```
diary on         % begin recording

% FEMA appeal for The Town of Kennebunkport, York county, Maine
% TRANSECT ID: YK-105
% calculation by SJH, Ransom Consulting, Inc. 02-Apr-2020
% 100-year wave runup using TAW methodology
% including berm and weighted average with foreshore if necessary
%
% chk nld 20200220
%
% This script assumes that the incident wave conditions provided
% as input in the configuration section below are the
% appropriate values located at the end of the foreshore
% or toe of the slope on which the run-up is being calculated
% the script does not attempt to apply a depth limit or any other
% transformation to the incident wave conditions other than
% conversion of the peak wave period to the spectral mean wave
% as recommended in the references below
%
% references:
%
% Van der Meer, J.W., 2002. Technical Report Wave Run-up and
% Wave Overtopping at Dikes. TAW Technical Advisory Committee on
% Flood Defence, The Netherlands.
%
% FEMA. 2007,  Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update
%
%
%

%-------------------------------------------------------------------------
% CONFIG
%-------------------------------------------------------------------------
fname='inpfiles/YK-105sta_ele_include.csv';   % file with station, elevation, include
                                    % third colunm is 0 for excluded points
imgname='logfiles/YK-105-runup';
SWEL=9.4073;  % 100-yr still water level including wave setup.
H0=3.7367;    % significant wave height at toe of structure
Tp=12.3575;    % peak period, 1/fma,
T0=Tp/1.1;

gamma_berm=0.8768;   % this may get changed automatically below
gamma_rough=0.6;
gamma_beta=1;
gamma_perm=1;

setupAtToe=0.10581;
maxSetup=0.56123;   % only used in case of berm/shallow foreshore weighted average

plotTitle='Iterative TAW for YK-105'

plotTitle =

Iterative TAW for YK-105



% END CONFIG
%------------------------------

SWEL=SWEL+setupAtToe

SWEL =

                   9.51311

SWEL_fore=SWEL+maxSetup

SWEL_fore =

                  10.07434



% FIND WAVELENGTH USING DEEPWATER DISPERSION RELATION
% using English units
L0=32.15/(2*pi)*T0^2

L0 =

          645.768678645481


% Find Hb (Munk, 1949)
%Hb=H0/(3.3*(H0/L0)^(1/3))
%Db=-Hb/.78+SWEL;  % depth at breaking

% The toe elevation here is only used to determine the average
% structure slope, it is not used to depth limit the wave height.
% Any depth limiting or other modification of the wave height
```

```
% to make it consitent with TAW guidance should be performed
% prior to the input of the significant wave height given above.
Ztoe=SWEL-1.5*H0

Ztoe =

                    3.90806


% read the transect
[sta,dep,inc] = textread(fname,'%n%n%n%*[^\n]','delimiter',',','headerlines',0);

% remove unselected points
k=find(inc==0);
sta(k)=[];
dep(k)=[];

sta_org=sta;  % used for plotting purposes
dep_org=dep;


% initial guess at maximum run-up elevation to estimate slope
Z2=SWEL+1.5*H0

Z2 =

                   15.11816


% determine station at the max runup and -1.5*H0 (i.e. the toe)
top_sta=-999;
toe_sta=-999;
for kk=1:length(sta)-1
    if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1)))    % here is the intersection of z2 with profile
       top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
    end
    if  ((Ztoe > dep(kk)) & (Ztoe <= dep(kk+1)))    % here is the intersection of Ztoe with profile
       toe_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Ztoe)
    end
end

toe_sta =

          326.792027257982

% check to make sure we got them, if not extend the end slopes outward
S=diff(dep)./diff(sta);
if toe_sta==-999
   dy=dep(1)-Ztoe;
   toe_sta=sta(1)-dy/S(1)
end
if top_sta==-999
   dy=Z2-dep(end);
