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User Manual for the Probabilistic Stream Simulation and Assessment Model (PSSAM)

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USER MANUAL FOR THE PROBABILISTIC
STREAM SIMULATION AND ASSESS-
MENT MODEL (PSSAM)

by

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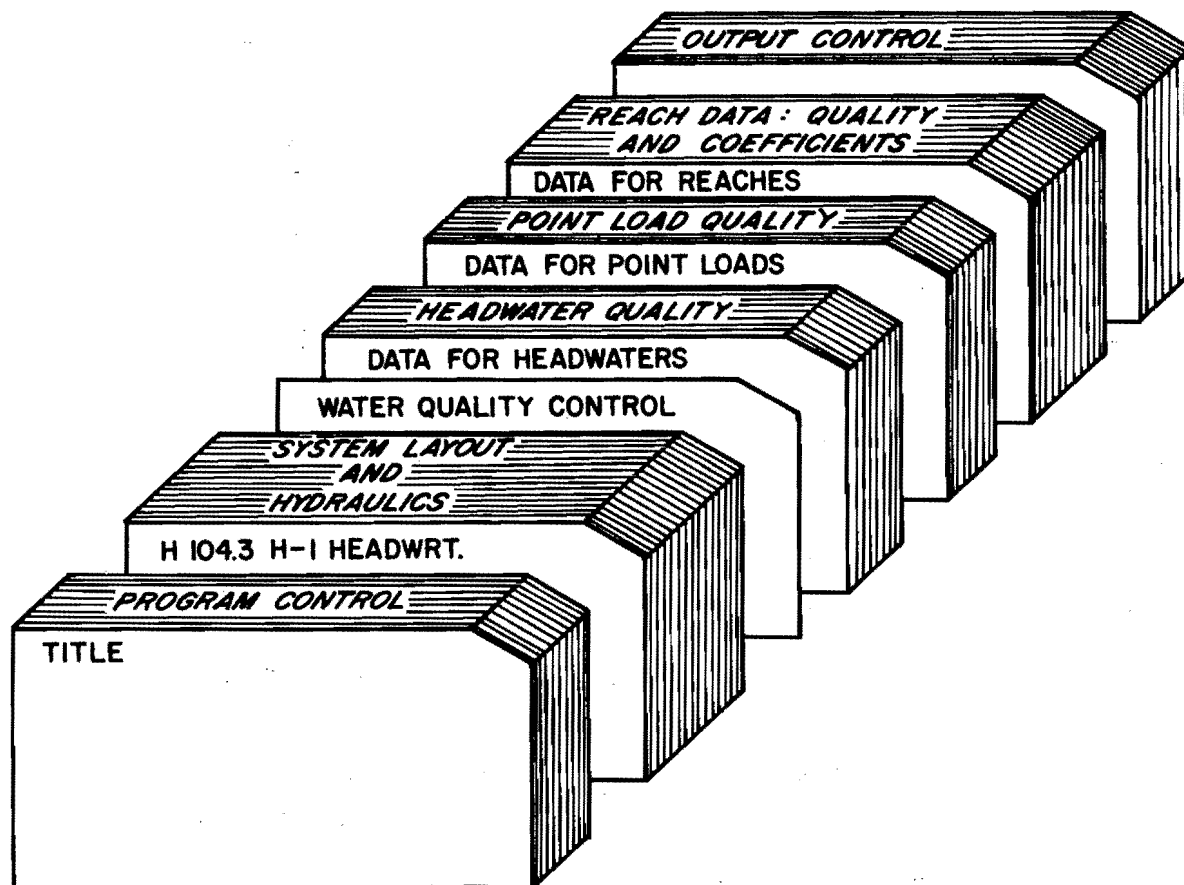APPENDIX A: Input Data Formats for Program PSSAM

Figure A.1. Typical data deck setup for PSSAM.

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
Program Control	1	1-80	20A4	TITLE (I)	Title of run
	2	1-80	20A4	SUBTL (I)	Subtitle of run
	3	1-2	I2	IOPRUN	Run option = 1: thru flow balance = 2: thru water quality coefficients = 3: complete run
	3	3-4	I2	ICVI	Metric conversion for input data = blank: all input is metric = 1: all input is English
	3	5-6	I2	ICVO	English conversion for output = blank: all output will be metric = 1: all output will be English
	3	7-8	I2	IOPECH	Echo input data = blank: echo input = 1: do not echo input data
	3	9-10	I2	IOPSUM	Summary option = blank: write summary for both hydraulics and quality = 1: write summary for hydraulics only = 2: write summary for quality only
	3	11-12	I2	IOPWRT	Output option = blank: write responses when calculated = 1: sort output by stream segment
	3	14	I1	IOPGW	Groundwater outflow option = blank: QG is modeled like QS = 1: QG is modeled as a fraction of stream flow

System Layout and Hydraulics: input formats are shown in Table A-1.

IFLAG
  H = headwater (considered the start of a new reach)
  R = start of a new reach
  J = junction: just downstream from a tributary junction (considered as the start of a new reach)
  L = point load
  D = point diversion
  C = check point (output desired at this point)
  B = branch point: just upstream from a tributary junction
  E = reach in which evaporation is significant (considered as the start of a new reach)
  T = terminal downstream point in the system

X = upstream distance to the point (miles or kilometers)

XID = point identification code

Description = point description

Column 31 = S: suppresses output for computer generated points

DX = maximum downstream element length; if the next downstream point is a greater distance away
        intermediate points will be generated

Q = for H or L: flow for headwater or point load (ft^3/sec or m^3/sec)
    = for E: evaporation (ft^3/sec/mile or m^3/sec/kilometer)

QS = lateral surface inflow (+) or outflow (-) (ft^3/sec/mile or m^3/sec/kilometer)

QG = lateral groundwater inflow (+) or outflow (-) (ft^3/sec/mile or m^3/sec/kilometer)
    = for IOPFLO = 1: outflow (-) (fraction of mainstream flow/mile or per kilometer)

S = average slope of stream bed (dimensionless)

n = Manning's coefficient

CQV = θ_1 in the equation $V = \theta_1 Q^{\theta_2}$

EQV = θ_2 in the equation $V = \theta_1 Q^{\theta_2}$

CAR = θ_3 in the equation $R = \theta_3 A^{\theta_4}$

EAR = θ_4 in the equation $R = \theta_3 A^{\theta_4}$

IOPRAD = E: use equations above to calculate hydraulic radius
        = ƀ: (blank) use Manning's equation to calculate hydraulic radius

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Table A-1. Input format for system layout and hydraulics.

Description	Symbol (IFLAG)	Format	Beginning Column	Headwater (H)	Reach (R)	Junction (J)	Point Load (L)	Point Diversion (D)	Check Point (C)	Branch Point (B)	Evaporation (E)	Terminal (T)
Type of Point	IFLAG	A1	1	H	R	J	L	D	C	B	E	T
Distance to Point (miles or km)	X	F7.0	2	*	*	*	*	*	*	*	*	*
Abbreviated Identification Symbol	XID	A4	9	*	*	*	*	*	*	*	*	*
Point Identification Description	Descript.	A2, 4A4	13	*	*	*	*	*	*	*	*	*
If = S, Suppress Output for Computer Generated Calculation Points		A1	31	*	*	*					*	
Maximum Downstream Element Length (miles or km)	DX	F3.0	32	*	*	*					*	
Point Flow & Evap. (cfs or cms) (cfs/mile or cms/km)	Q	F5.0	35	*			*	*			*	
Lateral Surface Inflow Downstream Reach (cfs/mile or cms/km)	QS	F5.0	40	*	*	*					*	
Lateral Groundwater Inflow Downstream Reach (cfs/mile or cms/km)	QG	F5.0	45	*	*	*					*	
Slope of Downstream Reach	S	F5.5	50	*	*	*					*	
Manning's Coefficient for Downstream Reach	n	F5.5	55	*	*	*					*	
Flow to Velocity Coefficient Downstream Reach	CQV	F5.0	60	*	*	*					*	
Flow to Velocity Exponent, Downstream Reach	EQV	F5.0	65	*	*	*					*	
Area to Hydraulic Radius Coefficient Downstream Reach	CAR	F5.0	70	*	*	*					*	
Area to Hydraulic Radius Exponent Downstream Reach	EAR	F5.0	75	*	*	*					*	
Flow to Hydraulic Radius Option. E = Empirical, M = Mannings	IOPRAD	A1	80	*	*	*					*	

Data Segment	Card No. In Data Segment	Format	Symbol	Description
Water Quality Control	1	Format Free	NR	Number of grid points for BOD (max. = 201)
	1	Format Free	RMIN	Value of BOD at grid point 1
	1	Format Free	RMAX	Value of BOD at grid point NR
	1	Format Free	NS	Number of grid points for transformed variable (max. = 201)
	1	Format Free	SMIN	Value of S at grid point 1
	1	Format Free	SMAX	Value of S at grid point NS
	1	Format Free	X2MIN	Value of DO at grid point 1
	1	Format Free	X2MAX	Value of DO at grid point NR
	1	Format Free	DTMAX	Maximum step size for finite difference algorithm (sec.)
	1	Format Free	IWTPDF	Output option of PDF of BOD and DO = 0: Output PDF of BOD and DO = 1: No output

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
Headwater Quality	1	1-18	A4		"DATA FOR HEADWATER"
	2	1-4	A4		Headwater identification code
	2	11-20	F10.0	XMO(1)	Mean BOD concentration at headwater (mg/ℓ)
	2	21-30	F10.0	XMO(3)	Variance of BOD concentration at headwater (mg/ℓ)^2
	2	31-40	F10.0	XMO(2)	Mean of DO concentration at headwater (mg/ℓ)
	2	41-50	F10.0	XMO(5)	Variance of DO concentration at headwater (mg/ℓ)^2
	2	51-60	F10.0	XMO(4)	Covariance of BOD-DO concentration at headwater (mg/ℓ)^2
Point Load Quality	1	1-20			"DATA FOR POINT LOADS"
	2				Same format as for headwater. Repeat card 2 for each point load. If there are no point loads, omit this section.

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
Reach Data: Quality and Coefficients	1	1-16			"DATA FOR REACHES"
	2	1-17			"WATER TEMPERATURE"
	3	1-10	F10.0	CTEMP(1)	Water temperature for reach 1 (^{0}C)
		11-20	F10.0	CTEMP(2)	Water temperature for reach 2 (^{0}C)
		21-30	F10.0	CTEMP(3)	Water temperature for reach 3 (^{0}C)
		. . .			
		71-80	F10.0	CTEMP(8)	Water temperature for reach 8 (^{0}C)
					(Use as many cards like 3 as necessary to include all reaches)
	4	1-17			"BOD DIFFUSE INPUT"
	5	1-4	A4		Reach identification code
	5	11-20	F10.0	CS(1,1)	Concentration of BOD in lateral surface inflow for reach 1 (mg/ℓ)
	5	21-30	F10.0	CS(3,1)	Variance of the white noise process for lateral inflow of BOD for reach 1 (mg/ℓ/sec)^2

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
	5	31-40	F10.0	CG(1,1)	Concentration of BOD in lateral ground inflow for reacn 1 (mg/ℓ)
	5	41-50	F10.0	CG(3,1)	Variance parameter of the white noise process for lateral ground inflow of BOD for reach 1 (mg/ℓ/sec)^2
	5	51-60	F10.0	COEF(1,7,1)	Leach rate of BOD for reach 1 (g/m^2/day)
	5	61-70	F10.0	COEF(3,7,1)	Variance parameter of the white noise process for BOD leach rate for reach 1 (g/m^2/day^2)^2
					(Use as many cards like 5 as necessary to include all reaches)
	6	1-25			"BOD EQUATION COEFFICIENTS"
	7	1-4	A4		Reach identification code
		11-20	F10.0	COEF(1,1,1)	$\beta_{1,1}$ for reach 1 (1/day)
		21-30	F10.0	COEF(3,1,1)	Standard deviation parameter of the white noise process for $\beta_{1,1}$ for reach 1 (percent of $\beta_{1,1}$)

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
	7	31-40	F10.0	COEF(1,2,1)	First-order decay rate ($\beta_{1,1}$) for reach 1 (1/day)
	7	41-50	F10.0	COEF(3,2,1)	Standard deviation parameter of the white noise process for $\beta_{2,1}$ for reach 1 (percent of $\beta_{2,1}$)
					(Use as many cards like 7 as necessary to include all reaches)
	8	1-16			"DO DIFFUSE INPUT"
	9				Same as card 5 except for DO
	10	1-24			"DO EQUATION COEFFICIENTS"
	11	1-4	A4		Reach identification code
	11	11-20	F10.0	COEF(2,1,1)	First-order removal rate ($\beta_{1,2}$) for reach 1 (1/day). If left Blank, program will calculate reaeration
	11	21-30	F10.0	COEF(4,1,1)	Standard deviation parameter of the white noise process for $\beta_{2,1}$ for reach 1 (percent of $\beta_{2,1}$)

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
	11	31-40	F10.0	COEF(2,2,1)	Dissolved oxygen saturation ($\beta_{2,2}$) for reach 1 (mg/ℓ) OPTIONAL: If COEF(2,2,1) is the negative of the elevation of reach 1 in km, the gram will calculate $\beta_{2,2}$
	11	41-50	F10.0	COEF(2,3,1)	Net oxygen production by phytoplankton ($\beta_{2,3}$) for reach 1 (mg/ℓ/day)
	11	51-60	F10.0	COEF(4,3,1)	Standard deviation parameter of white noise process for $\beta_{2,3}$ for reach 1 (percent $\beta_{2,3}$)
	11	61-70	F10.0	COEF(2,4,1)	Benthic uptake of oxygen ($\beta_{2,4}$) for reach 1 (g/m^2/day)/(mgO$_2$/ℓ)
	11	71-80	F10.0	COEF(4,4,1)	Standard deviation parameter of white noise process for $\beta_{2,4}$ for reach 1 (percent $\beta_{2,4}$) (Use as many cards like 11 as necessary to include all reaches.)

Data Segment	Card No. in Data Segment	Column	Format	Symbol	Description
Output Control	1	1-6	A6	TITPDF(1,1)	Output file title for marginal pdf of BOD at Calculation Point 1
	1	7-12	A6	TITPDF(1,2)	Output file title for marginal pdf of BOD at calculation point 2
		. . .			
	1	73-78	A6	TITPDF(1,13)	Output file title for marginal pdf of BOD at calculation point 13
					(Use as many cards like 1 as necessary to include all calculation points)
	2				Same as 1 except for marginal pdf of DO
	3				Same as 1 except for joint pdf of BOD-DO

NOTE: All output file titles must be followed by a "."

