GEOMETRIC SOLUTIONS

43.6532° N
79.3832° W



SAMPLE REPORT // GROUND CONDITION MAPPING AND EARTHWORKS VOLUMES

EARTHWORKS VOLUME REPORT

Existing ground model with two proposed-ground designs, a simple pad and a complex multi-segment grading plan, each with cut and fill volumes.

MAP // MODEL // DESIGN // MEASURE

DRONE PHOTOGRAMMETRY
RTK CONTROLLED
CUT / FILL VOLUMES

MODEL COVERAGE	CHECK-POINT ACCURACY	DESIGNS COMPARED
21.8 ha	1.7 cm horiz. / 2.4 cm vert.	2 proposed grounds

DRONE PHOTOGRAMMETRY MODEL

PREPARED BY GEOMETRIC SOLUTIONS

01 EXISTING GROUND: DRONE MODEL

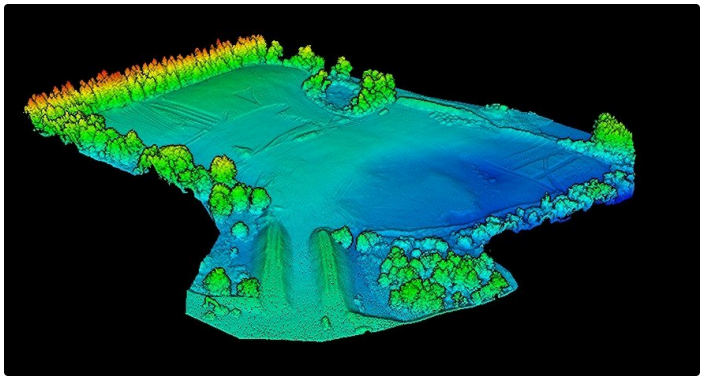
A high-resolution 3D model of the site as it stands today, captured by RTK drone and checked against independent ground check points. This is the baseline every volume is measured from.



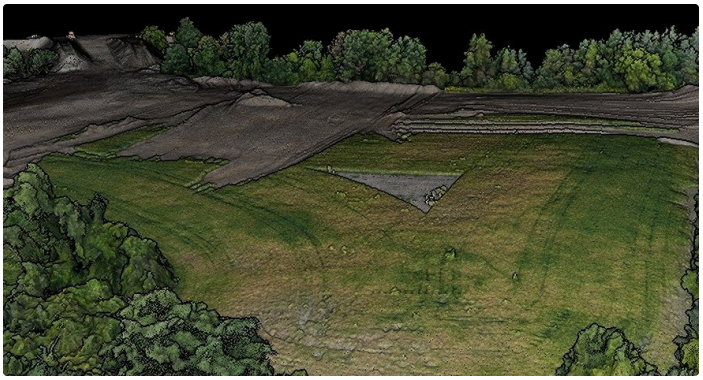
3D MESH MODEL



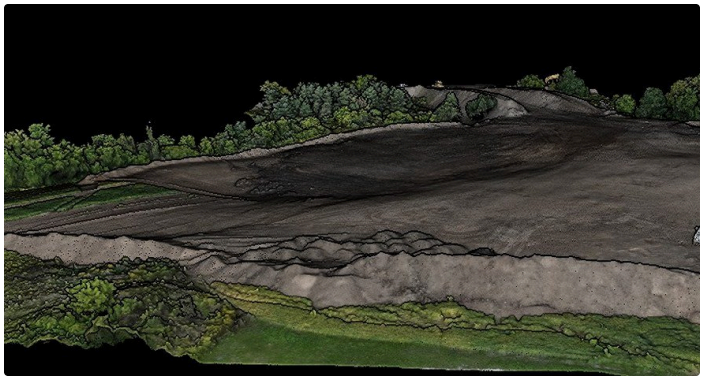
POINT CLOUD, TRUE COLOUR



ELEVATION MAP (BLUE = LOW, RED = HIGH)



CLOSE-UP: VEGETATED AREA



CLOSE-UP: GRADED SURFACE

SITE MODEL AT A GLANCE

Photos captured	**1,784 (all RTK fixed)**
Ground resolution	**2.4 cm per pixel**
Flight altitude	**67 m**
Model coverage	**21.8 ha**
Ground control	**9 control + 3 check points**
Check-point accuracy	**1.7 cm horiz. / 2.4 cm vert.**

02 BUILDING A PROPOSED GROUND

Every project starts with your idea for the finished ground. We turn it into a 3D proposed-ground surface built to your specifications, lay it over the drone model and measure the cut and fill. This report shows two designs on the same site.

01

YOU SHARE THE DESIGN IDEA

Target elevations, slopes, drainage direction, entrances, coordinates or a simple sketch. We review it together and refine the details.

02

WE BUILD THE PROPOSED SURFACE

A 3D proposed-ground model built to your coordinates, elevations and slopes, from a single pad to a multi-segment plan.

03

LAYERED ON EXISTING GROUND

The proposed model is laid over the drone model of existing ground. Cut and fill volumes and colour maps come straight from the difference.

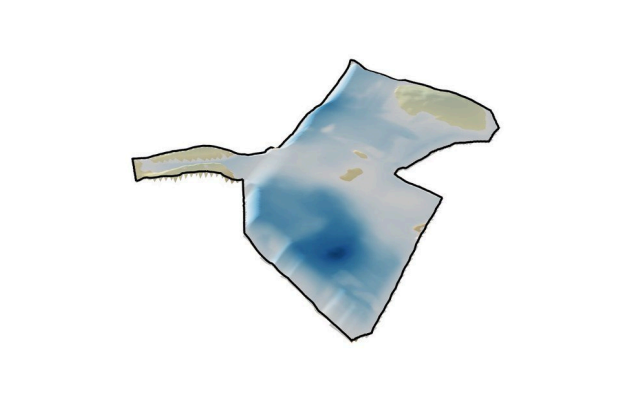
04

REPORT AND SITE MARKING

You receive the cut/fill report and models. If needed, we return to site and mark cut and fill areas with RTK GPS and markers.