   top_sta=sta(end)+dy/S(end)
end

top_sta =

          393.344106523961


% just so the reader can tell the values aren't -999 anymore
top_sta

top_sta =

          393.344106523961

toe_sta

toe_sta =

          326.792027257982




% check for case where the toe of slope is below SWL-1.5*H0
% in this case interpolate setup from the setupAtToe(really setup as first station), and the max setup
% also un-include points seaward of SWL-1.5*H0
if Ztoe > dep(1)
   dd=SWEL_fore-dep;
   k=find(dd<0,1); % k is index of first land point
   staAtSWL=interp1(dep(k-1:k),sta(k-1:k),SWEL_fore);
   dsta=staAtSWL-sta(1);
   dsetup=maxSetup-setupAtToe;
   dsetdsta=dsetup/dsta;
   setup=setupAtToe+dsetdsta*(toe_sta-sta(1));
   sprintf('-!!- Location of SWEL-1.5*H0 is %4.1f ft landward of toe of slope',dsta)
   sprintf('-!!- Setup is interpolated between setup at toe of slope and max setup')
```

```
   sprintf('-!!-       setup is adjusted to %4.2f feet',setup)
   SWEL=SWEL-setupAtToe+setup;
   sprintf('-!!-       SWEL is adjusted to %4.2f feet',SWEL)
   k=find(dep < SWEL-1.5*H0)
   sta(k)=[];
   dep(k)=[];
else
   sprintf('-!!- The User has selected a starting point that is %4.2f feet above the elevation of SWEL-1.5H0\n',dep(1
   sprintf('-!!- This may be reasonable for some cases.  However the user may want to consider:\n')
   sprintf('-!!-   1) Selecting a starting point that is at or below %4.2f feet elevation, or\n', Ztoe)
   sprintf('-!!-   2) Reducing the incident wave height to a depth limited condition.\n')
end

ans =

-!!- Location of SWEL-1.5*H0 is 69.7 ft landward of toe of slope


ans =

-!!- Setup is interpolated between setup at toe of slope and max setup


ans =

-!!-       setup is adjusted to 0.23 feet


ans =

-!!-       SWEL is adjusted to 9.64 feet


k =

     1
     2
     3
     4
     5
     6
     7
     8
     9
    10
    11
    12
    13
    14
    15
    16
    17
    18
    19
    20
    21



% now iterate converge on a runup elevation
tol=0.01;  % convergence criteria
R2del=999;
R2_new=3*H0; %initial guess
R2=R2_new;
iter=0;
R2_all=[];
topStaAll=[];
Berm_Segs=[];
TAW_ALWAYS_VALID=1;
while(abs(R2del) > tol && iter <= 25)
    iter=iter+1;
    sprintf ('!---------------- STARTING ITERATION %d ----------------!',iter)
    % elevation of toe of slope
    Ztoe
    % station of toe slope (relative to 0-NAVD88 shoreline
    toe_sta
    % station of top of slope/extent of 2% run-up
    top_sta
    % elevation of top of slope/extent of 2% run-up
    Z2
    % incident significant wave height
    H0
    % incident spectral peak wave period
    Tp
    % incident spectral mean wave period
    T0

    R2=R2_new
    Z2=R2+SWEL
```

```
% determine slope for this iteration
top_sta=-999;
for kk=1:length(sta)-1
   if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1)))    % here is the intersection of z2 with profile
      top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
      break;
   end
end
if top_sta==-999
   dy=Z2-dep(end);
   top_sta=sta(end)+dy/S(end)
end

% get the length of the slope (not accounting for berm)
Lslope=top_sta-toe_sta

% loop over profile segments to determine berm factor
% re-calculate influence of depth of berm based on this run-up elevation
% check for berm, berm width, berm height
berm_width=0;
rdh_sum=0;
Berm_Segs=[];
Berm_Heights=[];
for kk=1:length(sta)-1
   ddep=dep(kk+1)-dep(kk);
   dsta=sta(kk+1)-sta(kk);
   s=ddep/dsta;
   if  (s < 1/15)     % count it as a berm if slope is flatter than 1:15 (see TAW manual)
      sprintf ('Berm Factor Calculation: Iteration %d, Profile Segment: %d',iter,kk)
      berm_width=berm_width+dsta;   % tally the width of all berm segments
      % compute the rdh for this segment and weight it by the segment length
