



PROPERTY SURVEYED

Sample Site
Greater Toronto Area, ON

CAD / GIS-READY

SAMPLE REPORT · CLIENT DETAILS REMOVED

Aerial Site Survey & Mapping Report

Orthomosaic, elevation models, contours, 3D point cloud and mesh, stockpile volumes and a repeat-survey baseline, all produced from a single drone mapping flight.

Report no.	DHX-SAMPLE
Prepared for	Sample Client
Flight date	June 19, 2021
Report date	October 18, 2026
Area mapped	5.8 ha
Accuracy class	Mapping grade

SECTION 1

Survey Summary

Site	Sample Site, Greater Toronto Area, ON
Site coordinates	Withheld for privacy
Prepared for	Sample Client
Flight date / time	June 19, 2021 · 3:26–3:46 PM (20 min)
Aircraft / camera	Autel Robotics EVO II Pro · XT705 camera, 1-inch sensor, 20 MP
Flight pattern	Double-grid (crosshatch) mapping mission, 20 flight lines, nadir camera
Height / ground sampling	≈67 m above ground · 1.2 cm per pixel (native)
Images captured / used	485 / 485 (100% aligned)
Coordinate system	Withheld for privacy
Ground control	None used (drone GNSS only). See Sections 9–10.

ACCURACY CLASS

Mapping grade

Recon

Mapping

Engineering

Survey

Relative measurements (areas, heights, volumes) are reliable.
Absolute position is tied to drone GNSS only ($\pm 1\text{--}3\text{ m}$).

5.8

HECTARES

3 cm

ORTHO · PIXEL

19,666

M³ STOCKPILED

0.67

PX REPROJ.
ERROR

26

IMAGES / POINT

5

SITE
OBSERVATIONS

Summary

The site is a partly stripped greenfield development parcel of about 5.8 ha. It contains a grassed field crossed by a drainage swale, two sediment ponds, a haul road, and four large granular stockpiles beside the road frontage. All 485 images aligned into one model with a mean reprojection error of 0.67 pixels. From that model we produced a 3 cm orthomosaic, 10 cm surface and ground elevation models, 0.5 m contours, a classified colour point cloud and a textured 3D mesh.

The four stockpiles hold about **19,666 m³** ($\pm 1,084\text{ m}^3$), roughly **33,432 tonnes** at an assumed 1.7 t/m³. The largest, SP2, holds 8,129 m³. No urgent hazards were seen. The priority items are site housekeeping in the north swale and the lack of visible sediment controls around the stockpiles near the road.

Key results

Deliverable	Result	Format
01 Orthomosaic map	3 cm/pixel, 5.8 ha, seam-blended true ortho	GeoTIFF
02 Digital elevation model	DSM + DTM at 10 cm; contours at 0.5 m (2.5 m index)	GeoTIFF · DXF · GeoJSON
03 3D point cloud & mesh	6.9 M classified colour points; 0.72 M-face textured mesh	LAZ · OBJ
04 Volumetric & stockpile report	4 stockpiles, 19,666 m ³ in total; cut/fill to a 163.00 m reference grade	This report
05 Progress comparison baseline	Repeatable flight plan plus a ground control layout for the next visit	This report

SECTION 2

Deliverables at a Glance

#	Deliverable	What it is	Page
01	Orthomosaic map	One stitched, geo-rectified image of the whole site, corrected for terrain height (true ortho).	4
02	Digital elevation model	Surface model (DSM) and bare-earth ground model (DTM), with 0.5 m contours and a site cross-section.	5–6
03	3D point cloud & mesh	Dense colour point cloud classified as ground or non-ground, and a textured surface mesh.	7
04	Volumetric & stockpile report	Volume, footprint, height and tonnage for each pile, with profiles; cut/fill to a reference grade.	8–11
05	Progress comparison baseline	Locked flight parameters and a ground control and checkpoint layout, so the next visit can be compared directly.	18

