Auxiliary Spillway Layout Using the NRCS Tool

Overview: Create the surface model and earthwork volumes for the auxiliary spillway component of a pond embankment. The auxiliary spillway surface will tie into the embankment slope projections. Design elevations and dimensions of the auxiliary spillway from SITES or WinPond are needed in this process.

Software: AutoCAD Civil 3D 2018, Civil 3D Workspace, NRCS C3D 2018 template V1.0 (6/16/18), NRCS Customization 1.0

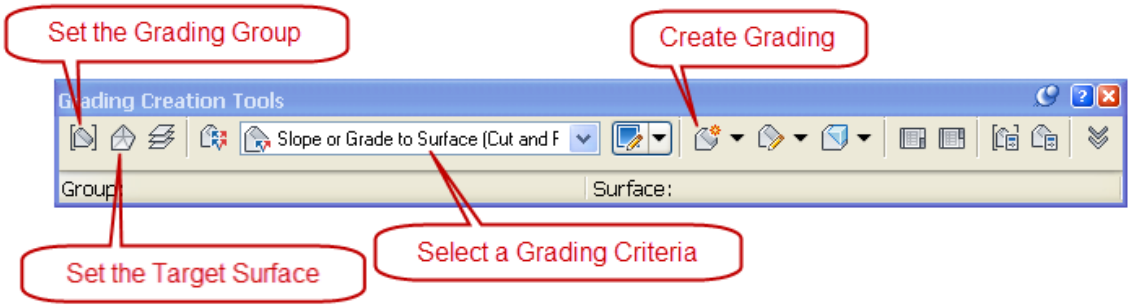
Prerequisite: A surveyed site with a surface model covering the footprint of the dam is needed. Create the pond embankment top of fill, but not slope projections. Refer to the instructions for *Pond Embankment*: "Placing the Centerline & Top of Dam".

Notation Method
Button to Press *Displayed Text* **Icon** Action {Text to Enter} *Menu Item…*

Auxiliary Spillway Layout

Grade the slopes of the embankment for a preliminary layout. Ignore any wave berm.

1) Click *Home… Create Design… Grading… Grading Creating Tools…*



2) Click **Set the Grading Group** .
3) Set the *Site* to *Embankment*. Click OK
4) Input a Grading Group *Name* as {*Embankment*} Click OK
5) Click **Set the Target Surface** . Select *Ognd*. Click OK

Downstream & Upstream embankment toe (preliminary)

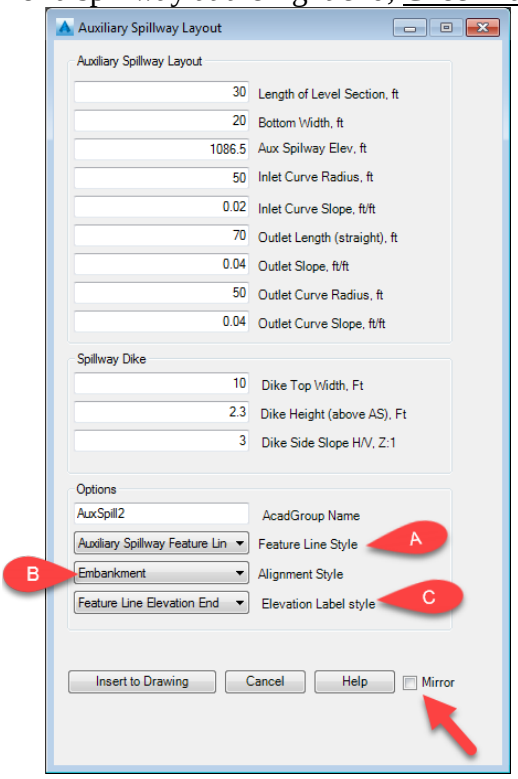
6) Pulldown the **Select a Grading Criteria** Slope to *Slope or Grade to Surface (Fill)*
7) Click **Create Grading.**
8) Select the downstream edge of the dam. Click downstream of the dam.
9) Apply to entire length? Input *Y* Press Enter
10) Slope or grade? Input *S* Press Enter.
11) Fill Slope? Input *3.* Press Enter
12) Select the upstream edge of the dam. Click upstream of the dam.
13) Apply to entire length? Input *Y* Press Enter
14) Slope or grade? Input *S* Press Enter.

