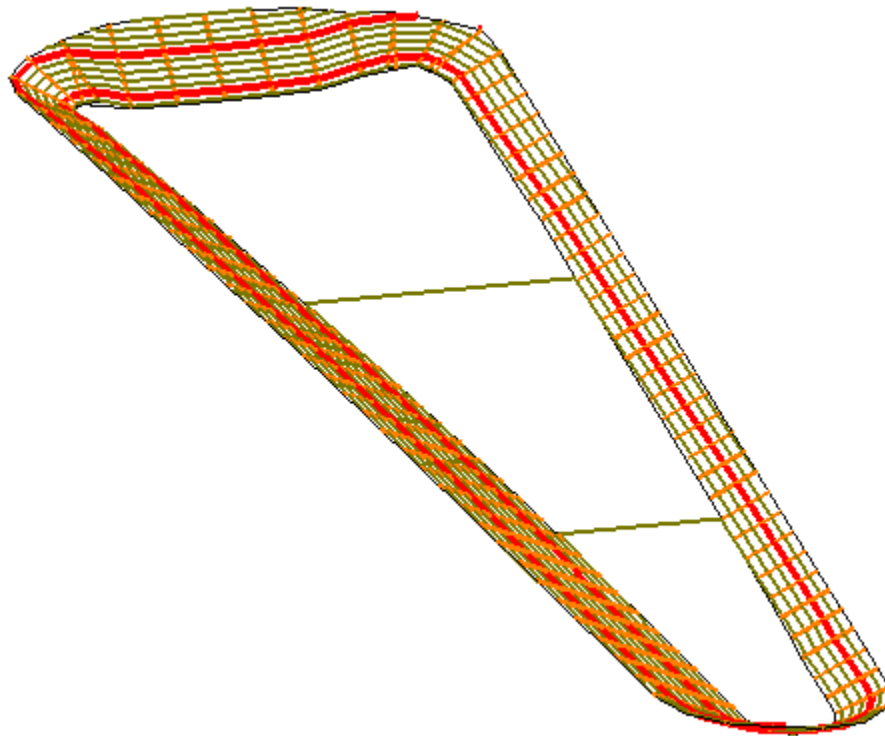# LAB 19 - Creating a Detention Pond

In this exercise, you will create a proposed digital terrain model (DTM) without using Roadway Modeler. Instead, a combination of feature creation and editing tools is used to develop the breaklines for a pond.


Chapter Objectives:

- Use a combination of feature tools to create a proposed design
- Understand the concept of creating a surface of features solely for use as a target

The following files are used for this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Existing_Pond-Lab.dtm
- C:\Projects\12345\Design\Drawings\Reference Files\12345DES_Pond.dgn as a reference file

Lab 19.1 - Load and Create Surfaces

1. Open MicroStation and InRoads using the *C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn* file.

2. Delete any MicroStation graphics currently in the design file.

3. Verify the correct *XIN* file is loaded.

4. Delete any MicroStation graphics currently in the design file.

5. Select **File > Open** from the InRoads menu.

6. Open *C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Existing_Pond-Lab.dtm*.

7. **Cancel** the *Open* dialog box.

8. Toggle *Locate Features/Locate Graphics* to *Locate Graphics*.

9. Select **File > New**.

10. Select the *Surface* tab.

11. Set the *Type* to *Design*

12. Key in *12345 pond* for the *Name*.

13. Key in *Pond training example* for the *Description*.

14. Set the *Preference* to *Proposed*

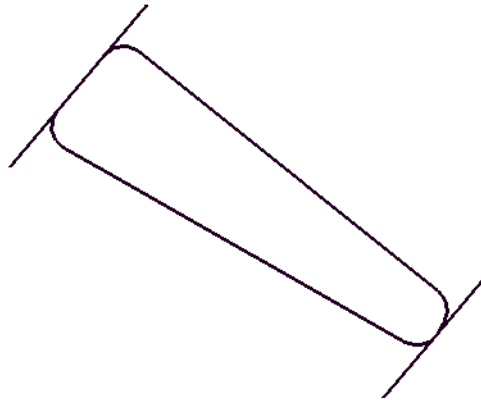15. **<D> Apply** and **Close** the *New* dialog box.
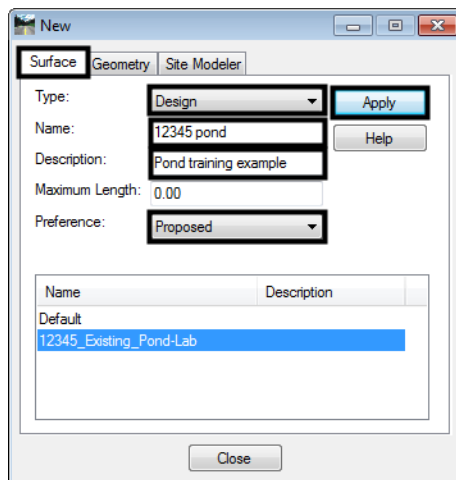
Lab 19.2 - Display the Pond Graphics

1. Toggle on the display for the *12345DES_Pond.dgn* reference file.
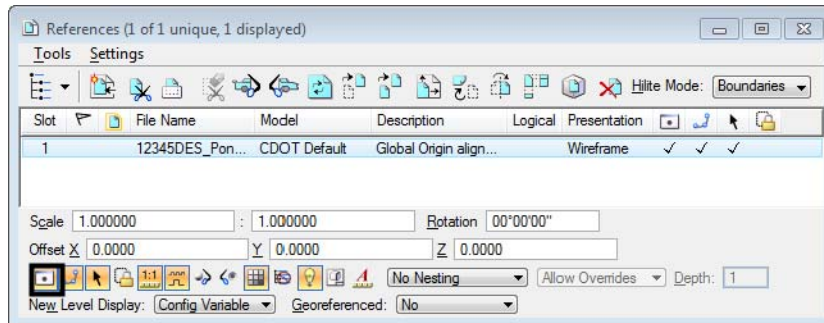
2. **Fit** the view to see the pond graphics.

