

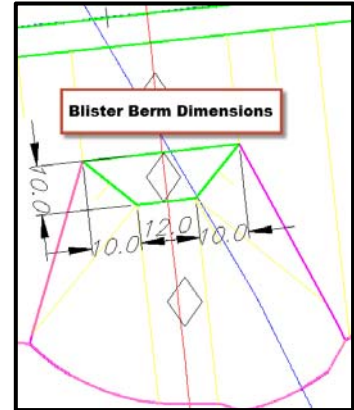
Pond Embankment w/ Blister Berm

Overview: Create the surface model and earthwork volumes for a pond embankment with a “blister” wave berm that does not extend across the entire face of the dam. Design elevations of the dam are needed.

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

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

Prerequisite: A surveyed site with a surface model covering the footprint of the dam is needed. Create the pond embankment top of fill feature lines, but not slope projections.





Embankment with a “Blister” Berm



Placing the Centerline & Top of Dam

Refer to the instructions for *Pond Embankment*: “Placing the Centerline & Top of Dam”.



Placing the Toes and Blister Berm of the Dam

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 toe

6. Pulldown the **Select a Grading Criteria**  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. Press **ESC** to exit the command



Create an alignment for the centerline of the pipe.

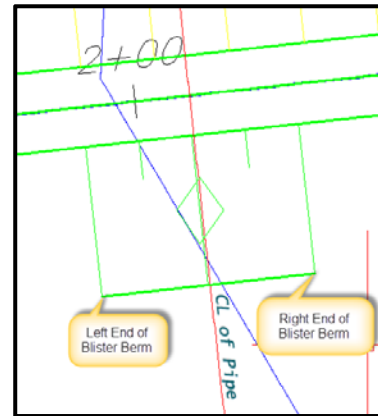
13. Click *Home... Create Design... Alignment... Alignment creation tools...*
14. Input a Name e.g. {*CL Pipe*}
15. Set the Alignment Style = *Pipe*
16. Set the Alignment label set = *Major (perp) Minor Geometry (100 and 50)*
17. Click **OK** and the Alignment Layout Tools will appear.
18. In the 1st column click **Tangent- tangent (no curves)** 
19. From the Transparent Command toolbar click the **Station Offset** command  ;
(or input {*SO*} and Press **Enter**)

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20. Select the *CL Dam* alignment and a tracking tool will appear.
Note: For each point created along the new alignment you will set a **station** along the *CL Dam* and then an **offset** relative to the *CL Dam*.
21. To set the station value for the starting point of *CL Pipe*, either input a station value “along the *CL Dam*” and press enter, or snap to the downstream toe of the dam where the pipe will outlet.
22. Input an offset distance from the *CL Dam* alignment past the upstream toe. (Positive is normally upstream. Watch the tracking tool for values.) E.g. {150} Press Enter.
23. Set the station value for the ending point of pipe alignment, using the same method as you did for the starting point. (Input a value or Snap to toe)
24. Input an offset distance from the *CL Dam* alignment past the downstream toe. (Negative is normally downstream) E.g. {-200} Press Enter.
25. Press ESC to exit the Station Offset transparent command
26. Press ESC to stop adding to the alignment
27. Close the Alignment Layout tool.
28. If the new alignment is backwards, select the alignment. On the context sensitive ribbon use *Alignment...Modify* ▼ ... *Reverse Direction*. Then click OK.

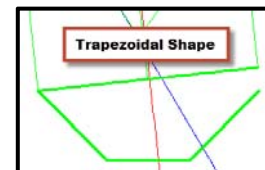
Establish the Blister Berm location

29. Pulldown the **Select a Grading Criteria**  to *Elevation Absolute & Slope*
30. Click **Create Grading**. 
31. Select the upstream edge of the dam. Click upstream of the dam.
32. Apply to entire length? Input *N* Press Enter
33. Osnap and click on the *CL* of pipe. Observe the station value (E.g. 1+28.27') and input a station that is 16' less. E.g. {112} Press Enter to set the left end of the blister berm.
34. Input *L* Enter. Input 32 Press Enter
35. Elevation? Input Elevation of wave berm. E.g. {1083.5} Press Enter.
36. Cut Slope? Input 3. Press Enter
37. Fill Slope? Input 3. Press Enter . Press ESC




Blister Berm trapezoidal shape

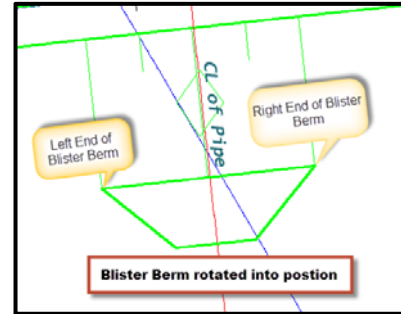
38. Click *Home... Create Design... Feature Line... Create Feature Line* ...
39. In the dialog box set the *Site* to *Embankment*, and set *Style* to *Embankment Feature Line*. Click **OK**
40. Osnap Click to the left end of the blister berm. Press Enter to accept the elevation.
41. Input {@10,-10} Press Enter. Press Enter.
42. Input {@12,0} Press Enter. Press Enter.
43. Input {@10,10} Press Enter. Press Enter.
44. Press Enter.



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Align the blister berm correctly


45. Click *Home... Modify... Rotate* ...
46. Select the blister berm feature line. Press **Enter**.
47. **Snap** to left end of the blister berm.
48. **R Enter**. Input a reference angle of **90 Enter**
49. **Snap** to right end of the projected blister berm.