APPENDIX B: Listing of Program PSSAM

```
100 C*       PROBABILISTIC STREAM SIMULATION AND ASSESSMENT MODEL   (PSSAM)
200 C*
300 FILE   5(KIND=DISK,TITLE='SSAMDATA',FILETYPE=8)
400 FILE   6(MAXRECSIZE=22)
500 FILE   7=FILE7
600 FILE   31(KIND=DISK,MAXRECSIZE=3,BLOCKSIZE=36,AREAS=1000,AREASIZE=36,
700        *  SAVEFACTOR=99,TITLE='DUM1')
800 FILE   32(KIND=DISK,MAXRECSIZE=3,BLOCKSIZE=36,AREAS=1000,AREASIZE=36,
900        *  SAVEFACTOR=99,TITLE='DUM2')
1000 FILE  33(KIND=DISK,MAXRECSIZE=10,BLOCKSIZE=60,AREAS=1000,AREASIZE=60,
1100       *  SAVEFACTOR=99,TITLE='DUM3')
1200       COMMON Q(500),X(500),XID(500),ABAR(500),RBAR(500),VBAR(500)
1300      *,IFLAG(500),NR,NW,TITLE(20),SUBTL(20),ZL(12,150),QL(150),QD(150)
1400      *,QS(100),QG(100),CS(12,100),CG(12,100),G(12,10),IV(12,10),NTD(12)
1500      *,ICODE(12),CODE(12),IPARAM(12),CHW(15,12),ZO(12),Z(12),NTI(12)
1600      *,IFORM(12,50),B(12,50),E(12,50),ET(12,50),C(12),ZJUNC(12),NCON
1700      *,NEND,NREACH,NHDW,NLOAD,NDIRV,NPTL,NRLM,NLDL,NITL,ZD(12,500)
1800      *,COEF(12,7,100),MAXHD,MAXBR,NCOE(12),NCONU(12),CX(12),CTEMP(100)
1900      *,NCOEFL,QEVAP(100),RAVEV(100),RAVED(100),ISOLVE
2000       DIMENSION TBL1(10)
2100       DATA TBL1/1HH,1HR,1HJ,1HL,1HD,1HC,1HB,1HE,1HT,1HS/
2200 C*                NR IS THE READ DEVICE AND NW IS THE WRITE DEVICE
2300       NR=5
2400       NW=6
2500 C*                NPTL IS THE NPOINT LIMIT, NRLM THE NO. OF REACH
2600 C*                LIMIT, NLDL THE MAX. NO. OF LOAPS ALSO THE MAX. NO.
2700 C*                OF DIVERSIONS, NITL THE MAX, NO. OF TERMS ALLOWED.
2800       NPTL=500
2900       NRLM=100
3000       NLDL=150
3100       NITL=50
3200       MAXHD=1
3300       MAXBR=14
3400       NCOEFL=7
3500    10 CALL CONTRL(TBL1)
3600       GOTO 10
3700       END
3800       SUBROUTINE CONTRL(TBL1)
3900       COMMON Q(500),X(500),XID(500),ABAR(500),RBAR(500),VBAR(500)
4000      *,IFLAG(500),NR,NW,TITLE(20),SUBTL(20),ZL(12,150),QL(150),QD(150)
4100      *,QS(100),QG(100),CS(12,100),CG(12,100),G(12,10),IV(12,10),NTD(12)
4200      *,ICODE(12),CODE(12),IPARAM(12),CHW(15,12),ZO(12),Z(12),NTI(12)
4300      *,IFORM(12,50),B(12,50),E(12,50),ET(12,50),C(12),ZJUNC(12),NCON
4400      *,NEND,NREACH,NHDW,NLOAD,NDIRV,NPTL,NRLM,NLDL,NITL,ZB(12,500)
4500      *,COEF(12,7,100),MAXHD,MAXBR,NCOE(12),NCONU(12),CX(12),CTEMP(100)
4600      *,NCOEFL,QEVAP(100),RAVEV(100),RAVED(100),ISOLVE
4700       COMMON/S/ NSEG(15),ISST(15,15),ISED(15,15),IRR(15,15),IJJ(15,15)
4800      *          ,ILL(15,15)
4900       DIMENSION TBL1(10),XLF(201,201),XLFXX(201,201),SX2GRD(201,201)
5000       DIMENSION ZB(15,12),IJCO(15)
```

```
5100        1 CALL HYDRAU(IOPRUN,NPOINT,ICVI,ICVO,IOPECH,IOPSUM,TBL1,IOPWRT)
5200        2 IF(IOPRUN.EQ.1) STOP
5300          CALL QUALIN(NR,NW,TITLE,SUBTL,NLOAD,COEF,IOPECH,ZL,NREACH,CS,CG,
5400        *          RAVEV,RAVED,CTEMP,IOPSUM,DTMAX,NPOINT)
5500          IF(IOPRUN.EQ.2) STOP
5600          DO 6 I=1,12
5700          ZO(I)=0.
5800        6 CONTINUE
5900          IW=0
6000          ID=0
6100          IL=0
6200          IH=0
6300          IR=0
6400          IJ=0
6500          IB=0
6600          NSTOP=NPOINT-1
6700          IPP=0
6800          DO 100 IP=1,NSTOP
6900          IFL=IFLAG(IP)
7000  C*
7100  C*      CALL PROGRAM THAT LINKS HYDRAULICS TO THE NUMERICAL SOLUTION
7200  C*      TO THE PDF OF BOD AND DO SUBROUTINES
7300  C*
7400          IF(IFL.EQ.1.OR.IFL.EQ.2)IRDUM=IR+1
7500          CALL LINK(IP,IRDUM,QS,QG,CS,CG,ABAR,RBAR,COEF)
7600          GOTO(101,102,108,103,104,107,108,102,108,107,107),IFL
7700  101     CONTINUE
7800  C*
7900  C*      HEADWATER
8000  C*
8100          IH=IH+1
8200          CALL INITCO(XLF,XLFXX,SX2GRD,ZO,NW)
8300  102     CONTINUE
8400  C*
8500  C*      HEAD OF REACH
8600  C*
8700          IR=IR+1
8800          GO TO 107
8900  103     CONTINUE
9000  C*
9100  C*      POINT LOAD
9200  C*
9300          IL=IL+1
9400          CALL LOAD(Q(IP),QL(IL),ZL(1,IL),ZL(2,IL),ZL(3,IL),ZL(4,IL),
9500        *          ZL(5,IL),XLF,XLFXX,SX2GRD,ZO)
9600          GO TO 107
9700  104     CONTINUE
9800  C*
9900  C*      POINT DIVERSION
10000 C*
```

```
10100        ID=ID+1
10200 107    CONTINUE
10300 C*
10400 C*     ALL OF THE ABOVE PLUS CALCULATION AND CHECK POINT
10500 C*
10600        DO 135 I=1,5
10700        ZD(I,IP)=ZO(I)
10800 135    CONTINUE
10900 C*
11000 C*     SOVLE FOR PDF AT NEXT TIME
11100 C*
11200        IPP1=IP+1
11300        TIME=(X(IP)-X(IPP1))*1000./VBAR(IP)
11400        IF(IFL.NE.9.AND.IOPWRT.EQ.0)CALL WRPT(1,IP,IW,ICVO)
11500        CALL PDF(TIME,XLF,XLFXX,SX26RB,ZO,DTMAX,IP,NW)
11600        IF(IFL.NE.9.AND.IOPWRT.EQ.0)CALL WRPT(1,IP,IW,ICVO)
11700 100    CONTINUE
11800        DO 145 I=1,5
11900        ZD(I,NPOINT)=ZO(I)
12000 145    CONTINUE
12100        IF(IOPWRT.EQ.0) GO TO 513
12200        CALL TITL(TITLE,SUBTL,NW)
12300        WRITE(NW,551)
12400  551 FORMAT(//,33X,'BOD',17X,'DO',11X,'BOD-DO',/,2X,'PNT  DISTANCE',
12500      *         3X,'ID',2(7X,'MEAN',6X,'VAR'),7X,'COV')
12600        DO 512 IH=1,NHDW
12700        N1=NSEG(IH)
12800        DO 514 I=1,N1
12900        N2=ISST(IH,I)
13000        N3=ISED(IH,I)
13100        IR=IRR(IH,I)
13200        DO 516 IP=N2,N3
13300        IF(ICVO.GT.0) X(IP)=X(IP)*.62137119
13400        IFL=IFLAG(IP)
13500        GOTO(560,561,561,520,520,520,520,561,520,516,520),IFL
13600  560 IR=IR+1
13700        WRITE(NW,570) IR,IH
13800  570 FORMAT(1H0 // 1H0,'REACH#',I3,4X,'HEADWATER',I3)
13900        GOTO 520
14000  561 IR=IR+1
14100        WRITE(NW,571) IR
14200  571 FORMAT(1H0,'REACH#',I3)
14300        WRITE(NW,553)IP,X(IP),XID(IP),ZB(1,IP),ZD(3,IP),ZD(2,IP),
14400      *            ZD(5,IP),ZD(4,IP)
14500  553 FORMAT(1H ,I4,F10.2,2X,A4,5F10.3)
14600        GOTO 516
14700  520 WRITE(NW,552)IP,X(IP),XID(IP),ZD(1,IP),ZD(3,IP),ZD(2,IP),
14800      *            ZD(5,IP),ZD(4,IP)
14900  552 FORMAT(1H0,I4,F10.2,2X,A4,5F10.3)
15000  516 CONTINUE
```

```
15100    514 CONTINUE
15200    512 CONTINUE
15300        GO TO 515
15400    513 CALL WRPT(1,NPOINT,IW,ICVO)
15500    515 CONTINUE
15600        STOP
15700    108 WRITE(6,601) IP,IFL
15800    601 FORMAT(1H /// 1H ,72HERROR IN SUBROUTINE CONTRL,  MAY BE CP TYPE,
15900       *STOP AT STATEMENT 108, IP=  ,I3,3X, 4HIFL=,I3)
16000        STOP
16100        END
16200        SUBROUTINE HYDRAU(IOPRUN,NPOINT,ICVI,ICVO,IOPECH,IOPSUM,TBL1,
16300       *IOPWRT)
16400        COMMON Q(500),X(500),XID(500),ABAR(500),RBAR(500),VBAR(500)
16500       *,IFLAG(500),NR,NW,TITLE(20),SUBTL(20),ZL(12,150),QL(150),QD(150)
16600       *,QS(100),QG(100),CS(12,100),CG(12,100),G(12,10),IV(12,10),NTB(12)
16700       *,ICODE(12),CODE(12),IPARAM(12),CHW(15,12),ZO(12),Z(12),NTI(12)
16800       *,IFORM(12,50),B(12,50),E(12,50),ET(12,50),C(12),ZJUNC(12),NCON
16900       *,NEND,NREACH,NHDW,NLOAD,NDIRV,NPTL,NRLM,NLDL,NITL,ZD(12,500)
17000       *,COEF(12,7,100),MAXHD,MAXBR,NCOE(12),NCONU(12),CX(12),CTEMP(100)
17100       *,NCOEFL,QEVAP(100),RAVEV(100),RAVED(100),ISOLVE
17200        DIMENSION TBL(14),TBL1(10),IJCO(15)
17300        COMMON/S/ NSEG(15),ISST(15,15),ISED(15,15),IRR(15,15),IJJ(15,15)
17400       *           ,ILL(15,15)
17500        DATA DATA1,END/3HICP,4HENDR/
17600 C*      READ TITLE AND SUBTITLE CARDS
17700      1 READ(NR,202) (TITLE(I),I=1,20)
17800        IF(TITLE(1).EQ.'ENDJ') STOP
17900        READ(NR,202) (SUBTL(I),I=1,20)
18000    202 FORMAT(20A4)
18100        CALL TITL(TITLE,SUBTL,NW)
18200        READ(NR,203)IOPRUN,ICVI,ICVO,IOPECH,IOPSUM,IOPWRT
18300       *     ,IOPGW
18400    203 FORMAT(7I2)
18500        WRITE(NW,204)IOPRUN,ICVI,ICVO,IOPECH,IOPSUM,IOPWRT,IOPGW
18600    204 FORMAT(9HOIOPRUN =I2,5X6HICVI =I2,5X6HICVO =I2,5X8HIOPECH =I2,
18700       *5X,8HIOPSUM =,I2,5X,8HIOPWRT =,I2,5X,'IOPGW=',I2)
18800 C*(TBL1)  H  R  J  L  D  C  B  E  T  S
18900 C*        1  2  3  4  5  6  7  8  9 10
19000        IF(IOPECH.NE.1) WRITE(NW,600)
19100    600 FORMAT(1HO,4HCARD,1X,8HDISTANCE,1X,20HMNEMONIC DESCRIPTION,1X,5HPR
19200       *INT,1X,5HDELTA,3X,4HFLOW,3X,7HLATERAL,2X,7HLATERAL,3X,5HSLOPE,3X,7
19300       *HMANNING,4X,3HVEL,6X,3HVEL,5X,4HHYDR,5X,4HHYDR,3X,4HHYDR/1H ,4HCOD
19400       *E,32X,4HCODE,16X,7HSURFACE,2X,6HGROUND,14X,3H N ,5X,4HCOEF,6X,3HEX
19500       *P,6X,4HCOEF,5X,3HEXP,4X,3HOPT/1H ,58X,4HFLOW,4X,4HFLOW/)
19600        IP=0
19700        IH=0
19800        IR=0
19900        IJ=0
20000        IL=0
```

```
20100        ID=0
20200        IB=0
20300        IBB=0
20400        ITERM=0
20500        IS=1
20600        IE=2
20700        IID1=0
20800        IID2=1
20900   400 CALL SYSDAT(IS,ICVI,IOPECH,TBL1,ZL,NR,NW,IOPGW)
21000   150 IP=IP+1
21100       IF(IP.LE.NPTL) GO TO 152
21200       WRITE(6,250)
21300   250 FORMAT(46H THE NUMBER OF CALCULATION POINTS EXCEEDS NPTL)
21400       STOP
21500   152 CALL SYSDAT(IE,ICVI,IOPECH,TBL1,ZL,NR,NW,IOPGW)
21600       X(IP)=ZL(IS,2)
21700       IFLAG(IP)=ZL(IS,1)+0.1
21800       IFL=IFLAG(IP)
21900       IF(IFL.LE.3.OR.IFL.EQ.8)XINC=ZL(IS,10)
22000       XEND=ZL(IE,2)
22100       XID(IP)=ZL(IS,3)
22200       IID1=IID1+1
22300       IF(IID1.LE.NRLM) GOTO 15
22400       IID1=1
22500       IID2=IID2+1
22600    15 DO 20 K=4,8
22700    20 COEF(K,IID2,IID1)=ZL(IS,K)
22800   160 IF(XINC.LT..01) GOTO 10
22900       XRUN=X(IP)-XINC*1.10
23000       IF(XRUN.LT.XEND) GOTO 10
23100       DELX=XINC*1000.
23200       GOTO 11
23300    10 DELX=(X(IP)-XEND)*1000.
23400       IFP1=ZL(IE,1)+0.1
23500       IF(IFP1.EQ.9) ITERM=1
23600       XRUN=-1000.
23700    11 IF(DELX.GE.0.0) GO TO 12
23800       WRITE( 6,205) XID(IP),IP,X(IP),DELX
23900   205 FORMAT(1H0,'CHECK FOR INCREASING MILEAGE IN THE DOWNSTREAM'
24000       *       ,' DIRECTION NEAR ',A4 / 1H ,'IP =',I4,5X,'X(IP) ='
24100       *       ,F12.3,' KM',5X,'DELX =',E11.3,' M')
24200       STOP
24300    12 IFL=IFLAG(IP)
24400       GO TO (101,102,103,104,105,106,107,102,108,106,106),IFL
24500   101 IH=IH+1
24600       IR=IR+1
24700       Q(IP)=ZL(IS,11)
24800       GO TO 110
24900   102 IR=IR+1
25000       Q(IP)=QEND
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```
25100        GO TO 114
25200    103 IR=IR+1
25300        K=IJCO(IB)
25400        Q(IP)=QEND+Q(K)
25500        IB=IB-1
25600        XTEST=ABS(X(IP)-X(K))/X(IP)
25700        IF(XTEST.LT.0.1) GOTO 114
25800        WRITE(NW,260) XID(IP),X(IP),X(K)
25900    260 FORMAT(1H0,'AT ',A4,',   RIVER MILES AT JUNCTION,',F8.2
26000      *        ,'  DO NOT MATCH BRANCH,',F8.2)
26100        IOPRUN=1
26200        GO TO 114
26300    110 IF(IH.LE.MAXHD) GO TO 114
26400        WRITE(6,251)
26500    251 FORMAT(51H THE MAXIMUM NUMBER OF HEADWATERS HAS BEEN EXCEEDED)
26600        STOP
26700    114 IF(IR.LE.NRLM) GO TO 115
26800        WRITE(NW,252)
26900    252 FORMAT(48H THE MAXIMUM NUMBER OF REACHES HAS BEEN EXCEEDED)
27000        STOP
27100    115 QS(IR)=ZL(IS,12)*0.001
27200        QG(IR)=ZL(IS,13)*.001
27300        IF(IFL.EQ.8) GOTO 702
27400        QEVAP(IR)=0.0
27500        GOTO 704
27600    702 QEVAP(IR) = ZL(IS,11)*0.001
27700    704 CONTINUE
27800        IFLICP=ZL(IS,9)+0.1
27900        SLOPE=ZL(IS,14)
28000        CHAN=ZL(IS,15)
28100        CQV=ZL(IS,16)
28200        EQV=ZL(IS,17)
28300        CAR=ZL(IS,18)
28400        EAR=ZL(IS,19)
28500        IOPRAD=ZL(IS,20)+0.1
28600        LID2=IID2
28700        LID1=IID1
28800        COEF(1,LID2,LID1)=0.
28900        COEF(2,LID2,LID1)=0.
29000        COEF(10,LID2,LID1)=0.
29100        IF(IR-1.NE.0) RAVEV(IR-1)=RAVEV(IR-1)/XNPPR
29200        IF(IR-1.NE.0) RAVED(IR-1)=RAVED(IR-1)/XNPPR
29300        XNPPR=0.0
29400        RAVEV(IR)=0.0
29500        RAVED(IR)=0.0
29600        GO TO 120
29700    104 IL=IL+1
29800        IF(IL.LE.NLDL) GO TO 116
29900        WRITE(NW,253)
30000    253 FORMAT(46H THE MAXIMUM NUMBER OF LOADS HAS BEEN EXCEEDED)
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30100       STOP
30200   116 QL(IL)=ZL(IS,11)
30300       Q(IP)=QEND+ZL(IS,11)
30400       COEF(3,IID2,IID1)=ZL(IS,11)
30500       GO TO 120
30600   105 ID=ID+1
30700       IF(ID.LE.NLDL) GO TO 117
30800       WRITE(NW,254)
30900   254 FORMAT(51H THE MAXIMUM NUMBER OF DIVERSIONS HAS BEEN EXCEEDED)
31000       STOP
31100   117 QD(ID)=ZL(IS,11)
31200       Q(IP)=QEND-ZL(IS,11)
31300       COEF(3,IID2,IID1)=ZL(IS,11)
31400       GO TO 120
31500   106 Q(IP)=QEND
31600       GO TO 120
31700   107 WRITE(6,256)
31800   256 FORMAT(61H COMPUTED GO TO HAS SENCED A BRANCH POINT, IT SHOULD NOT
31900       * HAVE)
32000       STOP
32100   120 IF(QG(IR).LT.0.0.AND.IOPGW.EQ.1)GOTO 200
32200       COEF(1,LID2,LID1)=QS(IR)*DELX+COEF(1,LID2,LID1)
32300       COEF(2,LID2,LID1)=QG(IR)*DELX+COEF(2,LID2,LID1)
32400       COEF(10,LID2,LID1)=-QEVAP(IR)*DELX+COEF(10,LID2,LID1)
32500       QEND=Q(IP)+(QS(IR)+QG(IR)-QEVAP(IR))*DELX
32600       QBAR=(Q(IP)+QEND)*.5
32700       GO TO 125
32800   200 QG(IR)=QG(IR)/100.
32900       FAC=EXP(QG(IR)*DELX)
33000       QEND=Q(IP)*FAC+(1.0-FAC)*(QS(IR)-QEVAP(IR))/(-QG(IR))
33100       IF(DELX.GT.0.0) GOTO 530
33200       QBAR=Q(IP)
33300       GOTO 532
33400   530 QBAR=(Q(IP)*(FAC-1.0)+(QS(IR)-QEVAP(IR))*((FAC-1.0)/QG(IR)
33500       *      -DELX))/(DELX*QG(IR))
33600   532 COEF(1,LID2,LID1)=QS(IR)*DELX+COEF(1,LID2,LID1)
33700       COEF(2,LID2,LID1)=QEND-Q(IP)-QS(IR)*DELX+COEF(2,LID2,LID1)
33800   125 IF(Q(IP).GT.0.0) GO TO 126
33900   534 WRITE(NW,127) IP,X(IP),Q(IP),QBAR
34000   127 FORMAT(1H0,'FLOW IS LE 0.0, IP=',I4,5X,'X(IP)=',F11.3,5X,'Q(IP)='
34100       *      ,E11.3,5X,'QBAR=',E11.3)
34200       IOPRUN=1
34300       Q(IP)=1.0E-6
34400       QBAR=1.0E-6
34500   126 IF(QBAR.LE.0.0)GOTO 534
34600       VBAR(IP)=CQV*QBAR**EQV
34700       IF(VBAR(IP))25,25,26
34800    25 ABAR(IP)=0.
34900       IOPRUN=1
35000       WRITE(NW,210) IP,XID(IP),VBAR(IP)
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35100    210 FORMAT(1H0,'ERROR: VBAR(IP) LE 0.  IP=',I4,5X,A4,5X,'VBAR(IP)='
35200      *       ,E11.3)
35300        GOTO 27
35400     26 ABAR(IP)=QBAR/VBAR(IP)
35500     27 COEF(9,IID2,IID1)=SLOPE
35600        IF(IOPRAD.EQ.1) GO TO 130
35700        IF(SLOPE.GT.0.0)GOTO 536
35800        WRITE(NW,538)SLOPE
35900    538 FORMAT(1H0,'ERROR: SLOPE =',E12.3)
36000        RBAR(IP)=1.0E8
36100        IOPRUN=1
36200        GOTO 136
36300    536 RBAR(IP)=(CMAN*VBAR(IP)/SQRT(SLOPE))**1.5
36400        GO TO 136
36500    130 RBAR(IP)=CAR*ABAR(IP)**EAR
36600    136 XNPPR=XNPPR+DELX
36700        RAVEV(IR)=RAVEV(IR)+VBAR(IP)*DELX
36800        RAVED(IR)=RAVED(IR)+RBAR(IP)*DELX
36900        IF(XRUN.GT.XEND) GOTO 140
37000        IF(ITERM.EQ.1) GO TO 108
37100    320 IDUN=IE
37200        IE=IS
37300        IS=IDUN
37400        IF(IFIX(ZL(IS,1)+0.1).NE.7) GO TO 150
37500        IP=IP+1
37600        IFLAG(IP)=ZL(IS,1)+0.1
37700        X(IP)=ZL(IS,2)
37800        XID(IP)=ZL(IS,3)
37900        IID1=IID1+1
38000        IF(IID1.LE.NRLM) GO TO 122
38100        IID1=1
38200        IID2=IID2+1
38300    122 DO 121 K=4,8
38400    121 COEF(K,IID2,IID1)=ZL(IS,K)
38500        IB=IB+1
38600        IBB=IBB+1
38700        IF(IBB.LE.MAXBR) GO TO 118
38800        WRITE(NW,255)
38900    255 FORMAT(49H THE MAXIMUM NUMBER OF BRANCHES HAS BEEN EXCEEDED)
39000        STOP
39100    118 Q(IP)=QEND
39200        IJCO(IB)=IP
39300        GO TO 400
39400    140 IP=IP+1
39500        IFLAG(IP)=IFLICP
39600        X(IP)=X(IP-1)-DELX*.001
39700        XID(IP)=DATA1
39800        IID1=IID1+1
39900        IF(IID1.LE.NRLM) GOTO 160
40000        IID1=1
```