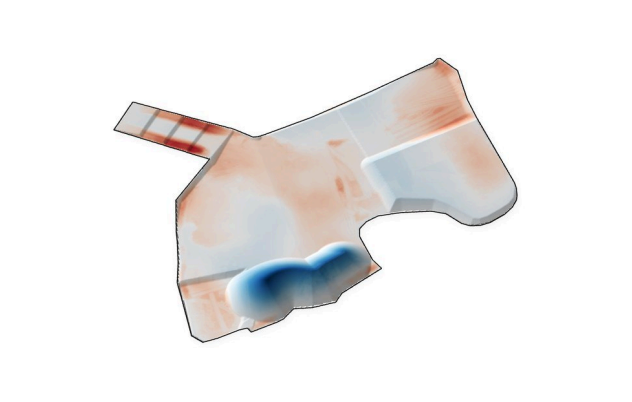
TWO DESIGNS, ONE SITE

DESIGN A: SIMPLE PAD



- One level pad graded with a 2% fall for drainage
- Perimeter slopes kept inside the property line
- Existing berms and access points preserved
- Mostly fill: the pad is raised above existing ground

DESIGN B: COMPLEX GRADING

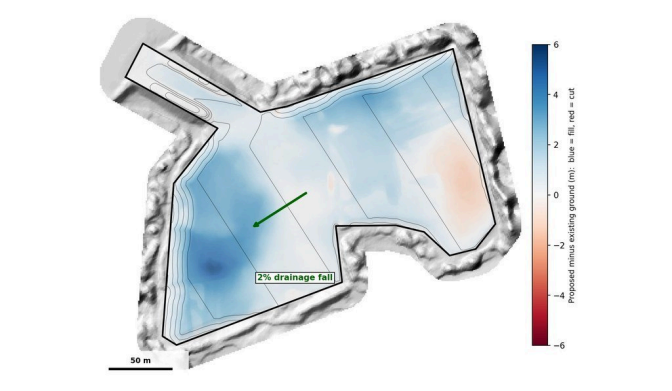


- Seven segments built from 61 client-supplied coordinates
- Flat pads, sloping pads, a stepped terrace and a 35 ft berm
- All segments tied together and into existing ground with 3:1 slopes
- Mixed cut and fill: pads cut in, berm built up

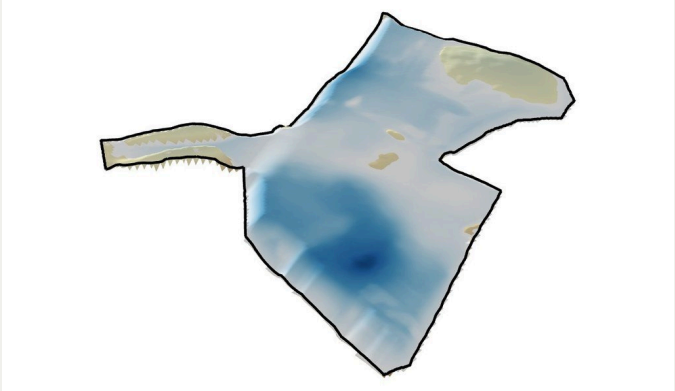
	DESIGN A: SIMPLE PAD	DESIGN B: COMPLEX GRADING
Fill (m^3)	**52,830**	**43,370**
Cut (m^3)	**2,635**	**24,810**
Net import (m^3)	**50,195**	**18,560**
Deepest fill / cut	about 5.5 m / 1.5 m	about 14 m / 5 m

03 DESIGN A: SIMPLE PAD VS EXISTING GROUND

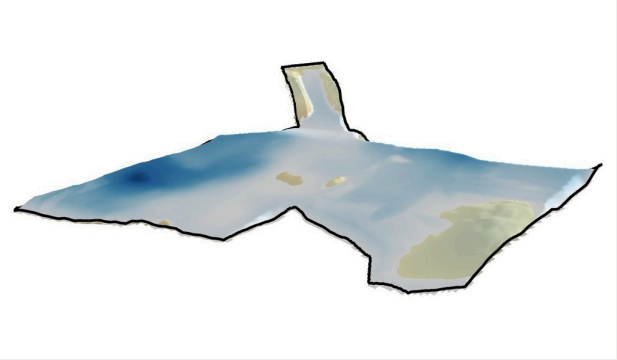
A single level pad with a 2% drainage fall, built to the target elevation and tied into existing ground inside the property line. Blue shows where ground is added; tan shows existing ground left above the pad.



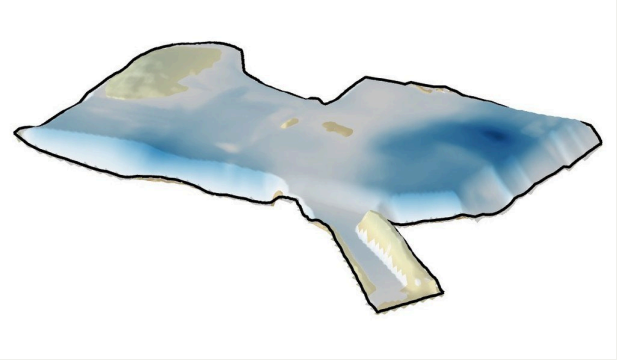
PLAN VIEW: ELEVATION CHANGE WITH CONTOURS



3D VIEW: OVERVIEW



3D VIEW: LOW ANGLE, SIDE ONE



3D VIEW: LOW ANGLE, SIDE TWO

COMPARE DESIGN OPTIONS (M³, APPROX.)

OPTION	FILL	CUT	NET
Pad 1 m lower	30,000	11,000	19,000
Selected design	**53,000**	**2,000**	**50,000**
Pad 1 m higher	79,000	<1,000	79,000

Raising or lowering the pad changes the material you import or remove. We can test options before earthmoving starts.

