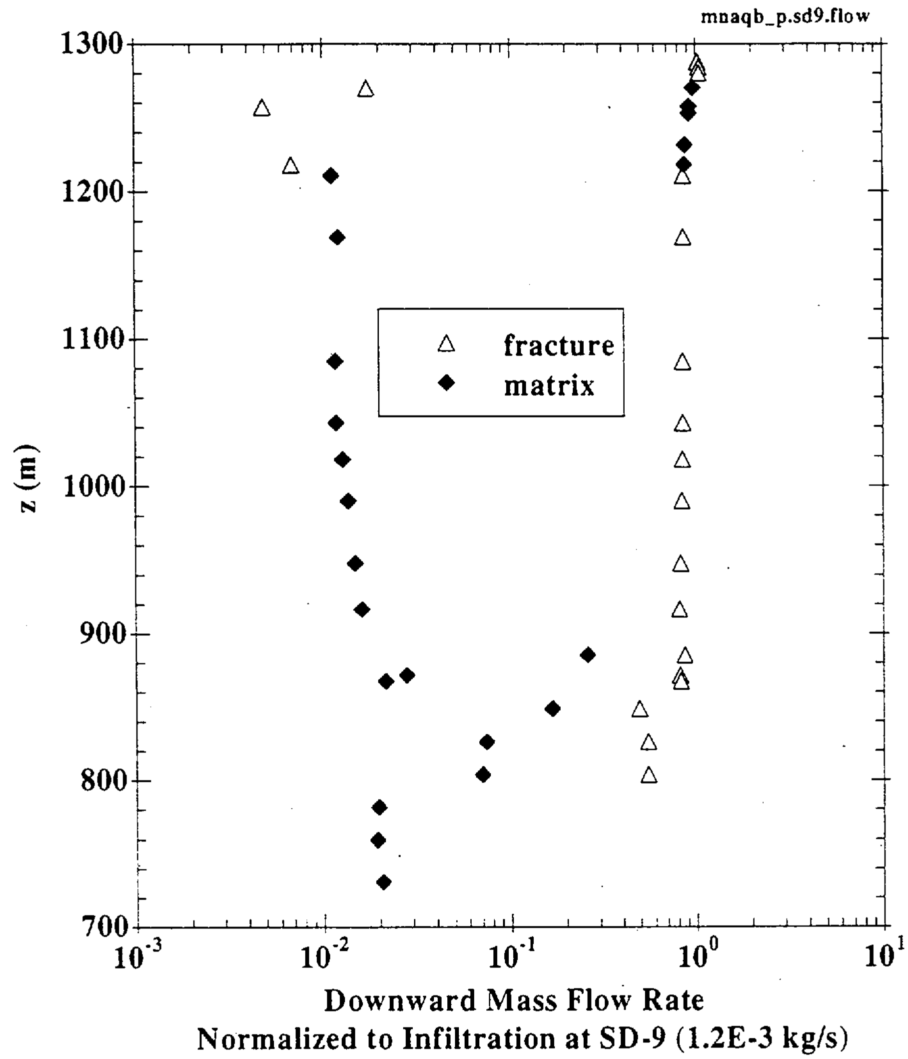


Figure 2-100. Simulated, downward, mass flow rates normalized to infiltration at borehole SD-9 for base-case simulation with mean present-day infiltration (mnaqb_p).

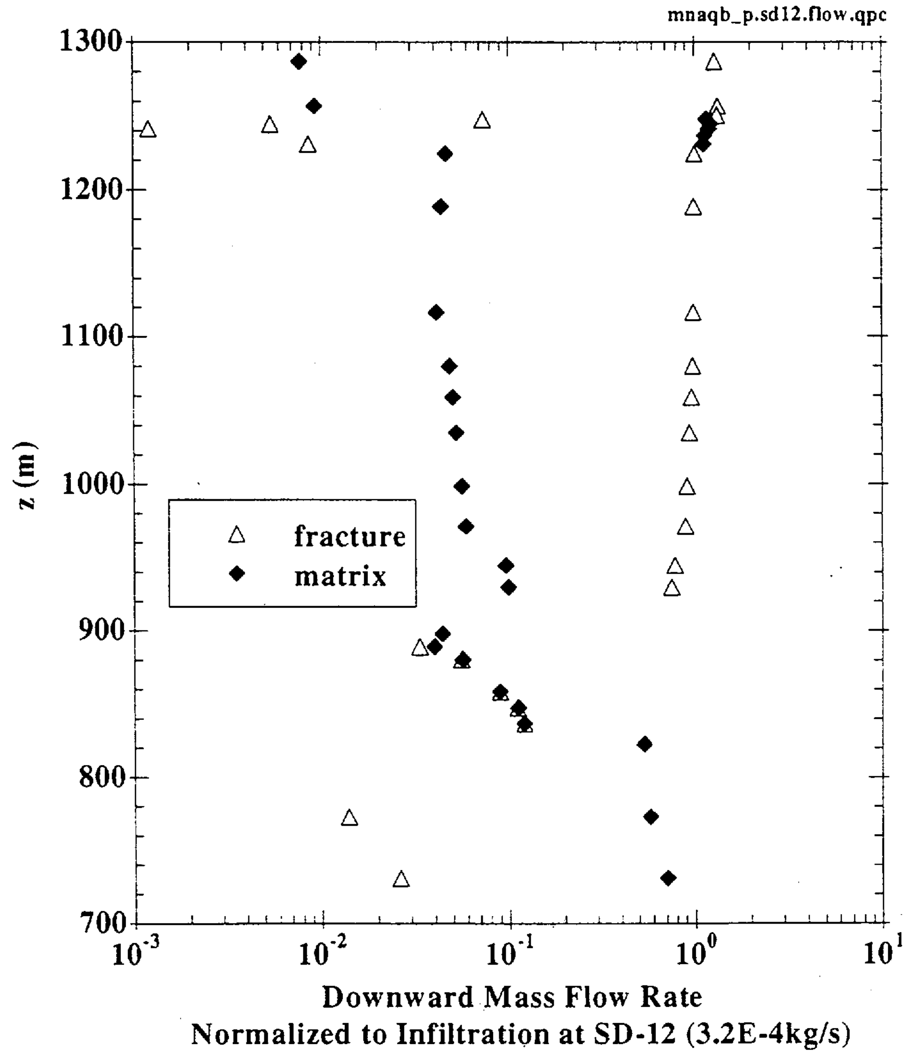


Figure 2-101. Simulated, downward, mass flow rates normalized to infiltration at borehole SD-12 for base-case simulation with mean present-day infiltration (mnaqb_p).

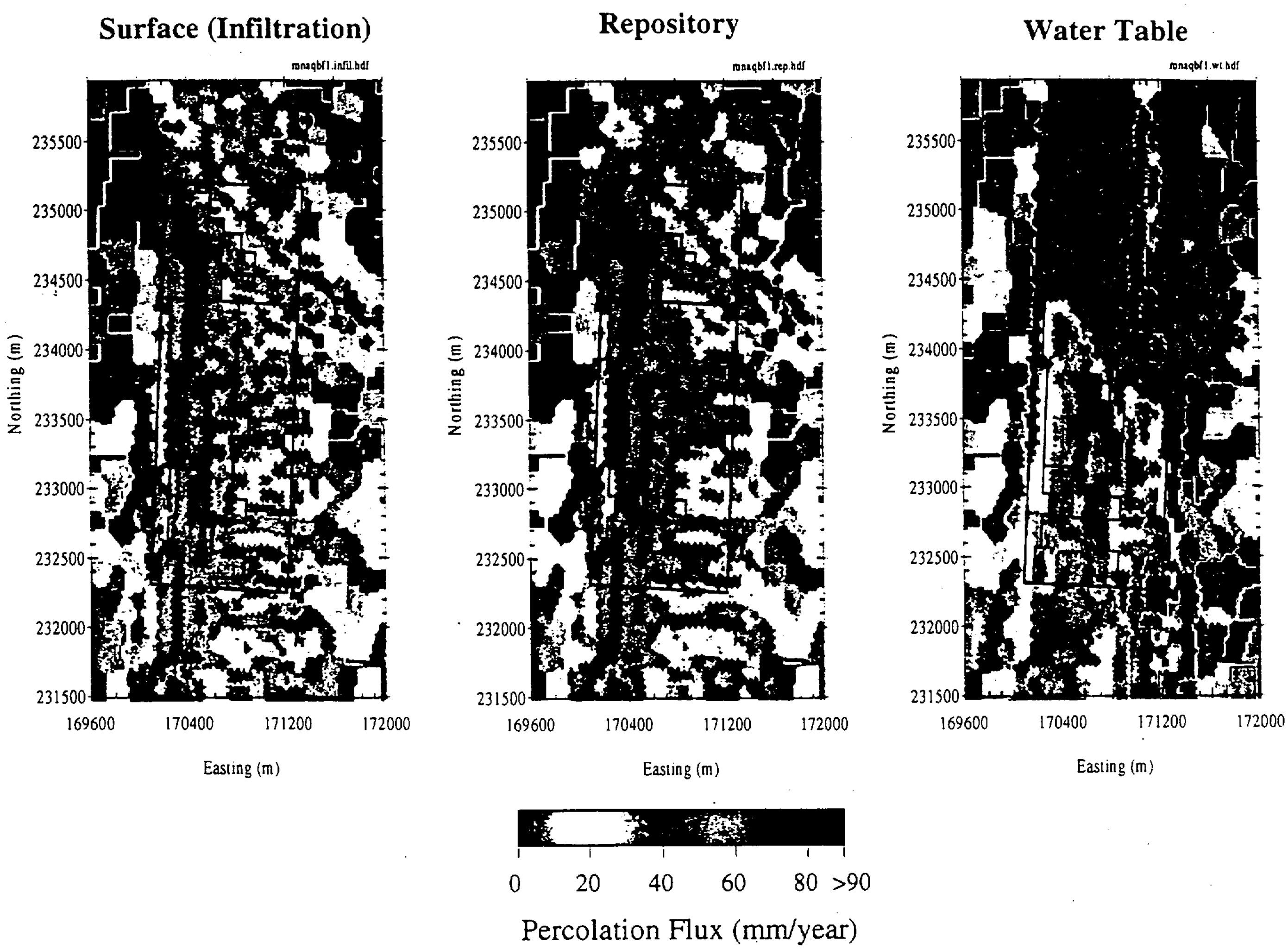


Figure 2-102. Total (fracture + matrix) percolation flux at three elevations (long-term-average climate, mean infiltration, base-case hydrologic properties).

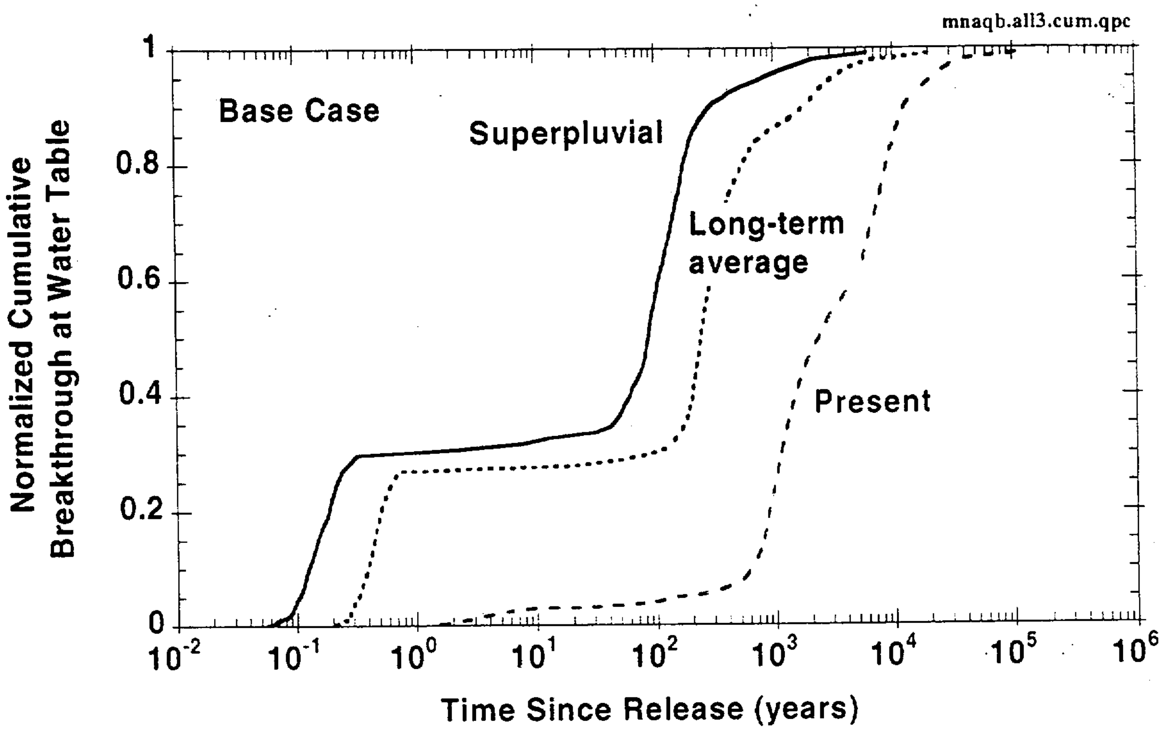


Figure 2-103. Breakthrough curves at the water table for pulse of an unretarded tracer released uniformly throughout the repository. Breakthrough curves for all three climate states are shown (mean infiltration, base-case hydrologic properties, no matrix diffusion).

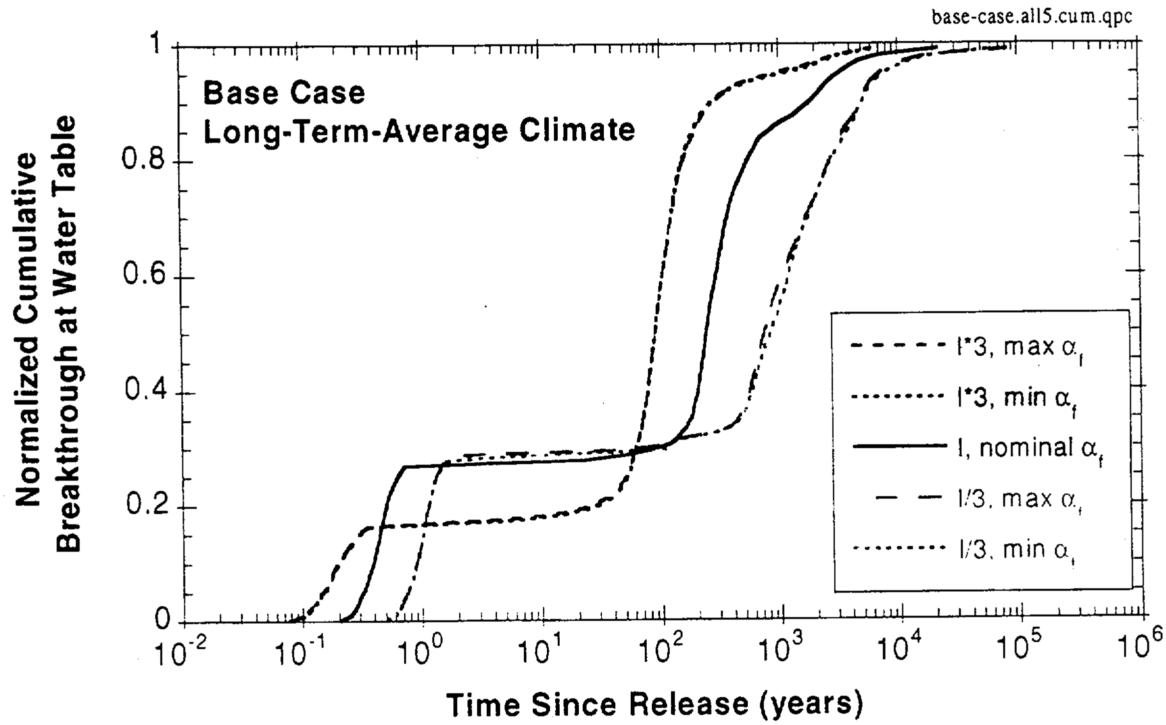


Figure 2-104. Breakthrough curves at the water table for pulse of an unretarded tracer released uniformly throughout the repository. Breakthrough curves for the five base-case, hydrologic-property sets are shown (long-term-average climate, no matrix diffusion).

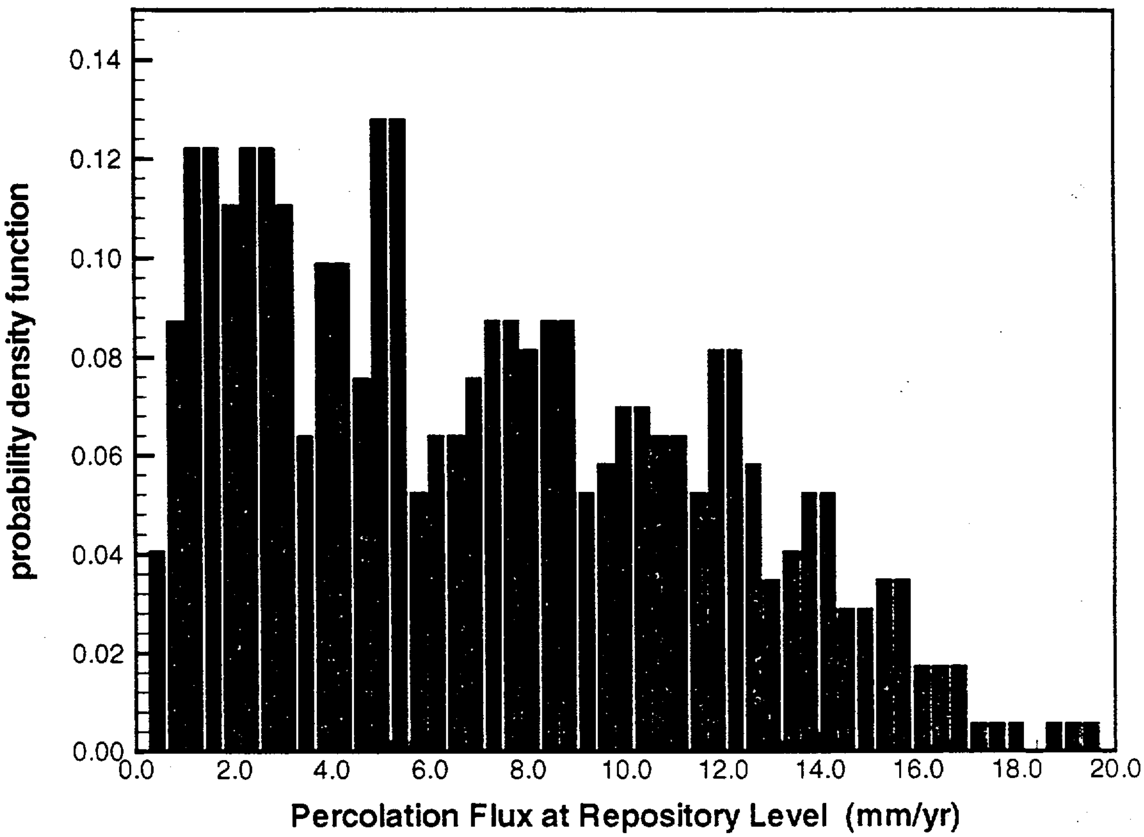


Figure 2-105. Fracture-percolation flux distribution over the potential repository for the base-case, present-day scenario.

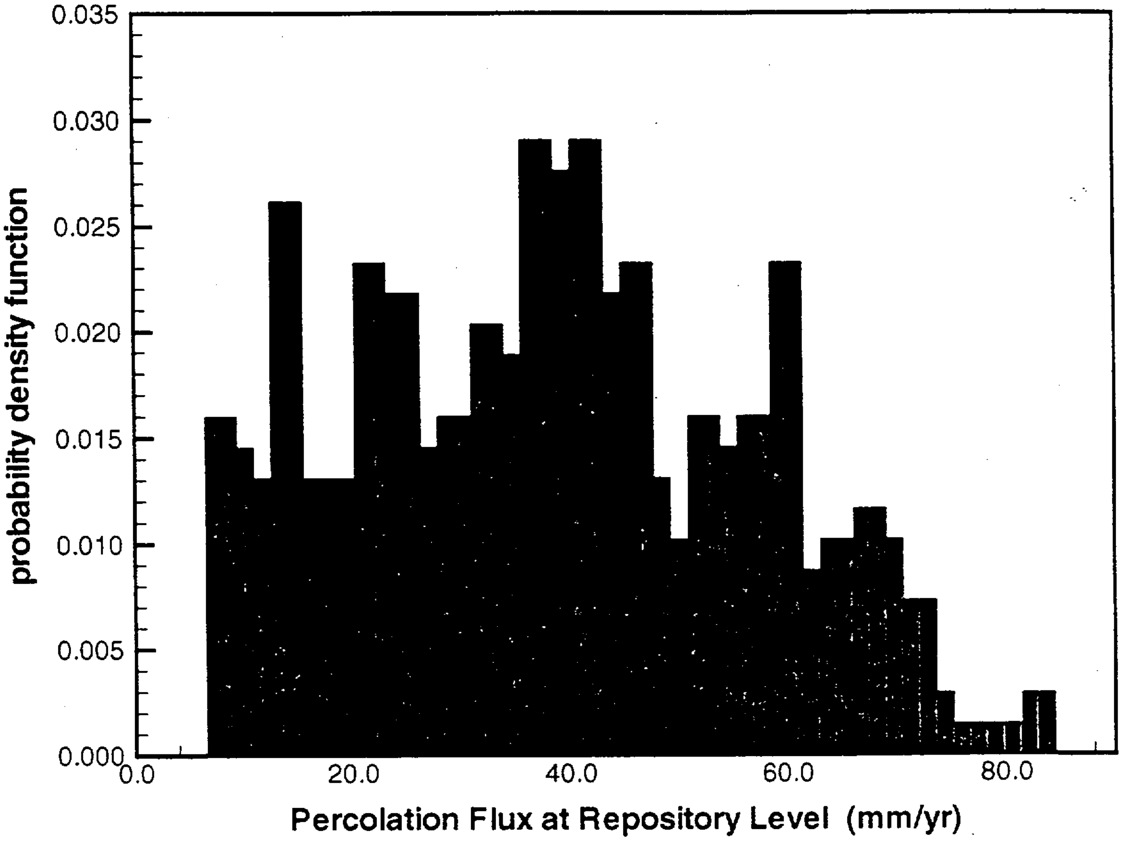


Figure 2-106. Fracture-percolation flux distribution over the potential repository for the base-case, long-term-average scenario.

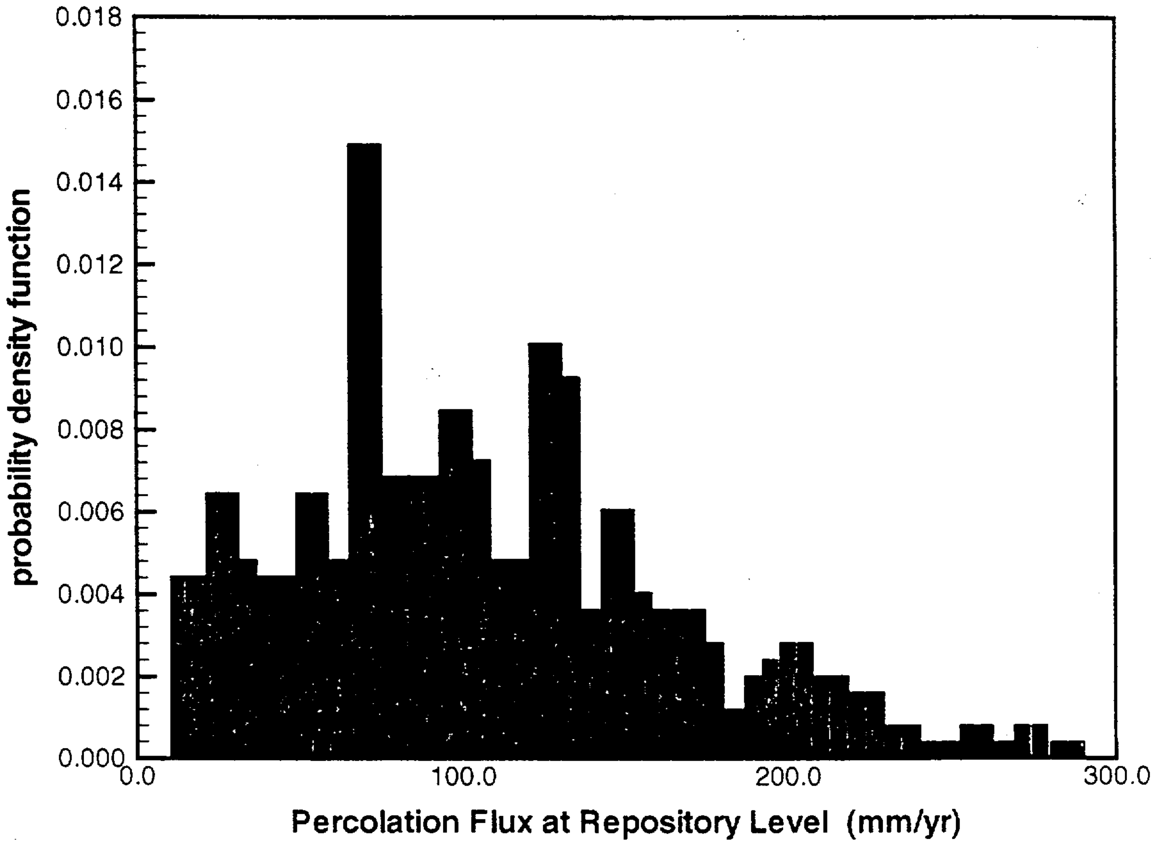


Figure 2-107. Flux distribution over the potential repository for the base-case, superpluvial scenario.

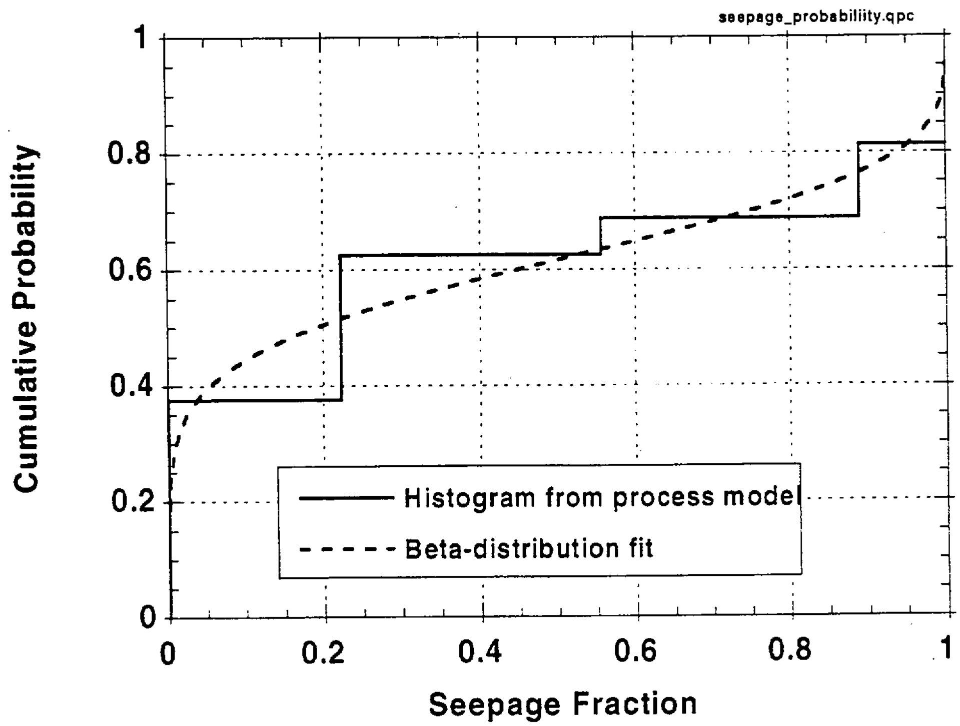


Figure 2-108. Comparison of CDF for f_s at 73.2 mm/yr from process model with beta-distribution fit.

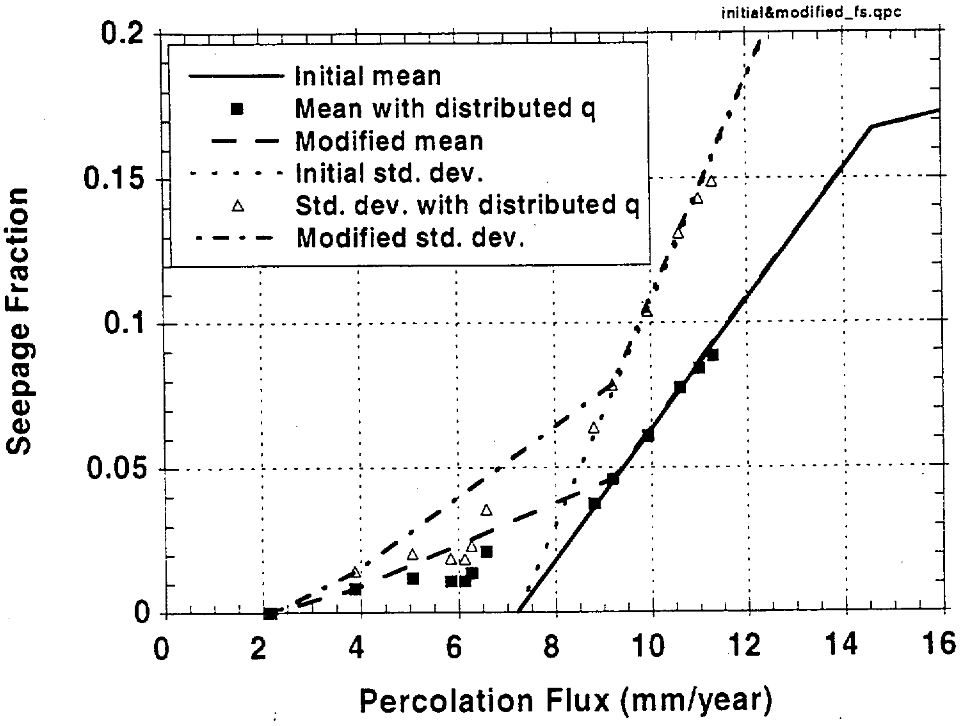


Figure 2-109. Initial and modified abstracted models for f_s.

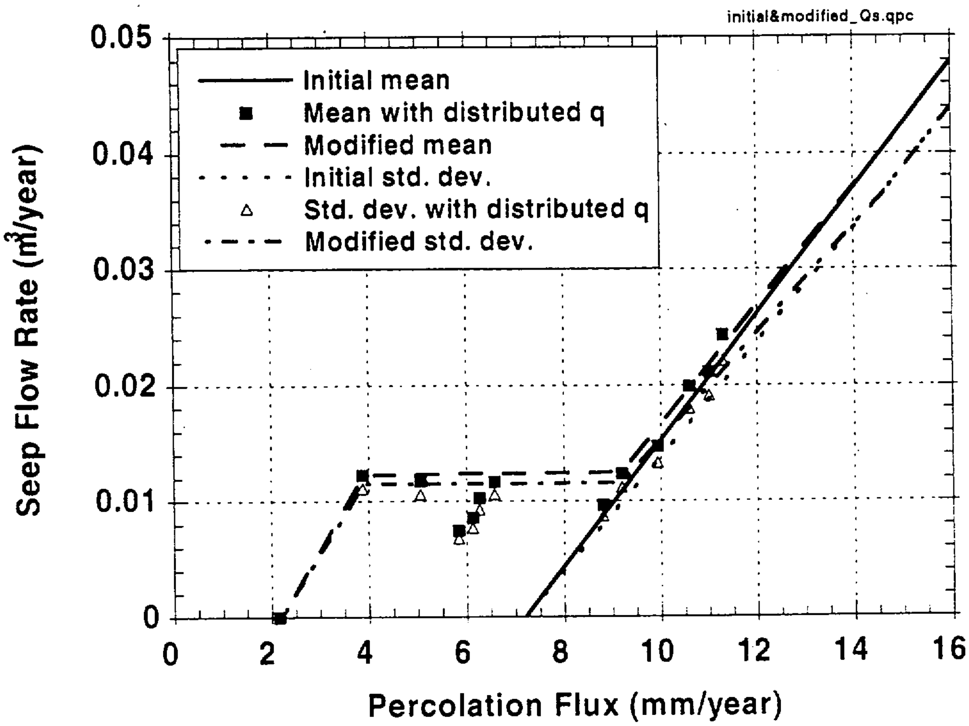


Figure 2-110. Initial and modified abstracted models for Q_s.