The pond you are going to create is beside a new roadway SH52. The toe of slope for the roadway is the boundary for the pond on the South side, with the existing ROW limiting the size on the North and other existing features dictating the basic shape of the pond. The graphic that you just toggled on shows what has previously been determined as the outer limit of the pond.

Lab 19.3 - Creating a feature for the top of pond

In this case, you are going to start with the known outside of the pond, so you must first set the elevations of this boundary. You will do this by draping the graphic element onto the existing topo.

1. Select **Surface > Design Surface > Generate Longitudinal Feature**.

On the *Main* tab:

2. Toggle off **Generate Graphics Only**.

3. Select **12345 pond** as the *Surface*.

4. Toggle on **Interval** and set it to *10*.

5. Toggle on **New** for the *Mode*.

6. Key in *Pond top* for the feature *Name*.

7. Set the *Feature Style* to **H_Detention_Pond-Top**.

8. Set the *Point Type* to **Breakline**.

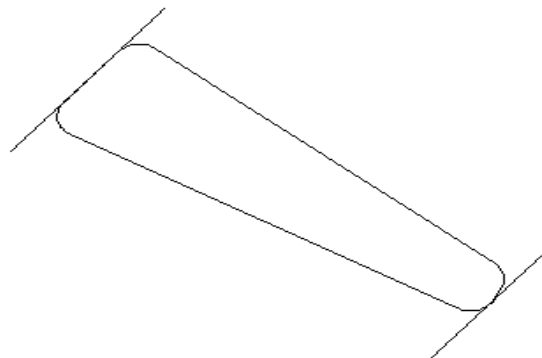9. Leave the *Point Density Interval* set to *0*.
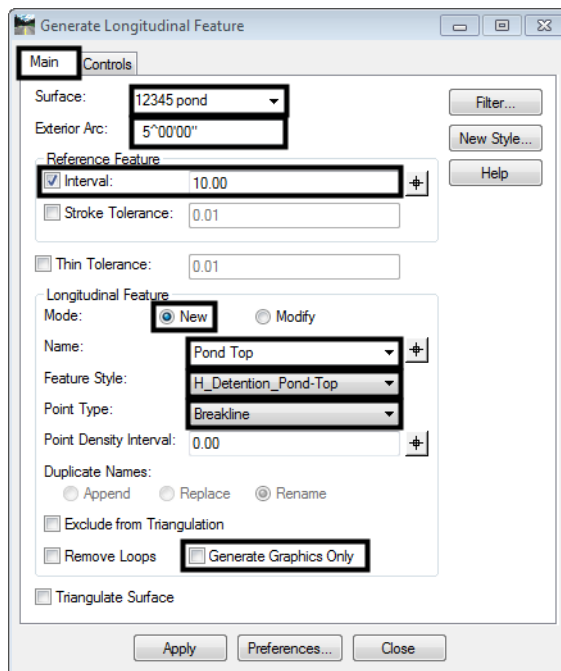
On the *Controls* tab:

10. Set the *Horizontal Method* to **Offset from Primary Feature**.

11. Set both *Offsets* to ***0.00***.

12. Set the *Vertical Method* to **Drape**.

13. Set the *Drape Surface* to **12345_Existing_Pond-Lab**.

14. **<D> Apply**, then **<D>** to Identify and **<D>** to Accept the pond outline as the *Primary Element*.
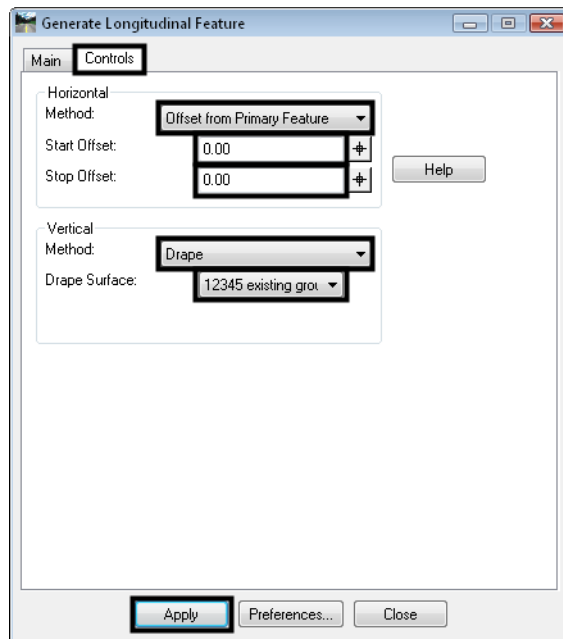
15. **<D>** to Identify and **<D>** to Accept the same shape again as the *Reference Element*.

> Identify beginning/Reset for Entire

16. Reset **<R>** for the *Entire shape*.

17. **<D>** anywhere for the *Location*.

