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SEDIMENT TRANSPORT CALCULATION IN TWO DIMENSIONS USING THE EINSTEIN'S PROCEDURE

A CASE STUDY : THE ZAIRE RIVER

by

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SUMMARY

Several one dimensional models for sediment transport calculations in open channel flows have been developed. Einstein model (1950) is one of the most advanced method for the computation of bed-load and suspended-load, because the begining and the end of the particle motion have to be expressed with the concept of probability, which relates instantaneous hydrodynamic lift forces to the particles weight.

The bed load equation expresses an equilibrium condition of the exchange of bed particles between the bed layer and the bed. This implies that the number of particles deposited per unit time and per unit bed area must be equal to the number of particles eroded per unit time and unit bed area.

Hence the goal of this thesis is limited to the study of the application of the Einstein model in the traditional way and in the two-dimensional approach based on measured hydraulic data of nine cross sections in the Zaire river; the results have been quite successful.

From the result obtained by the Einstein model, it was found that the calculated sediment transport rate underestimates the measured transport rate.

CONTENT

1. INTRODUCTION

One of the most difficult problems encountered in open channel hydraulics is the determination of the rate of movement of the bed material by a stream. The movement of bed material is a complex function of flow duration, sediment supply, and channel characteristics.

Every sediment particle which passes a particular cross section of the stream must satisfy the following two conditions: (1) it must have been eroded somewhere in the watershed above the cross section; (2) it must be transported by the flow from the place of erosion to the cross section.

Each of these two conditions may limit the sediment rate at the cross section, depending on the relative magnitude of two controls: The availability of the material in the watershed and the transporting ability of the stream.

The goal of this thesis does not attempt to give the specific solutions for all sediment problems in alluvial channels. It attempts only to study the application of EINSTEIN MODEL (1950) to nine cross sections in the ZAIRE RIVER, using the traditional procedure and the two dimensional approach.

The Zaire river is the second largest river in the world and the most important river in Africa. It is used as a mean of transportation interconnecting different important cities in central Africa. These sediment studies will help in estimating the amount of sediment transported in the river and later will mitigate the navigation problems.

2. LITERATURE REVIEW

2.1 PROPERTIES OF SEDIMENT

2.1.1 SIZE AND SHAPE

Sediment are broadly classified as cohesive and noncohesive. Noncohesive sediment particles react to fluid forces and their movements are affected by the physical properties of the particles such as size, shape, specific weight, density and fall velocity.

It is necessary to make statistical analysis of these characteristics, as determined from the adequate number of samples of sufficient size in order to define fully the representative particle characteristics of any sediment mixture as a whole. The statistical analysis may consist of frequency curves, quartile and moment measures.

The most commonly used method to determine size frequency is mechanical or sieve analysis. In general the results are presented as cumulative-size frequency curves. The fraction or percentage by weight of a sediment that is smaller or larger than a given size is plotted against particle size. From the size frequency curve it is possible to obtain:

D35, The size of sediment for which 35 percent of the sample is finer. This size was specified by EINSTEIN as a representative grain size of the sediment mixture.

D40, The size used by SCHOKLITSCH, to represent the mixture.

D50, The median diameter. SHIELDS used this size in his analysis of beginning of motion.

D65, The size used by EINSTEIN to express the roughness of a sediment mixture. It is also used by SENTURK.

D90, The size chosen by MEYER-PETER and MULLER to represent the roughness of a sediment mixture.

D85, The size used by SIMONS and RICHARDSON in the formula for the computation of the resistance to flow in sand bed channels.

D84.1 and D15.9, The sizes derived from a probabilistic analysis.

The sediment size frequency distribution is essentially a probabilistic approach used to help describe the transported sediment and the sediment mixture forming the bed of a river. The distribution of particle size usually follows the standardized normal (Gaussian) distribution.

$$F(u) = \int_{-\infty}^{u} f(u).du \quad \ldots\ldots\ldots\ldots\ldots \quad (2.1a)$$

$$f(u) = \frac{1}{\sqrt{2\pi}} e^{-z^2/2} \quad \ldots\ldots\ldots\ldots\ldots \quad (2.1b)$$

EINSTEIN, (1950) used this function to help explain the motion of particles on the bed of an alluvial channel. The use of normal probability paper provides a means of making the transformation. The characteristics of the cumulative distribution function are such that between the ordinates 0.8413 and 0.1587 the normal distribution can be approximated by a straight line. The fifty percent value of the ordinate is midway between these two values. The diameter corresponding to the fifty percent ordinate is called the geometric mean size.

Particle shape may be considered statistically as a distribution of the geometric properties of the grain, rather than a cataloging of the individual shape of each particle. Various schemes have been devised to take measurements and present data are useful in defining particle shape.

Shape factor (sphericity or roundness) can be computed for bulk sediments and presented as frequency curves when either moment or quartile measures are used to describe the shape factor of the sediment.

2.1.2 FALL VELOCITY

The primary variable defining the interaction of sediment transport with the bed, banks or suspended in the fluid is the fall velocity of sediment particles.

A particle falling at terminal velocity in a quiescent fluid is driven by the resulting force considering the particle buoyant weight and the resisting force resulting from fluid drag. The general drag equation is:

$$F_D = C_D . \rho . A . W^2 /2 \qquad .... \quad (2.2)$$

Where: F_D , is the drag force

C_D , is the drag coefficient

A , proyected area of the particle in the direction of fall.

For natural sands with the Reynolds number less than 0.1, the coefficient of drag (C), is independent of the shape factor and equal to 24/Re ; where Re is the Reynolds number of the particle.

For spheres the equation for fall velocity according to STOKES is:

$$W = \frac{(\rho_s - \rho).g.D^2}{18.\mu} \qquad \ldots\ldots\ldots\ldots (2.3)$$

Where: ρ_s ; is the density of the particle.
W ; the fall velocity
μ ; the Dynamic Viscosity
D ; the particle diameter.

When Reynolds number is greather than 0.1, the equation for fall velocity is:

$$W = \frac{4\,g}{3\,C_D}\,\frac{(\gamma_s - \gamma)}{\gamma}\,D \qquad \ldots\ldots\ldots\ldots (2.4)$$

Where: γ_s ; is the specific weight of the particle.
γ ; is the specific weight of the water.

2.2. FORMS OF BED ROUGHNESS

2.2.1 BED CONFIGURATION WITHOUT SEDIMENT MOVEMENT

Plane bed without movement has been studied to determine the flow conditions for the beginning of motion and the bed profiles that would form after beginning of motion. In general, SHIELD'S (1936) relation for the incipient motion of sediment is adequate.

With plane bed without bed material transport the values of CHEZY'S discharge coefficient range from 15 to 20 and the MANNING'S roughness coefficient vary from 0.012 to 0.016.

2.2.2 RIPPLES

In fine sand, ripples will usually occour as soon as particle show appreciable movement. SIMONS (1959) and KNOROZ (1959) observed that the length of the separation zone when the bed form was either ripples or dunes was about 10 times the height of the ripple or the dune. The separation zone downstream from a ripple cause very little, if any disturbance on the water surface. The concentration of sediment is small ranging from 10 to 200 ppm. Resistance to flow is large with the Manning's coefficient varying from 0.018 to 0.050 and the resulting discharge coefficient $C/\sqrt{g}$ ranges from 6 to 12. As the depth of flow increases, resistance to flow due to bed roughness decreases.

2.2.3 DUNES

When the shear stress (γRS) and stream power (γURS) are gradually increased over a bed of ripples, or if the bed material is coarser than 0.6 mm. over a plane bed, a new flow condition will be achieved that causes dunes to form. Dunes cause large separation zones in the flow. These zones, in turn, cause large boils to form on the surface of the stream. The sediment transport rate is relatively small. The concentration of bed materials ranges from approximately 100 to 1200 ppm.

For dunes, the Manning's coefficient (n) varies from 0.018 to 0.035 and the discharge coefficient $C/\sqrt{g}$ varies from 8 to 12-15. Resistance to flow increases with an increase in depth for coarser sand (D50 > 0.3 mm.) and decreases with an increase in depth for finer sands (D50 < 0.3 mm.).

2.2.4 PLANE BED WITH SEDIMENT MOVEMENT

If the shear stress or the stream power is continuosly increased, the size of dunes increases until the dunes reach a maximun height at a certain stream power. Finally, the dunes completely disappear and a flat bed is formed. In this case, the concentration of bed material ranges from about 1500 to 3000 ppm.

2.2.5 ANTIDUNES

When the shear stress or the stream power is further increased, water and sand waves gradually build up, from a plane bed and from a plane water surface the waves may grow in height until they become unstable and break like the sea surface or they may gradually subside and subsequently reform. As the antidunes form and increase in height, they may move upstream, downstream, or remain stationary. Their upstream movement led GILBERT (1914) to name them antidunes. This is the positive indication that the local flow is rapid (Fr > 1). KENNEDY (1961), studied the antidune flow and found that the wave length of antidunes is given by $L= 2\pi U^2/g$ where: U is the mean velocity and g the gravity.

2.2.6 CHUTES AND POOLS

At very steep slope, sand-bed channel flow changes to chutes and pools. Chutes and pools flow could not be attained using coarser sand because the steeper slope required could not be set up in the flume. This type of flow consisted of a log chute (3.048-9.144 mm.) in which the flow accelerate rapidly, a hydraulic jump at the end of the chute, and then a long pool (3.048-9.144 mm.) in which the flow was tranquil but was accelerating. The chutes and pools moved upstream at velocities of about 0.3-0.6 m/min. The elevation of the sand bed varied within wide limits, although at no time was the flume floor exposed. Resistance to flow was large, and $C/\sqrt{g}$ ranged from 9 to 16. This type of flow was frequently accompanied by a decrease in the mean velocity of the flow in the flume even though there was an increase in stream power.

2.3 BEGINNING OF SEDIMENT MOTION

When the drag force is less than some critical value the bed material of a channel remain motionless. Then the bed can be considered as rigid. But when the shear stress over the bed attains or exceeds its critical value, particle motion begin.

KRAMER (1965), has defined three types of motion of bed material:

(1) weak movement: only a few particles are in motion on the bed. The grain "moving on one square centimeter of the bed can be counted"

(2) Medium movement: the grain of mean diameter begin to move. The motion is not local in character but the bed continues to be plane.

(3) General movement: All the mixture is in motion; "the movement is occurring in all parts of the

bed at all times".

2.3.1 SHIELDS DIAGRAM

Many experiments have been conducted to develop and explicit solution of theoretical equation:

$$\frac{\rho U_{*c}^{2}}{\gamma_s' . Ds} = f(U_{*c}.Ds/\nu) \qquad ....(2.5)$$

Where: $\gamma_s' = (\gamma_s - \gamma)$

γ_s = specific weight of sediment

γ = specific weight of water

Ds = characteristic diameter of the particle

U*c = shear velocity at the threshold condition.

The earliest one is the graphical presentation given by Shields (1936) is widely accepted and $\tau_c/(\gamma_s-\gamma)Ds$ is often referred to as Shields parameter.(τ_c= critical shear stress)

Shields determined this relationship by measuring bed load transport for various values of $\tau/(\gamma_s-\gamma)Ds$.

Shields diagram can be divided in three regions:

REGION 1: $U_*.Ds/\nu < 3.63-5.0$

In this region $Ds < 3\delta$, and the boundary is considered hydraulically smooth (δ is the thickness of the laminar boundary layer).

REGION 2: $3.63-5.0 < U_*.Ds/\nu < 68.0-70.0$

In this region the boundary is in a transitional state and $\delta/3 < Ds < 6\delta$

REGION 3: $U_*.Ds/\nu > 70 - 500$

In this region the boundary is completely rough and:

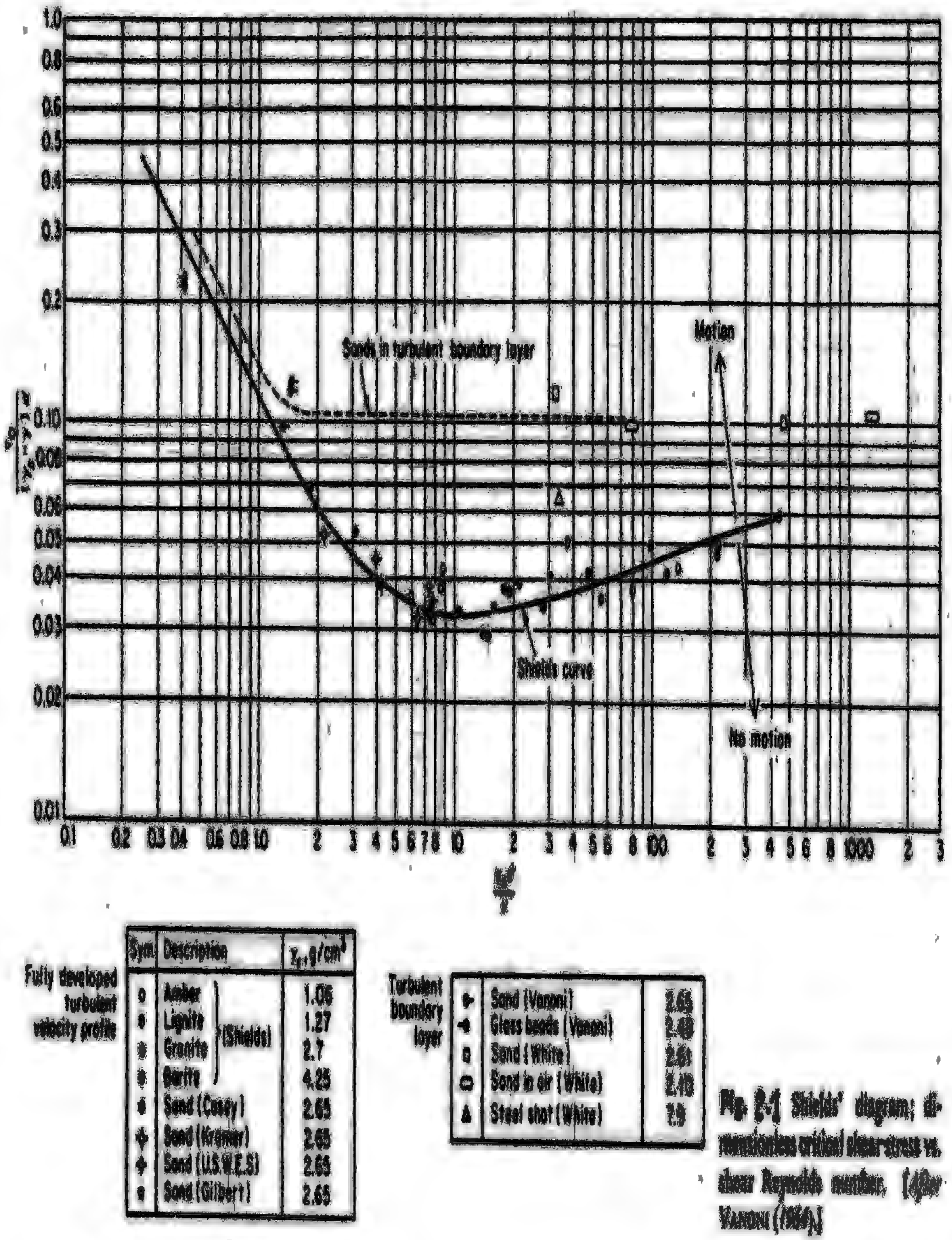


Fig. 2-1 Shields' diagram; dimensionless critical shear stress vs. shear Reynolds number. [After Vanoni (1964).]

$$F* = \frac{\tau_c}{(\gamma_s - \gamma).Ds} = 0.06$$

F* = dimensionless shear stress

2.4 BED LOAD TRANSPORT

When the flow over movable boundaries of a channel has hydraulic conditions exceeding the critical condition for motion of the bed material, sediment transport will start. If the motion of entrained particles is one of rolling, sliding, and sometimes jumping in the bed layer, this kind of sediment transport is commonly referred to as bed-load transport or contact load.

2.4.1 DU BOYS' FORMULA (1879)

Advances in the theory of sediment transportation may be assumed to have taken place with the introduction of the tractive force formula by Du Boys. SCHOKLITSCH (1914), proved Du Boys model of sliding layers to be wrong, but his experimental data could be well represented by Du Boys' equation. O'BRIEN and RINDLAUB (1934) generalized Du Boys' equation:

$$q_b = K\,\tau_o(\tau_o - \tau_c) \quad ....(2.6)$$

Where: q_b = Volume transport rate of the bed load per unit width (Kg/m.sec)

K = Parameter considered to depend largely upon sediment characteristics.

τ_o = Unit tractive force exerted by the flow on the bed of a wide channel (Kg/m^2)

τ_c = Critical shear stress (Kg/m^2).

2.4.2 MEYER - PETER AND MULLER FORMULA

Meyer - Peter and Muller (1948), based on experiments with sand particles of uniform sizes, natural gravel, lignite and barita developed a formula similar in the form to the Du Boys' formula.

$$q_b = \frac{(\gamma_s)}{\gamma_s - \gamma} \frac{(g)^{1/2}}{\gamma^{1/2}} \left[0.0661 \frac{(Q')}{Q} \frac{(D90^{1/6})^{3/2}}{n_b^{3/2}} d.S - 0.0076 (\gamma_s - \gamma) D_m \right]^{3/2} \qquad \ldots (2.7)$$

Where: q_b = Sediment discharge in Ton/day.ft

γ_s = Specific weight of particle

γ = Specific weight of water

g = gravity

D90 = Particle size at which 90% of the bed material is finer (m)

Dm = Effective diameter of sediment (mm)

Q' = Water discharge determing bed load transport

Q = Total water discharge

n_b = Roughness coefficient

d = Water depth

S = Energy slope.

2.4.3 EINSTEIN - BROWN FORMULA

This formula is a modification developed by BROWN (1950) of a formula by EINSTEIN (1942).

$$\phi = f(1/\psi) \qquad \ldots\ldots\ldots (2.8)$$

Where:

$$\phi = \frac{q_b}{\gamma_s . K \sqrt{g(\frac{\gamma_s}{\gamma} - 1) Ds^3}} \quad .... (2.8a)$$

$$\frac{1}{\psi} = \frac{\tau}{(\gamma_s - \gamma) Ds} \quad .... (2.8b)$$

$$K = \sqrt{\frac{2}{3} + \frac{36 \nu^2}{g Ds^3 (\frac{\gamma_s}{\gamma} - 1)}} - \sqrt{\frac{36 \nu^2}{g Ds^3 (\frac{\gamma_s}{\gamma} - 1)}} \quad ...(2.8c)$$

where: $1/\psi$ = Shields parameter
q_b = Sediment discharge per unit width
ϕ = Transport rate function
γ_s = Sediment specific weight
γ = Water specific weight
Ds = Representative diameter of the sediment
ν = Kinematic viscosity of water
τ = Shear stress

2.4.4 BAGNOLD'S STREAM POWER APPROACH

One of the most recent methods relating the work of energy expediture of a stream and the quantity of sediment transported by the flow is that of BAGNOLD (1966).

$$q_b = A_1 . B_1 . K_1 . D^{3/2} \sqrt{\cos\beta}\, (\theta_s - \theta_c) . \theta_s^{1/2} \quad ...... (2.9)$$

In which: A_1, B_1 and K_1 are dimensionless constant
θ_s = dimensionless tangential shear stress
θ_c = dimensionless tangential shear stress in which sediment particle begin to move on rippled sand bed.

β = inclination of the bed surface

2.4.5 SCHOKLITSCH (1914)

$$q_v = K' \, (\tau_o - \tau_c)^m \qquad \text{..............(2.10)}$$

Where: K' and m are a function of the median diameter of sediment $(1.5 < m < 1.8)$

τ_o , τ_c, the same defined in Du Boys formula.

2.4.6 SHIELDS (1936)

Proposed from his experimental results a dimensionally homogeneous transport function of the form:

$$\frac{q_b \, \gamma_s}{q.S.\gamma} = 10 \, \frac{(\tau_o - \tau_c)}{(\gamma_s - \gamma)\, Ds} \qquad \text{............ (2.11)}$$

with: q_b = Sediment discharge per unit width

q = Water discharge per unit width

τ_o = Intensity of bed shear

τ_c = Critical shear stress

Ds = Representative diameter

γ = specific weight of water

γ_s = specific weight of sediment

S = slope of the energy gradient.

2.4.7 KALINSKE (1942)

$$q_b = \alpha.P.Ds.\bar{u}_s \qquad \text{............... (2.12)}$$

Where: α = shape factor for packing (α = 2/3 for uniform spheres)

P = the fraction of bed covered by particles

Ds = representative diameter

$\bar{u}_s$ = the time average velocity of u

q_b = sediment discharge per unit width.

Kalinske developed a bed equation considering turbulent fluctuations of flow. He first assumed that the velocity of a sediment grain moving on the bed is given by:

$$u_s = b(u - Uc)$$

Where: u = is the instantaneous fluid velocity

Uc = the critical velocity for incipient motion

b = is a constant close to one

2.5 SUSPENDED LOAD TRANSPORT

A part of the sediment transported by the flow in streams is suspended in the flow. The weight of these sediment particles is continuosly supported by the fluid. Turbulence is the most important factor in the suspension of sediment.

Most of the earlier studies concerned with the suspension of sediment are unacceptable when considered in relation to the present state of knowledge of fluid motion.

2.5.1 LANE AND KALINSKE'S APPROACH (1941)

Lane and Kalinske (1941), concluded that the relation appears to be sufficiently accurate for practical purposes is

$$q_s = q.Ca.P_L.e^{15.W.a/(d.U*)} \quad \ldots\ldots\ldots \quad (2.13)$$

where: q_s = suspended bed material discharge per unit width

Ca = concentration by weight

a = level of reference above the bed

q = water discharge per unit weight

W = fall velocity of the suspended sediment

d = water depth

F_1 = function of (W/U*)

U* = shear velocity

2.5.2 BROOKS' APPROACH

By assuming the velocity defect relation and a concentration distribution. Brooks (1963) obtained the following equation:

$$q = C.q\left[1+\frac{U*}{K.U}\int_{E}^{1}\frac{(1-y)^{z_1}}{y}\,dy+\frac{U*}{K.U}\int_{E}^{1}\frac{(1-y)^{z_1}}{y}\,Lny.dy\right] \quad ....(2.14)$$

C = concentration at y = d/2

U* = shear velocity

U = mean velocity

q = discharge per unit width

q_s = suspended sediment discharge per unit width

k, z_1 = constants

E = a/d (a = 2D)

d = water depth

D = diameter of particle

2.5.3 BAGNOLD'S APPROACH (1966)

Bagnold noted that the sediment transport rate could be equated to a work rate. The suspended load work equation is:

$$\frac{(\gamma_s - \gamma)}{\gamma} q_s = (1 - e_b)\, e_s . \tau_o . U \frac{\bar{u}_s}{W} \quad \ldots\ldots\ldots \quad (2.15)$$

Where: q_s = suspended load discharge per unit width

$\bar{u}_s$ = the mean transport velocity of solids moving in suspension

e_s = suspended load transport efficiency

e_b = bed load transport efficiency

$\tau_o . U$ = stream power

W = settling velocity

3 EINSTEIN MODEL FOR SEDIMENT TRANSPORTATION IN OPEN CHANNEL FLOWS

3.1 APPROACH TO THE PROBLEM

The term "Bed - load Function" has proved to be useful in the description of the sediment movement in stream channels. It gives the rates at which flows of any magnitude in a given channel will transport the individual sediment sizes of which the channel bed is composed.

The bed load function developed by EINSTEIN (1950), is based on a large amount of experimental evidence on the existing theory of turbulent flow, and beyond the limits of existing theory, on reasonable speculation. Some universal constant of the various transportation equations were obtained from flume experiments. Some terms which Einstein recured frequently are defined as follows:

Bed Load: Bed particles moving in the bed layer. This motion occurs by rolling,sliding, and sometimes by jumping.

Suspended Load: particles moving outside the bed layer. The weight of suspended particles is continuosly supported by the fluid.

Bed Layer: A flow layer, 2 grain diameter thick, immediately above the bed. The thickness of the bed layer varies with the particle size.

Bed material: The sediment mixture of which the moving bed is composed.

Wash Load: That part of the sediment load which consists of grain sizes finer than those of the bed.

Bed Material Load: That part of the sediment load which consists of grain sizes represented in the bed.

Bed Load Function: The rate at which various discharges will transport the different grain sizes of the bed material in a given channel.

Bed Load Equation: The general relationship between bed - load rate, flow condition, and composition of the bed material.

3.2 LIMITATION OF THE BED LOAD FUNCTION

3.2.1 THE UNDETERMINED FUNCTION

Functions often become constant or even equal to zero under a wide range of conditions. Such functions may not have any value in certain ranges of conditions and is mathematically demonstrated wherever the solution of the equation which defines the function becomes imaginary. Functions that become indeterminate under a wide range of conditions seem to be rather unusual. Unfortunately, the bed load function has this character. The critical parameter deciding the significance of the function in a given flow is the the grain diameter of the sediment.

3.2.2 THE ALLUVIAL STREAM

Experience in concrete-lined channel shows that sediment up to a certain particle size may be fed into such a flow at any rate up to a certain limit without causing any deposits in the channel. An observer who examines the channel after the flow has passed can state only that the rate of sediment flow must have been below this limiting rate; that is, below the "SEDIMENT TRANSPORT CAPACITY" of the concrete channel. If the rate of sediment supply is larger than the capacity of the channel to move it, the surplus sediment drops out and begins to cover the channel bottom. More and more sediment is dropped if the supply continues to exceed the capacity until the channel profile is sufficiently changed to reach an equilibrium whereby at every section the transport is just reduced to the capacity value.

3.2.3 THE SEDIMENT MIXTURE

This problem is highly complicated by the fact that the sediment entering any natural river reach is never uniform in size, shape, and specific gravity but represents always a rather complex mixture of different grain types. It has been found experimentally that the shape of the different sediment particles with few exceptions is much less important than the particle size. As the derivations which follow do not introduce any molecular forces between sediment particles, they are automatically restricted to the larger particles, in general to those coarser than 250 mesh sieve (Tyler scale) or 0.061 millimeter in diameter. Again, beginning with the assumption of a flow in a concret channel. Assume a sediment supply at the upper end of the channel, consisting of all different sizes from a maximun size down through the silt and clay range. If the maximun grain is not too large to be moved by the flow, the channel will again stay clear at low rates of sediment supply. But an increase of the supply rate will eventually cause sediment deposition.

Under most conditions only the coarse sizes of sediment will be deposited. It is true that a small percentage of the finer sediments may be found between the larger particles when the flow is fast, but this amount is generally so small that one is tempted to conclude that small particles are caught accidentally between the larger ones rather than primarily deposited by the flow itself.

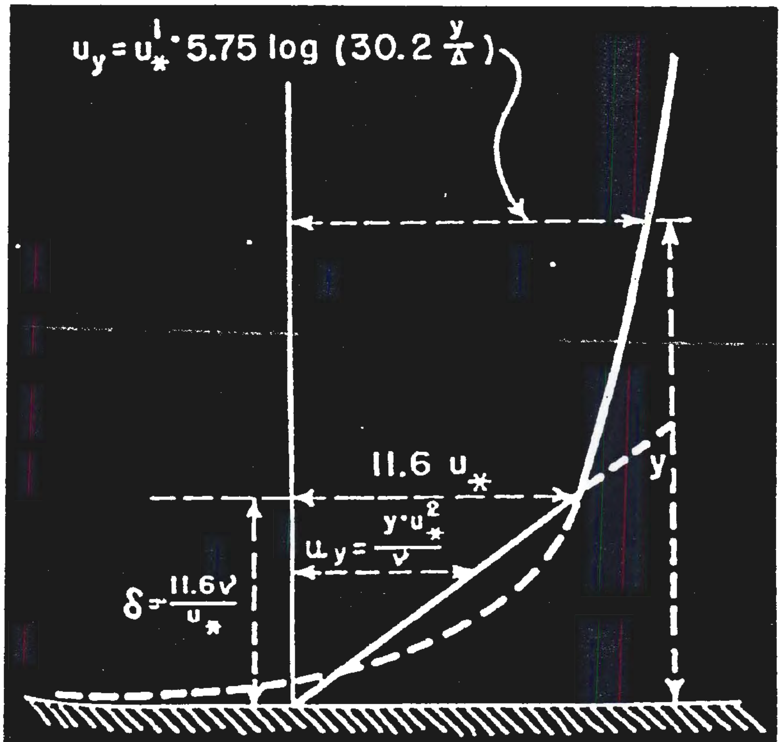
Another factor influencing the bed-load function is the shape of the channel cross section. If this section is not influenced either structurally or by vegetation it is only a function of sediment and of the flow.

3.3 HYDRAULIC OF THE ALLUVIAL CHANNEL

The transport of bed sediment in such a reach always equal its capacity to transport such sediment. It is easy to conclude from this that the flow is uniform or at least nearly so. The open channel hydraulics of nonuniform flow or the calculation of backwater curves is not particulary important in this connection. Where such calculations are necessary for channels that are very actively aggrading or degrading, they are based on the use of the Bernoulli equation as it is applied to channels with solids beds.

3.3.1 THE FRICTION FORMULA

The hydraulics of uniform flow include basically the description of the velocity distributions and of the frictional loss for turbulent flow. EINSTEIN found that the velocity distribution in open channel flow over a sediment bed is best described by the logarithmic formulas based on V.



Assumed velocity distribution near the laminar sublayer along a hydraulically smooth wall.

FIGURE 3.1

KARMAN'S similarity theorem with the constants as proposed by by KEULEGAN. He gives the vertical velocity distribution as:

$$\frac{\bar{u}}{u_*} = 5.50 + 5.75 \, \mathrm{Log}\left(\frac{y.u_*}{\nu}\right) = 5.75 \, \mathrm{Log}\left(\frac{9.05 \, y.u_*}{\nu}\right) \; \ldots \quad (3.1)$$

The equation (3.1) is applied for smooth boundaries and the equation (3.2) for hydraulically rough boundaries.

$$\frac{\bar{u}}{u_*} = 8.50 + 5.75 \, \mathrm{log}(y/K_s) = 5.75 \, \mathrm{Log}(30.2 \, y/K_s) \; \ldots\ldots \quad (3.2)$$

The transition between the two, including the rough and smooth conditions, may all be combined in the form:

$$\frac{\bar{u}}{u_*} = 5.75 \, \mathrm{Log}\left(30.2\frac{y.x}{Ks}\right) = 5.75 \, \mathrm{Log}\left(30.2\frac{y}{\Delta}\right) \; \ldots\ldots \quad (3.3)$$

Herein are:

$\bar{u}$ = the average point velocity at distance y from the bed

u_* = $\sqrt{\tau_0/\rho} = \sqrt{S.R.g}$, the shear velocity

S = the slope of the energy grade line

ρ = the density of the water

R = the hydraulics radius

g = the acceleration due to gravity

y = the distance from the bed

x = a corrective parameter (read from figure 3.2)

Δ = Ks/x, the apparent roughness of the surface

δ = $11.6\nu/u_*$ the thickness of the laminar sublayer of a smooth wall.

ν = the kinematic viscosity of water

3.3.2 THE FRICTION FACTOR

For uniform sediment, Ks is equal to the grain diameter as determined by sieving. Comparative flume experiments have shown that the representative grain diameter of a sediment mixture is given by the sieve size of which 65 percent of the mixture (by weight) is finer.

A sediment bed in motion usually does not remain flat and regular but shows ripples or bars of various shapes and sizes. These irregularities have some effect on the roughness of the bed.

3.3.3 RESISTANCE OF THE BARS

EINSTEIN has described a method by which the influence of side-wall friction on the results of bed-load experiments may be estimated. It is assumed that on such a bed friction develops in two distinctly different ways: (1) along the sediment grains of the surface as a rough wall with the representative grain diameter equal to Ks and in addition (2) by the separation of the flow from the surface at characteristic points of the ripples or bars.

Einstein justified in dividing the cross-sectional area into two parts. One will contribute the shear which is transmitted to the boundary along the roughness of the grainy sand surface. The other part will contribute the shear transmitted to the wall in the form of normal pressures at the different sides of the bars. These may be designated A' and A'' respectively. Both types of shear action are more or less evenly distributed over the entire bed surface and act, therefore, along the same perimeter. Two hydraulic radius may be defined as $R' = A'/P$ and $R'' = A''/P$, where naturally; the total hydraulic radius is

$$R = R' + R'' \qquad \ldots\ldots\ldots\ldots\ldots \quad (3.4)$$

This entire procedure of division may appear to be rather artificial since both actions occur along the same perimeter. The significance of this division becomes apparent, however, when one recalls that the transmission of shear to the boundary is accompanied by a transformation of flow energy into energy of turbulence. This energy transformation caused by the rough wall occurs at the grains themselves. This newly created turbulence stays at least for a short time in the immediate vicinity of the grains and, as will be shown later, has a great effect on the bed-load motion. The part of the energy which corresponds to the shape resistance is transformed into turbulence at the interface between wake and free stream flow, or at a considerable distance away from the grains. This energy does not contribute to the bed-load motion of the particles. Therefore, it may be largely neglected in the entire sediment picture. This may explain why the division of the shear into the two parts u'_* and u''_* is of first importance.

$$u'_* = \sqrt{S.R'.g} \qquad \ldots\ldots\ldots\ldots \quad (3.5)$$

$$u''_* = \sqrt{S.R''.g} \qquad \ldots\ldots\ldots\ldots \quad (3.6)$$

From this it is understandable that the velocity distribution near a sediment grain in the bed surface is described by equations (3.1), (3.2) and (3.3) whereby u_* assumes the value of u'_*. The average velocity in the vertical may be determined according to KEULEGAN for hydraulically smooth bed as:

$$\frac{\bar{U}}{u'_*} = 3.25 + 5.75 \, \mathrm{Log}\left(\frac{R' . u'_*}{\nu}\right) = 5.75 \, \mathrm{Log}\left(3.67 \, \frac{R' . u'_*}{\nu}\right) \quad \ldots (3.7)$$

And for a hydraulically rough bed:

$$\frac{\bar{U}}{u'_*} = 6.25 + 5.25 \, \mathrm{Log}(R'/Ks) = 5.75 \, \mathrm{Log}(12.27 \, R'/Ks) \quad \ldots (3.8)$$

The entire transition between the two cases inclusive of the extremes may be expessed by:

$$\frac{\bar{U}}{u'_*} = 5.75 \, \mathrm{Log} \left(12.27 \, \frac{R' . x}{Ks}\right) = 5.75 \, \mathrm{Log}\left(12.27 \, \frac{R'}{\Delta}\right) \quad \ldots\ldots (3.9)$$

Where x is the same function of Ks/δ', as given in figure 3.2 and $\delta' = 11.6\nu/u'_*$.

A corresponding expression u/u'_* may be calculated, and this expression must be expected to be a function of the ripple or bar pattern, basically corresponding to equation (3.9). The ripples and bars change considerably and consistently with different rates of sediment motion on the bed.

3.3.4 THE TRANSITION BETWEEN HYDRAULICALLY ROUGH AND SMOOTH BEDS

Einstein and El-Samni excperimentally showed that the theoretical boundary from which the distance y of equation (3.3) must be measured 0.2Ks below the plane which connects the most prominent points of the roughness protrusions. It is generally known, that the wall acts hydraulically rough if $Ks/\delta > 5$. The laminar sublayer as calculated for a smooth wall has then, a thickness of $\delta < Ks/5$.

3.4 THE BED LOAD CONCEPT

Bed-Load motion has been studied principally in laboratory flumes under conditions where suspension may be neglected. EINSTEIN has shown that the motion of the particles is fully governed by statistical laws which can be stated as follows:

1.- The probability of a given sediment being moved by the flow from the bed surface depends on the size of the particle, shape and weight and on the flow pattern near the bed.

2.- The particles move if the instantaneous hydrodynamic lift force overcomes the particle weight.

3.- Once in motion the probability of the particle being redeposited is equal in all points of the bed where the local flow would not immediately remove the particle again.

4.- The average distance travelled by any bed-load particle between consecutive points of deposition in the bed is a constant for any particle and is independent of the flow condition, the rate of transport and the bed composition.

5.- The motion of bed particles by saltation as described by BAGNOLD, may be neglected in water, as proved by KALINSKE.

6.- The disturbance of the bed surface by moving sediment particles may be neglected in water.

3.5 THE BED LOAD EQUATION

The bed-load equation by definition is the equation which relates the motion of the bed material per unit width of bed layer to the local flow. For each unit of time and of bed area the same number of a given type and size of particles must be deposited in the bed as are scoured from it. Let q_B equal the rate at which bed load moves through the unit width of cross section and let i_B equal the fraction of q_B in a given grain size or size range. Thus $q_B.i_B$ is the rate at which the given size moves through the unit width per unit of time. All the particles with a particular diameter D are just performing an individual step of 100.D or more generally, of A_L .D length (A_L = constant of the bed-load unit-step). When they pass through the particular cross section where q_B is measured, it is not known what part of A_L.D the individual particles have already travelled. They must be assumed to be deposited anywhere from zero to A_L.D downstream of the section. The area of deposition is A_L.D long and has unit width. If q_B is measured in dry weight per unit time and width and if $A_2.D^3$ is the volume of a particle, (A_2 = constant of grain volume), γ_s its density, and g the acceleration of gravity the number of such particles deposited per unit time in the unit of bed area may be expressed as:

$$\frac{q_B . i_B}{A_1 . D . A_2 . D^3 . \rho_s . g} = \frac{i_B . q_B}{A_2 . A_1 . g . \rho_s . D^4}$$

The rate at which sediment particles of this size are eroded from the bed per unit of time is proportional to the number of particles exposed at the bed surface per unit of area and to the probability p_s of of such a particle being eroded during a second. If i_b is the fraction of the bed sediment in the given size range it may be assumed that this represents also the fraction of the surface covered by particles in the same size. The number of the particles D in a unit area of bed surface is: $i_b / A_1 . D^2$; and the number of particles eroded per unit area and time is: $i_b . p_s / A_1 . D^2$.

In the time t , necessary to replace a bed particle by a similar one were known, the probability of removal p_s per second could be replaced by the absolute probability p to be exchanged as $p_s . t_1 = p$. Thus it follows that p_s is the number of exchanges per second, t_1 the time consumed by each exchange, and $p_s . t_1$ the total exchange time per second, or the fraction of the total time during which an exchange occurs, which is the definition of p.

The number of particles eroded per unit area and time is then: $i_b . p / A_1 . D^2 . t_1$

3.5.1 THE EXCHANGE TIME

The time t may be assumed to be proportional to the time necessary for it to settle in the fluid through a distance equal to its own size:

$$t_1 = A_3 \frac{D}{W} = A_3 \sqrt{\frac{D \cdot \rho}{g(\rho_s - \rho)}} \qquad \ldots\ldots\ldots\ldots (3.10)$$

and the number of particles eroded per unit of area and time is:

$$\frac{i_b \cdot p}{A_1 . D^2 . A_3} \sqrt{\frac{g(\rho_s - \rho)}{D \cdot \rho}}$$

Where: A_3 is the constant time scale

W is the settling velocity

ρ_s is the sediment density

ρ is the water density

The bed-Load equation (3.11) shows that this rate of scour equals the corresponding rate of deposit:

$$\frac{i_B \cdot q_B}{\rho_s \cdot A_2 \cdot A_L \cdot g \cdot D^4} = \frac{i_b \cdot p}{A_3 \cdot A_1 \cdot D^2} \sqrt{\frac{g(\rho_s - \rho)}{D . \rho}} \qquad \ldots\ldots (3.11)$$

3.5.2 THE EXCHANGE PROBABILITY

The probability, p, of being eroded has been defined as the fraction of the total time during which at any one spot the local flow conditions cause a sufficiently large lift on the particles to remove it with all points of the bed statistically equivalent, p may be also interpreted as the fraction of the bed on which at any time the lift on a particle of a given diameter D is sufficient to cause motion.

With this interpretation, p may be used to calculate the distance $A_L.D$ that a particle travels between consecutive places of rest. As long as p is small, deposition of the particle is practically everywhere possible and A_L equals a general constant, λ, which has about the value 100. If p is not small, however it must be recognized that deposition can not occur on that part (p) of the bed where the lift force exceeds the particle weight. By averaging the distances travelled by the individual particles until they are able to settle out, the value $A_L.D$ can be expressed as:

(1-p) particles are deposited after traveling $\lambda.D$

p particles are not deposited after travelling $\lambda.D$ of these, p(1-p) particles are deposited after travelling $2.\lambda.D$.

p^2 particles are not deposited after travelling $2\lambda.D$ of these, p (1-p) particles are deposited after traveling $3.\lambda.D$ and so on.

The total (and average) distance traveled by the unit is obtained by addition:

$$A_L.D = \sum_{n=0}^{\infty}(1-p)p^n(n+1)\lambda.D = \lambda.D/(1-p) \quad \ldots\ldots (3.12)$$

In this value is introduced in the above bed-load equation it may be rewritten:

$$\frac{q_s.i_s(1-p)}{A_2.\lambda.g.\rho_s.D^3} = \frac{i_b.p}{A_1.A_3.D^2}\sqrt{\frac{g(\rho_s-\rho)}{D\rho}} \quad \ldots\ldots (3.13)$$

or; separating p on one side of the equation:

$$\frac{p}{1-p} = \left(\frac{A_1 . A_3}{A_2 . \lambda}\right) \left(\frac{i_B}{i_b}\right) \left(\frac{q_B}{\rho_s . g}\right) \left(\frac{\rho}{\rho_s - \rho}\right)^{1/2} \left(\frac{1}{g . D^3}\right)^{1/2} \quad \ldots\ldots (3.14)$$

$$\frac{p}{1-p} = \left[A_* \left(\frac{i_B}{i_b}\right) \Phi \right] = A_* . \Phi, \quad \ldots\ldots\ldots (3.15)$$

Therefore: p is the probability of a particle being eroded from the bed and Φ is defined as:

$$\Phi = \frac{q_B}{\rho_s . g} \left(\frac{\rho}{\rho_s - \rho}\right)^{1/2} \left(\frac{1}{g . D^3}\right)^{1/2} \quad \ldots\ldots\ldots\ldots\ldots (3.16)$$

Thus Φ is a dimensionless measure of the bed-load transport: it may be called the intensity of bed-load transport. Being a dimensionless parameter it does not change with the scale and is, therefore invariant between model and prototype. This relation may also be expressed as follows: if Φ is equal in two different flows, the two rates of bed- load transport are dynamically similar.

3.5.3 DETERMINATION OF THE PROBABILITY p

As already noted, p is the probability of a particle being eroded from the bed, which means that the probability of the dynamic lift on the particle is larger than its weight (under water). The weight of the particle under water is:

$$W' = g(\rho_s - \rho) A_2 . D^3 \quad \ldots\ldots\ldots\ldots\ldots (3.17)$$

While the lift force may be expressed as:

$$L = C_L . \rho . u^2 . A_1 . D^2 / 2 \qquad \ldots\ldots\ldots\ldots\ldots \quad (3.18)$$

In these expression:

W' = weight of particle under water

A_1 = constant of grain area

A_2 = constant of grain volume

L = lift force on bed particle

ρ_s = density of particle

ρ = density of water

D = diameter of the particle

u = velocity in direction of the main flow

C_L = lift coefficient.

Einstein and El Samni found by measurement that the value of $C_L = 0.178$, and the velocity u near the bed which El Samni found must be measured at a distance 0.35D from the theoretical bed for uniform sediment.

The forces acting on individual particles of a natural sediment mixture in a bed cannot be measured very well. They must be determined from their effects on the movement of particles. In analyzing the experiments the following general results were found:

1.- The velocity acting on all particles of a mixture must be measured at a distance 0.35x from the theoretical bed, whereby:

$$X = 0.77\Delta \text{ if } \Delta/\delta > 1.80$$

$$\ldots\ldots\ldots \quad (3.19)$$

$$X = 1.39\delta \text{ if } \Delta/\delta < 1.80$$

2.- The particles smaller than X (X>D) seem to hide between the other particles or in the laminar sublayer, respectively, and their lift must thus be corrected by division with a parameter ξ which itself is a function of D/X (Figure 3.5).

3.- An additional correction factor Y was found to describe the change of the lift coefficient in mixtures with various roughness conditions. Figure 3.6, gives the correction factor Y in terms of Ks/δ , Y being unity for uniform sediment. Using these assumptions the velocity in the expression for the average lift L may be written as:

$$u = u_* 5.75 . \text{Log}\left(\frac{30.2 \; . \; 0.35 . X}{\Delta}\right)$$

$$u^2 = R_b' . S . g \; 5.75^2 \text{Log}^2 (10.6 \; X/\Delta)$$

Then at any instance the lift force may be described by:

$$L = 0.178 \rho . A_L . D^2 (1/2) R_b' . S . g \; 5.75^2 \text{Log}^2 (10.6 \; X/\Delta)(1+\eta) \quad .. (3.20)$$

Where; η is a parameter varying with time.

Now p may be expressed as the probability of W'/L to be smaller than unity:

$$1 > \frac{W'}{L} = \left[\frac{1}{1+\eta}\right]\left(\frac{\rho_s-\rho}{\rho} \frac{D}{R_b' . S}\right)\left(\frac{B . A_1}{0.178 A_L 5.75^2}\right)\frac{1}{\text{Log}^2 (10.6X/\Delta)} \; .. (3.21)$$

The value of η in this inequality may be either positive or negative. In both cases the lift is actually positive and must, therefore be understood on an absolute basis.

The inequality may be written in absolute values:

$$[\; 1+\eta \;] > B . \psi . 1/\beta_x^2 \quad .... (3.22)$$

Introducing the abbreviations:

$$\left.\begin{aligned} \psi &= \frac{\rho_s - \rho}{\rho} \; \frac{D}{R'_B . S} \\ B &= \frac{2.A_2}{0.178\ A_1\ 5.75^2} \\ \beta_x &= \mathrm{Log}(10.6\ X/\Delta) \end{aligned}\right\} \quad \text{..........} \quad (3.23)$$

Introducing the two correction factors ξ and Y according to the previously quoted assumptions, the inequality (3.22) may be generalized.

$$[1+\eta] > \xi . Y . B' . \psi . \ \beta^2/\beta_x^2 \quad \text{..........} \quad (3.24)$$

Where: ξ is a function of D/X (Figure 3.5)

Y is a function of Ks/δ (Figure 3.6)

$B' = B/\beta^2$

$\beta = \mathrm{Log}(10.6)$

and: $\beta^2/\beta_x^2 = 1$ for uniform grain and X=1

$Y = 1$ for uniform grain and X=1

$\xi = 1$ for uniform grain and X=1

Inequality (3.22) may be written more conveniently by squaring and division by η_o, the standard deviation of η. Introducing $\eta = \eta_o \cdot \eta_*$

$$[1/\eta_o + \eta_*]^2 > \xi^2 . Y^2 . B_*^2 . \psi (\beta^2/\beta_x^2)^2 = B_*^2 . \psi_*^2 \quad \text{....} \quad (3.25)$$

$$\text{If} \quad B_* = B'/\eta_o \quad \text{..........} \quad (3.26)$$

and $\Psi_* = \xi.Y(\beta^2/\beta_x^2)\Psi$

Using these symbols, the limiting cases of motion may be written as:

$$[1/\eta_o + \eta_*] = [B_*.\Psi_*]^2$$

$$[\eta_*]\ \mathrm{LIMIT} = \pm B_*.\Psi_* - 1/\eta_o \qquad \ldots\ldots\ldots (3.27)$$

As the probability for η_* values is distributed according to the normal error law, the probability p for motion is:

$$p = 1 - \frac{1}{\sqrt{\pi}} \int_{B_*.\Psi - 1/\eta_o}^{B_*.\Psi_* - 1/\eta_o} e^{-t^2}\,dt \qquad \ldots\ldots\ldots (3.28)$$

Where t is only a variable of integration.

By combination with equation (3.15) the final bed-load equation is obtained:

$$p = \frac{A_*.\phi(i_B/i_b)}{1-A_*\phi(i_B/i_b)} = \frac{A_*.\phi_*}{1-A_*.\phi_*} \qquad \ldots\ldots (3.29)$$

This equation is easy to use although it appears to be very complicated. η_o, A_* and B_* are universal constants such that the equation may be represented by a single curve between the flow intensity Ψ_* and the intensity of bed-load transport ϕ_*. This relationship may be calculated from tables of the probability integral for the value $1/\eta_o = 2.0$ as determined by El Samni. The constants A_* and B_* were determined from bed-load experiments with uniform grain for which $\phi_* = \phi$ and $\Psi_* = \Psi$.

Figure 3.7 shows a plot of some experimental points with the curve using $A_* = 27.0$ and $B_* = 0.156$. The formula can unquestionably be applied to coarse sediment as it is almost identical with most other bed-load formulas for low intensities. For the higher intensities which occur only with small paticle sizes, some applications to actual rivers have given encouraging results, while more applications under a wider range of conditions are still necessary to prove its universal applicability.

Although the correction Y as a function of Ks/δ does not require any explanation. The correction factor ξ which gives the effect on the transport when the small particles of the bed hide either behind and between larger particles or in the laminar sublayer, needs some comment.

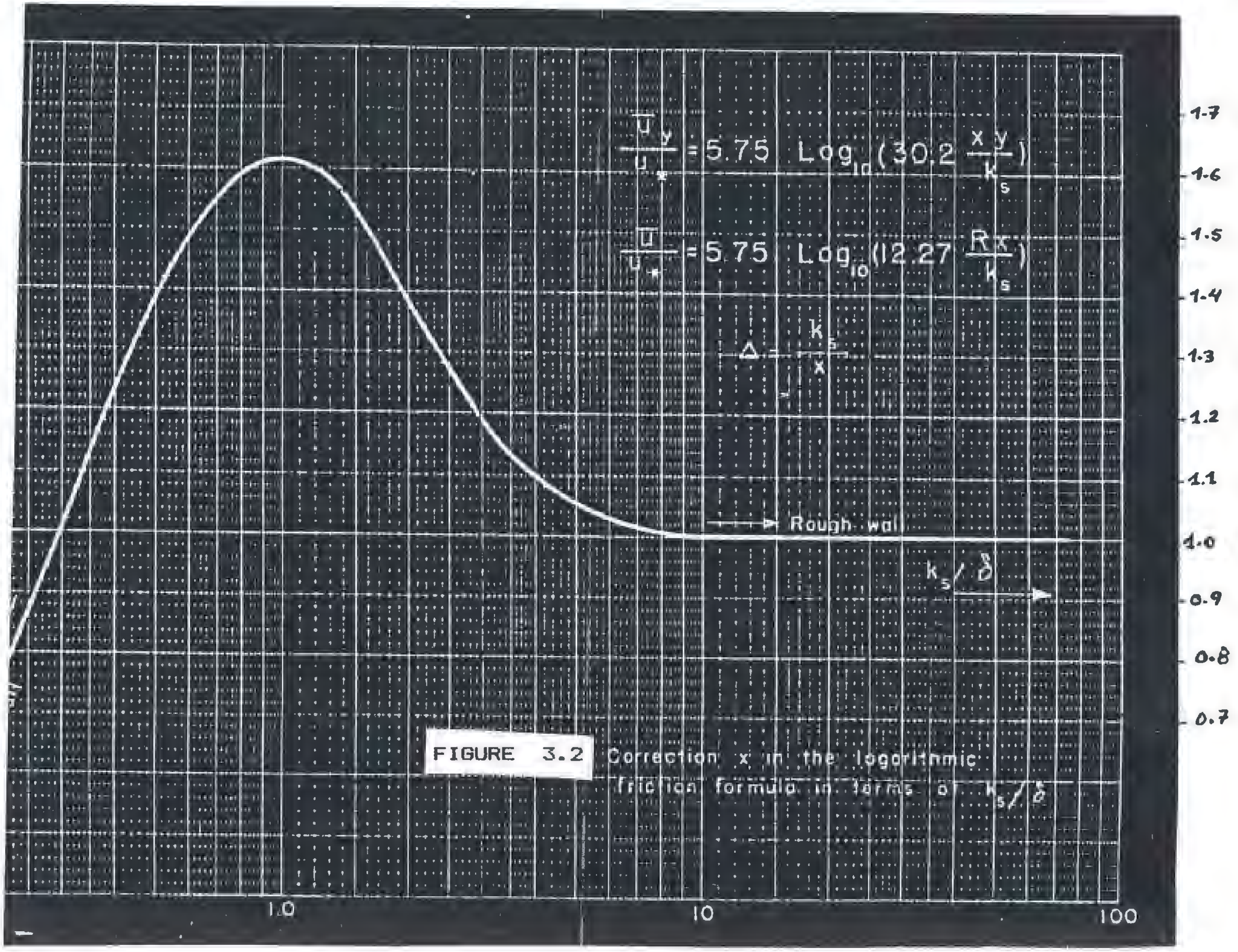


FIGURE 3.2 Correction x in the logarithmic friction formula in terms of k_s/δ

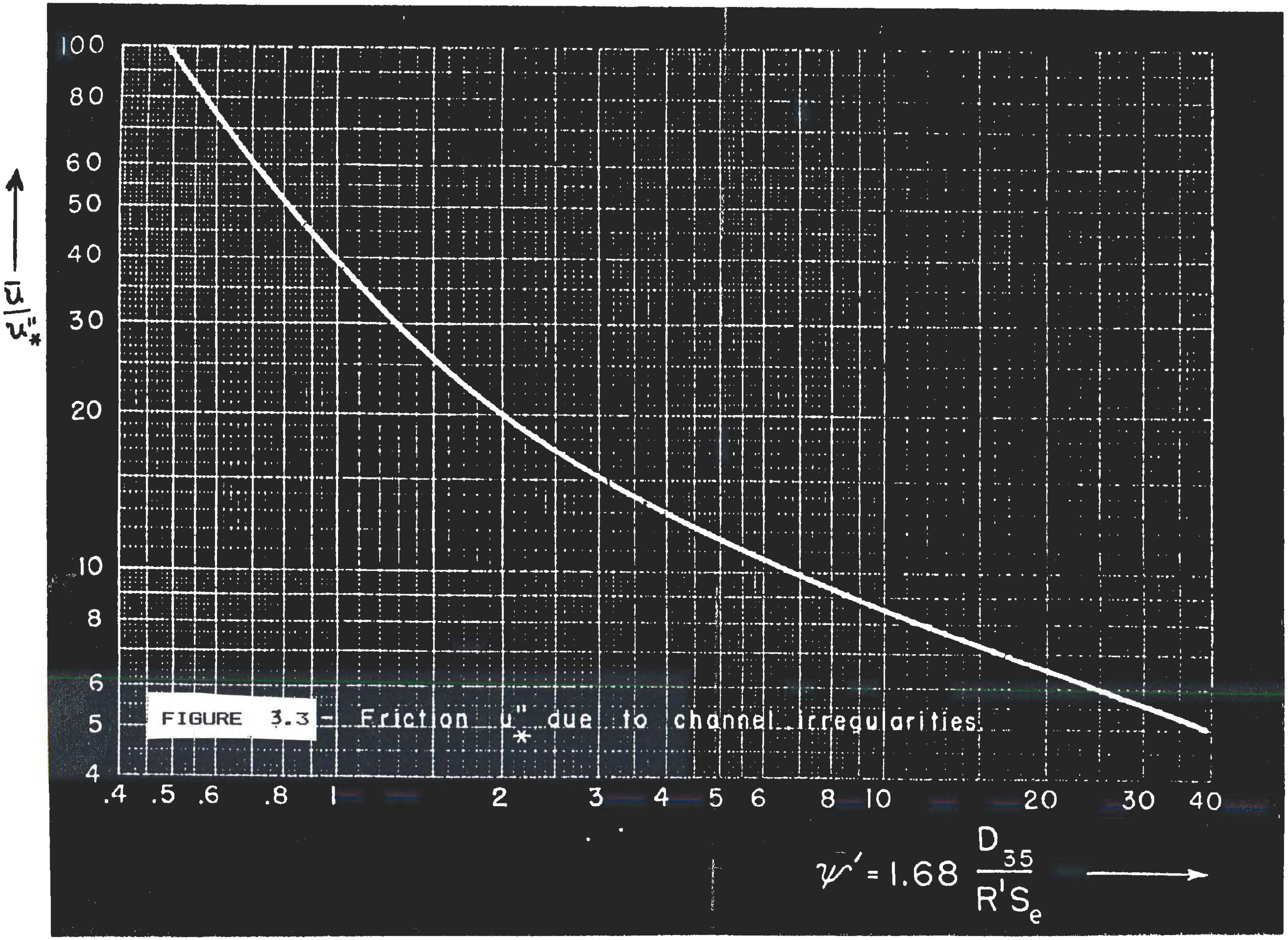


FIGURE 3.3 - Friction u''_* due to channel irregularities.

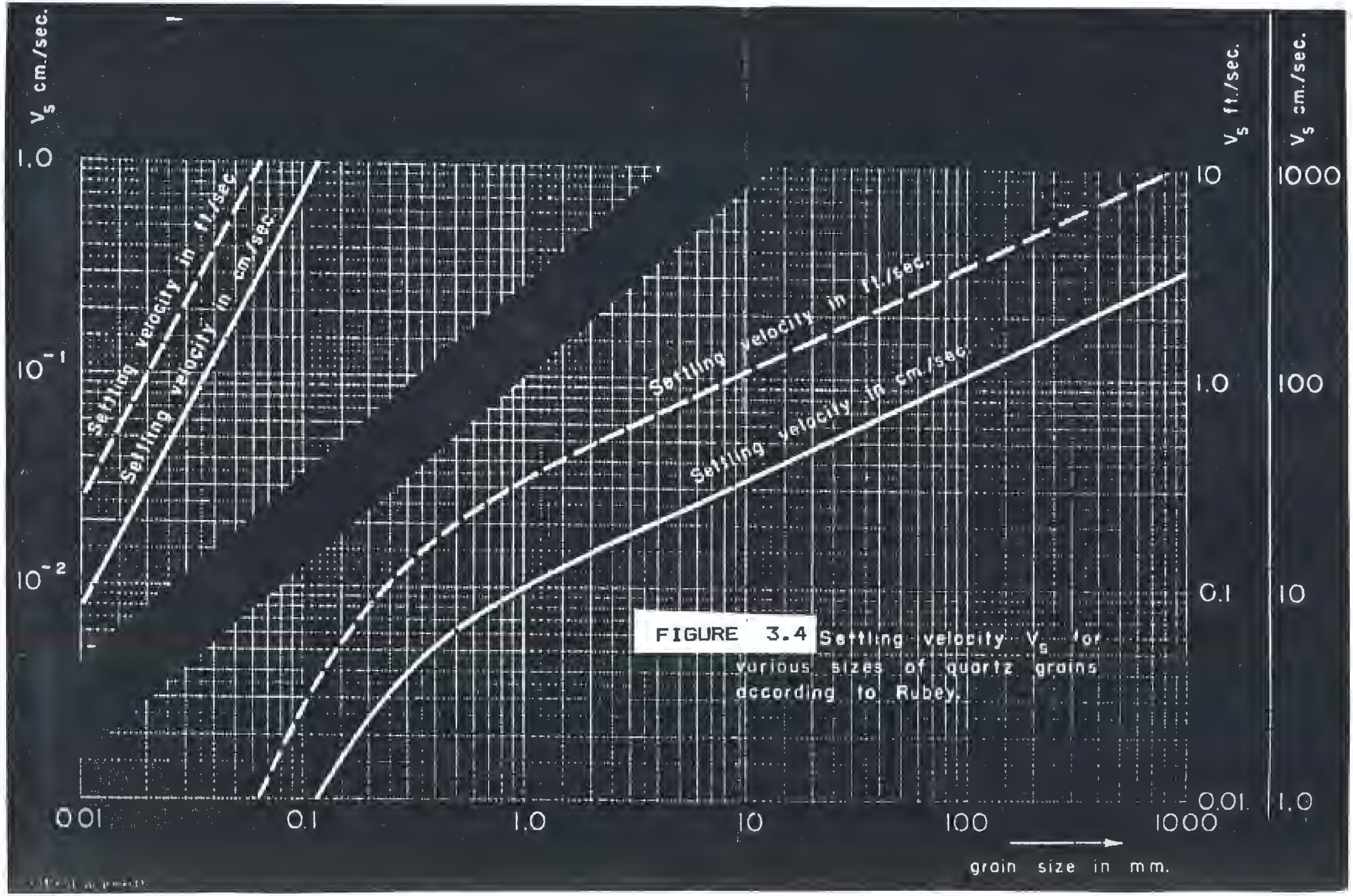


FIGURE 3.4 Settling velocity V_s for various sizes of quartz grains according to Rubey.

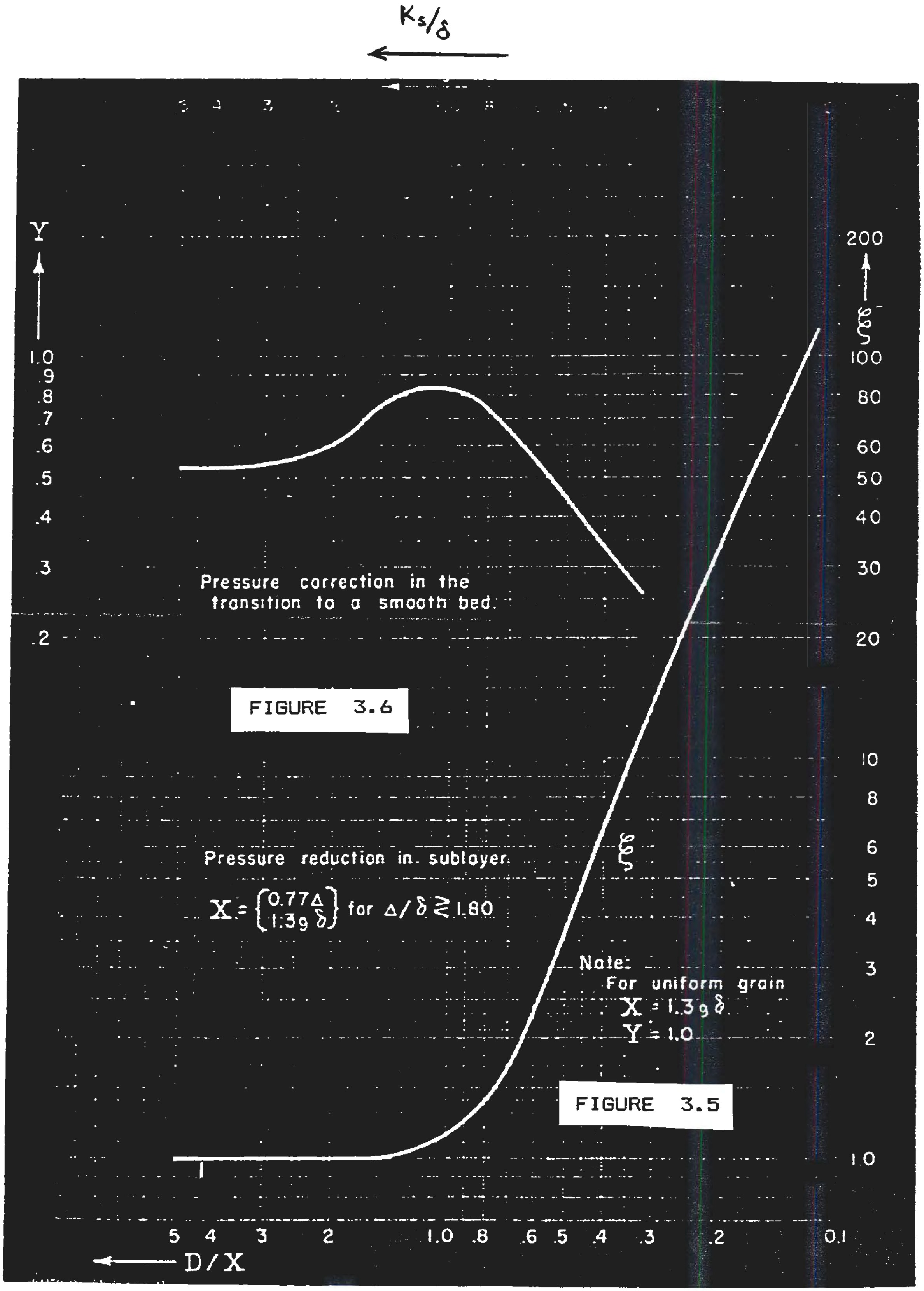


FIGURE 3.6

Pressure correction in the transition to a smooth bed.

FIGURE 3.5

Pressure reduction in sublayer.

$X = \begin{Bmatrix} 0.77\Delta \\ 1.39\,\delta \end{Bmatrix}$ for $\Delta/\delta \gtrless 1.80$

Note:
For uniform grain
$X = 1.39\,\delta$
$Y = 1.0$

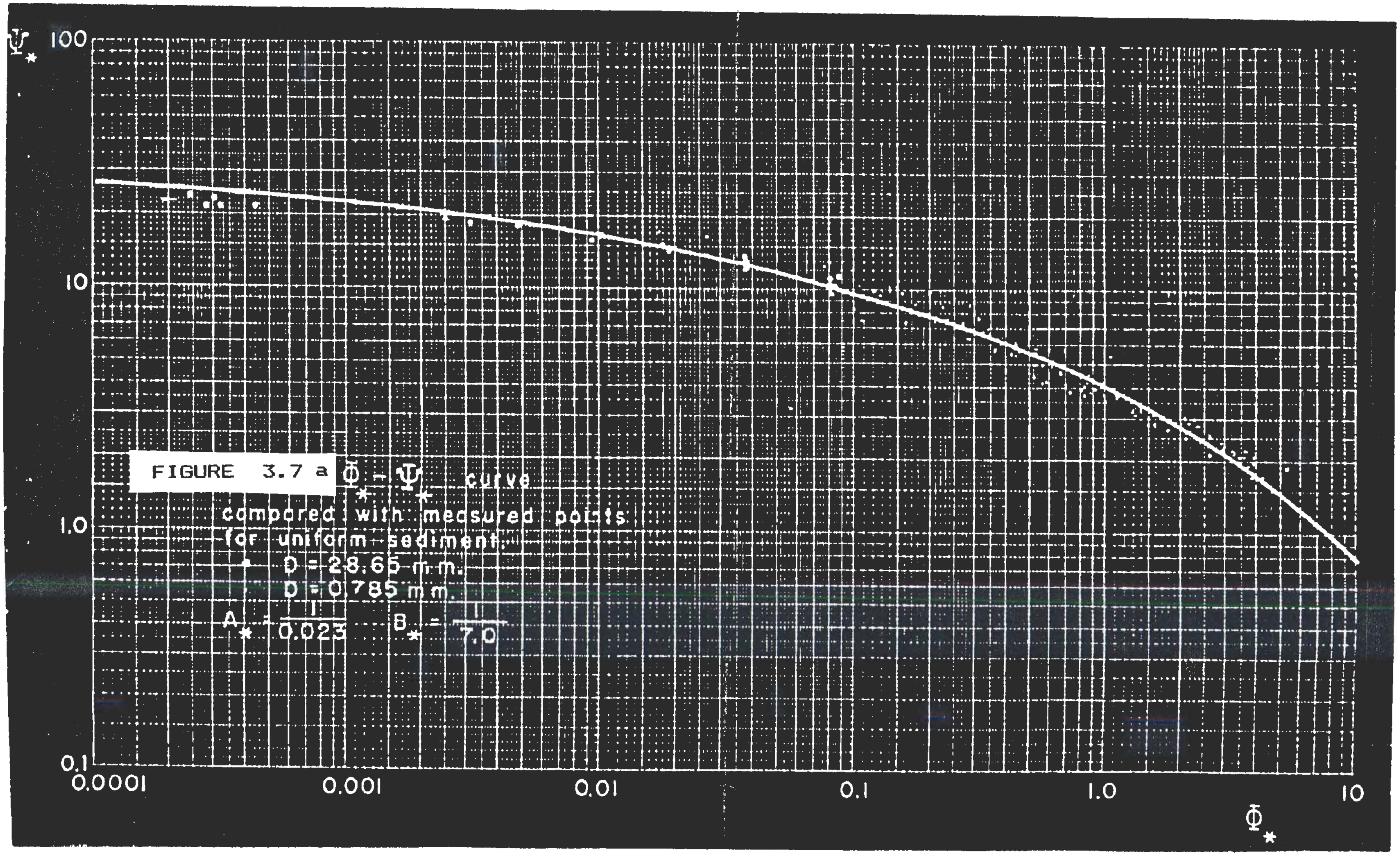


FIGURE 3.7 a $\Phi_* - \Psi_*$ curve compared with measured points for uniform sediment.

• D = 28.65 m.m.

D = 0.785 m.m.

$A_* = \frac{1}{0.023}$ $B_* = \frac{1}{7.0}$

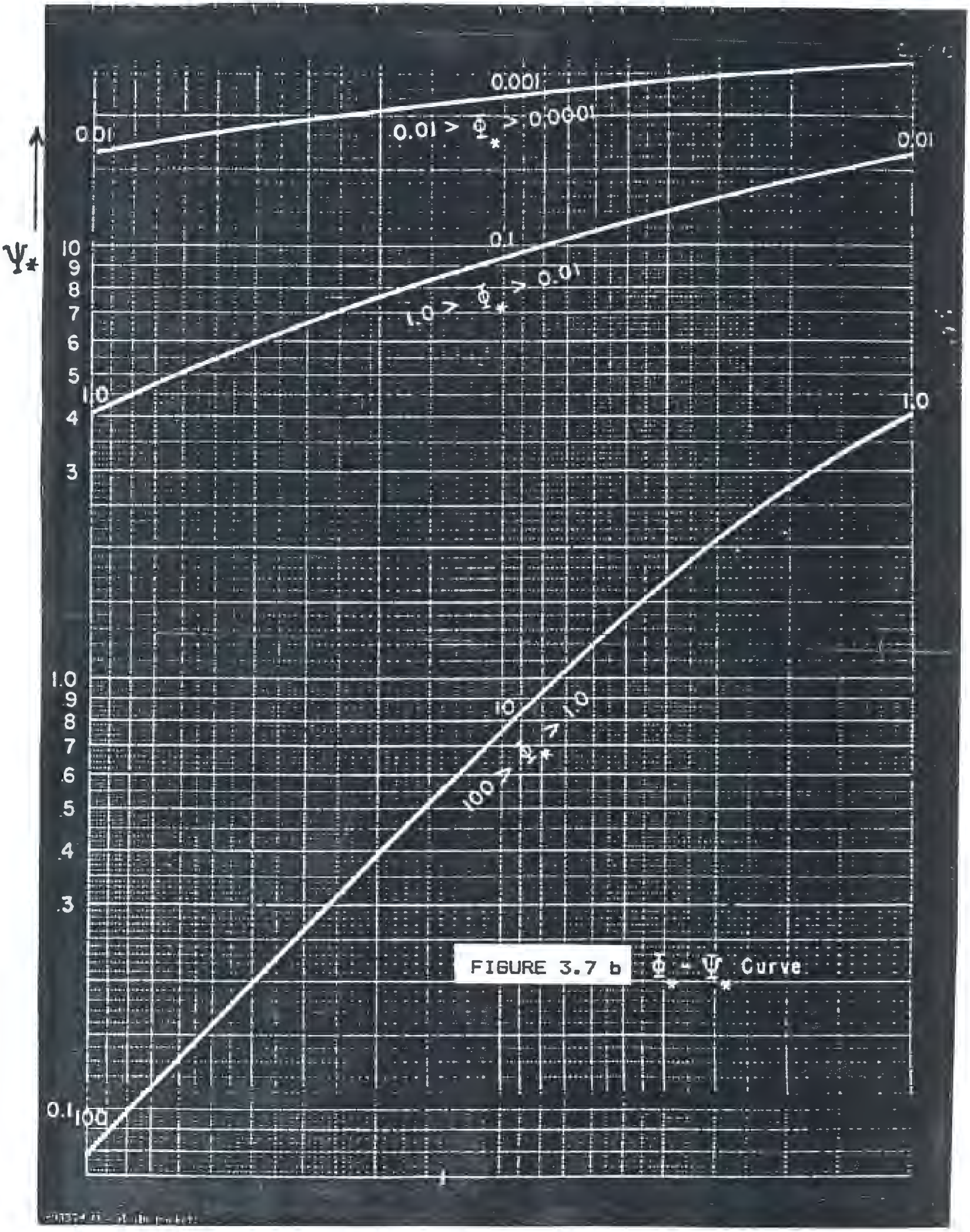


FIGURE 3.7 b $\Phi_* - \Psi_*$ Curve

3.6 SUSPENSION

The fine particles of the sediment load of streams move predominantly as suspended load.

Suspension as a mode of transport is opposite to what Bagnold called "Surface Creep" and to what he defined as the heavy concentration of motion is immediately at the bed.

The characteristic definition of a suspended solid particle is that its weight is supported by the surrounding fluid during its entire motion. While being moved by the fluid, the soil particle, which is heavier than the fluid, tends to settle in the surrounding fluid. If the fluid flow has only horizontal velocities, it is impossible to explain how any sediment particle can be permanently suspended. Only if the irregular motion of the fluid particles, called turbulence, is introduced can one show that sediment may be permanently suspended.

Assume an upward flow of velocity (V) in half the area in a channel cross section and a downward flow of the same velocity ($-V$) in the other half. The exchange discharge through the unit area is $q_x = V/2$. If the exchange takes place over an average distance of l_e at elevation y it can be assumed that the downward-moving fluid originates, as an average, from an elevation ($y + l_e/2$) while the upward-moving fluid originates from ($y - l_e/2$). The important assumption is made that the fluid preserves during its exchange the qualities of the fluid at the point of origin. Only after completion of the exchange travel over the distance l_e will it mix with the surrounding fluid. From this it is possible to calculate the transport of a given size of suspended particles with a known settling velocity W, if the concentration of these particles at y is C_y , the upward motion of particles per unit area and per unit time is:

$$C_{(y-\frac{1}{2}l_s)} \frac{1}{2}(V-W)$$

and the rate of downward is:

$$C_{(y+\frac{1}{2}l_s)} \frac{1}{2}(V+W)$$

the net upward motion is therefore:

$$\frac{1}{2} C_{(y-\frac{1}{2}l_s)}(V-W) - \frac{1}{2} C_{(y+\frac{1}{2}l_s)}(V+W) \qquad \ldots (3.30)$$

Neglecting all higher terms, the concentration may be expressed as:

$$C_{(y-\frac{1}{2}l_s)} = C_y - \frac{1}{2} l_s \frac{dC_y}{dy}$$

$$C_{(y+\frac{1}{2}l_s)} = C_y + \frac{1}{2} l_s \frac{dC_y}{dy} \qquad \ldots\ldots (3.31)$$

Introducing (3.31) in equation (3.30), the net upward motion is:

$$\frac{1}{2}[(C_y - \frac{1}{2} l_s \frac{dC_y}{dy})(V-W) - (C_y + \frac{1}{2} l_s \frac{dC_y}{dy})(V+W)] = -C_y.W - \frac{1}{2} V.l_s \frac{dC_y}{dy}$$

$$\ldots\ldots\ldots (3.32)$$

Most interesting is the equilibrium status at which there exists no net flow in either direction:

$$C_y.W + \frac{1}{2} V.l_c \frac{dC_y}{dy} = 0 \qquad ..... \qquad (3.33)$$

In equation (3.33) both V and l_c are unknown. It is customary to assume that these two values are equal to the corresponding values in a similar equation for the exchange of momentum transport, the depth d may be introduced.

$$\tau_y = \tau_0 \frac{d-y}{d} = \frac{1}{2} V.\rho [u_{(y-\frac{1}{2}l_c)} - u_{(y+\frac{1}{2}l_c)}]$$

$$= \frac{1}{2} V.\rho [(u_y - \frac{1}{2} l_c \frac{du}{dy}) - (u_y + \frac{1}{2} l_c \frac{du}{dy})]$$

$$= - \frac{1}{2} V.\rho.l_c \frac{du}{dy}$$

From this we calculate:

$$\frac{1}{2} V.l_c = - \frac{\tau_0}{\rho} \frac{d-y}{d} \frac{1}{du/dy} = - u_*^2 \frac{d-y}{d} \frac{1}{du/dy} \qquad ...(3.34)$$

Using equation (3.3) for the velocity distribution we may calculate du/dy

$$\frac{du_y}{dy} = \frac{5.75}{2.303} \frac{u_*}{y} \qquad ...(3.35)$$

Introducing this value into equation (3.34):

$$\frac{1}{2} V.l_c = -0.40 \ y.u_* \frac{d-u}{d} \qquad ...(3.36)$$

This value must be used in equation (3.33)

$$C_y.W = 0.40\ y.u_* \ \frac{d-y}{d}\ \frac{dC_y}{dy} \qquad \ldots(3.37)$$

Separating the variables:

$$\frac{dC_y}{C} = \frac{W}{0.40u_*}\ \frac{d}{y}\ \frac{dy}{(d-y)} \qquad \ldots(3.38)$$

And introducing the abbreviation:

$$z = \frac{W}{0.40u_*} \qquad \ldots(3.39)$$

We can integrate this equation from a to y

$$\int_a^y \frac{dC_y}{C} = \int_a^y d(\mathrm{Ln}C_y) = \mathrm{Ln}(C_y) - \mathrm{Ln}(C_a) = \mathrm{Ln}\left(\frac{C_y}{C_a}\right) \qquad \ldots(3.40)$$

$$= \int_a^y \frac{z.d.dy}{y(d-y)} = \int_a^y d\left(\mathrm{Ln}\left(\frac{d-y}{y}\right)^z\right) = \mathrm{Ln}\left(\frac{d-y}{y}.\frac{a}{d-a}\right)^z$$

This may be written in the form:

$$\frac{C_y}{C_a} = \left(\frac{d-y}{y}\ \frac{a}{d-a}\right)^z \qquad \ldots.(3.41)$$

and be used to calculate the concentration of a given grain size with the settling velocity W at the distance y from the bed , if the concentration Ca of the same particle at distance a is known.