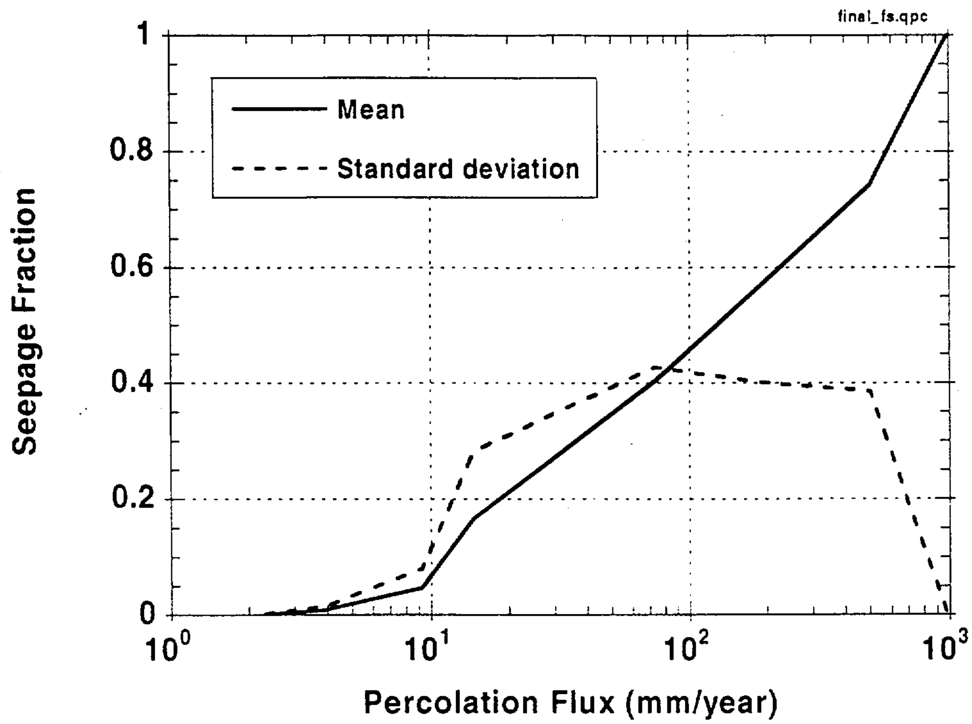


Figure 2-111. Final base-case abstraction of seepage fraction.

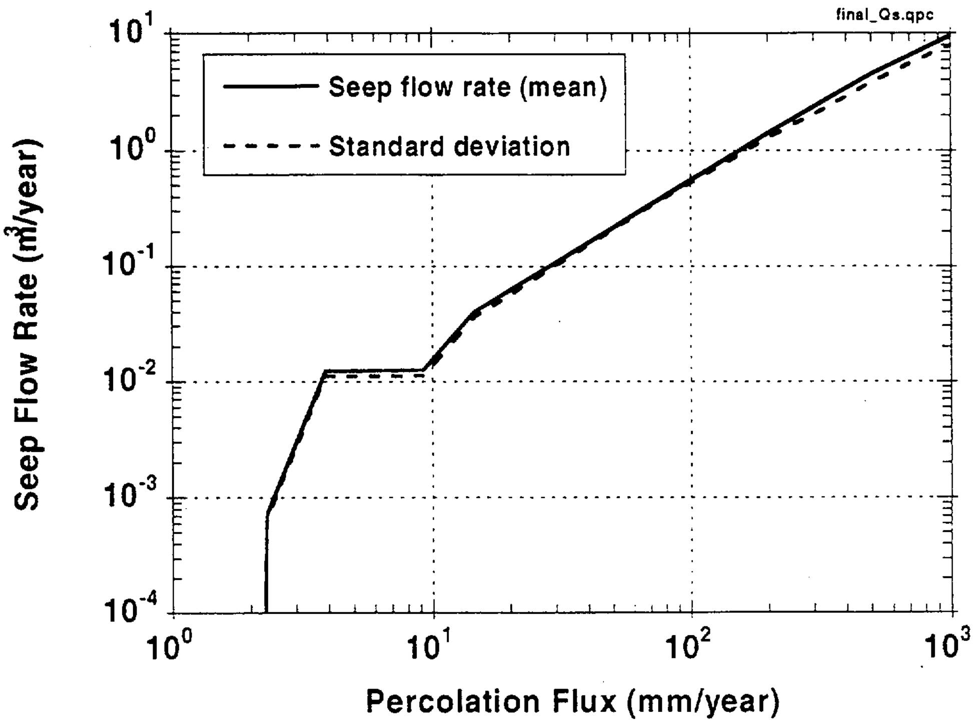


Figure 2-112. Final base-case abstraction of seep flow rate.

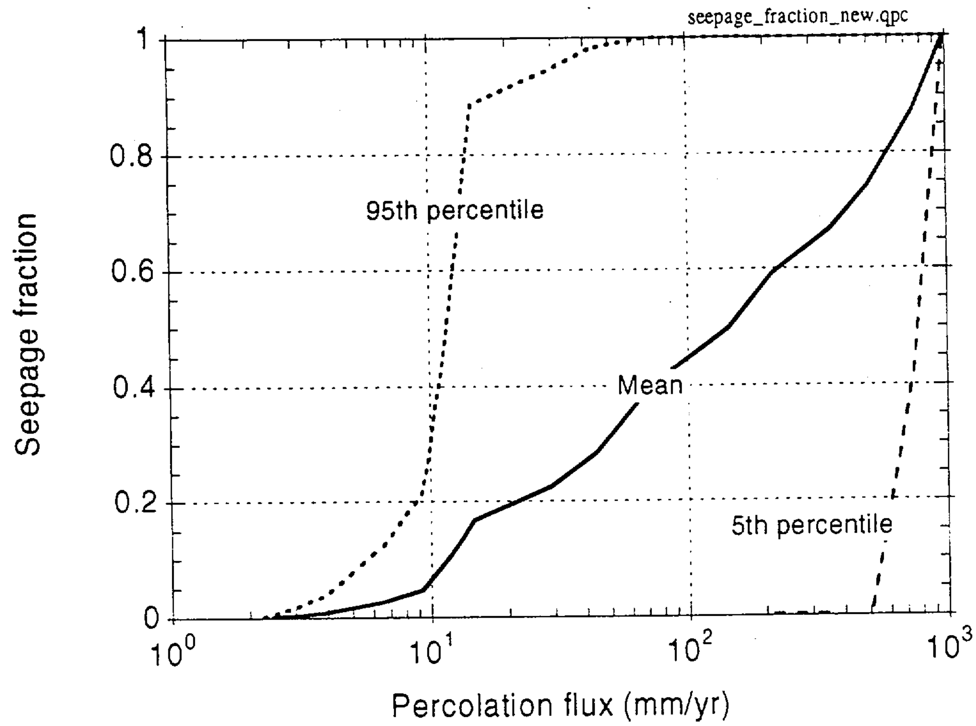


Figure 2-113. Mean, 5th percentile, and 95th percentile of f_s as a function of percolation.

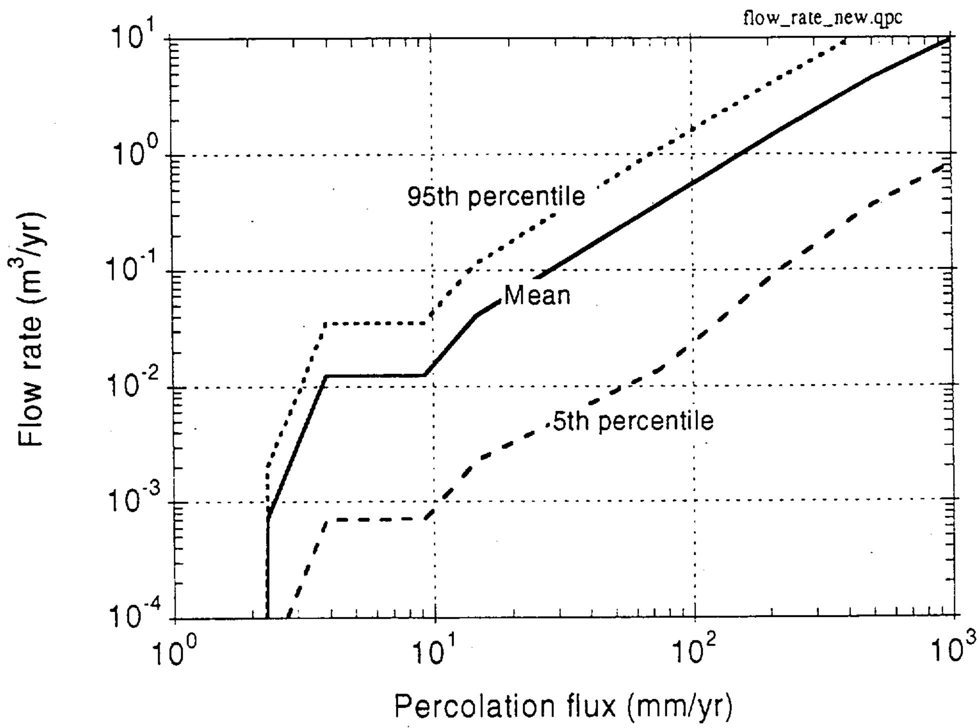


Figure 2-114. Mean, 5th percentile, and 95th percentile of Q_s as functions of percolation.

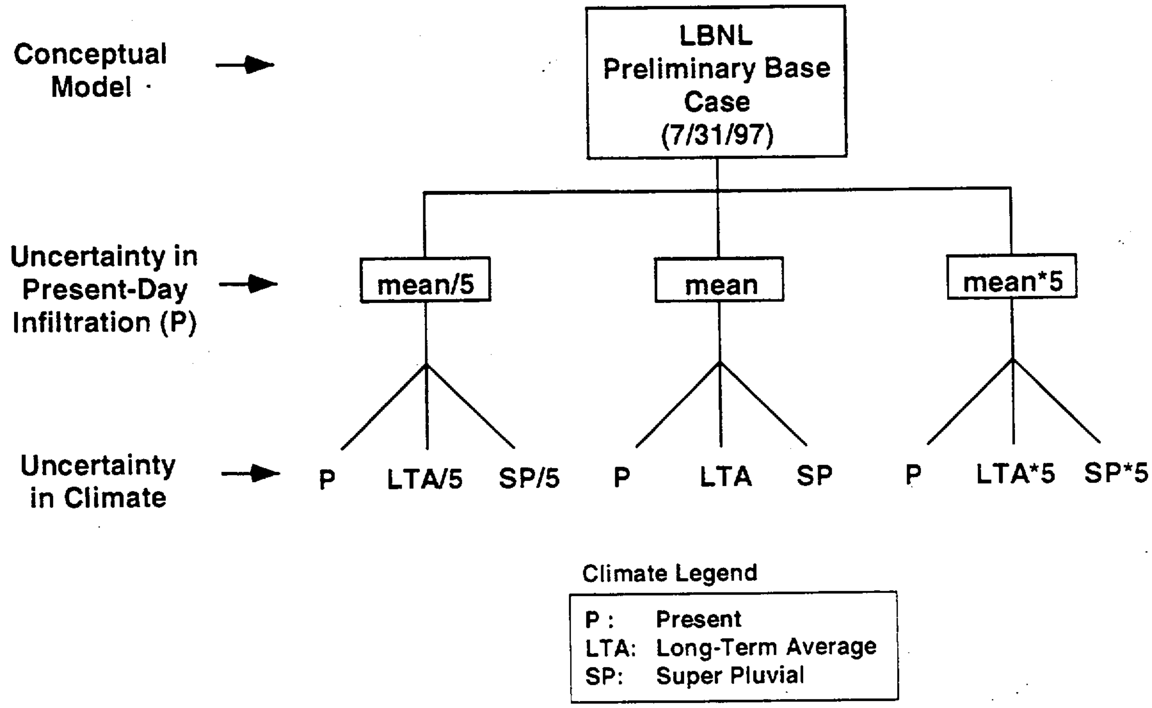


Figure 2-115. Tree-diagram of nine flow fields used for infiltration sensitivity study. These parameter sets were deemed the "preliminary base case".

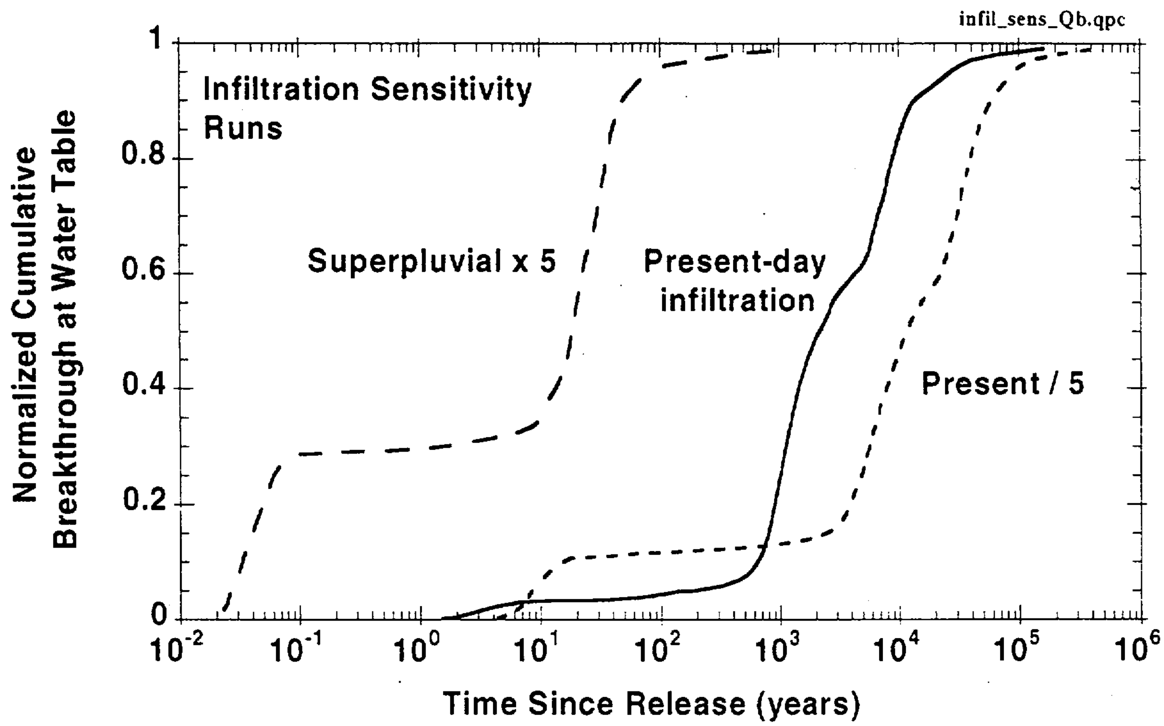


Figure 2-116. Breakthrough curves at the water table for pulse of an unretarded tracer released uniformly throughout the repository, using runs from infiltration sensitivity study. The extreme values are shown, along with the present-day breakthrough curve (preliminary base-case hydrologic properties, no matrix diffusion).

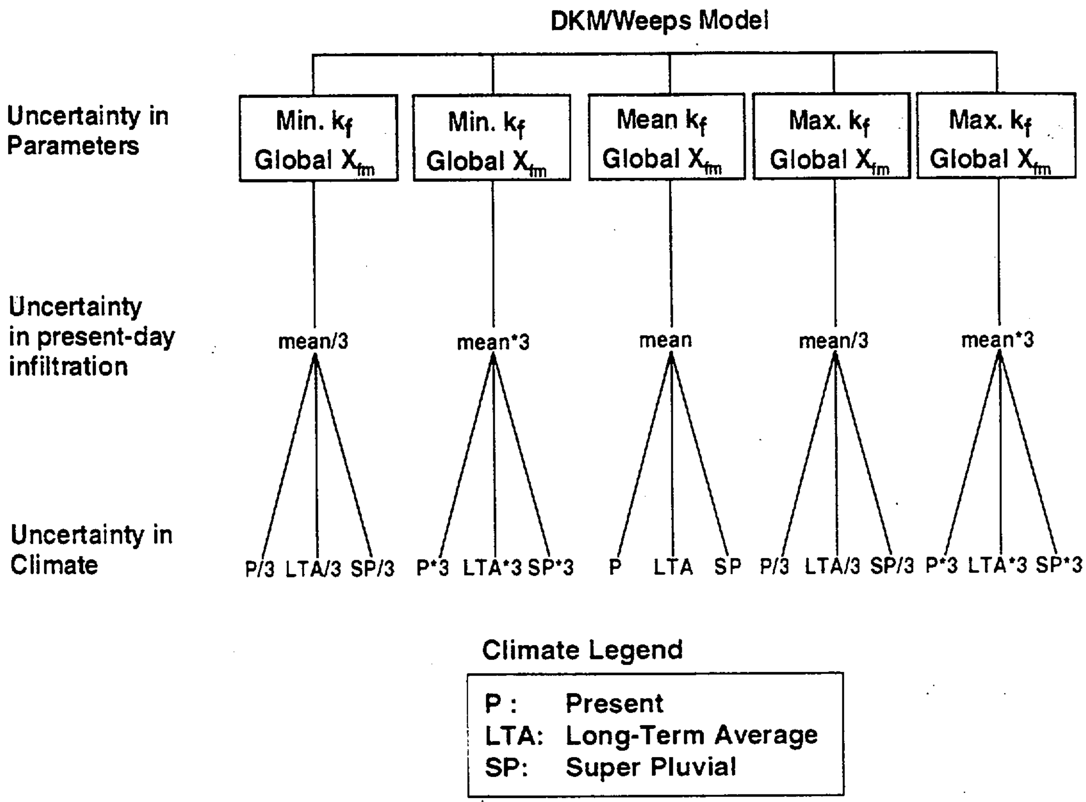


Figure 2-117. Tree-diagram of 15 flow fields created by the DKM/Weeps model. The parameters k_f and X_{fm} denote fracture permeability and a global fitted constant, respectively.

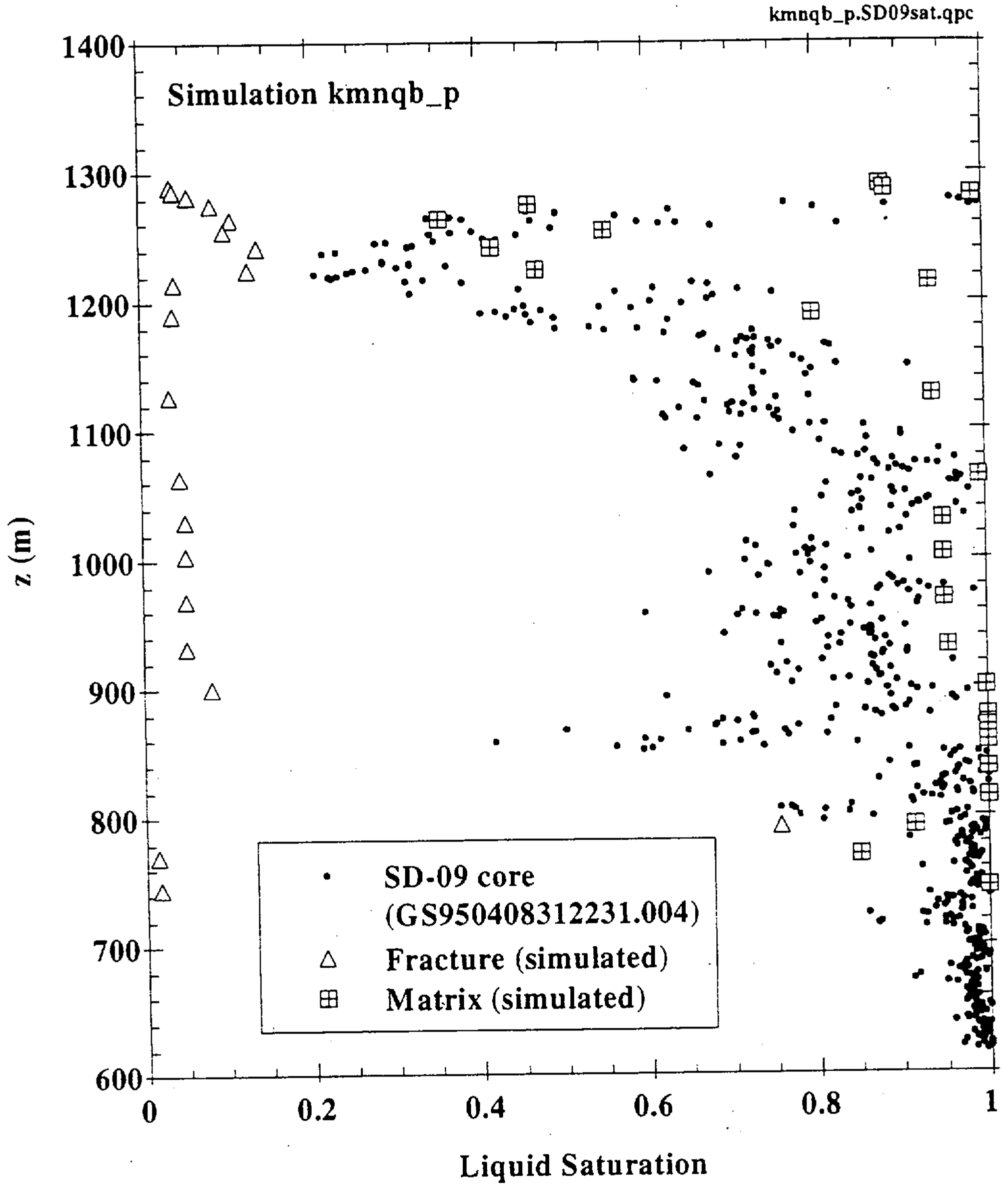


Figure 2-118. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-09 using the results of simulation kmnqb_p (minimum fracture permeability, present-day infiltration).

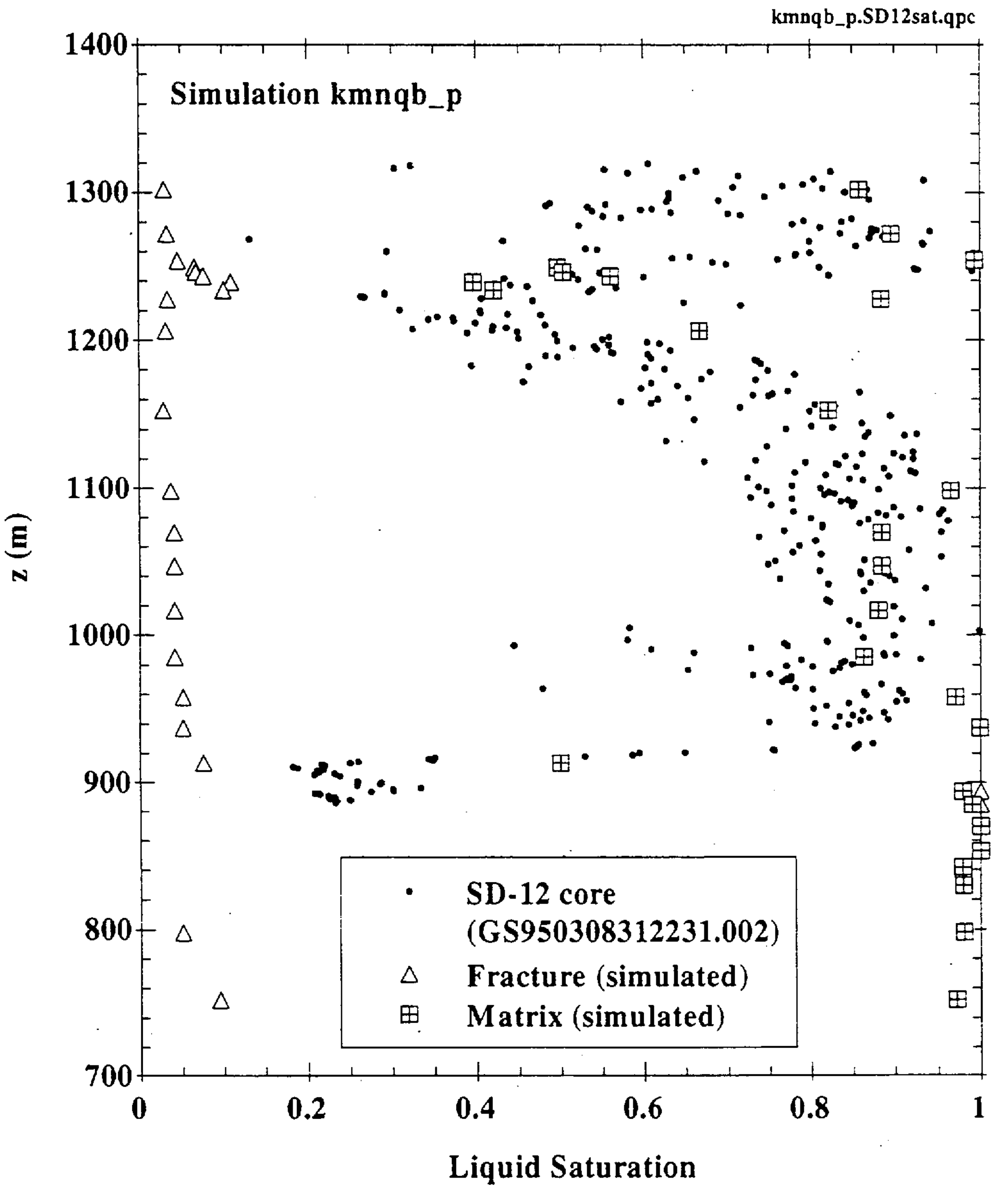


Figure 2-119. Comparison of modeled and observed matrix- and fracture-liquid saturations for borehole SD-12 using the results of simulation kmnqb_p (minimum fracture permeability, present-day infiltration).

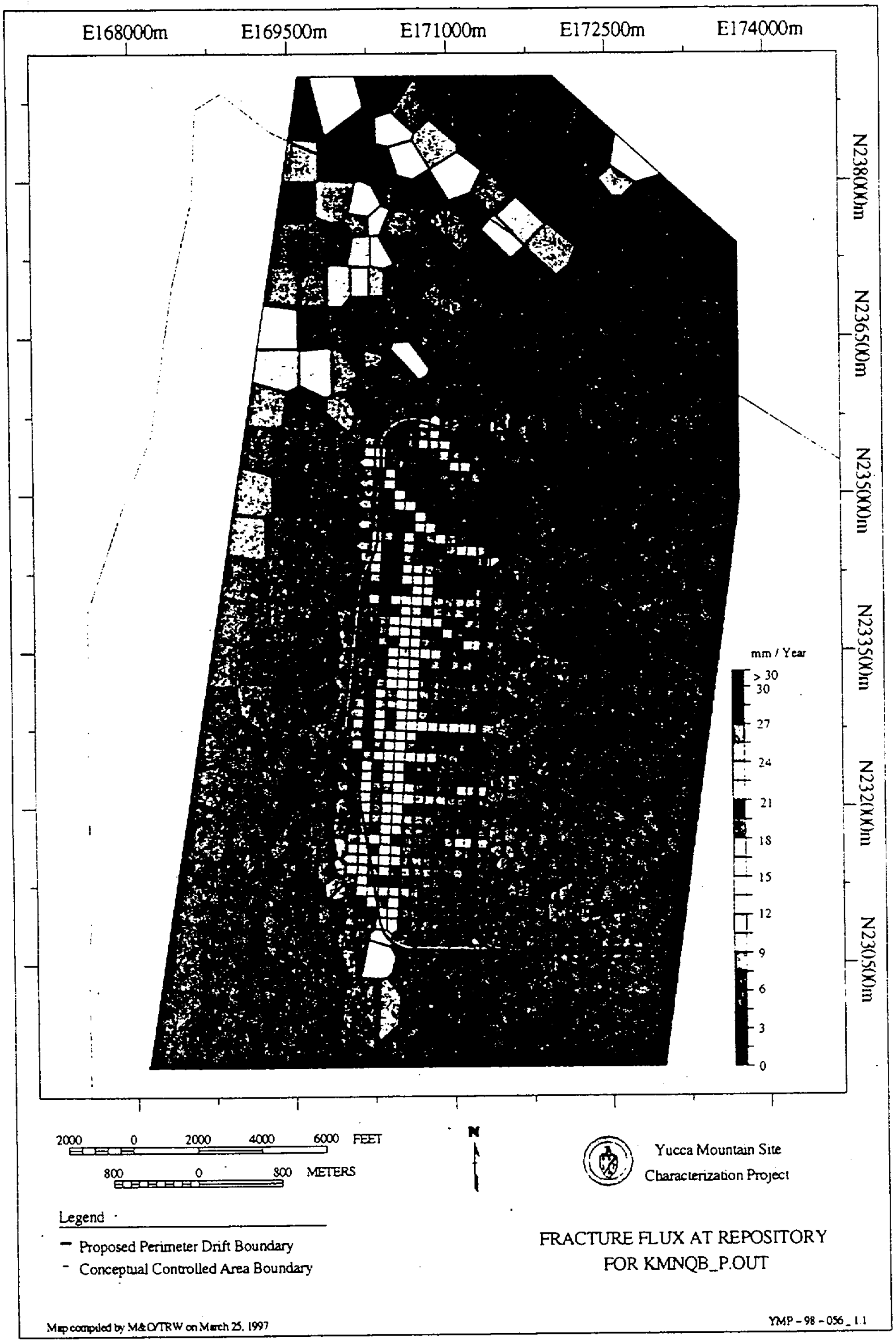


Figure 2-120. A plan view of the downward, fracture-percolation flux at the repository horizon using the DKM/Weeps alternative model (present-day mean infiltration, kmnqb_p).

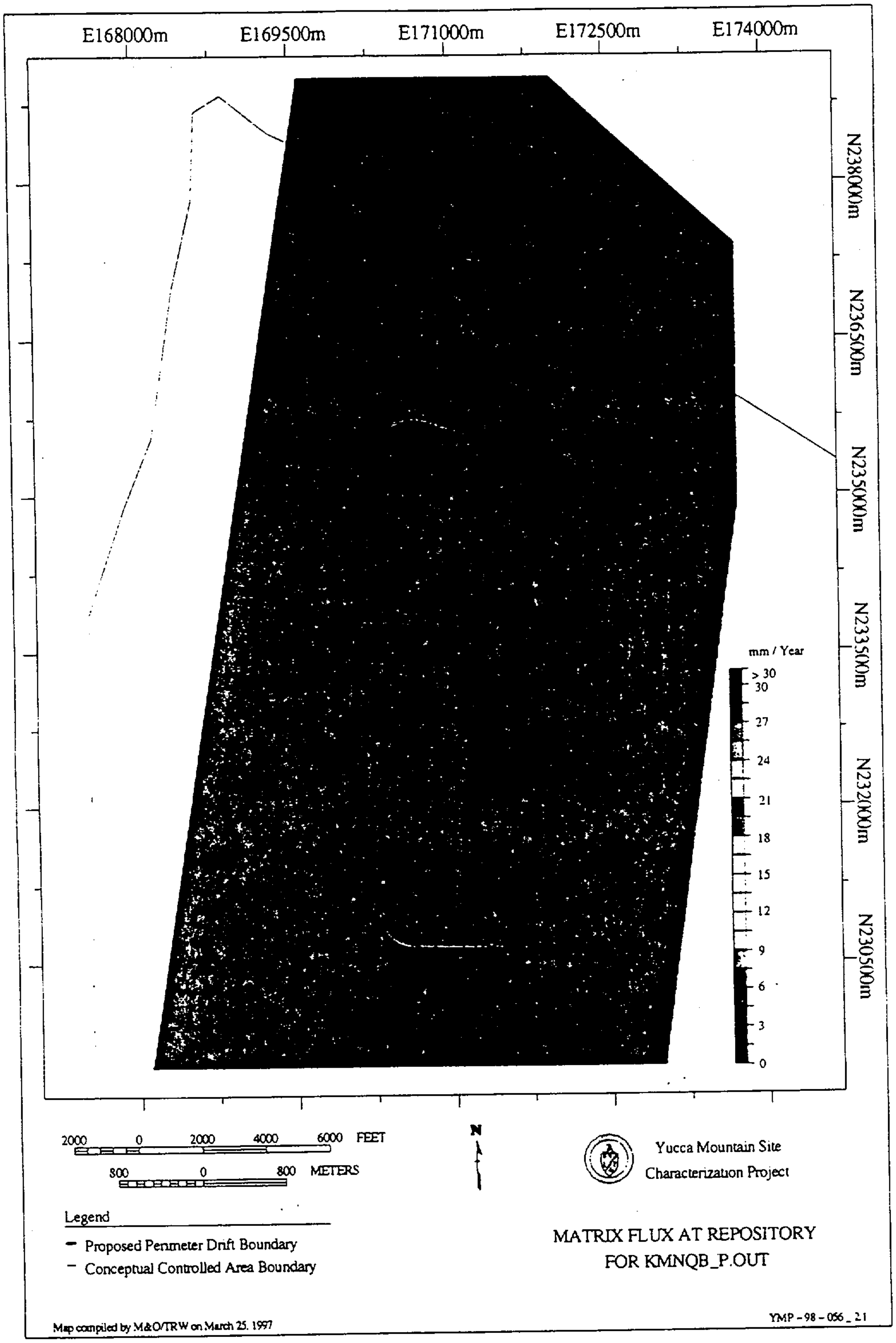


Figure 2-121. A plan view of the downward, matrix-percolation flux at the repository horizon using the DKM/Weeps alternative model (present-day mean infiltration, kmnqb_p).

