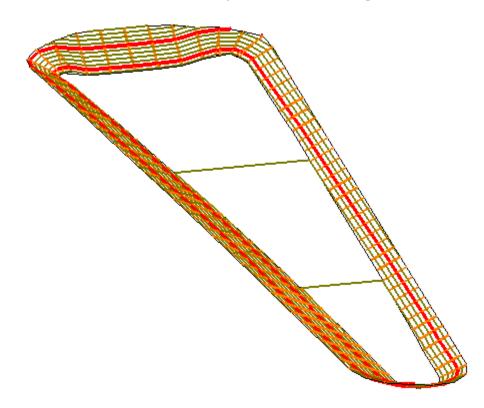
LAB 19 - Creating a Detention Pond

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:

- To learn the process of using the combination of several feature tools to create a proposed design.
- To understand the concept of creating a surface of features solely for use as a target.
- To realize the value of using Generate Longitudinal Feature and Generate Sloped Surface in creating proposed designs.

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 ground.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 the *Name* 12345 pond.
- 13. Key in the *Description Pond training example*
- 14. Set the *Preference* to *Proposed*
- 15. **<D> Apply** and **Close** the *New* dialog.

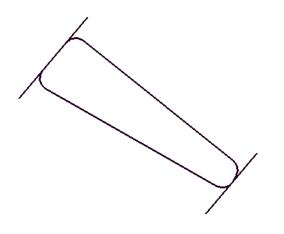
🐂 New			
Surface Geometry			
Туре:	Design	•	Apply
Name:	12345 pond		Help
Description:	Pond training exa	ample	
Maximum Length:	0.00		
Preference:	Proposed	-	
Name		Descriptio	n
Default			
12345 existing gro	und	Existing Gr	ound from
	Close		

Lab 19.2 - Display the Pond Graphics

1. Toggle on the display for the *12345DES_Pond.dgn* reference file.

<u>[</u> ools <u>S</u> ettings 	🕺 🖘 🗇 👔	p 🗗 🛐	70 🋱 📅 📦	🗙 <u>H</u> ilite Mode:	Boundaries	•				
ot 🍸 🏲 File Name		Model	Description	Logical	Presentation	0	•	2	۲	4
1 12345 Design Po	nd.dgn	CDOT Default	Aligned with Master Fi	ile	Wireframe	0	\checkmark	\checkmark	\checkmark	4
cale 1.000000	: 1.000000	Or	ientation Top	Rotation 0°0	0''					

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 the feature *Name Pond top*.
- 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 *O*.

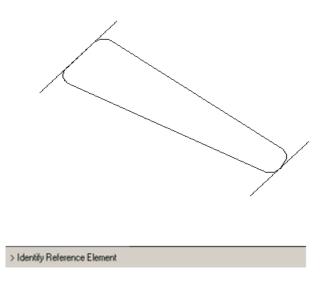
🕌 Generate Longitudina	al Feature	- • ×
Main Controls		
Surface: 12345 p	oond 👻	Filter
Exterior Arc: 5^00'0	0''	New Style
- Reference Feature		Help
🔽 Interval:	10.00	нер
Stroke Tolerance:	0.01	
- Longitudinal Feature Mode: ()	New 💿 Modify	
Name:	Pond top 🗸 🕈	
Feature Style:	H_Detention_Pond-Top 🔹	
Point Type:	Breakline 🔻	
Point Density Interval:	0.00 +	
Duplicate Names: Append	Replace () Rename	
Exclude from Triang	gulation	
Remove Loops	C Generate Graphics Only	
Triangulate Surface		
	ply Preferences Close]

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 ground.
- 14. **<D> Apply**, then **<D>** to Identify and **<D>** to Accept the pond outline as the *Primary Element*.

Generate Longit	udinal Feature	
Main Controls		
Horizontal		
Method:	Offset from Primary Feature 🔷 🔻	
Start Offset:	0.00 🕂	
Stop Offset:	0.00 +	Help
Vertical		
Method:	Drape 🔻	
Drape Surface:	12345 existing grot 💌	
	Apply Preferences CI	ose

> Identify 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.

