## APPENDICES

APPENDIX - A: Santa Fe River Model for DO and pH

A-1. Development of the Santa Fe River Water Quality Model to Simulate Diurnal DO and pH Fluctuations, prepared by Tetra Tech, Inc., November 23, 1999 (5 pages).

A-2. Calibrating Santa Fe River Water Quality Model, prepared by Tetra Tech, Inc., February 23, 2000 (10 pages).

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## APPENDIX - A: Santa Fe River Model for DO and pH

The following documents are included in Appendix - A.

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**APPENDIX - A: Santa Fe River Model for DO and pH (continue ...)**

A-1. Development of the Santa Fe River Water Quality Model to Simulate Diurnal DO and pH Fluctuations, prepared by Tetra Tech, Inc., November 23, 1999 (5 pages).

**Development of the Santa Fe River Water Quality Model to Simulate Diurnal DO and pH Fluctuations**
(Prepared by Tetra Tech, Inc., November 23, 1999)

## 1. Introduction

The EPA's WASP/EUTRO modeling framework has been selected to develop a water quality model for the Santa Fe River. The primary goal of the model is to simulate diurnal dissolved oxygen and pH fluctuations due to benthic (attached) algae in the study area. Since the WASP/EUTRO was originally developed for suspended plankton in the water column, it is necessary to modify the code to accommodate important features for attached algae. First, the phytoplankton slot in the WASP/EUTRO model code will be used for the attached algae with necessary modifications. The WASP/EUTRO modeling framework has a unique feature that is crucial to modeling the attached algae. In WASP, mass transport such as advective and dispersive flows may be turned off for any given system variables. In this case, the attached algae is not moving with the river flow and therefore it transport can be set to zero. Another key feature of the water quality is the incorporation of pH calculations in the river.

The observed data from June 7 to June 10, 1999 was used to configure and calibrate the water quality model. This technical memo serves to document the model design, code modifications, and model calibration results.

## 2. Model Segmentation and Mass Transport

A 3-mile reach of the Santa Fe River from the discharge of the wastewater treatment plant to about 1¼ miles below Preserve is divided into 12 segments, each of which is ¼ miles long. Because the attached algae reside at the bottom of the water column, another 12 segments are configured as a second layer below the water column. This second layer has a depth of 0.324 ft (0.1 m). A total of 24 segments are therefore configured for the Santa Fe River.

The water column depth ranges from 0.67 ft to 0.77 ft and the advective velocity associated with the river flow (essentially 100% wastewater flow, about 6.5 cfs during the period from June 7 to June 10, 1999) ranges from 0.42 ft/s to 0.55 ft/s along the study area. The water column is shallow and moves at a moderate speed. A vertical dispersion coefficient of $2.1 \times 10^{-5}$ $ft^2/s$ (or 0.02 $cm^2/s$) is used between the two water column layers. This value is relatively small, yet large enough to generate sufficient mixing between the two layers, making the thin, second layer a virtual layer. Note that this model design is not feasible with the QUAL2E modeling framework because QUAL2E cannot have a mutli-layer structure in the water column.

3. **Attached Algae Growth Kinetics**

As mentioned earlier, the phytoplankton slot in the WASP/EUTRO modeling framework is used for the attached algae. Since the attached algae are in the bottom of the river channel, it is not simulated in the surface layer of the water column. Thus, the algal concentration and growth rate in the surface layer are set to zero throughout the simulation. Since the mass transport is turned off for this system variable, no attached algae will be transport from the thin, second layer to the surface layer. Other system variables such as nutrients are freely transported between the two layers via the vertical dispersion coefficient. thereby making nutrients from the water column readily available for the attached algae in the second layer. Since the attached algae reside at the river bottom, its settling velocity is set to zero.

The key feature of this modeling analysis is diurnal simulations of DO and pH. To simulate them requires small time-step calculations of algal growth. In the EUTRO module, the algal growth rate as a function of light is evaluated on a daily average and depth average basis. This must be modified for instantaneous simulations of algal growth. Thus, the light reduction on algal growth should not integrate over time and depth. Instead, the following light reduction equation is used:

$$r = \frac{I}{Is} e^{[-\frac{I}{Is}+1]}$$

where

$r$ = light reduction factor for algal growth rate (dimensionless number),

$I$ = instantaneous light intensity (langley/day) reaching the surface of the second layer, and

$I_s$ = saturated light intensity for optimum algal growth (set at 525 langley/day).

Note that the EUTRO model identifies the proper segment numbers in the second layer to calculate the correct light attenuation through the water column, i.e., the surface layer. Since the attached algae is located at the bottom of the water column and no suspended algae in the water column, the self-shading effect of algae as specified in the original EUTRO model code must be turned off.

Attached algal growth can also be limited by the availability of substrate. To mimic this effect, a form of Michaelis-Menton kinetics is employed. The biomass level at which half the maximum growth rate occurs is 5.0 gm-C/m$^2$ (Warwick et al., 1997). This mechanism allows maximum rates of primary productivity at low levels of biomass with decreasing rates of primary productivity as the benthic community expands.

4. **pH – Alkalinity Kinetics in the Water Column**

The pH-alkalinity kinetics is based on the carbonate equilibrium in the water column as developed by Lung (1986) for a lake acidification model. In general, two system variables: $CO_2$ acidity and alkalinity are needed for the kinetics. However, algal photosynthesis and respiration do not alter alkalinity. In addition, a review of the field data shows that the alkalinity levels in the Santa Fe River remain relatively constant. It is therefore, justified to assume a constant alkalinity level in the water column and not to include alkalinity as a system variable in the model. Thus, $CO_2$ acidity is only the system variable to be added in the EUTRO code. The pH-alkalinity kinetics incorporated into the model is outlined below.

Algal photosynthesis can be represented by the following chemical equilibrium equation:

$$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$$

Note that this reaction will increase the pH level but will have no effect on alkalinity. The stoichiometry of this reaction is that generating one mg of algal biomass requires 3.666 mg of $CO_2$. Since it is mathematically attractive to express $CO_2$ acidity as $CaCO_3$, another ratio of 50/44 is needed to convert the $CO_2$ mass to $CaCO_3$ mass using the equivalent weights of these compounds. Therefore, the attached algal growth rate (in mg/L of algal carbon) is multiplied by 3.666 x 50 / 44 to determine the decrease rate of $CO_2$ acidity. The attached algal growth rate will be evaluated in the phytoplankton subroutine prior to the $CO_2$ acidity subroutine.

The above reaction is reversed during algal respiration as follows:

$$C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$$

Again, this reaction has no effect on the alkalinity level but will decrease the pH. The time rate of increase of the $CO_2$ acidity concentration during algal respiration is evaluated by multiplying the respiration rate by 3.666 x 50 /44.

Another key process in the $CO_2$ budget in the water column is the mass transfer across the air-water interface, which is similar to the oxygen reaeration process in the EUTRO model. Therefore, the reaeration coefficient values evaluated for oxygen transfer will be used for $CO_2$ transfer. This process is important as it supplies $CO_2$ from the atmosphere to the water column. An extra step is involved in this calculation, i.e., relating $CO_2$ to $CO_2$ acidity.

Another source of $CO_2$ acidity is the recycled carbon from dead attached algae via CBOD, which must be included in the model. Once the $CO_2$ acidity and alkalinity concentrations are determined, the hydronium ion concentration can be calculated using the following equation (Lung, 1986):

$$H = K_1[CO_2acy - K_2 - \frac{K_w}{K_1}]/(Alk + K_1)$$

Where

$H$ = hydronium ion molar concentration

$CO_2\ acy$ = $CO_2$ acidity concentration

$K_1$, $K_2$, $K_w$ = equilibrium constants

The pH value is then equal to $-\log_{10}(H)$.

## 5. Modifications of the WASP/EUTRO Code

A new subroutine called $CO_2$ Acid is added at the end of the EUTRO code. In the beginning of the EUTRO code, the new variable $CO_2$ acy is introduced by storing the value of C(ISEG,9), identifying it as the 9th system variable in the WASP/EUTRO model. The $CO_2$ Acid subroutine is called after the dissolved oxygen subroutine is called.

The light attenuation and light reduction effect on algal growth as described above are incorporated in the DITORO subroutine.

The COMMON block WASP.CMN is modified by changing the number of system variable from 8 to 9. Additional changes are also made in the WASP.FOR code to add the 9th variable in the screen display during the course of simulation. The ambient light intensity levels are updated every hour, therefore requiring 25 time breaks each day. Since the temperature levels are updated in the input data file on every 15-min., requiring 193 time breaks, the maximum number of time breaks, MB, in the WASP.CMN file must be increased to 193. [Other entries such as mass transport flows, volumes, boundary conditions, and loading rates are entered with two values: one at time 0.0 and the second one at time 365 day, indicating constant values throughout the

simulation.] In the EUTRO.CMN file, new variables such as $CO_2$ acy and pH are added in the COMMON block EUTRO8 to allow free transfer of information between subroutines.

### 6. Recompilation and Linking of the WASP/EUTRO Model

The WASP.FOR and EUTRO.FOR programs are recompiled and their object code is linked with a graphics library which provides on-screen real-time display of the simulation for any given 6 segments. The display shows the time-variable concentrations of ammonia, nitrite/nitrate, orthophosphate, phytoplankton carbon, CBOD, dissolved oxygen, and organic nitrogen, organic phosphorus, and $CO_2$ acidity. The model is run for 16 days until the results reach a dynamic steady state. While the results show diurnal changes of the water quality constituents, the diurnal cycle does not change from one day to the next. The maximum time-step used in the calculation is 0.002 day.

### 7. Model Calibration Results

Figure 1 shows the model calibration results for chlorophyll *a*, dissolved oxygen, pH, and $CO_2$ acidity at two locations: immediately below the treatment plant and Preserve. The hourly dissolved oxygen and pH measurements at these two sites during the period from June 7 to June 10, 1999 are also shown for comparison with the model results. While the maximum and minimum dissolved oxygen concentrations are slightly off from the data, the timing of diurnal changes match well with that from the data. The diurnal timing of the attached algal biomass, i.e., chlorophyll *a* is determined by the diurnal fluctuations of temperature and light intensity levels.

Note that the attached algae in the Santa Fe River reach a very high level of biomass of 1,200 μg/L chlorophyll *a*. Their growth is primarily limited by the inorganic nitrogen concentrations in the water column and to an extent by the $CO_2$ concentrations. The ambient orthophosphate concentrations are high, much higher than the Michaelis-Menton constant for inorganic phosphorus and therefore not a factor limiting growth.

The model also calculates Algal photosynthesis and respiration rates. The maximum calculated oxygen production rate during algal growth and respiration reaches about 10 mg/L/hr or 240 mg/L/day, which is supported by the dissolved oxygen gradients measured in the field at sampling sites, thereby further substantiating the validity of the model results.

**APPENDIX - A: Santa Fe River Model for DO and pH (continue ...)**

A-2. Calibrating Santa Fe River Water Quality Model, prepared by Tetra Tech, Inc., February 23, 2000 (10 pages).

(Prepared by Tetra Tech, Inc., February 23, 2000)

# CALIBRATING THE SANTA FE RIVER WATER QUALITY MODEL

## Data to Support Model Calibration

The receiving water data used to support the model calibration was collected during a survey from June 7 to June 10, 1999. Dissolved oxygen and pH levels were measured at two locations at 15-min intervals: immediately below the Santa Fe Plant and at Preserve. These values are available for comparison with the model results.

Measured hydraulic geometry of the Santa Fe River in the study area such as average velocity and water column depth is used to calculate the model segment volumes.

On-site measurements of key environmental parameters such as water temperature and solar radiation are incorporated into the model every 15 minutes for two days. That is, this data is recycled in the model computations when the total simulation time is longer than two days. Since observed solar radiation data were not available for Santa Fe, hourly historical data measured at Albuquerque, NM for the period 1961-1990 were used. The following procedure was used to estimate the solar radiation for Santa Fe:

1. Using hourly data for Albuquerque, the maximum solar radiation for each hour of each day of the year is determined by searching through the 1961-1990 period.
2. An assumption is made that given the 30-year period, clear-sky conditions would have occurred at least once each hour of each day during that period. The clear-sky solar radiation is taken as the maximum value found in step 1.
3. The clear-sky solar radiation values are then adjusted using the hourly cloud cover conditions recorded for Santa Fe in the climatology data set downloaded from NOAA/NCDC. The equation for adjusting solar radiation due to cloud cover is:

$$SR_{adj} = (1.0 - 0.65\, CC^2)\, SR_{clear}$$

where

$SR_{adj}$ = adjusted solar radiation

$CC$ = cloud cover fraction (0.0 = clear; 1.0 = overcast)

$SR_{clear}$ = clear-sky solar radiation

4. The $SR$ values are then corrected to photosynthetically active radiation (PAR) by multiplying total solar radiation by 0.43 for model input.

Since the wastewater flow is the total river flow during the June 1999 survey, the measured treatment plant effluent concentrations are used as upstream boundary conditions for the model input. No other point or nonpoint source loads are included in the model.

**Key Model Coefficients**

One of the key model parameters is reaeration coefficient, $k_a$. At large values of the reaeration coefficient, the time-variable dissolved oxygen curve does not diverge much from the saturation level. Also the shape of the curve is similar to that of the forcing function (in this case, the time-variable water temperature and light intensity levels), with the maximum oxygen concentration (minimum deficit) occurring shortly after solar noon. However, as $k_a$ decreases, the solution moves farther from saturation. In addition the shape departs from that of the forcing function and becomes more sinusoidal. The maximum concentration occurs later in the afternoon, and a clearly defined minimum occurs just after dawn. Thus, the model accurately depicts what is observed in the study area. The small $k_a$ retards the rate of reaeration transfer, allowing the effect of the previous day to carry over into the present day. This condition accounts for the minimum dissolved oxygen concentration (maximum deficit) occurring slightly after dawn.

Quantifying the reaeration coefficient, particularly for small streams at low flow rates, is extremely difficult. The WASP/EUTRO model offers three empirical equations to calculate the reaeration coefficient: Owens et al. (1964), Churchill et al. (1962) and O'Connor and Dobbins (1958). Yet, these equations are unsuitable for the Santa Fe River because they tend to overestimate $k_a$ rates for the extremely small flow rates and shallow waters found in the study area. A more reasonable equation is from Moog and Jirka (1998):

$$k_a = 1.740\ V^{0.46}\ S^{0.79}\ H0.76 \tag{1}$$

for the stream channel slope, $S > 0.0004$ and

$$k_a = 5.59\ S^{0.16}\ H^{0.73} \tag{2}$$

for $S < 0.0004$. An examination of the topographical map of the study area reveals that the average channel slope is approximately 0.005. Using Eq. 1 with an average velocity of 0.128 m/s and a depth of 0.235 m for the study area, one can calculate an average $k_a$ = 3.52 $day^{-1}$ at 20°C. Subsequent model calibration analyses result in a value of 2.50 $day^{-1}$. A constant reaeration coefficient value of 2.50 $day^{-1}$ is used in the model. Note that the same reaeration coefficient value is used for the exchange of $CO_2$ across the air-water interface.

Another key model parameter is the saturated dissolved oxygen level, which is calculated as a function of temperature as follows:

$$C_s = \frac{468}{31.6 + T} \tag{3}$$

where $C_s$ is saturated dissolved oxygen concentration in mg/L and $T$ is temperature in °C. Values generated by Eq. 3 must be multiplied by a factor of 0.78 to account for the thin air at the high elevation of the study area, 6,200 ft above the sea level. At 20°C, the saturated dissolved oxygen level in the Santa Fe River is only 7.07 mg/L.

The following equation by Kelly et al. (1974) is used to quantify the saturation concentration of $CO_2$ in the water column:

$$CO_{2(s)} = 50000\ x\ 10^{[\frac{2385.73}{T+273} - 17.5184 + 0.015164\ (T+273)]} \tag{4}$$

where $CO_{2(s)}$ is saturated $CO_2$ concentration in mg/L and $T$ is water temperature in °C. Again, the value calculated by Eq. 4 is then multiplied by a factor of 0.78 to account for the high altitude of the study area.

## Model Calibration

An important gage to calibrate the model is the sharp rising and declining rates of dissolved oxygen levels in the water column, with a maximum increase rate at over 240 mg $O_2$/L/day! Two factors contribute to this sharp daily swing of dissolved oxygen concentrations: the high benthic algal biomass and the carbon to chlorophyll *a* ratio in the algal biomass. The high algal biomass calculated by the model is about 1,000 μg/L, a level has been reported for the benthic algae in the east branch of Brandywine Creek in Pennsylvania (Knorr and Fairchild, 1987).

A series of model calibration runs have revealed that a high carbon to chlorophyll *a* ratio is needed to match the significant daily fluctuation of dissolved oxygen levels. The ratio used in the model is 266 μg C/μg chlorophyll *a*.

Values of other kinetic coefficients related to benthic algal growth and nutrient recycling are taken from a recent modeling study of Carson River, NV by Warwick et al. (1997) and further refined in model calibration. Table 1 lists these coefficient values used in the Santa Fe River model.

## Model Results

Figure 1 shows the results for the 4-day period of June 7 - June 10 in benthic algal biomass (chlorophyll *a*), $CO_2$ acidity, dissolved oxygen, and pH at the location immediately below the Santa Fe Plant. The model has reached a steady-state condition with repeated daily pattern for these water quality constituents. As stated earlier, the calculated chlorophyll *a* level of 1,000 μg/L is considered reasonable for the benthic algae as similar levels have been reported elsewhere (Knorr and Fairchild, 1987). While the benthic algal biomass is rising in the middle of the day, $CO_2$ acidity is declining. The rising benthic algal biomass results in the dissolved oxygen maximum in the afternoon. The subsequent decline in the algal biomass in the later part of the day produces a minimum dissolved oxygen by mid-night and early morning of the next day. The model calculated dissolved oxygen fluctuation (i.e., phase) follows the observed pattern closely. The calculated pH pattern also follows the temporal trend of $CO_2$ acidity concentrations, with lower pH levels matching higher $CO_2$ acidity concentrations.

Model results from segment 14 are compared with the data observed at Preserve (Figure 2). The calculated benthic algal chlorophyll *a* levels are slightly lower than those shown in Figure 1. The temporal trend of $CO_2$ acidity, dissolved oxygen, and pH is very similar to that at the location immediately below the Santa Fe Plant. The significant daily fluctuation of dissolved oxygen is also reproduced. Note the timing of minimum $CO_2$ concentrations match the time of the day for maximum dissolved oxygen levels. The slightly pronounced daily fluctuations of $CO_2$ acidity, dissolved oxygen, and pH at Preserve is due to the more significant fluctuation of water temperature at this location.

While the model results match the observed trend of dissolved oxygen and pH at both locations, there are differences between the calculated maximum/minimum values and the observed data. Because the model produces equilibrium values while the Santa Fe River may not reach a steady-state condition, the graph shows some day to day variations in dissolved oxygen and pH.

As previously mentioned, the reaeration coefficient, $k_a$ is a key model parameter. Figure 3 presents the comparison of model results (at Preserve) between $k_a = 2.50$ day$^{-1}$ and 3.50 day$^{-1}$. As expected, the higher $k_a$ yields lower $CO_2$ acidity concentrations in the water column by increasing its flux across the air-water interface because the $CO_2$ levels in the water column are considerably greater than its saturation level, particularly at mid-day when the water temperature is reaching its maximum. The higher $k_a$ value also raises the pH levels in the water column, responding to the lowered $CO_2$ acidity concentration. The higher $k_a$ value increases the minimum dissolved oxygen concentration slightly, thereby reducing the daily fluctuation by a small amount, i.e., less than 0.5 mg/L.