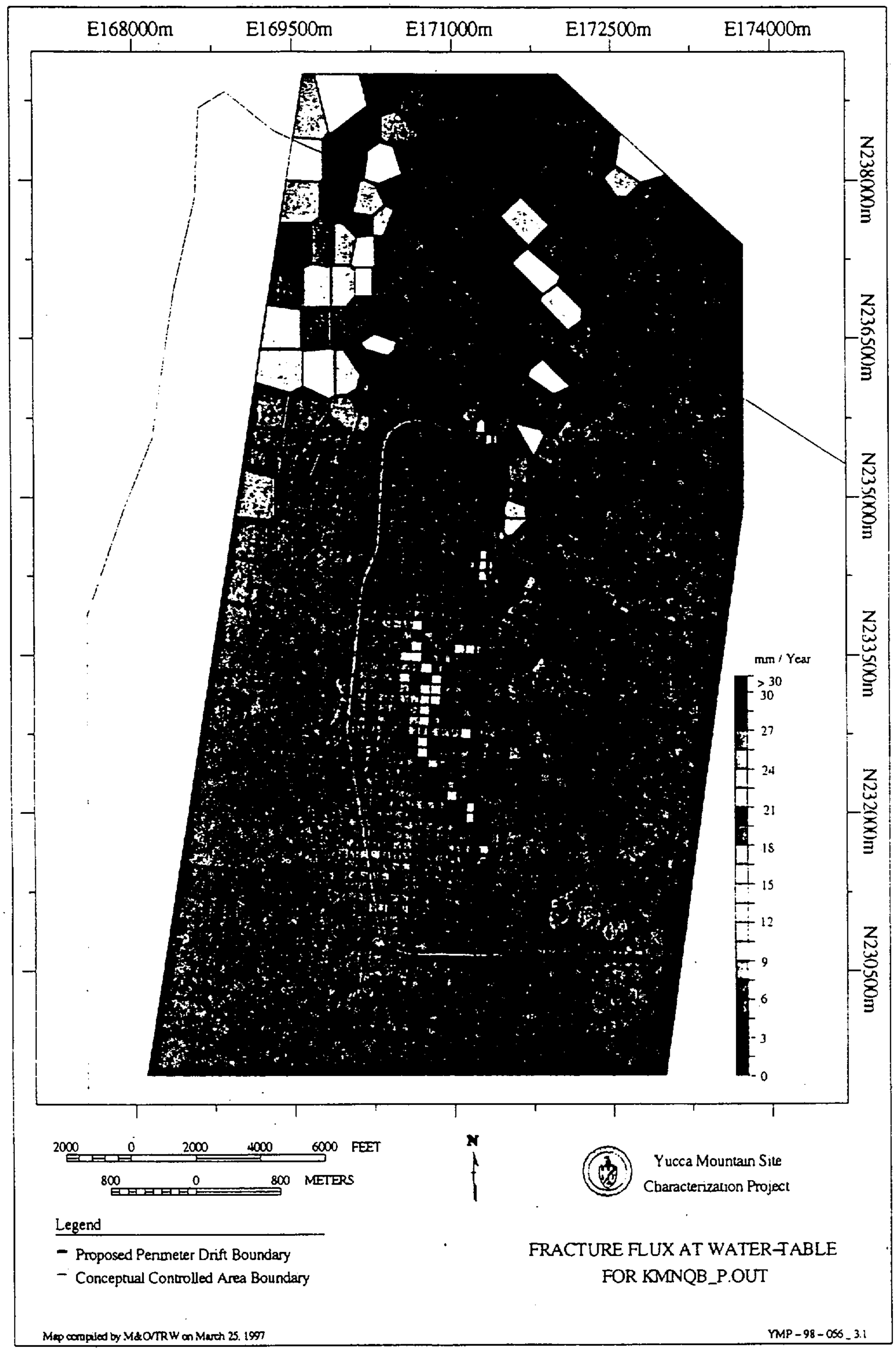


Figure 2-122. A plan view of the downward, fracture-percolation flux at the water table using the DKM/Weeps alternative model (present-day mean infiltration, kmnqb_p).

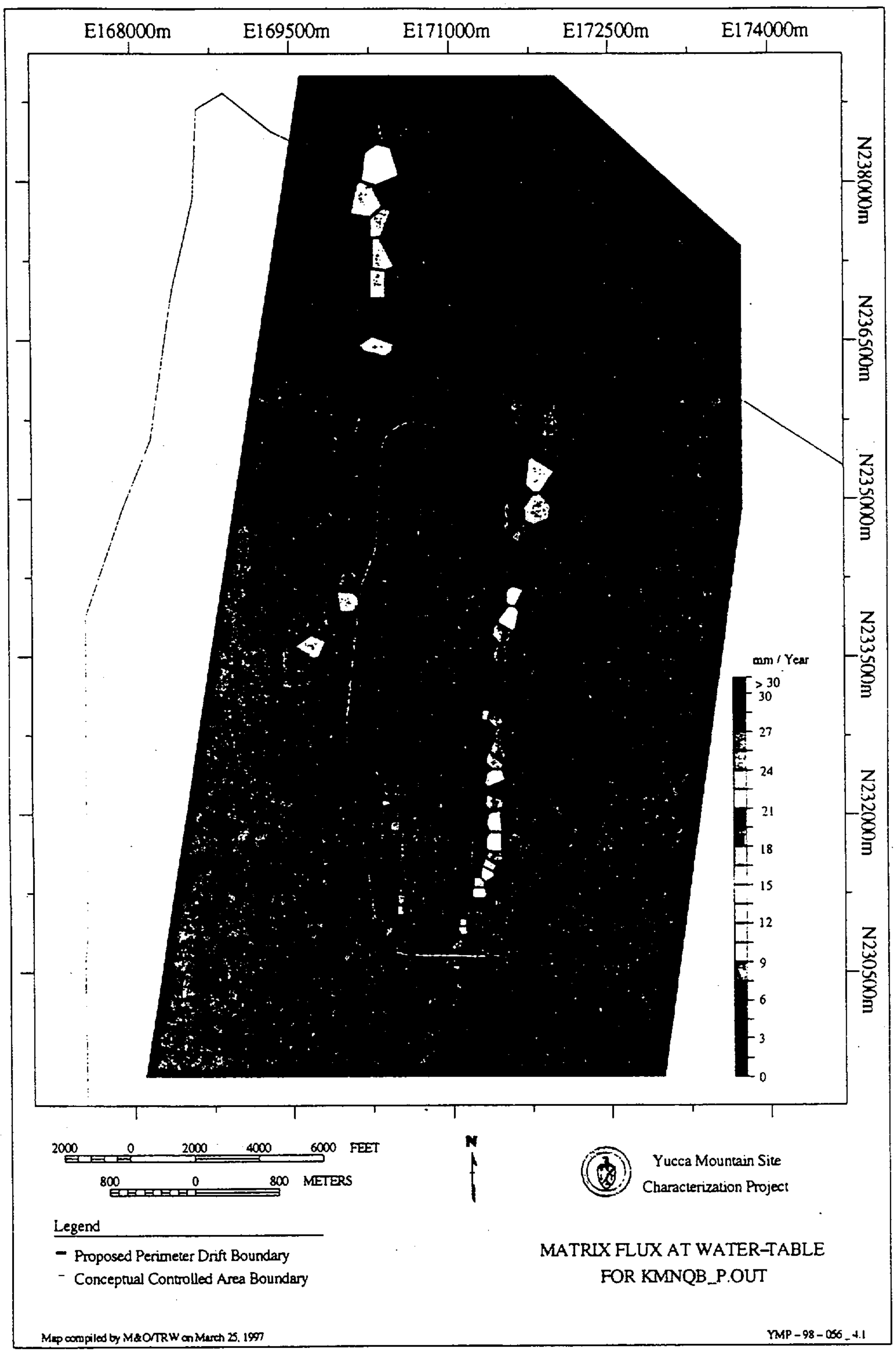


Figure 2-123. A plan view of the downward, matrix-percolation flux at the water table using the DKM/Weeps alternative model (present-day mean infiltration, kmnqb_p).

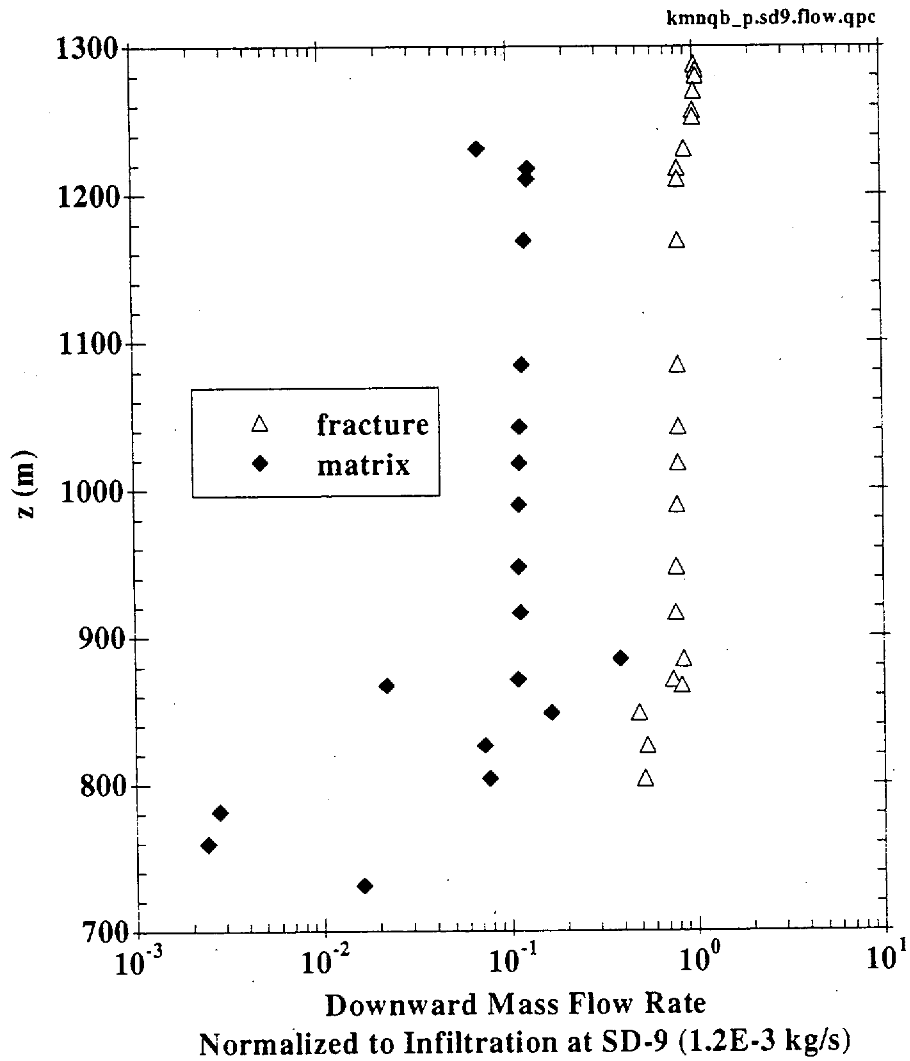


Figure 2-124. Simulated, downward, mass flow rates normalized to infiltration at borehole SD-9 for DKM/Weeps simulation with mean present-day infiltration (kmnqb_p).

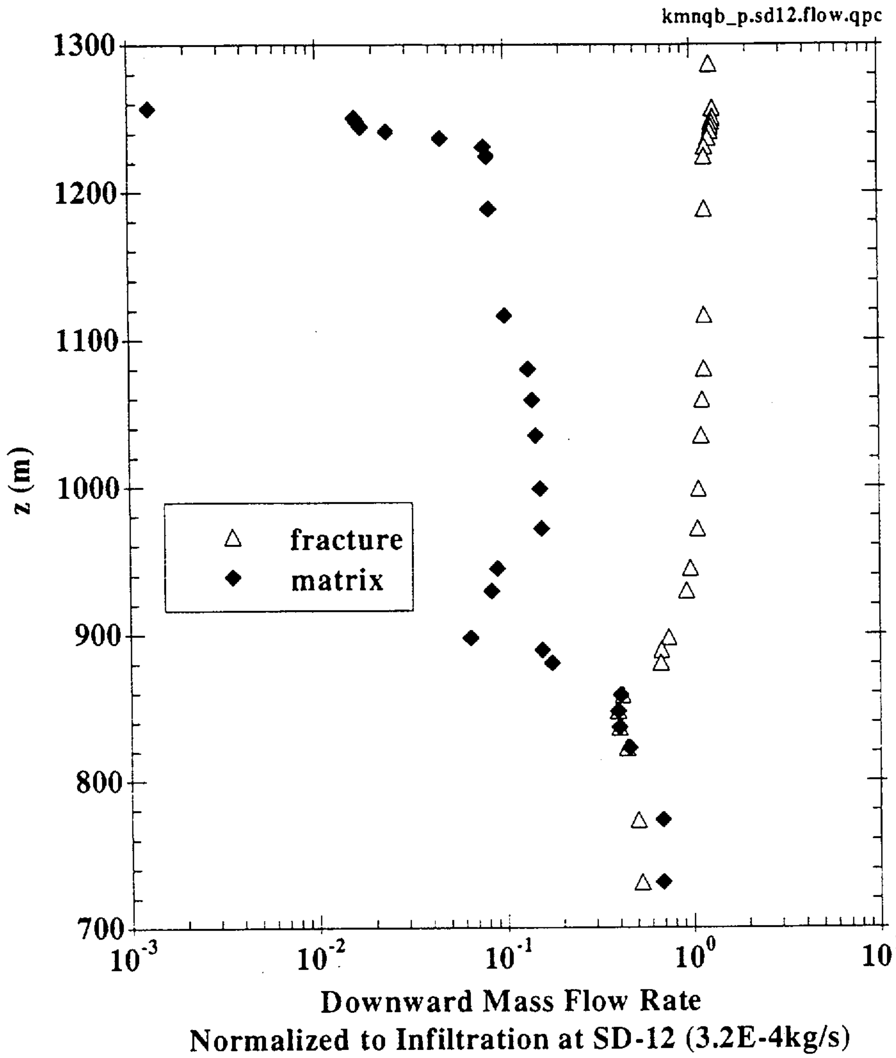


Figure 2-125. Simulated, downward, mass flow rates normalized to infiltration at borehole SD-12 for DKM/Weeps simulation with mean present-day infiltration (kmnqb_p).

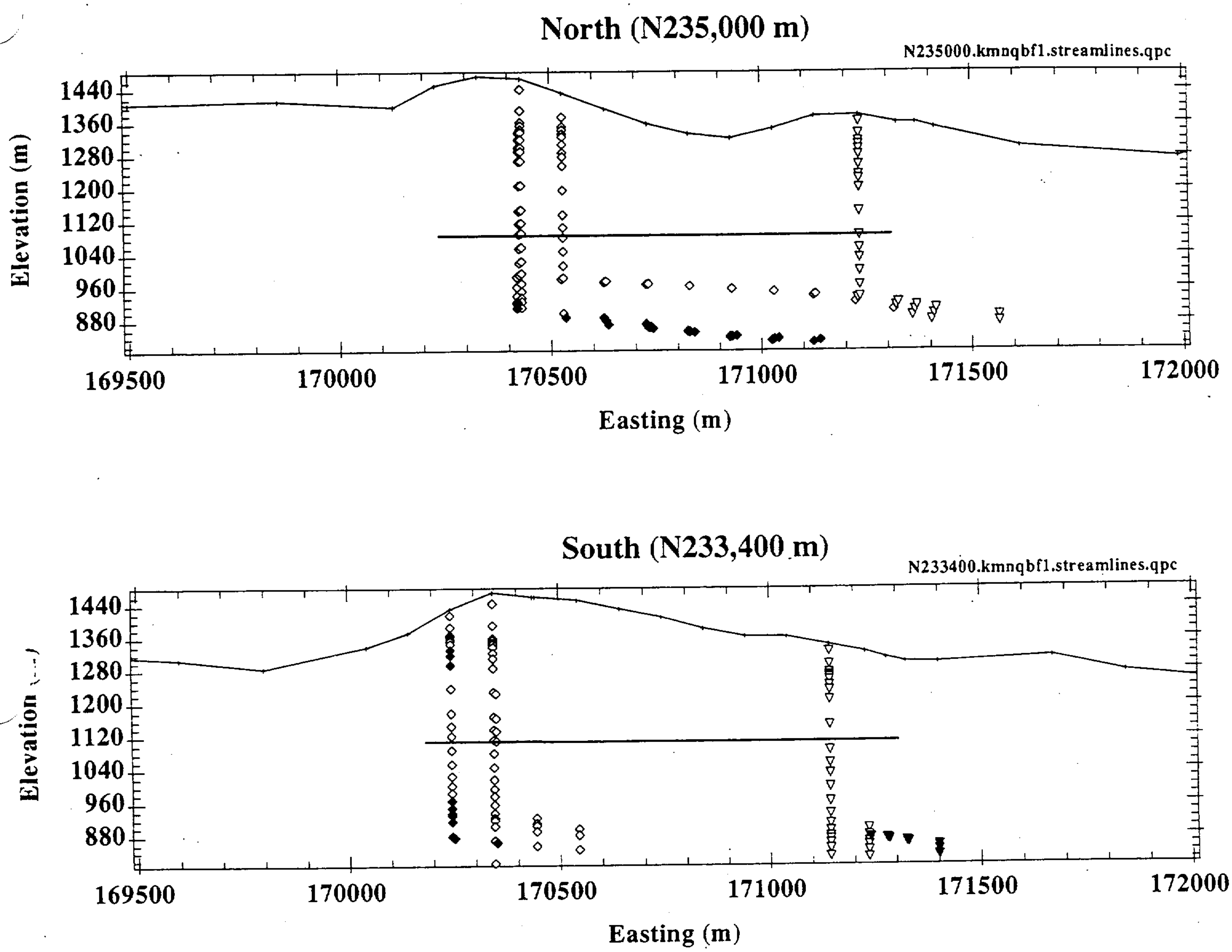


Figure 2-126. Paths of conservative tracers (non-sorbing, no matrix diffusion) along two east-west vertical cross-sections for the long-term-average DKM/Weeps simulation (kmnqbf1). The white symbols denote a higher concentration in the fractures, and the black symbols denote a higher concentration in the matrix.

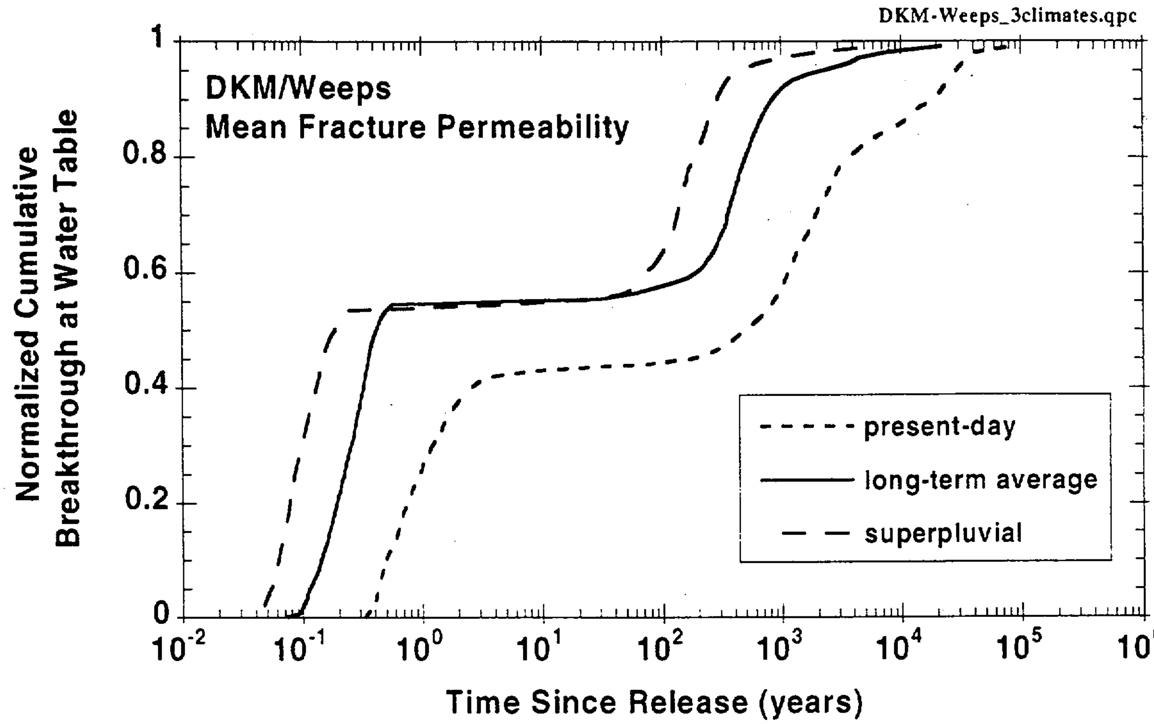


Figure 2-127. Breakthrough curves at the water table for pulse of an unretarded tracer released uniformly throughout the repository, using runs from the DKM/Weeps simulation using mean fracture permeability (kmnqb). Three climate states are shown.

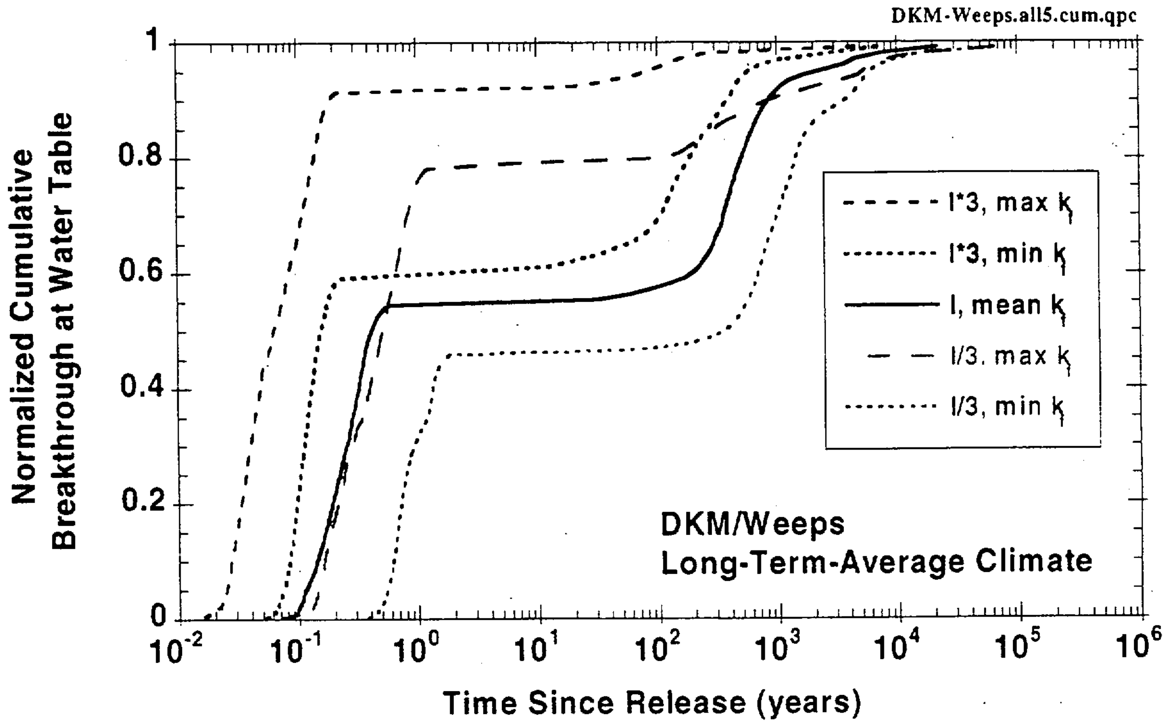
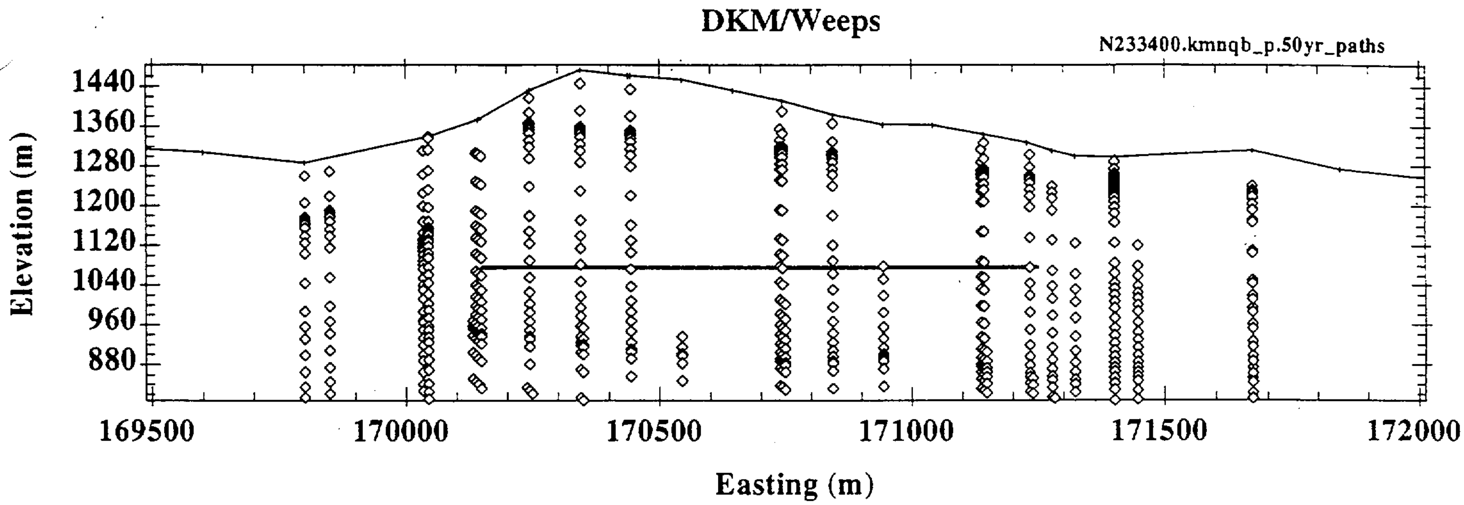


Figure 2-128. Breakthrough curves at the water table for pulse of an unretarded tracer released uniformly throughout the repository, using runs from the DKM/Weeps simulation using long-term-average climate. The fracture permeability, k_f, is varied in each run.



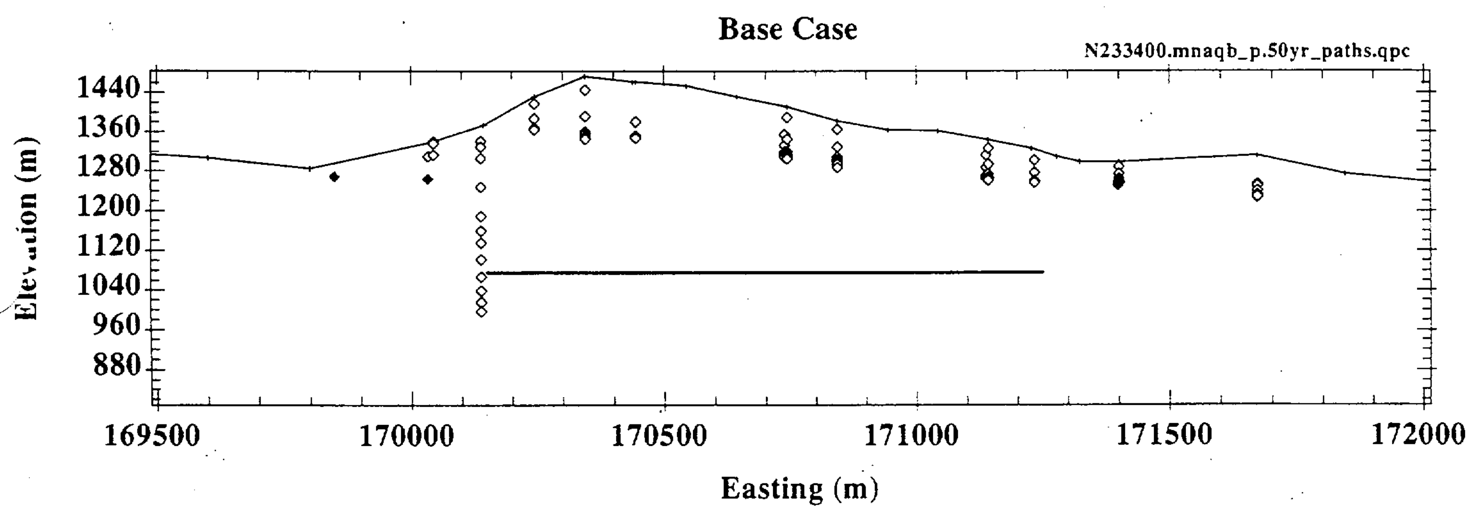
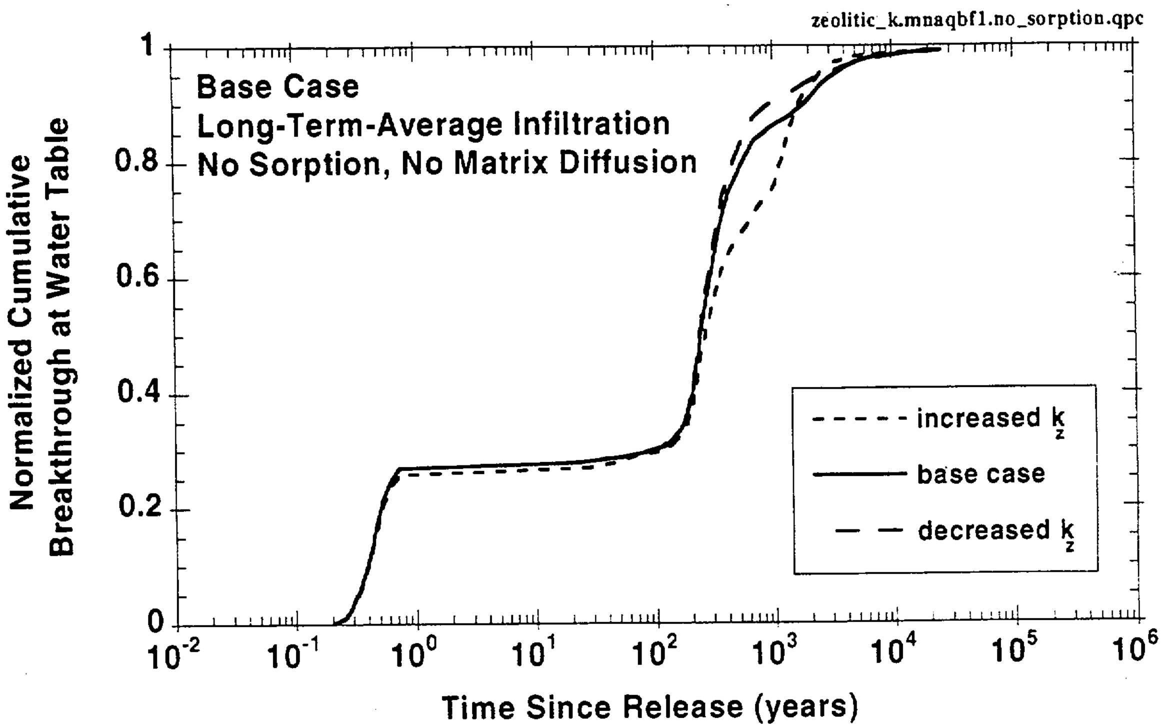
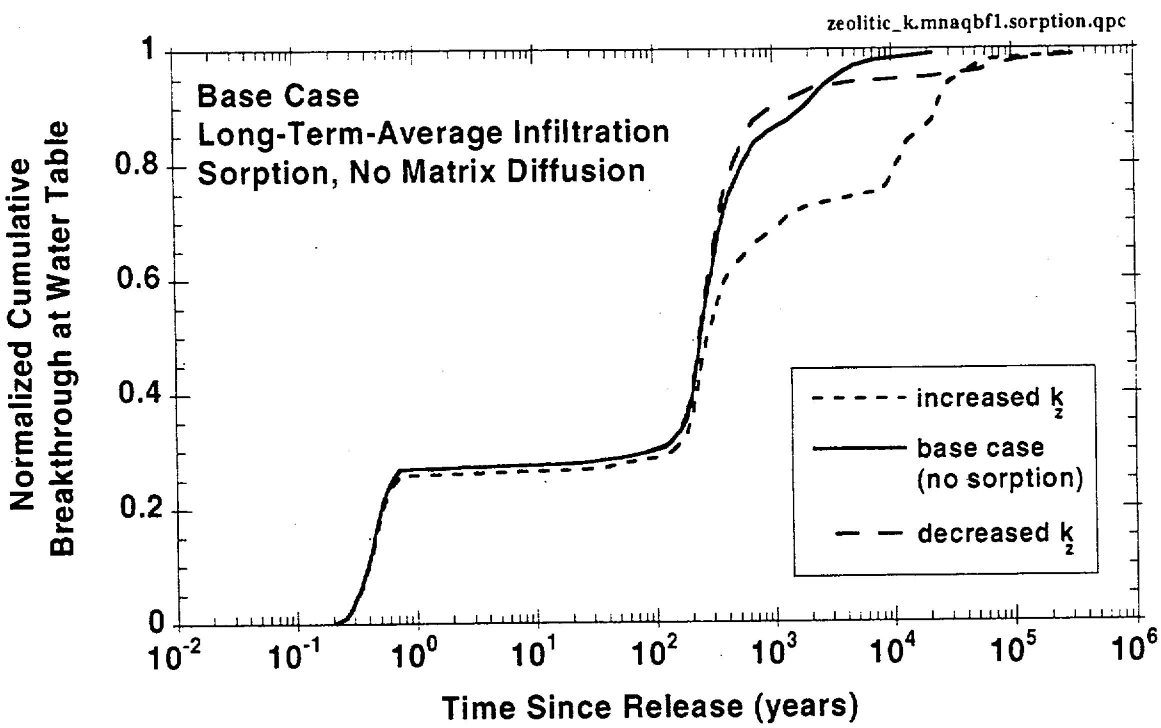


Figure 2-129. Paths of conservative tracers (non-sorbing, no matrix diffusion) along an east-west vertical cross-section through the center of the repository (N233,400 m) during a 50-year period using the present-day infiltration. The top figure shows the results using the DKM/Weeps simulation (kmnqb_p), and the bottom figure shows the results of the base-case simulation (mnaqb_p).