   Note: If your *Horizontal Offsets* were not 0, you would be telling InRoads which side to offset by moving your cursor to that location before **<D>**; since they are both 0, it does not matter where you identify the location.

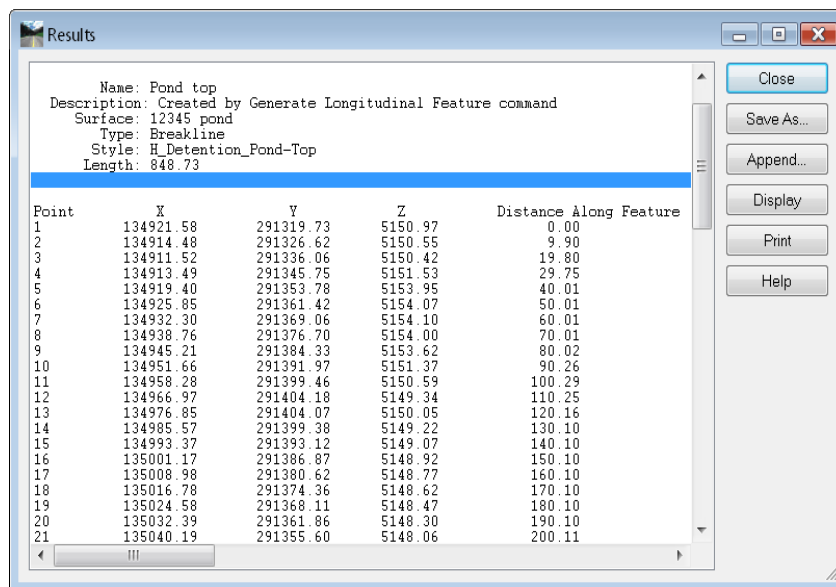The shape is draped on the existing model, but placed in the new surface.

18. **<D>** Close on the *Generate Longitudinal Feature* dialog box.

Lab 19.4 - Review the feature

1. Select **Surface > Feature > Feature Properties** from the InRoads main menu.

2. Set the *Surface* to *12345 pond*.

3. Highlight the *Pond top* feature and choose *List Points*.
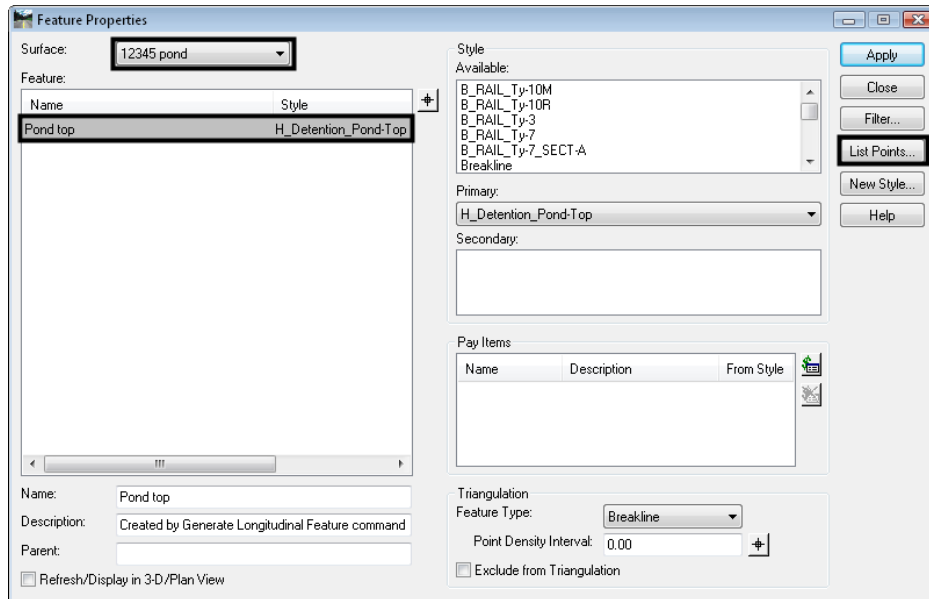
> ***Note:*** If you do not see the ***Pond top*** feature in the surface, go back and try the **Generate Longitudinal Feature** command again.


4. You should see all different elevations for the feature. If you have a feature listed, but the elevations are not in the range shown, use **Surface > Edit Surface > Delete Feature** to delete the feature, then try again.

5. **<D> Close** on the ***Results*** dialog box and again on ***Feature Properties*** dialog box.

Lab 19.5 - Create a target for the pond bottom

In this series of steps, you will create features from the two lines at either end of the pond. The one on the West side represents the 5144 elevation and on the East end 5141. These features will then be triangulated to form a 'dummy' surface that can be used as a target to create the pond bottom.

