Overview: Create the surface model and profile views for a denitrifying bioreactor and existing tile.

Software: AutoCAD Civil 3D 2022, Civil 3D Workspace, Iowa NRCS C3D 2022 template

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

Prerequisite

Prerequisite: A surveyed site is needed with enough details to provide these items:
- a surface model covering the location for a denitrifying bioreactor installation, and adjacent stream water level, and banks;
- the location of existing tile to be intercepted and tile depths.

Follow the instructions for *Original Ground Contour* and *Profile of Existing Tile*.

Denitrifying Bioreactor

Optional: Identify & label key elevations along the existing tile for helping design the Bioreactor.
Profile View labels: Label stations & elevations manually in a profile view.
1. Click *Annotate… Labels & Tables… Add Labels… Profile View… Station Elevation..*
2. Click the Profile View.
3. Input or Osnap to the station to be labeled. Press Enter
4. Input or Osnap to the elevation to be labeled. Press Enter
5. When done Press Enter

With design elevations determined, create a rectangle for the base location of the Bioreactor
6. Click *Home… Draw…Rectangle…*
7. Click a starting corner for the placement of the bioreactor.
8. Type {*R*} Press Enter to Rotate.
9. Move your cursor to until you get the correct rotation and then click to set the rotation.
10. In the dynamic input boxes enter the width and the length.
    E.g {*12*} Press Tab. {*50*} Press Enter
11. Select the rectangle. Right-click… *Properties* and pulldown the Layer to *C.Plan.Exca*

If needed to move the bioreactor into the correct final location
12. To move or rotate, click on the Rectangle you just created.
13. Left Click *Basic Modify Tools… Move.*
14. With Osnap off click into the drawing to set a handle point.
15. Move your cursor to relocate the rectangle and click to set the new location.
16. Left Click *Basic Modify Tools… Rotate.*
17. With Osnap off click into the drawing to set a rotation point.
18. Move your cursor to swivel the rectangle and click to set the new orientation.

Create feature lines for the bottom of bioreactor, top of woodchips, and top of soil cap.

Bottom of the Bioreactor
19. Click *Home… Create Design… Feature Line… Create Feature Lines from Objects*
20. Click on the rectangle polyline. Press Enter.
21. In the dialog box set
    Site to *Structure Excavation*,
    Name as {*Bottom of Bioreactor*}
    Style to *_2<Yellow>*,
    Uncheck *Erase existing entities*.
    Checkmark *Assign Elevations*.
22. Click OK
23. In the Assign Elevations box select *Elevation* and input the elevation of the bottom of bioreactor at the highest end. E.g. {*875.0*}. Click Ok.
    This bottom of bioreactor feature line will be edited later for final elevations.

Top of Woodchips
24. Click *Home… Create Design… Feature Line…*
                Create Feature Lines from Stepped Offset
25. When asked to specify offset distance type {*.5*} Press Enter.
26. Select the Bottom of Bioreactor feature line.
27. At *Specify Side to Offset*, move the cursor to the outside of the line and click.
28. At *Specify elevation difference*, input the depth of woodchips above the bottom. E.g. {*4*}
29. Press Enter. Press ESC.
30. Select the newly created feature line. Right click *Move to Site*.
31. Set *Destination Site* as *Concrete Tank - Granular Backfill* Click Ok.
32. Select the newest feature line again. Right click *Feature Line Properties*.
33. Checkmark *Name*, set to {*Top of Woodchips*}, set *Style* to *_1<Red>*. Click Ok.
    This top of wood chips feature line is ready.

Top of Soil cap
34. Click *Home… Create Design… Feature Line…*
                Create Feature Lines from Stepped Offset
35. When asked to specify offset distance type {*2*} Press Enter.
36. Select the *Top of Woodchips* feature line.
37. At *Specify Side to Offset*, move the cursor to the outside of the line and click.
38. At *Specify elevation difference*, input the thickness of the soil cap. E.g. {*2*}
39. Press Enter. Press ESC.
40. Select the newly feature line. Right click *Move to Site*.
41. Set *Destination Site* as *Embankment* Click Ok.
42. Select the newest feature line again. Right click *Feature Line Properties*.
43. Checkmark *Name*, set to {*Top of Soil cap*}, set *Style* to *Embankment Feature Line.*
    Click Ok.
    This top of soil cap feature line is ready.