3.7 INTEGRATION OF THE SUSPENDED LOAD

The integral of suspended load moving through the unit width of a cross section may be obtained by combining equations (3.42) and (3.3).

$$\int_{y}^{d} C_y.\bar{u}_y.dy = \int_{y}^{d} C_a.\left(\frac{d-y}{y} \; \frac{a}{d-a} \right)^{z} 5.75u_*Ln\left(30.2 \; \frac{y}{\Delta} \right) dy \quad ..(3.42)$$

Taking some of the constant factors out the integral, and referring the concentration to that at the lower limit of integration a, and replacing a by its dimensionless value $A_\varepsilon = a/d$, and using d as the unit for y, we obtain:

$$q_s = \int_{a}^{d} C_y.\bar{u}_y.dy = \int_{A_\varepsilon}^{1} d.C_y.\bar{u}_y.dy$$

$$= d.u_*.C_a\left(\frac{A_\varepsilon}{1-A_\varepsilon} \right)^{z} 5.75 \int_{A_\varepsilon}^{1} \left(\frac{1-y}{y} \right)^{z} Log\left(\frac{30.2y}{\Delta/d} \right) dy$$

$$= 5.75\; C_a.d.u_*\left(\frac{A_\varepsilon}{1-A_\varepsilon} \right)^{z} \left\{ Log\left(\frac{30.2d}{\Delta} \right) \int_{A_\varepsilon}^{1} \left(\frac{1-y}{y} \right)^{z} dy + \right.$$

$$\left. \int_{A_\varepsilon}^{1} \left(\frac{1-y}{y} \right)^{z} Log\; ydy \right\} \quad ...\;(3.43)$$

In order to reduce the two integrals in equation (3.43) into a basic form, the Log(y) is changed to Ln(y).

$$Log(y) = Ln(y).Log(e) \quad ...\;(3.44)$$

Where: Log(e) = 0.43429

Now we may write equation (3.44) in the form:

$$q_s = 5.75u_*.d.C_a\left(\frac{A_E}{1-A_E}\right)^z \left\{\mathrm{Log}\left(\frac{30.2d}{\Delta}\right)\int_{A_E}^{1}\left(\frac{1-y}{y}\right)^z dy\right.$$

$$\left.+\ 0.434\int_{A_E}^{1}\left(\frac{1-y}{y}\right)^z \mathrm{Ln}\ y\,dy\right\} \qquad \ldots\ldots \quad (2.45)$$

With:

$z = W/(0.40u_*)$

y measured with d as unit

$A_E = a/d$

$u_* = \sqrt{\tau_o/\rho} = \sqrt{gRS}$

Herein are:

q_s The sediment load in suspension per unit of width measured in weight, moving per unit of time between the water surface and the reference level $y = a$ (C_a is measured in weight per unit volume of mixture).

A_E The dimensionless distance of this lower limit of integration from the bed, $A_E = a/d$

z Defined as the settling velocity W of the particles divided by the Karman constant 0.40 and the shear velocity u_* .

y The variable of integration, the dimensionless distance of any point in the vertical from the bed, measured in water depths d.

It is convenient to transform equation (2.45) in order to make the numerical integration of suspended load:

$$q_s = 11.6u_*.C_a.a\ \left\{2.303\ \mathrm{Log}\left(\frac{30.2d}{\Delta}\right) I_1 + I_2\right\} \qquad \ldots (2.46)$$

With:

$$I_1 = 0.216 \frac{A_E^{z-1}}{(1-A_E)^z} \int_{A_E}^{1} \left(\frac{1-y}{y} \right)^z dy$$

$$\ldots (3.47)$$

$$I_2 = 0.216 \frac{A_E^{z-1}}{(1-A_E)^z} \int_{A_E}^{1} \left(\frac{1-y}{y} \right)^z \ln(y) dy$$

Herein ($11.6u_*$) is the flow velocity at the outer edge of the laminar sublayer in case of a hydraulically smooth bed, or the velocity in a distance of 3.68 roughness diameter from the wall in case of a rough wall. The symbol Ca stands for the sediment concentration at a distance 'a' from the bed. The integral values I_1 and I_2 are plotted in figures 3.8 and 3.9, respectively.

3.8 TRANSITION BETWEEN BED LOAD AND SUSPENDED LOAD

The total rate of transport, $q_B i_B$ of a given grain size in the bed and the thickness of the layer of 2D within this transport occurs have been determined and assumed respectively. From these values the average concentration in the bed layer may be found. The concentration is defined as the weight of solids per unit volume of water-sediment mixture. First, the weight of bed-load material in motion may be calculated for the unit of bed area. Let u_B be the average velocity with which bed-load material moves in the bed layer while in motion, not including the rest periods. Then the weight of particles of a given size per unit area is:

$$\frac{i_B \cdot q_B}{u_B}$$

The volume of the unit area of bed layer is 2D and the average concentration in the layer is:

$$\frac{i_B . q_B}{u_B 2D}$$

We may assume that the concentration in the entire bed layer is constant, since the layer is only two diameter thick. The following equation may be set up:

$$C_a = \frac{A_6 . i_B . q_B}{2D . u_B} \qquad ... (3.48)$$

The velocity u_B is not known. Both the flow velocity and the transport near the bed are functions of u'_B. The two must determine u_B. This makes it very probable that u_B is proportional to u'_B because it has the dimension of a velocity, too. Therefore, C_a may be expressed in the form:

$$C_a = A_6 \frac{i_B . q_B}{2D . u'_B} \qquad ... (3.49)$$

The value A_6 must be determined experimentally. It includes both the distribution of concentrations in the bed layer and the velocity of the bed layer. It can therefore, best be determined from flume experiments which compare the suspended load with the hydraulics of the flow. "Flume tests with Sediment Mixtures " suggests that $A_6 = 1/11.6$, and the equation (3.49) may thus be written as:

$$i_B . q_B = 11.6 \, C_a . u'_* . a \qquad ... (3.50)$$

and the total suspended load per unit width $i_s . q_{sw}$ may be calculated from equations (3.46) and (3.50):

$$i_s \cdot q_s = i_B \cdot q_B (2.303 \, \text{Log} (\frac{30.2 \, x}{Ks/d}) \, I_1 + I_2) \quad .. (3.31)$$

$$= i_B \cdot q_B \, (PE . I_1 + I_2)$$

$$\text{Whereby: } PE = 2.303 \, \text{Log} (\frac{30.2 \, x}{Ks/d}) = 2.303 \, \text{Log} (\frac{30.2 d}{\Delta}) \quad .. (3.32)$$

This relationship relates transportation as bed load to that in suspension of all particle sizes for which a bed load function exists. PE is called transport parameter.

3.9 THE TOTAL SEDIMENT TRANSPORT

The total load rate (q_T)$_T$ is obtained by addition of the bed load rate (q_B) and the suspended load rate (q_s).

$$i_T \cdot q_T = i_B \cdot q_B + i_s \cdot q_s = i_B \cdot q_B (PE . I_1 + I_2 + 1) \quad .. (3.33)$$

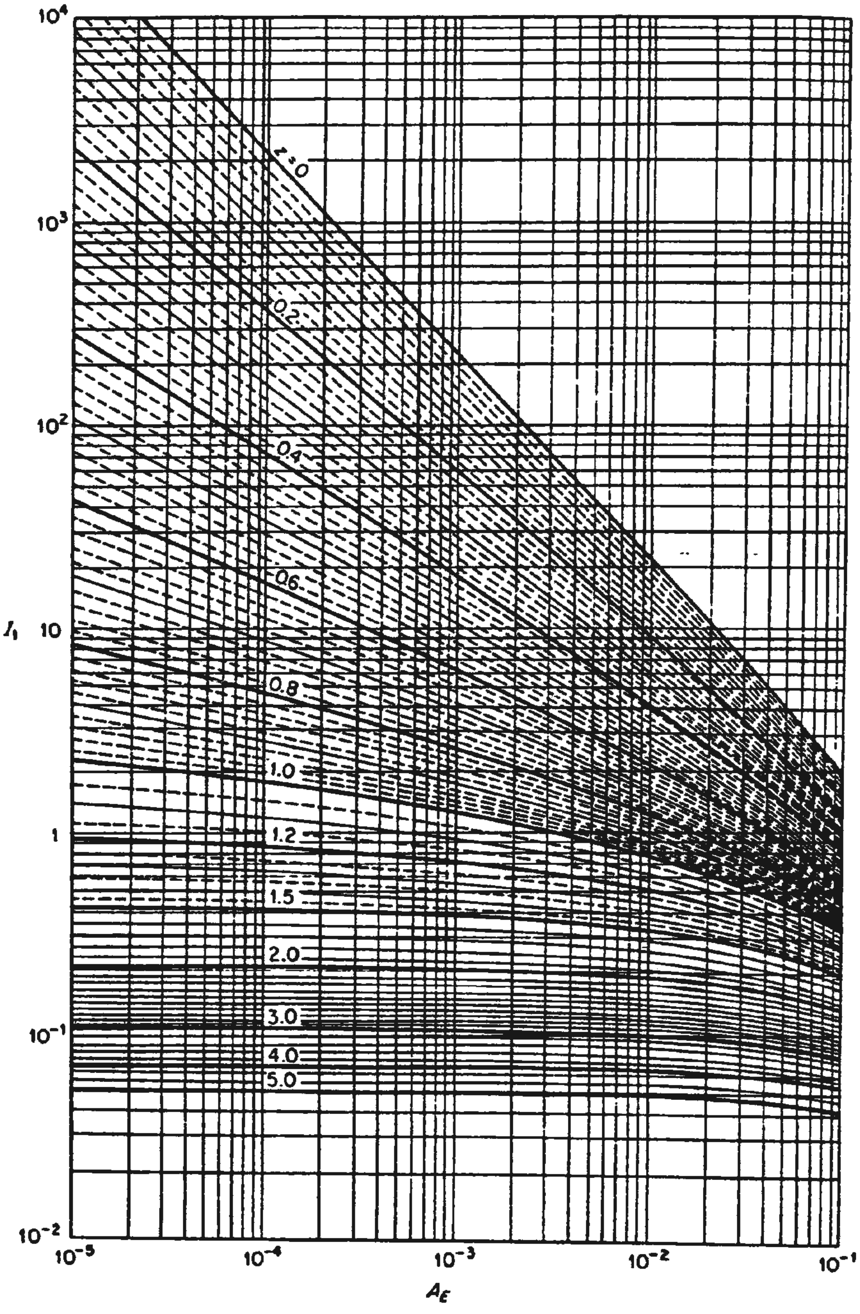


FIGURE 3.8 Function I_1 in terms of A_E for values of z. [*After* EINSTEIN (*1950*).]

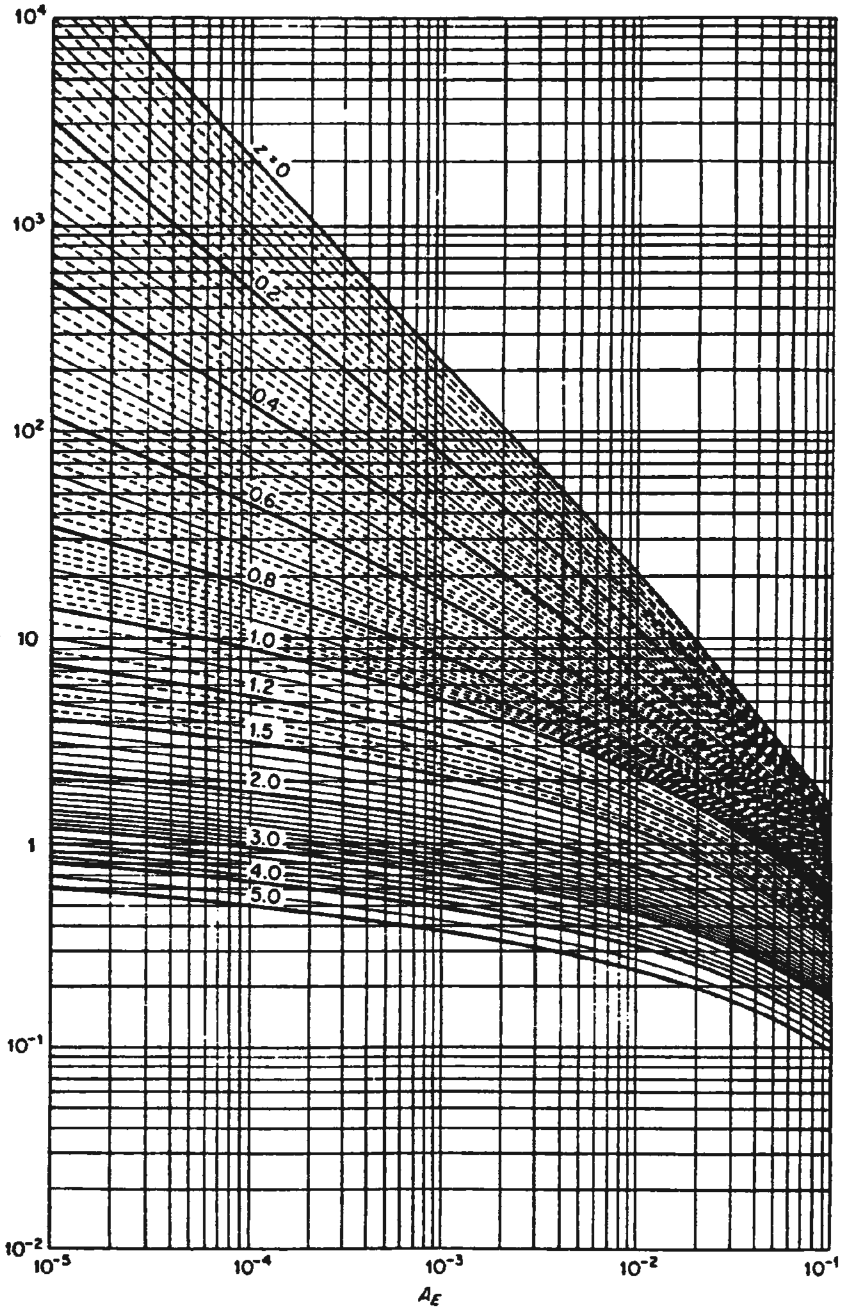


FIGURE 3.9 Function I_z in terms of A_E for values of z. [*After* EINSTEIN (*1950*).]

4. GENERAL DESCRIPTION OF THE SITES AND DATA

4.1 GENERAL DESCRIPTION OF THE SITES

The Zaire river is located in the central part of Africa. It is the second largest river in the world in terms of the annual fresh water inflow to the oceans.

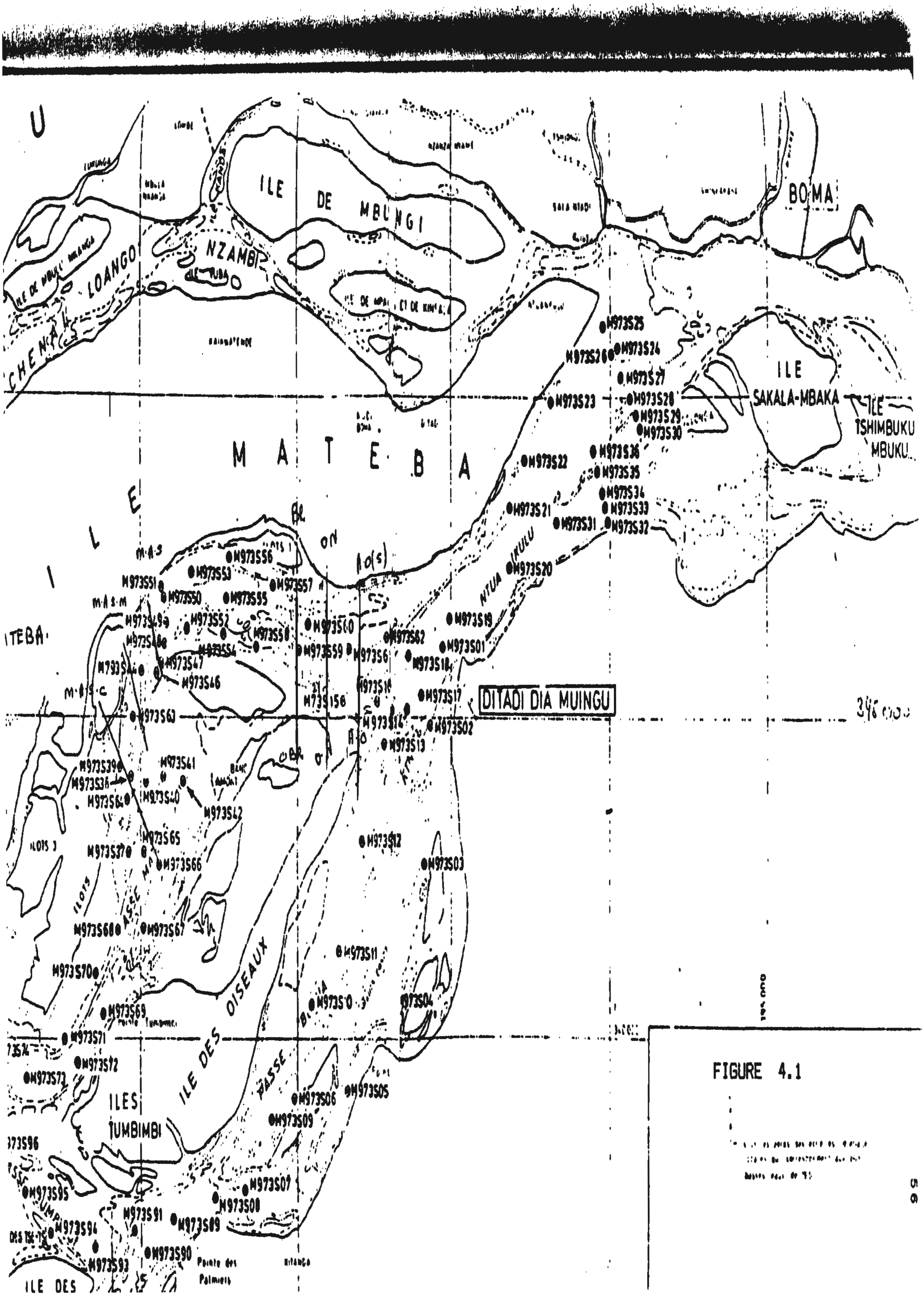
The head of the estuary is called the Matadi and the braided area, 60 Km.long, begins at the harbour of Boma, 60 Km. downstream from the harbour of Matadi. The study area is situated about 15 Km. downstream of Boma.

The measurements had been made at Mateba by three campaigns, one during the period August-September 1978, the second during october 1978 and the last in 1981.

These measurements were carried out for the following cross sections :

AMONT OISEAUX	1978
OISEAUX NORD	1978
BARRAJE	1978
MATEBA AMONT SUD	1978
MATEBA SUD MANDUD	1979
MATEBA SUD KAPITA	1979
MATEBA AMONT	1981
MATEBA CENTRAL	1981
MATEBA AVAL	1981

The location of these cross sections are shown on Figures 4.2.


U
ILE DE MBUNGI
BOMA
ILE DE MBULU MBANGA
LOANGO
NZAMBI
ILE TUBA
CHENAL
ILE SAKALA-MBAKA
ILE TSHIMBUKU MBUKU
MATEBA
ILE
ITEBA
DITADI DIA MUINGU
NTUA NKULU
ILOTS
ILE DES OISEAUX
PASSE
ILES TUMBIMBI
ILE DES
Pointe des Palmiers
Pointe Tumbimbi
BANC
M973S01
M973S02
M973S03
M973S04
M973S05
M973S06
M973S07
M973S08
M973S09
M973S10
M973S11
M973S12
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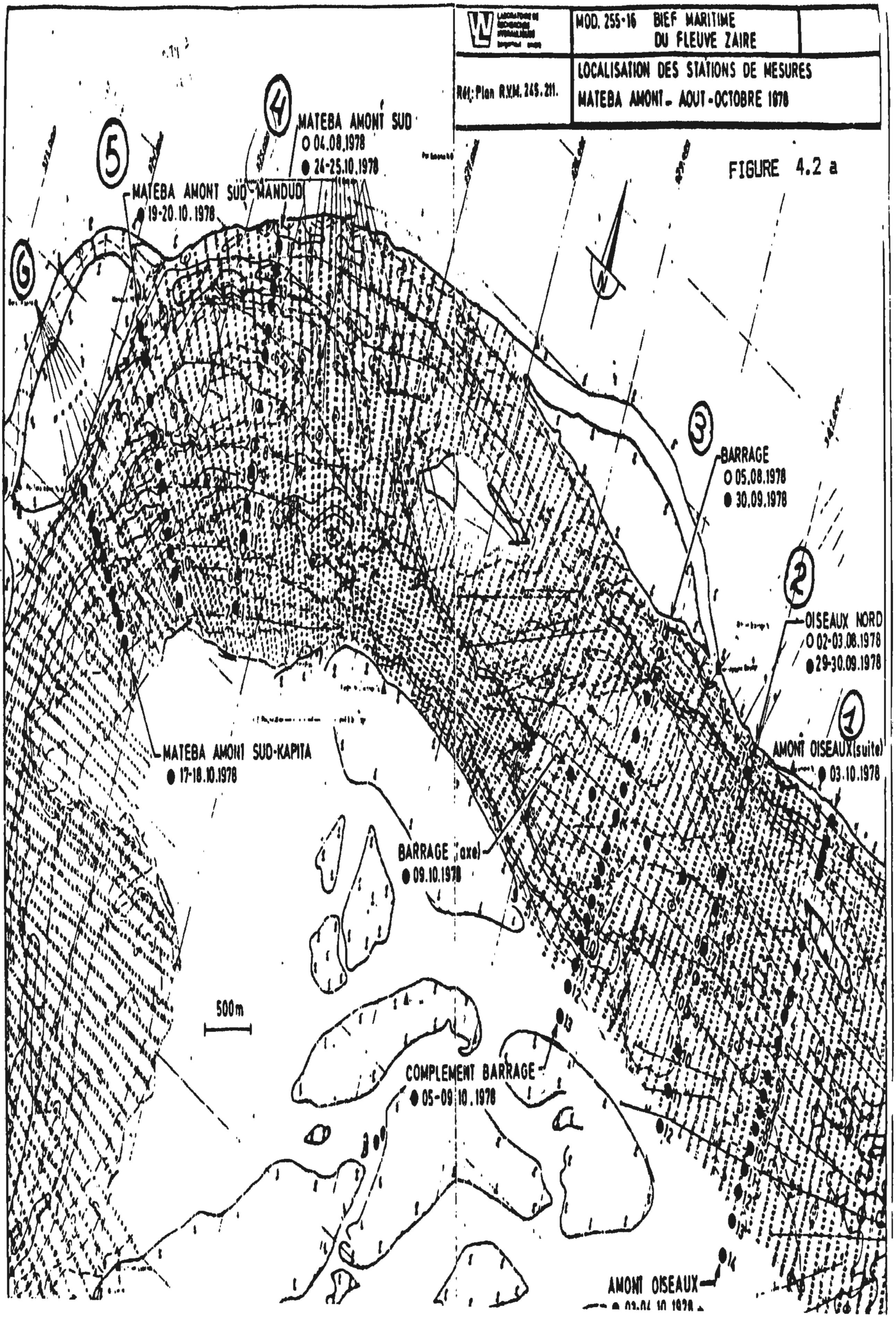
M973S156
346 000

FIGURE 4.1



MOD. 255-16 BIEF MARITIME
DU FLEUVE ZAIRE

Réf.: Plan R.V.M. 245.211.

LOCALISATION DES STATIONS DE MESURES
MATEBA AMONT – AOUT-OCTOBRE 1978

FIGURE 4.2 a

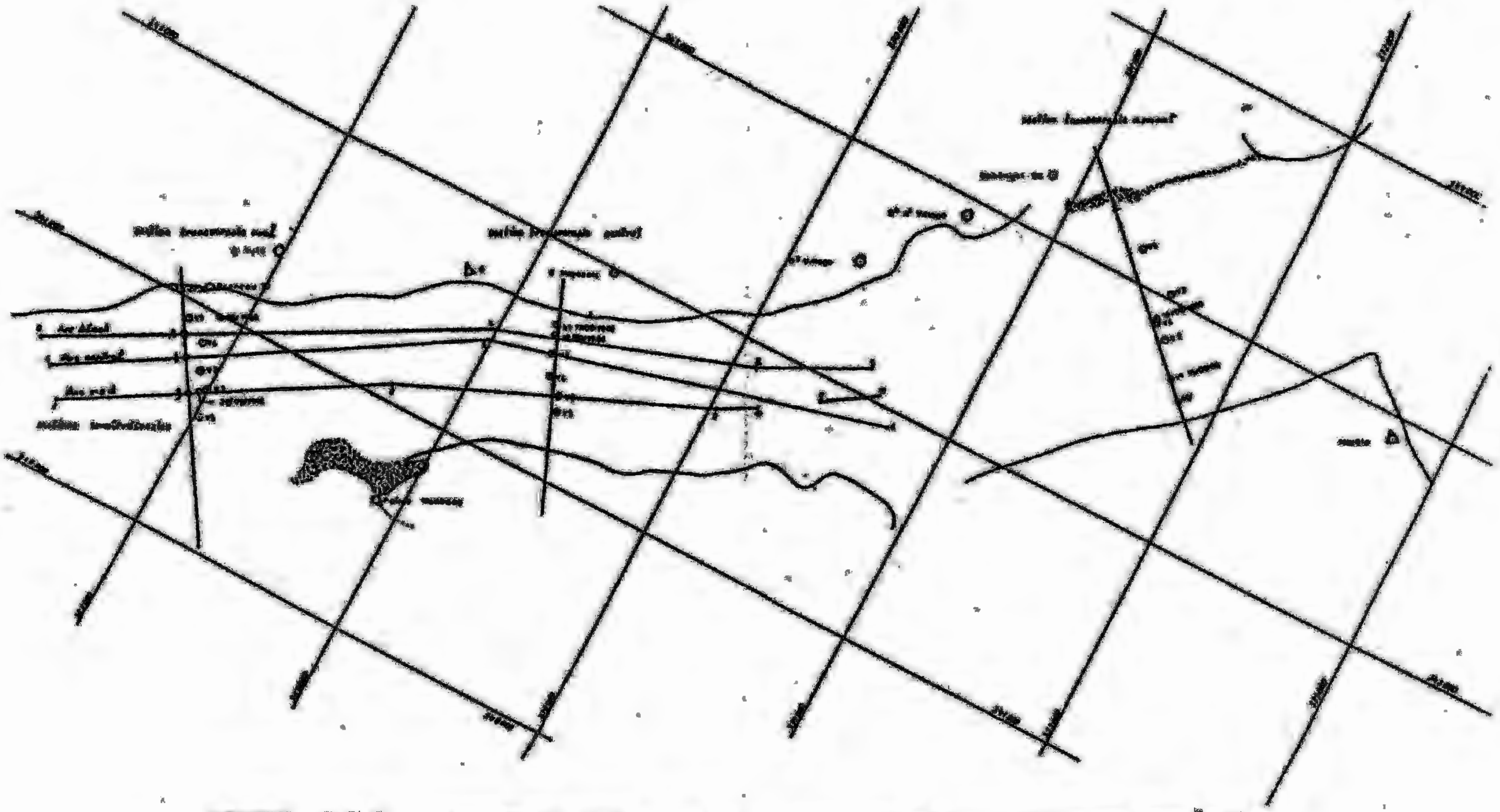


FIGURE 4.2 b MAP OF MATEBA WITH CROSS SECTIONS: AMONT, CENTRAL AND AVAL

4.2 GENERAL DESCRIPTION OF DATA

The data were obtained from measurements consisting of values of Z and V whereby Z is the distance in meters from the water surface to the point where the velocity (V) is measured in a considered vertical. The other data correspond to the coordinates of the verticals for each cross section.

The data mentioned above were provided from: data files VELOCIT and COORD, created by Amarakoon for six cross sections and from data file AVAL1 and CORDXY, created by Diver for the last three cross sections described in 4.1 .

These data files have been used to feed the computer program CHANGE which transforms the information for easy handling and use it to generate the requirement data through the program RATING.

For hydraulic considerations some cross sections were divided into two parts (1), and (2) and each of these was considered as independent.

a1.- DATA FILE : VELOCIT and AVAL1

- column 1 : vertical number
- column 2 : velocity of the water surface for each vertical (m/sec).
- column 3 : total water depth for each vertical (m).
- column 4 : number of velocity measurement in each vertical.
- column 5 to 17 : measurements of Z and V wherein, Z is the distance in meters from the water surface

to the point where the velocity (V) is measured.

b).- DATA FILE : COORD and CORDXY

- column 1 : vertical number
- column 2 : coordinate X of the vertical.
- column 3 : coordinate Y of the vertical.

c).- DATA FILE : ZADATA1 (*) and ZADATA2 (**)

- column 1 : vertical number
- column 2 : total water depth (m), for each vertical (the right and left banks are considered as vertical too).
- column 4 to 17 : values of Z and V wherein, Z is the distance in meters from the water surface to the point where the velocity (V) is measured.

(*) data file which contains information for the cross sections : Mateba Amont, Mateba Central, and Mateba Aval.

(**) contains the information for all cross sections considered in the present study.

d).- DATA FILE : RATING1

Generated by the computer program RATING

- column 1 : vertical number
- column 2 : total water depth for each vertical.
- column 3 : distance in meters from right bank to each vertical.

- column 4 to 17 : values of Zi and Q wherein, Zi is the distance from the bottom of each vertical to half of two consecutive points of velocities and Q is the discharge (m^3 /sec) to the corresponding Zi .

e).- DATA FILE : RATING2

obtained from computer program RATING

- column 1 : vertical number
- column 2 : height calculated from the reference to the bottom of each vertical. The maximum depth of the cross section is considered as the reference.
- column 3 : distance from right bank to each vertical.
- column 4 to 17 : values of Hi and Q wherein, Hi is the distance from datum to half of the two consecutive points of velocities and Q is the discharge (m^3/sec) to the corresponding Hi.

f).- DATA FILE : RATING3

obtained from computer program RATING

- column 1 : H water elevation from the bottom (m).
- colum 2 : total discharge corresponding to H (m^3/sec).
- column 3 : hydraulic area corresponding to H in).

- column 4 : wetted perimeter (m).
- column 5 : hydraulic radius (m).

g).- DATA FILE : RATING4

Obtained from program RATING

- column 1 : number of vertical.
- column 2 : water depth (m), for each vertical.
- column 3 : discharge for each vertical (m^3/sec).
- column 4 : hydraulic area (m) for each vertical.
- column 5 : mean velocity (m/sec) for each vertical
- column 6 : shear velocity (m/sec) for each vertical.
- column 7 : wetted perimeter (m) for each vertical.
- column 8 : hydraulic radius (m) for each vertical.

In the data file ZADATA2, RATING1, RATING2 and RATING4 we can identify :

ROW 1 to 6 : CROSS SECTION : AMONT OISEAUX 1
ROW 7 to 22 : CROSS SECTION : AMONT OISEAUX 2
ROW 23 to 28 : CROSS SECTION : OISEAUX NORD 1
ROW 29 to 40 : CROSS SECTION : OISEAUX NORD 2
ROW 41 to 47 : CROSS SECTION : BARRAJE 1
ROW 48 to 63 : CROSS SECTION : BARRAJE 2
ROW 64 to 72 : CROSS SECTION : MATEBA AMONT SUD 1
ROW 73 to 82 : CROSS SECTION : NATEBA AMONT SUD 2
ROW 83 to 95 : CROSS SECTION : MATEBA SUD MANDUDI
ROW 96 to 106 : CROSS SECTION : MATEBA SUD KAPITA
ROW 107 to 113 : CROSS SECTION : MATEBA AMONT
ROW 114 to 120 : CROSS SECTION : MATEBA CENTRAL

ROW 121 to 127 : CROSS SECTION : MATEBA AVAL

In data file RATING 3 we identify :

ROW 1 to 13 : CROSS SECTION : AMONT OISEAUX 1

ROW 14 to 23 : CROSS SECTION : AMONT OISEAUX 2

ROW 24 to 41 : CROSS SECTION : OISEAUX NORD 1

ROW 42 to 51 : CROSS SECTION : OISEAUX NORD 2

ROW 52 to 66 : CROSS SECTION : BARRAJE 1

ROW 67 to 81 : CROSS SECTION : BARRAJE 2

ROW 82 to 92 : CROSS SECTION : MATEBA AMONT SUD 1

ROW 93 to 101 : CROSS SECTION : MATEBA AMONT SUD 2

ROW 102 to 111 : CROSS SECTION : MATEBA SUD MANDUDI

ROW 112 to 130 : CROSS SECTION : MATEBA SUD KAPITA

ROW 131 to 140 : CROSS SECTION : MATEBA AMONT

ROW 141 to 153 : CROSS SECTION : MATEBA CANTRAL

ROW 154 to 166 : CROSS SECTION : MATEBA AVAL

h).- ADDITIONAL DATA

- SLOPE : see table 4.1
- D35 : 35 percent of the mixture is finer
  = 0.1567 mm.
- D65 : 65 percent of the mixture is finer
  = 0.325 mm.
- D50 : 50 percent of the mixture is finer
  = 0.240 mm.
- Temperature of water: 28.5 °C
- Kinematic viscosity of water: 0.841×10^{-6} m^2/sec
- Gravity: 9.81 m/sec^2
- Water density: 1000 Kg /m^3

4- Sediment density: 2650 Kg /m^3

The sediment transport will be calculated for the grain sizes between 0.2 and 0.4 mm. This will cover 100% of the bed material. The calculation will be performed for individual sieve fractions representing equal proportions of average grain sizes of 0.212, 0.254, 0.312 and 0.370 millimeters.

TABLE 4.1 DETERMINATION OF ENERGY SLOPE AND MANNING COEFFICIENT

Cross Section	Discharge Q	Area A	Mean Velocity V	Hydraulics Radius R	Chezy Coefficient C+	Manning Coefficient n++	Slope S++
	m^3/sec	m^2	m/sec	m			
Amont Oiseaux 1	3100.97	3121.84	0.993	5.89	51	0.026	0.000064
Amont Oiseaux 2	14091.99	12930.53	1.089	5.80	53	0.025	0.000071
Oiseaux Nord 1	5819.51	5146.10	1.131	11.44	54	0.028	0.0000386
Oiseaux Nord 2	10511.55	10155.60	1.035	5.10	51	0.026	0.000080
Barraje 1	4931.51	5889.00	0.837	7.85	41	0.034	0.000053
Barraje 2	10609.51	11670.4	0.909	6.27	44	0.031	0.000068
Mateba Amont Sud 1	3345.94	5206.70	0.643	6.13	32	0.042	0.000066
Mateba Amont Sud 2	8717.39	8738.15	0.998	6.03	50	0.027	0.000066
Mateba Sud Mandudi	12816.51	13126.4	0.976	8.02	48.6	0.029	0.0000503
Mateba Sud Kapita	11400.10	9881.68	1.154	8.52	55.7	0.026	0.0000503
Mateba Amont	4832.02	5028.7	0.961	5.06	50.0	0.026	0.000073
Mateba Central	6051.44	4913.7	1.231	7.70	60.9	0.023	0.000053
Mateba Aval	7416.61	5761.5	1.287	7.04	64.8	0.021	0.000056

+ Obtained from J. Amarakoon's Thesis, IUPHY/VUB, July 1986

++ Calculated from these equations: $n = \frac{R^{1/6}}{C}$; $V = C\sqrt{RS}$

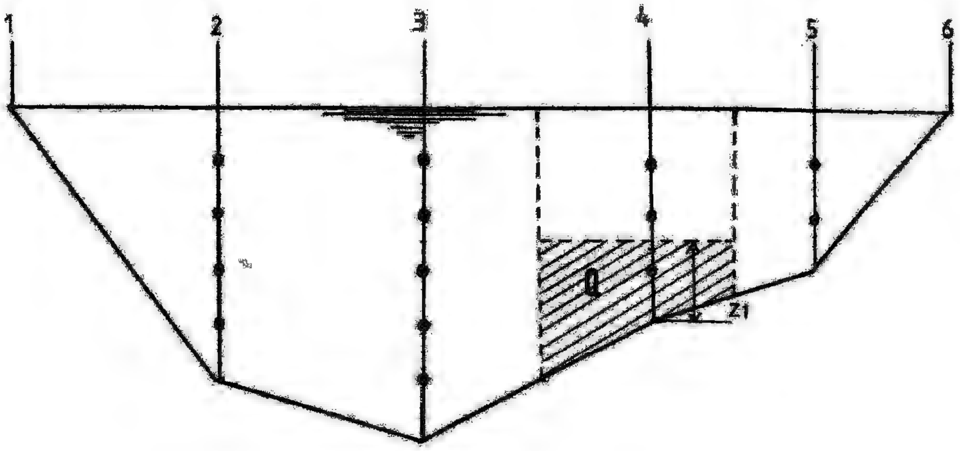


FIGURE 4.3 a   SCHEMATIC REPRESENTATION OF DATA FILE: RATING1

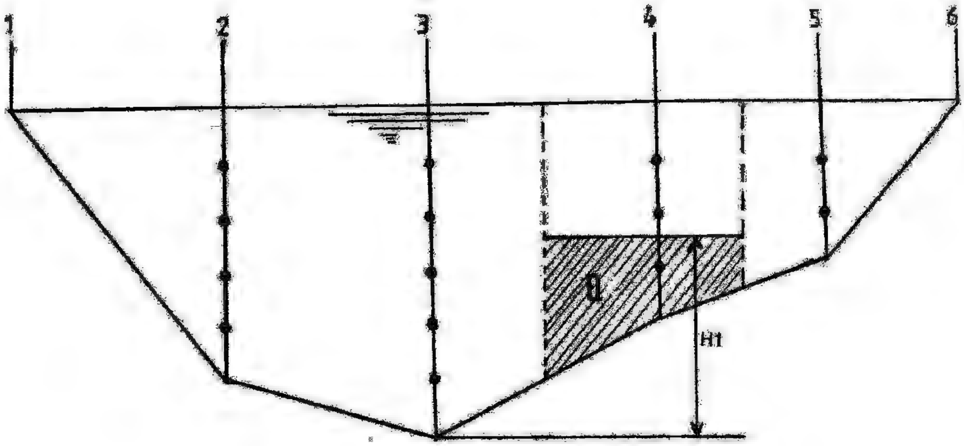


FIGURE 4.3 b   SCHEMATIC REPRESENTATION OF DATA FILE: RATING2

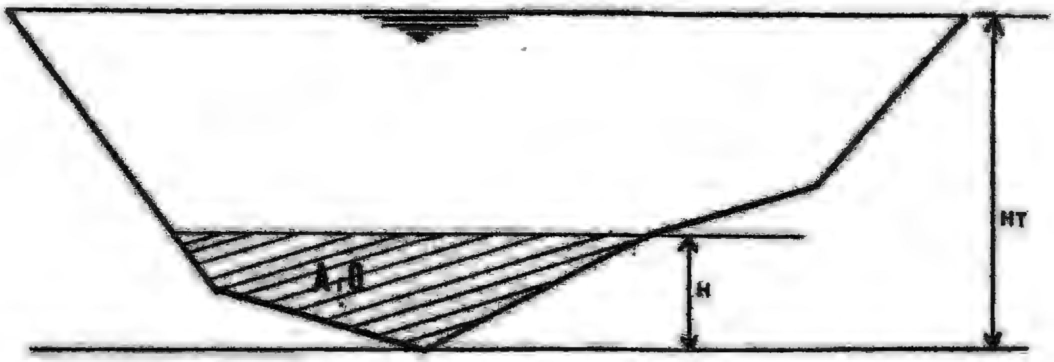


FIGURE 4.3 c SCHEMATIC REPRESENTATION OF DATA FILE: RATING3

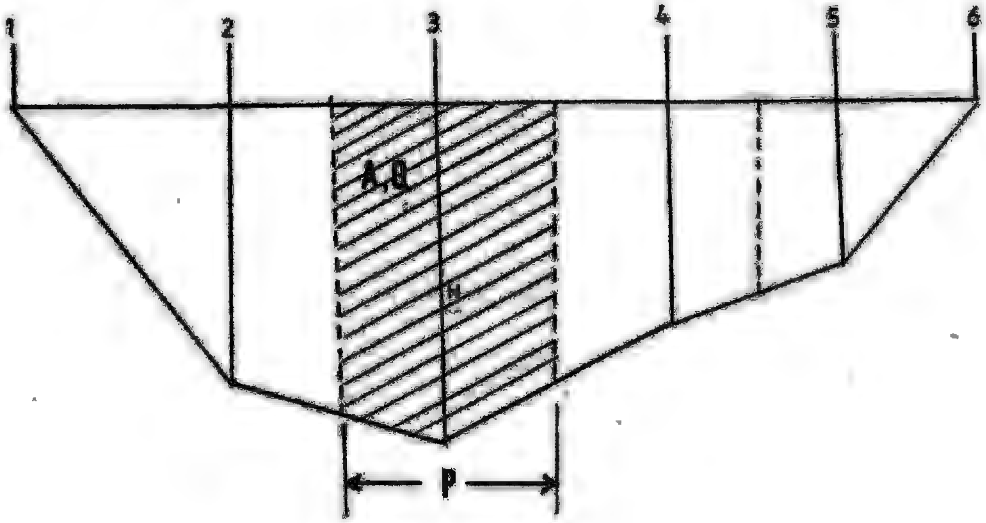


FIGURE 4.3 d SCHEMATIC REPRESENTATION OF DATA FILE: RATING4

FIGURE 4.4 a

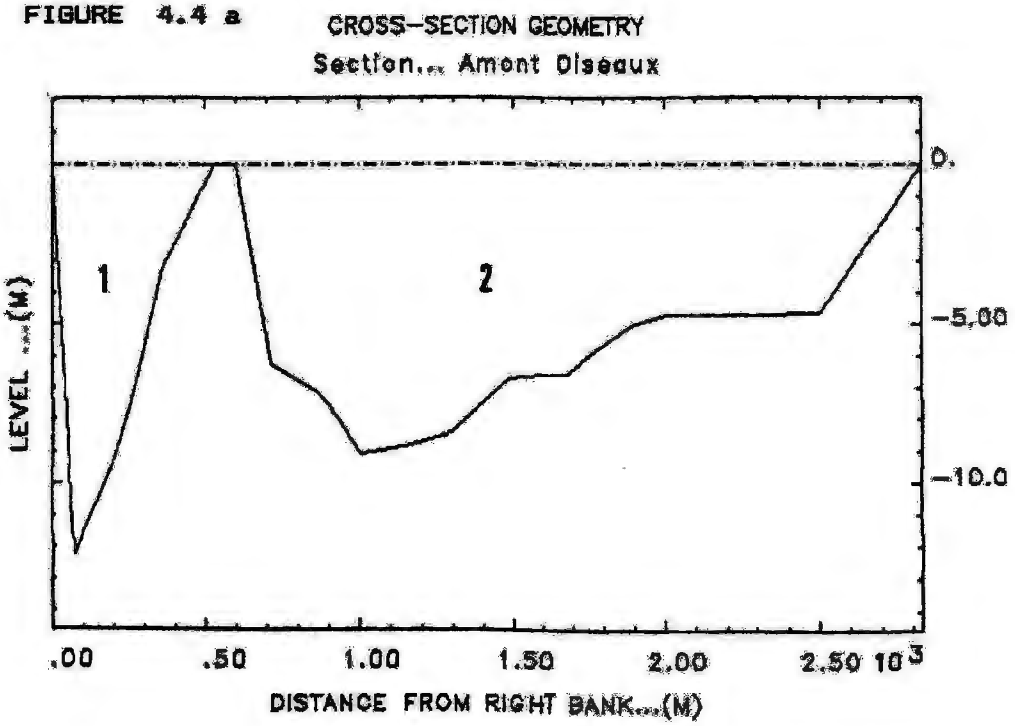


FIGURE 4.4 b

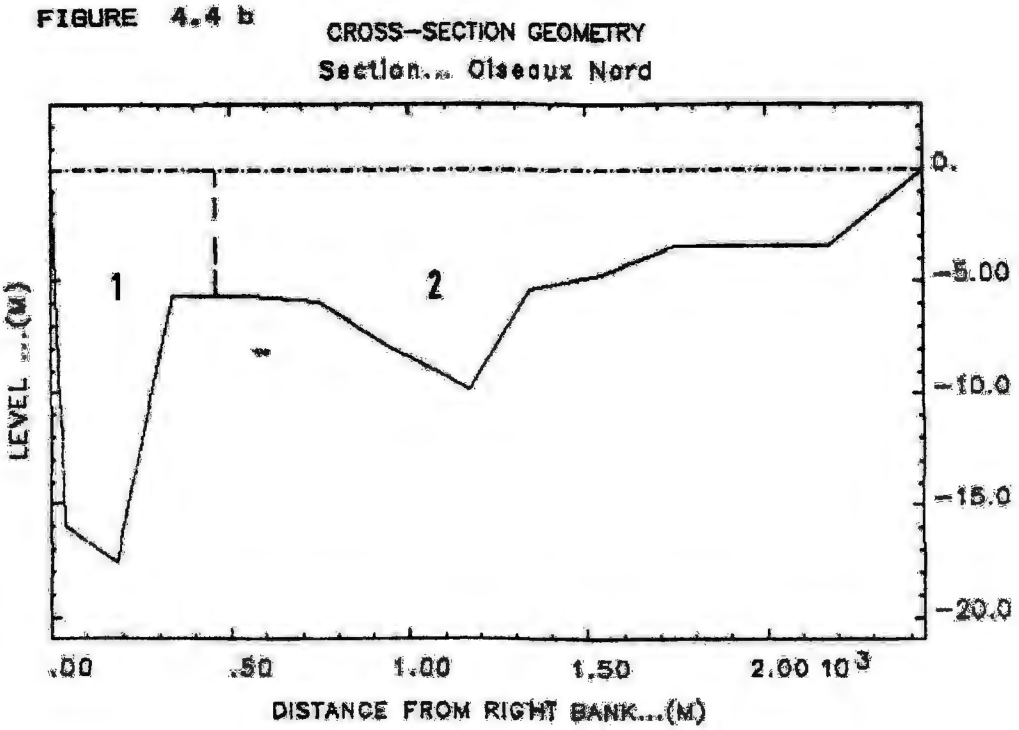
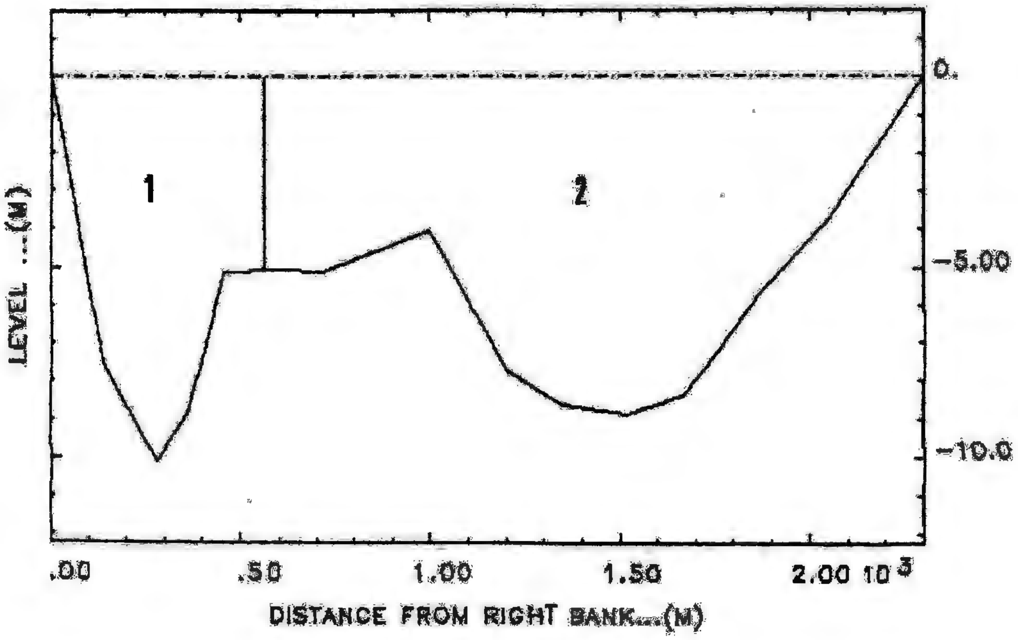
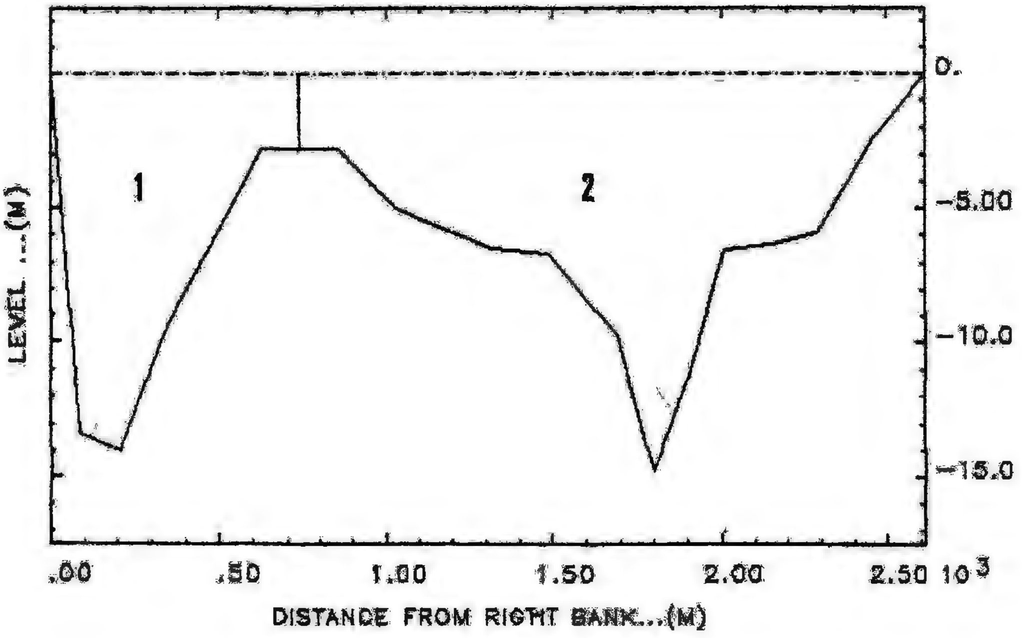


FIGURE 4.4 c



CROSS-SECTION GEOMETRY
Section... Matebo Amont Sud

FIGURE 4.4 d



CROSS-SECTION GEOMETRY
Section... Barraje

FIGURE 4.4 e

CROSS-SECTION GEOMETRY
Section... Mateba Sud Mandud

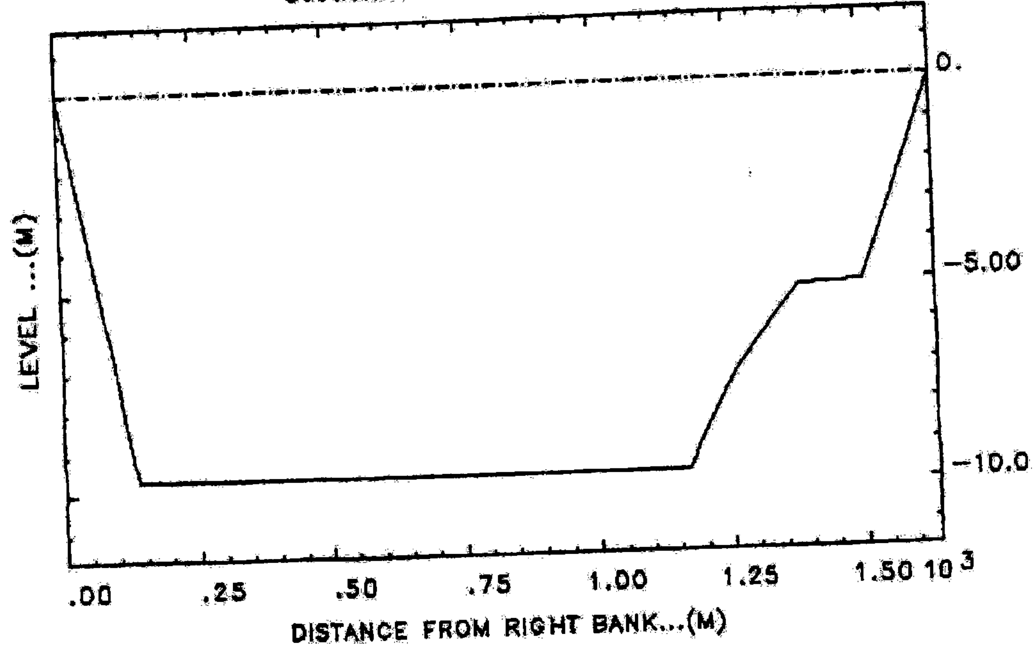


FIGURE 4.4 f

CROSS-SECTION GEOMETRY
Section... Mateba Sud Kapita

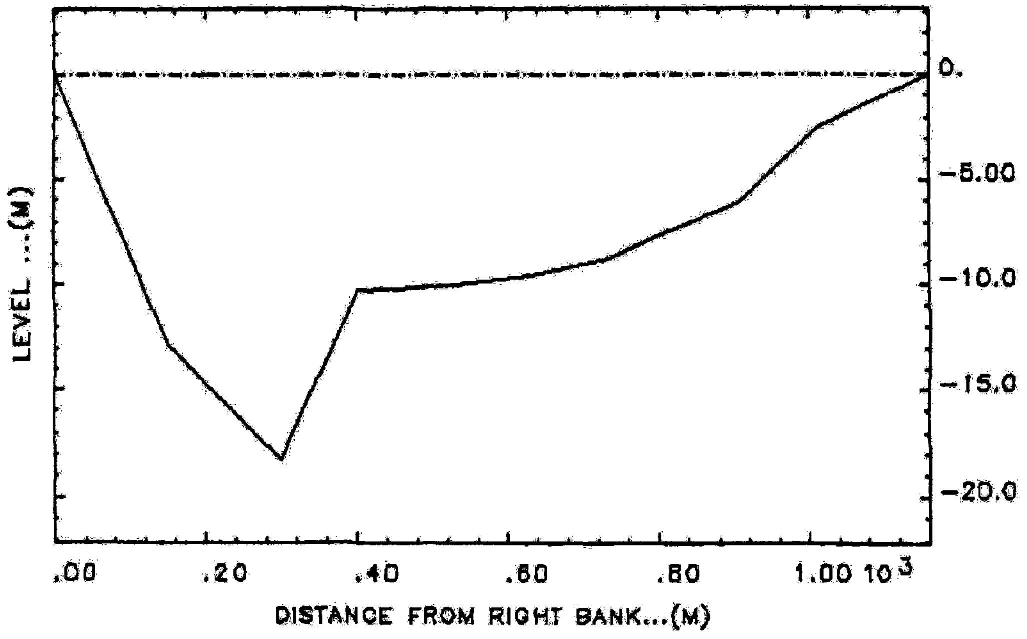


FIGURE 4.4 g

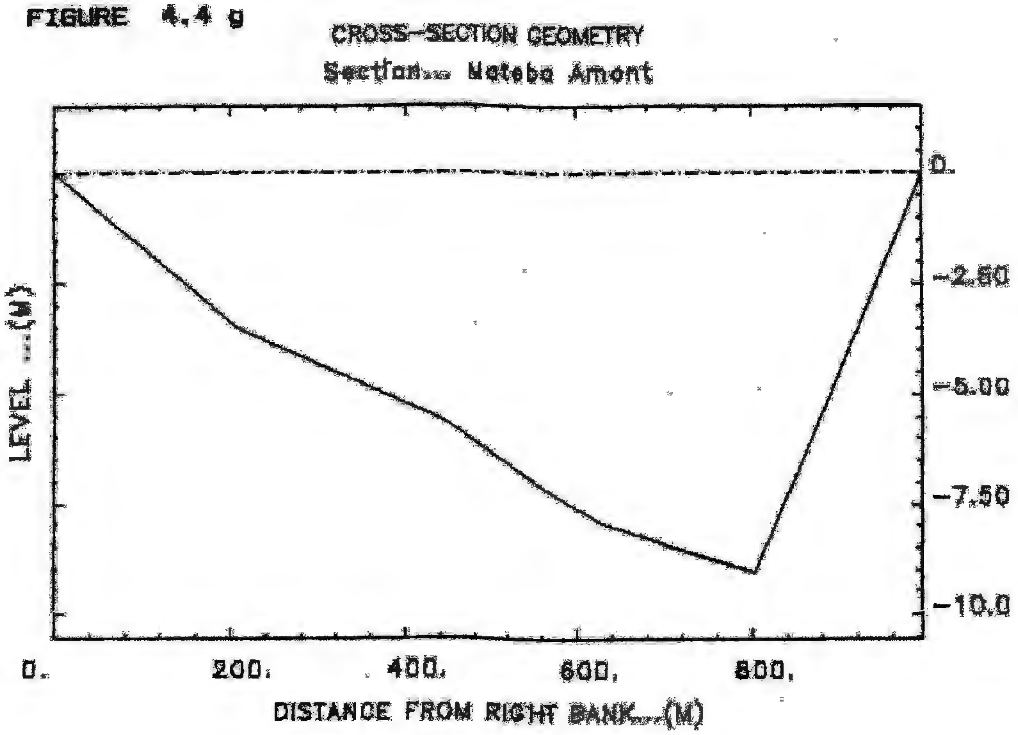


FIGURE 4.4 h

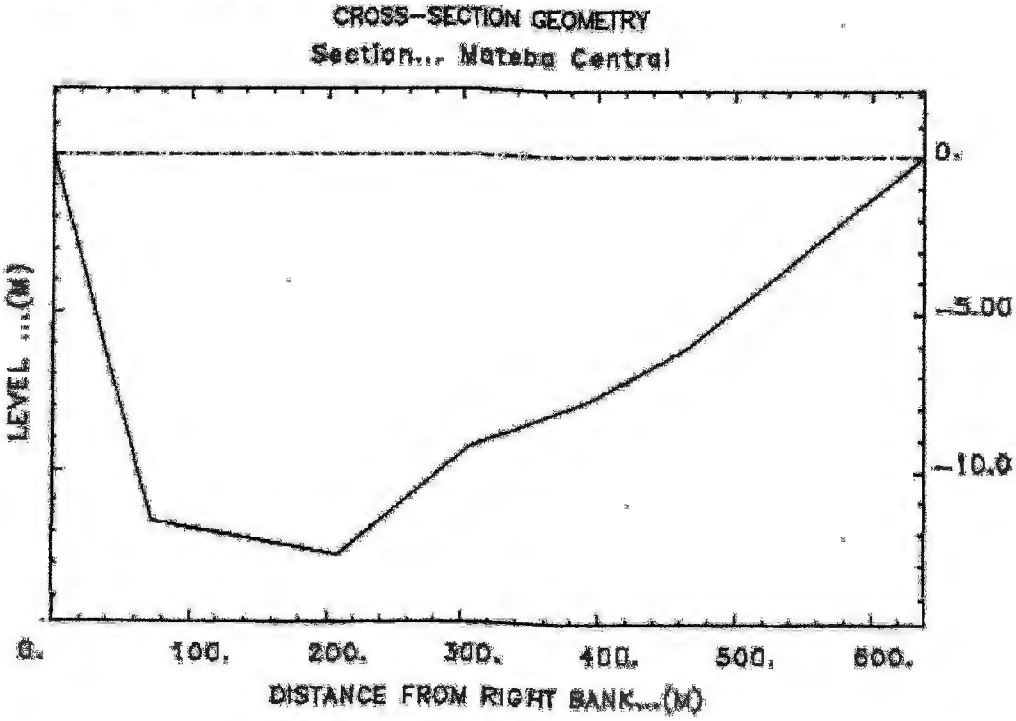


FIGURE 4.4 1

CROSS-SECTION GEOMETRY

Section... Mateba Aval

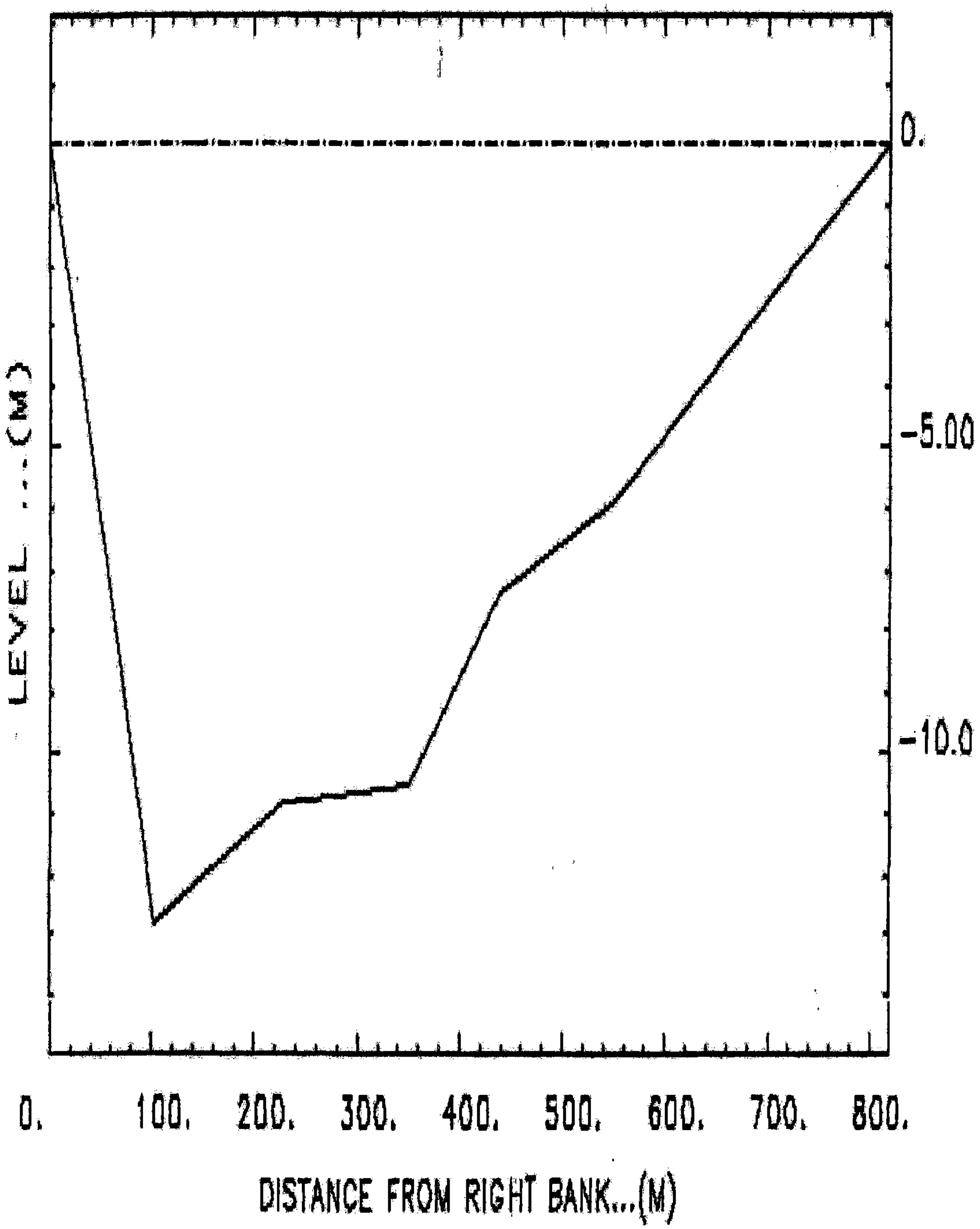


FIGURE 4.5 a RATING CURVE AND GEOMETRIC CHARAC.
Section..Amont Oiseaux 1

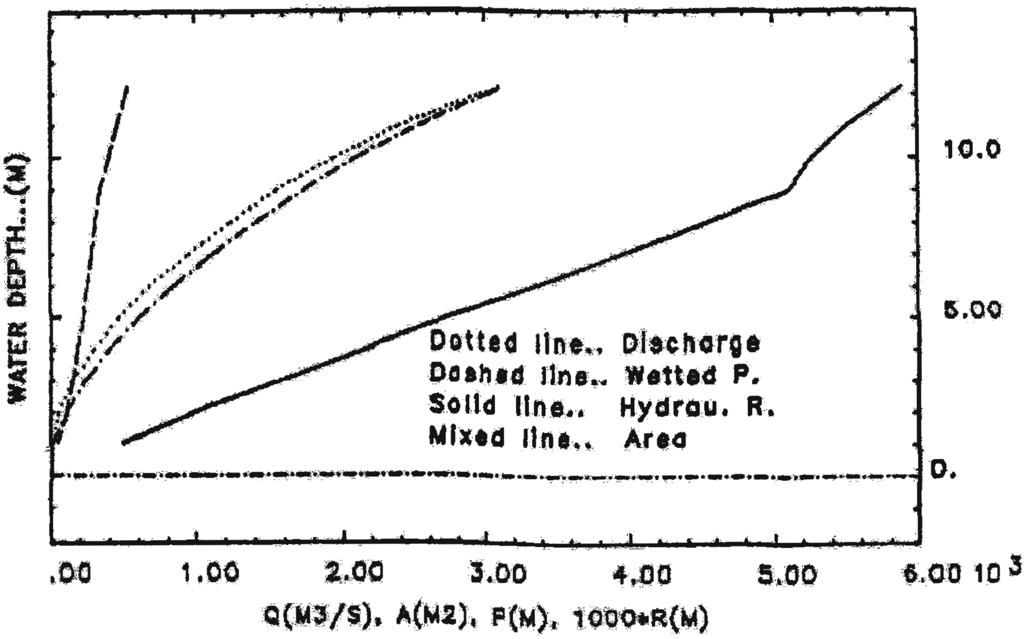


FIGURE 4.5 b RATING CURVE AND GEOMETRIC CHARAC.
Section..Amont Oiseaux 2

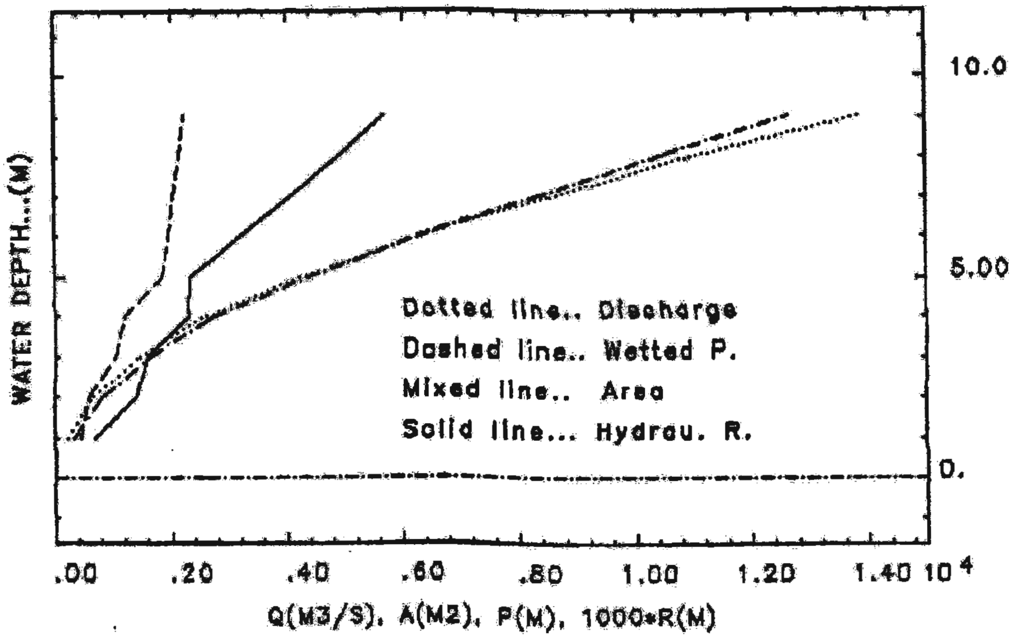


FIGURE 4.5 c

RATING CURVE AND GEOMETRIC CHARAC.
Section..Oiseaux Nord 1

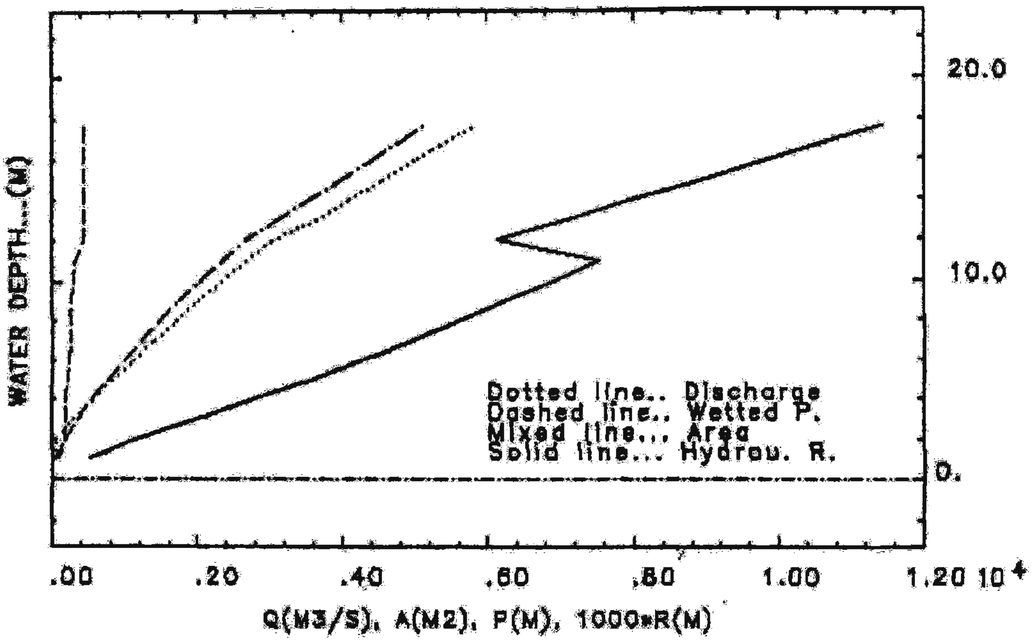


FIGURE 4.5 d

RATING CURVE AND GEOMETRIC CHARAC.
Section..Oiseaux Nord 2

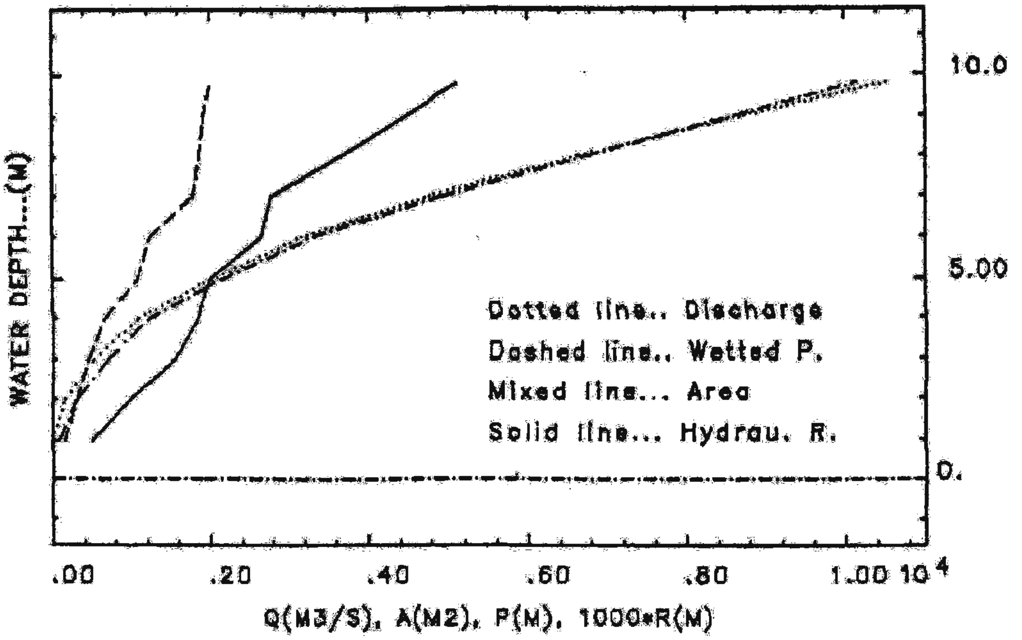


FIGURE 4.5 e RATING CURVE AND GEOMETRIC CHARAC.
Section..Barraje 1

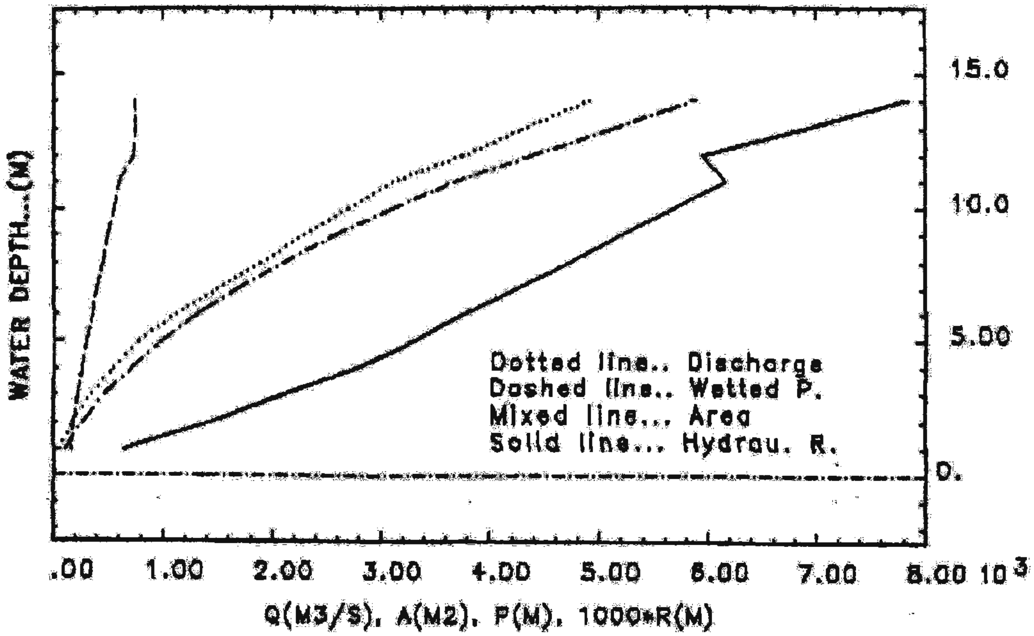


FIGURE 4.5 f RATING CURVE AND GEOMETRIC CHARAC.
Section..Barraje 2

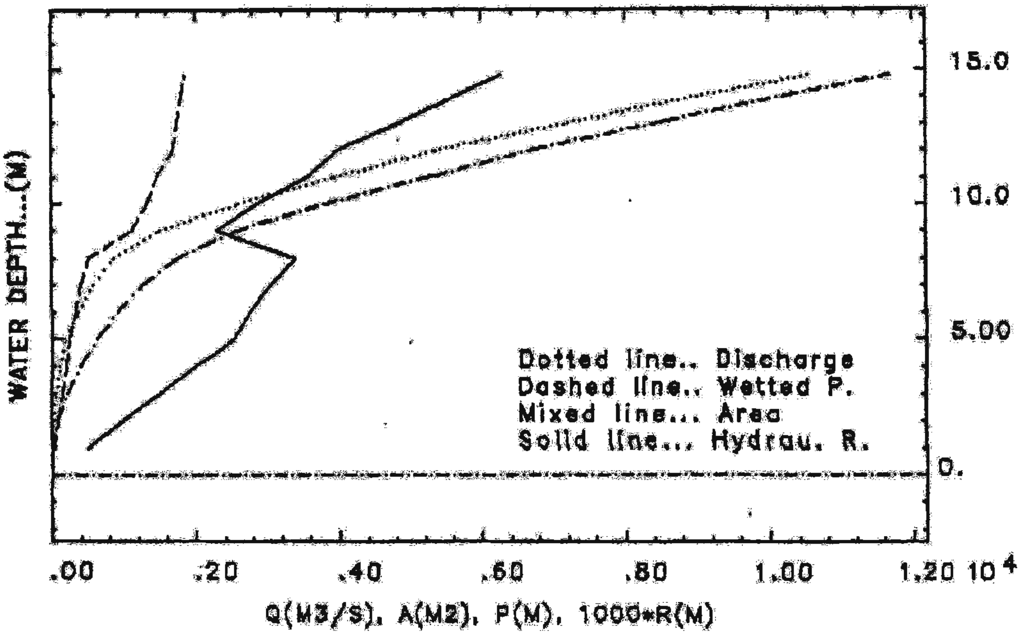


FIGURE 4.5 g RATING CURVE AND GEOMETRIC CHARAC.
Section..Mateba Amont Sud 1

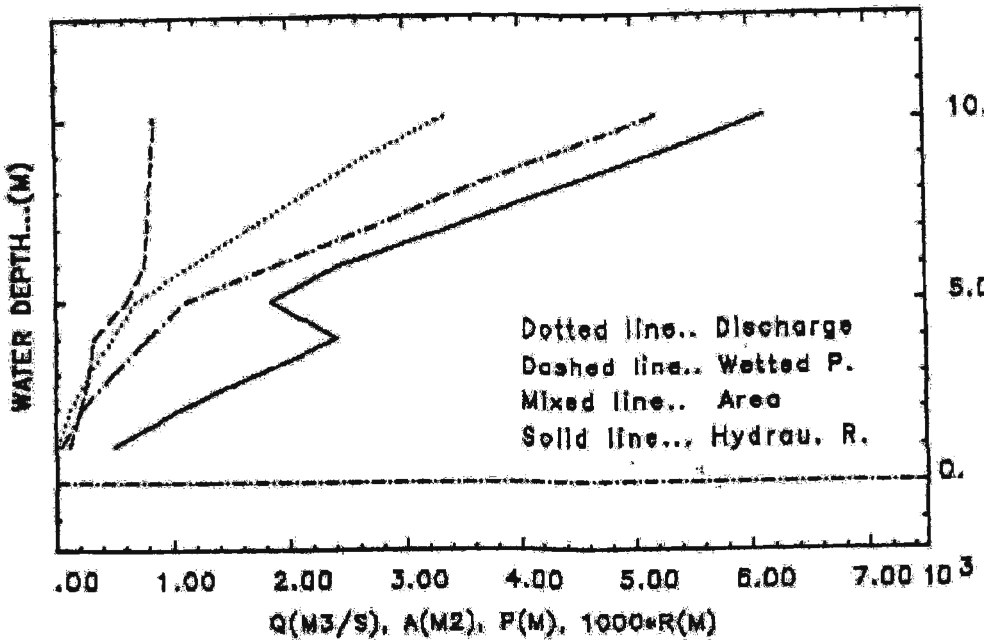


FIGURE 4.5 h RATING CURVE AND GEOMETRIC CHARAC.
Section..Mateba Amont Sud 2

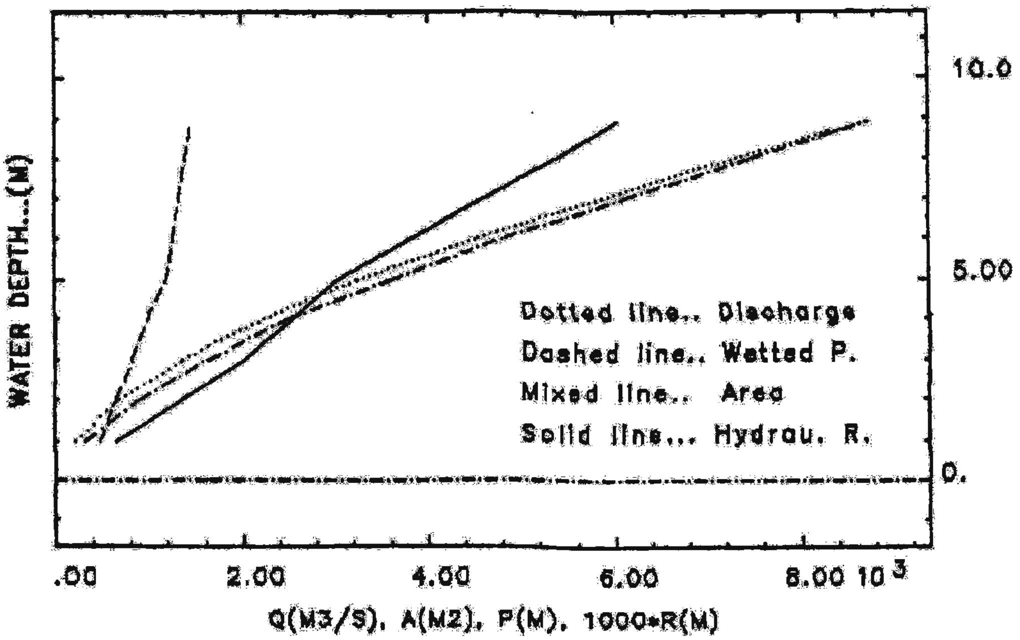


FIGURE 4.5 i

RATING CURVE AND GEOMETRIC CHARAC.
Section..Mateba Sud Mandud

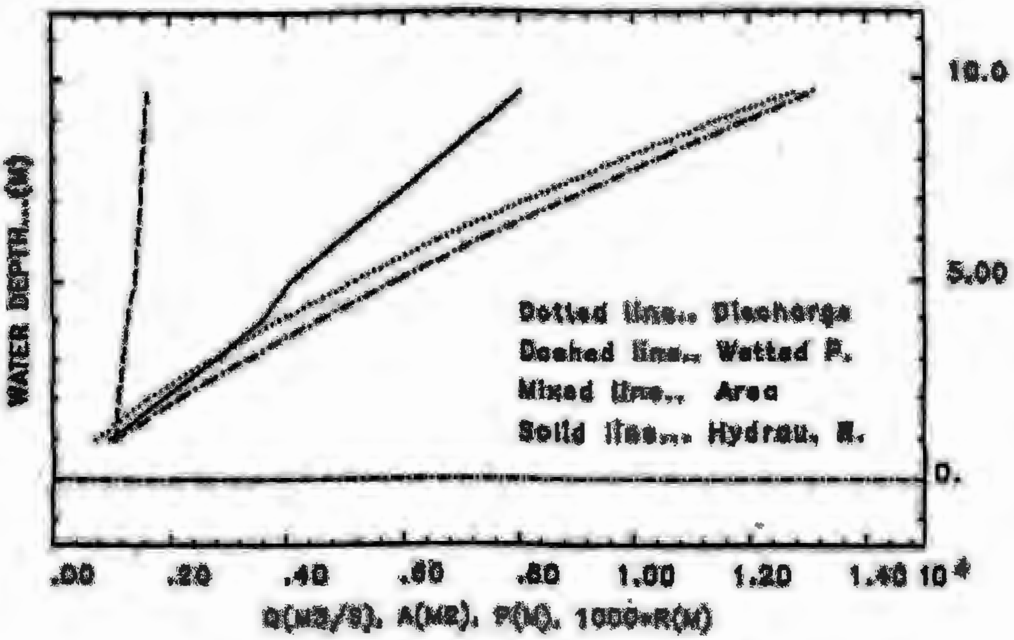


FIGURE 4.5 j

RATING CURVE AND GEOMETRIC CHARAC.
Section..Mateba Sud Kapita

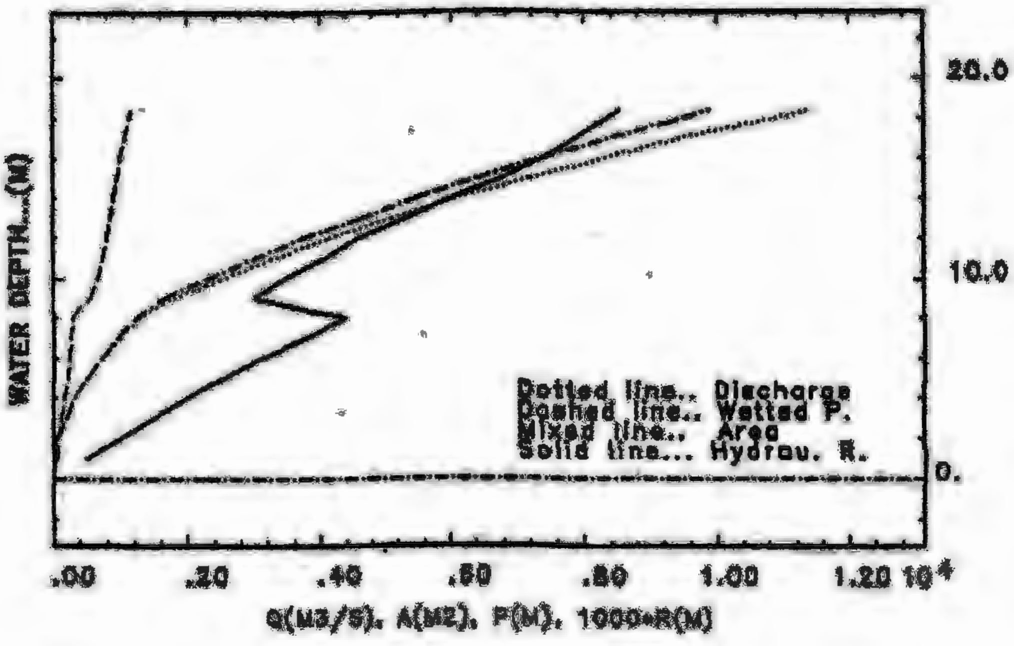


FIGURE 4.5 k

RATING CURVE AND GEOMETRIC CHARAC.
Section..Mateba Amont

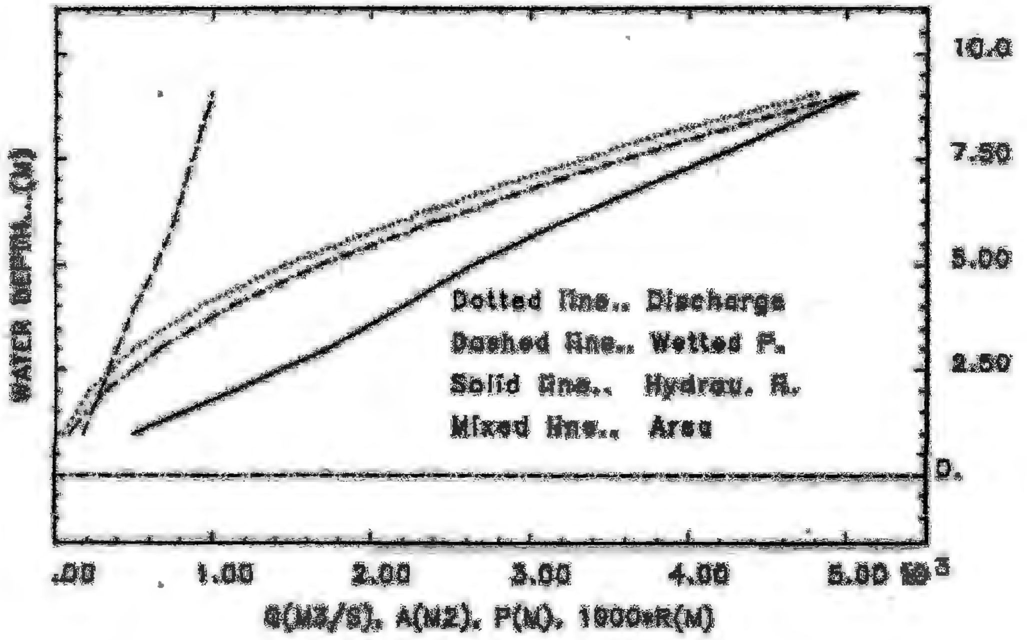
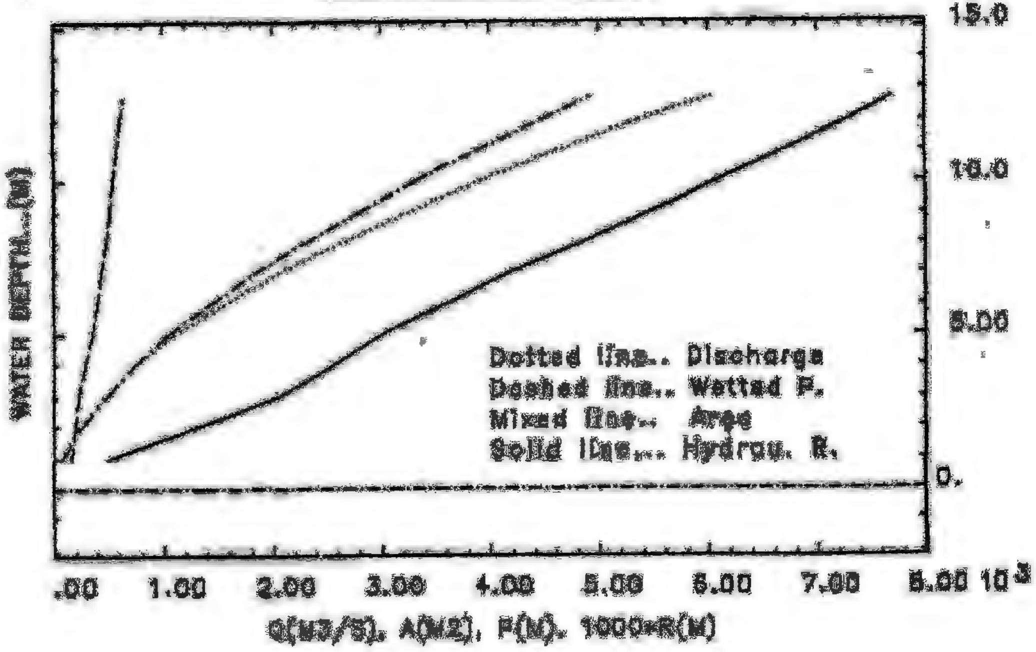


