

```

diary on          % begin recording

% FEMA appeal for The Town of Harpswell, Cumberland county, Maine
% TRANSECT ID: YK-15
% calculation by SJH, Ransom Consulting, Inc. 06-Feb-2020
% 100-year wave runup using TAW methodology
% including berm and weighted average with foreshore if necessary
%
% chk nld 20181015
%
% 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='infiles/YK-15sta_ele_include.csv'; % file with station, elevation, include
% third column is 0 for excluded points
imgname='logfiles/YK-15-runup';
SWEL=9.2819; % 100-yr still water level including wave setup.
H0=6.2414; % significant wave height at toe of structure
Tp=12.7769; % peak period, 1/fma,
T0=Tp/1.1;

gamma_berm=0.97227; % this may get changed automatically below
gamma_rough=1;
gamma_beta=1;
gamma_perm=1;

setupAtToe=0.18011;
maxSetup=1.0731; % only used in case of berm/shallow foreshore weighted average

plotTitle='Iterative TAW for YK-15'

plotTitle =

Iterative TAW for YK-15

% END CONFIG
%-----

SWEL=SWEL+setupAtToe

SWEL =

          9.46201

SWEL_fore=SWEL+maxSetup

SWEL_fore =

          10.53511

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

L0 =

          690.345868498104

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

Ztoe =

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0.0999099999999995

% 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 =

    18.82411

% 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 =

    0.137300683371296

% 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 =

    139.009591194968

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

top_sta =

    139.009591194968

toe_sta

toe_sta =

    0.137300683371296

% 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',de
    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')

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end

ans =

-!!- Location of SWEL-1.5*H0 is 73.7 ft landward of toe of slope

ans =

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

ans =

-!!-      setup is adjusted to 0.28 feet

ans =

-!!-      SWEL is adjusted to 9.56 feet

k =

    1
    2
    3
    4
    5
    6
    7
    8
    9

% now iterate converge on a runup elevation
tol=0.001; % 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)

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        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('!!! - - Iribarren number: %6.2f is outside the valid range (0.5-10), TAW NOT VALID - - !!!\n', Irb)
    TAW_VALID=0;
else
    sprintf('!!! - - Iribarren number: %6.2f is in the valid range (0.5-10), TAW RECOMMENDED - - !!!\n', Irb*gamma_berm)
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
    % 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;
    end
end

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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_old
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 =

    0.0999099999999995

toe_sta =

    0.137300683371296

top_sta =

    139.009591194968

Z2 =

    18.82411

H0 =

    6.2414

Tp =

    12.7769

T0 =

    11.6153636363636

R2 =

    18.7242

Z2 =

    28.2847933979306

top_sta =

    287.762474810226

Lslope =

    287.625174126855

ans =

```

Berm Factor Calculation: Iteration 1, Profile Segment: 51

dh =

0.62044339793057

rdh_sum =

0.00608326474456938

ans =

Berm Factor Calculation: Iteration 1, Profile Segment: 52

dh =

0.57329339793057

rdh_sum =

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 1, Profile Segment: 53

dh =

0.52614339793057

rdh_sum =

0.0156557422356077

ans =

Berm Factor Calculation: Iteration 1, Profile Segment: 54

dh =

0.47704339793057

rdh_sum =

0.0192549676367879

ans =

Berm Factor Calculation: Iteration 1, Profile Segment: 58

dh =

0.148243397930569

rdh_sum =

0.0196029164348988

ans =

Berm Factor Calculation: Iteration 1, Profile Segment: 87

dh =

-5.98750660206943

rdh_sum =

0.251389086452627

ans =

!----- End Berm Factor Calculation, Iter: 1 -----!

berm_width =

```

rB =
    0.0208604828079261

rdh_mean =
    0.0418981810754378

gamma_berm =
    0.980013533478082

slope =
    0.10007941756384

Irb =
    1.05253640463838

gamma_berm =
    0.980013533478082

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.980013533478082

ans =
!!! - - Iribaren number: 1.03 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:10.0 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    11.3952663845299

R2del =
    7.32893361547014

Z2 =
    20.9558597824604

ans =
!----- STARTING ITERATION 2 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =

