

*IV.*  
*WATER BALANCE*  
*PROGRAM*



```

DATA (VAL1(I),I=1,12)/
+140,140,140, 0, 0, 0, 0, 0, 0, 0, 0,140,140/
DATA (VAL2(I),I=1,12)/
+140,140,140,196,196,196,196,196, 0, 0,140,140/
DATA (TID1(I),I=1,12)/
+140,140,140, 0, 0, 0, 0, 0, 0, 0, 0,140,140/
DATA (TID2(I),I=1,12)/
+140,140,140,196,196,196,196,196, 0, 0,140,140/

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```

OPEN(10,FILE='MUSIQM.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(20,FILE='MUSIPM.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(30,FILE='MUSIDM.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(40,FILE='MUSIMM.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(50,FILE='GEN00M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(51,FILE='PRIA00M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(52,FILE='GEN20M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(53,FILE='PRIA20M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(54,FILE='ENVW00M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(55,FILE='ENVW20M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(56,FILE='ARIA00M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(57,FILE='ARIA20M.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')
OPEN(60,FILE='MUSI80.DAT',ACCESS='SEQUENTIAL',STATUS='UNKNOWN')

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```

DO 10 I=1,22
DO 20 J=1,12
DO 30 K=1,3
DEM(I,J,K)=0.0
REM(I,J,K)=0.0
PEM(I,J,K)=0.0
30 CONTINUE
20 CONTINUE
10 CONTINUE

```

```

WRITE (6,*) 'COMP YEAR ?'
READ (5,*) ICAS
WRITE (6,*) 'TO KOMERING ?'
READ (5,*) RTOK
RTOO=1.0-RTOK

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WRITE(20,*) ICAS
WRITE(30,*) ICAS
WRITE(40,*) ICAS

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```

c 1=OKU,2=OKI,3=ME,4=LAHAT,5=MURA,
c 6=MUBA,7=PLB,8=PAGARALAM,9=PRABUMULIH,10=BENGGELU
c water use of regency  DOM(10): piped water supply (l/s)
c " RYR(10): rural water supply (l/s)
c " DUS(10): industrial (1000m3/year)
c " GIN(10): mining (1000m3/year)
c " TOU(10): tourism (m3/year)
c " AQU(10): aquaculture (1000m3/year)
c " VES(10): livestock (m3/day)

c DATA (ATEC1(I),I=1,10)/0,0,0,0,357,0,0,0,0,0/
c DATA (ATEC2(I),I=1,10)/0,603,0,0,8305,0,0,0,0,0/

```

c DATA (ASET1(I),I=1,10)/0,0,1700,0,125,0,70,0,0,0,0/  
c DATA (ASET2(I),I=1,10)/2986,0,300,5208,580,0,0,0,0,1475/  
c DATA (ASNC1(I),I=1,10)/2260,0,1865,6805,1793,2645,105,0,0,26/  
c DATA (ASNC2(I),I=1,10)/6066,0,941,15933,2382,200,0,0,0,62/  
c DATA (AVAL1(I),I=1,10)/6772,70192,16206,0,3168,37420,5178,0,0,0/  
c DATA (AVAL2(I),I=1,10)/906,2685,0,0,86,540,75,0,0,0/  
c DATA (ATID1(I),I=1,10)/0,0,0,0,0,44365,50,0,0,0/  
c DATA (ATID2(I),I=1,10)/0,0,0,0,0,1289,25,0,0,0/

DATA (ATEC1(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ATEC2(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ASET1(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ASET2(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ASNC1(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ASNC2(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (AVAL1(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (AVAL2(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ATID1(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/  
DATA (ATID2(I),I=1,10)/0,0,0,0,0,0,0,0,0,0/

DATA (PTEC1(I),I=1,22)/  
+0,0,0,0,0,0,0,0,0,0,0,0,  
+0,0,0,0,0,0,0,0,0,0,0,0/  
DATA (PTEC2(I),I=1,22)/  
+5000,0,1025,10163,1749,13950,479,356,3590,2367,0,  
+257,0,0,0,346,16470,2262,63058,15740,0,701/  
DATA (PSET1(I),I=1,22)/  
+0,0,0,0,0,0,0,0,0,0,0,0,  
+0,0,0,0,0,0,0,0,0,0,0,0/  
DATA (PSET2(I),I=1,22)/  
+4782,5568,732,2233,2570,1656,342,254,2565,1691,0,  
+184,386,10062,1958,240,839,720,0,3275,0,0/  
DATA (PSNC1(I),I=1,22)/  
+0,0,0,0,0,0,0,0,0,0,0,0,  
+0,0,0,0,0,0,0,0,0,0,0,0/  
DATA (PSNC2(I),I=1,22)/  
+13402,15607,2850,7230,8976,6444,1331,990,9983,6581,0,  
+715,2820,16804,10664,1755,2875,5267,0,10825,0,0/  
DATA (PVAL1(I),I=1,22)/  
+0,0,0,0,0,0,0,0,0,0,0,0,  
+0,0,10301,0,0,8428,43562,0,0,0,0,0/  
DATA (PVAL2(I),I=1,22)/  
+0,0,0,0,360,0,0,821,0,538,9677,  
+13595,16701,0,41487,14325,0,0,0,48178,9997,12181/  
DATA (PTID1(I),I=1,22)/  
+0,0,0,0,0,0,0,0,0,0,0,0,  
+0,0,0,0,0,0,43296,0,0,0,0,0/  
DATA (PTID2(I),I=1,22)/  
+0,0,0,0,1206,0,0,2750,0,1803,32412,  
+45538,6680,0,0,13617,0,0,0,48068,32503,36135/