(a)



(b)

Figure 2-130. Breakthrough curves at the water table for pulse of (a) unretarded tracer (no sorption, no matrix diffusion) and (b) sorbing tracer (2.5 cc/g in zeolitic matrix) released uniformly throughout the repository using runs from the long-term-average base case with alterations to the zeolitic matrix permeability.

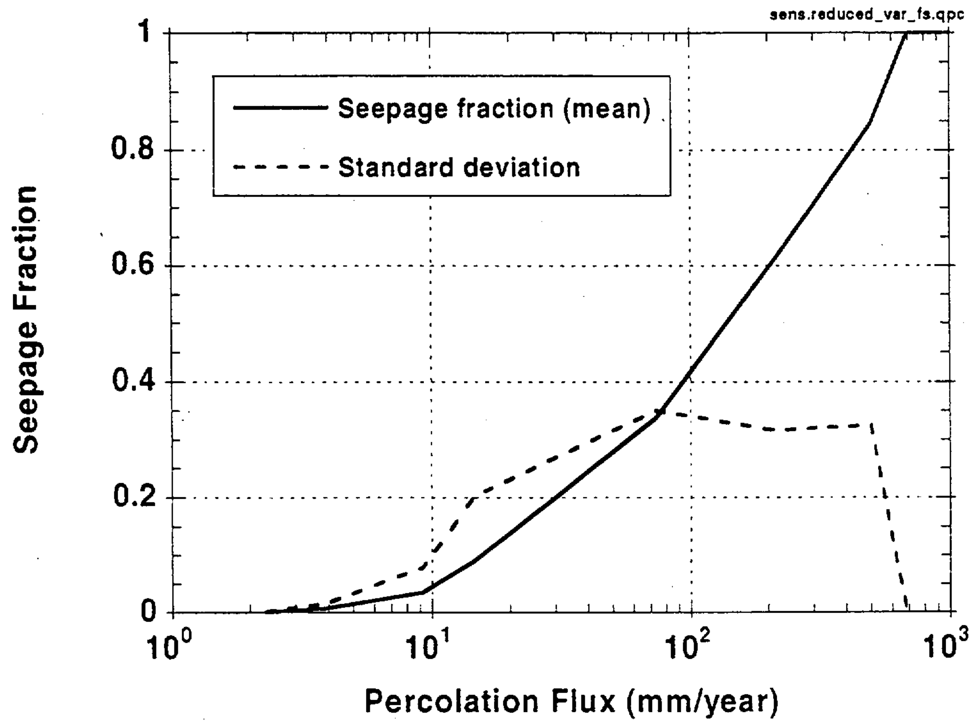


Figure 2-131. Mean and standard deviation of seepage fraction for the sensitivity analysis with reduced variance of fracture properties.

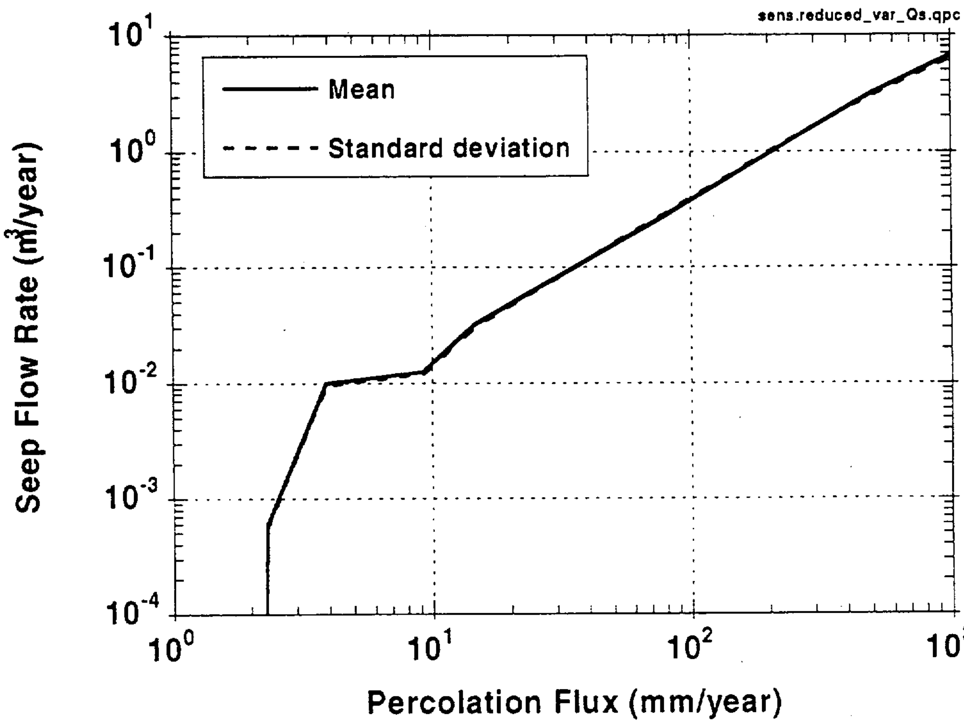


Figure 2-132. Mean and standard deviation of seep flow rate for the sensitivity analysis with reduced variance of fracture properties.

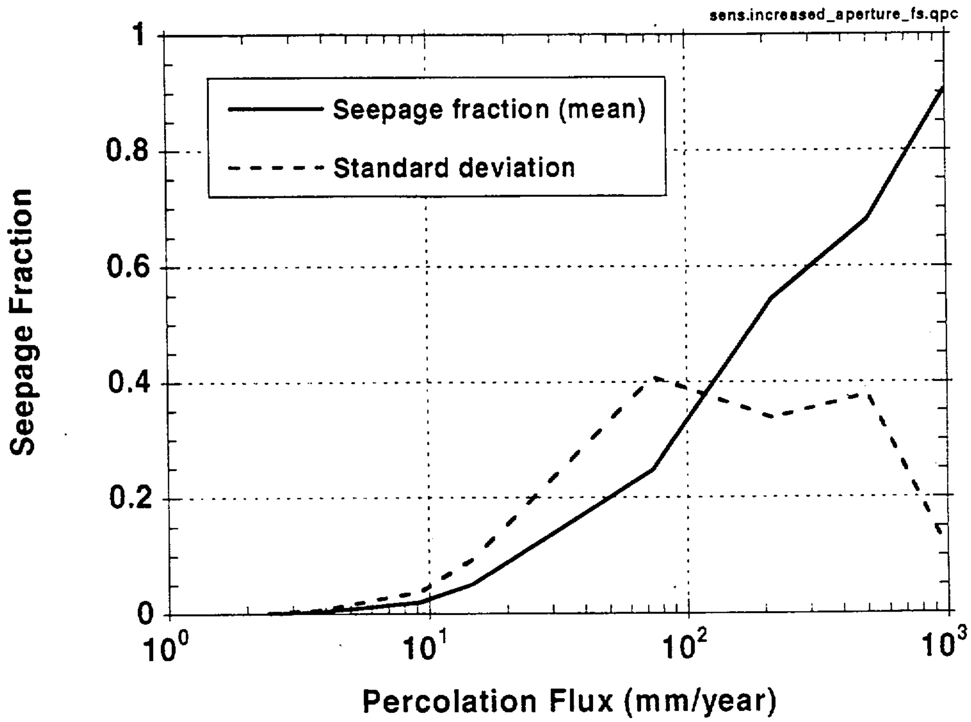


Figure 2-133. Mean and standard deviation of seepage fraction for the sensitivity analysis with increased fracture apertures.

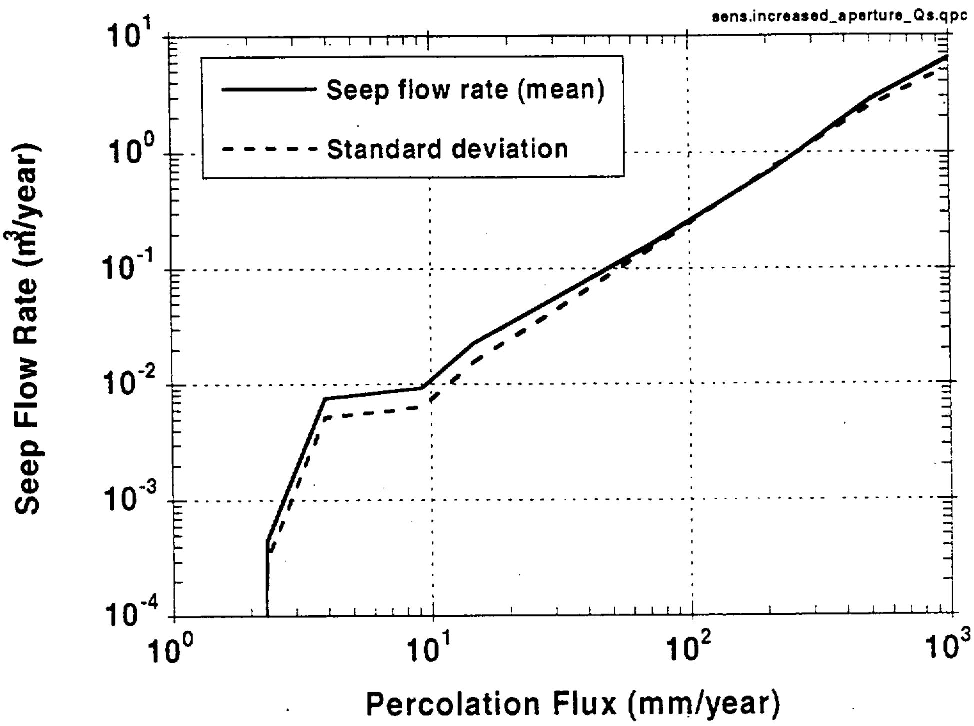


Figure 2-134. Mean and standard deviation of seep flow rate for the sensitivity analysis with increased fracture apertures.

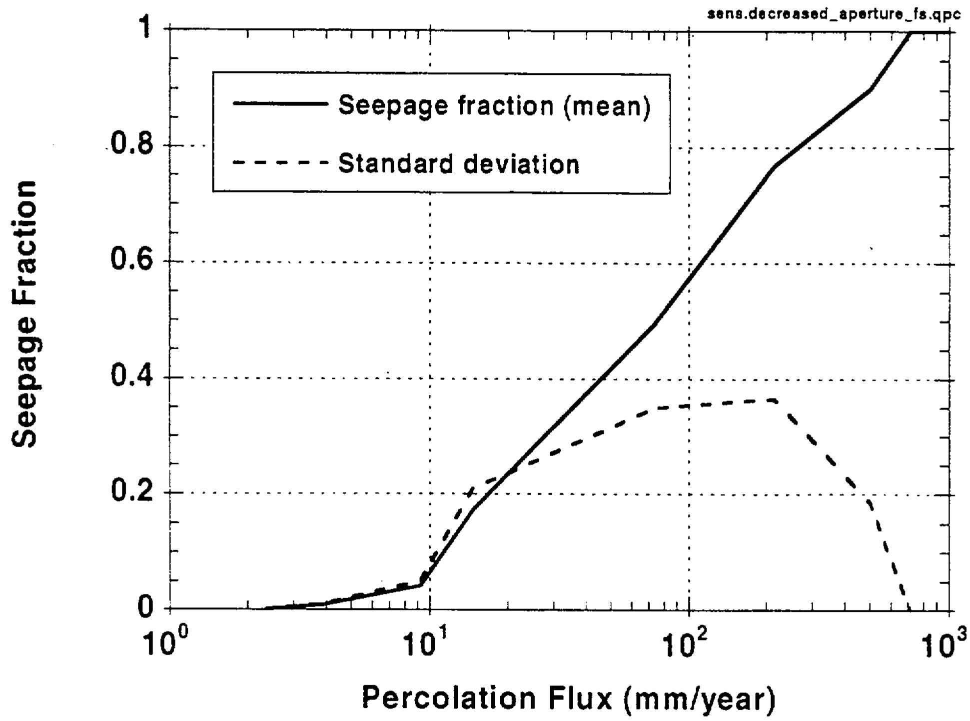


Figure 2-135. Mean and standard deviation of seepage fraction for the sensitivity analysis with decreased fracture apertures.

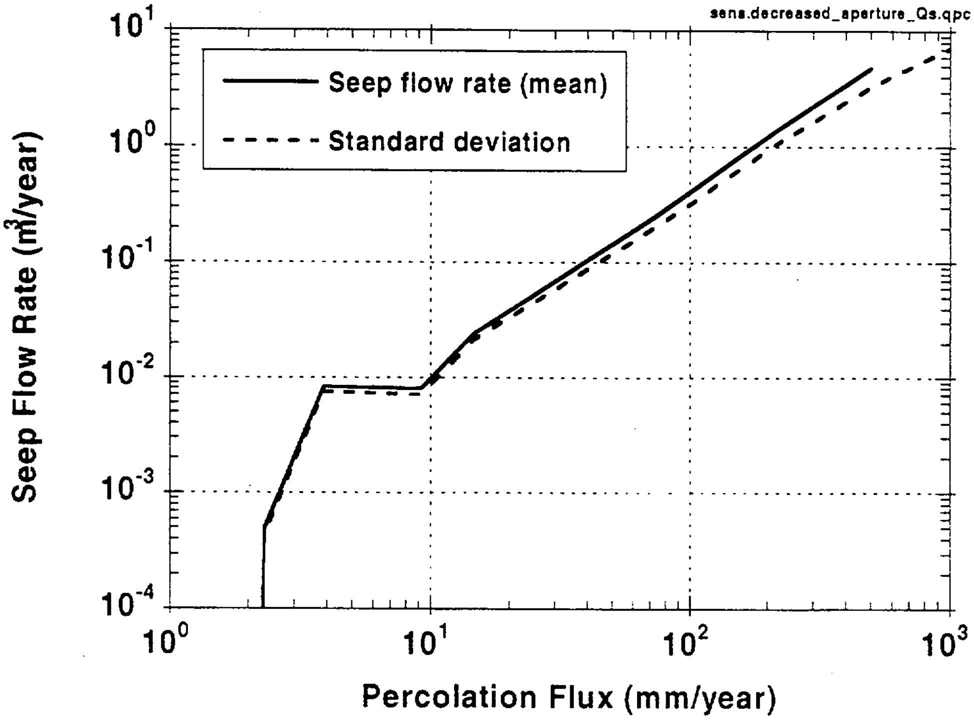


Figure 2-136. Mean and standard deviation of seep flow rate for the sensitivity analysis with decreased fracture apertures.

Chapter 2
Tables

Table 2-1. Summary of Data Tracking Numbers (DTNs) and Q Status of Source Data Used in TSPA-VA Calculations.

TYPE of Data Used	General Description	DTN	QA Status
Geologic Framework (only Q data summarized here; complete listing of Q & NQ data used in the development of the UZ flow model given in Bodvarsson et al. 1997; Ch. 3, pp. 23-27). Note: Use of non-Q is acceptable for TSPA-VA.	NRG-2c lithologic log	GS940308314211.012	Q
	NRG-2d lithologic log	GS940308314211.013	Q
	NRG-7/7a litho. log	GS940408314211.020	Q
	Summary of litho. logs	GS940308314211.009	Q
	SD-9 lithologic log	GS940808314211.041	Q
	SD-9 lithologic log	GS941108314211.052	Q
	Summary of litho. logs	GS941208314211.060	Q
	UZ N-11 litho. log	GS940308314211.010	Q
	UZ N-15,-16,-17 logs	GS940308314211.019	Q
	UZ N-36 litho. log	GS940308314211.018	Q
	UZ N-38 litho. log	GS940308314211.011	Q
	UZ N-63 litho. log	GS940308314211.017	Q
	UZ N-64 litho. log	GS940308314211.016	Q
	North Ramp Tiva litho.	GS931108314211.044	Q
	SD-7 geology	SNT02110894001.002	Q
	SD-12 geology	SNT02012894001.002	Q
	UZ-7a lithologic log	GS950908314211.034	Q
Matrix Properties: Saturation Moisture Potential Porosity Rock Grain Density van Genuchten param.	ESF Alcoves 2, 3, 4, 6	GS961008312231.009	Q
	SD-7	GS951108312231.009	Q
	SD-9	GS950408312231.004	Q
	SD-12	GS950308312231.002	Q
	UZ-14	GS950408312231.005	Q
	UZ#16	GS940508312231.006	Q
	UZ#16, N27	GS950608312231.008	Q
	NRG-6	GS950608312231.007	Q
	NRG-7a	GS951108312231.010	Q
	SD-9/12, N31/32	GS941208314211.060	Q
Fracture Data: (only Q data summarized here; complete listing of Q & NQ data used in development of UZ flow models given in Bodvarsson et al. 1997; Ch. 7, p, 4). Note: Use of non-Q is acceptable for TSPA-VA.	DLS 0+60 to 4+00	GS950508314224.002	Q
	DLS 4+00 to 8+00	GS950808314224.004	Q
	DLS 8+00 to 10+00	GS951108314224.005	Q
	DLS 10+00 to 18+00	GS960408314224.002	Q
	DLS 18+00 to 26+00	GS960608314224.006	Q
	DLS 26+00 to 30+00	GS960608314224.007	Q
	DLS 35+00 to 40+00	GS960808314224.011	Q
	DLS 40+00 to 45+00	GS960708314224.010	Q
	DLS 45+00 to 50+00	GS960808314224.013	Q
	Tiva Canyon Tuff	GS960408312281.001	Q
	Topopah Spring Tuff	GS970208312281.001	Q
	Fran Ridge	GS950108314222.001	Q
	SD-12	SNF29041993002.071	Q
	NRG-7a	SNF29041993002.015	Q
	NRG-7a	SNF29041993002.048	Q
Pneumatic/Air-k	Air-permeability	GS960908312232.013	Q
	In situ gas pressure	GS960908312261.004	Q
	In situ gas pressure	GS960908312261.003	Q
	In situ gas pressure	GS960208312261.001	Q
	In situ gas pressure	GS960308312232.001	Q
Temperature	In situ, temperature – UZ#4/5, UZ-7a, NRG-6, NRG-7a, SD-12	GS960308312232.001	Q
	Borehole temperature logs	GS950408318523.001/ NNA.1989.0123.0010	Non-Q

Table 2-1. (continued).

TYPE of Data Used	General Description	DTN	QA Status
Geochemical	$^{87}Sr/^{86}Sr$ chloride and $^{36}Cl/Cl$ chemical/isotopic data rock chemistry Sr isotopes Fracture-coatings	GS970308315215.006 LASL831222AQ97.001 GS970108312271.001 GS930108315213.005 GS920208315215.009 MOL.19960306.0564	Q Q Q Non-Q Q Q
Perched Water	G-2 pumping test UZ-14 pumping test	GS960508312312.006 GS960308312312.005	Q Q
Variable Infiltration Maps	Infiltration rates	GS960908312211.003	Q
Literature	LBNL June 1997 Milestone Report SP24UFM4	LB970601233129.001	Q

Table 2-2. Summary of Data Tracking Numbers and Q Status of UZ-flow Data and Simulations Developed in TSPA-VA.

Description, Organization, Principal Investigator	DTN	Q Status
Input and output files for preliminary base case, I*5; LBNL, Y. Wu	LB971100001254.001	NQ
Input and output files for preliminary base case; LBNL, Y. Wu	LB971100001254.002	NQ
Input and output files for preliminary base case, I/5; LBNL, Y. Wu	LB971100001254.003	NQ
Input and output files for DKM/Weeps; LBNL, Y. Wu	LB971100001254.004	NQ
Input and output files for post-processed files for 9 base-case UZ flow fields plus DKM/Weeps; SNL, C.K. Ho	SNT05091597001.002	NQ
Input and output files for base case, mean α_f; LBNL, Y. Wu	LB971212001254.001	NQ
Input and output files for base case, min α_f, I/3; LBNL, Y. Wu	LB971212001254.002	NQ
Input and output files for base case, min α_f, I*3; LBNL, Y. Wu	LB971212001254.003	NQ
Input and output files for base case, max α_f, I/3; LBNL, Y. Wu	LB971212001254.004	NQ
Input and output files for base case, max α_f, I*3; LBNL, Y. Wu	LB971212001254.005	NQ
Input and output files for DKM/Weeps, mean k_f; LBNL, Y. Wu	LB971212001254.006	NQ
Input and output files for DKM/Weeps, min k_f, I/3; LBNL, Y. Wu	LB971212001254.007	NQ
Input and output files for DKM/Weeps, min k_f, I*3; LBNL, Y. Wu	LB971212001254.008	NQ
Input and output files for DKM/Weeps, max k_f, I/3; LBNL, Y. Wu	LB971212001254.009	NQ
Input and output files for DKM/Weeps, max k_f, I*3; LBNL, Y. Wu	LB971212001254.010	NQ
Post-processing of 30 additional TOUGH2 UZ flow fields for FEHM particle tracking in TSPA-VA; SNL; C.K. Ho	SNT05091597001.007	NQ
Sensitivity of UZ flow to fracture and matrix permeabilities and van Genuchten alpha and beta in a 1-D column; SNL, S.J. Altman	SNT05091597001.004	NQ
Determining ranges for van Genuchten fracture alpha for use in UZ flow modeling; SNL, S.J. Altman	SNT05091597001.003	NQ
Evaluation of varying fracture permeability and van Genuchten fracture alpha on UZ flow in a 1-D column using a Weeps formulation of the DKM; SNL; R.J. MacKinnon	SNT05091597001.005	NQ
Liquid saturations, mass flow rates, percolation fluxes, and breakthrough curves for TSPA-VA; SNL, C.K. Ho	SNT05091597002.001	NQ
Post-processing of base-case UZ flow fields for SZ modeling in TSPA-VA; SNL; C.K. Ho	SNT05091597001.009	NQ
Seepage data for parameter sets, seepage rates, and niche study release tests; LBNL; C.F. Tsang	LB980412541195.001	NQ
Seepage model results for percolation flux, saturation contours on drift wall, seepage rates, trend of seepage rates, and discrete fracture studies; LBNL; C.F. Tsang	LB980412541195.002	NQ
Percolation fluxes at the repository horizon for the base-case, DKM/Weeps, and preliminary base-case flow fields; Duke E&S; Y. Xiang	MO9806SPAHGRAM.001 MO9806SPAMVIEW.001	NQ
Seepage model results used in TSPA-VA Technical Basis Document; SNL; M.L. Wilson	SNT05091597002.002	NQ
Breakthrough Curves and Particle Paths for Flow Fields Used in UZ-Flow Component of TSPA-VA; SNL; C.K.Ho	SNT05091597002.003	NQ

Table 2-3. Summary of Codes, Input/Output Files, and DTNs Associated with Technical Figures. Unless otherwise noted, codes are run on a Sun Ultra Sparc (UNIX operating system).

Figure	Subject	Code and Version	Input Filename	Output Filename	Data Tracking Number (DTN)	Q Status
Figure 2-7 through Figure 2-17	Infiltration modeling	USGS	not available	not available	GS960908312211.003	Q
Figure 2-18	Present-day infiltration	not available	not available	Qb.dat	LB971100001254.002	NQ
Figure 2-19	LTA infiltration	not available	not available	Qbf1.dat	LB971100001254.002	NQ
Figure 2-20	Superpluvial infiltration	not available	not available	Qbf2.dat	LB971100001254.002	NQ
Figure 2-22	Transient infiltration	TOUGH2 v. 3.1.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.006	NQ
Figure 2-23	Transient infiltration	TOUGH2 v. 3.1.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.006	NQ
Figure 2-28	Varying permeability and alphas	TOUGH2 v. 3.4.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.004	NQ
Figure 2-29	Varying permeability and alphas	TOUGH2 v. 3.4.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.004	NQ
Figure 2-31	Varying permeability and alphas	TOUGH2 v. 3.4.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.004	NQ
Figure 2-32	Varying permeability and alphas	TOUGH2 v. 3.4.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.004	NQ
Figure 2-33	Varying permeability and alphas	TOUGH2 v. 3.4.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.004	NQ
Figure 2-34	Varying permeability and alphas	TOUGH2 v. 3.4.1 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.004	NQ
Figure 2-37 through Figure 2-40	Ranges of alpha and k	TOUGH2 v. 3.1.2 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.005	NQ
Figure 2-41	Ranges of alpha and k	TOUGH2 v. 3.1.2 (SNL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.008	NQ
Figure 2-47	Weighting schemes	TOUGH2 v. 3.1.1 (SNL), FEHM (LANL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.008	NQ
Figure 2-48	Weighting schemes	TOUGH2 v. 3.1.1 (SNL), FEHM (LANL)	TOUGH2.INP	TOUGH2.OUT	SNT05091597001.008	NQ
Figure 2-53 through Figure 2-83	Seepage testing	TOUGH2 v. 3.1 (LBNL)	not available	not available	LB980412541195.001 LB980412541195.002	NQ

Table 2-3. (continued).

Figure	Subject	Code and Version	Input Filename	Output Filename	Data Tracking Number (DTN)	Q Status
Figure 2-85	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mnad3_p.dat	mnad3_p.out	LB971212001254.002	NQ
Figure 2-86	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mnaqb_p.dat	mnaqb_p.out	LB971212001254.001	NQ
Figure 2-87	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mxax3_p.dat	mxax3_p.out	LB971212001254.005	NQ
Figure 2-88	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mnad3_p.dat	mnad3_p.out	LB971212001254.002	NQ
Figure 2-89	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mnaqb_p.dat	mnaqb_p.out	LB971212001254.001	NQ
Figure 2-90	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mxax3_p.dat	mxax3_p.out	LB971212001254.005	NQ
Figure 2-91	UZ-flow results	TOUGH2 v. 1.3 (LBNL)	mnaqb_p.dat	mnaqb_p.out	LB971212001254.001	NQ
Figure 2-92	UZ-flow results	TOUGH2 v. 1.3 (LBNL), FEHM (LANL); post-processors: T2FEHM2 (SNL), convertini	mnaqbf1.dat	mnaqbf2.out	LB971212001254.001	NQ
Figure 2-94	Base-case histogram (repository subregions)†	TOUGH2 v. 1.3 (LBNL); post-processor: hgram (Duke)	mnaqb_p.dat	mnaqb_p.out	LB971212001254.001 MO98606SPAHGRAM.001	NQ
Figure 2-95 through Figure 2-101	Base-case, present-day UZ flow result	TOUGH2 v. 1.3 (LBNL)	mnaqb_p.dat	mnaqb_p.out	LB971212001254.001	NQ
Figure 2-102	LTA UZ-flow result	TOUGH2 v. 1.3 (LBNL)	mnaqbf1.dat	mnaqbf1.out	LB971212001254.001	NQ
Figure 2-103	Base-case breakthrough curves (3 climates) †	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	mnaqb_p.dat mnaqbf1.dat mnaqbf2.dat	mnaqb_p.out mnaqbf1.out mnaqbf2.out	LB971212001254.001 SNT05091597001.007 SNT05091597002.003	NQ
Figure 2-104	Base-case breakthrough curves (all LTA) †	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	mnaqbf1.dat mnad3f1.dat mnax3f1.dat mxad3f1.dat mxax3f1.dat	mnaqbf1.out mnad3f1.out mnax3f1.out mxad3f1.out mxax3f1.out	LB971212001254.001 LB971212001254.002 LB971212001254.003 LB971212001254.004 LB971212001254.005 SNT05091597001.007 SNT05091597002.003	NQ
Figure 2-105 through Figure 2-107	Preliminary base-case histograms (entire repository, 3 climates)	TOUGH2 v. 1.3 (LBNL)	Qb.dat Qbf1.dat Qbf2.dat	Qb.out Qbf1.out Qbf2.out	LB971100001254.002	NQ

Table 2-3. (continued).

Figure	Subject	Code and Version	Input Filename	Output Filename	Data Tracking Number (DTN)	Q Status
Figure 2-108 through Figure 2-114	Seepage base-case results	TOUGH2 v. 3.1 (LBNL); Excel 5.0 (SNL)	see LBNL DTNs	seeps.xls	LB980412541195.001 LB980412541195.002 SNT05091597002.002	NQ
Figure 2-116	Breakthrough curves for infiltration sensitivity†	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	Qb.dat Qb_f1.dat Qb_f2.dat	Qb.out Qb_f1.out Qb_f2.out	LB971100001254.002 SNT05091597001.002 SNT05091597002.003	NQ
Figure 2-118 through Figure 2-125	DKM/Weeps UZ flow results (mean k, present-day infiltration)	TOUGH2 v. 1.3 (LBNL)	kmnqb_p.dat	kmnqb_p.out	LB971212001254.006	NQ
Figure 2-126	DKM/Weeps particle paths (mean k, LTA) †	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	kmnqbf1.dat	kmnqbf1.out	LB971212001254.006 SNT05091597001.007 SNT05091597002.003	NQ
Figure 2-127	Breakthrough curves for DKM/Weeps (mean k, 3 climates) †	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	kmnqb_p.dat kmnqbf1.dat kmnqbf2.dat	kmnqb_p.out kmnqbf1.out kmnqbf2.out	LB971212001254.006 SNT05091597001.007 SNT05091597002.003	NQ
Figure 2-128	Breakthrough curves for DKM/Weeps (LTA, all k) †	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	kmnqbf1.dat kmnd3f1.dat kmnx3f1.dat kmxd3f1.dat kmxx3f1.dat	kmnqbf1.out kmnd3f1.out kmnx3f1.out kmxd3f1.out kmxx3f1.out	LB971212001254.006 LB971212001254.007 LB971212001254.008 LB971212001254.009 LB971212001254.010 SNT05091597001.007 SNT05091597002.003	NQ
Figure 2-129	Particle paths for DKM/Weeps and base case (mean infiltration) †	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	kmnqb_p.dat mnaqb_p.dat	kmnqb_p.out mnaqb_p.out	LB971212001254.006 LB971212001254.001 SNT05091597001.007 SNT05091597002.003	NQ
Figure 2-130	Breakthrough curves for zeolitic-matrix permeability sensitivity†	TOUGH2 v. 1.3 (LBNL); FEHMN (LANL); post-processors: T2FEHM2 (SNL), convertini	mnaqbf1.dat mnaqbf1in.dat mnaqbf1de.dat	mnaqbf1.out mnaqbf1in.out mnaqbf1de.out	LB971212001254.001 SNT05091597002.003	NQ
Figure 2-131 through Figure 2-136	Seepage sensitivity results	Excel 5.0 (SNL)	see LBNL DTNs	seeps+ap.xls seeps-ap.xls seepsnar.xls	SNT05091597002.002	NQ

†Input and output files listed are for flow fields. See corresponding DTNs for input and output files associated with associated post-processors. FEHMN is currently being qualified by Los Alamos National Laboratory.

