COMPUTER MODELS FOR TWO DIMENSIONAL SUBTERRANEAN FLOWS AND POLLUTANT TRANSPORT

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FOREWORD

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Detailed input requirements for a hydraulic and solute transport model are described along with an example solution for the movement of a chemical from the soil surface through ground water. Application of the model will permit design evaluation of future land application waste treatment sites.

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ABSTRACT

Computer simulation models were developed for ground-water movement and solute transport under two dimensional geometry. The hydraulic model is capable to predict the flow of soil water in both saturated and unsaturated regions, and for both transient and steady state cases. The transport model is capable to project the solute concentration or pollutant concentration, both in soils and soil water, provided that the reaction of the solute with soils can be described by linear instantaneous adsorption and first order kinetic reactions.

A detailed description of the input requirements to the models, as well as the program listing, is included in this document. Application of the models, to the problem of migration and absorption of Aldicarb on Wickham Farm, Long Island, is utilized as a practical example. Input data and computer printout of the hydraulic model for the Long Island case are given in Appendices C and D; input data and computer printout of the transport model are listed in Appendices E, F and G. Potential users can apply the models to their particular problems by following the examples.

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SECTION I

INTRODUCTION

Ground-water's role as a vital natural resource is threatened by increasing subsurface contamination. The origin of ground-water contaminants can be traced to industrial, agricultural, and municipal sources in addition to land-treatment waste management systems. The variety of sources and pollutant characteristics compounds the problems associated with the protecting of ground-water resources and public health. Research efforts are required to describe the mechanisms of transport, degradation, and sorption of contaminants in soils, as well as the fate of the contaminants in aquifers.

Ground-water comprises a major portion of the fresh-water supply in the United States. Exploitation and carelessness have resulted in adverse impacts on ground-water resources. Water tables in some parts of the country have dropped dramatically, and the quality of ground-water has deteriorated. In an effort to reduce and prevent water pollution, to reclaim and recycle wastewater, or to replinish ground-water supplies, PL92-500 and PL95-217 encourage land application as an alternative technique for wastewater management. In the arid southwestern part of the United States, land application methods are particularly promising for continuing growth and prosperity. However, the renovation and reclamation of wastewater by land application must not degrade the quality of ground-water.

Large scale use of agricultural pesticides represents another potential threat to ground-water quality. The impact of pesticides on soil and ground-water systems requires the knowledge of the reactions of pesticides with soils and the development of models to describe the sorption, leaching, and persistance of these contaminants in the subsurface environment. Therefore, research and model development on the behavior and dynamics of pollutants in soils and the migration in ground-water are essential for the successful compromise between ground-water quality and wastewater treatment.

The present study describes a two-dimensional solute transport model to simulate the movement of contaminants through soils and to project the concentration of contaminants in ground-water. The model consists of two submodels. The first is a hydraulic model which utilizes a unified approach to treat both the unsaturated and saturated regions simultaneously. The hydraulic model is used to develop volumetric water flux, soil moisture content and interstitial velocities of the flow-field under consideration. The second submodel is a solute transport model which simulates the migration, sorption, and degradation of contaminants in soil matrices based on the interstitial velocities of the hydraulic model.

The hydraulic model is solved using finite element techniques, and the solute model is based on a method of characteristics solution.

SECTION II

MATHEMATICAL DEVELOPMENT OF THE HYDRAULIC AND TRANSPORT EQUATIONS

The movement of water in saturated and unsaturated soils can be described by the following material balance:

$$\frac{\partial \theta}{\partial t} = \nabla (K \nabla H) \qquad (1)$$

where

θ = water content ratio, volume of water per unit volume of soil,

K = hydraulic conductivity of soil to water,

H = hydraulic head, and

t = time.

In general, K and θ will be functions of the pressure head, P. Including the effects of gravity, the hydraulic head is

$$H = P - y \qquad (2)$$

where y is the gravitational potential head.

For two-dimensional flow in a vertical plane assuming isotropic conditions, Equation 1 becomes

$$\frac{\partial \theta}{\partial t} = \frac{\partial}{\partial x} K(P) \frac{\partial H}{\partial x} + \frac{\partial}{\partial y} K(P) \frac{\partial H}{\partial y} \qquad (3)$$

where x is the horizontal axis and y is the vertical axis taken positive in the downward direction.

From Equation 2,

$$\frac{\partial H}{\partial x} = \frac{\partial P}{\partial x} \tag{4}$$

and

$$\frac{\partial H}{\partial y} = \frac{\partial P}{\partial y} - 1 \tag{5}$$

Also, by definition

$$\frac{\partial \theta}{\partial t} = \frac{\partial P}{\partial t} \frac{d\theta}{dP} \tag{6}$$

Substituting Equations 4, 5, and 6 into Equation 3 yields

$$\frac{d\theta}{dP} \frac{\partial P}{\partial t} = \frac{\partial}{\partial x} K(P) \frac{\partial P}{\partial x} + \frac{\partial}{\partial y} K(P) \frac{\partial P}{\partial y} - \frac{\partial K(P)}{\partial y} \tag{7}$$

Equation 7 describes the soil water pressure distribution in both saturated and unsaturated regions. The solution of this material balance equation together with appropriate boundary conditions will provide the soil water pressure distribution throughout the problem domain. Together with the soil properties, the pressure distribution can be used to provide information on the water content ratio, the volumetric water flux, and the interstitial velocity of water flow in the soil system.

The convective transport neglecting dispersion of a reactive solute through the soil water system can be expressed as

$$\frac{\partial(C\theta)}{\partial t} + \rho\,\frac{\partial S}{\partial t} = -\frac{\partial}{\partial x}(q_x C) - \frac{\partial}{\partial y}(q_y C) - \lambda\theta C \qquad (8)$$

where

C = solute concentration in soil water, mass of solute per unit volume of solution;

S = solute concentration in the soil matrix, mass of solute per unit mass of solids;

ρ = bulk density of the soil, mass of solids per unit volume of soil;

q_x, q_y = soil water flux, volume of water per unit area per unit time; and

λ = the rate of chemical/biological/radioactive decay of solute in the water by a first-order reaction.

The soil-water flux terms can be evaluated as

$$q_x = -\,K(P)\,\frac{\partial P}{\partial x} \qquad (9)$$

and

$$q_y = -\,K(P)\,\frac{\partial P}{\partial y} + K(P) \qquad (10)$$

The rate of change in solute concentration on the solid matrix, $\partial S/\partial t$, can be attributed to two mechanisms. The first is sorption of solute on the soil surface. Assuming a linear adsorption isotherm,

$$S = k_d C \tag{11}$$

where k_d is an equilibrium distribution coefficient which describes the partitioning of solute between the fluid and solid phases. The second mechanism is a change in adsorbed solute concentration by one or more first order reactions of the form

$$S = \sum_j \int a_j \, k_d \, (C - C_{ej}) \, dt \tag{12}$$

where a_j and C_{ej} are the first-order rate constant and the equilibrium concentration for the j^{th} reaction, respectively.

Adding the sorption and reaction mechanisms,

$$S = k_d C + \sum_j \int a_j \, k_d \, (C - C_{ej}) \, dt \tag{13}$$

and

$$\frac{\partial S}{\partial t} = k_d \frac{\partial C}{\partial t} + \sum_j a_j \, k_d \, (C - C_{ej}) \tag{14}$$

Substituting Equation 14 into Equation 8 yields

$$\frac{\partial (C\theta)}{\partial t} + \rho k_d \frac{\partial C}{\partial t} + \rho k_d \sum_j a_j (C - C_{ej}) = - \frac{\partial}{\partial x} (q_x C) - \frac{\partial}{\partial y} (q_y C) - \lambda \theta C \tag{15}$$

Carrying out the indicated differentiation, collecting terms, and rearranging yields

$$(\theta + \rho k_d) \frac{\partial C}{\partial t} + q_x \frac{\partial C}{\partial x} + q_y \frac{\partial C}{\partial y}$$

$$= - C \left[\frac{\partial \theta}{\partial t} + \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} \right] - \rho k_d \sum_j a_j (C - C_{ej}) - \lambda \theta C \qquad (16)$$

From the continuity equation, or conservation of mass,

$$\frac{\partial \theta}{\partial t} + \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} = 0 \qquad (17)$$

and Equation 16 becomes

$$\frac{\partial C}{\partial t} + \frac{q_x}{\theta + \rho k_d} \frac{\partial C}{\partial x} + \frac{q_y}{\theta + \rho k_d} \frac{\partial C}{\partial y} = - \frac{\rho k_d}{\theta + \rho k_d} \sum_j a_j (C - C_{ej}) - \frac{\lambda \theta C}{\theta + \rho k_d} \qquad (18)$$

Equations 3 and 18 are the two basic equations for the hydraulic model and the transport model, respectively. These two differential equations can be integrated to yield the moisture content and the pollutant concentration as a function of location and time.

SECTION III

THE HYDRAULIC MODEL

The differential equation describing the distribution of soil moisture can be solved by a variety of numerical methods. The two most common approaches to problems of this type are finite-difference and finite-element techniques. Both approaches reduce the governing differential equation to a set of linear algebraic equations. A finite-element method was selected in this study based on considerations of computational efficiency, accuracy, and stability.

Applying Galerkin's technique to the soil moisture equation

$$\frac{d\Theta}{dP}\frac{\partial P}{\partial t} = \frac{\partial}{\partial x} K \frac{\partial P}{\partial x} + \frac{\partial}{\partial y} K \frac{\partial P}{\partial y} - \frac{\partial K}{\partial y} \qquad (7)$$

will lead to a set of nonlinear ordinary differential equations. An approximate solution to Equation 7 can be defined in an element as

$$\tilde{P}^e(x,y,t) = \sum_{j=i}^{N} \Phi_j(x,y)\, P_j(t) \qquad (19)$$

where P_j is the pressure associated with node j, Φ_j is the linearily independent element basis function, or shape factor, and N is the number of nodes in the element. Galerkin's method requires that the residual, or error, be zero when weighted by each of the basis functions, or

$$\iint_{\Omega_e} \left[\frac{\partial}{\partial x} K \frac{\partial \tilde{P}^e}{\partial x} + \frac{\partial}{\partial y} K \frac{\partial \tilde{P}^e}{\partial y} - \frac{\partial K}{\partial y} - \frac{d\Theta}{dP^e} \frac{\partial \tilde{P}^e}{\partial t} \right] \Phi_j(x,y)\, dxdy = 0 \tag{20}$$

for j = 1 to N where Ω_e is the domain of element e plus its boundaries.

Equation 20 can be integrated by parts to eliminate the second derivatives. Applying the Green-Gauss theorm

$$\iint_{\Omega_e} \left[K \frac{\partial \tilde{P}^e}{\partial x} \frac{\partial \Phi_j}{\partial x} + K \frac{\partial \tilde{P}^e}{\partial y} \frac{\partial \Phi_j}{\partial y} \right] dxdy + \iint_{\Omega_e} \frac{\partial K}{\partial y} \Phi_j \, dxdy$$

$$+ \iint_{\Omega_e} \frac{d\Theta}{d\tilde{P}^e} \frac{\partial \tilde{P}^e}{\partial t} \Phi_j \, dxdy$$

$$= \int_{\Gamma_e} \left[K \frac{\partial \tilde{P}^e}{\partial x} n_x + K \frac{\partial \tilde{P}^e}{\partial y} n_y \right] \Phi_j \, d\Gamma \tag{21}$$

where Γ is the global boundary, Γ_e is the element boundary, and n is a unit vector normal to Γ.

Now spatial derivatives of $\tilde{P}^e$ can be written in terms of the nodal pressures $P_j(t)$ and the derivatives of the element basis functions:

$$\frac{\partial \tilde{P}^e}{\partial x} = \sum_{i=1}^{N} P_i \frac{\partial \Phi_i}{\partial x} \tag{22}$$

$$\frac{\partial \tilde{P}^e}{\partial y} = \sum_{i=1}^{N} P_i \frac{\partial \Phi_i}{\partial y} \tag{23}$$

The element basis functions also define, in terms of the time derivatives $\partial\tilde{P}^e/\partial t$ at the element nodes, the spatial variation of $\partial\tilde{P}^e/\partial t$ over the element

$$\frac{\partial\tilde{P}^e}{\partial t} = \sum_{i=1}^{N} \Phi_i \frac{\partial P_i}{\partial t} \tag{24}$$

Substituting Equations 22 and 23 into the first term of Equation 21,

$$\iint_{\Omega_e} \left[K \frac{\partial\tilde{P}^e}{\partial x} \frac{\partial\Phi_j}{\partial x} + K \frac{\partial\tilde{P}^e}{\partial y} \frac{\partial\phi_j}{\partial y} \right] dxdy$$

$$= \iint_{\Omega_e} K \left[\left(\sum_{i=1}^{N} \frac{\partial\Phi_i}{\partial x} P_i \right) \frac{\partial\Phi_j}{\partial x} + \left(\sum_{i=1}^{N} \frac{\partial\Phi_i}{\partial y} P_i \right) \frac{\partial\Phi_j}{\partial y} \right] dxdy \tag{25}$$

The integrand which involves spatial first-order derivatives of the element basis functions is independent of x and y because the basis functions are linear in x and y. Collecting like coefficients of the P_i, Equation 25 becomes

$$\iint_{\Omega_e} \left[K \frac{\partial\tilde{P}^e}{\partial x} \frac{\partial\Phi_j}{\partial x} + K \frac{\partial\tilde{P}^e}{\partial y} \frac{\partial\Phi_j}{\partial y} \right] dxdy$$

$$= \sum_{i=1}^{N} P_i \iint_{\Omega_e} K \left(\frac{\partial\Phi_i}{\partial x} \frac{\partial\Phi_j}{\partial x} + \frac{\partial\Phi_i}{\partial y} \frac{\partial\Phi_j}{\partial y} \right) dxdy \tag{26}$$

for j = 1,N

Equation 24 can be substituted into the third term of Equation 21 to yield

$$\iint_{\Omega_e} \frac{d\Theta}{dP} \frac{\partial \tilde{P}^e}{\partial t} \Phi_j \, dxdy = \sum_{i=1}^{N} \frac{\partial P_i}{\partial t} \iint_{\Omega_e} \frac{d\Theta}{dP} \Phi_i \Phi_j \, dxdy \qquad (27)$$

for j = 1,N.

Substituting Equations 26 and 27 back into Equation 21 gives

$$\sum_{i=1}^{N} \frac{\partial P_i}{\partial t} \iint_{\Omega_e} \frac{d\Theta}{dP} \Phi_i \Phi_j \, dxdy$$

$$= - \sum_{i=1}^{N} P_i \iint_{\Omega_e} \left(\frac{\partial \Phi_i}{\partial x} \frac{\partial \Phi_j}{\partial x} + \frac{\partial \Phi_i}{\partial y} \frac{\partial \Phi_j}{\partial y} \right) dxdy$$

$$+ \int_{\Gamma_e} \left(K \frac{\partial \tilde{P}^e}{\partial x} n_x + K \frac{\partial \tilde{P}^e}{\partial y} n_y \right) \Phi_j \, d\Gamma - \iint_{\Omega_e} \frac{\partial K}{\partial y} \Phi_j \, dxdy \qquad (28)$$

Equation 28 can be written in matrix notation by defining the following variables:

$$A_{NM}^e = - \iint_{\Omega_e} K \left(\frac{\partial \Phi_i}{\partial x} \frac{\partial \Phi_j}{\partial x} + \frac{\partial \Phi_i}{\partial y} \frac{\partial \Phi_j}{\partial y} \right) dxdy \qquad (29)$$

$$G_{NM}^e = \iint_{\Omega_e} \frac{d\Theta}{dP} \Phi_i \Phi_j \, dxdy \qquad (30)$$

$$F_N^e = \int_{\Gamma_e} \left(K \frac{\partial \tilde{P}^e}{\partial x} n_x + K \frac{\partial \tilde{P}^e}{\partial y} n_y \right) \Phi_j \, d\Gamma - \iint_{\Omega_e} \frac{\partial K}{\partial y} \Phi_j \, dxdy \qquad (31)$$

The local finite element equation then becomes

$$[G_{NM}]^e \frac{\partial P_N}{\partial t} = [A_{NM}]^e \, [P_N]^e + [F_N]^e \qquad (32)$$

where G_{NM} and A_{NM} are N x N matrices, P_N and F_N are N x 1 matrices, and N is the number of nodes in an element. The coefficient matrices $[G_{NM}]^e$, $[A_{NM}]^e$, and $[F_N]^e$ are functions of K(P), $\partial K(P)/\partial y$, and $d\Theta/dP$.

Therefore Equation 32 represents a system of nonlinear differential equations. Pinder, et al. (1973) proposed the approximation of these variables within an element by polynominal interpolation. Let

$$K(P)^e = \sum_{i=1}^{N} \Psi_{1,i} \; (x,y) \; K(P_i) \tag{33}$$

$$\left(\frac{\partial K}{\partial y}\right)^e = \sum_{i=1}^{N} K(P_i) \frac{\partial \Psi_{1,i}(x,y)}{\partial y} \tag{34}$$

$$\left(\frac{d\Theta}{dP}\right)^e = \sum_{i=1}^{N} \Psi_{2,i}(x,y) \; \left(\frac{d\Theta}{dP}\right)_i \tag{35}$$

where $\Psi_{1,i}(x,y)$ and $\Psi_{2,i}(x,y)$ are the linear interpolating functions. With these definitions, the coefficient matrices can be linearlized as

$$[A_{NM}]^e = \sum_{i=1}^{N} K(P_i) \iint_{\Omega_e} \Psi_{1,i} \left(\frac{\partial \Phi_i}{\partial x} \frac{\partial \Phi_j}{\partial x} + \frac{\partial \Phi_i}{\partial y} \frac{\partial \Phi_j}{\partial y}\right) dxdy \tag{36}$$

$$[G_{NM}]^e = \sum_{i=1}^{N} \left(\frac{d\Theta}{dP}\right)_i \iint_{\Omega_e} \Psi_{2,i} \; \Phi_i \; \Phi_j \; dxdy \tag{37}$$

$$[F_N]^e = \int_{\Gamma_e} \left(K \frac{\partial \tilde{P}^e}{\partial x} n_x + K \frac{\partial \tilde{P}^e}{\partial y} n_y\right) d\Gamma - f_N \tag{38}$$

where

$$f_N = \sum_{i=1}^{N} K(P_i) \iint_{\Omega_e} \frac{\partial \Psi_{1,i}}{\partial y} \Phi_j \; dxdy \tag{39}$$

The boundary integral term is the weighted average of the flux normal to the boundary and will be considered later.

The global finite element equation is obtained by summming the coefficient matrices for each element over all of the elements in the problem domain.

$$A_{ij} = \sum_{e=1}^{E} A^e_{NM} \; \Delta^e_{Ni} \; \Delta^e_{Mj} \tag{40}$$

$$G_{ij} = \sum_{e=1}^{E} G^e_{NM} \; \Delta^e_{Ni} \; \Delta^e_{Mj} \tag{41}$$

$$F_i = \sum_{e=1}^{E} F_N \; \Delta^e_{Ni} \tag{42}$$

Where E is the total number of nodes in the problem domain and the Δ^e are Boolean matrices. The global finite element equation is

$$G_{ij} \frac{dP_j}{dt} = A_{ij} \; P_j + F_i \tag{43}$$

where G_{ij} and A_{ij} are L x L coefficient matrices, F_i is a L x 1 matrix, and L is the total number of nodes in the problem domain. At this point Equation 42 is completely general in that the structure of the elements has not been specified.

Linear quadrelateral elements were selected in the present work as shown in Figure 1. Two coordinate systems are shown. The x-y system is the global coordinate system for the entire problem domain. The ξ-η system is a nondimensional local coordinate system with an origin located at the intersection of two lines that bisect opposite pairs of sides of an element. This local coordinate system simplifies the definition of the element basis, or shape, functions and facilitates the

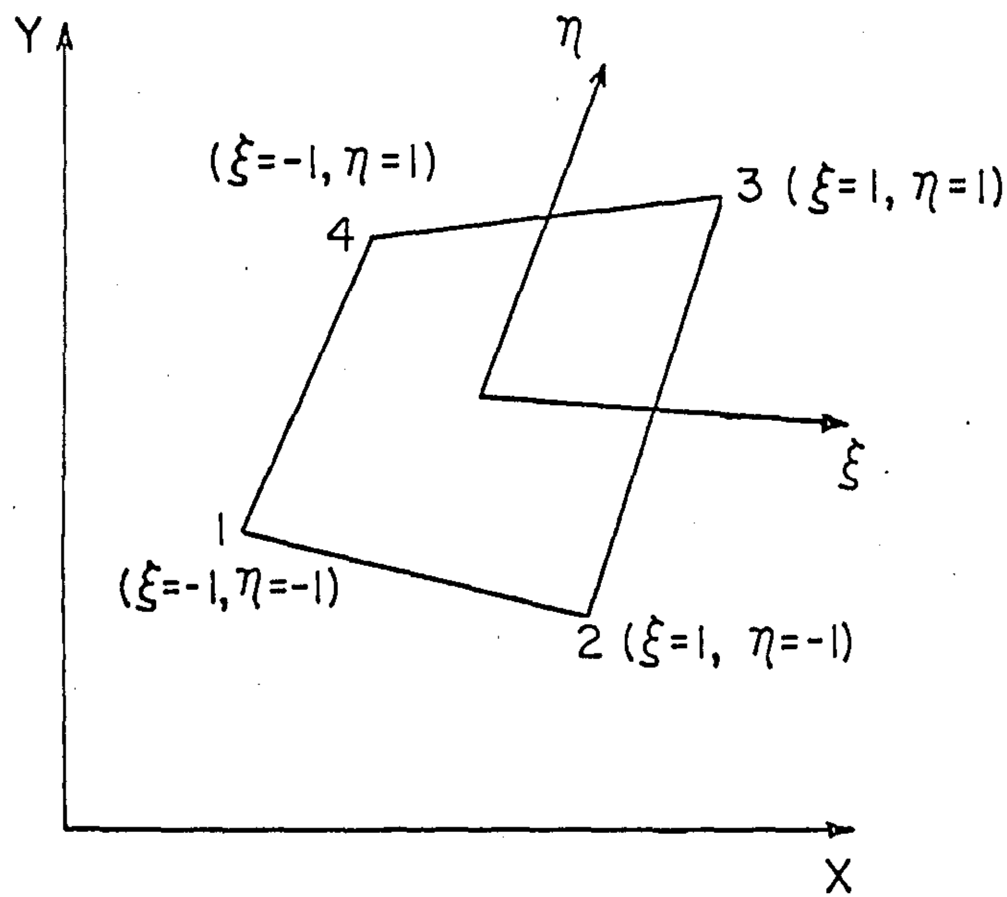

FIGURE 1. Linear Quadrelateral Element

integations required to evaluate the coefficient matrices in Equations 32 and 43.

The element basis functions written in terms of the nondimensional local coordinates are (Segerlund, 1976)

$$\phi_1(\xi,\eta) = \frac{1}{4}(1 - \xi)(1 - \eta) \tag{44a}$$

$$\phi_2(\xi,\eta) = \frac{1}{4}(1 + \xi)(1 - \eta) \tag{44b}$$

$$\phi_3(\xi,\eta) = \frac{1}{4}(1 + \xi)(1 + \eta) \tag{44c}$$

$$\phi_4(\xi,\eta) = \frac{1}{4}(1 - \xi)(1 + \eta) \tag{44d}$$

The interpolating polynominal for the linear quadrelateral element is

$$P^e = \phi_1(\xi,\eta)P_1 + \phi_2(\xi,\eta)P_2 + \phi_3(\xi,\eta)P_3 + \phi_4(\xi,\eta)P_4 \tag{45}$$

where P_1, P_2, P_3, and P_4 are the values at the four nodes. The interpolating polynominal can also be used to define the global coordinates of a point within an element, or

$$x = \phi_1(\xi,\eta)X_1 + \phi_2(\xi,\eta)X_2 + \phi_3(\xi,\eta)X_3 + \phi_4(\xi,\eta)X_4 \tag{46}$$

and

$$y = \phi_1(\xi,\eta)Y_1 + \phi_2(\xi,\eta)Y_2 + \phi_3(\xi,\eta)Y_3 + \phi_4(\xi,\eta)Y_4 \tag{47}$$

The derivitives of the basis functions, $\partial\Phi_i/\partial x$ and $\partial\Phi_i/\partial y$, follow from Equations 44, 46, and 47. The Jacobian matrix is defined by

$$\begin{Bmatrix} \dfrac{\partial\Phi_i}{\partial\xi} \\ \\ \dfrac{\partial\Phi_i}{\partial\eta} \end{Bmatrix} = \begin{bmatrix} \dfrac{\partial x}{\partial\xi} & \dfrac{\partial y}{\partial\xi} \\ \\ \dfrac{\partial x}{\partial\eta} & \dfrac{\partial y}{\partial\eta} \end{bmatrix} \begin{Bmatrix} \dfrac{\partial\Phi_i}{\partial x} \\ \\ \dfrac{\partial\Phi_i}{\partial y} \end{Bmatrix} = [J] \begin{Bmatrix} \dfrac{\partial\Phi_i}{\partial x} \\ \\ \dfrac{\partial\Phi_i}{\partial y} \end{Bmatrix} \tag{48}$$

which can be inverted to yield the derivatives with respect to x and y. The integrals in Equations 36, 37, and 39 are transformed according to

$$\iint_{\Omega_e} G(x,y)dxdy = \int_{-1}^{1}\int_{-1}^{1} g(\xi,\eta) \left|[J]\right| d\eta d\xi \tag{49}$$

or

$$\iint_{\Omega_e} \Psi_{1,i} \left(\frac{\partial\Phi_i}{\partial x}\frac{\partial\Phi_j}{\partial x} + \frac{\partial\Phi_i}{\partial y}\frac{\partial\Phi_j}{\partial y}\right) dydx$$

$$= \int_{-1}^{1}\int_{-1}^{1} \psi_{1,i} \left(\frac{\partial\phi_i}{\partial x}\frac{\partial\phi_j}{\partial x} + \frac{\partial\phi_i}{\partial y}\frac{\partial\phi_j}{\partial y}\right) \left|[J]\right| d\eta d\xi \tag{50}$$

$$\iint_{\Omega_e} \Psi_{i,i}\,\Phi_i\Phi_j\, dxdy = \int_{-1}^{1}\int_{-1}^{1} \psi_{i,i}\,\phi_2\phi_j \left|[J]\right| d\eta d\xi \tag{51}$$

$$\iint_{\Omega_e} \frac{\partial\Psi_{1,i}}{\partial y}\Phi_i\, dxdy = \int_{-1}^{1}\int_{-1}^{1} \frac{\partial\psi_{1,2}}{\partial y}\,\phi_2 \left|[J]\right| d\eta d\xi \tag{52}$$

where $\left|[J]\right|$ is the determinant of the Jacobian matrix as defined by Equation 48. With some algebraic manipulation

$$\left|[J]\right| = \frac{1}{8} (\alpha_0 + \alpha_1 \xi + \alpha_2 \eta) \tag{53}$$

where

$$\alpha_0 = (X_4 - X_2)(Y_1 - Y_3) - (X_1 - X_2)(Y_4 - Y_2) \tag{54a}$$

$$\alpha_1 = (X_3 - X_4)(Y_1 - Y_2) - (X_1 - X_2)(Y_3 - Y_4) \tag{54b}$$

$$\alpha_2 = (X_4 - X_1)(Y_2 - Y_3) - (X_2 - X_3)(Y_4 - Y_1) \tag{54c}$$

Equations 50, 51, and 52 can now be integrated by Gauss-Legendre quadrature. In general,

$$\int_{-1}^{1} \int_{-1}^{1} g(\xi,\eta) d\eta d\xi = \sum_{i=1}^{n} \sum_{j=1}^{n} W_i W_j \, g(\xi_i,\eta_j) \tag{55}$$

where the ξ_i and η_j are the quadrature points and the W_i and W_j are the weighting factors. Second order integration is required to evaluate the area integrals exactly for linear quadrelateral elements. The quadrature points n = 2 are $\xi_i = \pm 0.577350$ and $\eta_j = \pm 0.57350$, and the weighting factors are $W_i = W_j = 1.0$.

The coefficient matrices can now be written algebraically as

$$A_{NM}^{e} = \sum_{i=1}^{4} K(P_i) \left\{ \sum_{l=1}^{2} \sum_{m=1}^{2} \psi_{1,i}(\xi_l,\eta_m) \, b_{NM}(\xi_l,\eta_m) \left|[J]\right| \right\} \tag{56}$$

$$G_{NM} = \sum_{i=1}^{4} \left(\frac{d\Theta}{dP}\right)_i \left\{ \sum_{l=1}^{2} \sum_{m=1}^{2} \psi_{2,i} \, g_{NM}(\xi_l,\eta_m) \left|[J]\right| \right\} \tag{57}$$

$$f_N = \sum_{i=1}^{4} K(P_i) \left(\sum_{l=1}^{2} \sum_{m=1}^{2} C_{LN}(\xi_i, \eta_m) \left|[J]\right| \right) \tag{58}$$

where

$$b_{NM}(\xi,\eta) = \frac{\partial\phi_i}{\partial x}\frac{\partial\phi_j}{\partial x} + \frac{\partial\phi_i}{\partial y}\frac{\partial\phi_j}{\partial y} \tag{59}$$

$$C_{LN}(\xi,\eta) = \frac{\partial\psi_{1,i}}{\partial y}\phi_j \tag{60}$$

$$g_{NM}(\xi,\eta) = \phi_i \phi_j \tag{61}$$

The terms in brackets in Equations 56, 57, and 58 are functions of the element geometry alone. Therefore, they are constants once the finite element mesh is defined.

The boundary integral term in Equation 38 only contributes to elements located on the boundary of the problem domain. In assembling the global matrix by Equation 42, only boundary nodes will contribute to F_i. In other words $F_i = 0$ for all interior nodes. For a specified flux boundary condition, the volumetric flow through the side of an element is distributed between the adjacent modes, and the value of the boundary integral can be calculated from the flow through the segments of the boundary on either side of the boundary node. A specified pressure boundary condition essentially reduces the number of unknowns in the problem domain.

The global finite element equation

$$G_{ij}\frac{dP_j}{dt} = A_{ij} P_j + F_i \tag{43}$$

can be integrated in time using finite difference methods. Backward difference methods using properties averaged over a time step tend to be resistant to numerical oscillation (Reeves and Duguid, 1975; Frind and Verge, 1978), Equation 43 is integrated using a predictor-corrector method with coefficients evaluated at half a time step.

For the predictor, the finite difference form of Equation 43 can be written as

$$G_{ij}^{k+1/2} \frac{P_j^{k+1} - P_j^{k}}{\Delta t} = A_{ij}^{k+1/2} P_j^{k+1} + F_i^{k+1/2} \qquad (62)$$

where k+1/2 denotes the values calculated at the midpoint between the k^{th} and $k+1^{th}$ time steps. Equation 62 can be rearranged to

$$(G_{ij}^{k+1/2} - \Delta t\, A_{ij}^{K+1/2})(P_j^{k+1} - P^k{}_j)$$

$$= \Delta t\, F_i^{k+1/2} + \Delta t\, A_{ij}^{k+1/2} P_j^{k} \qquad (63)$$

which is the matrix equation for the change in pressure over a time step.

The rate of change in pressure can vary over a wide range in the region of the wetting front. Therefore, methods which are stable for stiff matrices must be considered for the corrector step to allow the use of reasonably large time steps. In the present work a fourth-order Newton backward difference method is used for the corrector. The finite difference form of Equation 43 becomes

$$G_{ij}^{k+1} (P_j^{k+1} - \frac{48}{25} P_j^{k} + \frac{36}{25} P_j^{k-1} - \frac{16}{25} P_j^{k-2} + \frac{3}{25} P_j^{k-3})$$

$$= \frac{12}{25} \Delta t \ (A_{ij}^{k+1} \ P_j^{k+1} + F_j^{k+1}) \tag{64}$$

Rearranging Equation 64 leads to the following matrix equation for the corrector step:

$$(G_{ij}^{k+1} - \frac{12}{25} \Delta t \ A_{ij}^{k+1}) \ P_j^{k+1}$$

$$= \frac{12}{25} \Delta t \ F_i^{k+1} - \frac{1}{25} G_{ij}^{k+1} \ (-48 \ P_j^k + 36 \ P_j^{k-1} - 16 \ P_j^{k-2} + 3 \ P_j^{k-3}) \tag{65}$$

The corrector is iterated three times at each time step to achieve fourth-order accuracy (Lambert, 1973).

In carrying out the integration over time using Equatons 63 and 65, the lumping process suggested by Briggs and Dixon (1968) and by Langsrud (1976) is used to reduce the computational requirements and to obtain a smooth solution. Equation 65 requires known pressure distributions at four time intervals to start the integration. A Runge-Kutta method, or the predictor defined in Equation 63 with a refined time step, is used to initiate the predictor-corrector method successfully.

The time integration procedure described above overcomes potential problems in applying the hydraulic model over the entire problem domain. For example, in an unsaturated region the hydraulic conductivity, K, can take on very small values; and from Equations 36 and 40 the A_{ij} in Equation 43 tend to zero, or

$$G_{ij} \frac{dP_j}{dt} = F_i \tag{66}$$

In a saturated region $d\Theta/dP = 0$, and G_{NM} in Equation 37 vanishs. As a result, the G_{ij} coefficient matrix in Equation 43 may become a singular matrix. If $G_{ij} = 0$ for some row i in the system of equations represented by Equation 43, the governing equation for this row will change to an algebraic equation, or

$$A_{ij}P_j + F_i = 0 \tag{67}$$

Therefore Equation 43 actually represents a system of ordinary differential equations represented by Equations 43 or 66 and algebraic equations represented by Equation 67. The A_{ij} may approach zero in the unstaurated zone, and the G_{ij} will vanish in the saturated zone. However, they will not vanish simultaneously, and coefficient matrices $(G_{ij}^{k+1/2} - \Delta t\ A_{ij}^{k+1/2})$ in Equation 63 and $(G_{ij}^{k+1} - \frac{12}{25} - \Delta t\ A_{ij}^{k+1})$ in Equation 65 will not become singular.

The hydraulic model can be solved to yield the distribution of pressure and soil moisture in the problem domain as a function of space and time. The resulting pressure distribution can also be used to calculate the water flux through the system. This flux distribution can be used, in turn, to project the transport of pollutants through the unsaturated and saturated regions of the system.

SECTION IV

THE TRANSPORT MODEL

The differential equation describing the conservation of a pollutant in an unsaturated/saturated subsurface environment was developed in Section II as

$$\frac{\partial C}{\partial t} + \frac{q_x}{\Theta + \rho k_d}\frac{\partial C}{\partial x} + \frac{q_y}{\Theta + \rho k_d}\frac{\partial C}{\partial y} = -\frac{\rho k_d}{\Theta + \rho k_d}\sum_j a_j\,(C - C_{ej}) - \frac{\lambda \Theta C}{\Theta + \rho k_d} \tag{18}$$

As in the case of the hydraulic model, a variety of numerical techniques may be used to integrate this equation in time and space. A method-of-characteristics approach has been selected in the present study to transform Equation 18 into an ordinary differential equation. Equation 18 can be written as

$$\frac{dc}{dt} = -\frac{\rho k_d}{\Theta + \rho k_d}\sum_j a_j(C - C_{ej}) - \frac{\lambda \Theta C}{\Theta + \rho k_d} \tag{68}$$

where the total derivative, dC/dt, implies differentiation along a characteristic line. The projections of this characteristic line on the x-t and y-t planes are given by

$$\frac{\delta x}{\delta t} = \frac{q_x}{\Theta + \rho k_d} \tag{69}$$

and

$$\frac{\delta y}{\delta t} = \frac{q_x}{\Theta + \rho k_d} \tag{70}$$

respectively. The geometry of the characteristic line and the projections on the x-t and y-t planes are shown in Figure 2.

A finite difference method is used to integrate Equation 68 along the characteristic line. The finite difference configuration in Figure 2 shows the characteristic line in the vicinity of the i,j grid point. The concentration at the location of the i^{th} grid point along the x-axis and the j^{th} grid point along the y-axis at time step ℓ is denoted by C_{ij}^{ℓ}. The concentration at the same node at time step $\ell+1$ is $C_{ij}^{\ell+1}$. The projection of the characteristic line on the x-t plane is shown as line 2-3, and the slope of the projection is given by Equation 69. The projection of the characteristic line on the y-t plane is shown in Figure 2 as line 2-4; the slope is given by Equation 70. The characteristic line is determined by the simultaneous solution of Equations 69 and 70.

The flux terms in Equations 69 and 70 as well as the soil moisture content in Equations 68, 69, and 70 are evaluated from the pressure distribution generated by the hydraulic model. Since the physical properties of both the soil and water have been assumed to be independent of pollutant concentrations, i.e. diulte solutions, the hydraulic and transport models can be uncoupled. In other words, the hydraulic model can be solved to yield the pressure at specified locations in the problem domain for specified times, independent of the transport equation. These pressures can then be used to evaluate the water flux and soil moisture at the same spatial and temporal locations

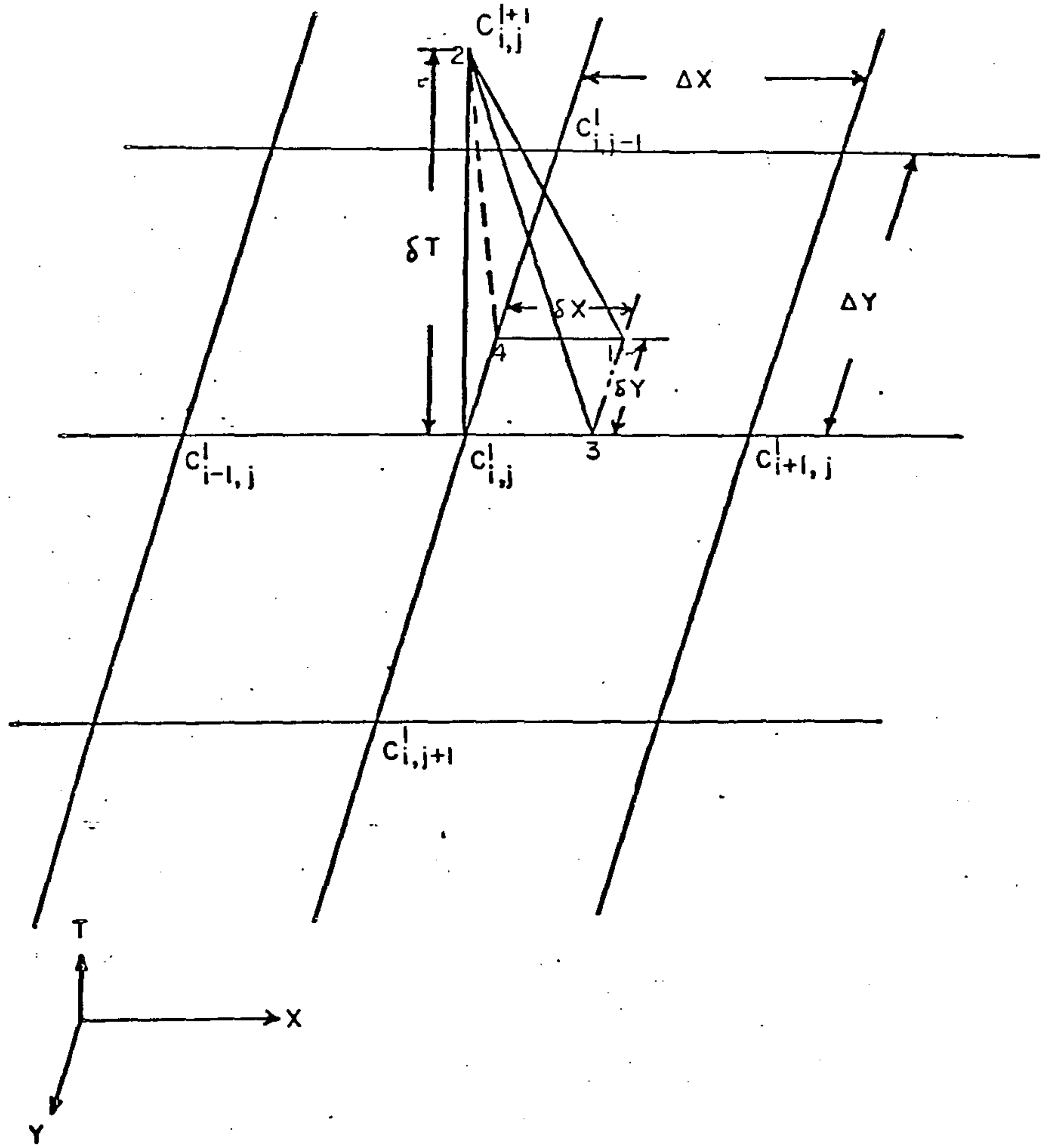

Figure 2. Characteristic Lines

in the transport model. The application of the hydraulic and transport models to a field problem is demonstrated in the next section.

SECTION V

APPLICATIONS OF THE HYDRAULIC AND TRANSPORT MODELS

This section is intended to serve as a user's guide for the hydraulic and transport models and to provide guidelines for assembling the input data required for each of the models.

Hydraulic Model

The data required by the hydraulic model for simulating the pressure distribution in the unsaturated and saturated regións include the definition of the finite element mesh, hydraulic conductivity relationships as a function of soil moisture, soil properties such as bulk density and porosity, and the initial and boundary conditions for the problem domain. Each of these topics will be considered in the following paragraphs.

Field site geometry. The hydraulic model has been developed for two dimensional flow in a vertical plane. The x-coordinate is the horizontal distance and the y-coordinate is depth. The coordinate system should be orientated so that the mathematical model approximates the field conditions to the extent possible. For example, the x-axis should be aligned with the regional hydraulic gradient.

The maximum depth in the problem domain would correpsond to an impervious zone underlying the field site or to a depth at which the flow field can be assumed to be horizontal.

Water table. The depth of the water table of the field site should be acquired empirically or experimentally. In addition, the initial soil moisture distribution must be estimated or measured.

Finite element mesh. Once the geometry and dimensions of the field site have been established the problem domain must be described as a finite element mesh. This is accomplished relatively easily by specifying the number of rows and the number of columns in the problem domain. In addition, two additional columns must be allocated to specify the boundary conditions. The elements themselves are formed by the intersection of "horizontal" and "vertical" lines (rows and columns). The only restrictions are that the "horizontal" lines do not cross each other and that "vertical" lines do not cross. Figure 3 shows a typical finite element mesh for the model. The number associated with the intersection of vertical and horizontal lines represents the numbering of the global nodes used in the model. The order is from top-to-bottom and from left-to-right. Global node 1 will be located at the upper left corner (Point A); the last global node will be located at the lower right corner (Point B).

The actual location of the global nodes must be specified by the user. The nodes need not lie on straight lines, but the user must specify the global coordinates (x,y) of each node in the finite element mesh.

Physical and hydraulic properties. The hydraulic model includes the following relationships for hydraulic conductivity and soil moisture retention parameters:

$$K = K_s \left(\frac{\Theta}{\Theta_s}\right)^{2b+2} \tag{71}$$

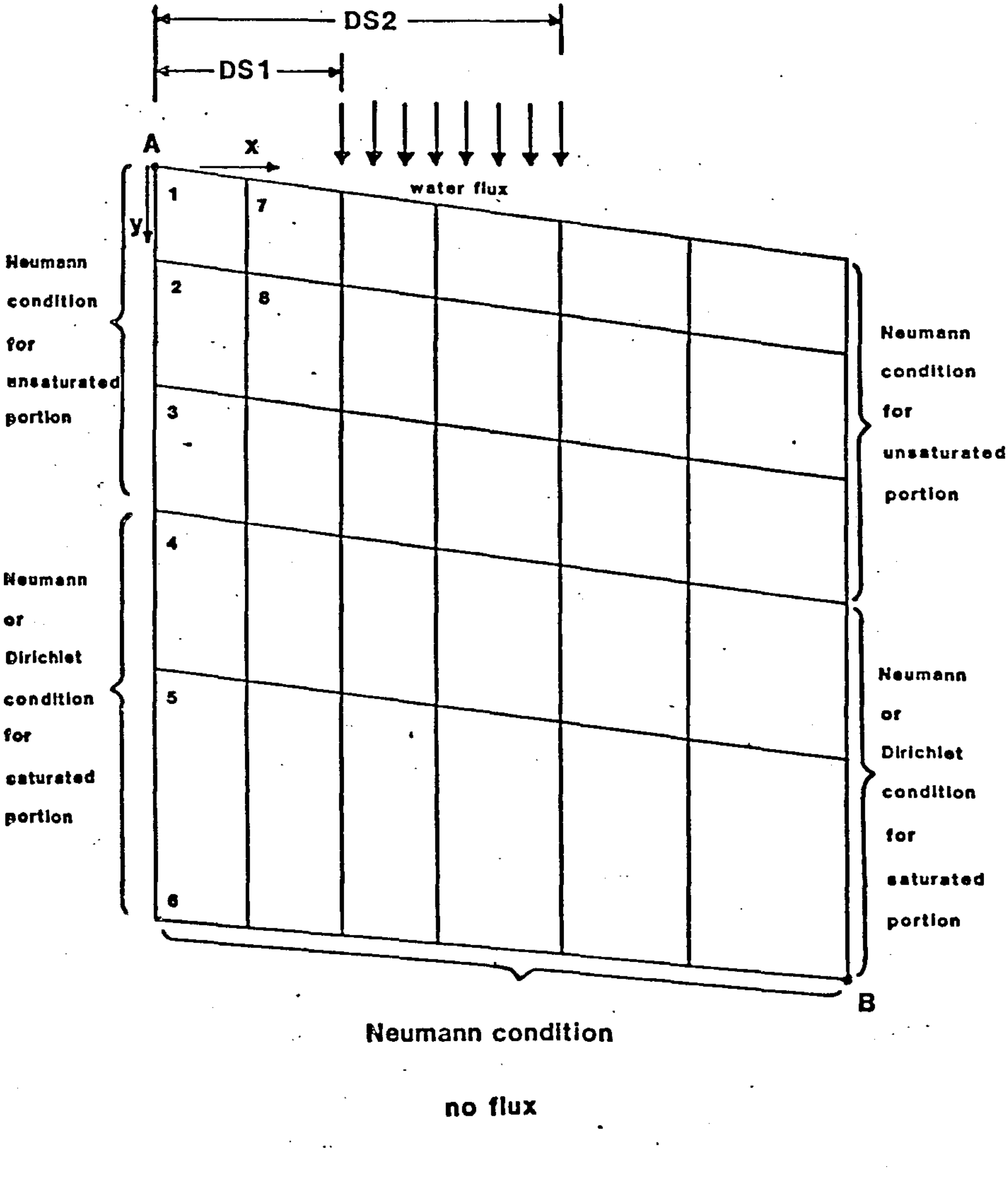

Figure 3. Configuration of Element Meshes of Hydraulic Model

and

$$\frac{P}{P_e} = \left(\frac{\Theta}{\Theta_s}\right)^{-b} \qquad (72)$$

where

Θ_s = porosity (cm^3/cm^3),

Θ = water content ratio (cm^3/cm^3),

K_s = saturated hydraulic conductivity (cm/hr),

K = hydraulic conductivity (cm/hr),

P = soil water pressure (cm of water),

P_e = air entry pressure (cm of water), and

b = empirical constant.

The parameters K_s, Θ_s, P_e, and b must be specified at each node in the problem domain. These hydraulic and water retention parameters should be measured, if possible. For cases where measured values are not available or measurement cannot be justified based on economic considerations, the work of Clapp and Hornberger (1978) can be used to estimate the required parameters. Table 1 presents the representative values for hydraulic parameters reported by Clapp and Hornberger (1978).

Initial and boundary conditions. The initial soil-water pressure must be specified at each node in the finite element mesh. If the soil moisutre distribution has been measured or can be estimated, i.e. from neutron capture logs, the initial pressure distribution can be calculated from Equation 72.

The numerical model provides for two types of boundary conditions. A zero-flux, or Neuman, boundary condition is assumed on

TABLE 1.

REPRESENTATIVE VALUES FOR HYDRAULIC PARAMETERS (STANDARD DEVIATIONS IN PARENTHESES)†

Soil Texture	Soils	Mean Clay Fraction	$\bar{b}$	$\bar{x}_e$ cm	$\bar{x}_e$ (log) cm	x_f cm	$\bar{\Theta}_s$ cm^3/cm^3	K_s* cm/min	S cm/min
Sand	13	0.03	4.05(1.78)	12.1(14.3)	3.50	4.66	0.395(0.056)	1.056	1.52
Loamy sand	30	0.06	4.38(1.47)	9.0(12.4)	1.78	2.38	0.410(0.068)	0.938	1.04
Sandy loam	204	0.09	4.90(1.75)	21.8(31.0)	7.18	9.52	0.435(0.086)	0.208	1.03
Silt loam	384	0.14	5.30(1.96)	78.6(51.2)	56.6	75.3	0.185(0.059)	0.0432	1.26
Loam	125	0.19	5.39(1.87)	47.8(51.2)	14.6	20.0	0.451(0.078)	0.0417	0.693
Sandy clay loam	80	0.28	7.12(2.43)	29.9(37.8)	8.63	11.7	0.420(0.059)	0.0378	0.488
Silty clay loam	147	0.34	7.75(2.77)	35.6(37.8)	14.6	19.7	0.477(0.057)	0.0102	0.310
Clay loam	262	0.34	8.52(3.44)	63.0(51.0)	36.1	48.1	0.476(0.053)	0.0147	0.537
Sandy clay	19	0.43	10.4(1.64)	15.3(17.3)	6.16	8.18	0.426(0.057)	0.0130	0.223
Silty clay	441	0.49	10.4(4.45)	49.0(62.1)	17.4	23.0	0.492(0.065)	0.0062	0.242
Clay	140	0.63	11.4(3.70)	40.5(39.7)	18.6	24.3	0.482(0.050)	0.0077	0.268

† from reference 12
* from reference 13

the vertical sides of the problem domain in the unsaturated zone. For the saturated zone, either a zero-flux or a fixed pressure head (Dirichlet boundary condition) may be specified. A zero-flux boundary condition is always assumed at the bottom boundary of the problem domain. A time series of fluxes are considered at the upper boundary of the problem domain.

Input data formats. The actual input data required by the hydraulic model can be classifed into the following four groups:

I Geometry and Nodal Coordinates,

II Soil Properties,

III Boundary and Initial Conditions, and

IV Time Integration and Output Parameters.

Tables 2 through 5 list all of the variables and input formats for each of the four groups of input data.

Transport Model

The input data required by the transport model include data which must also be provided for the hydraulic model. This common data base includes the site geometry, definition of the finite element mesh, and parameters relating hydraulic conductivity to soil-moisture retention.

Since the transport model can be uncoupled from the hydraulic model, the transport model code has been developed for use as a separate model, as well as for use in conjunction with the hydraulic model.

Field site geometry, nodal coordinates, and physical properties. When used in conjunction with the hydraulic model, the nodal coordinates, soil hydraulic parameters and soil-water pressure data can be read from a data file prepared automatically by the hydraulic

TABLE 2. HYDRAULIC MODEL GROUP I DATA
GEOMETRY AND NODAL COORDINATES

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	20A4	TITLE		Up to 80 alphanumeric characters may be used for problem identification
2	2I5	NNROW		Total number of horizontal dividing lines
		NNCOL		Total number of vertical dividing lines
3	3I2	IFLAGT		Creates an output file to be used for running transport. (Binary File) IFLAGT = 0 Creates a file IFLAGT = 1 No file
		IFLAGS		Creates either a steady state or a time variable pressure distribution file IFLAGS = 0 Steady state file IFLAGS = 1 Time variable file
		ISTART		Restart option - This run will continue a previous run ISTART = 0 option in effect ISTART = 1 New run but creates a restart file
4	20A4	AFMT		Format for global coordinates of nodes NOTE: Input data format must include opening and closing parentheses

5 to n	AFMT	X(I),Y(I)	cm	X,Y, coordinates for all nodes in the finite element-mesh, I = 1, NNTOT where NNTOT = NNROW * NNCOL NOTE: Coordinate pairs are entered by columns

TABLE 3. HYDRAULIC MODEL GROUP II DATA
SOIL PROPERTIES AND MOISTURE RETENTION PARAMETERS

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1 to NNTOT	4F10.0	CONDS(I)	cm/hr	Saturated conductivity for node I
		PENTR(I)	cm of H_2O	Air entry pressure for node I
		BPARA(I)		Empirical constant in Equations 71 and 72 for node I
		RATIO(I)	cm^3/cm^3	Saturated water content ration for node I NOTE: One card for each node I = 1,NNTOT where NNTOT = NNROW* NNCOL

TABLE 4. HYDRAULIC MODEL GROUP III DATA
BOUNDARY AND INITIAL CONDITIONS

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	2I5	IFLAGL		Type of boundary condition at left-hand boundary below water table IFLAGL = 1 Neuman Condition (Flux boundary) IFLAGL = -1 Dirichlet Condition (Head Boundary)
		IFLAGR		Type of boundary condition at right-hand boundary below water table IFLAGR = 1 Neuman Condition (Flux boundary) IFLAGL = -1 Dirichlet Condition (Head Boundary)
2	I5	IBC		Number of surface application periods during the simulation NOTE: IBC < 5
(3 + IBC)	2F10.0	DS1 DS2	cm cm	X-coordinate coordinates which define the distance over which a surface flux, q, is applied. $q = \begin{cases} 0 & X < DS1 \\ FLUX(J) & DS1 < X < DS2 \\ 0 & X > DS2 \end{cases}$ NOTE: See FIGURE 3

4 to (2 + IBC)	4F10.0	ON(J)	hr	Turn-on time for application period J
		OFF(J)	hr	Turn-off time for application period J
		FLUX(J)	$cm^3/hr/cm^2$	Water flux for application period J NOTE: One card for each application period J = 1, IBC
(4 + IBC)	20A4	BFMT		Format for initial pressure distribution NOTE: Input data format must include opening and closing parentheses
(4 + IBC) to m	BFMT	PRES(I)	cm of H_2O	Initial pressure at each global node in the finite element mesh NOTE: Values are read by columns

TABLE 5. HYDRAULIC MODEL GROUP IV DATA
TIME INTEGRATION AND OUTPUT PARAMETERS

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	4F10.0	TDEL	hr	Time step for integration
		TMAX	hr	Maximum simulation time
		PRT1	hr	Printout interval for soil pressure and water content distributions
		PSTED	cm/hr	Tolerance for steady state assumption. If the change in pressure over a time step is less than PSTED for all nodes; the system is assumed to have reached steady state, and the program terminates

model. The bulk density of the soil in the problem domain is the only soil property reauired for the transport model which is not used in the hydraulic model. Some of the boundary condition and time integration and output parameters can also be generated by the hydraulic model.

Soil-water pressure distribution. If the pressure distribution is generated by some other model, these data must be developed by the user, either manually or by some other independent code which will prepare the required data files.

Pollutant concentration and reaction data. Input data describing initial and boundary concentrations must be specified. The initial concentration distribution is assumed to be zero throughout the problem domain. The initial and final concentrations of all boundary input flux terms must be specified together with the corresponding starting and ending times for each input flux. Concentrations for intermediate times are obtained by linear interpolation.

The rate constants for the first order reaction in solution, λ, as well as the constants for each of the j reactions on the solid interface, a_j, must also be specified. In addition, the partition coefficient for the soil/pollutant system under consideration must be known or estimated.

Input data formats. Transport model input data can also be classified into five groups:

I Geometry and Nodal Coordinates,

II Soil properties,

III Chemical Reaction and Adsorption Parameters,

IV Boundary and Initial Conditions,

V Time integration and Output Parameters, and

VI Pressure Distribution

Tables 6 through 11 list the required input variables and formats for each of the six groups. Group I and most of Group II and Group VI input data can be read from a data file prepared by the hydraulic model if this option is selected.

TABLE 6. TRANSPORT MODEL GROUP I DATA
GEOMETRY AND NODAL COORDINATES

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	20A4	TITLE		Up to 80 alphanumeric characters may be used for problem identification
2	2I5	NROW		Total number of horizontal dividing lines
		NCOL		Total number of vertical dividing lines
3	I2	M		Total number of chemical reactions based on solid phase being considered in the computation
4	4I2	IFLAGT		Input data file option IFLAGT = 0 hydro file plus a user created file used IFLAG = 1 input file will be a user created one
		IFLAGS		Pressure distribution file description IFLAGS = 0 steady state IFLAGS = 1 time variable
		IPARAM		Modify parameter option IPARAM = 0 no modifications of the file created by the hydraulic model IPARAM = 1 modify the hydro file or read the user created

		IDEG		Degradation in the liquid phase IDEG = 0 no degradation IDEG = 1 degradation
5	20A4	CFMT		Format for global coordinates of grid points NOTE: Input data format must include opening and closing parentheses
6 to j	CFMT	X(I), Y(J)	cm	X,Y, coordinates for all grid points in the finite element-mesh, I = 1, NROW and, J = 1,NCOL NOTE: Coordinate pairs are entered by columns*

* can be supplied by either the hydro file or a user created file.

TABLE 7. TRANSPORT MODEL GROUP II DATA
SOIL PROPERTIES AND MOISTURE RETENTION PARAMETERS

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	F10.0	RU	gm/cm^3	Bulk density of soils
2 to k	4F10.0	CONDS(I,J)	cm/hr	Saturated conductivity for grid point (I,J)*
		PENTR(I,J)	cm of H_2O	Air entry pressure for grid point (I,J)*
		BPARA(I,J)		Empirical constant in Equations 71 and 72 for grid point (I,J)*
		RATIO(I,J)	cm^3/cm^3	Water content ratio for grid point (I,J) NOTE: For grid points I = 1,NROW J = 1,NCOL The data are entered by columns*

* can be supplied by either the hydro file or a user created file.