c DATA (PTEC1(I),I=1,22)/  
c +0,0,0,0,0,0,0,0,0,0,0,0,  
c +0,0,0,0,0,0,0,0,0,0,0,0/  
c DATA (PTEC2(I),I=1,22)/  
c +0,0,0,0,0,0,0,0,0,0,0,0,

```

C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PSET1(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PSET2(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PSNC1(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PSNC2(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PVAL1(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PVAL2(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PTID1(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/
C      DATA (PTID2(I),I=1,22)/
C      +0,0,0,0,0,0,0,0,0,0,0,
C      +0,0,0,0,0,0,0,0,0,0,0/

```

IF (ICAS.EQ.2020) GO TO 100

c year 2000 water use

```

READ(50,*) (DOM(I),I=1,10)
READ(50,*) (RYR(I),I=1,10)
READ(50,*) (DUS(I),I=1,10)
READ(50,*) (GIN(I),I=1,10)
READ(50,*) (TOU(I),I=1,10)
READ(50,*) (AQU(I),I=1,10)
READ(50,*) (VES(I),I=1,10)

```

```

DO 40 I=1,22
READ(51,*) (PRIA(I,J),J=1,10)
READ(56,*) (ARIA(I,J),J=1,10)

```

40 CONTINUE

c EVn: environmental flow (m3/s)

```

READ(54,*) (EVO(I),I=1,22)

```

GO TO 200

c year 2020 water use

```

100 READ(52,*) (DOM(I),I=1,10)
READ(52,*) (RYR(I),I=1,10)
READ(52,*) (DUS(I),I=1,10)
READ(52,*) (GIN(I),I=1,10)
READ(52,*) (TOU(I),I=1,10)
READ(52,*) (AQU(I),I=1,10)

```

```

        READ(52,*) (VES(I),I=1,10)

        DO 50 I=1,22
        READ(53,*) (PRIA(I,J),J=1,10)
        READ(57,*) (ARIA(I,J),J=1,10)
50 CONTINUE

        READ(55,*) (EVO(I),I=1,22)

200 IF(ICAS.EQ.2000) CALL DEMA00M
    IF(ICAS.EQ.2020) CALL DEMA20M

c simulation start

        DO 1000 IY=1,15
            IYEA=1985+IY

            DO 110 I=1,22
            DO 120 J=1,12
            READ(10,*) (Q(I,J,K),K=1,3)
120 CONTINUE
            110 CONTINUE

            DO 111 I=1,22
            DO 121 J=1,12
            DO 131 K=1,3
            Q(I,J,K)=Q(I,J,K)/86400.0
131 CONTINUE
121 CONTINUE
            111 CONTINUE

            DO 130 I=1,18
            TWRES(I)=0.0
            TWDEM(I)=0.0
            TWREM(I)=0.0
            TWNAT(I)=0.0
            TWDIS(I)=0.0
130 TWDEF(I)=0.0

            DO 2000 IM=1,12
            DO 3000 ID=1,3

            DO 60 I=1,22
            EV(I)=EVO(I)*FLOAT(IDAY(IM,ID))/1000.0
60 CONTINUE

c WRES: total water resources in the area (1000m3/S/10-day)
c WDEM: total water uses in the area (1000m3/S/10-day)
c WNAT: natural flow at the node (1000m3/S/10-day)
c WDIS: computed flow at the node (1000m3/S/10-day)
c WDEF: total water deficits in the area (1000m3/S/10-day)

c balance node #1

        IF (ICAS.EQ.2000) GO TO 380

```

c year 2020 case  
c block #1

```
QHEPP=Q(1,IM,ID)*(587.0/2389.0)
EVH=0.0*FLOAT(IDAY(IM,ID))*0.001
CALL BALAM(QHEPP,DEM(1,IM,ID)*0.25,REM(1,IM,ID)*0.25,DWN1,DEF1,
+RET1,EVH)

HEPP=DWN1+RET1-63.6*FLOAT(IDAY(IM,ID))*0.001
IF(HEPP) 310,320,320
310 HEPI=DWN1+RET1-1.6*FLOAT(IDAY(IM,ID))*0.001

IF(HEPI) 305,306,306

305 WDEM1=DEM(1,IM,ID)*0.25
WDIS1=DWN1+RET1+Q(1,IM,ID)*(1802.0/2389.0)
GO TO 300

306 WDEM1=DEM(1,IM,ID)*0.25+HEPI
WDIS1=1.6*FLOAT(IDAY(IM,ID))*0.001+Q(1,IM,ID)*(1802.0/2389.0)
GO TO 300

320 HEPI=62.0*FLOAT(IDAY(IM,ID))*0.001
WDEM1=DEM(1,IM,ID)*0.25+HEPI
WDIS1=DWN1+RET1-62.0*FLOAT(IDAY(IM,ID))*0.001+
+Q(1,IM,ID)*(1802/2389)
300 CALL BALAM(WDIS1,DEM(1,IM,ID)*0.75+PEM(1,IM,ID),
+REM(1,IM,ID)*0.75+PEM(1,IM,ID),DWNB,DEFB,RETB,EV(1))
```

