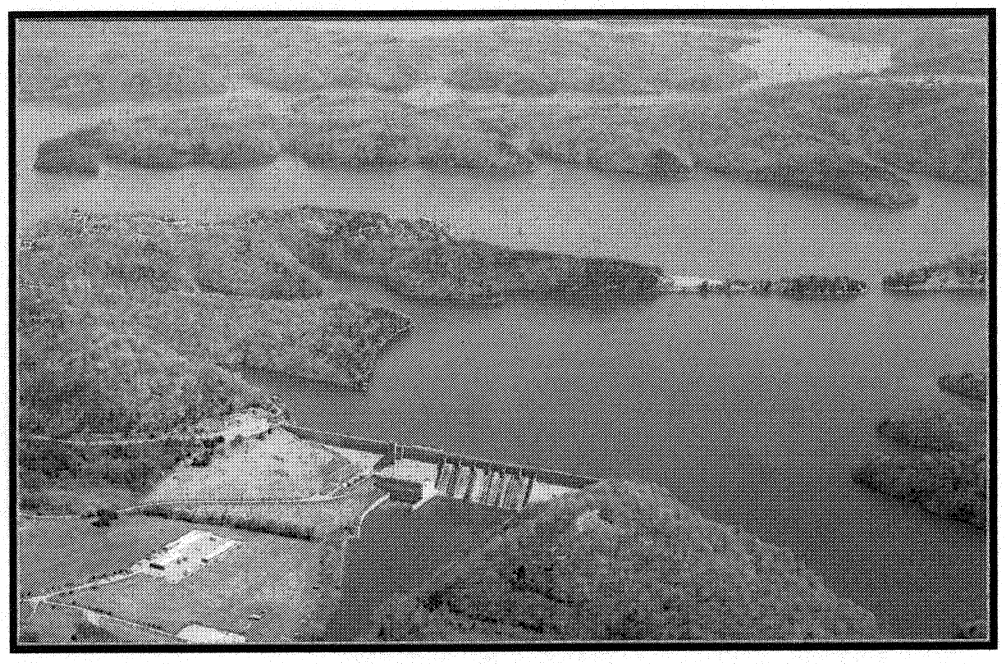
US Army Corps
of Engineers
Nashville District

DALE HOLLOW LAKE
CE-QUAL-W2
WATER QUALITY MODEL



FINAL REPORT
September 7, 2001

APPENDIX A

NPDES Discharges

NPDES Dischargers Registrered in Dale Hollow Lake Watershed

NAME	RECEIVING STREAM	NPDES PERMIT #	DESIGN FLOW (MGD)	FACILITY TYPE	COUNTY/ STATE
Jamestown STP	East Fork Obey River	TN0062634	0.63	Wastewater Treatment Plant (WWTP)	Fentress, TN
Estate of Bruno Gernt, Inc	East Fork Obey River, Lints Cove	TN0062928	N/A	Bituminous Coal & Lignite Surface Mining	Fentress, TN
Tennessee Mining, Inc	East Fork Obey, Gwinn Cove	TN0071897	N/A	Coal and Lignite Surface Mining	Fentrass, TN
Willow Grove Recreation Area	Dale Hollow Lake	TN0021369	0.0015	Sewage System	Clay, TN
Lilly Dale Recreation Area	Dale Hollow Lake	TN0021393	0.001	Sewage System	Clay, TN
Cedar Hill Resort STP	Dale Hollow Lake	TN0058033	N/A	Sewage System	Clay, TN
Salvation Army Camp Paradise	Dale Hollow Lake	TN0074314	N/A	N/A	Clay, TN
Obey RV Recreation Area	Dale Hollow Lake	TN0021377	0.0015	N/A	Pickett, TN
Star point Resort STP	Dale Hollow Lake	TN0026085	0.015	Sewage System	Pickett, TN
Byrdstown STP	Unnamed Tributary Town Creek, Wolf River	TN0062626	0.25	WWTP	Pickett, TN
Mountain View Farm	Dale Hollow Lake	TNA000029	N/A	N/A	Pickett, TN
Albany STP	Clear Fork, Spring Creek	KY0024295	0.45	WWTP	Clinton, KY
KY DOP Park, Dale Hollow State	Sulphur Creek	KY0049344	0.08	Sewage System	Clinton, KY
Trooper Island Inc	Dale Hollow Lake	KY0083518	0.01	N/A	Clinton, KY
Sulphur Creek Resort Inc	Williams Creek/ Dale Hollow Lake	KY0088633	0.017	Museum & Art Gallery	Cumberland, KY

APPENDIX B

CE-QUAL-W2 Revisions Documentation

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************************************************************************
**                      Task 1.1: Block Data                          **
************************************************************************

      BLOCK DATA COMMON_DATA
C       PARAMETER (NCP=21)                                          !5/14/97 FTN
        PARAMETER (NCP=24)                                          !5/14/97 FTN
        INTEGER    SNP
        REAL       NONZERO                                          !5/14/97 FTN
        CHARACTER  CUNIT*6,    CNAME2*17,   HNAME*24
C       DIMENSION  CUNIT(NCP), CNAME2(NCP), HNAME(4)                !4/16/97 FTN
        DIMENSION  CUNIT(NCP), CNAME2(NCP), HNAME(7)                !4/16/97 FTN
        COMMON /NAMESC/ HNAME, CNAME2, CUNIT
        COMMON /SNPUC/  SNP
        COMMON /NONZC/  NONZERO                                     !5/14/97 FTN
        DATA HNAME  /' Horizontal_velocity [U]',
     .               '   Vertical_velocity [W]',
     .               '        Temperature [T2]',
     .               'Limiting timestep [NDLT]',
     .               ' Density minus 900 [RHO]',                    !4/16/97 FTN
     .               'Vert eddy viscosity [AZ]',                    !4/16/97 FTN
     .               'Vert eddy diffusiv. [DZ]'/                    !4/16/97 FTN
        DATA CNAME2 /'           Tracer', ' Suspended_solids',
     .               '         Coliform', ' Dissolved_solids',
     .               '       Labile_DOM', '   Refractory_DOM',
C    .               '            Algae', '         Detritus',     !5/13/97 FTN
     .               '           Silica', '         Detritus',     !5/13/97 FTN
     .               '       Phosphorus', '         Ammonium',
     .               '  Nitrate-nitrite', ' Dissolved_oxygen',
     .               '         Sediment', ' Inorganic_carbon',
     .               '       Alkalinity', '               pH',
     .               '   Carbon_dioxide', '      Bicarbonate',
C    .               '        Carbonate', '             Iron',     !1/22/00 FTN
     .               '     Age of water', '             Iron',     !4/18/01 FTN
C    .               '            CBOD'/                            !5/13/97 FTN
     .               '             CBOD', '          Diatoms',     !5/13/97 FTN
     .               '           Greens', '    Cyanobacteria'/      !5/13/97 FTN
C                                                                   !5/13/97 FTN
C       DATA CUNIT /8*'g/m^3', 3*'mg/m^3', 4*'g/m^3', ' ',          !5/13/97 FTN
C    .              3*'g/m^3',   'mg/m^3',   'g/m^3'/               !5/13/97 FTN
C       DATA CUNIT /2*'g/m^3',  '/100mL', 12*'g/m^3', 'su', 8*'g/m^3'/ !1/19/00 FTN
        DATA CUNIT /2*'g/m^3',  '/100mL', 12*'g/m^3', 'su', 2*'g/m^3',  !4/18/01 FTN
     &                                          'days', 5*'g/m^3'/  !4/18/01 FTN
        DATA SNP   /20/
        DATA NONZERO /1.0E-20/                                      !5/14/97 FTN
      END

************************************************************************
**                 Task 1.2: Variable Declarations                    **
************************************************************************

      PROGRAM  CE_QUAL_W2
      INCLUDE  'w2.inc'

***** Type declaration

      REAL    MINDLT
      REAL    LAT,    LONG
      REAL    JDAY,   JDMIN
      REAL    JDAYTS                                                !FORTRAN
      REAL    NH3T1,  NH3T2,   NO3T1,  NO3T2,  NO3K1,  NO3K2,  NH3K1,
     .        NH3K2,  LABDK,   LRFDK,  NH3DK,  NO3DK,  NH3D,   NO3D,
     .        NH3RM,  NO3RM,   NH3REL, KBOD
      REAL    NXTVD,  NXTMSN,  NXTMTS, NXTMPR, NXTMCP, NXTMVP, NXTMRS,
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     .        NXTMSC, NXTMSP                                          !1/30/95 FTN
C    .        NXTMSC                                                  !1/30/95 FTN
      REAL    ICETH,  ICESW,   ICETHU, ICETH1, ICETH2, ICEMIN, ICET2,
     .        ICETHI, ICE_TOL
      INTEGER CON,    BTH,     RSI,    RSO,    TSR,    PRF,    VPL,
     .        CPL,    VPR,     SNP,    ERR,    WRN
      INTEGER SPR
      INTEGER TSRDP,  SNPDP,   VPLDP,  CPLDP,  PRFDP,  RSODP,  WSCDP,
     .        DLTDP,  SCRDP,   SPRDP
      INTEGER UHS,    DHS,     US,     DS,     CUS
      INTEGER CN,     TRCN,    DTCN,   PRCN,   UHCN,   DHCN
      INTEGER FREQUK, YEAR,    GDAY,   SKTI
      LOGICAL SNAPSHOT,        PROFILE,         TIME_SERIES,
     .        VECTOR,          CONTOUR,         RESTART_IN,
     .        RESTART_OUT,     SPREADSHEET
C                                                                     !10/6/98 FTN
C     Insert lines for AGPM output (from source code sent by G. Hauser) !10/6/98 FTN
      LOGICAL AGPM                                                    !10/6/98 FTN
      CHARACTER*3 APLC                                                !10/6/98 FTN
      CHARACTER*72 AGPMFN                                             !10/6/98 FTN
      REAL NXTMAP                                                     !10/6/98 FTN
C                                                                     !10/6/98 FTN
      LOGICAL TRIBUTARIES,     DIST_TRIBS,      WITHDRAWALS,
     .        EVAPORATION,     PRECIPITATION
      LOGICAL UP_FLOW,         DN_FLOW,         UP_HEAD,
     .        DN_HEAD,         UH_INTERNAL,     DH_INTERNAL,
     .        UH_EXTERNAL,     DH_EXTERNAL,     HEAD_BOUNDARY
      LOGICAL ISO_TEMP,        VERT_TEMP,       LONG_TEMP,
     .        ISO_CONC,        VERT_CONC,       LONG_CONC
      LOGICAL ADD_LAYER,       SUB_LAYER
      LOGICAL LONG_FORM,       SHORT_FORM
      LOGICAL OPEN_FILES,      OPEN_VPR,        OPEN_LPR
      LOGICAL FRESH_WATER,     SALT_WATER,      SUSP_SOLIDS,
     .        CONSTITUENTS,    LIMITING_FACTOR
      LOGICAL NO_WIND,         NO_INFLOW,       NO_OUTFLOW,
     .        NO_HEAT
      LOGICAL WINTER,          ICE_IN,          ALLOW_ICE,
     .        ICE,             ICE_CALC,        DETAILED_ICE,
     .        TERM_BY_TERM
      LOGICAL INTERP_INFLOW,   INTERP_OUTFLOW,  INTERP_MET,
     .        INTERP_DTRIBS,   INTERP_TRIBS,    INTERP_HEAD,
     .        INTERP_WITHDRWL, INTERPOLATE
      LOGICAL VOLUME_BALANCE,  MASS_BALANCE
      LOGICAL PLACE_QIN,       PLACE_QTR
      LOGICAL WARNING_OPEN,    VOLUME_WARNING
      LOGICAL SEL_WITHDRAWAL,  POINT_SINK
      LOGICAL END_RUN,         BRANCH_FOUND,    UPWIND,
     .        SHIFT_DEMAND,    LEAP_YEAR,       TRANSPORT,
     .        OXYGEN_DEMAND,   UPDATE_KINETICS, CALL_RATES,
     .        LIMITING_DLT,    SCREEN_OUTPUT
      CHARACTER*1  EXT1
      CHARACTER*2  EXT2
      CHARACTER*3  CPRC,   HPRC,  GDCH,  EXT3,  SCRC
      CHARACTER*3  ACC,    INACC, TRACC, DTACC, PRACC
      CHARACTER*3  SNPC,   VPLC,  TSRC,  PRFC,  CPLC,  RSOC, RSIC,
     .             SPRC
      CHARACTER*3  INFIC,  OUTIC, TRIC,  DTRIC, WDIC,  HDIC, METIC
      CHARACTER*3  CCC,    PQC,   VBC,   EVC,   ICEC,  PRC,  LIMC,
     .             DTRC,   QINC,  QOUTC, WINDC, HEATC, SWC,  SDC,
     .             MBC,    PQTC
      CHARACTER*3  PRSTYL, TSSTYL, CPSTYL, VPSTYL                     !1/31/95 FTN
      CHARACTER*3  DNPRN                                              !3/27/98 FTN
      CHARACTER*4  LFAC
      CHARACTER*5  FORM,   WTYPE
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      CHARACTER*6  CUNIT
      CHARACTER*6  DATE_STRNG                                          !9/24/97 FTN
      CHARACTER*7  BLANK,  CONV,  LFPR
      CHARACTER*8  SLTR,   SINK,  SLICE, SLHEAT
      CHARACTER*8  CTIME                                               !FORTRAN
      CHARACTER*8  CNAME3                                              !9/24/97 FTN
      CHARACTER*9  MONTH
      CHARACTER*9  CONV1,  BLANK1
      CHARACTER*12 RSOFN
      CHARACTER*12 CDATE                                               !FORTRAN
      CHARACTER*17 CNAME1, CNAME2
      CHARACTER*24 HNAME
      CHARACTER*72 TITLE
      CHARACTER*72 RSIFN,  VPRFN, TSRFN, PRFFN, VPLFN, CPLFN, METFN,
     .             QINFN,  TINFN, CINFN, QOTFN, QWDFN, QTRFN, TTRFN,
     .             CTRFN,  QDTFN, TDTFN, CDTFN, PREFN, TPRFN, CPRFN,
     .             EUHFN,  TUHFN, CUHFN, EDHFN, TDHFN, CDHFN, SNPFN,
     .             LPRFN,  BTHFN
      CHARACTER*72 SPRFN
      DOUBLE PRECISION VOLSBR, VOLTBR, VOLEV, VOLPR,  VOLTR,  VOLDT,
     .                 VOLWD,  VOLUH,  VOLDH, VOLIN,  VOLOUT, DLVOL
      DOUBLE PRECISION CMBRS,  CMBRT
      DOUBLE PRECISION BHRHO,  GMA,    BTA,   A,      C,      D,
     .                 V,      F
      DOUBLE PRECISION Z,      SZ,     ZMIN
      DOUBLE PRECISION BTAT,   GMAT,   AT,    CT,     DT,     VT
      DOUBLE PRECISION TADL,   TADV,   CADL,  CADV
      DOUBLE PRECISION AD1L,   AD2L,   AD3L,  AD1V,   AD2V,   AD3V
      DOUBLE PRECISION DX1,    DX2,    DX3,   ALFA
      DOUBLE PRECISION T1L,    T2L,    T3L,   C1L,    C2L,    C3L

***** Dimension statements

      DIMENSION ADMX(KMP,IMP), U(KMP,IMP),   SU(KMP,IMP),   W(KMP,IMP),
     .          SW(KMP,IMP),   AZ(KMP,IMP),  ADMZ(KMP,IMP), DZ(KMP,IMP),
     .          DX(KMP,IMP),   DM(KMP,IMP),  RHO(KMP,IMP),  P(KMP,IMP),
     .          HPG(KMP,IMP),  SB(KMP,IMP),  ST(KMP,IMP),   DZQ(KMP,IMP)
      DIMENSION T1(KMP,IMP),   T2(KMP,IMP),  TSS(KMP,IMP),  QSS(KMP,IMP)
      DIMENSION B(KMP,IMP),    BB(KMP,IMP),  BR(KMP,IMP),   BH(KMP,IMP),
     .          BHR(KMP,IMP),  HSEG(KMP,IMP)
      DIMENSION CONV(KMP,17)
      DIMENSION CONV1(KMP,17)
      DIMENSION NDLT(KMP,IMP)
      DIMENSION HKT1(IMP),     HKT2(IMP),    AVHKT(IMP),    BKT(IMP),
     .          BHKT1(IMP),    BHKT2(IMP),   BHRKT1(IMP),   BHRKT2(IMP),
     .          DLX(IMP),      DLXR(IMP)
      DIMENSION DLXTOT(NBP)                                            !2/11/95 FTN
      DIMENSION KB(IMP),       KBMIN(IMP)
      DIMENSION KTI(IMP),      SKTI(IMP)
      DIMENSION BHRHO(IMP),    A(IMP),       C(IMP),        D(IMP),
     .          F(IMP),        V(IMP),       BTA(IMP),      GMA(IMP),
     .          Z(IMP),        SZ(IMP)
      DIMENSION EV(IMP),       QDT(IMP),     QPR(IMP)
      DIMENSION Q(IMP),        QC(IMP),      QSSUM(IMP)
      DIMENSION ICETH(IMP),    ICE(IMP),     ICESW(IMP)
      DIMENSION SOD(IMP),      SODS(IMP)
      DIMENSION AZMXKT(IMP),   IPRF(IMP),    RN(IMP),       PHIO(IMP)
      DIMENSION ELWS(IMP),     ISPR(IMP)
      DIMENSION H(KMP),        AVH(KMP),     EL(KMP),       TVP(KMP),
     .          AZMAX(KMP)
      DIMENSION QWD(NWP),      TWD(NWP),     IWD(NWP),      KWD(NWP),
     .          JBWD(NWP)
      DIMENSION QTR(NTP),      TTR(NTP),     JBTR(NTP),     ITR(NTP),
     .          QTRFN(NTP),    TTRFN(NTP),   CTRFN(NTP),    KTTR(NTP),
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     .          KBTR(NTP)
      DIMENSION C2I(NCP),       AVCOUT(NCP),  CPRC(NCP),      CNAME1(NCP),
     .          CNAME2(NCP),    CUNIT(NCP),   ACC(NCP),       CN(NCP),
     .          INCN(NCP),      TRCN(NCP),    DTCN(NCP),      PRCN(NCP),
     .          UHCN(NCP),      DHCN(NCP),    INACC(NCP),     TRACC(NCP),
     .          DTACC(NCP),     PRACC(NCP)
      DIMENSION CNAME3(NCP)                                                !9/24/97 FTN
      DIMENSION DTRC(NBP),      SWC(NBP)
      DIMENSION QSUM(NBP),      NOUT(NBP)
      DIMENSION KTQIN(NBP),     KBQIN(NBP)
      DIMENSION ELUH(NBP),      ELDH(NBP),    JBUH(NBP),      JBDH(NBP)
      DIMENSION US(NBP),        CUS(NBP),     DS(NBP),        UHS(NBP),
     .          DHS(NBP)
      DIMENSION QIN(NBP),       PR(NBP),      QPRBR(NBP),     QDTR(NBP),
     .          EVBR(NBP)
      DIMENSION TIN(NBP),       TPR(NBP),     TDTR(NBP)
      DIMENSION VOLEV(NBP),     VOLPR(NBP),   VOLTR(NBP),     VOLDT(NBP),
     .          VOLUH(NBP),     VOLDH(NBP),   VOLIN(NBP),     VOLOUT(NBP),
     .          VOLWD(NBP),     VOLSBR(NBP),  VOLTBR(NBP),    DLVOL(NBP)
      DIMENSION QINFN(NBP),     TINFN(NBP),   CINFN(NBP),     QDTFN(NBP),
     .          TDTFN(NBP),     CDTFN(NBP),   PREFN(NBP),     TPRFN(NBP),
     .          CPRFN(NBP),     EUHFN(NBP),   TUHFN(NBP),     CUHFN(NBP),
     .          EDHFN(NBP),     TDHFN(NBP),   CDHFN(NBP),     QOTFN(NBP)
      DIMENSION UP_FLOW(NBP),       DN_FLOW(NBP),     UP_HEAD(NBP),
     .          DN_HEAD(NBP),       UH_EXTERNAL(NBP), DH_EXTERNAL(NBP),
     .          UH_INTERNAL(NBP),   DH_INTERNAL(NBP), DIST_TRIBS(NBP)
      DIMENSION NSTR(NBP),          KBSW(NSP,NBP)
      DIMENSION QSTR(NSP,NBP),      ESTR(NSP,NBP),    WSTR(NSP,NBP),
     .          SINK(NSP,NBP)
      DIMENSION CIN(NCP,NBP),       CDTR(NCP,NBP),    CPR(NCP,NBP)
      DIMENSION CTR(NCP,NTP),       CWD(NCP,NWP)
      DIMENSION CUH(KMC,NCP,NBP),   CDH(KMC,NCP,NBP)
      DIMENSION CMBRS(NCP,NBP),     CMBRT(NCP,NBP)
C     DIMENSION AGR(KMC,IMC),       ARR(KMC,IMC),     AMR(KMC,IMC),       !5/14/97 FTN
C    .          AER(KMC,IMC),       A1(KMC,IMC),      A2(KMC,IMC),        !5/14/97 FTN
      DIMENSION AGR(KMC,IMC,NAP),   ARR(KMC,IMC,NAP), AMR(KMC,IMC,NAP),   !5/14/97 FTN
     .          AER(KMC,IMC,NAP),   A1(KMC,IMC),      A2(KMC,IMC),        !5/14/97 FTN
     .          A3(KMC,IMC),        DETD(KMC,IMC),    SEDD(KMC,IMC),
     .          ORGD(KMC,IMC),      SO2D(KMC,IMC),    NH3D(KMC,IMC),
     .          NO3D(KMC,IMC),      CBODD(KMC,IMC),   OMRM(KMC,IMC),
C    .          NH3RM(KMC,IMC),     NO3RM(KMC,IMC),   AGRMR(KMC,IMC),     !5/13/97 FTN
     .          NH3RM(KMC,IMC),     NO3RM(KMC,IMC),   AGRMR(KMC,IMC,NAP),!5/13/97 FTN
C    .          AGRMF(KMC,IMC),     SETIN(KMC,IMC),   SETOUT(KMC,IMC),    !5/13/97 FTN
     .          AGRMF(KMC,IMC,NAP),SETIN(KMC,IMC),    SETOUT(KMC,IMC),    !5/13/97 FTN
C    .          LFAC(KMC,IMC),      LFPR(KMC,IMC)                         !5/14/97 FTN
     .          LFAC(KMC,IMC,NAP), LFPR(KMC,IMC,NAP)                      !5/14/97 FTN
      DIMENSION AGT1(NAP), AGT2(NAP), AGT3(NAP), AGT4(NAP),               !5/13/97 FTN
     &          AGK1(NAP), AGK2(NAP), AGK3(NAP), AGK4(NAP),               !5/13/97 FTN
     &          AGROW(NAP), AMORT(NAP), AEXCR(NAP), ARESP(NAP),           !5/13/97 FTN
     &          ASETL(NAP),  AHSP(NAP),  AHSN(NAP), AHSSI(NAP),           !5/13/97 FTN
     &          ASATUR(NAP), ABIOP(NAP), ABION(NAP), ABIOSI(NAP),         !5/13/97 FTN
     &          ABIOC(NAP)                                                !5/13/97 FTN
      DIMENSION COLTERM(3,KMP)                                            !4/14/95 FTN
      DIMENSION QUH1(KMP,NBP),      QUH2(KMP,NBP),    QDH1(KMP,NBP),
     .          QDH2(KMP,NBP),      TUH(KMP,NBP),     TDH(KMP,NBP),
     .          TSSUH1(KMP,NBP),    TSSUH2(KMP,NBP),  TSSDH1(KMP,NBP),
     .          TSSDH2(KMP,NBP),    AKBR(KMP,NBP),    QINF(KMP,NBP),
     .          QOUT(KMP,NBP),      KOUT(KMP,NBP),    QTRF(KMP,NTP)
      DIMENSION FETCHU(IMP,NBP),    FETCHD(IMP,NBP)
      DIMENSION ISO_CONC(NCP),      VERT_CONC(NCP),   LONG_CONC(NCP)
      DIMENSION C1S(KMC,IMC,NCP),   CSSB(KMC,IMC,NCP)
      DIMENSION CVP(KMC,NCP)
      DIMENSION SF1L(IMP),          SF2L(IMP,2),      SF3L(IMP,2),
     .          SF4L(IMP,2),        SF5L(IMP,2),      SF6L(IMP,2),
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     .          SF7L(IMP,2),       SF8L(IMP,2),       SF9L(IMP,2),
     .          SF10L(IMP,2),      SF11L(IMP,2),      SF12L(IMP,2),
     .          SF13L(IMP,2)
      DIMENSION SF1V(KMP),         SF2V(KMP,2),       SF3V(KMP,2),
     .          SF4V(KMP,2),       SF5V(KMP,2),       SF6V(KMP,2),
     .          SF7V(KMP,2),       SF8V(KMP,2),       SF9V(KMP,2),
     .          SF10V(KMP,2)
      DIMENSION DX1(KMP,IMP),      DX2(KMP,IMP),      DX3(KMP,IMP),
     .          AD1L(KMP,IMP),     AD2L(KMP,IMP),     AD3L(KMP,IMP),
     .          AD1V(KMP,IMP),     AD2V(KMP,IMP),     AD3V(KMP,IMP),
     .          TADL(KMP,IMP),     TADV(KMP,IMP)
      DIMENSION CT(KMP,IMP),       AT(KMP,IMP),       BTAT(KMP,IMP)
      DIMENSION VT(KMP),           DT(KMP),           GMAT(KMP)
      DIMENSION CADL(KMC,IMC,NCP),    CADV(KMC,IMC,NCP)
      DIMENSION CSSUH1(KMP,NCP,NBP),  CSSUH2(KMP,NCP,NBP),
     .          CSSDH1(KMP,NCP,NBP),  CSSDH2(KMP,NCP,NBP)
      DIMENSION SNPD(NDP), VPLD(NDP), PRFD(NDP), CPLD(NDP), RSOD(NDP),
     .          TSRD(NDP), DLTD(NDP), WSCD(NDP), SPRD(NDP), SCRD(NDP)
      DIMENSION SNPF(NDP), VPLF(NDP), PRFF(NDP), CPLF(NDP), RSOF(NDP),
     .          TSRF(NDP), DLTF(NDP), SCRF(NDP), SPRF(NDP)
      DIMENSION WSC(NDP),  WFC(NDP),  DLTMAX(NDP)
C     DIMENSION IPR(17),   IPRLF(17), IPRSF(11), TITLE(7),  HNAME(4),   !4/16/97 FTN
      DIMENSION IPR(17),   IPRLF(17), IPRSF(11), TITLE(7),  HNAME(7),   !4/16/97 FTN
C    .          HPRC(4)                                                 !4/16/97 FTN
     .          HPRC(7)                                                 !4/16/97 FTN
      DIMENSION SEL_WITHDRAWAL(NBP),  POINT_SINK(NSP,NBP),  ICE_IN(NBP),
     .          ALLOW_ICE(IMP),       TRANSPORT(NCP)

***** Common declaration

      COMMON /GLOBLC/ JB,    JC,      IU,     ID,     KT,    ELKT,
     .                DLT,   KB,      KTI
      COMMON /GEOMHC/ EL,    H,       HKT1,   HKT2
      COMMON /GEOMBC/ B,     BKT,     BH,     BHKT1,  BHKT2, BHRKT1
      COMMON /NAMESC/ HNAME, CNAME2,  CUNIT
      COMMON /DENITC/ DNPRN                                             !3/27/98 FTN
      COMMON /SNPUC/  SNP
      COMMON /TEMPC/  T1,    T2
      COMMON /ICEC/   ICE,   ICETH,   ICE_CALC
C     COMMON /HYDRC1/ U,     W,       AZ,     RHO,    NDLT              !4/17/97 FTN
      COMMON /HYDRC1/ U,     W,       AZ,     RHO,    NDLT,   DZ        !4/17/97 FTN
      COMMON /HYDRC2/ Z
      COMMON /PRNTC1/ IPR,   IEPR,    KEPR
      COMMON /PRNTC2/ TITLE, CPRC,    HPRC,   CONV
      COMMON /PRNTC3/ CUS,   DS
      COMMON /GRDLGC/ LONG_FORM,      SHORT_FORM,     LIMITING_FACTOR,
     .                OXYGEN_DEMAND
      COMMON /DNSPHC/ FRESH_WATER,    SALT_WATER,     SUSP_SOLIDS
      COMMON /GRTVDC/ CONSTITUENTS,   CN,             NAC
      COMMON /INTERC/ INTERP_INFLOW,  INTERP_OUTFLOW, INTERP_MET,
     .                INTERP_DTRIBS,  INTERP_TRIBS,   INTERP_HEAD,
     .                INTERP_WITHDRWL
      COMMON /TVDDSC/ NO_WIND,        NO_INFLOW,      NO_OUTFLOW,
     .                NO_HEAT
      COMMON /TVDLC1/ PRECIPITATION,  WITHDRAWALS,    TRIBUTARIES,
     .                DIST_TRIBS
      COMMON /TVDLC2/ UP_FLOW,        DN_FLOW,        UH_INTERNAL,
     .                UH_EXTERNAL,    DH_INTERNAL,    DH_EXTERNAL
      COMMON /TVDLC3/ OPEN_FILES,     TERM_BY_TERM
      COMMON /TVDMTC/ TAIR,   TDEW,   CLOUD,  PHI,    ET,     CSHE,
     .                SRO,    LAT,    LONG
      COMMON /FWCOEF/ FW_A0,  FW_A1,  FW_A2                             !1/30/95 FTN
      COMMON /TVDFNC/ METFN,  QWDFN,  QOTFN,  QINFN,  TINFN,  CINFN,
     .                QTRFN,  TTRFN,  CTRFN,  QDTFN,  TDTFN,  CDTFN,
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     .                PREFN,  TPRFN,  CPRFN,  EUHFN,  TUHFN,  CUHFN,
     .                EDHFN,  TDHFN,  CDHFN
      COMMON /TVDQC/  QIN,    QTR,    QDTR,   PR,     ELUH,   ELDH,
     .                QOUT,   QWD,    QSUM
      COMMON /TVDTC/  TIN,    TTR,    TDTR,   TPR,    TUH,    TDH
      COMMON /TVDCC1/ CIN,    CTR,    CDTR,   CPR,    CUH,    CDH
      COMMON /TVDCC2/ INCN,   TRCN,   DTCN,   PRCN,   UHCN,   DHCN
      COMMON /TVDCC3/ NACIN,  NACTR,  NACPR,  NACDT
      COMMON /RTMLTC/ OMT1,   OMT2,   NH3T1,  NH3T2,  NO3T1,  NO3T2,
     .                AGT1,   AGT2,   AGT3,   AGT4,   OMK1,   OMK2,
     .                NH3K1,  NH3K2,  NO3K1,  NO3K2,  AGK1,   AGK2,
     .                AGK3,   AGK4
      COMMON /DKORGC/ DETD,   ORGD
      COMMON /DKSEDC/ SEDD,   SO2D,   SOD
      COMMON /DKNITC/ NH3D,   NO3D
      COMMON /DKBODC/ CBODD
      COMMON /GBLRTC/ OMRM,   NH3RM,  NO3RM,  AGRMR,  AGRMF
      COMMON /GLBLCC/ PALT,   ALGDET, O2LIM,  WIND,   WSCDP,  WSC
      COMMON /WACHUS/ WSC_MIN,WSC_MAX                                 !1/30/95 FTN
      COMMON /DKMLTC/ A1,     A2,     A3
C     COMMON /CLFRMC/ COLQ10, COLDK                                   !2/02/95 FTN
      COMMON /CLFRMC/ COLQ10, COLDK,  COLKL,  CSETL,  COLTERM, CKSEG  !4/23/95 FTN
      COMMON /ORGDKC/ SEDDK,  DETDK,  LABDK,  REFDK,  LRFDK
      COMMON /SETLC1/ SETIN,  SETOUT
      COMMON /SETLC2/ SSETL,  DSETL,  ASETL,  FESETL
      COMMON /PHYTGC/ AGR,    ARR,    AMR,    AER
      COMMON /PHYTC1/ AEXCR,  AMORT,  AGROW,  ARESP,  ASATUR, AHSN,
C    .                AHSP                                           !5/13/97 FTN
     .                AHSP,   AHSSI                                  !5/13/97 FTN
C     COMMON /PHYTC2/ BETA,   EXH2O,  EXINOR, EXORG                  !5/14/97 FTN
      COMMON /PHYTC2/ BETA,   EXH2O,  EXINOR, EXORG, FREQUK, ALGLIT  !6/16/98 FTN
      COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                  !5/14/97 FTN
      COMMON /PHOSPC/ PO4REL, BIOP,   PARTP
      COMMON /NITROC/ BION,   PARTN,  NH3DK,  NH3REL, NO3DK
      COMMON /SILICC/ SIREL,  BIOSI                                  !5/16/97 FTN
      COMMON /OXYGNC/ O2ORG,  O2ALG,  O2NH3,  O2RESP
      COMMON /CARBNC/ CO2REL, BIOC
C     COMMON /IRONC/  FEREL                                          !1/19/00 FTN
      COMMON /CBODC/  KBOD,   TBOD,   RBOD
      COMMON /LFACC/  LFAC,   LFPR
      COMMON /SELWC/  NSTR,   QSTR,   ESTR,   WSTR,   KBSW,   NOUT,
     .                KOUT
      COMMON /GDAYC1/ GDAY,   DAYM,   JDAYG,  LEAP_YEAR
      COMMON /GDAYC2/ MONTH
      COMMON /SCRNC1/ JDAY,   DLTS,   ILOC,   KLOC,   MINDLT, JDMIN,
     .                IMIN,   KMIN,   DLTAV,  NIT,    NV,     YEAR,
     .                ELTMJD
      COMMON /SCRNC2/ NWD,    NTR
      COMMON /SCRNC3/ ZMIN
      COMMON /TVDSWC/ SEL_WITHDRAWAL, POINT_SINK


***** Data statements

        DATA CNAME1 /'Tracer',          'Suspended_solids',
     .               'Coliform',        'Dissolved_solids',
     .               'Labile_DOM',      'Refractory_DOM',
C    .               'Algae',           'Detritus',                  !5/13/97 FTN
     .               'Silica',          'Detritus',                  !5/13/97 FTN
     .               'Phosphorus',      'Ammonium',
     .               'Nitrate-nitrite', 'Dissolved_oxygen',
     .               'Sediment',        'Inorganic_carbon',
     .               'Alkalinity',      'pH',
     .               'Carbon_dioxide',  'Bicarbonate',
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C    .               'Carbonate',       'Iron',                          !1/22/00 FTN
     .               'Age of water',    'Iron',                          !4/18/01 FTN
C    .               'CBOD'/                                             !5/13/97 FTN
     .               'CBOD',            'Diatoms',                       !5/13/97 FTN
     .               'Greens',          'Cyanobacteria'/                 !5/13/97 FTN
      DATA CNAME3 /'TRACER', 'TSSMGL', 'COLFRM', 'TDSMGL', 'LABDOM',     !9/24/97 FTN
     &             'REFDOM', 'SILICA', 'DETRIT', 'PHOSPH', 'NH3NH4',     !9/24/97 FTN
     &             'NO2NO3', 'DISSOX', 'SEDMNT', 'TICARB', 'ALKALI',     !9/24/97 FTN
C    &             'PHxxxx', 'CO2xxx', 'HCO3xx', 'CO3xxx', 'IRONxx',     !1/22/00 FTN
     &             'PHxxxx', 'CO2xxx', 'HCO3xx', 'AGExxx', 'IRONxx',     !4/18/01 FTN
     &             'CBODxx', 'DIATOM', 'GREENS', 'BLUEGR'/               !9/24/97 FTN
      DATA RHOA   /1.25/,  RHOI  /1000.0/,   RHOICE /916.0/,
     .     RK1    /2.12/,  RL1   /333507.0/, RIMT   /0.0/
      DATA G      /9.8/,   VTOL  /1.0E3/,    CP     /4186.0/,
     .     AZDZFR /0.14/,  AZMIN /1.4E-6/,   DZMIN  /1.4E-7/,
     .                     ICE_TOL /0.005/                               !3/01/95 FTN
C    .     DZMAX  /1.0E3/, ICE_TOL /0.005/                               !3/01/95 FTN
      DATA BLANK  /'       '/
      DATA BLANK1 /'    m    '/
      DATA CON /10/, BTH /11/, RSI /12/, VPR /13/, LPR /14/
      DATA RSO /21/, TSR /22/, PRF /23/, VPL /24/, CPL /25/, WRN /26/,
     .     ERR /27/, SPR /28/
      NB = NBP

************************************************************************
**                        Task 1.3: Inputs                            **
************************************************************************

***** Open control file

      CALL TIMER (ISTART)
      OPEN (CON,FILE=CONFN,STATUS='OLD')

***** Read title cards

      READ (CON,*)
      READ (CON,1000) (TITLE(J),J=1,6)

***** Read time control cards

      READ (CON,1010)  TMSTRT, TMEND, YEAR
      READ (CON,1020)  NDT,    DLTMIN
      READ (CON,1030) (DLTD(J),  J=1,NDT)
      READ (CON,1030) (DLTMAX(J),J=1,NDT)
      READ (CON,1030) (DLTF(J),  J=1,NDT)

***** Read grid definition cards

      READ (CON,1040) (US(JB), DS(JB), UHS(JB), DHS(JB),JB=1,NBP)
      READ (CON,1030)  LAT,    LONG,   DATUM

***** Read initial condition cards

      READ (CON,1050)  T2I,    ICETHI, WTYPE
      READ (CON,1060)  VBC,    MBC,    PQC,    PQTC,   EVC,    PRC
      READ (CON,1060)  INFIC,  TRIC,   DTRIC,  HDIC,   OUTIC,  WDIC,
     .                 METIC
      READ (CON,1060)  WINDC,  QINC,   QOUTC,  HEATC
      READ (CON,1070)  ICEC,   SLICE,  SLHEAT, ALBEDO, HWI,    BETAI,
     .                 GAMMAI, ICEMIN, ICET2
C                                                                       !3/01/95 FTN
C     Read DZMAX but set it back to Tom Cole's original value if it     !3/01/95 FTN
C     was left blank in the control file.                               !3/01/95 FTN
C                                                                       !3/01/95 FTN
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C     READ (CON,1080)  SLTR,   THETA                                  !3/01/95 FTN
      READ (CON,1081)  SLTR,   THETA,  DZMAX                          !3/01/95 FTN
 1081 FORMAT(//8X,A8,2F8.0)                                           !3/01/95 FTN
      IF (DZMAX.LT.1.0E-12) DZMAX = 1.0E3                             !3/01/95 FTN
C                                                                     !1/30/95 FTN
C     Read a min and max value for WSC for adjusting it later based   !1/30/95 FTN
C     on wind direction and the axis of Wachusett Reservoir.          !1/30/95 FTN
C                                                                     !1/30/95 FTN
C     READ (CON,1090)  NWSC                                           !1/30/95 FTN
      READ (CON,1091)  NWSC, WSC_MIN, WSC_MAX                         !1/30/95 FTN
 1091 FORMAT(//(8X,I8,2F8.0))                                         !1/30/95 FTN
C                                                                     !1/30/95 FTN
      READ (CON,1030) (WSCD(J),J=1,NWSC)
      READ (CON,1030) (WSC(J), J=1,NWSC)
      READ (CON,1030) (WFC(J), J=1,NWSC)
C     READ (CON,1030)  AX,     DXI,    CHEZY,  CBHE,   TSED           !1/30/95 FTN
      READ (CON,1030)  AX,     DXI,    CHEZY,  CBHE,   TSED,          !1/30/95 FTN
     &                 FW_A0,  FW_A1,  FW_A2,  SRMULT                  !1/30/95 FTN
C                                                                     !1/30/95 FTN
C     Set wind function coefficients (FW_A0, FW_A1, FW_A2) to default !1/30/95 FTN
C     values (in SI units) if they were not specified in control file. !1/30/95 FTN
C     Also set solar radiation multiplier (1 - reflectance) to default !1/30/95 FTN
C     value if not specified in the control file.                     !1/30/95 FTN
C                                                                     !1/30/95 FTN
      IF (FW_A1.LT.1.0E-9 .AND. FW_A1.LT.1.0E-9 .AND. FW_A2.LT.1.0E-9) !1/30/95 FTN
     &                                                          THEN  !1/30/95 FTN
         FW_A0 = 9.2                                                  !1/30/95 FTN
         FW_A1 = 0.0                                                  !1/30/95 FTN
         FW_A2 = 0.46                                                 !1/30/95 FTN
      END IF                                                          !1/30/95 FTN
      IF (SRMULT.LT.1.0E-9) SRMULT = 0.94                             !1/30/95 FTN

***** Read inflow-outflow cards

      READ (CON,1060) (SWC(JB), JB=1,NBP)
      READ (CON,1090) (NSTR(JB),JB=1,NBP)
      READ (CON,1090)   (KBSW(JS,1), JS=1,NSTR(1))
      DO JB=2,NB
        READ (CON,1130) (KBSW(JS,JB),JS=1,NSTR(JB))
      END DO
      READ (CON,1100)   (SINK(JS,1), JS=1,NSTR(1))
      DO JB=2,NB
        READ (CON,1110) (SINK(JS,JB),JS=1,NSTR(JB))
      END DO
      READ (CON,1030)   (ESTR(JS,1), JS=1,NSTR(1))
      DO JB=2,NB
        READ (CON,1120) (ESTR(JS,JB),JS=1,NSTR(JB))
      END DO
      READ (CON,1030)   (WSTR(JS,1), JS=1,NSTR(1))
      DO JB=2,NB
        READ (CON,1120) (WSTR(JS,JB),JS=1,NSTR(JB))
      END DO
      READ (CON,1090) (NOUT(JB),  JB=1,NBP)
      READ (CON,1090) (KOUT(JO,1),JO=1,NOUT(1))
      DO JB=2,NB
        READ (CON,1130) (KOUT(JO,JB),JO=1,NOUT(JB))
      END DO
      READ (CON,1090)  NWD
      READ (CON,1090) (IWD(JW), JW=1,NWD)
      READ (CON,1090) (KWD(JW), JW=1,NWD)
C                                                                     !4/23/95 FTN
C     Read the maximum segment number into which the distributed trib !4/23/95 FTN
C     should be allowed to enter (dist trib will not be put into any  !4/23/95 FTN
C     segments d/s of MXSEGDTR).  If no value was entered for MXSEGDTR, !4/23/95 FTN
```

```
C     then set it to the total number of segments.                    !4/23/95 FTN
C                                                                     !4/23/95 FTN
C     READ (CON,1090)  NTR                                            !4/23/95 FTN
      READ (CON,1090)  NTR, MXSEGDTR                                  !4/23/95 FTN
      IF (MXSEGDTR.LT.1) MXSEGDTR = IMP                               !4/23/95 FTN
      READ (CON,1090) (ITR(JT), JT=1,NTP)
      READ (CON,1060) (DTRC(JB),JB=1,NBP)

***** Read output control cards (excluding constituents)

      READ (CON,1150)  SCRC, NSCR
      READ (CON,1030) (SCRD(J),J=1,NSCR)
      READ (CON,1030) (SCRF(J),J=1,NSCR)
C                                                                     !4/17/97 FTN
C     Read variables to indicate whether or not to print densities    !4/17/97 FTN
C     and vertical eddy viscosities and diffusivities                 !4/17/97 FTN
C                                                                     !4/17/97 FTN
C     READ (CON,1140)  FORM, (HPRC(J),J=1,4)                          !4/17/97 FTN
      READ (CON,1140)  FORM, (HPRC(J),J=1,7)                          !4/17/97 FTN
      READ (CON,1090) (IPRSF(I),I=1,11)
      READ (CON,1090) (IPRLF(I),I=1,17)
      READ (CON,1150)  SNPC, NSNP
      READ (CON,1030) (SNPD(J),J=1,NSNP)
      READ (CON,1030) (SNPF(J),J=1,NSNP)
C     READ (CON,1160)  PRFC, NPRF, NIPRF                              !1/30/95 FTN
      READ (CON,1161)  PRFC, NPRF, NIPRF, PRSTYL                      !1/31/95 FTN
 1161 FORMAT(//13X,A3,2I8,5X,A3)                                      !1/30/95 FTN
      READ (CON,1030) (PRFD(J),J=1,NPRF)
      READ (CON,1030) (PRFF(J),J=1,NPRF)
      READ (CON,1090) (IPRF(J),J=1,NIPRF)
      READ (CON,1160)  SPRC, NSPR, NISPR
      READ (CON,1030) (SPRD(J),J=1,NSPR)
      READ (CON,1030) (SPRF(J),J=1,NSPR)
      READ (CON,1090) (ISPR(J),J=1,NISPR)
C     READ (CON,1150)  TSRC, NTSR                                     !1/30/95 FTN
      READ (CON,1150)  TSRC, NTSR, TSSTYL                             !1/30/95 FTN
      READ (CON,1030) (TSRD(J),J=1,NTSR)
      READ (CON,1030) (TSRF(J),J=1,NTSR)
C     READ (CON,1150)  VPLC, NVPL                                     !1/30/95 FTN
      READ (CON,1150)  VPLC, NVPL, VPSTYL                             !1/30/95 FTN
      READ (CON,1030) (VPLD(J),J=1,NVPL)
      READ (CON,1030) (VPLF(J),J=1,NVPL)
C     READ (CON,1150)  CPLC, NCPL                                     !1/30/95 FTN
      READ (CON,1150)  CPLC, NCPL, CPSTYL                             !1/30/95 FTN
      READ (CON,1030) (CPLD(J),J=1,NCPL)
      READ (CON,1030) (CPLF(J),J=1,NCPL)
C                                                                     !10/6/98 FTN
C     Insert lines for AGPM output (from source code sent by G. Hauser) !10/6/98 FTN
C     READ ON/OFF SWITCH VALUE, START DAY, FREQUENCY                  !10/6/98 FTN
C                                                                     !10/6/98 FTN
      READ (CON,1150)  APLC                                           !10/6/98 FTN
      READ (CON,1030)  APLD,APLFD,APLFH                               !10/6/98 FTN
      APLF = APLFD + APLFH/24.                                        !10/6/98 FTN
      INTPLD = APLFD                                                  !10/6/98 FTN
      INTPLH = APLFH                                                  !10/6/98 FTN
      AGPM = APLC.EQ.' ON'                                            !10/6/98 FTN
      NXTMAP = APLD                                                   !10/6/98 FTN
C                                                                     !10/6/98 FTN
      READ (CON,1150)  RSOC, NRSO, RSIC
      READ (CON,1030) (RSOD(J),J=1,NRSO)
      READ (CON,1030) (RSOF(J),J=1,NRSO)

***** Read constituent control cards
```

```
      READ (CON,1170)  CCC, LIMC, SDC, FREQUK
      READ (CON,1060) (ACC(JC),  JC=1,NCP)
      READ (CON,1030) (C2I(JC),  JC=1,NCP)
C     Make sure that age of water is initialized to zero for whole grid !1/22/00 FTN
      C2I(20) = 1.0E-20                                                 !1/22/00 FTN
      READ (CON,1060) (CPRC(JC), JC=1,NCP)
      READ (CON,1060) (INACC(JC),JC=1,NCP)
      READ (CON,1060) (TRACC(JC),JC=1,NCP)
      READ (CON,1060) (DTACC(JC),JC=1,NCP)
      READ (CON,1060) (PRACC(JC),JC=1,NCP)

***** Read kinetics coefficients

C     Read minimum light level for algae as a fraction of the light     !6/16/98 FTN
C     that goes below the surface layer (if available light is less     !6/16/98 FTN
C     than that fraction, algae will be converted to detritus). Set     !6/16/98 FTN
C     this to -999 if no value was specified in the input file.         !6/16/98 FTN
C                                                                       !6/16/98 FTN
C     READ (CON,1030)  EXH2O,  EXINOR, EXORG,  BETA                     !6/16/98 FTN
      READ (CON,1030)  EXH2O,  EXINOR, EXORG,  BETA, ALGLIT             !6/16/98 FTN
      IF (ALGLIT.LE.1.0E-9) ALGLIT = -999.0                             !6/16/98 FTN
C                                                                       !5/09/95 FTN
C     Read the segment number for which components of coliform          !5/09/95 FTN
C     disappearance will be printed in the snapshot file.  If no        !5/09/95 FTN
C     value was specified, use the downstream end of branch 1.          !5/09/95 FTN
C                                                                       !5/09/95 FTN
C     READ (CON,1030)  COLQ10, COLDK                                    !2/02/95 FTN
      READ (CON,1030)  COLQ10, COLDK,  COLKL,  CSETL,  CKSEG            !4/23/95 FTN
      IF (CKSEG.LT.2.0) CKSEG = DS(1)                                   !5/09/95 FTN
      READ (CON,1030)  SSETL
C                                                                       !5/12/97 FTN
C     Read in kinetic rates for each of 3 types of algae. Also, read    !5/12/97 FTN
C     separate values for stoichiometric coeffs for each algae type.    !5/12/97 FTN
C     Then read temperature rate multipliers for each type of algae.    !5/12/97 FTN
C                                                                       !5/12/97 FTN
C     READ (CON,1030)  AGROW,  AMORT,  AEXCR,  ARESP,  ASETL, ASATUR,   !5/12/97 FTN
C    .                 ALGDET                                           !5/12/97 FTN
C     READ (CON,1030)  AGT1,   AGT2,   AGT3,   AGT4,   AGK1,  AGK2,     !5/12/97 FTN
C    .                 AGK3,   AGK4                                     !5/12/97 FTN
      READ (CON,1001)                                                   !5/12/97 FTN
      DO JA=1,NAP                                                       !5/12/97 FTN
        READ (CON,1120) AGROW(JA), AMORT(JA), AEXCR(JA), ARESP(JA),     !5/12/97 FTN
     &                  ASETL(JA),  AHSP(JA),  AHSN(JA), AHSSI(JA),     !5/12/97 FTN
     &                  ASATUR(JA)                                      !5/12/97 FTN
      END DO                                                            !5/12/97 FTN
      READ (CON,1001)                                                   !5/12/97 FTN
      DO JA=1,NAP                                                       !5/12/97 FTN
        READ (CON,1120) ABIOP(JA), ABION(JA), ABIOSI(JA), ABIOC(JA)     !5/12/97 FTN
      END DO                                                            !5/12/97 FTN
      READ (CON,1001)                                                   !5/12/97 FTN
      DO JA=1,NAP                                                       !5/12/97 FTN
        READ (CON,1120) AGT1(JA), AGT2(JA), AGT3(JA), AGT4(JA),         !5/12/97 FTN
     &                  AGK1(JA), AGK2(JA), AGK3(JA), AGK4(JA)          !5/12/97 FTN
      END DO                                                            !5/12/97 FTN
C                                                                       !5/12/97 FTN
      READ (CON,1030)  LABDK,  LRFDK,  REFDK
C     READ (CON,1030)  DETDK,  DSETL                                    !5/16/97 FTN
      READ (CON,1030)  DETDK,  DSETL,  ALGDET                           !5/16/97 FTN
      READ (CON,1030)  OMT1,   OMT2,   OMK1,   OMK2
      READ (CON,1030)  SEDDK,  FSOD
      READ (CON,1030) (SOD(I),I=1,IMP)
      READ (CON,1030)  KBOD,   TBOD,   RBOD
C     READ (CON,1030)  PO4REL, PARTP,  AHSP                             !5/13/97 FTN
      READ (CON,1030)  PO4REL, PARTP                                    !5/13/97 FTN
```

```
C     READ (CON,1030)  NH3REL, NH3DK,  PARTN,  AHSN                    !5/13/97 FTN
      READ (CON,1030)  NH3REL, NH3DK,  PARTN                           !5/13/97 FTN
      READ (CON,1030)  NH3T1,  NH3T2,  NH3K1,  NH3K2
C                                                                      !3/27/98 FTN
C     Read variable to indicate whether or not to print denitrification !3/27/98 FTN
C                                                                      !3/27/98 FTN
C     READ (CON,1030)  NO3DK                                           !3/27/98 FTN
      READ (CON,1031)  NO3DK,  DNPRN                                   !3/27/98 FTN
 1031 FORMAT(//(8X,F8.0,5X,A3))                                        !3/27/98 FTN
      READ (CON,1030)  NO3T1,  NO3T2,  NO3K1,  NO3K2
      READ (CON,1030)  SIREL                                           !5/16/97 FTN
      READ (CON,1030)  CO2REL
      READ (CON,1030)  FEREL,  FESETL
      READ (CON,1030)  O2NH3,  O2ORG,  O2RESP, O2ALG, BIOP,  BION,
C    .                 BIOC
     .                 BIOSI,  BIOC
      READ (CON,1030)  O2LIM

***** Read input filenames

      READ (CON,1000)  BTHFN
      READ (CON,1000)  VPRFN
      READ (CON,1000)  LPRFN
      READ (CON,1000)  RSIFN
      READ (CON,1000)  METFN
      READ (CON,1000)  QWDFN
      READ (CON,1000) (QINFN(JB),JB=1,NBP)
      READ (CON,1000) (TINFN(JB),JB=1,NBP)
      READ (CON,1000) (CINFN(JB),JB=1,NBP)
      READ (CON,1000) (QOTFN(JB),JB=1,NBP)
      READ (CON,1000) (QTRFN(JT),JT=1,NTP)
      READ (CON,1000) (TTRFN(JT),JT=1,NTP)
      READ (CON,1000) (CTRFN(JT),JT=1,NTP)
      READ (CON,1000) (QDTFN(JB),JB=1,NBP)
      READ (CON,1000) (TDTFN(JB),JB=1,NBP)
      READ (CON,1000) (CDTFN(JB),JB=1,NBP)
      READ (CON,1000) (PREFN(JB),JB=1,NBP)
      READ (CON,1000) (TPRFN(JB),JB=1,NBP)
      READ (CON,1000) (CPRFN(JB),JB=1,NBP)
      READ (CON,1000) (EUHFN(JB),JB=1,NBP)
      READ (CON,1000) (TUHFN(JB),JB=1,NBP)
      READ (CON,1000) (CUHFN(JB),JB=1,NBP)
      READ (CON,1000) (EDHFN(JB),JB=1,NBP)
      READ (CON,1000) (TDHFN(JB),JB=1,NBP)
      READ (CON,1000) (CDHFN(JB),JB=1,NBP)
C                                                                      !10/6/98 FTN
C     Insert lines for AGPM output (from source code sent by G. Hauser) !10/6/98 FTN
      READ (CON,1000) AGPMFN                                           !10/6/98 FTN

***************************************************************************
**                      Task 1.4.1: Zero Variables                     **
***************************************************************************

      DO I=1,17
        DO K=1,KMP
          CONV(K,I)  = BLANK
          CONV1(K,I) = BLANK1
        END DO
      END DO
      DO I=1,IMP
        DO K=1,KMP
C         LFPR(K,I) = BLANK                                            !5/16/97 FTN
          DO JA=1,NAP                                                  !5/16/97 FTN
            LFPR(K,I,JA) = BLANK                                       !5/16/97 FTN
```

```
        END DO                                                  !5/16/97 FTN
      END DO
    END DO
    DO I=1,IMP
      ICESW(I) = 1.0
      DO JB=1,NBP
        FETCHU(I,JB) = 0.0
        FETCHD(I,JB) = 0.0
      END DO
      IF (.NOT.RESTART_IN) THEN
        DO K=1,KMP
          U(K,I) = 0.0
          W(K,I) = 0.0
        END DO
      END IF
      DO K=1,KMP
        TSS(K,I) = 0.0
        QSS(K,I) = 0.0
        IF (CONSTITUENTS) THEN
          DO JC=1,NCP
            IF (.NOT.RESTART_IN) THEN
              CSSB(K,I,JC) = 0.0
              CSSK(K,I,JC) = 0.0
            END IF
          END DO
        END IF
      END DO
    END DO
    DO JB=1,NBP
      IF (.NOT.RESTART_IN) THEN
        VOLEV(JB)  = 0.0
        VOLPR(JB)  = 0.0
        VOLTR(JB)  = 0.0
        VOLDT(JB)  = 0.0
        VOLWD(JB)  = 0.0
        VOLUH(JB)  = 0.0
        VOLDH(JB)  = 0.0
        VOLIN(JB)  = 0.0
        VOLOUT(JB) = 0.0
        VOLSBR(JB) = 0.0
      END IF
      DO K=1,KMP
        AKBR(K,JB) = 0.0
      END DO
      DO JC=1,NCP
        CMBRT(JC,JB) = 0.0
      END DO
    END DO
    DLMR     = 0.0
    DLVR     = 0.0
    KEPR     = 0
    NAC      = 0
    NACIN    = 0
    NACTR    = 0
    NACDT    = 0
    NACPR    = 0
    NTAC     = 0
    KBMAX    = 0
    HMAX     = 0
    DLXMAX   = 0
    HMIN     = 1.0E10
    DLXMIN   = 1.0E10
    TITLE(7) = ' '
    KLOC     = 1
```

```
      ILOC     = 1

      LEAP_YEAR       = MOD(YEAR,4).EQ.0
      IF (RESTART_IN) THEN
        WINTER = .FALSE.
        IF (JDAY.GT.300.0.OR.JDAY.LT.40.0) WINTER = .TRUE.
      ELSE
        WINTER = .FALSE.
        IF (TMSTRT.GT.300.0.OR.TMSTRT.LT.40.0) WINTER = .TRUE.
      END IF
      DO JC=1,NCP
        TRANSPORT(JC) = .TRUE.
        IF (JC.EQ.13.OR.(JC.GT.15.AND.JC.LT.20)) TRANSPORT(JC) = .FALSE.
      END DO
      CALL_RATES = .FALSE.                                          !1/20/00 FTN
      DO JC=5,13
        IF (ACC(JC).EQ.' ON') CALL_RATES = .TRUE.
      END DO
      IF (.NOT.CALL_RATES) THEN                                     !5/16/97 FTN
        IF (ACC(03).EQ.' ON') CALL_RATES = .TRUE.                   !5/16/97 FTN
        IF (ACC(20).EQ.' ON') CALL_RATES = .TRUE.                   !5/16/97 FTN
        IF (ACC(21).EQ.' ON') CALL_RATES = .TRUE.                   !5/16/97 FTN
        IF (ACC(22).EQ.' ON') CALL_RATES = .TRUE.                   !5/16/97 FTN
        IF (ACC(23).EQ.' ON') CALL_RATES = .TRUE.                   !5/16/97 FTN
        IF (ACC(24).EQ.' ON') CALL_RATES = .TRUE.                   !5/16/97 FTN
      END IF                                                        !5/16/97 FTN
      DO JB=1,NBP
        UP_FLOW(JB)        = UHS(JB).EQ.0
        DN_FLOW(JB)        = DHS(JB).EQ.0
        UP_HEAD(JB)        = UHS(JB).NE.0
        DN_HEAD(JB)        = DHS(JB).NE.0
        UH_INTERNAL(JB)    = UHS(JB).GT.0
        DH_INTERNAL(JB)    = DHS(JB).GT.0
        UH_EXTERNAL(JB)    = UHS(JB).EQ.-1
        DH_EXTERNAL(JB)    = DHS(JB).EQ.-1
        DIST_TRIBS(JB)     = DTRC(JB).EQ.' ON'
        SEL_WITHDRAWAL(JB) = SWC(JB).EQ.' ON'
        DO JS=1,NSTR(JB)
          POINT_SINK(JS,JB) = SINK(JS,JB).EQ.'   POINT'
        END DO
        IF (UH_EXTERNAL(JB).OR.DH_EXTERNAL(JB)) HEAD_BOUNDARY = .TRUE.
      END DO

***** Convert rates from per-day to per-second

      KBOD   = KBOD/86400.0
C     ASETL  = ASETL/86400.0                                        !5/13/97 FTN
      SSETL  = SSETL/86400.0
      DSETL  = DSETL/86400.0
      CSETL  = CSETL/86400.0                                        !4/06/95 FTN
      LABDK  = LABDK/86400.0
      REFDK  = REFDK/86400.0
      LRFDK  = LRFDK/86400.0
      NH3DK  = NH3DK/86400.0
      NO3DK  = NO3DK/86400.0
      DETDK  = DETDK/86400.0
      COLDK  = COLDK/86400.0
      COLKL  = COLKL/86400.0                                        !4/06/95 FTN
      SEDDK  = SEDDK/86400.0
C     AEXCR  = AEXCR/86400.0                                        !5/13/97 FTN
C     AMORT  = AMORT/86400.0                                        !5/13/97 FTN
C     ARESP  = ARESP/86400.0                                        !5/13/97 FTN
C     AGROW  = AGROW/86400.0                                        !5/13/97 FTN
      DO JA=1,NAP                                                   !5/13/97 FTN
```

```
        AEXCR(JA) = AEXCR(JA)/86400.0                                   !5/13/97 FTN
        AMORT(JA) = AMORT(JA)/86400.0                                   !5/13/97 FTN
        ARESP(JA) = ARESP(JA)/86400.0                                   !5/13/97 FTN
        AGROW(JA) = AGROW(JA)/86400.0                                   !5/13/97 FTN
        ASETL(JA) = ASETL(JA)/86400.0                                   !5/13/97 FTN
      END DO                                                            !5/13/97 FTN
!5/13/97 FTN
      FESETL = FESETL/86400.0
      DO I=1,IMP
        SOD(I)  = SOD(I)/86400.0*FSOD
        SODS(I) = SOD(I)
      END DO

******* Minimum/maximum segment lengths (and total branch lengths)      !2/11/95 FTN
C       For total branch length, do not include segments d/s of         !4/23/95 FTN
C       MXSEGDTR (the maximum segment number into which the             !4/23/95 FTN
C       distributed tributary will be allowed to enter).                !4/23/95 FTN

        DLXTOT(JB) = 0.0                                                !2/11/95 FTN
        DO I=IU,ID
          IF (I.LE.MXSEGDTR) DLXTOT(JB) = DLXTOT(JB) + DLX(I)           !4/23/95 FTN
          DLXMIN = MIN(DLXMIN,DLX(I))
          DLXMAX = MAX(DLXMAX,DLX(I))
        END DO

******* Horizontal diffusivities

        DO I=IU,ID-1
          DO K=KT,KBMIN(I)
            DX(K,I) = DXI
          END DO
        END DO
      END DO
      IF (OPEN_VPR) CLOSE (VPR)
      IF (OPEN_LPR) CLOSE (LPR)
C     CALL GREGORIAN_DATE (YEAR)                                        !9/24/97 FTN
      CALL GREGORIAN_DATE (YEAR, IMON)                                  !9/24/97 FTN


C                                                                       !10/6/98 FTN
C     Insert lines for AGPM output (from source code sent by G. Hauser) !10/6/98 FTN
      IF (AGPM .AND. (.NOT.CONSTITUENTS)) WRITE (*,*) 'ERROR! --> If'// !2/18/99 FTN
     &  ' AGPM is turned on, then constituents must also be turned on'  !2/18/99 FTN
      IF (AGPM .AND. CONSTITUENTS .AND. NAC.EQ.0) WRITE (*,*)           !6/01/00 FTN
     &  'ERROR! --> If AGPM is turned on, then at least 1 ' //          !6/01/00 FTN
     &  'constituent must be turned on'                                 !6/01/00 FTN
      IF (AGPM) CALL OPENP(AGPMFN,INTPLD,INTPLH,IMP,KMP,NBP,            !10/6/98 FTN
     X US,DS,EL,DLX,TMEND,NCP,NAC,CN,CPRC)                              !10/6/98 FTN
C                                                                       !10/6/98 FTN
      OPEN (WRN,FILE='wrn.opt',STATUS='UNKNOWN')

***** Plot files

      IF (.NOT.RESTART_IN) THEN
C       IF (PROFILE) THEN                                               !1/30/95 FTN
        IF (PROFILE .AND. PRSTYL.NE.'FTN') THEN                         !1/31/95 FTN
          WRITE (PRF,2500)  TITLE
          WRITE (PRF,2510) (CPRC(JC),JC=1,NCP),' ON'
          WRITE (PRF,2520) (CNAME1(JC),CUNIT(JC),JC=1,NCP),
     .                     'Temperature     ','deg C  '
          WRITE (PRF,2530)  CONSTITUENTS,NAC+1,(CN(JC),JC=1,NAC),22
          WRITE (PRF,2540)  PRFDP,KT,(KB(IPRF(I)),I=1,NIPRF)
          WRITE (PRF,2550)  H
          DO JC=1,NAC
```

```
          IF (CPRC(CN(JC)).EQ.' ON') THEN
            DO JPRF=1,NIPRF
              I   = IPRF(JPRF)
              NRS = KB(I)-KT+1
              WRITE (PRF,2560) CN(JC),NRS,(C2(K,I,CN(JC)),K=KT,KB(I))
            END DO
          END IF
        END DO
        DO JPRF=1,NIPRF
          I   = IPRF(JPRF)
          NRS = KB(I)-KT+1
          WRITE (PRF,2560) 22,NRS,(T2(K,I),K=KT,KB(I))
        END DO
      END IF
      IF (PROFILE .AND. PRSTYL.EQ.'FTN') WRITE (PRF,2505)             !9/24/97 FTN
     &                          (CNAME3(CN(JC)),JC=1,NAC)             !9/24/97 FTN
 2505 FORMAT (51H"DATE$" "JDAY" "SEG" "LAYER"   "ELEVFT"      "TEMP", !9/24/97 FTN
     &         8X, 21(1H",A6,1H",8X))                                 !9/24/97 FTN
C     IF (TIME_SERIES) THEN                                           !1/30/95 FTN
      IF (TIME_SERIES .AND. TSSTYL.NE.'FTN') THEN                     !1/31/95 FTN
        WRITE (TSR,5000)  TITLE
        WRITE (TSR,5010)  NAC,(CN(JC),JC=1,NAC)
        WRITE (TSR,5020) (CNAME1(CN(JC)),CUNIT(CN(JC)),JC=1,NAC)
      END IF
      IF (TIME_SERIES .AND. TSSTYL.EQ.'FTN') THEN                     !3/30/98 FTN
        IF (ACC(22).EQ.' ON' .AND. ACC(23).EQ.' ON' .AND.             !3/30/98 FTN
     &                             ACC(24).EQ.' ON') THEN             !3/30/98 FTN
C                                                                     !6/22/98 FTN
C         If algae are being simulated, identify the upstream most    !6/22/98 FTN
C         and downstream most profile segments in the main stem       !6/22/98 FTN
C         (branch 1) for time series output at selected segments.     !6/22/98 FTN
C         Also identify the mid-lake station as the first segment     !6/22/98 FTN
C         listed in the control file that is between IPMIN and IPMAX. !6/22/98 FTN
C                                                                     !6/22/98 FTN
          IPMAX = 0                                                   !3/30/98 FTN
          IPMIN = 99                                                  !3/30/98 FTN
          DO JPRF = 1, NIPRF                                          !3/30/98 FTN
            IF (IPRF(JPRF).LT.IPMIN) IPMIN = IPRF(JPRF)               !3/30/98 FTN
            IF (IPRF(JPRF).GT.IPMAX .AND.                             !6/22/98 FTN
     &          IPRF(JPRF).LE.DS(1)) IPMAX = IPRF(JPRF)               !6/22/98 FTN
          END DO                                                      !3/30/98 FTN
          DO JPRF = NIPRF, 1, -1                                      !6/22/98 FTN
            IF (IPRF(JPRF).GT.IPMIN .AND. IPRF(JPRF).LT.IPMAX)        !6/22/98 FTN
     &                              IPML = IPRF(JPRF)                 !6/22/98 FTN
          END DO                                                      !6/22/98 FTN
          WRITE (TSR,2515) (CNAME3(CN(JC)),JC=1,NAC), "ALG1US",       !3/30/98 FTN
     &        "ALG2US", "ALG3US", "ALG1ML", "ALG2ML", "ALG3ML",       !6/22/98 FTN
     &        "ALG1DS", "ALG2DS", "ALG3DS", "HYDOUS", "HYDOML",       !6/22/98 FTN
     &        "HYDODS", "SECCUS", "SECCML", "SECCDS"                  !6/22/98 FTN
        ELSE                                                          !3/30/98 FTN
          WRITE (TSR,2515) (CNAME3(CN(JC)),JC=1,NAC),"SOLRAD","EVAPOR"!2/27/01 FTN
        END IF                                                        !3/30/98 FTN
      END IF                                                          !3/30/98 FTN
 2515 FORMAT (42H"YEAR" "JDAY"    "ELEVFT"       "SURFTEMP", 7X,     !9/30/97 FTN
     &         9H"OUTTEMP", 8X, 39(1H",A6,1H",8X))                    !6/22/98 FTN
C     IF (CONTOUR) THEN                                               !1/30/95 FTN
      IF (CONTOUR .AND. CPSTYL.NE.'FTN') THEN                         !1/31/95 FTN
        WRITE (CPL,5000) TITLE
        WRITE (CPL,8000) NBP
        WRITE (CPL,8000) IMP,KMP
        DO JB=1,NBP
          WRITE(CPL,8010) US(JB),DS(JB)
          WRITE(CPL,8010) (KB(I),I=US(JB),DS(JB))
        END DO
```

```
          WRITE (CPL,8020) DLX
          WRITE (CPL,8020) H
          WRITE (CPL,8000) NAC
          WRITE (CPL,8030) (CNAME1(CN(JC)),JC=1,NAC)
        END IF
C       IF (VECTOR) THEN                                                !1/30/95 FTN
        IF (VECTOR .AND. VPSTYL.NE.'FTN') THEN                          !1/31/95 FTN
          WRITE (VPL,*) TITLE
          WRITE (VPL,*) H,KB,US,DS,DLX
        END IF
      END IF

***** Screen output

      IF (SCREEN_OUTPUT) CALL SCREEN_OPEN

************************************************************************
**                        Task 2: Calculations                        **
************************************************************************

      IF (.NOT.SCREEN_OUTPUT) WRITE (*,*)                               !1/30/95 FTN
      JDPREV = -999                                                     !4/16/97 FTN
      RS_SUM = 0.0                                                      !4/23/95 FTN
      RS_CNT = 0.0                                                      !4/23/95 FTN
      EVAPDEP = 0.0                                                     !2/27/01 FTN
      DO WHILE (.NOT.END_RUN)
        IF (.NOT.SCREEN_OUTPUT) THEN                                    !1/30/95 FTN
          IF (INT(JDAY).GT.JDPREV) THEN                                 !4/17/97 FTN
            WRITE (*,'(A25,I5)') '+...Working on Julian day', INT(JDAY) !4/16/97 FTN
            JDPREV = INT(JDAY)                                          !4/16/97 FTN
          END IF                                                        !1/30/95 FTN
C         IF ( ABS(JDAY-TMSTRT) .LT. 1.0E-9) WRITE (*,*)                !debug
        END IF                                                          !1/30/95 FTN
        IF (JDAY.GE.NXTVD) CALL TIME_VARYING_DATA  (JDAY,NXTVD)
        IF (INTERPOLATE)   CALL INTERPOLATE_INPUTS (JDAY)

************************************************************************
**                 Task 2.1: Hydrodynamic Sources/Sinks               **
************************************************************************

        DO JB=1,NBP
          IU = CUS(JB)
          ID = DS(JB)
          IF (SEL_WITHDRAWAL(JB)) CALL SELECTIVE_WITHDRAWAL
        END DO

******* Timestep violation entry point

10010   CONTINUE
        EVAPVOL = 0.0                                                   !2/27/01 FTN
        TOT_SURF_AREA = 0.0                                             !2/27/01 FTN
        DO JB=1,NBP
          IU = CUS(JB)
          ID = DS(JB)
C                                                                       !12/1/00 FTN
C         If evaporation is included in the water budget or if the time !12/1/00 FTN
C         series output will include EVAPDEP (which will happen if any  !12/1/00 FTN
C         of the 3 algae types are not being simulated), then go ahead  !12/1/00 FTN
C         and go through the evaporation volume calculations, but don't !12/1/00 FTN
C         include them in the flow sources and sinks (QSS array) unless !12/1/00 FTN
C         the EVAPORATION switch is turned on.                          !12/1/00 FTN
C                                                                       !12/1/00 FTN
C         IF (EVAPORATION) THEN                                         !12/1/00 FTN
          IF (EVAPORATION .OR. ACC(22).NE.' ON'                         !12/1/00 FTN
```

```
     &                    .OR. ACC(23).NE.' ON'                        !12/1/00 FTN
     &                    .OR. ACC(24).NE.' ON') THEN                  !12/1/00 FTN
          EVBR(JB) = 0.0
C         FW       = WFC(WSCDP)*(9.2+0.46*WIND*WIND)                   !1/31/95 FTN
C                                                                      !1/31/95 FTN
C         Calculate wind function using coefficients read from        !1/31/95 FTN
C         control file (in SI units).                                  !1/31/95 FTN
C                                                                      !1/31/95 FTN
          FW = WFC(WSCDP) * (FW_A0 + FW_A1*WIND + FW_A2*WIND*WIND)    !1/31/95 FTN
          DO I=IU,ID
            TM    = (T2(KT,I)+TDEW)*0.5
            VPTG  = 0.35+0.015*TM+0.0012*TM*TM
            EV(I) = VPTG*(T2(KT,I)-TDEW)*FW*B(KT,I)*DLX(I)/2.45E9
            IF (EV(I).LT.0.0.OR.ICE(I)) EV(I) = 0.0
C           QSS(KT,I) = QSS(KT,I)-EV(I)                                !12/1/00 FTN
            IF (EVAPORATION) QSS(KT,I) = QSS(KT,I)-EV(I)               !12/1/00 FTN
            EVBR(JB)  = EVBR(JB)+EV(I)
            EVAPVOL   = EVAPVOL + EV(I)*DLT                            !2/27/01 FTN
            TOT_SURF_AREA = TOT_SURF_AREA + B(KT,I)*DLX(I)             !2/27/01 FTN
          END DO
        END IF
        IF (PRECIPITATION) THEN
          QPRBR(JB) = 0.0
          DO I=IU,ID
            QPR(I)    = PR(JB)*B(KTI(I),I)*DLX(I)
            QPRBR(JB) = QPRBR(JB)+QPR(I)
            QSS(KT,I) = QSS(KT,I)+QPR(I)
          END DO
        END IF
        IF (TRIBUTARIES) THEN
          DO JT=1,NTR

C                                                                      !2/11/95 FTN
C           Distribute flow from distributed tributary proportional   !2/11/95 FTN
C           to segment lengths (which is representative of shore      !2/11/95 FTN
C           length) rather than surface area.                         !2/11/95 FTN
C           Do not put dist trib flow into segments d/s of MXSEGDTR.  !4/23/95 FTN
C                                                                      !2/11/95 FTN
C           QDT(I)    = QDTR(JB)*B(KT,I)*DLX(I)/AKBR(KT,JB)           !2/11/95 FTN
            IF (I.LE.MXSEGDTR) QDT(I) = QDTR(JB) * DLX(I)/DLXTOT(JB)  !4/23/95 FTN
            QSS(KT,I) = QSS(KT,I)+QDT(I)
          END DO
        END IF
        IF (WITHDRAWALS) THEN
          DO JW=1,NWD
            IF (JB.EQ.JBWD(JW)) THEN
              I        = IWD(JW)
              K        = MAX(KT,KWD(JW))
              QSS(K,I) = QSS(K,I)-QWD(JW)
            END IF
          END DO
        END IF
        IF (UH_INTERNAL(JB)) THEN
          DO K=KT,KB(IU-1)
            QSS(K,UHS(JB)) = QSS(K,UHS(JB))-QUH2(K,JB)/DLT
          END DO
        END IF
        IF (DH_INTERNAL(JB)) THEN
          DO K=KT,KB(ID+1)
            QSS(K,DHS(JB)) = QSS(K,DHS(JB))+QDH2(K,JB)/DLT
          END DO
        END IF
      END DO
```

```
********* Average eddy diffusivities

          DO K=KT,KB(IDT)-1
            DZ(K,IDT) = DZ(K,IDT-1)
          END DO
C         DO I=IUT,IDT-1                                          !4/21/97 FTN
C           DO K=KT,KB(I)-1                                       !4/21/97 FTN
C             IF (K.GE.KBMIN(I)) THEN                             !4/21/97 FTN
C               IF (KB(I-1).GE.KB(I).AND.I.NE.IUT) THEN           !4/21/97 FTN
C                 DZ(K,I) = DZ(K,I-1)                             !4/21/97 FTN
C               ELSE                                              !4/21/97 FTN
C                 DZ(K,I) = DZMIN                                 !4/21/97 FTN
C               END IF                                            !4/21/97 FTN
C             ELSE                                                !4/21/97 FTN
C               DZ(K,I) = (DZ(K,I)+DZ(K+1,I))*0.5                 !4/21/97 FTN
C             END IF                                              !4/21/97 FTN
C           END DO                                                !4/21/97 FTN
C         END DO                                                  !4/21/97 FTN

******* Restore timestep dependent variables and restart calculations

        IF (CURMAX.LT.DLT.AND.DLT.GT.DLTMIN) THEN
          DLT = INT(DLTF(DLTDP)*CURMAX)
          IF (DLT.LE.DLTMIN) THEN
            WARNING_OPEN = .TRUE.
            WRITE (WRN,6000) JDAY,DLT
            DLT = DLTMIN
          END IF
          CURMAX = DLTMAX(DLTDP)/DLTF(DLTDP)
          IF (DLT.LT.MINDLT) THEN
            MINDLT = DLT
            JDMIN  = JDAY+DLT/86400.0
          END IF
          DO JB=1,NBP
            DO I=CUS(JB)-1,DS(JB)+1
              Z(I)   = SZ(I)
              KTI(I) = SKTI(I)
              DO K=KT,KB(I)
                U(K,I)   = SU(K,I)
                W(K,I)   = SW(K,I)
                QSS(K,I) = 0.0
              END DO
            END DO
          END DO
          NV = NV+1
          GO TO 10010
        END IF
        IF (EVAPORATION .OR. ACC(22).NE.' ON' .OR. ACC(23).NE.' ON'     !2/27/01 FTN
     &                  .OR. ACC(24).NE.' ON') THEN                     !2/27/01 FTN
          EVAPDEP = EVAPDEP + (EVAPVOL / TOT_SURF_AREA) * 39.37         !2/27/01 FTN
          EVAPVOL = 0.0                                                 !2/27/01 FTN
          TOT_SURF_AREA = 0.0                                           !2/27/01 FTN
        END IF                                                          !2/27/01 FTN

************************************************************************
**         Task 2.3: Temporal Balance Terms and Temperatures          **
************************************************************************

        IF (.NOT.NO_HEAT) THEN
          CALL HEAT_EXCHANGE (WFC(WSCDP),JDAY)
          RS = SRO*RHOI*CP
          RS_SUM = RS_SUM + RS                                          !4/23/95 FTN
          RS_CNT = RS_CNT + 1.0                                         !4/23/95 FTN
C         IF (TERM_BY_TERM) CALL RADIATION (RS,RSN,RAN)                 !1/31/95 FTN
```

```
          IF (TERM_BY_TERM) CALL RADIATION (RS,RSN,RAN,SRMULT)          !1/31/95 FTN
        END IF
        DO JB=1,NBP
          IU = CUS(JB)
          ID = DS(JB)

********* Heat exchange

          IF (.NOT.NO_HEAT) THEN
            DO I=IU,ID

************* Surface

              IF (.NOT.ICE(I)) THEN
                TOTALG = 0.0                                            !5/16/97 FTN
                DO JA=1,NAP                                             !5/16/97 FTN
                  TOTALG = TOTALG + ALGAE(KT,I,JA)                      !5/16/97 FTN
                END DO                                                  !5/16/97 FTN
C               GAMMA     = EXH2O+EXINOR*SS(KT,I)+EXORG*(ALGAE(KT,I)    !5/16/97 FTN
                GAMMA     = EXH2O+EXINOR*SS(KT,I)+EXORG*(TOTALG         !5/16/97 FTN
     .                      +DETRIT(KT,I))
                DEPTH     = HKT1(I)
                TSS(KT,I) = TSS(KT,I)-(1.0-BETA)*SRO*EXP(-GAMMA*DEPTH)
     .                      *B(KT,I)*DLX(I)
                IF (TERM_BY_TERM) THEN
                  CALL SURFACE_TERMS (WFC(WSCDP),WIND,T2(KT,I),RB,RE,RC)
                  RN(I)     = (RSN+RAN-RB-RE-RC)
                  TSS(KT,I) = TSS(KT,I)+RN(I)/RHOI/CP*B(KTI(I),I)*DLX(I)
                ELSE
                  TSS(KT,I) = TSS(KT,I)+CSHE*(ET-T2(KT,I))*B(KTI(I),I)
     .                        *DLX(I)
                END IF
                DO K=KT+1,KB(I)
                  TOTALG = 0.0                                          !5/16/97 FTN
                  DO JA=1,NAP                                           !5/16/97 FTN
                    TOTALG = TOTALG + ALGAE(K,I,JA)                     !5/16/97 FTN
                  END DO                                                !5/16/97 FTN
C                 GAMMA    = EXH2O+EXINOR*SS(K,I)+EXORG*(ALGAE(K,I)     !5/16/97 FTN
                  GAMMA    = EXH2O+EXINOR*SS(K,I)+EXORG*(TOTALG         !5/16/97 FTN
     .                       +DETRIT(K,I))
                  TSS(K,I) = TSS(K,I)+(1.0-BETA)*SRO*(EXP(-GAMMA*DEPTH)
     .                       -EXP(-GAMMA*(DEPTH+H(K))))*B(K,I)*DLX(I)
                  DEPTH    = DEPTH+H(K)
                END DO
              END IF

*************************************************************************
**                      Task 2.4:  Constituents                        **
*************************************************************************

        IF (CONSTITUENTS) THEN
          PALT = (1.-((EL(KT)-Z(DS(1)))/1000.0)/44.3)**5.25
          DO JB=1,NBP
            IU = CUS(JB)
            ID = DS(JB)

*********** Internal sources/sinks

            IF (UPDATE_KINETICS) THEN
              IF (CALL_RATES) THEN
C               CALL RATE_MULTIPLIERS                                   !2/27/01 FTN
                CALL RATE_MULTIPLIERS (JDAY, SNP)                       !2/27/01 FTN
C               CALL DECAY_CONSTANTS                                    !2/27/01 FTN
                CALL DECAY_CONSTANTS (JDAY, SNP, ACC(21))               !2/27/01 FTN
```

```
            END IF
            DO JAC=1,NAC
              JC = CN(JAC)
              IF (JC.EQ.2)  CALL SUSPENDED_SOLIDS
              IF (JC.EQ.3)  CALL COLIFORM
              IF (JC.EQ.5)  CALL LABILE_DOM
              IF (JC.EQ.6)  CALL REFRACTORY_DOM
C             IF (JC.EQ.7)  CALL PHYTOPLANKTON                        !5/13/97 FTN
              IF (JC.EQ.7)  CALL SILICA                               !5/13/97 FTN
              IF (JC.EQ.8)  CALL DETRITUS
              IF (JC.EQ.9)  CALL PHOSPHORUS
              IF (JC.EQ.10) CALL AMMONIUM
              IF (JC.EQ.11) CALL NITRATE
C             IF (JC.EQ.12) CALL DISSOLVED_OXYGEN                     !2/27/01 FTN
              IF (JC.EQ.12) CALL DISSOLVED_OXYGEN (JDAY, SNP)         !2/27/01 FTN
              IF (JC.EQ.13) CALL SEDIMENT
              IF (JC.EQ.14) CALL INORGANIC_CARBON
              IF (JC.EQ.16) CALL PH_CO2
              IF (JC.EQ.20) CALL IRON
              IF (JC.EQ.21) CALL BIOCHEMICAL_O2_DEMAND
              IF (JC.EQ.22) CALL PHYTOPLANKTON                        !5/13/97 FTN
            END DO
          END IF
C                                                                     !1/24/00 FTN
C     For age of water (state variable #19), set the source/sink term !4/18/01 FTN
C     for constituent kinetics (CSSK array) to 1.0 divided by 86400   !1/24/00 FTN
C     (number of seconds in a day) for each cell. In the constituent  !1/24/00 FTN
C     transport equations, the CSSK term gets multiplied directly by  !1/24/00 FTN
C     the time step (DLT). This will effectively increment the age    !1/24/00 FTN
C     of the water by the length of the time step.                    !1/24/00 FTN
C                                                                     !1/24/00 FTN
C     Then set all the boundary concentrations to zero so that the age !1/24/00 FTN
C     of water variable will represent the length of time that a parcel !1/24/00 FTN
C     of water has been in this waterbody (not counting time prior to !1/24/00 FTN
C     the beginning of the simulation).  Although water coming into   !1/24/00 FTN
C     this waterbody through an external head boundary could be water !1/24/00 FTN
C     that was already in this waterbody several time steps earlier   !1/24/00 FTN
C     and is now re-entering this waterbody, go ahead and set its age !1/24/00 FTN
C     to zero to be consistent for all boundary conditions.           !1/24/00 FTN
C                                                                     !1/24/00 FTN
          IF (ACC(19).EQ.' ON') THEN                                  !4/18/01 FTN
            DO I=IU,ID                                                !1/24/00 FTN
              DO K=KT,KB(I)                                           !1/24/00 FTN
                CSSK(K,I,19) = 1.0/86400.0                            !4/18/01 FTN
              END DO                                                  !1/24/00 FTN
            END DO                                                    !1/24/00 FTN
            IF (TRIBUTARIES) THEN                                     !1/24/00 FTN
              DO JT=1,NTR                                             !1/24/00 FTN
                CTR(19,JT) = 0.0                                      !4/18/01 FTN
              END DO                                                  !1/24/00 FTN
            END IF                                                    !1/24/00 FTN
            IF (DIST_TRIBS(JB)) CDTR(19,JB) = 0.0                     !4/18/01 FTN
            IF (PRECIPITATION)  CPR(19,JB)  = 0.0                     !4/18/01 FTN
            IF (UP_FLOW(JB))    CIN(19,JB)  = 0.0                     !4/18/01 FTN
            IF (UP_HEAD(JB)) THEN                                     !1/24/00 FTN
              DO K=KT,KB(IU)                                          !1/24/00 FTN
                C1S(K,IU-1,19) = 0.0                                  !4/18/01 FTN
              END DO                                                  !1/24/00 FTN
            END IF                                                    !1/24/00 FTN
            IF (DN_HEAD(JB)) THEN                                     !1/24/00 FTN
              DO K=KT,KB(ID+1)                                        !1/24/00 FTN
                C1S(K,ID+1,19) = 0.0                                  !4/18/01 FTN
              END DO                                                  !1/24/00 FTN
            END IF                                                    !1/24/00 FTN
```

```
            END IF                                                  !1/24/00 FTN
            DO JAC=1,NAC
              JC = CN(JAC)

C       CALL GREGORIAN_DATE (YEAR)                                  !9/24/97 FTN
        CALL GREGORIAN_DATE (YEAR, IMON)                            !9/24/97 FTN
        IF (CONSTITUENTS) THEN
          UPDATE_KINETICS = .FALSE.
          IF (MOD(NIT,FREQUK).EQ.0) UPDATE_KINETICS = .TRUE.
        END IF

C           IF (EVAPORATION.OR.PRECIPITATION) WRITE(SNP,3200) 'Surface',!1/31/95 FTN
C    .                                        ' Calculations'          !1/31/95 FTN
            IF (EVAPORATION.OR.PRECIPITATION) WRITE(SNP,3200) 'Surface' !1/31/95 FTN
     .                                     // ' Calculations'          !1/31/95 FTN
C           IF (EVAPORATION)   WRITE (SNP,3210) (JB,EV(JB),JB=1,NBP)    !4/26/95 FTN
            IF (EVAPORATION)   WRITE (SNP,3210) (JB,EVBR(JB),JB=1,NBP)  !4/26/95 FTN
C           IF (PRECIPITATION) WRITE (SNP,3220) (JB,QPR(JB),JB=1,NBP)   !4/26/95 FTN
            IF (PRECIPITATION) WRITE (SNP,3220) (JB,QPRBR(JB),JB=1,NBP) !4/26/95 FTN
            IF (HEAD_BOUNDARY) THEN
              WRITE (SNP,3230)
              DO JB=1,NBP
                IF (UH_EXTERNAL(JB)) WRITE (SNP,3240) JB,ELUH(JB)
                IF (DH_EXTERNAL(JB)) WRITE (SNP,3250) JB,ELDH(JB)
              END DO
            END IF
            IF (VOLUME_BALANCE) THEN
              WRITE (SNP,3260)
              DO JB=1,NBP
                IF (VOLSBR(JB).NE.0.0) DLVR = (VOLTBR(JB)-VOLSBR(JB))
     .                                       /VOLSBR(JB)
                WRITE (SNP,3270) JB,VOLSBR(JB),VOLTBR(JB),VOLTBR(JB)
     .                         -VOLSBR(JB),DLVR*100.0
              END DO

                    WRITE (SNP,3310) CNAME1(JAC),CMBRS(JAC,JB),
     .                               CMBRT(JAC,JB),(CMBRT(JAC,JB)
     .                               -CMBRS(JAC,JB)),DLMR*100.0
                  END IF
                END DO
              END DO
            END IF
            IF (CONSTITUENTS .AND. ACC(3).EQ.' ON') THEN                !4/14/95 FTN
              ID = NINT(CKSEG)                                          !4/24/95 FTN
              WRITE (SNP,3330) ID                                       !4/24/95 FTN
              DO K = KT, KB(ID)                                         !4/14/95 FTN
                IF (K.EQ.KT) THEN                                       !4/14/95 FTN
                  WRITE (SNP,3340) K, (COLTERM(M,K),M=1,3),             !4/24/95 FTN
     &                           (EL(K)-Z(ID)-HKT2(ID)/2.)/0.3048      !5/05/95 FTN
                ELSE                                                    !4/14/95 FTN
                  WRITE (SNP,3340) K, (COLTERM(M,K),M=1,3),             !4/24/95 FTN
     &                           (EL(K)-H(K)/2.)/0.3048                !5/04/95 FTN
                END IF                                                  !4/14/95 FTN
              END DO                                                    !4/14/95 FTN
            END IF                                                      !4/14/95 FTN
            WRITE (SNP,3320) 'Geometry',KT,ELKT,(JB,CUS(JB),JB=1,NBP)
            CALL PRINT_GRID (JDAY,GDAY,MONTH,YEAR)
          END IF
        END IF

******* Vertical profiles

        IF (PROFILE) THEN
          IF (JDAY.GE.NXTMPR.OR.JDAY.GE.PRFD(PRFDP+1)) THEN
```

```
          IF (JDAY.GE.PRFD(PRFDP+1)) THEN
            PRFDP  = PRFDP+1
            NXTMPR = PRFD(PRFDP)
          END IF
          NXTMPR = NXTMPR+PRFF(PRFDP)
          NSPRF  = NSPRF+1
          IF (PRSTYL.NE.'FTN') THEN                                  !1/31/95 FTN
            WRITE (PRF,2570) JDAY,MONTH,GDAY,YEAR,KT,SNGL(Z(DS(1))),
     .                       NSPRF
            DO JC=1,NAC
              IF (CPRC(CN(JC)).EQ.' ON') THEN
                DO JPRF=1,NIPRF
                  I   = IPRF(JPRF)
                  NRS = KB(I)-KT+1
                  WRITE (PRF,2560) CN(JC),NRS,(C2(K,I,CN(JC)),
     .                             K=KT,KB(I))
                END DO
              END IF
            END DO
          END IF                                                     !1/31/95 FTN
          IF (PRSTYL.EQ.'FTN') THEN                                  !9/24/97 FTN
            WRITE (DATE_STRNG(1:2),'(I2.2)') YEAR-1900               !9/24/97 FTN
            WRITE (DATE_STRNG(3:4),'(I2.2)') IMON                    !9/24/97 FTN
            WRITE (DATE_STRNG(5:6),'(I2.2)') GDAY                    !9/24/97 FTN
          END IF                                                     !9/24/97 FTN
          DO JPRF=1,NIPRF
            I   = IPRF(JPRF)
            NRS = KB(I)-KT+1
            IF (PRSTYL.NE.'FTN') THEN                                !1/31/95 FTN
              WRITE (PRF,2560) 22,NRS,(T2(K,I),K=KT,KB(I))
            ELSE                                                     !1/31/95 FTN
              DO K=KT,KB(I)                                          !2/11/95 FTN
                DO JC=1,NAC                                          !2/11/95 FTN
                  IF (C2(K,I,CN(JC)).LT.1.0E-20) C2(K,I,CN(JC)) =    !2/11/95 FTN
     &                                                   1.0E-20    !2/11/95 FTN
                END DO                                               !2/11/95 FTN
              END DO                                                 !2/11/95 FTN
              WRITE (PRF,'(1H",A6,1H",F7.2,2I5,23E16.8)') DATE_STRNG, !9/24/97 FTN
     &                JDAY,I,KT, (EL(KT)-Z(I))/0.3048, T2(KT,I),    !9/24/97 FTN
     &                (C2(KT,I,CN(JC)),JC=1,NAC)                    !4/13/95 FTN
              WRITE (PRF,'(1H",A6,1H",F7.2,2I5,23E16.8)') DATE_STRNG, !9/24/97 FTN
     &                JDAY,I,KT, (EL(KT)-Z(I)-HKT2(I)/2.)/0.3048,   !9/24/97 FTN
     &                T2(KT,I), (C2(KT,I,CN(JC)),JC=1,NAC)          !9/24/97 FTN
              DO K=KT+1,KB(I)                                        !1/31/95 FTN
                WRITE (PRF,'(1H",A6,1H",F7.2,2I5,23E16.8)')DATE_STRNG,!9/24/97 FTN
     &                     JDAY, I, K, (EL(K)-H(K)/2.)/0.3048,      !9/24/97 FTN
     &                     T2(K,I), (C2(K,I,CN(JC)),JC=1,NAC)       !9/24/97 FTN
              END DO                                                 !1/31/95 FTN
            END IF                                                   !1/31/95 FTN
          END DO
        END IF
      END IF

******* Velocity vectors

      IF (VECTOR) THEN
        IF (JDAY.GE.NXTMVP.OR.JDAY.GE.VPLD(VPLDP+1)) THEN
          IF (JDAY.GE.VPLD(VPLDP+1)) THEN
            VPLDP  = VPLDP+1
            NXTMVP = VPLD(VPLDP)
          END IF
          NXTMVP = NXTMVP+VPLF(VPLDP)
          IF (VPSTYL.NE.'FTN') THEN                                  !1/31/95 FTN
            WRITE (VPL,*) JDAY,MONTH//GDCH//', ',YEAR,KT,US
```

```
            WRITE (VPL,*) Z
            WRITE (VPL,*) U
            WRITE (VPL,*) W
          ELSE                                                      !1/31/95 FTN
            DO JB = 1, 1                                            !5/04/95 FTN
              DO I = CUS(JB), DS(JB)                                !1/31/95 FTN
C                                                                   !5/04/95 FTN
C               Then write horizontal and vertical velocity vectors !5/04/95 FTN
C               for each cell (along with elev of center of cell).  !5/04/95 FTN
C                                                                   !5/04/95 FTN
                WRITE (VPL,'(I5,F9.4,2I5,3E16.8)') YEAR, JDAY, I, KT, !6/04/95 FTN
     &                (EL(KT)-Z(I)-HKT2(I)/2.)/0.3048,U(KT,I),W(KT,I) !4/13/95 FTN
                DO K=KT+1,KB(I)                                     !1/31/95 FTN
                  WRITE (VPL,'(I5,F9.4,2I5,3E16.8)') YEAR, JDAY, I, !6/04/95 FTN
     &                    K, (EL(K)-H(K)/2.)/0.3048, U(K,I), W(K,I) !1/31/95 FTN
                END DO                                              !1/31/95 FTN
              END DO                                                !1/31/95 FTN
            END DO                                                  !1/31/95 FTN
          END IF                                                    !1/31/95 FTN
        END IF
      END IF

******* Contours

      IF (CONTOUR) THEN
        IF (JDAY.GE.NXTMCP.OR.JDAY.GE.CPLD(CPLDP+1)) THEN
          IF (JDAY.GE.CPLD(CPLDP+1)) THEN
            CPLDP  = CPLDP+1
            NXTMCP = CPLD(CPLDP)
          END IF
          NXTMCP = NXTMCP+CPLF(CPLDP)
C         WRITE (CPL,8040) JDAY,MONTH,GDAY,YEAR                     !4/14/95 FTN
          IF (CPSTYL.NE.'FTN') WRITE (CPL,8040) JDAY,MONTH,GDAY,YEAR !4/14/95 FTN
          DO JB=1,NBP
            IF (CPSTYL.NE.'FTN') THEN                               !1/31/95 FTN
              WRITE(CPL,8010) CUS(JB)
              WRITE(CPL,8010) KT
              WRITE(CPL,8050) QIN(JB),QSUM(JB)
              WRITE(CPL,8050) (Z(I),I=CUS(JB),DS(JB))
              DO I=CUS(JB),DS(JB)
                WRITE (CPL,8050) (T2(K,I),K=KT,KB(I))
              END DO
              DO JC=1,NAC
                DO I=CUS(JB),DS(JB)
                  IF (CPRC(CN(JC)).EQ.' ON') THEN
                    WRITE (CPL,8050) (C2(K,I,CN(JC)),K=KT,KB(I))
                  END IF
                END DO
              END DO
            ELSE                                                    !1/31/95 FTN
              DO I = CUS(JB), DS(JB)                                !1/31/95 FTN
                DO K=KT,KB(I)                                       !2/11/95 FTN
                  DO JC=1,NAC                                       !2/11/95 FTN
                    IF (C2(K,I,CN(JC)).LT.1.0E-20) C2(K,I,CN(JC)) = !2/11/95 FTN
     &                                                   1.0E-20   !2/11/95 FTN
                  END DO                                            !2/11/95 FTN
                END DO                                              !2/11/95 FTN
                WRITE (CPL,'(I5,F7.2,2I5,23E16.8)') YEAR, JDAY, I,KT, !4/13/95 FTN
     &                (EL(KT)-Z(I))/0.3048, T2(KT,I),              !4/13/95 FTN
     &                (C2(KT,I,CN(JC)),JC=1,NAC)                   !4/13/95 FTN
                WRITE (CPL,'(I5,F7.2,2I5,23E16.8)') YEAR, JDAY, I,KT, !1/31/95 FTN
     &                (EL(KT)-Z(I)-HKT2(I)/2.)/0.3048, T2(KT,I),!4/13/95 FTN
     &                (C2(KT,I,CN(JC)),JC=1,NAC)                   !4/13/95 FTN
                DO K=KT+1,KB(I)                                     !1/31/95 FTN
```

```
                  WRITE (CPL,'(I5,F7.2,2I5,23E16.8)') YEAR, JDAY, I,  !1/31/95 FTN
     &                          K, (EL(K)-H(K)/2.)/0.3048, T2(K,I),  !1/31/95 FTN
     &                         (C2(K,I,CN(JC)),JC=1,NAC)             !1/31/95 FTN
                 END DO                                               !1/31/95 FTN
               END DO                                                 !1/31/95 FTN
             END IF                                                   !1/31/95 FTN
           END DO
         END IF
       END IF
C                                                                     !10/6/98 FTN
C     Insert lines for AGPM output (from source code sent by G. Hauser) !10/6/98 FTN
       IF(AGPM) THEN                                                  !10/6/98 FTN
         IF(JDAY.GE.NXTMAP) THEN                                      !10/6/98 FTN
           DO JB=1,NBP                                                !10/6/98 FTN
             IF (DN_FLOW(JB)) THEN                                    !10/6/98 FTN
               AVTOUT = 0.0                                           !10/6/98 FTN
               DO JC=1,NAC                                            !10/6/98 FTN
                 AVCOUT(CN(JC)) = 0.0                                 !10/6/98 FTN
               END DO                                                 !10/6/98 FTN
               DO K=KT,KB(DS(JB))                                     !10/6/98 FTN
                 AVTOUT = AVTOUT+T2(K,DS(JB))*QOUT(K,JB)              !10/6/98 FTN
                 DO JC=1,NAC                                          !10/6/98 FTN
                   AVCOUT(CN(JC)) = AVCOUT(CN(JC))+QOUT(K,JB)         !10/6/98 FTN
     .                              *C2(K,DS(JB),CN(JC))              !10/6/98 FTN
                 END DO                                               !10/6/98 FTN
               END DO                                                 !10/6/98 FTN
                              QSOUT = QSUM(JB)                        !10/6/98 FTN
               IF (QSUM(JB).GT.0.0) THEN                              !10/6/98 FTN
                 AVTOUT = AVTOUT/QSUM(JB)                             !10/6/98 FTN
                 DO JC=1,NAC                                          !10/6/98 FTN
                   AVCOUT(CN(JC)) = AVCOUT(CN(JC))/QSUM(JB)           !10/6/98 FTN
                 END DO                                               !10/6/98 FTN
               END IF                                                 !10/6/98 FTN
             END IF                                                   !10/6/98 FTN
           END DO                                                     !10/6/98 FTN
           DO I=1,IMP                                                 !10/6/98 FTN
             ELWS(I) = EL(KT)-Z(I)                                    !10/6/98 FTN
           END DO                                                     !10/6/98 FTN
           CALL WRITEP(JDAY,MONTH,GDAY,YEAR,KT,KB,CUS,                !10/6/98 FTN
     X     NBP,NAC,NCP,CPRC,CN,C2,T2,U,W,ELKT,IMP,KMP,                !10/6/98 FTN
     X     NXTMAP,QSOUT,AVCOUT,AVTOUT,ELWS,KTI)                       !10/6/98 FTN
           NXTMAP = NXTMAP + APLF                                     !10/6/98 FTN
         END IF                                                       !10/6/98 FTN
       END IF                                                         !10/6/98 FTN

******* Time series

       IF (TIME_SERIES) THEN
         IF (JDAY.GE.NXTMTS.OR.JDAY.GE.TSRD(TSRDP+1)) THEN
           IF (JDAY.GE.TSRD(TSRDP+1)) THEN
             TSRDP  = TSRDP+1
             NXTMTS = TSRD(TSRDP)
           END IF
           NXTMTS = NXTMTS+TSRF(TSRDP)
           DO JB=1,NBP
             IF (DN_FLOW(JB)) THEN
               AVTOUT = 0.0
               DO JC=1,NAC
                 AVCOUT(CN(JC)) = 0.0
               END DO
               ID = DS(JB)                                            !3/14/97 FTN
               DO K=KT,KB(ID)
                 AVTOUT = AVTOUT+T2(K,DS(JB))*QOUT(K,JB)
                 DO JC=1,NAC
```

```
                AVCOUT(CN(JC)) = AVCOUT(CN(JC))+QOUT(K,JB)
     .                          *C2(K,DS(JB),CN(JC))
              END DO
            END DO
            IF (QSUM(JB).GT.0.0) THEN
              AVTOUT = AVTOUT/QSUM(JB)
              DO JC=1,NAC
                AVCOUT(CN(JC)) = AVCOUT(CN(JC))/QSUM(JB)
              END DO
            END IF
          END IF
        END DO
        IF (WITHDRAWALS) THEN
          DO JW=1,NWD
            TWD(JW) = T2(KWD(JW),IWD(JW))
            DO JC=1,NAC
              CWD(CN(JC),JW) = C2(KWD(JW),IWD(JW),CN(JC))
            END DO
          END DO
        END IF
        IF (TSSTYL.NE.'FTN') THEN                                !1/31/95 FTN
          IF (WITHDRAWALS) THEN
            WRITE (TSR,5030) JDAY,DLT,ELKT,AVTOUT,(AVCOUT(CN(JC)),
     .                       JC=1,NAC),(TWD(JW),JW=1,NWD),
     .                       ((CWD(CN(JC),JW),JC=1,NAC),JW=1,NWD)
          ELSE
            WRITE (TSR,5030) JDAY,DLT,ELKT,AVTOUT,(AVCOUT(CN(JC)),
     .                       JC=1,NAC)
          END IF
        ELSE                                                     !1/31/95 FTN
          IF (RS_CNT.GT.0.0) RS_AVG = RS_SUM / RS_CNT            !4/24/95 FTN
          RS_SUM = 0.0                                           !4/24/95 FTN
          RS_CNT = 0.0                                           !4/24/95 FTN
          DO JC=1,NAC                                            !2/11/95 FTN
            IF (AVCOUT(CN(JC)).LT.1.0E-20) AVCOUT(CN(JC)) = 1.0E-20 !2/11/95 FTN
          END DO                                                 !2/11/95 FTN
          IF (CONSTITUENTS) THEN                                 !9/30/97 FTN
C                                                                !6/22/98 FTN
C           If algae is being simulated, print the following extra !6/22/98 FTN
C           output at the u/s, mid-lake, and d/s profile stations: !6/22/98 FTN
C           1) avg algae conc in top 2 layers (for each group),  !6/22/98 FTN
C           2) hypolimnetic DO conc 3.5 m above the bottom, and  !6/22/98 FTN
C           3) secchi depth estimated as the depth to which 10% of !6/22/98 FTN
C           the atmospheric solar radiation penetrates. Calculate !6/22/98 FTN
C           the extinction coefficients using inorganic suspended !6/22/98 FTN
C           solids and detritus and algae conc's from top 3 layers. !6/22/98 FTN
C                                                                !6/22/98 FTN
            IF (ACC(22).EQ.' ON' .AND. ACC(23).EQ.' ON' .AND.    !3/30/98 FTN
     &                                 ACC(24).EQ.' ON') THEN    !3/30/98 FTN
              ALG1US = (C2(KT,IPMIN,22) + C2(KT+1,IPMIN,22)) / 2.0 !4/17/98 FTN
              ALG2US = (C2(KT,IPMIN,23) + C2(KT+1,IPMIN,23)) / 2.0 !4/17/98 FTN
              ALG3US = (C2(KT,IPMIN,24) + C2(KT+1,IPMIN,24)) / 2.0 !4/17/98 FTN
              ALG1ML = (C2(KT,IPML,22)  + C2(KT+1,IPML,22) ) / 2.0 !6/22/98 FTN
              ALG2ML = (C2(KT,IPML,23)  + C2(KT+1,IPML,23) ) / 2.0 !6/22/98 FTN
              ALG3ML = (C2(KT,IPML,24)  + C2(KT+1,IPML,24) ) / 2.0 !6/22/98 FTN
              ALG1DS = (C2(KT,IPMAX,22) + C2(KT+1,IPMAX,22)) / 2.0 !4/17/98 FTN
              ALG2DS = (C2(KT,IPMAX,23) + C2(KT+1,IPMAX,23)) / 2.0 !4/17/98 FTN
              ALG3DS = (C2(KT,IPMAX,24) + C2(KT+1,IPMAX,24)) / 2.0 !4/17/98 FTN
C                                                                !6/22/98 FTN
              FRACTION_SRO = 0.1                                 !6/22/98 FTN
              LAYERS_TO_AVG = 3                                  !6/22/98 FTN
              DO IP = 1, 3                                       !6/22/98 FTN
                IF (IP.EQ.1) IPROF = IPMIN                       !6/22/98 FTN
                IF (IP.EQ.2) IPROF = IPML                        !6/22/98 FTN
```

```
                  IF (IP.EQ.3) IPROF = IPMAX                          !6/22/98 FTN
                  PARTIC_ORG = 0.0                                    !6/22/98 FTN
                  PART_INORG = 0.0                                    !6/22/98 FTN
                  DO K = KT, KT-1+LAYERS_TO_AVG                       !6/22/98 FTN
                    PARTIC_ORG = PARTIC_ORG + DETRIT(K,IPROF)         !6/22/98 FTN
                    PART_INORG = PART_INORG + SS(K,IPROF)             !6/22/98 FTN
                    DO JA=1,NAP                                       !6/22/98 FTN
                      PARTIC_ORG = PARTIC_ORG + ALGAE(K,IPROF,JA)     !6/22/98 FTN
                    END DO                                            !6/22/98 FTN
                  END DO                                              !6/22/98 FTN
                  PARTIC_ORG = PARTIC_ORG / REAL(LAYERS_TO_AVG)       !6/22/98 FTN
                  PART_INORG = PART_INORG / REAL(LAYERS_TO_AVG)       !6/22/98 FTN
                  GAMMA = EXH2O+EXINOR*PART_INORG + EXORG*PARTIC_ORG  !6/22/98 FTN
                  SECCHI = LOG (FRACTION_SRO / (1.0-BETA)) / (-GAMMA) !6/22/98 FTN
                  IF (IP.EQ.1) SECCUS = SECCHI                        !6/22/98 FTN
                  IF (IP.EQ.2) SECCML = SECCHI                        !6/22/98 FTN
                  IF (IP.EQ.3) SECCDS = SECCHI                        !6/22/98 FTN
                END DO                                                !6/22/98 FTN
C                                                                     !6/22/98 FTN
                KUS = KB(IPMIN) - 3                                   !6/22/98 FTN
                KML = KB(IPML)  - 3                                   !6/22/98 FTN
                KDS = KB(IPMAX) - 3                                   !6/22/98 FTN
                WRITE (TSR,'(I5,F7.2,42E16.8)') YEAR, JDAY,           !6/23/98 FTN
     &                (EL(KT)-Z(DS(1)))/0.3048, T2(KT,DS(1)), AVTOUT, !3/30/98 FTN
     &                (AVCOUT(CN(JC)),JC=1,NAC), ALG1US, ALG2US,      !3/30/98 FTN
     &                ALG3US, ALG1ML, ALG2ML, ALG3ML, ALG1DS, ALG2DS, !6/22/98 FTN
     &                ALG3DS, C2(KUS,IPMIN,12), C2(KML,IPML,12),      !6/22/98 FTN
     &                C2(KDS,IPMAX,12), SECCUS, SECCML, SECCDS        !6/22/98 FTN
              ELSE                                                    !3/30/98 FTN
                WRITE (TSR,'(I5,F7.2,23E16.8)') YEAR, JDAY,           !9/30/97 FTN
     &                (EL(KT)-Z(DS(1)))/0.3048, T2(KT,DS(1)), AVTOUT, !9/30/97 FTN
     &                (AVCOUT(CN(JC)),JC=1,NAC), RS_AVG, EVAPDEP      !2/27/01 FTN
              END IF                                                  !3/30/98 FTN
            ELSE                                                      !9/30/97 FTN
               WRITE (TSR,'(I5,F7.2, 5E16.8)') YEAR, JDAY,            !12/1/00 FTN
     &               (EL(KT)-Z(DS(1)))/0.3048, T2(KT,DS(1)), AVTOUT   !9/30/97 FTN
     &              , RS_AVG, EVAPDEP                                 !2/27/01 FTN
            END IF                                                    !9/30/97 FTN
            EVAPDEP = 0.0                                             !2/27/01 FTN
          END IF                                                      !1/31/95 FTN
        END IF
      END IF


 3330 FORMAT (/,' Components of coliform disappearance (dC/dt) for',  !4/14/95 FTN
     &          ' segment',I3,':',/,' (all units are',                !4/24/95 FTN
     &          ' colonies per 100 mL per second)',/,27X,'Mortality', !4/14/95 FTN
     &        /,14X,'Mortality     due to',/,15X,'in dark      ',    !4/14/95 FTN
     &          ' light      Settling',/,14X,'---------    ---------', !4/14/95 FTN
     &          '    ---------',/)                                   !4/24/95 FTN
 3340 FORMAT (' Layer',I3,':',3E13.3,4X,'(middle elev = ',F6.2,')')   !4/14/95 FTN

************************************************************************
**        S U B R O U T I N E   G R E G O R I A N   D A T E        **
************************************************************************

C     SUBROUTINE GREGORIAN_DATE (YEAR)                                !9/24/97 FTN
      SUBROUTINE GREGORIAN_DATE (YEAR, IMON)                          !9/24/97 FTN

******* Variable declaration

        INTEGER   YEAR, GDAY
        LOGICAL   LEAP_YEAR
        CHARACTER MONTH*9
```

```
******* Common declaration

        COMMON /GDAYC1/ GDAY, DAYM, JDAYG, LEAP_YEAR
        COMMON /GDAYC2/ MONTH

******* Determine if new year (regular or leap) and increment year

        IF (.NOT.LEAP_YEAR.AND.JDAYG.EQ.365) THEN
          JDAYG     = JDAYG-365
          YEAR      = YEAR+1
          LEAP_YEAR = MOD(YEAR,4).EQ.0
        ELSE IF (JDAYG.EQ.366) THEN
          JDAYG     = JDAYG-366
          YEAR      = YEAR+1
          LEAP_YEAR = .FALSE.
        END IF

******* Determine month and day of year

        IF (LEAP_YEAR) THEN
          IF (JDAYG.GE.0.AND.JDAYG.LT.31) THEN
            GDAY  = JDAYG+1
            DAYM  = 31.0
            MONTH = '  January'
          ELSE IF (JDAYG.GE.31.AND.JDAYG.LT.60) THEN
            GDAY  = JDAYG-30
            DAYM  = 29.0
            MONTH = ' February'
          ELSE IF (JDAYG.GE.60.AND.JDAYG.LT.91) THEN
            GDAY  = JDAYG-59
            DAYM  = 31.0
            MONTH = '    March'
          ELSE IF (JDAYG.GE.91.AND.JDAYG.LT.121) THEN
            GDAY  = JDAYG-90
            DAYM  = 30.0
            MONTH = '    April'
          ELSE IF (JDAYG.GE.121.AND.JDAYG.LT.152) THEN
            GDAY  = JDAYG-120
            DAYM  = 31.0
            MONTH = '      May'
          ELSE IF (JDAYG.GE.152.AND.JDAYG.LT.182) THEN
            GDAY  = JDAYG-151
            DAYM  = 30.0
            MONTH = '     June'
          ELSE IF (JDAYG.GE.182.AND.JDAYG.LT.213) THEN
            GDAY  = JDAYG-181
            DAYM  = 31.0
            MONTH = '     July'
          ELSE IF (JDAYG.GE.213.AND.JDAYG.LT.244) THEN
            GDAY  = JDAYG-212
            DAYM  = 31.0
            MONTH = '   August'
          ELSE IF (JDAYG.GE.244.AND.JDAYG.LT.274) THEN
            GDAY  = JDAYG-243
            DAYM  = 30.0
            MONTH = 'September'
          ELSE IF (JDAYG.GE.274.AND.JDAYG.LT.305) THEN
            GDAY  = JDAYG-273
            DAYM  = 31.0
            MONTH = '  October'
          ELSE IF (JDAYG.GE.305.AND.JDAYG.LT.335) THEN
            GDAY  = JDAYG-304
            DAYM  = 30.0
```

```
          MONTH = ' November'
        ELSE IF (JDAYG.GE.335.AND.JDAYG.LT.366) THEN
          GDAY  = JDAYG-334
          DAYM  = 31.0
          MONTH = ' December'
        END IF
      ELSE
        IF (JDAYG.GE.0.AND.JDAYG.LT.31) THEN
          GDAY  = JDAYG+1
          DAYM  = 31.0
          MONTH = '  January'
        ELSE IF (JDAYG.GE.31.AND.JDAYG.LT.59) THEN
          GDAY  = JDAYG-30
          DAYM  = 29.0
          MONTH = ' February'
        ELSE IF (JDAYG.GE.59.AND.JDAYG.LT.90) THEN
          GDAY  = JDAYG-58
          DAYM  = 31.0
          MONTH = '    March'
        ELSE IF (JDAYG.GE.90.AND.JDAYG.LT.120) THEN
          GDAY  = JDAYG-89
          DAYM  = 30.0
          MONTH = '    April'
        ELSE IF (JDAYG.GE.120.AND.JDAYG.LT.151) THEN
          GDAY  = JDAYG-119
          DAYM  = 31.0
          MONTH = '      May'
        ELSE IF (JDAYG.GE.151.AND.JDAYG.LT.181) THEN
          GDAY  = JDAYG-150
          DAYM  = 30.0
          MONTH = '     June'
        ELSE IF (JDAYG.GE.181.AND.JDAYG.LT.212) THEN
          GDAY  = JDAYG-180
          DAYM  = 31.0
          MONTH = '     July'
        ELSE IF (JDAYG.GE.212.AND.JDAYG.LT.243) THEN
          GDAY  = JDAYG-211
          DAYM  = 31.0
          MONTH = '   August'
        ELSE IF (JDAYG.GE.243.AND.JDAYG.LT.273) THEN
          GDAY  = JDAYG-242
          DAYM  = 30.0
          MONTH = 'September'
        ELSE IF (JDAYG.GE.273.AND.JDAYG.LT.304) THEN
          GDAY  = JDAYG-272
          DAYM  = 31.0
          MONTH = '  October'
        ELSE IF (JDAYG.GE.304.AND.JDAYG.LT.334) THEN
          GDAY  = JDAYG-303
          DAYM  = 30.0
          MONTH = ' November'
        ELSE IF (JDAYG.GE.334.AND.JDAYG.LT.365) THEN
          GDAY  = JDAYG-333
          DAYM  = 31.0
          MONTH = ' December'
        END IF
      END IF
      IF (MONTH.EQ.'  January') THEN                          !9/24/97 FTN
        IMON = 1                                              !9/24/97 FTN
      ELSEIF (MONTH.EQ.' February') THEN                      !9/24/97 FTN
        IMON = 2                                              !9/24/97 FTN
      ELSEIF (MONTH.EQ.'    March') THEN                      !9/24/97 FTN
        IMON = 3                                              !9/24/97 FTN
      ELSEIF (MONTH.EQ.'    April') THEN                      !9/24/97 FTN
```

```
          IMON = 4                                                  !9/24/97 FTN
        ELSEIF (MONTH.EQ.'      May') THEN                          !9/24/97 FTN
          IMON = 5                                                  !9/24/97 FTN
        ELSEIF (MONTH.EQ.'     June') THEN                          !9/24/97 FTN
          IMON = 6                                                  !9/24/97 FTN
        ELSEIF (MONTH.EQ.'     July') THEN                          !9/24/97 FTN
          IMON = 7                                                  !9/24/97 FTN
        ELSEIF (MONTH.EQ.'   August') THEN                          !9/24/97 FTN
          IMON = 8                                                  !9/24/97 FTN
        ELSEIF (MONTH.EQ.'September') THEN                          !9/24/97 FTN
          IMON = 9                                                  !9/24/97 FTN
        ELSEIF (MONTH.EQ.'  October') THEN                          !9/24/97 FTN
          IMON = 10                                                 !9/24/97 FTN
        ELSEIF (MONTH.EQ.' November') THEN                          !9/24/97 FTN
          IMON = 11                                                 !9/24/97 FTN
        ELSEIF (MONTH.EQ.' December') THEN                          !9/24/97 FTN
          IMON = 12                                                 !9/24/97 FTN
        END IF                                                      !9/24/97 FTN
      END

******* Common declaration

        COMMON /SCRNC2/ NWD,    NTR
        COMMON /TVDMTC/ TAIR,   TDEW,    CLOUD,   PHI,   ET,    CSHE,
     .                  SRO,    LAT,     LONG
        COMMON /GLOBLC/ JB,     JC,      IU,      ID,    KT,    ELKT,
     .                  DLT,    KB(IMP), KTI(IMP)
        COMMON /GLBLCC/ PALT,   ALGDET,  O2LIM,   WIND,  WSCDP, WSC(NDP)
        COMMON /WACHUS/ WSC_MIN, WSC_MAX                            !1/31/95 FTN
        COMMON /INTN1C/ TAIRNX, TDEWNX,  CLOUDNX, PHINX, WINDNX
        COMMON /INTO1C/ TAIRO,  TDEWO,   CLOUDO,  PHIO,  WINDO
        COMMON /INTN3C/ CTRNX(NCP,NTP),     CINNX(NCP,NBP),
     .                  QOUTNX(KMP,NBP),    CDTRNX(NCP,NBP),
     .                  CPRNX(NCP,NBP),     TUHNX(KMP,NBP),
     .                  TDHNX(KMP,NBP),     QSTRNX(NSP,NBP),
     .                  CUHNX(KMP,NCP,NBP), CDHNX(KMP,NCP,NBP),
     .                  QDTRNX(NBP),        TDTRNX(NBP),
     .                  PRNX(NBP),          TPRNX(NBP),
     .                  ELUHNX(NBP),        ELDHNX(NBP),
     .                  QWDNX(NWP),         QTRNX(NTP),
     .                  TTRNX(NTP),         QINNX(NBP),
     .                  TINNX(NBP)
******* Meteorlogical data

        IF (JDAY.GE.NXMET1) THEN
          DO WHILE (JDAY.GE.NXMET1)
            NXMET2 = NXMET1
            TDEW   = TDEWNX
            TDEWO  = TDEWNX
            WIND   = WINDNX
            WINDO  = WINDNX
            PHI    = PHINX
            PHIO   = PHINX
            TAIR   = TAIRNX
            TAIRO  = TAIRNX
            CLOUD  = CLOUDNX
            CLOUDO = CLOUDNX
            READ (MET,1010) NXMET1,TAIRNX,TDEWNX,WINDNX,PHINX,CLOUDNX
C                                                                   !1/31/95 FTN
C           Adjust the wind for Wachusett Reservoir by assuming that  !1/31/95 FTN
C           WSC is a function of wind direction.  Use either a min or !1/31/95 FTN
C           max value of WSC (specified in the control file) depending !1/31/95 FTN
C           on whether or not the direction is within a 60-degree-wide !1/31/95 FTN
C           band along the lake axis, which runs SW-NE.  Skip these   !1/31/95 FTN
```

```
C           calculations if values were not specified in control file.  !1/31/95 FTN
C                                                                       !1/31/95 FTN
            IF (WSC_MIN.GT.0.0 .AND. WSC_MAX.GT.0.0) THEN               !1/31/95 FTN
               PI = 3.14159                                             !1/31/95 FTN
               AXIS1 = 5.0/4.0 * PI                                     !1/31/95 FTN
               AXIS2 = 1.0/4.0 * PI                                     !1/31/95 FTN
               IF (ABS(PHINX-AXIS1).LE.PI/6.0 .OR. ABS(PHINX-AXIS2).LE. !1/31/95 FTN
     &                                                 PI/6.0) THEN   !1/31/95 FTN
                  WINDNX = WINDNX * WSC_MAX                             !1/31/95 FTN
               ELSE                                                     !1/31/95 FTN
                  WINDNX = WINDNX * WSC_MIN                             !1/31/95 FTN
               END IF                                                   !1/31/95 FTN
            ELSE                                                        !1/31/95 FTN
               WINDNX = WINDNX*WSC(WSCDP)
            END IF                                                      !1/31/95 FTN
          END DO
        END IF
        NXTVD = MIN(NXTVD,NXMET1)

************************************************************************
**         S U B R O U T I N E   H E A T   E X C H A N G E          **
************************************************************************

      SUBROUTINE HEAT_EXCHANGE (WFC,JDAY)
        INCLUDE 'w2.inc'

******* Variable declaration

        REAL      JDAY, LAT, LONG, LONGO
        LOGICAL   LEAP_YEAR
        CHARACTER MONTH*9

******* Dimension declaration

        DIMENSION EQT(12)

******* Common declaration

        COMMON /GLBLCC/ PALT, ALGDET, O2LIM, WIND, WSCDP, WSC(NDP)
        COMMON /TVDMTC/ TAIR, TDEW,   CLOUD, PHI,  ET,    CSHE,
     .                  SRO,  LAT,    LONG
        COMMON /GDAYC1/ GDAY, DAYM,   JDAYG, LEAP_YEAR
        COMMON /FWCOEF/ FW_A0, FW_A1, FW_A2                             !1/31/95 FTN
        COMMON /GDAYC2/ MONTH

******* Equilibrium temperature and heat exchange coefficient

        ET    = TDEWT
C       FW    = WFC*(70.0+0.7*WINDT*WINDT)                              !1/31/95 FTN
C                                                                       !1/31/95 FTN
C       Calculate wind function using coefficients read from control    !1/31/95 FTN
C       file (in SI units).  Convert to subroutine units assuming that  !1/31/95 FTN
C       9.2 + 0.46W^2 in SI units is equivalent to 70 + 0.7*W^2 in      !1/31/95 FTN
C       subroutine units.                                               !1/31/95 FTN
C                                                                       !1/31/95 FTN
        FW    = ( (FW_A0*70.0/9.2) + (FW_A1*3.4027)*WINDT +             !1/31/95 FTN
     &            (FW_A2*0.7/0.46)*WINDT*WINDT ) * WFC                  !1/31/95 FTN
        HA    = 3.1872E-08*(TAIRT+460.0)*(TAIRT+460.0)*(TAIRT+460.0)
     .          *(TAIRT+460.0)
        TSTAR = (ET+TDEWT)*0.5
        BETA  = 0.255-(0.0085*TSTAR)+(0.000204*TSTAR*TSTAR)
        CSHE  = 15.7+(0.26+BETA)*FW
        ETP   = (SRO+HA-1801.0)/CSHE+(CSHE-15.7)*(0.26*TAIRT+BETA*TDEWT)
     .          /(CSHE*(0.26+BETA))
```

```
        J     = 0
        DO WHILE (ABS(ETP-ET).GT.0.05.AND.J.LT.50)
          ET    = ETP
          TSTAR = (ET+TDEWT)*0.5
          BETA  = 0.255-(0.0085*TSTAR)+(0.000204*TSTAR**2)
          CSHE  = 15.7+(0.26+BETA)*FW
          ETP   = (SRO+HA-1801.0)/CSHE+(CSHE-15.7)*(0.26*TAIRT+BETA
     .            *TDEWT)/(CSHE*(0.26+BETA))
          J     = J+1
        END DO
10000   CONTINUE


************************************************************************
**         S U B R O U T I N E   S U R F A C E   T E R M S          **
************************************************************************

      SUBROUTINE SURFACE_TERMS (WFC,WIND,TS,RB,RE,RC)

******* Common declaration

        COMMON /TVDMTC/ TAIR, TDEW, CLOUD, PHI, ET, CSHE, SRO, LAT,
     .                  LONG
        COMMON /FWCOEF/ FW_A0, FW_A1, FW_A2                          !1/31/95 FTN

******* Evaporation

        W2A = WIND*3600.0/(0.3048*5280.0)
C       FWA = WFC*(70.0+0.7*W2A*W2A)                                 !1/31/95 FTN
C                                                                    !1/31/95 FTN
C       Calculate wind function using coefficients read from control !1/31/95 FTN
C       file (in SI units).  Convert to subroutine units assuming that !1/31/95 FTN
C       9.2 + 0.46W^2 in SI units is equivalent to 70 + 0.7*W^2 in   !1/31/95 FTN
C       subroutine units.                                            !1/31/95 FTN
C                                                                    !1/31/95 FTN
        FWA = ( (FW_A0*70.0/9.2) + (FW_A1*3.4027)*W2A +              !1/31/95 FTN
     &          (FW_A2*0.7/0.46)*W2A*W2A ) * WFC                     !1/31/95 FTN
        FW  = 0.1313*FWA
        RE  = FW*DE

************************************************************************
**          S U B R O U T I N E   P R I N T   G R I D             **
************************************************************************

      SUBROUTINE PRINT_GRID (JDAY,GDAY,MONTH,YEAR)
        INCLUDE 'w2.inc'

******* Variable declaration

        REAL       JDAY,     ICETH
        INTEGER    SNP,      CN,      YEAR,     GDAY,     BL,
     .             CUS,      DS
        CHARACTER  CPRC*3,   HPRC*3,  LFAC*4,   CONV*7,   HUNIT*6,
     .             CUNIT*6,  LFPR*7,  BLANK*7,  MONTH*9,  CNAME2*17,
     .             HNAME*24, TITLE*72
     &           , CNAME1*13, DNPRN*3                                !3/27/98 FTN
        LOGICAL    CONSTITUENTS,  ICE, ICE_CALC, LONG_FORM, SHORT_FORM,
     .             OXYGEN_DEMAND, LIMITING_FACTOR
        DOUBLE PRECISION Z

******* Dimension declaration

C       DIMENSION HUNIT(4), BL(17)                                   !4/16/97 FTN
        DIMENSION HUNIT(7), BL(17)                                   !4/16/97 FTN
```

```
      DIMENSION NH3D(KMC,IMC), NO3D(KMC,IMC)                          !3/27/98 FTN

******* Common declaration

      COMMON /DKNITC/ NH3D, NO3D                                      !3/27/98 FTN
      COMMON /DENITC/ DNPRN                                           !3/27/98 FTN
      COMMON /SNPUC/  SNP
      COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
      COMMON /TEMPC/  T1(KMP,IMP),    T2(KMP,IMP)
      COMMON /HYDRC1/ U(KMP,IMP),     W(KMP,IMP),     AZ(KMP,IMP),
C    .                RHO(KMP,IMP),   NDLT(KMP,IMP)                   !4/16/97 FTN
     .                RHO(KMP,IMP),   NDLT(KMP,IMP), DZ(KMP,IMP)      !4/16/97 FTN
      COMMON /HYDRC2/ Z(IMP)
      COMMON /PRNTC1/ IPR(17),        IEPR,           KEPR
C     COMMON /PRNTC2/ TITLE(7),       CPRC(NCP),      HPRC(4),        !4/16/97 FTN
      COMMON /PRNTC2/ TITLE(7),       CPRC(NCP),      HPRC(7),        !4/16/97 FTN
     .                CONV(KMP,17)
      COMMON /PRNTC3/ CUS(NBP),       DS(NBP)
C     COMMON /LFACC/  LFAC(KMC,IMC),  LFPR(KMC,IMC)                   !5/14/97 FTN
      COMMON /LFACC/  LFAC(KMC,IMC,NAP),  LFPR(KMC,IMC,NAP)           !5/14/97 FTN
      COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)
      COMMON /GRDLGC/ LONG_FORM,      SHORT_FORM,     LIMITING_FACTOR,
     .                OXYGEN_DEMAND
      COMMON /GRTVDC/ CONSTITUENTS,   CN(NCP),        NAC
      COMMON /CBODC/  KBOD,           TBOD,           RBOD
C     COMMON /NAMESC/ HNAME(4),       CNAME2(NCP),    CUNIT(NCP)      !4/16/97 FTN
      COMMON /NAMESC/ HNAME(7),       CNAME2(NCP),    CUNIT(NCP)      !4/16/97 FTN
      COMMON /ICEC/   ICE(IMP),       ICETH(IMP),     ICE_CALC
      DATA   HUNIT(1) /'m/sec '/, HUNIT(2) /'mm/sec'/,
     .       HUNIT(3) /'deg C '/, HUNIT(4) /'      '/
     .     , HUNIT(5) /'kg/m3 '/, HUNIT(6) /'      '/                !4/16/97 FTN
     .     , HUNIT(7) /'      '/                                     !4/16/97 FTN
      DATA   BLANK    /'       '/

******* Velocities, temperatures, and vertical eddy viscosities

C     DO J=1,4                                                        !4/16/97 FTN
      DO J=1,7                                                        !4/16/97 FTN
        IF (HPRC(J).EQ.' ON') THEN
          DO I=1,IEPR
            DO K=KT,KB(IPR(I))
              IF (J.EQ.1) WRITE (CONV(K,I),'(F7.4)') U(K,IPR(I))
              IF (J.EQ.2) WRITE (CONV(K,I),'(F7.4)') W(K,IPR(I))*1000.
              IF (J.EQ.3) WRITE (CONV(K,I),'(F7.2)') T2(K,IPR(I))
              IF (J.EQ.4) WRITE (CONV(K,I),'(I7)')   NDLT(K,IPR(I))
              IF (J.EQ.5) WRITE (CONV(K,I),'(F7.3)')RHO(K,IPR(I))-900.!4/16/97 FTN
              IF (J.EQ.6) WRITE (CONV(K,I),'(1P,E7.1E1)')AZ(K,IPR(I)) !4/16/97 FTN
              IF (J.EQ.7) WRITE (CONV(K,I),'(1P,E7.1E1)')DZ(K,IPR(I)) !4/16/97 FTN
            END DO
******* Constituent concentrations

      DO J=1,NAC
        IF (CPRC(CN(J)).EQ.' ON') THEN
C         MULT = 1.0                                                  !5/13/97 FTN
C         IF (CN(J).GE.9.AND.CN(J).LE.11) MULT = 1000.0               !5/13/97 FTN
          DO I=1,IEPR
            DO K=KT,KB(IPR(I))
              IF (CN(J).EQ.3) THEN                                    !2/11/95 FTN
                WRITE (CONV(K,I),'(I6,1X)') NINT(C2(K,IPR(I),3))      !2/11/95 FTN
              ELSEIF (CN(J).GE.9.AND.CN(J).LE.11) THEN                !5/13/97 FTN
                WRITE (CONV(K,I),'(F7.3)') C2(K,IPR(I),CN(J))         !5/13/97 FTN
              ELSEIF (CN(J).GE.22) THEN                               !5/13/97 FTN
                WRITE (CONV(K,I),'(F7.3)') C2(K,IPR(I),CN(J))         !5/13/97 FTN
              ELSE                                                    !2/11/95 FTN
```

```
C                 WRITE (CONV(K,I),'(F7.2)') C2(K,IPR(I),CN(J))*MULT    !5/13/97 FTN
                  WRITE (CONV(K,I),'(F7.2)') C2(K,IPR(I),CN(J))         !5/13/97 FTN
                END IF                                                  !2/11/95 FTN
              END DO
            END DO
            DO JBL=1,NBL
              DO K=KT,KB(IPR(BL(JBL)))
                CONV(K,BL(JBL)) = BLANK
              END DO
            END DO
            WRITE (SNP,3040) (TITLE(I),I=1,7)
            WRITE (SNP,3050) MONTH,GDAY,YEAR,INT(JDAY),(JDAY-INT(JDAY))
     .                      *24.0
            IF (LONG_FORM)   WRITE (SNP,3120) CNAME2(CN(J)),CUNIT(CN(J))
            IF (SHORT_FORM)  WRITE (SNP,3130) CNAME2(CN(J)),CUNIT(CN(J))
            WRITE (SNP,3080) (IPR(I),I=1,IEPR)
            DO K=KT,KEPR
              WRITE (SNP,3090) K,(CONV(K,I),I=1,IEPR)
            END DO
C                                                                       !3/27/98 FTN
            IF (CN(J).EQ.11 .AND. DNPRN.EQ.' ON') THEN                  !3/27/98 FTN
              DO I=1,IEPR                                               !3/27/98 FTN
                DO K=KT,KB(IPR(I))                                      !3/27/98 FTN
                  WRITE (CONV(K,I),'(1P,E7.1E1)') NO3D(K,IPR(I))*86400. !3/31/98 FTN
                END DO                                                  !3/27/98 FTN
              END DO                                                    !3/27/98 FTN
              DO JBL=1,NBL                                              !3/27/98 FTN
                DO K=KT,KB(IPR(BL(JBL)))                                !3/27/98 FTN
                  CONV(K,BL(JBL)) = BLANK                               !3/27/98 FTN
                END DO                                                  !3/27/98 FTN
              END DO                                                    !3/27/98 FTN
              WRITE (SNP,3040) (TITLE(I),I=1,7)                         !3/27/98 FTN
              WRITE (SNP,3050) MONTH, GDAY, YEAR, INT(JDAY),            !3/27/98 FTN
     &                         (JDAY-INT(JDAY))*24.0                    !3/27/98 FTN
              IF (LONG_FORM) WRITE(SNP,3120)'  Denitrification','mg/L/d'!3/27/98 FTN
              IF (SHORT_FORM)WRITE(SNP,3130)'  Denitrification','mg/L/d'!3/27/98 FTN
              WRITE (SNP,3080) (IPR(I),I=1,IEPR)                        !3/27/98 FTN
              DO K=KT,KEPR                                              !3/27/98 FTN
                WRITE (SNP,3090) K,(CONV(K,I),I=1,IEPR)                 !3/27/98 FTN
              END DO                                                    !3/27/98 FTN
            END IF                                                      !3/27/98 FTN
          END IF
        END DO
        IF (LIMITING_FACTOR) THEN
          DO JA=1,NAP                                                   !5/14/97 FTN
            WRITE (SNP,3040) (TITLE(I),I=1,7)
            WRITE (SNP,3050)  MONTH,GDAY,YEAR,INT(JDAY),(JDAY-INT(JDAY))
     .                       *24.0
            IF (JA.EQ.1) CNAME1 = 'Diatoms'                             !5/14/97 FTN
            IF (JA.EQ.2) CNAME1 = 'Greens'                              !5/14/97 FTN
            IF (JA.EQ.3) CNAME1 = 'Cyanobacteria'                       !5/14/97 FTN
C           IF (LONG_FORM)    WRITE (SNP,3100)                          !5/14/97 FTN
            IF (LONG_FORM)    WRITE (SNP,3100) CNAME1                   !5/14/97 FTN
C           IF (SHORT_FORM)   WRITE (SNP,3110)                          !5/14/97 FTN
            IF (SHORT_FORM)   WRITE (SNP,3110) CNAME1                   !5/14/97 FTN
            WRITE (SNP,3080) (IPR(I),I=1,IEPR)
            DO K=KT,KEPR
C             WRITE (SNP,3090) K,(LFPR(K,IPR(I)),I=1,IEPR)              !5/14/97 FTN
              WRITE (SNP,3090) K,(LFPR(K,IPR(I),JA),I=1,IEPR)           !5/14/97 FTN
            END DO
          END DO                                                        !5/14/97 FTN
        END IF