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40100        IID2=IID2+1
40200    141 GO TO 160
40300    108 IP=IP+1
40400        IF(IP.LE.NPTL) GO TO 119
40500        WRITE(NW,250)
40600    119 CONTINUE
40700        IFLAG(IP)=9
40800        X(IP)=ZL(IE,2)
40900        XIB(IP)=ZL(IE,3)
41000        IID1=IID1+1
41100        IF(IID1.LE.NRLN) GOTO 112
41200        IID1=1
41300        IID2=IID2+1
41400    112 DO 113 K=4,8
41500    113 COEF(K,IID2,IID1)=ZL(IE,K)
41600        Q(IP)=QEND
41700        VBAR(IP)=VBAR(IP-1)
41800        RBAR(IP)=RBAR(IP-1)
41900        ABAR(IP)=ABAR(IP-1)
42000        RAVEV(IR)=RAVEV(IR)/XNPPR
42100        RAVED(IR)=RAVED(IR)/XNPPR
42200        NPOINT=IP
42300        NREACH=IR
42400        NHDW=IH
42500        NLOAD=IL
42600        NDIRV=ID
42700 C*
42800 C*                               SORT POINTS FOR OUTPUT BY TRIBUTARY
42900 C*
43000        IH=0
43100        IR=0
43200        IJ=0
43300        IB=0
43400        IL=0
43500        DO 610 IP=1,NPOINT
43600        IFL=IFLAG(IP)
43700        GO TO (501,502,503,504,500,500,507,502,508,500,500),IFL
43800    501 IH=IH+1
43900        IR=IR+1
44000        IX=IH
44100        NSEG(IH)=1
44200        IY=1
44300        IRR(IX,IY)=IR-1
44400        IJJ(IX,IY)=IJ
44500        ILL(IX,IY)=IL
44600        ISST(IX,IY)=IP
44700        GO TO 500
44800    502 IR=IR+1
44900        GO TO 500
45000    503 IJ=IJ+1
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```
45100        IR=IR+1
45200        ISED(IX,IY)=IP-1
45300        IX=IJCO(IB)
45400        IB=IB-1
45500        NSEG(IX)=NSEG(IX)+1
45600        IY=NSEG(IX)
45700        ISST(IX,IY)=IP
45800        IRR(IX,IY)=IR-1
45900        IJJ(IX,IY)=IJ-1
46000        ILL(IX,IY)=IL
46100        GO TO 500
46200    504 IL=IL+1
46300        GO TO 500
46400    507 IB=IB+1
46500        ISED(IX,IY)=IP
46600        IJCO(IB)=IX
46700    500 CONTINUE
46800    610 CONTINUE
46900    508 ISED(IX,IY)=IP
47000        IF(IOPSUM.GT.1) GO TO 151
47100        CALL SUMSYS(NPOINT,ICVO,IOPWRT)
47200    151 RETURN
47300        END
47400        SUBROUTINE QUALIN(NRD,NW,TITLE,SUBTL,NLOAD,COEF,IOPECH,ZL,NREACH,
47500       *                  CS,CG,RAVEV,RAVED,CTEMP,IOPSUM,DTMAX,NPOINT)
47600        COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
47700       *        FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
47800       *        X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
47900        COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
48000       *                VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
48100       *                RB,B22,XM0(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
48200        DIMENSION TITLE(20),SUBTL(20),COEF(12,7,100),ZL(12,150),
48300       *          CS(12,100),CG(12,100),RAVEV(100),RAVED(100),CTEMP(100)
48400        CALL TITL(TITLE,SUBTL,NW)
48500        WRITE(NW,2100)
48600   2100 FORMAT(//,1X,'PROBABILISTIC STREAM SIMULATION AND ASSESSMENT ',
48700       *          'MODEL, PSSAM',//)
48800 C*
48900 C*   READ IN INFO FOR NUMERICAL SOLUTION OF PDF
49000 C*
49100        READ(NRD,/)NR,RMIN,RMAX,NS,SMIN,SMAX,X2MIN,X2MAX,DTMAX,IWTPDF
49200        WRITE(NW,2200)NR,RMIN,RMAX,NS,SMIN,SMAX,X2MIN,X2MAX,DTMAX,IWTPDF
49300   2200 FORMAT(///,1X,'NR=',I3,3X,'RMIN=',F7.3,3X,'RMAX=',F7.3,3X,
49400       *          'NS=',I3,3X,'SMIN=',F7.3,3X,'SMAX=',F7.3,3X,/,1X,'X2MIN=',
49500       *       F7.3,3X,'X2MAX=',F7.3,3X,'DTMAX=',F10.2,'(SEC)',3X,
49600       *       'IWTPDF=',I2,//)
49700        NRM1=NR-1
49800        NSM1=NS-1
49900        DR=(RMAX-RMIN)/FLOAT(NRM1)
50000        DS=(SMAX-SMIN)/FLOAT(NSM1)
```

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50100        DX2=(X2MAX-X2MIN)/FLOAT(NRM1)
50200        R(1)=RMIN
50300        S(1)=SMIN
50400        X2(1)=X2MIN
50500        DO 10 I=2,NR
50600        IM1=I-1
50700        R(I)=R(IM1)+DR
50800        X2(I)=X2(IM1)+DX2
50900 10     CONTINUE
51000        DO 20 I=2,NS
51100        S(I)=S(I-1)+DS
51200 20     CONTINUE
51300 C*
51400 C*     READ HEADWATER HEADING CARD
51500 C*
51600        READ(NRD,1100)(COEF(12,1,J),J=1,10)
51700 1100   FORMAT(10A4)
51800        IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
51900 2300   FORMAT(/////,1X,10A4)
52000 C*
52100 C*     READ HEADWATER DATA
52200 C*
52300        READ(NRD,1200)COEF(12,1,1),XMO(1),XMO(3),XMO(2),XMO(5),XMO(4)
52400 1200   FORMAT(A4,6X,7F10.0)
52500        IF(IOPECH.EQ.0)WRITE(NW,2400)
52600 2400   FORMAT(//,17X,'BOD',19X,'DO',12X,'BOD-DO',/,12X,'MEAN',6X,
52700       *          'VAR',8X,'MEAN',6X,'VAR',8X,'COV')
52800        IF(IOPECH.EQ.0)WRITE(NW,2500)COEF(12,1,1),XMO(1),XMO(3),
52900       *                          XMO(2),XMO(5),XMO(4)
53000 2500   FORMAT(1X,A4,4X,2(F8.4,2X),1X,2(F8.4,2X),1X,F8.4)
53100        IF(NLOAD.LE.0)GO TO 35
53200 C*
53300 C*     READ IN POINT LOAD HEADING CARD
53400 C*
53500        READ(NRD,1100)(COEF(12,1,J),J=1,10)
53600        IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
53700        IF(IOPECH.EQ.0)WRITE(NW,2400)
53800 C*
53900 C*     READ POINT LOAD DATA
54000 C*
54100        DO 30 I=1,NLOAD
54200        READ(NRD,1200)COEF(12,1,1),ZL(1,I),ZL(3,I),ZL(2,I),ZL(5,I),
54300       *             ZL(4,I)
54400        IF(IOPECH.EQ.0)WRITE(NW,2500)COEF(12,1,1),ZL(1,I),ZL(3,I),
54500       *                          ZL(2,I),ZL(5,I),ZL(4,I)
54600 30     CONTINUE
54700 35     CONTINUE
54800 C*
54900 C*     READ REACHES HEADING AND WATER TEMPERATURE CARD
55000 C*
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55100        DO 40 I=1,2
55200        READ(NRD,1100)(COEF(12,1,J),J=1,10)
55300        IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
55400 40     CONTINUE
55500 C*
55600 C*     READ REACH TERMPERATURE
55700 C*
55800        READ(NRD,1300)(CTEMP(I),I=1,NREACH)
55900 1300   FORMAT(8F10.0)
56000        IF(IOPECH.EQ.0)WRITE(NW,2600)(CTEMP(I),I=1,NREACH)
56100 2600   FORMAT(13(3X,8(F6.2,2X),/))
56200 C*
56300 C*     READ BOD DIFFUSE INPUT HEADING CARD
56400 C*
56500        READ(NRD,1100)(COEF(12,1,J),J=1,10)
56600        IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
56700 C*
56800 C*     READ IN REACH ID,XS1,VXS1,XG1,VXG1,L1,VL1 FOR EACH REACH
56900 C*
57000        IF(IOPECH.EQ.0)WRITE(NW,2700)
57100 2700   FORMAT(/,14X,'SURFACE',12X,'GROUND',14X,'LEACH',/,6X,
57200      *        3(5X,'DET',4X,'VAR WNP'))
57300        DO 50 I=1,NREACH
57400        READ(NRD,1200)COEF(12,1,1),CS(1,I),CS(3,I),CG(1,I),CG(3,I),
57500      *              COEF(1,7,I),COEF(3,7,I)
57600        IF(IOPECH.EQ.0)WRITE(NW,2800)COEF(12,1,1),CS(1,I),CS(3,I),
57700      *              CG(1,I),CG(3,I),COEF(1,7,I),COEF(3,7,I)
57800 2800   FORMAT(1X,A4,1X,3(3X,F7.4,2X,F7.4))
57900 50     CONTINUE
58000 C*
58100 C*     READ BOD COEFFICIENTS HEADING CARD
58200 C*
58300        READ(NRD,1100)(COEF(12,1,J),J=1,10)
58400        IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
58500        IF(IOPECH.EQ.0)WRITE(NW,2900)
58600 2900   FORMAT(/,13X,'BETA 1,1',8X,'BETA 1,2',/,11X,'DET',2X,
58700      *        'STD WNP',4X,'DET'2X,'STD WNP')
58800        IF(IOPECH.EQ.0)WRITE(NW,4100)
58900 4100   FORMAT(16X,'PERCENT',9X,'PERCENT')
59000 C*
59100 C*     READ B11,VB11,B12,VB12 FOR EACH REACH
59200 C*
59300        DO 60 I=1,NREACH
59400        READ(NRD,1200)COEF(12,1,1),COEF(1,1,I),COEF(3,1,I),COEF(1,2,I),
59500      *              COEF(3,2,I)
59600        IF(IOPECH.EQ.0)WRITE(NW,4200)COEF(12,1,1),COEF(1,1,I),
59700      *                              COEF(3,1,I),COEF(1,2,I),COEF(3,2,I)
59800 4200   FORMAT(1X,A4,1X,2(3X,F6.3,2X,F5.2))
59900 60     CONTINUE
60000 C*
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60100 C*      READ DO DIFFUSE INPUT HEADING CARD
60200 C*
60300         READ(NRD,1100)(COEF(12,1,J),J=1,10)
60400         IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
60500         IF(IOPECH.EQ.0)WRITE(NW,2700)
60600 C*
60700 C*      READ XS2,VSX2,XG2,VXG2,L2,VL2 FOR EACH REACH
60800 C*
60900         DO 70 I=1,NREACH
61000         READ(NRD,1200)COEF(12,1,1),CS(2,I),CS(4,I),CG(2,I),CG(4,I),
61100       *             COEF(2,7,I),COEF(4,7,I)
61200         IF(IOPECH.EQ.0)WRITE(NW,2800)COEF(12,1,1),CS(2,I),CS(4,I),
61300       *                           CG(2,I),CG(4,I),COEF(2,7,I),
61400       *                           COEF(4,7,I)
61500 70      CONTINUE
61600 C*
61700 C*      READ DO COEFFICIENT HEADING CARD
61800 C*
61900         READ(NRD,1100)(COEF(12,1,J),J=1,10)
62000         IF(IOPECH.EQ.0)WRITE(NW,2300)(COEF(12,1,J),J=1,10)
62100         IF(IOPECH.EQ.0)WRITE(NW,4300)
62200 4300    FORMAT(/,13X,'BETA 2,1   BETA 2,2     BETA 2,3',8X,'BETA 2,4',
62300       *      /,11X,'DET  STD WNP',9X,2(4X,'DET  STD WNP'))
62400         IF(IOPECH.EQ.0)WRITE(NW,4400)
62500 4400    FORMAT(16X,'PERCENT',9X,2(9X,'PERCENT'))
62600 C*
62700 C*      READ B21,VB21,B22,B23,VB23,B24,VB24 FOR EACH REACH
62800 C*
62900         DO 80 I=1,NREACH
63000         READ(NRD,1200)COEF(12,1,1),COEF(2,1,I),COEF(4,1,I),COEF(2,2,I),
63100       *             COEF(2,3,I),COEF(4,3,I),COEF(2,4,I),COEF(4,4,I)
63200         IF(IOPECH.EQ.0)WRITE(NW,4500)COEF(12,1,1),COEF(2,1,I),COEF(4,1,I),
63300       *                           COEF(2,2,I),COEF(2,3,I),COEF(4,3,I),
63400       *                           COEF(2,4,I),COEF(4,4,I)
63500 4500    FORMAT(1X,A4,4X,F6.3,2X,F5.2,3X,F6.3,2(3X,F6.3,2X,F5.2))
63600 80      CONTINUE
63700 C*
63800 C*      SOVLE FOR (IF NECESSARY) AND TEMPERATURE ADJUST REAERATION
63900 C*      COEFFICIENT DO SATURATION AND FIRST-ORDER BOD DECAY RATE
64000 C*
64100         DO 100 I=1,NREACH
64200         IF(COEF(2,1,I).GT.1.E-10)GO TO 90
64300 C*
64400 C*      NEED TO CALCULATE REAERATION COEFFICIENT
64500 C*
64600         XX1=RAVEV(I)**0.0607
64700         XX2=RAVED(I)**1.689
64800         COEF(2,1,I)=5.58*XX1/XX2
64900 90      CONTINUE
65000 C*
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65100 C*    TEMPERATURE ADJUST REAERATION AND FIRST-ORDFER BOD COEFFICIENT
65200 C*
65300       T=CTEMP(I)
65400       COEF(2,1,I)=COEF(2,1,I)*(1.0159**(T-20.))
65500       COEF(1,1,I)=COEF(1,1,I)*(1.047**(T-20.))
65600       IF(COEF(2,2,I).GT.1.E-10)GO TO 100
65700 C*
65800 C*    CALCULATE DO SATURATION AT TEMPERATURE T
65900 C*
66000       TF=T*1.8+32.
66100       DOS=24.89-0.4259*TF+0.003734*TF*TF-0.00001328*TF**3
66200       COEF(2,2,I)=ABS(COEF(2,2,I)*1000.)
66300       COEF(2,2,I)=DOS*EXP(-(.03418*COEF(2,2,I))/
66400      *                   (288.-0.006496*COEF(2,2,I)))
66500 100   CONTINUE
66600 C*
66700 C*    CALCULATE VARIANCE OF WHITE NOISE PROCESS FOR COEFFICIENTS
66800 C*
66900       DO 110 I=1,NREACH
67000       COEF(3,1,I)=COEF(3,1,I)*COEF(1,1,I)/100.
67100       COEF(3,2,I)=COEF(3,2,I)*COEF(1,2,I)/100.
67200       COEF(4,1,I)=COEF(4,1,I)*COEF(2,1,I)/100.
67300       COEF(4,3,I)=COEF(4,3,I)*COEF(2,3,I)/100.
67400       COEF(4,4,I)=COEF(4,4,I)*COEF(2,4,I)/100.
67500 110   CONTINUE
67600       IF(IOPSUM.NE.0.AND.IOPSUM.NE.2)RETURN
67700 C*
67800 C*    OUTPUT TEMPERATURE CORRECTED WATER QUALITY COEFFICIENTS
67900 C*
68000       WRITE(NW,4600)
68100 4600  FORMAT(1H1,/////,10X,'TEMPERATURE CORRECTED WATER QUALITY ',
68200      *         'COEFFICIENTS',//,18X,'BOD')
68300       WRITE(NW,2900)
68400       WRITE(NW,4700)
68500 4700  FORMAT('+','REACH')
68600       DO 120 I=1,NREACH
68700       WRITE(NW,4800)I,COEF(1,1,I),COEF(3,1,I),COEF(1,2,I),COEF(3,2,I)
68800 4800  FORMAT(1X,I3,2X,2(3X,F6.3,2X,F5.3))
68900 120   CONTINUE
69000       WRITE(NW,4900)
69100 4900  FORMAT(/////,31X,'DO')
69200       WRITE(NW,4300)
69300       WRITE(NW,4700)
69400       DO 130 I=1,NREACH
69500       WRITE(NW,5100)I,COEF(2,1,I),COEF(4,1,I),COEF(2,2,I),COEF(2,3,I),
69600      *              COEF(4,3,I),COEF(2,4,I),COEF(4,4,I)
69700 5100  FORMAT(1X,I3,5X,F6.3,2X,F5.3,3X,F6.3,2(3X,F6.3,2X,F5.3))
69800 130   CONTINUE
69900 C*
70000 C*    CONVERT NOISE STD TO VARIANCE
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70100 C*
70200       DO 140 I=1,NREACH
70300       COEF(3,1,I)=COEF(3,1,I)**2
70400       COEF(3,2,I)=COEF(3,2,I)**2
70500       COEF(4,1,I)=COEF(4,1,I)**2
70600       COEF(4,3,I)=COEF(4,3,I)**2
70700       COEF(4,4,I)=COEF(4,4,I)**2
70800 140   CONTINUE
70900 C*
71000 C*    CONVERT UNITS OF WATER QUALITY COEFFICIENTS TO SEC.
71100 C*
71200       X=86400.
71300       DO 160 IR=1,NREACH
71400       DO 150 I=1,4
71500       COEF(I,1,IR)=COEF(I,1,IR)/X
71600       COEF(I,7,IR)=COEF(I,7,IR)/X
71700 150   CONTINUE
71800       COEF(1,2,IR)=COEF(1,2,IR)/X
71900       COEF(3,2,IR)=COEF(3,2,IR)/X
72000       COEF(2,3,IR)=COEF(2,3,IR)/X
72100       COEF(4,3,IR)=COEF(4,3,IR)/X
72200       COEF(2,4,IR)=COEF(2,4,IR)/X
72300       COEF(4,4,IR)=COEF(4,4,IR)/X
72400 160   CONTINUE
72500       IF(IWTPDF.EQ.1)GO TO 180
72600 C*
72700 C*    READ OUTPUT FILE TITLE FOR MARGINAL AND JOINT PDF
72800 C*
72900       DO 170 I=1,3
73000       READ(NRD,1400)(TITPDF(I,J),J=1,NPOINT)
73100 1400  FORMAT(13A6)
73200 170   CONTINUE
73300 180   CONTINUE
73400       RETURN
73500       END
73600       SUBROUTINE SYSDAT(I,ICONV,IOPECH,TBL1,ZL,NR,NW,IOPGW)
73700       DIMENSION TBL1(10),ZL(12,150)
73800     1 READ(NR,100)(ZL(I,K),K=1,20)
73900   100 FORMAT(A1,F7.0,A4,A2,4A4,A1,F3.0,3F5.0,2F5.4,4F5.0,A1)
74000       IF(IOPECH.NE.1)
74100      *WRITE(NW,2) (ZL(I,K),K=1,20)
74200     2 FORMAT(1H0,2X,A1,1X,F8.2,1X,A4,A2,4A4,2X,A1,2X,F6.2,3(1X,F8.2),6(1
74300      *X,F8.4),2X,A1)
74400       IF(ICONV.NE.1)GO TO 5
74500       ZL(I,2)=ZL(I,2)*1.60934
74600       ZL(I,10)=ZL(I,10)*1.60934
74700       ZL(I,16)=ZL(I,16)*0.3048*(35.31467**ZL(I,17))
74800       ZL(I,18)=ZL(I,18)*0.3048*(10.76391**ZL(I,19))
74900     5 CONTINUE
75000       DO 10 K=1,9
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75100        IF(TBL1(K).EQ.ZL(I,1)) GO TO 12
75200     10 CONTINUE
75300        WRITE(NW,3) ZL(I,1)
75400        WRITE(NW,2)(ZL(I,K),K=1,20)
75500      3 FORMAT(1X36HERROR IN INPUT DATA.  ALPHA CODE OF A1,11H IS ILLEGAL)
75600        STOP
75700     12 ZL(I,1)=K
75800        IF(ICONV.NE.1)GOTO 33
75900        IF(K.EQ.8) GOTO 35
76000        ZL(I,11)=ZL(I,11)*0.028317
76100        GOTO 37
76200     35 ZL(I,11)=ZL(I,11)*0.017595
76300     37 ZL(I,12)=ZL(I,12)*0.017595
76400        IF(ZL(I,13).LT.0.0.AND.IOPGW.EQ.1) GOTO 39
76500        ZL(I,13)=ZL(I,13)*0.017595
76600        GOTO 33
76700     39 ZL(I,13)=ZL(I,13)*0.621376
76800     33 CONTINUE
76900        IF(ZL(I,9).EQ.TBL1(10)) GO TO 15
77000        ZL(I,9)=11.0
77100        GO TO 20
77200     15 ZL(I,9)=10.0
77300     20 IF(ZL(I,20).EQ.TBL1(8)) GO TO 25
77400        ZL(I,20)=0.0
77500        GO TO 30
77600     25 ZL(I,20)=1.0
77700     30 CONTINUE
77800        RETURN
77900        END
78000        SUBROUTINE SUMSYS(NPOINT,ICVO,IOPWRT)
78100        COMMON Q(500),X(500),XID(500),ABAR(500),RBAR(500),VBAR(500)
78200       *,IFLAG(500),NR,NW,TITLE(20),SUBTL(20),ZL(12,150),QL(150),QD(150)
78300       *,QS(100),QG(100),CS(12,100),CG(12,100),G(12,10),IV(12,10),NTD(12)
78400       *,ICODE(12),CODE(12),IPARAM(12),CHW(15,12),Z0(12),Z(12),NTI(12)
78500       *,IFORM(12,50),B(12,50),E(12,50),ET(12,50),C(12),ZJUNC(12),NCON
78600       *,NEND,NREACH,NHDW,NLOAD,NDIRV,NPTL,NRLM,NLDL,NITL,ZD(12,500)
78700       *,COEF(12,7,100),MAXHD,MAXBR,NCOE(12),NCONU(12),CX(12),CTEMP(100)
78800       *,NCOEFL,QEVAP(100),RAVEV(100),RAVED(100),ISOLVE
78900        COMMON/S/ NSEG(15),ISST(15,15),ISED(15,15),IRR(15,15),IJJ(15,15)
79000       *          ,ILL(15,15)
79100        CALL TITL(TITLE,SUBTL,NW)
79200        WRITE(NW,100)
79300    100 FORMAT(1H0,25X,29HSUMMARY OF SYSTEM FLOW LAYOUT/)
79400        WRITE(NW,101)
79500    101 FORMAT(53X,62HLATERAL    LATERAL    MAIN-    MAIN-    MAIN-    MAIN
79600       *-    MAIN-,'    AVE.    AVE.')
79700        WRITE(NW,102)
79800    102 FORMAT(1H ,115HPT. F.   ID    IDENTIFICATION    DISTANCE    INPUT
79900       * SURFACE    GROUND    STREAM    STREAM    STREAM    STREAM    STREAM,
80000       *'   REACH   REACH')
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80100        WRITE(NW,103)
80200    103 FORMAT(1H ,114H          CODE                                    FLOW
80300      * FLOW        FLOW        FLOW      VEL.      AREA      H. RAD.   SLOPE,
80400      *'    VEL.    H.RAD.')
80500        IF(ICVO.EQ.0) GO TO 1
80600        WRITE(NW,104)
80700    104 FORMAT(1H ,105H                                        (MILES)   (CFS)
80800      * (CFS)       (CFS)       (CFS)     (FPS)     (SOF)     (FT),13X,
80900      *'(FPS)    (FT)')
81000        GO TO 2
81100      1 WRITE(NW,105)
81200    105 FORMAT(1H ,105H                                        (KM)      (CMS)
81300      * (CMS)       (CMS)       (CMS)     (MPS)     (SQM)     (M),13X,
81400      *'(MPS)    (M)')
81500      2 CONTINUE
81600        DO 504 IR=1,NREACH
81700        IF(ICVO.EQ.0) GOTO 506
81800        ZD(1,IR)=RAVEV(IR)*3.2808399
81900        ZD(2,IR)=RAVED(IR)*3.2808399
82000        GOTO 504
82100    506 ZD(1,IR)=RAVEV(IR)
82200        ZD(2,IR)=RAVED(IR)
82300    504 CONTINUE
82400        IH=0
82500        NHD=NHDW
82600        IF(IOPWRT.EQ.0) NHD=1
82700        DO 7 IHH=1,NHD
82800        N1=NSEG(IHH)
82900        IF(IOPWRT.EQ.0) N1=1
83000        DO 6 III=1,N1
83100        N2=ISST(IHH,III)
83200        N3=ISED(IHH,III)
83300        IR=IRR(IHH,III)
83400        IJ=IJJ(IHH,III)
83500        IF(IOPWRT.GT.0) GO TO 10
83600        N2=1
83700        N3=NPOINT
83800        IR=0
83900        IJ=0
84000     10 IID1=N2-1
84100        IID2=1
84200        DO 5 IP=N2,N3
84300        IID1=IID1+1
84400     20 IF(IID1.LE.NRLM) GO TO 3
84500        IID1=IID1-NRLM
84600        IID2=IID2+1
84700        GO TO 20