c block #2

```
CALL BALAM(DWNB+RETB+Q(2,IM,ID),DEM(2,IM,ID),REM(2,IM,ID),DWN2,
+DEF2,RET2,EV(2))
WRES(1,IM,ID)=Q(1,IM,ID)+Q(2,IM,ID)+RET1+RETB
WDEM(1,IM,ID)=WDEM1+DEM(1,IM,ID)*0.75+DEM(2,IM,ID)+PEM(1,IM,ID)
WREM(1,IM,ID)=REM(1,IM,ID)+REM(2,IM,ID)+PEM(1,IM,ID)
WNAT(1,IM,ID)=Q(1,IM,ID)+Q(2,IM,ID)
WDIS(1,IM,ID)=DWN2+RET2
WDEF(1,IM,ID)=DEF1+DEFB+DEF2
CALL DISMINM(IM,ID,WDIS(1,IM,ID),WDISMNM(1))
GO TO 390
```

c year 2000 case

```
380 CALL BALAM(Q(1,IM,ID),DEM(1,IM,ID),REM(1,IM,ID),DWN1,DEF1,
+RET1,EV(1))
CALL BALAM(DWN1+RET1+Q(2,IM,ID),DEM(2,IM,ID),REM(2,IM,ID),DWN2,
+DEF2,RET2,EV(2))
WRES(1,IM,ID)=Q(1,IM,ID)+Q(2,IM,ID)+RET1
WDEM(1,IM,ID)=DEM(1,IM,ID)+DEM(2,IM,ID)
WREM(1,IM,ID)=REM(1,IM,ID)+REM(2,IM,ID)
WNAT(1,IM,ID)=Q(1,IM,ID)+Q(2,IM,ID)
WDIS(1,IM,ID)=DWN2+RET2
WDEF(1,IM,ID)=DEF1+DEF2
CALL DISMINM(IM,ID,WDIS(1,IM,ID),WDISMNM(1))
```

c balance node #2

```
390 CALL BALAM(Q(4,IM,ID),DEM(4,IM,ID),REM(4,IM,ID),DWN4,DEF4,
+RET4,EV(4))
  WRES(2,IM,ID)=Q(4,IM,ID)
  WDEM(2,IM,ID)=DEM(4,IM,ID)
  WREM(2,IM,ID)=REM(4,IM,ID)
  WNAT(2,IM,ID)=Q(4,IM,ID)
WDIS(2,IM,ID)=DWN4
  WDEF(2,IM,ID)=DEF4
  CALL DISMINM(IM,ID,WDIS(2,IM,ID),WDISMNM(2))
```

c balance node #3

```
CALL BALAM(Q(5,IM,ID),DEM(5,IM,ID),REM(5,IM,ID),DWN5,DEF5,
+RET5,EV(5))
  WRES(3,IM,ID)=Q(5,IM,ID)
  WDEM(3,IM,ID)=DEM(5,IM,ID)
  WREM(3,IM,ID)=REM(5,IM,ID)
  WNAT(3,IM,ID)=Q(5,IM,ID)
WDIS(3,IM,ID)=DWN5
  WDEF(3,IM,ID)=DEF5
  CALL DISMINM(IM,ID,WDIS(3,IM,ID),WDISMNM(3))
```

c balance node #4

```
CALL BALAM(Q(6,IM,ID),DEM(6,IM,ID),REM(6,IM,ID),DWN6,DEF6,
+RET6,EV(6))
  WRES(4,IM,ID)=Q(6,IM,ID)
  WDEM(4,IM,ID)=DEM(6,IM,ID)
  WREM(4,IM,ID)=REM(6,IM,ID)
  WNAT(4,IM,ID)=Q(6,IM,ID)
WDIS(4,IM,ID)=DWN6
  WDEF(4,IM,ID)=DEF6
  CALL DISMINM(IM,ID,WDIS(4,IM,ID),WDISMNM(4))
```

c balance node #5

```
CALL BALAM(DWN6+RET6+Q(7,IM,ID),DEM(7,IM,ID),REM(7,IM,ID),DWN7,
+DEF7,RET7,EV(7))
  WRES(5,IM,ID)=DWN6+RET6+Q(7,IM,ID)
  WDEM(5,IM,ID)=DEM(7,IM,ID)
  WREM(5,IM,ID)=REM(7,IM,ID)
  WNAT(5,IM,ID)=Q(6,IM,ID)+Q(7,IM,ID)
WDIS(5,IM,ID)=DWN7
  WDEF(5,IM,ID)=DEF7
  CALL DISMINM(IM,ID,WDIS(5,IM,ID),WDISMNM(5))
```

c balance node #6

```
CALL BALAM(WDIS(1,IM,ID)+Q(3,IM,ID),DEM(3,IM,ID),REM(3,IM,ID),
+DWN3,DEF3,RET3,EV(3))
  WRES(6,IM,ID)=WDIS(1,IM,ID)+Q(3,IM,ID)+RET3+WDIS(2,IM,ID)+RET4+
+WDIS(3,IM,ID)+RET5+WDIS(5,IM,ID)+RET7
  WDEM(6,IM,ID)=DEM(3,IM,ID)
  WREM(6,IM,ID)=REM(3,IM,ID)
```



```

WNAT(6,IM,ID)=WNAT(1,IM,ID)+Q(3,IM,ID)+Q(4,IM,ID)+Q(5,IM,ID)+
+WNAT(5,IM,ID)
WDIS(6,IM,ID)=DWN3+RET3+DWN4+RET4+DWN5+RET5+DWN7+RET7
WDEF(6,IM,ID)=DEF3
CALL DISMINM(IM,ID,WDIS(6,IM,ID),WDISMNM(6))