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Table 1. EUTRO5 Model Kinetic Coefficients

| | | | | | |
|---|---|---|---|---|---|
| GLOBALS | 0 | | | | |
| NH3 | 1 | | | | |
| nitrificat | 2 | | | | |
| K12C | 11 | 0.20 | K12T | 12 | 1.08 |
| NO3 | 1 | | | | |
| denitrif | 2 | | | | |
| K20C | 21 | 0.10 | K20T | 22 | 1.045 |
| PO4 | 0 | | | | |
| PHYT | 4 | | | | |
| growth | 2 | | | | |
| K1C | 41 | 2.45 | K1T | 42 | 1.055 |
| light | 3 | | | | |
| LGHTS | 43 | 1.0 | CCHL | 46 | 266. |
| IS1 | 47 | 525. | | | |
| nutrients | 4 | | | | |
| KMNG1 | 48 | 0.025 | KMPG1 | 49 | 0.005 |
| NCRB | 58 | 0.18 | PCRB | 57 | 0.025 |
| death | 4 | | | | |
| K1RC | 50 | 0.600 | K1RT | 51 | 1.069 |
| K1D | 52 | 0.10 | KPZDC | 55 | 0.00 |
| CBOD | 1 | | | | |
| deoxygent | 2 | | | | |
| KDC | 71 | 0.07 | KDT | 72 | 1.05 |
| DO | 1 | | | | |
| ratio | 2 | | | | |
| OCRB | 81 | 2.67 | K2 | 82 | 2.50 |
| ON | 1 | | | | |
| mineralize | 3 | | | | |
| K71C | 91 | 0.500 | K71T | 92 | 1.08 |
| FON | 95 | 0.15 | | | |
| OP | 1 | | | | |
| mineralize | 3 | | | | |
| K83C | 100 | 0.75 | K83T | 101 | 1.08 |
| FOP | 104 | 0.50 | | | |
| CO2acy | 0 | | | | |

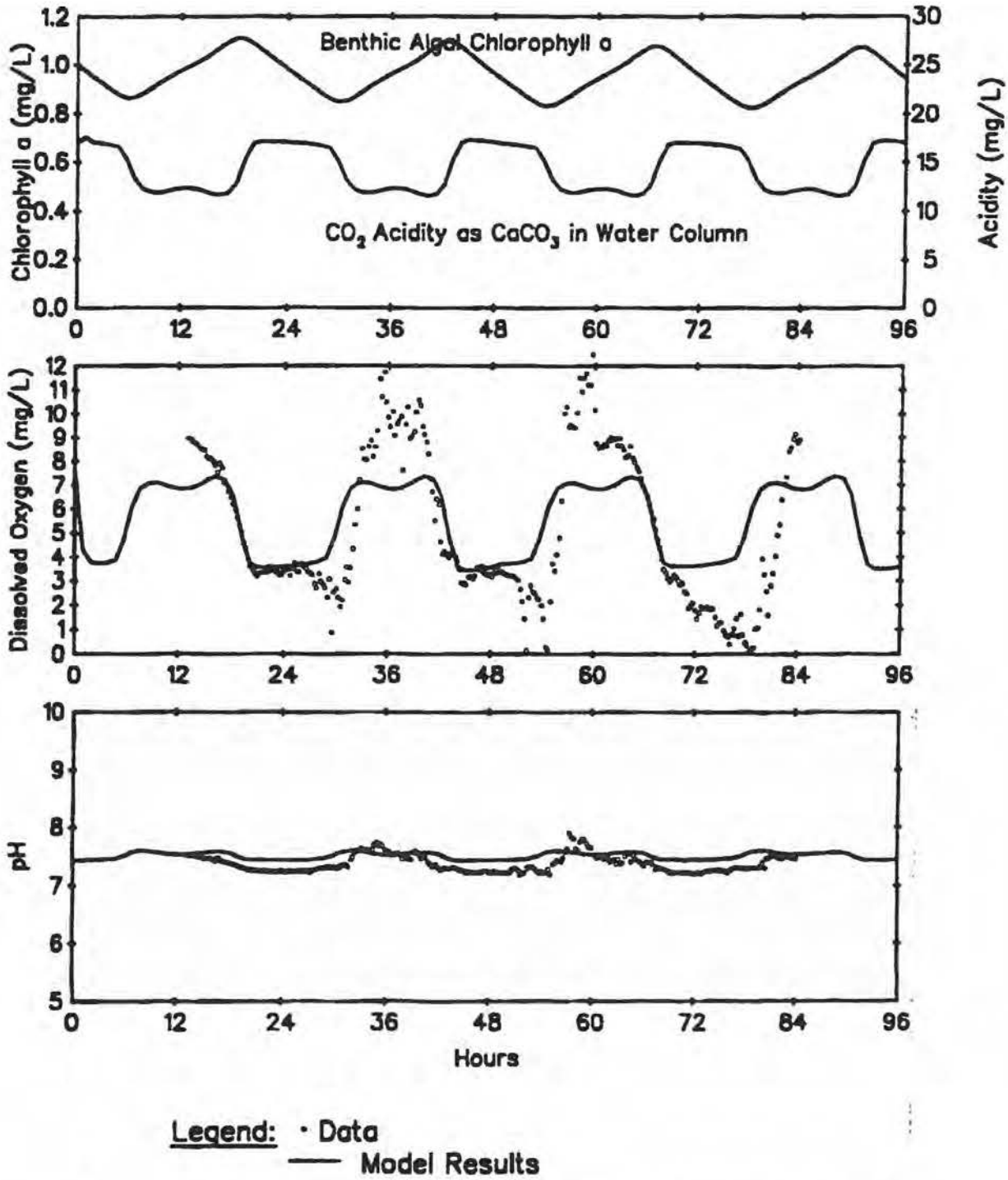


Figure 1. Model Results vs. Observed Data Immediately Below the Santa Fe Plant (June 7-June 10, 1999)

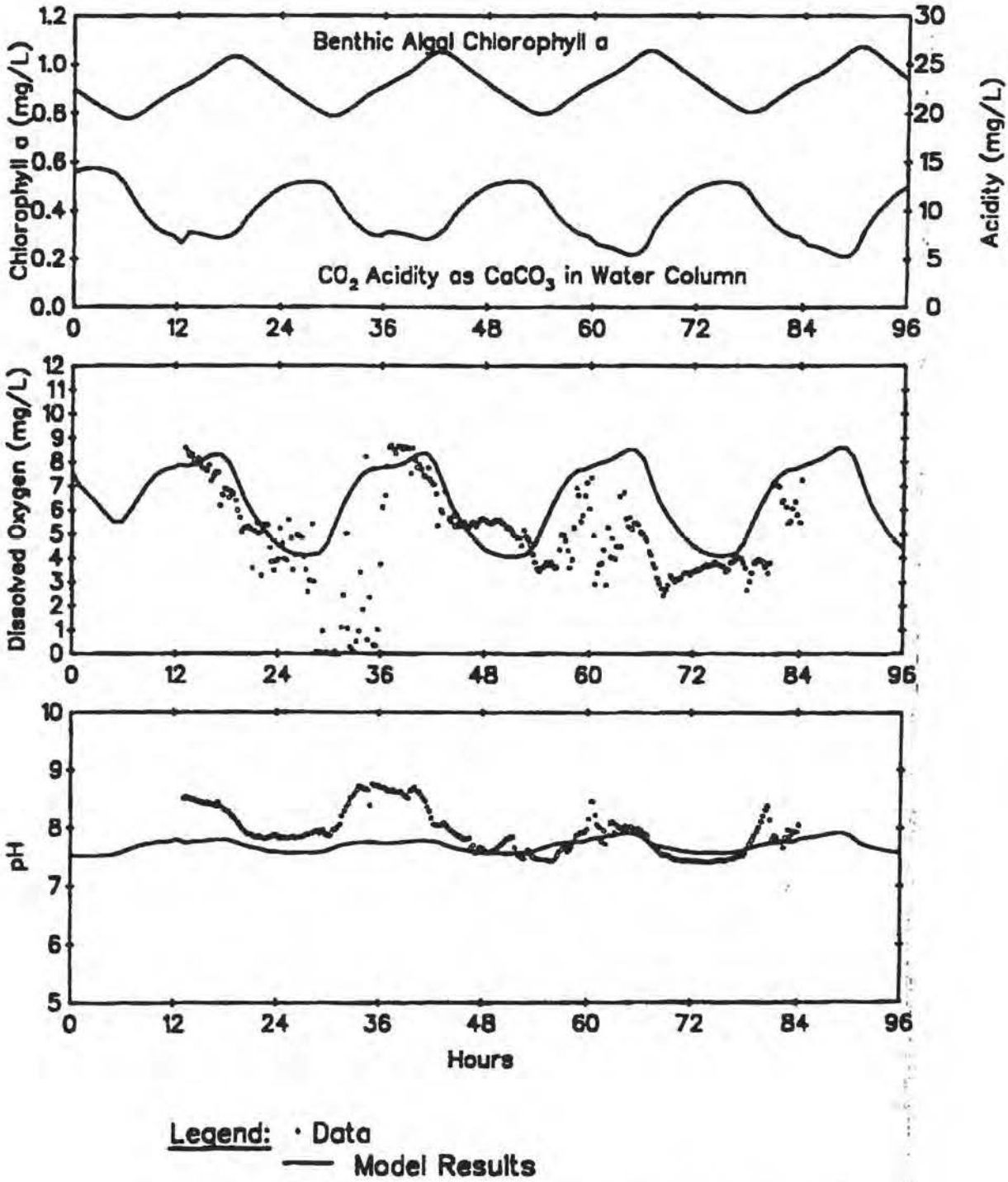


Figure 2. Model Results vs. Observed Data at Preserve (June 7-June 10, 1999)

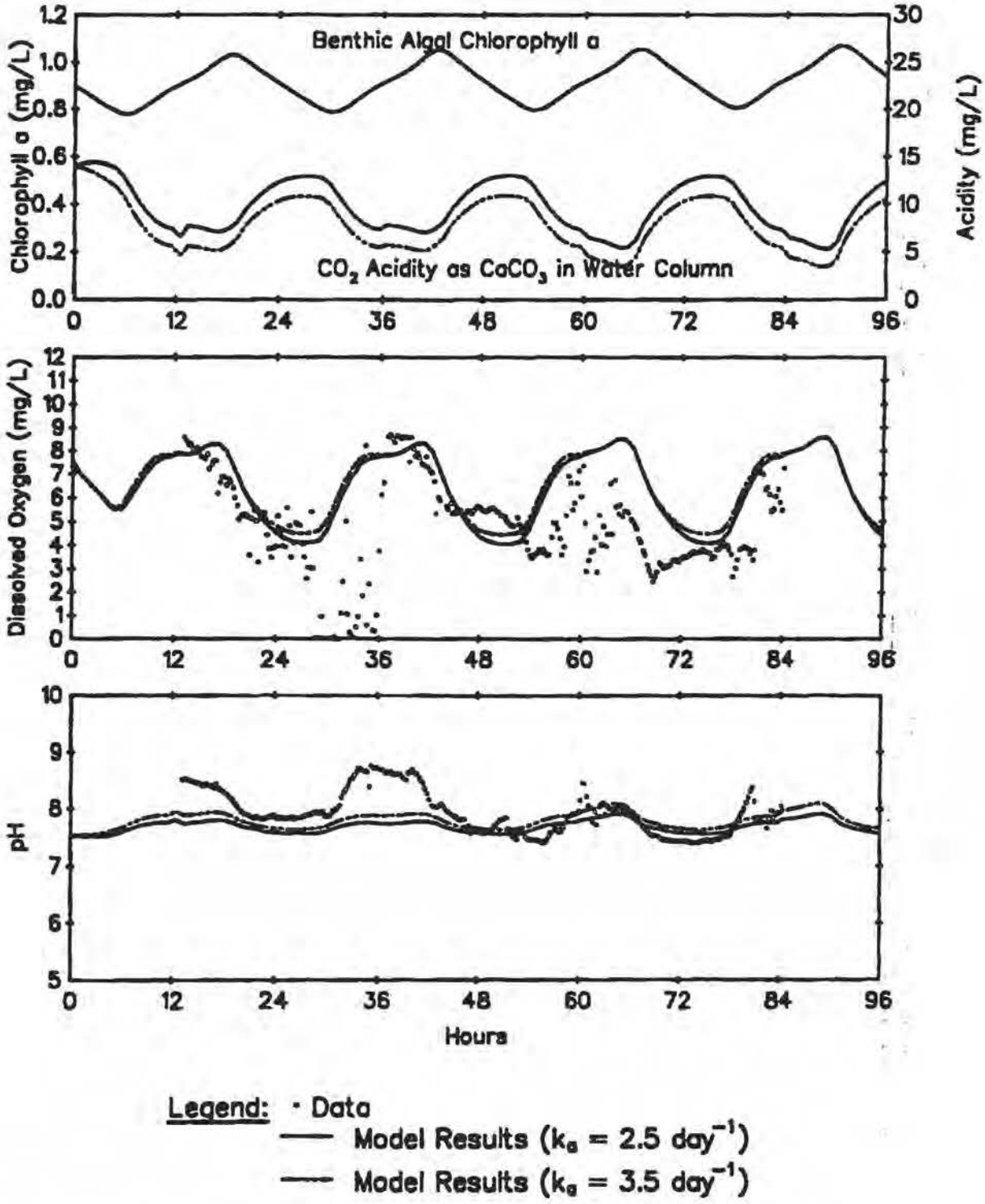


Figure 3. Model Sensitivity Analysis Results vs. Observed Data at Preserve (June 7-June 10, 1999)

**APPENDIX - A: Santa Fe River Model for DO and pH (continue ...)**

A-3. Technical Approach - Modeling Diurnal Fluctuations of pH and DO in the Santa Fe River, prepared by Tetra Tech, Inc., September 22, 1999 (1 page).

**Technical Approach – Modeling Diurnal Fluctuations of pH and DO in the Santa Fe River**
**(Prepared by Tetra Tech, Inc., September 22, 1999)**
**Wu-Seng Lung, PhD, PE**

The QUAL2E model was initially selected for this modeling study for the following reasons:

1. It has the capability to simulate diurnal temperature and DO fluctuations under the dynamic simulation mode.
2. It is easy to set up for shallow streams such as the portion of the Santa Fe River being studied.
3. It is an EPA model that has been widely accepted by the modeling profession and regulatory agencies.

Following the configuration of the modeling framework and a series of model runs, it was found that the chlorophyll *a* results from the model are not satisfactory when compared with the data. A careful review of the model applications indicated that while the attached algae remain stationary in the river channel, they are transported downstream with nutrients in the water column in the model. In addition, the growth rate of attached algae depends on the velocity in the water column, which is not accounted for in the QUAL2E model. The light intensity level for the QUAL2E model is used for the entire water column depth. However, the attached algae reside at the bottom. Although the Santa Fe River is quite shallow, this light intensity would still generate some inaccurate light readings for the attached algae at the bottom.

The surface light intensity level cannot be easily modified prior to input to the QUAL2E model because it is used to calculate a depth-average light level for algal growth. In addition, maintaining the attached algae stationary and incorporating velocity-dependent growth rate for attached algae are even more difficult to accommodate in the QUAL2E model, requiring a significant level of effort to revise the code.

On the other hand, it is much easier to use the EPA's WASP/EUTRO model to address the above difficulties. First, the WASP model has a unique feature of turning off mass transport, i.e., advective and dispersive flows for any given system variable(s). This is accomplished by exercising the transport by-pass option for the algal system, while maintaining mass transport for the nutrients. No code change is needed to accommodate this.

The velocity-dependent growth rate of algae can be accounted for by calling for the advective velocity in the EUTRO code. The correct light intensity for the attached algae can be quantified by configuring a second, thin layer in the EUTRO model for attached algae. As such, the correct light levels will be determined via attenuation through the first layer. [Note that the QUAL2E model cannot have multiple vertical layers in the water column.]

Diurnal fluctuations of pH and DO will be calculated in the EUTRO model. To accomplish this task, hourly or by-hourly light intensity levels will be incorporated into the input data file for a 24-hour input. The WASP/EUTRO model will be run time variably to a dynamic steady-state condition while the light intensity and temperature time functions will be recycled day after day in the calculation until the system reaches an equilibrium. That is, the diurnal fluctuations of pH and DO remain the same from one day to the next. In this model configuration for EUTRO, the Di Toro light option should be used and the f (fraction of day with daylight) value will be set to 1.0. The QUAL2E model runs will provide diurnal fluctuation of water temperature as a key input for the EUTRO model.

**APPENDIX - A: Santa Fe River Model for DO and pH (continue ...)**

A-4. Santa Fe River - Preliminary Reconnaissance, prepared by Tetra Tech, Inc., September 18, 1998 (3 pages).

**Santa Fe River-Preliminary Reconnaissance**
**September 18, 1998**

Tetra Tech staff (Jon Harcum) met with NMED (David Hogge, Peter Monihan, and Mike Coleman) and IPA (Kristen Martin, Willie Lane) staff on September 18, 1998 to discuss TMDL development for the Santa Fe River and related tributaries (Cienega and Alamo Creeks). David Hogge, Kristen Martin, Willie Lane, and Jon Harcum participated in a preliminary reconnaissance of the Santa Fe River and related tributaries. The Santa Fe River is currently on the 303(d) list for chlorine, pH, total ammonia, gross alpha, and stream bottom deposits. Cienega Creek is listed for fecal coliform, chlorine, and total ammonia. Alamo Creek is listed for metals. During the meeting NMED described their reclamation of the La Bajada mine site along the Santa Fe River that was completed during 1996 as well as general background information related to the other 303(d) stressors. Notably, there are no monitoring data for metals on Alamo Creek or stream bottom deposits. NMED confirmed that all monitoring for this project would be performed by NMED.

**Locations Visited During Preliminary Reconnaissance**

1. The preliminary reconnaissance started at the discharge point of the Santa Fe WWTP (T16N R8E Sec. 10 NWSW, elevation: 6270'). The flow from the discharge ditch was estimated as ~7 million gallons per day. Upstream of the discharge point, the Santa Fe River is a dry arroyo which will flow during snow melt and after rain events. The wetted portion of the streambed had noticeable algal growth suggesting nutrient enrichment. (The permit for the WWTP expired in 1991 and does not include ammonia limits or toxicity testing. It is believed that the discharger might have data related to these parameters. The discharger does have nitrates limits in their permit and does report total Kjeldahl nitrogen.) The pH of the discharge was measured as 7.7 using a pH meter with only one point of calibration. Total residual chlorine was measured as 0.12 milligrams per liter (mg/L), but was believed to be inaccurate due to interference and the WWTP no longer used chlorine for disinfection.

2. At the second stop (T16N R8E Sec. 16 NW, elevation: 6200'), approximately one mile downstream of the WWTP discharge, is a recently installed cattle exclosure. The left stream bank is unstable with some vertical facing walls as high as 10 to 15 feet in height above the streambed. This location also had noticeable algal growth. The pH at this site was 8.81. Downstream from this site, there are a few houses that, if on septic systems, might contribute to the nutrient loading. (Ground water inputs might also have an impact in this portion of the Santa Fe River.)

3. The third stop (T16N R8E Sec. 31 NWNW, elevation: 6000') is the last readily accessible location before the Santa Fe River enters the Cañada de Santa Fe.

4. A small animal operation exists at the confluence of Cienega Creek and the Santa Fe River (T15N R7E Sec. 1 NESW, elevation: 5900'). The sheep pens (less than 20 animals), located on the Santa Fe River right bank above the confluence appear to have an earthen berm limiting overland flow from the pens. The earth berms might have been installed to prevent flooding from the Santa Fe River. Hogs and chickens, located on the Cienega Creek right bank appear to have access to Cienega Creek with little apparent berming to prevent direct run-off from the lots. This might be contributing to the coliform source. Housing units located further up Cienega Creek might also contribute to the coliform source. It is not clear whether Cienega Creek is contributing to the nutrient enrichment of the Santa Fe River.

   Alamo Creek is believed to flow into Cienega Creek just upstream of the Cienega Creek/Santa Fe River confluence. Historically, a smelter was located on Alamo Creek and is the basis for listing Alamo Creek for metals.

5. At the reclamed La Bajada mine site (T15N R7E Sec. 9 NW, elevation: 5600'), a substantial effort was performed to grade, vegetate, and armor the site from further erosion that might lead to elevated gross alpha levels in the surface water. Minnows were sited in the stream at this point. Vegetation in some areas is poor, but would likely recover if not grazed. (Note: The U.S. Forest Service is in the process of building cattle

exclosures from the reclamation area.) It is likely that continued mid channel bank erosion at the upper end of the mine site will continue before stabilizing. Based on conversations with Peter Monihan, there is a remaining natural spring that might contribute to gross alpha levels. Qualitatively, the radiation levels have dropped dramatically from the pre-reclamation levels.

6. Finally, a USGS station (T15N R7E Sec. 8 SWNW, elevation: 5500') is located about 1.3 river miles downstream from the La Bajada mine.

**Issues/Discussion**

1. **Alamo Creek/Metals.** No data were collected to list this stream for metals according to NMED and IPA staff. Thus, metals monitoring on this stream is needed to confirm actual water quality standard violations. It is recommended to find the smelter site and develop a photo record of the site (documenting areas with high run-off potential that might contribute to elevated in-stream metal concentrations). If viable, the smelter site should be bracketed with an up and downstream station. Alternatively, a site downstream could be selected recognizing that if significant metals were detected, then additional monitoring would be necessary to bracket the source of the metals. Given the concerns related to sample contamination, some consideration for ultra-clean sampling should be considered. (Note that dissolved aluminum results along the Middle Rio Grande by NMED during 1994-1995 were noticeably greater than the results by USGS from 1994-1997.) Depending on the characteristics of the smelter site, NMED should consider both low flow and high flow periods of the year. Given likely site access and safety considerations, storm sampling is not recommended at this time. At this time it is unclear whether a TMDL is needed for this stressor. Note, that access to the downstream Alamo Creek site might be dependent on private property access. It is currently unknown whether Alamo Creek would have to be monitored for coliform or nutrients to differentiate it from Cienega Creek.

2. **Cienega Creek/Fecal Coliform.** Sampling near the confluence of Cienega Creek and the Santa Fe River might pose an access question due to private land holdings. To minimize private land owner sensitivity to sampling, it is likely that sampling will need to occur 1) below the confluence of Cienega Creek and the Santa Fe River, 2) at a bridge located upstream on Cienega Creek, and 3) above the confluence (above the sheep operations) on the Santa Fe River. A third station on Cienega Creek might be necessary to characterize coliform sources. Possible sources of coliform might include the animal operation at the confluence, housing units located further up Cienega Creek, and/or the Valle Visa Sewer Company; however, a more detailed survey of Cienega Creek should be done. The results of a more detailed survey might suggest it would be necessary to sample under both low and high flow conditions to characterize coliform sources. Monitoring should include fecal coliform (FC) and fecal streptococci (FS) to facilitate source identification. (FC/FS is generally above 4 for humans and below 1 for domestic animals.) According to NMED and IPA staff, BLM is pursuing acquisition of the land near the confluence. Pending resolution of land acquisition, a TMDL implementation plan might not be tractable (assuming that a TMDL is required).

3. **Cienega Creek/Chlorine.** As demonstrated on the Lower Rio Grande, the Jemez River, and on this preliminary reconnaissance, monitoring for total residual chlorine using portable kits is tenuous. Valle Visa mobile home park is located well upstream on Cienega Creek, but excess chlorine is not likely an issue, chlorine is not a reportable characteristic but evaluations will be conducted by NMED staff.