      dh=SWEL-(dep(kk)+dep(kk+1))/2
      if  dh < 0
          chi=R2;
      else
          chi=2* H0;
      end
      if (dh <= R2 & dh >=-2*H0)
         rdh=(0.5-0.5*cos(3.14159*dh/chi)) ;
      else
         rdh=1;
      end
      rdh_sum=rdh_sum + rdh * dsta
      Berm_Segs=[Berm_Segs, kk];
      Berm_Heights=[Berm_Heights, (dep(kk)+dep(kk+1))/2];
   end
   if dep(kk) >= Z2  % jump out of loop if we reached limit of run-up for this iteration
      break
   end
end
sprintf ('!------- End Berm Factor Calculation, Iter: %d ---------!',iter)
berm_width
rB=berm_width/Lslope
if (berm_width > 0)
   rdh_mean=rdh_sum/berm_width
else
   rdh_mean=1
end
gamma_berm=1- rB * (1-rdh_mean)
if gamma_berm > 1
   gamma_berm=1
end
if gamma_berm < 0.6
   gamma_berm =0.6
end
% Iribarren number
slope=(Z2-Ztoe)/(Lslope-berm_width)
Irb=(slope/(sqrt(H0/L0)))
% runup height
gamma_berm
gamma_perm
gamma_beta
gamma_rough
gamma=gamma_berm*gamma_perm*gamma_beta*gamma_rough

% check validity
TAW_VALID=1;
if (Irb*gamma_berm < 0.5 | Irb*gamma_berm > 10 )
   sprintf('!!! - - Iribaren number: %6.2f is outside the valid range (0.5-10), TAW NOT VALID - - !!!\n', Irb*gam
   TAW_VALID=0;
else
   sprintf('!!! - - Iribaren number: %6.2f is in the valid range (0.5-10), TAW RECOMMENDED - - !!!\n', Irb*gamma_
end
islope=1/slope;
if (slope < 1/8 | slope > 1)
   sprintf('!!! - - slope: 1:%3.1f V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!\n', islope)
   TAW_VALID=0;
else
   sprintf('!!! - - slope: 1:%3.1f V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!\n', islope)
end
```

```
    if TAW_VALID == 0
       TAW_ALWAYS_VALID=0;
    end

    if (Irb*gamma_berm < 1.8)
       R2_new=gamma*H0*1.77*Irb
    else
       R2_new=gamma*H0*(4.3-(1.6/sqrt(Irb)))
    end


    % check to see if we need to evaluate a shallow foreshore
    if berm_width > 0.25 * L0;
       disp ('!   Berm_width is greater than 1/4 wave length')
       disp ('!   Runup will be weighted average with foreshore calculation assuming depth limited wave height on ber
       % do the foreshore calculation
       fore_H0=0.78*(SWEL_fore-min(Berm_Heights))
       % get upper slope
       fore_toe_sta=-999;
       fore_toe_dep=-999;
       for kk=length(dep)-1:-1:1
          ddep=dep(kk+1)-dep(kk);
          dsta=sta(kk+1)-sta(kk);
          s=ddep/dsta;
          if s < 1/15
             break
          end
          fore_toe_sta=sta(kk);
          fore_toe_dep=dep(kk);
          upper_slope=(Z2-fore_toe_dep)/(top_sta-fore_toe_sta)
       end
       fore_Irb=upper_slope/(sqrt(fore_H0/L0));
       fore_gamma=gamma_perm*gamma_beta*gamma_rough;
       if (fore_Irb < 1.8)
          fore_R2=fore_gamma*fore_H0*1.77*fore_Irb;
       else
          fore_R2=fore_gamma*fore_H0*(4.3-(1.6/sqrt(fore_Irb)));
       end
       if berm_width >= L0
          R2_new=fore_R2
          disp ('berm is wider than one wavelength, use full shallow foreshore solution');
       else
          w2=(berm_width-0.25*L0)/(0.75*L0)
          w1=1-w2
          R2_new=w2*fore_R2 + w1*R2_new
       end
    end % end berm width check
    % convergence criterion
    R2del=abs(R2-R2_new)
    R2_all(iter)=R2_new;
    % get the new top station (for plot purposes)
    Z2=R2_new+SWEL
    top_sta=-999;
    for kk=1:length(sta)-1
       if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1)))    % here is the intersection of z2 with profile
          top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
          break;
       end
    end
    if top_sta==-999
       dy=Z2-dep(end);
       top_sta=sta(end)+dy/S(end);
    end
    topStaAll(iter)=top_sta;
end
ans =
!----------------- STARTING ITERATION 1 -----------------!