```

c balance node #7

```

CALL BALAM(Q(9,IM,ID),DEM(9,IM,ID),REM(9,IM,ID),DWN9,DEF9,
+RET9,EV(9))
WRES(7,IM,ID)=Q(9,IM,ID)
WDEM(7,IM,ID)=DEM(9,IM,ID)
WREM(7,IM,ID)=REM(9,IM,ID)
WNAT(7,IM,ID)=Q(9,IM,ID)
WDIS(7,IM,ID)=DWN9
WDEF(7,IM,ID)=DEF9
CALL DISMINM(IM,ID,WDIS(7,IM,ID),WDISMNM(7))

```

c balance node #8

```

CALL BALAM(DWN9+RET9+Q(10,IM,ID),DEM(10,IM,ID),REM(10,IM,ID),
+DWN10,DEF10,RET10,EV(10))
WRES(8,IM,ID)=DWN9+RET9+Q(10,IM,ID)
WDEM(8,IM,ID)=DEM(10,IM,ID)
WREM(8,IM,ID)=REM(10,IM,ID)
WNAT(8,IM,ID)=Q(9,IM,ID)+Q(10,IM,ID)
WDIS(8,IM,ID)=DWN10
WDEF(8,IM,ID)=DEF10
CALL DISMINM(IM,ID,WDIS(8,IM,ID),WDISMNM(8))

```

c balance node #9

```

CALL BALAM(Q(12,IM,ID),DEM(12,IM,ID),REM(12,IM,ID),DWN12,
+DEF12,RET12,EV(12))
WRES(9,IM,ID)=Q(12,IM,ID)
WDEM(9,IM,ID)=DEM(12,IM,ID)
WREM(9,IM,ID)=REM(12,IM,ID)
WNAT(9,IM,ID)=Q(12,IM,ID)
WDIS(9,IM,ID)=DWN12
WDEF(9,IM,ID)=DEF12
CALL DISMINM(IM,ID,WDIS(9,IM,ID),WDISMNM(9))

```

c balance node #10

```

CALL BALAM(Q(14,IM,ID),DEM(14,IM,ID),REM(14,IM,ID),DWN14,
+DEF14,RET14,EV(14))
WRES(10,IM,ID)=Q(14,IM,ID)
WDEM(10,IM,ID)=DEM(14,IM,ID)
WREM(10,IM,ID)=REM(14,IM,ID)
WNAT(10,IM,ID)=Q(14,IM,ID)
WDIS(10,IM,ID)=DWN14
WDEF(10,IM,ID)=DEF14
CALL DISMINM(IM,ID,WDIS(10,IM,ID),WDISMNM(10))

```

c balance node #11

```

CALL BALAM(DWN14+RET14+Q(15,IM,ID),DEM(15,IM,ID),REM(15,IM,ID),
+DWN15,DEF15,RET15,EV(15))
WRES(11,IM,ID)=DWN14+RET14+Q(15,IM,ID)
WDEM(11,IM,ID)=DEM(15,IM,ID)
WREM(11,IM,ID)=REM(15,IM,ID)
WNAT(11,IM,ID)=Q(14,IM,ID)+Q(15,IM,ID)
WDIS(11,IM,ID)=DWN15
WDEF(11,IM,ID)=DEF15
CALL DISMINM(IM,ID,WDIS(11,IM,ID),WDISMNM(11))

```

c

c balance node #14 (lake lanau & future dams are not computed)

c

```

CALL BALAM(Q(19,IM,ID),DEM(19,IM,ID),REM(19,IM,ID),DWN19,
+DEF19,RET19,EV(19))
BET=0.6
IF(ICAS.EQ.2020) RET19=RET19*BET
WRES(14,IM,ID)=Q(19,IM,ID)
WDEM(14,IM,ID)=DEM(19,IM,ID)
WREM(14,IM,ID)=REM(19,IM,ID)
WNAT(14,IM,ID)=Q(19,IM,ID)
WDIS(14,IM,ID)=DWN19
WDEF(14,IM,ID)=DEF19
CALL DISMINM(IM,ID,WDIS(14,IM,ID),WDISMNM(14))