DESIGN SUMMARY

- Level pad graded with a 2% fall for drainage
- Perimeter slopes kept inside the property line
- Existing berms and access points preserved
- Deepest fill about 5.5 m; deepest cut about 1.5 m

Fill (up to 6 m) — Cut (up to 6 m)

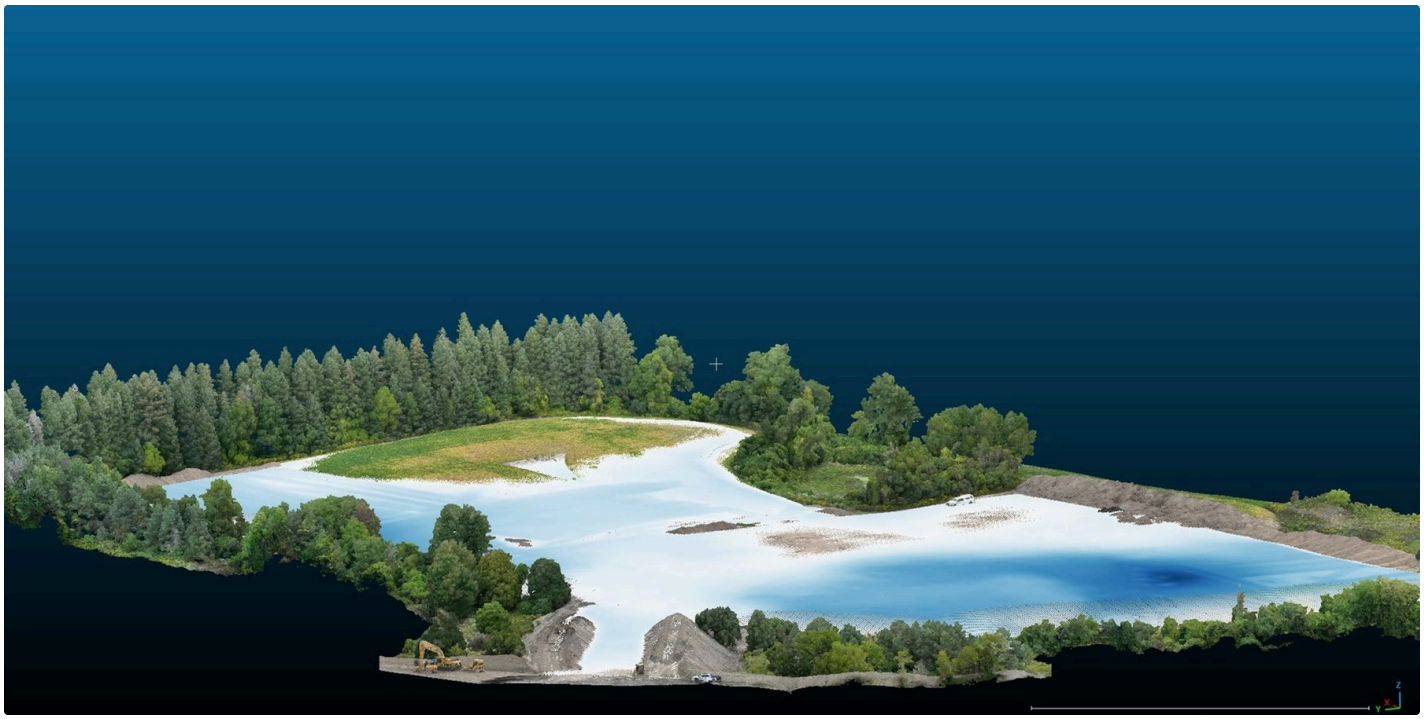
No change

04 DESIGN A: POINT-CLOUD COMPARISON

The proposed surface is compared directly against the drone point cloud, so the pictures and the volumes come from the same data. The darker the blue, the deeper the fill.



OBLIQUE VIEW OF THE SITE WITH THE PROPOSED SURFACE COLOURED BY FILL



SIDE VIEW: THE RAISED PAD AGAINST THE SURROUNDING EXISTING GROUND

05 DESIGN A: CUT AND FILL VOLUMES

Volumes are the sum of the height difference between the proposed and existing ground across the site, on a 0.5 m grid.

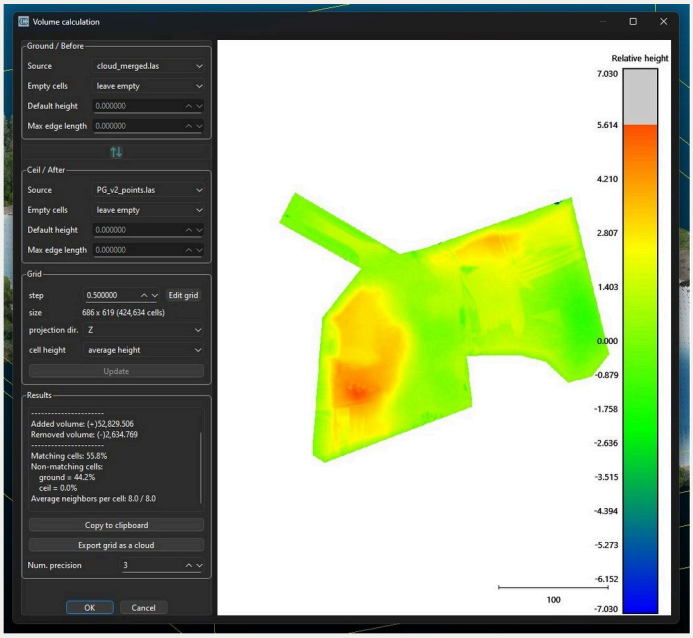


PLAN VIEW: FILL SHOWN IN BLUE



PLAN VIEW, ALTERNATE ORIENTATION

FILL (ADDED)	CUT (REMOVED)	NET FILL (IMPORT)
52,830 m³	2,635 m³	50,195 m³



VOLUME CALCULATION AND CUT/FILL GRID

HOW IT WAS MEASURED

The drone point cloud is the existing ground. The proposed surface is compared against it cell by cell on a 0.5 m grid.

ACCURACY

Checked against independent check points: 1.7 cm horizontal and 2.4 cm vertical (RMSE). We estimate the volumes are good to about ±2% (roughly ±1,000 m³).