Table 2-4. Important Issues from UZ-Flow Workshop.

1. Lateral flow and perched water below the repository	What is the appropriate dimensionality to use to model lateral flow for TSPA? Do we need to model UZ flow for TSPA in 3D, 2D, and/or 1D? What is the extent of the perched-water bodies? How do the properties of the zeolites affect lateral flow? How do we use perched water for calibration?
2. Flow channeling and seepage into drifts	What are the representative multiphase characteristics for fractures (coatings, aperture distributions)? Are bulk permeabilities representative? What is the spatial heterogeneity of fractures? Are other fracture properties related to bulk permeability? What is the appropriate conceptual model for fracture flow? How do fracture/matrix properties affect seeps and channeling? How do spatial, temporal, and volumetric flux differences influence seepage into drifts? How do different conceptual-flow models affect seepage and channeling? How representative are the isotopic and water-chemistry data? Does lateral flow in the PTn contribute to focusing flow? What features, processes, and parameters affect fracture/matrix interactions (coatings, connectivity, aperture, flux, etc.)? Can we incorporate what we know about fracture/matrix interactions into a continuum model?
3. Infiltration and future climate	What is the temporal variation of infiltration? How should we incorporate climate change? What is the range of present infiltration values? What spatial resolution is needed to properly represent variations in infiltration?
4. Model calibration	What is the appropriate approach for model calibration? How should we deal with non-unique calibration? Should we "calibrate" or "bound"? (Is the answer different for different parameters?) Should faults be part of calibration? What is the applicability and robustness of available data to calibration (e.g., temperature, ^{36}Cl)? How much should "inverse modeled" data be used vs. "lab modeled" data? How should we use perched water for calibration?

Table 2-5. Mean Annual Precipitation (MAP) for Different Climates.

Climate	MAP (mm/year)
dry (present)	150
long-term average	300
superpluvial	450

Table 2-6. Lower and Upper Bounding Estimates for Mean Annual Precipitation (MAP) for Different Climates.

Climate	MAP (mm/year) Lower Estimate	MAP (mm/year) Upper Estimate
dry (present)	75	250
long-term average	150	450
superpluvial	225	675

Table 2-7. Summary of Data Used in Climate Models for TSPA-VA.

Climate Parameter	Dry (present-day)	Long-term average	Superpluvial
Precipitation	Current distribution	2 × current	3 × current
Water-table rise	0	80 m (260 ft)	120 m (390 ft)
Saturated-zone flux	0.6 mm/year	3.9 × current	6.2 × current
Duration	0–10,000 years for current; 0–20,000 years for future dry climates	80,000–100,000 years	0–20,000 years

Table 2-8. Summary of Annual Statistics Obtained Using the 1980-1995 Developed Daily Precipitation Record to Simulate Net Infiltration and Runoff for Yucca Mountain.

Calendar Year	Avg. Precip-tation (mm)	Max. Precip-tation (mm)	Min. Precip-tation (mm)	Avg. Net Infil. (mm)	Max. Net Infil. (mm)	Min. Net Infil. (mm)	Avg. Run off (mm)	Max. Run off (mm)	Min. Run off (mm)
1980	144.0	229.2	106.9	1.70	51.20	0.00	0.00	0.00	0.00
1981	91.1	146.3	68.2	0.00	0.00	0.00	0.00	0.00	0.00
1982	149.3	237.7	110.8	0.00	9.93	0.00	0.00	0.00	0.00
1983	259.7	413.5	192.8	7.11	169.93	0.00	0.12	56.45	0.00
1984	193.5	308.0	143.6	2.59	104.87	0.00	0.01	31.80	0.00
1985	75.1	119.5	55.7	2.07	61.60	0.00	0.01	9.78	0.00
1986	129.9	206.7	96.4	0.03	30.05	0.00	0.00	0.00	0.00
1987	182.9	291.1	135.7	0.05	52.29	0.00	0.00	0.00	0.00
1988	125.4	199.7	93.1	0.53	54.81	0.00	0.00	5.10	0.00
1989	32.7	52.0	24.3	0.00	0.00	0.00	0.00	0.00	0.00
1990	69.8	111.1	51.8	0.00	0.00	0.00	0.00	0.00	0.00
1991	171.4	272.8	127.2	0.51	38.11	0.00	0.00	0.00	0.00
1992	287.1	457.1	213.1	25.96	252.54	0.00	9.25	150.07	0.00
1993	225.3	358.6	167.2	38.20	211.75	0.00	18.00	183.90	0.00
1994	108.7	173.0	80.7	0.00	29.12	0.00	0.00	0.00	0.00
1995	273.0	434.6	202.6	43.58	247.55	0.00	23.77	181.77	0.00
Average	157.5	250.7	116.9	7.64	82.11	0.00	3.20	38.68	0.00
Maximum	287.1	457.1	213.1	43.58	252.54	0.00	23.77	183.90	0.00
Minimum	32.7	52.0	24.3	0.00	0.00	0.00	0.00	0.00	0.00
Stand. Deviation	75.8	120.6	56.2	14.52	88.45	0.00	7.35	68.20	0.00
Coeff. of Variation	0.5	0.5	0.5	1.90	1.08	—	2.30	1.76	—

Table 2-9. Comparison of Average Annual Precipitation Obtained Using Measured and Modeled Daily Precipitation for the Locations of 10 Precipitation Stations Located within the Net Infiltration Modeling Domain.

		Precipitation station location			Record				Nearest model 30-meter node		Modeled average annual precip. (AAP)	
Site #	Precipitation station name	UTM easting (meters)	UTM northing (meters)	Station elev. (meters)	Start year	End year	# of years	Avg. annual precip. (mm)	UTM easting (meters)	UTM northing (meters)	Scaled 4JA 100-year AAP (mm)	1980-1995 AAP (mm)
1	USGS weather station 1	550424	4076521	1163	1988	1995	8	167	550421	4076523	141	148
2	USGS weather station 2	548038	4080316	1351	1988	1995	8	174	548051	4080303	164	172
3	R/EFPD Site 1	550784	4077374	1143	1986	1996	11	126	550781	4077363	139	145
4	R/EFPD Site 2	547646	4076753	1478	1989	1996	8	167	547631	4078743	178	167
5	R/EFPD Site 3	548874	4078701	1279	1989	1996	8	170	548861	4078713	155	163
6	R/EFPD Site 4	553117	4079779	1234	1989	1996	8	167	553121	4079793	149	157
7	R/EFPD Site 5	554385	4068727	953	1989	1996	8	130	554381	4068723	115	121
8	R/EFPD Site 6	549388	4083097	1315	1993	1996	4	221	549401	4083093	159	167
9	R/EFPD Site 7	552800	4077847	1081	1993	1996	4	182	552791	4077843	131	138
10	R/EFPD Site 8	551161	4075773	1131	1993	1996	4	178	551171	4075773	137	143
Mean average annual precipitation for locations with at least 8 years record								157			149	156
Mean average annual precipitation for all locations								168			147	154

Table 2-10. Station Information, Summary Statistics for Recorded Daily Precipitation, and Summary Statistics for 100-Year Simulations of Daily Precipitation for Four Selected Precipitation Stations Used as Representative Analog Climates for Yucca Mountain.

	Precipitation Station			
	4JA	Area 12 Mesa	Lake Valley Steward	South Lake
Station information				
Record starting date	12/01/57	03/11/59	01/01/71	01/01/75
Record ending date	12/31/93	12/31/93	12/31/93	12/31/93
Number of completed years in record	34	34	19	19
Latitude (decimal degrees)	36.7833	37.1833	38.3167	37.1833
Longitude (decimal degrees)	116.2833	116.2167	114.6500	118.5667
Elevation (meters)	1,043	2,283	1,936	2,920
Record of daily precipitation				
Average annual precipitation (mm)	133	324	404	487
Maximum annual precipitation (mm)	294	686	719	847
Minimum annual precipitation (mm)	39	141	238	264
Standard deviation annual precipitation (mm)	73	141	134	146
Maximum daily precipitation (mm)	82	76	70	124
Average annual maximum daily precipitation (mm)	24	37	39	48
100-year stochastic simulation of daily precipitation				
Simulation seed	1	3589	1	1
Average annual precipitation (mm)	140	327	389	483
Maximum annual precipitation (mm)	300	545	661	803
Minimum annual precipitation (mm)	19	161	154	229
Standard deviation annual precipitation (mm)	48	88	109	112
Maximum daily precipitation (mm)	82	76	70	99
Average annual maximum daily precipitation (mm)	27	43	38	46

Table 2-11. Summary Statistics for 10 Different Stochastic Simulations Modeled for One Current-Climate Analog Site and Three Potential Future-Climate Analog Sites.

Precipitation station	Record simulation	Sim. #	Sim. seed	Number of years	Avg. annual precip. (mm)	Max. annual precip. (mm)	Min. annual precip. (mm)	Stand. dev. annual precip. (mm)	Max. daily precip. (mm)	Avg. annual max. daily precip. (mm)
4JA	record			34	133	294	39	73	82	24
	simulation	1	1	100	140	300	19	48	82	27
	simulation	2	9069	100	133	314	41	48	82	26
	simulation	3	31849	100	129	301	27	54	82	25
	simulation	4	21429	100	135	273	60	41	82	26
	simulation	5	25361	100	131	293	35	48	70	25
	simulation	6	317	100	130	280	45	46	82	24
	simulation	7	24057	100	133	276	42	50	82	27
	simulation	8	3589	100	137	298	61	45	63	27
	simulation	9	10017	100	131	250	51	48	64	25
	simulation	10	2185	100	135	303	36	50	82	29
	average			100	133	289	42	48	77	26
Area 12 Mesa	record			34	324	686	141	141	76	37
	simulation	1	1	100	328	606	123	101	76	42
	simulation	2	9069	100	316	507	159	83	76	41
	simulation	3	31849	100	316	632	112	87	76	43
	simulation	4	21429	100	320	590	118	87	76	43
	simulation	5	25361	100	327	576	132	94	76	42
	simulation	6	317	100	322	566	171	90	76	43
	simulation	7	24057	100	327	518	86	92	76	41
	simulation	8	3589	100	327	545	161	88	76	44
	simulation	9	10017	100	314	576	117	94	76	39
	simulation	10	11277	100	330	532	113	80	76	40
	average			100	323	576	130	94	76	41
Lake Valley Steward	record			19	404	719	238	134	70	39
	simulation	1	1	100	389	661	154	109	70	38
	simulation	2	9069	100	381	519	228	91	70	40
	simulation	3	31849	100	382	677	212	90	70	40
	simulation	4	21429	100	389	718	175	96	70	40
	simulation	5	25361	100	396	596	181	97	70	40
	simulation	6	317	100	379	692	158	98	70	40
	simulation	7	24057	100	390	634	184	97	70	38
	simulation	8	3589	100	387	714	198	100	70	40
	simulation	9	10017	100	383	656	160	89	70	37
	simulation	10	11277	100	396	667	196	96	70	40

Table 2-11. (continued).

Precipitation station	Record simulation	Sim. #	Sim. seed	Number of years	Avg. annual precip. (mm)	Max. annual precip. (mm)	Min. annual precip. (mm)	Stand. dev. annual precip. (mm)	Max. daily precip. (mm)	Avg. annual max. daily precip. (mm)
	average			100	387	663	185	96	70	39
South Lake	record			19	487	847	264	146	124	48
	simulation	1	1	100	483	803	229	112	99	46
	simulation	2	9069	100	468	734	246	99	99	46
	simulation	3	31849	100	471	752	225	109	88	45
	simulation	4	21429	100	472	773	203	110	117	46
	simulation	5	25361	100	488	812	210	124	124	47
	simulation	6	317	100	464	640	240	87	95	46
	simulation	7	24057	100	473	734	236	121	109	45
	simulation	8	3589	100	487	831	290	112	101	47
	simulation	9	10017	100	483	955	226	123	92	46
	simulation	10	11277	100	477	987	240	120	124	47
	average			100	477	802	235	112	105	46

Table 2-12. Comparison of Simulation Results for the Entire Modeling Domain and Three Subareas Overlying the Potential Repository Site, Using the Original One-Year Simulation of Current Climate and the 100-Year Stochastic Simulation of Current Climate.

	Modeled Area			
	Full Grid	**Subarea 5**	**Subarea 3**	**Subarea 2**
Number of cells	253597	12900	5040	1080
Total area	228.24	11.61	4.54	0.97
Average elevation (m)	1237	1346	1294	1361
Maximum elevation (m)	1969	1506	1471	1471
Minimum elevation (m)	918	1195	1162	1256
Scaled 1-year simulation				
Mean net infiltration rate (mm/year)	3.77	6.52	5.79	8.38
Maximum net infiltration rate (mm/year)	63.16	30.51	30.51	27.34
Minimum net infiltration rate (mm/year)	0.00	0.00	0.00	0.00
Coefficient of variation	1.55	0.88	0.96	0.70
Scaled 4JA 100-year stochastic simulation				
Mean net infiltration rate (mm/year)	3.25	5.97	5.07	7.77
Maximum net infiltration rate (mm/year)	63.16	29.70	29.70	26.54
Minimum net infiltration rate (mm/year)	0.00	0.00	0.00	0.00
Coefficient of variation	1.70	0.94	1.06	0.76

Table 2-13. Summary Statistics for Daily Simulation Results for a Single Node and also for a 3 x 3 Cluster of Nodes Centered on the Location of Borehole SD-9.

		Single node centered on location of borehole SD-9			3 x 3 node cluster centered on location of borehole SD-9		
	Stochastic simulation	**1**	**2**	**3**	**1**	**2**	**3**
Average Annual (mm)	precipitation	157	157	157	158	158	158
	evapotranspiration	150	146	147	155	153	153
	change in soil water content	0.03	0.28	0.19	0.37	0.88	0.50
	net infiltration	7.56	10.86	10.52	2.42	3.65	3.52
	run off	0.00	0.00	0.16	0.00	0.00	0.05
Maximum annual (mm)	precipitation	336	371	367	337	371	367
	evapotranspiration	263	231	265	262	249	268
	change in soil water content	71	64	64	107	88	85
	net infiltration	73	140	107	24	60	46
	run off	0.0	0.0	16.1	0.0	0.0	5.3
Minimum Annual (mm)	precipitation	21	49	33	21	49	33
	evapotranspiration	39	52	34	63	68	52
	change in soil water content	-76	-71	-58	-125	-96	-98
	net infiltration	0	0	0	0	0	0
	run off	0	0	0	0	0	0
Maximum **daily (mm)**	precipitation	92	97	100	92	97	100
	evapotranspiration	1.75	1.75	1.76	1.39	1.42	1.55
	change in soil water content	70	74	76	77	89	76
	net infiltration	45	35	65	15	12	22
	run off	0.0	0.0	16.1	0.0	0.0	5.3
Minimum daily (mm)	precipitation	0	0	0	0	0	0
	evapotranspiration	0.003	0.004	0.003	0.027	0.027	0.027
	change in soil water content	-1.96	-1.95	-1.76	-1.39	-1.44	-1.56
	net infiltration	0	0	0	0	0	0
	run off	0	0	0	0	0	0

Table 2-14. Summary of Simulation Results for all Four Analog Potential Future Climates, According to the Full Modeling Domain and the Three Subareas Overlying the Potential Repository Site.

100-year analog climate	Area	Avg. Precip. rate (mm/yr)	Channel Avg. Net Infil. (mm/yr)	Non-Channel Avg. Net Infil. (mm/yr)	Combined: Avg. Net Infil. (mm/yr)	Combined: Max. Net Infil. (mm)	Combined: Min. Net Infil. (mm)	Combined: Stand. Dev. Net Infil. (mm)
4JA current climate	Full modeling domain	150.19	9.19	2.73	3.2	63.2	0.0	5.5
	Sub-area 5	—	—	—	6.0	29.7	0.0	5.6
	Sub-area 3	—	—	—	5.1	29.7	0.0	5.4
	Sub-area 2	—	—	—	7.8	26.5	0.0	5.9
Area 12 Mesa long-term average climate	Full modeling domain	288.70	76.96	15.38	19.7	275.3	0.0	30.6
	Sub-area 5	—	—	—	32.7	169.2	0.0	28.2
	Sub-area 3	—	—	—	28.8	169.2	0.0	28.3
	Sub-area 2	—	—	—	40.6	159.9	0.0	29.9
Lake Valley-Steward long-term average climate	Full modeling domain	344.04	120.63	24.41	31.2	390.8	0.0	46.1
	Sub-area 5	—	—	—	49.8	244.4	1.4	40.1
	Sub-area 3	—	—	—	44.1	244.4	0.5	40.6
	Sub-area 2	—	—	—	59.1	232.7	3.9	43.0
South Lake superpluvial climate	Full modeling domain	427.06	463.05	54.86	81.0	847.7	0.0	131.7
	Sub-area 5	—	—	—	108.0	706.5	9.9	116.1
	Sub-area 3	—	—	—	105.6	706.5	10.6	119.5
	Sub-area 2	—	—	—	120.1	694.4	11.0	120.7
South Lake x 1.581 upper bound climate	Full modeling domain	675.16	1361.11	173.37	250.2	2077.6	2.7	362.8
	Sub-area 5	—	—	—	229.4	1833.5	13.5	330.9
	Sub-area 3	—	—	—	241.9	1833.5	14.7	344.2
	Sub-area 2	—	—	—	223.0	1821.2	15.2	324.7

Table 2-15. Summary of Five-Year Average Net Infiltration Rates Using 100-Year Stochastic Simulations of Current Climate and Four Potential Future Climates.

	4JA 5-year averages			Area 12 Mesa 5- year averages			Lake Valley-Steward 5-year averages			South Lake 5-year averages			Scaled South Lake 5-year averages		
Simulation year	Precip-itation (mm)	Run off (mm)	Net Infil. (mm)	Precip-itation (mm)	Run off (mm)	Net Infil. (mm)	Precip-itation (mm)	Run off (mm)	Net Infil. (mm)	Precip-itation (mm)	Run off (mm)	Net Infil. (mm)	Precip-itation (mm)	Run off (mm)	Net Infil. (mm)
5	143	0.07	2.67	275	7.07	15.76	347	17.72	31.11	438	41.07	60.80	693	139.09	203.74
10	146	0.00	0.45	285	5.34	16.30	337	15.03	29.99	449	70.38	110.08	710	171.53	288.46
15	155	0.07	2.11	269	2.32	13.10	320	8.83	24.43	379	40.21	57.47	599	128.54	195.85
20	134	0.01	1.38	274	9.34	17.71	303	8.32	18.87	464	59.95	92.48	734	172.65	286.94
25	161	0.03	2.22	384	25.36	45.08	345	9.69	29.04	428	50.96	80.78	677	149.29	251.32
30	136	0.59	3.96	290	11.01	27.05	398	26.53	52.84	450	60.71	98.05	711	174.19	282.89
35	130	0.02	1.35	309	17.32	26.81	267	1.12	10.04	459	75.57	102.20	726	192.42	294.99
40	160	1.19	5.30	286	10.03	23.42	370	19.06	38.74	435	66.63	99.31	687	166.48	273.71
45	168	0.03	1.35	317	14.71	25.05	375	15.12	35.65	451	56.32	83.68	712	166.86	268.12
50	185	1.18	6.45	293	8.37	23.10	350	12.74	31.09	400	47.03	67.87	632	141.97	224.43
55	120	0.01	1.39	292	1.59	10.99	394	19.82	43.29	398	38.50	65.79	628	127.21	215.31
60	108	0.00	0.17	280	5.20	15.60	316	11.78	28.90	420	44.78	74.81	664	141.16	246.34
65	179	3.07	7.95	236	1.15	8.13	329	9.20	24.10	433	45.49	74.64	684	156.14	253.24
70	138	0.00	0.45	318	8.48	23.84	310	2.85	17.46	385	41.57	69.67	609	128.77	218.50
75	126	0.00	0.54	281	8.04	16.62	322	10.09	22.54	415	53.83	74.53	656	157.74	236.26
80	195	3.09	10.95	306	17.41	30.24	385	23.03	45.16	395	39.29	63.06	625	129.76	213.58
85	135	0.00	0.69	228	0.28	4.16	316	7.08	24.22	388	35.98	59.09	614	122.48	206.69
90	174	1.22	7.82	285	9.76	19.52	301	4.08	16.27	395	33.93	58.83	624	124.42	212.91
95	152	0.02	1.61	270	3.62	12.32	373	14.91	37.16	443	54.11	85.05	700	163.44	270.36
100	158	0.95	6.13	295	7.47	19.78	420	35.53	63.70	518	89.98	142.27	819	221.10	360.78
Average	150	0.58	3.25	289	8.69	19.73	328	13	30	427	52.31	81.02	675	153.76	250.22
Maximum	195	3.09	10.95	384	25.36	45.08	420	35.53	63.70	518	89.98	142.27	819	221.10	360.78
Minimum	108	0.00	0.17	228	0.28	4.16	267	1.12	10.04	379	33.93	57.47	599	122.48	195.85
Stand.Dev	23	0.97	3.11	32	6.26	9.00	39	8.38	13.02	34	14.74	21.45	54	25.63	41.19

Table 2-16. Average Net Infiltration Rates and Associated Probabilities.

	Dry (present-day) (mm/year)	Long-term average (mm/year)	Superpluvial (mm/year)	Probability (all climate states)
Low infiltration (base infiltration ÷ 3)	2.6	14	37	30%
Base infiltration	7.7	42	110	60%
High infiltration (base infiltration × 3)	23	125	340	10%

Table 2-17. Liquid Flow in Selected Fracture Connections as Percentage of Total Liquid Flow.

Selected Connections (with model layers)	Liquid Flow in Fracture Connections as Percentage of Total Liquid Flow
TCw1 to TCw2	100%
TCw2 to TCw3	100%
TCw3 to PTn1	100%
PTn1 to PTn2	9%
PTn2 to PTn3	2%
PTn3 to PTn4	0.2%
PTn4 to PTn5	0.003%
PTn5 to TSw1	25%
TSw4 to TSw5	99%
CH4z to LB	89%

Table 2-18. Relationship Between Model Layers and Geological Formations (Table 3.4-1 in Bodvarsson et al. 1997).

Geological Unit	Welding Intensity/ Formation Name	Model Unit	Hydrogeological Unit
PAINTBRUSH GROUP			
Tiva Canyon Tuff	M,D[1] (Tpcxxxx)	tcw11 tcw12	**Tiva Canyon (TCw)**
	D- Basal Vitrophyre (Tpcpv3) M (Tpcpv2)	tcw13	
	N,P (Tpcpv1)	ptn21	**Paintbrush (PTn)**
Bedded tuff	N (Tpbt4)		
Yucca Mountain Tuff	N,P,M (Tpy)	ptn22	
Bedded tuff	N (Tpbt3)	ptn23	
Pah Canyon Tuff	N,P,M (Tpp)	ptn24	
Bedded tuff	N (Tpbt2)	ptn25	
Topopah Spring Tuff	N,P (Tptrv3)		
	M (Tptrv2) D -Upper vitrophyre (Tptrv1)	tsw31	**Topopah Spring (TSw)**
	M,D (Tptrn)	tsw32	
	M,D,L (Tptrl) M,D,L (Tptpul)	tsw33	
	D (Tptpmn)	tsw34	
	M,D,L (Tptpll)	tsw35	
	D (Tptpln)	tsw36	
	D (Tptpv3)	tsw37	
	N,P,M; may be altered (Tptpv1, Tptpv2)	ch1(vc or zc)	**Calico Hills (CHn)**
Bedded tuff	N; may be altered (Tpbt1)		
Calico Hills Formation	N; unaltered (Ta - Vitric)	ch2(vc or zc)	
	N; altered (Ta - Zeolitic)	ch3(zc or vc)	
	N; may be altered (Thtbt)	ch4(vc or zc)	
CRATER FLAT GROUP			
Prow Pass Tuff	N; may be altered (Tpc) Unit 4		
	P,M Unit 3	pp3vp	
	N,P; generally altered Units 2,1	pp2zp	
Bedded tuff	N; generally altered (Tpcbt1)		
Upper Bullfrog Tuff	N,P; generally altered (Tcb)		
Middle Bullfrog Tuff	P,M	bf3vp	
Lower Bullfrog Tuff	N,P; generally altered	bf2zp	**Crater Flat Undifferentiated (CFu)**
Bedded tuff	N; generally altered (Tcbbt)		
Upper Tram Tuff	N,P; generally altered (Tct)		

[1] Welding Intensity N=Non-; P=Partially; M=Moderately; D=Densely

[2] L=Lithophysal Zone

[3] Units per Moyer and Geslin (1995)