TABLE 8. TRANSPORT MODEL GROUP III DATA
CHEMISTRY PROPERTIES

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	F10.0	CONC	ppm	Pollutant concentration of the loading flux
2	F10.0	PH		pH value of the soil solution NOTE: In this version of the program, this value is used for references purposes only
3	20A4	DFMT		Format for rate of reaction and partition coefficent data NOTE: Input data format must include opening and closing parentheses
4	3A4	TNAME(I)		Alphanumeric descriptive name of the i-th chemical reaction NOTE: 12 characters maximum
5 to (1*M)	DFMT	A(I,J,K)	1/hr	Rate of the i-th reaction based on solid phase at grid point (J,K) where J = 1,NROW and J = 1,NCOL NOTE: Rates of reaction are entered by columns
(1*M) + 1 to (m*IDEG)	DFMT	DEGRAD(I,J)	1/hr	Rate of degradation in the liquid phase at grid point (I,J) I = 1, NROW and K = 1, NCOL NOTE: Rates of reaction are entred by columns

(m*IDEG) to n	DFMT	SD(I,J)	Partition coefficient of the pollutant between solid phase and liquid phase at grid point (I,J) where I = 1,NROW J = 1,NCOL NOTE: Partition coefficients are entered by columns

TABLE 9. TRANSPORT MODEL GROUP IV DATA
BOUNDARY AND INITIAL CONDITIONS

CARD NO.	FORMAT	PARAMETERS	UNITS	REMARKS
1	I5	IFLAGL		Type of boundary condition at left-hand boundary IFLAGL = 1 Input concentration on left-hand boundary required IFLAGL = 0 No input concentration on left-hand boundary required
2	I5	IFLAGR		Type of boundary condition at right-hand boundary IFLAGR = 1 Input concentration on right-hand boundary required IFLAGR = 0 No input concentration on right-hand boundary required
3	I5	IFLAGB		Type of boundary condition at bottom boundary IFLAGB = 1 Input concentration on bottom boundary required IFLAGB = 0 No input concentration on bottom boundary required
IFLAGL + 3	2I5	+NIL +NFL		Starting and ending row number at the left-hand boundary on which input concentration is required

(IFLAGL * 2) + 3 to N1[a]	6F10.0	+CIL(I) I = NIL,NFL ppm	Input concentration at left-hand boundary at starting time
(N1 + IFLAGL) to N2[b]	6F10.0	+CFL(I) I = NIL,NFL ppm	Input concentration at the left-hand boundary at ending time
(N2 + IFLAGR)	2I5	°NIR °NFR	Starting and ending row number at the right-hand boundary on which input concentration is required
N2+(IFLAGR * 2) to N3[c]	6F10.0	°CIR(I) I = NIR,NFR ppm	Input concentration at the right-hand boundary at starting time
(N3+IFLAGR) to N4[d]	6F10.0	°CFR(I) I = NIR,NFR ppm	Input concentration at the right-hand boundary at ending time
(N4+IFLAGB)	2I5	#NIB	Starting and ending column number at the bottom boundary on which input concentration is required
N4+(IFLAGB * 2) to N5[e]	6F10.0	#CIB(I) I=NIB,NFB ppm	Input concentration on the bottom boundary at starting time

(N5+IFLAGB) to N6[f]	6F10.0	#CFB(I) I=NIB,NFB	ppm	Input concentration on the bottom boundary at ending time
(N4 + 1)	I5	IBC		Number of periods for which pollutant is loaded into the field NOTE: IBC < 20*
(N4 + 2) to (N4 + IBC + 2)	2F10.0	ON(J)	hr	Turn-on time for application period j
		OFF(J)	hr	Turn-off time for application period j NOTE: One card for each application period J = 1,IBC*
(N4 + IBC + 3)	2F10.0	DS1	cm	X-coordinate of coordinates which define the starting location where pollutant is applied on the surface
		DS2	cm	X-coordinate of coordinates which define the ending location where pollutant is applied on the surface*

[a] $N1 = IFLAGL + \left(\frac{NFL - NIL}{5} + 1\right) * IFLAGL + 4$

[b] $N2 = N1 + \left(\frac{NFL - NIL}{5} + 1\right) * IFLAGL + 4$

[c] $N3 = N2 + (IFLAGR * 2) + \left(\frac{NFR - NIR}{5} + 1\right) * IFLAGR$

[d] $N4 = N3 + \left(\frac{NFR - NIR}{5} + 1\right) * IFLAGR$

e $$N5 = N4 + \frac{(NFB - NIB + 1)}{5} * IFLAGB$$

f $$N6 = N5 = \frac{(NFB - NIB + 1)}{5} * IFLAGB$$

+ input required if IFLAGL = 1

° input required if IFLAGR = 1

input required if IFLAGB = 1

* can be supplied by either the hydro file or user created file

TABLE 10. TRANSPORT MODEL GROUP V DATA TIME INTEGRATION AND OUTPUT PARAMETERS

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	F10.2	DELT	hr	Time step for integration*
2	F102	TMAX	hr	Maximum simulation time
3	3F10.0	PER1	hr	Pivot point for printout interval
		PRT1	hr	Printout interval before the pivot point
		PRT2	hr	Printout interval after the pivot point

* can be supplied by either the hydro file or user created file.

TABLE 11. TRANSPORT MODEL GROUP VI DATA
PRESSURE DISTRIBUTION: INITIAL, TIME VARIABLE, AND OR
STEADY STATE

CARD NO.	FORMAT	PARAMETER	UNITS	REMARKS
1	20A4	EFMT		Format for the pressure distribution NOTE: Input data format must include opening and closing parentheses
2 to NPF	EFMT	PRES(I,J)	cm of H_2O	Pressure distribution at each grid point (I,J) NOTE: For the grid points I = 1, NROW J = 1, NCOL The data is entered by columns*
NPF + 1	I2	ISTATE		Steady state criteria of the presure distribution file NOTE: If IFLAGS = 0 then ISTATE = 0; If IFLAGS = 1 and ISTATE = 1 the pressure is still unsteady. ISTATE = 0 the pressure is assumed steady from this time on and read no more data*
(NPF + 1) + ISTATE to NPT*ISTATE	EFMFT	PRES(I,J)	cm of H_2O	Pressure distribution for each time step = DELT until ISTATE = 0*
(NPT*ISTATE) + 1	I2	ISTATE		Steady state criteria

* can be supplied by either the hydro file or user created file.

SECTION VI

Aldicarb Migration on Long Island

Field Site Description

The field site located in the vicinity of Cutchoque, Long Island, New York (Figure 4). Long Island is underlain by consolidated bedrock. The overlying wedge-shaped mass of unconsolidated sedimentary materials consititute the ground-water reservoirs of the upper glacial, Magothy, Jameco, and Loyd aquifers. Figure 5 shows the geological cross-section of Lond Island, and Figure 6 is a contour map of the top of the bedrock.

The field site is approximately rectangular in shape as shown in Figure 7. The surface contours are presented in Figure 8. Aldicarb was applied over the field during 1977, 1978, and 1979. On December 27, 1979, the soil profile was sampled from the surface to the water table to examine the residual amounts of Aldicarb at different locations. Core samples also provided a knowledge of soil texture and hydraulic properties of the site. The locations of the soil cores are summarized in Table 12. Composition profiles for two sampling sites are presented in Table 13.

Water sampling well clusters were installed at several locations to observe water quality. Each well cluster consisted of three to five wells ranging in depth from 1-2 feet to 19-20 feet below the water table. Water samples were collected from these wells in December, 1979, and May, 1980, to determine the concentrations of Aldicarb and its degradation products in the ground-water.

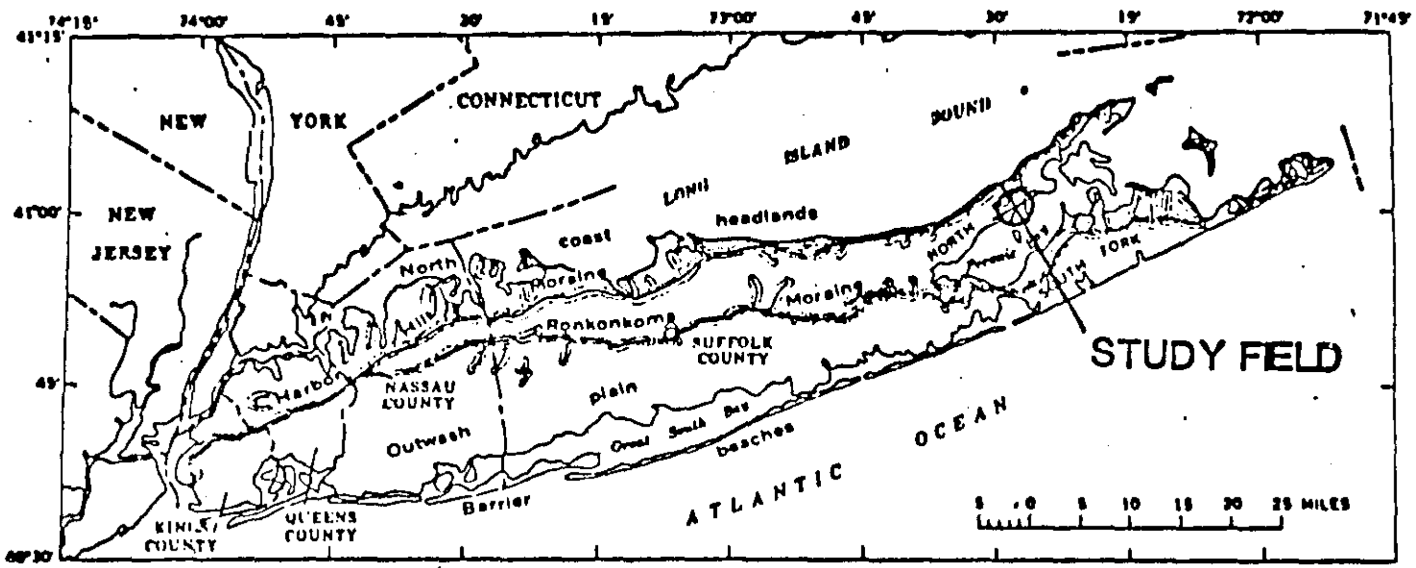

Figure 4. Map of Long Island Showing Study Field Location

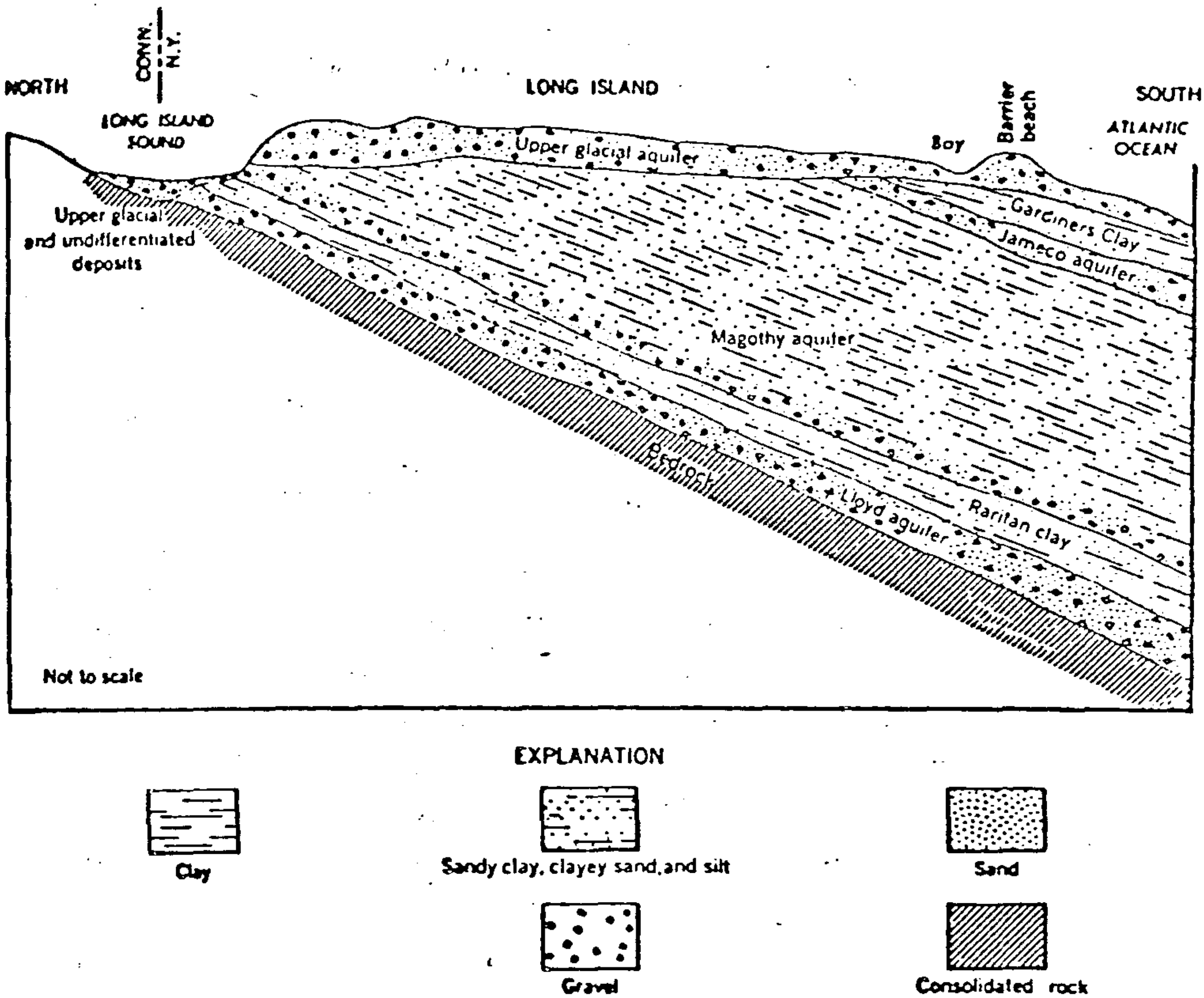

Figure 5. Generalized North-South Cross-Section Through Long Island Along the Nassau-Suffolk County Line

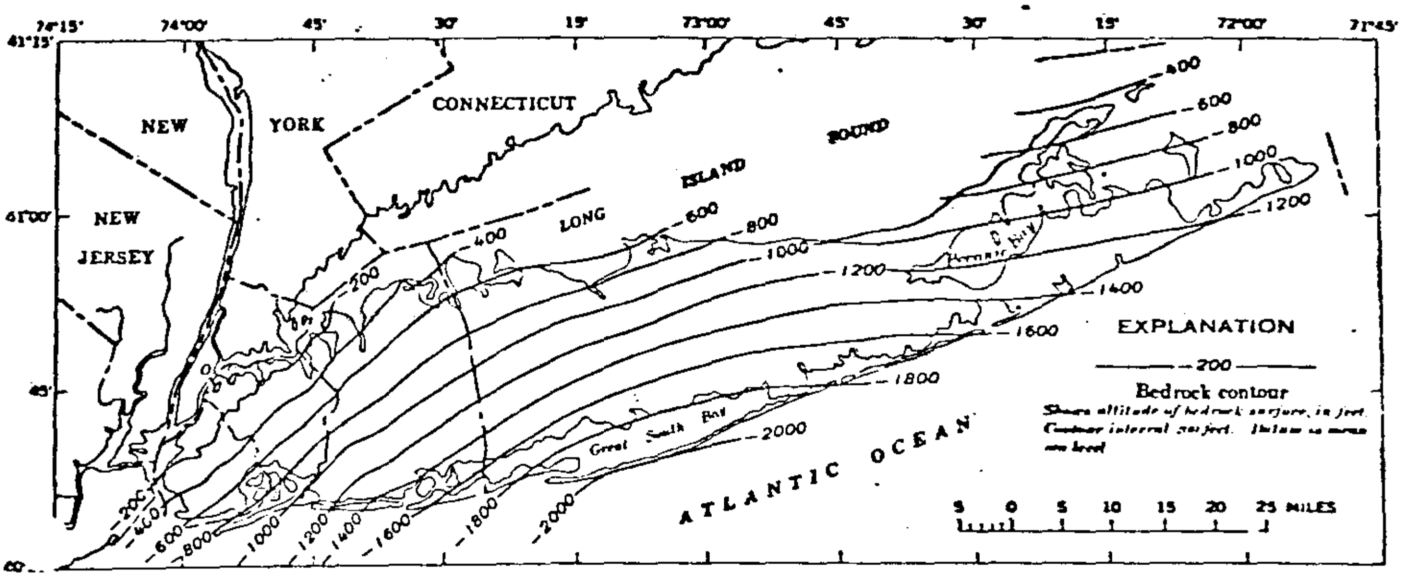

Figure 6. Contour Map of the Bedrock Surface

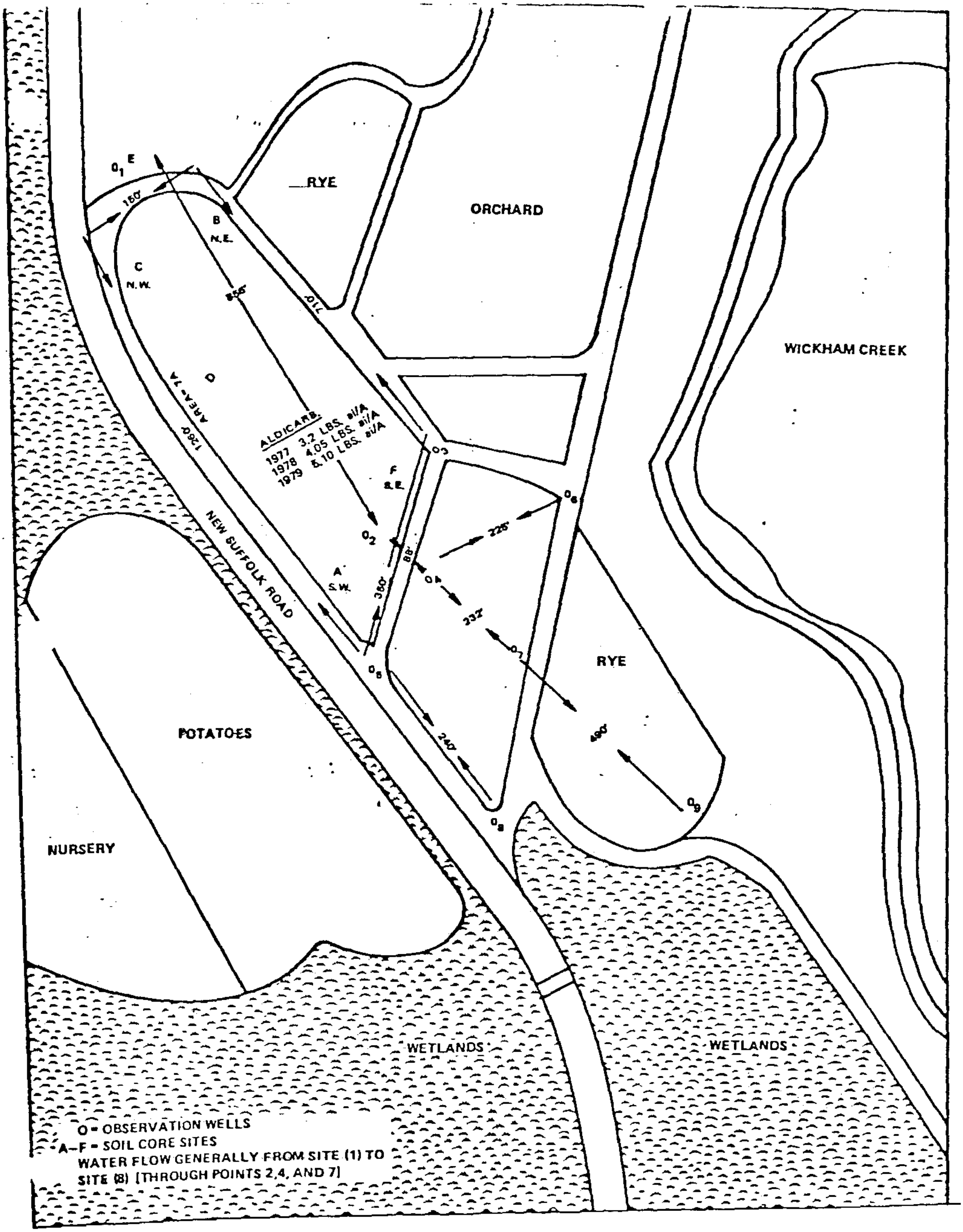

Figure 7. Field Dimension and Sampling Wells, Soil Cores

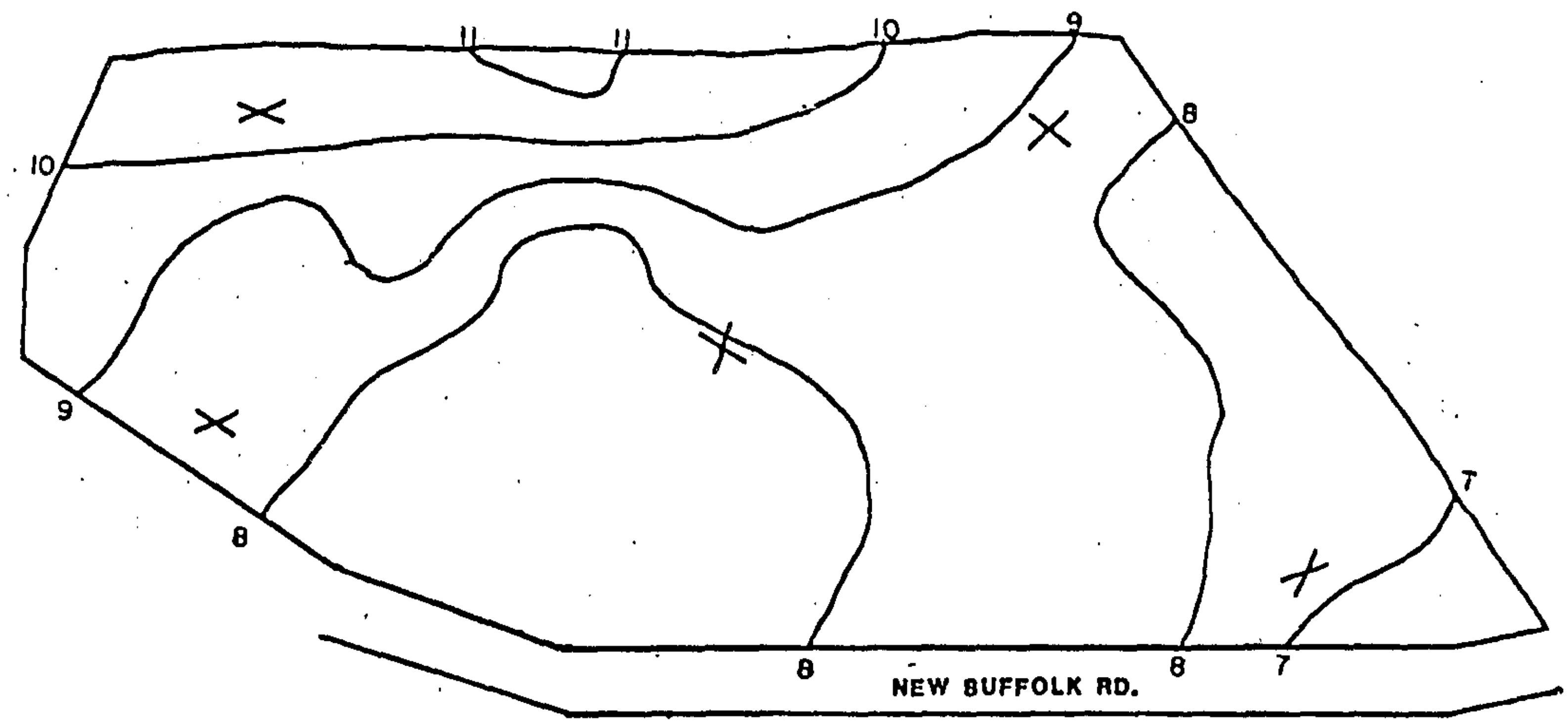

Figure 8. Surface Contour Map

TABLE 12

CODE FOR LABELING OF SOIL SAMPLES TAKEN FROM A
POTATO FIELD IN CUTCHOGUE, N.Y., DECEMBER 27, 1979

	SW CORNER	NE CORNER	NW CORNER	CENTER	CONTROL	SE CORNER
Surface-3 in	A12	B1	C12	D14	E1	F16
6 in	A11	B2	C11	D13	E2	F15
1 ft	A10	B3	C10	D12	E3	F14
1.5 ft	A9	B4	C9	D11	E4	F13
2 ft	A8	B5	C8	D10	E5	F12
2.5 ft	A7	B6	C7	D9	E6	F11
3 ft	A6	B7	C6	D8	E7	F10
3.5 ft	A5	B8	C5	D7	E8	F9
4 ft	A4	B9	C4	D6	E9	F8
4.5 ft	A3	B10	C3	D5	E10	F7
5 ft	A2	B11	C2	D4	E11	F6
5.5 ft	A1	B12	C1	D3	E12	F5
6 ft		B13		D2	E13	F4
6.5 ft		B14		D1	E14	F3
7 ft		B15			E15	F2
7.5 ft		B16			E16	F1
8 ft					E17	
8.5 ft					E18	
9 ft					E19	
9.5 ft					E20	

TABLE 13

SOIL COMPOSITIONS OF SOIL CORES COLLECTED FROM WICKHAM FARM, LONG ISLAND

Sample Code	Gravel (3" to #4 Sieve) %	Sand (#4 Sieve to 0.074mm)%	Silt (0.0074mm to 0.005mm)%	Clay (less than 0.005mm)%	Texture
B1	0.4	69.1	25.0	5.5	loamy sand
B2	0.4	68.1	24.2	7.3	loamy sand
B3	3.2	73.7	15.9	7.2	loamy sand
B4	7.3	84.5	4.0	4.2	sand
B5	4.5	94.8	0.7	0	sand
B6	6.6	92.0	1.4	0	sand
B7	6.6	91.8	1.6	0	sand
B8	10.8	88.1	1.1	0	sand
B9	21.3	62.0	14.2	2.5	sand
B10	6.2	34.3	50.0	9.5	sandy loam
B11	0.6	33.9	56.6	8.9	sandy loam
B12	8.2	74.2	15.3	2.3	sand
B13	4.2	91.6	3.1	1.1	sand
B14	9.7	89.6	0.7	0	sand
B15	6.1	93.2	0.7	0	sand
B16	8.4	90.3	1.3	0	sand
F1	7.1	90.6	2.3	0	sand
F2	0.6	98.0	1.4	0	sand
F3	0.8	97.9	1.3	0	sand
F4	2.3	96.5	0.3	0.9	sand
F5	2.7	95.3	1.3	0.7	sand
F6	3.2	95.7	1.0	0.1	sand
F7	3.8	93.7	2.5	0	sand
F8	4.4	92.6	1.4	1.6	sand
F9	12.0	85.8	0.5	1.7	sand
F10	14.0	82.8	1.8	1.4	sand
F11	8.4	82.0	6.0	3.6	sand
F12	17.0	64.4	15.0	3.6	sand
F13		51.7	34.5	13.8	silt loam
F14		37.6	46.1	16.3	silt loam
F15		41.1	43.9	15.0	silt loam
F16		40.4	46.4	13.2	silt loam

Preparation of Input Data for the Hydraulic Model

The actual elevation and slope of the water table beneath the field site can be obtained by subtraction of the depth of the saturated water zone beneath the surface from the surface elevation.

From the hydraulic data collected in the field, the ground-water movement is essentially from northwest to southeast. The two-dimensional hydraulic model can be used to approximate the flow conditions in the field for a vertical cross-section along line SS' in Figure 7. The line SS' passes through the well clusters of O_1, O_2, O_4, O_7, and O_9 from northwest to southeast in the field site, respectively.

The hydraulic model will be used to simulate the unsaturated zone and the upper portion of the saturated zone, simultaneously.

Geometry and Nodal Coordinates (Group I Input Data)

Figure 9 shows the finite element mesh configuration of the cross-section along line SS' in Figure 7. The elements are formed by twelve vertical lines and nineteen horizontal lines. The horizontal dimension of the field extends from S to S' as shown in both Figures 7 and 9. The shaded portions of 10m wide on each side of the field in Figure 9 are boundary fringes attached to the field mesh to incorporate Dirichlet boundary conditions in the saturated zone on the vertical boundaries. The actual thickness of the aquifer is over 100 feet. For the practical purpose of computation, an impervious boundary is assumed at a depth of 38.71 meters. A further downshift of this boundary causes little effect on the flow field. The elements are considerably smaller in the unsaturated region where the pressure changes more rapidly during a

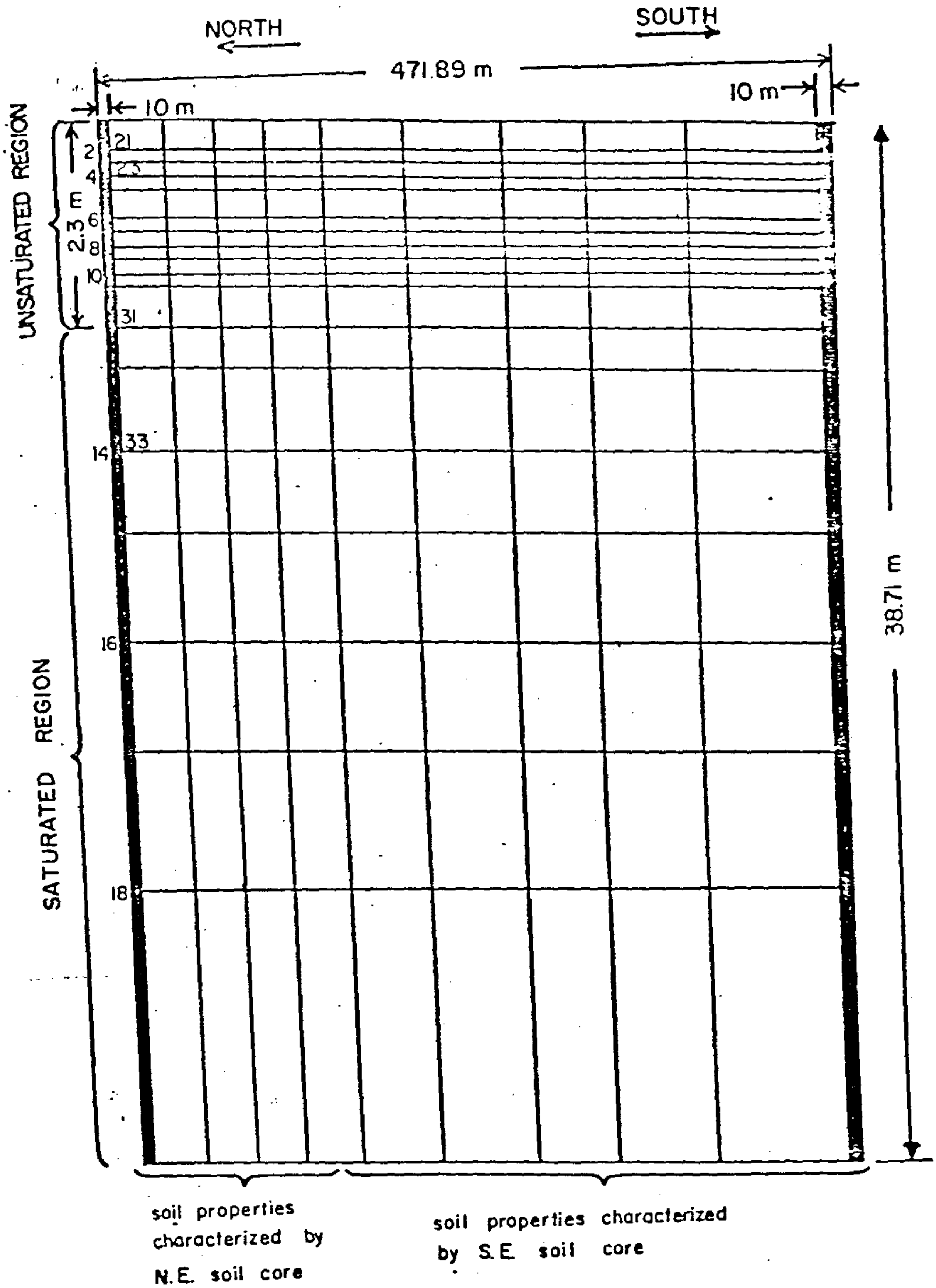

Figure 9: Finite Element Meshes

recharge period. The elements gradually take on larger dimensions toward the bottom of the problem domain. The global coordinates of every nodal point are required in the input and are listed in Appendix C. The nodes are numbered sequentially from top to bottom on a single column, and from the left column to the right column as shown by the small case numerals in Figure 9. The slope of the surface is calculated from the surface contour in Figure 8 and approximated by linearization.

Soil Properties (Group II Input Data)

The soil composition and texture from soil cores at sampling sites B and F (Table 12) are used in conjunction with Table 1 to characterize the hydraulic parameters at each node. The saturated conductivity and moisture retention parameters are listed in Appendix C.

Boundary and Initial Conditions (Group III Input Data)

Information about ground-water divides is not available; two fringes, each 10 meters wide, are attached to the finite element mesh configuration (Figure 9) to eliminate the need to establish the exact location of ground-water divides. Constant head (Dirichlet boundary) conditions are imposed on the saturated portion of the vertical boundaries of the problem domain. Further movement of these boundaries away from the site has little effect on the computational results. Constant pressure heads are selected in the hydraulic model by setting IFLAGL = -1 and IFLAGR = -1 (Table 4).

The surface water flux can be estimated from the water balance equation

$$L + P_r = ET + W_r + r \qquad (73)$$

P_r is the precipitation, L is any water loading other than precipitation, ET is the evapotranspiration, W_r is the recharge water flux, and r is the runoff rate. The present example, assumes L = 0 and r = 0. The recharge rate W_r is calculated from a knowledge of P_r and ET. Table 14 lists the climatic data recorded at Greenport Powerhouse Gauging Station, Long Island. This station is the only gauging station close to the study field, and the recorded data are the best available approximation to the actual conditions in the field. The evapotranspiration rate can be estimated form the pan evaporation rate as

$$ET = K\, C_{et}\, E_{pan} \qquad (74)$$

where E_{pan} is the pan evaporation, K is a crop coefficient, and C_{et} is the coefficient for the type of pan involved. In the present calculation, K is taken to be 0.65 for potatoes grown on the field. An average value of C_{et} = 0.85 is assumed (Table 15). Using these values in Equations 73 and 74, the recharge rate is estimated to be 0.00722 cm/hr, which is the average rainfall excess in the two-year period of 1978 through 1979. The input data for the number of application time periods and rates for each period required in Table 4 will be taken as one single application period covering the entire simulation time.

The recharge flux comes from average rainfall excess, therefore the recharge covers the whole surface in Figure 7. Consequently, DS1 and DS2 in Table 4 take the values of 0 cm and 47189 cm to include the entire surface of the problem domain.

TABLE 14

PRECIPITATION AND EVAPORATION AT
GREENPORT POWERHOUSE GAUGING STATION†

Year	Month	Precip (cm)	E_{pan} (cm)	Wind (km/mon)	ET (cm)	Rainfall excess
	Jan	20.9			3.8*	17.1
	Feb	3.6			3.8*	-0.3
	Mar	6.7			3.8*	2.9
	Apr	5.4	11.1		6.1	-0.7
	May	13.5	12.6	3924	6.9	6.5
1978	Jun	3.1	15.8	3446	8.7	-5.6
	Jul	16.9	18.2	3338	10.1	6.8
	Aug	26.6	12.0	2351	6.6	20.0
	Sep	7.6	10.3	2554	5.7	1.9
	Oct	8.3	8.7	2349	4.8	3.5
	Nov	7.3			3.8*	3.5
	Dec	15.3			3.8*	12.3
	Jan	33.9			3.5*	30.4
	Feb	11.8			3.5*	8.3
	Mar	6.4			3.5*	2.8
	Apr	11.1			3.5*	7.6
	May	14.1			3.5*	10.6
1979	Jun	4.1	16.7	2948	9.2	-5.2
	Jul	1.8	15.9	2224	8.8	-7.0
	Aug	10.1	13.4	2310	7.4	2.7
	Sep	9.7	11.0	2799	6.1	3.6
	Oct	9.4	7.1	3459	3.9	5.4
	Nov	10.2			3.5*	6.7
	Dec	4.9			3.5*	1.4

† From NOAA

* Estimated

TABLE 15

SUGGESTED VALUE FOR C RELATING EVAPORATION FROM A CLASS A PAN TO EVAPOTRANSPIRATION FROM 8-15 cm TALL, WELL WATERED GRASS TURF (Jensen, 1975)

	Pan surrounded by a short green crop				Pan surrounded by a dry surface ground			
Wind	Upwind fetch of crop (m)	Relative Humidity %* 20-40	40-70	>70	Upwind fetch of dry fallow (m)	Relative Humidity %* 20-40	40-70	>70
	0	0.55	0.65	0.75	0	0.7	0.8	0.85
Light	10	0.65	0.75	0.85	10	0.6	0.7	0.8
<170 km/day	100	0.7	0.8	0.85	100	0.55	0.65	0.75
	1000	0.7	0.85	0.85	1000	0.5	0.6	0.7
	0	0.5	0.6	0.65	0	0.65	0.75	0.8
Moderate	10	0.6	0.7	0.75	10	0.55	0.65	0.7
170-425 km/day	100	0.65	0.75	0.8	100	0.5	0.6	0.65
	1000	0.7	0.8	0.8	1000	0.45	0.55	0.6
	0	0.45	0.5	0.6	0	0.6	0.65	0.7
Strong	10	0.55	0.6	0.65	10	0.5	0.55	0.65
425-700 km/day	100	0.6	0.65	0.7	100	0.45	0.5	0.6
	1000	0.65	0.7	0.75	1000	0.4	0.45	0.55
	0	0.4	0.45	0.5	0	0.5	0.6	0.65
V. Strong	10	0.45	0.55	0.6	10	0.45	0.5	0.55
>700 km/day	100	0.5	0.6	0.65	100	0.4	0.45	0.5
	1000	0.55	0.6	0.65	1000	0.3	0.4	0.45

* Mean of maximum and minimum relative humidities

A constant recharge flux of 0.00722 cm/hr is assumed over the study site and the simulation is carried out for the steady state flow condition under this flux. Although initial pressure distribution attributes little importance to the steady state results, an initially linear relationship from the surface to the water table will conserve computation efforts. The initial soil moisture pressure distribution is listed in Appendix C.

Time Integration and Output Parameters (Group IV Input Data)

The integration is carried out by using step wise TDEL = 25 hours and covers a period of TMAX = 5000 hours. Whenever the pressure change of each nodal point over one time step is less than PSTED = 0.000001 cm of water, steady state is assumed and the calculation will be terminated.

Appendix C lists all the input data to the hydraulic model for the simulation of the subsurface water flow of the study site. Appendix D lists the output from this computer model.

CALCULATION OF INPUTS FOR THE TRANSPORT MODEL

The transport model, assumes that convection is the major mechanism in pollutant migration. From the results of the steady-state pressure distribution of the hydraulic model, the water flux and hence, determination of the convection velocity can be estimated. The transport model utilizes a method of characteristics and finite difference grid configuration in the computations. The geometric configuration of the finite element mesh in the hydraulic model can be used for the grid point geometry of the transport model. The following input data descriptions are prepared according to the input variables tabulated in Section V.

Geometry and Nodal Coordinates (Group I Input Data)

Although the finite element mesh can be redefined for the finite-difference mesh required by the transport model, the same nodal geometry can also be used for both models. The 10 meter wide boundary fringes in the finite element mesh are deleted, leaving a finite difference grid of 10 vertical lines and 19 horizontal lines. The finite difference grid is shown in Figure 10. The nodes are labeled by row, i, and column, j. The coordinates of the nodes $(x_{i,j},y_{i,j})$ are listed in Appendix E and F.

Soil Properties (Group II Input Data)

The bulk density of the soils is assumed to be the average value of 1.55 gm/cm^3. The hydraulic conductivity, air entry level, exponent parameter (b, equations 71 and 72), and saturated water content ratio of every grid point can be obtained from Table 1 and from the knowledge of the grid point coordinates in Figure 10.

Chemical Reaction and Adsorption Parameters (Group III Input Data)

Degradation of Aldicarb, sulphoxide, and sulphone is the only reaction to be considered in the present calculation. Since Aldicarb and its oxidation products, sulphoxide and sulphone, are equally toxic, and the transformation of Aldicarb into sulphoxide and sulphone is extremely fast compared with the half life of the products; the projection of the migration phemomenon will be based on the degradation

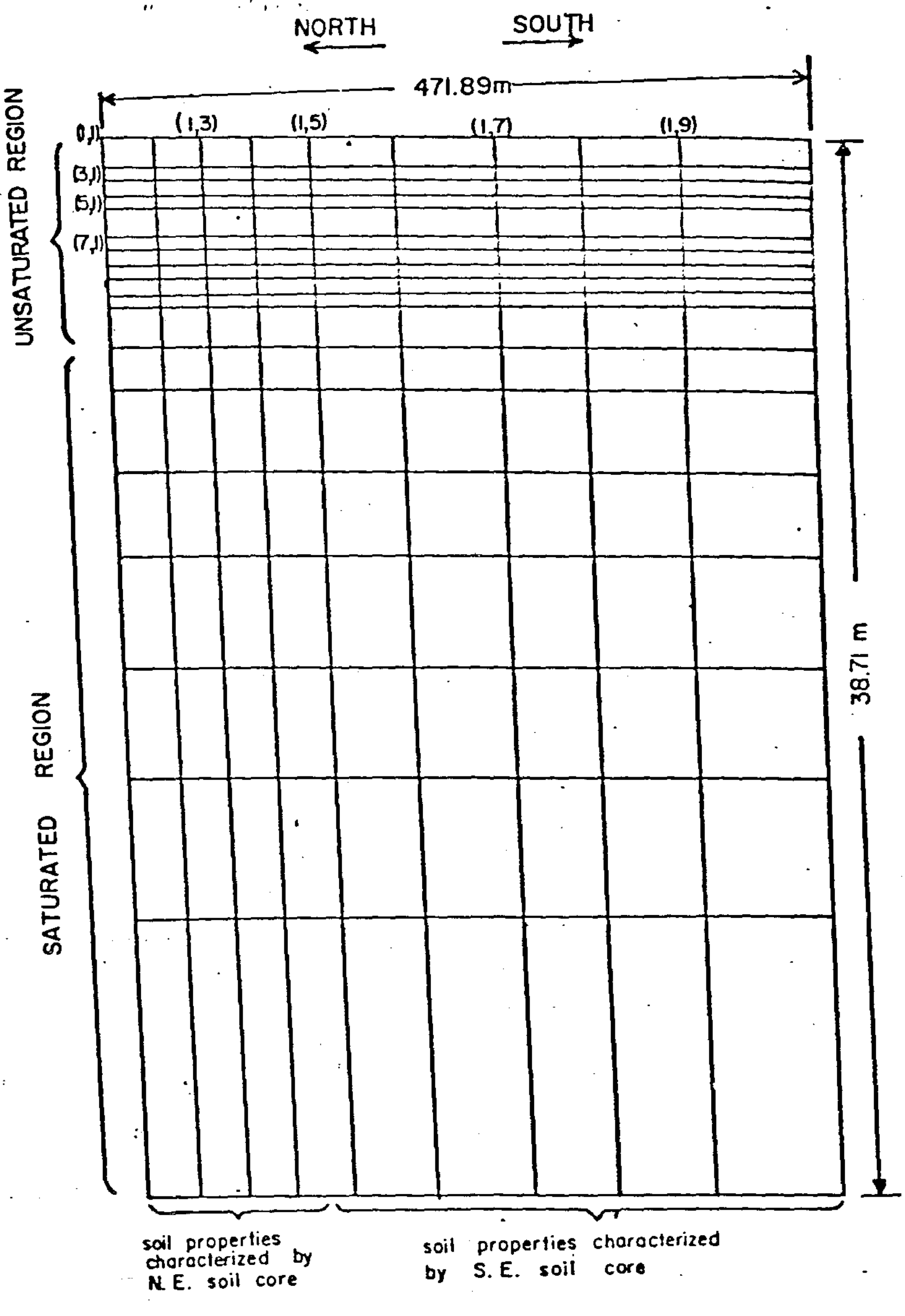

Figure 10. Grid Point Configuration of Transport Model

rate of sulphone and sulphoxide. The reported first order rate constant for degradation of Aldicarb sulphone and Aldicarb sulphoxide covers a wide range, 0.004 day^{-1} to 0.035 day^{-1}, depending on the soil texture and soil depth. For peaty soil, the degradation rate ranges from 0.0019 hr^{-1} to 0.00029 hr^{-1}; for sandy loam, the values are 0.00033 hr^{-1} to 0.00075 hr^{-1} (Smelt et al., 1978a, 1978b). In this study, the homogeneous reaction rate is used at every grid point above the water table. A zero degradation rate is assumed at every grid point below the water table. Minimum and maximum reaction rates of peaty sand and sandy loam can be used in the simulation to give upper and lower limits of the projection. The pH value required in Table 8 is used as a reference, no pratical calculation is based on this variable in the present versions of the transport model.

Chiou, et al. (1979) have studied the relationship between soil water distribution coefficients and solubility. The empirical relationship is

$$\log G = 4.04 - 0.557 \log S \qquad (75)$$

where G is the partition coefficient to the organic matter, and S is the solubility in micromoles per liter.

In this calculation, the solubility is taken to be 7800 ppm. The molecular weight of Aldicarb is 190.3, and, G is calculated as 29.564. G can be related to the soil partition coefficient (K_d) based on the fraction of organic matter in the soil where

$$K_d = \frac{G\ (\%\ \text{organic matter})}{100} \qquad (76)$$

Table 16 lists the organic matter content and corresponding partition coefficients from sampling sites B and F.

Boundary and Initial Conditions (Group IV Input Data)

From the results of the hydraulic model, ground-water flow is from north to south (left to right in Figure 10). Thus, IFLAGR = 0, IFLAGB = 0, and IFLAGL = 1 in Table 9. Since there is no Aldicarb upgradient of the problem domain, CIL(I) and CFL(I) in Table 9 are set equal to zero for all water flux at the left-hand boundary (Figure 10).

Aldicarb was applied only to the northwestern portion of the field site (Figure 7). Since only part of the surface shown in Figure 10 was subjected to application, DS1 = 0.0 and DS2 = 22,500 cm in Table 9.

From 1977 to 1979, Aldicarb was applied to the study field twice a year, once in April and once in June. Table 16 shows the date and amount of each application. The Aldicarb concentration on the surface is assumed to be its solubility 7800 ppm, hence the variable IBC in Table 9, and CONC in Table 8 will have the values of IBC = 6 and CONC = 7800 ppm.

The duration of each applicaton can be estimated from the knowledge of average recharge flux, solubility, and the total amount of Aldicarb per unit area, or

$$\Delta T \text{ (hour)} = \frac{10 \times \text{amount of aldicarb (kg/ha)}}{\text{water flux (cm/hr)} \times \text{solubility (ppm)}} \qquad (77)$$

TABLE 16

PARTITION COEFFICIENT

Depth (ft)	NE			SE		
	Sample code	Organic matter(%)	k_d	Sample code	Organic matter(%)	k_d
0"-3"	B1	0.7	0.2069	F16	0.3	0.0887
6"	B2	0.1	0.0296	F15	0.4	0.1183
1	B3	0.3	0.0887	F14	*0.1	0.0296
1.5	B4	*0.1	0.0296	F13	0.2	0.0591
2.0	B5	*0.1	0.0296	F12	0.1	0.0296
2.5	B6	*0.1	0.0296	F11	*0.1	0.0296
3.0	B7	0.1	0.0296	F10	0.1	0.0296
3.5	B8	0.1	0.0296	F9	*0.1	0.0296
4.0	B9	0.1	0.0296	F8	0.1	0.0296
4.5	B10	0.1	0.0296	F7	0.1	0.0296
5.0	B11	0.1	0.0296	F6	*0.1	0.0296
5.5	B12	*0.1	0.0296	F5	*0.1	0.0296
6.0	B13	*0.1	0.0296	F4	*0.1	0.0296
6.5	B14	0.2	0.0591	F3	*0.1	0.0296
7.0	B15	0.1	0.0296	F2	*0.1	0.0296
7.5	B16	0.1	0.0296	F1	0.3	0.0887

* below detectable limits

TABLE 17

ALDICARB APPLICATION PERIOD

Date	kg/ha
April 15, 1977	2.24
June 10, 1977	1.34
April 15, 1978	2.52
June 10, 1978	2.02
April 15, 1979	3.20
June 10, 1979	2.52

where ΔT is the duration of pesticide pulse. The starting time on April 15, 1977, is taken as time zero. The starting time and ending time of each application period is listed in Table 18.

All of the input data for the transport model are listed in Appendix E; the input data if using the hydro file option, in Appendix F; and the model output is presented in Appendix F.

Three groups of information are provided in the computer output. The first group under the title "Solution Concentration" represents the concentration of the pollutant in soil water at the time being considered. The second group output under the title "Instantaneous Adsorption of the Pollutant in ppm Based on Solid Phase" is the total amount of adsorption at every grid point (i,j). The third group output under the title "Decrease of Pollutant by Reaction in ppm of Liquid Phase" represents the total accumulated decrement of the pollutant at grid point (i,j) by degradation in the liquid phase, that is, the amount represented by the second term on the right hand side in Equation 18. The fourth group could be output under the title "Decrease of Pollutant in the Solid Phase by XXXX in ppm", this represents the total accumulated decrement of the pollutant at grid point (x,y) by various chemical reaction in the solid phase. Mathematically, it is the first term of Equation 18 corresponding to different a_j.

Results

The models were evaluated by comparing the projections for the transport of Aldicarb with field measurements at the site. Enfield et al., (1982) compared three different models with the Aldicarb data, and performed sensitivity analysis on the degradation rate of the pesticide

TABLE 18

PULSE DURATION OF ALDICARB APPLICATION

Period	Date	Starting Time (hr)	Ending Time (hr)
1	04/15/77	0.0	0.3980
2	06/10/77	1344.0	1344.2388
3	04/15/78	8760.0	8760.4478
4	06/10/78	10104.0	10104.3528
5	04/15/79	17520.0	17520.5672
6	06/10/79	18865.0	18864.4478

Aldicarb and its oxidation products Aldicarb sulphone and Aldicarb sulphoxide. The degradation rate assumed in this simulation was 0.00019 per hour, a value that is in the range of those reported by Smelt et al., (1978a and 1978b).

The model was evaluated for the period from April 1977, to April 1980, and compared to data collected in December 27, 1979. Figures 11 and 12 show the projections for the northeast and southeast locations at the time step closest to the sampling period. Similar results were obtained for degradation in the solid phase, as long as the total degradation rate was the same. This follows from

$$C_T = \Theta C + \rho S \tag{78}$$

where C_T is the total concentration (mass of solute per unit volume of soil). Assuming instantaneous and reversible kinetics and first-order reactions in the liquid and solid phases, the total concentration can be expressed as

$$C_T = \Theta \lambda C - \rho \sum_j a_j K_d C \tag{79}$$

and after grouping terms Equation 79 simplifies to

$$C_T = - \Theta \lambda_T C \tag{80}$$

where λ_T is the total degradation rate (time^{-1})

$$\lambda_T = \lambda + \frac{\rho k_d \sum_j a_j}{\Theta} \tag{81}$$

SIMULATION OF ALDICARB DECEMBER 1979 (DAY 1025)

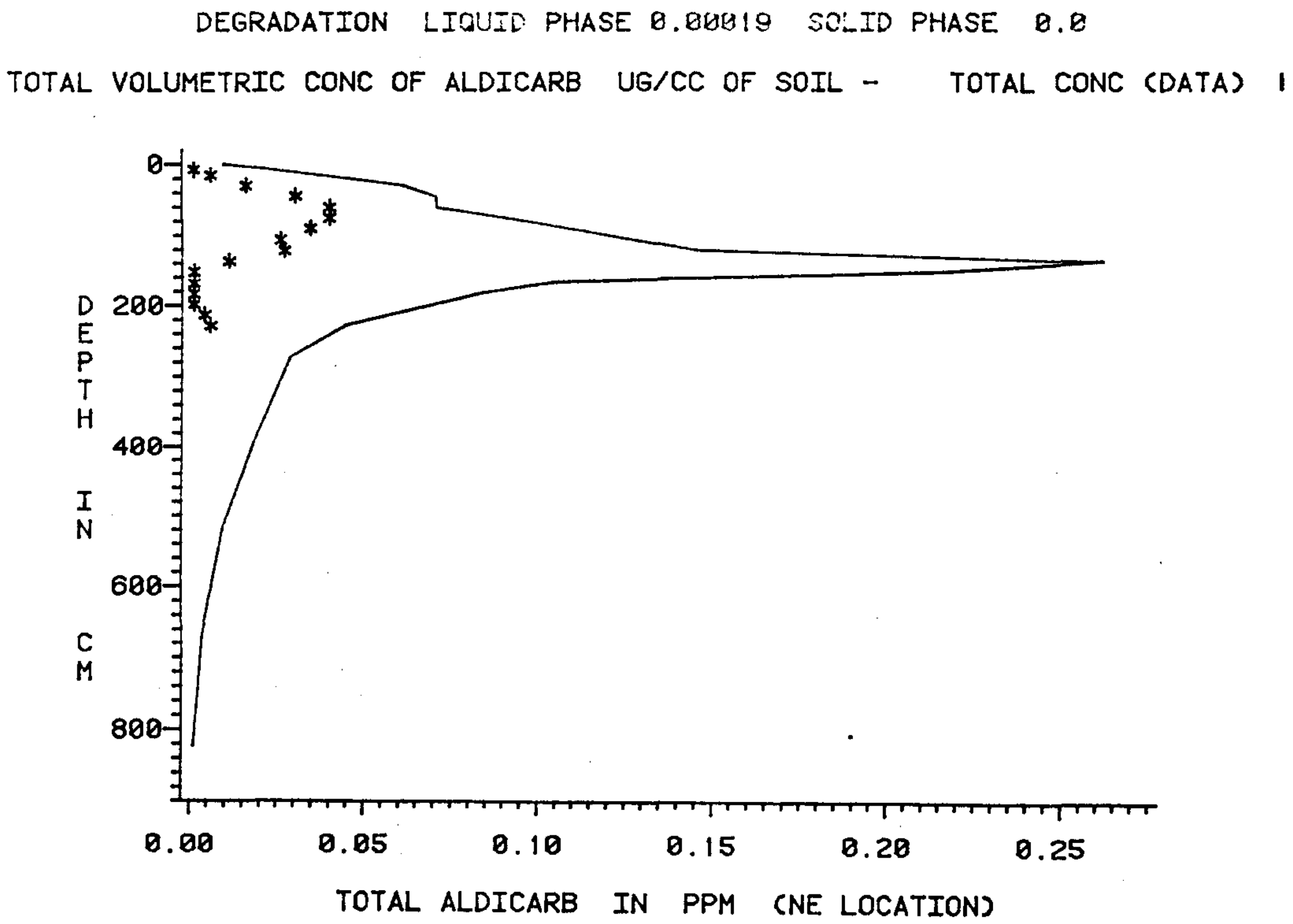

Figure 11. Simulation of Aldicarb NE location

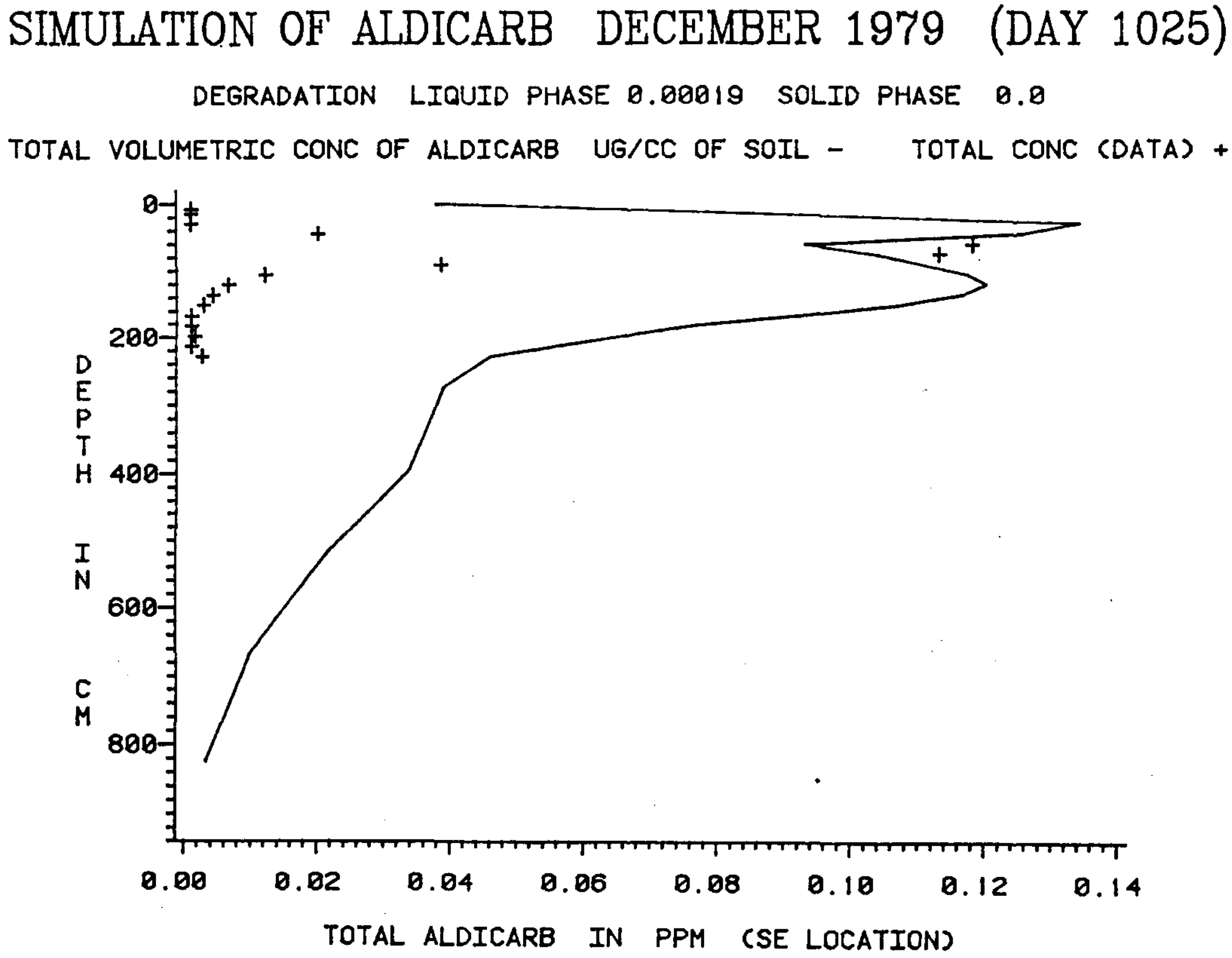

Figure 12. Simulation of Aldicarb SE location

The total concentration in a mass basis rather than on a volumetric basis is

$$C_{Tm} = \frac{C_T}{\rho} \tag{82}$$

where C_{Tm} is the total concentration (mass of solute per gram of solids). Figures 13 and 14 show the projections of the same locations but in the same units as the collected data (μg/g, Enfield et al., 1982). Figures 15 and 16 show the final simulation with degradation and sorption in the saturated zone.

The model can project the behavior of the pesticide Aldicarb in the saturated and unsaturated zones, overall the peaks of the data and prediction are very close. Degradation and sorption in the saturated zone improves the prediction, although there was not enough data to establish a pattern in the saturated zone. The concentration in the transport model is extremely sensitive to the degradation rate, and in order to refine the predictive ability of the model more accurate degradation rates, application periods, and a better estimate of the recharge rate are required.