DESIGN A AT A GLANCE

- Simple design: one pad, one grade
- Net import of about 50,000 m³ of fill
- Options tested at ±1 m before earthmoving

06 DESIGN B: COMPLEX PROPOSED GROUND

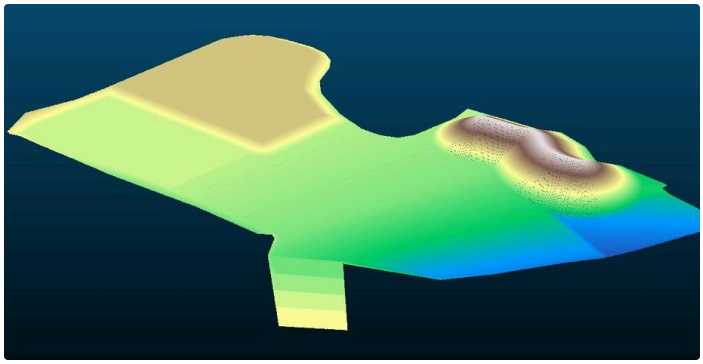
A multi-segment grading plan built to client specifications: two flat pads, two sloping pads, a 35 ft screening berm, a best-fit pad and a stepped terrace, all tied together with 3:1 slopes.

HOW IT WAS MADE

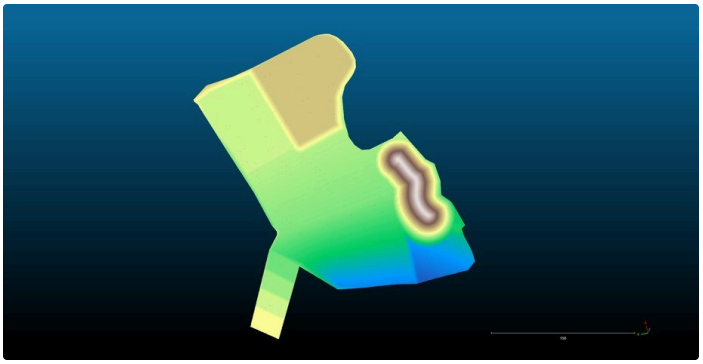
The client supplied 61 coordinates with elevations: 53 along the property line and 8 inside the site. Each segment was defined by its own perimeter points and a design rule. The surface meets existing ground at the property line with 3:1 slopes, and wherever two segments meet at different heights a 3:1 slope drops into the lower one, so the higher pad keeps its full footprint. The berm uses 2:1 faces, the steepest practical slope for compacted fill, so it reaches full height inside the site. The finished surface was exported as a 0.25 m point cloud (about 720,000 points) and laid over the drone model.

SEGMENT	DESIGN	ELEVATION (M)
S1	Flat pad at the elevation of perimeter point 41	315.73
S2	Flat pad, lower than S1, cut into higher ground along the property line	313.00
S3	Sloping pad falling about 1.6% toward the S5 boundary	312.68 → 311.50
S4	35 ft screening berm with a 3 m crest and 2:1 faces, widened north to reach full height	322.90 crest
S5	Sloping pad continuing the S3 fall down to the west edge	311.50 → 306.56
S6	Best-fit tilted plane for the least cut and fill, about 5.4% grade	305.2 – 309.2
S7	Stepped terrace: four treads with 1 m steps and 3:1 risers	314.08 → 311.26

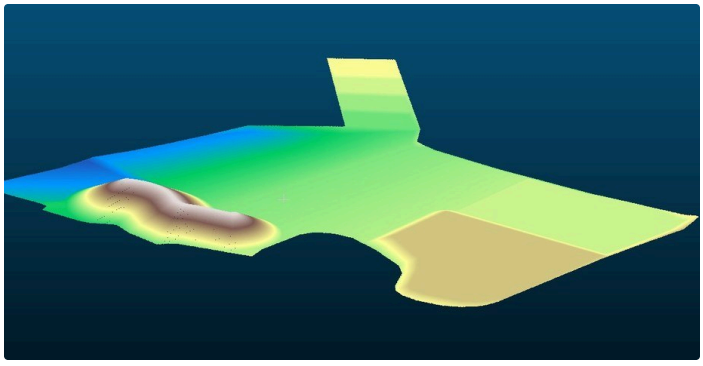
THE PROPOSED GROUND ON ITS OWN (COLOURED BY ELEVATION: BLUE = LOW, WHITE = HIGH)



