Creating Wetland Excavations

**Overview:** Create Meanders, Oxbows, and Excavated pools for wetlands. A surveyed site with a surface model of the areas to be excavated is needed. Depending on the desired shape of the excavations, there are two methods of creating a shape. Method 1: covers a trapezoidal channel that has a constant bottom width. Method 2: covers a variable structure that can be any shape that can be constructed.

**Software:** AutoCAD Civil 3D 2016, Civil 3D Workspace, NRCS C3D 2016 template

**Prerequisite:** A surveyed site with a surface model covering the planned excavation areas.

**Notation: Button to Press** 

<table>
<thead>
<tr>
<th>Displayed Text</th>
<th>Icon</th>
<th>Action</th>
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**Excavated Channel (Method 1)**

1) Draw a polyline to indicate the centerline of the excavated channel using Tool Palette>NRCS 11x17B... Click Plan Commands... Centerline Generic

2) Click Home... Create Design... Alignment... Create Alignment from Object...

3) Select object. Press Enter. Click OK Or R to reverse.

4) Input the Name to {CL Pool 1}.

5) Uncheck Add Curves between Tangents.

6) Check Erase Existing Entities. Click OK

7) Click Home... Create Design... Feature Line... Create Feature Line from Alignment...

8) Click on the Alignment polyline.

9) Select Plunge Pool – Excavation under Site.

10) Input {Site 1} under Name.

11) Uncheck Weed Points.

12) Pulldown Style = Stream Channel Cleanout Feature Line. Click OK

13) Select the Feature Line.
13) On the context sensitive Feature Line ribbon tab, enable the Edit Elevations panel using 
*Modify*... *Edit Elevations*....

14) **Click Edit Elevations**... *Elevation Editor*... and a panorama window appears.

15) **Select** the Raise\Lower button.

16) **Input** \{742.00\} for the desired bottom elevation. Press Enter

17) To change a single elevation **Click** into the elevation cell and type the new elevation. Press Enter.

18) **Click** on the panorama window to close.

19) Enable the Edit Geometry panel using *Modify*... *Edit Geometry*....

20) **Click** *Edit Geometry*... *Stepped Offset*.

21) **Input** ½ the bottom width. E.g. \{10\} Press Enter.

22) **Click** either side of the CL of Bottom.

23) **Input** the relative elevation \{0\}. Press Enter.

24) **Select** the CL of Bottom. **Click** the other side of the CL of Bottom.

25) **Input** the relative elevation \{0\}. Press Enter. Press Enter.

26) Enclose the ends of the bottom channel.

27) **Right Click** the Osnap Status. **Click** Settings... and checkmark only End Point and Object Snap On. Click OK.

28) **Click** Home... Create Design... Feature Line... Create Feature Line ... 

29) Click on the first end of the right edge of bottom. Press Enter to accept the elevation.

30) **Click** on the first end of the left edge of bottom. Press Enter. Press Enter.

31) Repeat for the opposite end of bottom.

32) **Select** one of the bottom channel feature line. From Feature Line... *Edit Geometry*...Join...

33) **Select** the other 3 bottom channel feature lines. Press Enter and they will be joined.

34) Save.

35) **Click** Home... Create Design... Grading... Grading Creating Tools...

36) **Click** Set the Grading Group.

37) **Set** the Site to Plunge Pool - Excavation.

38) **Input** a Grading Group Name e.g. \{Pool 1\} Click OK

39) **Click** Set the Target Surface. **Select** Ognd. Click OK

Up Slope grading

40) **Pull down** the Select a Grading Criteria to Slope or Grade to Surface (Cut)

41) **Click** Create Grading.
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42) Select the outside edge of the Excavated Channel Bottom. **Click** outside of the edge.
43) Apply to entire length? **Input Y** Press Enter
44) Slope or grade? **Input S** Press Enter.
45) Cut Slope? **Input 6**. Press Enter. Press ESC

Fill in void areas within the excavation grading.
46) **Click Home... Create Design... Grading... Create Grading Infill ...**
47) **Click** into the surface voids inside of the added feature lines. **Press Enter**.
48) **Press ESC**. Close the Grading Creation toolbar.

**Create the Excavation Surface**
49) **Toolspace> Prospector… Sites... Plunge Pool - Excavation ...Grading Groups... Right click Pool 1... Click Properties**
50) **Click** the **Information** tab and **Checkmark** the **Automatic Surface Creation**
51) In Create Surface, **pull down** the **Style to _Contours (1 and 5) and Triangles** Click **OK**
52) **Click OK**. **Click OK**.

Place slope labels on the cut slope.
53) **Annotate... Labels & Tables...Add Labels**
54) **Feature=Surface**; **Label Type = Slope**; **Slope Label Style = Fini Run over Rise (H:V)**
55) **Click Add**
56) **Select** the surface.
57) For One-point input {o} **Press Enter**
58) **Click** a location to place each slope label.
59) **Press ESC** when done. In the Add Labels box **click Close**

**Excavated Channel (Method 2)**

60) Using a 2d polyline from the Tool Palette draw a polyline to indicate the bottom of the excavated oxbow, meander, etc.
61) Close the Polyline typing {C} and then **Press Enter**.