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

```
**  S U B R O U T I N E   S E L E C T I V E   W I T H D R A W A L   **
***********************************************************************

      SUBROUTINE SELECTIVE_WITHDRAWAL
        INCLUDE 'w2.inc'

******* Variable declaration

        LOGICAL SEL_WITHDRAWAL, POINT_SINK
        DOUBLE PRECISION Z

******* Dimension declaration

        DIMENSION VNORM(KMP)

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /GEOMHC/ EL(KMP),       H(KMP),         HKT1(IMP),
     .                  HKT2(IMP)
        COMMON /TVDQC/  QIN(NBP),      QTR(NTP),       QDTR(NBP),
     .                  PR(NBP),       ELUH(NBP),      ELDH(NBP),
     .                  QOUT(KMP,NBP), QWD(NWP),       QSUM(NBP)
        COMMON /SELWC/  NSTR(NBP),     QSTR(NSP,NBP),  ESTR(NSP,NBP),
     .                  WSTR(NSP,NBP), KBSW(NSP,NBP),  NOUT(NBP),
     .                  KOUT(KMP,NBP)
        COMMON /HYDRC1/ U(KMP,IMP),    W(KMP,IMP),     AZ(KMP,IMP),
C    .                  RHO(KMP,IMP),  NDLT(KMP,IMP)                   !4/16/97 FTN
     .                  RHO(KMP,IMP),  NDLT(KMP,IMP),  DZ(KMP,IMP)     !4/16/97 FTN
        COMMON /HYDRC2/ Z(IMP)
        COMMON /TVDSWC/ SEL_WITHDRAWAL(NBP), POINT_SINK(NSP,NBP)

***********************************************************************
**      S U B R O U T I N E   R A T E   M U L T I P L I E R S      **
***********************************************************************

C     SUBROUTINE RATE_MULTIPLIERS                                      !2/27/01 FTN
      SUBROUTINE RATE_MULTIPLIERS (JDAY, SNP)                          !2/27/01 FTN
        INCLUDE 'w2.inc'

******* Variable declaration

        INTEGER SNP                                                    !2/27/01 FTN
        REAL JDAY                                                      !2/27/01 FTN
        REAL LAM1,  LAM2,  NH3K1, NH3K2, NO3K1, NO3K2, NH3T1, NH3T2,
     .       NO3T1, NO3T2, NH3RM, NO3RM                                !2/02/95 FTN
C    .       NO3T1, NO3T2, NH3RM, NO3RM, K1,    K2,    K3,    K4       !2/02/95 FTN
        DIMENSION AGT1(NAP), AGT2(NAP), AGT3(NAP), AGT4(NAP),          !5/13/97 FTN
    &             AGK1(NAP), AGK2(NAP), AGK3(NAP), AGK4(NAP)           !5/13/97 FTN

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /RTMLTC/ OMT1,  OMT2,  NH3T1, NH3T2, NO3T1, NO3T2, AGT1,
     .                  AGT2,  AGT3,  AGT4,  OMK1,  OMK2,  NH3K1, NH3K2,
     .                  NO3K1, NO3K2, AGK1,  AGK2,  AGK3,  AGK4
        COMMON /GBLRTC/ OMRM(KMC,IMC),  NH3RM(KMC,IMC), NO3RM(KMC,IMC),
C    .                  AGRMR(KMC,IMC), AGRMF(KMC,IMC)                 !5/13/97 FTN
     .                  AGRMR(KMC,IMC,NAP), AGRMF(KMC,IMC,NAP)         !5/13/97 FTN
        COMMON /TEMPC/  T1(KMP,IMP),    T2(KMP,IMP)

******* Rising and falling temperature rate functions

C       FR(TT,TT1,TT2,K1,K2) = K1*EXP(LOG(K2*(1.0-K1)/(K1*(1.0-K2)))   !2/02/95 FTN
```

```
C    .                          /(TT2-TT1)*(TT-TT1))                    !2/02/95 FTN
C       FF(TT,TT3,TT4,K3,K4) = K4*EXP(LOG(K3*(1.0-K4)/(K4*(1.0-K3)))    !2/02/95 FTN
C    .                          /(TT4-TT3)*(TT4-TT))                    !2/02/95 FTN
        DO I=IU,ID
          DO K=KT,KB(I)
            T1_ORIG = T1(K,I)                                           !2/27/01 FTN
            IF (T1(K,I).LT.0.1 .OR. T1(K,I).GT.40.0) THEN               !4/18/01 FTN
              WRITE (SNP,3140) JDAY, I, K, T1(K,I), T2(K,I)             !2/27/01 FTN
 3140         FORMAT (/,' WARNING! --> Water temp (T1) is < 0.1 C or',  !4/18/01 FTN
     &                  ' > 40 C in RATE_MULTIPLIERS subroutine',/,13X, !4/18/01 FTN
     &                  ' JDAY=',F6.2,'   Segment=',I2,'   Layer=',I2,  !2/27/01 FTN
     &                  '   T1=',E9.2,'   T2=',E9.2)                    !2/27/01 FTN
              T1(K,I) = MIN(MAX(T1(K,I),0.1),40.0)                      !4/18/01 FTN
            END IF                                                      !2/27/01 FTN
            LAM1       = FR(T1(K,I),NH3T1,NH3T2,NH3K1,NH3K2)
            NH3RM(K,I) = LAM1/(1.0+LAM1-NH3K1)
            LAM1       = FR(T1(K,I),NO3T1,NO3T2,NO3K1,NO3K2)
            NO3RM(K,I) = LAM1/(1.0+LAM1-NO3K1)
            LAM1       = FR(T1(K,I),OMT1,OMT2,OMK1,OMK2)
            OMRM(K,I)  = LAM1/(1.0+LAM1-OMK1)
C           LAM1       = FR(T1(K,I),AGT1,AGT2,AGK1,AGK2)                !5/13/97 FTN
C           LAM2       = FF(T1(K,I),AGT3,AGT4,AGK3,AGK4)                !5/13/97 FTN
C           AGRMR(K,I) = LAM1/(1.0+LAM1-AGK1)                           !5/13/97 FTN
C           AGRMF(K,I) = LAM2/(1.0+LAM2-AGK4)                           !5/13/97 FTN
            DO JA=1,NAP                                                 !5/13/97 FTN
              LAM1 = FR(T1(K,I),AGT1(JA),AGT2(JA),AGK1(JA),AGK2(JA))    !5/13/97 FTN
              LAM2 = FF(T1(K,I),AGT3(JA),AGT4(JA),AGK3(JA),AGK4(JA))    !5/13/97 FTN
              AGRMR(K,I,JA) = LAM1/(1.0+LAM1-AGK1(JA))                  !5/13/97 FTN
              AGRMF(K,I,JA) = LAM2/(1.0+LAM2-AGK4(JA))                  !5/13/97 FTN
            END DO                                                      !5/13/97 FTN
            T1(K,I) = T1_ORIG                                           !2/27/01 FTN
          END DO
        END DO
      END
      REAL FUNCTION FR(TT,TT1,TT2,K1,K2)                                !2/02/95 FTN
        REAL K1, K2                                                     !2/02/95 FTN
        FR = K1*EXP(LOG(K2*(1.0-K1)/(K1*(1.0-K2)))/(TT2-TT1)*(TT-TT1))  !2/02/95 FTN
      END                                                               !2/02/95 FTN
      REAL FUNCTION FF(TT,TT3,TT4,K3,K4)                                !2/02/95 FTN
        REAL K3, K4                                                     !2/02/95 FTN
        FF = K4*EXP(LOG(K3*(1.0-K4)/(K4*(1.0-K3)))/(TT4-TT3)*(TT4-TT))  !2/02/95 FTN
      END                                                               !2/02/95 FTN

************************************************************************
**      S U B R O U T I N E   D E C A Y   C O N S T A N T S         **
************************************************************************

C     SUBROUTINE DECAY_CONSTANTS                                        !2/27/01 FTN
      SUBROUTINE DECAY_CONSTANTS (JDAY, SNP, CBOD_ON_OFF)               !2/27/01 FTN
        INCLUDE 'w2.inc'

******* Variable declaration

        REAL LRFDK, LABDK, NH3DK, NO3DK, NH3D, NO3D, NH3RM, NH3REL,
     .       NO3RM, KBOD
        REAL JDAY                                                       !2/27/01 FTN
        INTEGER SNP                                                     !2/27/01 FTN
        CHARACTER CBOD_ON_OFF*3                                         !2/27/01 FTN
        DIMENSION ASETL(NAP)                                            !5/13/97 FTN

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /SETLC2/ SSETL, DSETL,   ASETL, FESETL
```

```
      COMMON /ORGDKC/ SEDDK, DETDK,   LABDK, REFDK,   LRFDK
      COMMON /NITROC/ BION,  PARTN,   NH3DK, NH3REL,  NO3DK
      COMMON /CBODC/  KBOD,  TBOD,    RBOD
      COMMON /GLBLCC/ PALT,  ALGDET,  O2LIM, WIND,    WSCDP, WSC(NDP)
      COMMON /DKORGC/ DETD(KMC,IMC),  ORGD(KMC,IMC)
      COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC),  SOD(IMP)
      COMMON /DKNITC/ NH3D(KMC,IMC),  NO3D(KMC,IMC)
      COMMON /DKBODC/ CBODD(KMC,IMC)
      COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),    A3(KMC,IMC)
      COMMON /GBLRTC/ OMRM(KMC,IMC),  NH3RM(KMC,IMC), NO3RM(KMC,IMC),
C    .                AGRMR(KMC,IMC), AGRMF(KMC,IMC)                  !5/13/97 FTN
     .                 AGRMR(KMC,IMC,NAP), AGRMF(KMC,IMC,NAP)         !5/13/97 FTN
      COMMON /GEOMHC/ EL(KMP),        H(KMP),         HKT1(IMP),
     .                 HKT2(IMP)
      COMMON /GEOMBC/ B(KMP,IMP),     BKT(IMP),       BH(KMP,IMP),
     .                 BHKT1(IMP),    BHKT2(IMP),     BHRKT1(IMP)
      COMMON /SETLC1/ SETIN(KMC,IMC), SETOUT(KMC,IMC)
      COMMON /TEMPC/  T1(KMP,IMP),    T2(KMP,IMP)

      DO I=IU,ID
        DO K=KT,KB(I)
          A1(K,I)    = (1.0+SIGN(1.0,DO(K,I)-O2LIM))*0.5
          A2(K,I)    = (1.0+SIGN(1.0,O2LIM-DO(K,I)))*0.5
          A3(K,I)    = (1.0+SIGN(1.0,DO(K,I)-1.E-10))*0.5
          ORGD(K,I)  = OMRM(K,I)*(LABDK*LABDOM(K,I)+REFDK
     .                 *REFDOM(K,I))*A3(K,I)
          NH3D(K,I)  = NH3DK*NH3RM(K,I)*NH3(K,I)*A1(K,I)
          NO3D(K,I)  = NO3DK*NO3RM(K,I)*NO3(K,I)*A2(K,I)
C                                                                     !2/27/01 FTN
          IF (T1(K,I).LT.0.1 .OR. T1(K,I).GT.40.0) THEN               !4/18/01 FTN
            IF (CBOD_ON_OFF.EQ.' ON') WRITE (SNP,3150) JDAY, I, K,    !2/27/01 FTN
     &                                        T1(K,I), T2(K,I)       !2/27/01 FTN
 3150       FORMAT (/,' WARNING! --> Water temp (T1) is < 0.1 C or',  !4/18/01 FTN
     &                ' > 40 C in DECAY_CONSTANTS subroutine',/,13X,  !4/18/01 FTN
     &                ' JDAY=',F6.2,'   Segment=',I2,'   Layer=',I2,  !2/27/01 FTN
     &                '   T1=',E9.2,'   T2=',E9.2)                    !2/27/01 FTN
            TEMP = MIN(MAX(T1(K,I),0.1),40.0)                         !4/18/01 FTN
            CBODD(K,I) = KBOD*TBOD**(TEMP-20.0)*A3(K,I)               !2/27/01 FTN
          ELSE                                                        !2/27/01 FTN
            CBODD(K,I) = KBOD*TBOD**(T1(K,I)-20.0)*A3(K,I)
          END IF                                                      !2/27/01 FTN
C                                                                     !2/27/01 FTN
          DETD(K,I)  = DETDK*OMRM(K,I)*DETRIT(K,I)*A3(K,I)
          SEDD(K,I)  = SEDDK*OMRM(K,I)*SEDMNT(K,I)*A3(K,I)
        END DO
      END DO
      DO I=IU,ID
C       SETOUT(KT,I) = (SSETL*SS(KT,I)+FESETL*FE(KT,I))/HKT2(I)       !5/14/97 FTN
C    .                 *A1(KT,I)                                      !5/14/97 FTN
        SETOUT(KT,I) = (SSETL*SS(KT,I) + FESETL*FE(KT,I)*A1(KT,I))    !4/18/01 FTN
     &                 /HKT2(I)                                       !4/18/01 FTN
        SETIN(KT,I)  = 0.0                                            !5/14/98 FTN
        DO K=KT+1,KB(I)
          SETIN(K,I)  = SETOUT(K-1,I)
C         SETOUT(K,I) = (SSETL*SS(K,I)+FESETL*FE(K,I))/H(K)*A1(K,I)   !5/14/97 FTN
          SETOUT(K,I) = (SSETL*SS(K,I)+FESETL*FE(K,I)*A1(K,I))/H(K)   !4/18/01 FTN
        END DO
      END DO
      DO I=IU,ID
        SO2D(KT,I) = SOD(I)/BHKT2(I)*OMRM(KT,I)*(B(KTI(I),I)
     .               -B(KT+1,I))
        DO K=KT+1,KB(I)-1
          SO2D(K,I) = SOD(I)/BH(K,I)*OMRM(K,I)*(B(K,I)-B(K+1,I))
        END DO
```

```
          SO2D(KB(I),I) = SOD(I)/BH(KB(I),I)*OMRM(KB(I),I)*B(KB(I),I)
        END DO
      END

************************************************************************
**      S U B R O U T I N E   S U S P E N D E D   S O L I D S       **
************************************************************************

      SUBROUTINE SUSPENDED_SOLIDS
        INCLUDE 'w2.inc'
        DIMENSION ASETL(NAP)                                        !5/13/97 FTN

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /SETLC2/ SSETL,   DSETL,  ASETL,     FESETL
        COMMON /GEOMHC/ EL(KMP), H(KMP), HKT1(IMP), HKT2(IMP)

        DO I=IU,ID
          SSSS(KT,I) = -SSETL*SS(KT,I)/HKT2(I)
          DO K=KT+1,KB(I)
            SSSS(K,I) = SSETL*(SS(K-1,I)-SS(K,I))/H(K)
          END DO
        END DO
      END

************************************************************************
**              S U B R O U T I N E   C O L I F O R M               **
************************************************************************

      SUBROUTINE COLIFORM
        INCLUDE 'w2.inc'
        DIMENSION ASETL(NAP)                                        !5/13/97 FTN
        INTEGER   FREQUK                                            !5/14/97 FTN
        REAL    LTCOEF, COLTERM(3,KMP)                              !4/14/95 FTN

******* Common declaration

C       COMMON /CLFRMC/ COLQ10, COLDK                               !2/02/95 FTN
        COMMON /CLFRMC/ COLQ10, COLDK, COLKL, CSETL, COLTERM, CKSEG !4/23/95 FTN
        COMMON /GEOMHC/ EL(KMP),        H(KMP),         HKT1(IMP),  !2/02/95 FTN
     .                  HKT2(IMP)                                   !2/02/95 FTN
        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /TEMPC/  T1(KMP,IMP), T2(KMP,IMP)

        COMMON /PHYTC2/ BETA,   EXH2O,  EXINOR, EXORG, FREQUK, ALGLIT  !6/16/98 FTN
        COMMON /SETLC2/ SSETL,  DSETL,  ASETL,  FESETL                 !2/02/95 FTN
        COMMON /TVDMTC/ TAIR,   TDEW,   CLOUD,  PHI,    ET,     CSHE,  !2/02/95 FTN
     .                  SRO,    LAT,    LONG                           !2/02/95 FTN
C                                                                     !2/02/95 FTN
C       Convert solar radiation as used in PHYTOPLANKTON subroutine   !2/02/95 FTN
C       (SRO*4.186E6, W/m2) to cal/cm2/hr.  Then calculate decay rate  !2/02/95 FTN
C       due to light and add that term and a settling term to COLSS.  !2/02/95 FTN
C       Use the depth to the middle of the layer for light extinction. !2/02/95 FTN
C                                                                     !2/02/95 FTN
        LTCOEF = (1.0-BETA)*SRO*4.186E6 * 0.08604                     !2/02/95 FTN
        DO I=IU,ID
          DO K=KT,KB(I)
            IF (K.EQ.KT) THEN                                         !2/02/95 FTN
               DEPTH = HKT2(I)/2.                                     !2/02/95 FTN
               SETTLE = -CSETL*COLFRM(KT,I)/HKT2(I)                   !2/02/95 FTN
            ELSE                                                      !2/02/95 FTN
               DEPTH = DEPTH + H(K)                                   !2/02/95 FTN
               SETTLE = CSETL*(COLFRM(K-1,I)-COLFRM(K,I))/H(K)        !2/02/95 FTN
```

```
          END IF                                                  !2/02/95 FTN
          TOTALG = 0.0                                            !6/27/97 FTN
          DO JA=1,NAP                                             !5/16/97 FTN
            TOTALG = TOTALG + ALGAE(K,I,JA)                       !5/16/97 FTN
          END DO                                                  !5/16/97 FTN
C         GAMMA = EXH2O+EXINOR*SS(K,I)+EXORG*(ALGAE(K,I)+DETRIT(K,I)) !2/02/95 FTN
          GAMMA = EXH2O+EXINOR*SS(K,I)+EXORG*    (TOTALG+DETRIT(K,I)) !5/16/97 FTN
          COLSS(K,I) = -COLDK*COLQ10**(T1(K,I)-20.0)*COLFRM(K,I)
     &                 -COLKL*LTCOEF*EXP(-GAMMA*DEPTH)*COLFRM(K,I)    !4/24/95 FTN
     &                 +SETTLE                                      !2/02/95 FTN
          IF (I.EQ.NINT(CKSEG)) THEN                              !4/23/95 FTN
            COLTERM(1,K) = -COLDK*COLQ10**(T1(K,I)-20.0)*COLFRM(K,I)  !4/14/95 FTN
            COLTERM(2,K) = -COLKL*LTCOEF*EXP(-GAMMA*DEPTH)*COLFRM(K,I)!4/24/95 FTN
            COLTERM(3,K) = SETTLE                                 !4/14/95 FTN
          END IF                                                  !4/14/95 FTN
        END DO
      END DO
    END

*************************************************************************
**          S U B R O U T I N E   L A B I L E   D O M              **
*************************************************************************

      SUBROUTINE LABILE_DOM
        INCLUDE 'w2.inc'

******* Variable declaration

        REAL LABDK, LRFDK, NH3RM, NO3RM

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /GLBLCC/ PALT,  ALGDET, O2LIM, WIND,  WSCDP, WSC(NDP)
        COMMON /ORGDKC/ SEDDK, DETDK,  LABDK, REFDK, LRFDK
        COMMON /GBLRTC/ OMRM(KMC,IMC),  NH3RM(KMC,IMC), NO3RM(KMC,IMC),
C    .                  AGRMR(KMC,IMC), AGRMF(KMC,IMC)                 !5/13/97 FTN
     .                  AGRMR(KMC,IMC,NAP), AGRMF(KMC,IMC,NAP)         !5/13/97 FTN
        COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),    A3(KMC,IMC)
C       COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),  !5/14/97 FTN
C    .                  AER(KMC,IMC)                                   !5/14/97 FTN
        COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),            !5/14/97 FTN
     .                  AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)             !5/14/97 FTN

        DO I=IU,ID
          DO K=KT,KB(I)
            DECAY       = OMRM(K,I)*A3(K,I)*(LABDK+LRFDK)*LABDOM(K,I)
C           ALGP        = (AER(K,I)+(1.0-ALGDET)*AMR(K,I))*ALGAE(K,I)  !5/14/97 FTN
            ALGP = 0.0                                                 !5/14/97 FTN
            DO JA=1,NAP                                                !5/14/97 FTN
              ALGP = ALGP + ( AER(K,I,JA) + (1.0-ALGDET)*AMR(K,I,JA) ) !5/14/97 FTN
     &                                          * ALGAE(K,I,JA)       !5/14/97 FTN
            END DO                                                     !5/14/97 FTN
            LDOMSS(K,I) = ALGP-DECAY
          END DO
        END DO
      END

*************************************************************************
**        S U B R O U T I N E   R E F R A C T O R Y   D O M        **
*************************************************************************

      SUBROUTINE REFRACTORY_DOM
        INCLUDE 'w2.inc'
```

```
******* Variable declaration

        REAL LRFDK, LABDK, NH3RM, NO3RM

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /ORGDKC/ SEDDK, DETDK, LABDK, REFDK, LRFDK
        COMMON /GBLRTC/ OMRM(KMC,IMC),  NH3RM(KMC,IMC), NO3RM(KMC,IMC),
C    .                  AGRMR(KMC,IMC), AGRMF(KMC,IMC)                  !5/13/97 FTN
     .                  AGRMR(KMC,IMC,NAP), AGRMF(KMC,IMC,NAP)          !5/13/97 FTN
        COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),    A3(KMC,IMC)

        DO I=IU,ID
          DO K=KT,KB(I)
            RDOMSS(K,I) = OMRM(K,I)*(LRFDK*LABDOM(K,I)-REFDK
     .                    *REFDOM(K,I))*A3(K,I)
          END DO
        END DO
      END

************************************************************************
**         S U B R O U T I N E   P H Y T O P L A N K T O N          **
************************************************************************

      SUBROUTINE PHYTOPLANKTON
        INCLUDE 'w2.inc'

******* Variable declaration

C       REAL      LAM1, LAM2,   LTCOEF, LLIM,   NLIM,  LIMIT, NETSET,   !5/14/97 FTN
        REAL      LAM1, LAM2,   LTCOEF, LLIM,   NLIM,  LIMIT,           !5/14/97 FTN
     .            LAT,  LONG,   NH3DK,  NH3REL, NO3DK, NH3RM, NO3RM
C       CHARACTER LF*3, LFAC*4, LFPR*7                                  !5/14/97 FTN
        CHARACTER       LFAC*4, LFPR*7                                  !5/14/97 FTN
        INTEGER   FREQUK                                                !5/14/97 FTN
        DIMENSION AGROW(NAP),  AMORT(NAP), AEXCR(NAP), ARESP(NAP),      !5/13/97 FTN
     &            ASETL(NAP),  AHSP(NAP),  AHSN(NAP),  AHSSI(NAP),      !5/13/97 FTN
     &            ASATUR(NAP), ABIOP(NAP), ABION(NAP), ABIOSI(NAP),     !5/13/97 FTN
     &            ABIOC(NAP)                                            !5/13/97 FTN

******* Common declaration

        COMMON /PHYTC1/ AEXCR,  AMORT,  AGROW,  ARESP,  ASATUR, AHSN,
C    .                  AHSP                                            !5/13/97 FTN
     .                  AHSP,   AHSSI                                   !5/13/97 FTN
C       COMMON /PHYTC2/ BETA,   EXH2O,  EXINOR, EXORG                   !5/14/97 FTN
        COMMON /PHYTC2/ BETA,   EXH2O,  EXINOR, EXORG, FREQUK, ALGLIT   !6/16/98 FTN
        COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                   !5/14/97 FTN
        COMMON /SETLC2/ SSETL,  DSETL,  ASETL,  FESETL
        COMMON /GLOBLC/ JB,     JC,     IU,     ID,     KT,     ELKT,
     .                  DLT,    KB(IMP),KTI(IMP)
        COMMON /TVDMTC/ TAIR,   TDEW,   CLOUD,  PHI,    ET,     CSHE,
     .                  SRO,    LAT,    LONG
        COMMON /PHOSPC/ PO4REL, BIOP,   PARTP
        COMMON /NITROC/ BION,   PARTN,  NH3DK,  NH3REL, NO3DK
C       COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C    .                  AER(KMC,IMC)                                    !5/14/97 FTN
        COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
     .                  AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
C       COMMON /LFACC/  LFAC(KMC,IMC),  LFPR(KMC,IMC)                   !5/14/97 FTN
        COMMON /LFACC/  LFAC(KMC,IMC,NAP),  LFPR(KMC,IMC,NAP)           !5/14/97 FTN
        COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),    A3(KMC,IMC)
```

```
      COMMON /GBLRTC/ OMRM(KMC,IMC),  NH3RM(KMC,IMC), NO3RM(KMC,IMC),
C    .                AGRMR(KMC,IMC), AGRMF(KMC,IMC)                 !5/13/97 FTN
     .                AGRMR(KMC,IMC,NAP), AGRMF(KMC,IMC,NAP)         !5/13/97 FTN
      COMMON /GEOMHC/ EL(KMP),        H(KMP),         HKT1(IMP),
     .                HKT2(IMP)

C     LTCOEF = (1.0-BETA)*SRO*4.186E6/ASATUR                         !5/14/97 FTN
      DTKU = DLT * REAL(FREQUK)                                      !5/14/97 FTN
      DO I=IU,ID

********* Limiting factor

        TOT_PARTIC_ORG = DETRIT(KT,I)                                !5/14/97 FTN
        DO JA=1,NAP                                                  !5/14/97 FTN
          TOT_PARTIC_ORG = TOT_PARTIC_ORG + ALGAE(KT,I,JA)           !5/14/97 FTN
        END DO                                                       !5/14/97 FTN
        GAMMA = EXH2O+EXINOR*SS(KT,I)+EXORG*TOT_PARTIC_ORG           !5/14/97 FTN
C       GAMMA = EXH2O+EXINOR*SS(KT,I)+EXORG*(ALGAE(KT,I)+DETRIT(KT,I))!5/14/97 FTN
        DEPTH = HKT2(I)                                              !5/14/97 FTN
C       LAM1  = LTCOEF                                               !5/14/97 FTN
C       LAM2  = LTCOEF*EXP(-GAMMA*DEPTH)                             !5/14/97 FTN
C       LLIM  = 2.718282*(EXP(-LAM2)-EXP(-LAM1))/(GAMMA*HKT2(I))     !5/14/97 FTN
C       PLIM  = PO4(KT,I)/(PO4(KT,I)+AHSP)                           !5/14/97 FTN
C       NLIM  = (NH3(KT,I)+NO3(KT,I))/(NH3(KT,I)+NO3(KT,I)+AHSN)     !5/14/97 FTN
C       LIMIT = MIN(PLIM,NLIM,LLIM)                                  !5/14/97 FTN
C       IF (LIMIT.EQ.PLIM) THEN                                      !5/14/97 FTN
C         WRITE (LFAC(KT,I),'(F4.3)') PLIM                           !5/14/97 FTN
C         LF         = ' P '                                         !5/14/97 FTN
C         LFPR(KT,I) = LF//LFAC(KT,I)                                !5/14/97 FTN
C       ELSE IF (LIMIT.EQ.NLIM) THEN                                 !5/14/97 FTN
C         WRITE (LFAC(KT,I),'(F4.3)') NLIM                           !5/14/97 FTN
C         LF         = ' N '                                         !5/14/97 FTN
C         LFPR(KT,I) = LF//LFAC(KT,I)                                !5/14/97 FTN
C       ELSE IF (LIMIT.EQ.LLIM) THEN                                 !5/14/97 FTN
C         WRITE (LFAC(KT,I),'(F4.3)') LLIM                           !5/14/97 FTN
C         LF         = ' L '                                         !5/14/97 FTN
C         LFPR(KT,I) = LF//LFAC(KT,I)                                !5/14/97 FTN
C       END IF                                                       !5/14/97 FTN
C                                                                    !5/14/97 FTN
        DO JA=1,NAP                                                  !5/14/97 FTN
          LTCOEF = (1.0-BETA) * SRO * 4.186E6 / ASATUR(JA)           !5/14/97 FTN
          LAM1 = LTCOEF                                              !5/14/97 FTN
          LAM2 = LTCOEF * EXP(-GAMMA*DEPTH)                          !5/14/97 FTN
          LLIM = 2.718282 * (EXP(-LAM2)-EXP(-LAM1)) / (GAMMA*HKT2(I)) !5/14/97 FTN
          PLIM = PO4(KT,I) / ( PO4(KT,I)+AHSP(JA)+1.0E-20 )          !5/14/97 FTN
          NLIM = ( NH3(KT,I)+NO3(KT,I) ) /                           !5/14/97 FTN
     &           ( NH3(KT,I)+NO3(KT,I)+AHSN(JA)+1.0E-20 )            !5/14/97 FTN
          SLIM = SI(KT,I) / ( SI(KT,I)+AHSSI(JA)+1.0E-20 )           !5/16/97 FTN
          LIMIT = MIN (PLIM, NLIM, SLIM, LLIM)                       !5/14/97 FTN
          IF (ABS(LIMIT-PLIM).LT.1.0E-9) THEN                        !5/14/97 FTN
            WRITE (LFAC(KT,I,JA),'(F4.3)') PLIM                      !5/14/97 FTN
            LFPR(KT,I,JA) = ' P '//LFAC(KT,I,JA)                     !5/14/97 FTN
          ELSEIF (ABS(LIMIT-NLIM).LT.1.0E-9) THEN                    !5/14/97 FTN
            WRITE (LFAC(KT,I,JA),'(F4.3)') NLIM                      !5/14/97 FTN
            LFPR(KT,I,JA) = ' N '//LFAC(KT,I,JA)                     !5/14/97 FTN
          ELSEIF (ABS(LIMIT-SLIM).LT.1.0E-9) THEN                    !5/14/97 FTN
            WRITE (LFAC(KT,I,JA),'(F4.3)') SLIM                      !5/14/97 FTN
            LFPR(KT,I,JA) = ' S '//LFAC(KT,I,JA)                     !5/14/97 FTN
          ELSEIF (ABS(LIMIT-LLIM).LT.1.0E-9) THEN                    !5/14/97 FTN
            WRITE (LFAC(KT,I,JA),'(F4.3)') LLIM                      !5/14/97 FTN
            LFPR(KT,I,JA) = ' L '//LFAC(KT,I,JA)                     !5/14/97 FTN
          END IF                                                     !5/14/97 FTN

********* Sources/sinks
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```
            ARR(KT,I,JA) = AGRMR(KT,I,JA) * AGRMF(KT,I,JA) * ARESP(JA)  !5/14/97 FTN
     &                                                     * A3(KT,I)   !5/14/97 FTN
            AMR(KT,I,JA) = (AGRMR(KT,I,JA) + 1.0-AGRMF(KT,I,JA))        !5/14/97 FTN
     &                                                     * AMORT(JA)  !5/14/97 FTN
            AA1 = AGRMR(KT,I,JA) * AGRMF(KT,I,JA) * AGROW(JA) * LIMIT   !5/14/97 FTN
            AA2 = PO4(KT,I) / ( ABIOP(JA)*DTKU*ALGAE(KT,I,JA)+1.0E-20 ) !5/14/97 FTN
            AA3 = ( NH3(KT,I)+NO3(KT,I) ) /                             !5/14/97 FTN
     &            ( ABION(JA)*DTKU*ALGAE(KT,I,JA)+1.0E-20 )             !5/14/97 FTN
            AGR(KT,I,JA) = MIN (AA1, AA2, AA3)                          !5/14/97 FTN
            AER(KT,I,JA) = MIN ( (1.0-LLIM)*AEXCR(JA), AGR(KT,I,JA) )   !5/14/97 FTN
            ALGSS(KT,I,JA) = ( AGR(KT,I,JA)                             !5/14/97 FTN
     &                       - ARR(KT,I,JA)                             !5/14/97 FTN
     &                       - AER(KT,I,JA)                             !5/14/97 FTN
     &                       - AMR(KT,I,JA)                             !5/14/97 FTN
     &                       - ASETL(JA)/HKT2(I) ) * ALGAE(KT,I,JA)     !5/14/97 FTN
          END DO                                                        !5/14/97 FTN
C         ARR(KT,I)   = AGRMR(KT,I)*AGRMF(KT,I)*ARESP*A3(KT,I)          !5/14/97 FTN
C         AMR(KT,I)   = (AGRMR(KT,I)+1.0-AGRMF(KT,I))*AMORT             !5/14/97 FTN
C         AGR(KT,I)   = AGRMR(KT,I)*AGRMF(KT,I)*AGROW*LIMIT             !5/14/97 FTN
C         AGR(KT,I)   = MIN(AGR(KT,I),PO4(KT,I)/(BIOP*DLT*ALGAE(KT,I)   !5/14/97 FTN
C    .                +1.0E-20),(NH3(KT,I)+NO3(KT,I))/(BION*DLT        !5/14/97 FTN
C    .                *ALGAE(KT,I)+1.0E-20))                           !5/14/97 FTN
C         AER(KT,I)   = MIN((1.0-LLIM)*AEXCR,AGR(KT,I))                 !5/14/97 FTN
C         GROWTH      = (AGR(KT,I)-ARR(KT,I)-AER(KT,I)-AMR(KT,I))       !5/14/97 FTN
C    .                *ALGAE(KT,I)                                     !5/14/97 FTN
C         NETSET      = -ASETL*ALGAE(KT,I)/HKT2(I)                      !5/14/97 FTN
C         ALGSS(KT,I) = GROWTH+NETSET                                   !5/14/97 FTN
          DO K=KT+1,KB(I)

*********** Limiting factor

            TOT_PARTIC_ORG = DETRIT(K,I)                                !5/14/97 FTN
            DO JA=1,NAP                                                 !5/14/97 FTN
              TOT_PARTIC_ORG = TOT_PARTIC_ORG + ALGAE(K,I,JA)           !5/14/97 FTN
            END DO                                                      !5/14/97 FTN
            GAMMA = EXH2O+EXINOR*SS(K,I)+EXORG*TOT_PARTIC_ORG           !5/14/97 FTN
C           GAMMA = EXH2O+EXINOR*SS(K,I)+EXORG*(ALGAE(K,I)+DETRIT(K,I)) !5/14/97 FTN
C           LAM1  = LTCOEF*EXP(-GAMMA*DEPTH)                            !5/14/97 FTN
C           LAM2  = LTCOEF*EXP(-GAMMA*(DEPTH+H(K)))                     !5/14/97 FTN
C           LLIM  = 2.718282*(EXP(-LAM2)-EXP(-LAM1))/(GAMMA*H(K))       !5/14/97 FTN
C           DEPTH = DEPTH+H(K)                                          !5/14/97 FTN
C           PLIM  = PO4(K,I)/(PO4(K,I)+AHSP)                            !5/14/97 FTN
C           NLIM  = (NH3(K,I)+NO3(K,I))/(NH3(K,I)+NO3(K,I)+AHSN)        !5/14/97 FTN
C           LIMIT = MIN(PLIM,NLIM,LLIM)                                 !5/14/97 FTN
C           IF (LIMIT.EQ.PLIM) THEN                                     !5/14/97 FTN
C             WRITE (LFAC(K,I),'(F4.3)') PLIM                           !5/14/97 FTN
C             LF        = ' P '                                         !5/14/97 FTN
C             LFPR(K,I) = LF//LFAC(K,I)                                 !5/14/97 FTN
C           ELSE IF (LIMIT.EQ.NLIM) THEN                                !5/14/97 FTN
C             WRITE (LFAC(K,I),'(F4.3)') NLIM                           !5/14/97 FTN
C             LF        = ' N '                                         !5/14/97 FTN
C             LFPR(K,I) = LF//LFAC(K,I)                                 !5/14/97 FTN
C           ELSE IF (LIMIT.EQ.LLIM) THEN                                !5/14/97 FTN
C             WRITE (LFAC(K,I),'(F4.3)') LLIM                           !5/14/97 FTN
C             LF        = ' L '                                         !5/14/97 FTN
C             LFPR(K,I) = LF//LFAC(K,I)                                 !5/14/97 FTN
C           END IF                                                      !5/14/97 FTN
            DO JA=1,NAP                                                 !5/14/97 FTN
              LTCOEF = (1.0-BETA) * SRO * 4.186E6 / ASATUR(JA)          !5/14/97 FTN
              LAM1 = LTCOEF * EXP(-GAMMA*DEPTH)                         !5/14/97 FTN
              LAM2 = LTCOEF * EXP(-GAMMA*(DEPTH+H(K)))                  !5/14/97 FTN
              LLIM = 2.718282 * (EXP(-LAM2)-EXP(-LAM1)) / (GAMMA*H(K))  !5/14/97 FTN
              PLIM = PO4(K,I) / ( PO4(K,I)+AHSP(JA)+1.0E-20 )           !5/14/97 FTN
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```
              NLIM = ( NH3(K,I)+NO3(K,I) ) /                          !5/14/97 FTN
     &               ( NH3(K,I)+NO3(K,I)+AHSN(JA)+1.0E-20 )           !5/14/97 FTN
              SLIM = SI(K,I) / ( SI(K,I)+AHSSI(JA)+1.0E-20 )          !5/16/97 FTN
              LIMIT = MIN (PLIM, NLIM, SLIM, LLIM)                    !5/14/97 FTN
              IF (ABS(LIMIT-PLIM).LT.1.0E-9) THEN                     !5/14/97 FTN
                WRITE (LFAC(K,I,JA),'(F4.3)') PLIM                    !5/14/97 FTN
                LFPR(K,I,JA) = ' P '//LFAC(K,I,JA)                    !5/14/97 FTN
              ELSEIF (ABS(LIMIT-NLIM).LT.1.0E-9) THEN                 !5/14/97 FTN
                WRITE (LFAC(K,I,JA),'(F4.3)') NLIM                    !5/14/97 FTN
                LFPR(K,I,JA) = ' N '//LFAC(K,I,JA)                    !5/14/97 FTN
              ELSEIF (ABS(LIMIT-SLIM).LT.1.0E-9) THEN                 !5/14/97 FTN
                WRITE (LFAC(K,I,JA),'(F4.3)') SLIM                    !5/14/97 FTN
                LFPR(K,I,JA) = ' S '//LFAC(K,I,JA)                    !5/14/97 FTN
              ELSEIF (ABS(LIMIT-LLIM).LT.1.0E-9) THEN                 !5/14/97 FTN
                WRITE (LFAC(K,I,JA),'(F4.3)') LLIM                    !5/14/97 FTN
                LFPR(K,I,JA) = ' L '//LFAC(K,I,JA)                    !5/14/97 FTN
              END IF                                                  !5/14/97 FTN

*********** Sources/sinks

              ARR(K,I,JA) = AGRMR(K,I,JA) * AGRMF(K,I,JA) * ARESP(JA)  !5/14/97 FTN
     &                                                  * A3(K,I)     !5/14/97 FTN
              AMR(K,I,JA) = (AGRMR(K,I,JA) + 1.0-AGRMF(K,I,JA))       !5/14/97 FTN
     &                                                  * AMORT(JA)   !5/14/97 FTN
              AA1 = AGRMR(K,I,JA) * AGRMF(K,I,JA) * AGROW(JA) * LIMIT  !5/14/97 FTN
              AA2 = PO4(K,I) / ( ABIOP(JA)*DTKU*ALGAE(K,I,JA)+1.0E-20 ) !5/14/97 FTN
              AA3 = ( NH3(K,I)+NO3(K,I) ) /                           !5/14/97 FTN
     &              ( ABION(JA)*DTKU*ALGAE(K,I,JA)+1.0E-20 )          !5/14/97 FTN
              AGR(K,I,JA) = MIN (AA1, AA2, AA3)                       !5/14/97 FTN
              AER(K,I,JA) = MIN ( (1.0-LLIM)*AEXCR(JA), AGR(K,I,JA) )  !5/14/97 FTN
              ALGSS(K,I,JA) = ( AGR(K,I,JA)                           !5/14/97 FTN
     &                        - ARR(K,I,JA)                           !5/14/97 FTN
     &                        - AER(K,I,JA)                           !5/14/97 FTN
     &                        - AMR(K,I,JA)                           !5/14/97 FTN
     &                        - ASETL(JA)/H(K) ) * ALGAE(K,I,JA)      !5/14/97 FTN
     &                        + ASETL(JA)/H(K) * ALGAE(K-1,I,JA)      !5/14/97 FTN
            END DO                                                    !5/14/97 FTN
C                                                                     !6/16/98 FTN
C           If the available light is below the user specified minimum  !6/16/98 FTN
C           level (e.g., 1%), then set the algae source/sink terms such !6/16/98 FTN
C           that the algae concentrations will go to zero by the next   !6/16/98 FTN
C           time the kinetic routines are updated (assume that algae is !6/16/98 FTN
C           converted to detritus).  Increase the detritus source/sink  !6/16/98 FTN
C           term to account for the addition of the algae.              !6/16/98 FTN
C                                                                       !6/16/98 FTN
            IF (EXP(-GAMMA*DEPTH).LE.ALGLIT) THEN                     !6/16/98 FTN
              DO JA=1,NAP                                             !6/16/98 FTN
                LFPR(K,I,JA) = ' Detrit'                              !6/16/98 FTN
                ALGSS(K,I,JA) = -ALGAE(K,I,JA)/DTKU                   !6/16/98 FTN
                DETSS(K,I) = DETSS(K,I) + ALGAE(K,I,JA)/DTKU          !6/16/98 FTN
              END DO                                                  !6/16/98 FTN
            END IF                                                    !6/16/98 FTN
            DEPTH = DEPTH+H(K)                                        !5/14/97 FTN
C           ARR(K,I)   = AGRMR(K,I)*AGRMF(K,I)*ARESP*A3(K,I)
C           AMR(K,I)   = (AGRMR(K,I)+1.0-AGRMF(K,I))*AMORT
C           AGR(K,I)   = AGRMR(K,I)*AGRMF(K,I)*AGROW*LIMIT
C           AGR(K,I)   = MIN(AGR(K,I),PO4(K,I)/(BIOP*DLT*ALGAE(K,I)
C    .                   +1.0E-20),(NH3(K,I)+NO3(K,I))/(BION*DLT
C    .                   *ALGAE(K,I)+1.0E-20))
C           AER(K,I)   = MIN((1.0-LLIM)*AEXCR,AGR(K,I))
C           GROWTH     = (AGR(K,I)-ARR(K,I)-AER(K,I)-AMR(K,I))
C    .                   *ALGAE(K,I)
C           NETSET     = ASETL*(ALGAE(K-1,I)-ALGAE(K,I))/H(K)
C           ALGSS(K,I) = GROWTH+NETSET
```

```
          END DO
        END DO
      END

************************************************************************
**              S U B R O U T I N E   D E T R I T U S              **
************************************************************************

      SUBROUTINE DETRITUS
        INCLUDE 'w2.inc'

******* Variable declaration

        REAL NETSET
        DIMENSION ASETL(NAP)                                          !5/13/97 FTN

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /GLBLCC/ PALT,  ALGDET, O2LIM, WIND, WSCDP, WSC(NDP)
        COMMON /SETLC2/ SSETL, DSETL,  ASETL, FESETL
        COMMON /DKORGC/ DETD(KMC,IMC), ORGD(KMC,IMC)
C       COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C    .                  AER(KMC,IMC)                                    !5/14/97 FTN
        COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
     .                  AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
        COMMON /GEOMHC/ EL(KMP),       H(KMP),       HKT1(IMP),
     .                  HKT2(IMP)

        DO I=IU,ID
          ALGP = 0.0                                                  !5/14/97 FTN
          DO JA=1,NAP                                                 !5/14/97 FTN
            ALGP = ALGP + ALGDET*AMR(KT,I,JA)*ALGAE(KT,I,JA)          !5/14/97 FTN
          END DO                                                      !5/14/97 FTN
C         ALGP        = ALGDET*AMR(KT,I)*ALGAE(KT,I)                  !5/14/97 FTN
          NETSET      = -DSETL*DETRIT(KT,I)/HKT2(I)
          DETSS(KT,I) = ALGP-DETD(KT,I)+NETSET
          DO K=KT+1,KB(I)
            ALGP = 0.0                                                !5/14/97 FTN
            DO JA=1,NAP                                               !5/14/97 FTN
              ALGP = ALGP + ALGDET*AMR(K,I,JA)*ALGAE(K,I,JA)          !5/14/97 FTN
            END DO                                                    !5/14/97 FTN
C           ALGP       = ALGDET*AMR(K,I)*ALGAE(K,I)                   !5/14/97 FTN
            NETSET     = DSETL*(DETRIT(K-1,I)-DETRIT(K,I))/H(K)
            DETSS(K,I) = ALGP-DETD(K,I)+NETSET
          END DO
        END DO
      END

************************************************************************
**              S U B R O U T I N E   P H O S P H O R U S          **
************************************************************************

      SUBROUTINE PHOSPHORUS
        INCLUDE 'w2.inc'
        DIMENSION  ABIOP(NAP), ABION(NAP), ABIOSI(NAP), ABIOC(NAP)      !5/14/97 FTN

******* Common declaration

        COMMON /PHOSPC/ PO4REL, BIOP, PARTP
        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /SETLC1/ SETIN(KMC,IMC), SETOUT(KMC,IMC)
        COMMON /DKORGC/ DETD(KMC,IMC),  ORGD(KMC,IMC)
        COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)
```

```
      COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),   A3(KMC,IMC)
C     COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C    .                AER(KMC,IMC)                                    !5/14/97 FTN
      COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
    .                 AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
      COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                   !5/14/97 FTN

      DO I=IU,ID
        DO K=KT,KB(I)
          ALGPROC = 0.0                                               !5/14/97 FTN
          DO JA=1,NAP                                                 !5/14/97 FTN
            ALGPROC = ALGPROC + (ARR(K,I,JA) - AGR(K,I,JA))           !5/14/97 FTN
    &                         * ALGAE(K,I,JA) * ABIOP(JA)             !5/14/97 FTN
          END DO                                                      !5/14/97 FTN
C         ALGP       = (ARR(K,I)-AGR(K,I))*ALGAE(K,I)                 !5/14/97 FTN
C         PO4SS(K,I) = BIOP*(ALGP+DETD(K,I)+ORGD(K,I)+SEDD(K,I))      !5/14/97 FTN
          PO4SS(K,I) = BIOP*     (DETD(K,I)+ORGD(K,I)+SEDD(K,I))      !5/14/97 FTN
    .                  +PO4REL*SO2D(K,I)*A2(K,I)+PARTP*(SETIN(K,I)
    .                  *PO4(K-1,I)-SETOUT(K,I)*PO4(K,I))
    &                  +ALGPROC                                       !5/14/97 FTN
        END DO
      END DO
     END

**********************************************************************
**             S U B R O U T I N E   A M M O N I U M              **
**********************************************************************

     SUBROUTINE AMMONIUM
      INCLUDE 'w2.inc'

******* Variable declaration

      REAL NH3REL, NH3D, NO3D, NH3DK, NO3DK
      REAL ABIOP(NAP), ABION(NAP), ABIOSI(NAP), ABIOC(NAP)            !5/14/97 FTN

******* Common declaration

      COMMON /NITROC/ BION, PARTN, NH3DK, NH3REL, NO3DK
      COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
      COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),   A3(KMC,IMC)
      COMMON /DKORGC/ DETD(KMC,IMC),  ORGD(KMC,IMC)
      COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)
      COMMON /DKNITC/ NH3D(KMC,IMC),  NO3D(KMC,IMC)
C     COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C    .                AER(KMC,IMC)                                    !5/14/97 FTN
      COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
    .                 AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
      COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                   !5/14/97 FTN

      DO I=IU,ID
        DO K=KT,KB(I)
          FRACNH3 = NH3(K,I) / ( NH3(K,I)+NO3(K,I)+1.0E-20 )          !5/14/97 FTN
          ALGPROC = 0.0                                               !5/14/97 FTN
          DO JA=1,NAP                                                 !5/14/97 FTN
            ALGPROC  = ALGPROC + (ARR(K,I,JA) - AGR(K,I,JA)*FRACNH3)  !5/14/97 FTN
    &                                 * ALGAE(K,I,JA) * ABION(JA)     !5/14/97 FTN
          END DO                                                      !5/14/97 FTN
C         ALGP       = (ARR(K,I)-AGR(K,I)*NH3(K,I)/(NH3(K,I)          !5/14/97 FTN
C    .                 +NO3(K,I)+1.0E-20))*ALGAE(K,I)                 !5/14/97 FTN
C         NH3SS(K,I) = BION*(ALGP+DETD(K,I)+ORGD(K,I)+SEDD(K,I))      !5/14/97 FTN
          NH3SS(K,I) = BION*     (DETD(K,I)+ORGD(K,I)+SEDD(K,I))      !5/14/97 FTN
    .                  +NH3REL*SO2D(K,I)*A2(K,I)-NH3D(K,I)
    &                  +ALGPROC                                       !5/14/97 FTN
```

```
          END DO
        END DO
      END

************************************************************************
**              S U B R O U T I N E   N I T R A T E                   **
************************************************************************

      SUBROUTINE NITRATE
        INCLUDE 'w2.inc'

******* Variable declaration

        REAL NH3D, NO3D, NH3DK, NO3DK, NH3REL
        REAL ABIOP(NAP), ABION(NAP), ABIOSI(NAP), ABIOC(NAP)           !5/14/97 FTN

******* Common declaration

        COMMON /NITROC/ BION, PARTN, NH3DK, NH3REL, NO3DK
        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /DKNITC/ NH3D(KMC,IMC), NO3D(KMC,IMC)
C       COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C     .                 AER(KMC,IMC)                                    !5/14/97 FTN
        COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
     .                  AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
        COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                   !5/14/97 FTN

        DO I=IU,ID
          DO K=KT,KB(I)
            FRACNO3 = 1.0 - ( NH3(K,I) / (NH3(K,I)+NO3(K,I)+1.0E-20) )  !5/14/97 FTN
            ALGC = 0.0                                                  !5/14/97 FTN
            DO JA=1,NAP                                                 !5/14/97 FTN
              ALGC = ALGC + ABION(JA)*FRACNO3*AGR(K,I,JA)*ALGAE(K,I,JA) !5/14/97 FTN
            END DO                                                      !5/14/97 FTN
C           ALGC       = BION*(1.0-NH3(K,I)/(NH3(K,I)+NO3(K,I)+1.0E-20))
C     .                  *AGR(K,I)*ALGAE(K,I)
            NO3SS(K,I) = NH3D(K,I)-NO3D(K,I)-ALGC
          END DO
        END DO
      END

************************************************************************
**      S U B R O U T I N E   D I S S O L V E D   O X Y G E N         **
************************************************************************

C     SUBROUTINE DISSOLVED_OXYGEN                                       !2/27/01 FTN
      SUBROUTINE DISSOLVED_OXYGEN (JDAY, SNP)                           !2/27/01 FTN
        INCLUDE 'w2.inc'

******* Variable declaration

        INTEGER SNP                                                     !2/27/01 FTN
        REAL    JDAY                                                    !2/27/01 FTN
        REAL    NH3D, KBOD, ICETH, NO3D
        LOGICAL ICE, ICE_CALC

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /GLBLCC/ PALT,   ALGDET, O2LIM, WIND, WSCDP, WSC(NDP)
        COMMON /OXYGNC/ O2ORG,  O2ALG,  O2NH3, O2RESP
        COMMON /CBODC/  KBOD,   TBOD,   RBOD
        COMMON /GEOMHC/ EL(KMP),        H(KMP),        HKT1(IMP),
     .                  HKT2(IMP)
```

```
      COMMON /ICEC/   ICE(IMP),       ICETH(IMP),    ICE_CALC
      COMMON /TEMPC/  T1(KMP,IMP),    T2(KMP,IMP)
      COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),   A3(KMC,IMC)
      COMMON /DKORGC/ DETD(KMC,IMC),  ORGD(KMC,IMC)
      COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)
      COMMON /DKNITC/ NH3D(KMC,IMC),  NO3D(KMC,IMC)
C     COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C    .                AER(KMC,IMC)                                    !5/14/97 FTN
      COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
     .                AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
      COMMON /DKBODC/ CBODD(KMC,IMC)

C     SATO(X) = EXP(7.7117-1.31403*(LOG(X+45.93)))*PALT               !2/02/95 FTN
C                                                                     !2/02/95 FTN
C     Use Kanwischer eqn (eqn B-19 in User Manual) for coefficient of !2/02/95 FTN
C     surface exchange for oxygen.  2E-9 is O2 diffusivity in m2/sec. !2/02/95 FTN
C                                                                     !2/02/95 FTN
C     O2EX    = (0.5+0.05*WIND*WIND)/86400.0                          !2/02/95 FTN
      O2EX    = 2.0E-9 / ( (200. - 60.*WIND**0.5) * 1.0E-6 )          !2/02/95 FTN
      DO I=IU,ID
        DOSS(KT,I) = 0.0
        DO K=KT,KB(I)
          ALGP = 0.0                                                  !5/14/97 FTN
          DO JA=1,NAP                                                 !5/14/97 FTN
            ALGP = ALGP + ( O2ALG*AGR(K,I,JA) - O2RESP*ARR(K,I,JA) )  !5/14/97 FTN
     &                                          * ALGAE(K,I,JA)      !5/14/97 FTN
          END DO                                                      !5/14/97 FTN
C         ALGP      = (O2ALG*AGR(K,I)-O2RESP*ARR(K,I))*ALGAE(K,I)     !5/14/97 FTN
          DOSS(K,I) = ALGP-O2NH3*NH3D(K,I)-O2ORG*(DETD(K,I)+SEDD(K,I))
     .                -SO2D(K,I)*A3(K,I)-O2ORG*ORGD(K,I)-CBODD(K,I)
     .                *CBOD(K,I)*RBOD
        END DO
        IF (T1(KT,I).LT.1.0 .OR. T1(KT,I).GT.35.0) THEN               !2/27/01 FTN
          WRITE (SNP,3160) JDAY, I, K, T1(KT,I), T2(KT,I)             !2/27/01 FTN
 3160     FORMAT (/,' WARNING! --> Water temp (T1) is < 1 C or >',    !2/27/01 FTN
     &            ' 35 C in DISSOLVED_OXYGEN subroutine',/,13X,       !2/27/01 FTN
     &            ' JDAY=',F6.2,'   Segment=',I2,'   Layer=',I2,      !2/27/01 FTN
     &            '   T1=',E9.2,'   T2=',E9.2)                        !2/27/01 FTN
          TEMP = MIN(MAX(T1(KT,I),1.0),35.0)                          !2/27/01 FTN
          SATDO = SATO(TEMP,PALT)                                     !2/27/01 FTN
        ELSE                                                          !2/27/01 FTN
C         SATDO = SATO(T1(KT,I))                                      !2/02/95 FTN
          SATDO = SATO(T1(KT,I),PALT)                                 !2/02/95 FTN
        END IF                                                        !2/27/01 FTN
        IF (.NOT.ICE(I)) DOSS(KT,I) = DOSS(KT,I)+(SATDO-DO(KT,I))*O2EX
     .                                /HKT2(I)
      END DO
    END
    REAL FUNCTION SATO (X,ALTCORR)                                    !2/02/95 FTN
    SATO = EXP(7.7117-1.31403*(LOG(X+45.93)))*ALTCORR                 !2/02/95 FTN
    END                                                               !2/02/95 FTN

************************************************************************
**              S U B R O U T I N E   S E D I M E N T               **
************************************************************************

    SUBROUTINE SEDIMENT
      INCLUDE 'w2.inc'
      INTEGER FREQUK                                                  !5/16/97 FTN
      DIMENSION ASETL(NAP)                                            !5/13/97 FTN

******* Common declaration

      COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
```

```
      COMMON /SETLC2/ SSETL,  DSETL,  ASETL,   FESETL
      COMMON /GEOMHC/ EL(KMP),        H(KMP),        HKT1(IMP),
     .                HKT2(IMP)
      COMMON /GEOMBC/ B(KMP,IMP),     BKT(IMP),      BH(KMP,IMP),
     .                BHKT1(IMP),     BHKT2(IMP),    BHRKT1(IMP)
      COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)
      COMMON /PHYTC2/ BETA,   EXH2O,  EXINOR, EXORG, FREQUK, ALGLIT   !6/16/98 FTN

      DTKU = DLT * REAL(FREQUK)                                       !5/14/97 FTN
      DO I=IU,ID
        ALGSET = 0.0                                                  !5/16/97 FTN
        DO JA=1,NAP                                                   !5/16/97 FTN
          ALGSET = ALGSET + ASETL(JA)*ALGAE(KT,I,JA)                  !5/16/97 FTN
        END DO                                                        !5/16/97 FTN
C       SETTLE       = (ASETL*ALGAE(KT,I)+DSETL*DETRIT(KT,I))*DLT     !5/16/97 FTN
        SETTLE       =            (ALGSET+DSETL*DETRIT(KT,I))*DLT     !5/16/97 FTN
     .                  /HKT2(I)*(1.0-B(KT+1,I)/BKT(I))
C       SEDMNT(KT,I) = MAX(SEDMNT(KT,I)+SETTLE-SEDD(KT,I)*DLT,0.0)    !5/16/97 FTN
        SEDMNT(KT,I) = MAX(SEDMNT(KT,I)+SETTLE-SEDD(KT,I)*DTKU,0.0)   !5/16/97 FTN
        DO K=KT+1,KB(I)-1
          ALGSET = 0.0                                                !5/16/97 FTN
          DO JA=1,NAP                                                 !5/16/97 FTN
            ALGSET = ALGSET + ASETL(JA)*ALGAE(K,I,JA)                 !5/16/97 FTN
          END DO                                                      !5/16/97 FTN
C         SETTLE      = (ASETL*ALGAE(K,I)+DSETL*DETRIT(K,I))*DLT/H(K) !5/16/97 FTN
          SETTLE      =           (ALGSET+DSETL*DETRIT(K,I))*DLT/H(K) !5/16/97 FTN
     .                   *(1.0-B(K+1,I)/B(K,I))
C         SEDMNT(K,I) = MAX(SEDMNT(K,I)+SETTLE-SEDD(K,I)*DLT,0.0)     !5/16/97 FTN
          SEDMNT(K,I) = MAX(SEDMNT(K,I)+SETTLE-SEDD(K,I)*DTKU,0.0)    !5/16/97 FTN
        END DO
        ALGSET = 0.0                                                  !5/16/97 FTN
        DO JA=1,NAP                                                   !5/16/97 FTN
          ALGSET = ALGSET + ASETL(JA)*ALGAE(KB(I),I,JA)               !5/16/97 FTN
        END DO                                                        !5/16/97 FTN
C       SETTLE          = (ASETL*ALGAE(KB(I),I)+DSETL*DETRIT(KB(I),I))!5/16/97 FTN
        SETTLE          =               (ALGSET+DSETL*DETRIT(KB(I),I))!5/16/97 FTN
     .                    *DLT/H(KB(I))
        SEDMNT(KB(I),I) = MAX(SEDMNT(KB(I),I)+SETTLE-SEDD(KB(I),I)
C    .                    *DLT,0.0)                                   !5/16/97 FTN
     .                    *DTKU,0.0)                                  !5/16/97 FTN
      END DO
     END

*************************************************************************
**      S U B R O U T I N E   I N O R G A N I C   C A R B O N       **
*************************************************************************

     SUBROUTINE INORGANIC_CARBON
      INCLUDE 'w2.inc'

******* Variable declaration

      LOGICAL ICE, ICE_CALC
      REAL ABIOP(NAP), ABION(NAP), ABIOSI(NAP), ABIOC(NAP)            !5/16/97 FTN

******* Common declaration

      COMMON /CARBNC/ CO2REL, BIOC
      COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
      COMMON /GLBLCC/ PALT, ALGDET, O2LIM, WIND,  WSCDP, WSC(NDP)
      COMMON /GEOMHC/ EL(KMP),        H(KMP),        HKT1(IMP),
     .                HKT2(IMP)
      COMMON /ICEC/   ICE(IMP),       ICETH(IMP),    ICE_CALC
      COMMON /TEMPC/  T1(KMP,IMP),    T2(KMP,IMP)
```

```
      COMMON /DKMLTC/ A1(KMC,IMC),   A2(KMC,IMC),   A3(KMC,IMC)
      COMMON /DKORGC/ DETD(KMC,IMC), ORGD(KMC,IMC)
      COMMON /DKSEDC/ SEDD(KMC,IMC), SO2D(KMC,IMC), SOD(IMP)
C     COMMON /PHYTGC/ AGR(KMC,IMC),   ARR(KMC,IMC),   AMR(KMC,IMC),   !5/14/97 FTN
C    .                AER(KMC,IMC)                                    !5/14/97 FTN
      COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/14/97 FTN
    .                 AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/14/97 FTN
      COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                   !5/16/97 FTN

      CO2EX = (0.5+0.05*WIND*WIND)/86400.0
      DO I=IU,ID
        CSS(KT,I) = 0.0
        DO K=KT,KB(I)
          ALGP = 0.0                                                  !5/16/97 FTN
          DO JA=1,NAP                                                 !5/16/97 FTN
            ALGP = ALGP + (ARR(K,I,JA)-AGR(K,I,JA)) * ALGAE(K,I,JA)   !5/16/97 FTN
    &                                               * ABIOC(JA)       !5/16/97 FTN
          END DO                                                      !5/16/97 FTN
C         ALGP     = (ARR(K,I)-AGR(K,I))*ALGAE(K,I)                   !5/16/97 FTN
C         CSS(K,I) = BIOC*(ALGP+ORGD(K,I)+DETD(K,I)+SEDD(K,I))        !5/16/97 FTN
          CSS(K,I) = BIOC*     (ORGD(K,I)+DETD(K,I)+SEDD(K,I))        !5/16/97 FTN
    .                +CO2REL*SO2D(K,I)*A3(K,I)
    &                +ALGP                                             !5/16/97 FTN
        END DO
        IF (.NOT.ICE(I)) CSS(KT,I) = CSS(KT,I)+CO2EX*(0.286
    .                                *EXP(-0.0314*(T2(KT,I))*PALT)
    .                                -CO2(KT,I))/HKT2(I)
      END DO
     END

************************************************************************
**                 S U B R O U T I N E   I R O N                      **
************************************************************************

     SUBROUTINE IRON
      INCLUDE 'w2.inc'

******* Variable declaration

      REAL NETSET
      DIMENSION ASETL(NAP)

******* Common declaration

      COMMON /IRONC/  FEREL
      COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
      COMMON /SETLC2/ SSETL,  DSETL,  ASETL,   FESETL
      COMMON /GEOMHC/ EL(KMP),        H(KMP),        HKT1(IMP),
    .                 HKT2(IMP)
      COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)
      COMMON /DKMLTC/ A1(KMC,IMC),    A2(KMC,IMC),   A3(KMC,IMC)

      DO I=IU,ID
        NETSET     = -FESETL*FE(KT,I)*A1(KT,I)/HKT2(I)
        SEDREL     = FEREL*SO2D(KT,I)*A2(KT,I)
        FESS(KT,I) = SEDREL+NETSET
        DO K=KT+1,KB(I)
          NETSET    = FESETL*(FE(K-1,I)*A1(K-1,I)-FE(K,I)
    .                 *A1(K,I))/H(K)
          SEDREL    = FEREL*SO2D(K,I)*A2(K,I)
          FESS(K,I) = SEDREL+NETSET
        END DO
      END DO
     END
```

```
************************************************************************
** S U B R O U T I N E   B I O C H E M I C A L   O 2   D E M A N D   **
************************************************************************

      SUBROUTINE BIOCHEMICAL_O2_DEMAND
        INCLUDE 'w2.inc'

******* Common declaration

        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)
        COMMON /DKBODC/ CBODD(KMC,IMC)

        DO I=IU,ID
          DO K=KT,KB(I)
            CBODSS(K,I) = -CBODD(K,I)*CBOD(K,I)
          END DO
        END DO
      END

************************************************************************!5/16/97 FTN
**                S U B R O U T I N E   S I L I C A                 **!5/16/97 FTN
************************************************************************!5/16/97 FTN
                                                                        !5/16/97 FTN
      SUBROUTINE SILICA                                                 !5/16/97 FTN
        INCLUDE 'w2.inc'                                                !5/16/97 FTN
                                                                        !5/16/97 FTN
******* Variable declaration                                            !5/16/97 FTN
                                                                        !5/16/97 FTN
        REAL ABIOP(NAP), ABION(NAP), ABIOSI(NAP), ABIOC(NAP)            !5/16/97 FTN
                                                                        !5/16/97 FTN
******* Common declaration                                              !5/16/97 FTN
                                                                        !5/16/97 FTN
        COMMON /GLOBLC/ JB, JC, IU, ID, KT, ELKT, DLT, KB(IMP), KTI(IMP)!5/16/97 FTN
        COMMON /GLBLCC/ PALT, ALGDET, O2LIM, WIND,  WSCDP, WSC(NDP)     !5/16/97 FTN
        COMMON /DKSEDC/ SEDD(KMC,IMC),  SO2D(KMC,IMC), SOD(IMP)         !5/16/97 FTN
        COMMON /DKORGC/ DETD(KMC,IMC),  ORGD(KMC,IMC)                   !6/27/97 FTN
        COMMON /PHYTGC/ AGR(KMC,IMC,NAP), ARR(KMC,IMC,NAP),             !5/16/97 FTN
     .                  AMR(KMC,IMC,NAP), AER(KMC,IMC,NAP)              !5/16/97 FTN
        COMMON /PHYTC3/ ABIOP,  ABION,  ABIOSI, ABIOC                   !5/16/97 FTN
        COMMON /SILICC/ SIREL, BIOSI                                    !5/16/97 FTN
                                                                        !5/16/97 FTN
        DO I=IU,ID                                                      !5/16/97 FTN
          DO K=KT,KB(I)                                                 !5/16/97 FTN
            ALGP = 0.0                                                  !5/16/97 FTN
            DO JA=1,NAP                                                 !5/16/97 FTN
              ALGP = ALGP - AGR(K,I,JA) * ALGAE(K,I,JA) * ABIOSI(JA)    !6/27/97 FTN
            END DO                                                      !5/16/97 FTN
            SEDREL1    = SEDD(K,I) * BIOSI                              !5/16/97 FTN
            SEDREL0    = SIREL * SO2D(K,I)                              !5/16/97 FTN
            SILSS(K,I) = SEDREL1 + SEDREL0 + ALGP + ORGD(K,I)*BIOSI     !6/27/97 FTN
          END DO                                                        !5/16/97 FTN
        END DO                                                          !5/16/97 FTN
      END                                                               !5/16/97 FTN
C                                                                       !10/6/98 FTN
C***********************************************************************!10/6/98 FTN
C                                                                       !10/6/98 FTN
C     Insert lines for AGPM output (from source code sent by G. Hauser) !10/6/98 FTN
C     New OPENP subroutine sent by J. Parsley                           !11/19/98 FTN
      SUBROUTINE OPENP(AGPMFN,INTPLD,INTPLH,IMP,KMP,NBP,US,DS,EL,DLX,
     X TMEND,NCP,NAC,CN,CPRC)
C
C     OPENP SETS OPENS THE AGPM OUTPUT FILE AND SETS UP THE HEADER
C     RECORD.
```

```
C
C     THIS VERSION OF OPENP DEALS WITH TWO ISSUES:
C
C     1. CUSTOMIZED CONSTITUENT LISTS IN W2
C     2. COMPUTING AN EXTRA CONSTITUENT FROM OTHER CONSTITUENTS
C
C
C------------
C     OPEN THE PLOT FILE AND WRITE OUT GEOMETRY RELATED INFO
C     ON THE FIRST RECORD.
C------------
C
      DIMENSION EL(KMP),DLX(IMP),INDX(100)
      INTEGER CN(NAC),US(NBP),DS(NBP),XLAT(24)
      CHARACTER*3 CPRC(NCP)
      CHARACTER*72 AGPMFN
      CHARACTER*4 VERSION
      INTEGER NUMDR
C
C     XLAT IS USED TO CONVERT THE W2 CONSTITUENT NUMBERS INTO
C     AGPM CONSTITUENT NUMBERS, BASED ON THE ORDER IN THE FILE
C     CONST.DEF
C
C                                                                !11/19/98 FTN
C     REMAPPING ARRAY CHANGES 7 TO 26, 8 TO 27                   !11/19/98 FTN
C     22 TO 28, 23 TO 29, AND 24 TO 30                           !11/19/98 FTN
C                                                                !11/19/98 FTN
      DATA XLAT/1,2,3,4,5,6,26,27,9,10,11,12,13,14,15,16,17,     !11/19/98 FTN
     X 18,19,20,21,28,29,30/                                     !11/19/98 FTN

C     EXTRA NEEDS TO BE AT LEAST KMPxIMP. IT IS USED TO
C     SET UP INTERNALLY COMPUTED CONSTITUENTS, IN THIS CASE
C     CHLOROPHYLL-A
C
C
      DIMENSION EXTRA(200,200)
C
C     WE ALSO NEED AN ARRAY OF SIZE NUMDR TO HOLD THE
C     DAM RELEASE DATA.
C
      DIMENSION DR(31)
C
      DATA IREC/1/
C                                                                !11/19/98 FTN
C     REMAPPING ARRAY CHANGES 7 TO 26, 8 TO 27                   !11/19/98 FTN
C     22 TO 28, 23 TO 29, AND 24 TO 30                           !11/19/98 FTN
C                                                                !11/19/98 FTN
      DATA XLAT/1,2,3,4,5,6,26,27,9,10,11,12,13,14,15,16,17,     !11/19/98 FTN
     X 18,19,20,21,28,29,30/                                     !11/19/98 FTN
```

Dale Hollow Lake CE-QUAL-W2 Control File

```
TITLE C ............................TITLE....................................
        Dale Hollow Lake, March 1 through November 30, 1973 (mbb)
        Water quality simulation w/ version 2.05.1
        Temperature calibration completed as of 01/10/01; inflow conc refer to
xcel
        03/15/01 raised all ASATUR's; 03/20/01 added DETRIT, RDOM; 03/21/01
corrected inflow conc files;
        03/29/01 rev DETDK,DSETL & ASATUR, rev DETRIT&RDOM; 04/04/01 rev CIC of
SI,DETRIT,RDOM,TDS,TSS;
        04/09/01 rev AGT1&2 (Diatoms&Green); 04/10/01 raised AGT1&2 for all
algae; 04/11/01 added iron
        05/14/01 rev inflow FE on unmonitoried tribs
TIME CON  TMSTRT   TMEND    YEAR
           59.49  333.51    1973

DLT CON      NDT  DLTMIN
               1     1.0

DLT DATE    DLTD
             0.0

DLT MAX   DLTMAX
          1800.0

DLT FRN     DLTF
            0.50

BRANCH G      US      DS     UHS     DHS
Br 1           2      22       0       0            Obey River (OR)
Br 2          25      26       0       3            WF Obey River (WO)
Br 3          29      30       0       8            Big Eagle Creek (BE)
Br 4          33      34       0      11            Ashburn Creek (AC)
Br 5          37      39       0      46            Illwill Creek (IL)
Br 6          42      47       0      12            Wolf River (WR)
Br 7          50      52       0      13            Sulphur Creek (SC)
Br 8          55      56       0      14            Irons Creek (IC)
Br 9          59      60       0      15            Holly Creek (HC)
Br 10         63      65       0      17            Mitchell Creek (MC)

LOCATION     LAT    LONG   DATUM
            36.6    85.3   154.3

INIT CND     T2I  ICETHI  WTYPEC
             6.0     0.0   FRESH

CALCULAT     VBC     MBC     PQC    PQTC     EVC     PRC
              ON      ON      ON      ON     OFF     OFF

INTERPOL   INFIC    TRIC   DTRIC    HDIC  QOUTIC    WDIC   METIC
              ON      ON      ON      ON      ON      ON      ON

DEAD SEA   WINDC    QINC   QOUTC   HEATC
              ON      ON      ON      ON

ICE COVER   ICEC   SLICE  SLHEAT  ALBEDO     HWI   BETAI  GAMMAI  ICEMIN   ICET2
```

```
             OFF  DETAIL    TERM    0.25    10.0     0.6    0.07    0.05     3.0

TRANSPORT  SLTRC   THETA   DZMAX
        QUICKEST    0.00    -999

WSC NUMB    NWSC WSC_MIN WSC_MAX
               1    -999    -999

WSC DATE    WSCD    WSCD
            59.5

WSC COEF     WSC     WSC
            0.55

WIND FUNC    WFC
             1.0

HYD COEF      AX      DX   CHEZY    CBHE    TSED   FW_A0   FW_A1   FW_A2  SRMULT
avg annual T @Livingston Radio-TN
             1.0     1.0    70.0  3.5E-7    10.0    -999    -999    -999    -999
changed from 14.2 to 10.0

SEL WITH     SWC     SWC     SWC     SWC     SWC     SWC     SWC     SWC     SWC
              ON     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF

N STRUC     NSTR    NSTR    NSTR    NSTR    NSTR    NSTR    NSTR    NSTR    NSTR
1=turb, 2-fishery, 3=tainter,
               5       0       0       0       0       0       0       0       0
4=servunit, 5=sluice
               0

K LIMIT     KLSW    KLSW    KLSW    KLSW    KLSW
Br 1          99      99      99      99      99
Br 2
Br 3
Br 4
Br 5
Br 6
Br 7
Br 8
Br 9
Br 10

SINK TYPE   SINK    SINK    SINK    SINK    SINK
Br 1       POINT   POINT    LINE   POINT   POINT
Br 2
Br 3
Br 4
Br 5
Br 6
Br 7
Br 8
Br 9
Br 10

E STRUC     TURB    FISH   TAINT   SERVU   SLUIC
```

```
Br 1        178.0   174.2   200.3   169.6   163.7
Br 2
Br 3
Br 4
Br 5
Br 6
Br 7
Br 8
Br 9
Br 10

W STRUC      WSTR    WSTR    WSTR    WSTR    WSTR
Br 1         0.00    0.00   121.9    0.00    0.00
Br 2
Br 3
Br 4
Br 5
Br 6
Br 7
Br 8
Br 9
Br 10

N OUTLET     NOUT    NOUT    NOUT    NOUT    NOUT    NOUT    NOUT    NOUT    NOUT
                5       0       0       0       0       0       0       0       0
                0

O LAYER      KOUT
Br 1            0
Br 2            0
Br 3            0
Br 4            0
Br 5            0
Br 6            0
Br 7            0
Br 8            0
Br 9            0
Br 10           0

N WDRWAL      NWD
                0

W SEGMNT      IWD
                0

W LAYER       KWD
                0

N TRIBS       NTR MXSGDTR                                Dist. tribs and Branches
only
                1    -999                                Spring Creek (to Wolf
Ck)

TRIB SEG      ITR
               42

DST TRIB     DTRC    DTRC    DTRC    DTRC    DTRC    DTRC    DTRC    DTRC    DTRC
```

	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	OFF								
SCR PRINT	SCRC	NSCR							
	OFF	1							
SCR DATE	SCRD								
	59.5								
SCR FREQ	SCRF								
	1.0								
SNAPSHOT	FORM	UPRN	WPRN	TPRN	DTPRN	RHOPRN	AZPRN	DZPRN	
	LONG	ON	ON	ON	OFF	OFF	OFF	OFF	
SHRT SEG	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF
	2	4	9	12	14	16	17	21	38
	40	41							
LONG SEG	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF
	2	5	8	11	14	17	20	22	26
	30	34	39	44	47	52	56	60	65
SNP PRINT	SNPC	NSNP							
	ON	15							
SNP DATE	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD
	59.5	91.5	92.5	118.5	137.5	138.5	155.5	156.5	181.5
	205.5	229.5	239.5	272.5	296.5	333.5			
SNP FREQ	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0
	999.0	999.0	999.0	999.0	999.0	999.0			
PRF PLOT	PRFC	NPRF	NPRS	PRSTYL					
	ON	18	16	FTN					
PRF DATE	PRFD	PRFD	PRFD	PRFD	PRFD	PRFD	PRFD	PRFD	PRFD
	59.5	91.5	92.5	93.5	131.5	138.5	139.5	156.5	157.5
	181.5	205.5	217.5	230.5	240.5	272.5	297.5	333.5	
PRF FREQ	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	
PRF SEG	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF
	2	14	4	8	9	11	12	16	17
	22	25	39	42	44	50	3		
SPR PLOT	SPRC	NSPR	NIPRF						
	OFF	1	1						
SPR DATE	SPRD								
	59.5								
SPR FREQ	SPRF								
	999.0								

```
SPR SEG      ISPR
               25

TSR PLOT     TSRC     NTSR  TSSTYL
               ON        1     FTN

TSR DATE     TSRD
             59.5

TSR FREQ     TSRF
              1.0

VPL PLOT     VPLC     NVPL  VPSTYL
              OFF        1

VPL DATE     VPLD
             59.5

VPL FREQ     VPLF
            999.0

CPL PLOT     CPLC     NCPL  CPSTYL
              OFF        1     FTN

CPL DATE     CPLD
             59.5

CPL FREQ     CPLF
            999.0

APGM OUT     APLC
              OFF                          on/off switch for APGM output

AGPM OUT2    APLD    APLFD   APLFH
             59.5     1.0     0.0         start date = APLD, frequency = APLFD +
APLFH/24

RESTART      RSOC     NRSO    RSIC
              OFF        0     OFF

RSO DATE     RSOD
            999.0

RSO FREQ     RSOF
            999.0

CST COMP      CCC     LIMC     SDC  FREQUK
               ON       ON     OFF       1

CST ACT       ACC      ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC
FOR DH need FE on (#20)
               ON       ON     OFF      ON      ON      ON      ON      ON      ON
               ON       ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
              OFF       ON      ON      ON      ON      ON

CST ICON      CIC      CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC
```

```
            0.00     2.0    0.00    98.0    0.10    0.10    1.50    1.00    0.01
            0.10    0.22    8.20    0.00    0.00    0.00    0.00    0.00    0.00
            0.00    0.21    0.00   0.001   0.001   0.001

CST PRNT    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CIN CON    INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CTR CON    TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CDT CON    DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CPR CON    PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC
              ON     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF

EX COEF    EXH2O  EXINOR   EXORG    BETA  ALGLIT
            0.31    0.03    0.09    0.43    0.01

COLIFORM  COLQ10   COLDK   COLKL   CSETL   CKSEG
Not simulating coliforms
            1.04    0.50   0.005    0.29   999.0

S SOLIDS   SSETL
Same as Center Hill (CH) Study
             0.4

ALGAE      AGROW   AMORT   AEXCR   ARESP   ASETL    AHSP    AHSN   AHSSI  ASATUR
Same as CH xcpt AGROW,
Diatoms    2.064    0.03    0.00    0.05    0.35   0.002    0.06     0.1    86.0
ARESP,AHSP, ASATUR for DH
Greens      2.05    0.03    0.00    0.05    0.15   0.003    0.06     0.0    75.0
Cyanobac    1.60    0.03    0.00   0.005    0.08   0.004    0.10     0.0    85.0

ALG STOI   ABIOP   ABION  ABIOSI   ABIOC
Same as Center Hill Study
Diatoms    0.004   0.067     0.0     0.5
Greens     0.004   0.067     0.0     0.5
Cyanobac   0.004   0.067     0.0     0.5

ALG RATE    AGT1    AGT2    AGT3    AGT4    AGK1    AGK2    AGK3    AGK4
AGK's CH Study; AGT's DH
Diatoms      8.0    14.0    20.0    25.0     0.1    0.98    0.98     0.1
Greens      10.0    16.0    25.0    30.0     0.1    0.98    0.98     0.1
```

```
Cyanobac     12.0     25.0     38.0     42.0      0.1     0.98     0.98      0.1

DISS ORG    LABDK    LRFDK    REFDK
Same as Center Hill Study
             0.30    0.001    0.001

DETRITUS    DETDK    DSETL   ALGDET
            0.006     0.10     0.80

ORG RATE     OMT1     OMT2     OMK1     OMK2
Same as Center Hill Study
              4.0     20.0      0.1     0.98

SEDIMENT    SEDDK     FSOD    (SEDDK set for 1st order NH3 & PO4 release from sed)
Same as Center Hill Study
             0.06      1.0

S DEMAND      SOD      SOD      SOD      SOD      SOD      SOD      SOD      SOD      SOD
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50     0.50
             0.50     0.50     0.50

CBOD         KBOD     TBOD     RBOD
             0.05     1.05     2.00

PHOSPHOR   PO4REL    PARTP
PARTP CH Study; PO4REL DH
            0.002     0.1

AMMONIA    NH3REL    NH3DK    PARTN
NH3REL/PARTN=CH; NH3DK=DH
            0.035     0.05     0.01

NH3 RATE    NH3T1    NH3T2    NH3K1    NH3K2
Same as Center Hill Study
              0.1     20.0      0.1     0.98

NITRATE     NO3DK    DNPRN
Same as Center Hill Study
              0.1       ON

NO3 RATE    NO3T1    NO3T2    NO3K1    NO3K2
Same as Center Hill Study
              5.0     20.0      0.1     0.98

SILICA      SIREL
Same as Center Hill Study
             0.01

SED CO2    CO2REL
Same as Center Hill Study (not simulated)
              0.1
```

```
IRON        FEREL  FESETL
              0.4     0.5

STOICHMT   O2NH3   O2ORG  O2RESP   O2ALG    BIOP    BION   BIOSI    BIOC
Same as Center Hill Study
            3.43     1.4     1.2     1.4   0.004   0.067     0.0     0.1

O2 LIMIT   O2LIM
Same as Center Hill Study
              0.2

BTH FILE..............................BTHFN...................................
        r:\projects\1150-041\W2_input\1973\73bath02.npt

VPR FILE..............................VPRFN...................................
        VPR.npt - not used

LPR FILE..............................LPRFN...................................
        lpr.npt - not used

RSI FILE..............................RSIFN...................................
        rsi.npt - not used

MET FILE..............................METFN...................................
        r:\projects\1150-041\W2_input\1973\73met03.npt
source of metdata=Nashville Int'l AP

QWD FILE..............................QWDFN...................................
        not used

QIN FILE..............................QINFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73q_or02.npt
Obey River
Br 2    r:\projects\1150-041\W2_input\1973\73q_wo02.npt
WF Obey River
Br 3    r:\projects\1150-041\W2_input\1973\73q_be01.npt
Big Eagle Creek
Br 4    r:\projects\1150-041\W2_input\1973\73q_ac01.npt
Ashburn Creek
Br 5    r:\projects\1150-041\W2_input\1973\73q_il01.npt
Illwill Creek
Br 6    r:\projects\1150-041\W2_input\1973\73q_wr02.npt
Wolf River
Br 7    r:\projects\1150-041\W2_input\1973\73q_sc01.npt
Sulphur Creek
Br 8    r:\projects\1150-041\W2_input\1973\73q_ic01.npt
Irons Creek
Br 9    r:\projects\1150-041\W2_input\1973\73q_hc02.npt
Holly Creek
Br 10   r:\projects\1150-041\W2_input\1973\73q_mc01.npt
Mitchell Creek

TIN FILE..............................TINFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73t_or03.npt
Br 2    r:\projects\1150-041\W2_input\1973\73t_wo03.npt
Br 3    r:\projects\1150-041\W2_input\1973\73t_be04.npt
```

```
Br 4    r:\projects\1150-041\W2_input\1973\73t_ac04.npt
Br 5    r:\projects\1150-041\W2_input\1973\73t_il04.npt
Br 6    r:\projects\1150-041\W2_input\1973\73t_wr03.npt
Br 7    r:\projects\1150-041\W2_input\1973\73t_sc04.npt
Br 8    r:\projects\1150-041\W2_input\1973\73t_ic04.npt
Br 9    r:\projects\1150-041\W2_input\1973\73t_hc04.npt
Br 10   r:\projects\1150-041\W2_input\1973\73t_mc04.npt

CIN FILE...............................CINFN....................................
Br 1    r:\projects\1150-041\W2_input\1973\73c_or07.npt
Br 2    r:\projects\1150-041\W2_input\1973\73c_wo08.npt
Br 3    r:\projects\1150-041\W2_input\1973\73c_be08.npt
Br 4    r:\projects\1150-041\W2_input\1973\73c_ac08.npt
Br 5    r:\projects\1150-041\W2_input\1973\73c_il08.npt
Br 6    r:\projects\1150-041\W2_input\1973\73c_wr08.npt
Br 7    r:\projects\1150-041\W2_input\1973\73c_sc08.npt
Br 8    r:\projects\1150-041\W2_input\1973\73c_ic08.npt
Br 9    r:\projects\1150-041\W2_input\1973\73c_hc08.npt
Br 10   r:\projects\1150-041\W2_input\1973\73c_mc08.npt

QOT FILE...............................QOTFN....................................
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Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br 10   not used

QTR FILE...............................QTRFN....................................
Tr 1    r:\projects\1150-041\W2_input\1973\73q_sp01.npt
Spring Creek

TTR FILE...............................TTRFN....................................
Tr 1    r:\projects\1150-041\W2_input\1973\73t_sp04.npt

CTR FILE...............................CTRFN....................................
Tr 1    r:\projects\1150-041\W2_input\1973\73c_sp08.npt

QDT FILE...............................QDTFN....................................
Distrib Tribs
Br 1    r:\projects\1150-041\W2_input\1973\73q_dt02.npt
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Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

TDT FILE...............................TDTFN....................................
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```

```
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

CDT FILE...............................CDTFN....................................
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Br 2    not used
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Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

PRE FILE...............................PREFN....................................
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Br 2    pre_br2.npt - not used
Br 3    pre_br3.npt - not used
Br 4    pre_br4.npt - not used
Br 5    pre_br5.npt-  not used
Br 6    pre_br6.npt - not used
Br 7    pre_br7.npt - not used
Br 8    pre_br8.npt - not used
Br 9    pre_br9.npt - not used
Br10    pre_br10.npt - not used

TPR FILE...............................TPRFN....................................
Br 1    tpr_br1.npt - not used
Br 2    tpr_br2.npt - not used
Br 3    tpr_br3.npt - not used
Br 4    tpr_br4.npt - not used
Br 5    tpr_br5.npt - not used
Br 6    tpr_br6.npt - not used
Br 7    tpr_br7.npt - not used
Br 8    tpr_br8.npt - not used
Br 9    tpr_br9.npt - not used
Br10    tpr_br10.npt - not used

CPR FILE...............................CPRFN....................................
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Br 3    cpr_br3.npt - not used
Br 4    cpr_br4.npt - not used
Br 5    cpr_br5.npt - not used
Br 6    cpr_br6.npt - not used
Br 7    cpr_br7.npt - not used
Br 8    cpr_br8.npt - not used
Br 9    cpr_br9.npt - not used
Br10    cpr_br10.npt - not used
```

```
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Br 4    euh_br4.npt - not used
Br 5    euh_br5.npt - not used
Br 6    euh_br6.npt - not used
Br 7    euh_br7.npt - not used
Br 8    euh_br8.npt - not used
Br 9    euh_br9.npt - not used
Br10    euh_br10.npt - not used

TUH FILE.............................TUHFN...................................
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Br 4    tuh_br4.npt - not used
Br 5    tuh_br5.npt - not used
Br 6    tuh_br6.npt - not used
Br 7    tuh_br7.npt - not used
Br 8    tuh_br8.npt - not used
Br 9    tuh_br9.npt - not used
Br10    tuh_br10.npt - not used

CUH FILE.............................CUHFN...................................
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Br 4    cuh_br4.npt - not used
Br 5    cuh_br5.npt - not used
Br 6    cuh_br6.npt - not used
Br 7    cuh_br7.npt - not used
Br 8    cuh_br8.npt - not used
Br 9    cuh_br9.npt - not used
Br10    cuh_br10.npt - not used

EDH FILE.............................EDHFN...................................
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Br 3    edh_br3.npt - not used
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Br 5    edh_br5.npt - not used
Br 6    edh_br6.npt - not used
Br 7    edh_br7.npt - not used
Br 8    edh_br8.npt - not used
Br 9    edh_br9.npt - not used
Br10    edh_br10.npt - not used

TDH FILE.............................TDHFN...................................
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Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
```

```
Br 8     tdh_br8.npt - not used
Br 9     tdh_br9.npt - not used
Br10     tdh_br10.npt - not used

CDH FILE.............................CDHFN...................................
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Br 6     tdh_br6.npt - not used
Br 7     tdh_br7.npt - not used
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Br10     tdh_br10.npt - not used


AGPM
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SNP FILE.............................SNPFN....................................
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TSR FILE.............................TSRFN....................................
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PRF FILE.............................PRFFN....................................
        prf.opt

VPL FILE.............................VPLFN....................................
        vpl.opt

CPL FILE.............................CPLFN....................................
        cpl.opt

SPR FILE.............................SPRFN....................................
        spr.opt
```

APPENDIX C

Bathymetry Plan

ftn Associates Ltd.
water resources / environmental consultants

MEMORANDUM

DATE: October 12, 2000

TO: Mr. Jack Brown
USAE Nashville District

FROM: Philip Massirer PM
FTN Associates, Ltd.

SUBJECT: Dale Hollow Lake Bathymetry Plan
FTN No. 1150-041

This memo fulfills the requirements of Task 3 to develop a plan describing the reservoir bathymetry, inflows, and outflows.

Dale Hollow Lake Bathymetry

1) The proposed model plan grid is shown in Figure 1. The model consists of a main branch of 20 segments with 3 embayments and 5 null embayments. The main branch extends up the East Fork of the Obey River to sampling station 3DAL20009. Embayments are modeled as branches with inflows entering their upstream boundary. Null embayments are water storage areas and are modeled as branches with zero upstream flows. Main branch and embayment cells represent the conveyance channel of the main channel and important tributaries. Volume will be added to null embayments as necessary to ensure that the total volume of the model corresponds to the District's elevation-volume curve. Based upon our experience with CE-QUAL-W2, we suspect we may encounter difficulty calibrating as a result of the number of branches in this model. In some applications, the noniterative solution scheme at branch intersections can affect calibration.

2) Embayments will be needed at West Fork Obey River, Big Eagle Creek, and Wolf River. The embayments will consist of 2 to 6 segments. Null embayments will be modeled at Ashburn Creek, Sulfur Creek, Irons Creek, Holly Creek, and Mitchell Creek. The null embayments will have 2 to 3 segments. The null embayment at Ashburn Creek will include volume from nonconveyance areas in Illwill Creek, along the Wolf River arm (including the area around Pilot Island), and on the Obey River upstream of Ashburn Creek. The null embayment at Irons Creek will include volume from several minor tributaries directly across the lake from

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Web Site: www.ftn-assoc.com
E-mail: ftn@ftn-assoc.com

Irons Creek. The null embayment at Mitchell Creek will include volume from the minor tributaries located between Holly Creek and the dam.

3) Volume will not be added to the Sulfur Creek and Holly Creek null embayments because these embayments will be used as prototypes to investigate the impacts of marinas and houseboats on water quality. Holly Creek will represent a small embayment and Sulfur Creek will be represent a medium to large embayment. Segment lengths in these prototype embayments will be small to allow simulation of the effects of marinas and houseboats.

4) Figure 2 shows the model flow lines and conveyance channel through Dale Hollow Lake. The flow line locations were chosen based on previous studies and professional judgement. The main branch flow line indicates how water is expected to follow the main channel.

5) Figure 3 shows the expected grid profile for the main stem of the model. Layers will be 1.0 meter thick. At the dam, layers will extend from elevation 503.0 feet (bottom elevation) to elevation 663.8 feet (just above the top of the flood pool). The grid profile may be modified from that shown in Figure 3 based on cross section data and calibration results.

6) Segments in the main stem and in the Wolf River branch vary in length from approximately 1.0 miles at the dam to 3.0 miles at the upstream end. Most of the segments are between 1.8 and 2.5 miles long. The segment boundaries were established at cross section locations to avoid interpolation between cross sections. Segment lengths in West Fork Obey River, Big Eagle Creek, Ashburn Creek, Irons Creek, and Mitchell Creek vary from approximately 1.0 to 1.5 miles.

7) Cell widths will be developed based on transects collected by the District supplemented with information from fishing maps with contours. Transects will be converted into HEC format and input to GEDA, which will calculate volumes at specified elevations. Average widths for each cell will be calculated from these volumes. The volumes of the model bathymetry will be checked against the District elevation-volume curve.

Dale Hollow Lake Flows

8) Reservoir inflows that will be included in the model are East Fork Obey River, West Fork Obey River, Big Eagle Creek, Wolf River, Spring Creek, and Illwill Creek. The combined drainage area for these 6 inflows accounts for more than 70% of the total drainage area of Dale Hollow Lake. The remainder of the inflow to the lake will be simulated as a distributed tributary to the main branch.

9) For each of the study years (1973, 1988, and 1991), USGS daily flow data are available for the East Fork Obey River and the Wolf River. The inflows for East Fork Obey River and Wolf River will be set equal to the measured USGS flows. For the West Fork Obey River, USGS daily flow data are available for water years 1944–71. During this period, the USGS

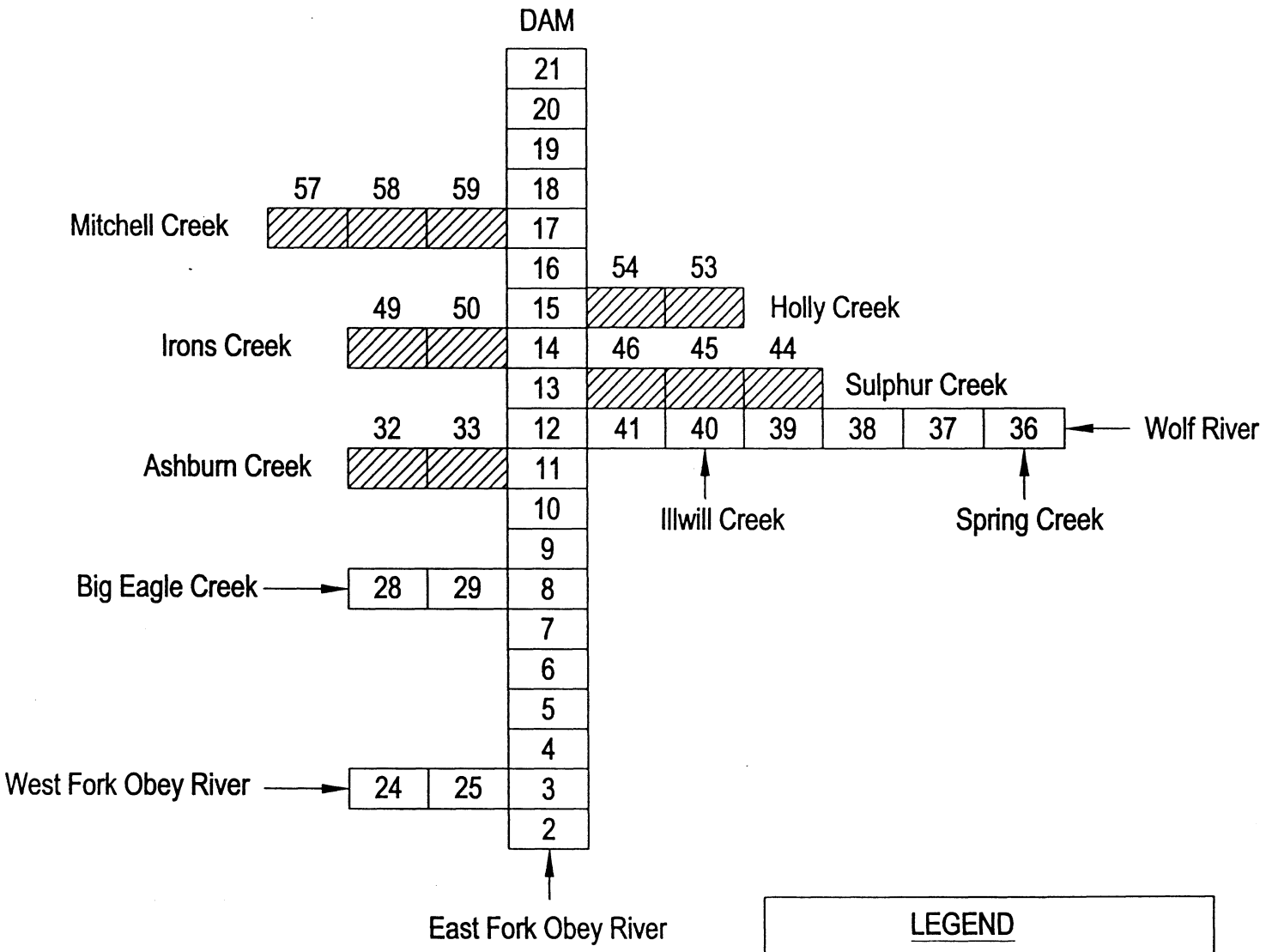
measured flows for both the East Fork Obey River and the West Fork Obey River. The average flow per unit of drainage area for water years 1944–71 was similar for these gages (1.97 cfs/mi^2 for the East Fork and 1.95 cfs/mi^2 for the West Fork). Therefore, the daily inflows for the West Fork Obey River during each study year will be estimated based on the measured flows per unit area of the East Fork Obey River.

10) Daily flow rates for the other inflows (Big Eagle Creek, Spring Creek, Illwill Creek, and the distributed tributary) will be estimated as the District's total back-calculated inflows to the reservoir minus the combined inflows for the Wolf River, East Fork Obey River, and West Fork Obey River. For the instances when the District's total back-calculated inflows to the reservoir are negative (i.e., evaporation exceeds inflow), these values will be adjusted by raising them to a selected minimum flow using the District program HECUPD. The selected minimum flow will be based on observed minimum flows from the USGS flow data (with adjustments for drainage area).

11) Dale Hollow power generation release records will be used for the reservoir outflows. Turbine releases will be modeled as a point sink with an effective withdrawal centerline elevation of 570 feet and a lower withdrawal limit of 510 feet. These elevations are based on the District's SELECT simulations (Memo to Files dated 13 November 98). Sluice releases will also be modeled as a point sink with a withdrawal centerline elevation of 537 feet. Spillway releases will be modeled as a line sink 600 ft wide with a withdrawal elevation of at least 651 feet. Characterization of the release structures may be modified during the calibration process.

12) The model will also include withdrawal of water for the Dale Hollow National Fish Hatchery. The exact location of this withdrawal and the approximate withdrawal rates for the study years will be obtained from the hatchery staff. According to the website for the hatchery, the average withdrawal rate prior to a 1993 expansion was about 7200 gallons per minute (16 cfs) and it was withdrawn from a depth of approximately 70 feet. For the projection simulations, the configuration of this withdrawal in the model will be changed to reflect current conditions (after the 1993 expansion).

P:\WP_FILES\1150-041\BATHYM2.doc\def



LEGEND

FLOW INPUT TO MODEL

NULL EMBAYMENT

FIGURE 1

CE-QUAL-W2 SEGMENTS FOR DALE HOLLOW LAKE

ftn Associates Ltd.

By: LOTG/JO
Date: October 11, 2000
File: 1150fg01.dwg
Project No. 1150-041

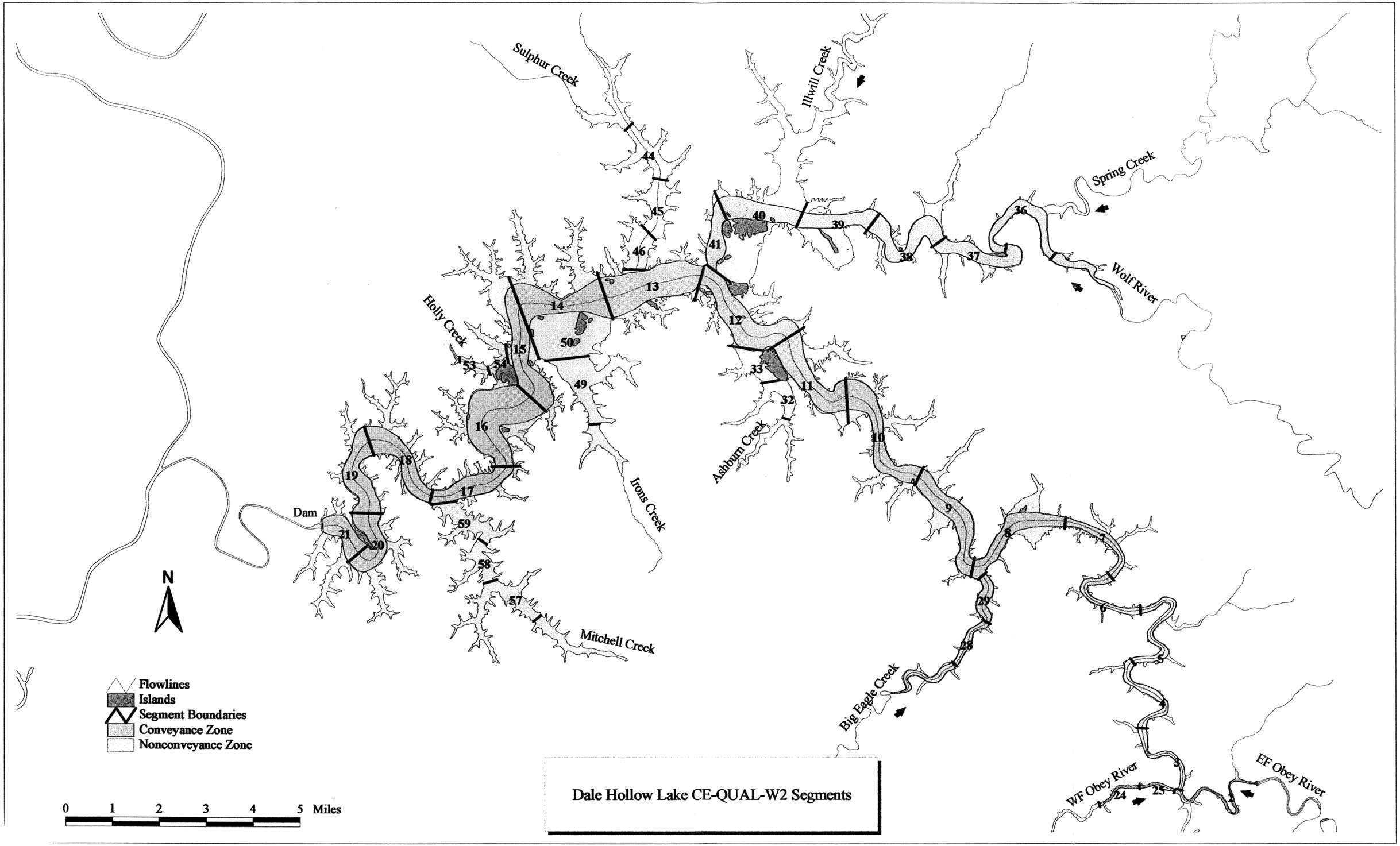

Sulphur Creek
Illwill Creek
Spring Creek
Wolf River
Holly Creek
Ashburn Creek
Irons Creek
Mitchell Creek
Big Eagle Creek
WF Obey River
EF Obey River
Dam
N
Flowlines
Islands
Segment Boundaries
Conveyance Zone
Nonconveyance Zone
0 1 2 3 4 5 Miles
Dale Hollow Lake CE-QUAL-W2 Segments

Figure 2

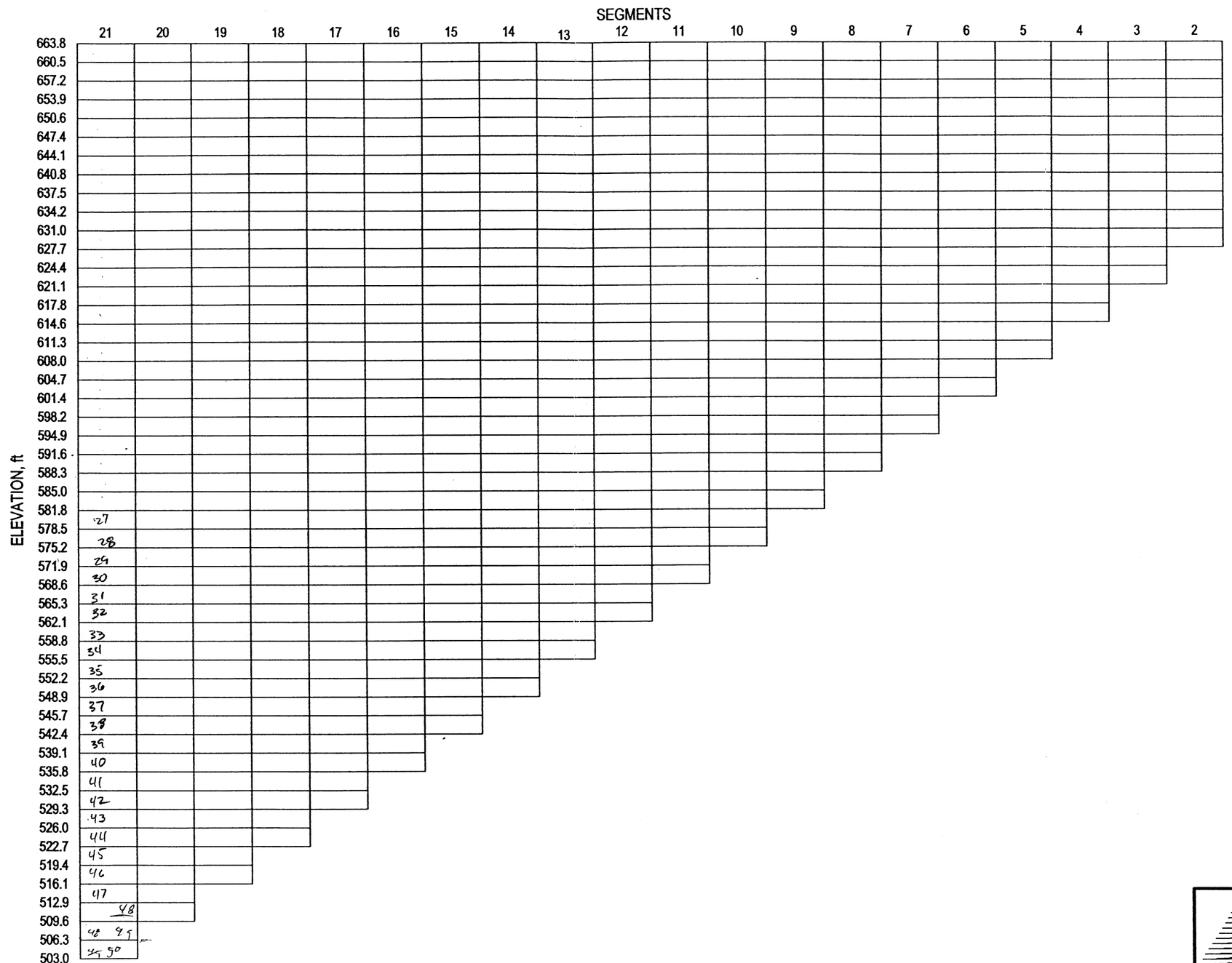


FIGURE 3

CE–QUAL–W2 GRID
DALE HOLLOW LAKE

tn Associates Ltd.

By: JCB
Date: October 11, 2000
File: 1150FG03.DWG
Project No. 1150–041

APPENDIX D

Bathymetry File

Bathymetry File (1991)

Dale Hollow Lake bathymetry with 10 branches, 66 segments, and 50 layers
MBB 11/10/00, 11/29/00, PHM 11/25/00
Delta X (DLX,meters)

8428.0	8428.0	3146.1	4146.5	4146.5	3333.9	3223.9	3938.0	3947.8	4301.0
3372.0	4143.1	3432.0	3054.1	3268.1	3782.0	2913.0	3202.8	2867.9	2315.0
824.9	824.9	824.9	1538.02	1538.0	1538.0	1538.0	2743.2	2743.2	1737.1
1737.1	2414.0	2414.0	2414.0	2414.0	2743.2	2743.2	2306.1	2506.7	2506.7
7151.2	7151.2	3298.2	3938.0	2641.1	2785.0	2153.1	2153.1	2174.14	2174.1
1957.1	1615.4	1615.4	2414.02	2414.0	2414.0	2414.0	1136.6	1136.6	1136.3
1136.3	2414.0	2414.0	2414.0	2414.0	2414.0				

Water Surface Elevation (ELWS) (start jday 060)

199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6
199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6
199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6
199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6
199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6
199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6	199.6
199.6	199.6	199.6	199.6	199.6	199.6				

Segment Orientation (in radians from due north consistent with wind direction)

1.4	1.4	2.62	3.05	3.05	1.92	0.09	0.79	2.62	2.44
2.44	2.09	1.31	1.31	5.93	0.52	1.31	2.27	0.17	0.35
2.35	2.36	2.36	4.36	4.36	4.36	4.36	3.67	3.67	3.23
3.23	2.62	2.62	2.62	2.62	0.7	0.7	0.52	0.35	0.35
1.92	1.92	1.75	1.92	1.67	1.67	0.26	0.26	5.76	5.76
0.35	0.52	0.52	2.53	2.53	2.53	2.53	4.88	4.88	4.88
4.88	2.36	2.36	4.54	2.36	2.36				

Height (layer thickness)

1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Segment 1 (upstream end of Branch 1 - Obey River)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 2

0.0	132.7	130.1	123.5	116.7	110.0	103.3	96.8	88.2	76.2
56.6	37.8	33.6	30.6	27.1	26.2	20.8	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 3

0.0	274.8	269.0	253.0	236.6	220.3	204.6	187.9	167.2	124.0
97.3	84.2	68.6	54.6	48.3	42.2	26.2	24.2	22.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 4

0.0	299.3	295.3	284.1	272.8	261.8	250.6	239.4	223.1	190.0
165.2	149.4	124.8	98.3	57.5	41.6	32.5	27.1	24.5	21.7
22.9	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 5

0.0	299.3	295.3	284.1	272.8	261.8	250.6	239.4	223.1	190.0
165.2	149.4	124.8	98.3	57.5	41.6	32.5	27.1	24.5	21.7
22.9	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 6

0.0	334.0	329.9	320.4	310.5	300.4	290.6	281.0	270.7	259.3
250.4	239.5	225.5	211.5	164.1	133.9	120.6	73.9	56.6	51.5
44.4	31.3	26.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 7

0.0	389.1	385.3	374.3	362.9	351.9	340.8	329.4	318.0	304.3
288.3	274.3	259.0	243.8	226.0	202.8	186.4	132.4	94.7	77.6
67.9	60.5	51.7	44.1	35.9	25.5	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 8

0.0	686.6	683.8	674.2	665.8	656.7	647.7	638.7	629.4	616.9
605.7	596.7	586.7	575.5	559.0	508.7	467.1	412.6	367.1	306.7
250.5	197.7	158.2	106.5	59.5	48.2	44.5	33.3	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 9

0.0	616.6	615.4	612.0	607.9	605.1	601.4	598.0	594.2	587.4
581.4	575.9	565.0	538.6	502.6	485.6	462.2	403.2	363.4	314.7
282.5	232.0	149.7	66.2	40.1	33.6	28.9	25.6	23.6	21.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 10

0.0	612.7	609.9	604.2	598.2	591.9	585.9	579.7	573.4	567.4
560.7	556.0	550.6	544.6	538.6	532.5	510.7	484.1	460.2	436.8
413.4	357.0	267.2	192.5	142.0	94.1	64.4	46.2	39.3	34.2
28.8	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 11

0.0	829.5	826.6	817.9	809.5	800.0	792.1	783.0	774.3	764.8
757.2	750.3	743.4	736.8	730.3	723.5	704.1	677.5	628.1	566.6
535.6	482.2	420.0	377.5	324.0	237.4	124.0	90.9	73.8	64.7
52.7	32.6	32.9	27.1	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 12

0.0	819.9	818.7	814.9	810.7	807.7	803.3	799.8	795.9	786.7
773.8	761.3	741.7	733.5	726.1	721.0	716.9	708.3	681.4	645.0
628.2	614.8	600.0	573.9	523.9	479.2	424.7	287.7	190.6	142.4
100.9	65.9	47.9	38.5	35.8	22.7	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 13

0.0	1003.3	1002.6	1000.5	997.6	995.3	993.0	990.5	988.0	980.5
969.1	957.2	939.4	932.2	926.2	921.2	916.2	911.2	898.3	876.1
864.5	853.3	837.5	822.5	805.0	785.2	746.8	688.9	605.3	370.2
210.8	119.4	88.3	70.7	60.0	51.8	46.8	30.2	26.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 14

0.0	1168.5	1168.1	1166.9	1166.5	1164.8	1164.4	1163.2	1162.4	1161.2
1160.3	1159.2	1158.8	1157.6	1157.2	1156.5	1156.0	1154.0	1146.8	1125.9
1099.0	1063.3	1042.4	1016.3	985.0	971.8	958.9	927.5	884.6	843.2
777.4	586.3	336.9	208.0	164.6	115.6	88.2	75.1	54.6	47.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 15

0.0	1023.7	1021.4	1015.4	1009.4	1003.8	997.4	991.8	985.4	979.0
974.4	970.0	964.4	959.5	955.0	951.2	947.1	942.2	936.6	933.2
904.3	860.8	840.9	812.8	780.1	772.0	764.4	751.2	734.7	719.0
684.4	600.2	457.8	363.6	300.2	251.4	220.2	166.6	90.1	66.8
47.3	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 16

0.0	1121.3	1121.3	1120.6	1120.3	1119.5	1119.0	1118.7	1117.7	1117.1
1112.2	1107.3	1103.8	1099.5	1095.3	1090.4	1085.3	1079.1	1073.0	1061.6
1041.6	1025.0	1008.4	995.1	986.7	977.8	967.9	952.0	923.8	882.6
731.5	508.9	360.2	275.3	185.1	77.5	60.5	46.4	35.0	30.5
28.5	22.1	21.1	20.1	0.0	0.0	0.0	0.0	0.0	0.0

Segment 17

0.0	705.2	704.7	704.3	703.9	702.9	702.6	702.2	701.4	699.7
697.2	692.9	687.0	676.9	665.6	658.6	648.7	641.2	632.3	619.3
597.8	579.3	561.2	545.2	534.2	521.8	508.1	495.1	479.5	460.1
444.1	414.6	347.7	316.2	290.9	227.8	150.2	84.6	70.3	63.1
57.3	50.8	42.1	41.7	34.6	0.0	0.0	0.0	0.0	0.0

Segment 18

0.0	603.8	603.4	601.9	599.6	599.0	596.9	595.0	593.5	590.8
587.9	585.0	582.4	577.0	572.8	566.6	562.1	552.1	538.7	530.3
522.0	514.6	507.7	500.0	493.2	479.0	463.3	446.4	435.3	425.8
398.2	356.2	330.4	309.4	291.8	261.9	224.7	180.7	142.4	122.5
86.1	63.2	48.2	39.4	32.2	0.0	0.0	0.0	0.0	0.0

Segment 19

0.0	811.2	809.5	805.2	800.5	795.5	791.1	786.4	781.7	775.7
769.5	763.3	756.0	748.3	741.9	735.5	728.2	718.4	706.0	696.6
687.9	677.3	667.1	658.1	650.0	624.4	576.4	538.8	500.3	472.1
432.7	359.8	307.9	261.3	243.3	230.5	194.5	145.8	121.4	111.6
102.6	83.3	56.4	41.1	33.4	26.5	20.6	0.0	0.0	0.0

Segment 20

0.0	795.7	794.6	793.5	793.0	791.6	791.4	789.8	789.3	787.2
783.9	779.2	776.1	766.0	756.5	748.4	739.0	725.7	713.6	701.9
692.2	683.4	674.9	666.4	655.8	625.0	558.3	527.6	500.1	478.9
458.8	439.8	417.4	396.2	380.4	345.4	320.1	280.8	192.3	151.5
134.6	113.1	84.8	70.5	60.4	53.0	45.9	26.5	0.0	0.0

Segment 21

0.0	665.2	665.2	664.5	663.7	663.0	661.5	661.5	660.0	660.0
656.9	655.6	653.3	644.4	637.0	628.5	619.9	605.0	593.1	583.5
574.1	566.4	558.2	550.0	541.1	527.4	505.4	496.5	483.1	466.0
451.9	433.1	414.0	393.9	368.7	341.2	317.3	289.1	245.3	199.9
154.6	112.7	101.1	88.4	69.1	47.6	39.1	32.0	23.0	0.0

Segment 22

0.0	665.2	665.2	664.5	663.7	663.0	661.5	661.5	660.0	660.0
656.9	655.6	653.3	644.4	637.0	628.5	619.9	605.0	593.1	583.5
574.1	566.4	558.2	550.0	541.1	527.4	505.4	496.5	483.1	466.0
451.9	433.1	414.0	393.9	368.7	341.2	317.3	289.1	245.3	199.9
154.6	112.7	101.1	88.4	69.1	47.6	39.1	32.0	23.0	0.0

Segment 23 (downstream end of Branch 1 - Obey River)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 24  (upstream end of Branch 2 - West Fork Obey River)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              25
     0.0   158.7   154.7   145.1   134.7   124.6   114.8   104.8    90.5    65.4
    45.2    38.7    33.9    30.7    27.1    26.2    20.7     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              26
     0.0   158.7   154.7   145.1   134.7   124.6   114.8   104.8    90.5    65.4
    45.2    38.7    33.9    30.7    27.1    26.2    20.7     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 27  (downstream end of Branch 2 - West Fork Obey River)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 28  (upstream end of Branch 3 - Big Eagle Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              29
     0.0   311.1   310.2   307.6   305.3   295.5   277.2   258.8   241.0   222.2
   204.7   184.6   161.4   136.8   112.7   100.0    89.0    77.8    66.2    54.5
    42.0    29.1     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              30
     0.0   335.3   333.2   329.0   323.3   318.2   314.2   308.5   303.6   298.6
   293.4   286.6   280.3   274.6   268.3   260.6   252.7   242.1   230.9   215.3
   198.0   148.3    75.5    52.2    22.7     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 31  (downstream end of Branch 3 - Big Eagle Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 32  (upstream end of Branch 4 - Ashburn Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
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     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment               33
     0.0  3430.1  3189.9  3058.2  2905.6  2674.1  2528.5  2324.1  2199.0  2120.4
  1906.9  1782.7  1628.1  1497.9  1271.6  1028.2   838.2   805.0   623.2   499.0
   377.3   282.2   237.0   193.0   121.3    61.8    53.2     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment               34
     0.0  4410.2  4101.3  3931.9  3735.7  3438.1  3250.9  2988.1  2827.3  2726.2
  2451.7  2292.0  2093.2  1925.9  1662.9  1371.0  1143.0  1097.7   872.4   720.7
   613.1   483.8   372.4   353.9   242.6   185.3   141.8    77.8    61.2    46.4
    41.8    22.3     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 35  (downstream end of Branch 4 - Ashburn Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 36  (upstream end of Branch 5 - Illwill Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment               37
     0.0   301.3   300.0   295.0   289.2   274.8   252.1   229.8   207.9   184.6
   162.3   142.6   123.4   102.8    84.9    66.8    56.8    54.1    50.5    39.9
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment               38
     0.0   411.6   408.4   401.0   393.5   385.0   378.1   370.1   362.7   351.5
   340.0   329.2   319.6   309.0   295.7   281.3   268.0   259.5   250.5   223.9
   178.8   136.1   109.0    81.9    46.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment               39
     0.0   640.4   637.9   632.1   626.2   620.5   614.5   608.6   602.7   596.9
   587.8   579.2   571.9   564.6   556.7   547.4   540.1   532.8   524.9   512.7
   501.0   461.3   433.0   406.1   359.1   209.4    51.4    20.6    20.4    20.2
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 40  (downstream end of Branch 5 - Illwill Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 41  (upstream end of Branch 6 - Wolf River)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
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     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              42
     0.0   453.7   448.8   434.7   420.5   406.6   392.5   378.5   359.9   291.7
   236.8   221.2   204.8   107.3    51.3    26.1    24.1     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              43
     0.0   485.2   482.2   473.3   465.1   456.7   448.0   439.9   430.9   423.5
   412.6   404.2   387.8   363.6   339.1   308.3   262.9   152.8    70.6    41.3
    24.5    20.5     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              44
     0.0   609.7   605.1   593.5   581.4   569.4   558.0   545.6   532.8   516.9
   498.1   484.2   465.6   444.7   422.6   398.9   357.2   313.9   251.3   204.6
   164.1   114.9    69.8    37.1    24.0    22.4     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              45
     0.0   623.6   621.7   612.0   604.1   595.2   586.4   577.6   566.9   550.7
   535.3   526.1   518.6   512.1   504.3   495.1   473.6   454.1   437.4   417.4
   394.6   365.9   332.0   215.4   148.1    75.7    34.4    23.7    20.4     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              46
     0.0   741.5   739.8   736.2   732.3   728.8   725.7   720.8   716.4   705.0
   696.1   690.4   686.0   679.4   663.1   654.8   649.1   642.0   634.1   628.4
   617.6   591.4   531.9   460.2   359.3   252.5   182.7   133.4    82.8    27.7
    25.7    23.7     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              47
     0.0   656.1   654.4   649.9   644.7   640.2   635.1   631.1   624.2   614.6
   607.9   601.5   598.0   594.0   588.4   563.3   515.5   481.8   464.8   453.9
   445.2   431.7   415.2   386.7   356.5   334.2   317.2   299.0   217.0   154.9
    98.0    75.2    64.9    50.1    38.7    24.7    20.7     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 48  (downstream end of Branch 6 - Wolf River)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment 49  (upstream end of Branch 7 - Sulphur Creek)
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

Segment              50
     0.0   411.8   408.9   401.6   396.0   388.6   381.9   374.5   368.3   362.1
   354.8   346.9   340.7   331.7   320.4   305.4   271.9   201.9   169.8   163.0
   158.2   149.5   127.5    50.8    10.7     1.2     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 51

0.0	563.3	561.4	553.9	545.8	539.6	531.4	523.8	516.9	510.0
499.5	493.1	486.9	478.7	469.3	458.8	448.0	438.6	428.0	416.7
403.2	381.6	347.8	253.8	190.5	164.1	157.9	149.8	134.1	78.2
20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 52

0.0	630.8	628.6	626.3	623.2	619.2	617.2	614.1	610.3	607.3
602.8	600.5	595.9	591.4	584.5	569.1	558.0	546.6	533.7	519.2
504.2	431.2	381.8	362.9	335.5	317.8	308.2	299.9	280.9	223.9
155.6	116.6	60.5	20.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 53 (downstream end of Branch 7 - Sulphur Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 54 (upstream end of Branch 8 - Irons Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 55

0.0	3430.1	3189.9	3058.2	2905.6	2674.1	2528.5	2324.1	2199.0	2120.4
1906.9	1782.7	1628.1	1497.9	1271.6	1113.9	990.6	951.3	810.1	665.3
518.8	443.5	338.6	321.7	218.4	164.7	124.1	66.7	51.0	27.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 56

0.0	4410.2	4101.3	3931.9	3735.7	3438.1	3250.9	2988.1	2827.3	2726.2
2451.7	2292.0	2093.2	1925.9	1760.7	1456.6	1219.2	1170.9	934.7	831.6
660.3	564.5	440.1	418.3	315.4	267.7	230.5	144.5	132.5	120.6
108.7	89.3	85.4	81.5	77.6	61.4	52.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 57 (downstream end of Branch 8 - Irons Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 58 (upstream end of Branch 9 - Holly Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 59

0.0	279.4	277.3	271.9	264.3	258.1	251.4	246.0	237.4	213.6
186.9	170.5	152.1	135.9	113.3	97.9	88.5	64.7	52.9	43.2
26.7	24.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 60

0.0	335.6	331.3	318.4	307.6	294.9	283.8	270.9	259.0	245.0
237.1	231.0	224.5	219.1	209.4	200.3	186.7	160.8	145.7	136.0
113.5	100.4	90.7	79.9	71.2	62.3	55.0	51.8	36.7	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 61 (downstream end of Branch 9 - Holly Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 62 (upstream end of Branch 10 - Mitchell Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 63

0.0	2205.1	2050.6	1966.0	1867.9	1719.0	1625.4	1494.0	1413.6	1363.1
1225.9	1146.0	1046.6	963.0	978.2	942.5	914.4	878.2	747.8	665.3
566.0	443.5	372.4	353.9	242.6	205.9	159.6	88.9	71.4	64.9
58.5	44.6	42.7	20.4	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 64

0.0	2940.1	2734.2	2621.3	2490.5	2292.0	2167.3	1992.1	1884.9	1817.5
1634.5	1528.0	1395.5	1283.9	1271.6	1199.6	1143.0	1097.7	997.0	942.5
848.9	725.8	609.4	579.1	461.0	411.8	372.3	255.6	244.7	231.9
217.4	208.3	206.3	203.7	200.3	196.4	185.9	159.0	142.0	71.2
28.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Segment 65

0.0	3675.2	3417.7	3276.6	3113.1	2865.1	2709.1	2490.1	2356.1	2271.8
2043.1	1910.0	1744.4	1604.9	1565.1	1456.6	1371.6	1317.2	1246.3	1219.7
1131.9	1088.7	1015.7	997.4	825.0	761.8	691.4	477.9	458.8	435.9
409.7	379.5	377.1	373.4	368.4	355.9	342.8	337.8	331.3	285.0
253.4	224.9	195.7	130.3	69.5	62.3	40.9	0.0	0.0	0.0

Segment 66 (downstream end of Branch 10 - Mitchell Creek)

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

APPENDIX E

District Select Simulations

CELRN-EP-H 13 November 1998

MEMORANDUM FOR FILES

SUBJECT: Dale Hollow Withdrawal Zone Studies

1. Recent Center Hill withdrawal zone studies concluded that bottom elevation in the vicinity of the powerhouse is the applicable elevation to use in SELECT program. Subsequently it was decided to review SELECT model application on Dale Hollow project. Paula Kee performed an update using SELECT version 2.01 in 1996 on an earlier Dale Hollow Withdrawal Zone Study. She used a bottom elevation of 503 and a withdrawal angle of 1.57 to come up with an effective centerline elevation of 568.

2. Dale Hollow Dam has three 15-feet diameter penstocks each with a centerline elevation of 563.05 and bottom elevations of 510, 520, & 530, as per project drawings (Q-3/214.2). It was determined to run SELECT by using a withdrawal angle of 3.14 since the penstocks are in the middle of the dam and to vary bottom elevations from 510 to 530 before selecting a suitable value.

3. The same input file that Paula had developed was used with one exception. Data for 17 Oct 1991 was deleted from consideration since the discharge was only 17 cfs. Results from several SELECT runs along with other computations are tabulated in the attached EXCEL printouts.

4. The first two runs were made to determine the sensitivity of the computed withdrawal zone to the withdrawal angle. The 'base condition' run used the values Paula had developed (bottom elevation = 503, centerline elevation = 568, & withdrawal angle = 1.57). For the 'new angle' run, withdrawal angle was set to 3.14. The boundaries of the withdrawal zone were narrower for the 'new angle' run, as shown by the Withdrawal Zone Limit Data in the attached printouts.

5. Two additional runs were made with bottom elevations changed to 510 and 530 to select an appropriate bottom elevation. The withdrawal angle was kept at 3.14 for all simulations. Results for the temperature computations after discarding three events with differences greater than 2.0^{0}C are summarized below:

Bottom Elevation	Average Error	Standard Error
503	-0.07	0.57
510	-0.14	0.50
530	-0.03	0.52

It was not apparent if one bottom elevation reproduced observed outflow temperatures better than others from this information.

6. The next step involved creating an input file containing several temperature and dissolved manganese profiles which included corresponding tailwater dissolved manganese values for comparison to predicted results so that a clear choice can be made on bottom elevation. Pertinent data retrieval on Water Quality Database resulted with only seven events from 1971 through 1997 period. Profiles and tailwater data were collected on different days for two of these events. Data for 17 Oct 1991 were excluded from evaluation since the discharge was only 17 cfs. Profiles were taken at station 3DAL20002 and tailwater data were collected at station 3DAL10001.

7. Simulations were made with bottom elevations set at 510, 520, and 530. Results from these runs along with observed manganese values are shown below:

Date	Observed Diss. Mn	Computed Mn (BE: 510)	Computed Mn (BE: 520)	Computed Mn (BE: 530)
10/10/72	330	538	532	536
10/30/79	300	267	316	277
09/23/82	<10	22	22	19
10/15/87	10	18	16	12
10/04/90	35	19	18	19
09/26/97	552	147	160	155

Again, an obvious conclusion can not be made as to the appropriate value for bottom elevation from these computations. It was decided to select bottom elevation of 510 since dissolved manganese concentrations would be higher at this level. This would ensure conservative output when this model is used for forecasting purposes in the future.

8. Three additional runs were made with the bottom elevation set at 510 and the withdrawal angle maintained at 3.14 to determine the optimum centerline elevation. Results for the temperature computations after eliminating three events with differences higher than 2.0^{o}C are shown below:

Centerline Elevation	Average Error	Standard Error
568	-0.14	0.50
569	-0.06	0.54
570	0.02	0.53
571	0.09	0.53

These computations indicate that the effective centerline elevation is 570, providing an average difference of 0.02°C in outflow temperature based on 13 events. Detailed EXCEL printouts including observed and computed values for each centerline elevation are attached.

9. The following files are used in the study:

Select.exe	-	SELECT executable, version 2.01
Select.in	-	required input file to SELECT
Select.out	-	default SELECT output file
Oldangle.dat	-	input file saved for Base Condition Run
Oldangle.out	-	output file saved for Base Condition Run
Newangle.dat	-	input file saved for Revised Withdrawal Angle Run
Newangle.out	-	output file saved for Revised Withdrawal Angle Run
Runb510c568.dat	-	input file saved for Bottom Elevation 510 Run
Runb510c568.out	-	output file saved for Bottom Elevation 510 Run
Runb530c568.dat	-	input file saved for Bottom Elevation 530 Run
Runb530c568.out	-	output file saved for Bottom Elevation 530 Run
Mnb510c568.dat	-	input file saved for Bottom Elevation 510 Manganese Run
Mnb510c568.out	-	output file saved for Bottom Elevation 510 Manganese Run
Mnb520c568.dat	-	input file saved for Bottom Elevation 520 Manganese Run
Mnb520c568.out	-	output file saved for Bottom Elevation 520 Manganese Run
Mnb530c568.dat	-	input file saved for Bottom Elevation 530 Manganese Run
Mnb530c568.out	-	output file saved for Bottom Elevation 530 Manganese Run
Runb510c569.dat	-	input file saved for Centerline Elevation 569 Run
Runb510c569.out	-	output file saved for Centerline Elevation 569 Run
Runb510c570.dat	-	input file saved for Centerline Elevation 570 Run
Runb510c570.out	-	output file saved for Centerline Elevation 570 Run
Runb510c571.dat	-	input file saved for Centerline Elevation 571 Run
Runb510c571.out	-	output file saved for Centerline Elevation 571 Run

Dal.xls - Excel file with computations for all runs
Dal.doc - MS Word file with documentation

All these files are stored in the \select\dal directory. The most applicable withdrawal zone data is contained in the runb510c570.out file.

Parvathi Gaddipati

Parvathi Gaddipati
Hydraulic Engineer
Water Management Section

Base Condition

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.: 568
Bottom Elev.: 503
Angle: 1.57

Input & Output Files: oldangle.dat & oldangle.out

	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
Date	Inst. Flow	HW Elev.	Observed Temp.	Computed Temp.	Difference	Diff. Squared	Observed D.O.	Computed D.O.	Difference	Diff. Squared	Above Bottom	Elevation	Above Bottom	Elevation
10/30/79	5418	641.3	15.5	15.0	-0.5	0.25	4.3	3.5	-0.8	0.64	0.0	503.0	138.3	641.3
11/20/79	5568	640.7	14.5	14.1	-0.4	0.16	7.7	6.8	-0.9	0.81	0.0	503.0	137.7	640.7
4/24/80	5370	650.4	8.7	9.5	0.8	0.64	11.2	7.9	-3.3	10.89	64.8	567.8	146.0	649.0
8/4/81	3438	645.9	10.7	12.1	1.4	1.96	5.9	5.0	-0.9	0.81	0.0	503.0	120.3	623.3
10/22/81	3737	638.3	13.8	12.9	-0.9	0.81	2.0	1.0	-1.0	1.00	0.0	503.0	135.3	638.3
9/23/82	3680	646.0	12.0	12.1	0.1	0.01	4.5	3.7	-0.8	0.64	0.0	503.0	125.4	628.4
9/1/83	5587	638.0	13.8	13.8	0.0	0.00	3.3	2.7	-0.6	0.36	0.0	503.0	130.5	633.5
6/16/86	1740	648.0	9.1	8.5	-0.6	0.36	9.1	9.2	0.1	0.01	0.0	503.0	117.0	620.0
5/20/88	1790	645.5	9.0	8.8	-0.2	0.04	10.5	9.9	-0.6	0.36	0.0	503.0	115.5	618.5
7/6/88	1710	642.9	9.9	9.9	0.0	0.00	7.9	7.7	-0.2	0.04	0.0	503.0	112.3	615.3
7/6/90	3560	648.9	13.0	11.0	-2.0	4.00	6.2	6.7	0.5	0.25	0.0	503.0	124.5	627.5
10/4/90	1677	639.5	14.7	11.9	-2.8	7.84	8.2	1.9	-6.3	39.69	0.0	503.0	109.0	612.0
7/24/91	1800	645.0	14.5	11.2	-3.3	10.89	6.8	5.5	-1.3	1.69	0.0	503.0	112.3	615.3
6/6/94	3565	649.7	10.0	10.1	0.1	0.01	7.9	6.8	-1.1	1.21	0.0	503.0	128.1	631.1
9/2/94	5155	642.6	12.2	12.4	0.2	0.04	2.8	2.2	-0.6	0.36	0.0	503.0	129.5	632.5
9/15/94	1875	641.2	12.2	12.5	0.3	0.09	1.9	1.4	-0.5	0.25	0.0	503.0	108.8	611.8
				Avg. Error:	-0.49			Avg. Error:	-1.14		Avg.:	507.1	Avg.:	627.4
				w/13 events	0.02			w/15 events	-0.80					
				Std. Error:	1.34			Std. Error:	1.98					
				w/13 events	0.60			w/15 events	1.17					

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.:		568		Input & Output Files:		newangle.dat & newangle.out								
Bottom Elev.:		503												
	Angle:	3.14												
	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
	Inst.	HW	Observed	Computed		Diff.	Observed	Computed		Diff.	Above		Above	
Date	Flow	Elev.	Temp.	Temp.	Difference	Squared	D.O.	D.O.	Difference	Squared	Bottom	Elevation	Bottom	Elevation
10/30/79	5418	641.3	15.5	15.3	-0.2	0.04	4.3	3.3	-1.0	1.00	0.0	503.0	138.3	641.3
11/20/79	5568	640.7	14.5	14.2	-0.3	0.09	7.7	7.1	-0.6	0.36	0.0	503.0	137.7	640.7
4/24/80	5370	650.4	8.7	9.2	0.5	0.25	11.2	7.9	-3.3	10.89	64.8	567.8	132.1	635.1
8/4/81	3438	645.9	10.7	12.1	1.4	1.96	5.9	4.9	-1.0	1.00	1.3	504.3	113.2	616.2
10/22/81	3737	638.3	13.8	13.0	-0.8	0.64	2.0	0.6	-1.4	1.88	1.3	504.3	118.6	621.6
9/23/82	3680	646.0	12.0	11.7	-0.3	0.09	4.5	3.8	-0.7	0.49	0.0	503.0	112.5	615.5
9/1/83	5587	638.0	13.8	13.8	0.0	0.00	3.3	2.7	-0.6	0.36	0.0	503.0	114.7	617.7
6/16/86	1740	648.0	9.1	8.4	-0.7	0.49	9.1	9.3	0.2	0.04	0.0	503.0	109.0	612.0
5/20/88	1790	645.5	9.0	8.6	-0.4	0.16	10.5	9.9	-0.6	0.36	0.0	503.0	108.3	611.3
7/6/88	1710	642.9	9.9	9.7	-0.2	0.04	7.9	7.7	-0.2	0.04	3.8	506.8	106.3	609.3
7/6/90	3560	648.9	13.0	10.7	-2.3	5.29	6.2	6.7	0.5	0.25	0.0	503.0	116.0	619.0
10/4/90	1677	639.5	14.7	11.8	-2.9	8.41	8.2	2.0	-6.2	38.44	10.9	513.9	102.7	605.7
7/24/91	1800	645.0	14.5	11.1	-3.4	11.56	6.8	5.6	-1.2	1.44	4.3	507.3	106.7	609.7
6/6/94	3565	649.7	10.0	9.8	-0.2	0.04	7.9	6.8	-1.1	1.21	0.0	503.0	120.1	623.1
9/2/94	5155	642.6	12.2	12.3	0.1	0.01	2.8	2.2	-0.6	0.36	0.0	503.0	113.2	616.2
9/15/94	1875	641.2	12.2	12.4	0.2	0.04	1.9	1.4	-0.5	0.25	11.4	514.4	102.5	605.5
				Avg. Error:	-0.59			Avg. Error:	-1.14		Avg.:	509.1	Avg:.	618.7
				w/13 events	-0.07			w/15 events	-0.80					
				Std. Error:	1.39			Std. Error:	1.97					
				w/13 events	0.57			w/15 events	1.19					

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.: 568
Bottom Elev.: 510
Angle: 3.14

Input & Output Files: runb510c568.dat & runb510c568.out

	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
Date	Inst. Flow	HW Elev.	Observed Temp.	Computed Temp.	Difference	Diff. Squared	Observed D.O.	Computed D.O.	Difference	Diff. Squared	Above Bottom	Elevation	Above Bottom	Elevation
10/30/79	5418	641.3	15.5	15.2	-0.3	0.09	4.3	3.3	-1.0	1.00	0.0	510.0	131.3	641.3
11/20/79	5568	640.7	14.5	14.2	-0.3	0.09	7.7	7.2	-0.5	0.25	0.0	510.0	130.7	640.7
4/24/80	5370	650.4	8.7	8.7	0.0	0.00	11.2	7.8	-3.4	11.56	0.0	510.0	125.3	635.3
8/4/81	3438	645.9	10.7	11.9	1.2	1.44	5.9	4.8	-1.1	1.21	0.0	510.0	105.9	615.9
10/22/81	3737	638.3	13.8	13.0	-0.8	0.64	2.0	0.7	-1.3	1.74	0.0	510.0	111.5	621.5
9/23/82	3680	646.0	12.0	11.8	-0.2	0.04	4.5	3.8	-0.7	0.49	0.0	510.0	106.0	616.0
9/1/83	5587	638.0	13.8	13.8	0.0	0.00	3.3	2.7	-0.6	0.36	0.0	510.0	108.3	618.3
6/16/86	1740	648.0	9.1	8.4	-0.7	0.49	9.1	9.3	0.2	0.04	0.0	510.0	102.2	612.2
5/20/88	1790	645.5	9.0	8.6	-0.4	0.16	10.5	9.9	-0.6	0.36	0.0	510.0	101.9	611.9
7/6/88	1710	642.9	9.9	9.7	-0.2	0.04	7.9	7.7	-0.2	0.04	0.0	510.0	98.4	608.4
7/6/90	3560	648.9	13.0	10.7	-2.3	5.29	6.2	6.7	0.5	0.25	0.0	510.0	108.8	618.8
10/4/90	1677	639.5	14.7	11.7	-3.0	9.00	8.2	1.9	-6.3	39.69	3.9	513.9	95.7	605.7
7/24/91	1800	645.0	14.5	11.0	-3.5	12.25	6.8	5.5	-1.3	1.69	0.0	510.0	99.4	609.4
6/6/94	3565	649.7	10.0	9.8	-0.2	0.04	7.9	6.8	-1.1	1.21	0.0	510.0	113.2	623.2
9/2/94	5155	642.6	12.2	12.2	0.0	0.00	2.8	2.2	-0.6	0.36	0.0	510.0	106.4	616.4
9/15/94	1875	641.2	12.2	12.3	0.1	0.01	1.9	1.3	-0.6	0.36	4.3	514.3	95.5	605.5
				Avg. Error:	-0.66			Avg. Error:	-1.16		Avg.:	510.5	Avg:.	618.8
				w/13 events	-0.14			w/15 events	-0.82					
				Std. Error:	1.40			Std. Error:	2.01					
				w/13 events	0.50			w/15 events	1.22					

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.: 568
Bottom Elev.: 530
Angle: 3.14

Input & Output Files: runb530c568.dat & runb530c568.out

	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
Date	Inst. Flow	HW Elev.	Observed Temp.	Computed Temp.	Difference	Diff. Squared	Observed D.O.	Computed D.O.	Difference	Diff. Squared	Above Bottom	Elevation	Above Bottom	Elevation
10/30/79	5418	641.3	15.5	15.2	-0.3	0.09	4.3	3.2	-1.1	1.21	0.0	530.0	111.3	641.3
11/20/79	5568	640.7	14.5	14.3	-0.2	0.04	7.7	7.4	-0.3	0.09	0.0	530.0	110.7	640.7
4/24/80	5370	650.4	8.7	9.2	0.5	0.25	11.2	7.9	-3.3	10.89	37.9	567.9	106.1	636.1
8/4/81	3438	645.9	10.7	11.9	1.2	1.44	5.9	4.8	-1.1	1.21	0.0	530.0	86.3	616.3
10/22/81	3737	638.3	13.8	13.0	-0.8	0.64	2.0	0.6	-1.4	1.85	0.0	530.0	91.6	621.6
9/23/82	3680	646.0	12.0	11.9	-0.1	0.01	4.5	3.9	-0.6	0.36	0.0	530.0	85.9	615.9
9/1/83	5587	638.0	13.8	14.0	0.2	0.04	3.3	2.8	-0.5	0.25	0.0	530.0	88.4	618.4
6/16/86	1740	648.0	9.1	8.4	-0.7	0.49	9.1	9.3	0.2	0.04	0.0	530.0	82.7	612.7
5/20/88	1790	645.5	9.0	8.7	-0.3	0.09	10.5	9.9	-0.6	0.36	0.0	530.0	82.3	612.3
7/6/88	1710	642.9	9.9	9.7	-0.2	0.04	7.9	7.7	-0.2	0.04	0.0	530.0	79.2	609.2
7/6/90	3560	648.9	13.0	10.8	-2.2	4.84	6.2	6.7	0.5	0.25	0.0	530.0	88.9	618.9
10/4/90	1677	639.5	14.7	11.7	-3.0	9.00	8.2	1.9	-6.3	39.69	0.0	530.0	75.5	605.5
7/24/91	1800	645.0	14.5	11.0	-3.5	12.25	6.8	5.6	-1.2	1.44	0.0	530.0	79.7	609.7
6/6/94	3565	649.7	10.0	9.9	-0.1	0.01	7.9	6.9	-1.0	1.00	0.0	530.0	93.7	623.7
9/2/94	5155	642.6	12.2	12.4	0.2	0.04	2.8	2.3	-0.5	0.25	0.0	530.0	86.9	616.9
9/15/94	1875	641.2	12.2	12.4	0.2	0.04	1.9	1.4	-0.5	0.25	0.0	530.0	75.4	605.4
				Avg. Error:	-0.57			Avg. Error:	-1.12		Avg.:	532.4	Avg:.	619.0
				w/13 events	-0.03			w/15 events	-0.77					
				Std. Error:	1.40			Std. Error:	1.99					
				w/13 events	0.52			w/15 events	1.18					

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.:		569		Input & Output Files:		runb510c569.dat & runb510c569.out								
Bottom Elev.:		510												
	Angle:	3.14												
	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
	Inst.	HW	Observed	Computed		Diff.	Observed	Computed		Diff.	Above		Above	
Date	Flow	Elev.	Temp.	Temp.	Difference	Squared	D.O.	D.O.	Difference	Squared	Bottom	Elevation	Bottom	Elevation
10/30/79	5418	641.3	15.5	15.3	-0.2	0.04	4.3	3.5	-0.8	0.64	0.0	510.0	131.3	641.3
11/20/79	5568	640.7	14.5	14.2	-0.3	0.09	7.7	7.2	-0.5	0.25	0.0	510.0	130.7	640.7
4/24/80	5370	650.4	8.7	8.8	0.1	0.00	11.2	7.8	-3.4	11.56	0.0	510.0	125.9	635.9
8/4/81	3438	645.9	10.7	12.1	1.4	1.96	5.9	4.9	-1.0	1.00	0.0	510.0	106.4	616.4
10/22/81	3737	638.3	13.8	13.0	-0.8	0.64	2.0	0.7	-1.3	1.72	0.0	510.0	112.5	622.5
9/23/82	3680	646.0	12.0	11.8	-0.2	0.04	4.5	3.8	-0.7	0.49	0.0	510.0	106.5	616.5
9/1/83	5587	638.0	13.8	13.8	0.0	0.00	3.3	2.7	-0.6	0.36	0.0	510.0	108.8	618.8
6/16/86	1740	648.0	9.1	8.4	-0.7	0.49	9.1	9.3	0.2	0.04	0.0	510.0	102.7	612.7
5/20/88	1790	645.5	9.0	8.7	-0.3	0.09	10.5	9.9	-0.6	0.36	0.0	510.0	102.4	612.4
7/6/88	1710	642.9	9.9	9.8	-0.1	0.01	7.9	7.7	-0.2	0.04	0.3	510.3	98.9	608.9
7/6/90	3560	648.9	13.0	10.7	-2.3	5.29	6.2	6.7	0.5	0.25	0.0	510.0	109.3	619.3
10/4/90	1677	639.5	14.7	11.9	-2.8	7.84	8.2	2.0	-6.2	38.44	5.3	515.3	96.2	606.2
7/24/91	1800	645.0	14.5	11.1	-3.4	11.56	6.8	5.6	-1.2	1.44	0.0	510.0	99.4	609.4
6/6/94	3565	649.7	10.0	9.9	-0.1	0.01	7.9	6.9	-1.0	1.00	0.0	510.0	113.8	623.8
9/2/94	5155	642.6	12.2	12.4	0.2	0.04	2.8	2.3	-0.5	0.25	0.0	510.0	107.5	617.5
9/15/94	1875	641.2	12.2	12.4	0.2	0.04	1.9	1.4	-0.5	0.25	5.8	515.8	95.9	605.9
				Avg. Error:	-0.58			Avg. Error:	-1.11		Avg.:	510.7	Avg.:	619.3
				w/13 events	-0.06			w/15 events	-0.77					
				Std. Error:	1.37			Std. Error:	1.97					
				w/13 events	0.54			w/15 events	1.18					

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.: 570
Bottom Elev.: 510
Angle: 3.14

Input & Output Files: runb510c570.dat & runb510c570.out

	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
Date	Inst. Flow	HW Elev.	Observed Temp.	Computed Temp.	Difference	Diff. Squared	Observed D.O.	Computed D.O.	Difference	Diff. Squared	Above Bottom	Elevation	Above Bottom	Elevation
10/30/79	5418	641.3	15.5	15.5	0.0	0.00	4.3	3.6	-0.7	0.49	0.0	510.0	131.3	641.3
11/20/79	5568	640.7	14.5	14.3	-0.2	0.04	7.7	7.3	-0.4	0.16	0.0	510.0	130.7	640.7
4/24/80	5370	650.4	8.7	8.8	0.1	0.00	11.2	7.8	-3.4	11.56	0.0	510.0	126.4	636.4
8/4/81	3438	645.9	10.7	12.2	1.5	2.25	5.9	4.9	-1.0	1.00	0.0	510.0	107.0	617.0
10/22/81	3737	638.3	13.8	13.1	-0.7	0.49	2.0	0.7	-1.3	1.69	0.0	510.0	113.5	623.5
9/23/82	3680	646.0	12.0	11.9	-0.1	0.01	4.5	3.9	-0.6	0.36	0.0	510.0	107.0	617.0
9/1/83	5587	638.0	13.8	14.0	0.2	0.04	3.3	2.9	-0.4	0.16	0.0	510.0	109.8	619.8
6/16/86	1740	648.0	9.1	8.5	-0.6	0.36	9.1	9.3	0.2	0.04	0.0	510.0	103.2	613.2
5/20/88	1790	645.5	9.0	8.8	-0.2	0.04	10.5	10.0	-0.5	0.25	0.0	510.0	103.0	613.0
7/6/88	1710	642.9	9.9	9.8	-0.1	0.01	7.9	7.7	-0.2	0.04	0.2	510.2	100.2	610.2
7/6/90	3560	648.9	13.0	10.8	-2.2	4.84	6.2	6.7	0.5	0.25	0.0	510.0	109.9	619.9
10/4/90	1677	639.5	14.7	11.9	-2.8	7.84	8.2	2.0	-6.2	38.44	6.3	516.3	96.7	606.7
7/24/91	1800	645.0	14.5	11.1	-3.4	11.56	6.8	5.6	-1.2	1.44	1.5	511.5	99.9	609.9
6/6/94	3565	649.7	10.0	9.9	-0.1	0.01	7.9	6.9	-1.0	1.00	0.0	510.0	114.3	624.3
9/2/94	5155	642.6	12.2	12.4	0.2	0.04	2.8	2.3	-0.5	0.25	0.0	510.0	108.5	618.5
9/15/94	1875	641.2	12.2	12.5	0.3	0.09	1.9	1.4	-0.5	0.25	6.8	516.8	96.4	606.4
				Avg. Error:	-0.51			Avg. Error:	-1.08		Avg.:	510.9	Avg.:	619.9
				w/13 events	0.02			w/15 events	-0.73					
				Std. Error:	1.36			Std. Error:	1.96					
				w/13 events	0.53			w/15 events	1.16					

DALE HOLLOW WITHDRAWAL STUDY

Centerline Elev.: 571
Bottom Elev.: 510
Angle: 3.14

Input & Output Files: runb510c571.dat & runb510c571.out

	Hydrologic Data		Temperature Data				D.O. Data				Withdrawal Zone Limit Data			
											Lower		Upper	
Date	Inst. Flow	HW Elev.	Observed Temp.	Computed Temp.	Difference	Diff. Squared	Observed D.O.	Computed D.O.	Difference	Diff. Squared	Above Bottom	Elevation	Above Bottom	Elevation
10/30/79	5418	641.3	15.5	15.6	0.1	0.01	4.3	3.8	-0.5	0.25	0.0	510.0	131.3	641.3
11/20/79	5568	640.7	14.5	14.3	-0.2	0.04	7.7	7.3	-0.4	0.16	0.0	510.0	130.7	640.7
4/24/80	5370	650.4	8.7	8.8	0.1	0.00	11.2	7.8	-3.4	11.56	0.0	510.0	127.0	637.0
8/4/81	3438	645.9	10.7	12.3	1.6	2.56	5.9	4.9	-1.0	1.00	0.0	510.0	107.5	617.5
10/22/81	3737	638.3	13.8	13.4	-0.4	0.16	2.0	0.9	-1.1	1.30	0.0	510.0	114.5	624.5
9/23/82	3680	646.0	12.0	12.1	0.1	0.01	4.5	4.0	-0.5	0.25	0.0	510.0	107.6	617.6
9/1/83	5587	638.0	13.8	14.0	0.2	0.04	3.3	2.9	-0.4	0.16	0.0	510.0	110.8	620.8
6/16/86	1740	648.0	9.1	8.5	-0.6	0.36	9.1	9.3	0.2	0.04	0.0	510.0	103.8	613.8
5/20/88	1790	645.5	9.0	8.8	-0.2	0.04	10.5	10.0	-0.5	0.25	0.0	510.0	103.0	613.0
7/6/88	1710	642.9	9.9	9.9	0.0	0.00	7.9	7.8	-0.1	0.01	1.7	511.7	100.6	610.6
7/6/90	3560	648.9	13.0	10.9	-2.1	4.41	6.2	6.7	0.5	0.25	0.0	510.0	110.4	620.4
10/4/90	1677	639.5	14.7	12.0	-2.7	7.29	8.2	2.1	-6.1	37.21	7.9	517.9	97.7	607.7
7/24/91	1800	645.0	14.5	11.2	-3.3	10.89	6.8	5.7	-1.1	1.21	0.7	510.7	101.2	611.2
6/6/94	3565	649.7	10.0	9.9	-0.1	0.01	7.9	6.9	-1.0	1.00	0.0	510.0	114.9	624.9
9/2/94	5155	642.6	12.2	12.5	0.3	0.09	2.8	2.3	-0.5	0.25	0.0	510.0	109.6	619.6
9/15/94	1875	641.2	12.2	12.5	0.3	0.09	1.9	1.5	-0.4	0.16	7.9	517.9	97.5	607.5
				Avg. Error:	-0.43			Avg. Error:	-1.02		Avg.:	511.1	Avg.:	620.5
				w/13 events	0.09			w/15 events	-0.68					
				Std. Error:	1.32			Std. Error:	1.92					
				w/13 events	0.53			w/15 events	1.13					

APPENDIX F

Model Year Selection

ftn Associates Ltd.
water resources / environmental consultants

MEMORANDUM

DATE: August 21, 2000

TO: Jack Brown, Nashville District Corps of Engineers

FROM: Philip Massirer, FTN Associates PAM

SUBJ: Selection of Study Years for CE-QUAL-W2 Modeling of Dale Hollow Lake
FTN Project No. 1150-041

1.0 INTRODUCTION

The purpose of this document is to describe the procedures used to select the years to simulate with the CE-QUAL-W2 model for Dale Hollow Lake. The scope of work states that the model is to be calibrated to one wet year, one dry year, and one typical year.

2.0 IDENTIFICATION OF AVAILABLE WATER QUALITY DATA

The first step was to determine the availability of water quality data. The District provided a sampling log summarizing which stations lake stations and inflow stations were sampled on which dates for 1971 through 1999 (Attachment A). This information was supplemented with information from two water quality reports on Dale Hollow Lake (references are listed at end of memo) and with data retrieved from STORET. All of this information was reviewed to determine which years had the most water quality data.

2.1 Data from the District

As shown in the sampling log in Attachment A, the years with the most in-lake sampling events were 1971 and 1979 (stations were sampled 6 to 8 times each year). During the 1990's, data were typically collected at a large number of lake and stream stations, but only twice per year. The only years besides 1971 and 1979 with more than 2 sampling events per year at in-lake stations were 1972, 1973, 1985, and 1988. The 1985 data were not shown on the sampling log but were identified in the District's water quality database. The reason for the 1985 data not being shown on the sampling log may be the fact that only in situ data are available for the lake stations for 1985.

For the inflow stations, the years with more than 2 sampling events per year were 1972, 1973, 1974, 1985, 1988, 1994, and 1997. The District's inflow data during the 1970's are not shown on

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the sampling log but were identified in the District's water quality database. The most extensive inflow data set collected by the District was in 1985, when 12 inflow stations were sampled 7 times for in situ data, nutrients, and other parameters. The 1985 data are presented in the District's water quality report titled "Water Quality Assessment Dale Hollow Lake and Its Inflows". Except for the 7 years mentioned above, the inflow stations were not sampled by the District more than twice per year.

The District's water quality data were also examined for availability of individual parameters. Chlorophyll data at lake stations are not available prior to 1977 or for the following years: 1978, 1984, 1985, 1989, 1992, 1993, 1995, and 1999. Nutrient data at lake stations are available for most of the years between 1971 and 1997. Nutrient data at inflow stations are available for some of the years between 1974 and 1997.

It should also be noted that the District selected Dale Hollow for an intensive survey during the year 2000. Data are being collected on 5 occasions rather than the normal two samplings. Since the 2000 data will not be available in time for this study, it is recommended that the 2000 data be used to confirm or validate the calibrated model. This would involve applying the calibrated model to the 2000 data set without any additional calibration or tuning to see how well the model does.

2.2 Data from STORET

Water quality data were identified in STORET from four different agencies: U.S. EPA, USGS, Tennessee Department of Environmental Conservation (TDEC), and Kentucky Department of Natural Resources (KDNR). The EPA data were collected between April 1973 and March 1974 as part of the National Eutrophication Survey (NES). The NES data were collected at 6 lake stations on 3 dates and at 10 non-lake stations on a monthly basis (8 inflow stations, 1 outflow station, and 1 municipal effluent discharge). The NES data at the lake stations consisted of vertical profiles of in situ measurements and nutrient concentrations and depth integrated samples for chlorophyll a. For the stream stations, the NES data included values for in situ measurements and nutrient concentrations. Some of the NES inflow stations are at the same locations as District inflow stations.

The USGS water quality data consisted mostly of temperature and conductivity measurements for the East and West Forks of the Obey River and the Wolf River. DO measurements were collected at three stations, but only during 1981. The temperature and conductivity data were collected from 1975 through 1996 at intervals ranging from monthly to twice per year. There were a number of years with no data.

The TDEC water quality data consisted only of measurements in the Obey River downstream of Dale Hollow Dam. These data included in situ measurements and concentrations of nutrients,

iron, and manganese. These data were collected from 1974 through 1998 at intervals ranging from monthly to twice per year.

The KDNR water quality data consisted of data collected at 6 stations in the northern part of the lake on 3 dates in 1987 and 3 dates in 1988. These data included in situ measurements and concentrations of nutrients and chlorophyll a.

3.0 IDENTIFICATION OF AVAILABLE USGS FLOW DATA

The USGS website was searched to identify stream gages with daily streamflow data in the watershed for Dale Hollow Lake. USGS flow data may be used to divide the total inflows among different streams. Table 1 lists the three stream gages that were identified as having daily flow data after the lake was impounded.

Table 1. USGS Stream Gages With Daily Flow Data.

Gage No.	Gage Name	Period of Record
03414500	East Fork Obey River near Jamestown, TN	1943-91
03415000	West Fork Obey River near Alpine, TN	1943-71, 1980-81
03416000	Wolf River near Byrdstown, TN	1943-91

4.0 CLASSIFICATION OF YEARS BASED ON INFLOW

Monthly net inflow data were obtained from the District for the period 1946-2000. Water quality data were available only for the period 1971-2000. Therefore, the years 1946-70 were not considered as potential study years for modeling. However, data from these years were kept in the flow analysis to have a longer period of record for comparison. The net inflow data were calculated by the District based on outflow records and change in storage computations. In many cases the net inflows during the late summer months were negative, presumably because evaporation exceeded inflow.

The goal of the this analysis was to classify the years as wet, dry, typical, or mixed. A mixed year was defined as a year having large monthly fluctuations in flows ranging from wet to dry conditions. A spreadsheet was developed to help perform this analysis. First, the years were ranked on the basis of annual inflow, from driest to wettest (Attachment B). Next, the mean and standard deviation were computed for both each month of the year and on an annual basis. The following criteria were then applied to classify a month or a year as wet, dry, or normal:

Dry: net inflow is more than one standard deviation below the mean
Typical: net inflow is within one standard deviation above or below the mean
Wet: net inflow is more than one standard deviation above the mean

Due to the large quantity of negative inflows in the input data set, the magnitude of the standard deviation was greater than the mean for most of the late summer and early autumn months. Therefore, using the above criteria, it was possible for a month with negative net inflow to still be considered "normal" and not "dry." Nevertheless, these criteria provided a useful relative basis on which to compare years. Dry years and wet years were classified based strictly on the above criteria. Mixed years were more difficult to evaluate and were classified based on inspection and judgement.

Using the methodology described above, the years with inflow data were classified as shown in Table 2.

Table 2. Classification of Years Based on Monthly Net Inflows.

Wet Years	Dry Years	Typical Years	Mixed Years
1950	1947	1949	1946
1951	1954	1952	1948
1957	1985	1953	1955
1962	1987	1959	1956
1972	1988	1960	1958
1973		1961	1963
1974		1964	1969
1975		1965	1977
1979		1966	1978
1982		1967	1981
1989		1968	1983
1994		1970	1986
		1971	1990
		1976	1992
		1980	1995
		1984	1997
		1991	1998
		1993	
		1996	
		1999	

The years with inflow data were also ranked based on average monthly inflows during the spring and late summer seasons. The spring season was defined as the months of March, April, and May. Stratification of the lake generally begins during this high runoff period. The late summer critical low flow period was defined as August, September, and October. These are the three months with the lowest net inflow. The spreadsheet used to rank the years based on spring

inflows is shown in Attachment C. The spreadsheet used to rank the years based on late summer inflows is shown in Attachment D.

5.0 SELECTION OF STUDY YEARS

The wet year selected for this study was 1973. As shown in Attachments C and D, the seasonal inflows for 1973 ranked 53rd (out of 55) for spring and 17th for late summer. The inflow ranking for the spring period was considered more important than late summer because spring is when the greatest nutrient loading occurs. The combination of the NES data (monthly values at 8 inflow stations) and the District data (3 values at 6 inflow stations) provides the best set of inflow water quality data among the wet years shown in Table 2. The other year that received close consideration for selection as a wet year was 1979. Although the District conducted in-lake sampling 8 times in 1979 and only 3 times in 1973, combining the NES data with the District data yields a total of 6 sampling events at lake stations during 1973. Also, there are no water quality data at inflow stations for 1979. The District did not collect any chlorophyll data in 1973, but the NES data includes chlorophyll data for lake stations. The wet years that were not selected were discarded for the following reasons:

1950, 1951, 1957, 1962 - prior to water quality data collection
1972 - lake data not as extensive as 1973 and 1979; no chlorophyll data
1974 - lake stations sampled only 1 time
1975 - no lake data at all
1979 - good lake data, but no water quality data at inflow stations
1982 - lake stations and inflow stations sampled only 1 time
1989 - no water quality data for lake stations or inflow stations
1994 - lake stations sampled only 2 times

The dry year selected for this study was 1988. As shown in Attachments C and D, the seasonal inflows for 1985 were the 2nd lowest for spring and the 16th lowest for late summer. The other year that received close consideration for selection as a dry year was 1985. The inflow water quality data for 1985 (12 stations sampled 7 times) was much more extensive than in 1988 (6 stations sampled 3 times). However, the only lake data that are available for 1985 are in situ data. The District's lake data for 1988 consist of in situ data, nutrients, and chlorophyll collected at 9 stations on 3 dates. Also, KDNR collected lake data in 1988 at 6 stations on 3 dates in the northern part of the reservoir. The KDNR data include in situ data, nutrients, and chlorophyll. Even though 1985 was not selected as a study year, the inflow data for that year can still be used when developing the model input for inflow water quality for 1988. The dry years that were not selected were discarded for the following reasons:

1947, 1954 - prior to water quality data collection
1985 - no nutrients or chlorophyll for lake stations (only in situ data)

1987 - lake stations and inflow stations sampled only 1 time by District

The typical year selected for this study was 1991. As shown in Attachments C and D, the seasonal inflows for 1991 were ranked 31st for spring and 13th for late summer. The inflow and lake data for 1991 consist of 2 sampling events, with data collected for in situ measurements, nutrients, and chlorophyll. This does not constitute an extensive data set, but none of the other years classified as typical in Table 2 had a more extensive data set. The typical years that were not selected were discarded for the following reasons:

1949 through 1970 - prior to water quality data collection
1971 - no chlorophyll data
1976 - no lake data at all; inflow stations only sampled once
1980 - only 1 lake station sampled; inflow stations only sampled once
1984 - no data at any of the lake or inflow stations
1993 - no data at any of the lake or inflow stations
1996 - extent of water quality data similar to 1991; no USGS flow data
1999 - no chlorophyll or nutrient data for lake stations

Because 1991 did not have an extensive data set, the availability of water quality data for the mixed years was evaluated to see if any of the mixed years could be used as a typical year. Several of the years had similar quantities of water quality data, but none had enough data to justify replacing 1991 as the selected typical year.

Ideally it would be desirable to select years that represent current conditions and are relatively close together in time. This was not possible in this case. Lack of water quality data meant the years with the most and best data had to be used whenever possible. Validating or confirming the model using data from 2000 would overcome these concerns.

PHM/blf

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ATTACHMENT A

Water Quality Sampling Log from Nashville District

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1	29-30 Apr 71	X	X	X	X	X														
2	7-9 Jun 71	X	X	X	X	X	X	X		X	X									
3	12-13 Jul 71		X	X	X	X	X	X		X	X									
4	2-3 Aug 71		X					X		X	X								OR 531	
5	30 Aug-1 Sep 71	X	X	X				X	X	X	X									
6	27-29 Sep 71	X X	X	X	X	X	X	X	X	X	X									
7	18-20 Oct 71	X	X	X		X		X		X	X									
8	1-2 May 72	X	X							X	X									
9	5 May 72													X						
10	5-7 Jun 72	X	X		X		X		X	X	X									
11	31 Jul-2 Aug 72	X	X		X		X	X	X	X X	X								Cricket Cr. 0.1	
12	11-12 Oct 72	X	X	X	X		X		X	X	X									
13	3-4 Apr 73	X	X		X		X	X	X	X	X									
14	5-6 Jun 73	X	X	X	X		X		X	X	X									
15	28-29 Aug 73	X	X		X					X	X									
16	22-23 Jul 74	X	X		X			X		X	X									
17	28-30 Jun 76	X										X	X	X	X	X				
18	19 Aug 76	X																		
19	1-2 Aug 77	X	X		X					X	X									
20	12-13 Mar 79		X	X	X		X	X		X	X									
21	2-3 Apr 79		X		X		X	X		X	X									
22	29-30 May 79	X	X	X	X		X	X		X	X									
23	24-25 Jul 79		X	X	X		X	X		X	X									
24	13 Aug 79	X																		
25	29-30 Aug 79	X	X	X	X	X	X	X		X	X									
26	11 Sep 79	X																		
27	1-2 Oct 79	X	X	X	X	X	X	X		X	X									
28	29-30 Oct 79	X	X	X	X		X	X		X	X									
29	19-20 Nov 79	X	X	X	X		X	X		X	X									
30	24 Apr 80	X	X																	
31	9 May 80												X		X	X				
	21-22 Jul 80	X	X																	

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1	21-22 Apr 81		X	X	X	X	X	X		X	X									
2	3-6 Aug 81	X	X	X	X	X	X	X		X	X		X	X	X		X		10023 10019, 10021, 10022,	
3	22 Oct 81	X	X																	
4	17-19 May 82												X	X	X	X	X		10024, 10025, 10026, 10048 10019, 10021, 10022, 10023	
5	5 Aug 82	X																		
6	16 Sep 82	X																		
7	22-23 Sep 82	X	X	X	X		X	X	X	X	X									
8	6 Jul 83	X																		
9	16 Aug 83	X																		
10	31 Aug-2 Sep 83	X	X	X	X	X	X	X	X	X	X									
11	6-7 Oct 83	X	X	X																
12	15 May 84	X X																	N2 Study	
13	20 Jun 84	X																		
14	27 Jul 84	X																		
15	12 Aug 85	X																		
16	7 MAY 86	X																		
17	16 JUN 86	X	X																	
18	6 OCT 87	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
19	4 MAY 88	X																		
20	18-20 MAY 88	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			20005 dup, 20007 dup, 10	
21	6 JUL 88	X	X																	
22	17 AUG 88	X																		
23	15 SEP 88		X																	
24	17 APR 89	X																		
25	12 OCT 89	X																		
26	5-6 JUL 90	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			20008 dup	20010 dup
27	23 AUG 90	X																		
28	3-4 OCT 90	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
29	[illegible] DEC 91	X																		
30	24 MAY 91	X																		
31	3 JUL 91	X																		
32	26 Jul-3 Aug 88		X	X	X	X	X	X	X	X	X	X	X	X	X	X				

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1	15-19 Sept 85	X	X	X	X	X	X	X	X	X	X	X	X	X	X			10016		
2																				
3																				
4																				
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6																				
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1	23-24 JUL 91	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
2	15 AUG 91	X																		
3	28 AUG 91	X																		
4	16-17 OCT 91	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			20004 dup	
5	15 APR 92	X																		
6	27 MAY 92	X																		
7	24 JUN 92	X																		
8	22 JUL 92	X																		
9	19 AUG 92	X																		
10	16 SEP 92	X																		
11	29-30 SEP 92	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			20004 dup	20008 dup
12	16 OCT 92	X																		
13	30 MAR 93	X																		
14	27 APR 93	X																		
15	1 JUL 93	X																		
16	10 AUG 93	X																		
17	02 SEP 93	X																		
18	07 OCT 93	X																		
19	10 NOV 93	X																		
20	08 FEB 94	X																		
21	15 MAR 94	X																		
22	13 APR 94	X																		
23	17 MAY 94	X																		
24	25-26 MAY 94	X										X		X	X				10022, 28	
25	06-07 JUN 94	X	X	X	X	X	X	X	X	X	X	X		X	X				20006 dup, Horse Cr. E-6, Williams Cr. E-5	
26	22 JUL 94	X																		
27	31 AUG 94											X	X	X	X				10022, 28	
28	01-02 SEP 94	X	X	X	X	X	X	X	X	X	X								20003 dup, 20008 dup	
29	12 SEP 94												X							
30	14 SEP 94	X																		
31	15 SEP 94	3	X																	
32	20 SEP 94	X																		

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1	03 OCT 94	X																		
2	13 OCT 94	X																		
3	24 OCT 94	X																		
4	31 OCT 94	X																		
5	04 NOV 94	X																		
6	08 NOV 94	X																		
7	18 NOV 94	X																		
8	28 NOV 94	X																		
9	05 Dec 94	X																		
10	18 Jan 95	X																		
11	14 Feb 95	X																		
12	15 Mar 95	X																		
13	12 Apr 95	X																		
14	18 Apr 95	X																		
15	17 May 95	X																		
16	14 Jun 95	X																		
17	21-23 Jun 95	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			20008, dup. profile	
18	17 Jul 95	X																		
19	01 Aug 95	X																		
20	16-18 Aug 95	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			10012, dup. Sample	
21	06 Sep 95	X																		
22	04 Oct 95	X																		
23	24 Oct 95	X																		
24	26 Oct 95	X																		
25	01 Nov 95	X																		
26	29 Nov 95	X	X																	
27	25 Jan 96	X																		
28	22 Feb 96	X																		
29	26 Mar 96	X																		
30	30 Apr 96	X																		
31	22 May 96	X																		

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1	12 Jun 96	X																		
2	19-21 Jun 96	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
3	24 Jul 96	X																		
4	19-21 Aug 96	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
5	01 Oct 96	X																		
6	04 NOV 96	X																		
7	18 NOV 96	X																		
8	03 DEC 96	X																		
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1	26 Feb 97	X																		
2	19 Mar 97	X																		
3	17 Apr 97	X																		
4	14 May 97	X																		
5	6 June 97	X																		
6	7-9 July 97	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
7	23 July 97	X																		
8	6-7 Aug 97	X										X	X	X	X	X	X			
9	12 Sept 97	X																		
10	24-26 Sept 97	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
11	16 Oct 97	X																		
12	30 Oct 97	X																		
13	13 Nov 97	X																		
14	10 Dec 97	X																		
15	15 Jan 98	X																		
16	11 Feb 98	X																		
17	19 Mar 98	X																		
18	15 Apr 98	X																		
19	15 May 98	X																		
20	09 Jun 98	X																		
21	25 Jun 98	X																		
22	10 Jul 98	X																		
23	24 Jul 98	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
24	17 Aug 98	X																		
25	03 Sep 98	X																		
26	17 Sep 98	X																	10001 (2nd)	
27	30 Sep 98	X																		
28	09 Oct 98	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
29	15 Oct 98	X																		
30	20 Oct 98	X																		
31	21 Oct 98		X																20002 (2nd)	
	22 Oct 98		X																	

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1	05 Nov 98	X																		
2	23 Nov 98	X																		
3	02 Dec 98	X																		
4	16 Dec 98	X																		
5	13 Jan 99	X																		
6	16 Feb 99	X																		
7	16 Mar 99	X																		
8	14 Apr 99	X																		
9	13 May 99	X																		
10	08 Jun 99	X	X																	
11	18 Jun 99	X																		
12	09 Jul 99	X																		
13	20, 22, 23 July 1999	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
14	06 Aug 1999	X																		
15	27 Aug 1999	X																		
16	10 Sep 1999	X																		
17	21, 23-24 Sep 1999	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
18	08 Oct 99	X																		
19	21 Oct 99	X																		
20	08 Nov 99	X																		
21	23 Nov 99	X																		
22	14 Dec 99	X																		
23	13 Jan 00	X																		
24																				
25																				
26																				
27																				
28																				
29																				
30																				
31																				

ATTACHMENT B

Years Ranked by Annual Inflow

YEARS RANKED BY ANNUAL INFLOWS TO DALE HOLLOW RESERVOIR

RANK	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	CLASS
1	85	1942	3029	1293	1113	357	165	111	444	-14	227	511	484	792	DRY
2	87	1677	2544	1673	1917	440	291	219	-57	-56	-137	124	1355	820	DRY
3	88	2606	1314	1346	1672	172	-141	130	-27	158	-73	1612	1913	885	DRY
4	47	5162	1050	1971	1549	1105	294	673	326	-227	34	-94	277	1019	DRY
5	54	3837	1175	2111	2064	673	226	21	-87	-46	-24	136	2272	1028	DRY
6	63	1124	2207	6835	496	668	566	870	99	-92	-134	-23	-2	1053	AVG
7	66	292	2171	1237	2037	1853	79	53	259	396	310	1201	2903	1054	AVG
8	99	4635	2027	2697	820	1107	672	629	74	-197	-46	54	201	1056	AVG
9	53	2770	3148	2829	1729	2142	435	137	-170	-73	-122	-113	92	1059	AVG
10	80	3727	1295	4826	2405	716	-14	-68	-97	-125	-127	85	74	1064	AVG
11	70	1145	3425	1829	3552	509	312	17	254	79	108	378	1410	1066	AVG
12	81	74	1184	1251	2458	1152	2745	145	124	516	754	869	1730	1074	AVG
13	68	2874	522	3817	2614	1881	692	24	-103	-55	-12	140	443	1076	AVG
14	86	827	2819	1476	370	1421	709	-22	-24	182	109	2980	2284	1082	AVG
15	93	2239	1530	3740	2107	815	245	-51	11	-35	50	333	2945	1163	AVG
16	52	4436	2388	4906	913	517	708	-62	-27	30	-115	52	302	1175	AVG
17	65	2413	2076	4639	3231	862	887	444	-83	-30	-127	75	-32	1194	AVG
18	58	1642	1804	2460	4298	2769	154	407	82	278	-41	354	313	1206	AVG
19	59	1660	2645	2379	2390	400	322	108	18	12	105	1271	3363	1212	AVG
20	95	2633	2034	2138	757	2599	788	63	-21	15	612	1925	1233	1229	AVG
21	60	1991	3131	3318	1072	1070	1480	1164	183	89	115	346	1164	1242	AVG
22	76	3438	2040	3339	1120	805	2357	351	-33	45	521	249	788	1252	AVG
23	64	1298	1969	3739	2590	600	248	151	55	362	307	782	3027	1259	AVG
24	69	1029	3188	1159	3362	1182	2070	286	168	95	-36	173	3297	1268	AVG
25	46	6632	3574	2514	862	640	698	12	71	-59	26	552	538	1311	AVG
26	77	1117	890	2406	4472	422	549	171	166	744	697	2316	2209	1345	AVG
27	48	879	6262	3690	948	254	94	158	156	-45	17	1814	2479	1377	AVG
28	92	3107	1444	2564	905	480	1219	857	1013	799	229	1410	2559	1385	AVG
29	78	3412	1231	3092	839	1848	278	296	630	77	-28	383	5303	1451	AVG
30	55	950	5303	7250	1707	370	960	71	46	316	238	279	739	1498	AVG
31	97	2887	2111	6533	1027	1211	3692	254	-57	17	-66	118	326	1502	AVG
32	83	1555	2608	682	3471	5265	990	117	-66	-114	129	1021	2514	1511	AVG
33	49	5333	2570	3106	1918	669	733	1013	374	-26	527	394	1993	1553	AVG
34	67	1098	1364	3648	1053	2231	301	2656	463	218	498	1469	3587	1558	AVG
35	61	1519	3214	3887	3074	1379	1541	427	292	-52	-117	434	3432	1577	AVG
36	71	2881	3820	2190	1498	2847	358	1060	2454	157	68	25	1736	1586	AVG

YEARS RANKED BY ANNUAL INFLOWS TO DALE HOLLOW RESERVOIR

RANK	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	CLASS
37	**96**	3225	1871	4105	2417	2035	624	154	123	132	39	1676	2760	1599	AVG
38	**90**	2634	4630	1634	1002	1882	247	22	-67	11	302	405	7597	1681	AVG
39	**91**	2700	5798	4249	1746	1198	233	52	-26	15	3	179	4331	1685	AVG
40	**98**	2919	2815	2494	4564	2417	2915	536	683	-160	-95	-31	1461	1699	AVG
41	**56**	2161	8764	3417	3863	481	-5	436	-17	-119	-40	-47	2773	1777	AVG
42	**84**	1504	4052	3652	2916	6349	120	106	-67	-148	464	1778	1582	1848	AVG
43	**82**	5195	2972	2314	2036	546	268	447	2134	2329	148	1031	4040	1951	WET
44	**72**	4849	3890	3500	3347	854	212	650	539	101	328	1096	5230	2050	WET
45	**74**	7065	3180	3437	3131	1276	664	25	245	1117	146	2141	2478	2054	WET
46	**62**	4454	7079	3936	5673	300	1162	88	-140	102	370	1255	943	2060	WET
47	**57**	6212	4631	2062	2581	687	1210	150	-140	562	260	3326	3375	2061	WET
48	**94**	4275	6733	6249	4754	965	683	673	391	69	57	292	884	2139	WET
49	**73**	1909	2946	5803	2476	4060	1854	1473	112	2	-41	2629	2807	2140	WET
50	**51**	3624	5727	3943	3143	525	362	172	-49	40	104	2143	6412	2160	WET
51	**75**	3412	4003	10244	2169	1388	303	26	48	875	1757	1425	1618	2263	WET
52	**89**	3878	5859	4077	2010	1591	2145	1245	748	1321	2974	1529	1134	2316	WET
53	**50**	9121	4940	2358	764	2551	2978	1570	531	502	31	1471	1847	2380	WET
54	**79**	5770	3305	2393	4446	2423	789	1578	632	1541	926	2640	2225	2382	WET
55	**2000**	600	1500	2179	3605	1713	282	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
	MEAN	2952	3087	3284	2274	1394	814	413	233	215	226	900	2088	1486	
	STD DEV	1867	1755	1762	1254	1198	854	535	485	475	505	894	1644	439	

ATTACHMENT C

Years Ranked by Spring Inflow

YEARS RANKED BY AVERAGE SPRING INFLOWS TO DALE HOLLOW RESERVOIR

RANK	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	SPRING* AVG
1	85	1942	3029	1293	1113	357	165	111	444	-14	227	511	484	792	921
2	88	2606	1314	1346	1672	172	-141	130	-27	158	-73	1612	1913	885	1063
3	86	827	2819	1476	370	1421	709	-22	-24	182	109	2980	2284	1082	1089
4	92	3107	1444	2564	905	480	1219	857	1013	799	229	1410	2559	1385	1316
5	46	6632	3574	2514	862	640	698	12	71	-59	26	552	538	1311	1339
6	87	1677	2544	1673	1917	440	291	219	-57	-56	-137	124	1355	820	1343
7	90	2634	4630	1634	1002	1882	247	22	-67	11	302	405	7597	1681	1506
8	99	4635	2027	2697	820	1107	672	629	74	-197	-46	54	201	1056	1541
9	47	5162	1050	1971	1549	1105	294	673	326	-227	34	-94	277	1019	1542
10	54	3837	1175	2111	2064	673	226	21	-87	-46	-24	136	2272	1028	1616
11	81	74	1184	1251	2458	1152	2745	145	124	516	754	869	1730	1074	1620
12	48	879	6262	3690	948	254	94	158	156	-45	17	1814	2479	1377	1631
13	82	5195	2972	2314	2036	546	268	447	2134	2329	148	1031	4040	1951	1632
14	66	292	2171	1237	2037	1853	79	53	259	396	310	1201	2903	1054	1709
15	59	1660	2645	2379	2390	400	322	108	18	12	105	1271	3363	1212	1723
16	76	3438	2040	3339	1120	805	2357	351	-33	45	521	249	788	1252	1755
17	57	6212	4631	2062	2581	687	1210	150	-140	562	260	3326	3375	2061	1777
18	60	1991	3131	3318	1072	1070	1480	1164	183	89	115	346	1164	1242	1820
19	95	2633	2034	2138	757	2599	788	63	-21	15	612	1925	1233	1229	1831
20	50	9121	4940	2358	764	2551	2978	1570	531	502	31	1471	1847	2380	1891
21	49	5333	2570	3106	1918	669	733	1013	374	-26	527	394	1993	1553	1898
22	69	1029	3188	1159	3362	1182	2070	286	168	95	-36	173	3297	1268	1901
23	78	3412	1231	3092	839	1848	278	296	630	77	-28	383	5303	1451	1926
24	70	1145	3425	1829	3552	509	312	17	254	79	108	378	1410	1066	1963
25	52	4436	2388	4906	913	517	708	-62	-27	30	-115	52	302	1175	2112
26	71	2881	3820	2190	1498	2847	358	1060	2454	157	68	25	1736	1586	2178
27	93	2239	1530	3740	2107	815	245	-51	11	-35	50	333	2945	1163	2221
28	53	2770	3148	2829	1729	2142	435	137	-170	-73	-122	-113	92	1059	2233
29	64	1298	1969	3739	2590	600	248	151	55	362	307	782	3027	1259	2310
30	67	1098	1364	3648	1053	2231	301	2656	463	218	498	1469	3587	1558	2311
31	91	2700	5798	4249	1746	1198	233	52	-26	15	3	179	4331	1685	2398
32	77	1117	890	2406	4472	422	549	171	166	744	697	2316	2209	1345	2433
33	2000	600	1500	2179	3605	1713	282	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	2499
34	51	3624	5727	3943	3143	525	362	172	-49	40	104	2143	6412	2160	2537
35	89	3878	5859	4077	2010	1591	2145	1245	748	1321	2974	1529	1134	2316	2559
36	72	4849	3890	3500	3347	854	212	650	539	101	328	1096	5230	2050	2567

YEARS RANKED BY AVERAGE SPRING INFLOWS TO DALE HOLLOW RESERVOIR

RANK	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	SPRING* AVG
37	56	2161	8764	3417	3863	481	-5	436	-17	-119	-40	-47	2773	1777	2587
38	74	7065	3180	3437	3131	1276	664	25	245	1117	146	2141	2478	2054	2615
39	80	3727	1295	4826	2405	716	-14	-68	-97	-125	-127	85	74	1064	2649
40	63	1124	2207	6835	496	668	566	870	99	-92	-134	-23	-2	1053	2666
41	68	2874	522	3817	2614	1881	692	24	-103	-55	-12	140	443	1076	2771
42	61	1519	3214	3887	3074	1379	1541	427	292	-52	-117	434	3432	1577	2780
43	96	3225	1871	4105	2417	2035	624	154	123	132	39	1676	2760	1599	2852
44	65	2413	2076	4639	3231	862	887	444	-83	-30	-127	75	-32	1194	2911
45	97	2887	2111	6533	1027	1211	3692	254	-57	17	-66	118	326	1502	2924
46	79	5770	3305	2393	4446	2423	789	1578	632	1541	926	2640	2225	2382	3087
47	55	950	5303	7250	1707	370	960	71	46	316	238	279	739	1498	3109
48	83	1555	2608	682	3471	5265	990	117	-66	-114	129	1021	2514	1511	3139
49	98	2919	2815	2494	4564	2417	2915	536	683	-160	-95	-31	1461	1699	3158
50	58	1642	1804	2460	4298	2769	154	407	82	278	-41	354	313	1206	3176
51	62	4454	7079	3936	5673	300	1162	88	-140	102	370	1255	943	2060	3303
52	94	4275	6733	6249	4754	965	683	673	391	69	57	292	884	2139	3989
53	73	1909	2946	5803	2476	4060	1854	1473	112	2	-41	2629	2807	2140	4113
54	84	1504	4052	3652	2916	6349	120	106	-67	-148	464	1778	1582	1848	4306
55	75	3412	4003	10244	2169	1388	303	26	48	875	1757	1425	1618	2263	4600
	MEAN	2952	3087	3284	2274	1394	814	413	233	215	226	900	2088	1486	2317
	STD DEV	1867	1755	1762	1254	1198	854	535	485	475	505	894	1644	439	816

* "Spring" is defined as the period of spring runoff and onset of stratification during the months of March, April, and May

ATTACHMENT D

Years Ranked by Late Summer Inflow

YEARS RANKED BY AVERAGE LATE SUMMER INFLOWS TO DALE HOLLOW RESERVOIR

RANK	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	LATE SUMMER* AVG
1	53	2770	3148	2829	1729	2142	435	137	-170	-73	-122	-113	92	1059	-122
2	80	3727	1295	4826	2405	716	-14	-68	-97	-125	-127	85	74	1064	-116
3	87	1677	2544	1673	1917	440	291	219	-57	-56	-137	124	1355	820	-83
4	65	2413	2076	4639	3231	862	887	444	-83	-30	-127	75	-32	1194	-80
5	56	2161	8764	3417	3863	481	-5	436	-17	-119	-40	-47	2773	1777	-59
6	68	2874	522	3817	2614	1881	692	24	-103	-55	-12	140	443	1076	-57
7	99	4635	2027	2697	820	1107	672	629	74	-197	-46	54	201	1056	-56
8	54	3837	1175	2111	2064	673	226	21	-87	-46	-24	136	2272	1028	-52
9	63	1124	2207	6835	496	668	566	870	99	-92	-134	-23	-2	1053	-42
10	52	4436	2388	4906	913	517	708	-62	-27	30	-115	52	302	1175	-37
11	97	2887	2111	6533	1027	1211	3692	254	-57	17	-66	118	326	1502	-35
12	83	1555	2608	682	3471	5265	990	117	-66	-114	129	1021	2514	1511	-17
13	91	2700	5798	4249	1746	1198	233	52	-26	15	3	179	4331	1685	-3
14	93	2239	1530	3740	2107	815	245	-51	11	-35	50	333	2945	1163	9
15	46	6632	3574	2514	862	640	698	12	71	-59	26	552	538	1311	13
16	88	2606	1314	1346	1672	172	-141	130	-27	158	-73	1612	1913	885	19
17	73	1909	2946	5803	2476	4060	1854	1473	112	2	-41	2629	2807	2140	24
18	51	3624	5727	3943	3143	525	362	172	-49	40	104	2143	6412	2160	32
19	61	1519	3214	3887	3074	1379	1541	427	292	-52	-117	434	3432	1577	41
20	48	879	6262	3690	948	254	94	158	156	-45	17	1814	2479	1377	43
21	47	5162	1050	1971	1549	1105	294	673	326	-227	34	-94	277	1019	44
22	59	1660	2645	2379	2390	400	322	108	18	12	105	1271	3363	1212	45
23	69	1029	3188	1159	3362	1182	2070	286	168	95	-36	173	3297	1268	76
24	90	2634	4630	1634	1002	1882	247	22	-67	11	302	405	7597	1681	82
25	84	1504	4052	3652	2916	6349	120	106	-67	-148	464	1778	1582	1848	83
26	86	827	2819	1476	370	1421	709	-22	-24	182	109	2980	2284	1082	89
27	96	3225	1871	4105	2417	2035	624	154	123	132	39	1676	2760	1599	98
28	58	1642	1804	2460	4298	2769	154	407	82	278	-41	354	313	1206	106
29	62	4454	7079	3936	5673	300	1162	88	-140	102	370	1255	943	2060	111
30	60	1991	3131	3318	1072	1070	1480	1164	183	89	115	346	1164	1242	129
31	98	2919	2815	2494	4564	2417	2915	536	683	-160	-95	-31	1461	1699	143
32	70	1145	3425	1829	3552	509	312	17	254	79	108	378	1410	1066	147
33	94	4275	6733	6249	4754	965	683	673	391	69	57	292	884	2139	172
34	76	3438	2040	3339	1120	805	2357	351	-33	45	521	249	788	1252	178
35	55	950	5303	7250	1707	370	960	71	46	316	238	279	739	1498	200
36	95	2633	2034	2138	757	2599	788	63	-21	15	612	1925	1233	1229	202

YEARS RANKED BY AVERAGE LATE SUMMER INFLOWS TO DALE HOLLOW RESERVOIR

RANK	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	LATE SUMMER* AVG
37	**85**	1942	3029	1293	1113	357	165	111	444	-14	227	511	484	792	219
38	**78**	3412	1231	3092	839	1848	278	296	630	77	-28	383	5303	1451	226
39	**57**	6212	4631	2062	2581	687	1210	150	-140	562	260	3326	3375	2061	227
40	**64**	1298	1969	3739	2590	600	248	151	55	362	307	782	3027	1259	241
41	**49**	5333	2570	3106	1918	669	733	1013	374	-26	527	394	1993	1553	292
42	**66**	292	2171	1237	2037	1853	79	53	259	396	310	1201	2903	1054	322
43	**72**	4849	3890	3500	3347	854	212	650	539	101	328	1096	5230	2050	323
44	**50**	9121	4940	2358	764	2551	2978	1570	531	502	31	1471	1847	2380	355
45	**67**	1098	1364	3648	1053	2231	301	2656	463	218	498	1469	3587	1558	393
46	**81**	74	1184	1251	2458	1152	2745	145	124	516	754	869	1730	1074	465
47	**74**	7065	3180	3437	3131	1276	664	25	245	1117	146	2141	2478	2054	503
48	**77**	1117	890	2406	4472	422	549	171	166	744	697	2316	2209	1345	536
49	**92**	3107	1444	2564	905	480	1219	857	1013	799	229	1410	2559	1385	680
50	**71**	2881	3820	2190	1498	2847	358	1060	2454	157	68	25	1736	1586	893
51	**75**	3412	4003	10244	2169	1388	303	26	48	875	1757	1425	1618	2263	893
52	**79**	5770	3305	2393	4446	2423	789	1578	632	1541	926	2640	2225	2382	1033
53	**82**	5195	2972	2314	2036	546	268	447	2134	2329	148	1031	4040	1951	1537
54	**89**	3878	5859	4077	2010	1591	2145	1245	748	1321	2974	1529	1134	2316	1681
55	**2000**	600	1500	2179	3605	1713	282	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
	MEAN	2952	3087	3284	2274	1394	814	413	233	215	226	900	2088	1486	225
	STD DEV	1867	1755	1762	1254	1198	854	535	485	475	505	894	1644	439	375

* "Late Summer" is defined as the critical low flow period during the months of August, September, and October

APPENDIX G

CE-Qual-W2 Control Files
1973
1988
1991

Dale Hollow Lake CE-QUAL-W2 Control File

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TITLE C ............................TITLE...................................
        Dale Hollow Lake, March 1 through November 30, 1973 (mbb)
        Water quality simulation w/ version 2.05.1
        Temperature calibration completed as of 01/10/01; inflow conc refer to xcel
        03/29/01 rev DETDK,DSETL & ASATUR, rev DETRIT&RDOM; 04/04/01 rev CIC of SI,DETRIT,RDOM,TDS,TSS;
        04/09/01 rev AGT1&2 (Diatoms&Green); 04/10/01 raised AGT1&2 for all algae; 04/11/01 added iron
        05/14/01 rev inflow FE on unmonitoried tribs; 05/30/01 revised starting elev USE BATH03 for '73
        08/16/01 rev spillway outflow to 0
TIME CON  TMSTRT   TMEND    YEAR
           59.49  333.51    1973

DLT CON      NDT  DLTMIN
               1     1.0

DLT DATE    DLTD
             0.0

DLT MAX   DLTMAX
          1800.0

DLT FRN     DLTF
            0.50

BRANCH G      US      DS     UHS     DHS
Br 1           2      22       0       0            Obey River (OR)
Br 2          25      26       0       3            WF Obey River (WO)
Br 3          29      30       0       8            Big Eagle Creek (BE)
Br 4          33      34       0      11            Ashburn Creek (AC)
Br 5          37      39       0      46            Illwill Creek (IL)
Br 6          42      47       0      12            Wolf River (WR)
Br 7          50      52       0      13            Sulphur Creek (SC)
Br 8          55      56       0      14            Irons Creek (IC)
Br 9          59      60       0      15            Holly Creek (HC)
Br 10         63      65       0      17            Mitchell Creek (MC)

LOCATION     LAT    LONG   DATUM
            36.6    85.3   154.3

INIT CND     T2I  ICETHI  WTYPEC
             6.0     0.0   FRESH

CALCULAT     VBC     MBC     PQC    PQTC     EVC     PRC
              ON      ON      ON      ON     OFF     OFF

INTERPOL   INFIC    TRIC   DTRIC    HDIC  QOUTIC    WDIC   METIC
              ON      ON      ON      ON      ON      ON      ON

DEAD SEA   WINDC    QINC   QOUTC   HEATC
              ON      ON      ON      ON

ICE COVER   ICEC   SLICE  SLHEAT  ALBEDO     HWI   BETAI  GAMMAI  ICEMIN   ICET2
             OFF  DETAIL    TERM    0.25    10.0     0.6    0.07    0.05     3.0

TRANSPORT  SLTRC   THETA   DZMAX
        QUICKEST    0.00    -999

WSC NUMB    NWSC WSC_MIN WSC_MAX
               1    -999    -999

WSC DATE    WSCD    WSCD
            59.5
```

WSC COEF	WSC	WSC								
	0.55									
WIND FUNC	WFC									
	1.0									
HYD COEF	AX	DX	CHEZY	CBHE	TSED	FW_A0	FW_A1	FW_A2	SRMULT	avg annual T @Livingston Radio-TN
	1.0	1.0	70.0	3.5E-7	10.0	-999	-999	-999	-999	changed from 14.2 to 10.0
SEL WITH	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	
	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
	OFF									
N STRUC	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	1=turb, 2-fishery, 3=tainter,
	5	0	0	0	0	0	0	0	0	4=servunit, 5=sluice
	0									
K LIMIT	KLSW	KLSW	KLSW	KLSW	KLSW					
Br 1	99	99	99	99	99					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
SINK TYPE	SINK	SINK	SINK	SINK	SINK					
Br 1	POINT	POINT	LINE	POINT	POINT					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
E STRUC	TURB	FISH	TAINT	SERVU	SLUIC					
Br 1	178.0	174.2	200.3	169.6	163.7					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
W STRUC	WSTR	WSTR	WSTR	WSTR	WSTR					
Br 1	0.00	0.00	121.9	0.00	0.00					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										

```
N OUTLET     NOUT    NOUT    NOUT    NOUT    NOUT    NOUT    NOUT    NOUT    NOUT
               5       0       0       0       0       0       0       0       0
               0

O LAYER      KOUT
Br 1            0
Br 2            0
Br 3            0
Br 4            0
Br 5            0
Br 6            0
Br 7            0
Br 8            0
Br 9            0
Br 10           0

N WDRWAL      NWD
               0

W SEGMNT      IWD
               0

W LAYER       KWD
               0

N TRIBS       NTR MXSGDTR                                Dist. tribs and Branches only
               1    -999                                 Spring Creek (to Wolf Ck)

TRIB SEG      ITR
              42

DST TRIB     DTRC    DTRC    DTRC    DTRC    DTRC    DTRC    DTRC    DTRC    DTRC
              ON     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF

SCR PRINT    SCRC    NSCR
             OFF       1

SCR DATE     SCRD
            59.5

SCR FREQ     SCRF
             1.0

SNAPSHOT     FORM    UPRN    WPRN    TPRN   DTPRN  RHOPRN   AZPRN   DZPRN
             LONG      ON      ON      ON     OFF     OFF     OFF     OFF

SHRT SEG    IPRSF   IPRSF   IPRSF   IPRSF   IPRSF   IPRSF   IPRSF   IPRSF   IPRSF
               2       4       9      12      14      16      17      21      38
              40      41

LONG SEG    IPRLF   IPRLF   IPRLF   IPRLF   IPRLF   IPRLF   IPRLF   IPRLF   IPRLF
               2       5       8      11      14      17      20      22      26
              30      34      39      44      47      52      56      60      65

SNP PRINT    SNPC    NSNP
              ON      19

SNP DATE     SNPD    SNPD    SNPD    SNPD    SNPD    SNPD    SNPD    SNPD    SNPD
            59.5    74.5    77.5    86.5    91.5    92.5    97.5   118.5   137.5
           138.5   155.5   156.5   181.5   205.5   229.5   239.5   272.5   296.5
           333.5
```

```
SNP FREQ    SNPF    SNPF    SNPF    SNPF    SNPF    SNPF    SNPF    SNPF    SNPF
           999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0
           999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0
           999.0

PRF PLOT    PRFC    NPRF    NPRS  PRSTYL
             ON      18      16     FTN

PRF DATE    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD
            59.5    91.5    92.5    93.5   131.5   138.5   139.5   156.5   157.5
           181.5   205.5   217.5   230.5   240.5   272.5   297.5   333.5

PRF FREQ    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF
           999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0
           999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0

PRF SEG     IPRF    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF
               2      14       4       8       9      11      12      16      17
              22      25      39      42      44      50       3

SPR PLOT    SPRC    NSPR   NIPRF
             OFF       1       1

SPR DATE    SPRD
            59.5

SPR FREQ    SPRF
           999.0

SPR SEG     ISPR
              25

TSR PLOT    TSRC    NTSR  TSSTYL
              ON       1     FTN

TSR DATE    TSRD
            59.5

TSR FREQ    TSRF
             1.0

VPL PLOT    VPLC    NVPL  VPSTYL
             OFF       1

VPL DATE    VPLD
            59.5

VPL FREQ    VPLF
           999.0

CPL PLOT    CPLC    NCPL  CPSTYL
             OFF       1     FTN

CPL DATE    CPLD
            59.5

CPL FREQ    CPLF
           999.0

APGM OUT    APLC
              ON                        on/off switch for APGM output

AGPM OUT2   APLD   APLFD   APLFH
            59.5     1.0     0.0        start date = APLD, frequency = APLFD + APLFH/24
```

```
RESTART     RSOC    NRSO    RSIC
             OFF       0     OFF

RSO DATE    RSOD
           999.0

RSO FREQ    RSOF
           999.0

CST COMP     CCC    LIMC     SDC  FREQUK
              ON      ON     OFF       1

CST ACT      ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC      FOR DH need FE on (#20)
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CST ICON     CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC
            0.00     2.0    0.00    98.0    0.10    0.10    1.50    1.00    0.01
            0.10    0.22    8.20    0.00    0.00    0.00    0.00    0.00    0.00
            0.00    0.21    0.00   0.001   0.001   0.001

CST PRNT    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CIN CON    INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CTR CON    TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CDT CON    DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CPR CON    PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC
              ON     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF

EX COEF    EXH2O  EXINOR   EXORG    BETA  ALGLIT
            0.31    0.03    0.09    0.43    0.01

COLIFORM  COLQ10   COLDK   COLKL   CSETL   CKSEG                                    Not simulating coliforms
            1.04    0.50   0.005    0.29   999.0

S SOLIDS   SSETL                                                                     Same as Center Hill (CH) Study
             0.4

ALGAE      AGROW   AMORT   AEXCR   ARESP   ASETL    AHSP    AHSN   AHSSI  ASATUR     Same as CH xcpt AGROW,
Diatoms    2.064    0.03    0.00    0.05    0.35   0.002    0.06     0.1    86.0     ARESP,AHSP, ASATUR for DH
Greens      2.05    0.03    0.00    0.05    0.15   0.003    0.06     0.0    75.0
Cyanobac    1.60    0.03    0.00   0.005    0.08   0.004    0.10     0.0    85.0

ALG STOI   ABIOP   ABION  ABIOSI   ABIOC                                            Same as Center Hill Study
Diatoms    0.004   0.067     0.0     0.5
```

```
Greens      0.004   0.067     0.0     0.5
Cyanobac    0.004   0.067     0.0     0.5

ALG RATE     AGT1    AGT2    AGT3    AGT4    AGK1    AGK2    AGK3    AGK4                    AGK's CH Study; AGT's DH
Diatoms       8.0    14.0    20.0    25.0     0.1    0.98    0.98     0.1
Greens       10.0    16.0    25.0    30.0     0.1    0.98    0.98     0.1
Cyanobac     12.0    25.0    38.0    42.0     0.1    0.98    0.98     0.1

DISS ORG    LABDK   LRFDK   REFDK                                                            Same as Center Hill Study
             0.30   0.001   0.001

DETRITUS    DETDK   DSETL  ALGDET
            0.006    0.10    0.80

ORG RATE     OMT1    OMT2    OMK1    OMK2                                                    Same as Center Hill Study
              4.0    20.0     0.1    0.98

SEDIMENT    SEDDK    FSOD    (SEDDK set for 1st order NH3 & PO4 release from sed)            Same as Center Hill Study
             0.06     1.0

S DEMAND      SOD     SOD     SOD     SOD     SOD     SOD     SOD     SOD     SOD
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
             0.50    0.50    0.50

CBOD         KBOD    TBOD    RBOD
             0.05    1.05    2.00

PHOSPHOR   PO4REL   PARTP                                                                     PARTP CH Study; PO4REL DH
            0.002     0.1

AMMONIA    NH3REL   NH3DK   PARTN                                                             NH3REL/PARTN=CH; NH3DK=DH
            0.035    0.05    0.01

NH3 RATE    NH3T1   NH3T2   NH3K1   NH3K2                                                     Same as Center Hill Study
              0.1    20.0     0.1    0.98

NITRATE     NO3DK   DNPRN                                                                     Same as Center Hill Study
              0.1      ON

NO3 RATE    NO3T1   NO3T2   NO3K1   NO3K2                                                     Same as Center Hill Study
              5.0    20.0     0.1    0.98

SILICA      SIREL                                                                             Same as Center Hill Study
             0.01

SED CO2    CO2REL                                                                             Same as Center Hill Study (not
si
              0.1

IRON        FEREL  FESETL
              0.4    0.5

STOICHMT    O2NH3   O2ORG  O2RESP   O2ALG    BIOP    BION   BIOSI    BIOC                    Same as Center Hill Study
             3.43     1.4     1.2     1.4   0.004   0.067     0.0     0.1

O2 LIMIT    O2LIM                                                                             Same as Center Hill Study
              0.2
```

```
BTH FILE...............................BTHFN...................................
        r:\projects\1150-041\W2_input\1973\73bath03.npt

VPR FILE...............................VPRFN...................................
        VPR.npt - not used

LPR FILE...............................LPRFN...................................
        lpr.npt - not used

RSI FILE...............................RSIFN...................................
        rsi.npt - not used

MET FILE...............................METFN...................................
        r:\projects\1150-041\W2_input\1973\73met03.npt                    source of metdata=Nashville
In

QWD FILE...............................QWDFN...................................
        not used

QIN FILE...............................QINFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73q_or02.npt                     Obey River
Br 2    r:\projects\1150-041\W2_input\1973\73q_wo02.npt                     WF Obey River
Br 3    r:\projects\1150-041\W2_input\1973\73q_be01.npt                     Big Eagle Creek
Br 4    r:\projects\1150-041\W2_input\1973\73q_ac01.npt                     Ashburn Creek
Br 5    r:\projects\1150-041\W2_input\1973\73q_il01.npt                     Illwill Creek
Br 6    r:\projects\1150-041\W2_input\1973\73q_wr02.npt                     Wolf River
Br 7    r:\projects\1150-041\W2_input\1973\73q_sc01.npt                     Sulphur Creek
Br 8    r:\projects\1150-041\W2_input\1973\73q_ic01.npt                     Irons Creek
Br 9    r:\projects\1150-041\W2_input\1973\73q_hc02.npt                     Holly Creek
Br 10   r:\projects\1150-041\W2_input\1973\73q_mc01.npt                     Mitchell Creek

TIN FILE...............................TINFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73t_or03.npt
Br 2    r:\projects\1150-041\W2_input\1973\73t_wo03.npt
Br 3    r:\projects\1150-041\W2_input\1973\73t_be04.npt
Br 4    r:\projects\1150-041\W2_input\1973\73t_ac04.npt
Br 5    r:\projects\1150-041\W2_input\1973\73t_il04.npt
Br 6    r:\projects\1150-041\W2_input\1973\73t_wr03.npt
Br 7    r:\projects\1150-041\W2_input\1973\73t_sc04.npt
Br 8    r:\projects\1150-041\W2_input\1973\73t_ic04.npt
Br 9    r:\projects\1150-041\W2_input\1973\73t_hc04.npt
Br 10   r:\projects\1150-041\W2_input\1973\73t_mc04.npt

CIN FILE...............................CINFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73c_or07.npt
Br 2    r:\projects\1150-041\W2_input\1973\73c_wo08.npt
Br 3    r:\projects\1150-041\W2_input\1973\73c_be08.npt
Br 4    r:\projects\1150-041\W2_input\1973\73c_ac08.npt
Br 5    r:\projects\1150-041\W2_input\1973\73c_il08.npt
Br 6    r:\projects\1150-041\W2_input\1973\73c_wr08.npt
Br 7    r:\projects\1150-041\W2_input\1973\73c_sc08.npt
Br 8    r:\projects\1150-041\W2_input\1973\73c_ic08.npt
Br 9    r:\projects\1150-041\W2_input\1973\73c_hc08.npt
Br 10   r:\projects\1150-041\W2_input\1973\73c_mc08.npt

QOT FILE...............................QOTFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73q_out2.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
```

```
Br 9    not used
Br 10   not used

QTR FILE..............................QTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1973\73q_sp01.npt                    Spring Creek

TTR FILE..............................TTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1973\73t_sp04.npt

CTR FILE..............................CTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1973\73c_sp08.npt

QDT FILE..............................QDTFN...................................  Distrib Tribs
Br 1    r:\projects\1150-041\W2_input\1973\73q_dt02.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

TDT FILE..............................TDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73t_dt04.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

CDT FILE..............................CDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1973\73c_dt08.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

PRE FILE..............................PREFN...................................
Br 1    pre_br1.npt - not used
Br 2    pre_br2.npt - not used
Br 3    pre_br3.npt - not used
Br 4    pre_br4.npt - not used
Br 5    pre_br5.npt-  not used
Br 6    pre_br6.npt - not used
Br 7    pre_br7.npt - not used
Br 8    pre_br8.npt - not used
Br 9    pre_br9.npt - not used
Br10    pre_br10.npt - not used

TPR FILE..............................TPRFN...................................
Br 1    tpr_br1.npt - not used
Br 2    tpr_br2.npt - not used
Br 3    tpr_br3.npt - not used
```

```
Br 4    tpr_br4.npt - not used
Br 5    tpr_br5.npt - not used
Br 6    tpr_br6.npt - not used
Br 7    tpr_br7.npt - not used
Br 8    tpr_br8.npt - not used
Br 9    tpr_br9.npt - not used
Br10    tpr_br10.npt - not used

CPR FILE..............................CPRFN...................................
Br 1    cpr_br1.npt - not used
Br 2    cpr_br2.npt - not used
Br 3    cpr_br3.npt - not used
Br 4    cpr_br4.npt - not used
Br 5    cpr_br5.npt - not used
Br 6    cpr_br6.npt - not used
Br 7    cpr_br7.npt - not used
Br 8    cpr_br8.npt - not used
Br 9    cpr_br9.npt - not used
Br10    cpr_br10.npt - not used

EUH FILE..............................EUHFN...................................
Br 1    euh_br1.npt - not used
Br 2    euh_br2.npt - not used
Br 3    euh_br3.npt - not used
Br 4    euh_br4.npt - not used
Br 5    euh_br5.npt - not used
Br 6    euh_br6.npt - not used
Br 7    euh_br7.npt - not used
Br 8    euh_br8.npt - not used
Br 9    euh_br9.npt - not used
Br10    euh_br10.npt - not used

TUH FILE..............................TUHFN...................................
Br 1    tuh_br1.npt - not used
Br 2    tuh_br2.npt - not used
Br 3    tuh_br3.npt - not used
Br 4    tuh_br4.npt - not used
Br 5    tuh_br5.npt - not used
Br 6    tuh_br6.npt - not used
Br 7    tuh_br7.npt - not used
Br 8    tuh_br8.npt - not used
Br 9    tuh_br9.npt - not used
Br10    tuh_br10.npt - not used

CUH FILE..............................CUHFN...................................
Br 1    cuh_br1.npt - not used
Br 2    cuh_br2.npt - not used
Br 3    cuh_br3.npt - not used
Br 4    cuh_br4.npt - not used
Br 5    cuh_br5.npt - not used
Br 6    cuh_br6.npt - not used
Br 7    cuh_br7.npt - not used
Br 8    cuh_br8.npt - not used
Br 9    cuh_br9.npt - not used
Br10    cuh_br10.npt - not used

EDH FILE..............................EDHFN...................................
Br 1    edh_br1.npt - not used
Br 2    edh_br2.npt - not used
Br 3    edh_br3.npt - not used
Br 4    edh_br4.npt - not used
Br 5    edh_br5.npt - not used
Br 6    edh_br6.npt - not used
Br 7    edh_br7.npt - not used
```

```
Br 8    edh_br8.npt - not used
Br 9    edh_br9.npt - not used
Br10    edh_br10.npt - not used

TDH FILE..............................TDHFN...................................
Br 1    tdh_br1.npt - not used
Br 2    tdh_br2.npt - not used
Br 3    tdh_br3.npt - not used
Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
Br 8    tdh_br8.npt - not used
Br 9    tdh_br9.npt - not used
Br10    tdh_br10.npt - not used

CDH FILE..............................CDHFN...................................
Br 1    tdh_br1.npt - not used
Br 2    tdh_br2.npt - not used
Br 3    tdh_br3.npt - not used
Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
Br 8    tdh_br8.npt - not used
Br 9    tdh_br9.npt - not used
Br10    tdh_br10.npt - not used

AGPM FILE............................AGPMFN..................................
        agpm73.w2p

SNP FILE..............................SNPFN...................................
        snp.opt

TSR FILE..............................TSRFN...................................
        tsr.opt

PRF FILE..............................PRFFN...................................
        prf.opt

VPL FILE..............................VPLFN...................................
        vpl.opt

CPL FILE..............................CPLFN...................................
        cpl.opt

SPR FILE..............................SPRFN...................................
        spr.opt
```