Ztoe =
                3.90806
toe_sta =
         326.792027257982
top_sta =
         393.344106523961
Z2 =
               15.11816
H0 =
                 3.7367
Tp =
                12.3575
T0 =
         11.2340909090909
R2 =
                11.2101
Z2 =
          20.845954296252
top_sta =
         453.683043773131
Lslope =
         126.891016515149
ans =
```

```
Berm Factor Calculation: Iteration 1, Profile Segment: 26
dh =
          2.81252729625202
rdh_sum =
         0.310601809144891
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 27
dh =
          2.75101129625202
rdh_sum =
         0.609302070071349
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 28
dh =
          2.68949579625202
rdh_sum =
         0.896235481783274
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 29
dh =
          2.62798029625202
rdh_sum =
          1.1715445140836
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 30
dh =
          2.56646429625202
rdh_sum =
          1.43537931694017
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 31
dh =
          2.50494829625202
rdh_sum =
          1.68789780791434
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 32
dh =
          2.44343279625202
rdh_sum =
          1.92926556143339
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 33
dh =
          2.38841079625202
rdh_sum =
          2.16080593444696
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 34
dh =
          2.34637479625202
rdh_sum =
          2.38493482809601
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 35
dh =
          2.31083229625202
rdh_sum =
          2.60286424384892
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 36
dh =
          2.27528979625202
rdh_sum =
          2.81465714801225
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 37
dh =
          2.23974729625202
rdh_sum =
          3.02037787673931
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 38
dh =
          2.20420479625202
rdh_sum =
          3.22009212166845
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 39
dh =
          2.16866229625202
rdh_sum =
          3.41386691525881
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 40
dh =
          2.13312029625202
rdh_sum =
          3.60177069793231
ans =
```

```
Berm Factor Calculation: Iteration 1, Profile Segment: 41
dh =
          2.09757779625202
rdh_sum =
          3.78387305550811
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 42
dh =
          2.06203529625202
rdh_sum =
           3.9602449519276
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 43
dh =
          2.02649279625202
rdh_sum =
          4.13095863033672
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 44
dh =
          1.99095029625202
rdh_sum =
          4.29608759695922
ans =
!------- End Berm Factor Calculation, Iter: 1 ---------!
berm_width =
    19
rB =
           0.14973479227926
rdh_mean =
          0.226109873524169
gamma_berm =
          0.884121722665171
slope =
          0.156990774981472
Irb =
           2.06380426567465
gamma_berm =
          0.884121722665171
gamma_perm =
     1
gamma_beta =
     1
gamma_rough =
                        0.6
gamma =
          0.530473033599103
ans =
!!! - - Iribaren number:   1.82 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:6.4 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!
R2_new =
            6.315854067419
R2del =
            4.894245932581
Z2 =
           15.951708363671
ans =
!----------------- STARTING ITERATION 2 -----------------!