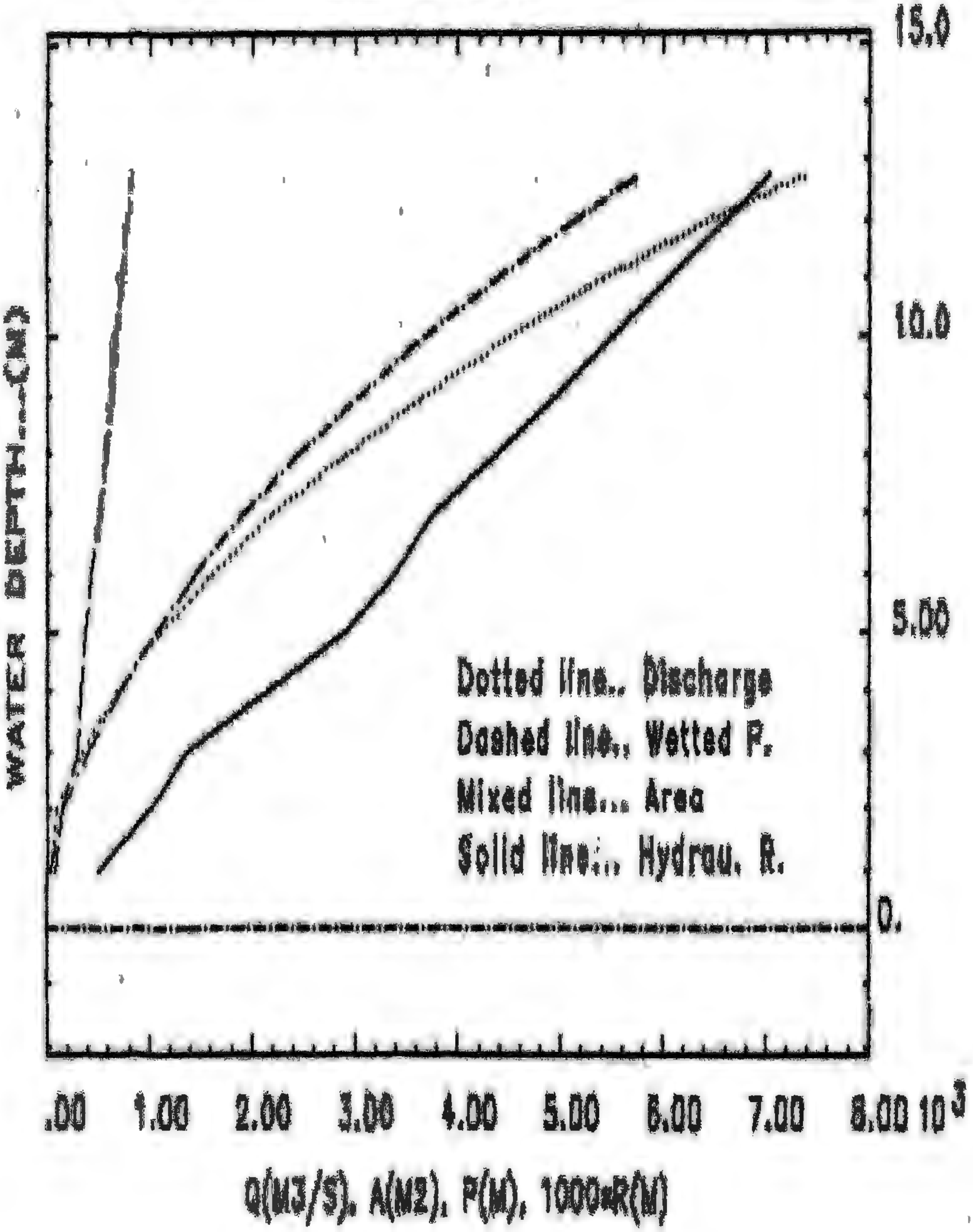
FIGURE 4.5 1

RATING CURVE AND GEOMETRIC CHARAC.
Section..Mateba Central



RATING CURVE AND GEOMETRIC CHARAC.

FIGURE 4.5 a Section..Moteba Aval



5. APPLICATION OF EINSTEIN MODEL TO THE DATA OF ZAIRE RIVER

5.1 TRADITIONAL EINSTEIN PROCEDURE

The procedure calculates sediment transport for different water stages (H) in the cross section as shown in Figure 4.3c. The calculation is ended when the stage corresponding to the total water depth or total discharge is reached.

In order to simplify the application of the model, the procedure of calculations is divided into two parts: (1) the hydraulic calculations and (2) the sediment transport calculations.

5.1.1 HYDRAULIC CALCULATIONS

The necessary data are provided from data file RATING3 (represented in figures 4.5a to 4.5m). Additional data such as diameter of particles, kinematic viscosity of water, gravity, water density, sediment density and slope are included into the main program EINSTEN . The hydraulic calculations were carried out in tabulated form consisting of 23 steps as follows:

STEP 1 : An analysis of the equations shows that the most direct approach is obtained if values of the hydraulic radius with respect to the grain, R', are assumed. Various values are assumed to cover the entire discharge range desired.

STEP 2 : From R' the corresponding friction velocity u'_* is calculated using equation 3.8 .

STEP 3 : The thickness of the laminar sublayer δ' is obtained from equation $\delta' = 11.6 \nu / u'_*$

STEP 4 : With Ks = D65 the values of Ks / δ' are calculated.

STEP 5 : The correction x for the transition from smooth to rough boundaries may be read from graph of figure 3.2 .

STEP 6 : The values of the apparent roughness Δ = Ks/x are calculated.

STEP 7 : The average flow velocity $\bar{U}$ is calculated from equation 3.9

STEP 8 : Next, for the determination of the frictional contribution of the channel irregularities, the parameter ψ' is calculated according to equation

$$\psi' = \frac{\rho_s - \rho}{\rho} \frac{D35}{R' S}$$

The parameter ψ' is dimensionless.

STEP 9 : From figure 3.3, the values of $\bar{U} / u''_*$ are read for th ψ' values.

STEP 10: The ve due to channel irregularities, u''_* is cal

STEP 11: The hydraulic radius with respect to channel irregularities, (R") is calculated from equation (3.6).

STEP 12: The two components R' and R" are usually the only components of the hydraulic radius R and it is calculated from equation (3.4) .

STEP 13: The total shear velocity is calculated from equation $u_* = \sqrt{g.R.S}$

STEP 14: The water elevation (d) is calculated as function of R. $d = a + b.R$; (a, b are constants).

STEP 15: The cross section area is obtained from description of the section for a given d (see figure 4.5).

STEP 16: The wetted perimeter is obtained from description of the cross section for a given d (see figure 4.5).

STEP 17: The flow discharge (Q) is obtained from the rating curve of figure 4.5, for a given d .

STEP 18: The calculated discharge (Q_1) is obtained from equation: $Q_1 = \bar{u}.A$.

STEP 19: The characteristic distance X is calculated from equati[illegible] .

STEP 20: The pressur[illegible]ction term Y is calculate from figure 3.6

STEP 21: β_x (logarithmic [illegible]ction) is equal to : $\beta_x = \text{Log}(10.6\ X/\Delta)$. See equation 3.23

STEP 22: The value of $(\beta / \beta_x)^2$ is calculated with $\beta = \text{Log}(10.6)$

STEP 23: The Einstein's Transport parameter PE is calculated from equation 3.52 .

3.1.2 SEDIMENT TRANSPORT CALCULATION

The sediment transport is calculated for the individual grain size fractions of the bed and for the entire range of discharges. In this respect, it is advantageous to distinguish in a separate table the steps which are common to all grain sizes and those which must be performed separately for each grain size. As the calculation of transport rate is performed for the flow rates given in Hydraulic Calculations it is convenient to summarize the calculation as follows:

STEP 1 : The representative grain sizes are chosen at the geometric mean of the two size limits of each sieve fraction (D) .

STEP 2 : The fraction i_b of the bed material for the same sieve fraction is determined as an average of all bed samples available for the river.

STEP 3 : The same R' values are used as in hydraulics calculations.

STEP 4 : Next, ψ is calculated using equation 3.23 .

STEP 5 : The ratio D/X is calculated for X given in step 19 of Hydraulic calculations.

STEP 6 : The ξ values are read from figure 3.8 in terms of D/X (ξ ,is called hiding factor).

STEP 7 : The parameter ψ_* ,intensity of shear for individual grain size, is calculated according to equation 3.26 .

STEP 8 : The intensity of transport for individual grain size ϕ_* is read in function of ψ_* from figure 3.7

STEP 9 : The bed-load rate $i_B.q_B$ is calculated from ϕ_* using equations (3.15) and (3.16) in the form

$$i_B.q_B = \phi_* . i_b . \rho_s . g^{3/2} . D^{3/2} \left(\frac{\rho_s - \rho}{\rho} \right)^{1/2} \text{ in } \left(\frac{\text{Newton}}{\text{m.sec.}}\right)$$

to convert in (Ton/m.day), we multiply by 86.4/9.81 .

STEP 10: $i_B.Q_B$,bed-load rate in weight per unit time for entire cross section $i_B.Q_B = i_B.q_B.P$

STEP 11: $\sum i_B.Q_B$ Bed load rate for all size fractions.

STEP 12: A_E is calculated as $A_E = 2D/d$

STEP 13: W_s the settling velocity is read from figure 3.4 .

STEP 14: The exponent z is calculated according to equation $z = W/0.4u'_*$

STEP 15: The integral I_1 is calculated from equation 3.47 as function of A_E and z. Also may be read from figure 3.8 .

STEP 16: The integral I_2 is calculated from equation 3.47 as function of A_E and z. Also may be read from figure 3.9 .

STEP 17: The expression $(PE.I_1 + I_2)$, is calculated.

STEP 18: The suspended sediment transport per unit width and time for a size fraction is calculated according the equation:

$i_s.q_s = i_B.q_B(PE.I_1 + I_2)$

STEP 19: The suspended sediment transport per unit time for a size fraction is calculated :

$i_s \cdot Q_s = i_s \cdot q_s \cdot P$ (P = wetted perimeter)

STEP 20: The total suspended sediment transport per unit time for all size fractions is calculated $\sum i_s \cdot Q_s$

STEP 21: The total sediment rate (bed-load plus suspended load) is calculated by summation of the values calculated in step 11 and step 20.

$$\sum i_T \cdot Q_T = \sum i_B \cdot Q_B + \sum i_s \cdot Q_s$$

TABLE 5.1 RELATIONSHIP BETWEEN THE SYMBOLS USED IN ANALYTICAL FORMULAS AND COMPUTER PROGRAM

HYDRAULIC CALCULATIONS

STEP	FORMULAS	PROGRAM	UNITS	REMARK
1	R'	R1	m	Assumed
2	u'_*	U1	m/s	$u'_* = \sqrt{g.R'.S}$
3	δ	DELTA1	m	$\delta = 11.6\nu/u'_*$
4	Ks/δ	M	-	with Ks = D65
5	x	X1	-	figure 3.2
6	Δ	DELTA2	m	$\Delta = Ks/x$
7	$\bar{u}$	U	m/s	equation 3.9
8	ψ'	C	-	$\psi' = (\rho_s - \rho) D35/\rho R'.S$
9	$\bar{u}/u''_*$	M2	-	figure 3.3
10	u''_*	U2	m/s	$u''_* = \bar{u}/f(\psi')$
11	R''	R2	m	$R'' = (u''_*)^2/gS$
12	R	R	m	$R = R' + R''$
13	u_*	UC	m/s	$u_* = \sqrt{g.R.S}$
14	d	H	m	$d = a + b.R$
15	A	A	m^2	figure 4.5
16	P	P	m	figure 4.5
17	Q	Q	m^3/s	figure 4.5
18	$Q1$	Q1	m^3/s	$Q1 = \bar{u}.A$
19	X	X2	m	equation 3.19
20	Y	Y	-	figure 3.6
21	β_x	BX	-	$\beta_x = Log(10.6X/\Delta)$
22	$(\beta/\beta_x)^2$	BB	-	with $\beta = Log10.6$
23	PE	PE	-	equation 3.52

TABLE 5.2 RELATIONSHIP BETWEEN THE SYMBOLS USED IN ANALYTICAL FORMULAS AND COMPUTER PROGRAM

SEDIMENT TRANSPORT CALCULATION

STEP	FORMULAS	PROGRAM	UNITS	REMARK
1	D	D	m	data
2	i_b	FBM	-	data
3	R'	R1	m	assumed
4	ψ	ISAP2	-	equation 3.23
5	D/X	DD	-	-
6	ξ	FF	-	read from fig. 3.5
7	ψ_*	ISIG	-	equation 3.26
8	ϕ_*	ISIIG	-	read from fig. 3.7
9	$i_B \cdot q_B$	BLSF	Ton/m.day	see step 9
10	$i_B \cdot Q_B$	BLEC	Ton/day	$i_B \cdot Q_B = i_B \cdot q_B \cdot P$
11	$\sum i_B \cdot Q_B$	TBLEC	Ton/day	-
12	A_E	AE	-	$A_E = 2D/d$
13	w	W	cm/sec	read from fig. 5.4
14	z	Z	-	$z = w/0.40u'_*$
15	I_1	FI1	-	equation 3.47
16	I_2	FI2	-	equation 3.47
17	$P_E \cdot I_1 + I_2$	IST	-	-
18	$i_s \cdot q_s$	BMLSF	Ton/m.day	$i_s q_s = i_B q_B (P_E I_1 + I_2)$
19	$i_s \cdot Q_s$	BMREC	Ton/day	$i_s Q_s = i_s q_s \cdot P$
20	$\sum i_s \cdot Q_s$	BMRAS	Ton/day	-
21	$\sum i_T \cdot Q_T$	TBLSL	Ton/day	$\sum i_T Q_T = \sum i_B Q_B + \sum i_s Q_s$

5.2 TWO-DIMENSIONAL APPROACH

5.2.1 CALCULATION OF MEAN VELOCITY

The mean velocity at each vertical for a given cross section was calculated considering a panel as shown in figure 4.3d. For each panel the discharge and the area were calculated through the computer program RATING and the mean velocity was obtained according to the following relation:

$$U = Q / A$$

in each vertical.

5.2.2 CALCULATION OF SHEAR VELOCITY

The velocity distribution in a uniform channel flow will become stable when the turbulent boundary layer is fully developed. With the assumption that the mixing length is proportional to water depth and that the shearing stress is constant, Prandt arrived at the following equation:

$$u = 5.75\, u_*.\mathrm{Log}(y) + C$$

Where: u = velocity at any point of the vertical

u_* = shear velocity

y = water depth to the point in consideration

C = constant

When velocity u is plotted against the logarithm of the corresponding depth, the gradient of the graph will be $5.75u_*$ and u_* = gradient/5.75

These calculations were made through the computer program RATING and the results are presented on data file

RATING4 (Appendix 10).

5.2.3 CALCULATION OF SEDIMENT TRANSPORT RATE

The necessary data are provided from data file RATING4. The same procedure described in 5.1 was used, as for hydraulic calculations and sediment transport calculations.

The additional data mentioned in 4.2 are included in the computer program EINSTE1, which performs the calculations for 127 verticals (13 cross sections). The results are presented in appendix 14.

5.3 GENERAL DESCRIPTION OF COMPUTER PROGRAMS

a.- PROGRAM CHANGE:

This program transforms the data obtained from original data base and feed it to the computer program RATING.

The most important change made to the data is the transformation of the coordinates in distance from right bank to each vertical as shown in data file ZADATA1 and ZADATA2 (appendix 3 and 5).

b.- PROGRAM RATING:

This is the most important program in transforming the data on file ZADATA2 into different ways. At the first time the values of I and V are transformed into Z1 and Q, then in values of H1 and Q and finally in H and Q for the entire cross section. The Figures 4.3a to 4.3d shown the sequential procedure on how the program RATING transforms the data on file ZADATA2 in the usefull way which are represented in the file RATING3. This transformation uses the computer program

EINSTEN.

Finally, the program calculates the requirement data for the program EINSTE1 which was developed to calculate the sediment transport in two-dimensional approach.

The meaning of Z, Z1, H1, H, V and Q were discussed in 4.2 and the output files RATING1, RATING2, RATING3 and RATING4 are shown in appendices 7, 8, 9 and 10 respectively.

c.- PROGRAM EINSTEN:

This computer program is used to calculate the sediment transport rate in the traditional way. It has the following structure:

- INPUT FILE: RATING3

  This file contains the hydraulic and geometric characteristic data of 13 cross sections as described in 4.2(g). As the program runs interactively some additional informations are given during the time of running. These informations are tabulated in table 5.3 .

- OUTPUT FILE:

  SEDIM1 : Results of the application of Einstein model

  SEDIM2 : Data file for plott program.

  perform: /Save,SEDIM2 = SEDPL1, in case of cross section Amont Oiseaux 1.

TABLE 5.3 ADDITIONAL INFORMATION REQUIRED BY THE COMPUTER PROGRAM EINSTEN

cross section	water depth HT	slope S	increment of R1 DIF
Amont Oiseaux 1	12.20	0.000064	0.15
Amont Oiseaux 2	9.04	0.000071	0.15
Oiseaux Nord 1	17.58	0.0000386	0.25
Oiseaux Nord 2	14.04	0.000053	0.20
Barraje 1	14.04	0.000053	0.20
Barraje 2	14.77	0.000068	0.15
Mateba Amont Sud 1	10.09	0.000066	0.15
Mateba Amont Sud 2	8.89	0.000066	0.15
Mateba Sud Mandud	9.69	0.0000503	0.20
Mateba Sud Kapita	18.31	0.0000503	0.20
Mateba Amont	9.05	0.000073	0.10
Mateba Central	12.70	0.000053	0.15
Mateba Aval	12.80	0.000056	0.15

d.- PROGRAM EINSTE1:

This program is used to calculate the sediment transport rate into two-dimensional approach. The calculations are performed for each vertical along the cross sections .

The program was runned considering 4 different energy slopes and 4 different particle diameters (D50) and the result corresponding to the cross sections Mateba Amont, Mateba Central and Mateba Aval are shown in Figures 6.3 and 6.4.

e.- PROGRAM PLSED1:

This program is used for plotting the bed-load and the suspended-load sediment transport for a given cross section.

f.- PROGRAM PLSLOPE:

This program is used for plotting the variation of sediment transport along the cross section for different slopes and different particle diameters.

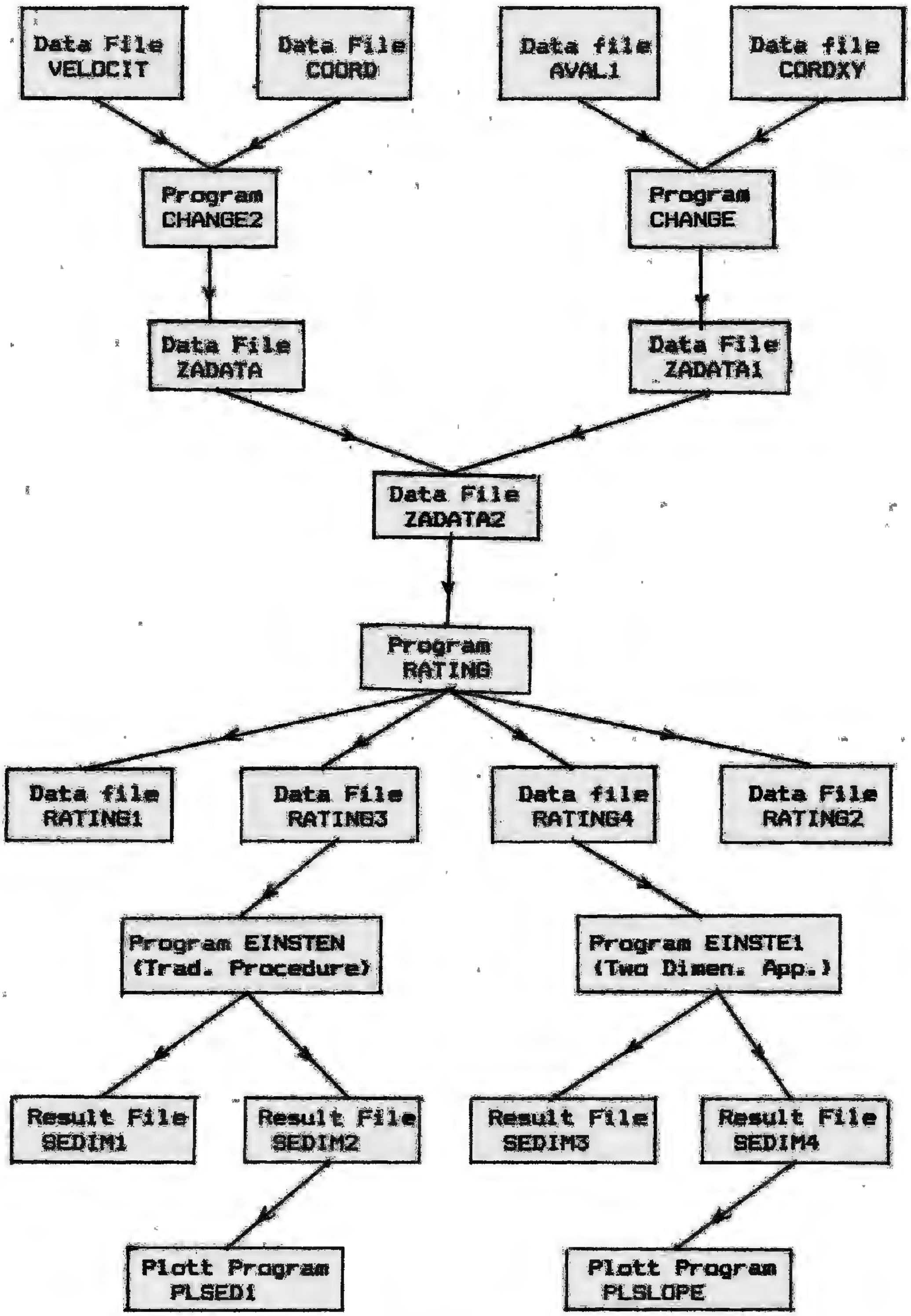


FIGURE 5.1 : FLOWCHART OF EINSTEIN MODEL

6. RESULTS

TABLE : 6.1. RESULTS OF EINSTEIN MODEL

(TRADITIONAL PROCEDURE)

CROSS SECTION	BED-LOAD (Ton/day)	SUSPENDED LOAD (Ton/day)	TOTAL LOAD (Ton/day)
AMONT OISEAUX 1	3,620.047	2,463.456	6,083.504
AMONT OISEAUX 2	13,108.429	8,180.790	21,289.219
OISEAUX NORD 1	3,110.902	2,133.106	5,244.008
OISEAUX NORD 2	9,519.284	5,350.864	14,869.859
BARRAJE 1	5,366.090	3,752.013	9,118.103
BARRAJE 2	9,836.514	5,812.749	15,649.263
MATEBA AMONT SUD 1	3,250.593	1,640.664	4,891.257
MATEBA AMONT SUD 2	7,077.607	4,020.999	11,098.606
MATEBA SUD MANDUD	8,334.358	4,835.455	13,169.813
MATEBA SUD KAPITA	8,840.458	6,407.343	15,247,801
MATEBA AMONT	1,904.103	771.759	2,675.862
MATEBA CENTRAL	3,904.787	2,500.900	6,409.687
MATEBA AVAL	4,051.222	2,310.197	6,361.419

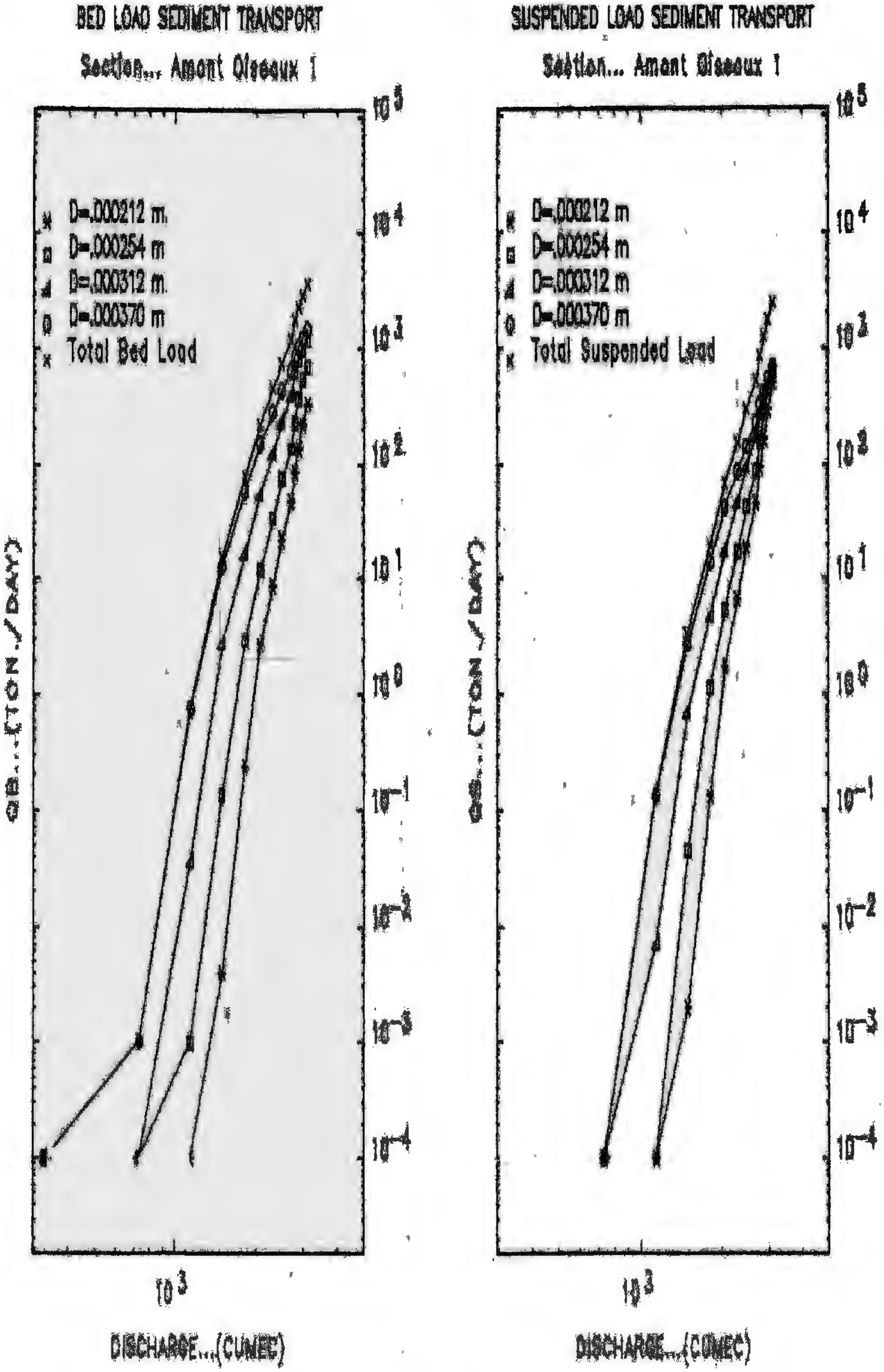
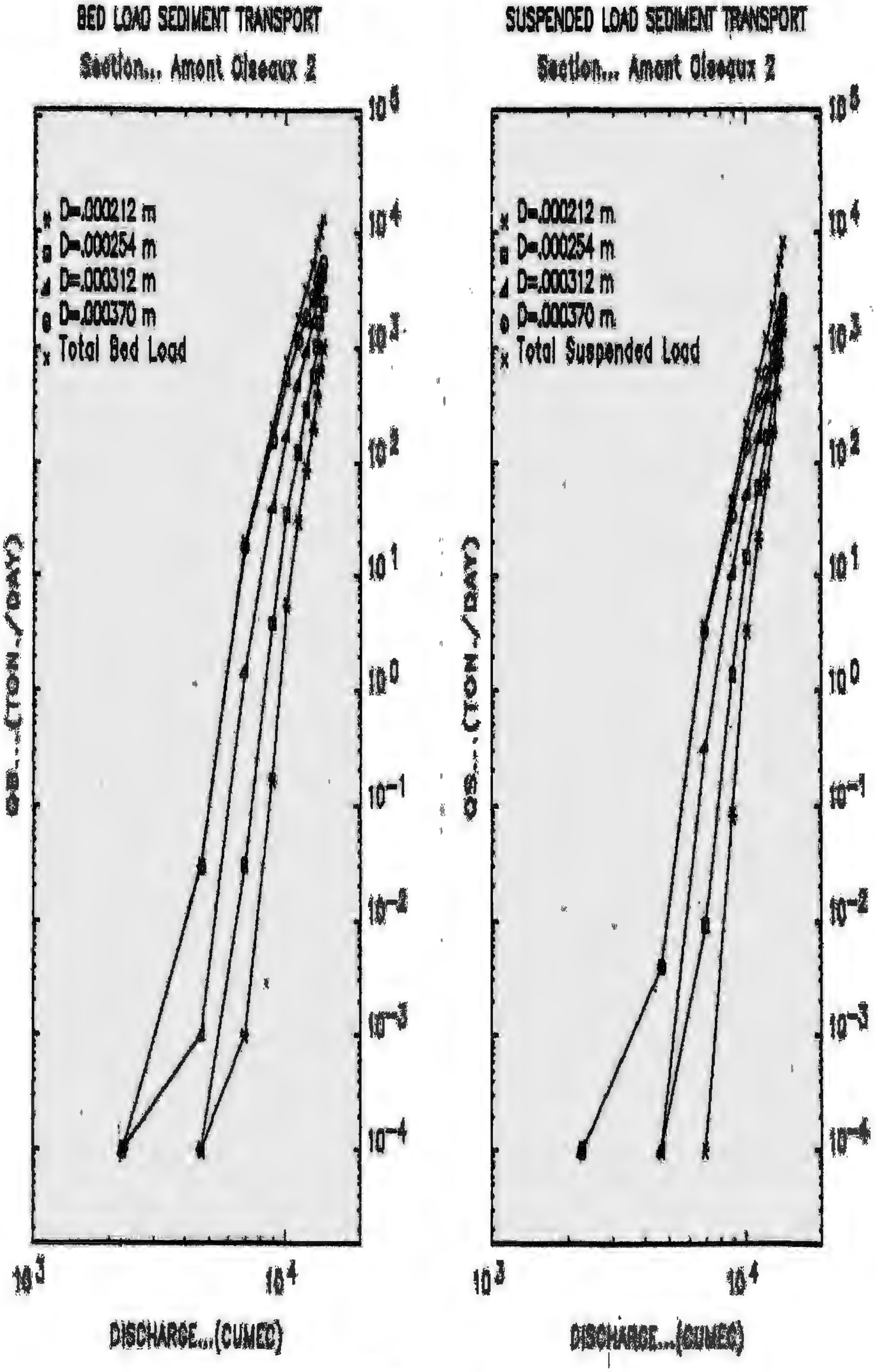

BED LOAD SEDIMENT TRANSPORT
Section... Amont Oiseaux 1
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Bed Load
QB...(TON./DAY)
DISCHARGE...(CUMEC)
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^3
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Amont Oiseaux 1
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
DISCHARGE...(CUMEC)
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^3

FIGURE 6.1 a



BED LOAD SEDIMENT TRANSPORT
Section... Amont Oiseaux 2

SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Amont Oiseaux 2

FIGURE 6.1 b

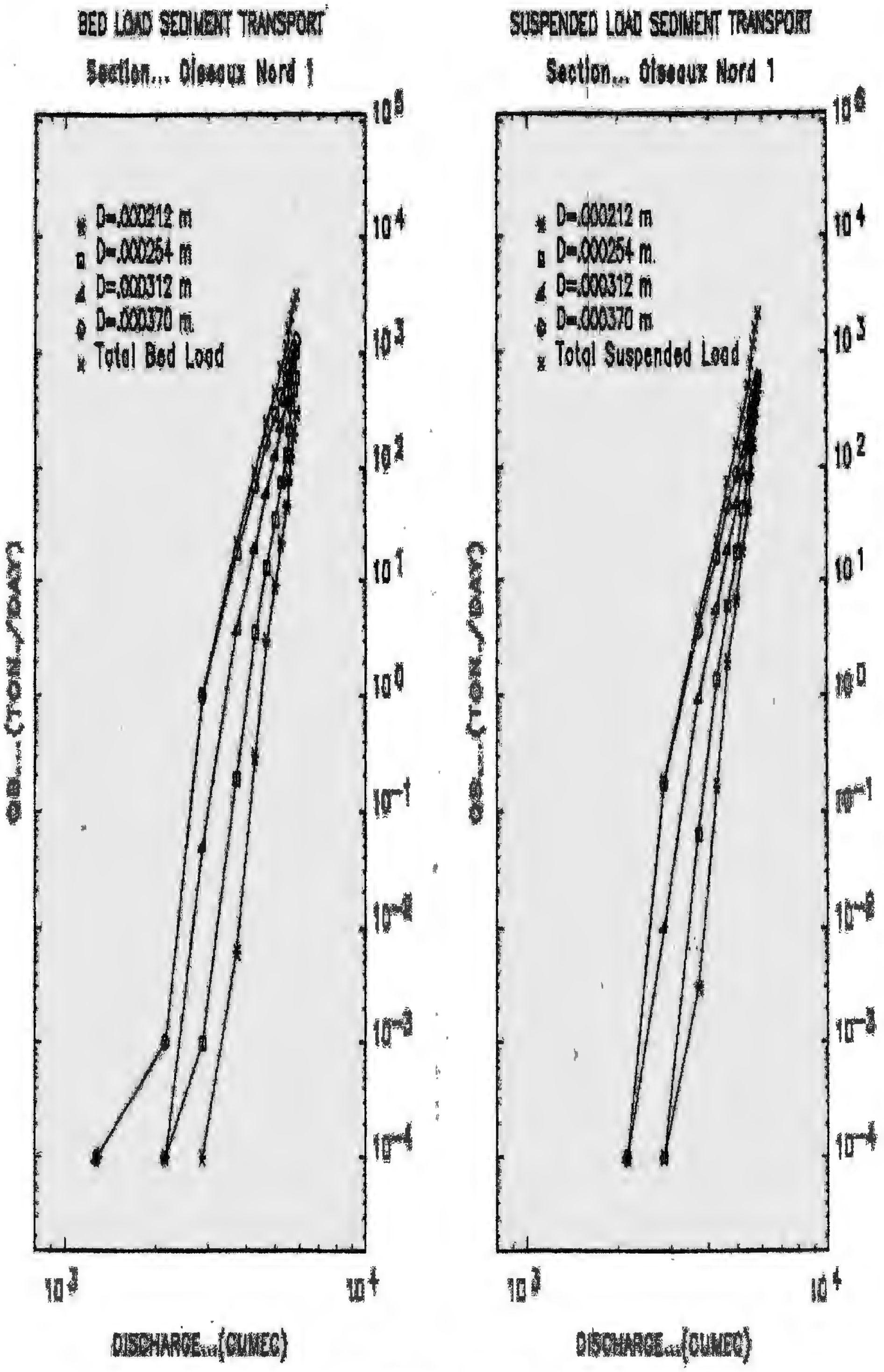
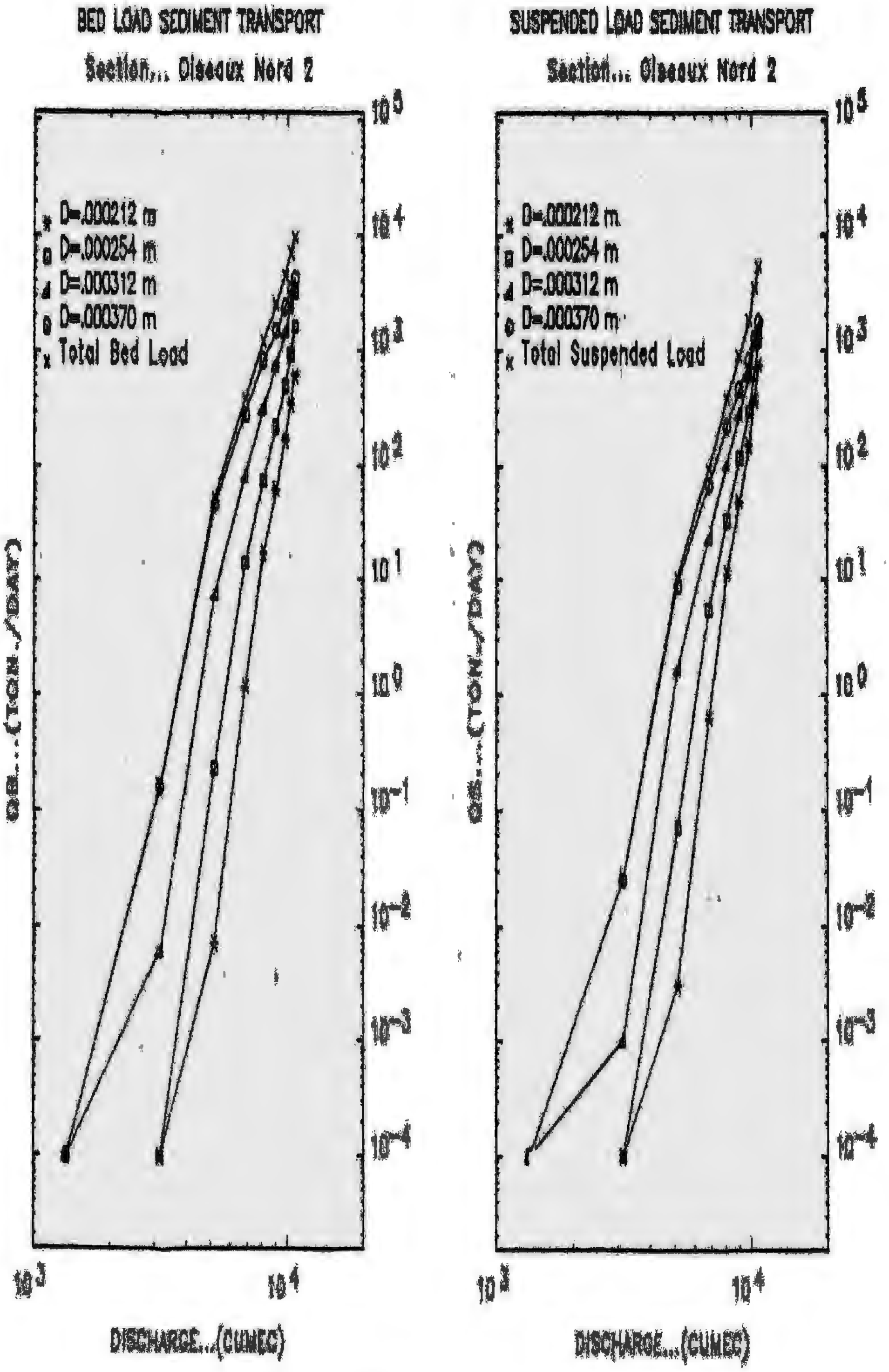

BED LOAD SEDIMENT TRANSPORT
Section... Oiseaux Nord 1
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m.
Total Bed Load
QB...(TON./DAY)
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^3
10^4
DISCHARGE...(CUMEC)
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Oiseaux Nord 1
D=.000212 m
D=.000254 m.
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^3
10^4
DISCHARGE...(CUMEC)

FIGURE 6.1 c



BED LOAD SEDIMENT TRANSPORT
Section... Oiseaux Nord 2

SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Oiseaux Nord 2

FIGURE 6.1 d

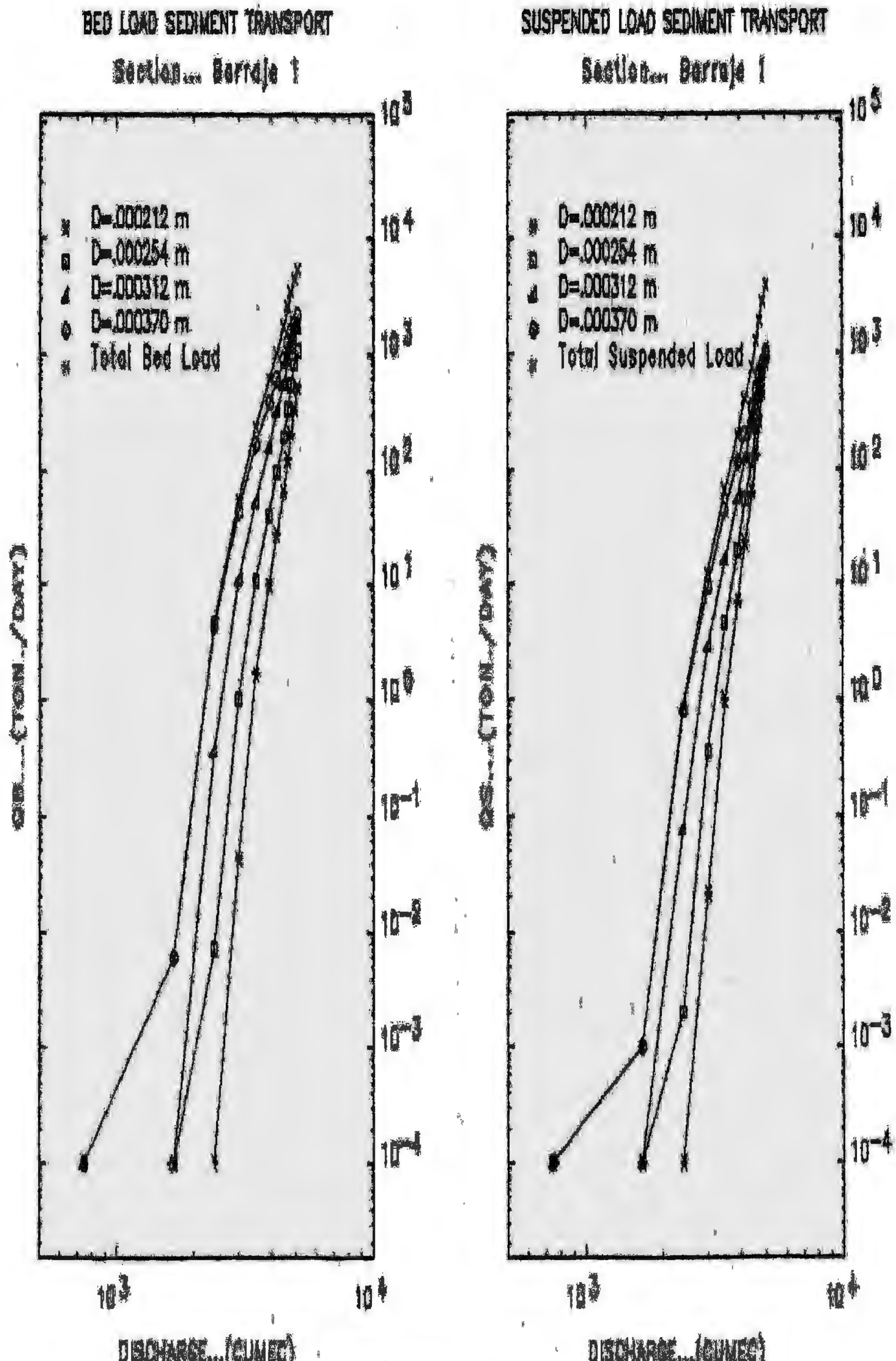

BED LOAD SEDIMENT TRANSPORT
Section... Barraje 1
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Bed Load
GB...(TON./DAY)
DISCHARGE...(CUMEC)
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Barraje 1
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
GS...(TON./DAY)
DISCHARGE...(CUMEC)
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4

FIGURE 6.1 e

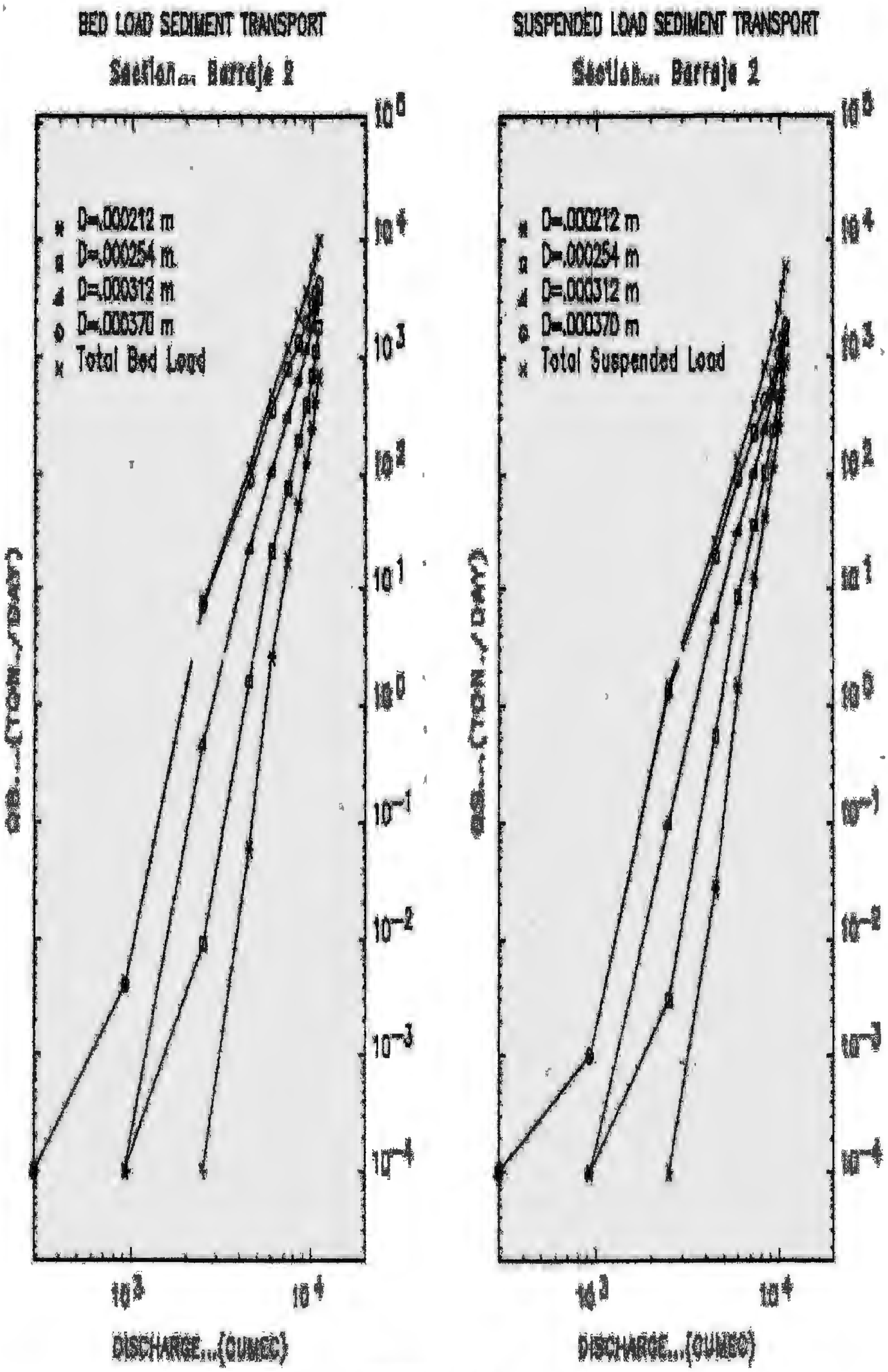
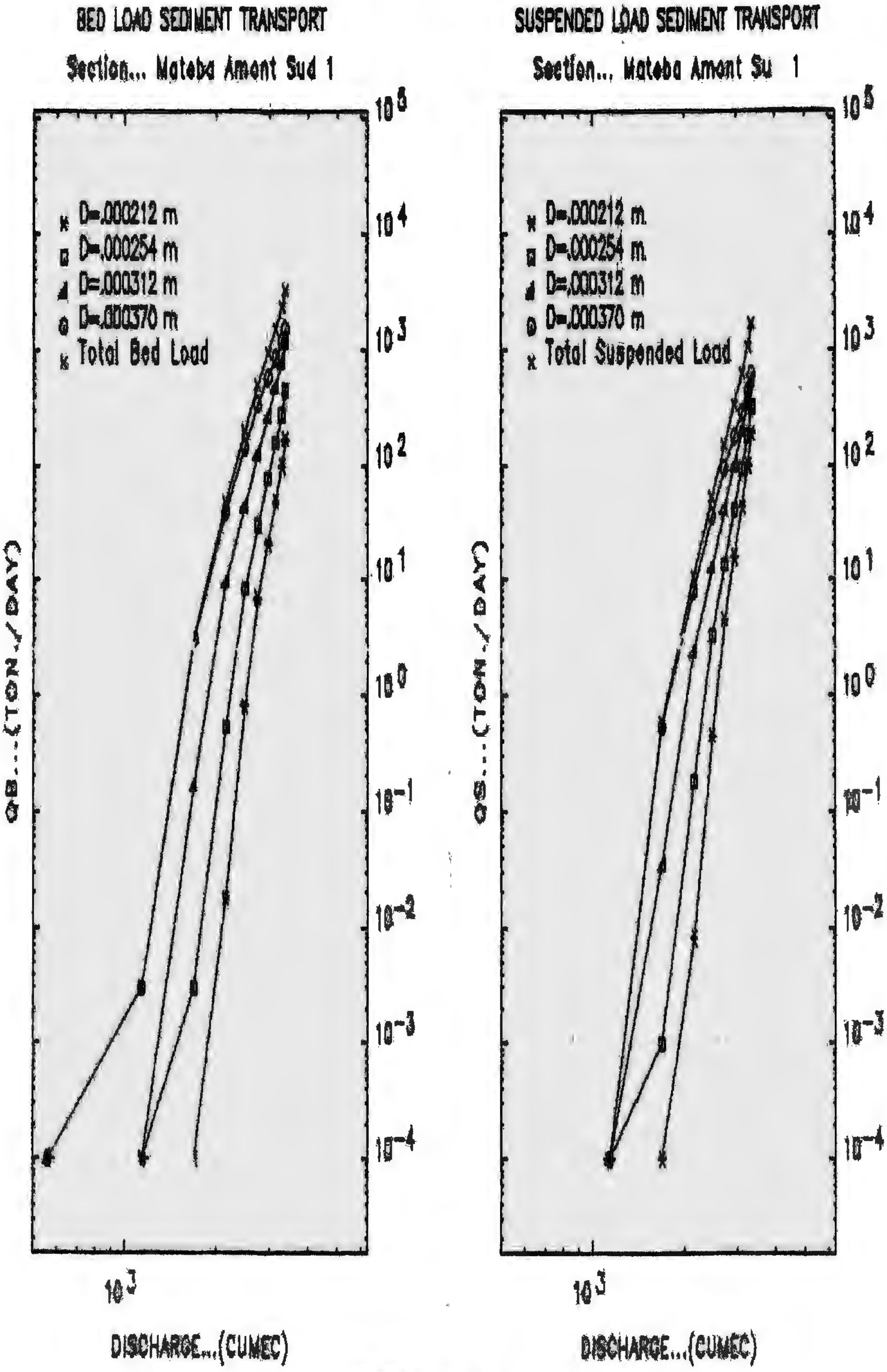

BED LOAD SEDIMENT TRANSPORT
Section... Barraje 2
D=.000212 m
D=.000254 m.
D=.000312 m
D=.000370 m
Total Bed Load
QS...(TON./DAY)
DISCHARGE...(CUMEC)
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Barraje 2
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
DISCHARGE...(CUMEC)
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^3
10^4

FIGURE 6.14



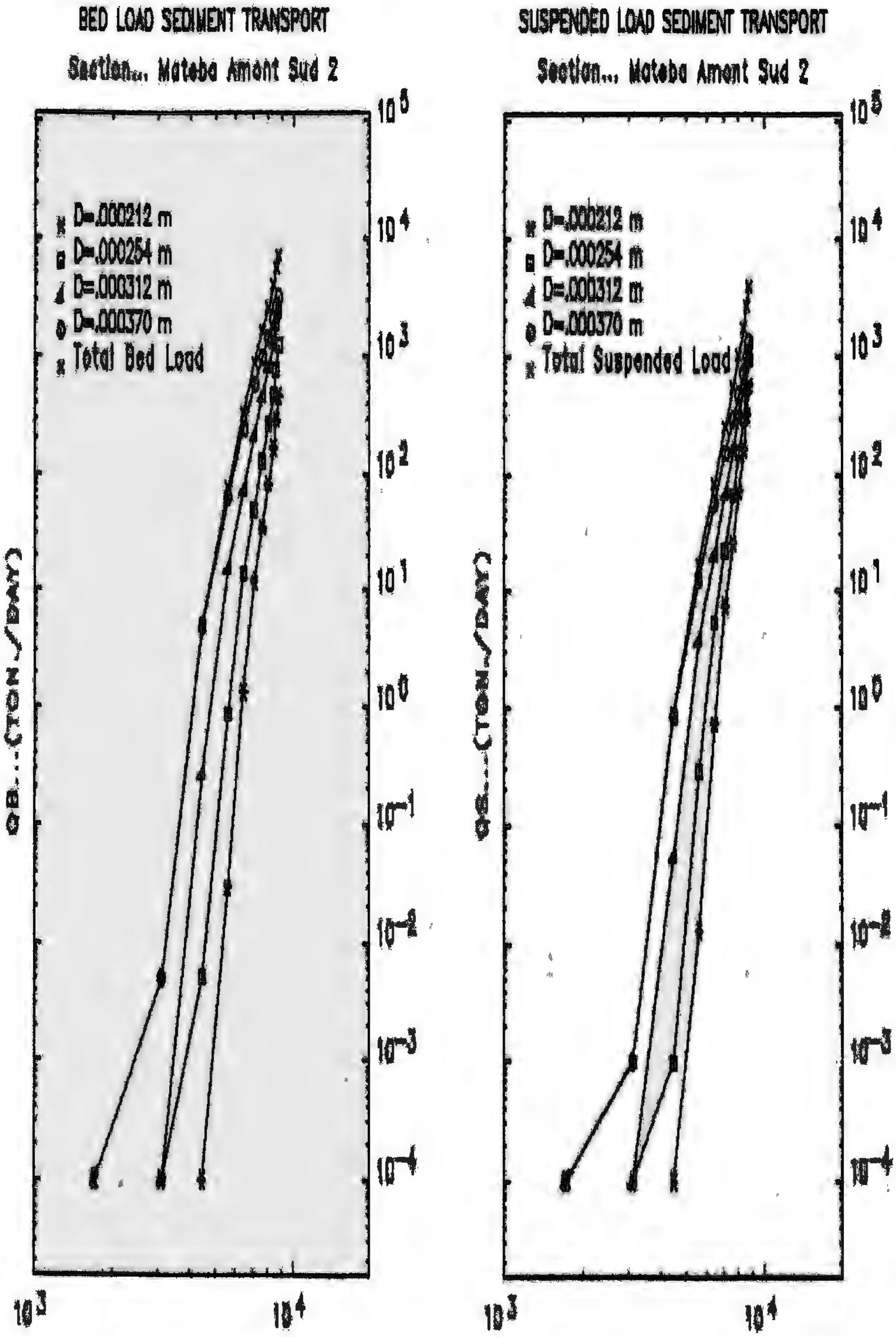
BED LOAD SEDIMENT TRANSPORT

Section... Mateba Amont Sud 1

SUSPENDED LOAD SEDIMENT TRANSPORT

Section... Mateba Amont Su 1

FIGURE 6.1 g



BED LOAD SEDIMENT TRANSPORT

Section... Mateba Amont Sud 2

SUSPENDED LOAD SEDIMENT TRANSPORT

Section... Mateba Amont Sud 2

FIGURE 6.1 h

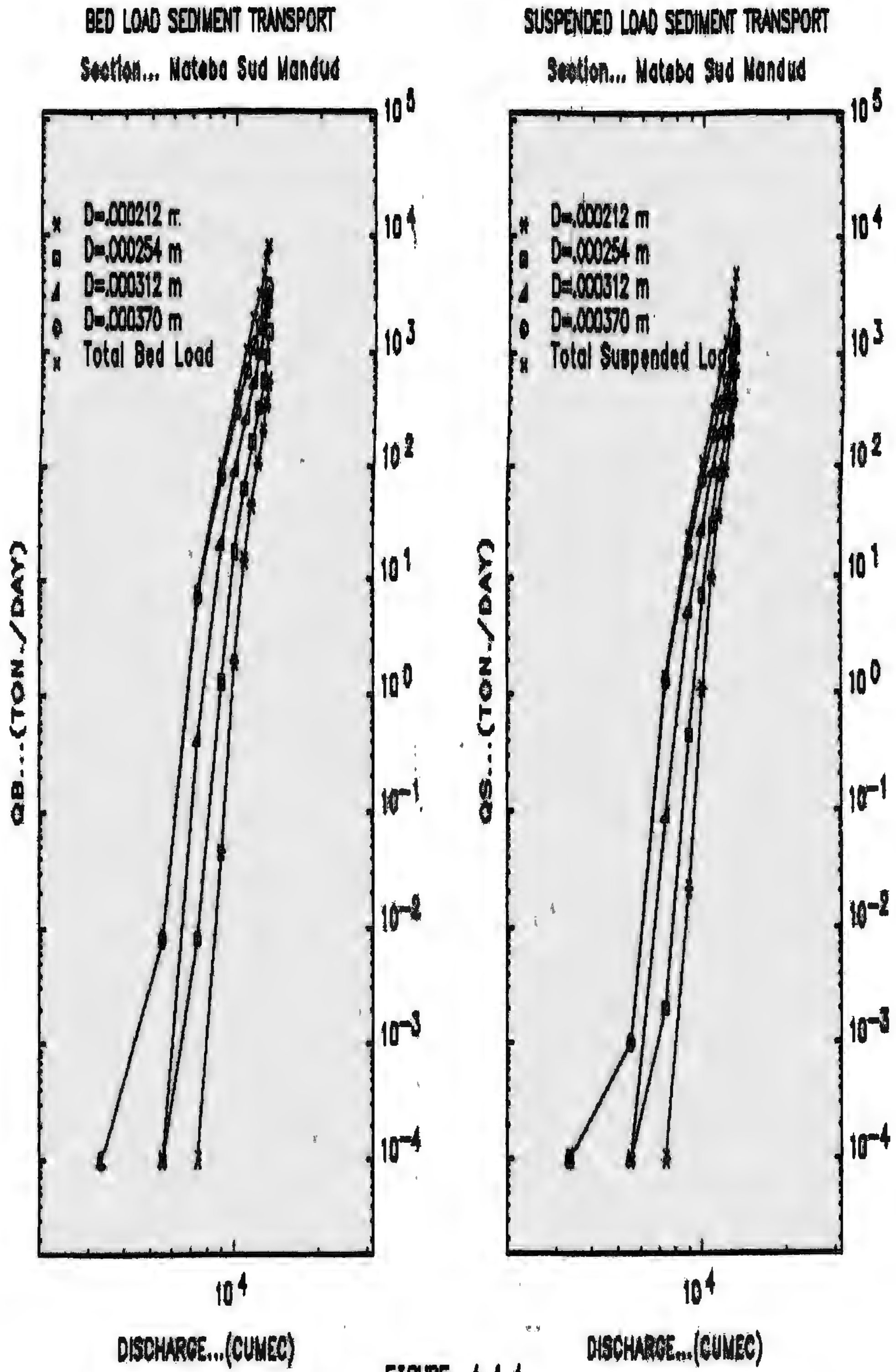

BED LOAD SEDIMENT TRANSPORT
Section... Mateba Sud Mandud
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Bed Load
QB...(TON./DAY)
DISCHARGE...(CUMEC)
10 4
10 5
10 4
10 3
10 2
10 1
10 0
10-1
10-2
10-3
10-4
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Mateba Sud Mandud
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
DISCHARGE...(CUMEC)
10 4

FIGURE 6.1 1

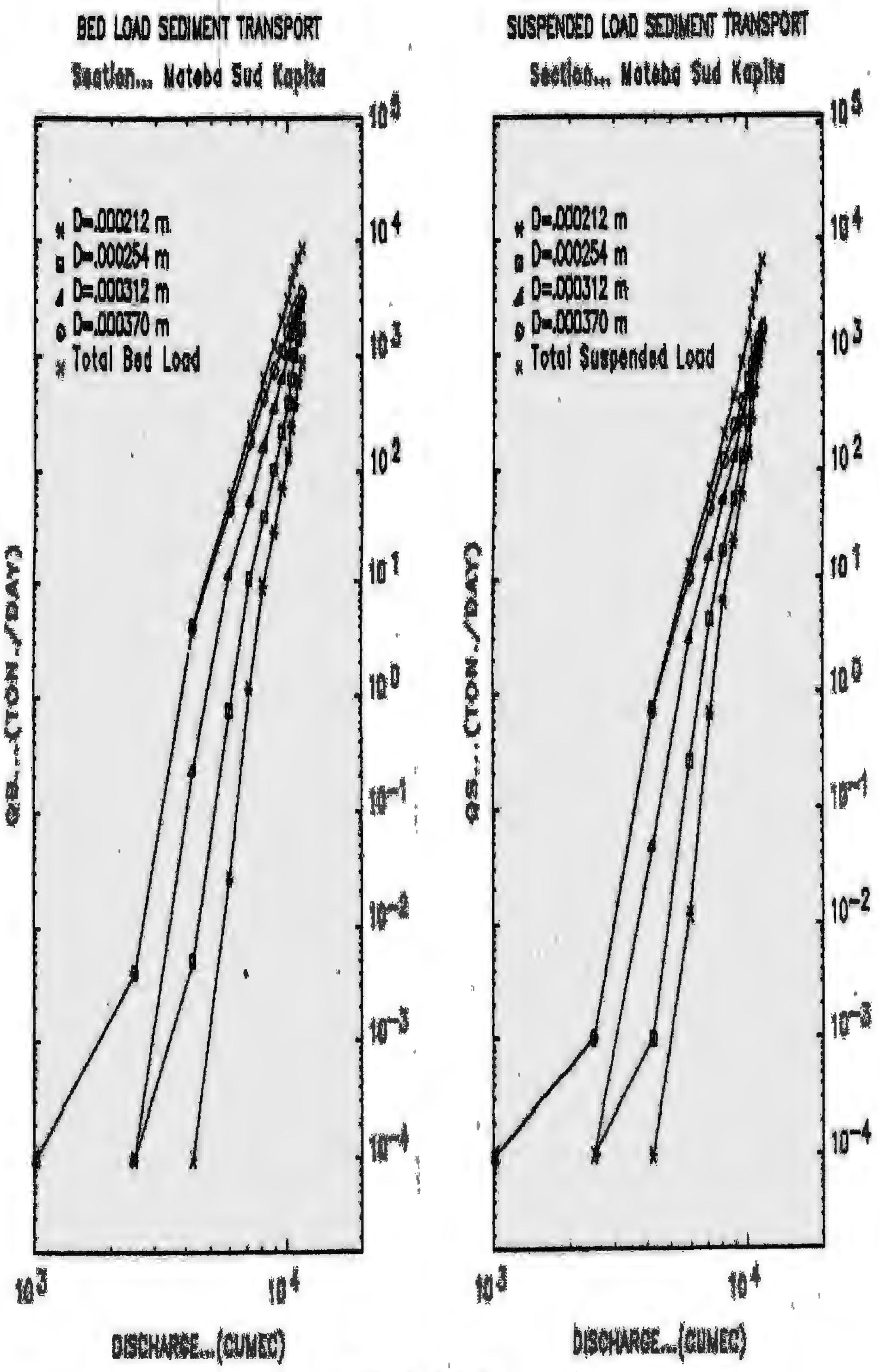
BED LOAD SEDIMENT TRANSPORT
Section... Mateba Sud Kapita
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Bed Load
QS...(TON./DAY)
DISCHARGE...(CUMEC)
10^3
10^4
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Mateba Sud Kapita
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
DISCHARGE...(CUMEC)

FIGURE A.1 1

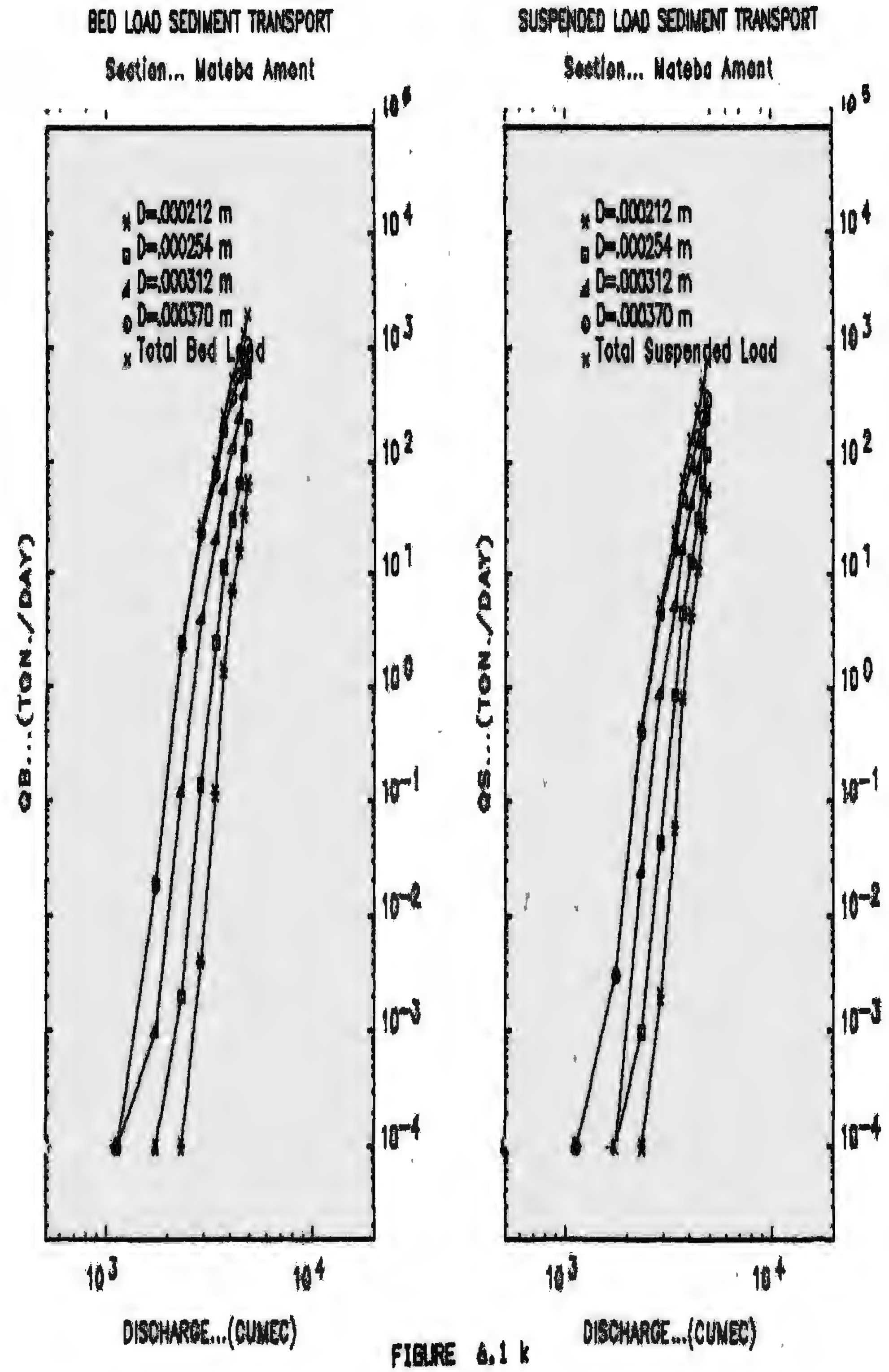

BED LOAD SEDIMENT TRANSPORT
Section... Mateba Ament
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Bed Load
QB...(TON./DAY)
10⁵
10⁴
10³
10²
10¹
10⁰
10⁻¹
10⁻²
10⁻³
10⁻⁴
10³
10⁴
DISCHARGE...(CUMEC)
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Mateba Ament
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
10⁵
10⁴
10³
10²
10¹
10⁰
10⁻¹
10⁻²
10⁻³
10⁻⁴
10³
10⁴
DISCHARGE...(CUMEC)