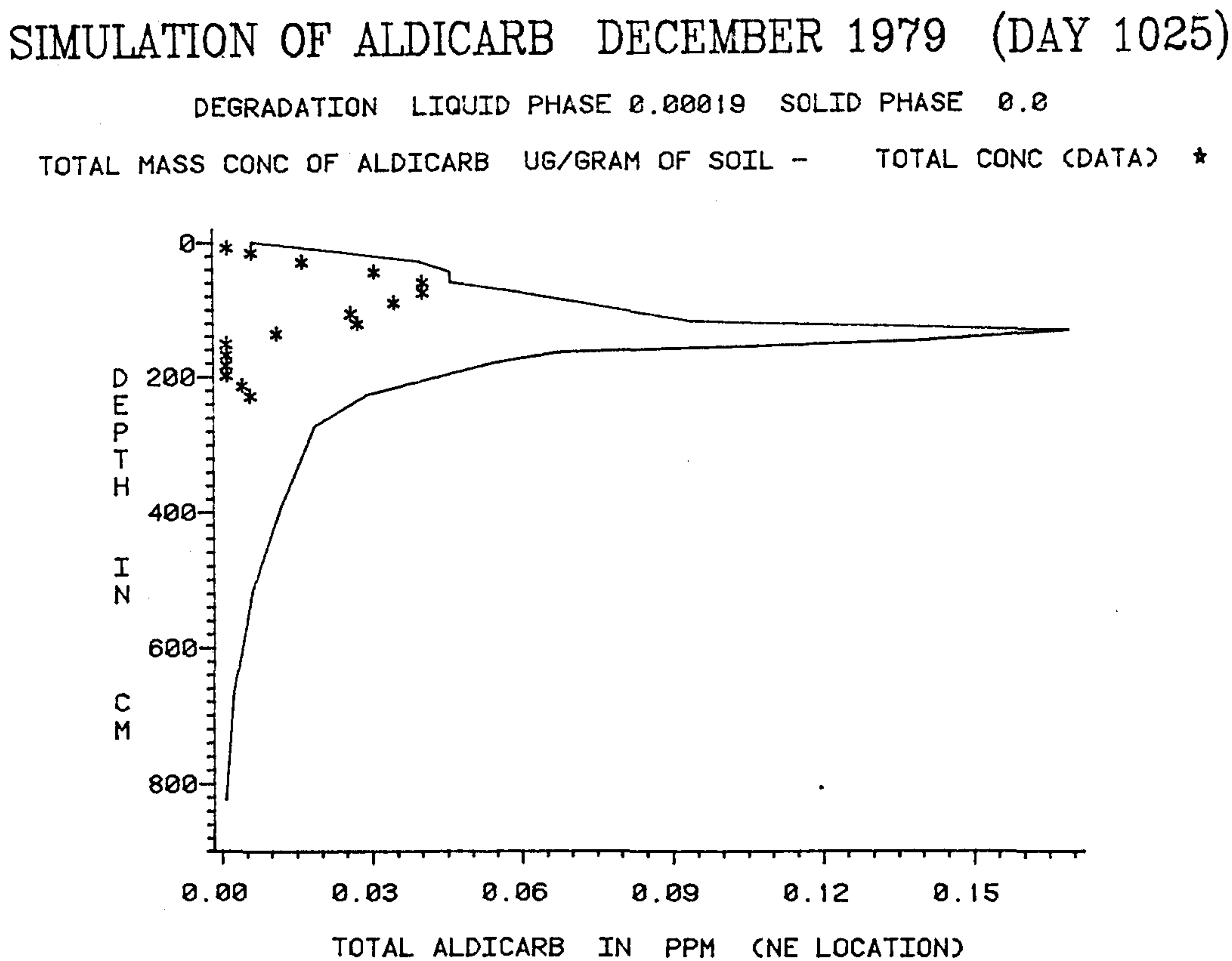

Figure 13. Simulation of Aldicarb mass concentration NE location

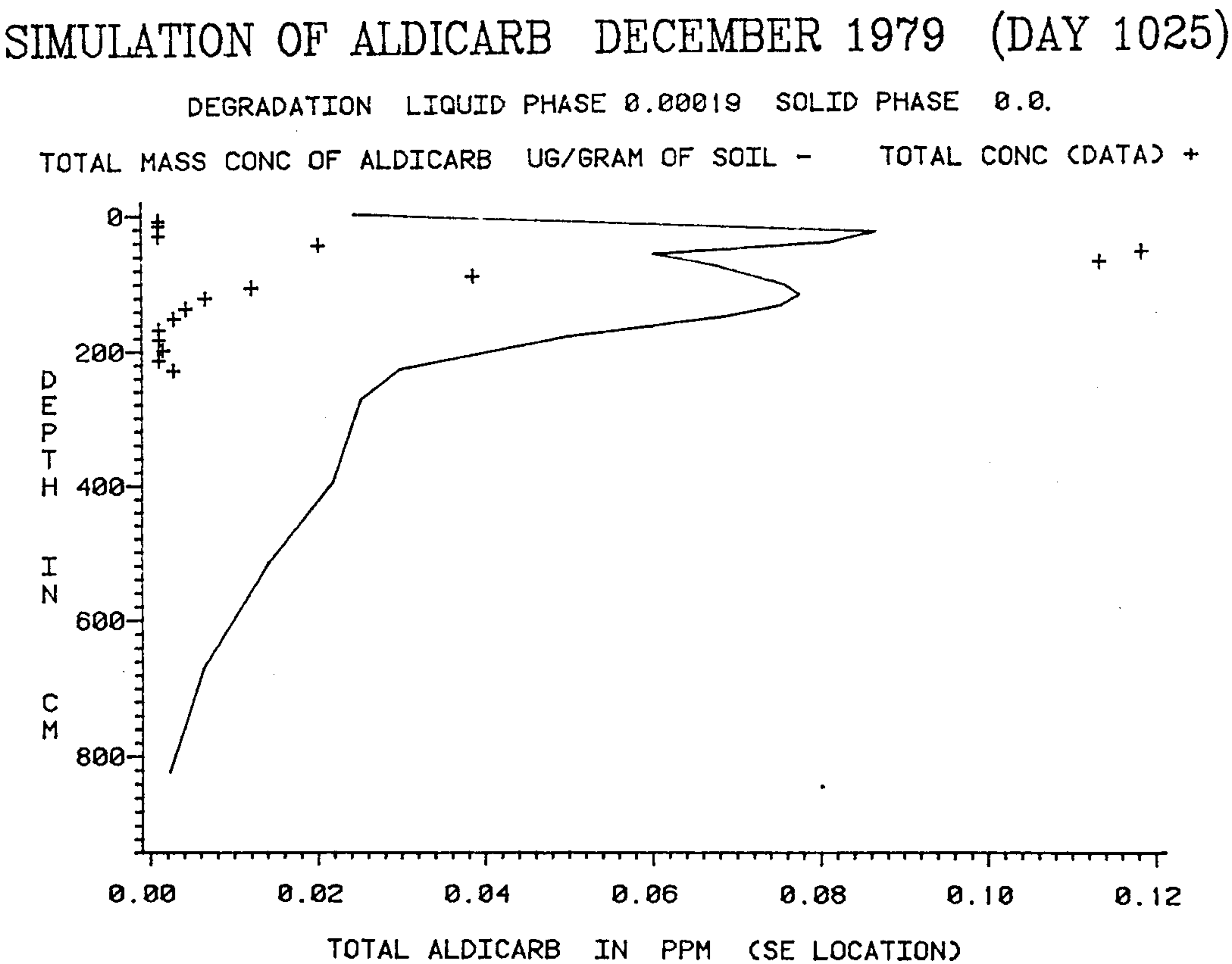

Figure 14. Simulation of Aldicarb mass concentration SE location

SIMULATION OF ALDICARB DECEMBER 1979 (DAY 1(

TOTAL DEGRADATION 0.00019 PER HOUR

TOTAL MASS CONC OF ALDICARB UG/GRAM OF SOIL - TOTAL CONC (DATA) *

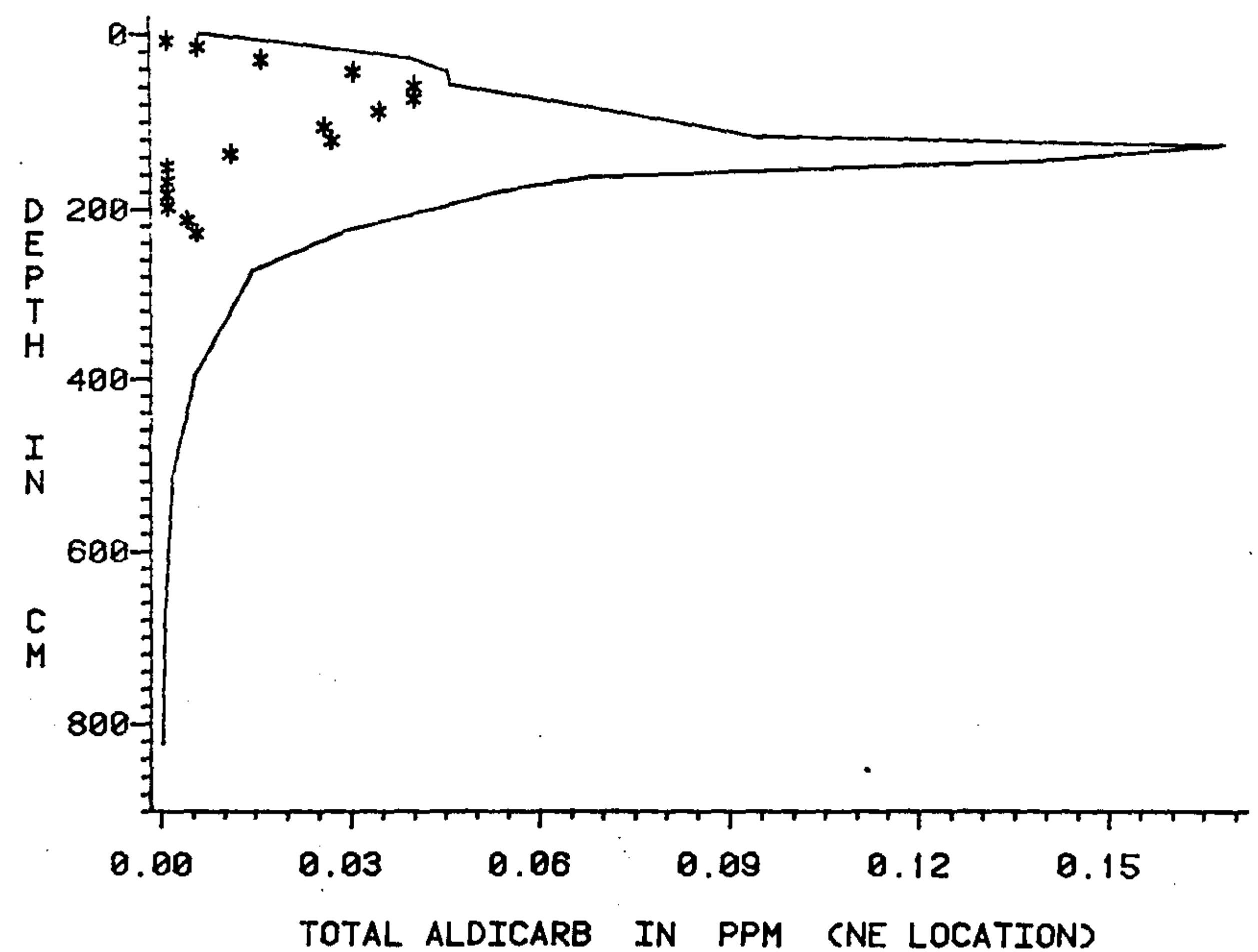

Figure 15. Simulation of Aldicarb mass concentration NE degradation in all nodes

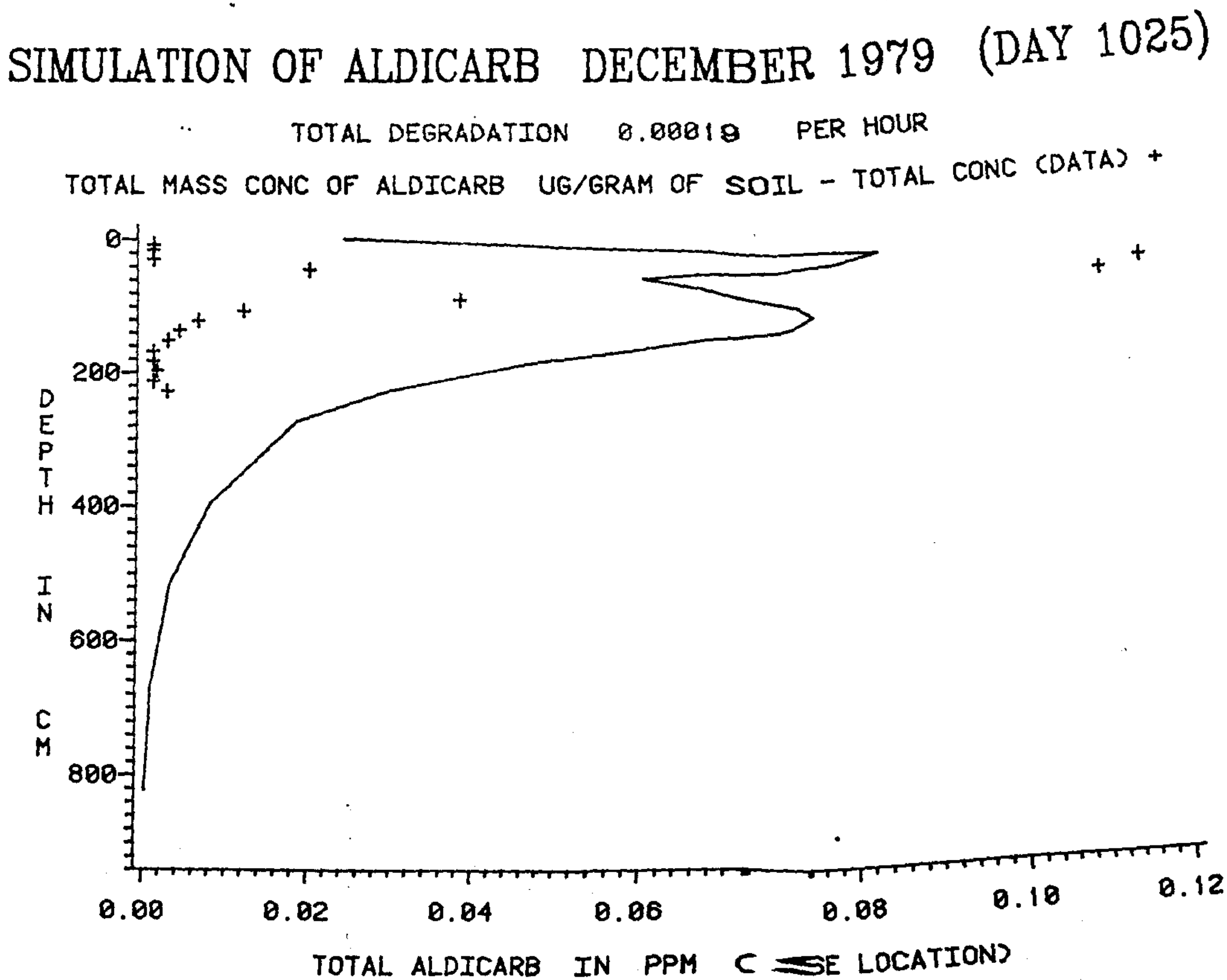

Figure 16. Simulation of Alidcarb mass concentration SE degradation in all nodes

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APPENDIX A

LISTING OF COMPUTER PROGRAM OF THE HYDRAULIC MODEL

```
      BLOCK DATA                                                         BLKD001
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART              BLKD002
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2                 BLKD003
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)                                    BLKD004
      COMMON/TURN/ IBC,ON(5),OFF(5),FLUX(5)                              BLKD005
      COMMON/PARAM/ DELX,TDEL,TIME,VALUE                                 BLKD006
      DATA NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART/0,0,0,0,0,0,0/      BLKD007
      DATA NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2/0,0,0,0,0,0.,0./        BLKD008
      DATA ANM,GNM/16*0.0,16*0.0/                                        BLKD009
      DATA IBC,ON,OFF,FLUX/0,5*0.0,5*0.0,5*0.0/                          BLKD010
      DATA DELX,TDEL,TIME,VALUE/0.0,0.0,0.0,0.0/                         BLKD011
      END                                                                BLKD012
C                                                                        BLKD013
```

```
C     MAIN PROGRAM
C
      COMMON Z(55000)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/MISC/TITLE(20),AFMT(20),BFMT(20),NI,NO,NT,NIR,NOR,NSS
C
C     SETUP INPUT OUTPUT LOGICAL UNITS
C
      NI  =  5
      NO  =  6
      NT  = 71
      NSS = 73
      NIR = 75
      NOR = 76
C
C     INITIALIZE NON-LABELLED COMMON
C
      IZ= 55000
      DO 100 I = 1,IZ
      Z(I)=0.0
  100 CONTINUE
C
C     READ AND PRINT PROBLEM TITLE
C
      READ(NI,120)(TITLE(I),I=1,20)
  120 FORMAT(20A4)
      WRITE(NO,125)(TITLE(I),I=1,20)
  125 FORMAT(1H1,5X,20A4)
C
C     READ GEOMETRY PARAMETERS
C
      READ(NI,2) NNCOL,NNROW
    2 FORMAT(2I5)
C
C     READ ALL THE OPTIONS
C
      READ(NI,130) IFLAGT, IFLAGS, ISTART
  130 FORMAT(3I2)
C
C
C     CALCULATION OF PARAMETERS FOR FINITE ELEMENT CONFIGURATION
C     AND SIZES OF VARIABLE-DIMENSIONED ARRAYS
C
      NB     = NNCOL + 2
      NB1    = NB    + 1
      NECOL  = NNCOL - 1
      NEROW  = NNROW - 1
      NETOT  = NECOL * NEROW
      NNTOT  = NNROW * NNCOL
      MAX1   = NNTOT
      MAX2   = NB1
      MAX3   = NETOT
C
C     CALCULATE STARTING LOCATIONS OF ONE-DIMENSIONAL ARRAYS
C
      IBPARA = 1
      ICONDS = IBPARA + NNTOT
      IF     = ICONDS + NNTOT
      IPENTR = IF     + NNTOT
      IPRES  = IPENTR + NNTOT
      IRATIO = IPRES  + NNTOT
      IST1   = IRATIO + NNTOT
      IST2   = IST1   + NNTOT
      IST3   = IST2   + NNTOT
      IST4   = IST3   + NNTOT
      IX     = IST4   + NNTOT
      IY     = IX     + NNTOT
      IYN    = IY     + NNTOT +  NB
      IYN1   = IYN    + NNTOT
```

```
      IYN2    = IYN1    + NNTOT
      IYN3    = IYN2    + NNTOT
C
C     TWO-DIMENSIONAL ARRAYS
C
      ICOEF   = IYN3    + NNTOT
      ICOEF1  = ICOEF   + NNTOT * NB1
      INTAB   = ICOEF1  + NNTOT * NB1
C
C     THREE-DIMENSIONAL ARRAYS
C
      ICRNM   = INTAB   + NETOT*4
C
C     FOUR-DIMENSIONAL ARRAYS
C
      IBRNM   = ICRNM   + NETOT * 16
      IGRNM   = IBRNM   + NETOT * 64
C
C     DOUBLE PRECISION ARRAY IN SUBROUTINE SYM
C
      IA      = IGRNM   + NETOT * 64
C
C     MAXIMUM LENGTH OF BLANK COMMON ARRAY Z
C
      IMAX    = IA      + NNTOT * NB1
C
C     PRINT GEOMETRY PARAMETERS
C
      WRITE(NO,111) NNCOL,NNROW,NETOT,NNTOT,NB
  111 FORMAT(1HO,5X,'NUMBER OF ROWS       =',I5,/,6X,
     1 'NUMBER OF COLUMNS    =',I5,/,6X,'NUMBER OF   ',
     2 'ELEMENTS =',I5,/,6X,'THE NUMBER OF NODES =',
     3 I5,/,6X,'SEMI-BAND WIDTH      =',I5)
      WRITE(NO,150) IFLAGT,IFLAGS,ISTART
  150 FORMAT(///,6X,'TRANSPORT INPUT FILE OPTION',14X,' =',I5,//,6X,
     1 'STEADY STATE PRESSURE DISTRIBUTION OPTION =',I5,//,6X,
     2 'RESTART PROGRAM OPTION                    =',I5)
      IF(IMAX.GT.IZ) GO TO 10
C
C     IBM 370 SYSTEM SUBROUTINE TO SUPPRESS UNDERFLOW WARNINGS
C
      CALL ERRSET(207,260,-1,1,0,208)
C
C     TRANSFER CONTROL TO SUBOUTINE HYDRO
C
      CALL HYDRO (MAX1,MAX2,MAX3,Z(IBPARA),Z(ICONDS),Z(IF),
     1 Z(IPENTR),Z(IPRES),Z(IRATIO),Z(IST1),Z(IST2),Z(IST3),Z(IST4),
     2 Z(IX),Z(IY),Z(IYN),Z(IYN1),Z(IYN2),Z(IYN3),Z(ICOEF),Z(ICOEF1),
     3 Z(INTAB),Z(ICRNM),Z(IBRNM),Z(IGRNM),Z(IA))
C
C     PROGRAM STOPS IF COMMON REQUIREMENT EXCEEDS
C     SPACE ALLOCATED
C
   10 WRITE (6,15) IZ,IMAX
   15 FORMAT(1H1,6X,'*** PROGRAM TERMINATED ***',6X,/,
     1 'COMMON REQUIREMENT EXCEEDS SPACE ALLOCATED IN BLANK
     2 COMMON ARRAY Z',/,6X,'SPACE ALLOCATED = ',I6,
     3 /,6X,'SPACE REQUIRED  = ',I6)
      STOP
      END
C
```

```
C      SUBROUTINE HYDRO
C
       SUBROUTINE HYDRO(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,
     2 CRNM,BRNM,GRNM,A)
       DOUBLE PRECISION A(MAX1,MAX2)
       DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),PRES(MAX1),
     1 RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),ST4(MAX1),X(MAX1),
     2 Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),YN3(MAX1),COEF(MAX1,MAX2),
     3 COEF1(MAX1,MAX2),NTAB(MAX3,4),CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),
     4 GRNM(MAX3,4,4,4)
       COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
       COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
       COMMON/LOCAL/ ANM(4,4),GNM(4,4)
       COMMON/TURN/ IBC,ON(5),OFF(5),FLUX(5)
       COMMON/PARAM/ DELX,TDEL,TIME,VALUE
       COMMON/MISC/TITLE(20),AFMT(20),BFMT(20),NI,NO,NT,NIR,NOR,NSS
C
C      CHECK FOR RESTART OPTION
C
       IF(ISTART.EQ.0) CALL RESTAR(MAX1,MAX2,MAX3,BPARA,CONDS,
     1 F,PENTR,PRES,RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,
     2 COEF,COEF1,NTAB,CRNM,BRNM,GRNM,A)
C
       IF(ISTART.EQ.0) GO TO 444
C
C      READ INPUT FORMAT FOR NODES IN (X,Y) PAIRS
C
       READ(NI,400)(AFMT(I),I=1,20)
  400  FORMAT(20A4)
C
C      READ GLOBAL COORDINATES OF ALL NODES IN (X,Y) PAIRS
C
       READ(NI,AFMT)(X(I),Y(I),I=1,NNTOT)
C
C      PRINT GLOBAL COORDINATES OF ALL NODES IN (X,Y) PAIRS
C
       WRITE(NO,300)
  300  FORMAT(1H1,5X,'GLOBAL COORDINATES OF NODES, (X,Y)',
     1 '  (ALL UNITS IN CM)')
       DO 7 I=1,NNCOL
       DO 8 J=1,NNROW
       K=I+(J-1)*NNCOL
       NTAB(J,1) = K
       ST1(J)=X(K)
     8 ST2(J)=Y(K)
       WRITE(NO,9)I,(NTAB(J,1),ST1(J),ST2(J),J=1,NNROW)
     9 FORMAT(1H0,3X,'ROW ',I3,
     1 /,(1X,4(3X,I4,1X,
     2 '(',E9.4,',',1X,E9.4,')')))
     7 CONTINUE
C
C      READ AND PRINT SATURATED CONDUCTIVITY, AIR ENTRY LEVEL,
C      PARAMETER OF EQN 20 AND 21, AND SATURATED WATER
C      CONTENT RATIO AT ALL GLOBAL NODES
C
       WRITE(NO,320)
  320  FORMAT(1H1,5X,'HYDRAULIC CONDUCTIVITY AND MOISTURE RETENTION',
     1 ' PARAMETERS',//,
     1 3X,'NODE',8X,'CONDS',8X,'PENTR',8X,'BPARA',8X,'RATIO',/,
     2 15X,'CM/HR',7X,'CM H2O',/)
       DO 450 I=1,NNTOT
       READ(NI,330) CONDS(I),PENTR(I),BPARA(I),RATIO(I)
  330  FORMAT(4F10.0)
       WRITE(NO,310) I,CONDS(I),PENTR(I),BPARA(I),RATIO(I)
  310  FORMAT(3X,I5,4(3X,F10.4))
  450  CONTINUE
C
C      READ AND PRINT CONTROL FLAG FOR BOUNDARY CONDITION AT
C      LEFT AND RIGHT SIDE BOUNDARY BELOW WATER TABLE
```

```
C
      READ(NI,2) IFLAGL,IFLAGR
      WRITE(NO,380) IFLAGL,IFLAGR
  380 FORMAT(1H1,5X,'CONTROL FLAG FOR BOUNDARY CONDITION',/,
     1 6X,'IFLAGL= ',I3,3X,'IFLAGR= ',I3)
C
C     READ AND PRINT BOUNDARY CONDITIONS
C
      READ(NI,330) DS1,DS2
      WRITE(NO,350) DS1,DS2
  350 FORMAT(1HO,5X,'BOUNDARY CONDITIONS',/,6X,'DS1= ',
     1 F10.4,3X,'DS2= ',F10.4)
C
C     READ AND PRINT NUMBER OF APPLICATIONS OF
C     WATER FLUX TO STUDY FIELD
C
      READ(NI,2) IBC
    2 FORMAT(5I5)
      WRITE(NO,360) IBC
  360 FORMAT(1HO,5X,'NUMBER OF APPLICATIONS OF WATER FLUX TO'
     1 ,' STUDY FIELD',/,6X,'IBC = ',I5,//,6X,
     2 'APPLICATION PERIOD',3X,'TURN ON TIME',3X,'TURN OFF TIME',
     3 3X,'WATER FLUX',/)
C
C     READ AND PRINT TURN ON TIME, TURN OFF TIME, AND MAGNITUDE OF
C     WATER FLUX FOR EACH APPLICATION PERIOD
C
      DO 375 I = 1,IBC
      READ(NI,330) ON(I),OFF(I),FLUX(I)
      WRITE(NO,370) I,ON(I),OFF(I),FLUX(I)
  370 FORMAT(13X,I5,10X,F10.2,4X,F10.2,4X,F10.6)
  375 CONTINUE
C
C     READ INPUT FORMAT FOR PRESSURE DISTRIBUTION
C
      READ(NI,400)(BFMT(I),I=1,20)
C
C     READ INITIAL CONDITION FOR SOIL WATER PRESSURE
C
      READ(NI,BFMT)(PRES(I),I=1,NNTOT)
C
C     READ AND PRINT PARAMETERS FOR INTEGRATION AND OUTPUT
C
      READ(NI,330) TDEL,TMAX,PRT1,PSTED
      WRITE(NO,390) TDEL,TMAX,PRT1,PSTED
  390 FORMAT(1HO,5X,'PARAMETERS FOR INTEGRATION AND OUTPUT',/,
     1 6X,'TIME STEP FOR INTEGRATION:',9X,'  TDEL  = ',F12.2,1X,'HR',/,
     2 6X,'MAXIMUM TIME PERIOD FOR SIMULATION:  TMAX  = ',F12.2,1X,'HR',
     3 /,6X,'PRINTOUT INTERVAL:',17X,'  PRT1  = ',F12.2,1X,'HR',/,
     4 6X,'STEADY ASSUMPTION:',17X,'  PSTED = ',E12.4,1X,'CM OF WATER')
C
C
C     CALL THE SUBROUTINE OUTFIL TO CREATE AN OUTPUT FILE FOR TRANSPORT
C
      IF(IFLAGT.EQ.O)
     1CALL OUTFIL(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     2 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     3 NTAB,CRNM,BRNM,GRNM,PRT1)
C
C
C     CALL SUBROUTINE INTEG TO PERFORM INTEGRATION ON EVERY ELEMENT
C
      DO 811 I=1,NETOT
      DO 811 J=1,4
  811 NTAB(I,J)=ITAB(I,J,NECOL,NNCOL)
      CALL INTEG(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
C
C     PRINT INITIAL CONDITIONS FOR SOIL WATER PRESSURE
```

```
C
      TIME=0.0
      NPBF = 1
      WRITE(NO,701) TIME
  701 FORMAT(1H1,'SOIL WATER PRESSURE AT TIME = ',
     1E12.4,' HOUR')
      CALL OUTPR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,
     2 COEF1,NTAB,CRNM,BRNM,GRNM,NPBF)
      PRT=PRT1
C
C     OBTAIN NECESSARY STARTING VALUES BY FOURTH ORDER RUNGE
C     KUTTA METHOD
C
      DO 110 I=1,NNTOT
  110 YN(I)=PRES(I)
      TDEL=0.1*TDEL
      NPBF = 0
      DO 123 K1=1,4
      DO 22 K=1,10
      CALL START(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,A)
      DO 321 I=1,NNTOT
      ST1(I)=COEF(I,NB1)
  321 PRES(I)=YN(I)+0.5*ST1(I)
      TIME=TIME+0.5*TDEL
      CALL START(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,A)
      DO 322 I=1,NNTOT
      ST2(I)=COEF(I,NB1)
  322 PRES(I)=YN(I)+0.5*ST2(I)
      CALL START(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,A)
      DO 21 I=1,NNTOT
      ST3(I)=COEF(I,NB1)
   21 PRES(I)=YN(I)+ST3(I)
      TIME=TIME+0.5*TDEL
      CALL START(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,A)
      DO 821 I=1,NNTOT
      ST4(I)=COEF(I,NB1)
      PRES(I)=YN(I)+(1./6.)*(ST1(I)+2.*ST2(I)+2.*
     1 ST3(I)+ST4(I))
  821 YN(I)=PRES(I)
   22 CONTINUE
      WRITE(NO,701) TIME
      CALL OUTPR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,NPBF)
  223 GO TO (125,126,127,123),K1
  125 DO 425 I=1,NNTOT
  425 YN3(I)=PRES(I)
      GO TO 123
  126 DO 426 I=1,NNTOT
  426 YN2(I)=PRES(I)
      GO TO 123
  127 DO 427 I=1,NNTOT
  427 YN1(I)=PRES(I)
  123 CONTINUE
      TDEL=10.0*TDEL
C
C     IF THE RESTART OPTION IS IN EFFECT THE PROGRAM WILL CONTINUE THE
C     THE INTEGRATION FROM THIS STEP, THE SAVER FROM THE LAST RUN HAS
C     THE REQUIRED TIME STEPS SAVED SO THAT THE PREDICTOR-CORRECTOR CAN
C     BE STARTTED.
C
```

```
  444 CONTINUE
C
C
C
C      START INTEGRATION BY PREDICTOR-CORRECTOR METHOD
C
C      SECOND ORDER PREDICTOR BY CENTRAL DIFFERENCE METHOD
C
       T1=12.0*TDEL/25.0
       NPBF = 1
C
   44 DO 140 I=1,NNTOT
  140 PRES(I)=1.5*YN(I)-0.5*YN1(I)
      CALL START(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,A)
  143 DO 141 I=1,NNTOT
  141 PRES(I)=YN(I)+COEF(I,NB1)
C
C      FOURTH ORDER CORRECTOR BY BACKWARD DIFFERENCE METHOD
C
      DO 47 I=1,NNTOT
      ST1(I)=(-48.0*YN(I)+36.0*YN1(I)-16.0*YN2(I)+
     1 3.0*YN3(I))/25.0
C     PRES(I)=0.5*(PRES(I)+YN(I))
   47 CONTINUE
      TIME=TIME+TDEL
      DO 243 K=1,3
      DO 247 I=1,NNTOT
      DO 247 J=1,NB
  247 COEF(I,J)=0.0
      CALL EQN(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
      DO 248 I=1,NNTOT
      ST2(I)=COEF(I,1)*ST1(I)
      DO 248 J=1,NB
  248 COEF1(I,J)=COEF(I,J)
      CALL DERIV(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
      DO 49 I=1,NNTOT
   49 COEF(I,NB1)=T1*F(I)-ST2(I)
      DO 50 I=1,NNTOT
      DO 151 J=1,NB
  151 COEF(I,J)=(-T1)*COEF(I,J)+COEF1(I,J)
   50 CONTINUE
      IF(IFLAGL.GT.0.AND.IFLAGR.GT.0) GO TO 152
      CALL BCCOR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
C
C      CALL SYM
C
  152 CALL SYM(COEF,NB1,NNTOT,NB,A)
  553 DO 46 I=1,NNTOT
   46 PRES(I)=COEF(I,NB1)
      IF(K.GE.3) GO TO 243
      DO 242 I=1,NNTOT
      ST1(I)=(-48.0*YN(I)+36.0*YN1(I)-16.0*YN2(I)+
     1 3.0*YN3(I))/25.0
C     PRES(I)=0.5*(PRES(I)+YN(I))
  242 CONTINUE
  243 CONTINUE
C
C      EXCHANGE STEP VALUE
C
      DO 45 I=1,NNTOT
      YN3(I)=YN2(I)
      YN2(I)=YN1(I)
```

```
      YN1(I)=YN(I)
   45 YN(I)=PRES(I)
C
C     CONTROL OF OUTPUT PRINTING
C
      IF(TIME.LE.PRT-0.001) GO TO 51
   52 PRT=PRT+PRT1
      WRITE(NO,701) TIME
      CALL OUTPR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,
     1 PRES,RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,
     2 COEF,COEF1,NTAB,CRNM,BRNM,GRNM,NPBF)
   51 IF(TIME.GT.TMAX) GO TO 53
      DO 54 I=1,NNTOT
      ST1(I)=ABS(YN(I)-YN1(I))
      IF(ST1(I).GT.PSTED) GO TO 56
   54 CONTINUE
      WRITE(NO,55)
   55 FORMAT(1H1,/
     1' **************************************************************'
     2,/,25X,'STEADY STATE ATTAINED',/,
     3' **************************************************************')
      GO TO 58
   56 GO TO 44
   53 WRITE(NO,57)
   57 FORMAT(1H1,/,
     1'**************************************************************'
     2,/,25X,'MAXIMUM TIME',/,
     3'**************************************************************')
      GO TO 58
C     ERROR EXIT FROM SUBROUTINE SYM
C
  199 WRITE(NO,62)
   62 FORMAT(1HO,'ERROR EXIT FROM SYM FOR SOLVING THE SYSTEM OF EQNS')
   58 WRITE(NO,BFMT)(PRES(I),I=1,NNTOT)
C
C     CHECK FOR FILE OUTPUT OPTION
      IF(IFLAGT.EQ.1) GO TO 60
C
C     WRITE THE LAST TIME VARIABLE OR THE STEADY PRESSURE DISTRIBUTION
C
      IFLAGS = 0
      NTRANS = NNTOT - NNCOL
      KTRN = NNCOL + 1
      WRITE(NT)(PRES(I),I=KTRN,NTRANS)
      WRITE(NT) IFLAGS
C
C     THIS WILL CREATE A FORMATED STEADY STATE FILE (TEMPORARY SECTION)
C
      WRITE(NSS,600)(PRES(I),I=KTRN,NTRANS)
      WRITE(NSS,610) IFLAGS
  600 FORMAT(6F12.0)
  610 FORMAT(I2)
C
C     WRITE ALL THE VARIABLES INTO A BINARY FILE FOR RESTART
C
   60 CALL SAVER(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,
     2 CRNM,BRNM,GRNM,A)
C
      CONTINUE
      STOP
      END
C
```

```
C.....SUBROUTINE ELMT1..................................................
C
      SUBROUTINE ELMT1(M,MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,CRNM,
     2 BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),PRES(MAX1),
     1 RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),ST4(MAX1),X(MAX1),
     2 Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),YN3(MAX1),COEF(MAX1,MAX2),
     3 COEF1(MAX1,MAX2),NTAB(MAX3,4),CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),
     4 GRNM(MAX3,4,4,4)
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)
      DIMENSION AK(4)
      DO 1 I=1,4
      J=NTAB(M,I)
      T1=PRES(J)
      CALL STRUC(J,T1,T2,2,MAX1,MAX2,MAX3,BPARA,CONDS,
     1 F,PENTR,PRES,RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,
     2 COEF,COEF1,NTAB,CRNM,BRNM,GRNM)
      AK(I)=T2
    1 CONTINUE
      DO 3 I=1,4
      DO 3 J=I,4
      ANM(I,J)=0.0
      DO 4 K=1,4
    4 ANM(I,J)=ANM(I,J)+BRNM(M,K,I,J)*AK(K)
      ANM(J,I)=ANM(I,J)
    3 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE ELMT2..................................................
C
      SUBROUTINE ELMT2(M,MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,
     2 CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      DIMENSION THETA(4)
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)
      DO 1 I=1,4
      J=NTAB(M,I)
      T1=PRES(J)
      CALL STRUC(J,T1,T2,1,MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,
     1 PRES,RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,
     2 COEF1,NTAB,CRNM,BRNM,GRNM)
      THETA(I)=T2
    1 CONTINUE
      DO 3 I=1,4
      DO 3 J=I,4
      GNM(I,J)=0.0
      DO 4 K=1,4
    4 GNM(I,J)=GNM(I,J)+GRNM(M,K,I,J)*THETA(K)
      GNM(J,I)=GNM(I,J)
    3 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE ELMT3...................................................
C
      SUBROUTINE ELMT3(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,
     2 CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      DIMENSION AK(4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/PARAM/ DELX,TDEL,TIME,VALUE
      DO 1 I=1,NNTOT
    1 F(I)=0.0
      N1=NNROW-1
      T4=DS2-DS1
      DO 2 I=1,N1
      M1=1+(I-1)*NNCOL
      M2=1+I*NNCOL
      T1=X(M2)-X(M1)
      T2=X(M2)-DS1
      T3=DS2-X(M1)
      T1=AMIN1(T1,T2,T3,T4)
      IF(X(M1).GE.DS2) GO TO 3
      IF(X(M2).LE.DS1) T1=0.0
      F(M1)=F(M1)+VALUE*T1/2.0
      F(M2)=F(M2)+VALUE*T1/2.0
    2 CONTINUE
    3 DO 14 I=1,NETOT
      DO 16 IR=1,4
      J=NTAB(I,IR)
      T1=PRES(J)
      CALL STRUC(J,T1,T2,2,MAX1,MAX2,MAX3,BPARA,CONDS,F,
     1 PENTR,PRES,RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,
     2 COEF,COEF1,NTAB,CRNM,BRNM,GRNM)
      AK(IR)=T2
   16 CONTINUE
      DO 22 IN=1,4
      J=NTAB(I,IN)
      DO 24 IR=1,4
   24 F(J)=F(J)+AK(IR)*CRNM(I,IR,IN)
   22 CONTINUE
   14 CONTINUE
      RETURN
      END
C
```

```
C.....INTEGER FUNCTION.................................................... ITAB001
C                                                                          ITAB002
      INTEGER FUNCTION ITAB(I,M,NECOL,NNCOL)                               ITAB003
      GO TO (4,3,2,1), M                                                   ITAB004
    1 ITAB=I+(I-1)/NECOL+1                                                 ITAB005
      GO TO 5                                                              ITAB006
    2 ITAB=I+(I-1)/NECOL+NNCOL+1                                           ITAB007
      GO TO 5                                                              ITAB008
    3 ITAB=I+(I-1)/NECOL+NNCOL                                             ITAB009
      GO TO 5                                                              ITAB010
    4 ITAB=I+(I-1)/NECOL                                                   ITAB011
    5 RETURN                                                               ITAB012
      END                                                                  ITAB013
C                                                                          ITAB014
```

```
C.....SUBROUTINE SYM.....................................................
C
      SUBROUTINE SYM(A1,NC,NR,NB,A)
      DIMENSION A1(NR,NC),A(NR,NC)
      DOUBLE PRECISION A,RATIO,T1
      DO 11 I=1,NR
      DO 11 J=1,NC
   11 A(I,J)=DBLE(A1(I,J))
      N1=NR-NB+1
      DO 1 K=1,N1
      IF(A(K,1).EQ.0.0) GO TO 4445
      DO 2 I=2,NB
      RATIO=A(K,I)/A(K,1)
      N2=NB+1-I
      NI=K+I-1
      DO 3 IQ=1,N2
    3 A(NI,IQ)=A(NI,IQ)-A(K,IQ+I-1)*RATIO
      A(NI,NC)=A(NI,NC)-A(K,NC)*RATIO
    2 CONTINUE
    1 CONTINUE
      N1=N1+1
      N3=NR-1
      DO 4 K=N1,N3
      NW=NR-K+1
      IF(A(K,1).EQ.0.0) GO TO 4447
      DO 5 I=2,NW
      RATIO=A(K,I)/A(K,1)
      NI=K+I-1
      N4=NW-I+1
      DO 6 IQ=1,N4
    6 A(NI,IQ)=A(NI,IQ)-A(K,IQ+I-1)*RATIO
      A(NI,NC)=A(NI,NC)-A(K,NC)*RATIO
    5 CONTINUE
    4 CONTINUE
      A(NR,NC)=A(NR,NC)/A(NR,1)
      N1=NR-1
      N2=NR-NB+1
      DO 7 LK=N2,N1
      K=N1+N2-LK
      N3=NR-K+1
      T1=0.0
      DO 8 I=2,N3
    8 T1=T1+A(K,I)*A(K+I-1,NC)
      A(K,NC)=(A(K,NC)-T1)/A(K,1)
    7 CONTINUE
      N2=N2-1
      DO 9 MK=1,N2
      K=N2+1-MK
      T1=0.0
      DO 10 I=2,NB
   10 T1=T1+A(K,I)*A(K+I-1,NC)
      A(K,NC)=(A(K,NC)-T1)/A(K,1)
    9 CONTINUE
      DO 12 I=1,NR
      DO 12 J=1,NC
   12 A1(I,J)=SNGL(A(I,J))
      RETURN
 4445 WRITE(6,4446) K
 4446 FORMAT(3X,I3,'A(K,1) = 0.0 IN FIRST LOOP')
      GO TO 4449
 4447 WRITE(6,4448) K
 4448 FORMAT(3X,I3,'A(K,1) = 0.0 IN SECOND LOOP')
 4449 STOP
      END
C
```

```
C.....SUBROUTINE APPLY.................................................
C
      SUBROUTINE APPLY
      COMMON/TURN/ IBC,ON(5),OFF(5),FLUX(5)
      COMMON/PARAM/ DELX,TDEL,TIME,VALUE
      DO 1 I=1,IBC
      T1=ON(I)
      T2=OFF(I)
      IF(TIME.LE.T2) GO TO 3
      GO TO 1
    3 IF(TIME.GE.T1) VALUE=FLUX(I)
      IF(TIME.LT.T1) VALUE=0.0
      GO TO 5
    1 CONTINUE
      VALUE=0.0
    5 RETURN
      END
C
```

```
C.....SUBROUTINE EQN..............................................
C
      SUBROUTINE EQN(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,
     2 COEF1,NTAB,CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)
      N1=NNTOT+1
      DO 1 I=1,NNTOT
    1 COEF(I,NB1)=F(I)
      DO 3 I=1,NETOT
      CALL ELMT2(I,MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,RATIO,
     1 ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,CRNM,
     2 BRNM,GRNM)
      DO 5 J=1,4
      JG=NTAB(I,J)
      DO 5 K=1,4
    5 COEF(JG,1)=COEF(JG,1)+GNM(J,K)
    3 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE INTEG..................................................
C
      SUBROUTINE INTEG(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      DIMENSION ABSCI(6),DTJ(3),H1(4),H2(4),H3(4),WEIGH(6),
     1 XLOC(4),YLOC(4),A(4,2),B(4,2),C(4,2),PHI(4,6,6)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      DATA WEIGH/0.1713,0.3608,
     1 0.4679,0.4679,0.3608,0.1713/
      DATA ABSCI/-0.9325,-0.6612,
     1 -0.2386,0.2386,0.6612,0.9325/
      H1(1)=-0.25
      H1(2)=0.25
      H1(3)=0.25
      H1(4)=-0.25
      H2(1)=-0.25
      H2(2)=-0.25
      H2(3)=0.25
      H2(4)=0.25
      H3(1)=0.25
      H3(2)=-0.25
      H3(3)=0.25
      H3(4)=-0.25
      DO 7 I=1,4
      DO 7 IQ=1,6
      DO 7 IS=1,6
    7 PHI(I,IQ,IS)=0.25+H1(I)*ABSCI(IQ)+H2(I)*ABSCI(IS)+
     1 H3(I)*ABSCI(IQ)*ABSCI(IS)
C     CALCULATE THE MATERIAL INDEPENDENT PART OF THE LOCAL
C     COEFFICIENTS
      DO 3 IELMT=1,NETOT
      DO 1 I=1,4
      J=NTAB(IELMT,I)
      XLOC(I)=X(J)
    1 YLOC(I)=Y(J)
      A(1,1)=YLOC(2)-YLOC(4)
      A(2,1)=YLOC(3)-YLOC(1)
      A(3,1)=YLOC(4)-YLOC(2)
      A(4,1)=YLOC(1)-YLOC(3)
      A(1,2)=XLOC(4)-XLOC(2)
      A(2,2)=XLOC(1)-XLOC(3)
      A(3,2)=XLOC(2)-XLOC(4)
      A(4,2)=XLOC(3)-XLOC(1)
      B(1,1)=YLOC(4)-YLOC(3)
      B(2,1)=YLOC(3)-YLOC(4)
      B(3,1)=YLOC(1)-YLOC(2)
      B(4,1)=YLOC(2)-YLOC(1)
      B(1,2)=XLOC(3)-XLOC(4)
      B(2,2)=XLOC(4)-XLOC(3)
      B(3,2)=XLOC(2)-XLOC(1)
      B(4,2)=XLOC(1)-XLOC(2)
      C(1,1)=YLOC(3)-YLOC(2)
      C(2,1)=YLOC(1)-YLOC(4)
      C(3,1)=YLOC(4)-YLOC(1)
      C(4,1)=YLOC(2)-YLOC(3)
      C(1,2)=XLOC(2)-XLOC(3)
      C(2,2)=XLOC(4)-XLOC(1)
      C(3,2)=XLOC(1)-XLOC(4)
      C(4,2)=XLOC(3)-XLOC(2)
      DTJ(1)=(XLOC(4)-XLOC(2))*(YLOC(1)-YLOC(3))-
     1 (XLOC(1)-XLOC(3))*(YLOC(4)-YLOC(2))
      DTJ(2)=(XLOC(3)-XLOC(4))*(YLOC(1)-YLOC(2))-
     1 (XLOC(1)-XLOC(2))*(YLOC(3)-YLOC(4))
```

```
      DTJ(3)=(XLOC(4)-XLOC(1))*(YLOC(2)-YLOC(3))-
     1 (XLOC(2)-XLOC(3))*(YLOC(4)-YLOC(1))
      DO 5 IR=1,4
      DO 5 IN=1,4
      DO 5 IM=1,4
      BRNM(IELMT,IR,IN,IM)=0.0
      CRNM(IELMT,IR,IN)=0.0
      GRNM(IELMT,IR,IN,IM)=0.0
      DO 9 IQ=1,6
      DO 9 IS=1,6
      XI=ABSCI(IQ)
      ETA=ABSCI(IS)
      T1=WEIGH(IQ)*WEIGH(IS)
      DJAC=(DTJ(1)+DTJ(2)*XI+DTJ(3)*ETA)/8.0
      DJAC=ABS(DJAC)
      PHINX=(A(IN,1)+B(IN,1)*XI+C(IN,1)*ETA)/(8.0*DJAC)
      PHIMX=(A(IM,1)+B(IM,1)*XI+C(IM,1)*ETA)/(8.0*DJAC)
      PHINY=(A(IN,2)+B(IN,2)*XI+C(IN,2)*ETA)/(8.0*DJAC)
      PHIMY=(A(IM,2)+B(IM,2)*XI+C(IM,2)*ETA)/(8.0*DJAC)
      BRNM(IELMT,IR,IN,IM)=BRNM(IELMT,IR,IN,IM)-T1*
     1 PHI(IR,IQ,IS)*(PHINX*PHIMX+PHINY*PHIMY)*DJAC
      CRNM(IELMT,IR,IN)=CRNM(IELMT,IR,IN)+T1*PHINY
     1 *PHI(IR,IQ,IS)*DJAC
      GRNM(IELMT,IR,IN,IM)=GRNM(IELMT,IR,IN,IM)+T1*
     1 PHI(IN,IQ,IS)*PHI(IM,IQ,IS)*PHI(IR,IQ,IS)*DJAC
    9 CONTINUE
    5 CONTINUE
    3 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE STRUC...........................................
C
      SUBROUTINE STRUC(J,T1,T2,ICON,MAX1,MAX2,MAX3,BPARA,CONDS,F,
     1 PENTR,PRES,RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,
     2 COEF,COEF1,NTAB,CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      IF(T1.GE.PENTR(J)) GO TO 3
      IF(ICON.EQ.2) T2=CONDS(J)*(T1/PENTR(J))**
     1 (-(2.+2./BPARA(J)))
      IF(ICON.EQ.1) T2=-RATIO(J)/(BPARA(J)*PENTR(J))*
     1 (T1/PENTR(J))**(-(1.0+1.0/BPARA(J)))
      GO TO 5
    3 IF(ICON.EQ.2) T2=CONDS(J)
      IF(ICON.EQ.1) T2=0.0
    5 RETURN
      END
C
```

```
C.....SUBROUTINE DERIV..............................................
C
      SUBROUTINE DERIV(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)
      N1=NNTOT+1
      DO 2 I=1,NNTOT
      DO 2 J=1,NB1
    2 COEF(I,J)=0.0
      DO 1 I=1,NETOT
      CALL ELMT1(I,MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,CRNM,
     2 BRNM,GRNM)
      DO 3 J=1,4
      JG=NTAB(I,J)
      DO 3 K=1,4
      KG=NTAB(I,K)
      I1=KG-JG+1
      IF(I1.LT.1.OR.I1.GT.NB) GO TO 3
      COEF(JG,I1)=COEF(JG,I1)+ANM(J,K)
    3 CONTINUE
    1 CONTINUE
      CALL APPLY
      CALL ELMT3(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,
     2 COEF1,NTAB,CRNM,BRNM,GRNM)
      RETURN
      END
C
```

```
C.....SUBROUTINE OUTPR...................................................
C
C      THE SUBROUTINE OUTPR WILL PRINT A HARDCOPY OUTPUT FILE AND HAS
C      THE OPTION OF WRITING THE TIME VARIABLE PRESSURE DISTRIBUTION
C      ON A BINARY FILE FOR FUTURE USE. IF  IFLAGT = 0,  THE PRESSURE
C      DISTRIBUTION WILL BE WRITTEN ON A FILE WITH FILE UNIT = NT.
C      THE FLAG  NPR  WILL SUPPRESS THE PRINTING (ON THE BINARY FILE)
C      OF THE PRESSURE DISTRIBUTION FOR THE RUNGE-KUTTA INTEGRATION
C      TIME STEP. FOR THOSE CALLS NPR WILL EQUAL ZERO SO THE BINARY
C      OPTION WILL NOT APPLY. IT WILL WRITE THE INITIAL DISTRIBUTION
C      AND THE PRESSURE DISTRIBUTION AT THE PRINTOUT INTERVAL  PRT1.
C
      SUBROUTINE OUTPR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,NPR)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/MISC/TITLE(20),AFMT(20),BFMT(20),NI,NO,NT,NIR,NOR,NSS
C
C      CHECK FOR THE FILE OUTPUT OPTION  < FILE FOR TRANSPORT >
C
      IF(IFLAGT.EQ.1) GO TO 5
      IF(IFLAGS.EQ.0) GO TO 5
      IF(NPR.EQ.0) GO TO 5
C
C      WRITE THE TIME VARIABLE PRESSURE DISTRIBUTION   < IFLAGS = 1 >
C
      NTRANS = NNTOT - NNCOL
      KTRN   = NNCOL + 1
      WRITE(NT)(PRES(I),I=KTRN,NTRANS)
      WRITE(NT) IFLAGS
C
    5 CONTINUE
C
      DO 10 I=1,NNCOL
      DO 20 J=1,NNROW
      K=I+(J-1)*NNCOL
   20 ST1(J)=PRES(K)
      WRITE(NO,30)I,(ST1(J),J=1,NNROW)
   30 FORMAT(1X,'ROW NUMBER =',I3/,(10E12.4))
   10 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE BCCOR...................................................
C
      SUBROUTINE BCCOR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
C
C     SET B.C. ON RIGHT HAND SIDE OF THE STUDY FIELD
C
      IF(IFLAGR.GT.0) GO TO 94
      N2=NNTOT-NNCOL+1
      DO 1 I=N2,NNTOT
      T1=PRES(I)
      IF(T1.GT.0.000) GO TO 2
    1 CONTINUE
      GO TO 94
    2 N2=I
      DO 3 I=N2,NNTOT
      T1=PRES(I)
      DO 5 J=1,NNTOT
      IF(I-J) 6,5,8
    6 IF(J-I+1.GT.NB) GO TO 5
      COEF(J,NB1)=COEF(J,NB1)-COEF(I,J-I+1)*T1
      GO TO 5
    8 IF(I-J+1.GT.NB) GO TO 5
      COEF(J,NB1)=COEF(J,NB1)-COEF(J,I-J+1)*T1
      COEF(J,I-J+1)=0.0
    5 CONTINUE
      DO 11 J=2,NB
   11 COEF(I,J)=0.0
      COEF(I,1)=1.0
      COEF(I,NB1)=T1
    3 CONTINUE
C
C     SET B.C. ON LEFT HAND SIDE OF THE STUDY FIELD
C
   94 IF(IFLAGL.GT.0) GO TO 19
      DO 92 I=1,NNCOL
      T1=PRES(I)
      IF(T1.GT.0.000) GO TO 93
   92 CONTINUE
      GO TO 19
   93 N2=I
      DO 12 I=N2,NNCOL
      T1=PRES(I)
      DO 15 J=1,NNTOT
      IF(I-J) 14,15,16
   14 IF(J-I+1.GT.NB) GO TO 15
      COEF(J,NB1)=COEF(J,NB1)-COEF(I,J-I+1)*T1
      GO TO 15
   16 IF(I-J+1.GT.NB) GO TO 15
      COEF(J,NB1)=COEF(J,NB1)-COEF(J,I-J+1)*T1
      COEF(J,I-J+1)=0.0
   15 CONTINUE
      DO 17 J=2,NB
   17 COEF(I,J)=0.0
      COEF(I,1)=1.0
      COEF(I,NB1)=T1
   12 CONTINUE
   19 RETURN
      END
C
```

```
C.....SUBROUTINE BC.................................................
C
      SUBROUTINE BC(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
C
C     SET B.C. ON THE RIGHT SIDE OF THE STUDY FIELD
C
      IF(IFLAGR.GT.0) GO TO 17
      N2=NNTOT-NNCOL+1
      DO 1 I=N2,NNTOT
      T1=PRES(I)
      IF(T1.GT.0.000) GO TO 2
    1 CONTINUE
      GO TO 17
    2 N2=I
      DO 3 I=N2,NNTOT
      DO 5 J=2,NB
    5 COEF(I,J)=0.0
      M1=I
      IF(I.GE.NB) M1=NB
      DO 7 J=2,M1
      COEF(I-J+1,J)=0.0
    7 CONTINUE
      COEF(I,1)=1.0
      COEF(I,NB1)=0.
    3 CONTINUE
C
C     SET B.C.ON THE LEFT HAND SIDE OF THE STUDY FIELD
C
   17 IF(IFLAGL.GT.0) GO TO 19
      DO 13 I=1,NNCOL
      T1=PRES(I)
      IF(T1.GT.0.000) GO TO 15
   13 CONTINUE
      GO TO 19
   15 N2=I
      DO 9 I=N2,NNCOL
      DO 10 J=2,NB
   10 COEF(I,J)=0.0
      M1=I
      IF(I.GE.NB) M1=NB
      DO 11 J=2,M1
      COEF(I-J+1,J)=0.0
   11 CONTINUE
      COEF(I,1)=1.0
      COEF(I,NB1)=0.0
    9 CONTINUE
   19 RETURN
      END
C
```

```
C.....SUBROUTINE OUTFIL.................................................
C
C     THE SUBROUTINE OUTFIL WILL CREATE AN OUTPUT FILE WITH DATA THAT
C     IS COMMON FOR BOTH THE HYDRAULIC AND THE TRANSPORT PROGRAMS. THE
C     FILE, A BINARY ONE WILL BE CREATED IF THE FLAG < IFLAGT > IS EQUAL
C     TO  O . ONE NEEDS TO ALLOCATE A FILE FOR SUCH PURPOSES, THE FILE
C     UNIT NUMBER  NT  WILL BE USED .
C
      SUBROUTINE OUTFIL(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,
     2 NTAB,CRNM,BRNM,GRNM,DELT)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),
     1 PRES(MAX1),RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),
     2 ST4(MAX1),X(MAX1),Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),
     3 YN3(MAX1),COEF(MAX1,MAX2),COEF1(MAX1,MAX2),NTAB(MAX3,4),
     4 CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/TURN/ IBC,ON(5),OFF(5),FLUX(5)
      COMMON/PARAM/ DELX,TDEL,TIME,VALUE
      COMMON/MISC/TITLE(20),AFMT(20),BFMT(20),NI,NO,NT,NIR,NOR,NSS
C
      NTRANS = NNTOT - NNCOL
      KTRN = NNCOL + 1
      LTRN = NNROW - 1
      DO 20 I=1,NNCOL
      DO 10 J=2,LTRN
      K=I+(J-1)*NNCOL
      ST1(J)=X(K)
   10 ST2(J)=Y(K)
      WRITE(NT)(ST1(J),ST2(J),J=2,LTRN)
   20 CONTINUE
      WRITE(NT)(CONDS(I),PENTR(I),BPARA(I),RATIO(I),I=KTRN,NTRANS)
      WRITE(NT)IBC
      WRITE(NT)(ON(I),OFF(I),I=1,IBC)
      WRITE(NT) DS1,DS2
      WRITE(NT) DELT
      RETURN
      END
C
```

```
C.....SUBROUTINE RESTAR..................................................
C
C     THE SUBROUTINE RESTAR WILL READ A BINARY FILE CONTAINING
C     ALL THE DATA  FROM THE LAST EXECUTION. THE STORED DATA
C     WILL BE USED TO EXECUTE THE PROGRAM STARTING AT THE TIME
C     THE LAST SIMULATION WAS TERMINATED.
C
      SUBROUTINE RESTAR(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,
     2 CRNM,BRNM,GRNM,A)
      DOUBLE PRECISION A(MAX1,MAX2)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),PRES(MAX1),
     1 RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),ST4(MAX1),X(MAX1),
     2 Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),YN3(MAX1),COEF(MAX1,MAX2),
     3 COEF1(MAX1,MAX2),NTAB(MAX3,4),CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),
     4 GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)
      COMMON/TURN/ IBC,ON(5),OFF(5),FLUX(5)
      COMMON/PARAM/ DELX,TDEL,TIME,VALUE
      COMMON/MISC/TITLE(20),AFMT(20),BFMT(20),NI,NO,NT,NIR,NOR,NSS
C
C
      READ(NIR) IFLAGL,IFLAGR,IBC,DS1,DS2,DELX,TDEL,TIME,VALUE
      READ(NIR) (ON(I),OFF(I),FLUX(I),I=1,IBC)
      READ(NIR) ((A(I,J),COEF(I,J),COEF1(I,J),I=1,MAX1),J=1,MAX2)
      READ(NIR) (BPARA(I),CONDS(I),PENTR(I),PRES(I),RATIO(I),I=1,NNTOT)
      READ(NIR) (X(I),Y(I),YN(I),YN1(I),YN2(I),YN3(I),I=1,NNTOT)
      READ(NIR) (F(I),ST1(I),ST2(I),ST3(I),ST4(I),I=1,NNTOT)
      READ(NIR) ((NTAB(I,J),I=1,MAX3),J=1,4)
      DO 5 L=1,4
         DO 4 K=1,4
            DO 3 J=1,4
               DO 2 I=1,MAX3
                  READ(NIR) BRNM(I,J,K,L),GRNM(I,J,K,L)
    2          CONTINUE
    3       CONTINUE
    4    CONTINUE
    5 CONTINUE
      DO 10 N=1,4
          DO 10 M=1,4
             DO 10 I=1,MAX3
                READ(NIR) CRNM(I,M,N)
   10 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE SAVER.................................................
C
C     THE SUBROUTINE SAVER WILL SAVE IN A BINARY FILE ALL THE DATA
C     FROM THE THE PRESENT EXECUTION. THE STORED DATA WILL BE USED
C     TO EXECUTE THE HYDRAULIC PROGRAM STARTING AT THE TIME WHEN
C     THIS SIMULATION WAS TERMINATED. IN THE NEXT RUN THE PROGRAM
C     WILL BYPASS THE RUNGE-KUTTA START UP AND WILL GO DIRECTLY TO
C     TO THE PREDICTOR-CORRECTOR INTEGRATION STEP. THE FILE WITH
C     FILE UNIT = 76 WILL BE USED TO STORE THE DATA.
C
      SUBROUTINE SAVER(MAX1,MAX2,MAX3,BPARA,CONDS,F,PENTR,PRES,
     1 RATIO,ST1,ST2,ST3,ST4,X,Y,YN,YN1,YN2,YN3,COEF,COEF1,NTAB,
     2 CRNM,BRNM,GRNM,A)
      DOUBLE PRECISION A(MAX1,MAX2)
      DIMENSION BPARA(MAX1),CONDS(MAX1),F(MAX1),PENTR(MAX1),PRES(MAX1),
     1 RATIO(MAX1),ST1(MAX1),ST2(MAX1),ST3(MAX1),ST4(MAX1),X(MAX1),
     2 Y(MAX1),YN(MAX1),YN1(MAX1),YN2(MAX1),YN3(MAX1),COEF(MAX1,MAX2),
     3 COEF1(MAX1,MAX2),NTAB(MAX3,4),CRNM(MAX3,4,4),BRNM(MAX3,4,4,4),
     4 GRNM(MAX3,4,4,4)
      COMMON/DIM/ NB,NB1,IFLAGL,IFLAGR,IFLAGT,IFLAGS,ISTART
      COMMON/GEOM/ NECOL,NNROW,NNCOL,NNTOT,NETOT,DS1,DS2
      COMMON/LOCAL/ ANM(4,4),GNM(4,4)
      COMMON/TURN/ IBC,ON(5),OFF(5),FLUX(5)
      COMMON/PARAM/ DELX,TDEL,TIME,VALUE
      COMMON/MISC/TITLE(20),AFMT(20),BFMT(20),NI,NO,NT,NIR,NOR,NSS
C
      WRITE(NOR) IFLAGL,IFLAGR,IBC,DS1,DS2,DELX,TDEL,TIME,VALUE
      WRITE(NOR) (ON(I),OFF(I),FLUX(I),I=1,IBC)
      WRITE(NOR) ((A(I,J),COEF(I,J),COEF1(I,J),I=1,MAX1),J=1,MAX2)
      WRITE(NOR) (BPARA(I),CONDS(I),PENTR(I),PRES(I),RATIO(I),I=1,NNTOT)
      WRITE(NOR) (X(I),Y(I),YN(I),YN1(I),YN2(I),YN3(I),I=1,NNTOT)
      WRITE(NOR) (F(I),ST1(I),ST2(I),ST3(I),ST4(I),I=1,NNTOT)
      WRITE(NOR) ((NTAB(I,J),I=1,MAX3),J=1,4)
      DO 5 L=1,4
         DO 4 K=1,4
            DO 3 J=1,4
               DO 2 I=1,MAX3
                  WRITE(NOR) BRNM(I,J,K,L),GRNM(I,J,K,L)
    2          CONTINUE
    3       CONTINUE
    4    CONTINUE
    5 CONTINUE
      DO 10 N=1,4
          DO 10 M=1,4
             DO 10 I=1,MAX3
                WRITE(NOR) CRNM(I,M,N)
   10 CONTINUE
      RETURN
      END
```