```

c balance node #15

```

CALL BALAM(DWN19*RTOK+RET19+Q(20,IM,ID),DEM(20,IM,ID),
+REM(20,IM,ID),DWN20,DEF20,RET20,EV(20))
WRES(15,IM,ID)=DWN19*RTOK+RET19+Q(20,IM,ID)
WDEM(15,IM,ID)=DEM(20,IM,ID)
WREM(15,IM,ID)=REM(20,IM,ID)
WNAT(15,IM,ID)=Q(19,IM,ID)*RTOK+Q(20,IM,ID)
WDIS(15,IM,ID)=DWN20
WDEF(15,IM,ID)=DEF20
CALL DISMINM(IM,ID,WDIS(15,IM,ID),WDISMNM(15))

```

c balance node #12

```

CALL BALAM(Q(17,IM,ID),DEM(17,IM,ID),REM(17,IM,ID),DWN17,
+DEF17,RET17,EV(17))
WRES(12,IM,ID)=Q(17,IM,ID)
WDEM(12,IM,ID)=DEM(17,IM,ID)
WREM(12,IM,ID)=REM(17,IM,ID)
WNAT(12,IM,ID)=Q(17,IM,ID)
WDIS(12,IM,ID)=DWN17
WDEF(12,IM,ID)=DEF17
CALL DISMINM(IM,ID,WDIS(12,IM,ID),WDISMNM(12))

```

c balance node #13

```

CALL BALAM(DWN19*RTOO+DWN17+RET17+Q(18,IM,ID),DEM(18,IM,ID),
+REM(18,IM,ID),DWN18,DEF18,RET18,EV(18))
WRES(13,IM,ID)=DWN19*RTOO+DWN17+RET17+Q(18,IM,ID)
WDEM(13,IM,ID)=DEM(18,IM,ID)
WREM(13,IM,ID)=REM(18,IM,ID)

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```

      WNAT(13,IM,ID)=Q(17,IM,ID)+Q(18,IM,ID)+Q(19,IM,ID)*RTOO
      WDIS(13,IM,ID)=DWN18
      WDEF(13,IM,ID)=DEF18
      CALL DISMINM(IM,ID,WDIS(13,IM,ID),WDISMNM(13))

```

```

c
c balance node #16
c

```

```

      CALL BALAM(WDIS(6,IM,ID)+Q(8,IM,ID),DEM(8,IM,ID),REM(8,IM,ID),
      +DWN8,DEF8,RET8,EV(8))
      CALL BALAM(DWN8+RET8+DWN10+RET10+Q(11,IM,ID),DEM(11,IM,ID),
      +REM(11,IM,ID),DWN11,DEF11,RET11,EV(11))
      CALL BALAM(DWN11+RET11+DWN12+RET12+Q(13,IM,ID),DEM(13,IM,ID),
      +REM(13,IM,ID),DWN13,DEF13,RET13,EV(13))
      CALL BALAM(DWN13+RET13+DWN15+RET15+Q(16,IM,ID),DEM(16,IM,ID),
      +REM(16,IM,ID),DWN16,DEF16,RET16,EV(16))

      WRES(16,IM,ID)=WDIS(6,IM,ID)+Q(8,IM,ID)+RET8+WDIS(8,IM,ID)+RET10+
      +Q(11,IM,ID)+RET11+WDIS(9,IM,ID)+RET12+Q(13,IM,ID)+RET13+
      +WDIS(11,IM,ID)+RET15+Q(16,IM,ID)+RET16+WDIS(13,IM,ID)+
+RET18+WDIS(15,IM,ID)+RET20
      WDEM(16,IM,ID)=DEM(8,IM,ID)+DEM(11,IM,ID)+DEM(13,IM,ID)+
      +DEM(16,IM,ID)
      WREM(16,IM,ID)=REM(8,IM,ID)+REM(11,IM,ID)+REM(13,IM,ID)+
      +REM(16,IM,ID)
      WNAT(16,IM,ID)=WNAT(6,IM,ID)+Q(8,IM,ID)+WNAT(8,IM,ID)+Q(11,IM,ID)+
      +WNAT(9,IM,ID)+Q(13,IM,ID)+WNAT(11,IM,ID)+Q(16,IM,ID)+
      +WNAT(13,IM,ID)+WNAT(15,IM,ID)
      WDIS(16,IM,ID)=DWN16+RET16+DWN18+RET18+DWN20+RET20
      WDEF(16,IM,ID)=DEF8+DEF11+DEF13+DEF16
      CALL DISMINM(IM,ID,WDIS(16,IM,ID),WDISMNM(16))

```

```

c balance node #17

```

```

      CALL BALAM(WDIS(16,IM,ID)+Q(21,IM,ID)+Q(22,IM,ID),
      +DEM(21,IM,ID)+DEM(22,IM,ID),REM(21,IM,ID)+REM(22,IM,ID),
      +DWN21,DEF21,RET21,EV(21)+EV(22))
      WRES(17,IM,ID)=WDIS(16,IM,ID)+Q(21,IM,ID)+Q(22,IM,ID)
      WDEM(17,IM,ID)=DEM(21,IM,ID)+DEM(22,IM,ID)
      WREM(17,IM,ID)=REM(21,IM,ID)+REM(22,IM,ID)
      WNAT(17,IM,ID)=WNAT(16,IM,ID)+Q(21,IM,ID)+Q(22,IM,ID)
      WDIS(17,IM,ID)=DWN21+RET21
      WDEF(17,IM,ID)=DEF21
      CALL DISMINM(IM,ID,WDIS(17,IM,ID),WDISMNM(17))