4. **Santa Fe River/Chlorine.** As demonstrated on the Lower Rio Grande, the Jemez River, and on this preliminary reconnaissance, monitoring for total residual chlorine using portable kits is tenuous. It is recommended to delete chlorine as a stressor to Santa Fe River although it might be appropriate to include a "no measurable total residual chlorine" statement in the Santa Fe WWTP permit.

5. **Santa Fe River/pH.** As demonstrated on this field reconnaissance, pH quickly increases (less than one mile) downstream of the WWTP effluent. The change is likely due to natural sources of bicarbonate material. However, a pH profile should be developed to demonstrate the increase along with a survey to document no other likely sources. Tetra Tech plans to review the long-term pH in more detail (in particular at the

downstream USGS station), but anticipates that the pH profile will be sufficient to demonstrate that higher pH values are due to natural background and no TMDL will be necessary.

6. **Santa Fe River/Total Ammonia.** According to IPA staff, there is sufficient data to document that total ammonia water quality standards are not being met in the river. Probable sources are the WWTP and animal operations on Cienega Creek. It would seem apparent that their permit might need to be updated to include an ammonia discharge limit and/or toxicity testing requirement. Nevertheless, it is recommended that NMED pursue effluent sampling for typical physical/chemical parameters as well as toxicity testing as it will support this issue and nutrient enrichment discussed later.

7. **Santa Fe River/Gross Alpha.** As stated earlier, substantial remediation has been completed at the La Bajada Mine. Tetra Tech has not reviewed the post remediation data at this time. If gross alpha levels are still above water quality standards, it would be necessary to determine the location of the radiation source. If the source can be narrowed to the natural spring described earlier, then a TMDL might not be warranted. If additional monitoring is warranted, NMED should consider sampling during low and high flow periods to better document gross alpha levels because of the likely variability in the natural spring's flow. It is also recommended that NMED develop permanent photo points to document the continued recovery and stability of stream banks as head cuts into the reclamed area could re–expose contaminated material.

8. **Santa Fe River/Stream Bottom Deposits.** During the last revision to New Mexico's 303(d) list, sediment was deleted as a stressor from numerous warm water fisheries due to a consultation from the FWS indicating that sediment is not a concern to warm water species in New Mexico. However, the Santa Fe River is listed as a limited cold water fishery. A recent study prepared for the City of Santa Fe requesting the river be listed as a warm water fishery was turned down. (During the fish survey, the consultant found some cold water species in the river.) The approach used to address sediment here is likely to have a dramatic effect on TMDL development throughout New Mexico even though this river is effluent dominated (unlike most cold water fisheries in New Mexico). Based on visual observation during the preliminary reconnaissance, it is likely that most of the sediment in the stream is derived from unstable streambanks. It should also be noted that at each site visited during the preliminary reconnaissance, the stream bed was sandy with some cobbles and not uncharacteristic of lower gradient streams in New Mexico. In other work, NMED does not currently have sufficient data to correlate stream embeddedness with stream health, suggesting that other measures might be necessary such as particle-size distribution or interstitial dissolved oxygen. NMED might need to consider the reference sites in biological studies performed by NMED or the City of Santa Fe for comparitive purposes. At this time a clear path for monitoring and TMDL development needs further evaluation. However, it is recommended that NMED establish permanent photo points along the Santa Fe River to compare streambank stabilization over time in grazed and ungrazed (recently fenced) areas. This comparison would provide a basis for determining whether exclosures are effective measures in improving streambank stabilization on the Santa Fe River.

9. **Santa Fe River/Nutrient Enrichment.** At each site visited along the Santa Fe River during the field reconnaissance, noticeable algal growth was observed in the wetted portion of the streambed although it is not identified on the 303(d) list. Biological sampling by NMED and the City of Santa Fe suggest nutrient enrichment. In an effluent dominated stream, this condition is not surprising at the upper end of the stream. It is somewhat surprising to see continued signs of algal growth nearly 12 miles downstream at the USGS station. The contribution of nutrients from Cienega Creek (6.7 miles downstream of the Santa Fe WWTP) to nutrient enrichment in the Santa Fe River is unknown. Because of the algal growth, NMED should confirm that the nutrient enrichment is not causing a dissolved oxygen problem below the WWTP. This would entail monitoring the diurnal fluctuation in dissolved oxygen together with the nutrient loading information from the WWTP suggested earlier.

**APPENDIX - A: Santa Fe River Model for DO and pH (continue ...)**

A-5. Santa Fe River Water Quality Model Calibration using June 1999 data, prepared by Tetra Tech, Inc., Model Input/Output files (45 pages).

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Santa Fe River Water Quality Model (June 1999 Data)
WASP5pH  V5.1
 NSEG NSYS ICRD MFLG IDMP NSLN INTY ADFC   DD HHMM                A: MODEL
OPTIONS
   24    9    0    0    1    0    0    0    1 0000
   11   12   13   14   15   16
    1
    0.0020        4.0
    1
    0.040       120.0
    0    0    0    0    0    0    0    0    0
    1    0    +    *    +    *    +    *    +    *    +    *
B:EXCHANGES
    1     1.e-4       1.00                    (surface water)
   12
     2210.       0.10    1    2
     2210.       0.10    3    4
     2298.       0.10    5    6
     2386.       0.10    7    8
     2474.       0.10    9   10
     2562.       0.10   11   12
     2610.       0.10   13   14
     2650.       0.11   15   16
     2650.       0.11   17   18
     2650.       0.11   19   20
     2650.       0.11   21   22
     2650.       0.11   23   24
    2
      0.02        0.0       0.02      365.0
    0    0    0    1    0    0    0    0    0
    1    0                 *    +    *    +    *    +    *    +    C:
VOLUMES
       1.0   0.02832    million cubic feet to cubic meters
         1         2         1    15920.     0.168       0.0    0.2350
0.0
         2        73         2      433.     0.168       0.0      0.01
0.0
         3         4         1    18324.     0.163       0.0    0.2350
0.0
         4        73         2      433.     0.163       0.0      0.01
0.0
         5         6         1    20732.     0.158       0.0    0.2350
0.0
         6        73         2      433.     0.158       0.0      0.01
0.0
         7         8         1    21938.     0.153       0.0    0.2350
0.0
         8        73         2      433.     0.153       0.0      0.01
0.0
         9        10         1    21938.     0.148       0.0    0.2350
0.0
        10        73         2      433.     0.148       0.0      0.01
0.0
        11        12         1    21938.     0.143       0.0    0.2350
0.0
        12        73         2      433.     0.143       0.0      0.01
0.0
        13        14         1    21938.     0.128       0.0    0.2350
0.0
        14        73         2      433.     0.128       0.0      0.01
0.0
        15        16         1    21938.     0.128       0.0    0.2350
0.0
        16        73         2      433.     0.128       0.0      0.01
0.0
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TTCAL1.INP

```
        17        18         1    21938.     0.128       0.0    0.2350
0.0
        18        73         2      433.     0.128       0.0      0.01
0.0
        19        20         1    21938.     0.128       0.0    0.2350
0.0
        20        73         2      433.     0.128       0.0      0.01
0.0
        21        22         1    21938.     0.128       0.0    0.2350
0.0
        22        73         2      433.     0.128       0.0      0.01
0.0
        23        24         1    21938.     0.128       0.0    0.2350
0.0
        24        73         2      433.     0.128       0.0      0.01
0.0
    1    5    *    +    *    +    *    *    *    +    *    +    D: FLOWS
    2       1.0   0.02832    cubic feet/second to cubic meters/second
   13                    Headwater above Santa Fe Plant
       1.0    0    1       1.0    1    3       1.0    3    5       1.0
5    7
       1.0    7    9       1.0    9   11       1.0   11   13       1.0
13   15
       1.0   15   17       1.0   17   19       1.0   19   21       1.0
21   23
       1.0   23    0
    2
     13.15        0.     13.15      365.
   13                    Headwater above Santa Fe Plant
       1.0    0    2       1.0    2    4       1.0    4    6       1.0
6    8
       1.0    8   10       1.0   10   12       1.0   12   14       1.0
14   16
       1.0   16   18       1.0   18   20       1.0   20   22       1.0
22   24
       1.0   24    0
    2
      0.00        0.      0.00      365.
    0                                     Field 2: pore water
    1       1.0       1.0                 Field 3: (Solids 1: organic
matter)
   24
     2210.    1    2     2210.    2   73     2210.    3    4     2210.
4   73
     2298.    5    6     2298.    6   73     2386.    7    8     2386.
8   73
     2472.    9   10     2474.   10   73     2562.   11   12     2562.
12   73
     2610.   13   14     2650.   14   73     2650.   15   16     2650.
16   73
     2650.   17   18     2650.   18   73     2650.   19   20     2650.
20   73
     2650.   21   22     2650.   22   73     2650.   23   24     2650.
24   73
    2
   3.0E-06        0.   3.0E-06      365.
    1       0.1     .0929 sq ft to sq m    Field 4: (Solids 2:
Phytoplankton)
   24
     2210.    1    2     2210.    2   73     2210.    3    4     2210.
4   73
     2298.    5    6     2298.    6   73     2386.    7    8     2386.
8   73
     2472.    9   10     2474.   10   73     2562.   11   12     2562.
12   73
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     2610.   13   14     2650.   14   73     2650.   15   16     2650.
16   73
     2650.   17   18     2650.   18   73     2650.   19   20     2650.
20   73
     2650.   21   22     2650.   22   73     2650.   23   24     2650.
24   73
   2
  0.0e-05        0.   0.0e-05      365.
   1       1.0      .0929 sq ft to sq m    Field 5: (Solids 3: Inorganic
matter)
  24
     2210.    1    2     2210.    2   73     2210.    3    4     2210.
4   73
     2298.    5    6     2298.    6   73     2386.    7    8     2386.
8   73
     2472.    9   10     2474.   10   73     2562.   11   12     2562.
12   73
     2610.   13   14     2650.   14   73     2650.   15   16     2650.
16   73
     2650.   17   18     2650.   18   73     2650.   19   20     2650.
20   73
     2650.   21   22     2650.   22   73     2650.   23   24     2650.
24   73
   2
  1.0E-06        0.   1.0E-06      365.
   0    0    0    1    0    0    0    0    0
        4    *    +    *    +    *    +    System 1 - Ammonia  E:
BOUNDARIES
      1.0       1.0                         mg/L (total)
   1    2                                   Santa Fe WWTP Input
    2.000        0.     2.000      365.
   2    2
    0.000        0.     0.000      365.
  23    2
    0.001        0.     0.001      365.
  24    2
    0.001        0.     0.001      365.
        4    *    +    *    +    *    +    System 2 - Nitrite/Nitrate
      1.0       1.0                         mg/L (total)
   1    2                                   Santa Fe WWTP Input
      3.0        0.       3.0      365.
   2    2
      0.0        0.       0.0      365.
  23    2
    0.150        0.     0.150      365.
  24    2
    0.150        0.     0.150      365.
        4    *    +    *    +    *    +    System 3 - Orthophosphate
      1.0       1.0                         mg/L (dissolved)
   1    2                                   Santa Fe WWTP Input
     0.40        0.      0.40      365.
   2    2
    0.000        0.     0.000      365.
  23    2
    0.010        0.     0.010      365.
  24    2
    0.010        0.     0.010      365.
        4    *    +    *    +    *    +    System 4 - Periphyton
      1.0       1.0                         ug/L  (viable chlorophyll-a)
   1    2                                   Santa Fe WWTP Input
      0.0        0.       0.0      365.
   2    2
      0.0        0.       0.0      365.
  23    2
     2.00        0.      2.00      365.
```

```
   24     2
      2.00          0.       2.00       365.
         4     *     +     *     +     *     +    System 5 - CBOD
       1.0        1.0                            mg/L (ultimate less algal
component)
    1     2                                       Santa Fe WWTP Input
     14.00          0.      14.00       365.
    2     2
      0.00          0.       0.00       365.
   23     2
      1.00          0.       1.00       365.
   24     2
      1.00          0.       1.00       365.
         4     *     +     *     +     *     +    System 6 - Dissolved Oxygen
       1.0        1.0                            mg/L
    1     2                                       Santa Fe WWTP Input
       5.0        0.0       5.0       365.
    2     2
      0.00          0.       0.00       365.
   23     2
      8.00          0.       8.00       365.
   24     2
      8.00          0.       8.00       365.
         4     *     +     *     +     *     +    System 7 - Nonliving Organic
N
       1.0        1.0                            mg/L (TKN - NH3 - algal N)
    1     2                                       Santa Fe WWTP Input
      0.80          0.       0.80       365.
    2     2
      0.00          0.       0.00       365.
   23     2
      0.40          0.       0.40       365.
   24     2
      0.40          0.       0.40       365.
         4     *     +     *     +     *     +    System 8 - Nonliving Organic
P
       1.0        1.0                            mg/L (TP - PO4 - algal P)
    1     2                                       Santa Fe WWTP Input
      0.10          0.       0.10       365.
    2     2
      0.00          0.       0.00       365.
   23     2
      0.04          0.       0.04       365.
   24     2
      0.04          0.       0.04       365.
         4     *     +     *     +     *     +    System 9 - CO2 Acidity
       1.0        1.0                            mg/L as CaCO3
    1     2                                       Santa Fe WWTP Input
      15.0          0.      15.0       365.
    2     2
       0.0          0.       0.0       365.
   23     2
      10.0          0.      10.0       365.
   24     2
      10.0          0.      10.0       365.
         0     *     +     *     +     *     +    System 1 - Ammonia F: PS
loads
         0     *     +     *     +     *     +    System 2 - Nitrite + Nitrate
         0     *     +     *     +     *     +    System 3 - Dissolved
Orthophosphate
         0     *     +     *     +     *     +    System 4 - Viable
chlorophylla-a
         0     *     +     *     +     *     +    System 5 - Ultimate CBOD (-
algae)
         0     *     +     *     +     *     +    System 6 - Dissolved Oxygen
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          0    *    +    *    +    *    +    System 7 - Nonliving Organic
N
          0    *    +    *    +    *    +    System 8 - Nonliving Organic
P
          0    *    +    *    +    *    +    System 9 - CO2 Acidity
          0                                   No NPS Loads
          8    *    +    *    +    *    +    *    +    *    +    G:
PARAMETERS
TMPSG     3        1.0 KESG     5       1.0 SOD1D    9        1.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          1
TMPSG     3        1.0 KESG     5       0.15SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          2
TMPSG     3        1.0 KESG     5       0.15SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          3
TMPSG     3        1.0 KESG     5       0.15SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          4
TMPSG     3        1.0 KESG     5       0.15SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          5
TMPSG     3        1.0 KESG     5       0.15SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          6
TMPSG     3        1.0 KESG     5       0.15SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          7
TMPSG     3        1.0 KESG     5       0.20SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          8
TMPSG     3        1.0 KESG     5       0.20SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
          9
TMPSG     3        1.0 KESG     5       0.20SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
         10
TMPSG     3        1.0 KESG     5       0.20SOD1D    9        0.0SODTA   12
1.0
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
1.0
         11
TMPSG     3        1.0 KESG     5       0.20SOD1D    9        0.0SODTA   12
1.0
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```
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
1.0
          12
TMPSG     3        1.0 KESG     5        0.20SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
1.0
          13
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          14
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          15
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          16
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        7.1 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          17
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          18
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          19
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          20
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          21
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          22
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          23
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
FNH4      7        0.0 FPO4     8        0.0 ITOTL    13        1.0TMPFN     4
2.0
          24
TMPSG     3        1.0 KESG     5        0.25SOD1D     9        0.0SODTA    12
1.0
```

```
FNH4      7        0.0 FPO4     8       0.0 ITOTL   13        1.0TMPFN    4
2.0
    +    *    +    *    +    *    +    *    +    *    +    *    H:
CONSTANTS
   GLOBALS          0
       NH3          1
nitrificat          2
      K12C         11       0.20       K12T        12       1.08
       NO3          1
  denitrif          2
      K20C         21       0.10       K20T        22      1.045
       PO4          0
      PHYT          4
    growth          2
       K1C         41       2.45        K1T        42      1.055
     light          3
     LGHTS         43        1.0       CCHL        46       133.
       IS1         47       525.
 nutrients          4
     KMNG1         48      0.025      KMPG1        49      0.005
      NCRB         58       0.18       PCRB        57      0.025
     death          4
      K1RC         50      0.600       K1RT        51      1.069
       K1D         52       0.30      KPZDC        55       0.00
      CBOD          1
 deoxygent          2
       KDC         71       0.07        KDT        72       1.05
        DO          1
     ratio          2
      OCRB         81       2.67         K2        82       4.50
        ON          1
mineralize          3
      K71C         91      0.500       K71T        92       1.08
       FON         95       0.15
        OP          1
mineralize          3
      K83C        100       0.75       K83T       101       1.08
       FOP        104       0.50
    CO2acy          0
         4    *    +    *    +    *    +    *    +    *    +    I: TIME
FUNCTION
TEMP1  193    1            River Water Temperature (C) below WWTP
     18.70   0.00000     18.80   0.01042     18.92   0.02083     18.94
0.03125
     18.82   0.04167     18.87   0.05208     18.92   0.06250     18.84
0.07292
     18.80   0.08333     18.85   0.09375     18.90   0.10417     18.87
0.11458
     18.83   0.12500     18.80   0.13542     18.74   0.14583     18.57
0.15625
     18.47   0.16667     18.45   0.17708     18.30   0.18750     18.09
0.19792
     17.87   0.20833     17.67   0.21875     17.62   0.22917     17.68
0.23958
     17.70   0.25000     17.72   0.26042     17.70   0.27083     17.62
0.28125
     17.55   0.29167     17.61   0.30208     17.70   0.31250     17.86
0.32292
     18.12   0.33333     18.45   0.34375     18.85   0.35417     19.40
0.36458
     20.00   0.37500     20.74   0.38542     21.51   0.39583     22.38
0.40625
     22.84   0.41667     23.33   0.42708     23.54   0.43750     23.81
0.44792
     24.25   0.45833     24.68   0.46875     24.86   0.47917     24.99
```