84800      3 CONTINUE
84900        IFL=IFLAG(IP)
85000        IF(ICVO.EQ.0) GO TO 4
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85100        XE=X(IP)*.62137119
85200        QE=Q(IP)* 35.314667
85300        VE=VBAR(IP)*3.2808399
85400        AE=ABAR(IP)*10.763910
85500        RE=RBAR(IP)*3.2808399
85600        COE1=COEF(1,IID2,IID1)*35.314667
85700        COE2=COEF(2,IID2,IID1)*35.314667
85800        COE3=COEF(3,IID2,IID1)*35.314667
85900        COE10=COEF(10,IID2,IID1)*35.314667
86000        COE9=COEF(9,IID2,IID1)
86100        GO TO (200,201,202,203,203,204,206,208,206,5,205),IFL
86200      4 GO TO (300,301,302,303,303,304,306,308,306,5,305),IFL
86300    200 IH=IH+1
86400        IR=IR+1
86500     30 WRITE(NW,106)  IR,IH,ZD(1,IR),ZD(2,IR)
86600    106 FORMAT(1H0 / 1H ,'REACH',I4,5X,'HEADWATER',I3,90X,F7.3,1X,F7.3)
86700     40 WRITE(NW,107) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,QE,COE1,
86800       *COE2,QE,VE,AE,RE,COE9
86900    107 FORMAT(1H ,I3,I2,2X,A4,1X,A2,4A4,F9.2,F11.4,F9.4,F10.4,F11.4,F9.3,
87000       *F9.2,F9.2,F9.5)
87100        GO TO 5
87200    201 IR=IR+1
87300        WRITE(NW,108) IR,ZD(1,IR),ZD(2,IR)
87400   ·108 FORMAT(1H0,'REACH',I4,107X,F7.3,1X,F7.3)
87500        WRITE(NW,109)IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,COE1,COE2
87600       *,QE,VE,AE,RE,COE9
87700    109 FORMAT(1H ,I3,I2,2X,A4,1X,A2,4A4,F9.2,11X,F9.4,F10.4,F11.4,F9.3,F9
87800       *.2,F9.2,F9.5)
87900        GO TO 5
88000    202 IJ=IJ+1
88100        IR=IR+1
88200        WRITE(NW,110) IR,IJ,ZD(1,IR),ZD(2,IR)
88300    110 FORMAT(1H0,'REACH',I4,5X,'JUNCTION',I3,91X,F7.3,1X,F7.3)
88400        WRITE(NW,109) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,COE1,COE
88500       *2,QE,VE,AE,RE,COE9
88600        GO TO 5
88700    203 IF(IFL.EQ.5)COE3=-COE3
88800        WRITE(NW,111) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,COE3,QE,
88900       *VE,AE,RE,COE9
89000    111 FORMAT(1H ,I3,I2,2X,A4,1X,A2,4A4,F9.2,F11.4,19X,F11.4,F9.3,2F9.2,F
89100       *9.5)
89200        GO TO 5
89300    204 WRITE(NW,112) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,QE,VE,AE
89400       *,RE,COE9
89500    112 FORMAT(1H ,I3,I2,2X,A4,1X,A2,4A4,F9.2,30X,F11.4,F9.3,2F9.2,F9.5)
89600        GO TO 5
89700    205 WRITE(NW,113)IP,IFL,XID(IP),XE,QE,VE,AE,RE,COE9
89800    113 FORMAT(1H ,I3,I2,2X,A4,19X,F9.2,30X,F11.4,F9.3,2F9.2,F9.5)
89900        GO TO 5
90000    206 WRITE(NW,114) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,QE
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90100    114 FORMAT(1H ,I3,I2,2X,A4,1X,A2,4A4,F9.2,30X,F11.4)
90200        GO TO 5
90300    208 IR=IR+1
90400        WRITE(NW,550)IR,ZD(1,IR),ZD(2,IR)
90500    550 FORMAT(1H0,'REACH',I4,3X,'EVAPORATION',93X,F7.3,1X,F7.3)
90600        WRITE(NW,107) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),XE,COE10
90700       *,COE1,COE2,QE,VE,AE,RE,COE9
90800        GOTO 5
90900    300 IH=IH+1
91000        IR=IR+1
91100     50 WRITE(NW,106) IR,IH,ZD(1,IR),ZD(2,IR)
91200     60 WRITE(NW,107)IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP), Q(IP)
91300       *,COEF(1,IID2,IID1),COEF(2,IID2,IID1),Q(IP),VBAR(IP),ABAR(IP),RBAR(
91400       *IP),COEF(9,IID2,IID1)
91500        GO TO 5
91600    301 IR=IR+1
91700        WRITE(NW,108) IR,ZD(1,IR),ZD(2,IR)
91800        WRITE(NW,109) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP)
91900       *,COEF(1,IID2,IID1),COEF(2,IID2,IID1),Q(IP),VBAR(IP),ABAR(IP),RBAR(
92000       *IP),COEF(9,IID2,IID1)
92100        GO TO 5
92200    302 IJ=IJ+1
92300        IR=IR+1
92400        WRITE(NW,110) IR,IJ,ZD(1,IR),ZD(2,IR)
92500        WRITE(NW,109) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP)
92600       *,COEF(1,IID2,IID1),COEF(2,IID2,IID1),Q(IP),VBAR(IP),ABAR(IP),RBAR(
92700       *IP),COEF(9,IID2,IID1)
92800        GO TO 5
92900    303 IF(IFL.EQ.5)COEF(3,IID2,IID1)=-COEF(3,IID2,IID1)
93000        WRITE(NW,111)IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP),COEF(3
93100       * ,IID2,IID1),Q(IP),VBAR(IP),ABAR(IP),RBAR(IP),COEF(9,IID2,IID1)
93200        GO TO 5
93300    304 WRITE(NW,112) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP),Q(IP)
93400       *,VBAR(IP),ABAR(IP),RBAR(IP),COEF(9,IID2,IID1)
93500        GO TO 5
93600    305 WRITE(NW,113)IP,IFL,XID(IP),X(IP),Q(IP),VBAR(IP),ABAR(IP),RBAR(IP)
93700       *,COEF(9,IID2,IID1)
93800        GO TO 5
93900    306 WRITE(NW,114) IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP),Q(IP)
94000        GOTO 5
94100    308 IR=IR+1
94200        WRITE(NW,550)IR,ZD(1,IR),ZD(2,IR)
94300        QQQQ=COEF(10,IID2,IID1)
94400        WRITE(NW,107)IP,IFL,XID(IP),(COEF(K,IID2,IID1),K=4,8),X(IP), QQQQ
94500       *,COEF(1,IID2,IID1),COEF(2,IID2,IID1),Q(IP),VBAR(IP),ABAR(IP),RBAR(
94600       *IP),COEF(9,IID2,IID1)
94700      5 CONTINUE
94800      6 CONTINUE
94900      7 CONTINUE
95000        WRITE(NW,502) NPOINT,NREACH,NHDW,NLOAD,NDIRV
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95100      502 FORMAT(1H0,'NPOINT =',I4,5X,'NREACH =',I3,5X,'NHWD =',I3,5X
95200      *          ,'NLOAD =',I3,5X,'NDIRV =',I3)
95300          RETURN
95400          END
95500          SUBROUTINE TITL(T,S,NW)
95600          DIMENSION T(1),S(1)
95700          WRITE(NW,100)(T(I),I=1,20)
95800      100 FORMAT(1H120A4)
95900          WRITE(NW,101)(S(I),I=1,20)
96000      101 FORMAT(1X20A4)
96100          RETURN
96200          END
96300          SUBROUTINE WRPT(L,IP,IW,ICVD)
96400          COMMON Q(500),X(500),XID(500),ABAR(500),RBAR(500),VBAR(500)
96500      *,IFLAG(500),NR,NW,TITLE(20),SUBTL(20),ZL(12,150),QL(150),QD(150)
96600      *,QS(100),QG(100),CS(12,100),CG(12,100),G(12,10),IV(12,10),NTD(12)
96700      *,ICODE(12),CODE(12),IPARAM(12),CHW(15,12),ZO(12),Z(12),NTI(12)
96800      *,IFORM(12,50),B(12,50),E(12,50),ET(12,50),C(12),ZJUNC(12),NCON
96900      *,NEND,NREACH,NHDW,NLOAD,NDIRV,NPTL,NRLM,NLDL,NITL,ZD(12,500)
97000      *,COEF(12,7,100),MAXHD,MAXBR,NCOE(12),NCONU(12),CX(12),CTEMP(100)
97100      *,NCOEFL,QEVAP(100),RAVEV(100),RAVED(100),ISOLVE
97200          IF(IW.NE.0) GO TO 10
97300          IW=1
97400          CALL TITL(TITLE,SUBTL,NW)
97500          WRITE(NW,101)
97600      101 FORMAT(//,33X,'BOD',17X,'DO',11X,'BOD-DO',/,2X,'PNT  DISTANCE',
97700      *          3X,'ID',2(7X,'MEAN',6X,'VAR'),7X,'COV')
97800  10      CONTINUE
97900          DUMX=X(IP)
98000          IF(ICVD.GT.0)DUMX=DUMX*0.62137119
98100          WRITE(NW,102)IP,DUMX,XID(IP),ZD(1,IP),ZD(3,ID),ZD(2,IP),
98200      *             ZD(5,IP),ZD(4,IP)
98300      102 FORMAT(1H0,I4,F10.2,2X,A4,5F10.3)
98400          RETURN
98500          END
98600          SUBROUTINE LINK(IP,IR,QQS,QQG,CS,CG,ABAR,RBAR,COEF)
98700          COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
98800      *          FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
98900      *          X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
99000          COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
99100      *                  VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
99200      *                  RB,B22,XM0(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
99300          DIMENSION QQS(100),QQG(100),CS(12,100),CG(12,100),ABAR(500),
99400      *             RBAR(500),COEF(12,7,100)
99500          QS=QQS(IR)/ABAR(IP)
99600          QG=QQG(IR)/ABAR(IP)
99700          XS1=CS(1,IR)
99800          XG1=CG(1,IR)
99900          XS2=CS(2,IR)
100000         XG2=CG(2,IR)
```

```
100100      RB=RBAR(IP)
100200      B22=COEF(2,2,IR)
100300      XLQ=(QQS(IR)+QQG(IR))/ABAR(IP)
100400      AA(1,1)=-(COEF(1,1,IR)+COEF(1,2,IR)+XLQ)
100500      AA(2,1)=-(COEF(1,1,IR))
100600      AA(2,2)=-(COEF(2,1,IR)+COEF(2,4,IR)/RB+XLQ)
100700      U(1)=COEF(1,7,IR)/RB+QS*XS1+QG*XG1
100800      U(2)=COEF(2,1,IR)*B22+COEF(2,3,IR)+COEF(2,7,IR)/RB+
100900     *      QS*XS2+QG*XG2
101000      VB11=COEF(3,1,IR)
101100      VB12=COEF(3,2,IR)
101200      VL1=COEF(3,7,IR)
101300      VXS1=CS(3,IR)
101400      VXG1=CG(3,IR)
101500      VB21=COEF(4,1,IR)
101600      VB23=COEF(4,3,IR)
101700      VB24=COEF(4,4,IR)
101800      VL2=COEF(4,7,IR)
101900      VXS2=CS(4,IR)
102000      VXG2=CG(4,IR)
102100      C1=VL1/(RB**2)+(QS**2)*VXS1+(QG**2)*VXG1
102200      P=SQRT(C1/(VB11+VB12))
102300      RETURN
102400      END
102500      SUBROUTINE PDF(TIME,XLF,XLFXX,SX2GRD,Z0,DTMAX,IPZ,NW)
102600      COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
102700     *       FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
102800     *       X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
102900      COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
103000     *                VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
103100     *                RB,B22,XMO(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
103200      DIMENSION A(201),B(201),C(201,201),D(201),E(201,201),
103300     *          G(201,201),H(201,201),XLF(201,201),XLFT1(201),
103400     *          XLFT2(201,201),CR1(201) ,
103500     *          CR2(201),CR3(201),CS1(201,201),CS2(201,201),
103600     *          CS3(201,201),DUM1(201),DUM2(201),DUM3(201),A1(201),
103700     *          A2(201),A3(201,201),A4(201,201),RHS(201),
103800     *          SX2GRD(201,201),XLFXX(201,201),X2SGRD(201,201),Z0(12)
103900      XX2(X,Y)=X+(VB11/(VB11+VB12))*(Y-P*ATAN(Y/P))
104000      IF(TIME.GT.(2.*DTMAX))GO TO 10
104100      NT=1
104200      DT=TIME/2.
104300      GO TO 20
104400 10   CONTINUE
104500      NT=INT(TIME/(2.*DTMAX)+1.)
104600      DT=TIME/FLOAT(2.*NT)
104700 20   CONTINUE
104800 C*
104900 C*   DEFINE SOME VARIABLES
105000 C*
```

```
105100        CALL TERMS
105200 C*
105300 C*     SET UP A,B,C,D,F,G,H MATRIX
105400 C*
105500        F=VB11+VB12+VB21+VB24/(RB**2)-AA(1,1)-AA(2,2)
105600        A5=F*DT
105700        DO 210 I=1,NR
105800        X1=R(I)
105900        A(I)=((X1**2)*(VB11+VB12)+VL1/(RB**2)+(QS**2)*VXS1+(QG**2)
106000      *                                              *VXG1)/2.
106100        B(I)=((X1**2)*VB11)/2.
106200        D(I)=2.*X1*(VB11+VB12)-(X1*AA(1,1)+U(1))
106300        A1(I)=DT*D(I)/(2.*DR)
106400        A2(I)=DT*A(I)/(DR**2)
106500 210    CONTINUE
106600        DO 230 J=1,NS
106700        Y1=S(J)
106800        DO 220 I=1,NR
106900        X1=R(I)
107000        Z2=XX2(Y1,X1)
107100        C(I,J)=((X1**2)*VB11+((-Z2+B22)**2)*VB21+(Z2**2)*VB24/(RB**2)+
107200      *         VL2/(RB**2)+(QS**2)*VXS2+(QG**2)*VXG2+VB23)/2.
107300        E(I,J)=2.*((Z2-B22)*VB21+Z2*VB24/(RB**2)+X1*VB11)
107400      *        -(X1*AA(2,1)+Z2*AA(2,2)+U(2))
107500        G(I,J)=(-(B(I)**2)/A(I))+C(I,J)
107600        H(I,J)=(X1/A(I))*(B(I)*(VB11+VB12)-A(I)*VB11)-D(I)*B(I)/A(I)
107700      *        +E(I,J)
107800        A3(I,J)=DT*H(I,J)/(2.*DS)
107900        A4(I,J)=DT*G(I,J)/(DS**2)
108000 220    CONTINUE
108100 230    CONTINUE
108200 C*
108300 C*     SET UP COEFFICIENT VECTORS FOR WHEN IMPLICIT IN R
108400 C*
108500        DO 240 I=2,NRM1
108600        CR1(I)=A1(I)-A2(I)
108700        CR2(I)=1.+2.*A2(I)
108800        CR3(I)=-A1(I)-A2(I)
108900 240    CONTINUE
109000 C*
109100 C*     SET UP COEFFICIENT VECTORS FOR WHEN IMPLICIT IN S
109200 C*
109300        DO 260 J=2,NSM1
109400        DO 250 I=2,NRM1
109500        CS1(I,J)=A3(I,J)-A4(I,J)
109600        CS2(I,J)=1.+2.*A4(I,J)
109700        CS3(I,J)=-A3(I,J)-A4(I,J)
109800 250    CONTINUE
109900 260    CONTINUE
110000 C*
```

```
110100 C*    LOOP ON TIME
110200 C*
110300       DO 410 IT=1,NT
110400 C*
110500 C*    FIRST  IMPLICIT IN R SO LOOP ON S
110600 C*
110700       DO 290 J=2,NSM1
110800       JM1=J-1
110900       JP1=J+1
111000 C*
111100 C*    SET UP RHS
111200 C*
111300       DO 270 I=2,NRM1
111400       RHS(I)=XLF(I,JM1)*(-A3(I,J)+A4(I,J))+
111500      *       XLF(I,J)*(1.0-2.0*A4(I,J)+A5)+
111600      *       XLF(I,JP1)*(A3(I,J)+A4(I,J))
111700 270   CONTINUE
111800       RHS(2)=RHS(2)-XLF(1,J)*(A1(2)-A2(2))
111900       RHS(NRM1)=RHS(NRM1)-XLF(NR,J)*(-A1(NRM1)-A2(NRM1))
112000 C*
112100 C*    SOLVE FOR XLF AT NEXT TIME
112200 C*
112300       CALL TRIDAG(2,NRM1,CR1,CR2,CR3,RHS,XLFT1)
112400       DO 280 I=2,NRM1
112500       XLFT2(I,J)=XLFT1(I)
112600       IF(XLFT2(I,J).LE.1.E-9)XLFT2(I,J)=0.
112700 280   CONTINUE
112800 290   CONTINUE
112900       DO 300 J=2,NSM1
113000       DO 300 I=2,NRM1
113100       XLF(I,J)=XLFT2(I,J)
113200 300   CONTINUE
113300       CALL MOMENT
113400 C*
113500 C*    NOW IMPLICIT IN S SO LOOP ON R
113600 C*
113700       DO 330 I=2,NRM1
113800       IM1=I-1
113900       IP1=I+1
114000 C*
114100 C*    SET UP RHS AND FILL DUMMY COEFFICIENT VECTORS
114200 C*
114300       DO 310 J=2,NSM1
114400       RHS(J)=XLF(IM1,J)*(-A1(I)+A2(I))+
114500      *       XLF(I,J)*(1.-2.*A2(I)+A5)+
114600      *       XLF(IP1,J)*(A1(I)+A2(I))
114700       DUM1(J)=CS1(I,J)
114800       DUM2(J)=CS2(I,J)
114900       DUM3(J)=CS3(I,J)
115000 310   CONTINUE
```

```
115100      RHS(2)=RHS(2)-XLF(I,1)*CS1(I,2)
115200      RHS(NSM1)=RHS(NSM1)-XLF(I,NS)*CS3(I,NSM1)
115300 C*
115400 C*   SOLVE OF XLF AT NEXT TIME
115500 C*
115600      CALL TRIDAG(2,NSM1,DUM1,DUM2,DUM3,RHS,XLFT1)
115700      DO 320 J=2,NSM1
115800      XLFT2(I,J)=XLFT1(J)
115900      IF(XLFT2(I,J).LE.1.E-9)XLFT2(I,J)=0.
116000 320  CONTINUE
116100 330  CONTINUE
116200      DO 340 J=2,NSM1
116300      DO 340 I=2,NRM1
116400      XLF(I,J)=XLFT2(I,J)
116500 340  CONTINUE
116600      CALL MOMENT
116700 410  CONTINUE
116800 C*
116900 C*   CALL OUTPUT ROUTINES
117000 C*
117100      CALL CONVRT(SX2GRD,XLF,XLFXX,X2,NR,NS,NR)
117200      CALL STAT(XLF,XLFXX,IPZ,NW)
117300      DO 440 I=1,5
117400      ZO(I)=XMO(I)
117500 440  CONTINUE
117600      RETURN
117700      END
117800      SUBROUTINE INITCO(XLF,XLFXX,SX2GRD,ZO,NW)
117900      COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
118000     *       FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
118100     *       X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
118200      COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
118300     *               VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
118400     *               RB,B22,XMO(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
118500      DIMENSION XLF(201,201),XLFXX(201,201),SX2GRD(201,201),ZO(12)
118600      STOX2(Z2,Z1)=Z2+(VB11/(VB11+VB12))*(Z1-P*ATAN(Z1/P))
118700      X1MEAN=XMO(1)
118800      X1STD=SQRT(XMO(3))
118900      X2MEAN=XMO(2)
119000      X2STD=SQRT(XMO(5))
119100      COVX=XMO(4)
119200      DO 10 J=1,NS
119300      DO 10 I=1,NR
119400      XLF(I,J)=0.
119500      XLFXX(I,J)=0.
119600 10   CONTINUE
119700      TOT=0.
119800      ROWSQ=(COVX/(X1STD*X2STD))**2
119900      DUM1=1./(2.*3.141592653589*X1STD*X2STD*SQRT(1.-ROWSQ))
120000      DUM2=-1./(2.*(1.-ROWSQ))
```

```
120100        DUM3=2.*SQRT(ROWSQ)
120200        DO 30 J=2,NSM1
120300        DO 20 I=2,NRM1
120400        TX2=STOX2(S(J),R(I))
120500        TERM2=(TX2-X2MEAN)/X2STD
120600        TERM3=TERM2*TERM2
120700        TERM1=(R(I)-X1MEAN)/X1STD
120800        XLF(I,J)=DUM1*(EXP(DUM2*(TERM1*TERM1-DUM3*TERM1*TERM2+TERM3)))
120900        IF(XLF(I,J).LE.1.E-12)XLF(I,J)=0.
121000 20     CONTINUE
121100 30     CONTINUE
121200        DO 40 J=1,NS
121300        DO 40 I=1,NR
121400        SX26RD(I,J)=STOX2(S(J),R(I))
121500 40     CONTINUE
121600        DO 50 I=1,5
121700        Z0(I)=XM0(I)
121800 50     CONTINUE
121900        DO 70 J=1,NR
122000        TERM2=(X2(J)-X2MEAN)/X2STD
122100        TERM3=TERM2*TERM2
122200        DO 60 I=1,NR
122300        TERM1=(R(I)-X1MEAN)/X1STD
122400        XLFXX(I,J)=DUM1*(EXP(DUM2*(TERM1*TERM1-DUM3*TERM1*TERM2+TERM3)))
122500        IF(XLFXX(I,J).LE.1.E-12)XLFXX(I,J)=0.
122600 60     CONTINUE
122700 70     CONTINUE
122800        CALL STAT(XLF,XLFXX,0,NW)
122900        RETURN
123000        END
123100        SUBROUTINE DTABLE(X,Y,TABLE,N,M)
123200        DIMENSION X(201),Y(201),TABLE(201,201)
123300 C*
123400 C*     DTABLE COMPUTES THE FINITE DIVIDED DIFFERENCES OF
123500 C*     Y(1)...Y(N) FOR ALL THE ORDERS M OR LESS AND STORES THEM
123600 C*     IN THE LOWER TRIANGULAR PORTION OF THE FIRST M COLUMNS OF
123700 C*     THE FIRST N-1 ROWS OF THE MATRIX TABLE.
123800 C*
123900 C*
124000 C*     CALCULATE FIRST ORDER DIFFERENCES
124100 C*
124200        NM1=N-1
124300        DO 10 I=1,NM1
124400        TABLE(I,1)=(Y(I+1)-Y(I))/(X(I+1)-X(I))
124500 10     CONTINUE
124600        IF(M.LE.1)RETURN
124700 C*
124800 C*     CALCULATE HIGHER ORDER DIFFERENCES
124900 C*
125000        DO 20 J=2,M
```

```
125100          DO 20 I=J,NM1
125200          ISUM=I+1-J
125300          TABLE(I,J)=(TABLE(I,J-1)-TABLE(I-1,J-1))/(X(I+1)-X(ISUM))
125400 20       CONTINUE
125500          RETURN
125600          END
125700          FUNCTION FNEWT(X,Y,TABLE,N,M,IDEG,XARG)
125800          DIMENSION X(201),Y(201),TABLE(201,201)
125900 C*
126000 C*       FNEWT ASSUMES THAT X(1)...X(N) ARE IN ASCENDING ORDER AND FIRST
126100 C*       SCANS THE X VECTOR TO DETERMIN WHICH ELEMENT IS NEAREST (.GE.)
126200 C*       THE INTERPOLATION ARGUMENT, XARG.  THE IDEG+1 BASE POINTS NEEDED
126300 C*       FOR THE EVALUATION OF THE DIVIDED-DIFFERENCE POLYNOMIAL OF
126400 C*       DEGREE IDEG+1 ARE THEN CENTERED ABOUT THE CHOSEN ELEMENT WITH
126500 C*       THE LARGEST HAVING THE SUBSCRIPT MAX.  IT IS ASSUMED THE THE
126600 C*       FIRST M DIVIDED DIFFERENCES HAVE BEEN COMPUTED BY THE
126700 C*       SUBROUTINE DTABLE AND ARE ALREADY PRESENT IN THE MATRIX TABLE.
126800 C*       MAX IS CHECKED TO INSURE THAT ALL REQUIRED BASE POINTS ARE
126900 C*       AVAILABLE, AND THE INTERPOLANT VALUE IS COMPUTED USING