Dale Hollow Lake CE-QUAL-W2 Control File

```
TITLE C ............................TITLE...................................
        Dale Hollow Lake, March 1 through November 30, 1988 (mbb)
        Water quality simulation w/ version 2.05.1
        Temperature calibration completed as of 01/10/01; for inflow conc refer to xcel (020701);
        03/15/01 raised all ASATUR's 125,135,125 respectively;03/20/01 added DETRIT&RDOM;
        03/29/01 revised DETDK, DSETL & ASATUR; 04/04/01 revised CIC of SI, DETRIT, RDOM, TDS, TSS;
        04/09/01 rev AGT1&2 (Diatoms&Green); 04/10/01 raised AGT1&2 for all algae; 04/11/01 added iron
        05/14/01 rev inflow FE conc for unmonitored tribs
TIME CON  TMSTRT   TMEND    YEAR
           60.49  334.51    1988

DLT CON      NDT  DLTMIN
               1     1.0

DLT DATE    DLTD
             0.0

DLT MAX   DLTMAX
          1800.0

DLT FRN     DLTF
            0.50

BRANCH G      US      DS     UHS     DHS
Br 1           2      22       0       0            Obey River (OR)
Br 2          25      26       0       3            WF Obey River (WO)
Br 3          29      30       0       8            Big Eagle Creek (BE)
Br 4          33      34       0      11            Ashburn Creek (AC)
Br 5          37      39       0      46            Illwill Creek (IL)
Br 6          42      47       0      12            Wolf River (WR)
Br 7          50      52       0      13            Sulphur Creek (SC)
Br 8          55      56       0      14            Irons Creek (IC)
Br 9          59      60       0      15            Holly Creek (HC)
Br 10         63      65       0      17            Mitchell Creek (MC)

LOCATION     LAT    LONG   DATUM
            36.6    85.3   154.3

INIT CND     T2I  ICETHI  WTYPEC
             7.0     0.0   FRESH

CALCULAT     VBC     MBC     PQC    PQTC     EVC     PRC
              ON      ON      ON      ON     OFF     OFF

INTERPOL   INFIC    TRIC   DTRIC    HDIC  QOUTIC    WDIC   METIC
              ON      ON      ON      ON      ON      ON      ON

DEAD SEA   WINDC    QINC   QOUTC   HEATC
              ON      ON      ON      ON

ICE COVER   ICEC   SLICE  SLHEAT  ALBEDO     HWI   BETAI  GAMMAI  ICEMIN   ICET2
             OFF  DETAIL    TERM    0.25    10.0     0.6    0.07    0.05     3.0

TRANSPORT  SLTRC   THETA   DZMAX
        QUICKEST    0.00    -999

WSC NUMB    NWSC WSC_MIN WSC_MAX
               1    -999    -999

WSC DATE    WSCD    WSCD
            60.5
```

WSC COEF	WSC	WSC								
	0.55									
WIND FUNC	WFC									
	1.0									
HYD COEF	AX	DX	CHEZY	CBHE	TSED	FW_A0	FW_A1	FW_A2	SRMULT	avg annual T @Livingston Radio-TN
	1.0	1.0	70.0	3.5E-7	9.0	-999	-999	-999	-999	changed from 14.3
SEL WITH	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	
	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
	OFF									
N STRUC	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	1=turb, 2-fishery, 3=tainter,
	5	0	0	0	0	0	0	0	0	4=servunit, 5=sluice
	0									
K LIMIT	KLSW	KLSW	KLSW	KLSW	KLSW					
Br 1	99	99	99	99	99					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
SINK TYPE	SINK	SINK	SINK	SINK	SINK					
Br 1	POINT	POINT	LINE	POINT	POINT					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
E STRUC	TURB	FISH	TAINT	SERVU	SLUIC					
Br 1	178.0	174.2	200.3	169.6	163.7					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
W STRUC	WSTR	WSTR	WSTR	WSTR	WSTR					
Br 1	0.00	0.00	121.9	0.00	0.00					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										

N OUTLET	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT
	5	0	0	0	0	0	0	0	0
	0								

O LAYER	KOUT
Br 1	0
Br 2	0
Br 3	0
Br 4	0
Br 5	0
Br 6	0
Br 7	0
Br 8	0
Br 9	0
Br 10	0

N WDRWAL	NWD
	0

W SEGMNT	IWD
	0

W LAYER	KWD
	0

N TRIBS	NTR	MXSGDTR	Dist. tribs and Branches only
	1	-999	Spring Creek (to Wolf Ck)

TRIB SEG	ITR
	42

DST TRIB	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC
	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	OFF								

SCR PRINT	SCRC	NSCR
	OFF	1

SCR DATE	SCRD
	65.5

SCR FREQ	SCRF
	1.0

SNAPSHOT	FORM	UPRN	WPRN	TPRN	DTPRN	RHOPRN	AZPRN	DZPRN
	LONG	ON	ON	ON	OFF	OFF	OFF	OFF

SHRT SEG	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF
	2	4	9	12	14	16	17	21	38
	40	41							

LONG SEG	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF
	2	5	8	11	14	17	20	22	26
	30	34	39	44	47	52	56	60	65

SNP PRINT	SNPC	NSNP
	ON	21

SNP DATE	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD
	60.5	91.5	130.5	138.5	139.5	140.5	166.5	187.5	207.5
	210.5	212.5	215.5	216.5	242.5	249.5	258.5	259.5	262.5
	272.5	302.5	334.5						

SNP FREQ	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0
	999.0	999.0	999.0						
PRF PLOT	PRFC	NPRF	NPRS	PRSTYL					
	ON	25	18	FTN					
PRF DATE	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD
	60.5	92.5	130.5	131.5	138.5	139.5	140.5	166.5	186.5
	188.5	208.5	211.5	213.5	215.5	216.5	217.5	242.5	249.5
	258.5	259.5	260.5	263.5	272.5	302.5	334.5		
PRF FREQ	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF	PRFF
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0
	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0	999.0
	999.0	999.0	999.0	999.0	999.0	999.0	999.0		
PRF SEG	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF	IPRF
	2	14	4	8	9	12	13	16	17
	22	25	38	39	42	44	50	51	59
SPR PLOT	SPRC	NSPR	NIPRF						
	OFF	1	1						
SPR DATE	SPRD								
	60.5								
SPR FREQ	SPRF								
	999.0								
SPR SEG	ISPR								
	25								
TSR PLOT	TSRC	NTSR	TSSTYL						
	ON	1	FTN						
TSR DATE	TSRD								
	60.5								
TSR FREQ	TSRF								
	1.0								
VPL PLOT	VPLC	NVPL	VPSTYL						
	OFF	1							
VPL DATE	VPLD								
	60.5								
VPL FREQ	VPLF								
	999.0								
CPL PLOT	CPLC	NCPL	CPSTYL						
	OFF	1	FTN						
CPL DATE	CPLD								
	60.5								
CPL FREQ	CPLF								
	999.0								
APGM OUT	APLC								
	ON								

on/off switch for APGM output

```
AGPM OUT2   APLD   APLFD   APLFH
             60.5     1.0     0.0        start date = APLD, frequency = APLFD + APLFH/24

RESTART     RSOC    NRSO    RSIC
             OFF       0     OFF

RSO DATE    RSOD
           999.0

RSO FREQ    RSOF
           999.0

CST COMP     CCC    LIMC     SDC  FREQUK
              ON      ON     OFF       1

CST ACT      ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CST ICON     CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC
            0.00     1.0    0.00   127.0    0.05    0.05    1.50    0.50    0.01
            0.20    0.10    8.10    0.00    0.00    0.00    0.00    0.00    0.00
            0.00    0.10    0.00   0.001   0.001   0.001

CST PRNT    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CIN CON    INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CTR CON    TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CDT CON    DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CPR CON    PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC
              ON     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF

EX COEF    EXH2O  EXINOR   EXORG    BETA  ALGLIT
            0.31    0.03    0.09    0.43    0.01

COLIFORM  COLQ10   COLDK   COLKL   CSETL   CKSEG                                   Not simulating coliforms
            1.04    0.50   0.005    0.29   999.0

S SOLIDS   SSETL                                                                    Same as Center Hill (CH) Stud
             0.4

ALGAE      AGROW   AMORT   AEXCR   ARESP   ASETL    AHSP    AHSN   AHSSI  ASATUR    Same as CH xcpt AGROW,
Diatoms    2.064    0.03    0.00    0.05    0.35   0.002    0.06     0.1    86.0    ARESP,AHSP, ASATUR for DH
Greens      2.05    0.03    0.00    0.05    0.15   0.003    0.06     0.0    75.0
Cyanobac    1.60    0.03    0.00   0.005    0.08   0.004    0.10     0.0    85.0
```

```
ALG STOI   ABIOP   ABION  ABIOSI   ABIOC                                          Same as Center Hill Study
Diatoms    0.004   0.067     0.0     0.5
Greens     0.004   0.067     0.0     0.5
Cyanobac   0.004   0.067     0.0     0.5

ALG RATE    AGT1    AGT2    AGT3    AGT4    AGK1    AGK2    AGK3    AGK4          AGK's CH Study; AGT's DH
Diatoms      8.0    14.0    20.0    25.0     0.1    0.98    0.98     0.1
Greens      10.0    16.0    25.0    30.0     0.1    0.98    0.98     0.1
Cyanobac    12.0    25.0    38.0    42.0     0.1    0.98    0.98     0.1

DISS ORG   LABDK   LRFDK   REFDK                                                  Same as Center Hill Study
            0.30   0.001   0.001

DETRITUS   DETDK   DSETL  ALGDET
           0.006    0.10    0.80

ORG RATE    OMT1    OMT2    OMK1    OMK2                                          Same as Center Hill Study
             4.0    20.0     0.1    0.98

SEDIMENT   SEDDK    FSOD    (SEDDK set for 1st order NH3 & PO4 release from sed)  Same as Center Hill Study
            0.06     1.0

S DEMAND     SOD     SOD     SOD     SOD     SOD     SOD     SOD     SOD     SOD
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50

CBOD        KBOD    TBOD    RBOD
            0.05    1.05    2.00

PHOSPHOR  PO4REL   PARTP                                                          PARTP CH Study; PO4REL DH
           0.002     0.1

AMMONIA   NH3REL   NH3DK   PARTN                                                  Same as CH excpt NH3DK set fo
           0.035    0.05    0.01

NH3 RATE   NH3T1   NH3T2   NH3K1   NH3K2                                          Same as Center Hill Study
             0.1    20.0     0.1    0.98

NITRATE    NO3DK   DNPRN                                                          Same as Center Hill Study
             0.1      ON

NO3 RATE   NO3T1   NO3T2   NO3K1   NO3K2                                          Same as Center Hill Study
             5.0    20.0     0.1    0.98

SILICA     SIREL                                                                  Same as Center Hill Study
            0.01

SED CO2   CO2REL                                                                  Same as Center Hill Study
             0.1

IRON       FEREL  FESETL
             0.4     0.5

STOICHMT   O2NH3   O2ORG  O2RESP   O2ALG    BIOP    BION   BIOSI    BIOC           Same as Center Hill Study
            3.43     1.4     1.2     1.4   0.004   0.067     0.0     0.5

O2 LIMIT   O2LIM                                                                  Same as Center Hill Study
             0.2
```

```
BTH FILE..............................BTHFN...................................
        r:\projects\1150-041\W2_input\1988\88bath01.npt

VPR FILE..............................VPRFN...................................
        VPR.npt - not used

LPR FILE..............................LPRFN...................................
        lpr.npt - not used

RSI FILE..............................RSIFN...................................
        rsi.npt - not used

MET FILE..............................METFN...................................
        r:\projects\1150-041\W2_input\1988\88met04.npt                    source of metdata=Nashville I

QWD FILE..............................QWDFN...................................
        not used

QIN FILE..............................QINFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88q_or02.npt                       Obey River
Br 2    r:\projects\1150-041\W2_input\1988\88q_wo02.npt                       WF Obey River
Br 3    r:\projects\1150-041\W2_input\1988\88q_be01.npt                       Big Eagle Creek
Br 4    r:\projects\1150-041\W2_input\1988\88q_ac01.npt                       Ashburn Creek
Br 5    r:\projects\1150-041\W2_input\1988\88q_il01.npt                       Illwill Creek
Br 6    r:\projects\1150-041\W2_input\1988\88q_wr02.npt                       Wolf River
Br 7    r:\projects\1150-041\W2_input\1988\88q_sc01.npt                       Sulphur Creek
Br 8    r:\projects\1150-041\W2_input\1988\88q_ic01.npt                       Irons Creek
Br 9    r:\projects\1150-041\W2_input\1988\88q_hc02.npt                       Holly Creek
Br 10   r:\projects\1150-041\W2_input\1988\88q_mc01.npt                       Mitchell Creek

TIN FILE..............................TINFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88t_or03.npt
Br 2    r:\projects\1150-041\W2_input\1988\88t_wo03.npt
Br 3    r:\projects\1150-041\W2_input\1988\88t_be04.npt
Br 4    r:\projects\1150-041\W2_input\1988\88t_ac04.npt
Br 5    r:\projects\1150-041\W2_input\1988\88t_il04.npt
Br 6    r:\projects\1150-041\W2_input\1988\88t_wr03.npt
Br 7    r:\projects\1150-041\W2_input\1988\88t_sc04.npt
Br 8    r:\projects\1150-041\W2_input\1988\88t_ic04.npt
Br 9    r:\projects\1150-041\W2_input\1988\88t_hc04.npt
Br 10   r:\projects\1150-041\W2_input\1988\88t_mc04.npt

CIN FILE..............................CINFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88c_or05.npt
Br 2    r:\projects\1150-041\W2_input\1988\88c_wo05.npt
Br 3    r:\projects\1150-041\W2_input\1988\88c_be06.npt
Br 4    r:\projects\1150-041\W2_input\1988\88c_ac06.npt
Br 5    r:\projects\1150-041\W2_input\1988\88c_il05.npt
Br 6    r:\projects\1150-041\W2_input\1988\88c_wr05.npt
Br 7    r:\projects\1150-041\W2_input\1988\88c_sc06.npt
Br 8    r:\projects\1150-041\W2_input\1988\88c_ic06.npt
Br 9    r:\projects\1150-041\W2_input\1988\88c_hc06.npt
Br 10   r:\projects\1150-041\W2_input\1988\88c_mc06.npt

QOT FILE..............................QOTFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88q_out.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
```

```
Br 9    not used
Br 10   not used

QTR FILE..............................QTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1988\88q_sp01.npt                    Spring Creek

TTR FILE..............................TTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1988\88t_sp04.npt

CTR FILE..............................CTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1988\88c_sp05.npt

QDT FILE..............................QDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88q_dt02.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

TDT FILE..............................TDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88t_dt04.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

CDT FILE..............................CDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1988\88c_dt06.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

PRE FILE..............................PREFN...................................
Br 1    pre_br1.npt - not used
Br 2    pre_br2.npt - not used
Br 3    pre_br3.npt - not used
Br 4    pre_br4.npt - not used
Br 5    pre_br5.npt-  not used
Br 6    pre_br6.npt - not used
Br 7    pre_br7.npt - not used
Br 8    pre_br8.npt - not used
Br 9    pre_br9.npt - not used
Br10    pre_br10.npt - not used

TPR FILE..............................TPRFN...................................
Br 1    tpr_br1.npt - not used
Br 2    tpr_br2.npt - not used
Br 3    tpr_br3.npt - not used
```

```
Br 4    tpr_br4.npt - not used
Br 5    tpr_br5.npt - not used
Br 6    tpr_br6.npt - not used
Br 7    tpr_br7.npt - not used
Br 8    tpr_br8.npt - not used
Br 9    tpr_br9.npt - not used
Br10    tpr_br10.npt - not used

CPR FILE..............................CPRFN...................................
Br 1    cpr_br1.npt - not used
Br 2    cpr_br2.npt - not used
Br 3    cpr_br3.npt - not used
Br 4    cpr_br4.npt - not used
Br 5    cpr_br5.npt - not used
Br 6    cpr_br6.npt - not used
Br 7    cpr_br7.npt - not used
Br 8    cpr_br8.npt - not used
Br 9    cpr_br9.npt - not used
Br10    cpr_br10.npt - not used

EUH FILE..............................EUHFN....................................
Br 1    euh_br1.npt - not used
Br 2    euh_br2.npt - not used
Br 3    euh_br3.npt - not used
Br 4    euh_br4.npt - not used
Br 5    euh_br5.npt - not used
Br 6    euh_br6.npt - not used
Br 7    euh_br7.npt - not used
Br 8    euh_br8.npt - not used
Br 9    euh_br9.npt - not used
Br10    euh_br10.npt - not used

TUH FILE..............................TUHFN....................................
Br 1    tuh_br1.npt - not used
Br 2    tuh_br2.npt - not used
Br 3    tuh_br3.npt - not used
Br 4    tuh_br4.npt - not used
Br 5    tuh_br5.npt - not used
Br 6    tuh_br6.npt - not used
Br 7    tuh_br7.npt - not used
Br 8    tuh_br8.npt - not used
Br 9    tuh_br9.npt - not used
Br10    tuh_br10.npt - not used

CUH FILE..............................CUHFN....................................
Br 1    cuh_br1.npt - not used
Br 2    cuh_br2.npt - not used
Br 3    cuh_br3.npt - not used
Br 4    cuh_br4.npt - not used
Br 5    cuh_br5.npt - not used
Br 6    cuh_br6.npt - not used
Br 7    cuh_br7.npt - not used
Br 8    cuh_br8.npt - not used
Br 9    cuh_br9.npt - not used
Br10    cuh_br10.npt - not used

EDH FILE..............................EDHFN....................................
Br 1    edh_br1.npt - not used
Br 2    edh_br2.npt - not used
Br 3    edh_br3.npt - not used
Br 4    edh_br4.npt - not used
Br 5    edh_br5.npt - not used
Br 6    edh_br6.npt - not used
Br 7    edh_br7.npt - not used
```

```
Br 8    edh_br8.npt - not used
Br 9    edh_br9.npt - not used
Br10    edh_br10.npt - not used

TDH FILE..............................TDHFN...................................
Br 1    tdh_br1.npt - not used
Br 2    tdh_br2.npt - not used
Br 3    tdh_br3.npt - not used
Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
Br 8    tdh_br8.npt - not used
Br 9    tdh_br9.npt - not used
Br10    tdh_br10.npt - not used

CDH FILE..............................CDHFN...................................
Br 1    tdh_br1.npt - not used
Br 2    tdh_br2.npt - not used
Br 3    tdh_br3.npt - not used
Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
Br 8    tdh_br8.npt - not used
Br 9    tdh_br9.npt - not used
Br10    tdh_br10.npt - not used

AGPM FILE............................AGPMFN...................................
        agmp88.w2p

SNP FILE..............................SNPFN...................................
        snp.opt

TSR FILE..............................TSRFN...................................
        tsr.opt

PRF FILE..............................PRFFN...................................
        prf.opt

VPL FILE..............................VPLFN...................................
        vpl.opt

CPL FILE..............................CPLFN...................................
        cpl.opt

SPR FILE..............................SPRFN...................................
        spr.opt
```

Dale Hollow Lake CE-QUAL-W2 Control File

```
TITLE C ............................TITLE...................................
        Dale Hollow Lake, March 1 through November 30, 1991 (mbb)
        Water quality simulation w/ version 2.05.1
        Temperature calibration completed as of 01/10/01; for inflow conc refer to xcel (020701)
        03/15/01 raised all ASATUR's 125,135,125 respectively; 03/20/01 added DETRIT, RDOM;
        03/29/01 revised DETKD, DSETL & ASATUR; 04/04/01 revised CIC of SI, DETRIT, RDOM, TDS, TSS;
        04/09/01 rev AGT1&2 (Diatoms&Green); 04/10/01 raised AGT1&2 for all algae; 04/11/01 Added Iron
        05/14/01 rev inflow FE for unmonitored tribs
TIME CON  TMSTRT   TMEND    YEAR
           59.49  333.51    1991

DLT CON      NDT  DLTMIN
               1     1.0

DLT DATE    DLTD
            60.0

DLT MAX   DLTMAX
          1800.0

DLT FRN     DLTF
            0.50

BRANCH G      US      DS     UHS     DHS
Br 1           2      22       0       0          Obey River (OR)
Br 2          25      26       0       3          WF Obey River (WO)
Br 3          29      30       0       8          Big Eagle Creek (BE)
Br 4          33      34       0      11          Ashburn Creek (AC)
Br 5          37      39       0      46          Illwill Creek (IL)
Br 6          42      47       0      12          Wolf River (WR)
Br 7          50      52       0      13          Sulphur Creek (SC)
Br 8          55      56       0      14          Irons Creek (IC)
Br 9          59      60       0      15          Holly Creek (HC)
Br 10         63      65       0      17          Mitchell Creek (MC)

LOCATION     LAT    LONG   DATUM
            36.6    85.3   154.3

INIT CND     T2I  ICETHI  WTYPEC
             9.0     0.0   FRESH

CALCULAT     VBC     MBC     PQC    PQTC     EVC     PRC
              ON      ON      ON      ON     OFF     OFF

INTERPOL   INFIC    TRIC   DTRIC    HDIC  QOUTIC    WDIC   METIC
              ON      ON      ON      ON      ON      ON      ON

DEAD SEA   WINDC    QINC   QOUTC   HEATC
              ON      ON      ON      ON

ICE COVER   ICEC   SLICE  SLHEAT  ALBEDO     HWI   BETAI  GAMMAI  ICEMIN   ICET2
             OFF  DETAIL    TERM    0.25    10.0     0.6    0.07    0.05     3.0

TRANSPORT  SLTRC   THETA   DZMAX
        QUICKEST    0.00    -999

WSC NUMB    NWSC WSC_MIN WSC_MAX
               1    -999    -999

WSC DATE    WSCD    WSCD
            59.5
```

WSC COEF	WSC	WSC								
	0.55									
WIND FUNC	WFC									
	1.0									
HYD COEF	AX	DX	CHEZY	CBHE	TSED	FW_A0	FW_A1	FW_A2	SRMULT	avg annual T @Livingston Radio-TN
	1.0	1.0	70.0	3.5E-7	10.0	-999	-999	-999	-999	used for TSED; chnged from 15.7 to
SEL WITH	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	
	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
	OFF									
N STRUC	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	NSTR	1=turb, 2-fishery, 3=tainter,
	5	0	0	0	0	0	0	0	0	4=servunit, 5=sluice
	0									
K LIMIT	KLSW	KLSW	KLSW	KLSW	KLSW					
Br 1	99	99	99	99	99					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
SINK TYPE	SINK	SINK	SINK	SINK	SINK					
Br 1	POINT	POINT	LINE	POINT	POINT					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
E STRUC	TURB	FISH	TAINT	SERVU	SLUIC					
Br 1	178.0	174.2	200.3	169.6	163.7					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										
W STRUC	WSTR	WSTR	WSTR	WSTR	WSTR					
Br 1	0.00	0.00	121.9	0.00	0.00					
Br 2										
Br 3										
Br 4										
Br 5										
Br 6										
Br 7										
Br 8										
Br 9										
Br 10										

N OUTLET	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT	NOUT
	5	0	0	0	0	0	0	0	0
	0								

O LAYER	KOUT
Br 1	0
Br 2	0
Br 3	0
Br 4	0
Br 5	0
Br 6	0
Br 7	0
Br 8	0
Br 9	0
Br 10	0

N WDRWAL	NWD
	0

W SEGMNT	IWD
	0

W LAYER	KWD

N TRIBS	NTR	MXSGDTR	Dist. tribs and Branches only
	1	-999	Spring Creek (to Wolf Ck)

TRIB SEG	ITR
	42

DST TRIB	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC	DTRC
	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
	OFF								

SCR PRINT	SCRC	NSCR
	OFF	1

SCR DATE	SCRD
	65.5

SCR FREQ	SCRF
	1.0

SNAPSHOT	FORM	UPRN	WPRN	TPRN	DTPRN	RHOPRN	AZPRN	DZPRN
	LONG	ON	ON	ON	OFF	OFF	OFF	OFF

SHRT SEG	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF	IPRSF
	2	4	9	12	14	16	17	21	38
	40	41							

LONG SEG	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF	IPRLF
	2	5	8	11	14	17	20	22	26
	30	34	39	47	52	56	60	65	

SNP PRINT	SNPC	NSNP
	ON	13

SNP DATE	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD	SNPD
	59.5	90.5	120.5	151.5	181.5	203.5	204.5	236.5	267.5
	288.5	289.5	305.5	333.5					

SNP FREQ	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF	SNPF

```
          999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0
          999.0   999.0   999.0   999.0

PRF PLOT   PRFC    NPRF    NPRS  PRSTYL
             ON      16      15     FTN

PRF DATE   PRFD    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD    PRFD
           59.5    91.5    92.5   118.5   131.5   137.5   155.5   181.5   204.5
          205.5   217.5   237.5   272.5   289.5   290.5   317.5

PRF FREQ   PRFF    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF    PRFF
          999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0   999.0
          999.0   999.0   999.0   999.0   999.0   999.0   999.0

PRF SEG    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF    IPRF
              2      14       4       8       9      12      13      16      17
             22      25      39      42      44      50

SPR PLOT   SPRC    NSPR   NIPRF
            OFF       1       1

SPR DATE   SPRD
           59.5

SPR FREQ   SPRF
          999.0

SPR SEG    ISPR
             25

TSR PLOT   TSRC    NTSR  TSSTYL
             ON       1     FTN

TSR DATE   TSRD
           59.5

TSR FREQ   TSRF
            1.0

VPL PLOT   VPLC    NVPL  VPSTYL
            OFF       1

VPL DATE   VPLD
           59.5

VPL FREQ   VPLF
          999.0

CPL PLOT   CPLC    NCPL  CPSTYL
            OFF       1     FTN

CPL DATE   CPLD
           59.5

CPL FREQ   CPLF
          999.0

APGM OUT   APLC
            OFF                        on/off switch for APGM output

AGPM OUT2  APLD   APLFD   APLFH
           59.5     1.0     0.0        start date = APLD, frequency = APLFD + APLFH/24

RESTART    RSOC    NRSO    RSIC
```

```
             OFF       0     OFF

RSO DATE    RSOD
           999.0

RSO FREQ    RSOF
           999.0

CST COMP     CCC    LIMC     SDC  FREQUK
              ON      ON     OFF       1

CST ACT      ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC     ACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CST ICON     CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC     CIC
            0.00     1.5    0.00   126.0    0.10    0.11    1.50    1.10    0.01
            0.20    0.20    8.60    0.00    0.00    0.00    0.00    0.00    0.00
            0.00   0.101    0.00   0.001   0.001   0.001

CST PRNT    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN    CPRN
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CIN CON    INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC   INACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CTR CON    TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC   TRACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF      ON      ON      ON      ON      ON

CDT CON    DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC   DTACC
              ON      ON     OFF      ON      ON      ON      ON      ON      ON
              ON      ON      ON     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF      ON      ON      ON      ON

CPR CON    PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC   PRACC
              ON     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF     OFF
             OFF     OFF     OFF     OFF     OFF     OFF

EX COEF    EXH2O  EXINOR   EXORG    BETA  ALGLIT
            0.31    0.03    0.09    0.43    0.01

COLIFORM  COLQ10   COLDK   COLKL   CSETL   CKSEG                                   Not simulating coliforms
            1.04    0.50   0.005    0.29   999.0

S SOLIDS   SSETL                                                                    Same as Center Hill (CH) Stud
             0.4

ALGAE      AGROW   AMORT   AEXCR   ARESP   ASETL    AHSP    AHSN   AHSSI  ASATUR    Same as CH xcpt AGROW,
Diatoms    2.064    0.03    0.00    0.05    0.35   0.002    0.06     0.1    86.0    ARESP,AHSP, ASATUR for DH
Greens      2.05    0.03    0.00    0.05    0.15   0.003    0.06     0.0    75.0
Cyanobac    1.60    0.03    0.00   0.005    0.08   0.004    0.10     0.0    85.0

ALG STOI   ABIOP   ABION  ABIOSI   ABIOC                                           Same as Center Hill Study
Diatoms    0.004   0.067     0.0     0.5
Greens     0.004   0.067     0.0     0.5
Cyanobac   0.004   0.067     0.0     0.5
```

```
ALG RATE    AGT1    AGT2    AGT3    AGT4    AGK1    AGK2    AGK3    AGK4                    AGK's CH Study; AGT's DH
Diatoms      8.0    14.0    20.0    25.0     0.1    0.98    0.98     0.1
Greens      10.0    16.0    25.0    30.0     0.1    0.98    0.98     0.1
Cyanobac    12.0    25.0    38.0    42.0     0.1    0.98    0.98     0.1

DISS ORG   LABDK   LRFDK   REFDK                                                            Same as Center Hill Study
            0.30   0.001   0.001

DETRITUS   DETDK   DSETL  ALGDET
           0.006    0.10    0.80

ORG RATE    OMT1    OMT2    OMK1    OMK2                                                    Same as Center Hill Study
             4.0    20.0     0.1    0.98

SEDIMENT   SEDDK    FSOD    (SEDDK set for 1st order NH3 & PO4 release from sed)            Same as Center Hill Study
            0.06     1.0

S DEMAND     SOD     SOD     SOD     SOD     SOD     SOD     SOD     SOD     SOD
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50    0.50
            0.50    0.50    0.50

CBOD        KBOD    TBOD    RBOD
            0.05    1.05    2.00

PHOSPHOR  PO4REL   PARTP                                                                    PARTP CH Study; PO4REL DH
           0.002     0.1

AMMONIA   NH3REL   NH3DK   PARTN                                                            Same as CH xcpt NH3DK set for
           0.035    0.05    0.01

NH3 RATE   NH3T1   NH3T2   NH3K1   NH3K2                                                    Same as Center Hill Study
             0.1    20.0     0.1    0.98

NITRATE    NO3DK   DNPRN                                                                    Same as Center Hill Study
             0.1      ON

NO3 RATE   NO3T1   NO3T2   NO3K1   NO3K2                                                    Same as Center Hill Study
             5.0    20.0     0.1    0.98

SILICA     SIREL                                                                            Same as Center Hill Study
            0.01

SED CO2   CO2REL                                                                            Same as Center Hill Study
             0.1

IRON       FEREL  FESETL
             0.4     0.5

STOICHMT   O2NH3   O2ORG  O2RESP   O2ALG    BIOP    BION   BIOSI    BIOC                    Same as Center Hill Study
            3.43     1.4     1.2     1.4   0.004   0.067     0.0     0.5

O2 LIMIT   O2LIM                                                                            Same as Center Hill Study
             0.2

BTH FILE...............................BTHFN....................................
        r:\projects\1150-041\W2_input\1991\91bath01.npt
```

```
VPR FILE..............................VPRFN...................................
        VPR.npt - not used

LPR FILE..............................LPRFN...................................
        lpr.npt - not used

RSI FILE..............................RSIFN...................................
        rsi.npt - not used

MET FILE..............................METFN...................................
        r:\projects\1150-041\W2_input\1991\91met03.npt                    source of metdata=Nashville I

QWD FILE..............................QWDFN...................................
        not used

QIN FILE..............................QINFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91q_or02.npt                     Obey River
Br 2    r:\projects\1150-041\W2_input\1991\91q_wo02.npt                     WF Obey River
Br 3    r:\projects\1150-041\W2_input\1991\91q_be01.npt                     Big Eagle Creek
Br 4    r:\projects\1150-041\W2_input\1991\91q_ac01.npt                     Ashburn Creek
Br 5    r:\projects\1150-041\W2_input\1991\91q_il01.npt                     Illwill Creek
Br 6    r:\projects\1150-041\W2_input\1991\91q_wr02.npt                     Wolf River
Br 7    r:\projects\1150-041\W2_input\1991\91q_sc01.npt                     Sulphur Creek
Br 8    r:\projects\1150-041\W2_input\1991\91q_ic01.npt                     Irons Creek
Br 9    r:\projects\1150-041\W2_input\1991\91q_hc02.npt                     Holly Creek
Br 10   r:\projects\1150-041\W2_input\1991\91q_mc01.npt                     Mitchell Creek

TIN FILE..............................TINFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91t_or03.npt
Br 2    r:\projects\1150-041\W2_input\1991\91t_wo03.npt
Br 3    r:\projects\1150-041\W2_input\1991\91t_be04.npt
Br 4    r:\projects\1150-041\W2_input\1991\91t_ac04.npt
Br 5    r:\projects\1150-041\W2_input\1991\91t_il04.npt
Br 6    r:\projects\1150-041\W2_input\1991\91t_wr03.npt
Br 7    r:\projects\1150-041\W2_input\1991\91t_sc04.npt
Br 8    r:\projects\1150-041\W2_input\1991\91t_ic04.npt
Br 9    r:\projects\1150-041\W2_input\1991\91t_hc04.npt
Br 10   r:\projects\1150-041\W2_input\1991\91t_mc04.npt

CIN FILE..............................CINFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91c_or06.npt
Br 2    r:\projects\1150-041\W2_input\1991\91c_wo05.npt
Br 3    r:\projects\1150-041\W2_input\1991\91c_be06.npt
Br 4    r:\projects\1150-041\W2_input\1991\91c_ac07.npt
Br 5    r:\projects\1150-041\W2_input\1991\91c_il05.npt
Br 6    r:\projects\1150-041\W2_input\1991\91c_wr05.npt
Br 7    r:\projects\1150-041\W2_input\1991\91c_sc07.npt
Br 8    r:\projects\1150-041\W2_input\1991\91c_ic07.npt
Br 9    r:\projects\1150-041\W2_input\1991\91c_hc07.npt
Br 10   r:\projects\1150-041\W2_input\1991\91c_mc07.npt

QOT FILE..............................QOTFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91q_out.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br 10   not used

QTR FILE..............................QTRFN...................................
```

```
Tr 1    r:\projects\1150-041\W2_input\1991\91q_sp01.npt                                    Spring Creek

TTR FILE...............................TTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1991\91t_sp04.npt

CTR FILE...............................CTRFN...................................
Tr 1    r:\projects\1150-041\W2_input\1991\91c_sp05.npt

QDT FILE...............................QDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91q_dt02.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

TDT FILE...............................TDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91t_dt04.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

CDT FILE...............................CDTFN...................................
Br 1    r:\projects\1150-041\W2_input\1991\91c_dt07.npt
Br 2    not used
Br 3    not used
Br 4    not used
Br 5    not used
Br 6    not used
Br 7    not used
Br 8    not used
Br 9    not used
Br10    not used

PRE FILE...............................PREFN...................................
Br 1    pre_br1.npt - not used
Br 2    pre_br2.npt - not used
Br 3    pre_br3.npt - not used
Br 4    pre_br4.npt - not used
Br 5    pre_br5.npt-  not used
Br 6    pre_br6.npt - not used
Br 7    pre_br7.npt - not used
Br 8    pre_br8.npt - not used
Br 9    pre_br9.npt - not used
Br10    pre_br10.npt - not used

TPR FILE...............................TPRFN...................................
Br 1    tpr_br1.npt - not used
Br 2    tpr_br2.npt - not used
Br 3    tpr_br3.npt - not used
Br 4    tpr_br4.npt - not used
Br 5    tpr_br5.npt - not used
Br 6    tpr_br6.npt - not used
Br 7    tpr_br7.npt - not used
```

```
Br 8    tpr_br8.npt - not used
Br 9    tpr_br9.npt - not used
Br10    tpr_br10.npt - not used

CPR FILE..............................CPRFN...................................
Br 1    cpr_br1.npt - not used
Br 2    cpr_br2.npt - not used
Br 3    cpr_br3.npt - not used
Br 4    cpr_br4.npt - not used
Br 5    cpr_br5.npt - not used
Br 6    cpr_br6.npt - not used
Br 7    cpr_br7.npt - not used
Br 8    cpr_br8.npt - not used
Br 9    cpr_br9.npt - not used
Br10    cpr_br10.npt - not used

EUH FILE..............................EUHFN...................................
Br 1    euh_br1.npt - not used
Br 2    euh_br2.npt - not used
Br 3    euh_br3.npt - not used
Br 4    euh_br4.npt - not used
Br 5    euh_br5.npt - not used
Br 6    euh_br6.npt - not used
Br 7    euh_br7.npt - not used
Br 8    euh_br8.npt - not used
Br 9    euh_br9.npt - not used
Br10    euh_br10.npt - not used

TUH FILE..............................TUHFN...................................
Br 1    tuh_br1.npt - not used
Br 2    tuh_br2.npt - not used
Br 3    tuh_br3.npt - not used
Br 4    tuh_br4.npt - not used
Br 5    tuh_br5.npt - not used
Br 6    tuh_br6.npt - not used
Br 7    tuh_br7.npt - not used
Br 8    tuh_br8.npt - not used
Br 9    tuh_br9.npt - not used
Br10    tuh_br10.npt - not used

CUH FILE..............................CUHFN...................................
Br 1    cuh_br1.npt - not used
Br 2    cuh_br2.npt - not used
Br 3    cuh_br3.npt - not used
Br 4    cuh_br4.npt - not used
Br 5    cuh_br5.npt - not used
Br 6    cuh_br6.npt - not used
Br 7    cuh_br7.npt - not used
Br 8    cuh_br8.npt - not used
Br 9    cuh_br9.npt - not used
Br10    cuh_br10.npt - not used

EDH FILE..............................EDHFN...................................
Br 1    edh_br1.npt - not used
Br 2    edh_br2.npt - not used
Br 3    edh_br3.npt - not used
Br 4    edh_br4.npt - not used
Br 5    edh_br5.npt - not used
Br 6    edh_br6.npt - not used
Br 7    edh_br7.npt - not used
Br 8    edh_br8.npt - not used
Br 9    edh_br9.npt - not used
Br10    edh_br10.npt - not used
```

```
TDH FILE..............................TDHFN...................................
Br 1    tdh_br1.npt - not used
Br 2    tdh_br2.npt - not used
Br 3    tdh_br3.npt - not used
Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
Br 8    tdh_br8.npt - not used
Br 9    tdh_br9.npt - not used
Br10    tdh_br10.npt - not used

CDH FILE..............................CDHFN...................................
Br 1    tdh_br1.npt - not used
Br 2    tdh_br2.npt - not used
Br 3    tdh_br3.npt - not used
Br 4    tdh_br4.npt - not used
Br 5    tdh_br5.npt - not used
Br 6    tdh_br6.npt - not used
Br 7    tdh_br7.npt - not used
Br 8    tdh_br8.npt - not used
Br 9    tdh_br9.npt - not used
Br10    tdh_br10.npt - not used

AGPM FILE............................AGPMFN....................................
        agpm91.w2p

SNP FILE..............................SNPFN...................................
        snp.opt

TSR FILE..............................TSRFN...................................
        tsr.opt

PRF FILE..............................PRFFN...................................
        prf.opt

VPL FILE..............................VPLFN...................................
        vpl.opt

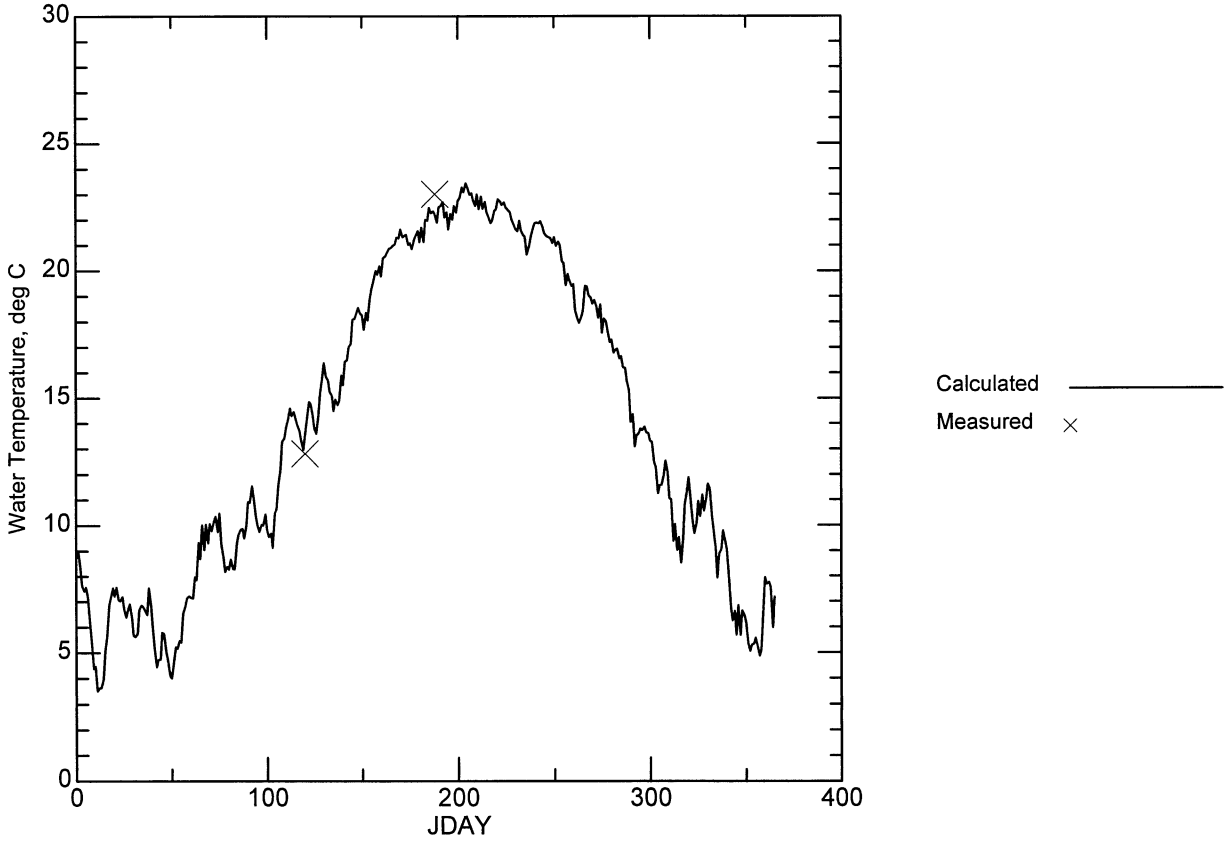
CPL FILE..............................CPLFN...................................
        cpl.opt

SPR FILE..............................SPRFN...................................
        spr.opt
```

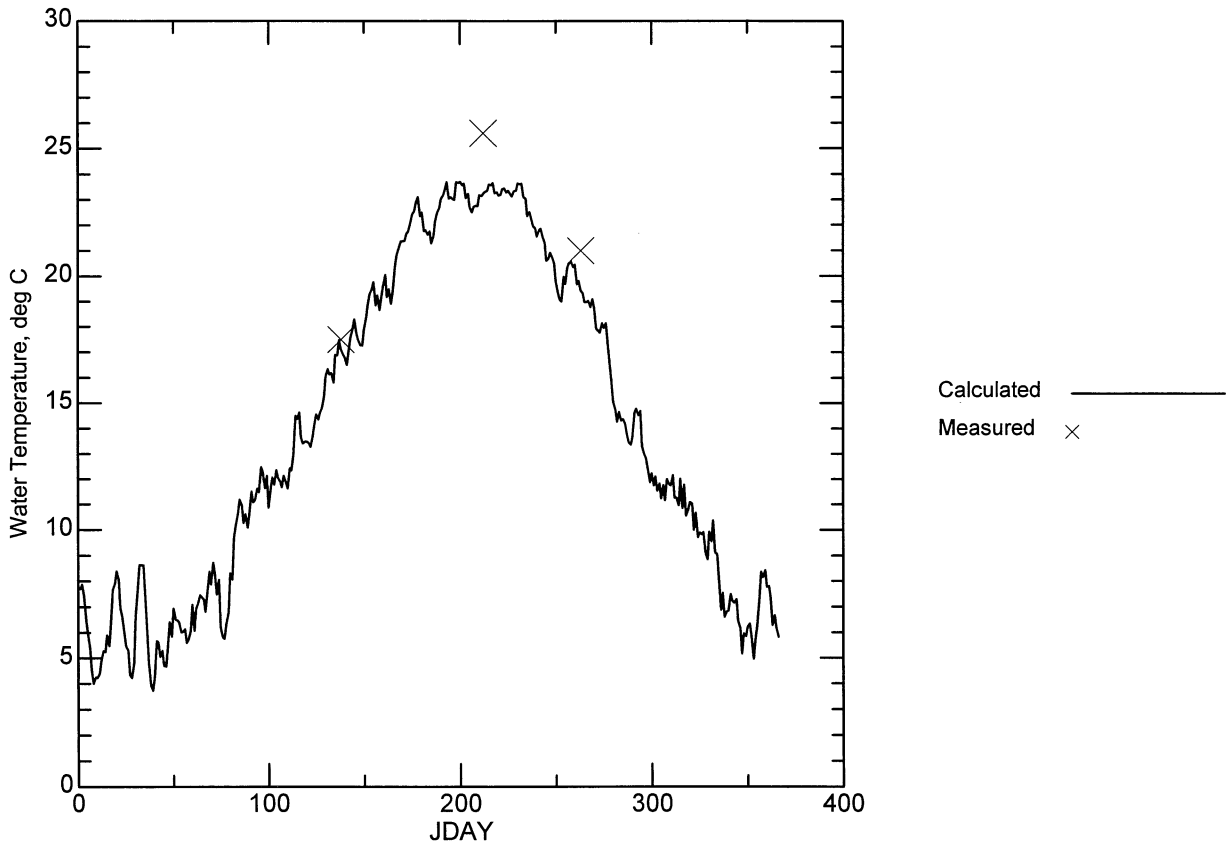
APPENDIX H

Estimated Water Temperatures

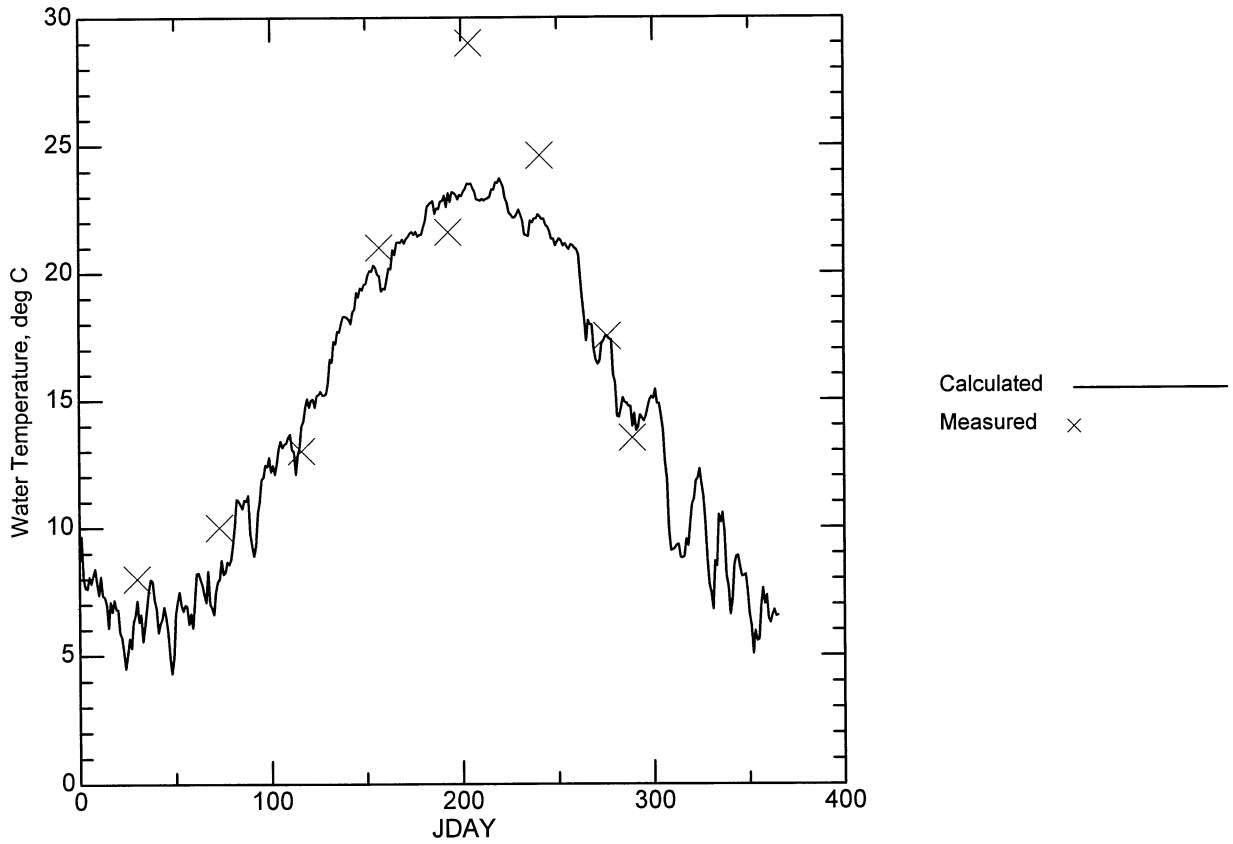
EF Obey River (OR) 1973



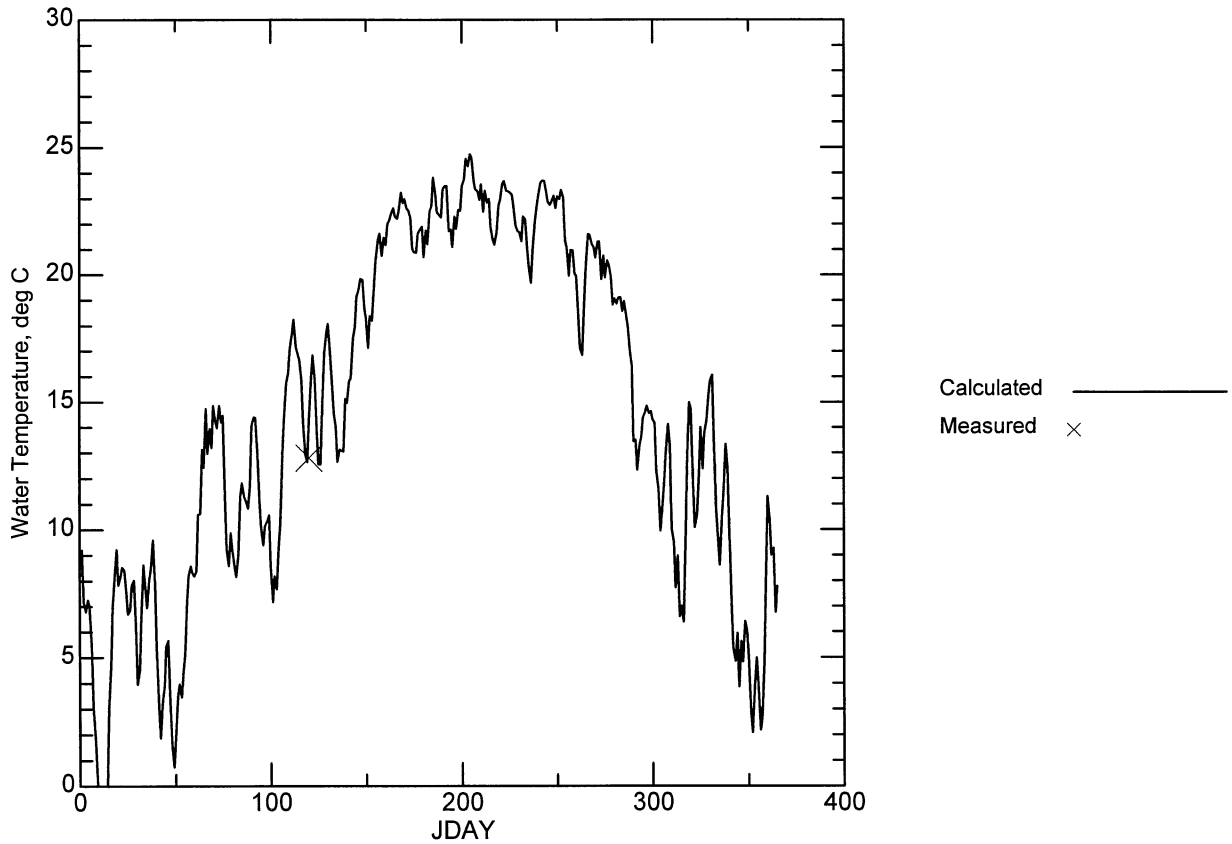
EF Obey River (OR) 1988



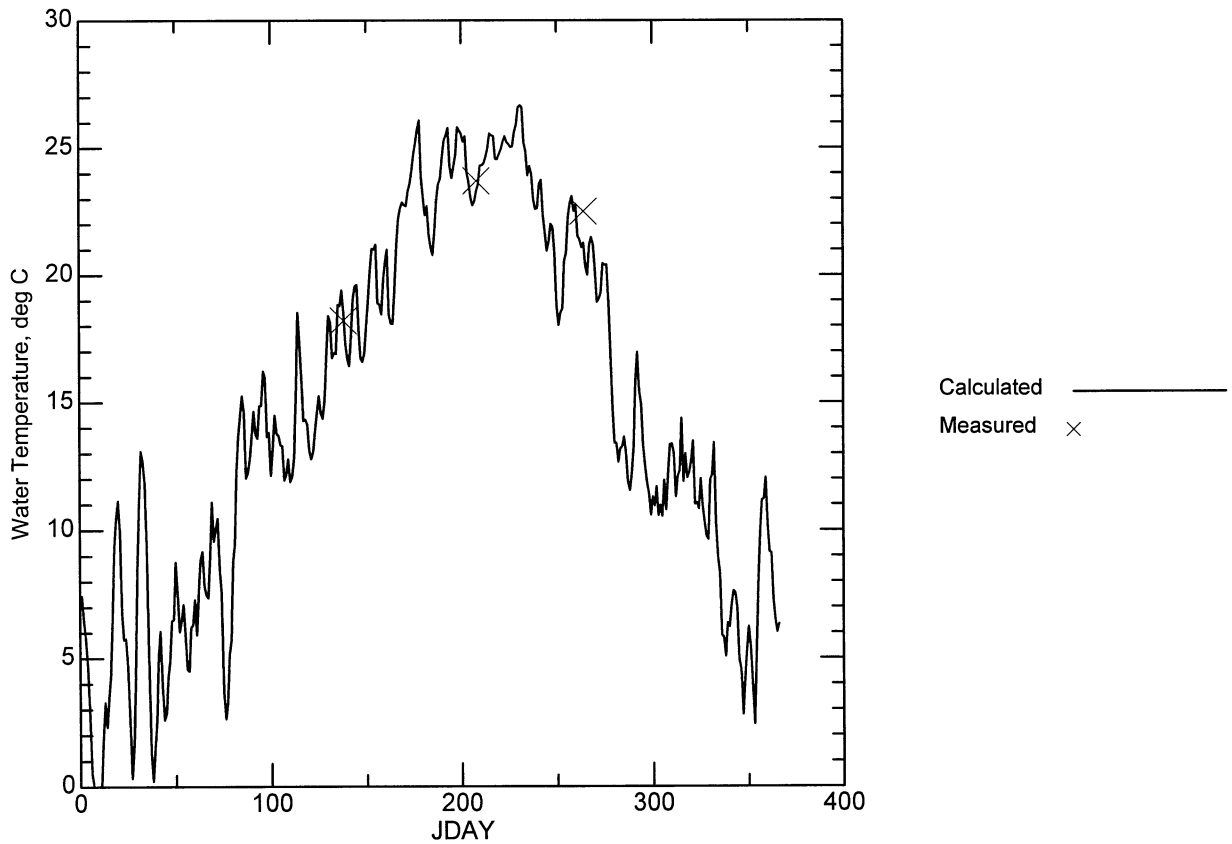
EF Obey River (OR) 1991



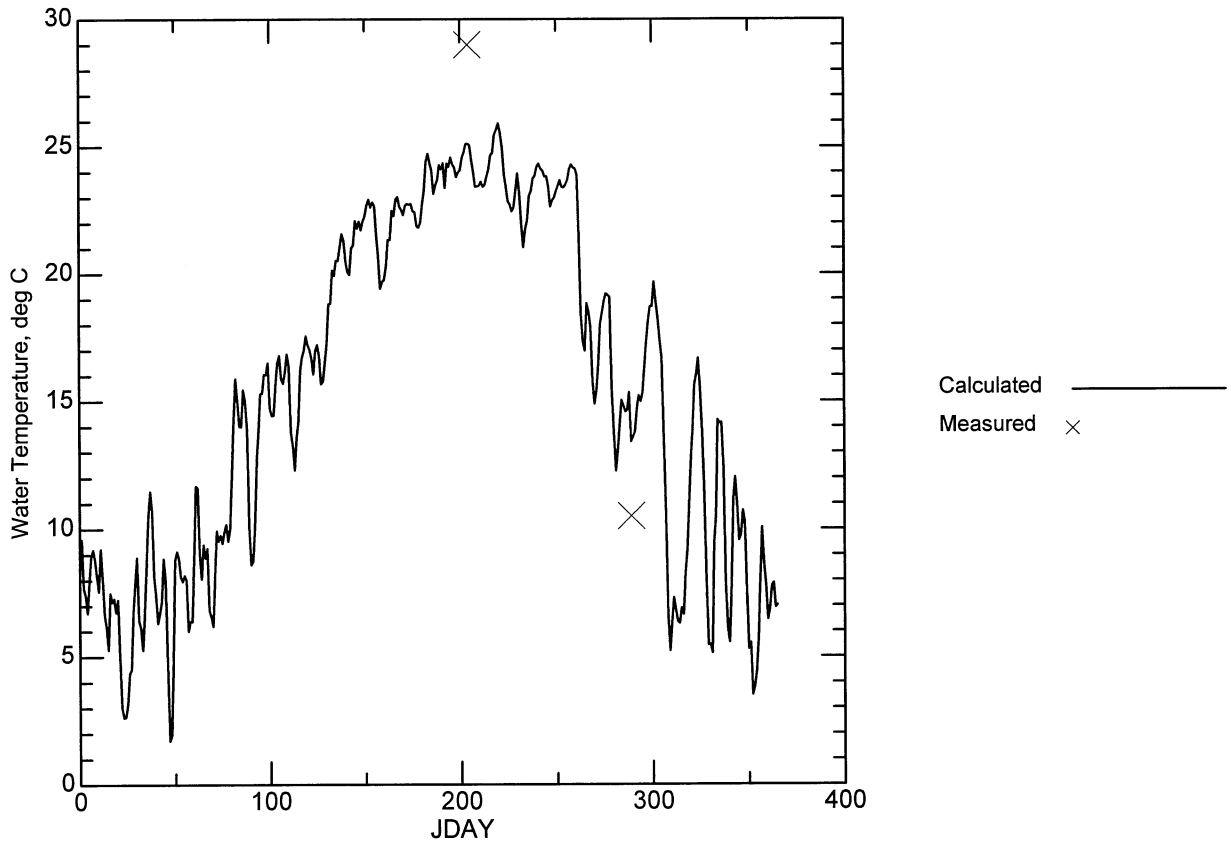
WF Obey River (WO) 1973



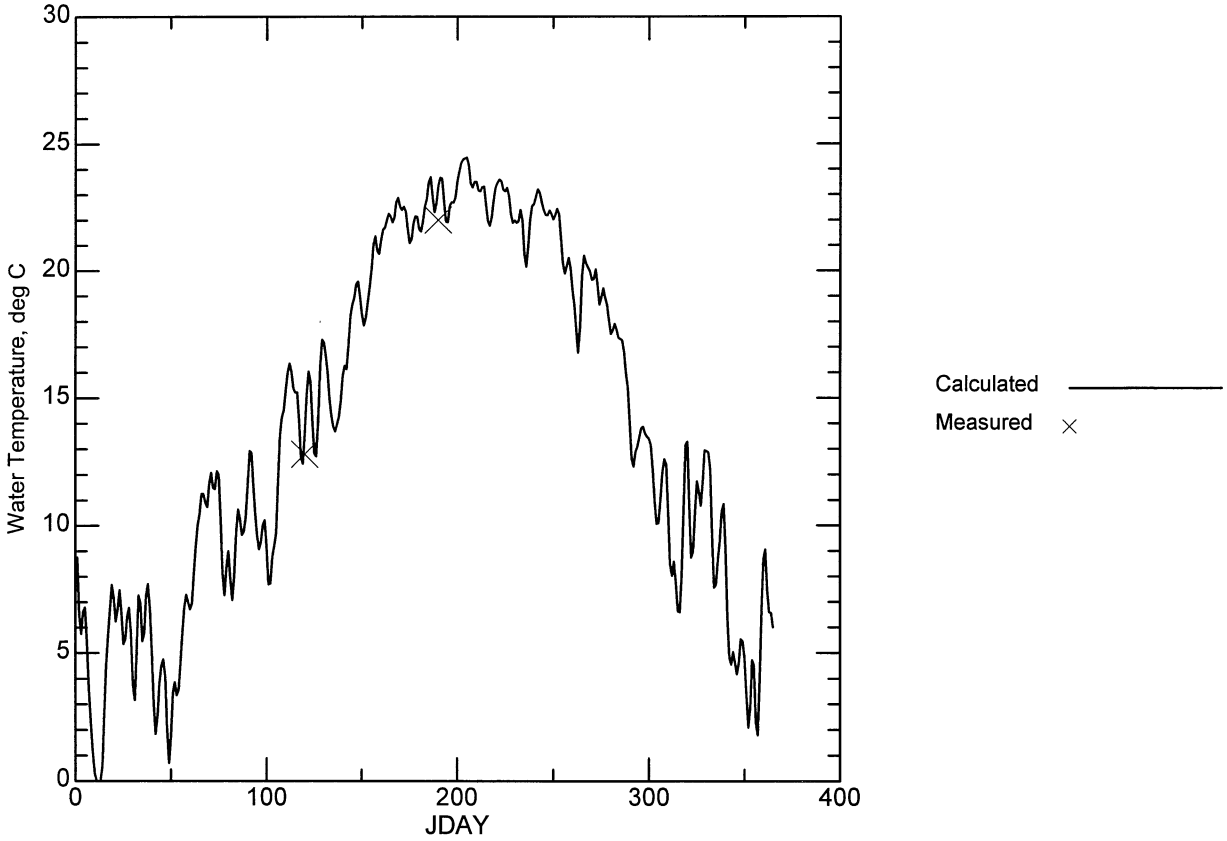
WF Obey River (WO) 1988



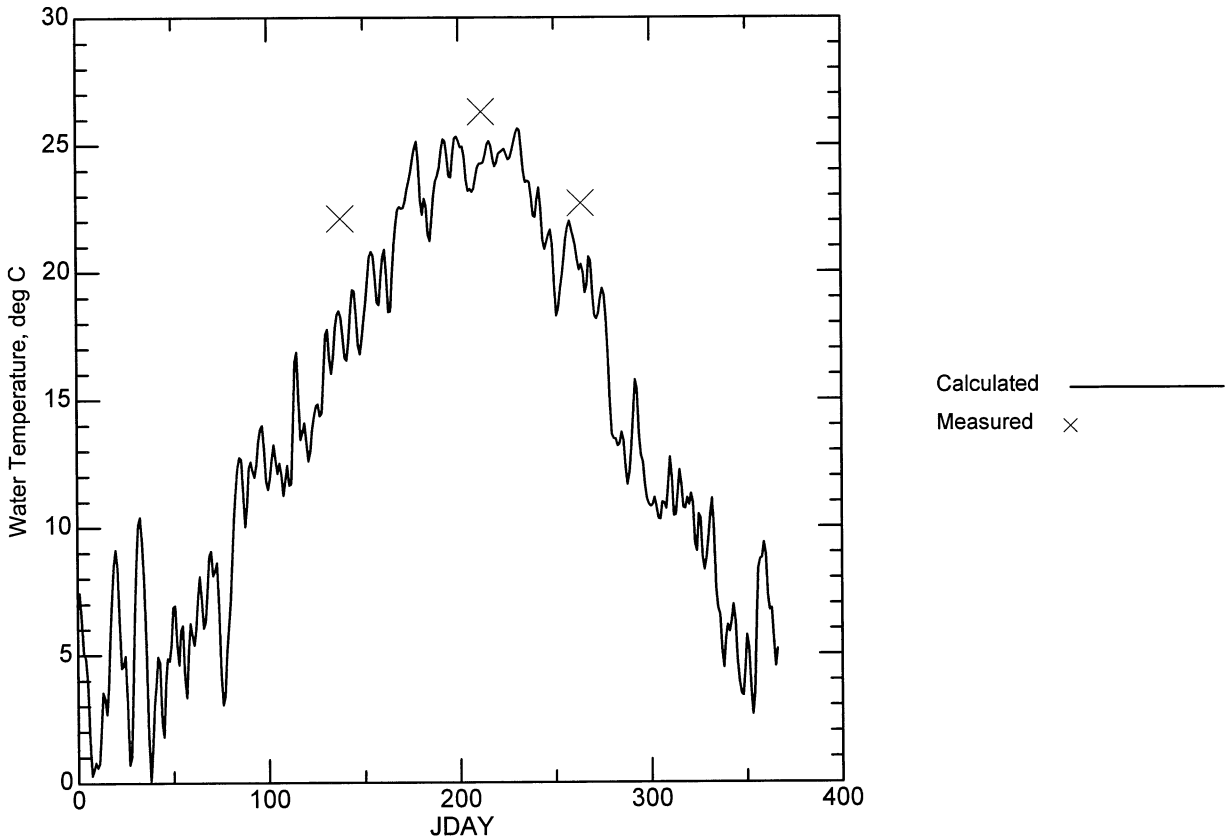
WF Obey River (WO) 1991



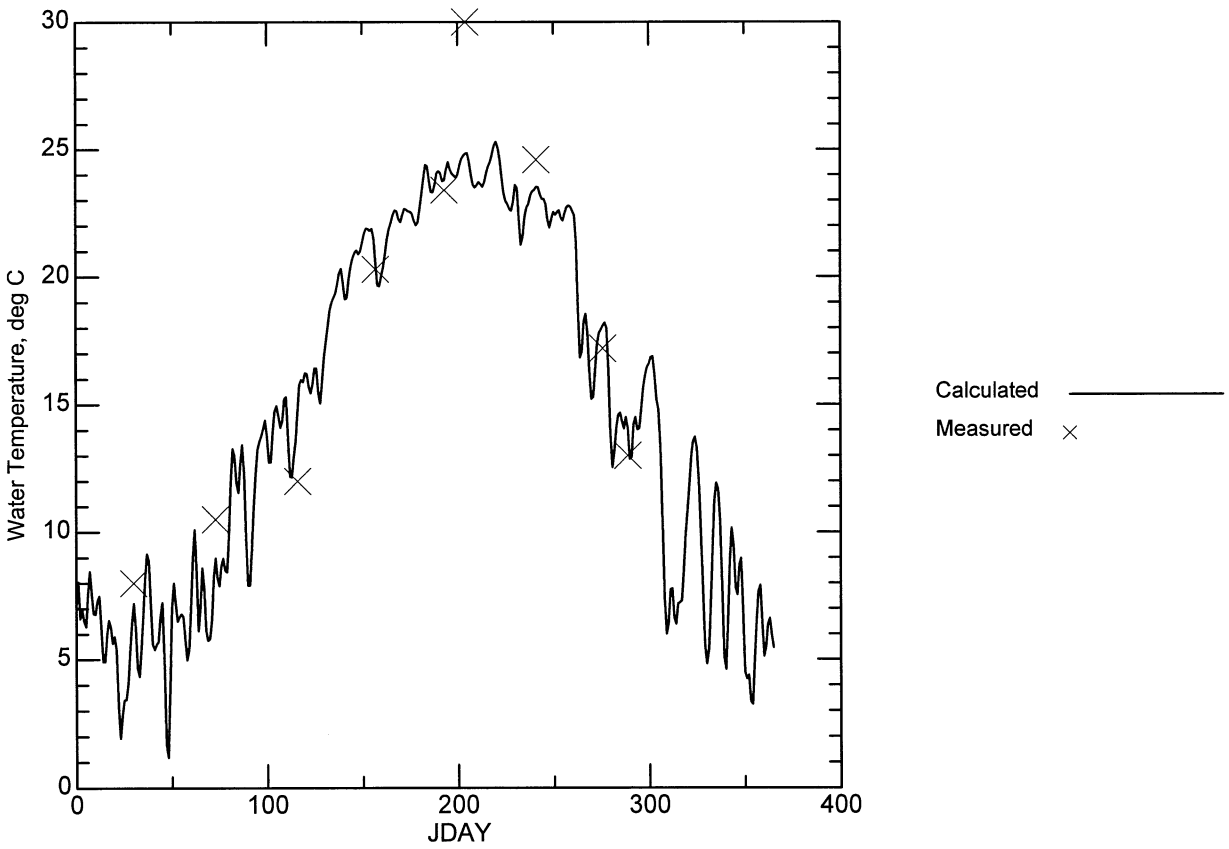
Wolf River (WR) 1973



Wolf River (WR) 1988

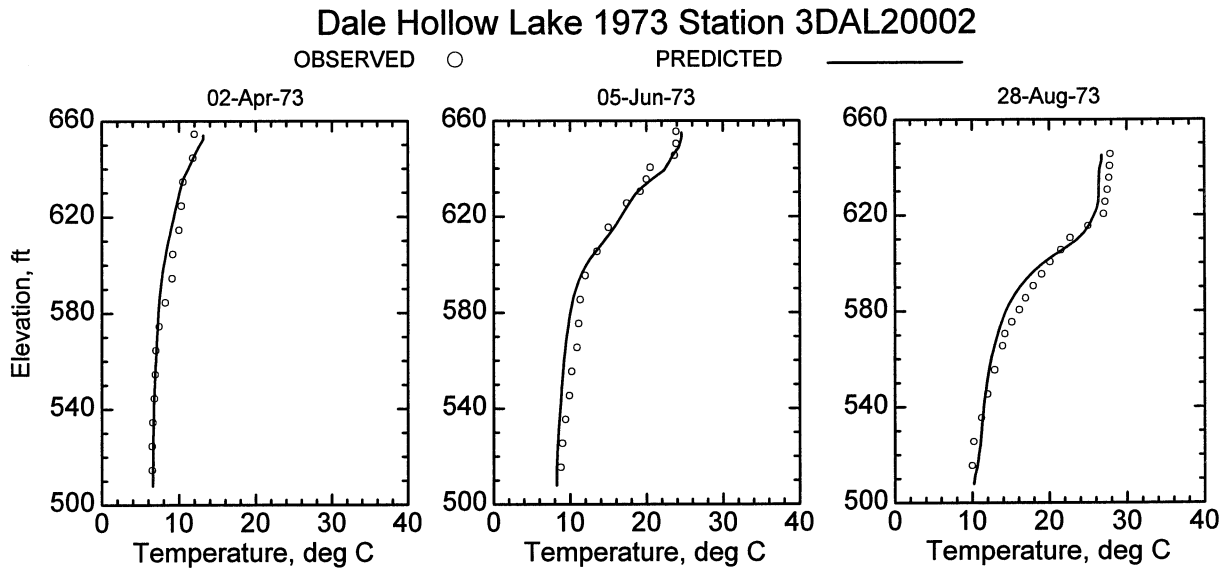


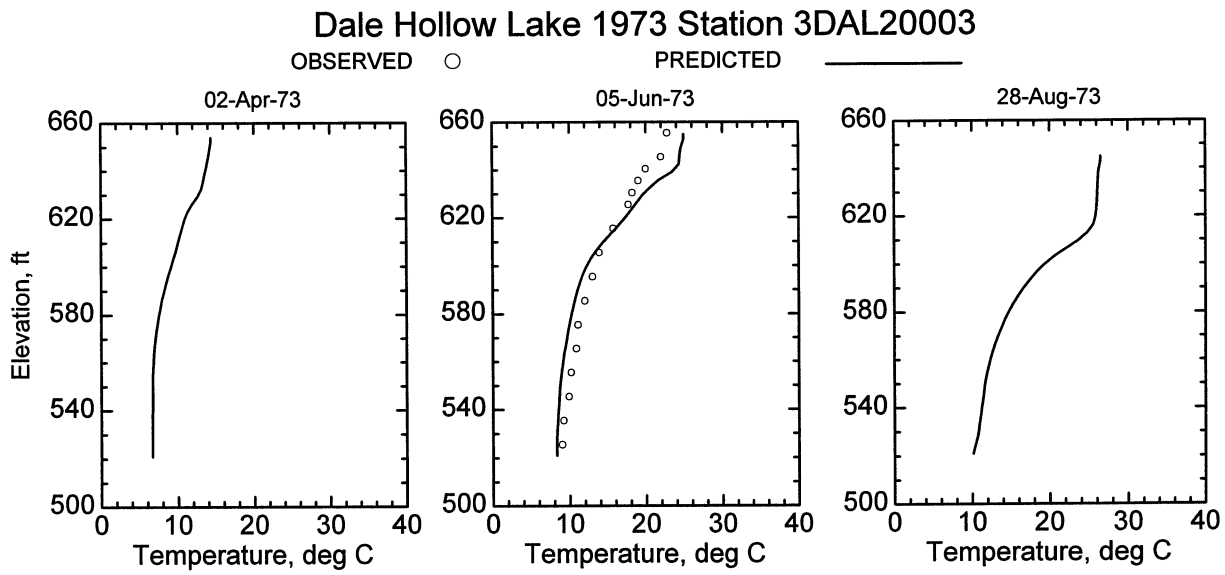
Wolf River (WR) 1991

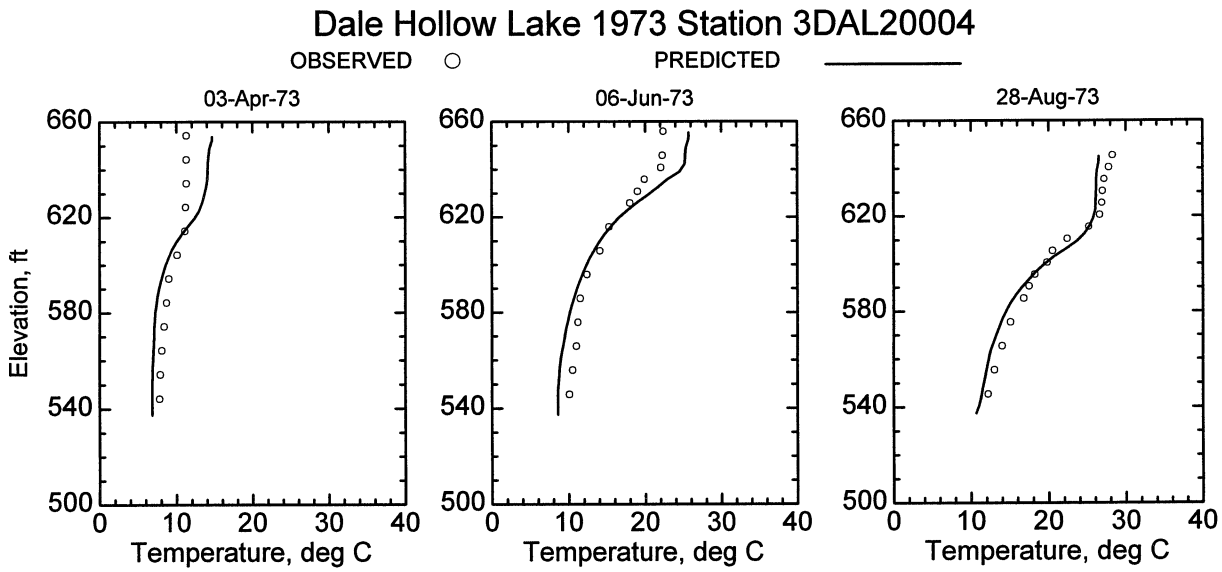


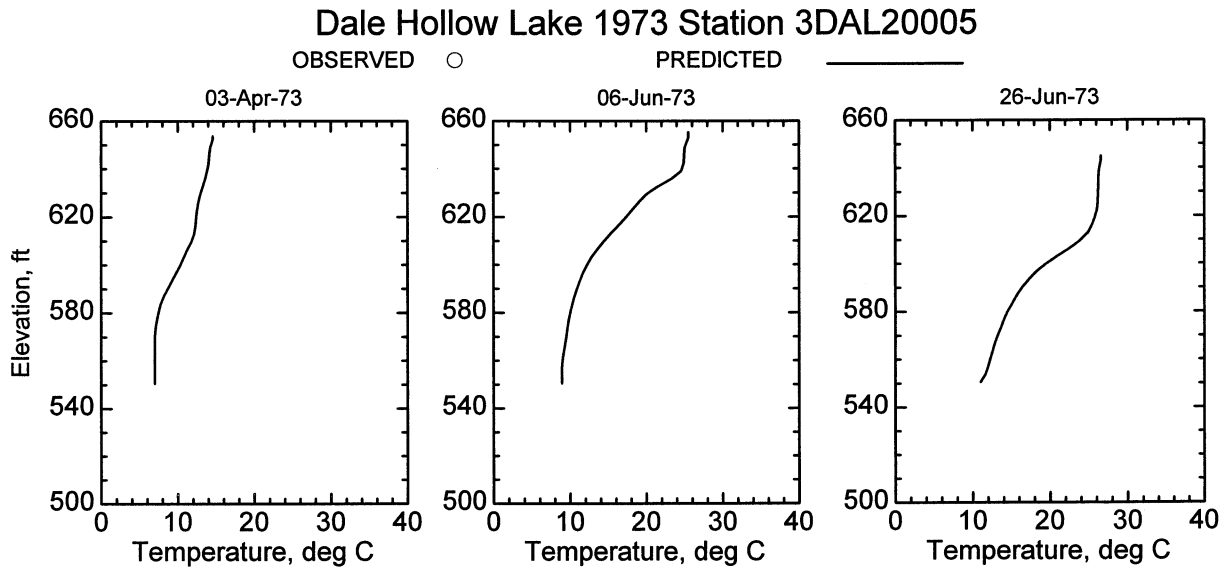
APPENDIX I

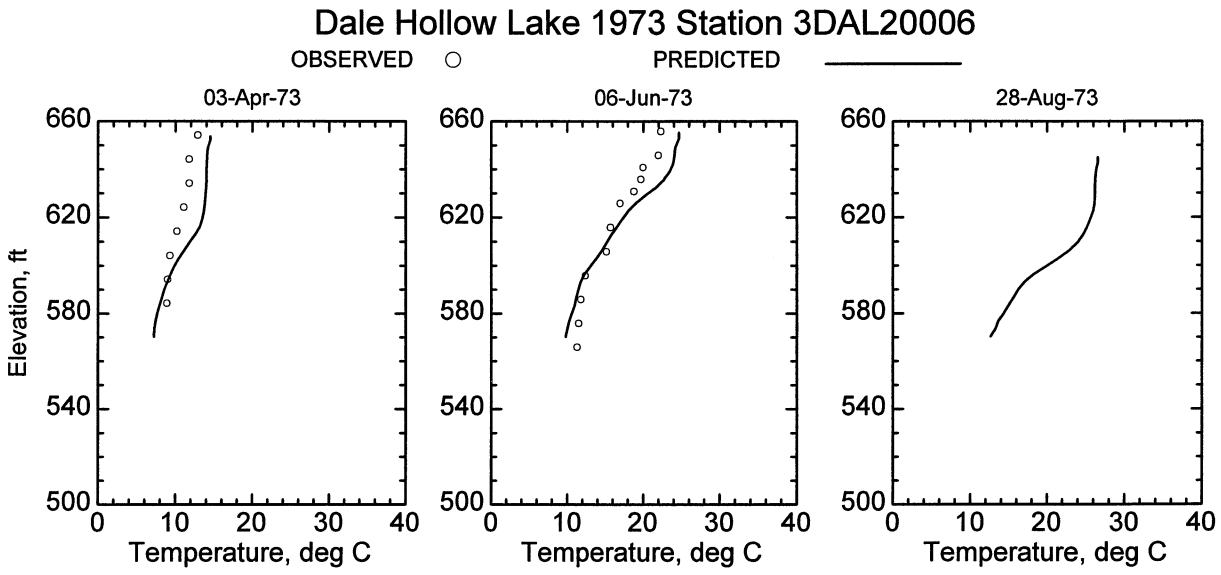
Comparison of Measured and Modeled Temperature Profiles

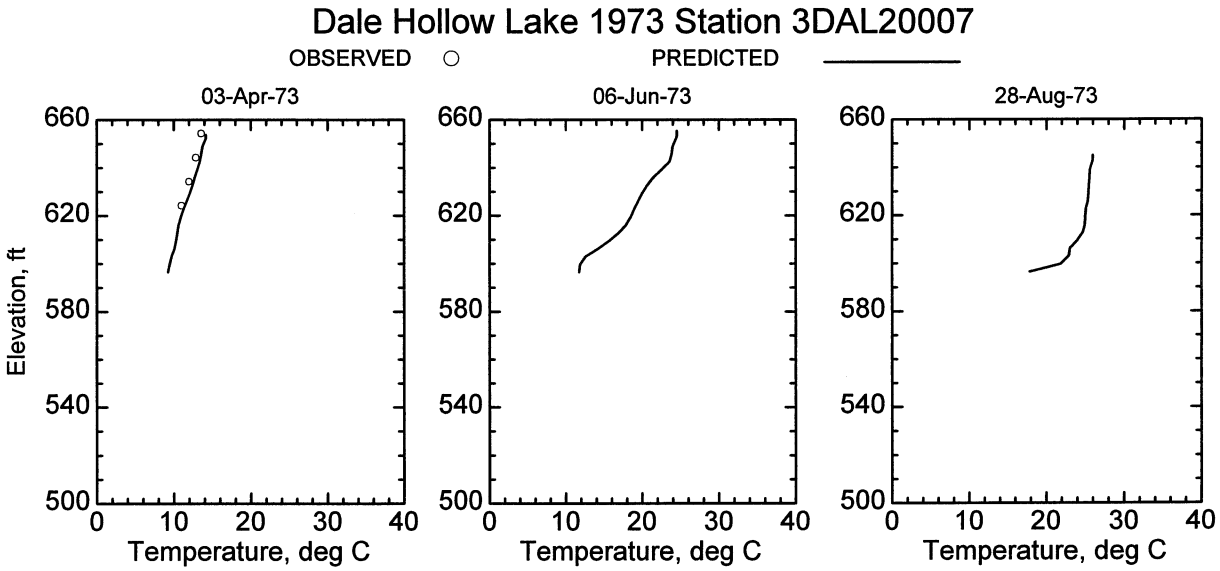

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

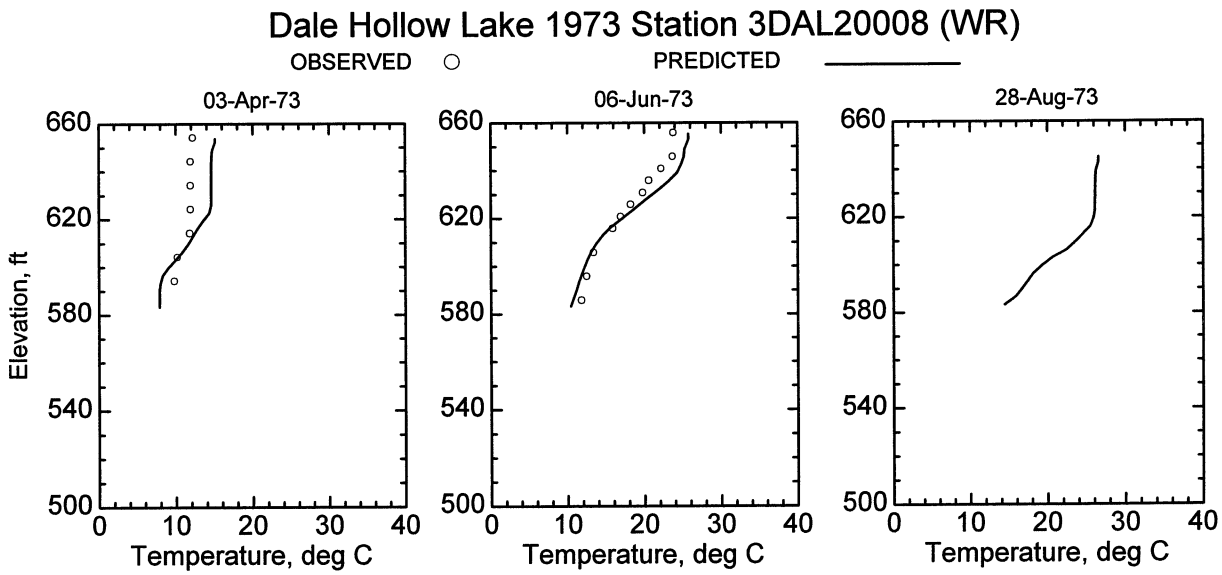

Dale Hollow Lake 1973 Station 3DAL20003
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

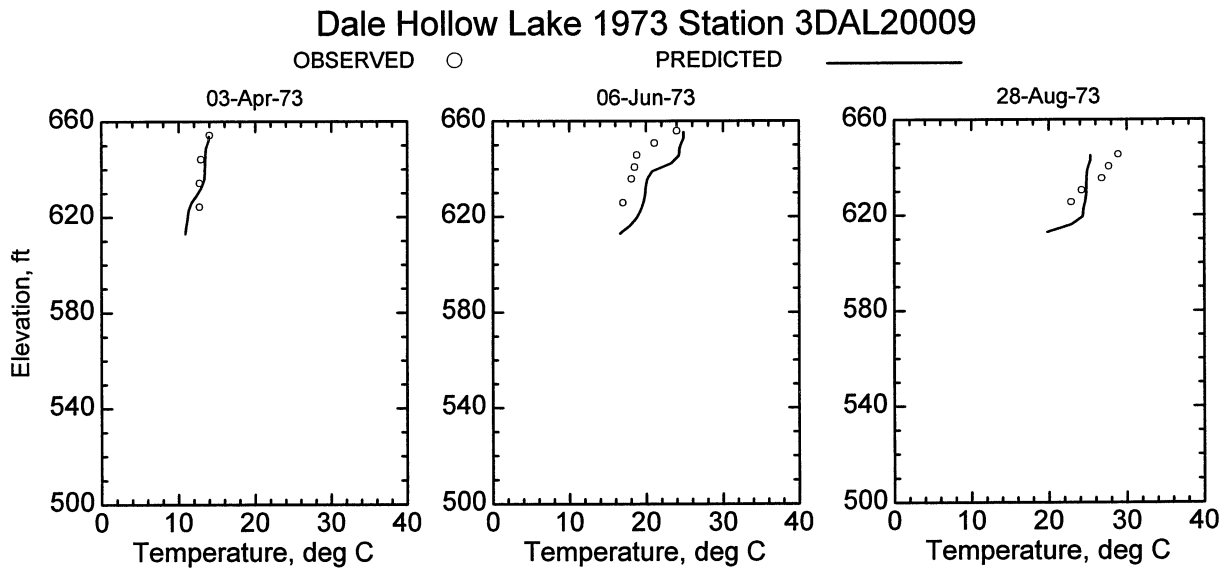

Dale Hollow Lake 1973 Station 3DAL20004
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

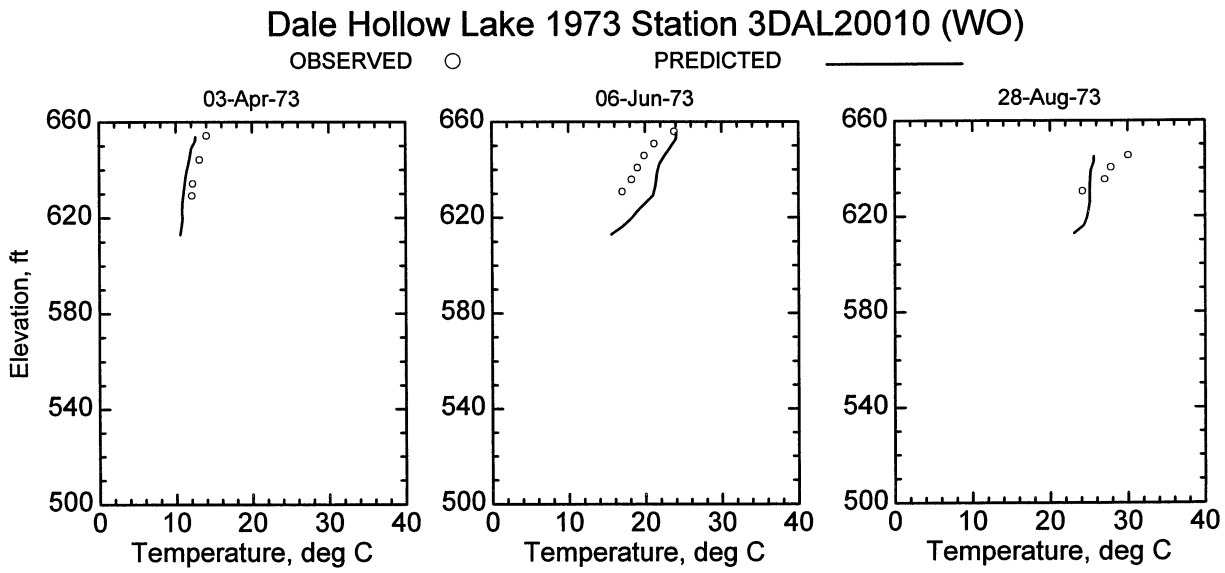

Dale Hollow Lake 1973 Station 3DAL20005
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
26-Jun-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

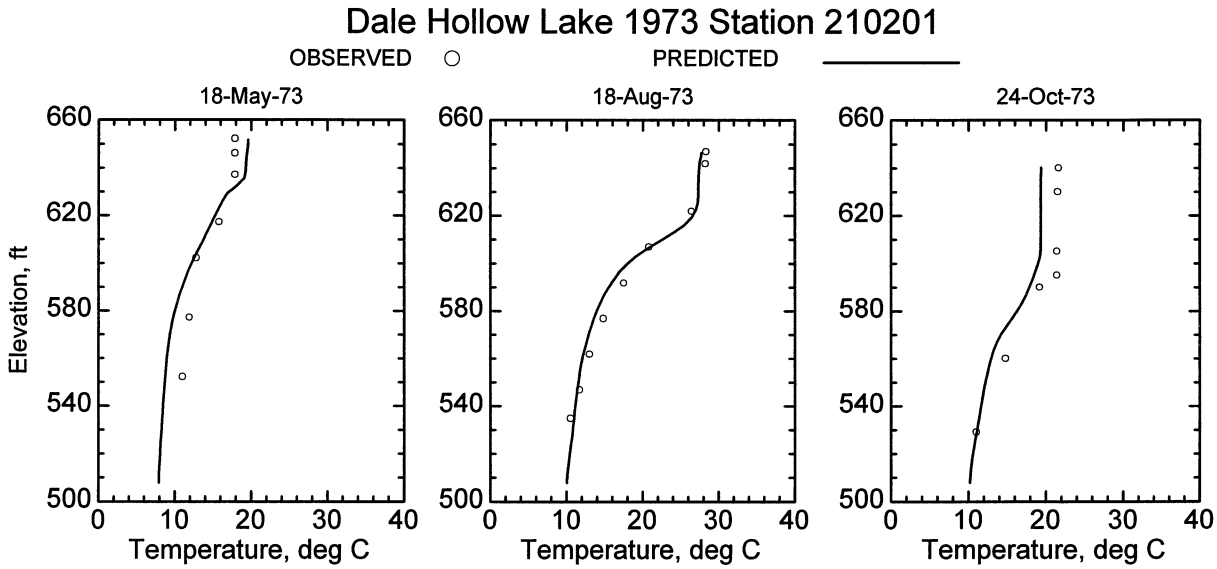

Dale Hollow Lake 1973 Station 3DAL20006
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

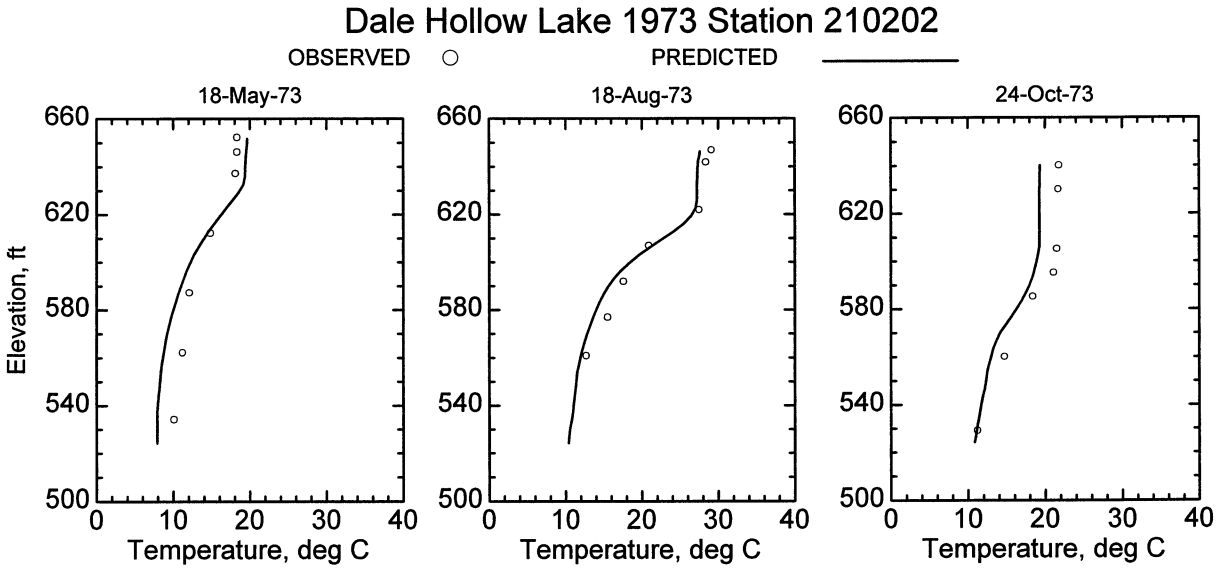

Dale Hollow Lake 1973 Station 3DAL20007
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

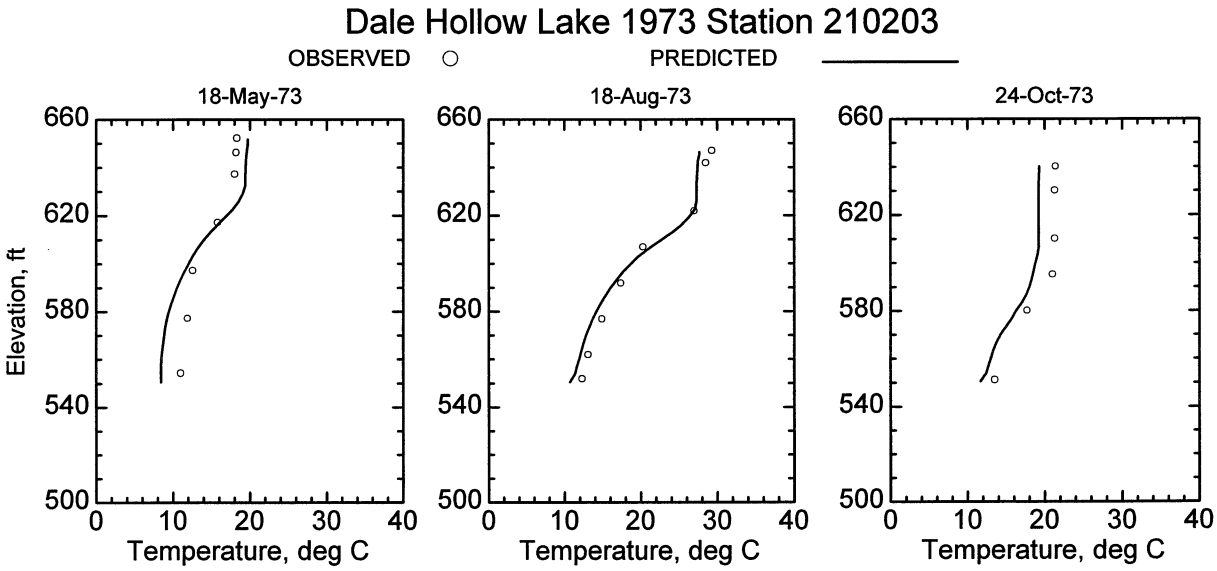

Dale Hollow Lake 1973 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

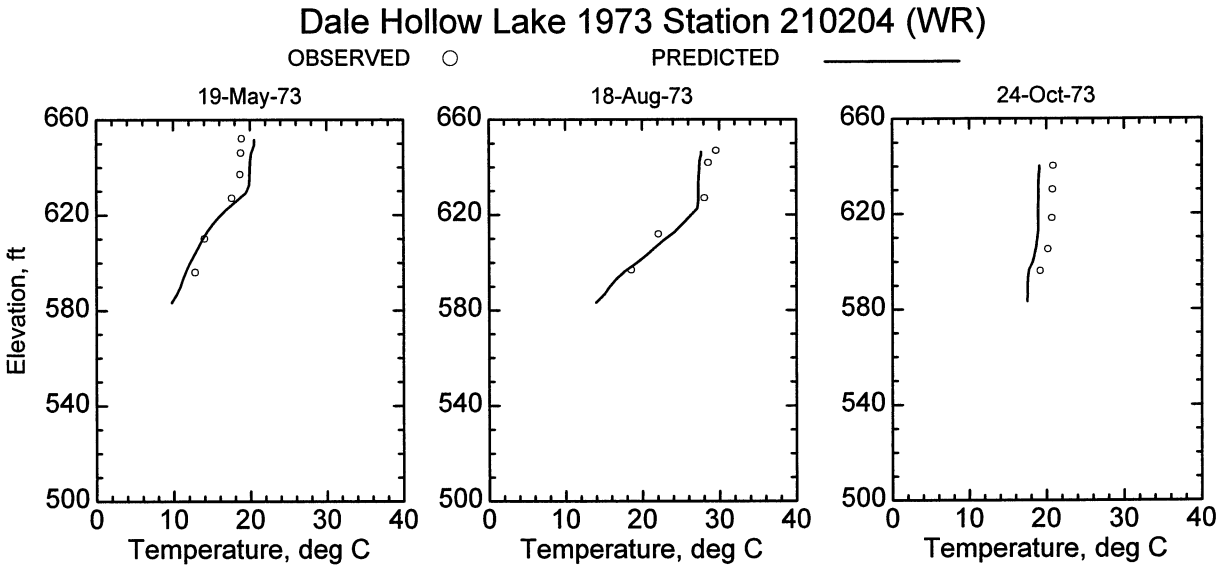

Dale Hollow Lake 1973 Station 3DAL20009
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

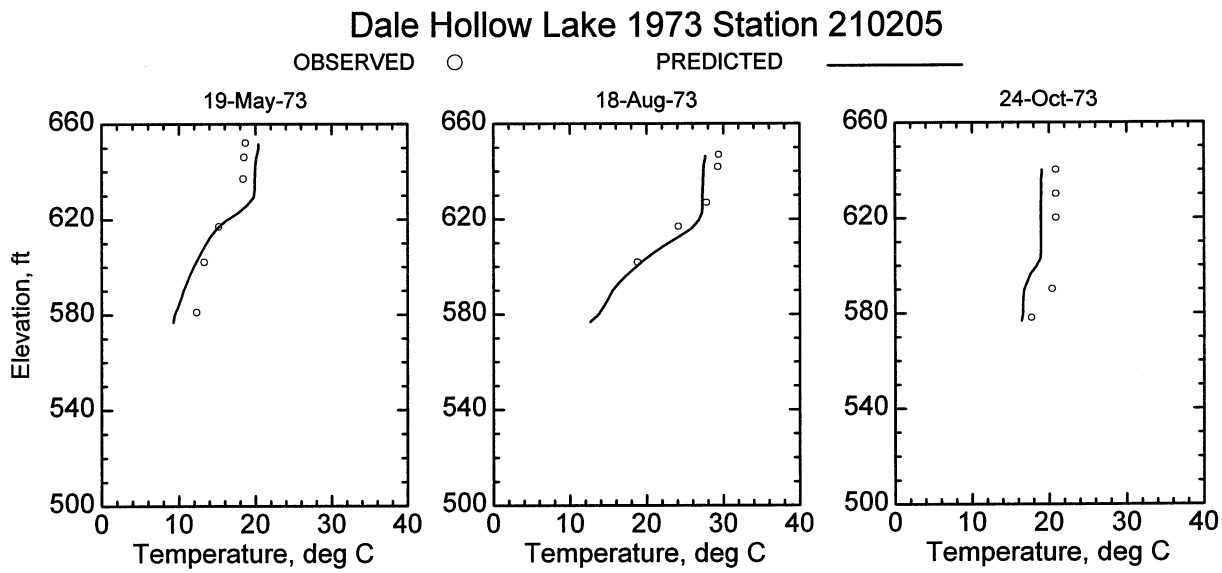

Dale Hollow Lake 1973 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

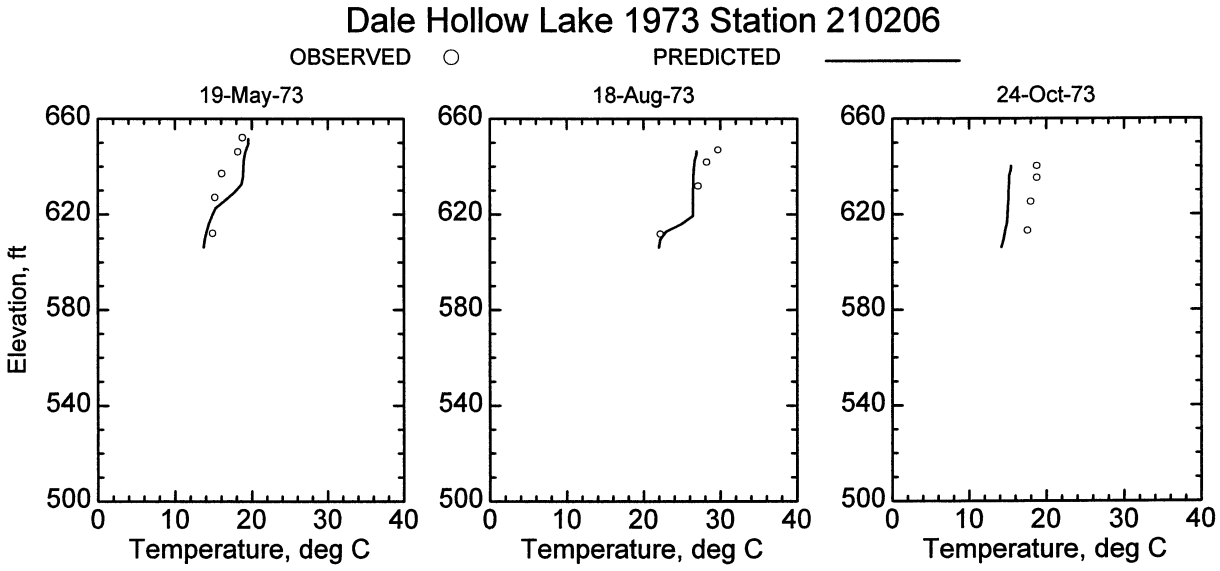

Dale Hollow Lake 1973 Station 210201
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

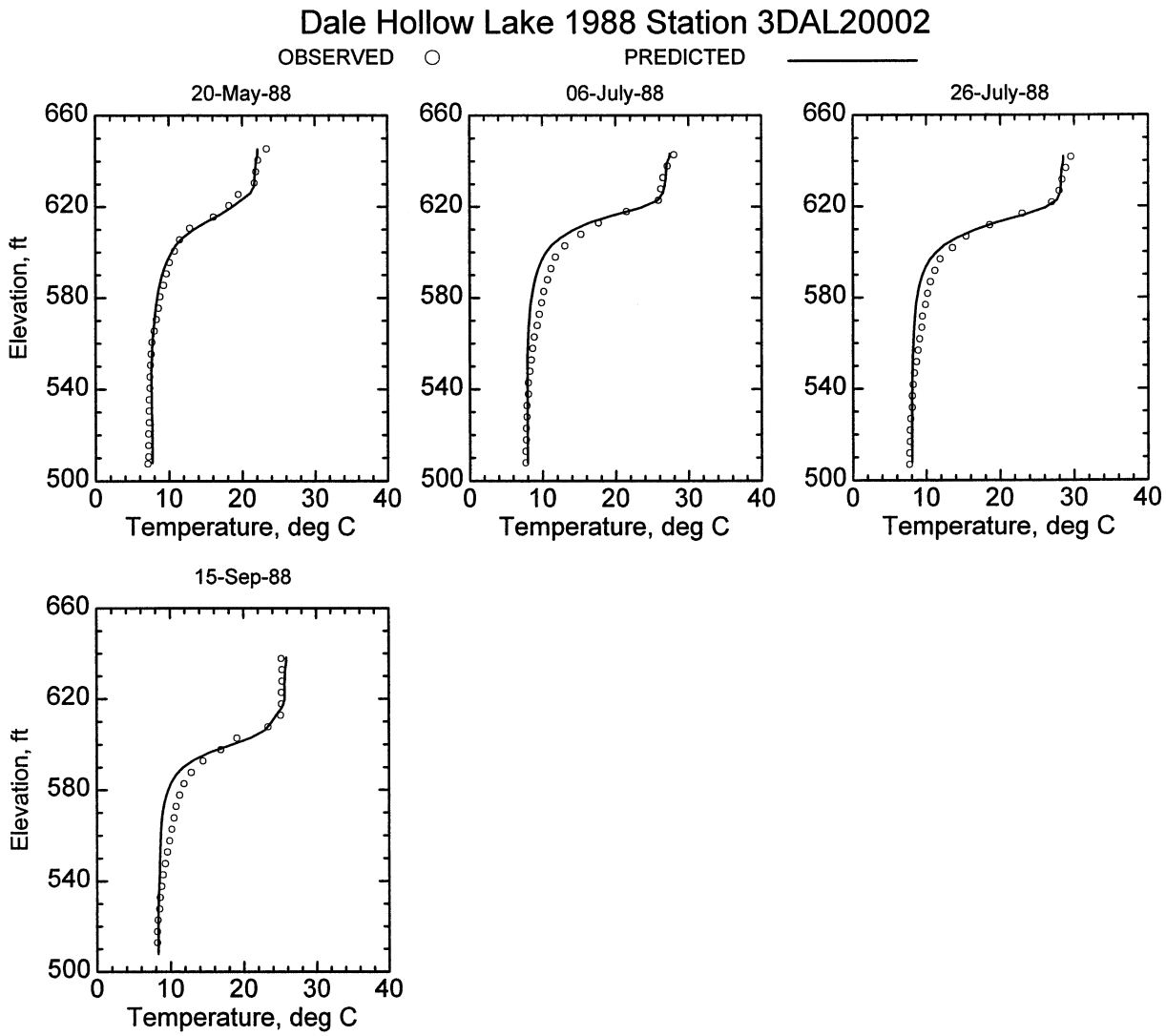

Dale Hollow Lake 1973 Station 210202
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

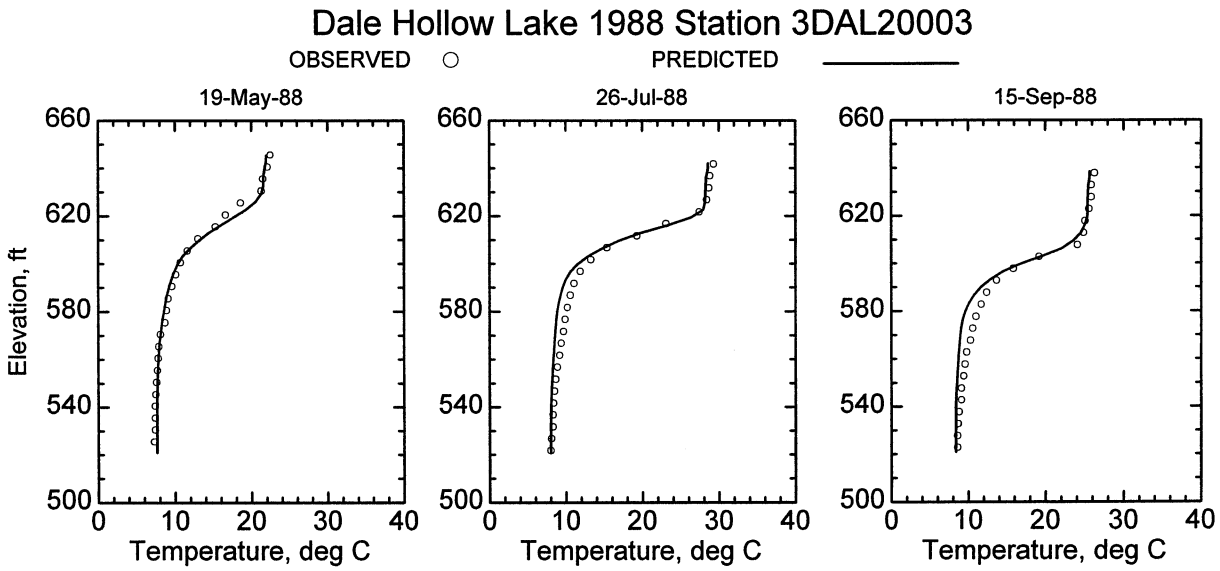

Dale Hollow Lake 1973 Station 210203
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

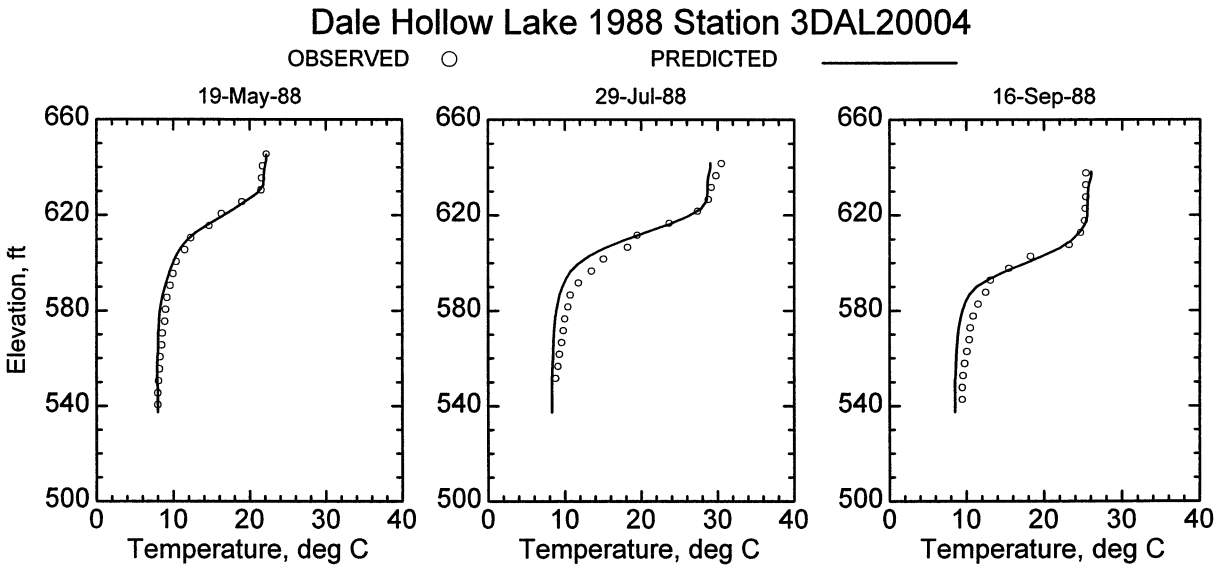

Dale Hollow Lake 1973 Station 210204 (WR)
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

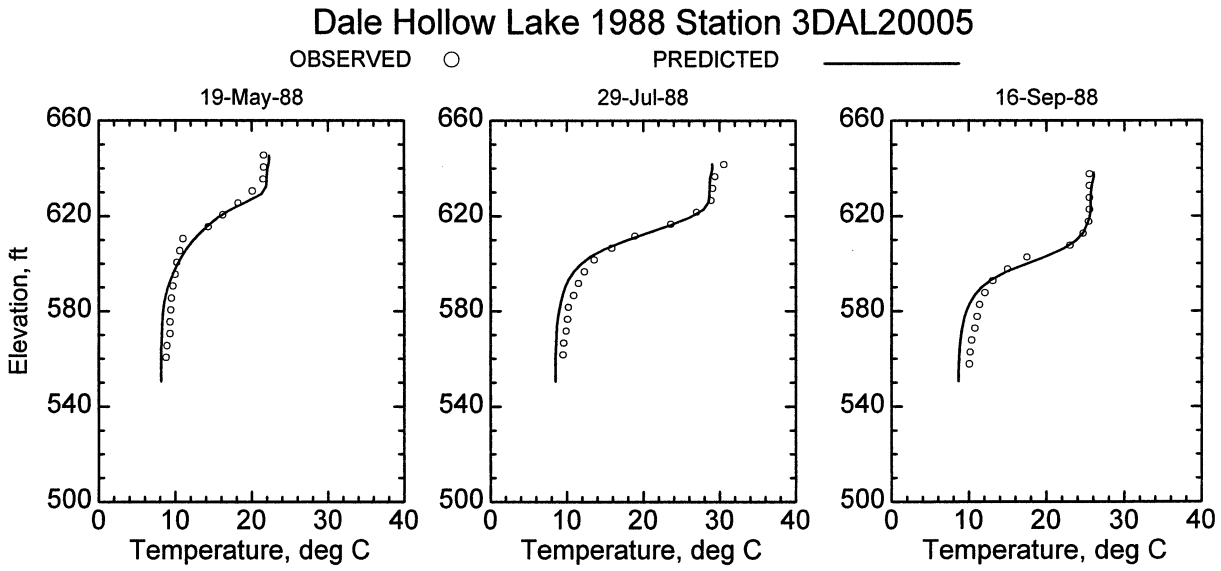

Dale Hollow Lake 1973 Station 210205
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

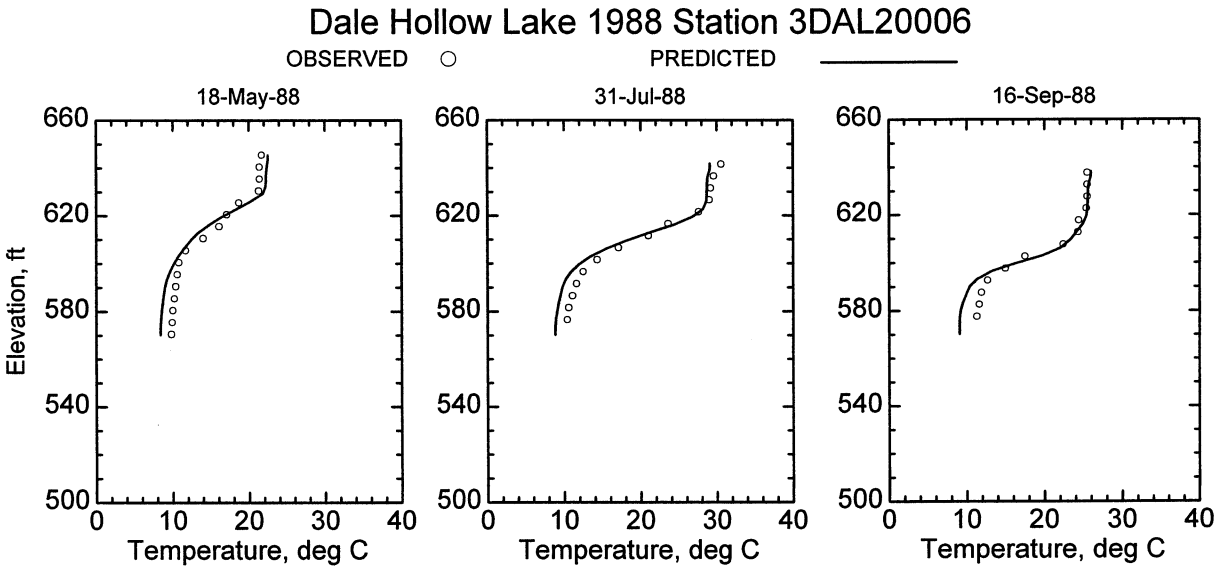

Dale Hollow Lake 1973 Station 210206
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

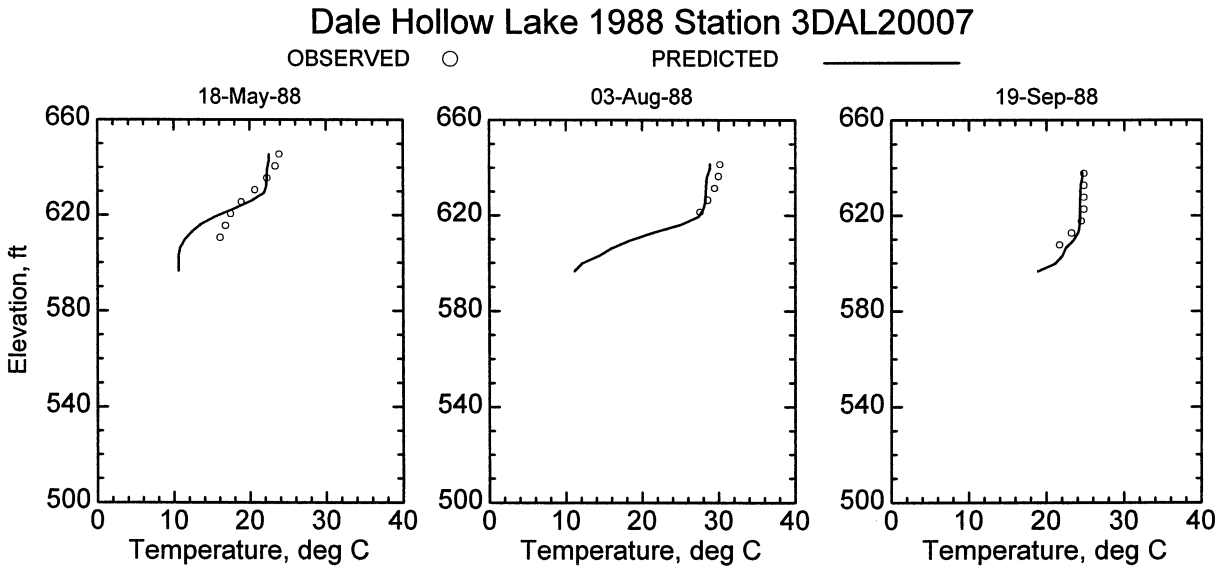

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
Temperature, deg C
660
620
580
540
500
0
10
20
30
40

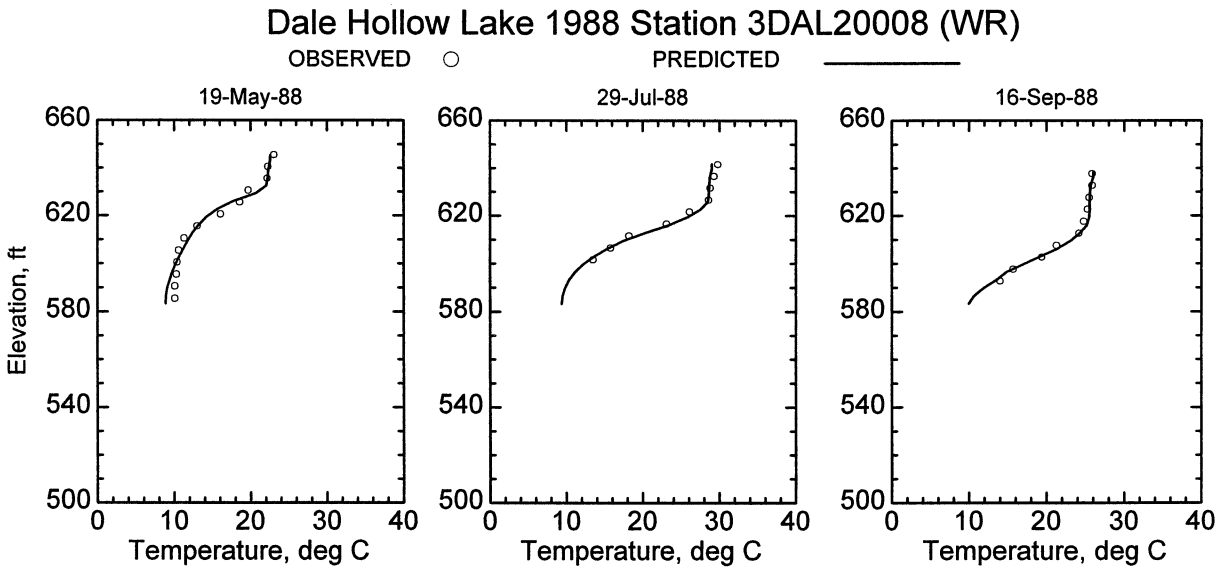

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

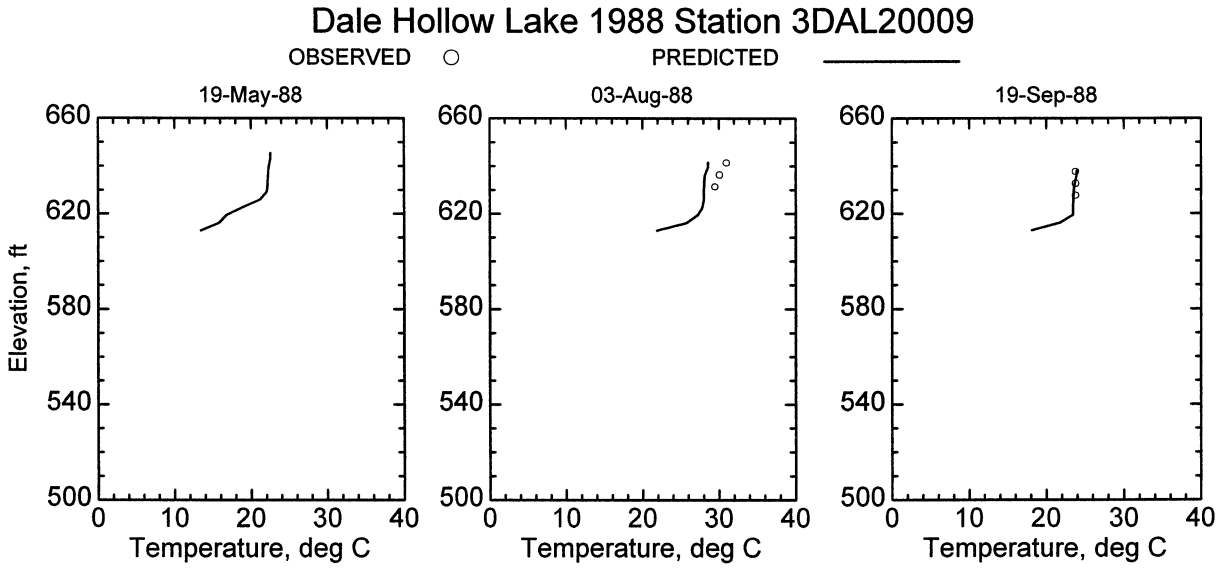

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

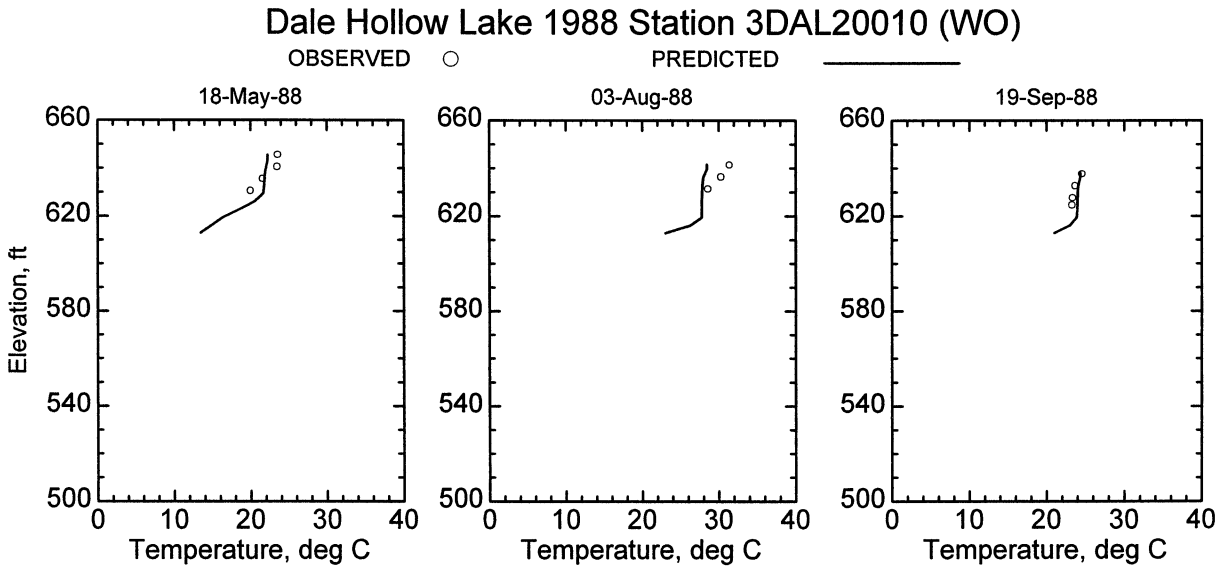

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

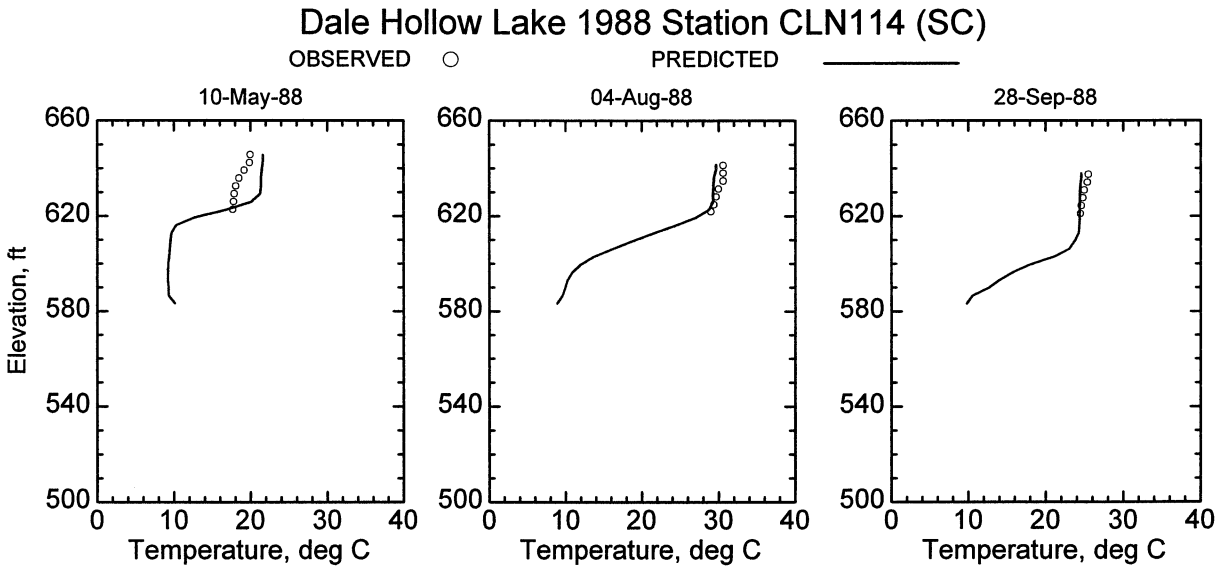

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

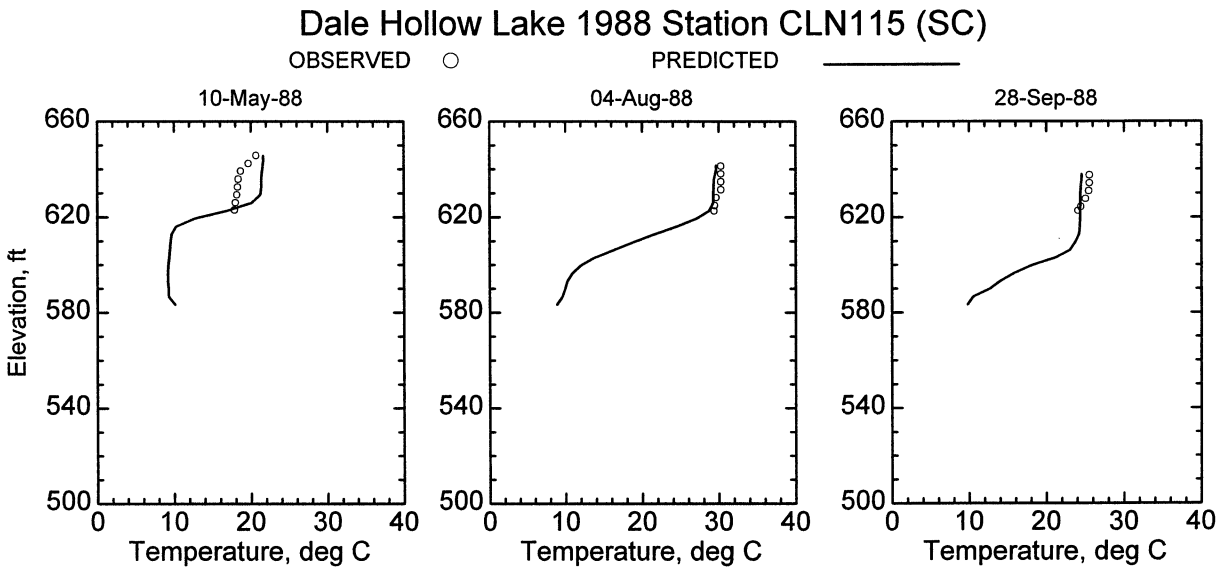

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

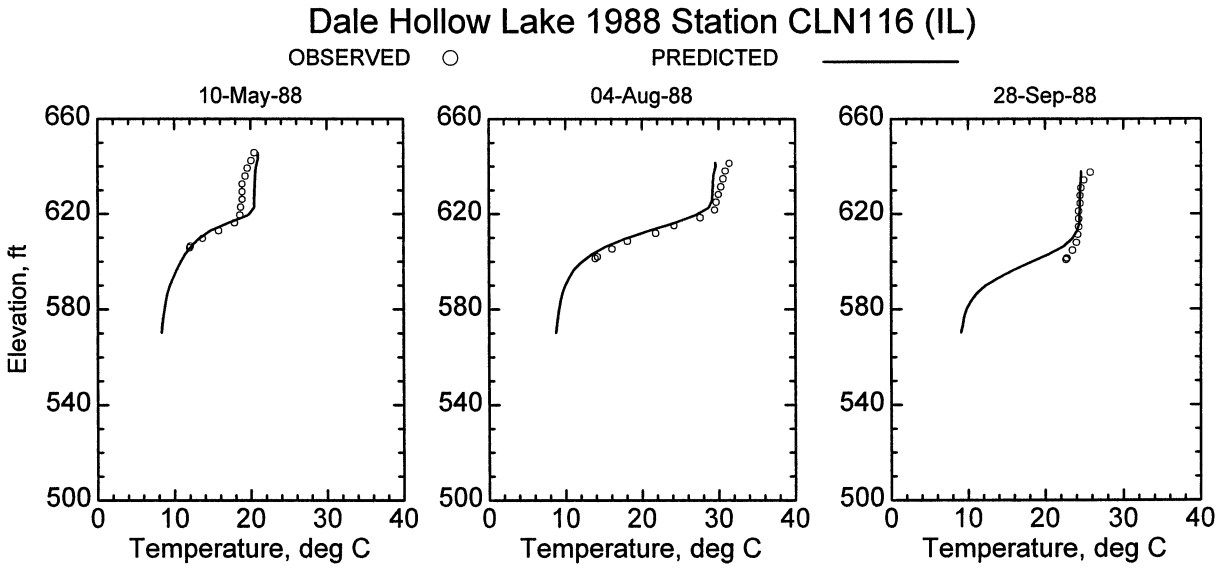

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

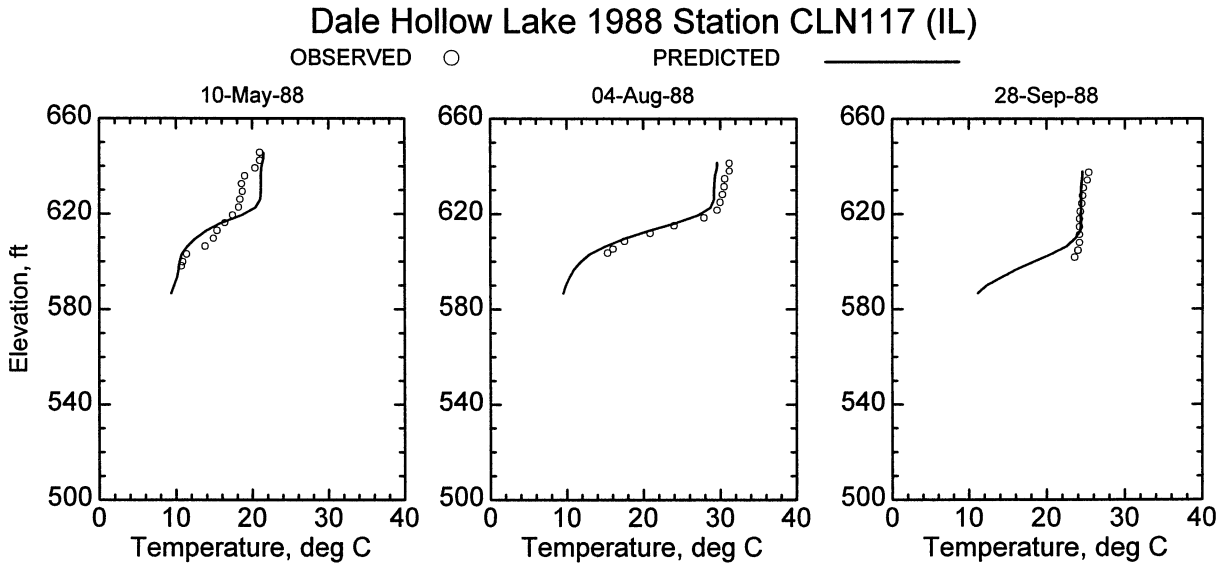

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
19-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

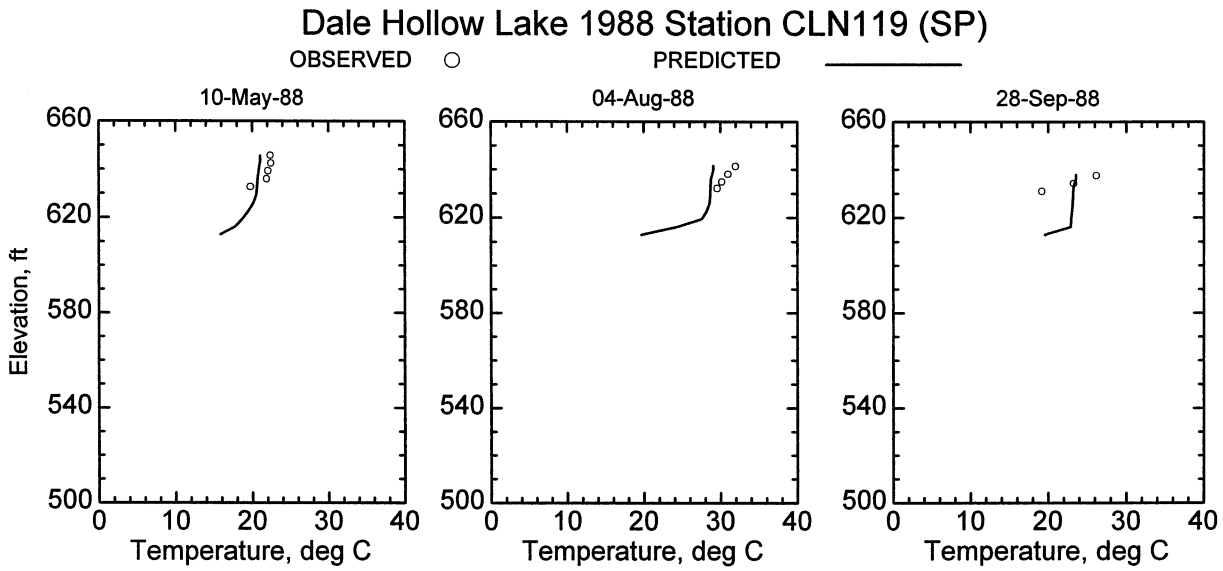

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

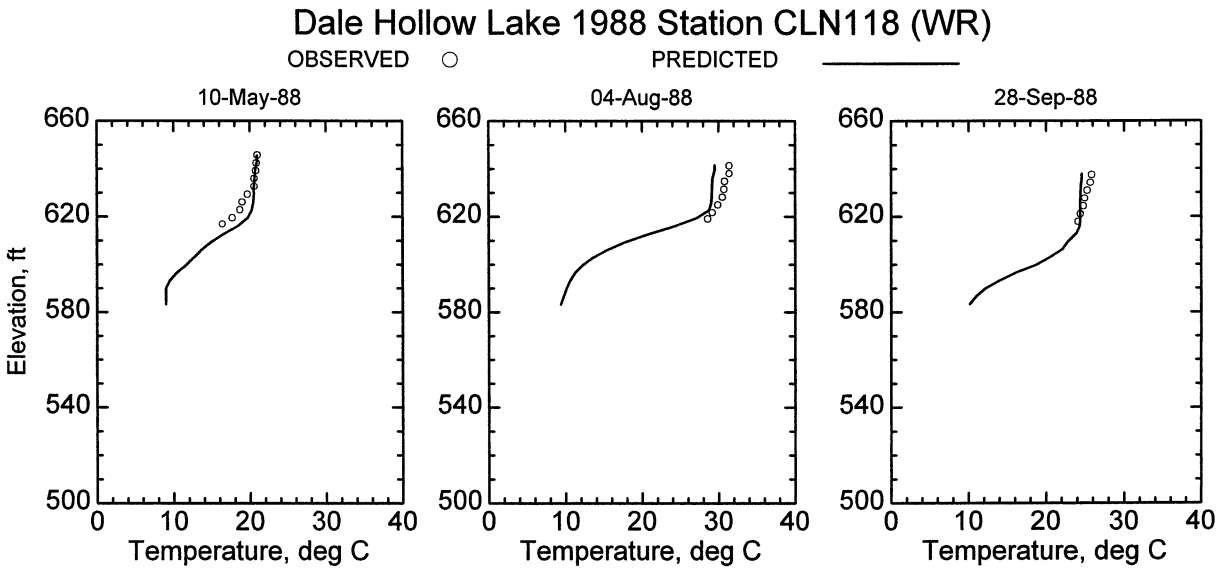

Dale Hollow Lake 1988 Station CLN114 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

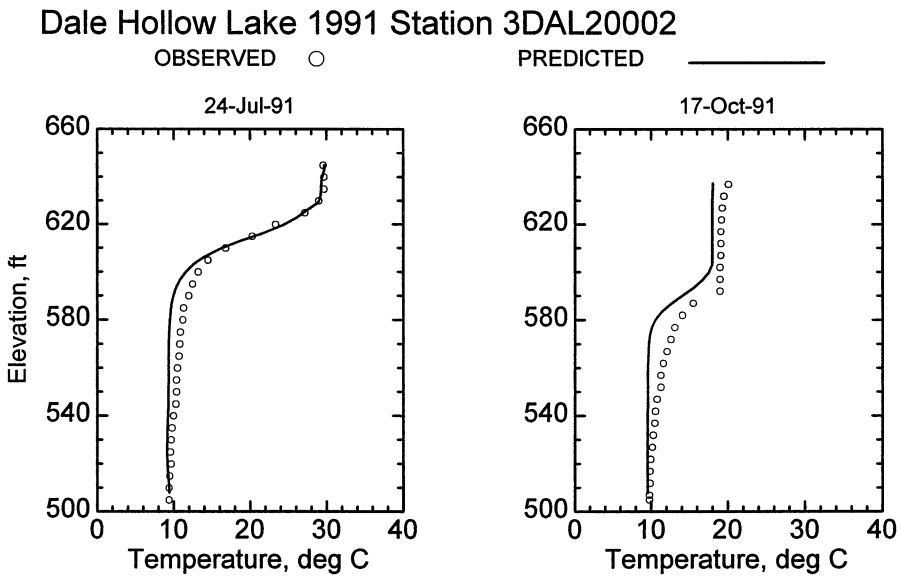

Dale Hollow Lake 1988 Station CLN115 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

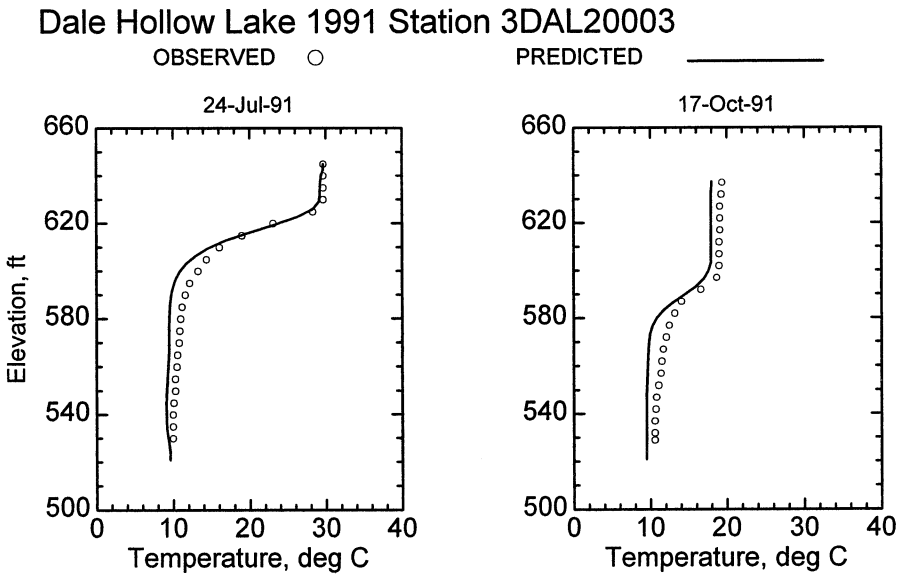

Dale Hollow Lake 1988 Station CLN116 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

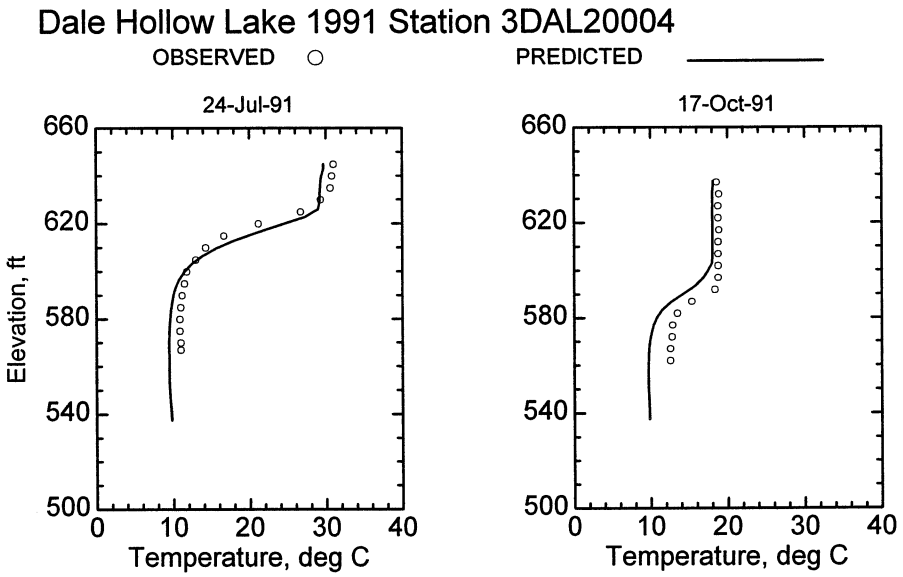

Dale Hollow Lake 1988 Station CLN117 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

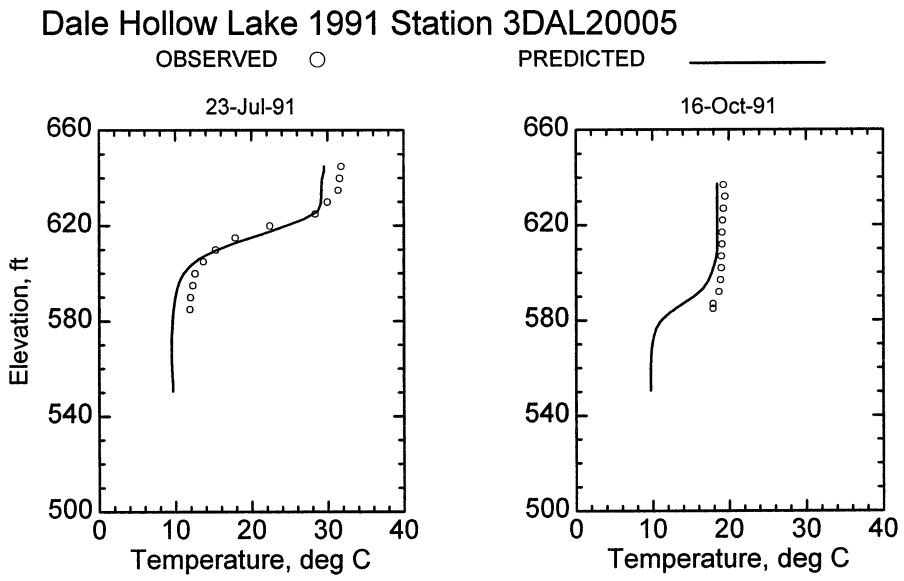

Dale Hollow Lake 1988 Station CLN119 (SP)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

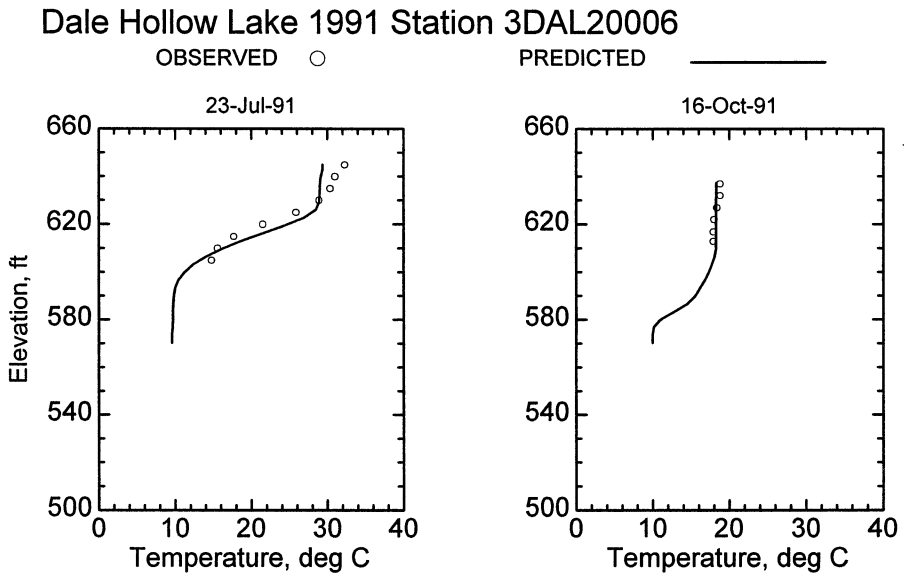

Dale Hollow Lake 1988 Station CLN118 (WR)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

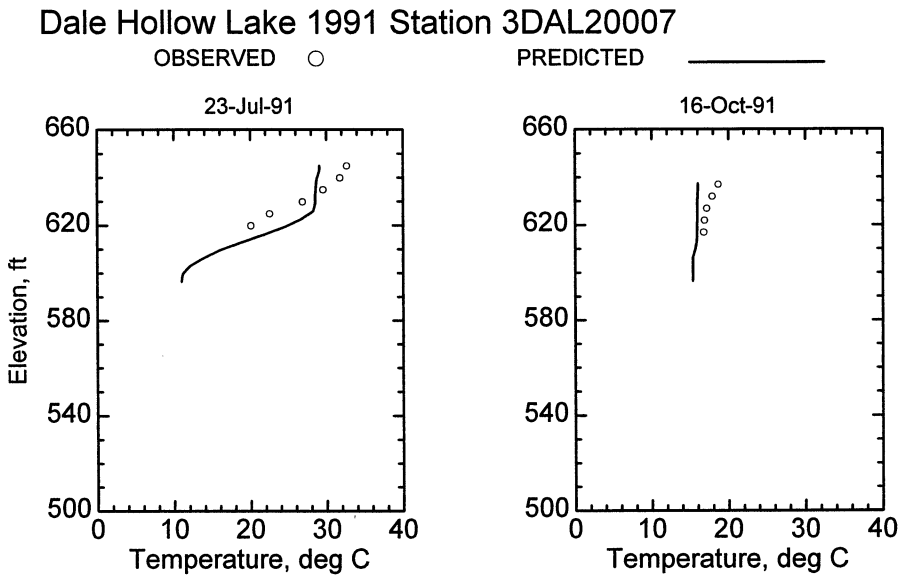

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

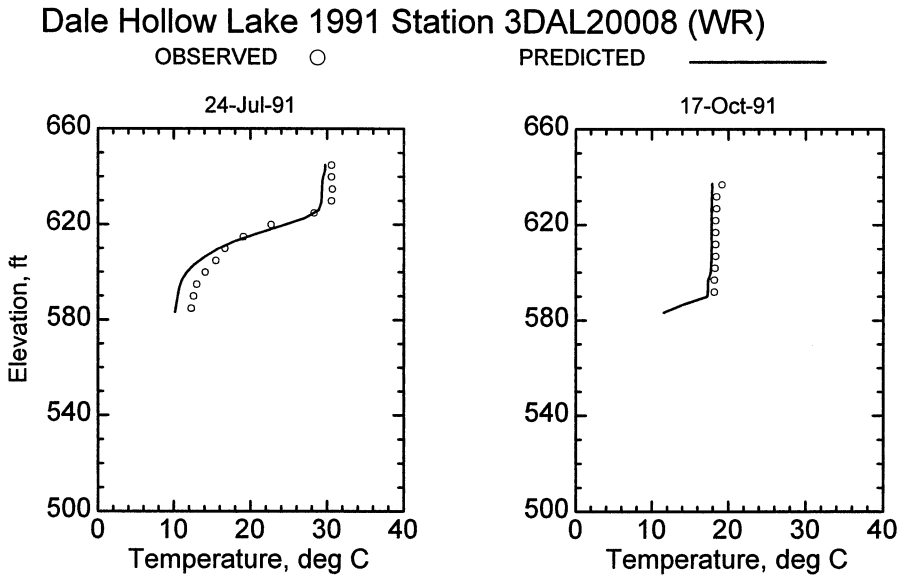

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

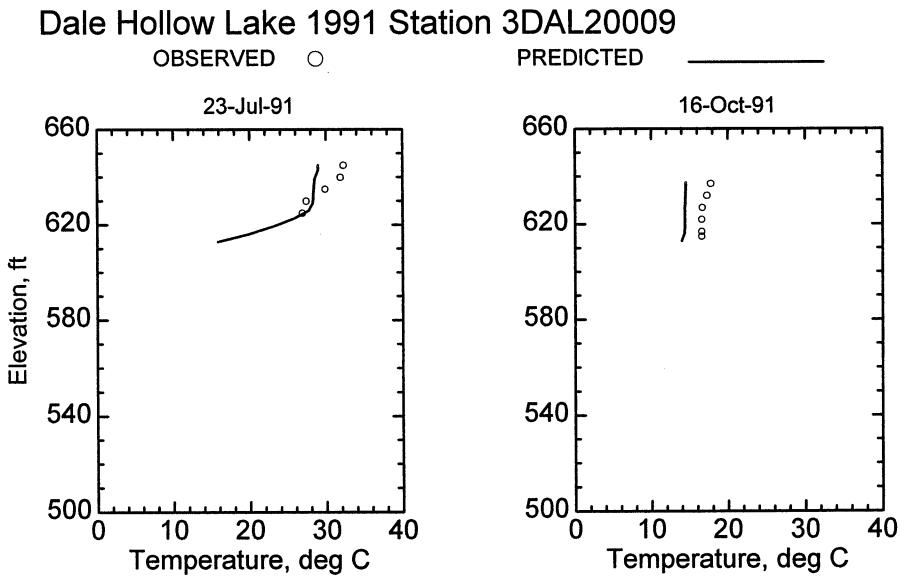

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

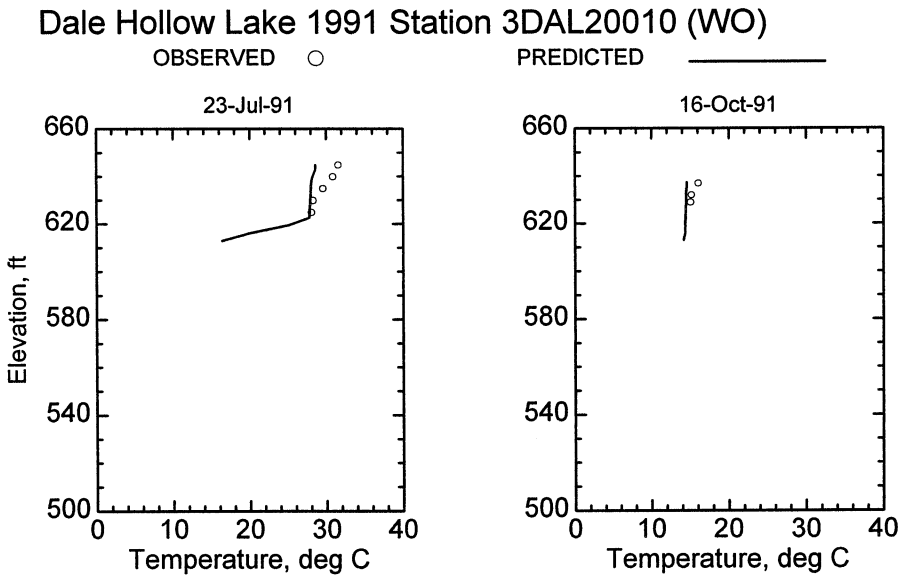

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C


Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C


Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C


Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

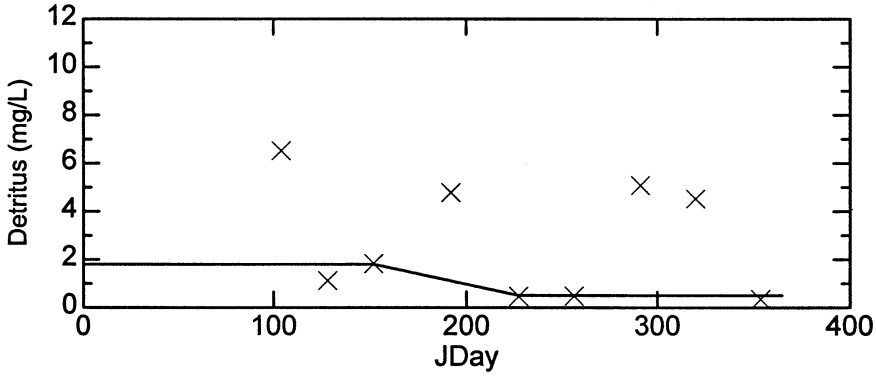

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C


Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
10
20
30
40
Temperature, deg C