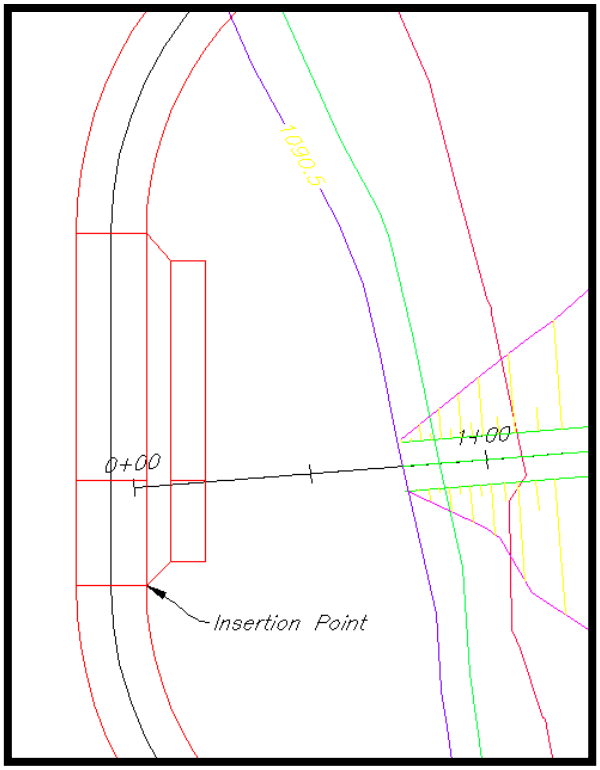
15) Fill Slope? Input *3*. Press Enter
16) Press ESC to exit the command
17) Close the Grading Tool
18) Use *Analyze…Inquiry… Distance…* to show the backslope distance and help determine the Outlet Length (Straight) needed for the spillway layout.

Placing the Spillway Layout

19) From Civil 3D Click *NRCS … NRCS Dams… Auxiliary Spillway ….*
20) Input the dimensions, slopes, radius and auxiliary spillway elevation. Use a dike height that accounts for the actual overfill where the spillway dike joins the dam.

    (The **Insert Elevation Point**  tool of the Feature Line Elevation Editor allows you to track elevations along the top of dam feature line.)
21) Set these:
    A- *Feature Line Style* to *Auxiliary Spillway Feature Line*.
    B – *Alignment Style* to *Embankment*
    C- *Elevation Label Style* to *Feature Line Elevation End*
22) For a spillway at the left end of the embankment leave the **Mirror** box Unchecked. For a spillway at the right end, Checkmark **Mirror**.

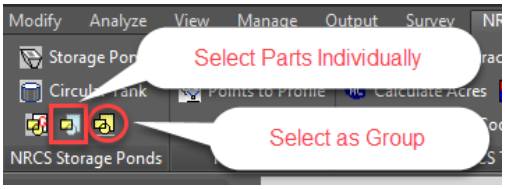




Note: If a second option for a spillway layout is being inserted, the **AcadGroup Name** should be changed to *AuxSpill2*. (Spaces are NOT allowed in the name)

23) Click Insert into Drawing. Select an insertion point in CAD for the upstream inside corner of the spillway level section.

Note: The spillway objects can be selected as a group or separately.
Separately: Click *NRCS … NRCS Storage Ponds… Turn Off: Selection by Group* .
As a group: Use *Turn On: Selection by Group* .

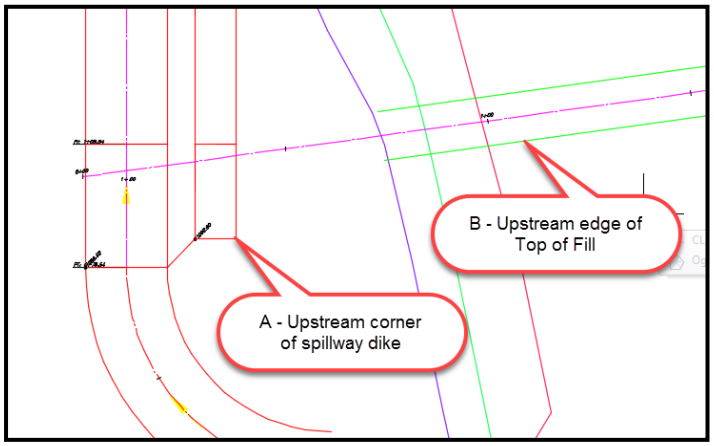


24) If the elevation of the spillway needs to be raised or lowered:
Select the spillway group, then click *Modify…Edit Elevations…Raise/Lower…*
Then input the elevation change E.g.{ *-3*}. *Press Enter*

Move and rotate the spillway as a group to make the layout fit the site. Use the User Defined Contours to help keep the level section and straight outlet section of the spillway bottom in cut.

25) Turn off the OsnapZ elevation setting: Type *Osnapz* Press Enter, Type *1* Press Enter
(This allows you to use Osnaps without changing the Elevation of the objects.)