Finalize the elevations for the Bottom of the Bioreactor
44. Select the *Bottom of Bioreactor* Feature line.
45. Right Click *Elevation Editor*
46. In the *Grading elevation editor* click the station cell and a location will be highlighted in the drawing with a Green Triangle around it.
47. For the corners that need elevation edited click into the Elevation cell.
48. Input the correct elevation for the bottom of bioreactor. E.g.{*874.8*} Press Enter.
49. When done click ☑ to close the Grading elevation editor.
50. Save the drawing.

Use the **Coordinate Tracker** ↥ to verify that the Ognd surface is above the top of woodchips. If not, relocate or lower the bioreactor.

Create surfaces for the bottom of bioreactor, top of wood chips, and top of soil cap.

Bottom of the Bioreactor
51. Click *Home… Create Design… Grading… Grading Creation Tools…*
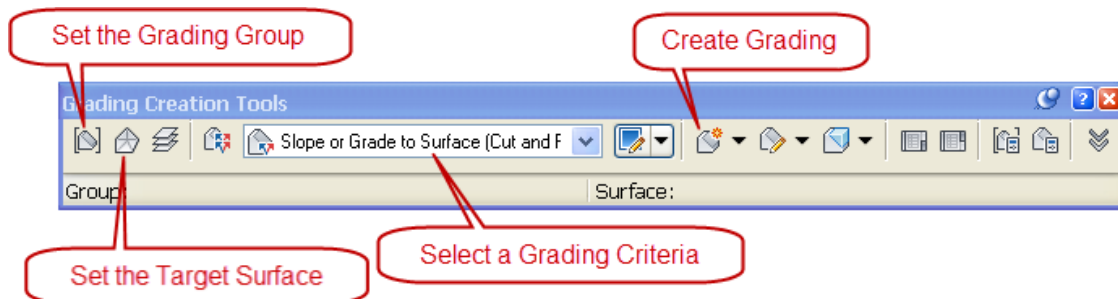
52. Click **Set the Grading Group** 🔳
53. Set the *Site* to *Structure Excavation*. Click OK
54. Input a Grading Group *Name* as {*Bioreactor*}
55. Checkmark Automatic Surface Creation, leave options as is, Click OK
56. In the *Create Surface* dialog input *Name* as {*Bottom of Bioreactor*}, Click OK
57. Click **Set the Target Surface** 🔷. Select *Ognd*. Click OK
58. Pulldown the **Select a Grading Criteria** to *Slope or Grade to Surface(Cut)*
59. Click **Create Grading.**
60. Select the *Bottom of Bioreactor* Feature Line, click outside the rectangle
61. Apply to entire length? Input *Y* Press Enter
62. Slope or grade? Input {*S*} Press Enter.
63. Cut Slope? Input .{*0.1*}. Press Enter
64. Press ESC to exit the command
65. Pulldown Create Grading, Click Create Infill
66. Click Inside the rectangle
67. Press ESC to exit the command

Top of Woodchips

68. Click **Set the Grading Group**
69. Set the *Site* to *Concrete Tank- Granular Backfill*.

70. Click *Create a Grading Group*
71. Input a Grading Group *Name* as {Woodchips}
72. Checkmark *Automatic Surface Creation*, leave options as is, Click OK
73. A *Create Surface* dialog box will appear, Click OK, Click OK

74. Click **Set the Target Surface** . Select *Ognd*. Click OK
75. Pulldown *Create Grading*, Click **Create Infill**
76. Click Inside the *Woodchips* rectangle
77. Press ESC to exit the command