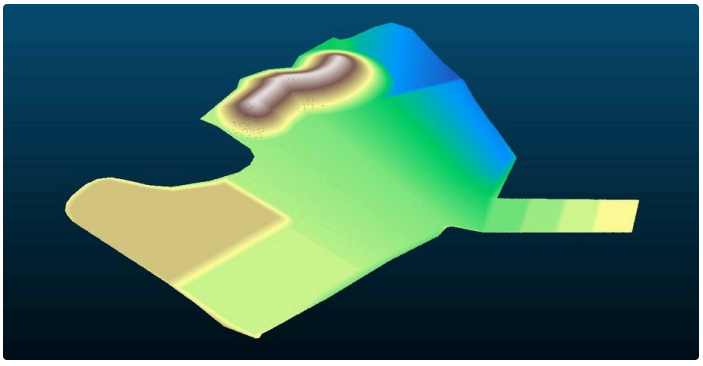
OBLIQUE VIEW



PLAN VIEW



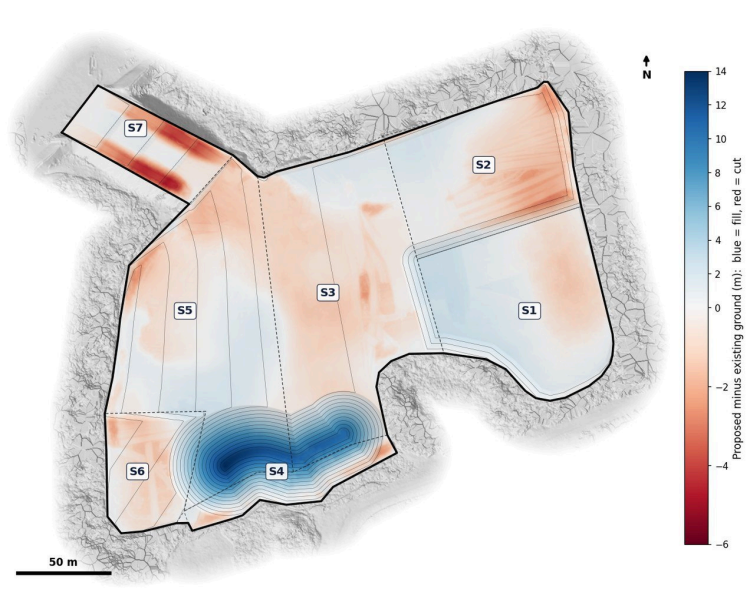
LOW ANGLE, SIDE ONE



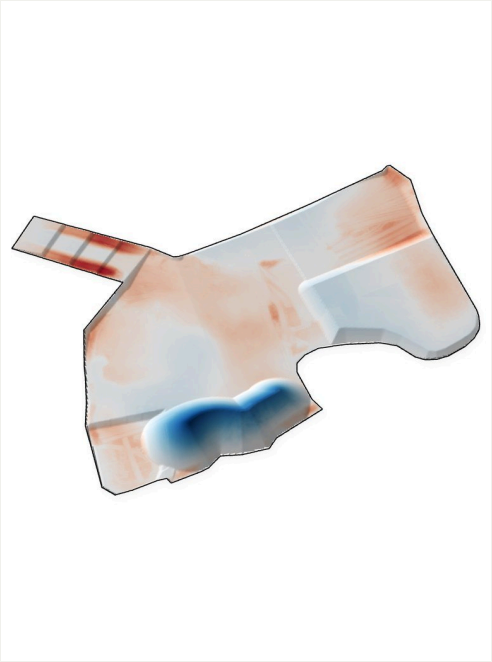
LOW ANGLE, SIDE TWO

07 DESIGN B: COMPLEX GROUND VS EXISTING GROUND

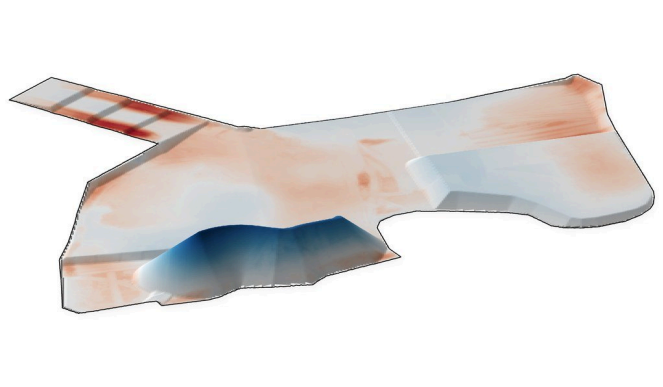
The complex surface compared against the bare ground of the drone model. Blue is fill and red is cut; the darker the colour, the deeper the change.



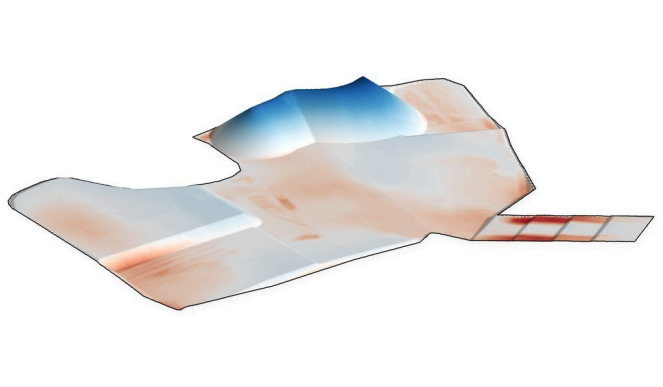
PLAN VIEW: ELEVATION CHANGE, 1 M CONTOURS, SEGMENTS LABELLED



3D VIEW: OVERVIEW



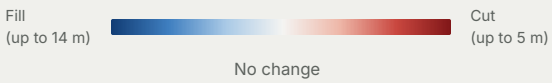
3D VIEW: LOW ANGLE, FROM THE SOUTH



3D VIEW: LOW ANGLE, FROM THE NORTH

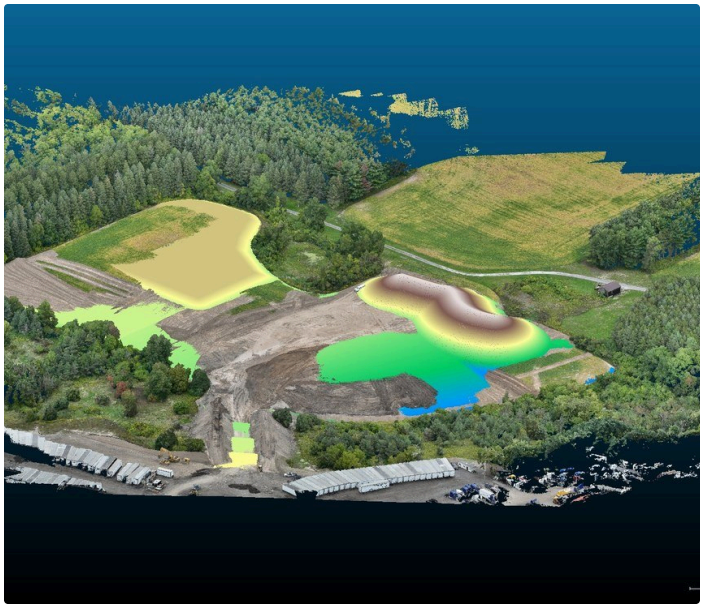
DESIGN SUMMARY

- Pads are mostly cut into existing ground; the berm is built up to 14 m above it
- The 35 ft berm accounts for about 29,700 m³, around two-thirds of all fill
- The stepped terrace (S7) cuts four level treads into the existing slope
- Every edge ties into existing ground at 3:1, so no retaining walls are needed