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.48958 | | | | | | |
| 25.14 | 0.50000 | 25.19 | 0.51042 | 25.18 | 0.52083 | 25.13 |
| 0.53125 | | | | | | |
| 24.95 | 0.54167 | 24.84 | 0.55208 | 24.64 | 0.56250 | 24.13 |
| 0.57292 | | | | | | |
| 23.74 | 0.58333 | 23.90 | 0.59375 | 23.95 | 0.60417 | 24.03 |
| 0.61458 | | | | | | |
| 23.96 | 0.62500 | 24.06 | 0.63542 | 24.09 | 0.64583 | 23.98 |
| 0.65625 | | | | | | |
| 23.84 | 0.66667 | 23.55 | 0.67708 | 23.22 | 0.68750 | 23.04 |
| 0.69792 | | | | | | |
| 22.30 | 0.70833 | 22.04 | 0.71875 | 21.78 | 0.72917 | 21.00 |
| 0.73958 | | | | | | |
| 20.57 | 0.75000 | 20.20 | 0.76042 | 19.87 | 0.77083 | 19.72 |
| 0.78125 | | | | | | |
| 19.70 | 0.79167 | 19.62 | 0.80208 | 19.47 | 0.81250 | 19.30 |
| 0.82292 | | | | | | |
| 19.12 | 0.83333 | 18.97 | 0.84375 | 18.72 | 0.85417 | 18.52 |
| 0.86458 | | | | | | |
| 18.51 | 0.87500 | 18.47 | 0.88542 | 18.45 | 0.89583 | 18.45 |
| 0.90625 | | | | | | |
| 18.39 | 0.91667 | 18.36 | 0.92708 | 18.50 | 0.93750 | 18.77 |
| 0.94792 | | | | | | |
| 18.99 | 0.95833 | 19.00 | 0.96875 | 18.91 | 0.97917 | 18.86 |
| 0.98958 | | | | | | |
| 18.92 | 1.00000 | 18.93 | 1.01042 | 19.07 | 1.02083 | 19.05 |
| 1.03125 | | | | | | |
| 19.05 | 1.04167 | 19.03 | 1.05208 | 18.99 | 1.06250 | 18.95 |
| 1.07292 | | | | | | |
| 18.97 | 1.08333 | 18.94 | 1.09375 | 18.91 | 1.10417 | 18.83 |
| 1.11458 | | | | | | |
| 18.72 | 1.12500 | 18.61 | 1.13542 | 18.45 | 1.14583 | 18.30 |
| 1.15625 | | | | | | |
| 18.11 | 1.16667 | 17.92 | 1.17708 | 17.70 | 1.18750 | 17.55 |
| 1.19792 | | | | | | |
| 17.55 | 1.20833 | 17.59 | 1.21875 | 17.58 | 1.22917 | 17.53 |
| 1.23958 | | | | | | |
| 17.43 | 1.25000 | 17.35 | 1.26042 | 17.29 | 1.27083 | 17.34 |
| 1.28125 | | | | | | |
| 17.47 | 1.29167 | 17.62 | 1.30208 | 17.80 | 1.31250 | 17.99 |
| 1.32292 | | | | | | |
| 18.32 | 1.33333 | 18.74 | 1.34375 | 19.24 | 1.35417 | 19.77 |
| 1.36458 | | | | | | |
| 20.39 | 1.37500 | 21.08 | 1.38542 | 21.87 | 1.39583 | 22.56 |
| 1.40625 | | | | | | |
| 23.17 | 1.41667 | 23.79 | 1.42708 | 24.18 | 1.43750 | 24.44 |
| 1.44792 | | | | | | |
| 24.78 | 1.45833 | 25.09 | 1.46875 | 25.36 | 1.47917 | 25.52 |
| 1.48958 | | | | | | |
| 25.52 | 1.50000 | 25.32 | 1.51042 | 25.06 | 1.52083 | 24.76 |
| 1.53125 | | | | | | |
| 24.74 | 1.54167 | 24.64 | 1.55208 | 24.65 | 1.56250 | 24.57 |
| 1.57292 | | | | | | |
| 24.47 | 1.58333 | 24.49 | 1.59375 | 24.39 | 1.60417 | 24.52 |
| 1.61458 | | | | | | |
| 24.60 | 1.62500 | 24.62 | 1.63541 | 24.58 | 1.64583 | 24.42 |
| 1.65625 | | | | | | |
| 24.30 | 1.66666 | 24.24 | 1.67708 | 24.16 | 1.68750 | 24.02 |
| 1.69791 | | | | | | |
| 23.71 | 1.70833 | 23.51 | 1.71875 | 23.20 | 1.72916 | 22.84 |
| 1.73958 | | | | | | |
| 22.54 | 1.75000 | 22.23 | 1.76041 | 21.83 | 1.77083 | 21.48 |
| 1.78125 | | | | | | |
| 21.20 | 1.79166 | 20.89 | 1.80208 | 20.57 | 1.81250 | 20.32 |
| 1.82291 | | | | | | |

```
     20.15    1.83333      20.02    1.84375      19.89    1.85416      19.76
1.86458
     19.62    1.87500      19.58    1.88541      19.55    1.89583      19.65
1.90625
     19.72    1.91666      19.74    1.92708      19.70    1.93750      19.66
1.94791
     19.61    1.95833      19.57    1.96875      19.55    1.97916      19.51
1.98958
     19.47    2.00000
TEMP2  193     2            River Temperature at Preserve
     18.70    0.00000      18.80    0.01042      18.92    0.02083      18.94
0.03125
     18.82    0.04167      18.87    0.05208      18.92    0.06250      18.84
0.07292
     18.80    0.08333      18.85    0.09375      18.90    0.10417      18.87
0.11458
     18.83    0.12500      18.80    0.13542      18.74    0.14583      18.57
0.15625
     18.47    0.16667      18.45    0.17708      18.30    0.18750      18.09
0.19792
     17.87    0.20833      17.67    0.21875      17.62    0.22917      17.68
0.23958
     17.70    0.25000      17.72    0.26042      17.70    0.27083      17.62
0.28125
     17.55    0.29167      17.61    0.30208      17.70    0.31250      17.86
0.32292
     18.12    0.33333      18.45    0.34375      18.85    0.35417      19.40
0.36458
     20.00    0.37500      20.74    0.38542      21.51    0.39583      22.38
0.40625
     22.84    0.41667      23.33    0.42708      23.54    0.43750      23.81
0.44792
     24.25    0.45833      24.68    0.46875      24.86    0.47917      24.99
0.48958
     25.14    0.50000      25.19    0.51042      25.18    0.52083      25.13
0.53125
     24.95    0.54167      24.84    0.55208      24.64    0.56250      24.13
0.57292
     23.74    0.58333      23.90    0.59375      23.95    0.60417      24.03
0.61458
     23.96    0.62500      24.06    0.63542      24.09    0.64583      23.98
0.65625
     23.84    0.66667      23.55    0.67708      23.22    0.68750      23.04
0.69792
     22.30    0.70833      22.04    0.71875      21.78    0.72917      21.00
0.73958
     20.57    0.75000      20.20    0.76042      19.87    0.77083      19.72
0.78125
     19.70    0.79167      19.62    0.80208      19.47    0.81250      19.30
0.82292
     19.12    0.83333      18.97    0.84375      18.72    0.85417      18.52
0.86458
     18.51    0.87500      18.47    0.88542      18.45    0.89583      18.45
0.90625
     18.39    0.91667      18.36    0.92708      18.50    0.93750      18.77
0.94792
     18.99    0.95833      19.00    0.96875      18.91    0.97917      18.86
0.98958
     18.92    1.00000      18.93    1.01042      19.07    1.02083      19.05
1.03125
     19.05    1.04167      19.03    1.05208      18.99    1.06250      18.95
1.07292
     18.97    1.08333      18.94    1.09375      18.91    1.10417      18.83
1.11458
     18.72    1.12500      18.61    1.13542      18.45    1.14583      18.30
```

```
1.15625
     18.11   1.16667     17.92   1.17708     17.70   1.18750     17.55
1.19792
     17.55   1.20833     17.59   1.21875     17.58   1.22917     17.53
1.23958
     17.43   1.25000     17.35   1.26042     17.29   1.27083     17.34
1.28125
     17.47   1.29167     17.62   1.30208     17.80   1.31250     17.99
1.32292
     18.32   1.33333     18.74   1.34375     19.24   1.35417     19.77
1.36458
     20.39   1.37500     21.08   1.38542     21.87   1.39583     22.56
1.40625
     23.17   1.41667     23.79   1.42708     24.18   1.43750     24.44
1.44792
     24.78   1.45833     25.09   1.46875     25.36   1.47917     25.52
1.48958
     25.52   1.50000     25.32   1.51042     25.06   1.52083     24.76
1.53125
     24.74   1.54167     24.64   1.55208     24.65   1.56250     24.57
1.57292
     24.47   1.58333     24.49   1.59375     24.39   1.60417     24.52
1.61458
     24.60   1.62500     24.62   1.63541     24.58   1.64583     24.42
1.65625
     24.30   1.66666     24.24   1.67708     24.16   1.68750     24.02
1.69791
     23.71   1.70833     23.51   1.71875     23.20   1.72916     22.84
1.73958
     22.54   1.75000     22.23   1.76041     21.83   1.77083     21.48
1.78125
     21.20   1.79166     20.89   1.80208     20.57   1.81250     20.32
1.82291
     20.15   1.83333     20.02   1.84375     19.89   1.85416     19.76
1.86458
     19.62   1.87500     19.58   1.88541     19.55   1.89583     19.65
1.90625
     19.72   1.91666     19.74   1.92708     19.70   1.93750     19.66
1.94791
     19.61   1.95833     19.57   1.96875     19.55   1.97916     19.51
1.98958
     19.47   2.00000
ITOT    26     5            Solar radiation (ly/day)
       0.0       0.0        0.0   0.03681       0.0   0.07847       0.0
0.12014
       0.0   0.16181       4.41   0.20347     78.51   0.24514    254.94
0.28681
    453.43   0.32874     626.33   0.37014    798.36   0.41181    924.50
0.45347
    984.49   0.49514     988.02   0.53681    935.97   0.57847    820.41
0.62014
    668.68   0.66181     486.95   0.70000    285.82   0.74514     94.39
0.78681
     10.59   0.82847        0.0   0.87014       0.0   0.91181       0.0
0.95347
       0.0   0.99514        0.0       1.0
F        2     6            Photoperiod (fraction of day)
      1.00        0.       1.00     365.0
Ammonia                                        3 0.00       10.    J:
INITIAL
    1      0.02        1.0    2      0.02        1.0    3      0.02
1.0
    4      0.02        1.0    5      0.02        1.0    6      0.02
1.0
    7      0.02        1.0    8      0.02        1.0    9      0.02
```

```
1.0
   10       0.02       1.0   11       0.02       1.0   12       0.02
1.0
   13       0.02       1.0   14       0.02       1.0   15       0.02
1.0
   16       0.02       1.0   17       0.02       1.0   18       0.02
1.0
   19       0.02       1.0   20       0.02       1.0   21       0.02
1.0
   22       0.02       1.0   23       0.02       1.0   24       0.02
1.0
Nitrite + Nitrate                                 3 0.00       10.    J:
INITIAL
    1       0.09       1.0    2       0.09       1.0    3       0.09
1.0
    4       0.09       1.0    5       0.09       1.0    6       0.09
1.0
    7       0.09       1.0    8       0.09       1.0    9       0.09
1.0
   10       0.09       1.0   11       0.09       1.0   12       0.09
1.0
   13       0.09       1.0   14       0.09       1.0   15       0.09
1.0
   16       0.09       1.0   17       0.09       1.0   18       0.09
1.0
   19       0.09       1.0   20       0.09       1.0   21       0.09
1.0
   22       0.09       1.0   23       0.09       1.0   24       0.09
1.0
Dissolved Orthophosphate                          3 0.00        5.    J:
INITIAL
    1      1.010       1.0    2      1.010       1.0    3      1.010
1.0
    4      1.010       1.0    5      1.010       1.0    6      1.010
1.0
    7      1.010       1.0    8      1.010       1.0    9      1.010
1.0
   10      1.010       1.0   11      1.010       1.0   12      1.010
1.0
   13      1.010       1.0   14      1.010       1.0   15      1.010
1.0
   16      1.010       1.0   17      1.010       1.0   18      1.010
1.0
   19      1.010       1.0   20      1.010       1.0   21      1.010
1.0
   22      1.010       1.0   23      1.010       1.0   24      1.010
1.0
Viable Chlorophyll-a (ug/l)                       4 0.00      500.    J:
INITIAL
    1         0.       0.0    2     1000.       0.0    3         0.
0.0
    4      1000.       0.0    5        0.       0.0    6      1000.
0.0
    7         0.       0.0    8      975.       0.0    9         0.
0.0
   10       950.       0.0   11        0.       0.0   12       925.
0.0
   13         0.       0.0   14      900.       0.0   15         0.
0.0
   16       900.       0.0   17        0.       0.0   18       900.
0.0
   19         0.       0.0   20      900.       0.0   21         0.
0.0
   22       900.       0.0   23        0.       0.0   24       900.
0.0
```

```
Carbonaceous BOD (ultimate - algae)          3 0.00      100.    J:
INITIAL
    1       5.0       1.0    2       5.0       1.0    3       5.0
1.0
    4       5.0       1.0    5       5.0       1.0    6       5.0
1.0
    7       5.0       1.0    8       5.0       1.0    9       5.0
1.0
   10       5.0       1.0   11       5.0       1.0   12       5.0
1.0
   13       5.0       1.0   14       5.0       1.0   15       5.0
1.0
   16       5.0       1.0   17       5.0       1.0   18       5.0
1.0
   19       5.0       1.0   20       5.0       1.0   21       5.0
1.0
   22       5.0       1.0   23       5.0       1.0   24       5.0
1.0
Dissolved Oxygen                             3 0.00       20.    J:
INITIAL
    1      7.99       1.0    2      7.59       1.0    3      7.59
1.0
    4      7.99       1.0    5      7.59       1.0    6      7.59
1.0
    7      7.99       1.0    8      7.59       1.0    9      7.59
1.0
   10      7.99       1.0   11      7.59       1.0   12      7.59
1.0
   13      7.99       1.0   14      7.59       1.0   15      7.59
1.0
   16      7.99       1.0   17      7.59       1.0   18      7.59
1.0
   19      7.99       1.0   20      7.59       1.0   21      7.59
1.0
   22      7.99       1.0   23      7.59       1.0   24      7.59
1.0
Nonliving Organic Nitrogen                   3 0.00       10.    J:
INITIAL
    1      1.02       0.7    2      1.02       0.7    3      1.02
0.7
    4      1.02       0.7    5      1.02       0.7    6      1.02
0.7
    7      1.02       0.7    8      1.02       0.7    9      1.02
0.7
   10      1.02       0.7   11      1.02       0.7   12      1.02
0.7
   13      1.02       0.7   14      1.02       0.7   15      1.02
0.7
   16      1.02       0.7   17      1.02       0.7   18      1.02
0.7
   19      1.02       0.7   20      1.02       0.7   21      1.02
0.7
   22      1.02       0.7   23      1.02       0.7   24      1.02
0.7
Nonliving Organic Phosphorus                 3 0.00        5.    J:
INITIAL
    1      0.10       1.0    2      0.10       1.0    3      0.10
1.0
    4      0.10       1.0    5      0.10       1.0    6      0.10
1.0
    7      0.10       1.0    8      0.10       1.0    9      0.10
1.0
   10      0.10       1.0   11      0.10       1.0   12      0.10
1.0
   13      0.10       1.0   14      0.10       1.0   15      0.10
```

```
1.0
   16       0.10        1.0   17       0.10        1.0   18       0.10
1.0
   19       0.10        1.0   20       0.10        1.0   21       0.10
1.0
   22       0.10        1.0   23       0.10        1.0   24       0.10
1.0
CO2 Acidity (mg/L as CaCO3)                    3 0.00     5000.    J:
INITIAL
    1       4.0         1.0    2        4.0        1.0    3        4.0
1.0
    4       4.0         1.0    5        4.0        1.0    6        4.0
1.0
    7       4.0         1.0    8        4.0        1.0    9        4.0
1.0
   10       4.0         1.0   11        4.0        1.0   12        4.0
1.0
   13       6.0         1.0   14        6.0        1.0   15        6.0
1.0
   16       6.0         1.0   17        6.0        1.0   18        6.0
1.0
   19       6.0         1.0   20        6.0        1.0   21        6.0
1.0
   22       6.0         1.0   23        6.0        1.0   24        6.0
1.0
```

```
*********************************************************************

            WASP  - - WATER QUALITY ANALYSIS SIMULATION PROGRAM

*********************************************************************

                          Supported by
                 Center for Exposure Assessment Modeling
                              (CEAM)
                 Athens Environmental Research Laboratory
                          College Station Road
                        Athens, Georgia  30613
                   FTS 250-3491 or (404) 546-3491

                          Version 4.32 pH
                 Compiled on: Date: Tuesday, 26 Oct 1999,

                     Maximum Parameters for this Model

            Systems:    9          Segments:  100     Break Points:
193
         Parameters:   15          Constants:  104    Boundary Cond:
35
       Waste Loads:     9     Print Interval:    5    Time Function:
23

*********************************************************************

     No. Segments --->    24        No. Systems --->     9


*********************************************************************
TIME VARIABLE SOLUTION TECHNIQUE

*********************************************************************
            System Bypass Options for System  1 TO  9 are 0 0 0 0 0 0 0
0 0
```

```
*********************************************************************
1

                          Simulation Time Steps
                           Option 0 Selected
                         Advection Factor = 0.000

        DT          T          DT          T          DT          T
      ------      -------    ------      -------    ------      -------

      0.00200     4.00000


                            Print Intervals

      PRINT       ELAPSED       PRINT       ELAPSED       PRINT
ELAPSED
    INTERVAL       TIME       INTERVAL       TIME       INTERVAL       TIME
   ----------  ----------  ----------  ----------  ----------
----------

       0.040      120.00
1


                          Exchange Coefficients
                          ---------------------


                     Number of Exchange Fields =   1


                      FIELD  1 has  1  Time Functions

                   SCALR = 0.100E-03  CONVR = 0.100E+01


                  Time Function  1 has 12 Exchanges

                      A          EL     From  To
                  ------------------------------------

                  0.221E+04 0.100E+00    1    2
                  0.221E+04 0.100E+00    3    4
                  0.230E+04 0.100E+00    5    6
                  0.239E+04 0.100E+00    7    8
                  0.247E+04 0.100E+00    9   10
                  0.256E+04 0.100E+00   11   12
                  0.261E+04 0.100E+00   13   14
                  0.265E+04 0.110E+00   15   16
```

```
                    0.265E+04 0.110E+00   17   18
                    0.265E+04 0.110E+00   19   20
                    0.265E+04 0.110E+00   21   22
                    0.265E+04 0.110E+00   23   24

              Number of Breaks in Time Function =   2

        Dispersion    Time    Dispersion    Time    Dispersion    Time
-----------------------------------------------------------------------

        0.200E-01  0.000E+00  0.200E-01  0.365E+03

            R Bypass Options for Systems 1 to  9 are  0  0  0  1  0
0  0  0  0
1
```

VOLUMES

```
        Bed Volume Option =     0  Bed Time Step =  0.000E+00

        Scale Factor =  0.1000E+01 Conversion Factor =  0.2832E-01

  Seg #   BOTSG   Type       Volume      V mult    V exp   D mult    D
exp
-----------------------------------------------------------------------
-
     1       2      1      15920.000    0.168    0.000    0.235
0.000
     2      73      2        433.000    0.168    0.000    0.010
0.000
     3       4      1      18324.000    0.163    0.000    0.235
0.000
     4      73      2        433.000    0.163    0.000    0.010
0.000
     5       6      1      20732.000    0.158    0.000    0.235
0.000
     6      73      2        433.000    0.158    0.000    0.010
0.000
     7       8      1      21938.000    0.153    0.000    0.235
0.000
     8      73      2        433.000    0.153    0.000    0.010
0.000
     9      10      1      21938.000    0.148    0.000    0.235
0.000
    10      73      2        433.000    0.148    0.000    0.010
0.000
    11      12      1      21938.000    0.143    0.000    0.235
0.000
    12      73      2        433.000    0.143    0.000    0.010
0.000
    13      14      1      21938.000    0.128    0.000    0.235
0.000
    14      73      2        433.000    0.128    0.000    0.010
0.000
```

```
    15      16      1       21938.000    0.128    0.000    0.235
0.000
    16      73      2         433.000    0.128    0.000    0.010
0.000
    17      18      1       21938.000    0.128    0.000    0.235
0.000
    18      73      2         433.000    0.128    0.000    0.010
0.000
    19      20      1       21938.000    0.128    0.000    0.235
0.000
    20      73      2         433.000    0.128    0.000    0.010
0.000
    21      22      1       21938.000    0.128    0.000    0.235
0.000
    22      73      2         433.000    0.128    0.000    0.010
0.000
    23      24      1       21938.000    0.128    0.000    0.235
0.000
    24      73      2         433.000    0.128    0.000    0.010
0.000
1


                                FLOWS
                                -----

                        Flow Option  1 Used
                    Number of Flow Fields =   5

                  Field  1 has   2 Inflows
                  SCALQ = 0.100E+01  CONVQ = 0.283E-01


                              Inflow Number  1
                              ----------------
     Continuity Array:

        Flow    From   To        Flow    From   To        Flow    From
To
-------------------------------------------------------------------------
--------

      0.100E+01    0    1      0.100E+01    1    3      0.100E+01    3
5
      0.100E+01    5    7      0.100E+01    7    9      0.100E+01    9
11
      0.100E+01   11   13      0.100E+01   13   15      0.100E+01   15
17
      0.100E+01   17   19      0.100E+01   19   21      0.100E+01   21
23
      0.100E+01   23    0

     Number of Breaks in Time Function =     2


        Flow      Time           Flow      Time           Flow      Time
-------------------------------------------------------------------------
------
```

| | | | |
|---|---|---|---|
| 0.131E+02 | 0.000E+00 | 0.131E+02 | 0.365E+03 |

Inflow Number 2

Continuity Array:

| Flow | From | To | Flow | From | To | Flow | From | To |
|---|---|---|---|---|---|---|---|---|
| 0.100E+01 | 0 | 2 | 0.100E+01 | 2 | 4 | 0.100E+01 | 4 | 6 |
| 0.100E+01 | 6 | 8 | 0.100E+01 | 8 | 10 | 0.100E+01 | 10 | 12 |
| 0.100E+01 | 12 | 14 | 0.100E+01 | 14 | 16 | 0.100E+01 | 16 | 18 |
| 0.100E+01 | 18 | 20 | 0.100E+01 | 20 | 22 | 0.100E+01 | 22 | 24 |
| 0.100E+01 | 24 | 0 | | | | | | |

Number of Breaks in Time Function = 2

| Flow | Time | Flow | Time | Flow | Time |
|---|---|---|---|---|---|
| 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.365E+03 | | |

Field 2 has 0 Inflows
SCALQ = 0.000E+00 CONVQ = 0.000E+00

Field 3 has 1 Inflows
SCALQ = 0.100E+01 CONVQ = 0.100E+01

Inflow Number 1

Solids Transport:

| Area | From | To | Area | From | To | Area | From | To |
|---|---|---|---|---|---|---|---|---|
| 0.221E+04 | 1 | 2 | 0.221E+04 | 2 | 73 | 0.221E+04 | 3 | 4 |
| 0.221E+04 | 4 | 73 | 0.230E+04 | 5 | 6 | 0.230E+04 | 6 | 73 |
| 0.239E+04 | 7 | 8 | 0.239E+04 | 8 | 73 | 0.247E+04 | 9 | 10 |
| 0.247E+04 | 10 | 73 | 0.256E+04 | 11 | 12 | 0.256E+04 | 12 | 73 |
| 0.261E+04 | 13 | 14 | 0.265E+04 | 14 | 73 | 0.265E+04 | 15 | 16 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.265E+04 | 16 | 73 | 0.265E+04 | 17 | 18 | 0.265E+04 | 18 | 73 |
| 0.265E+04 | 19 | 20 | 0.265E+04 | 20 | 73 | 0.265E+04 | 21 | 22 |
| 0.265E+04 | 22 | 73 | 0.265E+04 | 23 | 24 | 0.265E+04 | 24 | 73 |

Number of Breaks in Time Function = 2

| Velocity | Time | Velocity | Time | Velocity | Time |
|---|---|---|---|---|---|
| 0.300E-05 | 0.000E+00 | 0.300E-05 | 0.365E+03 | | |

Field 4 has 1 Inflows
SCALQ = 0.100E+00 CONVQ = 0.929E-01

Inflow Number 1

Solids Transport:

| Area | From | To | Area | From | To | Area | From | To |
|---|---|---|---|---|---|---|---|---|
| 0.221E+04 | 1 | 2 | 0.221E+04 | 2 | 73 | 0.221E+04 | 3 | 4 |
| 0.221E+04 | 4 | 73 | 0.230E+04 | 5 | 6 | 0.230E+04 | 6 | 73 |
| 0.239E+04 | 7 | 8 | 0.239E+04 | 8 | 73 | 0.247E+04 | 9 | 10 |
| 0.247E+04 | 10 | 73 | 0.256E+04 | 11 | 12 | 0.256E+04 | 12 | 73 |
| 0.261E+04 | 13 | 14 | 0.265E+04 | 14 | 73 | 0.265E+04 | 15 | 16 |
| 0.265E+04 | 16 | 73 | 0.265E+04 | 17 | 18 | 0.265E+04 | 18 | 73 |
| 0.265E+04 | 19 | 20 | 0.265E+04 | 20 | 73 | 0.265E+04 | 21 | 22 |
| 0.265E+04 | 22 | 73 | 0.265E+04 | 23 | 24 | 0.265E+04 | 24 | 73 |