1. Select **File > New** from the InRoads main menu.

2. Set the ***Type*** to **Design**.

3. Key in ***12345 dummy pond bottom*** for the ***Name***.

4. Key in ***Pond training example*** for the ***Description***.

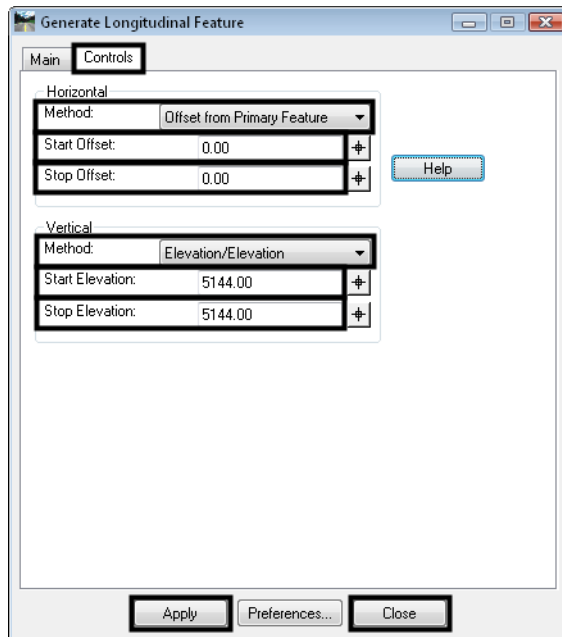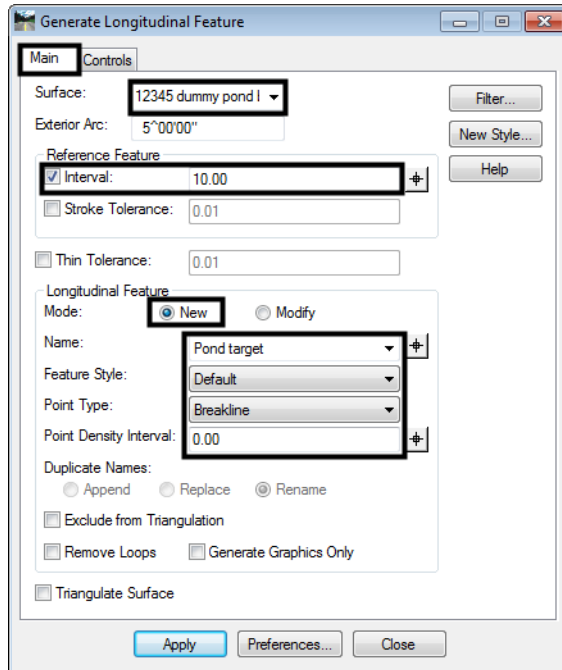5. Set the ***Preference*** to **Proposed**.
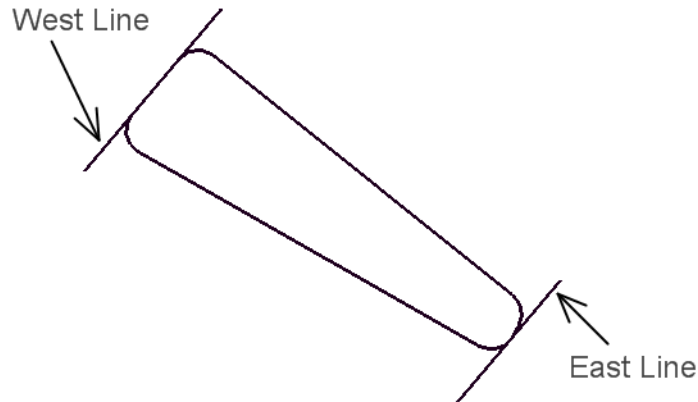
6. **<D> Apply** and **Close** the *New* dialog box.
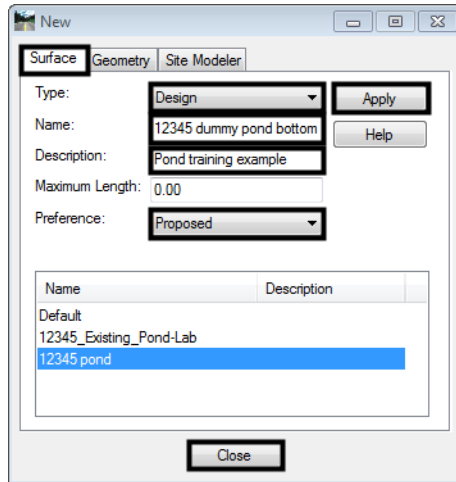
7. Select **Surface > Design Surface > Generate Longitudinal Feature** (**GLF**) from the InRoads main menu.

8. Set the *Surface* to *12345 dummy pond bottom*.

9. Set the other criteria as shown in the illustrations below to create a new feature.

10. **<D> Apply**.

11. Select the West linestring with a data point **<D>**.

The linestring highlights and you are prompted to *Accept/Reject*.

12. **<D>** to accept.

You are prompted to *Identify Reference Element*.

13. Select the same linestring again with a **<D>** and **<D>** again to *Accept* when the linestring highlights.

A tracking line appear and you are prompted to *Identify Beginning (Reset for Entire Element)*.

14. **<R>** Reset to copy the entire element.

15. **<D>** for the location.

Note: Since the horizontal offsets are 0.00, the location of the data point does not matter. If there were horizontal offsets, the data point would tell the software which way to make the copy, similar to a MicroStation copy command.

The line is made into a feature at elevation 5144 in the surface dummy pond bottom.

16. Repeat steps 7-14 to create a feature in the same surface for the East line, which should be set to an elevation of *5141*.

17. **<D> Close** to dismiss the *GLF* dialog box.

