NATIONAL RIVERS AUTHORITY
ANGLIAN REGION

COMPUTER FILES USED IN THE CALCULATION OF RUTLAND AND GRAFHAM YIELDS

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Introduction

Reservoir yield is calculated by simulating the behaviour of the system over the historic period. The first stage is to naturalise gauged flows so that future catchment conditions can be applied. Subsequently a simulation model is used to calculate the yield. For Rutland and Grafham calculation of yield is carried out in two stages; a simulation model calculates available water for each month of the historic period and a generic yield model called OSAY determines the yield using a levels of service approach.

Rutland and Grafham yield models have been used extensively in modelling for the National and Regional Water Resources Strategies. As well as calculating the yield of the systems in their existing configurations the models have also been used to investigate the advantages of augmentation of available flows from the Trent. This work has been reported in Cook et al (1993), Cook (1993) and Watts (1993). This document details the PC computer files used in the calculation of Rutland and Grafham yield.

File location

All of the files used for Rutland and Grafham yield analysis have been backed up onto two identical tapes called *Backup of Rutland and Grafham Data* and dated 17 June 1994 and 20 June 1994. Most of these files should not be needed and it is unlikely that it will be necessary to restore files from these.

The files actually needed for the calculation of Rutland and Grafham natural flows and yield have been backed up to a tape called *Rutland and Grafham Archive Tape* (dated 20 June 1994). This tape was created using a Cristie TS4000 portable tapestreamer. These are also two set of two disks with the same files zipped using PKZIP. This document describes the directory structure and files of these archived files.

A directory tree for the files is shown in figure 1. The description of the separate files is laid out in the order of this tree.

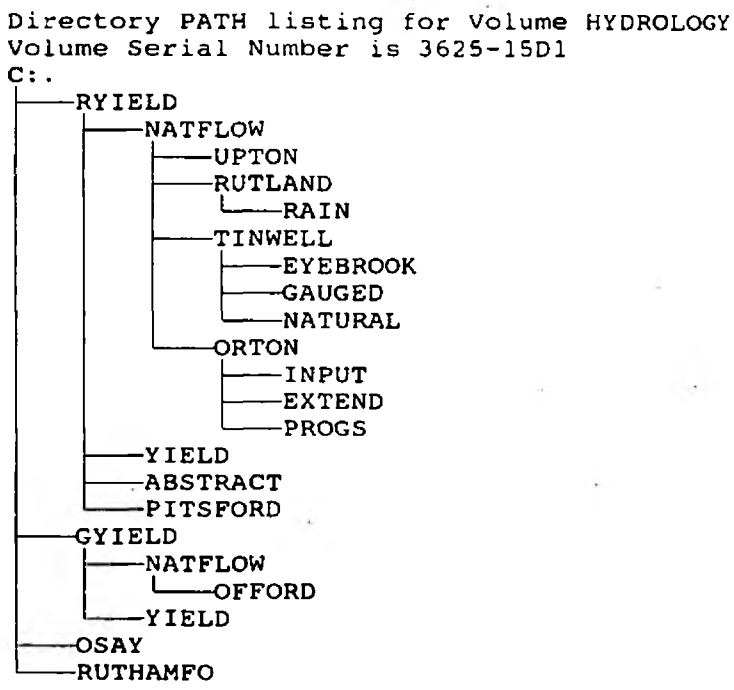

Figure 1: directory tree for Rutland and Grafham yield analysis files.

Files used

Rutland yield analysis

Flow naturalisation

Upton

Directory: *RYIELD\NATFLOW\UPTON*

File: *UPTON.TOT*

Daily mean flows at Upton gauging station. These are used in the calculation of Tinwell flows before 1969. UPTON.TOT contains flows from 1911 to 1992; 1911 to 1941 have been synthesised using HYRROM.

Rutland

Directory: *RYIELD\NATFLOW\RUTLAND\RAIN*

File: *NETPPT.FOR*

Fortran program for subtracting potential evaporation from rainfall to create a column of daily net precipitation values. This is the 1932 to 1992 version.

File: *RAIN3.COL*

Column of daily rainfall values 1932 to 1992.

File: *EVAP.MON*

Monthly evaporation values 1932 to 1992.

Directory: *RYIELD\NATFLOW\RUTLAND*

File: *NETRAIN.OUT*

Net rainfall in mm on surface of reservoir 1932 to 1992.

File: *INFLOW.FOR*

Program to calculate inflows to Rutland by adding Manton and Egleton flows after 1978; from 1932 uses regression against Upton.

File: *MANTON.FPS*

Gauged flow at Manton.

File: *EGLETON.FPS*

Gauged flow at Egleton.

File: *INFLOW.OUT*

Flows into Rutland calculated by INFLOW.FOR.

File: *RUTLAN.FOR*

Adds flows and net rainfall to give net flows into Rutland 1932 to 1992.

File: *RUTLAND.NAT*

Calculated natural Rutland inflows 1932 to 1992.

Eyebrook Reservoir

Directory: *RYIELD\NATFLOW\TINWELL\EYEBROOK*

File: *IMPOUN3.FOR*

Calculates Eye Brook reservoir impoundments 1932 to 1992.

File: *EYEBROO2.FIL*

Eye Brook Reservoir outflow 1932 to 1992 (1932 to 1937 filled with 1942 to 1947).

File: *EYEBROOK.IMP*

Eye Brook Reservoir net impoundment 1932 to 1992.

File: *EYEBROOK.INF*

Eye Brook inflows 1932 to 1992.

Tinwell gauged flows

Directory: *RYIELD\NATFLOW\TINWELL\GAUGED*

File: *TINWELL2.FOR*

Program to create an extended flow record for Tinwell from regression with Upton (to 1968), addition of Fosters Bridge and Barrowden (to 1989) and Tinwell gauged + abstractions.

File: *TINWELL.EXT*

Tinwell flows extended back to 1932.

File: *TINWELL.TOT*

Gauged Tinwell flows with daily abstractions added from 1989 onwards.

Tinwell natural flows

Directory: *RYIELD\NATFLOW\TINWELL\NATURAL*

File: *NATUR2.FOR*

Naturalises Tinwell flows

File: *WELLAND.ABS*

Annual Welland abstractions 1932 to 1992.

File: *TINWELL.NAT*

Tinwell naturalised flows 1932 to 1992.

Orton naturalisation

Directory: *RYIELD\NATFLOW\ORTON\INPUT*

File: *DUSABS.DAT*

Annual Duston Mill abstractions 1941 to 1992.

File: *DUSABS.MON*

Monthly Duston Mill abstractions 1989 to 1992.

File: *AGIND.DAT*

Annual agricultural and industrial abstractions in the Nene catchment 1941 to 1992.

File: *RESFAC.DAT*

Annual values relating inflow to the small reservoirs in the Nene catchment to the inflow to Pitsford.

File: *PWSDEM.DAT*

Public Water Supply demand profile

File: *DUSDEM.DAT*

Duston Mill demand profile (for use in years when only annual abstraction values are available)

File: *AGDEM.DAT*

Agricultural demand profile.

File: *CORBY.DAT*

Monthly supply in millions of gallons from Eye Brook Reservoir to Corby & District Water Company (1991 values used for 1992).

File: *WANSDAY.DAT*

Daily Wansford abstractions 1976 to 1992.

File: *PWS.DAT*

Annual public water supply in the Nene catchment broken down into water abstracted in the catchment and total water supplied (tcmd).

File: *STANMON.DAT*

Long term average monthly flows at St Andrews Gauging Station

File: *STANDREW.DAT*

Daily St Andrews gauged flows 1941 to 1992.

File: *FILES.IN*

List of files to be used in naturalisation.

Directory: *RYIELD\NATFLOW\ORTON\PROGS*

File: *FLOWNA3.FOR*

Calculates monthly and daily correction factors for the naturalisation of Orton flow (monthly Duston Mill abstractions used 1989 onwards).

File: *FLOWNA4.FOR*

Calculates monthly and daily correction factors for the naturalisation of Orton flow (monthly Duston Mill abstractions used 1969 onwards).

File: *NATFLO2.FOR*

Adds daily corrections to daily Orton flows to naturalis flows.

Directory: *RYIELD\NATFLOW\ORTON\EXTEND*

File: *ORTON3.NAT*

Natural Orton flow (most recent version). Uses Duston monthly abstractions 1969 to 1992.

File: *ORTON.NAT*

Natural Orton flow. Uses Duston monthly abstractions from 1989 to 1992.

File: *ORTONNAT.NAT*

Orton natural flow extended back to 1932 using HYRROM. Uses ORTON.NAT for the end of the period and not ORTON3.NAT, but this does not affect yield or flows significantly.

File: *ORTONHY3.SIM*

HYRROM simulation of early period of record.

File: *ORTON.FPS*

Flow processing file January 1941 to December 1942.

Rutland yield

Directory: *RYIELD\YIELD*

File: *RUTLAND2.FOR*

Program to prepare available volumes of water for OSAY. Can accept augmentation of Rutland.

File: *RUTLAND3.FOR*

As RUTLAND2.FOR but with 10% reduction in sewage effluent.

File: *RESERV.FOR*

Simulates reservoir operation to determine how much augmentation water would be used.

File: *TRENT.FOR*

Takes Trent flows and applies MRF to determine how much would be available for Rutland. Used in direct Trent-Rutland simulation.

File: *AVERAG.FOR*

Calculates average use of transferred water.

File: *RESERV2.FOR*

Improved version of RESERV.FOR.

File: *ZERO.AVL*

Available transfer water - all set at zero.

File: *TRENT25.AVL*

Example of available Trent transfer water.

File: *RUTLAND.NAT*

Rutland natural inflows.

File: *EYEBROOK.INF*

Eye Brook Reservoir natural inflows.

File: *TINWELL.EXT*

Extended Tinwell natural flows.

File: *PITSFORD.INF*

Pitsford natural inflows.

File: *OSAY.EXE*

OSAY yield assessment program (needs Salford Fortran DBOS to run)

File: *CONTROL.DAT*

example control file for OSAY.

Rutland actual abstraction data

Directory: *RYIELD\ABSTRACT*

Files: *RUTJAN90.CAL*

RUTJAN92.CAL

Supercalc 5 spreadsheets of abstractions to Rutland and Rutland levels and storages.

Pitsford inflows

Directory: *RYIELD\PITSFORD*

File: *PITS.FOR*

Calculates inflows to Pitsford 1932 to 1992 from St Andrews flows (needed for simulation of Pitsford behaviour in Rutland model).

File: *PITS.OUT*

Calculated Pitsford inflow sequence 1932 to 1992.

Grafham yield analysis

Offord naturalisation

Directory: *GYIELD\NATFLOW\OFFORD*

File: *NATVAR.CAL*

SuperCalc 5 spreadsheet for calculation of monthly variation (naturalisation) term

File: *NATVAR.WK1*

As NATVAR.CAL but in Lotus 1-2-3 format.

File: *SNAT.FOR*

Creates naturalised flow from gauged flow.

File: *OFFQ7092.DAT*

Flows upstream of Grafham intake.

File: *OFFQ7092.NAT*

Naturalised Offord flows 1970 to 1992.

File: *BREST.FOR*

Steve Cook's program for calculating Brownshill flows from Offord flows.

File: *BROWNS.FOR*

Program for calculating Brownshill flows from Offord flows using regression equation.

File: *BROWNS.NAT*

Natural Brownshill flows 1970 to 1992.

File: *VARN2.DAT*

Variation (naturalisation) term 1970 to 1992.

File: *QOFF3390.NAT*

Long term Offord natural flow.

File: *QBHL3390.NAT*

Long term Brownshill natural flow.

Yield analysis

Directory: *GYIELD\YIELD*

File: *GRAFIN5.FOR*

Grafham data preparation program. Does not include Brownshill abstraction but allows augmentation from another source (eg Trent transfers).

File: *GRAFIN6.FOR*

As GRAFIN5.FOR but with 10% reduction in sewage effluent.

File: *OFFQ3392.NAT*

Long term Offord natural flow.

File: *BROW3392.NAT*

Long term Brownshill natural flow.

File: *TRENT25.AVL*

Example of available transfer water.

File: *CONTROL.DAT*

Example OSAY control file.

File: *OSAY.EXE*

OSAY yield analysis program (needs Salford Fortran DBOS).

File: *RESERV.FOR*

Simulates reservoir operation (used to calculate how much transferred water would actually be used).

File: *DPLIST2.DAT*

Control for start and end dates of simulation.

File: *RESID.FOR*

Calculates residual flows downstream of Offord.

OSAY yield analysis program

Directory: *OSAY*

File: *OSAY.FOR*

Fortran code for OSAY (Operating Strategy Assessment of Yield) method.

File: *OSAY.EXE*

Compiled version (needs Salford Fortran DBOS to run).

Ruthamford actual abstractions

Directory: *RUTHAMFO*

Files: **.CAL*

Actual Ruthamford abstractions on SC5 spreadsheets 1989 to 1990.

Calculating reservoir yields

Rutland

Natural flows are required for the Nene at Orton, the Welland at Tinwell and for inflows to Rutland itself. The flow intercepted by Pitsford Reservoir in the Nene catchment and Eye Brook Reservoir in the Welland is also required.

Orton naturalisation

Orton naturalisation is described in Fawthrop (1990) and Watts (1992a). FLOWNA4.FOR is used to calculate monthly and daily correction factors for the gauged flow record. Artificial influence files are listed in the file called FILES.IN. NATFLO2.FOR is used to add the resulting daily corrections to the gauged flows.

Tinwell naturalisation

Tinwell naturalisation is described in Watts (1992b). The first stage in Tinwell naturalisation is to make a Tinwell gauged record. Flows are available from the gauging station only from 1986. To make these gauged flows reflect the water arriving at Tinwell before abstraction the abstractions have to be added back to the gauged flow. Abstractions are available only from 1989 onwards; Tinwell gauged flows are used from this date. From 1968 the upstream flows at Fosters Bridge and Barrowden can be added. Before 1968 a regression with gauged flows at Upton is used. Upton before 1941 has been extended using HYRROM. TINWELL2.FOR combines the records to create a Tinwell 'gauged' record from 1932 onwards.

Tinwell naturalisation itself is very simple. There are very few abstractions in the catchment. The major artificial influence is Eye Brook Reservoir. Impoundments by Eye Brook Reservoir are calculated by regression with Fosters Bridge from 1968 onwards; before this Upton is used. IMPOUN3.FOR calculates total impoundments and net impoundments. The net impoundments are used in naturalisation. NATUR2.FOR calculates Tinwell natural flows by adding artificial influences to the gauged record.

Rutland inflows

The calculation of inflows to Rutland Water is described in Watts (1992c). The components of inflow are flow from the surrounding catchment and the direct impact of rainfall and evaporation on the reservoir surface.

NETPPT.FOR combines daily rainfall values and monthly evaporation values to create a daily net precipitation record in mm.

Catchment inflow after 1978 is calculated by adding the gauged flows at Manton and Egleton and scaling by catchment area. Before 1978 regression equations relating Manton and Egleton to Upton are used. INFLOW.FOR carries out these calculations.

The net precipitation is scaled for the surface area of the reservoir and added to the inflow sequence to produce total net inflow to Rutland Water. NETPPT.FOR carries out this addition.

Pitsford inflows

These are calculated internally within the Orton naturalisation program and therefore are not required for Orton naturalisation. However they are needed for the simulation of Rutland behaviour. PITS.FOR calculates these inflows by a regression against St Andrews gauged flows.

Rutland yield analysis

RUTLAND2.FOR calculates the volume of water available for pumping to Rutland. It does

not simulate Rutland water levels. It uses the natural flows and denaturalises them for future conditions. Existing fully licensed abstractions are used but no reduction in minimum residual flow is permitted. Augmentation from additional sources is possible.

On running the program, several questions must be answered. The first asks for the demand year; this must be 1992, 2001, or 2011. The level of demand determines the volume of effluent in the rivers; this is especially significant in the Nene catchment.

The next prompt asks if pump scheduling is required. Without pump scheduling all water above the mrf and below the maximum pump capacity is assumed to be available for Rutland. With pump scheduling the existing stepped pump capacities are used (this results in a lower yield because some available water is not abstracted).

Leakage must be given in tcmd. A figure of 11 tcmd has been used in the water resources strategy. Leakage is treated as a component of the natural inflows.

Augmentation from additional sources is allowed. If this option is chosen a file with the daily values of potential augmentation must be provided. The file name must have the suffix .AVL (for available). Only the prefix to the name should be supplied to the program. The program will create two new files with .ABS and .US1 suffixes; these contain the total abstraction and the volume of this made up of transferred water respectively. To find out how much transferred water would be used for filling Rutland a further program called RESERV.FOR must be run, using these two files and the calculated yield as input.

After giving start year; start month, end year and end month the program will run. Output of monthly volumes available to Rutland Water is given in a file called RUT.DAT. Running OSAY using this file will allow the yield to be calculated. To correspond with the figures quoted in the Regional Strategy 5 tcmd should be subtracted from the calculated yields; this figure represents compensation releases.

To determine how much augmentation water would actually be used, RESERV2.FOR should be used. This simulates the behaviour of the reservoir system with the yield calculated by OSAY. This calculates the volume of water which would be needed to keep the reservoir as full as possible at all times but not allowing the reservoir to spill. Output is to a file with the same prefix as the input file but with the suffix .USE. This contains total volumes of transfer required.

Grafham

Grafham is a simpler reservoir system than Rutland. There is a single intake point on the Bedford Ouse at Offord, and there are no other significant reservoirs in the catchment. A licence exists for an abstraction at Brownshill (the tidal limit of the Bedford Ouse) and the programs have been written to incorporate this, although the option is disabled in the archived versions.

Offord naturalisation

Offord flows are naturalised using the SuperCalc 5 spreadsheet NATVAR.CAL. This calculates monthly values in tcmd. The correction value column is exported as an ASCII file and used in SNAT.FOR which adds the corrections to the 'gauged' flows in tcmd to naturalise Offord flow. Offord gauged flows are calculated by Central Area by adding upstream gauging stations and do not include the Offord abstraction. Natural Brownshill flow is calculated from the natural Offord flow using BROWNS.FOR. This method calculates natural flows from 1970 onwards. The natural flows from 1933 to 1970 are provided in the GYIELD\NATFLOW\OFFORD directory.

Grafham yield analysis

GRAFIN5.FOR calculates the water available for pumping to Grafham. No natural inflows are considered as the Grafham catchment is very small. Code for the calculation of supply from Brownshill is incorporated in GRAFIN5.FOR but is not used; the Brownshill abstraction would increase the yield of Grafham significantly.

GRAFIN5.FOR is less friendly than the Rutland programs. It asks for a demand year which must be 1991, 2001 or 2011. Its next request is for a file name. This is the file from which potential augmentation will be read. In this version of GRAFIN5.FOR this file must be used even if no augmentation is required. The file name must have a .AVL suffix. The program will create .ABS and .US1 files containing total abstraction and the volume of augmentation used. These files must not already exist. The maximum augmentation rate is requested next; if this is set at zero no augmentation will be allowed. After this the available flows are calculated and output to a file called GRAFHAM.DAT which can be used in OSAY to calculate the yield. Start and end dates for the simulation are held in a file called DPLIST2.DAT; these must coincide with the start and end dates of the naturalised flow files. 4 tcmd should be subtracted from the calculated Grafham yield to allow for compensation releases and leakage.

RESERV.FOR can be used to calculate how much of the augmentation water would actually have been used. This carries out a very simple simulation of the Grafham system with the calculated yield. The target is to keep Grafham as full as possible at all times.

RESID.FOR calculates residual flows downstream of Offord after abstraction. It adds transfers destined for Denver to denaturalised flow and subtracts actual abstraction at Offord. It was used in the calculation of the environmental impacts of various options for the National Water Resources Strategy.

References

Cook S 1993. *Stage 2 modelling of water storage and transfers in the Anglian Region.* Supporting documentation for the NRA Anglian Regional Water Resources Strategy.