FIGURE 6.1 k

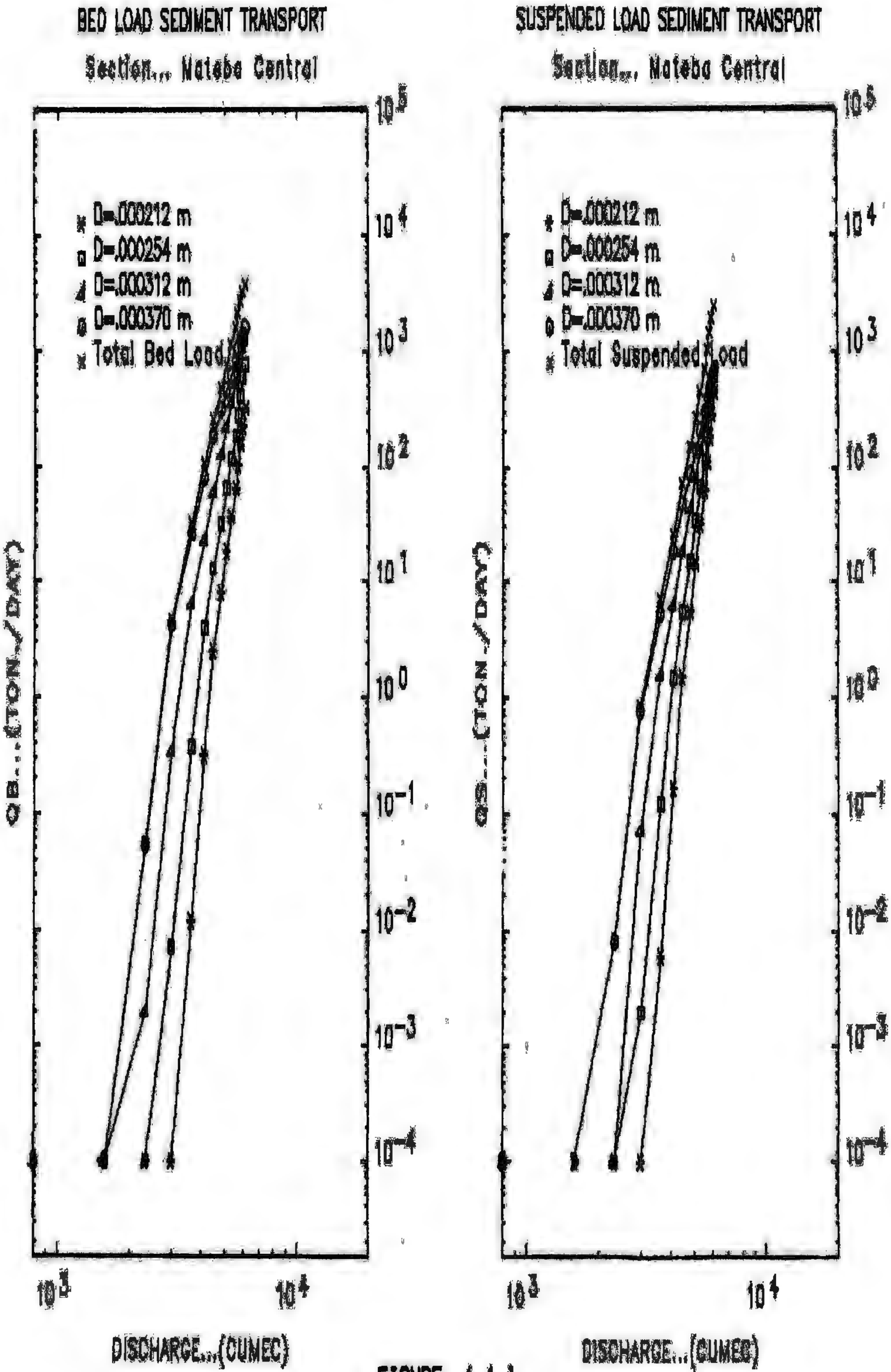

BED LOAD SEDIMENT TRANSPORT
Section... Mateba Central
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Bed Load
QB...(TON./DAY)
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^3
10^4
DISCHARGE...(CUMEC)
SUSPENDED LOAD SEDIMENT TRANSPORT
Section... Mateba Central
D=.000212 m
D=.000254 m
D=.000312 m
D=.000370 m
Total Suspended Load
QS...(TON./DAY)
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^3
10^4
DISCHARGE...(CUMEC)

FIGURE 6.1 1

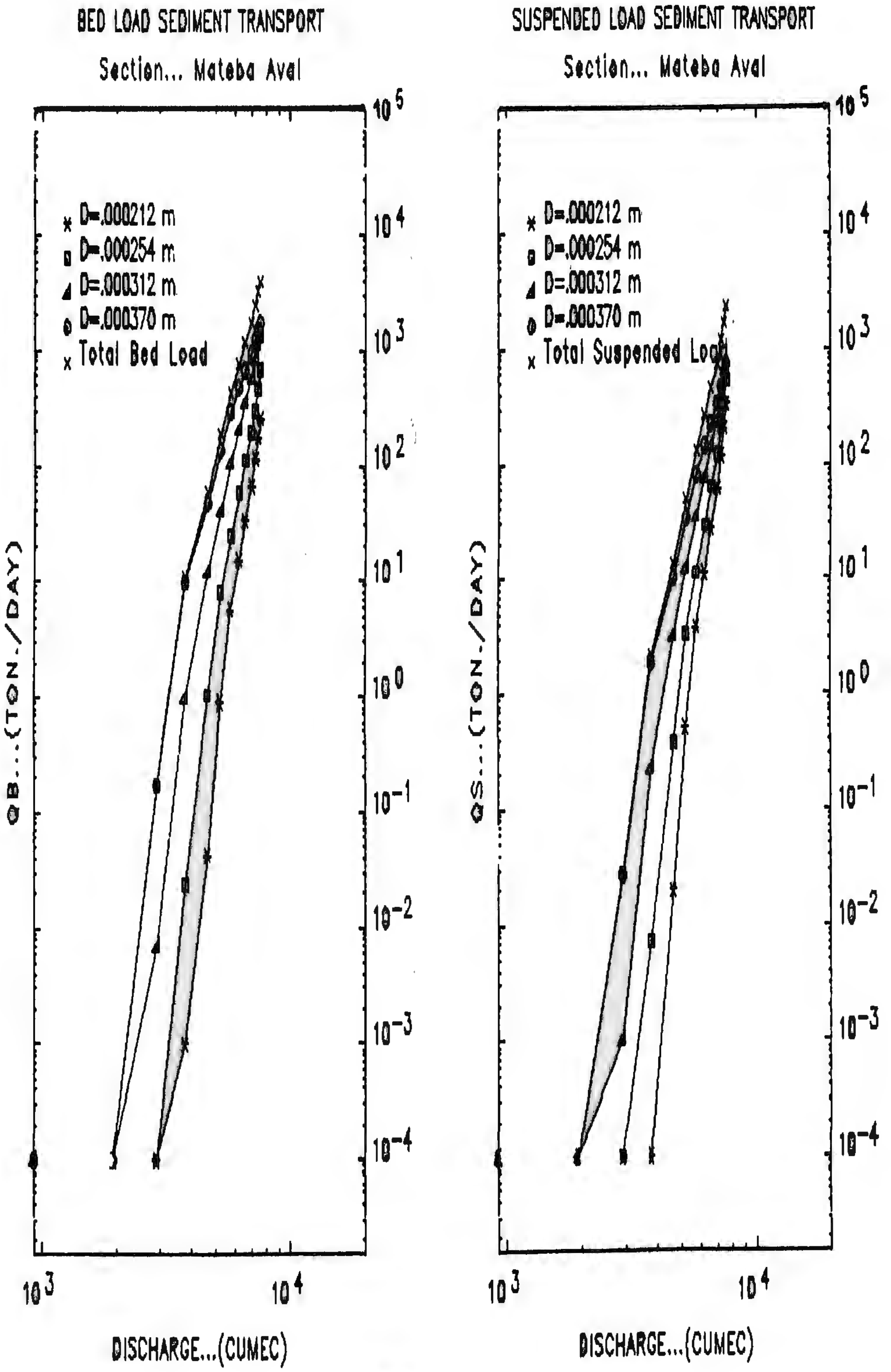


FIGURE 6.2 a VELOCITY VARIATION ALONG THE CROSS SECT.
Section... Mateba Amont

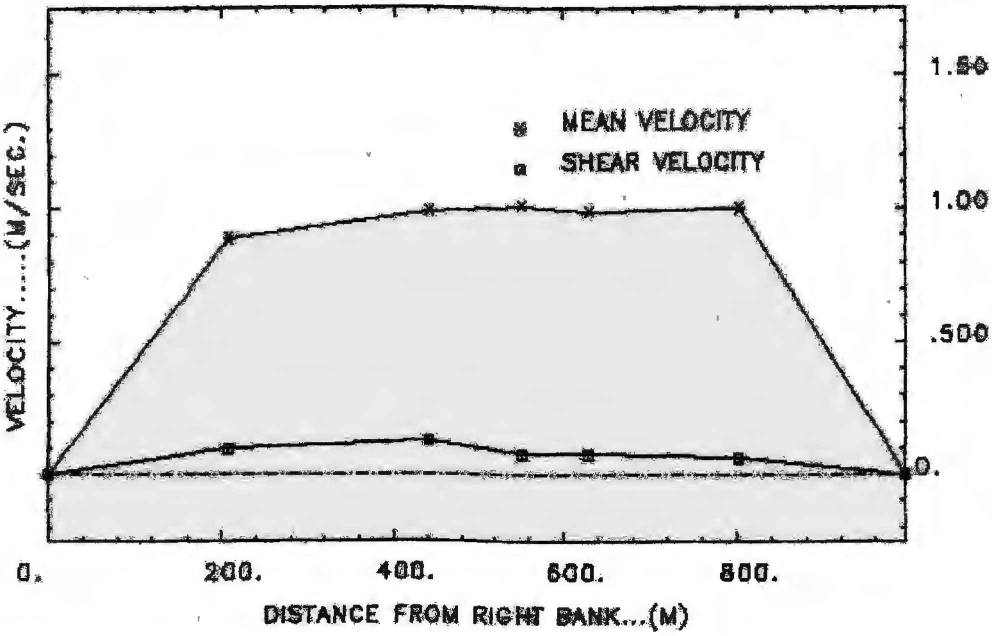
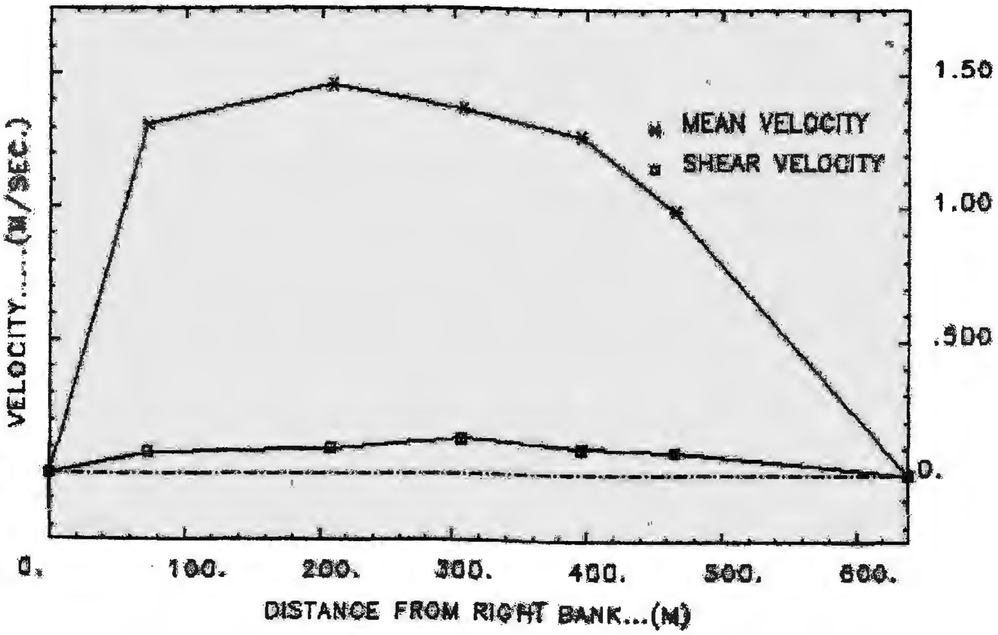


FIGURE 6.2 b VELOCITY VARIATION ALONG THE CROSS SECT.
Section... Mateba Central



VELOCITY VARIATION ALONG THE CROSS SECT.

FIGURE 6.2 c Section....Mateba Aval

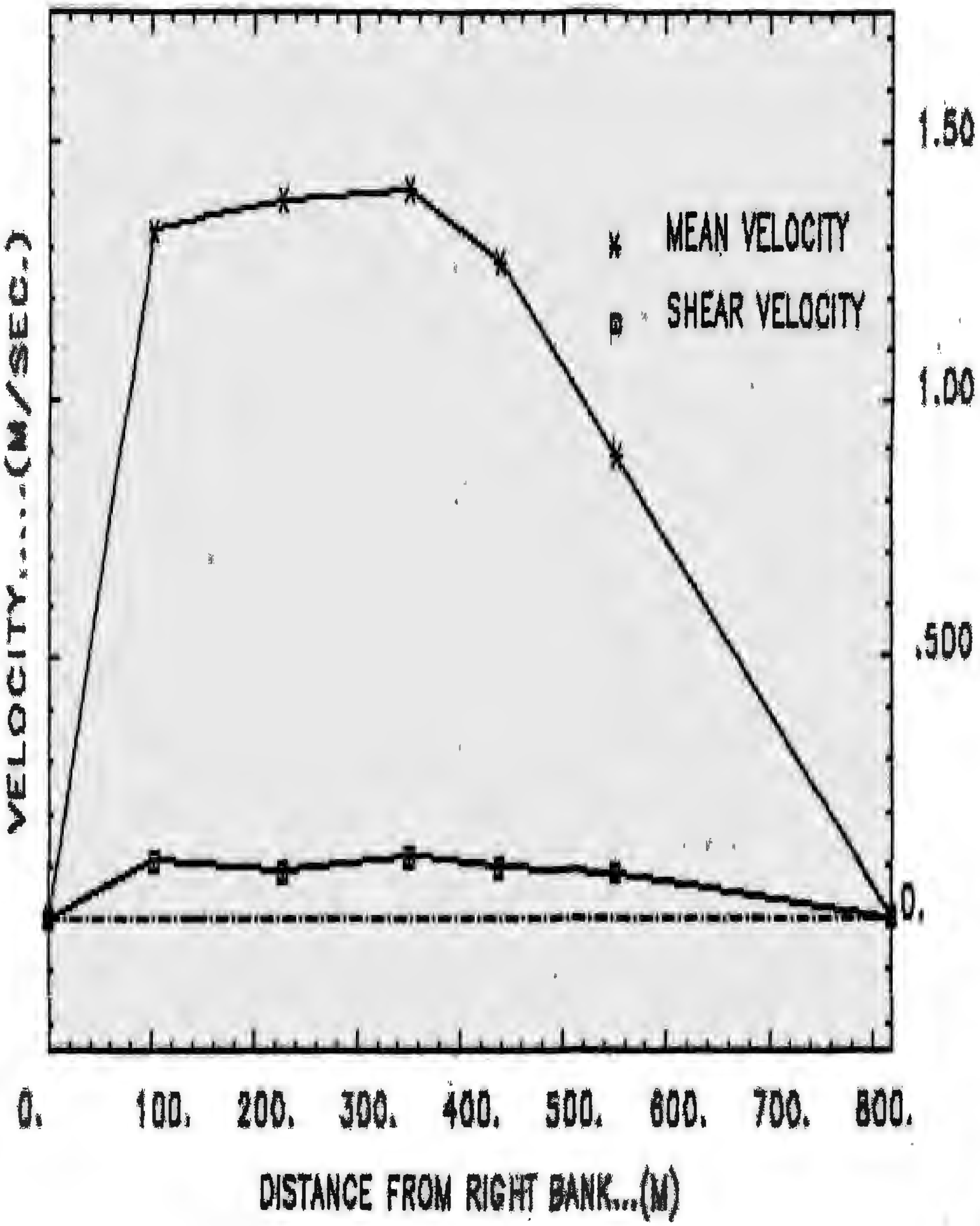


FIGURE 6.3 a SEDIMENT TRANSPORT ALONG THE CROSS SECT.
Section... Matebo Amont

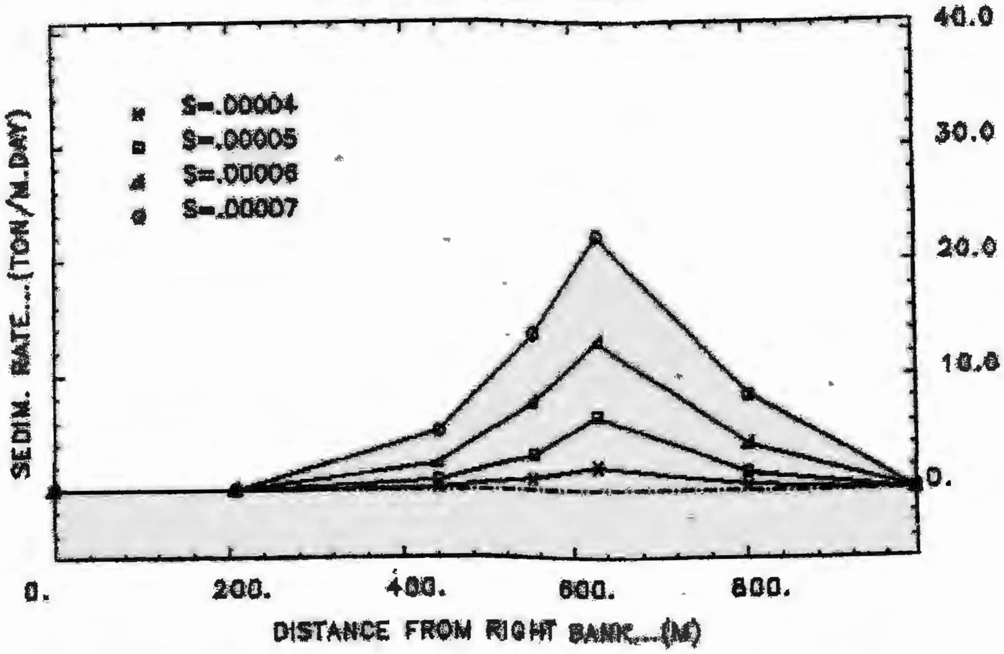


FIGURE 6.3 b SEDIMENT TRANSPORT ALONG THE CROSS SECT.
Section... Matebo Central

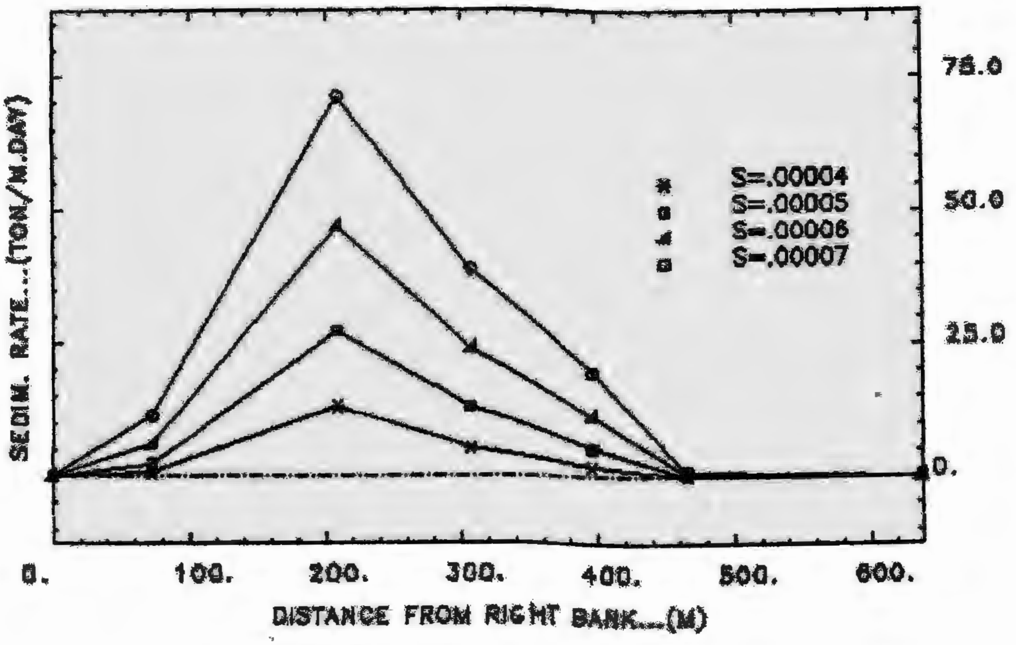


FIGURE 6.3 c SEDIMENT TRANSPORT ALONG THE CROSS SECT.

Section... Mateba Aval

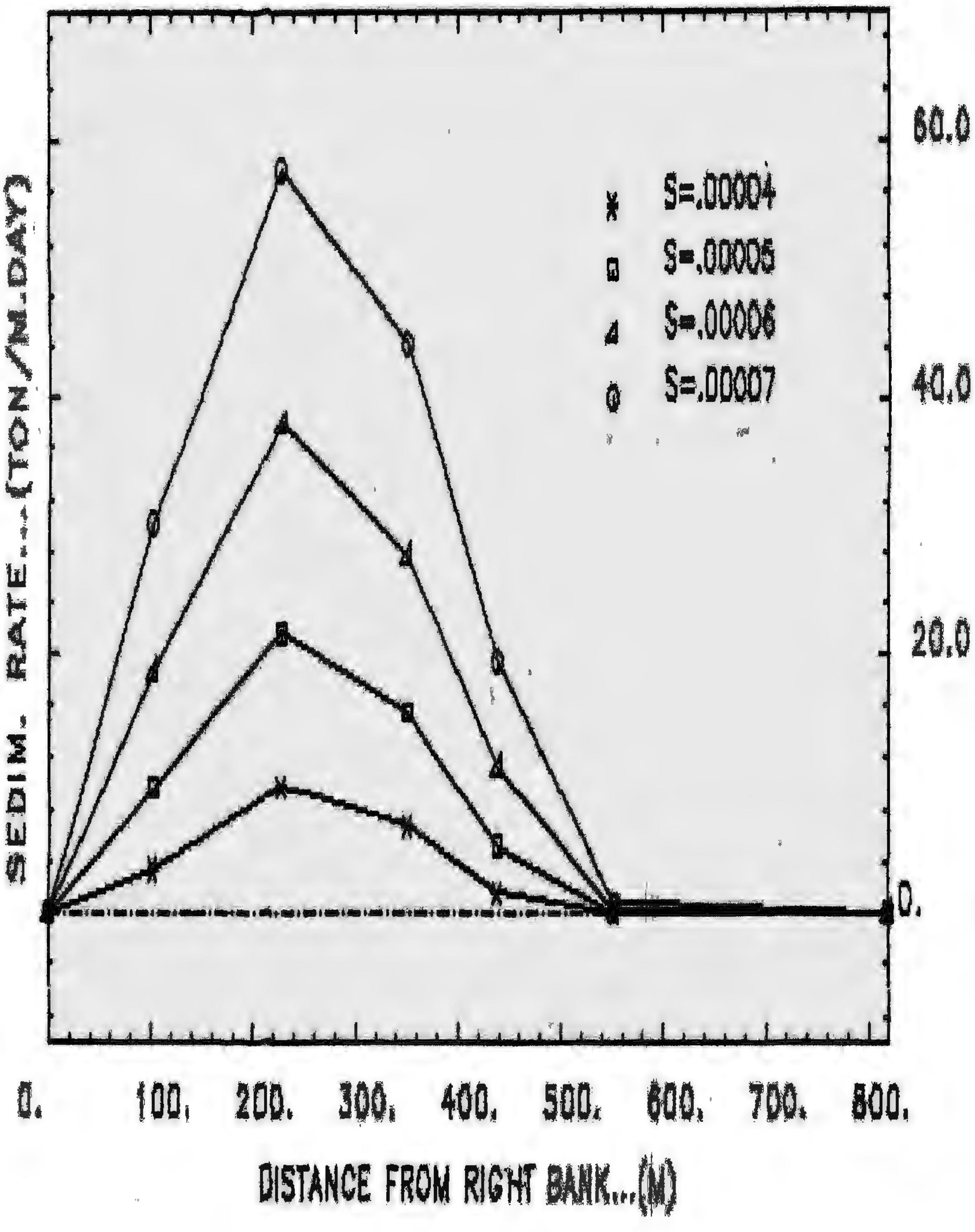


FIGURE 6.4 a SEDIMENT TRANSPORT ALONG THE CROSS SECTI
Section... Mateba Amont

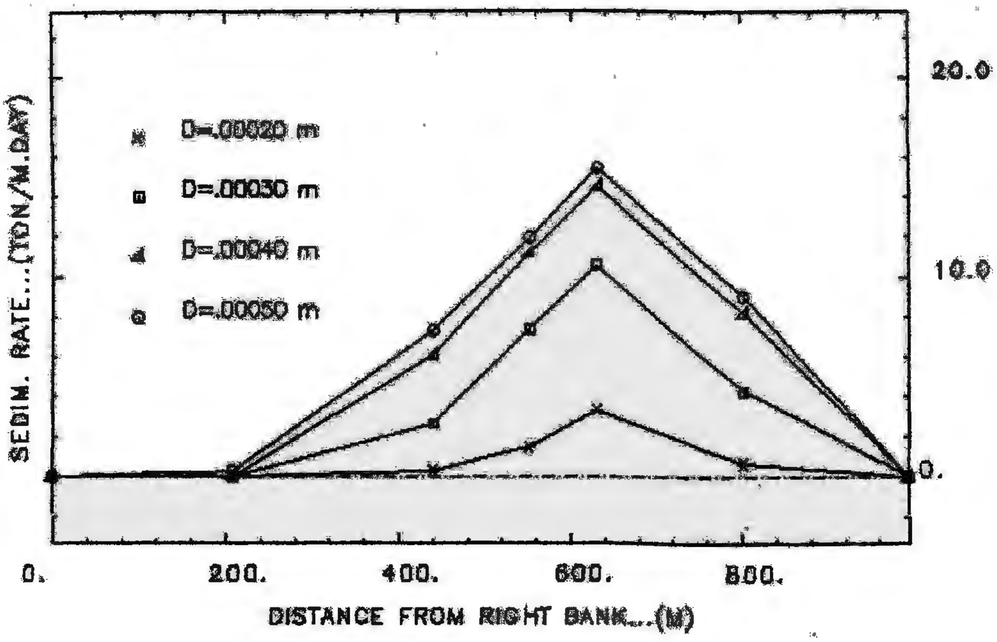


FIGURE 6.4 b SEDIMENT TRANSPORT ALONG THE CROSS SECT.
Section... Mateba Central

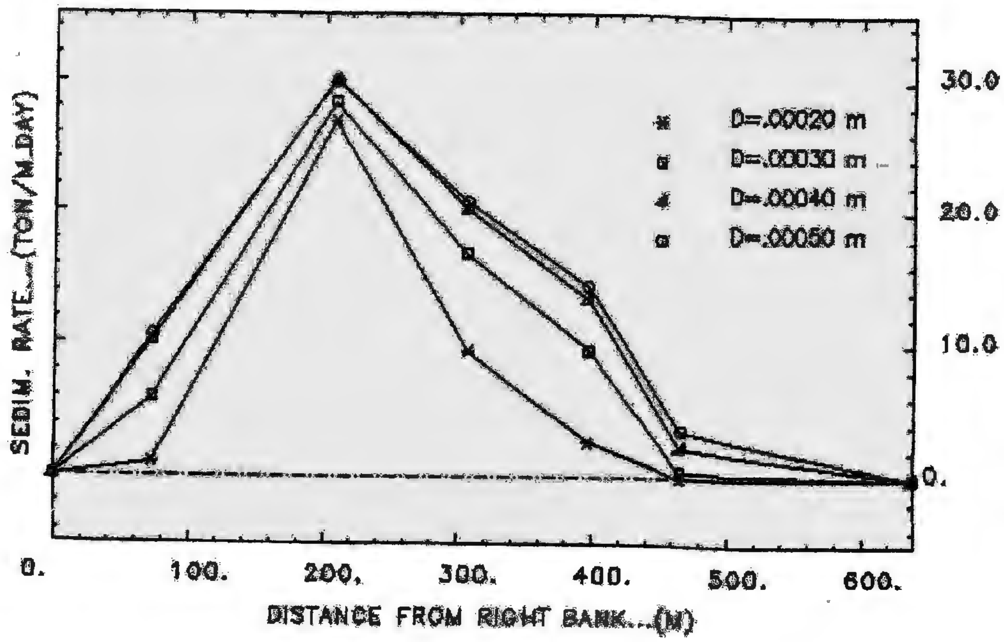


FIGURE 6.4 c SEDIMENT TRANSPORT ALONG THE CROSS SECT.

Section... Mateba Aval

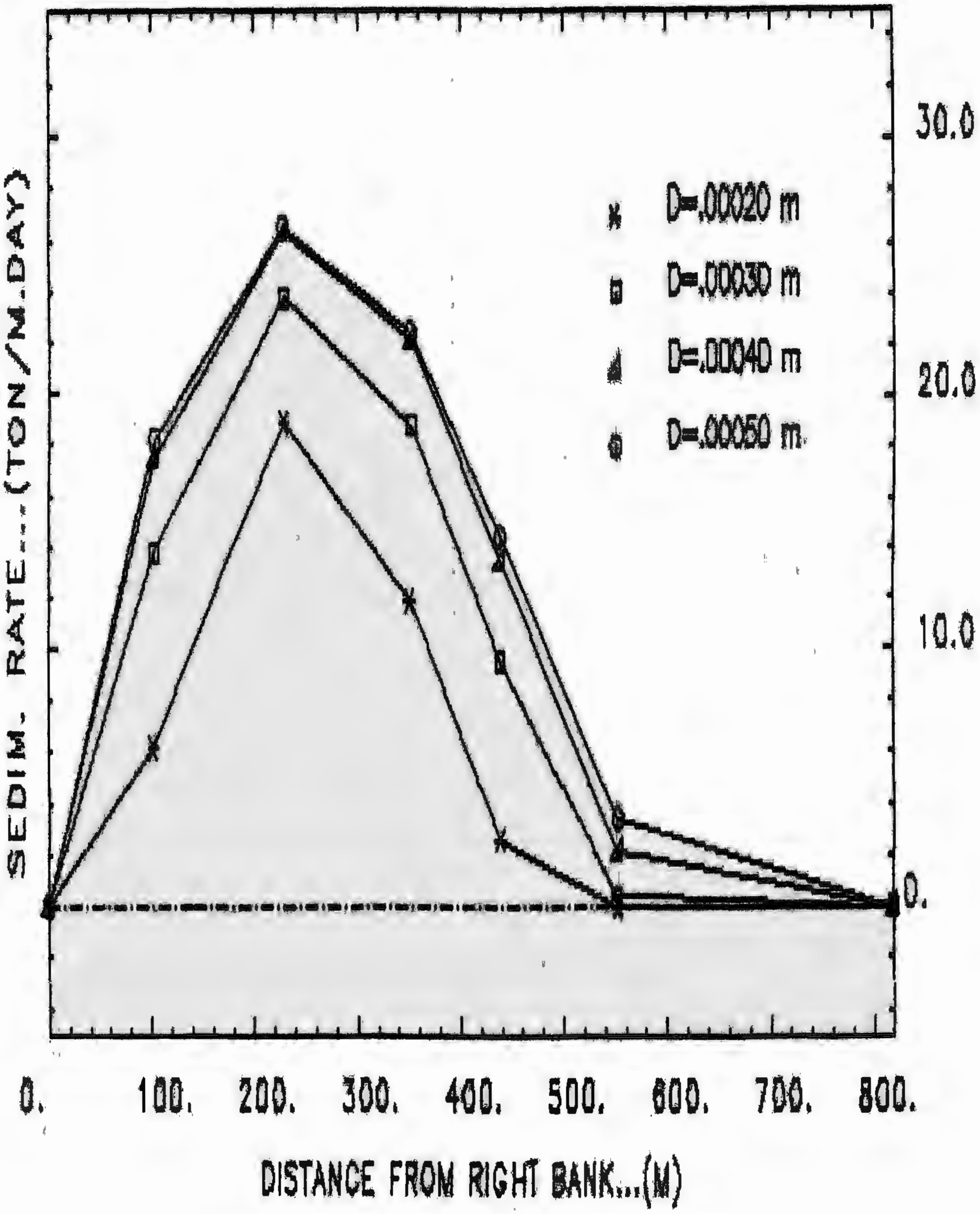


FIGURE 6.5a SEDIMENT TRANSPORT ALONG THE CROSS SECT.

Section... Mateba Amont

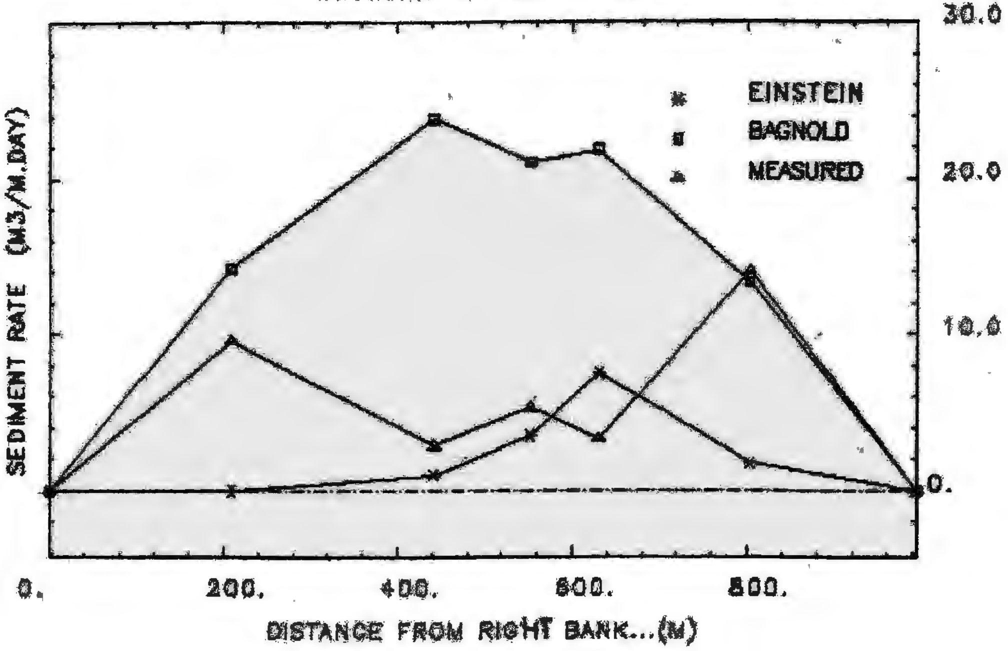


FIGURE SEDIMENT TRANSPORT ALONG THE CROSS SECT.

Section... Mateba Central

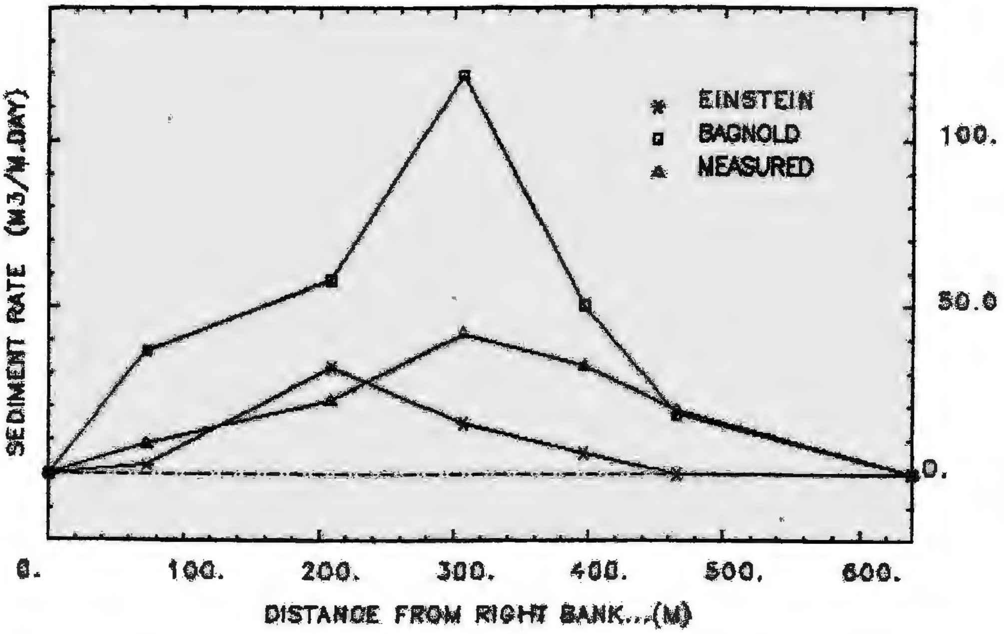


FIGURE 6.5c SEDIMENT TRANSPORT ALONG THE CROSS SECT.
Section... Mateba Aval

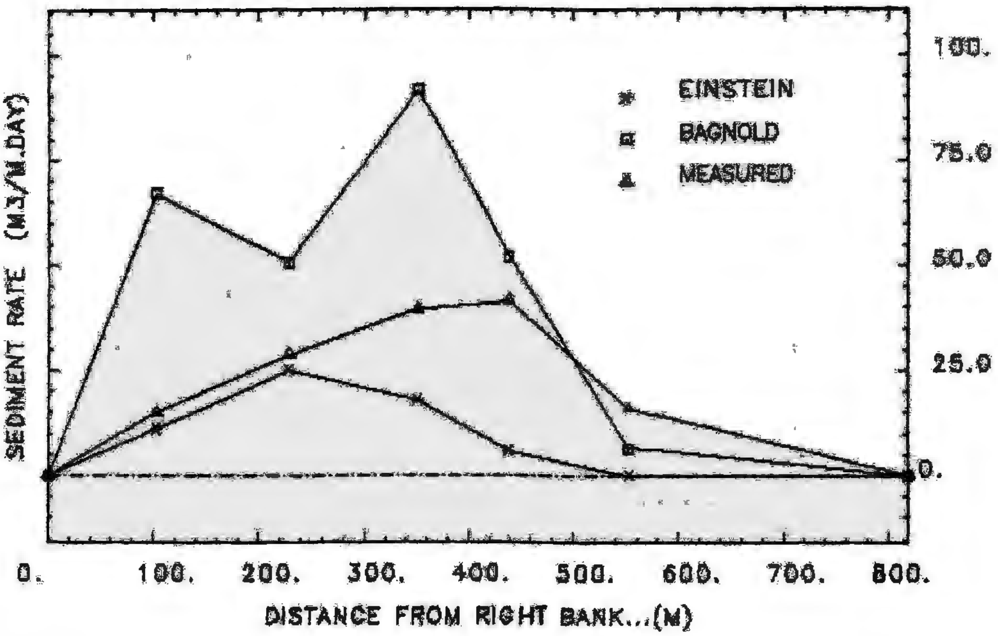
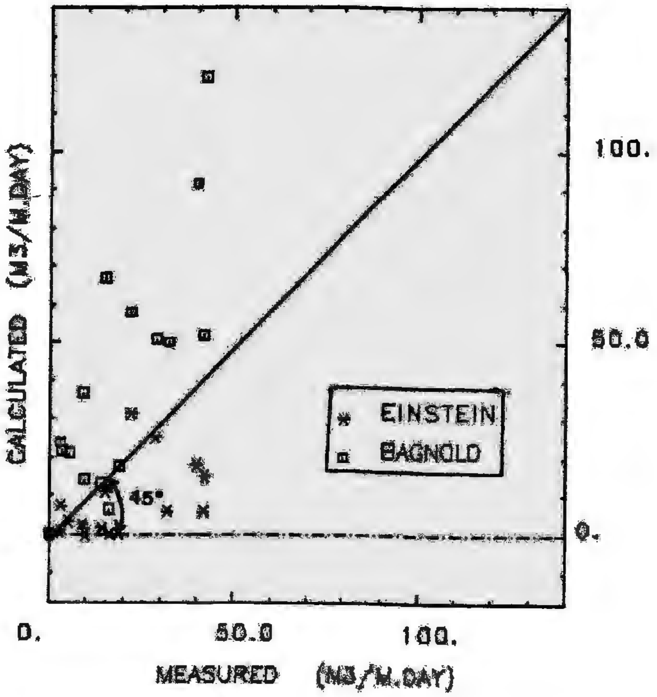


FIGURE 6.6 SEDIMENT TRANSPORT ALONG THE CROSS SECT.
Mateba STATION 1981



7. DISCUSSION OF RESULTS

a.- The accuracy of sediment transport calculation depends upon the degree of precision of the flume experimental graphs that were developed by Einstein. This is due to the inherent errors and the considerations that were adopt d during the process of his experiments.

b.- The following are comments concerning the graphs:

- The curve x against Kg/δ in Figure 3.2 was derived from NIKURADSE'S experiments, which used sand grains glued to steel pipes as roughness. The curve has always been found to describe reliably the roughness of plain sand beds. Same deviations may be expected if the range of grain sizes in the deposit is very large. The assumption that $Ks = D65$ may not be very reliable if the sediment contains appreciable amount of silt and clay.

- The curve u/u''_* against ψ' is less reliable than x curve. Basing on existing river measurements, it attempts to describe the effect of the irregularities of the natural stream channel on channel roughness. This curve seems, however, to describe rather closely the behavior of natural channels not constricted by artificial banks, vegetation or other obstructions.

- The curve of ξ against D/X has been derived entirely from flume experiments with graded sediments. No test was made of ungraded mixtures, such as those found in mountain rivers near the upper end of alluvial stream systems where slopes steep.

- The curve of Y against Ks/δ seems to be well defined by flume experiments. The scattering of the points is much smaller than that of the ξ curve.

- The $\phi_* - \psi_*$ curve is entirely theoretical, which represents equation (3.29). The three constants A_* ,B_* and η_o are obtained from reliable experiments.

- Figure 3.8 and Figure 3.9 give respectively integrals I_1 and I_2 in terms of the exponent z and the limit A_E , I_1 is always positive and I_2 is always negative. For values of z > 5 the expression PE.I_1 + I_2 usually becomes smaller than 0.2. These graphs are solutions of equation 3.47 according to the SIMPSON numerical integration method.

c.- The possible errors in the measurement of velocity, particle size, water depth and geometry of cross section which are normally greater than 40 percent were not taken into account in the calculation of the sediment transport.

d.- From the results obtained by application of Einstein model in the traditional procedure (Table 6.1) it can be said that the bed load is greater than the suspended-load for all cross sections. From Figures 6.1a to 6.1 m we can see that the bed-load and suspended-load vary for specific particle size. The sediment transport is higher for bigger particle size. This phenomena is clear in bed-load, because the intensity of transport, ϕ_* (Figure 3.7) decrease when intensity of shear, ψ_* , decreases. This is reflected in the ξ curve (hiding factor), Figure 3.5, which illustrates the fact that the small bed particles always tend to hide behind larger grains or in the laminar sublayer. Rather small amounts of similar particles in more prominent positions of the bed could support a very large additional transport of these particles without increasing effectively in their over-all concentrations i_b in the bed as a whole. This might explain the existence of wash load on the same bed which sustains bed-load function.

e.- The Figures 6.1a to 6.1 m show the plots of the bed-load and suspended-load of all grain sizes versus discharge. Each curve corresponds therefore, to an individual point of a cummulative curve. The group of curves mentioned above give the full description of the bed-load function.

f.- Each cross section has a complex geometry, hence, it was analysed separately. In those cases where the cross sections are split into two it is noticed that each part has totally different characteristics such as Chezy coefficient, Manning coefficient and slope (Table 4.1) and these justify separate treatment.

g.- The factors that influence the sediment transport rate according to their importance are mentioned below:

Slope, particle size, geometric characteristic of cross section, and discharge. These are interrelated and in the case of a rectangular channel it gives reliable results.

h.- The shear velocity, u_*, in the two-dimensional approach was calculated from the vertical velocity distribution. The value of u_* depends solely on the gradient of the regression line. The measured value of one point, either the velocity or depth would result in a "shift" of the regression line which in turn would affect the gradient and u_* .

i.- In the two-dimensional approach the effect of the bedform is small, because the panel corresponding to each vertical is very close to the rectangular shape. This is the reason why this appoach could represent in a better way the sediment transport calculation.

j.- The figures 6.5a to 6.5c show the plots of measured sediment transport and calculated sediment transport according to the Bagnold and Einstein models. In general the results obtained from Bagnold model [2] overestimates the measured values. Whereas the results from Einstein model underestimates the measured values. The overestimation of the Bagnold model can be due to the fact that Bagnold had made to arrive at his equation the assumption of fully turbulent flow; the bed-load and suspended-load afficiency factors were experimentally found and which may not be accurate in the natural stream. In the case of Einstein model the laminar sublayer is considered and where the small bed particles always tend to hide behind larger grains.

8. CONCLUSION

Since Einstein method is basically derived from bed-load measurements, it is not reliable to apply this when a large percentage of the sediment is in suspension. Einstein method considers the dependence of suspended sediment on turbulent intensity.

The results indicate that the sediment discharge increases when water discharge increases.

The total computed sediment rate at MATEBA STATION, varies between 13,169.8 Ton/day (cross section: Amont Oiseaux) and 15,247.801 Ton/day (cross section: Mateba Sud Kapita) for the year 1978 . For the year 1981 the sediment discharge varies between 2,675.862 Ton/day and 6,409.687 Ton/day .

The influence of bed forms is more important than the roughness due to particles in the case of the traditional procedure. In the two-dimensional approach this effect may be very small.

The accuracy of field measurement data and the effect of bed forms on the parameters of flow could not be evaluated properly.

From Figure 6.3 it is clear that the sediment rate varies with energy slope. The sediment transport increases exponentially as the energy slope is increased.

From Figure 6.4 we can conclude that the sediment rate also increases with the largeness of particle sizes. However the increase in sediment transport is less and less significant as the particle sizes increase further.

From figures 6.5 and 6.6 it is clear that the sediment transport calculated by the application of Einstein model underestimates the measured values.

Finally the sediment discharge in streams depends on many variables whose effects are complicated and interrelated.

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LIST OF FIGURES

LIST OF SYMBOLS

A	Total area of a cross section
a	Thickness of bed layer
A_E	a/d, Ratio of bed layer thickness to water depth.
A_1	Grain area constant.
A_2	Grain volume constant.
A_3	Constant of time scale.
A_5	Constant of bed layer concentration.
A_6	Constant of bed layer concentration.
A_L	Constant of the bed load unit step.
A_*	Constant referred to the scale of ϕ_*
A'	Cross sectional area pertaining to the grain.
A''	Cross sectional area pertaining to irregularities.
B	Constant referred to the scale of ψ
B'	Constant referred to the scale of ψ
B_*	Constant referred to the scale of ψ_*
C	Concentration in dry weight per unit of volume.
C_a	Concentration at distance "a" from bed.
C_L	Lift coefficient.
C_y	Concentration at distance "y" from bed.
d	Water depth.
D	Grain diameter.
D35	Grain size of which 35 percent is finer.
D65	Grain size of which 65 percent is finer.
g	Acceleration due to gravity.
i_b	Fraction of bed material in a given grain size.
i_B	Fraction of bed load in a given grain size.
i_s	Fraction of suspension in a given grain size.
i_T	Fraction of total load in a given grain size.

I_1	Integral value.
I_2	Integral value.
Ks	Roughness diameter.
l	Distance.
L	Lift force on bed particle.
l_e	Distance of exchange, mixing length.
p	Probability of a grain to be eroded.
PE	Parameter of total transport.
P	Wetted perimeter of bed load.
p_s	Probability of a grain to be eroded per second.
Q	Flow discharge.
q_v	Vertical exchange discharge per unit area.
R	Total hidraulic radius.
R'	Hidraulic radius with respect to the grain.
R"	Hidraulic radius for channel irregularities.
S	Energy slope
t	Variable of integration.
t_1	Exchange time of bed load particles.
u	Velocity in direction of the main flow.
$\bar{u}$	Time average of u, averaged over the vertical.
$\bar{u}_y$	Time average of the velocity u at y above the bed.
u_*	Shear velocity.
u'_*	Shear velocity with respect to the grain.
u''_*	Shear velocity for channel irregularities.
V	A vertical velocity.
W'	Weight of sediment particle under water.
W	Settling velocity of a sediment particle.
x	Parameter for transition smooth-rough.
X	Characteristic grain size of mixture.
y	Distance above the bed.

Y	Pressure correction in transition smooth-rough.
z	Exponent of suspended distribution.
β	A logarithmic function.
β_x	A logarithmic function.
δ	The thickness of the laminar sublayer.
Δ	The apparent roughness diameter.
η	Variability factor of lift.
η_0	Root mean square value of η
η_*	η measures in η_0 values.
λ	Single step of bed load measured in diameters.
ν	Kinematic viscosity.
ξ	"Hiding factor" of grains in a mixture.
ρ	Density of the fluid.
ρ_s	Density of the solids.
τ	A shear stress.
τ_0	The shear stress at the bed.
τ_y	Shear stress at a distance y from the bed.
ϕ	Intensity of transport.
ϕ_*	Intensity of transport for individual grain size.
ψ	Intensity of shear on representative particle.
ψ_*	Intensity of shear for individual grain size.

APPENDIX

APPENDIX 1a

J	CORDX	CORDY
1	371375	343190
2	371580	343075
3	371585	342880
4	371645	342830
5	371750	342690
6	369220	341655
7	369260	341525
8	369300	341435
9	369375	341370
10	369400	341305
11	367770	340930
12	367875	340860
13	367930	340740
14	367995	340680
15	368015	340550
16	371175	343250
17	371882	342551
18	369197	341724
19	369441	341134
20	367695	341000
21	368118	340299

1 — 5 : MATEBA AMONT

6 - 10: MATEBA CENTRAL

11 - 15: MATEBA AVAL

16 - 17: LEFT AND RIGHT BANK (M. AMONT)

18 - 19: LEFT AND RIGHT BANK (M. CENTRAL)

20 - 21: LEFT AND RIGTH BANK (M. AVAL)

APPENDIX 1b

```
      PROGRAM PLCROS
      INTEGER COD
      DIMENSION COD(127),ZR(127),B(127),Z(127)
C#############################################################
C
C     PROGRAME FOR PLOTTING THE CROSS SECTION OF THE ZAIRE RIVER
C     IN 6 DIFFERENT PLACES
C#############################################################
      OPEN (1,FILE='ZADATA2')
      DO 73 J=1,127
      READ(1,*)COD(J),ZR(J),B(J)
      Z(J)=(-1.)*ZR(J)
   73 CONTINUE
      NN=121
      MM=127
      CALL GROPEN
      CALL PLSIZE(20.,12.)
      CALL BOUNDS(0.,-12.8,818.7,0.)
      CALL UPPCMT('CROSS-SECTION GEOMETRY')
      CALL LOWCMT('S ECTION...   M ATEBA  A VAL')
      CALL XLABEL('DISTANCE FROM RIGTH BANK...(M)')
      CALL YLABEL('LEVEL ... (M)')
      DO 36 J=NN,MM
      CALL CUTYPE('SO')
      CALL DRAW(B(J),Z(J))
   36 CONTINUE
      CALL GRCLOS
      END
```

APPENDIX 2

J	V(1)	ZT	N	Z(2)	V(2)	Z(3)	V(3)	Z(4)	V(4)	Z(5)	V(5)	Z(6)	V(6)	Z(7)	V(7)	Z(8)	V(8)
	M/S	M		M	M/S	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S
1	.98	3.30	6	.30	.98	1.00	1.00	1.40	1.01	2.10	.90	2.80	.81	3.10	.65	.00	.00
2	1.16	5.55	6	.30	1.16	1.00	1.13	2.20	1.06	3.30	1.00	4.40	.89	5.10	.63	.00	.00
3	1.18	7.00	7	.30	1.18	1.00	1.16	1.40	1.16	2.80	1.11	4.20	.97	5.60	.94	6.60	.65
4	1.12	7.95	7	.30	1.12	1.00	1.10	1.59	1.14	3.18	1.12	4.77	.99	6.36	.88	7.55	.59
5	1.08	9.05	7	.30	1.08	1.00	1.08	1.81	1.06	3.62	1.05	5.43	1.02	7.24	.81	8.65	.63
6	1.30	11.65	7	.30	1.30	1.00	1.32	2.33	1.49	4.66	1.40	6.99	1.34	9.32	1.17	11.25	.86
7	1.69	12.70	7	.30	1.69	1.00	1.64	2.54	1.56	5.08	1.56	7.62	1.45	10.16	1.29	12.30	.86
8	1.63	9.25	7	.30	1.63	1.00	1.69	1.85	1.62	3.70	1.58	5.55	1.45	7.40	1.23	8.85	.65
9	1.52	7.70	7	.30	1.52	1.00	1.47	1.54	1.45	3.08	1.40	4.62	1.27	6.16	1.06	7.30	.84
10	1.08	6.05	7	.30	1.08	1.00	1.06	1.21	1.09	2.42	1.02	3.63	.96	4.84	.86	5.65	.60
11	1.53	12.80	7	.30	1.53	1.00	1.52	2.56	1.47	5.12	1.39	7.68	1.25	10.24	1.07	12.40	.59
12	1.59	10.80	7	.30	1.59	1.00	1.60	2.16	1.58	4.32	1.52	6.48	1.39	8.64	1.34	10.40	.87
13	1.70	10.50	7	.30	1.70	1.00	1.71	2.10	1.61	4.20	1.44	6.30	1.44	8.40	1.24	10.10	.73
14	1.53	7.40	7	.30	1.53	1.00	1.45	1.48	1.50	2.96	1.42	4.44	1.24	5.92	1.15	7.00	.83
15	.99	5.85	6	.30	.99	1.00	.94	2.34	.88	3.51	.87	4.68	.77	5.45	.66	.00	.00

APPENDIX 3

J	ZT	B	Z(1)	V(1)	Z(2)	V(2)	Z(3)	V(3)	Z(4)	V(4)	Z(5)	V(5)	Z(6)	V(6)	Z(7)	V(7)
	M	M	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S
1	.00	.0	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.0	.000
2	3.30	208.8	.00	.000	3.10	.650	2.80	.810	2.10	.900	1.40	1.010	1.00	1.000	.3	.980
3	5.55	441.2	.00	.000	5.10	.630	4.40	.890	3.30	1.000	2.20	1.060	1.00	1.130	.3	1.160
4	7.00	552.3	6.60	.650	5.60	.940	4.20	.970	2.80	1.110	1.40	1.160	1.00	1.160	.3	1.180
5	7.95	630.3	7.55	.590	6.36	.880	4.77	.990	3.18	1.120	1.59	1.140	1.00	1.100	.3	1.120
6	9.05	802.6	8.65	.630	7.24	.810	5.43	1.020	3.62	1.050	1.81	1.060	1.00	1.080	.3	1.080
7	.00	994.2	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.0	.000
8	.00	.0	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.0	.000
9	11.65	72.7	11.25	.860	9.32	1.170	6.99	1.340	4.66	1.400	2.33	1.490	1.00	1.320	.3	1.300
10	12.70	208.7	12.30	.860	10.16	1.290	7.62	1.450	5.08	1.560	2.54	1.560	1.00	1.640	.3	1.690
11	9.25	306.8	8.85	.650	7.40	1.230	5.55	1.450	3.70	1.580	1.85	1.620	1.00	1.690	.3	1.630
12	7.70	396.2	7.30	.840	6.16	1.060	4.62	1.270	3.08	1.400	1.54	1.450	1.00	1.470	.3	1.520
13	6.05	465.6	5.65	.600	4.84	.860	3.63	.960	2.42	1.020	1.21	1.090	1.00	1.060	.3	1.080
14	.00	636.5	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.0	.000
15	.00	.0	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.0	.000
16	12.80	102.6	12.40	.590	10.24	1.070	7.68	1.250	5.12	1.390	2.56	1.470	1.00	1.520	.3	1.530
17	10.80	228.0	10.40	.870	8.64	1.340	6.48	1.390	4.32	1.520	2.16	1.580	1.00	1.600	.3	1.590
18	10.50	350.3	10.10	.730	8.40	1.240	6.30	1.440	4.20	1.440	2.10	1.610	1.00	1.710	.3	1.700
19	7.40	438.6	7.00	.830	5.92	1.150	4.44	1.240	2.96	1.420	1.48	1.500	1.00	1.450	.3	1.530
20	5.85	552.2	.00	.000	5.45	.660	4.68	.770	3.51	.870	2.34	.880	1.00	.940	.3	.990
21	.00	818.7	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.00	.000	.0	.000

APPENDIK 4

```
      PROGRAM CHANGE
       DIMENSION A(25),D(25),C(25),B(25),JJ(25),N(25)
      DIMENSION ZT(25),Z8(25),V8(25),Z7(25),V7(25),Z6(25),V6(25),
     * Z5(25),V5(25),Z4(25),V4(25),Z3(25),V3(25),Z2(25),V2(25)
      OPEN (1,FILE='AVAL1')
      OPEN (2,FILE='CORDXY')
      OPEN (3,FILE='ZADATA1')
      DO 5 J=1,15
      READ(1,*)JJ(J),V2(J),ZT(J),N(J),Z2(J),V2(J),Z3(J),V3(J),
     *Z4(J),V4(J),Z5(J),V5(J),Z6(J),V6(J),Z7(J),V7(J),Z8(J),V8(J)
    5 CONTINUE
       DO 1 I=1,21
       READ(2,*)A(I),D(I),C(I)
    1 CONTINUE
      A1=0.
      A2=0.
      A3=0.
      A4=0.
      A5=0.
      A6=0.
      A7=0.
      A8=0.
      A9=0.
      B1=0.
      B2=0.
      B3=0.
      B4=0.
      B5=0.
      B6=0.
      B7=0.
      K1=1
      K2=7
      K3=8
      K4=14
      K5=15
      K6=21
       DO 2 I=1,5
       B(I)=((D(I)-D(16))**2+(C(I)-C(16))**2)**.5
    2  CONTINUE
      DO 3 I=6,10
      B(I)=((D(I)-D(18))**2+(C(I)-C(18))**2)**.5
    3 CONTINUE
      DO 4 I=11,15
      B(I)=((D(I)-D(20))**2+(C(I)-C(20))**2)**.5
    4 CONTINUE
      B(17)=((D(17)-D(16))**2+(C(17)-C(16))**2)**.5
      B(19)=((D(19)-D(18))**2+(C(19)-C(18))**2)**.5
      B(21)=((D(21)-D(20))**2+(C(21)-C(20))**2)**.5
      WRITE(3,50)K1,A1,A2,A3,A4,A5,A6,A7,A8,A9,B1,B2,B3,
     *  B4,B5,B6,B7
      DO 6 I=1,5
      K=I+1
      WRITE(3,50)K,ZT(I),B(I),Z8(I),V8(I),Z7(I),V7(I),Z6(I),V6(I),
     *   Z5(I),V5(I),Z4(I),V4(I),Z3(I),V3(I),Z2(I),V2(I)
    6 CONTINUE
      WRITE(3,50)K2,A1,B(17),A3,A4,A5,A6,A7,A8,A9,B1,B2,B3,
     *  B4,B5,B6,B7
      WRITE(3,50)K3,A1,A2,A3,A4,A5,A6,A7,A8,A9,B1,B2,B3,
     *  B4,B5,B6,B7
      DO 7 I=6,10
      K=I+3
      WRITE(3,50)K,ZT(I),B(I),Z8(I),V8(I),Z7(I),V7(I),Z6(I),V6(I),
     *   Z5(I),V5(I),Z4(I),V4(I),Z3(I),V3(I),Z2(I),V2(I)
    7 CONTINUE
      WRITE(3,50)K4,A1,B(19),A3,A4,A5,A6,A7,A8,A9,B1,B2,B3,
     *  B4,B5,B6,B7
      WRITE(3,50)K5,A1,A2,A3,A4,A5,A6,A7,A8,A9,B1,B2,B3,
     *  B4,B5,B6,B7
      DO 8 I=11,15
      K=I+5
      WRITE(3,50)K,ZT(I),B(I),Z8(I),V8(I),Z7(I),V7(I),Z6(I),V6(I),
     *   Z5(I),V5(I),Z4(I),V4(I),Z3(I),V3(I),Z2(I),V2(I)
    8 CONTINUE
      WRITE(3,50)K6,A1,B(21),A3,A4,A5,A6,A7,A8,A9,B1,B2,B3,
     *  B4,B5,B6,B7
   50 FORMAT(I3,F6.2,F7.1,F6.2,F6.3,F6.2,F6.3,F6.2,F6.3,F6.2
     *,F6.3,F6.2,F6.3,F6.2,F6.3,F3.1,F6.3)
      END
```

APPENDIX 5

J	ZT	X	Z(1)	V(1)	Z(2)	V(2)	Z(3)	V(3)	Z(4)	V(4)	Z(5)	V(5)	Z(6)	V(6)	Z(7)	V(7)
	M	M	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S	M	M/S

APPENDIX 6

```
      PROGRAM RATING
      INTEGER CODE
      REAL Z, B, ZL, V, R2, B1, B2, Z1, Z2, Q, A, VM, ZM, ZK, BK, MEANV
      DIMENSION CODE(127), Z(127), B(127), ZL(127, 7), V(127, 7), R2(127, 7),
     * B1(127), B2(127), Z1(127), Z2(127), Q(127, 7), A1(127, 7), ZR(127),
     * RT(127, 7), ZT(15), M1(15), M2(15), A2(127, 7), R1(127, 7), MEANV(127)
     * , US(127), PP(127), RH(127)
      OPEN (1, FILE='ZADATA2')
      OPEN (2, FILE='RATING1')
      OPEN (3, FILE='RATING2')
      OPEN (4, FILE='RATING3')
      OPEN (5, FILE='RATING4')
      DO 14 J=1, 127
      READ(1, *)CODE(J), Z(J), B(J), (ZL(J, I), V(J, I), I=1, 7)
   14 CONTINUE
      DO 15 J=1, 127
      N=7
      IF(V(J, 1).EQ.0.) K=2
      R2(J, 1)=0.0
      Q(J, 1)=0.0
      IF(V(J, 1).NE.0.) K=1
      IF(Z(J).EQ.0) THEN
      DO 81 I=1, N
      R2(J, I)=0.0
      Q(J, I)=0.0
   81 CONTINUE
      GO TO 2000
      ELSE IF(Z(J).NE.0) THEN
      GO TO 160
      ENDIF
  160 CONTINUE
      DO 255 I=K, N
      R1(J, I)=Z(J)-ZL(J, I)
  255 CONTINUE
      X11=0.0
      X12=0.0
      X13=0.0
      X14=0.0
      DO 80 I=K, N
      X11=X11+ALOG10(R1(J, I))
      X12=X12+V(J, I)
      X13=X13+ALOG10(R1(J, I))*V(J, I)
      X14=X14+ALOG10(R1(J, I))**2
   80 CONTINUE
      GRAD=(N*X13-X11*X12)/(N*X14-X11**2)
      A=X12/N-GRAD*X11/N
      US(J)=ABS(GRAD)/5.75
      IF(Z(J-1).EQ.0.AND.B(J).NE.B(J-1)) GO TO 200
      IF(Z(J+1).EQ.0.AND.B(J).NE.B(J+1)) GO TO 500
      IF(Z(J-1).EQ.0.AND.B(J).EQ.B(J-1)) GO TO 900
      IF(Z(J+1).EQ.0.AND.B(J).EQ.B(J+1)) GO TO 900
      IF(Z(J-1).NE.0.AND.Z(J+1).NE.0) GO TO 800
  200 IF(Z(J)-Z(J+1)) 300, 300, 400
  500 IF(Z(J)-Z(J-1)) 600, 600, 700
  300 Z1(J)=0.0
      Z2(J)=(Z(J+1)+Z(J))/2.
      B1(J)=B(J)-B(J-1)
      B2(J)=(B(J+1)-B(J))/2.
      I=K
      R2(J, I)= Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B2(J)*(Z2(J)-Z(J))/2.+R2(J, I)*B1(J)*R2(J, I)/(2.*Z(J))
     *           +R2(J, I)*B2(J)
      A2(J, I)=A1(J, I)
      Q(J, I)=ABS(A1(J, I)*V(J, I))
  340 I=I+1
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B2(J)*(R2(J, I)-R2(J, I-1))+(R2(J, I)-R2(J, I-1))*(B1(J)
     * *(R2(J, I)-R2(J, I-1))/(2.*Z(J)))
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      IF(I.EQ.(N-1)) GO TO 360
      IF(I.NE.(N-1)) GO TO 340
  360 I=N
      R2(J, I)=Z(J)
      A1(J, I)=B2(J)*(R2(J, I)-R2(J, I-1))+(R2(J, I)-R2(J, I-1))*(B1(J)+
     * B1(J)*R2(J, I-1)/Z(J))/2.
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
```

```
      GO TO 2000
  400 Z1(J)=0.0
      B1(J)=B(J)-B(J-1)
      Z2(J)=(Z(J+1)+Z(J))/2.
      B2(J)=(B(J+1)-B(J))/2.
      I=K
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B2(J)*((Z(J)-Z2(J))/2.+(Z2(J)-(ZL(J, I)+ZL(J, I+1))/2.))
     .    +R2(J, I)*B1(J)*R2(J, I)/(2.*Z(J))
      A2(J, I)=A1(J, I)
      Q(J, I)=ABS(A1(J, I)*V(J, I))
  440 I=I+1
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=((ZL(J, I-1)-ZL(J, I+1))/2.)*(B2(J))+B1(J)*(R2(J, I-1)+
     .R2(J, I))*(ZL(J, I-1)-ZL(J, I+1))/(4*Z(J))
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      IF(I.EQ.(N-1)) GO TO 460
      IF(I.NE.(N-1)) GO TO 440
  460 I=N
      R2(J, I)=Z(J)
      A1(J, I)=(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2.)*B2(J)+((B1(J)+(B1(J)
     .*R2(J, I-1))/(2.*Z(J))))*(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2.)
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      GO TO 2000
  600 Z1(J)=(Z(J)+Z(J-1))/2.
      B1(J)=(B(J)-B(J-1))/2.
      Z2(J)=0.0
      B2(J)=B(J+1)-B(J)
      I=K
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B1(J)*(Z1(J)-Z(J))/2.+R2(J, I)*B2(J)*R2(J, I)/(2.*Z(J))
     .  +R2(J, I)*B1(J)
      A2(J, I)=A1(J, I)
      Q(J, I)=ABS(A1(J, I)*V(J, I))
  640 I=I+1
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B1(J)*(ZL(J, I-1)-ZL(J, I+1))/2.+B2(J)*(R2(J, I-1)+R2(J, I))-
     .*(ZL(J, I-1)-ZL(J, I+1))/(4.*Z(J))
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      IF(I.EQ.(N-1)) GO TO 660
      IF(I.NE.(N-1)) GO TO 640
  660 I=N
      R2(J, I)=Z(J)
      A1(J, I)=(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2.)*B1(J)+((B2(J)+(B2(J)
     .*R2(J, I-1))/(2.*Z(J))))*(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2.)
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      GO TO 2000
  700 Z1(J)=(Z(J)+Z(J-1))/2.
      B1(J)=(B(J)-B(J-1))/2.
      Z2(J)=0.0
      B2(J)=B(J+1)-B(J)
      I=K
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B1(J)*((Z(J)-Z1(J))/2.+(Z1(J)-(ZL(J, I)+ZL(J, I+1))/2.))
     .          +R2(J, I)*B2(J)*R2(J, I)/(2.*Z(J))
      A2(J, I)=A1(J, I)
      Q(J, I)=ABS(A1(J, I)*V(J, I))
  740 I=I+1
      R2(J, I)=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I)=B1(J)*(ZL(J, I-1)-ZL(J, I+1))/2.+B2(J)*(R2(J, I-1)+R2(J, I))
     .*(ZL(J, I-1)-ZL(J, I+1))/(4.*Z(J))
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      IF(I.EQ.(N-1)) GO TO 760
      IF(I.NE.(N-1)) GO TO 740
  760 I=N
      R2(J, I)=Z(J)
      A1(J, I)=B1(J)*(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2.)+((B2(J)+(B2(J)
     .*R2(J, I-1))/(2.*Z(J))))*(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2.)
      A2(J, I)=A2(J, I-1)+A1(J, I)
      Q(J, I)=Q(J, I-1)+A1(J, I)*V(J, I)
      GO TO 2000
  800 Z1(J)=(Z(J)+Z(J-1))/2.
      Z2(J)=(Z(J)+Z(J+1))/2.
      IF(B(J-1).EQ.B(J-2)) THEN
      B1(J)=B(J)-B(J-1)
```

```
      B2(J)=(B(J+1)-B(J))/2
      ELSE IF(B(J-1).NE.B(J-2)) THEN
      B1(J)=(B(J)-B(J-1))/2
      B2(J)=(B(J+1)-B(J))/2
      ENDIF
      IF(B(J+1).EQ.B(J+2)) THEN
      B1(J)=(B(J)-B(J-1))/2
      B2(J)=B(J+1)-B(J)
      ELSE IF(B(J+1).NE.B(J+2)) THEN
      B1(J)=(B(J)-B(J-1))/2
      B2(J)=(B(J+1)-B(J))/2
      ENDIF
      I=K
      R2(J, I )=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I )=(B1(J)+B2(J))*((Z1(J)+Z(J)+Z2(J))/3.-
     (ZL(J, I)+ZL(J, I+1))/2. )
      A2(J, I )=A1(J, I)
      G(J, I )=ABS(A1(J, I)*V(J, I))
  840 I=I+1
      R2(J, I )=Z(J)-(ZL(J, I)+ZL(J, I+1))/2.
      A1(J, I )=(B1(J)+B2(J))*(ZL(J, I-1)-ZL(J, I+1))/2.
      A2(J, I )=A2(J, I-1)+A1(J, I)
      G(J, I )=G(J, I-1)+A1(J, I)*V(J, I)
      IF(I.EQ. (N-1)) GO TO 860
      IF(I.NE. (N-1)) GO TO 840
  860 I=N
      R2(J, I )=Z(J)
      A1(J, I )=(B1(J)+B2(J))*(ZL(J, I)+(ZL(J, I-1)-ZL(J, I))/2. )
      A2(J, I )=A2(J, I-1)+A1(J, I)
      G(J, I )=G(J, I-1)+A1(J, I)*V(J, I)
      GO TO 2000
  900 DO 82 I=1, N
      R2(J, I )=0.0
      G(J, I )=0.0
      A2(J, I )=0.0
   82 CONTINUE
      GO TO 2000
 2000 WRITE(2, 5000)J, Z(J), B(J), (R2(J, I), G(J, I), I=1, 7)
      IF(A2(J, 7).EQ.0) THEN
      MEANV(J)=0.0
      PP(J)=0.0
      RH(J)=0.0
      ELSE IF(A2(J, 7).NE.0) THEN
      MEANV(J)=G(J, 7)/A2(J, 7)
      PP(J)=B1(J)+B2(J)
      RH(J)=A2(J, 7)/PP(J)
      ENDIF
      WRITE(5, 7000)J, Z(J), G(J, 7), A2(J, 7), MEANV(J), US(J), PP(J), RH(J)
      IF(J.GE.1.AND.J.LE.6) ZR(J)=12.20-Z(J)
      IF(J.GE.7.AND.J.LE.22) ZR(J)=9.04-Z(J)
      IF(J.GE.23.AND.J.LE.28) ZR(J)=17.58-Z(J)
      IF(J.GE.29.AND.J.LE.40) ZR(J)=9.77-Z(J)
      IF(J.GE.41.AND.J.LE.47) ZR(J)=14.04-Z(J)
      IF(J.GE.48.AND.J.LE.63) ZR(J)=14.77-Z(J)
      IF(J.GE.64.AND.J.LE.72) ZR(J)=10.09-Z(J)
      IF(J.GE.73.AND.J.LE.82) ZR(J)=8.89-Z(J)
      IF(J.GE.83.AND.J.LE.95) ZR(J)=9.69-Z(J)
      IF(J.GE.96.AND.J.LE.106) ZR(J)=18.31-Z(J)
      IF(J.GE.107.AND.J.LE.113) ZR(J)=9.05-Z(J)
      IF(J.GE.114.AND.J.LE.120) ZR(J)=12.7-Z(J)
      IF(J.GE.121.AND.J.LE.127) ZR(J)=12.8-Z(J)
      DO 10 I=1, 7
      RT(J, I )=R2(J, I)+ZR(J)
   10 CONTINUE
      WRITE(3, 5000)J, ZR(J), B(J), (RT(J, I), G(J, I), I=1, 7)
   15 CONTINUE
      DATA (ZT(K), K=1, 13)/12.2, 9.04, 17.58, 9.77, 14.04, 14.77,
         10.09, 8.89, 9.69, 18.31, 9.05, 12.7, 12.8/
      DATA(M1(K), K=1, 13)/1, 7, 23, 29, 41, 48, 64, 73, 83,
        96, 107, 114, 121/
      DATA(M2(K), K=1, 13)/6, 22, 28, 40, 47, 63, 72, 82, 95,
        106, 113, 120, 127/
      DO 35 K=1, 13
   24 KK=M1(K)
      MM=M2(K)
      WD=ZT(K)
      H=1.0
   25 S=0.0
      A=0.0
```

```
      P=0.0
      DO 60 J=KK,MM
      IF(Q(J,2).EQ.0) THEN
      GO TO 17
      ELSE IF(Q(J,2).NE.0) THEN
      IF(H.GT.ZR(J).AND.H.LE.RT(J,1)) THEN
      S=S+(H-ZR(J))*Q(J,1)/(RT(J,1)-ZR(J))
      ENDIF
      IF(H.LE.RT(J,2).AND.H.GT.RT(J,1)) THEN
      S=S+Q(J,1)+(H-RT(J,1))*(Q(J,2)-Q(J,1))/(RT(J,2)-RT(J,1))
      ENDIF
      IF(H.LE.RT(J,3).AND.H.GT.RT(J,2)) THEN
      S=S+Q(J,2)+(H-RT(J,2))*(Q(J,3)-Q(J,2))/(RT(J,3)-RT(J,2))
      ENDIF
      IF(H.LE.RT(J,4).AND.H.GT.RT(J,3)) THEN
      S=S+Q(J,3)+(H-RT(J,3))*(Q(J,4)-Q(J,3))/(RT(J,4)-RT(J,3))
      ENDIF
      IF(H.LE.RT(J,5).AND.H.GT.RT(J,4)) THEN
      S=S+Q(J,4)+(H-RT(J,4))*(Q(J,5)-Q(J,4))/(RT(J,5)-RT(J,4))
      ENDIF
      IF(H.LE.RT(J,6).AND.H.GT.RT(J,5)) THEN
      S=S+Q(J,5)+(H-RT(J,5))*(Q(J,6)-Q(J,5))/(RT(J,6)-RT(J,5))
      ENDIF
      IF(H.LE.WD.AND.H.GT.RT(J,6)) THEN
      S=S+Q(J,6)+(H-RT(J,6))*(Q(J,7)-Q(J,6))/(WD-RT(J,6))
      ENDIF
      ENDIF
   17 CONTINUE
      IF(H.LT.ZR(J)) THEN
      GO TO 41
      ENDIF
      IF(H.GE.ZR(J)) GO TO 44
   44 CONTINUE
      IF(H.EQ.WD) THEN
      IF(J.EQ.MM) GO TO 41
      IF(J.NE.MM) GO TO 43
   43 A=A+(2*WD-ZR(J)-ZR(J+1))*(B(J+1)-B(J))/2
      P=P+B(J+1)-B(J)
      ELSE IF(H.NE.WD) THEN
      IF(H.LT.ZR(J-1).AND.H.GE.ZR(J+1)) THEN
      X=(H-ZR(J))*(B(J)-B(J-1))/(ZR(J-1)-ZR(J))
      A=A+X*(H-ZR(J))/2
      P=P+X
      ENDIF
      IF(H.LT.ZR(J-1).AND.H.LT.ZR(J+1)) THEN
      X=(H-ZR(J))*(B(J+1)-B(J))/(ZR(J+1)-ZR(J))
     *  +(B(J)-B(J-1))*(H-ZR(J))/(ZR(J-1)-ZR(J))
      A=A+X*(H-ZR(J))/2
      P=P+X
      ENDIF
      IF(H.GE.ZR(J-1).AND.H.GE.ZR(J+1)) THEN
      X=B(J)-B(J-1)
      A=A+((H-ZR(J))+(H-ZR(J-1)))*X/2
      P=P+X
      ENDIF
      IF(H.GE.ZR(J-1).AND.H.LT.ZR(J+1)) THEN
      X1=(H-ZR(J))*(B(J+1)-B(J))/(ZR(J+1)-ZR(J))
      X=B(J)-B(J-1)
      A=A+X1*(H-ZR(J))/2+(H-ZR(J)+H-ZR(J-1))*X/2
      P=P+X1+X
      ENDIF
      ENDIF
   41 CONTINUE
   60 CONTINUE
      R=A/P
      WRITE(4,6000)H,S,A,P,R
      IF((WD-H).GE.1.) THEN
      H=H+1.0
      GO TO 25
      ELSE IF((WD-H).LT.1.) THEN
      GO TO 40
      ENDIF
   40 IF(WD-H) 71,71,70
   70 H=WD
      GO TO 25
   71 CONTINUE
   35 CONTINUE
 6000 FORMAT(1X,F5.2,3X,F9.2,3X,F9.2,3X,F7.2,3X,F6.2)
 5000 FORMAT(I3,F6.2,F7.1,F6.2,F8.2,F6.2,F8.2,F6.2,F8.2,F6.2,F8.2,
     *           F6.2,F8.2,F6.2,F8.2,F6.2,F8.2)
 7000 FORMAT(I3,F8.2,3X,F8.2,3X,F8.2,1X,F8.2,F7.3,1X,F8.2,3X,F5.2)
      END
```