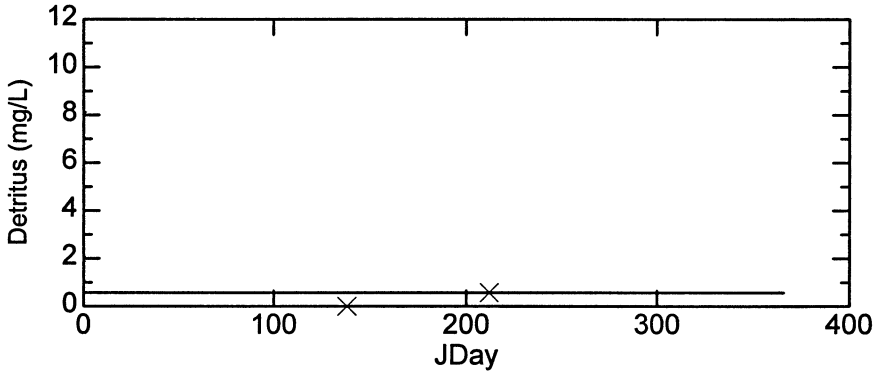
APPENDIX J

Plots of Estimated Input Water Quality for CE-QUAL-W2

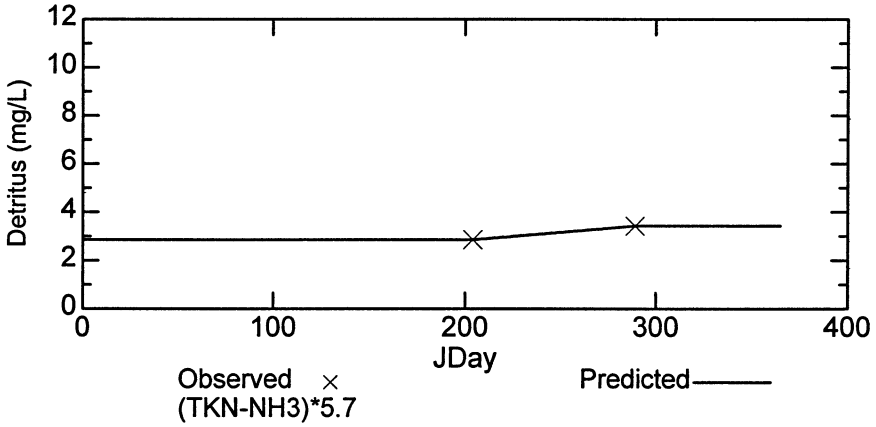
East Fork Obey River 1973



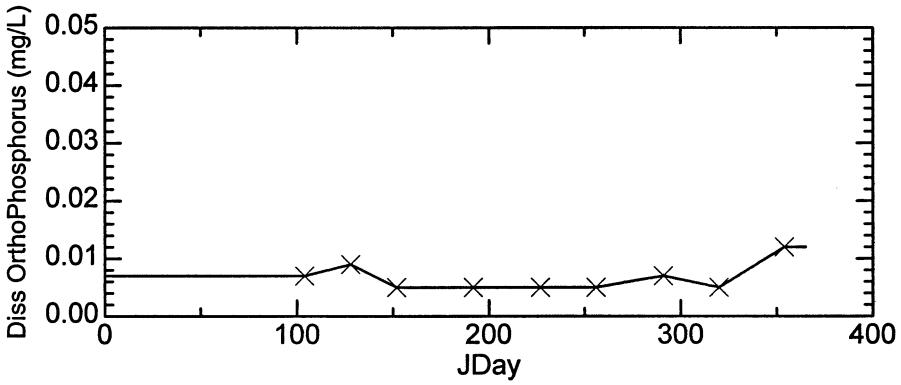
East Fork Obey River 1988



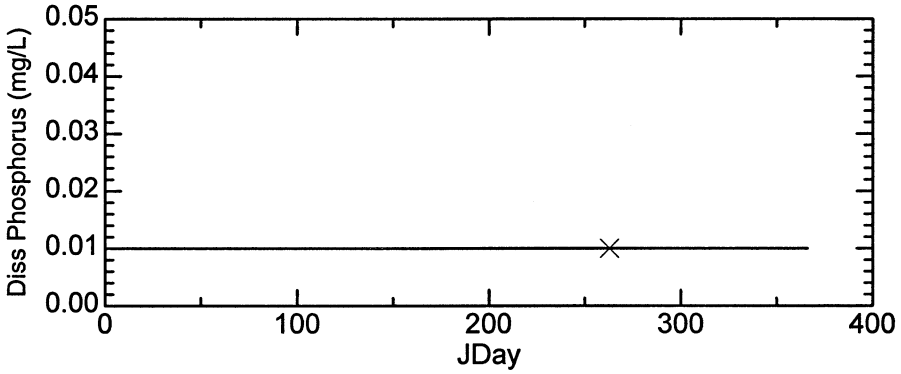
East Fork Obey River 1991



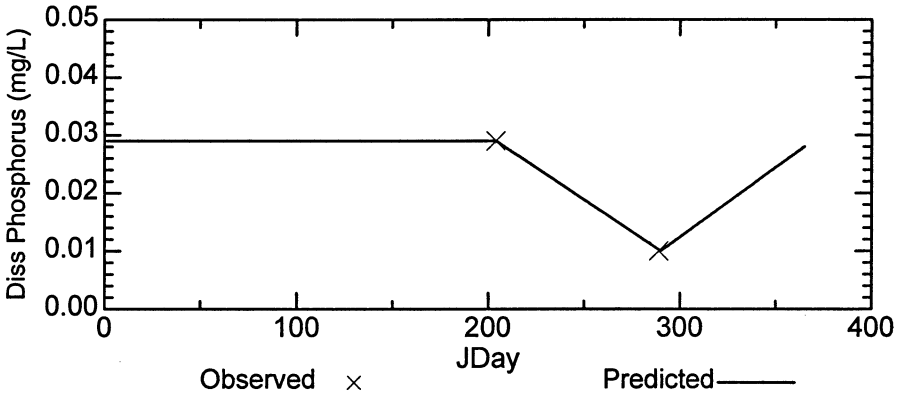
East Fork Obey River 1973



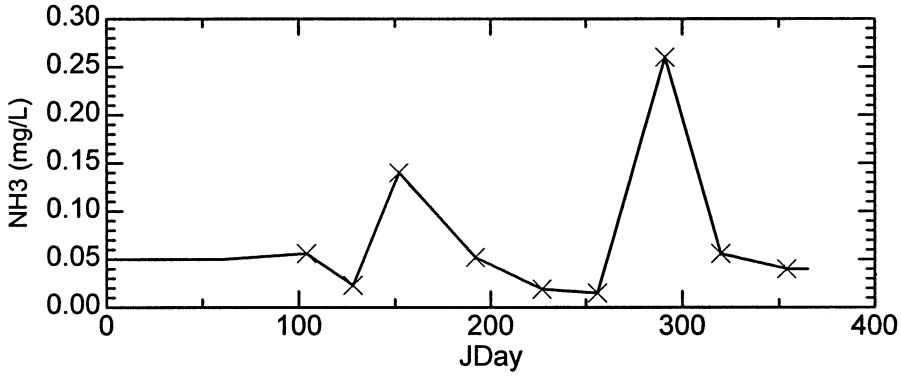
East Fork Obey River 1988



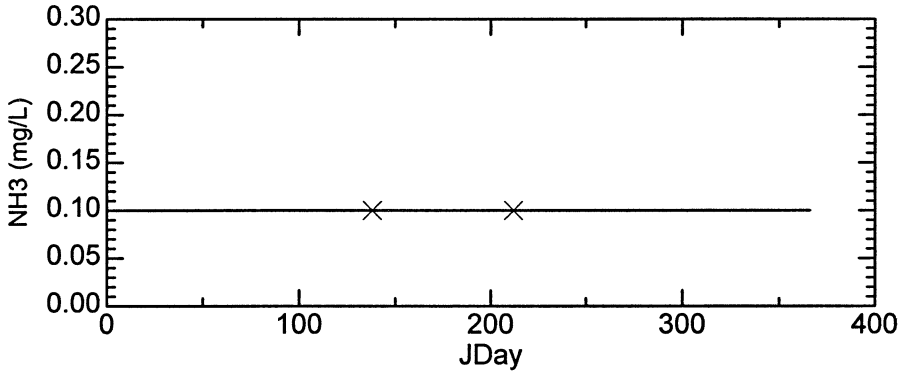
East Fork Obey River 1991



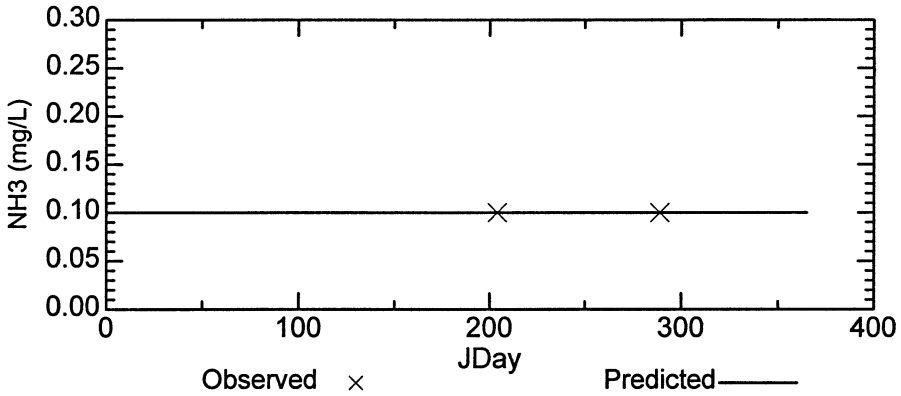
East Fork Obey River 1973



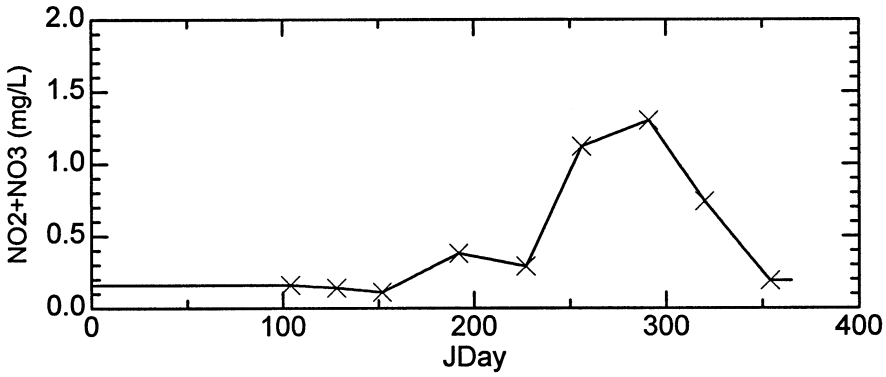
East Fork Obey River 1988



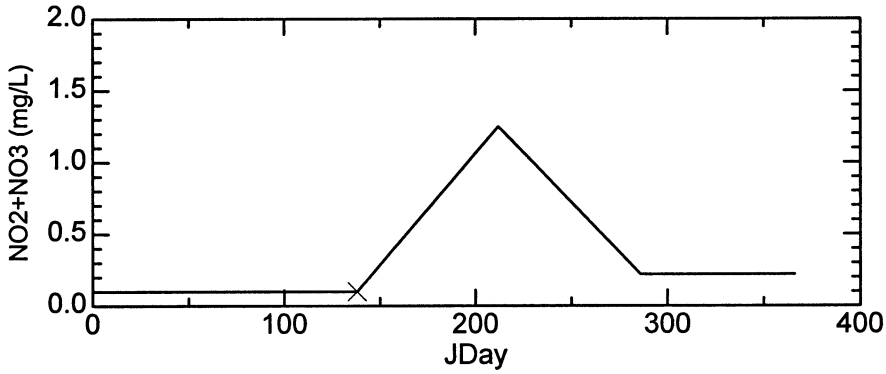
East Fork Obey River 1991



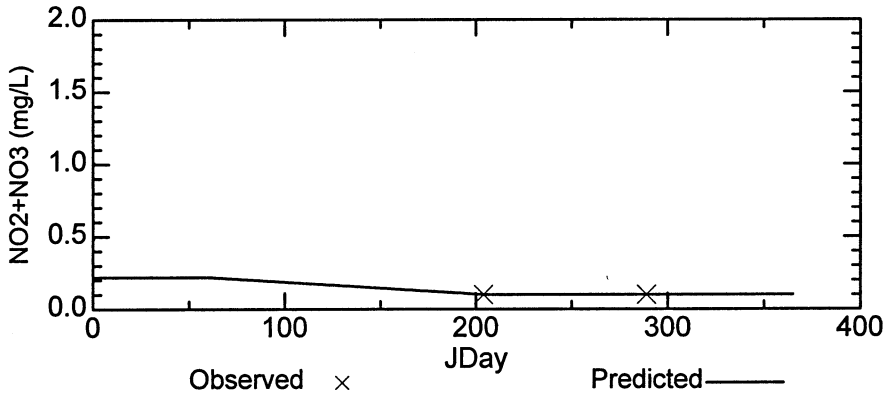
East Fork Obey River 1973



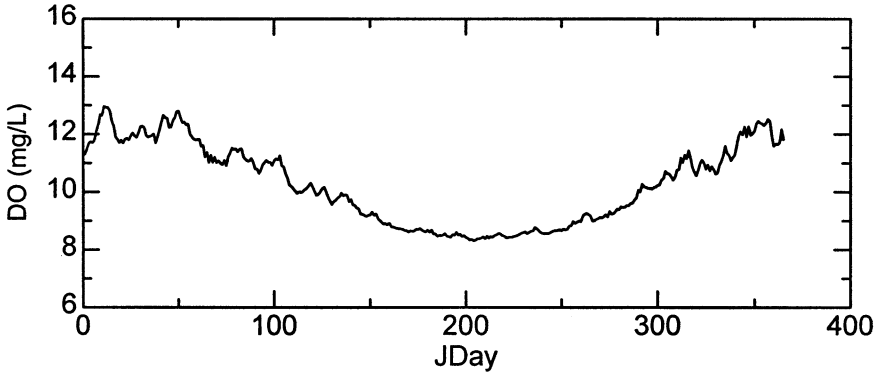
East Fork Obey River 1988



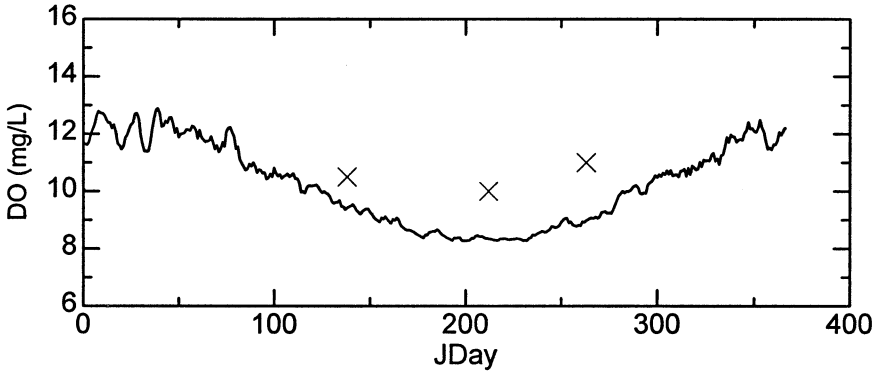
East Fork Obey River 1991



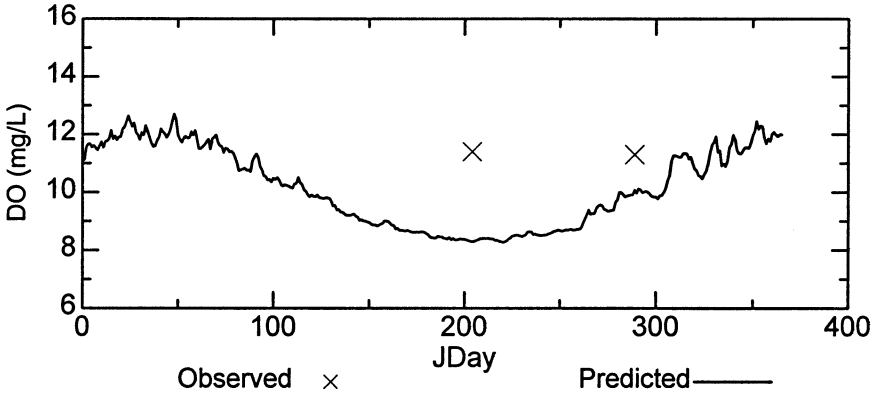
East Fork Obey River 1973



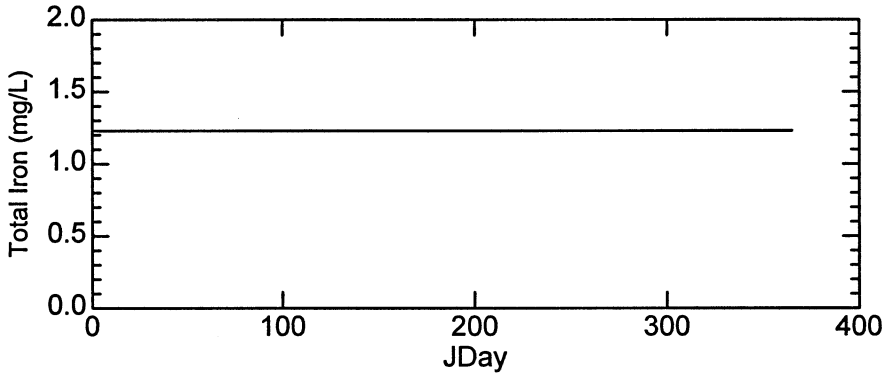
East Fork Obey River 1988



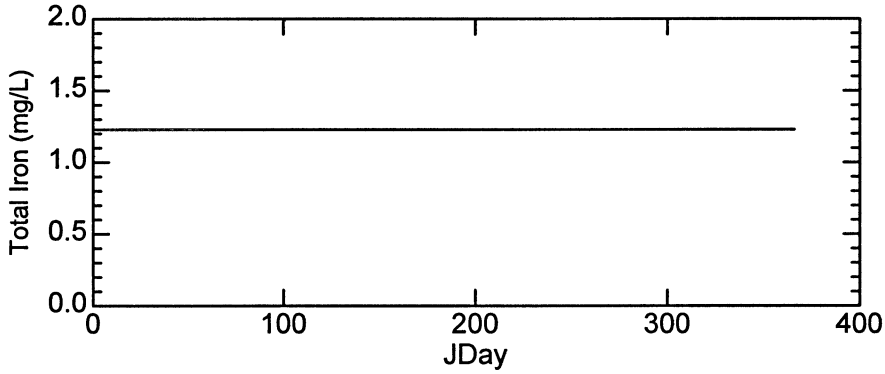
East Fork Obey River 1991



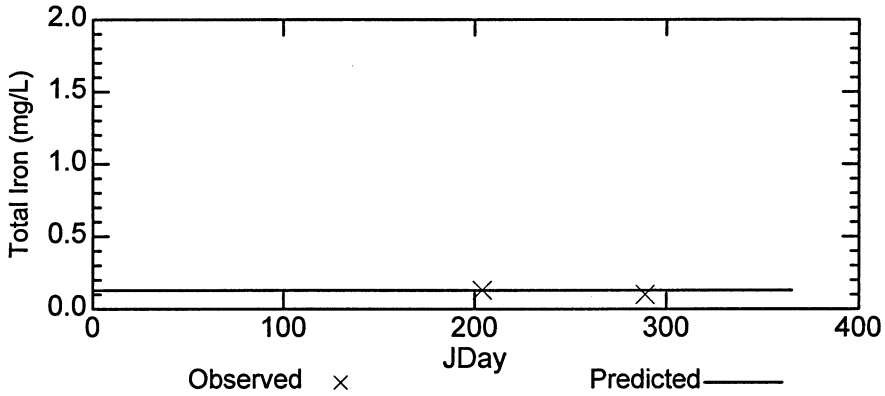
East Fork Obey River 1973



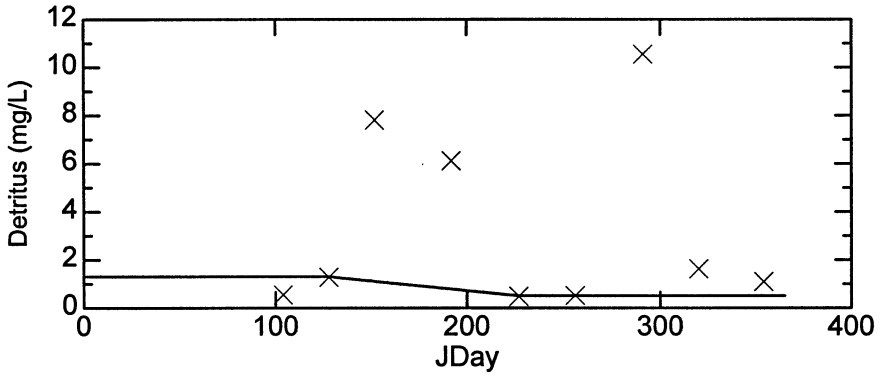
East Fork Obey River 1988



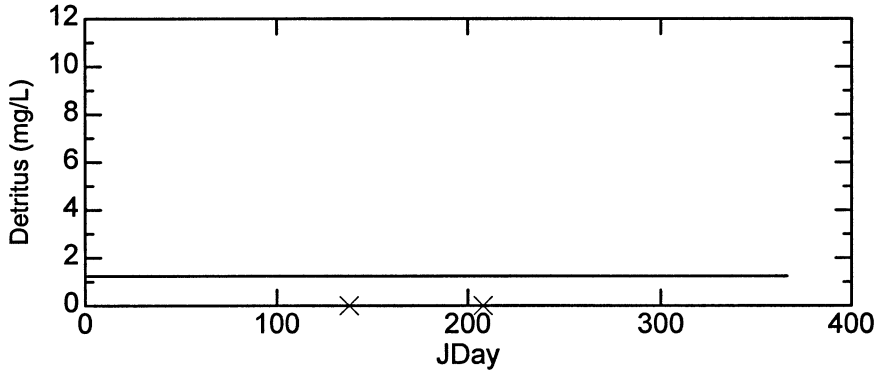
East Fork Obey River 1991



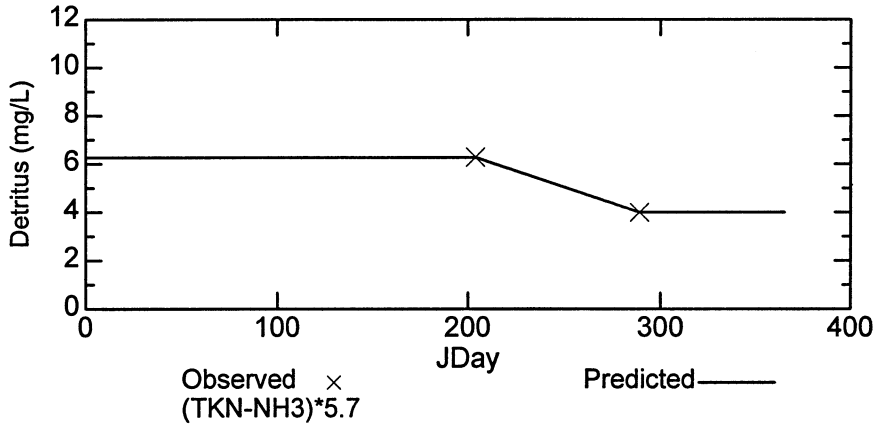
West Fork Obey River 1973



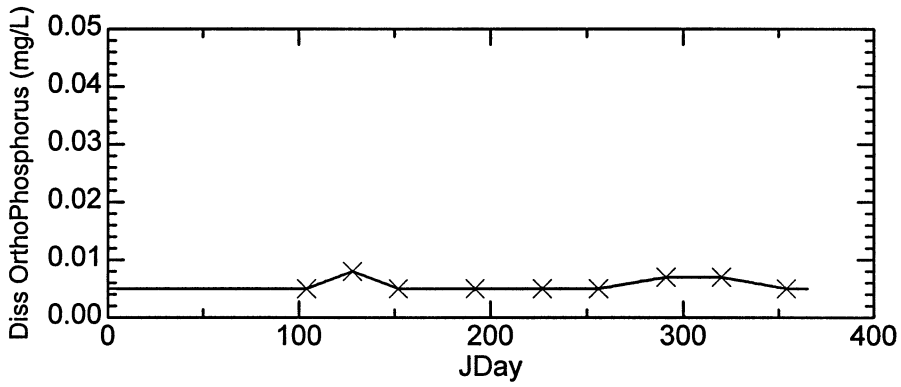
West Fork Obey River 1988



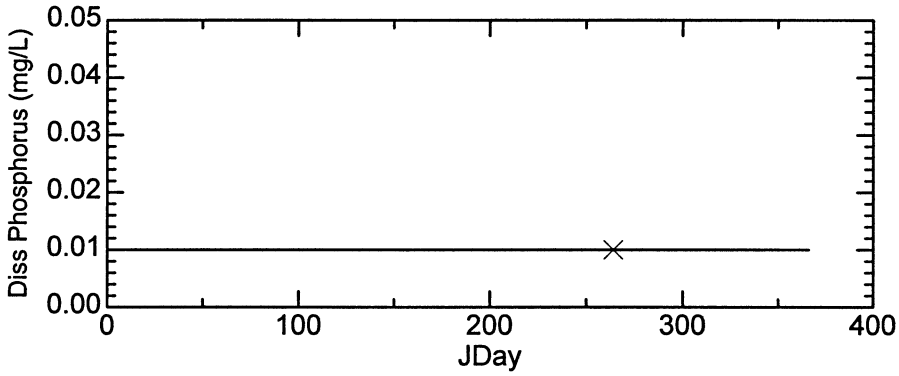
West Fork Obey River 1991



West Fork Obey River 1973



West Fork Obey River 1988



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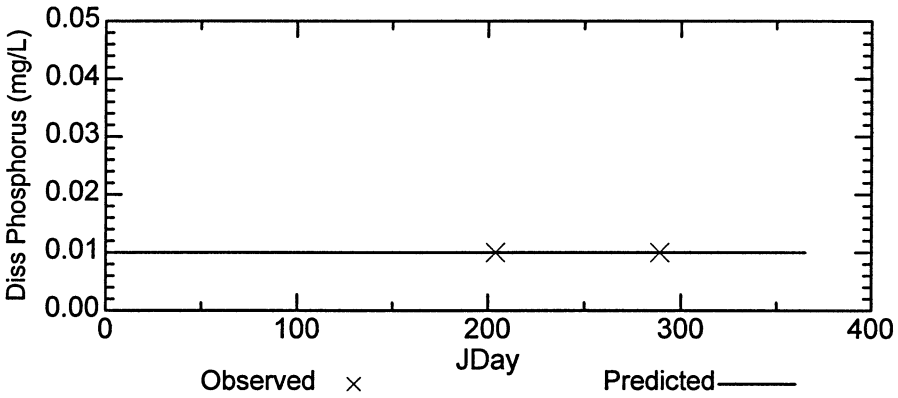
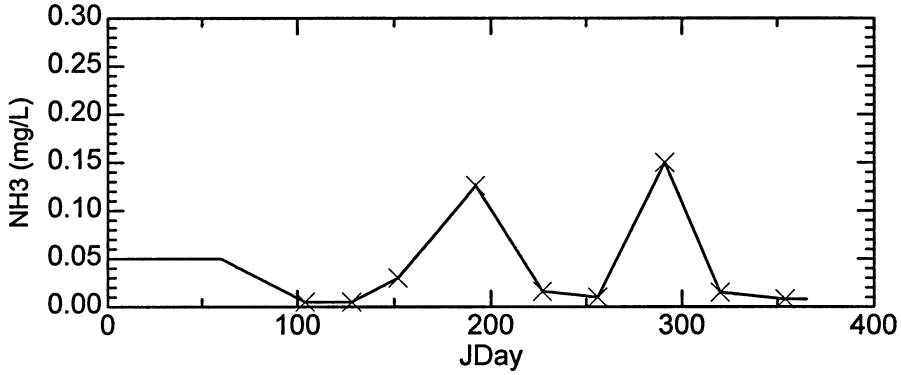
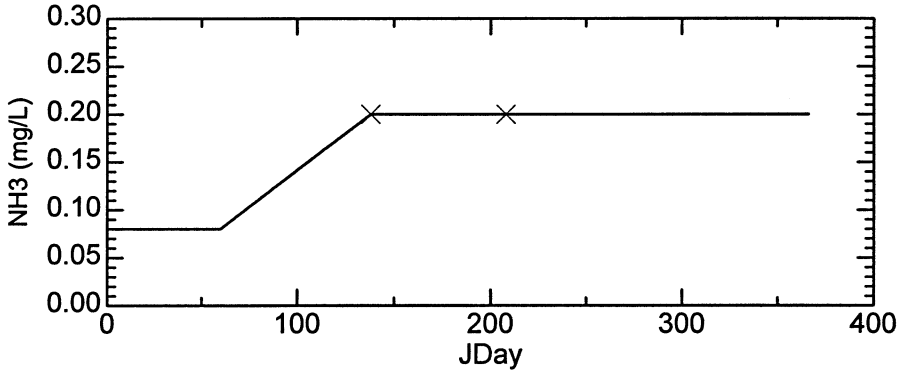


West Fork Obey River 1973



West Fork Obey River 1988



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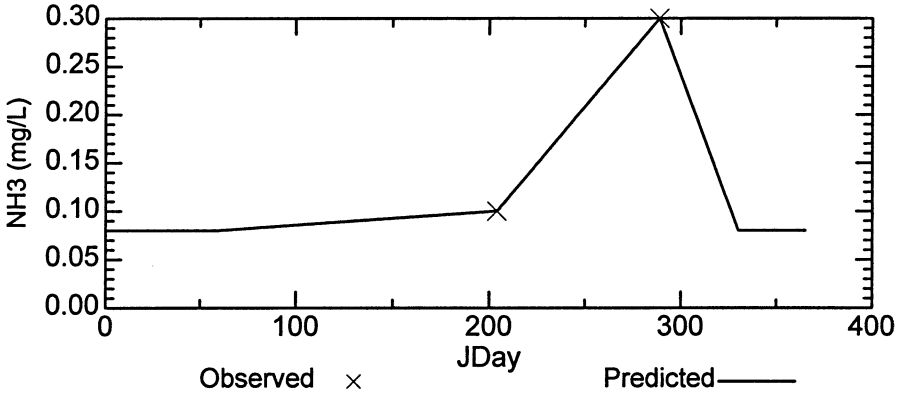

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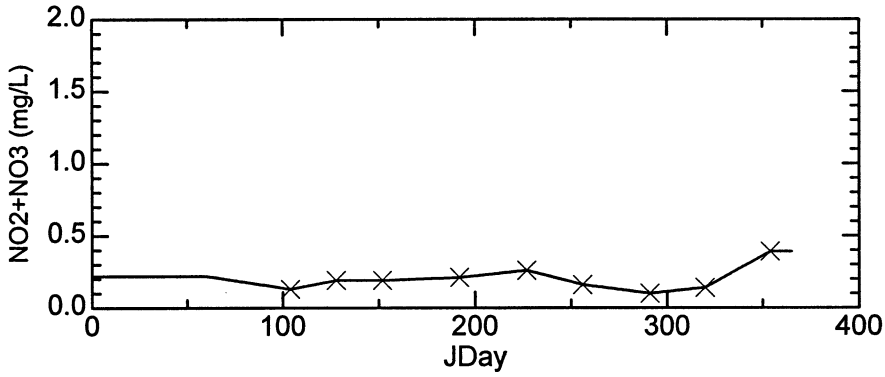

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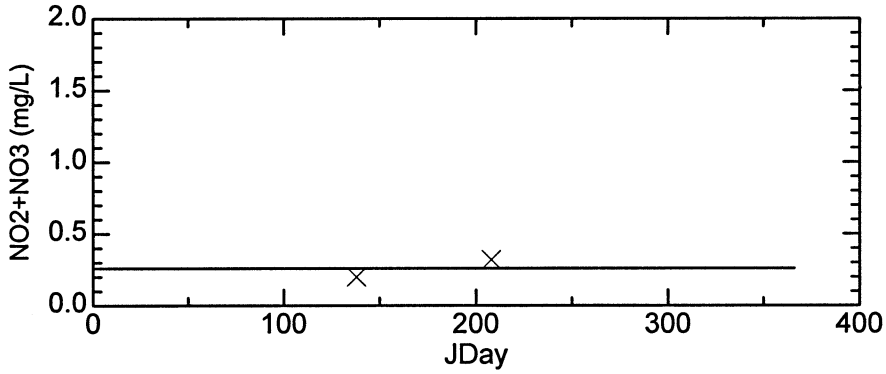

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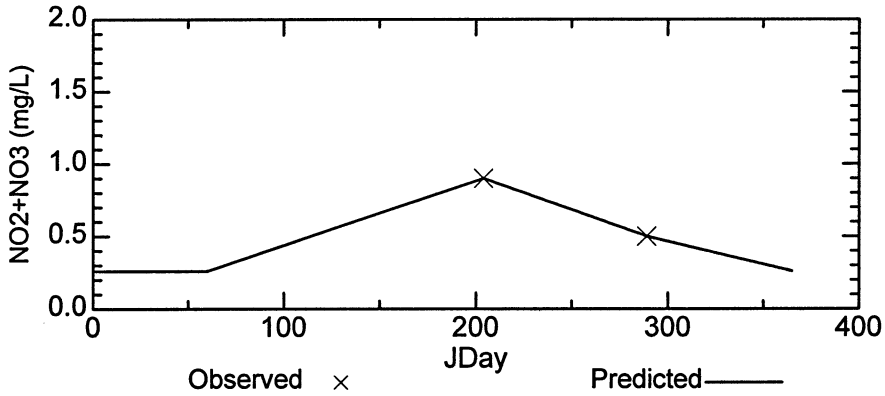
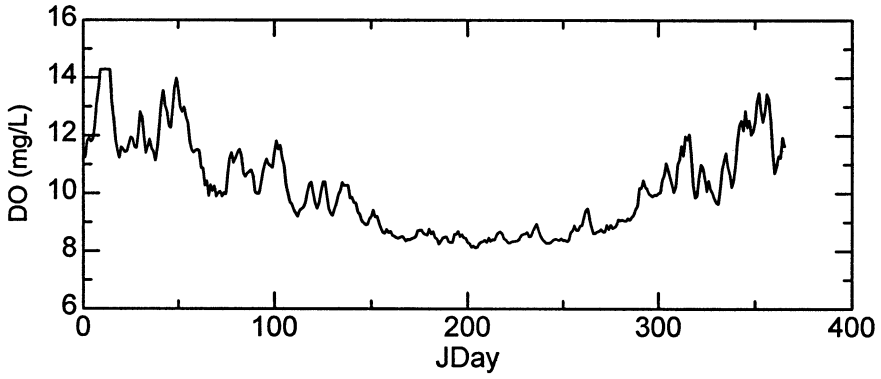
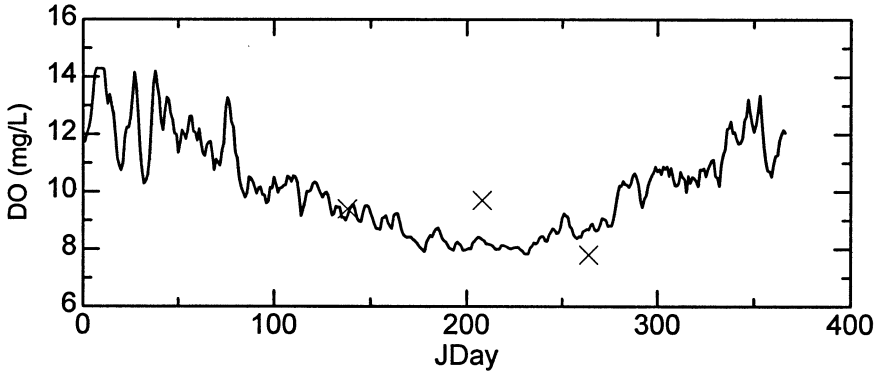


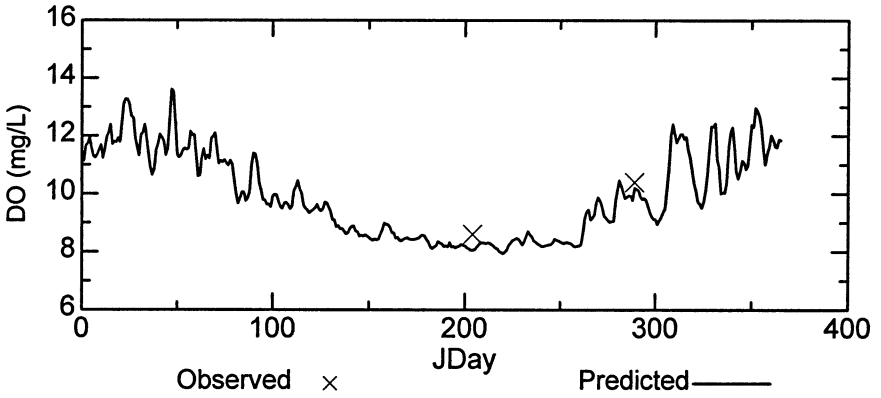
West Fork Obey River 1973



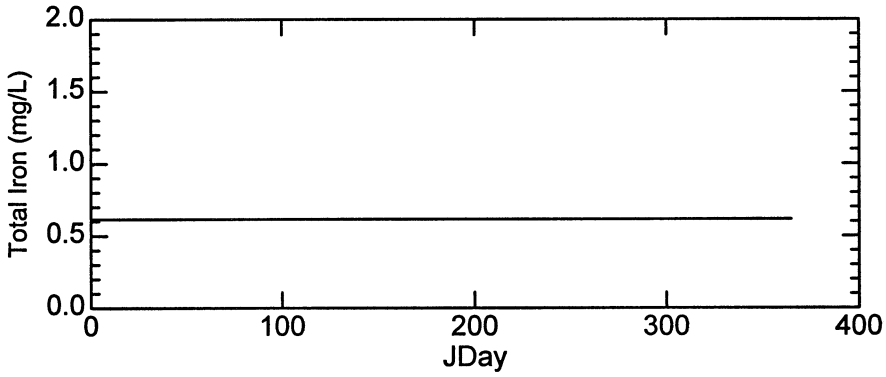
West Fork Obey River 1988



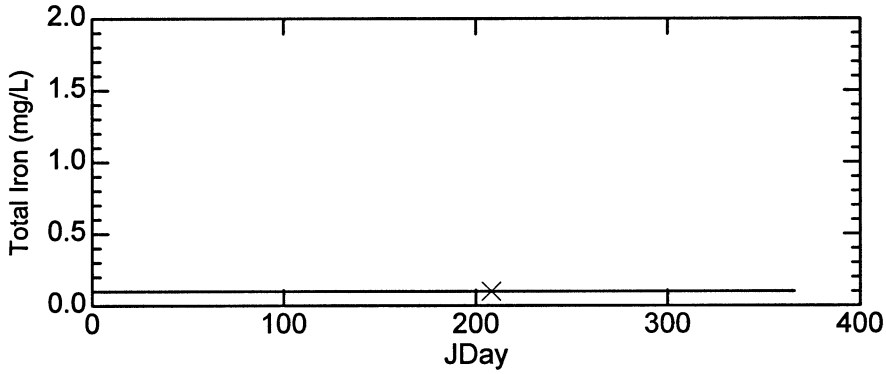
West Fork Obey River 1991



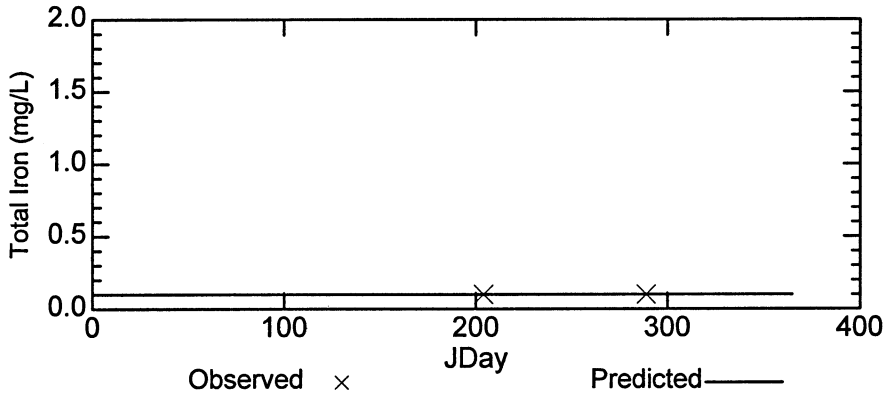
West Fork Obey River 1973



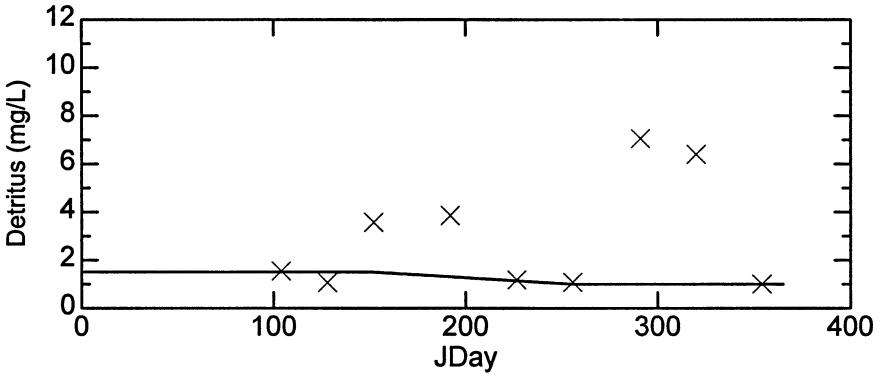
West Fork Obey River 1988



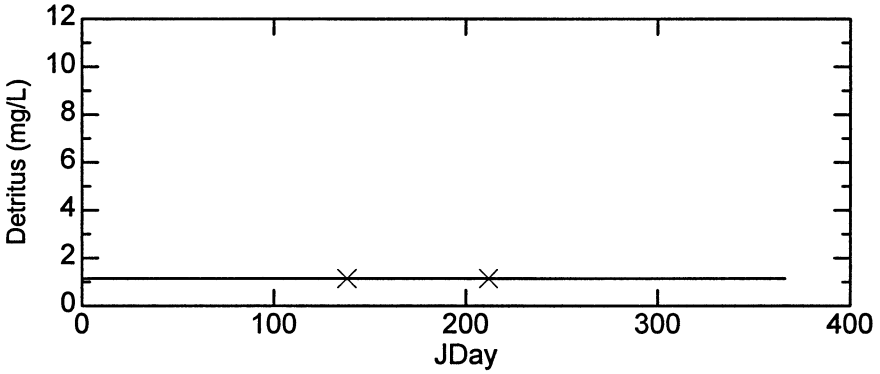
West Fork Obey River 1991



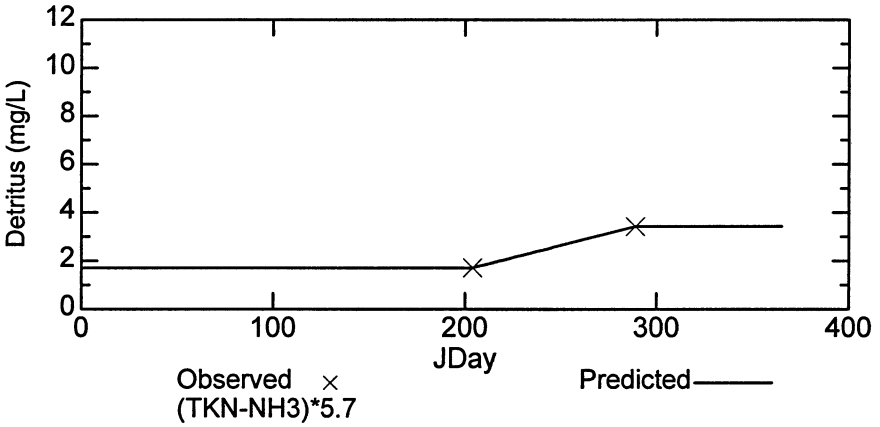
Wolf River 1973



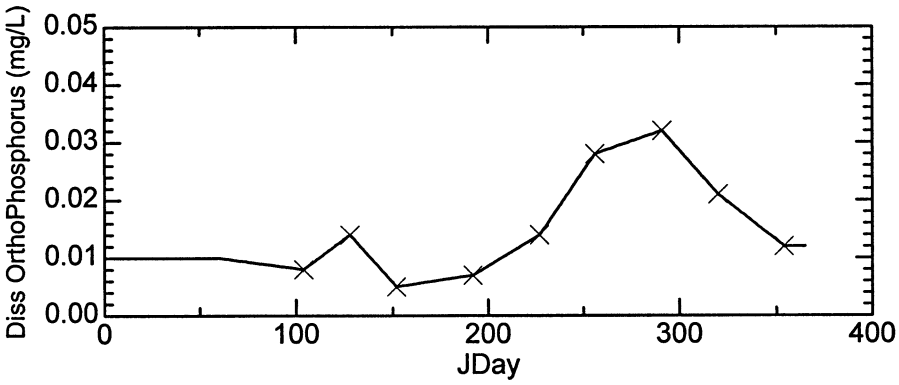
Wolf River 1988



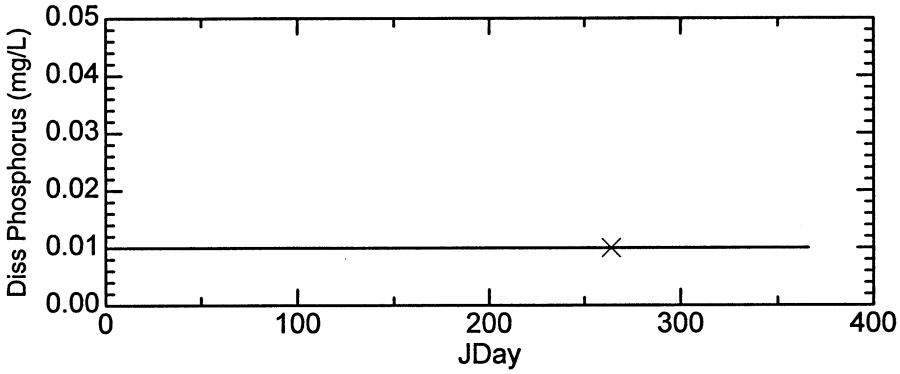
Wolf River 1991



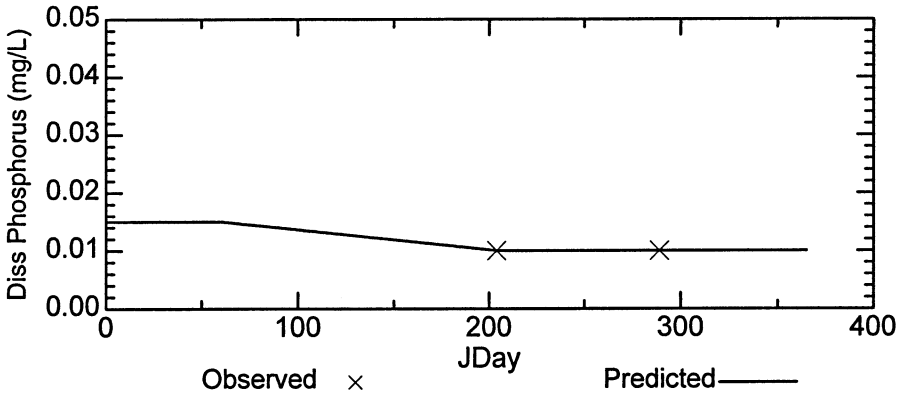
Wolf River 1973



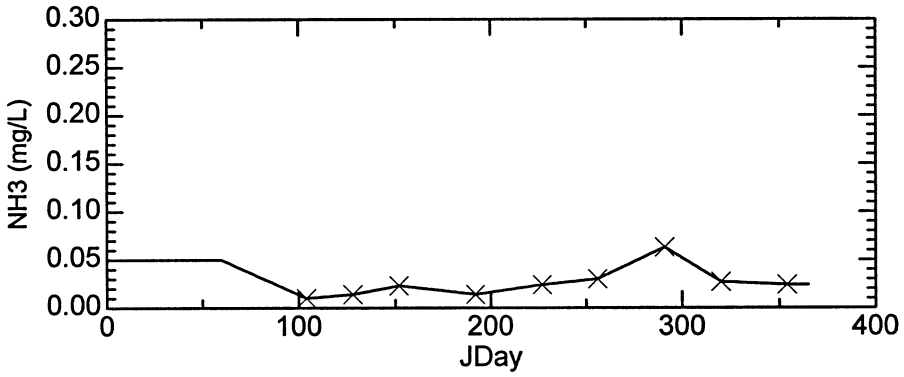
Wolf River 1988



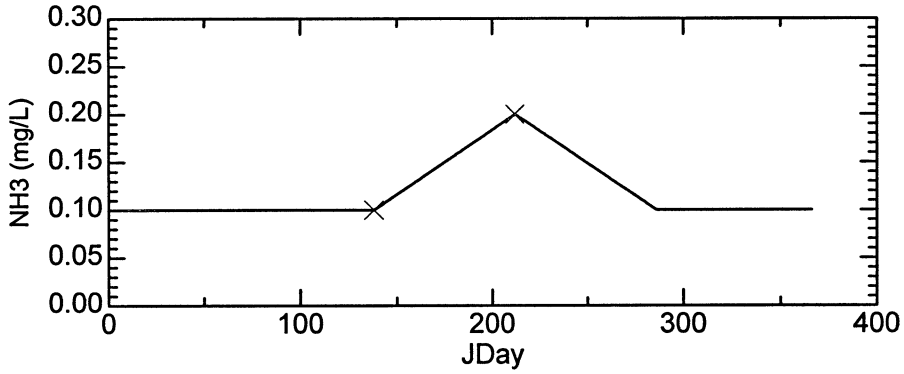
Wolf River 1991



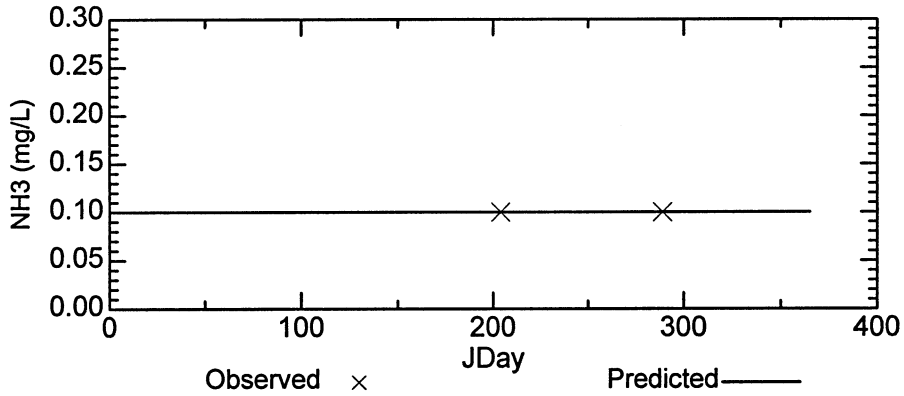
Wolf River 1973



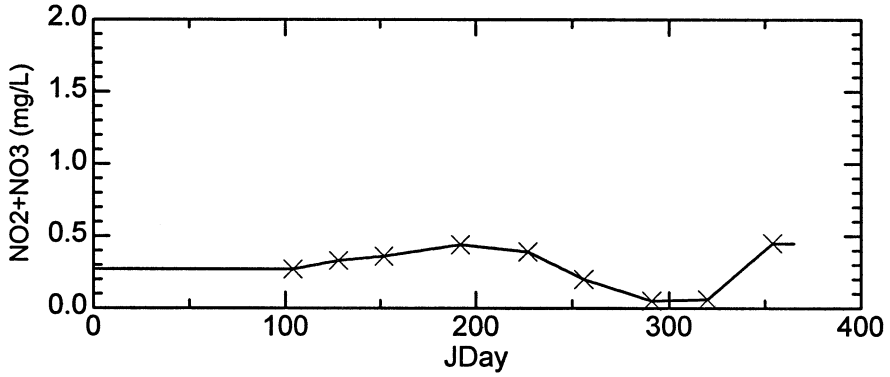
Wolf River 1988



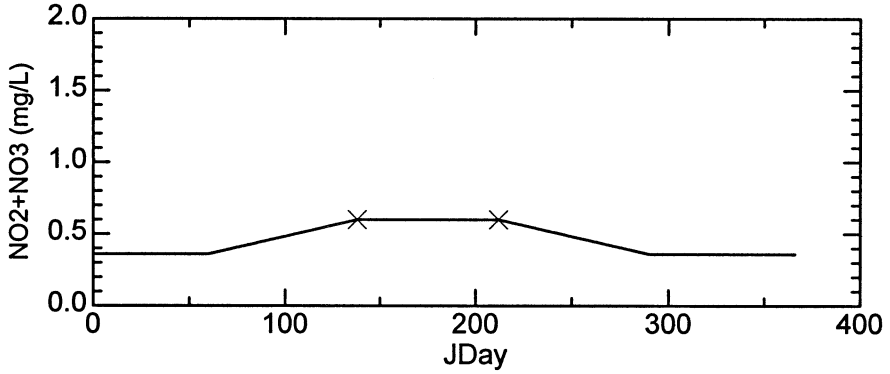
Wolf River 1991



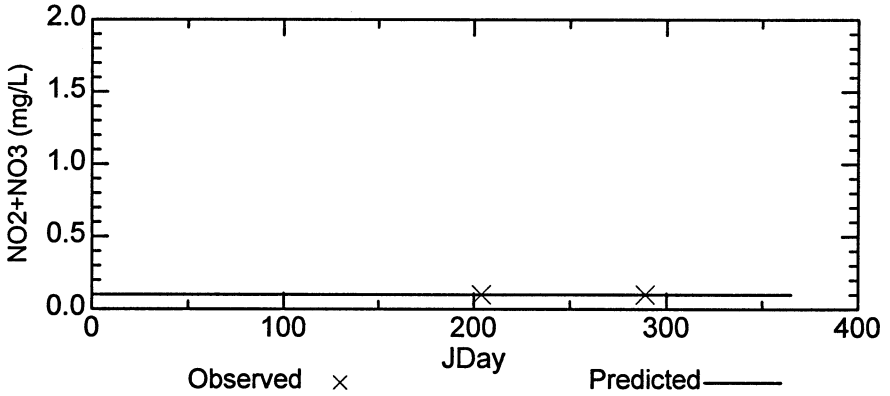
Wolf River 1973



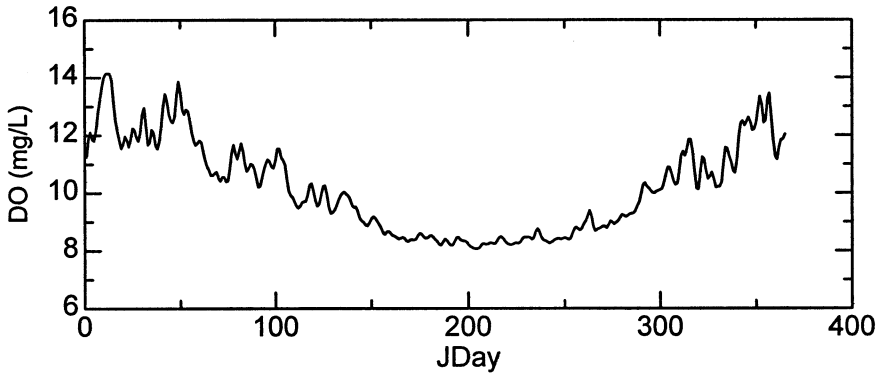
Wolf River 1988



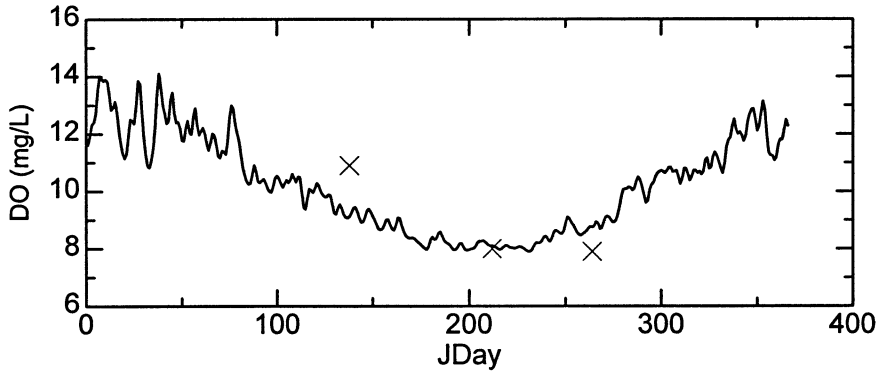
Wolf River 1991



Wolf River 1973



Wolf River 1988



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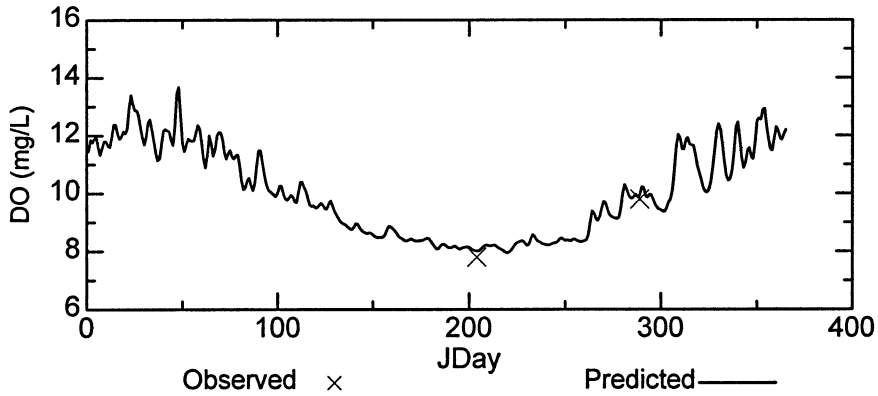
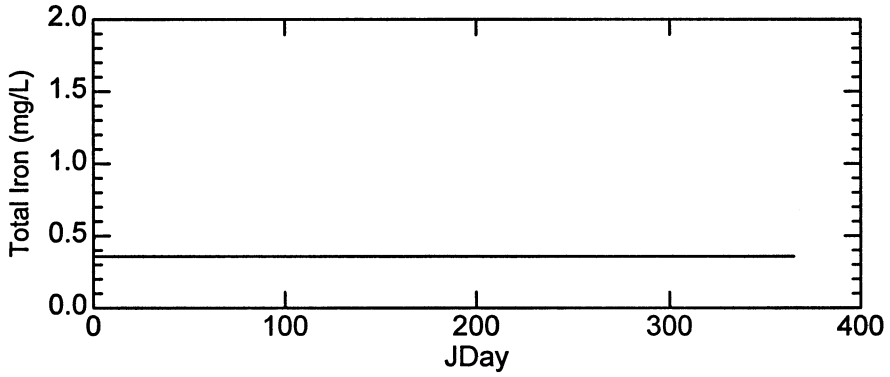


Wolf River 1973



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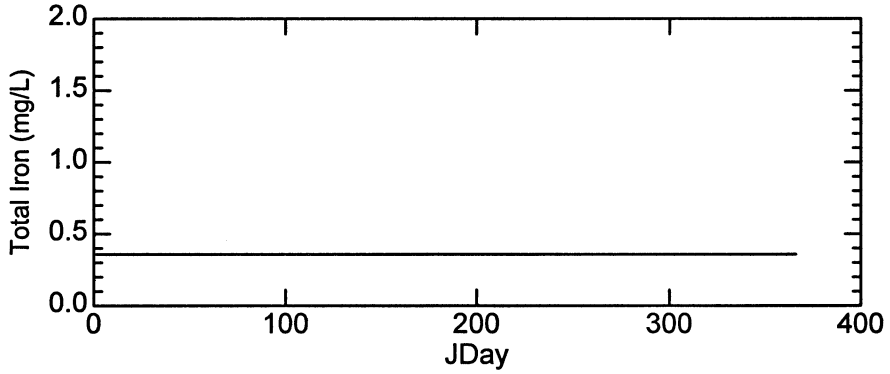

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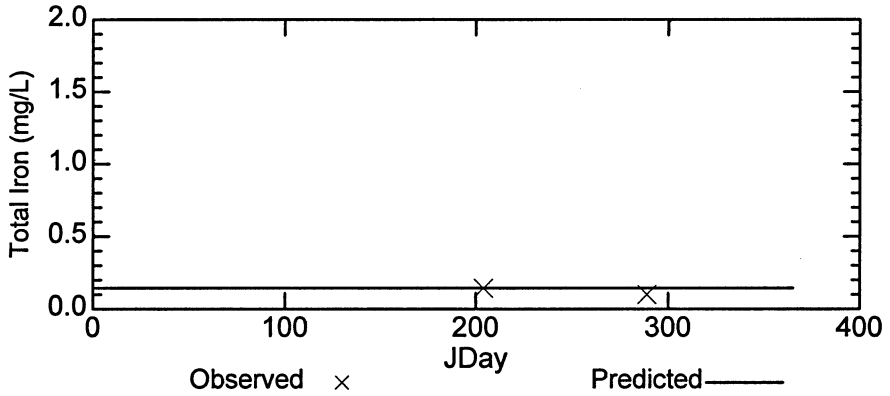
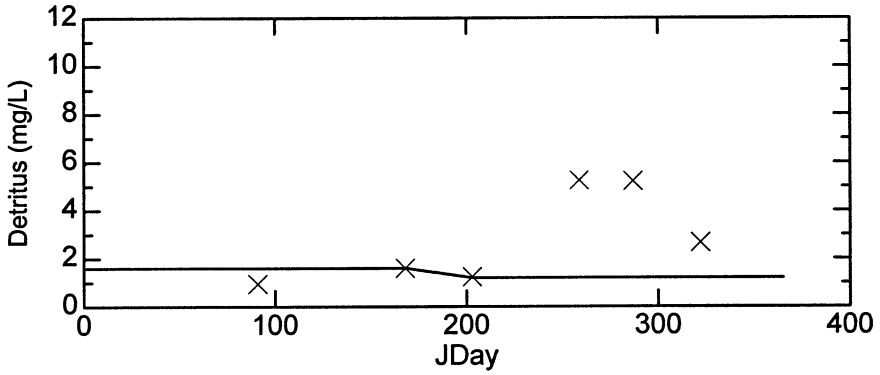


Illwill Creek 1973



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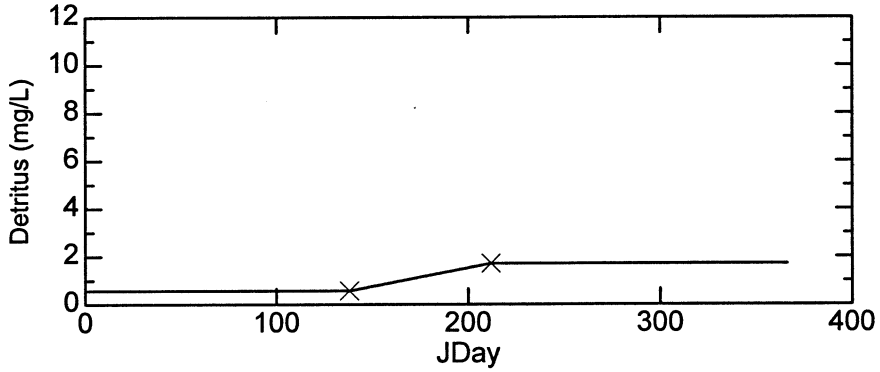

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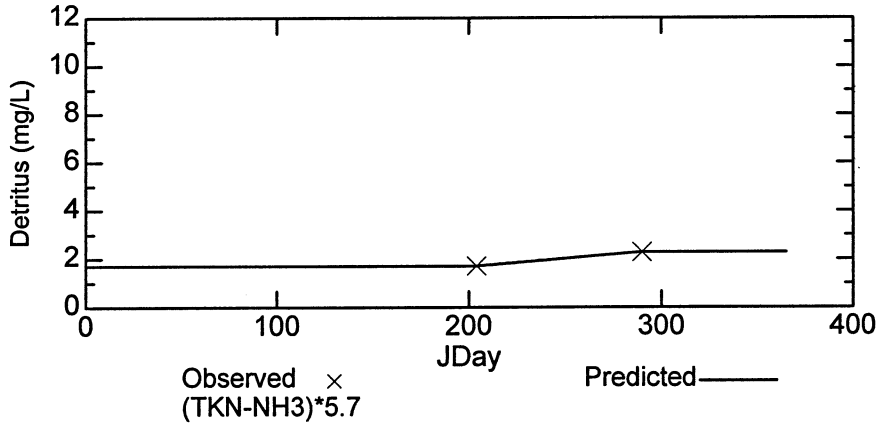

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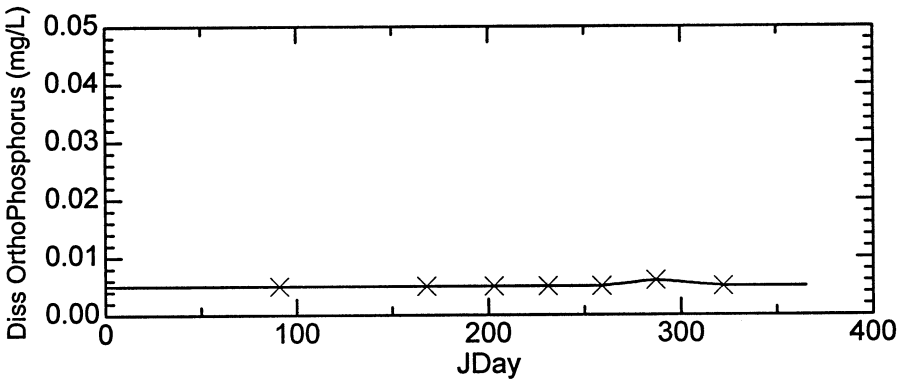

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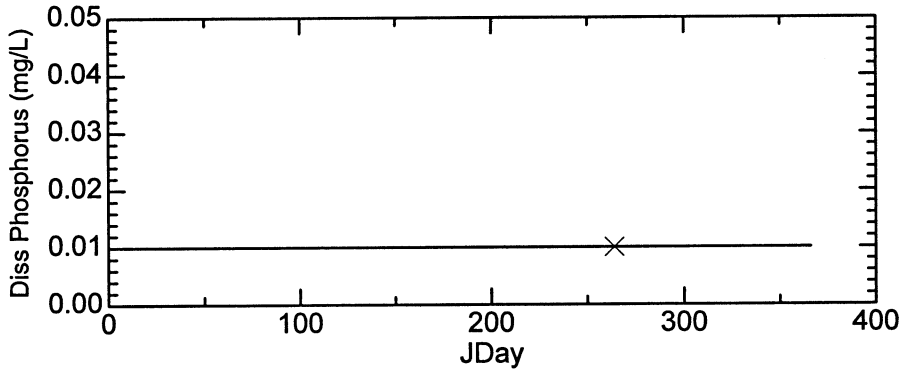

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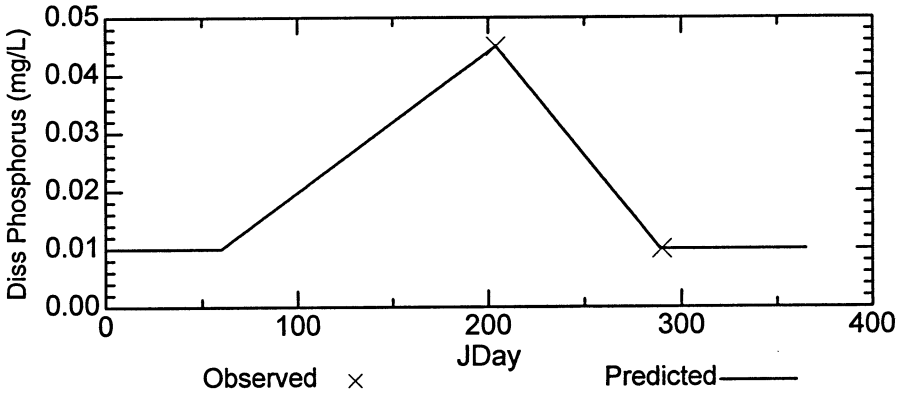

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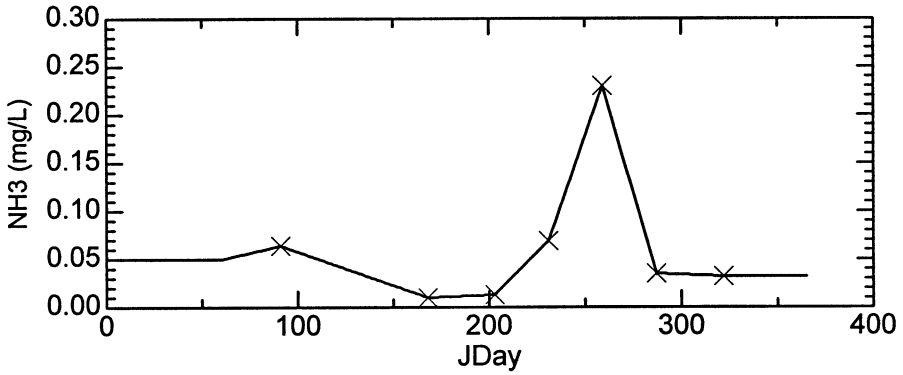

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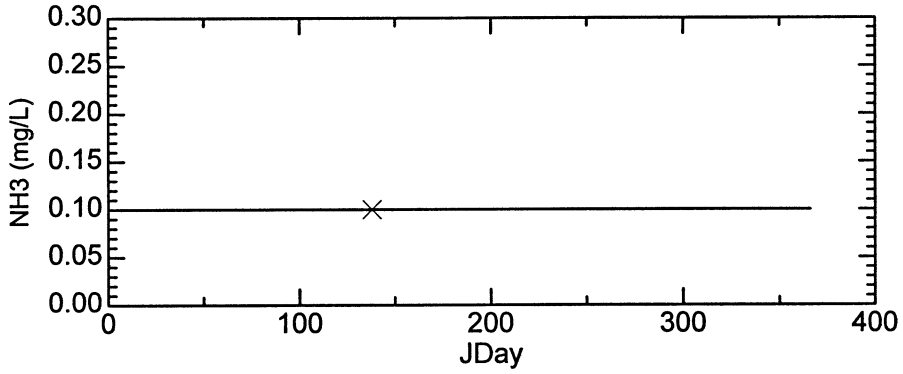

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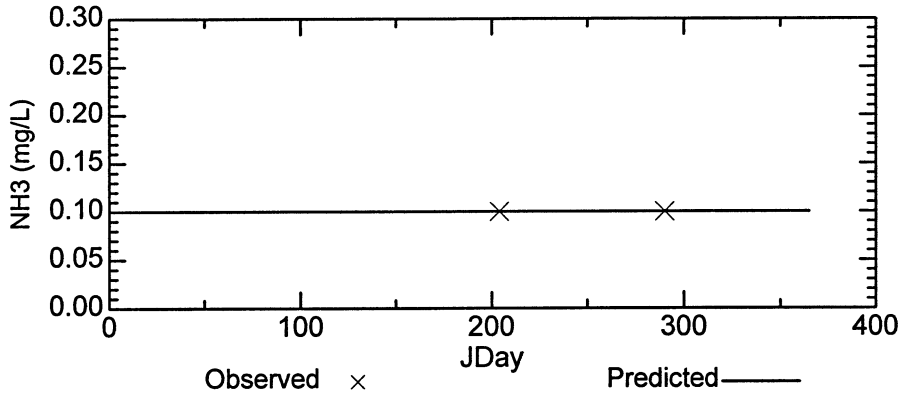

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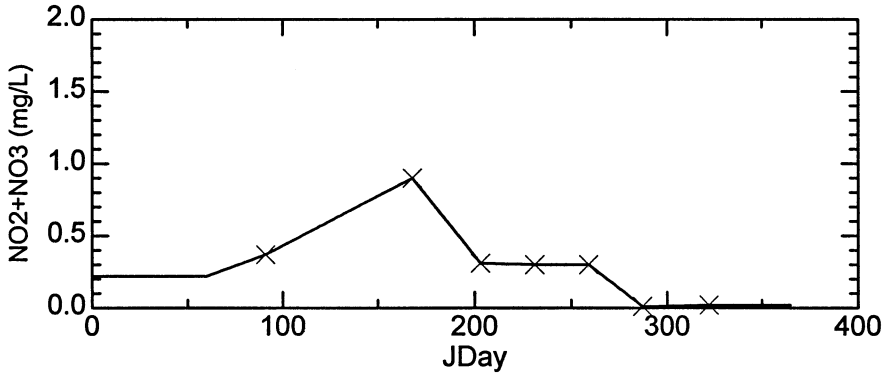

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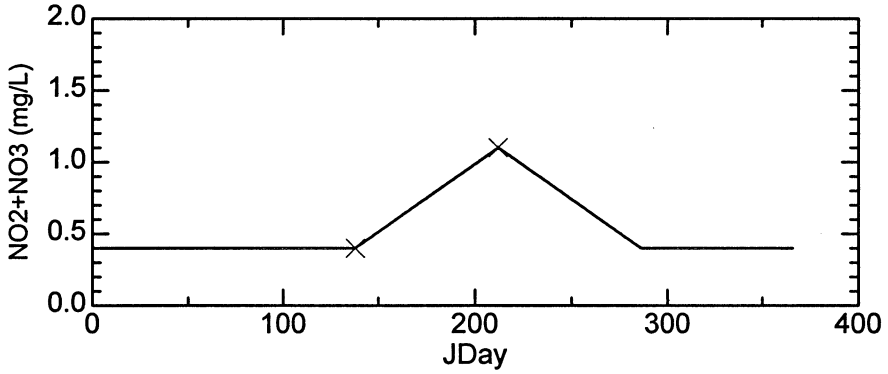

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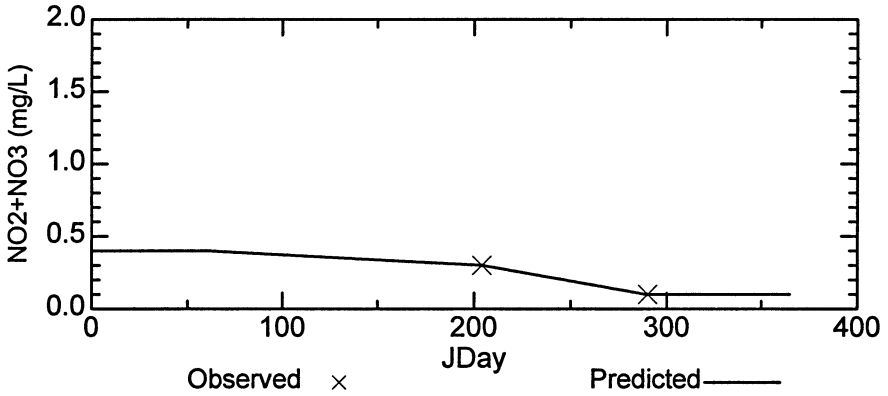

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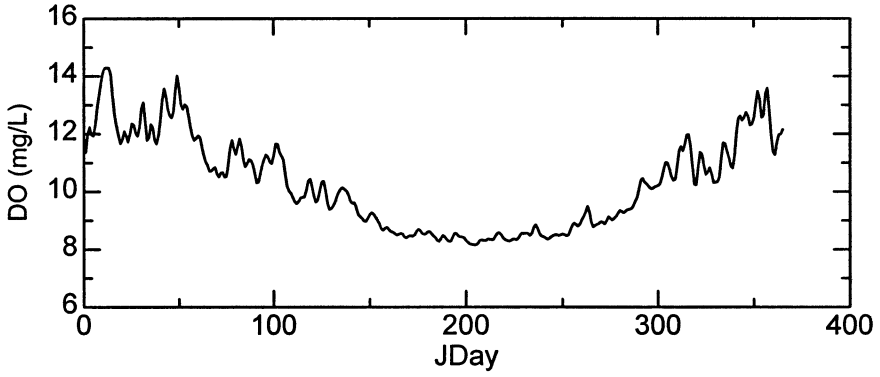

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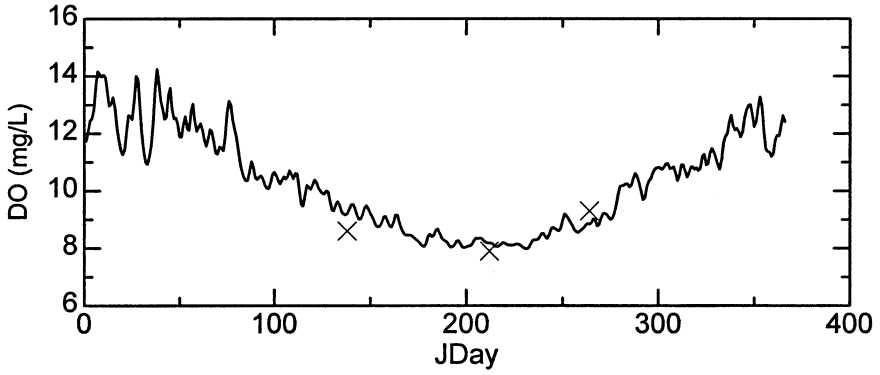

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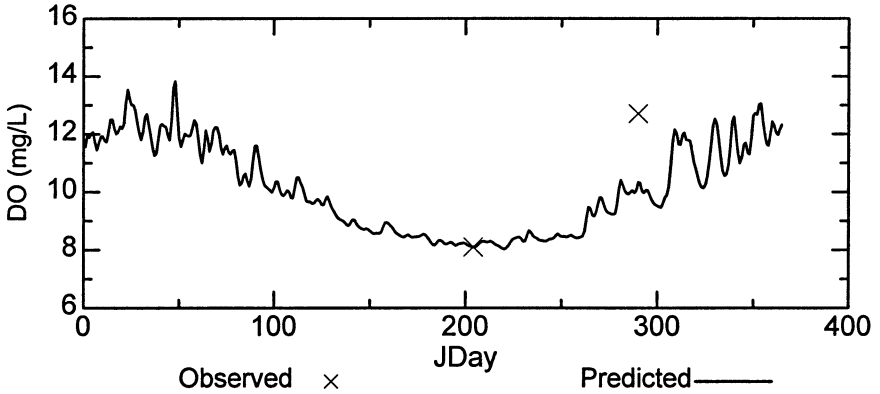

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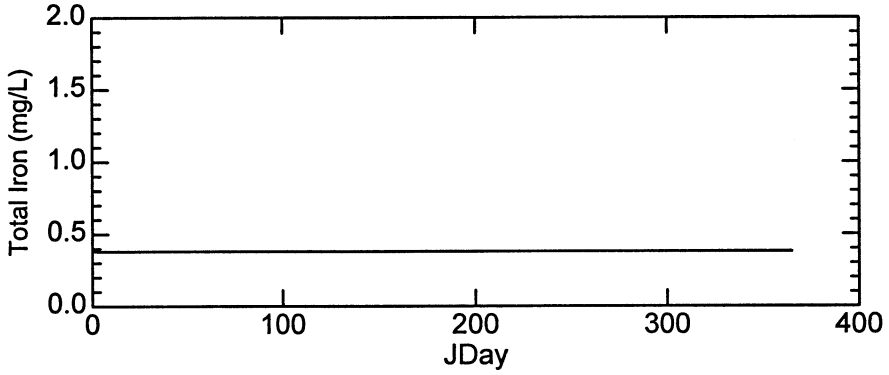

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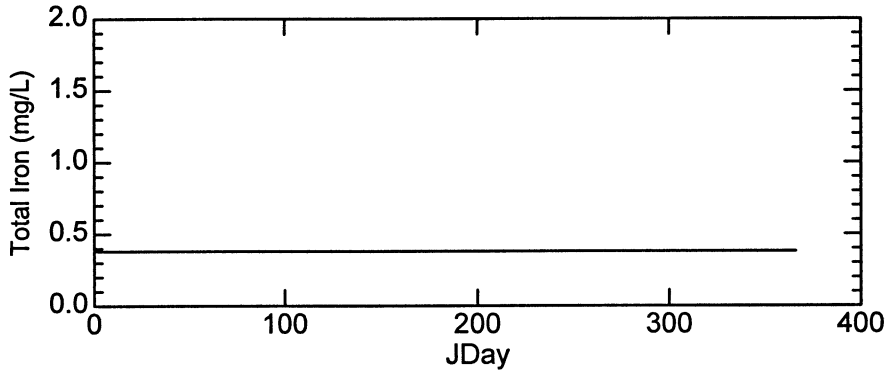

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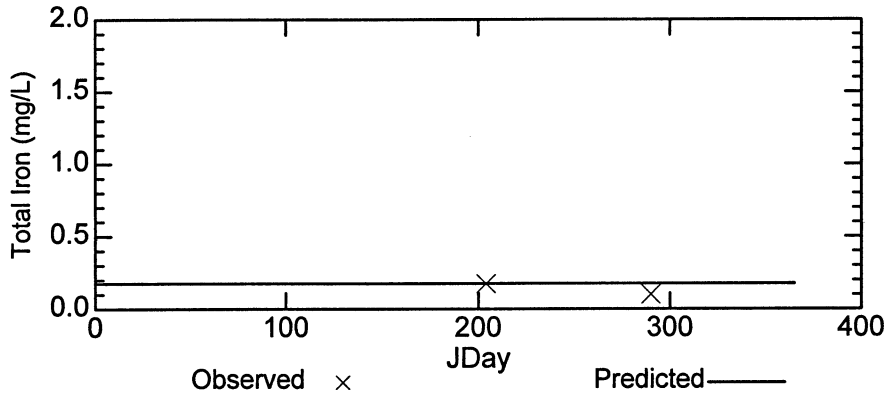
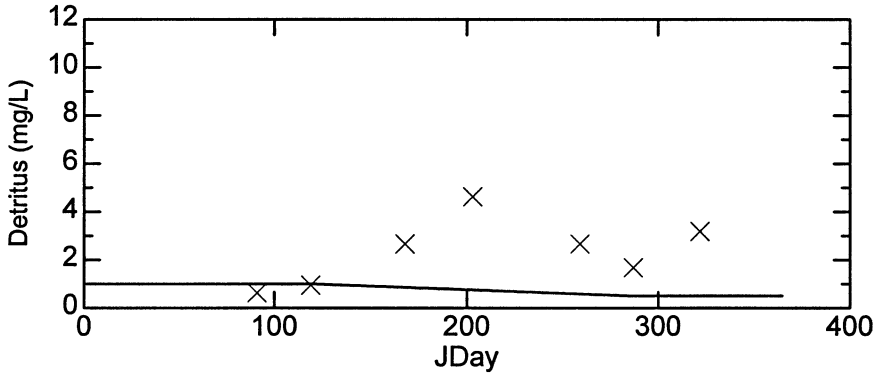


Spring Creek 1973



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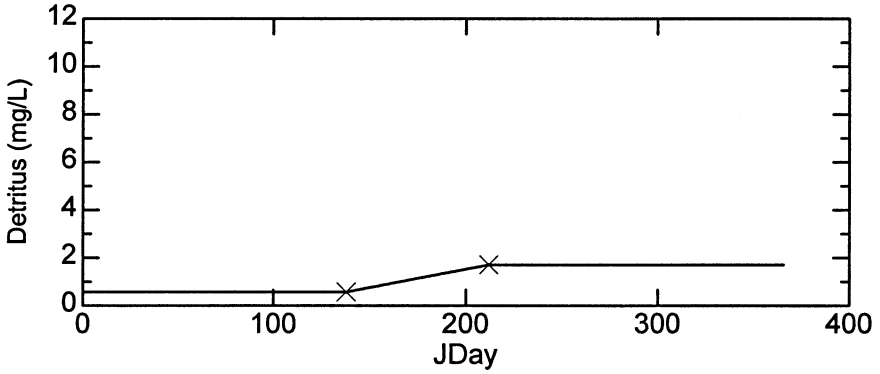

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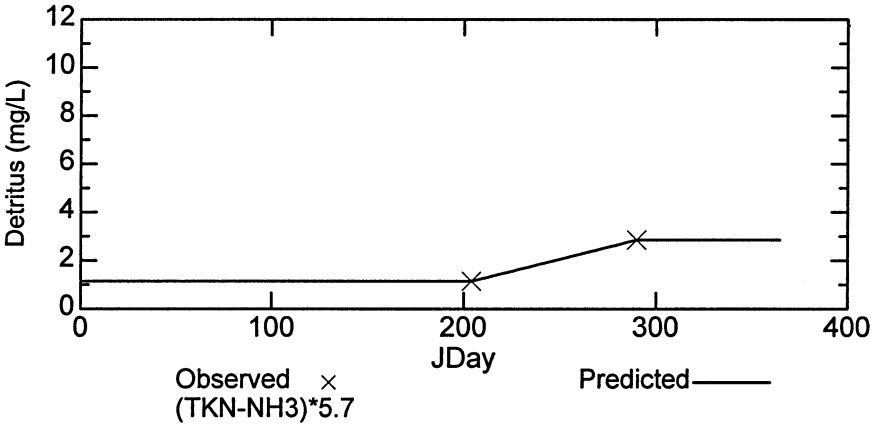

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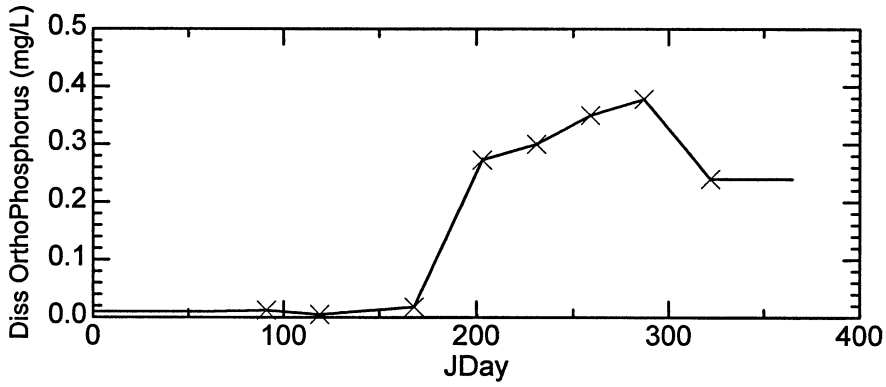

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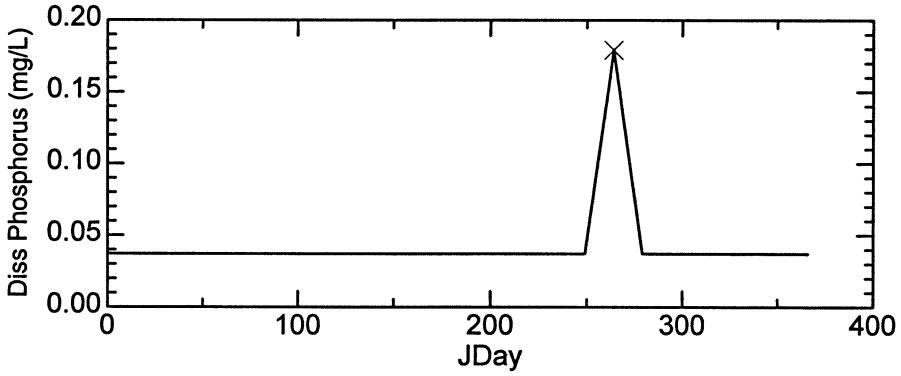

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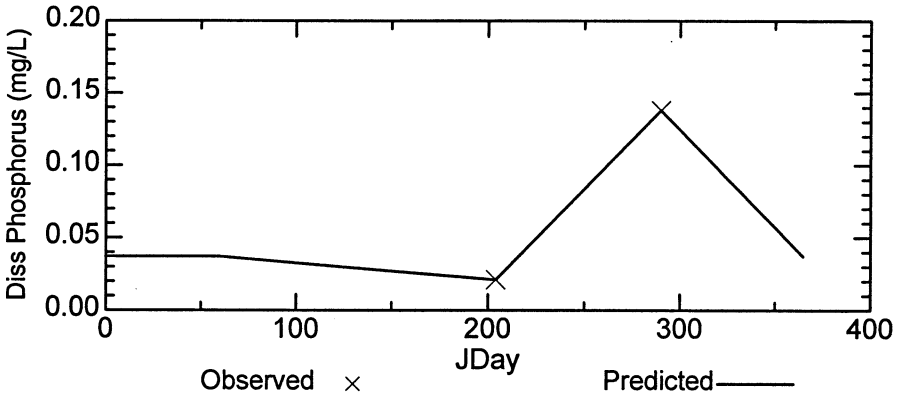

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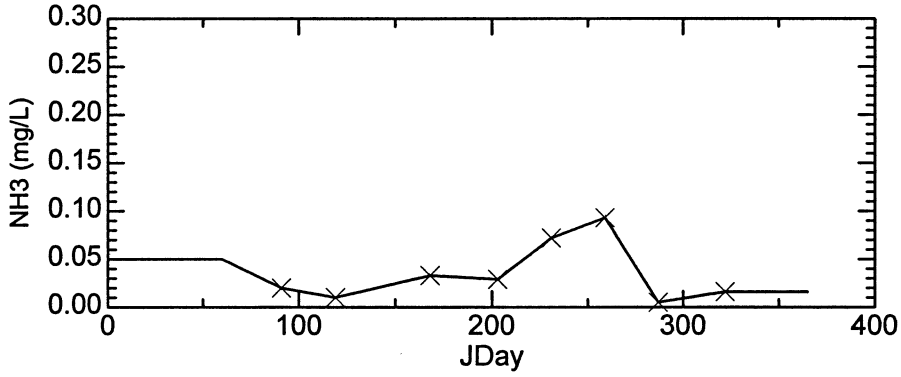

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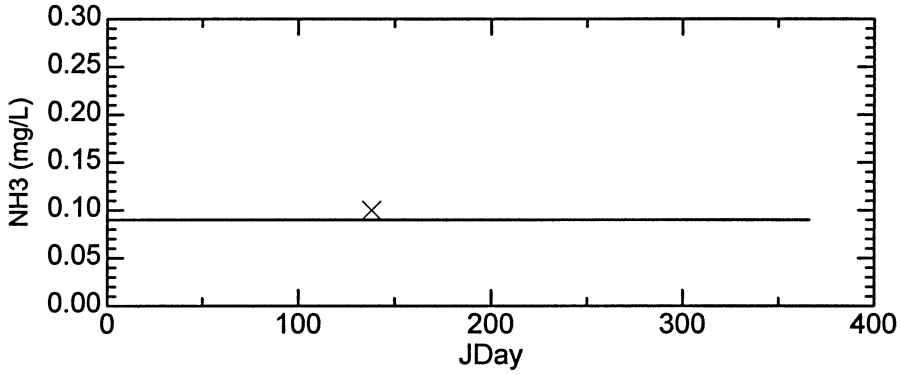

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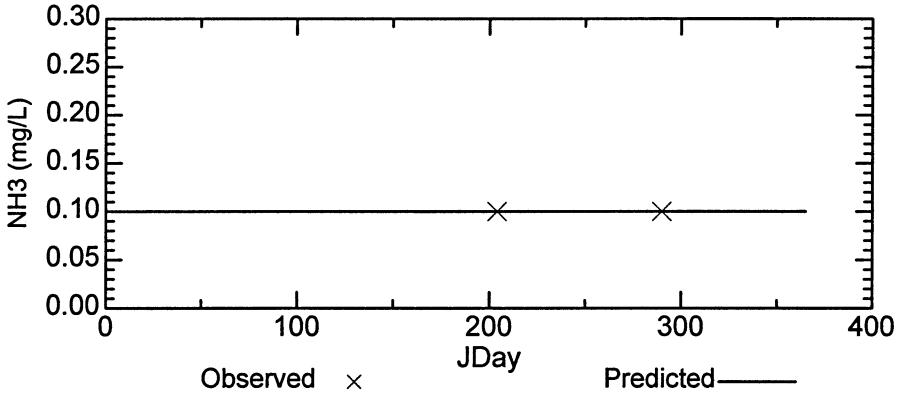

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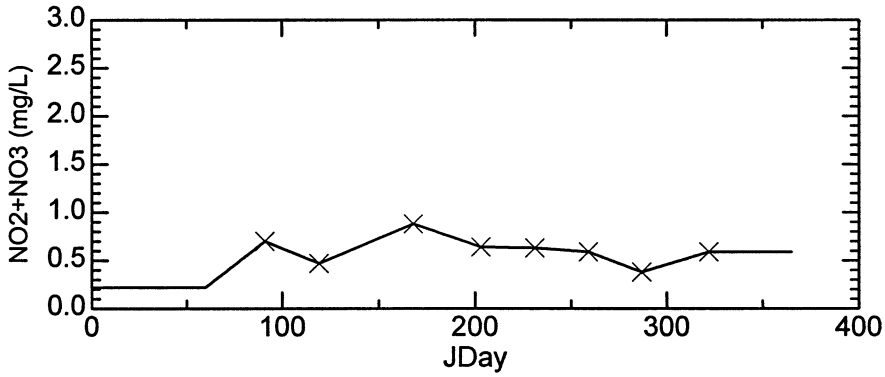

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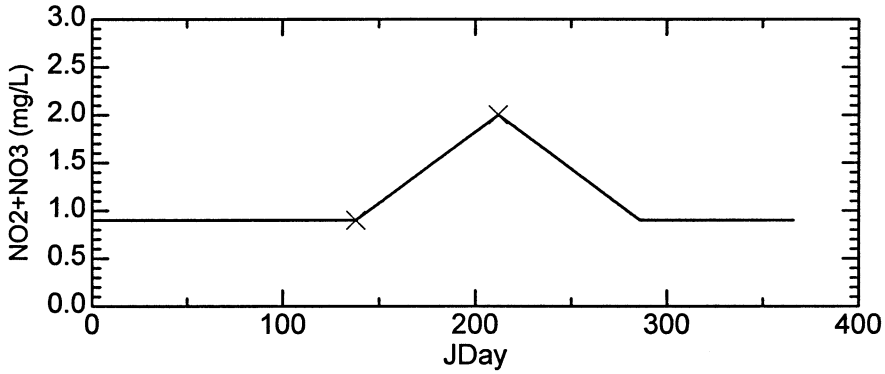

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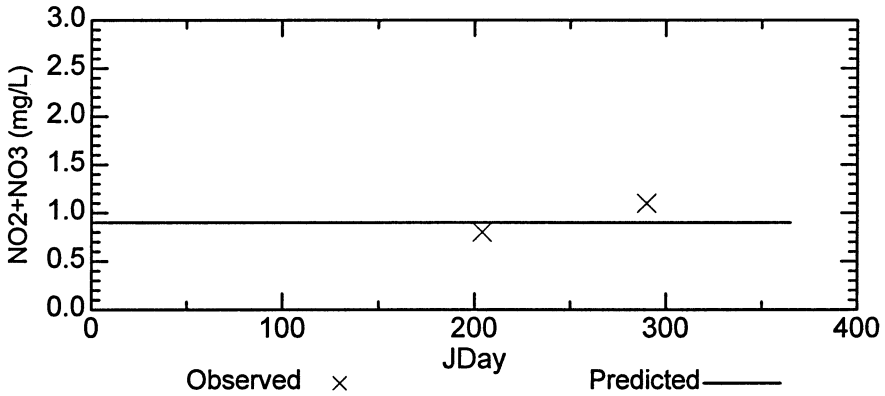

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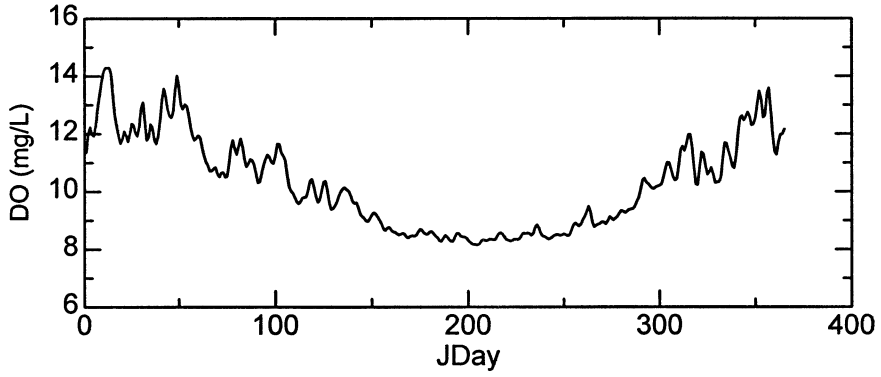

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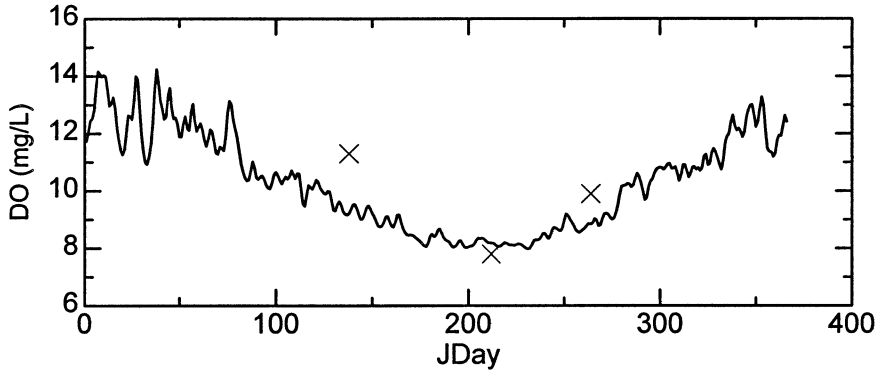

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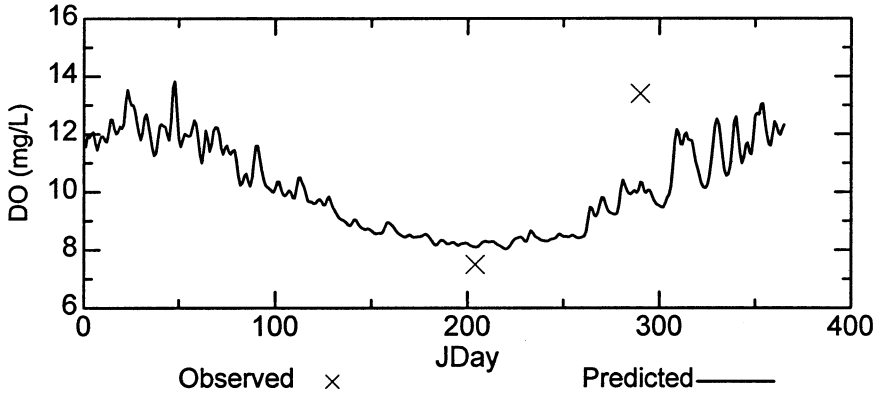

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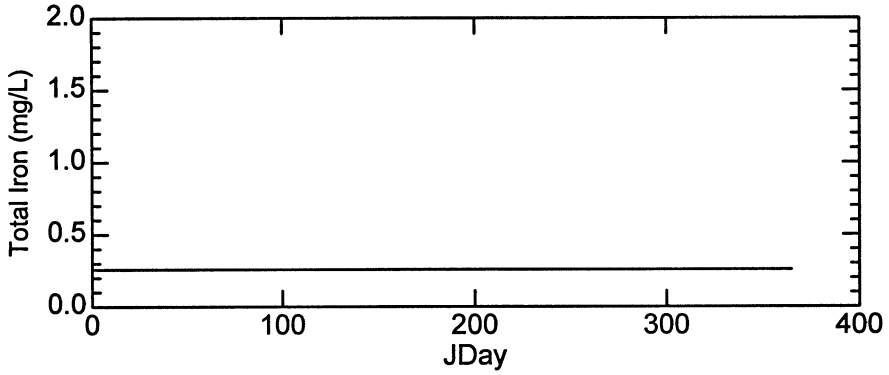

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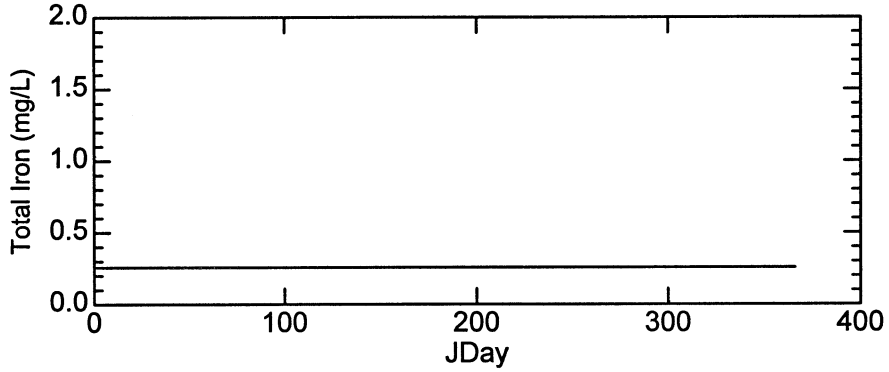

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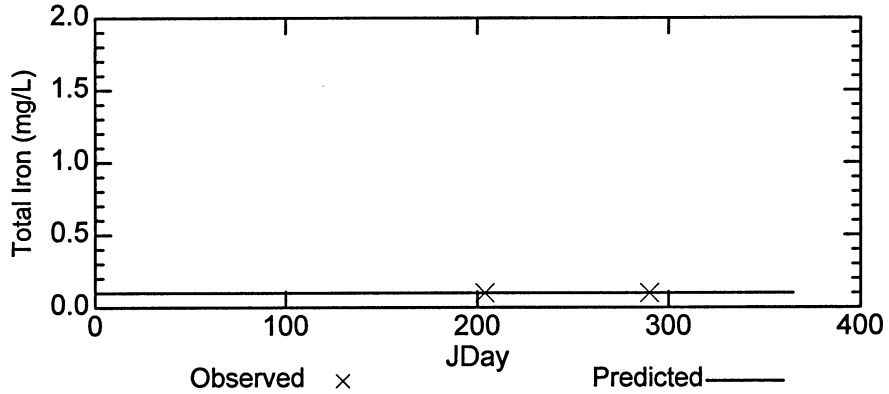
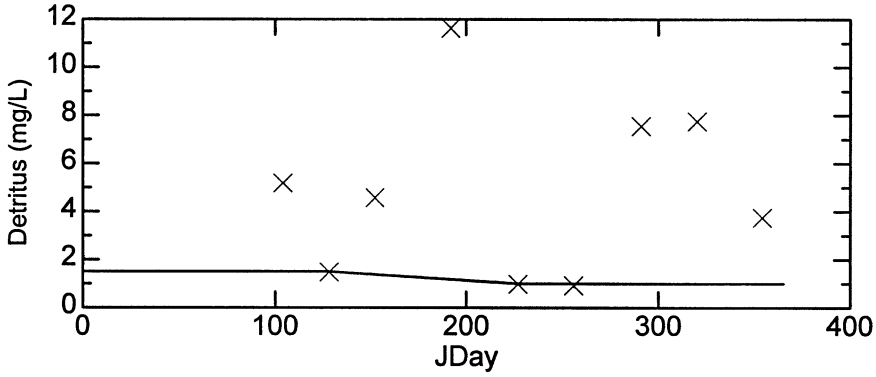


Big Eagle Creek 1973



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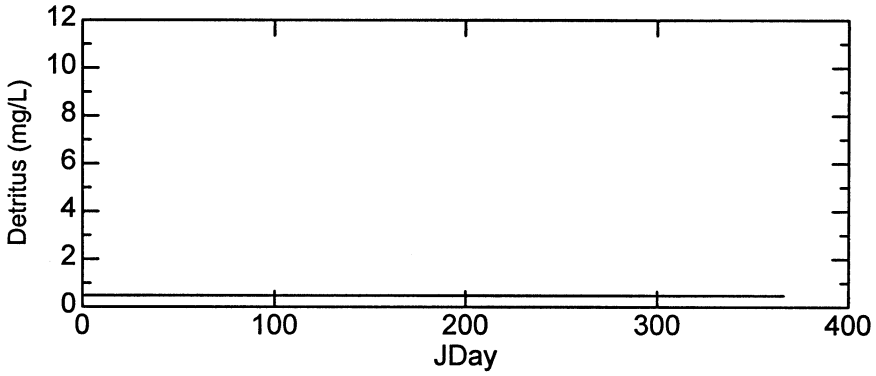

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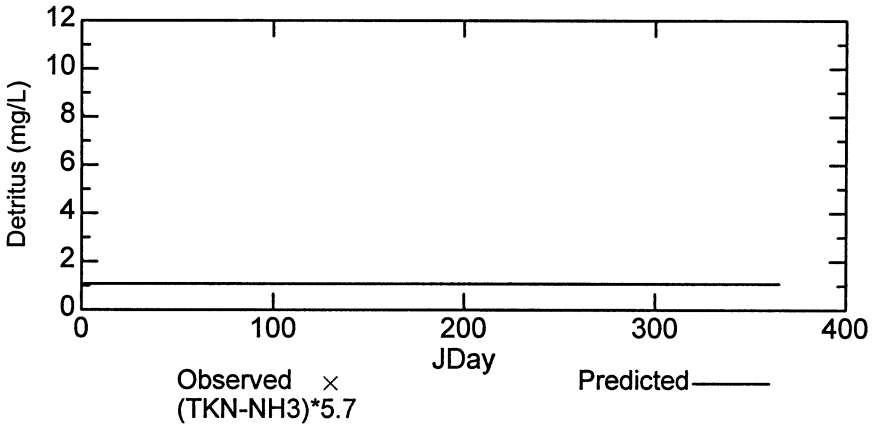

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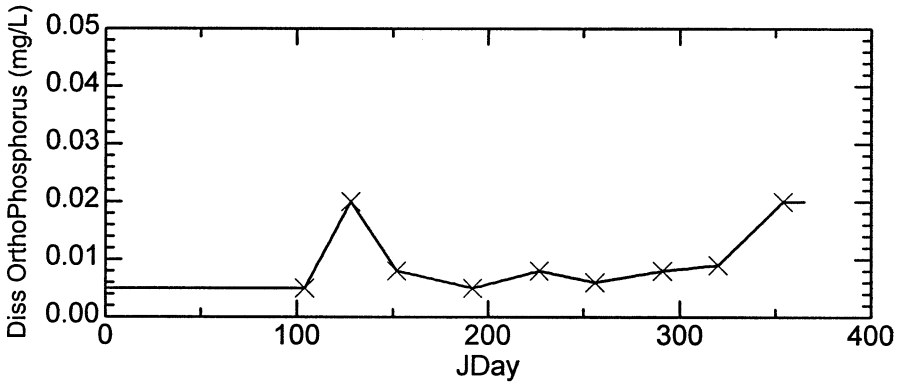

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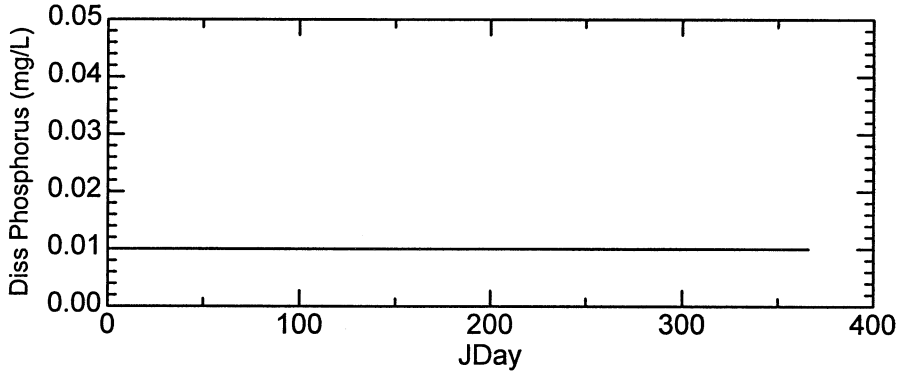

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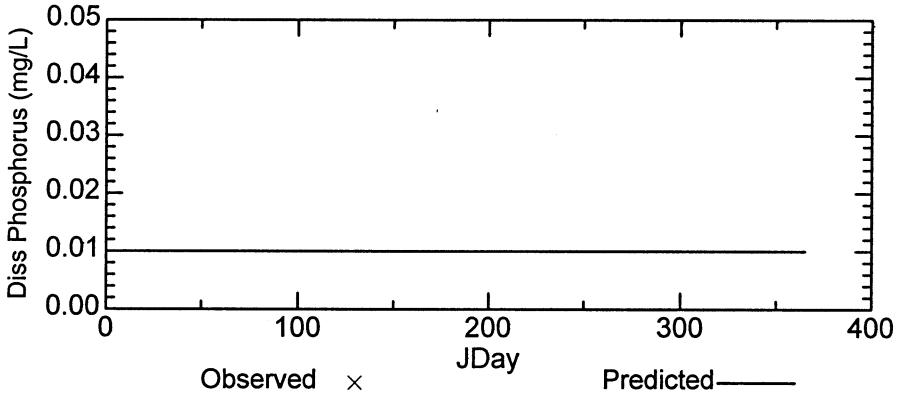

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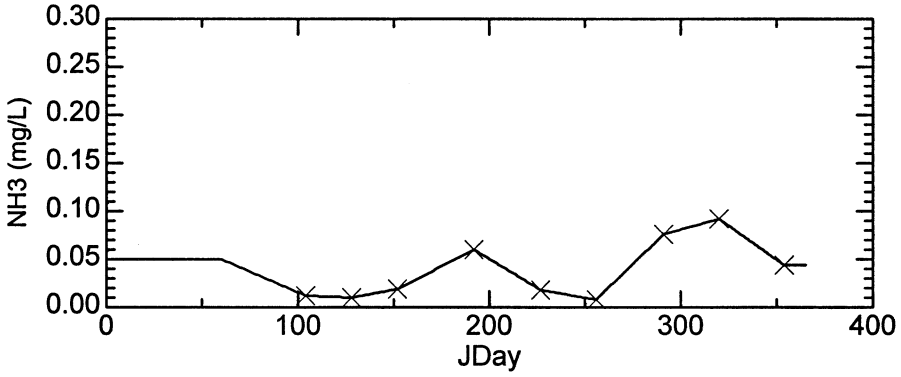

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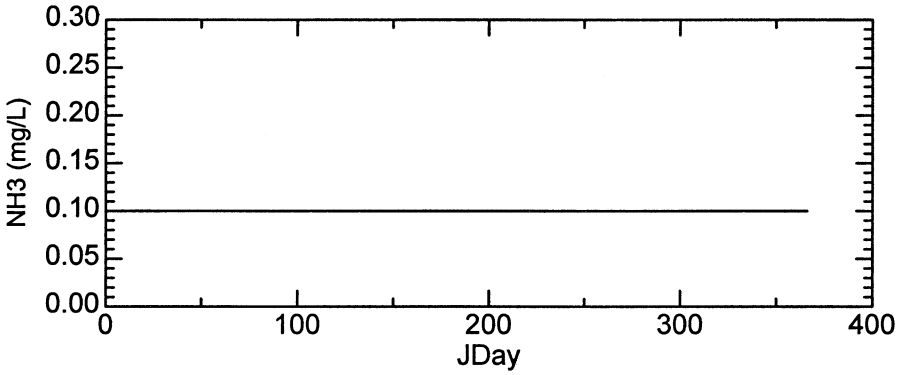

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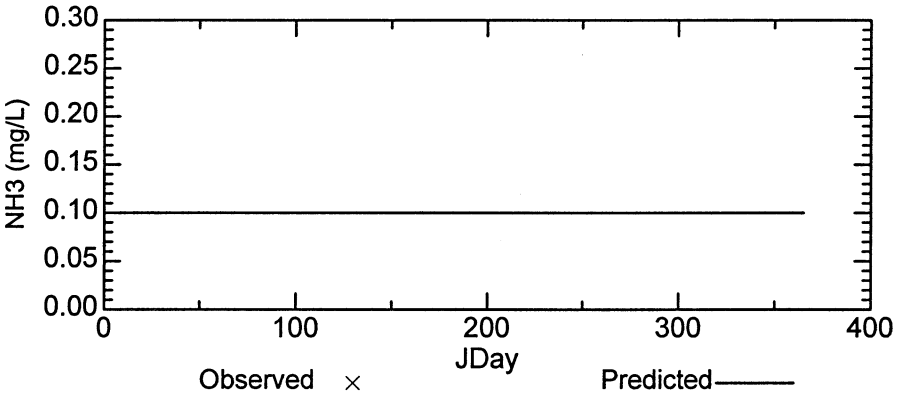

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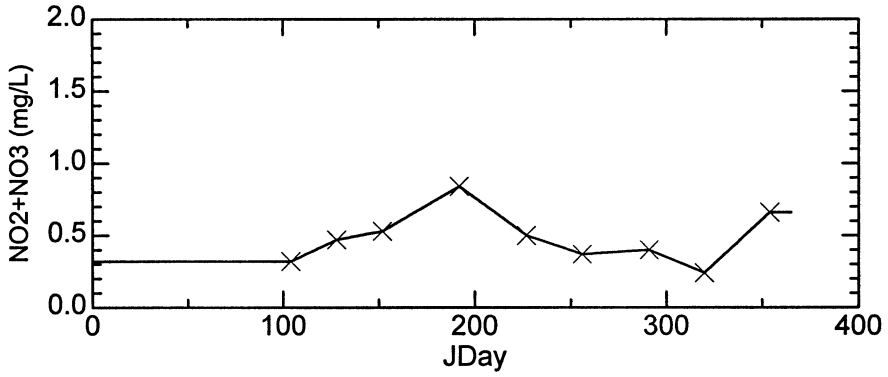

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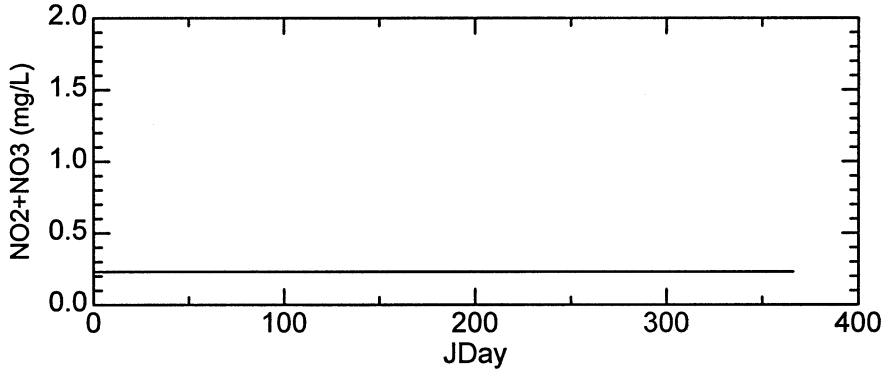

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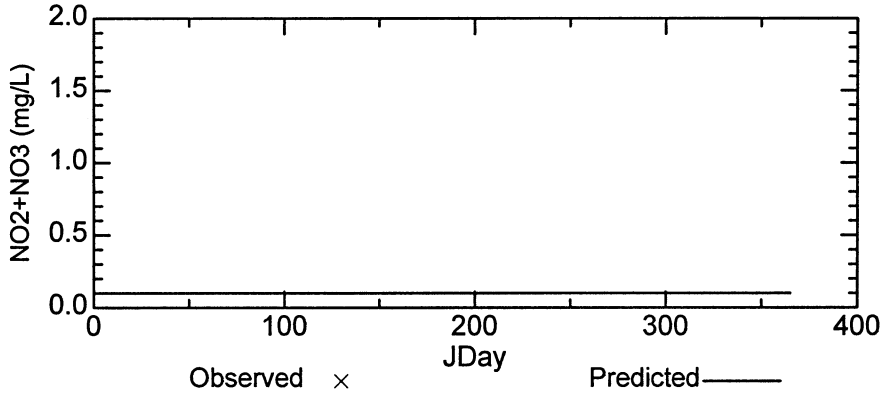

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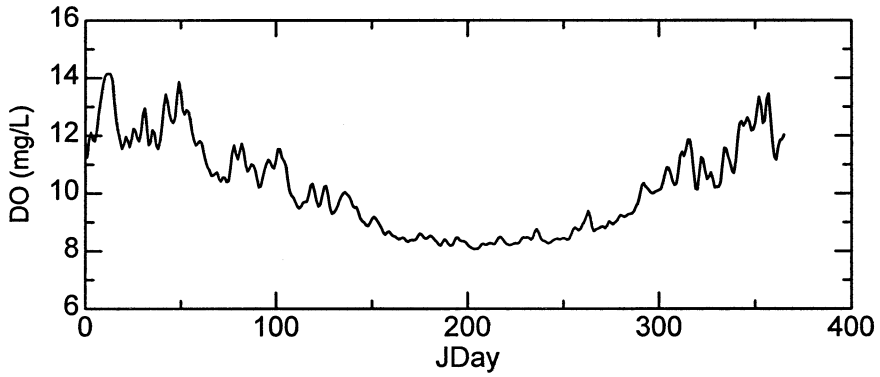

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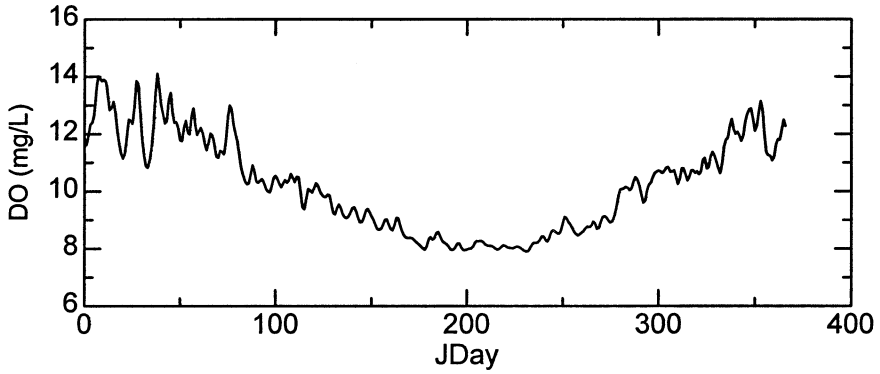

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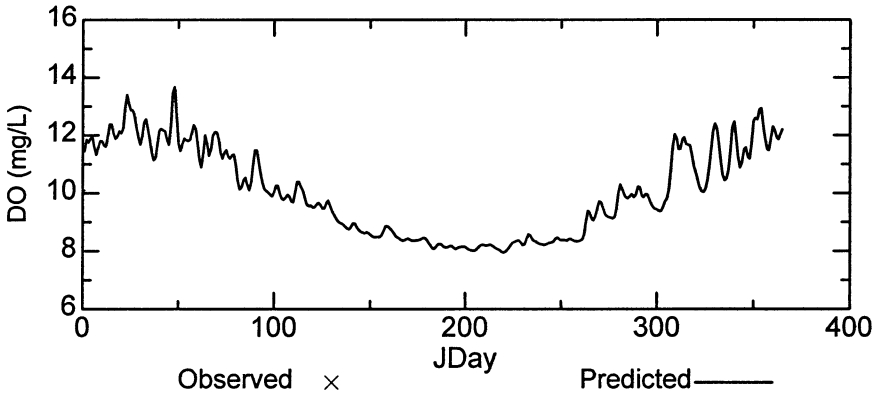

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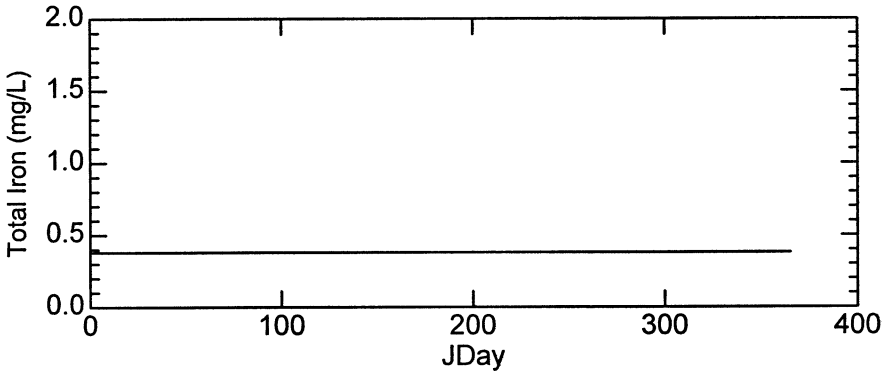

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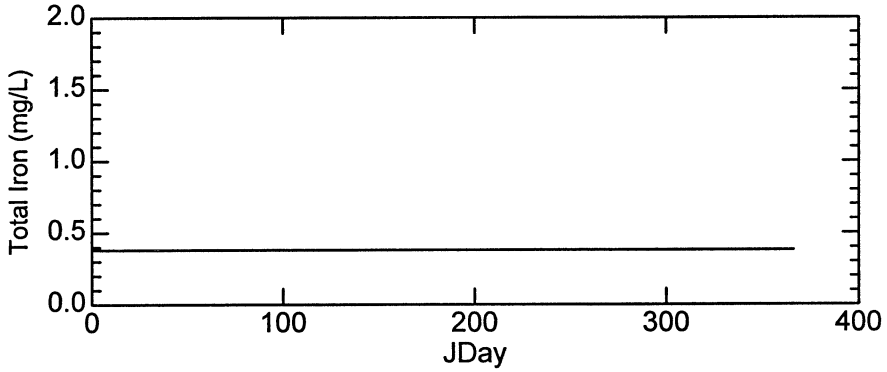
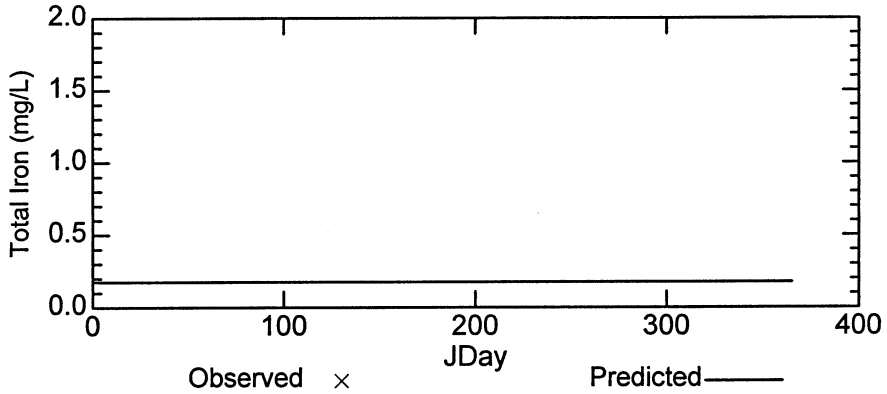


Big Eagle Creek 1991



APPENDIX K

Comparison of Measured and Modeled Water Quality

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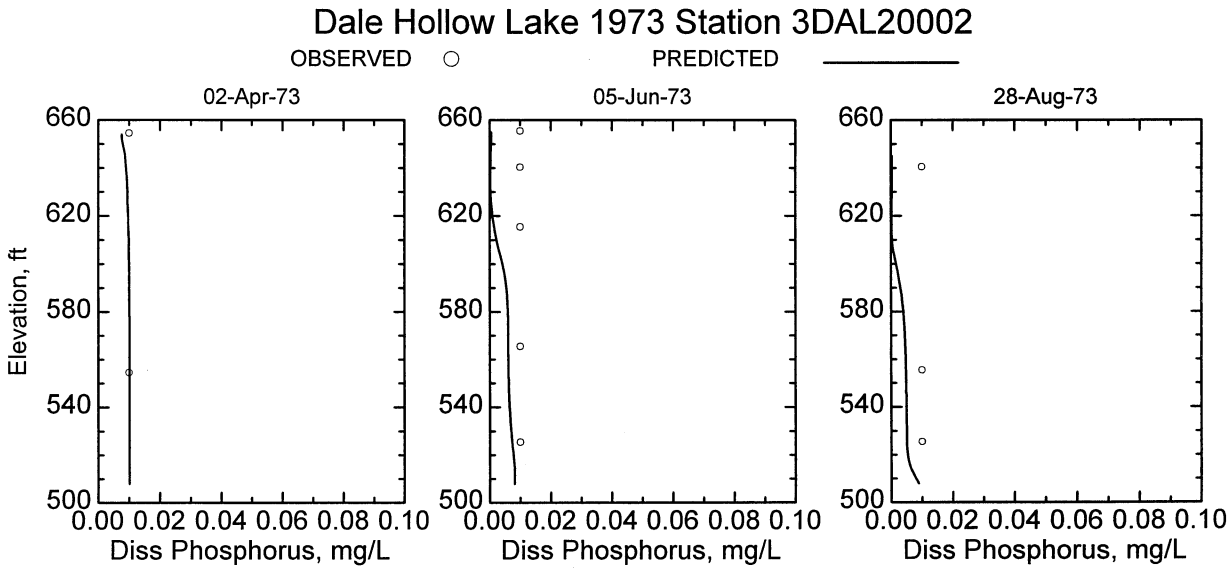
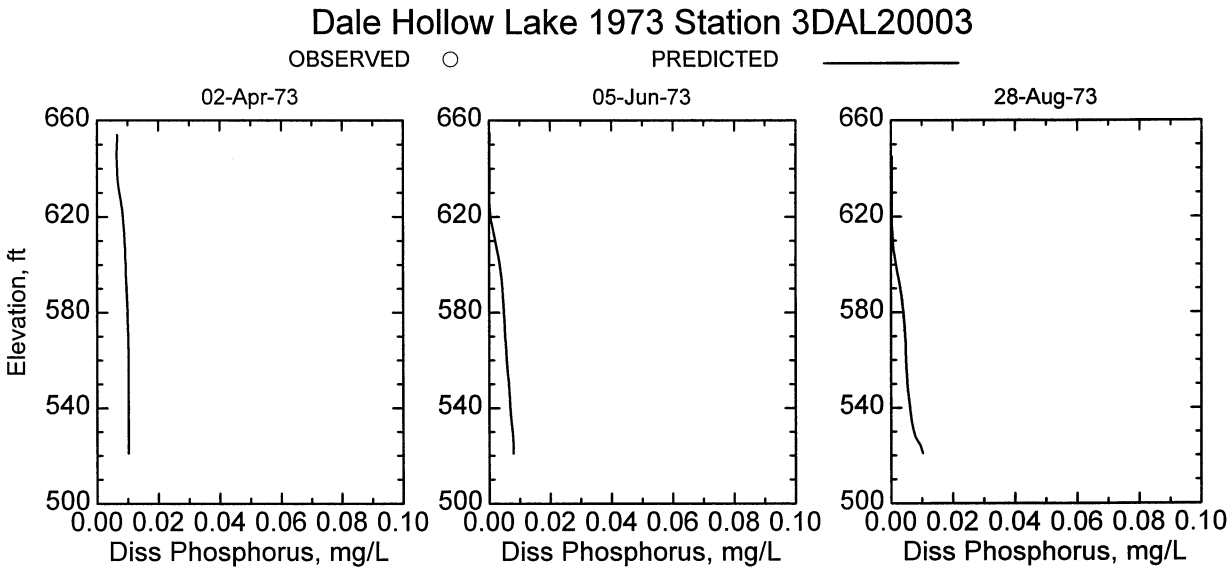

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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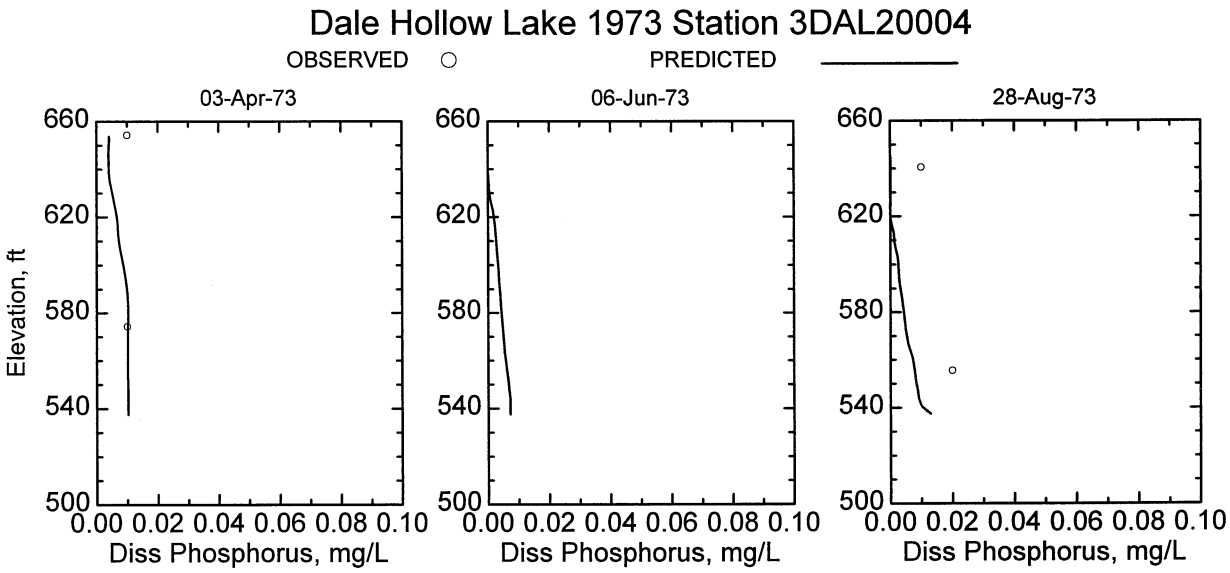
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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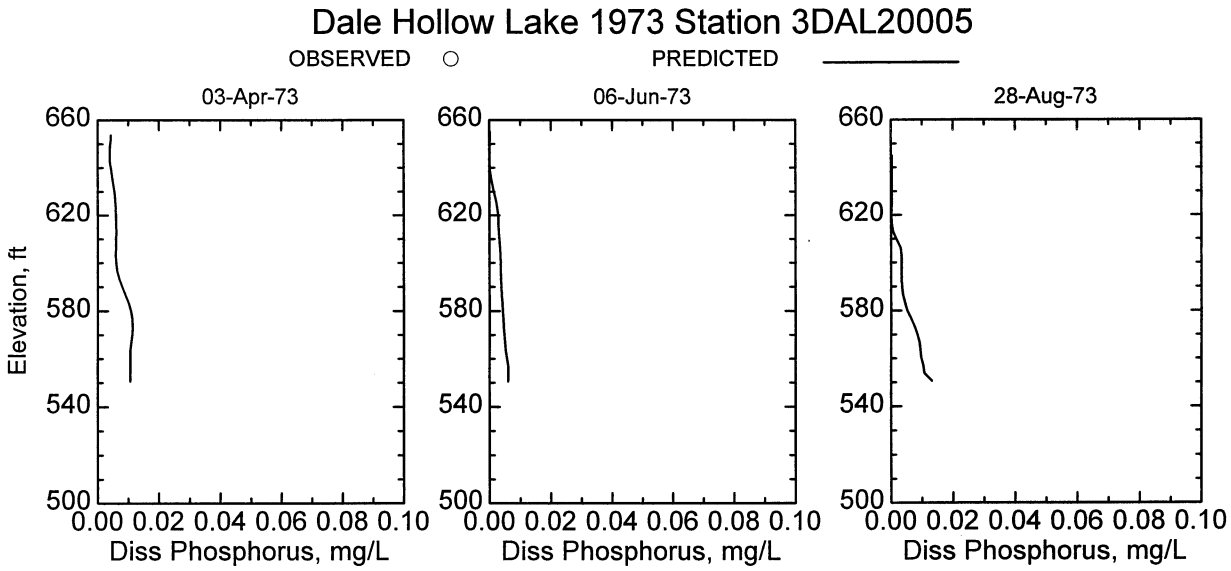
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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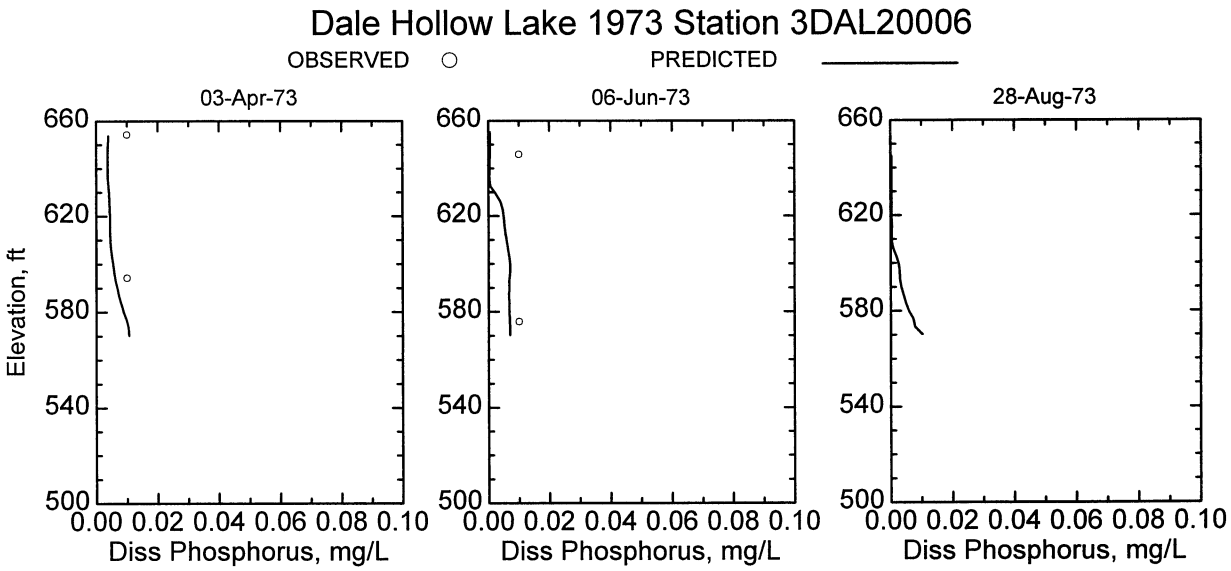
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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OBSERVED
PREDICTED
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06-Jun-73
28-Aug-73
Elevation, ft
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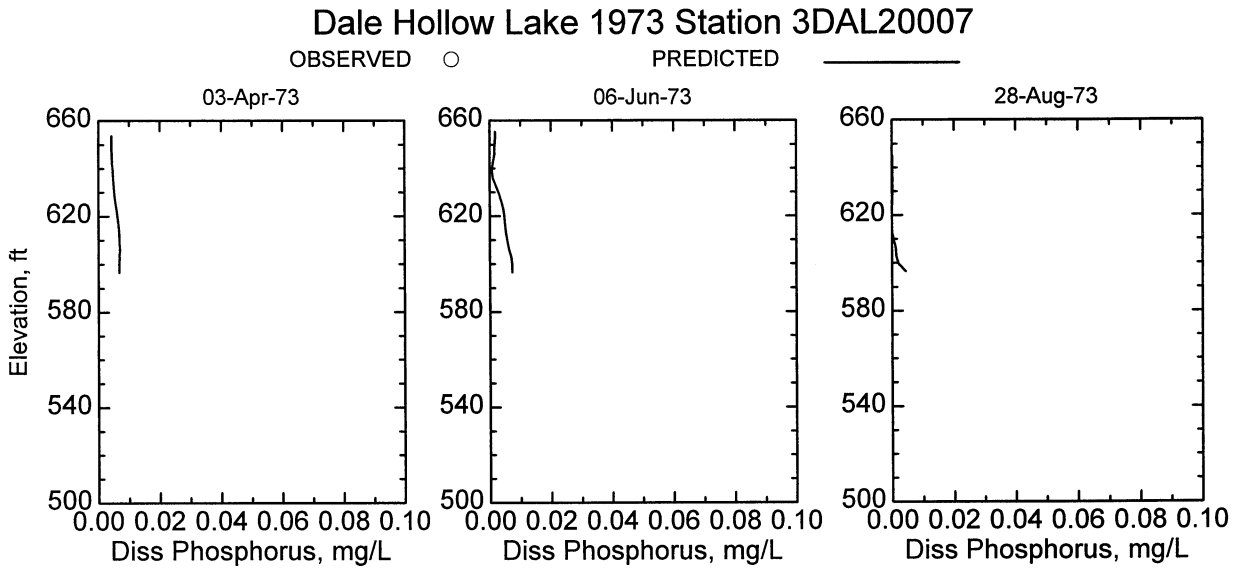
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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OBSERVED
PREDICTED
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06-Jun-73
28-Aug-73
Elevation, ft
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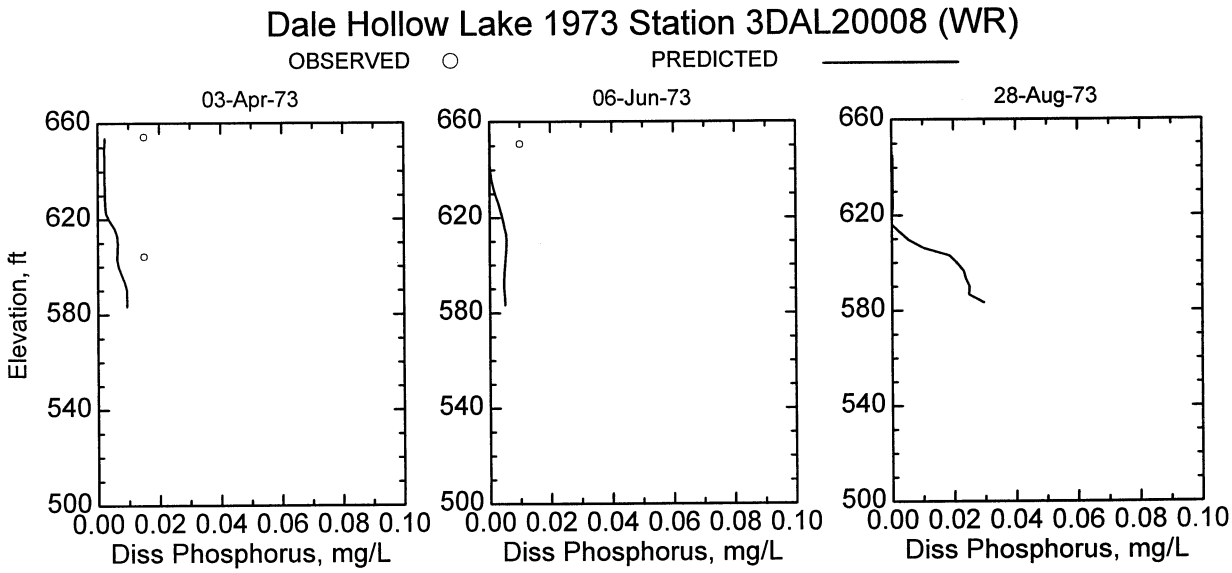
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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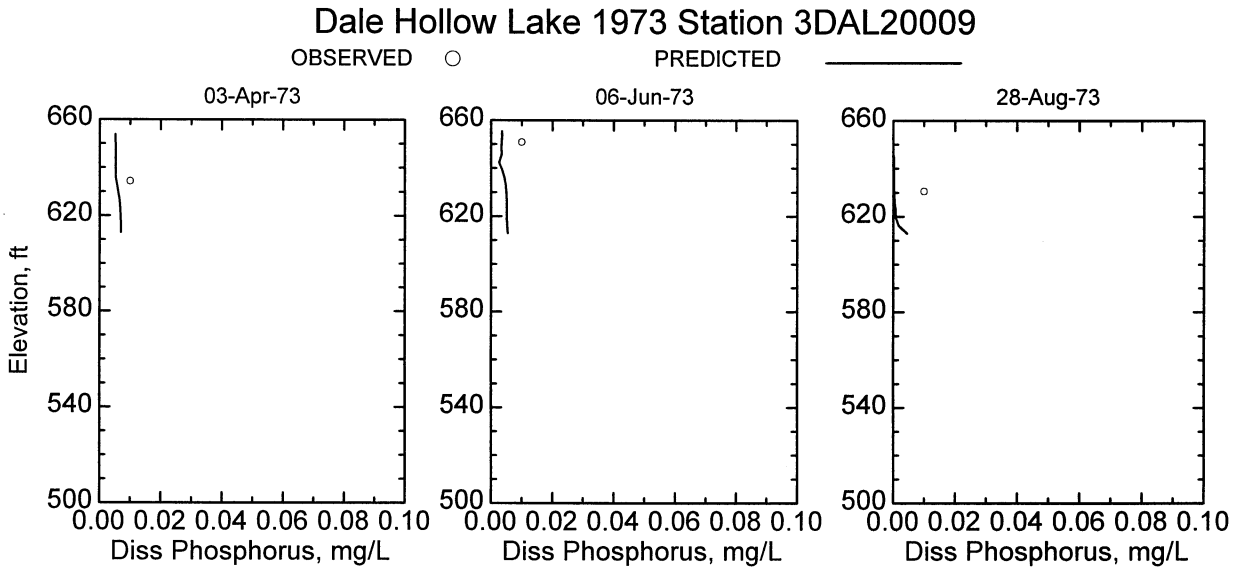
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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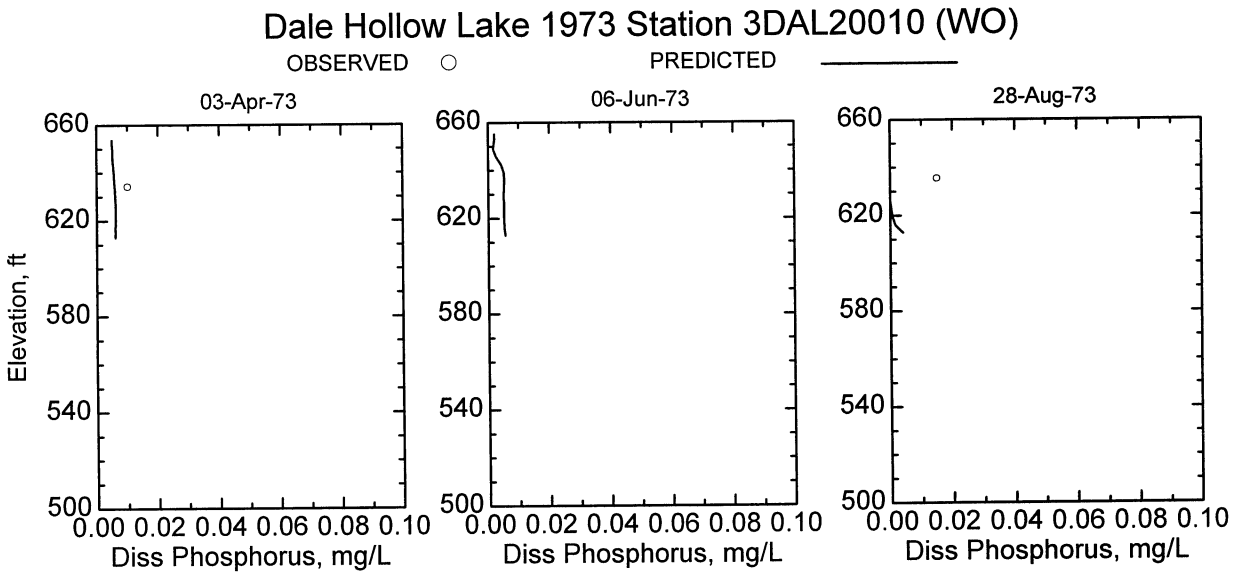
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L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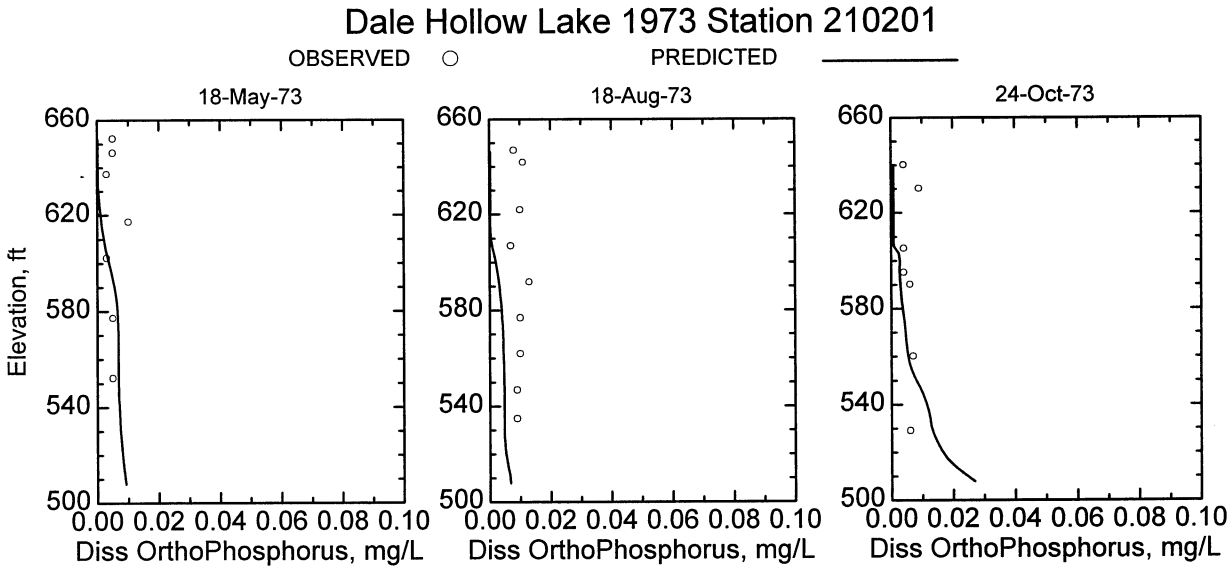
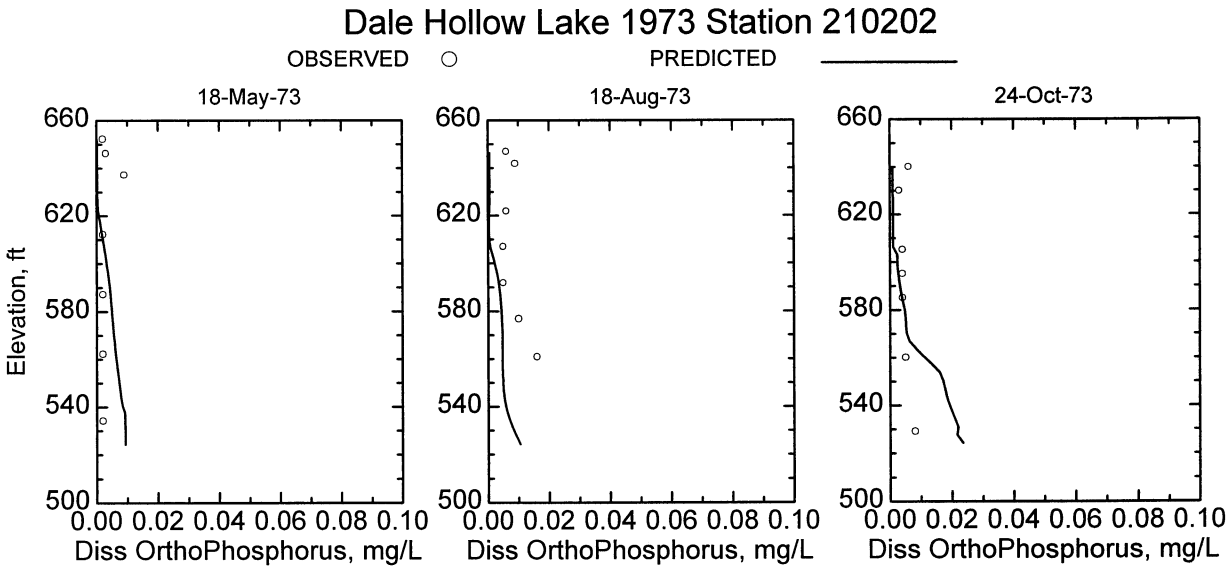
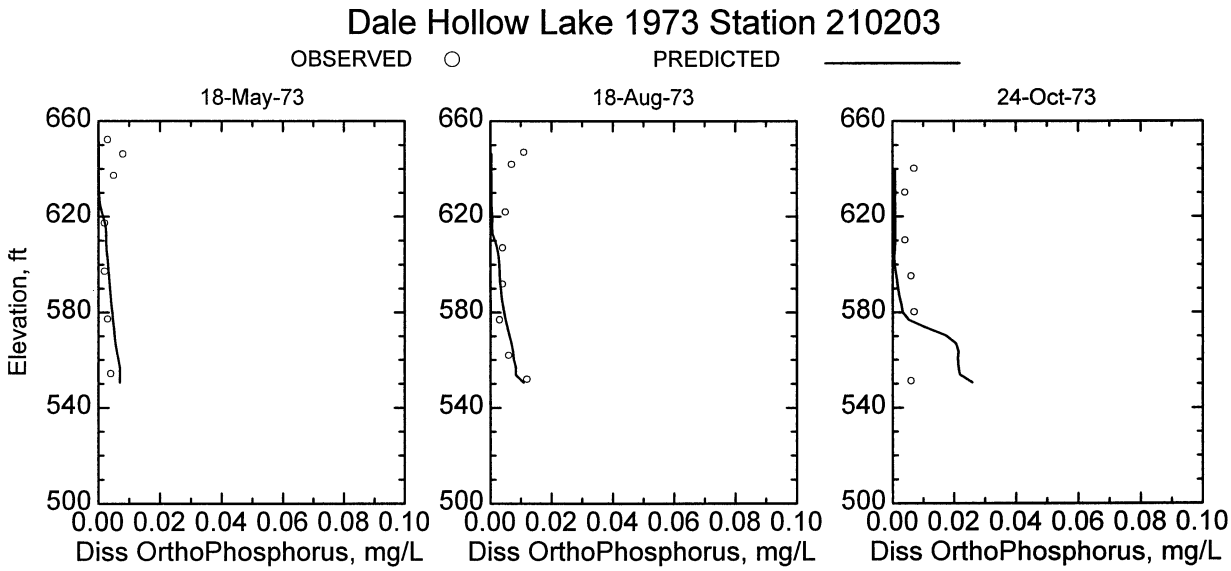
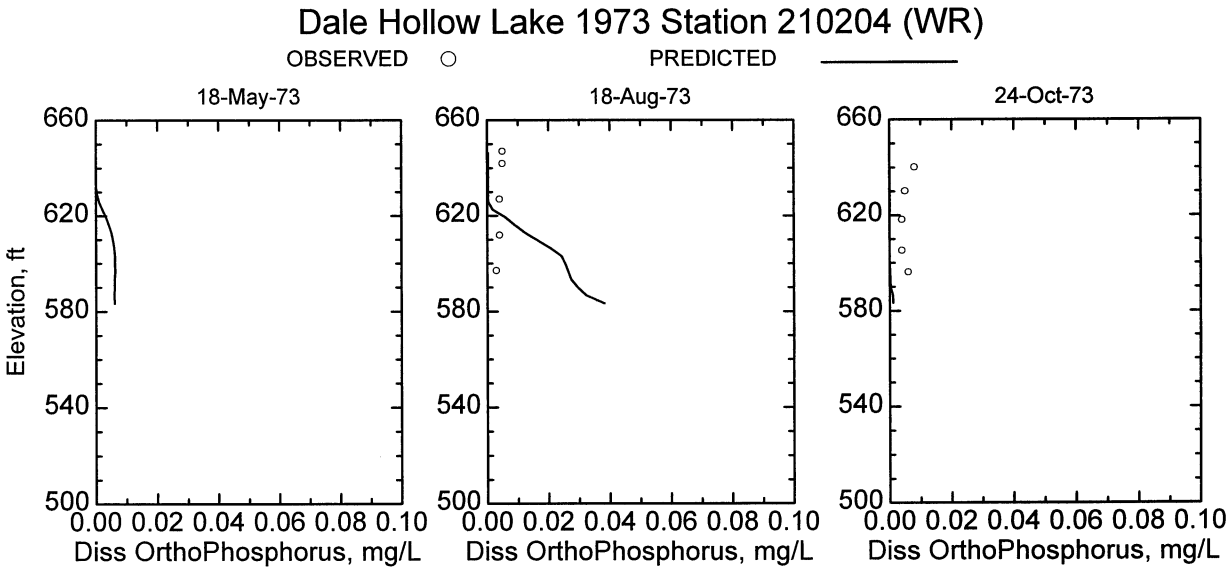
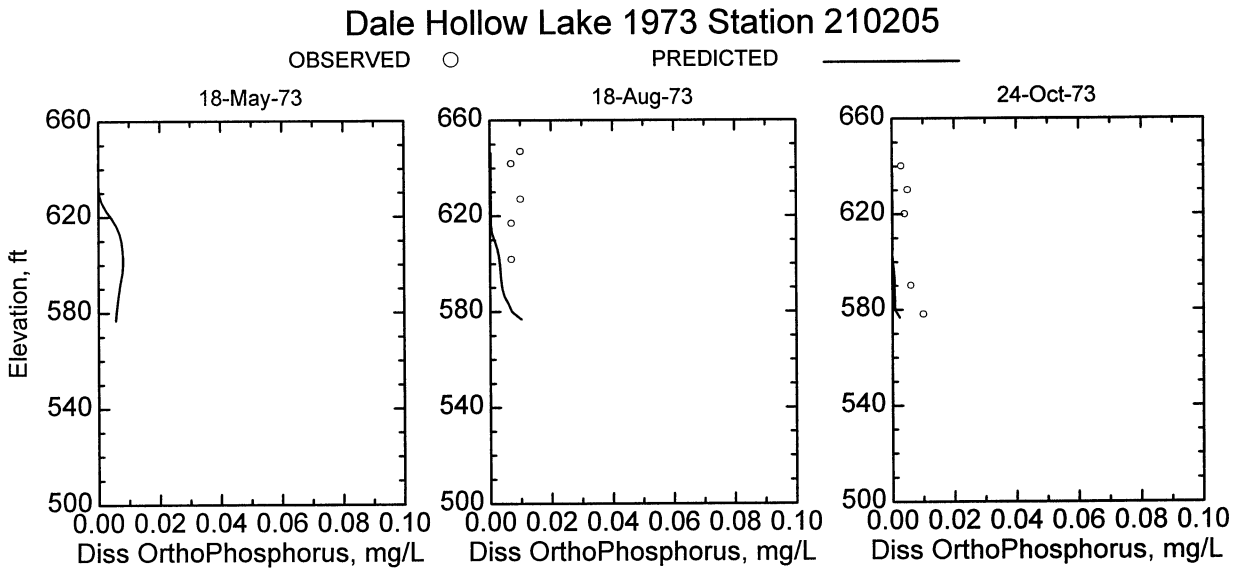
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

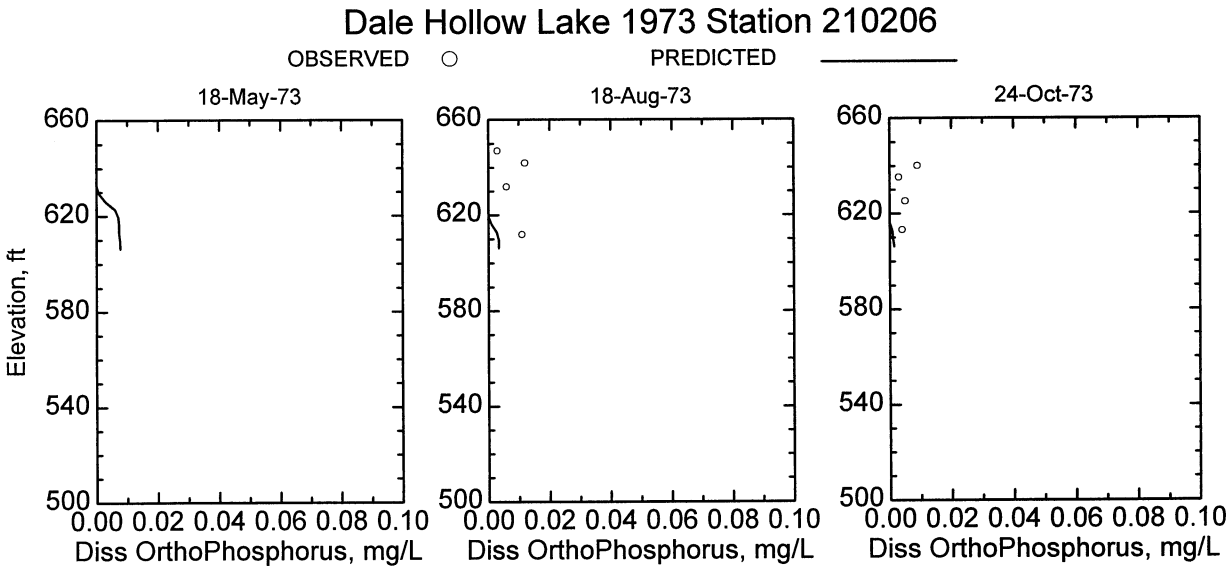

Dale Hollow Lake 1973 Station 210201
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss OrthoPhosphorus, mg/L


Dale Hollow Lake 1973 Station 210202
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss OrthoPhosphorus, mg/L


Dale Hollow Lake 1973 Station 210203
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss OrthoPhosphorus, mg/L


Dale Hollow Lake 1973 Station 210204 (WR)
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss OrthoPhosphorus, mg/L


Dale Hollow Lake 1973 Station 210205
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss OrthoPhosphorus, mg/L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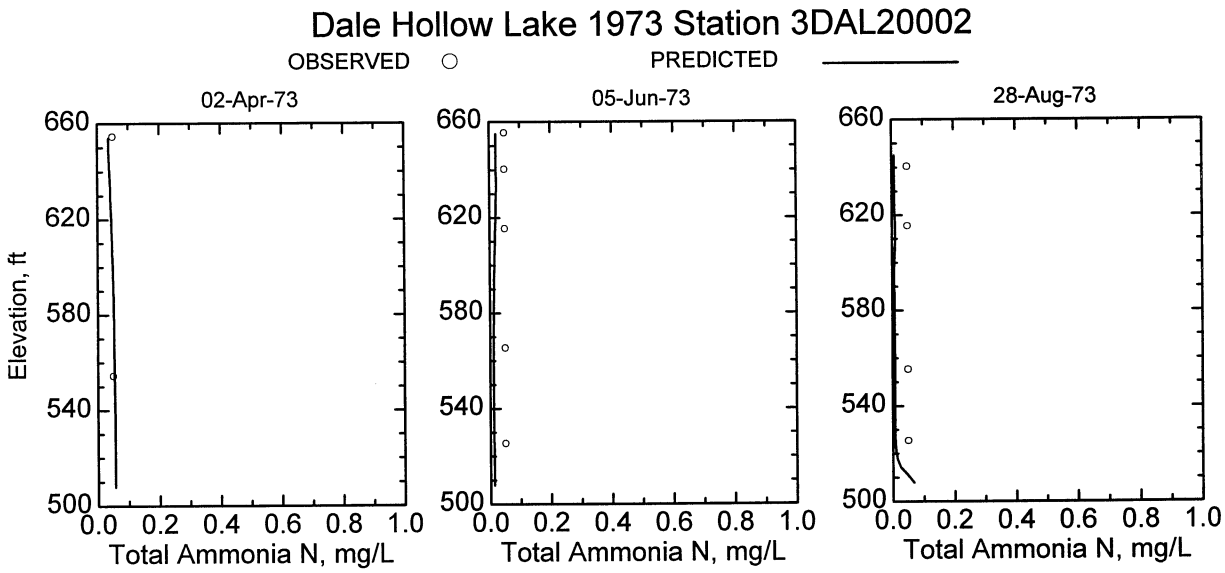
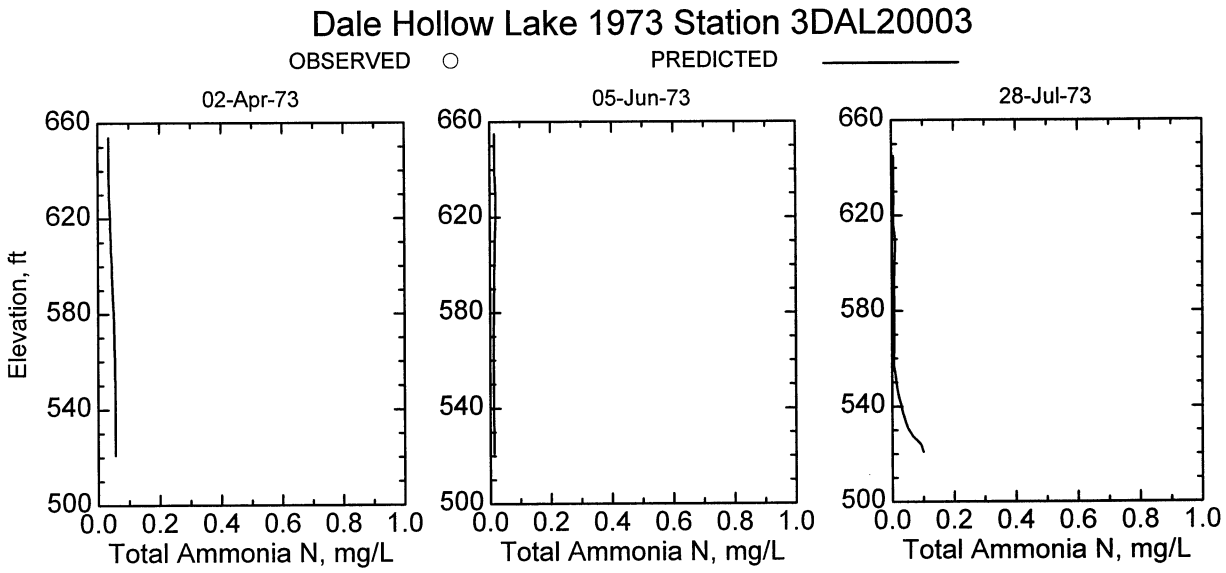
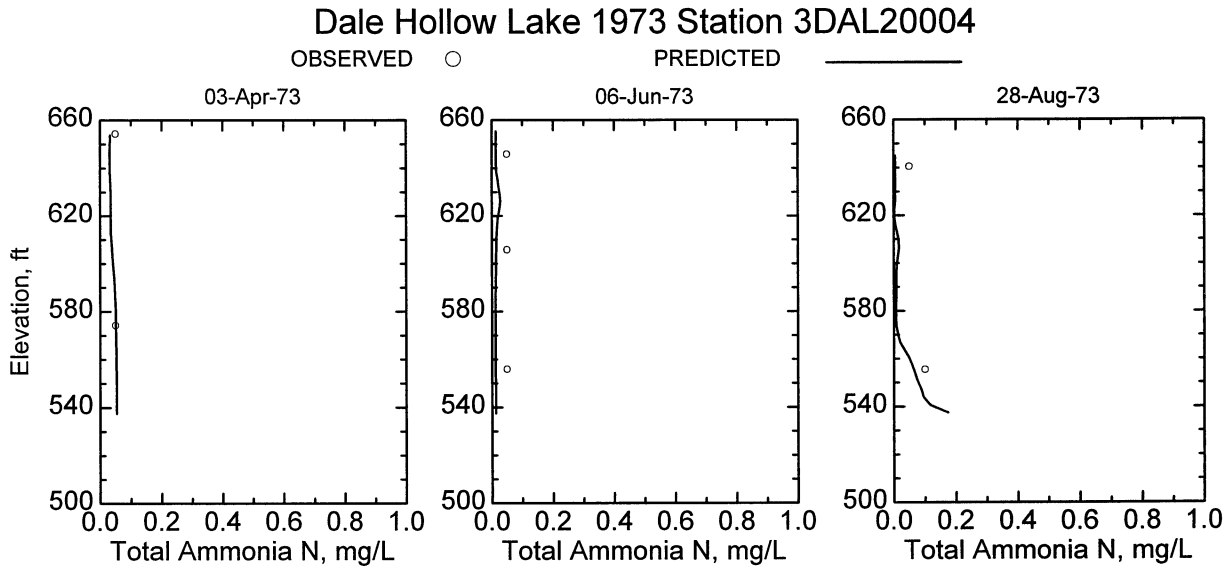
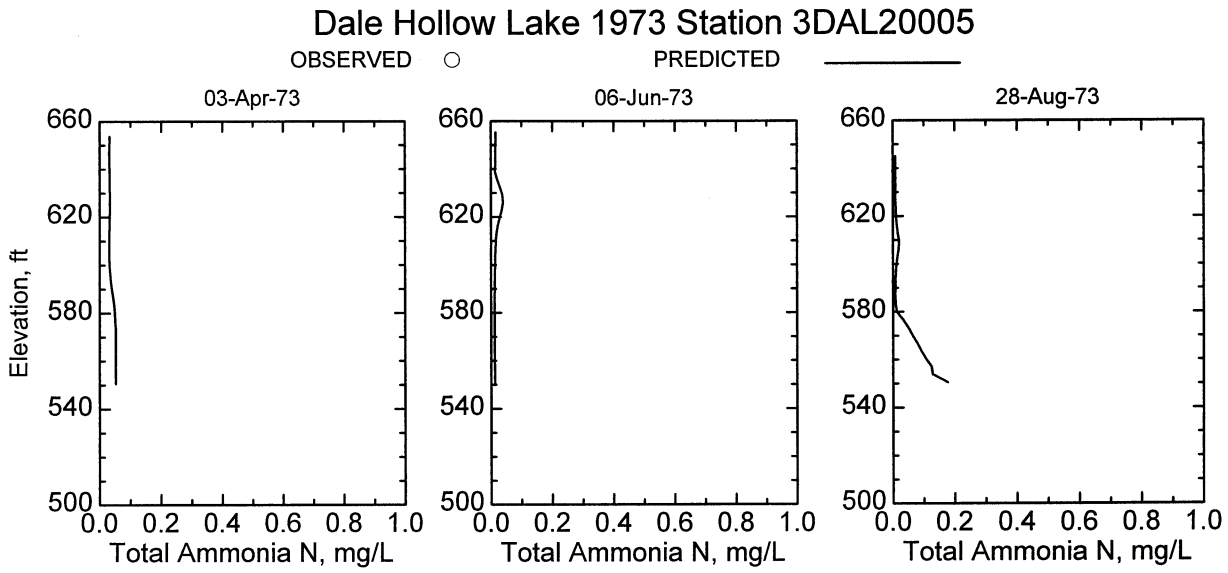
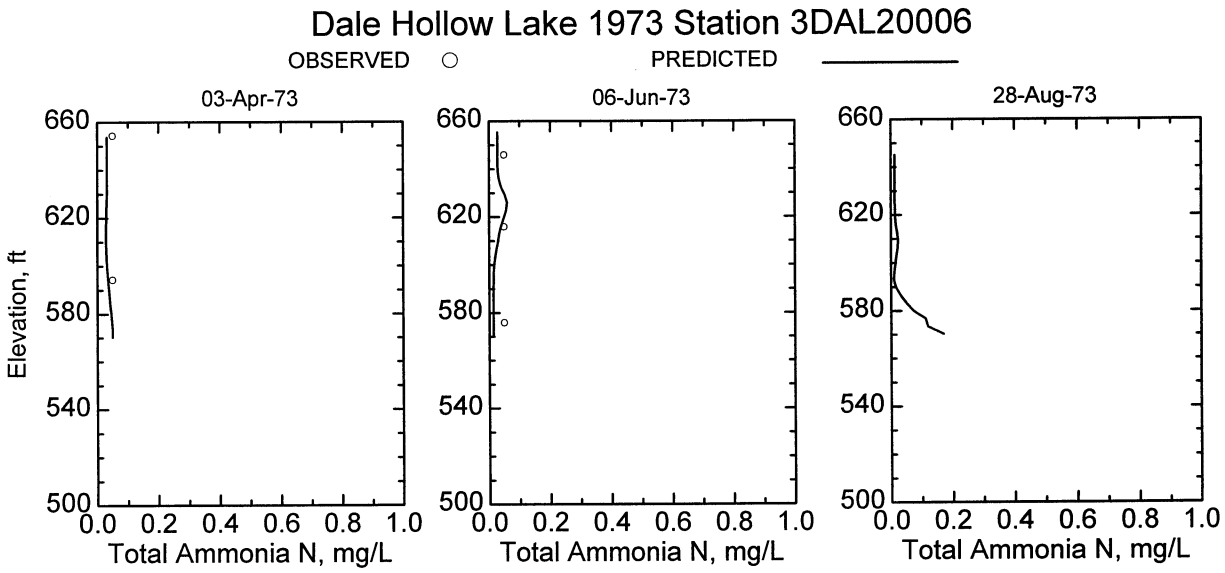
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss OrthoPhosphorus, mg/L

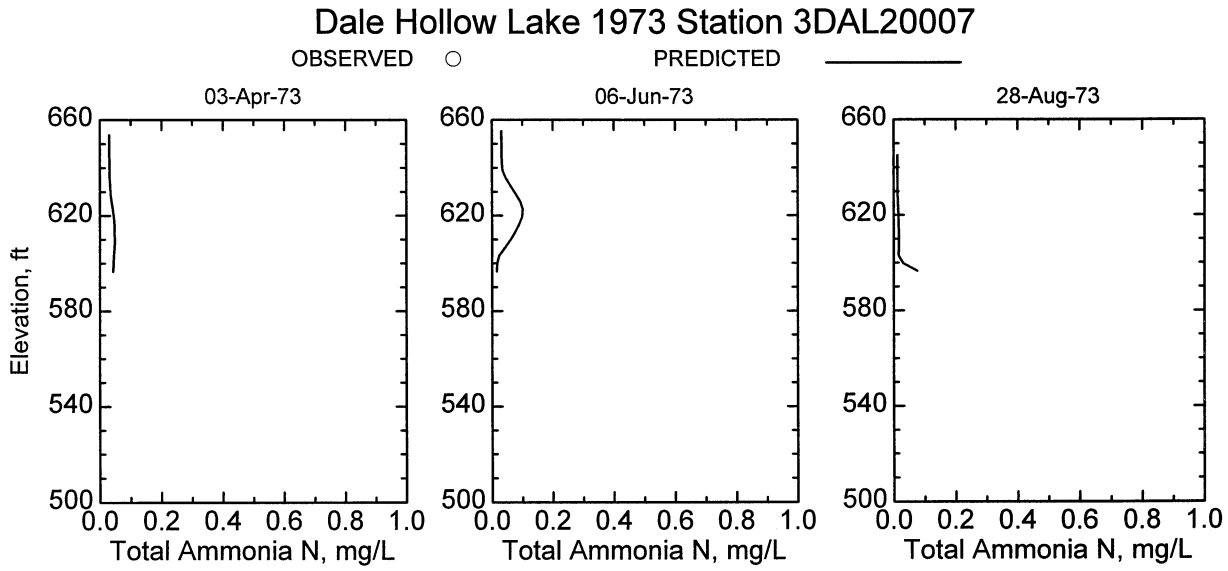

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L


Dale Hollow Lake 1973 Station 3DAL20003
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Jul-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L


Dale Hollow Lake 1973 Station 3DAL20004
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L


Dale Hollow Lake 1973 Station 3DAL20005
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L


Dale Hollow Lake 1973 Station 3DAL20006
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L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OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
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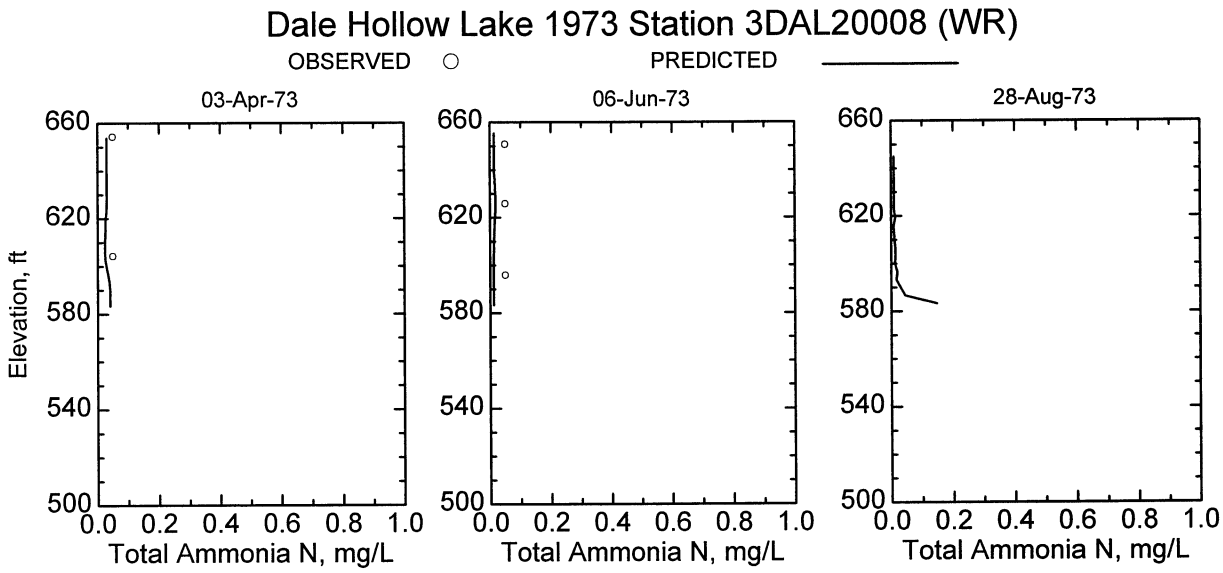
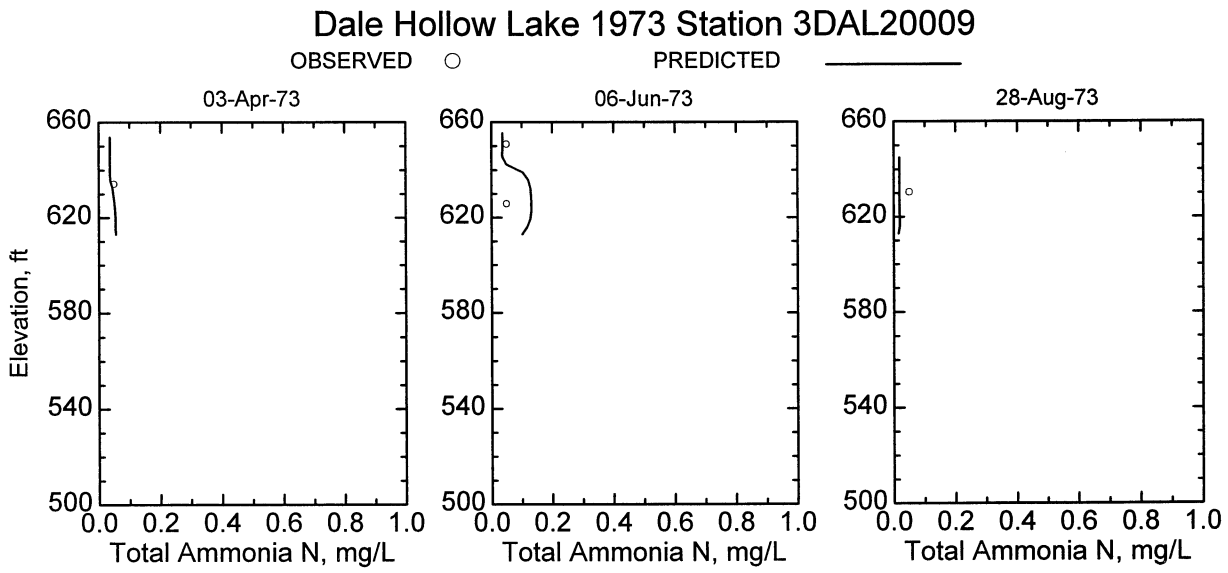
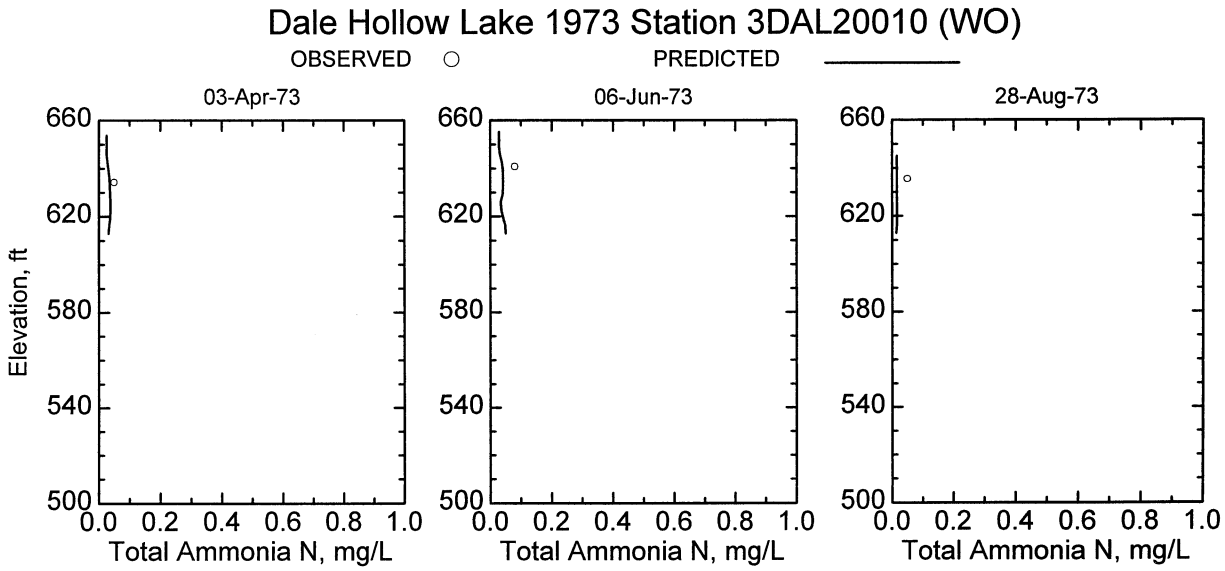
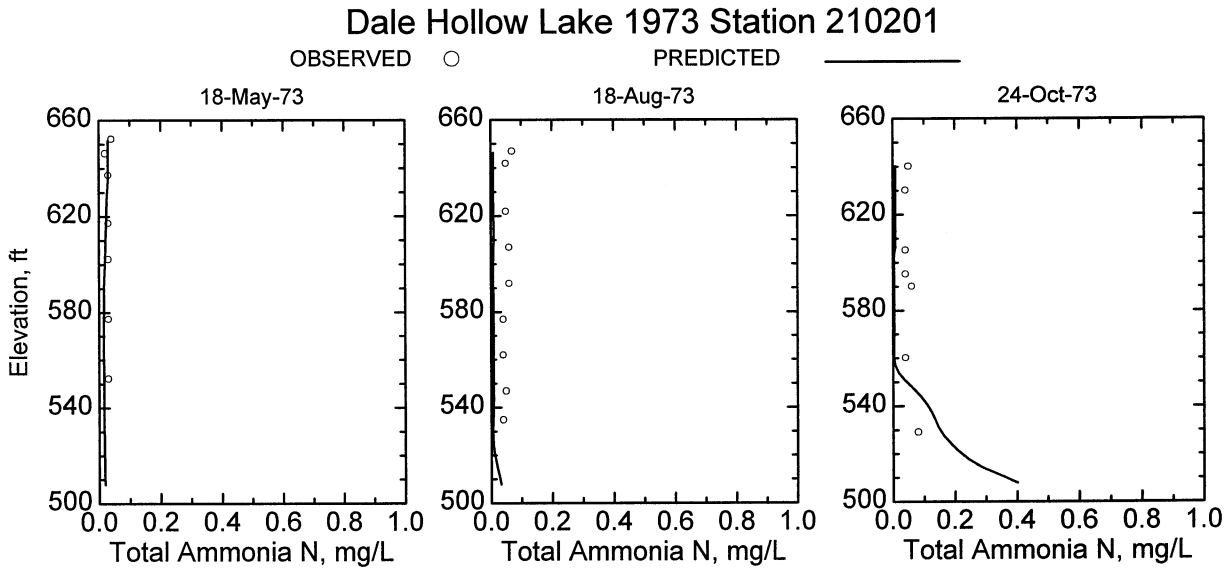
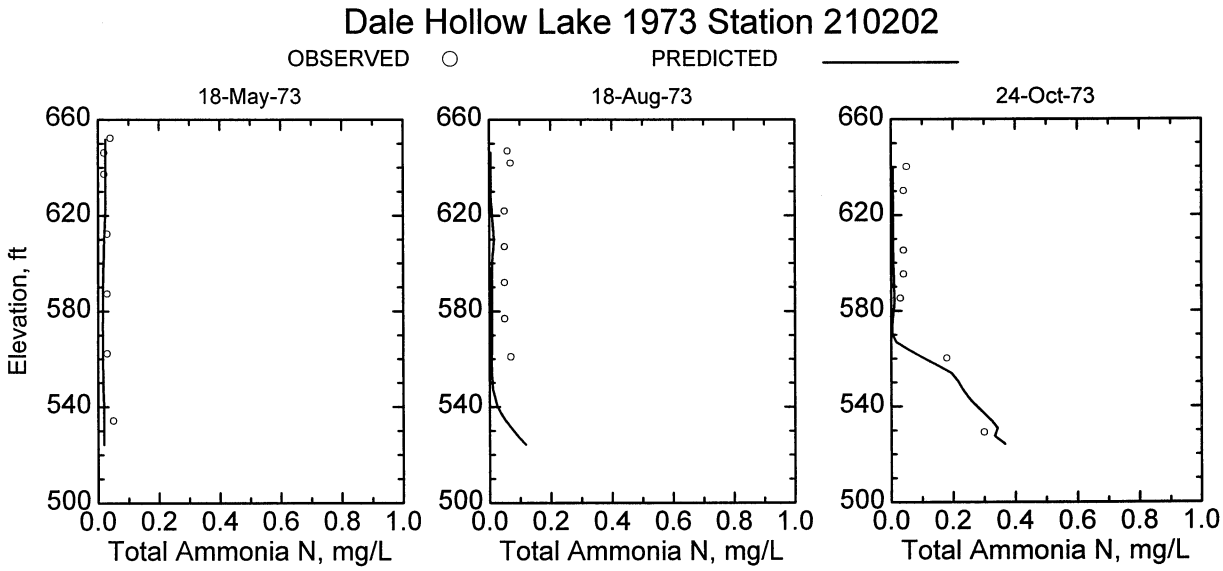
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

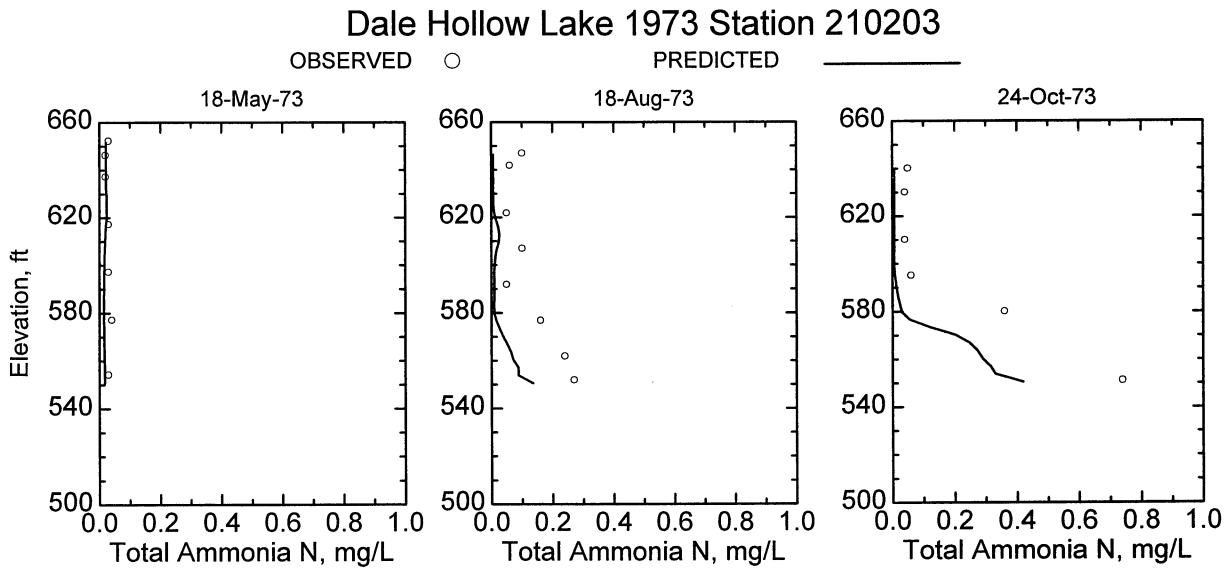

Dale Hollow Lake 1973 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

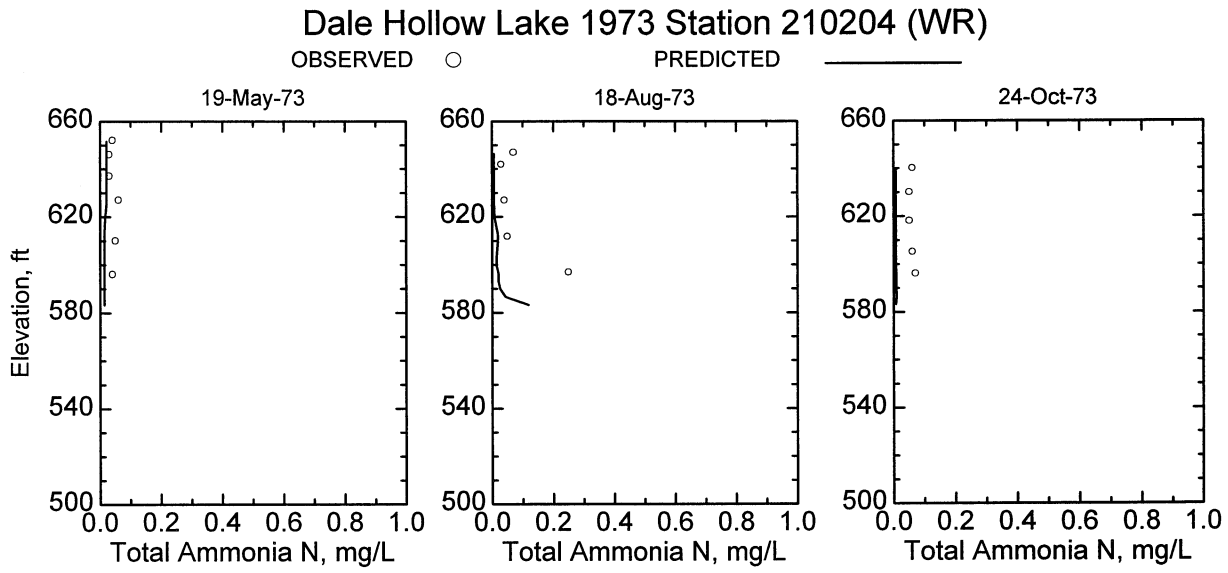

Dale Hollow Lake 1973 Station 3DAL20009
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