Cook S, G Watts & N Fawthrop 1993. *Preliminary modelling of water storage and transfers in the Anglian Region.* Supporting documentation for the NRA Anglian Regional

Water Resources Strategy.

Fawthrop N 1990. *Naturalisation of the Orton river flow record.* NRA internal report.

Watts G 1992a. *Naturalisation of the Orton flow record.* NRA internal report.

Watts G 1992b. *Naturalisation of Tinwell flows.* NRA internal report.

Watts G 1992c. *Natural inflows to Rutland Water.* NRA internal report.

Appendix 1: Programs used in yield analysis

Rutland yield analysis - RUTLAND2.FOR

```
C$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
C      Program : RUTDP1.FOR
C      Purpose : PREPARATION OF RUTLAND INFLOW DATA FOR OSAY PROGRAM

C      Synopsis: Creates monthly output of pumped values for 2
C                MRF combinations

C      Version 1.0  Anglian Water (G Spraggs) November 1992
C         Sections within marks shown below are to give extra output for
C         checking calculations. They are normally 'commented out'.
C         Remove comments to give output (files may be large).
C           ==== : calculation of river flows (file 09)
C           **** : Pitsford simulation (file 10)
C           ++++ : pump selection (file 11)
C           ---- : monthly (file 04) & monthly averages for complete
C                  run (end of file 04) of Eye Brook & Pitsford impound-
C                  ments & Duston abstraction. Add comment to 'Write'.
C         The following program modifications can be made by removing
C         comments within sections marked as follows:
C           """" : remove comments to omit pump scheduling
C           ^^^^ : remove comments to omit Eye Brook, Duston & Pitsford
C                  abstractions
C           #### : remove comment to zero Rutland natural inflows
C         The following modifications are +/- 10% & 20% sensitivity on
C         natural river flows:
C           //// : remove comment & add comment to normal line to add
C                  10% or 20% to nat flow
C           ____ : as above but flows reduced by 10% or 20%
C         Flow naturalisation and calculation of natural inflows
C         reported by NRA as follows:
C         'Naturalisation of the Orton Flow Record' Glen Watts, NRA
C          18 November 1992
C         'Naturalisation of Tinwell Flows' Glen Watts, NRA
C          4 December 1992
C         'Natural Inflows to Rutland Water' Glen Watts, NRA
C          1 December 1992
C
C         ALSO SEE COMMENTS IN PROGRAM
C
C      Some aspects of the program need improvement viz. :
C      -  Pitsford simulation assumes fixed Duston abstraction; needs
C         naturalised flows for Duston; combine preparation of Rutland &
C         Pitsford inflows for OSAY (need separate future abstractions &
C         effluents for catchments to Duston & Wansford)
C      -  Data missing from St Andrews gauged record used to produce
C         natural inflows - long term average for month used to 'infill'
C      -  Eye Brook natural inflows calc does not include rainfall &
C         evaporation, although effect probably small
C      -  calculation of natural inflow & compensation to Pitsford &
C         compensation flow to Eye Brook at very low res levels are
C         oversimplified (effect probably small)
C      -  Pitsford abstraction includes Ravensthorpe & Hollowell
C         abstractions (8 tcmd - effect probably small)
c
c************************************************************************
c
c      Revised version by Glenn Watts (NRA Anglian Region) 26/2/93
c
c      Revisions to:
c         effluent profile
c         spray irrigation profile
c         treatment of effluents at second MRF
c         option of pump scheduling
c         option of constant rate leakage
c
c      All changes are commented and in lower case
c""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""
c
c      Revision to include the possibility of use of Trent transfer
c      water
c
c      Glenn Watts 3 March 1993
c
c      Reads in extra available water and uses it to prepare input
c      file
c
c      NOTE: needs files to start in January 1972
c
c      Back to original file lengths
c
c0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0o0
c
c      Revised version Glenn Watts 26/7/93
c
```

```
c     Revisions to allow any period to be simulated
c
c
C$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

      DIMENSION RNAT(31),ENAT(31),PRNAT(31),QTOT(12),
     & QMRFW(2),QMRFN(2),PRCOMP(12),QSA(31),
     & EFFMON(12),SD(12),DUSFAC(12),TEBIMP(12),TDUSPR(12)
      REAL QRW(31),QRN(31),demred(12)
      INTEGER SM,SY,FM,FY,NDAYS(12),KOUNT(12)
      dimension abst(31),trans(31),used(31)
      character*8 fhead
      character*12 filein,filout,filou2
      logical pump,error,aug
      character*1 answ
      real leak
      CHARACTER*80 TITL
c     demred added to deal with second residual flow properly.  Before
c     this residual flow is introduced, demand control measures must
c     be in place; therefore effluent must be smaller by the same factor
c     as assumed in OSAY (GPW 23/2/93)
      data demred/0.86,0.86,0.84,0.78,0.72,0.68,0.68,0.72,0.74,
     &  0.78,0.84,0.86/

      write(6,*)'Note: maximum permitted pump capacities'
c      write(6,*)'Note: all data must start at the same time'
      PRINT*,'DEMAND YEAR?'
      PRINT*,' '
      READ(5,*)IYEAR

2010  write(6,*)'Pump scheduling (y or n)'
      read(5,'(a)',err=2010)answ
      if(answ.ne.'Y'.and.answ.ne.'y'.and.answ.ne.'N'.and.
     &  answ.ne.'n')then
        goto 2010
      end if
      if(answ.eq.'Y'.or.answ.eq.'y')then
        pump=.TRUE.
      else
        pump=.FALSE.
      end if

c   leakage added as daily input value in TCMD (GPW 24/2/93)
2020  write(6,*)'Leakage rate (TCMD)?'
      read(5,*,err=2020)leak
c
2021  write(6,*)'Augmentation? (y or n)'
      read(5,'(a)')answ
      if(answ.ne.'N'.and.answ.ne.'n'.and.answ.ne.'Y'
     &             .and.answ.ne.'y')then
        goto 2021
      end if
      if(answ.eq.'n'.or.answ.eq.'N')then
        aug=.FALSE.
      else
        aug=.TRUE.
      end if
      allow=0.
      if(aug)then
        write(6,*)'Filename?'
        read(5,'(a)')fhead
        filein=fhead//'.avl'
        filout=fhead//'.us1'
        filou2=fhead//'.abs'
        open(unit=15,file=filein,status='old')
        rewind 15
        open(unit=16,file=filout,status='unknown')
        rewind 16
        open(unit=17,file=filou2,status='unknown')
        rewind 17
119     write(6,*)'Maximum augmentation (TCMD)?'
        read(5,*,err=119)allow
        if(allow.lt.0.)then
          goto 119
        end if
      end if
c     allow=allow/86.4
2030  write(6,*)'Start year of analysis?'
      read(5,*,end=2030,err=2030)iystar
      if(iystar.lt.1900.or.iystar.gt.2000)then
        goto 2030
      end if
2040  write(6,*)'Start month of analysis?'
      read(5,*,end=2040,err=2040)imstar
      if(imstar.lt.1.or.imstar.gt.12)then
        goto 2040
      end if
2050  write(6,*)'End year of analysis?'
      read(5,*,end=2050,err=2050)iystop
      if(iystop.lt.iystar.or.iystop.gt.2000)then
        goto 2050
      end if
2060  write(6,*)'End month of analysis?'
      read(5,*,end=2060,err=2060)imstop
```

```
      if(imstop.lt.1.or.imstop.gt.12.or.
     &     (iystop.eq.iystar.and.imstop.lt.imstar))then
           goto 2060
        end if
C$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
C                        DATA STATEMENTS
C$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
C EYE BROOK RESERVOIR
C ===================
C VOLUME (TCM)
C ------------
      DATA EBV/8100./
C ABSTRACTION FOR 1992,2001,2011 CONDITIONS SAME (TCMD)
C -----------------------------------------------------
      data ebabs/4.9/
c      DATA EBABS/17.7/
C     DATA EBABS/0./
C COMPENSATION RELEASE (TCMD)
C --------------------------
      DATA ECOMP/3.18/

C PITSFORD RESERVOIR & DUSTON INTAKE
C ==================================
C DUSTON ABSTRACTION (TCMD; 1991 AVERAGE USED) & MONTHLY FACTORS (SAME
C AS NATURALISATION PROGRAM)
C -------------------------
      DATA DUSTABS/39./
C     DATA DUSTABS/0./
C     DATA DUSFAC/12*1./
      DATA DUSFAC/2.2,2.5,2.3,1.4,5*0.0,0.6,1.3,1.7/
C     1991 MONTHLY FACTORS (X 39. AVE)
C     DATA DUSFAC/2.2,2.0,2.1,2.0,2.1,1.7,1.7,0.2,0.5,1.5,1.2,1.5/
C DUSTON PUMP CAPACITY (USED IN THIS PROG AS LIMIT ON ABSTR)
C ----------------------------------------------------------
      DATA DPCAP/82./
C PITSFORD RES
C ------------
C VOLUME (TCM)
C ------------
      DATA PRV/17545./
C RES ABSTRACTION (INCLUDES PITS 39 + RAVENSTHORPE/HOLLOWELL 8;
C RAV/HOLL ARE SEPARATE IMPOUNDING RES'S BUT EXPEDIENT TO INCLUDE HERE)
C (NB. NO MONTHLY DISTRIBUTION FACTORS USED - CHECK ON 1991-2 ABSTR
C SHOWED ONLY MINOR MONTHLY VARIATION) (TCMD)
C -------------------------------------------
      DATA PRABS/47./
C     1991 ABSTR FOR PITS, RAV & HOLL.
C     -------------------------------
C     DATA PRABS/43./
C     DATA PRABS/0./
C COMPENSATION RELEASE (TCMD)
C ---------------------------
      DATA PRCOMP/4*0.909,7*2.727,0.909/

C MRF's (TCMD)
C ============
C TINWELL MRF
C -----------
      DATA QMRFW/36.,18./
C ORTON MRF's
C -----------
      DATA QMRFN/136.,68/

C PUMP CAPACITIES - WANSFORD & TINWELL (TCMD)
C ===========================================
C WELLAND (TINWELL) MAX.
C ----------------------
c
c     real licence maxima; Welland 6 pumps at 1052 l/s each
c                          Nene 7 pumps 1263 l/s each
c    (GPW 24/2/93)
c      DATA PCT/451./
      data pct/545./
C NENE (WANSFORD) MAX.
C --------------------
c      DATA PCW/505./
      data pcw/764./

C SI DEMAND FACTORS (SAME AS GRAFHAM PROG)
C ========================================
c     DATA SD/4*0.,1.2,2*3.6,2.4,1.2,3*0./
c   changed to match naturalisation program
      data sd/0.,0.,0.,0.,2.4,4.,4.,1.6,0.,0.,0.,0./

C Industrial & SI abstraction for 1992,2001,2011
C ==============================================
C Data obtained from NRA 27/11/92 (TCMD):
C (1) R Nene above Orton (above Wansford virtually same):
C                        1988    1991    2001    2011
C General Industry         57      57      57      63
C General Agriculture       1       1       2       2
C Spray Irrigation          3       3       4       4.5
C (2) R Welland above Tinwell:
C General Industry       11.5    11.5    11.5    12.5
```

```
C General Agriculture    0.5     0.5      1       1
C Spray Irrigation         1       1      1.5     2
C Notes: - General industry net consumption is 53%
C        - Welland Gen. Ind. incl. Eye Brook to Corby abstr. 4.9 TCMA
C Above used to give data below (tcmd):
c
c  Modified to include Eye Brook Res 17.7 TCMD , 70% as effluent
c  to Nene (GPW 23/2/93)
c
c  Also 0.5 TCMD total loss PWS from Welland (GPW 23/2/93)
      IF(IYEAR.EQ.1992)THEN
         ddw=7.2
c         DDW=6.7
c         DDN=31.3
c         ddn=18.9
          ddn=27.
         DSW=1.1
         DSN=3.1
      ENDIF
      IF(IYEAR.EQ.2001)THEN
         ddw=7.6
c         DDW=7.1
c         DDN=32.2
c         ddn=19.8
         ddn=28.
         DSW=1.5
         DSN=4.0
      ENDIF
      IF(IYEAR.EQ.2011)THEN
c         DDW=7.6
          ddw=8.1
c         DDN=35.4
c         ddn=23.
         ddn=31.
         DSW=2.0
         DSN=4.5
      ENDIF

C MONTHLY PWS FOR EFFLUENTS CALC (TCMD) - 1992,2001,2011 RESPECTIVELY
C (CALCULATED BY GS FROM DEMAND FORECASTS FOR CATCHMENT AREAS)
C -------------------------------------------------------------
      IF(IYEAR.EQ.1992)THEN
         PWSW=11.
         PWSN=147.
      ENDIF
      IF(IYEAR.EQ.2001)THEN
         PWSW=13.
         PWSN=163.
      ENDIF
      IF(IYEAR.EQ.2011)THEN
         PWSW=13.
         PWSN=185.
      ENDIF

C EFFLUENT RETURN DISTRIBUTION FACTORS - AVERAGE 90%
C (SAME AS USED FOR GRAFHAM MODEL)
C --------------------------------
c      DATA EFFMON/3*.95,2*.9,2*.85,.8,.85,.9,2*.95/
c     effluent modified to use above effluent factors and
c     demand factors used in naturalisation
       data effmon/0.76,0.86,0.95,0.99,0.99,1.02,1.02,0.88,
     &   0.77,0.81,0.86,0.76/
      DATA NDAYS/31,28,31,30,31,30,31,31,30,31,30,31/

C$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
C                   END OF DATA STATEMENTS
C$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

C File Opening Details
C --------------------
C 1=Welland at Tinwell (1/10/41-30/9/92)
C 2=Nene at Orton (1/1/41-30/9/92)
C 3=Natural Inflows to Rutland (1/10/41-30/9/92)
C   (Reservoir rainfall & evaporation accounted for)
C 4=Output
C 7=Natural Inflows to Eye Brook Res (1/10/41-30/9/92)
C   (Reservoir rainfall & evaporation NOT accounted for)
C 8=Natural Inflows to Pitsford (1/10/41-30/9/92)
C   (Reservoir rainfall & evaporation accounted for)
C 9=Output for checking calcs-normally commented
C 12=Input date control

      OPEN(1,FILE='TINWELL.ext',STATUS='OLD')
      OPEN(2,FILE='ORTONnat.NAT',STATUS='OLD')
      OPEN(3,FILE='RUTLAND.NAT',STATUS='OLD')
      OPEN(7,FILE='EYEBROOK.INF',STATUS='OLD')
      OPEN(8,FILE='PITSFORD.INF',STATUS='OLD')
C=============================================
C     open(9,file='rut.out',status='old')
C=============================================
C*********************************************
C     open(10,file='rpit.out',status='old')
C*********************************************
C+++++++++++++++++++++++++++++++++++++++++++++
```

```
C     open(11,file='pump.out',status='old')
C+++++++++++++++++++++++++++++++++++++++++++++
c      OPEN(12,FILE='DPLISTR.DAT',STATUS='OLD')
      IF(IYEAR.EQ.1992)THEN
      OPEN(4,FILE='RUT.DAT',STATUS='UNKNOWN')
      ENDIF
      IF(IYEAR.EQ.2001)THEN
      OPEN(4,FILE='RUT.DAT',STATUS='UNKNOWN')
      ENDIF
      IF(IYEAR.EQ.2011)THEN
      OPEN(4,FILE='RUT.DAT',STATUS='UNKNOWN')
      ENDIF
      open(unit=25,file='temp',status='unknown')
      rewind 25

C INPUT START AND END MONTH/YEAR
C ------------------------------
c      READ(12,*)SM,SY,FM,FY
c      NYEARS=FY-SY+1

C INITIALISE EYE BROOK & PITSFORD RESERVOIR VOLUMES
C -------------------------------------------------
      EBSP=EBV
      PRSP=PRV
c
c    26/7/93 initialise files using subroutine initia
c
      call initia(iystar,imstar,1,ndm,error)
      if(error)then
        write(6,*)'Error in file 1'
        stop
      end if
      call initia(iystar,imstar,2,ndm,error)
      if(error)then
        write(6,*)'Error in file 2'
        stop
      end if
      call initia(iystar,imstar,3,ndm,error)
      if(error)then
        write(6,*)'Error in file 3'
        stop
      end if
      call initia(iystar,imstar,7,ndm,error)
      if(error)then
        write(6,*)'Error in file 7'
        stop
      end if
      call initia(iystar,imstar,8,ndm,error)
      if(error)then
        write(6,*)'Error in file 8'
        stop
      end if
      if(aug)then
        call initi2(iystar,imstar,15,ndm,error)
        if(error)then
          write(6,*)'Error in file 15'
          stop
        end if
      end if
C FILE HEADER SKIPPING
C --------------------
c      READ(1,200)TITL
c      READ(8,200)TITL
c      DO 11 II=1,3
c      READ(1,200)TITL
c      READ(2,200)TITL
c      READ(3,200)TITL
c  11  READ(7,200)TITL
c
C SKIP FIRST 9 MONTHS ORTON DATA TO GIVE COMPATIBLE START DATE
C FOR ALL INPUT TIME SERIES
C -------------------------------------------------------------
c  15  CONTINUE
c      READ(2,199)IY,IM,ID
c 199  FORMAT(3X,3I3)
c      IF(IM.EQ.2.AND.MOD(IY,4).EQ.0)NDAYS(2)=29
c      READ(2,9998)(QRN(K),K=1,NDAYS(IM))
c9998  format(4x,8f9.3)
c      IF(IY.EQ.41.AND.IM.EQ.9.AND.ID.EQ.30)GO TO 16
c      GO TO 15
c  16  CONTINUE
C     YEAR LOOP
C     =========
c      DO 100 N=1,NYEARS
c      IYEAR=SY+N-1
c
        do 100 iyear=iystar,iystop
          n=iyear
          if(iyear.eq.iystar)then
            imsta=imstar
          else
            imsta=1
          end if
          if(iyear.eq.iystop)then
```

```
            imsto=imstop
          else
            imsto=12
          end if
          write(5,*)iyear
          do 101 imonth=imsta,imsto
            j=imonth
c
c
C         MONTH LOOP
C         ==========
c          SM1=1
c          FM1=12
c          IF(N.EQ.1)SM1=SM
c          IF(N.EQ.NYEARS)FM1=FM
c          DO 101 J=SM1,FM1

C=======================================================================
C Code to check calculation river flows - normally commented
C      if(iyear.ge.1974.and.iyear.le.1977)then
C      write(9,998)
C998   format('Yr   Mo Da MRF   WFlow =   WNat -  EBImp +   WEff',
C     &        ' - WSprIr -  WDDem    NFlow =   NNat - DusAbs - PitImp',
C     &        ' +   NEff -  NSpIr -  NDDem')
C      endif
C=======================================================================
C***********************************************************************
C Code to check calculation Duston abstr & Pitsford - normally commented
C      if(iyear.ge.1974.and.iyear.le.1977)then
C      write(10,995)
C995   format('DusAb1=river abstr when spill zero; DusAb2=reduced abstr',
C     &        ' to avoid spill')
C      write(10,996)
C      write(10,994)
C996   format('Yr   Mo Da MRF  DusAb1=Min[PCap / DuAbs] PotNewSt',
C     &        '=PitOldSt + NatInf -   PAbs -  PComp   PitCap    Spill',
C     &        '   DusAb2 PitFinSt   PitImp')
C994   format(76x,'[-  DusAb1]')
C      endif
C***********************************************************************

          QINN=0.0
          QINW=0.0
c          READ(1,200)TITL
c          READ(2,200)TITL
          NDAYS(2)=28
          IF(J.EQ.2.AND.MOD(IYEAR,4).EQ.0)NDAYS(2)=29
          READ(1,9998)(QRW(K),K=1,NDAYS(J))
          READ(2,9998)(QRN(K),K=1,NDAYS(J))
9998      format(4x,8f9.3)
 200      FORMAT(A80)
c
          if(aug)then
c            read(15,*)iy,im,ndm
            read(15,*)(trans(k),k=1,ndays(j))
          else
            do 271 k=1,31
            trans(k)=0.
271         continue
          end if
C         READ & SUM RUTLAND NATURAL INFLOWS
C         ----------------------------------
          TRNAT=0.
c          READ(3,200)TITL
          READ(3,9998)(RNAT(K),K=1,NDAYS(J))
          DO 3 K=1,NDAYS(J)
c Rutland leakage incorporated as -ve inflow (leakage TCMD) GPW 24/2/93
          TRNAT=TRNAT+RNAT(K)*86.4
          trnat=trnat-leak
3         continue
C         RUTLAND NAT INFLOWS ZERO
C         ------------------------
C   3     RNAT(K)=0.

C         EYE BROOK NATURAL INFLOWS
C         -------------------------
c          READ(7,200)TITL
          READ(7,9998)(ENAT(K),K=1,NDAYS(J))

C         PITSFORD NATURAL INFLOWS (CALC FROM CORREL ST ANDREWS GS
C         -USE LONG TERM MONTHLY AVERAGE IF DAILY DATA MISSING)
C         ----------------------------------------------------
c          READ(8,200)TITL
          READ(8,9998)(PRNAT(K),K=1,NDAYS(J))

C-----------------------------------------------------------------------
C         XEBIMP=0.
C         XDUSPR=0.
C-----------------------------------------------------------------------

C           MRF LOOP
C           ========
c   no second residual.....
            DO 103 I=1,2
```

```
            QTOT(I)=0.D
                ndm=ndays(j)
C               DAY LOOP
C               ========
                DO 102 K=1,NDAYS(J)
c
                avail=trans(k)
                if(avail.lt.0.)then
                  avail=0.
                end if

C               EYE BROOK RES SIMULATION
C               (RES IMPOUNDMENT CALC FOR CORRECTION OF TINWELL FLOW)
C               NATURAL INFLOW ZEROED IF INPUT DATA <0 (DATA DOES NOT
C               ALLOW FOR RAINFALL/EVAPORATION)
C               ------------------------------------------------------
                IF(ENAT(K).LT.0.)ENAT(K)=0.
C               EMPTY RES CAN'T RELEASE COMP FLOW! - ZERO COMP FLOW
C               --------------------------------------------------
                E1=ECOMP
                IF(EBSP+ENAT(K)*86.4-EBABS-E1.LT.0)E1=0.

                  EBS=EBSP+ENAT(K)*86.4-EBABS-E1
                IF(EBS.LT.0.)EBS=0.
                SPILL=0.
                IF(EBS.GT.EBV)THEN
                  SPILL=EBS-EBV
                  EBS=EBV
                  EBOUT=SPILL+E1
                ELSE
                  EBOUT=E1
                ENDIF

C                 EYE BROOK IMPOUNDMENT (RES INFLOW-RES OUTFLOW)
C                 ----------------------------------------------
                  EBIMP=(ENAT(K)*86.4)-EBOUT
                  EBSP=EBS

C               PITSFORD SIMULATION (ABSTR INCLUDES RAV/HOLL)
C               (DUSTON ABSTR & PITSFORD IMPOUNDMENT CALCULATED
C               FOR SUBTRACTION FROM WANSFORD FLOW)
C               ----------------------------------
C               DUSTON ABSTRACTION
C               (NOTE (1): ASSUMPTION THAT ABSTRACTION ALWAYS
C                AVAILABLE AT DUSTON MAY NOT BE VALID (NO SPECIFIC
C                DUSTON FLOW & NO MRF)
C               ---------------------------------
                DUSTON=0.
                D1=0.
                D2=0.
                Y1=0.
                Y2=0.
                Y3=0.
                Y4=0.
                D3=DUSTABS*DUSFAC(J)
                DUSTON=AMIN1(DPCAP,D3)
                D1=DUSTON
                Y2=PRNAT(K)*86.4
                Y3=PRSP+DUSTON-PRABS
                Y4=PRCOMP(J)
C               SIMPLIFIED ASSUMPTIONS FOR VERY LOW RES LEVELS
C               ----------------------------------------------
C               EMPTY RES CAN'T EVAPORATE! - ZERO NEG. 'NAT INFLOW'
C               ---------------------------------------------------
                IF(Y2.LT.0.AND.Y3-Y4+Y2.LT.0)Y2=0.
C               EMPTY RES CAN'T RELEASE COMP FLOW! - ZERO COMP FLOW
C               --------------------------------------------------
                IF(Y3+Y2-Y4.LT.0)Y4=0.
                PRS=Y3-Y4+Y2
                Y1=PRS

C               REDUCE DUSTON ABSTR TO AVOID SPILLAGE
C               -------------------------------------
                  SPILL=0.
                IF(PRS.GT.PRV)THEN
                  SPILL=PRS-PRV
                  DUSTON=AMAX1(0.,DUSTON-SPILL)
                  Y3=PRSP+DUSTON-PRABS
                  PRS=Y3-Y4+Y2
                ENDIF
                  D2=DUSTON

C               PITSFORD OUTFLOW CALC
C               ---------------------
                IF(PRS.LT.0.)PRS=0.
                IF(PRS.GT.PRV)THEN
                  SPILL=PRS-PRV
                  PRS=PRV
                  PROUT=SPILL+Y4
                ELSE
                  PROUT=Y4
                ENDIF

C               PITSFORD IMPOUNDMENT (RES INFLOW-RES OUTFLOW)
```

```
C                 ------------------------------------------
                    PRIMP=Y2-PROUT

C*****************************************************************************
C Code to check Duston calculation - normally commented
C      if(iyear.ge.1974.and.iyear.le.1977)then
C                 write(10,997)iyear,j,k,i,
C     &                        d1,dpcap,d3,y1,prsp,y2,prabs,
C     &                        prcomp(j),prv,spill,d2,prs,primp
C 997             format(i4,3i3,13f9.1)
C      endif
C*****************************************************************************
                    PRSP=PRS

C                 CALCULATE WELLAND & NENE FLOWS
C                 [NOTE (1):NENE FLOWS: ORTON CONVERTED TO WANSFORD USING
C                  DIVISOR 1.069 - THIS BASED ON CATCHMENT AREAS]
C                 ---------------------------------------------
                  X1=QRW(K)*86.4
                  X2=QRN(K)*86.4/1.069
C/////////////////////////////////////////////////////////////////////////////
C                 River flows +10%,20%
C                 X1=1.1*QRW(K)*86.4
C                 X2=1.1*QRN(K)*86.4/1.069
C                 X1=1.2*QRW(K)*86.4
C                 X2=1.2*QRN(K)*86.4/1.069
C/////////////////////////////////////////////////////////////////////////////
C_____________________________________________________________________________
C                 River flows -10%,-20%
C                 X1=0.9*QRW(K)*86.4
C                 X2=0.9*QRN(K)*86.4/1.069
C                 X1=0.8*QRW(K)*86.4
C                 X2=0.8*QRN(K)*86.4/1.069
C_____________________________________________________________________________

C^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
C                 ASSUME EYE BROOK, PITSFORD ABSENT
C                 ---------------------------------
C                 EBIMP=0.
C                 DUSTON=0.
C                 PRIMP=0.
C^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
c       effluent reduction for resid flow 2 (GPW 23/2/93)
        +         if(i.eq.1)then
                    factor=effmon(j)
                  else
                    factor=effmon(j)*demred(j)
                  end if
                  X3=AMAX1(0.,X1-EBIMP+PWSW*factor-DSW*SD(J)-DDW)
                  X4=AMAX1(0.,X2-DUSTON-PRIMP+PWSN*factor-DSN*SD(J)
     +                -DDN)

C~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
C                 MONTHLY SUMMARY CALCS FOR DUSTON/PITSFORD ABS
C                 --------------------------------------------
C                 IF(I.LE.1)THEN
C                 XEBIMP=XEBIMP+EBIMP
C                 XDUSPR=XDUSPR+DUSTON+PRIMP
C                 ENDIF

C                 LONG TERM EYE BK IMP, DUSTON ABS & PITS IMP
C                 -------------------------------------------
C                 IF(I.LE.1)THEN
C                 TEBIMP(J)=TEBIMP(J)+EBIMP
C                 TDUSPR(J)=TDUSPR(J)+DUSTON+PRIMP
C                 KOUNT(J)=KOUNT(J)+1
C                 ENDIF
C~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
C=============================================================================
C Code to check Flow calculation - normally commented
C      if(iyear.ge.1974.and.iyear.le.1977)then
C                 write(9,999)iyear,j,k,i,
C     &                       x3,x1,ebimp,pwsw*effmon(j),dsw*sd(j),
C     &                       ddw,x4,x2,duston,primp,pwsn*effmon(j),
C     &                       dsn*sd(j),ddn
C 999             format(i4,3i3,13f9.1)
C      endif
C=============================================================================

C                 INITIAL ESTIMATE OF WATER AVAILABLE
C                 (INCLUDES MRF & PUMP MAX. CONSTRAINTS)
C                 NB. 1.069 CONVERTS MRF FROM ORTON TO WANSFORD
C                 ---------------------------------------------
                  QINW=AMIN1(PCT,AMAX1((X3-QMRFW(1)),0.0))
                  QINN=AMIN1(PCW,AMAX1((X4-QMRFN(1)/1.069),0.0))
C                 QINN=AMIN1(PCW,AMAX1((X4-QMRFN(1)),0.0))
                  extra=pcw-qinn
                  if(extra.le.0.)then
                    extra=0.
                  end if
                  if(avail.gt.allow)then
                    avail=allow
                  end if
                  if(extra.gt.avail)then
```

```
                  extra=avail
                end if
                used(k)=extra
c                write(25,*)qinn,extra
                qinn=qinn+extra

c*****************************************************************************
C               NO PUMP SCHED.
C               -------------
                if(.not.pump)then
                  QW1=QINW
                  QN1=QINN
                end if
c*****************************************************************************


C               PUMP SCHEDULING - RIVER NENE AT WANSFORD
C               ----------------------------------------
C               AVAILABLE WATER LESS THAN PUMP MINIMUM
C               --------------------------------------
                IF(QINN.LT.40)QN=0.0

C               1VS
C               ---
                IF(QINN.GE.40.AND.QINN.LE.138)QN=QINN

C               BETWEEN 1VS & 1VS+1FS
C               ---------------------
                IF(QINN.GT.138.AND.QINN.LT.165)QN=138

C               1VS+1FS
C               -------
                IF(QINN.GE.165.AND.QINN.LE.262)QN=QINN

C               BETWEEN 1VS+1FS & 1VS+2FS
C               -------------------------
                IF(QINN.GT.262.AND.QINN.LT.288)QN=262

C               1VS+2FS
C               -------
                IF(QINN.GE.288.AND.QINN.LE.382)QN=QINN

C               BETWEEN 1VS+2FS & 1VS+3FS
C               -------------------------
                IF(QINN.GT.382.AND.QINN.LT.409)QN=382

C               1VS+3FS
C               -------
                IF(QINN.GE.409.AND.QINN.LE.505)QN=QINN

C               GREATER THAN 1VS+3FS
C               --------------------
                IF(QINN.GT.505)QN=505


C               PUMP SCHEDULING - RIVER WELLAND AT TINWELL
C               ------------------------------------------
C               AVAILABLE WATER LESS THAN PUMP MINIMUM
C               --------------------------------------

C               NEW PUMP (FS)
C               -------------
                IF(QINW.LT.10)QW=0.0
                IF(QINW.GE.10.AND.QINW.LT.42)QW=10.0

C               IF(QINW.LT.42)QW=0.0

C               1VS
C               ---
                IF(QINW.GE.42.AND.QINW.LE.128)QW=QINW

C               BETWEEN 1VS & 1VS+1FS
C               ---------------------
                IF(QINW.GT.128.AND.QINW.LT.146)QW=128

C               1VS+1FS
C               -------
                IF(QINW.GE.146.AND.QINW.LE.240)QW=QINW

C               BETWEEN 1VS+1FS & 1VS+2FS
C               -------------------------
                IF(QINW.GT.240.AND.QINW.LT.253)QW=240

C               1VS+2FS
C               -------
                IF(QINW.GE.253.AND.QINW.LE.346)QW=QINW

C               BETWEEN 1VS+2FS & 1VS+3FS
C               -------------------------
                IF(QINW.GT.346.AND.QINW.LT.350)QW=346

C               1VS+3FS
C               -------
                IF(QINW.GE.350.AND.QINW.LE.451)QW=QINW.
```

```
C                GREATER THAN 1VS+3FS
C                --------------------
                 IF(QINW.GT.451)QW=451

C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C Code to check Pump calculations - normally commented
C      if(iyear.ge.1974.and.iyear.le.1977)then
C                write(11,993)iyear,j,k,i,
C     &                       qinn,qn,qinw,qw
C 993            format(i4,3i3,4f9.1)
C      endif
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
C                NO PUMP SCHED
C                -------------
               if(.not.pump)then
                 QN=QN1
                 QW=QW1
               end if
               abst(k)=qn
C''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
                 QTOT(I)=QW+QN+QTOT(I)

C                END DAY LOOP
C                ============
 102             CONTINUE

C###############################################################################
C           ZERO RUTLAND NATURAL INFLOWS
C           ----------------------------
C           TRNAT=0.
C###############################################################################
            QTOT(I)=QTOT(I)+TRNAT

C           END MRF LOOP
C           ============
 103        CONTINUE
          if(aug)then
            write(16,9901)iyear,j,ndays(j)
            write(16,9900)(used(k),k=1,ndm)
            write(17,9901)iyear,j,ndays(j)
            write(17,9900)(abst(k),k=1,ndm)
          end if
9901      format(1x,i4,2i3)
9900      format(11f7.0)

C-------------------------------------------------------------------------------
C         MONTHLY SUMMARY CALCS FOR DUSTON/PITSFORD ABS
C         ---------------------------------------------
C         XEBIMP=XEBIMP/NDAYS(J)
C         XDUSPR=XDUSPR/NDAYS(J)
C         WRITE(4,202)J,IYEAR,(QTOT(K),K=1,2),XEBIMP,XDUSPR
          WRITE(4,202)J,IYEAR,(QTOT(K),K=1,2)
C-------------------------------------------------------------------------------
 202      FORMAT(2I5,4F7.0)

          if(iyear.ne.iystop.or.
     &         (iyear.eq.iystop.and.imonth.lt.imstop))then
            read(1,'(a)')titl
c            write(6,9198)titl
            read(2,'(a)')titl
c            write(6,9198)titl
            read(3,'(a)')titl
c            write(6,9198)titl
            read(7,'(a)')titl
c            write(6,9198)titl
            read(8,'(a)')titl
c            write(6,9198)titl
9198        format(3x,a40)
            if(aug)then
              read(15,'(a)')titl
c              write(6,9198)titl
            end if
          end if
C         END MONTH LOOP
C         ==============
 101      CONTINUE

C      END YEAR LOOP
C      =============
 100   CONTINUE

C-------------------------------------------------------------------------------
C      WRITE LONG TERM AVE EYE BK IMP,DUSDON ABS & PIT IMP
C      ---------------------------------------------------
C      DO 109 J=1,12
C      WRITE(4,*)TEBIMP(J)/KOUNT(J),TDUSPR(J)/KOUNT(J)
C 109 CONTINUE
C-------------------------------------------------------------------------------

       CLOSE (UNIT=1)
       CLOSE (UNIT=2)
       CLOSE (UNIT=3)
       CLOSE (UNIT=4)
```

```
      CLOSE (UNIT=7)
      CLOSE (UNIT=8)
      CLOSE (UNIT=12)

      STOP
      END
c*************************************************************************
c
      subroutine initia(iyrs,imons,iunit,ndm,error)
c
c*************************************************************************
c
      logical error
      dimension flow(31)
      do 100 i=1,3
        read(iunit,*)
100   continue
      ndmlas=-999.
c
200   read(iunit,9999,end=10000,err=10000)iyr,imon,ndm
9999  format(3x,3i3)
      if(iyr.gt.iyrs-1900.or.
     &      (iyr.eq.iyrs-1900.and.imon.gt.imons))then
        goto 10000
      end if
      if(iyr.lt.iyrs-1900.or.
     &      (iyr.eq.iyrs-1900.and.imon.lt.imons))then
        read(iunit,9998)(flow(i),i=1,ndm)
        ndmlas=ndm
9998    format(4x,8f9.3)
        goto 200
      end if
      if(ndmlas.gt.0)then
        flast=flow(ndmlas)
      else
        flast=998.
      end if
      return
10000 error=.TRUE.
      return
      end
c*************************************************************************
c
      subroutine initi2(iyrs,imons,iunit,ndm,error)
c
c*************************************************************************
c
      logical error
      dimension flow(31)
c      do 100 i=1,3
c        read(iunit,*)
c100    continue
      ndmlas=-999.
c
200   read(iunit,9999,end=10000,err=10000)iyr,imon,ndm
9999  format(i5,2i3)
      if(iyr.gt.iyrs.or.
     &      (iyr.eq.iyrs.and.imon.gt.imons))then
        goto 10000
      end if
      if(iyr.lt.iyrs.or.
     &      (iyr.eq.iyrs.and.imon.lt.imons))then
        read(iunit,9998)(flow(i),i=1,ndm)
        ndmlas=ndm
9998    format(11f7.0)
        goto 200
      end if
      if(ndmlas.gt.0)then
        flast=flow(ndmlas)
      else
        flast=998.
      end if
      return
10000 error=.TRUE.
      return
      end
```