26) To move the spillway layout and maintain the same elevation:
   a) Select any line of the spillway, Right-Click *Basic Modify… Move…*
   b) Shift + Right-click *Endpoint* to Point A of the spillway dike.
   c) Shift + Right-click *Nearest* along the (B) upstream top of fill so that the level section is in cut.



27) To rotate the spillway layout:
   a) Select any line of the spillway.
   b) Right-Click *Basic Modify… Rotate…*
   c) Shift + Right-click *Endpoint* to the pivot point A.
   d) Move your cursor to obtain the new rotation angle and click to set it.

Repeat as needed.
The Move and Rotate steps can also be used after the grading has been applied.
28) Save the drawing.

Grade the slopes for the preliminary auxiliary spillway layout.
29) Click *Home… Create Design… Grading… Grading Creating Tools…*
30) Click **Set the Grading Group**
31) Set the Site to *Auxiliary Spillway*.
32) Click **Create Grading Group**
33) Input a Grading Group Name E.g.{ *Auxiliary Spillway* } Click OK Click OK
34) Click **Set the Target Surface** . Select *Ogrnd*. Click OK

Uphill & Downhill Spillway grading (preliminary)
35) Pulldown the **Select a Grading Criteria** to *Slope or Grade to Surface (Cut)*
36) Click **Create Grading.**

37) Select the outside edge of the auxiliary spillway. Click outside of the edge.
38) Apply to entire length? Input *Y* Press Enter
39) Slope or grade? Input *S* Press Enter.
40) Cut Slope? Input *3.* Press Enter

41) Select the inside curve of the spillway outlet. Click inside of the curve.
42) Apply to entire length? Input *Y* Press Enter
43) Slope or grade? Input *S* Press Enter.
44) Cut Slope? Input *3.* Press Enter

45) Select the inside curve of the spillway inlet. Click inside of the curve.
46) Apply to entire length? Input *Y* Press Enter
47) Slope or grade? Input *S* Press Enter.
48) Cut Slope? Input *3.* Press Enter

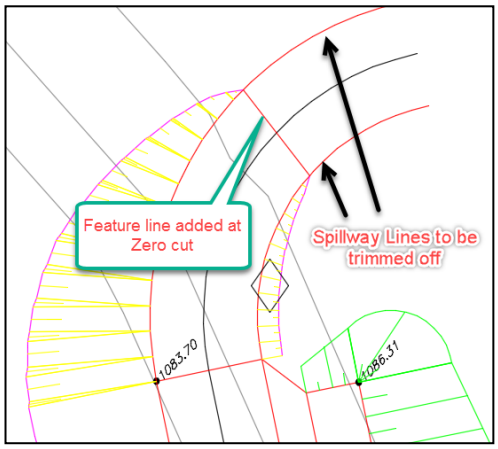
49) Pulldown the **Select a Grading Criteria** to *Slope or Grade to Surface (Cut and Fill)*
50) Click **Create Grading.** 
51) Select the downslope edge of the spillway dike. Click away from the spillway.
52) Apply to entire length? Input *Y* Press Enter
53) Slope or grade? Input *S* Press Enter.
54) Cut Slope? Input *3.* Press Enter
55) Slope or grade? Input *S* Press Enter.
56) Fill Slope? Input *3.* Press Enter
57) Press ESC
58) Close the Grading Tool
59) Save the drawing.

Evaluate the preliminary auxiliary spillway layout. The fill segments of the inlet and outlet will be trimmed off later.

- Is the outside cutslope on the spillway excessive?
- How do the inlet and outlet sections blend into the ground?
- Does the dike toe extend too far downhill?

Move or rotate the spillway group to improve the layout. The gradings will update automatically.

Create a feature line across the inlet and outlet at the zero cut locations of the spillway
60) Type *Osnapz* Press Enter, Type *0* Press Enter
61) Home… Create Design… Feature Line…Create Feature Line  …
62) In the Create Feature Lines box,
    a) Set the Site = *Auxiliary Spillway*,
    b) Checkmark Style = *Auxiliary Spillway Feature Line*,
63) Click Ok.
64) Osnap to the Endpoint of the inlet left Zero cut