127000 C*       NESTED POLYNOMIAL EVALUATION.  THE INTERPOLANT IS RETURNED
127100 C*       AS THE VALUE OF THE FUNCTION.
127200 C*
127300 C*
127400 C*       SEARCH X VECTOR FOR ELEMENT .GE. XARG
127500 C*
127600          IF(XARG.GT.X(1).AND.XARG.LT.X(N))GO TO 5
127700          FNEWT=0.
127800          RETURN
127900 5        CONTINUE
128000          DO 10 I=1,N
128100          II=I
128200          IF(I.EQ.N.OR.XARG.LE.X(I))GO TO 20
128300 10       CONTINUE
128400 20       CONTINUE
128500          MAX=II+IDEG/2
128600 C*
128700 C*       INSURE THAT ALL REQUIRED DIFFERENCES ARE IN TABLE
128800 C*
128900          IF(MAX.LE.IDEG)MAX=IDEG+1
129000          IF(MAX.GT.N)MAX=N
129100 C*
129200 C*       COMPUTE INTERPOLANT VALUE
129300 C*
129400          YEST=TABLE(MAX-1,IDEG)
129500          IF(IDEG.LE.1)GO TO 40
129600          IDEGM1=IDEG-1
129700          DO 30 I=1,IDEGM1
129800          ISUB1=MAX-I
129900          ISUB2=IDEG-I
130000          YEST=YEST*(XARG-X(ISUB1))+TABLE(ISUB1-1,ISUB2)
```

```
130100 30    CONTINUE
130200 40    CONTINUE
130300       ISUB1=MAX-IDEG
130400       FNEWT=YEST*(XARG-X(ISUB1))+Y(ISUB1)
130500       RETURN
130600       END
130700       SUBROUTINE TRIDAG(IF,L,A,B,C,D,V)
130800       DIMENSION A(201),B(201),C(201),D(201),V(201),BETA(202),GAMMA(202)
130900 C*
131000 C*    SUBROUTINE FOR SOLVING A SYSTEM OF LINEAR SIMULTANOUS
131100 C*    EQUATIONS HAVING A TRIDIAGONAL COEFFICIENT MATRIX.
131200 C*    THE EQUATIONS ARE NUMBERED IF THROUGH L, AND THEIR
131300 C*    SUB-DIAFGONAL, DIAGONAL, AND SUPER-DIAGONAL COEFFICIENTS
131400 C*    ARE STORED IN THE ARRAYS A,B,AND C.  THE RIGHT HAND
131500 C*    SIDE IS STORED IN ARRAY D.  THE COMPUTED SOLUTION VECTOR
131600 C*    V(IF)....V(L) IS STORED IN ARRAY V.
131700 C*
131800 C*
131900 C*    COMPUTE INTERMEDIATE ARRAYS BETA AND GAMMA
132000 C*
132100       BETA(IF)=B(IF)
132200       GAMMA(IF)=D(IF)/BETA(IF)
132300       IFP1=IF+1
132400       DO 10 I=IFP1,L
132500       IM1=I-1
132600       BETA(I)=B(I)-A(I)*C(IM1)/BETA(IM1)
132700       GAMMA(I)=(D(I)-A(I)*GAMMA(IM1))/BETA(I)
132800 10    CONTINUE
132900 C*
133000 C*    COMPUTE FINAL SOLUTION VECTOR V
133100 C*
133200       V(L)=GAMMA(L)
133300       LAST=L-IF
133400       DO 20 K=1,LAST
133500       I=L-K
133600       V(I)=GAMMA(I)-C(I)*V(I+1)/BETA(I)
133700 20    CONTINUE
133800       RETURN
133900       END
134000       SUBROUTINE CONVRT(GRD,XLF1,XLF2,Z,NR,N1,N2)
134100       DIMENSION GRD(201,201),XLF1(201,201),XLF2(201,201),Z(201)
134200       DIMENSION DUMGRD(201),DUMXLF(201),TABLE(201,201)
134300       DO 30 I=1,NR
134400       DO 10 J=1,N1
134500       DUMGRD(J)=GRD(I,J)
134600       DUMXLF(J)=XLF1(I,J)
134700 10    CONTINUE
134800 C*
134900 C*    CALCULATE DIVIDED DIFFERENCES
135000 C*
```

```
135100       N=10
135200       IF(N.GE.N1)N=N1-1
135300       CALL DTABLE(DUMGRD,DUMXLF,TABLE,N1,M)
135400 C*
135500 C*    DETERMINE XLF2 AT Z VALUES BY INTERPOLATION USING
135600 C*    FUNCTION FNEWT
135700       DO 20 J=1,N2
135800       XLF2(I,J)=FNEWT(DUMGRD,DUMXLF,TABLE,N1,M,N,Z(J))
135900       IF(XLF2(I,J).LE.1.E-12)XLF2(I,J)=0.
136000 20    CONTINUE
136100 30    CONTINUE
136200       RETURN
136300       END
136400       SUBROUTINE TERMS
136500       COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
136600      *               VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
136700      *               RB,B22,XM0(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
136800       TERM(1)=2.*AA(1,1)
136900       TERM(2)=VB11+VB12
137000       TERM(3)=VL1/(RB**2)+(QS**2)*VXS1+(QG**2)*VXG1
137100       TERM(4)=AA(2,2)+AA(1,1)
137200       TERM(5)=2.*AA(2,1)
137300       TERM(6)=2.*AA(2,2)
137400       TERM(7)=VB21+VB24/(RB**2)
137500       TERM(8)=2.*B22*VB21
137600       TERM(9)=(B22**2)*VB21+VB23+VL2/(RB**2)+(QS**2)*VXS2
137700      *                                    +(QG**2)*VXG2
137800       RETURN
137900       END
138000       SUBROUTINE MOMENT
138100       COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
138200      *               VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
138300      *               RB,B22,XM0(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
138400       REAL K
138500       DIMENSION K(5,4)
138600       DO 10 I=1,5
138700       XM(I)=XM0(I)
138800 10    CONTINUE
138900       CALL DRV
139000       DO 20 I=1,5
139100       K(I,1)=DT*DXM(I)
139200       XM(I)=XM0(I)+K(I,1)/2.
139300 20    CONTINUE
139400       CALL DRV
139500       DO 30 I=1,5
139600       K(I,2)=DT*DXM(I)
139700       XM(I)=XM0(I)+K(I,2)/2.
139800 30    CONTINUE
139900       CALL DRV
140000       DO 40 I=1,5
```

```
140100        K(I,3)=DT*DXM(I)
140200        XM(I)=XMO(I)+K(I,3)
140300 40     CONTINUE
140400        CALL DRV
140500        DO 50 I=1,5
140600        K(I,4)=DT*DXM(I)
140700        XMO(I)=XMO(I)+(K(I,1)+2.*(K(I,2)+K(I,3))+K(I,4))/6.
140800 50     CONTINUE
140900        RETURN
141000        END
141100        SUBROUTINE DRV
141200        COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
141300       *                VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
141400       *                RB,B22,XMO(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
141500        TERM10=XM(3)+XM(1)**2
141600        DXM(1)=AA(1,1)*XM(1)+U(1)
141700        DXM(2)=AA(2,1)*XM(1)+AA(2,2)*XM(2)+U(2)
141800        DXM(3)=TERM(1)*XM(3)+TERM(2)*TERM10+TERM(3)
141900        DXM(4)=AA(2,1)*XM(3)+TERM(4)*XM(4)+VB11*TERM10
142000        DXM(5)=TERM(5)*XM(4)+TERM(6)*XM(5)+VB11*TERM10
142100       *       +TERM(7)*(XM(5)+XM(2)**2)-TERM(8)*XM(2)+TERM(9)
142200        RETURN
142300        END
142400        SUBROUTINE STAT(XLF,XLFXX,IPZ,NW)
142500        COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
142600       *       FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
142700       *       X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
142800        COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
142900       *                VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
143000       *                RB,B22,XMO(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
143100        DIMENSION XLF(201,201),XLFXX(201,201)
143200        II=IPZ+1
143300        WRITE(NW,2000)II
143400 2000   FORMAT(1H1,///,1X,'MARGINAL DENSITY AT POINT ',I3)
143500        SX1=0.
143600        SX2=0.
143700        SSQX1=0.
143800        SSQX2=0.
143900        TOTX1=0.
144000        TOTX2=0.
144100        DO 20 I=1,NR
144200        FMX1(I)=0.
144300        DO 10 J=1,NRM1
144400        FMX1(I)=FMX1(I)+(XLFXX(I,J)+XLFXX(I,J+1))*DX2/2.
144500 10     CONTINUE
144600 20     CONTINUE
144700        DO 40 J=1,NR
144800        FMX2(J)=0.
144900        DO 30 I=1,NRM1
145000        FMX2(J)=FMX2(J)+(XLFXX(I,J)+XLFXX(I+1,J))*DR/2.
```

```
145100 30      CONTINUE
145200 40      CONTINUE
145300         DO 50 I=1,NRM1
145400         IP1=I+1
145500         VX1=VAL(R(I),FMX1(I),FMX1(IP1),DR)
145600         VX2=VAL(X2(I),FMX2(I),FMX2(IP1),DX2)
145700         DUMX1=(FMX1(I)+FMX1(IP1))*DR/2.
145800         DUMX2=(FMX2(I)+FMX2(IP1))*DX2/2.
145900         SX1=SX1+VX1*DUMX1
146000         SX2=SX2+VX2*DUMX2
146100         SSQX1=SSQX1+(VX1**2)*DUMX1
146200         SSQX2=SSQX2+(VX2**2)*DUMX2
146300         TOTX1=TOTX1+DUMX1
146400         TOTX2=TOTX2+DUMX2
146500 50      CONTINUE
146600         X1MEAN=SX1/TOTX1
146700         X2MEAN=SX2/TOTX2
146800         X1VAR=SSQX1/TOTX1-X1MEAN**2
146900         X2VAR=SSQX2/TOTX2-X2MEAN**2
147000         CALL COV(XLFXX)
147100         DO 70 J=1,NS
147200         FMS(J)=0.
147300         DO 60 I=1,NRM1
147400         FMS(J)=FMS(J)+(XLF(I,J)+XLF(I+1,J))*DR/2.
147500 60      CONTINUE
147600 70      CONTINUE
147700         TOTS=0.
147800         DO 80 J=1,NSM1
147900         TOTS=TOTS+(FMS(J)+FMS(J+1))*DS/2.
148000 80      CONTINUE
148100         CALL OUT(NW)
148200         WRITE(6,2100)XMO(1),X1MEAN,XMO(3),X1VAR,XMO(2),X2MEAN,XMO(5),
148300       *                X2VAR,XMO(4),COVX
148400 2100   FORMAT(//,16X,'MOMENT',/,15X,'EQUATIONS',5X,'PDF',/,1X,'X1 MEAN',
148500       *       7X,2(F8.4,3X),/,1X,'X1 VARIANCE',3X,2(F8.4,3X),/,1X,
148600       *       'X2 MEAN',7X,2(F8.4,3X),/,1X,'X2 VARIANCE',3X,2(F8.4,3X),
148700       *       /,1X,'COV(X1,X2)',4X,2(F8.4,3X),//)
148800         IF(IUTPDF.NE.1)CALL WRTPDF(II,XLFXX)
148900         RETURN
149000         END
149100         SUBROUTINE COV(XLFXX)
149200         COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
149300       *       FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
149400       *       X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IUTPDF
149500         COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
149600       *                 VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
149700       *                 RB,B22,XMO(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
149800         DIMENSION XLFXX(201,201)
149900         COVX=0.
150000         DUM=DR*DX2/4.
```

```
150100        DO 20 J=1,NRM1
150200        JP1=J+1
150300        DO 10 I=1,NRM1
150400        IP1=I+1
150500        VX1=(VAL(R(I),XLFXX(I,J),XLFXX(IP1,J),DR)+
150600       *      VAL(R(I),XLFXX(I,JP1),XLFXX(IP1,JP1),DR))/2.-X1MEAN
150700        VX2=(VAL(X2(J),XLFXX(I,J),XLFXX(I,JP1),DX2)+
150800       *      VAL(X2(J),XLFXX(IP1,J),XLFXX(IP1,JP1),DX2))/2.-X2MEAN
150900        COVX=COVX+VX1*VX2*DUM*(XLFXX(I,J)+XLFXX(IP1,J)+XLFXX(I,JP1)
151000       *                                        +XLFXX(IP1,JP1))
151100 10     CONTINUE
151200 20     CONTINUE
151300        RETURN
151400        END
151500        FUNCTION VAL(X,A,B,D)
151600        IF(A.NE.B)GO TO 10
151700        VAL=X+D/2.
151800        RETURN
151900 10     CONTINUE
152000        TERM=SQRT(8.*(A**2+B**2))
152100        VAL=X+(-4.*A+TERM)/((4.*(B-A))/D)
152200        RETURN
152300        END
152400        SUBROUTINE LOAD(ZQ,ZQB,X1LMEN,X2LMEN,X1LVAR,COVL,X2LVAR,
152500       *                XLF,XLFXX,SX2GRD,ZO)
152600        COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
152700       *       FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
152800       *       X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
152900        COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
153000       *                VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
153100       *                RB,B22,XMO(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
153200        DIMENSION XLF(201,201),XLFXX(201,201),SX2GRD(201,201),ZO(12)
153300        DIMENSION XLFL(201,201),TR(201),TX2(201),X2SGRD(201,201)
153400        DIMENSION Z(15),W(15)
153500        DATA Z/0.,.201194094,-.201194094,.394151347,-.394151347,
153600       *          .570972173,-.570972173,.724417731,-.724417731,
153700       *          .848206583,-.848206583,.937273392,-.937273392,
153800       *          .987992518,-.987992518/
153900        DATA W/.202578242,.198431485,.198431485,.186161000,.186161000,
154000       *       .166269206,.166269206,.139570678,.139570678,.107159220,
154100       *       .107159220,.070366047,.070366047,.030753242,.030753242/
154200        X2TOS(Z2,Z1)=Z2-(VB11/(VB11+VB12))*(Z1-P*ATAN(Z1/P))
154300        STOX2(Z2,Z1)=Z2+(VB11/(VB11+VB12))*(Z1-P*ATAN(Z1/P))
154400        QA=(ZQ-ZQB)/ZQ
154500        QB=ZQB/ZQ
154600        X1LSTD=SQRT(X1LVAR)
154700        X2LSTD=SQRT(X2LVAR)
154800        GRDSCL=9.
154900        TDR=DR
155000        TDX2=DX2
```

```
155100       DO 10 I=1,NR
155200       TR(I)=R(I)
155300       TX2(I)=X2(I)
155400 10    CONTINUE
155500       XMO(1)=QA*XMO(1)+QB*X1LMEN
155600       XMO(2)=QA*XMO(2)+QB*X2LMEN
155700       XMO(3)=QA**2*XMO(3)+(QB*X1LSTD)**2
155800       XMO(4)=QA**2*XMO(4)+QB**2*COVL
155900       XMO(5)=QA**2*XMO(5)+(QB*X2LSTD)**2
156000       DO 20 J=1,NR
156100       DO 20 I=1,NR
156200       XLF(I,J)=0.
156300 20    CONTINUE
156400       RMIN=INT(XMO(1)-GRDSCL*SQRT(XMO(3))+.5)
156500       RMAX=INT(XMO(1)+GRDSCL*SQRT(XMO(3))+.5)
156600       DR=(RMAX-RMIN)/FLOAT(NRM1)
156700       X2MIN=INT(XMO(2)-GRDSCL*SQRT(XMO(5))+.5)
156800       X2MAX=INT(XMO(2)+GRDSCL*SQRT(XMO(5))+.5)
156900       DX2=(X2MAX-X2MIN)/FLOAT(NRM1)
157000       R(1)=RMIN
157100       X2(1)=X2MIN
157200       DO 30 I=2,NR
157300       IM1=I-1
157400       R(I)=R(IM1)+DR
157500       X2(I)=X2(IM1)+DX2
157600 30    CONTINUE
157700       SMIN=INT(X2TOS(X2MIN,RMAX)-.5)
157800       SMAX=INT(X2TOS(X2MAX,RMIN)+.5)
157900       DS=(SMAX-SMIN)/FLOAT(NSM1)
158000       S(1)=SMIN
158100       DO 40 I=2,NS
158200       S(I)=S(I-1)+DS
158300 40    CONTINUE
158400       DO 50 J=1,NS
158500       DO 50 I=1,NR
158600       SX2GRD(I,J)=STOX2(S(J),R(I))
158700 50    CONTINUE
158800       ROWSQ=(COVL/(X1LSTD*X2LSTD))**2
158900       DUM1=1./(2.*3.141592653589*X1LSTD*X2LSTD*SQRT(1.-ROWSQ))
159000       DUM2=-1./(2.*(1.-ROWSQ))
159100       DUM3=2.*SQRT(ROWSQ)
159200       AI1=INT(X2LMEN-6.7*X2LSTD+.5)
159300       BI1=INT(X2LMEN+6.7*X2LSTD+.5)
159400       AI2=INT(X1LMEN-6.7*X1LSTD+.5)
159500       BI2=INT(X1LMEN+6.7*X1LSTD+.5)
159600       DO 140 IY2=2,NRM1
159700       Y2=X2(IY2)
159800       DO 130 JJ=1,15
159900       X4=(Z(JJ)*(BI1-AI1)+BI1+AI1)/2.
160000       C2=(Y2-QB*X4)/QA
```

```
160100        IF(C2.LE.TX2(2).OR.C2.GE.TX2(NRM1))GO TO 130
160200        J=(C2-TX2(1))/TDX2+1.
160300        JP1=J+1
160400        BETA=(C2-TX2(J))/(TX2(JP1)-TX2(J))
160500        OMB=1.-BETA
160600        TERM2=(X4-X2LMEN)/X2LSTD
160700        TERM3=TERM2*TERM2
160800        DO 120 IY1=2,NRM1
160900        Y1=R(IY1)
161000        DO 110 II=1,15
161100        X3=(Z(II)*(BI2-AI2)+BI2+AI2)/2.
161200        C1=(Y1-QB*X3)/QA
161300        I=(C1-TR(1))/TDR+1.
161400        IF(XLFXX(I,J).LE.1.E-12)GO TO 110
161500        IP1=I+1
161600        ALPHA=(C1-TR(I))/(TR(IP1)-TR(I))
161700        OMA=1.-ALPHA
161800        TERM1=(X3-X1LMEN)/X1LSTD
161900        FX3X4=DUM1*(EXP(DUM2*(TERM1*TERM1-DUM3*TERM1*TERM2+TERM3)))
162000        IF(FX3X4.LE.1.E-12)GO TO 110
162100        XLF(IY1,IY2)=XLF(IY1,IY2)+W(II)*W(JJ)*FX3X4*
162200       *           (OMA*OMB*XLFXX(I,J)+BETA*OMA*XLFXX(I,JP1)+
162300       *           ALPHA*OMB*XLFXX(IP1,J)+ALPHA*BETA*XLFXX(IP1,JP1))
162400 110    CONTINUE
162500 120    CONTINUE
162600 130    CONTINUE
162700 140    CONTINUE
162800        XMULT=((BI1-AI1)*(BI2-AI2))/(4.*QA**2)
162900        DO 150 J=1,NR
163000        DO 150 I=1,NR
163100        XLFXX(I,J)=XLF(I,J)*XMULT
163200        X2SGRD(I,J)=X2TOS(X2(J),R(I))
163300 150    CONTINUE
163400        CALL CONVRT(X2SGRD,XLFXX,XLF,S,NR,NR,NS)
163500        DO 160 I=1,5
163600        Z0(I)=XMO(I)
163700 160    CONTINUE
163800        RETURN
163900        END
164000        SUBROUTINE OUT(NW)
164100        COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
164200       *        FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
164300       *        X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
164400        WRITE(NW,2100)
164500 2100   FORMAT(//,3X,'BOD',7X,'PDF',10X,'DO',7X,'PDF',10X,'S',8X,'PDF')
164600        N=NR
164700        IF(NR.GT.NS)N=NS
164800        DO 10 I=1,N
164900        WRITE(NW,2200)R(I),FMX1(I),X2(I),FMX2(I),S(I),FMS(I)
165000 2200   FORMAT(1X,3(F7.3,2X,F9.6,4X))
```

```
165100 10     CONTINUE
165200        IF(N.NE.NR)GO TO 40
165300        WRITE(NW,2300)TOTX1,TOTX2
165400 2300   FORMAT(5X,2('TOT',2X,F6.3,11X))
165500        IF(N.NE.NS)GO TO 20
165600        WRITE(NW,2400)TOTS
165700 2400   FORMAT('+',48X,'TOT',2X,F6.3)
165800        RETURN
165900 20     CONTINUE
166000        ISTRT=N+1
166100        IEND=NS
166200        DO 30 I=ISTRT,IEND
166300        WRITE(NW,2500)S(I),FMS(I)
166400 2500   FORMAT('+',44X,F7.3,2X,F9.6)
166500        WRITE(NW,2600)
166600 2600   FORMAT(' ')
166700 30     CONTINUE
166800        WRITE(NW,2400)TOTS
166900        RETURN
167000 40     CONTINUE
167100        WRITE(NW,2600)
167200        WRITE(NW,2400)TOTS
167300        ISTRT=N+1
167400        IEND=NR
167500        DO 50 I=ISTRT,IEND
167600        WRITE(NW,2700)R(I),FMX1(I),X2(I),FMX2(I)
167700 2700   FORMAT('+',2(F7.3,2X,F9.6,4X))
167800        WRITE(NW,2600)
167900 50     CONTINUE
168000        WRITE(NW,2300)TOTX1,TOTX2
168100        RETURN
168200        END
168300        SUBROUTINE WRTPDF(II,XLFXX)
168400        COMMON /PDF/ NR,NRM1,DR,R(201),NS,NSM1,DS,S(201),DX2,X2(201),
168500       *        FMX1(201),FMX2(201),FMS(201),P,X1MEAN,X1STD,X2MEAN,X2STD,
168600       *        X1VAR,TOTX1,X2VAR,TOTX2,COVX,TOTS,IRPLT,ISPLT,IWTPDF
168700        COMMON /MOMENT/ DT,AA(2,2),U(2),VB11,VB12,VL1,VXS1,VXG1,VB21,
168800       *                VB24,VL2,VXS2,VXG2,VB23,QS,QG,XS1,XG1,XS2,XG2,
168900       *                RB,B22,XM0(5),XM(5),DXM(5),TERM(9),TITPDF(3,100)
169000        DIMENSION XLFXX(201,201),T(1)
169100        T(1)=TITPDF(1,II)
169200        CHANGE(31,TITLE=T)
169300        T(1)=TITPDF(2,II)
169400        CHANGE(32,TITLE=T)
169500        T(1)=TITPDF(3,II)
169600        CHANGE(33,TITLE=T)
169700        WRITE(31,2100)XM0(1),XM0(3)
169800        WRITE(31,2100)X1MEAN,X1VAR
169900        WRITE(32,2100)XM0(2),XM0(5)
170000        WRITE(32,2100)X2MEAN,X2VAR
```

```
170100 2100   FORMAT(F8.5,2X,F8.5)
170200        DO 10 I=1,NR
170300        WRITE(31,2200)R(I),FMX1(I)
170400        WRITE(32,2200)X2(I),FMX2(I)
170500 2200   FORMAT(F7.3,3X,F8.6)
170600 10     CONTINUE
170700        CLOSE(31,DISP=CRUNCH)
170800        CLOSE(32,DISP=CRUNCH)
170900        DO 20 I=1,NR
171000        WRITE(33,2300)(XLFXX(I,J),J=1,NR)
171100 2300   FORMAT(6E10.4)
171200 20     CONTINUE
171300        CLOSE(33,DISP=CRUNCH)
171400        RETURN
171500        END
H
```