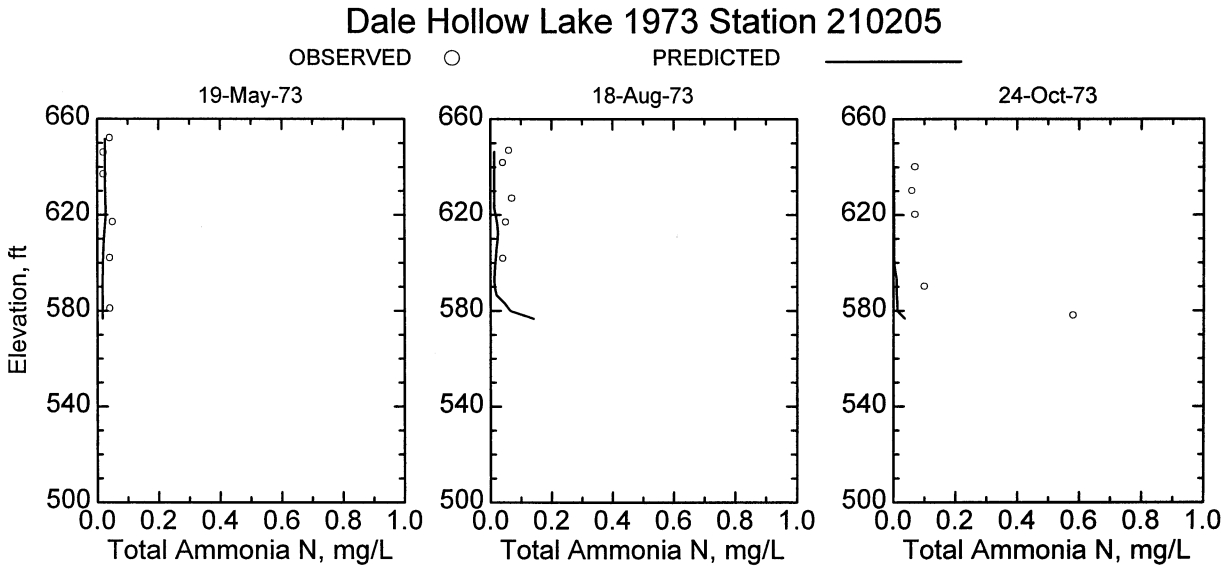

Dale Hollow Lake 1973 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

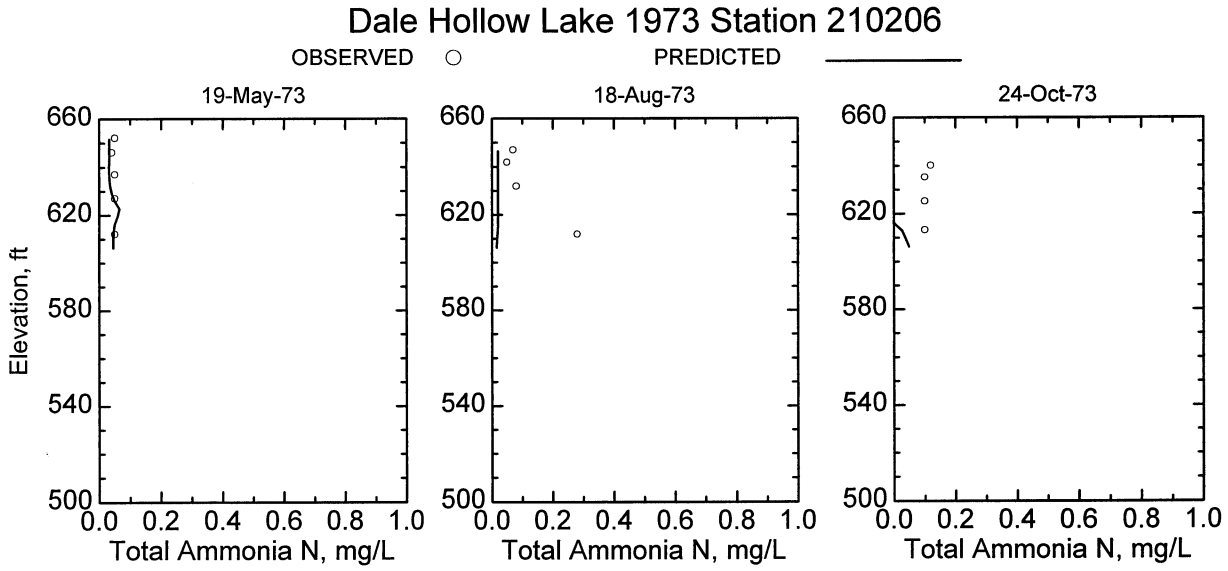

Dale Hollow Lake 1973 Station 210201
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

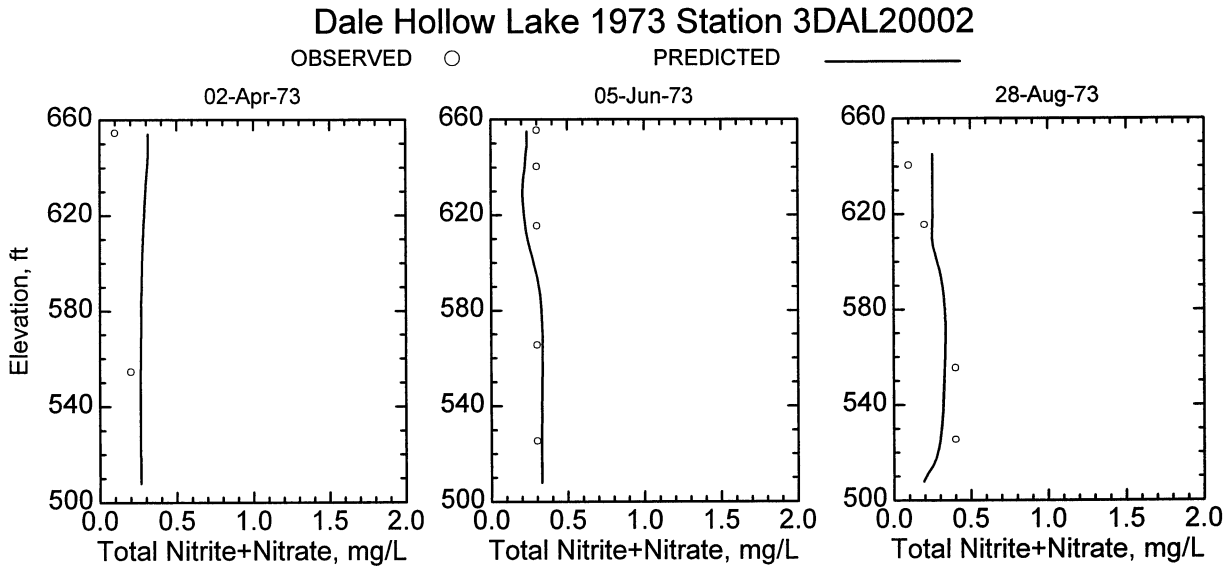

Dale Hollow Lake 1973 Station 210202
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

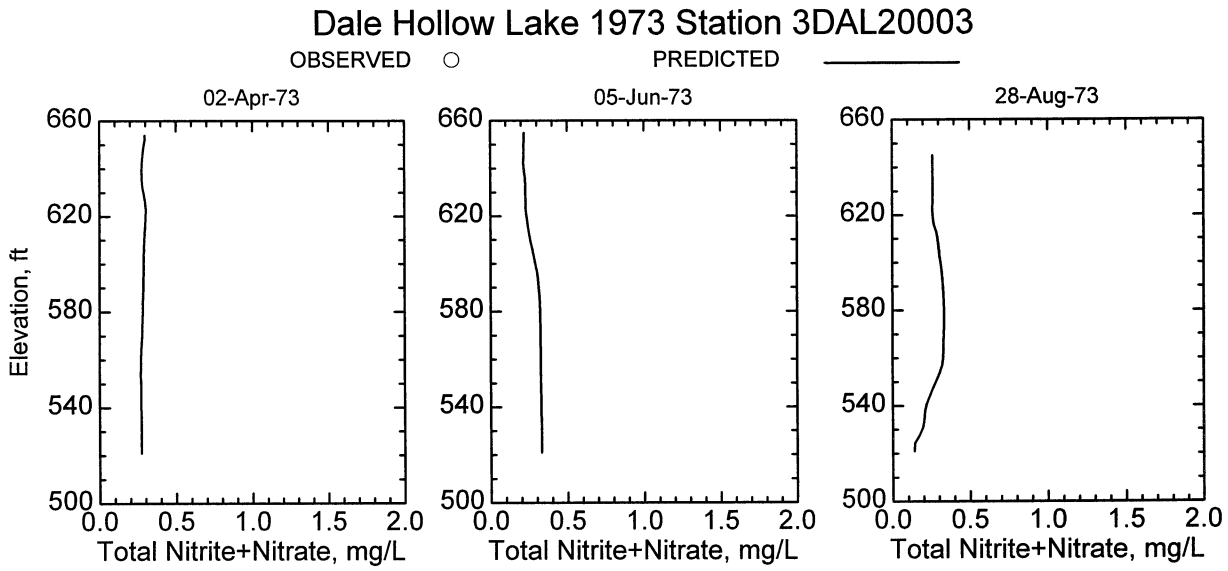

Dale Hollow Lake 1973 Station 210203
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

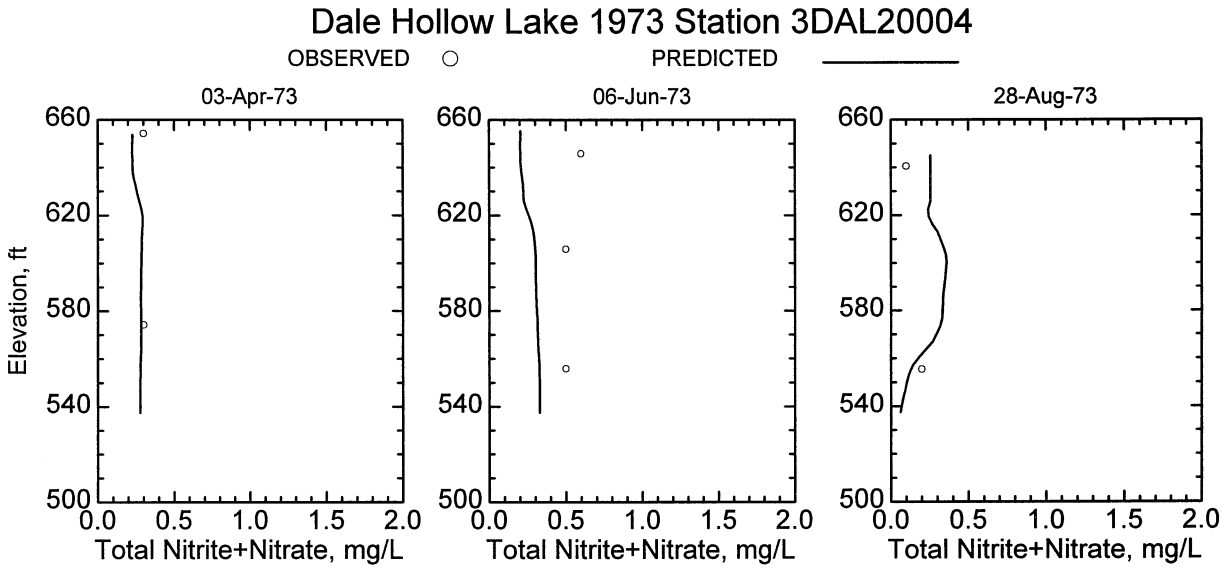

Dale Hollow Lake 1973 Station 210204 (WR)
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

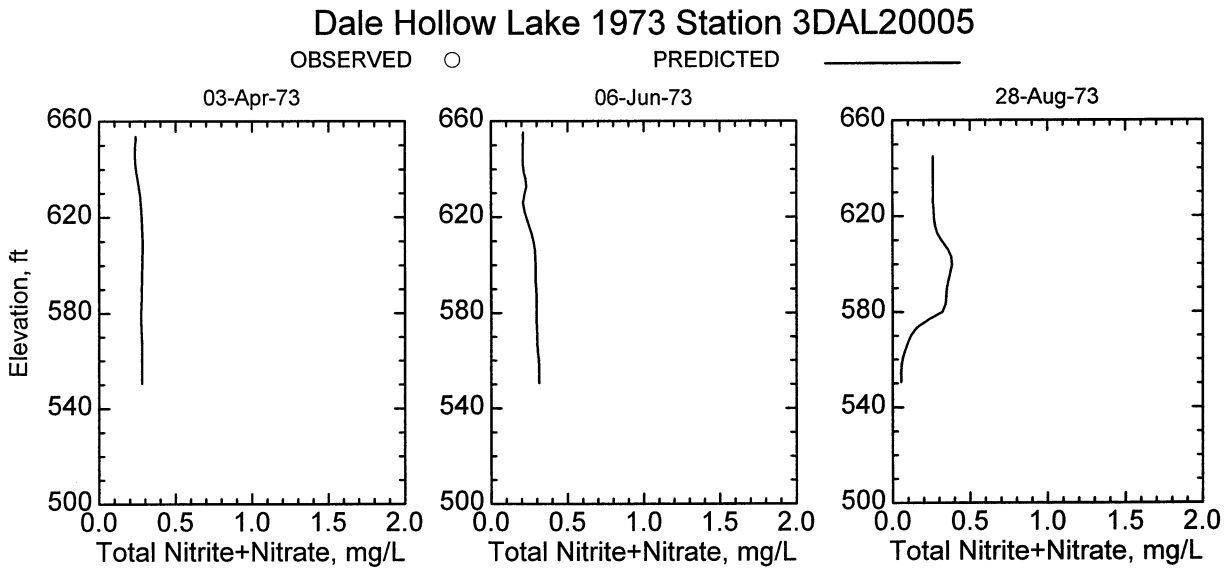

Dale Hollow Lake 1973 Station 210205
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

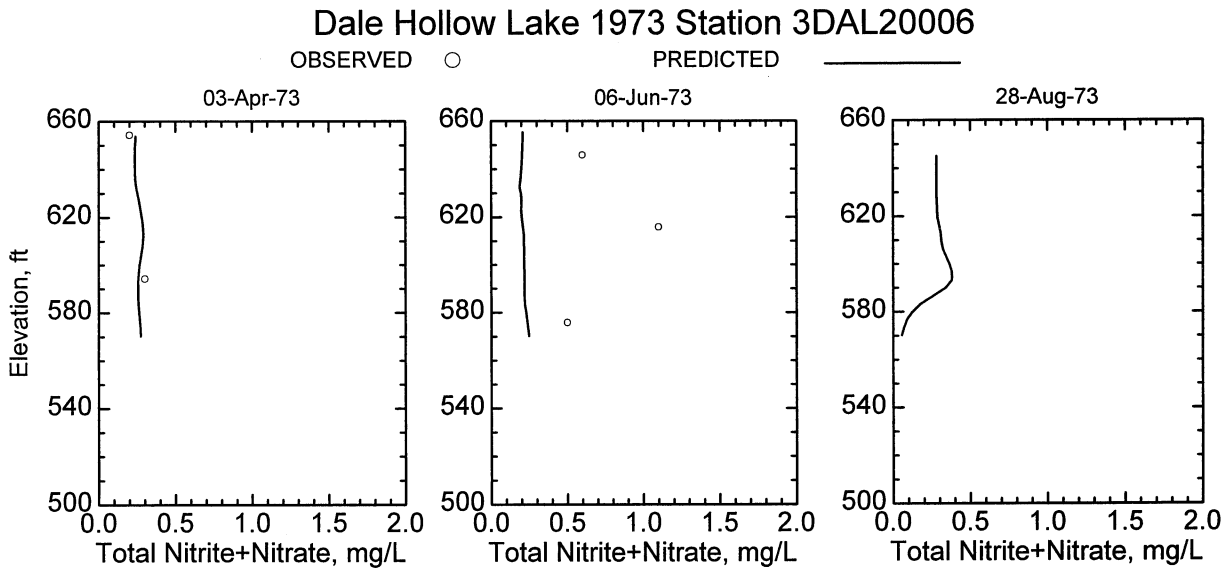

Dale Hollow Lake 1973 Station 210206
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

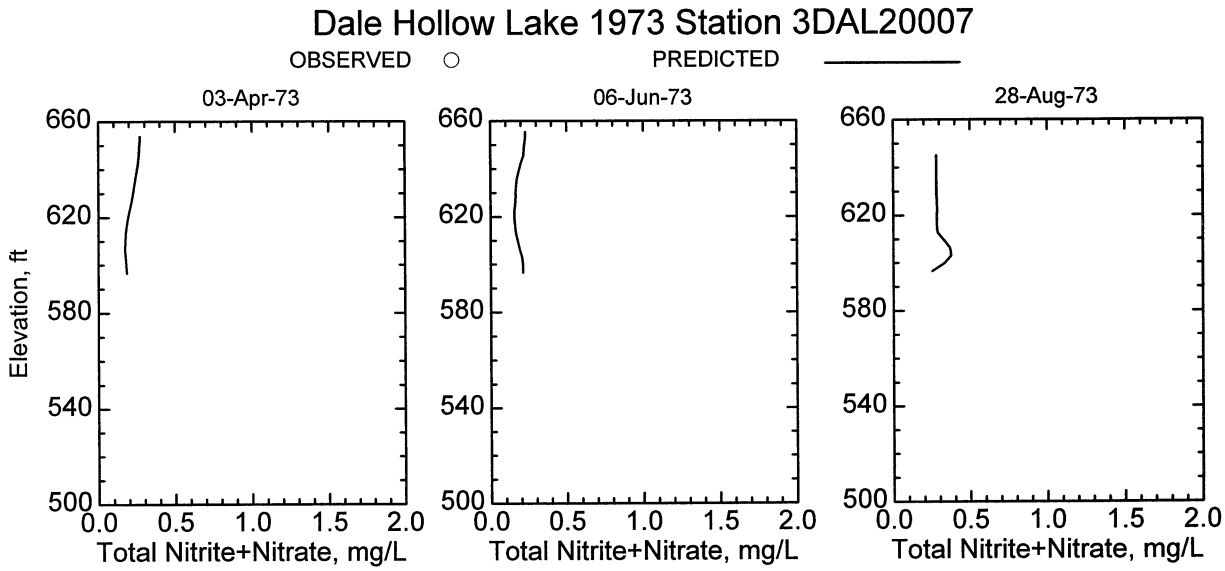

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

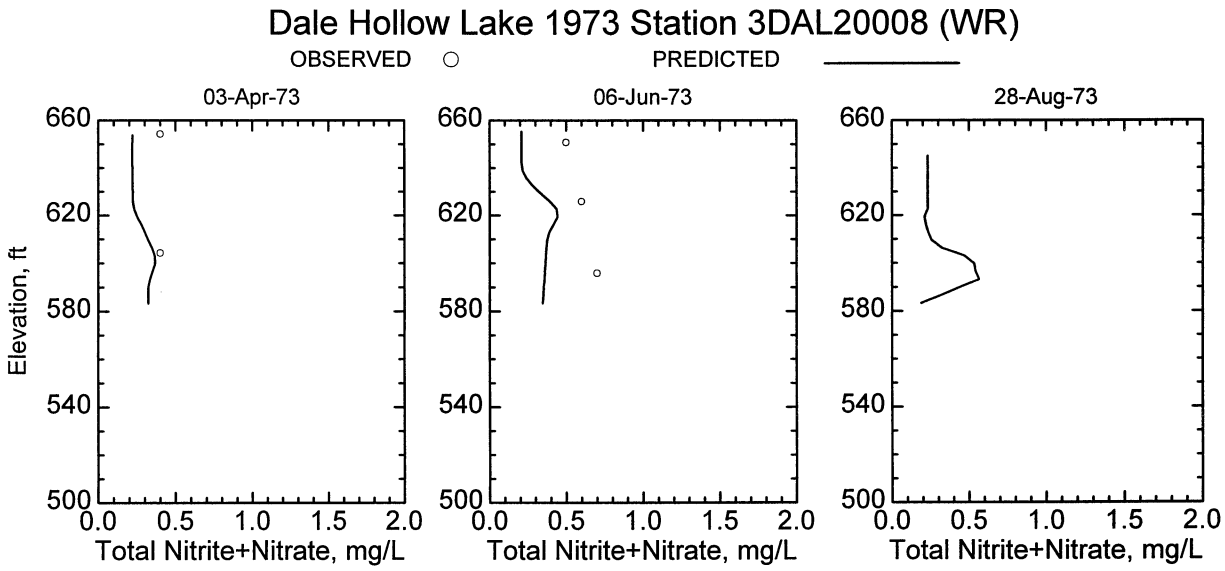

Dale Hollow Lake 1973 Station 3DAL20003
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

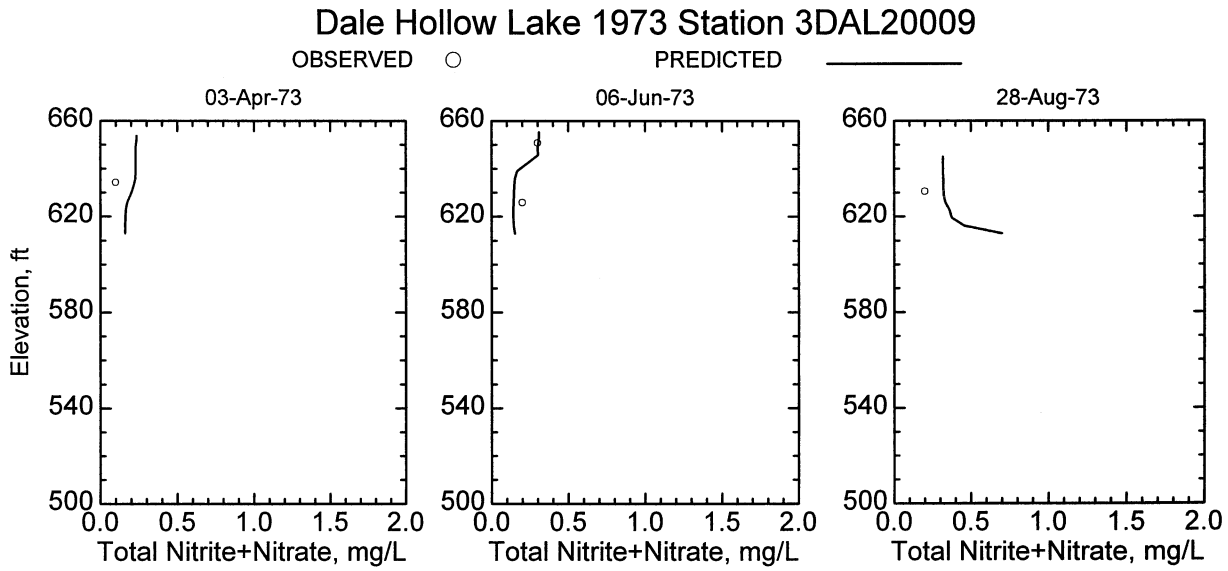

Dale Hollow Lake 1973 Station 3DAL20004
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

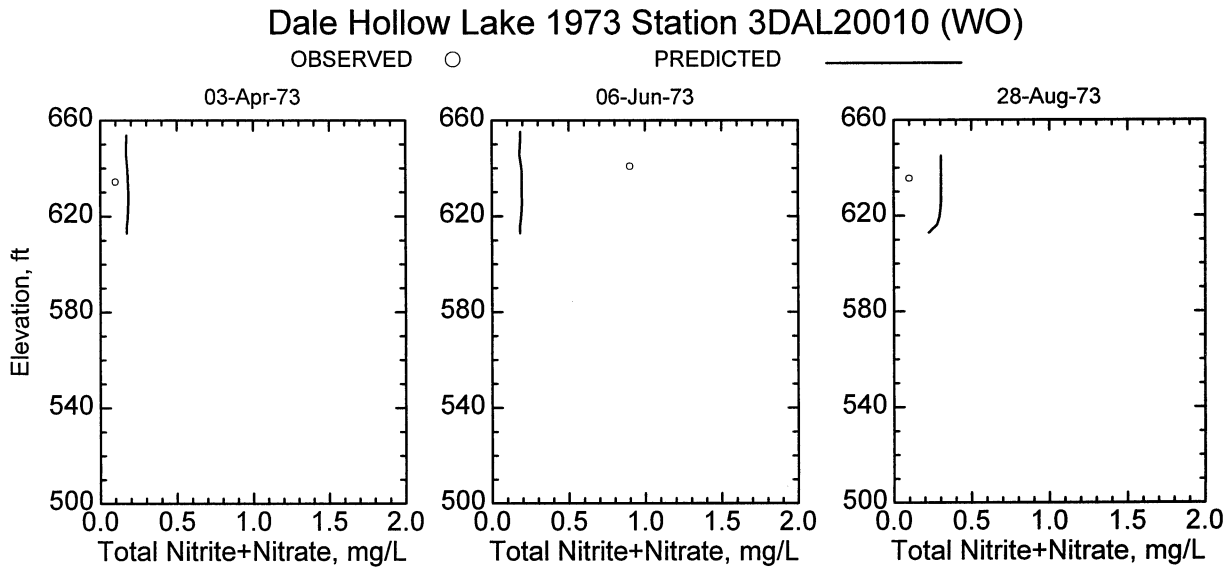

Dale Hollow Lake 1973 Station 3DAL20005
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

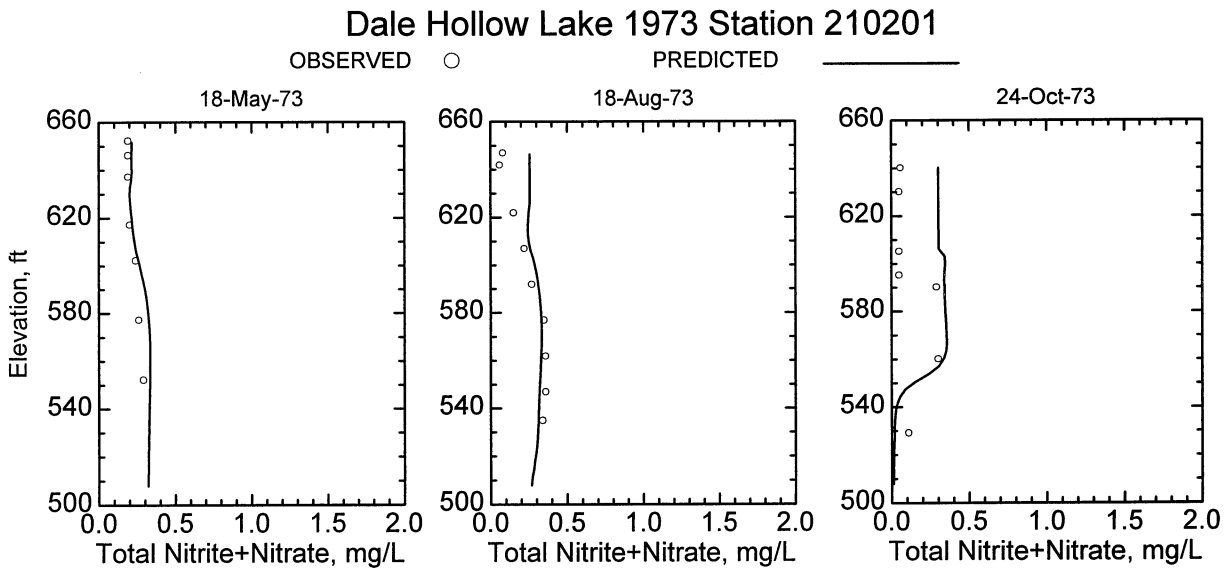

Dale Hollow Lake 1973 Station 3DAL20006
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

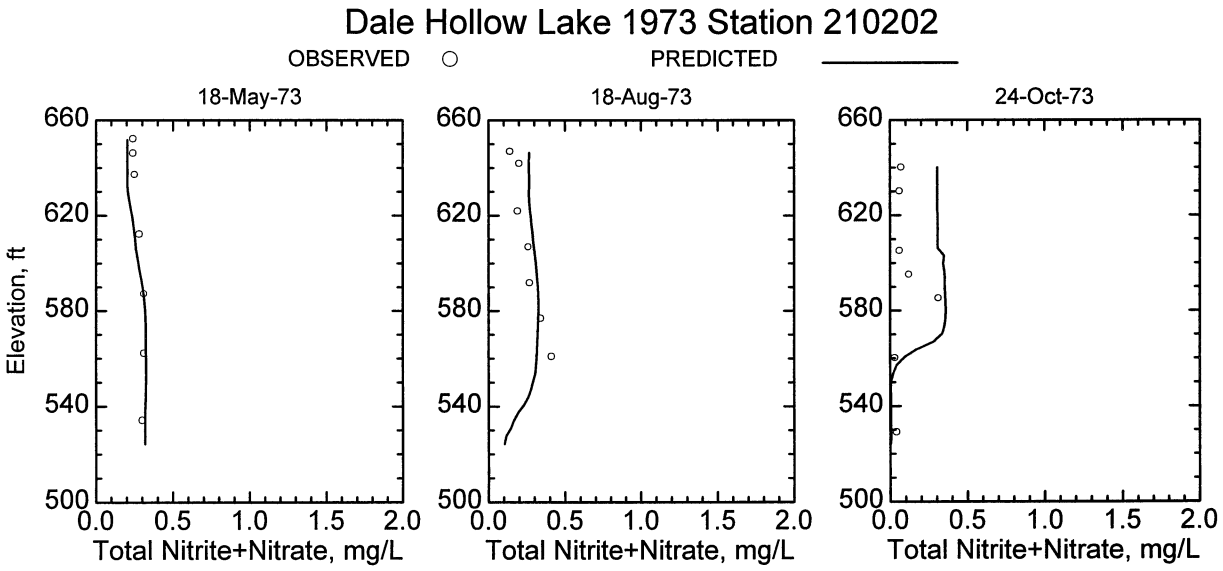

Dale Hollow Lake 1973 Station 3DAL20007
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

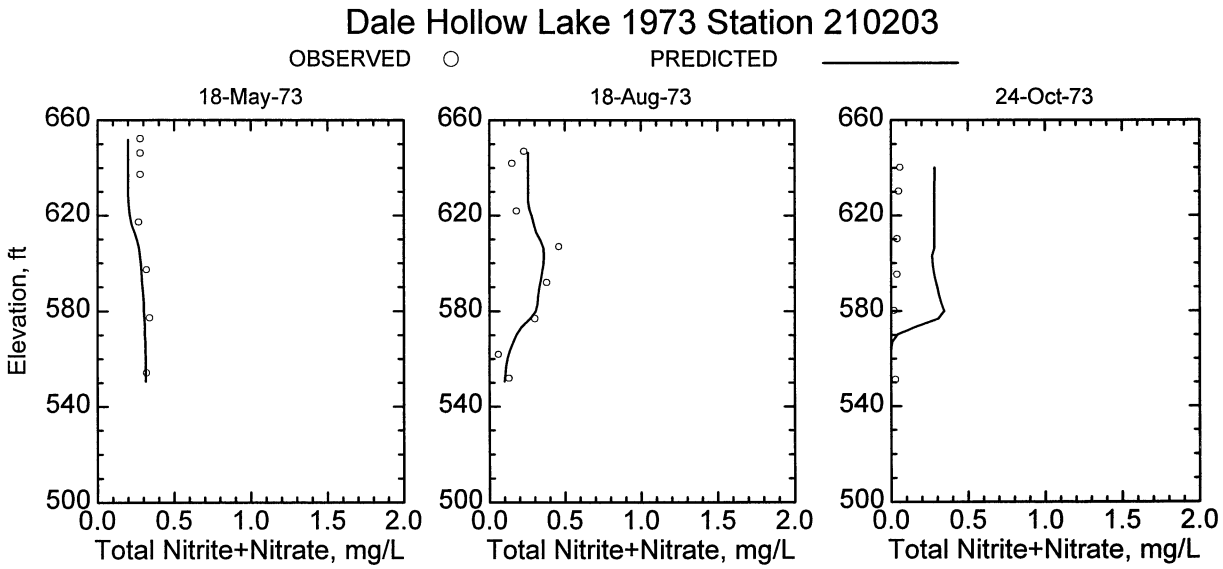

Dale Hollow Lake 1973 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

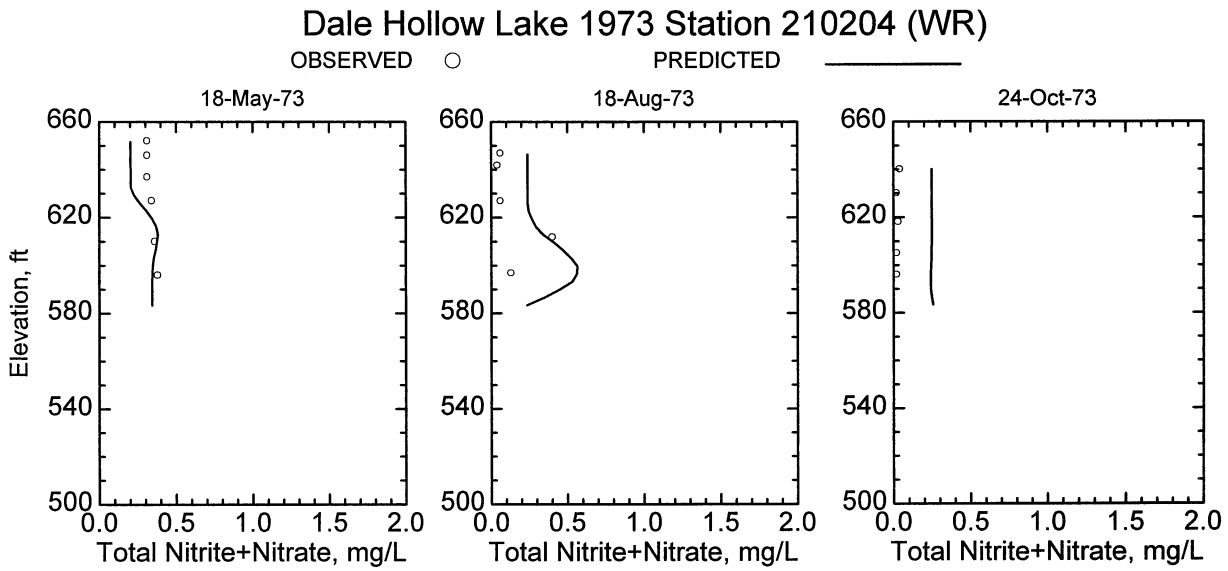

Dale Hollow Lake 1973 Station 3DAL20009
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

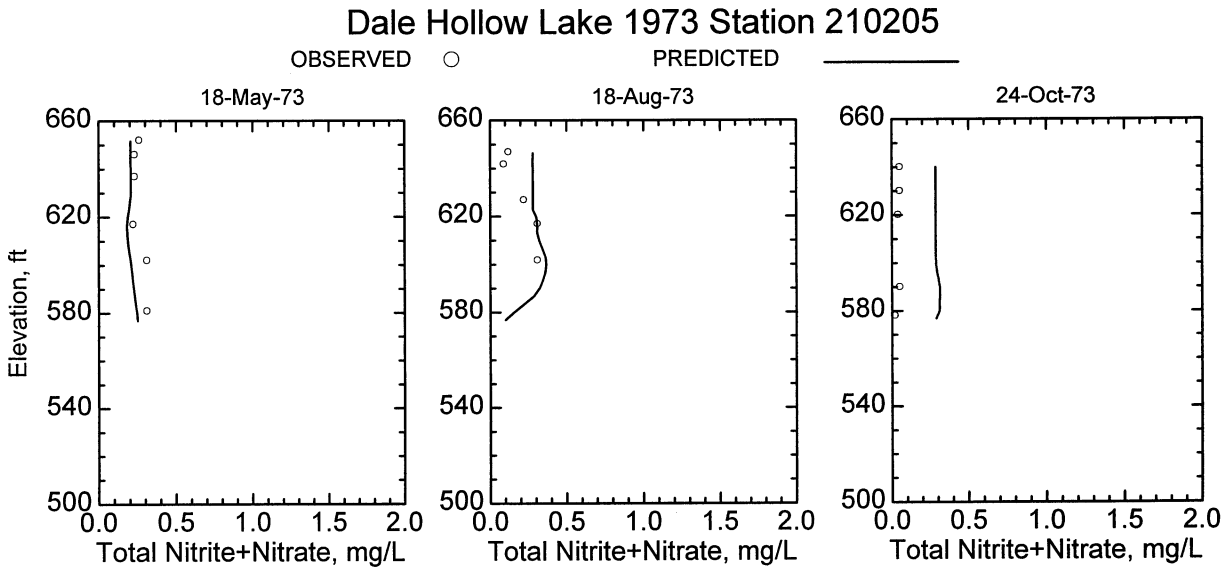

Dale Hollow Lake 1973 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

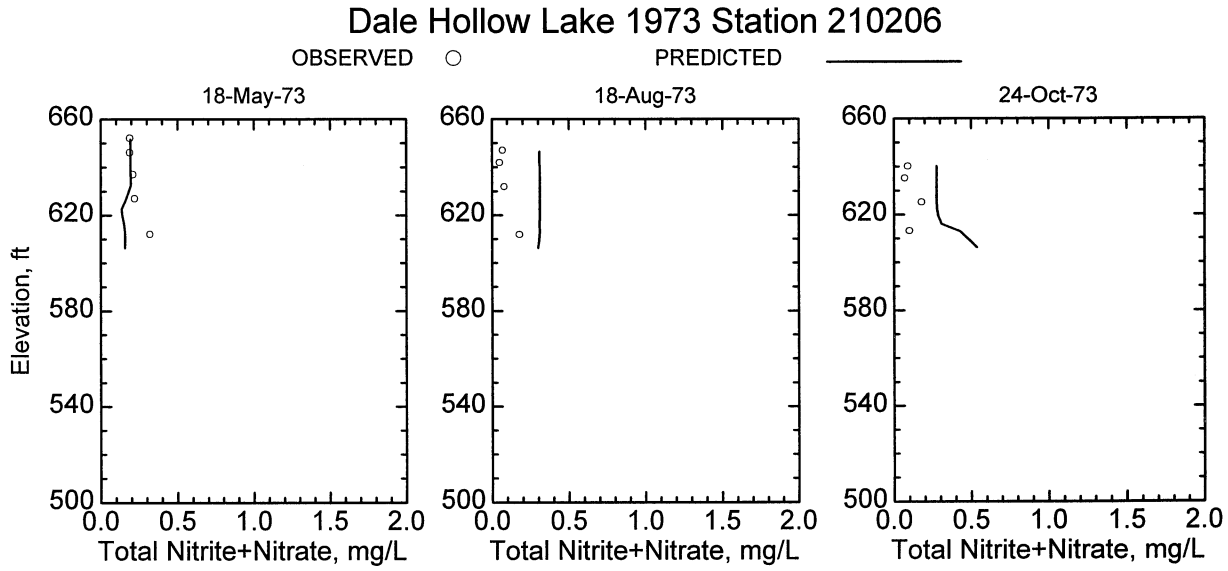

Dale Hollow Lake 1973 Station 210201
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

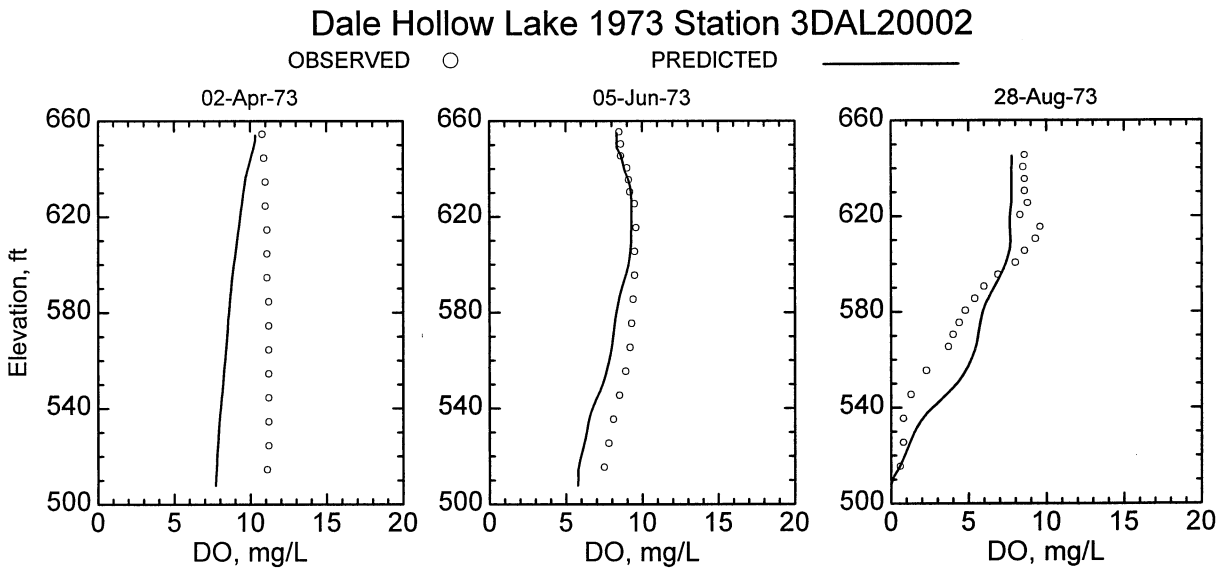

Dale Hollow Lake 1973 Station 210202
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

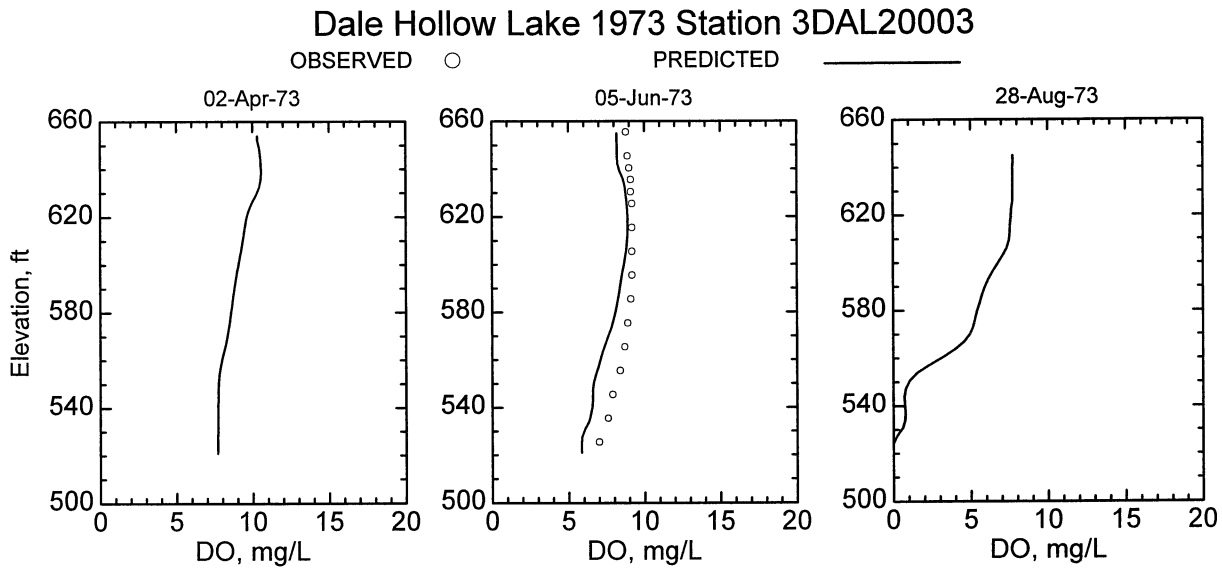

Dale Hollow Lake 1973 Station 210203
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

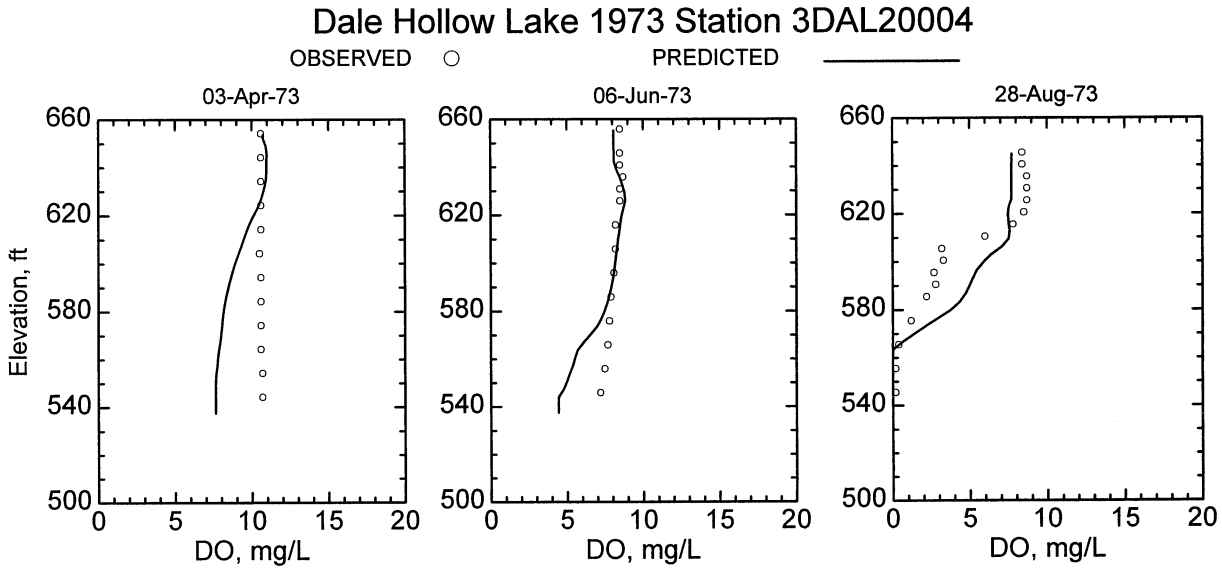

Dale Hollow Lake 1973 Station 210204 (WR)
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

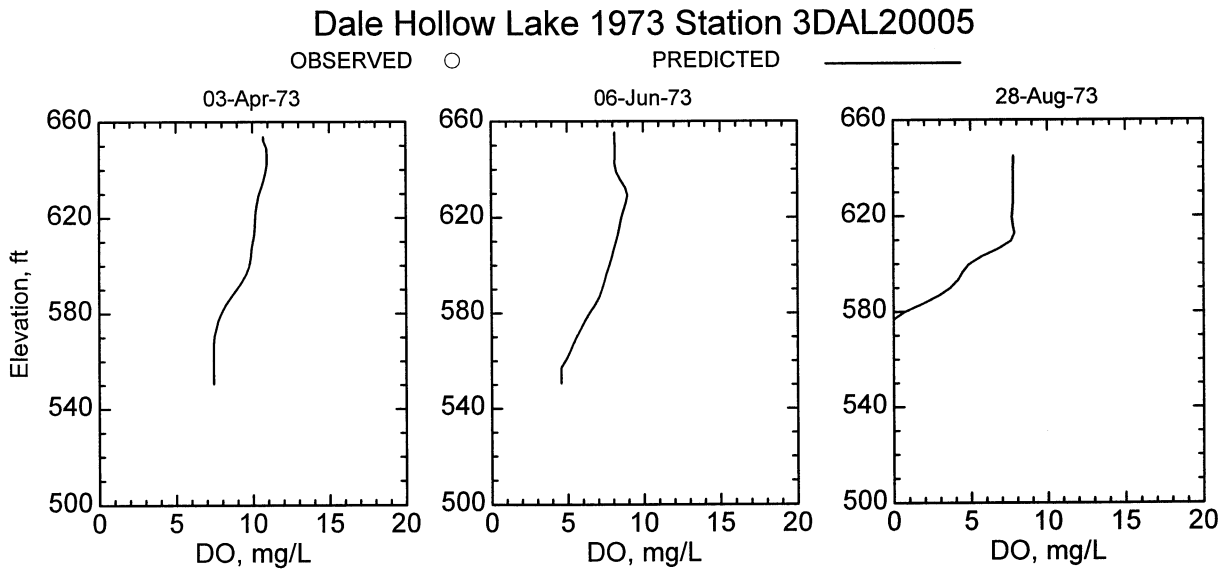

Dale Hollow Lake 1973 Station 210205
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

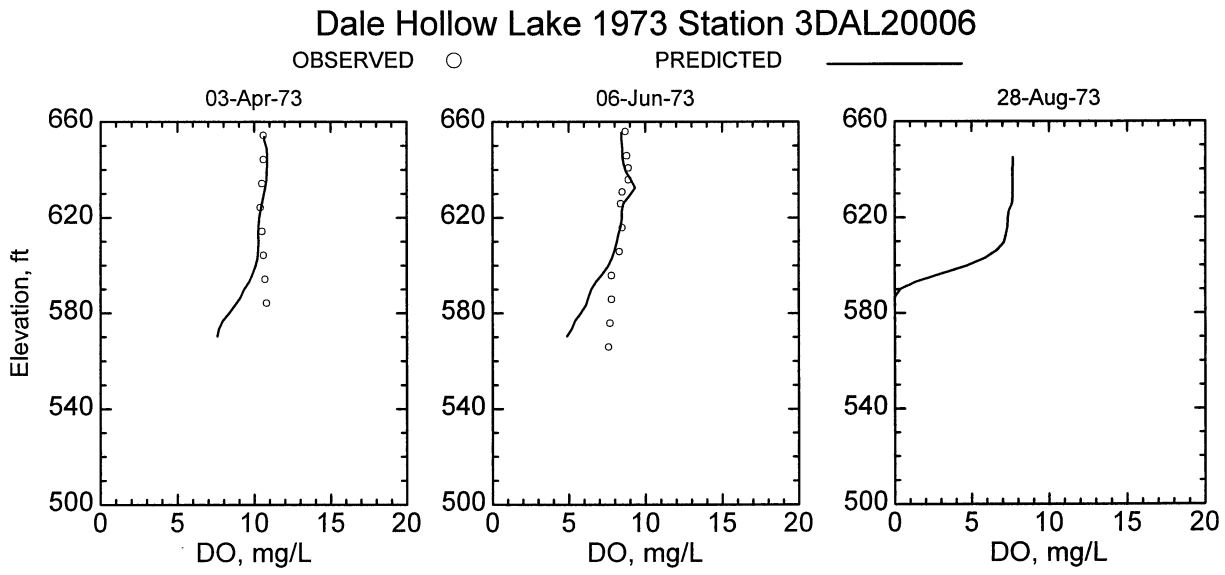

Dale Hollow Lake 1973 Station 210206
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

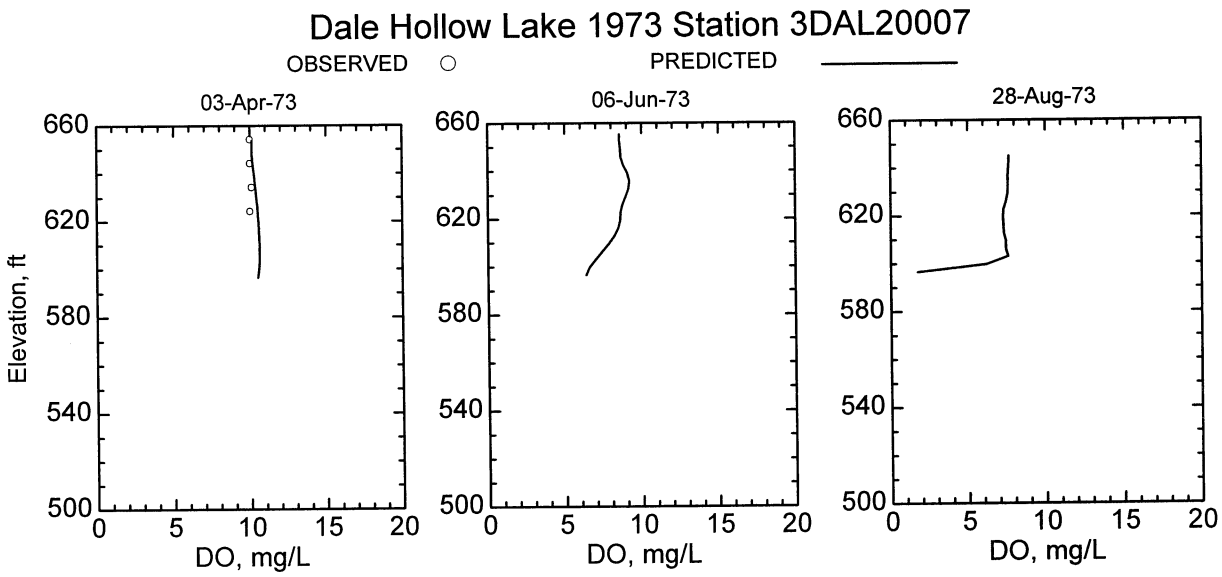

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

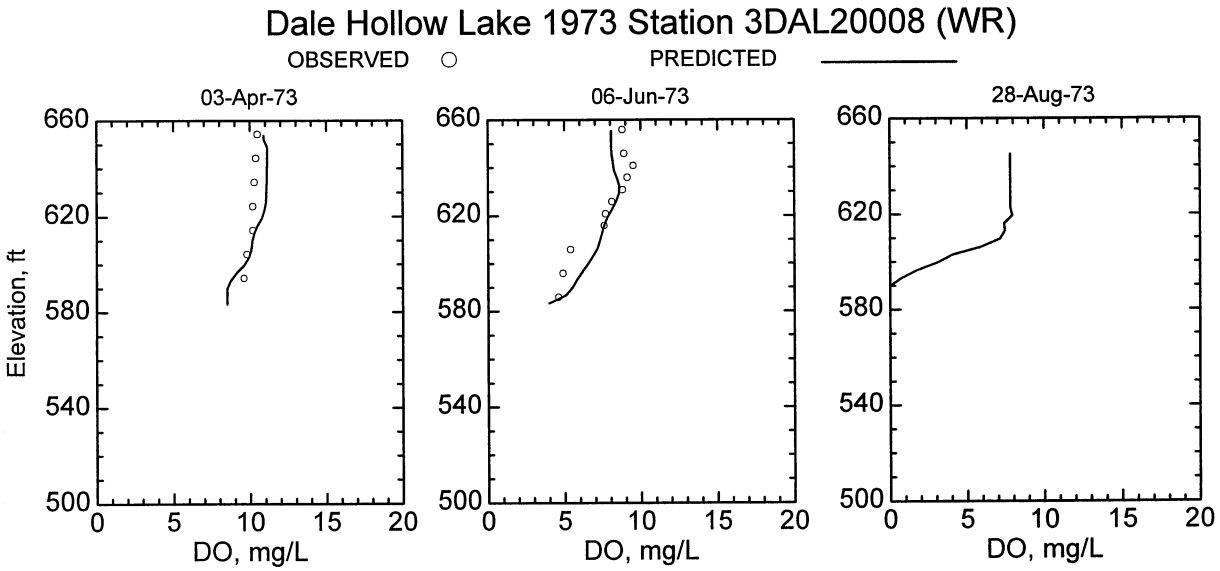

Dale Hollow Lake 1973 Station 3DAL20003
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

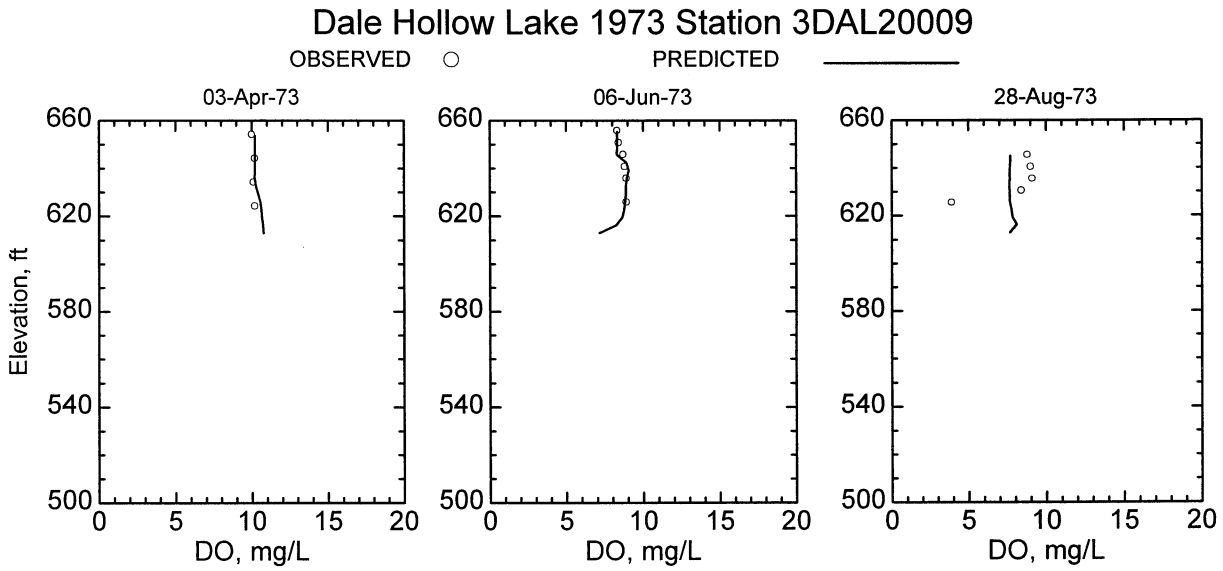

Dale Hollow Lake 1973 Station 3DAL20004
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

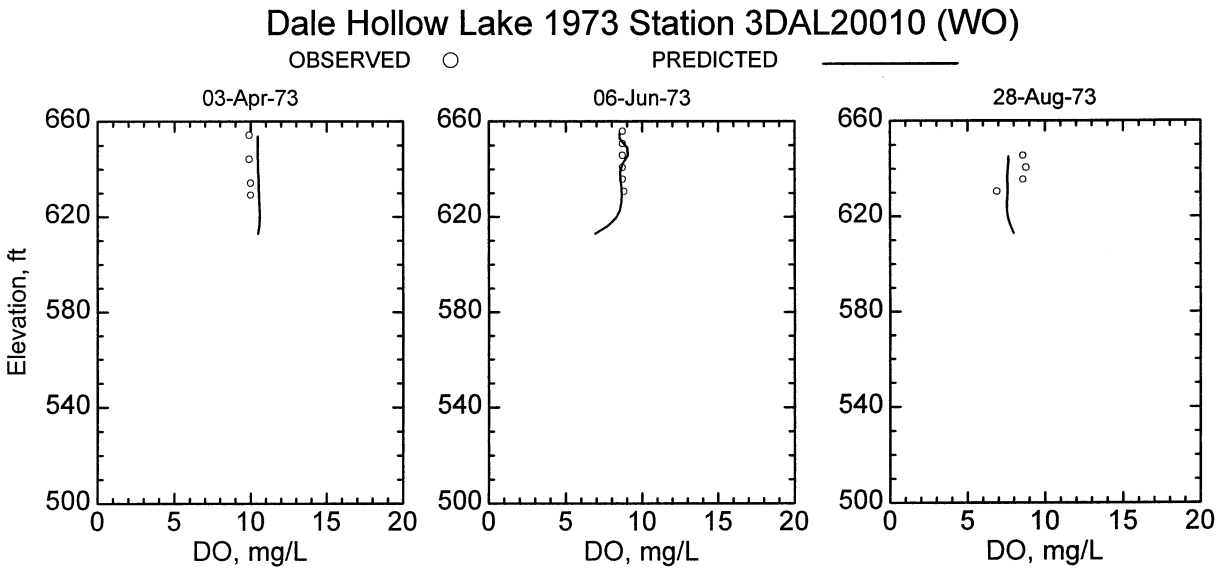

Dale Hollow Lake 1973 Station 3DAL20005
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

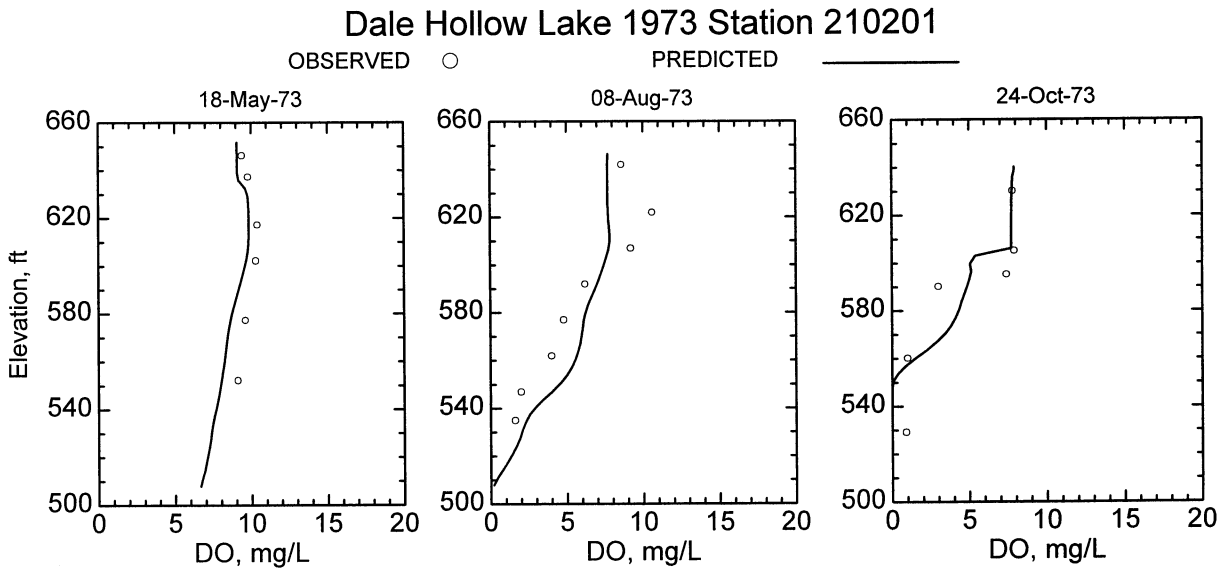

Dale Hollow Lake 1973 Station 3DAL20006
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

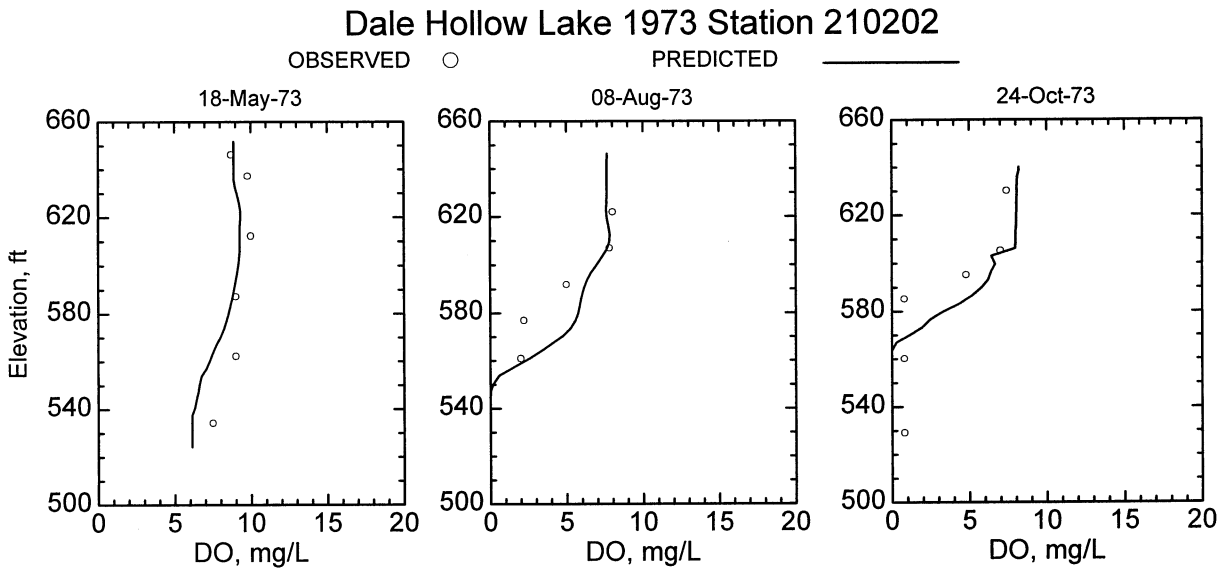

Dale Hollow Lake 1973 Station 3DAL20007
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

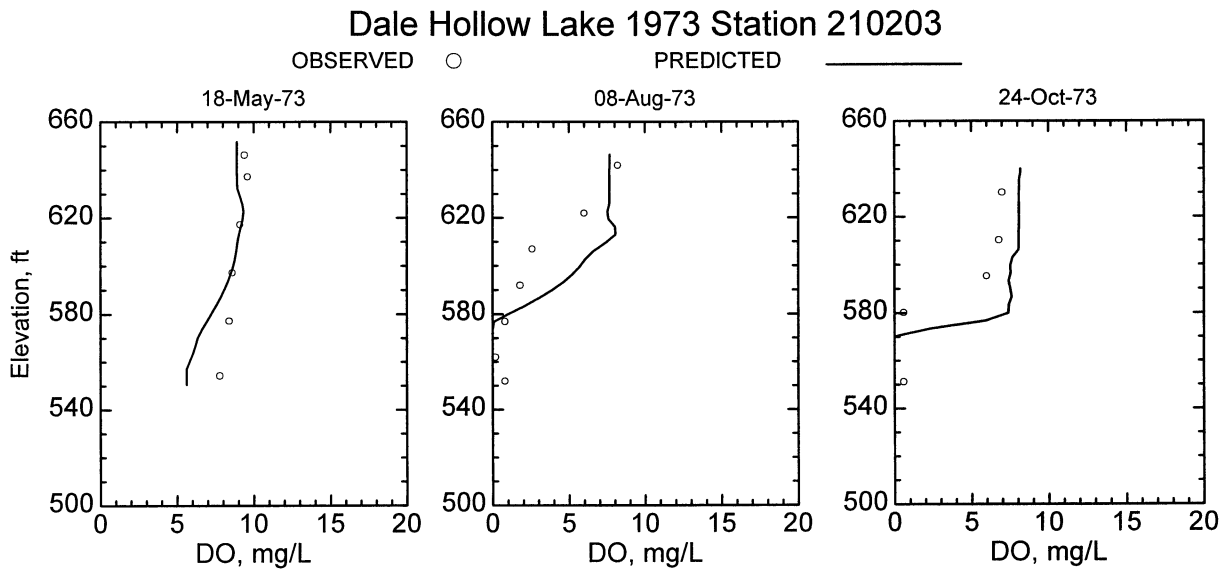

Dale Hollow Lake 1973 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

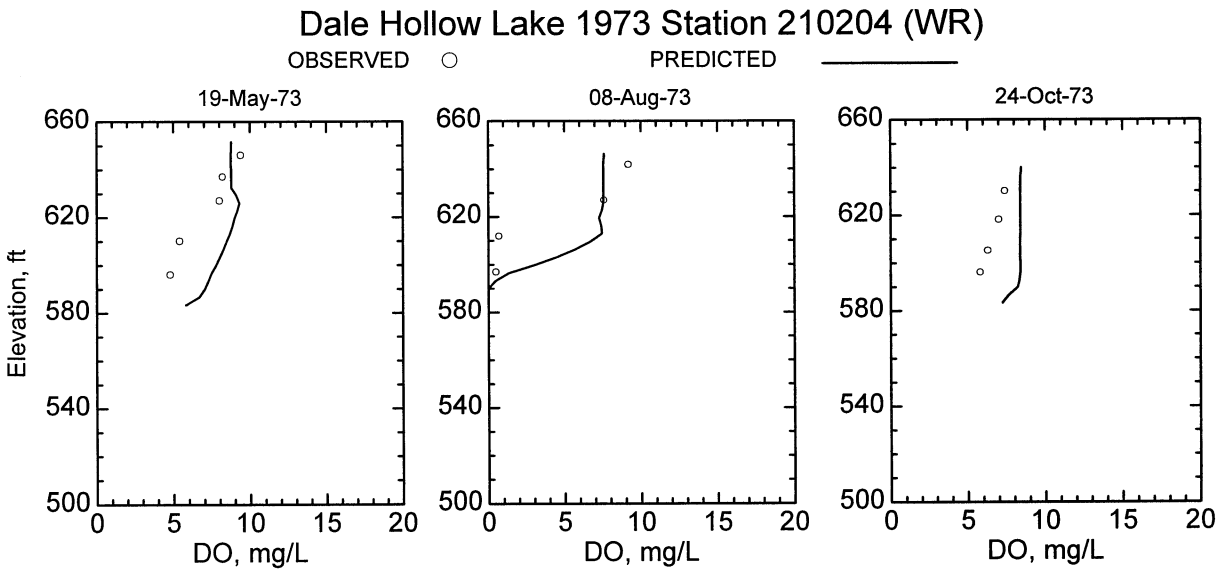

Dale Hollow Lake 1973 Station 3DAL20009
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

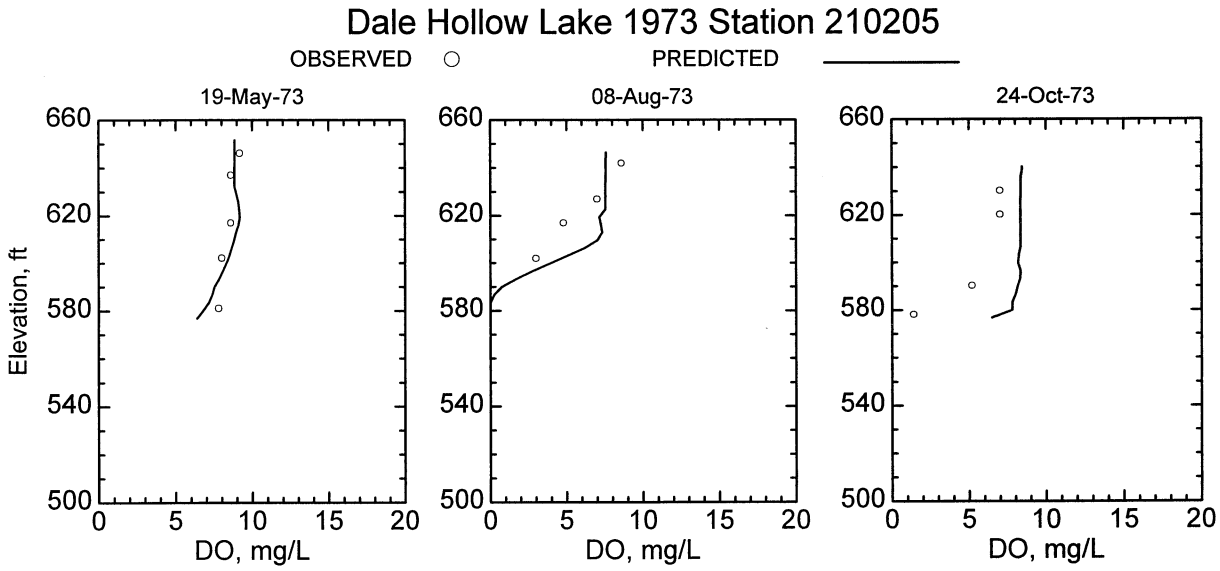

Dale Hollow Lake 1973 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

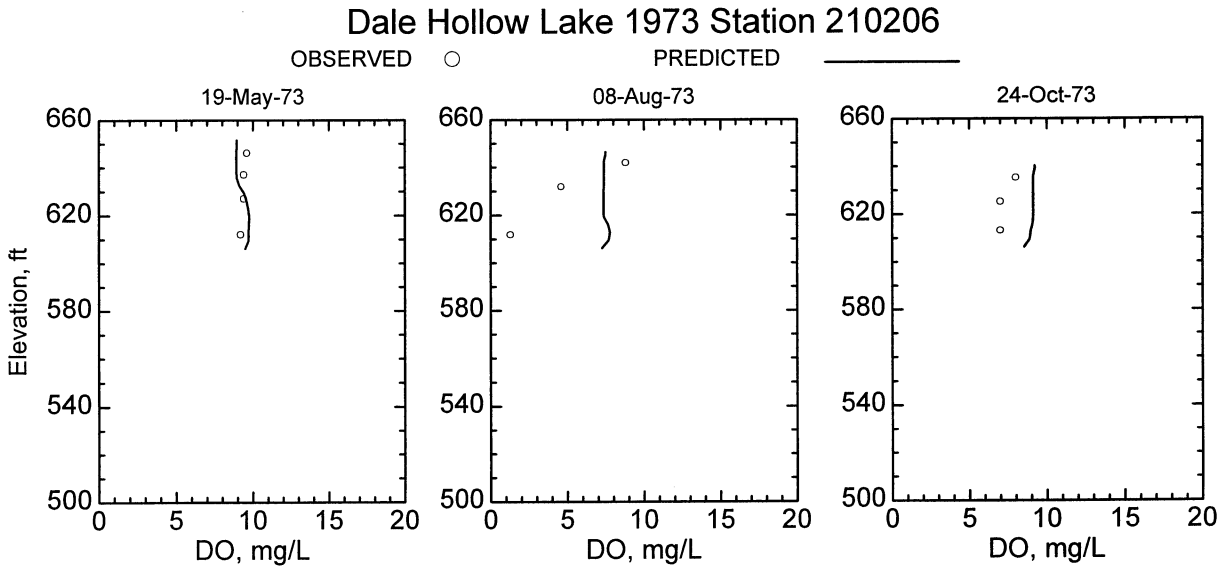

Dale Hollow Lake 1973 Station 210201
OBSERVED
PREDICTED
18-May-73
08-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

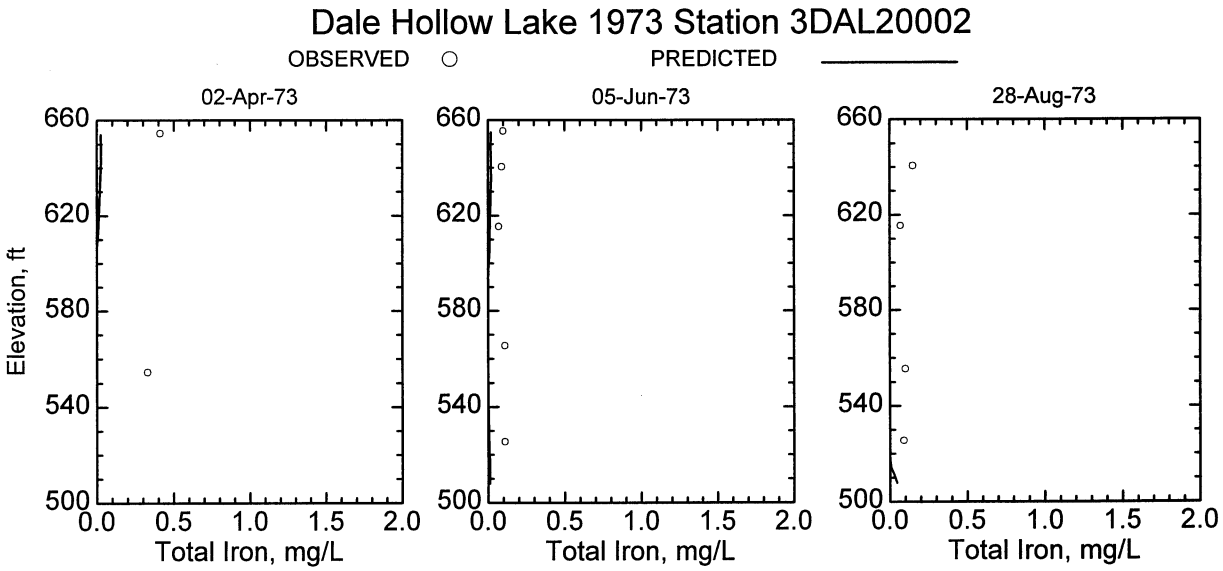

Dale Hollow Lake 1973 Station 210202
OBSERVED
PREDICTED
18-May-73
08-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

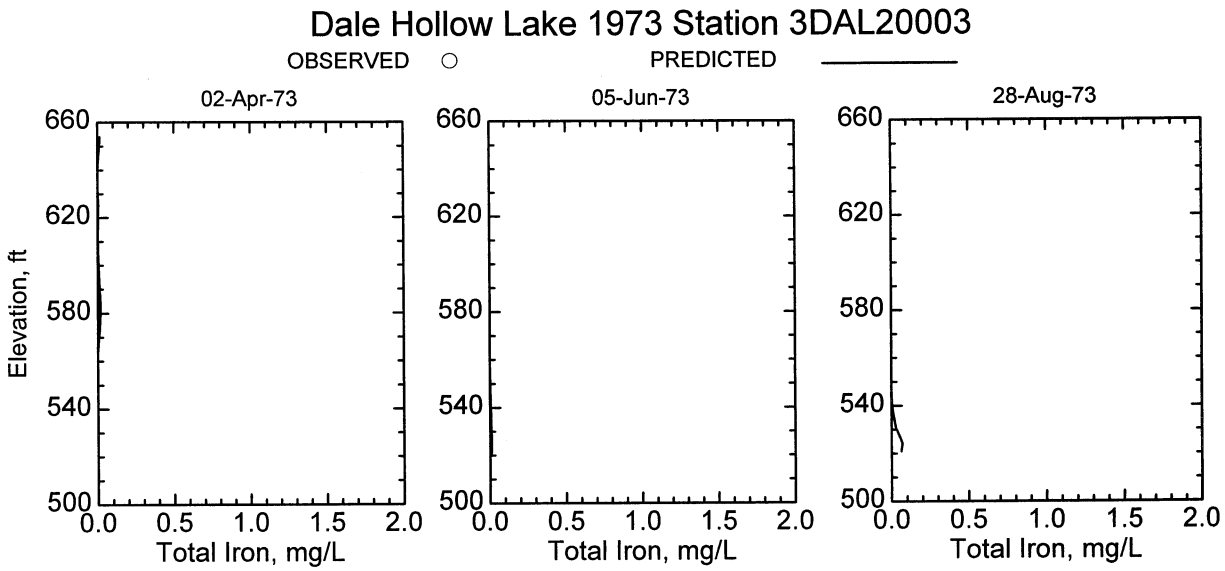

Dale Hollow Lake 1973 Station 210203
OBSERVED
PREDICTED
18-May-73
08-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

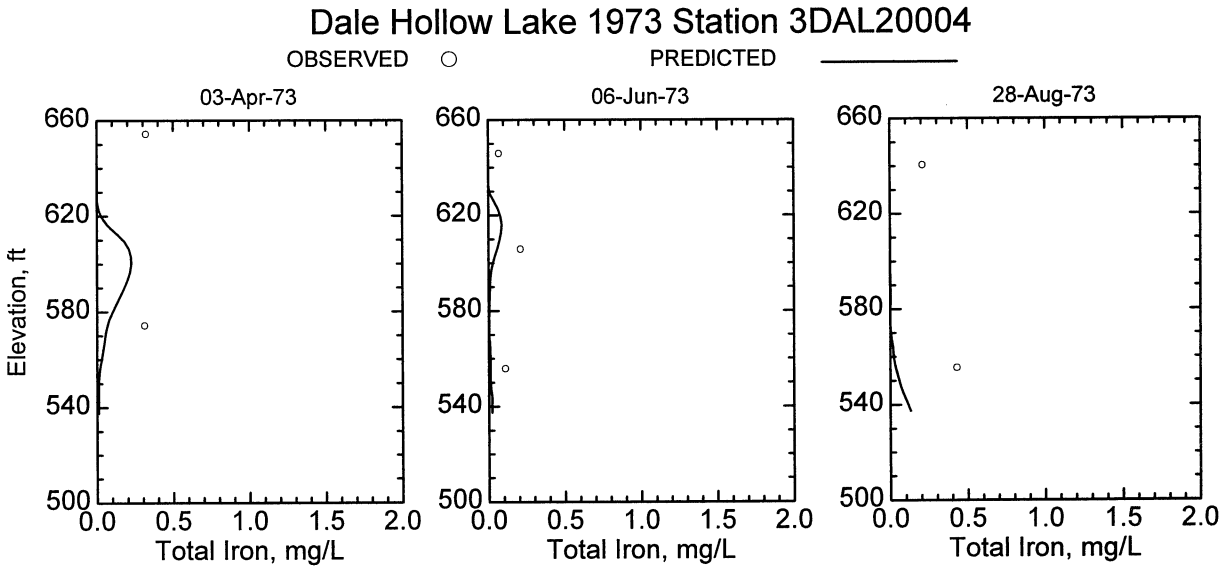

Dale Hollow Lake 1973 Station 210204 (WR)
OBSERVED
PREDICTED
19-May-73
08-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

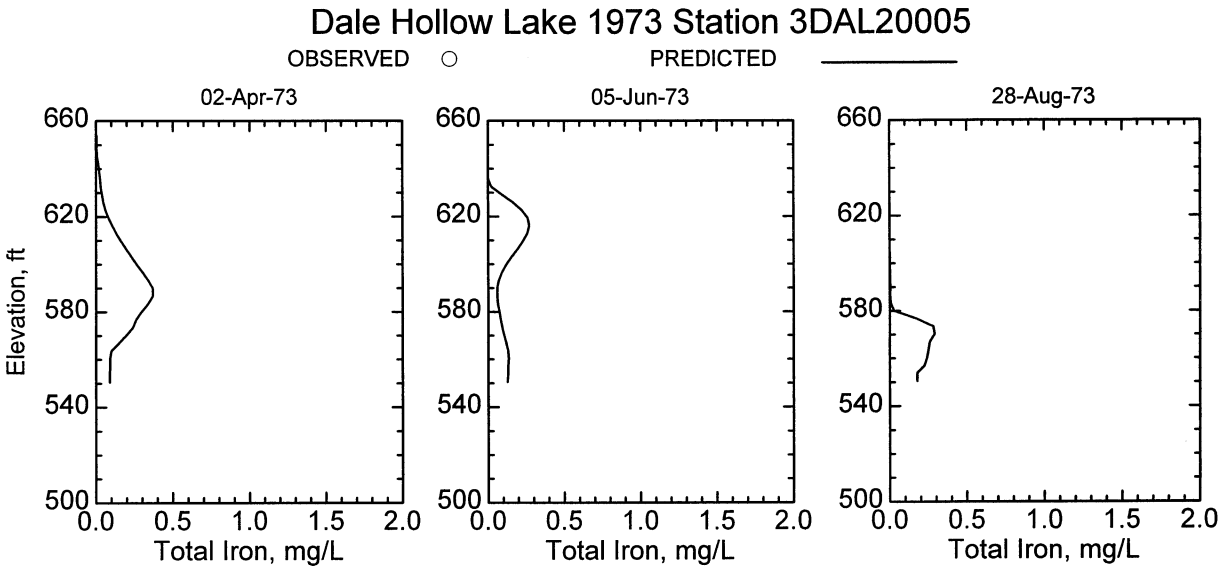

Dale Hollow Lake 1973 Station 210205
OBSERVED
PREDICTED
19-May-73
08-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

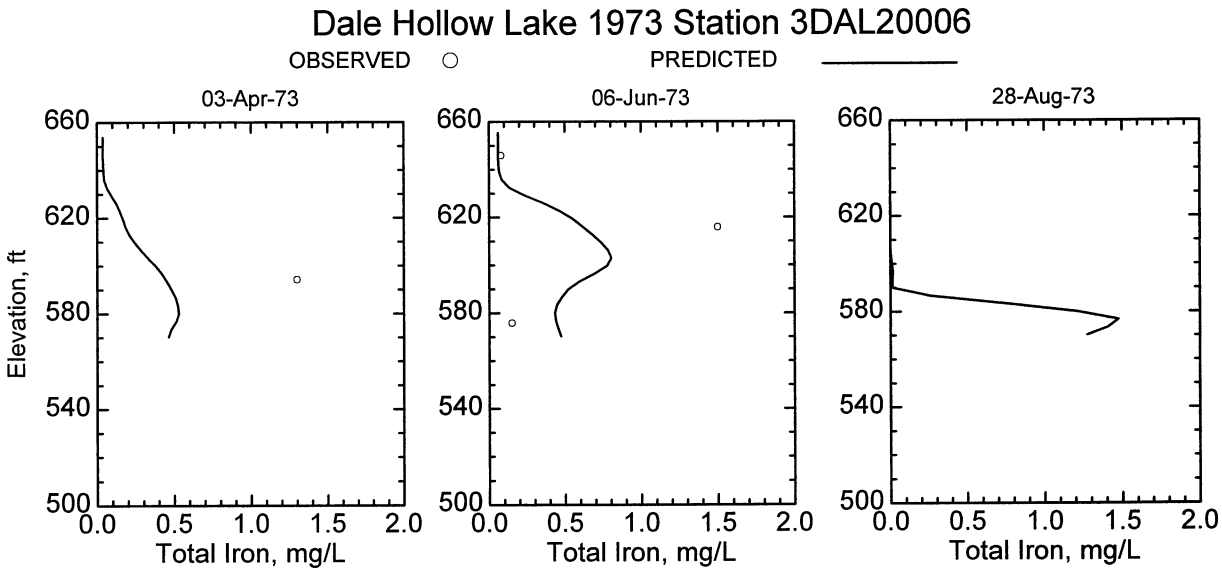

Dale Hollow Lake 1973 Station 210206
OBSERVED
PREDICTED
19-May-73
08-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

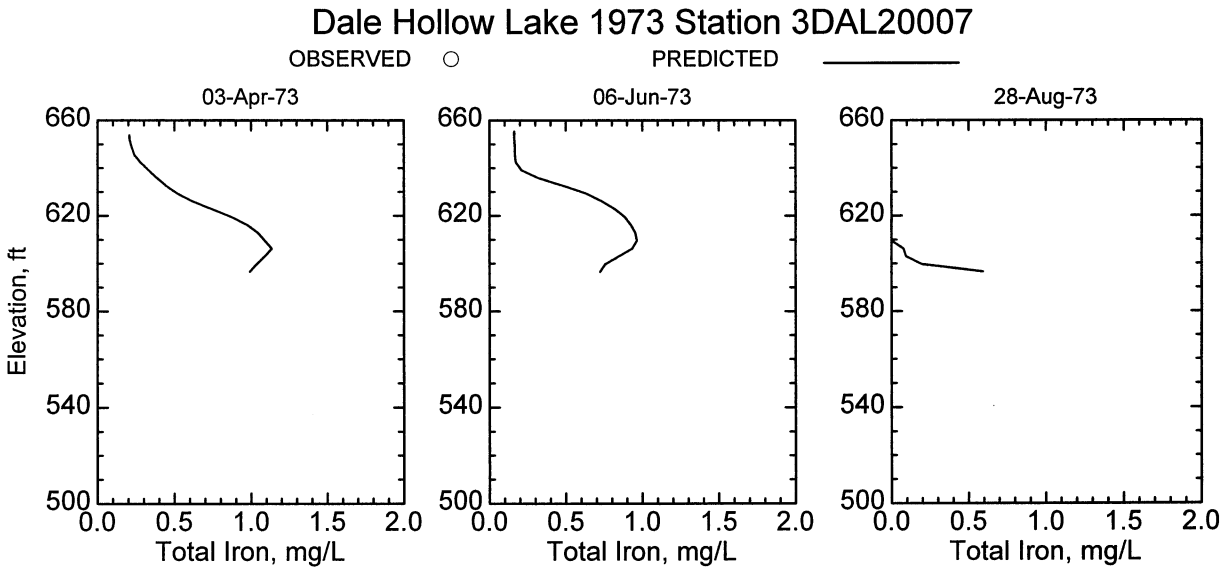

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

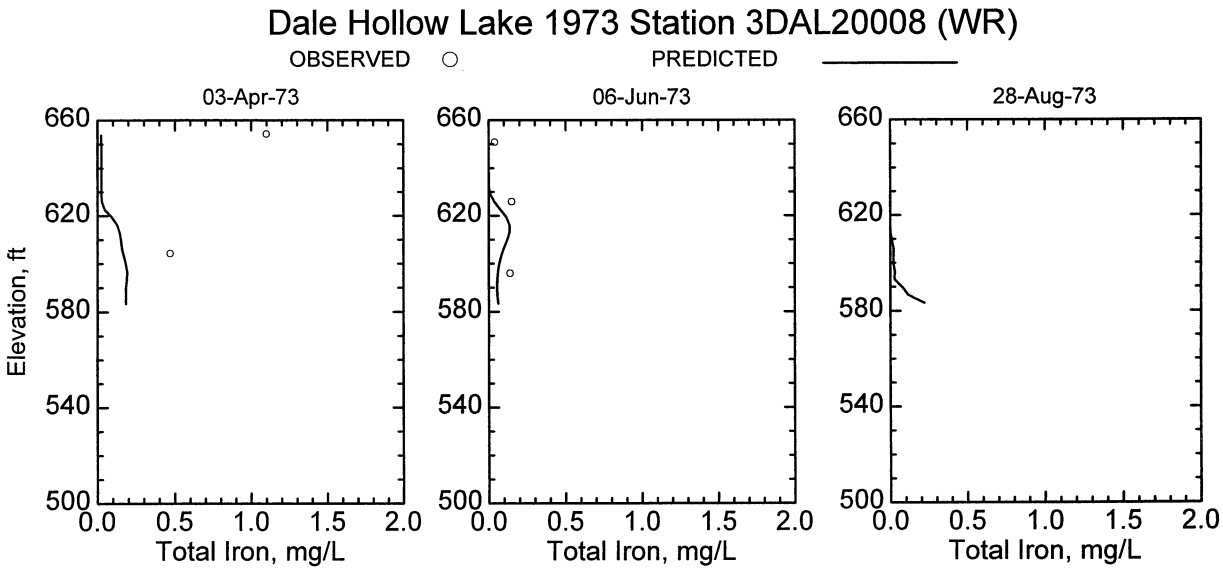

Dale Hollow Lake 1973 Station 3DAL20003
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

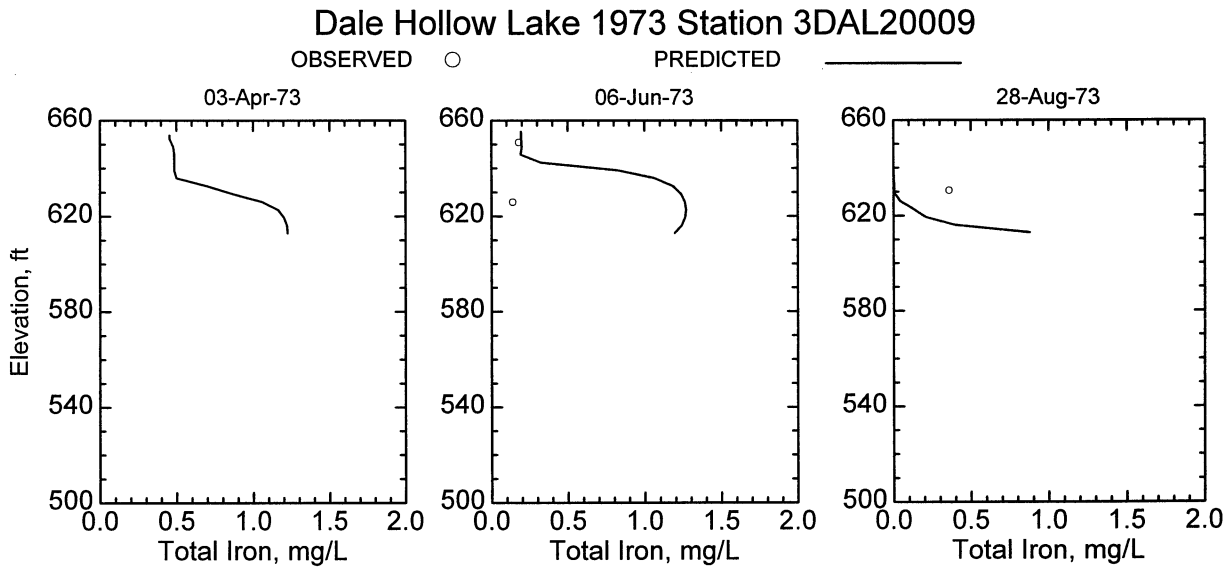

Dale Hollow Lake 1973 Station 3DAL20004
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

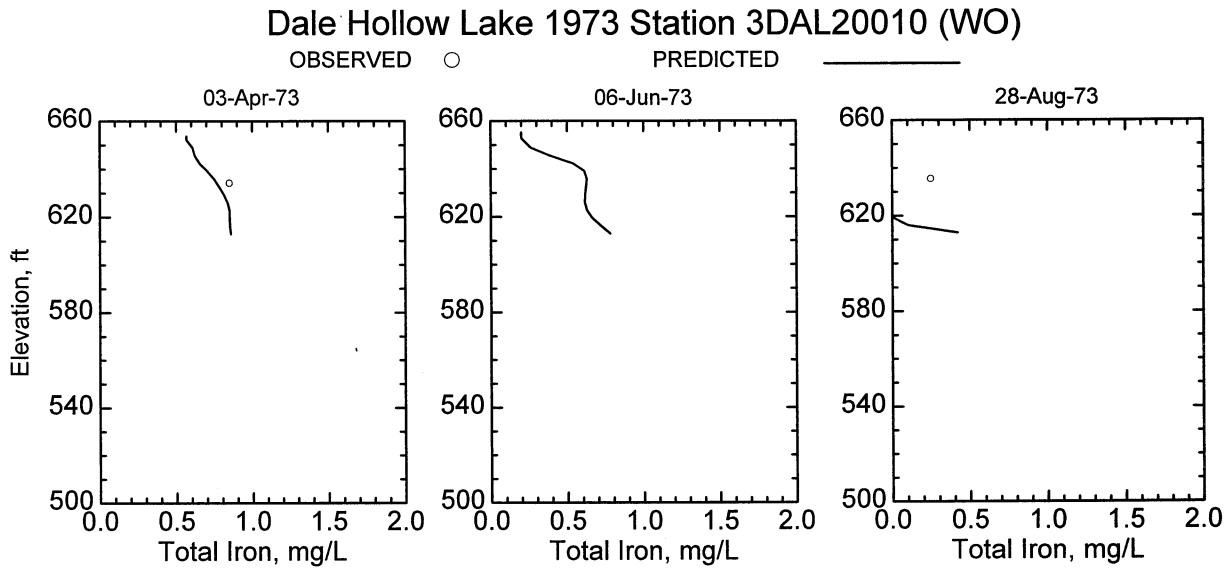

Dale Hollow Lake 1973 Station 3DAL20005
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

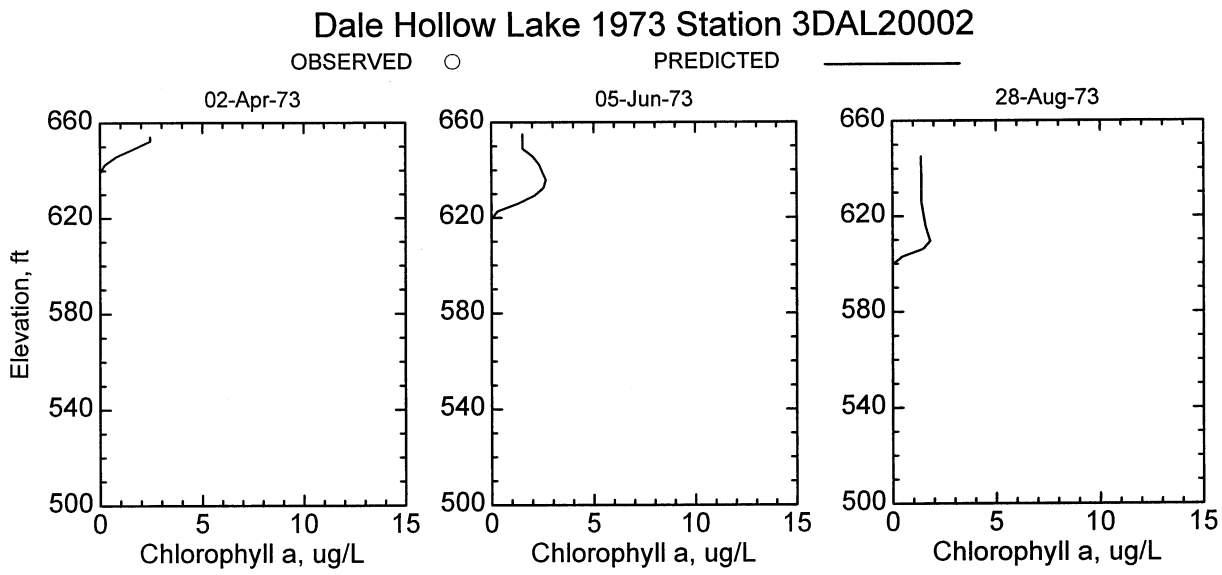

Dale Hollow Lake 1973 Station 3DAL20006
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

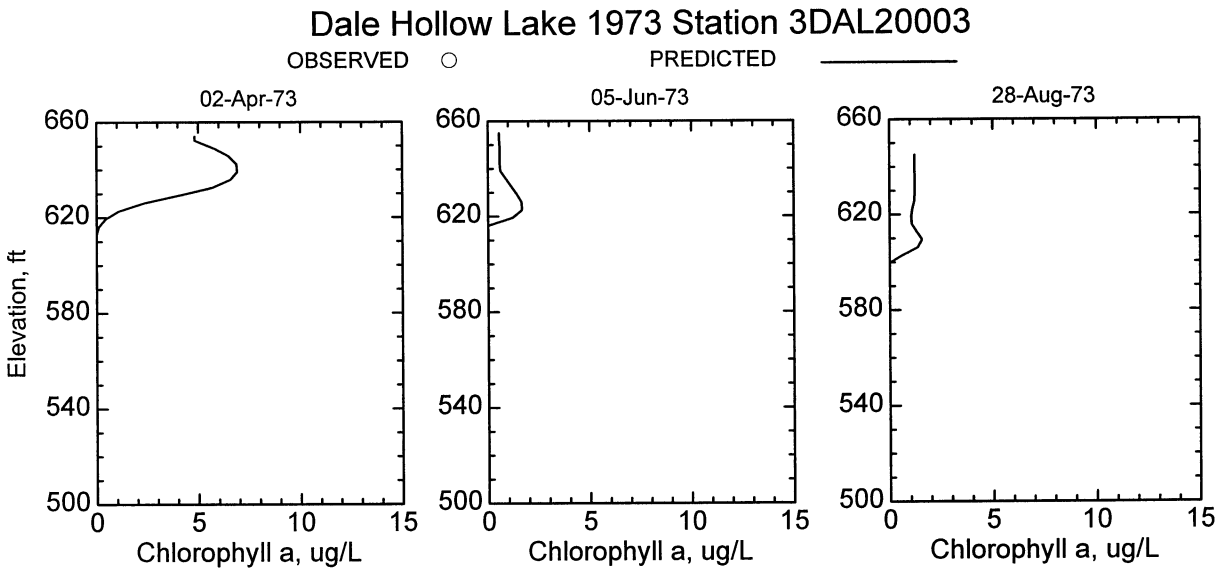

Dale Hollow Lake 1973 Station 3DAL20007
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

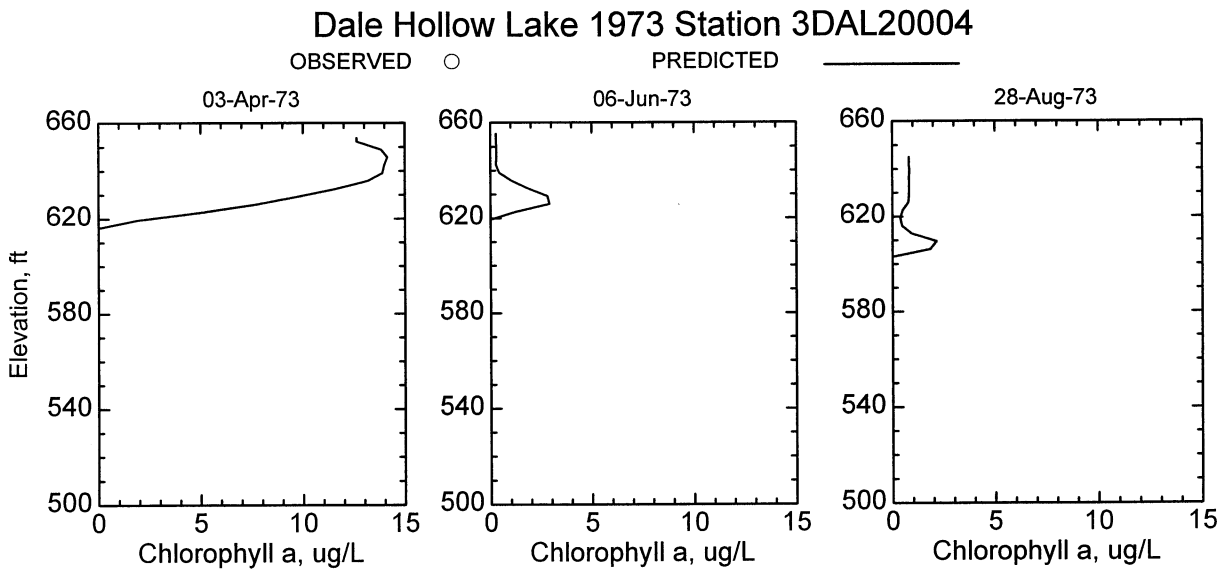

Dale Hollow Lake 1973 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

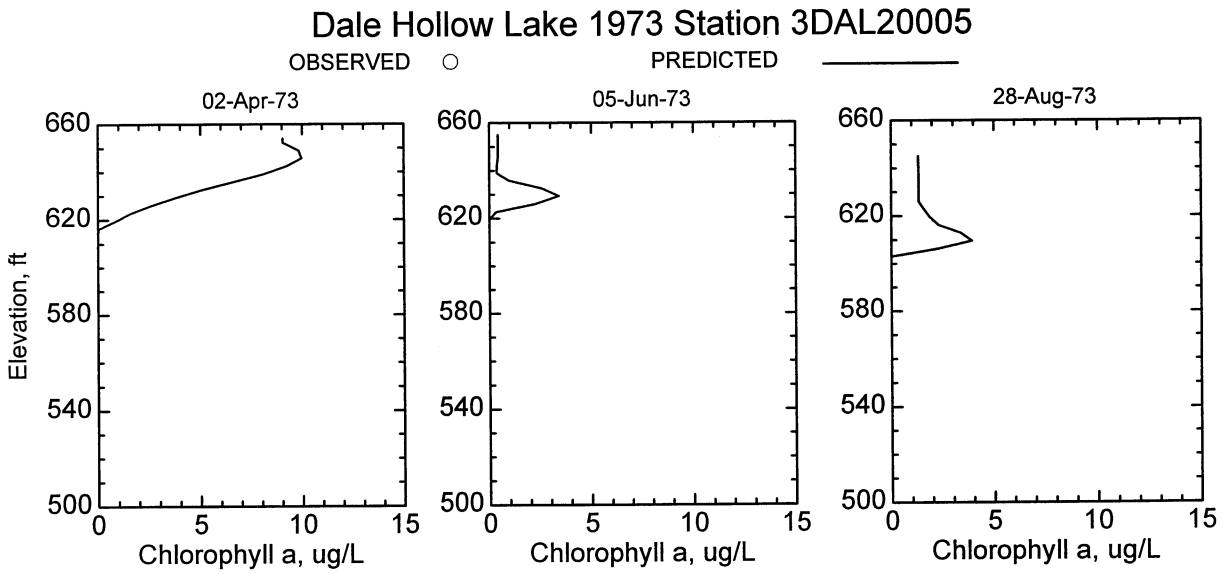

Dale Hollow Lake 1973 Station 3DAL20009
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

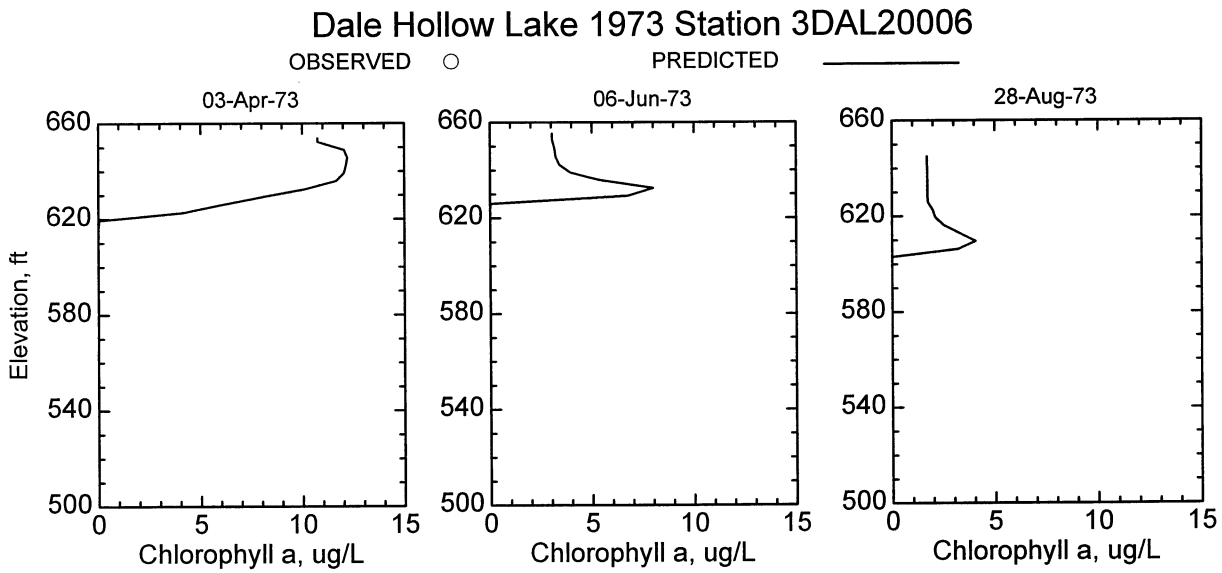

Dale Hollow Lake 1973 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

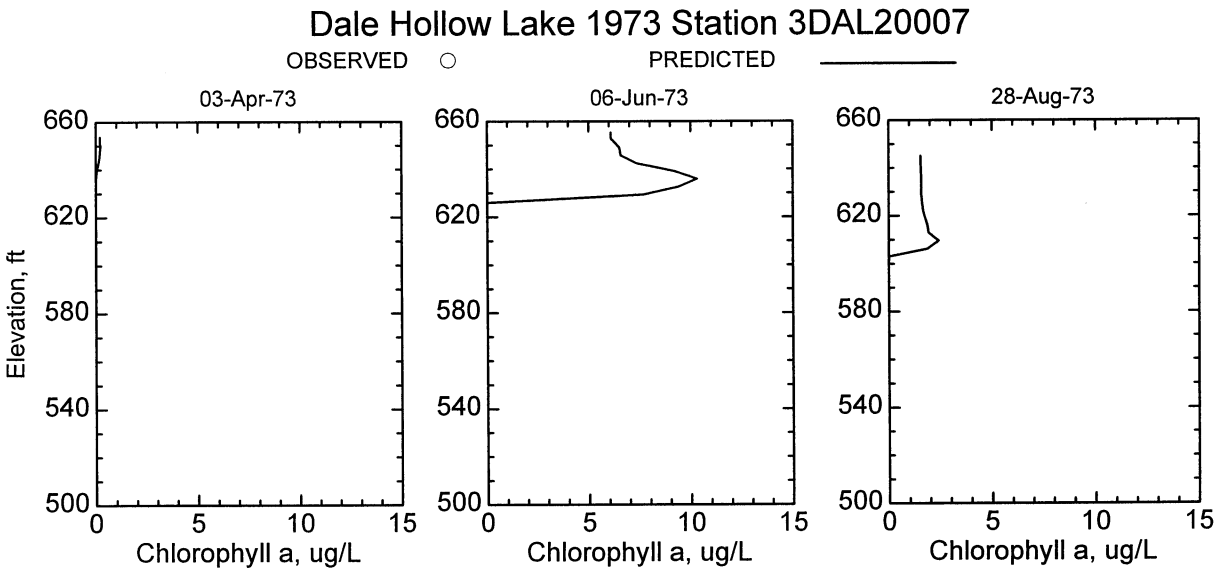

Dale Hollow Lake 1973 Station 3DAL20002
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

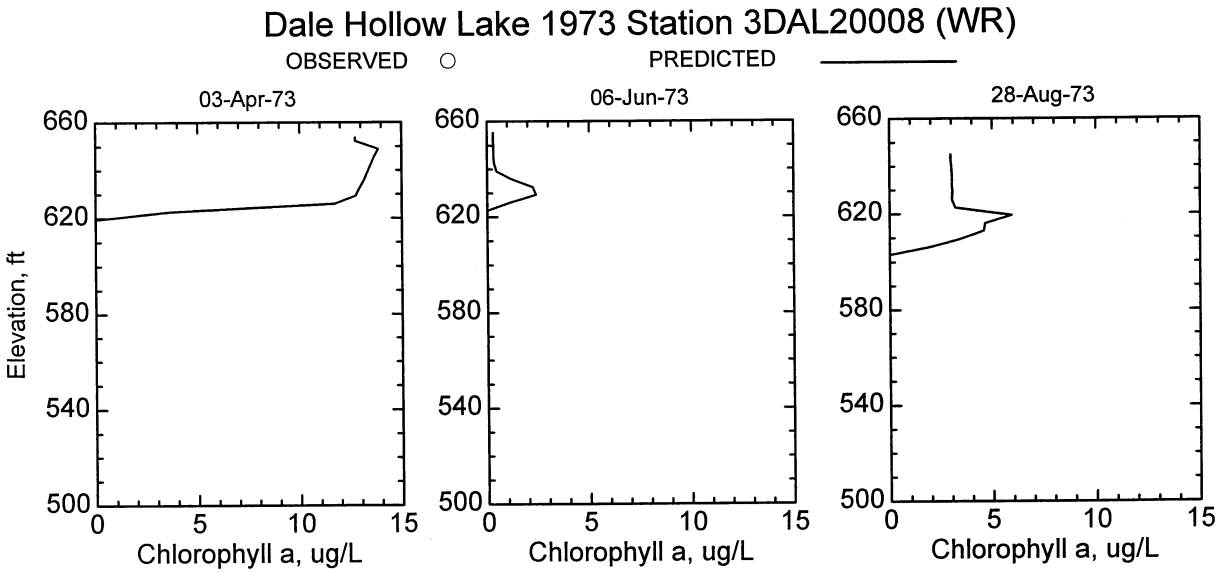

Dale Hollow Lake 1973 Station 3DAL20003
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

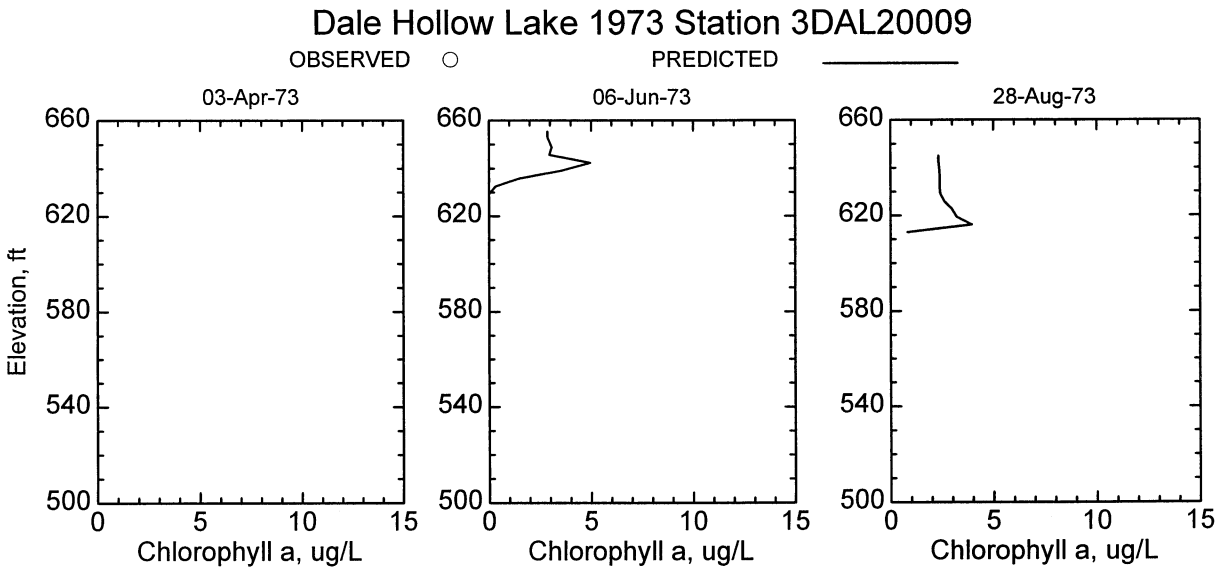

Dale Hollow Lake 1973 Station 3DAL20004
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

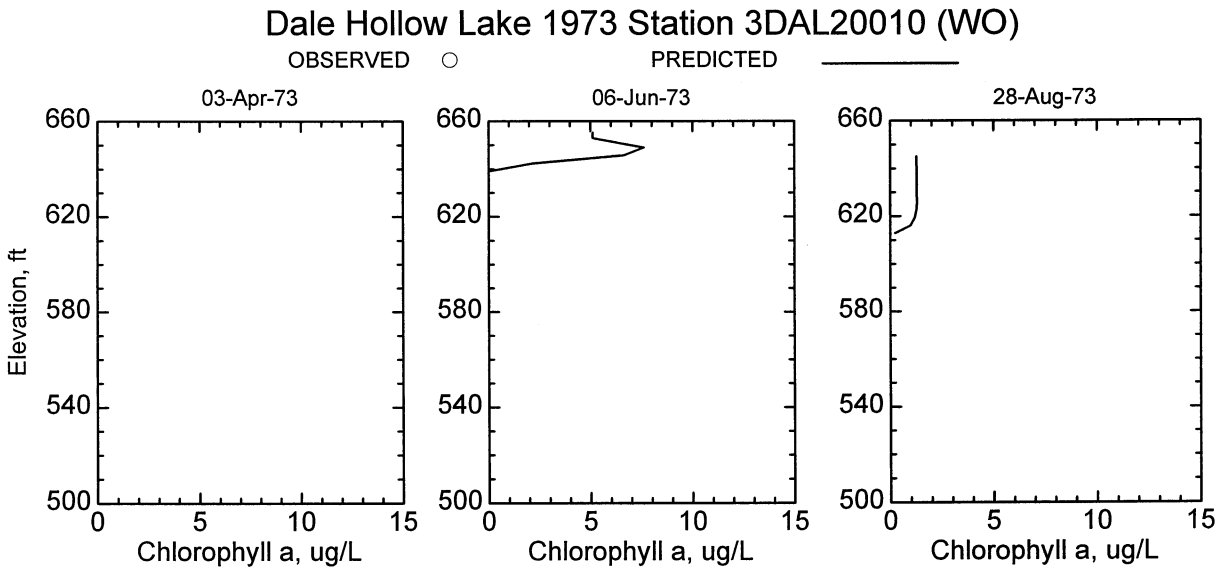

Dale Hollow Lake 1973 Station 3DAL20005
OBSERVED
PREDICTED
02-Apr-73
05-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

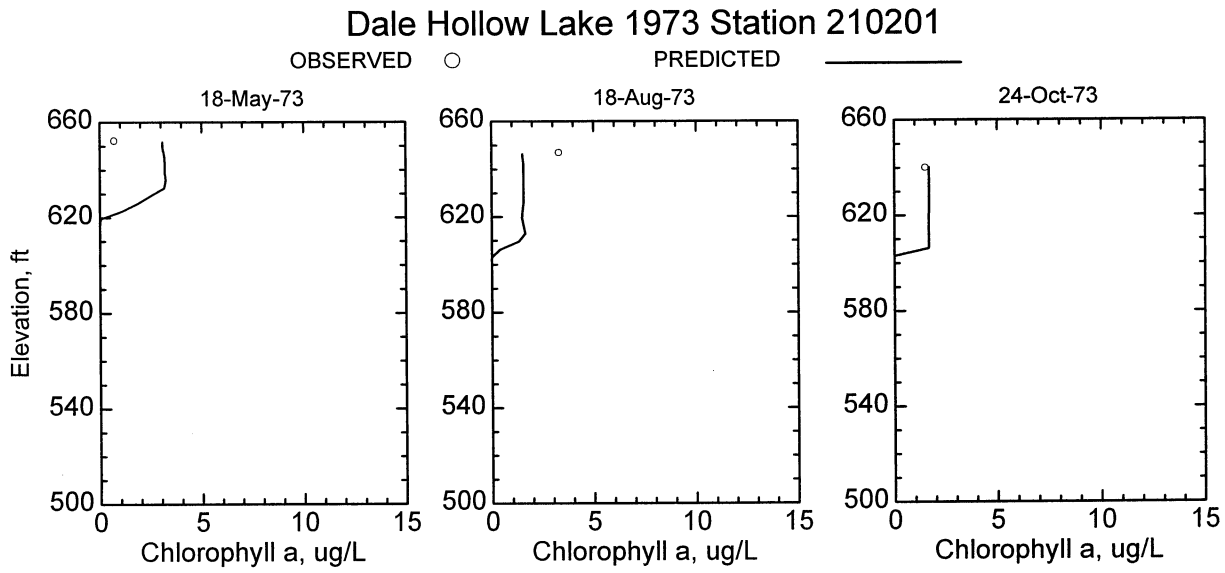

Dale Hollow Lake 1973 Station 3DAL20006
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

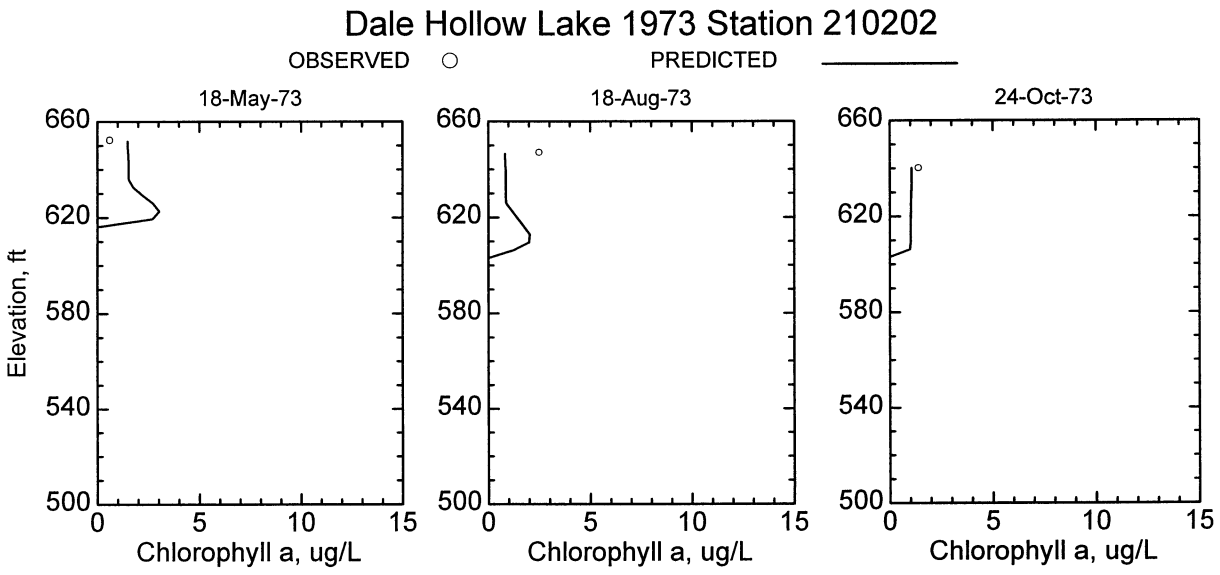

Dale Hollow Lake 1973 Station 3DAL20007
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

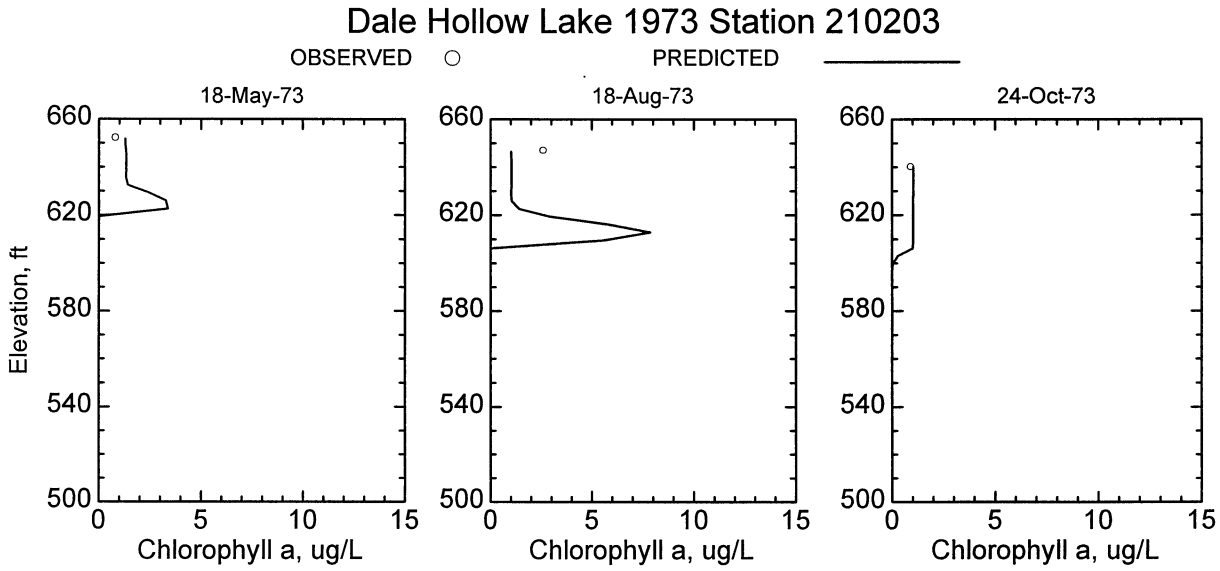

Dale Hollow Lake 1973 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

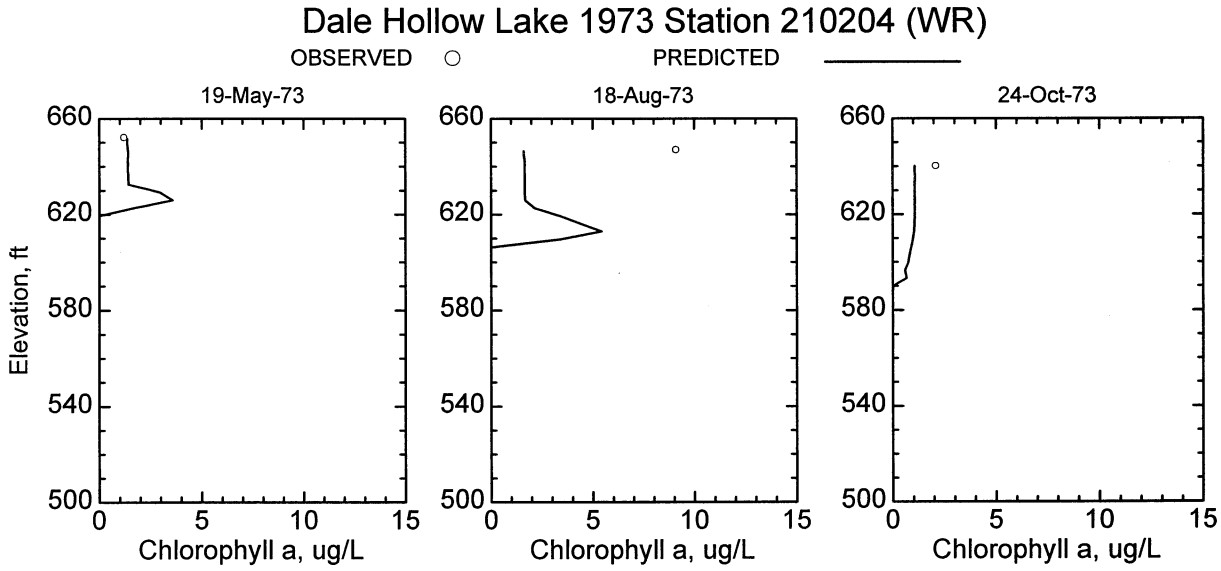

Dale Hollow Lake 1973 Station 3DAL20009
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

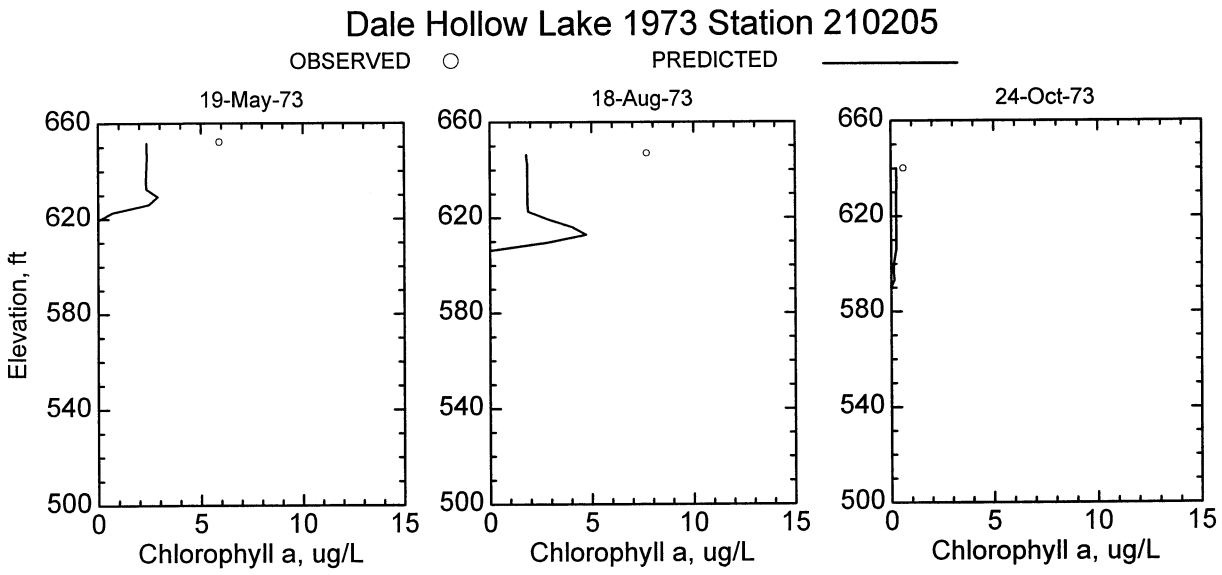

Dale Hollow Lake 1973 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
03-Apr-73
06-Jun-73
28-Aug-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

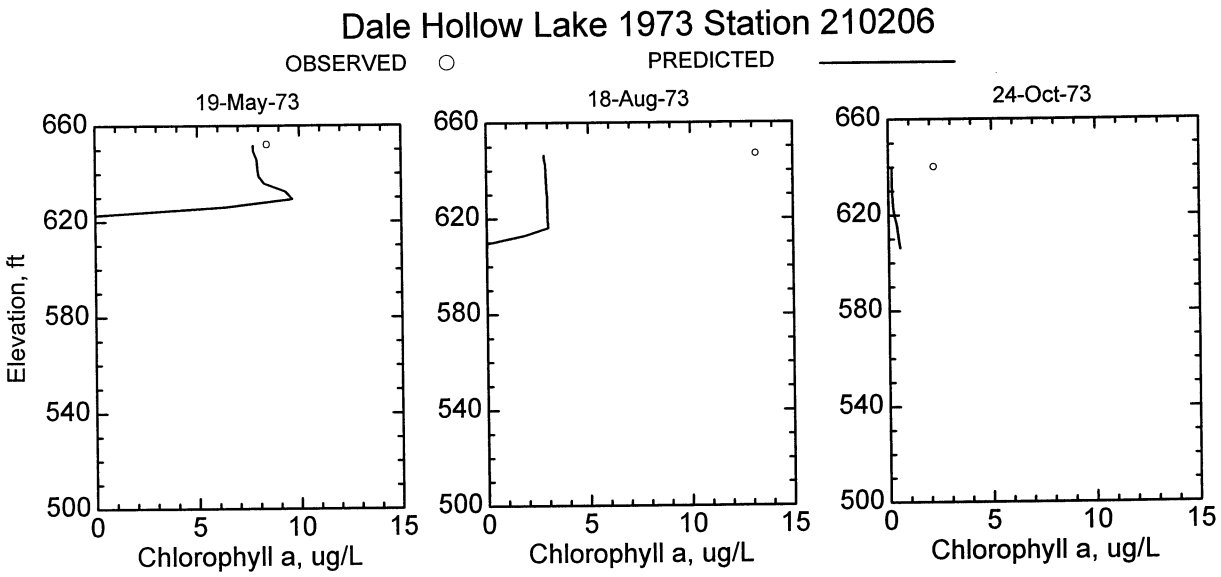

Dale Hollow Lake 1973 Station 210201
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

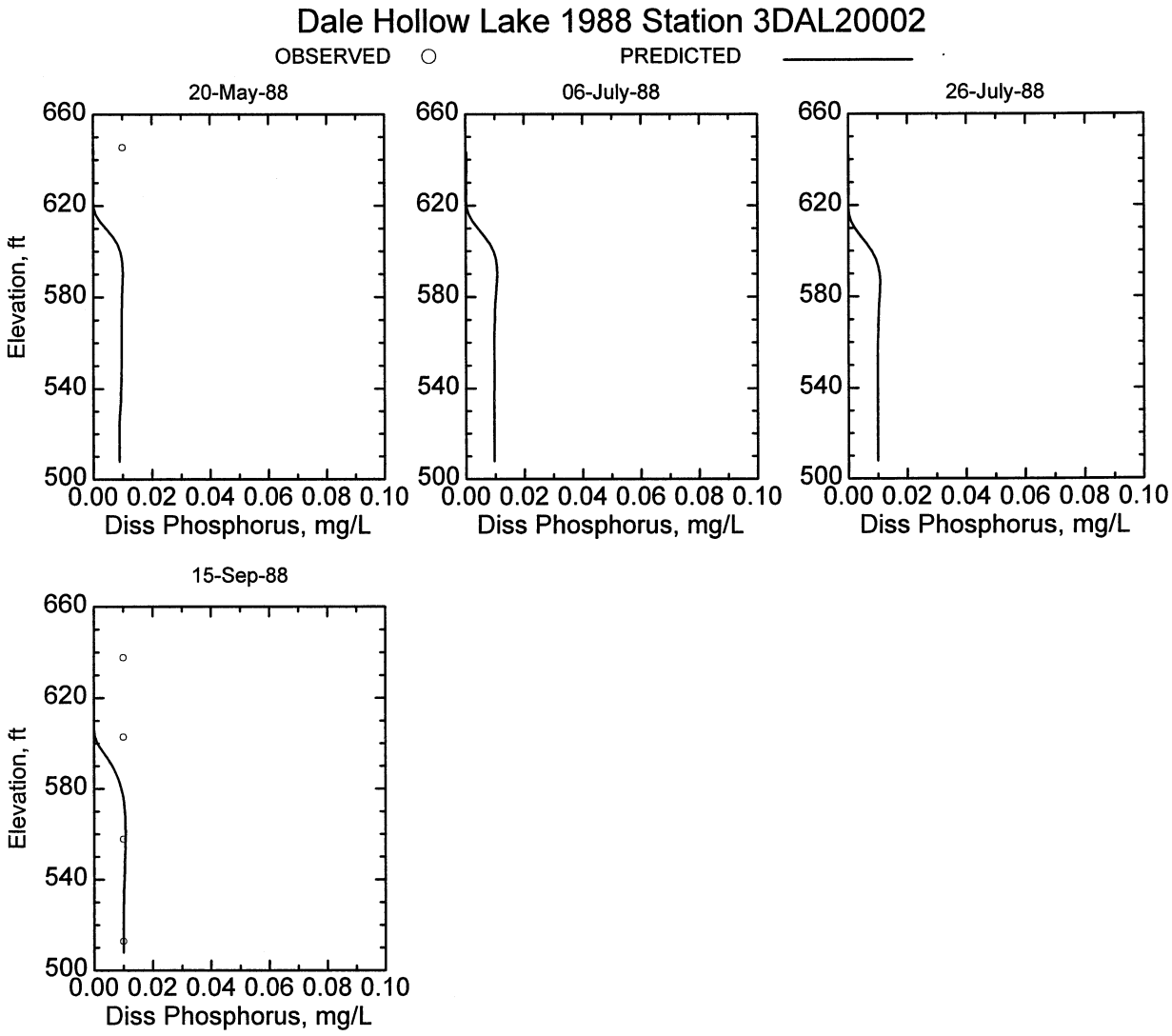

Dale Hollow Lake 1973 Station 210202
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

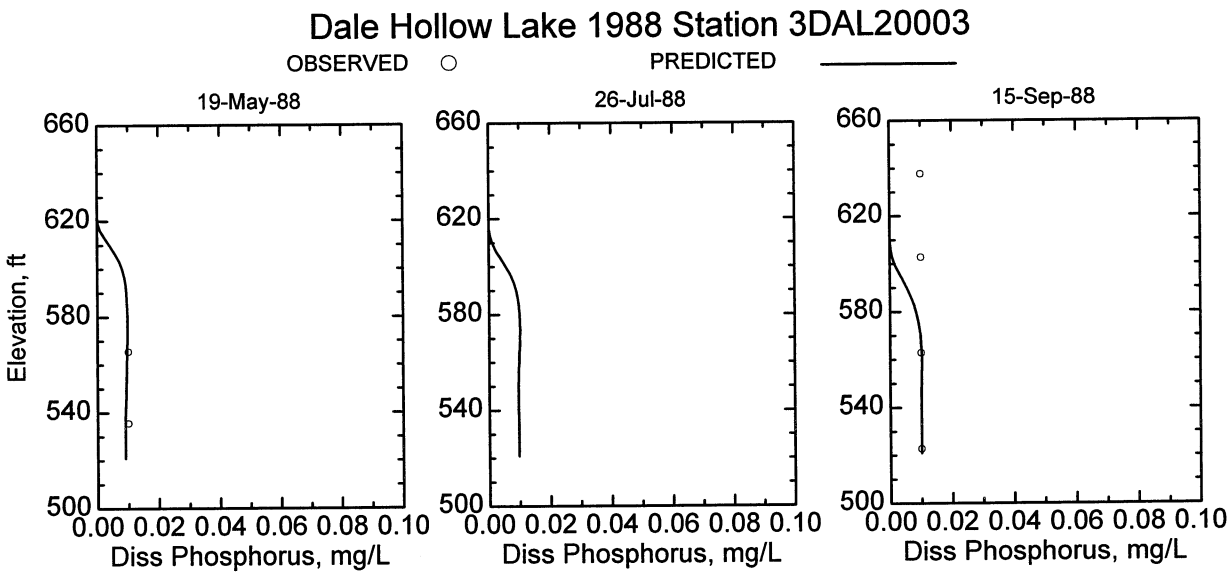

Dale Hollow Lake 1973 Station 210203
OBSERVED
PREDICTED
18-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

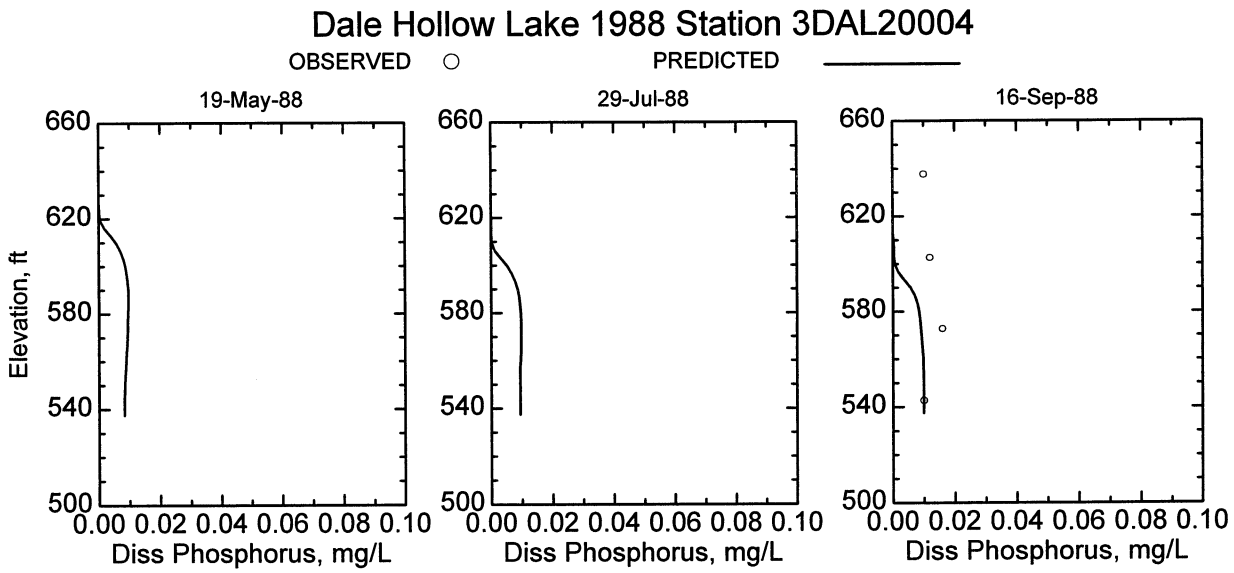

Dale Hollow Lake 1973 Station 210204 (WR)
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

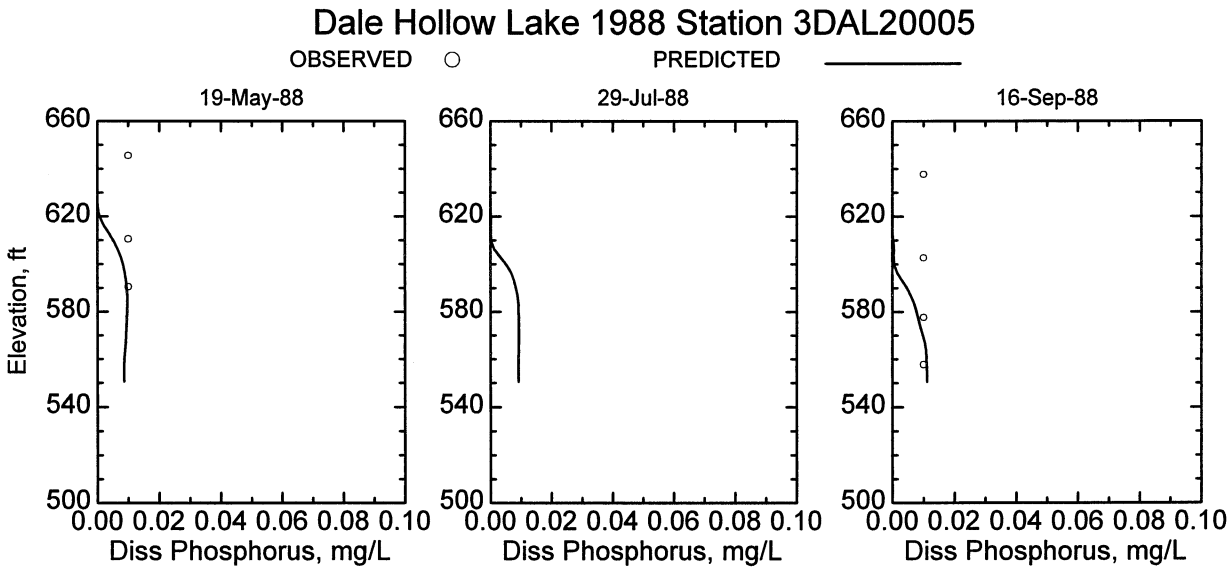

Dale Hollow Lake 1973 Station 210205
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

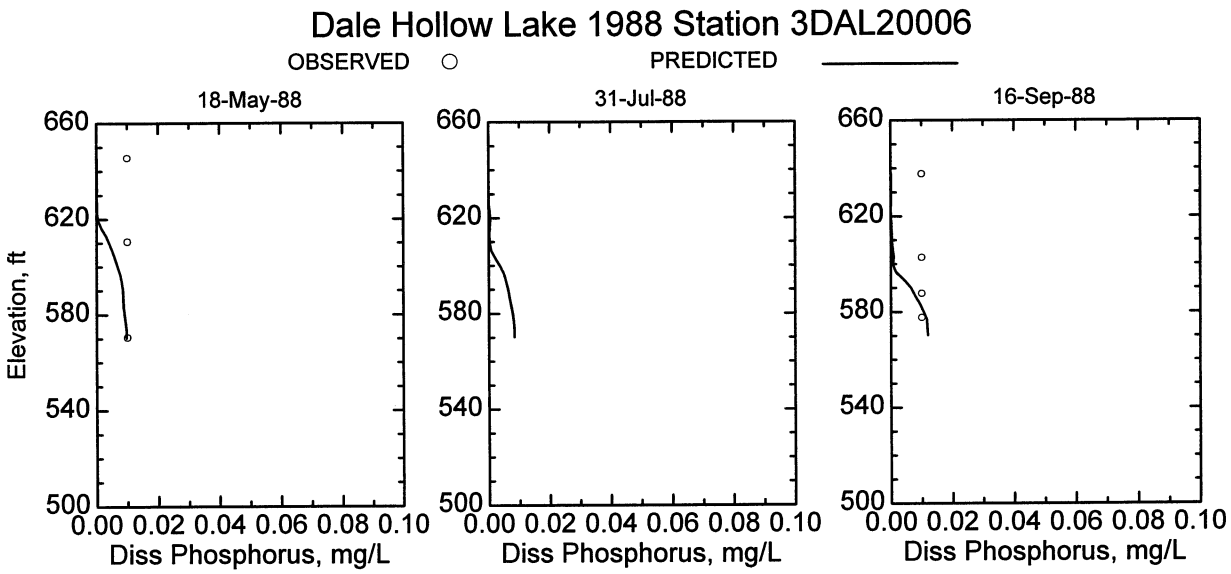

Dale Hollow Lake 1973 Station 210206
OBSERVED
PREDICTED
19-May-73
18-Aug-73
24-Oct-73
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

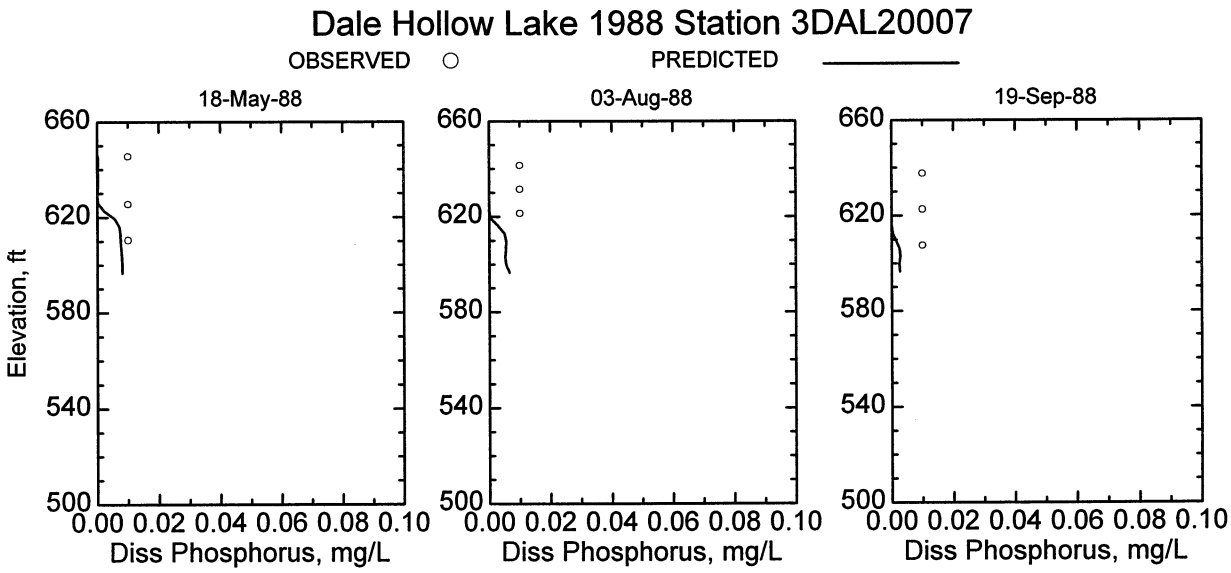

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

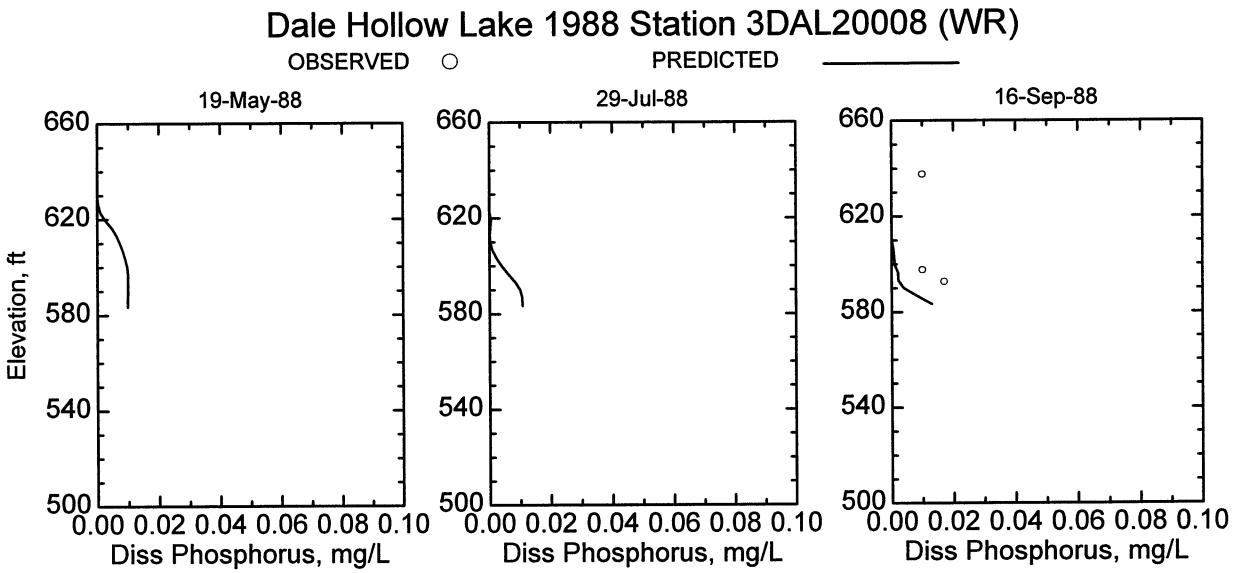

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

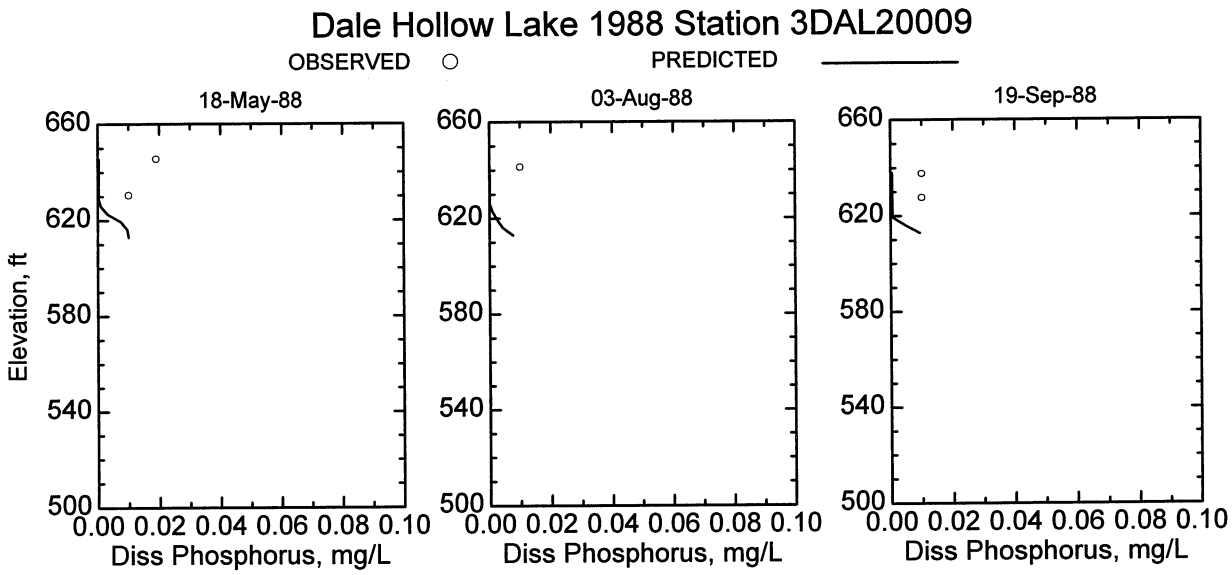

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

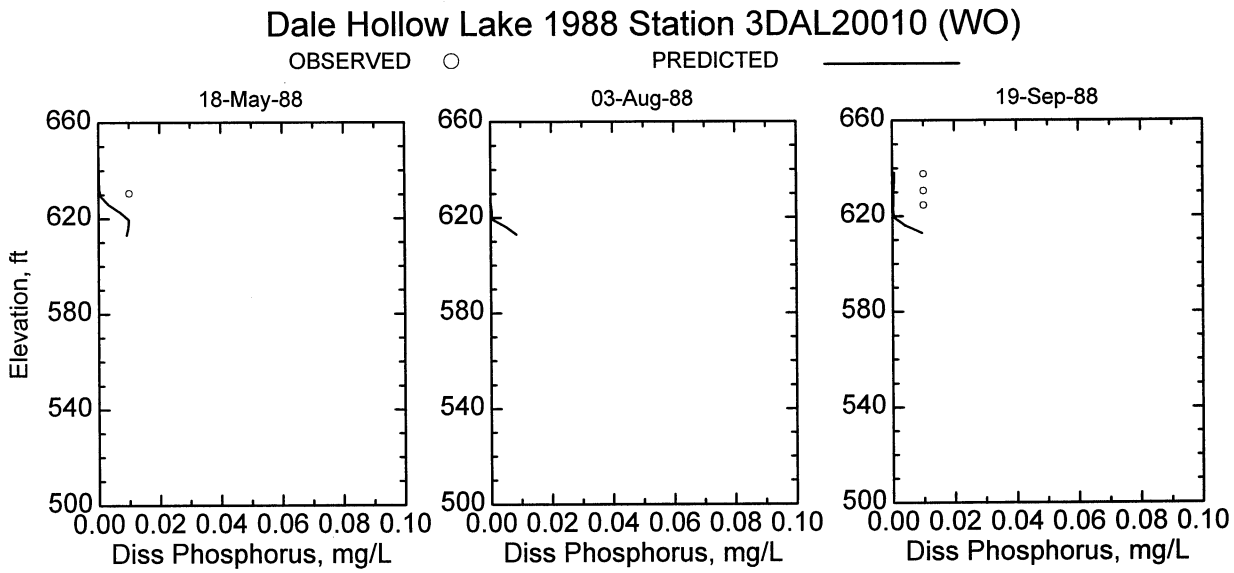

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

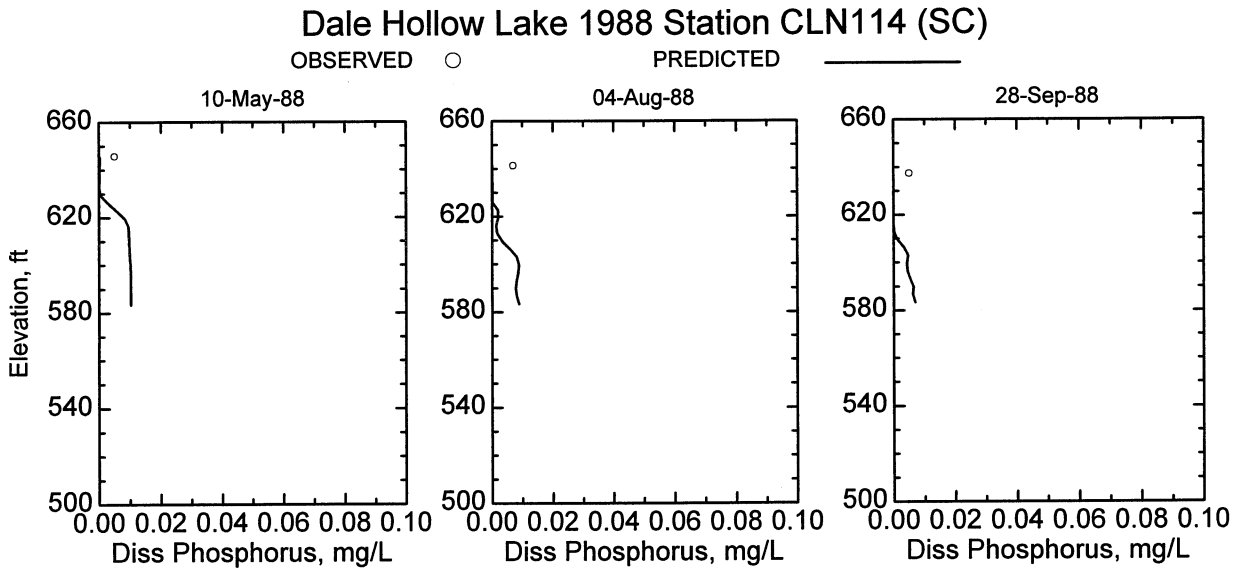

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

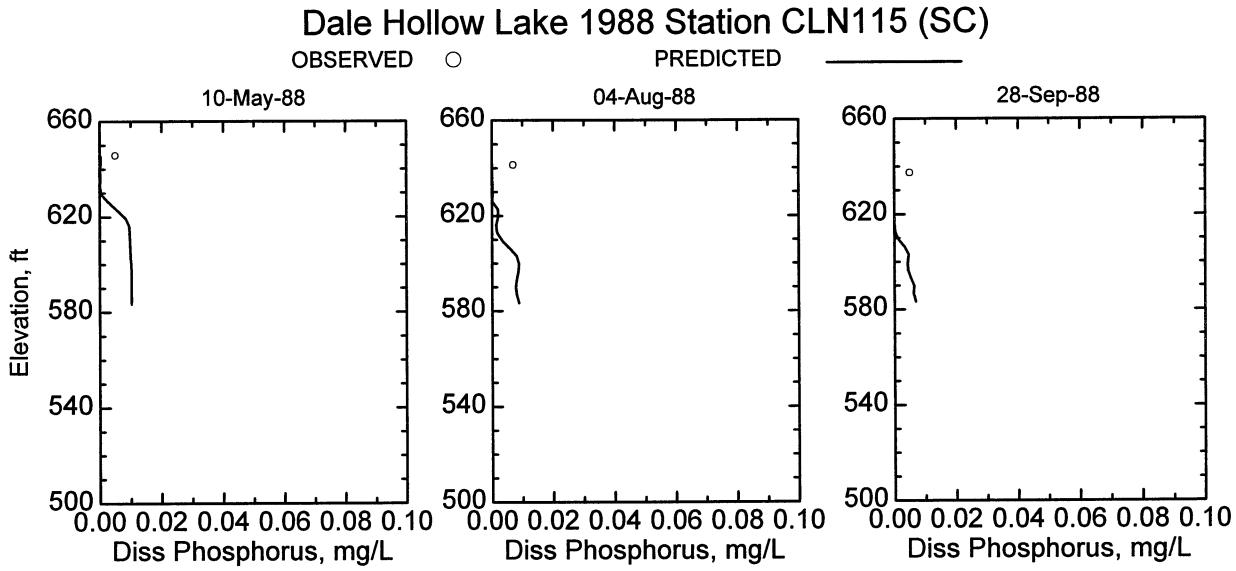

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

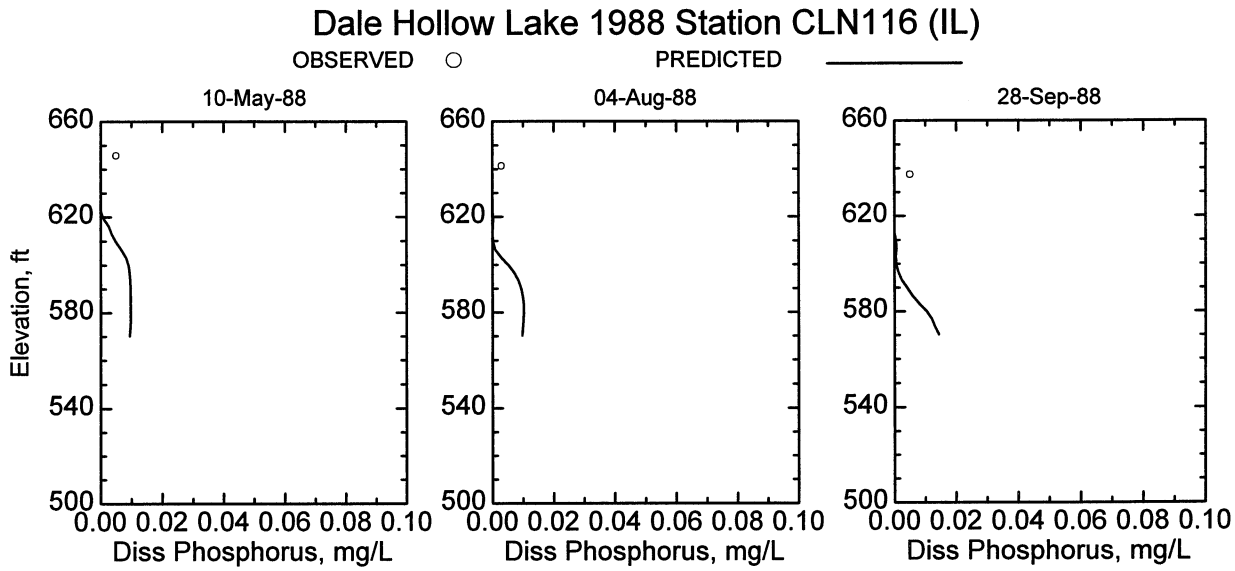

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

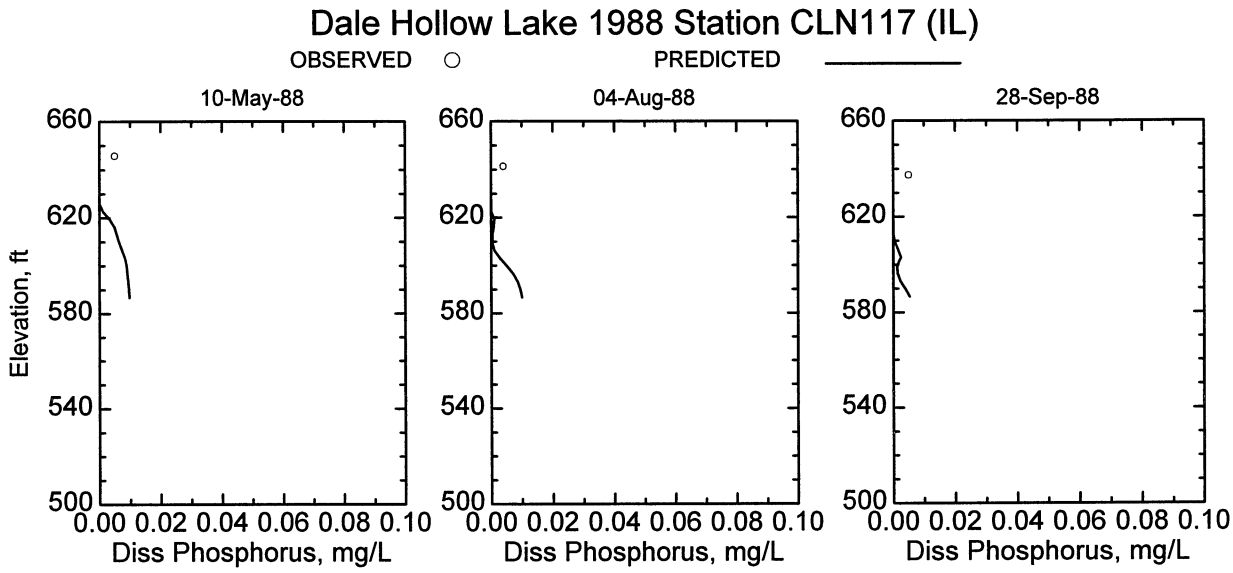

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

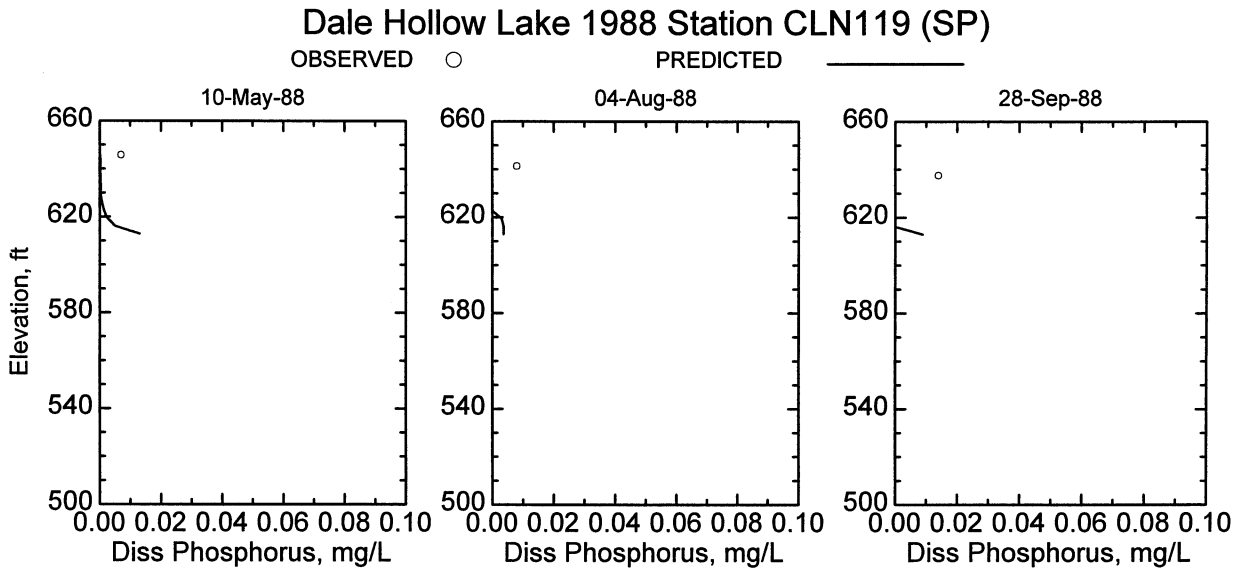

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

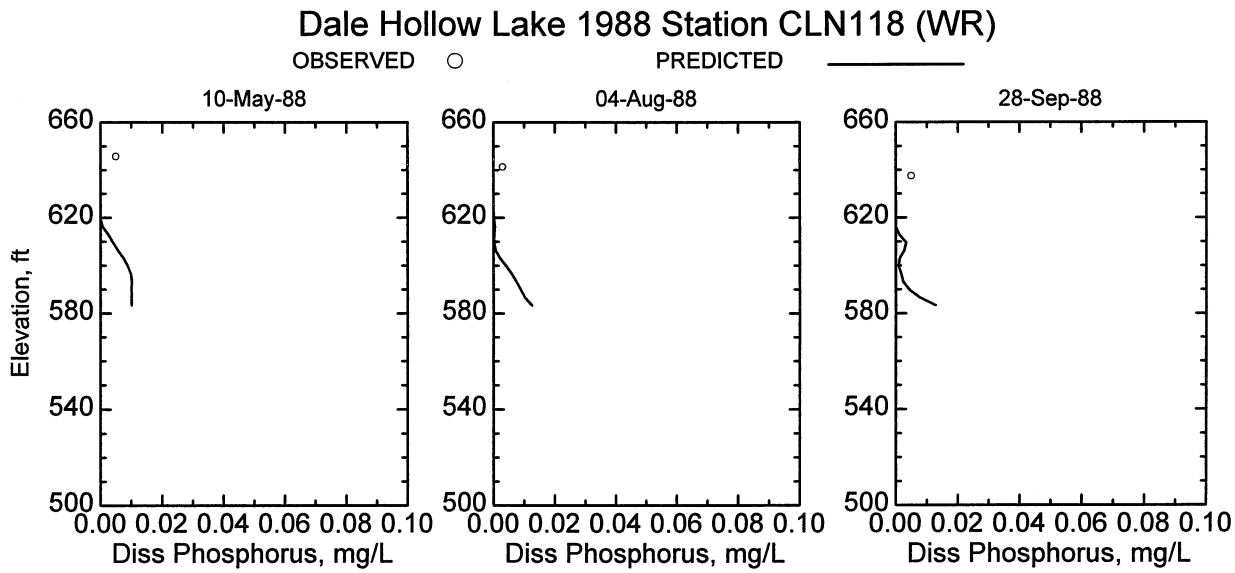

Dale Hollow Lake 1988 Station CLN114 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

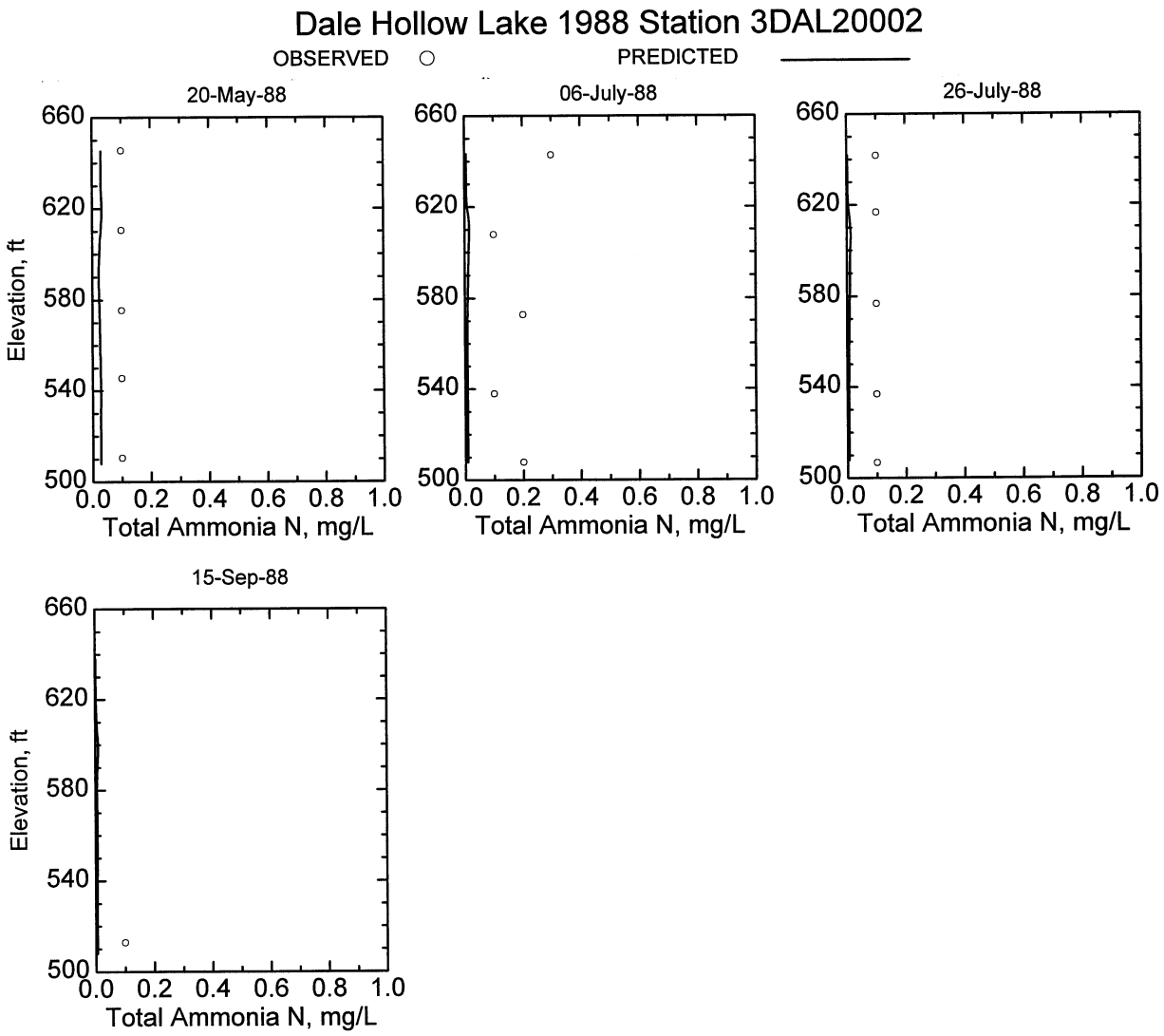

Dale Hollow Lake 1988 Station CLN115 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