APPENDIX 7

J	TT (M)	B (M)	Z1(1) (M)	Q(1) (M3/S)	Z1(2) (M)	Q(2) (M3/S)	Z1(3) (M)	Q(3) (M3/S)	Z1(4) (M)	Q(4) (M3/S)	Z1(5) (M)	Q(5) (M3/S)	Z1(6) (M)	Q(6) (M3/S)	Z1(7) (M)	Q(7) (M3/S)
1	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	12.20	67.0	[illegible]	[illegible]	[illegible]	[illegible]	6.10	343.83	[illegible]	[illegible]	10.46	832.94	11.39	976.79	12.20	1093.62
3	9.92	181.4	[illegible]	[illegible]	[illegible]	[illegible]	5.16	461.38	[illegible]	[illegible]	9.34	509.83	9.17	703.41	9.92	780.78
4	7.00	269.7	[illegible]	[illegible]	[illegible]	[illegible]	3.50	231.80	[illegible]	[illegible]	5.80	461.73	6.38	513.61	7.00	576.81
5	3.17	338.1	.00	.00	[illegible]	[illegible]	1.34	103.08	[illegible]	[illegible]	3.33	222.57	3.73	309.77	3.17	449.37
6	.00	530.1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8	6.22	120.0	.00	.00	.00	[illegible]	1.87	138.32	[illegible]	[illegible]	4.36	417.00	5.43	539.19	6.22	737.79
9	7.14	270.0	.00	.00	.00	[illegible]	3.97	335.77	[illegible]	[illegible]	4.73	410.13	6.49	677.08	7.14	753.76
10	9.04	300.0	[illegible]	[illegible]	[illegible]	[illegible]	4.92	549.36	[illegible]	[illegible]	4.44	1190.44	8.39	[illegible]	9.04	[illegible]
11	8.92	340.0	[illegible]	[illegible]	[illegible]	[illegible]	4.41	671.41	[illegible]	[illegible]	7.44	1447.93	9.17	1840.[illegible]	8.92	2009.[illegible]
12	8.38	690.0	[illegible]	[illegible]	[illegible]	[illegible]	4.17	681.17	[illegible]	[illegible]	7.04	1330.97	7.73	1485.97	8.38	1640.97
13	6.64	860.0	.00	.00	.00	[illegible]	3.00	347.38	[illegible]	[illegible]	4.67	893.04	5.85	1137.21	6.64	1304.97
14	6.97	1000.0	.00	.00	.00	[illegible]	2.10	193.04	[illegible]	[illegible]	4.67	400.36	5.60	615.48	6.97	710.[illegible]
15	6.55	1080.0	.00	.00	.00	[illegible]	1.69	99.95	[illegible]	[illegible]	4.47	390.28	5.71	470.44	6.55	736.91
16	5.82	1170.0	.00	.00	.00	[illegible]	1.75	155.57	[illegible]	[illegible]	4.03	435.39	5.04	569.69	5.82	678.[illegible]
17	5.04	1290.0	.00	.00	.00	[illegible]	1.52	133.10	[illegible]	[illegible]	3.93	412.33	4.39	552.30	5.04	622.[illegible]
18	4.69	1400.0	.00	.00	.00	[illegible]	1.41	138.47	[illegible]	[illegible]	3.25	356.63	4.07	474.57	4.69	567.33
19	4.84	1540.0	.00	.00	.00	[illegible]	1.18	121.03	[illegible]	[illegible]	3.15	401.10	4.01	531.34	4.84	630.31
20	4.69	1670.0	.00	.00	.00	[illegible]	1.76	272.36	[illegible]	[illegible]	3.43	372.71	4.12	706.97	4.69	923.73
21	4.65	1900.0	.00	.00	.00	[illegible]	.41	60.78	[illegible]	[illegible]	2.76	476.47	3.97	857.26	4.65	1377.91
22	.00	2230.3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	13.73	40.0	[illegible]	[illegible]	[illegible]	[illegible]	7.97	740.93	[illegible]	[illegible]	13.84	1407.70	15.28	1546.25	13.73	1637.45
25	17.98	180.0	[illegible]	[illegible]	[illegible]	[illegible]	8.80	1319.70	[illegible]	[illegible]	15.42	2734.30	[illegible]	2076.31	17.98	[illegible]
26	9.64	340.0	.00	.00	.00	[illegible]	1.49	487.77	[illegible]	[illegible]	3.88	734.81	4.78	1170.59	5.66	[illegible]
27	5.66	450.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28	.00	[illegible]	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
30	9.46	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
31	9.46	100.0	.00	.00	.00	[illegible]	1.71	170.37	[illegible]	[illegible]	3.77	333.44	4.98	702.78	9.66	820.97
32	9.86	300.0	.00	.00	.00	[illegible]	1.76	276.[illegible]	[illegible]	[illegible]	4.11	760.90	3.13	776.79	5.86	1164.37
33	7.78	480.0	[illegible]	[illegible]	[illegible]	[illegible]	3.89	1013.[illegible]	[illegible]	[illegible]	4.30	1721.18	7.13	1906.33	7.78	2032.[illegible]
34	7.77	720.0	[illegible]	[illegible]	[illegible]	[illegible]	4.97	747.86	[illegible]	[illegible]	6.30	1861.78	9.13	1772.34	9.77	1737.97
35	5.40	890.0	.00	.00	.00	[illegible]	1.62	367.97	[illegible]	[illegible]	3.78	847.69	4.71	1033.76	5.40	1204.[illegible]
36	4.73	1090.0	.00	.00	.00	[illegible]	1.43	233.73	[illegible]	[illegible]	3.33	632.[illegible]	4.13	837.73	4.73	783.[illegible]
37	3.46	1300.0	.00	.00	.00	[illegible]	1.46	265.27	[illegible]	[illegible]	2.41	907.46	3.03	602.[illegible]	3.46	708.71
38	3.47	1540.0	.00	.00	.00	[illegible]	.83	145.68	[illegible]	[illegible]	2.34	434.42	2.73	591.90	3.47	707.18
39	3.45	1730.0	.00	.00	.00	[illegible]	.90	96.01	[illegible]	[illegible]	2.36	431.67	2.94	424.34	3.43	587.[illegible]
40	.00	1990.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
41	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
42	13.3[illegible]	87.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.70	424.[illegible]	[illegible]	[illegible]	11.35	703.04	12.74	1024.[illegible]	13.3[illegible]	1153.04
43	14.04	309.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.82	805.[illegible]	[illegible]	[illegible]	12.14	1610.[illegible]	13.[illegible]	1790.87	14.04	1866.03
44	9.48	337.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.74	648.36	[illegible]	[illegible]	9.03	1116.47	8.[illegible]	1201.7[illegible]	9.48	1585.34
45	8.79	626.[illegible]	.00	.00	.00	[illegible]	1.19	398.60	[illegible]	[illegible]	2.10	605.4[illegible]	2.41	685.[illegible]	2.79	782.71
46	8.77	730.[illegible]	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
47	.00	750.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
48	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
49	2.79	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50	2.79	90.0	.00	.00	.00	[illegible]	.63	102.80	[illegible]	[illegible]	1.52	337.31	2.32	373.81	2.79	370.18
51	4.97	280.0	.00	.00	.00	[illegible]	1.49	163.81	[illegible]	[illegible]	3.49	492.93	4.33	634.20	4.97	745.57
52	5.61	400.0	.00	.00	.00	[illegible]	1.68	220.92	[illegible]	[illegible]	3.93	620.36	4.70	808.01	5.61	941.31
53	6.43	570.0	.00	.00	.00	[illegible]	1.74	314.70	[illegible]	[illegible]	4.33	863.[illegible]	5.66	1111.97	6.43	1273.7[illegible]
54	6.76	740.0	.00	.00	[illegible]	[illegible]	3.39	517.16	[illegible]	[illegible]	5.53	930.41	6.08	1611.34	6.76	1132.[illegible]
55	8.28	890.0	[illegible]	[illegible]	[illegible]	[illegible]	4.14	433.60	[illegible]	[illegible]	6.93	783.[illegible]	7.63	967.36	8.28	949.20
56	9.73	940.0	[illegible]	[illegible]	[illegible]	[illegible]	4.85	496.62	[illegible]	[illegible]	8.28	873.50	9.10	976.13	9.73	1077.40
57	14.77	1030.0	[illegible]	[illegible]	[illegible]	[illegible]	7.39	347.31	[illegible]	[illegible]	12.50	499.01	14.12	959.95	14.77	987.37
58	11.16	1130.0	[illegible]	[illegible]	[illegible]	[illegible]	9.38	224.75	[illegible]	[illegible]	7.89	433.[illegible]	10.51	491.01	11.16	927.[illegible]
59	6.55	1260.0	.00	.00	.00	[illegible]	3.13	257.65	[illegible]	[illegible]	9.10	437.[illegible]	8.[illegible]	808.[illegible]	6.55	971.00
60	4.30	1400.0	.00	.00	.00	[illegible]	1.34	171.91	[illegible]	[illegible]	4.26	347.24	3.47	723.[illegible]	4.30	845.70
61	3.92	1540.0	.00	.00	.00	[illegible]	1.43	160.14	[illegible]	[illegible]	4.00	460.47	3.13	915.[illegible]	3.92	1072.81
62	2.43	1710.0	.00	.00	.00	[illegible]	.74	100.04	[illegible]	[illegible]	1.72	238.80	2.96	310.70	2.43	434.76
63	.00	1840.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
65	7.33	140.0	[illegible]	[illegible]	[illegible]	[illegible]	3.78	261.22	[illegible]	[illegible]	6.30	443.[illegible]	4.90	484.93	7.33	603.32
66	10.09	280.0	[illegible]	[illegible]	[illegible]	[illegible]	3.03	336.07	[illegible]	[illegible]	8.58	684.46	9.44	732.87	10.09	770.30
67	8.86	360.0	[illegible]	[illegible]	[illegible]	[illegible]	4.43	223.34	[illegible]	[illegible]	7.48	622.58	8.21	471.78	8.86	517.17
68	5.13	460.0	.00	.00	.00	[illegible]	2.38	236.21	[illegible]	[illegible]	3.73	374.40	4.39	434.73	5.13	408.84
69	3.06	600.0	.00	.00	.00	[illegible]	1.49	114.97	[illegible]	[illegible]	3.32	334.03	4.40	434.47	3.06	912.49
70	5.10	720.0	.00	.00	.00	[illegible]	1.37	130.47	[illegible]	[illegible]	3.31	402.94	4.35	340.19	5.10	442.30
71	5.10	850.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
72	.00	950.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
73	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
74	9.10	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
75	4.09	90.0	.00	.00	.00	[illegible]	1.64	309.66	[illegible]	[illegible]	3.02	321.36	3.56	607.23	4.03	675.16
76	7.76	330.0	[illegible]	[illegible]	[illegible]	[illegible]	3.88	700.78	[illegible]	[illegible]	6.47	1370.04	7.11	1333.07	7.76	1705.13
77	8.62	500.0	[illegible]	[illegible]	[illegible]	[illegible]	4.31	726.79	[illegible]	[illegible]	7.26	1337.70	7.97	1493.64	8.62	1632.[illegible]
78	8.99	670.0	[illegible]	[illegible]	[illegible]	[illegible]	4.45	673.23	[illegible]	[illegible]	7.30	1311.00	8.24	1474.03	8.99	1606.71
79	8.39	820.0	[illegible]	[illegible]	[illegible]	[illegible]	4.20	608.30	[illegible]	[illegible]	7.03	1178.48	7.74	1334.21	8.39	1578.[illegible]
80	5.59	1030.0	.00	.00	.00	[illegible]	1.97	241.10	[illegible]	[illegible]	2.97	548.47	4.93	867.61	5.59	1039.[illegible]
81	3.78	1200.0	.00	.00	.00	[illegible]	1.13	72.77	[illegible]	[illegible]	2.64	276.34	3.24	461.[illegible]	3.78	874.70
82	.00	1450.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
83	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
84	9.69	136.4	[illegible]	[illegible]	[illegible]	[illegible]	4.10	317.83	[illegible]	[illegible]	5.07	679.36	9.04	762.78	9.69	903.17
85	9.69	287.9	[illegible]	[illegible]	[illegible]	[illegible]	4.81	773.22	[illegible]	[illegible]	8.37	1451.77	9.04	1603.81	9.69	1767.84
86	9.69	484.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.69	650.84	[illegible]	[illegible]	8.27	1109.67	9.04	1520.[illegible]	9.69	1313.90
87	9.69	681.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.84	420.13	[illegible]	[illegible]	8.20	771.16	9.04	868.00	9.69	946.77
88	9.69	818.1	[illegible]	[illegible]	[illegible]	[illegible]	5.68	606.37	[illegible]	[illegible]	8.37	797.21	9.04	1085.70	9.69	1184.77
89	9.69	924.[illegible]	.00	.00	[illegible]	[illegible]	4.70	773.30	[illegible]	[illegible]	8.23	1447.37	9.04	1609.32	9.69	1732.17
90	9.69	1073.7	.00	.00	[illegible]	[illegible]	4.30	631.04	[illegible]	[illegible]	8.11	1300.39	9.04	1475.79	9.69	1947.03
91	9.69	1166.[illegible]	.00	.00	[illegible]	[illegible]	4.34	428.9[illegible]	[illegible]	[illegible]	8.16	881.65	9.04	994.71	9.69	1676.[illegible]
92	7.20	1297.9	.00	.00	[illegible]	[illegible]	3.60	360.07	[illegible]	[illegible]	3.95	687.97	4.33	749.07	7.20	862.17
93	9.16	1370.7	.00	.00	.00	[illegible]	1.49	168.32	[illegible]	[illegible]	3.63	467.96	4.30	546.16	8.16	693.21
94	5.08	1471.9	.00	.00	.00	[illegible]	1.33	108.26	[illegible]	[illegible]	3.36	394.63	4.42	544.22	5.08	772.04
95	.00	1636.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
96	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
97	12.[illegible]	147.4	[illegible]	[illegible]	[illegible]	[illegible]	6.41	741.92	[illegible]	[illegible]	11.94	1332.07	12.17	1473.83	12.82	1674.[illegible]
98	18.31	278.7	[illegible]	[illegible]	[illegible]	[illegible]	9.10	1135.97	[illegible]	[illegible]	15.98	2260.66	[illegible]	2549.[illegible]	18.31	2661.91
99	10.72	402.2	[illegible]	[illegible]	[illegible]	[illegible]	5.91	867.70	[illegible]	[illegible]	8.78	1437.92	9.37	1603.30	10.72	1718.43
100	9.96	520.5	.00	.00	[illegible]	[illegible]	4.73	660.12	[illegible]	[illegible]	8.42	1314.37	9.31	1478.01	9.96	1377.80
101	9.36	631.9	[illegible]	[illegible]	[illegible]	[illegible]	4.78	581.67	[illegible]	[illegible]	8.03	1096.90	8.85	1314.37	9.36	1317.81
102	8.77	733.4	[illegible]	[illegible]	[illegible]	[illegible]	4.39	436.93	[illegible]	[illegible]	7.40	919.43	8.14	914.[illegible]	8.77	1001.96
103	7.40	815.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.70	292.77	[illegible]	[illegible]	6.19	513.17	6.73	566.34	7.40	629.81
104	6.06	907.7	.00	.00	.00	[illegible]	1.77	83.27	[illegible]	[illegible]	4.23	237.74	3.31	341.40	6.06	400.60
105	2.50	1011.1	.00	.00	.00	[illegible]	.75	72.60	[illegible]	[illegible]	1.73	200.34	2.10	262.20	2.50	377.96
106	.00	1160.3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
107	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
108	3.50	200.[illegible]	.00	.00	.00	[illegible]	1.05	139.22	[illegible]	[illegible]	2.30	297.24	2.85	372.17	3.50	366.88
109	5.55	441.[illegible]	.00	.00	.00	[illegible]	1.70	213.31	[illegible]	[illegible]	3.95	611.40	4.90	773.96	5.55	925.47
110	7.00	532.3	.00	.00	[illegible]	[illegible]	3.90	285.24	[illegible]	[illegible]	6.60	830.[illegible]	6.35	591.21	7.00	661.73
111	7.75	630.5	[illegible]	[illegible]	[illegible]	[illegible]	3.78	425.40	[illegible]	[illegible]	6.06	903.79	7.30	892.37	7.75	783.60
112	9.05	802.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.93	518.82	[illegible]	[illegible]	7.63	1226.15	8.40	1434.67	9.05	1692.[illegible]
113	.00	994.[illegible]	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
114	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
115	11.65	72.7	[illegible]	[illegible]	[illegible]	[illegible]	5.93	321.21	[illegible]	[illegible]	9.97	764.36	11.00	1026.17	11.65	1211.38
116	12.79	206.7	[illegible]	[illegible]	[illegible]	[illegible]	5.35	836.70	[illegible]	[illegible]	10.73	1693.20	12.05	1708.20	12.70	2036.78
117	9.23	306.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.63	529.60	[illegible]	[illegible]	7.83	1008.[illegible]	[illegible]	1131.43	9.23	1230.78
118	7.70	[illegible]	.00	.00	[illegible]	[illegible]	3.88	331.45	[illegible]	[illegible]	4.43	623.56	7.05	694.94	7.70	723.79
119	6.03	463.[illegible]	.00	.00	.00	[illegible]	3.00	211.95	[illegible]	[illegible]	4.93	511.17	3.40	599.22	6.03	798.12
120	.00	636.[illegible]	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
121	.00	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
122	12.80	102.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.40	383.97	[illegible]	[illegible]	11.02	1460.92	12.15	1737.38	12.80	1740.10
123	10.80	228.0	[illegible]	[illegible]	[illegible]	[illegible]	5.40	866.27	[illegible]	[illegible]	9.32	1598.32	10.15	1702.74	10.80	1710.86
124	10.30	330.5	[illegible]	[illegible]	[illegible]	[illegible]	5.25	626.73	[illegible]	[illegible]	8.99	1216.41	9.03	1378.46	10.30	1474.82
125	7.40	436.[illegible]	.00	.00	[illegible]	[illegible]	3.70	433.84	[illegible]	[illegible]	6.16	794.03	6.73	880.31	7.40	780.61
126	5.85	532.[illegible]	.00	.00	[illegible]	[illegible]	1.76	138.83	[illegible]	[illegible]	4.10	546.66	5.20	805.73	5.85	1090.22
127	.00	618.7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

APPENDIX B

J	HT (M)	S (M)	H1(1) (M)	Q(1) (M3/S)	H1(2) (M)	Q(2) (M3/S)	H1(3) (M)	Q(3) (M3/S)	H1(4) (M)	Q(4) (M3/S)	H1(5) (M)	Q(5) (M3/S)	H1(6) (M)	Q(6) (M3/S)	H1(7) (M)	Q(7) (M3/S)
1	12.20	0	12.20	.00	12.20	.00	12.20	.00	12.20	.00	12.20	.00	12.20	.00	12.20	.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

APPENDIX 9

W. ELEV. H (M)	DISCHAR. Q (M3/S)	AREA A (M2)	W. PERIM. P (M)	H. RAD. R (M)
1.00	18.09	24.31	52.61	.50
2.00	97.39	105.22	105.22	1.00
3.00	192.20	233.76	148.16	1.58
4.00	272.64	400.49	185.21	2.16
5.00	463.79	604.19	222.24	2.72
6.00	683.65	842.35	252.79	[illegible]
7.00	955.32	1109.60	281.71	[illegible]
8.00	1242.71	1405.77	310.44	[illegible]
9.00	1544.49	1730.87	[illegible]	[illegible]
10.00	1943.93	2077.75	378.69	[illegible]
11.00	2395.[illegible]	[illegible]	458.93	5.51
12.00	2762.77	3017.01	518.17	[illegible]
13.00	3100.97	3121.84	530.10	[illegible]
1.00	221.22	311.85	443.35	.70
2.00	668.71	819.09	584.33	1.40
3.00	1431.47	1643.25	1026.39	1.60
4.00	[illegible]	2720.10	1172.77	[illegible]
5.00	4245.19	4373.02	1845.41	[illegible]
6.00	6316.87	[illegible]	1955.78	[illegible]
7.00	8359.84	8284.[illegible]	2046.15	[illegible]
8.00	10953.69	10278.[illegible]	2136.92	[illegible]
9.00	13724.48	12557.[illegible]	2226.07	[illegible]
9.[illegible]	13841.34	12646.76	2230.50	[illegible]
1.00	17.91	47.14	78.27	.60
2.00	62.68	171.60	167.72	[illegible]
3.00	307.52	347.19	183.66	[illegible]
4.00	545.49	[illegible]	199.59	[illegible]
5.00	833.99	[illegible]	215.53	[illegible]
6.00	1118.84	[illegible]	231.44	[illegible]
7.00	1417.55	1237.27	247.39	[illegible]
8.00	1721.32	1484.65	263.30	[illegible]
9.00	2027.94	1799.79	279.26	[illegible]
10.00	2351.19	2045.18	295.19	[illegible]
11.00	2682.46	2346.34	311.13	[illegible]
12.00	3057.25	2674.13	435.97	[illegible]
13.00	3773.63	3111.44	438.50	[illegible]
14.00	4285.71	3551.19	441.01	[illegible]
15.00	4813.35	3973.44	443.52	8.05
16.00	5343.04	[illegible]	446.03	[illegible]
17.00	5574.62	[illegible]	448.54	10.[illegible]
17.[illegible]	6206.08	[illegible]	490.00	11.[illegible]
1.00	10.05	71.[illegible]	159.89	[illegible]
2.00	143.07	319.01	318.74	[illegible]
3.00	526.93	704.07	471.37	[illegible]
4.00	1072.73	1225.46	665.41	[illegible]
5.00	2018.93	2156.01	1063.85	[illegible]
6.00	3157.57	3324.92	1249.53	[illegible]
7.00	4772.35	[illegible]	1781.23	[illegible]
8.00	6651.91	6771.[illegible]	1856.61	[illegible]
9.00	8739.69	8646.[illegible]	1931.97	[illegible]
9.77	10911.95	10155.60	1990.00	[illegible]
1.00	53.10	96.50	192.07	[illegible]
2.00	172.75	266.14	187.21	[illegible]
3.00	351.16	470.77	222.35	[illegible]
4.00	530.37	710.84	257.47	[illegible]
5.00	773.78	987.57	276.94	[illegible]
6.00	1112.37	1310.97	348.42	[illegible]
7.00	1477.99	1694.13	377.70	[illegible]
8.00	1901.67	2106.76	447.38	[illegible]
9.00	2306.39	2578.89	476.86	[illegible]
10.00	2708.12	3100.47	546.34	[illegible]
11.00	3107.76	3671.55	575.81	[illegible]
12.00	3829.94	4372.66	736.61	[illegible]
13.00	4406.80	5112.55	743.17	[illegible]
14.00	5063.18	5897.01	749.74	[illegible]
14.[illegible]	5112.54	5959.00	750.00	[illegible]
1.00	3.10	24.81	49.61	[illegible]
2.00	18.64	77.37	77.73	[illegible]
3.00	40.01	223.52	149.84	[illegible]
4.00	111.76	379.41	178.76	[illegible]
5.00	182.59	516.44	242.73	[illegible]
6.00	360.79	700.73	327.03	[illegible]
7.00	577.57	1271.61	416.40	[illegible]
8.00	854.38	1774.73	507.88	[illegible]
9.00	1505.91	2577.49	1114.97	[illegible]
10.00	2371.21	3810.97	1333.77	[illegible]
11.00	3937.94	5518.73	1447.42	[illegible]
12.00	5411.79	6735.71	1694.35	[illegible]
13.00	7204.28	8474.16	1751.63	[illegible]
14.00	9072.13	10756.40	1812.86	[illegible]
14.77	10409.91	11670.45	1860.00	[illegible]
1.00	24.60	60.98	120.16	[illegible]
2.00	115.18	228.90	210.88	[illegible]
3.00	272.10	476.76	279.98	1.73
4.00	478.34	773.43	321.34	2.41
5.00	691.65	[illegible]	605.62	1.85
6.00	1202.39	[illegible]	774.16	[illegible]
7.00	1733.77	2668.73	772.70	[illegible]
8.00	2287.27	3470.70	811.25	[illegible]
9.00	2858.65	4271.22	827.79	[illegible]
10.00	3508.95	5130.28	848.33	[illegible]
10.07	3572.88	5206.70	850.00	[illegible]
1.00	221.83	315.27	484.30	[illegible]
2.00	684.20	888.34	651.27	[illegible]
3.00	1341.27	1617.01	806.07	[illegible]
4.00	2228.93	2506.11	984.76	[illegible]
5.00	3240.01	3600.93	1187.65	[illegible]
6.00	4348.97	4823.31	1257.85	[illegible]
7.00	5876.12	6116.40	1324.34	[illegible]
8.00	7315.36	7473.78	1390.[illegible]	[illegible]
8.[illegible]	8717.37	8738.15	1450.[illegible]	[illegible]
1.00	741.47	1055.47	1080.78	[illegible]
2.00	1645.14	2161.36	1131.36	1.91
3.00	2670.28	3321.20	1173.63	2.78
4.00	3881.30	4551.97	1267.12	3.59
5.00	5184.63	5903.93	1444.33	4.07
6.00	6654.25	7347.71	1483.30	4.76
7.00	8214.91	8873.42	1526.07	5.81
8.00	9823.75	10419.96	1546.93	6.63
9.00	11498.93	12067.29	1607.00	7.47
9.[illegible]	12616.91	13126.40	1634.00	8.02
1.00	12.65	17.77	35.97	.50
2.00	25.31	79.79	77.98	1.00
3.00	176.97	179.75	117.77	1.50
4.00	332.96	319.91	159.73	2.00
5.00	485.94	477.86	197.74	2.50
6.00	712.17	717.77	232.00	[illegible]
7.00	977.64	942.00	256.43	[illegible]
8.00	1270.61	1230.68	280.70	[illegible]
9.00	1778.13	1643.00	330.34	[illegible]
10.00	2492.78	2281.87	465.93	[illegible]
11.00	3264.90	2962.03	734.78	[illegible]
12.00	4143.72	3736.94	817.08	[illegible]
13.00	5100.74	4604.75	867.00	[illegible]
14.00	6132.46	5492.91	906.30	[illegible]
15.00	7201.40	6421.56	947.00	[illegible]
16.00	8306.81	7371.46	975.93	7.42
17.00	9524.97	8422.70	1066.79	[illegible]
18.00	10875.27	9325.36	1138.38	[illegible]
18.31	11400.10	9851.68	1160.38	[illegible]
1.00	48.14	56.70	177.81	[illegible]
2.00	213.08	325.43	208.34	[illegible]
3.00	478.71	643.13	366.40	[illegible]
4.00	914.70	1103.22	502.77	[illegible]
5.00	1452.77	1673.26	637.31	[illegible]
6.00	2135.98	2372.40	747.67	[illegible]
7.00	2918.03	3160.48	828.50	[illegible]
8.00	3746.61	4029.40	707.35	[illegible]
9.00	4774.69	4979.14	770.16	[illegible]
9.[illegible]	4882.02	5028.75	774.29	[illegible]
1.00	49.36	78.98	157.96	.50
2.00	222.92	260.29	175.90	[illegible]
3.00	434.97	476.42	233.47	[illegible]
4.00	737.60	731.65	294.27	[illegible]
5.00	1076.73	1047.64	348.17	[illegible]
6.00	1548.73	1420.14	376.45	[illegible]
7.00	2097.01	1839.92	440.03	[illegible]
8.00	2624.73	2377.36	474.85	[illegible]
9.00	3245.02	2769.64	507.47	[illegible]
10.00	3707.21	3316.70	544.47	[illegible]
11.00	4612.77	3878.60	579.31	[illegible]
12.00	5371.54	4475.32	614.13	[illegible]
12.70	6051.44	4913.74	638.90	7.70
1.00	27.97	35.34	70.73	[illegible]
2.00	88.18	141.43	141.45	1.00
3.00	241.51	377.76	[illegible]	[illegible]
4.00	481.37	708.02	[illegible]	[illegible]
5.00	1107.65	1034.51	[illegible]	[illegible]
6.00	1614.49	1445.51	428.07	[illegible]
7.00	2210.14	1914.20	507.99	[illegible]
8.00	2909.10	2448.97	561.56	[illegible]
9.00	3652.87	3037.32	615.15	[illegible]
10.00	4501.86	3677.83	668.70	[illegible]
11.00	5414.11	4374.72	722.27	[illegible]
12.00	6422.48	5123.78	775.84	[illegible]
12.[illegible]	7416.61	5761.89	818.70	7.04

APPENDIX 10

J	H. DEPTH H (M)	DISCHAR. Q (M3/S)	AREA A (M)	M. VEL. U (M/S)	S. VEL. US (M/S)	W.PERI. P (M)	H. RAD. R (M)
1	.00	.00	.00	.00	.000	.00	.00
2	12.20	1093.82	1096.02	1.00	.078	125.60	8.73
3	9.82	980.78	974.18	1.01	.039	99.73	9.77
4	7.00	576.81	603.87	.96	.037	88.35	6.84
5	2.19	449.97	497.86	.90	.171	216.20	2.30
6	.00	.00	.00	.00	.000	.00	.00
7	.00	.00	.00	.00	.000	.00	.00
8	6.22	732.76	628.92	1.15	.121	175.00	3.59
9	7.14	753.78	657.30	1.15	.090	90.00	7.30
10	9.04	1423.82	1172.70	1.21	.089	135.00	8.69
11	8.82	2009.26	1712.75	1.17	.074	175.00	9.79
12	8.38	1640.93	1388.33	1.18	.081	170.00	8.17
13	6.68	1304.97	1074.41	1.21	.121	155.00	6.93
14	6.97	710.88	658.17	1.08	.126	100.00	6.58
15	6.55	556.91	546.69	1.02	.119	85.00	6.43
16	5.82	672.83	610.22	1.10	.125	105.00	5.81
17	5.07	623.89	587.84	1.06	.117	115.00	5.11
18	4.67	589.35	592.92	.99	.130	125.00	4.74
19	4.66	630.31	677.15	.93	.086	145.00	4.67
20	4.97	823.73	842.10	.98	.102	180.00	4.68
21	4.63	1377.91	1386.61	.99	.046	435.50	3.18
22	.00	.00	.00	.00	.000	.00	.00
23	.00	.00	.00	.00	.000	.00	.00
24	[illegible]	1637.45	[illegible]	1.34	.069	110.00	11.11
25	[illegible]	3231.25	[illegible]	1.41	.068	180.00	[illegible]
26	[illegible]	1338.18	1453.87	.92	.106	190.00	7.65
27	[illegible]	.00	.00	.00	.000	.00	.00
28	.00	.00	.00	.00	.000	.00	.00
29	.00	.00	.00	.00	.000	.00	.00
30	[illegible]	.00	.00	.00	.000	.00	.00
31	[illegible]	820.97	854.00	.96	.116	150.00	5.69
32	[illegible]	1164.37	1167.87	1.00	.120	190.00	6.15
33	7.78	2092.99	1636.29	1.28	.093	210.00	7.79
34	9.77	1937.97	1785.55	1.09	.079	205.00	8.71
35	[illegible]	1204.29	1113.70	1.08	.110	185.00	6.02
36	4.73	985.59	951.88	1.04	.103	205.00	4.64
37	3.46	708.91	827.25	.86	.119	225.00	3.68
38	3.47	709.18	[illegible]	.95	.062	215.00	[illegible]
39	3.45	887.28	843.48	1.05	.085	[illegible]	[illegible]
40	.00	.00	.00	.00	.000	.00	.00
41	.00	.00	.00	.00	.000	.00	.00
42	12.39	1180.04	972.22	1.21	.118	148.50	6.55
43	14.04	1884.05	1656.34	1.14	.043	125.75	13.17
44	9.48	1263.54	1904.39	.66	.012	208.70	9.12
45	2.79	782.91	1042.93	.75	.106	267.05	3.91
46	2.79	.00	.00	.00	.000	.00	.00
47	.00	.00	.00	.00	.000	.00	.00
48	.00	.00	.00	.00	.000	.00	.00
49	2.77	.00	.00	.00	.000	.00	.00
50	2.79	390.18	441.47	.88	.046	140.00	3.15
51	4.97	745.57	730.57	1.02	.102	155.00	4.71
52	[illegible]	941.31	818.28	1.15	.133	145.00	5.64
53	[illegible]	1295.92	1077.78	1.20	.118	170.00	6.34
54	[illegible]	1137.38	959.03	1.19	.088	140.00	6.85
55	[illegible]	949.20	826.17	1.15	.057	100.00	8.26
56	[illegible]	1077.40	1034.17	1.04	.079	100.00	10.34
57	14.77	589.29	1397.83	.42	.025	105.00	13.31
58	11.16	539.29	1154.30	.47	.032	105.00	10.99
59	[illegible]	571.00	909.50	.63	.078	125.00	7.28
60	6.30	845.20	878.77	.96	.084	140.00	6.28
61	[illegible]	1092.81	837.77	1.30	.123	155.00	5.41
62	2.43	424.96	495.36	.86	.077	235.00	2.11
63	.00	.00	.00	.00	.000	.00	.00
64	.00	.00	.00	.00	.000	.00	.00
65	[illegible]	605.32	737.53	.82	.041	210.00	3.51
66	10.09	770.30	1040.78	.74	.042	110.00	9.46
67	[illegible]	517.17	757.70	.68	.028	90.00	8.42
68	[illegible]	484.84	688.90	.70	.061	120.00	5.74
69	[illegible]	512.45	660.18	.78	.096	130.00	5.08
70	[illegible]	662.50	967.75	.68	.073	190.00	5.09
71	5.10	.00	.00	.00	.000	.00	.00
72	.00	.00	.00	.00	.000	.00	.00
73	.00	.00	.00	.00	.000	.00	.00
74	5.10	.00	.00	.00	.000	.00	.00
75	4.09	695.16	847.58	.82	.075	175.00	4.84
76	7.76	1703.13	1637.13	1.04	.074	225.00	7.27
77	8.62	1629.99	1363.47	1.20	.083	160.00	8.52
78	[illegible]	1606.91	1401.87	1.15	.072	160.00	8.76
79	[illegible]	1476.85	1440.00	1.03	.086	180.00	8.00
80	[illegible]	1023.65	1087.75	.94	.144	190.00	5.73
81	[illegible]	579.70	893.26	.65	.071	335.00	2.67
82	.00	.00	.00	.00	.000	.00	.00
83	.00	.00	.00	.00	.000	.00	.00
84	[illegible]	903.17	931.70	.97	.041	218.15	4.27
85	7.69	1729.84	1688.00	1.02	.046	174.20	9.69
86	[illegible]	1315.59	1908.45	.69	.026	194.95	9.79
87	9.67	946.97	1614.84	.59	.036	164.65	9.81
88	[illegible]	1184.77	1174.43	1.01	.069	121.20	9.69
89	9.69	1732.17	1248.07	1.39	.070	128.80	9.69
90	9.67	1597.03	1174.43	1.36	.080	121.20	9.69
91	[illegible]	1076.95	843.10	1.28	.081	90.90	9.28
92	7.20	862.17	771.91	1.12	.105	106.05	7.28
93	[illegible]	695.21	664.98	1.05	.130	121.20	5.49
94	6.08	772.64	699.67	1.10	.120	196.70	3.56
95	.00	.00	.00	.00	.000	.00	.00
96	.00	.00	.00	.00	.000	.00	.00
97	[illegible]	1694.88	1308.43	1.30	.080	224.05	5.84
98	13.01	2661.91	2028.30	1.31	.048	126.40	16.05
99	10.22	1718.69	1324.22	1.30	.086	114.90	11.52
100	9.96	1597.60	1140.08	1.40	.089	114.85	9.93
101	9.39	1317.21	978.12	1.35	.086	103.75	9.43
102	8.77	1001.46	795.59	1.26	.088	91.95	8.66
103	7.40	629.81	637.94	.99	.061	86.15	7.41
104	6.08	400.60	555.63	.72	.084	97.65	5.69
105	2.30	377.98	391.85	.96	.096	201.10	1.95
106	.00	.00	.00	.00	.000	.00	.00
107	.00	.00	.00	.00	.000	.00	.00
108	3.50	566.85	638.51	.89	.093	325.00	1.96
109	[illegible]	925.47	936.04	.99	.127	171.73	5.45
110	7.00	663.73	653.77	1.01	.074	94.35	6.93
111	7.95	983.68	998.07	.99	.074	125.15	7.98
112	7.03	1692.29	[illegible]	1.00	.062	[illegible]	6.07
113	.00	.00	.00	.00	.000	.00	.00
114	.00	.00	.00	.00	.000	.00	.00
115	11.65	1211.38	[illegible]	1.31	.079	140.70	[illegible]
116	12.70	2036.78	1398.75	1.46	.093	117.05	11.95
117	[illegible]	1230.78	896.88	1.37	.131	93.75	9.57
118	7.79	773.39	609.06	1.27	.095	77.40	7.87
119	4.69	799.12	803.46	.99	.084	207.60	3.87
120	.00	.00	.00	.00	.000	.00	.00
121	.00	.00	.00	.00	.000	.00	.00
122	[illegible]	1940.10	[illegible]	1.33	.110	[illegible]	[illegible]
123	[illegible]	1910.86	[illegible]	1.39	.088	[illegible]	[illegible]
124	[illegible]	1494.82	[illegible]	1.41	.117	[illegible]	[illegible]
125	[illegible]	980.61	[illegible]	1.27	.094	[illegible]	[illegible]
126	[illegible]	1090.23	[illegible]	.87	.064	[illegible]	[illegible]
127	.00	.00	.00	.00	.000	.00	.00

APPENDIX 11

```
      PROGRAM EINSTEN
      REAL IS10, ISTI0, IST, M, M2, ISRF2, AS, M
      DIMENSION H5(200), Q5(200), P5(200), A5(200), R5(200)
     *  , R1(50), U1(50), DELTA1(50), M(50), X1(50), DELTA2(50)
     * , ABEL(50), U(50), C(50), M2(50), U2(50), R2(50), R(50), H(50), Q1(50)
     *  , X2(50), Y(50), BX(50), B(50), PE(50), DD(50, 5), FF(50, 5)
     *  , ISTI0(50, 5), BLBF(50, 5), BLEC(50, 5), TBLEC(50, 5), IBI0(50, 5)
     * , AE(50, 5), W(50), Z(50, 5), FI1(50, 5), FI2(50, 5), IST(50, 5)
     * , BMLBF(50, 5), BMREC(50, 5), BMRAB(50, 5), TBLBL(50, 5)
     * , D(5), T(5), FBM(5), R7(6), H7(6), Y7(6), A(50), P(50), Q(50), UC(50)
     *  , ISRF2(50, 5), BB(50), FFF(200), QQQ(200), RENE(10)
      CHARACTER*30 AYDE
      OPEN (1, FILE='RATING03')
      OPEN (2, FILE='SEDIM1')
      OPEN (3, FILE='SEDIM2')
      DATA R7(1), R7(2), R7(3), R7(4), R7(5), R7(6)
     * /. 10, . 010, . 0010, . 00010, . 000010, . 0000010/
      DATA H7(1), H7(2), H7(3), H7(4), H7(5), H7(6)
     * /. 020, . 0020, . 00020, . 000020, . 0000020, . 00000020/
      DATA Y7(1), Y7(2), Y7(3), Y7(4), Y7(5), Y7(6)
     * /0. 9999999, 0. 099, 0. 0099, 0. 00099, 0. 000099, 0. 0000099/
      DATA V10, D65, D35, G/0. 000000841, 0. 000325, 0. 0001567, 9. 81/
      DATA D(1), D(2), D(3), D(4)
     * /. 000212, . 000254, . 000312, . 000370/
      DATA FBM(1), FBM(2), FBM(3), FBM(4)/. 25, . 25, . 25, . 25/
      DATA SD, FD/2650. 0, 1000. 0/
      WRITE(*, *)'XXXXXXXXXXXXXXXXXXXX'
      WRITE(*, *)'DATA FILE:   RATING03'
      WRITE(*, *)'XXXXXXXXXXXXXXXXXXXX'
      N=166
      DO 10 J=1, N
      READ(1, *)HH, QQ, AA, PP, RR
      H5(J)=HH
      Q5(J)=QQ
      P5(J)=PP
      A5(J)=AA
      R5(J)=RR
   10 CONTINUE
    5 WRITE(*, *)'            NAME OF CROSS SECTION'
      WRITE(*, *)'            ---------------------'
      WRITE(*, *)'AMONT OISEAUX 1 ......... N1=1, N2=13'
      WRITE(*, *)'AMONT OISEAUX 2 ......... N1=14, N2=23'
      WRITE(*, *)'OISEAUX NORD 1 .......... N1=24, N2=41'
      WRITE(*, *)'OISEAUX NORD 2 .......... N1=42, N2=51'
      WRITE(*, *)'BARRAJE 1 ............... N1=52, N2=66'
      WRITE(*, *)'BARRAJE 2 ............... N1=67, N2=81'
      WRITE(*, *)'MATEBA AMONT SUD 1 ...... N1=82, N2=92'
      WRITE(*, *)'MATEBA AMONT SUD 2 ...... N1=93, N2=101'
      WRITE(*, *)'MATEBA SUD MANGUD ....... N1=102, N2=111'
      WRITE(*, *)'MATEBA SUD KAPITA ....... N1=112, N2=130'
      WRITE(*, *)'MATEBA AMONT ............ N1=131, N2=140'
      WRITE(*, *)'MATEBA CENTRAL .......... N1=141, N2=153'
      WRITE(*, *)'MATEBA AVAL ............. N1=154, N2=166'
      WRITE(*, *)'XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX'
      WRITE(*, *)'WRITE THE NAME OF THE CROSS SECTION'
      READ(*, 11)AYDE
   11 FORMAT(A30)
      WRITE(*, *)'GIVE THE VALUES OF: N1, N2'
      READ(*, *)N1, N2
      WRITE(*, *) 'THE TOTAL WATER DEPTH (HT) IS: '
      READ(*, *)HT
      WRITE(*, *) 'THE ENERGY LINE SLOPE (S)  IS: '
      READ(*, *)S
      WRITE(*, *) 'THE INCREMENT FOR R1(I), IS: '
      READ(*, *)DIF
      X11=0. 0
      X12=0. 0
      X13=0. 0
      X14=0. 0
      DO 60 J=N1, N2
      X11=X11+R5(J)
      X12=X12+H5(J)
      X13=X13+R5(J)*H5(J)
      X14=X14+R5(J)**2
   60 CONTINUE
      B5=(X13-X11*X12/(N2-N1+1))/(X14-X11**2/(N2-N1+1))
      A5=X12/(N2-N1+1)-B5*X11/(N2-N1+1)
      K5=D65
      I=1
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      NN=1
      R1(I)=DIF
   26 U1(I)=(R1(I)*G*S)**.5
      DELTA1(I)=(11.6*VIS)/U1(I)
      M(I)=KS/DELTA1(I)
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X   CALCULATION OF CORRECTION FACTOR IN THE        X
C X   LOGARITHMIC VELOCITY DISTRIBUTION    (XI)      X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      IF(M(I).LE.0.5) X1(I)=.7+(ALOG10(M(I))+.699)*1.7085
      IF((M(I).LE.0.6).AND.(M(I).GT.0.5)) THEN
      X1(I)=1.38+(ALOG10(M(I))+.3010)*1.2626
      ENDIF
      IF((M(I).LE.0.7).AND.(M(I).GT.0.6)) THEN
      X1(I)=1.48+(ALOG10(M(I))+.2218)*1.0463
      ENDIF
      IF((M(I).LE.0.8).AND.(M(I).GT.0.7)) THEN
      X1(I)=1.55+(ALOG10(M(I))+.1549)*.5172
      ENDIF
      IF((M(I).LE.0.9).AND.(M(I).GT.0.8)) THEN
      X1(I)=1.58+(ALOG10(M(I))+.0969)*.3871
      ENDIF
      IF((M(I).LE.1.0).AND.(M(I).GT.0.9)) THEN
      X1(I)=1.61+(ALOG10(M(I))+.0458)*.2183
      ENDIF
      IF((M(I).LE.1.2).AND.(M(I).GT.1.0)) THEN
      X1(I)=1.62-(ALOG10(M(I)))*.2525
      ENDIF
      IF((M(I).LE.1.4).AND.(M(I).GT.1.2)) THEN
      X1(I)=1.6-(ALOG10(M(I))-.0792)*.5979
      ENDIF
      IF((M(I).LE.3.0).AND.(M(I).GT.1.4)) THEN
      X1(I)=1.56-(ALOG10(M(I))-.1461)*1.0676
      ENDIF
      IF((M(I).LE.3.5).AND.(M(I).GT.3.0)) THEN
      X1(I)=1.2-(ALOG10(M(I))-.4771)*.8955
      ENDIF
      IF((M(I).LE.4.5).AND.(M(I).GT.3.5)) THEN
      X1(I)=1.14-(ALOG10(M(I))-.5441)*.55
      ENDIF
      IF((M(I).LE.6.0).AND.(M(I).GT.4.5)) THEN
      X1(I)=1.08-(ALOG10(M(I))-.6532)*.4
      ENDIF
      IF((M(I).LE.9.0).AND.(M(I).GT.6.0)) THEN
      X1(I)=1.03-(ALOG10(M(I))-.7782)*.1705
      ENDIF
      IF((M(I).GT.9.0)) X1(I)=1.0
      DELTA2(I)=KS/X1(I)
      U(I)=U1(I)*(5.75*ALOG10(12.27*R1(I)/DELTA2(I)))
      C(I)=(SD-FD)*D35/(FD*R1(I)*S)
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X   FRICTION U** DUE TO CHANNEL IRREGULARITIES     X
C X             FOR BAR RESISTANCE                   X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      IF(C(I).LE.1.0) M2(I)=10**(2.0-(ALOG10(C(I))+0.3188)*1.2654)
      IF((C(I).LE.1.5).AND.(C(I).GT.1.0)) THEN
      M2(I)=10**(1.5766-(ALOG10(C(I))-0.0000)*1.0795)
      ENDIF
      IF((C(I).LE.2.0).AND.(C(I).GT.1.5)) THEN
      M2(I)=10**(1.4065-(ALOG10(C(I))-0.1761)*0.8447)
      ENDIF
      IF((C(I).LE.3.0).AND.(C(I).GT.2.0)) THEN
      M2(I)=10**(1.3010-(ALOG10(C(I))-0.3010)*0.664)
      ENDIF
      IF((C(I).LE.4.0).AND.(C(I).GT.3.0)) THEN
      M2(I)=10**(1.1847-(ALOG10(C(I))-0.4771)*0.5664)
      ENDIF
      IF((C(I).LE.6.0).AND.(C(I).GT.4.0)) THEN
      M2(I)=10**(1.1139-(ALOG10(C(I))-0.6021)*0.5031)
      ENDIF
      IF((C(I).LE.10.).AND.(C(I).GT.6.0)) THEN
      M2(I)=10**(1.0253-(ALOG10(C(I))-0.7782)*0.4094)
      ENDIF
      IF((C(I).LE.100.).AND.(C(I).GT.10.)) THEN
        M2(I)=10**(0.9345-(ALOG10(C(I))-1.0)*.3904)
      ENDIF
      IF(C(I).GT.100.) M2(I)=10**(.5441-(ALOG10(C(I))-2.0)*.3984)
      U2(I)=U(I)/M2(I)
      R2(I)=(U2(I)**2)/(G*S)
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      R(I)=R1(I)+R2(I)
      VC(I)=(R(I)*G*S)**.5
      H(I)=AS+BS*R(I)
      IF(I.EQ.1) THEN
      ABEL(I)=0.0
      GO TO 17
      ELSE IF(I.NE.1) THEN
      GO TO 18
      ENDIF
   18 IF(H(I).LE.H(I-1)) THEN
      MM=MM
      RENE(MM)=H(I-1)
      ABEL(I)=100.
      GO TO 29
      ELSE IF(H(I).GT.H(I-1)) THEN
      ABEL(I)=0.0
      GO TO 29
      ENDIF
   29 IF(H(I).LE.RENE(1)) THEN
      ABEL(I)=100.
      GO TO 16
      ELSE IF(H(I).GT.RENE(1)) THEN
      ABEL(I)=0.0
      GO TO 17
      ENDIF
   17 CONTINUE
      RT=(HT-AS)/BS
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X  CALCULATION OF DISCHARGE Q(I), WETEED PERIMETERX
C X  P(I),AREA A(I),AND HYDRAULIC RADIUS R(I); FROM X
C X  DATA FILE........RATING CURVE                   X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      IF(H(I).LE.H5(1)) THEN
      Q(I)=H(I)*Q5(1)/H5(1)
      P(I)=H(I)*P5(1)/H5(1)
      A(I)=H(I)*A5(1)/H5(1)
      ENDIF
      IF(H(I).GT.H5(1).AND.H(I).LE.H5(N2)) THEN
      DO 250 J=N1,N2-1
      IF(H(I).LE.H5(J+1).AND.H(I).GT.H5(J)) THEN
      Q(I)=Q5(J)+(H(I)-H5(J))*(Q5(J+1)-Q5(J))/(H5(J+1)-H5(J))
      P(I)=P5(J)+(H(I)-H5(J))*(P5(J+1)-P5(J))/(H5(J+1)-H5(J))
      A(I)=A5(J)+(H(I)-H5(J))*(A5(J+1)-A5(J))/(H5(J+1)-H5(J))
      ENDIF
  250 CONTINUE
      ENDIF
      IF(H(I).GT.H5(N2)) THEN
      Q(I)=Q5(N2)+(H(I)-H5(N2))*(Q5(N2)-Q5(N2-1))/(H5(N2)-H5(N2-1))
      P(I)=P5(N2)+(H(I)-H5(N2))*(P5(N2)-P5(N2-1))/(H5(N2)-H5(N2-1))
      A(I)=A5(N2)+(H(I)-H5(N2))*(A5(N2)-A5(N2-1))/(H5(N2)-H5(N2-1))
      ENDIF
      Q1(I)=A(I)*U(I)
      IF((DELTA2(I)/DELTA1(I)).GE.1.80) X2(I)=0.77*DELTA2(I)
      IF((DELTA2(I)/DELTA1(I)).LT.1.80) X2(I)=1.39*DELTA1(I)
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X  PRESSURE CORRECTION FACTOR Y(I), IN THE        X
C X  TRANSITION TO A SMOOTH BED                     X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      IF(M(I).LE.0.1) Y(I)=10**(-2.+(ALOG10(M(I))+1.6576)*1.226)
      IF((M(I).LE..145).AND.(M(I).GT.0.1)) THEN
      Y(I)=10**(-1.1938+(ALOG10(M(I))+1.0000)*1.2007)
      ENDIF
      IF((M(I).LE..55).AND.(M(I).GT..145)) THEN
      Y(I)=10**(-1.000+(ALOG10(M(I))+0.8386)*1.2073)
      ENDIF
      IF((M(I).LE..70).AND.(M(I).GT..55)) THEN
      Y(I)=10**(-.3010+(ALOG10(M(I))+0.2596)*1.0879)
      ENDIF
      IF((M(I).LE..76).AND.(M(I).GT..70)) THEN
      Y(I)=10**(-.1871+(ALOG10(M(I))+0.1549)*0.9020)
      ENDIF
      IF((M(I).LE..90).AND.(M(I).GT..76)) THEN
      Y(I)=10**(-.1549+(ALOG10(M(I))+0.1192)*0.7891)
      ENDIF
      IF((M(I).LE.1.0).AND.(M(I).GT..90)) THEN
      Y(I)=10**(-.0969+(ALOG10(M(I))+0.0457)*0.4639)
      ENDIF
      IF((M(I).LE.1.1).AND.(M(I).GT.1.0)) THEN
      Y(I)=10**(-.0757+(ALOG10(M(I))+0.0000)*0.1232)
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      ENDIF
      IF((M(I).LE.1.2).AND.(M(I).GT.1.1)) THEN
      Y(I)=10**(-.0706-(ALOG10(M(I))-0.0414)*0.1349)
      ENDIF
      IF((M(I).LE.1.4).AND.(M(I).GT.1.2)) THEN
      Y(I)=10**(-.0757-(ALOG10(M(I))-0.0792)*0.3991)
      ENDIF
      IF((M(I).LE.1.65).AND.(M(I).GT.1.4)) THEN
      Y(I)=10**(-.1024-(ALOG10(M(I))-0.1461)*0.7353)
      ENDIF
      IF((M(I).LE.1.8).AND.(M(I).GT.1.65)) THEN
      Y(I)=10**(-.1549-(ALOG10(M(I))-0.2175)*1.0291)
      ENDIF
      IF((M(I).LE.2.0).AND.(M(I).GT.1.8)) THEN
      Y(I)=10**(-.1938-(ALOG10(M(I))-0.2553)*0.6127)
      ENDIF
      IF((M(I).LE.2.5).AND.(M(I).GT.2.0)) THEN
      Y(I)=10**(-.2218-(ALOG10(M(I))-0.3010)*0.3076)
      ENDIF
      IF((M(I).LE.3.0).AND.(M(I).GT.2.5)) THEN
      Y(I)=10**(-.2518-(ALOG10(M(I))-0.3979)*0.0985)
      ENDIF
      IF((M(I).LE.3.5).AND.(M(I).GT.3.0)) THEN
      Y(I)=10**(-.2596-(ALOG10(M(I))-0.4771)*0.1194)
      ENDIF
      IF(M(I).GT.3.5) Y(I)=10**(-.2676-(ALOG10(M(I))-.5441)*.0523)
      BX(I)=ALOG10(10.6*X2(I)/DELTA2(I))
      B(I)=ALOG10(10.6)
      BB(I)=(B(I)/BX(I))**2
      PE(I)=2.303*ALOG10(30.2*H(I)/DELTA2(I))
      IF(R(I)-RT) 28,27,27
   28 I=I+1
      R1(I)=R1(I-1)+DIF
      GO TO 26
   16 NN=NN+1
      I=I+1
      R1(I)=R1(I-1)+DIF
      GO TO 26
   27 N3=I
      WRITE(2,1000)AYDE
      WRITE(2,2500)
      DO 710 I=1,N3
      WRITE(2,2000) R1(I),U1(I),DELTA1(I),M(I),X1(I),DELTA2(I)
     *              ,U(I),C(I),M2(I),U2(I),R2(I),R(I)
  710 CONTINUE
      WRITE(2,1100)AYDE
      WRITE(2,3500)
      DO 720 I=1,N3
      WRITE(2,3000) UG(I),H(I),A(I),P(I),G(I),G1(I),X2(I),Y(I)
     *              ,BX(I),BB(I),PE(I)
  720 CONTINUE
C ***********************************************************
C *  BED MATERIAL LOAD CALCULATION                          *
C ***********************************************************
      DO 110 K=1,4
      DO 120 I=1,N3
      IF(ABEL(I).EQ.100.) GO TO 120
      ISRP2(I,K)=(SD-FD)*D(K)/(FD*R1(I)*S)
      DD(I,K)=D(K)/X2(I)
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %    HIDING FACTOR FF(I,K), IN TERMS OF D(K)/X2(I) %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      IF(DD(I,K).LE.0.10) FF(I,K)=10**(2.9542-(ALOG10(DD(I,K))
     *+1.3468)*2.2436)
      IF((DD(I,K).LE..12).AND.(DD(I,K).GT.0.10)) THEN
      FF(I,K)=10**(2.1761-(ALOG10(DD(I,K))+1.0000)*2.2235)
      ENDIF
      IF((DD(I,K).LE..255).AND.(DD(I,K).GT..12)) THEN
      FF(I,K)=10**(2.0000-(ALOG10(DD(I,K))+0.9208)*2.1350)
      ENDIF
      IF((DD(I,K).LE..64).AND.(DD(I,K).GT..255)) THEN
      FF(I,K)=10**(1.3010-(ALOG10(DD(I,K))+0.5934)*2.5025)
      ENDIF
      IF((DD(I,K).LE..7).AND.(DD(I,K).GT..64)) THEN
      FF(I,K)=10**(0.3010-(ALOG10(DD(I,K))+0.1938)*2.0129)
      ENDIF
      IF((DD(I,K).LE.0.8).AND.(DD(I,K).GT.0.7)) THEN
      FF(I,K)=10**(0.2227-(ALOG10(DD(I,K))+0.1549)*1.3207)
      ENDIF
      IF((DD(I,K).LE.0.9).AND.(DD(I,K).GT.0.8)) THEN
```

```
      FF(I,K)=10**(0.1461-(ALOG10(DD(I,K))+0.0969)*1.0313)
      ENDIF
      IF((DD(I,K).LE.1.0).AND.(DD(I,K).GT.0.9)) THEN
      FF(I,K)=10**(0.0934-(ALOG10(DD(I,K))+0.0458)*0.7140)
      ENDIF
      IF((DD(I,K).LE.1.1).AND.(DD(I,K).GT.1.0)) THEN
      FF(I,K)=10**(0.0607-(ALOG10(DD(I,K))-0.0000)*0.4662)
      ENDIF
      IF((DD(I,K).LE.1.3).AND.(DD(I,K).GT.1.1)) THEN
      FF(I,K)=10**(0.0414-(ALOG10(DD(I,K))-0.0414)*0.3945)
      ENDIF
      IF((DD(I,K).LE.1.5).AND.(DD(I,K).GT.1.3)) THEN
      FF(I,K)=10**(0.0128-(ALOG10(DD(I,K))-0.1139)*0.2058)
      ENDIF
      IF((DD(I,K).GT.1.5)) FF(I,K)=1.0
      ISIG(I,K)=FF(I,K)*Y(I)*ISRP2(I,K)*(B(I)/BX(I))**2
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X INTENSITY OF TRANSPORT FOR INDIVIDUAL GRAIN
C X         SIZE..... ISTIG(I,K)                  X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      IF(ISIG(I,K).LE.0.26) THEN
      ISTIG(I,K)=10**(2.0-(ALOG10(ISIG(I,K))+1.0969)*1.0215)
      ENDIF
      IF((ISIG(I,K).LE.0.75).AND.(ISIG(I,K).GT.0.26)) THEN
      ISTIG(I,K)=10**(1.4771-(ALOG10(ISIG(I,K))+0.5850)*1.0369)
      ENDIF
      IF((ISIG(I,K).LE.1.70).AND.(ISIG(I,K).GT.0.75)) THEN
      ISTIG(I,K)=10**(1.0-(ALOG10(ISIG(I,K))+0.1249)*1.1199)
      ENDIF
      IF((ISIG(I,K).LE.2.7).AND.(ISIG(I,K).GT.1.70)) THEN
      ISTIG(I,K)=10**(0.6021-(ALOG10(ISIG(I,K))-0.2304)*1.4980)
      ENDIF
      IF((ISIG(I,K).LE.4.1).AND.(ISIG(I,K).GT.2.7)) THEN
      ISTIG(I,K)=10**(0.3010-(ALOG10(ISIG(I,K))-0.4314)*1.6593)
      ENDIF
      IF((ISIG(I,K).LE.5.0).AND.(ISIG(I,K).GT.4.1)) THEN
      ISTIG(I,K)=10**(0.0-(ALOG10(ISIG(I,K))-0.6128)*2.5761)
      ENDIF
      IF((ISIG(I,K).LE.7.6).AND.(ISIG(I,K).GT.5.0)) THEN
      ISTIG(I,K)=10**(-.2218-(ALOG10(ISIG(I,K))-0.6989)*2.6229)
      ENDIF
      IF((ISIG(I,K).LE.9.40).AND.(ISIG(I,K).GT.7.6)) THEN
      ISTIG(I,K)=10**(-.6989-(ALOG10(ISIG(I,K))-0.8808)*3.2622)
      ENDIF
      IF((ISIG(I,K).LE.12.).AND.(ISIG(I,K).GT.9.40)) THEN
      ISTIG(I,K)=10**(-1.000-(ALOG10(ISIG(I,K))-.9731)*3.7502)
      ENDIF
      IF((ISIG(I,K).LE.16.5).AND.(ISIG(I,K).GT.12.)) THEN
      ISTIG(I,K)=10**(-1.3979-(ALOG10(ISIG(I,K))-1.0792)*4.3536)
      ENDIF
      IF((ISIG(I,K).LE.19.5).AND.(ISIG(I,K).GT.16.5)) THEN
      ISTIG(I,K)=10**(-2.000-(ALOG10(ISIG(I,K))-1.2175)*7.2124)
      ENDIF
      IF((ISIG(I,K).LE.22.).AND.(ISIG(I,K).GT.19.5)) THEN
      ISTIG(I,K)=10**(-2.5229-(ALOG10(ISIG(I,K))-1.2900)*9.1050)
      ENDIF
      IF((ISIG(I,K).LE.24.).AND.(ISIG(I,K).GT.22.)) THEN
      ISTIG(I,K)=10**(-3.000-(ALOG10(ISIG(I,K))-1.3424)*10.4987)
      ENDIF
      IF((ISIG(I,K).GT.24.0)) THEN
      ISTIG(I,K)=10**(-3.3979-(ALOG10(ISIG(I,K))-1.3802)*11.7598)
      ENDIF
      BLSF(I,K)=FBM(K)*ISTIG(I,K)*SD*(G**1.5)*(D(K)**1.5)*((SD/FD-1)
     ***.5)*86.4/9.81
      BLEC(I,K)=BLSF(I,K)*P(I)
      IF(K.EQ.1) THEN
      KK=I
      QQQ(KK)=BLEC(I,K)
      ELSE IF(K.NE.1) THEN
      KK=(K-1)*N3+I
      QQQ(KK)=BLEC(I,K)+QQQ(KK-N3)
      ENDIF
      IF(K.EQ.1) TBLEC(I,K)=BLEC(I,K)
      IF(K.NE.1) TBLEC(I,K)=BLEC(I,K)+QQQ(KK-N3)
      AE(I,K)=2*D(K)/H(I)
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X  CALCULATION OF SETTLING VELOCITY...W(I)           X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      T(K)=1000*D(K)
```

```
      IF(T(K).LE. 0. 10) W(I)=10**(-1. 0969+(ALOG10(T(K))+2. 0)*0. 9602)
      IF((T(K).LE. . 12).AND. (T(K).GT. 0. 10)) THEN
      W(I)=10**(-. 1367+(ALOG10(T(K))+1. 0)*1. 7260)
      ENDIF
      IF((T(K).LE. . 2).AND. (T(K).GT. . 12)) THEN
      W(I)=10**(0. 0000+(ALOG10(T(K))+0. 9208)*1. 6300)
      ENDIF
      IF((T(K).LE. 0. 3).AND. (T(K).GT. 0. 2)) THEN
      W(I)=10**(0. 3617+(ALOG10(T(K))+0. 6989)*1. 3034)
      ENDIF
      IF((T(K).LE. 0. 5).AND. (T(K).GT. 0. 3)) THEN
      W(I)=10**(0. 5911+(ALOG10(T(K))+0. 5229)*0. 9072)
      ENDIF
      IF((T(K).LE. 1. 0).AND. (T(K).GT. 0. 5)) THEN
      W(I)=10**(0. 7924+(ALOG10(T(K))+0. 3010)*0. 6897)
      ENDIF
      IF((T(K).LE. 10. ).AND. (T(K).GT. 1. 0)) THEN
      W(I)=10**(1. 0000+(ALOG10(T(K))-0. 0000)*0. 5563)
      ENDIF
      IF((T(K).LE. 100. ).AND. (T(K).GT. 10. )) THEN
      W(I)=10**(1. 5563+(ALOG10(T(K))-1. 0000)*0. 4649)
      ENDIF
      IF((T(K).GT. 100. )) W(I)=10**(2. 0212+(ALOG10(T(K))-2. )*. 4973)
      Z(I,K)=W(I)/(100*. 4*U1(I))
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C X    CALCULATION OF FUNCTIONS FI1(I,K) AND FI2(I,K)          X
C X    IN TERMS OF AE(I,K) AND Z(I,K)                          X
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      L=1
      A7=1. 0
      SUM1=0. 0
      SUM2=0. 0
   33 R6=R7(L)
      H6=H7(L)
      Y6=Y7(L)
   20 A7=A7-H6
      Y11=((1. -Y6)/Y6)**Z(I,K)
      Y12=((1. -Y6-0. 5*H6)/(Y6+0. 5*H6))**Z(I,K)
      Y13=((1. -Y6+0. 5*H6)/(Y6-0. 5*H6))**Z(I,K)
      Y21=(((1. -Y6)/Y6)**Z(I,K))*ALOG(Y6)
      Y22=(((1. -Y6-0. 5*H6)/(Y6+0. 5*H6))**Z(I,K))*ALOG(Y6+0. 5*H6)
      Y23=(((1. -Y6+0. 5*H6)/(Y6-0. 5*H6))**Z(I,K))*ALOG(Y6-0. 5*H6)
      SUM1=SUM1+(Y12+4*Y11+Y13)*H6/6.
      SUM2=SUM2+(Y22+4*Y21+Y23)*H6/6.
      IF(A7. EQ. (H6+AE(I,K))) GO TO 200
      IF(A7. NE. (H6+AE(I,K))) GO TO 300
  300 CONTINUE
       IF((A7-AE(I,K))-H6) 30,30,40
   40 IF(A7-(R6+H6))15,25,25
   25 Y6=A7-0. 5*H6
      GO TO 20
   30 Y6=(A7+AE(I,K))/2.
      H6=A7-AE(I,K)
      Y6=A7-0. 5*H6
      GO TO 20
   15 L=L+1
      GO TO 33
  200 Q1=(. 216)*(AE(I,K)**(Z(I,K)-1. ))/((1. -AE(I,K))**Z(I,K))
      FI1(I,K)=SUM1*Q1
      FI2(I,K)=SUM2*Q1
      IST(I,K)=PE(I)*FI1(I,K)+FI2(I,K)
      BMLSF(I,K)=BLSF(I,K)*IST(I,K)
      BMREC(I,K)=BMLSF(I,K)*P(I)
      IF(K. EQ. 1) THEN
      JJ=I
      FFF(JJ)=BMREC(I,K)
      ELSE IF(K. NE. 1) THEN
      JJ=(K-1)*N3+I
      FFF(JJ)=BMREC(I,K)+FFF(JJ-N3)
      ENDIF
      IF(K. EQ. 1) BMRAS(I,K)=BMREC(I,K)
      IF(K. NE. 1) BMRAS(I,K)=BMREC(I,K)+FFF(JJ-N3)
      TBLSL(I,K)=TBLEC(I,K)+BMRAS(I,K)
      WRITE(3,8000)H(I),Q(I),BLEC(I,K),TBLEC(I,K),BMREC(I,K)
     ,BMRAS(I,K),TBLSL(I,K)
  120 CONTINUE
  110 CONTINUE
      WRITE(2,1200)AYDE
      WRITE(2,4500)
      DO 730 K=1,4
      DO 740 I=1,N3
```

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      WRITE(2,4000) D(K),FBM(K),R1(I),ISRP2(I,K),DD(I,K),FF(I,K)
     *              ,ISIQ(I,K),ISTIQ(I,K),BLSF(I,K),BLEC(I,K),TBLEC(I,K)
  740 CONTINUE
      WRITE(2,1500)
  730 CONTINUE
      WRITE(2,1300)AYDE
      WRITE(2,5500)
      DO 750 K=1,4
      DO 760 I=1,N3
      WRITE(2,5000) AE(I,K),W(I),Z(I,K),FI1(I,K),FI2(I,K),IST(I,K)
     *              ,BMLSF(I,K),BMREC(I,K),BMRAS(I,K),TBLSL(I,K)
  760 CONTINUE
      WRITE(2,1500)
  750 CONTINUE
 1000 FORMAT(///24X,'CROSS SECTION: ',2X,A30,//
     *   13X,'H Y D R A U L I C S   C A L C U L A T I O N S...'//)
 1100 FORMAT(///18X,'CROSS SECTION: ',2X,A30,//
     *           7X,'H Y D R A U L I C S   C A L C U L A T I O N S...'
     * ,1X,'(CONTINUED)'//)
 1200 FORMAT(///26X,'CROSS SECTION: ',2X,A30,//
     * 13X,'S E D I M E N T   T R A N S P O R T   C A L C U L',1X,
     *    'A T I O N...'//)
 1300 FORMAT(///20X,'CROSS SECTION: ',2X,A30,//
     *           5X,'S E D I M E N T   T R A N S P O R T   C A L',1X,
     *    'C U L A T I O N...(CONTINUED)'//)
 2500 FORMAT(2X,'R1',4X,'U1',3X,'DELTA1',5X,'M',4X,'X1',3X,'DELTA2'
     *      ,4X,'U',6X,'C',8X,'M2',5X,'U2',5X,'R2',5X,'R'/
     * 1X,'(1)',3X,'(2)',4X,'(3)',6X,'(4)',3X,'(5)',4X,'(6)',4X,'(7)'
     * ,4X,'(8)',7X,'(9)',3X,'(10)',3X,'(11)',3X,'(12)'//)
 2000 FORMAT(F4.2,1X,F6.4,1X,F7.5,1X,F6.3,1X,F5.3,1X,F7.5,1X,
     *      F9.2,2X,F7.3,2X,F6.2,2X,F5.3,3X,F4.2,3X,F5.2,/)
 3500 FORMAT(2X,'UC',4X,'H',5X,'A',7X,'P',6X,'S',8X,'Q1',7X,'X2',
     *      6X,'Y',4X,'SX',5X,'SS',3X,'FE'/
     * 1X,'(13)',2X,'(14)',2X,'(15)',4X,'(16)',4X,'(17)'
     * ,4X,'(18)',5X,'(19)',3X,'(20)',2X,'(21)',2X,'(22)',3X,'(23)'//)
 3000 FORMAT(F5.3,1X,F5.2,1X,F7.1,1X,F6.1,1X,F7.1,1X,F7.1,
     *      1X,F8.6,1X,F5.3,1X,F5.3,1X,F5.3,1X,F6.3,/)
 1500 FORMAT(2X,90('-'))
 4500 FORMAT(4X,'D',5X,'FBM',4X,'R1',4X,'ISRP2',4X,'DD',6X,'FF',
     *      7X,'ISIQ',4X,'ISTIQ',4X,'BLSF',6X,'BLEC',5X,'TBLEC'/
     * 3X,'(1)',4X,'(2)',4X,'(3)',4X,'(4)',5X,'(5)',5X,'(6)',7X,'(7)'
     * ,6X,'(8)',5X,'(9)',6X,'(10)',7X,'(11)'//)
 4000 FORMAT(F8.6,1X,F4.2,1X,F5.2,3X,F7.3,1X
     *  ,F5.3,3X,F7.3,2X,F8.3,1X,F6.3,1X,F8.5,1X,F8.3,3X,F9.3)
 5500 FORMAT(4X,'AE',5X,'W',6X,'Z',7X,'FI1',7X,'FI2',
     *      6X,'IST',5X,'BMLSF',4X,'BMREC',3X,'BMRAS',5X,'TBLSL'/
     * 3X,'(12)',3X,'(13)',2X,'(14)',5X,'(15)',6X,'(16)',6X,'(17)'
     * ,4X,'(18)',5X,'(19)',6X,'(20)',7X,'(21)'//)
 5000 FORMAT(F8.6,1X,F4.2,1X,F5.2,1X,F9.4,1X,F9.4,1X,
     *      F8.3,1X,F7.3,1X,F9.3,1X,F9.3,1X,F10.3)
 8000 FORMAT(1X,F5.2,2X,F7.1,2X,F9.3,2X,F9.3,2X,F9.3,2X,F9.3,2X,F10.3)
      WRITE(*,*)'DO YOU WANT TO RUN FOR AN OTHER CROSS SECTION ?'
      WRITE(*,*)'WRITE (1) IF YES OR (0) IF NOT'
      READ(*,*)LAURA
      IF(LAURA.EQ.1) GO TO 3
      IF(LAURA.EQ.0) GO TO 799
  799 CONTINUE
      WRITE(*,*)'FILE: SEDIM1  (RESULTS OF EINSTEIN MODEL)'
      WRITE(*,*)'FILE: SEDIM2  (OUTPUT FOR PLOTTING)'
      END
```

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14.38.37.UCLP, 5B, OEFTERM, 0.448KLNS.
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APPENDIX 12