APPENDIX B

LISTING OF COMPUTER PROGRAM OF THE TRANSPORT MODEL

```
C     MAIN PROGRAM
C
      COMMON/MISC/TITLE(20),CFMT(20),DFMT(20),EFMT(20),NI,NO,
     1 NH,IFLAGT,IFLAGS,ISTATE,IDEG,IPARAM
      COMMON B(6000)
C
C     SETUP INPUT OUTPUT LOGICAL UNITS
C
      NI = 5
      NO = 6
      NH = 71
C
C     INITIALIZE NON-LABELLED COMMON
C
      IGREAT = 6000
      DO 120 I = 1,IGREAT
      B(I) = 0.0
  120 CONTINUE
C
C     READ AND PRINT PROBLEM TITLE
C
      READ(NI,100) (TITLE(I),I=1,20)
  100 FORMAT (20A4)
      WRITE(NO,200) (TITLE(I),I=1,20)
  200 FORMAT(1H1,4X,20A4)
C
C     READ AND PRINT GEOMETRY PARAMETERS AND NO OF REACTIONS
C
      READ(NI,300) NROW,NCOL
  300 FORMAT(2I5)
      WRITE(NO,400) NROW,NCOL
  400 FORMAT(1H0,4X,'NUMBER OF ROWS      =',I5,//,5X,
     1 'NUMBER OF COLUMNS   =',I5)
      READ(NI,500) M
  500 FORMAT(I2)
      WRITE(NO,600) M
  600 FORMAT(1H0,4X,'NUMBER OF DIFFERENT REACTIONS IN THE SOLID PHASE ='
     1 ,I5)
      READ(NI,650)IFLAGT,IFLAGS,IPARAM,IDEG
  650 FORMAT(4I2)
      WRITE(NO,660)IDEG,IFLAGT,IFLAGS,IPARAM
  660 FORMAT(1H0,4X,'FLAG FOR DEGRADATION IN THE LIQUID PHASE   : ',
     1 I3,//,4X,' FILE INPUT OPTION                           : ',I3,//,
     2 4X,' STEADY STATE PRESSURE DISTRIBUTION OPTION : ',I3,//,
     3 4X,' CHANGE PARAMETER FLAG OPTION                : ',I3)
C
C     CALCULATION OF PARAMETERS FOR FINITE ELEMENT CONFIGURATION
C     AND SIZES OF VARIABLE-DIMENSIONED ARRAYS
C     SIZE OF ARRAYS APPEARS IN ( )
C
C     CALCULATE STARTING LOCATIONS OF ONE-DIMENSIONAL ARRAYS
C
C     IATOT    = STARTING LOCATION OF ATOT(NCOL)
C     ICFB     = STARTING LOCATION OF CFB(NCOL)
C     ICFL     = STARTING LOCATION OF CFL(NROW)
C     ICFR     = STARTING LOCATION OF CFR(NROW)
C     ICIB     = STARTING LOCATION OF CIB(NCOL)
C     ICIL     = STARTING LOCATION OF CIL(NROW)
C     ICIR     = STARTING LOCATION OF CIR(NROW)
C     IOLD     = STARTING LOCATION OF OLD(NCOL)
C     IVEL     = STARTING LOCATION OF VEL(NCOL)
C
      IATOT    = 1
      ICFB     = IATOT   + NCOL
      ICFL     = ICFB    + NCOL
      ICFR     = ICFL    + NROW
      ICIB     = ICFR    + NROW
      ICIL     = ICIB    + NCOL
      ICIR     = ICIL    + NROW
      IOLD     = ICIR    + NROW
```

```
      IVEL     = IOLD   + NCOL
C
C     CALCULATE STARTING LOCATIONS OF TWO-DIMENSIONAL ARRAYS
C
C     IBPARA  = STARTING LOCATION OF BPARA(NRC)
C     ICN     = STARTING LOCATION OF CN(NRC)
C     ICNM    = STARTING LOCATION OF CNM(NRC)
C     ICNMP   = STARTING LOCATION OF CNMP(NRC)
C     ICO     = STARTING LOCATION OF CO(NRC)
C     ICONDI  = STARTING LOCATION OF CONDI(NRC)
C     ICONDS  = STARTING LOCATION OF CONDS(NRC)
C     IDELX   = STARTING LOCATION OF DELX(NRC)
C     IDELY   = STARTING LOCATION OF DELY(NRC)
C     IQXI    = STARTING LOCATION OF QXI(NRC)
C     IQXNM   = STARTING LOCATION OF QXNM(NRC)
C     IQYI    = STARTING LOCATION OF QYI(NRC)
C     IQYNM   = STARTING LOCATION OF QYNM(NRC)
C     IPENTR  = STARTING LOCATION OF PENTR(NRC)
C     IPRESI  = STARTING LOCATION OF PRESI(NRC)
C     IRATIO  = STARTING LOCATION OF RATIO(NRC)
C     ISD     = STARTING LOCATION OF SD(NRC)
C     ISDNM   = STARTING LOCATION OF SDNM(NRC)
C     ISORTN  = STARTING LOCATION OF SORTN(NRC)
C     ITNAME  = STARTING LOCATION OF TNAME(M,3)
C     IX      = STARTING LOCATION OF X(NRC)
C     IY      = STARTING LOCATION OF Y(NRC)
C     IZETAI  = STARTING LOCATION OF ZETAI(NRC)
C     IZENM   = STARTING LOCATION OF ZENM(NRC)
C     ICDEG   = STARTING LOCATION OF CDEG(NRC)
C     IDEGRA  = STARTING LOCATION OF DEGRAD(NRC)
C
C
C     IF THERE IS NO DEGRADATION IN THE SOLID PHASE THEN SET MO EQUAL
C     TO  1  SO THE ARRAYS IN TRANSPORT ARE WELL DIMENSIONED
C
      MO = M
      IF(M.EQ.0) MO = 1
C
C
      NRC= NROW*NCOL
      IBPARA  = IVEL   + NCOL
      ICN     = IBPARA + NRC
      ICNM    = ICN    + NRC
      ICNMP   = ICNM   + NRC
      ICO     = ICNMP  + NRC
      ICONDI  = ICO    + NRC
      ICONDS  = ICONDI + NRC
      IDELX   = ICONDS + NRC
      IDELY   = IDELX  + NRC
      IQXI    = IDELY  + NRC
      IQXNM   = IQXI   + NRC
      IQYI    = IQXNM  + NRC
      IQYNM   = IQYI   + NRC
      IPENTR  = IQYNM  + NRC
      IPRESI  = IPENTR + NRC
      IRATIO  = IPRESI + NRC
      ISD     = IRATIO + NRC
      ISDNM   = ISD    + NRC
      ISORTN  = ISDNM  + NRC
      ITNAME  = ISORTN + NRC
      IX      = ITNAME + 3*MO
      IY      = IX     + NRC
      IZETAI  = IY     + NRC
      IZENM   = IZETAI + NRC
      ICDEG   = IZENM  + NRC
      IDEGRA  = ICDEG  + NRC
C
C     CALCULATE STARTING LOCATIONS OF THREE-DIMENSIONAL ARRAYS
C
C     IA      = STARTING LOCATION OF A
```

```
C     IPC      = STARTING LOCATION OF PC
C
      IA       = IDEGRA  + NRC
      IPC      = IA      + MO*NRC
      IMAX     = IPC     + MO*NRC    + 40
C
C     PROGRAM STOPS IF COMMON REQUIREMENT EXCEEDS
C     SPACE ALLOCATED
C
      IF(IMAX.LT.IGREAT)  GO TO 1
      WRITE (6,700) IMAX,IGREAT
  700 FORMAT(1H1,4X,'*** PROGRAM TERMINATED ***',6X,/,
     1 'COMMON REQUIREMENT EXCEEDS SPACE ALLOCATED IN BLANK
     2 COMMON ARRAY Z',/,6X,'SPACE ALLOCATED = ',I6,
     3 /,6X,'SPACE REQUIRED   = ',I6)
      GO TO 2
C
C     IBM 370 SYSTEM SUBROUTINE TO SUPPRESS UNDERFLOW WARNINGS
C
    1 CALL ERRSET(207,260,-1,1,0,208)
C
C     TRANSFER CONTROL TO SUBROUTINE TRANS
C
      CALL TRANS(B(IATOT),B(ICFB),B(ICFL),B(ICFR),B(ICIB),B(ICIL),
     1 B(ICIR),B(IOLD),B(IVEL),B(IBPARA),B(ICN),B(ICNM),
     2 B(ICNMP),B(ICO),B(ICONDI),B(ICONDS),B(IDELX),B(IDELY),
     3 B(IQXI),B(IQXNM),B(IQYI),B(IQYNM),B(IPENTR),B(IPRESI),
     4 B(IRATIO),B(ISD),B(ISDNM),B(ISORTN),B(ITNAME),B(IX),B(IY),
     5 B(IZETAI),B(IZENM),B(ICDEG),B(IDEGRA),B(IA),B(IPC),
     6 NROW,NCOL,M,MO)
    2 STOP
      END
C
```

```
C.....SUBROUTINE TRANS.........................................
C
C
C
      SUBROUTINE TRANS(ATOT,CFB,CFL,CFR,CIB,CIL,CIR,OLD,VEL,
     1 BPARA,CN,CNM,CNMP,CO,CONDI,CONDS,DELX,DELY,QXI,QXNM,QYI,
     2 QYNM,PENTR,PRESI,RATIO,SD,SDNM,SORTN,TNAME,X,Y,ZETAI,ZENM,
     3 CDEG,DEGRAD,A,PC,NROW,NCOL,M,MO)
      COMMON B(6000)
C
C     SETUP ONE-DIMENSIONAL ARRAYS
C
      DIMENSION ATOT(NCOL),CFB(NCOL),CFL(NROW),CFR(NROW),CIB(NCOL),
     1 CIL(NROW),CIR(NROW),OLD(NCOL),ON(20),OFF(20),VEL(NCOL)
C
C     SETUP TWO-DIMENSIONAL ARRAYS
C
      DIMENSION BPARA(NROW,NCOL),CN(NROW,NCOL),CNM(NROW,NCOL),
     1 CNMP(NROW,NCOL),CO(NROW,NCOL),CONDI(NROW,NCOL),
     2 CONDS(NROW,NCOL),DELX(NROW,NCOL),DELY(NROW,NCOL),
     3 QXI(NROW,NCOL),QXNM(NROW,NCOL),QYI(NROW,NCOL),
     4 QYNM(NROW,NCOL),PENTR(NROW,NCOL),PRESI(NROW,NCOL),
     5 RATIO(NROW,NCOL),SD(NROW,NCOL),SDNM(NROW,NCOL),
     6 SORTN(NROW,NCOL),TNAME(MO,3),X(NROW,NCOL),Y(NROW,NCOL),
     7 ZETAI(NROW,NCOL),ZENM(NROW,NCOL),CDEG(NROW,NCOL),
     8 DEGRAD(NROW,NCOL)
C
C     SETUP THREE-DIMENSIONAL ARRAYS
C
      DIMENSION A(MO,NROW,NCOL),PC(MO,NROW,NCOL)
C
      COMMON/MISC/TITLE(20),CFMT(20),DFMT(20),EFMT(20),NI,NO,
     1 NH,IFLAGT,IFLAGS,ISTATE,IDEG,IPARAM
      COMMON /BLK2/ON,OFF,IBC,CONC
      COMMON /BLK3/RU,DELT
C
C     GROUP I INPUT DATA
C     GEOMETRY AND NODAL PARAMETERS
C
C     READ INPUT FORMAT FOR NODES IN (X,Y) PAIRS
C
      IF(IFLAGT.EQ.1) READ(NI,400)(CFMT(I),I=1,20)
  400 FORMAT(20A4)
C
C     READ GLOBAL COORDINATES OF ALL NODES IN (X,Y) PAIRS
C
      IF(IFLAGT.EQ.1)
     1 READ(NI,CFMT)((X(I,J),Y(I,J),J=1,NCOL),I=1,NROW)
C
      IF(IFLAGT.NE.0) GO TO 420
      DO 420 I=1,NROW
      READ(NH)(X(I,J),Y(I,J),J=1,NCOL)
  420 CONTINUE
C
C     PRINT GLOBAL COORDINATES OF ALL NODES IN (X,Y) PAIRS
C
      WRITE(NO,125)
  125 FORMAT(1H1)
      DO 8 I=1,NROW
      WRITE(NO,107)I,(X(I,J),Y(I,J),J=1,NCOL)
  107 FORMAT(1H0,4X,'GLOBAL COORDINATES, (X,Y) OF ROW =',
     1 I2,1X,' (ALL UNITS IN CM)',/,(1X,4(5X,
     2 '(',E9.4,',',1X,E9.4,')')))
    8 CONTINUE
C
C     GROUP II INPUT DATA
C     SOIL PROPERTIES AND MOISTURE RETENTION PARAMETERS
C
C     READ AND PRINT SOIL DENSITY, SATURATED CONDUCTIVITY,
C     AIR ENTRY LEVEL, B PARAMETER, AND
```

```
C     SATURATED WATER CONTENT RATIO AT ALL GLOBAL NODES
C
      READ(NI,710) RU
  710 FORMAT(F10.0)
      WRITE(NO,106) RU
  106 FORMAT(1H1,4X,'RU = ',F10.4,2X,'GRAM/CM-3')
      WRITE(NO,711)
  711 FORMAT(1H0,4X,'CONDUCTIVITY (CM/HR), AIR ENTRY LEVEL (CM), ' ,
     1 'EXPONENT B, AND SATURATED WATER CONTENT AT GRID POINT (I,J)')
      IF(IFLAGT.EQ.1)
     1 READ(NI,712) ((CONDS(I,J),PENTR(I,J),BPARA(I,J),RATIO(I,J),
     2 J=1,NCOL),I=1,NROW)
  712 FORMAT(4F10.0)
      IF(IFLAGT.EQ.0)
     1 READ(NH) ((CONDS(I,J),PENTR(I,J),BPARA(I,J),RATIO(I,J),
     2 I=1,NROW),J=1,NCOL)
      DO 50 I=1,NROW
      DO 50 J=1,NCOL
      WRITE(NO,228)I,J,CONDS(I,J),PENTR(I,J),BPARA(I,J),
     1 RATIO(I,J)
  228 FORMAT(6X,'I = ',I4,5X,'J = ',I4,5X,4F10.4)
   50 CONTINUE
C
C     GROUP III INPUT DATA
C     CHEMISTRY PROPERTIES
C
      READ(NI,714) CONC
  714 FORMAT(F10.0)
      WRITE(NO,716) CONC
  716 FORMAT(1H1,4X,'POLLUTANT CONCENTRATION = ',F10.4,' PPM')
      READ(NI,714) PH
      WRITE(NO,113) PH
  113 FORMAT(1H0,4X,'PH = ',F8.2)
C
C     READ INPUT FORMAT FOR CHEMISTRY PROPERTIES
C
      READ(NI,718)(DFMT(I),I=1,20)
  718 FORMAT(20A4)
C
C     READ REACTION PROPERTIES
C
      IF(M.LT.1) GO TO 4
C
      DO 123 I=1,M
      READ(NI,105) (TNAME(I,N),N=1,3)
  105 FORMAT(18A4)
      DO 123 J=1,NROW
      READ(NI,DFMT)(A(I,J,K),K=1,NCOL)
  123 CONTINUE
      DO 4 I=1,M
      WRITE(NO,124) (TNAME(I,N),N=1,3)
  124 FORMAT(1H1,4X,'REACTION RATE OF',1X,3A4,1X,
     1 'IN HOUR-1 AT EVERY GRID POINT')
      DO 4 J=1,NROW
      WRITE(NO,312)J,(A(I,J,K),K=1,NCOL)
  312 FORMAT(1H0,4X,'ROW # =',I2,/,(5X,10F10.4))
    4 CONTINUE
      IF(IDEG.EQ.0) GO TO 254
      READ(NI,DFMT)((DEGRAD(I,J),J=1,NCOL),I=1,NROW)
      WRITE(NO,252)
  252 FORMAT(1H1,4X,'DEGRADATION RATE IN THE LIQUID PHASE',
     1 1X,'AT EVERY GRID POINT (I,J)  IN  HR-1')
      DO 253 I=1,NROW
         WRITE(NO,312) I,(DEGRAD(I,J),J=1,NCOL)
  253 CONTINUE
  254 WRITE(NO,122)
      READ(NI,DFMT)((SD(I,J),J=1,NCOL),I=1,NROW)
  122 FORMAT(1H1,4X,'PARTITION COEFFICIENT OF GRID POINT (I,J)')
      DO 5 I=1,NROW
      WRITE(NO,312)I,(SD(I,J),J=1,NCOL)
```

```
    5 CONTINUE
C
C     GROUP IV INPUT DATA
C     BOUNDARY AND INITIAL CONDITIONS
C
      READ(NI,121) IFLAGL,IFLAGR,IFLAGB
  121 FORMAT(10I5)
      WRITE(NO,229) IFLAGL,IFLAGR,IFLAGB
  229 FORMAT(1H1,4X,'IFLAGL = ',I3,5X,
     1 'IFLAGR = ',I4,5X,'IFLAGB = ',I4)
      IF(IFLAGL.EQ.0) GO TO 11
      READ(NI,121) NIL,NFL
      WRITE(NO,230)NIL,NFL
  230 FORMAT(1H0,4X,'NIL = ',2X,I4,5X,'NFL = ',I4)
      READ(NI,499)(CIL(I),I=NIL,NFL)
      WRITE(NO,231)(CIL(I),I=NIL,NFL)
  231 FORMAT(1H0,4X,
     1 'INPUT CONCENTRATION ON THE LEFT BOUNDARY AT TIME=0.0',
     2 ' IN PPM',/,5X,'FROM ROW NIL TO ROW NFL',/,(5X,5F10.4))
      READ(NI,499) (CFL(I),I=NIL,NFL)
  499 FORMAT(6F10.0)
      WRITE(NO,232) (CFL(I),I=NIL,NFL)
  232 FORMAT(1H0,4X,
     1 'INPUT CONCENTRATION ON THE LEFT BOUNDARY AT MAXIMUM TIME',
     2 ' IN PPM',/,5X,'FROM ROW NIL TO ROW NFL',/,
     3 (5X,5F10.4))
   11 IF(IFLAGR.EQ.0)GO TO 12
      READ(NI,121) NIR,NFR
      WRITE(NO,233) NIR,NFR
  233 FORMAT(1H0,4X,'NIR = ',I4,5X,'NFR =',I4)
      READ(NI,498) (CIR(I),I=NIR,NFR)
  498 FORMAT(6F10.0)
      WRITE(NO,234) (CIR(I),I=NIR,NFR)
  234 FORMAT(1H0,4X,
     1 'INPUT CONCENTRATION ON THE RIGHT HAND SIDE BOUNDARY',
     2 ' AT TIME = 0.0 IN PPM',/,5X,'FROM ROW NIR TO ROW NFR',/,
     3 (5X,5F10.4))
      READ(NI,498)(CFR(I),I=NIR,NFR)
      WRITE(NO,235) (CFR(I),I=NIR,NFR)
  235 FORMAT(1H0,4X,
     1 'INPUT CONCENTRATION ON THE RIGHT HAND SIDE BOUNDARY AT ',
     2 'MAXIMUM TIME  (PPM)',/,5X,'FROM ROW NIR TO ROW',
     3 ' NFR',/,(5X,5F10.4))
   12 IF(IFLAGB.EQ.0) GO TO 13
      READ(NI,121) NIB,NFB
      WRITE(NO,236)NIB,NFB
  236 FORMAT(1H0,4X,'NIB = ',I4,5X,'NFB = ',I4)
      READ(NI,498) (CIB(I),I=NIB,NFB)
      WRITE(NO,237) (CIB(I),I=NIB,NFB)
  237 FORMAT(1H0,4X,
     1 'INPUT CONCENTRATION ON THE BOTTOM BOUNDARY AT',
     2 ' TIME =0.0 IN PPM',/,5X,'FROM COLUMN NIB TO COLUMN NFB',/,
     3 (5X,5F10.4))
      READ(NI,498) (CFB(I),I=NIB,NFB)
      WRITE(NO,238)(CFB(I),I=NIB,NFB)
  238 FORMAT(1H0,4X,
     1 'INPUT CONCENTRATION ON THE BOTTOM BOUNDARY AT MAXIMUM TIME',
     2 ' IN PPM',/,5X,' FROM COLUMN NIB TO',
     3 ' COLUMN NFB',/,(5X,5F10.4))
   13 CONTINUE
C
C
      IF(IFLAGT.EQ.0) READ(NH) IBC
      IF(IFLAGT.EQ.0) READ(NH) (ON(I),OFF(I),I=1,IBC)
C
      IF(IPARAM.EQ.1) READ(NI,102) IBC
  102 FORMAT(I5)
      WRITE(NO,115)IBC
  115 FORMAT(1H1,4X,'IBC = ',I5)
      IF(IPARAM.EQ.1) READ(NI,720) (ON(I),OFF(I),I=1,IBC)
```

```
  720 FORMAT(2F10.0)
      WRITE(NO,108) (ON(I),OFF(I),I=1,IBC)
  108 FORMAT(1HO,4X,'APPLICATION PERIOD OF POLLUTANT IN HOUR'/
     1 (6X,F10.4,5X,F12.4))
      IF(IFLAGT.EQ.O) READ(NH) DS1,DS2
      IF(IPARAM.EQ.1) READ(NI,722) DS1,DS2
  722 FORMAT(2F10.0)
      WRITE(NO,119) DS1,DS2
  119 FORMAT(1HO,4X,'STARTING LOCATION DS1 = ',F10.2,2X,'CM',/,
     1 5X,'ENDING   LOCATION DS2 = ',F10.2,2X,'CM')
C
C
C     GROUP V INPUT DATA
C     TIME INTEGRATION AND OUTPUT PARAMETERS
C
C
C     DELT IS THE PRINTING INTERVAL IN HYDRAUL OUTPUT FILE
C
      IF(IFLAGT.EQ.O) READ(NH) DELT
C
      IF(IPARAM.EQ.1) READ(NI,724) DELT
      READ(NI,724) TMAX
  724 FORMAT(2F10.0)
      WRITE(NO,109) DELT,TMAX
  109 FORMAT(1H1,4X,'PARAMETERS FOR INTEGRATION AND OUTPUT',/,
     1 5X,'TIME STEP FOR INTEGRATION:',9X,'  DELT  = ',F12.2,1X,'HR',/,
     2 5X,'MAXIMUM TIME PERIOD FOR SIMULATION:  TMAX  = ',F12.2,1X,'HR')
      READ(NI,726) PER1,PRT1,PRT2
  726 FORMAT(3F10.0)
      WRITE(NO,116) PER1,PRT1,PRT2
  116 FORMAT(1HO,
     1 4X,'PIVOT POINT FOR PRINTOUT     = ',F10.2,/,
     2 5X,'PRINT INTERVAL BEFORE PIVOT = ',F10.2,/,
     3 5X,'PRINT INTERVAL AFTER  PIVOT = ',F10.2)
C
C
C     PROGRAM INITIALIZATION
C
      TIMEI=0.0
      TIMEF=TMAX
      DO 3 I=1,NROW
      DO 3 J=1,NCOL
    3 CO(I,J)=0.0
      DO 22 I=1,M
      DO 22 J=1,NROW
      DO 22 K=1,NCOL
   22 PC(I,J,K)=0.0
      DO 26 I=1,NROW
      DO 26 J=1,NCOL
      CDEG(I,J)=0.0
   26 SORTN(I,J)=0.0
      PDIS=0.0
      TIME=0.0
      DAY=TIME/24.0
      PRT=PRT1
      KPD=1
      DO 1 J=1,NCOL
    1 ATOT(J)=0.0
      IF(M.LT.1) GO TO 2
      DO 2 J=1,NCOL
      DO 2 K=1,M
      ATOT(J)=ATOT(J) + A(K,1,J)
    2 CONTINUE
C
C
C     GROUP VI INPUT DATA
C
C     PRESSURE DISTRIBUTION
C     INITIAL, TIME VARIABLE, AND OR STEADY STATE
C
```

```
C
C     READ FORMAT FOR PRESSURE DISTRIBUTION
      IF(IFLAGT.EQ.1) READ(NI,732)(EFMT(I),I=1,20)
  732 FORMAT(20A4)
C
C     READ IN PRESSURE DISTRIBUTION
C
 3921 CONTINUE
      IF(IFLAGT.EQ.1)
     1 READ(NI,EFMT) ((PRESI(I,J),I=1,NROW),J=1,NCOL)
      IF(IFLAGT.EQ.0)
     1 READ(NH) ((PRESI(I,J),I=1,NROW),J=1,NCOL)
      WRITE(NO,240)
  240 FORMAT(1H1,4X,'PRESSURE DISTRIBUTION--CM OF WATER')
      WRITE(NO,205) DAY
  205 FORMAT(1H0,4X,'TIME = ',E15.6,' DAYS')
      DO 55 I=1,NROW
      WRITE(NO,312)I,(PRESI(I,J),J=1,NCOL)
   55 CONTINUE
C
C     READ THE STEADY STATE CRITERIA FLAG
C
      IF(IFLAGT.EQ.1)
     1 READ(NI,500) ISTATE
  500 FORMAT(I2)
      IF(IFLAGT.EQ.0)
     1 READ(NH) ISTATE
      WRITE(NO,1111) ISTATE
 1111 FORMAT(//,4X,' STEADY STATE CRITERIA :',I5,15X,'STEADY STATE = 0',
     15X,'STILL UNSTEADY = 1')
C
C
C     END OF ALL INPUT DATA, CALCULATION BEGINS
C
C     CALCULATE WATER FLUX AND WATER CONTENT
C     THE FOLLOWING IS VALID FOR GENERAL ISOPARAMETRIC ELEMENT
C
      DO 302 I=1,NROW
      DO 302 J=1,NCOL
      T1=PRESI(I,J)
      CALL STRUC(I,J,T1,T2,T3,CONDS,PENTR,BPARA,RATIO,NROW,NCOL)
      CONDI(I,J)=T2
      ZETAI(I,J)=T3
  302 CONTINUE
      CALL FLUX(PRESI,CONDI,QXI,QYI,NROW,NCOL,X,Y)
C
C     PRINT INITIAL CONDITION
C
      WRITE(NO,745)
  745 FORMAT(1H1)
      WRITE(NO,205) DAY
      DO 3101 I=1,NROW
      WRITE(NO,1070) I,(QXI(I,J),QYI(I,J),J=1,NCOL)
 1070 FORMAT(1H0,4X,'WATER FLUX AT GRID POINT (I,J) OF ROW # =',
     1 I2,/,(1X,5(3X,'(',E10.4,E11.4,')')))
 3101 CONTINUE
      WRITE(NO,3103)
 3103 FORMAT(1H1,4X,'WATER CONTENT RATIO AT GRID POINT (I,J)')
      WRITE(NO,205) DAY
      DO 3102 I=1,NROW
      WRITE(NO,312) I,(ZETAI(I,J),J=1,NCOL)
 3102 CONTINUE
      IF(TIME.NE.0.0) GO TO 3922
      WRITE(NO,103) DAY
  103 FORMAT(1H1,4X,'TIME = ',E15.6,' DAY',6X,
     1 'SOLUTION CONCENTRATION (PPM)')
      DO 311 I=1,NROW
      WRITE(NO,312)I,(CO(I,J),J=1,NCOL)
  311 CONTINUE
      IF(M.LT.1) GO TO 16
```

```
      DO 16 I=1,M
      WRITE(NO,110) (TNAME(I,N),N=1,3)
  110 FORMAT(1H1,4X,'DECREASE OF POLLUTANT IN THE SOLID PHASE',
     1 1X,'BY',3X,3A4,1X,'  IN   PPM')
      DO 313 J=1,NROW
  313 WRITE(NO,312) J,(PC(I,J,K),K=1,NCOL)
   16 CONTINUE
      IF(IDEG.EQ.0) GO TO 256
      WRITE(NO,244)
  244 FORMAT(1H1,4X,'DECREASE OF POLLUTANT BY DEGRADATION OF',
     1 1X,'THE LIQUID PHASE')
      DO 255 I=1,NROW
      WRITE(NO,312)I,(CDEG(I,J),J=1,NCOL)
  255 CONTINUE
  256 WRITE(NO,118)
  118 FORMAT(1H1,4X,'INSTANTANEOUS ABSORPTION OF THE POLLUTANT',
     1 ' IN PPM BASED ON SOLID PHASE')
      DO 314 I=1,NROW
  314 WRITE(NO,312)I,(SORTN(I,J),J=1,NCOL)
 3922 CONTINUE
C
      DO 316 I=1,NCOL
      OLD(I)=ZETAI(1,I)
  316 VEL(I)=QYI(1,I)/ZETAI(1,I)
C
C     EXCHANGE WATER FLUX AND WATER CONTENT
C
  392 DO 320 I=1,NROW
      DO 320 J=1,NCOL
      QXNM(I,J)=QXI(I,J)
      QYNM(I,J)=QYI(I,J)
      ZENM(I,J)=ZETAI(I,J)
      CNM(I,J)=CO(I,J)
      SDNM(I,J)=SD(I,J)
  320 CONTINUE
C
C     CALCULATE THE LOCATION OF INTERSECTION OF THE CHARACTERISTICS
C
      DO 336 K=1,2
      DO 322 I=2,NROW
      DO 322 J=1,NCOL
      DELX(I,J)=-QXNM(I,J)*DELT/(ZENM(I,J)+RU*SDNM(I,J))
      DELY(I,J)=-QYNM(I,J)*DELT/(ZENM(I,J)+RU*SDNM(I,J))
  322 CONTINUE
      CALL BC(NROW,NCOL,DELX,DELY)
C
C     CALCULATION OF CONCENTRATION AT THE INTERSECTION POINTS
C
      CALL INTER(CO,CNM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(ZETAI,ZENM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(QXI,QXNM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(QYI,QYNM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(SD,SDNM,NROW,NCOL,DELX,DELY,X,Y)
  336 CONTINUE
C
C     CALCULATION OF CONCENTRATION AT T+DELT
C
      DO 344 I=2,NROW
      DO 344 J=1,NCOL
      T1=DELT/(ZENM(I,J) + RU*SDNM(I,J))
      CNMP(I,J)=0.0
      IF(IDEG.EQ.1) CNMP(I,J)=CNMP(I,J)+T1*ZENM(I,J)*
     1 CNM(I,J)*DEGRAD(I,J)
      IF(M.EQ.0) GO TO 257
      DO 3440 K=1,M
 3440 CNMP(I,J)=CNMP(I,J) + T1*A(K,I,J)*CNM(I,J)*RU
  257 CN(I,J)=CNM(I,J) - CNMP(I,J)
  344 CONTINUE
      TIME=TIME + DELT
      ITER=1
```

```
C
C     CALCULATION OF THE AVERAGE SLOPE
C
  380 DO 911 I=2,NROW
      DO 911 J=1,NCOL
      T1=DELT/(ZETAI(I,J) + RU*SD(I,J))
      IF(IDEG.EQ.1) CNMP(I,J)=CNMP(I,J)+T1*ZETAI(I,J)*
     1 CN(I,J)*DEGRAD(I,J)
      IF(M.EQ.0) GO TO 258
      DO 9110 K=1,M
 9110 CNMP(I,J)=T1*A(K,I,J)*CN(I,J)*RU  + CNMP(I,J)
  258 CNMP(I,J)=CNM(I,J) - 0.5*CNMP(I,J)
  911 CONTINUE
C
C     ITERATION OF CONCENTRATION AT T+DELT
C
      DO 372 I=2,NROW
      DO 372 J=1,NCOL
      T1=ABS(CNMP(I,J) - CN(I,J))
      IF(T1.GT.1.0E-05) GO TO 374
  372 CONTINUE
      K=0
      GO TO 376
  374 K=1
  376 DO 378 I=2,NROW
      DO 378 J=1,NCOL
  378 CN(I,J)=CNMP(I,J)
      IF(K.LE.0) GO TO 913
      DO 468 I=2,NROW
      DO 468 J=1,NCOL
      DELX(I,J)=-0.5*(QXI(I,J)*DELT/(ZETAI(I,J)+RU*SD(I,J))
     1 + QXNM(I,J)*DELT/(ZENM(I,J) + RU*SDNM(I,J)))
      DELY(I,J)=-0.5*(QYI(I,J)*DELT/(ZETAI(I,J)+RU*SD(I,J))
     1 + QYNM(I,J)*DELT/(ZENM(I,J)+RU*SDNM(I,J)))
  468 CONTINUE
C
C     IMPOSE BOUNDARY CONDITION
C
      CALL BC(NROW,NCOL,DELX,DELY)
C
C     CALCULATION OF CONCENTRATION AT INTERSECTION POINTS
C
      CALL INTER(CO,CNM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(ZETAI,ZENM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(QXI,QXNM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(QYI,QYNM,NROW,NCOL,DELX,DELY,X,Y)
      CALL INTER(SD,SDNM,NROW,NCOL,DELX,DELY,X,Y)
C
      DO 914 I=2,NROW
      DO 914 J=1,NCOL
      CNMP(I,J)=0.0
      T1 = DELT/(ZENM(I,J) + RU*SDNM(I,J))
      IF(IDEG.EQ.1) CNMP(I,J)=CNMP(I,J)+T1*ZENM(I,J)*
     1 CNM(I,J)*DEGRAD(I,J)
      IF(M.EQ.0) GO TO 914
      DO 916 K=1,M
  916 CNMP(I,J)=CNMP(I,J) + T1*A(K,I,J)*CNM(I,J)*RU
  914 CONTINUE
      ITER=ITER + 1
      IF(ITER.LE.5) GO TO 380
C
  913 DO 377 I=1,NCOL
      TX=Y(2,I) - Y(1,I)
      THETAO=OLD(I)
      VELO=VEL(I)
      VEL1=VEL(I)
      THETA1=ZETAI(1,I)
      C=CO(1,I)
      TSOR=SD(1,I)
      ACAL=ATOT(I)
```

```
      TDEGRA = DEGRAD(1,I)
      CALL SUFAS(TX,VELO,VEL1,THETAO,THETA1,KPD,C,CA,THETAA,
     1 TIME,ICR,TSOR,ACAL,TDEGRA)
      OLD(I)=THETAA
      IF(X(1,I).LT.DS1.OR.X(1,I).GT.DS2) CN(1,I)=0.0
      IF(X(1,I).LE.DS2.AND.X(1,I).GE.DS1) CN(1,I)=CA
  377 CONTINUE
      IF(IFLAGL.EQ.0) GO TO 37
      DO 38 I=NIL,NFL
   38 CN(I,1)=CIL(I)+(CFL(I)-CIL(I))*TIME/(TIMEF-TIMEI)
   37 IF (IFLAGR.EQ.0) GO TO 39
      DO 40 I=NIR,NFR
   40 CN(I,NCOL)=CIR(I)+(CFR(I)-CIR(I))*TIME/(TIMEF-TIMEI)
   39 IF(IFLAGB.EQ.0) GO TO 41
      DO 42 I=NIB,NFB
   42 CN(NROW,I)=CIB(I)+(CFB(I)-CIB(I))*TIME/(TIMEF-TIMEI)
   41 KPD=ICR
C
      DO 379 I=1,NROW
      DO 379 J=1,NCOL
  379 SORTN(I,J)=CN(I,J)*SD(I,J)
C
C     CALCULATION OF THE  AMOUNT OF POLLUTANT CHANGES
C     IN THE SOLID AND LIQUID PHASES BY VARIOUS REACTIONS
C
      IF(M.EQ.0) GO TO 259
      DO 383 L=1,M
      DO 383 I=1,NROW
      DO 383 J=1,NCOL
  383 PC(L,I,J)=PC(L,I,J)+0.5*A(L,I,J)*(CN(I,J)+CO(I,J))*DELT
C
  259 IF(IDEG.EQ.0) GO TO 261
      DO 260 I=1,NROW
      DO 260 J=1,NCOL
  260 CDEG(I,J) = CDEG(I,J) + 0.5*DEGRAD(I,J)*(CN(I,J)+CO(I,J))
     1 *DELT*ZETAI(I,J)
  261 CONTINUE
C
C     EXCHANGE VALUES
C
      IF (TIME-PRT) 382,384,384
  384 DAY=TIME/24.0
      IF(TIME.LT.PER1) PRT=PRT + PRT1
      IF(TIME.GE.PER1) PRT=PRT + PRT2
      WRITE(NO,103) DAY
      DO 386 I=1,NROW
      WRITE(NO,312)I,(CN(I,J),J=1,NCOL)
  386 CONTINUE
      WRITE(NO,118)
      DO 387 I=1,NROW
  387 WRITE(NO,312)I,(SORTN(I,J),J=1,NCOL)
      IF(M.EQ.0) GO TO 262
      DO 385 I=1,M
      WRITE(NO,110) (TNAME(I,N),N=1,3)
      DO 385 J=1,NROW
  385 WRITE(NO,312) J,(PC(I,J,K),K=1,NCOL)
  262 IF(IDEG.EQ.0) GO TO 382
      WRITE(NO,244)
      DO 263 I=1,NROW
  263 WRITE(NO,312) I,(CDEG(I,J),J=1,NCOL)
C
  382 IF(TIME.GT.TMAX) GO TO 388
C
      DO 390 I=1,NROW
      DO 390 J=1,NCOL
      CO(I,J)=CN(I,J)
  390 CONTINUE
C
      IF(ISTATE.EQ.0) IFLAGS=0
      IF(IFLAGS.EQ.0) GO TO 392
```

```
      DAY = TIME/24.0                                                   TRAN561
      GO TO 3921                                                        TRAN562
C                                                                       TRAN563
  388 RETURN                                                            TRAN564
      END                                                               TRAN565
C                                                                       TRAN566
```

```
C.....SUBROUTINE FLUX.........................................
C
C
C
      SUBROUTINE FLUX(PRES,COND,QX,QY,NROW,NCOL,X,Y)
      DIMENSION PRES(NROW,NCOL),COND(NROW,NCOL),X(NROW,NCOL),
     1 QX(NROW,NCOL),QY(NROW,NCOL),Y(NROW,NCOL)
      NETOT=(NROW-1)*(NCOL-1)
      DO 7 I=1,NROW
      DO 7 J=1,NCOL
      QX(I,J)=0.0
    7 QY(I,J)=0.0
      DO 1 I=1,NETOT
      IY1=(I-1)/(NROW-1) + 1
      IX1=I-(IY1-1)*(NROW-1)
      IX2=IX1
      IY2=IY1+1
      IX3=IX1+1
      IY3=IY1
      IX4=IX1+1
      IY4=IY1+1
      X1=X(IX1,IY1)
      Y1=Y(IX1,IY1)
      X2=X(IX2,IY2)
      Y2=Y(IX2,IY2)
      X3=X(IX3,IY3)
      Y3=Y(IX3,IY3)
      X4=X(IX4,IY4)
      Y4=Y(IX4,IY4)
      P1=PRES(IX1,IY1)
      P2=PRES(IX2,IY2)
      P3=PRES(IX3,IY3)
      P4=PRES(IX4,IY4)
      TX1=((P2-P1)*(Y3-Y1)-(P3-P1)*(Y2-Y1))/
     1 ((X2-X1)*(Y3-Y1)-(X3-X1)*(Y2-Y1))
      TY1=((P3-P1)*(X2-X1)-(P2-P1)*(X3-X1))/
     1 ((X2-X1)*(Y3-Y1)-(X3-X1)*(Y2-Y1))-1.0
      TX2=((P1-P2)*(Y4-Y2)-(P4-P2)*(Y1-Y2))/
     1 ((X1-X2)*(Y4-Y2)-(X4-X2)*(Y1-Y2))
      TY2=((P4-P2)*(X1-X2)-(P1-P2)*(X4-X2))/
     1 ((X1-X2)*(Y4-Y2)-(X4-X2)*(Y1-Y2))-1.0
      TX3=((P1-P3)*(Y4-Y3)-(P4-P3)*(Y1-Y3))/
     1 ((X1-X3)*(Y4-Y3)-(X4-X3)*(Y1-Y3))
      TY3=((X1-X3)*(P4-P3)-(X4-X3)*(P1-P3))/
     1 ((X1-X3)*(Y4-Y3)-(X4-X3)*(Y1-Y3))-1.0
      TX4=((Y2-Y4)*(P3-P4)-(P2-P4)*(Y3-Y4))/
     1 ((X3-X4)*(Y2-Y4)-(X2-X4)*(Y3-Y4))
      TY4=((P2-P4)*(X3-X4)-(P3-P4)*(X2-X4))/
     1 ((X3-X4)*(Y2-Y4)-(X2-X4)*(Y3-Y4))-1.0
      QXEL=-(COND(IX1,IY1)*TX1+COND(IX2,IY2)*TX2+
     1 COND(IX3,IY3)*TX3+COND(IX4,IY4)*TX4)*0.25
      QYEL=-(COND(IX1,IY1)*TY1+COND(IX2,IY2)*TY2+
     1 COND(IX3,IY3)*TY3+COND(IX4,IY4)*TY4)*0.25
      QX(IX1,IY1)=QXEL*0.25+QX(IX1,IY1)
      QX(IX2,IY2)=QXEL*0.25+QX(IX2,IY2)
      QX(IX3,IY3)=QXEL*0.25+QX(IX3,IY3)
      QX(IX4,IY4)=QXEL*0.25+QX(IX4,IY4)
      QY(IX1,IY1)=QYEL*0.25+QY(IX1,IY1)
      QY(IX2,IY2)=QYEL*0.25+QY(IX2,IY2)
      QY(IX3,IY3)=QYEL*0.25+QY(IX3,IY3)
      QY(IX4,IY4)=QYEL*0.25+QY(IX4,IY4)
    1 CONTINUE
      DO 3 I=1,NROW
      QX(I,1)=QX(I,1)*2.0
      QY(I,1)=QY(I,1)*2.0
      QX(I,NCOL)=QX(I,NCOL)*2.0
      QY(I,NCOL)=QY(I,NCOL)*2.0
    3 CONTINUE
      DO 5 J=1,NCOL
      QX(1,J)=QX(1,J)*2.0
```

```
      QY(1,J)=QY(1,J)*2.0                                               FLUX071
      QX(NROW,J)=QX(NROW,J)*2.0                                         FLUX072
      QY(NROW,J)=QY(NROW,J)*2.0                                         FLUX073
    5 CONTINUE                                                          FLUX074
      RETURN                                                            FLUX075
      END                                                               FLUX076
C                                                                       FLUX077
```

```
C.....SUBROUTINE BC...................................
C
C
C
      SUBROUTINE BC(NROW,NCOL,DELX,DELY)
      DIMENSION DELX(NROW,NCOL),DELY(NROW,NCOL)
      DO 1 I=1,NROW
      IF(DELX(I,NCOL).LE.0.0) GO TO 3
      DELX(I,NCOL)=0.0
      DELY(I,NCOL)=0.0
    3 IF(DELX(I,1).GE.0.0) GO TO 1
      DELX(I,1)=0.0
      DELY(I,1)=0.0
    1 CONTINUE
      DO 332 I=1,NCOL
      IF (DELY(NROW,I).LE.0.0) GO TO 332
      DELX(NROW,I)=0.0
      DELY(NROW,I)=0.0
  332 CONTINUE
      RETURN
      END
C
```

```
C.....SUBROUTINE STRUC...............................................
C
C
C
      SUBROUTINE STRUC(IROW,ICOL,T1,T2,T3,CONDS,PENTR,BPARA,
     1 RATIO,NROW,NCOL)
      DIMENSION CONDS(NROW,NCOL),PENTR(NROW,NCOL),
     1 BPARA(NROW,NCOL),RATIO(NROW,NCOL)
      IF(T1.GE.PENTR(IROW,ICOL)) GO TO 3
      T2=CONDS(IROW,ICOL)*(T1/PENTR(IROW,ICOL))**
     1 (-(2.+2./BPARA(IROW,ICOL)))
      T3=RATIO(IROW,ICOL)*(PENTR(IROW,ICOL)/T1)**(1./BPARA(IROW,ICOL))
      GO TO 5
    3 T2=CONDS(IROW,ICOL)
      T3=RATIO(IROW,ICOL)
    5 RETURN
      END
C
```

```
C.....SUBROUTINE SUFAS.........................................
C
C
C
      SUBROUTINE SUFAS(DELX,VELO,VEL1,THETAO,THETA1,
     1 ICR,COLD,CA,THETAA,TIME,KPD,SD,ACAL,DEG)
      DIMENSION ON(20),OFF(20)
      COMMON /BLK2/ON,OFF,IBC,CONC
      COMMON /BLK3/RU,DELT
      KPD=ICR
      DELT1=0.0
   11 IF(ON(KPD).LT.TIME) GO TO 1
      GO TO 13
    1 IF(OFF(KPD).LT.TIME) GO TO 3
      T1=TIME-ON(KPD)
      IF(T1.GT.DELT) GO TO 5
      GO TO 7
    5 T1=DELT
    7 DELT1=DELT1+T1
      GO TO 13
    3 IF(OFF(KPD).LE.TIME-DELT) GO TO 9
      T2=OFF(KPD)-(TIME-DELT)
      T3=OFF(KPD)-ON(KPD)
      T1=AMIN1(T2,T3)
      DELT1=DELT1+T1
    9 IF(KPD-IBC) 15,13,13
   15 KPD=KPD+1
      GO TO 11
   13 T1=(0.5*DELX-VELO*DELT)*THETAO + VEL1*DELT*THETA1
      THETAA=T1/(0.5*DELX)
      T2=ACAL*DELT*DELX*0.25*RU
      CA=((0.5*DELX-VELO*DELT)*THETAO*COLD - T2*COLD +
     1 VEL1*DELT1*THETA1*CONC + RU*SD*COLD*0.5*DELX -
     2 0.25*DELT*DELX*DEG*THETAO*COLD)/
     3 (T1 + 0.5*DELX*RU*SD + T2 + 0.25*DELT*DELX*DEG*THETAA)
      RETURN
      END
```

```
C.....SUBROUTINE INTER.........................................
C
C
C
      SUBROUTINE INTER(FUNC,FUNCN,NROW,NCOL,DELX,DELY,X,Y)
      DIMENSION FUNC(NROW,NCOL),X(NROW,NCOL),Y(NROW,NCOL),
     1 FUNCN(NROW,NCOL),DELX(NROW,NCOL),DELY(NROW,NCOL)
      DO 1 I=2,NROW
      DO 1 J=1,NCOL
      IF(DELX(I,J)) 11,11,13
   11 IF(J.EQ.1) J1=J+1
      IF(J.NE.1) J1=J-1
      GO TO 2
   13 IF(J.LT.NCOL) J1=J+1
      IF(J.EQ.NCOL)J1=J-1
    2 IF(DELY(I,J)) 21,21,23
   21 I1=I-1
      GO TO 3
   23 IF(I.LT.NROW) I1=I+1
      IF(I.EQ.NROW) I1=I-1
    3 FX=((Y(I,J)-Y(I1,J))*(FUNC(I,J)-FUNC(I,J1))
     1 -(Y(I,J)-Y(I,J1))*(FUNC(I,J)-FUNC(I1,J)))
     2 /((X(I,J)-X(I,J1))*(Y(I,J)-Y(I1,J))-
     3 (X(I,J)-X(I1,J))*(Y(I,J)-Y(I,J1)))
      FY=((X(I,J)-X(I1,J))*(FUNC(I,J)-FUNC(I,J1))-
     1 (X(I,J)-X(I,J1))*(FUNC(I,J)-FUNC(I1,J)))/
     2 ((X(I,J)-X(I1,J))*(Y(I,J)-Y(I,J1))-
     3 (Y(I,J)-Y(I1,J))*(X(I,J)-X(I,J1)))
      FUNCN(I,J)=FUNC(I,J)+FX*DELX(I,J)+FY*DELY(I,J)
    1 CONTINUE
      RETURN
      END
```

APPENDIX C

LISTING OF INPUT DATA TO
THE HYDRAULIC MODEL

```
ALDICARB MIGRATION, WICKHAM FARM, SUFFOLK CO., LONG ISLAND, N.Y.                HYDRO01
   19    12                                                                     HYDRO02
 0 1 1                                                                          HYDRO03
(6(6F12.4,/),2F12.4)                                                            HYDRO04
      0.0000      0.0000      0.0000     30.4800      0.0000     45.7200 HYDRO05
      0.0000     60.9600      0.0000     76.2000      0.0000    106.6800 HYDRO06
      0.0000    121.9200      0.0000    137.1600      0.0000    152.4000 HYDRO07
      0.0000    167.6400      0.0000    182.8800      0.0000    228.6000 HYDRO08
      0.0000    274.3201      0.0000    396.2400      0.0000    518.1599 HYDRO09
      0.0000    670.5601      0.0000    822.9600      0.0000   1432.5601 HYDRO10
      0.0000   3870.9600                                                 HYDRO11
   1000.0000      2.8750   1000.0000     33.3550   1000.0000     48.5950 HYDRO12
   1000.0000     63.8350   1000.0000     79.0750   1000.0000    109.5550 HYDRO13
   1000.0000    124.7950   1000.0000    140.0350   1000.0000    155.2750 HYDRO14
   1000.0000    170.5150   1000.0000    185.7550   1000.0000    231.4750 HYDRO15
   1000.0000    277.1951   1000.0000    399.1150   1000.0000    521.0349 HYDRO16
   1000.0000    673.4351   1000.0000    825.8350   1000.0000   1435.4351 HYDRO17
   1000.0000   3873.8350                                                 HYDRO18
   4750.0000     13.6563   4750.0000     44.1362   4750.0000     59.3763 HYDRO19
   4750.0000     74.6163   4750.0000     89.8562   4750.0000    120.3362 HYDRO20
   4750.0000    135.5762   4750.0000    150.8163   4750.0000    166.0562 HYDRO21
   4750.0000    181.2962   4750.0000    196.5363   4750.0000    242.2563 HYDRO22
   4750.0000    287.9763   4750.0000    409.8962   4750.0000    531.8162 HYDRO23
   4750.0000    684.2163   4750.0000    836.6162   4750.0000   1446.2163 HYDRO24
   4750.0000   3884.6162                                                 HYDRO25
   8500.0000     24.4375   8500.0000     54.9175   8500.0000     70.1575 HYDRO26
   8500.0000     85.3975   8500.0000    100.6375   8500.0000    131.1175 HYDRO27
   8500.0000    146.3575   8500.0000    161.5975   8500.0000    176.8375 HYDRO28
   8500.0000    192.0775   8500.0000    207.3175   8500.0000    253.0375 HYDRO29
   8500.0000    298.7576   8500.0000    420.6775   8500.0000    542.5974 HYDRO30
   8500.0000    694.9976   8500.0000    847.3975   8500.0000   1456.9976 HYDRO31
   8500.0000   3895.3975                                                 HYDRO32
  12250.0000     35.2188  12250.0000     65.6987  12250.0000     80.9388 HYDRO33
  12250.0000     96.1788  12250.0000    111.4187  12250.0000    141.8987 HYDRO34
  12250.0000    157.1387  12250.0000    172.3788  12250.0000    187.6187 HYDRO35
  12250.0000    202.8587  12250.0000    218.0988  12250.0000    263.8188 HYDRO36
  12250.0000    309.5388  12250.0000    431.4587  12250.0000    553.3787 HYDRO37
  12250.0000    705.7788  12250.0000    858.1787  12250.0000   1467.7788 HYDRO38
  12250.0000   3906.1787                                                 HYDRO39
  16000.0000     46.0000  16000.0000     76.4800  16000.0000     91.7200 HYDRO40
  16000.0000    106.9600  16000.0000    122.2000  16000.0000    152.6800 HYDRO41
  16000.0000    167.9200  16000.0000    183.1600  16000.0000    198.4000 HYDRO42
  16000.0000    213.6400  16000.0000    228.8800  16000.0000    274.6001 HYDRO43
  16000.0000    320.3201  16000.0000    442.2400  16000.0000    564.1599 HYDRO44
  16000.0000    716.5601  16000.0000    868.9600  16000.0000   1478.5601 HYDRO45
  16000.0000   3916.9600                                                 HYDRO46
  22437.8008     64.5087  22437.8008     94.9887  22437.8008    110.2287 HYDRO47
  22437.8008    125.4687  22437.8008    140.7087  22437.8008    171.1887 HYDRO48
  22437.8008    186.4287  22437.8008    201.6687  22437.8008    216.9087 HYDRO49
  22437.8008    232.1487  22437.8008    247.3887  22437.8008    293.1086 HYDRO50
  22437.8008    338.8286  22437.8008    460.7488  22437.8008    582.6687 HYDRO51
  22437.8008    735.0686  22437.8008    887.4687  22437.8008   1497.0686 HYDRO52
  22437.8008   3935.4687                                                 HYDRO53
  28875.6016     83.0173  28875.6016    113.4973  28875.6016    128.7374 HYDRO54
  28875.6016    143.9774  28875.6016    159.2173  28875.6016    189.6974 HYDRO55
  28875.6016    204.9373  28875.6016    220.1774  28875.6016    235.4173 HYDRO56
  28875.6016    250.6573  28875.6016    265.8975  28875.6016    311.6174 HYDRO57
  28875.6016    357.3374  28875.6016    479.2573  28875.6016    601.1772 HYDRO58
  28875.6016    753.5774  28875.6016    905.9773  28875.6016   1515.5774 HYDRO59
  28875.6016   3953.9773                                                 HYDRO60
  35313.3984    101.5260  35313.3984    132.0060  35313.3984    147.2460 HYDRO61
  35313.3984    162.4860  35313.3984    177.7260  35313.3984    208.2060 HYDRO62
  35313.3984    223.4460  35313.3984    238.6860  35313.3984    253.9260 HYDRO63
  35313.3984    269.1660  35313.3984    284.4060  35313.3984    330.1260 HYDRO64
  35313.3984    375.8459  35313.3984    497.7661  35313.3984    619.6860 HYDRO65
  35313.3984    772.0859  35313.3984    924.4861  35313.3984   1534.0859 HYDRO66
  35313.3984   3972.4861                                                 HYDRO67
  41751.1992    120.0347  41751.1992    150.5147  41751.1992    165.7547 HYDRO68
  41751.1992    180.9947  41751.1992    196.2347  41751.1992    226.7147 HYDRO69
  41751.1992    241.9547  41751.1992    257.1946  41751.1992    272.4348 HYDRO70
```

41751.1992	287.6748	41751.1992	302.9148	41751.1992	348.6348	HYDR071
41751.1992	394.3547	41751.1992	516.2747	41751.1992	638.1946	HYDR072
41751.1992	790.5947	41751.1992	942.9946	41751.1992	1552.5947	HYDR073
41751.1992	3990.9946					HYDR074
48189.0000	138.5434	48189.0000	169.0234	48189.0000	184.2634	HYDR075
48189.0000	199.5034	48189.0000	214.7434	48189.0000	245.2234	HYDR076
48189.0000	260.4634	48189.0000	275.7034	48189.0000	290.9434	HYDR077
48189.0000	306.1833	48189.0000	321.4233	48189.0000	367.1433	HYDR078
48189.0000	412.8633	48189.0000	534.7834	48189.0000	656.7034	HYDR079
48189.0000	809.1033	48189.0000	961.5034	48189.0000	1571.1033	HYDR080
48189.0000	4009.5034					HYDR081
49189.0000	141.4184	49189.0000	171.8984	49189.0000	187.1384	HYDR082
49189.0000	202.3784	49189.0000	217.6184	49189.0000	248.0984	HYDR083
49189.0000	263.3384	49189.0000	278.5784	49189.0000	293.8184	HYDR084
49189.0000	309.0583	49189.0000	324.2983	49189.0000	370.0183	HYDR085
49189.0000	415.7383	49189.0000	537.6584	49189.0000	659.5784	HYDR086
49189.0000	811.9783	49189.0000	964.3784	49189.0000	1573.9783	HYDR087
49189.0000	4012.3784					HYDR088
12.4800	-21.8000	4.9000	0.4350			HYDR089
12.4800	-21.8000	4.9000	0.4350			HYDR090
12.4800	-21.8000	4.9000	0.4350			HYDR091
63.3600	-12.1000	4.0500	0.3950			HYDR092
63.3600	-12.1000	4.0500	0.3950			HYDR093
63.3600	-12.1000	4.0500	0.3950			HYDR094
56.2800	-9.0000	4.3800	0.4100			HYDR095
2.5920	-78.6000	5.3000	0.4850			HYDR096
2.5920	-78.6000	5.3000	0.4850			HYDR097
56.2800	-9.0000	4.3800	0.4100			HYDR098
63.3600	-12.1000	4.0500	0.3950			HYDR099
63.3600	-12.1000	4.0500	0.3950			HYDR100
63.3600	-12.1000	4.0500	0.3950			HYDR101
63.3600	-12.1000	4.0500	0.3950			HYDR102
63.3600	-12.1000	4.0500	0.3950			HYDR103
63.3600	-12.1000	4.0500	0.3950			HYDR104
63.3600	-12.1000	4.0500	0.3950			HYDR105
63.3600	-12.1000	4.0500	0.3950			HYDR106
63.3600	-12.1000	4.0500	0.3950			HYDR107
12.4800	-21.8000	4.9000	0.4350			HYDR108
12.4800	-21.8000	4.9000	0.4350			HYDR109
12.4800	-21.8000	4.9000	0.4350			HYDR110
63.3600	-12.1000	4.0500	0.3950			HYDR111
63.3600	-12.1000	4.0500	0.3950			HYDR112
63.3600	-12.1000	4.0500	0.3950			HYDR113
56.2800	-9.0000	4.3800	0.4100			HYDR114
2.5920	-78.6000	5.3000	0.4850			HYDR115
2.5920	-78.6000	5.3000	0.4850			HYDR116
56.2800	-9.0000	4.3800	0.4100			HYDR117
63.3600	-12.1000	4.0500	0.3950			HYDR118
63.3600	-12.1000	4.0500	0.3950			HYDR119
63.3600	-12.1000	4.0500	0.3950			HYDR120
63.3600	-12.1000	4.0500	0.3950			HYDR121
63.3600	-12.1000	4.0500	0.3950			HYDR122
63.3600	-12.1000	4.0500	0.3950			HYDR123
63.3600	-12.1000	4.0500	0.3950			HYDR124
63.3600	-12.1000	4.0500	0.3950			HYDR125
63.3600	-12.1000	4.0500	0.3950			HYDR126
12.4800	-21.8000	4.9000	0.4350			HYDR127
12.4800	-21.8000	4.9000	0.4350			HYDR128
12.4800	-21.8000	4.9000	0.4350			HYDR129
63.3600	-12.1000	4.0500	0.3950			HYDR130
63.3600	-12.1000	4.0500	0.3950			HYDR131
63.3600	-12.1000	4.0500	0.3950			HYDR132
56.2800	-9.0000	4.3800	0.4100			HYDR133
2.5920	-78.6000	5.3000	0.4850			HYDR134
2.5920	-78.6000	5.3000	0.4850			HYDR135
56.2800	-9.0000	4.3800	0.4100			HYDR136
63.3600	-12.1000	4.0500	0.3950			HYDR137
63.3600	-12.1000	4.0500	0.3950			HYDR138
63.3600	-12.1000	4.0500	0.3950			HYDR139
63.3600	-12.1000	4.0500	0.3950			HYDR140