Lab 19.4 - Review the feature

- 1. Select Surface > Feature > Feature Properties.
- 2. Set the *Surface* to *12345 pond*.
- 3. Highlight the *Pond top* feature and choose *List Points*.

🖮 Feature Pro	operties					
Surface: Feature: Name Pond top	12345 pond • Style • H_Detention_Pond-Top	Style Available: B_RAIL_Ty-1 B_RAIL_Ty-1 B_RAIL_Ty-7 B_RAIL_Ty-7 B_RAIL_Ty-7 Breakline Primaty: H_Detention_ Secondaty:	_SECT-A		•	Apply Close Filter List Points New Style Help
		Pay Items Name	Description	From Style	6	
Name: Description: Parent: Refresh/Dis	Pond top Created by Generate Longitudinal Feature command splay in 3-D/Plan View		Breakline ity Interval: 0,00 m Triangulation	•		

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

Su	Name: Pond top iption: Created 1 rface: 12345 pon Type: Breakline Style: H_Detentio	ď	gitudinal Feat	ure command	^	Close Save As Append
L	ength: 848.73				Ξ	~hheur
Point	X	V	Z	Distance Along Feature		Display
1	134921.58	291319.73	5150.97	0.00		
2 3	134914.48	291326.62	5150.55	9.90		Print
	134911.52	291336.06	5150.42	19.80		
4 5	134913.49	291345.75	5151.53	29.75		Help
6	134919.40 134925.85	291353.78 291361.42	5153.95 5154.07	40.01 50.01		
ь 7	134922.30	291369.06	5154.07	60.01		
, 8	134938.76	291376.70	5154.00	70.01		
9	134945.21	291384.33	5153.62	80.02		
10	134951.66	291391.97	5151.37	90.26		
11	134958.28	291399.46	5150.59	100.29		
12	134966.97	291404.18	5149.34	110.25		
13	134976.85	291404.07	5150.05	120.16		
14	134985.57	291399.38	5149.22	130.10		
15	134993.37	291393.12	5149.07	140.10		
16	135001.17	291386.87	5148.92	150.10		
17	135008.98	291380.62	5148.77	160.10		
18	135016.78	291374.36	5148.62	170.10		
19	135024.58 135032.39	291368.11 291361.86	5148.47 5148.30	180.10 190.10		
20						

- 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* box and again on *Feature Properties*.

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.
- 2. Set the *Type* to *Design*.
- 3. Key in the Name: 12345 dummy pond bottom.
- 4. Key in the *Description*: *Pond training example*.
- 5. Set the *Preference* to *Proposed*.

6. **<D> Apply** and **Close** the *New* dialog.

🐂 New		
Surface Geometry	V	
Туре:	Design 👻	Apply
Name:	12345 dummy pond bottom	Help
Description:	Pond training example	
Maximum Length:	0.00	
Preference:	Proposed 👻	
· · · ·		
Name	Descriptio	n
Default		
12345 pond	Pond trainir	ng example
12345 existing gro	bund	
	Close	

On the *Surface* tab:

Select Surface > Design Surface > Generate Longitudinal Feature (GLF).

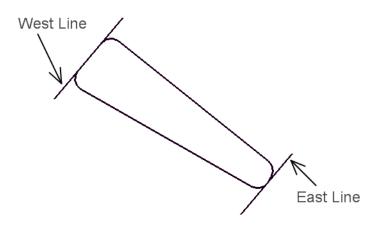
7. Set the *Surface* to *12345 dummy pond bottom*.

🕌 Generate Longitudina	l Feature	- • •
Main Controls		
Surface: 12345 c	lummy pond 👻	Filter
Exterior Arc: 5^00'0	0''	New Style
Reference Feature		Help
🔽 Interval:	10.00	(nop
Stroke Tolerance:	0.01	
_ Longitudinal Feature		
	New 🔘 Modify	
Name:	Pond target 🛛 👻 🕈	
Feature Style:	Default 👻	
Point Type:	Breakline 🔹	
Point Density Interval:	0.00 +	
Duplicate Names: Append	Replace 🔘 Rename	
Exclude from Triang	julation	
Remove Loops	Generate Graphics Only	
Triangulate Surface		
App	oly Preferences Close]

8. Set the other criteria as shown to create a new feature.

Main Controls		
<u>Horizontal</u>		
Method:	Offset from Primary Feature 🔹	
Start Offset:	0.00 🕂	
Stop Offset:	0.00 🕂	Help
_ Vertical		
Method:	Elevation/Elevation 🗸	
Start Elevation:	5144.00 +	•
Stop Elevation:	5144.00 🔶	
	5144.00	J

- 9. **<D> Apply**.
- 10. Select the West linestring with a data point *<D>*.