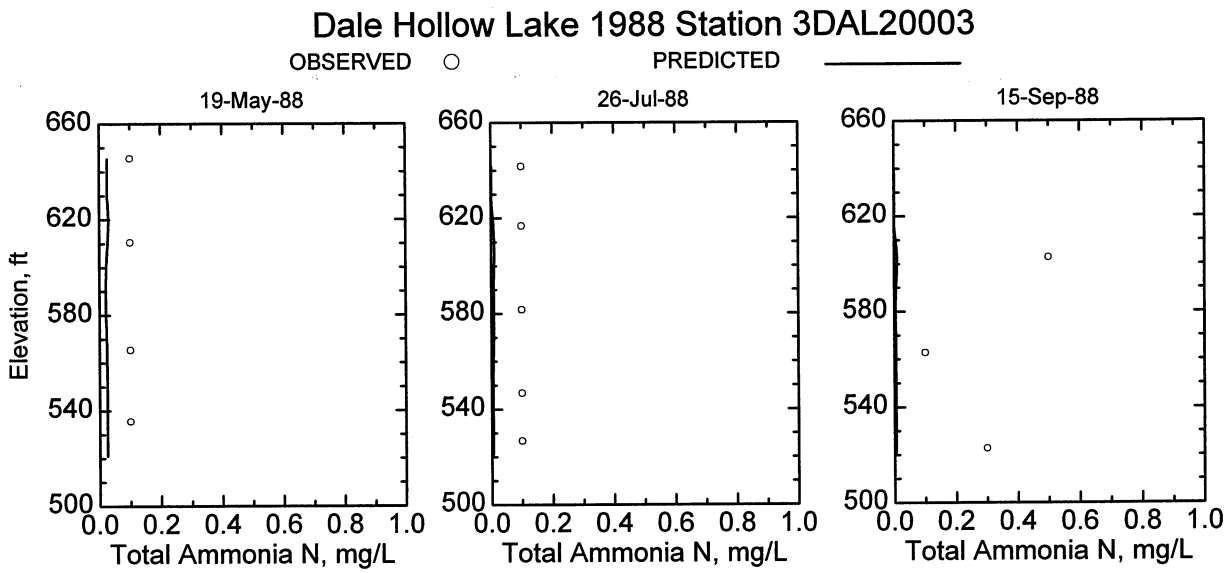

Dale Hollow Lake 1988 Station CLN116 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

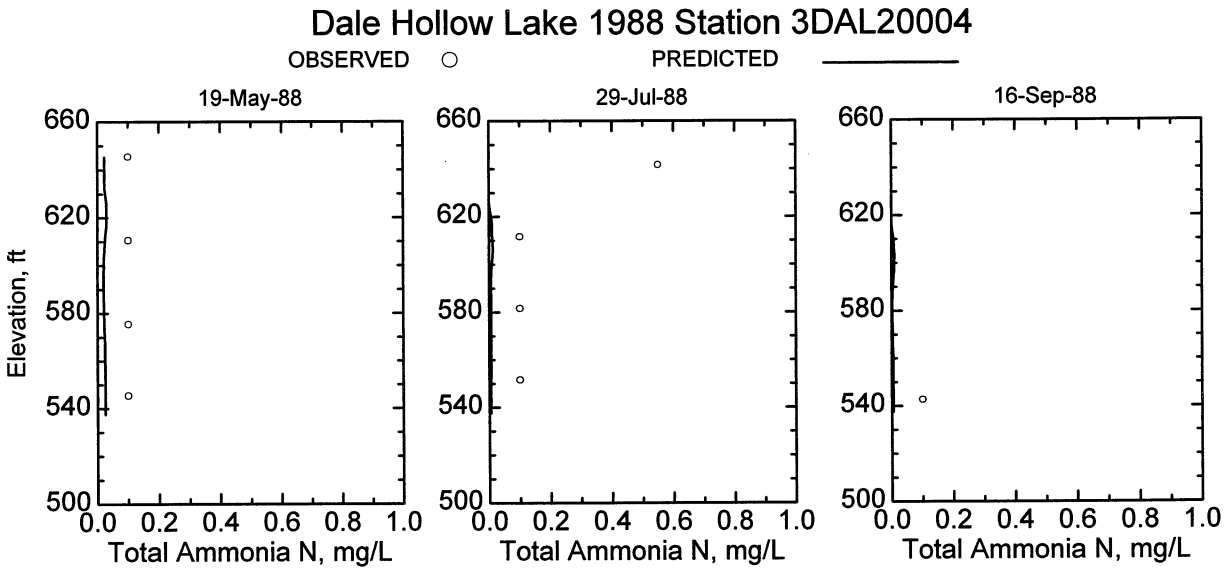

Dale Hollow Lake 1988 Station CLN117 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

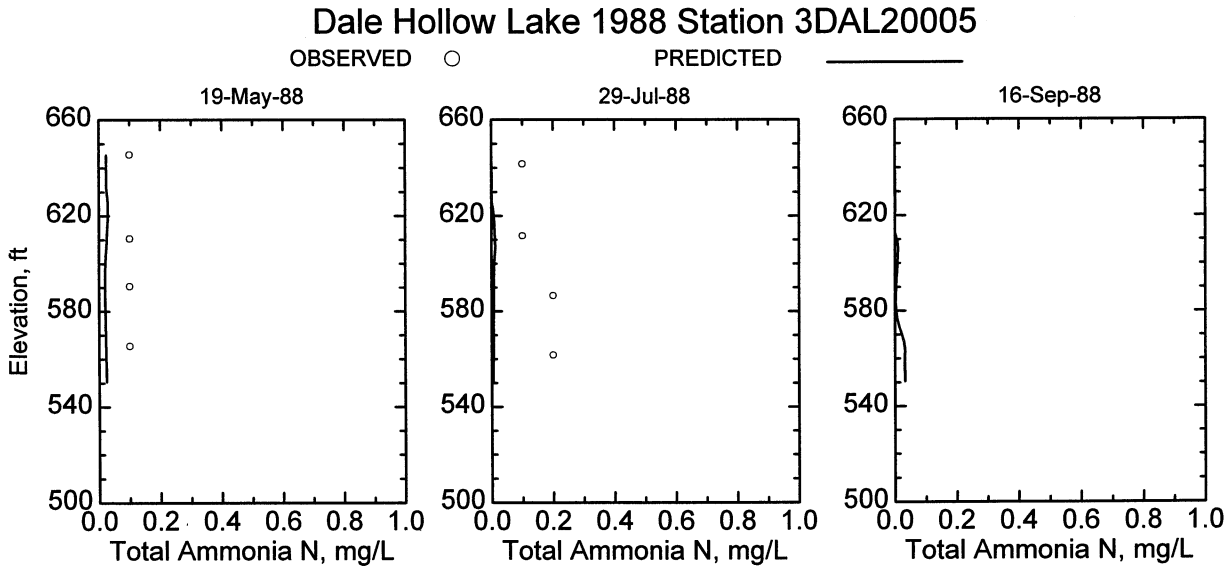

Dale Hollow Lake 1988 Station CLN119 (SP)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

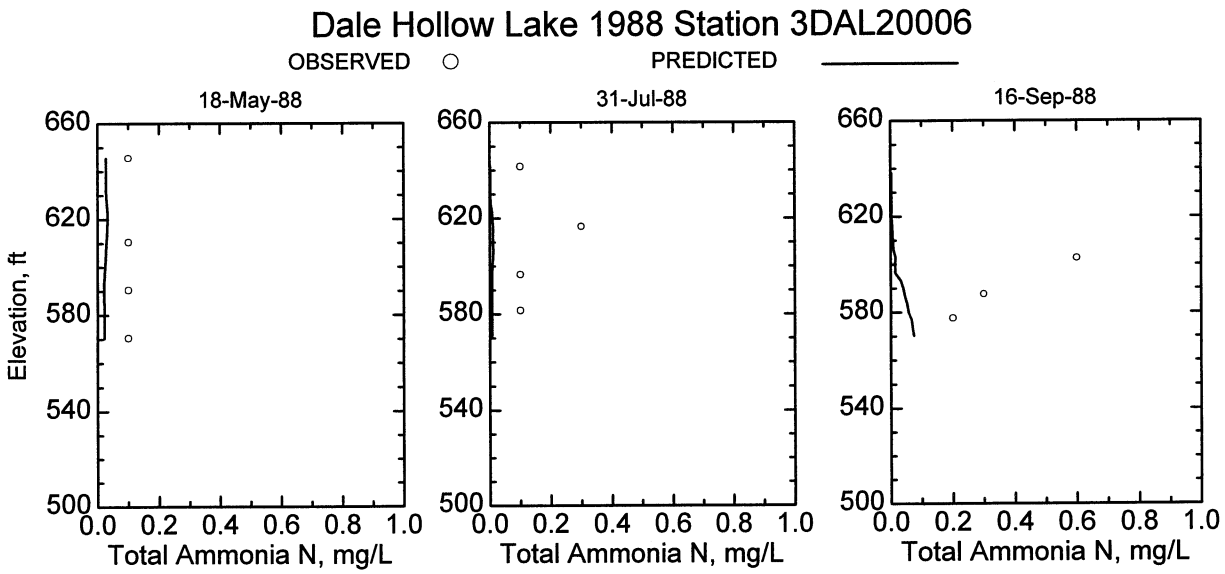

Dale Hollow Lake 1988 Station CLN118 (WR)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

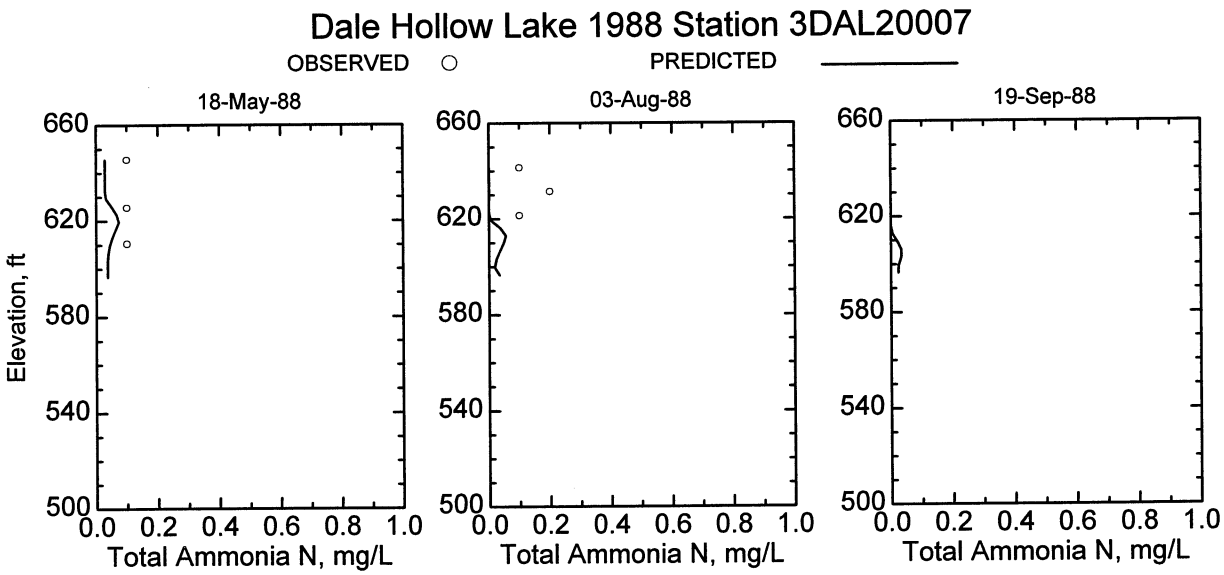

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

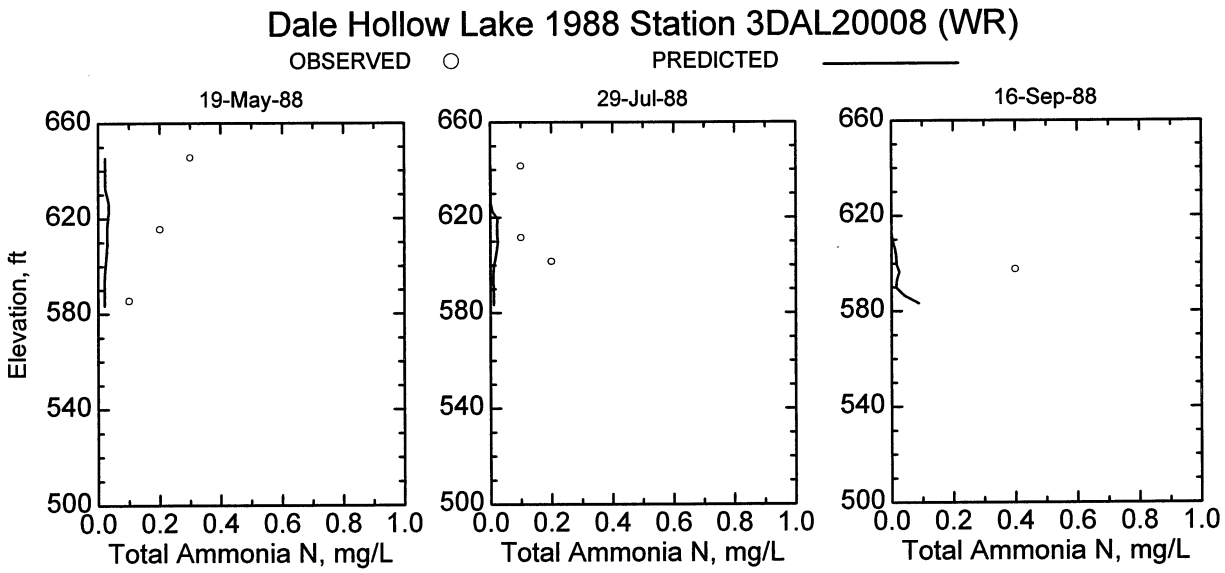

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

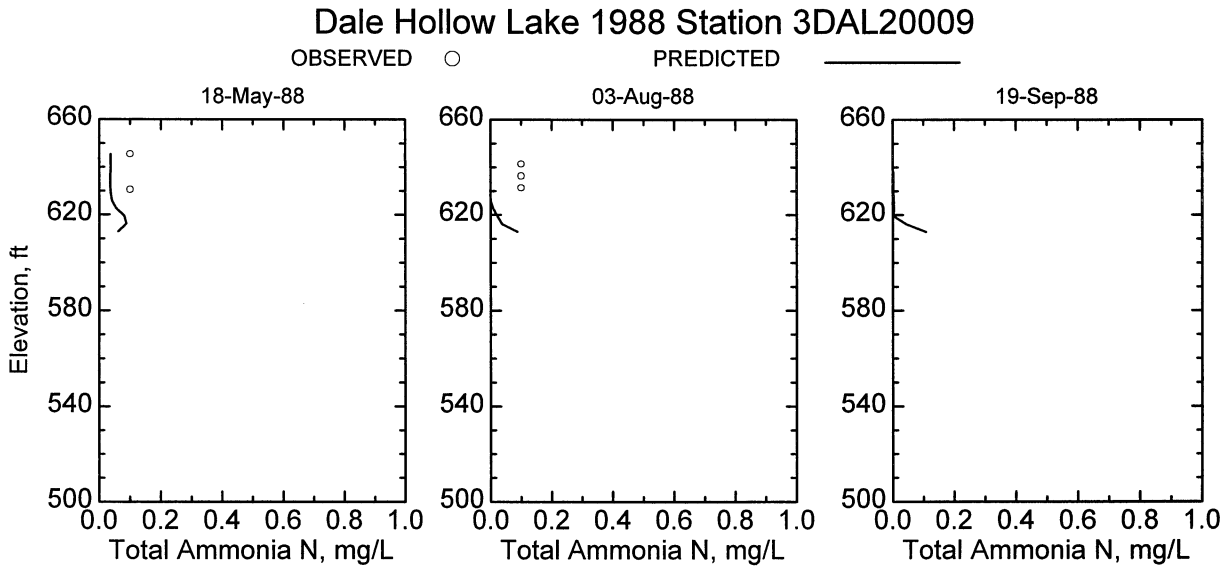

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

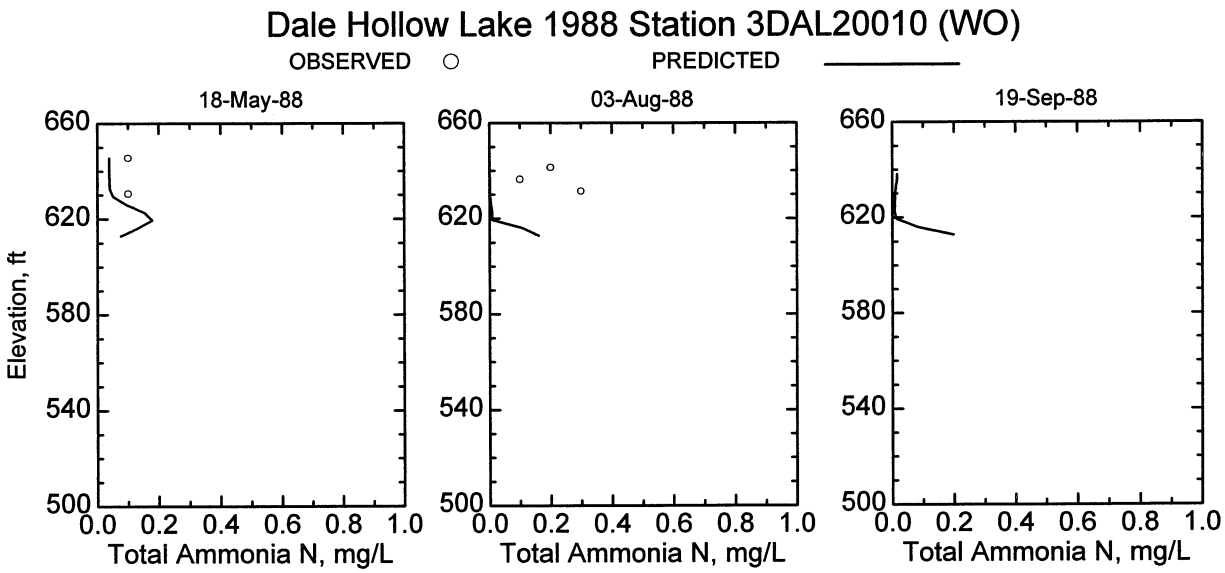

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

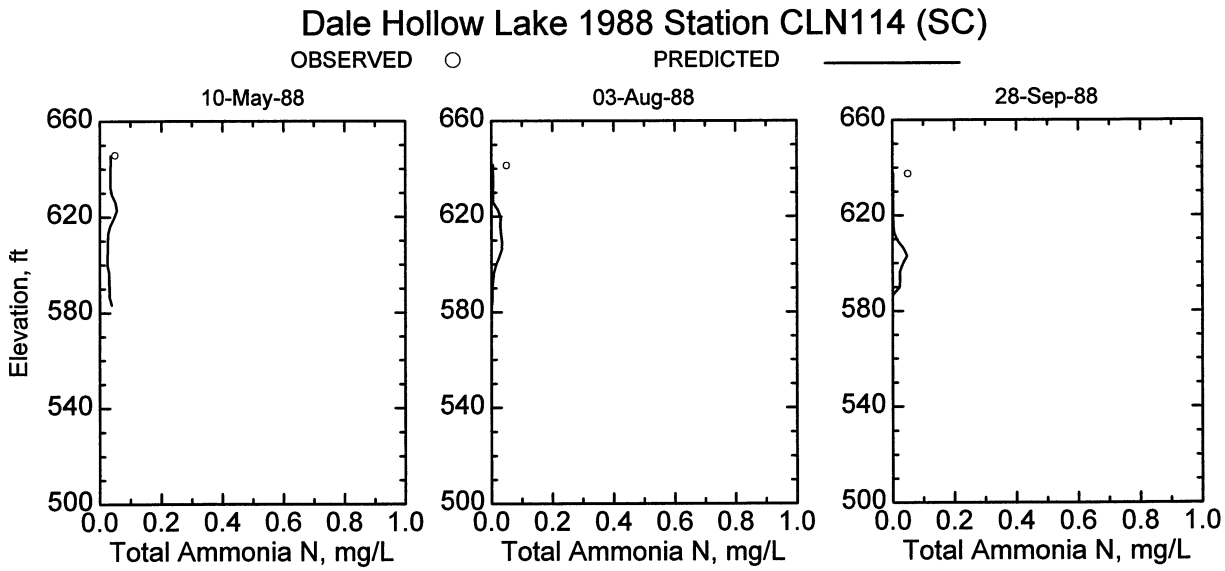

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

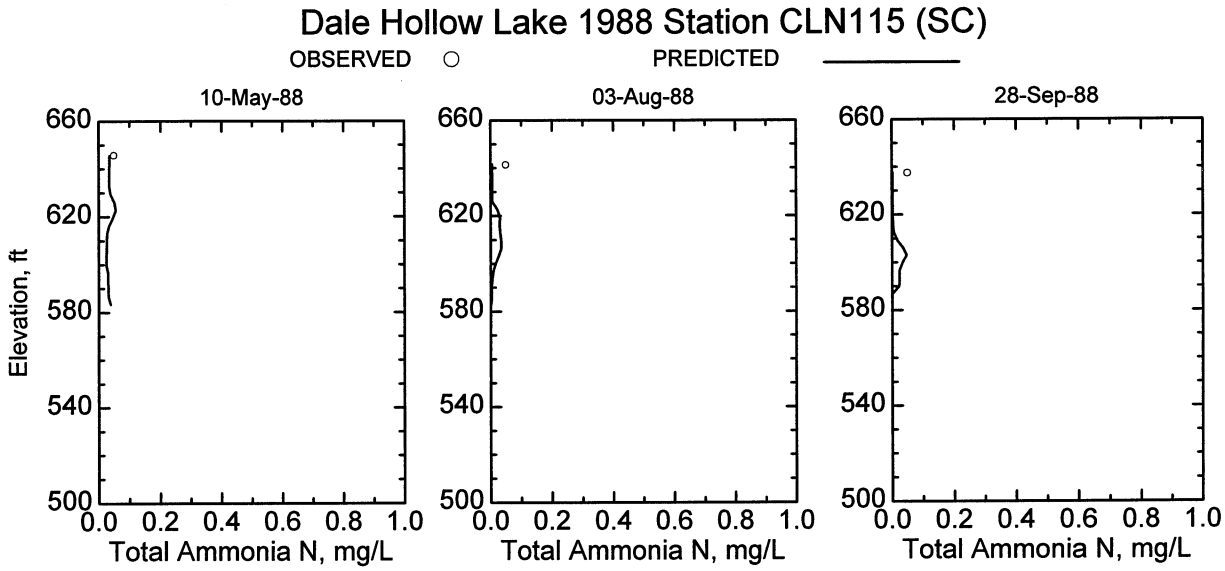

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

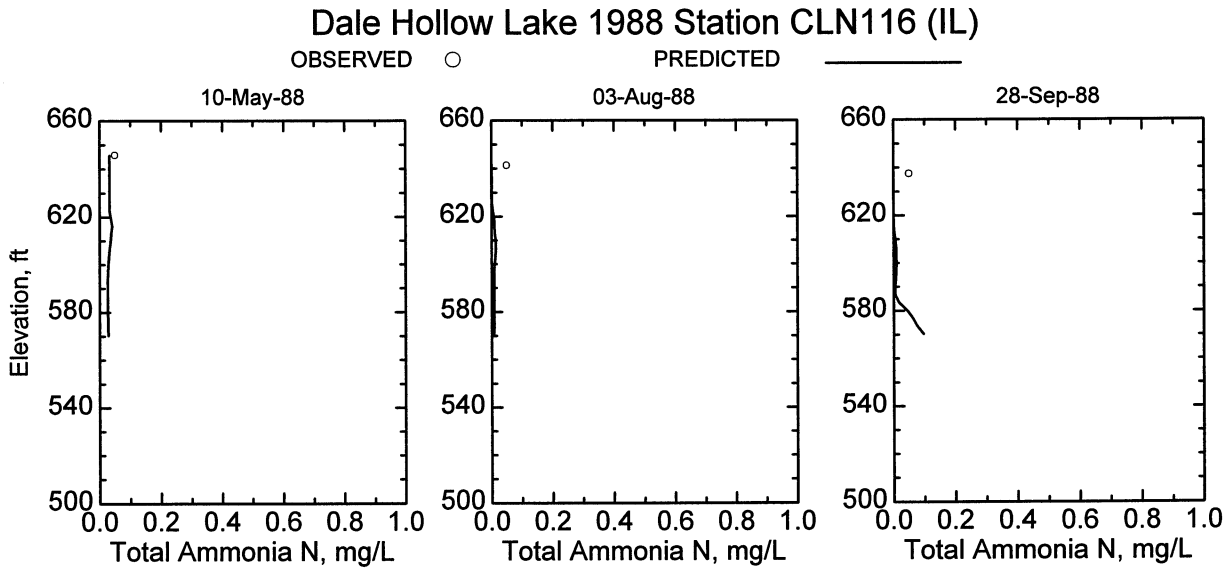

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

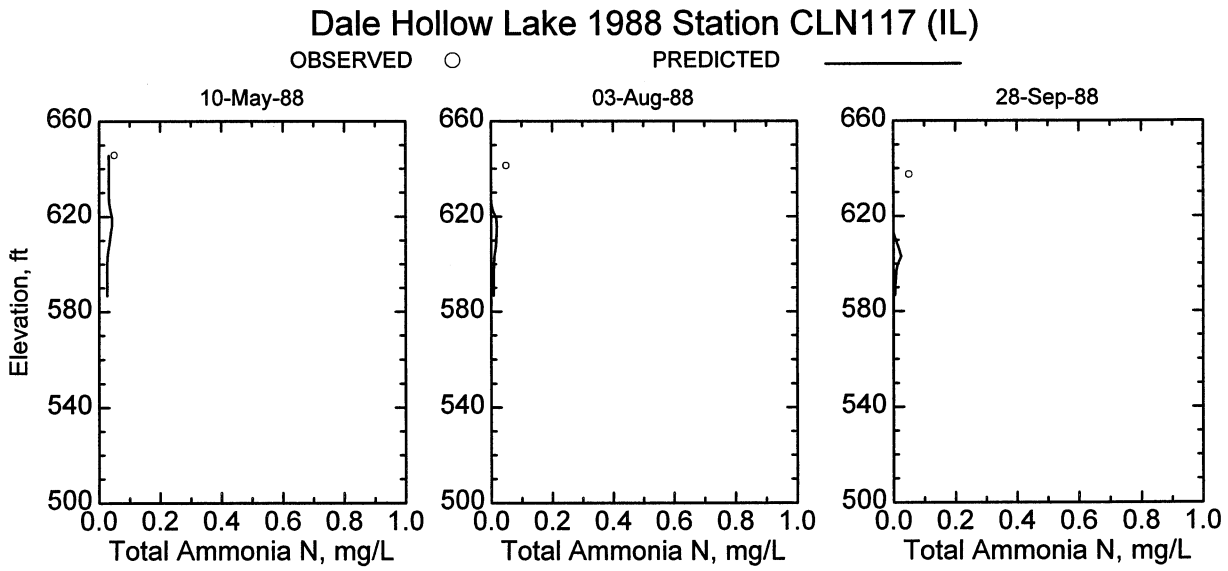

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

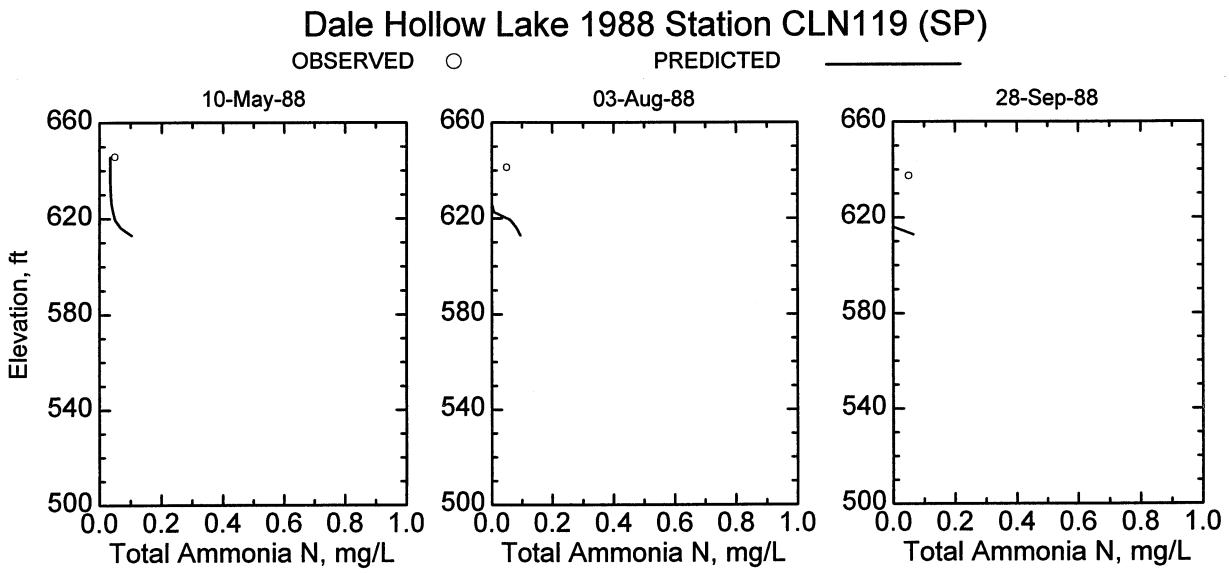

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

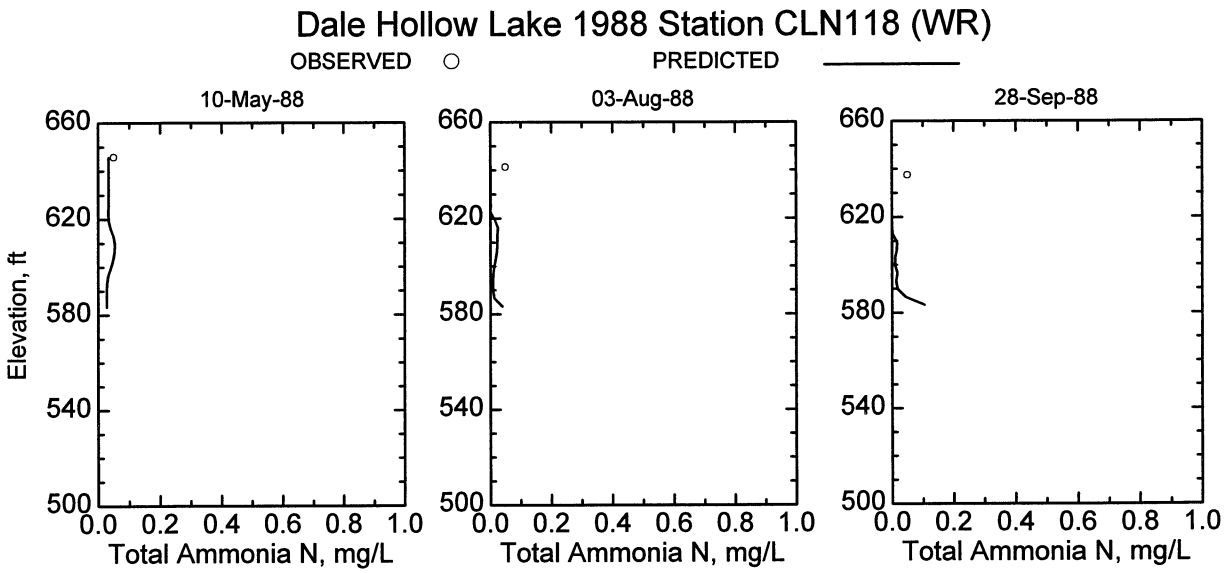

Dale Hollow Lake 1988 Station CLN114 (SC)
OBSERVED
PREDICTED
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

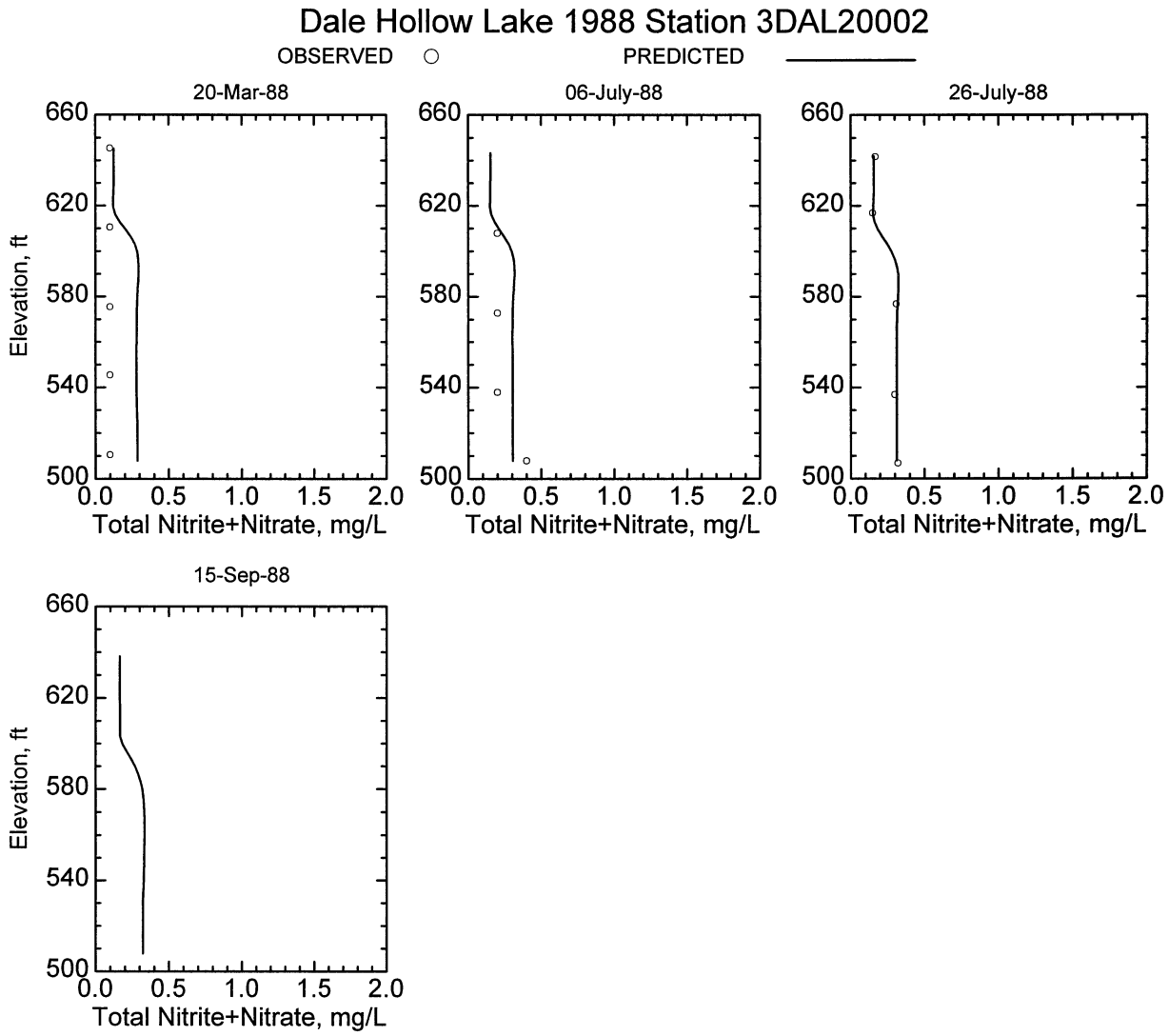

Dale Hollow Lake 1988 Station CLN115 (SC)
OBSERVED
PREDICTED
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

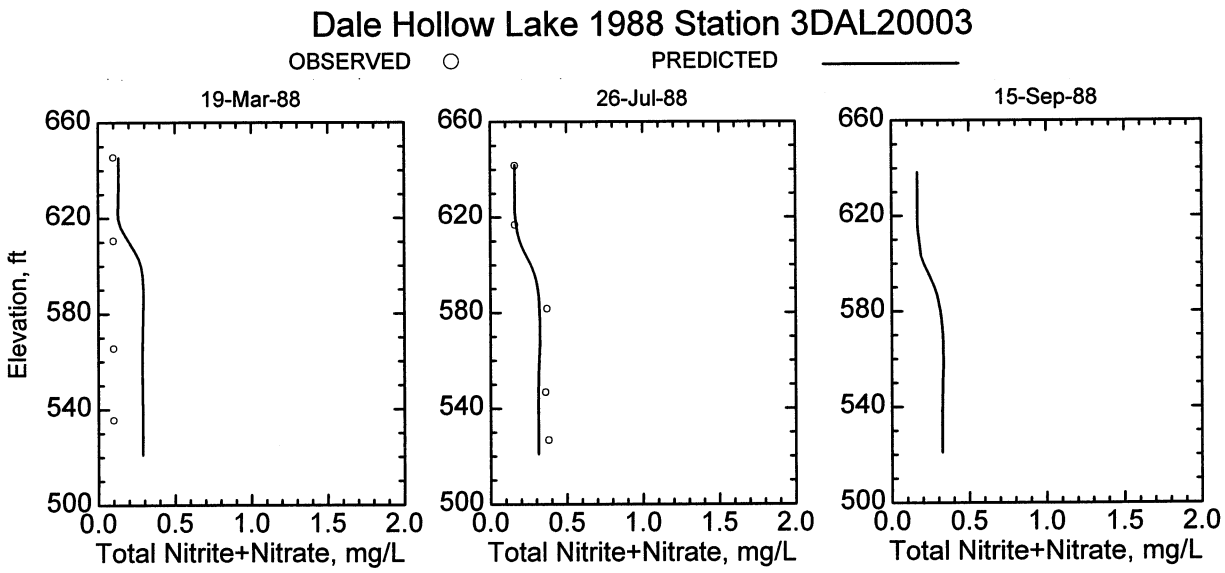

Dale Hollow Lake 1988 Station CLN116 (IL)
OBSERVED
PREDICTED
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

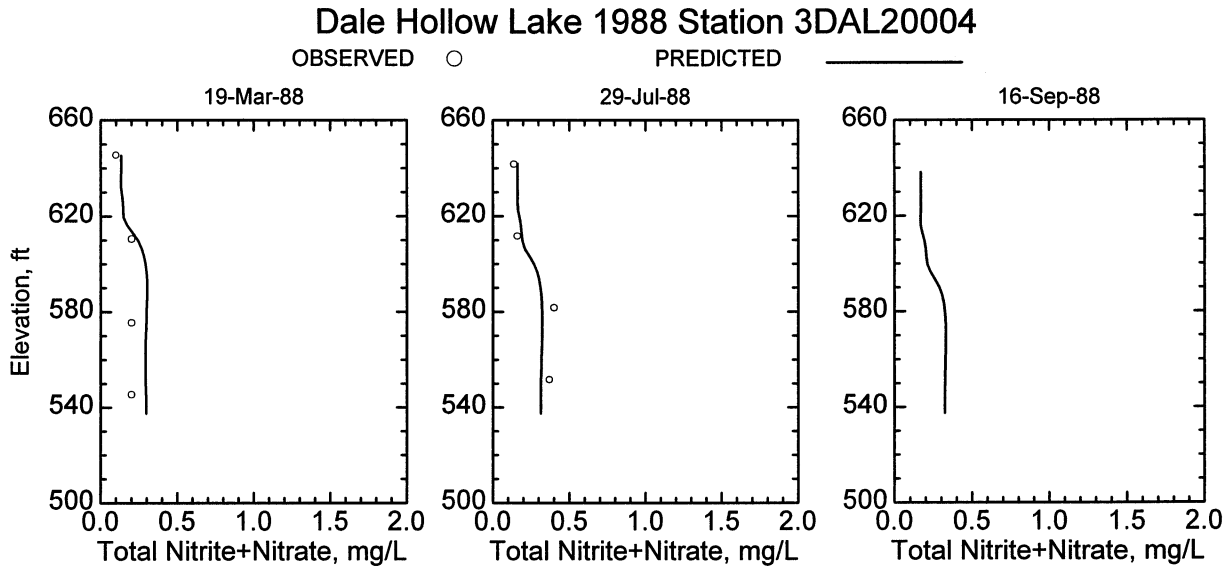

Dale Hollow Lake 1988 Station CLN117 (IL)
OBSERVED
PREDICTED
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

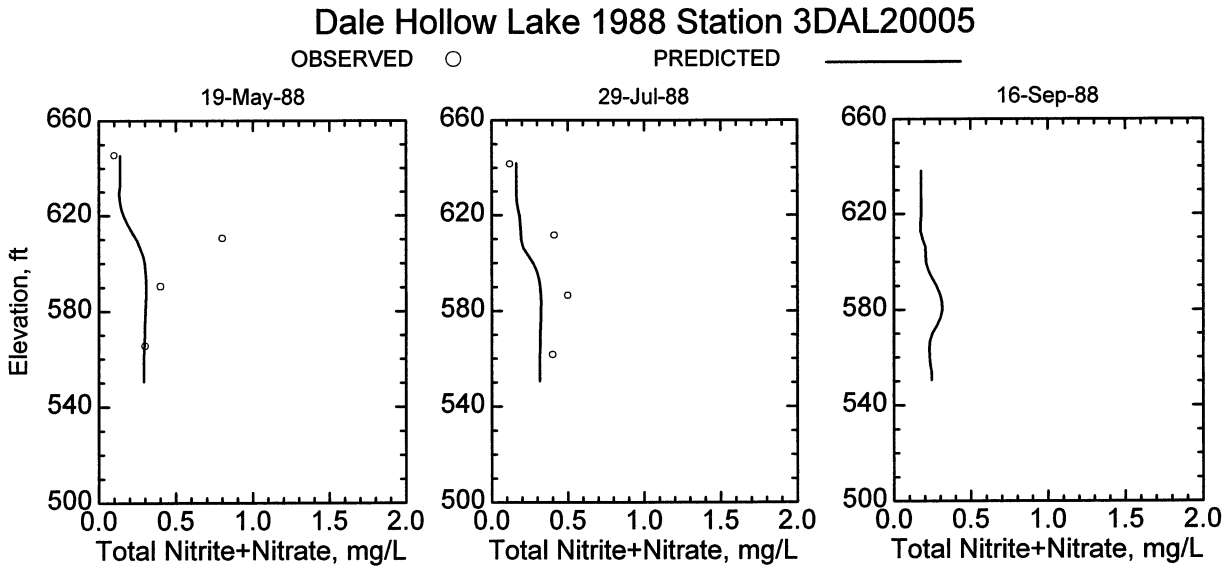

Dale Hollow Lake 1988 Station CLN119 (SP)
OBSERVED
PREDICTED
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

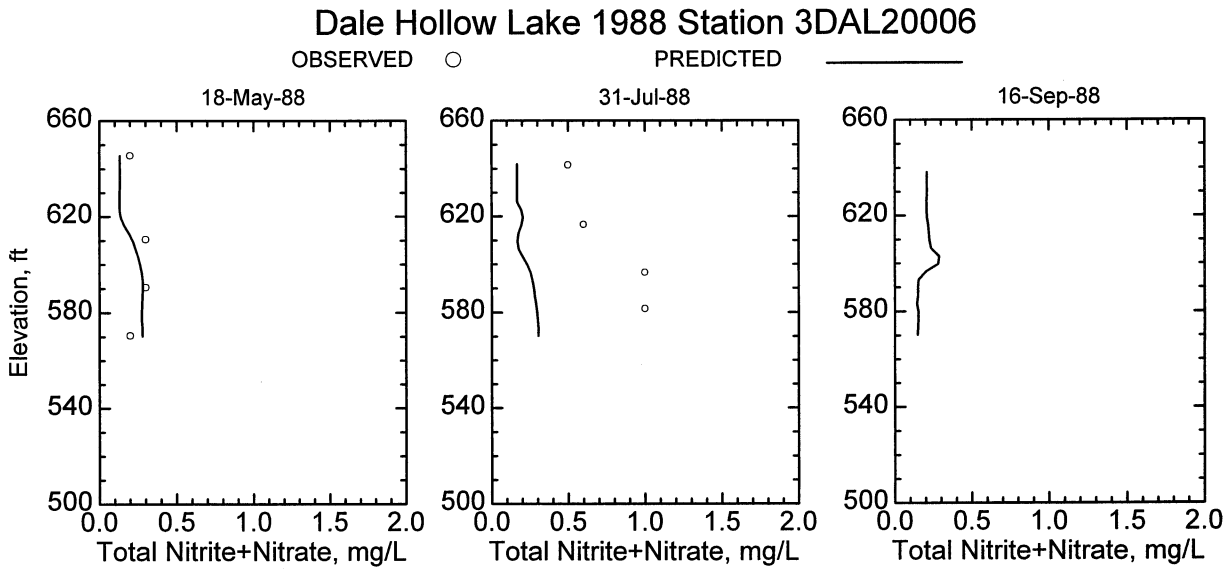

Dale Hollow Lake 1988 Station CLN118 (WR)
OBSERVED
PREDICTED
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

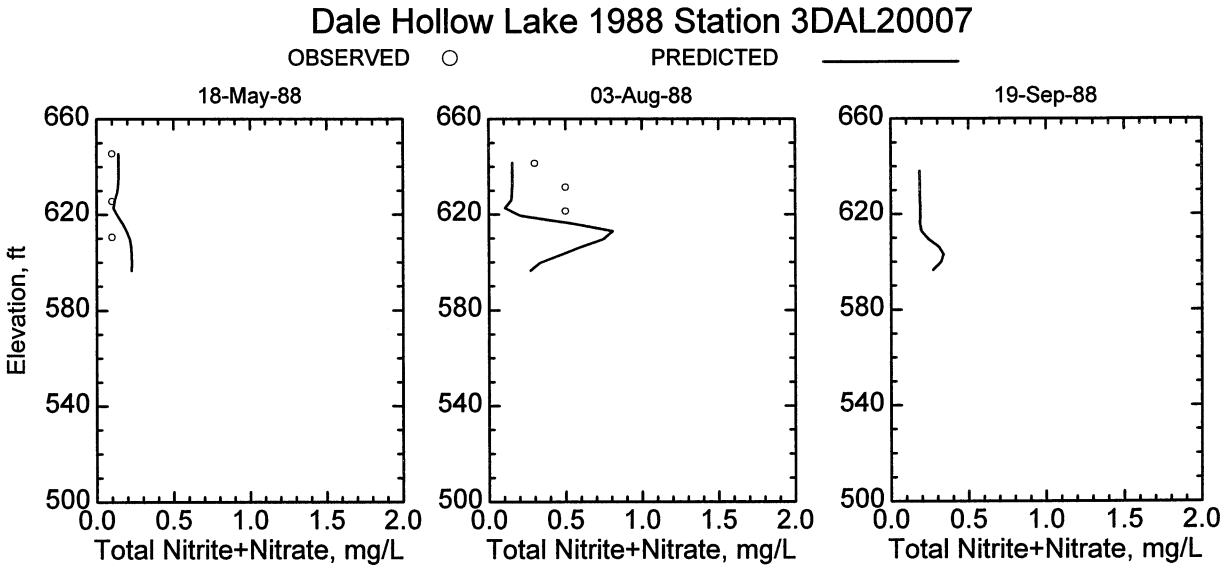

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-Mar-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

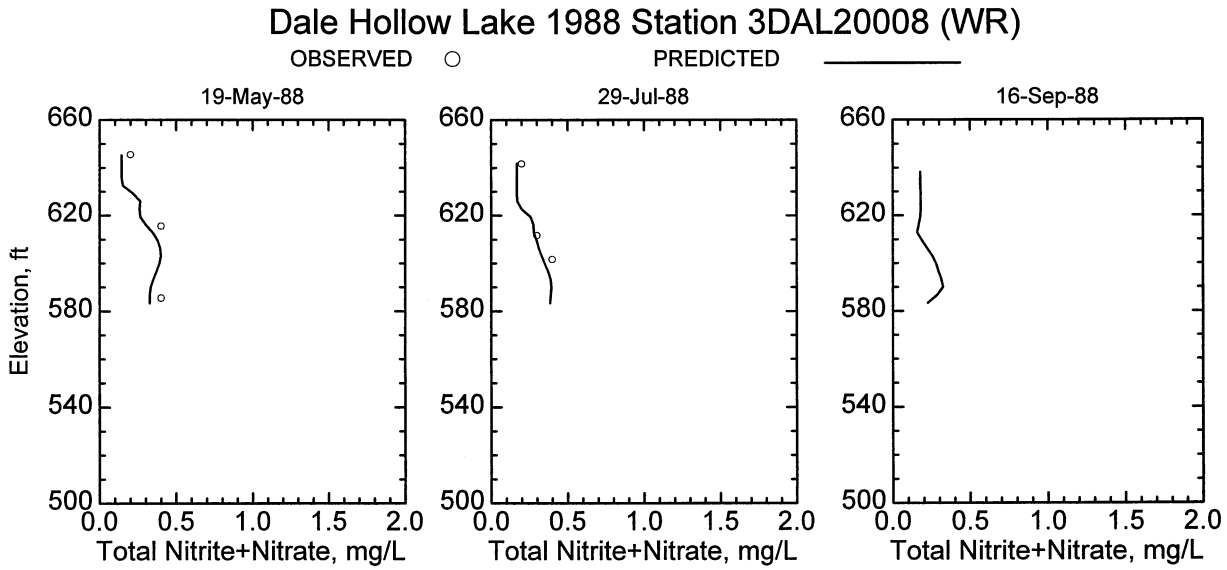

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-Mar-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

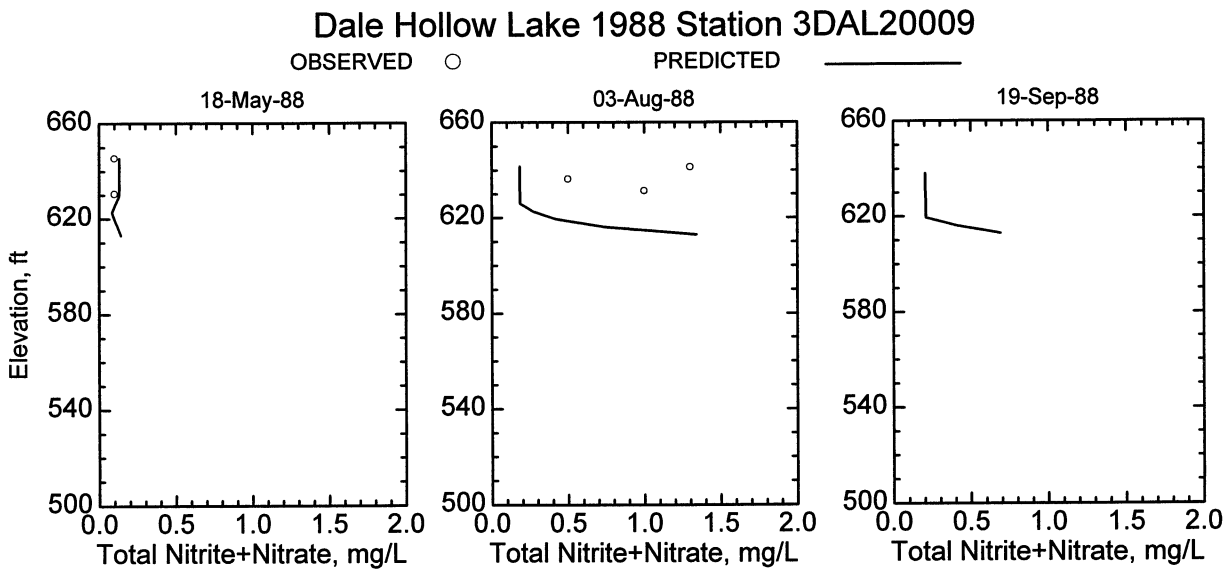

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-Mar-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

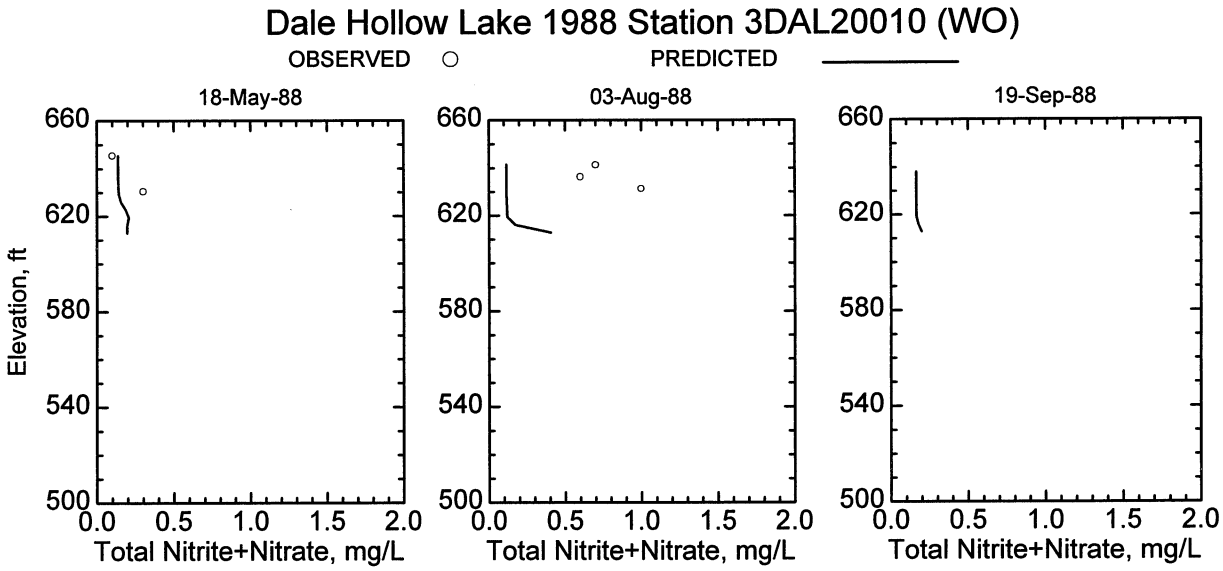

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

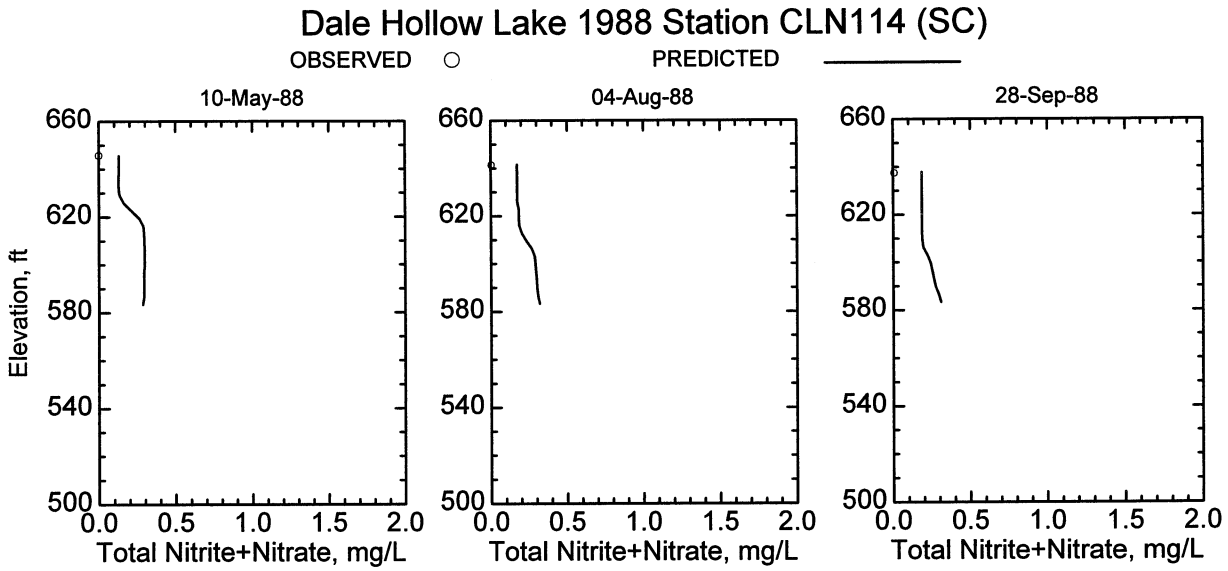

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

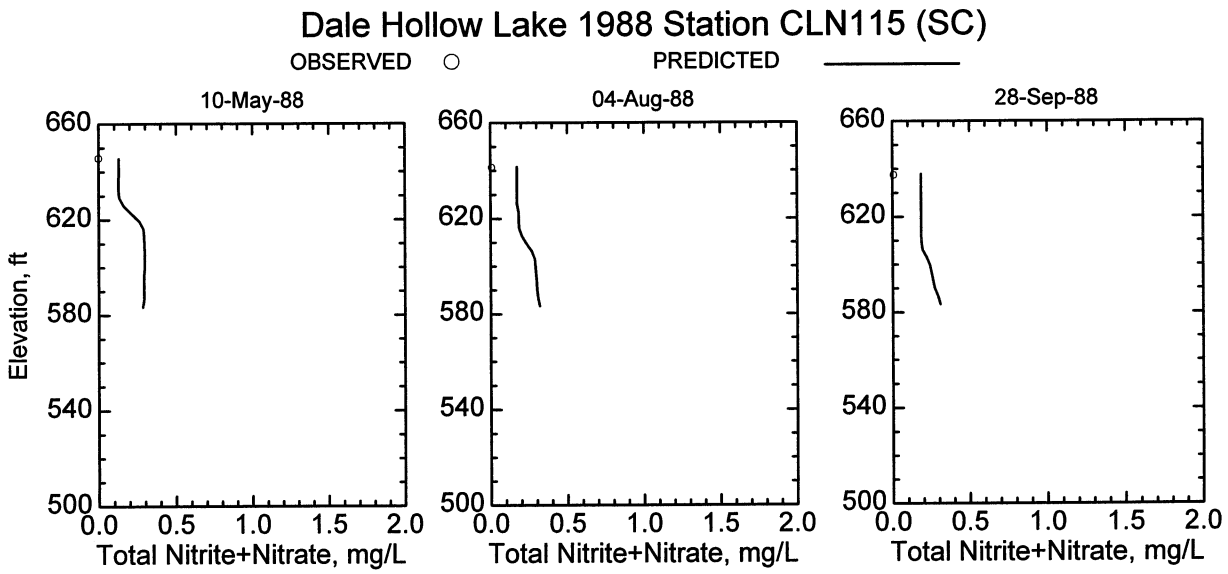

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

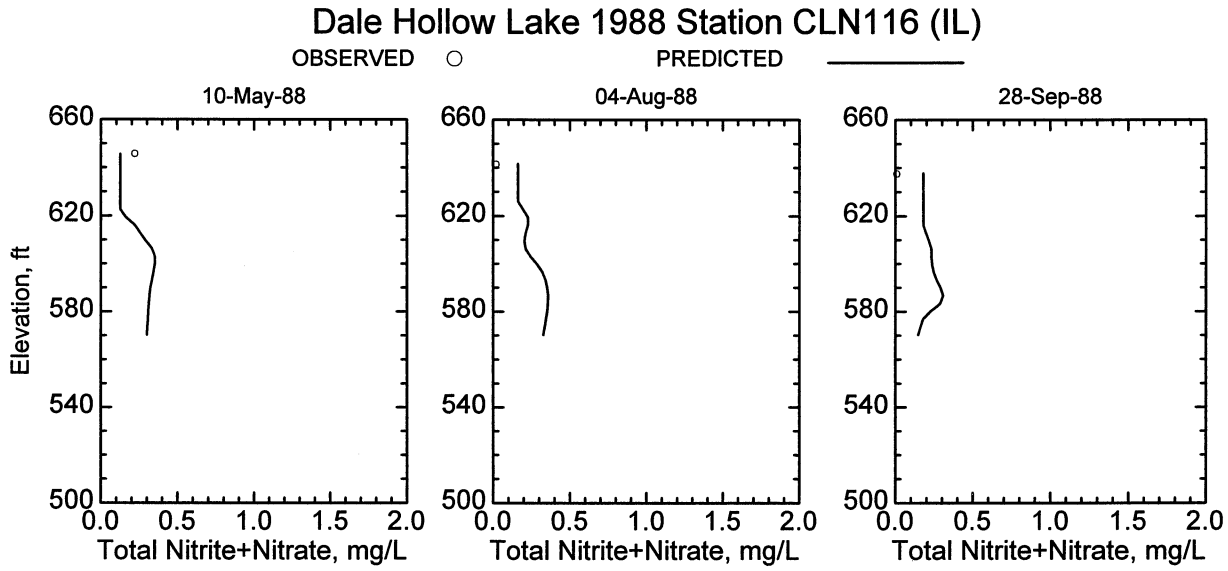

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

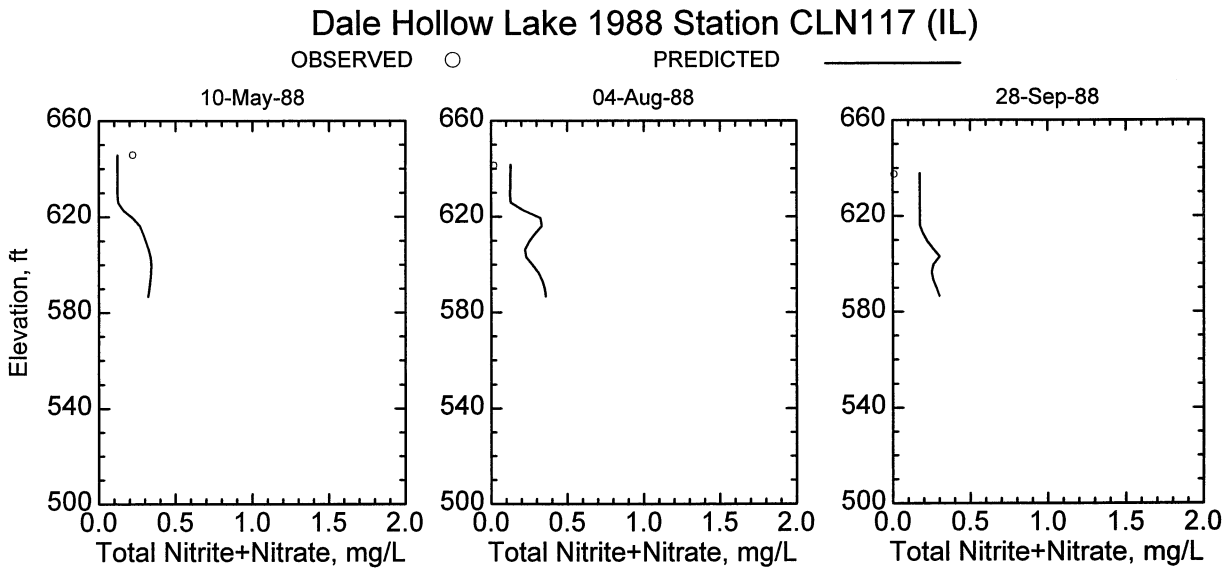

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

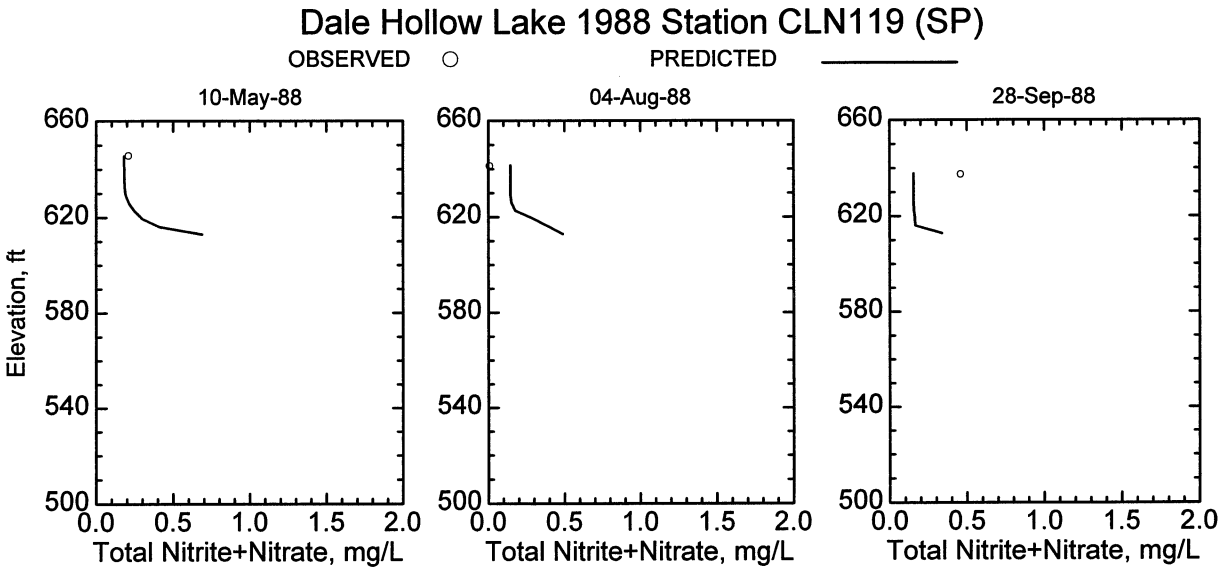

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

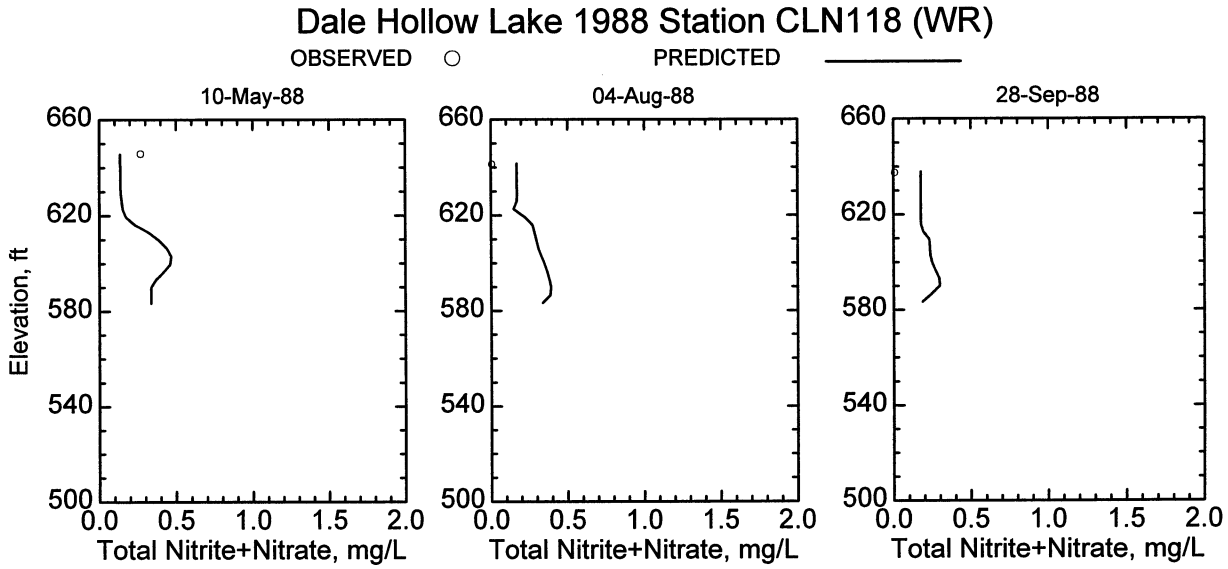

Dale Hollow Lake 1988 Station CLN114 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

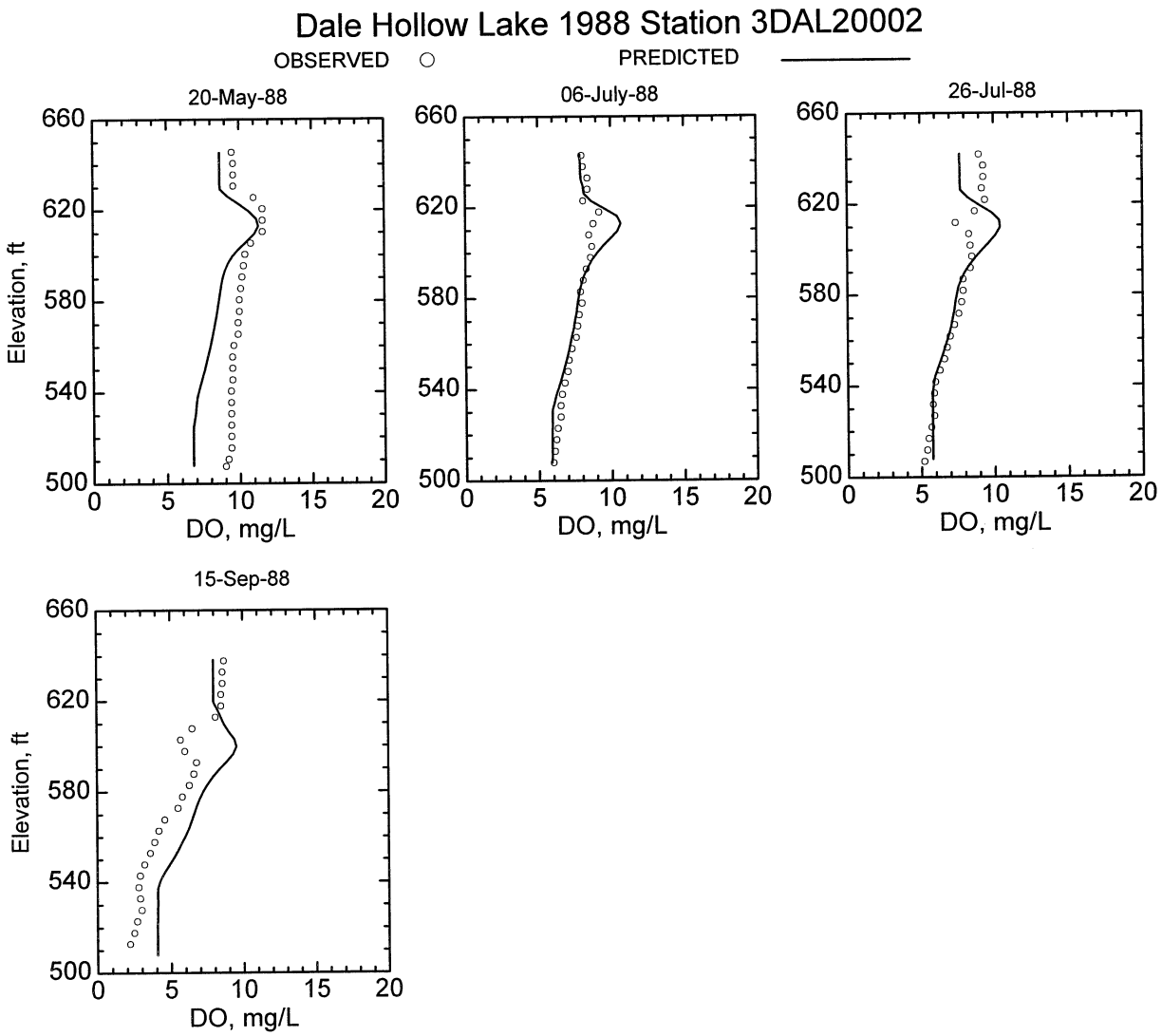

Dale Hollow Lake 1988 Station CLN115 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

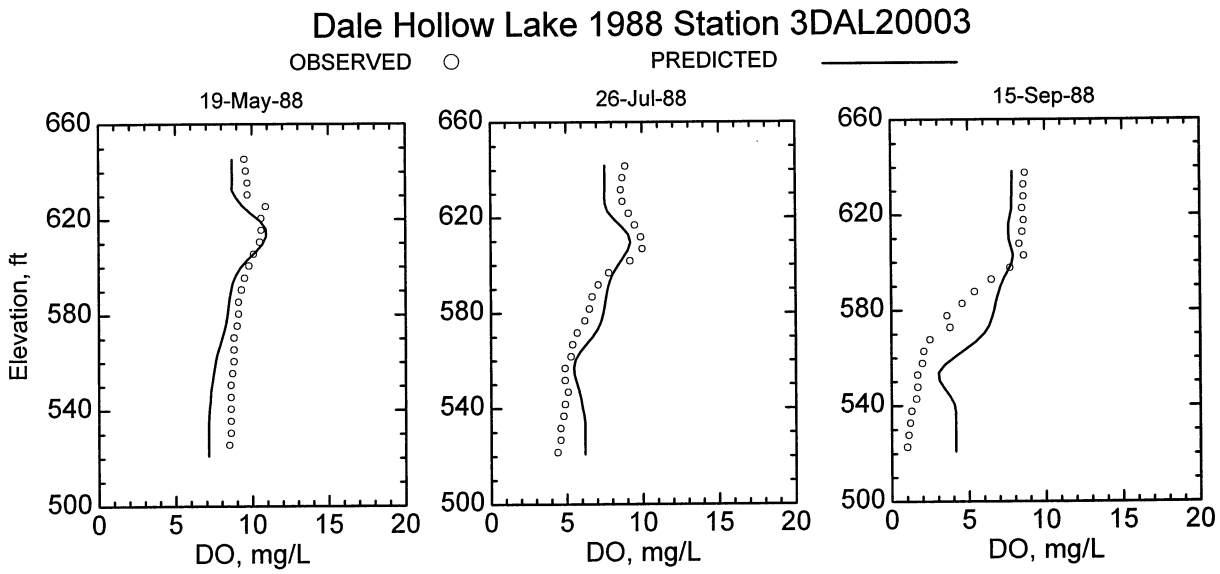

Dale Hollow Lake 1988 Station CLN116 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

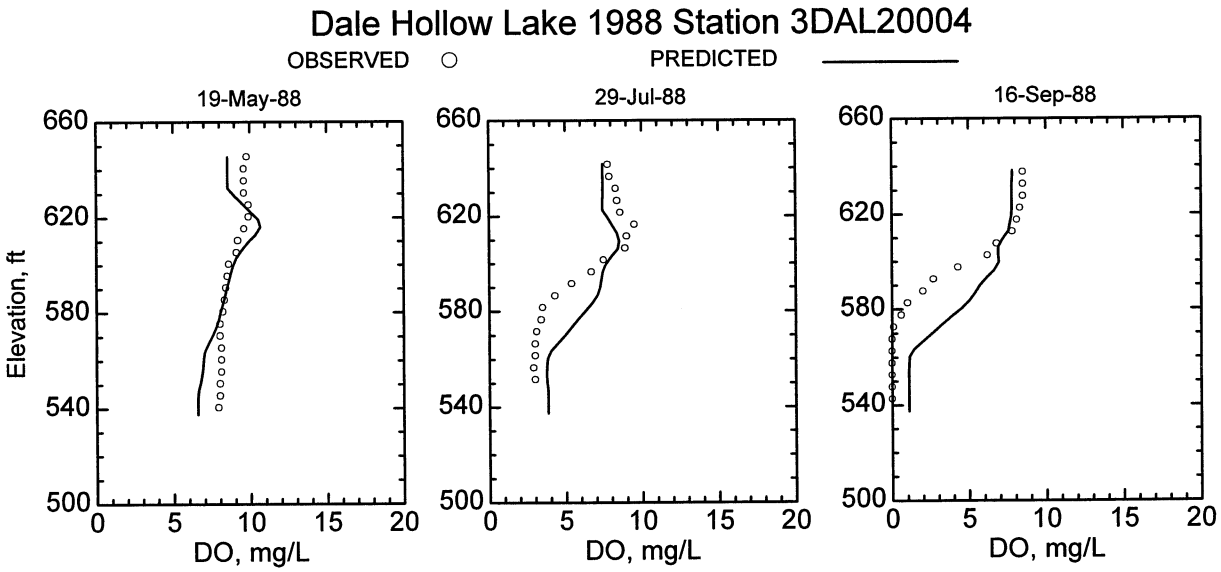

Dale Hollow Lake 1988 Station CLN117 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

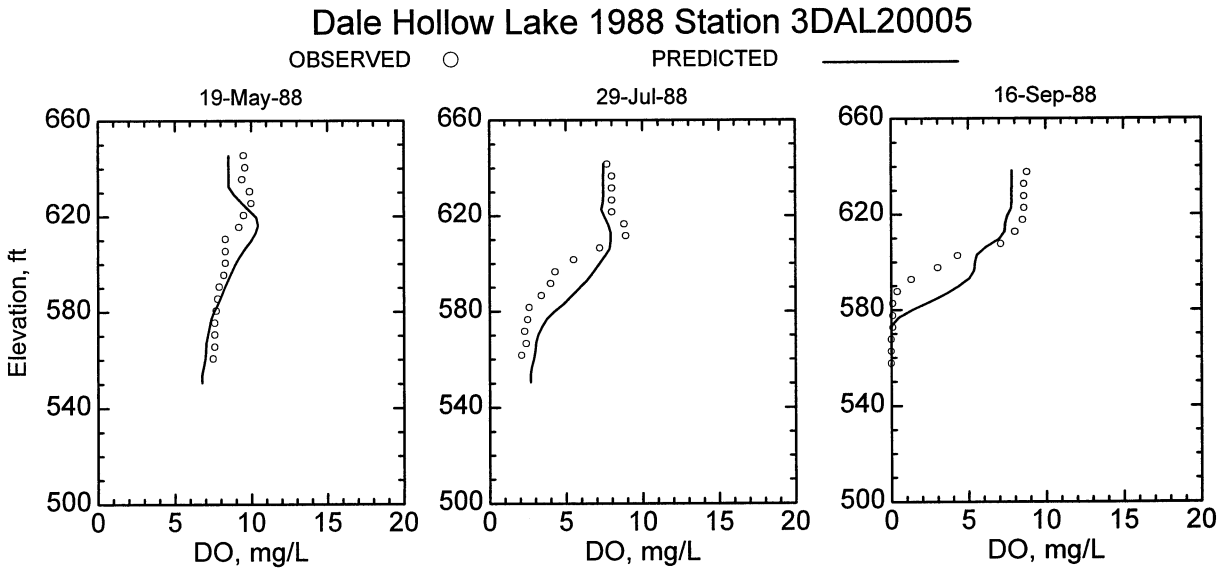

Dale Hollow Lake 1988 Station CLN119 (SP)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

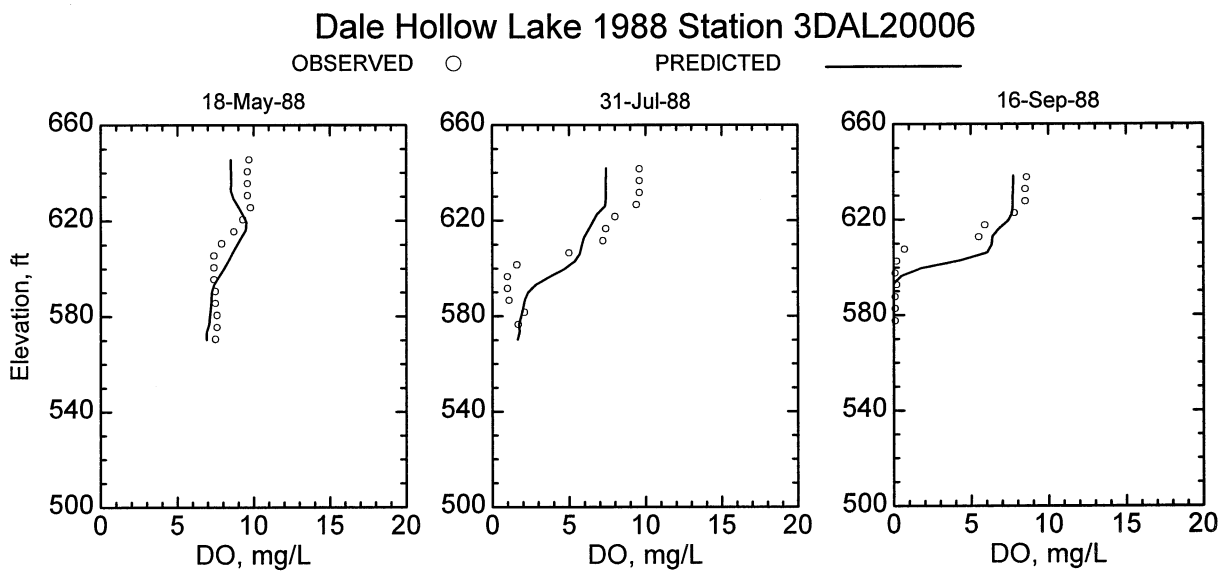

Dale Hollow Lake 1988 Station CLN118 (WR)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

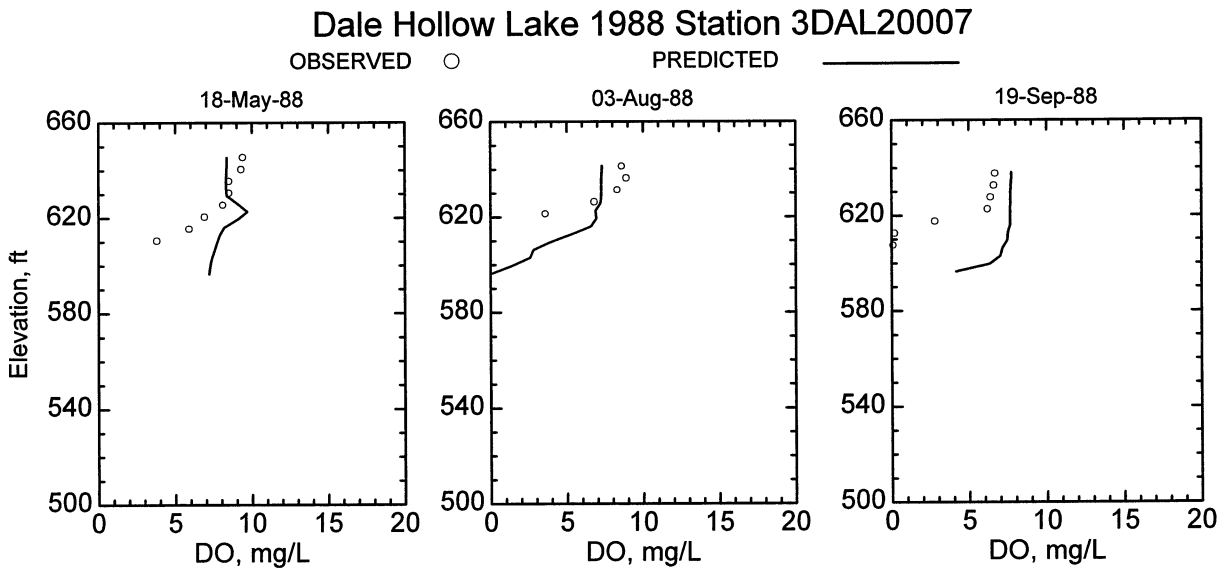

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-May-88
06-July-88
26-Jul-88
15-Sep-88
Elevation, ft
DO, mg/L
660
620
580
540
500
0
5
10
15
20

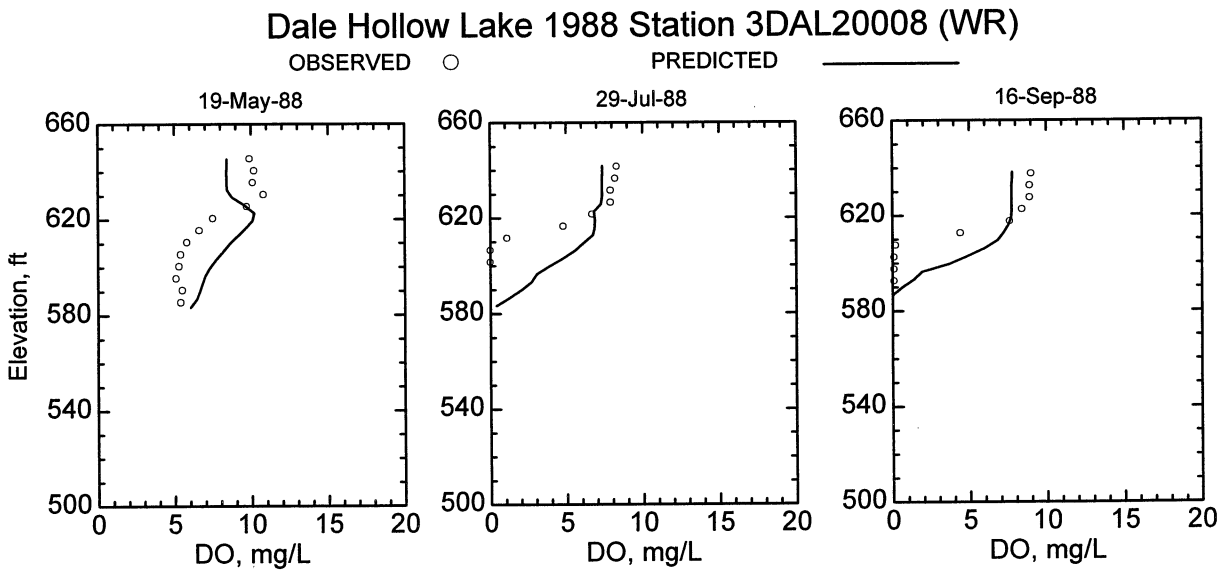

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

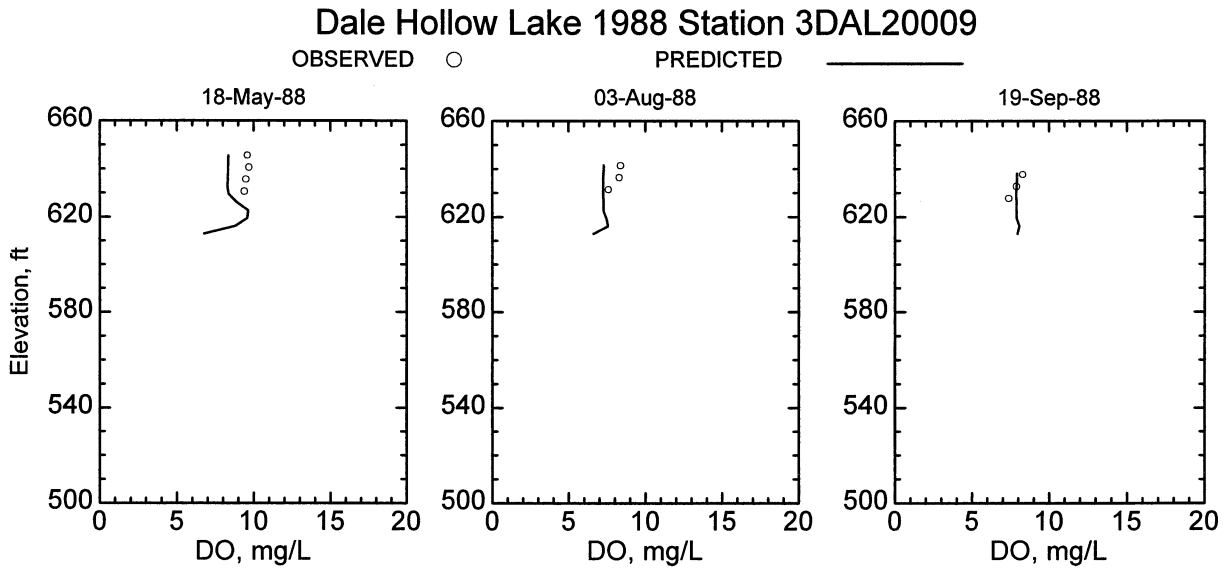

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

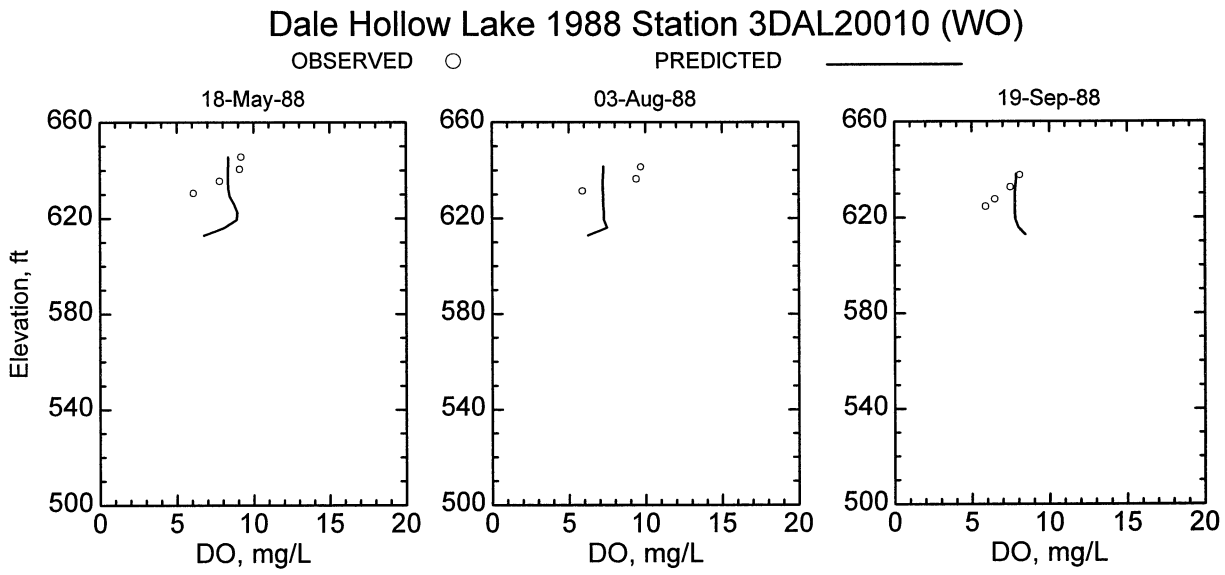

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

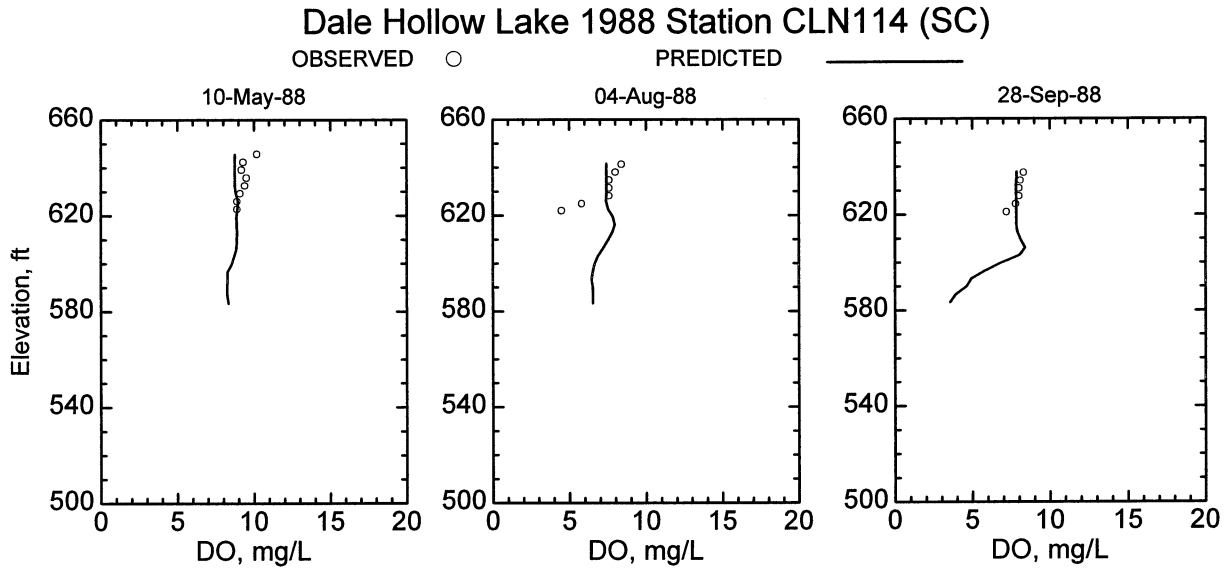

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

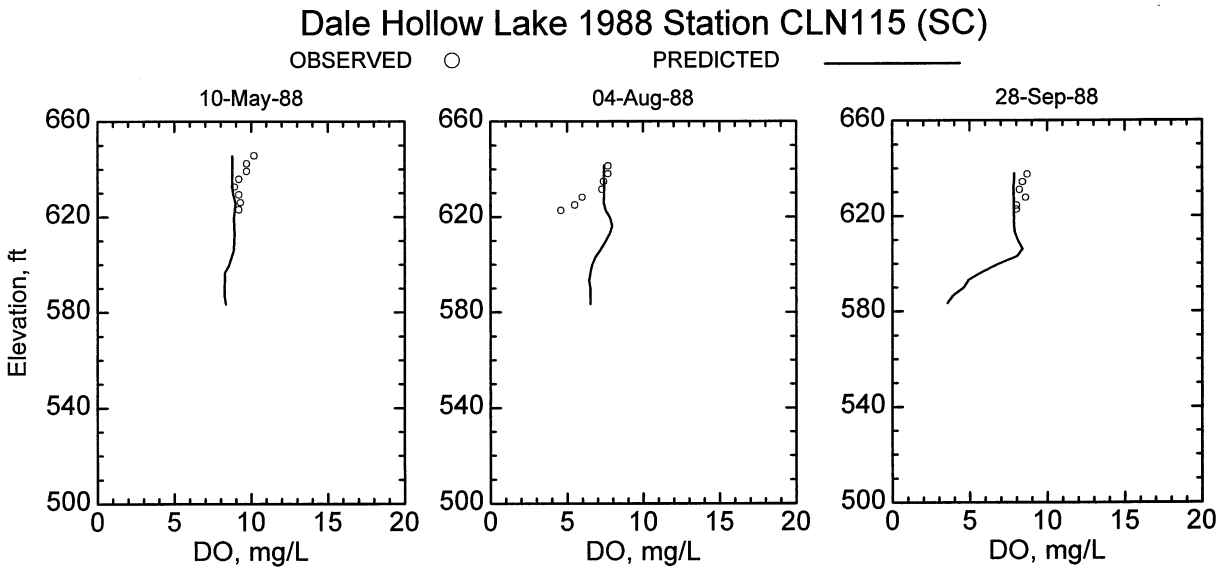

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

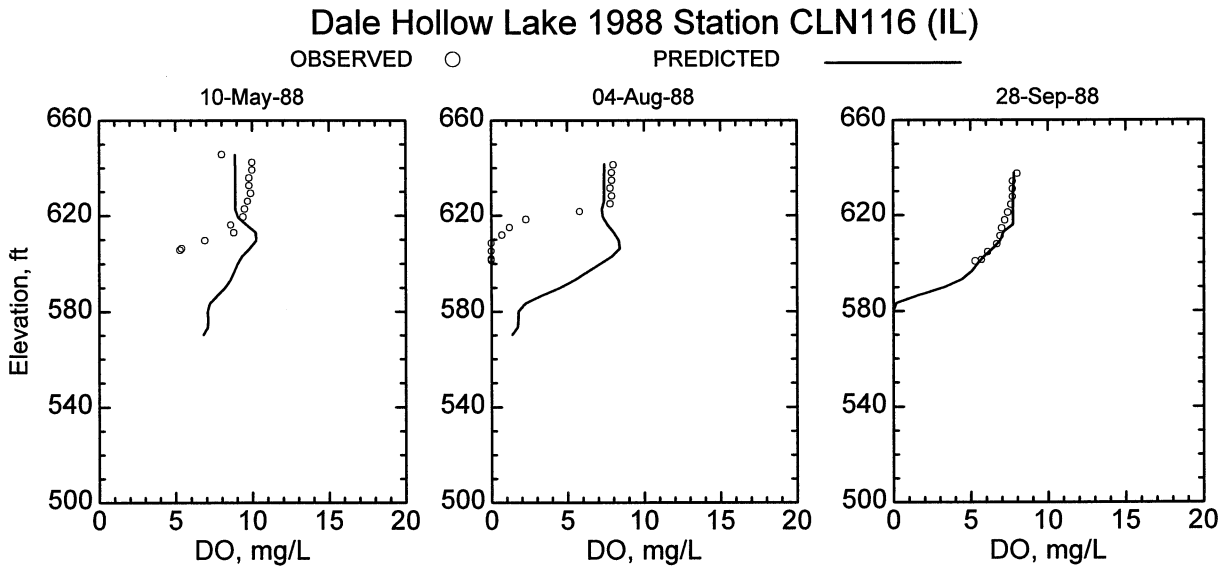

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

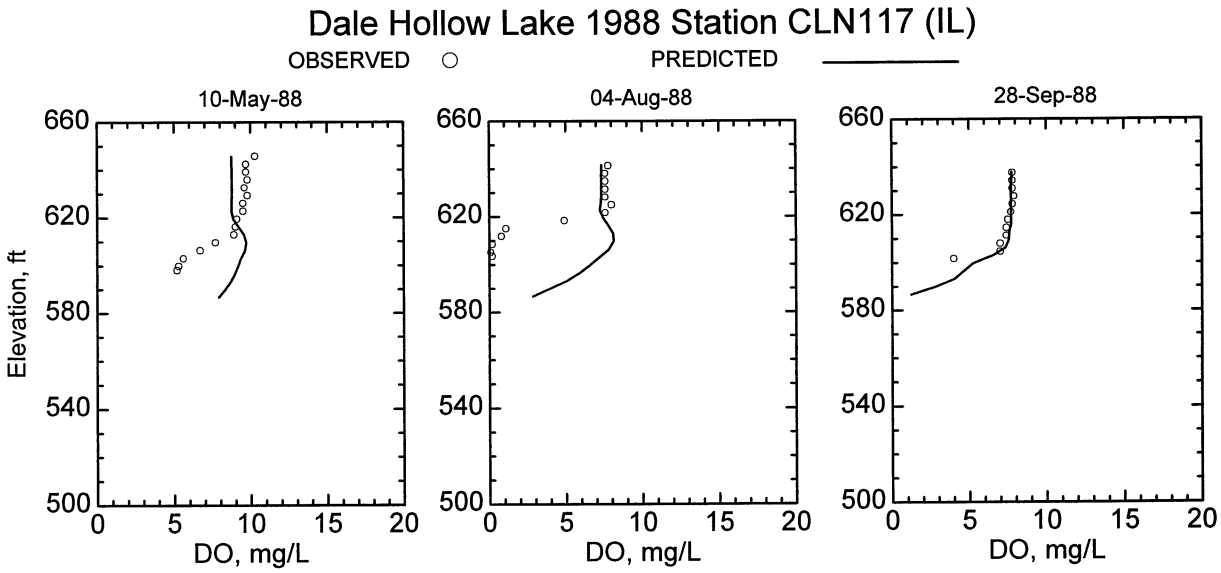

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

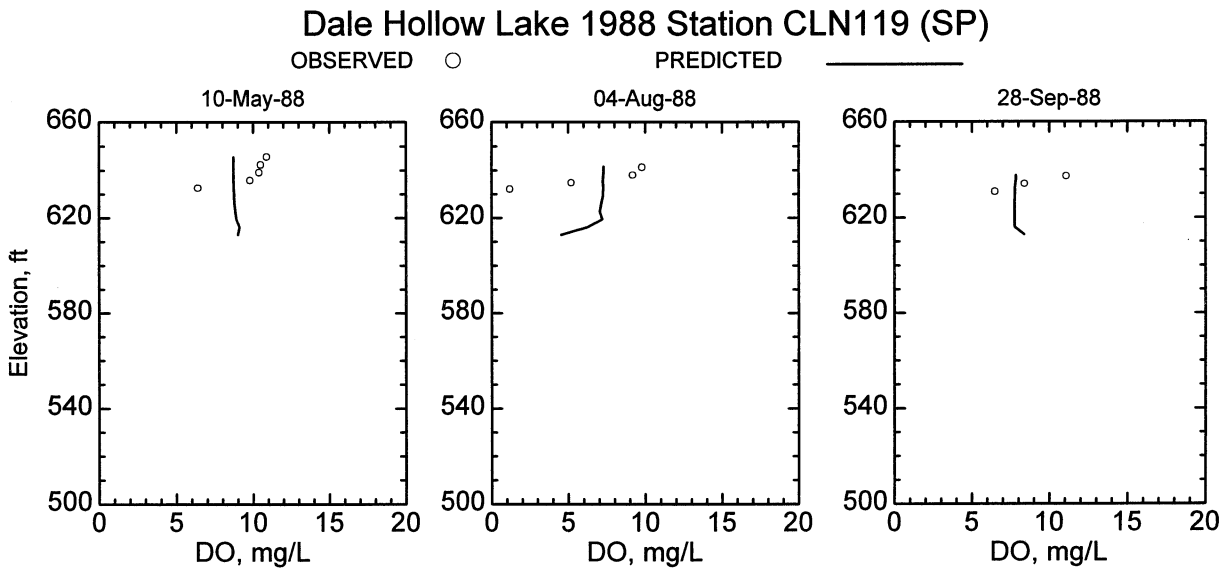

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

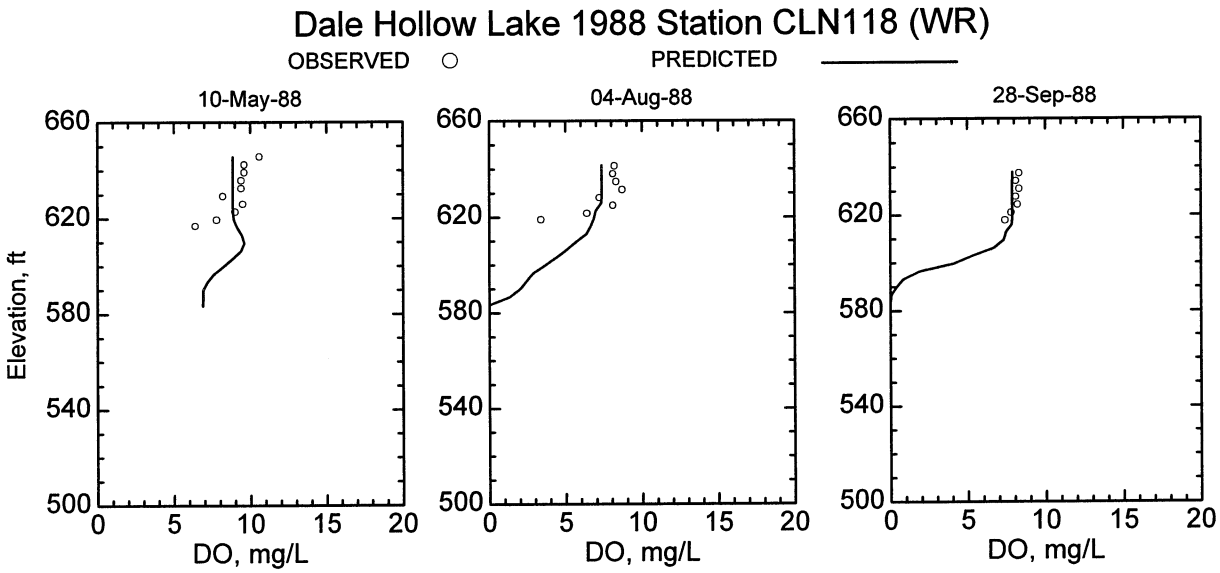

Dale Hollow Lake 1988 Station CLN114 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

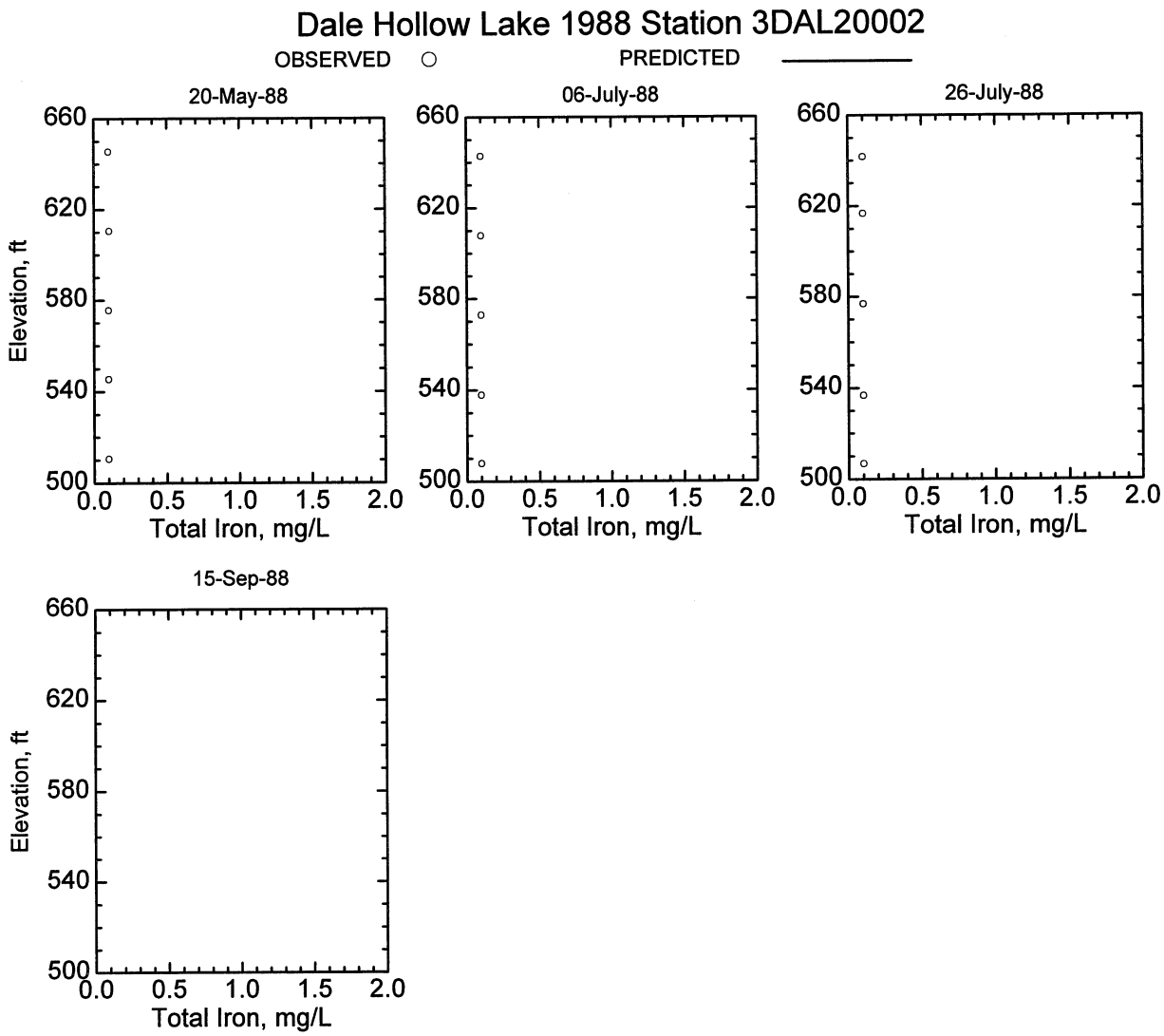

Dale Hollow Lake 1988 Station CLN115 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

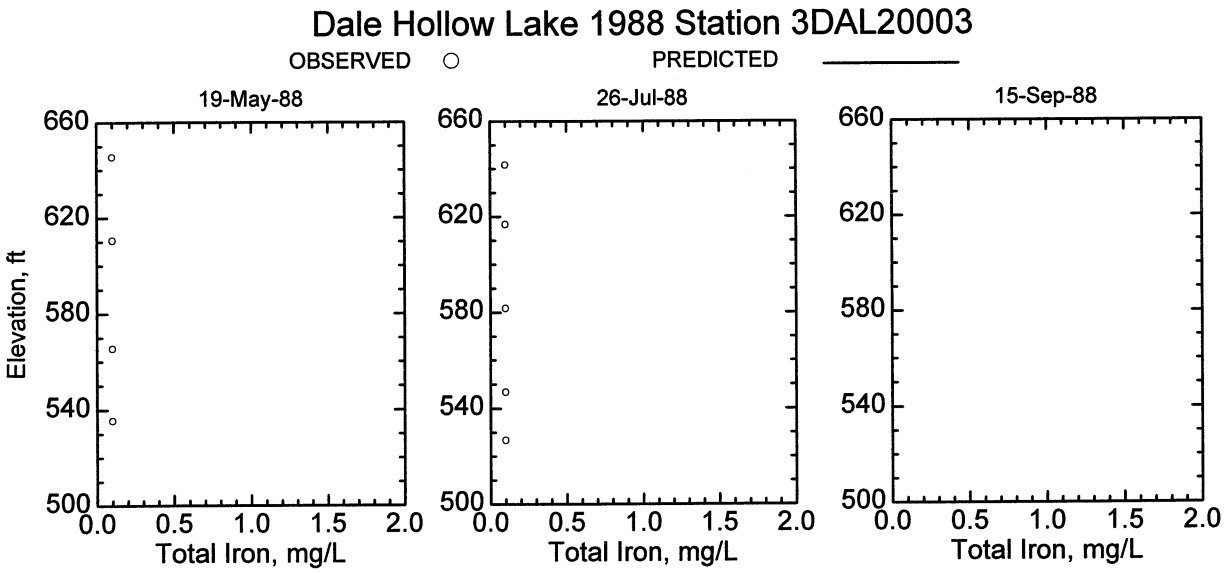

Dale Hollow Lake 1988 Station CLN116 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

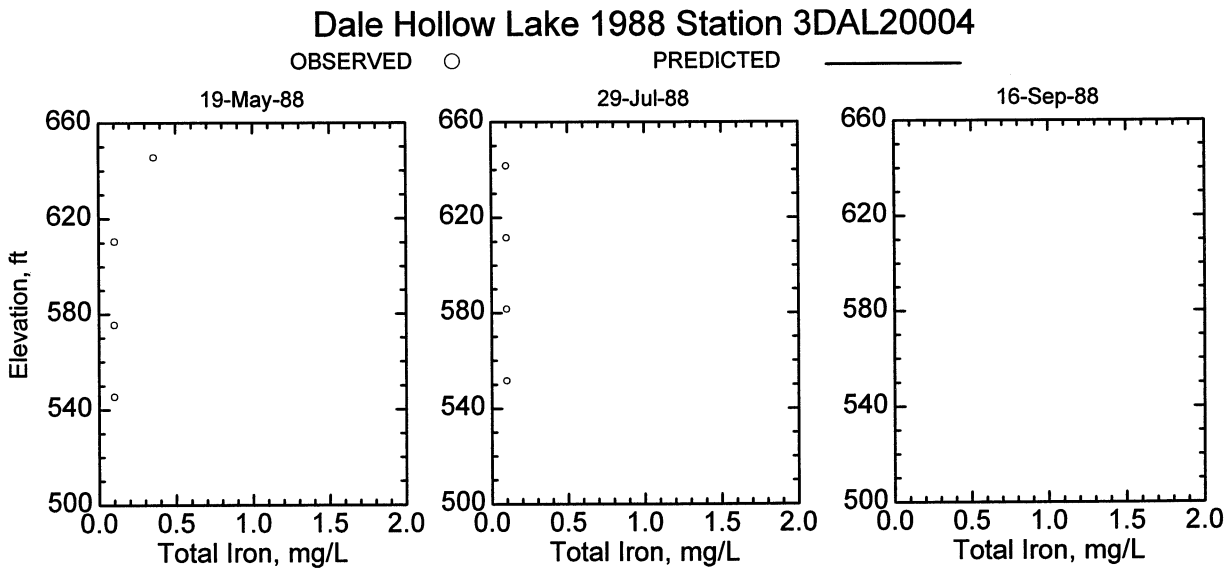

Dale Hollow Lake 1988 Station CLN117 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

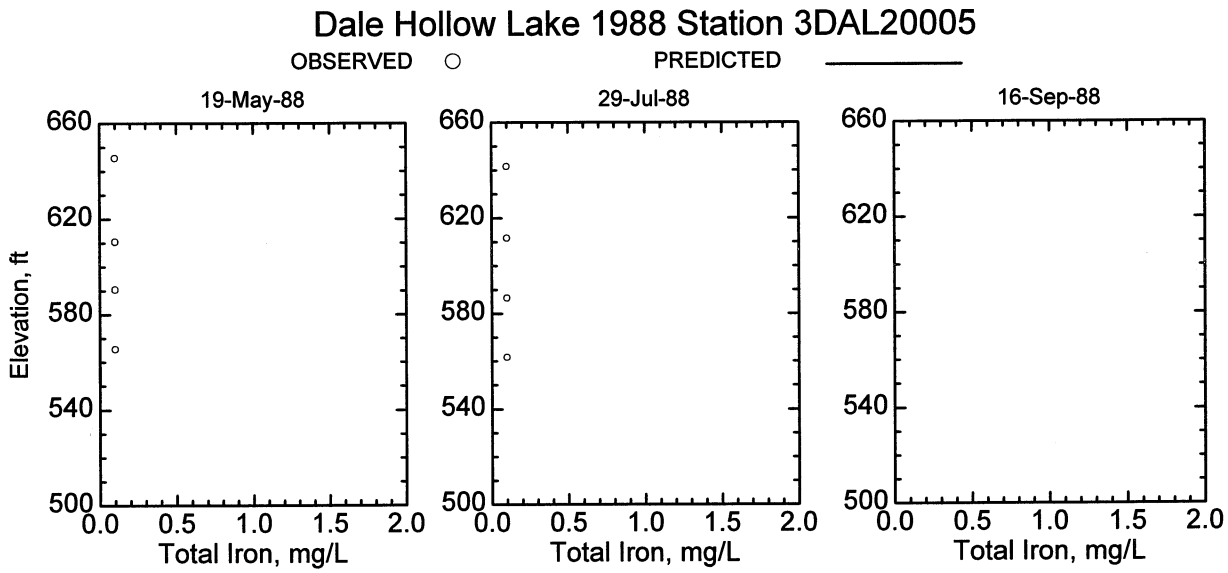

Dale Hollow Lake 1988 Station CLN119 (SP)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

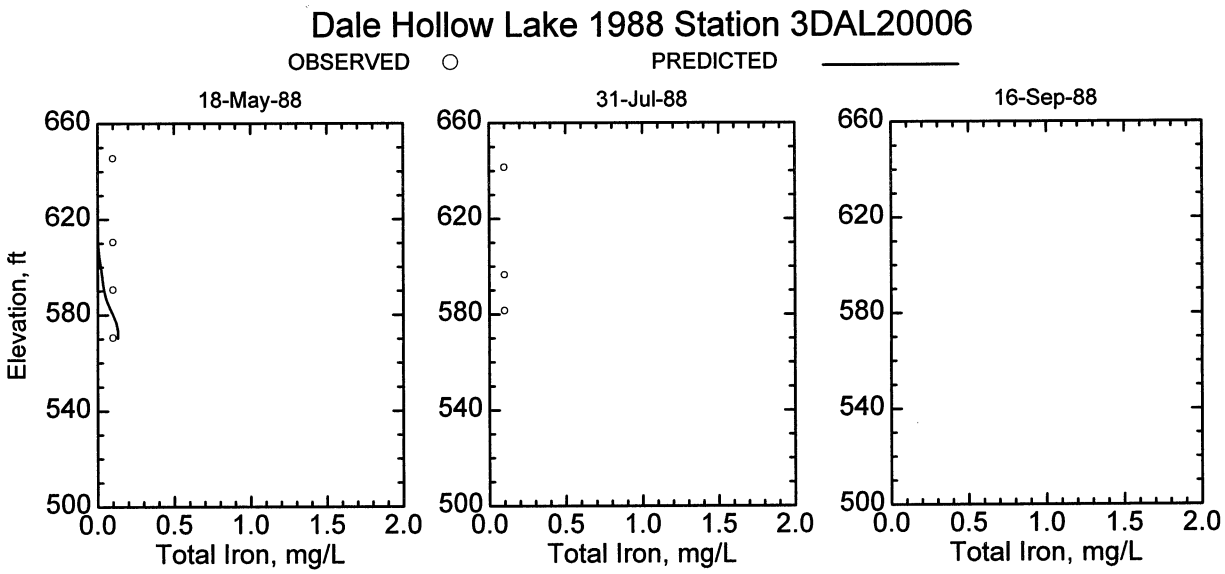

Dale Hollow Lake 1988 Station CLN118 (WR)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

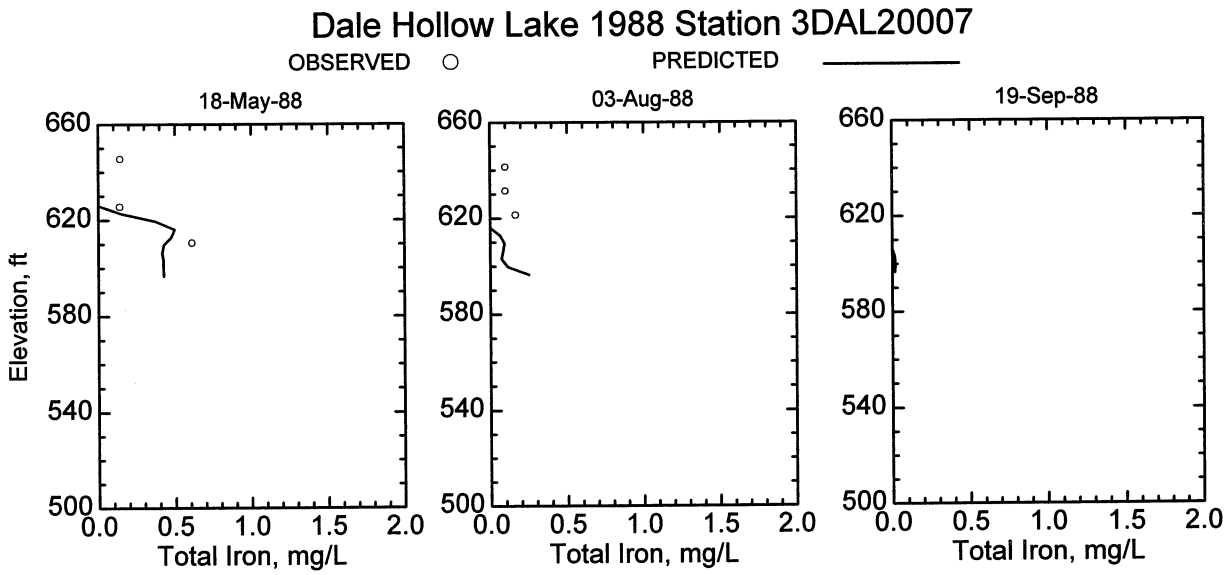

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

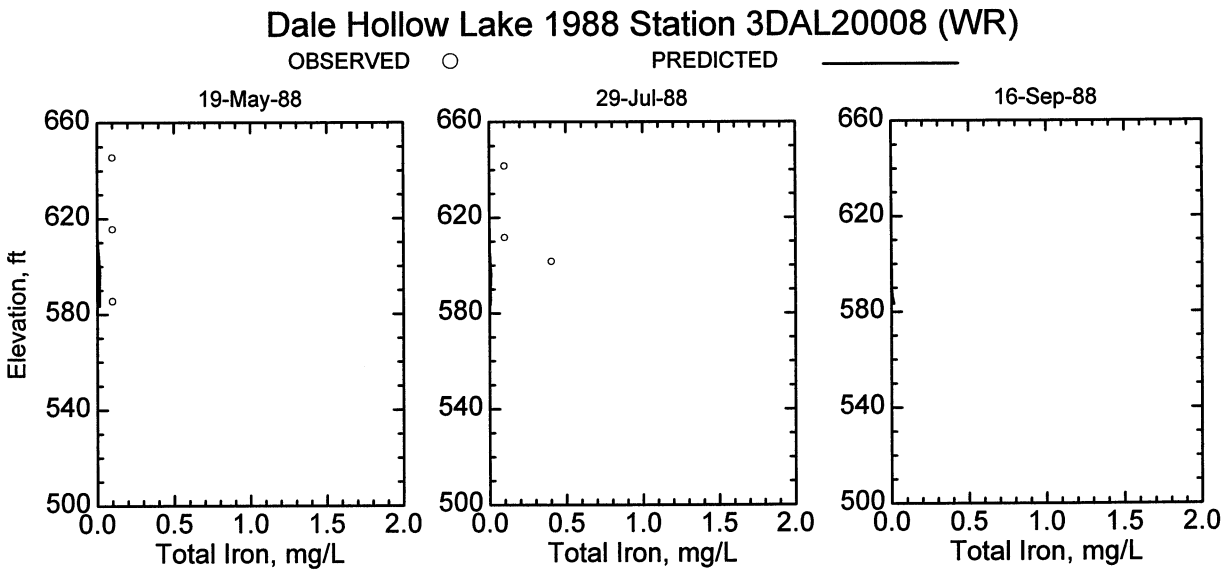

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

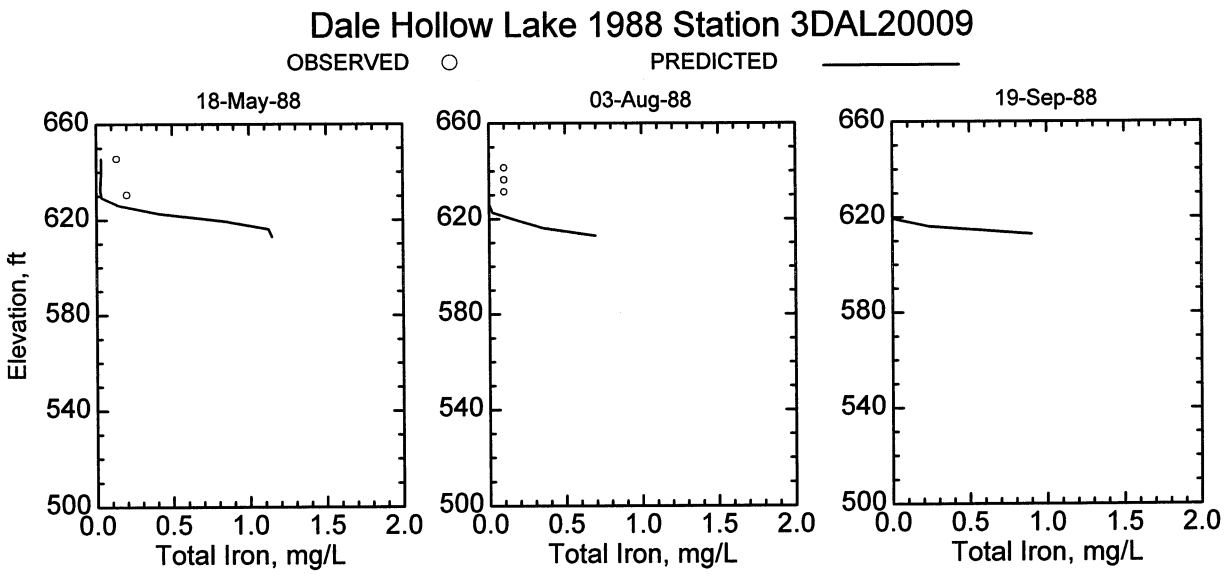

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

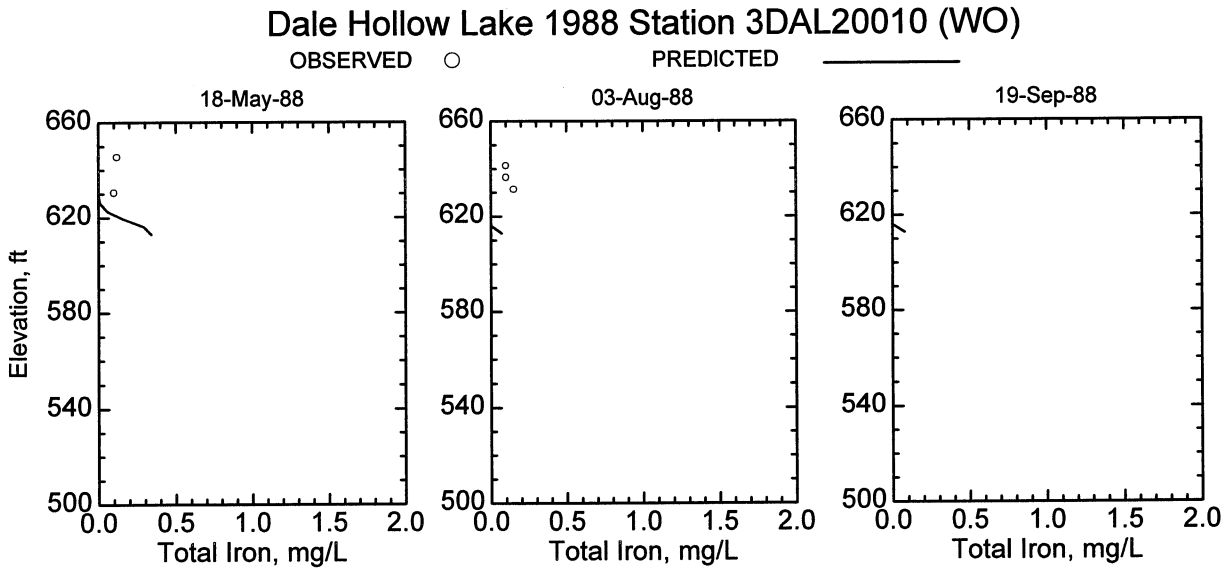

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

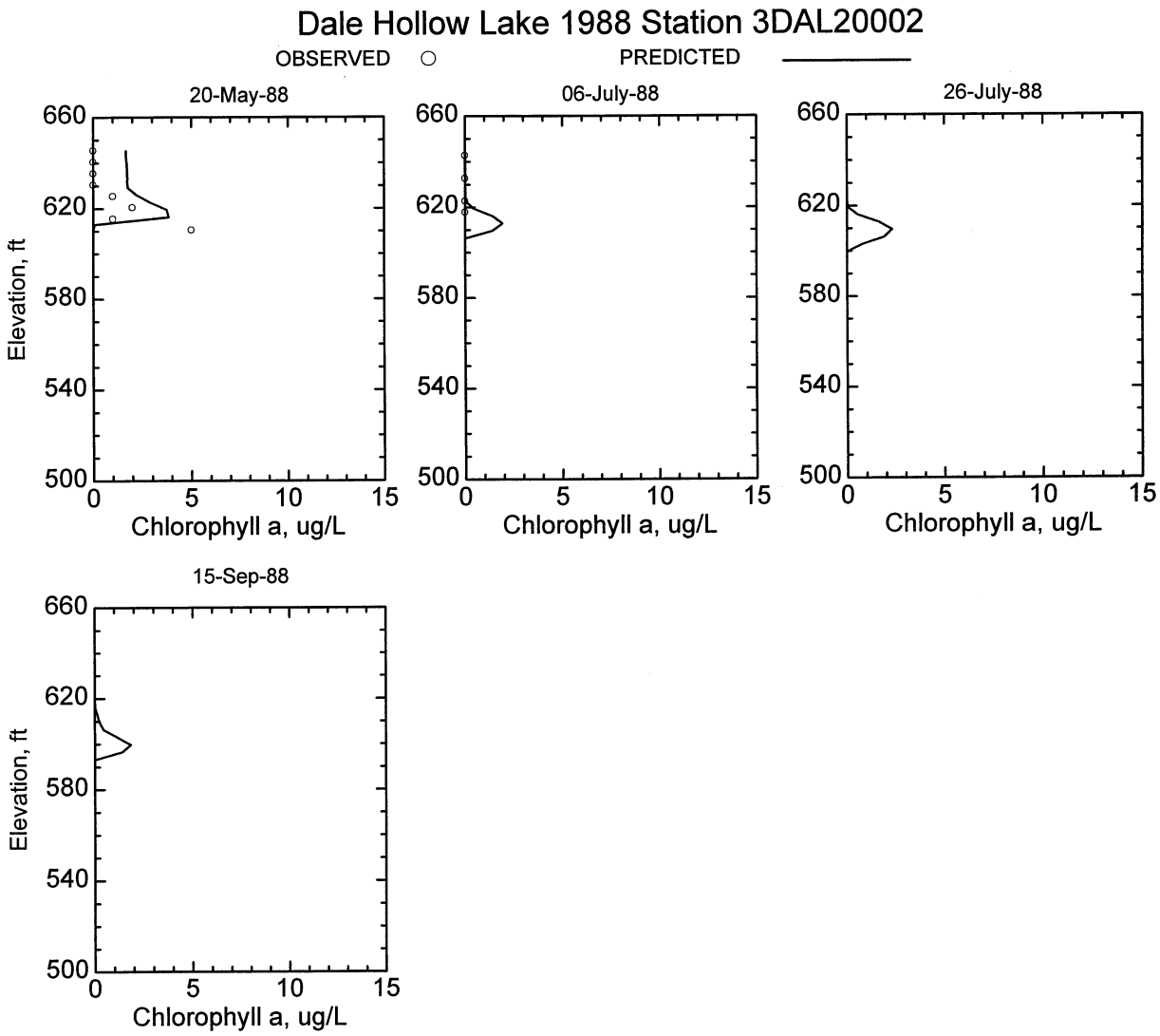

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

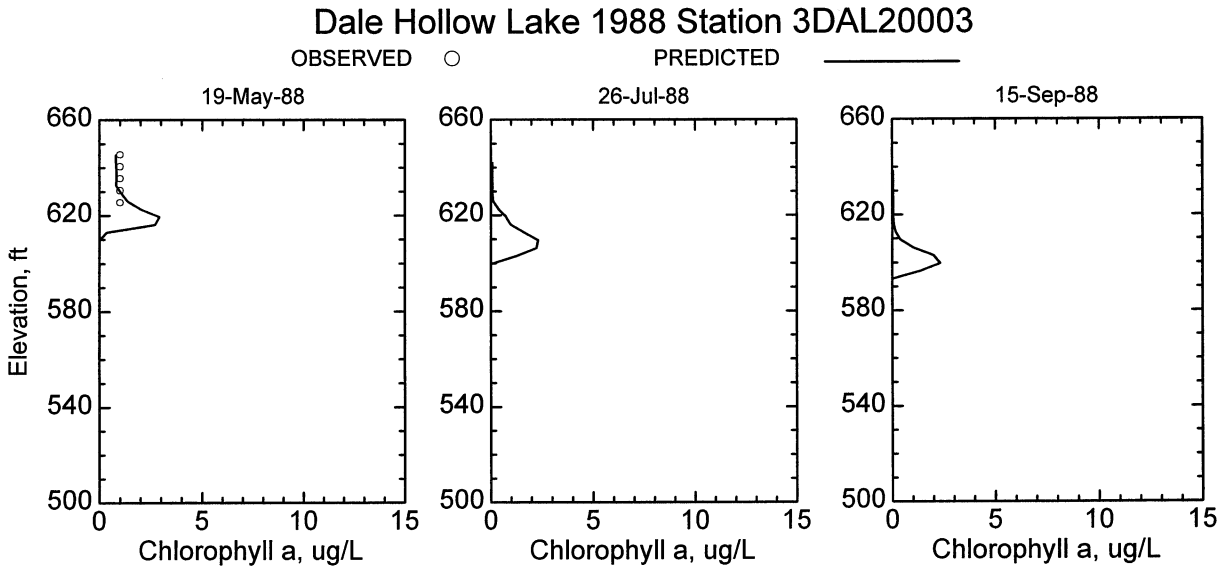

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

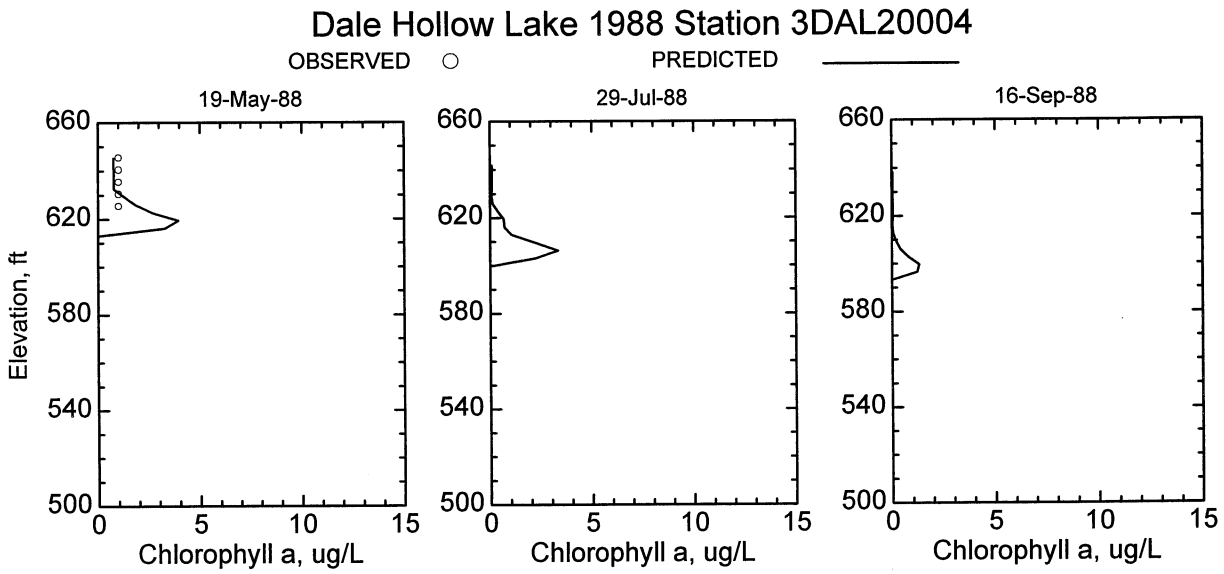

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

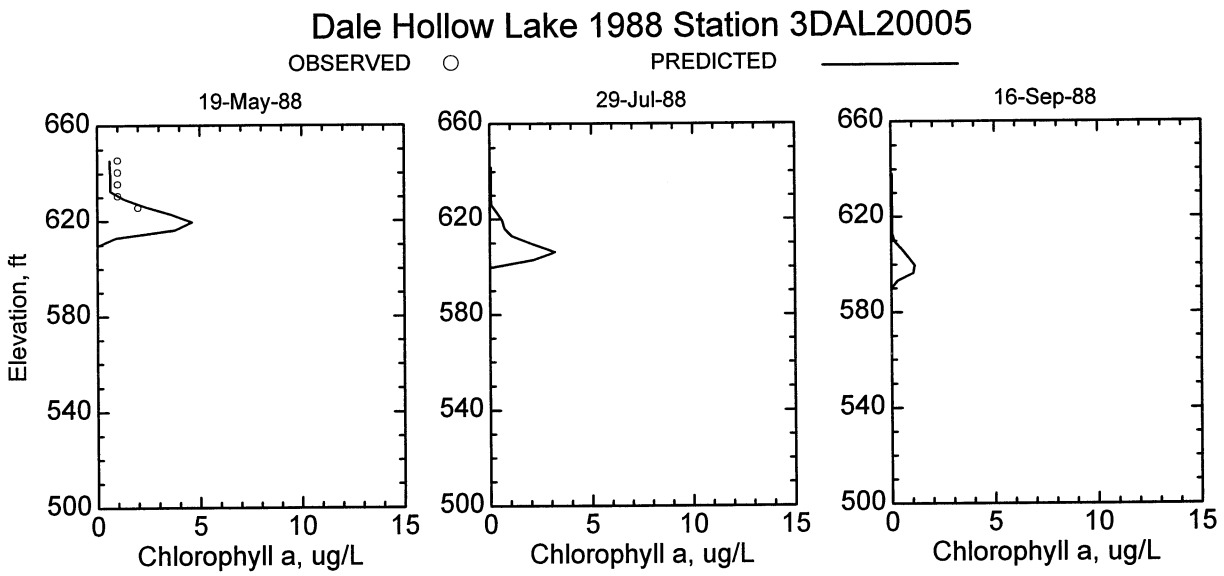

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

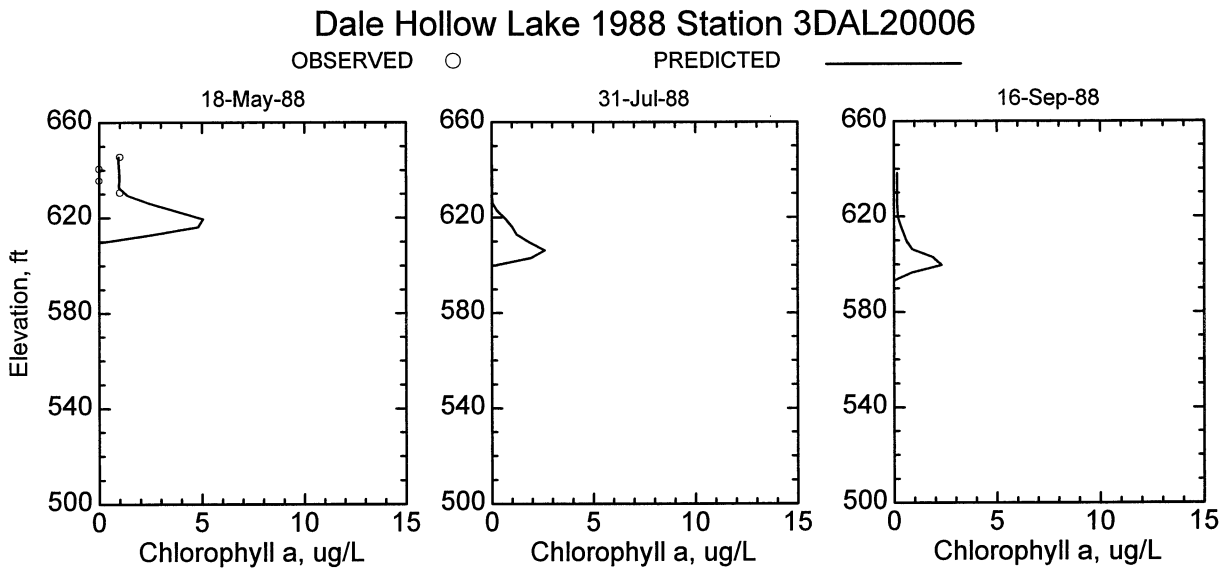

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

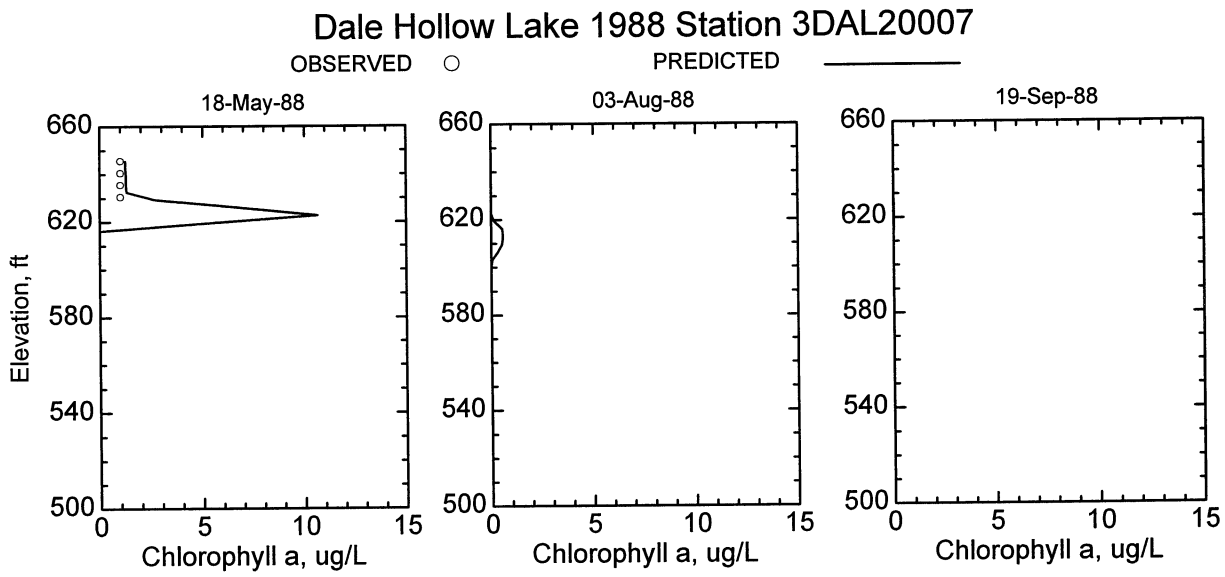

Dale Hollow Lake 1988 Station 3DAL20002
OBSERVED
PREDICTED
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

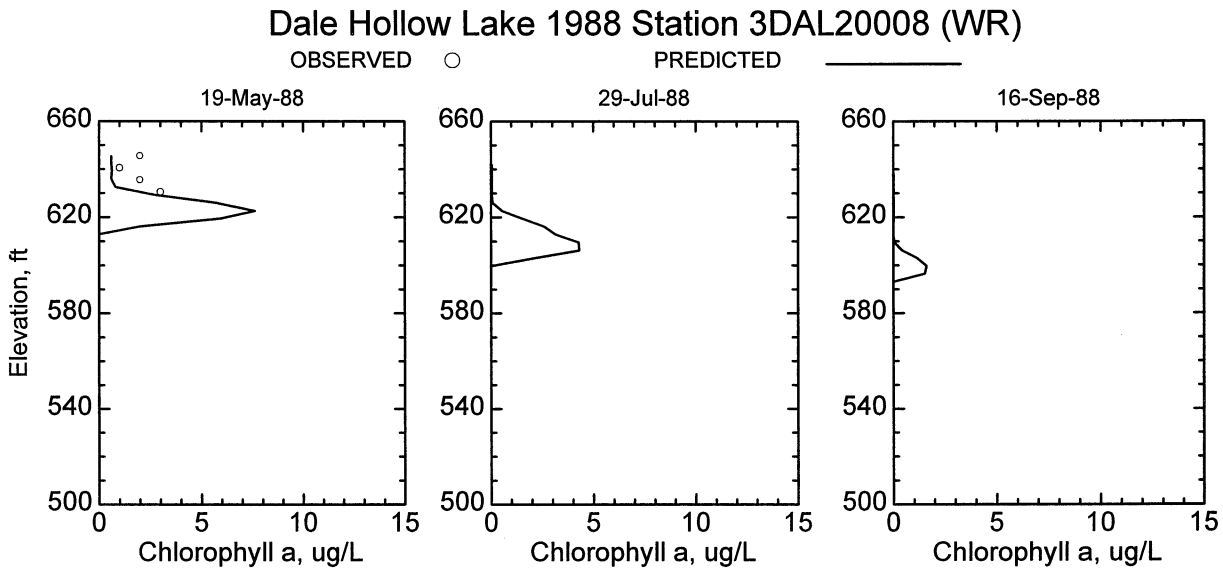

Dale Hollow Lake 1988 Station 3DAL20003
OBSERVED
PREDICTED
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

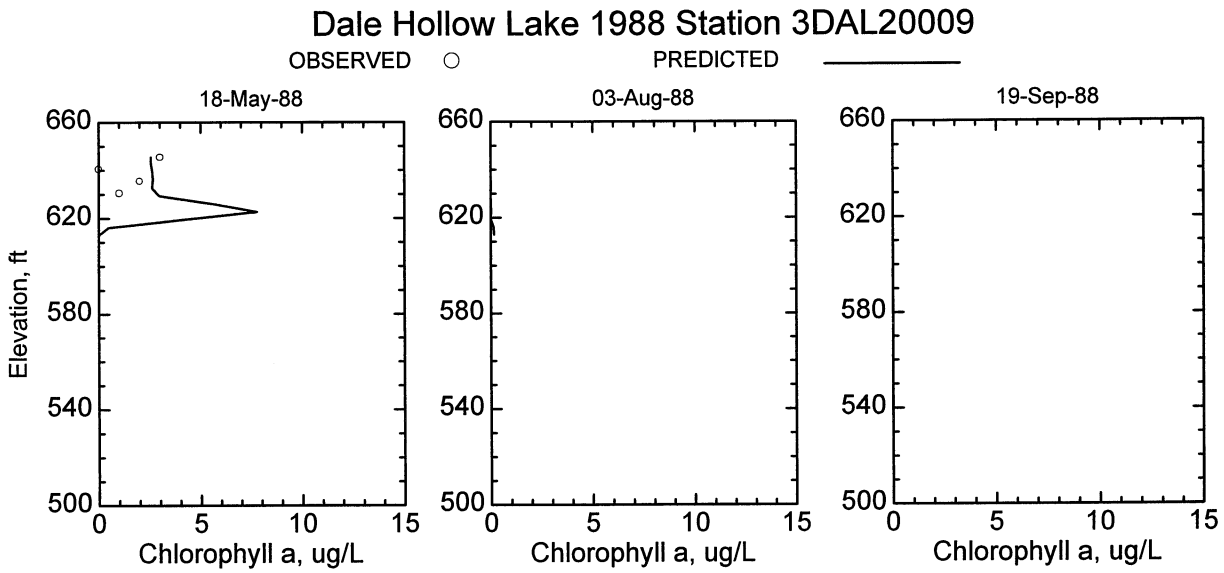

Dale Hollow Lake 1988 Station 3DAL20004
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

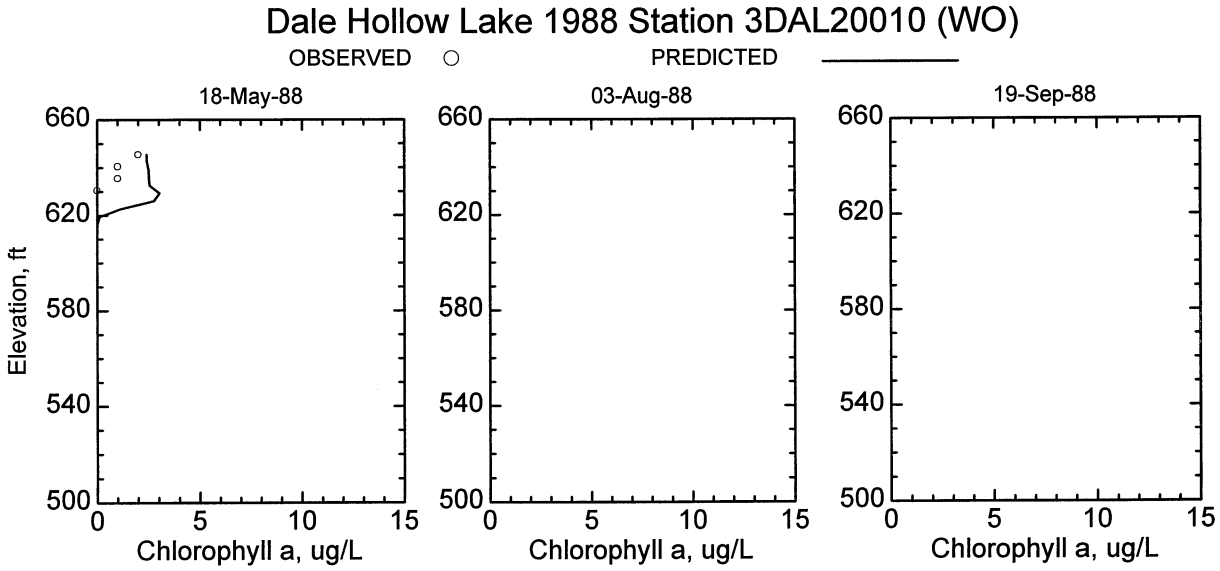

Dale Hollow Lake 1988 Station 3DAL20005
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

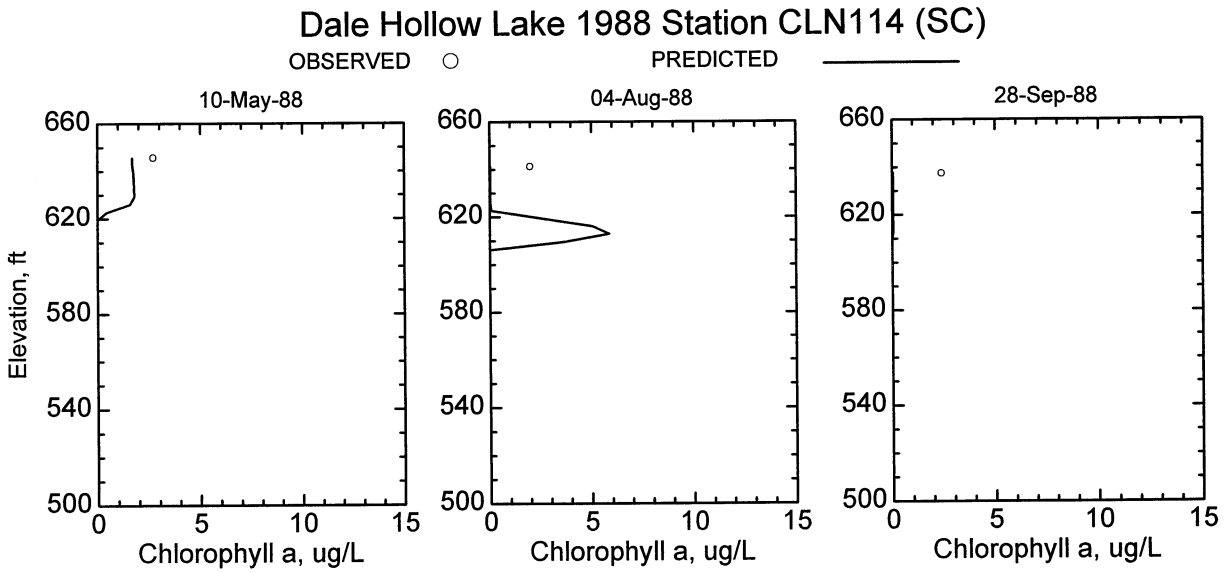

Dale Hollow Lake 1988 Station 3DAL20006
OBSERVED
PREDICTED
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

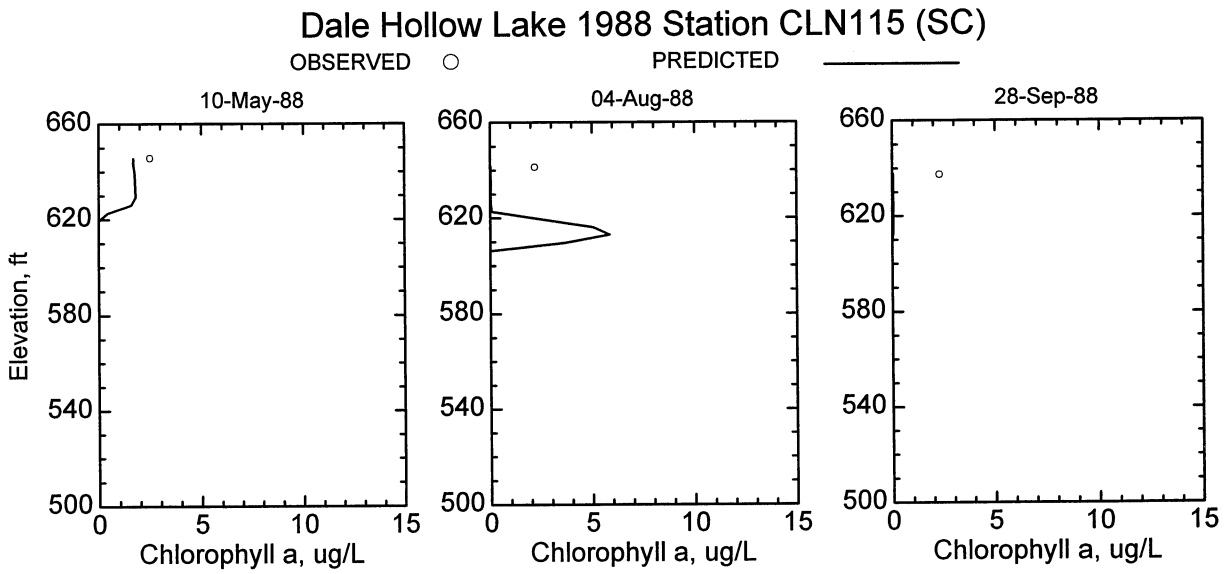

Dale Hollow Lake 1988 Station 3DAL20007
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

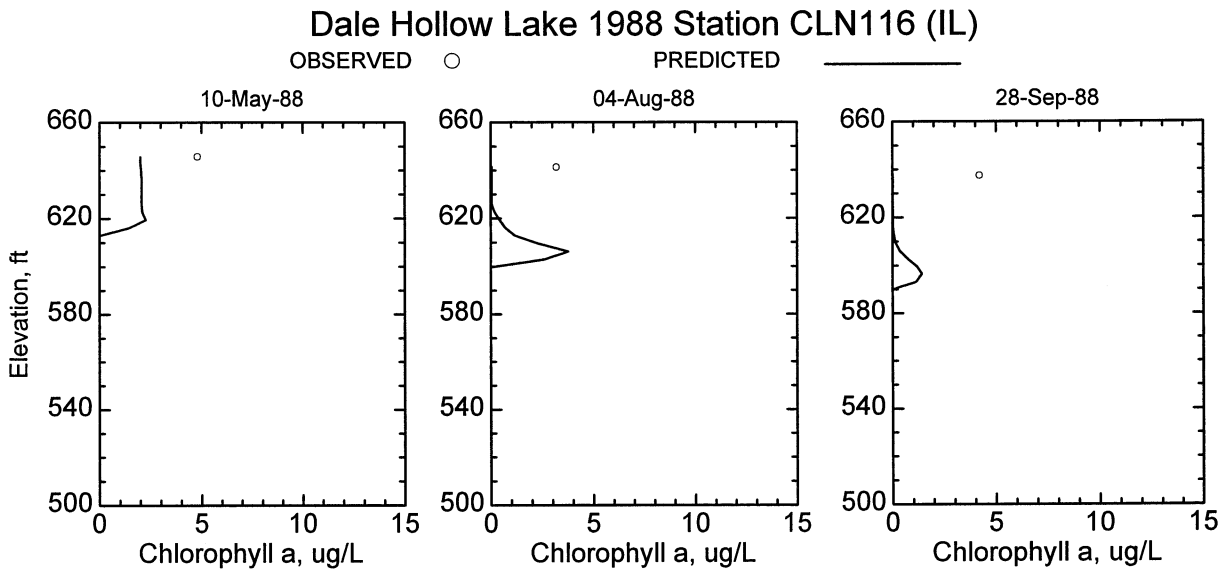

Dale Hollow Lake 1988 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

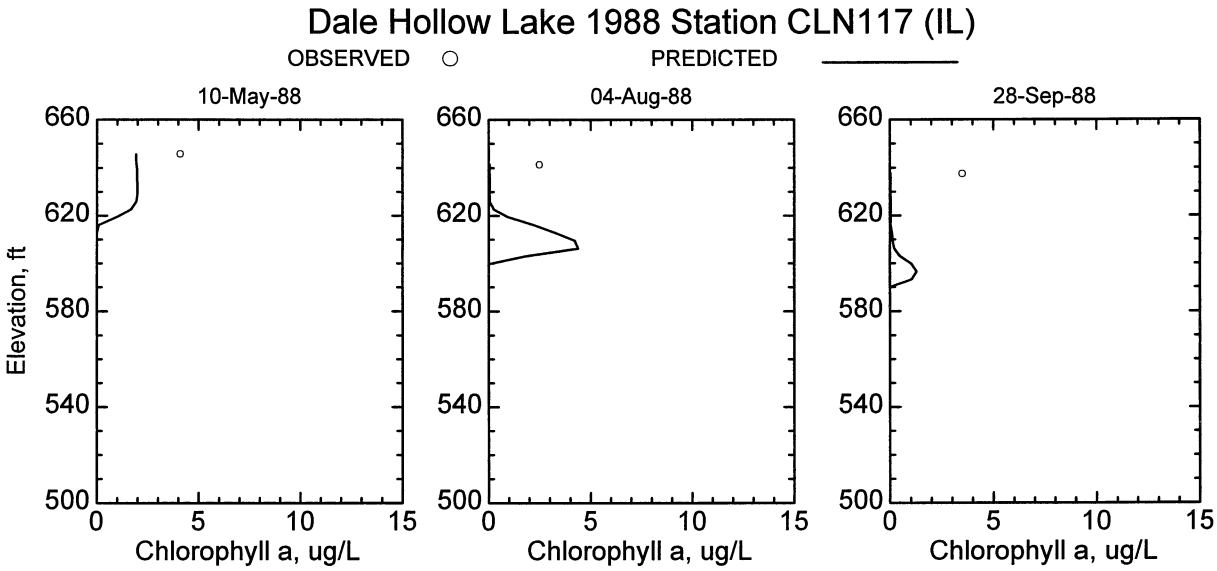

Dale Hollow Lake 1988 Station 3DAL20009
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

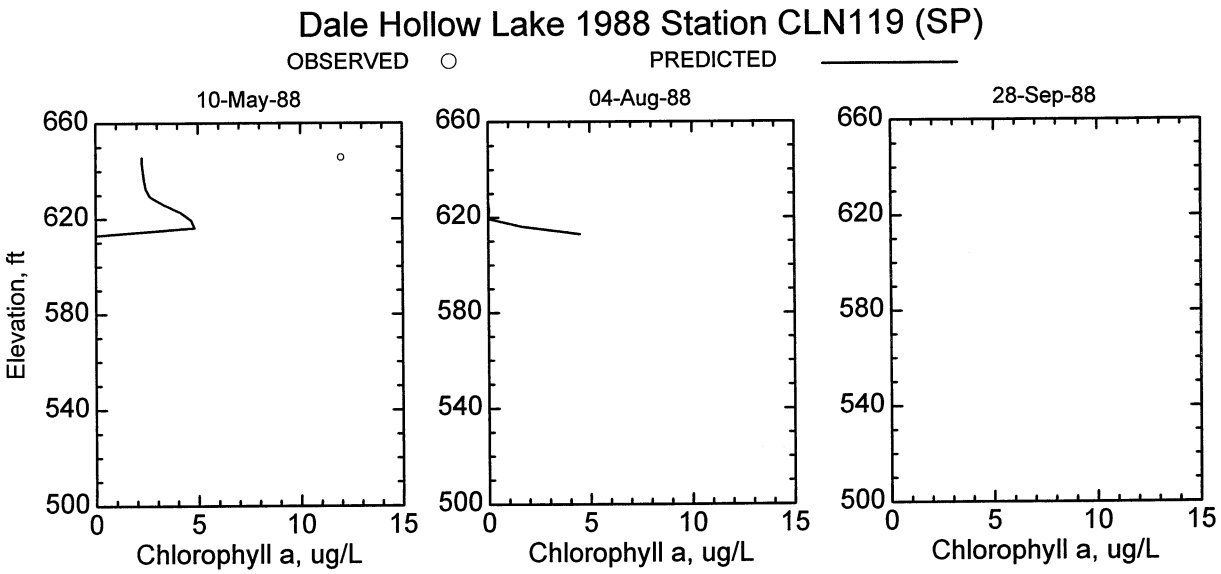

Dale Hollow Lake 1988 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

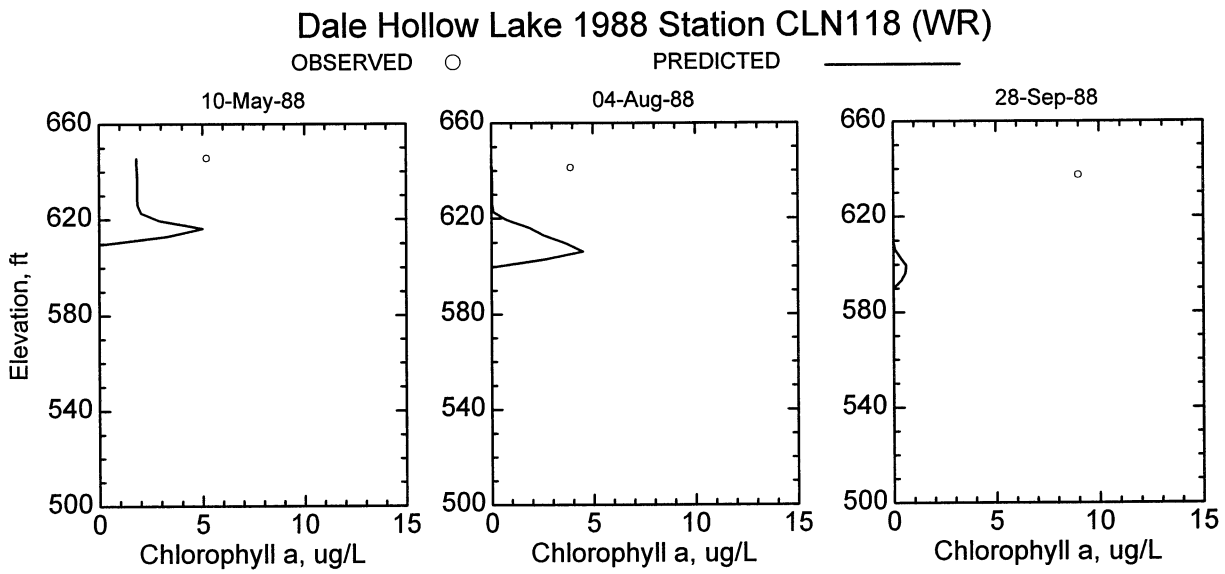

Dale Hollow Lake 1988 Station CLN114 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

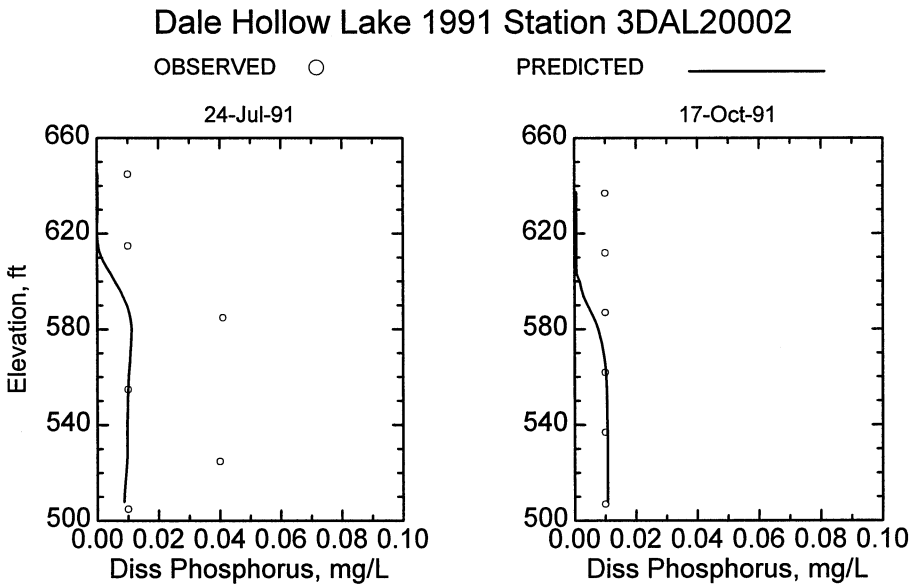

Dale Hollow Lake 1988 Station CLN115 (SC)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

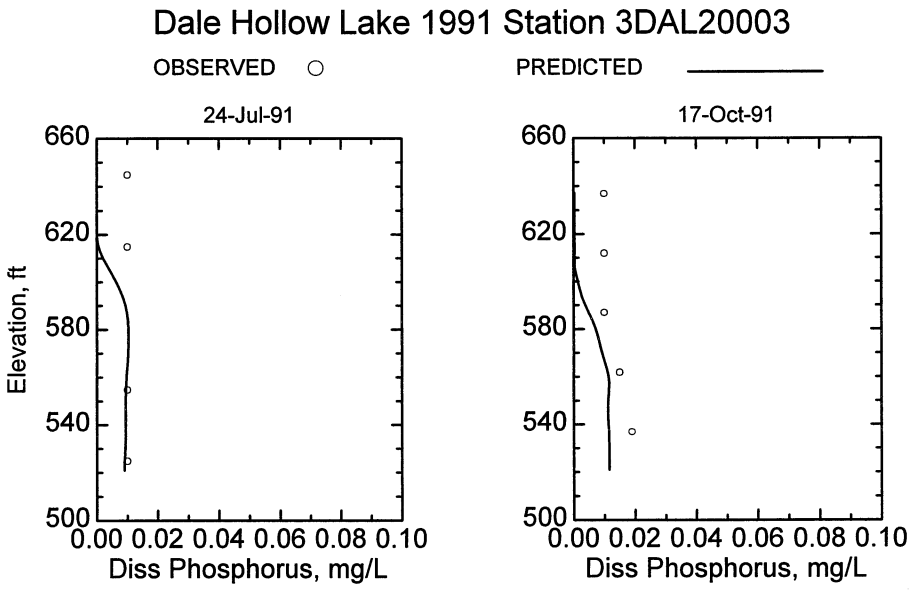

Dale Hollow Lake 1988 Station CLN116 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

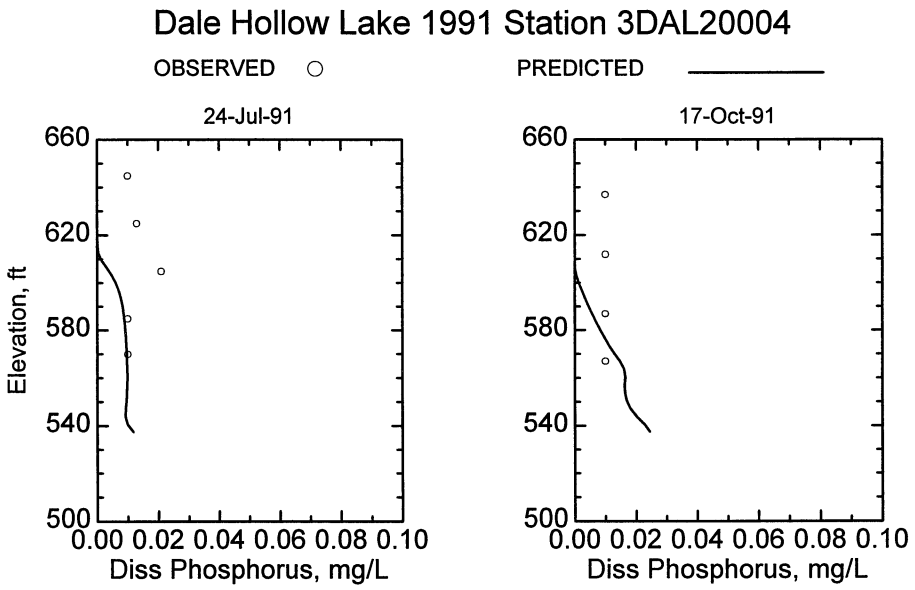

Dale Hollow Lake 1988 Station CLN117 (IL)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

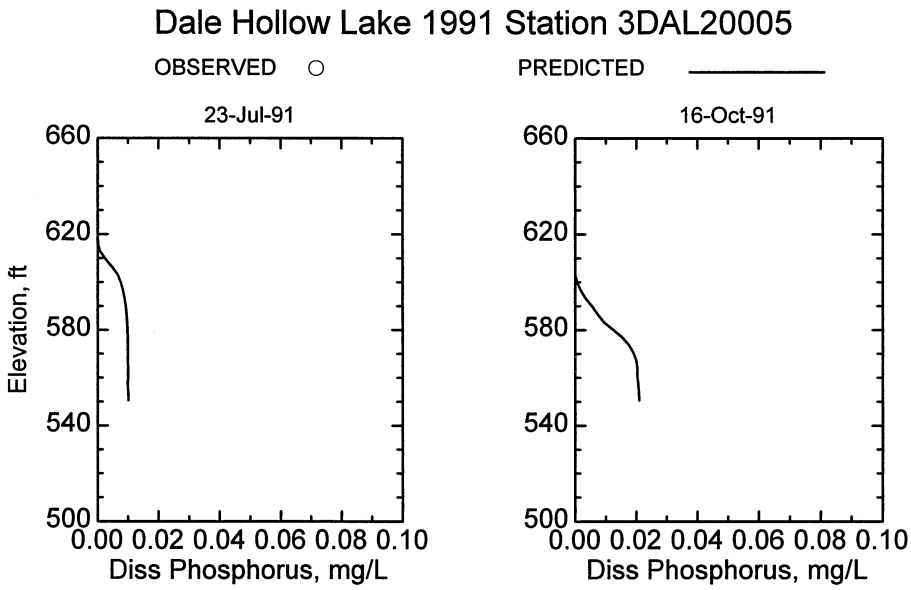

Dale Hollow Lake 1988 Station CLN119 (SP)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

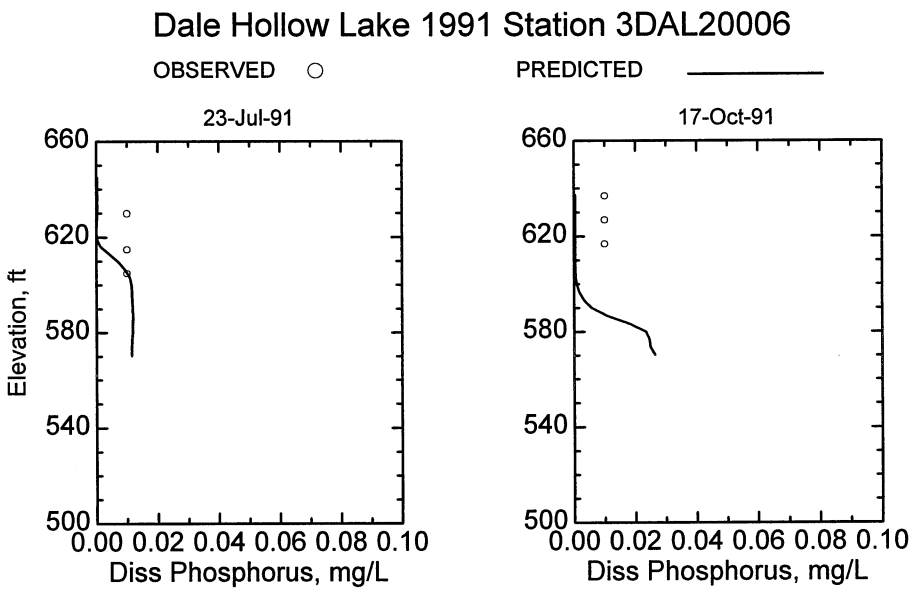

Dale Hollow Lake 1988 Station CLN118 (WR)
OBSERVED
PREDICTED
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

