Process for Calculating Elevation Difference Between Existing and Proposed Grades at Utilities

The intent of this exercise is to be able to generate an accurate and complete list of all utility poles, anchors, etc. that fall within the proposed grading limits of your project.

You will generate reports showing both the existing ground elevation and proposed ground elevation at each utility pole. The grade change can then be calculated and the list delivered to each utility company for determination of whether the pole needs to be relocated or replaced.

Keep in mind that a *visual evaluation and good engineering judgment* must be used when evaluating the list. For example, your proposed dtm may not be exhaustive of every finished grade condition, especially say near an entrance. So if a utility pole exists near an entrance, the report may show a 2m cut at that pole, when in reality there may be no excavation at all.

In addition, there may be poles that exist just outside of the grading limit, but may be impacted by a culvert or other conditions. Or a pole may exist within the grading limits of a short sideroad where no proposed dtm or cross sections were necessary.

A thorough QC of the list must be made prior to delivering to the utility company.

- **1.** Before you begin, you must have an existing ground dtm and a proposed finished ground dtm created.
- 2. Copy the Topographic base file to a new 3d file called utilities.dgn (.dwg in AutoCad)
- 3. Isolate all layers with utility poles, anchors, etc.
 - i.e. PH-E-UTL-AN Photogrammetry Anchors PH-E-UTL-BH – Photogrammetry Bell/Hydro Poles PH-E-UTL-HP – Photogrammetry Hydro Poles PH-E-UTL-BP – Photogrammetry Bell Poles PH-E-UTL-LS – Photogrammetry Light Standards SP-E-UTL-AN – Survey Anchors SP-E-UTL-BH – Survey Bell/Hydro Poles SP-E-UTL-HP – Survey Bell/Hydro Poles SP-E-UTL-BP – Survey Bell Poles SP-E-UTL-LS – Survey Light Standards

Verify that these layers contain all of the utility facilities that you wish to report. Ensure that no miscellaneous information is included, i.e. aerial lines, clearance text, etc.

This process will still work even if the graphic symbols are shared cells with tags.

Surface Geometry	y Drainage		
Туре:	Existing	× (Apply
Name:	ExistingUtilities		Help
Description:	Existing Utilities		
Maximum Length:	0.000		
Preference:	мто	~	
Name		Description	
Default Hwy6exst Hwy6R0W		Highway6 Ex Highway 6 Ri	
Hwy6top	Created from roadwa		

4. FILE >NEW. Create a new dtm called ExistingUtilities.dtm

This new dtm will be used as a "container" to store the horizontal and vertical locations of all the existing utility poles, anchors, etc.

5. FILE >IMPORT SURFACE

	I From Geom		
Surface:	ExistingUtilitie	s 💌	Apply
Load From:	Level	~	Filter
Level:	PH-E-UTL-HF	· ·	Results
Elevations:	Drape Surface	e 💙	
Intercept Surface:	Hwy6exst	~	Preferences
🗹 Drape Vertices C	Inly		Help
Thin Surface			
Tolerance:	5.000		
- Features	-		
Use Tagged G	raphics Informatio	on	
Seed Name:		PH-E-UTL-HP	✓ +
Feature Style:		Utl Hydro Pole	~
Point Type:		Random	~
📃 Maximum Se	egment Length:	0.000	
Point Densit	y Interval:	0.000	
Duplicate Names: O Append	O Replace	Rename	
Exclude from T	riangulation		

Select the From Graphics Tab. Select your Existing Utilities surface and load from Level (Layer).

Select your first layer that contains utilities, i.e. Hydro Poles.

Set the elevations to Drape Surface and select your existing ground surface as the intercept surface. Toggle on Drape Vertices only.

For the seed name, type in the same name as the Level (Layer) you are importing from. Select the appropriate feature style and set Point Type to Random.

You do not need to triangulate anything in this surface, so check on Exclude from Triangulation.