Number of Breaks in Time Function = 2

| Velocity | Time | Velocity | Time | Velocity | Time |
|---|---|---|---|---|---|
| 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.365E+03 | | |

Field 5 has 1 Inflows

SCALQ = 0.100E+01  CONVQ = 0.929E-01

Inflow Number 1

Solids Transport:

| Area | From | To | Area | From | To | Area | From | To |
|---|---|---|---|---|---|---|---|---|
| 0.221E+04 | 1 | 2 | 0.221E+04 | 2 | 73 | 0.221E+04 | 3 | 4 |
| 0.221E+04 | 4 | 73 | 0.230E+04 | 5 | 6 | 0.230E+04 | 6 | 73 |
| 0.239E+04 | 7 | 8 | 0.239E+04 | 8 | 73 | 0.247E+04 | 9 | 10 |
| 0.247E+04 | 10 | 73 | 0.256E+04 | 11 | 12 | 0.256E+04 | 12 | 73 |
| 0.261E+04 | 13 | 14 | 0.265E+04 | 14 | 73 | 0.265E+04 | 15 | 16 |
| 0.265E+04 | 16 | 73 | 0.265E+04 | 17 | 18 | 0.265E+04 | 18 | 73 |
| 0.265E+04 | 19 | 20 | 0.265E+04 | 20 | 73 | 0.265E+04 | 21 | 22 |
| 0.265E+04 | 22 | 73 | 0.265E+04 | 23 | 24 | 0.265E+04 | 24 | 73 |

Number of Breaks in Time Function = 2

| Velocity | Time | Velocity | Time | Velocity | Time |
|---|---|---|---|---|---|
| 0.100E-05 | 0.000E+00 | 0.100E-05 | 0.365E+03 | | |

```
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
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QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
```

```
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
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QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
QSUMX=      0.000
```

Q Bypass Options for Systems 1 to 9 are 0 0 0 1 0 0 0 0 0
1

## Boundary Conditions

Boundary Concentrations for System 1

BC Option 0 Used No.Of BC'S Read 4

Scale Factor = 0.1000E+01 Conversion Factor = 0.1000E+01

| Segment | No.Brk. | BC(T) | T | BC(T) | T |
|---|---|---|---|---|---|
| 1 | 2 | 0.2000000E+01 | 0.00 | 0.2000000E+01 | 365.00 |
| 2 | 2 | 0.0000000E+00 | 0.00 | 0.0000000E+00 | 365.00 |
| 23 | 2 | 0.1000000E-02 | 0.00 | 0.1000000E-02 | 365.00 |
| 24 | 2 | 0.1000000E-02 | 0.00 | 0.1000000E-02 | 365.00 |

Boundary Concentrations for System 2

BC Option 0 Used No.Of BC'S Read 4

Scale Factor = 0.1000E+01 Conversion Factor = 0.1000E+
01

| Segment | No.Brk. | BC(T) | T | BC(T) | T |
|---|---|---|---|---|---|
| 1 | 2 | 0.3000000E+01 | 0.00 | 0.3000000E+01 | 365.00 |
| 2 | 2 | 0.0000000E+00 | 0.00 | 0.0000000E+00 | 365.00 |
| 23 | 2 | 0.1500000E+00 | 0.00 | 0.1500000E+00 | 365.00 |
| 24 | 2 | 0.1500000E+00 | 0.00 | 0.1500000E+00 | 365.00 |

Boundary Concentrations for System 3

BC Option 0 Used No.Of BC'S Read 4

Scale Factor = 0.1000E+01 Conversion Factor = 0.1000E+
01

| Segment | No.Brk. | BC(T) | T | BC(T) | T |
|---|---|---|---|---|---|
| 1 | 2 | 0.4000000E+00 | 0.00 | 0.4000000E+00 | 365.00 |
| 2 | 2 | 0.0000000E+00 | 0.00 | 0.0000000E+00 | 365.00 |
| 23 | 2 | 0.1000000E-01 | 0.00 | 0.1000000E-01 | 365.00 |
| 24 | 2 | 0.1000000E-01 | 0.00 | 0.1000000E-01 | 365.00 |

Boundary Concentrations for System 4

BC Option 0 Used No.Of BC'S Read 4

Scale Factor = 0.1000E+01 Conversion Factor = 0.1000E+
01

```
        Segment  No.Brk.      BC(T)            T            BC(T)
T
-----------------------------------------------------------------------
             1       2      0.0000000E+00      0.00    0.0000000E+00
365.00
             2       2      0.0000000E+00      0.00    0.0000000E+00
365.00
            23       2      0.2000000E+01      0.00    0.2000000E+01
365.00
            24       2      0.2000000E+01      0.00    0.2000000E+01
365.00

                    Boundary Concentrations for System  5
                 BC Option  0 Used     No.Of BC'S Read    4
            Scale Factor =  0.1000E+01  Conversion Factor =  0.1000E+
01

        Segment  No.Brk.      BC(T)            T            BC(T)
T
-----------------------------------------------------------------------
             1       2      0.1400000E+02      0.00    0.1400000E+02
365.00
             2       2      0.0000000E+00      0.00    0.0000000E+00
365.00
            23       2      0.1000000E+01      0.00    0.1000000E+01
365.00
            24       2      0.1000000E+01      0.00    0.1000000E+01
365.00

                    Boundary Concentrations for System  6
                 BC Option  0 Used     No.Of BC'S Read    4
            Scale Factor =  0.1000E+01  Conversion Factor =  0.1000E+
01

        Segment  No.Brk.      BC(T)            T            BC(T)
T
-----------------------------------------------------------------------
             1       2      0.5000000E+01      0.00    0.5000000E+01
365.00
             2       2      0.0000000E+00      0.00    0.0000000E+00
365.00
```

```
            23      2      0.8000000E+01      0.00   0.8000000E+01
365.00

            24      2      0.8000000E+01      0.00   0.8000000E+01
365.00

                    Boundary Concentrations for System  7

                BC Option  0 Used     No.Of BC'S Read    4

            Scale Factor =  0.1000E+01  Conversion Factor =  0.1000E+
01


        Segment  No.Brk.      BC(T)            T           BC(T)
T
-----------------------------------------------------------------------
             1      2      0.8000000E+00      0.00   0.8000000E+00
365.00

             2      2      0.0000000E+00      0.00   0.0000000E+00
365.00

            23      2      0.4000000E+00      0.00   0.4000000E+00
365.00

            24      2      0.4000000E+00      0.00   0.4000000E+00
365.00

                    Boundary Concentrations for System  8

                BC Option  0 Used     No.Of BC'S Read    4

            Scale Factor =  0.1000E+01  Conversion Factor =  0.1000E+
01


        Segment  No.Brk.      BC(T)            T           BC(T)
T
-----------------------------------------------------------------------
             1      2      0.1000000E+00      0.00   0.1000000E+00
365.00

             2      2      0.0000000E+00      0.00   0.0000000E+00
365.00

            23      2      0.4000000E-01      0.00   0.4000000E-01
365.00

            24      2      0.4000000E-01      0.00   0.4000000E-01
365.00
```

Boundary Concentrations for System 9

BC Option 0 Used No.Of BC'S Read 4

Scale Factor = 0.1000E+01 Conversion Factor = 0.1000E+
01

| Segment | No.Brk. | BC(T) | T | BC(T) | T |
|---|---|---|---|---|---|
| 1 | 2 | 0.1500000E+02 | 0.00 | 0.1500000E+02 | 365.00 |
| 2 | 2 | 0.0000000E+00 | 0.00 | 0.0000000E+00 | 365.00 |
| 23 | 2 | 0.1000000E+02 | 0.00 | 0.1000000E+02 | 365.00 |
| 24 | 2 | 0.1000000E+02 | 0.00 | 0.1000000E+02 | 365.00 |

Waste Loads

Forcing Functions For System 1

Wk Option 3 Used No.of WK'S Read 0

No Forcing Function for System 1
1

Forcing Functions For System 2

Wk Option 3 Used No.of WK'S Read 0

No Forcing Function for System 2
1

Forcing Functions For System 3

Wk Option 3 Used No.of WK'S Read 0

No Forcing Function for System 3
1

```
                Forcing Functions For System  4
                ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
          Wk Option  3 Used     No.of WK'S Read    0


             No Forcing Function for System  4
1

                Forcing Functions For System  5
                ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
          Wk Option  3 Used     No.of WK'S Read    0


             No Forcing Function for System  5
1

                Forcing Functions For System  6
                ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
          Wk Option  3 Used     No.of WK'S Read    0


             No Forcing Function for System  6
1

                Forcing Functions For System  7
                ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
          Wk Option  3 Used     No.of WK'S Read    0


             No Forcing Function for System  7
1

                Forcing Functions For System  8
                ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
          Wk Option  3 Used     No.of WK'S Read    0


             No Forcing Function for System  8
1

                Forcing Functions For System  9
                ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

```
                    Wk Option  3 Used     No.of WK'S Read    0


                    No Forcing Function for System  9
1
                              Segment Parameters
                              ------------------

 PARM     SCALE       PARM     SCALE       PARM     SCALE       PARM
SCALE

-----------------------------------------------------------------------------
-------
 TMPSG   0.100E+01    KESG   0.100E+01   SOD1D   0.100E+01   SODTA
0.100E+01
 FNH4    0.000E+00    FPO4   0.000E+00   ITOTL   0.100E+01   TMPFN
0.100E+01


 Segment #   1
 TMPSG   3 0.100E+01  KESG   5 0.150E+00 SOD1D   9 0.000E+00 SODTA  12
0.100E+01
 FNH4    7 0.000E+00  FPO4   8 0.000E+00 ITOTL  13 0.100E+01 TMPFN   4
0.100E+01


 Segment #   2
 TMPSG   3 0.100E+01  KESG   5 0.150E+00 SOD1D   9 0.000E+00 SODTA  12
0.100E+01
 FNH4    7 0.000E+00  FPO4   8 0.000E+00 ITOTL  13 0.100E+01 TMPFN   4
0.100E+01


 Segment #   3
 TMPSG   3 0.100E+01  KESG   5 0.150E+00 SOD1D   9 0.000E+00 SODTA  12
0.100E+01
 FNH4    7 0.000E+00  FPO4   8 0.000E+00 ITOTL  13 0.100E+01 TMPFN   4
0.100E+01


 Segment #   4
 TMPSG   3 0.100E+01  KESG   5 0.150E+00 SOD1D   9 0.000E+00 SODTA  12
0.100E+01
 FNH4    7 0.000E+00  FPO4   8 0.000E+00 ITOTL  13 0.100E+01 TMPFN   4
0.100E+01


 Segment #   5
 TMPSG   3 0.100E+01  KESG   5 0.150E+00 SOD1D   9 0.000E+00 SODTA  12
0.100E+01
 FNH4    7 0.000E+00  FPO4   8 0.000E+00 ITOTL  13 0.100E+01 TMPFN   4
0.100E+01


 Segment #   6
 TMPSG   3 0.100E+01  KESG   5 0.150E+00 SOD1D   9 0.000E+00 SODTA  12
0.100E+01
 FNH4    7 0.000E+00  FPO4   8 0.000E+00 ITOTL  13 0.100E+01 TMPFN   4
0.100E+01


 Segment #   7
```

```
 TMPSG    3 0.100E+01  KESG    5 0.200E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.100E+01

 Segment #    8
 TMPSG    3 0.100E+01  KESG    5 0.200E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.100E+01

 Segment #    9
 TMPSG    3 0.100E+01  KESG    5 0.200E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.100E+01

 Segment #   10
 TMPSG    3 0.100E+01  KESG    5 0.200E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.100E+01

 Segment #   11
 TMPSG    3 0.100E+01  KESG    5 0.200E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.100E+01

 Segment #   12
 TMPSG    3 0.100E+01  KESG    5 0.200E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.100E+01

 Segment #   13
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.200E+01

 Segment #   14
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.200E+01

 Segment #   15
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL   13 0.100E+01 TMPFN   4
0.200E+01

 Segment #   16
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D    9 0.000E+00 SODTA  12
0.100E+01
```

```
 FNH4     7 0.710E+01  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  17
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  18
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  19
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  20
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  21
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  22
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  23
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

 Segment #  24
 TMPSG    3 0.100E+01  KESG    5 0.250E+00 SOD1D   9 0.000E+00 SODTA   12
0.100E+01
 FNH4     7 0.000E+00  FPO4    8 0.000E+00 ITOTL  13 0.100E+01 TMPFN    4
0.200E+01