Lab 19.6 - Review the feature

1. Select **Surface > Feature > Feature Properties** from the InRoads main menu.

2. Set the *Surface* to **12345 dummy pond bottom**.

3. Highlight the **Pond target** (5144 elevation) feature and **<D>** the **List Points** button.
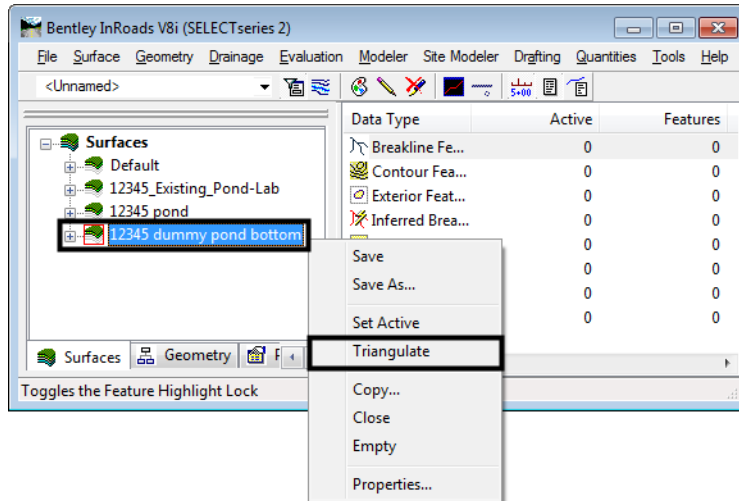
   You should see all 5144 elevations for the feature.
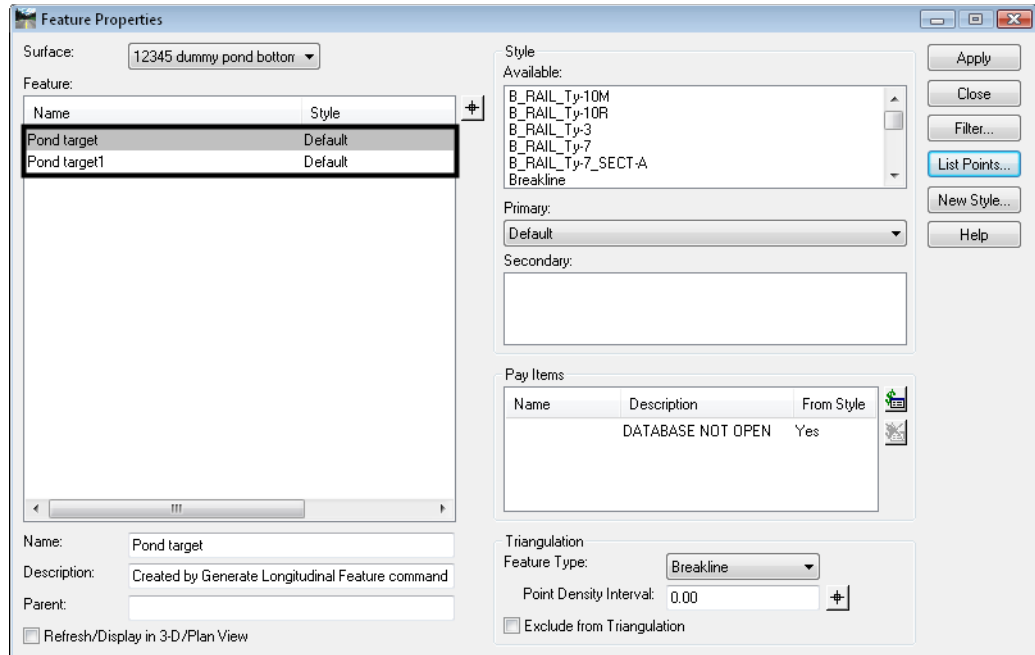
4. **<D> Close** on both the *Results* and *Feature Properties* dialog boxes.

5. Turn off the reference with the original pond graphics.
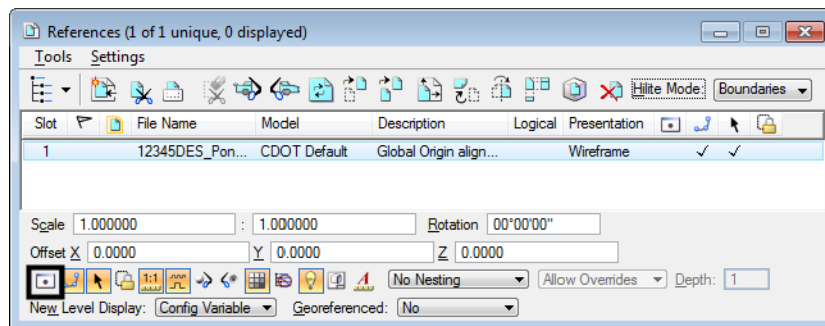
6. **Triangulate** the dummy pond bottom surface.

Lab 19.7 - Define the pond side slopes

This series of steps takes you through creating sideslopes from the new top-of-pond outline down to the target DTM.

1. Set the *Locate* mode to **Features**.

Since the source for the slopes is the feature created for the top of the pond, you must first change the *Locate* mode.

2. Select the **Surface > Design Surface > Generate Sloped Surface** (**GSS**) from the InRoads main menu.

On the *Main* tab:

3.   Set *Source Surface* to **12345 pond**.

4.   Set *Intercept Surface* to **12345 dummy pond bottom**.

5.   Set *Destination Surface* to **12345 pond**.

6.   For *Interval* key in **10**.

7.   For *Cut Slope* key in **50%**.

8.   For *Fill Slope* key in **-50%**.

In the *Feature* area:

9.   Toggle off **Generate Graphics Only**.

10. Toggle off **Tic Marks** and **Source**.

11. Toggle on **Transverse**. Key in **transverse** for the *Name* and set the *Feature Style* to **DTM_Transverse**.

12. Toggle on *Catch Point.* For *Catch Point* key in **Pond bottom** and set the *Feature Style* to **H_Detention_Pond-Bottom**.