- **6.** Repeat the above step for each and every level (layer) you wish to include. Be sure to match the seed name to the level (layer) and select the appropriate feature style.
- 7. Verify that all of your features have been imported correctly. **SURFACE >FEATURE > FEATURE PROPERTIES**

Surface: Feature:	ExistingUtilities			Style Available:				Apply
Name Style De PH-E-UTL-AN Utl Anchor PH-E-UTL-BH Utl Bell and Hydro Pole PH-E-UTL-HP Utl Hydro Pole PH-E-UTL-LS Utl Light Standard	Descriptic 4	<u>+</u>]	Unpaved Road Utl Bell and Hydro Pole Utl Bell Pole Utl Hydro Pole Utl Light Standard V Median Ditch	ŝ		<	Close Filter List Points	
SP-E-UTL-AN	Utl Anchor			Primary:				New Style
SP-E-UTL-BH SP-E-UTL-BP	Uti Bell and Hydro Pole Uti Bell Pole			Utl Anchor			~	Help
SP-E-UTL-LS	Utl Light Standard			Pay Items				
				Name De	scription	From Style	%	
							*	
<		2						
< lame:	PH-E-UTL-AN	>		Triangulation				
				Triangulation Feature Type: Point Density Interval	Random	•		

Select each feature in the left window and press List Points:

Feature	e Points				<u>^</u>	Close
						Save As
	Name: PH-E-UTI	L-AN				Append
	iption:	••• · · • · · · ·				- appond
Su	urface: Existing	gUtilities				Display
	Tupe: Point					
	Type: Point Style: Utl Anch	וסד			_	Dispidy
	Type: Point Style: Utl Anch Length: 18761.83					Print
	Style: Utl Anch					
I	Style: Utl Anch		z	Distance Along F	eatur	Print
I	Style: Utl Anch Length: 18761.81	17	Z 386.5508	Distance Along F 0.000	eatur	Print
I Point	Style: Utl Anch Length: 18761.81 X	17 Y			eatur	Print
I Oint	Style: Utl Anch ength: 18761.81 X 200378.5340	L7 ¥ 4885410.8920	386.5508	0.000	eatur	Print
I Point	Style: Utl Anch ength: 18761.81 X 200378.5340 200434.3090 200437.2310	L7 4885410.8920 4885248.3130 4885249.5210	386.5508 385.9850 385.9864	0.000 171.881 175.043	eatur	Print
I Point	Style: Utl Anch ength: 18761.83 200378.5340 200434.3090 200437.2310 200407.0370	Y 4885410.8920 4885248.3130 4885249.5210 4885227.5820	386.5508 385.9850 385.9864 385.6511	0.000 171.881 175.043 212.390	eatur	Print
I Point 2 3 4	Style: Utl Anch ength: 18761.81 200378.5340 200434.3090 200437.2310 200407.0370 200420.9040	Υ 4885410.8920 4885248.3130 4885249.5210 4885227.5820 4885157.9140	386.5508 385.9850 385.9864 384.6511 380.0648	0.000 171.881 175.043 212.390 283.572	eatur	Print
	Style: Utl Anch ength: 18761.83 200378.5340 200434.3090 200437.2310 200407.0370	Y 4885410.8920 4885248.3130 4885249.5210 4885227.5820	386.5508 385.9850 385.9864 385.6511	0.000 171.881 175.043 212.390	eatur	Print

Look through the point list to verify that all of the desired features were imported. Also, verify that a Z elevation appears for each point. If any points have been duplicated or are missing elevations, verify the dtm and the cells (blocks) at these locations and repeat Step 5 above.

Note, if you repeat step 5, be sure to Empty the surface first.

Save your ExistingUtilities.dtm surface.

8. The next steps are to isolate only the utilities that fall within the proposed grading limits.

Open a new empty drawing file or delete all of the graphics in your current working file.

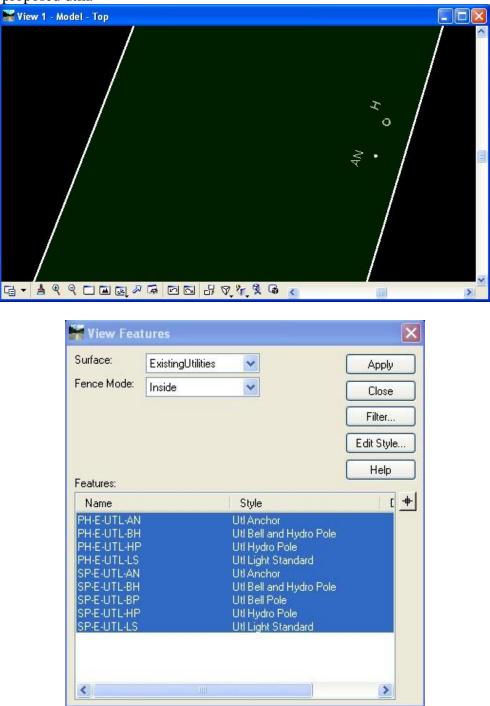
SURFACE >VIEW SURFACE >PERIMETER

f View	Perimeter		×
Surface:	Hwy6top	~	Apply
			Close
			Preferences
Symbolog	y:		Help
Object		Name	
Perimeter			

View the perimeter of your proposed ground dtm.