```

172.52766953554

Z2 =

20.9558597824604

H0 =

6.2414

TP =

12.7769

T0 =

11.6153636363636

R2 =

11.3952663845299

Z2 =

20.9558597824604

top_sta =

172.52766953554

Lslope =

172.390368852169

ans =

Berm Factor Calculation: Iteration 2, Profile Segment: 51

dh =

0.62044339793057

rdh_sum =

0.00608326474456938

ans =

Berm Factor Calculation: Iteration 2, Profile Segment: 52

dh =

0.57329339793057

rdh_sum =

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 2, Profile Segment: 53

dh =

0.52614339793057

rdh_sum =

0.0156557422356077

ans =

Berm Factor Calculation: Iteration 2, Profile Segment: 54

dh =

0.47704339793057


```
rdh_sum =
    0.0192549676367879

ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 58

dh =
    0.148243397930569

rdh_sum =
    0.0196029164348988

ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 87

dh =
   -5.98750660206943

rdh_sum =
    0.559517705584329

ans =
!----- End Berm Factor Calculation, Iter: 2 -----!

berm_width =
    6

rB =
    0.0348047285933081

rdh_mean =
    0.0932529509307214

gamma_berm =
    0.968440915054361

slope =
    0.125343491491326

Irb =
    1.31823896551901

gamma_berm =
    0.968440915054361

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.968440915054361
```

```

ans =
!!! - - Iribaren number: 1.28 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.0 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!

R2_new =
14.1033588731152

R2del =
2.70809248858536

Z2 =
23.6639522710458

ans =
!----- STARTING ITERATION 3 -----!

Ztoe =
0.0999099999999995

toe_sta =
0.137300683371296

top_sta =
215.107740110781

Z2 =
23.6639522710458

H0 =
6.2414

Tp =
12.7769

T0 =
11.6153636363636

R2 =
14.1033588731152

Z2 =
23.6639522710458

top_sta =
215.107740110781

Lslope =
214.97043942741

ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 51

dh =
0.62044339793057

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```
rdh_sum =
    0.00608326474456938

ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 52

dh =
    0.57329339793057

rdh_sum =
    0.0112786210205525

ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 53

dh =
    0.52614339793057

rdh_sum =
    0.0156557422356077

ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 54

dh =
    0.47704339793057

rdh_sum =
    0.0192549676367879

ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 58

dh =
    0.148243397930569

rdh_sum =
    0.0196029164348988

ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 87

dh =
    -5.98750660206943

rdh_sum =
    0.402184420469069

ans =
!----- End Berm Factor Calculation, Iter: 3 -----!

berm_width =
    6

rB =
    0.0279108142309308
```

```

rdh_mean =
    0.0670307367448448

gamma_berm =
    0.973960068210117

slope =
    0.112762562664904

Irb =
    1.18592518995645

gamma_berm =
    0.973960068210117

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.973960068210117

ans =
!!! - - Iribaren number: 1.16 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.9 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    12.7600897277018

R2del =
    1.34326914541338

Z2 =
    22.3206831256324

ans =
!----- STARTING ITERATION 4 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =
    193.987156063401

Z2 =
    22.3206831256324

```

```

H0 =
        6.2414

Tp =
        12.7769

T0 =
        11.6153636363636

R2 =
        12.7600897277018

Z2 =
        22.3206831256324

top_sta =
        193.987156063401

Lslope =
        193.84985538003

ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 51

dh =
        0.62044339793057

rdh_sum =
        0.00608326474456938

ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 52

dh =
        0.57329339793057

rdh_sum =
        0.0112786210205525

ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 53

dh =
        0.52614339793057

rdh_sum =
        0.0156557422356077

ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 54

dh =
        0.47704339793057

rdh_sum =
        0.0192549676367879