Table 2-19. Matrix (a) and Fracture (b) Parameter Sets for the DKM Base Case (Minimum ∀f Present-day Infiltration Divided by Three). (DTN: LB971212001254.002)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.37E-18	0.066	1.18E-06	0.232	0.13	1.00
tcw12	5.37E-18	0.066	1.32E-06	0.236	0.13	1.00
tcw13	4.90E-17	0.140	6.46E-07	0.427	0.33	1.00
ptn21	3.09E-14	0.369	3.80E-05	0.231	0.10	1.00
ptn22	3.02E-15	0.234	8.71E-06	0.488	0.14	1.00
ptn23	8.32E-14	0.353	4.57E-05	0.287	0.17	1.00
ptn24	1.15E-13	0.469	4.27E-05	0.349	0.10	1.00
ptn25	2.46E-13	0.464	1.95E-04	0.279	0.10	1.00
tsw31	4.90E-17	0.042	1.00E-05	0.237	0.11	1.00
tsw32	2.75E-16	0.146	2.29E-05	0.273	0.04	1.00
tsw33	1.15E-17	0.135	6.76E-06	0.248	0.06	1.00
tsw34	4.07E-18	0.089	1.02E-06	0.322	0.18	1.00
tsw35	1.55E-17	0.115	3.31E-06	0.229	0.08	1.00
tsw36	8.91E-17	0.092	7.41E-07	0.414	0.18	1.00
tsw37	1.29E-17	0.020	1.55E-06	0.387	0.50	1.00
ch1zc	1.38E-17	0.193	8.32E-07	0.366	0.36	1.00
ch2zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch3zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch4zc	1.55E-17	0.169	7.76E-07	0.477	0.33	1.00
ch1vc	1.32E-12	0.265	6.61E-05	0.190	0.04	1.00
ch2vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch3vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch4vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
pp3vp	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
bf3vb	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
tm3vt	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
pp2zp	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
bf2zb	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
tsw37/pcM37	6.08E-19	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-19	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-20	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-19	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	5.73E-04	0.492	0.01	1.00	1.020	1.90E-01
tcw12	1.38E-11	6.03E-12	2.99E-04	4.88E-04	0.492	0.01	1.00	1.830	1.90E-01
tcw13	2.82E-12	2.40E-13	7.05E-05	5.67E-04	0.492	0.01	1.00	1.270	1.90E-01
ptn21	5.25E-13	5.25E-13	4.84E-05	5.85E-04	0.492	0.01	1.00	0.870	1.00E+00
ptn22	1.95E-13	1.95E-13	4.83E-05	2.74E-04	0.492	0.01	1.00	0.290	1.00E+00
ptn23	2.57E-13	2.57E-13	1.30E-04	6.18E-04	0.492	0.01	1.00	0.290	1.00E+00
ptn24	6.17E-14	6.17E-14	6.94E-05	2.35E-04	0.492	0.01	1.00	0.630	1.00E+00
ptn25	7.76E-14	7.76E-14	3.86E-05	4.14E-04	0.279	0.01	1.00	0.650	1.00E+00
tsw31	1.07E-11	1.00E-12	8.92E-05	3.98E-05	0.481	0.01	1.00	1.100	5.00E-01
tsw32	1.51E-11	7.08E-13	1.29E-04	2.53E-04	0.488	0.01	1.00	1.010	1.90E-01
tsw33	2.63E-11	8.91E-13	1.05E-04	2.76E-04	0.492	0.01	1.00	0.690	1.90E-01
tsw34	6.76E-12	4.27E-13	1.24E-04	1.98E-04	0.492	0.01	1.00	1.880	1.90E-01
tsw35	3.80E-12	9.12E-13	3.29E-04	3.40E-04	0.492	0.01	1.00	1.810	1.90E-01
tsw36	1.20E-12	1.20E-12	3.99E-04	3.92E-04	0.492	0.01	1.00	2.100	1.90E-01
tsw37	1.20E-12	1.20E-12	4.92E-04	5.77E-04	0.492	0.01	1.00	2.880	1.90E-01
ch1zc	2.40E-14	2.40E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch2zc	1.18E-14	1.18E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	1.18E-14	1.18E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	1.55E-14	1.55E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch1vc	1.74E-13	1.74E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	1.00E+00
ch2vc	2.88E-13	2.88E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	1.00E+00
ch3vc	2.88E-13	2.88E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	1.00E+00
ch4vc	2.88E-13	2.88E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	1.00E+00
pp3vp	6.92E-13	6.92E-13	7.14E-05	2.53E-04	0.492	0.01	1.00	0.420	1.90E-01
bf3vb	6.92E-13	6.92E-13	7.14E-05	2.53E-04	0.492	0.01	1.00	0.420	1.90E-01
tm3vt	6.92E-13	6.92E-13	7.14E-05	2.53E-04	0.492	0.01	1.00	0.420	1.90E-01
pp2zp	6.46E-14	6.46E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
bf2zb	6.46E-14	6.46E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
tsw37/pcM37	3.04E-19	3.04E-19	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcM1z	1.20E-18	1.20E-18	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcM2z	3.50E-19	3.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcM62	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcM3z	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcM4z	8.40E-19	8.40E-19	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-19	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-20. Matrix (a) and Fracture (b) Parameter Sets for the DKM Base Case (Minimum $\forall_f'$, Present-day Infiltration Multiplied by Three). (DTN: LB971212001254.003)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.37E-18	0.066	1.18E-06	0.232	0.13	1.00
tcw12	5.37E-18	0.066	1.32E-06	0.236	0.13	1.00
tcw13	4.90E-17	0.140	6.46E-07	0.427	0.33	1.00
ptn21	3.09E-14	0.369	3.80E-05	0.231	0.10	1.00
ptn22	3.02E-15	0.234	8.71E-06	0.488	0.14	1.00
ptn23	8.32E-14	0.353	4.57E-05	0.287	0.17	1.00
ptn24	1.15E-13	0.469	4.27E-05	0.349	0.10	1.00
ptn25	2.46E-13	0.464	1.95E-04	0.279	0.10	1.00
tsw31	4.90E-17	0.042	1.00E-05	0.237	0.11	1.00
tsw32	2.75E-16	0.146	2.29E-05	0.273	0.04	1.00
tsw33	1.15E-17	0.135	6.76E-06	0.248	0.06	1.00
tsw34	4.07E-18	0.089	1.02E-06	0.322	0.18	1.00
tsw35	1.55E-17	0.115	3.31E-06	0.229	0.08	1.00
tsw36	8.91E-17	0.092	7.41E-07	0.414	0.18	1.00
tsw37	1.29E-17	0.020	1.55E-06	0.387	0.50	1.00
ch1zc	1.38E-17	0.193	8.32E-07	0.366	0.36	1.00
ch2zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch3zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch4zc	1.55E-17	0.169	7.76E-07	0.477	0.33	1.00
ch1vc	1.32E-12	0.265	6.61E-05	0.190	0.04	1.00
ch2vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch3vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch4vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
pp3vp	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
bf3vb	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
tm3vt	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
pp2zp	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
bf2zb	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
tsw37/pcM37	6.08E-17	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-17	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-17	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_m (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	5.73E-04	0.492	0.01	1.00	1.020	4.75E-04
tcw12	1.38E-11	6.03E-12	2.99E-04	4.88E-04	0.492	0.01	1.00	1.830	4.75E-04
tcw13	2.82E-12	2.40E-13	7.05E-05	5.67E-04	0.492	0.01	1.00	1.270	4.75E-04
ptn21	5.25E-13	5.25E-13	4.84E-05	5.85E-04	0.492	0.01	1.00	0.870	4.75E-04
ptn22	1.95E-13	1.95E-13	4.83E-05	2.74E-04	0.492	0.01	1.00	0.290	5.46E-03
ptn23	2.57E-13	2.57E-13	1.30E-04	6.18E-04	0.492	0.01	1.00	0.290	5.46E-03
ptn24	6.17E-14	6.17E-14	6.94E-05	2.35E-04	0.492	0.01	1.00	0.630	5.46E-03
ptn25	7.76E-14	7.76E-14	3.86E-05	4.14E-04	0.279	0.01	1.00	0.650	5.46E-03
tsw31	1.07E-11	1.00E-12	8.92E-05	3.98E-05	0.481	0.01	1.00	1.100	5.46E-03
tsw32	1.51E-11	7.08E-13	1.29E-04	2.53E-04	0.488	0.01	1.00	1.010	5.00E-01
tsw33	2.63E-11	8.91E-13	1.05E-04	2.76E-04	0.492	0.01	1.00	0.690	4.75E-04
tsw34	6.76E-12	4.27E-13	1.24E-04	1.98E-04	0.492	0.01	1.00	1.880	4.75E-04
tsw35	3.80E-12	9.12E-13	3.29E-04	3.40E-04	0.492	0.01	1.00	1.810	4.75E-04
tsw36	1.20E-12	1.20E-12	3.99E-04	3.92E-04	0.492	0.01	1.00	2.100	4.75E-04
tsw37	1.20E-12	1.20E-12	4.92E-04	5.77E-04	0.492	0.01	1.00	2.880	4.75E-04
ch1zc	2.40E-14	2.40E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	4.75E-04
ch2zc	1.18E-14	1.18E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	1.18E-14	1.18E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	1.55E-14	1.55E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
ch1vc	1.74E-13	1.74E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	1.00E+00
ch2vc	2.88E-13	2.88E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	5.46E-03
ch3vc	2.88E-13	2.88E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	5.46E-03
ch4vc	2.88E-13	2.88E-13	7.14E-05	5.42E-04	0.492	0.01	1.00	0.420	5.46E-03
pp3vp	6.92E-13	6.92E-13	7.14E-05	2.53E-04	0.492	0.01	1.00	0.420	5.46E-03
bf3vb	6.92E-13	6.92E-13	7.14E-05	2.53E-04	0.492	0.01	1.00	0.420	4.75E-04
tm3vt	6.92E-13	6.92E-13	7.14E-05	2.53E-04	0.492	0.01	1.00	0.420	4.75E-04
pp2zp	6.46E-14	6.46E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	4.75E-04
bf2zb	6.46E-14	6.46E-14	1.10E-05	2.85E-04	0.492	0.01	1.00	0.067	1.00E+00
tsw37/pcF37	6.08E-17	6.08E-17	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-16	1.20E-16	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-17	3.50E-17	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-17	4.50E-17	1.10E-04	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-04	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-04	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-17	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-21. Matrix (a) and Fracture (b) Parameter Sets for the DKM Base Case (Mean ∀f, Present-day Infiltration). (DTN: LB971212001254.001)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{lrm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.37E-18	0.066	1.18E-06	0.232	0.13	1.00
tcw12	5.37E-18	0.066	1.32E-06	0.236	0.13	1.00
tcw13	4.90E-17	0.140	6.46E-07	0.427	0.33	1.00
ptn21	3.09E-14	0.369	3.80E-05	0.231	0.10	1.00
ptn22	3.02E-15	0.234	8.71E-06	0.488	0.14	1.00
ptn23	8.32E-14	0.353	4.57E-05	0.287	0.17	1.00
ptn24	1.15E-13	0.469	4.27E-05	0.349	0.10	1.00
ptn25	2.46E-13	0.464	1.95E-04	0.279	0.10	1.00
tsw31	4.90E-17	0.042	1.00E-05	0.237	0.11	1.00
tsw32	2.75E-16	0.146	2.29E-05	0.273	0.04	1.00
tsw33	1.15E-17	0.135	6.76E-06	0.248	0.06	1.00
tsw34	4.07E-18	0.089	1.02E-06	0.322	0.18	1.00
tsw35	1.55E-17	0.115	3.31E-06	0.229	0.08	1.00
tsw36	8.91E-17	0.092	7.41E-07	0.414	0.18	1.00
tsw37	1.29E-17	0.020	1.55E-06	0.387	0.50	1.00
ch1zc	1.38E-17	0.193	8.32E-07	0.366	0.36	1.00
ch2zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch3zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch4zc	1.55E-17	0.169	7.76E-07	0.477	0.33	1.00
ch1vc	1.32E-12	0.265	6.61E-05	0.190	0.04	1.00
ch2vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch3vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch4vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
pp3vp	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
bf3vb	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
tm3vt	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
pp2zp	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
bf2zb	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
tsw37/pcM37	6.08E-18	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-18	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{lrf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	2.53E-03	0.492	0.01	1.00	1.020	8.00E-03
tcw12	1.38E-11	6.03E-12	2.99E-04	2.02E-03	0.492	0.01	1.00	1.830	8.00E-03
tcw13	2.82E-12	2.40E-13	7.05E-05	8.10E-04	0.492	0.01	1.00	1.270	8.00E-03
ptn21	5.25E-13	5.25E-13	4.84E-05	1.31E-03	0.492	0.01	1.00	0.870	8.36E-01
ptn22	1.95E-13	1.95E-13	4.83E-05	9.42E-04	0.492	0.01	1.00	0.290	8.36E-01
ptn23	2.57E-13	2.57E-13	1.30E-04	1.03E-03	0.492	0.01	1.00	0.290	8.36E-01
ptn24	6.17E-14	6.17E-14	6.94E-05	6.42E-04	0.492	0.01	1.00	0.630	8.36E-01
ptn25	7.76E-14	7.76E-14	3.86E-05	6.93E-04	0.279	0.01	1.00	0.650	8.36E-01
tsw31	1.07E-11	1.00E-12	8.92E-05	3.98E-05	0.481	0.01	1.00	1.100	5.00E-01
tsw32	1.51E-11	7.08E-13	1.29E-04	1.18E-03	0.488	0.01	1.00	1.010	8.00E-03
tsw33	2.63E-11	8.91E-13	1.05E-04	1.40E-03	0.492	0.01	1.00	0.690	8.00E-03
tsw34	6.76E-12	4.27E-13	1.24E-04	8.36E-04	0.492	0.01	1.00	1.880	8.00E-03
tsw35	3.80E-12	9.12E-13	3.29E-04	1.41E-03	0.492	0.01	1.00	1.810	8.00E-03
tsw36	1.20E-12	1.20E-12	3.99E-04	1.18E-03	0.492	0.01	1.00	2.100	8.00E-03
tsw37	1.20E-12	1.20E-12	4.92E-04	1.21E-03	0.492	0.01	1.00	2.880	8.00E-03
ch1zc	2.40E-14	2.40E-14	1.10E-05	4.76E-04	0.492	0.01	1.00	0.067	1.00E+00
ch2zc	1.18E-14	1.18E-14	1.10E-05	4.76E-04	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	1.18E-14	1.18E-14	1.10E-05	4.76E-04	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	1.55E-14	1.55E-14	1.10E-05	4.76E-04	0.492	0.01	1.00	0.067	1.00E+00
ch1vc	1.74E-13	1.74E-13	7.14E-05	9.07E-04	0.492	0.01	1.00	0.420	8.36E-01
ch2vc	2.88E-13	2.88E-13	7.14E-05	9.07E-04	0.492	0.01	1.00	0.420	8.36E-01
ch3vc	2.88E-13	2.88E-13	7.14E-05	9.07E-04	0.492	0.01	1.00	0.420	8.36E-01
ch4vc	2.88E-13	2.88E-13	7.14E-05	9.07E-04	0.492	0.01	1.00	0.420	8.36E-01
pp3vp	6.92E-13	6.92E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	8.00E-03
bf3vb	6.92E-13	6.92E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	8.00E-03
tm3vt	6.92E-13	6.92E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	8.00E-03
pp2zp	6.46E-14	6.46E-14	1.10E-05	4.76E-04	0.492	0.01	1.00	0.067	1.00E+00
bf2zb	6.46E-14	6.46E-14	1.10E-05	4.76E-04	0.492	0.01	1.00	0.067	1.00E+00
tsw37/pcF37	3.04E-18	3.04E-18	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-17	1.20E-17	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-18	3.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-18	4,50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw73/pwF37	3.04E-18	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-22. Matrix (a) and Fracture (b) Parameter Sets for the DKM Base Case (Maximum $\forall_f$, Present-day Infiltration Divided by Three). (DTN: LB971212001254.004)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{lrm} (-)	matrix satiated saturation S_{lsm} (-)
tcw11	5.37E-18	0.066	1.18E-06	0.232	0.13	1.00
tcw12	5.37E-18	0.066	1.32E-06	0.236	0.13	1.00
tcw13	4.90E-17	0.140	6.46E-07	0.427	0.33	1.00
ptn21	3.09E-14	0.369	3.80E-05	0.231	0.10	1.00
ptn22	3.02E-15	0.234	8.71E-06	0.488	0.14	1.00
ptn23	8.32E-14	0.353	4.57E-05	0.287	0.17	1.00
ptn24	1.15E-13	0.469	4.27E-05	0.349	0.10	1.00
ptn25	2.46E-13	0.464	1.95E-04	0.279	0.10	1.00
tsw31	4.90E-17	0.042	1.00E-05	0.237	0.11	1.00
tsw32	2.75E-16	0.146	2.29E-05	0.273	0.04	1.00
tsw33	1.15E-17	0.135	6.76E-06	0.248	0.06	1.00
tsw34	4.07E-18	0.089	1.02E-06	0.322	0.18	1.00
tsw35	1.55E-17	0.115	3.31E-06	0.229	0.08	1.00
tsw36	8.91E-17	0.092	7.41E-07	0.414	0.18	1.00
tsw37	1.29E-17	0.020	1.55E-06	0.387	0.50	1.00
ch1zc	1.38E-17	0.193	8.32E-07	0.366	0.36	1.00
ch2zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch3zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch4zc	1.55E-17	0.169	7.76E-07	0.477	0.33	1.00
ch1vc	1.32E-12	0.265	6.61E-05	0.190	0.04	1.00
ch2vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch3vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch4vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
pp3vp	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
bf3vb	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
tm3vt	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
pp2zp	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
bf2zb	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
tsw37/pcM37	6.08E-19	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-19	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-20	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-19	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{lrf} (-)	fracture satiated saturation S_{lsf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_m (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	1.03E-02	0.492	0.01	1.00	1.020	5.03E-02
tcw12	1.38E-11	6.03E-12	2.99E-04	7.49E-03	0.492	0.01	1.00	1.830	5.03E-02
tcw13	2.82E-12	2.40E-13	7.05E-05	1.11E-03	0.492	0.01	1.00	1.270	5.03E-02
ptn21	5.25E-13	5.25E-13	4.84E-05	2.80E-03	0.492	0.01	1.00	0.870	8.98E-01
ptn22	1.95E-13	1.95E-13	4.83E-05	3.09E-03	0.492	0.01	1.00	0.290	8.98E-01
ptn23	2.57E-13	2.57E-13	1.30E-04	1.65E-03	0.492	0.01	1.00	0.290	8.98E-01
ptn24	6.17E-14	6.17E-14	6.94E-05	1.67E-03	0.492	0.01	1.00	0.630	8.98E-01
ptn25	7.76E-14	7.76E-14	3.86E-05	1.10E-03	0.279	0.01	1.00	0.650	8.98E-01
tsw31	1.07E-11	1.00E-12	8.92E-05	3.98E-05	0.481	0.01	1.00	1.100	5.00E-01
tsw32	1.51E-11	7.08E-13	1.29E-04	5.42E-03	0.488	0.01	1.00	1.010	5.03E-02
tsw33	2.63E-11	8.91E-13	1.05E-04	6.78E-03	0.492	0.01	1.00	0.690	5.03E-02
tsw34	6.76E-12	4.27E-13	1.24E-04	3.16E-03	0.492	0.01	1.00	1.880	5.03E-02
tsw35	3.80E-12	9.12E-13	3.29E-04	5.59E-03	0.492	0.01	1.00	1.810	5.03E-02
tsw36	1.20E-12	1.20E-12	3.99E-04	3.19E-03	0.492	0.01	1.00	2.100	5.03E-02
tsw37	1.20E-12	1.20E-12	4.92E-04	2.00E-03	0.492	0.01	1.00	2.880	5.03E-02
ch1zc	2.40E-14	2.40E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch2zc	1.18E-14	1.18E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	1.18E-14	1.18E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	1.55E-14	1.55E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch1vc	1.74E-13	1.74E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	8.98E-01
ch2vc	2.88E-13	2.88E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	8.98E-01
ch3vc	2.88E-13	2.88E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	8.98E-01
ch4vc	2.88E-13	2.88E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	8.98E-01
pp3vp	6.92E-13	6.92E-13	7.14E-05	5.42E-03	0.492	0.01	1.00	0.420	5.03E-02
bf3vb	6.92E-13	6.92E-13	7.14E-05	5.42E-03	0.492	0.01	1.00	0.420	5.03E-02
tm3vt	6.92E-13	6.92E-13	7.14E-05	5.42E-03	0.492	0.01	1.00	0.420	5.03E-02
pp2zp	6.46E-14	6.46E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
bf2zb	6.46E-14	6.46E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
tsw37/pcF37	3.04E-19	3.04E-19	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-18	1.20E-18	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-19	3.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-19	8.40E-19	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-19	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-23. Matrix (a) and Fracture (b) Parameter Sets for the DKM Base Case (Maximum $\forall_f$, Present-day Infiltration Multiplied by Three). (DTN: LB971212001254.005)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{lrm} (-)	matrix satiated saturation S_{lsm} (-)
tcw11	5.37E-18	0.066	1.18E-06	0.232	0.13	1.00
tcw12	5.37E-18	0.066	1.32E-06	0.236	0.13	1.00
tcw13	4.90E-17	0.140	6.46E-07	0.427	0.33	1.00
ptn21	3.09E-14	0.369	3.80E-05	0.231	0.10	1.00
ptn22	3.02E-15	0.234	8.71E-06	0.488	0.14	1.00
ptn23	8.32E-14	0.353	4.57E-05	0.287	0.17	1.00
ptn24	1.15E-13	0.469	4.27E-05	0.349	0.10	1.00
ptn25	2.46E-13	0.464	1.95E-04	0.279	0.10	1.00
tsw31	4.90E-17	0.042	1.00E-05	0.237	0.11	1.00
tsw32	2.75E-16	0.146	2.29E-05	0.273	0.04	1.00
tsw33	1.15E-17	0.135	6.76E-06	0.248	0.06	1.00
tsw34	4.07E-18	0.089	1.02E-06	0.322	0.18	1.00
tsw35	1.55E-17	0.115	3.31E-06	0.229	0.08	1.00
tsw36	8.91E-17	0.092	7.41E-07	0.414	0.18	1.00
tsw37	1.29E-17	0.020	1.55E-06	0.387	0.50	1.00
ch1zc	1.38E-17	0.193	8.32E-07	0.366	0.36	1.00
ch2zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch3zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch4zc	1.55E-17	0.169	7.76E-07	0.477	0.33	1.00
ch1vc	1.32E-12	0.265	6.61E-05	0.190	0.04	1.00
ch2vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch3vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch4vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
pp3vp	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
bf3vb	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
tm3vt	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
pp2zp	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
bf2zb	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
tsw37/pcM37	6.08E-17	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-17	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-17	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{lrf} (-)	fracture satiated saturation S_{lsf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	1.03E-02	0.492	0.01	1.00	1.020	4.62E-05
tcw12	1.38E-11	6.03E-12	2.99E-04	7.49E-03	0.492	0.01	1.00	1.830	4.62E-05
tcw13	2.82E-12	2.40E-13	7.05E-05	1.11E-03	0.492	0.01	1.00	1.270	4.62E-05
ptn21	5.25E-13	5.25E-13	4.84E-05	2.80E-03	0.492	0.01	1.00	0.870	4.02E-03
ptn22	1.95E-13	1.95E-13	4.83E-05	3.09E-03	0.492	0.01	1.00	0.290	4.02E-03
ptn23	2.57E-13	2.57E-13	1.30E-04	1.65E-03	0.492	0.01	1.00	0.290	4.02E-03
ptn24	6.17E-14	6.17E-14	6.94E-05	1.67E-03	0.492	0.01	1.00	0.630	4.02E-03
ptn25	7.76E-14	7.76E-14	3.86E-05	1.10E-03	0.279	0.01	1.00	0.650	4.02E-03
tsw31	1.07E-11	1.00E-12	8.92E-05	3.98E-05	0.481	0.01	1.00	1.100	5.00E-01
tsw32	1.51E-11	7.08E-13	1.29E-04	5.42E-03	0.488	0.01	1.00	1.010	4.62E-05
tsw33	2.63E-11	8.91E-13	1.05E-04	6.78E-03	0.492	0.01	1.00	0.690	4.62E-05
tsw34	6.76E-12	4.27E-13	1.24E-04	3.16E-03	0.492	0.01	1.00	1.880	4.62E-05
tsw35	3.80E-12	9.12E-13	3.29E-04	5.59E-03	0.492	0.01	1.00	1.810	4.62E-05
tsw36	1.20E-12	1.20E-12	3.99E-04	3.19E-03	0.492	0.01	1.00	2.100	4.62E-05
tsw37	1.20E-12	1.20E-12	4.92E-04	2.00E-03	0.492	0.01	1.00	2.880	4.62E-05
ch1zc	2.40E-14	2.40E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch2zc	1.18E-14	1.18E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	1.18E-14	1.18E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	1.55E-14	1.55E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
ch1vc	1.74E-13	1.74E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	4.02E-03
ch2vc	2.88E-13	2.88E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	4.02E-03
ch3vc	2.88E-13	2.88E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	4.02E-03
ch4vc	2.88E-13	2.88E-13	7.14E-05	1.44E-03	0.492	0.01	1.00	0.420	4.02E-03
pp3vp	6.92E-13	6.92E-13	7.14E-05	5.42E-03	0.492	0.01	1.00	0.420	4.62E-05
bf3vb	6.92E-13	6.92E-13	7.14E-05	5.42E-03	0.492	0.01	1.00	0.420	4.62E-05
tm3vt	6.92E-13	6.92E-13	7.14E-05	5.42E-03	0.492	0.01	1.00	0.420	4.62E-05
pp2zp	6.46E-14	6.46E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
bf2zb	6.46E-14	6.46E-14	1.10E-05	7.58E-04	0.492	0.01	1.00	0.067	1.00E+00
tsw37/pcF37	6.08E-17	6.08E-17	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-16	1.20E-16	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-17	3.50E-17	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-17	4.50E-17	1.10E-04	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-04	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-04	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-17	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-24. (a) Fault Matrix and (b) Fracture Properties. (DTN: LBL971100001254.002)

Model Layer/ Block Name	Matrix Permeability k_m (m^2)	Matrix Porosity ϕ_m (-)	Matrix van Genuchten Alpha α_m (1/Pa)	Matrix van Genuchten m (λ) m_m (-)	Matrix Residual Saturation S_{lrm} (-)	Matrix Satiated Saturation S_{lsm} (-)
tcwMg	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
ptnMg	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
tswMg	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
chnMg	5.00E-15	0.200	6.10E-05	0.500	0.00	1.00
tcwMi	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
ptnMi	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
tswMi	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
chnMi	5.00E-15	0.200	6.10E-05	0.500	0.00	1.00
tcwMd	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
ptnMd	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
tswMd	1.00E-13	0.200	6.10E-05	0.500	0.00	1.00
chnMd	5.00E-15	0.200	6.10E-05	0.500	0.00	1.00
chaMd	2.55E-13	0.100	1.39E-06	0.225	0.06	1.00
tcwMs	1.00E-13	0.050	2.00E-05	0.500	0.00	1.00
ptnMs	1.00E-13	0.050	2.00E-05	0.500	0.00	1.00
tswMs	1.00E-13	0.050	2.00E-05	0.500	0.00	1.00
chnMs	5.00E-14	0.100	2.00E-05	0.500	0.00	1.00

(a)

Model Layer/ Block Name	Vertical fracture permeability k_f (m^2)	Horizontal fracture permeability k_f (m^2)	Fracture porosity ϕ_f (-)	Fracture van Genuchten alpha α_f (1/Pa)	Fracture van Genuchten m (λ) m_f (-)	Fracture residual saturation S_{lrf} (-)	Fracture satiated saturation S_{lsf} (-)	Fracture frequency f (1/m)	Fracture-matrix modifier for DKM Base Case fmx (-)	Fracture-matrix modifier for DKM Weeps fmx (-)
tcwFg	9.90E-12	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-04	5.0E-02
ptnFg	2.00E-13	2.00E-13	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-01	5.0E-02
tswFg	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-02	5.0E-02
chnFg	5.00E-14	5.00E-14	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-01	5.0E-02
tcwFi	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-04	5.0E-02
ptnFi	2.00E-13	2.00E-13	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-01	5.0E-02
tswFi	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-02	5.0E-02
chnFi	5.00E-14	5.00E-14	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-01	5.0E-02
tcwFd	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-04	5.0E-02
ptnFd	2.00E-13	2.00E-13	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-01	5.0E-02
tswFd	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-02	5.0E-02
chnFd	5.00E-14	5.00E-14	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	5.0E-01	5.0E-02
chaFd	2.88E-13	2.88E-13	1.14E-05	7.39E-06	0.225	0.06	1.00	4.51	5.0E-01	5.0E-02
tcwFs	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	1.0E-02	5.0E-02
ptnFs	1.00E-12	1.00E-12	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	1.0E-02	5.0E-02
tswFs	2.00E-11	2.00E-11	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	1.0E-02	5.0E-02
chnFs	5.00E-13	5.00E-13	3.34E-04	1.00E-03	0.500	0.00	1.00	4.51	1.0E-02	5.0E-02

(b)

Table 2-25. Rock Names for Perched-Water Zone Property Specification.

3-D model layers	1-D inversion layers	3-D model layers	1-D inversion layers
(X=M for matrixD , =F for fracture blocks)			
ch3vc	ch2vc	pcX37	tsw37
ch4vc	ch2vc	pcX1z	ch1zc
ch2zc	ch3zc	pcX2z	ch2zc
bf3vb	pp3vp	pcX62	ch2zc
tm3vt	pp3vp	pcX3z	ch3zc
bf2zb	pp2zp	pcX4z	ch4zc
		ChaXd	ch2vc

Table 2-26. Rock Names for Fault Property Specification.

3-D Fault Model Block	Hydrogeologic Unit	3-D Fault Model Block	Hydrogeologic Unit
(X=M for matrix block, F for fracture block)			
Ghost Dance Fault		**Dune Wash Fault**	
TcwXg	TCw	TcwXd	TCw
PtnXg	PTn	PtnXd	PTn
TswXg	TSw	tswXd	TSw
ChnXg	CHn	chnXd	CHn
Iron Ridge Fault		**Solitario Canyon Fault**	
tcwXi	TCw	TcwXs	TCw
ptnXi	PTn	PtnXs	PTn
tswXi	TSw	TswXs	TSw
	CHn	ChnXs	CHn

Table 2-27. DTNs for ESF Detailed Line Survey (DLS) Data.

DTN	Description
GS950508314224.002	DLS from North Ramp of the ESF, Station 0+60 to 4+00
GS950808314224.004	Provisional results: Geologic Data - North Ramp of the ESF, DLS from Station 4+00 to 8+00
GS951108314224.005	Provisional results: Geologic Data - North Ramp of the ESF, DLS from Station 8+00 to 10+00
GS960408314224.002	Provisional results: Geologic Data - North Ramp of the ESF, DLS from Station 10+00 to 18+00
GS960608314224.006	Provisional results: Geotechnical Data Survey for Station 18+00 to 26+00, North Ramp of the ESF: DLS
GS960608314224.007	Provisional results: Geotechnical Data Survey for Station 26+00 to 30+00, North Ramp and Main Drift of the ESF: DLS
GS960808314224.011	Provisional results: Geotechnical Data for Station 35+00 to Station 40+00, Main Drift of the ESF: DLS

Table 2-28. Fracture Permeability and Ranges. (LB970601233129.001)

Model Layer	log k_f (m^2)	S.D.	k_f (m^2)	k_f - 2S.D. (m^2)	k_f + 2S.D. (m^2)
TCw11	-11.22	0.61	6.03E-12	3.63E-13	1.00E-10
TCw12	-11.22	0.61	6.03E-12	3.63E-13	1.00E-10
TC13	-12.62	—	2.40E-13	—	—
PTn21	-12.28	0.19	5.25E-13	2.19E-13	1.26E-12
PTn22	-12.71	0.47	1.95E-13	2.24E-14	1.70E-12
PTn23	-12.59	0.21	2.57E-13	9.77E-14	6.76E-13
PTn24	-13.21	0.32	6.17E-14	1.41E-14	2.69E-13
PTn25	-13.11	0.07	7.76E-14	5.62E-14	1.07E-13
TSw31	-12.00	—	1.00E-12	—	—
TSw32	-12.15	0.66	7.08E-13	3.39E-14	1.48E-11
TSw33	-12.05	0.67	8.91E-13	4.07E-14	1.95E-11
TSw34	-12.37	0.56	4.27E-13	3.24E-14	5.62E-12
TSw35	-12.04	0.54	9.12E-13	7.59E-14	1.10E-11
TSw36	-11.92	0.34	1.20E-12	2.51E-13	5.75E-12
TSw37	-11.92	—	1.20E-12	—	—
CHv	-12.76	—	1.74E-13	—	—
CHz	-13.60	—	2.51E-14	—	—

Table 2-29. ESF Fracture-frequency Data and Ranges. (LB970601233129.001)

Model Layer	Number of Samples	Geometric Mean (1/m)	Arithmetic Mean (1/m)	Mean Reported in Bodvarsson et al. (1997, Chapter 7) (1/m)	10^{th} Percentile (1/m)	90^{th} Percentile (1/m)
TCw11	387	1.48	0.74	1.02	0.36	7.69
TCw12	327	2.91	1.75	1.83	0.95	12.50
TC13	58	1.80	1.25	1.27	0.70	5.26
PTn	100	0.93	0.54	0.29 - 0.87	0.23	4.35
TSw31	133	2.69	0.96	1.10	0.60	25.00
TSw32	489	1.74	0.94	1.01	0.37	8.33
TSw33	615	1.30	0.61	0.69	0.25	7.69
TSw34	1240	2.91	1.61	1.88	0.71	16.67

Table 2-30. Borehole, Fracture-frequency Data and Ranges. (LB970601233129.001)

Model Layer	Number of Samples	Geometric Mean (1/m)	Arithmetic Mean (1/m)	Mean Reported in Bodvarsson et al. (1997, Chapter 7) (1/m)	Minimum	Maximum
TSw32	28	—	0.96	0.99	0.00	3.70
TSw33	52	—	0.64	0.61	0.00	2.61
TSw34	24	1.72	2.16	2.22	0.50	9.41
TSw35	61	—	1.83	1.81	0.00	6.18
TSw36	41	1.98	2.08	2.10	0.90	3.46
TSw37	5	2.02	2.82	2.88	0.37	6.33
CHv	14	—	0.39	0.42	0.00	1.08
CHz	7	—	0.23	0.067	0.00	1.48

Table 2-31. Analog Layers Used to Determine Fracture-Frequency Ranges.

Model Layer	Analog	Reasoning
TSw35	TSw33	Both are welded lithophysal tuff unit
TSw36	TSw34	Both are welded non-lithophysal tuff unit
TSw37	TSw31	Both are vitrophyres
CHv	PTn	Both are non-welded and PTn is similar to the CHv
CHz	PTn	Both the CHz and PTn are non-welded. The PTn most likely has a wider range of F_f than CHz. Using this wider range for the CHz F_f increases the uncertainty in CHz F_f. Increasing the uncertainty seems to be the best option without a better alternative for bounding the CHz F_f.

Table 2-32. Summary of Data Used to Calculate Fracture-Alpha Distributions. (LB970601233129.001)

Model Layer	Min k_f (m^2)	Mean k_f (m^2)	Max k_f (m^2)	Min F_f (1/m)	Mean F_f (1/m)	Max F_f (1/m)
TCw11	3.63E-13	6.03E-12	1.00E-10	0.36	1.48	7.69
TCw12	3.63E-13	6.03E-12	1.00E-10	0.95	2.91	12.50
TCw13	2.40E-13	2.40E-13	2.40E-13	0.70	1.80	5.26
PTn21	2.19E-13	5.25E-13	1.26E-12	0.23	0.93	4.35
PTn22	2.24E-14	1.95E-13	1.70E-12	0.23	0.93	4.35
PTn23	9.77E-14	2.57E-13	6.76E-13	0.23	0.93	4.35
PTn24	1.41E-14	6.17E-14	2.69E-13	0.23	0.93	4.35
PTn25	5.62E-14	7.76E-14	1.07E-13	0.23	0.93	4.35
TSw31	1.00E-12	1.00E-12	1.00E-12	0.60	2.69	25.00
TSw32	3.39E-14	7.08E-13	1.48E-11	0.37	1.74	8.33
TSw33	4.07E-14	8.91E-13	1.95E-11	0.25	1.30	7.69
TSw34	3.24E-14	4.27E-13	5.62E-12	0.71	2.91	16.67
TSw35	7.59E-14	9.12E-13	1.10E-11	0.25	1.30	7.69
TSw36	2.51E-13	1.20E-12	5.75E-12	0.71	2.91	16.67
TSw37	1.20E-12	1.20E-12	1.20E-12	0.60	2.69	25.00
CHv	1.74E-13	1.74E-13	1.74E-13	0.23	0.93	4.35
CHz	2.51E-14	2.51E-14	2.51E-14	0.23	0.93	4.35

Table 2-33. Summary of α_f Distributions. (DTN:SNT05091597001.003)

Model Layer	Min α_f (1/Pa)	Mean α_f (1/Pa)	Max α_f (1/Pa)
TCw11	5.73E-4	2.53E-3	1.03E-2
TCw12	4.88E-4	2.02E-3	7.49E-3
TCw13	5.67E-4	8.10E-4	1.11E-3
PTn21	5.85E-4	1.31E-3	2.80E-3
PTn22	2.74E-4	9.42E-4	3.09E-3
PTn23	6.18E-4	1.03E-3	1.65E-3
PTn24	2.35E-4	6.42E-4	1.67E-3
PTn25	4.14E-4	6.93E-4	1.10E-3
TSw31	5.42E-4	1.14E-3	1.88E-3
TSw32	2.53E-4	1.18E-3	5.42E-3
TSw33	2.76E-4	1.40E-3	6.78E-3
TSw34	1.98E-4	8.36E-4	3.16E-3
TSw35	3.40E-4	1.41E-3	5.59E-3
TSw36	3.92E-4	1.18E-3	3.19E-3
TSw37	5.77E-4	1.21E-3	2.00E-3
CHv	5.42E-4	9.07E-4	1.44E-3
CHz	2.85E-4	4.76E-4	7.58E-4

Table 2-34. Summary of Beta Distribution Fitting Parameters for k_f and Fracture Spacing.