```
      PROGRAM EINSTE1
      REAL ISIG,ISTIG,IST,M,M2,ISRP2,KS,N
      DIMENSION H5(200),G5(200),P5(200),A5(200),R5(200)
     *,III(130),R1(130),U1(130),DELTA1(130),M(130),X1(130),DELTA2(130)
     *,U(130),C(130),M2(130),U2(130),R2(130),R(130),H(130),Q1(130)
     *,US(130),X2(130),Y(130),BX(130),B(130),PE(130),DD(130),FF(130)
     *,R3(130),ISTIG(130),BLSF(130),BLEC(130),TBLEC(130),ISIG(130)
     *,AE(130),W(130),Z(130),FI1(130),FI2(130),IST(130)
     *,BMLSF(130),BMREC(130),BMRAS(130),TBLSL(130)
     *,T(5),R7(6),H7(6),Y7(6),A(130),P(130),Q(130),UC(130)
     * ,ISRP2(130),BB(130),FFF(200),GGG(200),RENE(10)
      OPEN (1,FILE='RATING4')
      OPEN (2,FILE='SEDIM3')
      OPEN (3,FILE='SEDIM4')
      DATA R7(1),R7(2),R7(3),R7(4),R7(5),R7(6)
     */.10,.010,.0010,.00010,.000010,.0000010/
      DATA H7(1),H7(2),H7(3),H7(4),H7(5),H7(6)
     */.020,.0020,.00020,.000020,.0000020,.00000020/
      DATA Y7(1),Y7(2),Y7(3),Y7(4),Y7(5),Y7(6)
     */0.9899999,0.099,0.0099,0.00099,0.000099,0.0000099/
      DATA VIS,D65,D35,FBM,G/0.000000841,0.000325,
     * 0.0001567,1.0,9.81/
      DATA SD,FD/2650.0,1000.0/
      N=127
      DO 10 I=1,N
      READ(1,*)III(I),H(I),Q(I),A(I),U(I),US(I),P(I),R(I)
 10   CONTINUE
      WRITE(*,*) 'THE ENERGY LINE SLOPE (S)  IS:'
      READ(*,*)S
      WRITE(*,*)'THE DIAMETER OF THE PARTICLE (D50) IS:'
      READ(*,*)D50
      KS=D65
      DO 50 I=1,N
      IF(US(I).EQ.0) GO TO 55
      R1(I)=0.29*R(I)
 65   U1(I)=(R1(I)*G*S)**.5
      DELTA1(I)=(11.6*VIS)/U1(I)
      M(I)=KS/DELTA1(I)
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %   CALCULATION OF CORRECTION FACTOR IN THE           %
C %   LOGARITHMIC VELOCITY DISTRIBUTION    (X1)         %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      IF(M(I).LE.0.5) X1(I)=.7+(ALOG10(M(I))+.699)*1.7085
      IF((M(I).LE.0.6).AND.(M(I).GT.0.5)) THEN
      X1(I)=1.38+(ALOG10(M(I))+.3010)*1.2626
      ENDIF
      IF((M(I).LE.0.7).AND.(M(I).GT.0.6)) THEN
      X1(I)=1.48+(ALOG10(M(I))+.2218)*1.0463
      ENDIF
      IF((M(I).LE.0.8).AND.(M(I).GT.0.7)) THEN
      X1(I)=1.55+(ALOG10(M(I))+.1549)*.5172
      ENDIF
      IF((M(I).LE.0.9).AND.(M(I).GT.0.8)) THEN
      X1(I)=1.58+(ALOG10(M(I))+.0969)*.5871
      ENDIF
      IF((M(I).LE.1.0).AND.(M(I).GT.0.9)) THEN
      X1(I)=1.61+(ALOG10(M(I))+.0458)*.2183
      ENDIF
      IF((M(I).LE.1.2).AND.(M(I).GT.1.0)) THEN
      X1(I)=1.62-(ALOG10(M(I)))*.2525
      ENDIF
      IF((M(I).LE.1.4).AND.(M(I).GT.1.2)) THEN
      X1(I)=1.6-(ALOG10(M(I))-.0792)*.5979
      ENDIF
      IF((M(I).LE.3.0).AND.(M(I).GT.1.4)) THEN
      X1(I)=1.56-(ALOG10(M(I))-.1461)*1.0876
      ENDIF
      IF((M(I).LE.3.5).AND.(M(I).GT.3.0)) THEN
      X1(I)=1.2-(ALOG10(M(I))-.4771)*.8955
      ENDIF
      IF((M(I).LE.4.5).AND.(M(I).GT.3.5)) THEN
      X1(I)=1.14-(ALOG10(M(I))-.5441)*.55
      ENDIF
      IF((M(I).LE.6.0).AND.(M(I).GT.4.5)) THEN
      X1(I)=1.08-(ALOG10(M(I))-.6532)*.4
      ENDIF
      IF((M(I).LE.9.0).AND.(M(I).GT.6.0)) THEN
      X1(I)=1.03-(ALOG10(M(I))-.7782)*.1705
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```
      ENDIF
      IF((M(I).GT. 9. 0)) X1(I)=1. 0
      DELTA2(I)=KS/X1(I)
      C(I)=(SD-FD)*D35/(FD*R1(I)*S)
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %   FRICTION U"* DUE TO CHANNEL IRREGULARITIES    %
C %             FOR BAR RESISTANCE                  %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      IF(C(I).LE. 1. 0) M2(I)=10**(2. 0-(ALOG10(C(I))+0. 3188)*1. 2654)
      IF((C(I).LE. 1. 5). AND. (C(I).GT. 1. 0)) THEN
      M2(I)=10**(1. 5966-(ALOG10(C(I))-0. 0000)*1. 0795)
      ENDIF
      IF((C(I).LE. 2. 0). AND. (C(I).GT. 1. 5)) THEN
      M2(I)=10**(1. 4065-(ALOG10(C(I))-0. 1761)*0. 8447)
      ENDIF
      IF((C(I).LE. 3. 0). AND. (C(I).GT. 2. 0)) THEN
      M2(I)=10**(1. 3010-(ALOG10(C(I))-0. 3010)*0. 664)
      ENDIF
      IF((C(I).LE. 4. 0). AND. (C(I).GT. 3. 0)) THEN
      M2(I)=10**(1. 1847-(ALOG10(C(I))-0. 4771)*0. 5664)
      ENDIF
      IF((C(I).LE. 6. 0). AND. (C(I).GT. 4. 0)) THEN
      M2(I)=10**(1. 1139-(ALOG10(C(I))-0. 6021)*0. 5031)
      ENDIF
      IF((C(I).LE. 10. ). AND. (C(I).GT. 6. 0)) THEN
      M2(I)=10**(1. 0253-(ALOG10(C(I))-0. 7782)*0. 4094)
      ENDIF
      IF((C(I).LE. 100. ). AND. (C(I).GT. 10. )) THEN
        M2(I)=10**(0. 9345-(ALOG10(C(I))-1. 0)*. 3984)
      ENDIF
      IF(C(I).GT. 100. ) M2(I)=10**(. 5441-(ALOG10(C(I))-2. 0)*. 3984)
      U2(I)=U(I)/M2(I)
      R2(I)=R(I)-R1(I)
      R(I)=R1(I)+R2(I)
      IF((DELTA2(I)/DELTA1(I)). GE. 1. 80) X2(I)=0. 77*DELTA2(I)
      IF((DELTA2(I)/DELTA1(I)). LT. 1. 80) X2(I)=1. 39*DELTA1(I)
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %  PRESSURE CORRECTION FACTOR Y(I), IN THE          %
C %  TRANSITION TO A SMOOTH BED                       %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      IF(M(I).LE. 0. 1) Y(I)=10**(-2. +(ALOG10(M(I))+1. 6576)*1. 226)
      IF((M(I).LE. . 145). AND. (M(I).GT. 0. 1)) THEN
      Y(I)=10**(-1. 1938+(ALOG10(M(I))+1. 0000)*1. 2007)
      ENDIF
      IF((M(I).LE. . 55). AND. (M(I).GT. . 145)) THEN
      Y(I)=10**(-1. 000+(ALOG10(M(I))+0. 8386)*1. 2073)
      ENDIF
      IF((M(I).LE. . 70). AND. (M(I).GT. . 55)) THEN
      Y(I)=10**(-. 3010+(ALOG10(M(I))+0. 2596)*1. 0879)
      ENDIF
      IF((M(I).LE. . 76). AND. (M(I).GT. . 70)) THEN
      Y(I)=10**(-. 1871+(ALOG10(M(I))+0. 1549)*0. 9020)
      ENDIF
      IF((M(I).LE. . 90). AND. (M(I).GT. . 76)) THEN
      Y(I)=10**(-. 1549+(ALOG10(M(I))+0. 1192)*0. 7891)
      ENDIF
      IF((M(I).LE. 1. 0). AND. (M(I).GT. . 90)) THEN
      Y(I)=10**(-. 0969+(ALOG10(M(I))+0. 0457)*0. 4639)
      ENDIF
      IF((M(I).LE. 1. 1). AND. (M(I).GT. 1. 0)) THEN
      Y(I)=10**(-. 0757+(ALOG10(M(I))+0. 0000)*0. 1232)
      ENDIF
      IF((M(I).LE. 1. 2). AND. (M(I).GT. 1. 1)) THEN
      Y(I)=10**(-. 0706-(ALOG10(M(I))-0. 0414)*0. 1349)
      ENDIF
      IF((M(I).LE. 1. 4). AND. (M(I).GT. 1. 2)) THEN
      Y(I)=10**(-. 0757-(ALOG10(M(I))-0. 0792)*0. 3991)
      ENDIF
      IF((M(I).LE. 1. 65). AND. (M(I).GT. 1. 4)) THEN
      Y(I)=10**(-. 1024-(ALOG10(M(I))-0. 1461)*0. 7353)
      ENDIF
      IF((M(I).LE. 1. 8). AND. (M(I).GT. 1. 65)) THEN
      Y(I)=10**(-. 1549-(ALOG10(M(I))-0. 2175)*1. 0291)
      ENDIF
      IF((M(I).LE. 2. 0). AND. (M(I).GT. 1. 8)) THEN
      Y(I)=10**(-. 1938-(ALOG10(M(I))-0. 2553)*0. 6127)
      ENDIF
      IF((M(I).LE. 2. 5). AND. (M(I).GT. 2. 0)) THEN
      Y(I)=10**(-. 2218-(ALOG10(M(I))-0. 3010)*0. 3096)
```

```
      ENDIF
      IF((M(I).LE.3.0).AND.(M(I).GT.2.5)) THEN
      Y(I)=10**(-.2518-(ALOG10(M(I))-0.3979)*0.0985)
      ENDIF
      IF((M(I).LE.3.5).AND.(M(I).GT.3.0)) THEN
      Y(I)=10**(-.2596-(ALOG10(M(I))-0.4771)*0.1194)
      ENDIF
      IF(M(I).GT.3.5) Y(I)=10**(-.2676-(ALOG10(M(I))-.5441)*.0523)
      BX(I)=ALOG10(10.6*X2(I)/DELTA2(I))
      B(I)=ALOG10(10.6)
      BB(I)=(B(I)/BX(I))**2
      PE(I)=2.303*ALOG10(30.2*H(I)/DELTA2(I))
C%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C%       BED     MATERIAL    LOAD     CALCULATION               %
C%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      ISRP2(I)=(SD-FD)*D50/(FD*R1(I)*S)
      DD(I)=D50/X2(I)
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %     HIDING FACTOR FF(I), IN TERMS OF D50/X2(I) %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      IF(DD(I).LE.0.10) FF(I)=10**(2.9542-(ALOG10(DD(I))
     .+1.3468)*2.2436)
      IF((DD(I).LE..12).AND.(DD(I).GT.0.10)) THEN
      FF(I)=10**(2.1761-(ALOG10(DD(I))+1.0000)*2.2235)
      ENDIF
      IF((DD(I).LE..255).AND.(DD(I).GT..12)) THEN
      FF(I)=10**(2.0000-(ALOG10(DD(I))+0.9208)*2.1350)
      ENDIF
      IF((DD(I).LE..64).AND.(DD(I).GT..255)) THEN
      FF(I)=10**(1.3010-(ALOG10(DD(I))+0.5934)*2.5025)
      ENDIF
      IF((DD(I).LE..7).AND.(DD(I).GT..64)) THEN
      FF(I)=10**(0.3010-(ALOG10(DD(I))+0.1938)*2.0129)
      ENDIF
      IF((DD(I).LE.0.8).AND.(DD(I).GT.0.7)) THEN
      FF(I)=10**(0.2227-(ALOG10(DD(I))+0.1549)*1.3207)
      ENDIF
      IF((DD(I).LE.0.9).AND.(DD(I).GT.0.8)) THEN
      FF(I)=10**(0.1461-(ALOG10(DD(I))+0.0969)*1.0313)
      ENDIF
      IF((DD(I).LE.1.0).AND.(DD(I).GT.0.9)) THEN
      FF(I)=10**(0.0934-(ALOG10(DD(I))+0.0458)*0.7140)
      ENDIF
      IF((DD(I).LE.1.1).AND.(DD(I).GT.1.0)) THEN
      FF(I)=10**(0.0607-(ALOG10(DD(I))-0.0000)*0.4662)
      ENDIF
      IF((DD(I).LE.1.3).AND.(DD(I).GT.1.1)) THEN
      FF(I)=10**(0.0414-(ALOG10(DD(I))-0.0414)*0.3945)
      ENDIF
      IF((DD(I).LE.1.5).AND.(DD(I).GT.1.3)) THEN
      FF(I)=10**(0.0128-(ALOG10(DD(I))-0.1139)*0.2058)
      ENDIF
      IF((DD(I).GT.1.5)) FF(I)=1.0
      ISIG(I)=FF(I)*Y(I)*ISRP2(I)*(B(I)/BX(I))**2
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C % INTENSITY OF TRANSPORT FOR INDIVIDUAL GRAIN
C %          SIZE.....ISTIG(I)                    %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      IF(ISIG(I).LE.0.26) THEN
      ISTIG(I)=10**(2.0-(ALOG10(ISIG(I))+1.0969)*1.0215)
      ENDIF
      IF((ISIG(I).LE.0.75).AND.(ISIG(I).GT.0.26)) THEN
      ISTIG(I)=10**(1.4771-(ALOG10(ISIG(I))+0.5850)*1.0369)
      ENDIF
      IF((ISIG(I).LE.1.70).AND.(ISIG(I).GT.0.75)) THEN
      ISTIG(I)=10**(1.0-(ALOG10(ISIG(I))+0.1249)*1.1199)
      ENDIF
      IF((ISIG(I).LE.2.7).AND.(ISIG(I).GT.1.70)) THEN
      ISTIG(I)=10**(0.6021-(ALOG10(ISIG(I))-0.2304)*1.4980)
      ENDIF
      IF((ISIG(I).LE.4.1).AND.(ISIG(I).GT.2.7)) THEN
      ISTIG(I)=10**(0.3010-(ALOG10(ISIG(I))-0.4314)*1.6593)
      ENDIF
      IF((ISIG(I).LE.5.0).AND.(ISIG(I).GT.4.1)) THEN
      ISTIG(I)=10**(0.0-(ALOG10(ISIG(I))-0.6128)*2.5761)
      ENDIF
      IF((ISIG(I).LE.7.6).AND.(ISIG(I).GT.5.0)) THEN
      ISTIG(I)=10**(-.2218-(ALOG10(ISIG(I))-0.6989)*2.6229)
      ENDIF
```

```
      IF((ISIG(I).LE. 9. 40). AND. (ISIG(I). GT. 7. 6)) THEN
      ISTIG(I)=10**(-. 6989-(ALOG10(ISIG(I))-0. 8808)*3. 2622)
      ENDIF
      IF((ISIG(I).LE. 12. ). AND. (ISIG(I). GT. 9. 40)) THEN
      ISTIG(I)=10**(-1. 000-(ALOG10(ISIG(I))-. 9731)*3. 7502)
      ENDIF
      IF((ISIG(I).LE. 16. 5). AND. (ISIG(I). GT. 12. )) THEN
      ISTIG(I)=10**(-1. 3979-(ALOG10(ISIG(I))-1. 0792)*4. 3536)
      ENDIF
      IF((ISIG(I).LE. 19. 5). AND. (ISIG(I). GT. 16. 5)) THEN
      ISTIG(I)=10**(-2. 000-(ALOG10(ISIG(I))-1. 2175)*7. 2124)
      ENDIF
      IF((ISIG(I).LE. 22. ). AND. (ISIG(I). GT. 19. 5)) THEN
      ISTIG(I)=10**(-2. 5229-(ALOG10(ISIG(I))-1. 2900)*9. 1050)
      ENDIF
      IF((ISIG(I).LE. 24. ). AND. (ISIG(I). GT. 22. )) THEN
      ISTIG(I)=10**(-3. 000-(ALOG10(ISIG(I))-1. 3424)*10. 4987)
      ENDIF
      IF((ISIG(I). GT. 24. 0)) THEN
      ISTIG(I)=10**(-3. 3979-(ALOG10(ISIG(I))-1. 3802)*11. 7598)
      ENDIF
      BLSF(I)=FBM*ISTIG(I)*SD*(G**1. 5)*(D50**1. 5)*((SD/FD-1)
     . **. 5)*86. 4/9. 81
      BLEC(I)=BLSF(I)*P(I)
      AE(I)=2*D50/H(I)
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %  CALCULATION OF SETTLING VELOCITY...W(I)             %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      T(K)=1000*D50
      IF(T(K). LE. 0. 10) W(I)=10**(-1. 0969+(ALOG10(T(K))+2. 0)*0. 9602)
      IF((T(K). LE. . 12). AND. (T(K). GT. 0. 10)) THEN
      W(I)=10**(-. 1367+(ALOG10(T(K))+1. 0)*1. 7260)
      ENDIF
      IF((T(K). LE. . 2). AND. (T(K). GT. . 12)) THEN
      W(I)=10**(0. 0000+(ALOG10(T(K))+0. 9208)*1. 6300)
      ENDIF
      IF((T(K). LE. 0. 3). AND. (T(K). GT. 0. 2)) THEN
      W(I)=10**(0. 3617+(ALOG10(T(K))+0. 6989)*1. 3034)
      ENDIF
      IF((T(K). LE. 0. 5). AND. (T(K). GT. 0. 3)) THEN
      W(I)=10**(0. 5911+(ALOG10(T(K))+0. 5229)*0. 9072)
      ENDIF
      IF((T(K). LE. 1. 0). AND. (T(K). GT. 0. 5)) THEN
      W(I)=10**(0. 7924+(ALOG10(T(K))+0. 3010)*0. 6897)
      ENDIF
      IF((T(K). LE. 10. ). AND. (T(K). GT. 1. 0)) THEN
      W(I)=10**(1. 0000+(ALOG10(T(K))-0. 0000)*0. 5563)
      ENDIF
      IF((T(K). LE. 100. ). AND. (T(K). GT. 10. )) THEN
      W(I)=10**(1. 5563+(ALOG10(T(K))-1. 0000)*0. 4649)
      ENDIF
      IF((T(K). GT. 100. )) W(I)=10**(2. 0212+(ALOG10(T(K))-2. )*. 4973)
      Z(I)=W(I)/(100*. 4*U1(I))
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
C %    CALCULATION OF FUNCTIONS FI1(I) AND FI2(I)             %
C %    IN TERMS OF AE(I) AND Z(I)                             %
C %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
      L=1
      A7=1. 0
      SUM1=0. 0
      SUM2=0. 0
   35 R6=R7(L)
      H6=H7(L)
      Y6=Y7(L)
   20 A7=A7-H6
      Y11=((1. -Y6)/Y6)**Z(I)
      Y12=((1. -Y6-0. 5*H6)/(Y6+0. 5*H6))**Z(I)
      Y13=((1. -Y6+0. 5*H6)/(Y6-0. 5*H6))**Z(I)
      Y21=(((1. -Y6)/Y6)**Z(I))*ALOG(Y6)
      Y22=(((1. -Y6-0. 5*H6)/(Y6+0. 5*H6))**Z(I))*ALOG(Y6+0. 5*H6)
      Y23=(((1. -Y6+0. 5*H6)/(Y6-0. 5*H6))**Z(I))*ALOG(Y6-0. 5*H6)
      SUM1=SUM1+(Y12+4*Y11+Y13)*H6/6.
      SUM2=SUM2+(Y22+4*Y21+Y23)*H6/6.
      IF(A7. EQ. (H6+AE(I))) GO TO 200
      IF(A7. NE. (H6+AE(I))) GO TO 300
  300 CONTINUE
       IF((A7-AE(I))-H6) 30, 30, 40
   40 IF(A7-(R6+H6))15, 25, 25
   25 Y6=A7-0. 5*H6
      GO TO 20
   30 Y6=(A7+AE(I))/2
      H6=A7-AE(I)
```

```
      Y6=A7-0.5*H6
      GO TO 20
   15 L=L+1
      GO TO 35
  200 G1=(.216)*(AE(I)**(Z(I)-1.))/((1.-AE(I))**Z(I))
      FI1(I)=SUM1*G1
      FI2(I)=SUM2*G1
      IST(I)=PE(I)*FI1(I)+FI2(I)
      BMLSF(I)=BLSF(I)*IST(I)
      BMREC(I)=BMLSF(I)*P(I)
      TBLSL(I)=BLEC(I)+BMREC(I)
   55 CONTINUE
   50 CONTINUE
      WRITE(2,1000)
      WRITE(2,2500)
      DO 710 I=1,N
      WRITE(2,2000)I,R1(I),U1(I),DELTA1(I),M(I),X1(I),DELTA2(I)
     .              ,U(I),C(I),M2(I),U2(I),R2(I),R(I)
  710 CONTINUE
      WRITE(2,1100)
      WRITE(2,3500)
      DO 720 I=1,N
      WRITE(2,3000)I,US(I),H(I),A(I),P(I),Q(I),X2(I),Y(I)
     .              ,BX(I),BB(I),PE(I)
  720 CONTINUE
      WRITE(2,1200)
      WRITE(2,4500)
      DO 740 I=1,N
      WRITE(2,4000)I,D50,FBM,R1(I),ISRP2(I),DD(I),FF(I)
     .              ,ISIG(I),ISTIG(I),BLSF(I),BLEC(I)
  740 CONTINUE
      WRITE(2,1300)
      WRITE(2,5500)
      DO 760 I=1,N
      WRITE(2,5000)I,AE(I),W(I),Z(I),FI1(I),FI2(I),IST(I)
     .              ,BMLSF(I),BMREC(I),TBLSL(I)
  760 CONTINUE
      DO 730 I=1,127
      WRITE(3,6000)I,BLSF(I),BLEC(I),BMLSF(I),BMREC(I),TBLSL(I)
  730 CONTINUE
 1000 FORMAT(///24X,'EINSTEIN MODEL: TWO DIMENSIONAL APPROACH'///
     .   15X,'H Y D R A U L I C S   C A L C U L A T I O N S...'//)
 1100 FORMAT(///20X,'EINSTEIN MODEL: TWO DIMENSIONAL APPROACH'///
     .              7X,'H Y D R A U L I C S   C A L C U L A T I O N S...'
     .,1X,'(CONTINUED)'//)
 1200 FORMAT(///20X,'EINSTEIN MODEL: TWO DIMENSIONAL APPROACH'///
     .13X,'S E D I M E N T   T R A N S P O R T   C A L C U L',1X,
     .   'A T I O N...'//)
 1300 FORMAT(///20X,'EINSTEIN MODEL: TWO DIMENTIONAL APPROACH'///
     .              5X,'S E D I M E N T   T R A N S P O R T   C A L',1X,
     .   'C U L A T I O N...(CONTINUED)'//)
 2500 FORMAT(8X,'R1',4X,'U1',3X,'DELTA1',5X,'M',4X,'X1',3X,
     .  'DELTA2',4X,'U',6X,'C',8X,'M2',5X,'U2',5X,'R2',6X,'R'/
     .  7X,'(1)',3X,'(2)',4X,'(3)',6X,'(4)',3X,'(5)',4X,'(6)',4X,'(7)'
     . ,4X,'(8)',7X,'(9)',3X,'(10)',3X,'(11)',3X,'(12)'//)
 2000 FORMAT(I4,2X,F4.2,1X,F6.4,1X,F7.5,1X,F6.3,1X,F5.3,1X,F7.5,1X,
     .          F5.2,2X,F7.3,2X,F6.2,2X,F5.3,3X,F5.2,3X,F5.2)
 3500 FORMAT(8X,'US',4X,'H',5X,'A',8X,'P',6X,'Q',7X,'X2',
     .          6X,'Y',4X,'BX',5X,'BB',4X,'PE'/
     .  7X,'(13)',2X,'(14)',2X,'(15)',4X,'(16)',4X,'(17)'
     . ,5X,'(18)',3X,'(19)',2X,'(20)',2X,'(21)',3X,'(22)'//)
 3000 FORMAT(I4,2X,F5.3,1X,F5.2,1X,F7.1,1X,F6.1,1X,F7.1,
     .          1X,F8.6,1X,F5.3,1X,F5.3,1X,F5.3,1X,F6.3)
 4500 FORMAT(10X,'D',5X,'FBM',4X,'R1',4X,'ISRP2',4X,'DD',6X,'FF',
     .          7X,'ISIG',4X,'ISTIG',4X,'BLSF',6X,'BLEC'/
     .  9X,'(1)',4X,'(2)',4X,'(3)',4X,'(4)',5X,'(5)',5X,'(6)',7X,'(7)'
     . ,6X,'(8)',5X,'(9)',6X,'(10)'//)
 4000 FORMAT(I4,2X,F8.6,1X,F4.2,1X,F5.2,3X,F7.3,1X
     .  ,F5.3,3X,F7.3,2X,F8.3,1X,F6.3,1X,F8.5,1X,F8.3)
 5500 FORMAT(10X,'AE',5X,'W',6X,'Z',7X,'FI1',7X,'FI2',
     .          6X,'IST',5X,'BMLSF',4X,'BMREC',5X,'TBLSL'/
     .  9X,'(12)',3X,'(13)',2X,'(14)',5X,'(15)',6X,'(16)',6X,'(17)'
     . ,4X,'(18)',5X,'(19)',7X,'(20)'//)
 5000 FORMAT(I4,2X,F8.6,1X,F4.2,1X,F5.2,1X,F9.4,1X,F9.4,1X,
     .           F8.3,1X,F7.3,1X,F9.3,1X,F10.3)
 6000 FORMAT(I4,5F10.3)
      WRITE(*,*)'FILE: SEDIM3  (RESULTS OF EINSTEIN MODEL)'
      WRITE(*,*)'FILE: SEDIM4  (OUTPUT FOR PLOTTING)'
      END
```

APPENDIX 13

```
      PROGRAM PLSEDIM
      DIMENSION H(200),Q(200),B(200),TB(200),S(200),TS(200),TBS(200)
     ,Q1(200),B1(200),TB1(200),S1(200),TS1(200),TBS1(200)
      OPEN (1,FILE='SEDPL10')
C###############################################################
C
C     PROGRAME FOR PLOTTING THE BED LOAD SEDIMENT DISCHARGE
C     AND SUSPENDED SEDIMENT DISCHARGE
C###############################################################
      N=52
      N1=13
      N2=N1+1
      N3=N2+N1-1
      N4=N3+1
      N5=N4+N1-1
      N6=N5+1
      DO 73 I=1,N
      READ(1,*)H(I),Q1(I),B1(I),TB1(I),S1(I),TS1(I),TBS1(I)
      Q(I)=ALOG10(Q1(I))
      IF(B1(I).EQ.0.) THEN
      B(I)=-4.
      ELSE IF(B1(I).NE.0.) THEN
      B(I)=ALOG10(B1(I))
      ENDIF
      IF(S1(I).EQ.0.) THEN
      S(I)=-4.
      ELSE IF(S1(I).NE.0.) THEN
      S(I)=ALOG10(S1(I))
      ENDIF
      IF(TS1(I).EQ.0.) THEN
      TS(I)=-4.
      ELSE IF(TS1(I).NE.0.) THEN
      TS(I)=ALOG10(TS1(I))
      ENDIF
      IF(TB1(I).EQ.0.) THEN
      TB(I)=-4.
      ELSE IF(TB1(I).NE.0.) THEN
      TB(I)=ALOG10(TB1(I))
      ENDIF
73    CONTINUE
      CALL GROPEN
      CALL PLSIZE(12.,20.)
      CALL OPTION('LX,LY')
      CALL BOUNDS(3.,-3.,4.3,4.)
      CALL YLABEL('QB...(TON./DAY)')
      CALL XLABEL('DISCHARGE...(CUMEC)')
      CALL UPPCMT('BED LOAD SEDIMENT TRANSPORT')
      CALL LOWCMT('S_ECTION..._ M_ATEBA_ S_UD_ K_APITA')
      DO 36 I=1,N1
      CALL CUTYPE('AS,SO')
      CALL DRAW(Q(I),B(I))
36    CONTINUE
      CALL CUNEXT
      DO 46 I=N2,N3
      CALL CUTYPE('SQ,SO')
      CALL DRAW(Q(I),B(I))
46    CONTINUE
      CALL CUNEXT
      DO 56 I=N4,N5
      CALL CUTYPE('DE,SO')
      CALL DRAW(Q(I),B(I))
56    CONTINUE
      CALL CUNEXT
      DO 66 I=N6,N
      CALL CUTYPE('CI,SO')
      CALL DRAW(Q(I),B(I))
66    CONTINUE
      CALL CUNEXT
      DO 76 I=N6,N
      CALL CUTYPE('CR,SO')
      CALL DRAW(Q(I),TB(I))
76    CONTINUE
      CALL CUNEXT
      CALL DRAWCU(3.1,1,4.1,1,1,'AS')
      CALL ADDCMT(3.15,4.1,'D=.000212 _MM')
      CALL DRAWCU(3.1,1,3.8,1,1,'SQ')
      CALL ADDCMT(3.15,3.8,'D=.000254 _MM')
      CALL DRAWCU(3.1,1,3.5,1,1,'DE')
      CALL ADDCMT(3.15,3.5,'D=.000312 _MM')
      CALL DRAWCU(3.1,1,3.2,1,1,'CI')
      CALL ADDCMT(3.15,3.2,'D=.000370 _MM')
      CALL DRAWCU(3.1,1,2.9,1,1,'CR')
      CALL ADDCMT(3.15,2.9,'T_OTAL_ B_ED_ L_OAD')
      CALL GRNEXT
      CALL PLSIZE(12.,20.)
      CALL OPTION('LX,LY')
```

```
      CALL BOUNDS(3.,-3.,4.3,4.)
      CALL YLABEL('QS...(TON./DAY)')
      CALL XLABEL('DISCHARGE...(CUMEC)')
      CALL UPPCMT('SUSPENDED LOAD SEDIMENT TRANSPORT')
      CALL LOWCMT('S_ECTION..._ M_ATEBA_ S_UD_ K_APITA')
      DO 86 I=1,N1
      CALL CUTYPE('AS,SO')
      CALL DRAW(Q(I),S(I))
86    CONTINUE
      CALL CUNEXT
      DO 96 I=N2,N3
      CALL CUTYPE('SQ,SO')
      CALL DRAW(Q(I),S(I))
96    CONTINUE
      CALL CUNEXT
      DO 97 I=N4,N5
      CALL CUTYPE('DE,SO')
      CALL DRAW(Q(I),S(I))
97    CONTINUE
      CALL CUNEXT
      DO 98 I=N6,N
      CALL CUTYPE('CI,SO')
      CALL DRAW(Q(I),S(I))
98    CONTINUE
      CALL CUNEXT
      DO 99 I=N6,N
      CALL CUTYPE('CR,SO')
      CALL DRAW(Q(I),TS(I))
99    CONTINUE
      CALL CUNEXT
      CALL DRAWCU(3.1,1.4.1,1,1,'AS')
      CALL ADDCMT(3.15,4.1,'D=.000212 _MM')
      CALL DRAWCU(3.1,1,3.8,1,1,'SQ')
      CALL ADDCMT(3.15,3.8,'D=.000254 _MM')
      CALL DRAWCU(3.1,1,3.5,1,1,'DE')
      CALL ADDCMT(3.15,3.5,'D=.000312 _MM')
      CALL DRAWCU(3.1,1,3.2,1,1,'CI')
      CALL ADDCMT(3.15,3.2,'D=.000370 _MM')
      CALL DRAWCU(3.1,1,2.9,1,1,'CR')
      CALL ADDCMT(3.15,2.9,'T_OTAL_ S_USPENDED_ L_OAD')
      CALL GRCLOS
      END
```

APPENDIX 14

EINSTEIN MODEL: TWO DIMENSIONAL APPROACH

HYDRAULICS CALCULATIONS.

	RH (1)	U* (2)	DELTA1 (3)	M (4)	X1 (5)	DELTA2 (6)	U (7)	C (8)	MS (9)	U2 (10)	RB' (11)	.(12)
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0352	.00028	1.174	1.602	.00020	[illegible]	2.043	19.72	.051	[illegible]	[illegible]
[illegible]	[illegible]	.0372	.00026	1.241	1.591	.00020	[illegible]	1.829	21.57	.047	[illegible]	[illegible]
[illegible]	[illegible]	.0312	.00031	1.039	1.616	.00020	[illegible]	2.607	16.77	.057	[illegible]	[illegible]
[illegible]	.67	.0181	.00054	.603	1.482	.00022	[illegible]	7.733	[illegible]	.074	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0214	.00046	.714	1.551	.00021	[illegible]	[illegible]	11.09	.104	[illegible]	[illegible]
[illegible]	[illegible]	.0322	.00030	1.074	1.612	.00020	[illegible]	[illegible]	17.21	.066	[illegible]	[illegible]
[illegible]	[illegible]	.0352	.00028	1.171	1.603	.00020	[illegible]	[illegible]	[illegible]	.062	[illegible]	[illegible]
[illegible]	[illegible]	.0353	.00028	1.177	1.602	.00020	[illegible]	[illegible]	[illegible]	.059	[illegible]	[illegible]
[illegible]	[illegible]	.0341	.00029	1.136	1.606	.00020	[illegible]	2.183	18.87	.063	[illegible]	[illegible]
[illegible]	[illegible]	.0314	.00031	1.046	1.615	.00020	[illegible]	[illegible]	[illegible]	.072	[illegible]	[illegible]
[illegible]	[illegible]	.0306	.00032	1.019	1.618	.00020	[illegible]	2.710	16.34	.066	[illegible]	[illegible]
[illegible]	[illegible]	.0302	.00032	1.008	1.617	.00020	[illegible]	2.773	16.10	.063	[illegible]	[illegible]
[illegible]	[illegible]	.0287	.00034	.958	1.616	.00020	[illegible]	[illegible]	15.10	.073	[illegible]	[illegible]
[illegible]	[illegible]	.0270	.00036	.898	1.610	.00020	[illegible]	3.490	14.04	.075	[illegible]	[illegible]
[illegible]	[illegible]	.0260	.00038	.865	1.600	.00020	[illegible]	3.762	13.46	.074	[illegible]	[illegible]
[illegible]	[illegible]	.0258	.00038	.859	1.598	.00020	[illegible]	3.818	13.35	.070	[illegible]	[illegible]
[illegible]	[illegible]	.0258	.00038	.860	1.596	.00020	[illegible]	3.810	13.36	.073	[illegible]	[illegible]
[illegible]	[illegible]	.0213	.00046	.709	1.553	.00021	[illegible]	5.607	10.77	.070	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0398	.00025	1.324	1.574	.00021	[illegible]	[illegible]	[illegible]	.056	[illegible]	[illegible]
[illegible]	[illegible]	.0467	.00021	1.555	1.510	.00022	[illegible]	[illegible]	[illegible]	.042	[illegible]	[illegible]
[illegible]	[illegible]	.0330	.00030	1.079	1.610	.00020	[illegible]	[illegible]	18.06	[illegible]	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0284	.00034	.948	1.615	.00020	[illegible]	[illegible]	14.73	.064	[illegible]	[illegible]
[illegible]	[illegible]	.0296	.00033	.985	1.619	.00020	[illegible]	[illegible]	[illegible]	.064	[illegible]	[illegible]
[illegible]	[illegible]	.0333	.00029	1.109	1.609	.00020	[illegible]	[illegible]	[illegible]	.070	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00028	1.173	1.603	.00020	[illegible]	2.047	[illegible]	.055	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00033	.975	1.618	.00020	[illegible]	[illegible]	15.41	.070	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00038	.856	1.597	.00020	[illegible]	[illegible]	13.30	.078	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00043	.762	1.567	.00021	[illegible]	[illegible]	[illegible]	.073	[illegible]	[illegible]
[illegible]	[illegible]	.0222	.00044	.740	1.563	.00021	[illegible]	[illegible]	11.46	.083	[illegible]	[illegible]
[illegible]	.67	.0184	.00053	.613	1.470	.00022	[illegible]	[illegible]	[illegible]	.108	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0305	.00032	1.017	1.618	.00020	[illegible]	2.722	[illegible]	.074	[illegible]	[illegible]
[illegible]	[illegible]	.0433	.00023	1.442	1.546	.00021	[illegible]	[illegible]	28.48	.040	[illegible]	[illegible]
[illegible]	[illegible]	.0360	.00027	1.201	1.600	.00020	[illegible]	[illegible]	20.40	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0236	.00041	.786	1.576	.00021	[illegible]	[illegible]	12.17	[illegible]	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0212	.00046	.705	1.552	.00021	[illegible]	[illegible]	10.72	.081	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00038	.862	1.577	.00020	[illegible]	[illegible]	13.41	.076	[illegible]	[illegible]
[illegible]	[illegible]	.0283	.00034	.944	1.614	.00020	[illegible]	[illegible]	[illegible]	.077	[illegible]	[illegible]
[illegible]	[illegible]	.0301	.00032	1.001	1.620	.00020	[illegible]	[illegible]	15.76	.073	[illegible]	[illegible]
[illegible]	[illegible]	.0314	.00031	1.045	1.615	.00020	[illegible]	[illegible]	[illegible]	.070	[illegible]	[illegible]
[illegible]	[illegible]	.0343	.00028	[illegible]	1.605	.00020	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0384	[illegible]	1.278	1.584	.00021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1.451	1.549	.00021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1.317	1.576	.00021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0322	.00030	1.072	1.612	.00020	[illegible]	2.449	17.48	.036	[illegible]	[illegible]
[illegible]	[illegible]	.0299	.00033	.996	1.620	.00020	[illegible]	[illegible]	[illegible]	.061	[illegible]	[illegible]
[illegible]	[illegible]	.0277	.00035	.924	1.613	.00020	[illegible]	[illegible]	[illegible]	.090	[illegible]	[illegible]
[illegible]	.61	.0173	.00056	.577	1.459	.00022	[illegible]	8.451	9.21	.093	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0224	.00044	.745	1.564	.00021	[illegible]	[illegible]	11.54	.071	[illegible]	[illegible]
[illegible]	[illegible]	.0367	.00027	1.222	1.595	.00020	[illegible]	[illegible]	21.02	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0346	.00028	1.154	1.604	.00020	[illegible]	2.113	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0286	.00034	.952	1.615	.00020	[illegible]	3.107	15.00	.047	[illegible]	[illegible]
[illegible]	[illegible]	.0269	.00036	.896	1.609	.00020	[illegible]	[illegible]	14.00	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0269	.00036	.894	1.609	.00020	[illegible]	[illegible]	14.01	[illegible]	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0262	.00037	.874	1.603	.00020	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0322	.00030	1.073	1.612	.00020	[illegible]	2.446	17.50	.059	[illegible]	[illegible]
[illegible]	[illegible]	.0348	.00028	1.160	1.604	.00020	[illegible]	[illegible]	19.40	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0353	.00028	1.176	1.602	.00020	[illegible]	[illegible]	19.77	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0337	.00029	1.124	1.607	.00020	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0285	.00034	.951	1.619	.00020	[illegible]	[illegible]	14.77	.063	[illegible]	[illegible]
[illegible]	.77	.0195	.00050	.649	1.516	.00021	[illegible]	6.678	10.15	.064	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0250	.00039	.832	1.590	.00020	[illegible]	[illegible]	12.90	.078	[illegible]	[illegible]
[illegible]	[illegible]	.0371	.00026	1.237	1.592	.00020	[illegible]	1.840	21.45	.048	[illegible]	[illegible]
[illegible]	[illegible]	.0371	.00026	1.237	1.592	.00020	[illegible]	1.840	21.45	.032	[illegible]	[illegible]
[illegible]	[illegible]	.0371	.00026	1.237	1.592	.00020	[illegible]	1.840	21.45	.037	[illegible]	[illegible]
[illegible]	[illegible]	.0371	.00026	1.237	1.592	.00020	[illegible]	1.840	21.45	.047	[illegible]	[illegible]
[illegible]	[illegible]	.0371	.00026	1.237	1.592	.00020	[illegible]	1.840	21.45	.065	[illegible]	[illegible]
[illegible]	[illegible]	.0371	.00026	1.237	1.592	.00020	[illegible]	1.840	21.45	.063	[illegible]	[illegible]
[illegible]	[illegible]	.0363	.00027	1.210	1.598	.00020	[illegible]	[illegible]	[illegible]	.063	[illegible]	[illegible]
[illegible]	[illegible]	.0322	.00030	1.072	1.612	.00020	[illegible]	2.449	17.48	.064	[illegible]	[illegible]
[illegible]	[illegible]	.0279	.00035	.931	1.613	.00020	[illegible]	3.248	14.63	.072	[illegible]	[illegible]
[illegible]	[illegible]	.0225	.00043	.750	1.565	.00021	[illegible]	[illegible]	11.61	.095	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0288	.00034	.960	1.616	.00020	[illegible]	3.053	15.15	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0478	.00020	1.593	1.499	.00022	[illegible]	1.111	35.26	.037	[illegible]	[illegible]
[illegible]	[illegible]	.0403	.00024	1.349	1.570	.00021	[illegible]	1.547	[illegible]	.052	[illegible]	[illegible]
[illegible]	[illegible]	.0376	.00026	1.252	1.589	.00020	[illegible]	[illegible]	21.90	.054	[illegible]	[illegible]
[illegible]	[illegible]	.0367	.00027	1.222	1.595	.00020	[illegible]	1.885	21.02	.064	[illegible]	[illegible]
[illegible]	[illegible]	.0351	.00028	1.169	1.603	.00020	[illegible]	[illegible]	[illegible]	.064	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00030	1.082	1.611	.00020	[illegible]	[illegible]	17.67	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00034	.748	1.615	.00020	[illegible]	[illegible]	14.93	.048	[illegible]	[illegible]
[illegible]	.57	.0167	.00059	.555	1.437	.00023	[illegible]	[illegible]	8.72	.108	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.57	.0167	.00058	.556	1.438	.00023	[illegible]	[illegible]	8.74	.100	[illegible]	[illegible]
[illegible]	[illegible]	.0278	.00035	[illegible]	1.613	.00020	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0314	.00031	1.045	1.615	.00020	[illegible]	[illegible]	16.70	.060	[illegible]	[illegible]
[illegible]	[illegible]	.0337	.00029	1.122	1.607	.00020	[illegible]	[illegible]	[illegible]	.053	[illegible]	[illegible]
[illegible]	[illegible]	.0294	.00033	.979	1.618	.00020	[illegible]	[illegible]	15.49	.065	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	.0305	.00032	1.018	1.618	.00020	[illegible]	2.718	16.31	.080	[illegible]	[illegible]
[illegible]	[illegible]	.0412	.00024	1.374	[illegible]	.00021	[illegible]	[illegible]	25.64	.057	[illegible]	[illegible]
[illegible]	[illegible]	.0369	.00026	1.229	1.594	.00020	[illegible]	[illegible]	[illegible]	.065	[illegible]	[illegible]
[illegible]	[illegible]	.0331	.00030	1.101	1.609	.00020	[illegible]	[illegible]	18.11	.070	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00042	.782	1.575	.00021	[illegible]	[illegible]	12.11	[illegible]	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00
[illegible]	[illegible]	[illegible]	.00028	1.181	[illegible]	.00020	[illegible]	2.017	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0397	.00025	1.323	[illegible]	.00021	[illegible]	[illegible]	[illegible]	.058	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00026	[illegible]	[illegible]	.00020	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1.100	1.610	[illegible]	[illegible]	[illegible]	[illegible]	.079	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.00042	.771	1.572	.00021	[illegible]	[illegible]	[illegible]	.073	[illegible]	[illegible]
[illegible]	.00	.0000	.00000	.000	.000	.00000	.00	.000	.00	.000	.00	.00

EINSTEIN MODEL: TWO DIMENSIONAL APPROACH

HYDRAULICS CALCULATIONS... (CONTINUED)

	US (13)	H (14)	A (15)	P (16)	Q (17)	XS (18)	Y (19)	BX (20)	BH (21)	PE (22)
1	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
2	.078	12.[illegible]	1074.[illegible]	123.[illegible]	1092.[illegible]	.000385	[illegible]	1.[illegible]	.619	14.[illegible]
3	.059	9.[illegible]	[illegible]	100.0	[illegible]	.000364	[illegible]	1.[illegible]	[illegible]	14.[illegible]
4	.057	7.[illegible]	[illegible]	88.[illegible]	876.[illegible]	.000435	[illegible]	1.[illegible]	[illegible]	13.[illegible]
5	.171	3.17	497.[illegible]	216.2	449.6	.000750	[illegible]	1.[illegible]	[illegible]	12.[illegible]
6	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
7	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
8	.121	6.[illegible]	[illegible]	193.0	722.8	.000633	[illegible]	1.[illegible]	[illegible]	13.711
9	[illegible]	7.14	[illegible]	70.0	753.[illegible]	.000421	[illegible]	1.[illegible]	[illegible]	13.[illegible]
10	[illegible]	7.[illegible]	[illegible]	139.0	1423.[illegible]	.000386	[illegible]	1.[illegible]	[illegible]	14.[illegible]
11	.074	[illegible]	[illegible]	195.0	2007.3	.000384	[illegible]	1.[illegible]	[illegible]	14.[illegible]
12	[illegible]	[illegible]	[illegible]	170.0	1640.9	.000378	[illegible]	1.[illegible]	[illegible]	14.[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	1309.[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
14	[illegible]	[illegible]	[illegible]	100.0	710.9	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
15	[illegible]	[illegible]	[illegible]	85.0	[illegible]	.000448	[illegible]	1.[illegible]	[illegible]	13.[illegible]
16	.125	[illegible]	[illegible]	105.0	672.8	.000472	[illegible]	1.[illegible]	[illegible]	13.[illegible]
17	.117	[illegible]	[illegible]	115.0	623.7	.000503	[illegible]	1.[illegible]	[illegible]	13.[illegible]
18	.130	[illegible]	[illegible]	125.0	[illegible]	.000522	.773	1.[illegible]	.310	13.[illegible]
19	[illegible]	[illegible]	[illegible]	145.0	630.3	.000526	.771	1.[illegible]	[illegible]	13.[illegible]
20	.102	[illegible]	[illegible]	180.0	[illegible]	.000526	.771	1.[illegible]	[illegible]	13.[illegible]
21	[illegible]	4.[illegible]	[illegible]	435.[illegible]	1377.7	.000638	[illegible]	1.[illegible]	[illegible]	13.[illegible]
22	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
23	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
24	[illegible]	15.[illegible]	[illegible]	110.0	1637.5	.000341	[illegible]	1.[illegible]	[illegible]	14.[illegible]
25	[illegible]	17.[illegible]	[illegible]	180.0	[illegible]	.000290	[illegible]	1.[illegible]	[illegible]	14.[illegible]
26	[illegible]	[illegible]	[illegible]	190.0	[illegible]	.000411	.850	1.[illegible]	[illegible]	12.[illegible]
27	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
28	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
29	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
30	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
31	.116	[illegible]	[illegible]	150.0	821.[illegible]	.000477	[illegible]	1.[illegible]	[illegible]	13.[illegible]
32	[illegible]	[illegible]	[illegible]	190.0	1164.4	.000458	[illegible]	1.[illegible]	[illegible]	13.[illegible]
33	[illegible]	[illegible]	[illegible]	210.0	2073.0	.000407	[illegible]	1.[illegible]	[illegible]	13.[illegible]
34	[illegible]	[illegible]	[illegible]	205.0	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
35	.110	[illegible]	[illegible]	[illegible]	1204.3	.000463	[illegible]	1.[illegible]	[illegible]	13.[illegible]
36	.103	[illegible]	[illegible]	205.0	[illegible]	.000520	[illegible]	1.[illegible]	[illegible]	13.[illegible]
37	.117	[illegible]	[illegible]	[illegible]	[illegible]	.000593	.702	1.[illegible]	[illegible]	13.[illegible]
38	[illegible]	[illegible]	[illegible]	315.0	[illegible]	.000610	[illegible]	1.[illegible]	[illegible]	13.[illegible]
39	[illegible]	[illegible]	[illegible]	355.0	[illegible]	.000737	[illegible]	1.[illegible]	[illegible]	12.[illegible]
40	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
41	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
42	.115	12.[illegible]	[illegible]	148.[illegible]	1180.0	.000444	[illegible]	1.[illegible]	[illegible]	14.[illegible]
43	.063	14.[illegible]	[illegible]	125.[illegible]	[illegible]	.000313	.773	1.[illegible]	[illegible]	14.[illegible]
44	.017	9.[illegible]	[illegible]	208.7	1265.5	.000374	.840	1.[illegible]	[illegible]	14.[illegible]
45	.106	2.[illegible]	1042.[illegible]	267.1	782.9	.000575	.719	1.[illegible]	[illegible]	12.[illegible]
46	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
47	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
48	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
49	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
50	[illegible]	[illegible]	[illegible]	140.0	370.2	.000641	[illegible]	1.[illegible]	[illegible]	12.[illegible]
51	.102	[illegible]	[illegible]	155.0	[illegible]	.000524	.773	1.[illegible]	[illegible]	13.[illegible]
52	.135	[illegible]	[illegible]	145.0	941.3	.000477	.810	1.[illegible]	[illegible]	13.[illegible]
53	[illegible]	[illegible]	[illegible]	170.0	[illegible]	.000431	.840	1.[illegible]	[illegible]	13.[illegible]
54	[illegible]	[illegible]	[illegible]	140.0	1157.4	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
55	.097	[illegible]	[illegible]	100.0	947.2	.000374	[illegible]	1.[illegible]	[illegible]	14.[illegible]
56	.079	[illegible]	[illegible]	100.0	1077.4	.000394	[illegible]	1.[illegible]	[illegible]	14.[illegible]
57	[illegible]	14.77	[illegible]	105.0	[illegible]	.000311	.779	1.[illegible]	[illegible]	14.[illegible]
58	[illegible]	11.[illegible]	[illegible]	105.0	[illegible]	.000343	[illegible]	1.[illegible]	[illegible]	14.[illegible]
59	.076	[illegible]	[illegible]	125.0	971.0	.000421	[illegible]	1.[illegible]	[illegible]	13.[illegible]
60	[illegible]	[illegible]	[illegible]	140.0	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
61	.123	[illegible]	[illegible]	155.0	1072.8	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
62	.077	2.[illegible]	[illegible]	235.0	425.0	.000783	[illegible]	1.[illegible]	[illegible]	12.[illegible]
63	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
64	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
65	[illegible]	7.[illegible]	[illegible]	210.0	605.3	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
66	[illegible]	10.[illegible]	[illegible]	110.0	790.3	.000370	[illegible]	1.[illegible]	[illegible]	13.[illegible]
67	[illegible]	[illegible]	[illegible]	90.0	917.2	.000391	[illegible]	1.[illegible]	[illegible]	13.[illegible]
68	[illegible]	[illegible]	[illegible]	120.0	484.8	.000475	[illegible]	1.[illegible]	[illegible]	13.[illegible]
69	[illegible]	[illegible]	[illegible]	130.0	312.5	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
70	[illegible]	[illegible]	[illegible]	190.0	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	12.[illegible]
71	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
72	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
73	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
74	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
75	.077	[illegible]	[illegible]	179.0	675.2	.000517	[illegible]	1.[illegible]	[illegible]	13.[illegible]
76	.074	7.[illegible]	[illegible]	225.0	1703.1	.000421	[illegible]	1.[illegible]	[illegible]	14.[illegible]
77	[illegible]	[illegible]	[illegible]	160.0	1630.0	.000390	[illegible]	1.[illegible]	[illegible]	14.[illegible]
78	.072	[illegible]	[illegible]	160.0	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
79	[illegible]	[illegible]	[illegible]	180.0	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
80	[illegible]	[illegible]	[illegible]	190.0	1023.7	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
81	[illegible]	3.[illegible]	[illegible]	335.0	979.7	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
82	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
83	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
84	[illegible]	[illegible]	[illegible]	212.2	903.2	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
85	[illegible]	[illegible]	[illegible]	174.2	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
86	[illegible]	[illegible]	[illegible]	197.0	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
87	[illegible]	[illegible]	[illegible]	166.7	947.0	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
90	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.000363	[illegible]	1.[illegible]	[illegible]	14.[illegible]
91	[illegible]	[illegible]	[illegible]	90.[illegible]	[illegible]	.000373	[illegible]	1.[illegible]	[illegible]	13.[illegible]
92	.105	7.[illegible]	[illegible]	106.1	[illegible]	.000421	[illegible]	1.[illegible]	[illegible]	13.[illegible]
93	.120	[illegible]	[illegible]	121.2	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
94	.120	[illegible]	[illegible]	[illegible]	772.6	.000603	[illegible]	1.[illegible]	[illegible]	12.[illegible]
95	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
96	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
97	[illegible]	12.[illegible]	[illegible]	224.1	1694.9	.000470	[illegible]	1.[illegible]	[illegible]	14.[illegible]
98	[illegible]	[illegible]	[illegible]	126.4	2461.9	.000284	.719	1.[illegible]	[illegible]	14.[illegible]
99	[illegible]	10.[illegible]	[illegible]	114.9	1719.7	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
100	[illegible]	[illegible]	[illegible]	114.9	1597.6	.000361	[illegible]	1.[illegible]	[illegible]	14.[illegible]
101	[illegible]	[illegible]	[illegible]	103.5	1317.2	.000370	[illegible]	1.[illegible]	[illegible]	14.[illegible]
102	[illegible]	[illegible]	[illegible]	92.0	1001.5	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
103	[illegible]	7.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
104	[illegible]	6.[illegible]	[illegible]	[illegible]	400.6	.000477	[illegible]	1.[illegible]	[illegible]	13.[illegible]
105	[illegible]	2.[illegible]	[illegible]	201.1	378.0	[illegible]	[illegible]	1.[illegible]	[illegible]	12.[illegible]
106	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
107	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
108	[illegible]	3.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
109	.127	[illegible]	[illegible]	171.0	[illegible]	.000487	[illegible]	1.[illegible]	[illegible]	13.[illegible]
110	.074	7.[illegible]	[illegible]	74.6	443.7	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
111	.074	7.[illegible]	[illegible]	135.[illegible]	783.7	.000402	[illegible]	1.[illegible]	[illegible]	13.[illegible]
112	[illegible]	9.[illegible]	[illegible]	277.[illegible]	[illegible]	.000461	[illegible]	1.[illegible]	[illegible]	13.[illegible]
113	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
114	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
115	.077	11.[illegible]	[illegible]	140.7	1211.4	.000444	[illegible]	1.[illegible]	[illegible]	14.[illegible]
116	.093	12.[illegible]	[illegible]	117.1	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
117	.131	9.[illegible]	[illegible]	[illegible]	1230.[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
118	[illegible]	7.[illegible]	[illegible]	79.4	773.4	.000410	[illegible]	1.[illegible]	[illegible]	13.[illegible]
119	[illegible]	4.[illegible]	[illegible]	207.6	799.1	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
120	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
121	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000
122	.110	[illegible]	[illegible]	[illegible]	1940.1	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
123	[illegible]	[illegible]	[illegible]	124.0	1910.9	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
124	.117	[illegible]	[illegible]	105.3	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	14.[illegible]
125	[illegible]	7.[illegible]	[illegible]	[illegible]	[illegible]	.000411	[illegible]	1.[illegible]	[illegible]	13.[illegible]
126	[illegible]	5.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	13.[illegible]
127	.000	.00	.0	.0	.0	.000000	.000	.000	.000	.000

EINSTEIN MODEL: TWO DIMENSIONAL APPROACH

SEDIMENT TRANSPORT CALCULATION..

	D (1)	FBM (2)	RI (3)	ISRP2 (4)	DD (5)	FF (6)	ISIO (7)	ISTIO (8)	BLSF (9)	BLLC (10)
1	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
2	.000240	1.00	2.33	3.128	.634	2.134	3.480	1.313	4.47682	564.801
3	.000240	1.00	2.83	2.801	.657	1.885	2.824	1.856	4.35835	435.817
4	.000240	1.00	1.78	3.973	[illegible]	[illegible]	5.545	.457	1.32588	138.345
5	.000240	1.00	.67	11.874	.320	11.322	32.105	.000	.00004	.010
6	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
7	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
8	.000240	1.00	.94	8.453	.379	7.403	19.176	.003	.01190	2.240
9	.000240	1.00	2.12	3.741	.570	2.647	4.717	[illegible]	2.14455	[illegible]
10	.000240	1.00	[illegible]	3.143	[illegible]	2.174	3.511	[illegible]	4.43096	[illegible]
11	.000240	1.00	[illegible]	[illegible]	.425	[illegible]	3.441	[illegible]	4.58124	[illegible]
12	.000240	1.00	[illegible]	3.943	.463	2.318	3.464	1.058	3.62274	615.[illegible]
13	.000240	1.00	2.01	3.741	.376	2.848	5.413	.487	[illegible]	[illegible]
14	.000240	1.00	1.91	4.131	.541	[illegible]	5.757	.374	1.27748	[illegible]
15	.000240	1.00	1.85	4.247	[illegible]	[illegible]	6.217	[illegible]	1.16061	96.601
16	.000240	1.00	1.69	4.701	.509	3.551	7.419	.218	.72763	74.611
17	.000240	1.00	1.45	5.344	.477	4.170	9.256	.105	.33784	41.[illegible]
18	.000240	1.00	1.37	5.763	.460	4.581	10.445	.047	.23085	28.897
19	.000240	1.00	1.39	5.848	.456	4.647	10.679	.042	.21111	30.610
20	.000240	1.00	1.36	[illegible]	.457	[illegible]	10.657	[illegible]	[illegible]	36.491
21	.000240	1.00	.92	[illegible]	.376	[illegible]	15.657	.003	.00750	4.137
22	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
23	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
24	.000240	1.00	3.22	2.438	.704	1.439	2.279	[illegible]	7.03772	997.490
25	.000240	1.00	4.44	1.763	[illegible]	[illegible]	1.387	5.014	17.17177	2573.769
26	.000240	1.00	2.22	2.570	.584	2.517	4.311	.782	2.67844	308.942
27	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
28	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
29	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
30	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
31	.000240	1.00	1.45	4.800	.504	3.645	7.592	.192	.65874	75.811
32	.000240	1.00	1.78	4.447	[illegible]	3.307	6.726	.276	.94774	177.315
33	.000240	1.00	[illegible]	3.326	[illegible]	2.190	4.353	.857	2.93387	[illegible]
34	.000240	1.00	[illegible]	3.136	[illegible]	2.140	[illegible]	1.303	4.46236	[illegible]
35	.000240	1.00	1.73	4.227	[illegible]	3.377	6.777	[illegible]	[illegible]	[illegible]
36	.000240	1.00	1.35	[illegible]	[illegible]	4.705	10.895	[illegible]	[illegible]	41.[illegible]
37	.000240	1.00	1.07	7.421	.403	[illegible]	15.674	.013	.04384	4.635
38	.000240	1.00	1.01	7.870	.393	6.748	17.179	.007	.02546	5.317
39	.000240	1.00	.69	11.473	.326	10.848	30.456	.000	.00008	.027
40	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
41	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
42	.000240	1.00	1.70	4.170	.540	3.037	6.038	.371	1.26501	188.148
43	.000240	1.00	4.62	2.074	.724	1.483	1.727	3.847	13.24343	1665.[illegible]
44	.000240	1.00	[illegible]	2.471	.638	2.017	[illegible]	1.717	5.20273	1085.[illegible]
45	.000240	1.00	[illegible]	6.785	.417	[illegible]	14.[illegible]	[illegible]	[illegible]	17.[illegible]
46	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
47	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
48	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
49	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
50	.000240	1.00	.91	8.379	[illegible]	[illegible]	17.777	.002	.00831	[illegible]
51	.000240	1.00	1.37	5.778	[illegible]	4.418	[illegible]	.043	.22271	34.[illegible]
52	.000240	1.00	1.64	4.842	.501	3.488	7.810	.183	.62678	90.[illegible]
53	.000240	1.00	[illegible]	4.301	.532	3.177	[illegible]	[illegible]	[illegible]	[illegible]
54	.000240	1.00	[illegible]	3.947	.555	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
55	.000240	1.00	[illegible]	3.376	.607	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
56	.000240	1.00	[illegible]	2.721	.679	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
57	.000240	1.00	[illegible]	2.049	.771	1.471	1.709	3.777	13.[illegible]	1430.[illegible]
58	.000240	1.00	[illegible]	2.485	.700	[illegible]	2.275	2.365	[illegible]	[illegible]
59	.000240	1.00	[illegible]	3.731	.570	[illegible]	4.747	[illegible]	2.11677	244.[illegible]
60	.000240	1.00	1.85	4.349	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	145.[illegible]
61	.000240	1.00	1.57	4.948	.491	[illegible]	[illegible]	.143	.49543	72.[illegible]
62	.000240	1.00	.61	12.943	.307	12.412	36.[illegible]	.000	.00001	[illegible]
63	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
64	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
65	.000240	1.00	1.02	7.737	.376	[illegible]	14.779	.007	[illegible]	[illegible]
66	.000240	1.00	2.74	2.887	.645	1.943	2.783	1.675	[illegible]	[illegible]
67	.000240	1.00	2.45	[illegible]	[illegible]	2.278	3.719	1.126	[illegible]	[illegible]
68	.000240	1.00	1.66	4.778	.505	[illegible]	7.376	[illegible]	[illegible]	[illegible]
69	.000240	1.00	1.47	5.374	.476	4.201	9.346	[illegible]	[illegible]	[illegible]
70	.000240	1.00	1.48	[illegible]	.474	[illegible]	9.316	[illegible]	[illegible]	[illegible]
71	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
72	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
73	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
74	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
75	.000240	1.00	1.40	5.943	.444	4.453	10.097	.074	.26170	45.790
76	.000240	1.00	[illegible]	3.746	.570	[illegible]	4.730	[illegible]	[illegible]	477.[illegible]
77	.000240	1.00	[illegible]	3.205	.616	[illegible]	[illegible]	1.215	[illegible]	[illegible]
78	.000240	1.00	[illegible]	3.115	[illegible]	[illegible]	[illegible]	1.328	[illegible]	737.[illegible]
79	.000240	1.00	[illegible]	3.414	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	604.[illegible]
80	.000240	1.00	1.66	4.746	.505	[illegible]	[illegible]	.200	[illegible]	130.[illegible]
81	.000240	1.00	.77	10.227	.345	[illegible]	25.[illegible]	.000	[illegible]	[illegible]
82	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
83	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
84	.000240	1.00	[illegible]	6.221	.442	5.049	11.809	[illegible]	.14531	30.874
85	.000240	1.00	2.81	2.818	.657	1.877	2.856	[illegible]	6.24153	1037.274
86	.000240	1.00	2.81	2.818	.657	1.877	2.856	[illegible]	6.24153	1227.[illegible]
87	.000240	1.00	2.81	2.818	.657	1.877	2.856	[illegible]	6.24153	1040.181
88	.000240	1.00	2.81	2.818	.657	1.877	2.856	[illegible]	6.24153	[illegible]
89	.000240	1.00	2.81	2.818	.657	1.877	2.856	[illegible]	6.24153	[illegible]
90	.000240	1.00	2.81	2.818	.657	1.877	2.856	[illegible]	6.24153	[illegible]
91	.000240	1.00	[illegible]	[illegible]	.643	2.751	[illegible]	1.600	5.46032	478.[illegible]
92	.000240	1.00	2.11	3.731	.570	2.678	4.742	.618	2.11677	224.[illegible]
93	.000240	1.00	1.39	[illegible]	[illegible]	[illegible]	8.182	.147	[illegible]	43.[illegible]
94	.000240	1.00	1.03	7.671	[illegible]	[illegible]	[illegible]	.010	.03417	6.721
95	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
96	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
97	.000240	1.00	1.67	4.676	[illegible]	[illegible]	7.354	.218	.74684	167.[illegible]
98	.000240	1.00	4.65	1.703	.846	1.322	1.303	5.390	18.45797	2337.227
99	.000240	1.00	3.34	2.369	.717	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	.000240	1.00	2.88	2.750	[illegible]	[illegible]	[illegible]	1.761	[illegible]	771.[illegible]
101	.000240	1.00	[illegible]	2.887	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	400.[illegible]
102	.000240	1.00	[illegible]	3.134	[illegible]	[illegible]	[illegible]	1.279	4.38043	402.[illegible]
103	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.672	[illegible]	198.[illegible]
104	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	64.[illegible]
105	.000240	1.00	.57	14.[illegible]	[illegible]	13.[illegible]	41.[illegible]	.000	.00000	.000
106	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
107	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
108	.000240	1.00	.57	13.934	[illegible]	13.831	41.032	.000	.00000	.001
109	.000240	1.00	[illegible]	5.011	.473	[illegible]	8.286	.151	.51666	88.736
110	.000240	1.00	[illegible]	3.747	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
111	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.768	3.31670	[illegible]
112	.000240	1.00	1.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	247.[illegible]
113	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
114	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
115	.000240	1.00	1.70	[illegible]	.541	3.051	5.971	.373	1.27841	179.877
116	.000240	1.00	4.47	[illegible]	.730	1.381	2.015	3.103	10.62273	1243.414
117	.000240	1.00	3.78	[illegible]	[illegible]	1.721	2.721	1.735	6.01710	[illegible]
118	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.797	[illegible]	216.[illegible]
119	.000240	1.00	1.13	7.057	.413	[illegible]	14.[illegible]	.018	[illegible]	12.[illegible]
120	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
121	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000
122	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	774.[illegible]
123	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
124	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	726.[illegible]
125	.000240	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
126	.000240	1.00	[illegible]	7.[illegible]	[illegible]	[illegible]	15.[illegible]	[illegible]	[illegible]	14.[illegible]
127	.000240	1.00	.00	.000	.000	.000	.000	.000	.00000	.000

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EINSTEIN MODEL: TWO DIMENTIONAL APPROACH

S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...(CONTINUED)

          AE        W       Z          FI1          FI2          IST      SMLEF      SMREC       TBLSL
         (12)     (13)    (14)        (15)         (16)         (17)      (18)       (19)        (20)

   1   .000000    .00     .00       .0000        .0000        .000      .000       .000        .000
   2   .000039   2.72    2.07       .2020      -1.8602       1.051     4.738    373.777    1158.400
   3   .000047   2.72    1.76       .2253      -2.0024       1.198     7.577    759.[illegible]  1375.041
   4   .0000[illegible]   2.72    2.34       .1615      -1.4274        .812     1.271    112.[illegible]   250.[illegible]
   5   .000150   2.72    4.03       .0713       -.6037        .[illegible]      .000       .00[illegible]        .013
   6   .000000    .00     .00       .0000        .0000        .000      .000       .000        .[illegible]
[illegible]
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APPENDIX 15

CROSS SECTION: AMONT OISEAUX 1

HYDRAULICS CALCULATIONS...

R1 (1)	U1 (2)	DELTA1 (3)	M (4)	X1 (5)	DELTA2 (6)	U (7)	C (8)	M2 (9)	U2 (10)	R2 (11)	H (12)
.15	.0097	.00101	.323	1.056	.00031	.21	26.933	5.80	.036	2.11	2.26
.30	.0137	.00071	.457	1.314	.00025	.33	13.466	7.64	.043	2.96	3.26
.45	.0168	.00058	.560	1.442	.00023	.42	8.978	8.99	.047	3.55	4.00
.60	.0194	.00050	.647	1.514	.00021	.51	6.733	10.11	.050	3.99	4.59
.75	.0217	.00045	.723	1.557	.00021	.58	5.387	11.19	.052	4.27	5.02
.90	.0238	.00041	.792	1.578	.00021	.65	4.489	12.27	.053	4.42	5.32
1.05	.0257	.00038	.855	1.597	.00020	.71	3.848	13.29	.053	4.53	5.58
1.20	.0274	.00036	.914	1.612	.00020	.77	3.367	14.33	.054	4.57	5.77
1.35	.0291	.00034	.970	1.617	.00020	.82	2.993	15.30	.054	4.61	5.96
1.50	.0307	.00032	1.022	1.618	.00020	.88	2.693	16.41	.053	4.53	6.03
1.65	.0322	.00030	1.072	1.612	.00020	.93	2.448	17.48	.053	4.46	6.11
1.80	.0336	.00029	1.120	1.608	.00020	.97	2.244	18.52	.053	4.40	6.20
1.95	.0350	.00028	1.166	1.603	.00020	1.02	2.072	19.54	.052	4.35	6.30

CROSS SECTION: AMONT OISEAUX 1

HYDRAULICS CALCULATIONS... (CONTINUED)

UC (13)	H (14)	A (15)	P (16)	Q (17)	Q1 (18)	X2 (19)	Y (20)	SX (21)	BB (22)	FE (23)
.038	4.19	439.3	192.2	323.6	92.6	.001397	.263	1.683	.371	12.929
.045	6.18	890.7	258.0	732.8	293.3	.000988	.400	1.627	.397	13.536
.050	7.65	1300.8	300.4	1140.9	591.8	.000807	.510	1.579	.422	13.842
.054	8.82	1672.9	334.4	1492.7	946.7	.000699	.576	1.538	.445	14.034
.056	9.67	1979.7	379.6	1814.5	1147.2	.000625	.669	1.502	.466	14.156
.058	10.27	2217.5	415.2	2067.6	1433.4	.000570	.723	1.468	.488	14.228
.059	10.79	2438.2	445.9	2299.9	1728.3	.000528	.768	1.439	.507	14.289
.060	11.16	2605.7	467.9	2484.7	2000.0	.000494	.806	1.414	.525	14.331
.061	11.52	2788.0	490.2	2696.6	2294.4	.000466	.828	1.390	.544	14.368
.062	11.68	2862.6	499.3	2783.3	2506.3	.000442	.842	1.368	.562	14.381
.062	11.83	2941.6	509.0	2875.1	2723.0	.000421	.847	1.348	.581	14.392
.062	12.02	3027.5	519.4	2976.6	2748.9	.000403	.848	1.325	.599	14.403
.063	12.21	3124.4	530.4	3104.5	3188.3	.000388	.843	1.307	.616	14.416

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                         CROSS SECTION:   AMONT OISEAUX 1
               S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..

     D.      FSM     SI.     ISRF2      DD.       FT.       ISIO     ISTIO      BLBF       BLEC       TBLEC
    (1)      (2)     (3)      (4)       (5)       (6)        (7)      (8)        (9)       (10)        (11)

  .000212    .25     .15    34.438     .192     40.615   219.914     .000     .00000       .000        .000
  .000212    .25     .30    18.217     .219     33.792    93.744     .000     .00000       .000        .000
  .000212    .25     .45    12.144     .263     18.956    48.440     .000     .00000       .000        .000
  .000212    .25     .60     9.109     .303     12.946    31.297     .000     .00001       .004        .004
  .000212    .25     .75     7.288     .337      9.792    22.263     .001     .00063       .239        .239
  .000212    .25     .90     6.073     .373      7.795    16.706     .004     .00650      2.700       2.700
  .000212    .25    1.05     5.209     .401      6.427    13.044     .020     .01970      8.821       8.821
  .000212    .25    1.20     4.555     .437      5.437    10.490     .066     .04710     22.030      22.030
  .000212    .25    1.35     4.049     .459      4.693     8.998     .134     .09651     47.311      47.311
  .000212    .25    1.50     3.644     .480      4.114     7.097     .237     .17010     84.973      84.973
  .000212    .25    1.65     3.313     .503      3.651     5.951     .380     .27007    137.473     137.473
  .000212    .25    1.80     3.036     .524      3.273     5.046     .586     .41656    216.213     216.213
  .000212    .25    1.95     2.803     .547      2.962     4.311     .879     .62464    331.320     331.320
 ------------------------------------------------------------------------------------------------------------
  .000254    .25     .15    43.656     .182     41.208   173.847     .000     .00000       .000        .000
  .000254    .25     .30    21.828     .257     17.605    60.014     .000     .00000       .000        .000
  .000254    .25     .45    14.552     .319     11.604    36.720     .000     .00000       .001        .001
  .000254    .25     .60    10.914     .364      8.236    23.623     .000     .00040       .139        .139
  .000254    .25     .75     8.731     .406      6.229    16.768     .008     .00762      2.972       3.131
  .000254    .25     .90     7.276     .449      4.959    12.733     .031     .02882     11.766      14.667
  .000254    .25    1.05     6.237     .481      4.087     9.942     .081     .07554     33.685      42.904
  .000254    .25    1.20     5.457     .514      3.460     7.778     .170     .15804     73.949      75.788
  .000254    .25    1.35     4.851     .549      2.986     6.520     .297     .27840    134.469     183.780
  .000254    .25    1.50     4.366     .575      2.617     5.409     .468     .43499    227.184     312.199
  .000254    .25    1.65     3.969     .603      2.333     4.938     .771     .71884    369.876     503.348
  .000254    .25    1.80     3.638     .630      2.089     3.846    1.112    1.03673    538.467     794.692
  .000254    .25    1.95     3.358     .655      1.907     3.324    1.416    1.33039    700.337    1031.698
 ------------------------------------------------------------------------------------------------------------
  .000312    .25     .15    53.625     .223     26.963   139.253     .000     .00000       .000        .000
  .000312    .25     .30    26.813     .316     11.718    49.734     .000     .00000       .000        .000
  .000312    .25     .45    17.875     .387      7.055    27.109     .000     .00012       .034        .037
  .000312    .25     .60    13.406     .447      4.722    17.490     .007     .00604      2.788       2.920
  .000312    .25     .75    10.725     .499      3.723    12.458     .034     .04315     16.377      19.907
  .000312    .25     .90     8.937     .547      2.964     9.348     .102     .12921     53.693      68.380
  .000312    .25    1.05     7.661     .591      2.444     7.311     .222     .28228    125.057     148.363
  .000312    .25    1.20     6.703     .632      2.068     5.870     .394     .47752    233.952     357.970
  .000312    .25    1.35     5.958     .670      1.825     4.857     .623     .90322    393.734     577.516
  .000312    .25    1.50     5.363     .706      1.651     4.192     .943    1.19990    598.669     910.820
  .000312    .25    1.65     4.875     .741      1.550     3.710    1.176    1.49284    759.474    1263.022
  .000312    .25    1.80     4.469     .773      1.464     3.319    1.420    1.80109    939.957    1690.969
  .000312    .25    1.95     4.125     .805      1.371     2.979    1.699    2.19447   1143.792    2175.490
 ------------------------------------------------------------------------------------------------------------
  .000370    .25     .15    63.994     .265     18.205   113.180     .000     .00000       .000        .000
  .000370    .25     .30    31.777     .374      7.648    38.449     .000     .00000       .001        .001
  .000370    .25     .45    21.198     .454      4.605    20.960     .002     .00253       .796        .799
  .000370    .25     .60    15.898     .530      3.213    13.930     .024     .03[illegible]     12.778      19.903
  .000370    .25     .75    12.719     .592      2.430     9.642     .071     .14695     56.534      76.044
  .000370    .25     .90    10.599     .649      1.947     7.383     .224     .36464    152.242     220.962
  .000370    .25    1.05     9.085     .701      1.646     5.908     .387     .63459    282.993     491.319
  .000370    .25    1.20     7.947     .749      1.527     5.143     .557     .91367    457.917     797.367
  .000370    .25    1.35     7.066     .794      1.413     4.497     .788    1.29173    633.209    1210.721
  .000370    .25    1.50     6.359     .837      1.336     4.021    1.033    1.67249    845.147    1755.976
  .000370    .25    1.65     5.781     .878      1.272     3.617    1.231    2.01819   1027.194    2290.216
  .000370    .25    1.80     5.299     .917      1.223     3.290    1.441    2.36219   1224.901    2717.470
  .000370    .25    1.95     4.892     .955      1.189     3.019    1.662    2.72360   1444.977    3630.047
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                  CROSS SECTION:  AMONT OISEAUX 1
  S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..(CONTINUED)

     AE       W       Z        FI1        FI2        IST.     BHLBF      BHBEC      BHBAG       TBLBL
    (12)     (13)    (14)      (15)       (16)       (17)      (18)       (19)       (20)        (21)

  .000101   2.48    6.37     .0401     -.3614      .197      .000       .000       .000        .000
  .000067   2.48    4.58     .0614     -.5710      .280      .000       .000       .000        .000
  .000055   2.48    3.67     .0803     -.7870      .354      .000       .000       .000        .000
  .000048   2.48    3.20     .0984     -.9532      .447      .000       .002       .002        .006
  .000044   2.48    2.84     .1162    -1.1059      .541      .000       .157       .157        .367
  .000041   2.48    2.61     .1343    -1.2716      .630      .004      1.723      1.723       4.423
  .000039   2.48    2.42     .1524    -1.4377      .740      .018      6.928      6.928      15.349
  .000038   2.48    2.26     .1714    -1.6090      .840      .040     18.670     18.670      40.728
  .000037   2.48    2.13     .1910    -1.7818      .963      .093     45.980     45.980      93.841
  .000036   2.48    2.02     .2114    -1.9552     1.085      .185     92.237     92.237     177.210
  .000036   2.48    1.93     .2326    -2.1334     1.217      .327    167.325    167.325     304.777
  .000035   2.48    1.84     .2553    -2.3173     1.340      .566    294.014    294.014     510.227
  .000035   2.48    1.77     .2790    -2.5075     1.518      .946    501.921    501.921     833.242
 ------------------------------------------------------------------------------------------------------------
  .000121   3.14    8.09     .0305     -.2707      .124      .000       .000       .000        .000
  .000082   3.14    5.72     .0458     -.4212      .179      .000       .000       .000        .000
  .000066   3.14    4.67     .0587     -.5501      .265      .000       .000       .000        .001
  .000058   3.14    4.04     .0704     -.6673      .326      .000       .044       .046        .185
  .000053   3.14    3.62     .0825     -.7817      .386      .003      1.118      1.246       4.377
  .000049   3.14    3.30     .0938     -.8974      .445      .013      5.329      7.092      21.719
  .000047   3.14    3.06     .1050     -.9950      .505      .038     17.014     23.941      66.047
  .000046   3.14    2.86     .1161    -1.0985      .566      .089     41.837     60.326     156.814
  .000044   3.14    2.70     .1273    -1.2020      .627      .175     85.610    131.199     314.739
  .000043   3.14    2.56     .1384    -1.3033      .690      .314    156.624    249.043     541.223
  .000043   3.14    2.44     .1501    -1.4058      .755      .543    276.177    443.904     946.852
  .000042   3.14    2.33     .1610    -1.5061      .822      .852    443.484    734.498    1491.190
  .000042   3.14    2.24     .1737    -1.6122      .891     1.177    634.203   1126.123    2197.781
 ------------------------------------------------------------------------------------------------------------
  .000149   4.04   10.41     .0230     -.1999      .097      .000       .000       .000        .000
  .000101   4.04    7.36     .0340     -.3079      .153      .000       .000       .000        .000
  .000082   4.04    6.01     .0432     -.3977      .200      .000       .007       .007        .049
  .000071   4.04    5.21     .0514     -.4786      .243      .003       .673       .731       3.649
  .000065   4.04    4.66     .0591     -.5536      .282      .012      4.623      8.879      23.377
  .000061   4.04    4.25     .0664     -.6246      .321      .041     17.205     24.857      72.376
  .000058   4.04    3.94     .0736     -.6929      .358      .101     45.111     60.693     237.019
  .000056   4.04    3.68     .0806     -.7567      .396      .198     92.955    153.081     482.931
  .000054   4.04    3.47     .0874     -.8234      .433      .347    170.353    301.468     878.770
  .000053   4.04    3.29     .0943     -.8857      .469      .565    280.845    520.908    1440.737
  .000053   4.04    3.14     .1010     -.9473      .506      .795    384.041    827.846    2070.968
  .000052   4.04    3.01     .1077    -1.0087      .542      .977    507.481   1243.979    2934.547
  .000051   4.04    2.89     .1144    -1.0678      .579     1.249    662.662   1768.798    3764.239
 ------------------------------------------------------------------------------------------------------------
  .000177   4.72   12.19     .0174     -.1657      .085      .000       .000       .000        .000
  .000120   4.72    8.97     .0285     -.2535      .132      .000       .000       .000        .001
  .000097   4.72    7.02     .0357     -.3262      .171      .000       .130       .137        .733
  .000084   4.72    6.08     .0426     -.3913      .206      .004      2.676      3.398      17.300
  .000076   4.72    5.44     .0487     -.4506      .239      .036     13.476     19.365      95.409
  .000072   4.72    4.96     .0549     -.5063      .269      .079     41.016     65.273     283.834
  .000069   4.72    4.59     .0601     -.5595      .299      .190     84.683    153.335     604.690
  .000066   4.72    4.30     .0659     -.6104      .328      .300    140.412    273.494    1050.880
  .000064   4.72    4.05     .0705     -.6601      .357      .461    225.965    527.426    1738.147
  .000063   4.72    3.84     .0760     -.7076      .385      .651    325.210    855.119    2611.114
  .000062   4.72    3.66     .0811     -.7543      .412      .832    423.479   1251.021    3541.237
  .000062   4.32    3.51     .0861     -.8004      .440     1.039    519.410   1783.389    4700.899
  .000061   4.72    3.37     .0911     -.8462      .467     1.272    674.671   2463.456    6083.504
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                              CROSS SECTION:  AMONT OISEAUX 2
                        HYDRAULICS  CALCULATIONS...

  R1      U1     DELTA1      M      X1    DELTA2     U        C          M2      U2      R2      H
  (1)     (2)     (3)       (4)    (5)     (6)      (7)      (8)        (9)    (10)    (11)    (12)

  .15   .0102   .00095    .341  1.095   .00030    .22    24.277      6.04    .037    1.96    2.11
  .30   .0148   .00067    .482  1.352   .00024    .35    12.139      7.96    .044    2.74    3.04
  .45   .0177   .00055    .590  1.471   .00022    .45     8.092      9.38    .048    3.27    3.72
  .60   .0204   .00048    .681  1.538   .00021    .53     6.069     10.55    .051    3.60    4.28
  .75   .0229   .00043    .761  1.569   .00021    .61     4.855     11.79    .052    3.85    4.60
  .90   .0250   .00039    .834  1.591   .00020    .68     4.046     12.92    .053    3.99    4.89
 1.05   .0270   .00036    .901  1.610   .00020    .75     3.468     14.09    .053    4.04    5.09
 1.20   .0289   .00034    .963  1.616   .00020    .81     3.035     15.20    .053    4.06    5.26
 1.35   .0307   .00032   1.022  1.618   .00020    .87     2.697     16.39    .053    4.01    5.36
 1.50   .0323   .00030   1.077  1.612   .00020    .92     2.428     17.58    .052    3.95    5.45
 1.65   .0339   .00029   1.129  1.607   .00020    .97     2.207     18.73    .052    3.87    5.54


                              CROSS SECTION:  AMONT OISEAUX 2
                     HYDRAULICS  CALCULATIONS... (CONTINUED)

   UC      H        A        P         Q         Q1          X2        Y      BX      BB     PE
  (13)   (14)     (15)     (16)      (17)      (18)        (19)      (20)    (21)    (22)   (23)

  .038   3.71   2427.5  1144.3    2260.2     541.1     .001327    .280  1.676   .374  12.843
  .046   5.19   4731.6  1882.4    4634.0    1645.9     .000938    .426  1.617   .402  13.390
  .051   6.26   6809.6  1979.6    6706.3    3048.5     .000766    .539  1.565   .429  13.662
  .055   7.14   8577.2  2058.8    8894.8    4579.5     .000663    .631  1.522   .454  13.838
  .057   7.65   9654.4  2105.3   10127.8    5896.8     .000593    .701  1.482   .478  13.928
  .058   8.11  10616.1  2146.5   11298.8    7233.3     .000542    .753  1.449   .501  13.999
  .060   8.42  11289.2  2174.3   12113.7    8435.0     .000501    .800  1.420   .521  14.049
  .061   8.70  11903.6  2199.8   12894.1    9626.3     .000469    .826  1.393   .542  14.086
  .061   8.86  12247.9  2214.1   13331.3   10616.7     .000442    .842  1.368   .562  14.104
  .062   8.99  12536.5  2226.0   13697.9   11557.7     .000420    .848  1.344   .582  14.116
  .062   9.13  12854.8  2238.9   14113.2   12529.7     .000400    .847  1.321   .602  14.128

17.31.38.UCLP,  58.  DEFTERM,  0.064KLNS.
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                    CROSS SECTION:  AMONT OISEAUX 2
          S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...

     D       FBM     RI     ISSP2      DD       FF        ISIG     ISTIG     BLBF       BLEC        TBLEC
    (1)      (2)     (3)     (4)       (5)      (6)        (7)      (8)       (9)       (10)         (11)

 .000212    .25     .15    32.845    .160    34.257    187.029     .000    .00000        .000         .000
 .000212    .25     .30    16.423    .226    25.597     72.933     .000    .00000        .000         .000
 .000212    .25     .45    10.948    .277    16.296     41.305     .000    .00000        .001         .001
 .000212    .25     .60     8.211    .320    11.369     26.728     .000    .00008        .169         .169
 .000212    .25     .75     6.569    .357     8.600     18.948     .004    .00242       5.319        5.319
 .000212    .25     .90     5.474    .391     6.845     14.141     .020    .01372      29.873       29.873
 .000212    .25    1.05     4.692    .423     5.645     11.044     .055    .03883      84.433       84.433
 .000212    .25    1.20     4.106    .452     4.776      8.767     .125    .08721     176.237      176.237
 .000212    .25    1.35     3.649    .479     4.122      7.117     .238    .16869     373.939      373.939
 .000212    .25    1.50     3.285    .505     3.613      5.899     .376    .28142     626.438      626.438
 .000212    .25    1.65     2.986    .530     3.206      4.882     .635    .45346    1015.239     1015.239
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 .000254    .25     .15    39.352    .191    36.886    132.340     .000    .00000        .000         .000
 .000254    .25     .30    19.676    .271    17.217     58.033     .000    .00000        .000         .000
 .000254    .25     .45    13.117    .332    10.364     31.482     .000    .00002        .030         .031
 .000254    .25     .60     9.838    .383     7.233     20.372     .002    .00188       3.  4        4.029
 .000254    .25     .75     7.870    .428     5.471     14.442     .018    .01665      35.059       40.978
 .000254    .25     .90     6.559    .469     4.355     10.778     .060    .05580     119.771      149.643
 .000254    .25    1.05     5.622    .507     3.571      8.417     .143    .12361     290.524      374.958
 .000254    .25    1.20     4.919    .542     3.038      6.682     .280    .24132     574.852      771.089
 .000254    .25    1.35     4.372    .574     2.622      5.425     .484    .45139     979.770     1373.707
 .000254    .25    1.50     3.935    .605     2.278      4.463     .803    .74842    1664.913     2292.451
 .000254    .25    1.65     3.577    .635     2.040      3.721    1.175   1.09515    2451.919     3467.150
 ----------------------------------------------------------------------------------------------------------
 .000312    .25     .15    48.338    .235    23.777    120.624     .000    .00000        .000         .000
 .000312    .25     .30    24.169    .333    10.290     42.606     .000    .00000        .001         .001
 .000312    .25     .45    16.113    .407     6.196     23.113     .001    .00076       1.496        1.527
 .000312    .25     .60    12.085    .470     4.323     14.956     .018    .01747      40.081       44.111
 .000312    .25     .75     9.668    .526     3.270     10.603     .064    .08078     170.062      210.640
 .000312    .25     .90     8.056    .576     2.603      7.913     .178    .22295     477.683      627.328
 .000312    .25    1.05     6.905    .622     2.146      6.180     .344    .43672     949.385     1324.945
 .000312    .25    1.20     6.042    .665     1.851      4.949     .600    .76147    1675.124     2446.213
 .000312    .25    1.35     5.371    .706     1.653      4.200     .940   1.19291    2641.477     4014.885
 .000312    .25    1.50     4.834    .744     1.542      3.679    1.197   1.51913    3381.624     5674.073
 .000312    .25    1.65     4.394    .780     1.449      3.244    1.475   1.87235    4192.000     7659.150
 ----------------------------------------------------------------------------------------------------------
 .000370    .25     .15    57.324    .279    15.988     94.187     .000    .00000        .000         .000
 .000370    .25     .30    28.662    .394     6.714     33.778     .000    .00002        .027         .031
 .000370    .25     .45    19.108    .483     4.044     17.890     .006    .00915      18.112       19.639
 .000370    .25     .60    14.331    .558     2.821     11.576     .046    .07509     184.906      198.617
 .000370    .25     .75    11.465    .624     2.134      8.207     .156    .25517     537.217      747.856
 .000370    .25     .90     9.554    .683     1.794      6.323     .324    .53106    1139.871     1787.217
 .000370    .25    1.05     8.189    .738     1.558      5.319     .510    .83594    1817.629     3142.174
 .000370    .25    1.20     7.165    .789     1.426      4.569     .757   1.23999    2727.736     5173.949
 .000370    .25    1.35     6.369    .837     1.337      4.028    1.030   1.68776    3736.808     7781.693
 .000370    .25    1.50     5.732    .882     1.266      3.583    1.291   2.04991    4563.198    10237.232
 .000370    .25    1.65     5.211    .925     1.216      3.231    1.485   2.43391    5449.271    13108.429
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                    CROSS SECTION:  AMONT OISEAUX 2
     S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...(CONTINUED)

    AF        W      Z          FI1          FI2        IST     BHLBF      BHBEC       BHRAS        TBLBL
   (12)     (13)   (14)        (15)         (16)       (17)     (18)       (19)        (20)         (21)

 .000114   2.48   6.07        .0426       -.3785      .169     .000        .000        .000         .000
 .000082   2.48   4.29        .0637       -.5981      .281     .000        .000        .000         .000
 .000068   2.48   3.50        .0843       -.7937      .385     .000        .000        .000         .001
 .000059   2.48   3.03        .1062       -.9812      .488     .000        .081        .081         .246
 .000055   2.48   2.71        .1260      -1.1617      .594     .002       3.276       3.276        8.779
 .000052   2.48   2.48        .1462      -1.3424      .704     .010      21.037      21.037       50.910
 .000050   2.48   2.29        .1669      -1.5232      .822     .032      69.419      69.419      133.852
 .000049   2.48   2.15        .1885      -1.7079      .948     .085     185.993     185.993      382.230
 .000048   2.48   2.02        .2111      -1.8938     1.083     .183     405.038     405.038      778.777
 .000047   2.48   1.92        .2348      -2.0851     1.229     .346     770.176     770.174     1376.613
 .000046   2.48   1.83        .2599      -2.2827     1.389     .630    1410.453    1410.453     2423.692
 ----------------------------------------------------------------------------------------------------------
 .000137   3.14   7.68        .0323       -.2827      .133     .000        .000        .000         .000
 .000098   3.14   5.43        .0488       -.4393      .214     .000        .000        .000         .000
 .000081   3.14   4.43        .0629       -.5745      .285     .000        .009        .009         .040
 .000071   3.14   3.84        .0761       -.6996      .353     .001       1.363       1.444        3.473
 .000066   3.14   3.43        .0887       -.8171      .419     .007      14.675      17.950       58.928
 .000063   3.14   3.14        .1011       -.9316      .484     .027      58.021      79.058      228.702
 .000060   3.14   2.90        .1135      -1.0432      .552     .074     160.226     229.645      604.602
 .000058   3.14   2.72        .1259      -1.1541      .619     .162     336.111     542.104     1313.194
 .000057   3.14   2.56        .1384      -1.2634      .689     .311     689.087    1094.125     2467.834
 .000057   3.14   2.43        .1512      -1.3728      .761     .569    1267.719    2037.871     4330.342
 .000056   3.14   2.32        .1641      -1.4834      .836     .915    2048.651    3459.104     6726.262
 ----------------------------------------------------------------------------------------------------------
 .000168   4.04   7.89        .0243       -.2085      .104     .000        .000        .000         .000
 .000120   4.04   6.99        .0361       -.3196      .163     .000        .000        .000         .001
 .000100   4.04   5.71        .0459       -.4133      .214     .000        .320        .329        1.854
 .000087   4.04   4.94        .0548       -.4982      .260     .005      10.423      11.867       55.978
 .000082   4.04   4.42        .0632       -.5762      .303     .025      51.611      69.561      280.201
 .000077   4.04   4.04        .0711       -.6509      .345     .077     165.038     244.095      871.423
 .000074   4.04   3.74        .0789       -.7218      .387     .169     367.974     597.217     1721.764
 .000072   4.04   3.50        .0864       -.7913      .428     .326     716.811    1296.919     3705.128
 .000070   4.04   3.30        .0941       -.8586      .469     .559    1237.462    2331.587     6346.472
 .000069   4.04   3.13        .1016       -.9249      .509     .773    1721.026    3758.917     9432.991
 .000068   4.04   2.98        .1090       -.9908      .550    1.029    2304.407    5763.511    13422.669
 ----------------------------------------------------------------------------------------------------------
 .000200   4.72  11.94        .0205       -.1727      .091     .000        .000        .000         .000
 .000143   4.72   8.16        .0302       -.2630      .141     .000        .004        .004         .035
 .000118   4.72   6.66        .0382       -.3384      .183     .002       3.314       3.643       23.283
 .000104   4.72   5.77        .0453       -.4061      .221     .017      34.103      43.970      244.587
 .000097   4.72   5.16        .0519       -.4676      .256     .065     137.357     206.918      934.774
 .000091   4.72   4.71        .0582       -.5258      .289     .154     327.562     573.657     2340.874
 .000088   4.72   4.36        .0643       -.5811      .322     .269     584.804    1182.023     4324.177
 .000085   4.72   4.08        .0701       -.6346      .353     .438     963.841    2222.736     7376.705
 .000084   4.72   3.85        .0759       -.6860      .384     .647    1436.376    3767.761    11519.654
 .000082   4.72   3.65        .0815       -.7361      .415     .890    1893.091    5652.008    15889.240
 .000081   4.72   3.46        .0871       -.7857      .445    1.084    2426.279    8189.790    21298.219
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17.36.31.UCLP, 58, OEFTERM, 0.128KLNS.
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CROSS SECTION: DISEAUX NORD 1

HYDRAULICS CALCULATIONS..

R1 (1)	U1 (2)	DELTA1 (3)	H (4)	K1 (5)	DELTA2 (6)	U (7)	G (8)	H2 (9)	U2 (10)	R2 (11)	R (12)
.25	.0097	.00100	.324	1.036	.00031	.22	26.793	5.81	.039	3.92	4.17
.50	.0138	.00071	.458	1.315	.00025	.35	13.397	7.65	.045	5.43	5.75
.75	.0169	.00058	.561	1.443	.00023	.45	8.931	9.01	.050	6.50	7.25
1.00	.0195	.00050	.648	1.515	.00021	.53	6.698	10.13	.053	7.27	8.29
1.25	.0218	.00045	.725	1.558	.00021	.61	5.359	11.22	.054	7.77	9.02
1.50	.0238	.00041	.794	1.578	.00021	.68	4.466	12.30	.055	8.04	9.54
1.75	.0257	.00038	.858	1.598	.00020	.74	3.828	13.33	.056	8.22	9.97
2.00	.0275	.00035	.917	1.612	.00020	.80	3.349	14.37	.056	8.28	10.28
2.25	.0292	.00033	.972	1.617	.00020	.86	2.977	15.36	.056	8.33	10.38
2.50	.0308	.00032	1.025	1.617	.00020	.92	2.679	16.47	.056	8.19	10.69
2.75	.0323	.00030	1.075	1.612	.00020	.97	2.436	17.34	.055	8.06	10.81
3.00	.0337	.00029	1.123	1.607	.00020	1.02	2.233	18.57	.055	7.94	10.94
3.25	.0351	.00028	1.169	1.603	.00020	1.07	2.061	19.60	.054	7.84	11.09

CROSS SECTION: DISEAUX NORD 1

HYDRAULICS CALCULATIONS.. (CONTINUED)

UC (13)	H (14)	A (15)	P (16)	Q (17)	Q1 (18)	X2 (19)	Y (20)	BX (21)	BB (22)	FE (23)
.040	6.51	1111.0	239.5	1270.0	248.6	.001394	.264	1.682	.371	13.371
.047	9.38	1864.7	285.3	2150.2	648.4	.000965	.401	1.626	.398	13.955
.052	11.48	2502.2	370.5	2854.7	1118.1	.000805	.511	1.578	.422	14.249
.056	13.15	3177.8	438.9	3721.2	1691.6	.000697	.598	1.537	.445	14.434
.058	14.34	3700.7	441.8	4271.5	2252.9	.000623	.671	1.501	.467	14.548
.060	15.17	4068.3	443.9	4642.8	2760.4	.000569	.728	1.467	.489	14.618
.061	15.87	4378.6	445.7	4991.2	3258.8	.000527	.770	1.439	.508	14.675
.062	16.36	4598.8	446.9	5223.2	3700.6	.000493	.807	1.413	.526	14.714
.063	16.85	4817.4	448.1	5453.4	4154.2	.000465	.829	1.389	.545	14.747
.064	17.03	4897.6	448.6	5538.7	4491.5	.000441	.843	1.366	.563	14.738
.064	17.22	4985.3	449.1	5637.7	4832.0	.000420	.848	1.344	.582	14.766
.064	17.44	5081.8	449.6	5746.8	5180.5	.000402	.848	1.324	.600	14.775
.065	17.67	5185.7	450.2	5864.2	5537.4	.000387	.843	1.306	.617	14.786

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                 CROSS SECTION:  OISEAUX NORD 1
    S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...

    D      FBM    R1    ISRP2     DD       EF       ISIG    ISTIG     BLEF       BLEC      TBLEC
   (1)     (2)    (3)    (4)      (5)      (6)       (7)     (8)       (9)       (10)       (11)

 .000212   .25    .25   36.249   .158    40.279   214.364    .000   .00000       .000       .000
 .000212   .25    .50   18.124   .215    28.768    83.161    .000   .00000       .000       .000
 .000212   .25    .75   12.083   .263    18.435    48.095    .000   .00000       .000       .000
 .000212   .25   1.00    9.062   .304    13.862    31.013    .000   .00001       .006       .006
 .000212   .25   1.25    7.250   .340     9.729    22.084    .001   .00068       .302       .302
 .000212   .25   1.50    6.041   .373     7.744    16.967    .019   .00671      3.066      3.066
 .000212   .25   1.75    5.178   .402     6.386    13.736    .029   .02051      9.148      9.142
 .000212   .25   2.00    4.531   .430     5.403    10.396    .069   .04871     21.770     21.770
 .000212   .25   2.25    4.028   .456     4.663     8.482    .140   .09738     44.933     44.933
 .000212   .25   2.50    3.625   .481     4.087     7.029    .246   .17452     78.286     78.286
 .000212   .25   2.75    3.295   .505     3.627     5.894    .390   .27677    124.380    124.380
 .000212   .25   3.00    3.021   .527     3.253     4.995    .601   .42758    192.252    192.252
 .000212   .25   3.25    2.788   .548     2.943     4.267    .902   .64129    288.727    288.727
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 .000254   .25    .25   43.430   .182    40.980   174.608    .000   .00000       .000       .000
 .000254   .25    .50   21.715   .258    17.478    67.479    .000   .00000       .000       .000
 .000254   .25    .75   14.477   .316    11.728    36.626    .000   .00000       .001       .001
 .000254   .25   1.00   10.858   .364     8.182    23.637    .000   .00044       .172       .177
 .000254   .25   1.25    8.686   .400     6.187    16.832    .009   .00808      3.547      3.670
 .000254   .25   1.50    7.238   .446     4.927    12.627    .032   .03788     13.263     16.331
 .000254   .25   1.75    6.204   .482     4.062     9.859    .084   .07794     34.734     43.876
 .000254   .25   2.00    5.429   .515     3.437     7.924    .179   .16374     72.730     94.900
 .000254   .25   2.25    4.826   .547     2.966     6.463    .306   .28502    127.722    172.253
 .000254   .25   2.50    4.343   .576     2.600     5.397    .501   .46661    209.308    287.994
 .000254   .25   2.75    3.948   .604     2.308     4.472    .790   .73681    330.882    439.262
 .000254   .25   3.00    3.619   .631     2.070     3.807   1.131  1.05447    474.122    666.374
 .000254   .25   3.25    3.341   .657     1.897     3.295   1.438  1.34010    603.350    892.077
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 .000312   .25    .25   53.347   .224    26.417   138.254    .000   .00000       .000       .000
 .000312   .25    .50   26.674   .317    11.642    49.578    .000   .00000       .000       .000
 .000312   .25    .75   17.782   .388     7.009    26.890    .000   .00013       .049       .050
 .000312   .25   1.00   13.337   .448     4.891    17.354    .007   .00882      3.872      4.971
 .000312   .25   1.25   10.669   .501     3.699    12.358    .035   .04469     19.745     23.619
 .000312   .25   1.50    8.891   .548     2.949     9.270    .105   .13277     58.938     75.269
 .000312   .25   1.75    7.621   .592     2.439     7.238    .227   .28848    128.845    173.441
 .000312   .25   2.00    6.668   .633     2.054     5.817    .403   .51177    228.708    323.200
 .000312   .25   2.25    5.927   .672     1.815     4.897    .646   .81927    367.139    537.394
 .000312   .25   2.50    5.339   .708     1.649     4.164    .961  1.21936    546.964    834.560
 .000312   .25   2.75    4.850   .742     1.549     3.694   1.189  1.50876    677.547   1132.809
 .000312   .25   3.00    4.446   .775     1.457     3.276   1.437  1.82342    819.842   1486.236
 .000312   .25   3.25    4.104   .807     1.387     2.960   1.717  2.17941    981.232   1873.309
 ------------------------------------------------------------------------------------------------
 .000370   .25    .25   63.264   .269    18.088   112.860    .000   .00000       .000       .000
 .000370   .25    .50   31.632   .379     7.598    38.343    .000   .00000       .001       .001
 .000370   .25    .75   21.088   .460     4.575    20.813    .002   .00271      1.006      1.056
 .000370   .25   1.00   15.816   .531     3.192    13.432    .024   .04015     17.617     21.690
 .000370   .25   1.25   12.653   .594     2.414     9.565    .094   .15352     67.833     91.440
 .000370   .25   1.50   10.544   .650     1.937     7.231    .220   .37348    169.797    241.066
 .000370   .25   1.75    9.038   .702     1.662     5.877    .393   .64336    284.723    499.163
 .000370   .25   2.00    7.908   .751     1.522     5.111    .566   .92777    414.707    737.913
 .000370   .25   2.25    7.029   .796     1.408     4.471    .800  1.31149    587.705   1127.097
 .000370   .25   2.50    6.326   .840     1.332     3.998   1.043  1.70899    764.602   1601.162
 .000370   .25   2.75    5.751   .880     1.268     3.596   1.243  2.03753    915.003   2047.812
 .000370   .25   3.00    5.272   .920     1.221     3.271   1.499  2.38417   1071.992   2538.227
 .000370   .25   3.25    4.866   .957     1.186     3.002   1.677  2.74081   1237.992   3110.902
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               CROSS SECTION: OISEAUX NORD 1
  S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...(CONTINUED)

    AE      U      Z       FI1       FI2      IST    BMLEF     BMREC      BMRAS      TBLBL
   (12)    (13)   (14)     (15)      (16)     (17)    (18)      (19)       (20)       (21)

 .000065  2.48   6.37    .0402    -.3799    .158    .000       .000       .000       .000
 .000045  2.48   4.51    .0616    -.5785    .261    .000       .000       .000       .000
 .000037  2.48   3.68    .0806    -.7724    .356    .000       .000       .000       .000
 .000032  2.48   3.19    .0985    -.9762    .449    .000       .003       .003       .000
 .000030  2.48   2.85    .1167   -1.1840    .544    .000       .164       .164       .446
 .000028  2.48   2.60    .1348   -1.3272    .641    .004      1.965      1.965      3.031
 .000027  2.48   2.41    .1532   -1.5090    .744    .015      6.801      6.801     13.943
 .000026  2.48   2.25    .1723   -1.6819    .853    .042     18.566     18.566     40.336
 .000025  2.48   2.12    .1920   -1.8424    .969    .076     43.133     43.133     87.666
 .000025  2.48   2.02    .2126   -2.0444   1.092    .191     85.325     85.325    163.811
 .000025  2.48   1.92    .2341   -2.2319   1.226    .337    152.443    152.443    276.823
 .000024  2.48   1.84    .2568   -2.4247   1.370    .586    263.413    263.413    455.665
 .000024  2.48   1.77    .2805   -2.6247   1.527    .980    441.029    441.029    729.756
 ------------------------------------------------------------------------------------------
 .000078  3.14   8.07    .0306    -.2848    .124    .000       .000       .000       .000
 .000054  3.14   5.70    .0459    -.4412    .199    .000       .000       .000       .000
 .000044  3.14   4.66    .0590    -.5758    .266    .000       .000       .000       .001
 .000039  3.14   4.03    .0712    -.7000    .328    .000       .043       .066       .264
 .000035  3.14   3.61    .0828    -.8170    .388    .003      1.384      1.548      3.419
 .000033  3.14   3.29    .0942    -.9293    .447    .013      9.733      7.898     24.229
 .000032  3.14   3.05    .1054   -1.0393    .507    .040     17.631     24.422     60.298
 .000031  3.14   2.85    .1166   -1.1473    .568    .078     41.334     57.900    154.400
 .000030  3.14   2.69    .1279   -1.2552    .630    .180     80.503    123.636    279.891
 .000030  3.14   2.55    .1392   -1.3610    .694    .324    145.191    230.716    518.310
 .000029  3.14   2.43    .1508   -1.4674    .759    .539    231.039    403.483    858.744
 .000029  3.14   2.33    .1625   -1.5749    .826    .871    371.484    655.097   1321.471
 .000029  3.14   2.24    .1749   -1.6838    .896   1.201    540.754    981.793   1873.840
 ------------------------------------------------------------------------------------------
 .000076  4.04  10.39    .0231    -.2114    .098    .000       .000       .000       .000
 .000067  4.04   7.34    .0341    -.3221    .153    .000       .000       .000       .000
 .000054  4.04   6.00    .0432    -.4159    .200    .000       .010       .010       .041
 .000047  4.04   5.19    .0515    -.5006    .243    .002       .941      1.007      3.079
 .000044  4.04   4.64    .0593    -.5789    .283    .013      5.594      7.142     30.737
 .000041  4.04   4.24    .0667    -.6537    .322    .043     18.970     26.868    102.137
 .000039  4.04   3.93    .0738    -.7257    .360    .104     46.260     79.681    243.122
 .000038  4.04   3.67    .0808    -.7922    .397    .203     90.862    150.762    473.970
 .000037  4.04   3.46    .0877    -.8596    .434    .356    159.440    283.075    822.469
 .000037  4.04   3.28    .0946    -.9245    .471    .574    237.639    486.354   1322.914
 .000036  4.04   3.13    .1013    -.9887    .508    .766    343.962    747.445   1880.253
 .000036  4.04   3.00    .1081   -1.0526    .545    .973    446.487   1101.584   2587.819
 .000035  4.04   2.88    .1149   -1.1164    .582   1.268    571.004   1552.787   3426.096
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 .000114  4.72  12.12    .0199    -.1752    .089    .000       .000       .000       .000
 .000079  4.72   8.57    .0285    -.2658    .132    .000       .000       .000       .001
 .000064  4.72   7.00    .0360    -.3414    .172    .000       .173       .183      1.239
 .000056  4.72   6.06    .0427    -.4092    .207    .008      3.644      4.631     24.341
 .000053  4.72   5.42    .0489    -.4712    .240    .037     16.246     23.389    114.837
 .000049  4.72   4.95    .0547    -.5292    .270    .101     44.820     71.691    312.797
 .000047  4.72   4.58    .0603    -.5845    .300    .193     86.120    156.801    615.764
 .000045  4.72   4.29    .0657    -.6375    .330    .306    136.702    287.464   1025.379
 .000044  4.72   4.04    .0710    -.6893    .358    .470    210.512    473.587   1620.686
 .000043  4.72   3.83    .0762    -.7387    .386    .660    296.089    784.443   2383.605
 .000043  4.72   3.66    .0813    -.7873    .414    .843    378.676   1126.120   3173.932
 .000042  4.72   3.50    .0864    -.8354    .441   1.052    473.160   1574.744   4132.971
 .000042  4.72   3.36    .0914    -.8830    .469   1.289    580.319   2133.106   5244.008
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                               CROSS SECTION:  OISEAUX NORD 2
                        H Y D R A U L I C S   C A L C U L A T I O N S...

   R1      U1     DELTA1        M      X1    DELTA2      U        C          M2      U2      R2       R
  (1)     (2)      (3)         (4)    (5)     (6)       (7)      (8)         (9)    (10)    (11)     (12)

  .15   .0108   .00090       .361  1.139   .00029     .24    21.546       6.33    .038    1.79     1.94
  .30   .0153   .00064       .511  1.392   .00023     .37    10.773       8.35    .044    2.51     2.81
  .45   .0188   .00052       .626  1.499   .00022     .48     7.182       9.85    .048    2.98     3.43
  .60   .0217   .00045       .723  1.557   .00021     .57     5.387      11.19    .051    3.28     3.88
  .75   .0243   .00040       .808  1.583   .00021     .65     4.309      12.32    .052    3.42     4.17
  .90   .0266   .00037       .885  1.606   .00020     .72     3.591      13.82    .052    3.50     4.40
 1.05   .0287   .00034       .956  1.616   .00020     .79     3.078      15.08    .053    3.53     4.58
 1.20   .0307   .00032      1.022  1.618   .00020     .86     2.693      16.41    .052    3.49     4.69
 1.35   .0325   .00030      1.084  1.611   .00020     .92     2.394      17.75    .052    3.42     4.77


                             CROSS SECTION:  OISEAUX NORD 2
                   H Y D R A U L I C S   C A L C U L A T I O N S...  (CONTINUED)

     UC      H        A          P         Q          Q1           X2       Y       BX       BB      PE
    (13)   (14)     (15)       (16)      (17)        (18)         (19)     (20)    (21)     (22)    (23)

    .039   4.27    1480.1     780.0    1345.9       351.8     .001250    .301   1.667    .378  13.025
    .047   5.98    3298.5    1245.8    3131.9      1221.6     .000884    .458   1.603    .409  13.561
    .052   7.20    5299.8    1796.5    5152.0      2523.3     .000722    .576   1.548    .439  13.821
    .055   8.08    6910.5    1862.9    6826.9      3921.0     .000625    .669   1.502    .466  13.975
    .057   8.67    8019.4    1907.1    8049.3      5203.6     .000559    .735   1.460    .493  14.061
    .059   9.11    8867.4    1940.5    8999.9      6418.9     .000510    .790   1.427    .516  14.125
    .060   9.47    9566.1    1967.4    9819.9      7589.4     .000472    .823   1.396    .539  14.170
    .061   9.68    9988.0    1983.6   10314.9      8574.3     .000442    .842   1.368    .562  14.194
    .061   9.85   10322.2    1996.4   10707.1      9494.2     .000417    .848   1.340    .585  14.207

 17.45.27.UCLP,  3B,  OEFTERM,  0.064KLNS.
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                         CROSS SECTION:  OISEAUX NORD 2
             S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..

    D      FBM     R1     ISRP2     DD       FF       ISIG    ISTIG    BLSF       BLEC      TBLEC
   (1)     (2)     (3)     (4)      (5)      (6)       (7)     (8)      (9)       (10)       (11)

 .000212  .25    .15    29.150   .170    47.767   158.692   .000   .00000      .000       .000
 .000212  .25    .30    14.575   .240    22.792    62.172   .000   .00000      .000       .000
 .000212  .25    .45     9.717   .294    14.039    34.498   .000   .00000      .007       .007
 .000212  .25    .60     7.288   .339     9.792    22.263   .001   .00063     1.168      1.168
 .000212  .25    .75     5.830   .379     7.407    15.646   .010   .00896    17.088     17.088
 .000212  .25    .90     4.858   .415     5.876    11.679   .044   .03149    61.101     61.101
 .000212  .25   1.05     4.164   .449     4.862     8.985   .116   .08236   162.029    162.029
 .000212  .25   1.20     3.644   .480     4.114     7.097   .239   .17018   337.961    337.961
 .000212  .25   1.35     3.239   .509     3.550     5.709   .424   .30111   601.136    601.136
 ----------------------------------------------------------------------------------------------
 .000234  .25    .15    34.925   .203    32.474   129.239   .000   .00000      .000       .000
 .000234  .25    .30    17.463   .287    14.829    48.463   .000   .00000      .000       .000
 .000234  .25    .45    11.642   .352     8.928    26.263   .000   .00013      .222       .239
 .000234  .25    .60     8.731   .406     6.229    16.968   .008   .00762    14.176     15.369
 .000234  .25    .75     6.985   .454     4.712    11.925   .041   .03819    72.823     87.911
 .000234  .25    .90     5.821   .498     3.731     8.901   .119   .11134   216.056    277.137
 .000234  .25   1.05     4.989   .538     3.073     6.848   .263   .24907   482.131    644.139
 .000234  .25   1.20     4.366   .575     2.617     5.409   .488   .45477   902.909   1340.049
 .000234  .25   1.35     3.881   .610     2.250     4.351   .858   .79984  1596.795   2197.931
 ----------------------------------------------------------------------------------------------
 .000312  .25    .15    42.900   .250    20.933   102.348   .000   .00000      .000       .000
 .000312  .25    .30    21.450   .353     8.863    35.381   .000   .00000      .006       .006
 .000312  .25    .45    14.300   .432     5.336    19.281   .003   .00413     7.415      7.654
 .000312  .25    .60    10.725   .499     3.723    12.458   .034   .04315    80.377     95.741
 .000312  .25    .75     8.580   .558     2.816     8.735   .126   .16000   305.135    395.046
 .000312  .25    .90     7.150   .611     2.242     6.939   .277   .37716   731.882   1009.039
 .000312  .25   1.05     6.129   .660     1.877     5.106   .568   .72066  1417.791   2051.931
 .000312  .25   1.20     5.363   .706     1.631     4.192   .949  1.19878  2378.243   3618.312
 .000312  .25   1.35     4.767   .749     1.527     3.615  1.232  1.56396  3122.279   5320.210
 ----------------------------------------------------------------------------------------------
 .000370  .25    .15    50.875   .296    13.770    79.843   .000   .00000      .000       .000
 .000370  .25    .30    25.438   .419     5.785    27.940   .000   .00013      .162       .168
 .000370  .25    .45    16.958   .513     3.483    14.924   .019   .02538    45.893     83.247
 .000370  .25    .60    12.719   .592     2.430     9.642   .091   .14879   277.479    373.221
 .000370  .25    .75    10.175   .662     1.869     6.889   .239   .42412   808.830   1203.876
 .000370  .25    .90     8.479   .725     1.574     5.510   .465   .76194  1478.954   2487.976
 .000370  .25   1.05     7.268   .783     1.440     4.643   .726  1.18760  2340.377   4402.329
 .000370  .25   1.20     6.359   .837     1.336     4.021  1.033  1.69263  3357.470   6975.783
 .000370  .25   1.35     5.653   .888     1.257     3.328  1.283  2.10332  4199.074   9319.284
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                       CROSS SECTION: OISEAUX NORD 2
       S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..(CONTINUED)

    AE       U      X         PI1        PI2      IST    BMLSF     BMREC      BMBAS      TBLBL
   (12)    (13)   (14)       (15)       (16)     (17)    (18)      (19)       (20)       (21)

 .000077  2.48   5.72      .0458     -.4127    .184    .000       .000       .000       .000
 .000071  2.48   4.04      .0710     -.6550    .308    .000       .000       .000       .000
 .000059  2.48   3.30      .0939     -.8737    .424    .000       .003       .003       .010
 .000052  2.48   2.86      .1162    -1.0830    .541    .000       .632       .632      1.801
 .000049  2.48   2.56      .1388    -1.2881    .663    .006     11.328     11.328     28.416
 .000047  2.48   2.33      .1619    -1.4939    .793    .025     48.467     48.467    109.568
 .000045  2.48   2.16      .1860    -1.7030    .933    .077    151.208    151.208    313.236
 .000044  2.48   2.02      .2114    -1.9154   1.085    .185    366.341    366.341    703.902
 .000043  2.48   1.91      .2383    -2.1340   1.251    .377    752.216    752.216   1353.352
 ----------------------------------------------------------------------------------------------
 .000119  3.14   7.23      .0347     -.3078    .144    .000       .000       .000       .000
 .000085  3.14   5.12      .0525     -.4793    .233    .000       .000       .000       .000
 .000071  3.14   4.18      .0680     -.6285    .311    .000       .073       .073       .315
 .000063  3.14   3.62      .0825     -.7668    .386    .003      5.485      6.117     21.482
 .000059  3.14   3.24      .0966     -.8983    .460    .018     33.913     44.840    134.731
 .000056  3.14   2.95      .1106    -1.0262    .535    .060    115.661    164.128    441.289
 .000054  3.14   2.73      .1245    -1.1526    .612    .150    294.938    446.146   1090.306
 .000052  3.14   2.56      .1386    -1.2773    .690    .314    622.964    989.306   2229.375
 .000052  3.14   2.41      .1530    -1.4021    .771    .617   1231.976   1983.792   4181.723
 ----------------------------------------------------------------------------------------------
 .000146  4.04   9.31      .0260     -.2264    .112    .000       .000       .000       .000
 .000104  4.04   6.59      .0387     -.3478    .177    .000       .001       .001       .007
 .000087  4.04   5.38      .0494     -.4505    .232    .001      1.719      1.794      9.448
 .000077  4.04   4.66      .0591     -.5432    .282    .012     22.691     28.808    124.949
 .000072  4.04   4.16      .0682     -.6274    .330    .053    100.738    143.979    940.623
 .000068  4.04   3.80      .0771     -.7116    .377    .142    276.043    440.171   1449.210
 .000066  4.04   3.52      .0857     -.7911    .423    .305    600.182   1046.329   3108.279
 .000064  4.04   3.29      .0942     -.8680    .469    .562   1115.636   2104.942   5723.254
 .000063  4.04   3.10      .1026     -.9434    .515    .805   1606.919   3590.711   8910.921
 ----------------------------------------------------------------------------------------------
 .000173  4.72  10.87      .0219     -.1874    .098    .000       .000       .000       .000
 .000124  4.72   7.69      .0323     -.2859    .152    .000       .025       .026       .194
 .000103  4.72   6.28      .0410     -.3684    .198    .005      9.014     10.808     64.036
 .000092  4.72   5.44      .0487     -.4420    .239    .036     66.249     95.056    469.277
 .000085  4.72   4.86      .0559     -.5097    .277    .117    224.041    367.620   1573.495
 .000081  4.72   4.44      .0629     -.5737    .314    .239    464.383    904.554   3392.150
 .000078  4.72   4.11      .0695     -.6347    .350    .416    818.628   1864.936   6267.284
 .000076  4.72   3.84      .0760     -.6933    .385    .651   1291.900   3396.842  10372.629
 .000075  4.72   3.62      .0823     -.7504    .419    .882   1797.864   5350.575  14869.899
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17.51.26.UCLP, 58, DEFTERM, 0.128KLNS.
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                         CROSS SECTION:  BARRAJE 1
                  H Y D R A U L I C S   C A L C U L A T I O N S...

  R1     U1    DELTA1      M     X1   DELTA2    U        C         M2     U2     R2      R
  (1)    (2)    (3)       (4)    (5)    (6)     (7)      (8)       (9)   (10)   (11)    (12)

  .20  .0102  .00096    .340 1.093  .00030    .23    24.392     6.03   .038   2.79    2.99
  .40  .0144  .00068    .480 1.350  .00024    .36    12.196     7.95   .045   3.89    4.29
  .60  .0177  .00055    .588 1.469  .00022    .46     8.131     9.36   .049   4.63    5.23
  .80  .0204  .00048    .679 1.536  .00021    .53     6.098    10.53   .052   5.19    5.99
 1.00  .0228  .00043    .760 1.568  .00021    .63     4.878    11.76   .053   5.44    6.44
 1.20  .0250  .00039    .832 1.590  .00020    .70     4.065    12.89   .054   5.63    6.83
 1.40  .0270  .00036    .899 1.610  .00020    .76     3.485    14.06   .054   5.69    7.09
 1.60  .0288  .00034    .961 1.616  .00020    .83     3.049    15.16   .055   5.73    7.33
 1.80  .0306  .00032   1.019 1.618  .00020    .89     2.710    16.34   .054   5.66    7.46
 2.00  .0322  .00030   1.074 1.612  .00020    .94     2.439    17.53   .054   5.57    7.57
 2.20  .0338  .00029   1.127 1.607  .00020   1.00     2.217    18.67   .053   5.48    7.68
 2.40  .0353  .00028   1.177 1.602  .00020   1.05     2.033    19.78   .053   5.40    7.80


                       CROSS SECTION:  BARRAJE 1
              H Y D R A U L I C S   C A L C U L A T I O N S...  (CONTINUED)

   UC      H       A        P        Q        Q1         X2        Y     BX      BB     PE
  (13)   (14)    (15)     (16)     (17)     (18)       (19)      (20)   (21)    (22)   (23)

  .039   4.88    954.0   293.9    744.5    219.1    .001330    .279  1.676   .374  13.116
  .047   7.41   1835.5   418.0   1662.7    663.1    .000940    .425  1.617   .402  13.745
  .052   9.23   2701.1   508.5   2400.5   1240.5    .000768    .538  1.566   .429  14.050
  .056  10.72   3511.9   582.0   2997.5   1921.9    .000665    .629  1.522   .453  14.244
  .058  11.59   4085.1   678.8   3490.4   2536.1    .000595    .700  1.483   .478  14.342
  .060  12.35   4629.6   738.9   3939.3   3230.0    .000543    .752  1.450   .500  14.419
  .061  12.86   5007.9   742.3   4210.4   3830.0    .000503    .799  1.421   .520  14.472
  .062  13.32   5350.1   745.3   4482.4   4427.1    .000470    .823  1.394   .541  14.511
  .062  13.57   5541.3   746.9   4641.0   4913.9    .000443    .842  1.367   .561  14.531
  .063  13.78   5692.3   748.2   4766.2   5367.5    .000421    .847  1.345   .581  14.543
  .063  14.00   5857.6   749.7   4903.3   5838.4    .000401    .847  1.323   .601  14.555
  .064  14.24   6035.4   751.5   5063.3   6327.9    .000384    .842  1.302   .620  14.569
```