Ztoe =
                    3.90806
toe_sta =
          326.792027257982
top_sta =
          402.125047285504
Z2 =
           15.951708363671
H0 =
                     3.7367
Tp =
                    12.3575
T0 =
          11.2340909090909
R2 =
            6.315854067419
Z2 =
           15.951708363671
top_sta =
          402.125047285504
Lslope =
          75.3330200275217
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 26
dh =
          2.81252729625202
rdh_sum =
          0.310601809144891
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 27
dh =
```

```
          2.75101129625202
rdh_sum =
         0.609302070071349
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 28
dh =
          2.68949579625202
rdh_sum =
         0.896235481783274
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 29
dh =
          2.62798029625202
rdh_sum =
          1.1715445140836
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 30
dh =
          2.56646429625202
rdh_sum =
          1.43537931694017
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 31
dh =
          2.50494829625202
rdh_sum =
          1.68789780791434
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 32
dh =
          2.44343279625202
rdh_sum =
          1.92926556143339
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 33
dh =
          2.38841079625202
rdh_sum =
          2.16080593444696
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 34
dh =
          2.34637479625202
rdh_sum =
          2.38493482809601
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 35
dh =
          2.31083229625202
rdh_sum =
          2.60286424384892
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 36
dh =
          2.27528979625202
rdh_sum =
          2.81465714801225
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 37
dh =
          2.23974729625202
rdh_sum =
          3.02037787673931
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 38
dh =
          2.20420479625202
rdh_sum =
          3.22009212166845
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 39
dh =
          2.16866229625202
rdh_sum =
          3.41386691525881
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 40
dh =
          2.13312029625202
rdh_sum =
          3.60177069793231
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 41
dh =
          2.09757779625202
rdh_sum =
          3.78387305550811
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 42
dh =
```

```
          2.06203529625202
rdh_sum =
           3.9602449519276
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 43
dh =
          2.02649279625202
rdh_sum =
          4.13095863033672
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 44
dh =
          1.99095029625202
rdh_sum =
          4.29608759695922
ans =
!------- End Berm Factor Calculation, Iter: 2 ---------!
berm_width =
    19
rB =
          0.252213438317734
rdh_mean =
          0.226109873524169
gamma_berm =
          0.804814510321385
slope =
          0.213793763547331
Irb =
           2.81053763340994
gamma_berm =
          0.804814510321385
gamma_perm =
     1
gamma_beta =
     1
gamma_rough =
                       0.6
gamma =
          0.482888706192831
ans =
!!! - - Iribaren number:   2.26 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:4.7 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!
R2_new =
           6.03685528351079
R2del =
          0.278998783908204
Z2 =
           15.6727095797628
ans =
!----------------- STARTING ITERATION 3 -----------------!
Ztoe =
                    3.90806
toe_sta =
          326.792027257982
top_sta =
          399.185959524296
Z2 =
          15.6727095797628
H0 =
                     3.7367
Tp =
                    12.3575
T0 =
          11.2340909090909
R2 =
          6.03685528351079
Z2 =
          15.6727095797628
top_sta =
          399.185959524296
Lslope =
          72.3939322663136
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 26
dh =
          2.81252729625202
rdh_sum =
          0.310601809144891
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 27
dh =
          2.75101129625202
rdh_sum =
          0.609302070071349
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 28
dh =
          2.68949579625202
rdh_sum =
```

```
         0.896235481783274
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 29
dh =
          2.62798029625202
rdh_sum =
           1.1715445140836
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 30
dh =
          2.56646429625202
rdh_sum =
          1.43537931694017
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 31
dh =
          2.50494829625202
rdh_sum =
          1.68789780791434
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 32
dh =
          2.44343279625202
rdh_sum =
          1.92926556143339
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 33
dh =
          2.38841079625202
rdh_sum =
          2.16080593444696
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 34
dh =
          2.34637479625202
rdh_sum =
          2.38493482809601
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 35
dh =
          2.31083229625202
rdh_sum =
          2.60286424384892
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 36
dh =
          2.27528979625202
rdh_sum =
          2.81465714801225
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 37
dh =
          2.23974729625202
rdh_sum =
          3.02037787673931
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 38
dh =
          2.20420479625202
rdh_sum =
          3.22009212166845
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 39
dh =
          2.16866229625202
rdh_sum =
          3.41386691525881
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 40
dh =
          2.13312029625202
rdh_sum =
          3.60177069793231
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 41
dh =
          2.09757779625202
rdh_sum =
          3.78387305550811
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 42
dh =
          2.06203529625202
rdh_sum =
           3.9602449519276
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 43
dh =
          2.02649279625202
rdh_sum =
```

```
          4.13095863033672
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 44
dh =
          1.99095029625202
rdh_sum =
          4.29608759695922
ans =
!------- End Berm Factor Calculation, Iter: 3 ---------!