Grafham yield - naturalisation spreadsheet

TABLE 1 : ANNUAL DATA : UNITS TCMD

Col.1 : Total supply from Grafham to Bedford and Bucks. (from AWS. See GS note 22/7/91)
Col.2 : Supply to Middleton Cheney (From FH, based on pop. estimates)
Col.3 : Supply to St.Neots (From FH - 1987 to 1990 figures interpolated)
Col.4 : Greensand abstractions into supply (from S114 returns)
Col.5 : Foxcote abstractions into supply (From S114 returns)
Col.6 : Clapham abstractions into supply (From S114 returns)
Col.7 : Oolite + gravels abstractions into supply (From S114 returns)
Col.8 : Lee Valley Water Co. Abstractions from Chalk sources into supply (From S114 returns)
Col.9 : Lee Valley Water into supply (ex. Grafham other than Luton + Dunstable)
Col.10: Supply to Luton + Dunstable (From AWS. Based on pop'n in STW area. See GS note 25/6/91. Figures available only for 1971,1981, remaining years interpolated.)
Col.11: Net imports from the Thames Area (From FH)
Col.12: Industrial abstractions (From NRA - PWG. 1984 to 1990 figures interpolated.)
Col.13: Spray irrigation abstractions (From NRA - PWG. 1984 to 1990 figures interpolated.)