```

```

c balance node #18

```

```

c      CALL BALAM(Q(22,IM,ID),DEM(22,IM,ID),REM(22,IM,ID),DWN22,DEF22,
c      +RET22,EV(22))
c      WRES(18,IM,ID)=Q(22,IM,ID)
c      WDEM(18,IM,ID)=DEM(22,IM,ID)
c      WNAT(18,IM,ID)=Q(22,IM,ID)
c      WDIS(18,IM,ID)=DWN22

```

```

c      WDEF(18,IM,ID)=DEF22
c      CALL DISMINM(IM,ID,WDIS(18,IM,ID),WDISMNM(18))

      DO 140 I=1,18
      TWRES(I)=TWRES(I)+WRES(I,IM,ID)
      TWDEM(I)=TWDEM(I)+WDEM(I,IM,ID)
      TWREM(I)=TWREM(I)+WREM(I,IM,ID)
      TWNAT(I)=TWNAT(I)+WNAT(I,IM,ID)
      TWDIS(I)=TWDIS(I)+WDIS(I,IM,ID)
140 TWDEF(I)=TWDEF(I)+WDEF(I,IM,ID)

      3000 CONTINUE
2000 CONTINUE

c write: year, node name, brown(5)
c write: month, decade & WRES(IY,IM,ID),WDEM(,,),WNAT(,,),WDIS(,,),WDEF(,,)
C write: year total

```

```

      DO 4000 I=1,17
      DO 5000 J=1,12
      DO 6000 K=1,3

      IF(J.EQ.1.AND.K.EQ.1) WRITE(20,950) IYEA,BLONDM(I),
      +(BROWNM(IT),IT=1,5)
      WRITE(20,951) J,K,WRES(I,J,K),WDEM(I,J,K),
      +WNAT(I,J,K),WDIS(I,J,K),WDEF(I,J,K)
      IF(J.EQ.12.AND.K.EQ.3) WRITE(20,952) TWRES(I),TWDEM(I),
      +TWNAT(I),TWDIS(I),TWDEF(I)
950 FORMAT(/ /I4,4X,A12/8X,5(X,A12))
951 FORMAT(2I4,5(X,F12.3))
952 FORMAT(' Total ',5(X,F12.3))

6000 CONTINUE
5000 CONTINUE
4000 CONTINUE

```

c write: summary tables (year deficit & minimum computed flow)

```

      IF(IY.EQ.1) WRITE(30,990) (BLONDM(I),I=1,17)
      WRITE(30,991) IYEA,(TWDEF(I),I=1,17)
990 FORMAT(5X,17(X,A12))
991 FORMAT(X,I4,17(X,F12.3))

      IF(IY.EQ.1) WRITE(40,992) (BLONDM(I),I=1,17)
      WRITE(40,993) IYEA,(WDISMNM(I),I=1,17)
992 FORMAT(5X,17(X,A12))
993 FORMAT(X,I4,17(X,F12.3))

      IF(IY.EQ.1) WRITE(60,992) (BLONDM(I),I=1,17)
      DO 994 I=1,18
      IF(TWREM(I).EQ.0.0) DEF80(I)=- 1.0
      IF(TWREM(I).NE.0.0) DEF80(I)=TWDEF(I)/TWREM(I)

c      IF(TWDEM(I).EQ.0.0) DEF80(I)=- 1.0
c      IF(TWDEM(I).NE.0.0) DEF80(I)=TWDEF(I)/TWDEM(I)

```

```

994 CONTINUE
      WRITE(60,993) IYEA,(DEF80(I),I=1,17)

c      IF(IY.EQ.2) STOP
c      WRITE(6,*) (TWREM(I),I=1,17)

1000 CONTINUE

      CLOSE (10)
      CLOSE (20)
      CLOSE (30)
      CLOSE (40)
      CLOSE (50)
      CLOSE (51)
      CLOSE (52)
      CLOSE (53)
      CLOSE (54)
      CLOSE (55)
      CLOSE (56)
      CLOSE (57)
      CLOSE (60)

      STOP
      END

      SUBROUTINE BALAM(Q,D,R,DW,DF,RE,EV)
c Q : available water resources (1000m3/S/10-day)
c D : water use (1000m3/S/10-day)
c R : irrigation water use (1000m3/S/10-day)
c DW: discharge after intake (1000m3/S/10-day)
c DF: deficit of block (1000m3/S/10-day)
c RE: return flow from irrigation water use of block (1000m3/S/10-day)
c EV: environmental in-stream use (1000m3/S/10-day)

      IF(Q.GE.EV) GO TO 100
      IF(Q.LT.EV) GO TO 200

100 AV=Q-EV
      IF(D.LT.AV) GO TO 120
      IF(D.GE.AV) GO TO 140

140 DIF=D-AV
      IF(DIF.GE.R) GO TO 142
      IF(DIF.LT.R) GO TO 144

142 DW=EV
      AV=Q-EV
      DF=D-AV
      RE=0.0
c      CF=D-AV-R
      GO TO 300

144 DW=EV
      AV=Q-EV
      DF=D-AV