	Log k_f (m^2)	Log Fracture Spacing (m)
Mean	-12.05	-0.11
Standard Deviation	0.67	0.62
Minimum	-14.73	-2.301
Maximum	-9.37	1.391
p	7.5	4.47652
q	7.5	3.07957

Table 2-35. Summary of Mean, Maximum, and Minimum ∀f and kf Values for Each Model Layer. (DTN: SNT05091597001.003, DTN: LB970601233129.001)

Model Layer	Min[2] α_f	Mean[1] α_f	Max[2] α_f		Min[2] k_f	Mean[1] k_f	Max[2] k_f
	(Pa^{-1})	(Pa^{-1})	(Pa^{-1})		(m^2)	(m^2)	(m^2)
tcwF1	5.73E-04	2.37E-03	1.03E-02		2.29E-12	2.29E-11	2.29E-10
tcwF2	4.88E-04	2.37E-03	7.49E-03		1.26E-12	1.51E-10	1.51E-10
tcwF3	5.67E-04	9.12E-03	1.11E-03		8.13E-13	9.78E-12	9.78E-12
ptnF1	5.85E-04	1.10E-03	2.80E-03		2.19E-13	1.26E-12	1.26E-12
ptnF2	2.74E-04	1.85E-03	3.09E-03		2.24E-14	1.70E-12	1.70E-12
ptnF3	6.18E-04	3.45E-03	1.65E-03		9.77E-14	6.76E-13	6.76E-13
ptnF4	2.35E-04	9.13E-04	1.67E-03		1.41E-14	6.17E-14	2.69E-13
ptnF5	4.14E-04	1.11E-03	1.10E-03		5.62E-14	7.76E-14	1.07E-13
tswF1	5.42E-04	1.54E-03	1.88E-03		3.23E-13	1.07E-11	3.54E-10
tswF2	2.53E-04	1.42E-03	5.42E-03		9.10E-13	1.51E-11	2.51E-10
tswF3	2.76E-04	1.73E-03	6.78E-03		1.51E-12	2.63E-11	4.57E-10
tswF4	1.98E-04	9.73E-04	3.16E-03		7.08E-13	6.76E-12	6.46E-11
tswF5	3.40E-04	1.26E-03	5.59E-03		1.38E-12	3.80E-12	1.05E-11
tswF6	3.92E-04	1.32E-03	3.19E-03		2.51E-13	1.20E-12	5.74E-12
tswF7	5.77E-04	1.19E-03	2.00E-03		1.20E-13	1.20E-12	1.20E-11
ch1Fz	2.85E-04	1.14E-03	7.58E-04		2.51E-15	2.51E-14	2.51E-13
ch2Fz	2.85E-04	1.14E-03	7.58E-04		2.51E-15	2.51E-14	2.51E-13
ch3Fz	2.85E-04	1.14E-03	7.58E-04		2.51E-15	2.51E-14	2.51E-13
ch4Fz	2.85E-04	1.14E-03	7.58E-04		2.51E-15	2.51E-14	2.51E-13
ch1Fv	5.42E-04	1.18E-03	1.44E-03		1.74E-14	1.74E-13	1.74E-12
ch2Fv	5.42E-04	1.18E-03	1.44E-03		1.74E-14	1.74E-13	1.74E-12
ch3Fv	5.42E-04	1.18E-03	1.44E-03		1.74E-14	1.74E-13	1.74E-12
ch4Fv	5.42E-04	1.18E-03	1.44E-03		1.74E-14	1.74E-13	1.74E-12
pp3Fv	5.42E-04	1.42E-03	1.44E-03		1.74E-14	7.08E-13	1.74E-12
bf3Fv	5.42E-04	1.42E-03	1.44E-03		1.74E-14	7.08E-13	1.74E-12
tm3Fv	5.42E-04	1.42E-03	1.44E-03		1.74E-14	7.08E-13	1.74E-12
pp2Fz	2.85E-04	1.14E-03	7.58E-04		2.51E-15	2.51E-14	2.51E-13
bf2Fz	2.85E-04	1.14E-03	7.58E-04		2.51E-15	2.51E-14	2.51E-13

[1] Mean fracture alpha and mean-fracture permeability values were taken from the DKM/Weeps mean property set (DTN LB971100001254.004).

[2] Minimum and maximum fracture-alpha and mean-fracture permeability values were taken from DTN:SNT05091597001.003.

Table 2-36. Fracture/Matrix Geometric Conductance Parameters for Uniform Fracture Sets.

Fracture Set	*N*	*A*	*d*
1-D	2	$2V/D$	$D/6$
2-D	4	$4V/D$	$D/8$
3-D	6	$6V/D$	$D/10$

Table 2-37. Files, Parameter Sets, Infiltration Scenarios, and Meshes Used in the Simulations.

LBNL Simulation Designation	Parameter Set/ Calibration	Infiltration Scenario	Water Table	DTN
mnad3_p	minimum alpha, fitted Xfm	Present-day infiltration divided by 3	Base case	LB971212001254.002
mnad3f1	minimum alpha, fitted Xfm	long-term infiltration divided by 3	810m	LB971212001254.002
mnad3f2	minimum alpha, fitted Xfm	superpluvial infiltration divided by 3	850m	LB971212001254.002
mnax3_p	minimum alpha, fitted Xfm	present-day infiltration multiplied by 3	Base case	LB971212001254.003
mnax3f1	minimum alpha, fitted Xfm	long-term infiltration multiplied by 3	810m	LB971212001254.003
mnax3f2	minimum alpha, fitted Xfm	superpluvial infiltration multiplied by 3	850m	LB971212001254.003
mnaqb_p	mean alpha, fitted Xfm	present-day infiltration	Base case	LB971212001254.006
mnaqbf1	mean alpha, fitted Xfm	long-term infiltration	810m	LB971212001254.006
mnaqbf2	mean alpha, fitted Xfm	superpluvial infiltration	850m	LB971212001254.006
mxad3_p	maximum alpha, fitted Xfm	present-day infiltration divided by 3	Base case	LB971212001254.004
mxad3f1	maximum alpha, fitted Xfm	long-term infiltration divided by 3	810m	LB971212001254.004
mxad3f2	maximum alpha, fitted Xfm	superpluvial infiltration divided by 3	850m	LB971212001254.004
mxax3_p	maximum alpha, fitted Xfm	present-day infiltration multiplied by 3	Base case	LB971212001254.005
mxax3f1	maximum alpha, fitted Xfm	long-term infiltration multiplied by 3	810m	LB971212001254.005
mxax3f2	maximum alpha, fitted Xfm	superpluvial infiltration multiplied by 3	850m	LB971212001254.005

Table 2-38. Niche, Liquid-Release Tests: Test Setup and Test Results.

Test Name	Test 1	Test 2	Test 3	Test 4	Test 5
Injection Length (m)	0.33	0.33	0.33	0.33	0.33
Air Permeability (m^2)	1.96×10^{-12}	1.89×10^{-10}	1.62×10^{-12}	7.04×10^{-12}	1.14×10^{-12}
Potential flow into rock* (g/s)	0.70	67.0	0.57	2.49	0.40
Average Injection Rate (g/s)	1.97	2.88	2.05	0.52	0.62**
Injection Time (min)	8.58	5.92	8.22	31.83	8.67
Injected Mass (g)	1014.1	1051.8	1019.8	999.1	283.1
Mass captured in Niche (g)	228.0	99.6	275.7	0.0	0.0
Seepage Percentage	22.5	9.5	27.0	0.0	0.0
First Arrival (min)	6.78	2.83	3.47	NA	NA
Duration of Dripping (min)	33.83	NR	17.63	NA	NA

* This potential flow rate is estimated from the air permeability of the borehole, assuming saturated unit-gradient flow over an area approximately half of the packed-off borehole interval.

** A rate of 0.62 g/s is the adjusted injection rate, considering the fact that in this particular test, 70% of the liquid returned.

NR: Not recorded.

NA: Not applicable.

Table 2-39. Niche, Liquid-Release Tests: Modeling Results.

Test Name	Test 1	Test 2	Test 3	Test 4	Test 5**
Mass captured in Niche (g)	210.1	0.0 (57.0*)	192.0	0.0	0.0
Seepage Percentage	20.7	0.0 (5.4*)	19.6	0.0	0.0
First Arrival (min)	5.3	NA (3.9*)	6.3	NA	NA
Duration of Dripping (min)	12.8	NA (2.0*)	15.0	NA	NA

* These results are obtained when assuming an anisotropic permeability for Test 2 (see text).

** Test 5 is simulated assuming the adjusted injection rate of 0.62 g/s.

Table 2-40. Mean Percolation Fluxes Over Each Repository Subregion for the Base-case Simulations. (DTN: MO9806SPAHGRAM.001)

	Mean Percolation Flux Over Each Repository Subregion (mm/year)								
Repository Subregion	P (mnaqb_p)	LTA (mnaqbf1)	SP (mnaqbf2)	P/3 (mnad3_p)	LTA/3 (mnad3f1)	SP/3 (mnad3f2)	P x 3 (mxax3_p)	LTA x 3 (mxax3f1)	SP x 3 (mxax3f2)
CC	11	55	140	3.6	18	45	34	160	410
NE	3.9	31	120	1.3	10	40	11	93	360
NW	9.2	45	100	2.9	15	33	28	140	300
SC	11	51	120	3.5	17	39	33	150	360
SE	5.0	33	97	1.6	11	32	15	100	290
SW	5.8	32	81	1.8	11	27	17	97	240

Table 2-41. Overview of Repository Fluxes for the Different Cases.

UZ-Model Case	Mean Flux (mm/yr)	95th percentile (mm/yr)	Maximum (mm/yr)
Qb	7.01	14.6	19.5
Qb_f1	38.8	67.9	83.8
Qb_f2	105.8	213.4	287.9
Qbd5	1.4	2.8	3.7
Qbd5_f1	7.75	13.5	16.5
Qbd5_f2	21.1	41.9	55.7
Qbx5	35.1	73.2	97.6
Qbx5_f1	194.0	333.2	406.3
Qbx5_f2	527.0	1000.4	1334.5

Table 2-42. Relative Weights for Fracture-Hydrologic Properties in the Base-case Seepage Model.

vG α (1/Pa)	ave. k = 10^{-14} m^2	ave. k = 10^{-13} m^2	ave. k = 10^{-12} m^2
3.3×10^{-3}	0.0625	0.125	0.0625
9.7×10^{-4}	0.125	0.25	0.125
3.3×10^{-4}	0.0625	0.125	0.0625

Table 2-43a. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 14.6 mm/yr, for Three 5-m Drift Segments, Between Spring Lines ($-5\pi/4$ to $5\pi/4$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	9.46	1.63	8.31	0.0	0.0	0.0	0.0	0.0	0.0
9.7×10^{-4}	4.28	0.0	0.19	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-43b. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 14.6 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall ($-5\pi/2$ to $5\pi/2$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	13.73	1.63	8.31	3.39	0.0	0.0	0.0	0.0	0.0
9.7×10^{-4}	9.74	0.0	0.19	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	3.26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-44a. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 73.2 mm/yr, for Three 5-m Drift Segments, Between Spring Lines (–5π/4 to 5π/4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m²			ave. $k = 10^{-13}$ m²			ave. $k = 10^{-12}$ m²		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	18.12	14.60	21.17	7.13	0.26	4.65	0.0	0.0	0.0
9.7×10^{-4}	8.94	2.50	10.03	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	3.83	0.0	2.62	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-44b. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 73.2 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall (–5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m²			ave. $k = 10^{-13}$ m²			ave. $k = 10^{-12}$ m²		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	22.22	14.60	21.17	10.93	0.26	4.65	0.0	0.0	0.0
9.7×10^{-4}	14.32	2.50	10.03	5.06	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	8.64	0.0	2.62	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-45a. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 213.4 mm/yr, for Three 5-m Drift Segments, Between Spring Lines (–5π/4 to 5π/4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	27.61	22.74	25.00	10.25	3.97	11.52	0.0	0.0	0.06
9.7×10^{-4}	17.19	12.12	19.20	5.72	0.0	3.07	0.0	0.0	0.0
3.3×10^{-4}	8.25	1.56	9.48	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-45b. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 213.4 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall (–5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	30.51	22.85	25.00	14.79	3.97	11.52	4.39	0.0	0.06
9.7×10^{-4}	21.51	12.12	19.20	10.92	0.0	3.07	0.0	0.0	0.0
3.3×10^{-4}	11.85	1.56	9.48	3.74	0.0	0.0	0.0	0.0	0.0

Table 2-46a. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 500 mm/yr, for Three 5-m Drift Segments, Between Spring Lines (−5π/4 to 5π/4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. *k* = 10^{-14} m²**			**ave. *k* = 10^{-13} m²**			**ave. *k* = 10^{-12} m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	32.77	27.95	26.89	15.26	11.87	18.79	7.36	0.03	3.59
9.7×10^{-4}	23.79	18.93	23.21	8.43	0.84	6.53	0.0	0.0	0.0
3.3×10^{-4}	13.39	10.64	17.41	2.91	0.0	1.11	0.0	0.0	0.0

Table 2-46b. Part 1: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 500 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall (−5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. *k* = 10^{-14} m²**			**ave. *k* = 10^{-13} m²**			**ave. *k* = 10^{-12} m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	35.06	28.17	26.89	19.61	11.87	18.79	12.62	0.03	3.59
9.7×10^{-4}	27.06	18.93	23.21	13.65	0.84	6.53	4.28	0.0	0.0
3.3×10^{-4}	16.79	10.64	17.41	7.83	0.0	1.11	0.34	0.0	0.0

Table 2-47a. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 14.6 mm/yr, for Three 5-m Drift Segments, Between Spring Lines (–5π/4 to 5π /4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	3.88	1.86	9.49	0.0	0.0	0.0	0.0	0.0	0.0
9.7×10^{-4}	0.0	0.37	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-47b. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 14.6 Mm/Yr, for Three 5-M Drift Segments, All Around Drift Wall (–5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	3.88	3.15	9.49	0.0	0.0	0.0	0.0	0.0	0.0
9.7×10^{-4}	0.0	0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-48a. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 73.2 mm/yr, for Three 5-m Drift Segments, Between Spring Lines ($-5\pi/4$ to $5\pi/4$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	13.98	13.30	27.02	0.76	1.23	1.94	0.0	0.0	0.0
9.7×10^{-4}	3.87	2.53	12.28	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	0.23	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-48b. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 73.2 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall ($-5\pi/2$ to $5\pi/2$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m^2			ave. $k = 10^{-13}$ m^2			ave. $k = 10^{-12}$ m^2		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	14.09	13.78	27.02	0.76	1.98	1.94	0.0	0.0	0.0
9.7×10^{-4}	3.87	2.88	12.28	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	0.24	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-49a. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 213.4 mm/yr, for Three 5-m Drift Segments, Between Spring Lines ($-5\pi/4$ to $5\pi/4$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. $k = 10^{-14}$ m^2**			**ave. $k = 10^{-13}$ m^2**			**ave. $k = 10^{-12}$ m^2**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	20.17	19.53	35.70	6.35	3.05	14.84	0.0	0.07	0.04
9.7×10^{-4}	9.78	9.02	23.89	0.0	0.65	0.04	0.0	0.0	0.0
3.3×10^{-4}	2.05	2.04	8.21	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-49b. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 213.4 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall ($-5\pi/2$ to $5\pi/2$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. $k = 10^{-14}$ m^2**			**ave. $k = 10^{-13}$ m^2**			**ave. $k = 10^{-12}$ m^2**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	20.31	19.94	35.71	6.35	4.07	14.84	0.0	0.07	0.04
9.7×10^{-4}	9.82	9.46	23.89	0.0	0.97	0.04	0.0	0.0	0.0
3.3×10^{-4}	2.05	2.10	8.21	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-50a. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 500 mm/yr, for Three 5-m Drift Segments, Between Spring Lines ($-5\pi/4$ to $5\pi/4$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. *k* = 10^{-14} m²**			**ave. *k* = 10^{-13} m²**			**ave. *k* = 10^{-12} m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	23.24	22.90	39.45	11.83	10.03	23.73	1.16	0.92	0.24
9.7×10^{-4}	14.40	14.80	31.40	1.79	1.81	6.95	0.0	0.0	0.0
3.3×10^{-4}	8.52	0.57	18.72	0.0	0.07	0.0	0.0	0.0	0.0

Table 2-50b. Part 2: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 500 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall ($-5\pi/2$ to $5\pi/2$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. *k* = 10^{-14} m²**			**ave. *k* = 10^{-13} m²**			**ave. *k* = 10^{-12} m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	23.40	24.82	39.68	11.90	10.61	23.73	0.0	1.39	0.24
9.7×10^{-4}	15.34	16.46	31.42	1.79	2.19	6.95	0.0	0.0	0.0
3.3×10^{-4}	9.62	1.39	18.72	0.0	0.07	0.0	0.0	0.0	0.0

Table 2-51a. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 14.6 mm/yr, for Three 5-m Drift Segments, Between Spring Lines (–5π/4 to 5π/4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m²			ave. $k = 10^{-13}$ m²			ave. $k = 10^{-12}$ m²		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	8.24	10.65	1.80	0.64	3.45	0.0	0.0	0.0	0.0
9.7×10^{-4}	1.50	5.86	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	1.55	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-51b. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 14.6 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall (–5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	ave. $k = 10^{-14}$ m²			ave. $k = 10^{-13}$ m²			ave. $k = 10^{-12}$ m²		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	8.24	10.65	1.80	0.64	3.45	0.0	0.0	0.0	0.0
9.7×10^{-4}	1.50	5.86	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.0	1.55	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-52a. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 73.2 mm/yr, for Yhree 5-m Drift Segments, Between Spring Lines (–5π/4 to 5π/4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. *k* = 10^{-14} m²**			**ave. *k* = 10^{-13} m²**			**ave. *k* = 10^{-12} m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	22.85	18.29	18.44	4.22	8.27	0.002	0.0	0.0	0.0
9.7×10^{-4}	11.38	9.10	2.86	0.09	4.10	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.83	5.19	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-52b. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 73.2 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall (–5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. *k* = 10^{-14} m²**			**ave. *k* = 10^{-13} m²**			**ave. *k* = 10^{-12} m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	22.85	18.29	22.14	4.22	8.27	0.73	0.0	0.0	0.0
9.7×10^{-4}	11.38	9.10	6.63	0.09	4.10	0.0	0.0	0.0	0.0
3.3×10^{-4}	0.83	5.19	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-53a. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 213.4 mm/yr, for Three 5-m Drift Segments, Between Spring Lines (–5π/4 to 5π/4 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. $k = 10^{-14}$ m²**			**ave. $k = 10^{-13}$ m²**			**ave. $k = 10^{-12}$ m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	29.50	24.00	33.73	11.96	12.07	2.57	1.26	5.24	0.0
9.7×10^{-4}	22.28	14.30	18.23	2.08	6.58	0.0	0.0	0.0	0.0
3.3×10^{-4}	10.11	6.74	2.20	0.0	2.98	0.0	0.0	0.0	0.0

Table 2-53b. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 213.4 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall (–5π/2 to 5π/2 meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. $k = 10^{-14}$ m²**			**ave. $k = 10^{-13}$ m²**			**ave. $k = 10^{-12}$ m²**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	29.50	24.00	36.86	11.96	12.07	5.33	1.26	5.24	0.0
9.7×10^{-4}	22.28	14.30	22.08	2.08	6.58	0.03	0.0	0.0	0.0
3.3×10^{-4}	10.11	6.74	5.22	0.0	2.98	0.0	0.0	0.0	0.0

Table 2-54a. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 500 mm/yr, for Three 5-m Drift Segments, Between Spring Lines ($-5\pi/4$ to $5\pi/4$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. $k = 10^{-14}$ m^2**			**ave. $k = 10^{-13}$ m^2**			**ave. $k = 10^{-12}$ m^2**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	32.38	27.20	38.65	18.86	15.85	10.88	3.27	7.53	0.0
9.7×10^{-4}	28.35	20.71	31.39	7.32	8.28	0.50	0.0	0.0	0.0
3.3×10^{-4}	19.15	11.63	12.55	0.38	4.69	0.0	0.0	0.0	0.0

Table 2-54b. Part 3: Rate of Seepage into Drift as a Function of Mean Permeability and van Genuchten α for a Percolation Flux of 500 mm/yr, for Three 5-m Drift Segments, All Around Drift Wall ($-5\pi/2$ to $5\pi/2$ meters). The seepage rate is given as percentage (%) of percolation flow over the entire 15-m section.

vG α (1/Pa)	**ave. $k = 10^{-14}$ m^2**			**ave. $k = 10^{-13}$ m^2**			**ave. $k = 10^{-12}$ m^2**		
drift segment (m)	0–5	5–10	10–15	0–5	5–10	10–15	0–5	5–10	10–15
3.3×10^{-3}	32.38	27.20	41.46	18.86	15.85	14.92	3.27	7.53	0.29
9.7×10^{-4}	28.35	20.71	34.72	7.32	8.28	2.85	0.0	0.0	0.0
3.3×10^{-4}	19.15	11.63	15.50	0.38	4.69	0.0	0.0	0.0	0.0

Table 2-55. Statistics for Seepage Distributions at Different Fluxes.

q (mm/yr)	mean f_s	std.dev. f_s	mean Q_s (m^3/yr)	std.dev. Q_s (m^3/yr)
14.6	0.167	0.283	0.0402	0.0364
73.2	0.403	0.427	0.361	0.352
213.	0.590	0.398	1.54	1.38
500.	0.743	0.386	4.50	3.77

Table 2-56. Additional Points Used for Definition of the Base-case Seepage Abstraction.

q (mm/yr)	mean f_s	std.dev. f_s	mean Q_s (m^3/yr)	std.dev. Q_s (m^3/yr)
0.	0.	0.	0.	0.
2.2	0.	0.	0.	0.
3.9	0.00844	0.0144	0.0123	0.0111
9.2	0.0462	0.0785	0.0124	0.0112
980.	1.	0.	extrapolate	extrapolate
>980.	1.	0.	extrapolate	extrapolate

Table 2-57. Parameter Sets and Simulations Used in Infiltration Sensitivity Study.

LBNL Simulation Designation	Infiltration Scenario	Water Table
Qbd5.dat	Present-day infiltration divided by 5	Base Case (~730 m)
Qbd5_f1.dat	Long term divided by 5	810m
Qbd5_f2.dat	Superpluvial divided by 5	850m
Qb.dat	Present-day infiltration	Base Case
Qb_f1.dat	Long term	810m
Qb_f2.dat	Superpluvial	850m
Qbx5.dat	Base case multiplied by 5	Base Case
Qbx5_f1.dat	Long term multiplied by 5	810m
Qbx5_f2.dat	Superpluvial multiplied by 5	850m

Table 2-58. (a) Matrix and (b) Fracture Parameter Sets for the Infiltration Sensitivity Study (present-day infiltration divided by five). (DTN: LB971100001254.003)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{lrm} (-)	matrix satiated saturation S_{lsm} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.232	0.13	1.00
tcw12	5.40E-18	0.066	1.29E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	7.30E-07	0.426	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.228	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.492	0.14	1.00
ptn23	5.40E-14	0.353	3.66E-05	0.279	0.17	1.00
ptn24	8.80E-14	0.469	4.30E-05	0.326	0.10	1.00
ptn25	7.73E-14	0.464	1.96E-04	0.272	0.10	1.00
tsw31	6.87E-16	0.042	1.33E-05	0.230	0.11	1.00
tsw32	3.63E-16	0.146	2.32E-05	0.278	0.04	1.00
tsw33	2.11E-17	0.135	6.44E-06	0.248	0.06	1.00
tsw34	6.75E-18	0.089	1.14E-06	0.323	0.18	1.00
tsw35	7.97E-18	0.115	3.16E-06	0.232	0.08	1.00
tsw36	9.62E-17	0.092	6.92E-07	0.414	0.18	1.00
tsw37	6.69E-18	0.020	1.34E-06	0.372	0.50	1.00
ch1zc	6.00E-17	0.193	6.90E-07	0.359	0.36	1.00
ch2zc	1.88E-18	0.240	2.49E-06	0.221	0.20	1.00
ch3zc	1.88E-18	0.240	2.49E-06	0.221	0.20	1.00
ch4zc	1.33E-17	0.169	7.83E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.187	0.04	1.00
ch2vc	5.50E-14	0.321	8.65E-05	0.222	0.06	1.00
ch3vc	5.50E-14	0.321	8.65E-05	0.222	0.06	1.00
ch4vc	5.50E-14	0.321	8.65E-05	0.222	0.06	1.00
pp3vp	1.24E-15	0.274	1.81E-05	0.310	0.07	1.00
bf3vb	1.24E-15	0.274	1.81E-05	0.310	0.07	1.00
tm3vt	1.24E-15	0.274	1.81E-05	0.310	0.07	1.00
pp2zp	9.40E-18	0.197	1.71E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.71E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-18	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-18	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{lrf} (-)	fracture satiated saturation S_{lsf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.28E-11	6.02E-12	2.33E-04	2.37E-04	0.492	0.01	1.00	1.020	5.00E-04
tcw12	1.38E-11	6.02E-12	2.99E-04	2.37E-04	0.492	0.01	1.00	1.830	5.00E-04
tcw13	2.81E-12	2.40E-13	7.05E-05	9.12E-05	0.492	0.01	1.00	1.270	5.00E-04
ptn21	5.19E-13	5.19E-13	4.84E-05	1.10E-03	0.492	0.01	1.00	0.870	5.00E-01
ptn22	1.96E-13	1.96E-13	4.83E-05	1.85E-03	0.492	0.01	1.00	0.290	5.00E-01
ptn23	2.55E-13	2.55E-13	1.30E-04	3.45E-03	0.492	0.01	1.00	0.290	5.00E-01
ptn24	6.12E-14	6.12E-14	6.94E-05	9.13E-04	0.492	0.01	1.00	0.630	5.00E-01
ptn25	7.73E-14	7.73E-14	3.86E-05	1.96E-04	0.272	0.10	1.00	0.650	5.00E-01
tsw31	1.06E-11	1.00E-12	8.92E-05	1.49E-04	0.491	0.01	1.00	1.100	5.00E-04
tsw32	1.50E-11	7.08E-13	1.29E-04	9.13E-05	0.487	0.01	1.00	1.010	1.58E-02
tsw33	2.65E-11	8.91E-13	1.05E-04	1.63E-04	0.492	0.01	1.00	0.690	5.00E-04
tsw34	6.69E-12	4.27E-13	1.24E-04	9.73E-05	0.492	0.01	1.00	1.880	5.00E-04
tsw35	3.79E-12	9.12E-13	3.29E-04	1.26E-04	0.492	0.01	1.00	1.810	5.00E-04
tsw36	1.20E-12	1.20E-12	3.99E-04	1.32E-04	0.492	0.01	1.00	2.100	5.00E-04
tsw37	1.20E-12	1.20E-12	4.92E-04	1.19E-04	0.492	0.01	1.00	2.880	5.00E-04
ch1zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
ch2zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
ch3zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
ch4zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
ch1vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
ch2vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
ch3vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
ch4vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
pp3vp	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.492	0.01	1.00	0.420	5.00E-04
bf3vb	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.492	0.01	1.00	0.420	5.00E-04
tm3vt	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.492	0.01	1.00	0.420	5.00E-04
pp2zp	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
bf2zb	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
tsw37/pcF37	3.04E-19	3.04E-18	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-18	1.20E-17	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-19	3.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-19	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-19	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-19	8.40E-18	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw73/pwF37	3.04E-18	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-59. (a) Matrix and (b) Fracture Parameter Sets for the DKM Base Case (present-day infiltration). (DTN: LB971100001254.002)

Model Layer / Block Name	matrix permeability	matrix porosity	matrix van Genuchten alpha	matrix van Genuchten m (λ)	matrix residual saturation	matrix satiated saturation
	k_m (m^2)	ϕ_m (-)	α_m (1/Pa)	m_m (-)	S_{rm} (-)	S_{sm} (-)
tcw11	5.37E-18	0.066	1.18E-06	0.232	0.13	1.00
tcw12	5.37E-18	0.066	1.32E-06	0.236	0.13	1.00
tcw13	4.90E-17	0.140	6.46E-07	0.427	0.33	1.00
ptn21	3.09E-14	0.369	3.80E-05	0.231	0.10	1.00
ptn22	3.02E-15	0.234	8.71E-06	0.488	0.14	1.00
ptn23	8.32E-14	0.353	4.57E-05	0.287	0.17	1.00
ptn24	1.15E-13	0.469	4.27E-05	0.349	0.10	1.00
ptn25	2.46E-13	0.464	1.95E-04	0.279	0.10	1.00
tsw31	4.90E-17	0.042	1.00E-05	0.237	0.11	1.00
tsw32	2.75E-16	0.146	2.29E-05	0.273	0.04	1.00
tsw33	1.15E-17	0.135	6.76E-06	0.248	0.06	1.00
tsw34	4.07E-18	0.089	1.02E-06	0.322	0.18	1.00
tsw35	1.55E-17	0.115	3.31E-06	0.229	0.08	1.00
tsw36	8.91E-17	0.092	7.41E-07	0.414	0.18	1.00
tsw37	1.29E-17	0.020	1.55E-06	0.387	0.50	1.00
ch1zc	1.38E-17	0.193	8.32E-07	0.366	0.36	1.00
ch2zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch3zc	9.12E-18	0.240	1.95E-06	0.220	0.20	1.00
ch4zc	1.55E-17	0.169	7.76E-07	0.477	0.33	1.00
ch1vc	1.32E-12	0.265	6.61E-05	0.190	0.04	1.00
ch2vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch3vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
ch4vc	2.57E-13	0.321	7.41E-05	0.224	0.06	1.00
pp3vp	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
bf3vb	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
tm3vt	2.82E-15	0.274	1.74E-05	0.311	0.07	1.00
pp2zp	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
bf2zb	5.75E-17	0.197	1.66E-06	0.316	0.18	1.00
tsw37/pcM37	6.08E-18	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-18	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability	horizontal fracture permeability	fracture porosity	fracture van Genuchten alpha	fracture van Genuchten m (λ)	fracture residual saturation	fracture satiated saturation	fracture frequency	fracture-matrix connection area modification factor
	k_f (m^2)	k_f (m^2)	ϕ_f (-)	α_f (1/Pa)	m_f (-)	S_{rf} (-)	S_{sf} (-)	f (1/m)	X_{fm} (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	2.95E-04	0.492	0.01	1.00	1.020	4.90E-04
tcw12	1.38E-11	6.03E-12	2.99E-04	2.95E-04	0.492	0.01	1.00	1.830	4.90E-04
tcw13	2.82E-12	2.40E-13	7.05E-05	9.12E-05	0.492	0.01	1.00	1.270	4.90E-04
ptn21	5.25E-13	5.25E-13	4.84E-05	1.10E-03	0.492	0.01	1.00	0.870	1.10E-01
ptn22	1.95E-13	1.95E-13	4.83E-05	1.82E-03	0.492	0.01	1.00	0.290	7.08E-01
ptn23	2.57E-13	2.57E-13	1.30E-04	3.39E-03	0.492	0.01	1.00	0.290	6.92E-01
ptn24	6.17E-14	6.17E-14	6.94E-05	9.33E-04	0.492	0.01	1.00	0.630	4.79E-01
ptn25	7.76E-14	7.76E-14	3.86E-05	1.95E-04	0.279	0.01	1.00	0.650	4.79E-01
tsw31	1.07E-11	1.00E-12	8.92E-05	3.98E-05	0.481	0.01	1.00	1.100	5.01E-01
tsw32	1.51E-11	7.08E-13	1.29E-04	9.33E-05	0.488	0.01	1.00	1.010	2.88E-05
tsw33	2.63E-11	8.91E-13	1.05E-04	1.78E-04	0.492	0.01	1.00	0.690	7.94E-05
tsw34	6.76E-12	4.27E-13	1.24E-04	9.77E-05	0.492	0.01	1.00	1.880	1.55E-04
tsw35	3.80E-12	9.12E-13	3.29E-04	1.10E-04	0.492	0.01	1.00	1.810	7.76E-02
tsw36	1.20E-12	1.20E-12	3.99E-04	1.32E-04	0.492	0.01	1.00	2.100	4.79E-05
tsw37	1.20E-12	1.20E-12	4.92E-04	1.18E-04	0.492	0.01	1.00	2.880	4.90E-04
ch1zc	2.40E-14	2.40E-14	1.10E-05	1.12E-03	0.492	0.01	1.00	0.067	1.82E-01
ch2zc	1.18E-14	1.18E-14	1.10E-05	1.23E-03	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	1.18E-14	1.18E-14	1.10E-05	1.23E-03	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	1.55E-14	1.55E-14	1.10E-05	1.15E-03	0.492	0.01	1.00	0.067	5.01E-01
ch1vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	4.90E-01
ch2vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	4.90E-01
ch3vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	4.90E-01
ch4vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	4.90E-01
pp3vp	6.92E-13	6.92E-13	7.14E-05	1.41E-03	0.492	0.01	1.00	0.420	5.13E-04
bf3vb	6.92E-13	6.92E-13	7.14E-05	1.41E-03	0.492	0.01	1.00	0.420	5.13E-04
tm3vt	6.92E-13	6.92E-13	7.14E-05	1.41E-03	0.492	0.01	1.00	0.420	5.13E-04
pp2zp	6.46E-14	6.46E-14	1.10E-05	3.72E-04	0.492	0.01	1.00	0.067	4.90E-01
bf2zb	6.46E-14	6.46E-14	1.10E-05	3.72E-04	0.492	0.01	1.00	0.067	4.90E-01
tsw37/pcF37	3.04E-18	3.04E-18	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-17	1.20E-17	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-18	3.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-18	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw73/pwF37	3.04E-18	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-60. (a) Matrix and (b) Fracture Parameter Sets for the DKM Base Case (present-day infiltration multiplied by five). (DTN: LB971100001254.001)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.232	0.13	1.00
tcw12	5.40E-18	0.066	1.29E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	7.30E-07	0.426	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.228	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.492	0.14	1.00
ptn23	5.40E-14	0.353	3.66E-05	0.279	0.17	1.00
ptn24	8.80E-14	0.469	4.30E-05	0.326	0.10	1.00
ptn25	7.73E-14	0.464	1.96E-04	0.272	0.10	1.00
tsw31	6.87E-16	0.042	1.33E-05	0.230	0.11	1.00
tsw32	3.63E-16	0.146	2.32E-05	0.278	0.04	1.00
tsw33	2.11E-17	0.135	6.44E-06	0.248	0.06	1.00
tsw34	6.75E-18	0.089	1.14E-06	0.323	0.18	1.00
tsw35	7.97E-18	0.115	3.16E-06	0.232	0.08	1.00
tsw36	9.62E-17	0.092	6.92E-07	0.414	0.18	1.00
tsw37	6.69E-18	0.020	1.34E-06	0.372	0.50	1.00
ch1zc	6.00E-17	0.193	6.90E-07	0.359	0.36	1.00
ch2zc	1.88E-18	0.240	2.49E-06	0.221	0.20	1.00
ch3zc	1.88E-18	0.240	2.49E-06	0.221	0.20	1.00
ch4zc	1.33E-17	0.169	7.83E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.187	0.04	1.00
ch2vc	5.50E-14	0.321	8.65E-05	0.222	0.06	1.00
ch3vc	5.50E-14	0.321	8.65E-05	0.222	0.06	1.00
ch4vc	5.50E-14	0.321	8.65E-05	0.222	0.06	1.00
pp3vp	1.24E-15	0.274	1.81E-05	0.310	0.07	1.00
bf3vb	1.24E-15	0.274	1.81E-05	0.310	0.07	1.00
tm3vt	1.24E-15	0.274	1.81E-05	0.310	0.07	1.00
pp2zp	9.40E-18	0.197	1.71E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.71E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-18	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-18	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-11	6.21E-12	2.33E-04	2.37E-04	0.492	0.01	1.00	1.020	5.00E-04
tcw12	1.38E-11	6.03E-12	2.99E-04	2.37E-04	0.492	0.01	1.00	1.830	5.00E-04
tcw13	2.82E-12	2.40E-13	7.05E-05	9.12E-05	0.492	0.01	1.00	1.270	5.00E-04
ptn21	5.25E-13	5.25E-13	4.84E-05	1.10E-03	0.492	0.01	1.00	0.870	5.00E-01
ptn22	1.95E-13	1.95E-13	4.83E-05	1.85E-03	0.492	0.01	1.00	0.290	5.00E-01
ptn23	2.57E-13	2.57E-13	1.30E-04	3.45E-03	0.492	0.01	1.00	0.290	5.00E-01
ptn24	6.17E-14	6.17E-14	6.94E-05	9.13E-04	0.492	0.01	1.00	0.630	5.00E-01
ptn25	7.76E-14	7.76E-14	3.86E-05	1.64E-04	0.286	0.01	1.00	0.650	5.00E-01
tsw31	1.07E-11	1.00E-12	8.92E-05	1.36E-04	0.491	0.01	1.00	1.100	5.00E-04
tsw32	1.51E-11	7.08E-13	1.29E-04	6.13E-05	0.484	0.01	1.00	1.010	4.91E-01
tsw33	2.63E-11	8.91E-13	1.05E-04	1.68E-04	0.492	0.01	1.00	0.690	1.58E-04
tsw34	6.76E-12	4.27E-13	1.24E-04	9.50E-05	0.492	0.01	1.00	1.880	5.00E-03
tsw35	3.80E-12	9.12E-13	3.29E-04	1.27E-04	0.492	0.01	1.00	1.810	5.00E-04
tsw36	1.20E-12	1.20E-12	3.99E-04	1.32E-04	0.492	0.01	1.00	2.100	1.65E-04
tsw37	1.20E-12	1.20E-12	4.92E-04	1.19E-04	0.492	0.01	1.00	2.880	5.00E-04
ch1zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
ch2zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	1.00E+00
ch3zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	1.00E+00
ch4zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
ch1vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
ch2vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
ch3vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
ch4vc	2.88E-13	2.88E-13	7.14E-05	1.18E-03	0.492	0.01	1.00	0.420	5.00E-01
pp3vp	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.492	0.01	1.00	0.420	5.00E-04
bf3vb	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.492	0.01	1.00	0.420	5.00E-04
tm3vt	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.492	0.01	1.00	0.420	5.00E-04
pp2zp	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
bf2zb	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.492	0.01	1.00	0.067	5.00E-01
tsw37/pcF37	6.08E-17	6.08E-18	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-16	1.20E-17	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-17	3.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-17	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw73/pwF37	3.04E-18	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-61. Average Percolation Fluxes Over the Six Subregions of the Repository for the Infiltration-sensitivity Runs (nomenclature for the different cases is given in Table 2-57). (DTN: MO9806SPAHGRAM.001)