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13
1970	16.00	4.00	3.09	29.00	8.00	26.10	.00	20.50	.00	14.97	8.00	7.40	6.00
1971	21.00	4.10	3.48	29.50	6.60	24.70	.00	21.60	.00	15.40	8.00	7.40	6.00
1972	22.80	4.10	3.81	29.30	6.40	25.20	.00	21.70	.00	15.83	9.00	7.40	6.00
1973	30.00	4.20	3.90	30.20	6.70	24.20	.00	21.90	.00	16.26	9.00	7.40	6.00
1974	31.97	4.20	3.99	27.30	5.00	23.20	1.20	21.90	.00	16.69	10.00	7.40	6.00
1975	39.64	4.30	4.29	27.40	6.80	22.50	1.90	20.70	.00	17.12	11.00	7.00	4.90
1976	27.72	4.10	3.42	25.90	6.90	20.70	2.20	19.80	.00	17.55	9.00	6.50	6.50
1977	48.00	4.30	4.27	27.40	5.90	20.60	2.20	19.20	.00	17.98	11.00	6.40	3.50
1978	53.00	4.30	4.73	27.20	7.30	20.30	2.90	19.10	.00	18.41	11.00	5.30	1.60
1979	57.50	4.40	5.25	29.50	6.70	23.00	2.50	17.90	.00	18.84	11.00	5.90	4.00
1980	64.78	4.40	6.07	27.70	6.60	22.20	2.00	17.60	.00	19.27	10.00	5.50	3.60
1981	65.45	4.50	6.90	27.60	6.80	22.20	1.60	18.90	.00	19.70	9.00	5.90	4.50
1982	68.88	4.50	5.49	31.90	8.70	22.60	1.80	20.00	.00	19.73	8.00	5.30	3.30
1983	74.38	4.60	5.10	32.00	8.30	19.20	1.60	17.70	.00	19.75	7.59	4.10	3.20
1984	82.24	4.60	4.96	32.36	8.72	19.82	2.85	21.27	.00	19.78	7.61	4.50	3.50
1985	78.73	4.70	5.27	30.97	8.97	21.30	2.34	21.07	.00	19.80	3.58	4.90	1.60
1986	77.59	4.80	5.23	30.89	9.08	23.60	3.04	22.59	.00	22.00	1.52	5.29	3.10
1987	85.49	4.80	5.46	30.17	7.98	24.70	2.17	24.24	.00	22.20	1.50	5.69	1.60
1988	98.39	4.90	6.69	29.35	5.28	23.05	1.79	23.12	.00	22.40	1.00	6.09	1.60
1989	105.06	4.90	5.91	28.37	.13	22.39	1.15	25.66	.00	22.60	1.00	6.49	5.50
1990	106.85	5.00	6.14	28.39	6.07	25.01	1.16	21.01	.00	22.80	.50	6.88	5.50
1991	113	5.00	6.37	28.00	6.00	25.00	1.00	20.00	5.00	23.00	.50	7.28	5.50
1992	118.00	5.00	6.5	28.00	6.00	25.00	1.00	20.00	5.00	23.00	.50	7.68	5.50

TABLE 2 : MONTHLY DEMAND ADJUSTMENT FACTORS

Col.1 : PWS. Data from GORM
Col.2 : Spray Irrigation. Data from GORM
Col.3 : Clapham. See note by GS on 'Summary of further computer modelling...' dated 30/6/88

MONTH	1 PWS	2 S.I.	3 CLAPHAM
JAN	.950	.000	.840
FEB	.955	.000	.720
MAR	.975	.000	1.030
APR	1.000	.000	.940
MAY	1.025	1.200	1.070

JUN	1.045	3.600	1.130
JUL	1.050	3.600	1.290
AUG	1.045	2.400	1.130
SEP	1.025	1.200	1.130
OCT	1.000	.000	.990
NOV	.975	.000	.830
DEC	.955	.000	.910

TABLE 3 : MONTHLY RETURN FACTORS

Col.1 : PWS. Effluent returns reflect seasonal variation in losses. Broadly similar to GORM. Ave=0.9.
Col.2 : INDUSTRY. Guesstimate by NPF.
Col.3 : S.I. The effect of SI on reducing SMDs has been ignored.

	1	2	3
MONTH	PWS	IND.	S.I.
JAN	.950	.750	.000
FEB	.950	.750	.000
MAR	.950	.750	.000
APR	.900	.750	.000
MAY	.900	.750	.000
JUN	.850	.750	.000
JUL	.850	.750	.000
AUG	.800	.750	.000
SEP	.850	.750	.000
OCT	.900	.750	.000
NOV	.950	.750	.000
DEC	.950	.750	.000

TABLE 4 : MONTHLY DATA

Col.1 : Bedford and Bucks. PWS effluent (catchment gain) calculated from (t1c1-t1c2)*t2c1*t3c1 where t1=Table 1; c1=Column 1; t2=Tabl
Col.2 : St.Neots PWS effluent (catchment gain) calculated from t1c3*t2c1*t3c1
Col.3 : Net Greensand abstraction (catchment loss) calculated from t1c4*(1-t3c1) i.e.Net=abstraction into supply minus effluent retur
Col.4 : Net Foxcote abstraction (catchment loss) calculated from t1c5*(1-t3c1)
Col.5 : Net Clapham abstractions (catchment loss) calculated from t1c6*t2c3*(1-t3c1)
Col.6 : Net Oolite + gravels abstraction (catchment loss) calculated from t1c7*(1-t3c1)
Col.7 : Net Lee Valley Water Co. Chalk abstraction (catchment loss) calculated from t1c8*(1-t3c1)
Col.8 : Lee Valley Water (ex. Grafham other than Luton + Dunstable) effluent (catchment gain) calculated from t1c9*t2c1*t3c1
Col.9 : Effluent returned from Luton + Dunstable (catchment gain) calculated from t1c10*t2c1*t3c1
Col.10: Effluent derived from Thames imports (catchment gain) calculated from t1c11*t2c1*t3c1
Col.11: Net Industrial abstraction (catchment loss) calculated from t1c12*(1-t3c2)
Col.12: Net Spray Irrigation abstraction (catchment loss) calculated from t1c13*t2c2*(1-t3c3)
Col.13: Variation term = Catchment Losses - Catchment Gains = (c3+c4+c5+c6+c7+c11+c12)-(c1+c2+c8+c9+c10)

N.B. note that columns 3,4,6 and 7 do not include the PWS demand factors (ref.GS note 'Summary of further computer modelling...' da

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13
1970	JAN	10.83	2.79	1.45	.40	1.10	.00	1.03	.00	13.51	7.22	1.85	.00	-28.53
	FEB	10.89	2.80	1.45	.40	.94	.00	1.03	.00	13.58	7.26	1.85	.00	-28.87
	MAR	11.12	2.86	1.45	.40	1.34	.00	1.03	.00	13.87	7.41	1.85	.00	-29.18
	APR	10.80	2.78	2.90	.80	2.45	.00	2.05	.00	13.47	7.20	1.85	.00	-24.20
	MAY	11.07	2.85	2.90	.80	2.79	.00	2.05	.00	13.81	7.38	1.85	7.20	-17.52
	JUN	10.66	2.74	4.35	1.20	4.42	.00	3.08	.00	13.30	7.11	1.85	21.60	2.69
	JUL	10.71	2.76	4.35	1.20	5.05	.00	3.08	.00	13.36	7.14	1.85	21.60	3.16
	AUG	10.03	2.58	5.80	1.60	5.90	.00	4.10	.00	12.51	6.69	1.85	14.40	1.83
	SEP	10.46	2.69	4.35	1.20	4.42	.00	3.08	.00	13.04	6.97	1.85	7.20	-11.06
	OCT	10.80	2.78	2.90	.80	2.58	.00	2.05	.00	13.47	7.20	1.85	.00	-24.07

	NOV	11.12	2.86	1.45	.40	1.08	.00	1.03	.00	13.87	7.41	1.85	.00	-29.44
	DEC	10.89	2.80	1.45	.40	1.19	.00	1.03	.00	13.58	7.26	1.85	.00	-28.62
1971	JAN	15.25	3.14	1.48	.33	1.04	.00	1.08	.00	13.90	7.22	1.85	.00	-33.74
	FEB	15.33	3.15	1.48	.33	.89	.00	1.08	.00	13.97	7.26	1.85	.00	-34.09
	MAR	15.65	3.22	1.48	.33	1.27	.00	1.08	.00	14.26	7.41	1.85	.00	-34.54
	APR	15.21	3.13	2.95	.66	2.32	.00	2.16	.00	13.86	7.20	1.85	.00	-29.46
	MAY	15.59	3.21	2.95	.66	2.64	.00	2.16	.00	14.21	7.38	1.85	7.20	-22.92
	JUN	15.01	3.09	4.43	.99	4.19	.00	3.24	.00	13.68	7.11	1.85	21.60	-2.59
	JUL	15.08	3.10	4.43	.99	4.78	.00	3.24	.00	13.74	7.14	1.85	21.60	-2.19
	AUG	14.13	2.91	5.90	1.32	5.58	.00	4.32	.00	12.87	6.69	1.85	14.40	-3.22
	SEP	14.72	3.03	4.43	.99	4.19	.00	3.24	.00	13.42	6.97	1.85	7.20	-16.25
	OCT	15.21	3.13	2.95	.66	2.45	.00	2.16	.00	13.86	7.20	1.85	.00	-29.33
	NOV	15.65	3.22	1.48	.33	1.03	.00	1.08	.00	14.26	7.41	1.85	.00	-34.79
	DEC	15.33	3.15	1.48	.33	1.12	.00	1.08	.00	13.97	7.26	1.85	.00	-33.86
1972	JAN	16.88	3.44	1.47	.32	1.06	.00	1.09	.00	14.29	8.12	1.85	.00	-36.94
	FEB	16.97	3.45	1.47	.32	.91	.00	1.09	.00	14.36	8.17	1.85	.00	-37.32
	MAR	17.32	3.53	1.47	.32	1.30	.00	1.09	.00	14.66	8.34	1.85	.00	-37.83
	APR	16.83	3.43	2.93	.64	2.37	.00	2.17	.00	14.25	8.10	1.85	.00	-32.65
	MAY	17.25	3.51	2.93	.64	2.70	.00	2.17	.00	14.60	8.30	1.85	7.20	-26.18
	JUN	16.61	3.38	4.40	.96	4.27	.00	3.26	.00	14.06	7.99	1.85	21.60	-5.72
	JUL	16.69	3.40	4.40	.96	4.88	.00	3.26	.00	14.13	8.03	1.85	21.60	-5.31
	AUG	15.63	3.18	5.86	1.28	5.70	.00	4.34	.00	13.23	7.52	1.85	14.40	-6.15
	SEP	16.29	3.32	4.40	.96	4.27	.00	3.26	.00	13.79	7.84	1.85	7.20	-19.31
	OCT	16.83	3.43	2.93	.64	2.49	.00	2.17	.00	14.25	8.10	1.85	.00	-32.52
	NOV	17.32	3.53	1.47	.32	1.05	.00	1.09	.00	14.66	8.34	1.85	.00	-38.08
	DEC	16.97	3.45	1.47	.32	1.15	.00	1.09	.00	14.36	8.17	1.85	.00	-37.08
1973	JAN	23.28	3.52	1.51	.34	1.02	.00	1.10	.00	14.67	8.12	1.85	.00	-43.80
	FEB	23.41	3.54	1.51	.34	.87	.00	1.10	.00	14.75	8.17	1.85	.00	-44.20
	MAR	23.90	3.61	1.51	.34	1.25	.00	1.10	.00	15.06	8.34	1.85	.00	-44.87
	APR	23.22	3.51	3.02	.67	2.27	.00	2.19	.00	14.63	8.10	1.85	.00	-39.46
	MAY	23.80	3.60	3.02	.67	2.59	.00	2.19	.00	15.00	8.30	1.85	7.20	-33.18
	JUN	22.92	3.46	4.53	1.01	4.10	.00	3.29	.00	14.44	7.99	1.85	21.60	-12.45
	JUL	23.03	3.48	4.53	1.01	4.68	.00	3.29	.00	14.51	8.03	1.85	21.60	-12.10
	AUG	21.57	3.26	6.04	1.34	5.47	.00	4.38	.00	13.59	7.52	1.85	14.40	-12.47
	SEP	22.48	3.40	4.53	1.01	4.10	.00	3.29	.00	14.17	7.84	1.85	7.20	-25.91
	OCT	23.22	3.51	3.02	.67	2.40	.00	2.19	.00	14.63	8.10	1.85	.00	-39.34
	NOV	23.90	3.61	1.51	.34	1.00	.00	1.10	.00	15.06	8.34	1.85	.00	-45.11
	DEC	23.41	3.54	1.51	.34	1.10	.00	1.10	.00	14.75	8.17	1.85	.00	-43.97
1974	JAN	25.06	3.60	1.37	.25	.97	.06	1.10	.00	15.06	9.03	1.85	.00	-47.15
	FEB	25.19	3.62	1.37	.25	.84	.06	1.10	.00	15.14	9.07	1.85	.00	-47.57
	MAR	25.72	3.69	1.37	.25	1.19	.06	1.10	.00	15.46	9.26	1.85	.00	-48.32
	APR	24.99	3.59	2.73	.50	2.18	.12	2.19	.00	15.02	9.00	1.85	.00	-43.03
	MAY	25.62	3.68	2.73	.50	2.48	.12	2.19	.00	15.40	9.23	1.85	7.20	-36.84
	JUN	24.67	3.54	4.10	.75	3.93	.18	3.29	.00	14.82	8.88	1.85	21.60	-16.22
	JUL	24.78	3.56	4.10	.75	4.49	.18	3.29	.00	14.90	8.93	1.85	21.60	-15.91
	AUG	23.22	3.33	5.46	1.00	5.24	.24	4.38	.00	13.95	8.36	1.85	14.40	-16.29
	SEP	24.19	3.47	4.10	.75	3.93	.18	3.29	.00	14.54	8.71	1.85	7.20	-29.63
	OCT	24.99	3.59	2.73	.50	2.30	.12	2.19	.00	15.02	9.00	1.85	.00	-42.91
	NOV	25.72	3.69	1.37	.25	.96	.06	1.10	.00	15.46	9.26	1.85	.00	-48.55
	DEC	25.19	3.62	1.37	.25	1.06	.06	1.10	.00	15.14	9.07	1.85	.00	-47.35
1975	JAN	31.89	3.87	1.37	.34	.95	.10	1.04	.00	15.45	9.93	1.75	.00	-55.61
	FEB	32.06	3.89	1.37	.34	.81	.10	1.04	.00	15.53	9.98	1.75	.00	-56.07
	MAR	32.73	3.97	1.37	.34	1.16	.10	1.04	.00	15.86	10.19	1.75	.00	-57.00
	APR	31.81	3.86	2.74	.68	2.12	.19	2.07	.00	15.41	9.90	1.75	.00	-51.43
	MAY	32.60	3.96	2.74	.68	2.41	.19	2.07	.00	15.79	10.15	1.75	5.88	-46.78
	JUN	31.39	3.81	4.11	1.02	3.81	.29	3.11	.00	15.21	9.77	1.75	17.64	-28.46
	JUL	31.54	3.83	4.11	1.02	4.35	.29	3.11	.00	15.28	9.82	1.75	17.64	-28.20
	AUG	29.54	3.59	5.48	1.36	5.09	.38	4.14	.00	14.31	9.20	1.75	11.76	-26.68
	SEP	30.79	3.74	4.11	1.02	3.81	.29	3.11	.00	14.92	9.58	1.75	5.88	-39.06
	OCT	31.81	3.86	2.74	.68	2.23	.19	2.07	.00	15.41	9.90	1.75	.00	-51.32
	NOV	32.73	3.97	1.37	.34	.93	.10	1.04	.00	15.86	10.19	1.75	.00	-57.23
	DEC	32.06	3.89	1.37	.34	1.02	.10	1.04	.00	15.53	9.98	1.75	.00	-55.85
1976	JAN	21.32	3.09	1.30	.35	.87	.11	.99	.00	15.84	8.12	1.63	.00	-43.13
	FEB	21.43	3.10	1.30	.35	.75	.11	.99	.00	15.92	8.17	1.63	.00	-43.51

	MAR	21.88	3.17	1.30	.35	1.07
	APR	21.26	3.08	2.59	.69	1.95
	MAY	21.79	3.15	2.59	.69	2.21
	JUN	20.98	3.04	3.89	1.04	3.51
	JUL	21.08	3.05	3.89	1.04	4.01
	AUG	19.75	2.86	5.18	1.38	4.68
	SEP	20.58	2.98	3.89	1.04	3.51
	OCT	21.26	3.08	2.59	.69	2.05
	NOV	21.88	3.17	1.30	.35	.86
	DEC	21.43	3.10	1.30	.35	.94
1977	JAN	39.44	3.85	1.37	.30	.87
	FEB	39.65	3.87	1.37	.30	.74
	MAR	40.48	3.95	1.37	.30	1.06
	APR	39.33	3.84	2.74	.59	1.94
	MAY	40.31	3.93	2.74	.59	2.20
	JUN	38.82	3.79	4.11	.89	3.49
	JUL	39.00	3.81	4.11	.89	3.99
	AUG	36.53	3.57	5.48	1.18	4.66
	SEP	38.07	3.72	4.11	.89	3.49
	OCT	39.33	3.84	2.74	.59	2.04
	NOV	40.48	3.95	1.37	.30	.85
	DEC	39.65	3.87	1.37	.30	.94
1978	JAN	43.95	4.27	1.36	.37	.85
	FEB	44.18	4.29	1.36	.37	.73
	MAR	45.11	4.38	1.36	.37	1.05
	APR	43.83	4.26	2.72	.73	1.91
	MAY	44.93	4.37	2.72	.73	2.17
	JUN	43.26	4.20	4.08	1.10	3.44
	JUL	43.46	4.22	4.08	1.10	3.93
	AUG	40.71	3.96	5.44	1.46	4.59
	SEP	42.43	4.12	4.08	1.10	3.44
	OCT	43.83	4.26	2.72	.73	2.01
	NOV	45.11	4.38	1.36	.37	.84
	DEC	44.18	4.29	1.36	.37	.92
1979	JAN	47.92	4.74	1.48	.34	.97
	FEB	48.17	4.76	1.48	.34	.83
	MAR	49.18	4.86	1.48	.34	1.18
	APR	47.79	4.73	2.95	.67	2.16
	MAY	48.98	4.84	2.95	.67	2.46
	JUN	47.17	4.66	4.43	1.01	3.90
	JUL	47.39	4.69	4.43	1.01	4.45
	AUG	44.39	4.39	5.90	1.34	5.20
	SEP	46.26	4.57	4.43	1.01	3.90
	OCT	47.79	4.73	2.95	.67	2.28
	NOV	49.18	4.86	1.48	.34	.95
	DEC	48.17	4.76	1.48	.34	1.05
1980	JAN	54.49	5.47	1.39	.33	.93
	FEB	54.78	5.50	1.39	.33	.80
	MAR	55.93	5.62	1.39	.33	1.14
	APR	54.34	5.46	2.77	.66	2.09
	MAY	55.70	5.60	2.77	.66	2.38
	JUN	53.63	5.39	4.16	.99	3.76
	JUL	53.89	5.41	4.16	.99	4.30
	AUG	50.48	5.07	5.54	1.32	5.02
	SEP	52.61	5.29	4.16	.99	3.76
	OCT	54.34	5.46	2.77	.66	2.20
	NOV	55.93	5.62	1.39	.33	.92
	DEC	54.78	5.50	1.39	.33	1.01
1981	JAN	55.01	6.22	1.38	.34	.93
	FEB	55.30	6.26	1.38	.34	.80
	MAR	56.45	6.39	1.38	.34	1.14
	APR	54.86	6.21	2.76	.68	2.09
	MAY	56.23	6.36	2.76	.68	2.38
	JUN	54.14	6.13	4.14	1.02	3.76