Remove the slope projection between the blister berm and top of fill.



50. Select the grading diamond. Press **Delete**.

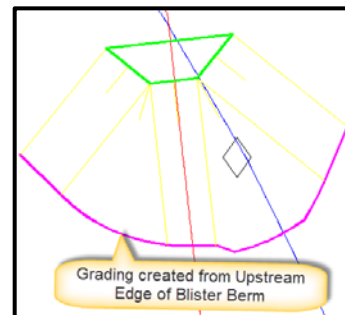
Fill in the blister berm upstream edge

51. Click *Home... Create Design... Feature Line... Create Feature Line* ...
52. In the dialog box set the *Site to Embankment*, and set *Style to Embankment Feature Line*. Click **OK**
53. **Osnap Click** to the left end of the blister berm. Press **Enter** to accept the elevation.
54. **Osnap** on to the right end of the blister berm. Press **Enter**.
55. Press **Enter**.
56. Save the drawing.



Upstream toes

57. Pulldown the **Select a Grading Criteria**  to *Slope or Grade to Surface (Fill)*
58. Click **Create Grading**. 
59. Select the upstream edge of the blister berm.
60. Click upstream of the blister berm.
61. Apply to entire length? Input **Y** Press **Enter**
62. Slope or grade? Input **S** Press **Enter**.
63. Fill Slope? Input **3**. Press **Enter**



64. Select the left upstream edge of the top of dam. Click upstream of the dam.
65. Apply to entire length? Input **N** Press **Enter**
66. Select the start point: Input **0** Press **Enter** Press **Enter**
67. **Osnap** to the left end of the blister berm. Press **Enter**
68. Slope or grade? Input **S** Press **Enter**.
69. Fill Slope? Input **3**. Press **Enter**
70. Select the right upstream edge of the top of dam. Click upstream of the dam.
71. **Osnap** on the right end of the blister berm Press **Enter**
72. Click past the right end of the dam. Press **Enter**.
73. Slope or grade? Input **S** Press **Enter**.
74. Fill Slope? Input **3**. Press **Enter**
75. Press **ESC** to exit the command.
76. Close the Grading Creation tool.
77. Save the drawing.

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Create feature lines for end of fill and spillway transitions.

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

79. Click *Home... Create Design... Feature Line... Create Feature Line* ...

80. In the dialog box set the *Site* to *Embankment*, and set *Style* to *Embankment Catch Line*. Click **OK**

81. Click on the left end of the US edge of top of fill. Press **Enter** to accept the elevation.

82. Click on the left end of the DS edge of top of fill. Press **Enter**. Press **Enter**.

Repeat for the right end of Top of Fill, and for the Embankment to Spillway transitions as needed.

Creating a Surface Model for the Embankment

Convert gradings to become the embankment surface model.

83. Toolspace> Prospector... *Sites...Embankment...Grading Groups...* Right click *Embankment...* Click *Properties*

84. Click the *Information* tab and Checkmark the *Automatic Surface Creation*

85. In Create Surface, pull down the *Style* to *Contours (1 and 5) and Triangles* Click **OK**

86. Click **OK** . Click **OK** .

Add the downstream edge of blister berm to surface

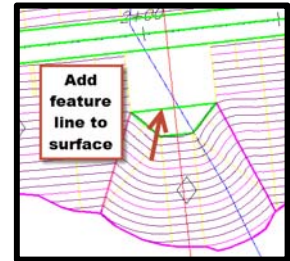
87. Select the feature line at the DS edge of the berm

88. Right-Click *Add to Surface As Breakline...*

89. In Select Surface, pull down to the *Embankment* surface. Click **OK**

90. Checkmark *Supplementing factors: Distance = {2}*

91. Click **OK**



Fill in void areas within the embankment surface model.

92. Click *Home... Create Design... Grading... Create Grading Infill* ...

93. Click into the surface voids inside of the added feature lines. Press **Enter**.

Remove exterior triangles that are not wanted.

94. Select the *Embankment* surface

95. *Tin Surface... Modify Surface...Edit Surface... Delete lines...*

96. Click on the exterior triangles to be removed. Press **Enter**.



97. Save the drawing.



Verify the surface & lock it

98. Select the *Embankment* surface. Right-Click, Click *Object Viewer*.




99. Press **ESC** when done visually reviewing the surface.


100. Use *Home...Palettes* .. *Coordinate Tracker*  to inspect the elevations of the *Embankment* surface.

101. Toolspace> Prospector... *Surfaces...* Right-Click *Embankment...* Click *Lock...*

Computing the Earthfill Volume for the Embankment & Stripping

Compute earthfill volume

102. Click *Analyze... Volumes and Materials... Volumes Dashboard* 
103. In Panorama click **Create new Volume Entry** 
104. Input a Name E.g. {V Embankment - Ognd}
105. Set the Style = *_ <off>* Click
106. Set the Base Surface = *Ognd*. Set the Comparison Surface = *Embankment*
107. Click
108. In Panorama click **Create new Volume Entry** 
109. Input a Name E.g. {V Embankment - Strip}
110. Set the Style = *_ <off>* Click
111. Set the Base Surface = *Strip*. Set the Comparison Surface = *Embankment*
112. Click
113. Two volume surface gets created and the Fill column will show the volume.
114. Save the drawing.

115. Use **Generate Cut/Fill Report**  to create a report. It can be saved or information can be copied from the report into Word or Excel Document
116. In Civil 3D click dismiss to close the **Volumes Dashboard** Panorama.