9. SURFACE >VIEW SURFACE >FEATURES

Set Fence (Region) Type to Element and place a fence (Region) on the perimeter of the proposed dtm.



Only the features within your proposed grading limits should be displayed. Verify that the displayed features have been displayed on the correct levels (layers).

urface Geometry	y Drainage					
Гуре:	Design	v	Apply			
lame:	ImpactedUtilities		Help			
Description:	Impacted Utilities within g	gra 🗌				
الملاحمة المستخلف	0.000					
Maximum Length:	0.000					
Maximum Lengin. Preference:	Default	*				
	Default	ription				
Preference:	Default Desci Highwa Highwa Created	ay6 Exis ay 6 Rig	ting Gro ht of W padway			

10. FILE >NEW. Create a new dtm called ImpactedUtilities.dtm

This new dtm will be used as a "container" to store the horizontal and proposed ground vertical locations of all the utility poles, anchors, etc. in the impacted areas of new grading.

11. FILE >IMPORT SURFACE

From Graphics DEN	From Geome	etry			
Surface:	ImpactedUtiliti	ies	~	A	oply
Load From:	Level		~	Fil	ter
Level:	SP-E-UTL-AN	9	~	Bes	ults
Elevations:	Drape Surface	e	~	Preferences	
Intercept Surface:	Hwy6top		~		
🔽 Drape Vertices 0	nly			Н	elp
🔲 Thin Surface					
Tolerance:	5.000				
Features	-				
Use Tagged Gr	aphics Informatio	on			
Seed Name:		Impacted	Anchors	*	+
Feature Style:		Utl Anch	or	*	
Point Type:		Random		*	
📃 Maximum Se	egment Length:	0.000			
Point Densit	y Interval:	0.000			
Duplicate Names:	O Replace (Rename	,		
Exclude from T	riangulation				

Select the From Graphics Tab. Select your Impacted Utilities surface and load from Level (Layer).

Select your first layer that contains utilities, i.e. Hydro Poles.

Set the elevations to Drape Surface and select your proposed ground surface as the intercept surface. Toggle on Drape Vertices only.

For the seed name, type in a name such as ImpactedAnchors. Select the appropriate feature style and set Point Type to Random.

You do not need to triangulate anything in this surface, so check on Exclude from Triangulation.

12. Repeat the above step for each and every level (layer) you wish to include. Be sure to select the appropriate feature style.

13. TOOLS >XML REPORTS >STATION OFFSET

Station Offset Report General Include	Surface: Features:	ImpactedUtilities 🔽	Filter
Horizontal Alignments	Name	Style	Description
		HydroPol Utl Hydro Pole LightStan Utl Light Standard	
	<		>

On the General window, set active your centerline alignment. On the Include window, toggle on the On-Alignment horizontal points. On the Features window, select all of your features.

The station and offset report will display from your centerline alignment to the impacted utilities showing the Proposed Ground Elevation.