[redacted]											
.11	.99	.00	16.26	8.34	1.63	.00	-44.21				
.22	1.98	.00	15.80	8.10	1.63	.00	-39.18				
.22	1.98	.00	16.19	8.30	1.63	7.80	-32.32				
.33	2.97	.00	15.59	7.99	1.63	23.40	-10.85				
.33	2.97	.00	15.66	8.03	1.63	23.40	-10.58				
.44	3.96	.00	14.67	7.52	1.63	15.60	-11.94				
.33	2.97	.00	15.29	7.84	1.63	7.80	-25.54				
.22	1.98	.00	15.80	8.10	1.63	.00	-39.08				
.11	.99	.00	16.26	8.34	1.63	.00	-44.41				
.11	.99	.00	15.92	8.17	1.63	.00	-43.31				
.11	.96	.00	16.23	9.93	1.60	.00	-64.24				
.11	.96	.00	16.31	9.98	1.60	.00	-64.73				
.11	.96	.00	16.65	10.19	1.60	.00	-65.87				
.22	1.92	.00	16.18	9.90	1.60	.00	-60.24				
.22	1.92	.00	16.59	10.15	1.60	4.20	-57.51				
.33	2.88	.00	15.97	9.77	1.60	12.60	-42.45				
.33	2.88	.00	16.05	9.82	1.60	12.60	-42.28				
.44	3.84	.00	15.03	9.20	1.60	8.40	-38.73				
.33	2.88	.00	15.67	9.58	1.60	4.20	-49.54				
.22	1.92	.00	16.18	9.90	1.60	.00	-60.14				
.11	.96	.00	16.65	10.19	1.60	.00	-66.08				
.11	.96	.00	16.31	9.98	1.60	.00	-64.54				
.15	.96	.00	16.62	9.93	1.33	.00	-69.76				
.15	.96	.00	16.70	9.98	1.33	.00	-70.28				
.15	.96	.00	17.05	10.19	1.33	.00	-71.54				
.29	1.91	.00	16.57	9.90	1.33	.00	-65.68				
.29	1.91	.00	16.98	10.15	1.33	1.92	-65.36				
.44	2.87	.00	16.35	9.77	1.33	5.76	-54.58				
.44	2.87	.00	16.43	9.82	1.33	5.76	-54.45				
.58	3.82	.00	15.39	9.20	1.33	3.84	-48.20				
.44	2.87	.00	16.04	9.58	1.33	1.92	-57.02				
.29	1.91	.00	16.57	9.90	1.33	.00	-65.57				
.15	.96	.00	17.05	10.19	1.33	.00	-71.74				
.15	.96	.00	16.70	9.98	1.33	.00	-70.09				
.13	.90	.00	17.00	9.93	1.48	.00	-74.32				
.13	.90	.00	17.09	9.98	1.48	.00	-74.88				
.13	.90	.00	17.45	10.19	1.48	.00	-76.20				
.25	1.79	.00	16.96	9.90	1.48	.00	-70.07				
.25	1.79	.00	17.38	10.15	1.48	4.80	-66.96				
.38	2.69	.00	16.73	9.77	1.48	14.40	-50.07				
.38	2.69	.00	16.81	9.82	1.48	14.40	-49.89				
.50	3.58	.00	15.75	9.20	1.48	9.60	-46.13				
.38	2.69	.00	16.41	9.58	1.48	4.80	-58.17				
.25	1.79	.00	16.96	9.90	1.48	.00	-69.96				
.13	.90	.00	17.45	10.19	1.48	.00	-76.43				
.13	.90	.00	17.09	9.98	1.48	.00	-74.66				
.10	.88	.00	17.39	9.03	1.38	.00	-81.38				
.10	.88	.00	17.48	9.07	1.38	.00	-81.97				
.10	.88	.00	17.85	9.26	1.38	.00	-83.44				
.20	1.76	.00	17.34	9.00	1.38	.00	-77.29				
.20	1.76	.00	17.78	9.23	1.38	4.32	-74.84				
.30	2.64	.00	17.12	8.88	1.38	12.96	-58.84				
.30	2.64	.00	17.20	8.93	1.38	12.96	-58.71				
.40	3.52	.00	16.11	8.36	1.38	8.64	-54.21				
.30	2.64	.00	16.79	8.71	1.38	4.32	-65.85				
.20	1.76	.00	17.34	9.00	1.38	.00	-77.18				
.10	.88	.00	17.85	9.26	1.38	.00	-83.67				
.10	.88	.00	17.48	9.07	1.38	.00	-81.76				
.08	.95	.00	17.78	8.12	1.48	.00	-81.98				
.08	.95	.00	17.87	8.17	1.48	.00	-82.57				
.08	.95	.00	18.25	8.34	1.48	.00	-84.06				
.16	1.89	.00	17.73	8.10	1.48	.00	-77.84				
.16	1.89	.00	18.17	8.30	1.48	5.40	-74.32				
.24	2.84	.00	17.50	7.99	1.48	16.20	-56.08				

	JUL	54.40	6.15	4.14	1.02	4.30
	AUG	50.95	5.77	5.52	1.36	5.02
	SEP	53.10	6.01	4.14	1.02	3.76
	OCT	54.86	6.21	2.76	.68	2.20
	NOV	56.45	6.39	1.38	.34	.92
	DEC	55.30	6.26	1.38	.34	1.01
1982	JAN	58.10	4.95	1.60	.44	.95
	FEB	58.41	4.98	1.60	.44	.81
	MAR	59.63	5.09	1.60	.44	1.16
	APR	57.94	4.94	3.19	.87	2.12
	MAY	59.39	5.06	3.19	.87	2.42
	JUN	57.19	4.88	4.79	1.31	3.83
	JUL	57.46	4.90	4.79	1.31	4.37
	AUG	53.82	4.59	6.38	1.74	5.11
	SEP	56.09	4.78	4.79	1.31	3.83
	OCT	57.94	4.94	3.19	.87	2.24
	NOV	59.63	5.09	1.60	.44	.94
	DEC	58.41	4.98	1.60	.44	1.03
1983	JAN	62.98	4.60	1.60	.42	.81
	FEB	63.31	4.63	1.60	.42	.69
	MAR	64.63	4.72	1.60	.42	.99
	APR	62.80	4.59	3.20	.83	1.80
	MAY	64.37	4.70	3.20	.83	2.05
	JUN	61.98	4.53	4.80	1.25	3.25
	JUL	62.28	4.55	4.80	1.25	3.72
	AUG	58.34	4.26	6.40	1.66	4.34
	SEP	60.80	4.44	4.80	1.25	3.25
	OCT	62.80	4.59	3.20	.83	1.90
	NOV	64.63	4.72	1.60	.42	.80
	DEC	63.31	4.63	1.60	.42	.87
1984	JAN	70.07	4.48	1.62	.44	.83
	FEB	70.44	4.50	1.62	.44	.71
	MAR	71.91	4.60	1.62	.44	1.02
	APR	69.88	4.46	3.24	.87	1.86
	MAY	71.62	4.58	3.24	.87	2.12
	JUN	68.96	4.41	4.85	1.31	3.36
	JUL	69.29	4.43	4.85	1.31	3.83
	AUG	64.91	4.15	6.47	1.74	4.48
	SEP	67.64	4.32	4.85	1.31	3.36
	OCT	69.88	4.46	3.24	.87	1.96
	NOV	71.91	4.60	1.62	.44	.82
	DEC	70.44	4.50	1.62	.44	.90
1985	JAN	66.81	4.76	1.55	.45	.89
	FEB	67.16	4.78	1.55	.45	.77
	MAR	68.57	4.88	1.55	.45	1.10
	APR	66.63	4.75	3.10	.90	2.00
	MAY	68.29	4.86	3.10	.90	2.28
	JUN	65.76	4.68	4.65	1.35	3.61
	JUL	66.07	4.71	4.65	1.35	4.12
	AUG	61.89	4.41	6.19	1.79	4.81
	SEP	64.50	4.59	4.65	1.35	3.61
	OCT	66.63	4.75	3.10	.90	2.11
	NOV	68.57	4.88	1.55	.45	.88
	DEC	67.16	4.78	1.55	.45	.97
1986	JAN	65.69	4.72	1.54	.45	.99
	FEB	66.04	4.74	1.54	.45	.85
	MAR	67.42	4.84	1.54	.45	1.22
	APR	65.51	4.71	3.09	.91	2.22
	MAY	67.15	4.82	3.09	.91	2.53
	JUN	64.66	4.64	4.63	1.36	4.00
	JUL	64.97	4.67	4.63	1.36	4.57
	AUG	60.85	4.37	6.18	1.82	5.33
	SEP	63.42	4.56	4.63	1.36	4.00
	OCT	65.51	4.71	3.09	.91	2.34

.24	2.84	.00	17.58	8.03	1.48	16.20	-55.96
.32	3.78	.00	16.47	7.52	1.48	10.80	-52.44
.24	2.84	.00	17.16	7.84	1.48	5.40	-65.24
.16	1.89	.00	17.73	8.10	1.48	.00	-77.73
.08	.95	.00	18.25	8.34	1.48	.00	-84.28
.08	.95	.00	17.87	8.17	1.48	.00	-82.36
.09	1.00	.00	17.81	7.22	1.33	.00	-82.69
.09	1.00	.00	17.90	7.26	1.33	.00	-83.29
.09	1.00	.00	18.27	7.41	1.33	.00	-84.79
.18	2.00	.00	17.76	7.20	1.33	.00	-78.15
.18	2.00	.00	18.20	7.38	1.33	3.96	-76.09
.27	3.00	.00	17.53	7.11	1.33	11.88	-60.30
.27	3.00	.00	17.61	7.14	1.33	11.88	-60.17
.36	4.00	.00	16.49	6.69	1.33	7.92	-54.76
.27	3.00	.00	17.19	6.97	1.33	3.96	-66.56
.18	2.00	.00	17.76	7.20	1.33	.00	-78.04
.09	1.00	.00	18.27	7.41	1.33	.00	-85.02
.09	1.00	.00	17.90	7.26	1.33	.00	-83.07
.08	.89	.00	17.82	6.85	1.03	.00	-87.44
.08	.89	.00	17.92	6.89	1.03	.00	-88.04
.08	.89	.00	18.29	7.03	1.03	.00	-89.69
.16	1.77	.00	17.78	6.83	1.03	.00	-83.21
.16	1.77	.00	18.22	7.00	1.03	3.84	-81.42
.24	2.66	.00	17.54	6.74	1.03	11.52	-66.06
.24	2.66	.00	17.63	6.77	1.03	11.52	-66.03
.32	3.54	.00	16.51	6.35	1.03	7.68	-60.49
.24	2.66	.00	17.21	6.61	1.03	3.84	-72.00
.16	1.77	.00	17.78	6.83	1.03	.00	-83.11
.08	.89	.00	18.29	7.03	1.03	.00	-89.88
.08	.89	.00	17.92	6.89	1.03	.00	-87.86
.14	1.06	.00	17.85	6.87	1.13	.00	-94.05
.14	1.06	.00	17.95	6.90	1.13	.00	-94.69
.14	1.06	.00	18.32	7.05	1.13	.00	-96.47
.29	2.13	.00	17.80	6.85	1.13	.00	-89.48
.29	2.13	.00	18.25	7.02	1.13	4.20	-87.50
.43	3.19	.00	17.57	6.76	1.13	12.60	-70.83
.43	3.19	.00	17.65	6.79	1.13	12.60	-70.83
.57	4.25	.00	16.54	6.36	1.13	8.40	-64.91
.43	3.19	.00	17.23	6.63	1.13	4.20	-77.36
.29	2.13	.00	17.80	6.85	1.13	.00	-89.38
.14	1.06	.00	18.32	7.05	1.13	.00	-96.67
.14	1.06	.00	17.95	6.90	1.13	.00	-94.50
.12	1.05	.00	17.87	3.23	1.23	.00	-87.38
.12	1.05	.00	17.96	3.25	1.23	.00	-88.00
.12	1.05	.00	18.34	3.32	1.23	.00	-89.62
.23	2.11	.00	17.82	3.22	1.23	.00	-82.85
.23	2.11	.00	18.27	3.30	1.23	1.92	-82.97
.35	3.16	.00	17.59	3.18	1.23	5.76	-71.11
.35	3.16	.00	17.67	3.20	1.23	5.76	-71.04
.47	4.21	.00	16.55	2.99	1.23	3.84	-63.29
.35	3.16	.00	17.25	3.12	1.23	1.92	-73.20
.23	2.11	.00	17.82	3.22	1.23	.00	-82.75
.12	1.05	.00	18.34	3.32	1.23	.00	-89.83
.12	1.05	.00	17.96	3.25	1.23	.00	-87.80
.15	1.13	.00	19.86	1.37	1.32	.00	-86.05
.15	1.13	.00	19.96	1.38	1.32	.00	-86.67
.15	1.13	.00	20.38	1.41	1.32	.00	-88.23
.30	2.26	.00	19.80	1.37	1.32	.00	-81.28
.30	2.26	.00	20.30	1.40	1.32	3.72	-79.54
.46	3.39	.00	19.54	1.35	1.32	11.16	-63.87
.46	3.39	.00	19.64	1.36	1.32	11.16	-63.73
.61	4.52	.00	18.39	1.27	1.32	7.44	-57.67
.46	3.39	.00	19.17	1.32	1.32	3.72	-69.58
.30	2.26	.00	19.80	1.37	1.32	.00	-81.17

	NOV	67.42	4.84	1.54	.45	.98	.15	1.13
	DEC	66.04	4.74	1.54	.45	1.07	.15	1.13
1987	JAN	72.82	4.92	1.51	.40	1.04	.11	1.21
	FEB	73.21	4.95	1.51	.40	.89	.11	1.21
	MAR	74.74	5.05	1.51	.40	1.27	.11	1.21
	APR	72.62	4.91	3.02	.80	2.32	.22	2.42
	MAY	74.44	5.03	3.02	.80	2.64	.22	2.42
	JUN	71.67	4.85	4.53	1.20	4.19	.32	3.64
	JUL	72.02	4.87	4.53	1.20	4.78	.32	3.64
	AUG	67.46	4.56	6.03	1.60	5.58	.43	4.85
	SEP	70.30	4.75	4.53	1.20	4.19	.32	3.64
	OCT	72.62	4.91	3.02	.80	2.45	.22	2.42
	NOV	74.74	5.05	1.51	.40	1.03	.11	1.21
	DEC	73.21	4.95	1.51	.40	1.12	.11	1.21
1988	JAN	84.37	6.04	1.47	.26	.97	.09	1.16
	FEB	84.82	6.07	1.47	.26	.83	.09	1.16
	MAR	86.60	6.20	1.47	.26	1.19	.09	1.16
	APR	84.14	6.02	2.94	.53	2.17	.18	2.31
	MAY	86.24	6.17	2.94	.53	2.47	.18	2.31
	JUN	83.04	5.94	4.40	.79	3.91	.27	3.47
	JUL	83.44	5.97	4.40	.79	4.46	.27	3.47
	AUG	78.16	5.59	5.87	1.06	5.21	.36	4.62
	SEP	81.45	5.83	4.40	.79	3.91	.27	3.47
	OCT	84.14	6.02	2.94	.53	2.28	.18	2.31
	NOV	86.60	6.20	1.47	.26	.96	.09	1.16
	DEC	84.82	6.07	1.47	.26	1.05	.09	1.16
1989	JAN	90.39	5.34	1.42	.01	.94	.06	1.28
	FEB	90.87	5.36	1.42	.01	.81	.06	1.28
	MAR	92.77	5.48	1.42	.01	1.15	.06	1.28
	APR	90.14	5.32	2.84	.01	2.10	.12	2.57
	MAY	92.40	5.45	2.84	.01	2.40	.12	2.57
	JUN	88.97	5.25	4.26	.02	3.80	.17	3.85
	JUL	89.39	5.28	4.26	.02	4.33	.17	3.85
	AUG	83.73	4.94	5.67	.03	5.06	.23	5.13
	SEP	87.26	5.15	4.26	.02	3.80	.17	3.85
	OCT	90.14	5.32	2.84	.01	2.22	.12	2.57
	NOV	92.77	5.48	1.42	.01	.93	.06	1.28
	DEC	90.87	5.36	1.42	.01	1.02	.06	1.28
1990	JAN	91.92	5.54	1.42	.30	1.05	.06	1.05
	FEB	92.40	5.57	1.42	.30	.90	.06	1.05
	MAR	94.34	5.69	1.42	.30	1.29	.06	1.05
	APR	91.67	5.53	2.84	.61	2.35	.12	2.10
	MAY	93.96	5.67	2.84	.61	2.68	.12	2.10
	JUN	90.47	5.45	4.26	.91	4.24	.17	3.15
	JUL	90.90	5.48	4.26	.91	4.84	.17	3.15
	AUG	85.15	5.13	5.68	1.21	5.65	.23	4.20
	SEP	88.74	5.35	4.26	.91	4.24	.17	3.15
	OCT	91.67	5.53	2.84	.61	2.48	.12	2.10
	NOV	94.34	5.69	1.42	.30	1.04	.06	1.05
	DEC	92.40	5.57	1.42	.30	1.14	.06	1.05
1991	JAN	97.47	5.75	1.40	.30	1.05	.05	1.00
	FEB	97.98	5.78	1.40	.30	.90	.05	1.00
	MAR	100.04	5.90	1.40	.30	1.29	.05	1.00
	APR	97.20	5.73	2.80	.60	2.35	.10	2.00
	MAY	99.63	5.88	2.80	.60	2.68	.10	2.00
	JUN	95.93	5.66	4.20	.90	4.24	.15	3.00
	JUL	96.39	5.68	4.20	.90	4.84	.15	3.00
	AUG	90.29	5.32	5.60	1.20	5.65	.20	4.00
	SEP	94.10	5.55	4.20	.90	4.24	.15	3.00
	OCT	97.20	5.73	2.80	.60	2.48	.10	2.00
	NOV	100.04	5.90	1.40	.30	1.04	.05	1.00
	DEC	97.98	5.78	1.40	.30	1.14	.05	1.00
1992	JAN	101.98	5.87	1.40	.30	1.05	.05	1.00
	FEB	102.52	5.90	1.40	.30	.90	.05	1.00

.00	20.38	1.41	1.32	.00	-88.47
.00	19.96	1.38	1.32	.00	-86.45
.00	20.04	1.35	1.42	.00	-93.45
.00	20.14	1.36	1.42	.00	-94.12
.00	20.56	1.39	1.42	.00	-95.82
.00	19.98	1.35	1.42	.00	-88.66
.00	20.48	1.38	1.42	1.92	-88.89
.00	19.72	1.33	1.42	5.76	-76.52
.00	19.81	1.34	1.42	5.76	-76.39
.00	18.56	1.25	1.42	3.84	-68.08
.00	19.34	1.31	1.42	1.92	-78.49
.00	19.98	1.35	1.42	.00	-88.54
.00	20.56	1.39	1.42	.00	-96.07
.00	20.14	1.36	1.42	.00	-93.88
.00	20.22	.90	1.52	.00	-106.06
.00	20.32	.91	1.52	.00	-106.79
.00	20.75	.93	1.52	.00	-108.78
.00	20.16	.90	1.52	.00	-101.58
.00	20.66	.92	1.52	1.92	-102.14
.00	19.90	.89	1.52	5.76	-89.65
.00	19.99	.89	1.52	5.76	-89.62
.00	18.73	.84	1.52	3.84	-80.83
.00	19.52	.87	1.52	1.92	-91.39
.00	20.16	.90	1.52	.00	-101.46
.00	20.75	.93	1.52	.00	-109.01
.00	20.32	.91	1.52	.00	-106.57
.00	20.40	.90	1.62	.00	-111.70
.00	20.50	.91	1.62	.00	-112.45
.00	20.93	.93	1.62	.00	-114.57
.00	20.34	.90	1.62	.00	-107.45
.00	20.85	.92	1.62	6.60	-103.47
.00	20.07	.89	1.62	19.80	-81.67
.00	20.17	.89	1.62	19.80	-81.68
.00	18.89	.84	1.62	13.20	-77.46
.00	19.69	.87	1.62	6.60	-92.66
.00	20.34	.90	1.62	.00	-107.34
.00	20.93	.93	1.62	.00	-114.79
.00	20.50	.91	1.62	.00	-112.24
.00	20.58	.45	1.72	.00	-112.89
.00	20.69	.45	1.72	.00	-113.66
.00	21.12	.46	1.72	.00	-115.77
.00	20.52	.45	1.72	.00	-108.43
.00	21.03	.46	1.72	6.60	-104.46
.00	20.25	.44	1.72	19.80	-82.37
.00	20.35	.45	1.72	19.80	-82.32
.00	19.06	.42	1.72	13.20	-77.86
.00	19.86	.44	1.72	6.60	-93.33
.00	20.52	.45	1.72	.00	-108.30
.00	21.12	.46	1.72	.00	-116.02
.00	20.69	.45	1.72	.00	-113.42
4.51	20.76	.45	1.82	.00	-123.32
4.54	20.87	.45	1.82	.00	-124.15
4.63	21.30	.46	1.82	.00	-126.47
4.50	20.70	.45	1.82	.00	-118.91
4.61	21.22	.46	1.82	6.60	-115.20
4.44	20.43	.44	1.82	19.80	-92.80
4.46	20.53	.45	1.82	19.80	-92.80
4.18	19.23	.42	1.82	13.20	-87.77
4.36	20.04	.44	1.82	6.60	-103.57
4.50	20.70	.45	1.82	.00	-118.79
4.63	21.30	.46	1.82	.00	-126.72
4.54	20.87	.45	1.82	.00	-123.91
4.51	20.76	.45	1.92	.00	-127.85
4.54	20.87	.45	1.92	.00	-128.70