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

11. **<D>** to accept.

You are prompted to *Identify Reference Element*.

12. 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)*.

- 13. **<R>** Reset to copy the entire element.
- 14. $\langle \mathbf{D} \rangle$ 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 shape is made into a feature at elevation 5144 in the surface dummy pond bottom.

Lab 19.6 - Review the feature

- 1. Select Surface > Feature > Feature Properties.
- 2. Set the *Surface* to *12345 dummy pond bottom*.
- 3. Highlight the *Pond target* (5144 elevation) feature and choose *List Points*.

You should see all 5144 elevations for the feature.

4. Repeat section 1.5 steps 7-13 to create a feature in the same surface for the East line, which should be set to an elevation of *5141*.

🕈 Feature Pro	operties							
Surface:	12345 dummy pond bottor 💌		Style Available:					Apply
eature: Name	Style	+	B_RAIL_Ty-10M B_RAIL_Ty-10R				-	Close
^D ond target	Default		B_RAIL_Ty-10R B_RAIL_Ty-3 B_RAIL_Ty-7					Filter
Pond target1	Default		B_RAIL_Ty-7_S Breakline	ECT-A			-	List Points.
			Primary:					New Style.
			Default				•	Help
			Secondary:					
			Pay Items					
			Name	Desc	ription	From Style	\$	
				DATA	BASE NOT OPEN	Yes	*	
•	4 III							
lame:	Pond target		Triangulation Feature Type:		Breakline	•		
escription:	Created by Generate Longitudinal Feature command		Point Density	nterval	0.00			
arent:						+		
	splay in 3-D/Plan View		Exclude from	i riangula	tion			

You should now have two features in 12345 dummy pond bottom.

- 5. Select **Close** to dismiss the *GLF* dialog box.
- 6. Turn off the reference with the original pond graphics.

🙀 Refer	ences (1 of 1 uni	que, 0 displayed)									, • 🗙
<u>T</u> ools	<u>S</u> ettings										
i . •	陸 🎗 🗅	🛒 🖘 🗇 🛃	ĉ° 🕻 🖪) 🛃 🛱 🚰	🕲 🗙 н	ilite Mode: (Boundaries -	•			
Slot 🎙 🎙	File Name		Model	Description		Logical	Presentation	0	• 4	*	(<u>A</u>
1	12345 Design	Pond.dgn	CDOT Defau	It Aligned with M	aster File		Wireframe	0	\checkmark	\checkmark	\checkmark
	1 000000	1 000000									
	1.000000	: 1.000000		Irientation Top	Hot	ation 0°0'0					
Offset <u>X</u>	-178956.971	<u>Y</u> -178956.9	71	2 -178956.971		• 2 k	<u></u>	6	• 🌐 🚯	9	P
No Nes	sting 🔻 🛛	Allow Overrides 🔻 <u>D</u> e	oth: 1 N	e <u>w</u> Level Display: (Config Variable					_	

7. **Triangulate** the dummy pond bottom surface.

	valuation Modeler Drafting Iools Help			
	Data Type	Active	Features	^
🖃 🗐 Surfaces	ℜ Breakline Features	0	0	
📄 🌧 Default	Sontour Features	0	0	
12345 existing ground	Exterior Features	0	0	=
12345 Design pond	🥂 Inferred Breaklines	0	0	
🗄 🌄 12345 dummy pond botto		0	0	
	Save	0	0	
	Save As	0	0	-
💐 Surfaces 🖁 Geometry 📉 P	Set Active			•
Toggles the Station Lock	Triangulate			H
	Сору			
	Close			
	Empty			
	Properties			

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 bottom of the pond, you must first change the *Locate* mode.