CROSS SECTION: BARRAJE 1

SEDIMENT TRANSPORT CALCULATION..

D (1)	FGM (2)	RI (3)	1SRP2 (4)	DD (5)	FF (6)	ISIG (7)	ISTIG (8)	BLSF (9)	BLEC (10)	TBLEC (11)
.000212	.25	.20	33.000	.159	54.530	188.248	.000	.00000	.000	.000
.000212	.25	.40	16.500	.225	26.017	73.294	.000	.00000	.000	.000
.000212	.25	.60	11.000	.276	16.392	41.604	.000	.00000	.000	.000
.000212	.25	.80	8.250	.319	11.437	26.918	.000	.00007	.043	.043
.000212	.25	1.00	6.600	.356	8.650	19.091	.003	.00248	1.686	1.686
.000212	.25	1.20	5.500	.391	6.886	14.248	.017	.01347	9.951	9.951
.000212	.25	1.40	4.714	.422	5.678	11.130	.053	.03772	27.998	27.998
.000212	.25	1.60	4.125	.451	4.804	8.839	.122	.08687	64.744	64.744
.000212	.25	1.80	3.667	.478	4.146	7.179	.232	.16508	123.302	123.302
.000212	.25	2.00	3.300	.504	3.634	5.909	.387	.27508	205.828	205.828
.000212	.25	2.20	3.000	.529	3.225	4.927	.623	.44277	331.936	331.936
.000212	.25	2.40	2.750	.552	2.893	4.153	.968	.68782	516.879	516.879
.000254	.25	.20	39.538	.191	37.072	153.333	.000	.00000	.000	.000
.000254	.25	.40	19.769	.270	17.319	58.452	.000	.00000	.000	.000
.000254	.25	.60	13.179	.331	10.428	31.710	.000	.00001	.007	.007
.000254	.25	.80	9.884	.382	7.275	20.516	.002	.00176	1.024	1.067
.000254	.25	1.00	7.908	.427	5.503	14.551	.017	.01612	10.741	12.626
.000254	.25	1.20	6.590	.468	4.380	10.860	.058	.05424	40.078	50.029
.000254	.25	1.40	5.648	.505	3.612	8.483	.140	.13028	96.703	124.701
.000254	.25	1.60	4.942	.540	3.056	6.737	.274	.25581	190.648	255.373
.000254	.25	1.80	4.393	.573	2.637	5.472	.473	.44136	329.663	452.765
.000254	.25	2.00	3.954	.604	2.312	4.504	.785	.73187	547.624	753.452
.000254	.25	2.20	3.594	.634	2.052	3.756	1.157	1.07845	808.499	1140.436
.000254	.25	2.40	3.295	.662	1.870	3.217	1.495	1.39408	1047.603	1864.478
.000312	.25	.20	48.566	.235	23.897	121.410	.000	.00000	.000	.000
.000312	.25	.40	24.283	.332	10.391	42.913	.000	.00000	.000	.000
.000312	.25	.60	16.189	.406	6.232	23.280	.001	.00070	.356	.364
.000312	.25	.80	12.142	.469	4.348	15.063	.015	.01888	10.785	12.059
.000312	.25	1.00	9.713	.525	3.289	10.683	.042	.07853	33.312	45.938
.000312	.25	1.20	8.094	.579	2.618	7.973	.171	.21713	160.438	210.464
.000312	.25	1.40	6.938	.621	2.159	6.228	.337	.42794	317.646	442.347
.000312	.25	1.60	6.071	.664	1.857	5.034	.589	.74770	597.233	812.626
.000312	.25	1.80	5.396	.704	1.638	4.229	.926	1.17483	877.517	1330.482
.000312	.25	2.00	4.857	.742	1.546	3.701	1.189	1.50433	1125.614	1879.066
.000312	.25	2.20	4.415	.778	1.452	3.269	1.460	1.85233	1388.669	2527.109
.000312	.25	2.40	4.047	.813	1.377	2.910	1.766	2.24177	1684.610	3249.088
.000370	.25	.20	57.594	.278	16.083	96.897	.000	.00000	.000	.000
.000370	.25	.40	28.797	.393	6.756	33.219	.000	.00001	.006	.006
.000370	.25	.60	19.198	.482	4.068	18.019	.005	.00869	4.416	4.780
.000370	.25	.80	14.399	.556	2.838	11.658	.045	.07308	42.528	54.580
.000370	.25	1.00	11.519	.622	2.147	8.267	.152	.24899	169.027	234.766
.000370	.25	1.20	9.599	.682	1.762	6.364	.319	.52222	385.861	596.325
.000370	.25	1.40	8.228	.736	1.562	5.345	.503	.82513	612.464	1054.811
.000370	.25	1.60	7.199	.787	1.431	4.594	.746	1.22305	911.496	1724.122
.000370	.25	1.80	6.399	.835	1.340	4.050	1.021	1.67312	1249.713	2380.199
.000370	.25	2.00	5.759	.880	1.269	3.602	1.240	2.03224	1520.618	3399.684
.000370	.25	2.20	5.236	.923	1.218	3.247	1.473	2.41397	1809.441	4338.946
.000370	.25	2.40	4.800	.964	1.181	2.958	1.719	2.81717	2117.003	5366.090

CROSS SECTION: BARRAJE 1

SEDIMENT TRANSPORT CALCULATION..(CONTINUED)

AE (12)	N (13)	Z (14)	FI1 (15)	FI2 (16)	IST (17)	SMLSF (18)	SMREC (19)	SMRAS (20)	TBLSL (21)
.000087	2.48	4.08	.0423	-.3873	.168	.000	.000	.000	000
.000057	2.48	4.30	.0634	-.6194	.280	.000	.000	.000	000
.000046	2.48	3.51	.0860	-.8240	.383	.000	.000	.000	000
.000040	2.48	3.04	.1038	-1.0210	.486	.000	.021	.021	064
.000037	2.48	2.72	.1256	-1.2098	.591	.001	.976	.976	2.482
.000034	2.48	2.48	.1456	-1.3988	.701	.007	6.776	6.776	16.937
.000033	2.48	2.30	.1663	-1.5880	.818	.031	22.712	22.712	50.910
.000032	2.48	2.15	.1877	-1.7808	.943	.082	61.065	61.065	125.810
.000031	2.48	2.03	.2101	-1.9760	1.078	.178	132.888	132.888	256.190
.000031	2.48	1.92	.2338	-2.1763	1.223	.336	251.756	251.756	437.985
.000030	2.48	1.83	.2587	-2.3837	1.382	.612	438.768	438.768	790.705
.000030	2.48	1.76	.2852	-2.5991	1.557	1.071	804.540	804.540	1321.415
.000104	3.14	7.70	.0323	-.2912	.132	.000	.000	.000	.000
.000069	3.14	5.44	.0486	-.4551	.213	.000	.000	.000	000
.000055	3.14	4.44	.0627	-.5968	.284	.000	.002	.002	010
.000047	3.14	3.85	.0758	-.7283	.352	.001	.360	.381	1.448
.000044	3.14	3.44	.0884	-.8512	.417	.007	4.563	5.539	18.184
.000041	3.14	3.14	.1008	-.9709	.483	.026	17.342	26.318	76.347
.000040	3.14	2.91	.1131	-1.0876	.549	.072	53.123	76.035	200.736
.000038	3.14	2.72	.1255	-1.2033	.617	.158	117.622	178.688	434.080
.000037	3.14	2.57	.1379	-1.3178	.686	.303	226.269	359.136	812.122
.000037	3.14	2.43	.1506	-1.4322	.758	.554	414.891	666.648	1420.100
.000036	3.14	2.32	.1635	-1.5478.	.832	.897	672.483	1131.291	2271.687
.000036	3.14	2.22	.1767	-1.6650	.909	1.267	952.472	1757.012	3321.490
.000128	4.04	9.91	.0243	-.2148	.103	.000	.000	.000	000
.000084	4.04	7.01	.0360	-.3319	.163	.000	.000	.000	000
.000068	4.04	5.72	.0458	-.4297	.213	.000	.076	.078	442
.000058	4.04	4.95	.0546	-.5188	.259	.009	2.847	3.228	13.280
.000054	4.04	4.43	.0629	-.6004	.302	.024	16.181	21.681	87.619
.000051	4.04	4.05	.0709	-.6784	.344	.075	55.242	81.560	272.024
.000049	4.04	3.75	.0787	-.7529	.386	.165	122.532	198.567	640.914
.000047	4.04	3.50	.0863	-.8256	.426	.319	237.608	416.275	1228.721
.000046	4.04	3.30	.0938	-.8959	.467	.548	407.674	768.831	2077.313
.000045	4.04	3.13	.1012	-.9651	.507	.763	570.765	1237.412	3116.479
.000045	4.04	2.99	.1087	-1.0339	.548	1.014	760.500	1891.751	4420.855
.000044	4.04	2.86	.1161	-1.1026	.589	1.320	991.771	2748.783	5997.871
.000132	4.72	11.57	.0203	-.1780	.090	.000	.000	.000	000
.000100	4.72	8.18	.0302	-.2737	.141	.000	.001	.001	007
.000080	4.72	6.68	.0381	-.3531	.183	.002	.807	.885	3.665
.000069	4.72	5.78	.0452	-.4232	.220	.016	9.356	12.984	67.164
.000064	4.72	5.17	.0518	-.4876	.255	.063	43.073	64.753	299.719
.000060	4.72	4.72	.0580	-.5486	.288	.150	111.189	192.749	789.074
.000058	4.72	4.37	.0641	-.6064	.321	.265	196.396	394.963	1449.775
.000056	4.72	4.09	.0699	-.6624	.352	.431	320.981	737.277	2461.399
.000055	4.72	3.86	.0756	-.7161	.383	.641	478.729	1247.560	3827.734
.000054	4.72	3.66	.0813	-.7684	.413	.840	628.643	1866.058	5265.740
.000053	4.72	3.49	.0868	-.8202	.444	1.071	802.764	2694.514	7033.060
.000052	4.72	3.34	.0923	-.8714	.474	1.333	1003.230	3752.013	9118.103

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                         CROSS SECTION:  BARRAJE 2
                 H Y D R A U L I C S   C A L C U L A T I O N S...

  R1     U1    DELTA1      M     X1   DELTA2    U      C        M2    U2    R2     N
  (1)    (2)    (3)       (4)   (5)    (6)     (7)    (8)      (9)  (10)  (11)  (12)

  .15  .0100  .00078    .333 1.079  .00030   .22  25.349     5.94  .037  2.02  2.17
  .30  .0141  .00069    .471 1.336  .00024   .34  12.674     7.83  .043  2.83  3.13
  .45  .0173  .00056    .577 1.459  .00022   .44   8.450     9.21  .048  3.38  3.83
  .60  .0200  .00049    .666 1.528  .00021   .52   6.337    10.37  .050  3.80  4.40
  .75  .0224  .00044    .745 1.564  .00021   .60   5.070    11.54  .052  4.02  4.77
  .90  .0245  .00040    .816 1.585  .00021   .67   4.225    12.65  .053  4.16  5.06
 1.05  .0265  .00037    .882 1.605  .00020   .73   3.621    13.75  .053  4.24  5.29
 1.20  .0283  .00034    .943 1.614  .00020   .79   3.169    14.83  .053  4.27  5.47
 1.35  .0300  .00033   1.000 1.620  .00020   .85   2.817    15.93  .053  4.25  5.60
 1.50  .0316  .00031   1.054 1.614  .00020   .90   2.535    17.09  .053  4.18  5.68
 1.65  .0332  .00029   1.105 1.609  .00020   .95   2.304    18.20  .052  4.12  5.77


                      CROSS SECTION:  BARRAJE 2
            H Y D R A U L I C S   C A L C U L A T I O N S... (CONTINUED)

   UC      H       A        P        Q        Q1         X2       Y     BX     BB     FE
  (13)   (14)    (15)     (16)     (17)     (18)       (19)    (20)   (21)   (22)   (23)

  .038   5.63    794.3   295.4    294.0    173.0   .001356  .273 1.679  .373 13.245
  .046   8.11   1826.3   875.6    925.2    621.0   .000959  .415 1.621  .400 13.825
  .051   9.92   3715.7  1316.9   2507.4   1626.6   .000783  .527 1.571  .426 14.114
  .054  11.39   5817.9  1558.1   4517.2   3037.9   .000678  .616 1.529  .450 14.299
  .056  12.34   7336.5  1713.7   6020.5   4384.1   .000606  .688 1.490  .473 14.402
  .058  13.10   8646.3  1737.5   7386.4   5763.5   .000553  .741 1.457  .496 14.475
  .059  13.66   9659.1  1792.4   8446.8   7060.8   .000512  .787 1.428  .515 14.530
  .060  14.13  10498.8  1821.0   9335.6   8307.9   .000479  .817 1.402  .535 14.570
  .061  14.48  11138.1  1842.3  10030.7   9449.7   .000452  .840 1.378  .554 14.597
  .062  14.69  11516.0  1854.9  10441.5  10391.4   .000429  .845 1.354  .574 14.608
  .062  14.91  11927.4  1868.6  10888.8  11379.0   .000409  .849 1.331  .593 14.620

 18.00.45.UCLP, 5B, OEFTERM, 0.064KLNS.
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                         CROSS SECTION:  BARRAJE 2
              S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N . .

    D       FSM      RI      ISRP2      DD        FF        ISIG     ISTID      BLEF        BLEC        TBLEC
   (1)      (2)      (3)      (4)       (5)       (6)       (7)       (8)        (9)        (10)         (11)

 .000212    .25     .15     34.294    .156     36.816   198.324     .000     .00000        .000         .000
 .000212    .25     .30     17.147    .221     27.110    77.182     .000     .00000        .000         .000
 .000212    .25     .45     11.431    .271     17.800    44.133     .000     .00000        .000         .000
 .000212    .25     .60      8.574    .313     12.000    28.529     .000     .00004        .058         .058
 .000212    .25     .75      6.859    .350      9.077    20.264     .002     .00150       2.974        2.974
 .000212    .25     .90      5.716    .383      7.225    15.156     .014     .01029      18.088       18.088
 .000212    .25    1.05      4.899    .414      5.958    11.836     .042     .02994      53.671       53.671
 .000212    .25    1.20      4.287    .442      5.041     9.446     .098     .06978     127.068      127.068
 .000212    .25    1.35      3.810    .469      4.350     7.709     .191     .13572     250.040      250.040
 .000212    .25    1.50      3.429    .495      3.813     6.344     .321     .22834     423.535      423.535
 .000212    .25    1.65      3.118    .519      3.384     5.319     .511     .36324     678.730      678.730
 ------------------------------------------------------------------------------------------------------------
 .000254    .25     .15     41.088    .187     38.626   161.703     .000     .00000        .000         .000
 .000254    .25     .30     20.544    .265     18.173    61.789     .000     .00000        .000         .000
 .000254    .25     .45     13.696    .325     10.942    33.638     .000     .00001        .009         .010
 .000254    .25     .60     10.272    .375      7.634    21.741     .001     .00104       1.617        1.675
 .000254    .25     .75      8.218    .419      5.774    15.449     .013     .01243      21.305       23.879
 .000254    .25     .90      6.848    .459      4.596    11.552     .046     .04303      75.618       93.706
 .000254    .25    1.05      5.870    .496      3.790     9.021     .114     .10638     191.027      244.698
 .000254    .25    1.20      5.136    .530      3.207     7.200     .231     .21491     391.341      516.410
 .000254    .25    1.35      4.565    .562      2.769     5.876     .393     .36620     674.632      924.672
 .000254    .25    1.50      4.109    .593      2.426     4.833     .634     .60754    1130.601     1554.139
 .000254    .25    1.65      3.735    .621      2.153     4.091    1.020     .95108    1777.146     2455.876
 ------------------------------------------------------------------------------------------------------------
 .000312    .25     .15     50.471    .230     24.877   128.038     .000     .00000        .000         .000
 .000312    .25     .30     25.235    .325     10.862    45.511     .000     .00000        .000         .000
 .000312    .25     .45     16.824    .399      6.540    24.676     .000     .00036        .479         .487
 .000312    .25     .60     12.618    .460      4.563    15.762     .012     .01467      22.851       24.336
 .000312    .25     .75     10.094    .515      3.451    11.339     .049     .06280     107.619      131.498
 .000312    .25     .90      8.412    .564      2.747     8.481     .140     .17750     311.964      405.670
 .000312    .25    1.05      7.210    .609      2.265     6.623     .287     .36414     632.662      897.360
 .000312    .25    1.20      6.309    .651      1.933     5.330     .507     .64385    1172.429     1690.839
 .000312    .25    1.35      5.608    .690      1.717     4.477     .777    1.01174    1864.268     2788.939
 .000312    .25    1.50      5.047    .728      1.586     3.884    1.074    1.38854    2575.528     4129.663
 .000312    .25    1.65      4.588    .763      1.489     3.442    1.337    1.69635    3169.726     5625.602
 ------------------------------------------------------------------------------------------------------------
 .000370    .25     .15     59.853    .273     16.876   102.912     .000     .00000        .000         .000
 .000370    .25     .30     29.926    .386      7.099    35.225     .000     .00001        .004         .004
 .000370    .25     .45     19.951    .473      4.268    19.119     .003     .00567       7.473        7.961
 .000370    .25     .60     14.963    .546      2.978    12.354     .035     .05778      90.020      114.946
 .000370    .25     .75     11.971    .610      2.253     8.777     .125     .20496     351.285      482.783
 .000370    .25     .90      9.975    .669      1.832     6.706     .278     .45521     800.044     1205.719
 .000370    .25    1.05      8.550    .722      1.603     5.557     .495     .74524    1339.727     2233.087
 .000370    .25    1.20      7.482    .772      1.467     4.779     .667    1.07283    1990.022     3680.861
 .000370    .25    1.35      6.650    .819      1.367     4.227     .925    1.51530    2791.383     5980.322
 .000370    .25    1.50      5.989    .863      1.274     3.759    1.155    1.89321    3511.625     7641.288
 .000370    .25    1.65      5.441    .905      1.233     3.384    1.375    2.25356    4210.913     9836.914
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                         CROSS SECTION: BARRAJE 2
       S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N . . (CONTINUED)

    AE        W       Z        FI1        FI2       IST      BMLSF     BMBEC       BMBAS       TBLBL
   (12)     (13)    (14)      (15)       (16)      (17)      (18)      (19)        (20)        (21)

 .000075   2.48    6.20     .0415     -.3864     .164      .000       .000        .000         .000
 .000052   2.48    4.38     .0638     -.6104     .272      .000       .000        .000         .000
 .000043   2.48    3.58     .0837     -.8099     .372      .000       .000        .000         .000
 .000037   2.48    3.10     .1028     -.9999     .471      .000       .027        .027         .085
 .000034   2.48    2.77     .1218    -1.1839     .571      .001      1.470       1.470        4.043
 .000032   2.48    2.53     .1410    -1.3461     .676      .007     12.220      12.220       30.308
 .000031   2.48    2.34     .1606    -1.5491     .787      .024     42.217      42.217       95.858
 .000030   2.48    2.19     .1811    -1.7347     .905      .063    114.736     114.736      242.004
 .000029   2.48    2.07     .2024    -1.9235    1.031      .140    257.834     257.834      507.874
 .000029   2.48    1.96     .2247    -2.1156    1.167      .266    494.209     494.209      917.743
 .000028   2.48    1.87     .2482    -2.3141    1.315      .477    892.192     892.192     1570.922
 ----------------------------------------------------------------------------------------------------
 .000090   3.14    7.85     .0314     -.2873     .129      .000       .000        .000         .000
 .000063   3.14    5.55     .0475     -.4491     .207      .000       .000        .000         .000
 .000051   3.14    4.53     .0612     -.5871     .276      .000       .003        .003         .012
 .000045   3.14    3.92     .0739     -.7148     .342      .000       .552        .580        2.255
 .000041   3.14    3.51     .0861     -.8348     .405      .009      8.624      10.074       33.972
 .000039   3.14    3.20     .0980     -.9511     .468      .020     35.364      47.984      141.290
 .000037   3.14    2.97     .1099    -1.0647     .532      .057    101.544     143.762      388.459
 .000036   3.14    2.77     .1217    -1.1770     .596      .129    233.378     348.314      864.723
 .000035   3.14    2.62     .1337    -1.2884     .663      .243    447.116     704.950     1629.622
 .000035   3.14    2.48     .1458    -1.3990     .730      .445    825.822    1320.030     2874.166
 .000034   3.14    2.37     .1581    -1.5107     .801      .761   1422.841    2313.033     4770.909
 ----------------------------------------------------------------------------------------------------
 .000111   4.04   10.10     .0238     -.2138     .101      .000       .000        .000         .000
 .000077   4.04    7.14     .0352     -.3274     .159      .000       .000        .000         .000
 .000063   4.04    5.83     .0447     -.4232     .208      .000       .099        .102         .989
 .000055   4.04    5.05     .0533     -.5101     .252      .004      5.767       6.347       30.873
 .000051   4.04    4.52     .0614     -.5900     .294      .018     31.682      41.776      173.274
 .000048   4.04    4.12     .0691     -.6659     .335      .059    104.472     152.056      557.727
 .000046   4.04    3.82     .0766     -.7388     .375      .136    244.646     388.408     1285.767
 .000044   4.04    3.57     .0840     -.8096     .414      .267    485.557     833.871     2524.710
 .000043   4.04    3.37     .0912     -.8786     .453      .459    844.788    1549.938     4338.877
 .000042   4.04    3.19     .0984     -.9459     .492      .683   1266.814    2586.844     6716.507
 .000042   4.04    3.05     .1056    -1.0128     .531      .900   1682.351    3977.384     9622.986
 ----------------------------------------------------------------------------------------------------
 .000132   4.72   11.79     .0200     -.1773     .088      .000       .000        .000         .000
 .000091   4.72    8.34     .0295     -.2702     .137      .000       .001        .001         .009
 .000075   4.72    6.81     .0372     -.3471     .178      .001      1.330       1.432        9.392
 .000065   4.72    5.90     .0441     -.4164     .214      .012     19.308      25.655      140.201
 .000060   4.72    5.27     .0505     -.4776     .248      .051     87.264     127.039      611.822
 .000057   4.72    4.81     .0566     -.5371     .281      .128    224.565     376.621     1582.339
 .000054   4.72    4.46     .0625     -.5958     .312      .233    416.942     805.350     3038.436
 .000052   4.72    4.17     .0682     -.6504     .343      .375    681.970    1515.841     5196.702
 .000051   4.72    3.93     .0737     -.7032     .373      .565   1040.481    2570.419     8170.941
 .000050   4.72    3.73     .0792     -.7543     .402      .761   1411.618    3998.462    11639.730
 .000050   4.72    3.56     .0845     -.8047     .431      .972   1815.365    5812.749    15649.263
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10.04.26.UCLP,  35,  DEPTERM,  0.120KLNS.
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                         CROSS SECTION:  MATEBA AMONT SUD 1
                   H Y D R A U L I C S   C A L C U L A T I O N S...

   R1     U1    DELTA1      H     K1    DELTA2     U       C         M2     U2     R2      R
   (1)    (2)    (3)       (4)    (5)    (6)      (7)     (8)       (9)   (10)   (11)   (12)

   .15  .0099  .00099   .328 1.068  .00030   .21   26.117     5.87   .037   2.06   2.21
   .30  .0139  .00070   .466 1.325  .00025   .33   13.058     7.73   .043   2.89   3.19
   .45  .0171  .00057   .569 1.451  .00022   .43    8.706     9.10   .047   3.46   3.71
   .60  .0197  .00049   .657 1.521  .00021   .51    6.529    10.24   .050   3.89   4.49
   .75  .0220  .00044   .734 1.561  .00021   .59    5.223    11.37   .052   4.14   4.89
   .90  .0241  .00040   .804 1.581  .00021   .66    4.353    12.46   .053   4.29   5.19
  1.05  .0261  .00037   .869 1.601  .00020   .72    3.731    13.52   .053   4.38   5.43
  1.20  .0279  .00035   .929 1.610  .00020   .78    3.265    14.58   .053   4.41   5.61
  1.35  .0296  .00033   .985 1.619  .00020   .84    2.902    15.62   .054   4.42   5.77
  1.50  .0312  .00031  1.038 1.616  .00020   .89    2.612    16.75   .052   4.39   5.85


                       CROSS SECTION:  MATEBA AMONT SUD 1
              H Y D R A U L I C S   C A L C U L A T I O N S... (CONTINUED)

   UC     H      A        P        G        G1        X2       Y     BX     BB     PE
  (13)   (14)   (15)     (16)     (17)     (18)      (19)    (20)   (21)   (22)   (23)

  .038   4.39   909.7   431.2    360.9    194.9   .001376  .268 1.681  .372 12.986
  .045   5.93  1833.7   762.8   1136.1    615.7   .000973  .408 1.624  .399 13.304
  .050   7.07  2721.8   793.9   1689.6   1173.0   .000794  .518 1.575  .424 13.769
  .054   7.98  3454.4   810.9   2135.2   1776.3   .000688  .606 1.533  .447 13.938
  .056   8.60  3966.6   822.5   2481.3   2334.8   .000615  .678 1.496  .470 14.039
  .058   9.07  4352.5   831.2   2731.7   2857.7   .000562  .732 1.462  .492 14.106
  .059   9.45  4668.1   838.1   2957.1   3361.1   .000520  .778 1.434  .511 14.159
  .060   9.74  4910.2   843.4   3130.0   3827.7   .000486  .812 1.408  .530 14.196
  .061   9.99  5121.7   848.1   3280.9   4280.6   .000459  .834 1.384  .549 14.223
  .062  10.11  5226.3   850.4   3361.0   4646.5   .000435  .844 1.360  .568 14.236

18.10.13.UCLP.   58,  DEFTERM.  0.064KLNS.
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                        CROSS SECTION:  MATEBA AMONT SUD 1
            S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...

     D       FSM      BL     ISRP2     DD        FF        ISIO      ISTIO      BLSF       BLEC       TBLEC
    (1)      (2)      (3)     (4)      (5)       (6)       (7)        (8)       (9)        (10)        (11)

 .000212    .25      .15    35.333    .154     58.636    206.899     .000     .00000       .000         .000
 .000212    .25      .30    17.667    .218     27.987     80.346     .000     .00000       .000         .000
 .000212    .25      .45    11.778    .267     17.859     46.203     .000     .00000       .000         .000
 .000212    .25      .60     8.833    .308     12.437     29.838     .000     .00002       .018         .018
 .000212    .25      .75     7.067    .345      9.422     21.225     .001     .00099       .810         .810
 .000212    .25      .90     5.889    .377      7.300     15.901     .012     .00833      6.942        6.942
 .000212    .25     1.05     5.048    .408      6.185     12.414     .034     .02452     20.550       20.550
 .000212    .25     1.20     4.417    .436      5.233      9.946     .081     .05750     48.902       48.902
 .000212    .25     1.35     3.926    .462      4.516      8.116     .161     .11476     97.329       97.329
 .000212    .25     1.50     3.533    .487      3.996      6.704     .270     .19750    168.028      168.028
 ---------------------------------------------------------------------------------------------------------
 .000254    .25      .15    42.333    .185     39.877    168.524     .000     .00000       .000         .000
 .000254    .25      .30    21.167    .261     18.864     64.883     .000     .00000       .000         .000
 .000254    .25      .45    14.111    .320     11.398     35.213     .000     .00003       .003         .003
 .000254    .25      .60    10.583    .369      7.925     22.742     .001     .00066       .333         .331
 .000254    .25      .75     8.467    .413      5.994     16.177     .011     .01016      8.348        9.168
 .000254    .25      .90     7.056    .452      4.771     12.119     .038     .03573     29.673       36.637
 .000254    .25     1.05     6.048    .488      3.934      9.463     .097     .09097     76.173       96.724
 .000254    .25     1.20     5.292    .522      3.327      7.581     .201     .18771    158.320      206.822
 .000254    .25     1.35     4.704    .554      2.873      6.186     .343     .31997    271.373      368.678
 .000254    .25     1.50     4.233    .584      2.518      5.110     .567     .52825    449.244      617.272
 ---------------------------------------------------------------------------------------------------------
 .000312    .25      .15    52.000    .227     25.709    133.437     .000     .00000       .000         .000
 .000312    .25      .30    26.000    .321     11.275     47.636     .000     .00000       .000         .000
 .000312    .25      .45    17.333    .393      6.789     25.854     .000     .00031       .168         .171
 .000312    .25      .60    13.000    .453      4.736     16.677     .009     .01164      9.452       10.003
 .000312    .25      .75    10.400    .507      3.583     11.877     .043     .05279     43.416       52.985
 .000312    .25      .90     8.667    .555      2.852      8.898     .120     .15179    124.197      162.779
 .000312    .25     1.05     7.429    .600      2.355      6.949     .253     .32122    267.218      365.943
 .000312    .25     1.20     6.500    .641      1.992      5.571     .432     .57324    483.494      690.316
 .000312    .25     1.35     5.778    .680      1.769      4.679     .712     .90319    764.001     1134.699
 .000312    .25     1.50     5.200    .717      1.618      4.032    1.028    1.30472   1107.577     1726.849
 ---------------------------------------------------------------------------------------------------------
 .000370    .25      .15    61.667    .269     17.518    107.843     .000     .00000       .000         .000
 .000370    .25      .30    30.833    .380      7.394     34.871     .000     .00000       .003         .003
 .000370    .25      .45    20.556    .466      4.431     20.011     .003     .00388      3.082        3.253
 .000370    .25      .60    15.417    .538      3.091     12.923     .029     .04749     38.812       48.815
 .000370    .25      .75    12.333    .601      2.338      9.193     .108     .17634    144.794      177.340
 .000370    .25      .90    10.278    .659      1.888      6.984     .250     .40916    340.072      502.847
 .000370    .25     1.05     8.810    .711      1.635      5.727     .420     .68894    577.048      943.010
 .000370    .25     1.20     7.708    .761      1.497      4.969     .611    1.00130    844.943     1534.859
 .000370    .25     1.35     6.852    .807      1.399      4.353     .897    1.40447   1191.149     2323.842
 .000370    .25     1.50     6.167    .850      1.318      3.886    1.093    1.79172   1523.744     3250.993
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                       CROSS SECTION: MATEBA AMONT SUD 1
     S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...(CONTINUED)

    AE      W      Z         FI1        FI2        IST      BHLSF      BHREC      BHRAB      TBLBL
   (12)   (13)   (14)       (15)       (16)       (17)      (18)       (19)       (20)       (21)

 .000097  2.48   6.29      .0408     -.3698      .160      .000       .000       .000        .000
 .000071  2.48   4.45      .0624     -.5795      .266      .000       .000       .000        .000
 .000060  2.48   3.63      .0820     -.7661      .363      .000       .000       .000        .000
 .000053  2.48   3.15      .1006     -.9434      .459      .000       .008       .008        .026
 .000049  2.48   2.81      .1190    -1.1149      .556      .001       .451       .451       1.261
 .000047  2.48   2.57      .1376    -1.2846      .657      .005      4.558      4.558      11.300
 .000045  2.48   2.38      .1566    -1.4547      .763      .019     15.681     15.681      36.232
 .000044  2.48   2.23      .1763    -1.6263      .876      .050     42.484     42.484      90.985
 .000043  2.48   2.10      .1967    -1.8011      .996      .114     76.976     76.976     174.301
 .000043  2.48   1.99      .2180    -1.9778     1.125      .222    109.087    109.087     337.116
 ---------------------------------------------------------------------------------------------------
 .000116  3.14   7.97      .0310     -.2769      .126      .000       .000       .000        .000
 .000086  3.14   5.63      .0467     -.4269      .203      .000       .000       .000        .000
 .000072  3.14   4.60      .0600     -.5597      .270      .000       .001       .001        .004
 .000064  3.14   3.98      .0724     -.6794      .334      .000       .179       .186        .737
 .000059  3.14   3.56      .0843     -.7879      .376      .004      3.306      3.737      12.723
 .000056  3.14   3.25      .0959     -.8964      .456      .016     13.553     18.113      54.750
 .000054  3.14   3.01      .1074    -1.0026      .518      .047     39.479     55.160     131.884
 .000052  3.14   2.82      .1187    -1.1072      .581      .109     91.979    134.463     341.284
 .000051  3.14   2.66      .1303    -1.2112      .645      .206    173.013    271.989     640.687
 .000050  3.14   2.52      .1422    -1.3139      .710      .378    319.053    506.140    1125.412
 ---------------------------------------------------------------------------------------------------
 .000142  4.04  10.25      .0234     -.2049      .097      .000       .000       .000        .000
 .000105  4.04   7.25      .0346     -.3112      .156      .000       .000       .000        .000
 .000088  4.04   5.92      .0439     -.4011      .204      .000       .034       .039        .206
 .000078  4.04   5.13      .0523     -.4853      .247      .000      2.337      2.324      12.926
 .000073  4.04   4.59      .0602     -.5574      .288      .019     12.530     16.276      68.561
 .000069  4.04   4.19      .0678     -.6285      .328      .050     41.352     99.465     222.260
 .000066  4.04   3.88      .0751     -.6969      .367      .118     98.709    193.869     519.807
 .000064  4.04   3.63      .0823     -.7631      .405      .232    175.781    330.244    1020.560
 .000062  4.04   3.42      .0893     -.8279      .443      .400    339.241    611.230    1743.929
 .000062  4.04   3.24      .0963     -.8907      .480      .637    533.107   1041.246    2768.078
 ---------------------------------------------------------------------------------------------------
 .000169  4.72  11.97      .0197     -.1694      .086      .000       .000       .000        .000
 .000125  4.72   8.46      .0290     -.2564      .135      .000       .000       .000        .004
 .000105  4.72   6.91      .0366     -.3287      .173      .001       .838       .873       3.827
 .000093  4.72   5.98      .0434     -.3939      .210      .010      8.103     10.626      39.141
 .000086  4.72   5.35      .0496     -.4533      .244      .043     35.317     51.593     249.133
 .000082  4.72   4.89      .0556     -.5093      .279      .113     73.584    153.049     655.916
 .000078  4.72   4.52      .0613     -.5622      .306      .211    176.428    330.294    1273.304
 .000076  4.72   4.23      .0668     -.6133      .336      .336    283.410    613.634    2148.313
 .000074  4.72   3.99      .0722     -.6639      .365      .512    434.322   1045.752    3371.974
 .000073  4.72   3.78      .0776     -.7107      .373      .709    599.417   1640.464    4891.257
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18.10.56.UCLP, 38, DEFTERM, 0.128KLNS.
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                          CROSS SECTION:  MATEBA AMONT SUD 2
                  H Y D R A U L I C S   C A L C U L A T I O N S...

  R1     U1    DELTA1      H     X1   DELTA2     U       C         H2      V      B2      R
 (1)    (2)     (3)       (4)   (5)    (6)      (7)     (8)       (9)    (10)   (11)   (12)

  .15  .0099  .00099    .328 1.068  .00030    .21    26.117      5.87   .037   2.06    2.21
  .30  .0139  .00070    .464 1.325  .00025    .33    13.058      7.73   .043   2.89    3.19
  .45  .0171  .00057    .569 1.451  .00022    .43     8.706      9.10   .047   3.46    3.91
  .60  .0197  .00049    .657 1.521  .00021    .51     6.529     10.24   .050   3.89    4.49
  .75  .0220  .00044    .734 1.561  .00021    .59     5.223     11.37   .052   4.14    4.89
  .90  .0241  .00040    .804 1.581  .00021    .66     4.353     12.46   .053   4.29    5.19
 1.05  .0261  .00037    .869 1.601  .00020    .72     3.731     13.52   .053   4.38    5.43
 1.20  .0279  .00035    .929 1.613  .00020    .78     3.265     14.58   .053   4.41    5.61
 1.35  .0296  .00033    .985 1.619  .00020    .84     2.902     15.62   .054   4.42    5.77
 1.50  .0312  .00031   1.038 1.616  .00020    .89     2.612     16.75   .053   4.35    5.85
 1.65  .0327  .00030   1.089 1.611  .00020    .94     2.374     17.84   .053   4.29    5.94


                     CROSS SECTION:  MATEBA AMONT SUD 2
          H Y D R A U L I C S   C A L C U L A T I O N S... (CONTINUED)

  UC     H       A        P        Q        Q1        X2       Y     BX      BB     PE
 (13)   (14)   (15)     (16)     (17)     (18)      (19)     (20)   (21)   (22)   (23)

 .038   3.42  1987.0   880.3   1722.2    425.8   .001376   .268  1.681   .372 12.736
 .045   4.87  3459.5  1161.5   3109.3   1157.8   .000973   .408  1.624   .399 13.307
 .050   5.94  4748.3  1253.5   4466.4   2046.7   .000794   .518  1.575   .424 13.595
 .054   6.80  5854.8  1310.8   5607.2   3010.6   .000688   .606  1.533   .447 13.778
 .056   7.39  6639.4  1349.9   6430.5   3907.9   .000615   .678  1.496   .470 13.887
 .058   7.83  7238.0  1379.2   7065.2   4752.2   .000562   .732  1.462   .492 13.958
 .059   8.18  7729.8  1402.8   7599.1   5568.6   .000520   .778  1.434   .511 14.014
 .060   8.45  8115.5  1420.8   8026.8   6326.4   .000486   .812  1.408   .530 14.054
 .061   8.69  8452.4  1436.6   8400.4   7064.3   .000459   .834  1.384   .549 14.086
 .062   8.80  8617.3  1444.3   8583.3   7661.2   .000435   .844  1.360   .568 14.097
 .062   8.93  8794.6  1452.6   8779.9   8266.6   .000415   .849  1.338   .587 14.108

18.11.13.UCLP, 5B, DEFTERM, 0.064KLNS.
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CROSS SECTION: MATEBA AMONT SUD 2

S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N . .