13. Set the *Point Type* to **Breakline**.

14. For *Point Density Interval* key in **10.000**.
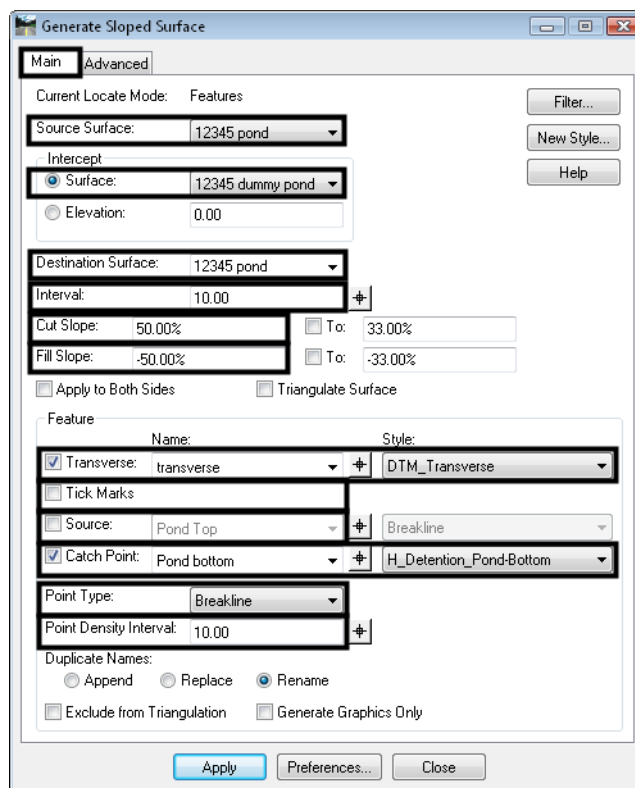
15. On the *Advanced* tab, key in **5^00'00.00"** for *Exterior Arc*.
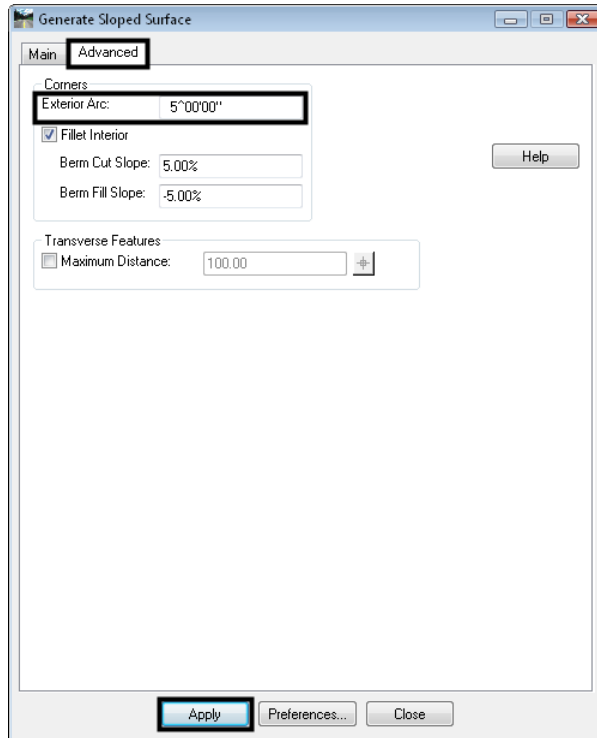

16. **<D> Apply** to run the **GSS** command.

    You will be prompted to *Identify Feature*.

17. **<D>** on the closed feature that represents the top of your pond.
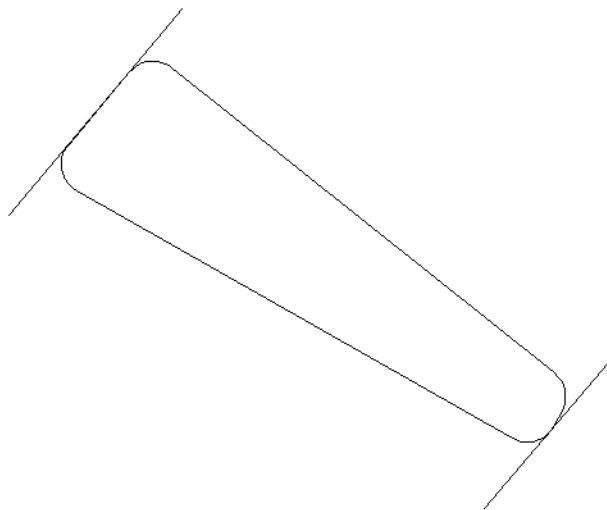
    The entire pond top will highlight and you will be prompted to *<Accept/Reject>*.

18. **<D>** in an area away from the shape to accept the pond top.