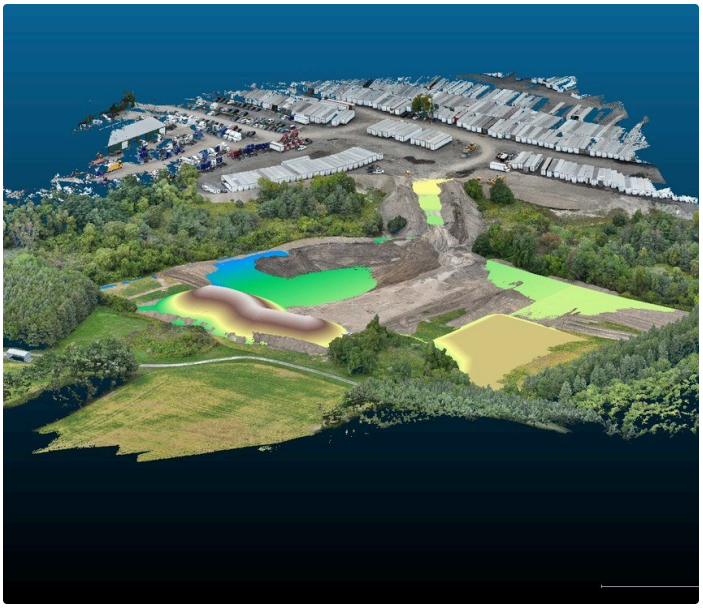


08 DESIGN B: POINT-CLOUD COMPARISON

The proposed surface laid directly on the full-colour drone point cloud, so the pads, berm and terraces can be judged in context against the existing trees, roads and buildings. The surface is coloured by elevation.



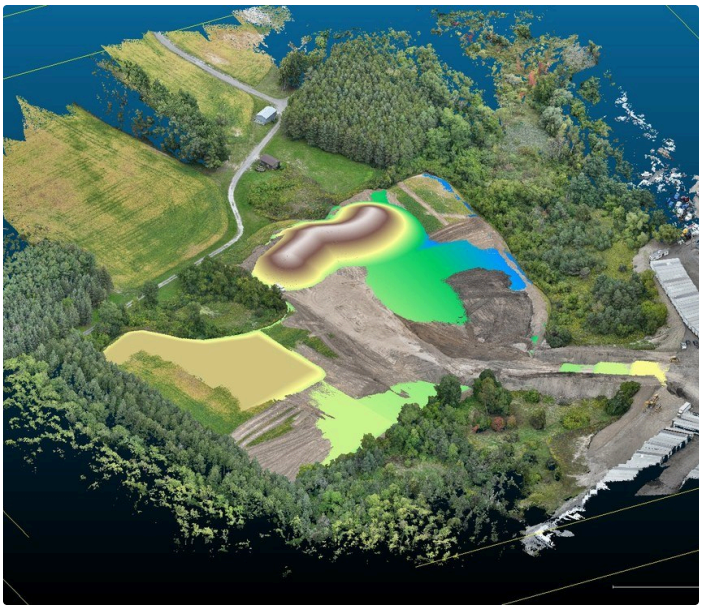
OBLIQUE VIEW FROM THE SOUTH



OBLIQUE VIEW FROM THE NORTH



PLAN VIEW

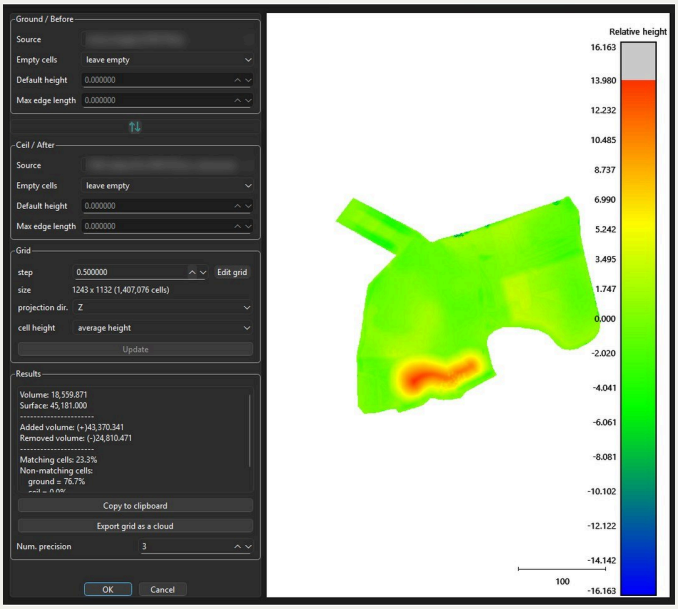


OBLIQUE VIEW FROM THE EAST

09 DESIGN B: CUT AND FILL VOLUMES

The same method as Design A: the proposed surface is compared against the drone point cloud cell by cell on a 0.5 m grid, across the 4.5 ha graded area.

FILL (ADDED)	CUT (REMOVED)	NET FILL (IMPORT)
43,370 m³	24,810 m³	18,560 m³



VOLUME CALCULATION AND CUT/FILL GRID

VOLUME BY SEGMENT (M³, APPROX.)

SEGMENT	FILL	CUT
S1 Flat pad	6,200	2,100
S2 Flat pad	1,800	5,300
S3 Sloping pad	1,700	6,800
S4 Berm	**29,700**	**600**
S5 Sloping pad	3,700	4,300
S6 Best-fit pad	200	1,800
S7 Stepped terrace	200	3,800

Segment figures are rounded and sum to within 1% of the totals.

HOW IT WAS MEASURED

The drone point cloud is the existing ground and the 0.25 m proposed-ground point cloud is the design. Both are averaged into 0.5 m cells and the height difference is summed: positive is fill, negative is cut.

ACCURACY

Checked against independent check points: 1.7 cm horizontal and 2.4 cm vertical (RMSE). We estimate the volumes are good to about ±2% (roughly ±900 m³ of fill).

10 CUT LINE PROFILES

Cut lines turn the 3D model into simple 2D sections. Each line runs between two of the client's coordinates and shows the height of the site along it, with the Design B proposed ground laid on top, so slopes, high and low spots and the depth of cut or fill can be read at any point.