Soil Cap

78. Click **Set the Grading Group**
79. Set the *Site* to *Embankment*. Click OK

80. Click *Create a Grading Group*
81. Input a *Grading Group Name* as {Soil Cap}
82. Checkmark *Automatic Surface Creation*, leave options as is, Click OK
83. At the *Create Surface* dialog, Click OK, Click OK

84. Click **Set the Target Surface** . Select *Ognd*. Click OK
85. Pulldown *Create Grading*, Click **Create Infill**
86. Click Inside the rectangle
87. Press ESC to exit the command
88. Pulldown the **Select a Grading Criteria** to *Slope or Grade to Surface(Cut and Fill)*

89. Click **Create Grading.**
90. Select the *Soil Cap* Feature Line, Click outside of the rectangle.
91. Apply to entire length? Input *Y* Press Enter
92. Slope or grade? Input {S} Press Enter.
93. Cut Slope? Input {3}. Press Enter
94. Slope or grade? Input {S} Press Enter
95. Fill Slope? Input {3}. Press Enter
96. Press ESC to exit the command
97. Close the *Grading Creation Tools* toolbar
98. Save the Drawing

Use the **Coordinate Tracker** to verify the elevations of the *Soil Cap*, *Woodchips*, and *Bioreactor* surfaces are correct.

Create Profile Views for Construction Plans

Create the alignment of the tile and bioreactor.
99. Tool Palette>NRCS 11x17B… Click *Plan Commands… Alignment - Generic*
100. <u>Draw</u> a polyline of the new system through the existing tile line, through the center of bioreactor, and back out to existing tile (or new tile outlet). Use Endpoint, Midpoint, and Nearest Osnaps if desired. <u>Press Enter</u> when finished drawing the polyline<u>.</u>
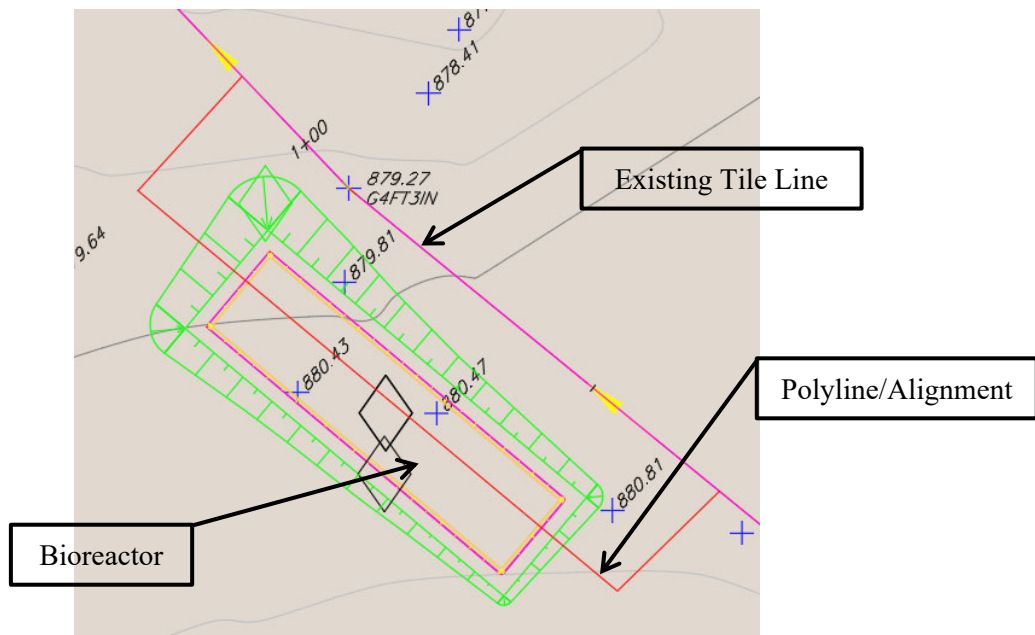
101. <u>Click</u> *Home… Create Design… Alignment… Create Alignment from Objects…*
102. <u>Select</u> the line that was drawn by clicking closer to the uphill end of the line. <u>Press Enter</u>
103. If the direction of the alignment is correct (typically with station 0+00 being the upstream end), <u>press Enter</u>. ({R} <u>Enter</u> to reverse)
104. <u>Input</u> the *Name* as {*Bioreactor and Tile*}
105. <u>Uncheck</u> *Add Curves between tangents*
106. <u>Click</u> Ok