D (1)	FSM (2)	S1 (3)	ISOP2 (4)	DD (5)	FF (6)	ISIG (7)	ISTIG (8)	BLSF (9)	BLEC (10)	TBLEC (11)
.000212	.25	.15	35.333	.194	58.456	204.599	.000	.00000	.000	.000
.000212	.25	.30	17.667	.219	27.987	80.344	.000	.00000	.000	.000
.000212	.25	.45	11.778	.247	17.855	46.203	.000	.00000	.000	.000
.000212	.25	.60	8.833	.309	12.487	27.838	.000	.00002	.027	.029
.000212	.25	.75	7.067	.343	9.482	21.225	.001	.00099	1.330	1.330
.000212	.25	.90	5.889	.377	7.900	15.901	.012	.00938	11.519	11.519
.000212	.25	1.05	5.048	.408	6.183	12.416	.036	.02432	34.396	34.396
.000212	.25	1.20	4.417	.436	5.233	9.946	.081	.05750	81.704	81.704
.000212	.25	1.35	3.926	.462	4.516	8.116	.161	.11476	164.840	164.840
.000212	.25	1.50	3.533	.487	3.950	6.704	.278	.19730	285.371	285.371
.000212	.25	1.65	3.212	.511	3.513	5.622	.441	.31344	455.312	455.312
.000254	.25	.15	42.333	.189	39.077	148.524	.000	.00000	.000	.000
.000254	.25	.30	21.167	.241	19.864	64.585	.000	.00000	.000	.000
.000254	.25	.45	14.111	.320	11.358	35.213	.000	.00000	.009	.009
.000254	.25	.60	10.583	.369	7.725	22.742	.001	.00064	.962	.971
.000254	.25	.75	8.467	.413	5.774	16.177	.011	.01016	13.71	19.040
.000254	.25	.90	7.056	.452	4.771	12.119	.039	.03873	49.277	60.790
.000254	.25	1.05	6.048	.488	3.734	9.463	.097	.07697	127.494	161.071
.000254	.25	1.20	5.292	.522	3.257	7.571	.201	.10771	246.799	348.404
.000254	.25	1.35	4.704	.554	2.873	6.186	.343	.21947	457.673	634.329
.000254	.25	1.50	4.233	.584	2.518	5.110	.567	.35425	742.973	1049.362
.000254	.25	1.65	3.848	.612	2.239	4.289	.892	.53199	1200.977	1663.[illegible]
.000312	.25	.15	52.000	.227	25.705	133.437	.000	.00000	.000	.000
.000312	.25	.30	26.000	.321	11.273	47.636	.000	.00000	.000	.000
.000312	.25	.45	17.333	.393	6.787	25.854	.006	.00021	.263	.271
.000312	.25	.60	13.000	.453	4.734	16.477	.009	.01166	15.278	16.149
.000312	.25	.75	10.400	.507	3.583	11.877	.042	.05279	71.256	86.304
.000312	.25	.90	8.667	.555	2.832	8.878	.120	.15177	207.352	270.140
.000312	.25	1.05	7.429	.600	2.332	6.948	.253	.32122	450.602	612.492
.000312	.25	1.20	6.500	.641	1.972	5.571	.453	.57324	814.477	1162.881
.000312	.25	1.35	5.778	.680	1.769	4.679	.712	.90319	1297.932	1922.070
.000312	.25	1.50	5.200	.717	1.618	4.032	1.028	1.30472	1894.448	2732.791
.000312	.25	1.65	4.727	.752	1.519	3.578	1.254	1.94116	2311.365	3975.273
.000370	.25	.15	61.667	.269	17.518	107.843	.000	.00000	.000	.000
.000370	.25	.30	30.833	.380	7.397	34.871	.000	.00000	.009	.009
.000370	.25	.45	20.556	.466	4.431	20.011	.003	.00309	4.944	9.137
.000370	.25	.60	15.417	.538	3.071	12.723	.029	.04749	42.284	78.424
.000370	.25	.75	12.333	.601	2.339	9.173	.108	.17624	237.912	324.210
.000370	.25	.90	10.278	.659	1.899	6.784	.250	.40716	564.327	934.473
.000370	.25	1.05	8.810	.711	1.635	5.727	.420	.68094	949.069	1570.357
.000370	.25	1.20	7.708	.761	1.497	4.963	.611	1.00130	1432.607	2589.960
.000370	.25	1.35	6.852	.807	1.360	4.353	.857	1.40447	2017.601	3739.791
.000370	.25	1.50	6.167	.850	1.313	3.856	1.073	1.79172	2587.847	5530.640
.000370	.25	1.65	5.606	.892	1.252	3.476	1.303	2.13868	3102.334	7077.607

CROSS SECTION: MATEBA AMONT SUD 2

S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N . . (CONTINUED)

AK (12)	U (13)	Z (14)	F11 (15)	F12 (16)	IST (17)	BHLSF (18)	BHSEC (19)	BHSAS (20)	TBLBL (21)
.000124	2.48	4.29	.0408	-.3594	.140	.000	.000	.000	.000
.000087	2.48	4.45	.0626	-.5472	.266	.000	.000	.000	.000
.000071	2.48	3.63	.0820	-.7510	.363	.000	.000	.000	.000
.000062	2.48	3.15	.1006	-.9273	.457	.000	.013	.013	.042
.000057	2.48	2.81	.1190	-1.0947	.556	.001	.737	.737	2.069
.000054	2.48	2.57	.1376	-1.2642	.657	.005	7.964	7.964	19.083
.000052	2.48	2.38	.1564	-1.4320	.763	.019	26.249	26.249	60.641
.000050	2.48	2.23	.1762	-1.6012	.876	.050	71.960	71.960	153.264
.000049	2.48	2.10	.1966	-1.7736	.996	.114	164.247	164.247	329.107
.000048	2.48	1.99	.2180	-1.9473	1.125	.222	321.074	321.074	606.449
.000047	2.48	1.90	.2403	-2.1266	1.264	.396	579.604	579.604	1030.719
.000149	3.14	7.77	.0310	-.2457	.126	.000	.000	.000	.000
.000104	3.14	5.63	.0466	-.4179	.203	.000	.000	.000	.000
.000086	3.14	4.60	.0600	-.5436	.271	.000	.001	.001	.007
.000075	3.14	3.98	.0724	-.6435	.334	.000	.280	.301	1.192
.000067	3.14	3.56	.0843	-.7790	.376	.004	5.424	6.144	21.213
.000065	3.14	3.25	.0959	-.8823	.436	.016	22.475	30.057	90.853
.000062	3.14	3.01	.1074	-.9871	.510	.047	66.976	92.320	234.311
.000060	3.14	2.82	.1189	-1.0903	.561	.109	154.979	224.470	574.903
.000058	3.14	2.66	.1305	-1.1930	.649	.200	276.449	460.670	1086.229
.000058	3.14	2.52	.1422	-1.2942	.710	.379	541.836	864.710	1911.293
.000057	3.14	2.40	.1541	-1.3961	.777	.647	737.628	1519.232	3179.130
.000183	4.04	10.28	.0233	-.1980	.077	.000	.000	.000	.000
.000128	4.04	7.23	.0346	-.3043	.156	.000	.000	.000	.000
.000105	4.04	5.93	.0439	-.3934	.204	.000	.094	.095	.326
.000092	4.04	5.13	.0534	-.4740	.247	.003	3.779	4.060	20.249
.000084	4.04	4.59	.0603	-.5483	.288	.019	20.851	26.717	113.022
.000080	4.04	4.19	.0679	-.6185	.328	.050	68.621	96.670	348.526
.000076	4.04	3.88	.0751	-.6861	.367	.118	165.206	237.526	870.019
.000074	4.04	3.63	.0823	-.7514	.405	.232	329.801	536.300	1719.181
.000072	4.04	3.42	.0893	-.8154	.443	.400	574.629	1039.319	2757.389
.000071	4.04	3.24	.0963	-.8773	.480	.627	905.379	1768.289	4701.080
.000070	4.04	3.09	.1033	-.9387	.510	.884	1197.479	2718.727	6466.000
.000217	4.72	11.97	.0197	-.1644	.086	.000	.000	.000	.000
.000152	4.72	8.46	.0289	-.2306	.135	.000	.001	.001	.006
.000125	4.72	6.91	.0366	-.3223	.173	.001	.849	.905	6.041
.000109	4.72	5.98	.0433	-.3848	.210	.010	13.094	17.174	95.598
.000100	4.72	5.35	.0496	-.4450	.244	.043	57.964	84.683	408.900
.000095	4.72	4.87	.0554	-.5005	.275	.113	135.244	253.723	1088.377
.000090	4.72	4.52	.0613	-.5534	.306	.211	275.310	552.837	2131.194
.000088	4.72	4.23	.0668	-.6037	.336	.336	477.444	1033.744	3619.312
.000085	4.72	3.99	.0723	-.6529	.365	.512	734.082	1771.401	5711.192
.000084	4.72	3.78	.0776	-.7001	.393	.705	1018.081	2784.370	8307.010
.000083	4.72	3.61	.0828	-.7465	.422	.901	1308.272	4020.999	11098.606

18.12.24. UCLP, 55, DEFTERM, 0.128KLNS.

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                         CROSS SECTION:  MATEBA SUD MANDUDI
                 H Y D R A U L I C S   C A L C U L A T I O N S...

  R1     U1     DELTA1      M      X1   DELTA2     U        C          M2      U2      R2       R
 (1)    (2)     (3)        (4)    (5)    (6)      (7)      (8)        (9)    (10)    (11)    (12)

  .20  .0099  .00098      .331  1.074  .00030    .22    25.701      5.90   .038    2.90    3.10
  .40  .0140  .00069      .468  1.331  .00024    .35    12.851      7.78   .045    4.04    4.44
  .60  .0172  .00057      .573  1.455  .00022    .45     8.567      9.16   .049    4.82    5.42
  .80  .0199  .00049      .662  1.525  .00021    .53     6.425     10.31   .052    5.41    6.21
 1.00  .0222  .00044      .740  1.562  .00021    .61     5.140     11.46   .053    5.73    6.73
 1.20  .0243  .00040      .811  1.583  .00021    .68     4.284     12.56   .054    5.93    7.13
 1.40  .0263  .00037      .876  1.603  .00020    .74     3.672     13.65   .055    6.04    7.44
 1.60  .0281  .00035      .936  1.614  .00020    .81     3.213     14.72   .055    6.08    7.68
 1.80  .0298  .00033      .993  1.619  .00020    .86     2.856     15.79   .055    6.07    7.87
 2.00  .0314  .00031     1.047  1.615  .00020    .92     2.570     16.93   .054    5.97    7.97
 2.20  .0329  .00030     1.098  1.610  .00020    .97     2.336     18.04   .054    5.88    8.08


                      CROSS SECTION:  MATEBA SUD MANDUDI
             H Y D R A U L I C S   C A L C U L A T I O N S...(CONTINUED)

   UC     H      A         P         Q         Q1          X2        Y      BX      BB     PE
  (13)  (14)   (15)      (16)      (17)      (18)        (19)      (20)   (21)    (22)   (23)

  .039  3.55   4001.6   1234.2    3348.9     893.5    .001365    .271   1.679   .373  12.781
  .047  5.24   6254.9   1454.1    5538.1    2174.3    .000965    .411   1.622   .399  13.384
  .052  6.47   8074.6   1504.4    7387.8    3609.3    .000788    .523   1.573   .425  13.684
  .055  7.46   9585.3   1544.9    8935.2    5106.5    .000683    .612   1.531   .449  13.873
  .058  8.11  10593.9   1571.4   10006.3    6455.5    .000610    .683   1.493   .472  13.981
  .059  8.61  11388.7   1591.9   10840.0    7737.6    .000557    .737   1.459   .494  14.055
  .061  8.99  11998.2   1607.6   11479.4    8936.0    .000516    .783   1.431   .513  14.111
  .062  9.30  12488.9   1619.9   12060.3   10066.5    .000483    .815   1.405   .533  14.150
  .062  9.54  12879.0   1629.8   12523.0   11126.8    .000455    .837   1.381   .551  14.179
  .063  9.66  13078.4   1634.8   12759.6   12015.6    .000432    .845   1.357   .571  14.189
  .063  9.80  13297.3   1640.3   13019.2   12913.8    .000412    .850   1.335   .590  14.200

 18.21.31.UCLP, 58, OEFTERM, 0.064KLNS.
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                       CROSS SECTION:  MATEBA SUD MANDUDI
              S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..

    D      FSM     Y1     1000F2     DD       SF        2000      SPTIO      BLEF        BLEC       TBLEC
   (1)     (2)    (3)      (4)      (5)      (6)        (7)        (8)        (9)        (10)        (11)

 .000212   .25    .20    34.771    .135    37.661    202.337     .000     .00000        .000        .000
 .000212   .25    .40    17.386    .220    27.512     78.631     .000     .00000        .000        .000
 .000212   .25    .60    11.590    .269    17.500     45.080     .000     .00000        .000        .000
 .000212   .25    .80     8.693    .311    12.210     29.125     .000     .00003        .045        .045
 .000212   .25   1.00     6.954    .347     9.235     20.703     .002     .00126       1.941       1.941
 .000212   .25   1.20     5.795    .380     7.351     15.496     .013     .00934      14.873      14.873
 .000212   .25   1.40     4.967    .411     6.062     12.101     .039     .03742      44.080      44.080
 .000212   .25   1.60     4.346    .439     5.129      9.674     .090     .06380     103.356     103.356
 .000212   .25   1.80     3.863    .466     4.426      7.895     .177     .12558     204.667     204.667
 .000212   .25   2.00     3.477    .491     3.880      6.508     .300     .21355     349.106     349.106
 .000212   .25   2.20     3.161    .515     3.443      5.459     .476     .33869     555.354     555.354
 ---------------------------------------------------------------------------------------------------------
 .000254   .25    .20    41.660    .186    39.200    164.825     .000     .00000        .000        .000
 .000254   .25    .40    20.830    .263    18.490     63.313     .000     .00000        .000        .000
 .000254   .25    .60    13.887    .322    11.133     34.359     .000     .00001        .008        .009
 .000254   .25    .80    10.415    .372     7.767     22.199     .001     .00085       1.310       1.359
 .000254   .25   1.00     8.332    .416     5.875     15.779     .012     .01132      17.799      19.736
 .000254   .25   1.20     6.943    .456     4.677     11.811     .042     .03959      63.01       77.991
 .000254   .25   1.40     5.951    .492     3.856      9.223     .106     .09916     157.377     203.480
 .000254   .25   1.60     5.208    .526     3.263      7.374     .217     .20186     326.797     430.334
 .000254   .25   1.80     4.629    .558     2.818      6.017     .369     .34403     560.681     765.348
 .000254   .25   2.00     4.166    .588     2.468      4.960     .612     .57074     933.033    1282.137
 .000254   .25   2.20     3.787    .617     2.191      4.161     .963     .89777    1472.621    2028.175
 ---------------------------------------------------------------------------------------------------------
 .000312   .25    .20    51.173    .229    25.269    130.510     .000     .00000        .000        .000
 .000312   .25    .40    25.586    .323    11.051     46.482     .000     .00000        .000        .000
 .000312   .25    .60    17.058    .396     6.654     25.225     .000     .00028        .425        .434
 .000312   .25    .80    12.793    .457     4.642     16.298     .011     .01339      20.692      22.047
 .000312   .25   1.00    10.235    .511     3.511     11.585     .046     .05795      91.038     110.794
 .000312   .25   1.20     8.529    .560     2.799      8.671     .130     .16510     262.815     349.706
 .000312   .25   1.40     7.310    .605     2.303      6.771     .271     .34360     552.363     755.843
 .000312   .25   1.60     6.397    .646     1.960      5.440     .481     .61014     998.395    1418.730
 .000312   .25   1.80     5.686    .686     1.741      4.569     .756     .96007    1564.684    2330.031
 .000312   .25   2.00     5.117    .723     1.601      3.952    1.063    1.34910    2208.489    3487.628
 .000312   .25   2.20     4.652    .758     1.503      3.307    1.296    1.64504    2698.362    4724.837
 ---------------------------------------------------------------------------------------------------------
 .000370   .25    .20    60.686    .271    17.170    105.165     .000     .00000        .000        .000
 .000370   .25    .40    30.343    .383     7.213     35.978     .000     .00001        .008        .008
 .000370   .25    .60    20.229    .469     4.343     17.924     .003     .00486       7.308       7.741
 .000370   .25    .80    15.171    .542     3.030     12.614     .032     .05276      81.518     103.562
 .000370   .25   1.00    12.137    .606     2.292      8.967     .117     .19114     300.352     411.146
 .000370   .25   1.20    10.114    .664     1.857      6.833     .264     .43328     689.728    1030.434
 .000370   .25   1.40     8.669    .717     1.617      5.635     .438     .71844    1154.933    1910.776
 .000370   .25   1.60     7.586    .767     1.481      4.875     .640    1.04947    1700.082    3118.832
 .000370   .25   1.80     6.743    .813     1.377      4.285     .893    1.46276    2384.282    4714.314
 .000370   .25   2.00     6.069    .857     1.304      3.817    1.126    1.84555    3017.087    6904.715
 .000370   .25   2.20     5.517    .899     1.241      3.434    1.342    2.19946    3607.820    8334.338
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                       CROSS SECTION: MATEBA SUD MANDUDI
        S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N...(CONTINUED)

    AE       U       Z         FI1        FI2       IST      SMLSF      SMREC       SMRAS       TBLSL
   (12)    (13)    (14)       (15)       (16)      (17)      (18)       (19)        (20)        (21)

 .000117   2.48    6.24      .0412     -.3644      .162      .000       .000        .000        .000
 .000081   2.48    4.41      .0623     -.5778      .269      .000       .000        .000        .000
 .000066   2.48    3.60      .0829     -.7670      .368      .000       .000        .000        .000
 .000057   2.48    3.12      .1018     -.9472      .463      .000       .021        .021        .066
 .000052   2.48    2.79      .1205    -1.1209      .564      .001      1.075       1.075       3.036
 .000049   2.48    2.55      .1394    -1.2931      .667      .006      9.916       9.916      24.789
 .000047   2.48    2.36      .1588    -1.4653      .775      .021     34.184      34.184      78.265
 .000046   2.48    2.21      .1788    -1.6397      .891      .057     92.089      92.089     195.445
 .000044   2.48    2.08      .1997    -1.8169     1.015      .127    207.665     207.665     412.332
 .000044   2.48    1.97      .2215    -1.9962     1.147      .245    400.421     400.421     749.327
 .000043   2.48    1.88      .2445    -2.1811     1.290      .437    716.865     716.865    1272.437
 ---------------------------------------------------------------------------------------------------------
 .000143   3.14    7.90      .0313     -.2726      .127      .000       .000        .000        .000
 .000097   3.14    5.39      .0471     -.4251      .205      .000       .000        .000        .000
 .000079   3.14    4.56      .0606     -.5568      .274      .000       .002        .003        .011
 .000068   3.14    3.95      .0732     -.6775      .338      .000       .443        .464       1.918
 .000063   3.14    3.53      .0852     -.7913      .400      .005      7.126       8.221      27.958
 .000059   3.14    3.23      .0970     -.9013      .462      .018     29.141      39.057     116.948
 .000056   3.14    2.99      .1087    -1.0087      .525      .032     83.739     117.922     321.402
 .000055   3.14    2.79      .1204    -1.1146      .589      .119    172.644     284.733     715.088
 .000053   3.14    2.63      .1322    -1.2198      .654      .225    346.872     574.557    1339.905
 .000053   3.14    2.50      .1441    -1.3237      .721      .411    672.626    1073.047    2355.187
 .000052   3.14    2.38      .1562    -1.4284      .790      .709   1162.771    1879.856    3706.032
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 .000176   4.04   10.17      .0236     -.2011      .100      .000       .000        .000        .000
 .000119   4.04    7.19      .0349     -.3098      .157      .000       .000        .000        .006
 .000096   4.04    5.87      .0444     -.4010      .206      .000       .088        .090        .324
 .000084   4.04    5.09      .0527     -.4836      .250      .003      3.173       5.639      27.689
 .000077   4.04    4.55      .0609     -.5594      .292      .017     26.551      34.772     143.366
 .000072   4.04    4.15      .0685     -.6314      .332      .055     87.140     126.197     466.703
 .000069   4.04    3.84      .0759     -.7004      .371      .127    204.931     322.853    1078.676
 .000067   4.04    3.60      .0832     -.7674      .410      .250    405.078     689.811    2108.561
 .000065   4.04    3.39      .0903     -.8327      .448      .430    701.392    1276.149    3606.181
 .000065   4.04    3.22      .0974     -.8961      .487      .656   1073.018    2146.062    5633.690
 .000064   4.04    3.07      .1045     -.9590      .525      .863   1416.196    3296.013    8022.550
 ---------------------------------------------------------------------------------------------------------
 .000208   4.72   11.87      .0177     -.1666      .087      .000       .000        .000        .000
 .000141   4.72    8.40      .0272     -.2551      .136      .000       .001        .001        .010
 .000114   4.72    6.85      .0367     -.3287      .176      .001      1.289       1.379       9.120
 .000099   4.72    5.94      .0438     -.3948      .213      .011     17.335      22.973     126.339
 .000091   4.72    5.31      .0501     -.4547      .246      .047     73.948     108.721     519.867
 .000086   4.72    4.85      .0562     -.5112      .278      .121    171.823     318.920    1348.454
 .000082   4.72    4.49      .0620     -.5650      .309      .222    357.146     680.000    2579.776
 .000080   4.72    4.20      .0673     -.6164      .339      .356    576.966    1266.777    4385.604
 .000078   4.72    3.96      .0730     -.6665      .369      .540    877.845    2153.994    6870.308
 .000077   4.72    3.75      .0784     -.7146      .398      .734   1200.691    3346.753    9851.469
 .000076   4.72    3.58      .0837     -.7621      .427      .939   1539.443    4835.455   13169.813
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16.21.55.UCLF, 55. SEPTERM, 6.128KLNS.
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CROSS SECTION: MATEBA SUD KAPITA

HYDRAULICS CALCULATIONS...

R1 (1)	U1 (2)	DELTA1 (3)	M (4)	X1 (5)	DELTA2 (6)	U (7)	C (8)	M2 (9)	U2 (10)	R2 (11)	R (12)
.20	.0099	.00098	.331	1.074	.00030	.22	25.701	5.90	.038	2.90	3.10
.40	.0140	.00069	.468	1.331	.00024	.35	12.851	7.78	.045	4.04	4.44
.60	.0172	.00057	.573	1.455	.00022	.45	8.567	9.16	.049	4.82	5.42
.80	.0199	.00049	.662	1.525	.00021	.53	6.425	10.31	.052	5.41	6.21
1.00	.0222	.00044	.740	1.562	.00021	.61	5.140	11.46	.053	5.73	6.73
1.20	.0243	.00040	.811	1.583	.00021	.68	4.284	12.56	.054	5.93	7.13
1.40	.0263	.00037	.876	1.603	.00020	.74	3.672	13.65	.055	6.04	7.44
1.60	.0281	.00035	.936	1.614	.00020	.81	3.213	14.72	.055	6.08	7.68
1.80	.0298	.00033	.993	1.619	.00020	.86	2.856	15.79	.055	6.07	7.87
2.00	.0314	.00031	1.047	1.613	.00020	.92	2.570	16.93	.054	5.97	7.97
2.20	.0329	.00030	1.098	1.610	.00020	.97	2.336	18.04	.054	5.88	8.08
2.40	.0344	.00028	1.146	1.605	.00020	1.02	2.142	19.11	.053	5.79	8.19
2.60	.0358	.00027	1.193	1.601	.00020	1.07	1.977	20.19	.053	5.69	8.29

CROSS SECTION: MATEBA SUD KAPITA

HYDRAULICS CALCULATIONS... (CONTINUED)

US (13)	H (14)	A (15)	P (16)	Q (17)	Q1 (18)	X2 (19)	Y (20)	BX (21)	BS (22)	PE (23)
.039	7.08	982.6	258.4	1020.3	219.4	.001363	.271	1.679	.373	13.470
.047	10.00	2278.5	665.1	2489.5	792.0	.000965	.411	1.622	.399	14.030
.052	12.12	3862.0	823.2	4260.4	1726.3	.000788	.523	1.573	.425	14.312
.055	13.84	5347.4	901.6	5967.6	2848.8	.000683	.612	1.531	.449	14.491
.058	14.76	6383.8	947.3	7158.1	3890.1	.000610	.683	1.493	.472	14.594
.059	15.83	7222.2	987.4	8115.5	4906.8	.000557	.737	1.459	.494	14.663
.061	16.49	7896.6	1030.5	8904.5	5881.1	.000516	.783	1.431	.513	14.717
.062	17.01	8437.5	1068.0	9543.4	6800.9	.000483	.815	1.405	.533	14.755
.062	17.43	8896.3	1097.7	10113.5	7685.9	.000455	.837	1.381	.551	14.782
.063	17.64	9130.8	1112.8	10404.9	8388.8	.000432	.848	1.357	.571	14.792
.063	17.88	9388.2	1129.5	10724.8	9117.4	.000412	.850	1.335	.590	14.802
.064	18.13	9672.4	1147.5	11103.6	9880.9	.000394	.845	1.314	.608	14.813
.064	18.34	9931.6	1163.0	11456.6	10618.0	.000379	.841	1.296	.626	14.822

CROSS SECTION: MATEBA SUD KAPITA

SEDIMENT TRANSPORT CALCULATION..

D (1)	FSM (2)	R1 (3)	ISRF2 (4)	DD (5)	FF (6)	ISIG (7)	ISTIG (8)	BLSF (9)	BLEC (10)	TBLEC (11)
.000212	.25	.20	34.771	.155	57.661	202.337	.000	.00000	.000	.000
.000212	.25	.40	17.386	.220	27.512	78.631	.000	.00000	.000	.000
.000212	.25	.60	11.590	.269	17.500	45.080	.000	.00000	.000	.000
.000212	.25	.80	8.693	.311	12.210	29.125	.000	.00003	.026	.026
.000212	.25	1.00	6.954	.347	9.235	20.703	.002	.00124	1.170	1.170
.000212	.25	1.20	5.795	.380	7.351	15.496	.013	.00934	9.225	9.225
.000212	.25	1.40	4.967	.411	6.062	12.101	.039	.02742	28.257	28.257
.000212	.25	1.60	4.346	.439	5.129	9.674	.090	.06380	68.138	68.138
.000212	.25	1.80	3.863	.466	4.426	7.895	.177	.12558	137.845	137.845
.000212	.25	2.00	3.477	.491	3.880	6.508	.300	.21355	237.646	237.646
.000212	.25	2.20	3.161	.515	3.443	5.459	.476	.33849	382.355	382.355
.000212	.25	2.40	2.898	.538	3.088	4.602	.743	.52794	605.820	605.820
.000212	.25	2.60	2.675	.560	2.794	3.933	1.072	.76173	885.878	885.878
.000254	.25	.20	41.660	.186	39.200	164.825	.000	.00000	.000	.000
.000254	.25	.40	20.830	.263	18.490	63.313	.000	.00000	.000	.000
.000254	.25	.60	13.887	.322	11.133	34.359	.000	.00001	.005	.005
.000254	.25	.80	10.415	.372	7.767	22.199	.001	.00088	.764	.771
.000254	.25	1.00	8.332	.416	5.875	15.779	.012	.01132	10.728	11.899
.000254	.25	1.20	6.943	.456	4.677	11.811	.042	.03957	39.088	48.314
.000254	.25	1.40	5.951	.492	3.856	9.223	.106	.09916	102.182	130.439
.000254	.25	1.60	5.208	.526	3.263	7.374	.217	.20186	215.576	283.715
.000254	.25	1.80	4.629	.558	2.816	6.017	.369	.34403	377.624	515.469
.000254	.25	2.00	4.166	.588	2.468	4.960	.612	.57074	635.141	872.788
.000254	.25	2.20	3.787	.617	2.191	4.161	.963	.89777	1014.050	1396.603
.000254	.25	2.40	3.472	.645	1.971	3.520	1.288	1.20090	1378.037	1983.877
.000254	.25	2.60	3.205	.671	1.819	3.068	1.616	1.50878	1754.669	2640.947
.000312	.25	.20	51.173	.229	25.269	130.510	.000	.00000	.000	.000
.000312	.25	.40	25.586	.323	11.051	46.482	.000	.00000	.000	.000
.000312	.25	.60	17.058	.396	6.654	25.225	.000	.00028	.233	.237
.000312	.25	.80	12.793	.457	4.642	16.298	.011	.01337	12.076	12.867
.000312	.25	1.00	10.235	.511	3.511	11.585	.046	.05795	54.896	66.799
.000312	.25	1.20	8.529	.560	2.795	8.671	.130	.16510	163.016	211.330
.000312	.25	1.40	7.310	.605	2.305	6.771	.271	.34360	354.089	484.528
.000312	.25	1.60	6.397	.646	1.960	5.440	.481	.61014	651.607	935.322
.000312	.25	1.80	5.686	.686	1.741	4.569	.756	.96007	1053.829	1569.298
.000312	.25	2.00	5.117	.723	1.601	3.952	1.063	1.34910	1501.337	2374.123
.000312	.25	2.20	4.652	.758	1.503	3.507	1.296	1.64504	1858.097	3234.702
.000312	.25	2.40	4.264	.792	1.419	3.112	1.580	2.00516	2300.953	4284.830
.000312	.25	2.60	3.936	.824	1.358	2.813	1.869	2.37198	2758.553	5399.099
.000370	.25	.20	60.686	.271	17.170	105.165	.000	.00000	.000	.000
.000370	.25	.40	30.343	.383	7.213	35.978	.000	.00001	.004	.004
.000370	.25	.60	20.229	.469	4.343	19.524	.003	.00486	3.999	4.236
.000370	.25	.80	15.171	.542	3.030	12.614	.032	.05276	47.574	60.441
.000370	.25	1.00	12.137	.606	2.292	8.967	.117	.19114	181.074	247.869
.000370	.25	1.20	10.114	.664	1.857	6.833	.264	.43328	427.818	639.148
.000370	.25	1.40	8.669	.717	1.617	5.633	.438	.71844	740.362	1224.990
.000370	.25	1.60	7.586	.767	1.481	4.875	.640	1.04947	1120.773	2056.115
.000370	.25	1.80	6.743	.813	1.377	4.285	.893	1.46296	1605.837	3175.135
.000370	.25	2.00	6.069	.857	1.304	3.817	1.126	1.84555	2053.815	4427.940
.000370	.25	2.20	5.517	.899	1.241	3.434	1.342	2.19948	2484.352	5739.054
.000370	.25	2.40	5.057	.939	1.203	3.128	1.566	2.56746	2946.203	7231.033
.000370	.25	2.60	4.668	.977	1.169	2.872	1.805	2.95910	3441.359	8840.458

CROSS SECTION: MATEBA SUD KAPITA

SEDIMENT TRANSPORT CALCULATION..(CONTINUED)

AE (12)	W (13)	Z (14)	FI1 (15)	FI2 (16)	IST (17)	BMLSF (18)	BMBEC (19)	BMRAB (20)	TBLBL (21)
.000060	2.48	6.24	.0412	-.3927	.162	.000	.000	.000	000
.000042	2.48	4.41	.0633	-.6183	.269	.000	.000	.000	000
.000035	2.48	3.60	.0829	-.8191	.368	.000	.000	.000	000
.000031	2.48	3.12	.1018	-1.0101	.469	.000	.012	.012	039
.000028	2.48	2.79	.1205	-1.1948	.564	.001	.660	.660	1.831
.000027	2.48	2.55	.1395	-1.3781	.667	.006	6.191	6.191	13.377
.000026	2.48	2.36	.1588	-1.5619	.776	.021	21.918	21.918	50.176
.000025	2.48	2.21	.1789	-1.7480	.891	.057	60.729	60.729	128.867
.000024	2.48	2.08	.1997	-1.9376	1.015	.127	139.928	139.928	277.773
.000024	2.48	1.97	.2216	-2.1301	1.148	.245	272.765	272.765	510.411
.000024	2.48	1.88	.2446	-2.3288	1.292	.437	494.157	494.157	876.713
.000023	2.48	1.80	.2689	-2.5345	1.449	.765	877.691	877.691	1483.511
.000023	2.48	1.73	.2947	-2.7471	1.621	1.234	1435.676	1435.676	2321.553
.000072	3.14	7.90	.0313	-.2741	.127	.000	.000	.000	000
.000051	3.14	5.59	.0471	-.4553	.205	.000	.000	.000	000
.000042	3.14	4.56	.0606	-.5942	.274	.000	.001	.001	006
.000037	3.14	3.95	.0732	-.7227	.338	.000	.258	.271	1.061
.000034	3.14	3.53	.0852	-.8436	.400	.005	4.296	4.957	16.855
.000032	3.14	3.23	.0970	-.9604	.462	.018	18.077	24.228	72.942
.000031	3.14	2.99	.1087	-1.0747	.525	.052	53.685	79.604	206.043
.000030	3.14	2.79	.1204	-1.1875	.589	.119	127.018	187.747	471.441
.000029	3.14	2.63	.1322	-1.2996	.654	.223	247.141	387.069	902.538
.000029	3.14	2.50	.1441	-1.4106	.721	.412	457.956	730.721	1603.509
.000028	3.14	2.38	.1562	-1.5225	.790	.709	800.998	1295.155	2691.760
.000028	3.14	2.28	.1686	-1.6357	.862	1.035	1187.241	2064.932	4048.808
.000028	3.14	2.19	.1812	-1.7500	.936	1.413	1642.833	3078.509	5719.056
.000088	4.04	10.17	.0236	-.2179	.100	.000	.000	.000	000
.000062	4.04	7.19	.0349	-.3321	.157	.000	.000	.000	000
.000051	4.04	5.87	.0443	-.4286	.206	.000	.048	.049	286
.000045	4.04	5.09	.0529	-.5161	.250	.003	3.019	3.290	16.157
.000042	4.04	4.55	.0609	-.5966	.292	.017	16.007	20.764	87.759
.000039	4.04	4.15	.0685	-.6731	.332	.055	54.032	78.281	289.610
.000038	4.04	3.84	.0759	-.7465	.371	.127	131.377	206.981	691.509
.000037	4.04	3.60	.0832	-.8177	.410	.250	267.069	404.816	1390.138
.000036	4.04	3.39	.0904	-.8872	.448	.431	472.568	859.637	2428.939
.000035	4.04	3.22	.0974	-.9548	.487	.656	730.499	1461.220	3835.345
.000035	4.04	3.07	.1045	-1.0219	.525	.863	973.269	2270.424	5525.127
.000034	4.04	2.94	.1115	-1.0887	.564	1.130	1296.748	3361.680	7646.510
.000034	4.04	2.82	.1186	-1.1551	.603	1.430	1662.747	4741.256	10140.356
.000105	4.72	11.87	.0199	-.1810	.088	.000	.000	.000	000
.000074	4.72	8.40	.0292	-.2739	.136	.000	.001	.001	004
.000061	4.72	6.85	.0369	-.3517	.176	.001	.705	.754	4.990
.000053	4.72	5.94	.0438	-.4215	.213	.011	10.111	13.401	73.842
.000049	4.72	5.31	.0501	-.4852	.246	.047	44.572	65.536	313.405
.000047	4.72	4.85	.0561	-.5452	.278	.120	118.962	177.342	836.390
.000045	4.72	4.49	.0619	-.6023	.309	.222	228.888	435.868	1660.758
.000043	4.72	4.20	.0675	-.6578	.339	.356	380.377	835.193	2891.308
.000042	4.72	3.96	.0730	-.7105	.369	.540	592.608	1452.245	4627.380
.000042	4.72	3.75	.0784	-.7619	.398	.735	817.390	2278.610	6706.550
.000041	4.72	3.58	.0837	-.8125	.427	.939	1060.137	3330.561	9069.615
.000041	4.72	3.43	.0890	-.8626	.455	1.169	1341.748	4703.428	11934.461
.000040	4.72	3.29	.0942	-.9120	.484	1.433	1666.086	6402.343	15242.881

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                         CROSS SECTION:  MATEBA AMONT
                  H Y D R A U L I C S   C A L C U L A T I O N S...

   R1      U1     DELTA1       M      X1    DELTA2     U        C          M2      U2      R2       R
  (1)     (2)      (3)        (4)    (5)     (6)      (7)      (8)        (9)    (10)    (11)    (12)

   .10   .0085   .00115     .282   .955   .00034    .17    35.418      5.20    .033    1.55     1.65
   .20   .0120   .00082     .399  1.212   .00027    .27    17.709      6.88    .040    2.21     2.41
   .30   .0147   .00067     .488  1.362   .00024    .35    11.806      8.05    .044    2.69     2.99
   .40   .0169   .00058     .564  1.446   .00022    .42     8.855      9.04    .047    3.05     3.45
   .50   .0189   .00052     .630  1.502   .00022    .48     7.084      9.90    .049    3.34     3.84
   .60   .0207   .00047     .691  1.544   .00021    .54     5.903     10.69    .051    3.59     4.19
   .70   .0224   .00044     .746  1.564   .00021    .59     5.060     11.55    .051    3.70     4.40
   .80   .0239   .00041     .797  1.579   .00021    .64     4.427     12.35    .052    3.79     4.59
   .90   .0254   .00038     .846  1.594   .00020    .67     3.935     13.12    .053    3.87     4.77
  1.00   .0268   .00036     .892  1.608   .00020    .74     3.542     13.93    .053    3.90     4.90
  1.10   .0281   .00035     .935  1.614   .00020    .78     3.220     14.70    .053    3.92     5.02
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                         CROSS SECTION:  MATEBA AMONT
            H Y D R A U L I C S   C A L C U L A T I O N S... (CONTINUED)

   UC      H       A        P        Q        Q1        X2        Y     BX      BB     PE
  (13)   (14)    (15)     (16)     (17)     (18)      (19)      (20)   (21)    (22)   (23)

  .034   3.05    683.0   391.8    514.1    118.2   .001602   .223  1.698   .365  12.507
  .042   4.41   1337.9   558.2   1136.2    364.7   .001133   .339  1.651   .386  13.118
  .046   5.44   1979.4   685.6   1753.3    698.7   .000925   .433  1.614   .404  13.443
  .050   6.27   2581.7   769.1   2345.9   1090.2   .000801   .514  1.577   .423  13.646
  .052   6.97   3137.8   826.2   2895.6   1520.2   .000717   .580  1.545   .440  13.791
  .055   7.59   3670.4   873.9   3404.3   1987.8   .000654   .640  1.518   .456  13.903
  .056   7.97   4000.3   906.6   3718.9   2377.4   .000606   .688  1.490   .474  13.965
  .057   8.32   4332.8   935.2   4075.0   2789.9   .000567   .727  1.465   .490  14.018
  .058   8.64   4637.7   961.1   4408.1   3204.7   .000534   .762  1.444   .504  14.065
  .059   8.87   4852.5   979.4   4637.6   3571.4   .000507   .794  1.424   .518  14.099
  .060   9.08   5061.0   996.8   4869.3   3941.8   .000483   .814  1.405   .532  14.127
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                      CROSS SECTION:   HATEBA AMONT
        S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..

    D       FSM     RI     ISRF2     DD        FF       ISIG    ISTIG      BLEF       BLEC      TBLEC
   (1)      (2)    (3)      (4)      (5)       (6)       (7)     (8)        (9)       (10)       (11)

 .000212    .25    .10    47.918    .132    81.200   316.527    .000    .00000       .000       .000
 .000212    .25    .20    23.959    .187    38.744   121.366    .000    .00000       .000       .000
 .000212    .25    .30    15.973    .229    25.132    70.167    .000    .00000       .000       .000
 .000212    .25    .40    11.979    .265    18.238    47.424    .000    .00000       .000       .000
 .000212    .25    .50     9.584    .296    13.795    33.747    .000    .00001       .004       .004
 .000212    .25    .60     7.986    .324    10.981    25.633    .000    .00013       .115       .115
 .000212    .25    .70     6.845    .350     9.035    20.203    .002    .00174      1.400      1.400
 .000212    .25    .80     5.990    .374     7.661    16.340    .010    .00742      6.936      6.936
 .000212    .25    .90     5.324    .397     6.612    13.325    .024    .01690     16.241     16.241
 .000212    .25   1.00     4.792    .418     5.795    11.424    .048    .03420     33.499     33.499
 .000212    .25   1.10     4.356    .439     5.144     9.712    .088    .06288     62.683     62.683
 -----------------------------------------------------------------------------------------------------
 .000254    .25    .10    57.411    .159    55.203   257.820    .000    .00000       .000       .000
 .000254    .25    .20    28.705    .224    26.340    98.855    .000    .00000       .000       .000
 .000254    .25    .30    19.137    .275    16.629    55.625    .000    .00000       .000       .000
 .000254    .25    .40    14.353    .317    11.602    36.146    .000    .00000       .002       .002
 .000254    .25    .50    11.482    .354     8.776    25.721    .000    .00017       .136       .141
 .000254    .25    .60     9.568    .388     6.986    19.537    .003    .00275      2.406      2.921
 .000254    .25    .70     8.202    .419     5.760    15.398    .014    .01260     11.421     12.821
 .000254    .25    .80     7.176    .448     4.874    12.454    .034    .03173     29.672     36.606
 .000254    .25    .90     6.379    .476     4.206    10.308    .071    .06595     63.386     79.627
 .000254    .25   1.00     5.741    .501     3.686     8.707    .128    .11965    117.186    150.686
 .000254    .25   1.10     5.219    .526     3.272     7.402    .214    .19982    199.186    261.870
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 .000312    .25    .10    70.521    .195    39.885   204.144    .000    .00000       .000       .000
 .000312    .25    .20    35.260    .275    16.507    76.100    .000    .00000       .000       .000
 .000312    .25    .30    23.507    .337     9.737    40.838    .000    .00000       .001       .001
 .000312    .25    .40    17.630    .389     6.734    26.537    .000    .00016       .120       .122
 .000312    .25    .50    14.104    .435     5.245    18.884    .004    .00480      3.963      4.104
 .000312    .25    .60    11.753    .477     4.175    14.343    .018    .02336     20.459     22.980
 .000312    .25    .70    10.074    .515     3.443    11.305    .050    .06352     57.387     70.408
 .000312    .25    .80     8.815    .551     2.913     9.143    .109    .13887    129.866    166.474
 .000312    .25    .90     7.836    .584     2.518     7.968    .202    .25668    246.695    326.322
 .000312    .25   1.00     7.052    .616     2.203     6.392    .315    .39764    371.401    542.087
 .000312    .25   1.10     6.411    .646     1.964     5.458    .477    .60485    602.932    864.801
 -----------------------------------------------------------------------------------------------------
 .000370    .25    .10    83.630    .231    24.727   168.226    .000    .00000       .000       .000
 .000370    .25    .20    41.815    .327    10.774    58.902    .000    .00000       .000       .000
 .000370    .25    .30    27.877    .400     6.487    31.609    .000    .00003       .018       .018
 .000370    .25    .40    20.908    .462     4.526    20.940    .003    .00306      2.355      2.477
 .000370    .25    .50    16.726    .516     3.423    14.616    .017    .02779     22.939     27.063
 .000370    .25    .60    13.938    .566     2.725    11.102    .054    .08779     76.900     79.880
 .000370    .25    .70    11.947    .611     2.247     8.750    .126    .20702    187.693    238.101
 .000370    .25    .80    10.454    .653     1.920     7.147    .235    .38510    360.129    526.999
 .000370    .25    .90     9.292    .693     1.706     6.089    .358    .58636    563.553    889.875
 .000370    .25   1.00     8.363    .730     1.577     5.434    .482    .79028    773.988   1316.075
 .000370    .25   1.10     7.603    .766     1.483     4.887    .634   1.04261   1039.302   1904.103
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                      CROSS SECTION:   HATEBA AMONT
  S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..(CONTINUED)

    AE       B       Z        FI1        FI2       IST    BMLBF     BMREC      BMRAB      TBLBL
   (12)    (13)    (14)      (15)       (16)      (17)    (18)      (19)       (20)       (21)

 .000139  4.72    7.33     .0341     -.2977     .129    .000       .000       .000       .000
 .000096  4.72    5.18     .0517     -.4655     .212    .000       .000       .000       .000
 .000078  4.72    4.23     .0668     -.6116     .287    .000       .000       .000       .000
 .000068  4.72    3.66     .0811     -.7478     .358    .000       .000       .000       .000
 .000061  4.72    3.28     .0948     -.8789     .429    .000       .002       .002       .006
 .000056  4.72    2.99     .1084    -1.0072     .500    .000       .057       .057       .172
 .000053  4.72    2.77     .1220    -1.1318     .572    .001       .801       .801      2.200
 .000051  4.72    2.59     .1357    -1.2563     .646    .003      4.482      4.482     11.418
 .000049  4.72    2.44     .1497    -1.3813     .724    .012     11.792     11.792     27.992
 .000048  4.72    2.32     .1639    -1.5061     .805    .028     26.951     26.951     60.451
 .000047  4.72    2.21     .1785    -1.6329     .887    .056     55.716     55.716    118.377
 ----------------------------------------------------------------------------------------------
 .000167  4.72    9.28     .0261     -.2239     .103    .000       .000       .000       .000
 .000115  4.72    6.56     .0389     -.3459     .164    .000       .000       .000       .000
 .000093  4.72    5.34     .0496     -.4489     .218    .000       .000       .000       .000
 .000081  4.72    4.64     .0594     -.5433     .267    .000       .001       .001       .003
 .000073  4.72    4.15     .0686     -.6318     .314    .000       .043       .045       .189
 .000067  4.72    3.79     .0775     -.7171     .360    .001       .867       .924      3.449
 .000064  4.72    3.51     .0862     -.7982     .405    .005      4.630      5.430     18.251
 .000061  4.72    3.28     .0947     -.8778     .450    .014     13.341     17.843     54.491
 .000059  4.72    3.09     .1032     -.9564     .496    .033     31.419     43.171    122.797
 .000057  4.72    2.93     .1117    -1.0334     .542    .065     63.476     90.427    241.113
 .000056  4.72    2.80     .1203    -1.1100     .589    .117    117.117    172.832    434.702
 ----------------------------------------------------------------------------------------------
 .000205  4.72   11.74     .0197     -.1659     .081    .000       .000       .000       .000
 .000141  4.72    8.44     .0290     -.2538     .127    .000       .000       .000       .000
 .000115  4.72    6.89     .0367     -.3264     .166    .000       .000       .000       .001
 .000100  4.72    5.97     .0439     -.3920     .201    .000       .024       .025       .147
 .000090  4.72    5.34     .0498     -.4526     .234    .001       .927       .972      3.076
 .000082  4.72    4.87     .0558     -.5102     .263    .006      5.439      6.350     25.330
 .000078  4.72    4.51     .0618     -.5638     .293    .019     16.976     22.407     92.814
 .000075  4.72    4.22     .0670     -.6160     .324    .045     42.054     59.877    226.371
 .000072  4.72    3.98     .0725     -.6668     .353    .090     86.974    130.144    456.466
 .000070  4.72    3.78     .0778     -.7159     .381    .155    147.147    239.976    781.663
 .000069  4.72    3.60     .0831     -.7643     .409    .247    246.689    419.518   1284.319
 ----------------------------------------------------------------------------------------------
 .000243  4.72   13.94     .0167     -.1377     .071    .000       .000       .000       .000
 .000168  4.72    9.86     .0244     -.2093     .111    .000       .000       .000       .000
 .000136  4.72    8.05     .0307     -.2686     .144    .000       .003       .003       .021
 .000118  4.72    6.97     .0362     -.3214     .173    .001       .407       .431      2.909
 .000106  4.72    6.23     .0413     -.3699     .199    .006      4.579      5.551     32.619
 .000098  4.72    5.69     .0461     -.4157     .225    .020     17.292     23.642    123.922
 .000093  4.72    5.27     .0506     -.4581     .249    .052     44.695     69.102    327.203
 .000089  4.72    4.93     .0550     -.4990     .272    .103     97.938    157.835    684.434
 .000086  4.72    4.65     .0593     -.5387     .295    .173    166.080    276.224   1186.099
 .000083  4.72    4.41     .0634     -.5768     .317    .251    243.413    484.987   1801.064
 .000081  4.72    4.20     .0675     -.6142     .339    .353    352.241    771.739   2675.862
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                         CROSS SECTION:  MATEBA CENTRAL
              H Y D R A U L I C S   C A L C U L A T I O N S...

  RI     U1    DELTA1      M     X1   DELTA2    U       C        M2    U2    R2      R
  (1)    (2)    (3)       (4)    (5)    (6)    (7)     (8)      (9)  (10)  (11)   (12)

  .15  .0088  .00110    .294   .986  .00033  .19   32.523     5.38  .0 5  2.41   2.56
  .30  .0125  .00078    .416  1.244  .00026  .30   16.261     7.09  .042  3.40   3.70
  .45  .0153  .00064    .510  1.390  .00023  .38   10.841     8.33  .046  4.10   4.55
  .60  .0177  .00055    .588  1.469  .00022  .46    8.131     9.36  .049  4.63   5.23
  .75  .0197  .00049    .658  1.522  .00021  .53    6.505    10.26  .051  5.06   5.81
  .90  .0216  .00045    .721  1.557  .00021  .59    5.420    11.16  .053  5.33   6.23
 1.05  .0234  .00042    .778  1.574  .00021  .64    4.646    12.06  .053  5.49   6.54
 1.20  .0250  .00039    .832  1.590  .00020  .70    4.065    12.89  .054  5.63   6.83
 1.35  .0265  .00037    .883  1.605  .00020  .75    3.614    13.77  .054  5.68   7.03
 1.50  .0279  .00035    .930  1.613  .00020  .80    3.252    14.62  .055  5.71   7.21
 1.65  .0293  .00033    .976  1.618  .00020  .84    2.957    15.43  .055  5.74   7.39
 1.80  .0306  .00032   1.019  1.618  .00020  .89    2.710    16.34  .054  5.66   7.46
 1.95  .0318  .00031   1.061  1.614  .00020  .93    2.502    17.24  .054  5.59   7.54
 2.10  .0330  .00030   1.101  1.609  .00020  .97    2.323    18.11  .054  5.52   7.62
 2.25  .0342  .00029   1.139  1.606  .00020 1.01    2.168    18.95  .053  5.46   7.71


                   CROSS SECTION:  MATEBA CENTRAL
        H Y D R A U L I C S   C A L C U L A T I O N S... (CONTINUED)

  UC     H       A        P        Q       Q1        X2       Y     BX    BB    PE
 (13)   (14)    (15)     (16)     (17)    (18)      (19)    (20)  (21)  (22)  (23)

 .036   4.17   785.1   295.0    799.9   149.4   .001336  .235 1.694  .366 12.856
 .044   6.06  1446.0   399.1   1580.0   430.8   .001086  .357 1.644  .389 13.462
 .049   7.48  2057.6   436.6   2327.2   791.4   .000887  .456 1.604  .408 13.783
 .052   8.60  2592.3   495.7   2996.8  1190.6   .000768  .538 1.566  .427 13.978
 .055   9.57  3088.3   529.4   3621.6  1625.1   .000687  .608 1.533  .448 14.120
 .057  10.26  3464.9   553.7   4094.8  2035.7   .000627  .667 1.503  .466 14.213
 .058  10.77  3752.0   571.5   4454.3  2417.1   .000580  .713 1.474  .484 14.273
 .060  11.25  4030.5   588.2   4806.0  2812.0   .000543  .752 1.450  .500 14.327
 .060  11.59  4229.5   599.8   5058.9  3165.3   .000512  .788 1.428  .515 14.365
 .061  11.89  4408.6   610.2   5286.7  3511.8   .000486  .812 1.407  .531 14.396
 .062  12.18  4588.0   620.4   5546.2  3866.0   .000463  .831 1.388  .546 14.423
 .062  12.30  4664.1   624.6   5664.2  4135.9   .000443  .842 1.369  .561 14.433
 .063  12.43  4744.1   629.1   5788.3  4407.8   .000426  .846 1.350  .576 14.441
 .063  12.57  4830.1   633.9   5921.8  4685.7   .000410  .850 1.333  .591 14.449
 .063  12.71  4921.3   638.9   6063.2  4969.8   .000396  .846 1.317  .606 14.458
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                         CROSS SECTION:   MATERA CENTRAL
           S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..

    [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
   (1)    (2)    (3)     (4)      (5)      (6)       (7)      (8)      (9)      (10)       (11)

 .000213  .25   .15   44.000   .138   74.132   220.813   .000   .00000     .000       .000
 .000213  .25   .30   22.000   .175   35.372   109.077   .000   .00000     .000       .000
 .000213  .25   .45   14.667   .229   22.949    64.681   .000   .00000     .000       .000
 .000213  .25   .60   11.000   .274   16.272    41.604   .000   .00000     .000       .000
 .000213  .25   .75    8.800   .302   12.777    30.449   .000   .00002     .012       .012
 .000213  .25   .90    7.333   .326    9.869    22.481   .001   .00097     .314       .314
 .000213  .25  1.05    6.286   .357    8.136    17.814   .004   .00437    2.495      2.495
 .000213  .25  1.20    5.500   .391    6.884    14.240   .017   .01347    7.721      7.721
 .000213  .25  1.35    4.889   .414    5.942    11.797   .043   .03032   18.100     18.100
 .000213  .25  1.50    4.400   .437    5.206     9.851   .085   .05893   35.762     35.762
 .000213  .25  1.65    4.000   .456    4.623     8.381   .143   .10430   64.085     64.085
 .000213  .25  1.80    3.667   .478    4.146     7.177   .232   .16508  103.111    103.111
 .000213  .25  1.95    3.385   .498    3.751     6.172   .342   .24335  153.084    153.084
 .000213  .25  2.10    3.143   .517    3.419     5.400   .470   .34043  220.851    220.851
 .000213  .25  2.25    2.933   .535    3.136     4.714   .670   .47617  317.017    317.017
 ----------------------------------------------------------------------------------------------
 .000234  .25   .15   92.717   .169   80.370   220.730   .000   .00000     .000       .000
 .000234  .25   .30   24.359   .234   24.047    80.031   .000   .00000     .000       .000
 .000234  .25   .45   17.972   .287   14.944    48.916   .000   .00000     .000       .000
 .000234  .25   .60   13.179   .331   10.426    31.710   .000   .00001     .007       .007
 .000234  .25   .75   10.943   .370    7.887    23.613   .001   .00070     .379       .388
 .000234  .25   .90    8.786   .404    6.270    17.134   .000   .00710    3.933      4.247
 .000234  .25  1.05    7.931   .436    5.177    13.434   .026   .02264   12.949     19.444
 .000234  .25  1.20    6.970   .464    4.390    10.860   .058   .05424   31.903     39.524
 .000234  .25  1.35    6.057   .496    3.790     8.991   .116   .10773   64.629     82.816
 .000234  .25  1.50    5.773   .523    3.313     7.331   .208   .17979  116.529    133.497
 .000234  .25  1.65    4.768   .549    2.941     6.385   .313   .29404  182.417    246.905
 .000234  .25  1.80    4.373   .573    2.637     5.472   .473   .44134  275.480    378.791
 .000234  .25  1.95    4.055   .596    2.386     4.717   .676   .64658  408.190    541.278
 .000234  .25  2.10    3.765   .619    2.175     4.116   .970   .92312  595.121    809.973
 .000234  .25  2.25    3.514   .641    1.994     3.593  1.244  1.15961  740.999   1097.917
 ----------------------------------------------------------------------------------------------
 .000312  .25   .15   64.755   .203   32.486   151.110   .000   .00000     .000       .000
 .000312  .25   .30   32.377   .287   14.834    64.713   .000   .00000     .000       .000
 .000312  .25   .45   21.585   .352    9.539    35.914   .000   .00000     .003       .003
 .000312  .25   .60   16.187   .406    6.232    23.280   .001   .00070     .347       .354
 .000312  .25   .75   12.951   .454    4.714    16.602   .010   .01214    4.427      6.812
 .000312  .25   .90   10.792   .498    3.733    12.579   .035   .04135   22.097     37.144
 .000312  .25  1.05    9.251   .536    3.074     9.879   .085   .10938   60.187     73.632
 .000312  .25  1.20    8.094   .575    2.610     7.773   .171   .21713  127.710    167.534
 .000312  .25  1.35    7.195   .610    2.239     6.601   .297   .36736  220.336    303.132
 .000312  .25  1.50    6.475   .643    1.904     5.940   .456   .58173  354.993    507.452
 .000312  .25  1.65    5.887   .674    1.803     4.810   .663   .84108  521.796    765.300
 .000312  .25  1.80    5.396   .704    1.636     4.225   .926  1.17463  733.921   1112.612
 .000312  .25  1.95    4.981   .733    1.578     3.820  1.124  1.42710  897.744   1439.020
 .000312  .25  2.10    4.625   .760    1.497     3.481  1.312  1.64536 1099.391   1861.564
 .000312  .25  2.25    4.317   .787    1.431     3.169  1.534  1.94989 1249.820   2303.737
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 .000370  .25   .15   74.792   .341   82.578   147.249   .000   .00000     .000       .000
 .000370  .25   .30   38.396   .341    9.483    51.637   .000   .00000     .000       .000
 .000370  .25   .45   25.397   .417    5.830    27.777   .000   .00013     .093       .093
 .000370  .25   .60   19.198   .482    4.069    18.019   .005   .00649    4.304      4.660
 .000370  .25   .75   15.358   .539    3.077    12.830   .030   .04647   23.774     32.384
 .000370  .25   .90   12.797   .590    2.449     9.737   .088   .14361   71.912    106.833
 .000370  .25  1.05   10.970   .638    2.020     7.646   .176   .32141  183.674    292.304
 .000370  .25  1.20    9.577   .682    1.763     6.364   .319   .52222  307.194    474.609
 .000370  .25  1.35    8.532   .723    1.600     5.549   .487   .74939  449.472    752.634
 .000370  .25  1.50    7.677   .762    1.493     4.943   .610  1.01344  617.890   1125.320
 .000370  .25  1.65    6.981   .799    1.402     4.436   .818  1.33513  830.167   1395.470
 .000370  .25  1.80    6.399   .835    1.340     4.050  1.021  1.67312 1045.069   2137.681
 .000370  .25  1.95    5.907   .869    1.284     3.704  1.183  1.93946 1220.179   2479.199
 .000370  .25  2.10    5.486   .903    1.230     3.414  1.398  2.22136 1408.027   3247.991
 .000370  .25  2.25    5.119   .933    1.200     3.170  1.553  2.51213 1605.050   3705.787
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                      CROSS SECTION:   MATERA CENTRAL
      S E D I M E N T   T R A N S P O R T   C A L C U L A T I O N..(CONTINUED)

  [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
    (12)    (13)   (14)     (15)      (16)      (17)     (18)      (19)       (20)       (21)

 .000102  4.72   7.02    .0399   -.3241    .137    .000      .000       .000       .000
 .000070  4.72   4.97    .0545   -.5074    .226    .000      .000       .000       .000
 .000057  4.72   4.05    .0707   -.6462    .306    .000      .000       .000       .000
 .000049  4.72   3.51    .0860   -.8157    .383    .000      .000       .000       .000
 .000044  4.72   3.14    .1009   -.9482    .460    .000      .006       .006       .010
 .000041  4.72   2.87    .1157  -1.1087    .539    .000      .169       .169       .457
 .000039  4.72   2.65    .1309  -1.2432    .618    .003     1.543      1.543      4.037
 .000038  4.72   2.48    .1456  -1.3853    .701    .009     5.553      5.553     13.474
 .000037  4.72   2.34    .1610  -1.5253    .780    .024    14.736     14.736     36.224
 .000036  4.72   2.22    .1761  -1.6727    .860    .052    31.630     31.630     67.993
 .000035  4.72   2.12    .1932  -1.8109    .976    .101    62.141     62.141    136.620
 .000034  4.72   2.03    .2101  -1.9552   1.078    .170   111.117    111.117    214.220
 .000034  4.72   1.95    .2277  -2.1029   1.188    .269   181.474    181.474    334.360
 .000034  4.72   1.88    .2460  -2.2344   1.301    .453   287.234    287.234    508.084
 .000033  4.72   1.81    .2652  -2.4109   1.434    .706   451.382    451.382    764.399
 ------------------------------------------------------------------------------------------
 .000122  4.72   8.57    .0274   -.2436    .107    .000      .000       .000       .000
 .000084  4.72   6.37    .0407   -.3743    .174    .000      .000       .000       .000
 .000069  4.72   5.13    .0525   -.4690    .233    .000      .000       .000       .000
 .000059  4.72   4.41    .0637   -.5724    .284    .000      .002       .008       .007
 .000053  4.72   3.98    .0726   -.6902    .339    .000      .124       .130       .513
 .000048  4.72   3.63    .0822   -.7635    .388    .000     1.818      3.481      8.938
 .000047  4.72   3.34    .0913   -.8731    .433    .010     5.611      7.134     22.395
 .000045  4.72   3.16    .1009   -.9610    .483    .028    13.376     20.949     40.774
 .000044  4.72   2.96    .1100  -1.0491    .535    .057    34.419     48.791    131.548
 .000043  4.72   2.81    .1193  -1.1341    .589    .111    67.723     99.853    232.041
 .000042  4.72   2.68    .1286  -1.2199    .634    .186   119.480    178.823    414.727
 .000041  4.72   2.57    .1379  -1.3043    .684    .303   187.212    300.829    679.120
 .000041  4.72   2.47    .1474  -1.3920    .740    .460   301.848    483.345   1044.617
 .000040  4.72   2.38    .1570  -1.4741    .794    .732   464.730    751.984   1597.957
 .000040  4.72   2.30    .1667  -1.5601    .851    .987   630.330   1081.712   2139.630
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 .000190  4.72  11.44    .0207   -.1800    .086    .000      .000       .000       .000
 .000103  4.72   8.09    .0305   -.2730    .138    .000      .000       .000       .000
 .000083  4.72   6.61    .0386   -.3594    .176    .000      .000       .000       .003
 .000073  4.72   5.73    .0458   -.4264    .213    .000      .074       .076       .430
 .000065  4.72   5.12    .0525   -.4929    .240    .002      .894      1.724      8.539
 .000061  4.72   4.67    .0590   -.5551    .281    .012     4.436      8.117     39.241
 .000058  4.72   4.32    .0650   -.6143    .313    .032    16.833     25.987    101.629
 .000055  4.72   4.03    .0709   -.6715    .344    .075    43.970     64.723    232.457
 .000054  4.72   3.81    .0769   -.7273    .378    .138    82.719    131.470    434.623
 .000052  4.72   3.63    .0829   -.7814    .406    .234   144.160    243.713    731.193
 .000051  4.72   3.43    .0888   -.8390    .437    .367   227.773    406.010   1174.321
 .000051  4.72   3.30    .0936   -.8967    .467    .540   342.864    642.713   1755.329
 .000050  4.72   3.17    .0994   -.9380    .497    .709   446.161    929.803   2300.923
 .000050  4.72   3.06    .1049   -.9871    .527    .878   554.607   1309.992   3170.159
 .000049  4.72   2.93    .1105  -1.0400    .550   1.086   694.985   1776.497   4060.434
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 .000176  4.72  13.34    .0179   -.1476    .075    .000      .000       .000       .000
 .000122  4.72   9.44    .0254   -.2278    .117    .000      .000       .000       .000
 .000099  4.72   7.71    .0322   -.2727    .138    .000      .004       .000       .044
 .000086  4.72   6.68    .0381   -.3497    .169    .002      .786       .043      8.322
 .000077  4.72   5.97    .0434   -.4023    .211    .010     3.455      7.190     37.744
 .000072  4.72   5.49    .0483   -.4916    .238    .034    18.902     27.019    133.679
 .000067  4.72   5.05    .0534   -.4963    .263    .065    48.394     74.343    333.650
 .000066  4.72   4.73    .0580   -.5433    .290    .130    89.910    193.433    639.131
 .000064  4.72   4.43    .0626   -.5845    .313    .234   140.804    271.776   1024.609
 .000062  4.72   4.22    .0670   -.6281    .336    .341   207.882    431.379   1574.919
 .000061  4.72   4.03    .0714   -.6692    .360    .482   296.817    704.832   2300.309
 .000060  4.72   3.86    .0734   -.7084    .383    .641   400.342   1043.349   3200.936
 .000060  4.72   3.70    .0777   -.7475    .406    .787   493.194   1424.690   4103.996
 .000057  4.72   3.57    .0841   -.7840    .429    .955   603.387   1911.979   5101.969
 .000056  4.72   3.45    .0882   -.8342    .431   1.133   724.803   2500.900   6404.697
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CROSS SECTION: MATEBA AVAL

HYDRAULICS CALCULATIONS...

R1 (1)	U1 (2)	DELTA1 (3)	M (4)	X1 (5)	DELTA2 (6)	U (7)	C (8)	M2 (9)	U2 (10)	R2 (11)	R (12)
.15	.0091	.00107	.302	1.007	.00032	.20	30.780	5.50	.036	2.32	2.47
.30	.0128	.00076	.428	1.264	.00026	.31	15.390	7.24	.042	3.27	3.57
.45	.0157	.00062	.524	1.405	.00023	.40	10.260	8.51	.046	3.94	4.39
.60	.0182	.00054	.605	1.484	.00022	.47	7.695	9.57	.049	4.43	5.03
.75	.0203	.00048	.676	1.534	.00021	.54	6.156	10.49	.052	4.85	5.60
.90	.0222	.00044	.741	1.563	.00021	.60	5.130	11.47	.053	5.05	5.95
1.05	.0240	.00041	.800	1.580	.00021	.66	4.397	12.39	.053	5.20	6.25
1.20	.0257	.00038	.855	1.597	.00020	.72	3.848	13.29	.054	5.31	6.51
1.35	.0272	.00036	.907	1.611	.00020	.77	3.420	14.21	.054	5.34	6.69
1.50	.0287	.00034	.956	1.616	.00020	.82	3.078	15.08	.054	5.37	6.87
1.65	.0301	.00032	1.003	1.620	.00020	.87	2.798	16.00	.054	5.34	6.99
1.80	.0314	.00031	1.048	1.615	.00020	.91	2.565	16.95	.054	5.26	7.06
1.95	.0327	.00030	1.090	1.611	.00020	.95	2.368	17.88	.053	5.19	7.14

CROSS SECTION: MATEBA AVAL

HYDRAULICS CALCULATIONS... (CONTINUED)

UC (13)	H (14)	A (15)	P (16)	Q (17)	Q1 (18)	X2 (19)	Y (20)	BX (21)	BB (22)	PE (23)
.037	4.38	910.5	349.6	930.7	178.5	.001494	.243	1.671	.368	12.971
.044	6.54	1700.7	471.6	1938.8	521.7	.001056	.369	1.639	.391	13.555
.049	8.01	2453.1	561.9	2914.3	970.9	.000862	.471	1.597	.412	13.863
.053	9.17	3143.3	624.0	3792.8	1485.3	.000747	.554	1.558	.433	14.052
.055	10.17	3797.5	677.8	4657.4	2055.7	.000668	.626	1.524	.453	14.190
.057	10.80	4234.7	711.5	5232.0	2558.3	.000610	.684	1.493	.472	14.268
.059	11.33	4624.2	740.1	5751.2	3063.2	.000565	.729	1.464	.491	14.327
.060	11.79	4966.4	764.6	6211.0	3563.0	.000528	.768	1.439	.507	14.378
.061	12.12	5221.2	782.4	6574.3	4017.9	.000498	.803	1.418	.523	14.414
.061	12.44	5473.3	799.3	6967.3	4482.3	.000472	.823	1.396	.539	14.443
.062	12.65	5638.7	810.4	7225.1	4884.6	.000450	.840	1.376	.555	14.462
.062	12.78	5746.6	817.7	7393.2	5237.3	.000431	.845	1.356	.571	14.469
.063	12.93	5863.5	825.5	7575.4	5599.1	.000414	.849	1.338	.587	14.478

CROSS SECTION: MATEBA AVAL

SEDIMENT TRANSPORT CALCULATION..

D (1)	FBM (2)	SI (3)	ISRP2 (4)	DD (5)	FF (6)	ISIG (7)	ISTIG (8)	BLSF (9)	BLEC (10)	TBLEC (11)
.000212	.25	.15	41.643	.143	69.901	260.005	.000	.00000	.000	.000
.000212	.25	.30	20.821	.201	33.353	100.302	.000	.00000	.000	.000
.000212	.25	.45	13.881	.246	21.635	58.355	.000	.00000	.000	.000
.000212	.25	.60	10.411	.284	15.301	38.249	.000	.00000	.001	.001
.000212	.25	.75	8.329	.317	11.373	27.305	.000	.00006	.042	.042
.000212	.25	.90	6.940	.348	9.212	20.639	.002	.00127	.904	.904
.000212	.25	1.05	5.949	.375	7.596	16.163	.011	.00778	5.757	5.757
.000212	.25	1.20	5.205	.401	6.427	13.044	.028	.01978	15.125	15.125
.000212	.25	1.35	4.627	.426	5.547	10.780	.060	.04252	33.267	33.269
.000212	.25	1.50	4.164	.449	4.862	8.985	.116	.08236	65.832	65.832
.000212	.25	1.65	3.786	.471	4.315	7.617	.199	.14114	114.389	114.389
.000212	.25	1.80	3.470	.492	3.870	6.464	.303	.21561	176.305	176.305
.000212	.25	1.95	3.203	.512	3.501	5.594	.447	.31763	262.221	262.221
.000254	.25	.15	49.893	.170	47.322	211.781	.000	.00000	.000	.000
.000254	.25	.30	24.946	.240	22.473	81.699	.000	.00000	.000	.000
.000254	.25	.45	16.631	.295	13.951	45.083	.000	.00000	.000	.000
.000254	.25	.60	12.473	.340	9.733	29.152	.000	.00004	.024	.024
.000254	.25	.75	9.979	.380	7.362	20.818	.002	.00154	1.047	1.089
.000254	.25	.90	8.315	.416	5.860	15.731	.012	.01148	8.166	9.070
.000254	.25	1.05	7.128	.450	4.832	12.319	.036	.03328	24.629	30.386
.000254	.25	1.20	6.237	.481	4.089	9.942	.081	.07554	57.757	72.883
.000254	.25	1.35	5.544	.510	3.529	8.216	.155	.14460	113.131	146.400
.000254	.25	1.50	4.989	.538	3.093	6.848	.263	.24507	195.888	261.719
.000254	.25	1.65	4.536	.564	2.745	5.806	.405	.37791	306.274	420.664
.000254	.25	1.80	4.158	.589	2.462	4.942	.618	.57616	471.118	647.424
.000254	.25	1.95	3.838	.613	2.227	4.264	.904	.84292	695.874	958.096
.000312	.25	.15	61.286	.209	30.633	147.690	.000	.00000	.000	.000
.000312	.25	.30	30.643	.295	13.849	61.291	.000	.00000	.000	.000
.000312	.25	.45	20.429	.362	8.338	33.098	.000	.00001	.007	.007
.000312	.25	.60	15.321	.418	5.818	21.403	.001	.00163	1.017	1.041
.000312	.25	.75	12.257	.467	4.400	15.279	.014	.01774	12.023	13.113
.000312	.25	.90	10.214	.512	3.503	11.549	.046	.05862	41.708	50.778
.000312	.25	1.05	8.755	.553	2.888	9.044	.113	.14392	106.515	136.901
.000312	.25	1.20	7.661	.591	2.444	7.299	.222	.28225	215.801	288.683
.000312	.25	1.35	6.810	.627	2.109	6.032	.367	.46536	364.092	510.492
.000312	.25	1.50	6.129	.660	1.877	5.106	.568	.72066	576.042	837.762
.000312	.25	1.65	5.571	.693	1.705	4.431	.819	1.03944	842.411	1263.075
.000312	.25	1.80	5.107	.724	1.599	3.942	1.067	1.35470	1107.723	1755.147
.000312	.25	1.95	4.714	.753	1.516	3.566	1.261	1.60028	1321.109	2279.204
.000370	.25	.15	72.679	.248	21.286	138.186	.000	.00000	.000	.000
.000370	.25	.30	36.339	.350	9.039	47.440	.000	.00000	.000	.000
.000370	.25	.45	24.226	.429	5.442	25.618	.000	.00030	.171	.178
.000370	.25	.60	18.170	.495	3.797	16.566	.010	.01593	9.740	10.782
.000370	.25	.75	14.536	.554	2.872	11.826	.043	.06927	46.949	60.062
.000370	.25	.90	12.113	.607	2.286	8.739	.118	.19307	137.365	188.143
.000370	.25	1.05	10.383	.655	1.907	7.082	.241	.39457	292.029	428.929
.000370	.25	1.20	9.085	.701	1.668	5.908	.387	.63455	485.164	773.847
.000370	.25	1.35	8.075	.743	1.543	5.233	.532	.87166	681.973	1192.465
.000370	.25	1.50	7.268	.783	1.440	4.643	.726	1.18960	950.885	1788.647
.000370	.25	1.65	6.607	.821	1.362	4.197	.943	1.54371	1251.091	2514.166
.000370	.25	1.80	6.057	.856	1.302	3.809	1.130	1.85233	1514.632	3269.779
.000370	.25	1.95	5.591	.893	1.250	3.485	1.310	2.14648	1772.018	4051.222

CROSS SECTION: MATEBA AVAL

SEDIMENT TRANSPORT CALCULATION..(CONTINUED)

AE (12)	U (13)	Z (14)	FI1 (15)	FI2 (16)	IST (17)	BNLSF (18)	BNREC (19)	BNRAS (20)	TBLBL (21)
.000072	4.72	6.83	.0371	-.3379	.143	.000	.000	.000	.000
.000065	4.72	4.83	.0564	-.5270	.238	.000	.000	.000	.000
.000053	4.72	3.74	.0733	-.6973	.320	.000	.000	.000	.000
.000046	4.72	3.42	.0894	-.8553	.401	.000	.000	.000	.001
.000042	4.72	3.06	.1051	-1.0086	.482	.000	.020	.020	.063
.000039	4.72	2.79	.1207	-1.1572	.565	.001	.511	.511	1.415
.000037	4.72	2.58	.1365	-1.3051	.650	.005	3.745	3.745	9.502
.000036	4.72	2.42	.1526	-1.4535	.740	.015	11.193	11.193	26.318
.000035	4.72	2.28	.1671	-1.6024	.834	.035	27.756	27.756	61.026
.000034	4.72	2.16	.1861	-1.7538	.933	.077	61.446	61.446	127.278
.000034	4.72	2.06	.2037	-1.9068	1.037	.147	118.822	118.822	233.211
.000033	4.72	1.97	.2220	-2.0621	1.150	.248	202.776	202.776	379.082
.000033	4.72	1.89	.2411	-2.2216	1.269	.403	332.883	332.883	595.104
.000111	4.72	8.63	.0283	-.2538	.113	.000	.000	.000	.000
.000078	4.72	6.11	.0422	-.3719	.181	.000	.000	.000	.000
.000063	4.72	4.99	.0541	-.5094	.241	.000	.000	.000	.000
.000055	4.72	4.32	.0650	-.6173	.276	.000	.007	.007	.032
.000050	4.72	3.87	.0753	-.7198	.349	.001	.364	.384	1.475
.000047	4.72	3.53	.0854	-.8169	.401	.005	3.275	3.786	12.856
.000045	4.72	3.27	.0952	-.9114	.453	.019	11.151	14.896	45.282
.000043	4.72	3.06	.1050	-1.0043	.505	.039	29.173	40.366	113.249
.000042	4.72	2.88	.1147	-1.0956	.558	.081	63.146	90.903	237.303
.000041	4.72	2.73	.1245	-1.1866	.612	.150	119.840	181.286	443.005
.000040	4.72	2.61	.1344	-1.2766	.667	.252	204.179	323.001	743.665
.000040	4.72	2.50	.1443	-1.3662	.722	.416	340.296	543.072	1190.496
.000039	4.72	2.40	.1544	-1.4563	.780	.657	542.548	875.431	1833.526
.000136	4.72	11.13	.0214	-.1880	.097	.000	.000	.000	.000
.000095	4.72	7.87	.0315	-.2869	.140	.000	.000	.000	.000
.000078	4.72	6.43	.0398	-.3693	.183	.000	.001	.001	.008
.000068	4.72	5.57	.0473	-.4436	.221	.000	.225	.232	1.274
.000061	4.72	4.98	.0543	-.5130	.257	.005	3.096	3.482	16.595
.000058	4.72	4.54	.0609	-.5775	.292	.017	12.178	15.964	66.742
.000055	4.72	4.21	.0673	-.6395	.325	.047	34.660	49.556	186.457
.000053	4.72	3.94	.0736	-.6994	.358	.101	77.351	117.717	406.400
.000051	4.72	3.71	.0797	-.7575	.391	.182	142.408	233.311	743.803
.000050	4.72	3.52	.0857	-.8145	.423	.303	243.860	425.146	1262.908
.000049	4.72	3.36	.0917	-.8701	.456	.473	383.731	706.732	1969.807
.000049	4.72	3.21	.0976	-.9247	.487	.660	539.795	1082.867	2838.014
.000048	4.72	3.09	.1035	-.9788	.519	.831	686.010	1561.441	3840.645
.000161	4.72	12.99	.0180	-.1560	.078	.000	.000	.000	.000
.000113	4.72	9.19	.0264	-.2368	.121	.000	.000	.000	.000
.000092	4.72	7.50	.0333	-.3038	.157	.000	.027	.028	.206
.000081	4.72	6.50	.0394	-.3640	.189	.003	1.882	2.115	12.896
.000073	4.72	5.81	.0449	-.4185	.219	.015	10.265	13.746	73.809
.000069	4.72	5.30	.0502	-.4695	.246	.048	33.858	49.822	237.965
.000065	4.72	4.91	.0552	-.5181	.273	.108	79.775	129.331	558.260
.000063	4.72	4.55	.0601	-.5648	.299	.190	145.200	262.917	1036.764
.000061	4.72	4.33	.0648	-.6097	.325	.283	221.545	454.855	1647.321
.000059	4.72	4.11	.0695	-.6536	.350	.416	332.606	757.752	2546.399
.000059	4.72	3.92	.0740	-.6961	.374	.578	468.466	1175.198	3689.364
.000058	4.72	3.75	.0785	-.7375	.399	.738	603.650	1686.517	4956.295
.000057	4.72	3.60	.0830	-.7784	.423	.907	748.756	2310.197	6361.419