```

```

ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 58

dh =
    0.148243397930569

rdh_sum =
    0.0196029164348988

ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 87

dh =
   -5.98750660206943

rdh_sum =
    0.471355124267988

ans =
!----- End Berm Factor Calculation, Iter: 4 -----!

berm_width =
    6

rB =
    0.0309517899213151

rdh_mean =
    0.0785591873779981

gamma_berm =
    0.971479757542798

slope =
    0.118290073104814

Irb =
    1.24405808188013

gamma_berm =
    0.971479757542798

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.971479757542798

ans =
!!! - - Iribaren number: 1.21 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

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ans =

!!! - - slope: 1:8.5 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =

    13.351488796225

R2del =

    0.591399068523152

Z2 =

    22.9120821941556

ans =

!----- STARTING ITERATION 5 -----!

Ztoe =

    0.0999099999999995

toe_sta =

    0.137300683371296

top_sta =

    203.285883555903

Z2 =

    22.9120821941556

H0 =

    6.2414

Tp =

    12.7769

T0 =

    11.6153636363636

R2 =

    13.351488796225

Z2 =

    22.9120821941556

top_sta =

    203.285883555903

Lslope =

    203.148582872532

ans =

Berm Factor Calculation: Iteration 5, Profile Segment: 51

dh =

    0.62044339793057

rdh_sum =

    0.00608326474456938

```

```
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 52

dh =

    0.57329339793057

rdh_sum =

    0.0112786210205525

ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 53

dh =

    0.52614339793057

rdh_sum =

    0.0156557422356077

ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 54

dh =

    0.47704339793057

rdh_sum =

    0.0192549676367879

ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 58

dh =

    0.148243397930569

rdh_sum =

    0.0196029164348988

ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 87

dh =

   -5.98750660206943

rdh_sum =

    0.438984926669583

ans =
!----- End Berm Factor Calculation, Iter: 5 -----!

berm_width =

    6

rB =

    0.029535032512458

rdh_mean =

    0.0731641544449305
```



```

gamma_berm =
    0.97262587316782

slope =
    0.115710556280818

Irb =
    1.21692927328269

gamma_berm =
    0.97262587316782

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.97262587316782

ans =
!!! - - Iribaren number: 1.18 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    13.0757449067675

R2del =
    0.275743889457516

Z2 =
    22.636338304698

ans =
!----- STARTING ITERATION 6 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =
    198.950287809716

Z2 =
    22.636338304698

H0 =
    6.2414

```

Tp =
 12.7769

 T0 =
 11.6153636363636

 R2 =
 13.0757449067675

 Z2 =
 22.636338304698

 top_sta =
 198.950287809716

 Lslope =
 198.812987126345

 ans =
 Berm Factor Calculation: Iteration 6, Profile Segment: 51

 dh =
 0.62044339793057

 rdh_sum =
 0.00608326474456938

 ans =
 Berm Factor Calculation: Iteration 6, Profile Segment: 52

 dh =
 0.57329339793057

 rdh_sum =
 0.0112786210205525

 ans =
 Berm Factor Calculation: Iteration 6, Profile Segment: 53

 dh =
 0.52614339793057

 rdh_sum =
 0.0156557422356077

 ans =
 Berm Factor Calculation: Iteration 6, Profile Segment: 54

 dh =
 0.47704339793057

 rdh_sum =
 0.0192549676367879

 ans =
 Berm Factor Calculation: Iteration 6, Profile Segment: 58

```

dh =
    0.148243397930569

rdh_sum =
    0.0196029164348988

ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 87

dh =
    -5.98750660206943

rdh_sum =
    0.45367907178888

ans =
!----- End Berm Factor Calculation, Iter: 6 -----!

berm_width =
    6

rB =
    0.0301791149900435

rdh_mean =
    0.07561317863148

gamma_berm =
    0.972102823822639

slope =
    0.11688231503789

Irb =
    1.22925267383092

gamma_berm =
    0.972102823822639

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.972102823822639

ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

```

```

R2_new =
    13.2010552683118

R2del =
    0.125310361544315

Z2 =
    22.7616486662424

ans =
!----- STARTING ITERATION 7 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =
    200.920576513243

Z2 =
    22.7616486662424

H0 =
    6.2414

Tp =
    12.7769

T0 =
    11.6153636363636

R2 =
    13.2010552683118

Z2 =
    22.7616486662424

top_sta =
    200.920576513243

Lslope =
    200.783275829872

ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 51

dh =
    0.62044339793057

rdh_sum =
    0.00608326474456938

ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 52