63.3600	-12.1000	4.0500	0.3950	HYDR141
63.3600	-12.1000	4.0500	0.3950	HYDR142
63.3600	-12.1000	4.0500	0.3950	HYDR143
63.3600	-12.1000	4.0500	0.3950	HYDR144
63.3600	-12.1000	4.0500	0.3950	HYDR145
12.4800	-21.8000	4.9000	0.4350	HYDR146
12.4800	-21.8000	4.9000	0.4350	HYDR147
12.4800	-21.8000	4.9000	0.4350	HYDR148
63.3600	-12.1000	4.0500	0.3950	HYDR149
63.3600	-12.1000	4.0500	0.3950	HYDR150
63.3600	-12.1000	4.0500	0.3950	HYDR151
56.2800	-9.0000	4.3800	0.4100	HYDR152
2.5920	-78.6000	5.3000	0.4850	HYDR153
2.5920	-78.6000	5.3000	0.4850	HYDR154
56.2800	-9.0000	4.3800	0.4100	HYDR155
63.3600	-12.1000	4.0500	0.3950	HYDR156
63.3600	-12.1000	4.0500	0.3950	HYDR157
63.3600	-12.1000	4.0500	0.3950	HYDR158
63.3600	-12.1000	4.0500	0.3950	HYDR159
63.3600	-12.1000	4.0500	0.3950	HYDR160
63.3600	-12.1000	4.0500	0.3950	HYDR161
63.3600	-12.1000	4.0500	0.3950	HYDR162
63.3600	-12.1000	4.0500	0.3950	HYDR163
63.3600	-12.1000	4.0500	0.3950	HYDR164
12.4800	-21.8000	4.9000	0.4350	HYDR165
12.4800	-21.8000	4.9000	0.4350	HYDR166
12.4800	-21.8000	4.9000	0.4350	HYDR167
63.3600	-12.1000	4.0500	0.3950	HYDR168
63.3600	-12.1000	4.0500	0.3950	HYDR169
63.3600	-12.1000	4.0500	0.3950	HYDR170
56.2800	-9.0000	4.3800	0.4100	HYDR171
2.5920	-78.6000	5.3000	0.4850	HYDR172
2.5920	-78.6000	5.3000	0.4850	HYDR173
56.2800	-9.0000	4.3800	0.4100	HYDR174
63.3600	-12.1000	4.0500	0.3950	HYDR175
63.3600	-12.1000	4.0500	0.3950	HYDR176
63.3600	-12.1000	4.0500	0.3950	HYDR177
63.3600	-12.1000	4.0500	0.3950	HYDR178
63.3600	-12.1000	4.0500	0.3950	HYDR179
63.3600	-12.1000	4.0500	0.3950	HYDR180
63.3600	-12.1000	4.0500	0.3950	HYDR181
63.3600	-12.1000	4.0500	0.3950	HYDR182
63.3600	-12.1000	4.0500	0.3950	HYDR183
2.5920	-78.6000	5.3000	0.4850	HYDR184
2.5920	-78.6000	5.3000	0.4850	HYDR185
2.5020	-47.8000	5.3900	0.4510	HYDR186
56.2800	-9.0000	4.3800	0.4100	HYDR187
63.3600	-12.1000	4.0500	0.3950	HYDR188
63.3600	-12.1000	4.0500	0.3950	HYDR189
63.3600	-12.1000	4.0500	0.3950	HYDR190
63.3600	-12.1000	4.0500	0.3950	HYDR191
63.3600	-12.1000	4.0500	0.3950	HYDR192
63.3600	-12.1000	4.0500	0.3950	HYDR193
63.3600	-12.1000	4.0500	0.3950	HYDR194
63.3600	-12.1000	4.0500	0.3950	HYDR195
63.3600	-12.1000	4.0500	0.3950	HYDR196
63.3600	-12.1000	4.0500	0.3950	HYDR197
63.3600	-12.1000	4.0500	0.3950	HYDR198
63.3600	-12.1000	4.0500	0.3950	HYDR199
63.3600	-12.1000	4.0500	0.3950	HYDR200
63.3600	-12.1000	4.0500	0.3950	HYDR201
63.3600	-12.1000	4.0500	0.3950	HYDR202
2.5920	-78.6000	5.3000	0.4850	HYDR203
2.5920	-78.6000	5.3000	0.4850	HYDR204
2.5020	-47.8000	5.3900	0.4510	HYDR205
56.2800	-9.0000	4.3800	0.4100	HYDR206
63.3600	-12.1000	4.0500	0.3950	HYDR207
63.3600	-12.1000	4.0500	0.3950	HYDR208
63.3600	-12.1000	4.0500	0.3950	HYDR209
63.3600	-12.1000	4.0500	0.3950	HYDR210

63.3600	-12.1000	4.0500	0.3950	HYDR211
63.3600	-12.1000	4.0500	0.3950	HYDR212
63.3600	-12.1000	4.0500	0.3950	HYDR213
63.3600	-12.1000	4.0500	0.3950	HYDR214
63.3600	-12.1000	4.0500	0.3950	HYDR215
63.3600	-12.1000	4.0500	0.3950	HYDR216
63.3600	-12.1000	4.0500	0.3950	HYDR217
63.3600	-12.1000	4.0500	0.3950	HYDR218
63.3600	-12.1000	4.0500	0.3950	HYDR219
63.3600	-12.1000	4.0500	0.3950	HYDR220
63.3600	-12.1000	4.0500	0.3950	HYDR221
2.5920	-78.6000	5.3000	0.4850	HYDR222
2.5920	-78.6000	5.3000	0.4850	HYDR223
2.5020	-47.8000	5.3900	0.4510	HYDR224
56.2800	-9.0000	4.3800	0.4100	HYDR225
63.3600	-12.1000	4.0500	0.3950	HYDR226
63.3600	-12.1000	4.0500	0.3950	HYDR227
63.3600	-12.1000	4.0500	0.3950	HYDR228
63.3600	-12.1000	4.0500	0.3950	HYDR229
63.3600	-12.1000	4.0500	0.3950	HYDR230
63.3600	-12.1000	4.0500	0.3950	HYDR231
63.3600	-12.1000	4.0500	0.3950	HYDR232
63.3600	-12.1000	4.0500	0.3950	HYDR233
63.3600	-12.1000	4.0500	0.3950	HYDR234
63.3600	-12.1000	4.0500	0.3950	HYDR235
63.3600	-12.1000	4.0500	0.3950	HYDR236
63.3600	-12.1000	4.0500	0.3950	HYDR237
63.3600	-12.1000	4.0500	0.3950	HYDR238
63.3600	-12.1000	4.0500	0.3950	HYDR239
63.3600	-12.1000	4.0500	0.3950	HYDR240
2.5920	-78.6000	5.3000	0.4850	HYDR241
2.5920	-78.6000	5.3000	0.4850	HYDR242
2.5020	-47.8000	5.3900	0.4510	HYDR243
56.2800	-9.0000	4.3800	0.4100	HYDR244
63.3600	-12.1000	4.0500	0.3950	HYDR245
63.3600	-12.1000	4.0500	0.3950	HYDR246
63.3600	-12.1000	4.0500	0.3950	HYDR247
63.3600	-12.1000	4.0500	0.3950	HYDR248
63.3600	-12.1000	4.0500	0.3950	HYDR249
63.3600	-12.1000	4.0500	0.3950	HYDR250
63.3600	-12.1000	4.0500	0.3950	HYDR251
63.3600	-12.1000	4.0500	0.3950	HYDR252
63.3600	-12.1000	4.0500	0.3950	HYDR253
63.3600	-12.1000	4.0500	0.3950	HYDR254
63.3600	-12.1000	4.0500	0.3950	HYDR255
63.3600	-12.1000	4.0500	0.3950	HYDR256
63.3600	-12.1000	4.0500	0.3950	HYDR257
63.3600	-12.1000	4.0500	0.3950	HYDR258
63.3600	-12.1000	4.0500	0.3950	HYDR259
2.5920	-78.6000	5.3000	0.4850	HYDR260
2.5920	-78.6000	5.3000	0.4850	HYDR261
2.5020	-47.8000	5.3900	0.4510	HYDR262
56.2800	-9.0000	4.3800	0.4100	HYDR263
63.3600	-12.1000	4.0500	0.3950	HYDR264
63.3600	-12.1000	4.0500	0.3950	HYDR265
63.3600	-12.1000	4.0500	0.3950	HYDR266
63.3600	-12.1000	4.0500	0.3950	HYDR267
63.3600	-12.1000	4.0500	0.3950	HYDR268
63.3600	-12.1000	4.0500	0.3950	HYDR269
63.3600	-12.1000	4.0500	0.3950	HYDR270
63.3600	-12.1000	4.0500	0.3950	HYDR271
63.3600	-12.1000	4.0500	0.3950	HYDR272
63.3600	-12.1000	4.0500	0.3950	HYDR273
63.3600	-12.1000	4.0500	0.3950	HYDR274
63.3600	-12.1000	4.0500	0.3950	HYDR275
63.3600	-12.1000	4.0500	0.3950	HYDR276
63.3600	-12.1000	4.0500	0.3950	HYDR277
63.3600	-12.1000	4.0500	0.3950	HYDR278
2.5920	-78.6000	5.3000	0.4850	HYDR279
2.5920	-78.6000	5.3000	0.4850	HYDR280

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  2.5020  -47.8000    5.3900    0.4510                                                    HYDR281
 56.2800   -9.0000    4.3800    0.4100                                                    HYDR282
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR283
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR284
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR285
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR286
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR287
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR288
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR289
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR290
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR291
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR292
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR293
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR294
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR295
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR296
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR297
  2.5920  -78.6000    5.3000    0.4850                                                    HYDR298
  2.5920  -78.6000    5.3000    0.4850                                                    HYDR299
  2.5020  -47.8000    5.3900    0.4510                                                    HYDR300
 56.2800   -9.0000    4.3800    0.4100                                                    HYDR301
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR302
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR303
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR304
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR305
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR306
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR307
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR308
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR309
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR310
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR311
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR312
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR313
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR314
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR315
 63.3600  -12.1000    4.0500    0.3950                                                    HYDR316
 -1   -1                                                                                  HYDR317
   1000.     48189.                                                                       HYDR318
   1                                                                                      HYDR319
  0.0000  1000000.   0.007220                                                             HYDR320
(3(6F12.6,/),F12.6)                                                                       HYDR321
 -228.600006 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR322
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR323
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR324
 3642.360110                                                             HYDR325
 -228.600006 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR326
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR327
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR328
 3642.360110                                                             HYDR329
 -228.600006 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR330
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR331
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR332
 3642.360110                                                             HYDR333
 -228.600006 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR334
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR335
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR336
 3642.360110                                                             HYDR337
 -228.599991 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR338
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR339
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR340
 3642.360110                                                             HYDR341
 -228.599991 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR342
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR343
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR344
 3642.360110                                                             HYDR345
 -228.599991 -198.119995 -182.880005 -167.639999 -152.400009 -121.919998 HYDR346
 -106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR347
   45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR348
 3642.360110                                                             HYDR349
 -228.599991 -198.119995 -182.880005 -167.639999 -152.399994 -121.919998 HYDR350
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-106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR351
  45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR352
3642.360110                                                             HYDR353
-228.599991 -198.119995 -182.880005 -167.639999 -152.399994 -121.919998 HYDR354
-106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR355
  45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR356
3642.360110                                                             HYDR357
-228.600006 -198.120010 -182.880005 -167.639999 -152.400009 -121.919998 HYDR358
-106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR359
  45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR360
3642.360110                                                             HYDR361
-228.600006 -198.120010 -182.880005 -167.639999 -152.400009 -121.919998 HYDR362
-106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR363
  45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR364
3642.360110                                                             HYDR365
-228.600006 -198.120010 -182.880005 -167.639999 -152.400009 -121.919998 HYDR366
-106.679993  -91.440002  -76.199997  -60.960007  -45.720001    0.000000 HYDR367
  45.720001  167.639999  289.560059  441.959961  594.360107 1203.959960 HYDR368
3642.360110                                                             HYDR369
      25.       5000.       500.0.00000100                              HYDR370
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APPENDIX D

LISTING OF COMPUTER PRINTOUT FROM
THE HYDRAULIC MODEL

ALDICARB MIGRATION, WICKHAM FARM, SUFFOLK CO., LONG ISLAND, N.Y.

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NUMBER OF ROWS        =   19
NUMBER OF COLUMNS     =   12
NUMBER OF  ELEMENTS =  198
THE NUMBER OF NODES =  228
SEMI-BAND WIDTH       =   21


TRANSPORT INPUT FILE OPTION                   =    0

STEADY STATE PRESSURE DISTRIBUTION OPTION =    1

RESTART PROGRAM OPTION                        =    1
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GLOBAL COORDINATES OF NODES, (X,Y) (ALL UNITS IN CM)

ROW 1
1 (.0000E+00, .0000E+00) 20 (.1000E+04, .2875E+01) 39 (.4750E+04, .1366E+02) 58 (.8500E+04, .2444E+02)
77 (.1225E+05, .3522E+02) 96 (.1600E+05, .4600E+02) 115 (.2244E+05, .6451E+02) 134 (.2888E+05, .8302E+02)
153 (.3531E+05, .1015E+03) 172 (.4175E+05, .1200E+03) 191 (.4819E+05, .1385E+03) 210 (.4919E+05, .1414E+03)

ROW 2
2 (.0000E+00, .3048E+02) 21 (.1000E+04, .3335E+02) 40 (.4750E+04, .4414E+02) 59 (.8500E+04, .5492E+02)
78 (.1225E+05, .6570E+02) 97 (.1600E+05, .7648E+02) 116 (.2244E+05, .9499E+02) 135 (.2888E+05, .1135E+03)
154 (.3531E+05, .1320E+03) 173 (.4175E+05, .1505E+03) 192 (.4819E+05, .1690E+03) 211 (.4919E+05, .1719E+03)

ROW 3
3 (.0000E+00, .4572E+02) 22 (.1000E+04, .4860E+02) 41 (.4750E+04, .5938E+02) 60 (.8500E+04, .7016E+02)
79 (.1225E+05, .8094E+02) 98 (.1600E+05, .9172E+02) 117 (.2244E+05, .1102E+03) 136 (.2888E+05, .1287E+03)
155 (.3531E+05, .1472E+03) 174 (.4175E+05, .1658E+03) 193 (.4819E+05, .1843E+03) 212 (.4919E+05, .1871E+03)

ROW 4
4 (.0000E+00, .6096E+02) 23 (.1000E+04, .6384E+02) 42 (.4750E+04, .7462E+02) 61 (.8500E+04, .8540E+02)
80 (.1225E+05, .9618E+02) 99 (.1600E+05, .1070E+03) 118 (.2244E+05, .1255E+03) 137 (.2888E+05, .1440E+03)
156 (.3531E+05, .1625E+03) 175 (.4175E+05, .1810E+03) 194 (.4819E+05, .1995E+03) 213 (.4919E+05, .2024E+03)

ROW 5
5 (.0000E+00, .7620E+02) 24 (.1000E+04, .7907E+02) 43 (.4750E+04, .8986E+02) 62 (.8500E+04, .1006E+03)
81 (.1225E+05, .1114E+03) 100 (.1600E+05, .1222E+03) 119 (.2244E+05, .1407E+03) 138 (.2888E+05, .1592E+03)
157 (.3531E+05, .1777E+03) 176 (.4175E+05, .1962E+03) 195 (.4819E+05, .2147E+03) 214 (.4919E+05, .2176E+03)

ROW 6
6 (.0000E+00, .1067E+03) 25 (.1000E+04, .1096E+03) 44 (.4750E+04, .1203E+03) 63 (.8500E+04, .1311E+03)
82 (.1225E+05, .1419E+03) 101 (.1600E+05, .1527E+03) 120 (.2244E+05, .1712E+03) 139 (.2888E+05, .1897E+03)
158 (.3531E+05, .2082E+03) 177 (.4175E+05, .2267E+03) 196 (.4819E+05, .2452E+03) 215 (.4919E+05, .2481E+03)

ROW 7
7 (.0000E+00, .1219E+03) 26 (.1000E+04, .1248E+03) 45 (.4750E+04, .1356E+03) 64 (.8500E+04, .1464E+03)
83 (.1225E+05, .1571E+03) 102 (.1600E+05, .1679E+03) 121 (.2244E+05, .1864E+03) 140 (.2888E+05, .2049E+03)
159 (.3531E+05, .2234E+03) 178 (.4175E+05, .2420E+03) 197 (.4819E+05, .2605E+03) 216 (.4919E+05, .2633E+03)

ROW 8
8 (.0000E+00, .1372E+03) 27 (.1000E+04, .1400E+03) 46 (.4750E+04, .1508E+03) 65 (.8500E+04, .1616E+03)
84 (.1225E+05, .1724E+03) 103 (.1600E+05, .1832E+03) 122 (.2244E+05, .2017E+03) 141 (.2888E+05, .2202E+03)
160 (.3531E+05, .2387E+03) 179 (.4175E+05, .2572E+03) 198 (.4819E+05, .2757E+03) 217 (.4919E+05, .2786E+03)

ROW 9
9 (.0000E+00, .1524E+03) 28 (.1000E+04, .1553E+03) 47 (.4750E+04, .1661E+03) 66 (.8500E+04, .1768E+03)
85 (.1225E+05, .1876E+03) 104 (.1600E+05, .1984E+03) 123 (.2244E+05, .2169E+03) 142 (.2888E+05, .2354E+03)
161 (.3531E+05, .2539E+03) 180 (.4175E+05, .2724E+03) 199 (.4819E+05, .2909E+03) 218 (.4919E+05, .2938E+03)

ROW 10
10 (.0000E+00, .1676E+03) 29 (.1000E+04, .1705E+03) 48 (.4750E+04, .1813E+03) 67 (.8500E+04, .1921E+03)
86 (.1225E+05, .2029E+03) 105 (.1600E+05, .2136E+03) 124 (.2244E+05, .2321E+03) 143 (.2888E+05, .2507E+03)
162 (.3531E+05, .2692E+03) 181 (.4175E+05, .2877E+03) 200 (.4819E+05, .3062E+03) 219 (.4919E+05, .3091E+03)

ROW 11
11 (.0000E+00, .1829E+03) 30 (.1000E+04, .1858E+03) 49 (.4750E+04, .1965E+03) 68 (.8500E+04, .2073E+03)
87 (.1225E+05, .2181E+03) 106 (.1600E+05, .2289E+03) 125 (.2244E+05, .2474E+03) 144 (.2888E+05, .2659E+03)
163 (.3531E+05, .2844E+03) 182 (.4175E+05, .3029E+03) 201 (.4819E+05, .3214E+03) 220 (.4919E+05, .3243E+03)

ROW 12
12 (.0000E+00, .2286E+03) 31 (.1000E+04, .2315E+03) 50 (.4750E+04, .2423E+03) 69 (.8500E+04, .2530E+03)
88 (.1225E+05, .2638E+03) 107 (.1600E+05, .2746E+03) 126 (.2244E+05, .2931E+03) 145 (.2888E+05, .3116E+03)
164 (.3531E+05, .3301E+03) 183 (.4175E+05, .3486E+03) 202 (.4819E+05, .3671E+03) 221 (.4919E+05, .3700E+03)

ROW 13

13 (.0000E+00, .2743E+03)	32 (.1000E+04, .2772E+03)	51 (.4750E+04, .2880E+03)	70 (.8500E+04, .2988E+03)
89 (.1225E+05, .3095E+03)	108 (.1600E+05, .3203E+03)	127 (.2244E+05, .3388E+03)	146 (.2888E+05, .3573E+03)
165 (.3531E+05, .3758E+03)	184 (.4175E+05, .3944E+03)	203 (.4819E+05, .4129E+03)	222 (.4919E+05, .4157E+03)
ROW 14			
14 (.0000E+00, .3962E+03)	33 (.1000E+04, .3991E+03)	52 (.4750E+04, .4099E+03)	71 (.8500E+04, .4207E+03)
90 (.1225E+05, .4315E+03)	109 (.1600E+05, .4422E+03)	128 (.2244E+05, .4607E+03)	147 (.2888E+05, .4793E+03)
166 (.3531E+05, .4978E+03)	185 (.4175E+05, .5163E+03)	204 (.4819E+05, .5348E+03)	223 (.4919E+05, .5377E+03)
ROW 15			
15 (.0000E+00, .5182E+03)	34 (.1000E+04, .5210E+03)	53 (.4750E+04, .5318E+03)	72 (.8500E+04, .5426E+03)
91 (.1225E+05, .5534E+03)	110 (.1600E+05, .5642E+03)	129 (.2244E+05, .5827E+03)	148 (.2888E+05, .6012E+03)
167 (.3531E+05, .6197E+03)	186 (.4175E+05, .6382E+03)	205 (.4819E+05, .6567E+03)	224 (.4919E+05, .6596E+03)
ROW 16			
16 (.0000E+00, .6706E+03)	35 (.1000E+04, .6734E+03)	54 (.4750E+04, .6842E+03)	73 (.8500E+04, .6950E+03)
92 (.1225E+05, .7058E+03)	111 (.1600E+05, .7166E+03)	130 (.2244E+05, .7351E+03)	149 (.2888E+05, .7536E+03)
168 (.3531E+05, .7721E+03)	187 (.4175E+05, .7906E+03)	206 (.4819E+05, .8091E+03)	225 (.4919E+05, .8120E+03)
ROW 17			
17 (.0000E+00, .8230E+03)	36 (.1000E+04, .8258E+03)	55 (.4750E+04, .8366E+03)	74 (.8500E+04, .8474E+03)
93 (.1225E+05, .8582E+03)	112 (.1600E+05, .8690E+03)	131 (.2244E+05, .8875E+03)	150 (.2888E+05, .9060E+03)
169 (.3531E+05, .9245E+03)	188 (.4175E+05, .9430E+03)	207 (.4819E+05, .9615E+03)	226 (.4919E+05, .9644E+03)
ROW 18			
18 (.0000E+00, .1433E+04)	37 (.1000E+04, .1435E+04)	56 (.4750E+04, .1446E+04)	75 (.8500E+04, .1457E+04)
94 (.1225E+05, .1468E+04)	113 (.1600E+05, .1479E+04)	132 (.2244E+05, .1497E+04)	151 (.2888E+05, .1516E+04)
170 (.3531E+05, .1534E+04)	189 (.4175E+05, .1553E+04)	208 (.4819E+05, .1571E+04)	227 (.4919E+05, .1574E+04)
ROW 19			
19 (.0000E+00, .3871E+04)	38 (.1000E+04, .3874E+04)	57 (.4750E+04, .3885E+04)	76 (.8500E+04, .3895E+04)
95 (.1225E+05, .3906E+04)	114 (.1600E+05, .3917E+04)	133 (.2244E+05, .3935E+04)	152 (.2888E+05, .3954E+04)
171 (.3531E+05, .3972E+04)	190 (.4175E+05, .3991E+04)	209 (.4819E+05, .4010E+04)	228 (.4919E+05, .4012E+04)

```
SOIL WATER PRESSURE AT TIME =   0.2000E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9959E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8599E+02 -0.8444E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7080E+02 -0.6924E+02 -0.6811E+02 -0.6715E+02 -0.6736E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5760E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3888E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3843E+02 -0.4105E+02
-0.4492E+02 -0.4570E+02
ROW NUMBER = 12
-0.1637E-01  0.7883E+00  0.3285E+01  0.5270E+01  0.6834E+01  0.7949E+01  0.8911E+01  0.8707E+01  0.7284E+01  0.4663E+01
 0.7863E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5098E+02  0.5255E+02  0.5366E+02  0.5463E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

HYDRAULIC CONDUCTIVITY AND MOISTURE RETENTION PARAMETERS

NODE	CONDS CM/HR	PENTR CM H2O	BPARA	RATIO
1	12.4800	-21.8000	4.9000	0.4350
2	12.4800	-21.8000	4.9000	0.4350
3	12.4800	-21.8000	4.9000	0.4350
4	63.3600	-12.1000	4.0500	0.3950
5	63.3600	-12.1000	4.0500	0.3950
6	63.3600	-12.1000	4.0500	0.3950
7	56.2800	-9.0000	4.3800	0.4100
8	2.5920	-78.6000	5.3000	0.4850
9	2.5920	-78.6000	5.3000	0.4850
10	56.2800	-9.0000	4.3800	0.4100
11	63.3600	-12.1000	4.0500	0.3950
12	63.3600	-12.1000	4.0500	0.3950
13	63.3600	-12.1000	4.0500	0.3950
14	63.3600	-12.1000	4.0500	0.3950
15	63.3600	-12.1000	4.0500	0.3950
16	63.3600	-12.1000	4.0500	0.3950
17	63.3600	-12.1000	4.0500	0.3950
18	63.3600	-12.1000	4.0500	0.3950
19	63.3600	-12.1000	4.0500	0.3950
20	12.4800	-21.8000	4.9000	0.4350
21	12.4800	-21.8000	4.9000	0.4350
22	12.4800	-21.8000	4.9000	0.4350
23	63.3600	-12.1000	4.0500	0.3950
24	63.3600	-12.1000	4.0500	0.3950
25	63.3600	-12.1000	4.0500	0.3950
26	56.2800	-9.0000	4.3800	0.4100
27	2.5920	-78.6000	5.3000	0.4850
28	2.5920	-78.6000	5.3000	0.4850
29	56.2800	-9.0000	4.3800	0.4100
30	63.3600	-12.1000	4.0500	0.3950
31	63.3600	-12.1000	4.0500	0.3950
32	63.3600	-12.1000	4.0500	0.3950
33	63.3600	-12.1000	4.0500	0.3950
34	63.3600	-12.1000	4.0500	0.3950
35	63.3600	-12.1000	4.0500	0.3950
36	63.3600	-12.1000	4.0500	0.3950
37	63.3600	-12.1000	4.0500	0.3950
38	63.3600	-12.1000	4.0500	0.3950
39	12.4800	-21.8000	4.9000	0.4350
40	12.4800	-21.8000	4.9000	0.4350
41	12.4800	-21.8000	4.9000	0.4350
42	63.3600	-12.1000	4.0500	0.3950
43	63.3600	-12.1000	4.0500	0.3950
44	63.3600	-12.1000	4.0500	0.3950
45	56.2800	-9.0000	4.3800	0.4100
46	2.5920	-78.6000	5.3000	0.4850
47	2.5920	-78.6000	5.3000	0.4850
48	56.2800	-9.0000	4.3800	0.4100
49	63.3600	-12.1000	4.0500	0.3950
50	63.3600	-12.1000	4.0500	0.3950
51	63.3600	-12.1000	4.0500	0.3950
52	63.3600	-12.1000	4.0500	0.3950
53	63.3600	-12.1000	4.0500	0.3950
54	63.3600	-12.1000	4.0500	0.3950
55	63.3600	-12.1000	4.0500	0.3950
56	63.3600	-12.1000	4.0500	0.3950
57	63.3600	-12.1000	4.0500	0.3950
58	12.4800	-21.8000	4.9000	0.4350

59	12.4800	-21.8000	4.9000	0.4350
60	12.4800	-21.8000	4.9000	0.4350
61	63.3600	-12.1000	4.0500	0.3950
62	63.3600	-12.1000	4.0500	0.3950
63	63.3600	-12.1000	4.0500	0.3950
64	56.2800	-9.0000	4.3800	0.4100
65	2.5920	-78.6000	5.3000	0.4850
66	2.5920	-78.6000	5.3000	0.4850
67	56.2800	-9.0000	4.3800	0.4100
68	63.3600	-12.1000	4.0500	0.3950
69	63.3600	-12.1000	4.0500	0.3950
70	63.3600	-12.1000	4.0500	0.3950
71	63.3600	-12.1000	4.0500	0.3950
72	63.3600	-12.1000	4.0500	0.3950
73	63.3600	-12.1000	4.0500	0.3950
74	63.3600	-12.1000	4.0500	0.3950
75	63.3600	-12.1000	4.0500	0.3950
76	63.3600	-12.1000	4.0500	0.3950
77	12.4800	-21.8000	4.9000	0.4350
78	12.4800	-21.8000	4.9000	0.4350
79	12.4800	-21.8000	4.9000	0.4350
80	63.3600	-12.1000	4.0500	0.3950
81	63.3600	-12.1000	4.0500	0.3950
82	63.3600	-12.1000	4.0500	0.3950
83	56.2800	-9.0000	4.3800	0.4100
84	2.5920	-78.6000	5.3000	0.4850
85	2.5920	-78.6000	5.3000	0.4850
86	56.2800	-9.0000	4.3800	0.4100
87	63.3600	-12.1000	4.0500	0.3950
88	63.3600	-12.1000	4.0500	0.3950
89	63.3600	-12.1000	4.0500	0.3950
90	63.3600	-12.1000	4.0500	0.3950
91	63.3600	-12.1000	4.0500	0.3950
92	63.3600	-12.1000	4.0500	0.3950
93	63.3600	-12.1000	4.0500	0.3950
94	63.3600	-12.1000	4.0500	0.3950
95	63.3600	-12.1000	4.0500	0.3950
96	2.5920	-78.6000	5.3000	0.4850
97	2.5920	-78.6000	5.3000	0.4850
98	2.5020	-47.8000	5.3900	0.4510
99	56.2800	-9.0000	4.3800	0.4100
100	63.3600	-12.1000	4.0500	0.3950
101	63.3600	-12.1000	4.0500	0.3950
102	63.3600	-12.1000	4.0500	0.3950
103	63.3600	-12.1000	4.0500	0.3950
104	63.3600	-12.1000	4.0500	0.3950
105	63.3600	-12.1000	4.0500	0.3950
106	63.3600	-12.1000	4.0500	0.3950
107	63.3600	-12.1000	4.0500	0.3950
108	63.3600	-12.1000	4.0500	0.3950
109	63.3600	-12.1000	4.0500	0.3950
110	63.3600	-12.1000	4.0500	0.3950
111	63.3600	-12.1000	4.0500	0.3950
112	63.3600	-12.1000	4.0500	0.3950
113	63.3600	-12.1000	4.0500	0.3950
114	63.3600	-12.1000	4.0500	0.3950
115	2.5920	-78.6000	5.3000	0.4850
116	2.5920	-78.6000	5.3000	0.4850
117	2.5020	-47.8000	5.3900	0.4510
118	56.2800	-9.0000	4.3800	0.4100
119	63.3600	-12.1000	4.0500	0.3950
120	63.3600	-12.1000	4.0500	0.3950
121	63.3600	-12.1000	4.0500	0.3950
122	63.3600	-12.1000	4.0500	0.3950
123	63.3600	-12.1000	4.0500	0.3950
124	63.3600	-12.1000	4.0500	0.3950

```
SOIL WATER PRESSURE AT TIME =   0.2500E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9959E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8599E+02 -0.8444E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7079E+02 -0.6924E+02 -0.6811E+02 -0.6715E+02 -0.6736E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5759E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3888E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3843E+02 -0.4105E+02
-0.4492E+02 -0.4570E+02
ROW NUMBER = 12
-0.1637E-01  0.7891E+00  0.3287E+01  0.5271E+01  0.6834E+01  0.7950E+01  0.8910E+01  0.8707E+01  0.7284E+01  0.4664E+01
 0.7864E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5099E+02  0.5255E+02  0.5366E+02  0.5462E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

125	63.3600	-12.1000	4.0500	0.3950
126	63.3600	-12.1000	4.0500	0.3950
127	63.3600	-12.1000	4.0500	0.3950
128	63.3600	-12.1000	4.0500	0.3950
129	63.3600	-12.1000	4.0500	0.3950
130	63.3600	-12.1000	4.0500	0.3950
131	63.3600	-12.1000	4.0500	0.3950
132	63.3600	-12.1000	4.0500	0.3950
133	63.3600	-12.1000	4.0500	0.3950
134	2.5920	-78.6000	5.3000	0.4850
135	2.5920	-78.6000	5.3000	0.4850
136	2.5020	-47.8000	5.3900	0.4510
137	56.2800	-9.0000	4.3800	0.4100
138	63.3600	-12.1000	4.0500	0.3950
139	63.3600	-12.1000	4.0500	0.3950
140	63.3600	-12.1000	4.0500	0.3950
141	63.3600	-12.1000	4.0500	0.3950
142	63.3600	-12.1000	4.0500	0.3950
143	63.3600	-12.1000	4.0500	0.3950
144	63.3600	-12.1000	4.0500	0.3950
145	63.3600	-12.1000	4.0500	0.3950
146	63.3600	-12.1000	4.0500	0.3950
147	63.3600	-12.1000	4.0500	0.3950
148	63.3600	-12.1000	4.0500	0.3950
149	63.3600	-12.1000	4.0500	0.3950
150	63.3600	-12.1000	4.0500	0.3950
151	63.3600	-12.1000	4.0500	0.3950
152	63.3600	-12.1000	4.0500	0.3950
153	2.5920	-78.6000	5.3000	0.4850
154	2.5920	-78.6000	5.3000	0.4850
155	2.5020	-47.8000	5.3900	0.4510
156	56.2800	-9.0000	4.3800	0.4100
157	63.3600	-12.1000	4.0500	0.3950
158	63.3600	-12.1000	4.0500	0.3950
159	63.3600	-12.1000	4.0500	0.3950
160	63.3600	-12.1000	4.0500	0.3950
161	63.3600	-12.1000	4.0500	0.3950
162	63.3600	-12.1000	4.0500	0.3950
163	63.3600	-12.1000	4.0500	0.3950
164	63.3600	-12.1000	4.0500	0.3950
165	63.3600	-12.1000	4.0500	0.3950
166	63.3600	-12.1000	4.0500	0.3950
167	63.3600	-12.1000	4.0500	0.3950
168	63.3600	-12.1000	4.0500	0.3950
169	63.3600	-12.1000	4.0500	0.3950
170	63.3600	-12.1000	4.0500	0.3950
171	63.3600	-12.1000	4.0500	0.3950
172	2.5920	-78.6000	5.3000	0.4850
173	2.5920	-78.6000	5.3000	0.4850
174	2.5020	-47.8000	5.3900	0.4510
175	56.2800	-9.0000	4.3800	0.4100
176	63.3600	-12.1000	4.0500	0.3950
177	63.3600	-12.1000	4.0500	0.3950
178	63.3600	-12.1000	4.0500	0.3950
179	63.3600	-12.1000	4.0500	0.3950
180	63.3600	-12.1000	4.0500	0.3950
181	63.3600	-12.1000	4.0500	0.3950
182	63.3600	-12.1000	4.0500	0.3950
183	63.3600	-12.1000	4.0500	0.3950
184	63.3600	-12.1000	4.0500	0.3950
185	63.3600	-12.1000	4.0500	0.3950
186	63.3600	-12.1000	4.0500	0.3950
187	63.3600	-12.1000	4.0500	0.3950
188	63.3600	-12.1000	4.0500	0.3950
189	63.3600	-12.1000	4.0500	0.3950
190	63.3600	-12.1000	4.0500	0.3950

191	2.5920	-78.6000	5.3000	0.4850
192	2.5920	-78.6000	5.3000	0.4850
193	2.5020	-47.8000	5.3900	0.4510
194	56.2800	-9.0000	4.3800	0.4100
195	63.3600	-12.1000	4.0500	0.3950
196	63.3600	-12.1000	4.0500	0.3950
197	63.3600	-12.1000	4.0500	0.3950
198	63.3600	-12.1000	4.0500	0.3950
199	63.3600	-12.1000	4.0500	0.3950
200	63.3600	-12.1000	4.0500	0.3950
201	63.3600	-12.1000	4.0500	0.3950
202	63.3600	-12.1000	4.0500	0.3950
203	63.3600	-12.1000	4.0500	0.3950
204	63.3600	-12.1000	4.0500	0.3950
205	63.3600	-12.1000	4.0500	0.3950
206	63.3600	-12.1000	4.0500	0.3950
207	63.3600	-12.1000	4.0500	0.3950
208	63.3600	-12.1000	4.0500	0.3950
209	63.3600	-12.1000	4.0500	0.3950
210	2.5920	-78.6000	5.3000	0.4850
211	2.5920	-78.6000	5.3000	0.4850
212	2.5020	-47.8000	5.3900	0.4510
213	56.2800	-9.0000	4.3800	0.4100
214	63.3600	-12.1000	4.0500	0.3950
215	63.3600	-12.1000	4.0500	0.3950
216	63.3600	-12.1000	4.0500	0.3950
217	63.3600	-12.1000	4.0500	0.3950
218	63.3600	-12.1000	4.0500	0.3950
219	63.3600	-12.1000	4.0500	0.3950
220	63.3600	-12.1000	4.0500	0.3950
221	63.3600	-12.1000	4.0500	0.3950
222	63.3600	-12.1000	4.0500	0.3950
223	63.3600	-12.1000	4.0500	0.3950
224	63.3600	-12.1000	4.0500	0.3950
225	63.3600	-12.1000	4.0500	0.3950
226	63.3600	-12.1000	4.0500	0.3950
227	63.3600	-12.1000	4.0500	0.3950
228	63.3600	-12.1000	4.0500	0.3950

CONTROL FLAG FOR BOUNDARY CONDITION
IFLAGL= -1   IFLAGR= -1

BOUNDARY CONDITIONS
DS1= 1000.0000   DS2= 48189.0000

NUMBER OF APPLICATIONS OF WATER FLUX TO STUDY FIELD
IBC = 1

APPLICATION PERIOD	TURN ON TIME	TURN OFF TIME	WATER FLUX
1	0.00	1000000.00	0.007220

PARAMETERS FOR INTEGRATION AND OUTPUT

TIME STEP FOR INTEGRATION:	TDEL =	25.00	HR
MAXIMUM TIME PERIOD FOR SIMULATION:	TMAX =	5000.00	HR
PRINTOUT INTERVAL:	PRT1 =	500.00	HR
STEADY ASSUMPTION:	PSTED =	0.1000E-05	CM OF WATER

```
SOIL WATER PRESSURE AT TIME =    0.0000E+00 HOUR
ROW NUMBER =  1
-0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03 -0.2286E+03
-0.2286E+03 -0.2286E+03
ROW NUMBER =  2
-0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03 -0.1981E+03
-0.1981E+03 -0.1981E+03
ROW NUMBER =  3
-0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03 -0.1829E+03
-0.1829E+03 -0.1829E+03
ROW NUMBER =  4
-0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03 -0.1676E+03
-0.1676E+03 -0.1676E+03
ROW NUMBER =  5
-0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03 -0.1524E+03
-0.1524E+03 -0.1524E+03
ROW NUMBER =  6
-0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03 -0.1219E+03
-0.1219E+03 -0.1219E+03
ROW NUMBER =  7
-0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03 -0.1067E+03
-0.1067E+03 -0.1067E+03
ROW NUMBER =  8
-0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02 -0.9144E+02
-0.9144E+02 -0.9144E+02
ROW NUMBER =  9
-0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02 -0.7620E+02
-0.7620E+02 -0.7620E+02
ROW NUMBER = 10
-0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02 -0.6096E+02
-0.6096E+02 -0.6096E+02
ROW NUMBER = 11
-0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02 -0.4572E+02
-0.4572E+02 -0.4572E+02
ROW NUMBER = 12
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 0.0000E+00  0.0000E+00
ROW NUMBER = 13
 0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02  0.4572E+02
 0.4572E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03  0.1676E+03
 0.1676E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03  0.2896E+03
 0.2896E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03  0.4420E+03
 0.4420E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03  0.5944E+03
 0.5944E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04
 0.1204E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04  0.3642E+04
 0.3642E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.2500E+02 HOUR
ROW NUMBER =  1
-0.2308E+03 -0.2217E+03 -0.2198E+03 -0.2198E+03 -0.2210E+03 -0.2236E+03 -0.2235E+03 -0.2235E+03 -0.2236E+03 -0.2235E+03
-0.2242E+03 -0.2295E+03
ROW NUMBER =  2
-0.1990E+03 -0.1942E+03 -0.1931E+03 -0.1932E+03 -0.1933E+03 -0.1938E+03 -0.1938E+03 -0.1938E+03 -0.1939E+03 -0.1938E+03
-0.1944E+03 -0.1987E+03
ROW NUMBER =  3
-0.1834E+03 -0.1800E+03 -0.1792E+03 -0.1792E+03 -0.1792E+03 -0.1789E+03 -0.1790E+03 -0.1790E+03 -0.1790E+03 -0.1790E+03
-0.1796E+03 -0.1834E+03
ROW NUMBER =  4
-0.1679E+03 -0.1656E+03 -0.1649E+03 -0.1650E+03 -0.1649E+03 -0.1648E+03 -0.1648E+03 -0.1648E+03 -0.1649E+03 -0.1649E+03
-0.1653E+03 -0.1679E+03
ROW NUMBER =  5
-0.1526E+03 -0.1510E+03 -0.1505E+03 -0.1505E+03 -0.1504E+03 -0.1505E+03 -0.1505E+03 -0.1505E+03 -0.1505E+03 -0.1506E+03
-0.1509E+03 -0.1525E+03
ROW NUMBER =  6
-0.1220E+03 -0.1213E+03 -0.1209E+03 -0.1208E+03 -0.1208E+03 -0.1208E+03 -0.1209E+03 -0.1209E+03 -0.1209E+03 -0.1209E+03
-0.1212E+03 -0.1219E+03
ROW NUMBER =  7
-0.1067E+03 -0.1063E+03 -0.1061E+03 -0.1060E+03 -0.1059E+03 -0.1058E+03 -0.1059E+03 -0.1059E+03 -0.1059E+03 -0.1060E+03
-0.1062E+03 -0.1067E+03
ROW NUMBER =  8
-0.9148E+02 -0.9117E+02 -0.9090E+02 -0.9078E+02 -0.9075E+02 -0.9072E+02 -0.9077E+02 -0.9079E+02 -0.9081E+02 -0.9088E+02
-0.9108E+02 -0.9141E+02
ROW NUMBER =  9
-0.7624E+02 -0.7595E+02 -0.7568E+02 -0.7557E+02 -0.7553E+02 -0.7555E+02 -0.7561E+02 -0.7563E+02 -0.7566E+02 -0.7574E+02
-0.7595E+02 -0.7617E+02
ROW NUMBER = 10
-0.6099E+02 -0.6075E+02 -0.6048E+02 -0.6036E+02 -0.6032E+02 -0.6036E+02 -0.6042E+02 -0.6043E+02 -0.6047E+02 -0.6055E+02
-0.6077E+02 -0.6094E+02
ROW NUMBER = 11
-0.4575E+02 -0.4555E+02 -0.4527E+02 -0.4515E+02 -0.4510E+02 -0.4513E+02 -0.4519E+02 -0.4521E+02 -0.4524E+02 -0.4533E+02
-0.4556E+02 -0.4570E+02
ROW NUMBER = 12
-0.1867E-01  0.1685E+00  0.4502E+00  0.5718E+00  0.6160E+00  0.5875E+00  0.5248E+00  0.5082E+00  0.4745E+00  0.3916E+00
 0.1563E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4588E+02  0.4617E+02  0.4629E+02  0.4633E+02  0.4631E+02  0.4624E+02  0.4623E+02  0.4619E+02  0.4611E+02
 0.4587E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1678E+03  0.1681E+03  0.1682E+03  0.1683E+03  0.1682E+03  0.1682E+03  0.1681E+03  0.1681E+03  0.1680E+03
 0.1678E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2897E+03  0.2900E+03  0.2901E+03  0.2902E+03  0.2901E+03  0.2901E+03  0.2901E+03  0.2900E+03  0.2899E+03
 0.2897E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4421E+03  0.4424E+03  0.4425E+03  0.4426E+03  0.4425E+03  0.4425E+03  0.4425E+03  0.4424E+03  0.4423E+03
 0.4421E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5945E+03  0.5948E+03  0.5949E+03  0.5950E+03  0.5949E+03  0.5949E+03  0.5949E+03  0.5948E+03  0.5947E+03
 0.5945E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1204E+04  0.1204E+04  0.1205E+04  0.1205E+04  0.1205E+04  0.1204E+04  0.1204E+04  0.1204E+04  0.1204E+04
 0.1204E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3642E+04  0.3643E+04  0.3643E+04  0.3643E+04  0.3643E+04  0.3643E+04  0.3643E+04  0.3643E+04  0.3643E+04
 0.3642E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.5000E+02 HOUR
ROW NUMBER =  1
-0.2318E+03 -0.2205E+03 -0.2181E+03 -0.2181E+03 -0.2192E+03 -0.2219E+03 -0.2217E+03 -0.2218E+03 -0.2219E+03 -0.2219E+03
-0.2230E+03 -0.2302E+03
ROW NUMBER =  2
-0.1999E+03 -0.1931E+03 -0.1915E+03 -0.1915E+03 -0.1916E+03 -0.1921E+03 -0.1921E+03 -0.1921E+03 -0.1922E+03 -0.1922E+03
-0.1932E+03 -0.1994E+03
ROW NUMBER =  3
-0.1841E+03 -0.1791E+03 -0.1777E+03 -0.1777E+03 -0.1776E+03 -0.1773E+03 -0.1773E+03 -0.1773E+03 -0.1774E+03 -0.1775E+03
-0.1784E+03 -0.1840E+03
ROW NUMBER =  4
-0.1685E+03 -0.1648E+03 -0.1637E+03 -0.1636E+03 -0.1634E+03 -0.1632E+03 -0.1633E+03 -0.1633E+03 -0.1634E+03 -0.1635E+03
-0.1643E+03 -0.1684E+03
ROW NUMBER =  5
-0.1530E+03 -0.1504E+03 -0.1494E+03 -0.1492E+03 -0.1491E+03 -0.1491E+03 -0.1491E+03 -0.1491E+03 -0.1492E+03 -0.1494E+03
-0.1501E+03 -0.1528E+03
ROW NUMBER =  6
-0.1222E+03 -0.1209E+03 -0.1201E+03 -0.1198E+03 -0.1197E+03 -0.1196E+03 -0.1196E+03 -0.1197E+03 -0.1198E+03 -0.1200E+03
-0.1207E+03 -0.1221E+03
ROW NUMBER =  7
-0.1068E+03 -0.1061E+03 -0.1054E+03 -0.1051E+03 -0.1049E+03 -0.1046E+03 -0.1047E+03 -0.1047E+03 -0.1048E+03 -0.1051E+03
-0.1058E+03 -0.1068E+03
ROW NUMBER =  8
-0.9152E+02 -0.9097E+02 -0.9026E+02 -0.8989E+02 -0.8971E+02 -0.8959E+02 -0.8961E+02 -0.8967E+02 -0.8980E+02 -0.9010E+02
-0.9082E+02 -0.9148E+02
ROW NUMBER =  9
-0.7627E+02 -0.7576E+02 -0.7506E+02 -0.7469E+02 -0.7450E+02 -0.7445E+02 -0.7449E+02 -0.7454E+02 -0.7468E+02 -0.7500E+02
-0.7574E+02 -0.7621E+02
ROW NUMBER = 10
-0.6101E+02 -0.6058E+02 -0.5987E+02 -0.5950E+02 -0.5930E+02 -0.5926E+02 -0.5930E+02 -0.5936E+02 -0.5950E+02 -0.5983E+02
-0.6059E+02 -0.6095E+02
ROW NUMBER = 11
-0.4575E+02 -0.4539E+02 -0.4468E+02 -0.4430E+02 -0.4410E+02 -0.4405E+02 -0.4408E+02 -0.4414E+02 -0.4429E+02 -0.4462E+02
-0.4540E+02 -0.4570E+02
ROW NUMBER = 12
-0.1873E-01  0.3177E+00  0.1031E+01  0.1417E+01  0.1620E+01  0.1670E+01  0.1636E+01  0.1575E+01  0.1431E+01  0.1094E+01
 0.3080E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4603E+02  0.4675E+02  0.4713E+02  0.4734E+02  0.4739E+02  0.4736E+02  0.4729E+02  0.4715E+02  0.4681E+02
 0.4602E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1679E+03  0.1687E+03  0.1690E+03  0.1693E+03  0.1693E+03  0.1693E+03  0.1692E+03  0.1691E+03  0.1687E+03
 0.1679E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2899E+03  0.2906E+03  0.2910E+03  0.2912E+03  0.2912E+03  0.2912E+03  0.2911E+03  0.2910E+03  0.2906E+03
 0.2898E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4422E+03  0.4430E+03  0.4434E+03  0.4436E+03  0.4436E+03  0.4436E+03  0.4435E+03  0.4434E+03  0.4430E+03
 0.4422E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5946E+03  0.5953E+03  0.5957E+03  0.5960E+03  0.5960E+03  0.5960E+03  0.5959E+03  0.5958E+03  0.5954E+03
 0.5946E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1204E+04  0.1205E+04  0.1205E+04  0.1206E+04  0.1206E+04  0.1206E+04  0.1206E+04  0.1205E+04  0.1205E+04
 0.1204E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3643E+04  0.3644E+04  0.3644E+04  0.3644E+04  0.3644E+04  0.3644E+04  0.3644E+04  0.3643E+04
 0.3643E+04  0.3642E+04
```

SOIL WATER PRESSURE AT TIME =   0.7500E+02 HOUR
ROW NUMBER = 1
-0.2324E+03 -0.2201E+03 -0.2174E+03 -0.2172E+03 -0.2182E+03 -0.2207E+03 -0.2205E+03 -0.2206E+03 -0.2208E+03 -0.2210E+03
-0.2225E+03 -0.2307E+03
ROW NUMBER = 2
-0.2003E+03 -0.1928E+03 -0.1908E+03 -0.1906E+03 -0.1905E+03 -0.1909E+03 -0.1909E+03 -0.1909E+03 -0.1911E+03 -0.1913E+03
-0.1927E+03 -0.1999E+03
ROW NUMBER = 3
-0.1845E+03 -0.1788E+03 -0.1770E+03 -0.1768E+03 -0.1765E+03 -0.1761E+03 -0.1761E+03 -0.1761E+03 -0.1763E+03 -0.1766E+03
-0.1780E+03 -0.1844E+03
ROW NUMBER = 4
-0.1688E+03 -0.1646E+03 -0.1630E+03 -0.1627E+03 -0.1624E+03 -0.1621E+03 -0.1621E+03 -0.1621E+03 -0.1623E+03 -0.1626E+03
-0.1639E+03 -0.1687E+03
ROW NUMBER = 5
-0.1532E+03 -0.1501E+03 -0.1488E+03 -0.1484E+03 -0.1481E+03 -0.1479E+03 -0.1479E+03 -0.1480E+03 -0.1482E+03 -0.1486E+03
-0.1498E+03 -0.1531E+03
ROW NUMBER = 6
-0.1223E+03 -0.1207E+03 -0.1196E+03 -0.1191E+03 -0.1187E+03 -0.1185E+03 -0.1185E+03 -0.1186E+03 -0.1188E+03 -0.1193E+03
-0.1205E+03 -0.1222E+03
ROW NUMBER = 7
-0.1068E+03 -0.1060E+03 -0.1050E+03 -0.1043E+03 -0.1040E+03 -0.1036E+03 -0.1035E+03 -0.1036E+03 -0.1039E+03 -0.1044E+03
-0.1057E+03 -0.1068E+03
ROW NUMBER = 8
-0.9154E+02 -0.9086E+02 -0.8981E+02 -0.8919E+02 -0.8882E+02 -0.8856E+02 -0.8851E+02 -0.8860E+02 -0.8887E+02 -0.8946E+02
-0.9069E+02 -0.9152E+02
ROW NUMBER = 9
-0.7629E+02 -0.7566E+02 -0.7461E+02 -0.7399E+02 -0.7361E+02 -0.7343E+02 -0.7339E+02 -0.7348E+02 -0.7376E+02 -0.7437E+02
-0.7562E+02 -0.7623E+02
ROW NUMBER = 10
-0.6102E+02 -0.6048E+02 -0.5944E+02 -0.5880E+02 -0.5842E+02 -0.5825E+02 -0.5821E+02 -0.5830E+02 -0.5859E+02 -0.5921E+02
-0.6049E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4530E+02 -0.4426E+02 -0.4361E+02 -0.4322E+02 -0.4304E+02 -0.4299E+02 -0.4308E+02 -0.4338E+02 -0.4401E+02
-0.4531E+02 -0.4571E+02
ROW NUMBER = 12
-0.1860E-01 0.4139E+00 0.1457E+01 0.2105E+01 0.2494E+01 0.2677E+01 0.2724E+01 0.2634E+01 0.2337E+01 0.1703E+01
 0.4032E+00 0.9453E-02
ROW NUMBER = 13
 0.4572E+02 0.4613E+02 0.4717E+02 0.4782E+02 0.4821E+02 0.4840E+02 0.4844E+02 0.4835E+02 0.4805E+02 0.4742E+02
 0.4612E+02 0.4572E+02
ROW NUMBER = 14
 0.1676E+03 0.1680E+03 0.1691E+03 0.1697E+03 0.1701E+03 0.1703E+03 0.1704E+03 0.1703E+03 0.1700E+03 0.1693E+03
 0.1680E+03 0.1676E+03
ROW NUMBER = 15
 0.2896E+03 0.2899E+03 0.2910E+03 0.2916E+03 0.2920E+03 0.2922E+03 0.2923E+03 0.2922E+03 0.2919E+03 0.2912E+03
 0.2899E+03 0.2896E+03
ROW NUMBER = 16
 0.4420E+03 0.4423E+03 0.4434E+03 0.4440E+03 0.4444E+03 0.4446E+03 0.4447E+03 0.4446E+03 0.4443E+03 0.4436E+03
 0.4423E+03 0.4420E+03
ROW NUMBER = 17
 0.5944E+03 0.5947E+03 0.5958E+03 0.5964E+03 0.5968E+03 0.5970E+03 0.5971E+03 0.5970E+03 0.5967E+03 0.5960E+03
 0.5947E+03 0.5944E+03
ROW NUMBER = 18
 0.1204E+04 0.1204E+04 0.1205E+04 0.1206E+04 0.1206E+04 0.1207E+04 0.1207E+04 0.1207E+04 0.1206E+04 0.1206E+04
 0.1204E+04 0.1204E+04
ROW NUMBER = 19
 0.3642E+04 0.3643E+04 0.3644E+04 0.3644E+04 0.3645E+04 0.3645E+04 0.3645E+04 0.3645E+04 0.3645E+04 0.3644E+04
 0.3643E+04 0.3642E+04

```
SOIL WATER PRESSURE AT TIME =   0.1000E+03 HOUR
ROW NUMBER =  1
-0.2326E+03 -0.2199E+03 -0.2170E+03 -0.2166E+03 -0.2174E+03 -0.2198E+03 -0.2195E+03 -0.2196E+03 -0.2199E+03 -0.2204E+03
-0.2223E+03 -0.2310E+03
ROW NUMBER =  2
-0.2005E+03 -0.1926E+03 -0.1903E+03 -0.1900E+03 -0.1897E+03 -0.1900E+03 -0.1898E+03 -0.1899E+03 -0.1903E+03 -0.1907E+03
-0.1925E+03 -0.2001E+03
ROW NUMBER =  3
-0.1847E+03 -0.1786E+03 -0.1766E+03 -0.1762E+03 -0.1757E+03 -0.1752E+03 -0.1751E+03 -0.1752E+03 -0.1755E+03 -0.1760E+03
-0.1778E+03 -0.1847E+03
ROW NUMBER =  4
-0.1689E+03 -0.1644E+03 -0.1626E+03 -0.1621E+03 -0.1616E+03 -0.1612E+03 -0.1610E+03 -0.1611E+03 -0.1615E+03 -0.1621E+03
-0.1638E+03 -0.1689E+03
ROW NUMBER =  5
-0.1533E+03 -0.1500E+03 -0.1484E+03 -0.1478E+03 -0.1473E+03 -0.1470E+03 -0.1469E+03 -0.1470E+03 -0.1474E+03 -0.1481E+03
-0.1497E+03 -0.1532E+03
ROW NUMBER =  6
-0.1223E+03 -0.1206E+03 -0.1192E+03 -0.1185E+03 -0.1180E+03 -0.1176E+03 -0.1175E+03 -0.1176E+03 -0.1180E+03 -0.1188E+03
-0.1204E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1059E+03 -0.1046E+03 -0.1038E+03 -0.1033E+03 -0.1027E+03 -0.1026E+03 -0.1027E+03 -0.1031E+03 -0.1039E+03
-0.1056E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9079E+02 -0.8947E+02 -0.8863E+02 -0.8809E+02 -0.8769E+02 -0.8753E+02 -0.8765E+02 -0.8808E+02 -0.8894E+02
-0.9061E+02 -0.9154E+02
ROW NUMBER =  9
-0.7629E+02 -0.7559E+02 -0.7428E+02 -0.7343E+02 -0.7288E+02 -0.7257E+02 -0.7242E+02 -0.7254E+02 -0.7298E+02 -0.7387E+02
-0.7555E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6040E+02 -0.5910E+02 -0.5825E+02 -0.5769E+02 -0.5740E+02 -0.5724E+02 -0.5737E+02 -0.5781E+02 -0.5872E+02
-0.6042E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4523E+02 -0.4393E+02 -0.4306E+02 -0.4249E+02 -0.4219E+02 -0.4203E+02 -0.4215E+02 -0.4260E+02 -0.4352E+02
-0.4524E+02 -0.4571E+02
ROW NUMBER = 12
-0.1836E-01  0.4839E+00  0.1785E+01  0.2651E+01  0.3220E+01  0.3528E+01  0.3686E+01  0.3563E+01  0.3113E+01  0.2194E+01
 0.4727E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4620E+02  0.4750E+02  0.4837E+02  0.4894E+02  0.4925E+02  0.4940E+02  0.4928E+02  0.4883E+02  0.4791E+02
 0.4619E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1681E+03  0.1694E+03  0.1703E+03  0.1708E+03  0.1712E+03  0.1713E+03  0.1712E+03  0.1707E+03  0.1698E+03
 0.1681E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2900E+03  0.2913E+03  0.2922E+03  0.2928E+03  0.2931E+03  0.2932E+03  0.2931E+03  0.2927E+03  0.2917E+03
 0.2900E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4424E+03  0.4437E+03  0.4446E+03  0.4452E+03  0.4455E+03  0.4456E+03  0.4455E+03  0.4450E+03  0.4441E+03
 0.4424E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5948E+03  0.5961E+03  0.5970E+03  0.5975E+03  0.5979E+03  0.5980E+03  0.5979E+03  0.5974E+03  0.5965E+03
 0.5948E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1204E+04  0.1206E+04  0.1207E+04  0.1207E+04  0.1207E+04  0.1208E+04  0.1207E+04  0.1207E+04  0.1206E+04
 0.1204E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3644E+04  0.3645E+04  0.3645E+04  0.3646E+04  0.3646E+04  0.3646E+04  0.3645E+04  0.3644E+04
 0.3643E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.5000E+03 HOUR
ROW NUMBER =  1
-0.2328E+03 -0.2197E+03 -0.2155E+03 -0.2141E+03 -0.2140E+03 -0.2155E+03 -0.2144E+03 -0.2146E+03 -0.2159E+03 -0.2178E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1924E+03 -0.1889E+03 -0.1875E+03 -0.1863E+03 -0.1856E+03 -0.1847E+03 -0.1849E+03 -0.1862E+03 -0.1882E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1784E+03 -0.1751E+03 -0.1737E+03 -0.1723E+03 -0.1708E+03 -0.1700E+03 -0.1701E+03 -0.1714E+03 -0.1734E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1642E+03 -0.1612E+03 -0.1596E+03 -0.1582E+03 -0.1569E+03 -0.1560E+03 -0.1562E+03 -0.1574E+03 -0.1596E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1498E+03 -0.1470E+03 -0.1453E+03 -0.1439E+03 -0.1428E+03 -0.1419E+03 -0.1421E+03 -0.1434E+03 -0.1456E+03
-0.1495E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1204E+03 -0.1178E+03 -0.1160E+03 -0.1146E+03 -0.1135E+03 -0.1126E+03 -0.1128E+03 -0.1141E+03 -0.1164E+03
-0.1202E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1057E+03 -0.1032E+03 -0.1014E+03 -0.9992E+02 -0.9861E+02 -0.9769E+02 -0.9789E+02 -0.9920E+02 -0.1016E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9051E+02 -0.8809E+02 -0.8622E+02 -0.8477E+02 -0.8361E+02 -0.8270E+02 -0.8290E+02 -0.8422E+02 -0.8664E+02
-0.9034E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7531E+02 -0.7290E+02 -0.7103E+02 -0.6956E+02 -0.6851E+02 -0.6762E+02 -0.6781E+02 -0.6914E+02 -0.7158E+02
-0.7528E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6013E+02 -0.5773E+02 -0.5586E+02 -0.5439E+02 -0.5336E+02 -0.5247E+02 -0.5266E+02 -0.5399E+02 -0.5645E+02
-0.6014E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4495E+02 -0.4256E+02 -0.4068E+02 -0.3920E+02 -0.3816E+02 -0.3726E+02 -0.3746E+02 -0.3879E+02 -0.4126E+02
-0.4495E+02 -0.4570E+02
ROW NUMBER = 12
-0.1657E-01  0.7603E+00  0.3148E+01  0.5034E+01  0.6509E+01  0.7554E+01  0.8446E+01  0.8252E+01  0.6919E+01  0.4449E+01
 0.7570E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4647E+02  0.4886E+02  0.5075E+02  0.5222E+02  0.5327E+02  0.5416E+02  0.5397E+02  0.5263E+02  0.5016E+02
 0.4647E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1708E+03  0.1727E+03  0.1741E+03  0.1752E+03  0.1761E+03  0.1759E+03  0.1745E+03  0.1721E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2927E+03  0.2946E+03  0.2960E+03  0.2971E+03  0.2980E+03  0.2978E+03  0.2964E+03  0.2940E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4451E+03  0.4469E+03  0.4484E+03  0.4495E+03  0.4504E+03  0.4502E+03  0.4488E+03  0.4464E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5974E+03  0.5993E+03  0.6008E+03  0.6019E+03  0.6027E+03  0.6025E+03  0.6012E+03  0.5987E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1210E+04  0.1211E+04  0.1212E+04  0.1212E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3650E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.1000E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2140E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1853E+03 -0.1843E+03 -0.1845E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1594E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1451E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9961E+02 -0.9823E+02 -0.9724E+02 -0.9745E+02 -0.9885E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8796E+02 -0.8600E+02 -0.8445E+02 -0.8323E+02 -0.8226E+02 -0.8246E+02 -0.8387E+02 -0.8643E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7277E+02 -0.7081E+02 -0.6925E+02 -0.6813E+02 -0.6718E+02 -0.6738E+02 -0.6879E+02 -0.7138E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5760E+02 -0.5563E+02 -0.5408E+02 -0.5298E+02 -0.5202E+02 -0.5222E+02 -0.5364E+02 -0.5624E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4243E+02 -0.4045E+02 -0.3889E+02 -0.3778E+02 -0.3682E+02 -0.3702E+02 -0.3844E+02 -0.4105E+02
-0.4493E+02 -0.4570E+02
ROW NUMBER = 12
-0.1637E-01  0.7876E+00  0.3279E+01  0.5259E+01  0.6818E+01  0.7930E+01  0.8889E+01  0.8686E+01  0.7267E+01  0.4654E+01
 0.7835E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4899E+02  0.5097E+02  0.5253E+02  0.5364E+02  0.5460E+02  0.5440E+02  0.5298E+02  0.5037E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1744E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2963E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4498E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5989E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.1500E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9960E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8599E+02 -0.8444E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7080E+02 -0.6924E+02 -0.6811E+02 -0.6716E+02 -0.6736E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5760E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3888E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3843E+02 -0.4105E+02
-0.4493E+02 -0.4570E+02
ROW NUMBER = 12
-0.1636E-01  0.7884E+00  0.3286E+01  0.5270E+01  0.6833E+01  0.7950E+01  0.8909E+01  0.8707E+01  0.7283E+01  0.4663E+01
 0.7861E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5098E+02  0.5255E+02  0.5366E+02  0.5462E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.3000E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9960E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8599E+02 -0.8444E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7079E+02 -0.6924E+02 -0.6811E+02 -0.6715E+02 -0.6736E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5759E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3888E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3843E+02 -0.4105E+02
-0.4493E+02 -0.4570E+02
ROW NUMBER = 12
-0.1636E-01  0.7883E+00  0.3286E+01  0.5271E+01  0.6833E+01  0.7949E+01  0.8911E+01  0.8707E+01  0.7284E+01  0.4664E+01
 0.7863E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5099E+02  0.5255E+02  0.5366E+02  0.5463E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

SOIL WATER PRESSURE AT TIME = 0.3500E+04 HOUR

ROW NUMBER = 1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03

ROW NUMBER = 2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03

ROW NUMBER = 3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03

ROW NUMBER = 4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03

ROW NUMBER = 5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03

ROW NUMBER = 6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03

ROW NUMBER = 7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9960E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03

ROW NUMBER = 8
-0.9155E+02 -0.9048E+02 -0.8796E+02 -0.8599E+02 -0.8444E+02 -0.8321E+02 -0.8224E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02

ROW NUMBER = 9
-0.7629E+02 -0.7528E+02 -0.7277E+02 -0.7080E+02 -0.6924E+02 -0.6811E+02 -0.6716E+02 -0.6736E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02

ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5760E+02 -0.5562E+02 -0.5407E+02 -0.5296E+02 -0.5200E+02 -0.5221E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02

ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4243E+02 -0.4044E+02 -0.3888E+02 -0.3776E+02 -0.3680E+02 -0.3701E+02 -0.3843E+02 -0.4105E+02
-0.4493E+02 -0.4570E+02

ROW NUMBER = 12
-0.1639E-01 0.7887E+00 0.3282E+01 0.5270E+01 0.6831E+01 0.7949E+01 0.8908E+01 0.8704E+01 0.7283E+01 0.4663E+01
0.7859E+00 0.9453E-02

ROW NUMBER = 13
0.4572E+02 0.4650E+02 0.4900E+02 0.5098E+02 0.5255E+02 0.5366E+02 0.5462E+02 0.5442E+02 0.5300E+02 0.5038E+02
0.4650E+02 0.4572E+02

ROW NUMBER = 14
0.1676E+03 0.1684E+03 0.1709E+03 0.1729E+03 0.1745E+03 0.1756E+03 0.1765E+03 0.1763E+03 0.1749E+03 0.1723E+03
0.1684E+03 0.1676E+03

ROW NUMBER = 15
0.2896E+03 0.2903E+03 0.2928E+03 0.2948E+03 0.2964E+03 0.2975E+03 0.2984E+03 0.2982E+03 0.2968E+03 0.2942E+03
0.2903E+03 0.2896E+03

ROW NUMBER = 16
0.4420E+03 0.4427E+03 0.4452E+03 0.4472E+03 0.4487E+03 0.4499E+03 0.4508E+03 0.4506E+03 0.4492E+03 0.4466E+03
0.4427E+03 0.4420E+03

ROW NUMBER = 17
0.5944E+03 0.5951E+03 0.5976E+03 0.5996E+03 0.6011E+03 0.6022E+03 0.6032E+03 0.6030E+03 0.6016E+03 0.5990E+03
0.5951E+03 0.5944E+03

ROW NUMBER = 18
0.1204E+04 0.1205E+04 0.1207E+04 0.1209E+04 0.1211E+04 0.1212E+04 0.1213E+04 0.1213E+04 0.1211E+04 0.1208E+04
0.1205E+04 0.1204E+04

ROW NUMBER = 19
0.3642E+04 0.3643E+04 0.3645E+04 0.3647E+04 0.3649E+04 0.3650E+04 0.3651E+04 0.3651E+04 0.3649E+04 0.3647E+04
0.3643E+04 0.3642E+04