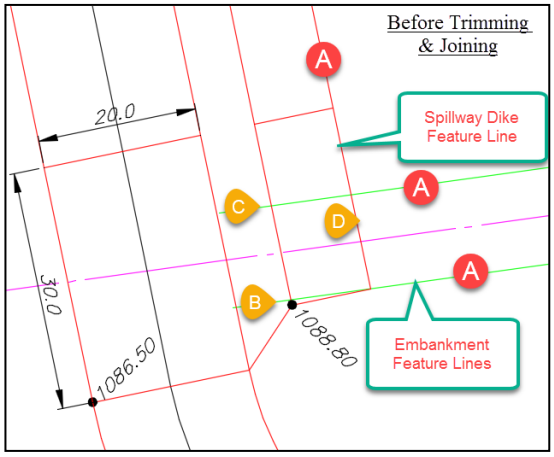


65) Press Enter
66) Osnap to the Endpoint of the inlet right Zero cut
67) Press Enter. Press Enter
68) Press Enter to restart the Feature Line command
    a) Set the Site = *Auxiliary Spillway,*
    b) Checkmark Style = *Auxiliary Spillway Feature Line,*
69) Click Ok.
70) Osnap to the Endpoint of the outlet left Zero cut
71) Press Enter
72) Osnap to the Endpoint of the outlet right Zero cut
73) Press Enter. Press Enter

Remove all 4 auxiliary spillway gradings & the 2 embankment gradings.
74) In the drawing select the gradings. Click *Gradings…Modify… Delete...*

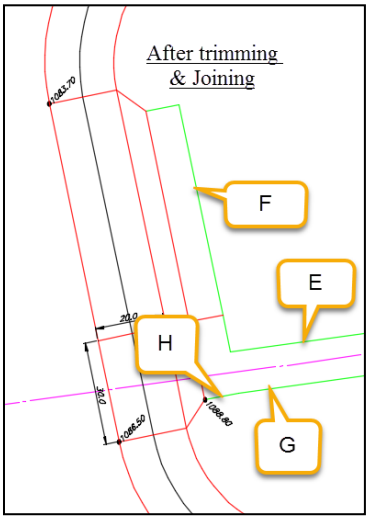
Trim off the fill segment of the inlet /outlet curves
75) Modify… Edit Geometry… Trim…
76) Cutting edge? Select the feature lines added across the inlet and outlet zero cut locations. Press Enter
77) Object to trim? Click the upstream and downstream edges past the trim lines.
78) Press Enter

Trim Embankment and Spillway dike for merging.
79) NRCS … NRCS Storage Ponds… Turn Off: Selection by Group  .



80) Modify… Edit Geometry… Trim…
81) Cutting edge? Select the feature lines of dike & embankment (A x3). Press Enter
82) Object to trim? Click the interior lines. (B, C, D)
83) Press Enter.

84) Osnap the ends of the embankment feature lines to the top of dike Endpoints so elevations will match.



Join the dike top to the embankment feature lines
85) *Modify… Edit Geometry… Join…*
86) Select the downstream embankment feature line (E).
87) Select the dike edge feature line (F). Press Enter
88) *Modify… Edit Geometry… Join…*
89) Select the upstream embankment feature line (G).
90) Select the upstream dike feature line (H). Press Enter

Move all of the auxiliary spillway feature lines to the Grade stabilization site.

91) Toolspace> Prospector…*Sites…* *Auxiliary Spillway…* Right click *Feature Lines…* Click *Move to Site…*
92) Set Destination Site = *Embankment*
93) Click Ok
94) Save the drawing

Create Final Embankment and Spillway Gradings

95) Click *Home… Create Design… Grading… Grading Creating Tools…*
96) Click **Set the Grading Group**  **.**
97) Set the *Site* to *Embankment*. Click OK
98) Set the *Group Name* as *Embankment* Click OK
99) Click **Set the Target Surface**  **.** Select *Ognd*. Click OK

Uphill & Downhill Spillway grading

100) Pulldown the **Select a Grading Criteria** to *Slope or Grade to Surface (Cut)*
101) Click **Create Grading.** 
102) Select the outside edge of the auxiliary spillway. Click outside of the edge.
103) Apply to entire length? Input *Y* Press Enter
104) Slope or grade? Input *S* Press Enter.
105) Cut Slope? Input *3.* Press Enter

106) Select the inside curve of the spillway outlet. Click inside of the curve.
107) Apply to entire length? Input *Y* Press Enter
108) Slope or grade? Input *S* Press Enter.
109) Cut Slope? Input *3.* Press Enter

110) Select the inside curve of the spillway inlet. Click inside of the curve.
111) Apply to entire length? Input *Y* Press Enter
112) Slope or grade? Input *S* Press Enter.
113) Cut Slope? Input *3.* Press Enter
114) Press ESC

Note: For embankments with a blister berm go to the **HowTo- Pond Embankment Blister Berm C3D** document. Continue at *Placing the Toes and Blister Berm of the Dam: "Downstream toe"*.

Note: For embankment with a wave berm or no berm go to the **HowTo- Pond Embankment C3D** document. Continue at *Placing the Toes and Wave Berm of the Dam: "Downstream toe"*.