PLAN VIEW: TRUE-COLOUR DRONE MODEL WITH CUT LINES, TICKS EVERY 10 M, LABELLED EVERY 50 M

CUT LINE ENDPOINTS

POINT	EASTING	NORTHING	LATITUDE	LONGITUDE	CLIENT	MODEL
Cut Line 1 start: point 42	619,438.18	4,862,117.24	43.9024850	-79.5127055	315.14	315.54
Cut Line 1 end: point 10	619,179.00	4,861,983.22	43.9013207	-79.5159618	305.01	310.58
Cut Line 2 start: point 3	619,174.37	4,862,183.51	43.9031242	-79.5159746	314.04	314.03
Cut Line 2 end: point 25	619,326.39	4,862,018.43	43.9016137	-79.5141192	312.12	312.14

HOW IT WAS MEASURED

Every point in the drone point cloud within 0.25 m of the line is sampled every 0.5 m, and the middle (median) height at each step forms the profile. Because all points are used, trees, equipment and stockpiles on the line show up in the profile.

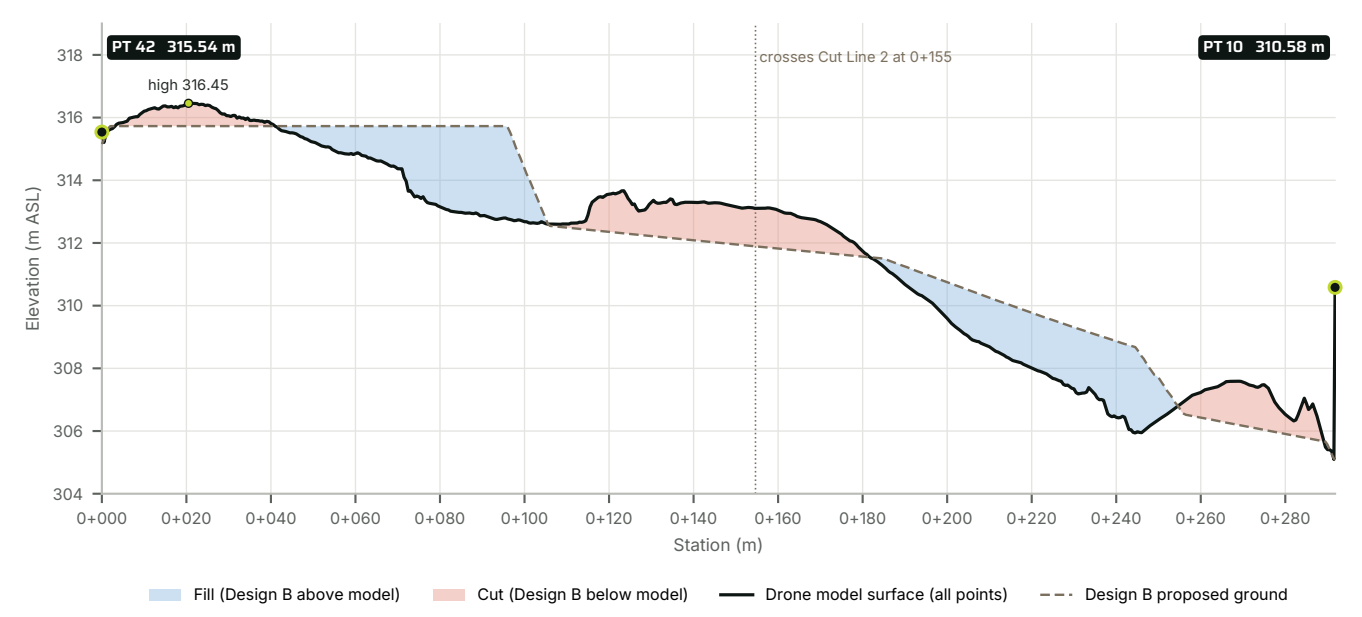
COORDINATES

Horizontal: WGS 84 / UTM zone 17N (metres). Vertical: CGVD2013, metres above sea level. Model heights match the client coordinates to within a few centimetres on open ground; a tree or object at a point raises the model height there.

11 CUT LINE 1: COORDINATE 42 TO 10

The section along Cut Line 1 from coordinate 42 (station 0+000) to coordinate 10 (station 0+291.78). The solid line is the drone model surface; the dashed line is the Design B proposed ground. Blue shading is fill, red is cut.

LINE LENGTH	ELEVATION CHANGE	HIGH / LOW	AVERAGE GRADE
291.8 m	−4.95 m	316.5 / 305.1 m	−1.7 %



PROFILE ALONG CUT LINE 1, VERTICAL SCALE EXAGGERATED ABOUT 7X

STATION TABLE, EVERY 10 M (HEIGHTS IN M)