```
SOIL WATER PRESSURE AT TIME =   0.4000E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9959E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8598E+02 -0.8444E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7079E+02 -0.6923E+02 -0.6811E+02 -0.6715E+02 -0.6736E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5759E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3887E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3843E+02 -0.4105E+02
-0.4493E+02 -0.4570E+02
ROW NUMBER = 12
-0.1637E-01  0.7893E+00  0.3287E+01  0.5273E+01  0.6836E+01  0.7952E+01  0.8911E+01  0.8708E+01  0.7284E+01  0.4663E+01
 0.7861E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5099E+02  0.5255E+02  0.5367E+02  0.5463E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.4500E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9959E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8599E+02 -0.8444E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7079E+02 -0.6924E+02 -0.6811E+02 -0.6715E+02 -0.6735E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5760E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3888E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3842E+02 -0.4105E+02
-0.4493E+02 -0.4570E+02
ROW NUMBER = 12
-0.1637E-01  0.7886E+00  0.3285E+01  0.5271E+01  0.6834E+01  0.7950E+01  0.8911E+01  0.8709E+01  0.7285E+01  0.4663E+01
 0.7859E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5099E+02  0.5255E+02  0.5367E+02  0.5463E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

```
SOIL WATER PRESSURE AT TIME =   0.5000E+04 HOUR
ROW NUMBER =  1
-0.2327E+03 -0.2196E+03 -0.2154E+03 -0.2139E+03 -0.2137E+03 -0.2151E+03 -0.2139E+03 -0.2142E+03 -0.2155E+03 -0.2176E+03
-0.2221E+03 -0.2311E+03
ROW NUMBER =  2
-0.2006E+03 -0.1923E+03 -0.1887E+03 -0.1872E+03 -0.1860E+03 -0.1852E+03 -0.1842E+03 -0.1844E+03 -0.1858E+03 -0.1879E+03
-0.1923E+03 -0.2003E+03
ROW NUMBER =  3
-0.1848E+03 -0.1783E+03 -0.1750E+03 -0.1734E+03 -0.1720E+03 -0.1704E+03 -0.1695E+03 -0.1697E+03 -0.1710E+03 -0.1732E+03
-0.1775E+03 -0.1848E+03
ROW NUMBER =  4
-0.1690E+03 -0.1641E+03 -0.1610E+03 -0.1593E+03 -0.1579E+03 -0.1565E+03 -0.1555E+03 -0.1557E+03 -0.1571E+03 -0.1593E+03
-0.1635E+03 -0.1690E+03
ROW NUMBER =  5
-0.1534E+03 -0.1497E+03 -0.1468E+03 -0.1450E+03 -0.1436E+03 -0.1424E+03 -0.1414E+03 -0.1416E+03 -0.1430E+03 -0.1454E+03
-0.1494E+03 -0.1533E+03
ROW NUMBER =  6
-0.1223E+03 -0.1203E+03 -0.1177E+03 -0.1158E+03 -0.1143E+03 -0.1131E+03 -0.1121E+03 -0.1123E+03 -0.1137E+03 -0.1162E+03
-0.1201E+03 -0.1223E+03
ROW NUMBER =  7
-0.1068E+03 -0.1056E+03 -0.1031E+03 -0.1011E+03 -0.9959E+02 -0.9821E+02 -0.9722E+02 -0.9743E+02 -0.9883E+02 -0.1014E+03
-0.1053E+03 -0.1069E+03
ROW NUMBER =  8
-0.9155E+02 -0.9048E+02 -0.8795E+02 -0.8598E+02 -0.8443E+02 -0.8321E+02 -0.8223E+02 -0.8244E+02 -0.8385E+02 -0.8642E+02
-0.9031E+02 -0.9155E+02
ROW NUMBER =  9
-0.7629E+02 -0.7528E+02 -0.7276E+02 -0.7079E+02 -0.6923E+02 -0.6811E+02 -0.6715E+02 -0.6735E+02 -0.6877E+02 -0.7137E+02
-0.7525E+02 -0.7624E+02
ROW NUMBER = 10
-0.6102E+02 -0.6010E+02 -0.5759E+02 -0.5562E+02 -0.5406E+02 -0.5296E+02 -0.5200E+02 -0.5220E+02 -0.5362E+02 -0.5623E+02
-0.6011E+02 -0.6096E+02
ROW NUMBER = 11
-0.4575E+02 -0.4492E+02 -0.4242E+02 -0.4044E+02 -0.3887E+02 -0.3776E+02 -0.3680E+02 -0.3700E+02 -0.3843E+02 -0.4104E+02
-0.4492E+02 -0.4570E+02
ROW NUMBER = 12
-0.1637E-01  0.7885E+00  0.3287E+01  0.5273E+01  0.6838E+01  0.7953E+01  0.8912E+01  0.8708E+01  0.7284E+01  0.4665E+01
 0.7863E+00  0.9453E-02
ROW NUMBER = 13
 0.4572E+02  0.4650E+02  0.4900E+02  0.5099E+02  0.5255E+02  0.5367E+02  0.5463E+02  0.5442E+02  0.5300E+02  0.5038E+02
 0.4650E+02  0.4572E+02
ROW NUMBER = 14
 0.1676E+03  0.1684E+03  0.1709E+03  0.1729E+03  0.1745E+03  0.1756E+03  0.1765E+03  0.1763E+03  0.1749E+03  0.1723E+03
 0.1684E+03  0.1676E+03
ROW NUMBER = 15
 0.2896E+03  0.2903E+03  0.2928E+03  0.2948E+03  0.2964E+03  0.2975E+03  0.2984E+03  0.2982E+03  0.2968E+03  0.2942E+03
 0.2903E+03  0.2896E+03
ROW NUMBER = 16
 0.4420E+03  0.4427E+03  0.4452E+03  0.4472E+03  0.4487E+03  0.4499E+03  0.4508E+03  0.4506E+03  0.4492E+03  0.4466E+03
 0.4427E+03  0.4420E+03
ROW NUMBER = 17
 0.5944E+03  0.5951E+03  0.5976E+03  0.5996E+03  0.6011E+03  0.6022E+03  0.6032E+03  0.6030E+03  0.6016E+03  0.5990E+03
 0.5951E+03  0.5944E+03
ROW NUMBER = 18
 0.1204E+04  0.1205E+04  0.1207E+04  0.1209E+04  0.1211E+04  0.1212E+04  0.1213E+04  0.1213E+04  0.1211E+04  0.1208E+04
 0.1205E+04  0.1204E+04
ROW NUMBER = 19
 0.3642E+04  0.3643E+04  0.3645E+04  0.3647E+04  0.3649E+04  0.3650E+04  0.3651E+04  0.3651E+04  0.3649E+04  0.3647E+04
 0.3643E+04  0.3642E+04
```

****
MAXIMUM TIME
****

-232.747620	-200.635742	-184.769638	-169.015427	-153.361099	-122.339111
-106.838943	-91.553879	-76.292801	-61.021194	-45.745728	-0.016362
45.720001	167.639999	289.560059	441.959961	594.360107	1203.959960
3642.360110					
-219.636810	-192.345322	-178.347488	-164.135880	-149.729614	-120.346558
-105.633255	-90.483414	-75.283875	-60.101028	-44.922150	0.788835
46.502777	168.412598	290.323242	442.712891	595.103271	1204.670650
3643.016360					
-215.397156	-188.728134	-174.998398	-161.025925	-146.812698	-117.679794
-103.083618	-87.951630	-72.761780	-57.594482	-42.422974	3.286298
49.000916	170.905624	292.810791	445.193115	597.575684	1207.112790
3645.393550					
-213.883286	-187.216370	-173.424271	-159.345978	-145.044525	-115.783081
-101.125122	-85.984924	-70.793549	-55.620697	-40.438095	5.271733
50.986191	172.892120	294.798340	447.182129	599.566162	1209.107670
3647.391850					
-213.719025	-185.967148	-171.953735	-157.867813	-143.551468	-114.273941
-99.592773	-84.436310	-69.234421	-54.061310	-38.874390	6.835262
52.549591	174.455170	296.361328	448.744385	601.127930	1210.667240
3648.950440					
-215.069656	-185.228149	-170.425491	-156.452576	-142.389114	-113.078506
-98.211014	-83.206619	-68.107498	-52.956833	-37.758133	7.951864
53.666397	175.571823	297.477783	449.861328	602.245605	1211.791260
3650.078610					
-213.930771	-184.241196	-169.483582	-155.495453	-141.420303	-112.086914
-97.216797	-82.231247	-67.151978	-51.998245	-36.797379	8.912332
54.626785	176.532471	298.438477	450.821777	603.207031	1212.753910
3651.049320					
-214.172363	-184.443787	-169.675125	-155.693695	-141.623856	-112.298340
-97.429642	-82.439316	-67.354950	-52.202057	-37.001602	8.708121
54.422516	176.327911	298.233643	450.617432	603.001465	1212.546630
3650.833980					
-215.502045	-185.788879	-171.026642	-157.054367	-142.997864	-113.690933
-98.830276	-83.848557	-68.771545	-53.622955	-38.425552	7.284265
52.998764	174.904556	296.810547	449.193604	601.578369	1211.123290
3649.414060					
-217.599472	-187.935440	-173.207214	-159.334152	-145.381073	-116.190094
-101.371384	-86.421204	-71.366287	-56.233047	-41.044937	4.664104
50.378113	172.282730	294.187500	446.570312	598.953613	1208.494870
3646.771970					
-222.062485	-192.317307	-177.536148	-163.522598	-149.443283	-120.135498
-105.282379	-90.311966	-75.247864	-60.112228	-44.925491	0.785816
46.501495	168.409180	290.317627	442.704346	595.092773	1204.654300
3642.989010					
-231.118057	-200.278503	-184.828873	-169.039978	-153.287628	-122.302673
-106.900909	-91.550934	-76.241592	-60.962555	-45.704620	0.009453
45.720001	167.639999	289.560059	441.959961	594.360107	1203.959960
3642.360110					

APPENDIX E

LISTING OF INPUT DATA TO THE TRANSPORT MODEL

```
ALDICARB PROJECTION FOR LONG ISLAND, NE AND SE CORNER 1977-1979             TRINO01
  19    10                                                                  TRINO02
 0                                                                          TRINO03
 1 1 1 1                                                                    TRINO04
(3(6F12.0,/),2F12.0)                                                        TRINO05
      0.0000      0.0000   3750.0000     10.7812   7500.0000     21.5625 TRINO06
  11250.0000     32.3437  15000.0000     43.1250  21437.8008     61.6337 TRINO07
  27875.5996     80.1423  34313.3984     98.6510  40751.1992    117.1597 TRINO08
  47189.0000    135.6684                                                 TRINO09
      0.0000     30.4800   3750.0000     41.2612   7500.0000     52.0425 TRINO10
  11250.0000     62.8237  15000.0000     73.6050  21437.8008     92.1137 TRINO11
  27875.5996    110.6224  34313.3984    129.1310  40751.1992    147.6397 TRINO12
  47189.0000    166.1484                                                 TRINO13
      0.0000     45.7200   3750.0000     56.5013   7500.0000     67.2825 TRINO14
  11250.0000     78.0638  15000.0000     88.8450  21437.8008    107.3537 TRINO15
  27875.5996    125.8624  34313.3984    144.3710  40751.1992    162.8797 TRINO16
  47189.0000    181.3884                                                 TRINO17
      0.0000     60.9600   3750.0000     71.7412   7500.0000     82.5225 TRINO18
  11250.0000     93.3037  15000.0000    104.0850  21437.8008    122.5937 TRINO19
  27875.5996    141.1024  34313.3984    159.6110  40751.1992    178.1197 TRINO20
  47189.0000    196.6284                                                 TRINO21
      0.0000     76.2000   3750.0000     86.9812   7500.0000     97.7625 TRINO22
  11250.0000    108.5437  15000.0000    119.3250  21437.8008    137.8337 TRINO23
  27875.5996    156.3423  34313.3984    174.8510  40751.1992    193.3597 TRINO24
  47189.0000    211.8684                                                 TRINO25
      0.0000    106.6800   3750.0000    117.4613   7500.0000    128.2425 TRINO26
  11250.0000    139.0237  15000.0000    149.8050  21437.8008    168.3137 TRINO27
  27875.5996    186.8224  34313.3984    205.3310  40751.1992    223.8397 TRINO28
  47189.0000    242.3484                                                 TRINO29
      0.0000    121.9200   3750.0000    132.7012   7500.0000    143.4825 TRINO30
  11250.0000    154.2637  15000.0000    165.0450  21437.8008    183.5537 TRINO31
  27875.5996    202.0623  34313.3984    220.5710  40751.1992    239.0797 TRINO32
  47189.0000    257.5884                                                 TRINO33
      0.0000    137.1600   3750.0000    147.9413   7500.0000    158.7225 TRINO34
  11250.0000    169.5038  15000.0000    180.2850  21437.8008    198.7937 TRINO35
  27875.5996    217.3024  34313.3984    235.8110  40751.1992    254.3197 TRINO36
  47189.0000    272.8284                                                 TRINO37
      0.0000    152.4000   3750.0000    163.1812   7500.0000    173.9625 TRINO38
  11250.0000    184.7437  15000.0000    195.5250  21437.8008    214.0337 TRINO39
  27875.5996    232.5423  34313.3984    251.0510  40751.1992    269.5597 TRINO40
  47189.0000    288.0684                                                 TRINO41
      0.0000    167.6400   3750.0000    178.4212   7500.0000    189.2025 TRINO42
  11250.0000    199.9837  15000.0000    210.7650  21437.8008    229.2737 TRINO43
  27875.5996    247.7823  34313.3984    266.2910  40751.1992    284.7997 TRINO44
  47189.0000    303.3084                                                 TRINO45
      0.0000    182.8800   3750.0000    193.6613   7500.0000    204.4425 TRINO46
  11250.0000    215.2238  15000.0000    226.0050  21437.8008    244.5137 TRINO47
  27875.5996    263.0223  34313.3984    281.5310  40751.1992    300.0397 TRINO48
  47189.0000    318.5484                                                 TRINO49
      0.0000    228.6000   3750.0000    239.3813   7500.0000    250.1625 TRINO50
  11250.0000    260.9438  15000.0000    271.7250  21437.8008    290.2337 TRINO51
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  47189.0000    364.2684                                                 TRINO53
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  11250.0000    306.6638  15000.0000    317.4450  21437.8008    335.9537 TRINO55
  27875.5996    354.4623  34313.3984    372.9710  40751.1992    391.4797 TRINO56
  47189.0000    409.9884                                                 TRINO57
      0.0000    396.2400   3750.0000    407.0212   7500.0000    417.8025 TRINO58
  11250.0000    428.5837  15000.0000    439.3650  21437.8008    457.8737 TRINO59
  27875.5996    476.3824  34313.3984    494.8910  40751.1992    513.3997 TRINO60
  47189.0000    531.9084                                                 TRINO61
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  11250.0000    550.5038  15000.0000    561.2850  21437.8008    579.7937 TRINO63
  27875.5996    598.3024  34313.3984    616.8110  40751.1992    635.3197 TRINO64
  47189.0000    653.8284                                                 TRINO65
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  11250.0000    702.9037  15000.0000    713.6850  21437.8008    732.1937 TRINO67
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      0.0000    822.9600   3750.0000    833.7413   7500.0000    844.5225 TRINO70
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.02960	.02960	.02960	.02960	.02960	TRIN329
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.02960	.02960	.02960	.02960	.02960	TRIN331
.02960	.02960	.02960	.02960	.02960	TRIN332
.02960	.02960	.02960	.02960	.02960	TRIN333
.02960	.02960	.02960	.02960	.02960	TRIN334
.02960	.02960	.02960	.02960	.02960	TRIN335
.02960	.02960	.02960	.02960	.02960	TRIN336
.08870	.08870	.08870	.08870	.08870	TRIN337
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN338
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN339
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN340
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN341
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN342
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN343
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN344
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN345
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN346
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN347
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN348
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN349
0.00000	0.00000	0.00000	0.00000	0.00000	TRIN350

```
  0.00000   0.00000   0.00000   0.00000   0.00000                               TRIN351
    1    0    0                                                                 TRIN352
    2   19                                                                      TRIN353
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRIN354
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRIN355
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRIN356
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRIN357
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRIN358
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRIN359
    6                                                                   TRIN360
    0.000     0.3980                                                    TRIN361
 1344.000  1344.2388                                                    TRIN362
 8760.000  8760.4482                                                    TRIN363
10104.000 10104.3584                                                    TRIN364
17520.000 17520.5664                                                    TRIN365
18864.000 18864.4473                                                    TRIN366
    0.000 22500.0000                                                    TRIN367
   200.00                                                               TRIN368
 30528.00                                                               TRIN369
 21400.000 21400.000   800.000                                          TRIN370
(6F12.0)                                                                TRIN371
   -217.8293   -191.1799   -177.4432   -163.4535   -149.2305   -120.0947 TRIN372
   -105.5023    -90.3733    -75.1832    -60.0142    -44.8493       .8599 TRIN373
     46.5730    168.4783    290.3849    442.7698    595.1564   1204.7150 TRIN374
   3643.0542   -215.7300   -188.8861   -175.0851   -161.0520   -146.7887 TRIN375
   -117.5884   -102.9591    -87.8214    -72.6289    -57.4579    -42.2825 TRIN376
      3.4274     49.1424    171.0485    292.9548    445.3382    597.7222 TRIN377
   1207.2646   3645.5520   -213.5446   -186.9109   -173.1321   -159.0651 TRIN378
   -144.7727   -115.5220   -100.8690    -85.7295    -70.5386    -55.3667 TRIN379
    -40.1843      5.5254     51.2399    173.1456    295.0519    447.4354 TRIN380
    599.8196   1209.3638   3647.6550   -213.4352   -185.6630   -171.6401 TRIN381
   -157.5447   -143.2199   -113.9299    -99.2420    -84.0843    -68.8821 TRIN382
    -53.7086    -38.5204      7.1894     52.9040    174.8097    296.7159 TRIN383
    449.0993    601.4834   1211.0271   3649.3171   -214.6459   -184.8017 TRIN384
   -169.9970   -156.0172   -141.9458   -112.6251    -97.7539    -82.7468 TRIN385
    -67.6460    -52.4937    -37.2940      8.4158     54.1304    176.0360 TRIN386
    297.9422    450.3255    602.7095   1212.2528   3650.5415   -213.4024 TRIN387
   -183.7079   -168.9471   -154.9498   -140.8642   -111.5181    -96.6431 TRIN388
    -81.6536    -66.5711    -51.4153    -36.2131      9.4968     55.2113 TRIN389
    177.1169    299.0230    451.4062    603.7902   1213.3333   3651.6208 TRIN390
   -213.6634   -183.9283   -169.1553   -155.1615   -141.0782   -111.7373 TRIN391
    -96.8626    -81.8679    -66.7802    -51.6251    -36.4234      9.2864 TRIN392
     55.0009    176.9064    298.8124    451.1956    603.5794   1213.1218 TRIN393
   3651.4075   -215.0000   -185.2888   -170.5279   -156.5590   -142.5044 TRIN394
   -113.1974    -98.3363    -83.3538    -68.2757    -53.1263    -37.9282 TRIN395
      7.7816     53.4961    175.4015    297.3074    449.6905    602.0743 TRIN396
   1211.6172   3649.9036   -217.5085   -187.8177   -173.0719   -159.1507 TRIN397
   -145.1499   -115.9084   -101.0724    -86.1097    -71.0468    -55.9086 TRIN398
    -40.7178      4.9916     50.7059    172.6114    294.5172    446.9000 TRIN399
    599.2833   1208.8226   3647.0974   -221.2034   -191.5487   -176.8268 TRIN400
   -162.9751   -149.0538   -119.9094   -105.1112    -90.1791    -75.1400 TRIN401
    -60.0190    -44.8397       .8706     46.5854    168.4903    290.3964 TRIN402
    442.7804    595.1658   1204.7195   3643.0442                         TRIN403
 0                                                                      TRIN404
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APPENDIX F

LISTING OF USER INPUT DATA TO THE TRANSPORT MODEL IF USING THE HYDRO CREATED FILE

```
ALDICARB PROJECTION FOR LONG ISLAND, NE AND SE CORNER 1977-1979       TRFI001
   19    10                                                           TRFI002
 1                                                                    TRFI003
 0 1 1 0                                                              TRFI004
    1.5500                                                            TRFI005
 7800.0000                                                            TRFI006
    7.0000                                                            TRFI007
(5F10.0/5F10.0)                                                       TRFI008
DEGRAD                                                                TRFI009
    .00019    .00019    .00019    .00019    .00019                    TRFI010
    .00019    .00019    .00019    .00019    .00019                    TRFI011
    .00019    .00019    .00019    .00019    .00019                    TRFI012
    .00019    .00019    .00019    .00019    .00019                    TRFI013
    .00019    .00019    .00019    .00019    .00019                    TRFI014
    .00019    .00019    .00019    .00019    .00019                    TRFI015
    .00019    .00019    .00019    .00019    .00019                    TRFI016
    .00019    .00019    .00019    .00019    .00019                    TRFI017
    .00019    .00019    .00019    .00019    .00019                    TRFI018
    .00019    .00019    .00019    .00019    .00019                    TRFI019
    .00019    .00019    .00019    .00019    .00019                    TRFI020
    .00019    .00019    .00019    .00019    .00019                    TRFI021
    .00019    .00019    .00019    .00019    .00019                    TRFI022
    .00019    .00019    .00019    .00019    .00019                    TRFI023
    .00019    .00019    .00019    .00019    .00019                    TRFI024
    .00019    .00019    .00019    .00019    .00019                    TRFI025
    .00019    .00019    .00019    .00019    .00019                    TRFI026
    .00019    .00019    .00019    .00019    .00019                    TRFI027
    .00019    .00019    .00019    .00019    .00019                    TRFI028
    .00019    .00019    .00019    .00019    .00019                    TRFI029
    .00019    .00019    .00019    .00019    .00019                    TRFI030
    .00019    .00019    .00019    .00019    .00019                    TRFI031
    .00019    .00019    .00019    .00019    .00019                    TRFI032
    .00019    .00019    .00019    .00019    .00019                    TRFI033
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI034
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI035
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI036
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI037
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI038
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI039
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI040
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI041
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI042
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI043
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI044
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI045
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI046
   0.00000   0.00000   0.00000   0.00000   0.00000                    TRFI047
    .20690    .20690    .20690    .20690    .20690                    TRFI048
    .08870    .08870    .08870    .08870    .08870                    TRFI049
    .08870    .08870    .08870    .08870    .08870                    TRFI050
    .02960    .02960    .02960    .02960    .02960                    TRFI051
    .02960    .02960    .02960    .02960    .02960                    TRFI052
    .05910    .05910    .05910    .05910    .05910                    TRFI053
    .02960    .02960    .02960    .02960    .02960                    TRFI054
    .02960    .02960    .02960    .02960    .02960                    TRFI055
    .02960    .02960    .02960    .02960    .02960                    TRFI056
    .02960    .02960    .02960    .02960    .02960                    TRFI057
    .02960    .02960    .02960    .02960    .02960                    TRFI058
    .02960    .02960    .02960    .02960    .02960                    TRFI059
    .02960    .02960    .02960    .02960    .02960                    TRFI060
    .02960    .02960    .02960    .02960    .02960                    TRFI061
    .02960    .02960    .02960    .02960    .02960                    TRFI062
    .02960    .02960    .02960    .02960    .02960                    TRFI063
    .02960    .02960    .02960    .02960    .02960                    TRFI064
    .02960    .02960    .02960    .02960    .02960                    TRFI065
    .02960    .02960    .02960    .02960    .02960                    TRFI066
    .02960    .02960    .02960    .02960    .02960                    TRFI067
    .02960    .02960    .02960    .02960    .02960                    TRFI068
    .02960    .02960    .02960    .02960    .02960                    TRFI069
    .02960    .02960    .02960    .02960    .02960                    TRFI070
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  .08870    .08870    .08870    .08870    .08870                                        TRFI071
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI072
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI073
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI074
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI075
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI076
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI077
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI078
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI079
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI080
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI081
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI082
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI083
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI084
 0.00000   0.00000   0.00000   0.00000   0.00000                                        TRFI085
    1    0    0                                                                         TRFI086
    2   19                                                                              TRFI087
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRFI088
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRFI089
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRFI090
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRFI091
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRFI092
      0.0000      0.0000      0.0000      0.0000      0.0000      0.0000 TRFI093
    6                                                                               TRFI094
    0.000      0.3980                                                               TRFI095
 1344.000   1344.2388                                                               TRFI096
 8760.000   8760.4482                                                               TRFI097
10104.000  10104.3584                                                               TRFI098
17520.000  17520.5664                                                               TRFI099
18864.000  18864.4473                                                               TRFI100
    0.000  22500.0000                                                               TRFI101
   200.00                                                                           TRFI102
 30528.00                                                                           TRFI103
 21400.000 21400.000   800.000                                                      TRFI104
```

APPENDIX G

LISTING OF COMPUTER PRINTOUT FROM TRANSPORT MODEL

```
ALDICARB PROJECTION FOR LONG ISLAND, NE AND SE CORNER 1977-1979

NUMBER OF ROWS      =    19

NUMBER OF COLUMNS   =    10

NUMBER OF DIFFERENT REACTIONS IN THE SOLID PHASE =     0

FLAG FOR DEGRADATION IN THE LIQUID PHASE  :    1

FILE INPUT OPTION                         :    1

STEADY STATE PRESSURE DISTRIBUTION OPTION :    0

CHANGE PARAMETER FLAG OPTION              :    1
```

```
GLOBAL COORDINATES, (X,Y) OF ROW = 1  (ALL UNITS IN CM)
 (.0000E+00, .0000E+00)     (.3750E+04, .1078E+02)     (.7500E+04, .2156E+02)     (.1125E+05, .3234E+02)
 (.1500E+05, .4313E+02)     (.2144E+05, .6163E+02)     (.2788E+05, .8014E+02)     (.3431E+05, .9865E+02)
 (.4075E+05, .1172E+03)     (.4719E+05, .1357E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 2  (ALL UNITS IN CM)
 (.0000E+00, .3048E+02)     (.3750E+04, .4126E+02)     (.7500E+04, .5204E+02)     (.1125E+05, .6282E+02)
 (.1500E+05, .7360E+02)     (.2144E+05, .9211E+02)     (.2788E+05, .1106E+03)     (.3431E+05, .1291E+03)
 (.4075E+05, .1476E+03)     (.4719E+05, .1661E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 3  (ALL UNITS IN CM)
 (.0000E+00, .4572E+02)     (.3750E+04, .5650E+02)     (.7500E+04, .6728E+02)     (.1125E+05, .7806E+02)
 (.1500E+05, .8885E+02)     (.2144E+05, .1074E+03)     (.2788E+05, .1259E+03)     (.3431E+05, .1444E+03)
 (.4075E+05, .1629E+03)     (.4719E+05, .1814E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 4  (ALL UNITS IN CM)
 (.0000E+00, .6096E+02)     (.3750E+04, .7174E+02)     (.7500E+04, .8252E+02)     (.1125E+05, .9330E+02)
 (.1500E+05, .1041E+03)     (.2144E+05, .1226E+03)     (.2788E+05, .1411E+03)     (.3431E+05, .1596E+03)
 (.4075E+05, .1781E+03)     (.4719E+05, .1966E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 5  (ALL UNITS IN CM)
 (.0000E+00, .7620E+02)     (.3750E+04, .8698E+02)     (.7500E+04, .9776E+02)     (.1125E+05, .1085E+03)
 (.1500E+05, .1193E+03)     (.2144E+05, .1378E+03)     (.2788E+05, .1563E+03)     (.3431E+05, .1749E+03)
 (.4075E+05, .1934E+03)     (.4719E+05, .2119E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 6  (ALL UNITS IN CM)
 (.0000E+00, .1067E+03)     (.3750E+04, .1175E+03)     (.7500E+04, .1282E+03)     (.1125E+05, .1390E+03)
 (.1500E+05, .1498E+03)     (.2144E+05, .1683E+03)     (.2788E+05, .1868E+03)     (.3431E+05, .2053E+03)
 (.4075E+05, .2238E+03)     (.4719E+05, .2423E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 7  (ALL UNITS IN CM)
 (.0000E+00, .1219E+03)     (.3750E+04, .1327E+03)     (.7500E+04, .1435E+03)     (.1125E+05, .1543E+03)
 (.1500E+05, .1650E+03)     (.2144E+05, .1836E+03)     (.2788E+05, .2021E+03)     (.3431E+05, .2206E+03)
 (.4075E+05, .2391E+03)     (.4719E+05, .2576E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 8  (ALL UNITS IN CM)
 (.0000E+00, .1372E+03)     (.3750E+04, .1479E+03)     (.7500E+04, .1587E+03)     (.1125E+05, .1695E+03)
 (.1500E+05, .1803E+03)     (.2144E+05, .1988E+03)     (.2788E+05, .2173E+03)     (.3431E+05, .2358E+03)
 (.4075E+05, .2543E+03)     (.4719E+05, .2728E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW = 9  (ALL UNITS IN CM)
 (.0000E+00, .1524E+03)     (.3750E+04, .1632E+03)     (.7500E+04, .1740E+03)     (.1125E+05, .1847E+03)
 (.1500E+05, .1955E+03)     (.2144E+05, .2140E+03)     (.2788E+05, .2325E+03)     (.3431E+05, .2511E+03)
 (.4075E+05, .2696E+03)     (.4719E+05, .2881E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW =10  (ALL UNITS IN CM)
 (.0000E+00, .1676E+03)     (.3750E+04, .1784E+03)     (.7500E+04, .1892E+03)     (.1125E+05, .2000E+03)
 (.1500E+05, .2108E+03)     (.2144E+05, .2293E+03)     (.2788E+05, .2478E+03)     (.3431E+05, .2663E+03)
 (.4075E+05, .2848E+03)     (.4719E+05, .3033E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW =11  (ALL UNITS IN CM)
 (.0000E+00, .1829E+03)     (.3750E+04, .1937E+03)     (.7500E+04, .2044E+03)     (.1125E+05, .2152E+03)
 (.1500E+05, .2260E+03)     (.2144E+05, .2445E+03)     (.2788E+05, .2630E+03)     (.3431E+05, .2815E+03)
 (.4075E+05, .3000E+03)     (.4719E+05, .3185E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW =12  (ALL UNITS IN CM)
 (.0000E+00, .2286E+03)     (.3750E+04, .2394E+03)     (.7500E+04, .2502E+03)     (.1125E+05, .2609E+03)
 (.1500E+05, .2717E+03)     (.2144E+05, .2902E+03)     (.2788E+05, .3087E+03)     (.3431E+05, .3273E+03)
 (.4075E+05, .3458E+03)     (.4719E+05, .3643E+03)     (

GLOBAL COORDINATES, (X,Y) OF ROW =13  (ALL UNITS IN CM)
```

```
 (.0000E+00, .2743E+03)      (.3750E+04, .2851E+03)      (.7500E+04, .2959E+03)      (.1125E+05, .3067E+03)
 (.1500E+05, .3174E+03)      (.2144E+05, .3360E+03)      (.2788E+05, .3545E+03)      (.3431E+05, .3730E+03)
 (.4075E+05, .3915E+03)      (.4719E+05, .4100E+03)      (
GLOBAL COORDINATES, (X,Y) OF ROW =14  (ALL UNITS IN CM)
 (.0000E+00, .3962E+03)      (.3750E+04, .4070E+03)      (.7500E+04, .4178E+03)      (.1125E+05, .4286E+03)
 (.1500E+05, .4394E+03)      (.2144E+05, .4579E+03)      (.2788E+05, .4764E+03)      (.3431E+05, .4949E+03)
 (.4075E+05, .5134E+03)      (.4719E+05, .5319E+03)      (

GLOBAL COORDINATES, (X,Y) OF ROW =15  (ALL UNITS IN CM)
 (.0000E+00, .5182E+03)      (.3750E+04, .5289E+03)      (.7500E+04, .5397E+03)      (.1125E+05, .5505E+03)
 (.1500E+05, .5613E+03)      (.2144E+05, .5798E+03)      (.2788E+05, .5983E+03)      (.3431E+05, .6168E+03)
 (.4075E+05, .6353E+03)      (.4719E+05, .6538E+03)      (

GLOBAL COORDINATES, (X,Y) OF ROW =16  (ALL UNITS IN CM)
 (.0000E+00, .6706E+03)      (.3750E+04, .6813E+03)      (.7500E+04, .6921E+03)      (.1125E+05, .7029E+03)
 (.1500E+05, .7137E+03)      (.2144E+05, .7322E+03)      (.2788E+05, .7507E+03)      (.3431E+05, .7692E+03)
 (.4075E+05, .7877E+03)      (.4719E+05, .8062E+03)      (

GLOBAL COORDINATES, (X,Y) OF ROW =17  (ALL UNITS IN CM)
 (.0000E+00, .8230E+03)      (.3750E+04, .8337E+03)      (.7500E+04, .8445E+03)      (.1125E+05, .8553E+03)
 (.1500E+05, .8661E+03)      (.2144E+05, .8846E+03)      (.2788E+05, .9031E+03)      (.3431E+05, .9216E+03)
 (.4075E+05, .9401E+03)      (.4719E+05, .9586E+03)      (

GLOBAL COORDINATES, (X,Y) OF ROW =18  (ALL UNITS IN CM)
 (.0000E+00, .1433E+04)      (.3750E+04, .1443E+04)      (.7500E+04, .1454E+04)      (.1125E+05, .1465E+04)
 (.1500E+05, .1476E+04)      (.2144E+05, .1494E+04)      (.2788E+05, .1513E+04)      (.3431E+05, .1531E+04)
 (.4075E+05, .1550E+04)      (.4719E+05, .1568E+04)      (

GLOBAL COORDINATES, (X,Y) OF ROW =19  (ALL UNITS IN CM)
 (.0000E+00, .3871E+04)      (.3750E+04, .3882E+04)      (.7500E+04, .3893E+04)      (.1125E+05, .3903E+04)
 (.1500E+05, .3914E+04)      (.2144E+05, .3933E+04)      (.2788E+05, .3951E+04)      (.3431E+05, .3970E+04)
 (.4075E+05, .3988E+04)      (.4719E+05, .4007E+04)      (
```

RU = 1.5500 GRAM/CM-3

CONDUCTIVITY (CM/HR), AIR ENTRY LEVEL (CM), EXPONENT B, AND SATURATED WATER CONTENT AT GRID POINT (I,J)

I = 1	J = 1	12.4800	-21.8000	4.9000	0.4350
I = 1	J = 2	12.4800	-21.8000	4.9000	0.4350
I = 1	J = 3	12.4800	-21.8000	4.9000	0.4350
I = 1	J = 4	12.4800	-21.8000	4.9000	0.4350
I = 1	J = 5	2.5920	-78.6000	5.3000	0.4850
I = 1	J = 6	2.5920	-78.6000	5.3000	0.4850
I = 1	J = 7	2.5920	-78.6000	5.3000	0.4850
I = 1	J = 8	2.5920	-78.6000	5.3000	0.4850
I = 1	J = 9	2.5920	-78.6000	5.3000	0.4850
I = 1	J = 10	2.5920	-78.6000	5.3000	0.4850
I = 2	J = 1	12.4800	-21.8000	4.9000	0.4350
I = 2	J = 2	12.4800	-21.8000	4.9000	0.4350
I = 2	J = 3	12.4800	-21.8000	4.9000	0.4350
I = 2	J = 4	12.4800	-21.8000	4.9000	0.4350
I = 2	J = 5	2.5920	-78.6000	5.3000	0.4850
I = 2	J = 6	2.5920	-78.6000	5.3000	0.4850
I = 2	J = 7	2.5920	-78.6000	5.3000	0.4850
I = 2	J = 8	2.5920	-78.6000	5.3000	0.4850
I = 2	J = 9	2.5920	-78.6000	5.3000	0.4850
I = 2	J = 10	2.5920	-78.6000	5.3000	0.4850
I = 3	J = 1	12.4800	-21.8000	4.9000	0.4350
I = 3	J = 2	12.4800	-21.8000	4.9000	0.4350
I = 3	J = 3	12.4800	-21.8000	4.9000	0.4350
I = 3	J = 4	12.4800	-21.8000	4.9000	0.4350
I = 3	J = 5	2.5020	-47.8000	5.3900	0.4510
I = 3	J = 6	2.5020	-47.8000	5.3900	0.4510
I = 3	J = 7	2.5020	-47.8000	5.3900	0.4510
I = 3	J = 8	2.5020	-47.8000	5.3900	0.4510
I = 3	J = 9	2.5020	-47.8000	5.3900	0.4510
I = 3	J = 10	2.5020	-47.8000	5.3900	0.4510
I = 4	J = 1	63.3600	-12.1000	4.0500	0.3950
I = 4	J = 2	63.3600	-12.1000	4.0500	0.3950
I = 4	J = 3	63.3600	-12.1000	4.0500	0.3950
I = 4	J = 4	63.3600	-12.1000	4.0500	0.3950
I = 4	J = 5	56.2800	-9.0000	4.3800	0.4100
I = 4	J = 6	56.2800	-9.0000	4.3800	0.4100
I = 4	J = 7	56.2800	-9.0000	4.3800	0.4100
I = 4	J = 8	56.2800	-9.0000	4.3800	0.4100
I = 4	J = 9	56.2800	-9.0000	4.3800	0.4100
I = 4	J = 10	56.2800	-9.0000	4.3800	0.4100
I = 5	J = 1	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 2	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 3	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 4	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 5	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 6	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 7	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 8	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 9	63.3600	-12.1000	4.0500	0.3950
I = 5	J = 10	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 1	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 2	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 3	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 4	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 5	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 6	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 7	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 8	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 9	63.3600	-12.1000	4.0500	0.3950
I = 6	J = 10	63.3600	-12.1000	4.0500	0.3950

I	=	7	J	=	1	56.2800	-9.0000	4.3800	0.4100
I	=	7	J	=	2	56.2800	-9.0000	4.3800	0.4100
I	=	7	J	=	3	56.2800	-9.0000	4.3800	0.4100
I	=	7	J	=	4	56.2800	-9.0000	4.3800	0.4100
I	=	7	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	7	J	=	6	63.3600	-12.1000	4.0500	0.3950
I	=	7	J	=	7	63.3600	-12.1000	4.0500	0.3950
I	=	7	J	=	8	63.3600	-12.1000	4.0500	0.3950
I	=	7	J	=	9	63.3600	-12.1000	4.0500	0.3950
I	=	7	J	=	10	63.3600	-12.1000	4.0500	0.3950
I	=	8	J	=	1	2.5920	-78.6000	5.3000	0.4850
I	=	8	J	=	2	2.5920	-78.6000	5.3000	0.4850
I	=	8	J	=	3	2.5920	-78.6000	5.3000	0.4850
I	=	8	J	=	4	2.5920	-78.6000	5.3000	0.4850
I	=	8	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	8	J	=	6	63.3600	-12.1000	4.0500	0.3950
I	=	8	J	=	7	63.3600	-12.1000	4.0500	0.3950
I	=	8	J	=	8	63.3600	-12.1000	4.0500	0.3950
I	=	8	J	=	9	63.3600	-12.1000	4.0500	0.3950
I	=	8	J	=	10	63.3600	-12.1000	4.0500	0.3950
I	=	9	J	=	1	2.5920	-78.6000	5.3000	0.4850
I	=	9	J	=	2	2.5920	-78.6000	5.3000	0.4850
I	=	9	J	=	3	2.5920	-78.6000	5.3000	0.4850
I	=	9	J	=	4	2.5920	-78.6000	5.3000	0.4850
I	=	9	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	9	J	=	6	63.3600	-12.1000	4.0500	0.3950
I	=	9	J	=	7	63.3600	-12.1000	4.0500	0.3950
I	=	9	J	=	8	63.3600	-12.1000	4.0500	0.3950
I	=	9	J	=	9	63.3600	-12.1000	4.0500	0.3950
I	=	9	J	=	10	63.3600	-12.1000	4.0500	0.3950
I	=	10	J	=	1	56.2800	-9.0000	4.3800	0.4100
I	=	10	J	=	2	56.2800	-9.0000	4.3800	0.4100
I	=	10	J	=	3	56.2800	-9.0000	4.3800	0.4100
I	=	10	J	=	4	56.2800	-9.0000	4.3800	0.4100
I	=	10	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	10	J	=	6	63.3600	-12.1000	4.0500	0.3950
I	=	10	J	=	7	63.3600	-12.1000	4.0500	0.3950
I	=	10	J	=	8	63.3600	-12.1000	4.0500	0.3950
I	=	10	J	=	9	63.3600	-12.1000	4.0500	0.3950
I	=	10	J	=	10	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	1	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	2	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	3	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	4	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	6	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	7	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	8	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	9	63.3600	-12.1000	4.0500	0.3950
I	=	11	J	=	10	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	1	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	2	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	3	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	4	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	6	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	7	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	8	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	9	63.3600	-12.1000	4.0500	0.3950
I	=	12	J	=	10	63.3600	-12.1000	4.0500	0.3950
I	=	13	J	=	1	63.3600	-12.1000	4.0500	0.3950
I	=	13	J	=	2	63.3600	-12.1000	4.0500	0.3950
I	=	13	J	=	3	63.3600	-12.1000	4.0500	0.3950
I	=	13	J	=	4	63.3600	-12.1000	4.0500	0.3950
I	=	13	J	=	5	63.3600	-12.1000	4.0500	0.3950
I	=	13	J	=	6	63.3600	-12.1000	4.0500	0.3950

I =	13	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	13	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	13	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	13	J =	10	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	1	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	2	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	3	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	4	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	5	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	6	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	14	J =	10	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	1	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	2	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	3	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	4	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	5	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	6	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	15	J =	10	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	1	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	2	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	3	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	4	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	5	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	6	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	16	J =	10	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	1	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	2	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	3	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	4	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	5	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	6	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	17	J =	10	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	1	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	2	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	3	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	4	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	5	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	6	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	18	J =	10	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	1	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	2	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	3	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	4	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	5	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	6	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	7	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	8	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	9	63.3600	-12.1000	4.0500	0.3950
I =	19	J =	10	63.3600	-12.1000	4.0500	0.3950

POLLUTANT CONCENTRATION = 7800.0000 PPM

PH =   7.00

DEGRADATION RATE IN THE LIQUID PHASE AT EVERY GRID POINT (I,J) IN HR-1

ROW # = 1	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 2	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 3	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 4	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 6	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 7	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 8	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # = 9	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # =10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # =11	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # =12	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PARTITION COEFFICIENT OF GRID POINT (I,J)

ROW # = 1

0.2069	0.2069	0.2069	0.2069	0.2069	0.0887	0.0887	0.0887	0.0887	0.0887

ROW # = 2

0.0887	0.0887	0.0887	0.0887	0.0887	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # = 3

0.0296	0.0296	0.0296	0.0296	0.0296	0.0591	0.0591	0.0591	0.0591	0.0591

ROW # = 4

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # = 5

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # = 6

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # = 7

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # = 8

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # = 9

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # =10

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # =11

0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296	0.0296

ROW # =12

0.0296	0.0296	0.0296	0.0296	0.0296	0.0887	0.0887	0.0887	0.0887	0.0887

ROW # =13

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =14

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =15

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =16

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =17

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =18

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =19

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

```
IFLAGL =   1     IFLAGR =    0     IFLAGB =    0

NIL =      2     NFL =   19

INPUT CONCENTRATION ON THE LEFT BOUNDARY AT TIME=0.0 IN PPM
FROM ROW NIL TO ROW NFL
    0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     0.0000     0.0000

INPUT CONCENTRATION ON THE LEFT BOUNDARY AT MAXIMUM TIME IN PPM
FROM ROW NIL TO ROW NFL
    0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     0.0000     0.0000
```

IBC = 6

APPLICATION PERIOD OF POLLUTANT IN HOUR

0.0000	0.3980
1344.0000	1344.2388
8760.0000	8760.4492
10104.0000	10104.3594
17520.0000	17520.5664
18864.0000	18864.4492

STARTING LOCATION DS1 = 0.00 CM
ENDING LOCATION DS2 = 22500.00 CM

```
PARAMETERS FOR INTEGRATION AND OUTPUT
TIME STEP FOR INTEGRATION:            DELT  =       200.00 HR
MAXIMUM TIME PERIOD FOR SIMULATION:   TMAX  =     30528.00 HR

PIVOT POINT FOR PRINTOUT     =   21400.00
PRINT INTERVAL BEFORE PIVOT  =   21400.00
PRINT INTERVAL AFTER  PIVOT  =     800.00
```

PRESSURE DISTRIBUTION--CM OF WATER

TIME = 0.000000E+00 DAYS

ROW # = 1	-217.8293	-215.7300	-213.5446	-213.4352	-214.6459	-213.4024	-213.6634	-215.0000	-217.5085	-221.2034
ROW # = 2	-191.1799	-188.8861	-186.9109	-185.6630	-184.8017	-183.7079	-183.9283	-185.2888	-187.8177	-191.5487
ROW # = 3	-177.4432	-175.0851	-173.1321	-171.6401	-169.9970	-168.9471	-169.1553	-170.5279	-173.0719	-176.8268
ROW # = 4	-163.4535	-161.0520	-159.0651	-157.5447	-156.0172	-154.9498	-155.1615	-156.5590	-159.1507	-162.9751
ROW # = 5	-149.2305	-146.7887	-144.7727	-143.2199	-141.9458	-140.8642	-141.0782	-142.5044	-145.1499	-149.0538
ROW # = 6	-120.0947	-117.5884	-115.5220	-113.9299	-112.6251	-111.5181	-111.7373	-113.1974	-115.9084	-119.9094
ROW # = 7	-105.5023	-102.9591	-100.8690	-99.2420	-97.7539	-96.6431	-96.8626	-98.3363	-101.0724	-105.1112
ROW # = 8	-90.3733	-87.8214	-85.7295	-84.0843	-82.7468	-81.6536	-81.8679	-83.3538	-86.1097	-90.1791
ROW # = 9	-75.1832	-72.6289	-70.5386	-68.8821	-67.6460	-66.5711	-66.7802	-68.2757	-71.0468	-75.1400
ROW # =10	-60.0142	-57.4579	-55.3667	-53.7086	-52.4937	-51.4153	-51.6251	-53.1263	-55.9086	-60.0190
ROW # =11	-44.8493	-42.2825	-40.1843	-38.5204	-37.2940	-36.2131	-36.4234	-37.9282	-40.7178	-44.8397
ROW # =12	0.8599	3.4274	5.5254	7.1894	8.4158	9.4968	9.2864	7.7816	4.9916	0.8706
ROW # =13	46.5730	49.1424	51.2399	52.9040	54.1304	55.2113	55.0009	53.4961	50.7059	46.5854
ROW # =14	168.4783	171.0485	173.1456	174.8097	176.0360	177.1169	176.9064	175.4015	172.6114	168.4903
ROW # =15	290.3850	292.9548	295.0520	296.7158	297.9421	299.0229	298.8125	297.3074	294.5171	290.3965
ROW # =16	442.7698	445.3381	447.4353	449.0994	450.3254	451.4062	451.1956	449.6904	446.8999	442.7805
ROW # =17	595.1565	597.7222	599.8196	601.4834	602.7095	603.7903	603.5793	602.0742	599.2832	595.1658
ROW # =18	1204.7151	1207.2646	1209.3638	1211.0271	1212.2527	1213.3333	1213.1218	1211.6172	1208.8225	1204.7195
ROW # =19	3643.0542	3645.5520	3647.6550	3649.3171	3650.5415	3651.6208	3651.4075	3649.9036	3647.0974	3643.0442

TIME = 0.000000E+00 DAYS

WATER FLUX AT GRID POINT (I,J) OF ROW # = 1

(0.1134E-03 0.7181E-02)	(0.1160E-03 0.7286E-02)	(0.1316E-03 0.6984E-02)	(0.3156E-03 0.6162E-02)	(0.6255E-03 0.6265E-02)
(0.7973E-03 0.7063E-02)	(0.8515E-03 0.7266E-02)	(0.8881E-03 0.7210E-02)	(0.9120E-03 0.7224E-02)	(0.9205E-03 0.7218E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 2

(0.1304E-03 0.7191E-02)	(0.1348E-03 0.7269E-02)	(0.1499E-03 0.7042E-02)	(0.2975E-03 0.6422E-02)	(0.5609E-03 0.6500E-02)
(0.7168E-03 0.7102E-02)	(0.7650E-03 0.7255E-02)	(0.7977E-03 0.7213E-02)	(0.8183E-03 0.7222E-02)	(0.8255E-03 0.7217E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 3

(0.1637E-03 0.7210E-02)	(0.1709E-03 0.7236E-02)	(0.1867E-03 0.7158E-02)	(0.2440E-03 0.6948E-02)	(0.3535E-03 0.6975E-02)
(0.4316E-03 0.7180E-02)	(0.4607E-03 0.7232E-02)	(0.4804E-03 0.7217E-02)	(0.4918E-03 0.7219E-02)	(0.4955E-03 0.7215E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 4

(0.2026E-03 0.7219E-02)	(0.2122E-03 0.7220E-02)	(0.2318E-03 0.7215E-02)	(0.2335E-03 0.7200E-02)	(0.2258E-03 0.7203E-02)
(0.2364E-03 0.7217E-02)	(0.2530E-03 0.7221E-02)	(0.2635E-03 0.7219E-02)	(0.2685E-03 0.7216E-02)	(0.2695E-03 0.7213E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 5

(0.2880E-03 0.7219E-02)	(0.3027E-03 0.7220E-02)	(0.3326E-03 0.7215E-02)	(0.3488E-03 0.7203E-02)	(0.3584E-03 0.7205E-02)
(0.3831E-03 0.7218E-02)	(0.4096E-03 0.7221E-02)	(0.4244E-03 0.7219E-02)	(0.4282E-03 0.7215E-02)	(0.4274E-03 0.7211E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 6

(0.3576E-03 0.7218E-02)	(0.3774E-03 0.7221E-02)	(0.4173E-03 0.7208E-02)	(0.4801E-03 0.7176E-02)	(0.5825E-03 0.7181E-02)
(0.6710E-03 0.7214E-02)	(0.7164E-03 0.7222E-02)	(0.7385E-03 0.7219E-02)	(0.7386E-03 0.7214E-02)	(0.7332E-03 0.7209E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 7

(0.1304E-02 0.7213E-02)	(0.1384E-02 0.7240E-02)	(0.1543E-02 0.7154E-02)	(0.1462E-02 0.6926E-02)	(0.1141E-02 0.6956E-02)
(0.1025E-02 0.7178E-02)	(0.1093E-02 0.7233E-02)	(0.1120E-02 0.7216E-02)	(0.1109E-02 0.7213E-02)	(0.1094E-02 0.7205E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 8

(0.3589E-02 0.7209E-02)	(0.3764E-02 0.7268E-02)	(0.4109E-02 0.7080E-02)	(0.3618E-02 0.6582E-02)	(0.2247E-02 0.6646E-02)
(0.1606E-02 0.7128E-02)	(0.1709E-02 0.7248E-02)	(0.1739E-02 0.7212E-02)	(0.1698E-02 0.7212E-02)	(0.1661E-02 0.7201E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # = 9