P:\2538\000-00\Inroads\InRoads	File Name: P:\25 Last Revised: DryC Input Grid Factor: 1.0000	2/15/2008 8:38:16 /	$\sim \sim$	ometry\2538-Hwy 6.alg Note: All units in this report are in meters unless specified otherwise.			
StationOffset	Feature	Station	Offset	Elevation	Northing	Easting	Ô
A: ProfileExistingProposedE A: ProfileStationElevation x	ImpactedLightStandards	22+255.613	-10.599	383.216	4883458.913	200705.683	
ProfileStationElevation.x ProfileStationElevationA	ImpactedHydroPoles	22+272.583	13.252	382.696	4883479.082	200726.898	
StationBaseCoordinates	ImpactedHydroPoles	22+419.268	28.003	378.982	4883626.380	200720.784	
StationBaseSingle.xsl	ImpactedAnchors	23+255.379	20.630	376.214	4884448.703	200562.359	
StationBaseVerticalClea StationOffset.xsl	ImpactedHydroPoles	23+255.503	16.418	375.926	4884447.956	200558.212	
StationOffsetAlongSingle	ImpactedAnchors	23+255.634	12.261	377.308	4884447.228	200554.117	
StationOffsetAlongSingle	ImpactedAnchors	23+255.799	12.874	377.098	4884447.516	200554.683	
StationOffsetWithVersin TransverseFeature.xsl	ImpactedAnchors	23+503.327	12.716	376.758	4884689.609	200503.705	
uperelevation	ImpactedAnchors	23+503.543	14.037	377.417	4884690.080	200504.958	
urfaces	ImpactedHydroPoles	23+585.932	15.976	376.192	4884771.158	200491.584	
Survey abling	ImpactedHydroPoles	23+825.113	-12.668	373.776	4885001.234	200420.219	
rabiling	ImpactedHydroPoles	23+898.196	16.390	375.422	4885078.363	200435.602	

Repeat this step with another report showing the Existing Ground Elevations.

14. Once you have created the proposed and existing ground elevation report, create an excel spreadsheet to organize your results.

🕙 Eile Edit Vi	ew Insert Form	at <u>T</u> ools	Data Window	Help						Туре а	question	for help	
🗅 💕 🖫 🖪 🔒	3131210	2-19	- (* - 1 🔒 💈	E → Ѯ↓ 🏭 🙆	Arial	• 10	• B I L	ī ≣ ≣ ⊒	·a· \$ %	• .0 .00 •.€ 00. •	#	• 🙆 •	<u>A</u> -
<u>)</u> •) •) @ 4	5 X 15 X 1	3 14 10	Reply with	hanges End Revi	ew								
A17 -	<i>f</i> ∞ Hydro	A Commission of the second											
A	B	C	D	E	F	G	Н	i i	J	K	1	M	
7	XXX	XX	XX	XXX	XXX		XX	XXX		XX	12. 1		- X - 1
8 Feature	Station	Offset	Elevation Proposed	Northing	Easting	Distance from EP to Feature	Clear Zone from EP	Within Clear Zone Y/N	Elevation Existing	Grade Change			
IO Hydro Pole	22+272.583	13.252	382.696	4883479.082	200726.898	9.41	7	NO	384.945	-2.25			
11 Hydro Pole	22+419.268	28.003	378.982	4883626.380	200720.784	24.25	7	NO	379.370	-0.39			
12 Hydro Pole	23+255.503	16.418	375.926	4884447.956	200558.212	12.67	7	NO	376.515	-0.59			
13 anchor	23+255.634	12.261	377.308	4884447.228	200554.117	8.51	7	NO	376.655	0.65			
4 anchor	23+255.799	12.874	377.098	4884447.516	200554.683	9.12	7	NO	376.308	0.79			
5 anchor	23+503.327	12.716	376.758	4884689.609	200503.705	8.97	7	NO	377.680	-0.92			
6 anchor	23+503.543	14.037	377.417	4884690.080	200504.958	10.29	7	NO	378.090	-0.67			
7 Hydro Pole	23+825.113	-12.668	373.776	4885001.234	200420.219	-8.92	7	NO	374.302	-0.53			
8 Hydro Pole	24+235.936	16.458	385.030	4885410.548	200374.219	11.13	7	NO	386.661	-1.63			
19 Hydro Pole	24+312.149	17.288	383.104	4885485.589	200360.962	9.97	7	NO	384.055	-0.95			
20 Hydro Pole	24+389.683	16.866	381.747	4885560.735	200348.772	9.22	7	NO	382.924	-1.18			
21 anchor	24+389.739	12.297	383.113	4885560.317	200344.222	4.65	9	YES	382.838	0.27			
2 anchor	24+467.567	12.353	382.928	4885636.391	200341.488	4.70	9	YES	382.408	0.52			
23 Hydro Pole	Conflict List	16 422	381.664	4885636 781	200345 571	8 78	q	YES	382 502	-0.84			

You could identify which features fall within the clear zone within your spreadsheet, however you could also use the same process above to do the same. i.e. Draw your proposed clear zone lines and create a closed shape. Then display only the features within this shape. Your utilities can now easily be displayed in your cross sections if needed.