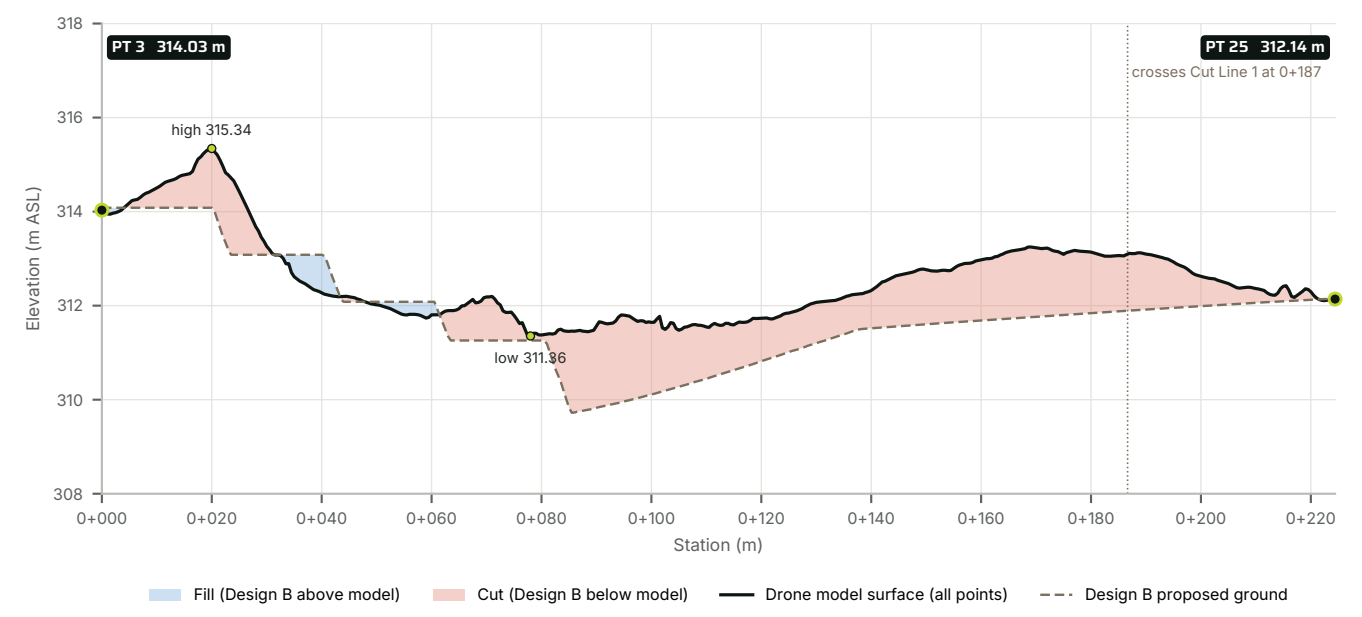
STATION	MODEL	DESIGN B	FILL + / CUT −
0+000	315.54	315.16	−0.38
0+010	316.20	315.73	−0.48
0+020	316.45	315.73	−0.72
0+030	316.06	315.73	−0.33
0+040	315.81	315.73	−0.08
0+050	315.22	315.73	+0.51
0+060	314.85	315.73	+0.88
0+070	314.37	315.73	+1.36
0+080	**313.15**	**315.73**	**+2.58**
0+090	**312.87**	**315.73**	**+2.86**
0+100	312.68	314.37	+1.69
0+110	312.61	312.49	−0.12
0+120	313.55	312.35	−1.20
0+130	313.29	312.22	−1.07
0+140	313.29	312.09	−1.21
0+150	313.14	311.95	−1.19
0+160	313.04	311.82	−1.22
0+170	312.68	311.69	−0.99
0+180	311.74	311.56	−0.17
0+190	310.68	311.25	+0.57
0+200	309.59	310.74	+1.15
0+210	308.69	310.25	+1.56
0+220	308.02	309.78	+1.76
0+230	307.35	309.31	+1.96
0+240	**306.44**	**308.87**	**+2.43**
0+250	306.37	307.71	+1.34
0+260	307.23	306.43	−0.80
0+270	307.56	306.17	−1.39
0+280	306.53	305.91	−0.62
0+290	305.40	305.56	+0.16
0+291.78	**310.58**	**305.10**	**−5.49**

Highlighted rows have 2 m or more of fill or cut. The full 0.5 m profile is supplied as a CSV.

12 CUT LINE 2: COORDINATE 3 TO 25

The section along Cut Line 2 from coordinate 3 (station 0+000) to coordinate 25 (station 0+224.41). The solid line is the drone model surface; the dashed line is the Design B proposed ground. Blue shading is fill, red is cut.

LINE LENGTH	ELEVATION CHANGE	HIGH / LOW	AVERAGE GRADE
224.4 m	−1.89 m	315.3 / 311.4 m	−0.8 %



PROFILE ALONG CUT LINE 2, VERTICAL SCALE EXAGGERATED ABOUT 9X

STATION TABLE, EVERY 10 M (HEIGHTS IN M)

STATION	MODEL	DESIGN B	FILL + / CUT −
0+000	314.03	314.08	+0.05
0+010	314.50	314.08	−0.42
0+020	315.34	314.08	−1.26
0+030	313.26	313.08	−0.18
0+040	312.27	313.08	+0.81
0+050	312.02	312.08	+0.06
0+060	311.81	312.08	+0.28
0+070	312.19	311.26	−0.93
0+080	311.38	311.26	−0.12
0+090	311.56	309.83	−1.74
0+100	311.64	310.11	−1.54
0+110	311.55	310.44	−1.10
0+120	311.73	310.82	−0.91
0+130	312.07	311.20	−0.87
0+140	312.32	311.52	−0.80
0+150	312.76	311.60	−1.16
0+160	312.97	311.69	−1.29
0+170	313.22	311.76	−1.46
0+180	313.14	311.84	−1.30
0+190	313.10	311.92	−1.18
0+200	312.63	311.99	−0.64
0+210	312.36	312.06	−0.30
0+220	312.30	312.13	−0.17
0+224.41	312.14	312.15	+0.01

Highlighted rows have 2 m or more of fill or cut. The full 0.5 m profile is supplied as a CSV.

13 WHAT YOU RECEIVE

Every cut/fill project can come with the same core package, whatever the complexity of the design.

DELIVERABLES

- Volume report with cut/fill maps (PDF)
- Proposed-ground and existing-ground point clouds (LAS)
- Surface models and elevation maps (GeoTIFF)
- CAD-ready property line and linework (DXF)
- Cut/fill quantities by scenario or segment (Excel)
- Cut-line profiles with station tables (PDF, CSV)
- Interactive 3D web view of the design, on request

ON-SITE CUT/FILL MARKING

Once the report is approved we can return to site and mark the cut and fill areas on the ground. Using RTK GPS, we set out the design limits and grade points from the proposed surface with stakes, flags or paint, showing where material comes off or goes on and by how much. Crews and operators work straight from the marks.

SAMPLE ONLY

The proposed grounds shown are illustrative designs built to demonstrate our process. They are not engineer grade or certified, and all volumes and grades are for demonstration only and do not represent your project.

For the most accurate volumes, engineer-grade CAD drawings can be imported and layered over the 3D model, comparing the existing ground against an engineer-certified proposed ground.

Sample report for illustration. Site details have been removed.

GEOMETRIC SOLUTIONS

GROUND CONDITION MAPPING AND MODELLING | TORONTO, ONTARIO

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