Data package

File	Contents	Size
site_Orthomosaic.tif	RGB + alpha GeoTIFF, 3 cm, internal overviews, JPEG-compressed	75 MB
site_DSM.tif / _DTM.tif	32-bit elevation GeoTIFFs, 10 cm cells, nodata -9999	14 / 13 MB
site_Contours_0.5m.dxf / .geojson	3D contour polylines, index (2.5 m) and intermediate layers	2.5 MB
site_PointCloud.laz	LAS 1.4, RGB, class 2 = ground, class 1 = other; 6.9 M points	54 MB
mesh/site_mesh.obj (+ .mtl, texture .jpg)	Textured 2.5D surface mesh, 360,737 vertices	53 MB
Raw imagery (485 JPG)	Original 20 MP images with GNSS EXIF	5.3 GB

All raster and vector files carry their coordinate system and open directly in AutoCAD Civil 3D, QGIS, ArcGIS Pro, Global Mapper and similar software.

How to read this report

Sections 3–6 present the measured products. Section 7 lists site conditions visible in the imagery, rated on the DroneHubX severity scale, and Section 8 turns them into an action plan. Section 9 sets out the baseline for the next survey. Section 10 explains how accurate the data is and what is needed to upgrade it to survey grade.

SECTION 3

Orthomosaic Map



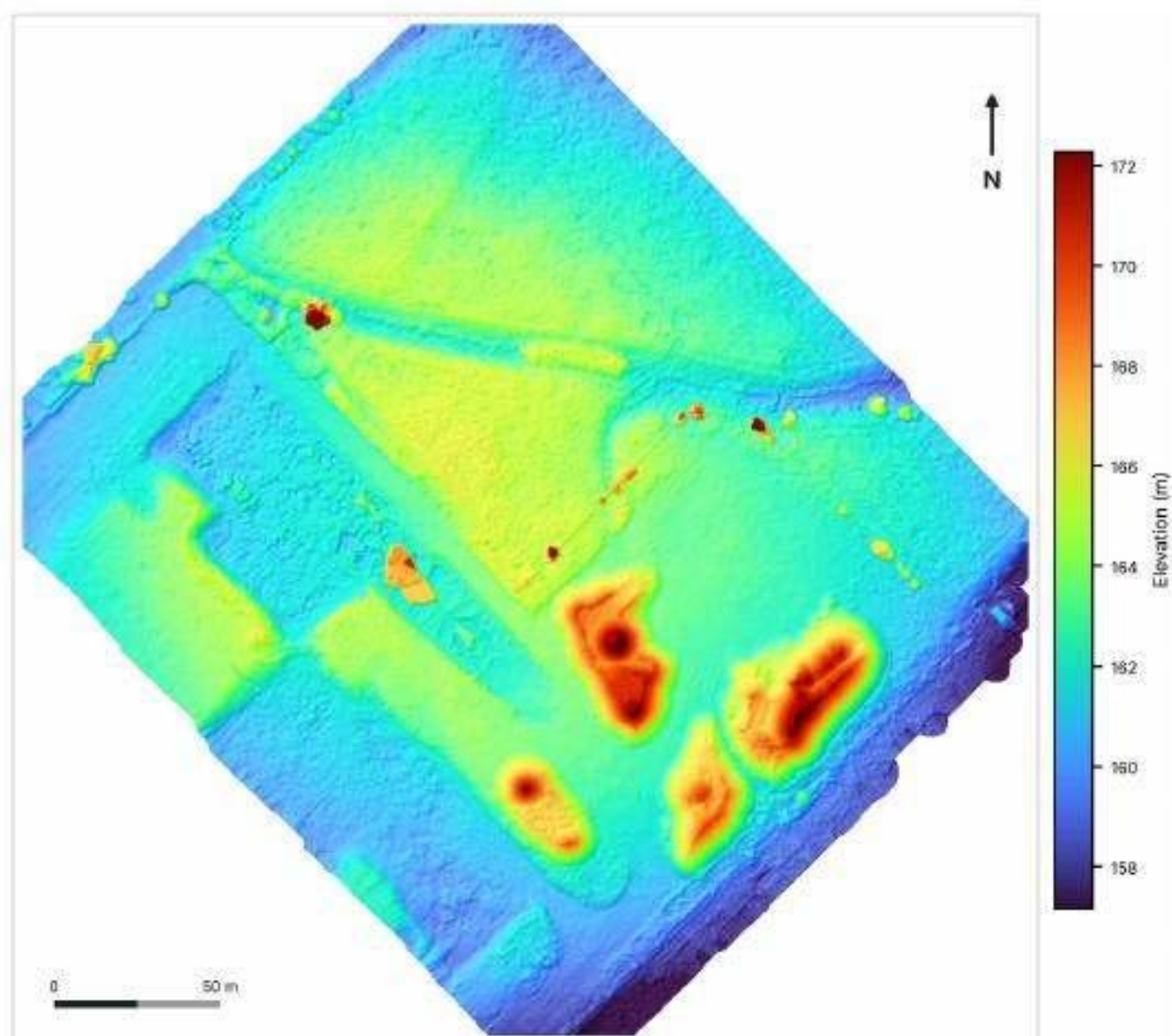
Figure 3.1 - True orthomosaic, 3 cm ground pixel, 5.8 ha.