```

```

dh =

    0.57329339793057

rdh_sum =

    0.0112786210205525

ans =

Berm Factor Calculation: Iteration 7, Profile Segment: 53

dh =

    0.52614339793057

rdh_sum =

    0.0156557422356077

ans =

Berm Factor Calculation: Iteration 7, Profile Segment: 54

dh =

    0.47704339793057

rdh_sum =

    0.0192549676367879

ans =

Berm Factor Calculation: Iteration 7, Profile Segment: 58

dh =

    0.148243397930569

rdh_sum =

    0.0196029164348988

ans =

Berm Factor Calculation: Iteration 7, Profile Segment: 87

dh =

    -5.98750660206943

rdh_sum =

    0.446917288010514

ans =

!----- End Berm Factor Calculation, Iter: 7 -----!

berm_width =

    6

rB =

    0.0298829669712329

rdh_mean =

    0.074486214668419

gamma_berm =

    0.972342902121516

slope =

```

```

0.116343349138638

Irb =
    1.22358436316694

gamma_berm =
    0.972342902121516

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.972342902121516

ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    13.143427973929

R2del =
    0.0576272943827796

Z2 =
    22.7040213718596

ans =
!----- STARTING ITERATION 8 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =
    200.014486978922

Z2 =
    22.7040213718596

H0 =
    6.2414

Tp =
    12.7769

```

```
T0 =  
    11.6153636363636  
  
R2 =  
    13.143427973929  
  
Z2 =  
    22.7040213718596  
  
top_sta =  
    200.014486978922  
  
Lslope =  
    199.877186295551  
  
ans =  
Berm Factor Calculation: Iteration 8, Profile Segment: 51  
  
dh =  
    0.62044339793057  
  
rdh_sum =  
    0.00608326474456938  
  
ans =  
Berm Factor Calculation: Iteration 8, Profile Segment: 52  
  
dh =  
    0.57329339793057  
  
rdh_sum =  
    0.0112786210205525  
  
ans =  
Berm Factor Calculation: Iteration 8, Profile Segment: 53  
  
dh =  
    0.52614339793057  
  
rdh_sum =  
    0.0156557422356077  
  
ans =  
Berm Factor Calculation: Iteration 8, Profile Segment: 54  
  
dh =  
    0.47704339793057  
  
rdh_sum =  
    0.0192549676367879  
  
ans =  
Berm Factor Calculation: Iteration 8, Profile Segment: 58  
  
dh =  
    0.148243397930569  
  
rdh_sum =
```

0.0196029164348988

ans =

Berm Factor Calculation: Iteration 8, Profile Segment: 87

dh =

-5.98750660206943

rdh_sum =

0.450009254625427

ans =

!----- End Berm Factor Calculation, Iter: 8 -----!

berm_width =

6

rB =

0.0300184333750227

rdh_mean =

0.0750015424375712

gamma_berm =

0.972232995429663

slope =

0.116589846406174

Irb =

1.22617677781165

gamma_berm =

0.972232995429663

gamma_perm =

1

gamma_beta =

1

gamma_rough =

1

gamma =

0.972232995429663

ans =

!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =

!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =

13.1697862373223


```

R2del =
    0.0263582633932824

Z2 =
    22.7303796352529

ans =
!----- STARTING ITERATION 9 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =
    200.42892508259

Z2 =
    22.7303796352529

H0 =
    6.2414

Tp =
    12.7769

T0 =
    11.6153636363636

R2 =
    13.1697862373223

Z2 =
    22.7303796352529

top_sta =
    200.42892508259

Lslope =
    200.291624399219

ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 51

dh =
    0.62044339793057

rdh_sum =
    0.00608326474456938

ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 52

dh =
    0.57329339793057

rdh_sum =