Extract profile of the Original Ground and Bioreactor surfaces along the alignment and place them into a profile view.
107. <u>Click</u> *Home… Create Design… Profile… Create Surface Profile…*
108. <u>Pulldown</u> the alignment to *Bioreactor and Tile*.
109. <u>Select</u> surfaces: *Bottom of Bioreactor*, *Ognd*, *Woodchips*, *Soil cap*. <u>Click</u> Add
110. Change style for each surface. E.g. (*Structure Excavation* for *Bioreactor*, *Flowline* for *woodchips*, *Embankment* for *Soil Cap*)
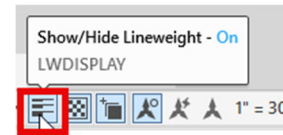111. <u>Click</u> Draw in profile view
112. Set the *Profile View* style to the Horizontal/Vertical scaling desired. E.g. (*A20Hx5V*)
113. <u>Click</u> Create Profile View

114. Click a model space location in the drawing to place your created Profile View
115. Select the profile grid
116. Right-click *Display Order… Send to Back*.
     Also toggle **Show/hide Lineweight** to *On* for more visibility

Create a Named View in order to find this Profile View easily later
117. Zoom to a full view of the profile view that you just created.
118. Click *View … View Manager… New…*
119. Input a View Name. E.g {*Profile Bioreactor*}
120. Open the advanced settings tab by clicking ⊙ … On the View Properties tab Uncheck *Save layer snapshot with view*.
121. Click OK to go back to the *View Manager*… Click OK to exit the *View Manager*.

Create the alignment to create a cross section view of the bioreactor.
122. Tool Palette>NRCS 11x17B… Click *Plan Commands… Alignment - Generic*
123. Draw a polyline going across the bioreactor. Use Perpendicular and Extension Osnaps if desired. Press Enter when finished drawing the polyline.
124. Click *Home… Create Design… Alignment… Create Alignment from Objects…*
125. Select the line that was drawn by clicking closer to the left end of the line when looking in the direction of flow through the bioreactor. Press Enter
126. If the direction of the alignment is correct (typically with station 0+00 being the upstream end), press Enter. ({R} Enter to reverse)
127. Input the *Name* as {*Bioreactor Xsec*}
128. Uncheck *Add Curves between tangents*
129. Click Ok

Extract profile of the Original Ground and Bioreactor surfaces along the *Xsec* alignment and place them into a profile view.
130. Click *Home… Create Design… Profile… Create Surface Profile…*
131. Pulldown the alignment to *Bioreactor Xsec*.
132. Select surfaces: *Bottom of Bioreactor, Ognd, Woodchips, Soil cap*. Click Add
133. Change style for each surface. E.g. (*Structure Excavation* for *Bioreactor*, *Flowline* for *woodchips*, *Embankment* for *Soil Cap*)
134. Click Draw in profile view
135. Set the *Profile View* style to the Horizontal/Vertical scaling desired. E.g. (*A20Hx5V*)
136. Click Create Profile View
137. Click a model space location in the drawing to place your created Profile View
138. Select the profile grid
139. Right-click *Display Order… Send to Back*.

Create a Named View in order to find this Profile View easily later

140. <u>Zoom</u> to a full view of the profile view that you just created.

141. <u>Click</u> *View … View Manager… New…*

142. <u>Input</u> a View Name. E.g {*Xsec Bioreactor*}

143. <u>Open</u> the advanced settings tab by <u>clicking</u> ⌄ … On the View Properties tab <u>Uncheck</u> *Save layer snapshot with view*.

144. <u>Click</u> OK to go back to the *View Manager*… <u>Click</u> OK to exit the *View Manager*.

145. <u>Save</u> the Drawing