19. When prompted to *Identify beginning/Reset for Entire*, **<R>** to run side slopes around the entire complex shape.

20. When prompted for *Location*, **<D>** inside the shape, so the sideslopes will go in instead of out.
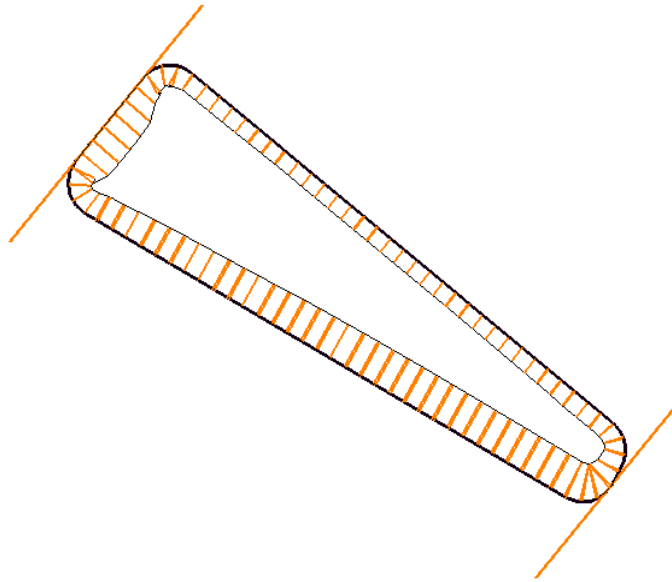
Graphics appear as shown above.

21. **<R>** and then select Close to dismiss the dialog box.

Lab 19.8 - Evaluate the pond surface

1. **<R>** on the pond surface in the Explorer portion of the InRoads menu and select **Triangulate**.
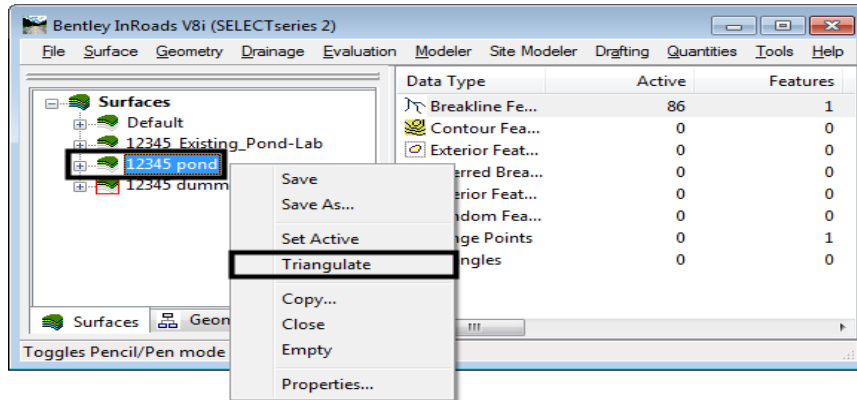
2. Select **Surface > View Surface > Contours** from the InRoads main menu.

3. Select **Preferences**.

4. Highlight the **Proposed 5′ Mjr – 1′ Minor** preference.

5. **<D> Load**, then **Close**.

6. Set the *Surface* to **12345 pond**.

7. **<D> Apply.**

Lab 19.9 - Save the pond surface to the hard disk
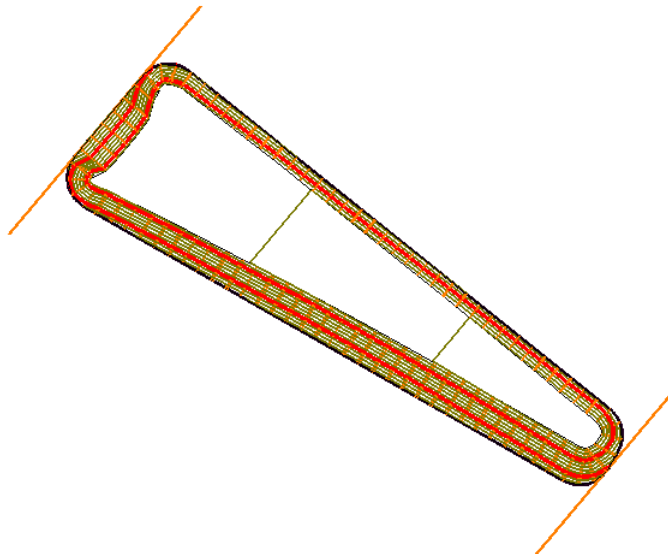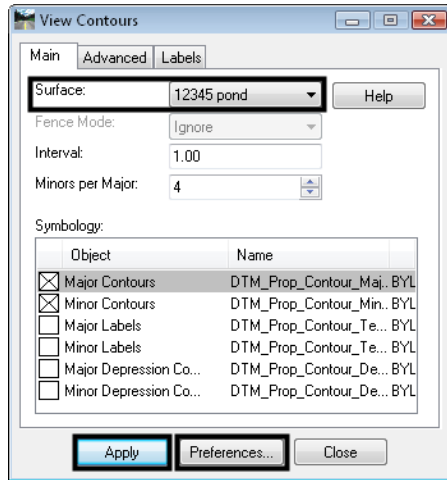
1. Select **File > Save As** from the InRoads main menu.

2. Set the *Save as type* to **Surfaces (*.dtm)**.

3. Set the *Active Surface* to **12345 pond**.

4. Verify the *Name* is **12345 pond.dtm**.

5. Verify the folder is **c:\12345\Design\InRoads**.

6. Select **Save**.

7. **Cancel** the *Save As* dialog box.