```

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 9, Profile Segment: 53

dh =

0.52614339793057

rdh_sum =

0.0156557422356077

ans =

Berm Factor Calculation: Iteration 9, Profile Segment: 54

dh =

0.47704339793057

rdh_sum =

0.0192549676367879

ans =

Berm Factor Calculation: Iteration 9, Profile Segment: 58

dh =

0.148243397930569

rdh_sum =

0.0196029164348988

ans =

Berm Factor Calculation: Iteration 9, Profile Segment: 87

dh =

-5.98750660206943

rdh_sum =

0.448591311516428

ans =

!----- End Berm Factor Calculation, Iter: 9 -----!

berm_width =

6

rB =

0.029956320030841

rdh_mean =

0.0747652185860713

gamma_berm =

0.972283370784299

slope =

0.11647681522675

Irb =

```

1.22498802757609

gamma_berm =
    0.972283370784299

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.972283370784299

ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    13.157700150674

R2del =
    0.0120860866482602

Z2 =
    22.7182935486046

ans =
!----- STARTING ITERATION 10 -----!

Ztoe =
    0.0999099999999995

toe_sta =
    0.137300683371296

top_sta =
    200.238892273655

Z2 =
    22.7182935486046

H0 =
    6.2414

Tp =
    12.7769

T0 =
    11.6153636363636

R2 =

```

13.157700150674

Z2 =

22.7182935486046

top_sta =

200.238892273655

Lslope =

200.101591590284

ans =

Berm Factor Calculation: Iteration 10, Profile Segment: 51

dh =

0.62044339793057

rdh_sum =

0.00608326474456938

ans =

Berm Factor Calculation: Iteration 10, Profile Segment: 52

dh =

0.57329339793057

rdh_sum =

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 10, Profile Segment: 53

dh =

0.52614339793057

rdh_sum =

0.0156557422356077

ans =

Berm Factor Calculation: Iteration 10, Profile Segment: 54

dh =

0.47704339793057

rdh_sum =

0.0192549676367879

ans =

Berm Factor Calculation: Iteration 10, Profile Segment: 58

dh =

0.148243397930569

rdh_sum =

0.0196029164348988

ans =

Berm Factor Calculation: Iteration 10, Profile Segment: 87

dh =

-5.98750660206943

rdh_sum =

0.44924070584552

ans =

!----- End Berm Factor Calculation, Iter: 10 -----!

berm_width =

6

rB =

0.0299847689981659

rdh_mean =

0.0748734509742533

gamma_berm =

0.972260294133393

slope =

0.11652858363134

Irb =

1.22553247649243

gamma_berm =

0.972260294133393

gamma_perm =

1

gamma_beta =

1

gamma_rough =

1

gamma =

0.972260294133393

ans =

!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =

!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =

13.1632356924805

R2del =

0.00553554180651439

Z2 =

22.7238290904111

ans =

!----- STARTING ITERATION 11 -----!

Ztoe =

0.0999099999999995

toe_sta =

0.137300683371296

top_sta =

200.325929094513

Z2 =

22.7238290904111

H0 =

6.2414

Tp =

12.7769

T0 =

11.6153636363636

R2 =

13.1632356924805

Z2 =

22.7238290904111

top_sta =

200.325929094513

Lslope =

200.188628411141

ans =

Berm Factor Calculation: Iteration 11, Profile Segment: 51

dh =

0.62044339793057

rdh_sum =

0.00608326474456938

ans =

Berm Factor Calculation: Iteration 11, Profile Segment: 52

dh =

0.57329339793057

rdh_sum =

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 11, Profile Segment: 53

dh =

0.52614339793057

rdh_sum =

0.0156557422356077

ans =

Berm Factor Calculation: Iteration 11, Profile Segment: 54

dh =

0.47704339793057

rdh_sum =

0.0192549676367879

ans =

Berm Factor Calculation: Iteration 11, Profile Segment: 58

dh =

0.148243397930569

rdh_sum =

0.0196029164348988

ans =

Berm Factor Calculation: Iteration 11, Profile Segment: 87

dh =

-5.98750660206943

rdh_sum =

0.448943113997963

ans =

!----- End Berm Factor Calculation, Iter: 11 -----!