berm_width =
    19
rB =
          0.262452935007111
rdh_mean =
          0.226109873524169
gamma_berm =
          0.796890264933394
slope =
          0.220336826309853
Irb =
           2.8965528839332
gamma_berm =
          0.796890264933394
gamma_perm =
     1
gamma_beta =
     1
gamma_rough =
                       0.6
gamma =
          0.478134158960036
ans =
!!! - - Iribaren number:   2.31 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:4.5 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!
R2_new =
           6.00292477229057
R2del =
        0.0339305112202197
Z2 =
           15.6387790685426
ans =
!----------------- STARTING ITERATION 4 -----------------!
Ztoe =
                    3.90806
toe_sta =
          326.792027257982
top_sta =
          398.828521585456
Z2 =
          15.6387790685426
H0 =
                     3.7367
Tp =
                    12.3575
T0 =
          11.2340909090909
R2 =
          6.00292477229057
Z2 =
          15.6387790685426
top_sta =
          398.828521585456
Lslope =
          72.0364943274741
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 26
dh =
          2.81252729625202
rdh_sum =
          0.310601809144891
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 27
dh =
          2.75101129625202
rdh_sum =
          0.609302070071349
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 28
dh =
          2.68949579625202
rdh_sum =
          0.896235481783274
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 29
dh =
          2.62798029625202
rdh_sum =
           1.1715445140836
ans =
```

```
Berm Factor Calculation: Iteration 4, Profile Segment: 30
dh =
          2.56646429625202
rdh_sum =
          1.43537931694017
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 31
dh =
          2.50494829625202
rdh_sum =
          1.68789780791434
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 32
dh =
          2.44343279625202
rdh_sum =
          1.92926556143339
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 33
dh =
          2.38841079625202
rdh_sum =
          2.16080593444696
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 34
dh =
          2.34637479625202
rdh_sum =
          2.38493482809601
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 35
dh =
          2.31083229625202
rdh_sum =
          2.60286424384892
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 36
dh =
          2.27528979625202
rdh_sum =
          2.81465714801225
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 37
dh =
          2.23974729625202
rdh_sum =
          3.02037787673931
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 38
dh =
          2.20420479625202
rdh_sum =
          3.22009212166845
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 39
dh =
          2.16866229625202
rdh_sum =
          3.41386691525881
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 40
dh =
          2.13312029625202
rdh_sum =
          3.60177069793231
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 41
dh =
          2.09757779625202
rdh_sum =
          3.78387305550811
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 42
dh =
          2.06203529625202
rdh_sum =
           3.9602449519276
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 43
dh =
          2.02649279625202
rdh_sum =
          4.13095863033672
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 44
dh =
          1.99095029625202
rdh_sum =
          4.29608759695922
ans =
```

```
!------- End Berm Factor Calculation, Iter: 4 ---------!
berm_width =
    19
rB =
         0.26375520043531
rdh_mean =
         0.226109873524169
gamma_berm =
         0.79588245457646
slope =
         0.221182022252663
Irb =
         2.90766384884376
gamma_berm =
         0.79588245457646
gamma_perm =
     1
gamma_beta =
     1
gamma_rough =
                      0.6
gamma =
         0.477529472745876
ans =
!!! - - Iribaren number:   2.31 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:4.5 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!
R2_new =
         5.99854119440962
R2del =
       0.00438357788095534
Z2 =
         15.6343954906616
% final 2% runup elevation
Z2=R2_new+SWEL
Z2 =
         15.6343954906616
diary off
-1.000000e+00
```