	MAR	104.67	5.70	1.40	.30	1.29
	APR	101.70	5.85	2.80	.60	2.35
	MAY	104.24	5.66	2.80	.60	2.68
	JUN	100.37	5.77	4.20	.90	4.24
	JUL	100.85	5.46	4.20	.90	4.84
	AUG	94.47	5.77	5.60	1.20	5.65
	SEP	98.45	6.00	4.20	.90	4.24
	OCT	101.70	6.18	2.80	.60	2.48
	NOV	104.67	6.02	1.40	.30	1.04
	DEC	102.52	.00	1.40	.30	1.14
1993	JAN					
	FEB					
	MAR					
	APR					
	MAY					
	JUN					
	JUL					
	AUG					
	SEP					
	OCT					
	NOV					
	DEC					
1994	JAN					

.05	1.00	4.63	21.30	.46	1.92	.00	-130.81
.10	2.00	4.50	20.70	.45	1.92	.00	-123.43
.10	2.00	4.61	21.22	.46	1.92	6.60	-119.50
.15	3.00	4.44	20.43	.44	1.92	19.80	-97.25
.15	3.00	4.46	20.53	.45	1.92	19.80	-96.94
.20	4.00	4.18	19.23	.42	1.92	13.20	-92.30
.15	3.00	4.36	20.04	.44	1.92	6.60	-108.27
.10	2.00	4.50	20.70	.45	1.92	.00	-123.63
.05	1.00	4.63	21.30	.46	1.92	.00	-131.38
.05	1.00	4.54	20.87	.45	1.92	.00	-122.57
							66.41
							66.41
							66.41
							66.41
							66.41
							66.41
							66.41
							66.41
							66.41
							50.88
							66.41
							-23.94
							-16.98

SNAT.FOR - creates Offord naturalised flow

```
c program to construct daily naturalised flow file
c input 1 : daily gauged flows
c input 2 : monthly variations
c
      dimension gflow(31)
      real nflow(31)
      open(1,file='offq7092.dat')
      open(2,file='varn2.dat')
      open(3,file='offq7092.nat')
    5 read(1,*,end=99)ny,nm,nd
   10 format(i5,2i3)
      read(1,*)(gflow(i),i=1,nd)
   11 format(11f7.0)
      read(2,*,end=99)varn
      tnflow=0.0
      do 20 k=1,nd
        nflow(k)=gflow(k)+varn
        tnflow=tnflow+nflow(k)
   20 continue
      write(3,12)ny,nm,nd,ifix(0.5+tnflow/float(nd)),
     1           (ifix(nflow(k)+0.5),k=1,nd)
   12 format(i5,2i3,i10,3x,'NATURALISED OFFORD FLOW (TCMD)',/,(11I7))
      goto 5
   99 stop
      end
```

BROWNS.FOR - creates Brownshill flows from Grafham flows

```
c**********************************************************************
c
        program browns
c
c**********************************************************************
c
c    Calculates Brownshill flow from Offord flow using regression
c    equations provided by Steve Cook.
c
c    Glenn Watts 1 March 1993
c
c----------------------------------------------------------------------
c
        dimension flow(31),brown(31)
        open(unit=11,file='offq7092.nat',status='old')
        rewind 11
        open(unit=12,file='browns.nat',status='new')
        rewind 12
100     read(11,*,end=200,err=200)iy,im,ndm
        read(11,*)(flow(i),i=1,ndm)
        do 300 i=1,ndm
          if(flow(i).le.384.)then
            brown(i)=0.73*(flow(i)**1.05531)
          end if
          if(flow(i).gt.384..and.flow(i).le.1020.)then
            brown(i)=0.669*(flow(i)**1.06925)
          end if
          if(flow(i).gt.1020.)then
            brown(i)=0.923*(flow(i)**1.02283)
          end if
300     continue
        write(12,9999)iy,im,ndm
        write(12,9998)(brown(i),i=1,ndm)
        goto 100
200     stop
9999    format(1x,i4,i3,i3,8x,
     &       'Naturalised Brownshill (from Offord)')
9998    format(1x,11f7.0)
        end
```

GRAFIN5.FOR - Grafham yield program

```
C ********************************************************************
c
C       Program : GRAFOP1.FOR
C       Purpose : PREPARATION OF GRAFHAM INFLOW DATA FOR OSAY PROGRAM
c
C       Synopsis: Creates monthly output of pumped values for 7
C                 combinations of MRF, Pump coeffs etc
c
C       Version 1.0   Anglian Water 1991
C               1.1   Paul Garrad June 1991
C                       Increase Options to 7
C                       Add Comments
C                       Include Brownshill abstraction
```

```
C                       Remove anomolies re PWS
C                       Pump Scheduling
C                       Add Brampton
C                       Change SPRAY
C                       Modify Brownshill MRF
C
C       Version 1.2     E.E.M. Wilson Sept 1991
C                       Revision of Abstractions
C                       Revision of Effluent Return %s
C                       Option to modify pump combinations
C                       and maximum pump capacity included
C
c       Version 1.3     G Spraggs April 1992
c                       Minor mods to output
c
c       Version 2       Glenn Watts March 1993
c                       Version for NRA strategic options
c                       Includes use of transfer water from Trent
c                       Witham Ancholme system.  No second MRF
c                       level, Brownshill abstraction assumed to
c                       exist.  Output of use of additional water.
c                       No pump scheduling.  Does not include
c                       reservoir simulation.
C*************************************************************************

C     DATA STATEMENTS
C     ---------------

      REAL XX(31),FLOFF(31),trans(31),mrfb,mfoff,
     & FLBHL(31),SD(12),EFFMON(12),abs(31)

      INTEGER SM,SY,FM,FY,ND(12)

      CHARACTER*8 fhead
      character*12 filein,filout,filou2
      write(6,*)'Not including Brownshill'
c
109   write(6,*)' DEMAND YEAR?'
      write(6,*)
      READ(5,*,err=109,end=109)IYEAR
      if(iyear.ne.1991.and.iyear.ne.2001.and.iyear.ne.2011)then
        goto 109
      end if
c
C     Pumping Coefficient and MRF's
C     -----------------------------
c
      acoff=1.0
      mfoff=136.
      mrfb=75.
c
C     Max Pump capacities - Offord, BHill, Combined
C     ---------------------------------------------
      DATA PCOFF/454./
      data pcbhl/0./
c      DATA PCBHL/455./
      DATA BHCOM/500./
      DATA BRAMP/4.545/
      DATA EFF/0.9/

C     No days per month
C     -----------------
      DATA ND/31,28,31,30,31,30,31,31,30,31,30,31/

C     SI Demand factors
C     -----------------
      DATA SD/4*0.,1.2,2*3.6,2.4,1.2,3*0./

C     Abstraction for CEGB at Barford
C     -------------------------------
      DATA ABBRF/0./

C     Industrial and SI abstraction for 1991,2001,2011
C     ------------------------------------------------------------------
       IF(IYEAR.EQ.1991)THEN
            DDOFF=9.
            DSOFF=8.
            DSBHL=0.
       ENDIF
       IF(IYEAR.EQ.2001)THEN
            DDOFF=10.
            DSOFF=10.
            DSBHL=0.
       ENDIF
       IF(IYEAR.EQ.2011)THEN
            DDOFF=11.
            DSOFF=11.
            DSBHL=0.
       ENDIF

C     Yield of Grafham for Bedford/M Keynes/Lee VWCo, Huntingdon/St Ives
C     ------------------------------------------------------------------
C     and Luton/Dunstable (1991,2001,2011)
c     ------------------------------------
```

```
c
       IF(IYEAR.EQ.1991)THEN
           YBML=124.
           YH=16.
           DL=24.
       ENDIF
       IF(IYEAR.EQ.2001)THEN
           YBML=152.
           YH=19.
           DL=28.
       ENDIF
       IF(IYEAR.EQ.2011)THEN
           YBML=180.
           YH=23.
           DL=32.
       ENDIF

C      Ouse abstraction for PWS - Lee VWCo, Greensand/Foxcote, Clapham
C      ---------------------------------------------------------------
C      1991,2001, 2011
c      ---------------
c
       IF(IYEAR.EQ.1991)THEN
          VCH=30.
          GF=42.
          C=24.
       ENDIF
       IF(IYEAR.EQ.2001)THEN
          VCH=33.
          GF=42.
          C=24.
       ENDIF
       IF(IYEAR.EQ.2011)THEN
          VCH=33.
          GF=42.
          C=24.
       ENDIF
C
C      Effluent Return Distribution Factors - 90%:
C      -------------------------------------------
C      changed to reflect peaking of PWS demand used in naturalisation
c
       DATA EFFMON/.9025,.90725,.92625,.9,.9225,.88825,.8925,
      & .836,.87125,.9,.92625,.90725/

C      Open Control file:
c      ------------------

       OPEN(12,FILE='DPLIST2.DAT',STATUS='OLD')

C      Input Start and End Month/Year
C      ------------------------------

       READ(12,*)SM,SY,FM,FY

C      Input relevant filenames
C      ------------------------
C      Open data files
C      ---------------
       open (11,file='offq3392.nat',status='old')
       open (12,file='brow3392.nat',status='old')
       open (14,file='grafham.dat',status='unknown')
c
        write(6,*)'File name?'
        read(5,'(a)')fhead
        filein=fhead//'.avl'
        filout=fhead//'.us1'
        filou2=fhead//'.abs'
        open(unit=15,file=filein,status='old')
        rewind 15
        open(unit=16,file=filout,status='new')
        rewind 16
        open(unit=17,file=filou2,status='new')
        rewind 17
c       open(unit=21,file='temp',status='unknown')
c       rewind 21
119    write(6,*)'Maximum augmentation (TCMD?)'
       read(5,*,err=119)allow
       if(allow.lt.0.)then
         goto 119
       end if

c       write(14,1002)iyear
c 1002 format(' Demand Year :',i5)

c-------------------------------------------------------------------------
       NM=SM
       NY=SY
       KEY=1

       pcoff=pcoff+bramp

C ***************************************************************************
```

```
C     MAIN CALCULATION LOOP
C     ---------------------
3     continue
1     CONTINUE


C     Read Flow data
C     --------------
      NDAYS=ND(NM)
      IF(NM.EQ.2.AND.MOD(NY,4).EQ.0)NDAYS=29
      READ(11,*)
      READ(12,*)
      READ(11,*)(FLOFF(J),J=1,NDAYS)
      READ(12,*)(FLBHL(J),J=1,NDAYS)
      read(15,*)iy,im,ndm
      read(15,*)(trans(j),j=1,ndm)
      IF(NM.EQ.1)PRINT*,NY
c
      sum=0.
c
C     Start monthly loop
C     ------------------
      DO 2 J=1,NDAYS

C     Loop for each option
C     --------------------
c
        DSML=0.
        PSUOFF=VCH+GF+C

C     EFF = % effluent return
C     -----------------------
C
        EFF=EFFMON(NM)
        EFFOFF=(YBML+DL)*EFF
        EFFBHL=YH*EFF
c
        SPRAY=DSOFF*SD(NM)
c
        avail=trans(j)
c        avail=0.
        if(avail.gt.allow)then
          avail=allow
        end if
c
c     Flow available at Offord
C     ------------------------
        FLOW=AMAX1((FLOFF(J)+EFFOFF-((1.-EFF)*PSUOFF)
     *  -DDOFF-SPRAY-ABBRF),0.)
c
        if(flow.gt.136.)then
          flow=flow-14.
          if(flow.lt.136.)then
            flow=136.
          end if
        end if
        abst1=0.
        abst2=0.
        abst3=0.
        abst4=0.
        excess=flow-mfoff
c     75% take rule above MRF....
        excess=0.75*excess
        if(excess.lt.0.)then
          excess=0.
        end if
        if(excess.ge.pcoff)then
          abst1=pcoff
        else
          abst1=excess
          extra=pcoff-excess
          if(avail.gt.extra)then
            abst2=extra
            if(abst2.gt.allow)then
              abst2=allow
            end if
          else
            abst2=avail
          end if
        end if
        aleft=avail-abst2
        if(abst1+abst2.gt.bhcom)then
          aleft=bhcom-abst1-abst2
        end if
        if(aleft.lt.0.)then
          aleft=0.
        end if
c
c   downstream flow;
        flow=flow-abst1

C     FOR BROWNSHILL ABSTRACTION
C     --------------------------
c     Flow Available (not including transfer water)
```

```
C     --------------
      SPRAY1=(DSBHL+DSML)*SD(NM)

      bhill=MAX(0.,(FLOW+FLBHL(J)-FLOFF(J)+EFFBHL-SPRAY1))
      exbhil=bhill-mrfb
      if(exbhil.lt.0.)then
        exbhil=0.
      end if
      if(exbhil.gt.pcbhl)then
        abst3=pcbhl
      else
        abst3=exbhil
        extra=pcbhl-exbhil
        if(extra.gt.aleft)then
          abst4=aleft
        else
          abst4=extra
        end if
      end if
c
c    total daily abstraction:
c
      abs(j)=abst1+abst2+abst3+abst4
      xx(j)=abst2+abst4
c      write(21,*)abst1,abst2,abst3,abst4
c
      sum=sum+abs(j)
2      CONTINUE
c
C     Print monthly total
C     ---------------------------

      WRITE(14,400)NM,NY,sum
400   FORMAT(I3,I5,1x,12F7.0)
       write(16,9999)ny,nm,ndays
       write(16,9998)(xx(j),j=1,ndays)
       write(17,9999)ny,nm,ndays
       write(17,9998)(abs(j),j=1,ndays)
9999  format(1x,i4,2i3)
9998  format(11f7.0)

      IF(NM.EQ.FM.AND.NY.EQ.FY)STOP
      NM=NM+1

      IF(NM.LE.12)GO TO 3
      NM=1
      NY=NY+1

      GO TO 3

      END
```

Appendix 2 : Backup of Rutland & Grafham data

20/6/94

VOLUME HEADER : Glenn - Rutland & Grafham data
AREA HEADER :

C:\

C:\AWARUT

DPLISTR.DAT	18	10/02/93	11:42
EYEBROOK.INF	190,976	02/12/92	12:30
ORTON.NAT	193,902	27/11/92	09:29
PITSFORD.INF	191,287	11/12/92	09:53
RUTDP1.FOR	24,961	10/02/93	16:35
RUTLAND.EXE	41,120	10/02/93	11:44
RUTLAND.NAT	190,985	02/12/92	12:31
TINWELL.NAT	190,963	25/11/92	17:25
RUT01BB.DAT	15,912	01/02/93	15:41
RUT01BB.OUT	9,671	01/02/93	15:46
RUT11CC.DAT	15,912	01/02/93	15:48
RUT11CC.OUT	9,671	01/02/93	15:50
RUT92AA.DAT	15,912	01/02/93	15:33
RUT92AA.OUT	9,671	14/01/93	16:29
README.OSY	243	12/02/93	09:46
RUT92.DAT	9,126	23/02/93	12:29
RUTDP1.EXE	36,428	23/02/93	12:28

C:\AWARUT\NRA

DPLISTR.DAT	17	17/02/93	15:06
EYEBROOK.INF	190,976	02/12/92	12:30
ORTON.NAT	193,902	27/11/92	09:29
PITSFORD.INF	191,287	11/12/92	09:53
RUTDP1.FOR	24,961	23/02/93	11:22
RUTLAND.EXE	41,120	10/02/93	11:44
RUTLAND.NAT	190,985	02/12/92	12:31
TINWELL.NAT	190,963	25/11/92	17:25
RUT92.DAT	15,912	23/02/93	13:05
RUT01BB.OUT	9,671	01/02/93	15:46
RUTDP1.EXE	36,492	23/02/93	11:23
RUT11CC.OUT	9,671	01/02/93	15:50
RUTDP1A.FOR	25,279	17/02/93	17:23
RUT92AA.OUT	9,671	14/01/93	16:29
README.OSY	243	12/02/93	09:46
COMPARE.CAL	4,682	18/02/93	10:53
RUTDP1A.EXE	36,492	22/02/93	16:41
RUTDP2.FOR	25,918	22/02/93	16:41
RUT92A.DAT	15,912	22/02/93	16:42
RUT01.DAT	15,912	23/02/93	11:24
RUTDP2.EXE	36,620	22/02/93	16:44
RUT11.DAT	15,912	23/02/93	11:26

C:\AWARUT\NRA\CORRECT

RUTLAND.FOR	26,873	24/02/93	11:38
DPLISTR.DAT	17	03/03/93	11:54
RUT01.DAT	15,990	20/05/93	11:27
RUT11.DAT	15,990	10/03/93	15:06
RUTLAND3.FOR	27,698	10/03/93	14:59
CONTROL.OLD	701	23/02/93	17:08
OSAY.EXE	46,768	05/11/92	11:10
CONTROL.DAT	695	20/05/93	11:28
RUTLAND2.FOR	27,530	05/03/93	09:51
RUTLAND.EXE	36,858	24/02/93	11:38
RUTLAND.NAT	191,888	23/02/93	15:50
TINWELL.NAT	191,923	23/02/93	17:37
EYEBROOK.INF	191,875	23/02/93	14:04
PITSFORD.INF	192,229	23/02/93	16:05
CONTROL.NEW	692	23/02/93	17:11
RUT01.DRT	4,247	20/05/93	11:29
RUT92.DAT	15,990	10/03/93	15:01
ORTON.NAT	194,844	24/02/93	11:05
ORTONORI.NAT	148,869	26/02/93	10:27
README	660	26/02/93	14:00
CONTROL.CON	701	03/03/93	10:24
RUTLAND3.EXE	36,920	10/03/93	14:59
RUTLAND4.FOR	27,613	08/03/93	14:12
RUT.DAT	15,990	05/03/93	11:28
OSAY.FOR	26,543	05/03/93	09:27

C:\AWARUT\NRA\CORRECT\SOS

RUTLAND.NAT	78,656	03/03/93	11:26

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RUTLAND2.FOR              29,360  03/03/93  10:49
RUTLAND2.EXE              38,188  03/03/93  10:50
TINWELL.NAT               78,688  03/03/93  10:45
ORTON.NAT                 78,810  03/03/93  11:32
ORTONORI.NAT             148,869  26/02/93  10:27
EYEBROOK.INF              78,640  03/03/93  10:45
PITSFORD.INF              78,805  03/03/93  10:46
DPLISTR.DAT                   17  05/03/93  13:58
ZERO.AVL                  59,241  02/03/93  13:08
FIFTY.AVL                 59,241  02/03/93  13:08
CONTROL.DAT                  692  08/03/93  14:48
HUNDRED.AVL               59,241  02/03/93  13:08
FIFTY.US1                 59,241  08/03/93  14:59
FIFTY.ABS                 59,241  08/03/93  14:59
RESERV.FOR                 2,810  05/03/93  13:55
RUT.DAT                    6,552  08/03/93  14:59
OSAY.EXE                  46,768  05/11/92  11:10
CONTROL.OLD                  701  23/02/93  17:08
CONTROL.NEW                  692  23/02/93  17:11
CONTROL.CON                  701  03/03/93  10:24
RUT.DRT                    4,247  08/03/93  14:59
RUT3.EXE                  36,920  03/03/93  11:29
RUT3.FOR                  27,528  03/03/93  11:28
RUTLAND3.FOR              29,492  05/03/93  13:19
RUTLAND3.EXE              38,126  05/03/93  13:19
TEMP                     385,024  20/05/93  10:46
FIFTY.USE                 59,241  05/03/93  14:05
RESERV.EXE                31,418  05/03/93  13:56
RESFIL.OUT               168,762  05/03/93  14:05
RUTLAND4.FOR              29,574  08/03/93  14:38
RUTLAND4.EXE              38,126  08/03/93  14:38