APPENDIX C: Output from Sensitivity Problem Run 1

SENSITIVITY PROBLEM
INPUT NOISE STD = 20%   COEFFICIENT NOISE STD = 40%

IOPRUN = 3   ICVI = 0   ICVD = 0   IOPECH = 0   IOPSUM = 0   IOPURT = 1   IOPGW= 0

CARD CODE	DISTANCE	MNEMONIC	DESCRIPTION	PRINT CODE	DELTA	FLOW	LATERAL SURFACE FLOW	LATERAL GROUND FLOW	SLOPE	MANNING N	VEL COEF	VEL EXP	HYDR COEF	HYDR EXP	HYDR OPT
H	20.00	H	HEAD OF REACH		0.00	5.00	0.02	0.02	0.0000	0.0000	0.0900	0.6000	0.5332	0.6000	E
C	15.00	C-1	CHECK POINT 1		0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
C	10.00	C-2	CHECK POINT 2		0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
C	5.00	C-3	CHECK POINT 3		0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
T	0.00	T	TERMINATION		0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

SENSITIVITY PROBLEM
INPUT NOISE STD = 20%   COEFFICIENT NOISE STD = 40%

SUMMARY OF SYSTEM FLOW LAYOUT

PT. F.	ID CODE	IDENTIFICATION	DISTANCE (KM)	INPUT FLOW (CMS)	LATERAL SURFACE FLOW (CMS)	LATERAL GROUND FLOW (CMS)	MAIN-STREAM FLOW (CMS)	MAIN-STREAM VEL. (MPS)	MAIN-STREAM AREA (SQM)	MAIN-STREAM H. RAD. (M)	MAIN-STREAM SLOPE	AVE. REACH VEL. (MPS)	AVE. REACH H.RAD. (M)
REACH 1		HEADWATER 1										0.248	3.389
1 1	H	HEAD OF REACH	20.00	5.0000	0.4000	0.4000	5.0000	0.239	21.32	3.34	0.00000		
2 6	C-1	CHECK POINT 1	15.00				5.2000	0.245	21.65	3.37	0.00000		
3 6	C-2	CHECK POINT 2	10.00				5.4000	0.250	21.97	3.40	0.00000		
4 6	C-3	CHECK POINT 3	5.00				5.6000	0.256	22.29	3.43	0.00000		
5 9	T	TERMINATION	0.00				5.8000						

NPOINT = 5   NREACH = 1   NHWD = 1   NLOAD = 0   NDIRV = 0

SENSITIVITY PROBLEM
INPUT NOISE STD = 20%   COEFFICIENT NOISE STD = 40%

PROBABILISTIC STREAM SIMULATION AND ASSESSMENT MODEL, PSSAM

NR=101   RMIN= 3.000   RMAX= 22.000   NS=101   SMIN=-20.000   SMAX= 10.000
X2MIN= -3.000   X2MAX= 12.000   DTMAX=   4000.00(SEC)   IUTPDF= 0