485 images

Each ground cell is taken from the most straight-down view available and blended across seams. Water surfaces and the far edges of the flight have the lowest image quality.

SECTION 4

Digital Elevation Model



Surface statistics

Lowest ground	156.8 m
Highest point	174.7 m (SP1 crest)
Site relief	18.0 m
Cell size	0.10 m
Depth samples fused	31.1 million

DSM vs DTM

The **DSM** records the top of everything: ground, stockpiles, vegetation and vehicles. The **DTM** removes vegetation, vehicles and small objects with a morphological ground filter. Stockpiles are kept in the DTM as terrain.

Elevation datum

Heights are as recorded by the aircraft's GNSS and have not been tied to a CGVD2013 benchmark, so absolute elevations may be off by several metres. Height differences, slopes and volumes are not affected.

Figure 4.1 - Digital surface model (DSM), hill-shaded

10 cm cells

SECTION 4 · CONTINUED

Contours & Site Cross-Section

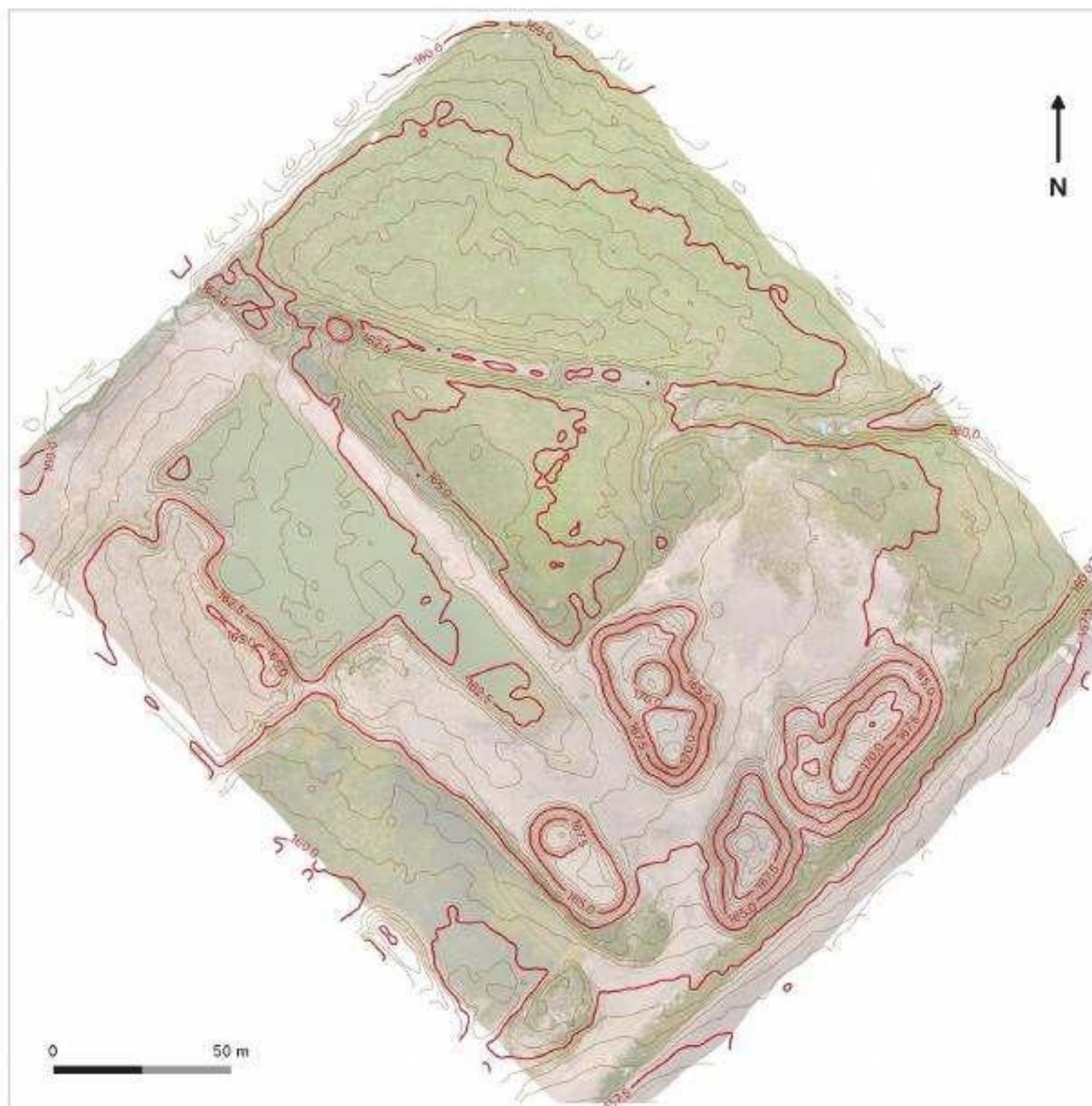


Figure 4.2 · 0.5 m contours from the ground model (DTM); index contours every 2.5 m, labelled

DXF · GeoJSON



Figure 4.3 · North-west to south-east cross-section through the site, DSM vs DTM

Vertical exaggeration ≈ 5×

SECTION 5

3D Point Cloud & Mesh



Figure 5.1 · Oblique view of the coloured dense point cloud, looking north

Gaps = open water (no texture to match)