C:\AWARUT\NRA\CORRECT\SOS\TEST

RUTLAND3.EXE              38,126  05/03/93  13:19
EYEBROOK.INF              78,640  03/03/93  10:45
PITSFORD.INF              78,805  03/03/93  10:46
RUTLAND.NAT               78,656  03/03/93  11:26
TINWELL.NAT               78,688  03/03/93  10:45
ORTON.NAT                 78,810  03/03/93  11:32
ORTONORI.NAT             148,869  26/02/93  10:27
ZERO.AVL                  59,241  02/03/93  13:08
DPLISTR.DAT                   17  05/03/93  13:58
ZERO.US1                  59,241  20/05/93  11:21
ZERO.ABS                  59,241  20/05/93  11:21
RUT.DAT                    6,552  20/05/93  11:21
TEMP                     260,814  20/05/93  11:21
OSAY.EXE                  46,768  05/11/92  11:10
CONTROL.DAT                  693  20/05/93  11:22
RUT.DRT                    4,247  20/05/93  11:22

C:\AWARUT\TEMP

TEMP.ZIP                 366,450  31/01/94  12:03

C:\AVAIL

AVAIL.ZIP                188,074  31/01/94  09:41

C:\GRAFHAM


C:\GRAFHAM\INPUT

DPLIST.DAT                    17  01/04/92  15:16
QBHL3390.NAT             194,224  05/11/91  19:35
QOFF3390.NAT             191,440  05/11/91  19:35
OFFORD.DAT                16,821  05/11/92  17:20

C:\GRAFHAM\PROGRAMS

GRAFDP1.FOR                8,436  19/05/92  14:36
GRAFDP1H.FOR               7,913  16/03/92  17:08
SIM.FOR                   26,050  16/03/92  17:11
README.PRG                   321  19/05/92  15:06
GRAFDP1A.FOR               8,438  05/11/92  14:53
GRAFDP1B.FOR               8,447  05/11/92  17:08

C:\GRAFHAM\PROGRAMS\NRA

GRAFDP1.FOR                8,436  19/05/92  14:36
GRAFIN.FOR                 8,797  02/03/93  16:01
BROW7292.NAT              70,329  02/03/93  12:11
OFFQ7292.NAT              69,321  02/03/93  12:11
FPREP.FOR                  1,058  02/03/93  12:55
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DPLIST.DAT                16  02/03/93  13:02
OSAY.EXE              46,768  05/11/92  11:10
GRAFIN3.FOR            9,037  15/03/93  14:02
GRAFHAM.DRT            4,247  11/05/93  13:30
GRAFHAM.DAT            4,536  11/05/93  13:20
GRAFIN3.EXE           31,792  15/03/93  14:02
CONTROL.NEW              701  04/03/93  15:23
CONTROL.OLD              701  02/03/93  13:19
CONTROL.DAT              701  02/03/93  13:19
GRAFIN.EXE            33,678  02/03/93  16:01
RESERV.FOR             2,781  02/03/93  16:52
HUNDRED.ABS           59,241  04/03/93  15:54
RESERV.EXE            31,382  02/03/93  16:52
RESFIL.OUT           168,762  02/03/93  16:58
INFILE                    16  02/03/93  17:21
GRAFIN2.FOR            8,973  04/03/93  13:36
GRAFIN2.EXE           33,812  04/03/93  13:36

C:\GRAFHAM\PROGRAMS\NRA\3392

GRAFIN2.FOR            9,013  09/03/93  11:16
DPLIST.DAT                16  15/03/93  14:46
GRAFHAM.DAT           12,960  11/05/93  13:31
CONTROL.DAT              701  02/03/93  13:19
OSAY.EXE              46,768  05/11/92  11:10
QBHL3390.NAT         194,224  05/11/91  19:35
QOFF3390.NAT         191,440  05/11/91  19:35
BROW7292.NAT          70,329  02/03/93  12:11
OFFQ7292.NAT          69,321  02/03/93  12:11
OFFQ3392.NAT         198,045  09/03/93  11:06
BROW3392.NAT         200,925  09/03/93  11:07
GRAFHAM.DRT            4,247  17/03/93  11:01
GRAFIN2.EXE           31,792  09/03/93  11:17
CONTROL.NEW              701  04/03/93  15:23
CONTROL.OLD              701  02/03/93  13:19
GRAFIN3.FOR            9,013  09/03/93  11:32
FPS.EXE               29,026  15/03/93  16:24
GRAFIN3.EXE           31,792  09/03/93  11:33
OFFNAT.FPS           224,613  15/03/93  16:27
TEST                   2,584  15/03/93  16:28
GRAFIN4.FOR            9,013  16/03/93  17:28
GRAFIN5.FOR            9,157  17/03/93  10:34
GRAFIN4.EXE           31,792  16/03/93  17:29
GRAFIN5.EXE           31,860  17/03/93  10:34
README                   143  10/06/93  11:03

C:\GRAFHAM\RESULTS

GR109-01.OUT          10,580  02/04/92  12:29
GR109-11.OUT          10,580  02/04/92  12:32
GR109-91.OUT          10,580  02/04/92  12:26
GRAF01.OUT            10,580  02/04/92  10:04
GRAF11.OUT            10,580  02/04/92  10:24
GRAF91.OUT            10,580  02/04/92  10:08
GRAFLB01.OUT          10,580  02/04/92  10:45
GRAFLB11.OUT          10,580  02/04/92  10:47
GRAFLB91.OUT          10,580  02/04/92  10:44
OF109-01.DAT          16,705  02/04/92  12:18
OF109-11.DAT          16,705  02/04/92  12:18
OF109-91.DAT          16,705  02/04/92  12:19
OFFLB01.DAT           16,705  02/04/92  10:40
OFFLB11.DAT           16,705  02/04/92  10:40
OFFLB91.DAT           16,705  02/04/92  10:40
OFFORD01.DAT          16,705  02/04/92  10:02
OFFORD11.DAT          16,705  02/04/92  10:22
OFFORD91.DAT          16,705  01/04/92  17:32
README.OSY               571  19/05/92  15:21
OFFORD.DAT                99  19/05/92  14:53

C:\GRAFHAM\RUTLAND

RUTFEB92.CAL           8,324  20/05/92  11:27
RUTAUG91.CAL           7,294  20/05/92  12:01
RUTDEC91.CAL           7,257  20/05/92  11:36
RUTJAN92.CAL           7,810  20/05/92  11:33
RUTJUL91.CAL           7,204  20/05/92  12:03
RUTNOV91.CAL           7,197  20/05/92  11:43
RUTOCT91.CAL           7,446  20/05/92  11:57
RUTSEP91.CAL           6,789  20/05/92  11:59
RUTAPR91.CAL           7,354  20/05/92  13:17
RUTFEB91.CAL           7,457  20/05/92  13:20
RUTJAN91.CAL           9,347  20/05/92  13:22
RUTJUN91.CAL           7,140  20/05/92  13:13
RUTMAR91.CAL           7,493  20/05/92  13:18
RUTMAY91.CAL           7,693  20/05/92  13:15
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RUTDEC90.CAL              8,387  20/05/92  13:32
RUTNOV90.CAL              7,755  20/05/92  13:51
RUTOCT90.CAL              8,172  20/05/92  13:54
RUTSEP90.CAL              8,023  20/05/92  14:03
RUTAUG90.CAL              8,124  20/05/92  14:06
RUTJUL90.CAL              7,304  20/05/92  14:12
RUTJUN90.CAL              7,106  20/05/92  14:16
RUTMAY90.CAL              8,221  20/05/92  14:20
RUTAPR90.CAL              8,028  20/05/92  14:29
RUTMAR90.CAL              7,934  20/05/92  14:32
RUTFEB90.CAL              7,128  20/05/92  14:35
RUTJAN90.CAL              7,179  20/05/92  14:48
RUTAPR90.CSV                512  16/11/92  11:27
TEMP2.CAL                27,973  16/11/92  12:17

C:\GRAFHAM\NATURAL

NATVAR.BAK              162,944  05/09/91  16:34
OFFQ7090.DAT             70,071  02/08/91  15:52
OFFQ7090.NAT             69,314  05/09/91  16:39
SNAT.EXE                 27,088  01/03/93  14:26
SNAT.FOR                    736  01/03/93  14:26
VARN1.DAT                 5,888  05/09/91  16:33
VARN2.DAT                 5,504  26/02/93  16:45
NATVAR.CAL              109,220  26/02/93  16:45
FLOW9192.CAL             76,895  01/03/93  10:44
FLOW9192.CSV             11,744  02/03/93  12:02
FLCONV.FOR                1,450  01/03/93  11:48
TRANS.FOR                   485  01/03/93  14:19
OUTPUT                   78,606  01/03/93  13:59
TCMD.OUT                  5,645  02/03/93  12:04
OFFQ7092.NAT             75,919  02/03/93  12:06
OFFQ7092.DAT             75,715  02/03/93  12:06
BROWNS.NAT               77,023  02/03/93  12:08
BROWNS.FOR                1,291  01/03/93  16:20
TRANS.MAP                     0  02/03/93  12:04
BROWNS.EXE               33,762  02/03/93  12:08
TRANS.EXE                29,000  02/03/93  12:04
TRANS2.FOR                  487  09/05/94  12:11
TEMP                     75,715  02/03/93  12:06
TRANS2.EXE               29,002  09/05/94  12:12
CUMECS.OUT               86,126  09/05/94  12:19
DIAG                        516  13/06/94  15:04
NATVAR.WK1              194,560  16/06/94  16:09
TRANS2.OBJ                1,294  09/05/94  12:12

C:\GRAFHAM\NATURAL\BROWNS

BREST.FOR                 1,864  05/11/91  19:29

C:\MINE


C:\MINE\UTILS

ADDENDUM.DOC             21,473  15/03/90  01:10
APPNOTE.TXT              25,811  15/03/90  01:10
AUTHVERI.FRM              1,744  15/03/90  01:10
CHKLIST.CPS                  54  08/06/92  15:51
DEDICATE.DOC                720  15/03/90  01:10
LICENSE.DOC               9,366  15/03/90  01:10
MANUAL.DOC              140,355  21/07/89  01:01
OMBUDSMN.ASP                595  15/03/90  01:10
ORDER.DOC                 4,701  15/03/90  01:10
PKUNZIP.EXE              23,528  15/03/90  01:10
PKZ110.EXE              149,219  23/03/90  05:25
PKZIP.EXE                34,296  15/03/90  01:10
PKZIPFIX.EXE              9,224  15/03/90  01:10
POPDIR.COM                  628  21/03/99  13:43
PUSHDIR.COM                 717  21/03/99  13:43
PUTAV.EXE                 4,479  15/03/90  01:10
READ.ME                   1,819  10/08/90  15:43
README.DOC                  800  15/03/90  01:10
WHATSNEW.110              2,916  15/03/90  01:10
ZIP2EXE.EXE              22,188  15/03/90  01:10

C:\ORTON2


C:\ORTON2\INPUT

INPUT.ZIP                91,285  16/06/94  14:28

C:\ORTON2\OUTPUT
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OUTPUT.ZIP              56,262  16/06/94   14:28

C:\ORTON2\RETURN

RETURN.ZIP             254,766  16/06/94   14:29

C:\ORTON2\PROGS

PROGS.ZIP               10,745  16/06/94   14:30

C:\ORTON2\FLOWS

FLOWS.ZIP              231,473  16/06/94   14:31

C:\ORTON2\REPORTS

REPORTS.ZIP             34,939  16/06/94   14:32

C:\ORTON2\OLD

OLD.ZIP                247,170  16/06/94   14:33

C:\ORTON2\YIELD

FLOWNA3.FOR             11,268  23/02/93   11:46
FLOWNA4.FOR             11,268  24/02/93   10:57

C:\ORTON2\INPUT2

INPUT2.ZIP              67,333  16/06/94   14:34

C:\ORTON2\OUTPUT2

OUTPUT2.ZIP            167,642  16/06/94   14:36

C:\ORTON2\ORIG

ORIG.ZIP               152,517  16/06/94   14:37

C:\ORTON2\EXTEND

EXTEND.ZIP             160,127  16/06/94   14:38

C:\OSAY

CONTROL.DAT                700  15/02/93   15:00
GPW                     10,581  05/11/92   15:00
OSAY.EXE                46,768  05/11/92   11:10
OFF91.DAT               14,352  11/07/91   13:56
OFF91.~DR                6,397  11/07/91   14:00
OSAYOLD.EXE             46,768  15/07/91   13:36
OSAY.FOR                26,491  15/07/91   13:36
OSAYBAT.BAT                 42  17/10/91   09:14
OSAYBAT.~BA                 29  17/10/91   09:11
OFF91.DRT                6,397  05/11/92   13:12
OFFORD.DAT              16,704  05/11/92   14:59
OFFORD.DRT               6,397  05/11/92   14:59
OFFORD91.DAT            16,705  01/04/92   17:32
OFFORD91.DRT             6,397  05/11/92   13:39
OFFORDB.DAT             16,704  05/11/92   17:21
OFFORDB.DRT              4,247  15/02/93   16:34
CONTROL.OLD                701  05/11/92   17:21
TEST8                   10,547  15/02/93   16:34
OSAY2.FOR               26,495  29/06/93   13:11
OSAY2.EXE               84,996  29/06/93   13:11

C:\OSAY\BACKUP

CONTROL.DAT                700  16/10/91   08:51
GPW                      9,657  05/11/92   09:28
OSAY.EXE                46,768  05/11/92   11:10
OFF91.DAT               14,352  11/07/91   13:56
OFF91.DRT                6,397  11/07/91   14:00
OSAYOLD.EXE             46,768  15/07/91   13:36
OSAY.FOR                26,491  15/07/91   13:36
OSAYBAT.BAT                 42  17/10/91   09:14
OSAYBAT.~BA                 29  17/10/91   09:11

C:\GERRY

CONTROL.DAT                695  20/05/93   11:59
DPLISTR.DAT                 17  03/03/93   11:54
EYEBROOK.INF           191,875  23/02/93   14:04
OSAY.EXE                46,768  05/11/92   11:10
OSAY.FOR                26,543  05/03/93   09:27
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PITSFORD.INF          192,229  23/02/93  16:05
RUT01.DAT              15,990  20/05/93  11:55
RUTLAND.NAT           191,888  23/02/93  15:50
RUTLAND3.EXE           36,920  10/03/93  14:59
RUTLAND3.FOR           27,698  10/03/93  14:59
TINWELL.NAT           191,923  23/02/93  17:37
ORTON.NAT             194,844  24/02/93  11:05
RUT01.DRT               4,247  20/05/93  11:56
RUT92.DAT              15,990  20/05/93  11:57
RUT92.DRT               4,247  20/05/93  11:57
RUT11.DAT              15,990  20/05/93  11:58
RUT11.DRT               4,247  20/05/93  11:59

C:\GERRY\DATAPREP


C:\GERRY\OSAY

OSAYMM.EXE             94,864  02/06/93  11:10
OSAYMM.FOR             32,317  08/06/93  17:20
RUTCR.DAT                 229  08/06/93  14:40

C:\PITSFORD

PITSFORD.ZIP          148,348  18/10/93  17:29
STANDREW.DAT          194,897  16/02/93  09:36
PITS.FOR                1,019  11/03/93  17:21
STANMON.DAT                97  22/09/92  16:28
PITSFORD.INF          191,293  11/03/93  17:22
PITS.OUT              193,716  11/03/93  17:21

C:\PITSFORD\EXTEND

EXTEND.ZIP            123,656  18/10/93  17:28

C:\RPLAN


C:\RPLAN\GRAFHAM

GRAFHAM.ZIP           806,834  01/11/93  11:57

C:\RPLAN\GRAFHAM\FLOWS

GRAFIN2.FOR             9,606  27/04/93  12:07
BROW7292.NAT           70,329  02/03/93  12:11
GRAFIN2.EXE            33,936  27/04/93  12:07
OFFQ7292.NAT           69,321  02/03/93  12:11
DPLIST.DAT                 16  11/03/93  15:52
GRAFHAM.DAT             4,464  15/03/93  14:10
CONTROL.DAT               701  02/03/93  13:19
TEMP                   77,398  23/04/93  16:34
DENAT                  77,412  27/04/93  13:26
NAT                    77,397  27/04/93  13:26
RESERV.FOR              3,011  27/04/93  13:23
TEST.ABS               58,299  27/04/93  11:53
TEST.USE                   15  27/04/93  12:03
RESERV.EXE             31,510  27/04/93  13:23
RESFIL.OUT            166,078  27/04/93  13:26
TEST2.ABS              58,299  27/04/93  13:26
TEST2.US1              59,241  09/03/93  15:07
TEST2.USE              58,299  27/04/93  13:26
R43OFF-D.DAT           77,365  23/04/93  15:34
RESID.FOR               1,768  27/04/93  15:17
RESID.FPS              77,406  29/04/93  13:24

C:\RPLAN\GRAFHAM\EXTEND

GRAFIN5.FOR             9,160  28/07/93  10:07
OFFQ3392.NAT          198,045  09/03/93  11:06
BROW3392.NAT          200,925  09/03/93  11:07
DPLIST2.DAT                17  11/05/93  13:53
GRAFIN5.EXE            33,794  28/07/93  10:07
GRAFHAM.DRT             4,247  16/06/94  16:35
TRENT25.AVL           169,875  01/09/93  10:39
TRENT25.US1            99,328  17/06/94  08:40
TRENT25.ABS            99,328  17/06/94  08:40
GRAFHAM.DAT             7,168  17/06/94  08:40
GRAFIN6.FOR             9,254  08/03/94  08:55
GRAFIN6.EXE            33,814  08/03/94  08:55
OSAY.EXE               46,768  05/11/92  11:10
CONTROL.DAT               701  02/03/93  13:19
GRAFIN6.OBJ             6,877  08/03/94  08:55
RESERV.FOR              2,901  28/07/93  11:00
RESERV.EXE             31,414  28/07/93  11:00
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C:\RPLAN\GRAFHAM\SIMULA

GRSIM.FOR                11,498  29/10/93  14:41
DPLIST2.DAT                  17  11/05/93  13:53
GRSIM.EXE                35,966  29/10/93  14:41
OFFQ3392.NAT            198,045  09/03/93  11:06
BROW3392.NAT            200,925  09/03/93  11:07
GRAFHAM.DAT              12,960  29/10/93  14:42
TEST.US1                169,245  29/10/93  13:19
TEST.ABS                169,245  29/10/93  13:19
GRSIM.OBJ                 9,657  29/10/93  14:41
BHDOWN.DAT              224,655  29/10/93  13:21
BHILLNA.DAT             224,628  29/10/93  14:42
BH2000.DAT              224,621  29/10/93  14:42
DIAG                      1,204  29/10/93  15:56
RESFILL                  16,560  29/10/93  14:42
TEST2.US1               169,245  29/10/93  14:30
TEST2.ABS               169,245  29/10/93  14:30
BHDOWN2.DAT             224,631  29/10/93  14:42
TEST3.US1               169,245  29/10/93  14:42
TEST3.ABS               224,613  29/10/93  14:44

C:\RPLAN\RUTLAND

RUTLAND.ZIP             282,171  01/11/93  12:00

C:\RPLAN\CONVENT

YIELD.FOR                 3,448  10/05/93  17:45
TEST2.USE                58,299  27/04/93  13:26
ZERO.ABS                 58,299  11/05/93  11:48
YIELD2.FOR                3,530  11/05/93  12:30
LONG2.ABS                11,520  11/05/93  13:54
LONG3.ABS               169,245  11/05/93  14:00
RUTS.ABS                 58,299  11/05/93  15:42
YIELDP.FOR                6,619  12/05/93  14:46
TRENT25.ABS             167,085  01/09/93  10:43
YIELDP.DBG                   12  01/09/93  12:04
YIELD3.FOR                4,106  01/09/93  15:03
RUT.DAT                  18,720  01/09/93  13:54
YIELD3.EXE               33,468  01/09/93  15:03
RUT.O                    18,720  01/09/93  15:05
RES.FIL                   4,080  01/09/93  15:29
RUT.OS                   15,912  01/09/93  15:07
YIELD3.OBJ                4,018  01/09/93  15:03