	Mean Percolation Flux Over Each Repository Subregion (mm/year)								
Repository Subregion	**P (Qb)**	**LTA (Qb_f1)**	**SP (Qb_f2)**	**P/5 (Qbd5)**	**LTA/5 (Qbd5_f1)**	**SP/5 (Qbd5_f2)**	**Px5 (Qbx5)**	**LTAx5 (Qbx5_f1)**	**SPx5 (Qbx5_f2)**
CC	11	55	140	2.2	11	21	57	270	670
NE	3.9	31	120	.77	6.0	24	20	160	600
NW	9.2	46	100	1.7	8.8	20	47	230	500
SC	11	51	120	2.1	10	23	55	250	580
SE	5.0	34	97	.99	6.6	19	25	170	500
SW	5.8	33	81	1.1	6.2	16	30	170	400

Table 2-62. Table of 15 Runs Using the DKM/Weeps Model.

LBNL Simulation Designation	Parameter Set/ Calibration	Infiltration scenario	Water Table
kmid3_p	minimum k_f, fitted X_{fm}	Present-day infiltration divided by 3	Base case (~730 m)
kmid3f1	minimum k_f, fitted X_{fm}	Long-term infiltration divided by 3	810m
kmid3f2	minimum k_f, fitted X_{fm}	Superpluvial infiltration divided by 3	850m
kmix3_p	minimum k_f, fitted X_{fm}	Present-day infiltration multiplied by 3	Base case (~730 m)
kmix3f1	minimum k_f, fitted X_{fm}	Long-term infiltration multiplied by 3	810m
kmix3f2	minimum k_f, fitted X_{fm}	Superpluvial infiltration multiplied by 3	850m
kmnqb_p	mean k_f Fitted X_{fm}	Long-term infiltration	Base case (~730 m)
kmnqbf1	mean k_f Fitted X_{fm}	Long-term infiltration	810m
kmnqbf2	mean k_f Fitted X_{fm}	Superpluvial infiltration	850m
kmxd3_p	maximum k_f, fitted X_{fm}	Present-day infiltration divided by 3	Base case (~730 m)
kmxd3f1	maximum k_f, fitted X_{fm}	Long-term infiltration divided by 3	810m
kmxd3f2	maximum k_f, fitted X_{fm}	Superpluvial infiltration divided by 3	850m
kmxx3_p	maximum k_f, fitted X_{fm}	Present-day infiltration multiplied by 3	Base case (~730 m)
kmxx3f1	maximum k_f, fitted X_{fm}	Long-term infiltration multiplied by 3	810m
kmxx3f2	maximum k_f, fitted X_{fm}	Superpluvial infiltration multiplied by 3	850m

Table 2-63. (a) Matrix and (b) Fracture Parameter Sets for the DKM/Weeps Model (minimum k_f, present-day infiltration divided by three). (DTN: LB971212001254.007)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw12	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	2.30E-07	0.437	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.222	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.488	0.14	1.00
ptn23	5.40E-14	0.353	2.59E-05	0.237	0.17	1.00
ptn24	8.80E-14	0.469	3.41E-05	0.299	0.10	1.00
ptn25	3.20E-13	0.464	9.80E-05	0.227	0.10	1.00
tsw31	7.60E-17	0.042	3.35E-06	0.203	0.11	1.00
tsw32	1.70E-16	0.146	2.04E-05	0.251	0.04	1.00
tsw33	2.00E-17	0.135	6.57E-06	0.249	0.06	1.00
tsw34	4.00E-18	0.089	6.40E-07	0.320	0.18	1.00
tsw35	2.30E-17	0.115	2.73E-06	0.227	0.08	1.00
tsw36	9.62E-17	0.092	4.70E-07	0.416	0.18	1.00
tsw37	5.00E-18	0.020	1.00E-07	0.368	0.50	1.00
ch1zc	6.00E-18	0.193	1.90E-07	0.359	0.36	1.00
ch2zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch3zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch4zc	8.40E-18	0.169	1.50E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.227	0.04	1.00
ch2vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch3vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch4vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
pp3vp	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
bf3vb	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
tm3vt	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
pp2zp	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-19	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-19	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-20	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-19	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-12	6.03E-12	2.33E-04	2.37E-03	0.633	0.01	1.00	1.020	1.45E-01
tcw12	1.26E-12	6.03E-12	2.99E-04	2.37E-03	0.633	0.01	1.00	1.830	1.45E-01
tcw13	8.13E-13	2.40E-13	7.05E-05	9.12E-04	0.633	0.01	1.00	1.270	1.45E-01
ptn21	2.19E-13	5.25E-13	4.84E-05	1.10E-03	0.633	0.01	1.00	0.870	1.45E-01
ptn22	2.24E-14	1.95E-13	4.83E-05	1.85E-03	0.633	0.01	1.00	0.290	1.45E-01
ptn23	9.77E-14	2.57E-13	1.30E-04	3.45E-03	0.633	0.01	1.00	0.290	1.45E-01
ptn24	1.41E-14	6.17E-14	6.94E-05	9.13E-04	0.633	0.01	1.00	0.630	1.45E-01
ptn25	5.62E-14	7.76E-14	3.86E-05	1.11E-03	0.633	0.01	1.00	0.650	1.45E-01
tsw31	3.23E-13	1.00E-12	8.92E-05	1.54E-03	0.633	0.01	1.00	1.100	1.45E-01
tsw32	9.10E-13	7.08E-13	1.29E-04	1.42E-03	0.633	0.01	1.00	1.010	1.45E-01
tsw33	1.51E-12	8.91E-13	1.05E-04	1.73E-03	0.633	0.01	1.00	0.690	1.45E-01
tsw34	7.08E-13	4.27E-13	1.24E-04	9.73E-04	0.633	0.01	1.00	1.880	1.45E-01
tsw35	1.38E-12	9.12E-13	3.29E-04	1.26E-03	0.633	0.01	1.00	1.810	1.45E-01
tsw36	2.51E-13	1.20E-12	3.99E-04	1.32E-03	0.633	0.01	1.00	2.100	1.45E-01
tsw37	1.20E-13	1.20E-12	4.92E-04	1.19E-03	0.633	0.01	1.00	2.880	1.45E-01
ch1zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.45E-01
ch2zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.45E-01
ch3zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.45E-01
ch4zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.45E-01
ch1vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.45E-01
ch2vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.45E-01
ch3vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.45E-01
ch4vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.45E-01
pp3vp	7.08E-14	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	1.45E-01
bf3vb	7.08E-14	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	1.45E-01
tm3vt	7.08E-14	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	1.45E-01
pp2zp	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.45E-01
bf2zb	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.45E-01
tsw37/pcF37	3.04E-19	3.04E-19	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-18	1.20E-18	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-19	3.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-19	8.40E-19	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-19	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-64. (a) Matrix and (b) Fracture Parameter Sets for the DKM/Weeps Model (maximum k_f, present-day infiltration divided by three). (DTN: LB971212001254.009)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{lrm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw12	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	2.30E-07	0.437	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.222	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.488	0.14	1.00
ptn23	5.40E-14	0.353	2.59E-05	0.237	0.17	1.00
ptn24	8.80E-14	0.469	3.41E-05	0.299	0.10	1.00
ptn25	3.20E-13	0.464	9.80E-05	0.227	0.10	1.00
tsw31	7.60E-17	0.042	3.35E-06	0.203	0.11	1.00
tsw32	1.70E-16	0.146	2.04E-05	0.251	0.04	1.00
tsw33	2.00E-17	0.135	6.57E-06	0.249	0.06	1.00
tsw34	4.00E-18	0.089	6.40E-07	0.320	0.18	1.00
tsw35	2.30E-17	0.115	2.73E-06	0.227	0.08	1.00
tsw36	9.62E-17	0.092	4.70E-07	0.416	0.18	1.00
tsw37	5.00E-18	0.020	1.00E-07	0.368	0.50	1.00
ch1zc	6.00E-18	0.193	1.90E-07	0.359	0.36	1.00
ch2zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch3zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch4zc	8.40E-18	0.169	1.50E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.227	0.04	1.00
ch2vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch3vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch4vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
pp3vp	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
bf3vb	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
tm3vt	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
pp2zp	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-19	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-19	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-20	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-19	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{lrf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-10	6.03E-12	2.33E-04	2.37E-03	0.633	0.01	1.00	1.020	5.09E+00
tcw12	1.51E-10	6.03E-12	2.99E-04	2.37E-03	0.633	0.01	1.00	1.830	5.09E+00
tcw13	9.78E-12	2.40E-13	7.05E-05	9.12E-04	0.633	0.01	1.00	1.270	5.09E+00
ptn21	1.26E-12	5.25E-13	4.84E-05	1.10E-03	0.633	0.01	1.00	0.870	5.09E+00
ptn22	1.70E-12	1.95E-13	4.83E-05	1.85E-03	0.633	0.01	1.00	0.290	5.09E+00
ptn23	6.76E-13	2.57E-13	1.30E-04	3.45E-03	0.633	0.01	1.00	0.290	5.09E+00
ptn24	2.69E-13	6.17E-14	6.94E-05	9.13E-04	0.633	0.01	1.00	0.630	5.09E+00
ptn25	1.07E-13	7.76E-14	3.86E-05	1.11E-03	0.633	0.01	1.00	0.650	5.09E+00
tsw31	3.54E-10	1.00E-12	8.92E-05	1.54E-03	0.633	0.01	1.00	1.100	5.09E+00
tsw32	2.51E-10	7.08E-13	1.29E-04	1.42E-03	0.633	0.01	1.00	1.010	5.09E+00
tsw33	4.57E-10	8.91E-13	1.05E-04	1.73E-03	0.633	0.01	1.00	0.690	5.09E+00
tsw34	6.46E-11	4.27E-13	1.24E-04	9.73E-04	0.633	0.01	1.00	1.880	5.09E+00
tsw35	1.05E-11	9.12E-13	3.29E-04	1.26E-03	0.633	0.01	1.00	1.810	5.09E+00
tsw36	5.74E-12	1.20E-12	3.99E-04	1.32E-03	0.633	0.01	1.00	2.100	5.09E+00
tsw37	1.20E-11	1.20E-12	4.92E-04	1.19E-03	0.633	0.01	1.00	2.880	5.09E+00
ch1zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	5.09E+00
ch2zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	5.09E+00
ch3zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	5.09E+00
ch4zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	5.09E+00
ch1vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	5.09E+00
ch2vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	5.09E+00
ch3vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	5.09E+00
ch4vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	5.09E+00
pp3vp	7.08E-12	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	5.09E+00
bf3vb	7.08E-12	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	5.09E+00
tm3vt	7.08E-12	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	5.09E+00
pp2zp	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	5.09E+00
bf2zb	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	5.09E+00
tsw37/pcF37	3.04E-19	3.04E-19	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-18	1.20E-18	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-19	3.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-19	8.40E-19	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-19	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-65. (a) Matrix and (b) Fracture Parameter Sets for the DKM/Weeps Model (mean k_f, present-day infiltration). (DTN: LB971212001254.006)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw12	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	2.30E-07	0.437	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.222	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.488	0.14	1.00
ptn23	5.40E-14	0.353	2.59E-05	0.237	0.17	1.00
ptn24	8.80E-14	0.469	3.41E-05	0.299	0.10	1.00
ptn25	3.20E-13	0.464	9.80E-05	0.227	0.10	1.00
tsw31	7.60E-17	0.042	3.35E-06	0.203	0.11	1.00
tsw32	1.70E-16	0.146	2.04E-05	0.251	0.04	1.00
tsw33	2.00E-17	0.135	6.57E-06	0.249	0.06	1.00
tsw34	4.00E-18	0.089	6.40E-07	0.320	0.18	1.00
tsw35	2.30E-17	0.115	2.73E-06	0.227	0.08	1.00
tsw36	9.62E-17	0.092	4.70E-07	0.416	0.18	1.00
tsw37	5.00E-18	0.020	1.00E-07	0.368	0.50	1.00
ch1zc	6.00E-18	0.193	1.90E-07	0.359	0.36	1.00
ch2zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch3zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch4zc	8.40E-18	0.169	1.50E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.227	0.04	1.00
ch2vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch3vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch4vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
pp3vp	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
bf3vb	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
tm3vt	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
pp2zp	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-18	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-18	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-11	6.03E-12	2.33E-04	2.37E-03	0.633	0.01	1.00	1.020	7.68E-02
tcw12	1.38E-11	6.03E-12	2.99E-04	2.37E-03	0.633	0.01	1.00	1.830	7.68E-02
tcw13	2.82E-12	2.40E-13	7.05E-05	9.12E-04	0.633	0.01	1.00	1.270	7.68E-02
ptn21	5.25E-13	5.25E-13	4.84E-05	1.10E-03	0.633	0.01	1.00	0.870	7.68E-02
ptn22	1.95E-13	1.95E-13	4.83E-05	1.85E-03	0.633	0.01	1.00	0.290	7.68E-02
ptn23	2.57E-13	2.57E-13	1.30E-04	3.45E-03	0.633	0.01	1.00	0.290	7.68E-02
ptn24	6.17E-14	6.17E-14	6.94E-05	9.13E-04	0.633	0.01	1.00	0.630	7.68E-02
ptn25	7.76E-14	7.76E-14	3.86E-05	1.11E-03	0.633	0.01	1.00	0.650	7.68E-02
tsw31	1.07E-11	1.00E-12	8.92E-05	1.54E-03	0.633	0.01	1.00	1.100	7.68E-02
tsw32	1.51E-11	7.08E-13	1.29E-04	1.42E-03	0.633	0.01	1.00	1.010	7.68E-02
tsw33	2.63E-11	8.91E-13	1.05E-04	1.73E-03	0.633	0.01	1.00	0.690	7.68E-02
tsw34	6.76E-12	4.27E-13	1.24E-04	9.73E-04	0.633	0.01	1.00	1.880	7.68E-02
tsw35	3.80E-12	9.12E-13	3.29E-04	1.26E-03	0.633	0.01	1.00	1.810	7.68E-02
tsw36	1.20E-12	1.20E-12	3.99E-04	1.32E-03	0.633	0.01	1.00	2.100	7.68E-02
tsw37	1.20E-12	1.20E-12	4.92E-04	1.19E-03	0.633	0.01	1.00	2.880	7.68E-02
ch1zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	7.68E-02
ch2zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	7.68E-02
ch3zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	7.68E-02
ch4zc	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	7.68E-02
ch1vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	7.68E-02
ch2vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	7.68E-02
ch3vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	7.68E-02
ch4vc	1.74E-13	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	7.68E-02
pp3vp	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	7.68E-02
bf3vb	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	7.68E-02
tm3vt	7.08E-13	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	7.68E-02
pp2zp	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	7.68E-02
bf2zb	2.51E-14	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	7.68E-02
tsw37/pcF37	3.04E-18	3.04E-18	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-17	1.20E-17	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-18	3.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-18	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-17	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-66. (a) Matrix and (b) Fracture Parameter Sets for the DKM/Weeps Model (minimum k_f, present-day infiltration multiplied by three). (DTN: LB971212001254.008)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{sm} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw12	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	2.30E-07	0.437	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.222	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.488	0.14	1.00
ptn23	5.40E-14	0.353	2.59E-05	0.237	0.17	1.00
ptn24	8.80E-14	0.469	3.41E-05	0.299	0.10	1.00
ptn25	3.20E-13	0.464	9.80E-05	0.227	0.10	1.00
tsw31	7.60E-17	0.042	3.35E-06	0.203	0.11	1.00
tsw32	1.70E-16	0.146	2.04E-05	0.251	0.04	1.00
tsw33	2.00E-17	0.135	6.57E-06	0.249	0.06	1.00
tsw34	4.00E-18	0.089	6.40E-07	0.320	0.18	1.00
tsw35	2.30E-17	0.115	2.73E-06	0.227	0.08	1.00
tsw36	9.62E-17	0.092	4.70E-07	0.416	0.18	1.00
tsw37	5.00E-18	0.020	1.00E-07	0.368	0.50	1.00
ch1zc	6.00E-18	0.193	1.90E-07	0.359	0.36	1.00
ch2zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch3zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch4zc	8.40E-18	0.169	1.50E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.227	0.04	1.00
ch2vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch3vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch4vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
pp3vp	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
bf3vb	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
tm3vt	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
pp2zp	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-17	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-17	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-17	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-18	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-18	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-12	6.03E-12	2.33E-04	2.37E-03	0.633	0.01	1.00	1.020	9.52E-04
tcw12	1.26E-12	6.03E-12	2.99E-04	2.37E-03	0.633	0.01	1.00	1.830	9.52E-04
tcw13	8.13E-13	2.40E-13	7.05E-05	9.12E-04	0.633	0.01	1.00	1.270	9.52E-04
ptn21	2.19E-13	5.25E-13	4.84E-05	1.10E-03	0.633	0.01	1.00	0.870	9.52E-04
ptn22	2.24E-14	1.95E-13	4.83E-05	1.85E-03	0.633	0.01	1.00	0.290	9.52E-04
ptn23	9.77E-14	2.57E-13	1.30E-04	3.45E-03	0.633	0.01	1.00	0.290	9.52E-04
ptn24	1.41E-14	6.17E-14	6.94E-05	9.13E-04	0.633	0.01	1.00	0.630	9.52E-04
ptn25	5.62E-14	7.76E-14	3.86E-05	1.11E-03	0.633	0.01	1.00	0.650	9.52E-04
tsw31	3.23E-13	1.00E-12	8.92E-05	1.54E-03	0.633	0.01	1.00	1.100	9.52E-04
tsw32	9.10E-13	7.08E-13	1.29E-04	1.42E-03	0.633	0.01	1.00	1.010	9.52E-04
tsw33	1.51E-12	8.91E-13	1.05E-04	1.73E-03	0.633	0.01	1.00	0.690	9.52E-04
tsw34	7.08E-13	4.27E-13	1.24E-04	9.73E-04	0.633	0.01	1.00	1.880	9.52E-04
tsw35	1.38E-12	9.12E-13	3.29E-04	1.26E-03	0.633	0.01	1.00	1.810	9.52E-04
tsw36	2.51E-13	1.20E-12	3.99E-04	1.32E-03	0.633	0.01	1.00	2.100	9.52E-04
tsw37	1.20E-13	1.20E-12	4.92E-04	1.19E-03	0.633	0.01	1.00	2.880	9.52E-04
ch1zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	9.52E-04
ch2zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	9.52E-04
ch3zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	9.52E-04
ch4zc	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	9.52E-04
ch1vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	9.52E-04
ch2vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	9.52E-04
ch3vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	9.52E-04
ch4vc	1.74E-14	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	9.52E-04
pp3vp	7.08E-14	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	9.52E-04
bf3vb	7.08E-14	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	9.52E-04
tm3vt	7.08E-14	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	9.52E-04
pp2zp	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	9.52E-04
bf2zb	2.51E-15	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	9.52E-04
tsw37/pcF37	6.08E-17	6.08E-18	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-16	1.20E-16	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-17	3.50E-17	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-17	4.50E-17	1.10E-04	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-18	4.50E-18	1.10E-04	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-18	8.40E-18	1.10E-04	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-17	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-67. (a) Matrix and (b) Fracture Parameter Sets for the DKM/Weeps Model (maximum k_f, present-day infiltration multiplied by three). (DTN: LB971212001254.010)

Model Layer / Block Name	matrix permeability k_m (m^2)	matrix porosity ϕ_m (-)	matrix van Genuchten alpha α_m (1/Pa)	matrix van Genuchten m (λ) m_m (-)	matrix residual saturation S_{rm} (-)	matrix satiated saturation S_{am} (-)
tcw11	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw12	5.40E-18	0.066	1.15E-06	0.231	0.13	1.00
tcw13	5.00E-17	0.140	2.30E-07	0.437	0.33	1.00
ptn21	1.60E-14	0.369	3.65E-05	0.222	0.10	1.00
ptn22	3.30E-15	0.234	7.56E-06	0.488	0.14	1.00
ptn23	5.40E-14	0.353	2.59E-05	0.237	0.17	1.00
ptn24	8.80E-14	0.469	3.41E-05	0.299	0.10	1.00
ptn25	3.20E-13	0.464	9.80E-05	0.227	0.10	1.00
tsw31	7.60E-17	0.042	3.35E-06	0.203	0.11	1.00
tsw32	1.70E-16	0.146	2.04E-05	0.251	0.04	1.00
tsw33	2.00E-17	0.135	6.57E-06	0.249	0.06	1.00
tsw34	4.00E-18	0.089	6.40E-07	0.320	0.18	1.00
tsw35	2.30E-17	0.115	2.73E-06	0.227	0.08	1.00
tsw36	9.62E-17	0.092	4.70E-07	0.416	0.18	1.00
tsw37	5.00E-18	0.020	1.00E-07	0.368	0.50	1.00
ch1zc	6.00E-18	0.193	1.90E-07	0.359	0.36	1.00
ch2zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch3zc	4.50E-18	0.240	3.94E-06	0.225	0.20	1.00
ch4zc	8.40E-18	0.169	1.50E-07	0.476	0.33	1.00
ch1vc	1.60E-12	0.265	9.80E-05	0.227	0.04	1.00
ch2vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch3vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
ch4vc	5.50E-14	0.321	9.80E-05	0.227	0.06	1.00
pp3vp	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
bf3vb	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
tm3vt	1.90E-15	0.274	1.82E-05	0.313	0.07	1.00
pp2zp	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
bf2zb	9.40E-18	0.197	1.79E-06	0.312	0.18	1.00
tsw37/pcM37	6.08E-19	0.036	3.37E-07	0.372	0.20	1.00
ch1zc/pcM1z	5.40E-19	0.288	1.90E-07	0.359	0.36	1.00
ch2zc/pcM2z	4.50E-20	0.332	4.21E-06	0.228	0.20	1.00
ch2zc/pcM62	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch3zc/pcM3z	4.50E-19	0.332	4.21E-06	0.228	0.20	1.00
ch4zc/pcM4z	8.40E-19	0.266	1.50E-07	0.476	0.33	1.00

(a)

Model Layer / Block Name	vertical fracture permeability k_f (m^2)	horizontal fracture permeability k_f (m^2)	fracture porosity ϕ_f (-)	fracture van Genuchten alpha α_f (1/Pa)	fracture van Genuchten m (λ) m_f (-)	fracture residual saturation S_{rf} (-)	fracture satiated saturation S_{sf} (-)	fracture frequency f (1/m)	fracture-matrix connection area modification factor X_{fm} (-)
tcw11	2.29E-10	6.03E-12	2.33E-04	2.37E-03	0.633	0.01	1.00	1.020	1.30E-02
tcw12	1.51E-10	6.03E-12	2.99E-04	2.37E-03	0.633	0.01	1.00	1.830	1.30E-02
tcw13	9.78E-12	2.40E-13	7.05E-05	9.12E-04	0.633	0.01	1.00	1.270	1.30E-02
ptn21	1.26E-12	5.25E-13	4.84E-05	1.10E-03	0.633	0.01	1.00	0.870	1.30E-02
ptn22	1.70E-12	1.95E-13	4.83E-05	1.85E-03	0.633	0.01	1.00	0.290	1.30E-02
ptn23	6.76E-13	2.57E-13	1.30E-04	3.45E-03	0.633	0.01	1.00	0.290	1.30E-02
ptn24	2.69E-13	6.17E-14	6.94E-05	9.13E-04	0.633	0.01	1.00	0.630	1.30E-02
ptn25	1.07E-13	7.76E-14	3.86E-05	1.11E-03	0.633	0.01	1.00	0.650	1.30E-02
tsw31	3.54E-10	1.00E-12	8.92E-05	1.54E-03	0.633	0.01	1.00	1.100	1.30E-02
tsw32	2.51E-10	7.08E-13	1.29E-04	1.42E-03	0.633	0.01	1.00	1.010	1.30E-02
tsw33	4.57E-10	8.91E-13	1.05E-04	1.73E-03	0.633	0.01	1.00	0.690	1.30E-02
tsw34	6.46E-11	4.27E-13	1.24E-04	9.73E-04	0.633	0.01	1.00	1.880	1.30E-02
tsw35	1.05E-11	9.12E-13	3.29E-04	1.26E-03	0.633	0.01	1.00	1.810	1.30E-02
tsw36	5.74E-12	1.20E-12	3.99E-04	1.32E-03	0.633	0.01	1.00	2.100	1.30E-02
tsw37	1.20E-11	1.20E-12	4.92E-04	1.19E-03	0.633	0.01	1.00	2.880	1.30E-02
ch1zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.30E-02
ch2zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.30E-02
ch3zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.30E-02
ch4zc	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.30E-02
ch1vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.30E-02
ch2vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.30E-02
ch3vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.30E-02
ch4vc	1.74E-12	1.74E-13	7.14E-05	1.18E-03	0.633	0.01	1.00	0.420	1.30E-02
pp3vp	7.08E-12	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	1.30E-02
bf3vb	7.08E-12	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	1.30E-02
tm3vt	7.08E-12	7.08E-13	7.14E-05	1.42E-03	0.633	0.01	1.00	0.420	1.30E-02
pp2zp	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.30E-02
bf2zb	2.51E-13	2.51E-14	1.10E-05	1.14E-03	0.633	0.01	1.00	0.067	1.30E-02
tsw37/pcF37	3.04E-19	3.04E-19	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00
ch1zc/pcF1z	1.20E-18	1.20E-18	1.10E-05	1.90E-07	0.359	0.36	1.00	0.067	1.00E+00
ch2zc/pcF2z	3.50E-19	3.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch2zc/pcF62	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch3zc/pcF3z	4.50E-19	4.50E-19	1.10E-05	4.21E-06	0.228	0.20	1.00	0.067	1.00E+00
ch4zc/pcF4z	8.40E-19	8.40E-19	1.10E-05	1.50E-07	0.476	0.33	1.00	0.067	1.00E+00
tsw37/pwF37	3.04E-19	1.50E-13	4.92E-04	3.37E-07	0.372	0.20	1.00	2.880	1.00E+00

(b)

Table 2-68. Average Percolation Fluxes Over the Six Subregions of the Repository for the DKM/Weeps Runs (nomenclature for the different cases is given in Table 2-62). (DTN: MO9806SPAHGRAM.001)

Repository Subregion	Mean Percolation Flux Over Each Repository Subregion (mm/year)								
	P (kmnqb_p)	LTA (kmnqbf1)	SP (kmnqbf2)	P/3 (kmid3_p)	LTA/3 (kmid3f1)	SP/3 (kmid3f2)	Px3 (kmxx_p)	LTAx3 (kmxxf1)	SPx3 (kmxxf2)
CC	10	53	140	2.2	15	39	34	170	420
NE	3.2	30	120	0.88	10	42	11	90	360
NW	8.2	45	100	1.4	11	28	29	140	320
SC	9.8	50	120	2.0	12	29	33	160	370
SE	4.4	32	96	1.4	12	35	14	98	290
SW	5.4	32	82	1.6	10	27	18	99	250

Table 2-69. Permeabilities (k) and Standard Deviations (σ) for Zeolitic-matrix Units Used in Sensitivity Analysis (these data are not qualified).

Model Layer	USGS Layer	k (m^2)	log k	σ (log k)	log (k + σ)	log (k - σ)	k + σ (m^2)	k - σ (m^2)
ch1zc	Bt1a	1.38E-17	-16.86	1.24	-15.62	-18.10	2.3982E-16	7.9411E-19
ch2zc	same as ch3zc	9.12E-18	-17.04	0.67	-16.37	-17.71	4.2657E-17	1.9498E-18
ch3zc	CHz	9.12E-18	-17.04	0.67	-16.37	-17.71	4.2657E-17	1.9498E-18
ch4zc	Bt	1.55E-17	-16.81	0.41	-16.40	-17.22	3.9841E-17	6.0302E-18
pp2zp	Pp1	5.75E-17	-16.24	0.76	-15.48	-17.00	3.3088E-16	9.9924E-18
bf2bp	same as pp2zp	5.75E-17	-16.24	0.76	-15.48	-17.00	3.3088E-16	9.9924E-18