1
                    Environmental and Chemical Constants
                    ------------------------------------

                 No Constants Enter for System  1:     GLOBALS
```

NH3 Constants for System 2

Number of Constants for System 2; Group nitrificat is 2

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| K12C | 11 | 0.200E+00 | K12T | 12 | 0.108E+01 |

NO3 Constants for System 3

Number of Constants for System 3; Group denitrif is 2

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| K20C | 21 | 0.100E+00 | K20T | 22 | 0.104E+01 |

No Constants Enter for System 4: PO4

PHYT Constants for System 5

Number of Constants for System 5; Group growth is 2

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| K1C | 41 | 0.245E+01 | K1T | 42 | 0.105E+01 |

Number of Constants for System 5; Group light is 3

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| LGHTS | 43 | 0.100E+01 | CCHL | 46 | 0.133E+03 |
| IS1 | 47 | 0.525E+03 | | 0 | 0.000E+00 |

Number of Constants for System 5; Group nutrients is 4

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| KMNG1 | 48 | 0.250E-01 | KMPG1 | 49 | 0.500E-02 |
| NCRB | 58 | 0.180E+00 | PCRB | 57 | 0.250E-01 |

Number of Constants for System 5; Group death is 4

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| K1RC | 50 | 0.600E+00 | K1RT | 51 | 0.107E+01 |
| K1D | 52 | 0.300E+00 | KPZDC | 55 | 0.000E+00 |

CBOD Constants for System 6

Number of Constants for System 6; Group deoxygent is 2

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| KDC | 71 | 0.700E-01 | KDT | 72 | 0.105E+01 |

DO Constants for System 7

Number of Constants for System 7; Group ratio is 2

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| OCRB | 81 | 0.267E+01 | K2 | 82 | 0.450E+01 |

ON Constants for System 8

Number of Constants for System 8; Group mineralize is 3

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| K71C | 91 | 0.500E+00 | K71T | 92 | 0.108E+01 |
| FON | 95 | 0.150E+00 | | 0 | 0.000E+00 |

OP Constants for System 9

Number of Constants for System 9; Group mineralize is 3

| Constant | Const. # | K Value | Constant | Const. # | K Value |
|---|---|---|---|---|---|
| K83C | 100 | 0.750E+00 | K83T | 101 | 0.108E+01 |
| FOP | 104 | 0.500E+00 | | 0 | 0.000E+00 |

No Constants Enter for System 10: CO2acy

1

## Environmental Time Functions

Piecewise Linear Functions

| | VAL(T) | T | VAL(T) | T | VAL(T) | T |
|---|---|---|---|---|---|---|
| TEMP1 | 0.18700E+02 | 0.00 | 0.18800E+02 | 0.01 | 0.18920E+02 | 0.02 |
| | 0.18940E+02 | 0.03 | 0.18820E+02 | 0.04 | 0.18870E+02 | 0.05 |
| | 0.18920E+02 | 0.06 | 0.18840E+02 | 0.07 | 0.18800E+02 | 0.08 |
| | 0.18850E+02 | 0.09 | 0.18900E+02 | 0.10 | 0.18870E+02 | 0.11 |
| | 0.18830E+02 | 0.13 | 0.18800E+02 | 0.14 | 0.18740E+02 | 0.15 |
| | 0.18570E+02 | 0.16 | 0.18470E+02 | 0.17 | 0.18450E+02 | 0.18 |
| | 0.18300E+02 | 0.19 | 0.18090E+02 | 0.20 | 0.17870E+02 | 0.21 |
| | 0.17670E+02 | 0.22 | 0.17620E+02 | 0.23 | 0.17680E+02 | 0.24 |
| | 0.17700E+02 | 0.25 | 0.17720E+02 | 0.26 | 0.17700E+02 | 0.27 |
| | 0.17620E+02 | 0.28 | 0.17550E+02 | 0.29 | 0.17610E+02 | 0.30 |
| | 0.17700E+02 | 0.31 | 0.17860E+02 | 0.32 | 0.18120E+02 | 0.33 |
| | 0.18450E+02 | 0.34 | 0.18850E+02 | 0.35 | 0.19400E+02 | 0.36 |
| | 0.20000E+02 | 0.38 | 0.20740E+02 | 0.39 | 0.21510E+02 | 0.40 |
| | 0.22380E+02 | 0.41 | 0.22840E+02 | 0.42 | 0.23330E+02 | 0.43 |
| | 0.23540E+02 | 0.44 | 0.23810E+02 | 0.45 | 0.24250E+02 | 0.46 |
| | 0.24680E+02 | 0.47 | 0.24860E+02 | 0.48 | 0.24990E+02 | 0.49 |
| | 0.25140E+02 | 0.50 | 0.25190E+02 | 0.51 | 0.25180E+02 | 0.52 |
| | 0.25130E+02 | 0.53 | 0.24950E+02 | 0.54 | 0.24840E+02 | 0.55 |
| | 0.24640E+02 | 0.56 | 0.24130E+02 | 0.57 | 0.23740E+02 | 0.58 |
| | 0.23900E+02 | 0.59 | 0.23950E+02 | 0.60 | 0.24030E+02 | 0.61 |
| | 0.23960E+02 | 0.63 | 0.24060E+02 | 0.64 | 0.24090E+02 | 0.65 |
| | 0.23980E+02 | 0.66 | 0.23840E+02 | 0.67 | 0.23550E+02 | 0.68 |
| | 0.23220E+02 | 0.69 | 0.23040E+02 | 0.70 | 0.22300E+02 | 0.71 |
| | 0.22040E+02 | 0.72 | 0.21780E+02 | 0.73 | 0.21000E+02 | 0.74 |
| | 0.20570E+02 | 0.75 | 0.20200E+02 | 0.76 | 0.19870E+02 | 0.77 |
| | 0.19720E+02 | 0.78 | 0.19700E+02 | 0.79 | 0.19620E+02 | 0.80 |
| | 0.19470E+02 | 0.81 | 0.19300E+02 | 0.82 | 0.19120E+02 | 0.83 |
| | 0.18970E+02 | 0.84 | 0.18720E+02 | 0.85 | 0.18520E+02 | 0.86 |
| | 0.18510E+02 | 0.88 | 0.18470E+02 | 0.89 | 0.18450E+02 | 0.90 |
| | 0.18450E+02 | 0.91 | 0.18390E+02 | 0.92 | 0.18360E+02 | 0.93 |
| | 0.18500E+02 | 0.94 | 0.18770E+02 | 0.95 | 0.18990E+02 | 0.96 |
| | 0.19000E+02 | 0.97 | 0.18910E+02 | 0.98 | 0.18860E+02 | 0.99 |
| | 0.18920E+02 | 1.00 | 0.18930E+02 | 1.01 | 0.19070E+02 | 1.02 |
| | 0.19050E+02 | 1.03 | 0.19050E+02 | 1.04 | 0.19030E+02 | 1.05 |
| | 0.18990E+02 | 1.06 | 0.18950E+02 | 1.07 | 0.18970E+02 | 1.08 |
| | 0.18940E+02 | 1.09 | 0.18910E+02 | 1.10 | 0.18830E+02 | 1.11 |
| | 0.18720E+02 | 1.13 | 0.18610E+02 | 1.14 | 0.18450E+02 | 1.15 |
| | 0.18300E+02 | 1.16 | 0.18110E+02 | 1.17 | 0.17920E+02 | 1.18 |
| | 0.17700E+02 | 1.19 | 0.17550E+02 | 1.20 | 0.17550E+02 | 1.21 |
| | 0.17590E+02 | 1.22 | 0.17580E+02 | 1.23 | 0.17530E+02 | 1.24 |
| | 0.17430E+02 | 1.25 | 0.17350E+02 | 1.26 | 0.17290E+02 | 1.27 |
| | 0.17340E+02 | 1.28 | 0.17470E+02 | 1.29 | 0.17620E+02 | 1.30 |
| | 0.17800E+02 | 1.31 | 0.17990E+02 | 1.32 | 0.18320E+02 | 1.33 |
| | 0.18740E+02 | 1.34 | 0.19240E+02 | 1.35 | 0.19770E+02 | 1.36 |
| | 0.20390E+02 | 1.38 | 0.21080E+02 | 1.39 | 0.21870E+02 | 1.40 |
| | 0.22560E+02 | 1.41 | 0.23170E+02 | 1.42 | 0.23790E+02 | 1.43 |
| | 0.24180E+02 | 1.44 | 0.24440E+02 | 1.45 | 0.24780E+02 | 1.46 |
| | 0.25090E+02 | 1.47 | 0.25360E+02 | 1.48 | 0.25520E+02 | 1.49 |
| | 0.25520E+02 | 1.50 | 0.25320E+02 | 1.51 | 0.25060E+02 | 1.52 |
| | 0.24760E+02 | 1.53 | 0.24740E+02 | 1.54 | 0.24640E+02 | 1.55 |
| | 0.24650E+02 | 1.56 | 0.24570E+02 | 1.57 | 0.24470E+02 | 1.58 |
| | 0.24490E+02 | 1.59 | 0.24390E+02 | 1.60 | 0.24520E+02 | 1.61 |
| | 0.24600E+02 | 1.63 | 0.24620E+02 | 1.64 | 0.24580E+02 | 1.65 |
| | 0.24420E+02 | 1.66 | 0.24300E+02 | 1.67 | 0.24240E+02 | 1.68 |
| | 0.24160E+02 | 1.69 | 0.24020E+02 | 1.70 | 0.23710E+02 | 1.71 |
| | 0.23510E+02 | 1.72 | 0.23200E+02 | 1.73 | 0.22840E+02 | 1.74 |
| | 0.22540E+02 | 1.75 | 0.22230E+02 | 1.76 | 0.21830E+02 | 1.77 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 0.21480E+02 | 1.78 | 0.21200E+02 | 1.79 | 0.20890E+02 | 1.80 |
| | 0.20570E+02 | 1.81 | 0.20320E+02 | 1.82 | 0.20150E+02 | 1.83 |
| | 0.20020E+02 | 1.84 | 0.19890E+02 | 1.85 | 0.19760E+02 | 1.86 |
| | 0.19620E+02 | 1.88 | 0.19580E+02 | 1.89 | 0.19550E+02 | 1.90 |
| | 0.19650E+02 | 1.91 | 0.19720E+02 | 1.92 | 0.19740E+02 | 1.93 |
| | 0.19700E+02 | 1.94 | 0.19660E+02 | 1.95 | 0.19610E+02 | 1.96 |
| | 0.19570E+02 | 1.97 | 0.19550E+02 | 1.98 | 0.19510E+02 | 1.99 |
| | 0.19470E+02 | 2.00 | | | | |
| TEMP2 | 0.18700E+02 | 0.00 | 0.18800E+02 | 0.01 | 0.18920E+02 | 0.02 |
| | 0.18940E+02 | 0.03 | 0.18820E+02 | 0.04 | 0.18870E+02 | 0.05 |
| | 0.18920E+02 | 0.06 | 0.18840E+02 | 0.07 | 0.18800E+02 | 0.08 |
| | 0.18850E+02 | 0.09 | 0.18900E+02 | 0.10 | 0.18870E+02 | 0.11 |
| | 0.18830E+02 | 0.13 | 0.18800E+02 | 0.14 | 0.18740E+02 | 0.15 |
| | 0.18570E+02 | 0.16 | 0.18470E+02 | 0.17 | 0.18450E+02 | 0.18 |
| | 0.18300E+02 | 0.19 | 0.18090E+02 | 0.20 | 0.17870E+02 | 0.21 |
| | 0.17670E+02 | 0.22 | 0.17620E+02 | 0.23 | 0.17680E+02 | 0.24 |
| | 0.17700E+02 | 0.25 | 0.17720E+02 | 0.26 | 0.17700E+02 | 0.27 |
| | 0.17620E+02 | 0.28 | 0.17550E+02 | 0.29 | 0.17610E+02 | 0.30 |
| | 0.17700E+02 | 0.31 | 0.17860E+02 | 0.32 | 0.18120E+02 | 0.33 |
| | 0.18450E+02 | 0.34 | 0.18850E+02 | 0.35 | 0.19400E+02 | 0.36 |
| | 0.20000E+02 | 0.38 | 0.20740E+02 | 0.39 | 0.21510E+02 | 0.40 |
| | 0.22380E+02 | 0.41 | 0.22840E+02 | 0.42 | 0.23330E+02 | 0.43 |
| | 0.23540E+02 | 0.44 | 0.23810E+02 | 0.45 | 0.24250E+02 | 0.46 |
| | 0.24680E+02 | 0.47 | 0.24860E+02 | 0.48 | 0.24990E+02 | 0.49 |
| | 0.25140E+02 | 0.50 | 0.25190E+02 | 0.51 | 0.25180E+02 | 0.52 |
| | 0.25130E+02 | 0.53 | 0.24950E+02 | 0.54 | 0.24840E+02 | 0.55 |
| | 0.24640E+02 | 0.56 | 0.24130E+02 | 0.57 | 0.23740E+02 | 0.58 |
| | 0.23900E+02 | 0.59 | 0.23950E+02 | 0.60 | 0.24030E+02 | 0.61 |
| | 0.23960E+02 | 0.63 | 0.24060E+02 | 0.64 | 0.24090E+02 | 0.65 |
| | 0.23980E+02 | 0.66 | 0.23840E+02 | 0.67 | 0.23550E+02 | 0.68 |
| | 0.23220E+02 | 0.69 | 0.23040E+02 | 0.70 | 0.22300E+02 | 0.71 |
| | 0.22040E+02 | 0.72 | 0.21780E+02 | 0.73 | 0.21000E+02 | 0.74 |
| | 0.20570E+02 | 0.75 | 0.20200E+02 | 0.76 | 0.19870E+02 | 0.77 |
| | 0.19720E+02 | 0.78 | 0.19700E+02 | 0.79 | 0.19620E+02 | 0.80 |
| | 0.19470E+02 | 0.81 | 0.19300E+02 | 0.82 | 0.19120E+02 | 0.83 |
| | 0.18970E+02 | 0.84 | 0.18720E+02 | 0.85 | 0.18520E+02 | 0.86 |
| | 0.18510E+02 | 0.88 | 0.18470E+02 | 0.89 | 0.18450E+02 | 0.90 |
| | 0.18450E+02 | 0.91 | 0.18390E+02 | 0.92 | 0.18360E+02 | 0.93 |
| | 0.18500E+02 | 0.94 | 0.18770E+02 | 0.95 | 0.18990E+02 | 0.96 |
| | 0.19000E+02 | 0.97 | 0.18910E+02 | 0.98 | 0.18860E+02 | 0.99 |
| | 0.18920E+02 | 1.00 | 0.18930E+02 | 1.01 | 0.19070E+02 | 1.02 |
| | 0.19050E+02 | 1.03 | 0.19050E+02 | 1.04 | 0.19030E+02 | 1.05 |
| | 0.18990E+02 | 1.06 | 0.18950E+02 | 1.07 | 0.18970E+02 | 1.08 |
| | 0.18940E+02 | 1.09 | 0.18910E+02 | 1.10 | 0.18830E+02 | 1.11 |
| | 0.18720E+02 | 1.13 | 0.18610E+02 | 1.14 | 0.18450E+02 | 1.15 |
| | 0.18300E+02 | 1.16 | 0.18110E+02 | 1.17 | 0.17920E+02 | 1.18 |
| | 0.17700E+02 | 1.19 | 0.17550E+02 | 1.20 | 0.17550E+02 | 1.21 |
| | 0.17590E+02 | 1.22 | 0.17580E+02 | 1.23 | 0.17530E+02 | 1.24 |
| | 0.17430E+02 | 1.25 | 0.17350E+02 | 1.26 | 0.17290E+02 | 1.27 |
| | 0.17340E+02 | 1.28 | 0.17470E+02 | 1.29 | 0.17620E+02 | 1.30 |
| | 0.17800E+02 | 1.31 | 0.17990E+02 | 1.32 | 0.18320E+02 | 1.33 |
| | 0.18740E+02 | 1.34 | 0.19240E+02 | 1.35 | 0.19770E+02 | 1.36 |
| | 0.20390E+02 | 1.38 | 0.21080E+02 | 1.39 | 0.21870E+02 | 1.40 |
| | 0.22560E+02 | 1.41 | 0.23170E+02 | 1.42 | 0.23790E+02 | 1.43 |
| | 0.24180E+02 | 1.44 | 0.24440E+02 | 1.45 | 0.24780E+02 | 1.46 |
| | 0.25090E+02 | 1.47 | 0.25360E+02 | 1.48 | 0.25520E+02 | 1.49 |
| | 0.25520E+02 | 1.50 | 0.25320E+02 | 1.51 | 0.25060E+02 | 1.52 |
| | 0.24760E+02 | 1.53 | 0.24740E+02 | 1.54 | 0.24640E+02 | 1.55 |
| | 0.24650E+02 | 1.56 | 0.24570E+02 | 1.57 | 0.24470E+02 | 1.58 |
| | 0.24490E+02 | 1.59 | 0.24390E+02 | 1.60 | 0.24520E+02 | 1.61 |
| | 0.24600E+02 | 1.63 | 0.24620E+02 | 1.64 | 0.24580E+02 | 1.65 |
| | 0.24420E+02 | 1.66 | 0.24300E+02 | 1.67 | 0.24240E+02 | 1.68 |
| | 0.24160E+02 | 1.69 | 0.24020E+02 | 1.70 | 0.23710E+02 | 1.71 |
| | 0.23510E+02 | 1.72 | 0.23200E+02 | 1.73 | 0.22840E+02 | 1.74 |
| | 0.22540E+02 | 1.75 | 0.22230E+02 | 1.76 | 0.21830E+02 | 1.77 |

```
          0.21480E+02   1.78    0.21200E+02   1.79    0.20890E+02   1.80
          0.20570E+02   1.81    0.20320E+02   1.82    0.20150E+02   1.83
          0.20020E+02   1.84    0.19890E+02   1.85    0.19760E+02   1.86
          0.19620E+02   1.88    0.19580E+02   1.89    0.19550E+02   1.90
          0.19650E+02   1.91    0.19720E+02   1.92    0.19740E+02   1.93
          0.19700E+02   1.94    0.19660E+02   1.95    0.19610E+02   1.96
          0.19570E+02   1.97    0.19550E+02   1.98    0.19510E+02   1.99
          0.19470E+02   2.00
 ITOT     0.00000E+00   0.00    0.00000E+00   0.04    0.00000E+00   0.08
          0.00000E+00   0.12    0.00000E+00   0.16    0.44100E+01   0.20
          0.78510E+02   0.25    0.25494E+03   0.29    0.45343E+03   0.33
          0.62633E+03   0.37    0.79836E+03   0.41    0.92450E+03   0.45
          0.98449E+03   0.50    0.98802E+03   0.54    0.93597E+03   0.58
          0.82041E+03   0.62    0.66868E+03   0.66    0.48695E+03   0.70
          0.28582E+03   0.75    0.94390E+02   0.79    0.10590E+02   0.83
          0.00000E+00   0.87    0.00000E+00   0.91    0.00000E+00   0.95
          0.00000E+00   1.00    0.00000E+00   1.00
 F        0.10000E+01   0.00    0.10000E+01 365.00
1
```

## Initial Conditions

```
                    Initial Conditions for System 1
   Particulate Fraction of System is Transported by Solids Field    3
                     Density of System =  0.100E+01

      1 0.2000E-01 0.1000E+01      2 0.2000E-01 0.1000E+01      3
0.2000E-01 0.1000E+01
      4 0.2000E-01 0.1000E+01      5 0.2000E-01 0.1000E+01      6
0.2000E-01 0.1000E+01
      7 0.2000E-01 0.1000E+01      8 0.2000E-01 0.1000E+01      9
0.2000E-01 0.1000E+01
     10 0.2000E-01 0.1000E+01     11 0.2000E-01 0.1000E+01     12
0.2000E-01 0.1000E+01
     13 0.2000E-01 0.1000E+01     14 0.2000E-01 0.1000E+01     15
0.2000E-01 0.1000E+01
     16 0.2000E-01 0.1000E+01     17 0.2000E-01 0.1000E+01     18
0.2000E-01 0.1000E+01
     19 0.2000E-01 0.1000E+01     20 0.2000E-01 0.1000E+01     21
0.2000E-01 0.1000E+01
     22 0.2000E-01 0.1000E+01     23 0.2000E-01 0.1000E+01     24
0.2000E-01 0.1000E+01

                    Initial Conditions for System 2
   Particulate Fraction of System is Transported by Solids Field    3
                     Density of System =  0.100E+01

      1 0.9000E-01 0.1000E+01      2 0.9000E-01 0.1000E+01      3
0.9000E-01 0.1000E+01
      4 0.9000E-01 0.1000E+01      5 0.9000E-01 0.1000E+01      6
0.9000E-01 0.1000E+01
      7 0.9000E-01 0.1000E+01      8 0.9000E-01 0.1000E+01      9
0.9000E-01 0.1000E+01
     10 0.9000E-01 0.1000E+01     11 0.9000E-01 0.1000E+01     12
0.9000E-01 0.1000E+01
     13 0.9000E-01 0.1000E+01     14 0.9000E-01 0.1000E+01     15
0.9000E-01 0.1000E+01
     16 0.9000E-01 0.1000E+01     17 0.9000E-01 0.1000E+01     18
0.9000E-01 0.1000E+01
```

```
      19 0.9000E-01 0.1000E+01      20 0.9000E-01 0.1000E+01      21
0.9000E-01 0.1000E+01
      22 0.9000E-01 0.1000E+01      23 0.9000E-01 0.1000E+01      24
0.9000E-01 0.1000E+01

                    Initial Conditions for System 3
    Particulate Fraction of System is Transported by Solids Field    3
                    Density of System =  0.100E+01

       1 0.1010E+01 0.1000E+01       2 0.1010E+01 0.1000E+01       3
0.1010E+01 0.1000E+01
       4 0.1010E+01 0.1000E+01       5 0.1010E+01 0.1000E+01       6
0.1010E+01 0.1000E+01
       7 0.1010E+01 0.1000E+01       8 0.1010E+01 0.1000E+01       9
0.1010E+01 0.1000E+01
      10 0.1010E+01 0.1000E+01      11 0.1010E+01 0.1000E+01      12
0.1010E+01 0.1000E+01
      13 0.1010E+01 0.1000E+01      14 0.1010E+01 0.1000E+01      15
0.1010E+01 0.1000E+01
      16 0.1010E+01 0.1000E+01      17 0.1010E+01 0.1000E+01      18
0.1010E+01 0.1000E+01
      19 0.1010E+01 0.1000E+01      20 0.1010E+01 0.1000E+01      21
0.1010E+01 0.1000E+01
      22 0.1010E+01 0.1000E+01      23 0.1010E+01 0.1000E+01      24
0.1010E+01 0.1000E+01

                    Initial Conditions for System 4
    Particulate Fraction of System is Transported by Solids Field    4
                    Density of System =  0.100E+01

       1 0.1000E-23 0.0000E+00       2 0.1000E+04 0.0000E+00       3
0.1000E-23 0.0000E+00
       4 0.1000E+04 0.0000E+00       5 0.1000E-23 0.0000E+00       6
0.1000E+04 0.0000E+00
       7 0.1000E-23 0.0000E+00       8 0.9750E+03 0.0000E+00       9
0.1000E-23 0.0000E+00
      10 0.9500E+03 0.0000E+00      11 0.1000E-23 0.0000E+00      12
0.9250E+03 0.0000E+00
      13 0.1000E-23 0.0000E+00      14 0.9000E+03 0.0000E+00      15
0.1000E-23 0.0000E+00
      16 0.9000E+03 0.0000E+00      17 0.1000E-23 0.0000E+00      18
0.9000E+03 0.0000E+00
      19 0.1000E-23 0.0000E+00      20 0.9000E+03 0.0000E+00      21
0.1000E-23 0.0000E+00
      22 0.9000E+03 0.0000E+00      23 0.1000E-23 0.0000E+00      24
0.9000E+03 0.0000E+00

                    Initial Conditions for System 5
    Particulate Fraction of System is Transported by Solids Field    3
                    Density of System =  0.100E+01

       1 0.5000E+01 0.1000E+01       2 0.5000E+01 0.1000E+01       3
0.5000E+01 0.1000E+01
       4 0.5000E+01 0.1000E+01       5 0.5000E+01 0.1000E+01       6
0.5000E+01 0.1000E+01
       7 0.5000E+01 0.1000E+01       8 0.5000E+01 0.1000E+01       9
0.5000E+01 0.1000E+01
      10 0.5000E+01 0.1000E+01      11 0.5000E+01 0.1000E+01      12
0.5000E+01 0.1000E+01
      13 0.5000E+01 0.1000E+01      14 0.5000E+01 0.1000E+01      15
0.5000E+01 0.1000E+01
      16 0.5000E+01 0.1000E+01      17 0.5000E+01 0.1000E+01      18
```

```
0.5000E+01 0.1000E+01
      19 0.5000E+01 0.1000E+01      20 0.5000E+01 0.1000E+01      21
0.5000E+01 0.1000E+01
      22 0.5000E+01 0.1000E+01      23 0.5000E+01 0.1000E+01      24
0.5000E+01 0.1000E+01

                    Initial Conditions for System 6
    Particulate Fraction of System is Transported by Solids Field    3
                      Density of System =  0.100E+01

       1 0.7990E+01 0.1000E+01       2 0.7590E+01 0.1000E+01       3
0.7590E+01 0.1000E+01
       4 0.7990E+01 0.1000E+01       5 0.7590E+01 0.1000E+01       6
0.7590E+01 0.1000E+01
       7 0.7990E+01 0.1000E+01       8 0.7590E+01 0.1000E+01       9
0.7590E+01 0.1000E+01
      10 0.7990E+01 0.1000E+01      11 0.7590E+01 0.1000E+01      12
0.7590E+01 0.1000E+01
      13 0.7990E+01 0.1000E+01      14 0.7590E+01 0.1000E+01      15
0.7590E+01 0.1000E+01
      16 0.7990E+01 0.1000E+01      17 0.7590E+01 0.1000E+01      18
0.7590E+01 0.1000E+01
      19 0.7990E+01 0.1000E+01      20 0.7590E+01 0.1000E+01      21
0.7590E+01 0.1000E+01
      22 0.7990E+01 0.1000E+01      23 0.7590E+01 0.1000E+01      24
0.7590E+01 0.1000E+01

                    Initial Conditions for System 7
    Particulate Fraction of System is Transported by Solids Field    3
                      Density of System =  0.100E+01

       1 0.1020E+01 0.7000E+00       2 0.1020E+01 0.7000E+00       3
0.1020E+01 0.7000E+00
       4 0.1020E+01 0.7000E+00       5 0.1020E+01 0.7000E+00       6
0.1020E+01 0.7000E+00
       7 0.1020E+01 0.7000E+00       8 0.1020E+01 0.7000E+00       9
0.1020E+01 0.7000E+00
      10 0.1020E+01 0.7000E+00      11 0.1020E+01 0.7000E+00      12
0.1020E+01 0.7000E+00
      13 0.1020E+01 0.7000E+00      14 0.1020E+01 0.7000E+00      15
0.1020E+01 0.7000E+00
      16 0.1020E+01 0.7000E+00      17 0.1020E+01 0.7000E+00      18
0.1020E+01 0.7000E+00
      19 0.1020E+01 0.7000E+00      20 0.1020E+01 0.7000E+00      21
0.1020E+01 0.7000E+00
      22 0.1020E+01 0.7000E+00      23 0.1020E+01 0.7000E+00      24
0.1020E+01 0.7000E+00

                    Initial Conditions for System 8
    Particulate Fraction of System is Transported by Solids Field    3
                      Density of System =  0.100E+01

       1 0.1000E+00 0.1000E+01       2 0.1000E+00 0.1000E+01       3
0.1000E+00 0.1000E+01
       4 0.1000E+00 0.1000E+01       5 0.1000E+00 0.1000E+01       6
0.1000E+00 0.1000E+01
       7 0.1000E+00 0.1000E+01       8 0.1000E+00 0.1000E+01       9
0.1000E+00 0.1000E+01
      10 0.1000E+00 0.1000E+01      11 0.1000E+00 0.1000E+01      12
0.1000E+00 0.1000E+01
      13 0.1000E+00 0.1000E+01      14 0.1000E+00 0.1000E+01      15
0.1000E+00 0.1000E+01
```

```
      16 0.1000E+00 0.1000E+01      17 0.1000E+00 0.1000E+01      18
0.1000E+00 0.1000E+01
      19 0.1000E+00 0.1000E+01      20 0.1000E+00 0.1000E+01      21
0.1000E+00 0.1000E+01
      22 0.1000E+00 0.1000E+01      23 0.1000E+00 0.1000E+01      24
0.1000E+00 0.1000E+01

                    Initial Conditions for System 9
    Particulate Fraction of System is Transported by Solids Field     3
                      Density of System =  0.100E+01

       1 0.4000E+01 0.1000E+01       2 0.4000E+01 0.1000E+01       3
0.4000E+01 0.1000E+01
       4 0.4000E+01 0.1000E+01       5 0.4000E+01 0.1000E+01       6
0.4000E+01 0.1000E+01
       7 0.4000E+01 0.1000E+01       8 0.4000E+01 0.1000E+01       9
0.4000E+01 0.1000E+01
      10 0.4000E+01 0.1000E+01      11 0.4000E+01 0.1000E+01      12
0.4000E+01 0.1000E+01
      13 0.6000E+01 0.1000E+01      14 0.6000E+01 0.1000E+01      15
0.6000E+01 0.1000E+01
      16 0.6000E+01 0.1000E+01      17 0.6000E+01 0.1000E+01      18
0.6000E+01 0.1000E+01
      19 0.6000E+01 0.1000E+01      20 0.6000E+01 0.1000E+01      21
0.6000E+01 0.1000E+01
      22 0.6000E+01 0.1000E+01      23 0.6000E+01 0.1000E+01      24
0.6000E+01 0.1000E+01

                Stability Criteria for Numerical Integration

              System   Maximum Concentration
                1              10.00
                2              10.00
                3               5.00
                4             500.00
                5             100.00
                6              20.00
                7              10.00
                8               5.00
                9            5000.00