```

```

      RE=(AV-(D-R))*0.2
c     CF=0.0
      GO TO 300

```

```

120 DW=Q-D
     AV=Q-EV

```

```

      DF=0.0
      RE=R*0.2
c     CF=0.0
      GO TO 300

```

```

200 DW=Q

```

```

      AV=0.0
      DF=D
      RE=0.0
c     CF=D-R

```

```

300 RETURN
     END

```

```

SUBROUTINE DEMA00M

```

```

COMMON/WP/DET(10,8,12,3),PEM(22,12,3),DEM(22,12,3),
+REM(22,12,3)

```

```

COMMON/DAYS/IDAY(12,3),MDAY(12)

```

```

COMMON/DEMDM/DOM(10),RZR(10),DUS(10),GIN(10),TOU(10),
+AQU(10),VES(10)

```

```

COMMON/ARIALM/ARIA(22,10),PRIA(22,10)

```

```

c 1=OKU,2=OKI,3=ME,4=LAHAT,5=MURA,6=MUBA,7=PLB,8=PAGARALAM,9=PRABUMULIH,10=BENGKELU

```

```

c unit water use of l.g. 1 DOM(10): piped water supply (l/s)

```

```

c "      2 RZR(10): rural water supply (l/s)

```

```

c "      3 DUS(10): industrial (1000m3/year)

```

```

c "      4 GIN(10): mining (1000m3/year)

```

```

c "      5 TOU(10): tourism (m3/year)

```

```

c "      6 RRI(10): irrigation (1000m3/yera)

```

```

c "      7 AQU(10): aquaculture (1000m3/year)

```

```

c "      8 VES(10): livestock (m3/day)

```

```

c DET(10,8,12,3): water use of regencies/municipalities (1000m3/S/10-day)

```

```

c DEM(22,12,3): water use of sub-basins (1000m3/S/10-day)

```

```

c PEM(22,12,3): increase of irrigation water use of sub-basins (1000m3/S/10-day)

```

```

c REM(22,12,3): irrigation water use of sub-basins (1000m3/S/10-day)

```

```

COMMON/DIVRM/TEC1(12),TEC2(12),SET1(12),SET2(12),SNC1(12),
+SNC2(12),VAL1(12),VAL2(12),TID1(12),TID2(12)

```

```

COMMON/APADM/A TEC1(10),A TEC2(10),A SET1(10),A SET2(10),A SNC1(10),
+ASNC2(10),A VAL1(10),A VAL2(10),A TID1(10),A TID2(10)

```

```

c DIVRM: diversion requirement by paddy type (mm/month)

```

```

c APADM: area of paddy field in each regency/municipality (ha)

```

```

c DET(10,8,12,3): time distribution of water use of each regency/municipality

```

```

DO 100 I=1,10

```

```

DO 110 K=1,12

```

```

DO 120 L=1,3

```

```

DET(I,1,K,L)=DOM(I)*FLOAT(IDAY(K,L))*0.001/1000.0

```

```

DET(I,2,K,L)=RZR(I)*FLOAT(IDAY(K,L))*0.001/1000.0

```

```

DET(I,3,K,L)=DUS(I)*(FLOAT(IDAY(K,L))/365.0)/86400.0

```

```

DET(I,4,K,L)=GIN(I)*(FLOAT(IDAY(K,L))/365.0)/86400.0

```

```

DET(I,5,K,L)=TOU(I)*(FLOAT(IDAY(K,L))/365.0)*0.001/86400.0
DET(I,7,K,L)=AQU(I)*(FLOAT(IDAY(K,L))/365.0)/86400.0
DET(I,8,K,L)=VES(I)*FLOAT(IDAY(K,L))*0.001/86400.0

```

c irrigation

```

DET(I,6,K,L)=(TEC1(K)*ATEC1(I)+TEC2(K)*ATEC2(I)+SET1(K)*ASET1(I)+
+SET2(K)*ASET2(I)+SNC1(K)*ASNC1(I)+SNC2(K)*ASNC2(I)+
+VAL1(K)*AVAL1(I)+VAL2(K)*AVAL2(I)+TID1(K)*ATID1(I)+
+TID2(K)*ATID2(I))*FLOAT(IDAY(K,L))/(FLOAT(MDAY(K))*100.0*86400.0)
120 CONTINUE
110 CONTINUE
100 CONTINUE
DO 300 I=1,8
DO 310 J=1,12
DO 320 K=1,3
DET(4,I,J,K)=DET(4,I,J,K)+DET(8,I,J,K)
DET(3,I,J,K)=DET(3,I,J,K)+DET(9,I,J,K)
320 CONTINUE
310 CONTINUE
300 CONTINUE
c DEM(22,12,3) & REM(22,12,3): aera distribution of water use based on the time distribution
DO 200 I=1,22
DO 210 J=1,8
DO 220 K=1,10
DO 230 L=1,12
DO 240 M=1,3
IF(J.NE.6) DEM(I,L,M)=DEM(I,L,M)+DET(K,J,L,M)*PRIA(I,K)
IF(J.EQ.6) REM(I,L,M)=REM(I,L,M)+DET(K,J,L,M)*ARIA(I,K)
240 CONTINUE
230 CONTINUE
220 CONTINUE
210 CONTINUE
200 CONTINUE
DO 600 I=1,22
DO 610 J=1,12
DO 620 K=1,3
DEM(I,J,K)=DEM(I,J,K)+REM(I,J,K)
620 CONTINUE
610 CONTINUE
600 CONTINUE
RETURN
END