2. Select the Surface > Design Surface > Generate Sloped Surface (GSS).

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* category:

- 9. Turn 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*.

🕌 Generate Sloped Surfa	ice			
Main Advanced				
Current Locate Mode:	Features			Filter
Source Surface:	12345 pond 🔹			New Style
Intercept				Help
Surface:	12345 dummy pond 🔻			Пеф
Elevation:	0.00			
Destination Surface:	12345 pond 🗸			
Interval:	10.00	+		
Cut Slope: 50.00%	To:	3	3.00%	
Fill Slope: .50.00%	🔲 To:		3.00%	
Apply to Both Sides	Triangulate	Surfa	ace	·
Feature				
Name			Style:	
	verse 🔻	+	DTM_Transverse	•
Tick Marks				
Source: Ponc	i Top 👻	+	Breakline	
Catch Point: Ponc	l bottom 👻	ŧ	H_Detention_Pond-E	lottom 👻
Point Type:	Breakline 🔹			
Point Density Interval:	10.00	÷		
Duplicate Names:				
	Replace 💿 Rename			
Exclude from Triang	ulation 📃 Generate G	iraphi	cs Only	
	Apply Preference	:es	Close	

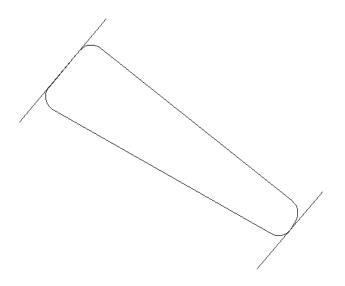
15. On the *Advanced* tab, key in *5[^]00'00.00"* for *Exterior Arc*.

Generate Sloped S	urface		
Main Advanced			
Corners			
Exterior Arc:	5^00'00''		
V Fillet Interior			
Berm Cut Slope:	5.00%		Help
Berm Fill Slope:	-5.00%		
Transverse Feature	\$		
🔲 Maximum Distan	ce: 100.00	-#-	
	Apply Preference	es Close	

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

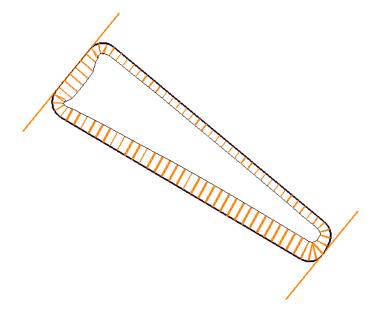
You will be prompted to *Identify Feature*.

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.

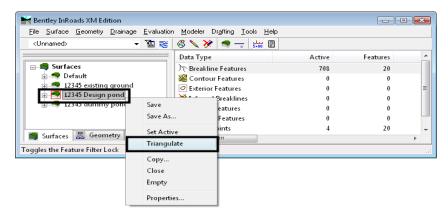


Graphics will appear as shown.

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

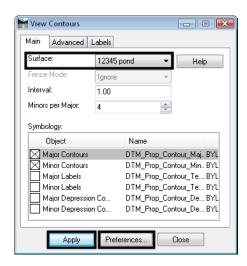
Lab 19.8 - Evaluate the pond surface

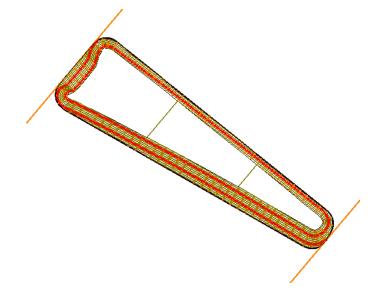
1. Right-click on the pond surface in the Explorer portion of the InRoads menu and select **Tri-angulate**.



- 2. Select Surface > View Surface > Contours.
- 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.
- 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* box.

Lab 19.10 - Calculate the pond's capacity

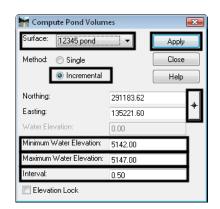
1. Select Tools > Application Add-ins, toggle on *Hydrology and Hydraulics Add-in* (if it's not already on) and choose OK.