Completed
```

```
# WASP5pH EDF dump file
#
# Seg    = model segment number
# Time   = simulation time in days
# Tchlax = total chlorophyll-a [periphyton] (ug/L)
# DO     = dissolved oxygen (mg/L)
# CO2acy = carbon dioxide acidity (mg/L)
# pH     = pH (standard units)
# CO2sat = saturated CO2 concentration (mg/L)
# Nlim   = Michaelis Nitrogen limitation factor
# Plim   = Michaelis Phosphorus limitation factor
#
# Seg    Time Tchlax     DO CO2acy     pH  CO2sat    Nlim    Plim
    2    0.00 1000.0   7.59   4.00   8.08    0.61    0.81    1.00
   14    0.00  900.0   7.59   6.00   7.90    0.61    0.81    1.00
    2    0.04  966.3   4.57  15.30   7.49    0.60    0.99    0.99
   14    0.04  869.7   7.05   5.19   7.96    0.60    0.88    1.00
    2    0.08  932.2   4.43  15.80   7.48    0.60    1.00    0.99
   14    0.08  838.9   6.58   5.98   7.90    0.60    0.97    0.99
    2    0.12  900.8   4.45  15.77   7.48    0.60    1.00    0.99
   14    0.12  810.7   5.80   8.41   7.75    0.60    0.99    0.99
    2    0.16  870.6   4.48  15.70   7.48    0.61    1.00    0.99
   14    0.16  783.5   5.26  10.21   7.67    0.61    0.99    0.99
    2    0.20  843.8   4.55  15.58   7.49    0.62    1.00    0.99
   14    0.20  759.4   5.09  10.86   7.65    0.62    0.99    0.99
    2    0.24  825.3   5.05  14.79   7.52    0.62    1.00    0.99
   14    0.24  742.7   5.44  10.46   7.67    0.62    0.99    0.99
    2    0.28  828.7   5.84  13.56   7.56    0.63    0.99    0.99
   14    0.28  745.8   6.16   9.39   7.72    0.63    0.99    0.99
    2    0.32  852.2   6.33  12.82   7.58    0.62    0.99    0.99
   14    0.32  767.4   6.76   8.47   7.76    0.62    0.99    0.99
    2    0.36  885.0   6.53  12.51   7.58    0.60    0.99    0.99
   14    0.36  797.9   7.17   7.83   7.78    0.60    0.99    0.99
    2    0.40  922.1   6.64  12.34   7.56    0.55    0.99    0.99
   14    0.40  832.9   7.42   7.37   7.79    0.55    0.99    0.99
    2    0.44  960.5   6.61  12.37   7.55    0.53    0.99    0.99
   14    0.44  869.8   7.44   7.18   7.78    0.53    0.99    0.99
    2    0.48  996.9   6.57  12.29   7.54    0.51    0.99    0.99
   14    0.48  905.4   7.37   6.90   7.79    0.51    0.99    0.99
    2    0.52 1032.5   6.56  12.29   7.54    0.50    0.99    0.99
   14    0.52  940.6   7.30   6.58   7.81    0.50    0.99    0.99
    2    0.56 1070.4   6.62  12.22   7.54    0.51    0.99    0.99
   14    0.56  978.2   7.31   6.29   7.83    0.51    0.99    0.99
    2    0.60 1108.8   6.77  12.07   7.56    0.52    0.99    0.99
   14    0.60 1016.1   7.43   6.08   7.85    0.52    0.99    0.99
    2    0.64 1154.6   7.05  11.61   7.57    0.52    0.99    0.99
   14    0.64 1060.9   7.71   5.67   7.88    0.52    0.99    0.99
    2    0.68 1208.0   7.25  11.44   7.58    0.53    0.99    0.99
   14    0.68 1112.3   7.94   5.42   7.91    0.53    0.99    0.99
    2    0.72 1260.4   7.07  11.84   7.58    0.55    0.99    0.99
   14    0.72 1162.2   7.89   5.86   7.88    0.55    0.99    0.99
    2    0.76 1296.1   6.33  13.05   7.55    0.58    0.99    0.99
   14    0.76 1195.8   7.34   7.12   7.82    0.58    0.99    0.99
    2    0.80 1295.3   5.06  15.04   7.49    0.59    1.00    0.99
   14    0.80 1195.2   6.25   9.13   7.71    0.59    0.99    0.99
    2    0.84 1262.6   4.31  16.20   7.47    0.60    1.00    0.99
   14    0.84 1165.0   5.38  10.67   7.65    0.60    1.00    0.99
    2    0.88 1221.6   4.25  16.28   7.47    0.61    1.00    0.99
   14    0.88 1127.1   5.00  11.35   7.63    0.61    1.00    0.99
    2    0.92 1181.1   4.28  16.21   7.47    0.61    1.00    0.99
   14    0.92 1089.8   4.81  11.69   7.61    0.61    1.00    0.99
    2    0.96 1141.7   4.27  16.19   7.47    0.60    1.00    0.99
   14    0.96 1053.4   4.71  11.85   7.60    0.60    1.00    0.99
    2    1.00 1103.2   4.30  16.12   7.47    0.60    1.00    0.99
   14    1.00 1017.8   4.69  11.84   7.60    0.60    1.00    0.99
```

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | 1.04 | 1065.7 | 4.32 | 16.07 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 1.04 | 983.3 | 4.70 | 11.79 | 7.60 | 0.60 | 1.00 | 0.99 |
| 2 | 1.08 | 1029.6 | 4.35 | 16.00 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 1.08 | 950.0 | 4.72 | 11.72 | 7.61 | 0.60 | 1.00 | 0.99 |
| 2 | 1.12 | 994.9 | 4.38 | 15.93 | 7.48 | 0.61 | 1.00 | 0.99 |
| 14 | 1.12 | 917.9 | 4.76 | 11.64 | 7.61 | 0.61 | 1.00 | 0.99 |
| 2 | 1.16 | 961.9 | 4.43 | 15.83 | 7.48 | 0.62 | 1.00 | 0.99 |
| 14 | 1.16 | 887.5 | 4.82 | 11.53 | 7.62 | 0.62 | 1.00 | 0.99 |
| 2 | 1.20 | 931.4 | 4.53 | 15.68 | 7.49 | 0.63 | 1.00 | 0.99 |
| 14 | 1.20 | 859.4 | 4.93 | 11.38 | 7.63 | 0.63 | 1.00 | 0.99 |
| 2 | 1.24 | 911.9 | 5.07 | 14.82 | 7.52 | 0.63 | 1.00 | 0.99 |
| 14 | 1.24 | 841.3 | 5.41 | 10.63 | 7.66 | 0.63 | 1.00 | 0.99 |
| 2 | 1.28 | 916.1 | 5.92 | 13.50 | 7.56 | 0.63 | 0.99 | 0.99 |
| 14 | 1.28 | 845.2 | 6.23 | 9.38 | 7.72 | 0.63 | 1.00 | 0.99 |
| 2 | 1.32 | 941.8 | 6.44 | 12.70 | 7.58 | 0.62 | 0.99 | 0.99 |
| 14 | 1.32 | 869.2 | 6.90 | 8.36 | 7.76 | 0.62 | 0.99 | 0.99 |
| 2 | 1.36 | 977.6 | 6.67 | 12.35 | 7.58 | 0.59 | 0.99 | 0.99 |
| 14 | 1.36 | 903.1 | 7.34 | 7.64 | 7.79 | 0.59 | 0.99 | 0.99 |
| 2 | 1.40 | 1018.0 | 6.77 | 12.18 | 7.56 | 0.55 | 0.99 | 0.99 |
| 14 | 1.40 | 942.0 | 7.59 | 7.15 | 7.80 | 0.55 | 0.99 | 0.99 |
| 2 | 1.44 | 1059.5 | 6.75 | 12.10 | 7.55 | 0.52 | 0.99 | 0.99 |
| 14 | 1.44 | 982.6 | 7.62 | 6.85 | 7.80 | 0.52 | 0.99 | 0.99 |
| 2 | 1.48 | 1098.9 | 6.69 | 12.13 | 7.54 | 0.50 | 0.99 | 0.99 |
| 14 | 1.48 | 1021.9 | 7.53 | 6.49 | 7.81 | 0.50 | 0.99 | 0.99 |
| 2 | 1.52 | 1136.8 | 6.65 | 12.21 | 7.54 | 0.51 | 0.99 | 0.99 |
| 14 | 1.52 | 1060.1 | 7.43 | 6.26 | 7.83 | 0.51 | 0.99 | 0.99 |
| 2 | 1.56 | 1174.1 | 6.71 | 12.15 | 7.55 | 0.51 | 0.99 | 0.99 |
| 14 | 1.56 | 1097.7 | 7.45 | 6.07 | 7.85 | 0.51 | 0.99 | 0.99 |
| 2 | 1.60 | 1215.3 | 6.90 | 11.87 | 7.56 | 0.52 | 0.99 | 0.99 |
| 14 | 1.60 | 1139.2 | 7.61 | 5.78 | 7.87 | 0.52 | 0.99 | 0.99 |
| 2 | 1.64 | 1264.9 | 7.22 | 11.41 | 7.57 | 0.51 | 0.99 | 0.99 |
| 14 | 1.64 | 1188.2 | 7.91 | 5.34 | 7.90 | 0.51 | 0.99 | 0.99 |
| 2 | 1.68 | 1322.5 | 7.45 | 11.09 | 7.59 | 0.52 | 0.99 | 0.99 |
| 14 | 1.68 | 1244.7 | 8.18 | 4.98 | 7.94 | 0.52 | 0.99 | 0.99 |
| 2 | 1.72 | 1381.2 | 7.32 | 11.45 | 7.58 | 0.53 | 0.99 | 0.99 |
| 14 | 1.72 | 1301.2 | 8.15 | 5.18 | 7.93 | 0.53 | 0.99 | 0.99 |
| 2 | 1.76 | 1422.5 | 6.49 | 12.85 | 7.54 | 0.55 | 0.99 | 0.99 |
| 14 | 1.76 | 1340.6 | 7.51 | 6.56 | 7.83 | 0.55 | 0.99 | 0.99 |
| 2 | 1.80 | 1421.1 | 5.00 | 15.19 | 7.48 | 0.57 | 1.00 | 0.99 |
| 14 | 1.80 | 1339.2 | 6.19 | 9.00 | 7.71 | 0.57 | 0.99 | 0.99 |
| 2 | 1.84 | 1383.4 | 4.16 | 16.49 | 7.45 | 0.58 | 1.00 | 0.99 |
| 14 | 1.84 | 1303.6 | 5.20 | 10.83 | 7.63 | 0.58 | 1.00 | 0.99 |
| 2 | 1.88 | 1336.1 | 4.09 | 16.58 | 7.45 | 0.59 | 1.00 | 0.99 |
| 14 | 1.88 | 1259.0 | 4.78 | 11.65 | 7.61 | 0.59 | 1.00 | 0.99 |
| 2 | 1.92 | 1289.6 | 4.11 | 16.51 | 7.45 | 0.59 | 1.00 | 0.99 |
| 14 | 1.92 | 1215.2 | 4.56 | 12.07 | 7.59 | 0.59 | 1.00 | 0.99 |
| 2 | 1.96 | 1244.6 | 4.15 | 16.43 | 7.46 | 0.59 | 1.00 | 0.99 |
| 14 | 1.96 | 1172.8 | 4.48 | 12.20 | 7.59 | 0.59 | 1.00 | 0.99 |
| 2 | 2.00 | 1201.4 | 4.19 | 16.34 | 7.47 | 0.61 | 1.00 | 0.99 |
| 14 | 2.00 | 1132.1 | 4.49 | 12.17 | 7.59 | 0.61 | 1.00 | 0.99 |
| 2 | 2.04 | 1160.9 | 4.26 | 16.21 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 2.04 | 1094.0 | 4.56 | 12.05 | 7.60 | 0.60 | 1.00 | 0.99 |
| 2 | 2.08 | 1121.8 | 4.29 | 16.14 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 2.08 | 1057.1 | 4.62 | 11.96 | 7.60 | 0.60 | 1.00 | 0.99 |
| 2 | 2.12 | 1084.0 | 4.32 | 16.08 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 2.12 | 1021.5 | 4.66 | 11.87 | 7.60 | 0.60 | 1.00 | 0.99 |
| 2 | 2.16 | 1047.7 | 4.36 | 16.00 | 7.48 | 0.61 | 1.00 | 0.99 |
| 14 | 2.16 | 987.3 | 4.71 | 11.77 | 7.61 | 0.61 | 1.00 | 0.99 |
| 2 | 2.20 | 1013.9 | 4.45 | 15.84 | 7.48 | 0.62 | 1.00 | 0.99 |
| 14 | 2.20 | 955.4 | 4.81 | 11.61 | 7.62 | 0.62 | 1.00 | 0.99 |
| 2 | 2.24 | 992.2 | 5.05 | 14.89 | 7.51 | 0.62 | 1.00 | 0.99 |
| 14 | 2.24 | 934.9 | 5.35 | 10.78 | 7.65 | 0.62 | 1.00 | 0.99 |
| 2 | 2.28 | 996.4 | 5.98 | 13.45 | 7.56 | 0.63 | 0.99 | 0.99 |
| 14 | 2.28 | 938.7 | 6.25 | 9.39 | 7.72 | 0.63 | 1.00 | 0.99 |
| 2 | 2.32 | 1023.4 | 6.52 | 12.63 | 7.58 | 0.62 | 0.99 | 0.99 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 | 2.32 | 964.2 | 6.97 | 8.31 | 7.77 | 0.62 | 0.99 | 0.99 |
| 2 | 2.36 | 1060.3 | 6.73 | 12.30 | 7.58 | 0.60 | 0.99 | 0.99 |
| 14 | 2.36 | 999.8 | 7.43 | 7.57 | 7.80 | 0.60 | 0.99 | 0.99 |
| 2 | 2.40 | 1099.5 | 6.84 | 12.14 | 7.57 | 0.55 | 0.99 | 0.99 |
| 14 | 2.40 | 1038.1 | 7.70 | 7.08 | 7.80 | 0.55 | 0.99 | 0.99 |
| 2 | 2.44 | 1141.9 | 6.80 | 12.19 | 7.55 | 0.53 | 0.99 | 0.99 |
| 14 | 2.44 | 1080.1 | 7.73 | 6.88 | 7.80 | 0.53 | 0.99 | 0.99 |
| 2 | 2.48 | 1181.6 | 6.74 | 12.13 | 7.55 | 0.51 | 0.99 | 0.99 |
| 14 | 2.48 | 1120.2 | 7.65 | 6.63 | 7.81 | 0.51 | 0.99 | 0.99 |
| 2 | 2.52 | 1220.1 | 6.72 | 12.15 | 7.54 | 0.50 | 0.99 | 0.99 |
| 14 | 2.52 | 1159.5 | 7.57 | 6.33 | 7.83 | 0.50 | 0.99 | 0.99 |
| 2 | 2.56 | 1258.9 | 6.77 | 12.09 | 7.55 | 0.51 | 0.99 | 0.99 |
| 14 | 2.56 | 1199.1 | 7.56 | 6.06 | 7.85 | 0.51 | 0.99 | 0.99 |
| 2 | 2.60 | 1299.9 | 6.93 | 11.94 | 7.56 | 0.52 | 0.99 | 0.99 |
| 14 | 2.60 | 1240.9 | 7.69 | 5.84 | 7.87 | 0.52 | 0.99 | 0.99 |
| 2 | 2.64 | 1348.9 | 7.24 | 11.44 | 7.58 | 0.52 | 0.99 | 0.99 |
| 14 | 2.64 | 1290.1 | 7.99 | 5.39 | 7.90 | 0.52 | 0.99 | 0.99 |
| 2 | 2.68 | 1406.4 | 7.46 | 11.21 | 7.59 | 0.53 | 0.99 | 0.99 |
| 14 | 2.68 | 1346.9 | 8.25 | 5.09 | 7.93 | 0.53 | 0.99 | 0.99 |
| 2 | 2.72 | 1463.1 | 7.28 | 11.64 | 7.59 | 0.55 | 0.99 | 0.99 |
| 14 | 2.72 | 1402.2 | 8.19 | 5.55 | 7.91 | 0.55 | 0.99 | 0.99 |
| 2 | 2.76 | 1502.2 | 6.48 | 12.93 | 7.56 | 0.58 | 0.99 | 0.99 |
| 14 | 2.76 | 1439.8 | 7.58 | 6.90 | 7.83 | 0.58 | 0.99 | 0.99 |
| 2 | 2.80 | 1501.4 | 5.07 | 15.15 | 7.49 | 0.59 | 1.00 | 0.99 |
| 14 | 2.80 | 1438.8 | 6.33 | 9.18 | 7.71 | 0.59 | 0.99 | 0.99 |
| 2 | 2.84 | 1464.2 | 4.19 | 16.50 | 7.46 | 0.60 | 1.00 | 0.99 |
| 14 | 2.84 | 1403.0 | 5.30 | 10.96 | 7.64 | 0.60 | 1.00 | 0.99 |
| 2 | 2.88 | 1416.6 | 4.11 | 16.60 | 7.46 | 0.61 | 1.00 | 0.99 |
| 14 | 2.88 | 1357.4 | 4.86 | 11.74 | 7.61 | 0.61 | 1.00 | 0.99 |
| 2 | 2.92 | 1369.7 | 4.15 | 16.52 | 7.46 | 0.61 | 1.00 | 0.99 |
| 14 | 2.92 | 1312.5 | 4.64 | 12.12 | 7.60 | 0.61 | 1.00 | 0.99 |
| 2 | 2.96 | 1324.1 | 4.14 | 16.50 | 7.46 | 0.60 | 1.00 | 0.99 |
| 14 | 2.96 | 1268.7 | 4.52 | 12.30 | 7.59 | 0.60 | 1.00 | 0.99 |
| 2 | 3.00 | 1279.4 | 4.18 | 16.42 | 7.46 | 0.60 | 1.00 | 0.99 |
| 14 | 3.00 | 1225.9 | 4.51 | 12.29 | 7.59 | 0.60 | 1.00 | 0.99 |
| 2 | 3.04 | 1236.0 | 4.20 | 16.36 | 7.46 | 0.60 | 1.00 | 0.99 |
| 14 | 3.04 | 1184.3 | 4.51 | 12.24 | 7.59 | 0.60 | 1.00 | 0.99 |
| 2 | 3.08 | 1194.1 | 4.23 | 16.28 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 3.08 | 1144.2 | 4.55 | 12.15 | 7.59 | 0.60 | 1.00 | 0.99 |
| 2 | 3.12 | 1153.8 | 4.27 | 16.20 | 7.47 | 0.60 | 1.00 | 0.99 |
| 14 | 3.12 | 1105.5 | 4.59 | 12.05 | 7.60 | 0.60 | 1.00 | 0.99 |
| 2 | 3.16 | 1115.4 | 4.33 | 16.09 | 7.48 | 0.61 | 1.00 | 0.99 |
| 14 | 3.16 | 1068.8 | 4.65 | 11.93 | 7.61 | 0.61 | 1.00 | 0.99 |
| 2 | 3.20 | 1080.0 | 4.43 | 15.92 | 7.49 | 0.63 | 1.00 | 0.99 |
| 14 | 3.20 | 1034.9 | 4.77 | 11.75 | 7.62 | 0.63 | 1.00 | 0.99 |
| 2 | 3.24 | 1056.0 | 5.02 | 14.99 | 7.51 | 0.63 | 1.00 | 0.99 |
| 14 | 3.24 | 1011.7 | 5.31 | 10.92 | 7.65 | 0.63 | 1.00 | 0.99 |
| 2 | 3.28 | 1058.3 | 5.97 | 13.52 | 7.56 | 0.63 | 0.99 | 0.99 |
| 14 | 3.28 | 1013.6 | 6.24 | 9.49 | 7.71 | 0.63 | 1.00 | 0.99 |
| 2 | 3.32 | 1085.2 | 6.56 | 12.60 | 7.59 | 0.62 | 0.99 | 0.99 |
| 14 | 3.32 | 1039.4 | 7.02 | 8.30 | 7.77 | 0.62 | 0.99 | 0.99 |
| 2 | 3.36 | 1123.8 | 6.82 | 12.20 | 7.59 | 0.59 | 0.99 | 0.99 |
| 14 | 3.36 | 1076.9 | 7.53 | 7.48 | 7.80 | 0.59 | 0.99 | 0.99 |
| 2 | 3.40 | 1167.3 | 6.93 | 12.02 | 7.57 | 0.55 | 0.99 | 0.99 |
| 14 | 3.40 | 1119.8 | 7.82 | 6.93 | 7.81 | 0.55 | 0.99 | 0.99 |
| 2 | 3.44 | 1212.0 | 6.91 | 11.96 | 7.56 | 0.52 | 0.99 | 0.99 |
| 14 | 3.44 | 1164.6 | 7.86 | 6.63 | 7.81 | 0.52 | 0.99 | 0.99 |
| 2 | 3.48 | 1254.1 | 6.83 | 12.01 | 7.55 | 0.50 | 0.99 | 0.99 |
| 14 | 3.48 | 1207.5 | 7.76 | 6.29 | 7.83 | 0.50 | 0.99 | 0.99 |
| 2 | 3.52 | 1294.2 | 6.78 | 12.11 | 7.55 | 0.51 | 0.99 | 0.99 |
| 14 | 3.52 | 1248.8 | 7.65 | 6.08 | 7.84 | 0.51 | 0.99 | 0.99 |
| 2 | 3.56 | 1333.3 | 6.82 | 12.06 | 7.55 | 0.51 | 0.99 | 0.99 |
| 14 | 3.56 | 1289.2 | 7.65 | 5.90 | 7.86 | 0.51 | 0.99 | 0.99 |
| 2 | 3.60 | 1376.5 | 7.03 | 11.77 | 7.56 | 0.52 | 0.99 | 0.99 |
| 14 | 3.60 | 1333.5 | 7.82 | 5.61 | 7.88 | 0.52 | 0.99 | 0.99 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | 3.64 | 1428.3 | 7.36 | 11.28 | 7.58 | 0.51 | 0.99 | 0.99 |
| 14 | 3.64 | 1385.9 | 8.14 | 5.14 | 7.92 | 0.51 | 0.99 | 0.99 |
| 2 | 3.68 | 1489.0 | 7.62 | 10.93 | 7.60 | 0.52 | 0.99 | 0.99 |
| 14 | 3.68 | 1446.4 | 8.42 | 4.75 | 7.96 | 0.52 | 0.99 | 0.99 |
| 2 | 3.72 | 1551.1 | 7.49 | 11.27 | 7.59 | 0.53 | 0.99 | 0.99 |
| 14 | 3.72 | 1507.4 | 8.41 | 4.92 | 7.95 | 0.53 | 0.99 | 0.99 |
| 2 | 3.76 | 1595.4 | 6.63 | 12.72 | 7.55 | 0.55 | 0.99 | 0.99 |
| 14 | 3.76 | 1550.2 | 7.72 | 6.36 | 7.85 | 0.55 | 0.99 | 0.99 |
| 2 | 3.80 | 1594.4 | 5.00 | 15.28 | 7.48 | 0.57 | 1.00 | 0.99 |
| 14 | 3.80 | 1548.7 | 6.26 | 9.03 | 7.71 | 0.57 | 0.99 | 0.99 |
| 2 | 3.84 | 1552.9 | 4.05 | 16.76 | 7.44 | 0.58 | 1.00 | 0.99 |
| 14 | 3.84 | 1508.2 | 5.13 | 11.08 | 7.62 | 0.58 | 1.00 | 0.99 |
| 2 | 3.88 | 1499.9 | 3.96 | 16.87 | 7.44 | 0.59 | 1.00 | 0.99 |
| 14 | 3.88 | 1456.7 | 4.65 | 12.00 | 7.59 | 0.59 | 1.00 | 0.99 |
| 2 | 3.92 | 1447.7 | 3.99 | 16.79 | 7.45 | 0.59 | 1.00 | 0.99 |
| 14 | 3.92 | 1406.0 | 4.40 | 12.46 | 7.58 | 0.59 | 1.00 | 0.99 |
| 2 | 3.96 | 1397.1 | 4.04 | 16.69 | 7.45 | 0.59 | 1.00 | 0.99 |
| 14 | 3.96 | 1356.9 | 4.31 | 12.60 | 7.57 | 0.59 | 1.00 | 0.99 |
| 2 | 4.00 | 1348.7 | 4.08 | 16.60 | 7.46 | 0.61 | 1.00 | 0.99 |
| 14 | 4.00 | 1309.8 | 4.32 | 12.57 | 7.58 | 0.61 | 1.00 | 0.99 |

Mass Balance for Constituent 1

Initial Mass is 0.1459E+00 KG