```

```

SUBROUTINE DISMINM(IM,ID,WD,WM)
IF(IM.EQ.1.AND.ID.EQ.1) GO TO 100
WM=MIN(WM,WD)
GO TO 200
100 WM=WD
200 RETURN
END

```

```

SUBROUTINE DEMA20M
COMMON/WP/DET(10,8,12,3),PEM(22,12,3),DEM(22,12,3),
+REM(22,12,3)
COMMON/DAYS/IDAY(12,3),MDAY(12)
COMMON/DEMDM/DOM(10),RYR(10),DUS(10),GIN(10),TOU(10),

```

```

+AQU(10),VES(10)
COMMON/ARIALM/ARIA(22,10),PRIA(22,10)
COMMON/DIVRM/TEC1(12),TEC2(12),SET1(12),SET2(12),SNC1(12),
+SNC2(12),VAL1(12),VAL2(12),TID1(12),TID2(12)
COMMON/APADM/ATEC1(10),ATEC2(10),ASET1(10),ASET2(10),ASNC1(10),
+ASNC2(10),AVAL1(10),AVAL2(10),ATID1(10),ATID2(10)
COMMON/PPADM/PTEC1(22),PTEC2(22),PSET1(22),PSET2(22),PSNC1(22),
+PSNC2(22),PVAL1(22),PVAL2(22),PTID1(22),PTID2(22)
DO 100 I=1,10
DO 110 K=1,12
DO 120 L=1,3
DET(I,1,K,L)=DOM(I)*FLOAT(IDAY(K,L))*0.001/1000.0
DET(I,2,K,L)=RYS(I)*FLOAT(IDAY(K,L))*0.001/1000.0
DET(I,3,K,L)=DUS(I)*(FLOAT(IDAY(K,L))/365.0)/86400.0
DET(I,4,K,L)=GIN(I)*(FLOAT(IDAY(K,L))/365.0)/86400.0
DET(I,5,K,L)=TOU(I)*(FLOAT(IDAY(K,L))/365.0)*0.001/86400.0
DET(I,7,K,L)=AQU(I)*(FLOAT(IDAY(K,L))/365.0)/86400.0
DET(I,8,K,L)=VES(I)*FLOAT(IDAY(K,L))*0.001/86400.0
DET(I,6,K,L)=(TEC1(K)*ATEC1(I)+TEC2(K)*ATEC2(I)+SET1(K)*ASET1(I)+
+SET2(K)*ASET2(I)+SNC1(K)*ASNC1(I)+SNC2(K)*ASNC2(I)+
+VAL1(K)*AVAL1(I)+VAL2(K)*AVAL2(I)+TID1(K)*ATID1(I)+
+TID2(K)*ATID2(I))*FLOAT(IDAY(K,L))/(FLOAT(MDAY(K))*100.0*86400.0)
120 CONTINUE
110 CONTINUE
100 CONTINUE
DO 300 I=1,8
DO 310 J=1,12
DO 320 K=1,3
DET(4,I,J,K)=DET(4,I,J,K)+DET(8,I,J,K)
DET(3,I,J,K)=DET(3,I,J,K)+DET(9,I,J,K)
320 CONTINUE
310 CONTINUE
300 CONTINUE
DO 200 I=1,22
DO 210 J=1,8
DO 220 K=1,10
DO 230 L=1,12
DO 240 M=1,3
IF(J.NE.6) DEM(I,L,M)=DEM(I,L,M)+DET(K,J,L,M)*PRIA(I,K)
IF(J.EQ.6) REM(I,L,M)=REM(I,L,M)+DET(K,J,L,M)*ARIA(I,K)
240 CONTINUE
230 CONTINUE
220 CONTINUE
210 CONTINUE
200 CONTINUE
DO 600 I=1,22
DO 610 J=1,12
DO 620 K=1,3
DEM(I,J,K)=DEM(I,J,K)+REM(I,J,K)
620 CONTINUE
610 CONTINUE
600 CONTINUE
c calculation of PEM(22,12,3), then, add PEM to DEM & REM except for 1.
DO 400 I=1,22
DO 420 K=1,12
DO 430 L=1,3

```



```

      PEM(I,K,L)=(TEC1(K)*PTEC1(I)+TEC2(K)*PTEC2(I)+SET1(K)*PSET1(I)+
      +SET2(K)*PSET2(I)+SNC1(K)*PSNC1(I)+SNC2(K)*PSNC2(I)+
      +VAL1(K)*PVAL1(I)+VAL2(K)*PVAL2(I)+TID1(K)*PTID1(I)+
      +TID2(K)*PTID2(I))*FLOAT(IDAY(K,L))/(FLOAT(MDAY(K))*100.0*86400.0)
430 CONTINUE
      420 CONTINUE
400 CONTINUE
      DO 500 I=2,22
      DO 510 J=1,12
      DO 520 K=1,3
      DEM(I,J,K)=DEM(I,J,K)+PEM(I,J,K)
      REM(I,J,K)=REM(I,J,K)+PEM(I,J,K)
520 CONTINUE
510 CONTINUE
500 CONTINUE
      RETURN
      END

```