										ОК
Graphics Translator Add-In										OIX.
Horizontal and Vertical Elements Add-In									C	ancel
Hydrology and Hydraulics Add-In								1	_	
Import AMSA Add-In										lelp
Import LAS Add-In										
Import SRV Add-In										
Import Subsurface Add-In										
Import Versine Add-In								≡		
Light Rail Manufacturing Add-In										
Lot Layout Add-In										
Multiple Horizontal Element Regression Analysis Add-In										
Multiple Vertical Element Regression Analysis Add-In										
Named Symbology Tools Add-In										
Place Cell/Block Add-In										
Quantity Add-In								-		
Description The Hydrology and Hydraulics Add-In lets you display features that affect w	vater flow	on a [)TM, c	fisplay	flow pa	aths (tr	ickles)	and ti	ibutari	es,
compute water volume in retention ponds, and generate water surface dec	ks for HE	C-2, W	/SPR0), and	HEC-F	AS.				
				-					-	42
Command		1.8							1000	6.
	×	X	×	_		×	×	204		
Evaluation>Hydrology and Hydraulics>Generate Water Surface Data	×	Х	×	X	Х	Х	Х	-	:	:
Evaluation>Hydrology and Hydraulics>Generate Water Surface Data Evaluation>Hydrology and Hydraulics>Pass through Contours	×××	× ×	× ×	× ×	× ×	× ×	× ×	-	•	•
valuation>Hydrology and Hydraulics>Generate Water Surface Data Evaluation>Hydrology and Hydraulics>Pass through Contours Evaluation>Hydrology and Hydraulics>Display Flat Areas	× × ×	-								
Command Evaluation>Hydrology and Hydraulics>Generate Water Surface Data Evaluation>Hydrology and Hydraulics>Pass through Contours Evaluation>Hydrology and Hydraulics>Display Flat Areas Evaluation>Hydrology and Hydraulics>Display Valleys and Ridges Evaluation>Hydrology and Hydraulics>Display Peaks and Pits	×××	× ×	× ×	× ×	× ×	× ×	× ×	-		

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.

- 2. Select Evaluation > Hydrology and Hydraulics > Compute Pond Volumes.
- 3. Set the *Surface* to *12345 pond*.
- 4. Set the *Method* to *Incremental*.
- 5. For the *Minimum Water Elevation* key in 5142.
- 6. For the Maximum Water Elevation key in *5147*.
- 7. For the *Interval* key in *0.5*.
- 8. 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.
- 9. **<D> Apply** and the volume is calculated for the range of elevations you entered. A report is shown with the incremental volumes.

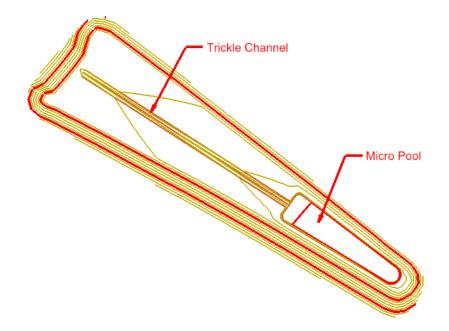


Elevation	Incremental Volume	Cumulative Volume	Acre-Feet	Surface Area	Close
	cu ft	cu ft		sq ft	Save A
5142.00	1076.01	1076.01	0.02	2865.92	- Save A
5142.50	2071.19	3147.20	0.07	5544.57	Appen
5143.00	3605.25	6752.45	0.16	9019.63	Displa
5143.50	5558.26	12310.71	0.28	13348.39	Print
5144.00	7826.31	20137.02	0.46	17119.15	
5144.50	8753.37	28890.39	0.66	17895.19	Help
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	

- 10. **Save** the report to your hard drive if desired.
- 11. Close the Compute Pond Volumes dialog.

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 proficient tool for creating 3D features.
- Simple sideslopes can be formed with GSS.
- Staged water volumes can be computed for DTMs using the **Pond Volumes** command on the **Hydrology and Hydraulics Add-in**.