berm_width =

6

rB =

0.0299717323986924

rdh_mean =

0.0748238523329938

gamma_berm =

0.972270868080471

slope =

0.116504860637417

Irb =

1.22528298148798

gamma_berm =

0.972270868080471

```

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.972270868080471

ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    13.1606990385011

R2del =
    0.00253665397939962

Z2 =
    22.7212924364317

ans =
!----- STARTING ITERATION 12 -----!

Ztoe =
    0.09990999999999995

toe_sta =
    0.137300683371296

top_sta =
    200.286044597981

Z2 =
    22.7212924364317

H0 =
    6.2414

Tp =
    12.7769

T0 =
    11.6153636363636

R2 =
    13.1606990385011

Z2 =

```


22.7212924364317

top_sta =

200.286044597981

Lslope =

200.14874391461

ans =

Berm Factor Calculation: Iteration 12, Profile Segment: 51

dh =

0.62044339793057

rdh_sum =

0.00608326474456938

ans =

Berm Factor Calculation: Iteration 12, Profile Segment: 52

dh =

0.57329339793057

rdh_sum =

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 12, Profile Segment: 53

dh =

0.52614339793057

rdh_sum =

0.0156557422356077

ans =

Berm Factor Calculation: Iteration 12, Profile Segment: 54

dh =

0.47704339793057

rdh_sum =

0.0192549676367879

ans =

Berm Factor Calculation: Iteration 12, Profile Segment: 58

dh =

0.148243397930569

rdh_sum =

0.0196029164348988

ans =

Berm Factor Calculation: Iteration 12, Profile Segment: 87

dh =

-5.98750660206943

```

rdh_sum =
    0.449079450791231

ans =
!----- End Berm Factor Calculation, Iter: 12 -----!

berm_width =
    6

rB =
    0.0299777049940408

rdh_mean =
    0.0748465751318718

gamma_berm =
    0.972266023555077

slope =
    0.116515729024654

Irb =
    1.22539728444363

gamma_berm =
    0.972266023555077

gamma_perm =
    1

gamma_beta =
    1

gamma_rough =
    1

gamma =
    0.972266023555077

ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =
    13.1618611786255

R2del =
    0.00116214012432181

Z2 =
    22.722454576556

ans =

```

!----- STARTING ITERATION 13 -----!

Ztoe =

0.0999099999999995

toe_sta =

0.137300683371296

top_sta =

200.304317241445

Z2 =

22.722454576556

H0 =

6.2414

Tp =

12.7769

T0 =

11.6153636363636

R2 =

13.1618611786255

Z2 =

22.722454576556

top_sta =

200.304317241445

Lslope =

200.167016558074

ans =

Berm Factor Calculation: Iteration 13, Profile Segment: 51

dh =

0.62044339793057

rdh_sum =

0.00608326474456938

ans =

Berm Factor Calculation: Iteration 13, Profile Segment: 52

dh =

0.57329339793057

rdh_sum =

0.0112786210205525

ans =

Berm Factor Calculation: Iteration 13, Profile Segment: 53

dh =

0.52614339793057

```

rdh_sum =
    0.0156557422356077

ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 54

dh =
    0.47704339793057

rdh_sum =
    0.0192549676367879

ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 58

dh =
    0.148243397930569

rdh_sum =
    0.0196029164348988

ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 87

dh =
    -5.98750660206943

rdh_sum =
    0.449016982401097

ans =
!----- End Berm Factor Calculation, Iter: 13 -----!

berm_width =
    6

rB =
    0.0299749684197308

rdh_mean =
    0.0748361637335162

gamma_berm =
    0.972268243224835

slope =
    0.116510749238349

Irb =
    1.22534491197283

gamma_berm =
    0.972268243224835

gamma_perm =
    1

```

gamma_beta =

1

gamma_rough =

1

gamma =

0.972268243224835

ans =

!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!

ans =

!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!

R2_new =

13.1613286985788

R2del =

0.000532480046684825

Z2 =

22.7219220965094

% final 2% runup elevation

Z2=R2_new+SWEL

Z2 =

22.7219220965094

diary off