DATA FOR HEADWATER

	BOD		DO		BOD-DO
	MEAN	VAR	MEAN	VAR	COV
H	15.0000	3.0000	5.0000	1.0000	1.0000

DATA FOR REACH

WATER TEMPERATURE
   16.00

BOD DIFFUSE INPUT

	SURFACE			GROUND			LEACH		
	DET	VAR	UNP	DET	VAR	UNP	DET	VAR	UNP
R1	10.0000	4.0000		5.0000	1.0000		1.0000	0.0400	

BOD EQUATION COEFFICIENTS

	BETA 1,1			BETA 1,2		
	DET	STD	UNP PERCENT	DET	STD	UNP PERCENT
R1	0.300	40.00		0.000	0.00	

DO DIFFUSE INPUT

	SURFACE			GROUND			LEACH		
	DET	VAR	UNP	DET	VAR	UNP	DET	VAR	UNP
R1	3.0000	0.3600		0.0000	0.0000		0.0000	0.0000	

DO EQUATION COEFFICIENTS

	BETA 2,1			BETA 2,2	BETA 2,3			BETA 2,4		
	DET	STD	UNP PERCENT		DET	STD	UNP PERCENT	DET	STD	UNP PERCENT
R1	0.000	40.00		-1.000	1.000	40.00		0.200	40.00	

TEMPERATURE CORRECTED WATER QUALITY COEFFICIENTS

BOD

REACH	BETA 1,1			BETA 1,2		
	DET	STD	UNP	DET	STD	UNP
1	0.250	0.100		0.000	0.000	

DO

REACH	BETA 2,1			BETA 2,2	BETA 2,3			BETA 2,4		
	DET	STD	UNP		DET	STD	UNP	DET	STD	UNP
1	0.613	0.245		8.692	1.000	0.400		0.200	0.080	

MARGINAL DENSITY AT POINT   1

BOD	PDF	DO	PDF	S	PDF
3.000	0.000000	-3.000	0.000000	-20.000	0.000000
3.190	0.000000	-2.850	0.000000	-19.700	0.000000
3.380	0.000000	-2.700	0.000000	-19.400	0.000000
3.570	0.000000	-2.550	0.000000	-19.100	0.000000
3.760	0.000000	-2.400	0.000000	-18.800	0.000000
3.950	0.000000	-2.250	0.000000	-18.500	0.000000
4.140	0.000000	-2.100	0.000000	-18.200	0.000000
4.330	0.000000	-1.950	0.000000	-17.900	0.000000
4.520	0.000000	-1.800	0.000000	-17.600	0.000000
4.710	0.000000	-1.650	0.000000	-17.300	0.000000
4.900	0.000000	-1.500	0.000000	-17.000	0.000000
5.090	0.000000	-1.350	0.000000	-16.700	0.000000
5.280	0.000000	-1.200	0.000000	-16.400	0.000000
5.470	0.000000	-1.050	0.000000	-16.100	0.000001
5.660	0.000000	-0.900	0.000000	-15.800	0.000002
5.850	0.000000	-0.750	0.000000	-15.500	0.000006
6.040	0.000000	-0.600	0.000000	-15.200	0.000019
6.230	0.000001	-0.450	0.000000	-14.900	0.000050
6.420	0.000001	-0.300	0.000000	-14.600	0.000126
6.610	0.000002	-0.150	0.000001	-14.300	0.000294
6.800	0.000003	-0.000	0.000001	-14.000	0.000644
6.990	0.000005	0.150	0.000003	-13.700	0.001336
7.180	0.000009	0.300	0.000006	-13.400	0.002631
7.370	0.000014	0.450	0.000013	-13.100	0.004938
7.560	0.000023	0.600	0.000025	-12.800	0.008842
7.750	0.000036	0.750	0.000048	-12.500	0.015125
7.940	0.000057	0.900	0.000089	-12.200	0.024725
8.130	0.000088	1.050	0.000163	-11.900	0.038631
8.320	0.000136	1.200	0.000292	-11.600	0.057695
8.510	0.000206	1.350	0.000510	-11.300	0.082368
8.700	0.000309	1.500	0.000873	-11.000	0.112406
8.890	0.000457	1.650	0.001459	-10.700	0.146635
9.080	0.000669	1.800	0.002384	-10.400	0.182851
9.270	0.000968	1.950	0.003810	-10.100	0.217954
9.460	0.001383	2.100	0.005953	-9.800	0.248335
9.650	0.001952	2.250	0.009094	-9.500	0.270468
9.840	0.002723	2.400	0.013583	-9.200	0.281575
10.030	0.003754	2.550	0.019837	-8.900	0.280200
10.220	0.005111	2.700	0.028327	-8.600	0.266523
10.410	0.006877	2.850	0.039550	-8.300	0.242321
10.600	0.009142	3.000	0.053991	-8.000	0.210587
10.790	0.012007	3.150	0.072065	-7.700	0.174925

10.980	0.015582	3.300	0.094049	-7.400	0.138882
11.170	0.019979	3.450	0.120009	-7.100	0.105392
11.360	0.025311	3.600	0.149727	-6.800	0.076442
11.550	0.031682	3.750	0.182649	-6.500	0.052992
11.740	0.039183	3.900	0.217852	-6.200	0.035111
11.930	0.047880	4.050	0.254059	-5.900	0.022234
12.120	0.057807	4.200	0.289692	-5.600	0.013456
12.310	0.068958	4.350	0.322972	-5.300	0.007783
12.500	0.081275	4.500	0.352065	-5.000	0.004302
12.690	0.094648	4.650	0.375240	-4.700	0.002272
12.880	0.108902	4.800	0.391043	-4.400	0.001147
13.070	0.123803	4.950	0.398444	-4.100	0.000553
13.260	0.139061	5.100	0.396952	-3.800	0.000255
13.450	0.154330	5.250	0.386668	-3.500	0.000112
13.640	0.169227	5.400	0.368270	-3.200	0.000047
13.830	0.183343	5.550	0.342943	-2.900	0.000019
14.020	0.196261	5.700	0.312253	-2.600	0.000007
14.210	0.207575	5.850	0.277983	-2.300	0.000003
14.400	0.216916	6.000	0.241968	-2.000	0.000001
14.590	0.223966	6.150	0.205933	-1.700	0.000000
14.780	0.228479	6.300	0.171364	-1.400	0.000000
14.970	0.230295	6.450	0.139424	-1.100	0.000000
15.160	0.229349	6.600	0.110913	-0.800	0.000000
15.350	0.225675	6.750	0.086268	-0.500	0.000000
15.540	0.219403	6.900	0.065605	-0.200	0.000000
15.730	0.210754	7.050	0.048780	0.100	0.000000
15.920	0.200025	7.200	0.035462	0.400	0.000000
16.110	0.187572	7.350	0.025205	0.700	0.000000
16.300	0.173789	7.500	0.017515	1.000	0.000000
16.490	0.159094	7.650	0.011900	1.300	0.000000
16.680	0.143899	7.800	0.007903	1.600	0.000000
16.870	0.128598	7.950	0.005132	1.900	0.000000
17.060	0.113550	8.100	0.003257	2.200	0.000000
17.250	0.099063	8.250	0.002021	2.500	0.000000
17.440	0.085391	8.400	0.001225	2.800	0.000000
17.630	0.072726	8.550	0.000726	3.100	0.000000
17.820	0.061198	8.700	0.000421	3.400	0.000000
18.010	0.050881	8.850	0.000238	3.700	0.000000
18.200	0.041798	9.000	0.000132	4.000	0.000000
18.390	0.033925	9.150	0.000071	4.300	0.000000
18.580	0.027206	9.300	0.000037	4.600	0.000000
18.770	0.021557	9.450	0.000019	4.900	0.000000
18.960	0.016876	9.600	0.000010	5.200	0.000000
19.150	0.013054	9.750	0.000005	5.500	0.000000
19.340	0.009977	9.900	0.000002	5.800	0.000000
19.530	0.007534	10.050	0.000001	6.100	0.000000
19.720	0.005621	10.200	0.000000	6.400	0.000000
19.910	0.004143	10.350	0.000000	6.700	0.000000
20.100	0.003018	10.500	0.000000	7.000	0.000000
20.290	0.002172	10.650	0.000000	7.300	0.000000
20.480	0.001544	10.800	0.000000	7.600	0.000000

20.670	0.001085	10.950	0.000000	7.900	0.000000
20.860	0.000753	11.100	0.000000	8.200	0.000000
21.050	0.000516	11.250	0.000000	8.500	0.000000
21.240	0.000350	11.400	0.000000	8.800	0.000000
21.430	0.000234	11.550	0.000000	9.100	0.000000
21.620	0.000155	11.700	0.000000	9.400	0.000000
21.810	0.000101	11.850	0.000000	9.700	0.000000
22.000	0.000065	12.000	0.000000	10.000	0.000000
TOT	1.000	TOT	1.000	TOT	1.000

	MOMENT EQUATIONS	PDF
X1 MEAN	15.0000	14.9998
X1 VARIANCE	3.0000	2.9986
X2 MEAN	5.0000	4.9999
X2 VARIANCE	1.0000	0.9999
COV(X1,X2)	1.0000	0.9995

MARGINAL DENSITY AT POINT   2

BOD	PDF	DO	PDF	S	PDF
3.000	0.000000	-3.000	0.000000	-20.000	0.000000
3.190	0.000000	-2.850	0.000000	-19.700	0.000000
3.380	0.000000	-2.700	0.000000	-19.400	0.000000
3.570	0.000000	-2.550	0.000000	-19.100	0.000000
3.760	0.000000	-2.400	0.000000	-18.800	0.000000
3.950	0.000000	-2.250	0.000000	-18.500	0.000000
4.140	0.000000	-2.100	0.000000	-18.200	0.000000
4.330	0.000000	-1.950	0.000001	-17.900	0.000000
4.520	0.000000	-1.800	0.000001	-17.600	0.000000
4.710	0.000000	-1.650	0.000002	-17.300	0.000000
4.900	0.000000	-1.500	0.000003	-17.000	0.000000
5.090	0.000000	-1.350	0.000004	-16.700	0.000000
5.280	0.000000	-1.200	0.000006	-16.400	0.000000
5.470	0.000000	-1.050	0.000010	-16.100	0.000000
5.660	0.000000	-0.900	0.000014	-15.800	0.000000
5.850	0.000001	-0.750	0.000022	-15.500	0.000000
6.040	0.000001	-0.600	0.000033	-15.200	0.000001
6.230	0.000003	-0.450	0.000050	-14.900	0.000003
6.420	0.000005	-0.300	0.000074	-14.600	0.000009
6.610	0.000008	-0.150	0.000110	-14.300	0.000025
6.800	0.000015	-0.000	0.000163	-14.000	0.000069
6.990	0.000025	0.150	0.000241	-13.700	0.000173
7.180	0.000042	0.300	0.000354	-13.400	0.000406
7.370	0.000070	0.450	0.000517	-13.100	0.000888
7.560	0.000114	0.600	0.000750	-12.800	0.001827
7.750	0.000183	0.750	0.001083	-12.500	0.003552
7.940	0.000290	0.900	0.001553	-12.200	0.006551
8.130	0.000450	1.050	0.002213	-11.900	0.011502
8.320	0.000687	1.200	0.003132	-11.600	0.019253
8.510	0.001034	1.350	0.004400	-11.300	0.030763
8.700	0.001530	1.500	0.006133	-11.000	0.046943
8.890	0.002228	1.650	0.008477	-10.700	0.068441
9.080	0.003196	1.800	0.011613	-10.400	0.095364
9.270	0.004512	1.950	0.015761	-10.100	0.127017
9.460	0.006274	2.100	0.021176	-9.800	0.161754
9.650	0.008591	2.250	0.028152	-9.500	0.196990
9.840	0.011586	2.400	0.037006	-9.200	0.229464
10.030	0.015392	2.550	0.048068	-8.900	0.255711
10.220	0.020147	2.700	0.061655	-8.600	0.272663
10.410	0.025984	2.850	0.078037	-8.300	0.278242
10.600	0.033025	3.000	0.097400	-8.000	0.271778
10.790	0.041371	3.150	0.119797	-7.700	0.254140

10.980	0.051087	3.300	0.145102	-7.400	0.227548
11.170	0.062192	3.450	0.172963	-7.100	0.195112
11.360	0.074651	3.600	0.202776	-6.800	0.160242
11.550	0.088361	3.750	0.233670	-6.500	0.126074
11.740	0.103148	3.900	0.264528	-6.200	0.095037
11.930	0.118766	4.050	0.294034	-5.900	0.068652
12.120	0.134896	4.200	0.320754	-5.600	0.047531
12.310	0.151159	4.350	0.343250	-5.300	0.031545
12.500	0.167128	4.500	0.360201	-5.000	0.020072
12.690	0.182343	4.650	0.370535	-4.700	0.012247
12.880	0.196339	4.800	0.373542	-4.400	0.007166
13.070	0.208663	4.950	0.368955	-4.100	0.004022
13.260	0.218905	5.100	0.356983	-3.800	0.002166
13.450	0.226718	5.250	0.338302	-3.500	0.001119
13.640	0.231835	5.400	0.313983	-3.200	0.000555
13.830	0.234092	5.550	0.285390	-2.900	0.000264
14.020	0.233429	5.700	0.254045	-2.600	0.000121
14.210	0.229896	5.850	0.221489	-2.300	0.000053
14.400	0.223648	6.000	0.189156	-2.000	0.000022
14.590	0.214934	6.150	0.158267	-1.700	0.000009
14.780	0.204080	6.300	0.129766	-1.400	0.000004
14.970	0.191470	6.450	0.104294	-1.100	0.000001
15.160	0.177526	6.600	0.082192	-0.800	0.000000
15.350	0.162679	6.750	0.063538	-0.500	0.000000
15.540	0.147355	6.900	0.048200	-0.200	0.000000
15.730	0.131952	7.050	0.035899	0.100	0.000000
15.920	0.116827	7.200	0.026263	0.400	0.000000
16.110	0.102283	7.350	0.018883	0.700	0.000000
16.300	0.088563	7.500	0.013350	1.000	0.000000
16.490	0.075850	7.650	0.009286	1.300	0.000000
16.680	0.064264	7.800	0.006358	1.600	0.000000
16.870	0.053871	7.950	0.004288	1.900	0.000000
17.060	0.044688	8.100	0.002849	2.200	0.000000
17.250	0.036688	8.250	0.001866	2.500	0.000000
17.440	0.029815	8.400	0.001206	2.800	0.000000
17.630	0.023987	8.550	0.000769	3.100	0.000000
17.820	0.019108	8.700	0.000483	3.400	0.000000
18.010	0.015075	8.850	0.000300	3.700	0.000000
18.200	0.011779	9.000	0.000184	4.000	0.000000
18.390	0.009117	9.150	0.000111	4.300	0.000000
18.580	0.006991	9.300	0.000066	4.600	0.000000
18.770	0.005312	9.450	0.000039	4.900	0.000000
18.960	0.003999	9.600	0.000023	5.200	0.000000
19.150	0.002983	9.750	0.000013	5.500	0.000000
19.340	0.002204	9.900	0.000007	5.800	0.000000
19.530	0.001613	10.050	0.000004	6.100	0.000000
19.720	0.001168	10.200	0.000002	6.400	0.000000
19.910	0.000835	10.350	0.000001	6.700	0.000000
20.100	0.000589	10.500	0.000001	7.000	0.000000
20.290	0.000409	10.650	0.000000	7.300	0.000000
20.480	0.000277	10.800	0.000000	7.600	0.000000

20.670	0.000183	10.950	0.000000	7.900	0.000000
20.860	0.000118	11.100	0.000000	8.200	0.000000
21.050	0.000074	11.250	0.000000	8.500	0.000000
21.240	0.000046	11.400	0.000000	8.800	0.000000
21.430	0.000028	11.550	0.000000	9.100	0.000000
21.620	0.000013	11.700	0.000000	9.400	0.000000
21.810	0.000001	11.850	0.000000	9.700	0.000000
22.000	0.000000	12.000	0.000000	10.000	0.000000
TOT	1.000	TOT	1.000	TOT	1.000

	MOMENT EQUATIONS	PDF
X1 MEAN	13.9267	13.9526
X1 VARIANCE	2.9215	2.9156
X2 MEAN	4.7351	4.7403
X2 VARIANCE	1.2098	1.1841
COV(X1,X2)	1.0251	1.0193

MARGINAL DENSITY AT POINT 3

BOD	PDF	DO	PDF	S	PDF
3.000	0.000000	-3.000	0.000001	-20.000	0.000000
3.190	0.000000	-2.850	0.000001	-19.700	0.000000
3.380	0.000000	-2.700	0.000001	-19.400	0.000000
3.570	0.000000	-2.550	0.000002	-19.100	0.000000
3.760	0.000000	-2.400	0.000002	-18.800	0.000000
3.950	0.000000	-2.250	0.000003	-18.500	0.000000
4.140	0.000000	-2.100	0.000005	-18.200	0.000000
4.330	0.000000	-1.950	0.000007	-17.900	0.000000
4.520	0.000000	-1.800	0.000009	-17.600	0.000000
4.710	0.000000	-1.650	0.000013	-17.300	0.000000
4.900	0.000000	-1.500	0.000019	-17.000	0.000000
5.090	0.000000	-1.350	0.000027	-16.700	0.000000
5.280	0.000000	-1.200	0.000038	-16.400	0.000000
5.470	0.000001	-1.050	0.000053	-16.100	0.000000
5.660	0.000002	-0.900	0.000074	-15.800	0.000000
5.850	0.000003	-0.750	0.000104	-15.500	0.000000
6.040	0.000006	-0.600	0.000146	-15.200	0.000000
6.230	0.000012	-0.450	0.000204	-14.900	0.000000
6.420	0.000022	-0.300	0.000285	-14.600	0.000001
6.610	0.000040	-0.150	0.000396	-14.300	0.000002
6.800	0.000070	-0.000	0.000548	-14.000	0.000007
6.990	0.000121	0.150	0.000758	-13.700	0.000018
7.180	0.000204	0.300	0.001044	-13.400	0.000047
7.370	0.000337	0.450	0.001433	-13.100	0.000119
7.560	0.000545	0.600	0.001959	-12.800	0.000284
7.750	0.000863	0.750	0.002668	-12.500	0.000634
7.940	0.001338	0.900	0.003616	-12.200	0.001333
8.130	0.002033	1.050	0.004877	-11.900	0.002643
8.320	0.003029	1.200	0.006543	-11.600	0.004967
8.510	0.004424	1.350	0.008728	-11.300	0.008875
8.700	0.006338	1.500	0.011571	-11.000	0.015122
8.890	0.008909	1.650	0.015237	-10.700	0.024598
9.080	0.012292	1.800	0.019923	-10.400	0.038231
9.270	0.016652	1.950	0.025848	-10.100	0.056799
9.460	0.022155	2.100	0.033259	-9.800	0.080687
9.650	0.028959	2.250	0.042418	-9.500	0.109626
9.840	0.037201	2.400	0.053587	-9.200	0.142486
10.030	0.046979	2.550	0.067015	-8.900	0.177210
10.220	0.058338	2.700	0.082909	-8.600	0.210940
10.410	0.071256	2.850	0.101402	-8.300	0.240369
10.600	0.085634	3.000	0.122520	-8.000	0.262266
10.790	0.101281	3.150	0.146146	-7.700	0.274055