(0.4187E-02 0.7226E-02)	(0.4358E-02 0.7256E-02)	(0.4694E-02 0.7135E-02)	(0.4321E-02 0.6823E-02)	(0.3228E-02 0.6861E-02)
(0.2795E-02 0.7164E-02)	(0.2968E-02 0.7240E-02)	(0.2984E-02 0.7216E-02)	(0.2854E-02 0.7209E-02)	(0.2756E-02 0.7195E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =10

(0.3445E-02 0.7236E-02)	(0.3687E-02 0.7227E-02)	(0.4171E-02 0.7215E-02)	(0.4661E-02 0.7204E-02)	(0.5220E-02 0.7207E-02)
(0.5810E-02 0.7224E-02)	(0.6148E-02 0.7226E-02)	(0.6052E-02 0.7220E-02)	(0.5583E-02 0.7199E-02)	(0.5270E-02 0.7181E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =11

(0.3784E-01 0.7390E-02)	(0.3916E-01 0.7351E-02)	(0.4172E-01 0.7336E-02)	(0.4437E-01 0.7365E-02)	(0.4757E-01 0.7364E-02)
(0.5129E-01 0.7351E-02)	(0.5486E-01 0.7350E-02)	(0.5785E-01 0.7375E-02)	(0.6040E-01 0.7323E-02)	(0.6161E-01 0.7250E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =12

(0.1055E+00 0.7935E-02)	(0.1086E+00 0.7658E-02)	(0.1146E+00 0.7463E-02)	(0.1205E+00 0.7522E-02)	(0.1274E+00 0.7503E-02)
(0.1362E+00 0.7563E-02)	(0.1459E+00 0.7623E-02)	(0.1553E+00 0.7644E-02)	(0.1647E+00 0.7541E-02)	(0.1694E+00 0.7425E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =13

(0.1387E+00 0.7856E-02)	(0.1427E+00 0.7588E-02)	(0.1504E+00 0.7405E-02)	(0.1577E+00 0.7468E-02)	(0.1665E+00 0.7482E-02)
(0.1779E+00 0.7587E-02)	(0.1906E+00 0.7665E-02)	(0.2033E+00 0.7668E-02)	(0.2161E+00 0.7639E-02)	(0.2227E+00 0.7619E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =14

(0.1387E+00 0.7210E-02)	(0.1427E+00 0.7204E-02)	(0.1504E+00 0.7238E-02)	(0.1577E+00 0.7303E-02)	(0.1665E+00 0.7338E-02)
(0.1779E+00 0.7375E-02)	(0.1906E+00 0.7422E-02)	(0.2033E+00 0.7455E-02)	(0.2161E+00 0.7479E-02)	(0.2227E+00 0.7492E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =15

(0.1387E+00 0.6838E-02)	(0.1427E+00 0.6934E-02)	(0.1504E+00 0.7031E-02)	(0.1577E+00 0.7050E-02)	(0.1665E+00 0.7069E-02)
(0.1779E+00 0.7090E-02)	(0.1906E+00 0.7132E-02)	(0.2033E+00 0.7192E-02)	(0.2161E+00 0.7170E-02)	(0.2227E+00 0.7111E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =16

(0.1388E+00 0.6347E-02)	(0.1427E+00 0.6550E-02)	(0.1504E+00 0.6741E-02)	(0.1577E+00 0.6742E-02)	(0.1665E+00 0.6779E-02)
(0.1779E+00 0.6815E-02)	(0.1906E+00 0.6853E-02)	(0.2033E+00 0.6929E-02)	(0.2161E+00 0.6853E-02)	(0.2227E+00 0.6726E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =17

(0.1389E+00 0.5601E-02)	(0.1428E+00 0.5915E-02)	(0.1504E+00 0.6216E-02)	(0.1577E+00 0.6225E-02)	(0.1665E+00 0.6265E-02)
(0.1779E+00 0.6305E-02)	(0.1906E+00 0.6340E-02)	(0.2033E+00 0.6419E-02)	(0.2161E+00 0.6258E-02)	(0.2226E+00 0.6030E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =18

(0.1392E+00 0.3706E-02)	(0.1429E+00 0.4048E-02)	(0.1504E+00 0.4367E-02)	(0.1577E+00 0.4362E-02)	(0.1665E+00 0.4395E-02)
(0.1779E+00 0.4431E-02)	(0.1906E+00 0.4454E-02)	(0.2033E+00 0.4533E-02)	(0.2161E+00 0.4346E-02)	(0.2224E+00 0.4082E-02)

WATER FLUX AT GRID POINT (I,J) OF ROW # =19

(0.1395E+00 0.2255E-02)	(0.1431E+00 0.2564E-02)	(0.1504E+00 0.2856E-02)	(0.1578E+00 0.2854E-02)	(0.1665E+00 0.2889E-02)
(0.1779E+00 0.2928E-02)	(0.1906E+00 0.2954E-02)	(0.2033E+00 0.3031E-02)	(0.2160E+00 0.2851E-02)	(0.2223E+00 0.2602E-02)

WATER CONTENT RATIO AT GRID POINT (I,J)

TIME = 0.000000E+00 DAYS

ROW #										
1	0.2719	0.2725	0.2730	0.2731	0.4013	0.4017	0.4016	0.4011	0.4003	0.3990
2	0.2793	0.2800	0.2806	0.2810	0.4128	0.4132	0.4131	0.4125	0.4115	0.4100
3	0.2836	0.2843	0.2850	0.2855	0.3564	0.3568	0.3567	0.3562	0.3552	0.3538
4	0.2077	0.2085	0.2091	0.2096	0.2138	0.2141	0.2140	0.2136	0.2128	0.2116
5	0.2124	0.2133	0.2140	0.2146	0.2151	0.2155	0.2154	0.2149	0.2139	0.2125
6	0.2241	0.2253	0.2263	0.2271	0.2277	0.2283	0.2282	0.2274	0.2261	0.2242
7	0.2337	0.2350	0.2361	0.2370	0.2358	0.2365	0.2363	0.2355	0.2339	0.2316
8	0.4724	0.4750	0.4771	0.4789	0.2457	0.2465	0.2464	0.2453	0.2433	0.2406
9	0.4850	0.4850	0.4850	0.4850	0.2582	0.2593	0.2591	0.2577	0.2551	0.2516
10	0.2659	0.2685	0.2708	0.2727	0.2749	0.2764	0.2761	0.2741	0.2707	0.2660
11	0.2858	0.2900	0.2937	0.2968	0.2992	0.3013	0.3009	0.2979	0.2927	0.2858
12	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
13	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
14	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
15	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
16	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
17	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
18	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950
19	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950	0.3950

TIME =   0.000000E+00 DAY   SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW #										
ROW # = 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 2
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 3
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 4
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 5
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 6
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 7
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 8
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # = 9
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =10
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =11
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =12
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =13
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =14
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =15
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =16
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =17
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =18
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

ROW # =19
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

TIME = 0.891667E+03 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.3651	0.3570	0.3824	0.4549	0.5172	0.2695	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.9433	0.9475	0.9457	0.8329	0.7977	0.0004	0.0000	0.0000	0.0000
ROW # = 3	0.0000	1.0741	1.0592	1.0060	0.8031	0.9181	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	1.0819	1.0533	0.9680	0.7260	0.8983	0.0004	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.9874	0.9515	0.8530	0.6130	0.7984	0.0004	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.6257	0.5965	0.5234	0.3682	0.4894	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.4411	0.4177	0.3623	0.2591	0.3394	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.2284	0.2161	0.1898	0.1771	0.2184	0.0003	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.1292	0.1272	0.1236	0.1297	0.1379	0.0003	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1050	0.1072	0.1115	0.1098	0.0965	0.0004	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1017	0.1074	0.1135	0.1073	0.0855	0.0019	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0946	0.1084	0.1085	0.1035	0.1006	0.0123	0.0012	0.0001	0.0000
ROW # =13	0.0000	0.0907	0.1152	0.1146	0.1123	0.1173	0.0277	0.0049	0.0008	0.0001
ROW # =14	0.0000	0.0448	0.0680	0.0735	0.0747	0.0798	0.0322	0.0098	0.0025	0.0006
ROW # =15	0.0000	0.0191	0.0339	0.0394	0.0408	0.0434	0.0223	0.0082	0.0024	0.0006
ROW # =16	0.0000	0.0063	0.0123	0.0150	0.0156	0.0167	0.0097	0.0039	0.0012	0.0003
ROW # =17	0.0000	0.0016	0.0035	0.0043	0.0045	0.0049	0.0030	0.0012	0.0004	0.0001
ROW # =18	0.0000	0.0001	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0755	0.0739	0.0791	0.0941	0.1070	0.0239	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0837	0.0840	0.0839	0.0739	0.0236	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0318	0.0314	0.0298	0.0238	0.0543	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0320	0.0312	0.0287	0.0215	0.0266	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0292	0.0282	0.0252	0.0181	0.0236	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0185	0.0177	0.0155	0.0109	0.0145	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0131	0.0124	0.0107	0.0077	0.0100	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0068	0.0064	0.0056	0.0052	0.0065	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0038	0.0038	0.0037	0.0038	0.0041	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0031	0.0032	0.0033	0.0033	0.0029	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0030	0.0032	0.0034	0.0032	0.0025	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0028	0.0032	0.0032	0.0031	0.0089	0.0011	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8741	0.8777	0.8733	0.8541	1.1794	1.2391	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.6641	0.6532	0.6187	0.7593	0.8582	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.5673	0.5564	0.5233	0.5239	0.5932	0.0003	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.3590	0.3522	0.3314	0.2699	0.3041	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.3173	0.3115	0.2938	0.2363	0.2642	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.2557	0.2517	0.2387	0.1944	0.2140	0.0002	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.2320	0.2285	0.2167	0.1762	0.1932	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.3755	0.3688	0.3454	0.1604	0.1765	0.0003	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3077	0.3003	0.2772	0.1477	0.1634	0.0004	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1481	0.1457	0.1349	0.1377	0.1533	0.0007	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1373	0.1375	0.1272	0.1297	0.1456	0.0026	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1017	0.1081	0.0998	0.1003	0.1106	0.0098	0.0007	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.925000E+03 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.1692	0.1637	0.1812	0.2348	0.2915	0.1118	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.6255	0.6418	0.6778	0.6470	0.5173	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.7907	0.7961	0.7984	0.6985	0.6946	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.8877	0.8809	0.8502	0.6956	0.7663	0.0005	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.9232	0.9047	0.8456	0.6544	0.7765	0.0005	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.7435	0.7165	0.6443	0.4695	0.5999	0.0005	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.6045	0.5769	0.5070	0.3628	0.4772	0.0005	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.3613	0.3396	0.2888	0.2594	0.3456	0.0004	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.1958	0.1856	0.1632	0.1803	0.2309	0.0004	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1321	0.1285	0.1211	0.1305	0.1480	0.0005	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1011	0.1033	0.1041	0.1051	0.1002	0.0017	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0811	0.0942	0.0959	0.0921	0.0883	0.0114	0.0011	0.0001	0.0000
ROW # =13	0.0000	0.0842	0.1099	0.1114	0.1087	0.1110	0.0279	0.0051	0.0009	0.0001
ROW # =14	0.0000	0.0462	0.0711	0.0774	0.0786	0.0833	0.0345	0.0106	0.0028	0.0007
ROW # =15	0.0000	0.0204	0.0364	0.0427	0.0444	0.0472	0.0247	0.0093	0.0028	0.0007
ROW # =16	0.0000	0.0068	0.0137	0.0168	0.0177	0.0189	0.0112	0.0046	0.0015	0.0004
ROW # =17	0.0000	0.0018	0.0040	0.0051	0.0054	0.0058	0.0036	0.0016	0.0005	0.0001
ROW # =18	0.0000	0.0001	0.0002	0.0003	0.0003	0.0003	0.0002	0.0001	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0350	0.0339	0.0375	0.0486	0.0603	0.0099	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0555	0.0569	0.0601	0.0574	0.0153	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0234	0.0236	0.0236	0.0207	0.0410	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0263	0.0261	0.0252	0.0206	0.0227	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0273	0.0268	0.0250	0.0194	0.0230	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0220	0.0212	0.0191	0.0139	0.0178	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0179	0.0171	0.0150	0.0107	0.0141	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0107	0.0101	0.0085	0.0077	0.0102	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0058	0.0055	0.0048	0.0053	0.0068	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0039	0.0038	0.0036	0.0039	0.0044	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0030	0.0031	0.0031	0.0031	0.0030	0.0000	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0024	0.0028	0.0028	0.0027	0.0078	0.0010	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8847	0.8879	0.8845	0.8679	1.2034	1.2501	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.6972	0.6869	0.6533	0.8057	0.8991	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6077	0.5967	0.5626	0.5649	0.6371	0.0003	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.3905	0.3833	0.3606	0.2932	0.3315	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.3487	0.3422	0.3219	0.2573	0.2904	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.2795	0.2746	0.2591	0.2090	0.2332	0.0002	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.2509	0.2465	0.2325	0.1874	0.2080	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.3967	0.3888	0.3627	0.1685	0.1870	0.0003	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3194	0.3116	0.2876	0.1537	0.1706	0.0004	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1528	0.1505	0.1396	0.1426	0.1583	0.0007	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1417	0.1421	0.1320	0.1344	0.1497	0.0027	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1069	0.1142	0.1059	0.1062	0.1162	0.0105	0.0008	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.958333E+03 DAY SOLUTION CONCENTRATION (PPM)

ROW #										
ROW # = 1	0.0784	0.0751	0.0858	0.1213	0.1642	0.0464	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.3956	0.4146	0.4632	0.4801	0.3211	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.5350	0.5502	0.5833	0.5598	0.4798	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.6439	0.6521	0.6635	0.5948	0.5740	0.0004	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.7316	0.7306	0.7167	0.6038	0.6377	0.0005	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.7253	0.7090	0.6598	0.5098	0.6047	0.0006	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.6677	0.6456	0.5843	0.4354	0.5439	0.0006	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.4754	0.4504	0.3876	0.3421	0.4477	0.0007	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.2876	0.2703	0.2292	0.2519	0.3363	0.0007	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1940	0.1834	0.1597	0.1794	0.2319	0.0007	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1320	0.1287	0.1185	0.1284	0.1504	0.0021	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0758	0.0869	0.0877	0.0865	0.0858	0.0105	0.0011	0.0001	0.0000
ROW # =13	0.0000	0.0770	0.1027	0.1059	0.1036	0.1041	0.0274	0.0053	0.0009	0.0002
ROW # =14	0.0000	0.0465	0.0730	0.0803	0.0815	0.0858	0.0365	0.0115	0.0032	0.0008
ROW # =15	0.0000	0.0216	0.0389	0.0459	0.0480	0.0510	0.0271	0.0104	0.0033	0.0009
ROW # =16	0.0000	0.0074	0.0150	0.0187	0.0199	0.0213	0.0128	0.0055	0.0018	0.0005
ROW # =17	0.0000	0.0021	0.0046	0.0059	0.0063	0.0068	0.0044	0.0020	0.0007	0.0002
ROW # =18	0.0000	0.0001	0.0002	0.0003	0.0003	0.0004	0.0002	0.0001	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0162	0.0155	0.0178	0.0251	0.0340	0.0041	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0351	0.0368	0.0411	0.0426	0.0095	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0158	0.0163	0.0173	0.0166	0.0284	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0191	0.0193	0.0196	0.0176	0.0170	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0217	0.0216	0.0212	0.0179	0.0189	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0215	0.0210	0.0195	0.0151	0.0179	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0198	0.0191	0.0173	0.0129	0.0161	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0141	0.0133	0.0115	0.0101	0.0133	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0085	0.0080	0.0068	0.0075	0.0100	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0057	0.0054	0.0047	0.0053	0.0069	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0039	0.0038	0.0035	0.0038	0.0045	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0022	0.0026	0.0026	0.0026	0.0076	0.0009	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8896	0.8927	0.8898	0.8750	1.2170	1.2546	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7186	0.7092	0.6774	0.8409	0.9250	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6361	0.6257	0.5925	0.5990	0.6688	0.0003	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4148	0.4076	0.3848	0.3143	0.3533	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.3757	0.3690	0.3476	0.2780	0.3137	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3050	0.2995	0.2819	0.2261	0.2543	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.2739	0.2688	0.2524	0.2018	0.2266	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.4272	0.4177	0.3875	0.1798	0.2021	0.0004	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3372	0.3283	0.3020	0.1621	0.1818	0.0005	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1594	0.1568	0.1453	0.1490	0.1662	0.0007	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1467	0.1471	0.1370	0.1396	0.1553	0.0027	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1116	0.1196	0.1114	0.1115	0.1214	0.0111	0.0009	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.991667E+03 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0363	0.0344	0.0407	0.0626	0.0926	0.0192	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.2427	0.2597	0.3069	0.3456	0.1941	0.0002	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.3435	0.3608	0.4046	0.4255	0.3129	0.0003	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4329	0.4476	0.4809	0.4728	0.3957	0.0004	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.5221	0.5319	0.5494	0.5058	0.4688	0.0004	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.6145	0.6102	0.5908	0.4891	0.5281	0.0006	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.6244	0.6130	0.5758	0.4547	0.5250	0.0007	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5245	0.5039	0.4469	0.3929	0.4835	0.0008	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3679	0.3480	0.2972	0.3162	0.4088	0.0009	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2695	0.2537	0.2158	0.2397	0.3154	0.0011	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1875	0.1791	0.1553	0.1721	0.2212	0.0031	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0826	0.0909	0.0882	0.0904	0.0961	0.0101	0.0011	0.0001	0.0000
ROW # =13	0.0000	0.0721	0.0967	0.1005	0.0992	0.0999	0.0266	0.0053	0.0010	0.0002
ROW # =14	0.0000	0.0462	0.0739	0.0822	0.0836	0.0874	0.0383	0.0124	0.0035	0.0009
ROW # =15	0.0000	0.0225	0.0411	0.0490	0.0514	0.0545	0.0296	0.0116	0.0038	0.0010
ROW # =16	0.0000	0.0080	0.0164	0.0207	0.0222	0.0237	0.0146	0.0064	0.0022	0.0006
ROW # =17	0.0000	0.0023	0.0052	0.0068	0.0074	0.0079	0.0052	0.0024	0.0009	0.0002
ROW # =18	0.0000	0.0001	0.0003	0.0004	0.0004	0.0005	0.0003	0.0001	0.0001	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0075	0.0071	0.0084	0.0130	0.0191	0.0017	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0215	0.0230	0.0272	0.0307	0.0057	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0102	0.0107	0.0120	0.0126	0.0185	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0128	0.0132	0.0142	0.0140	0.0117	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0155	0.0157	0.0163	0.0150	0.0139	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0182	0.0181	0.0175	0.0145	0.0156	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0185	0.0181	0.0170	0.0135	0.0155	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0155	0.0149	0.0132	0.0116	0.0143	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0109	0.0103	0.0088	0.0094	0.0121	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0080	0.0075	0.0064	0.0071	0.0093	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0056	0.0053	0.0046	0.0051	0.0065	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0024	0.0027	0.0026	0.0027	0.0085	0.0009	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8919	0.8948	0.8923	0.8787	1.2246	1.2565	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7320	0.7233	0.6937	0.8666	0.9409	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6549	0.6452	0.6138	0.6256	0.6900	0.0003	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4317	0.4250	0.4030	0.3316	0.3690	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.3960	0.3895	0.3682	0.2962	0.3318	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3281	0.3223	0.3037	0.2435	0.2741	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.2973	0.2916	0.2735	0.2179	0.2460	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.4637	0.4527	0.4181	0.1937	0.2197	0.0004	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3616	0.3513	0.3214	0.1733	0.1967	0.0005	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1688	0.1658	0.1531	0.1578	0.1778	0.0007	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1537	0.1539	0.1431	0.1464	0.1638	0.0029	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1163	0.1248	0.1166	0.1168	0.1268	0.0117	0.0010	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.102500E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0168	0.0158	0.0193	0.0323	0.0522	0.0080	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.1458	0.1593	0.1989	0.2435	0.1153	0.0001	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.2131	0.2286	0.2710	0.3120	0.1963	0.0002	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.2772	0.2926	0.3322	0.3577	0.2582	0.0003	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.3482	0.3620	0.3944	0.3972	0.3201	0.0003	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.4711	0.4758	0.4807	0.4284	0.4159	0.0006	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.5166	0.5157	0.5047	0.4260	0.4472	0.0007	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5019	0.4903	0.4519	0.3994	0.4519	0.0009	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.4077	0.3906	0.3425	0.3506	0.4239	0.0011	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.3298	0.3130	0.2691	0.2887	0.3652	0.0014	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2481	0.2370	0.2028	0.2210	0.2851	0.0043	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1010	0.1067	0.0988	0.1040	0.1175	0.0105	0.0010	0.0001	0.0000
ROW # =13	0.0000	0.0721	0.0949	0.0978	0.0982	0.1010	0.0259	0.0053	0.0010	0.0002
ROW # =14	0.0000	0.0455	0.0741	0.0834	0.0851	0.0886	0.0398	0.0132	0.0038	0.0010
ROW # =15	0.0000	0.0233	0.0431	0.0519	0.0546	0.0579	0.0320	0.0129	0.0043	0.0012
ROW # =16	0.0000	0.0086	0.0178	0.0227	0.0245	0.0263	0.0164	0.0074	0.0026	0.0008
ROW # =17	0.0000	0.0025	0.0058	0.0077	0.0085	0.0092	0.0061	0.0029	0.0011	0.0003
ROW # =18	0.0000	0.0001	0.0003	0.0005	0.0005	0.0006	0.0004	0.0002	0.0001	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0035	0.0033	0.0040	0.0067	0.0108	0.0007	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0129	0.0141	0.0176	0.0216	0.0034	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0063	0.0068	0.0080	0.0092	0.0116	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0082	0.0087	0.0098	0.0106	0.0076	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0103	0.0107	0.0117	0.0118	0.0095	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0139	0.0141	0.0142	0.0127	0.0123	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0153	0.0153	0.0149	0.0126	0.0132	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0149	0.0145	0.0134	0.0118	0.0134	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0121	0.0116	0.0101	0.0104	0.0125	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0098	0.0093	0.0080	0.0085	0.0108	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0073	0.0070	0.0060	0.0065	0.0084	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0030	0.0032	0.0029	0.0031	0.0104	0.0009	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8929	0.8958	0.8935	0.8806	1.2289	1.2573	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7401	0.7321	0.7043	0.8849	0.9504	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6667	0.6578	0.6283	0.6455	0.7037	0.0003	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4428	0.4366	0.4158	0.3451	0.3796	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4100	0.4039	0.3835	0.3110	0.3447	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3467	0.3410	0.3222	0.2595	0.2906	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3177	0.3120	0.2931	0.2338	0.2636	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5011	0.4891	0.4512	0.2086	0.2374	0.0004	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3904	0.3787	0.3452	0.1865	0.2132	0.0005	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1812	0.1775	0.1632	0.1689	0.1922	0.0008	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1633	0.1632	0.1512	0.1554	0.1755	0.0030	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1218	0.1307	0.1222	0.1226	0.1332	0.0124	0.0010	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.105833E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0078	0.0072	0.0091	0.0167	0.0294	0.0033	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0863	0.0963	0.1269	0.1689	0.0678	0.0001	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.1291	0.1414	0.1771	0.2230	0.1200	0.0002	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.1717	0.1851	0.2219	0.2616	0.1623	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.2219	0.2355	0.2708	0.2983	0.2077	0.0003	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3362	0.3455	0.3650	0.3512	0.3038	0.0005	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3909	0.3971	0.4059	0.3680	0.3473	0.0006	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.4303	0.4279	0.4116	0.3686	0.3781	0.0008	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3995	0.3889	0.3534	0.3489	0.3869	0.0011	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.3552	0.3417	0.3018	0.3110	0.3676	0.0016	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2919	0.2817	0.2445	0.2578	0.3187	0.0052	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1253	0.1298	0.1170	0.1234	0.1430	0.0116	0.0010	0.0001	0.0000
ROW # =13	0.0000	0.0779	0.0990	0.0998	0.1018	0.1081	0.0258	0.0053	0.0010	0.0002
ROW # =14	0.0000	0.0453	0.0742	0.0842	0.0865	0.0900	0.0411	0.0140	0.0041	0.0011
ROW # =15	0.0000	0.0238	0.0448	0.0545	0.0576	0.0610	0.0344	0.0142	0.0048	0.0014
ROW # =16	0.0000	0.0091	0.0192	0.0247	0.0269	0.0288	0.0183	0.0084	0.0031	0.0010
ROW # =17	0.0000	0.0028	0.0065	0.0087	0.0097	0.0105	0.0071	0.0035	0.0013	0.0004
ROW # =18	0.0000	0.0002	0.0004	0.0005	0.0006	0.0007	0.0005	0.0002	0.0001	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0016	0.0015	0.0019	0.0035	0.0061	0.0003	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0077	0.0085	0.0113	0.0150	0.0020	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0038	0.0042	0.0052	0.0066	0.0071	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0051	0.0055	0.0066	0.0077	0.0048	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0066	0.0070	0.0080	0.0088	0.0061	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0100	0.0102	0.0108	0.0104	0.0090	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0116	0.0118	0.0120	0.0109	0.0103	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0127	0.0127	0.0122	0.0109	0.0112	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0118	0.0115	0.0105	0.0103	0.0115	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0105	0.0101	0.0089	0.0092	0.0109	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0086	0.0083	0.0072	0.0076	0.0094	0.0002	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0037	0.0038	0.0035	0.0037	0.0127	0.0010	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8934	0.8963	0.8941	0.8816	1.2313	1.2576	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7450	0.7375	0.7112	0.8977	0.9561	0.0003	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6740	0.6657	0.6379	0.6599	0.7121	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4498	0.4441	0.4246	0.3551	0.3863	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4191	0.4135	0.3943	0.3223	0.3532	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3605	0.3551	0.3368	0.2730	0.3030	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3340	0.3284	0.3095	0.2481	0.2779	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5350	0.5226	0.4828	0.2230	0.2531	0.0004	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.4204	0.4077	0.3711	0.2004	0.2294	0.0006	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1953	0.1911	0.1751	0.1815	0.2078	0.0009	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1753	0.1749	0.1613	0.1663	0.1894	0.0032	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1285	0.1378	0.1286	0.1294	0.1410	0.0130	0.0011	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.109167E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0036	0.0033	0.0043	0.0086	0.0166	0.0014	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0506	0.0575	0.0800	0.1158	0.0395	0.0001	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0769	0.0860	0.1137	0.1564	0.0720	0.0001	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.1039	0.1143	0.1448	0.1866	0.0993	0.0001	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.1371	0.1485	0.1802	0.2170	0.1302	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.2277	0.2382	0.2634	0.2740	0.2097	0.0004	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.2770	0.2864	0.3063	0.2990	0.2517	0.0005	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.3389	0.3434	0.3455	0.3158	0.2909	0.0007	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.3545	0.3511	0.3322	0.3181	0.3197	0.0010	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.3426	0.3349	0.3064	0.3039	0.3301	0.0015	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.3060	0.2998	0.2675	0.2720	0.3147	0.0057	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1477	0.1530	0.1373	0.1426	0.1645	0.0133	0.0011	0.0001	0.0000
ROW # =13	0.0000	0.0884	0.1086	0.1068	0.1097	0.1199	0.0265	0.0053	0.0010	0.0002
ROW # =14	0.0000	0.0458	0.0750	0.0853	0.0882	0.0922	0.0422	0.0147	0.0044	0.0012
ROW # =15	0.0000	0.0243	0.0462	0.0568	0.0605	0.0639	0.0367	0.0154	0.0054	0.0016
ROW # =16	0.0000	0.0096	0.0205	0.0267	0.0293	0.0314	0.0203	0.0096	0.0036	0.0012
ROW # =17	0.0000	0.0030	0.0072	0.0098	0.0109	0.0119	0.0082	0.0041	0.0016	0.0005
ROW # =18	0.0000	0.0002	0.0005	0.0006	0.0007	0.0008	0.0006	0.0003	0.0001	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0007	0.0007	0.0009	0.0018	0.0034	0.0001	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0045	0.0051	0.0071	0.0103	0.0012	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0023	0.0025	0.0034	0.0046	0.0043	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0031	0.0034	0.0043	0.0055	0.0029	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0041	0.0044	0.0053	0.0064	0.0039	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0067	0.0070	0.0078	0.0081	0.0062	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0082	0.0085	0.0091	0.0089	0.0074	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0100	0.0102	0.0102	0.0093	0.0086	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0105	0.0104	0.0098	0.0094	0.0095	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0101	0.0099	0.0091	0.0090	0.0098	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0091	0.0089	0.0079	0.0081	0.0093	0.0002	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0044	0.0045	0.0041	0.0042	0.0146	0.0012	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8936	0.8965	0.8943	0.8821	1.2327	1.2578	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7478	0.7407	0.7155	0.9066	0.9594	0.0004	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6784	0.6705	0.6441	0.6701	0.7172	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4541	0.4488	0.4303	0.3623	0.3905	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4248	0.4197	0.4016	0.3307	0.3587	0.0002	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3701	0.3651	0.3476	0.2838	0.3119	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3458	0.3406	0.3223	0.2601	0.2886	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5628	0.5506	0.5104	0.2358	0.2656	0.0005	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.4484	0.4352	0.3965	0.2135	0.2433	0.0006	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2096	0.2051	0.1878	0.1944	0.2225	0.0009	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1886	0.1880	0.1729	0.1785	0.2041	0.0035	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1368	0.1463	0.1363	0.1374	0.1503	0.0138	0.0011	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.112500E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0017	0.0015	0.0020	0.0044	0.0093	0.0006	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0294	0.0341	0.0499	0.0786	0.0229	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0453	0.0516	0.0720	0.1081	0.0426	0.0001	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0619	0.0695	0.0928	0.1307	0.0597	0.0001	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0828	0.0915	0.1173	0.1542	0.0795	0.0001	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.1483	0.1579	0.1830	0.2060	0.1388	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.1868	0.1967	0.2203	0.2320	0.1730	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.2500	0.2581	0.2722	0.2555	0.2098	0.0005	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.2904	0.2929	0.2894	0.2709	0.2444	0.0008	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.3017	0.3001	0.2855	0.2743	0.2706	0.0014	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2902	0.2893	0.2671	0.2628	0.2803	0.0055	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1616	0.1694	0.1536	0.1562	0.1759	0.0149	0.0012	0.0001	0.0000
ROW # =13	0.0000	0.1006	0.1213	0.1174	0.1202	0.1331	0.0282	0.0053	0.0010	0.0002
ROW # =14	0.0000	0.0475	0.0769	0.0872	0.0907	0.0956	0.0435	0.0154	0.0047	0.0013
ROW # =15	0.0000	0.0248	0.0476	0.0590	0.0631	0.0668	0.0389	0.0167	0.0060	0.0018
ROW # =16	0.0000	0.0100	0.0217	0.0287	0.0317	0.0340	0.0224	0.0108	0.0042	0.0014
ROW # =17	0.0000	0.0033	0.0079	0.0109	0.0123	0.0134	0.0094	0.0048	0.0020	0.0007
ROW # =18	0.0000	0.0002	0.0005	0.0008	0.0009	0.0010	0.0007	0.0004	0.0002	0.0001
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0003	0.0003	0.0004	0.0009	0.0019	0.0001	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0026	0.0030	0.0044	0.0070	0.0007	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0013	0.0015	0.0021	0.0032	0.0025	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0018	0.0021	0.0027	0.0039	0.0018	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0025	0.0027	0.0035	0.0046	0.0024	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0044	0.0047	0.0054	0.0061	0.0041	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0055	0.0058	0.0065	0.0069	0.0051	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0074	0.0076	0.0081	0.0076	0.0062	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0086	0.0087	0.0086	0.0080	0.0072	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0089	0.0089	0.0085	0.0081	0.0080	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0086	0.0086	0.0079	0.0078	0.0083	0.0002	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0048	0.0050	0.0045	0.0046	0.0156	0.0013	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8937	0.8966	0.8945	0.8824	1.2335	1.2578	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7495	0.7426	0.7183	0.9126	0.9613	0.0004	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6809	0.6735	0.6481	0.6771	0.7202	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4567	0.4517	0.4341	0.3674	0.3930	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4283	0.4235	0.4064	0.3367	0.3621	0.0003	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3764	0.3718	0.3552	0.2921	0.3178	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3540	0.3492	0.3318	0.2696	0.2962	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5840	0.5724	0.5329	0.2465	0.2749	0.0005	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.4722	0.4590	0.4195	0.2251	0.2544	0.0007	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2228	0.2183	0.2001	0.2066	0.2352	0.0010	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2018	0.2012	0.1851	0.1907	0.2178	0.0038	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1461	0.1560	0.1450	0.1464	0.1605	0.0146	0.0012	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.115833E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0008	0.0007	0.0010	0.0023	0.0053	0.0002	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0170	0.0200	0.0309	0.0530	0.0132	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0264	0.0307	0.0451	0.0739	0.0250	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0364	0.0417	0.0587	0.0903	0.0354	0.0001	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0492	0.0555	0.0750	0.1077	0.0477	0.0001	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0937	0.1016	0.1235	0.1505	0.0890	0.0002	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.1214	0.1301	0.1528	0.1738	0.1143	0.0003	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.1752	0.1844	0.2039	0.1979	0.1439	0.0004	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.2231	0.2292	0.2369	0.2186	0.1759	0.0006	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2467	0.2497	0.2478	0.2323	0.2064	0.0011	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2531	0.2570	0.2464	0.2359	0.2296	0.0049	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1640	0.1751	0.1620	0.1611	0.1754	0.0161	0.0013	0.0001	0.0000
ROW # =13	0.0000	0.1112	0.1339	0.1288	0.1306	0.1445	0.0303	0.0055	0.0010	0.0002
ROW # =14	0.0000	0.0502	0.0799	0.0902	0.0941	0.0999	0.0450	0.0160	0.0050	0.0014
ROW # =15	0.0000	0.0254	0.0490	0.0611	0.0658	0.0698	0.0411	0.0180	0.0066	0.0021
ROW # =16	0.0000	0.0105	0.0229	0.0306	0.0340	0.0366	0.0245	0.0121	0.0048	0.0016
ROW # =17	0.0000	0.0035	0.0086	0.0120	0.0137	0.0149	0.0107	0.0056	0.0023	0.0008
ROW # =18	0.0000	0.0002	0.0006	0.0009	0.0010	0.0011	0.0008	0.0005	0.0002	0.0001
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0002	0.0001	0.0002	0.0005	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0015	0.0018	0.0027	0.0047	0.0004	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0008	0.0009	0.0013	0.0022	0.0015	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0011	0.0012	0.0017	0.0027	0.0010	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0015	0.0016	0.0022	0.0032	0.0014	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0028	0.0030	0.0037	0.0045	0.0026	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0036	0.0039	0.0045	0.0051	0.0034	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0052	0.0055	0.0060	0.0059	0.0043	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0066	0.0068	0.0070	0.0065	0.0052	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0073	0.0074	0.0073	0.0069	0.0061	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0075	0.0076	0.0073	0.0070	0.0068	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0049	0.0052	0.0048	0.0048	0.0156	0.0014	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8938	0.8966	0.8945	0.8825	1.2339	1.2579	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7504	0.7437	0.7200	0.9167	0.9624	0.0004	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6825	0.6752	0.6506	0.6820	0.7220	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4582	0.4534	0.4364	0.3710	0.3946	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4304	0.4259	0.4095	0.3410	0.3641	0.0003	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3805	0.3762	0.3604	0.2982	0.3217	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3595	0.3550	0.3384	0.2768	0.3013	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.5992	0.5883	0.5502	0.2550	0.2815	0.0005	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.4911	0.4782	0.4389	0.2347	0.2627	0.0007	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2341	0.2296	0.2112	0.2172	0.2452	0.0010	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2139	0.2135	0.1967	0.2021	0.2295	0.0040	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1559	0.1664	0.1546	0.1559	0.1711	0.0155	0.0013	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.119167E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0004	0.0003	0.0005	0.0012	0.0030	0.0001	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0097	0.0117	0.0191	0.0355	0.0076	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0153	0.0181	0.0281	0.0501	0.0146	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0212	0.0248	0.0368	0.0617	0.0208	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0289	0.0333	0.0474	0.0743	0.0283	0.0001	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0579	0.0639	0.0815	0.1076	0.0556	0.0001	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0766	0.0836	0.1030	0.1268	0.0732	0.0002	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.1179	0.1265	0.1469	0.1482	0.0950	0.0003	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.1627	0.1703	0.1843	0.1692	0.1207	0.0005	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1897	0.1956	0.2028	0.1870	0.1487	0.0009	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2059	0.2131	0.2127	0.1994	0.1758	0.0040	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1554	0.1697	0.1610	0.1570	0.1645	0.0167	0.0014	0.0001	0.0000
ROW # =13	0.0000	0.1176	0.1431	0.1384	0.1386	0.1513	0.0325	0.0058	0.0010	0.0002
ROW # =14	0.0000	0.0533	0.0839	0.0940	0.0981	0.1048	0.0467	0.0167	0.0053	0.0015
ROW # =15	0.0000	0.0262	0.0505	0.0633	0.0685	0.0729	0.0432	0.0192	0.0072	0.0023
ROW # =16	0.0000	0.0109	0.0241	0.0325	0.0364	0.0393	0.0266	0.0134	0.0055	0.0019
ROW # =17	0.0000	0.0038	0.0093	0.0131	0.0151	0.0165	0.0120	0.0065	0.0028	0.0010
ROW # =18	0.0000	0.0002	0.0007	0.0010	0.0012	0.0013	0.0010	0.0006	0.0002	0.0001
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0001	0.0001	0.0001	0.0002	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0009	0.0010	0.0017	0.0032	0.0002	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0005	0.0005	0.0008	0.0015	0.0009	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0006	0.0007	0.0011	0.0018	0.0006	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0009	0.0010	0.0014	0.0022	0.0008	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0017	0.0019	0.0024	0.0032	0.0016	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0023	0.0025	0.0031	0.0038	0.0022	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0035	0.0037	0.0043	0.0044	0.0028	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0048	0.0050	0.0055	0.0050	0.0036	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0056	0.0058	0.0060	0.0055	0.0044	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0061	0.0063	0.0063	0.0059	0.0052	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0046	0.0050	0.0048	0.0046	0.0146	0.0015	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8938	0.8967	0.8945	0.8826	1.2342	1.2579	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7510	0.7444	0.7210	0.9194	0.9630	0.0004	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6833	0.6762	0.6521	0.6853	0.7231	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4591	0.4544	0.4379	0.3734	0.3954	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4317	0.4273	0.4114	0.3439	0.3653	0.0003	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3831	0.3790	0.3639	0.3027	0.3242	0.0003	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3630	0.3588	0.3430	0.2822	0.3046	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.6097	0.5995	0.5629	0.2614	0.2859	0.0005	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.5053	0.4929	0.4544	0.2423	0.2685	0.0007	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2429	0.2388	0.2206	0.2260	0.2526	0.0011	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2240	0.2240	0.2071	0.2120	0.2388	0.0042	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1656	0.1768	0.1643	0.1655	0.1814	0.0165	0.0014	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.122500E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0002	0.0001	0.0002	0.0006	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0056	0.0068	0.0117	0.0237	0.0044	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0088	0.0106	0.0173	0.0337	0.0085	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0123	0.0146	0.0229	0.0418	0.0121	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0169	0.0198	0.0297	0.0507	0.0166	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0351	0.0395	0.0528	0.0756	0.0341	0.0001	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0473	0.0526	0.0680	0.0905	0.0457	0.0001	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0768	0.0840	0.1024	0.1081	0.0609	0.0002	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.1137	0.1213	0.1376	0.1267	0.0798	0.0003	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.1388	0.1458	0.1581	0.1446	0.1023	0.0006	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1581	0.1667	0.1736	0.1606	0.1275	0.0031	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1387	0.1553	0.1514	0.1455	0.1464	0.0164	0.0014	0.0001	0.0000
ROW # =13	0.0000	0.1185	0.1471	0.1441	0.1426	0.1525	0.0343	0.0061	0.0011	0.0002
ROW # =14	0.0000	0.0563	0.0881	0.0983	0.1024	0.1096	0.0486	0.0174	0.0056	0.0016
ROW # =15	0.0000	0.0272	0.0523	0.0657	0.0713	0.0762	0.0454	0.0205	0.0078	0.0026
ROW # =16	0.0000	0.0113	0.0252	0.0344	0.0387	0.0420	0.0288	0.0147	0.0062	0.0022
ROW # =17	0.0000	0.0040	0.0099	0.0143	0.0166	0.0182	0.0135	0.0074	0.0032	0.0012
ROW # =18	0.0000	0.0003	0.0007	0.0011	0.0013	0.0015	0.0012	0.0007	0.0003	0.0001
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0000	0.0000	0.0000	0.0001	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0005	0.0006	0.0010	0.0021	0.0001	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0003	0.0003	0.0005	0.0010	0.0005	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0004	0.0004	0.0007	0.0012	0.0004	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0005	0.0006	0.0009	0.0015	0.0005	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0010	0.0012	0.0016	0.0022	0.0010	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0014	0.0016	0.0020	0.0027	0.0014	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0023	0.0025	0.0030	0.0032	0.0018	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0034	0.0036	0.0041	0.0037	0.0024	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0041	0.0043	0.0047	0.0043	0.0030	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0047	0.0049	0.0051	0.0048	0.0038	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0041	0.0046	0.0045	0.0043	0.0130	0.0015	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1	0.8938	0.8967	0.8946	0.8826	1.2343	1.2579	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.7513	0.7448	0.7217	0.9213	0.9634	0.0004	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.6838	0.6768	0.6531	0.6876	0.7237	0.0004	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.4596	0.4551	0.4389	0.3751	0.3960	0.0002	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.4324	0.4281	0.4127	0.3459	0.3660	0.0003	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.3846	0.3808	0.3662	0.3058	0.3257	0.0004	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.3651	0.3612	0.3460	0.2860	0.3067	0.0004	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.6166	0.6071	0.5719	0.2662	0.2888	0.0005	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.5154	0.5036	0.4662	0.2481	0.2724	0.0007	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.2496	0.2458	0.2280	0.2329	0.2579	0.0011	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.2320	0.2325	0.2158	0.2202	0.2457	0.0044	0.0001	0.0000	0.0000
ROW # =12	0.0000	0.1744	0.1866	0.1737	0.1746	0.1907	0.0175	0.0014	0.0001	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TIME = 0.125833E+04 DAY SOLUTION CONCENTRATION (PPM)

ROW # = 1	0.0001	0.0001	0.0001	0.0003	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0032	0.0040	0.0071	0.0157	0.0025	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0050	0.0062	0.0106	0.0226	0.0049	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0071	0.0086	0.0141	0.0281	0.0070	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0097	0.0117	0.0184	0.0343	0.0097	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0210	0.0240	0.0338	0.0524	0.0206	0.0001	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0287	0.0325	0.0441	0.0635	0.0280	0.0001	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0487	0.0543	0.0696	0.0772	0.0381	0.0001	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0768	0.0835	0.0993	0.0924	0.0512	0.0002	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0974	0.1043	0.1184	0.1082	0.0679	0.0004	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.1157	0.1244	0.1352	0.1244	0.0884	0.0022	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.1177	0.1353	0.1356	0.1291	0.1249	0.0155	0.0015	0.0001	0.0000
ROW # =13	0.0000	0.1140	0.1451	0.1446	0.1418	0.1481	0.0353	0.0064	0.0011	0.0002
ROW # =14	0.0000	0.0587	0.0919	0.1025	0.1064	0.1138	0.0507	0.0181	0.0059	0.0018
ROW # =15	0.0000	0.0283	0.0542	0.0682	0.0743	0.0796	0.0476	0.0217	0.0084	0.0028
ROW # =16	0.0000	0.0117	0.0264	0.0362	0.0411	0.0447	0.0310	0.0161	0.0069	0.0025
ROW # =17	0.0000	0.0042	0.0106	0.0155	0.0181	0.0200	0.0149	0.0084	0.0038	0.0014
ROW # =18	0.0000	0.0003	0.0008	0.0013	0.0015	0.0017	0.0013	0.0008	0.0004	0.0001
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

INSTANTANEOUS ABSORPTION OF THE POLLUTANT IN PPM BASED ON SOLID PHASE

ROW # = 1	0.0000	0.0000	0.0000	0.0001	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # = 2	0.0000	0.0003	0.0004	0.0006	0.0014	0.0001	0.0000	0.0000	0.0000	0.0000
ROW # = 3	0.0000	0.0001	0.0002	0.0003	0.0007	0.0003	0.0000	0.0000	0.0000	0.0000
ROW # = 4	0.0000	0.0002	0.0003	0.0004	0.0008	0.0002	0.0000	0.0000	0.0000	0.0000
ROW # = 5	0.0000	0.0003	0.0003	0.0005	0.0010	0.0003	0.0000	0.0000	0.0000	0.0000
ROW # = 6	0.0000	0.0006	0.0007	0.0010	0.0016	0.0006	0.0000	0.0000	0.0000	0.0000
ROW # = 7	0.0000	0.0008	0.0010	0.0013	0.0019	0.0008	0.0000	0.0000	0.0000	0.0000
ROW # = 8	0.0000	0.0014	0.0016	0.0021	0.0023	0.0011	0.0000	0.0000	0.0000	0.0000
ROW # = 9	0.0000	0.0023	0.0025	0.0029	0.0027	0.0015	0.0000	0.0000	0.0000	0.0000
ROW # =10	0.0000	0.0029	0.0031	0.0035	0.0032	0.0020	0.0000	0.0000	0.0000	0.0000
ROW # =11	0.0000	0.0034	0.0037	0.0040	0.0037	0.0026	0.0001	0.0000	0.0000	0.0000
ROW # =12	0.0000	0.0035	0.0040	0.0040	0.0038	0.0111	0.0014	0.0001	0.0000	0.0000
ROW # =13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ROW # =19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DECREASE OF POLLUTANT BY DEGRADATION OF THE LIQUID PHASE

ROW # = 1

0.8938	0.8967	0.8946	0.8827	1.2344	1.2579	0.0000	0.0000	0.0000	0.0000

ROW # = 2

0.0000	0.7515	0.7450	0.7221	0.9225	0.9636	0.0004	0.0000	0.0000	0.0000

ROW # = 3

0.0000	0.6841	0.6772	0.6537	0.6891	0.7241	0.0004	0.0000	0.0000	0.0000

ROW # = 4

0.0000	0.4599	0.4554	0.4395	0.3762	0.3963	0.0002	0.0000	0.0000	0.0000

ROW # = 5

0.0000	0.4328	0.4286	0.4134	0.3473	0.3665	0.0003	0.0000	0.0000	0.0000

ROW # = 6

0.0000	0.3856	0.3818	0.3677	0.3080	0.3267	0.0004	0.0000	0.0000	0.0000

ROW # = 7

0.0000	0.3665	0.3627	0.3480	0.2888	0.3080	0.0004	0.0000	0.0000	0.0000

ROW # = 8

0.0000	0.6211	0.6120	0.5781	0.2696	0.2906	0.0005	0.0000	0.0000	0.0000

ROW # = 9

0.0000	0.5224	0.5111	0.4749	0.2524	0.2750	0.0007	0.0000	0.0000	0.0000

ROW # =10

0.0000	0.2544	0.2509	0.2337	0.2381	0.2614	0.0011	0.0000	0.0000	0.0000

ROW # =11

0.0000	0.2380	0.2389	0.2228	0.2266	0.2506	0.0045	0.0001	0.0000	0.0000

ROW # =12

0.0000	0.1821	0.1954	0.1824	0.1829	0.1989	0.0185	0.0015	0.0001	0.0000

ROW # =13

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =14

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =15

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =16

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =17

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =18

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

ROW # =19

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

APPENDIX H

LIST OF SYMBOLS USED IN THE MODEL DEVELOPMENT

APPENDIX H

LIST OF SYMBOLS USED IN THE MODEL DEVELOPMENT

a	rate of transformation in the solid phase ($time^{-1}$)
C	solute concentration (mass of solute per unit volume of solution)
C_{ej}	equilibrium concentration or threshold concentration before the reaction can proceed; this term usually equals zero for chemical processes (mass of solute per unit volume of solution)
H	total hydraulic head
j	index
k_d	solid/liquid partition coefficient
K	isotropic hydraulic conductivity
$\tilde{P}_e$	estimated pressure head in element e
P	pressure head
q	flux (mass per unit area per unit time)
S	solute concentration in soil matrix (mass of solute per unit mass of solids)
t	time
x	distance normal to gravitational field
y	dimension parellel to gravitational field or distance below a reference point (usually at or near soil surface) positive is down
Γ	global boundary
Γe	element boundary
Ω_e	domain of element e
ϕ	element basis function
ρ	bulk density of soil, mass of solids per unit volume
θ	water content ratio
λ	rate of chemical/biological/radioactive decay of solute in the liquid phase ($time^{-1}$)

USER'S MANUAL FOR TWO-DIMENSIONAL LANDFILL LEACHATE PLUMES (FORTRAN)

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FORTRAN PROGRAM FOR EVALUATING
LANDFILL LEACHATE PLUMES

BY

D. C. Kent, J. Wagner and F. Witz

Part I

Program Description

Introduction

A FORTRAN computer program has been developed to calculate plume concentrations. The equation is derived from Wilson and Miller (1978). The operation of the program is largely the same as that of the VSBASIC version described in the primary manual. The program can calculate and display the concentration at a single point or as a grid map of concentration. The parameters needed to describe the problem are defined in Table I-1.

The program was developed and tested using Microsoft FORTRAN-80 under CPM* on a North Star and Kaypro Microcomputer. With only minor changes, the program should function using any FORTRAN IV compiler. The program requires approximately 36K of user storage when using Microsoft FORTRAN-80 under CPM* on an 8 byte computer.

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* CPM is a registered trademark of Digital Research.

TABLE I-1

DEFINITION OF TERMS

Primary Variables:			(Units)
C	=	Concentration of leachate at a specific time and distance.	(M/L^3)
X	=	Distance from source where concentration of leachate is computed. Distance is measured in direction of ground-water flow (gradient).	(L)
y	=	Transverse distance measured from the center-line of ground-water flow.	(L)
t	=	Sample time from beginning of leachate source flow.	(T)
Aquifer Parameters:			
m	=	Effective aquifer thickness or zone of mixing.	(L)
n	=	Effective porosity of aquifer or zone of mixing.	(dimensionless)
V	=	Velocity of ground-water flow within voids; estimated directly or from: $V = \frac{KI}{n}$ (or) $V = \frac{TI}{mn}$	(L/T)
where:			
K	=	Coefficient of permeability or hydraulic conductivity of aquifer or zone of mixing.	(L/T)
T	=	Transmissivity of aquifer or zone of mixing.	(L^2/T)
I	=	Gradient of ground-water flow.	(dimensionless)

TABLE I-1
continued

Transport Parameters: (Units)

D_x	=	Longitudinal dispersion coefficient (mixing rate) in the x direction; estimated directly or from:	(L^2/T)

$$D_x = a_x V + D_m$$

where:

a_x	=	Longitudinal dispersivity.	(L)
D_m	=	Molecular diffusion coefficient, which is assumed to be negligible for velocities typical of permeable aquifers. D_m may be the dominant process in aquitards where $a_x V$ would be negligible ($V < 0.1$ cm/yr).	
D_y	=	Transverse dispersion coefficient (mixing rate) in the y direction; estimated directly or from:	(L^2/T)

$$D_y = a_y V + D_m \quad \text{(or)} \quad D_y = \frac{D_x}{D_r} + D_m$$

where:

a_y	=	Transverse dispersiviity	(L)
D_r	=	a ratio which commonly ranges between 5 and 10 for medium to coarse sand aquifers.	(dimensionless)
R_d	=	Retardation factor; estimated directly or from:	(dimensionless)

$$R_d = 1 + \frac{p_b K_d}{n_t} \quad \text{(or)} \quad R_d = \frac{V}{V_d}$$

where:

p_b	=	Bulk density of aquifer medium	(M/L^3)
n_t	=	Total porosity.	(dimensionless)
K_d	=	Distribution factor for sorption on aquifer medium (from sorption isotherm column studies).	(L^3/M)
V	=	Velocity of ground water.	(L/T)
V_d	=	Observed velocity of leachate for a given concentration and chemical species.	(L/T)

TABLE I-1
continued

Transport Parameters (continued): (Units)

γ	=	(Gamma) Coefficient for radioactive or biological decay. For no decay, the value is one. Calculated from:	(dimensionless)

$$\gamma = 1 + \frac{4D_x\lambda}{V^2} \quad \text{(or)} \quad \gamma = 1 + \frac{4D_x \log(2)}{V^2\, t_{1/2}}$$

where:

λ	=	(Lambda) Decay constant.	(1/T)
$t_{1/2}$	=	Halflife; time when half of the original mass remains.	(T)

Source Rate of Leachate:

Q_m	=	Mass flow rate estimated directly or obtained from:	(M/T)

$$Q_m = AQ_r \quad \text{(or)} \quad Q_m = QC_o$$

$$\text{(or)} \quad Q_m = AQ_vC_o$$

where:

Q_r	=	Mass per area flow rate.	(M/L^2T)
Q	=	Volume flow rate.	(L^3/T)
Q_v	=	Recharge rate.	(L/T)
A	=	Area of source.	(L^2)
C_o	=	Initial concentration.	(M/L^3)

TABLE I-1
continued

Intermediate Variables: (Units)

r	=	A weighted distance or radius; given by: $$r = \sqrt{(x^2 + \frac{D_x}{D_y} y^2)}$$	(L)
X_D	=	A characteristic dispersion length or scale factor; given by: $$X_D = \frac{D_x}{\sqrt{\gamma}\ V}$$	(L)
T_D	=	A characteristic dispersion time or scale factor; given by: $$T_D = \frac{R_d D_x}{\gamma\ V^2}$$	(T)
Q_D	=	A characteristic dilution-dispersion flow; given by: $$Q_D = nm\sqrt{D_x D_y}$$	(L^3/T)
r_m	=	Minimum distance from a non-point source for which equation has a certain accuracy; given by: $$r_m = \frac{V\sqrt{\gamma}\ L^2}{50\ D_x N}\ (1 + \frac{D_x}{D_y})$$ (or) $$r_m = \frac{L^2}{50\ X_D N}\ (1 + \frac{D_x}{D_y})$$	(L)

where:

N	=	Allowable approximation accuracy.	(dimensionless)
L	=	The greater of the source length and width.	

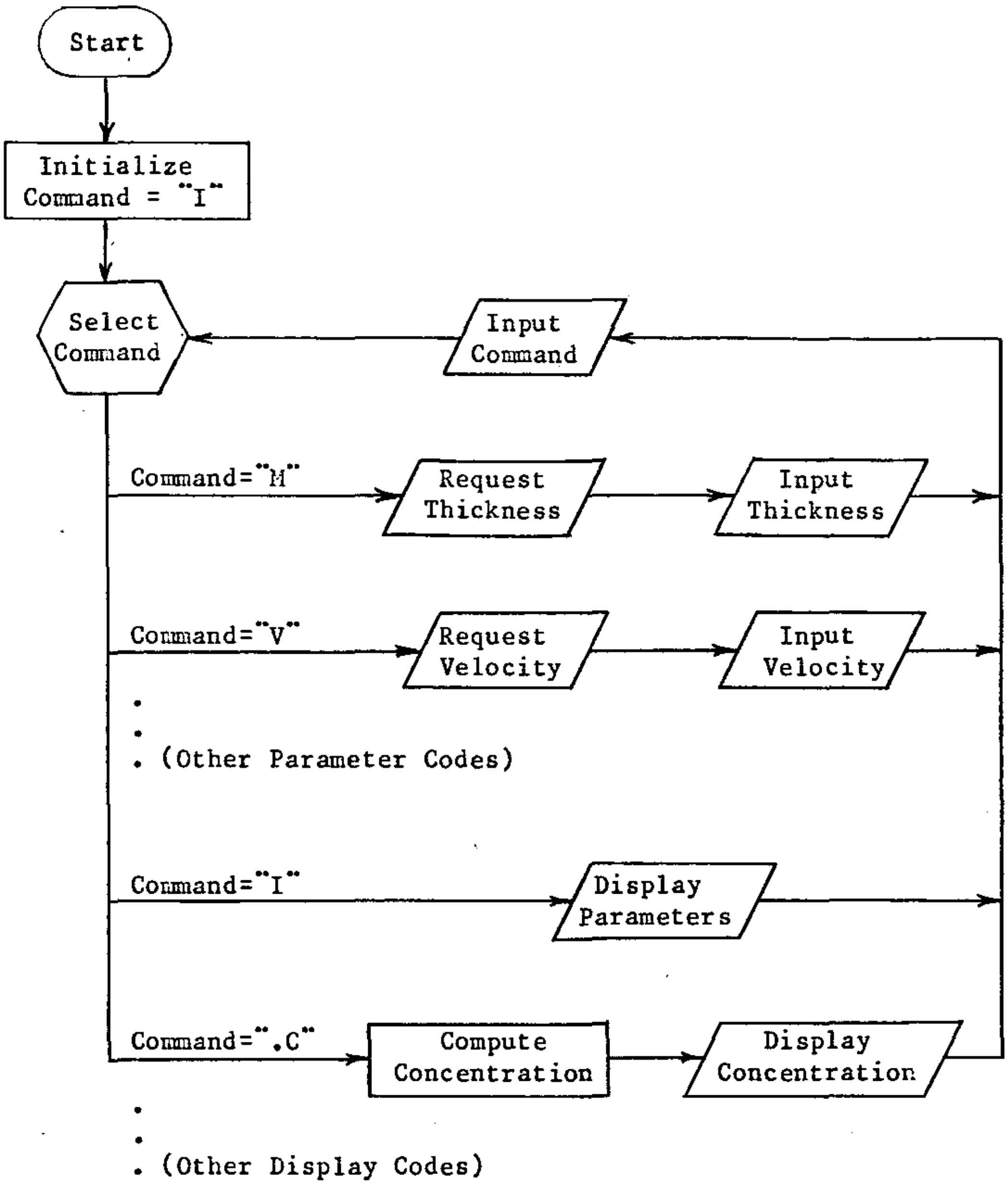

Figure I-1. Program Logic Flowchart

Assumptions and Limitations

The concentration equation is based on the following assumptions:

1. The ground-water flow regime is saturated.
2. The aquifer is unlimited (infinite) in areal extent (x and y directions).
3. All aquifer properties are homogeneous.
4. The ground-water flow is continuous and uniform in direction and velocity.
5. There is no dilution of the plume from recharge outside the source area.
6. The leachate source is a point in plain view.
7. The leachate is evenly distributed over the vertical dimension of the saturated zone.
8. The leachate source supplies a constant mass flow rate.

Although the program has been tested, the current version is subject to revision. As with any complex computer program, the results should be checked by professionals whenever safety is involved. The authors cannot assume any liability for damage resulting from the use of this program.

Program Description

Initialization

When the FORTRAN version is started, the user has the choice of entering all of the required parameters or recovering parameters saved during a previous execution of the program with the "OD" command. The units for any parameter (as listed in Appendix 1) can be modified in the BLOCK DATA section of the program, if the corresponding conversion factor (variable beginning with "U") is modified accordingly.

Commands

As shown by the flowchart in Figure I-1, once initialized, the program operates on the basis of requesting a command from the user, which designates a particular operation to be performed. In the FORTRAN version, all commands must be entered in upper case. (Many keyboards have a special shift for this purpose.) The commands are listed in Appendix I-A. The commands may be entered in any order, one at a time. A more detailed listing of the parameters and corresponding commands is also shown in Appendix I-A. The parameters are explained in Table I-1. During execution of the program, all parameters retain their values until changed by the user.

In some cases, more than one command is provided to enter a given parameter or to perform a given operation. Some commands provide a menu to select other commands (e.g. "D"), whereas some commands simply perform two or more other commands (e.g. ".IG"). When first using the program, most users will prefer to learn only one command for each operation. The commands used in the examples should serve this purpose and will be sufficient for most problems. Other commands for faster operation can be learned later.