62) **Click Home... Create Design... Feature Line... Create Feature Line from Object...**
63) **Select** the Polyline. **Press Enter**.
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64) **Select** *Plunge Pool – Excavation* under *Site*.
65) **Pulldown** the *Style = Stream Channel Cleanout Feature Line*
66) **Check** *Erase Existing Entities*.
67) Uncheck *Weed Points*. **Click** OK
68) **Select** the Feature Line,
69) **Right Click** then **click** *Elevation Editor...* and a panorama window appears.

70) **Select** the *Raise\Lower* button.
71) **Input** \{742.00\} for the desired bottom elevation. **Press Enter**
72) To change a single elevation **click** into the elevation cell and type the new elevation. **Press Enter**.

73) **Click** on the panorama window to close.

Grade the bottom of the excavation to the Surface.

74) **Click** *Home... Create Design... Grading... Grading Creating Tools...*
75) **Click** *Set the Grading Group*.
76) **Set** the *Site* to *Plunge Pool - Excavation*.

77) **Click** *Create a Grading Group*.
78) **Input** a Grading Group *Name* e.g. \{Pool 2\} **Click** OK **Click** OK
79) **Click** *Set the Target Surface* . **Select** *Ognd*. **Click** OK

Up Slope grading with varying slopes
80) **Pulldown** the *Select a Grading Criteria to Slope or Grade to Surface (Cut)*
81) **Click** *Create Grading*. 
82) **Select** the edge of the Excavation bottom. **Click** outside of the bottom.
83) **Apply** to entire length? **Input** \{N\} **Press Enter**
84) **Click** the starting location of the slope. **Press Enter** to accept the station.
85) **Click** the ending location of the constant slope. **Press Enter** to accept the station.
86) **Slope or grade? Input** \{S\} **Press Enter**.
87) **Cut Slope? Input** \{10\} **Press Enter**
88) **Select** the Excavation feature line. **Click** outside of the bottom.
89) Leaving a gap after the first grading, **click** the starting location of the slope. **Press Enter** to accept the station.
90) **Click** the ending location of the slope. **Press Enter** to accept the station.
91) **Slope or grade? Input** \{S\} **Press Enter**.
92) **Cut Slope? Input** \{20\} **Press Enter**
93) **When done** press ESC.
94) **To place the transitions between gradings click** *Create Transition* 
95) **Select** the Excavation feature line.
96) **Click** in the gap between gradings and repeat for all gaps.
97) **Press** ESC
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Fill in void areas within the excavation grading.

98) Click Home... Create Design... Grading... Create Grading Infill ...
99) Click into the surface voids inside of the added feature lines. Press Enter.
100) Press ESC. Close the Grading Creation toolbar.

Create the Excavation Surface

101) Toolspace> Prospector… Sites... Plunge Pool - Excavation ...Grading Groups...
    Right click Pool 2... Click Properties
102) Click the Information tab and Checkmark the Automatic Surface Creation
103) In Create Surface, pulldown the Style to _Contours (1 and 5) and Triangles Click
    OK or Grid Magneta (5x5)
104) Click OK. Click OK .

Place slope labels on the cut slope.

105) Annotate... Labels & Tables...Add Labels
106) Feature=Surface; Label Type = Slope;
    Slope Label Style = Fini Run over Rise (H:V)
107) Click Add
108) Select the surface.
109) For One-point input {o} Press Enter
110) Click a location to place each slope label.
111) Press ESC when done. In the Add Labels box click Close

Create Volume Report

Compute earthwork volume
1. Click Analyze... Volume and Materials... Volume Dashboard...
2. Click Create New Volume Surface.
3. Input a Name E.g. {V Pool 2 - Ogd}
4. Set Style = _<off>
5. Click in the Base Surface cell Select Eg. {Ogd}.
6. Click in the Comparison Surface cell Select Eg. {Pool 2}.
7. Click OK.
8. The Volume Panorama will show the volumes, to print the report, Click Generate Report.

To track depths of the Excavation.

9. Use Home... Palettes ▼. Coordinate Tracker on the V Pool 2 – Ogd surface to see the Cut or Fill depths.
Transitions and Grading Around Corners (Optional)

The grading command called Create Transition is available from the Create Grading dropdown on the Grading Creation toolbar.

It can be used to transition between gradings that are of a similar kind. E.g. You can transition between 2 gradings that both use Slope or Grade to Surface (Fill).

You can also insert transition points into an exist grading using the Points option that shows up after you click Create Transition.

If you want to do a transition that goes around a corner, you might get better results if you apply an arc to the feature line at the corners.

-Applying an arc to a corner will allow the slopes to vary as it goes around the arc.
-Not applying an arc to corner will have the slopes at a constant value as it rotates around the corner.

To apply an arc to a feature line:

1. Select the feature line.
2. On the context sensitive Feature Line menu, enable the Edit Geometry panel and use the Fillet command.
3. Type {r} Enter to set the radius
4. Input a radius. E.g. {0.5} Press Enter
5. Then either click corners to apply the Fillet to or type {a} to apply the fillet to all corners of the feature line.
6. Press ESC to quit the command

Then you can create a grading that ends at the start of the radius, and another grading that starts at the end of the radius and use the Create Transition going around the fillet.

The radius of a fillet can be modified but only if a grading is not attached to the feature line fillet. To edit it, select the feature line and on the Feature Line Ribbon use Edit Geometry.... Edit Curve...

An Edit Feature Line box will let you change the radius.