C:\RPLAN\RUT2

RUT2.ZIP                340,047  01/11/93  11:53

C:\RPLAN\EXTEND

EXTEND.ZIP            1,279,075  08/03/94  08:24

C:\RPLAN\EXTEND\TEST

TEST.ZIP                490,226  29/10/93  09:41

C:\RPLAN\EXTEND\SIMULA

SIMULA.ZIP              803,241  01/11/93  11:55

C:\RUTHAMFO

REPAPR90.CAL             73,932  26/04/90  12:29
REPAUG89.CAL             56,761  26/04/90  11:40
REPDEC89.CAL             58,840  26/04/90  12:11
REPFEB90.CAL             68,545  26/04/90  12:25
REPJAN90.CAL             69,925  26/04/90  12:17
REPJUL90.CAL             71,911  25/07/90  12:24
REPJULY8.CAL             28,227  16/10/89  15:13
REPJUN90.CAL             71,970  02/07/90  14:38
REPMAR90.CAL             74,840  26/04/90  12:29
REPMAY89.CAL             23,752  22/05/89  08:37
REPMAY90.CAL             77,318  25/05/90  13:54
REPNOV89.CAL             56,692  26/04/90  12:02
REPOCT89.CAL             50,641  26/04/90  11:59
REPSEP89.CAL             54,254  26/04/90  11:51
REPSUM89.CAL            107,564  21/05/90  15:05
REPAPR90.CSV                768  16/11/92  10:30
REPAUG89.CSV                768  16/11/92  10:32
REPDEC89.CSV                512  16/11/92  10:33
REPFEB90.CSV                384  16/11/92  10:35
REPJAN90.CSV                512  16/11/92  10:36
REPJULY8.CSV                256  16/11/92  10:37
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REPJUL90.CSV                512  16/11/92  10:40
REPJUN90.CSV                512  16/11/92  10:41
REPMAR90.CSV                640  16/11/92  10:42
REPMAY90.CSV                384  16/11/92  10:44
REPNOV89.CSV                768  16/11/92  10:45
REPOCT89.CSV                640  16/11/92  10:47
REPSEP89.CSV                768  16/11/92  10:48
REPSUM89.BAK              7,808  16/11/92  10:51
TINWELL.CAL             110,564  16/11/92  14:54
TINWELL.CSV              16,896  16/11/92  14:54
REPSUM89.CSV              9,654  16/11/92  11:07

C:\RUTLAND

FLSUM.FOR                 1,632  30/11/92  17:00
NETRAIN.OUT             190,934  01/12/92  16:26
RUTLAN.FOR                1,252  27/11/92  18:08
RUTLAND.NA2             190,946  27/11/92  18:09
INFLOW.FOR                3,712  01/12/92  09:24
RUTLAND.NA3             190,946  01/12/92  11:59
NAT84                     4,379  12/01/93  15:27
INFLOW.OUT              190,951  01/12/92  11:57
RUTLAND.NAT             191,888  23/02/93  15:50
MCONV.FOR                   894  12/01/93  15:31
COLUM.FOR                   429  12/01/93  15:28
COMPARE.CAL              61,218  17/02/93  11:00

C:\RUTLAND\RAIN

RAIN.ZIP                461,496  26/07/93  09:37
EVAP.MON                  4,659  27/11/92  16:55

C:\RUTLAND\EXTEND

RUTLAN.FOR                1,160  23/07/93  14:51
INFLOW.FOR                3,666  22/07/93  14:06
COLUM.FOR                   429  12/01/93  15:28
MANTON.FPS               55,980  26/11/92  16:29
EGLETON.FPS              55,328  01/12/92  11:55
INFLOW.OUT              227,444  22/07/93  14:06
NETRAIN.OUT             227,427  23/07/93  14:44
RUTLAND.NAT             228,381  23/07/93  15:01

C:\RUTLAND\EXTEND\RAIN

NETPPT.FOR                1,482  22/07/93  09:58
RAINCO.FOR                1,154  23/07/93  14:06
RAIN3.EXE               113,961  23/07/93  15:07
EVAP.MON                  5,612  22/07/93  11:25
RJOIN.FOR                   543  27/11/92  16:17
RAIN3.COL               599,940  23/07/93  14:32

C:\RUTSIM

RSIM.FOR                 38,544  08/06/93  16:33
RUTDP4.FOR               36,560  08/06/93  11:06

C:\WELLAND

WELLAND.ZIP           1,882,242  06/09/93  09:39

C:\WELLAND\PROGS

FLSPLIT.FOR               1,070  16/11/92  16:08
TINWELL.FOR               5,413  25/11/92  14:17
FLPLOT4.FOR               4,314  10/12/92  17:51
IBM_CONF.CNF              1,162  15/09/92  14:27
TINABS.FOR                1,668  25/11/92  16:58
DIAG                        120  15/12/92  17:42
TEMP.OUT                 19,431  25/11/92  16:11
TEMP6.OUT                19,431  25/11/92  16:56

C:\WELLAND\TINWELL

TINWELL.ZIP             374,118  01/11/93  12:02

C:\WELLAND\UPTON

UPTON.ZIP               409,287  01/11/93  12:03
UPTON.FPS               208,123  18/06/93  12:18

C:\WELLAND\NPF

EYEB6888.DAT             76,606  29/03/90  09:55
FOST6888.DAT             76,606  29/03/90  09:51
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RUTPUMP2.EXE            88,224  14/05/90  15:41
RUTPUMP2.FOR            12,421  14/05/90  15:41
TIN6888.DAT             76,481  29/03/90  11:22
BARR6888.DAT            76,606  29/03/90  09:49
FB&B-TIN.EXE            35,232  29/03/90  11:21
FB&B-TIN.FOR             2,361  29/03/90  11:22
INFLOWS.DAT              4,355  28/03/90  11:13

C:\WELLAND\EYEBROOK

EYEBROOK.ZIP           401,834  06/09/93  09:35

C:\WELLAND\EYEBROOK\EXTEND

IMPOUN3.FOR              3,107  23/07/93  10:59
EYEBROO2.FIL           239,186  22/07/93  18:03
EYEBROOK.IMP           228,392  23/07/93  11:00
FOSTERS.FPS             98,360  23/02/93  13:47
EYEBROOK.INF           228,359  23/07/93  11:00

C:\WELLAND\LICS

GLENN2.LIC              94,533  24/11/92  08:04
LICENCE.CAL             24,321  24/11/92  13:16

C:\WELLAND\BARROW

BARROW.FPS             109,118  19/11/92  15:23

C:\WELLAND\OUTPUT

OUTPUT.ZIP             658,016  01/11/93  12:06

C:\WELLAND\OLD

TIN4284                151,943  17/02/93  12:21
TIN.FOR                  1,144  17/02/93  12:24
WELLAND.OLD            161,017  17/02/93  12:26

C:\WELLAND\ABS

DAILY.CAL              173,285  17/11/92  18:06
TINWELL.CAL            184,629  25/11/92  17:08
TINWELL.CSV             19,968  25/11/92  17:08
WELLAND.CAL              5,420  26/11/92  11:10
WELLAND.ABS              3,547  26/11/92  11:26
ABS2.CSV                 2,816  10/12/92  15:00

C:\WELLAND\FLOWS

FLOWS.ZIP              365,715  01/11/93  12:08
TINWELL.TOT             21,029  23/02/93  15:24

C:\WELLAND\FLOWS\EXTEND

TINWELL2.FOR             5,371  23/07/93  11:39
FOSTERS.FPS             98,360  23/02/93  13:47
BARROW.FPS             109,794  23/07/93  13:38
TINWELL.EXT            228,396  23/07/93  13:47

C:\WELLAND\NATURAL

NATUR.BAK                2,516  26/11/92  12:00
WELLAND.ABS              3,547  26/11/92  11:26
EYEBROOK.IMP           191,875  23/02/93  14:04
TINWELL.FIL            191,902  23/02/93  15:33
FLPLOT4.FOR              4,314  25/11/92  13:33
TEST                     2,584  16/03/93  09:31
NATUR.FOR                3,612  26/11/92  12:27
TINWELL.NAT            191,907  23/02/93  15:39
IBM_CONF.CNF             1,162  15/09/92  14:27
DIAG                       120  26/11/92  13:27
TEMP                       867  10/12/92  16:50
TEMP2                      867  10/12/92  16:57
YEARS.TIN                  896  10/12/92  17:14
NATUR2.FOR               3,728  23/02/93  15:38
MONTH.OUT               45,510  23/02/93  15:39
TEST2                    2,584  16/03/93  09:31
TINWELL2.NAT           190,965  26/11/92  13:47

C:\WELLAND\NATURAL\EXTEND

NATUR2.FOR               3,634  23/07/93  13:36
WELLAND.ABS              4,061  23/07/93  13:22
TINWELL.EXT            228,396  23/07/93  13:47
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EYEBROOK.IMP            228,392  23/07/93  11:00
TINWELL.NAT             228,401  23/07/93  13:49

C:\WELLAND\DEC92

TINWELL.NAT             190,965  26/11/92  12:29
RUTLAND.NAT             190,946  01/12/92  16:27
EYEBROOK.INF            190,933  01/12/92  13:08

C:\NENEPLAN

ORTRUT.FPS              200,770  09/11/93  14:31
MONTH.AVE                   384  09/11/93  14:50

C:\NEWRUT


C:\NEWRUT\OSAY

OSAYMM.EXE               94,864  02/06/93  11:10
OSAYMM.FOR               32,317  08/06/93  17:20
RUTCR.DAT                   229  08/06/93  14:40

C:\NEWRUT\DATAPREP

DUSTON.S1A              177,936  17/03/93  09:44
EYEBROOK.INF            191,875  23/02/93  14:04
ORTON.NAT               194,844  24/02/93  11:05
PITSFORD.INF            192,229  23/02/93  16:05
RUTDP4.FOR               36,560  08/06/93  11:06
RUTLAND.NAT             191,888  23/02/93  15:50
RUTLAND4.EXE             45,840  08/06/93  11:02
TINWELL.NAT             191,923  23/02/93  17:37
RUTIN.DAT                 1,714  08/09/93  11:57
PITSFAIL.OUT             18,720  08/09/93  11:59
RUT92.DAT                15,912  08/09/93  11:56
FORT10                      206  08/09/93  11:59
RUT01.DAT                16,109  08/09/93  11:59

C:\NEWRUT\RUTSIM

RUTLAND.FOR              27,527  26/02/93  13:42
RUTSIM.EXE               56,784  08/06/93  14:56

C:\ARCHIVE


C:\ARCHIVE\RYIELD


C:\ARCHIVE\RYIELD\NATFLOW


C:\ARCHIVE\RYIELD\NATFLOW\UPTON

UPTON.TOT               308,446  23/07/93  13:41

C:\ARCHIVE\RYIELD\NATFLOW\RUTLAND

NETRAIN.OUT             227,427  23/07/93  14:44
INFLOW.FOR                3,666  22/07/93  14:06
MANTON.FPS               55,980  26/11/92  16:29
EGLETON.FPS              55,328  01/12/92  11:55
RUTLAN.FOR                1,160  23/07/93  14:51
RUTLAND.NAT             228,381  23/07/93  15:01

C:\ARCHIVE\RYIELD\NATFLOW\RUTLAND\RAIN

NETPPT.FOR                1,482  22/07/93  09:58
RAIN3.COL               599,940  23/07/93  14:32
EVAP.MON                  5,612  22/07/93  11:25

C:\ARCHIVE\RYIELD\NATFLOW\TINWELL


C:\ARCHIVE\RYIELD\NATFLOW\TINWELL\EYEBROOK

IMPOUN3.FOR               3,107  23/07/93  10:59
EYEBROOK.IMP            228,392  23/07/93  11:00
EYEBROOK.INF            228,359  23/07/93  11:00

C:\ARCHIVE\RYIELD\NATFLOW\TINWELL\GAUGED

TINWELL2.FOR              5,371  23/07/93  11:39
TINWELL.EXT             228,396  23/07/93  13:47
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TINWELL.TOT              21,029  23/02/93  15:24

C:\ARCHIVE\RYIELD\NATFLOW\TINWELL\NATURAL

NATUR2.FOR                3,634  23/07/93  13:36
WELLAND.ABS               4,061  23/07/93  13:22

C:\ARCHIVE\RYIELD\NATFLOW\ORTON


C:\ARCHIVE\RYIELD\NATFLOW\ORTON\INPUT

DUSABS.DAT                  600  12/11/92  14:38
DUSABS.MON                1,664  24/02/93  10:52
AGIND.DAT                   758  22/09/92  12:57
RESFAC.DAT                  676  22/09/92  12:58
PWSDEM.DAT                   61  22/09/92  11:30
DUSDEM.DAT                   60  22/09/92  11:31
AGDEM.DAT                    60  22/09/92  11:32
CORBY.DAT                 6,160  11/11/92  16:26
WANSDAY.DAT              64,311  16/02/93  09:41
PWS.DAT                     851  18/11/92  15:51
FILES.IN                    232  23/02/93  11:47
STANDREW.DAT            194,897  16/02/93  09:36

C:\ARCHIVE\RYIELD\NATFLOW\ORTON\EXTEND

ORTON3.NAT              194,844  24/02/93  11:05
ORTON.NAT               193,902  27/11/92  09:29
ORTONNAT.NAT            228,540  26/07/93  15:39
ORTONHY3.SIM             37,486  21/07/93  15:41
ORTON.FPS               203,158  16/02/93  10:13

C:\ARCHIVE\RYIELD\NATFLOW\ORTON\PROGS

FLOWNA3.FOR              11,094  15/12/92  13:11
NATFLO2.FOR               3,075  24/11/92  15:45
FLOWNA4.FOR              11,268  24/02/93  10:57

C:\ARCHIVE\RYIELD\YIELD

RUTLAND2.FOR             34,944  02/09/93  15:42
RUTLAND3.FOR             35,059  08/03/94  08:17
RESERV.FOR                2,932  29/07/93  11:49
TRENT.FOR                 2,171  27/07/93  17:13
AVERAG.FOR                1,660  01/09/93  10:11
ZERO.AVL                169,245  26/10/93  15:14
TRENT25.AVL             169,875  01/09/93  10:39
RUTLAND.NAT             228,381  23/07/93  15:01
EYEBROOK.INF            228,359  23/07/93  11:00
TINWELL.EXT             228,396  23/07/93  13:47
PITSFORD.INF            228,354  26/07/93  14:59
OSAY.EXE                 46,768  05/11/92  11:10
RUTLAND2.EXE             40,072  02/09/93  16:29
RUTLAND3.EXE             40,108  08/03/94  08:17
RESERV2.EXE              31,498  26/10/93  17:35
TRENT.EXE                32,346  27/07/93  17:13
AVERAG.EXE               31,002  01/09/93  10:11
CONTROL.DAT                 693  07/03/94  17:07
ORTONNAT.NAT            228,540  26/07/93  15:39

C:\ARCHIVE\RYIELD\ABSTRACT

RUTFEB92.CAL              8,324  20/05/92  11:27
RUTAUG91.CAL              7,294  20/05/92  12:01
RUTDEC91.CAL              7,257  20/05/92  11:36
RUTJAN92.CAL              7,810  20/05/92  11:33
RUTJUL91.CAL              7,204  20/05/92  12:03
RUTNOV91.CAL              7,197  20/05/92  11:43
RUTOCT91.CAL              7,446  20/05/92  11:57
RUTSEP91.CAL              6,789  20/05/92  11:59
RUTAPR91.CAL              7,354  20/05/92  13:17
RUTFEB91.CAL              7,457  20/05/92  13:20
RUTJAN91.CAL              9,347  20/05/92  13:22
RUTJUN91.CAL              7,140  20/05/92  13:13
RUTMAR91.CAL              7,493  20/05/92  13:18
RUTMAY91.CAL              7,693  20/05/92  13:15
RUTDEC90.CAL              8,387  20/05/92  13:32
RUTNOV90.CAL              7,755  20/05/92  13:51
RUTOCT90.CAL              8,172  20/05/92  13:54
RUTSEP90.CAL              8,023  20/05/92  14:03
RUTAUG90.CAL              8,124  20/05/92  14:06
RUTJUL90.CAL              7,304  20/05/92  14:12
RUTJUN90.CAL              7,106  20/05/92  14:16
RUTMAY90.CAL              8,221  20/05/92  14:20
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RUTAPR90.CAL              8,028  20/05/92  14:29
RUTMAR90.CAL              7,934  20/05/92  14:32
RUTFEB90.CAL              7,128  20/05/92  14:35
RUTJAN90.CAL              7,179  20/05/92  14:48
TEMP2.CAL                27,973  16/11/92  12:17

C:\ARCHIVE\RYIELD\PITSFORD

PITS.FOR                  1,495  26/07/93  14:59
PITS.OUT                228,354  26/07/93  14:59

C:\ARCHIVE\GYIELD


C:\ARCHIVE\GYIELD\NATFLOW


C:\ARCHIVE\GYIELD\NATFLOW\OFFORD

NATVAR.CAL              109,220  26/02/93  16:45
NATVAR.WK1              194,560  16/06/94  16:09
SNAT.FOR                    736  01/03/93  14:26
OFFQ7092.DAT             75,715  02/03/93  12:06
OFFQ7092.NAT             75,919  02/03/93  12:06
BREST.FOR                 1,864  05/11/91  19:29
BROWNS.FOR                1,291  01/03/93  16:20
VARN2.DAT                 5,504  26/02/93  16:45
QBHL3390.NAT            194,224  05/11/91  19:35
QOFF3390.NAT            191,440  05/11/91  19:35

C:\ARCHIVE\GYIELD\YIELD

GRAFIN5.FOR               9,160  28/07/93  10:07
GRAFIN5.EXE              33,794  28/07/93  10:07
GRAFIN6.EXE              33,814  08/03/94  08:55
GRAFIN6.FOR               9,254  08/03/94  08:55
OFFQ3392.NAT            198,045  09/03/93  11:06
BROW3392.NAT            200,925  09/03/93  11:07
TRENT25.AVL             169,875  01/09/93  10:39
CONTROL.DAT                 701  02/03/93  13:19
OSAY.EXE                 46,768  05/11/92  11:10
RESERV.FOR                2,901  28/07/93  11:00
RESERV.EXE               31,414  28/07/93  11:00
DPLIST2.DAT                  17  11/05/93  13:53
RESID.FOR                 1,768  27/04/93  15:17

C:\ARCHIVE\OSAY

OSAY.FOR                 26,491  15/07/91  13:36
OSAY.EXE                 46,768  05/11/92  11:10

C:\ARCHIVE\RUTHAMFO

REPAPR90.CAL             73,932  26/04/90  12:29
REPAUG89.CAL             56,761  26/04/90  11:40
REPDEC89.CAL             58,840  26/04/90  12:11
REPFEB90.CAL             68,545  26/04/90  12:25
REPJAN90.CAL             69,925  26/04/90  12:17
REPJUL90.CAL             71,911  25/07/90  12:24
REPJULY8.CAL             28,227  16/10/89  15:13
REPJUN90.CAL             71,970  02/07/90  14:38
REPMAR90.CAL             74,840  26/04/90  12:29
REPMAY89.CAL             23,752  22/05/89  08:37
REPMAY90.CAL             77,318  25/05/90  13:54
REPNOV89.CAL             56,692  26/04/90  12:02
REPOCT89.CAL             50,641  26/04/90  11:59
REPSEP89.CAL             54,254  26/04/90  11:51
REPSUM89.CAL            107,564  21/05/90  15:05
TINWELL.CAL             110,564  16/11/92  14:54

********* STATISTICS *********
Number of files verified ..... 697
Number of files skipped ...... 0
Total size ................... 48,511,859
Time taken (HH:MM:SS) ........ 00:10:04

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