Dispersion Coefficients

The program accepts either dispersion coefficient ("DX", "DY") or dipersivity ("AX", "AY"). If dispersivity is entered, then the dispersion coefficient will change whenever velocity is changed. Similarly, when the dispersion ratio ("DR") is used, the y dispersion coefficient ("DY") will change whenever the x dispersion coefficient ("DX") is changed. If the user enters a value for the y dispersion coefficient ("DY"), then the value entered will be retained until changed by the user.

Source data

The FORTRAN version accepts the source flow rate in any of the following forms:

1. Total mass flow
2. Mass per area flow
3. Volume flow and concentration
4. Volume per area flow and concentration .

The basic equation for concentration assumes a constant source flow rate. However, the equation can be applied to a source with a number of time steps, each having a constant flow rate. Computer memory limits the total number of time steps from all sources. The limit, displayed by the "Q" command, will vary from computer to computer. The limit, displayed by the "Q" command, will vary from computer to computer. The concentration can be displayed for sample times during any time step. (Time steps that have not begun are ignored.)

When organizing data for the program, the user must select a zero reference time. Source starting times (beginning of time step) and sample times (when concentration is calculated) are then described as the length of time before (negative time) or after (positive time) the reference time. The zero reference time must be chosen before the earliest desired sample time, because negative sample times are not allowed.

As time passes, the concentration at a given location reaches a constant value known as steady state. The steady state value for concentration can be useful, for example, as a "worst case" scenario. With the FORTRAN version, a negative value for sample time (usually -1) is used to request concentration at steady state. This is why actual sample times cannot be negative. (Negative values are allowed for starting times of source time steps.)

In the basic equation, the contaminant is assumed to enter the ground water directly below a point source. In practice, however, the equation can be used for locations far enough from a non-point source so that the source appears to be a point. Wilson and Miller (1978) provided two equations which relate the accuracy of approximation to the distance from the source, as shown in Table I-1. The FORTRAN version uses these equations to calculate an estimate of the accuracy of the results.

The FORTRAN version accepts data for either point or non-point sources. Since the equation requires sources to appear as point sources, the program divides non-point sources into subareas using one of the accuracy equations in the manner shown in Table I-1. The desired accuracy, initially 10% or 0.1, is set by the "QE" command. Sample locations near a large source could take considerable computation time (e.g 5 seconds on a microcomputer). To limit the computation to a reasonable time, a limit is placed on the number of subareas for each source. The limit is initially set at 100 subareas, but may be changed by the "QN" command.

The FORTRAN version accepts data for multiple sources. As a result, the source location is requested. As with time, the user must select an arbitrary zero reference location. Source and sample locations are then described as the distance down-gradient (+x) or up-gradient (-x) from the zero reference and the perpendicular distance from the x axis (+ or -y). After all information for one source has been entered, the program will allow adding another source. Another source can also be added after concentration has been displayed by re-entering the "Q" command. The number of sources is limited by the total number of time steps for all sources.

Source data may be changed during the use of the "Q" command by entering a negative number to "back up" or delete time steps. For example, if two sources have been entered each having three time steps, entering a negative number will have the following effect:

NUMBER ENTERED	RESULT
-1	First source unchanged. Second source with 2 time steps.
-2	First source unchanged. Second source with 1 time step.
-3	First source only.
-4	First source with 2 time steps.
-5	First source with 1 time step.
-6	No source data.
<-6	No source data.

The ".IQ" (or ".DQ") command may be used to observe these affects.

In addition to completely changing source data with the "Q" command, the FORTRAN version also provides the "QM" command which allows the user to change the mass flow rate. The "QM" command will prompt the user for a time step number to change. Entering a value of -1 will list the time steps with the current source flow rate. If a time step number is entered the program will prompt for the mass flow rate. The rate must be entered as a mass flow rate regardless of the original form.

Grid Map

The ".G" command will calculate and print a map of the concentration for locations on a grid. The first time the grid map command is entered, the FORTRAN version will prompt for the grid limits, if the "L" command has not been used. The FORTRAN version requires only

1. The x lower limit (left edge),
2. The x upper limit (right edge) or the x spacing (horizonal interval between nodes)
3. The y lower limit (top edge)
4. The y upper limit (bottom edge)

If the x upper limit or spacing is omitted, the number of nodes will be determined by the "SN" parameter. The "SN" parameter is normally set to zero, in which case the number of nodes will be adjusted to fill the length of line set by the "SL" parameter. The number of columns per node is set by the "SX" parameter. The number of lines per node is set by the "SY" parameter. The y spacing will default to the x spacing (square nodes). If the x upper limit and spacing of "SN" specify a map wider than the length of line ("SL"), then the map will be displayed in more than one section, which can be joined together. The initial values are

SL = 80 columns per line,
SN = 0 nodes per grid,
SX = 6 columns per node,
SY = 2 line per node.

If all of the concentration values on the grid map appear as zeros, most likely the values are too small to print. In this case, use the "SC" command to enter a multiplier of 10,100, etc. Values which are too large to print will be converted to a (magnitude) + (one digit exponent of ten) and marked by a negative sign. (If the exponent exceeds ten, only the exponent is shown.) The larger values can be reduced with a multiplier of 0.1, 0.01, etc. The ".C" command can used to print the actual concentration value, in order to choose a scale factor. Values at or within a source location will be shown as "-1".

Prompting For All Parameters

The "IP" command prompts for all problem parameters. The following parameters are not prompted for:

1. The input units ("IR" and "IL" commands).
2. The output options and units ("OW", "OP", "OE" and "OT" commands).
3. The grid map scale parameters ("SC", "SL", "SN", "SX" and "SY" commands).

These parameters retain the same values as before the "IP" command. They all have initial values as shown in Appendix I-B.

Saving Parameter Values

The "OD" command saves all problem parameters to a file. The "IL" command restores the saved parameters. The following parameters are not saved:

1. The input units ("IR" and "IL" commands).
2. The output options and units ("OW", "OP", "OE" and "OT" commands).

These parameters retain the same values as before the "IL" command.

Appendix I-A

List of Commands

COMMAND	PARAMETERS SET OR ACTION TAKEN
A	Dispersivity menu for AX,AY or AX,AR.
AX	Dispersivity in x direction.
AY	Dispersivity in y direction.
AR	Dispersion ratio (Dx/Dy = Ax/Ay).
C	Case title.
D	Dispersion coefficient menu for DX,DY or DX,DR or AX,AY or AX,DR.
DX	Dispersion coefficient in x direction.
DY	Dispersion coefficient in y direction.
DR	Dispersion ratio (Dx/Dy).
DM	Molecular diffusion coefficient.
E	Exit from program.
G	Decay menu for GG, GL or GT.
GG	Decay coefficient (gamma).
GL	Decay lambda.
GT	Decay half-life time.
H	Help. List all one letter codes.
I	Input menu for IP, IL, IR, or I commands.
IP	Prompt for all parameters.
IL	Load parameters previously stored by OD command.
IR	Read input from another source.
L	Grid limits, LX and LY.
LX	Grid limits in x drection.
LY	Grid limits in y direction.
M	Aquifer thickness.
O	Output menu for OD, OW, OP, OE or OT.
OD	Dump all parameters to disk to be restored by IL command.
OW	Write results to another destination.
OP	Set prompting options.
OE	Set echo options.
OT	Set trace options.
P	Porosity
Q	Source data. (See Table X-3.)
QE	Desired number of subareas for non-point source.
QN	Maximum number of subareas for non-point source.
QM	Change source mass flow rate.

Appendix I-A
continued

COMMAND	PARAMETERS SET OR ACTION TAKEN
R	Retardation factor.
S	Grid map scale parameters menu for SC, SL, SN, SX or SY.
SC	Concentration multiplier.
SL	Line length.
SN	Number of nodes per line.
SX	Node spacing in x direction.
SY	Node spacing in y direction.
T	Sample time.
V	Velocity.
XY	Sample x and y location for .C command.
X	Sample x location for .C command.
Y	Sample y location for .C command.
ZM	Aquifer thickness (same as M command).
.C	Display single point concentration.
.D	Display parameters and source data.
.DP	Display parameters.
.DQ	Display souce data.
.DC	Display parameters, source data and single point concentration.
.DG	Display parameters, source data and concentration grid map.
.FF	Page printer. (Form feed.)
.G	Display concentration grid map.
.I	Display input parameters and source data.
.IP	Display input parameters.
.IQ	Display input source data.
.IC	Display input parameters, source data and single point concentration.
.IG	Display input parameters, source data and grid map.

APPENDIX I-B

PARAMETER VARIABLES AND COMMANDS

COMMAND	DATA VARIABLE	UNIT VARIABLE	INITIAL UNIT	DESCRIPTION (INITIAL VALUE)
C	HHC1	-	-	Title, any 72 characters.
C	HHC2	-	-	Title, any 72 characters.
C	HHC3	-	-	Title, any 72 characters.
M,ZM*	ZM	UZM	FT	Aquifer thickness.
P	P	-	-	Porosity.
V	V	UV	FT/D	Velocity.
DX	DX	UD	FT2/D	X Dispersion coefficient.
DY	DY	UD	FT2/D	Y Dispersion coefficient.
AX	AX	UA	FT	Dispersivity in x direction.
AY	AY	UA	FT	Dispersivity in y direction.
DR,AR*	DR	-	-	Dispersion ratio, Dx/Dy = Ax/Ay.
DM	DM	UD	FT2/D	Molecular diffusion coefficient, (0.0)
R	R	-	-	Retardation factor.
GG	GG			Decay coefficient, gamma.
GL	GL	UGL	1/YR	Decay lambda.
GT	GT	UGT	YR	Decay half-life time.
Q	QQXL	UQL	FT	Source minimum x location.
Q	QQXM	UQL	FT	Source maximum x location.
Q	QQYL	UQL	FT	Source minimum y location.
Q	QQYM	QQL	FT	Source maximum y location.
Q	QQSL	UQL	FT	Source minimum size.
Q	QQSM	UQL	FT	Source maximum size.
Q	QQA	UQA	FT2	Source area.
Q	QQT	UQT	DAYS	Source time.
Q	QQV	UQV	FT/D	Source volume flow rate/area.
Q	QQ	UQ	FT3/D	Source volume flow rate.
Q	QQC	UQC	MG/L	Source concentration.
Q	QQR	UQR	LB/FT2/D	Source mass flow rate/area.
Q,QM*	QQM	UQM	LBM/D	Source mass flow rate.
QE	NQE	-	-	Desired accuracy. (0.1)
QN	NQN	-	-	Maximum number of subareas. (100)

* Either command may be used.

APPENDIX I-B

continued

COMMAND	DATA VARIABLE	UNIT VARIABLE	INITIAL UNIT	DESCRIPTION (INITIAL VALUE)
T	TC	UTC	DAYS	Sample time.
XC	X$C	ULC	FT	Sample x location.
YC	Y$C	ULC	FT	Sample y location.
LX	XGL	ULC	FT	Grid x minimum.
LX	XGM	ULC	FT	Grid x maximum.
LX	XGI	ULC	FT	Grid x increment.
LY	YGL	ULC	FT	Grid y minimum.
LY	YGM	ULC	FT	Grid y maximum.
LY	YGI	ULC	FT	Grid y increment.
SC	SC	-	-	Concentration multiplier. (1)
SL	NSL	-	-	Print line length. (80 characters)
SN	NSN	-	-	Nodes per line. (0)
SX	NSX	-	-	Grid x spacing. (6 characters/node)
SY	NSY	-	-	Grid y spacing. (3 lines/node)
.C	C	UC	MG/L	Result concentration.
IR	LUR	-	-	FORTRAN unit for input. (*)
	LUW	-	-	FORTRAN unit for results. (*)
	BOP,LUP	-	-	FORTRAN unit and option for prompting. (Prompting on, *)
OE	DOE,LUE	-	-	FORTRAN unit and option for echo. (Echo off, *)
OT	BT1-BT8	-	-	Trace options for program development. (All off)
	BATCH	-	-	Bath option: abort command when error occurs. (**)

* Value for unit depends on system. Unit 1 is used for most microcomputer systems.
** Batch option is set in program and cannot be changed by user.

PART II

PROGRAM OPERATIONS AND APPLICATIONS

The program begins by prompting the user with 4 options labeled 1,2,3, and -1.

```
 1    TO PROMPT FOR ALL REQUIRED PARAMETERS (IP),
 2    TO LOAD PREVIOUSLY SAVED PARAMETERS (IL),
 3    TO READ COMMANDS FROM ANOTHER SOURCE (IR),
-1    TO SET OUTPUT PARAMETERS (O):
```

In order to enter your hydrogeologic parameters, the user must prompt for them by entering:

? 1

and then pressing RETURN, the program will now ask you for "Three Title Lines". This allows the operator to document the case study being modeled. On each title line a specific characteristic for the case study can be documented, thus distinguishing one computer run from another. For example: Location of Problem, Type of contaminate, Source of data. The PROMPT for Problem title:

THREE TITLE LINES:

THE USER RESPONDS WITH (80 characters per line):

? Babylon site, N.Y.

? Chloride, single point source

? O.S.U. Consultants

Once documented, the program prompts the operator for the hydrogeologic parameters.

The first parameter prompted for is Saturated Thickness.

THICKNESS (FT):

THE USER RESPONDS WITH (5 characters per variable):

? 110

Next porosity is PROMPTED FOR.

POROSITY (UNITLESS):

THE USER RESPONDS WITH (5 characters per variable):

? .35

Then you are PROMPTED for ground-water velocity

VELOCITY (FT/D):

THE USER RESPONDS WITH (5 characters per variable):

? 1.5

Now the program cues the modeler to construct a grid map. It is easiest to begin with a simple grid (i.e. 10 x 10). Superimpose the grid on the potentiometric map of the problem site. Grid squares are then assigned to points of interest. For example, a simplified schematic of a potentiometric map with a source and sample locations is shown in Figure 1. The model orients flow from left to right. Therefore, the map should be oriented perpendicular to the equipotential contours. Prepare a grid such as the 10 x 10 grid shown in Figure 2.

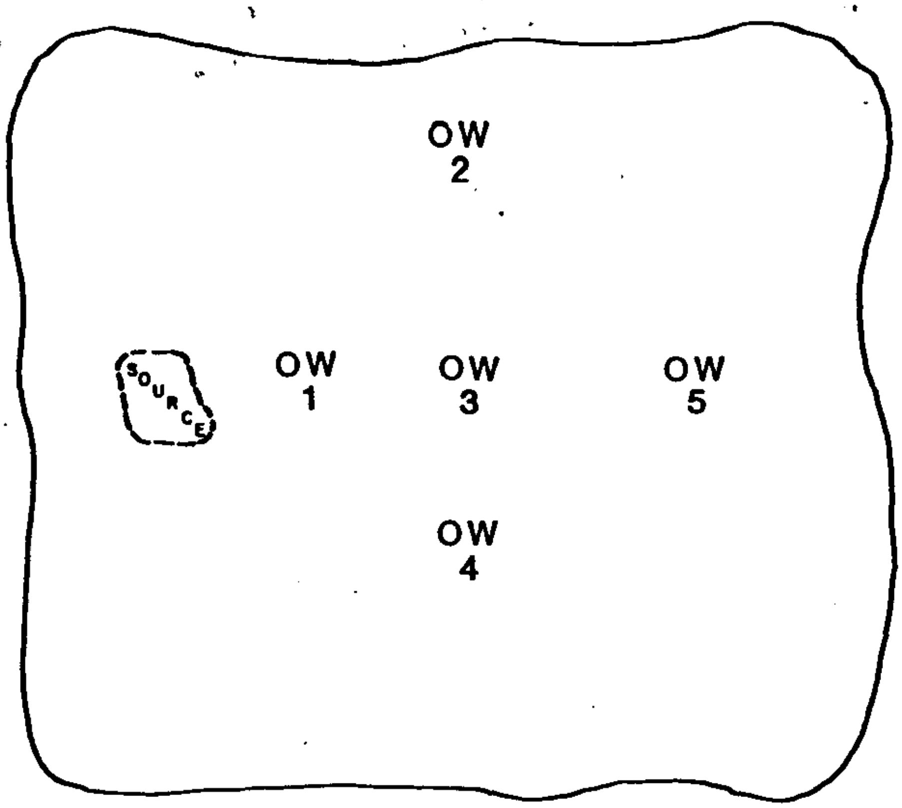

Figure 1
OW=observation wells for sampling

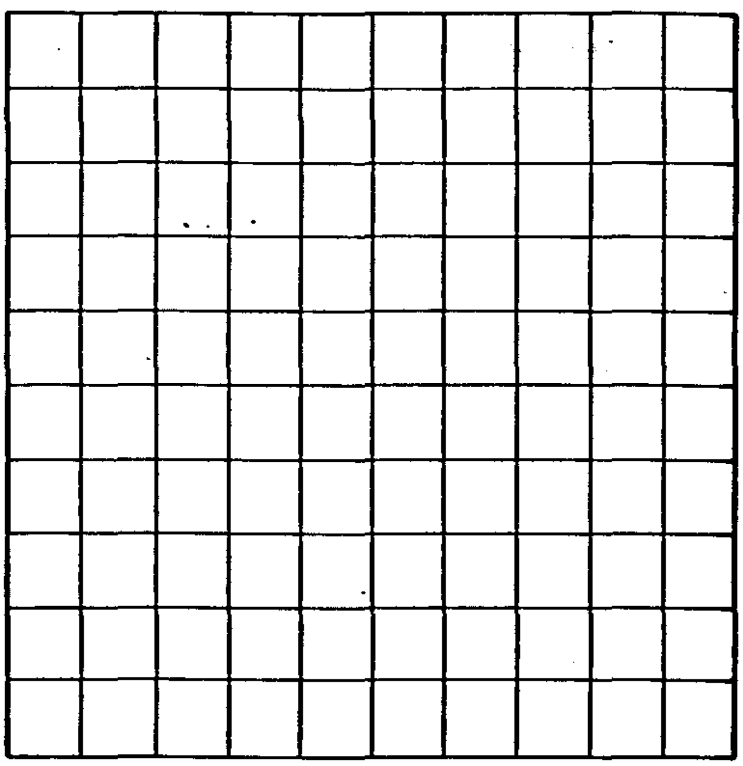

Figure 2

Overlay the grid onto the map as shown in Figure 3. Now the source and each observation well can be assigned to the center of the closest grid square. The location of each value will be referenced by an "X" and a "Y" value. You can arbitrarily set your origin (X=0, Y=0) in the lower left corner of the grid as shown in Figure 3. The source has been assigned to square (500, 1250) in Figure 3 (Over 2 squares in the X direction, up 5 squares in the Y direction). Observation well #1 has been assigned to square (1000, 1250); observation well #2 to (1500, 2000); observation well #3 to (1500, 1250); observation well #4 to (1500, 500); and observation well #5 to square (2250, 1250).

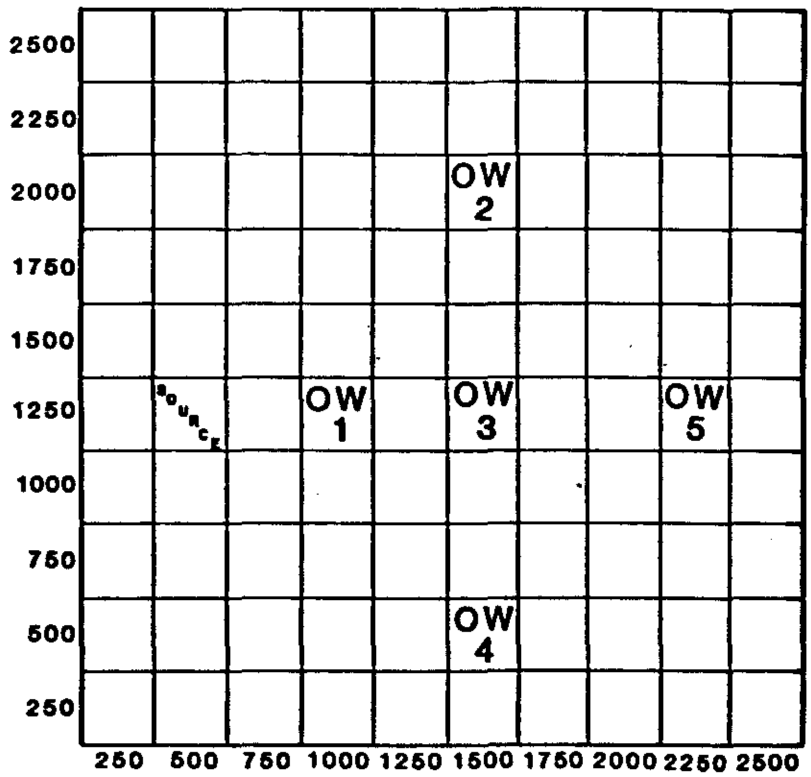

Figure 3

Once the grid map is aligned and coordinates are known for the source and sample locations, specifications can be provided for a grid map display. The map will represent the distribution of concentrations based on the location of the source and observation wells after data entry is completed. In order to generate the data necessary for the grid map display, the following PROMPTS will appear:

```
GRID MAP X LOCATIONS (FT)
MINIMUM, (MAXIMUM), (INTERVAL):
```

For the example used here, THE USER RESPONDS WITH (5 characters per variable):

```
?   0, 2500,  250
```

Next the Y dimensions are PROMPTED for. The following PROMPTS will be printed on the screen:

```
GRID MAP Y LOCATIONS (FT)
MINIMUM, MAXIMUM, (INTERVAL):
```

Again, for our example THE USER RESPONDS WITH (5 characters per variable):

```
?    0, 2500,  250
```

Now the program PROMPTS the user for information about the contaminant source. The following PROMPTS will appear from the main source menu:

```
****BEGIN SOURCE INFORMATION****
 CURRENTLY USING 0 OF 10 TIME STEPS
 0 TO END SOURCE INFORMATION
 1 TO ADD POINT SOURCE
 2 TO ADD NON-POINT SOURCE
-N TO DELETE LAST N TIME STEPS
```

For our example, THE USER RESPONDS WITH (5 characters per variable):

```
?    1
```

In order to preserve continuity in the sequential operation of the program, the source area and flow rate prompting routine shall be explained for a single point source. Multiple and non point source options will be explained later.

After choosing Option 1, the program will prompt for the location of the source and the source area (the approximate surface area that the contaminant source occupies). The following prompts will appear on the screen:

```
LOCATION:
```

THE USER RESPONDS WITH (5 characters per variable):

```
? 500, 1250
SOURCE AREA (FT2):
```

THE USER RESPONDS WITH (5 characters per variable):

```
? 1550
```

Next the program prompts the user for a flow rate. The rate can be calculated by using one of the four options shown below. Usually this parameter is unknown to the hydrogeologist. Therefore, this parameter is generally considered to be a variable. Four options are available for determining mass flow rate:

```
1 FOR MASS FLOW RATE (LBM/D),
2 FOR MASS/AREA RATE (LB/FT2/D),
3 FOR VOLUME FLOW RATE (FT3/D),
     AND CONCENTRATION (MG/L),
4 FOR VOLUME/AREA RATE (FT/D),
     AND CONCENTRATION (MG/L):
```

Option 1 MASS FLOW RATE, (LBM/DAY)

The following PROMPT will appear on the screen:

```
TIME, MASS FLOW RATE, (CONCENTRATION):
```

What is required of the user is a time (in days) at which the contaminant begins to flow through the system and the mass flow rate. When modeling only one source, set the time equal to 0. Do not let this confuse you. You are merely designating a reference point in time after which concentrations are to be observed. This concept is doubly powerful. With one source being modeled, the contaminant can be introduced at time 0, and then again at specified time increments after 0 thus simulating slugs of contaminant flow in response to a series of recharge events.

After the time is requested, a mass flow rate and a concentration must follow (separated by commas). The mass flow rate is in pounds per day. (See Table II-1). Entering a concentration is optional which is indicated by parentheses in the prompt above. If a concentration is known and entered, then a volumetric flow rate will also be calculated. After this information is entered, the program is designed to prompt the user for the same information again. This involves the time step concept which will be discussed after all of the options have been explained. The mass flow rate data can also be entered by using one of the other options:

Option 2 MASS/AREA FLOW RATE (1B/FT2/D)

The following PROMPT will appear on the screen:

TIME, MASS/AREA RATE, (CONCENTRATION):

This option is similar to Option 1 except that a mass per area rate is prompted for rather than a mass rate. Again entering concentration is optional.

Option 3 VOLUME FLOW RATE (FT3/D and MG/L)

The following PROMPT will appear on the screen:

TIME, VOLUME FLOW RATE, CONCENTRATION:

Again, what is required of the user is similar to the previous options with the exception that the rate is now a volume flow rate. However, entering a concentration is mandatory.

Option 4 VOLUME/AREA FLOW RATE (FT/D and MG/L)

The following PROMPT will appear:

TIME, VOLUME/AREA RATE, CONCENTRATION:

This option is very similar to Option 3.

Now we will return to the main source menu and explain why and how each option is used in conjunction with the mass flow rate. The following is a list of the PROMPTS of the menu:

```
CURRENTLY USING 0 OF 10 TIME STEPS.
 0 TO END SOURCE INFORMATION.
 1 TO ADD POINT SOURCE,
 2 TO ADD NON-POINT SOURCE,
-N TO DELETE LAST N TIME STEPS:
```

<u>Option 0</u> to end source information.

This option provides the means to stop entering source information and implies that the user wishes to proceed to the next step in the program.

<u>Option 1</u> To add a point source

This option allows the user to add a contaminant source at a specific X, Y location. In the grid system the point source originates from a specific square whose location has been assigned by the user. Figure 4 is a simplified grid. For example, assume that two single point sources are located at (100,100) and (100,200) in Figure 4. Next, the program prompts the user for the source area. The source area may encompass the whole square or less than the square depending upon the scale of the grid set up by the user. After the source area is entered, the time, flow rate, and concentration is prompted for. If the contaminant source encompasses several adjacent squares and or parts of squares, then Option 2 should be used.

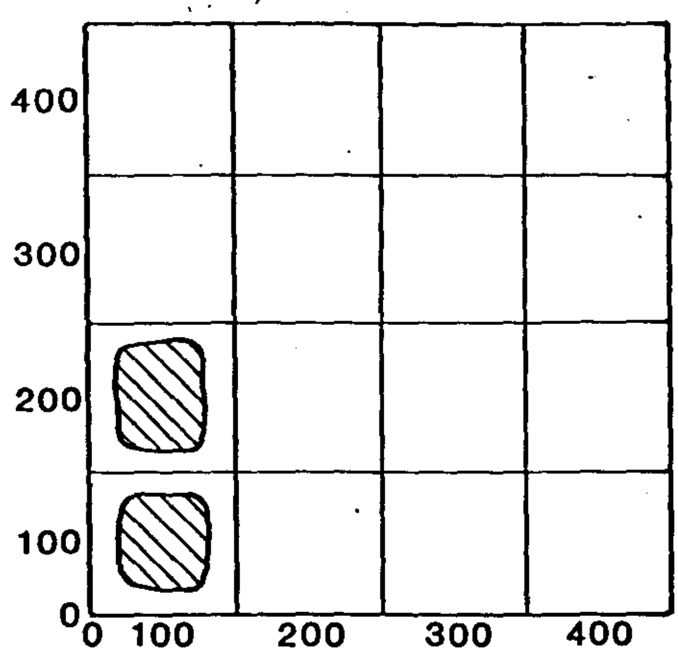

Figure 4

Option 2 To add a non-point source

The power of this option becomes evident when the area of the contamination source is very large with respect to the grid size. In the schematic grid system shown in Figure 5 the source originates from several squares and parts of squares.

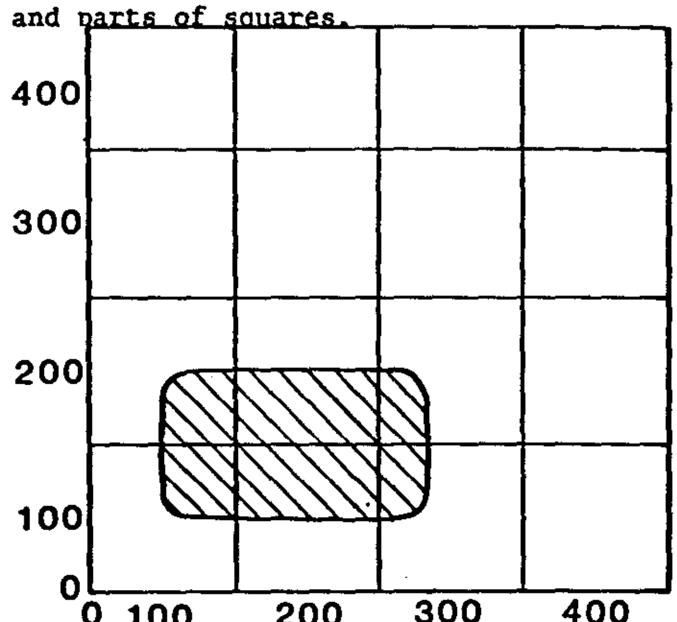

Figure 5

The following prompt will appear:

X LOCATION MINIMUM, MAXIMUM (FT):

For the schematic presented above THE USER WOULD RESPOND WITH
(5 characters per variable):

? 50, 250

Next the Y location is prompted for. The following prompt will appear:

Y LOCATION, MINIMUM, MAXIMUM (FT):

For the schematic presented above THE USER WOULD RESPOND WITH
(5 characters per variable):

? 50, 150

Again, the program prompts the user for a time, flow rate and concentration.

Option -N To dèlete last N time steps

An example will best illustrate the use of this option using several time steps. Let us initially model one point source. Let's assume that we have data for this example over a 20-year period. The contaminant has leached into the groundwater at an average rate of 52 pounds per day during the 20-year period. We also have observed concentrations at several observation wells located at various distances from the source. These data were gathered on an irregular time schedule over 20 years as shown in Table II-1 below. The concentration of the source is also shown for each time period.

Table II-1

Time (days)	Mass Flow rate (lbs/d)	Concentration (mg/l)	Time Step
0	52	100	1
365	52	110	2
548	52	130	3
730	52	160	4
1095	52	160	5
1643	52	180	6
2190	52	190	7
2920	52	200	8
4015	52	210	9
7300	52	250	10

The data is interpreted as follows. Initially, we observe a source concentration of 100 (mg/l). This will be our reference point in time, thus we designate it with a time = 0. This is our first time step. A year later we observe a concentration of 110 (mg/l). We have taken a second step in time which is equal to a period of 1 year. Thus our time step is #2. A year and a half from time = 0, we observe a concentration of 130 (mg/l). We have now taken our third step in time which is equal to a period of .5 years. Thus our time step is designated #3. Two years from our reference point in time we observed a concentration of 160 (mg/l). This is our fourth step in time with a period equal to .5 years. Three years later we again observe a concentration of 160 (mg/l). This is our fifth step in time with a period equal to 1 year. The remainder of the table follows in a similar manner.

In order to enter this data into the computer, Option 1 was selected for the multiple time step example. The following PROMPT will appear:

```
TIME, MASS FLOW RATE, (CONCENTRATION):
```

THE USER RESPONDS WITH (5 characters per variable):

```
?    0,   52,  100
```

The user enters the respective values and the program responds with another PROMPT:

```
ENTER 0 TO RETURN TO MAIN SOURCE MENU
TIME, MASS FLOW RATE, (CONCENTRATION):
```

THE USER RESPONDS WITH (5 characters per variable):

```
?  365,   52,  120
```

Suppose upon entering the data, the user enters an incorrect concentration at the next time step (120 instead of 110 while entering time step #2). To correct for this error, enter "0" to return to the main source menu. The program responds with:

```
CURRENTLY USING 2 OF 10 TIME STEPS
 0 TO END SOURCE INFORMATION
 1 TO ADD POINT SOURCE
 2 TO ADD NON POINT SOURCE
-N TO DELETE LAST N TIME STEPS:
```

USER RESPONDS WITH (5 characters per variable):

```
?   -1
```

By entering -1 the information contained in the last time step (#2) is deleted.

The program responds with:

```
CURRENTLY USING 1 OF 10 TIME STEPS
 0 TO END SOURCE INFORMATION
 1 TO ADD POINT SOURCE
 2 TO ADD NON POINT SOURCE
-N TO DELETE LAST N TIME STEPS:
```

THE USER RESPONDS WITH (5 characters per variable):

```
?    1
```

In order to continue entering the data, the user must designate the point source again for time step 2 and subsequent time steps. Once this option has been entered, the user has returned to the time, flow rate, concentration mode for entering time step 2 data. When all the data has been entered, the program responds with:

```
ENTER 0 TO RETURN TO MAIN SOURCE MENU
TIME, MASS FLOW RATE, CONCENTRATION
```

THE USER RESPONDS WITH (5 characters per variable):

```
?    0
```

The program responds with:

```
CURRENTLY USING 10 OF 10 TIME STEPS
 0 TO END SOURCE INFORMATION
 1 TO ADD POINT SOURCE
 2 TO ADD NON-POINT SOURCE
-N TO DELETE LAST N TIME STEPS:
```

The above prompt confirms that the mass flow rate source has been entered for all 10 time steps. In order to end source information

THE USER RESPONDS WITH (5 characters per variable):

? 0

The program informs the user of this by the following statement:

****END SOURCE INFORMATION***

Next, the program prompts for a sample time:

SAMPLE TIME (DAYS)

THE USER RESPONDS WITH (5 characters per variable):

? 2330

The sample time is a point in time, after time 0, at which concentrations are to be computed and plotted on the grid. However, these concentrations will approach equilbrium (steady state) when the concentrations remain constant over time at a specific location on the grid. This is referred to as a "steady state" condition. If the user wishes to compute the concentrations throughout the grid under this condition,

THE USER RESPONDS WITH (5 characters per variable):

? -1

The last prompts are for retardation, decay, and dispersion. Usually, the user lacks information about these parameters. Suppose the user has values for retardation and decay only.

The retardation PROMPT:

RETARDATION (UNITLESS)

THE USER RESPONDS WITH:

? 1

This indicates that the source is not "retarded" or influenced in any way by sorption on surfaces within the earth material as it travels through the system.

The PROMPT for decay information is next:

```
0 FOR NO DECAY
1 FOR DECAY COEFFICIENT (GG)
2 FOR DECAY LAMBDA (GL)
3 FOR DECAY HALF-LIFE (GT)
```

Initially THE USER SHOULD RESPOND WITH (5 characters per variable):

```
?    0
```

Now the user has reduced the number of unknowns to 1 variable, dispersion. This parameter controls the shape of the plume. In other words, what is the rate at which the contaminant disperses in the X direction versus the rate it disperses in the Y direction? If the rates are the same then this ratio of X:Y (the dispersion ratio) equals 1. The user has 4 options for entering dispersion values depending upon the information available. The following is the list of prompt options for dispersion:

```
1 FOR X AND Y DISPERSION (DX, DY),
2 FOR X DISPERSION AND DISPERSION RATIO (DX, DR),
3 FOR X AND Y DISPERSIVITY (AX, AY),
4 FOR X DISPERSIVITY AND DISPERSION RATIO (AX, DR),
     (USE DM FOR MOLECULAR DIFFUSION)
```

In order to consider these options (1-4), the user should refer to Table I-1 for the definition of dispersion. The options are described as follows:

Option 1 Allows the user to enter values for dispersion in the X and Y directions. The dispersion ratio and the X and Y dispersivities will be calculated for you.

Option 2 Allows the user to enter values for dispersion in the X direction and the dispersion ratio. Dispersion in the Y direction and the X and Y dispersivities will be calculated for the user.

Option 3 Allows the user to enter the X and Y dispersivities. The X and Y dispersions and the dispersion ratio will be calculated automatically.

Option 4 Allows the user to enter the X dispersivity and the dispersion ratio. The Y dispersivity and the X and Y dispersions are calculated for the user.

If the dimensions of an existing plume can be measured, then this ratio of X and Y using Option 1 can be used as a starting point in order to generate an initial value for the dispersion ratio. The program responds with:

```
1 FOR X AND Y DISPERSION (DX, DY)
2 FOR X DISPERSION AND DISPERSION RATIO (DX,DR)
3 FOR X AND Y DISPERSIVITY (AX,AY)
4 FOR X DISPERSIVITY AND DISPERSION RATIO (AX,DR)
     (USE DM FOR MOLECULAR DIFFUSION)
```

THE USER RESPONDS WITH (5 characters per variable):

```
? 1
```

THE PROGRAM RESPONDS WITH;

```
X DISPERSION          (FT2/D)
```

THE USER RESPONDS WITH (5 characters per variable):

```
? 105
```

THE PROGRAM RESPONDS WITH:

```
Y DISPERSION          (FT2/D)
```

THE USER RESPONDS WITH (5 characters per variable):

```
? 21
```

Once all of the data has been entered, a series of commands can be used to display the values. This list can be called by pressing "H" and press return. The Display commands are used to reproduce the values of the data which you have entered, or to produce the solution as a single point concentration or as the grid map in Figure 3 showing all of the concentrations. The Display commands are:

.C	Display a single point (x,y) concentration
.D	Display all parameters
.G	Display grid map concentrations
.I	Display input parameters
.DG	Display all parameters and grid map concentrations

If the user enters .D, all parameters and values are displayed as entered for the single point example. The display is shown in Appendix A. Once displayed, the user can enter .G which will display grid map of concentrations for the solution (See Appendix A). Once the solution has been completed, the user can store the data. In order to store the data used in this example, the "OD" command is used. The following response will appear on the screen:

DUMP FILE UNIT (6 TO 10):

This means that a total of 5 different sets of data may be saved (numbered 6,7,8,9.and 10). The user must now assign a number (either 6,7,8,9, or 10) to the data set. Once the number is chosen, (i.e. 6), the input data is copied to the disk under the Fortran file name with that number.

At this point, the following PROMPT appears:

COMMAND

The user now has three choices; end the program by entering E; initiate a new problem by using the COMMAND I to recall the list of PROMPT options; or change selected parameters by using an EDIT command. These can be listed by entering the HELP COMMAND, H. Some of the more useful edit commands are listed:

```
D     Dispersion
L     Grid Limits
M     Aquifer Thickness
P     Porosity
R     Retardation
V     Ground water velocity
Q     Source
QM    Source mass rate only
```

For example, the user will commonly want to make changes in the source term (Q), Dispersion (D) or Retardation (R).

Suppose the user ends the program using the COMMAND E and returns later, wanting to modify the data saved in data set 6. When the program begins, the initial PROMPT appears:

```
 1  TO PROMPT FOR ALL REQUIRED PARAMATERS (IP),
 2  TO LOAD PREVIOUSLY SAVED PARAMETERS (IL),
 3  TO READ COMMANDS FROM ANOTHER SOURCE (IR),
-1  TO SET OUTPUT PARAMETERS (O)
```

To load information in data set 6, THE USER SHOULD RESPOND WITH (5 characters per variable):

```
?    2
```

THE PROGRAM RESPONSE IS:

```
LOAD FILE UNIT (6 TO 10):
```

The user responds with the data set number to be loaded. In this example, THE USER RESPONDS WITH (5 characters per variable):

```
?    6
```

The input parameters that had been previously saved in data set 6 are now loaded into the program.

THE PROGRAM RESPONDS WITH:

```
COMMAND
```

IN ORDER TO REVIEW THE DATA IN DATA SET 6, THE USER RESPONDS WITH (5 characaters per variable):

? .I

Once the data set is loaded from the file, the concentrations at the observation wells can be matched to those of the computer run and the accuracy of the dispersion ratio can be tested.

The dispersion can be changed by entering the EDIT command D. One of the four options to enter dispersion is to be selected. The user will enter the new dispersion parameters indicated in the PROMPT. By varying the dispersion ratio, a "best fit" can be attempted. The process of matching computed and observed data is referred to as calibration. The procedure for changing one variable while all others are held constant is referred to as sensitivity analysis.

Once the general shape of the plume is achieved by adjusting the dispersion ratio, the velocity or retardation can be varied in order to shorten or lengthen the plume. An example of a sensitivity analysis run of retardation for calibration of dispersion is shown in Appendix B. Retardation must be greater than 1 in order to represent the effects of sorption phenomena. Let us suppose that the concentrations at X = 1750, Y = 750,100,1250, are all slightly higher than "actual" concentrations. By increasing the retardation, these values will be lowered for X = 1750. If values should be increased, then velocity should be increased instead. In the example, in Appendix B, retardation was changed from 1 to 1.3. The resulting concentrations at X = 1750, Y = 750,100,1250 have all slightly lowered in value. Retardation effects become more pronounced after a certain traveled distance and time.

Once the changes in Dispersion and Retardation are complete, the user will use the Display (.D, .C, .G, .DG) COMMANDS in order to view the new solution on the screen. The user can save the new data for the corresponding solution by using the OD or I COMMANDS as described earlier.

The user may decide to begin a new problem, but will introduce several contaminant sources. The parameters and grid used in Figure 3 and Appendix A can also be used here except for the addition of another source using the main source menu. The step by step procedure and output are shown in Appendix C.

There are two point sources located at X = 500, Y = 500, and X = 500, Y = 1250 (See Figure 3 for grid location). The hydrologic parameters are identical, with the exception of one important change. Notice that the number of time steps (i.e. the number of start times for each source) is now 5. A total of 10 time steps and/or sources can be used. By using two sources, only 5 time steps are available. Combining both sources is essentially the same as over-laying the grid solution for each of the individual plumes on one another and adding the values which appear in the same grid square. The plumes begin to overlap at X =250, Y = 1250, to 1500. This feature is especially powerful and time saving.

Alternatively, the user may choose a non point source as shown in Figure 5 (large source area) rather than a multiple point source. To do so, Option 2 of the main source menu was used. The step by step procedure and output are shown in Appendix D.

Table of Contents
for Appendices

APPENDIX II-A

SINGLE POINT SOURCE

```
COMMAND>.D

SINGLE
POINT
SOURCE

THICKNESS          =  110.000      FT
POROSITY           =  .350000
VELOCITY           =  1.50000      FT/D

X DISPERSION       =  105.000      FT2/D
Y DISPERSION       =  21.0000      FT2/D
X DISPERSIVITY     =  70.0000      FT
Y DISPERSIVITY     =  14.0000      FT
DISPERSION RATIO=     5.00000
MOL. DIFFUSION     =  0.00000      FT2/D

RETARDATION        = 1.000000
DECAY GAMMA        = 1.000000
DECAY LAMBDA       =  0.00000      1/YR

ACCURACY           =  .100000E+00
MAXIMUM DIVISION=        100

X, Y LOCATION      =  500.000      ,     1250.00      FT
SOURCE AREA        =  1550.00      FT2
```

START TIME (DAYS)	VOLUME/ AREA RATE (FT/D)	VOLUME FLOW RATE (FT3/D)	SOURCE CONCENTR. (MG/L)	MASS/AREA RATE (LB/FT2/D)	MASS FLOW RATE (LBM/D)
0.00000	5.37394	8329.60	100.0000	.335484E-01	52.0000
365.000	4.88540	7572.36	110.000	.335484E-01	52.0000
548.000	4.13380	6407.39	130.000	.335484E-01	52.0000
730.000	3.35871	5206.00	160.000	.335484E-01	52.0000
1095.00	3.35871	5206.00	160.000	.335484E-01	52.0000
1641.00	2.98552	4627.56	180.000	.335484E-01	52.0000
2190.00	2.82839	4384.00	190.000	.335484E-01	52.0000
2920.00	2.68697	4164.80	200.000	.335484E-01	52.0000
4015.00	2.55902	3966.48	210.000	.335484E-01	52.0000
7300.00	2.14957	3331.84	250.000	.335484E-01	52.0000

```
COMMAND>.G

SAMPLE TIME        =   2333.30     DAYS
X SCALE            (  1.000000     FT       )
Y SCALE            (  1.000000     FT       )
CONCENTRATION      (  1.000000     MG/L     )
```

Y \ X	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
2500	0	0	0	0	0	0	0	0	0	0	0
2250	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
1750	0	0	0	0	0	0	1	1	2	2	3
1500	0	0	1	3	7	9	11	13	13	13	14
1250	0	2	-1	69	49	40	34	31	28	26	24
1000	0	0	1	3	7	9	11	13	13	13	14
750	0	0	0	0	0	0	1	1	2	2	3
500	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

```
WORST APPROXIMATION = +- 6.66     %.
    1 SOURCE(S) SHOWN AS "-1".
```

APPENDIX II-B

SINGLE POINT SOURCE

SENSITIVITY ANALYSIS

COMMAND>.DG

SINGLE POINT SOURCE
SENSITIVITY ANALYSIS
DISPERSION

THICKNESS = 110.000 FT
POROSITY = .350000
VELOCITY = 1.50000 FT/D

X DISPERSION = 105.000 FT2/D
Y DISPERSION = 21.0000 FT2/D
X DISPERSIVITY = 70.0000 FT
Y DISPERSIVITY = 14.0000 FT
DISPERSION RATIO= 5.00000
MOL. DIFFUSION = 0.00000 FT2/D

RETARDATION = 1.30000
DECAY GAMMA = 1.000000
DECAY LAMBDA = 0.00000 1/YR

ACCURACY = .100000E+00
MAXIMUM DIVISION= 100

X, Y LOCATION = 500.000 , 1250.00 FT
SOURCE AREA = 1550.00 FT2

START TIME (DAYS)	VOLUME/ AREA RATE (FT/D)	VOLUME FLOW RATE (FT3/D)	SOURCE CONCENTR. (MG/L)	MASS/AREA RATE (LB/FT2/D)	MASS FLOW RATE (LBM/D)
0.00000	5.37394	8329.60	100.0000	.335484E-01	52.0000
365.000	4.88540	7572.36	110.000	.335484E-01	52.0000
548.000	4.13380	6407.39	130.000	.335484E-01	52.0000
730.000	3.35871	5206.00	160.000	.335484E-01	52.0000
1095.00	3.35871	5206.00	160.000	.335484E-01	52.0000
1641.00	2.98552	4627.56	180.000	.335484E-01	52.0000
2190.00	2.82839	4384.00	190.000	.335484E-01	52.0000
2920.00	2.68697	4164.80	200.000	.335484E-01	52.0000
4015.00	2.55902	3966.48	210.000	.335484E-01	52.0000
7300.00	2.14957	3331.84	250.000	.335484E-01	52.0000

SAMPLE TIME = 2333.30 DAYS
X SCALE (1.000000 FT)
Y SCALE (1.000000 FT)
CONCENTRATION (1.000000 MG/L)

Y \ X	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
2500	0	0	0	0	0	0	0	0	0	0	0
2250	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
1750	0	0	0	0	0	0	1	1	2	2	2
1500	0	0	1	3	7	9	11	12	13	13	12
1250	0	2	-1	69	49	40	34	30	27	24	21
1000	0	0	1	3	7	9	11	12	13	13	12
750	0	0	0	0	0	0	1	1	2	2	2
500	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

WORST APPROXIMATION = +- 6.66 %.
1 SOURCE(S) SHOWN AS "-1".

APPENDIX II-C

TWO POINT SOURCES

```
GROUNDWATER PLUME CALCULATION PROGRAM
D.C. KENT, HYDROGEOLOGIST
FRED WITZ, PROGRAMMER
GEOLOGY DEPARTMENT, OKLAHOMA STATE UNIVERSITY
FORTRAN VERSION 1.0 (1983, MAY)

 1 TO PROMPT FOR ALL REQUIRED PARAMETERS (IP),
 2 TO LOAD PREVIOUSLY SAVED PARAMETERS (IL),
 3 TO READ COMMANDS FROM ANOTHER SOURCE (IR),
-1 TO SET OUTPUT PARAMETERS (O):
?1

THREE TITLE LINES:
?TWO

?POINT

?SOURCES

THICKNESS         (FT      ):
?110

POROSITY          (UNITLESS):
?.35

VELOCITY          (FT/D    ):
?1.5

GRID MAP X LOCATIONS (FT       ),
MINIMUM, (MAXIMUM), (INTERVAL):
?0,2500,250

GRID MAP Y LOCATIONS (FT       ),
MINIMUM, MAXIMUM, (INTERVAL):
?0,2500,250

**** BEGIN SOURCE INFORMATION ****
CURRENTLY USING   0 OF  10 TIME STEPS.
 0 TO END SOURCE INFORMATION,
 1 TO ADD POINT SOURCE,
 2 TO ADD NON-POINT SOURCE,
-N TO DELETE LAST N TIME STEPS:
?1

X LOCATION, Y LOCATION (FT       ):
?500,1000

SOURCE AREA       (FT2     ):
?1550

1 FOR MASS FLOW RATE    (LBM/D   ),
2 FOR MASS/AREA RATE    (LB/FT2/D),
3 FOR VOLUME FLOW RATE  (FT3/D   ),
      AND CONCENTRATION (MG/L    ),
4 FOR VOLUME/AREA RATE  (FT/D    ),
      AND CONCENTRATION (MG/L    ):
?1

TIME, MASS FLOW RATE, (CONCENTRATION):
?0,52,100

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?730,52,160

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?2190,52,170

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?4015,52,210

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?7300,52,250

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?0

CURRENTLY USING   5 OF  10 TIME STEPS.
 0 TO END SOURCE INFORMATION,
 1 TO ADD POINT SOURCE,
 2 TO ADD NON-POINT SOURCE,
-N TO DELETE LAST N TIME STEPS:
?1

X LOCATION, Y LOCATION (FT       ):
?500,1750

SOURCE AREA       (FT2     ):
?1550

1 FOR MASS FLOW RATE    (LBM/D   ),
2 FOR MASS/AREA RATE    (LB/FT2/D),
3 FOR VOLUME FLOW RATE  (FT3/D   ),
      AND CONCENTRATION (MG/L    ),
4 FOR VOLUME/AREA RATE  (FT/D    ),
      AND CONCENTRATION (MG/L    ):
?1
```

```
TIME. MASS FLOW RATE, (CONCENTRATION):
?0,52,100

ENTER     0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?730,52,160

ENTER     0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?2190,52,190

ENTER     0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?4015,52,210

ENTER     0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?7300,52,250

ENTER     0 TO RETURN TO MAIN SOURCE MENU;
TIME. MASS FLOW RATE, (CONCENTRATION):
?0

CURRENTLY USING  10 OF  10 TIME STEPS.
 0 TO END SOURCE INFORMATION,
 1 TO ADD POINT SOURCE,
 2 TO ADD NON-POINT SOURCE,
-N TO DELETE LAST N TIME STEPS:
?-10

**** END SOURCE INFORMATION ****
-1 FOR STEADY STATE,
SAMPLE TIME      (DAYS     ):
?-1

RETARDATION      (UNITLESS):
?1

0 FOR NO DECAY,
1 FOR DECAY COEFFICIENT, GAMMA (GG),
2 FOR DECAY LAMBDA (GL),
3 FOR DECAY HALF-LIFE (GT):
?0

1 FOR X AND Y DISPERSION (DX, DY),
2 FOR X DISPERSION AND DISPERSION RATIO (DX, DR),
3 FOR X AND Y DISPERSIVITY (AX, AY),
4 FOR X DISPERSIVITY AND DISPERSION RATIO (AX, DR),
  (USE DM FOR MOLECULAR DIFFUSION):
?2

X DISPERSION     (FT2/D    ):
?105

DISPERSION RATIO (UNITLESS):
?5

COMMAND?
```

.DG

TWO
POINT
SOURCES

THICKNESS = 110.000 FT
POROSITY = .350000
VELOCITY = 1.50000 FT/D

X DISPERSION = 105.000 FT2/D
Y DISPERSION = 21.0000 FT2/D
X DISPERSIVITY = 70.0000 FT
Y DISPERSIVITY = 14.0000 FT
DISPERSION RATIO= 5.00000
MOL. DIFFUSION = 0.00000 FT2/D

RETARDATION = 1.000000
DECAY GAMMA = 1.000000
DECAY LAMBDA = 0.00000 1/YR

ACCURACY = .100000E+00
MAXIMUM DIVISION= 100

X, Y LOCATION = 500.000 , 1000.000 FT
SOURCE AREA = 1550.00 FT2

START TIME (DAYS)	VOLUME/ AREA RATE (FT/D)	VOLUME FLOW RATE (FT3/D)	SOURCE CONCENTR. (MG/L)	MASS/AREA RATE (LB/FT2/D)	MASS FLOW RATE (LBM/D)
0.00000	5.37394	8329.60	100.0000	.335484E-01	52.0000
730.000	3.35871	5206.00	160.000	.335484E-01	52.0000
2190.00	2.82839	4384.00	190.000	.335484E-01	52.0000
4015.00	2.55902	3966.48	210.000	.335484E-01	52.0000
7300.00	2.14957	3331.84	250.000	.335484E-01	52.0000

X, Y LOCATION = 500.000 , 1750.00 FT
SOURCE AREA = 1550.00 FT2

START TIME (DAYS)	VOLUME/ AREA RATE (FT/D)	VOLUME FLOW RATE (FT3/D)	SOURCE CONCENTR. (MG/L)	MASS/AREA RATE (LB/FT2/D)	MASS FLOW RATE (LBM/D)
0.00000	5.37394	8329.60	100.0000	.335484E-01	52.0000
730.000	3.35871	5206.00	160.000	.335484E-01	52.0000
2190.00	2.82839	4384.00	190.000	.335484E-01	52.0000
4015.00	2.55902	3966.48	210.000	.335484E-01	52.0000
7300.00	2.14957	3331.84	250.000	.335484E-01	52.0000

SAMPLE TIME = STEADY STATE
X SCALE (1.000000 FT)
Y SCALE (1.000000 FT)
CONCENTRATION (1.000000 MG/L)

Y \ X	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
2500	0	0	0	0	0	0	0	0	0	0	0
2250	0	0	0	0	0	0	1	1	2	2	3
2000	0	0	1	3	7	9	11	13	13	14	14
1750	0	2	-1	69	49	40	34	31	28	26	25
1500	0	0	1	3	7	10	12	14	15	16	17
1250	0	0	1	3	7	10	12	14	15	16	17
1000	0	2	-1	69	49	40	34	31	28	26	25
750	0	0	1	3	7	9	11	13	13	14	14
500	0	0	0	0	0	0	1	1	2	2	3
250	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

WORST APPROXIMATION = +- 1.06 %.
2 SOURCE(S) SHOWN AS "-1".

COMMAND?E

END OF PLUME PROGRAM.
GOODBYE. STOP

APPENDIX II-D

NON POINT SOURCE

```
GROUNDWATER PLUME CALCULATION PROGRAM
D.C. KENT, HYDROGEOLOGIST
FRED WITZ, PROGRAMMER
GEOLOGY DEPARTMENT, OKLAHOMA STATE UNIVERSITY
FORTRAN VERSION 1.0 (1983, MAY)


 1 TO PROMPT FOR ALL REQUIRED PARAMETERS (IP),
 2 TO LOAD PREVIOUSLY SAVED PARAMETERS (IL),
 3 TO READ COMMANDS FROM ANOTHER SOURCE (IR),
-1 TO SET OUTPUT PARAMETERS (O):
?1

THREE TITLE LINES:
?NON

?POINT

?SOURCE

THICKNESS          (FT       ):
?110

POROSITY           (UNITLESS):
?.35

VELOCITY           (FT/D     ):
?1.5

GRID MAP X LOCATIONS (FT       ),
MINIMUM, (MAXIMUM), (INTERVAL):
?0,2500,250

GRID MAP Y LOCATIONS (FT       ),
MINIMUM, MAXIMUM, (INTERVAL):
?0,2500,250

**** BEGIN SOURCE INFORMATION ****
CURRENTLY USING   0 OF  10 TIME STEPS.
 0 TO END SOURCE INFORMATION,
 1 TO ADD POINT SOURCE,
 2 TO ADD NON-POINT SOURCE,
-N TO DELETE LAST N TIME STEPS:
?2

X LOCATION MINIMUM, MAXIMUM (FT       ):
?350,800

Y LOCATION MINIMUM, MAXIMUM (FT       ):
?1000,1300

1 FOR MASS FLOW RATE     (LBM/D    ),
2 FOR MASS/AREA RATE     (LB/FT2/D),
3 FOR VOLUME FLOW RATE   (FT3/D    ),
      AND CONCENTRATION (MG/L     ),
4 FOR VOLUME/AREA RATE   (FT/D     ),
      AND CONCENTRATION (MG/L     ):
?1

TIME, MASS FLOW RATE, (CONCENTRATION):
?0,52,200

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?730,52,300

ENTER .  0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?2190,52,400

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?4015,52,425

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?7300,52,500

ENTER    0 TO RETURN TO MAIN SOURCE MENU;
TIME, MASS FLOW RATE, (CONCENTRATION):
?0

CURRENTLY USING   5 OF  10 TIME STEPS.
 0 TO END SOURCE INFORMATION,
 1 TO ADD POINT SOURCE,
 2 TO ADD NON-POINT SOURCE,
-N TO DELETE LAST N TIME STEPS:
?0

**** END SOURCE INFORMATION ****
-1 FOR STEADY STATE,
SAMPLE TIME        (DAYS     ):
?-1

RETARDATION        (UNITLESS):
?1

0 FOR NO DECAY,
1 FOR DECAY COEFFICIENT, GAMMA (GG),
2 FOR DECAY LAMBDA (GL),
3 FOR DECAY HALF-LIFE (GT):
?0

1 FOR X AND Y DISPERSION (DX, DY),
2 FOR X DISPERSION AND DISPERSION RATIO (DX, DR),
3 FOR X AND Y DISPERSIVITY (AX, AY),
4 FOR X DISPERSIVITY AND DISPERSION RATIO (AX, DR),
  (USE DM FOR MOLECULAR DIFFUSION):
?2

X DISPERSION       (FT2/D    ):
?105

DISPERSION RATIO (UNITLESS):
?5
```

```
COMMAND?.DG

NON
POINT
SOURCE

THICKNESS         =  110.000      FT
POROSITY          =  .350000
VELOCITY          =  1.50000      FT/D

X DISPERSION      =  105.000      FT2/D
Y DISPERSION      =  21.0000      FT2/D
X DISPERSIVITY    =  70.0000      FT
Y DISPERSIVITY    =  14.0000      FT
DISPERSION RATIO=    5.00000
MOL. DIFFUSION    =  0.00000      FT2/D

RETARDATION       = 1.000000
DECAY GAMMA       = 1.000000
DECAY LAMBDA      =  0.00000      1/YR

ACCURACY          =  .100000E+00
MAXIMUM DIVISION=        100

X LOCATION        =  350.000      TO   800.000      FT
Y LOCATION        = 1000.000      TO   1300.00      FT
SOURCE AREA       =  135000.      FT2
```

START TIME (DAYS)	VOLUME/ AREA RATE (FT/D)	VOLUME FLOW RATE (FT3/D)	SOURCE CONCENTR. (MG/L)	MASS/AREA RATE (LB/FT2/D)	MASS FLOW RATE (LBM/D)
0.00000	.308504E-01	4164.80	200.000	.385185E-03	52.0000
730.000	.205669E-01	2776.53	300.000	.385185E-03	52.0000
2190.00	.154252E-01	2082.40	400.000	.385185E-03	52.0000
4015.00	.145178E-01	1959.91	425.000	.385185E-03	52.0000
7300.00	.123401E-01	1665.92	500.000	.385185E-03	52.0000

```
SAMPLE TIME       = STEADY STATE
X SCALE           ( 1.000000      FT      )
Y SCALE           ( 1.000000      FT      )
CONCENTRATION     ( 1.000000      MG/L    )
```

Y \ X	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
2500	0	0	0	0	0	0	0	0	0	0	0
2250	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
1750	0	0	0	0	0	0	0	0	1	1	1
1500	0	0	0	1	2	4	5	6	7	8	8
1250	0	1	-1	-1	33	30	27	26	24	23	23
1000	0	1	-1	-1	24	23	23	22	21	20	20
750	0	0	0	0	1	2	3	4	5	6	6
500	0	0	0	0	0	0	0	0	0	1	1
250	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

```
WORST APPROXIMATION = +- 8.00     %.
    4 SOURCE(S) SHOWN AS "-1".
```