10.980	0.117919	3.300	0.171981	-7.400	0.274315
11.170	0.135184	3.450	0.199518	-7.100	0.263062
11.360	0.152637	3.600	0.228033	-6.800	0.241736
11.550	0.169782	3.750	0.256586	-6.500	0.212896
11.740	0.186091	3.900	0.284059	-6.200	0.179723
11.930	0.201030	4.050	0.309211	-5.900	0.145449
12.120	0.214092	4.200	0.330761	-5.600	0.112861
12.310	0.224822	4.350	0.347495	-5.300	0.083976
12.500	0.232848	4.500	0.358373	-5.000	0.059922
12.690	0.237903	4.650	0.362637	-4.700	0.041010
12.880	0.239835	4.800	0.359896	-4.400	0.026920
13.070	0.238620	4.950	0.350182	-4.100	0.016951
13.260	0.234356	5.100	0.333954	-3.800	0.010238
13.450	0.227254	5.250	0.312065	-3.500	0.005932
13.640	0.217624	5.400	0.285686	-3.200	0.003298
13.830	0.205852	5.550	0.256190	-2.900	0.001758
14.020	0.192376	5.700	0.225030	-2.600	0.000899
14.210	0.177658	5.850	0.193610	-2.300	0.000441
14.400	0.162164	6.000	0.163179	-2.000	0.000208
14.590	0.146335	6.150	0.134746	-1.700	0.000094
14.780	0.130577	6.300	0.109042	-1.400	0.000041
14.970	0.115239	6.450	0.086503	-1.100	0.000017
15.160	0.100611	6.600	0.067299	-0.800	0.000007
15.350	0.086915	6.750	0.051372	-0.500	0.000003
15.540	0.074311	6.900	0.038498	-0.200	0.000001
15.730	0.062893	7.050	0.028340	0.100	0.000000
15.920	0.052705	7.200	0.020508	0.400	0.000000
16.110	0.043742	7.350	0.014599	0.700	0.000000
16.300	0.035960	7.500	0.010232	1.000	0.000000
16.490	0.029290	7.650	0.007066	1.300	0.000000
16.680	0.023643	7.800	0.004812	1.600	0.000000
16.870	0.018916	7.950	0.003234	1.900	0.000000
17.060	0.015005	8.100	0.002147	2.200	0.000000
17.250	0.011801	8.250	0.001409	2.500	0.000000
17.440	0.009206	8.400	0.000915	2.800	0.000000
17.630	0.007122	8.550	0.000588	3.100	0.000000
17.820	0.005467	8.700	0.000374	3.400	0.000000
18.010	0.004163	8.850	0.000236	3.700	0.000000
18.200	0.003145	9.000	0.000148	4.000	0.000000
18.390	0.002357	9.150	0.000092	4.300	0.000000
18.580	0.001752	9.300	0.000056	4.600	0.000000
18.770	0.001291	9.450	0.000034	4.900	0.000000
18.960	0.000944	9.600	0.000021	5.200	0.000000
19.150	0.000684	9.750	0.000012	5.500	0.000000
19.340	0.000491	9.900	0.000007	5.800	0.000000
19.530	0.000349	10.050	0.000004	6.100	0.000000
19.720	0.000245	10.200	0.000003	6.400	0.000000
19.910	0.000171	10.350	0.000001	6.700	0.000000
20.100	0.000117	10.500	0.000001	7.000	0.000000
20.290	0.000079	10.650	0.000000	7.300	0.000000
20.480	0.000052	10.800	0.000000	7.600	0.000000

20.670	0.000034	10.950	0.000000	7.900	0.000000
20.860	0.000022	11.100	0.000000	8.200	0.000000
21.050	0.000014	11.250	0.000000	8.500	0.000000
21.240	0.000008	11.400	0.000000	8.800	0.000000
21.430	0.000004	11.550	0.000000	9.100	0.000000
21.620	0.000002	11.700	0.000000	9.400	0.000000
21.810	0.000001	11.850	0.000000	9.700	0.000000
22.000	0.000000	12.000	0.000000	10.000	0.000000
TOT	1.000	TOT	1.000	TOT	1.000

	MOMENT EQUATIONS	PDF
X1 MEAN	12.9789	13.0252
X1 VARIANCE	2.8011	2.7960
X2 MEAN	4.5793	4.5837
X2 VARIANCE	1.3152	1.2751
COV(X1,X2)	0.9922	0.9861

MARGINAL DENSITY AT POINT   4

BOD	PDF	DO	PDF	S	PDF
3.000	0.000000	-3.000	0.000002	-20.000	0.000000
3.190	0.000000	-2.850	0.000003	-19.700	0.000000
3.380	0.000000	-2.700	0.000004	-19.400	0.000000
3.570	0.000000	-2.550	0.000005	-19.100	0.000000
3.760	0.000000	-2.400	0.000007	-18.800	0.000000
3.950	0.000000	-2.250	0.000009	-18.500	0.000000
4.140	0.000000	-2.100	0.000013	-18.200	0.000000
4.330	0.000000	-1.950	0.000017	-17.900	0.000000
4.520	0.000000	-1.800	0.000024	-17.600	0.000000
4.710	0.000000	-1.650	0.000032	-17.300	0.000000
4.900	0.000000	-1.500	0.000044	-17.000	0.000000
5.090	0.000001	-1.350	0.000060	-16.700	0.000000
5.280	0.000002	-1.200	0.000082	-16.400	0.000000
5.470	0.000003	-1.050	0.000111	-16.100	0.000000
5.660	0.000007	-0.900	0.000151	-15.800	0.000000
5.850	0.000015	-0.750	0.000205	-15.500	0.000000
6.040	0.000029	-0.600	0.000278	-15.200	0.000000
6.230	0.000055	-0.450	0.000376	-14.900	0.000000
6.420	0.000101	-0.300	0.000508	-14.600	0.000000
6.610	0.000182	-0.150	0.000686	-14.300	0.000001
6.800	0.000317	-0.000	0.000922	-14.000	0.000001
6.990	0.000540	0.150	0.001238	-13.700	0.000003
7.180	0.000893	0.300	0.001658	-13.400	0.000007
7.370	0.001440	0.450	0.002214	-13.100	0.000016
7.560	0.002265	0.600	0.002947	-12.800	0.000040
7.750	0.003473	0.750	0.003909	-12.500	0.000095
7.940	0.005200	0.900	0.005165	-12.200	0.000222
8.130	0.007604	1.050	0.006797	-11.900	0.000494
8.320	0.010869	1.200	0.008905	-11.600	0.001042
8.510	0.015194	1.350	0.011609	-11.300	0.002079
8.700	0.020783	1.500	0.015052	-11.000	0.003939
8.890	0.027834	1.650	0.019404	-10.700	0.007109
9.080	0.036517	1.800	0.024855	-10.400	0.012249
9.270	0.046954	1.950	0.031621	-10.100	0.020178
9.460	0.059203	2.100	0.039931	-9.800	0.031799
9.650	0.073233	2.250	0.050024	-9.500	0.047953
9.840	0.088913	2.400	0.062132	-9.200	0.069213
10.030	0.105999	2.550	0.076461	-8.900	0.095632
10.220	0.124140	2.700	0.093170	-8.600	0.126511
10.410	0.142879	2.850	0.112337	-8.300	0.160264
10.600	0.161678	3.000	0.133932	-8.000	0.194444

10.790	0.179939	3.150	0.157777	-7.700	0.225984
10.980	0.197040	3.300	0.183524	-7.400	0.251621
11.170	0.212372	3.450	0.210628	-7.100	0.268450
11.360	0.225379	3.600	0.238341	-6.800	0.274460
11.550	0.235586	3.750	0.265721	-6.500	0.268930
11.740	0.242636	3.900	0.291668	-6.200	0.252568
11.930	0.246308	4.050	0.314981	-5.900	0.227365
12.120	0.246524	4.200	0.334442	-5.600	0.196198
12.310	0.243355	4.350	0.348912	-5.300	0.162292
12.500	0.237006	4.500	0.357438	-5.000	0.128684
12.690	0.227799	4.650	0.359355	-4.700	0.097807
12.880	0.216149	4.800	0.354366	-4.400	0.071252
13.070	0.202534	4.950	0.342588	-4.100	0.049748
13.260	0.187463	5.100	0.324560	-3.800	0.033285
13.450	0.171450	5.250	0.301201	-3.500	0.021338
13.640	0.154987	5.400	0.273728	-3.200	0.013105
13.830	0.138520	5.550	0.243545	-2.900	0.007708
14.020	0.122439	5.700	0.212111	-2.600	0.004342
14.210	0.107064	5.850	0.180815	-2.300	0.002341
14.400	0.092642	6.000	0.150868	-2.000	0.001208
14.590	0.079347	6.150	0.123225	-1.700	0.000596
14.780	0.067288	6.300	0.098542	-1.400	0.000281
14.970	0.056513	6.450	0.077181	-1.100	0.000127
15.160	0.047020	6.600	0.059230	-0.800	0.000055
15.350	0.038766	6.750	0.044560	-0.500	0.000023
15.540	0.031679	6.900	0.032886	-0.200	0.000009
15.730	0.025665	7.050	0.023826	0.100	0.000003
15.920	0.020620	7.200	0.016961	0.400	0.000001
16.110	0.016432	7.350	0.011874	0.700	0.000000
16.300	0.012992	7.500	0.008183	1.000	0.000000
16.490	0.010193	7.650	0.005557	1.300	0.000000
16.680	0.007937	7.800	0.003723	1.600	0.000000
16.870	0.006135	7.950	0.002464	1.900	0.000000
17.060	0.004708	8.100	0.001612	2.200	0.000000
17.250	0.003588	8.250	0.001043	2.500	0.000000
17.440	0.002715	8.400	0.000669	2.800	0.000000
17.630	0.002040	8.550	0.000426	3.100	0.000000
17.820	0.001523	8.700	0.000269	3.400	0.000000
18.010	0.001129	8.850	0.000168	3.700	0.000000
18.200	0.000831	9.000	0.000105	4.000	0.000000
18.390	0.000607	9.150	0.000065	4.300	0.000000
18.580	0.000441	9.300	0.000040	4.600	0.000000
18.770	0.000318	9.450	0.000025	4.900	0.000000
18.960	0.000227	9.600	0.000015	5.200	0.000000
19.150	0.000161	9.750	0.000009	5.500	0.000000
19.340	0.000113	9.900	0.000005	5.800	0.000000
19.530	0.000079	10.050	0.000003	6.100	0.000000
19.720	0.000055	10.200	0.000002	6.400	0.000000
19.910	0.000037	10.350	0.000001	6.700	0.000000
20.100	0.000025	10.500	0.000001	7.000	0.000000
20.290	0.000017	10.650	0.000000	7.300	0.000000

20.480	0.000011	10.800	0.000000	7.600	0.000000
20.670	0.000007	10.950	0.000000	7.900	0.000000
20.860	0.000005	11.100	0.000000	8.200	0.000000
21.050	0.000003	11.250	0.000000	8.500	0.000000
21.240	0.000001	11.400	0.000000	8.800	0.000000
21.430	0.000001	11.550	0.000000	9.100	0.000000
21.620	0.000001	11.700	0.000000	9.400	0.000000
21.810	0.000000	11.850	0.000000	9.700	0.000000
22.000	0.000000	12.000	0.000000	10.000	0.000000
TOT	1.000	TOT	1.000	TOT	1.000

	MOMENT EQUATIONS	PDF
X1 MEAN	12.1386	12.2005
X1 VARIANCE	2.6577	2.6550
X2 MEAN	4.5026	4.5025
X2 VARIANCE	1.3583	1.3097
COV(X1,X2)	0.9293	0.9246

MARGINAL DENSITY AT POINT 5

BOD	PDF	DO	PDF	S	PDF
3.000	0.000000	-3.000	0.000004	-20.000	0.000000
3.190	0.000000	-2.850	0.000005	-19.700	0.000000
3.380	0.000000	-2.700	0.000006	-19.400	0.000000
3.570	0.000000	-2.550	0.000009	-19.100	0.000000
3.760	0.000000	-2.400	0.000011	-18.800	0.000000
3.950	0.000000	-2.250	0.000015	-18.500	0.000000
4.140	0.000000	-2.100	0.000020	-18.200	0.000000
4.330	0.000000	-1.950	0.000027	-17.900	0.000000
4.520	0.000000	-1.800	0.000037	-17.600	0.000000
4.710	0.000000	-1.650	0.000049	-17.300	0.000000
4.900	0.000001	-1.500	0.000065	-17.000	0.000000
5.090	0.000003	-1.350	0.000087	-16.700	0.000000
5.280	0.000007	-1.200	0.000116	-16.400	0.000000
5.470	0.000015	-1.050	0.000155	-16.100	0.000000
5.660	0.000032	-0.900	0.000207	-15.800	0.000000
5.850	0.000064	-0.750	0.000276	-15.500	0.000000
6.040	0.000125	-0.600	0.000367	-15.200	0.000000
6.230	0.000235	-0.450	0.000488	-14.900	0.000000
6.420	0.000427	-0.300	0.000648	-14.600	0.000000
6.610	0.000749	-0.150	0.000860	-14.300	0.000000
6.800	0.001272	-0.000	0.001139	-14.000	0.000000
6.990	0.002094	0.150	0.001506	-13.700	0.000001
7.180	0.003344	0.300	0.001987	-13.400	0.000002
7.370	0.005184	0.450	0.002615	-13.100	0.000004
7.560	0.007814	0.600	0.003433	-12.800	0.000008
7.750	0.011461	0.750	0.004494	-12.500	0.000017
7.940	0.016370	0.900	0.005864	-12.200	0.000038
8.130	0.022794	1.050	0.007625	-11.900	0.000086
8.320	0.030966	1.200	0.009875	-11.600	0.000193
8.510	0.041076	1.350	0.012734	-11.300	0.000421
8.700	0.053241	1.500	0.016343	-11.000	0.000877
8.890	0.067483	1.650	0.020865	-10.700	0.001743
9.080	0.083702	1.800	0.026487	-10.400	0.003304
9.270	0.101660	1.950	0.033417	-10.100	0.005982
9.460	0.120982	2.100	0.041876	-9.800	0.010367
9.650	0.141160	2.250	0.052094	-9.500	0.017208
9.840	0.161577	2.400	0.064292	-9.200	0.027367
10.030	0.181537	2.550	0.078671	-8.900	0.041710
10.220	0.200312	2.700	0.095382	-8.600	0.060920
10.410	0.217187	2.850	0.114502	-8.300	0.085272
10.600	0.231506	3.000	0.136003	-8.000	0.114388
10.790	0.242722	3.150	0.159717	-7.700	0.147064

10.980	0.250425	3.300	0.185309	-7.400	0.181218
11.170	0.254373	3.450	0.212253	-7.100	0.214033
11.360	0.254498	3.600	0.239819	-6.800	0.242300
11.550	0.250904	3.750	0.267086	-6.500	0.262921
11.740	0.243852	3.900	0.292965	-6.200	0.273455
11.930	0.233734	4.050	0.316259	-5.900	0.272597
12.120	0.221041	4.200	0.335738	-5.600	0.260434
12.310	0.206325	4.350	0.350238	-5.300	0.238436
12.500	0.190164	4.500	0.358772	-5.000	0.209163
12.690	0.173129	4.650	0.360632	-4.700	0.175778
12.880	0.155754	4.800	0.355477	-4.400	0.141488
13.070	0.138515	4.950	0.343393	-4.100	0.109054
13.260	0.121815	5.100	0.324906	-3.800	0.080465
13.450	0.105975	5.250	0.300943	-3.500	0.056817
13.640	0.091234	5.400	0.272757	-3.200	0.038378
13.830	0.077750	5.550	0.241807	-2.900	0.024789
14.020	0.065613	5.700	0.209620	-2.600	0.015303
14.210	0.054847	5.850	0.177656	-2.300	0.009025
14.400	0.045430	6.000	0.147185	-2.000	0.005081
14.590	0.037297	6.150	0.119203	-1.700	0.002730
14.780	0.030358	6.300	0.094387	-1.400	0.001398
14.970	0.024507	6.450	0.073088	-1.100	0.000682
15.160	0.019625	6.600	0.055369	-0.800	0.000317
15.350	0.015595	6.750	0.041059	-0.500	0.000140
15.540	0.012299	6.900	0.029825	-0.200	0.000059
15.730	0.009630	7.050	0.021240	0.100	0.000023
15.920	0.007487	7.200	0.014843	0.400	0.000009
16.110	0.005781	7.350	0.010190	0.700	0.000003
16.300	0.004434	7.500	0.006881	1.000	0.000001
16.490	0.003379	7.650	0.004577	1.300	0.000000
16.680	0.002559	7.800	0.003002	1.600	0.000000
16.870	0.001926	7.950	0.001944	1.900	0.000000
17.060	0.001441	8.100	0.001245	2.200	0.000000
17.250	0.001071	8.250	0.000790	2.500	0.000000
17.440	0.000792	8.400	0.000496	2.800	0.000000
17.630	0.000582	8.550	0.000310	3.100	0.000000
17.820	0.000425	8.700	0.000192	3.400	0.000000
18.010	0.000309	8.850	0.000118	3.700	0.000000
18.200	0.000223	9.000	0.000073	4.000	0.000000
18.390	0.000160	9.150	0.000044	4.300	0.000000
18.580	0.000114	9.300	0.000027	4.600	0.000000
18.770	0.000081	9.450	0.000016	4.900	0.000000
18.960	0.000057	9.600	0.000010	5.200	0.000000
19.150	0.000040	9.750	0.000006	5.500	0.000000
19.340	0.000028	9.900	0.000004	5.800	0.000000
19.530	0.000019	10.050	0.000002	6.100	0.000000
19.720	0.000013	10.200	0.000001	6.400	0.000000
19.910	0.000009	10.350	0.000001	6.700	0.000000
20.100	0.000006	10.500	0.000000	7.000	0.000000
20.290	0.000004	10.650	0.000000	7.300	0.000000
20.480	0.000003	10.800	0.000000	7.600	0.000000

20.670	0.000002	10.950	0.000000	7.900	0.000000
20.860	0.000001	11.100	0.000000	8.200	0.000000
21.050	0.000001	11.250	0.000000	8.500	0.000000
21.240	0.000000	11.400	0.000000	8.800	0.000000
21.430	0.000000	11.550	0.000000	9.100	0.000000
21.620	0.000000	11.700	0.000000	9.400	0.000000
21.810	0.000000	11.850	0.000000	9.700	0.000000
22.000	0.000000	12.000	0.000000	10.000	0.000000
TOT	1.000	TOT	1.000	TOT	1.000

	MOMENT EQUATIONS	PDF
X1 MEAN	11.3907	11.4644
X1 VARIANCE	2.5035	2.5039
X2 MEAN	4.4831	4.4763
X2 VARIANCE	1.3632	1.3099
COV(X1,X2)	0.8530	0.8503

SENSITIVITY PROBLEM
INPUT NOISE STD = 20%   COEFFICIENT NOISE STD = 40%

PNT	DISTANCE	ID	BOD MEAN	BOD VAR	DO MEAN	DO VAR	BOD-DO COV

REACH# 1   HEADWATER 1

PNT	DISTANCE	ID	MEAN	VAR	MEAN	VAR	COV
1	20.00	H	15.000	3.000	5.000	1.000	1.000
2	15.00	C-1	13.927	2.921	4.735	1.210	1.025
3	10.00	C-2	12.979	2.801	4.579	1.315	0.992
4	5.00	C-3	12.139	2.658	4.503	1.358	0.929
5	0.00	T	11.391	2.504	4.483	1.363	0.853