| Time | Accumulated Mass In (KG) ***** Advection | Dispersion | Resident Loading Mass (KG) | Excess Advection Mass (KG) | Accumulated Mass Out (KG) ********** Dispersion | Buried | Kinetic |
|---|---|---|---|---|---|---|---|
| 0.000 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 | 0.0000E+00 |
| 0.040 | 0.2574E+01 | 0.0000E+00 | 0.0000E+00 | 0.3213E-01 | 0.0000E+00 | 0.0000E+00 | 0.8699E-01 |
| 0.082 | 0.5277E+01 | 0.0000E+00 | 0.0000E+00 | 0.8264E-01 | 0.0000E+00 | 0.0000E+00 | 0.1542E+00 |
| 0.122 | 0.7851E+01 | 0.0000E+00 | 0.0000E+00 | 0.1659E+00 | 0.0000E+00 | 0.0000E+00 | 0.1957E+00 |
| 0.162 | 0.1043E+02 | 0.0000E+00 | 0.0000E+00 | 0.4250E+00 | 0.0000E+00 | 0.0000E+00 | 0.2163E+00 |
| 0.200 | 0.1287E+02 | 0.0000E+00 | 0.0000E+00 | 0.1092E+01 | 0.0000E+00 | 0.0000E+00 | 0.2179E+00 |
| 0.240 | 0.1544E+02 | 0.0000E+00 | 0.0000E+00 | 0.2411E+01 | 0.0000E+00 | 0.0000E+00 | 0.1822E+00 |
| 0.280 | 0.1802E+02 | 0.0000E+00 | 0.0000E+00 | 0.4286E+01 | 0.0000E+00 | 0.0000E+00 | 0.6973E-01 |
| 0.320 | 0.2059E+02 | 0.0000E+00 | 0.0000E+00 | 0.6505E+01 | 0.0000E+00 | 0.0000E+00 | -0.1113E+00 |
| 0.360 | 0.2317E+02 | 0.0000E+00 | 0.0000E+00 | 0.8881E+01 | 0.0000E+00 | 0.0000E+00 | -0.3300E+00 |
| 0.400 | 0.2574E+02 | 0.0000E+00 | 0.0000E+00 | 0.1130E+02 | 0.0000E+00 | 0.0000E+00 | -0.5812E+00 |
| 0.440 | 0.2831E+02 | 0.0000E+00 | 0.0000E+00 | 0.1370E+02 | 0.0000E+00 | 0.0000E+00 | -0.8643E+00 |
| 0.480 | 0.3089E+02 | 0.0000E+00 | 0.0000E+00 | 0.1608E+02 | 0.0000E+00 | 0.0000E+00 | -0.1158E+01 |
| 0.520 | 0.3346E+02 | 0.0000E+00 | 0.0000E+00 | 0.1842E+02 | 0.0000E+00 | 0.0000E+00 | -0.1460E+01 |
| 0.562 | 0.3617E+02 | 0.0000E+00 | 0.0000E+00 | 0.2086E+02 | 0.0000E+00 | 0.0000E+00 | -0.1777E+01 |
| 0.602 | 0.3874E+02 | 0.0000E+00 | 0.0000E+00 | 0.2315E+02 | 0.0000E+00 | 0.0000E+00 | -0.2076E+01 |
| 0.642 | 0.4131E+02 | 0.0000E+00 | 0.0000E+00 | 0.2544E+02 | 0.0000E+00 | 0.0000E+00 | -0.2399E+01 |
| 0.682 | 0.4389E+02 | 0.0000E+00 | 0.0000E+00 | 0.2771E+02 | 0.0000E+00 | 0.0000E+00 | -0.2745E+01 |
| 0.722 | 0.4646E+02 | 0.0000E+00 | 0.0000E+00 | 0.2998E+02 | 0.0000E+00 | 0.0000E+00 | -0.3074E+01 |
| 0.762 | 0.4904E+02 | 0.0000E+00 | 0.0000E+00 | 0.3224E+02 | 0.0000E+00 | 0.0000E+00 | -0.3329E+01 |
| 0.802 | 0.5161E+02 | 0.0000E+00 | 0.0000E+00 | 0.3452E+02 | 0.0000E+00 | 0.0000E+00 | -0.3453E+01 |
| 0.842 | 0.5418E+02 | 0.0000E+00 | 0.0000E+00 | 0.3683E+02 | 0.0000E+00 | 0.0000E+00 | -0.3468E+01 |
| 0.882 | 0.5676E+02 | 0.0000E+00 | 0.0000E+00 | 0.3920E+02 | 0.0000E+00 | 0.0000E+00 | -0.3452E+01 |
| 0.922 | 0.5933E+02 | 0.0000E+00 | 0.0000E+00 | 0.4162E+02 | 0.0000E+00 | 0.0000E+00 | -0.3436E+01 |
| 0.962 | 0.6191E+02 | 0.0000E+00 | 0.0000E+00 | 0.4410E+02 | 0.0000E+00 | 0.0000E+00 | -0.3426E+01 |
| 1.002 | 0.6448E+02 | 0.0000E+00 | 0.0000E+00 | 0.4662E+02 | 0.0000E+00 | 0.0000E+00 | -0.3421E+01 |
| 1.042 | 0.6705E+02 | 0.0000E+00 | 0.0000E+00 | 0.4917E+02 | | | |

| | | | | |
|---|---|---|---|---|
| 0.0000E+00 | 0.0000E+00 | -0.3421E+01 | 0.1461E+02 | -0.1229E-05 |
| 1.082 | 0.6963E+02 | 0.0000E+00 | 0.0000E+00 | 0.5174E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3424E+01 | 0.1462E+02 | -0.7537E-06 |
| 1.122 | 0.7220E+02 | 0.0000E+00 | 0.0000E+00 | 0.5431E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3430E+01 | 0.1461E+02 | -0.1429E-06 |
| 1.162 | 0.7478E+02 | 0.0000E+00 | 0.0000E+00 | 0.5688E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3438E+01 | 0.1460E+02 | 0.1300E-05 |
| 1.202 | 0.7735E+02 | 0.0000E+00 | 0.0000E+00 | 0.5945E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3449E+01 | 0.1459E+02 | 0.1241E-05 |
| 1.242 | 0.7993E+02 | 0.0000E+00 | 0.0000E+00 | 0.6202E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3492E+01 | 0.1456E+02 | 0.8693E-06 |
| 1.282 | 0.8250E+02 | 0.0000E+00 | 0.0000E+00 | 0.6458E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3612E+01 | 0.1445E+02 | 0.9097E-06 |
| 1.322 | 0.8507E+02 | 0.0000E+00 | 0.0000E+00 | 0.6711E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.3805E+01 | 0.1430E+02 | 0.1787E-06 |
| 1.362 | 0.8765E+02 | 0.0000E+00 | 0.0000E+00 | 0.6961E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.4040E+01 | 0.1415E+02 | 0.1280E-05 |
| 1.402 | 0.9022E+02 | 0.0000E+00 | 0.0000E+00 | 0.7206E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.4310E+01 | 0.1399E+02 | -0.8040E-06 |
| 1.442 | 0.9280E+02 | 0.0000E+00 | 0.0000E+00 | 0.7448E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.4613E+01 | 0.1385E+02 | -0.2196E-05 |
| 1.482 | 0.9537E+02 | 0.0000E+00 | 0.0000E+00 | 0.7684E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.4927E+01 | 0.1375E+02 | -0.4610E-06 |
| 1.522 | 0.9794E+02 | 0.0000E+00 | 0.0000E+00 | 0.7917E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.5245E+01 | 0.1367E+02 | 0.1074E-05 |
| 1.562 | 0.1005E+03 | 0.0000E+00 | 0.0000E+00 | 0.8147E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.5551E+01 | 0.1364E+02 | -0.1027E-07 |
| 1.602 | 0.1031E+03 | 0.0000E+00 | 0.0000E+00 | 0.8376E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.5869E+01 | 0.1361E+02 | -0.8127E-06 |
| 1.642 | 0.1057E+03 | 0.0000E+00 | 0.0000E+00 | 0.8603E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.6215E+01 | 0.1357E+02 | -0.1723E-05 |
| 1.682 | 0.1082E+03 | 0.0000E+00 | 0.0000E+00 | 0.8829E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.6585E+01 | 0.1352E+02 | -0.1880E-05 |
| 1.722 | 0.1108E+03 | 0.0000E+00 | 0.0000E+00 | 0.9053E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.6952E+01 | 0.1348E+02 | -0.6167E-06 |
| 1.762 | 0.1134E+03 | 0.0000E+00 | 0.0000E+00 | 0.9277E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.7247E+01 | 0.1352E+02 | -0.9191E-06 |
| 1.802 | 0.1160E+03 | 0.0000E+00 | 0.0000E+00 | 0.9502E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.7386E+01 | 0.1370E+02 | -0.6526E-06 |
| 1.842 | 0.1185E+03 | 0.0000E+00 | 0.0000E+00 | 0.9731E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.7395E+01 | 0.1398E+02 | -0.1996E-05 |
| 1.882 | 0.1211E+03 | 0.0000E+00 | 0.0000E+00 | 0.9966E+02 |
| 0.0000E+00 | 0.0000E+00 | -0.7368E+01 | 0.1423E+02 | -0.6037E-06 |
| 1.922 | 0.1237E+03 | 0.0000E+00 | 0.0000E+00 | 0.1021E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7343E+01 | 0.1442E+02 | -0.2347E-07 |
| 1.962 | 0.1263E+03 | 0.0000E+00 | 0.0000E+00 | 0.1045E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7324E+01 | 0.1454E+02 | -0.2882E-05 |
| 2.002 | 0.1288E+03 | 0.0000E+00 | 0.0000E+00 | 0.1071E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7309E+01 | 0.1461E+02 | -0.2815E-05 |
| 2.042 | 0.1314E+03 | 0.0000E+00 | 0.0000E+00 | 0.1096E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7298E+01 | 0.1464E+02 | 0.6267E-06 |
| 2.082 | 0.1340E+03 | 0.0000E+00 | 0.0000E+00 | 0.1122E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7290E+01 | 0.1465E+02 | 0.1477E-05 |
| 2.122 | 0.1366E+03 | 0.0000E+00 | 0.0000E+00 | 0.1148E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7286E+01 | 0.1464E+02 | -0.2044E-05 |
| 2.162 | 0.1391E+03 | 0.0000E+00 | 0.0000E+00 | 0.1174E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7285E+01 | 0.1464E+02 | -0.6715E-06 |
| 2.202 | 0.1417E+03 | 0.0000E+00 | 0.0000E+00 | 0.1199E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7289E+01 | 0.1462E+02 | 0.3599E-07 |
| 2.242 | 0.1443E+03 | 0.0000E+00 | 0.0000E+00 | 0.1225E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7327E+01 | 0.1458E+02 | 0.2168E-05 |
| 2.282 | 0.1469E+03 | 0.0000E+00 | 0.0000E+00 | 0.1251E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7451E+01 | 0.1447E+02 | 0.5186E-06 |
| 2.322 | 0.1494E+03 | 0.0000E+00 | 0.0000E+00 | 0.1276E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7650E+01 | 0.1431E+02 | 0.5663E-06 |

| | | | | |
|---|---|---|---|---|
| 2.362 | 0.1520E+03 | 0.0000E+00 | 0.0000E+00 | 0.1301E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.7889E+01 | 0.1414E+02 | -0.6260E-06 |
| 2.400 | 0.1544E+03 | 0.0000E+00 | 0.0000E+00 | 0.1324E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.8148E+01 | 0.1399E+02 | -0.1448E-05 |
| 2.440 | 0.1570E+03 | 0.0000E+00 | 0.0000E+00 | 0.1349E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.8451E+01 | 0.1385E+02 | 0.1233E-05 |
| 2.480 | 0.1596E+03 | 0.0000E+00 | 0.0000E+00 | 0.1372E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.8762E+01 | 0.1375E+02 | 0.8821E-06 |
| 2.520 | 0.1622E+03 | 0.0000E+00 | 0.0000E+00 | 0.1396E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.9080E+01 | 0.1367E+02 | 0.1907E-05 |
| 2.560 | 0.1647E+03 | 0.0000E+00 | 0.0000E+00 | 0.1419E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.9398E+01 | 0.1363E+02 | 0.1891E-05 |
| 2.600 | 0.1673E+03 | 0.0000E+00 | 0.0000E+00 | 0.1441E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.9712E+01 | 0.1361E+02 | 0.1363E-06 |
| 2.640 | 0.1699E+03 | 0.0000E+00 | 0.0000E+00 | 0.1464E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1005E+02 | 0.1357E+02 | 0.1893E-05 |
| 2.680 | 0.1725E+03 | 0.0000E+00 | 0.0000E+00 | 0.1487E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1042E+02 | 0.1352E+02 | -0.1886E-05 |
| 2.720 | 0.1750E+03 | 0.0000E+00 | 0.0000E+00 | 0.1509E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1077E+02 | 0.1350E+02 | 0.1381E-05 |
| 2.760 | 0.1776E+03 | 0.0000E+00 | 0.0000E+00 | 0.1532E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1104E+02 | 0.1356E+02 | 0.2150E-06 |
| 2.800 | 0.1802E+03 | 0.0000E+00 | 0.0000E+00 | 0.1554E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1117E+02 | 0.1374E+02 | 0.1617E-05 |
| 2.840 | 0.1828E+03 | 0.0000E+00 | 0.0000E+00 | 0.1577E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1117E+02 | 0.1402E+02 | 0.1701E-05 |
| 2.880 | 0.1853E+03 | 0.0000E+00 | 0.0000E+00 | 0.1601E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1113E+02 | 0.1427E+02 | 0.2064E-05 |
| 2.920 | 0.1879E+03 | 0.0000E+00 | 0.0000E+00 | 0.1625E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1110E+02 | 0.1445E+02 | 0.1622E-05 |
| 2.960 | 0.1905E+03 | 0.0000E+00 | 0.0000E+00 | 0.1650E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1106E+02 | 0.1457E+02 | -0.7012E-06 |
| 3.000 | 0.1931E+03 | 0.0000E+00 | 0.0000E+00 | 0.1675E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1104E+02 | 0.1464E+02 | 0.7808E-06 |
| 3.040 | 0.1956E+03 | 0.0000E+00 | 0.0000E+00 | 0.1701E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1102E+02 | 0.1467E+02 | 0.1839E-05 |
| 3.080 | 0.1982E+03 | 0.0000E+00 | 0.0000E+00 | 0.1727E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1100E+02 | 0.1468E+02 | -0.3662E-06 |
| 3.120 | 0.2008E+03 | 0.0000E+00 | 0.0000E+00 | 0.1753E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1099E+02 | 0.1467E+02 | -0.2791E-06 |
| 3.160 | 0.2034E+03 | 0.0000E+00 | 0.0000E+00 | 0.1779E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1098E+02 | 0.1466E+02 | 0.1947E-06 |
| 3.200 | 0.2059E+03 | 0.0000E+00 | 0.0000E+00 | 0.1804E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1098E+02 | 0.1465E+02 | -0.7690E-06 |
| 3.240 | 0.2085E+03 | 0.0000E+00 | 0.0000E+00 | 0.1830E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1101E+02 | 0.1461E+02 | -0.9622E-07 |
| 3.280 | 0.2111E+03 | 0.0000E+00 | 0.0000E+00 | 0.1856E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1112E+02 | 0.1449E+02 | -0.1622E-05 |
| 3.320 | 0.2136E+03 | 0.0000E+00 | 0.0000E+00 | 0.1881E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1132E+02 | 0.1432E+02 | -0.2738E-05 |
| 3.360 | 0.2162E+03 | 0.0000E+00 | 0.0000E+00 | 0.1907E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1157E+02 | 0.1414E+02 | -0.2623E-05 |
| 3.400 | 0.2188E+03 | 0.0000E+00 | 0.0000E+00 | 0.1931E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1186E+02 | 0.1397E+02 | -0.4051E-05 |
| 3.440 | 0.2214E+03 | 0.0000E+00 | 0.0000E+00 | 0.1955E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1217E+02 | 0.1382E+02 | -0.3474E-05 |
| 3.480 | 0.2239E+03 | 0.0000E+00 | 0.0000E+00 | 0.1979E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1250E+02 | 0.1371E+02 | -0.2976E-05 |
| 3.520 | 0.2265E+03 | 0.0000E+00 | 0.0000E+00 | 0.2002E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1283E+02 | 0.1363E+02 | -0.3710E-05 |
| 3.560 | 0.2291E+03 | 0.0000E+00 | 0.0000E+00 | 0.2025E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1315E+02 | 0.1360E+02 | -0.4625E-05 |
| 3.600 | 0.2317E+03 | 0.0000E+00 | 0.0000E+00 | 0.2048E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1348E+02 | 0.1357E+02 | -0.3333E-05 |
| 3.640 | 0.2342E+03 | 0.0000E+00 | 0.0000E+00 | 0.2070E+03 |

| | | | | |
|---|---|---|---|---|
| 0.0000E+00 | 0.0000E+00 | -0.1384E+02 | 0.1353E+02 | -0.3595E-05 |
| 3.680 | 0.2368E+03 | 0.0000E+00 | 0.0000E+00 | 0.2093E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1423E+02 | 0.1347E+02 | -0.4502E-05 |
| 3.720 | 0.2394E+03 | 0.0000E+00 | 0.0000E+00 | 0.2115E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1461E+02 | 0.1343E+02 | -0.4530E-05 |
| 3.760 | 0.2420E+03 | 0.0000E+00 | 0.0000E+00 | 0.2137E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1492E+02 | 0.1347E+02 | -0.3268E-05 |
| 3.800 | 0.2445E+03 | 0.0000E+00 | 0.0000E+00 | 0.2160E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1506E+02 | 0.1367E+02 | -0.3028E-05 |
| 3.840 | 0.2471E+03 | 0.0000E+00 | 0.0000E+00 | 0.2182E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1506E+02 | 0.1396E+02 | -0.5348E-05 |
| 3.880 | 0.2497E+03 | 0.0000E+00 | 0.0000E+00 | 0.2206E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1501E+02 | 0.1424E+02 | -0.3233E-05 |
| 3.920 | 0.2523E+03 | 0.0000E+00 | 0.0000E+00 | 0.2230E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1497E+02 | 0.1444E+02 | -0.3021E-05 |
| 3.960 | 0.2548E+03 | 0.0000E+00 | 0.0000E+00 | 0.2255E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1493E+02 | 0.1458E+02 | -0.2087E-05 |
| 4.000 | 0.2574E+03 | 0.0000E+00 | 0.0000E+00 | 0.2280E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1490E+02 | 0.1466E+02 | -0.1562E-05 |
| 4.001 | 0.2574E+03 | 0.0000E+00 | 0.0000E+00 | 0.2280E+03 |
| 0.0000E+00 | 0.0000E+00 | -0.1490E+02 | 0.1466E+02 | -0.1562E-05 |