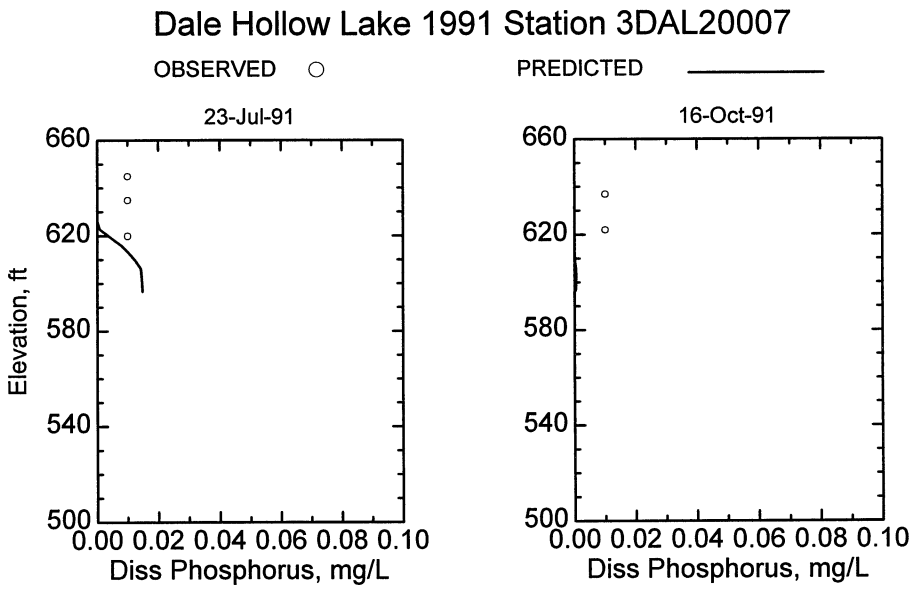

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

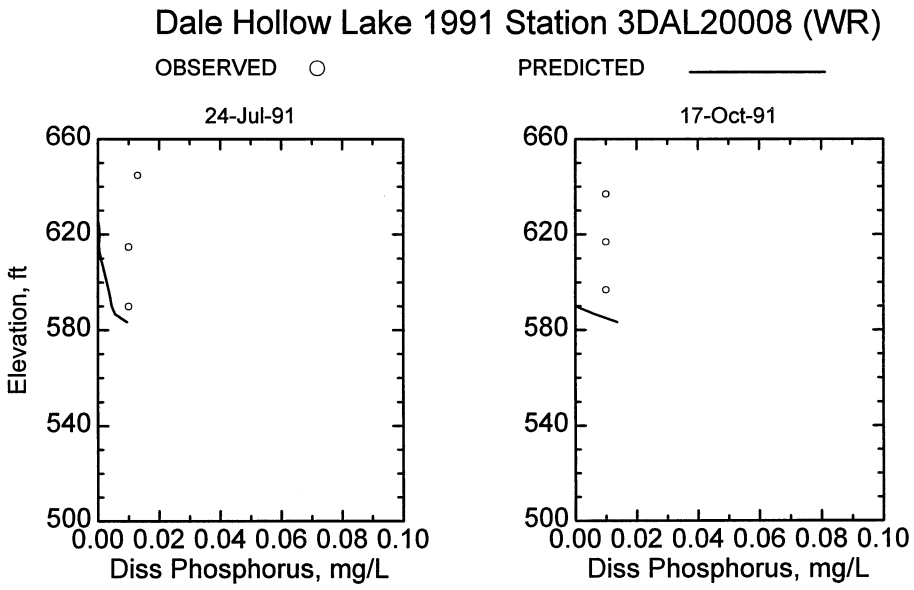

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

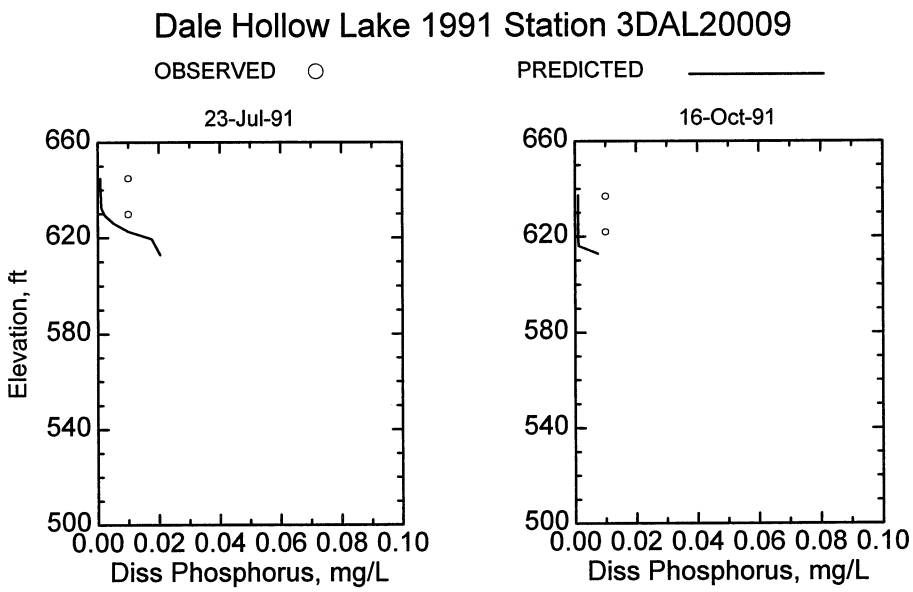

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

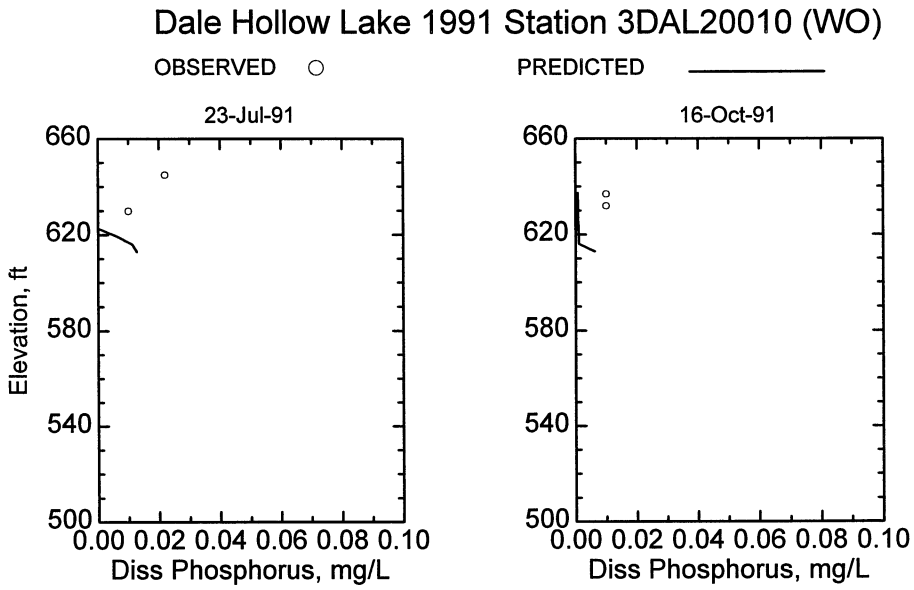

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

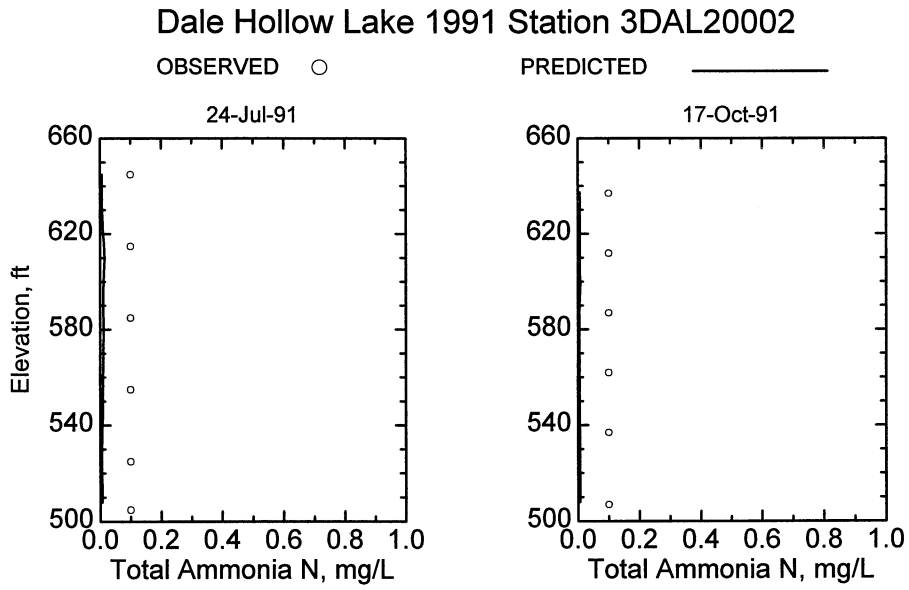

Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

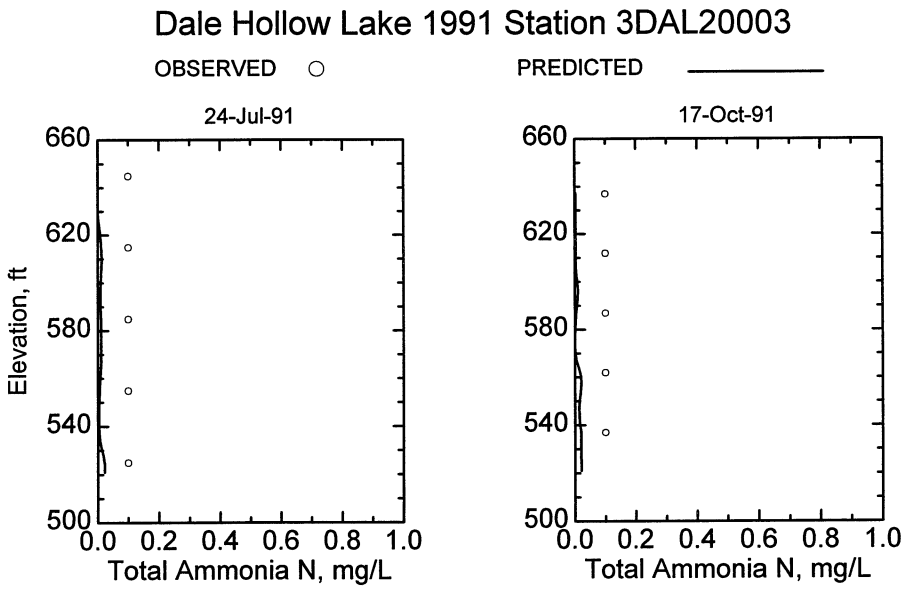

Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

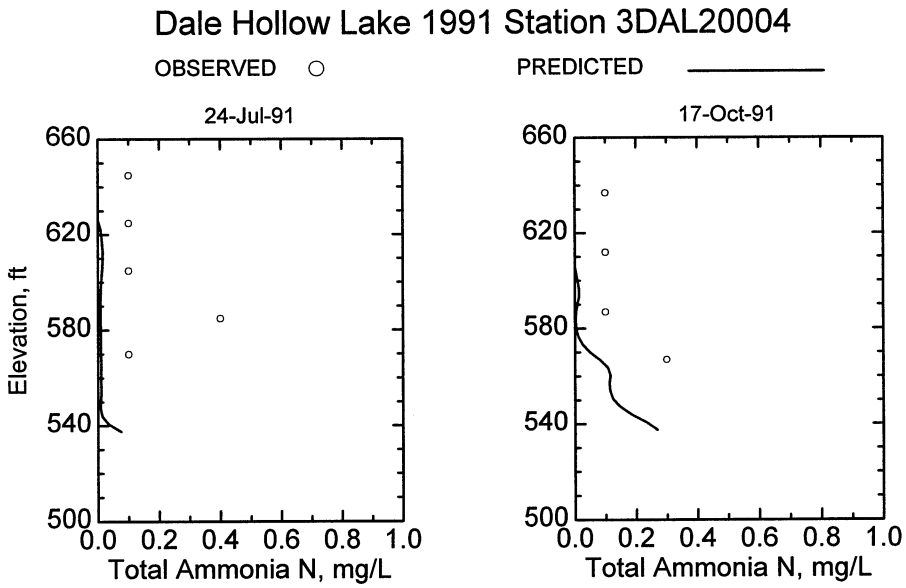

Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

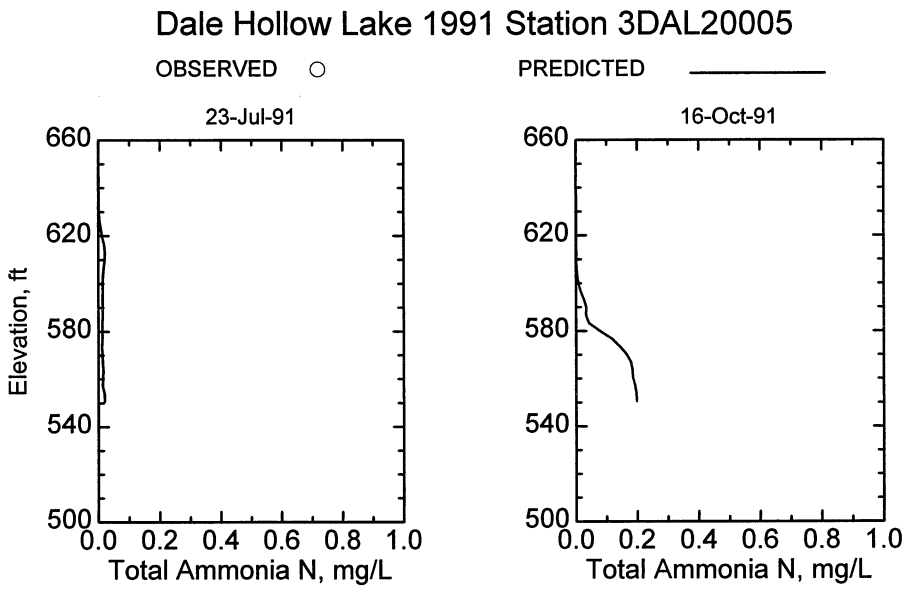

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

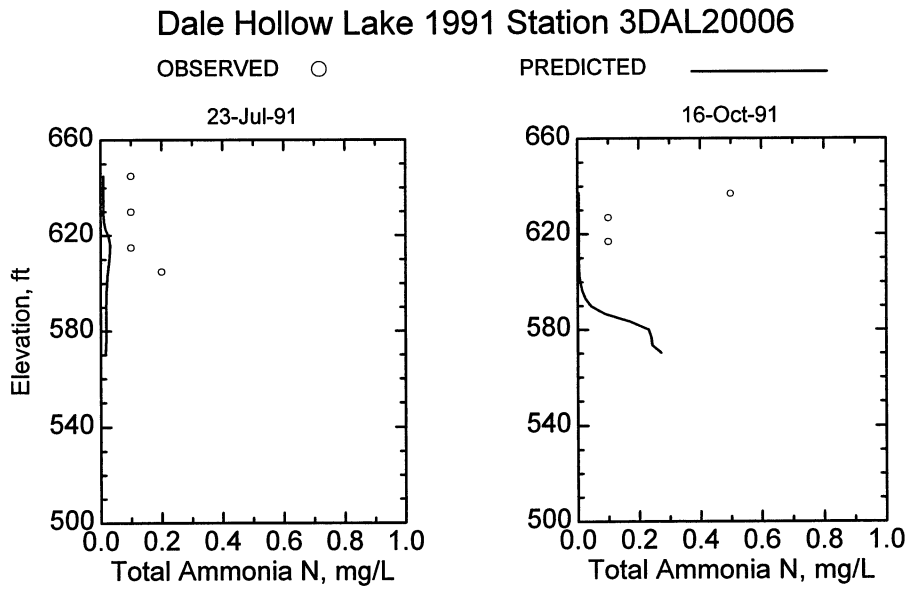

Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

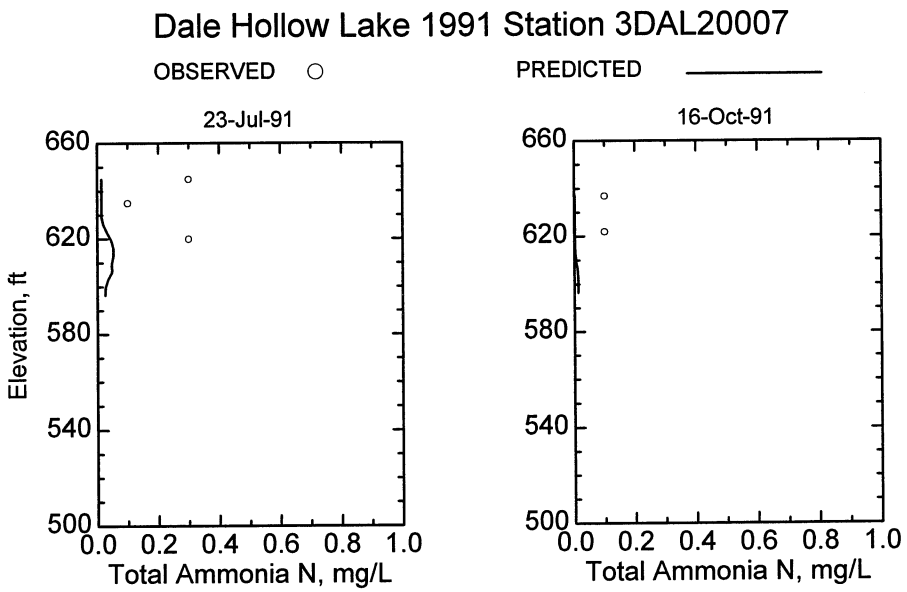

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

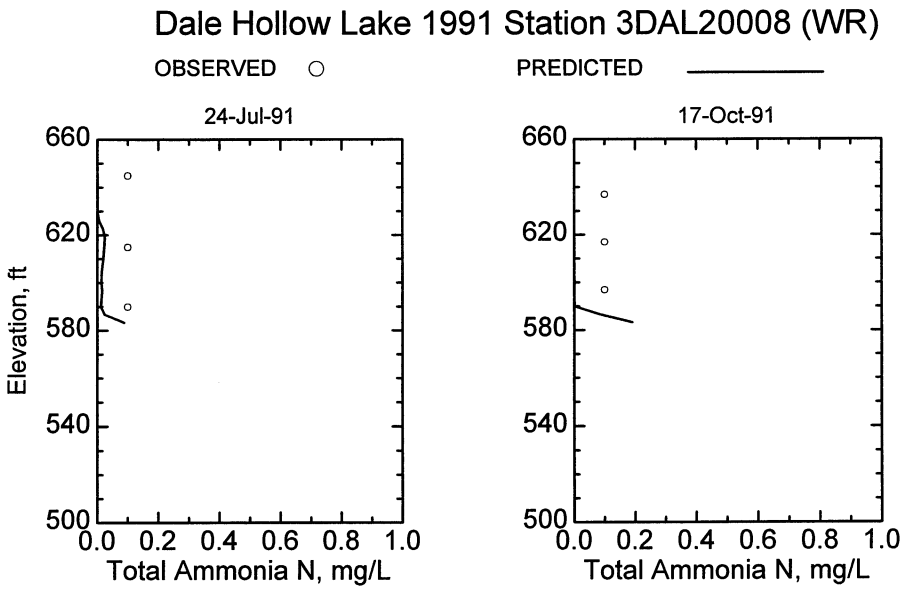

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

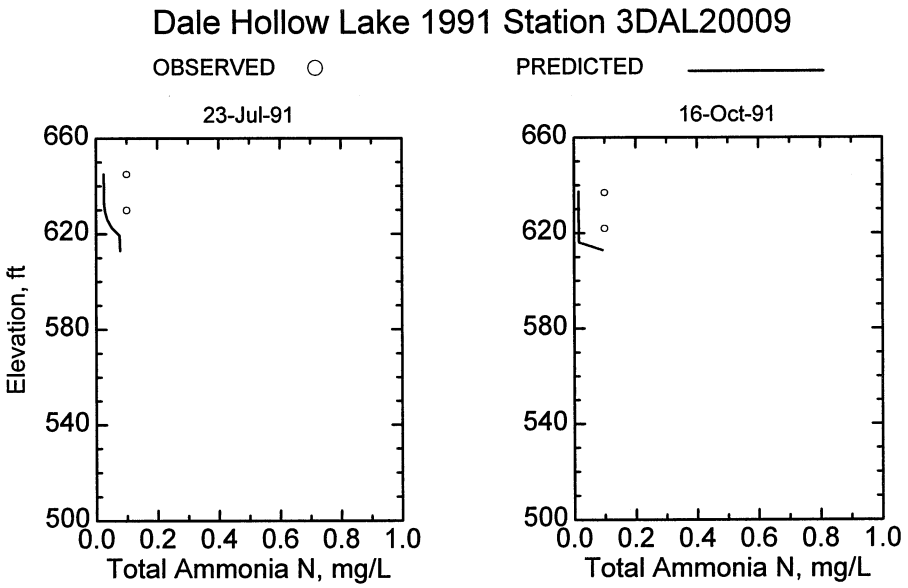

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

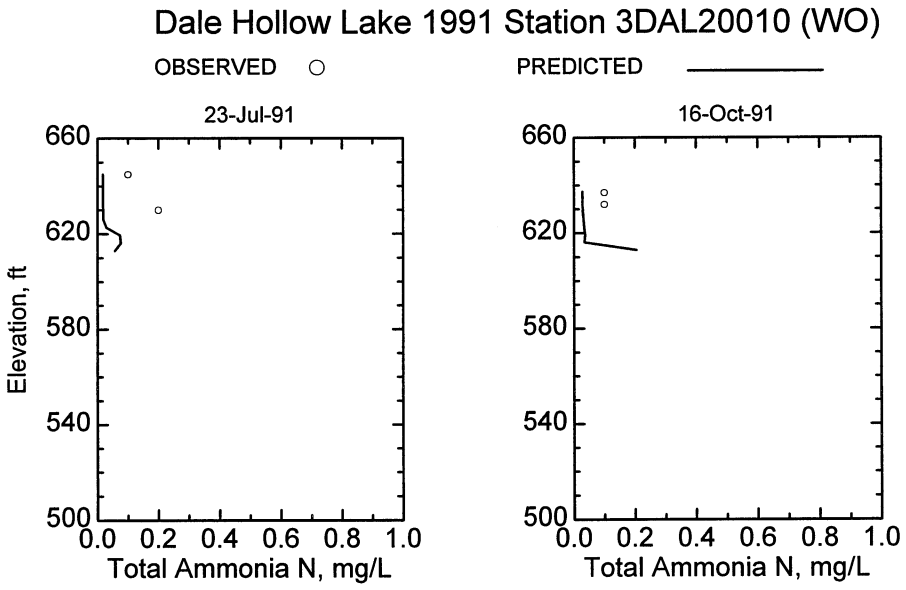

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

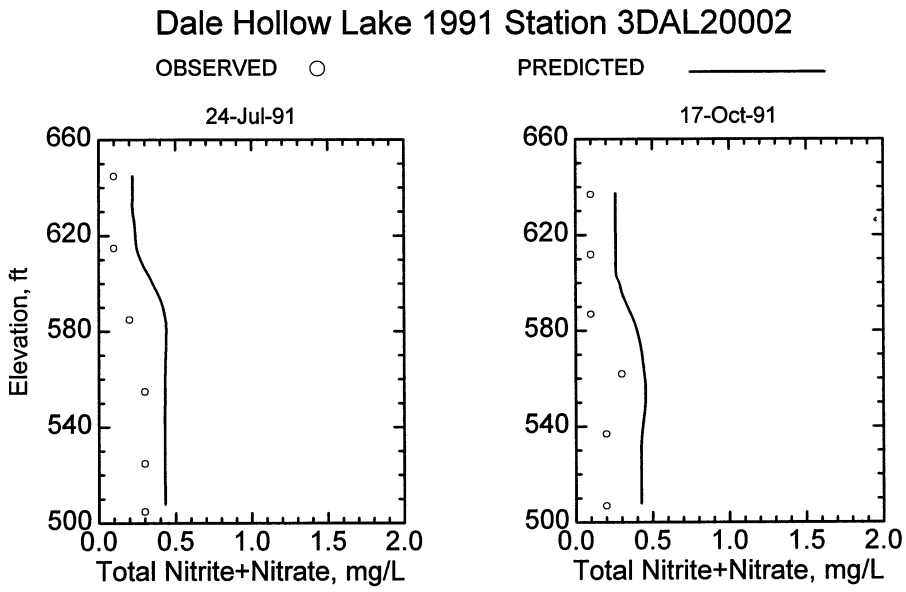

Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

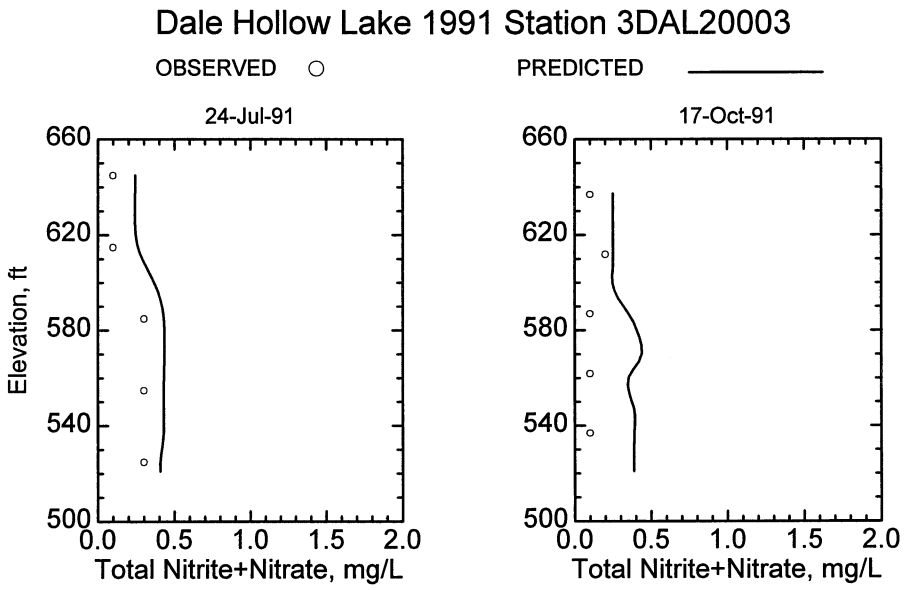

Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

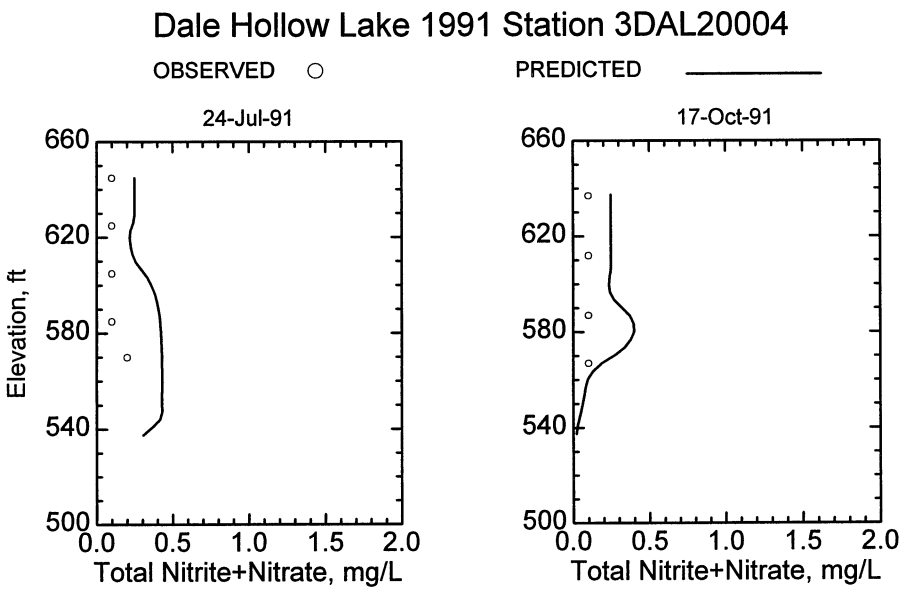

Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

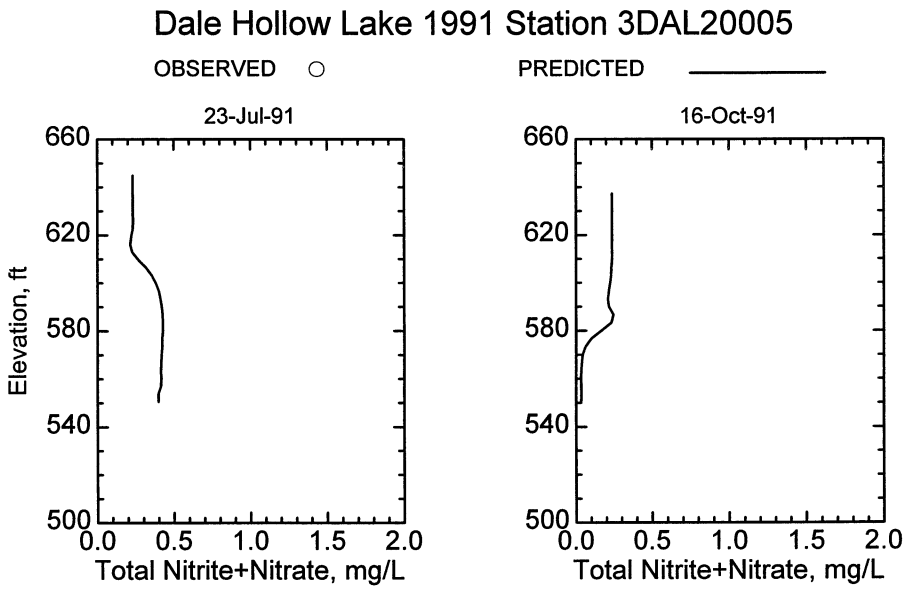

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

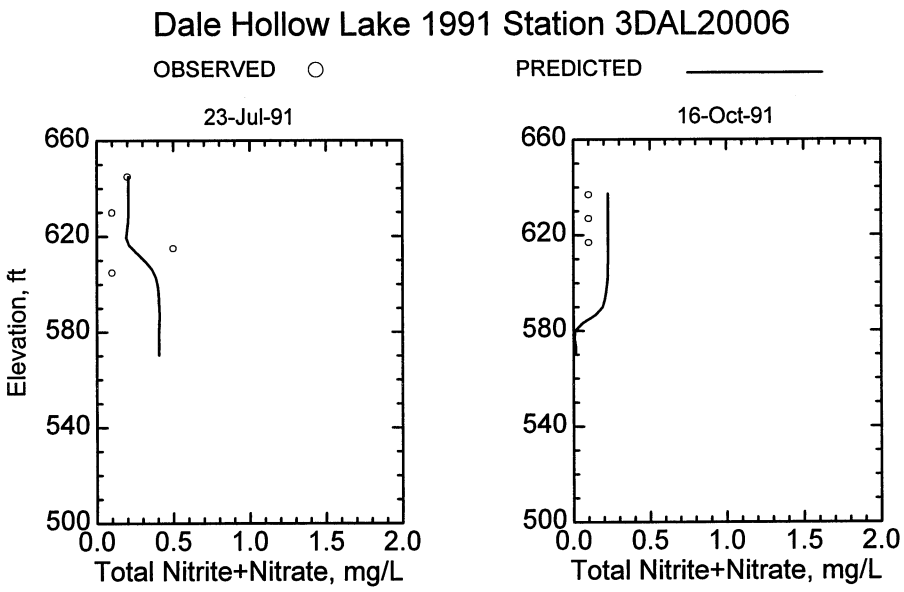

Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

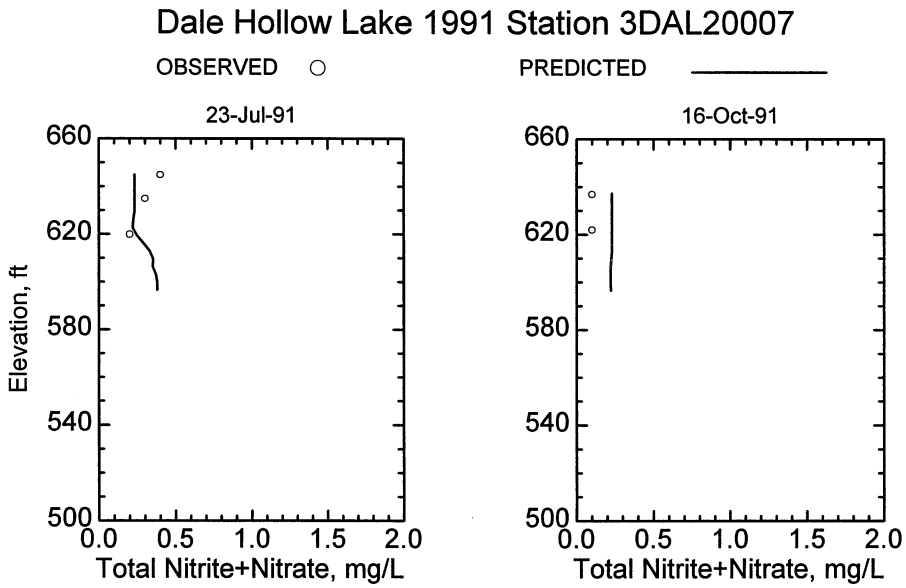

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

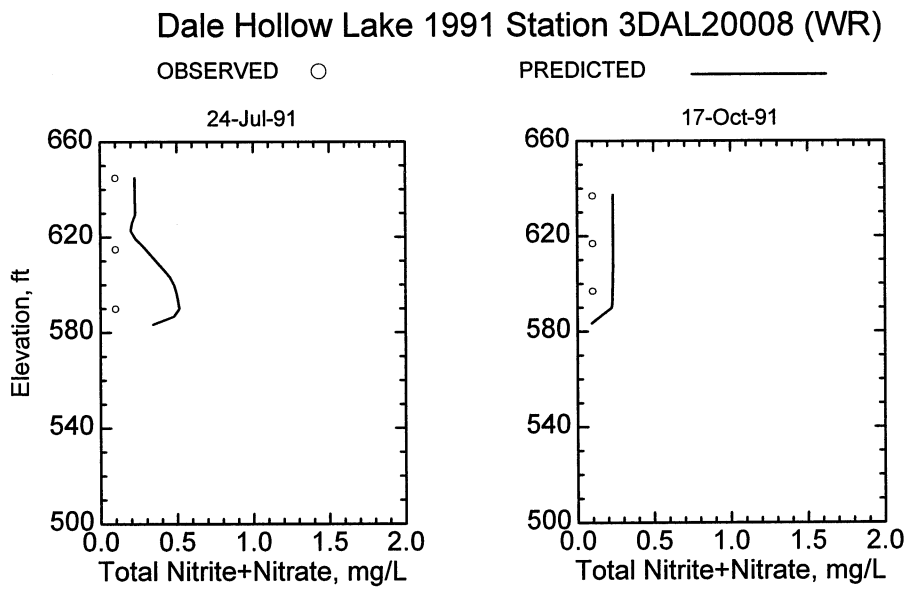

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

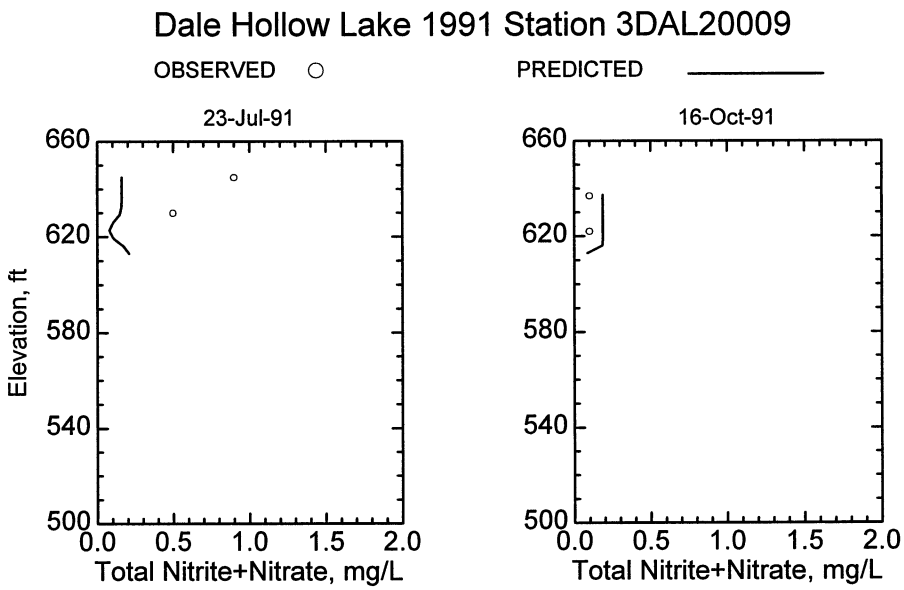

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

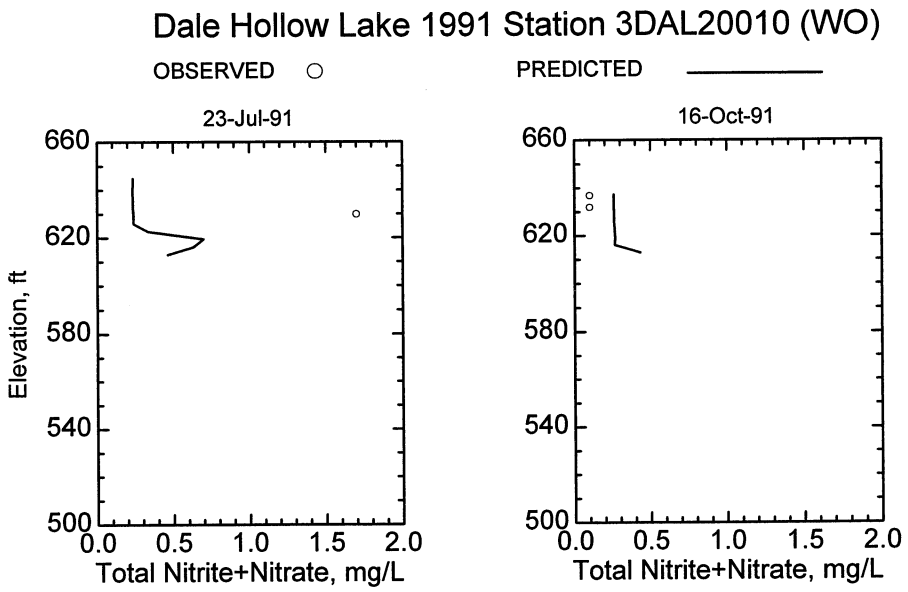

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

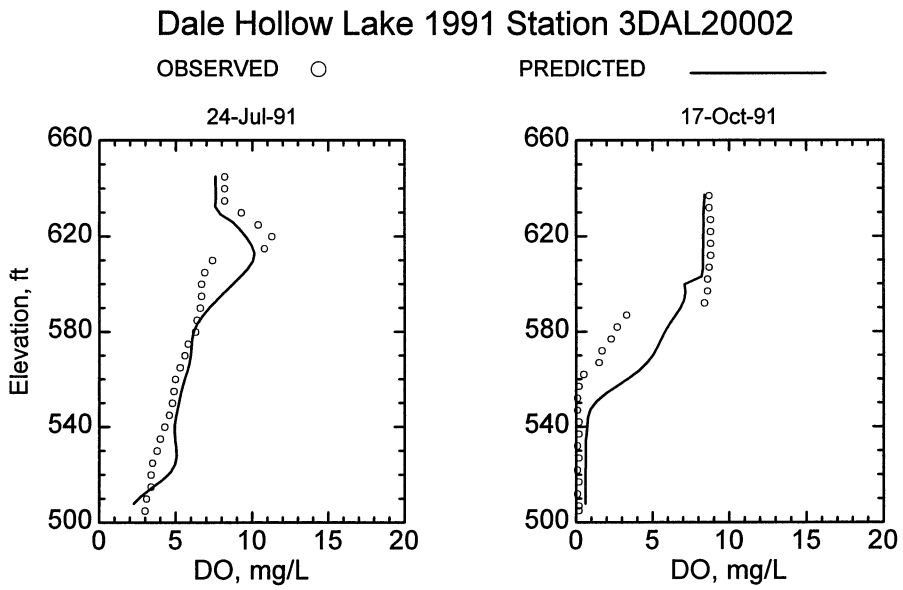

Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

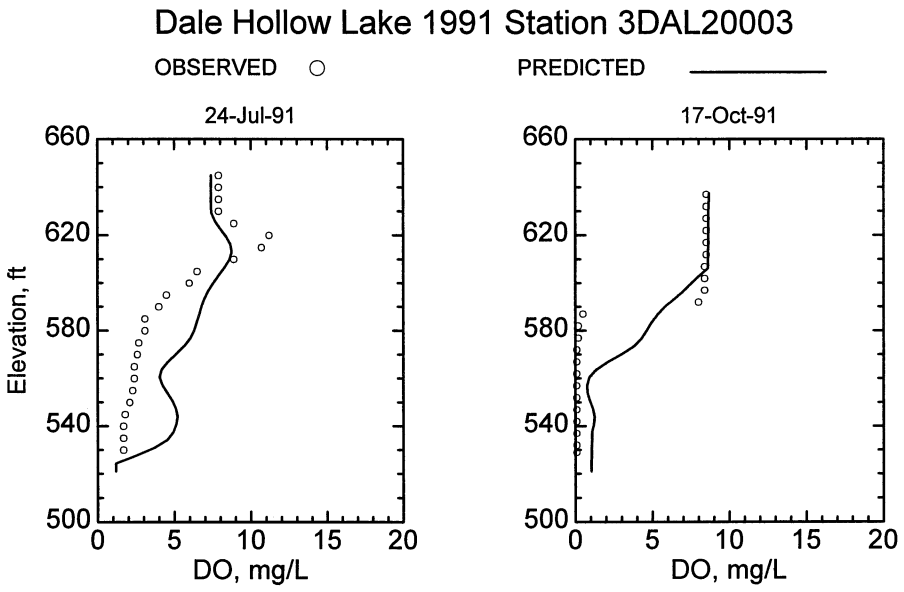

Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

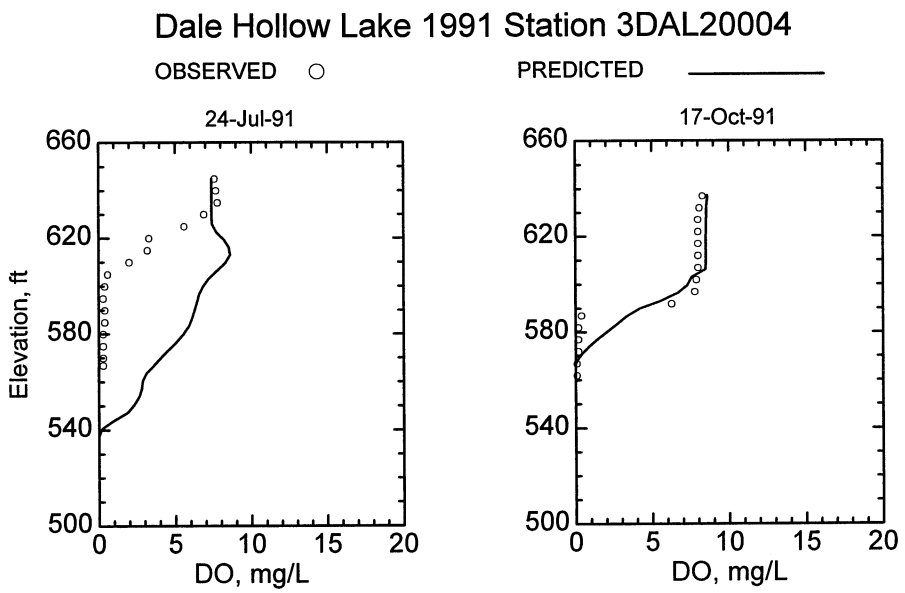

Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

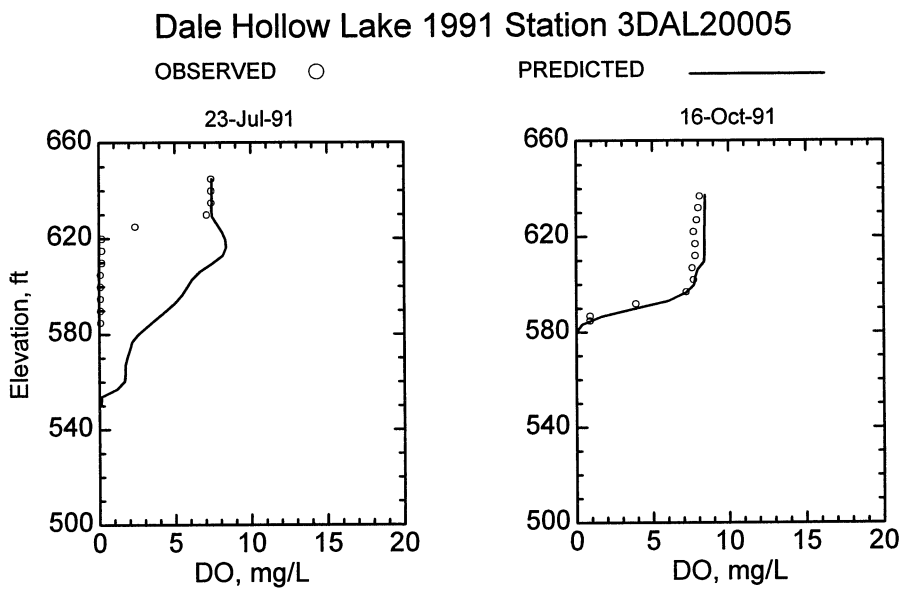

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

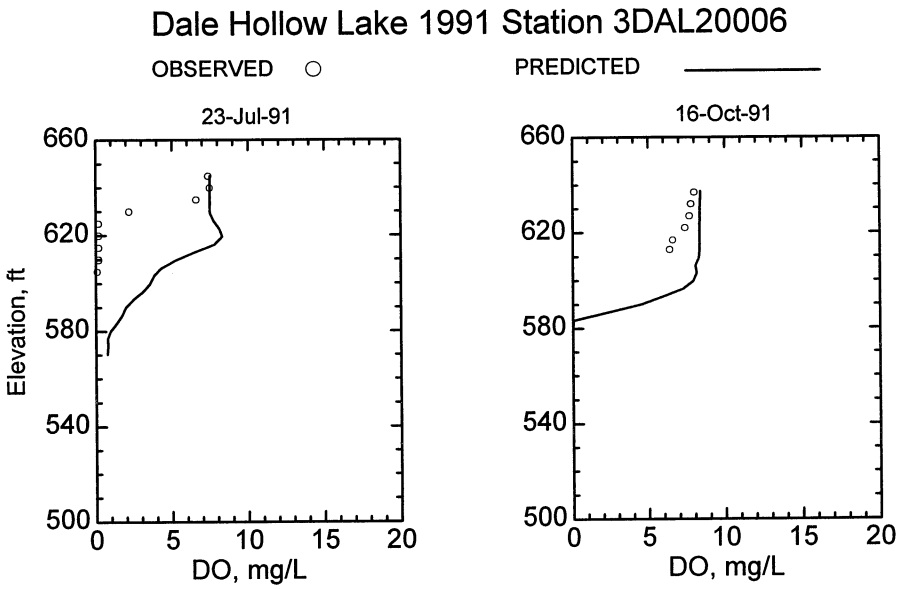

Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Nitrite+Nitrate, mg/L

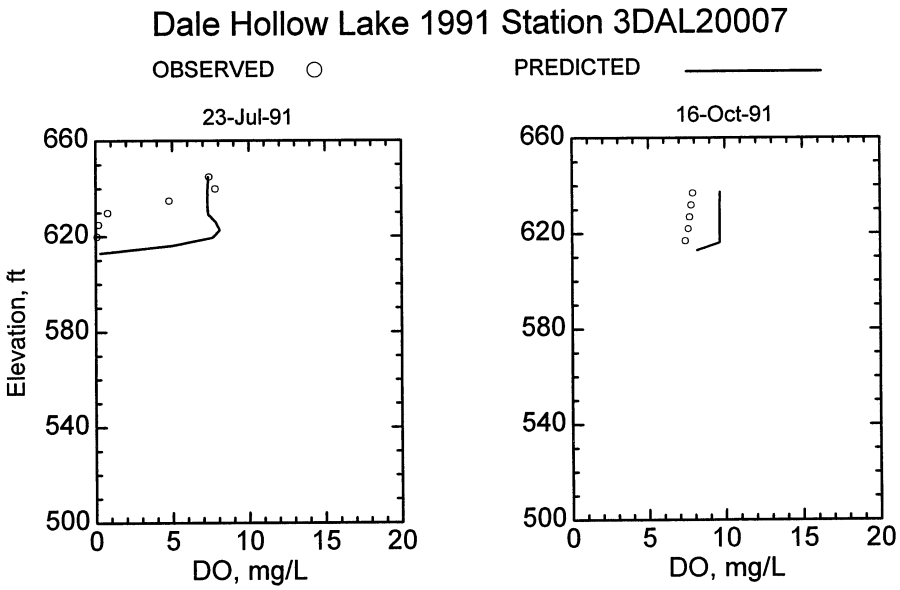

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

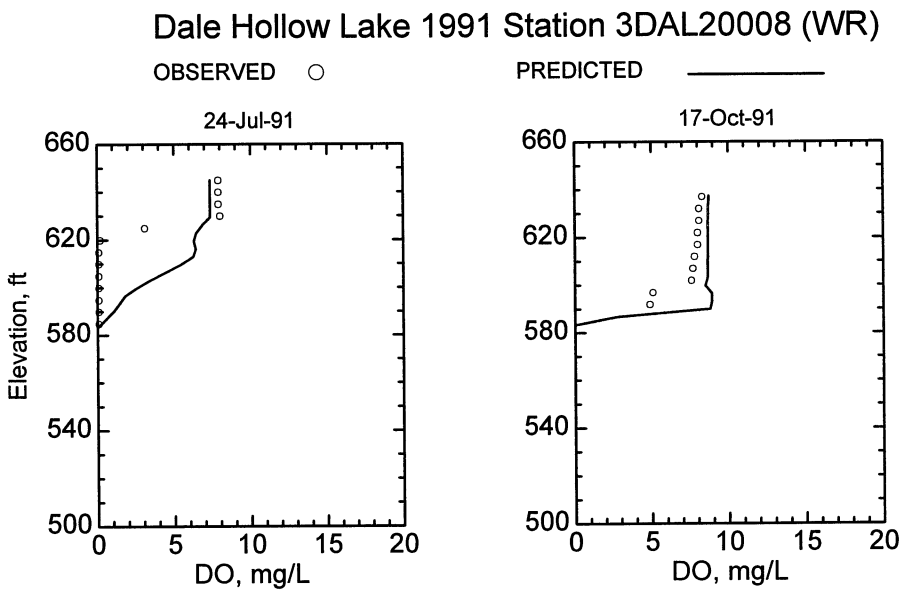

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

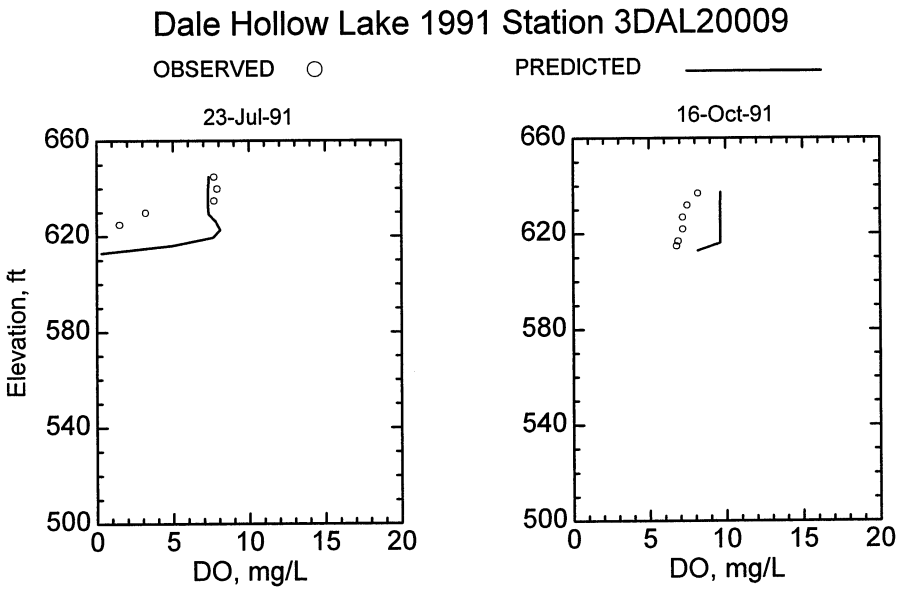

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

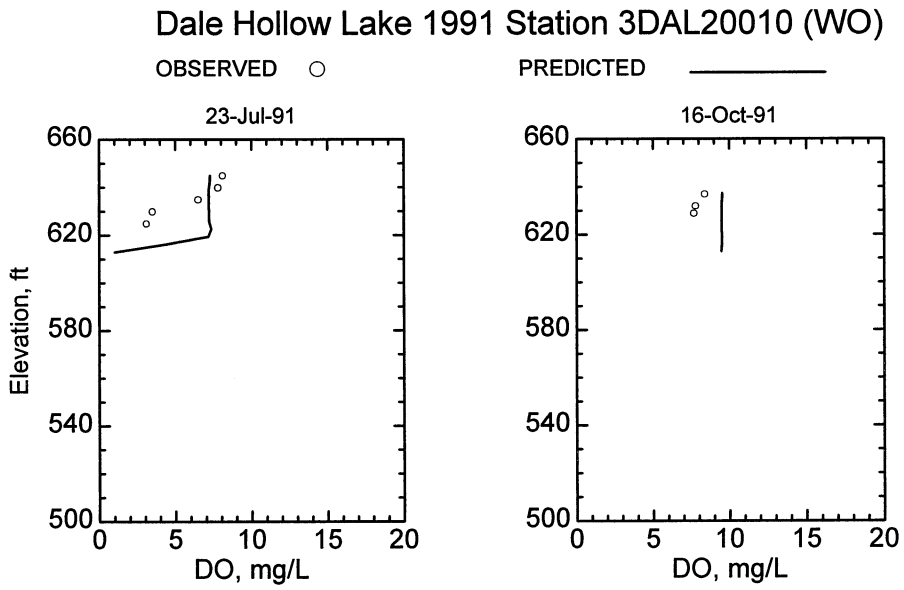

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

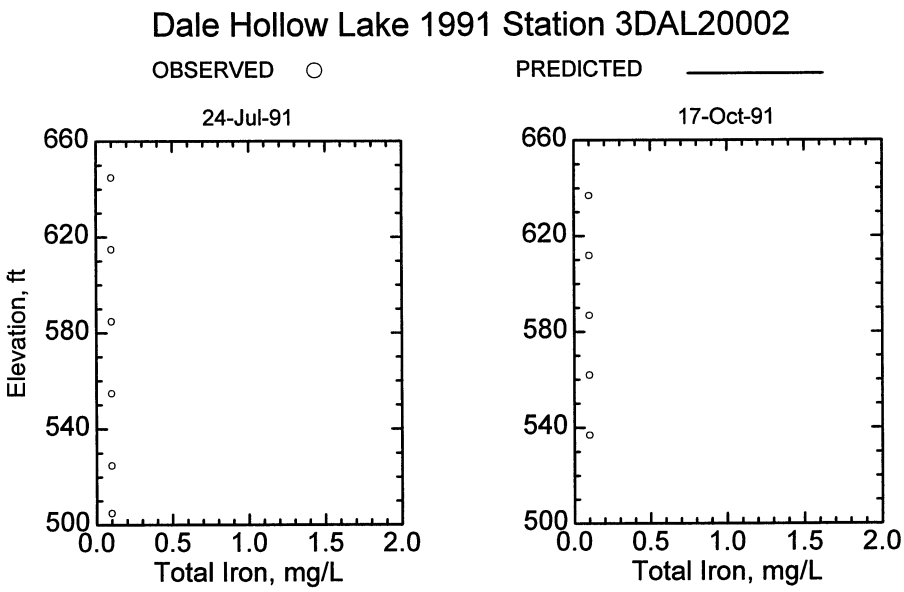

Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

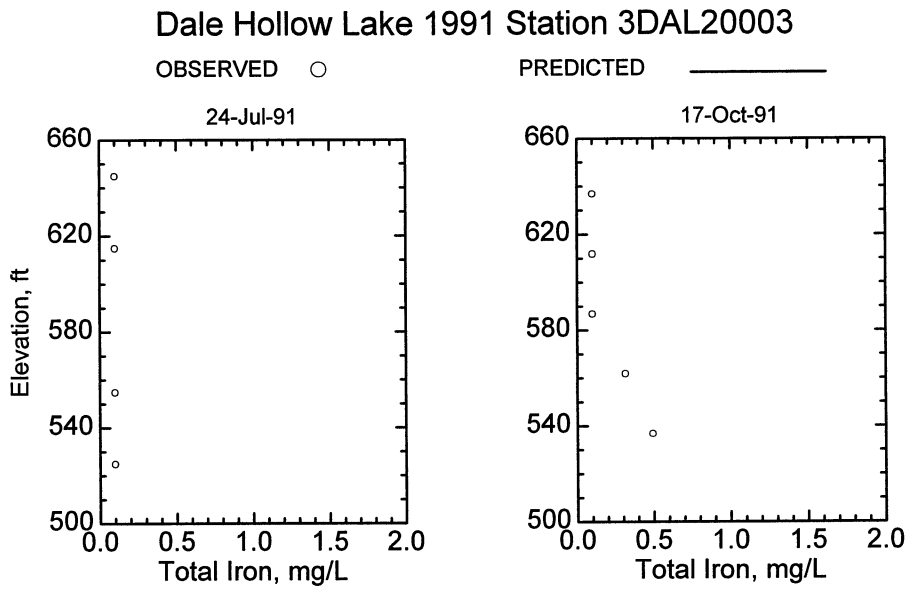

Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

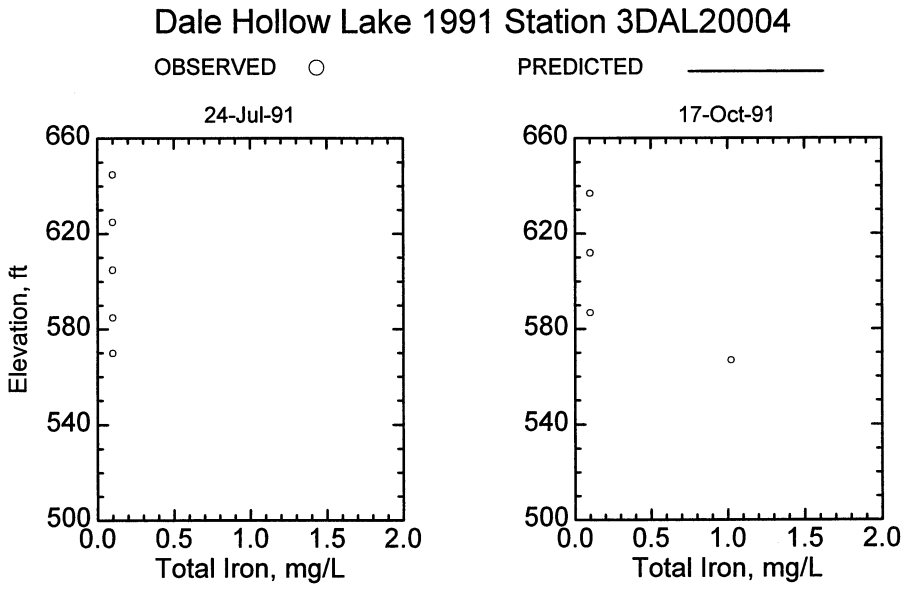

Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

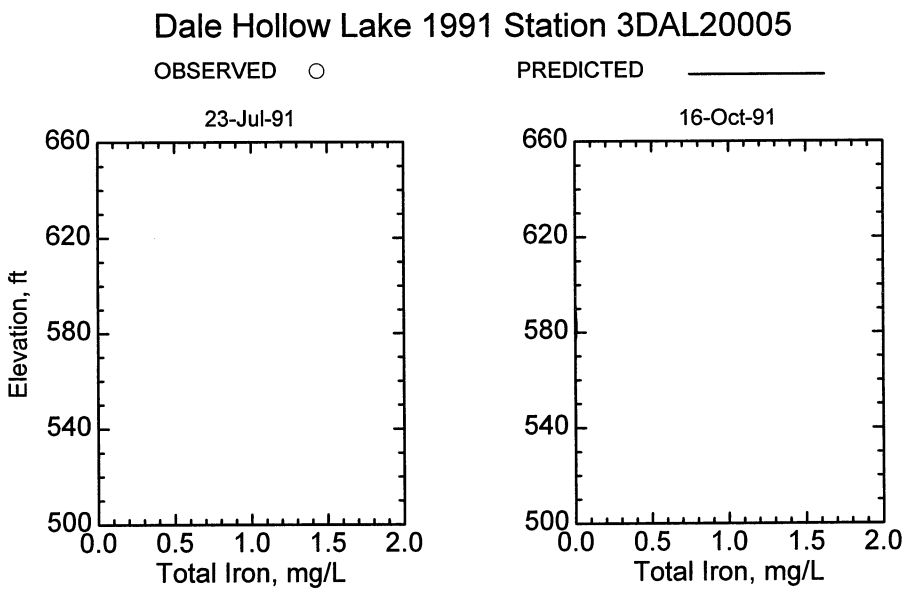

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

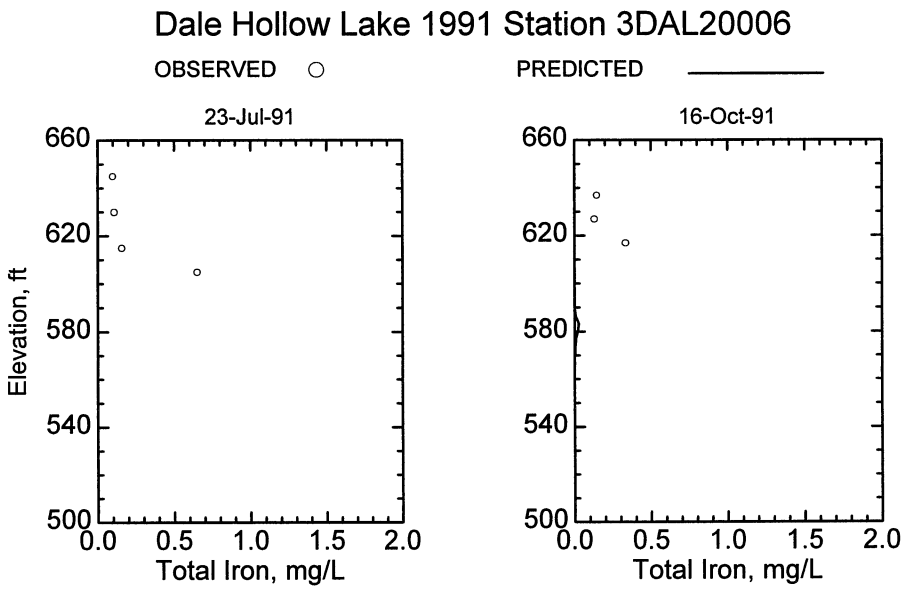

Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

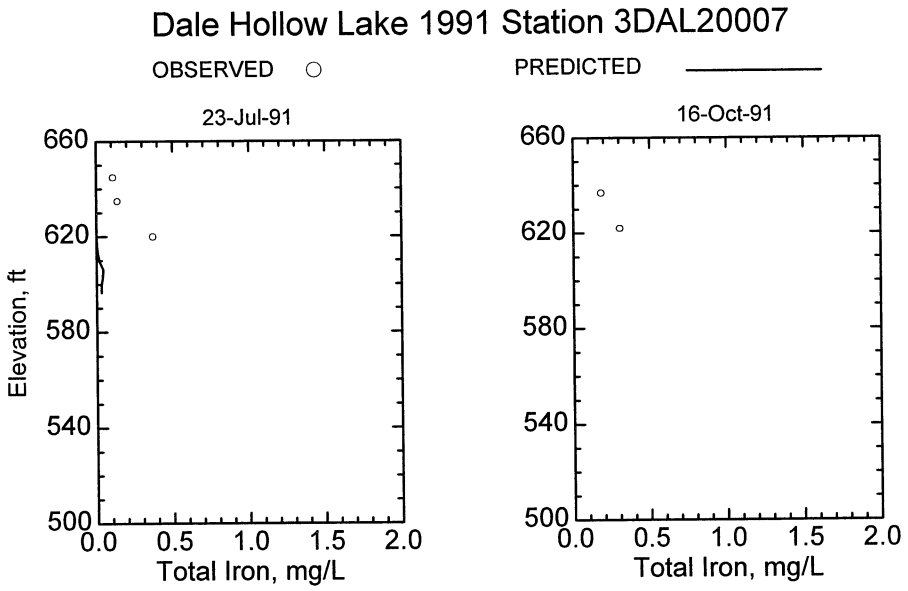

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

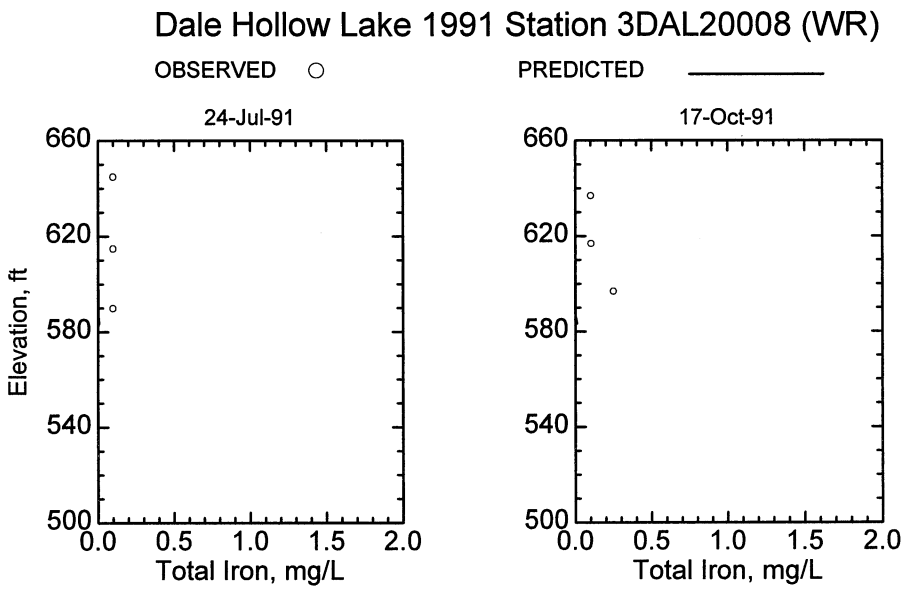

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

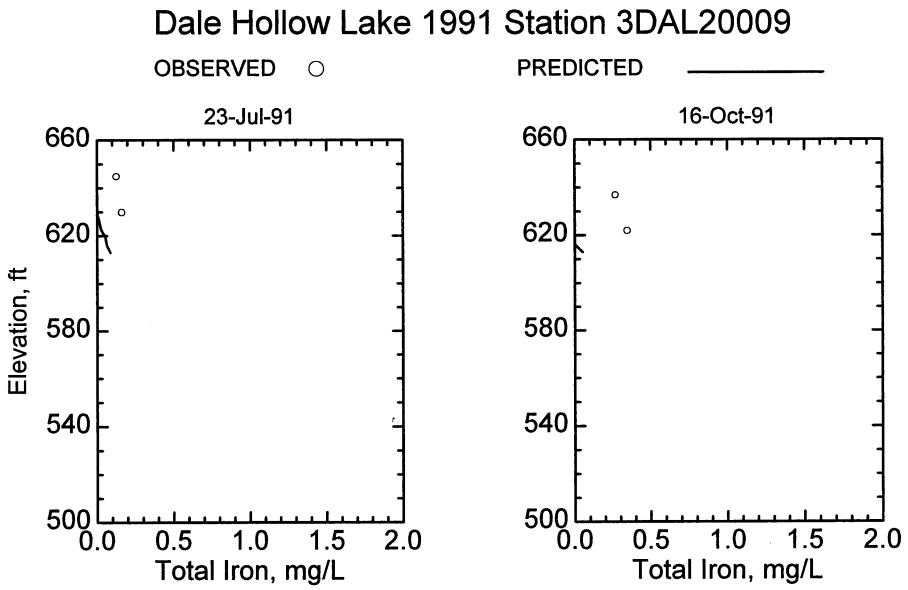

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

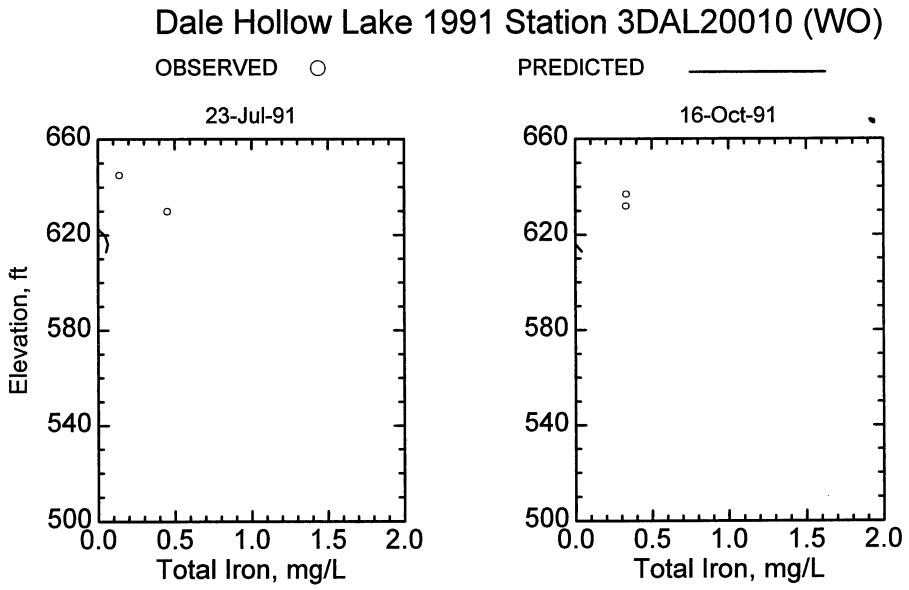

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

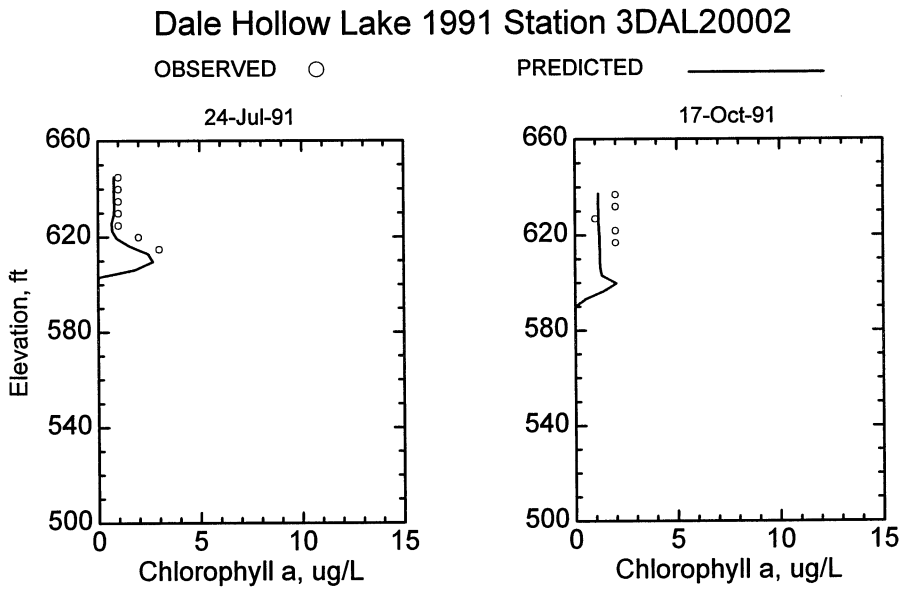

Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

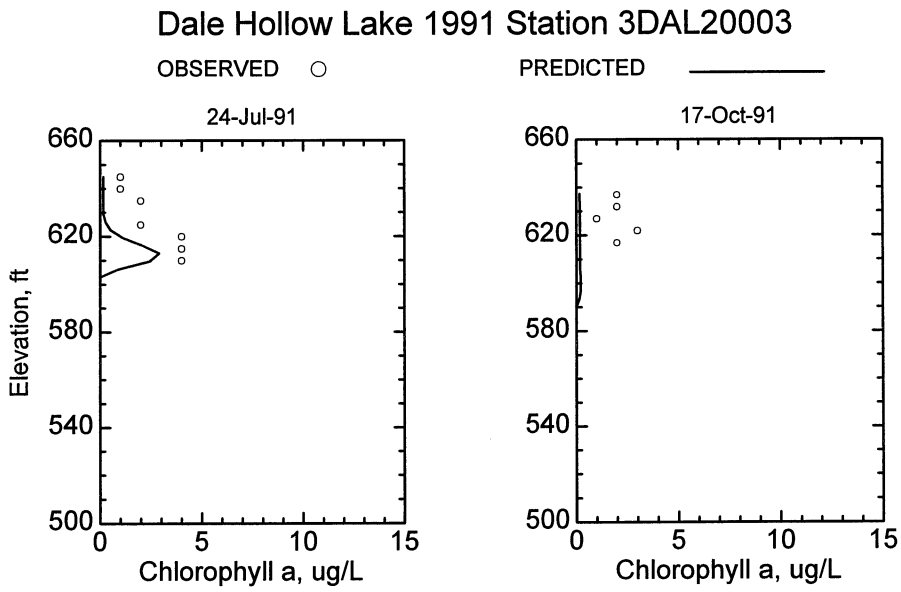

Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

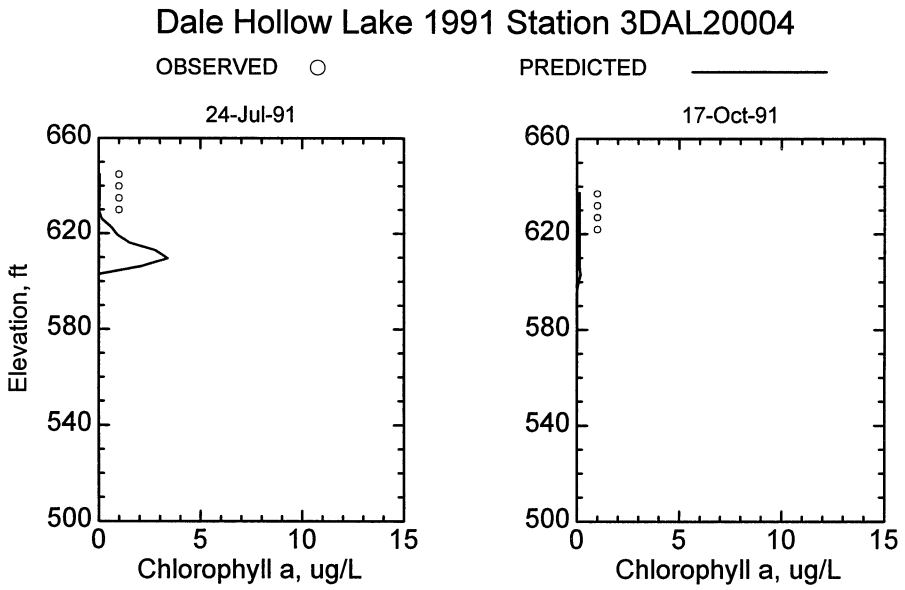

Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

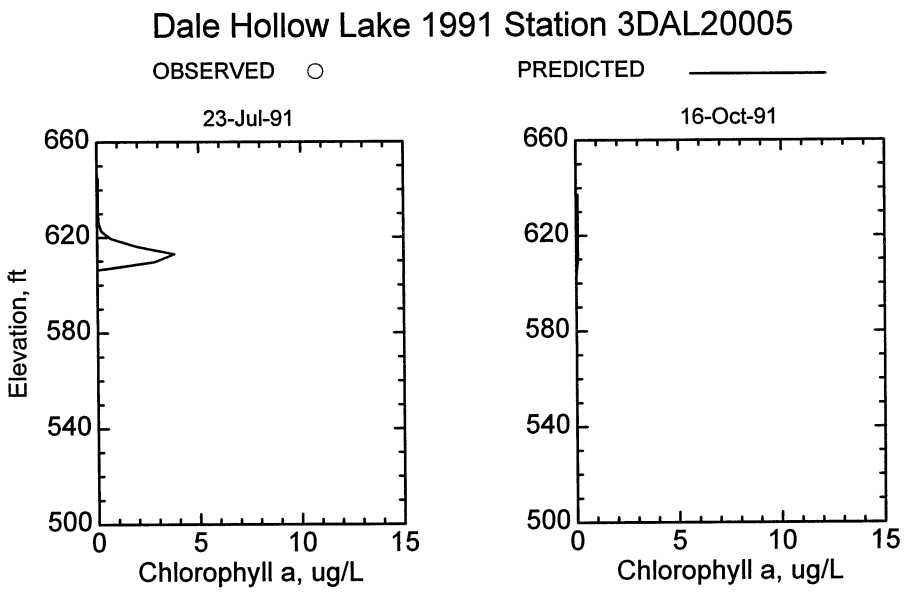

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

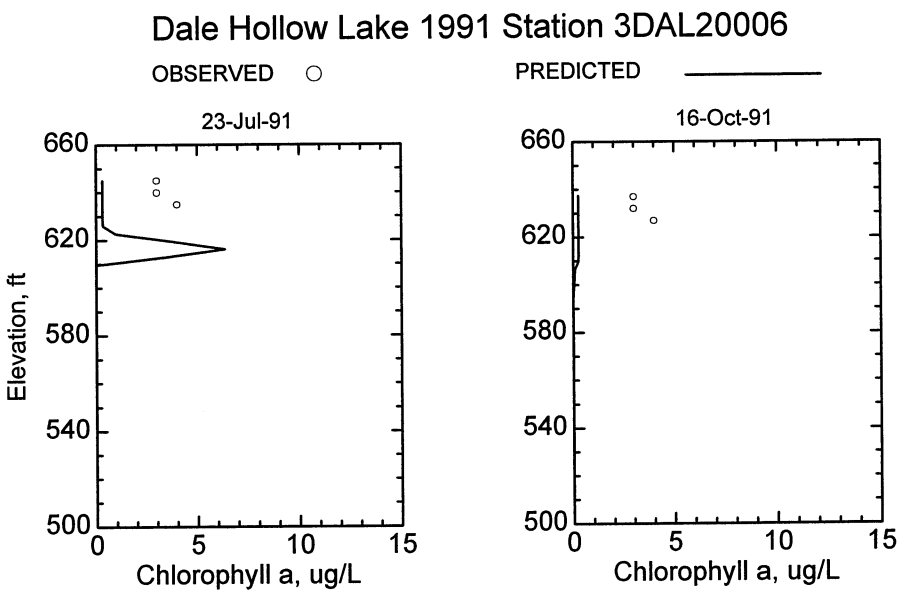

Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0.0
0.5
1.0
1.5
2.0
Total Iron, mg/L

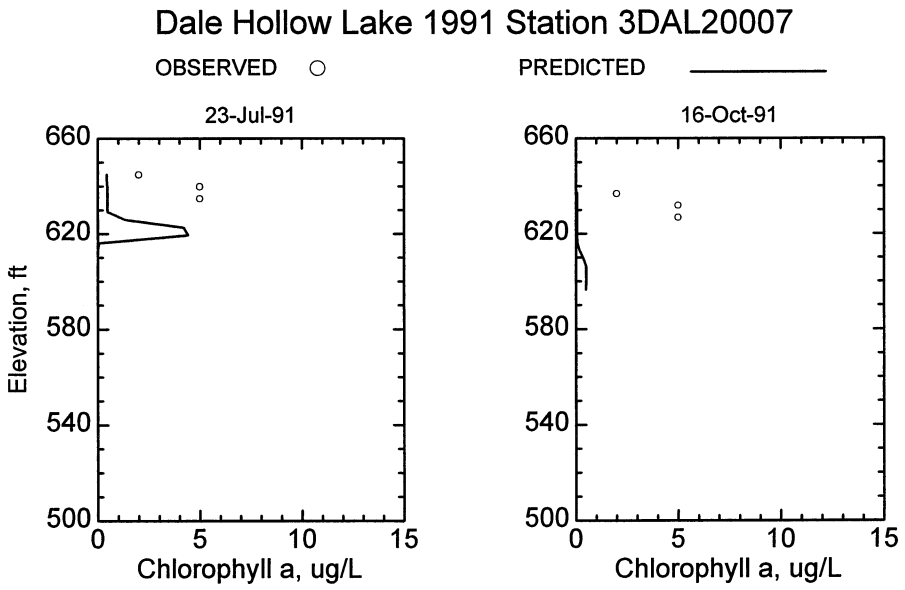

Dale Hollow Lake 1991 Station 3DAL20002
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

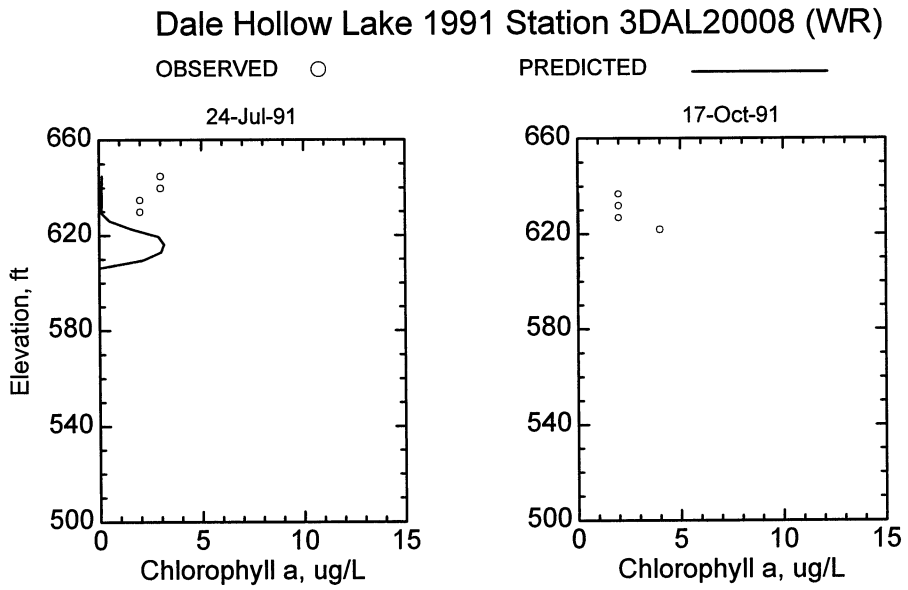

Dale Hollow Lake 1991 Station 3DAL20003
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

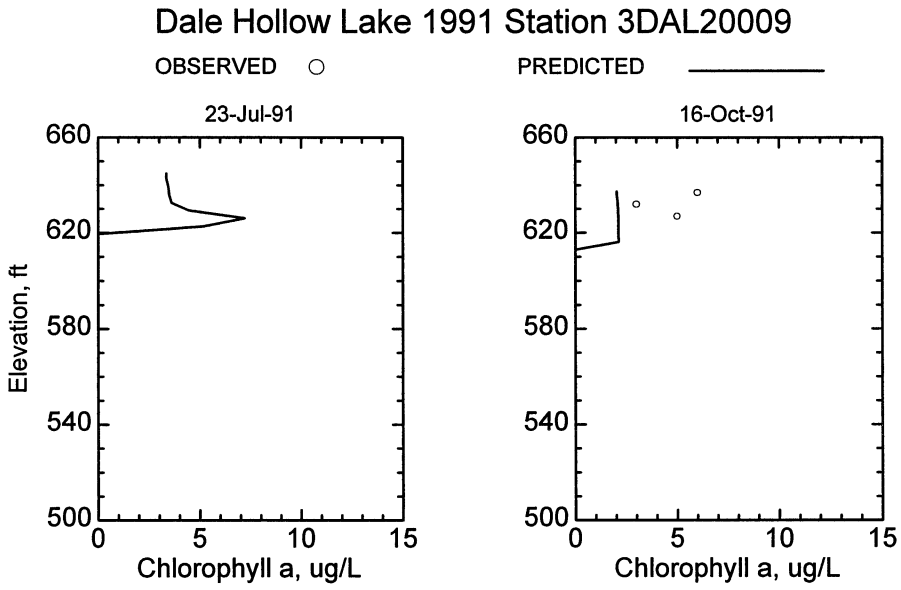

Dale Hollow Lake 1991 Station 3DAL20004
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

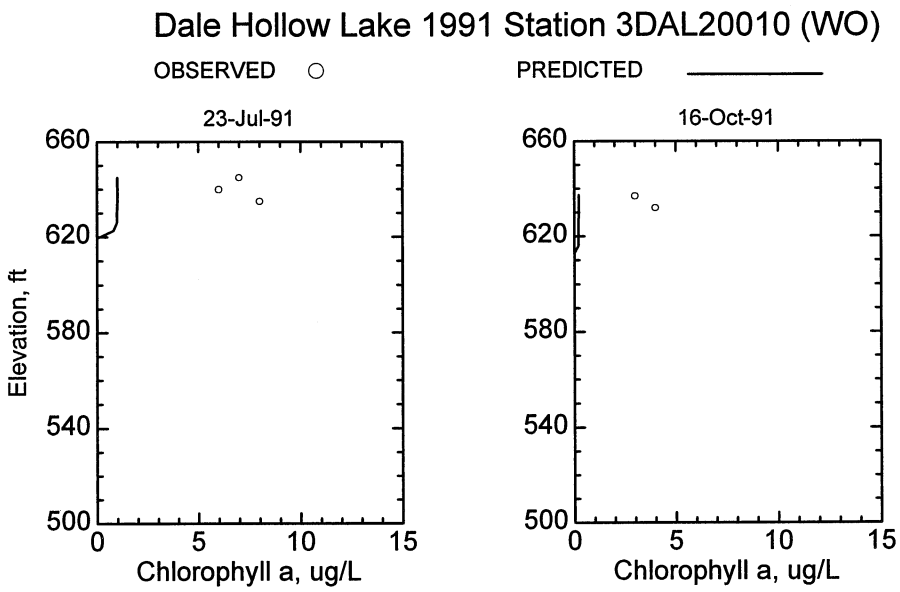

Dale Hollow Lake 1991 Station 3DAL20005
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L


Dale Hollow Lake 1991 Station 3DAL20006
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L


Dale Hollow Lake 1991 Station 3DAL20007
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

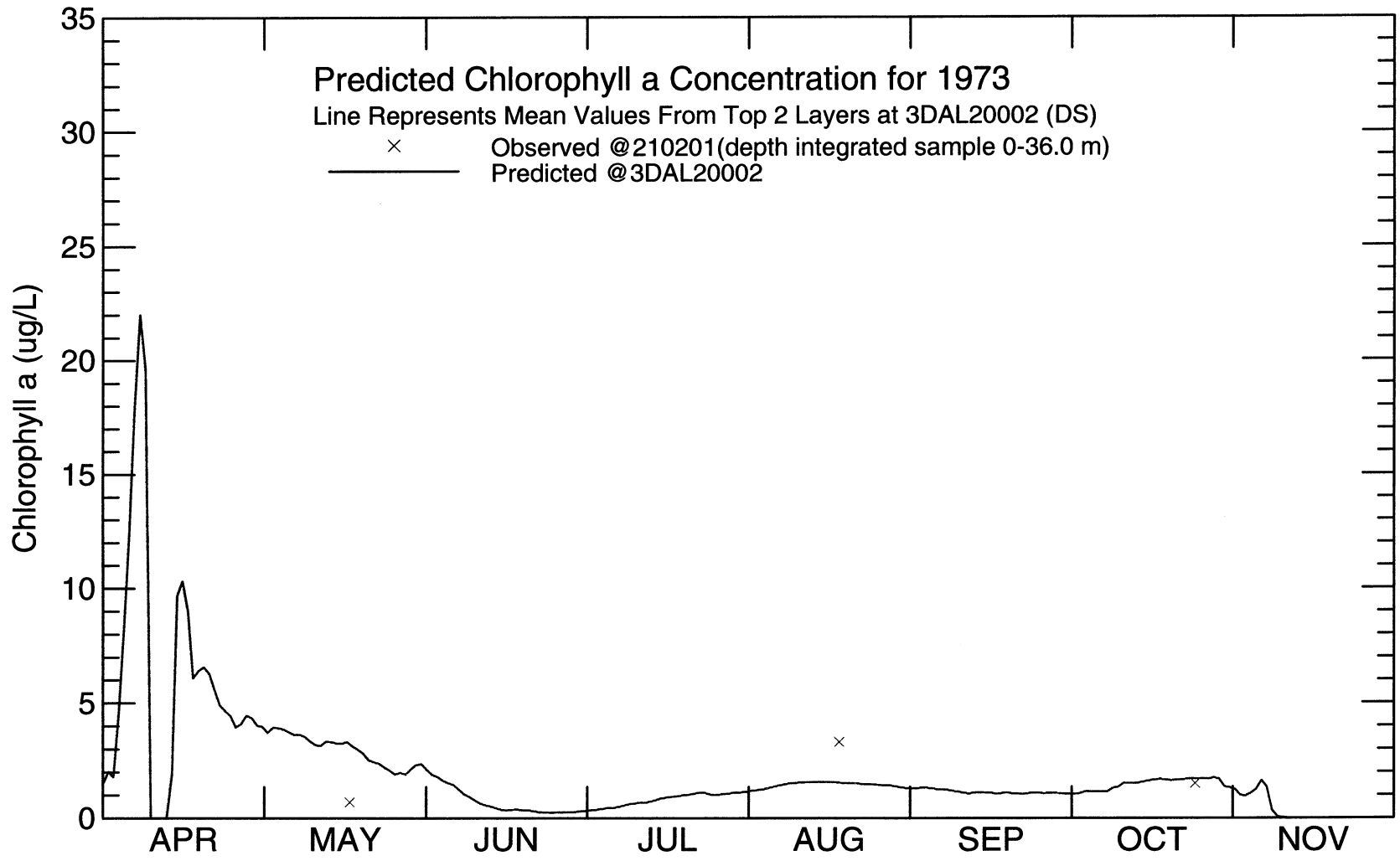

Dale Hollow Lake 1991 Station 3DAL20008 (WR)
OBSERVED
PREDICTED
24-Jul-91
17-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

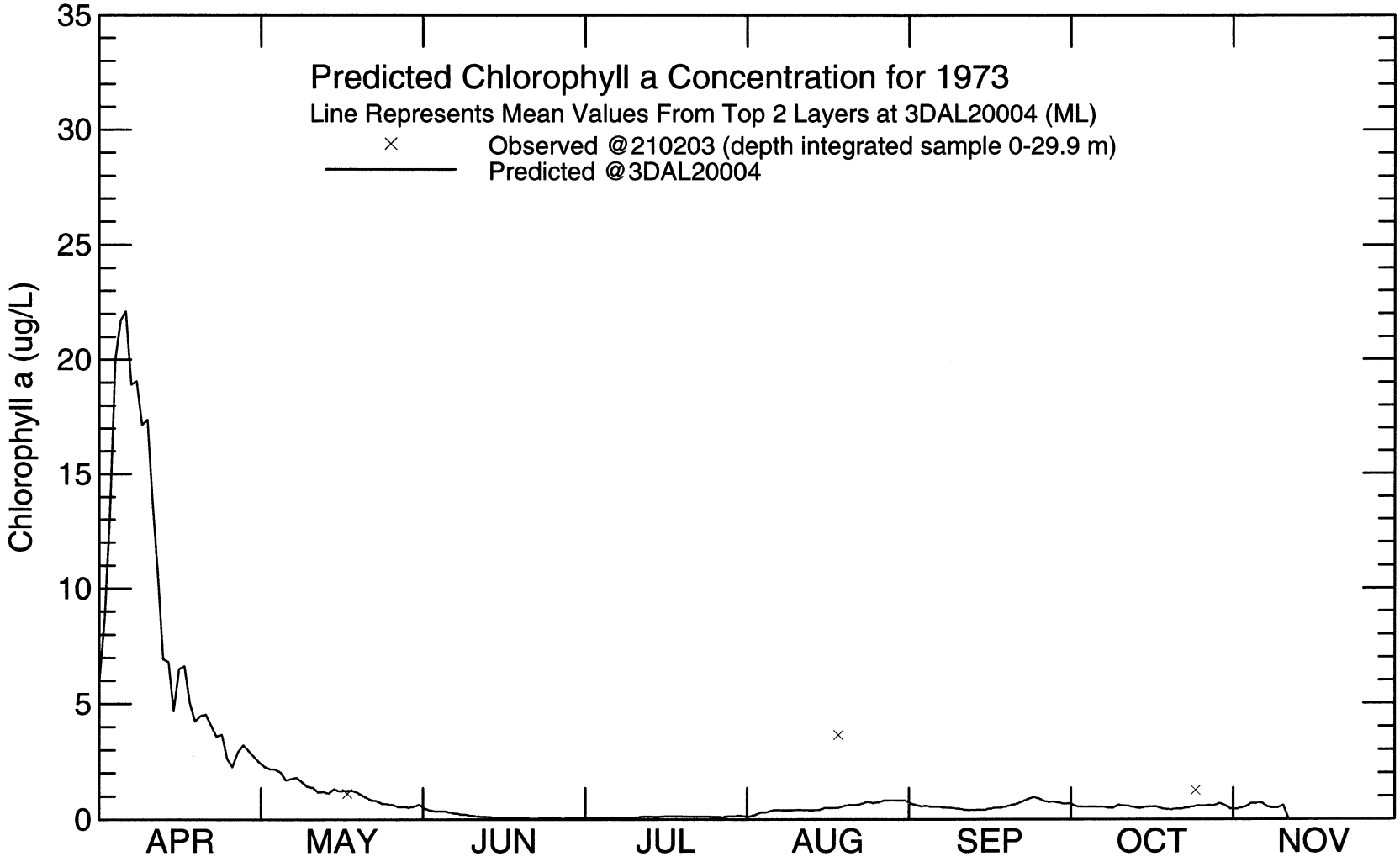

Dale Hollow Lake 1991 Station 3DAL20009
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

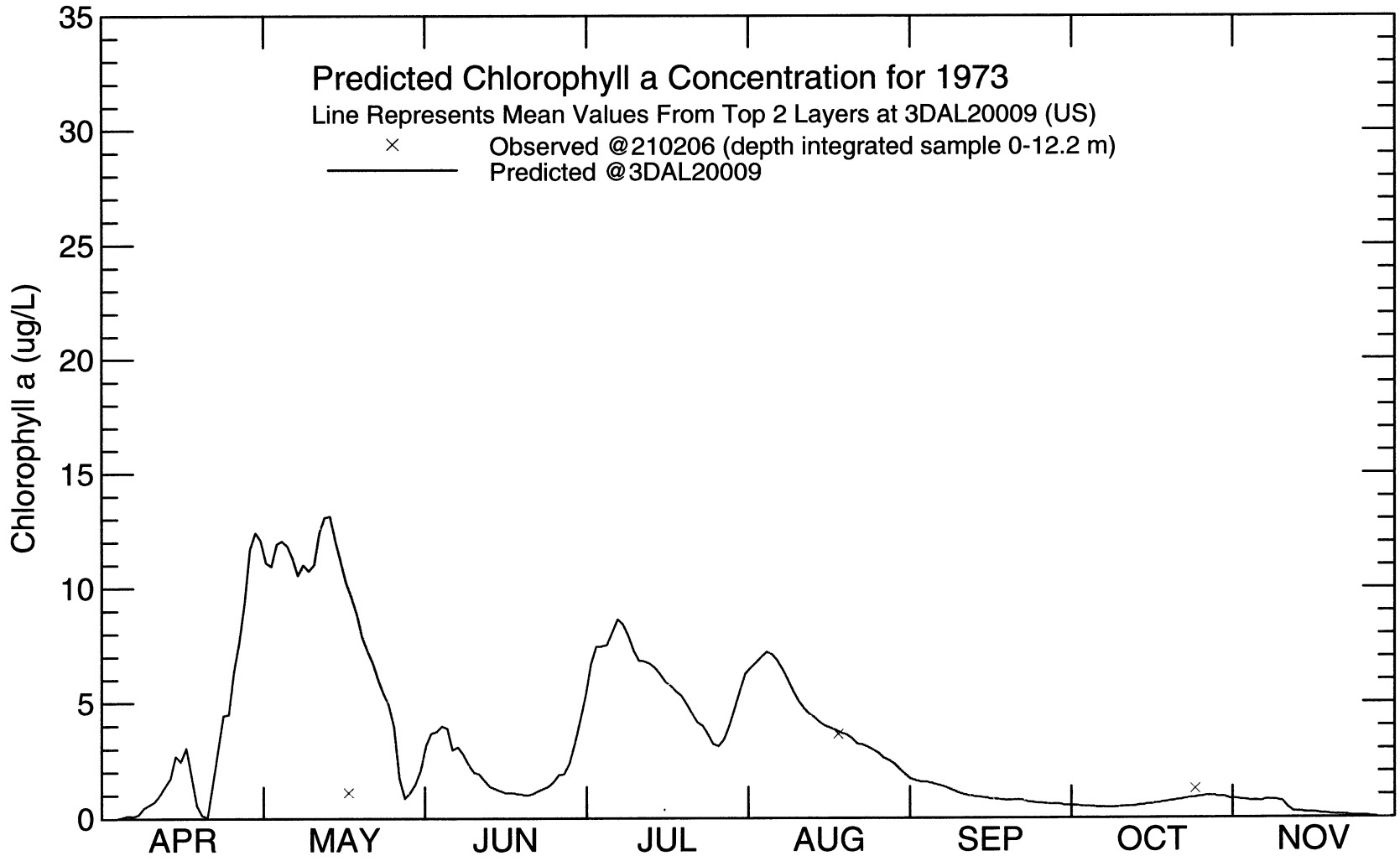

Dale Hollow Lake 1991 Station 3DAL20010 (WO)
OBSERVED
PREDICTED
23-Jul-91
16-Oct-91
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

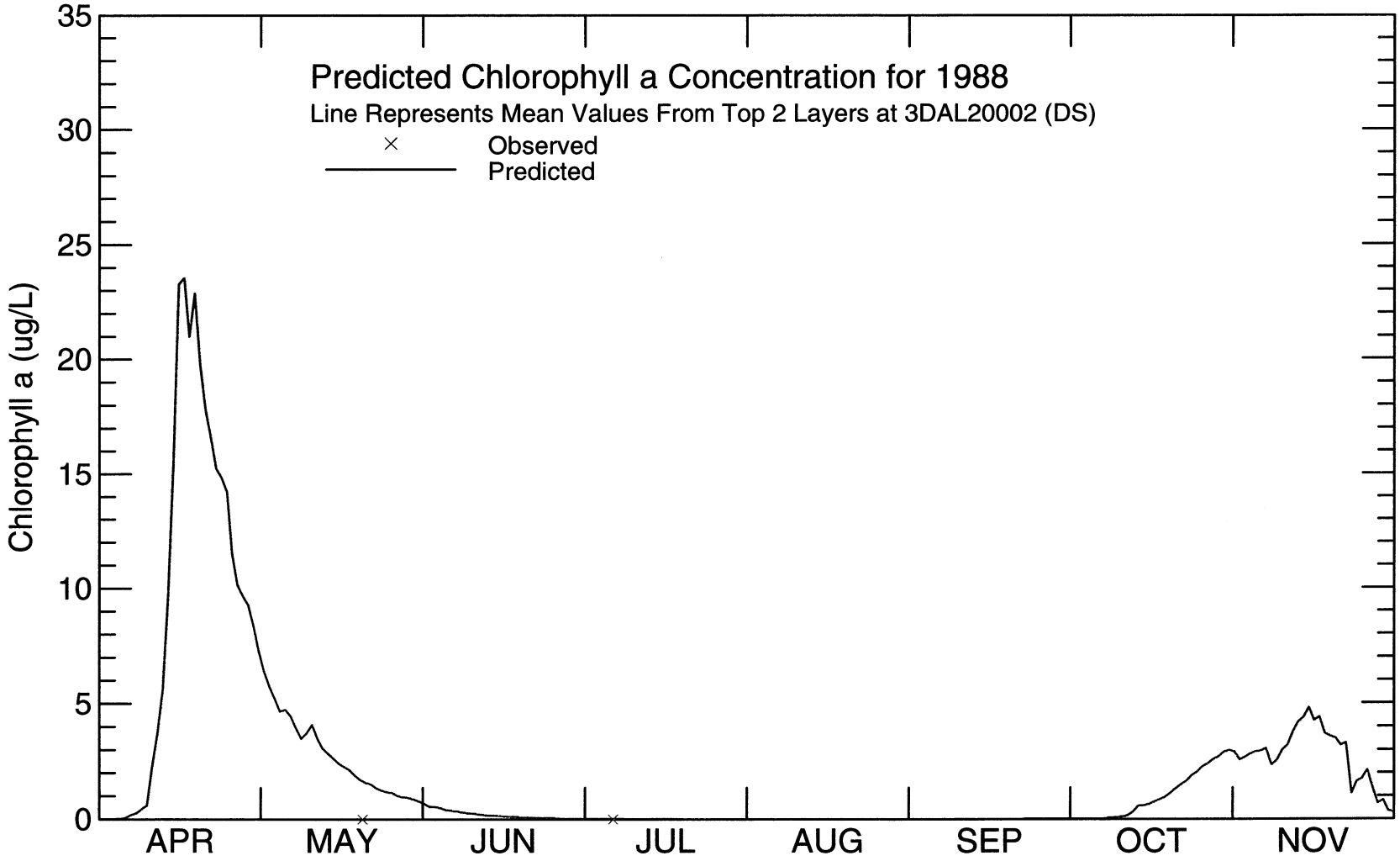
APPENDIX L

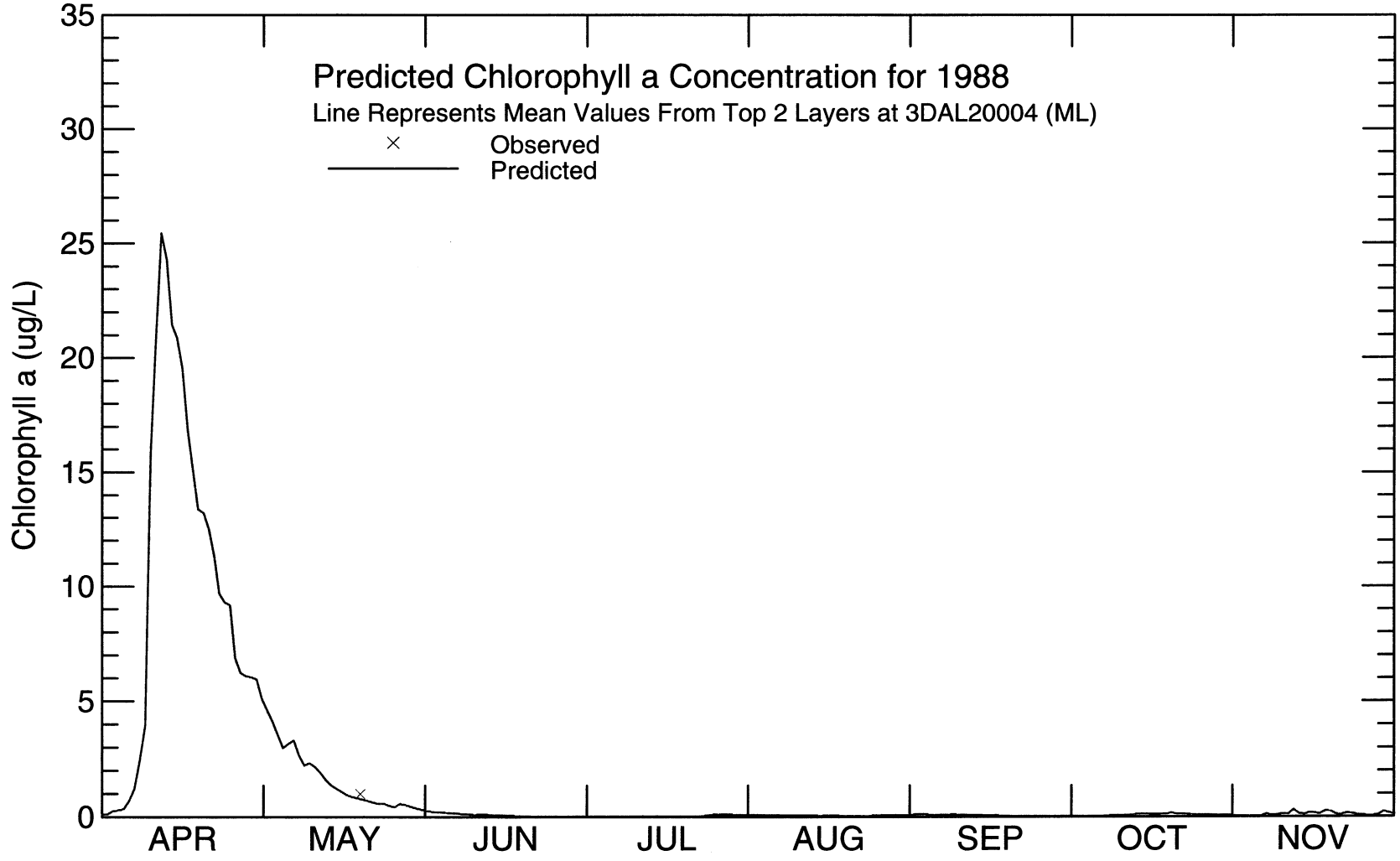
Chlorophyll *a* Time Series Plots

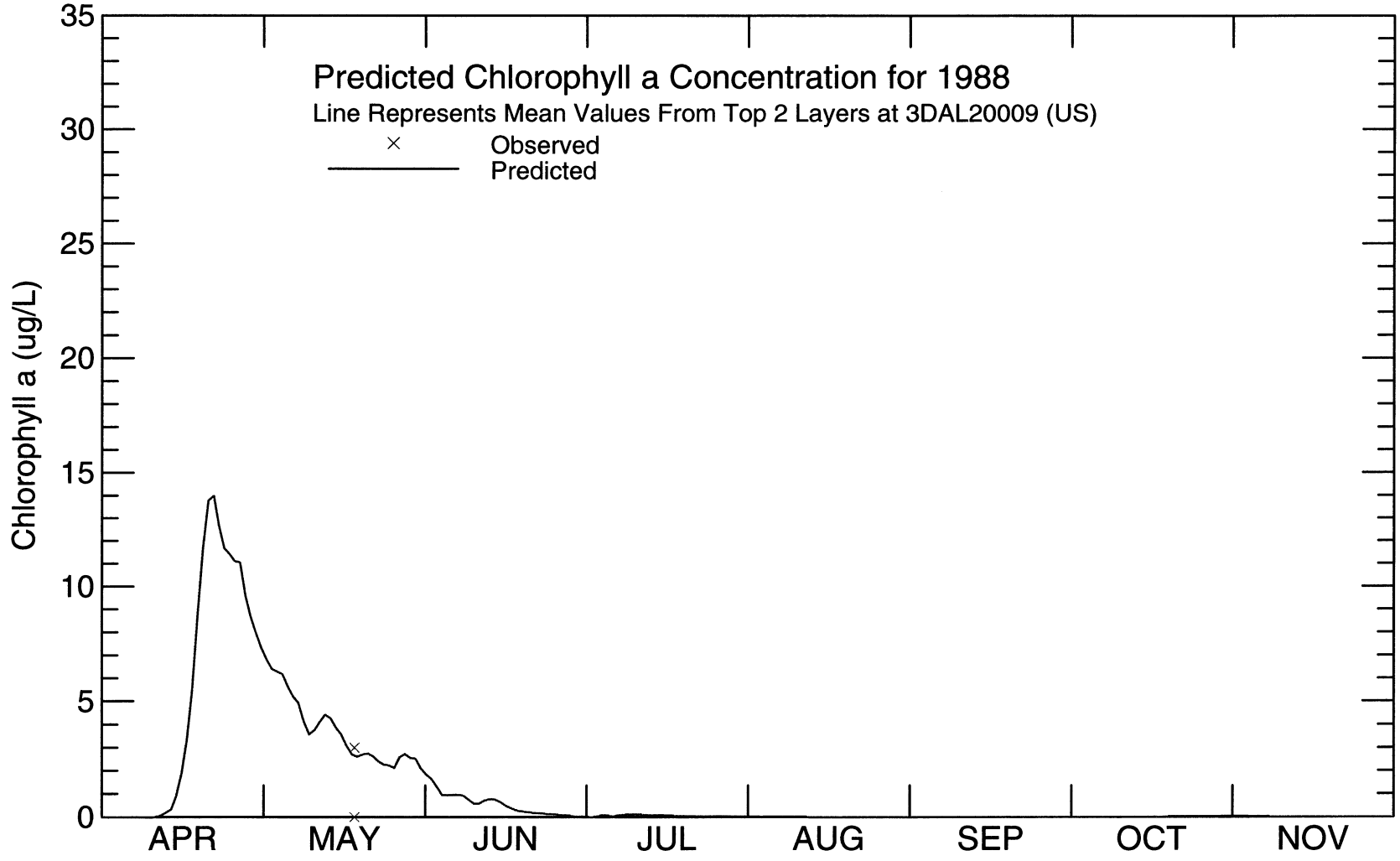

Predicted Chlorophyll a Concentration for 1973
Line Represents Mean Values From Top 2 Layers at 3DAL20002 (DS)
Observed @210201(depth integrated sample 0-36.0 m)
Predicted @3DAL20002
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

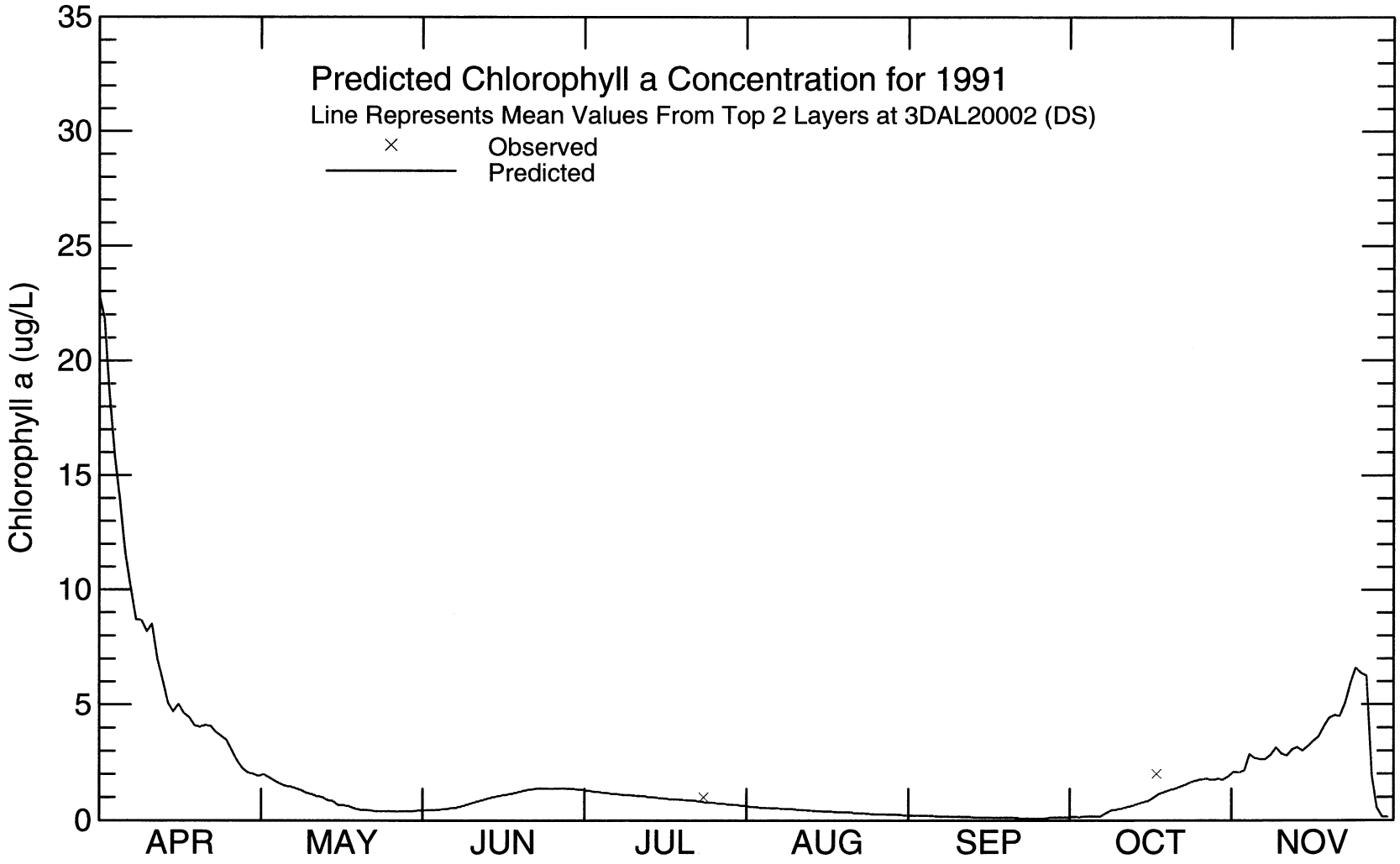

Predicted Chlorophyll a Concentration for 1973
Line Represents Mean Values From Top 2 Layers at 3DAL20004 (ML)
Observed @210203 (depth integrated sample 0-29.9 m)
Predicted @3DAL20004
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

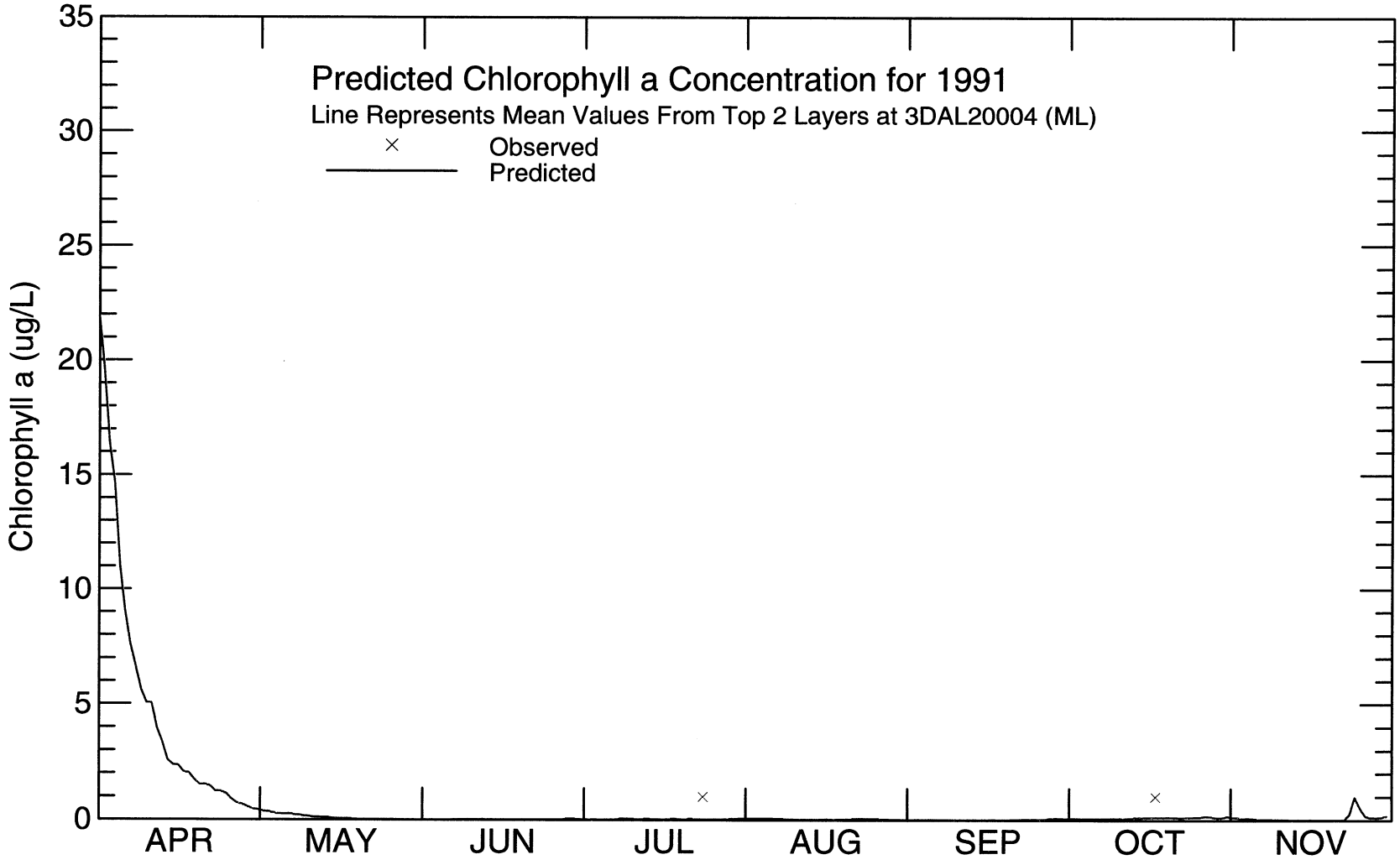

Predicted Chlorophyll a Concentration for 1973
Line Represents Mean Values From Top 2 Layers at 3DAL20009 (US)
Observed @210206 (depth integrated sample 0-12.2 m)
Predicted @3DAL20009
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

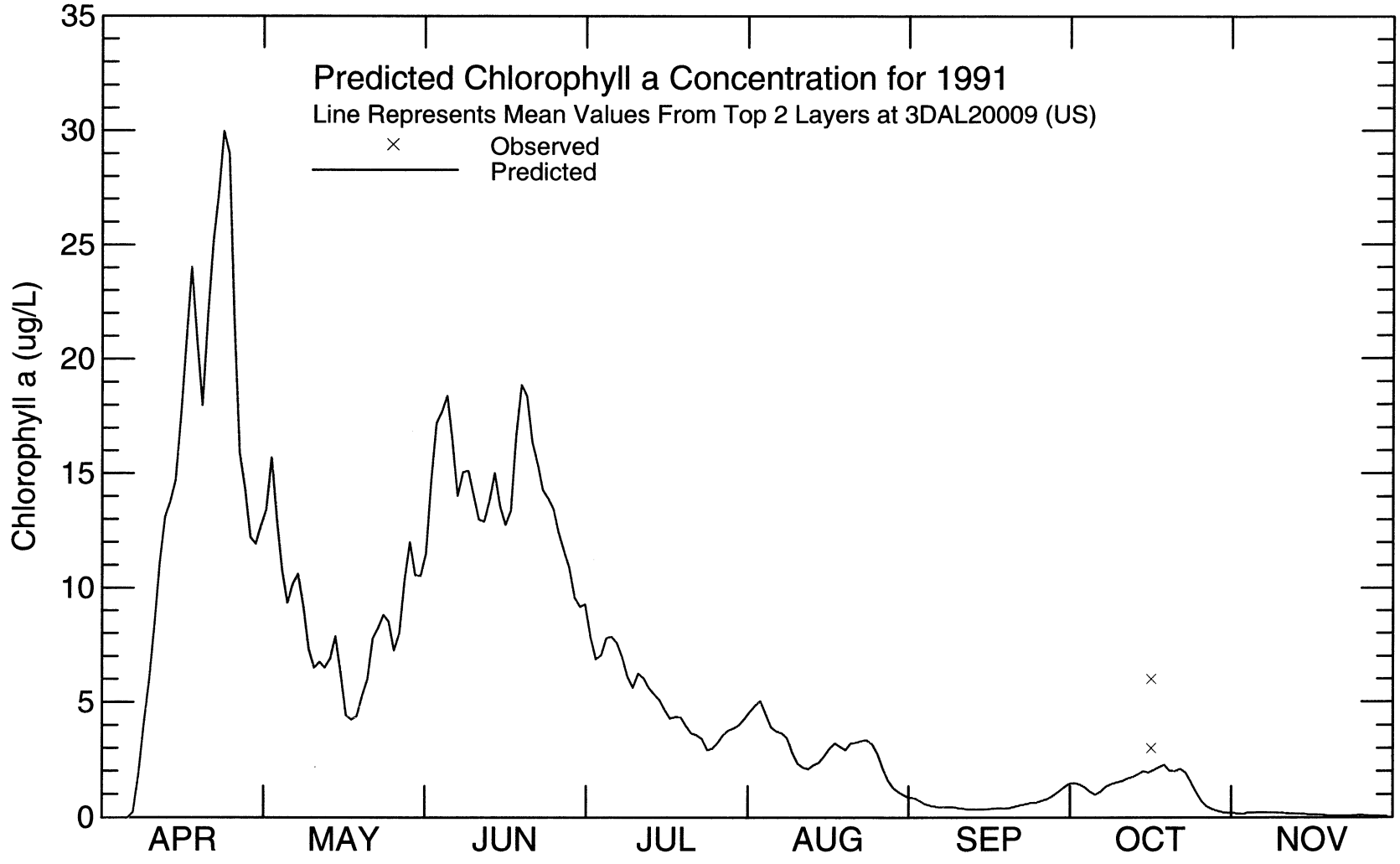

Predicted Chlorophyll a Concentration for 1988
Line Represents Mean Values From Top 2 Layers at 3DAL20002 (DS)
Observed
Predicted
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV


Predicted Chlorophyll a Concentration for 1988
Line Represents Mean Values From Top 2 Layers at 3DAL20004 (ML)
Observed
Predicted
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV


Predicted Chlorophyll a Concentration for 1988
Line Represents Mean Values From Top 2 Layers at 3DAL20009 (US)
Observed
Predicted
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

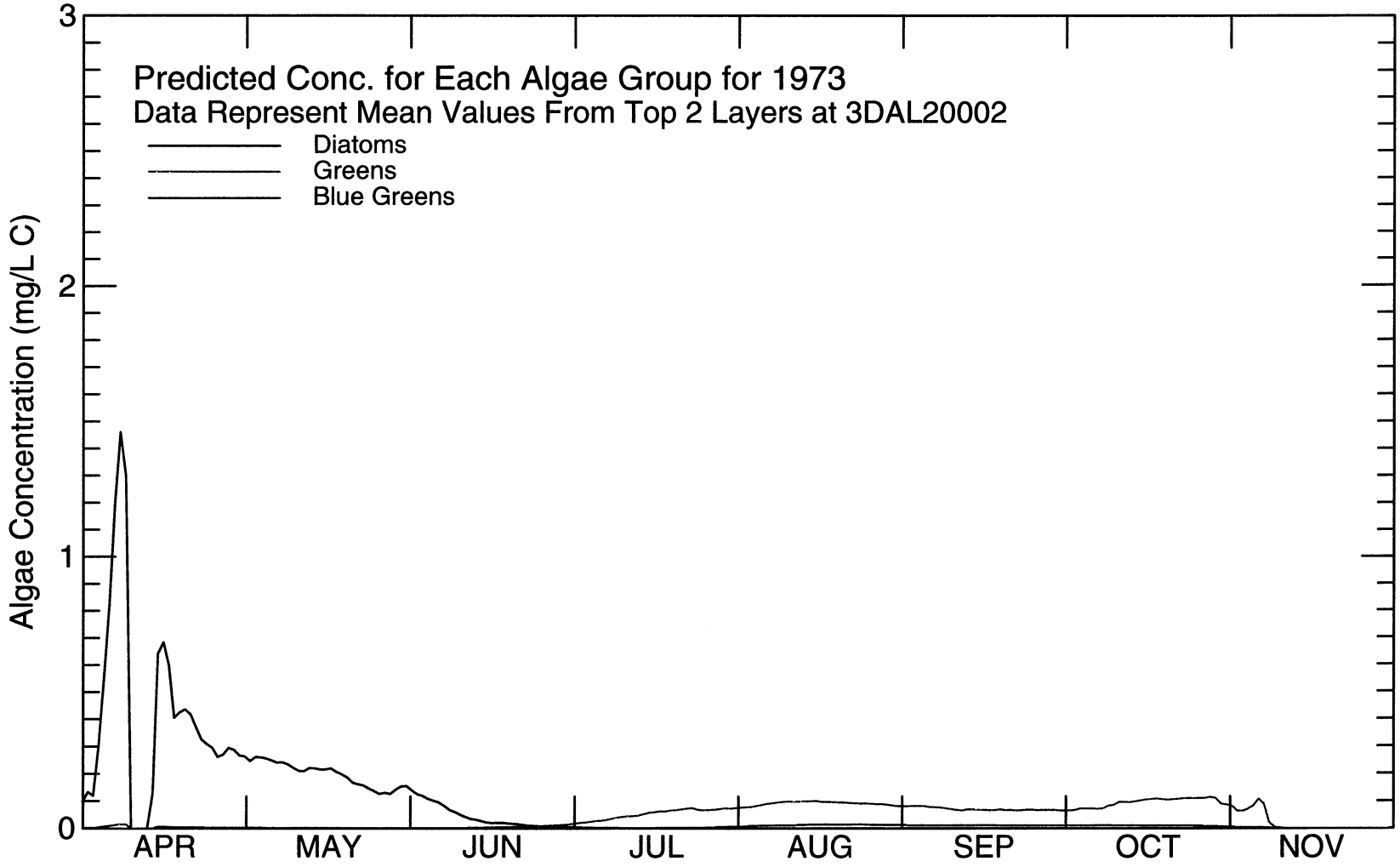

Predicted Chlorophyll a Concentration for 1991
Line Represents Mean Values From Top 2 Layers at 3DAL20002 (DS)
Observed
Predicted
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

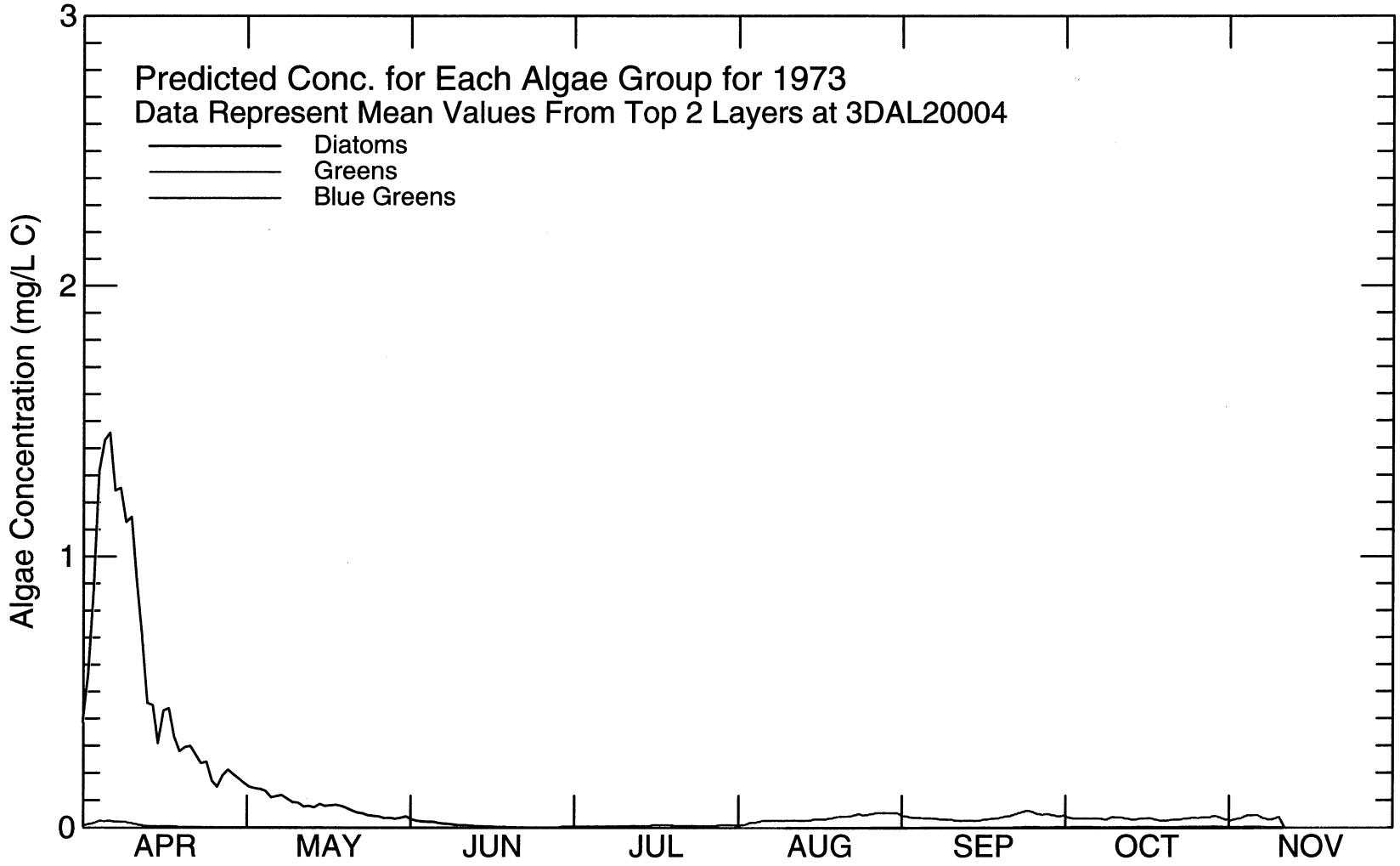

Predicted Chlorophyll a Concentration for 1991
Line Represents Mean Values From Top 2 Layers at 3DAL20004 (ML)
Observed
Predicted
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

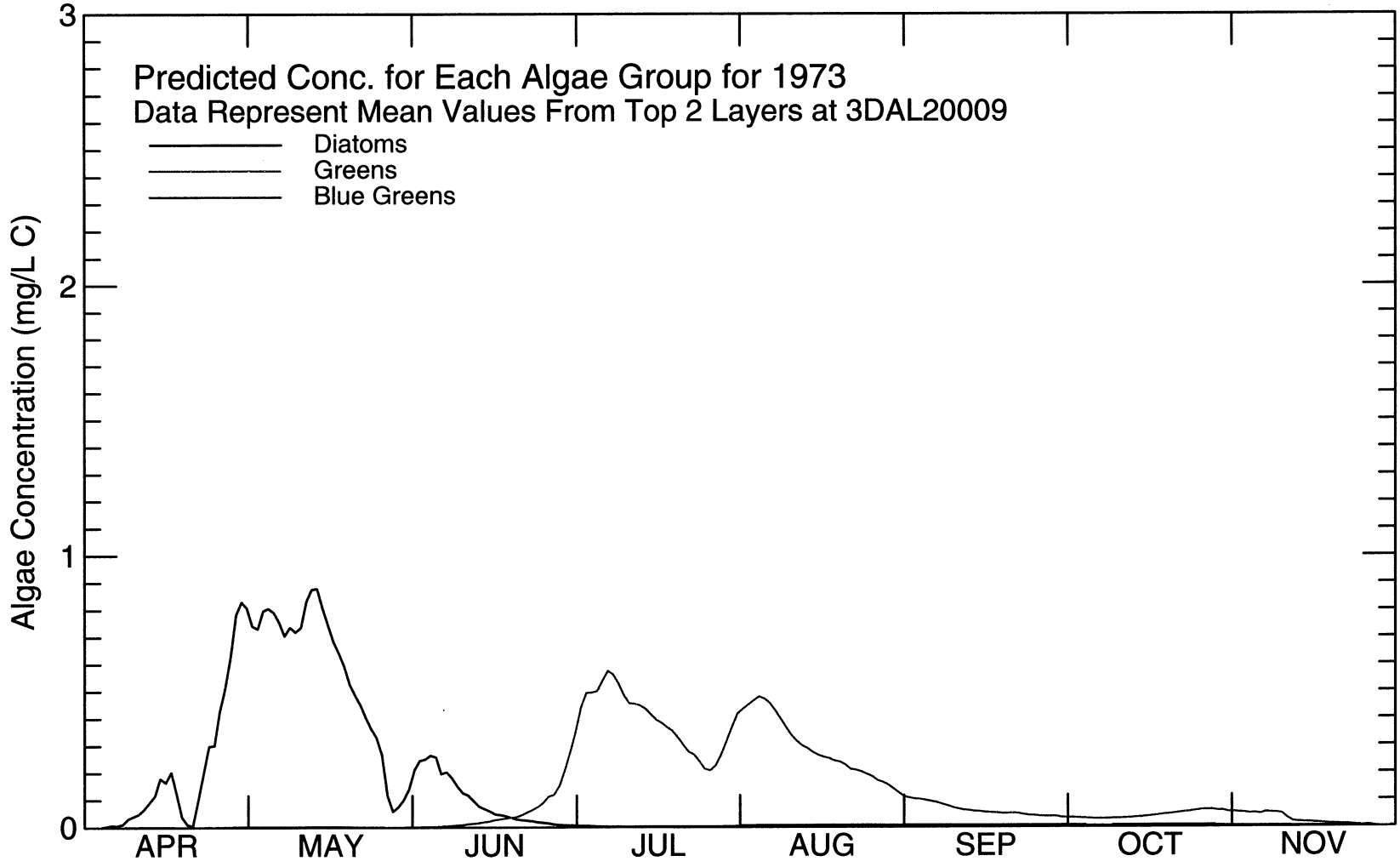

Predicted Chlorophyll a Concentration for 1991
Line Represents Mean Values From Top 2 Layers at 3DAL20009 (US)
Observed
Predicted
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

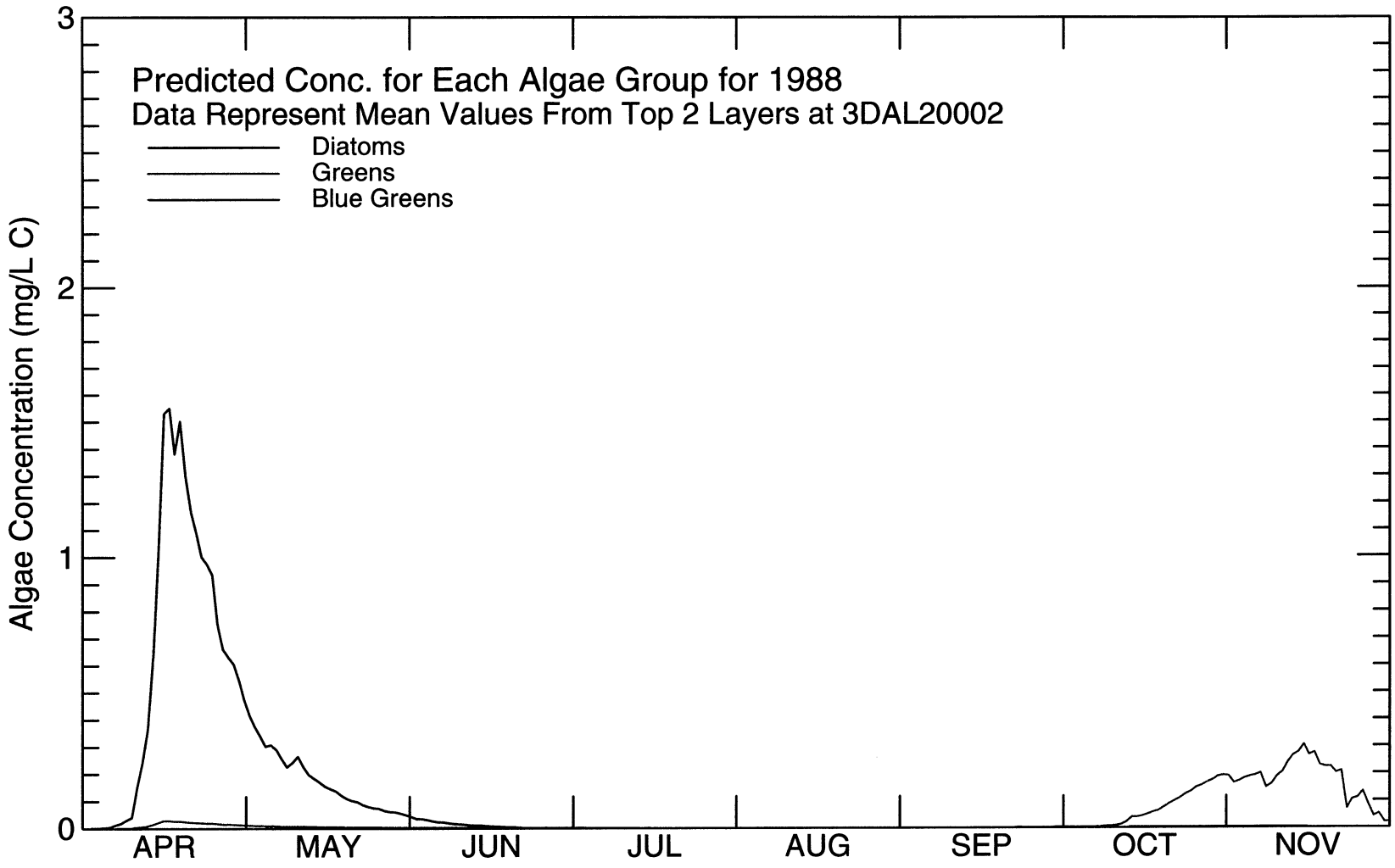
APPENDIX M

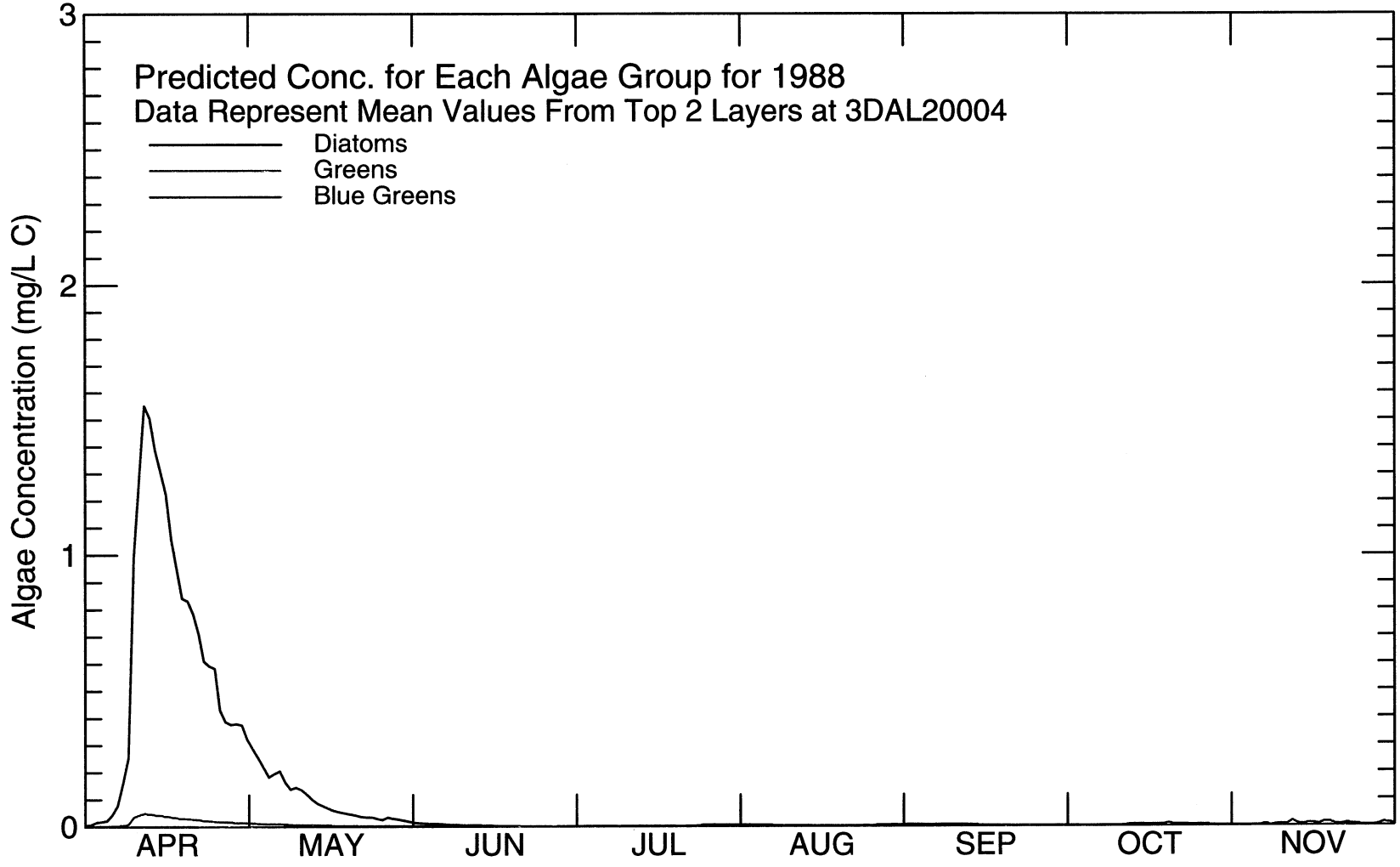
Algae Group Time Series Plots

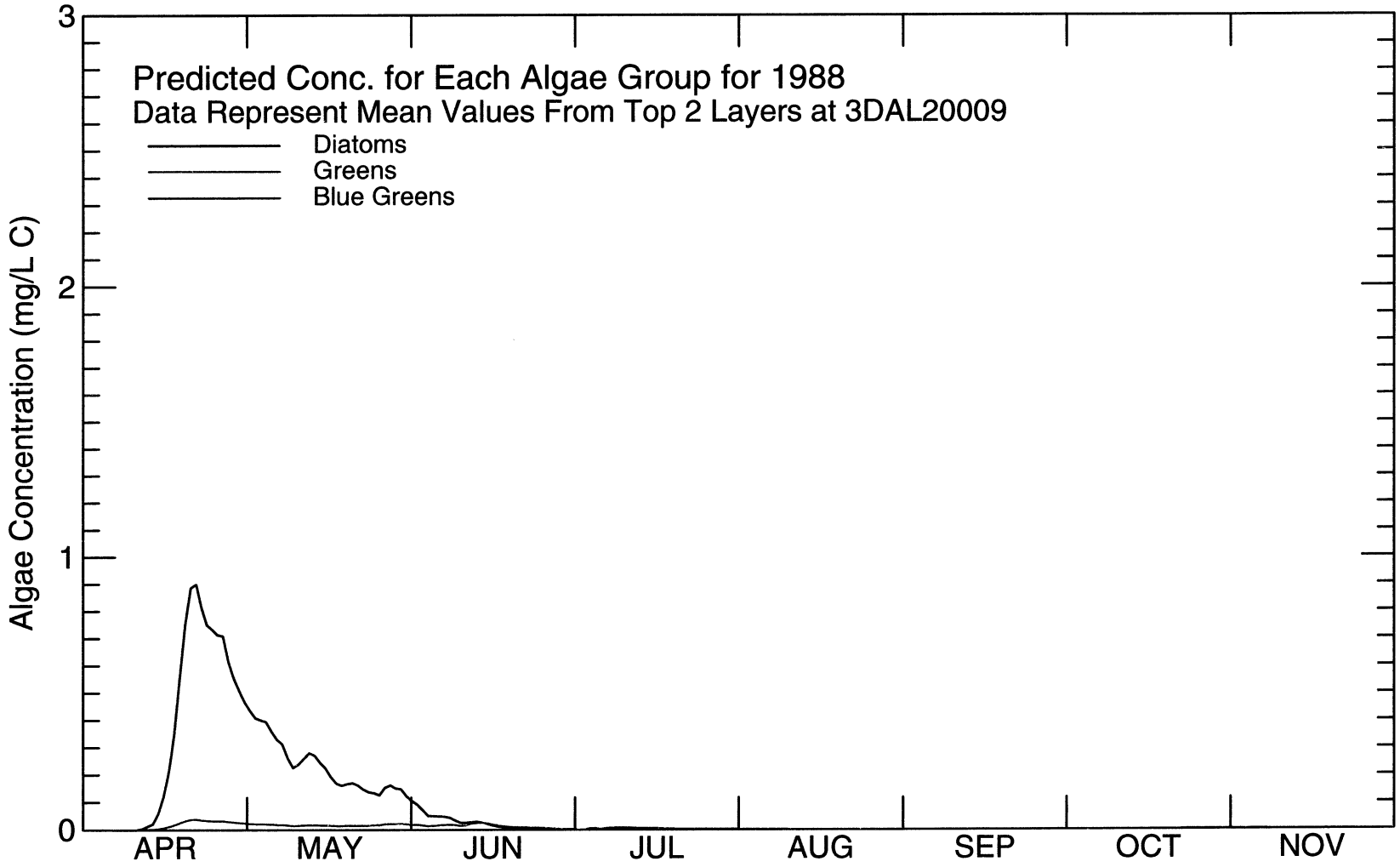

Predicted Conc. for Each Algae Group for 1973
Data Represent Mean Values From Top 2 Layers at 3DAL20002
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

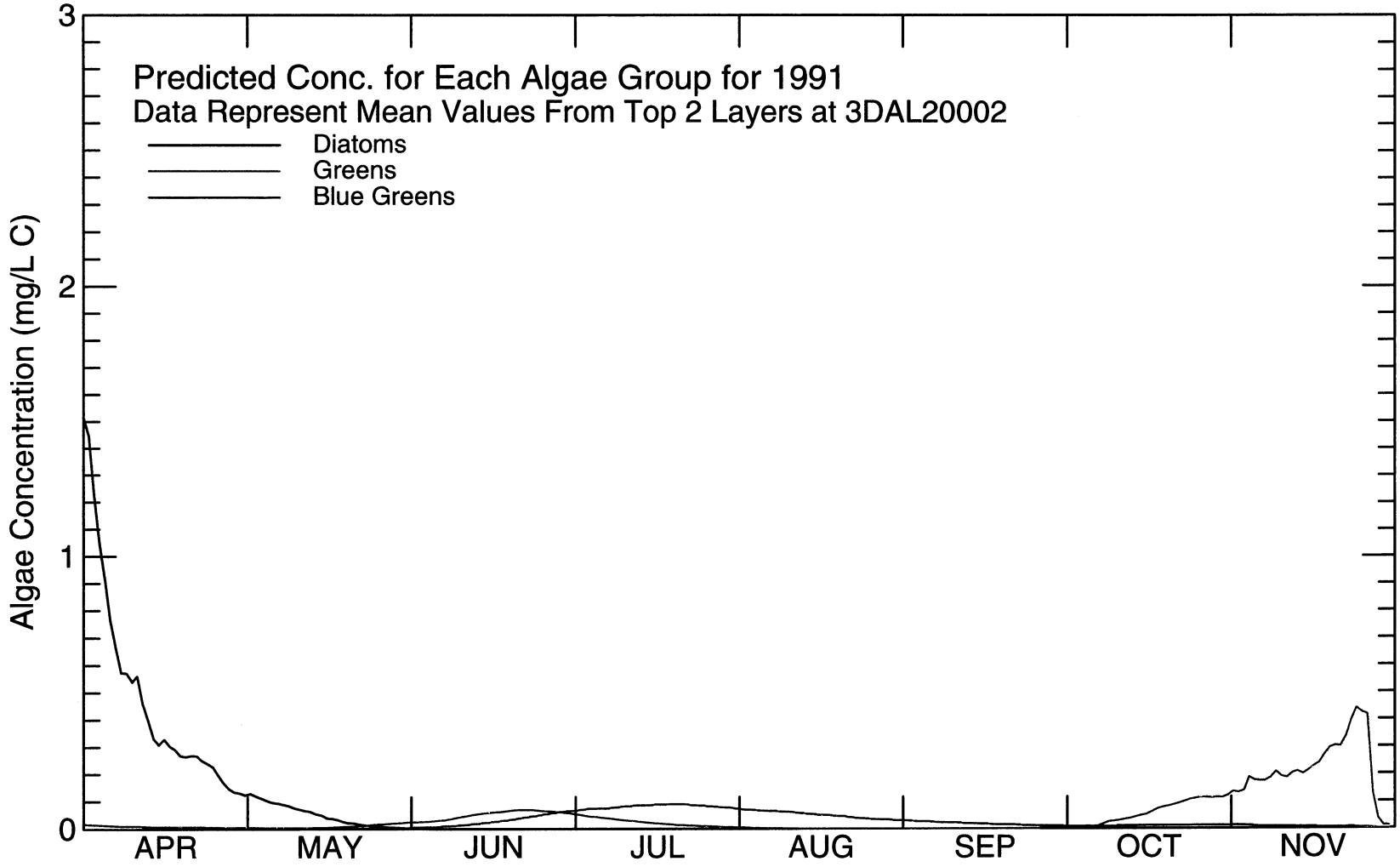

Predicted Conc. for Each Algae Group for 1973
Data Represent Mean Values From Top 2 Layers at 3DAL20004
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

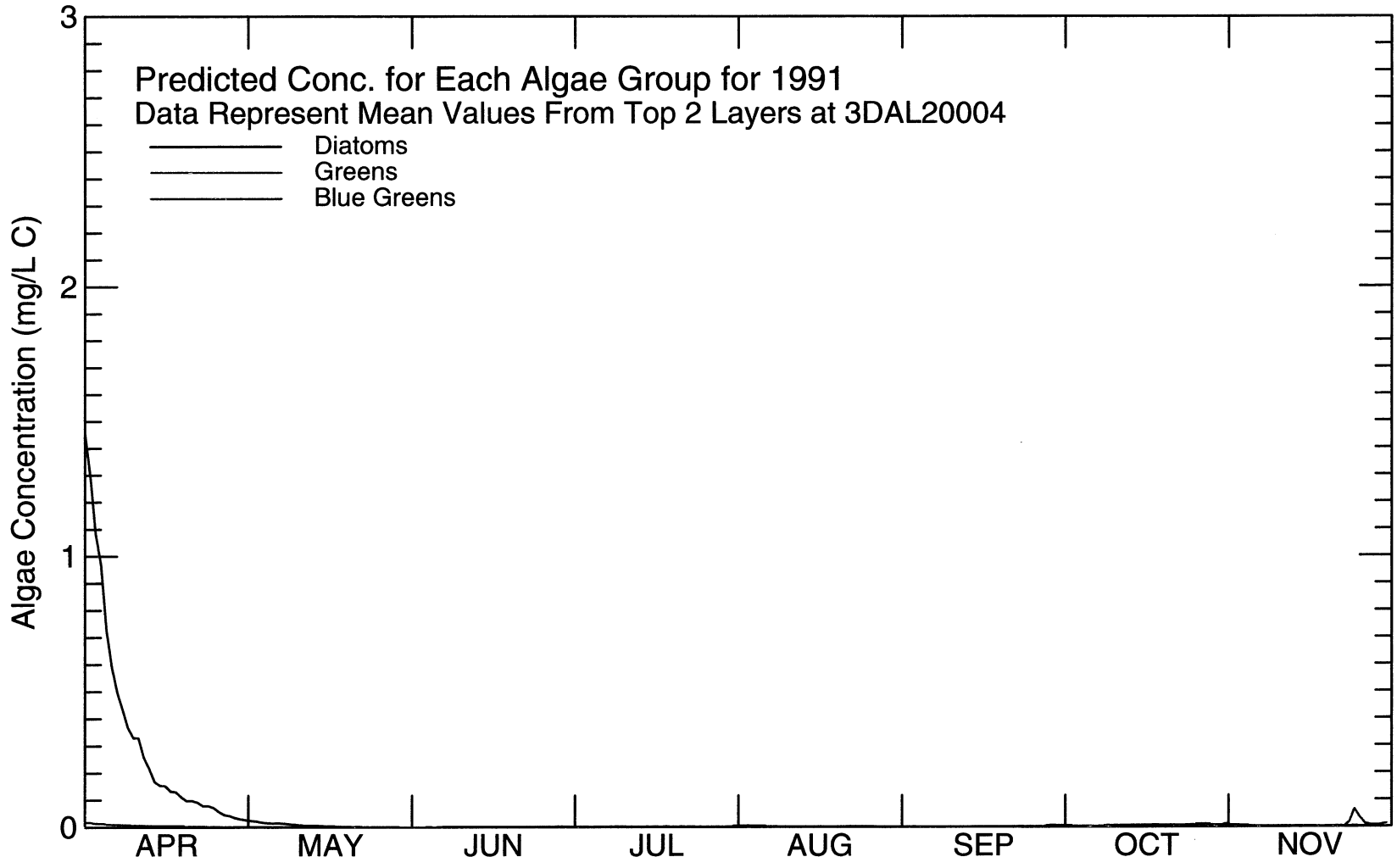

Predicted Conc. for Each Algae Group for 1973
Data Represent Mean Values From Top 2 Layers at 3DAL20009
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

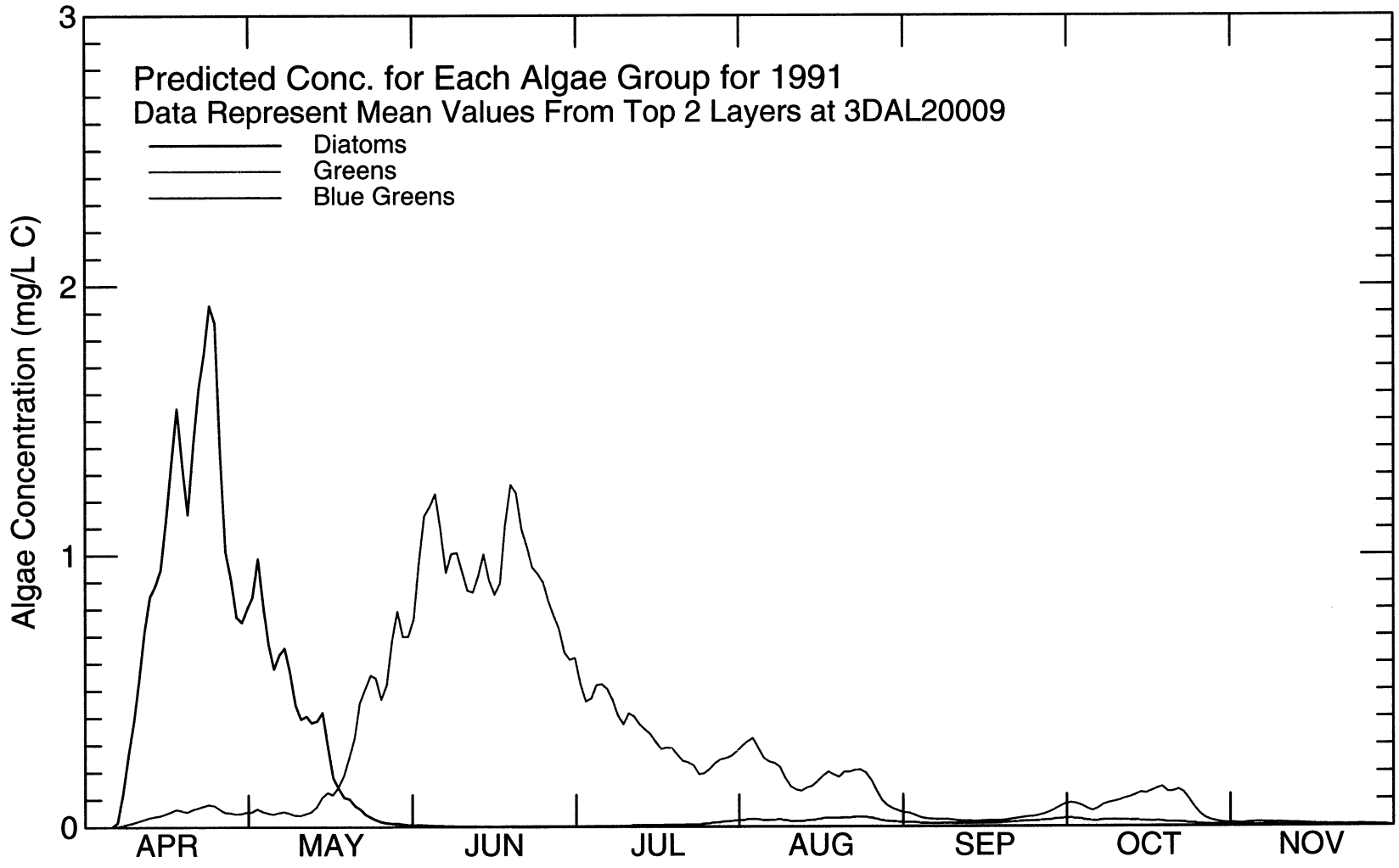

Predicted Conc. for Each Algae Group for 1988
Data Represent Mean Values From Top 2 Layers at 3DAL20002
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV


Predicted Conc. for Each Algae Group for 1988
Data Represent Mean Values From Top 2 Layers at 3DAL20004
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV


Predicted Conc. for Each Algae Group for 1988
Data Represent Mean Values From Top 2 Layers at 3DAL20009
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

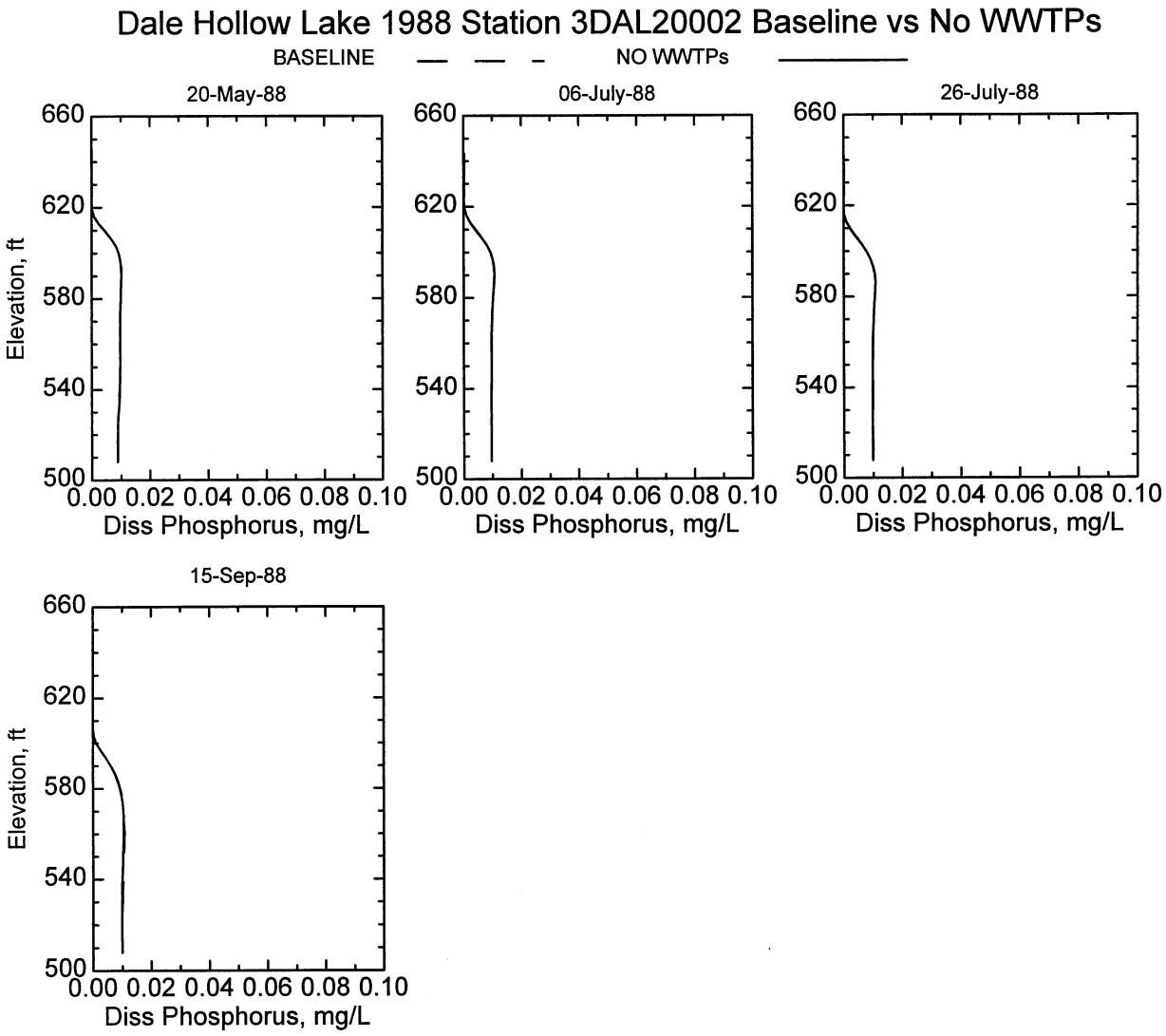

Predicted Conc. for Each Algae Group for 1991
Data Represent Mean Values From Top 2 Layers at 3DAL20002
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

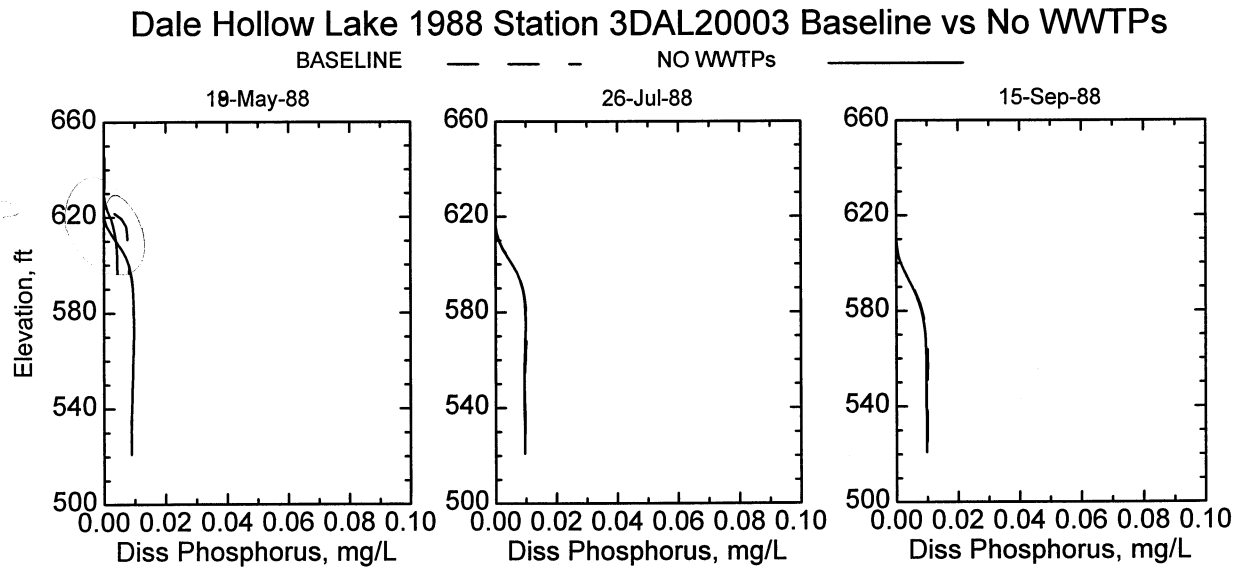

Predicted Conc. for Each Algae Group for 1991
Data Represent Mean Values From Top 2 Layers at 3DAL20004
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

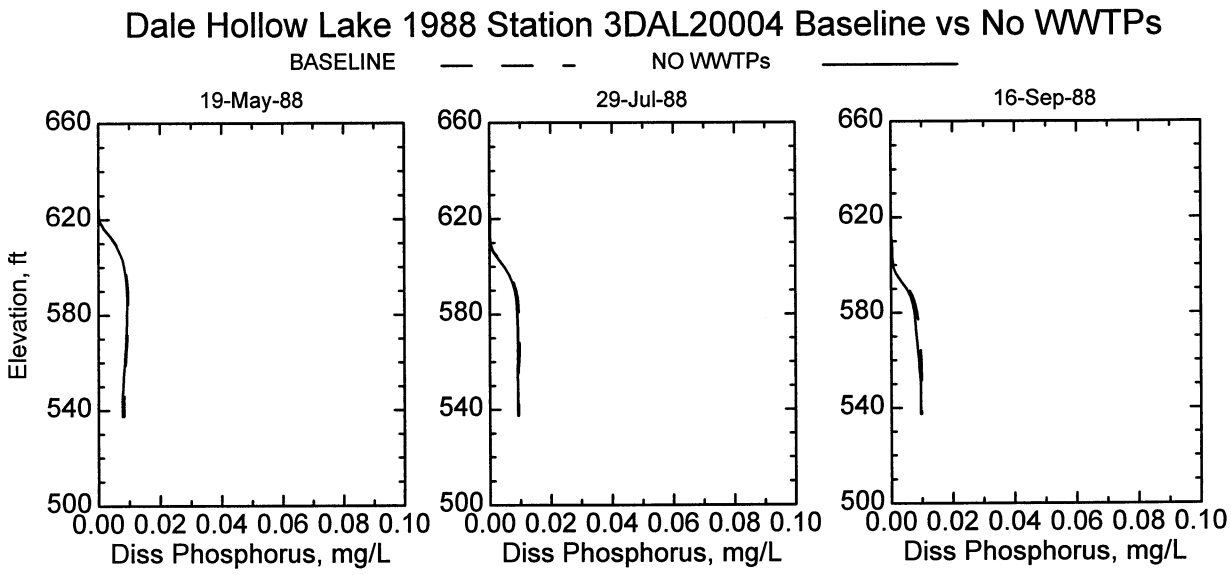

Predicted Conc. for Each Algae Group for 1991
Data Represent Mean Values From Top 2 Layers at 3DAL20009
Diatoms
Greens
Blue Greens
Algae Concentration (mg/L C)
3
2
1
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

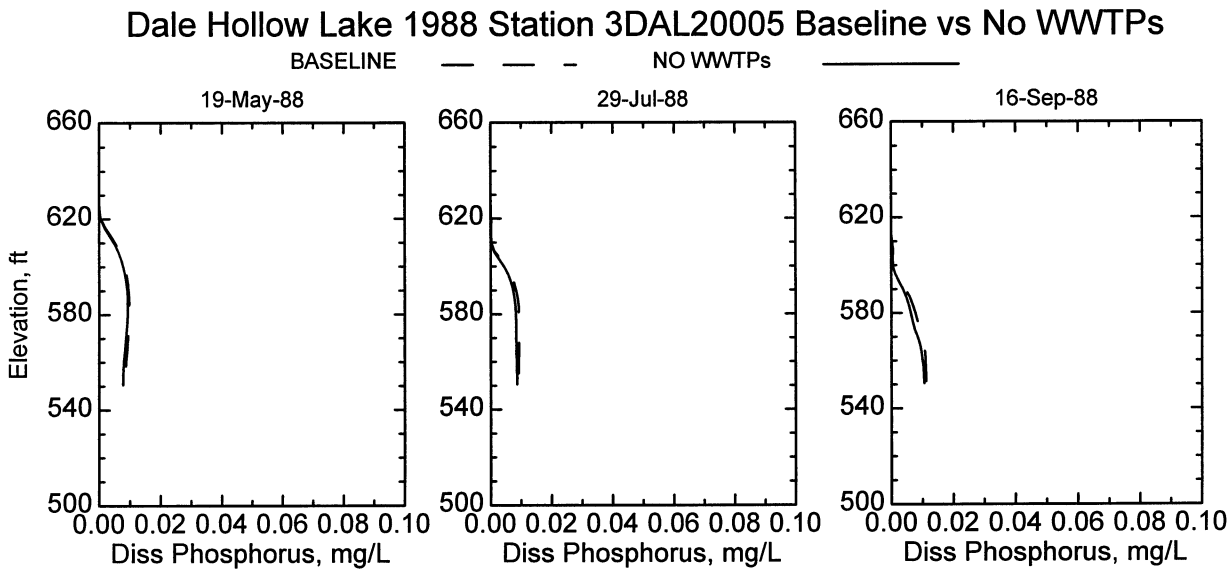
APPENDIX N

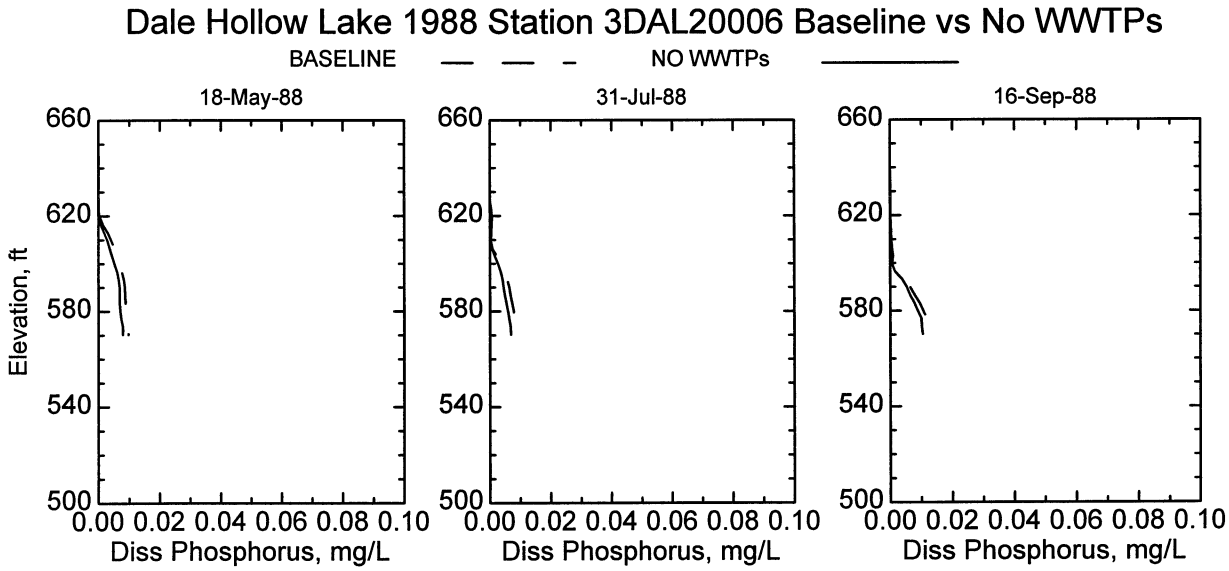
Scenario One: Major Point Source Removal Comparison Plots of Baseline and Point Sources Removed

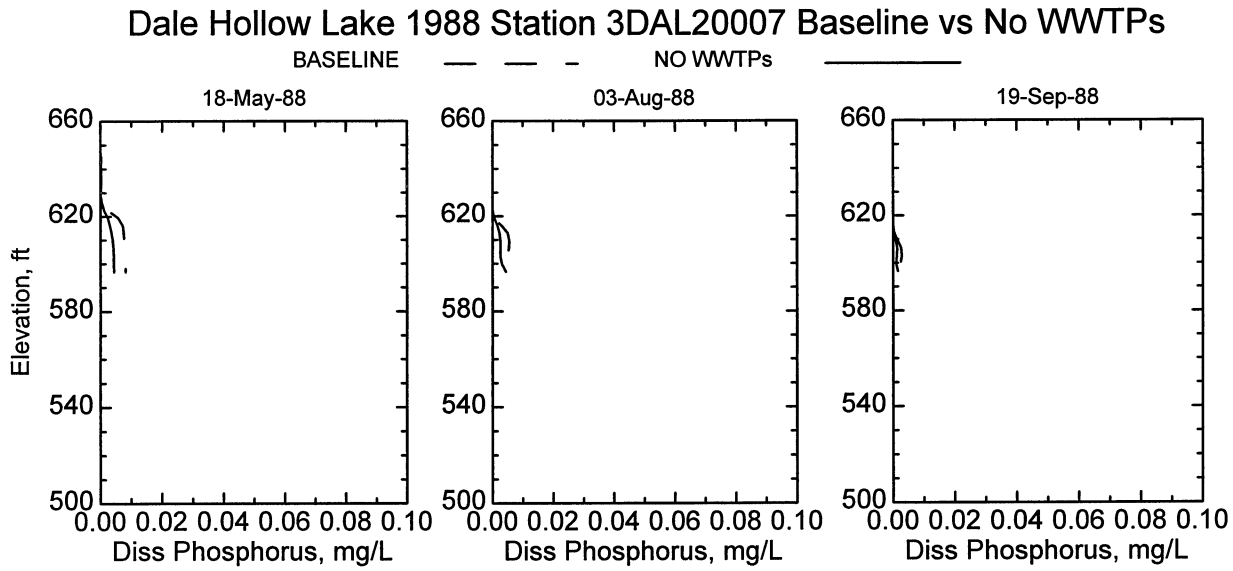

Dale Hollow Lake 1988 Station 3DAL20002 Baseline vs No WWTPs
BASELINE
NO WWTPs
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

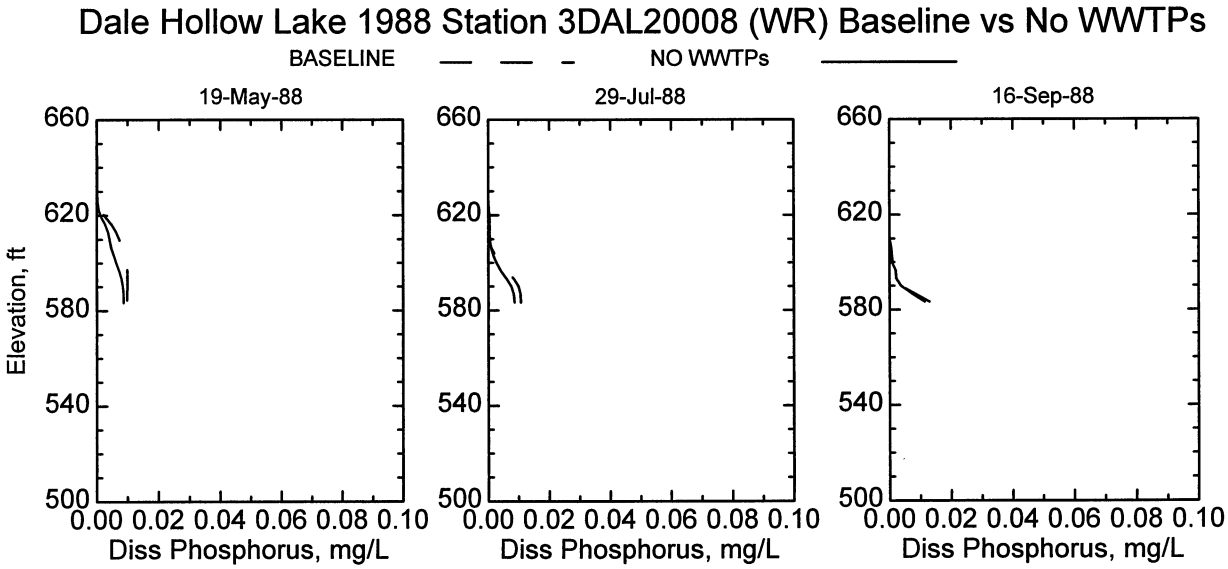

Dale Hollow Lake 1988 Station 3DAL20003 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

