Appendix C

Photosynthetic Active Radiation (PAR) Calculations for Critical Conditions

7Q10 Summer PAR Worksheet

```
20050208: This program is from a diskette provided with the following reference;
        S. Lawrence Dingman, Physical Hydrology, University of New Hampshire, Macmillan Publishing Co., NY, 1994.

SOLARRAD.W K1     DAILY GLOBAL RADIATION ON AN INCLINED SURFACE
                  See Appendix E.
            Units: MJ = MJ/m^2 h; W = W/m^2; cal = cal/cm^2 day
SolarCon (Isc) =          4.921 MJ   =        1367 W    =          2821 cal
======== ======== ======== ======== ======== ======== ========== ========
------>   ENTER            LOCATION: Jaffrey NH
------>   ENTER   LATITUDE (Lambda):    42.800 degrees=>       0.747 radians
------>   ENTER   SLOPE ANGLE (beta):    0.000 degrees=>       0.000 radians
------>   ENTER SLOPE AZIMUTH (alpha):   0.000 degrees=>       0.000 radians
------>   ENTER        YEAR   DAY (J):     183   => Date =      01-Jul
------>   ENTER OPTICAL AIR MASS (Mopt) FROM FIG.E-4:            3.2          QUAL2e: keep at 3.2
------>   ENTER   AIR TEMP:      27.0 C
------>   ENTER   REL HUM:        70 %
Vap Pres=     25.04 mb Dew Pt=     21.1 C Precip   Water=          4.1 cm
------>   ENTER   SURFACE ALBEDO:      0.05                                ALBEDO = Surface Reflectivity (set=~ 0.05 for water)
------>   ENTER   DUST ATTENUATION (gamma-dust):              0.06         Dust Attenuation: Range = 0 - 0.15 per QUAL2E
======== ======== ======== ======== ======== ======== ========== ========
HORIZONTAL        Day Angle (Gamma) =     3.133 radians =      179.507 degrees
          Declination       (delta) =     0.403 radians =       23.112 degrees
  Eccentricity    = (ro/r)^2 =            0.967
  Sunrise     Thr=    -7.552 h Sunset     Ths =     7.552 h
PolarSum      Thr=           h Sunset     Ths =           h
PolarWin      Thr=           h Sunset     Ths =           h
     Day Length =  15.104  h          PolarSum            PolarWin
Extraterr     KET =   41.688 MJ   =    1.16E+04 W    =        995.749 cal
PolarSum * KET =              MJ   =    0.00E+00 W    =          0.000 cal
                    tau-sa =     0.472      tau =     0.412
Direct        Kdir=   17.173 MJ   =    4.77E+03 W    =        410.188 cal
PolarSum * Kdir=              MJ   =    0.00E+00 W    =          0.000 cal
                    tau-s =     0.619 gamma-s =     0.441
Diffuse       Kdif=    9.193 MJ   =    2.55E+03 W    =        219.593 cal
PolarSum * Kdif=              MJ   =    0.00E+00 W    =          0.000 cal
Global         Kg =   26.366 MJ   =    7.32E+03 W    =        629.781 cal
PolarSum * Kg =               MJ   =    0.00E+00 W    =          0.000 cal

Backscat      Kbs =    0.291 MJ   =    8.08E+01 W    =          6.944 cal

PolarSum * Kbs =              MJ   =    0.00E+00 W    =          0.000 cal
CLEAR SKY  K'cs =   26.657 MJ   =    7.41E+03 W    =      636.726 cal <===
POLARSUM *                    MJ   =    0.00E+00 W    =          0.000 cal<===
======== ======== ======== ======== ======== ======== ========== ========
SLOPE:        Delta  Omega =     0.000 radians =      0.000 degrees
Equivalent tLatitude = e   =     0.747 radians =     42.800 degrees
            Noon =     0.000 h            0.000 radians =        0.000 degrees
  Sunrise     (Tsr) =    -7.552 h           -1.977 radians =     -113.279 degrees
 Sunset    (Tss) =    7.552 h            1.977 radians =  113.279 degrees
     Day Length =  15.104  h
Extraterr  KET =  24.362 MJ     = ######## W      =   581.916 cal
Polar Sum* KET =  30.447 MJ     = ######## W      =   727.259 cal
CLEAR SKY  Kcs =  19.520 MJ     = ######## W      =   466.251 cal <===
POLARSUM*         12.542 MJ     = ######## W      =   299.587 cal <===
SlopeFactor (f sd) Direct :  0.584     Polar   Sum* =  #DIV/0!
SlopeFactor (f sl)  Total :  0.732     Polar   Sum* =  #DIV/0!
======== ======== ======== ======== ======== ======== ========== ========
       * Ignore "Polar Summer" results unless other values = ERR
       * If all values = ERR, clear-sky radiation = 0.
```

BTU/ft2	Fraction available for photosynthesis	Fraction Cloud Cover	Forest Canopy Density	QUAL2e Total Daily Solar Radiation (Input for Option 2 Light Ave Method) = Total Daily PAR
2347.607	0.440	0.050	0.010	994.332
Range	.43-.45	0-1.0	0-1.0	