Lab 19.10 - Calculate the pond's capacity

1. Select **Tools > Application Add-ins** from the InRoads main menu.

2. Toggle on **Hydrology and Hydraulics Add-in** (if it's not already on).

3. **<D> OK** then **<D> Close**.
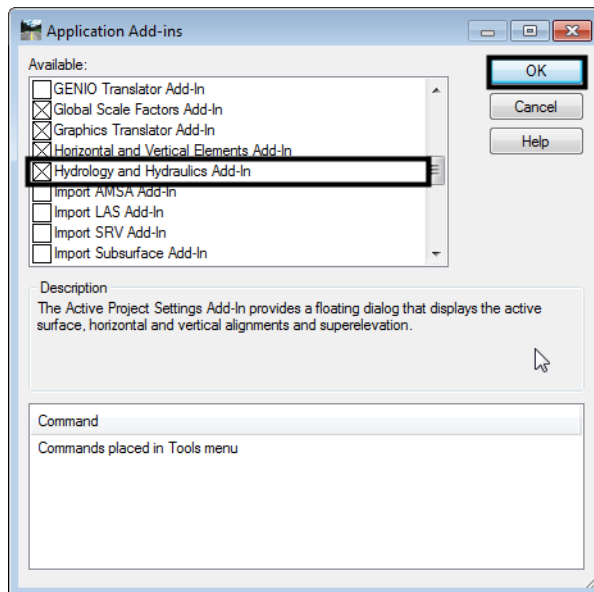
The command for calculating the pond volume is located on this add-in.

Next, compute the volume of water your pond will hold for a range of water elevations.

4. Select **Evaluation > Hydrology and Hydraulics > Compute Pond Volumes** from the InRoads main menu.

5. Set the *Surface* to **12345 pond**.

6. Set the *Method* to **Incremental**.

7. For the *Minimum Water Elevation* key in ***5142***.

8. For the *Maximum Water Elevation* key in ***5147***.

9. For the *Interval* key in ***0.5***.

10. Select the *Target* button next to the *Northing* and *Easting* fields and place a **<D>** in the middle of your pond toward the lower end.

11. **<D> Apply** and the volume is calculated for the range of elevations you entered. A report is shown with the incremental volumes.

Elevation	Incremental Volume	Cumulative Volume	Acre-Feet	Surface Area
	cu ft	cu ft		sq ft
5142.00	1076.01	1076.01	0.02	2865.92
5142.50	2071.19	3147.20	0.07	5544.57
5143.00	3605.25	6752.45	0.16	9019.63
5143.50	5558.26	12310.71	0.28	13348.39
5144.00	7826.31	20137.02	0.46	17119.15
5144.50	8753.37	28890.39	0.66	17895.19
5145.00	9142.65	38033.04	0.87	18676.26
5145.50	9534.45	47567.49	1.09	19462.38
5146.00	9928.77	57496.26	1.32	20253.58
5146.50	10325.64	67821.90	1.56	21049.80
5147.00	0.00	67821.90	0.00	0.00

12. **Save** the report to your hard drive if desired.

13. **Close** the *Compute Pond Volumes* dialog box.

Lab 19.11 - Challenge

If you would like a challenge on this activity, complete the following steps.
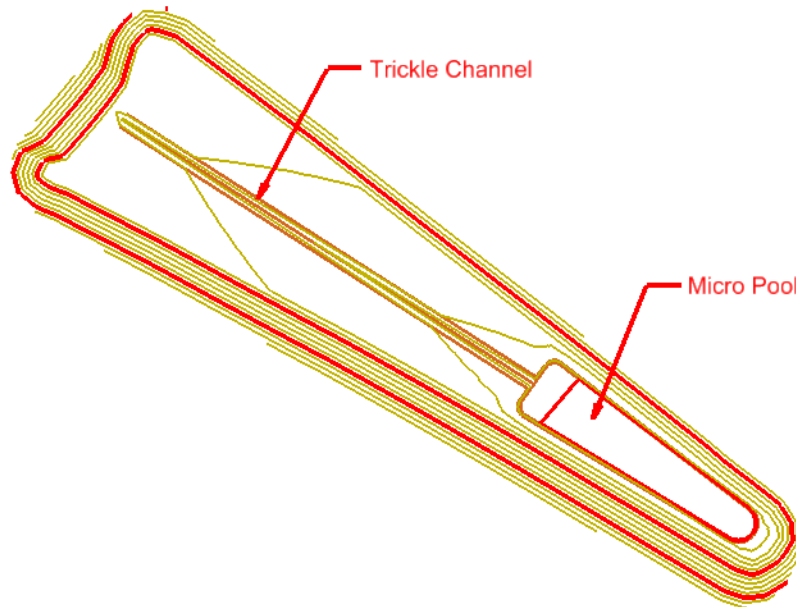
1. Add a micro pool of your own design at the deep end of the pond.

2. Add a trickle channel from the upper end down to the micro pool.

3. Zoom in close to the upper end of the pond and look at the pond toe line. Clean up the problems in the corner using **Design Surface** and **Edit Surface** tools.

Chapter Summary:

-   Design surfaces can be created using a variety of tools to create features.

-   Dummy surfaces can be created just to use as intercept targets for design commands.

-   The Generate Longitudinal Feature command is a very powerful tool for creating 3D features.

-   Simple sideslopes can be formed with Generate Sloped Surface command.

-   Staged water volumes can be computed for DTMs using the Pond Volumes command on the Hydrology and Hydraulics Add-in.