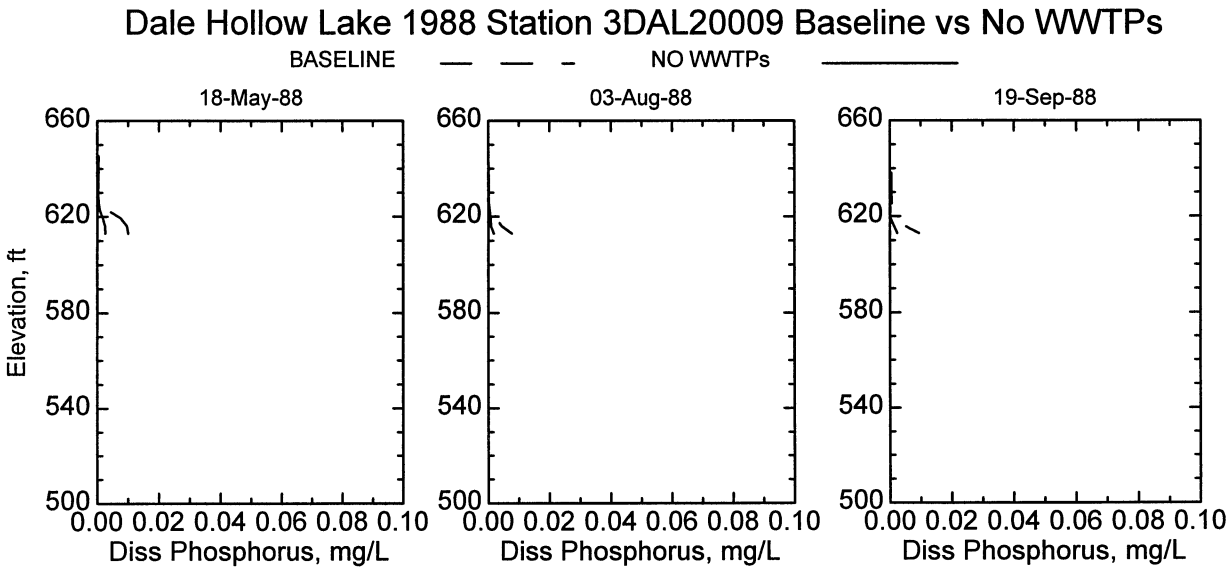

Dale Hollow Lake 1988 Station 3DAL20004 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

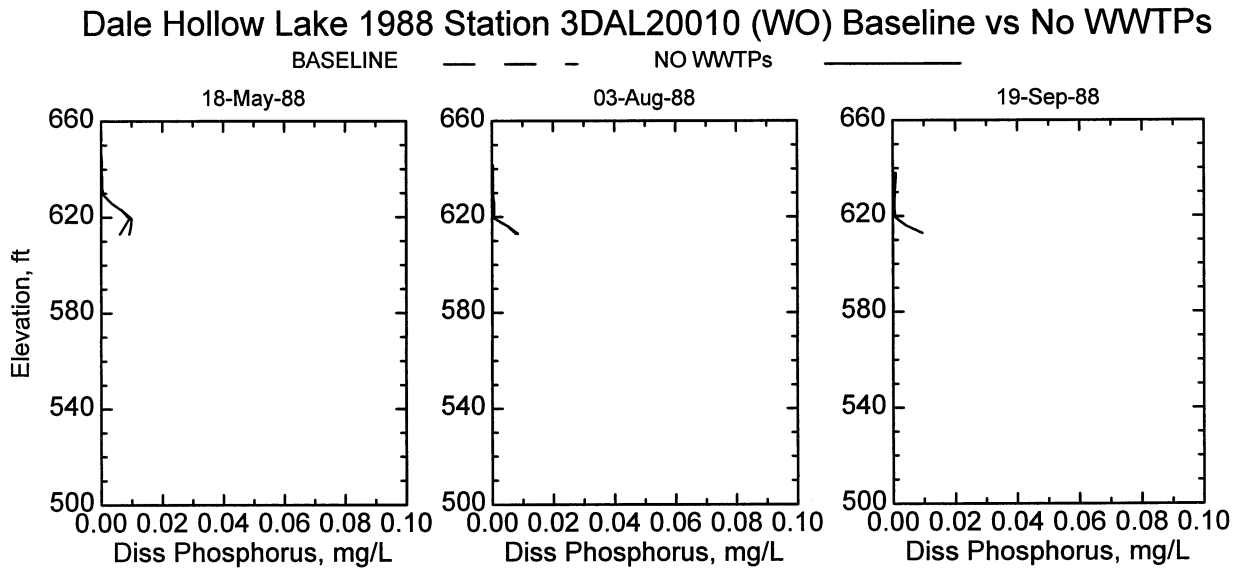

Dale Hollow Lake 1988 Station 3DAL20005 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

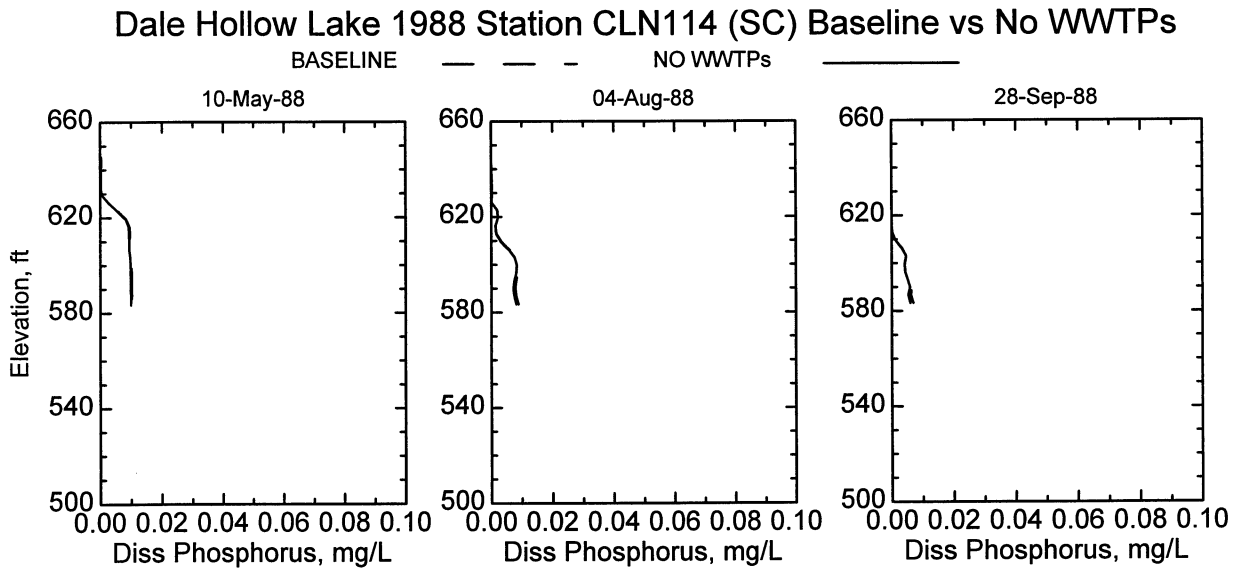

Dale Hollow Lake 1988 Station 3DAL20006 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

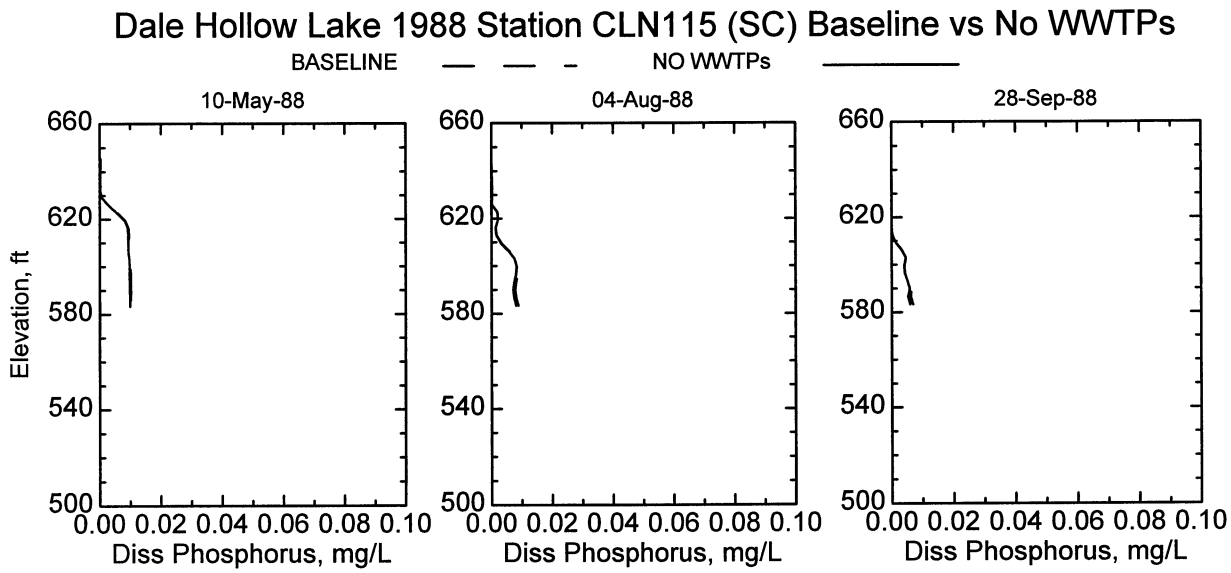

Dale Hollow Lake 1988 Station 3DAL20007 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

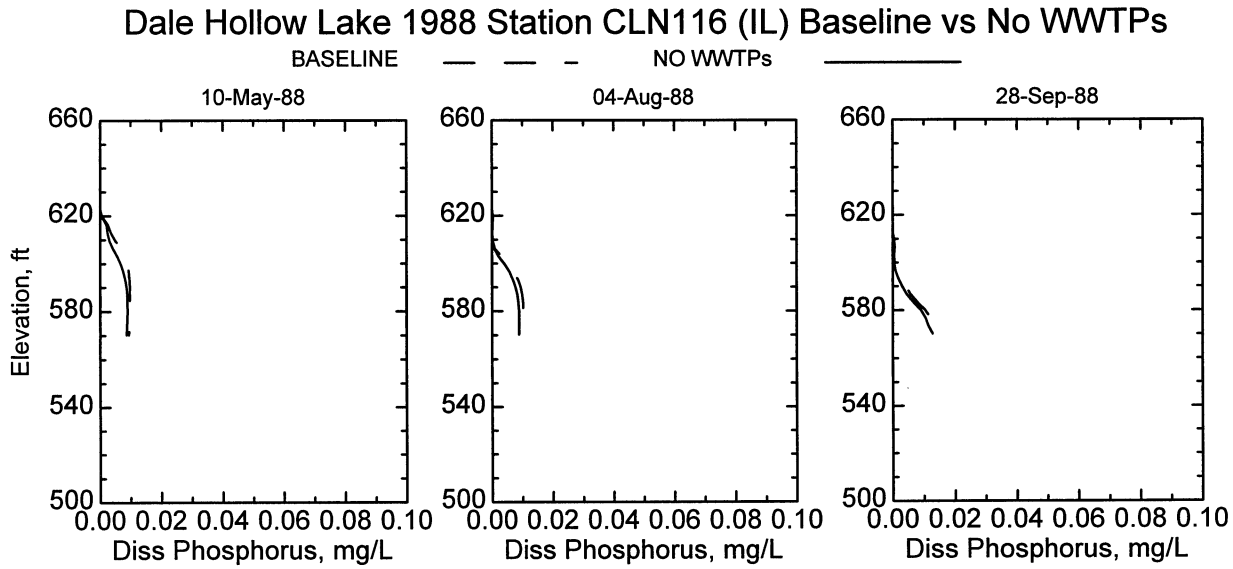

Dale Hollow Lake 1988 Station 3DAL20008 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

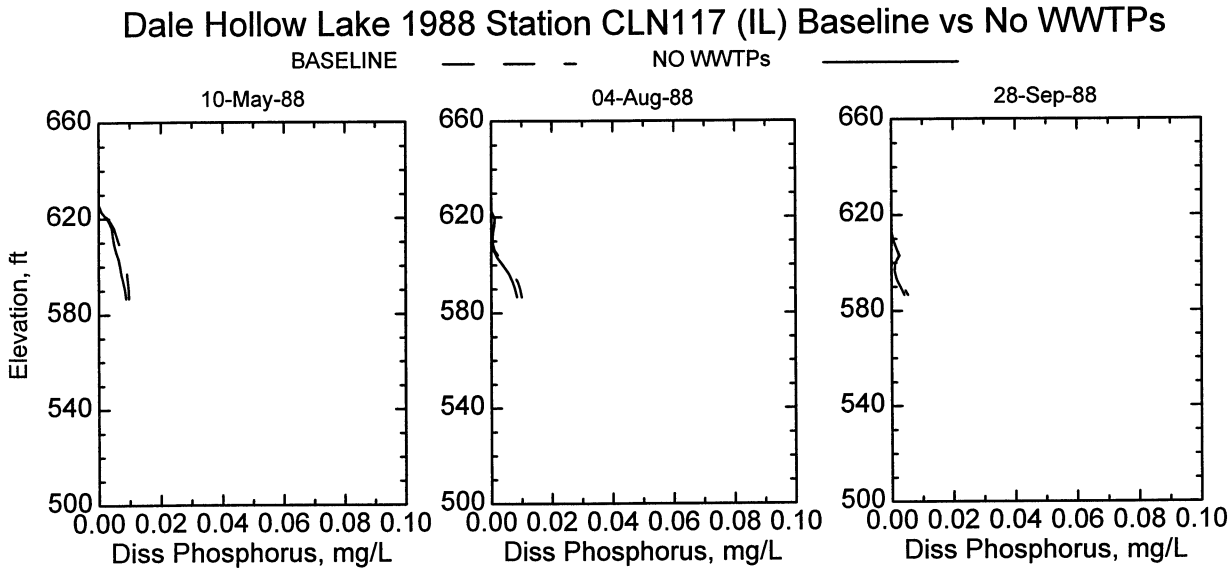

Dale Hollow Lake 1988 Station 3DAL20009 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

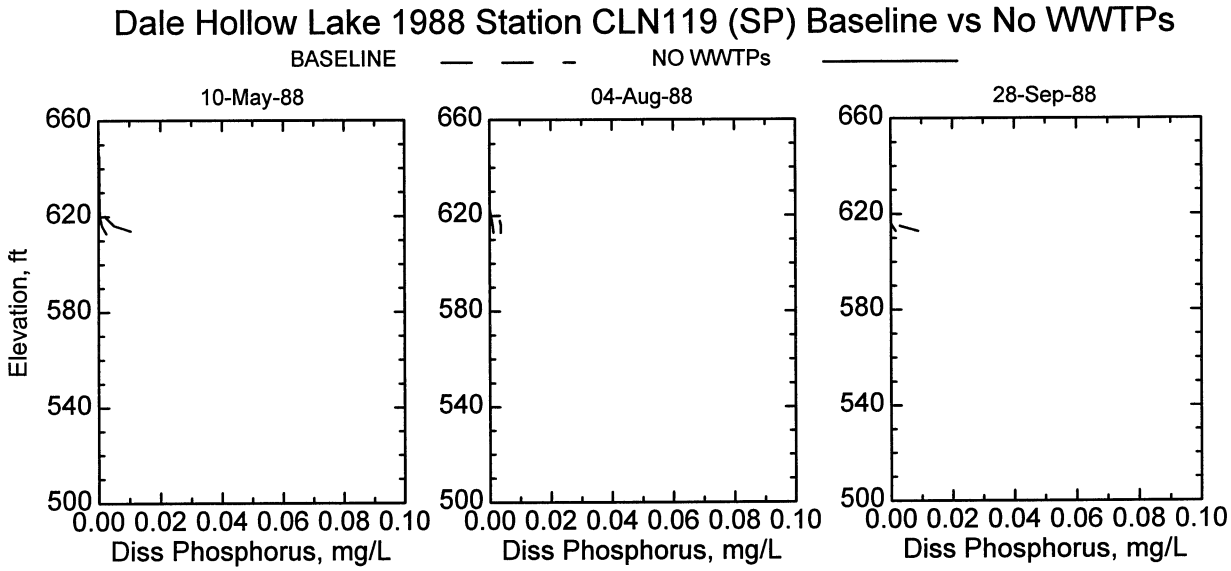

Dale Hollow Lake 1988 Station 3DAL20010 (WO) Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

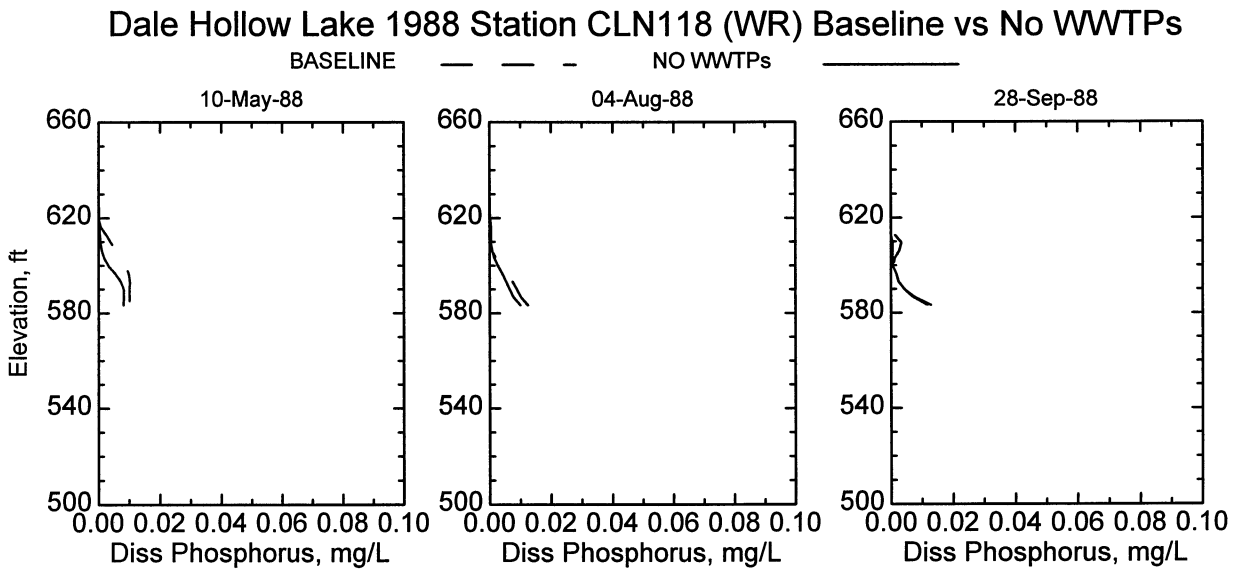

Dale Hollow Lake 1988 Station CLN114 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

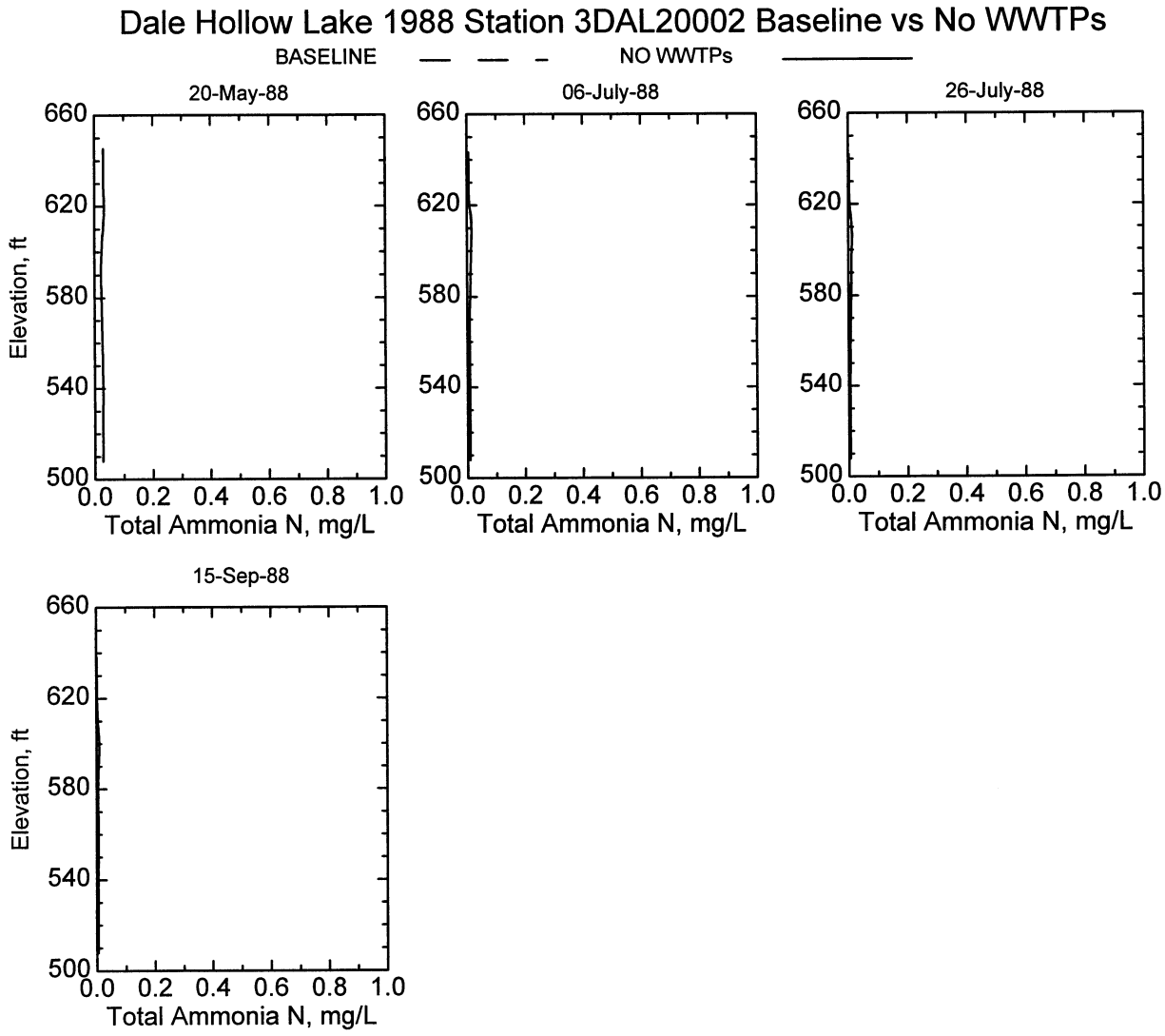

Dale Hollow Lake 1988 Station CLN115 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

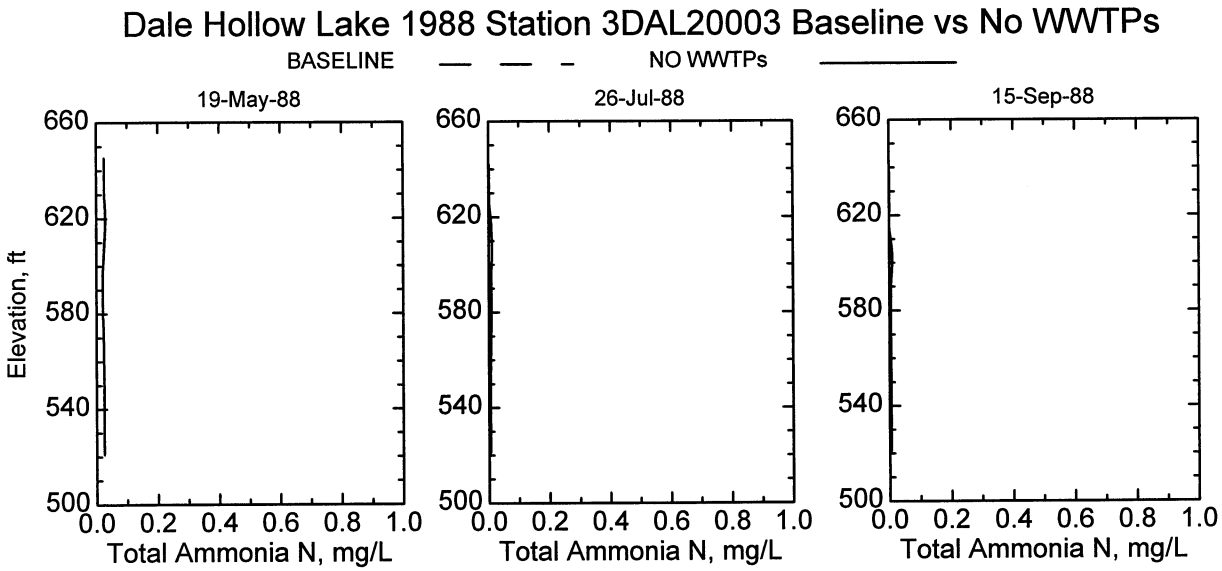

Dale Hollow Lake 1988 Station CLN116 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

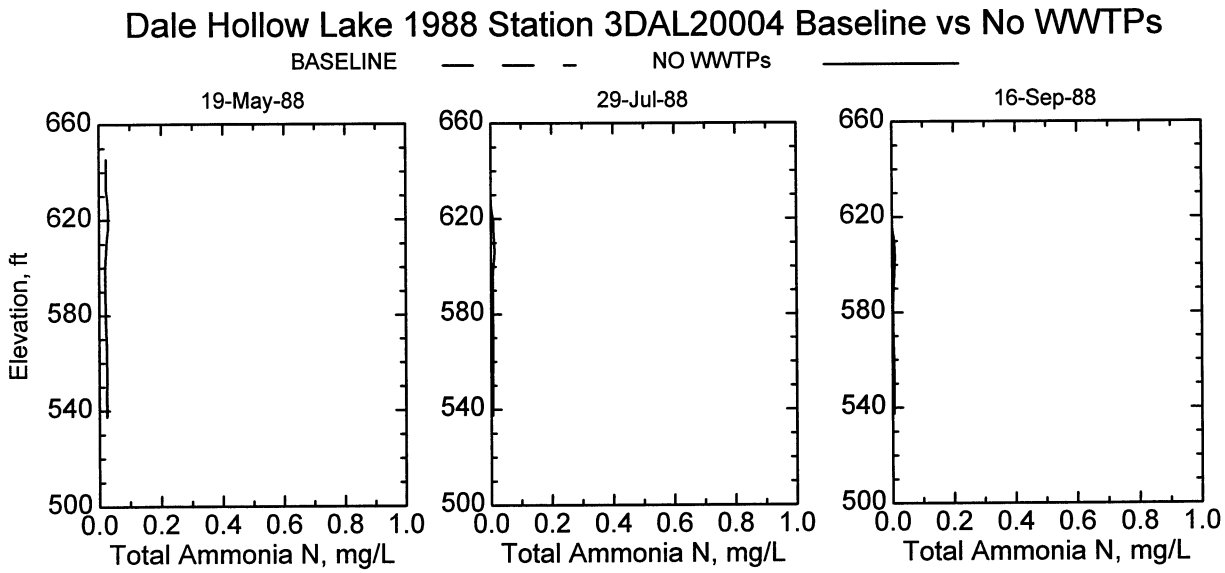

Dale Hollow Lake 1988 Station CLN117 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

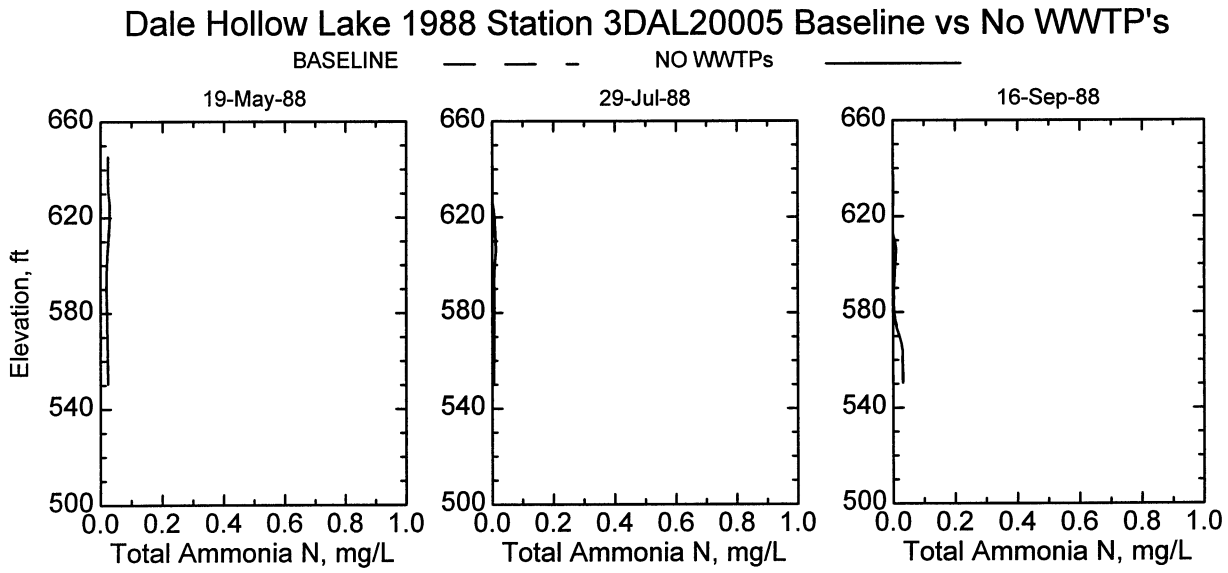

Dale Hollow Lake 1988 Station CLN119 (SP) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

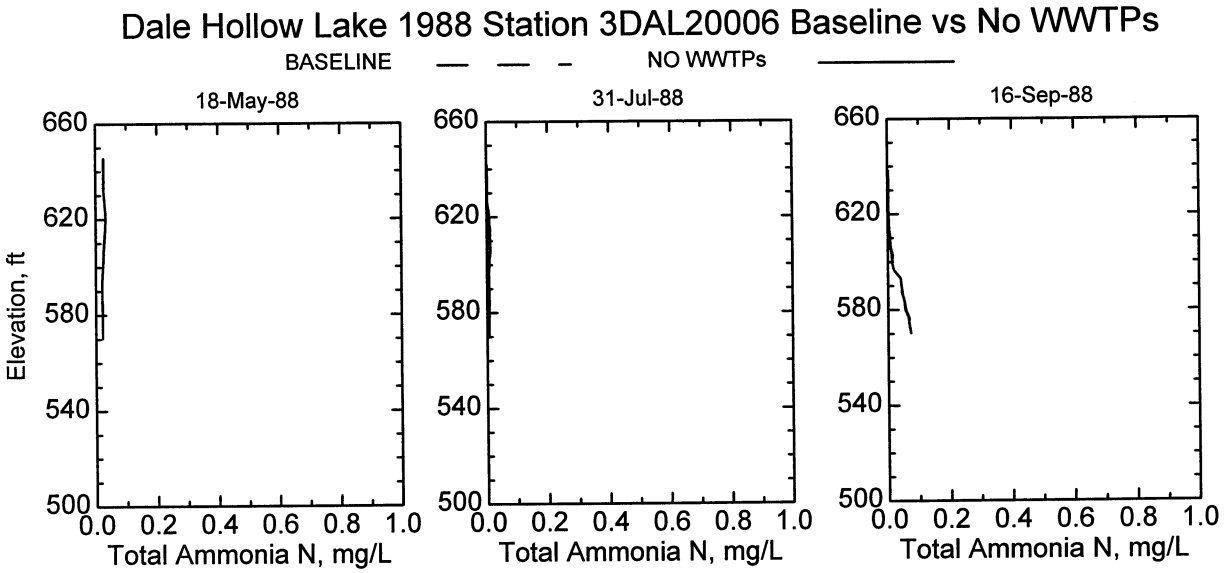

Dale Hollow Lake 1988 Station CLN118 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

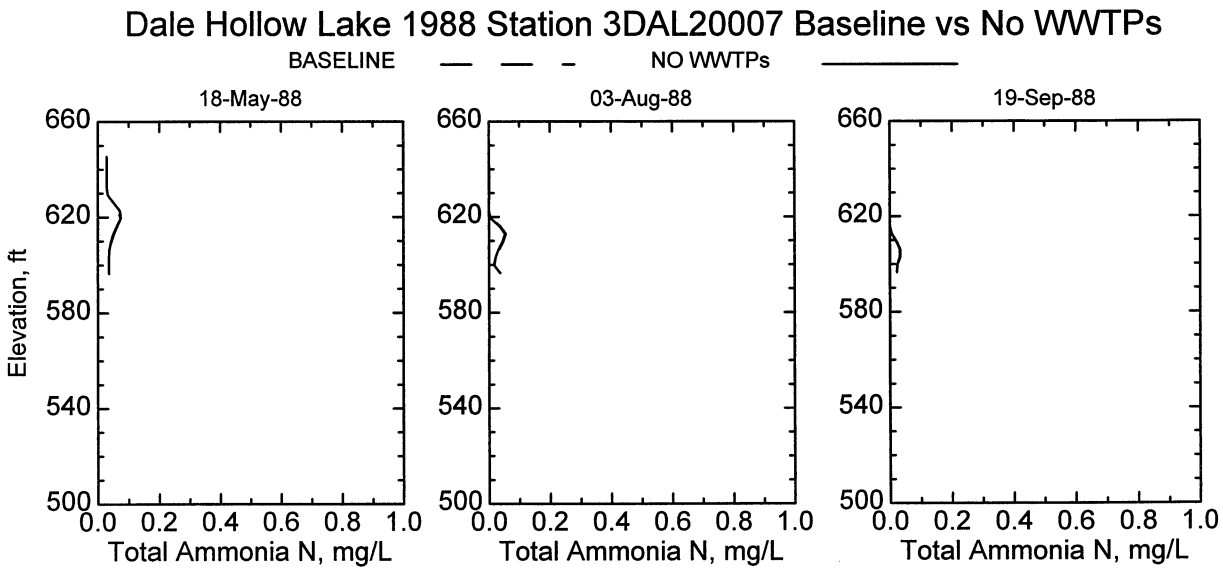

Dale Hollow Lake 1988 Station 3DAL20002 Baseline vs No WWTPs
BASELINE
NO WWTPs
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

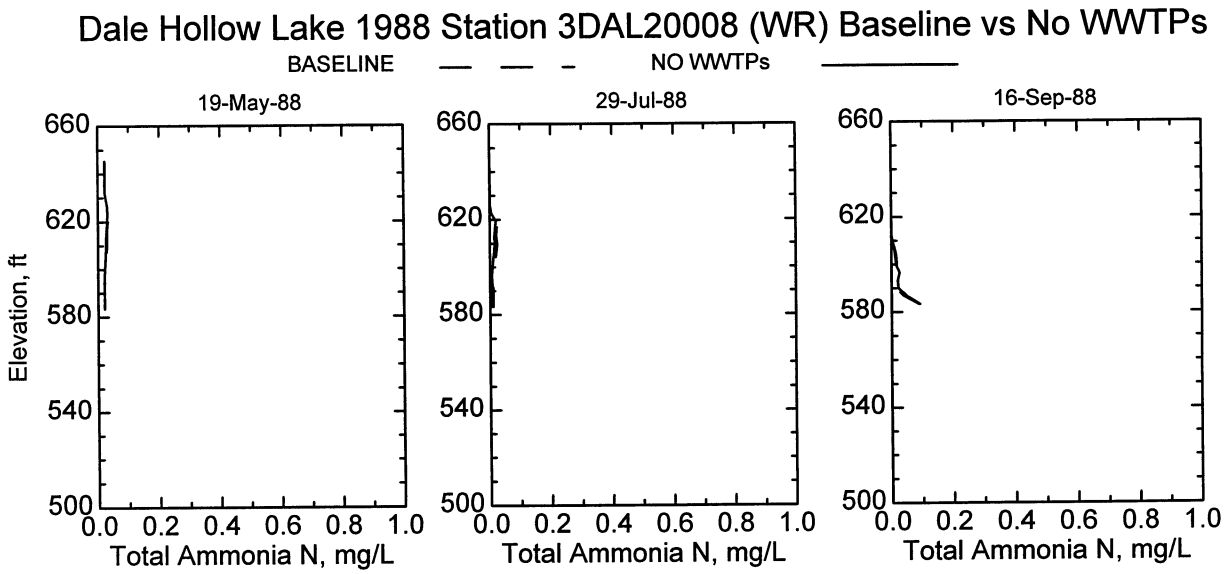

Dale Hollow Lake 1988 Station 3DAL20003 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

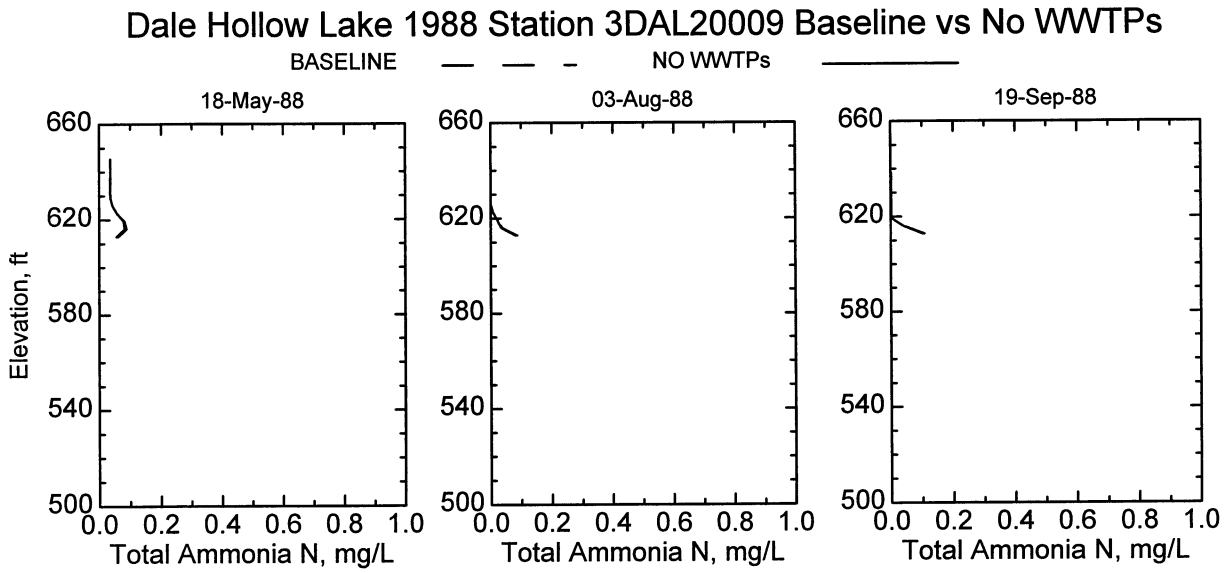

Dale Hollow Lake 1988 Station 3DAL20004 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

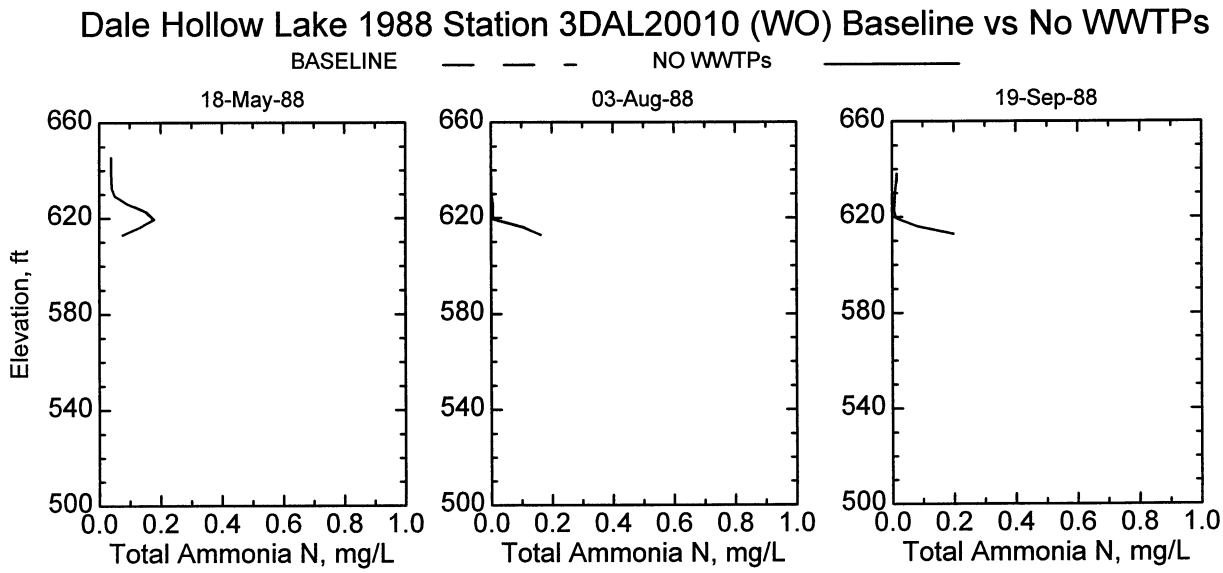

Dale Hollow Lake 1988 Station 3DAL20005 Baseline vs No WWTP's
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

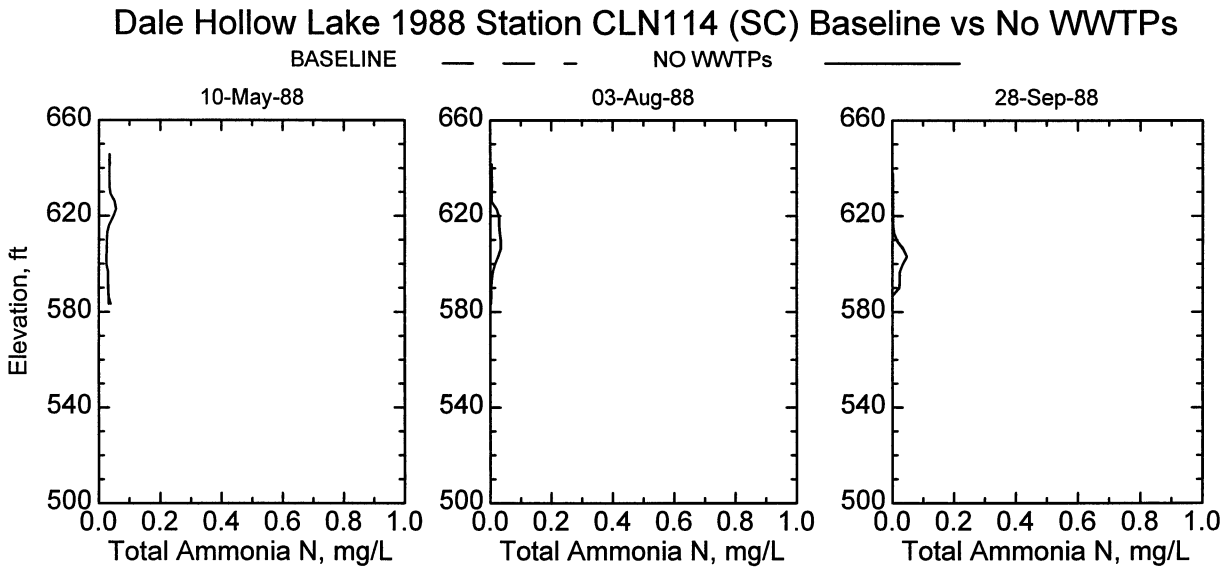

Dale Hollow Lake 1988 Station 3DAL20006 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

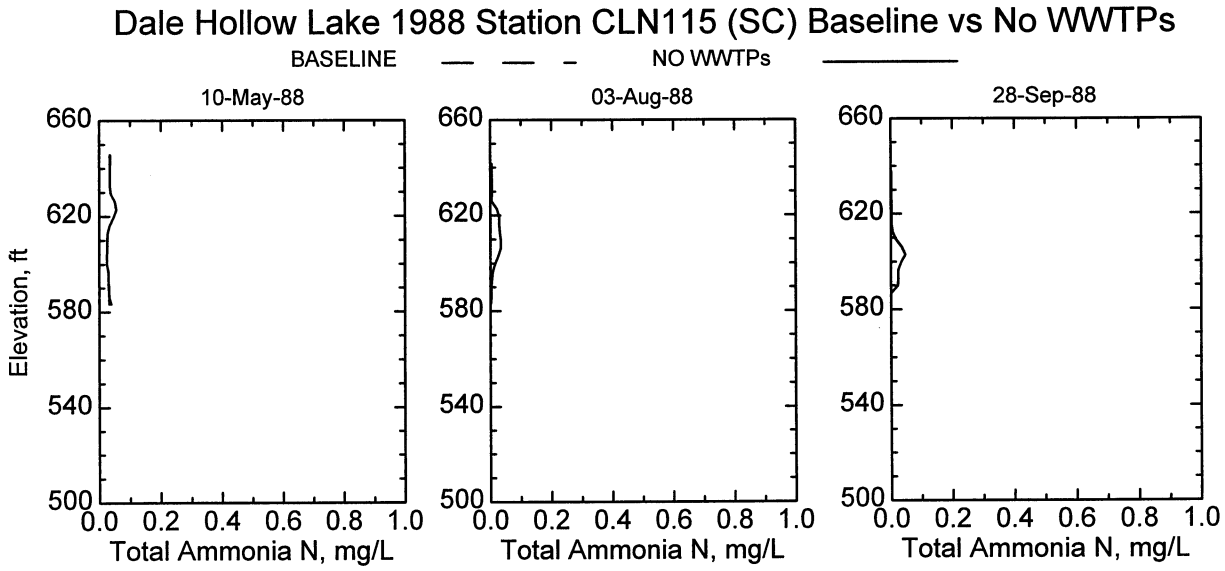

Dale Hollow Lake 1988 Station 3DAL20007 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

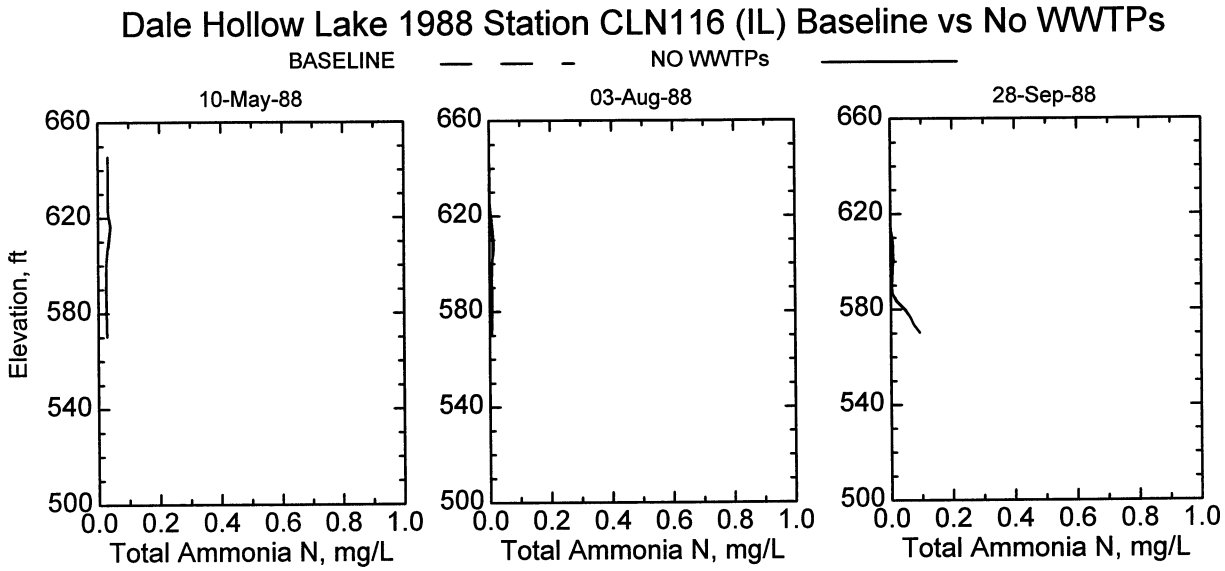

Dale Hollow Lake 1988 Station 3DAL20008 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

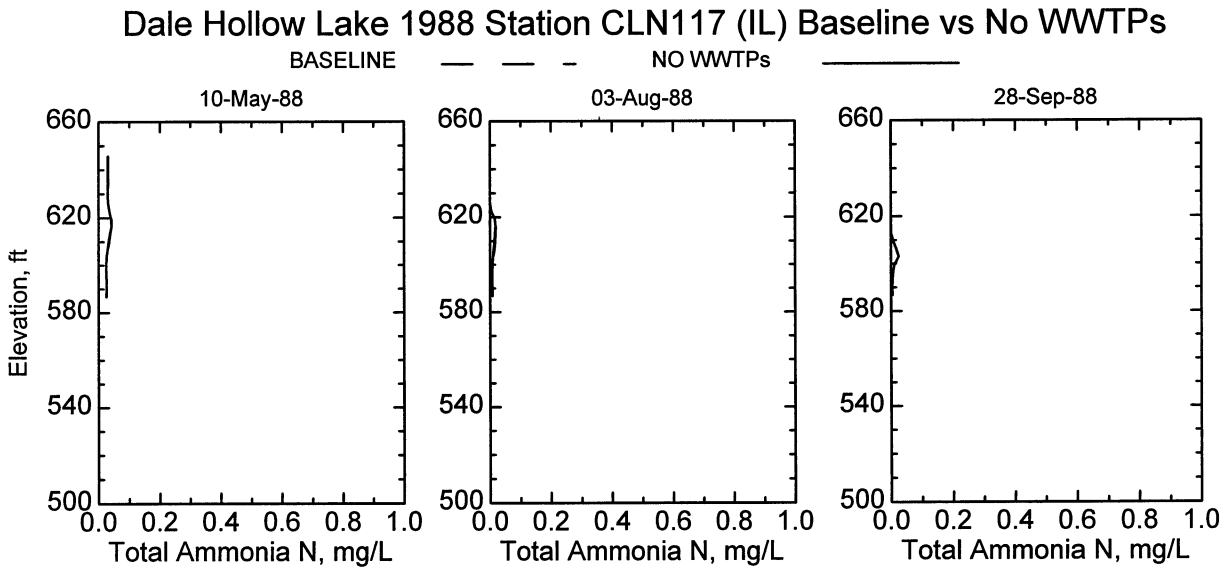

Dale Hollow Lake 1988 Station 3DAL20009 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

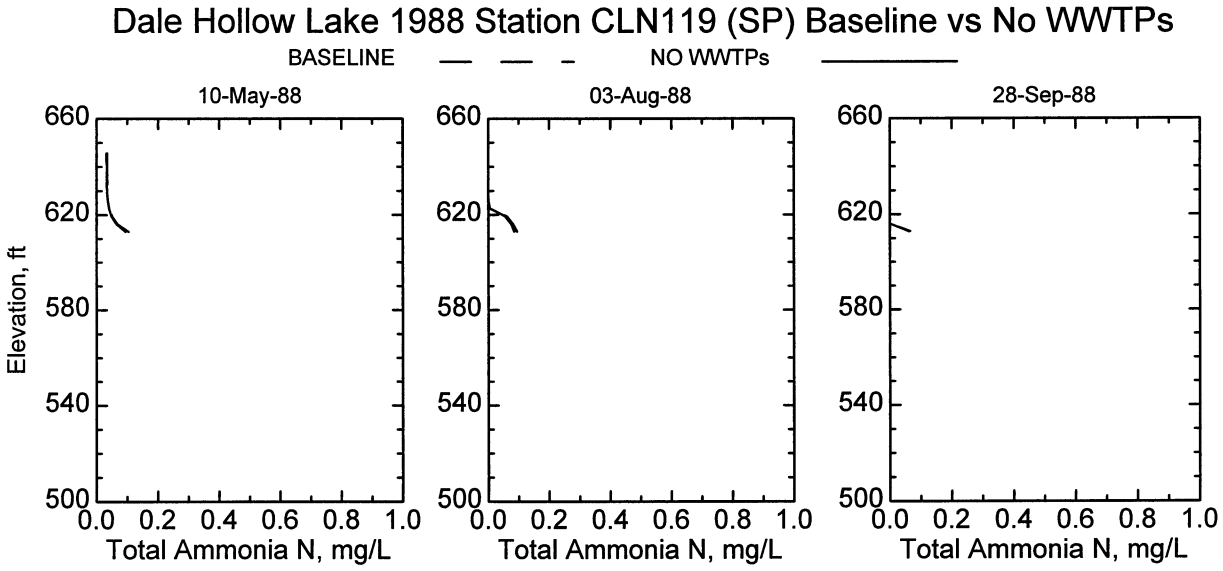

Dale Hollow Lake 1988 Station 3DAL20010 (WO) Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

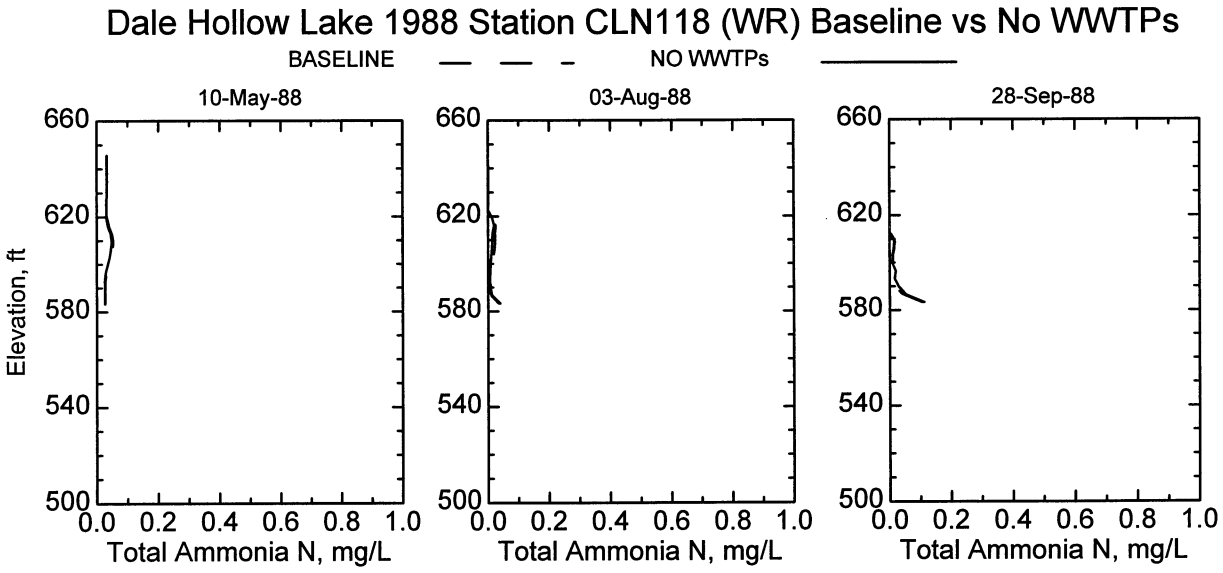

Dale Hollow Lake 1988 Station CLN114 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

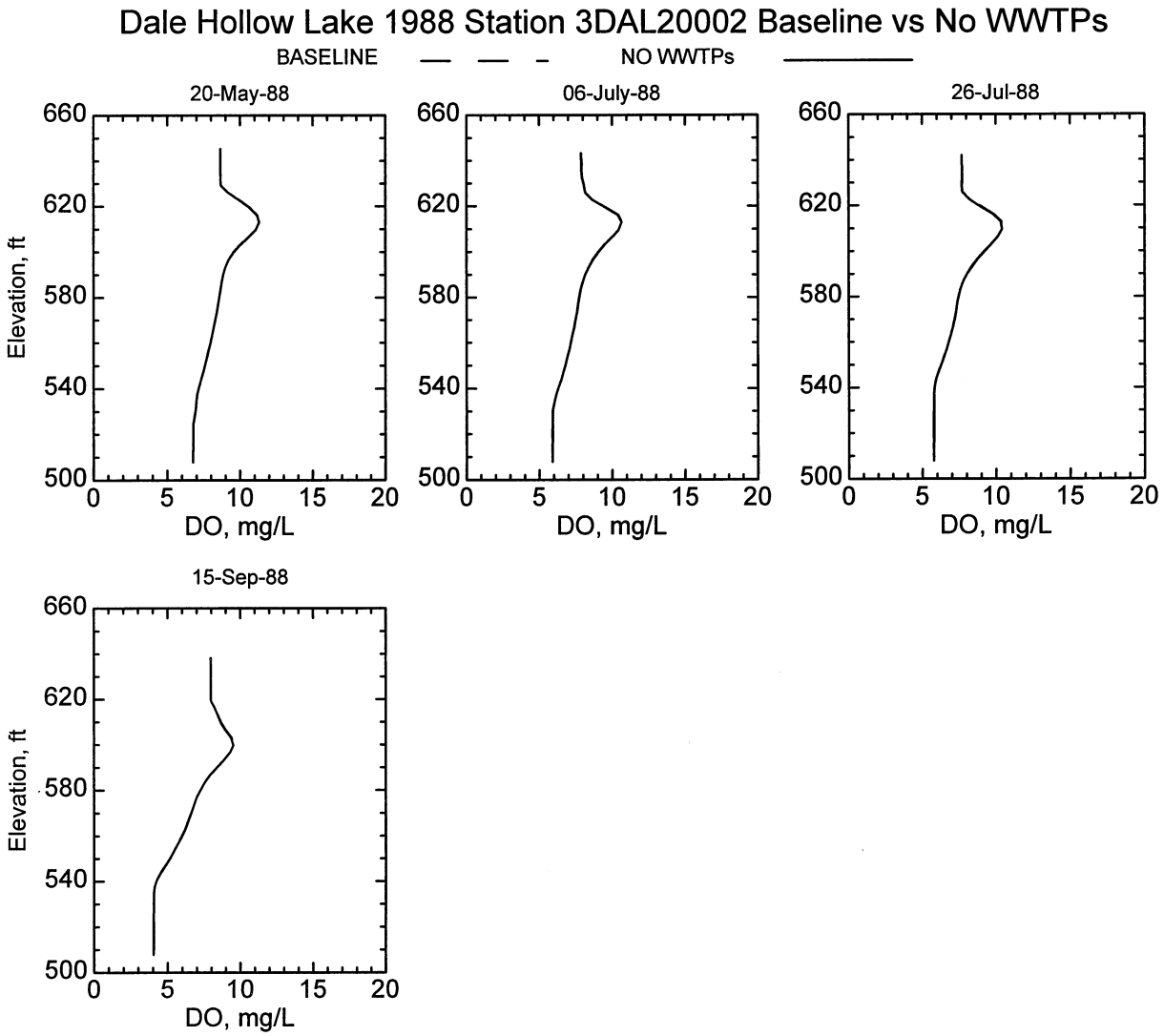

Dale Hollow Lake 1988 Station CLN115 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

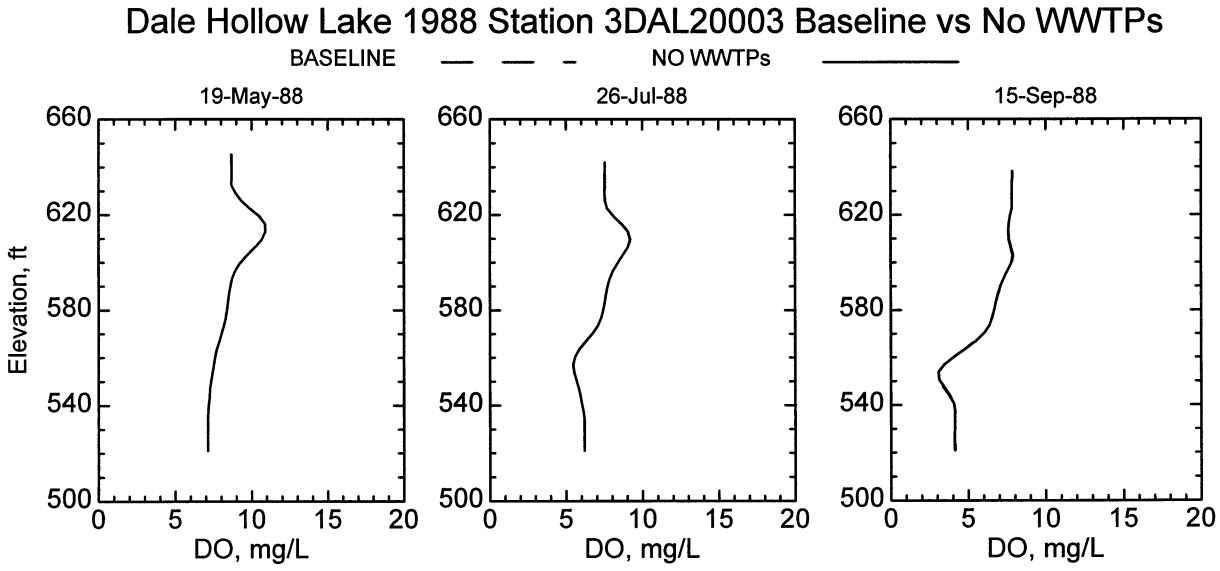

Dale Hollow Lake 1988 Station CLN116 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

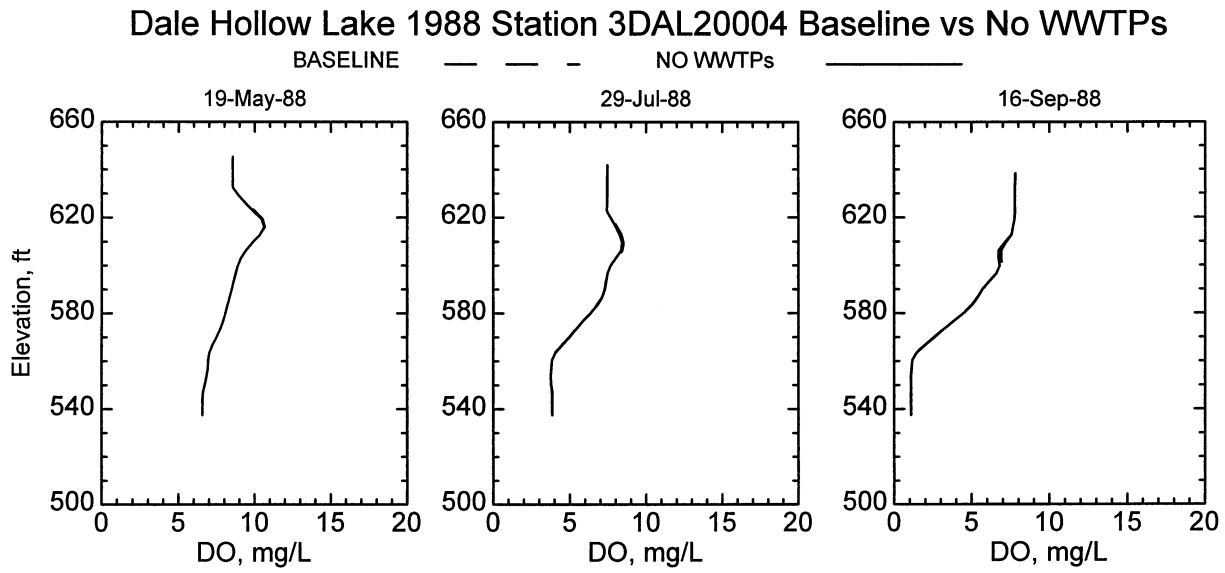

Dale Hollow Lake 1988 Station CLN117 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

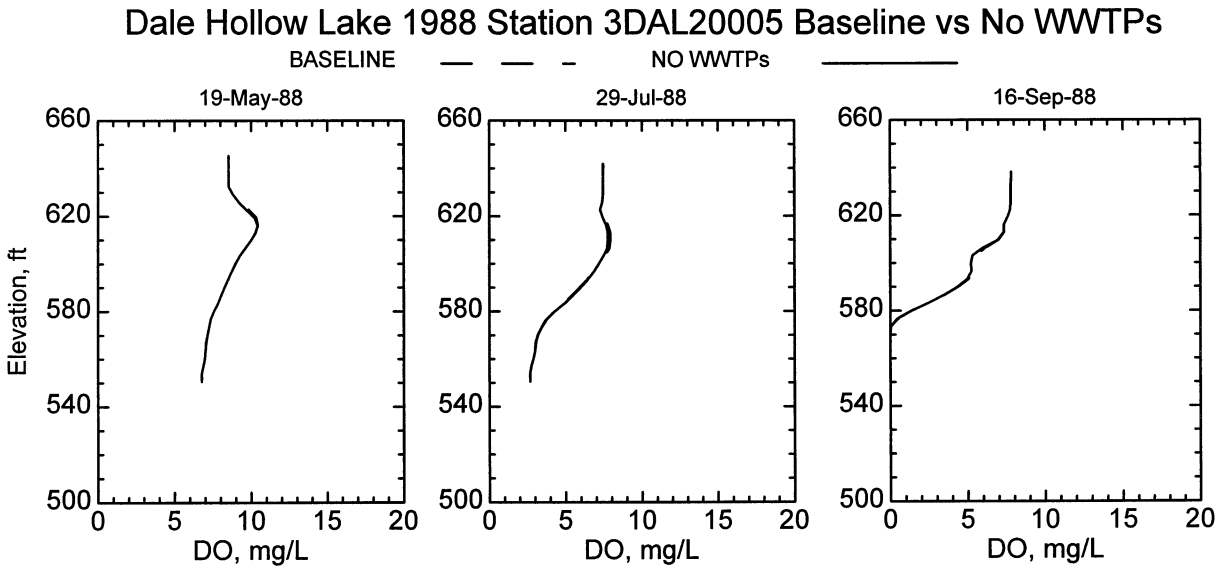

Dale Hollow Lake 1988 Station CLN119 (SP) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

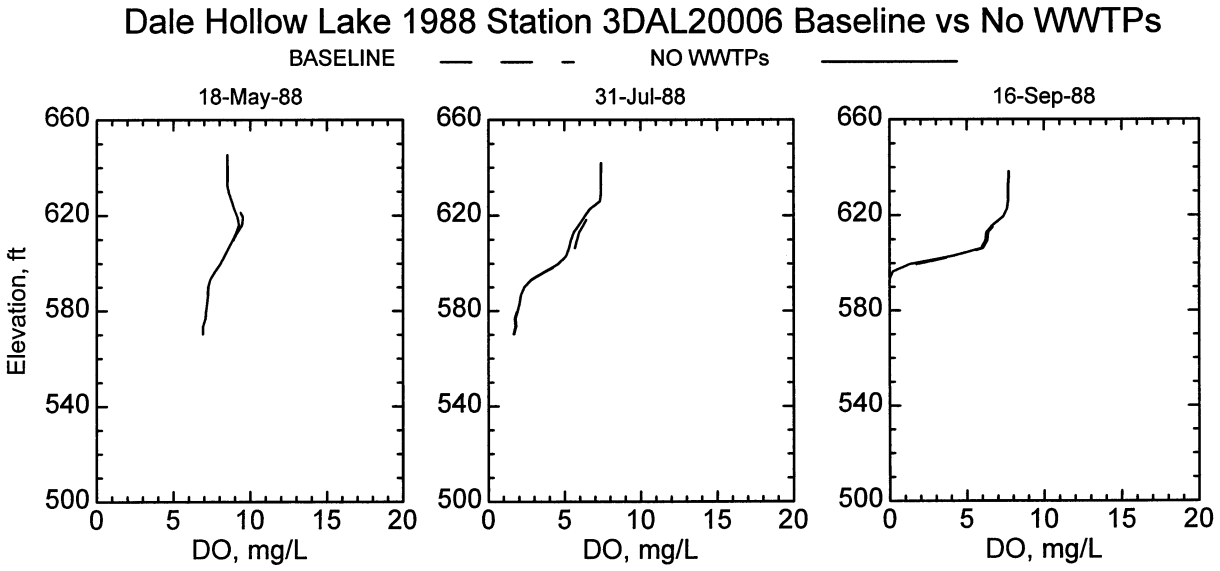

Dale Hollow Lake 1988 Station CLN118 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
03-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

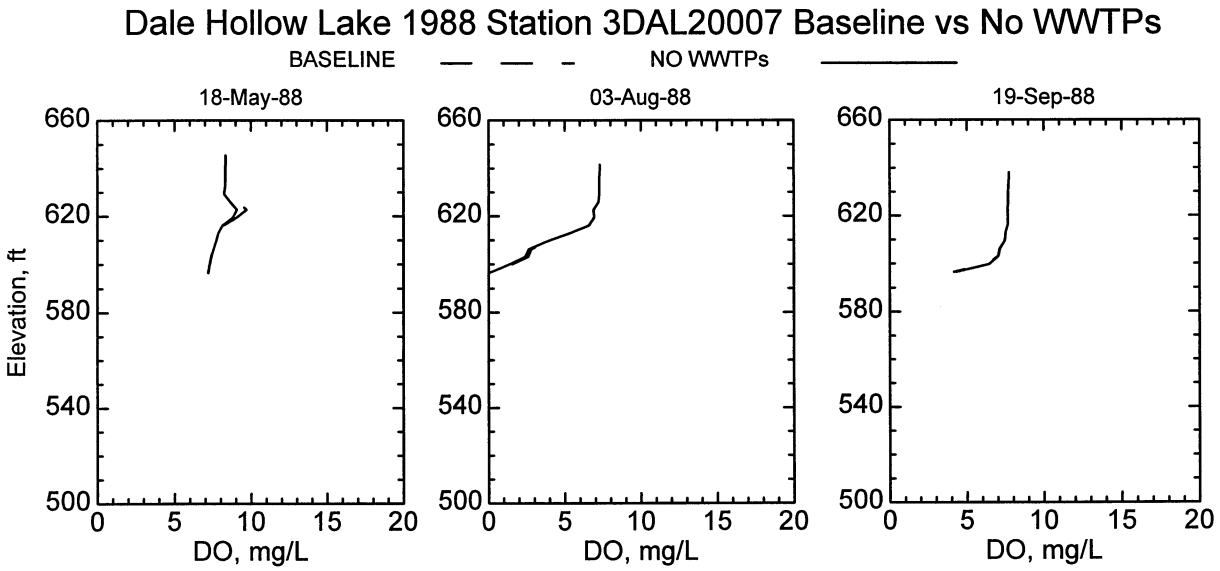

Dale Hollow Lake 1988 Station 3DAL20002 Baseline vs No WWTPs
BASELINE
NO WWTPs
20-May-88
06-July-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

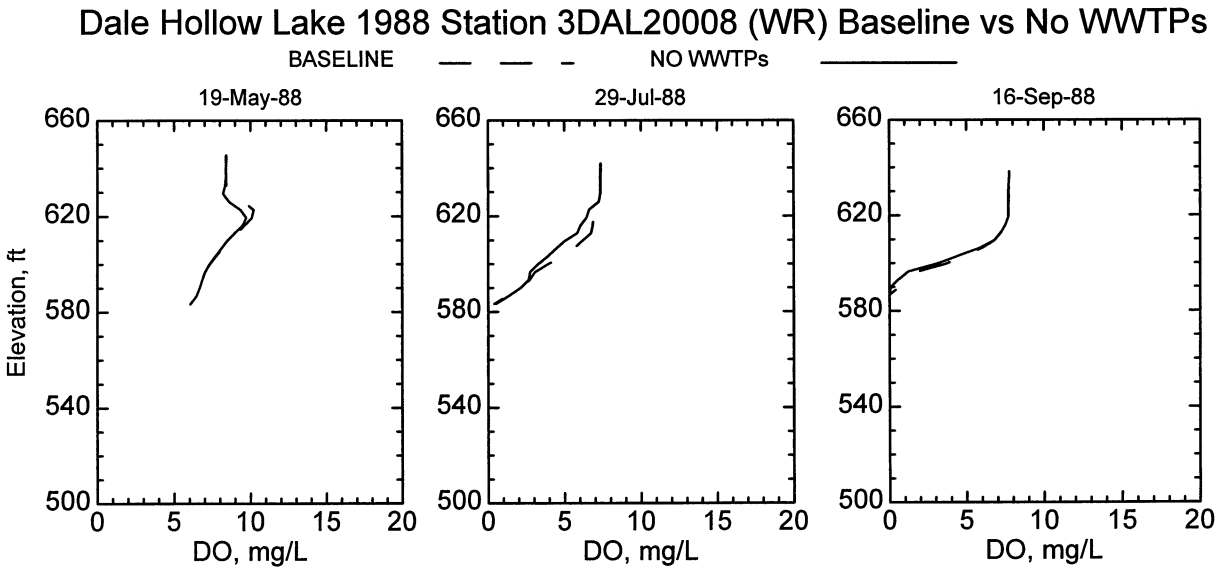

Dale Hollow Lake 1988 Station 3DAL20003 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

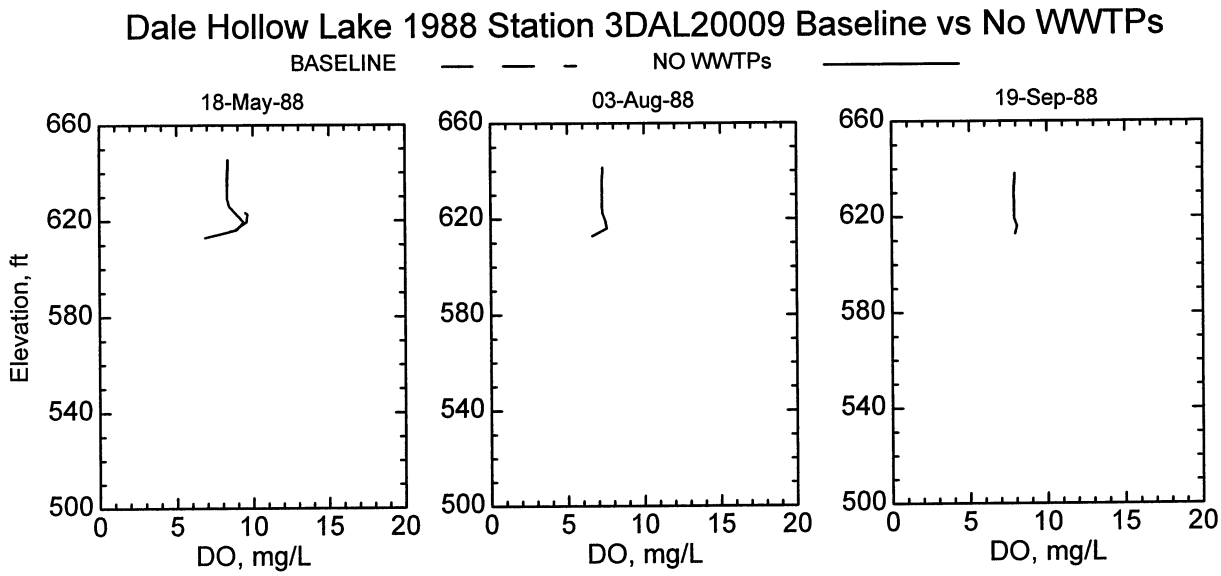

Dale Hollow Lake 1988 Station 3DAL20004 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

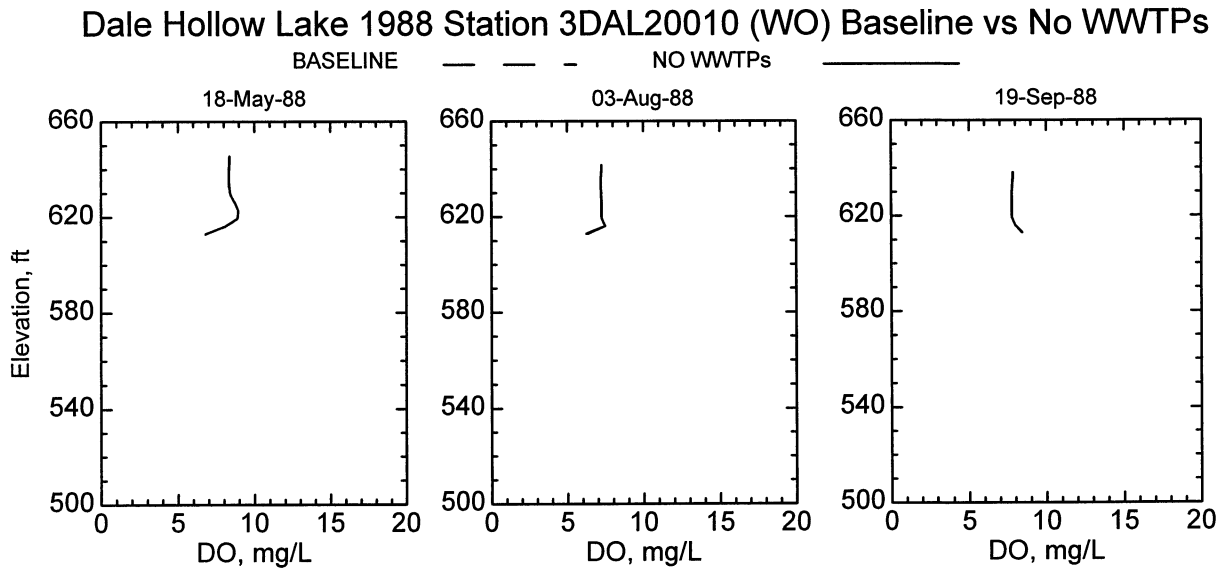

Dale Hollow Lake 1988 Station 3DAL20005 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

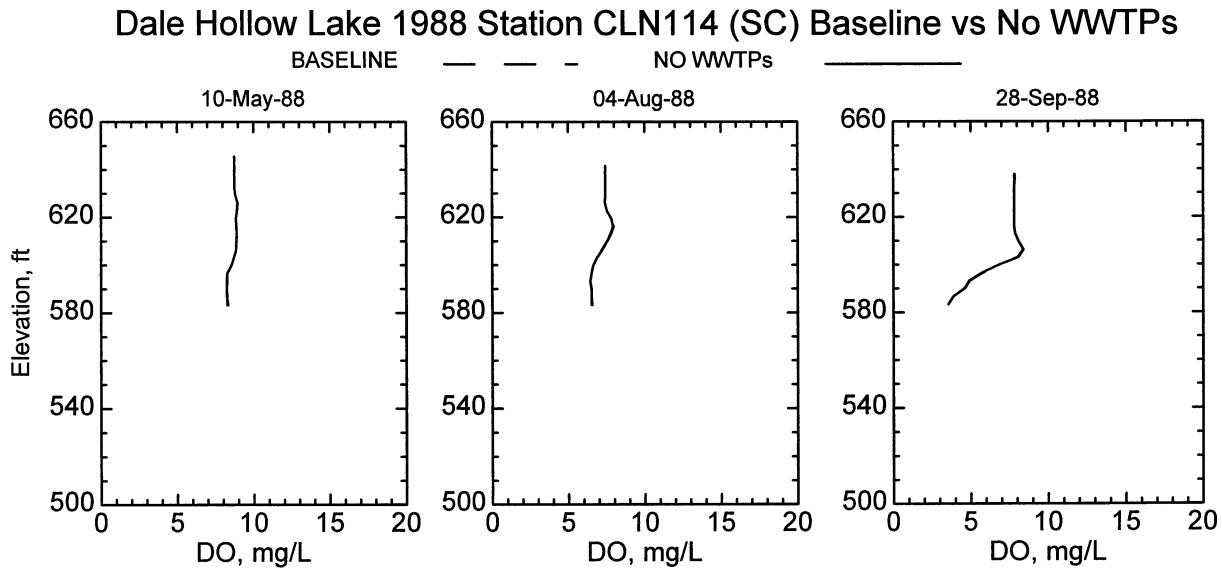

Dale Hollow Lake 1988 Station 3DAL20006 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

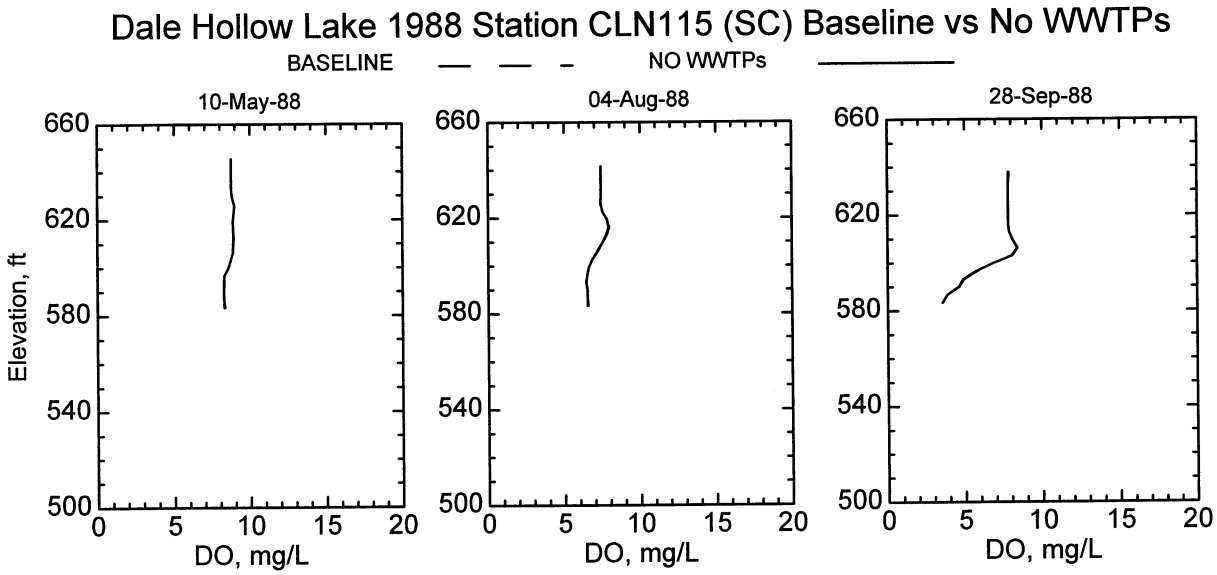

Dale Hollow Lake 1988 Station 3DAL20007 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

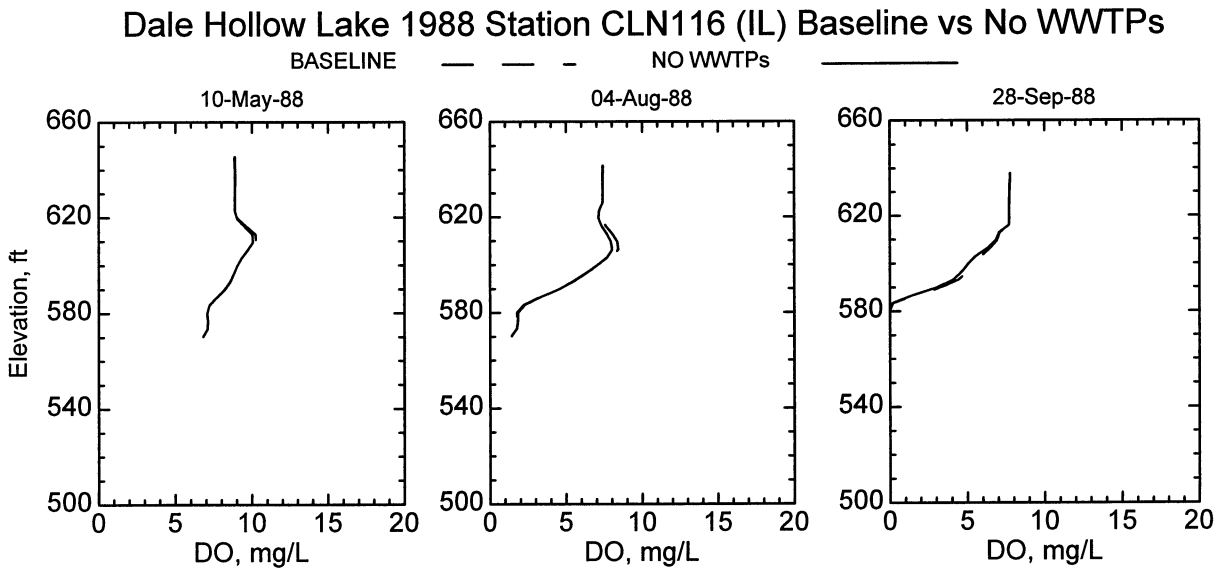

Dale Hollow Lake 1988 Station 3DAL20008 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

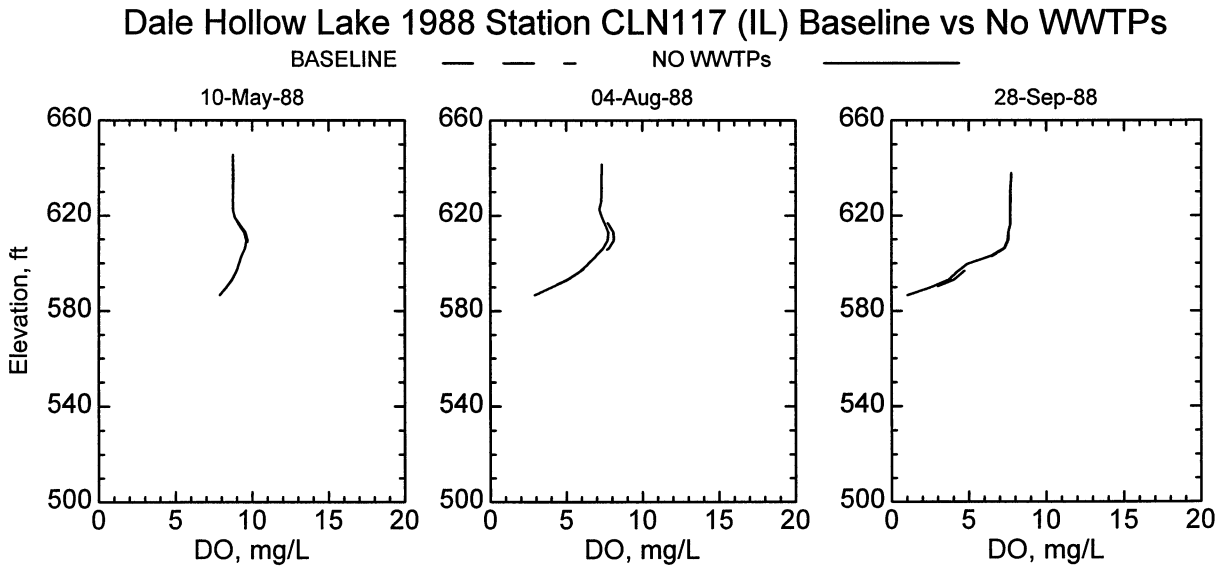

Dale Hollow Lake 1988 Station 3DAL20009 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

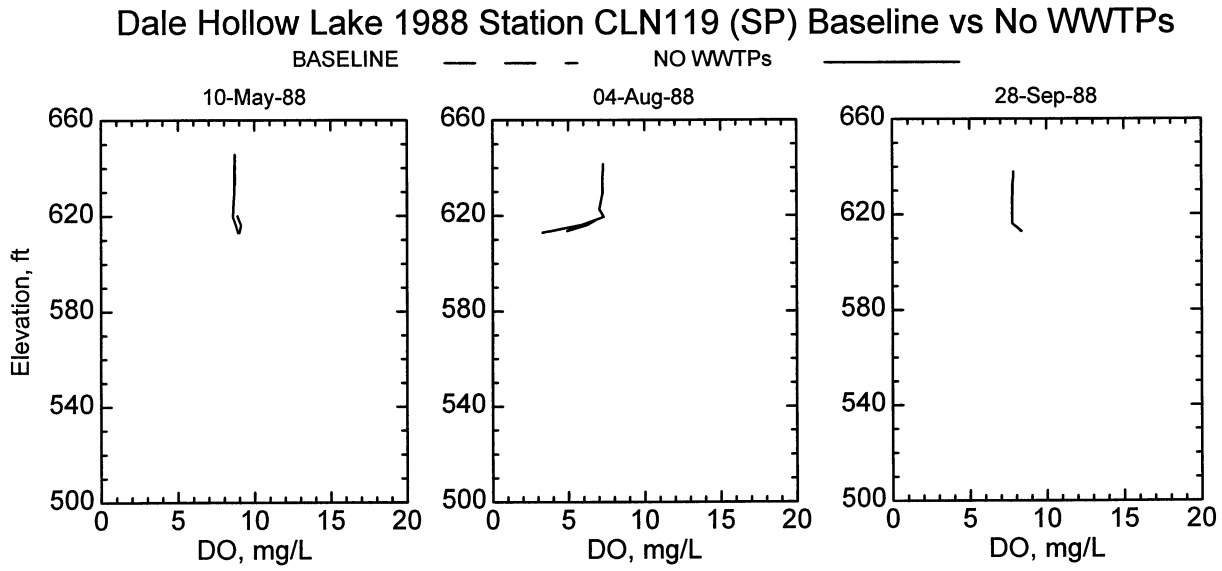

Dale Hollow Lake 1988 Station 3DAL20010 (WO) Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

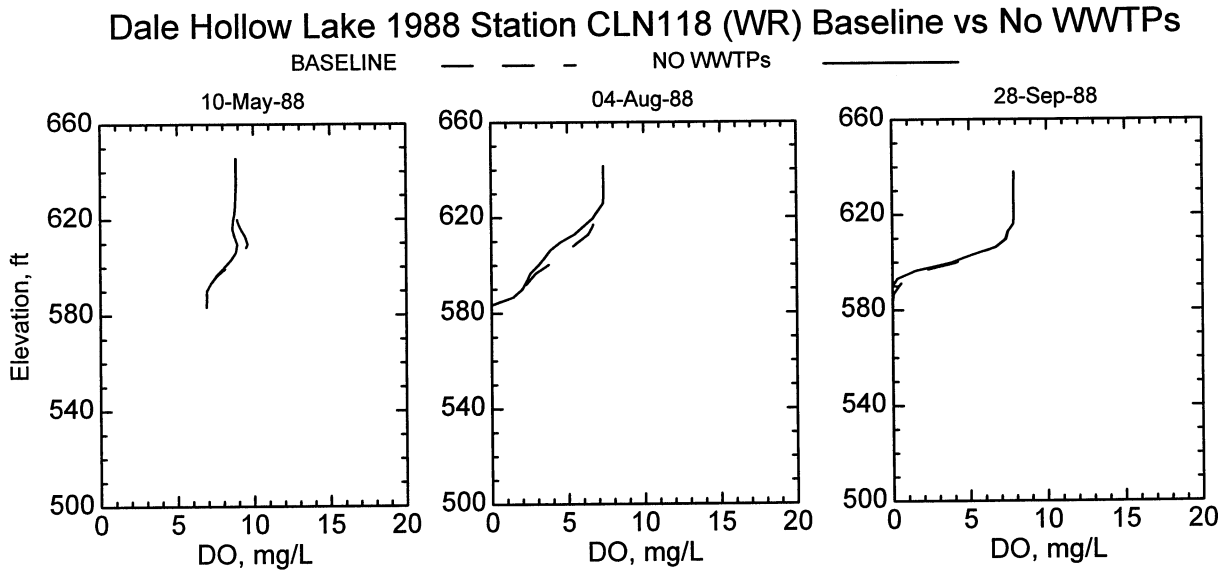

Dale Hollow Lake 1988 Station CLN114 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

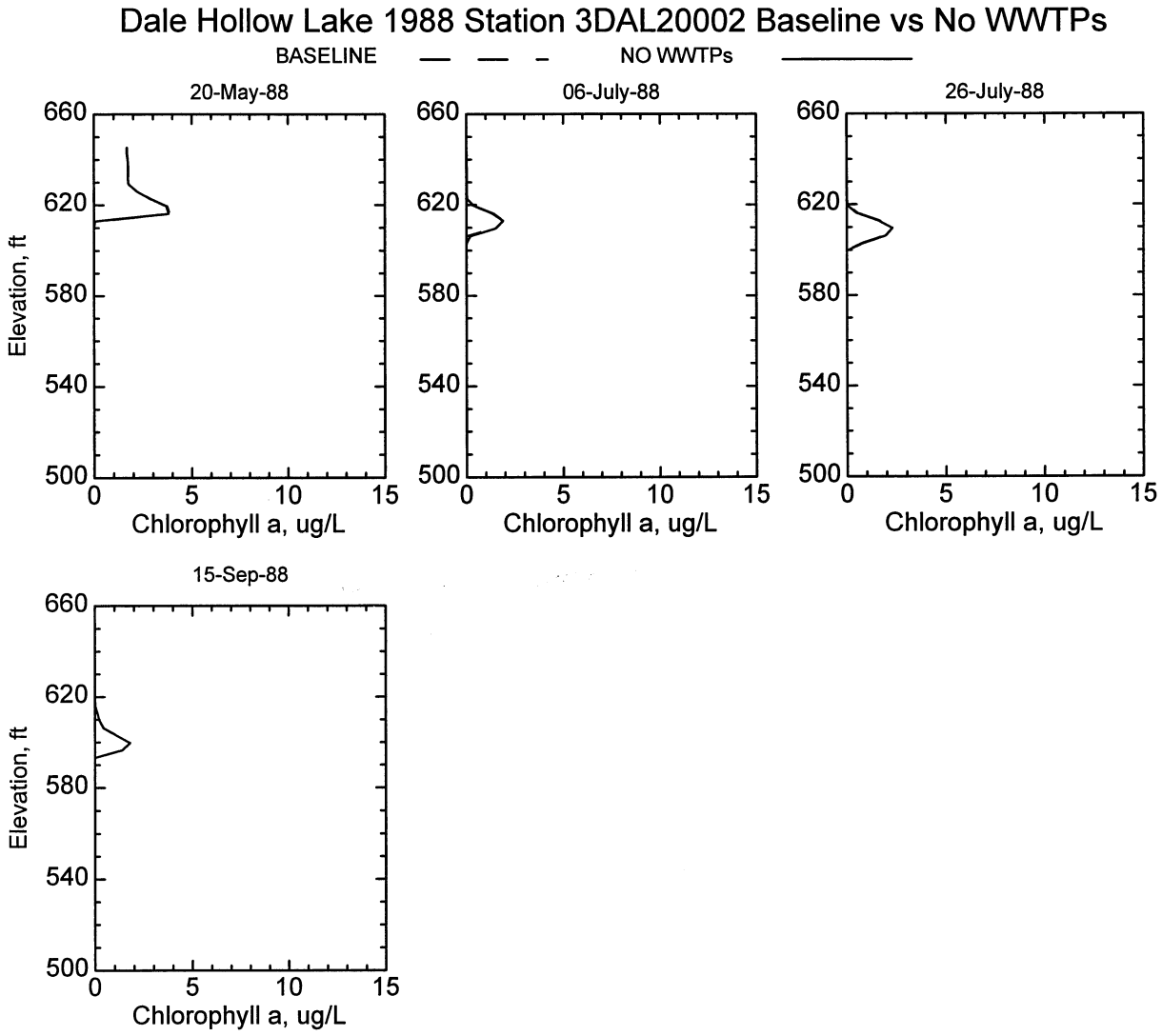

Dale Hollow Lake 1988 Station CLN115 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

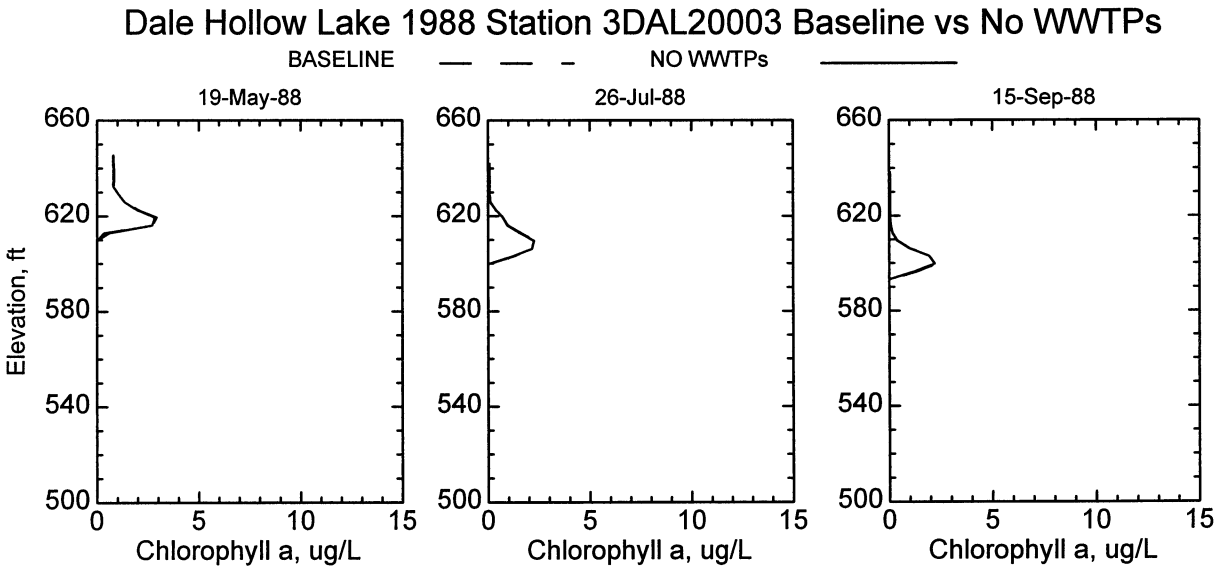

Dale Hollow Lake 1988 Station CLN116 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

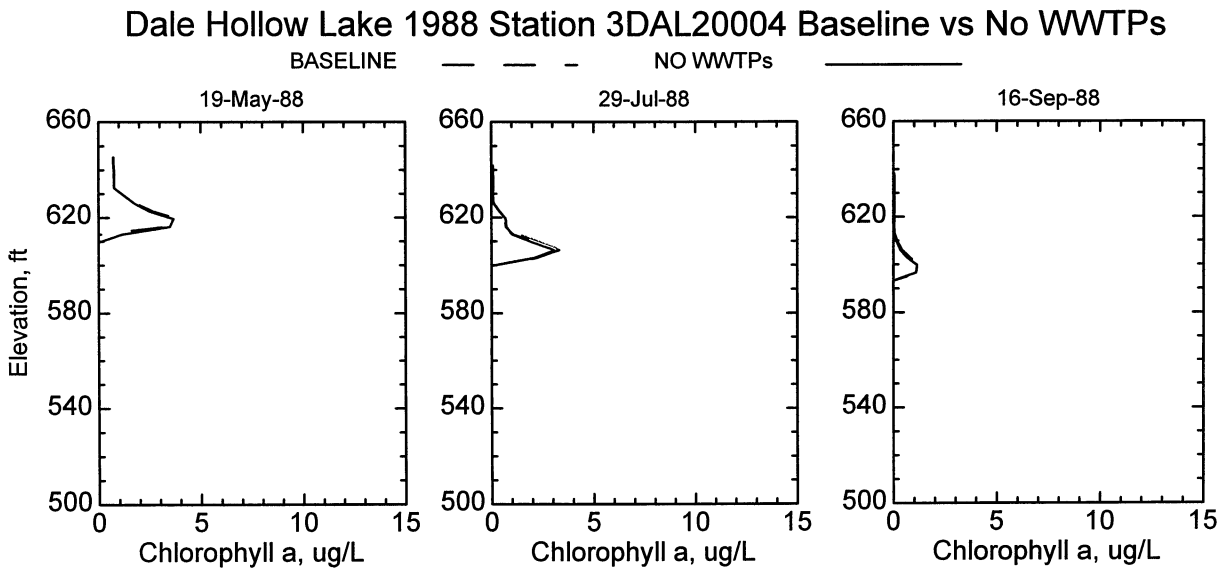

Dale Hollow Lake 1988 Station CLN117 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

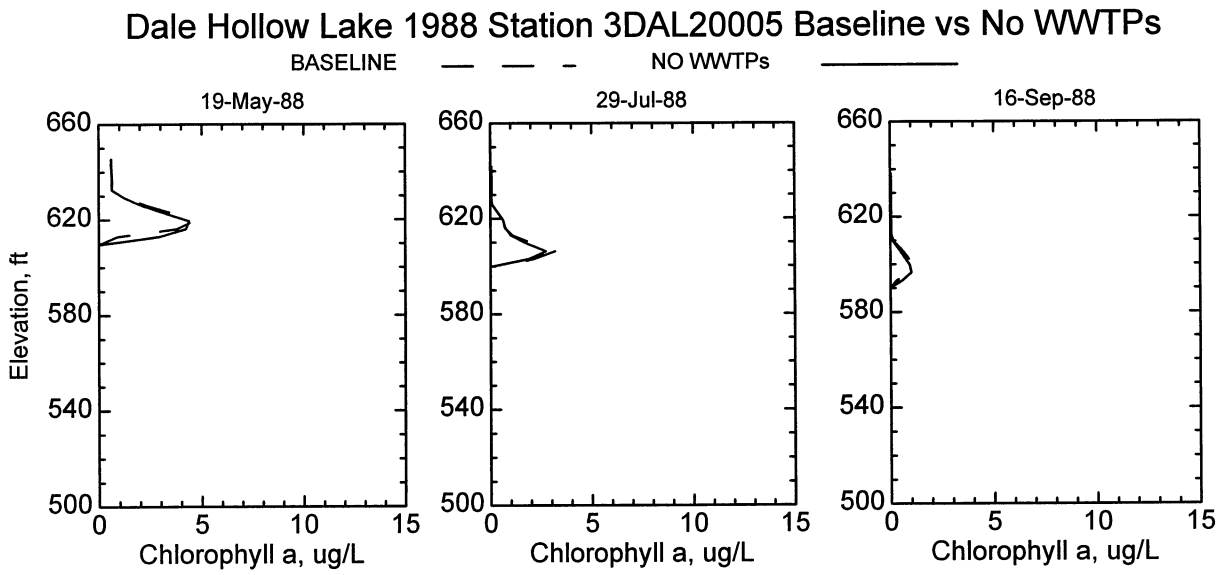

Dale Hollow Lake 1988 Station CLN119 (SP) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

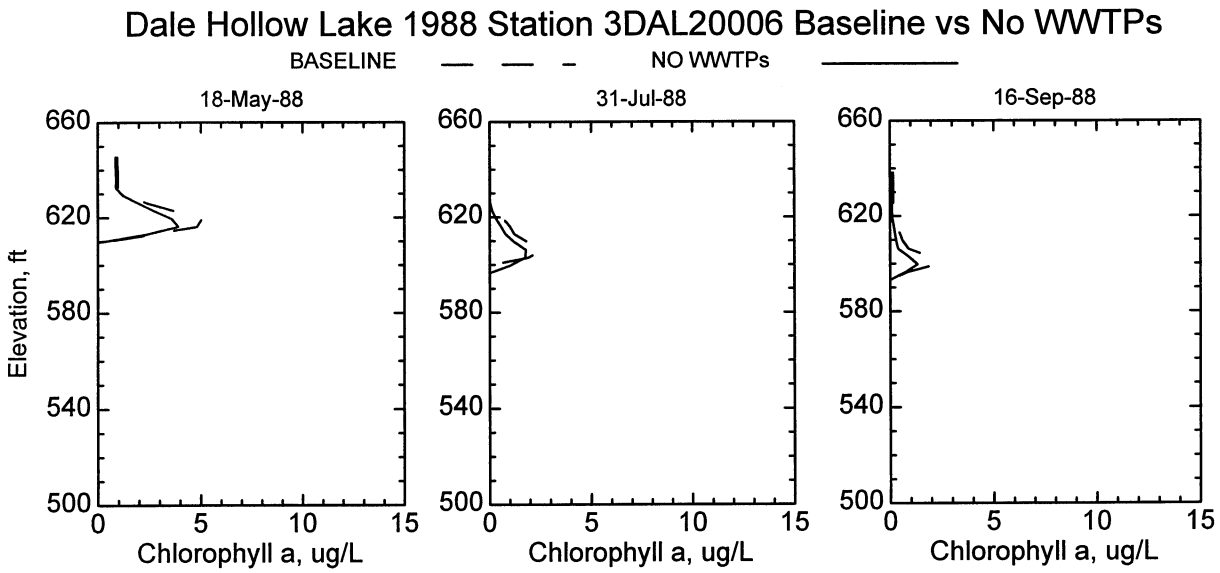

Dale Hollow Lake 1988 Station CLN118 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L

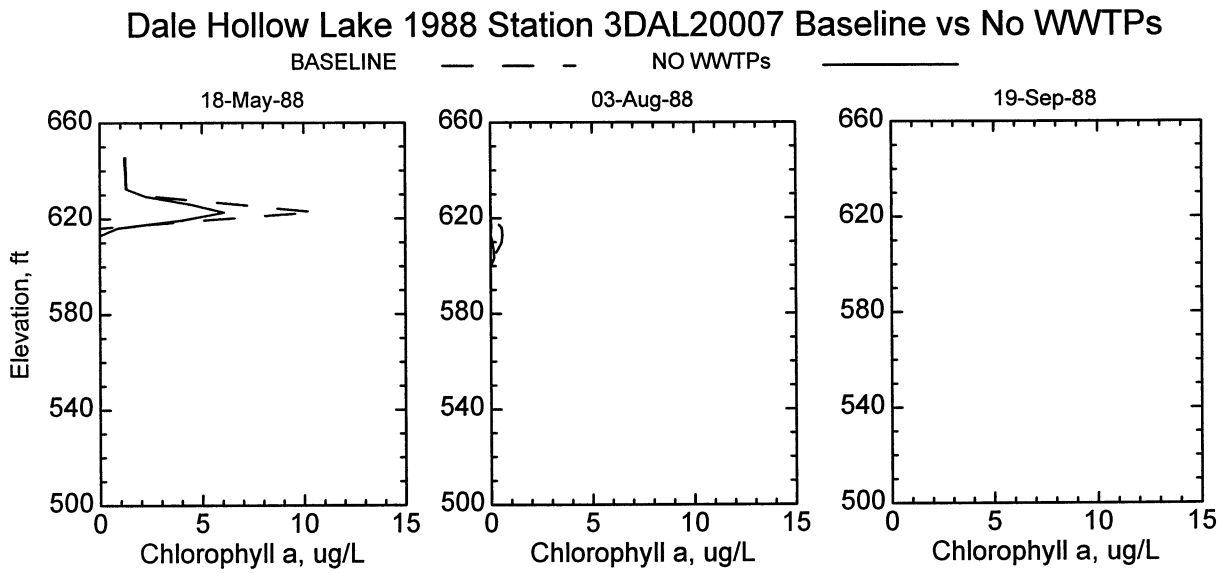

Dale Hollow Lake 1988 Station 3DAL20002 Baseline vs No WWTPs
BASELINE
NO WWTPs
20-May-88
06-July-88
26-July-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

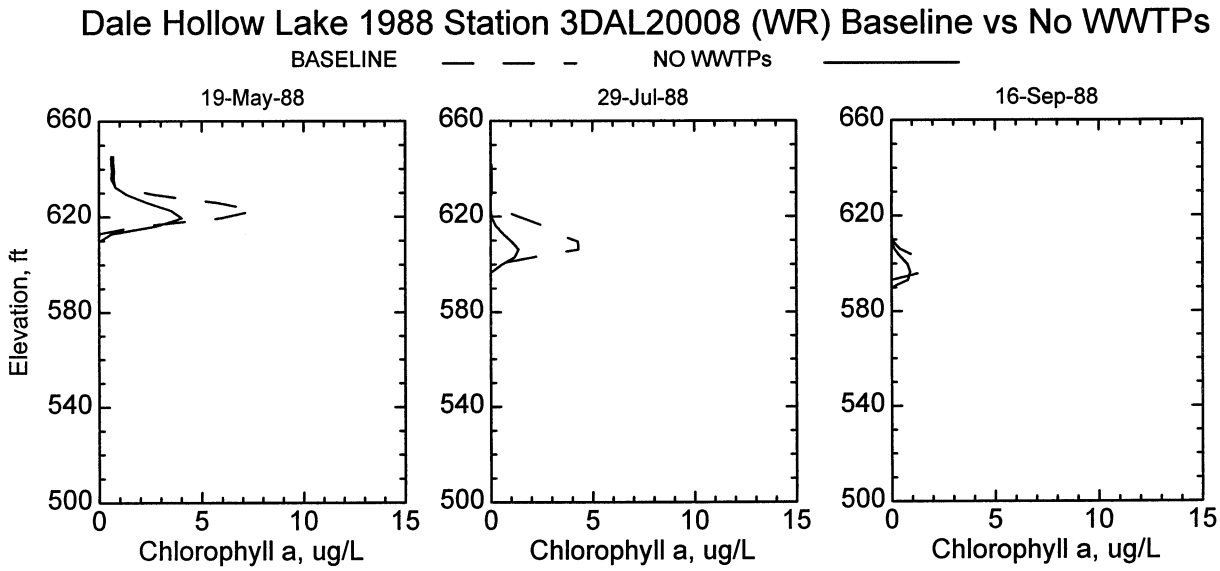

Dale Hollow Lake 1988 Station 3DAL20003 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
26-Jul-88
15-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

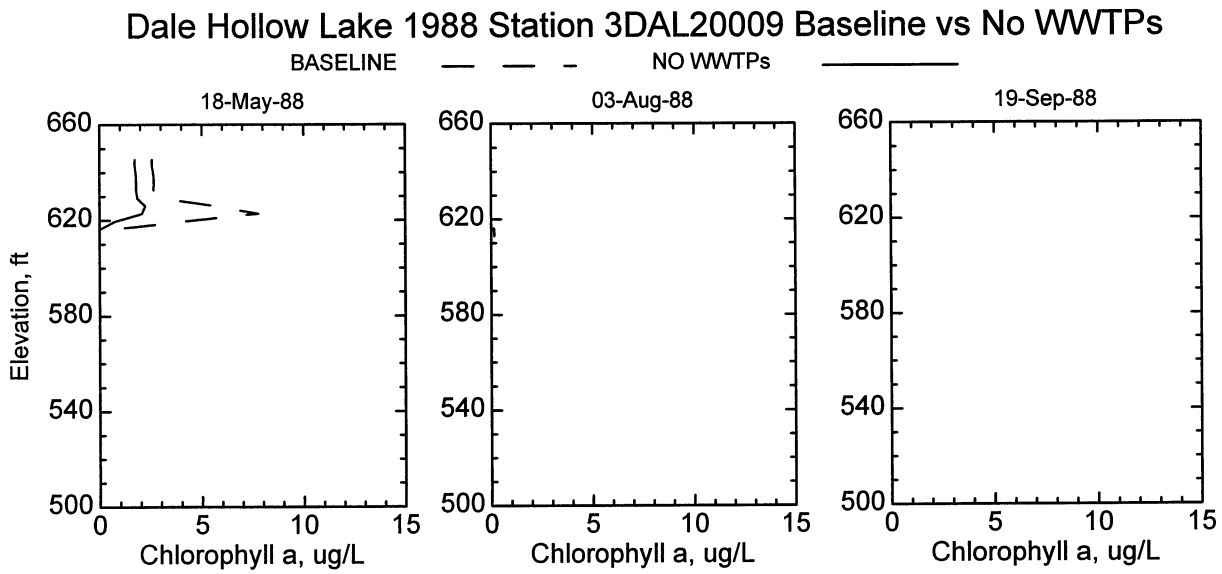

Dale Hollow Lake 1988 Station 3DAL20004 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

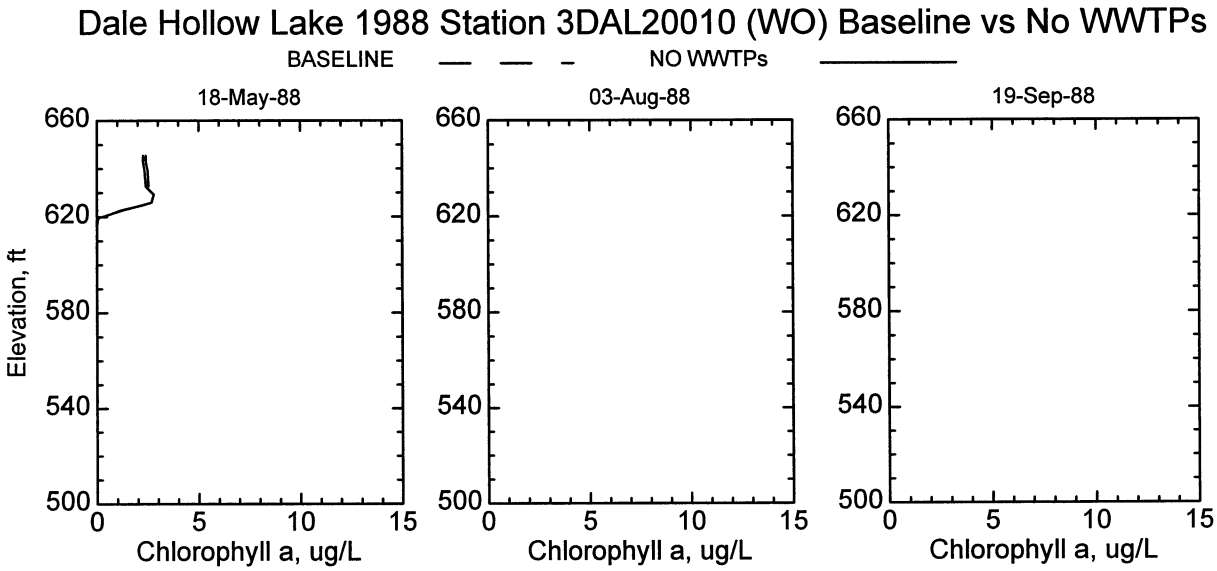

Dale Hollow Lake 1988 Station 3DAL20005 Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

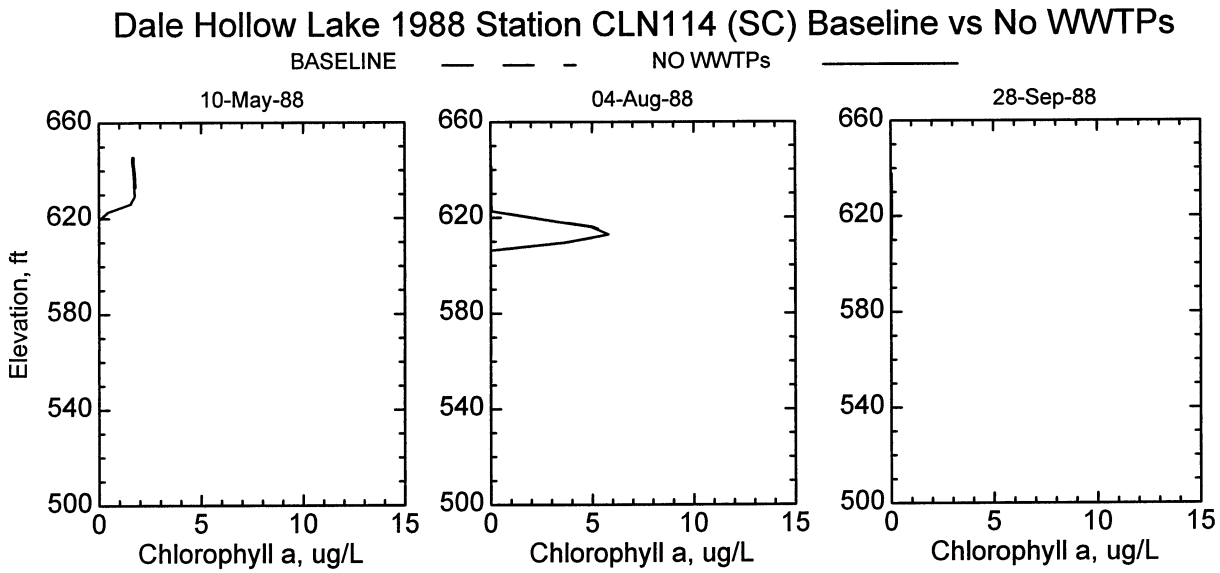

Dale Hollow Lake 1988 Station 3DAL20006 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
31-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

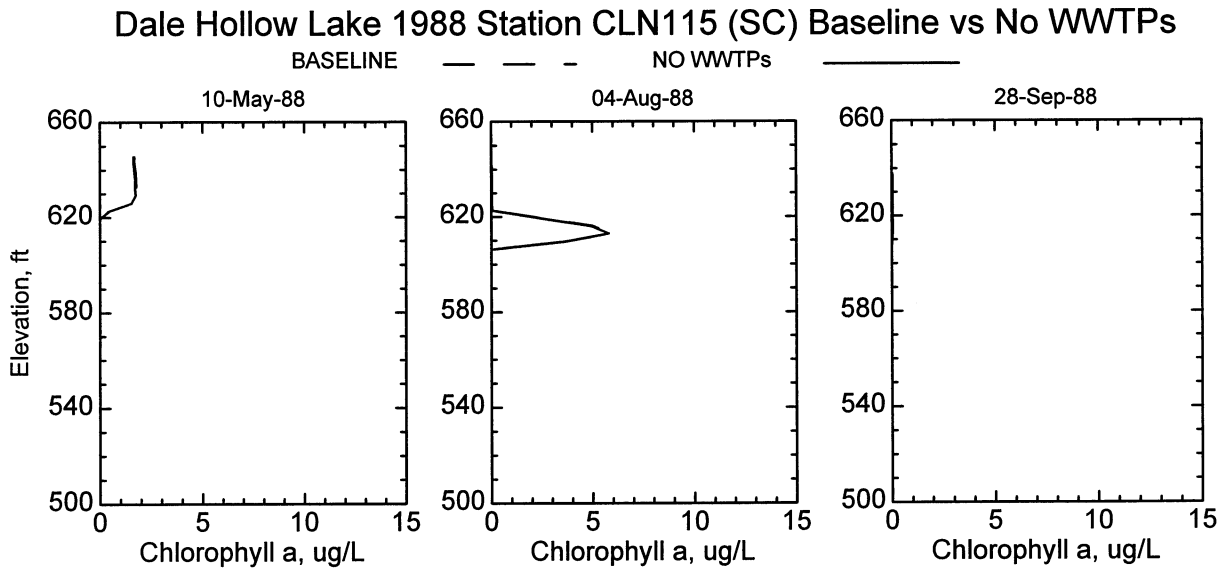

Dale Hollow Lake 1988 Station 3DAL20007 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

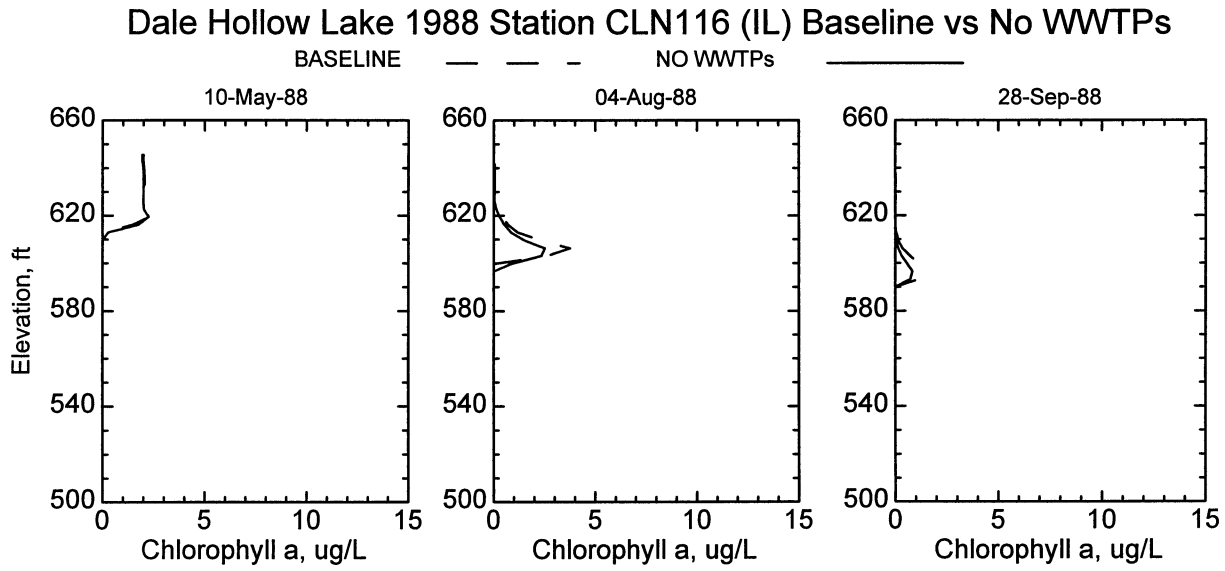

Dale Hollow Lake 1988 Station 3DAL20008 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
19-May-88
29-Jul-88
16-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

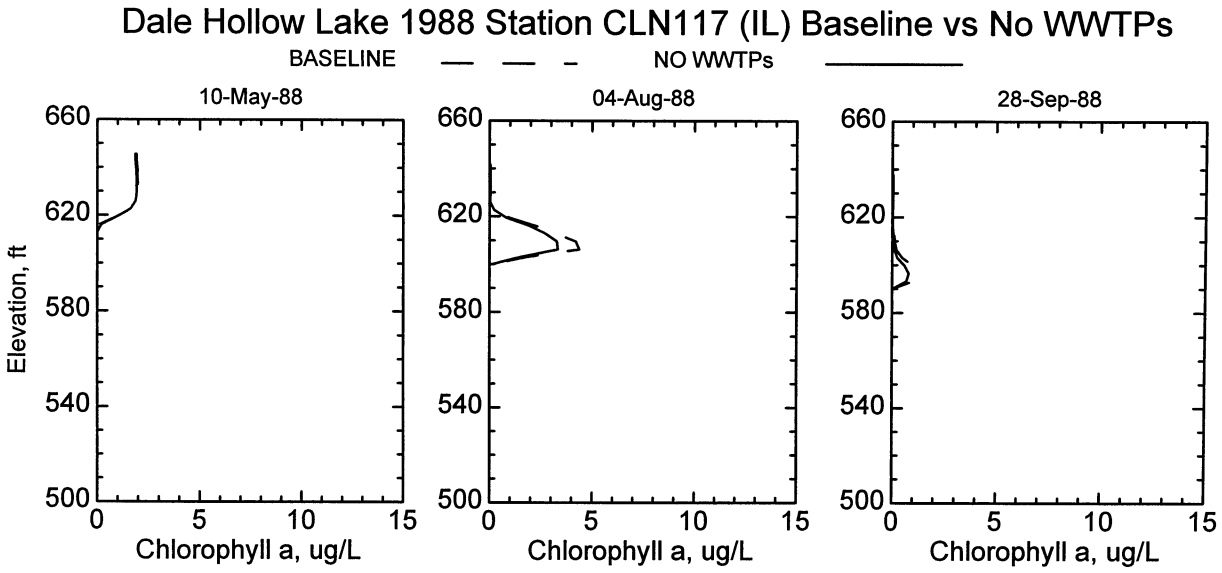

Dale Hollow Lake 1988 Station 3DAL20009 Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

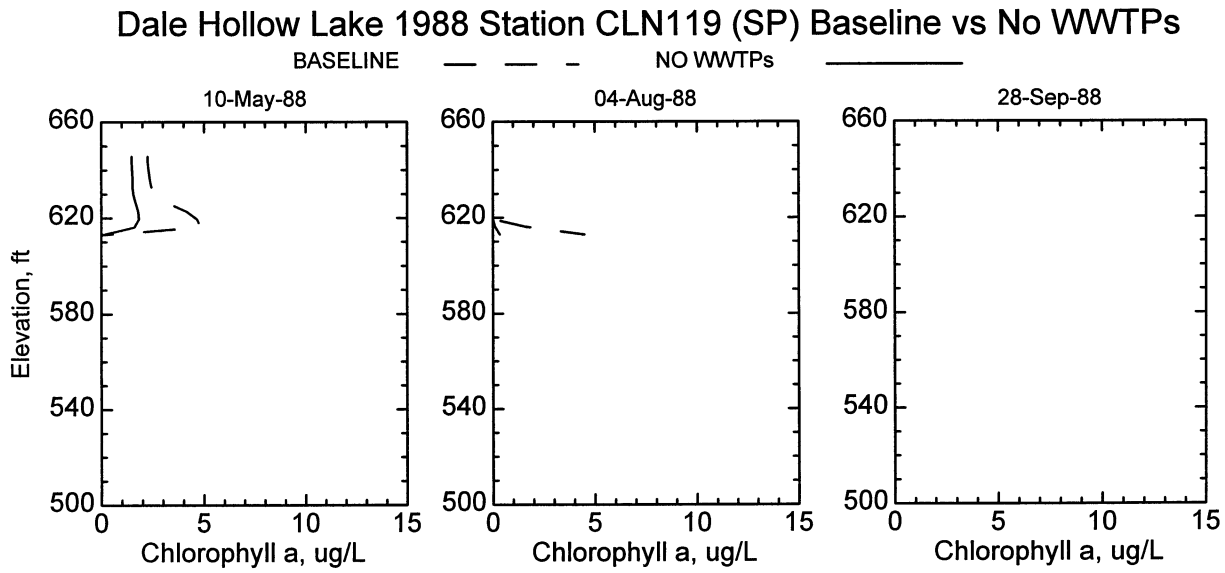

Dale Hollow Lake 1988 Station 3DAL20010 (WO) Baseline vs No WWTPs
BASELINE
NO WWTPs
18-May-88
03-Aug-88
19-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

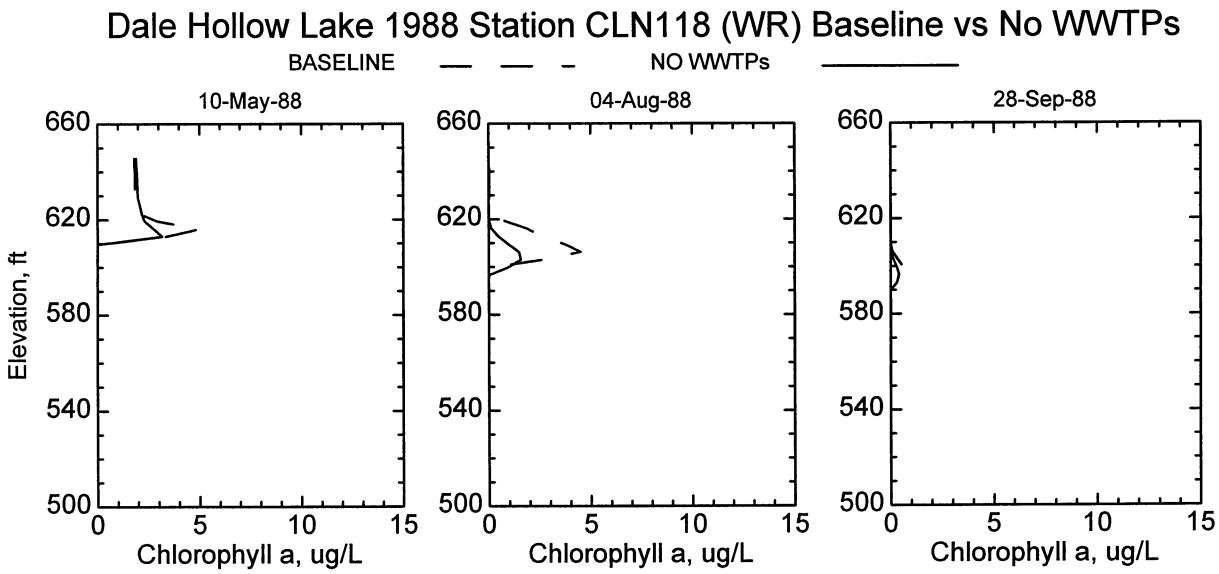

Dale Hollow Lake 1988 Station CLN114 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

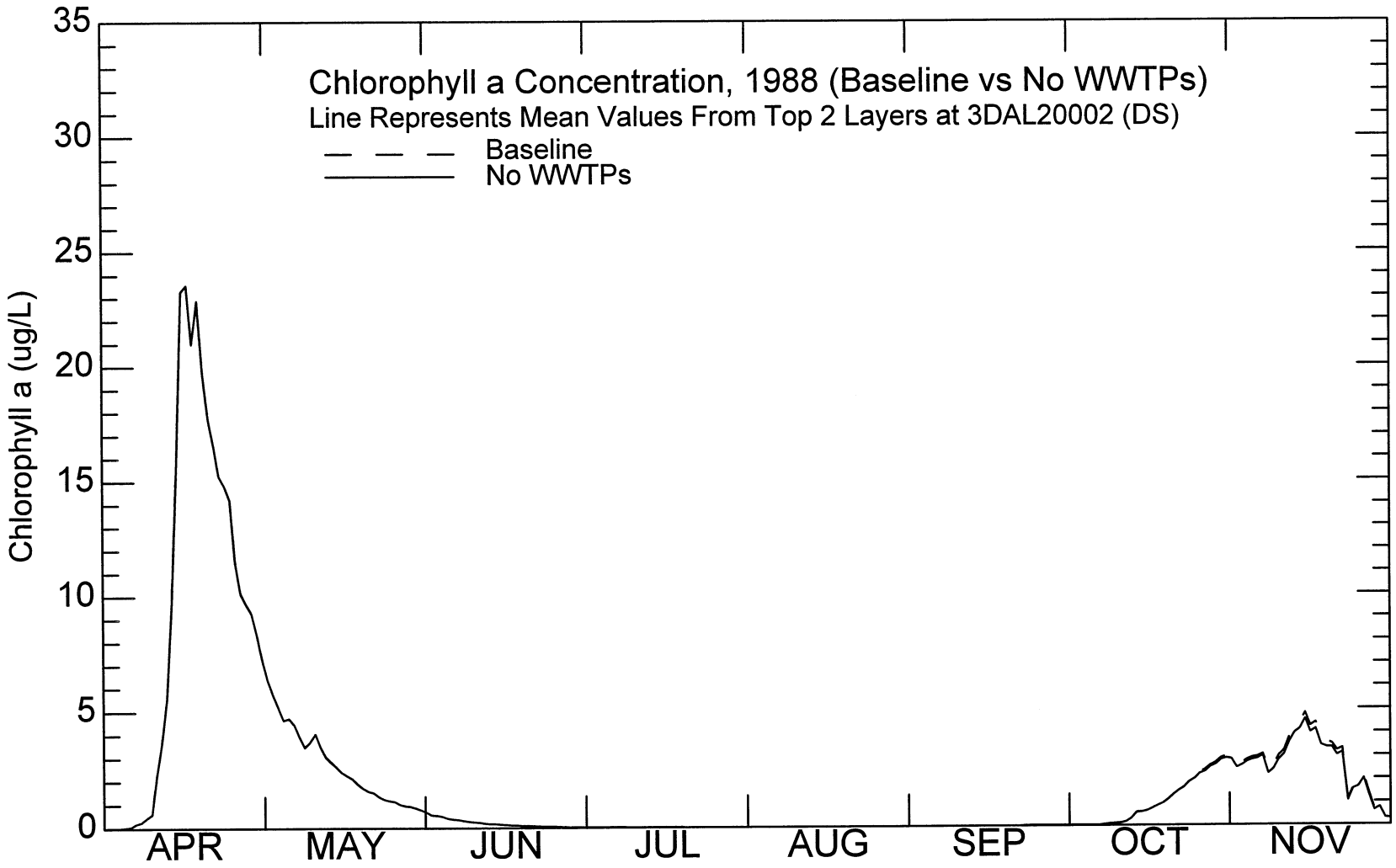

Dale Hollow Lake 1988 Station CLN115 (SC) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

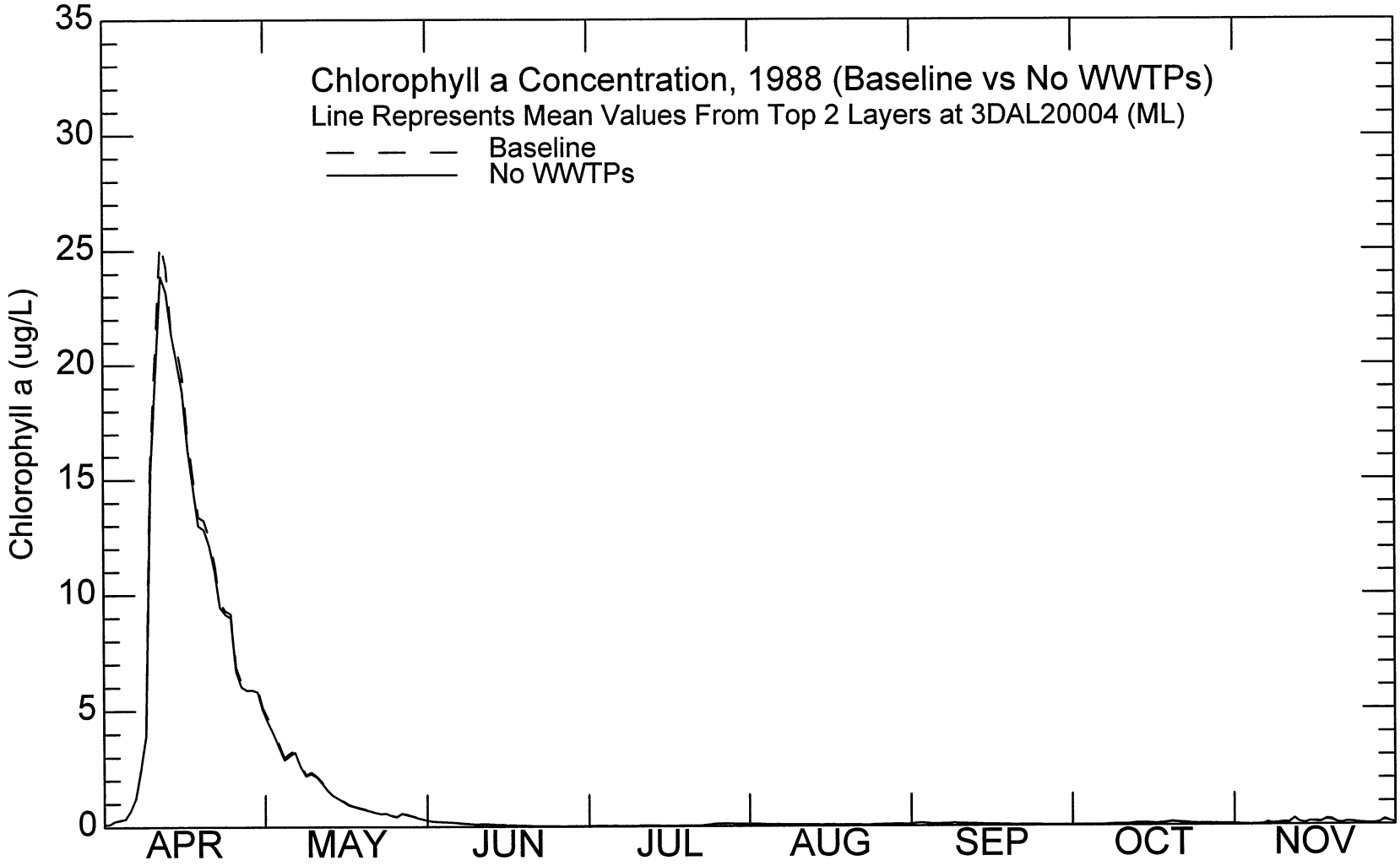

Dale Hollow Lake 1988 Station CLN116 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

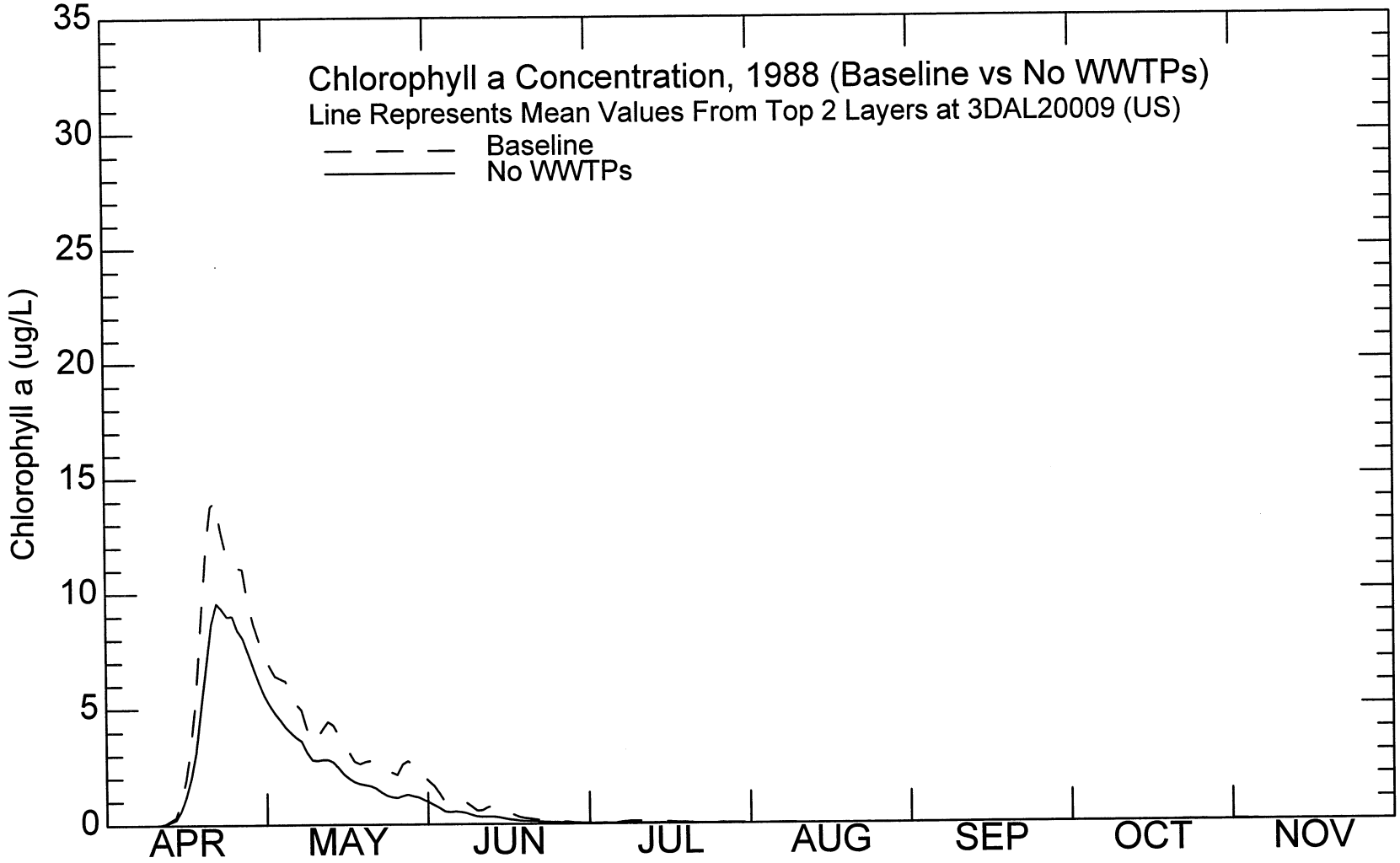

Dale Hollow Lake 1988 Station CLN117 (IL) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L


Dale Hollow Lake 1988 Station CLN119 (SP) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L


Dale Hollow Lake 1988 Station CLN118 (WR) Baseline vs No WWTPs
BASELINE
NO WWTPs
10-May-88
04-Aug-88
28-Sep-88
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L

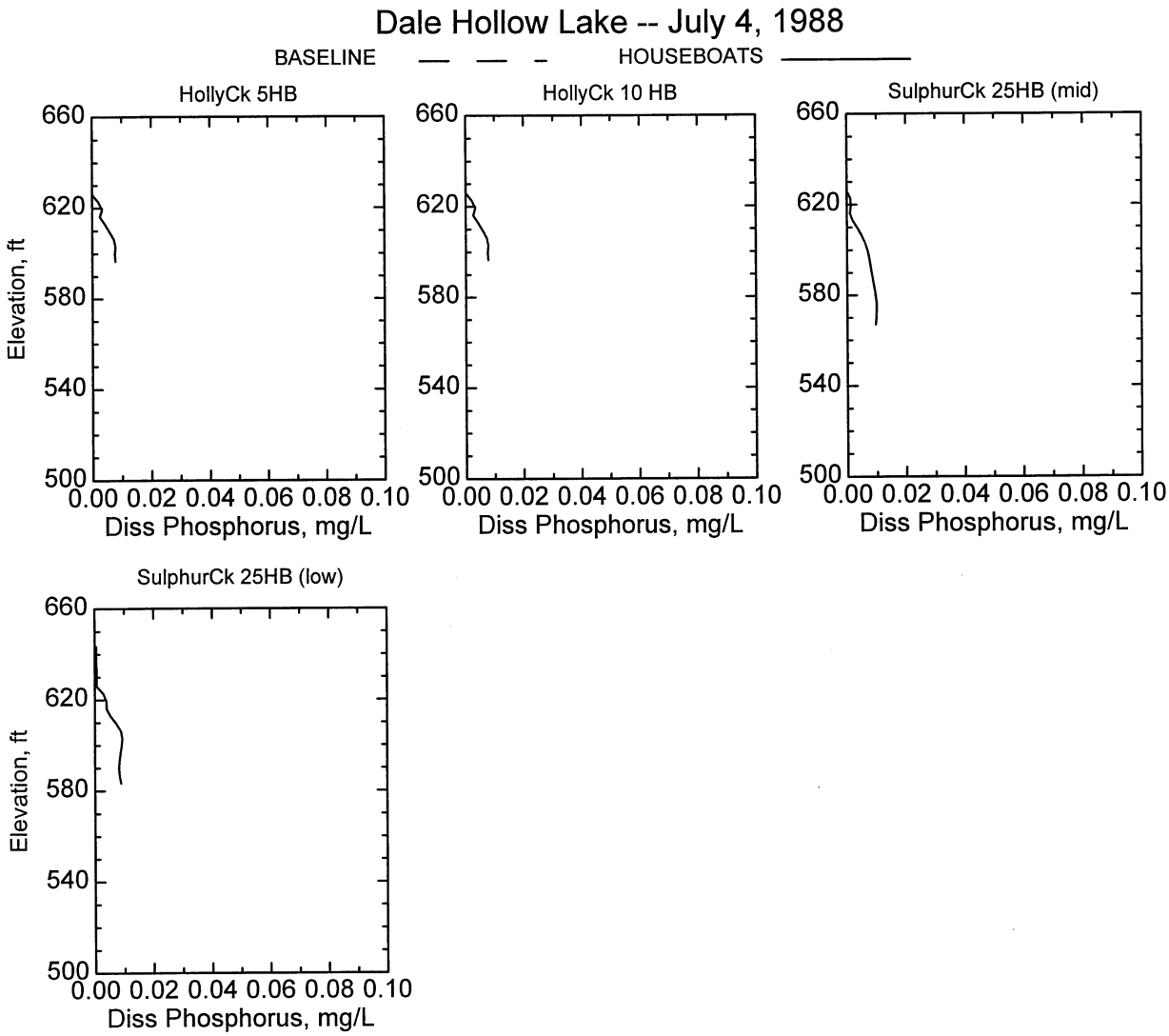

Chlorophyll a Concentration, 1988 (Baseline vs No WWTPs)
Line Represents Mean Values From Top 2 Layers at 3DAL20002 (DS)
Baseline
No WWTPs
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

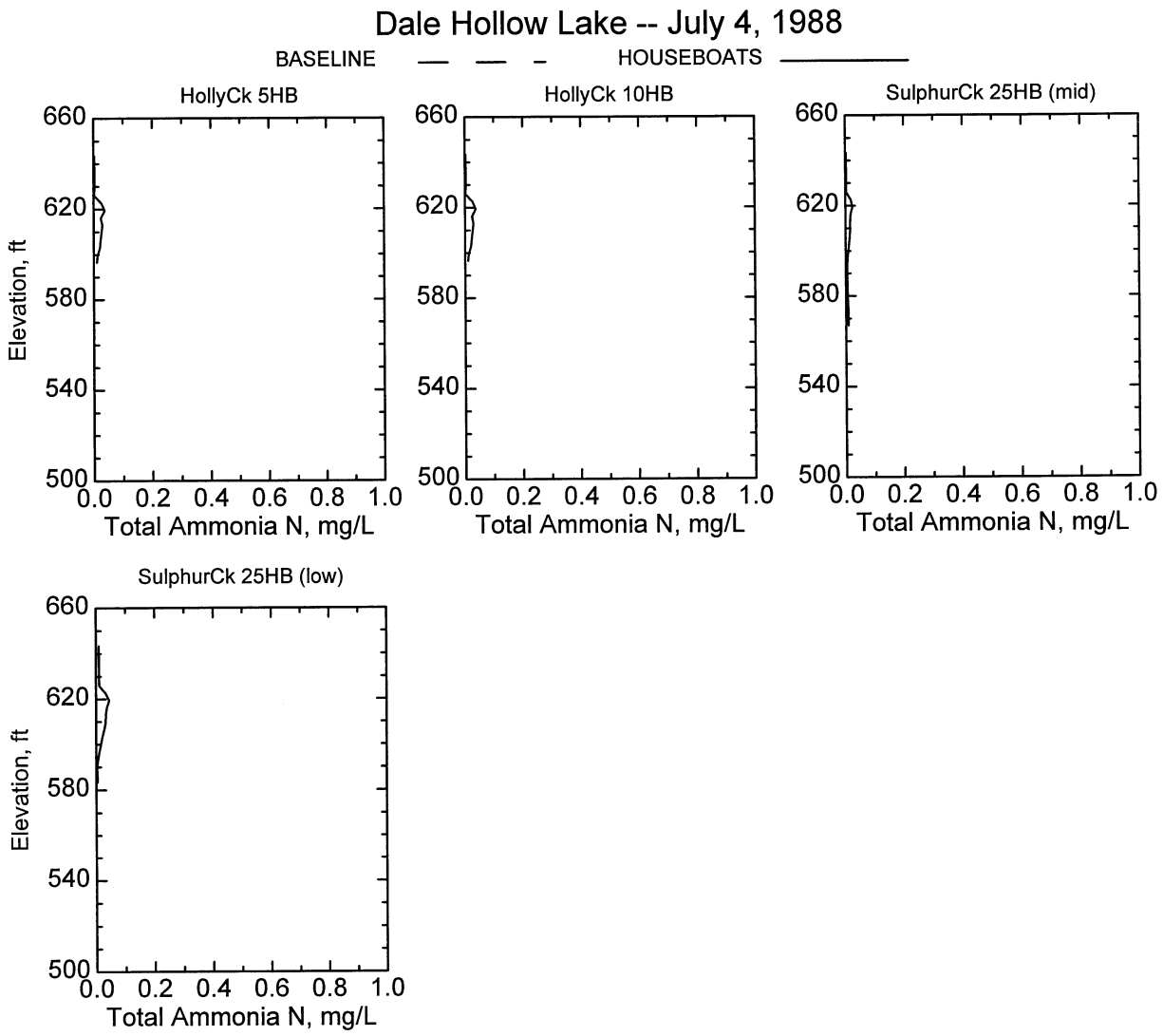

Chlorophyll a Concentration, 1988 (Baseline vs No WWTPs)
Line Represents Mean Values From Top 2 Layers at 3DAL20004 (ML)
Baseline
No WWTPs
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

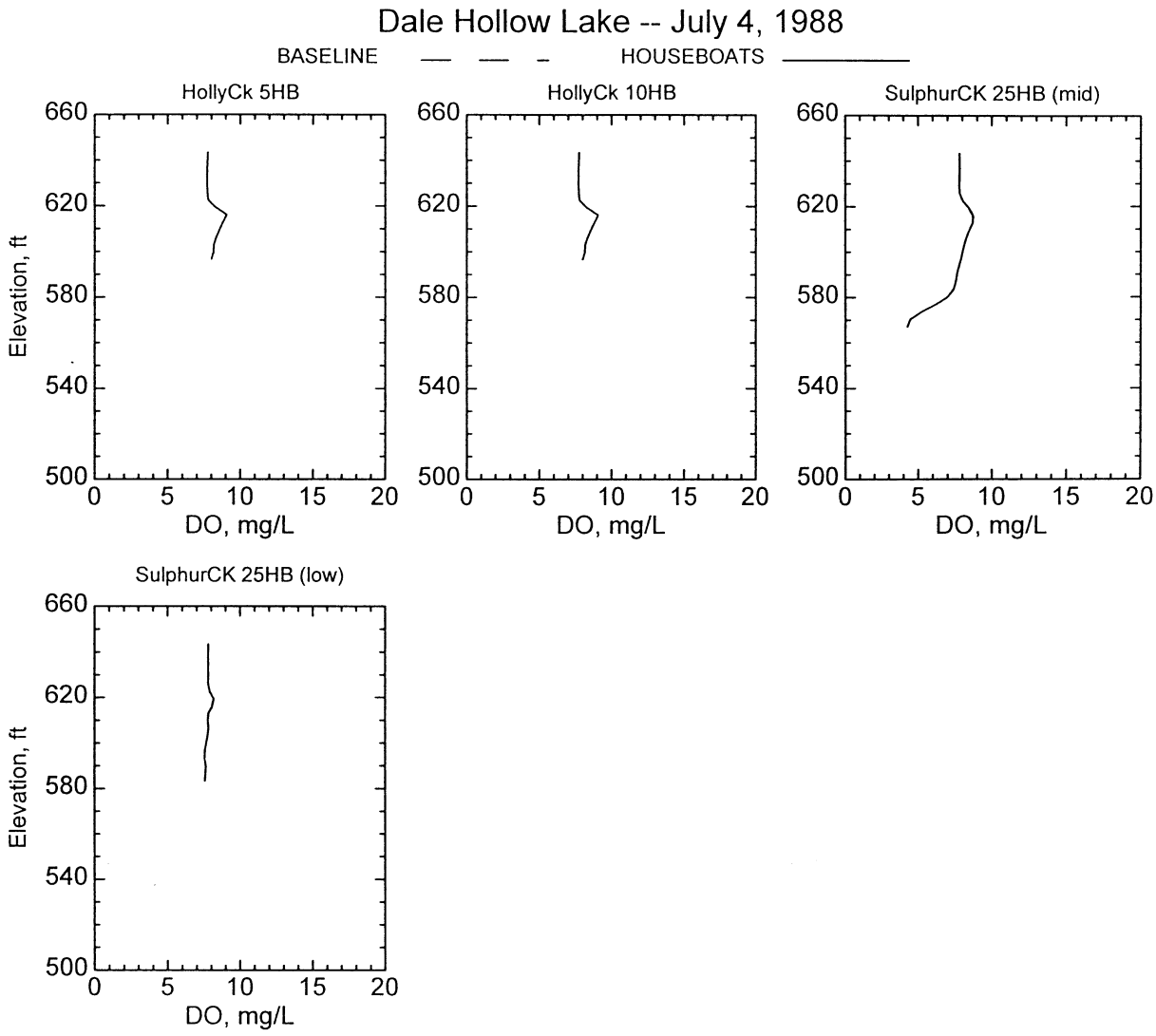

Chlorophyll a Concentration, 1988 (Baseline vs No WWTPs)
Line Represents Mean Values From Top 2 Layers at 3DAL20009 (US)
Baseline
No WWTPs
Chlorophyll a (ug/L)
35
30
25
20
15
10
5
0
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV

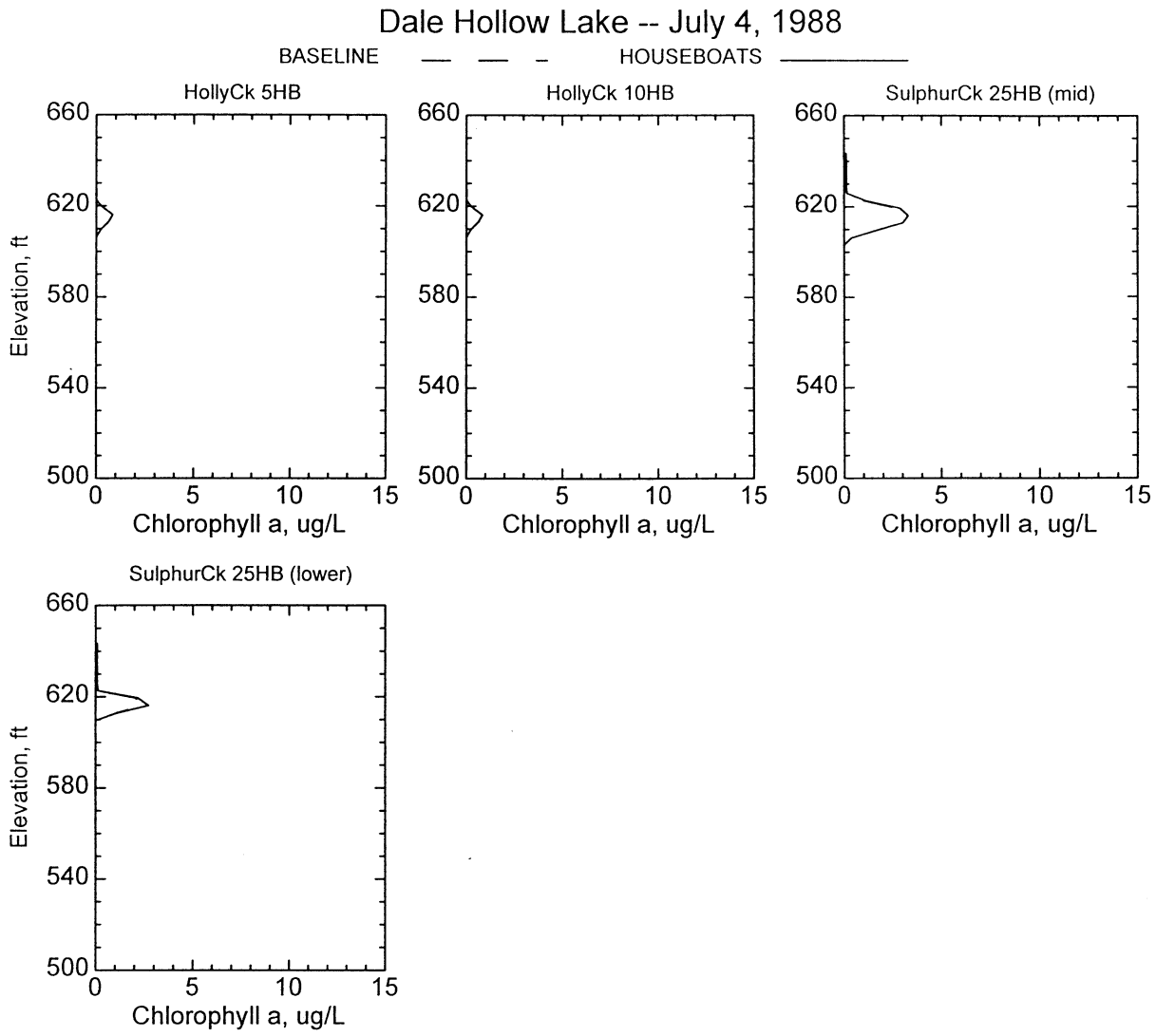
APPENDIX O

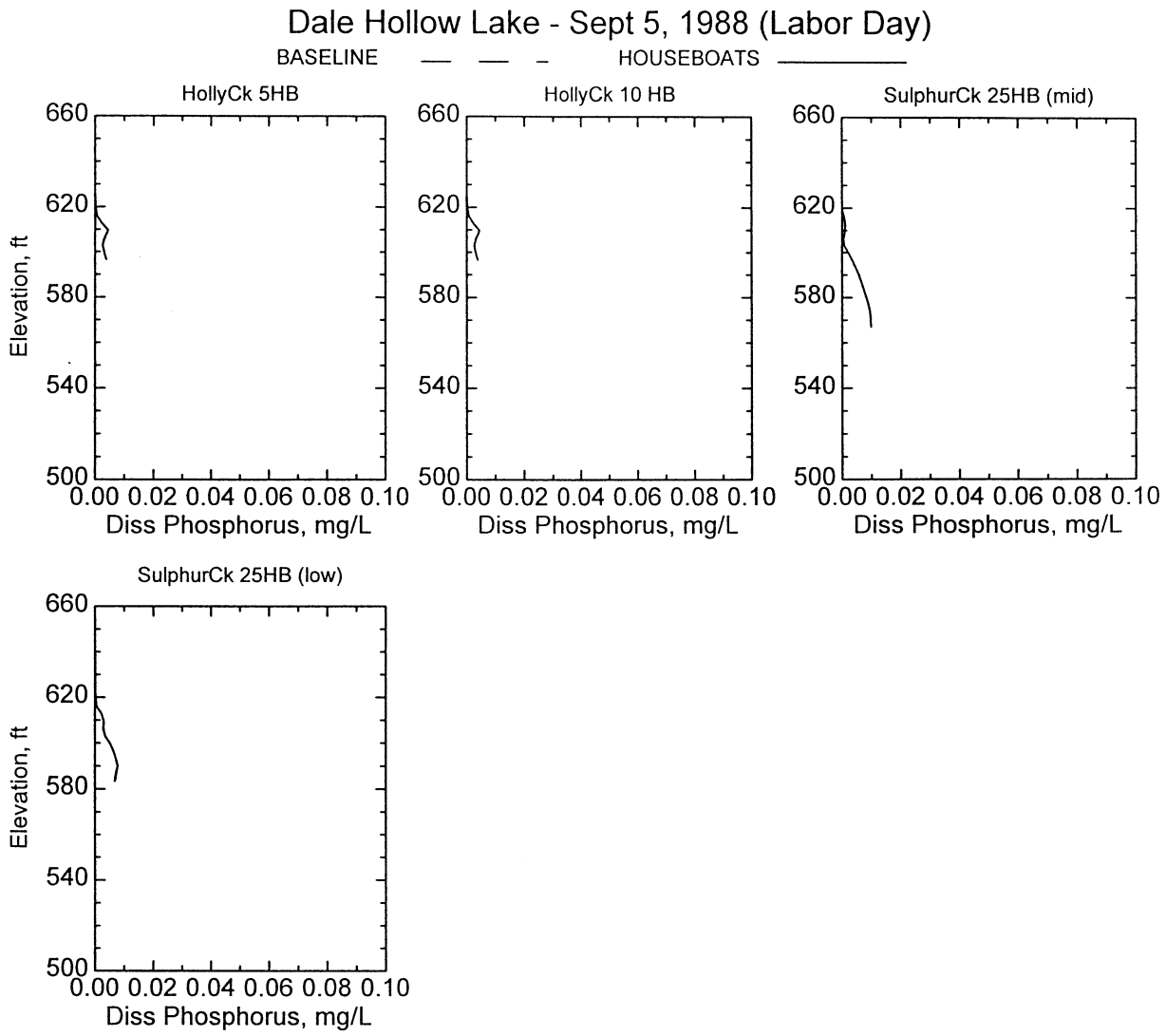
Scenario Two: Houseboat Impacts Comparison Profiles Plots of Baseline and Houseboats Added

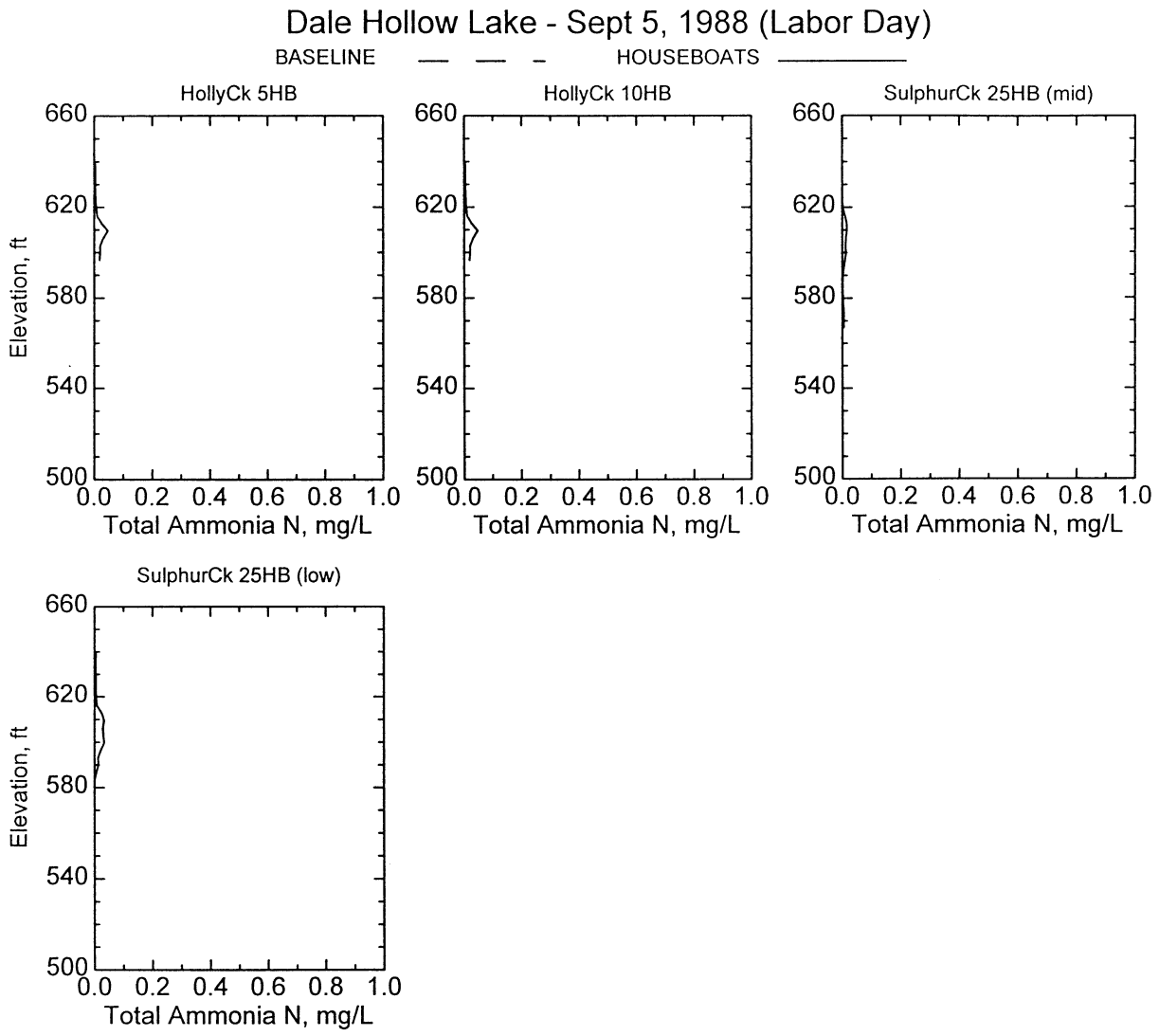

Dale Hollow Lake -- July 4, 1988
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10 HB
SulphurCk 25HB (mid)
SulphurCk 25HB (low)
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L

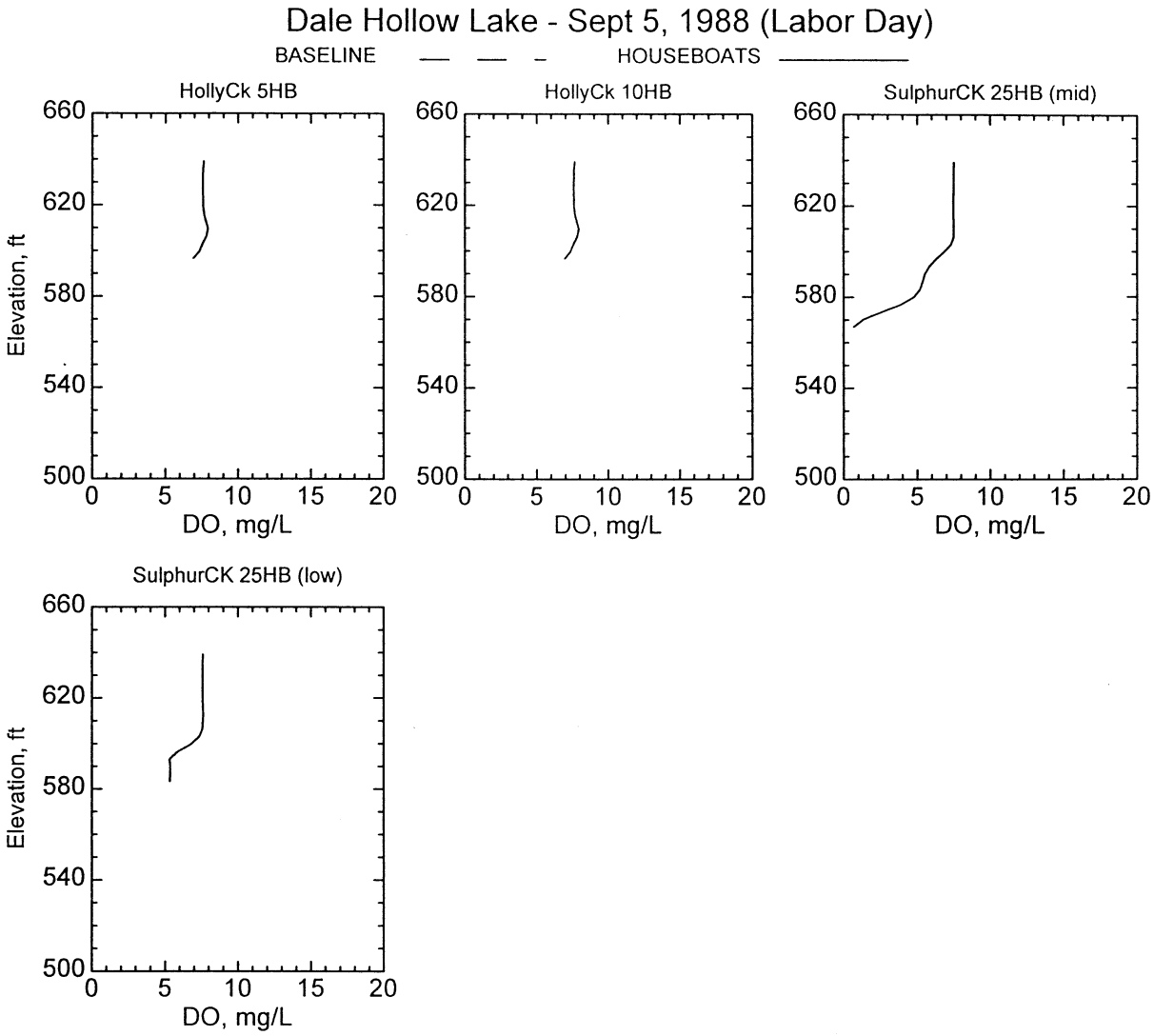

Dale Hollow Lake -- July 4, 1988
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10HB
SulphurCk 25HB (mid)
SulphurCk 25HB (low)
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L

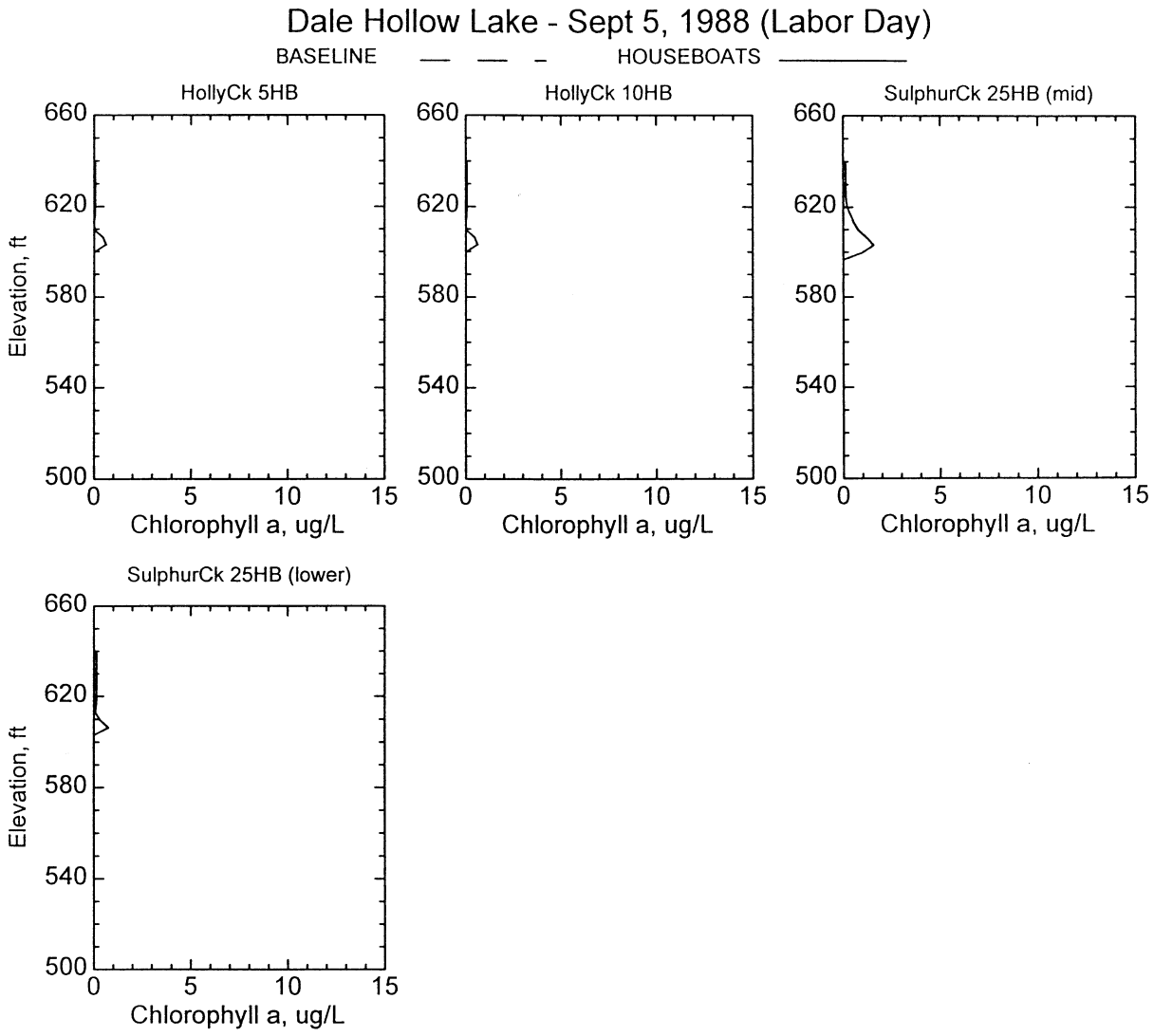

Dale Hollow Lake -- July 4, 1988
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10HB
SulphurCK 25HB (mid)
SulphurCK 25HB (low)
Elevation, ft
660
620
580
540
500
0
5
10
15
20
DO, mg/L


Dale Hollow Lake -- July 4, 1988
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10HB
SulphurCk 25HB (mid)
SulphurCk 25HB (lower)
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L


Dale Hollow Lake - Sept 5, 1988 (Labor Day)
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10 HB
SulphurCk 25HB (mid)
SulphurCk 25HB (low)
Elevation, ft
660
620
580
540
500
0.00 0.02 0.04 0.06 0.08 0.10
Diss Phosphorus, mg/L


Dale Hollow Lake - Sept 5, 1988 (Labor Day)
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10HB
SulphurCk 25HB (mid)
SulphurCk 25HB (low)
Elevation, ft
660
620
580
540
500
0.0 0.2 0.4 0.6 0.8 1.0
Total Ammonia N, mg/L


Dale Hollow Lake - Sept 5, 1988 (Labor Day)
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10HB
SulphurCK 25HB (mid)
SulphurCK 25HB (low)
Elevation, ft
DO, mg/L
660
620
580
540
500
0
5
10
15
20


Dale Hollow Lake - Sept 5, 1988 (Labor Day)
BASELINE
HOUSEBOATS
HollyCk 5HB
HollyCk 10HB
SulphurCk 25HB (mid)
SulphurCk 25HB (lower)
Elevation, ft
660
620
580
540
500
0
5
10
15
Chlorophyll a, ug/L