Figure 5.2 · Stockpile area, close oblique view

Point cloud render

Product	Specification
Sparse model	219,417 tie points · mean track length 8.8 images · 4,001 observations per image
Dense point cloud	Multi-view stereo depth maps from all 485 images, fused into 6.9 M delivered points (LAZ, RGB, ground/non-ground classes)
Textured mesh	360,737 vertices · 718,938 faces · 0.4 m spacing · orthomosaic texture (OBJ)

SECTION 6

Volumetric & Stockpile Report



Figure 6.1 · Stockpile footprints and measured volumes

Base: best-fit toe plane

ID	Material (visual)	Footprint m ²	Max height m	Volume m ³	Uncertainty	Tonnes @1.7
SP1	Light granular (crushed stone)	1,404	11.1	5,762	±178	9,796
SP2	Light granular, twin crest	1,854	11.5	8,129	±463	13,820
SP3	Dark grey granular	1,107	8.1	3,577	±277	6,081
SP4	Light granular, by pond	707	9.2	2,197	±166	3,734
Total		5,072		19,666	±1,084	33,432

Method. Each pile's toe was traced from the 10 cm DSM, and the base surface is a plane fitted robustly to a ring of ground 1–2 m outside the toe. Volume is the DSM above that base. Uncertainty = footprint × the standard deviation of the ground ring about the plane. Tonnage uses an assumed bulk density of 1.7 t/m³ for loose granular material; replace it with the supplier's density for billing. Material types are visual only.

SECTION 6 · CONTINUED

Stockpile Detail

SP1 · 5,762 m³ (±178 m³ · 9,796 t)

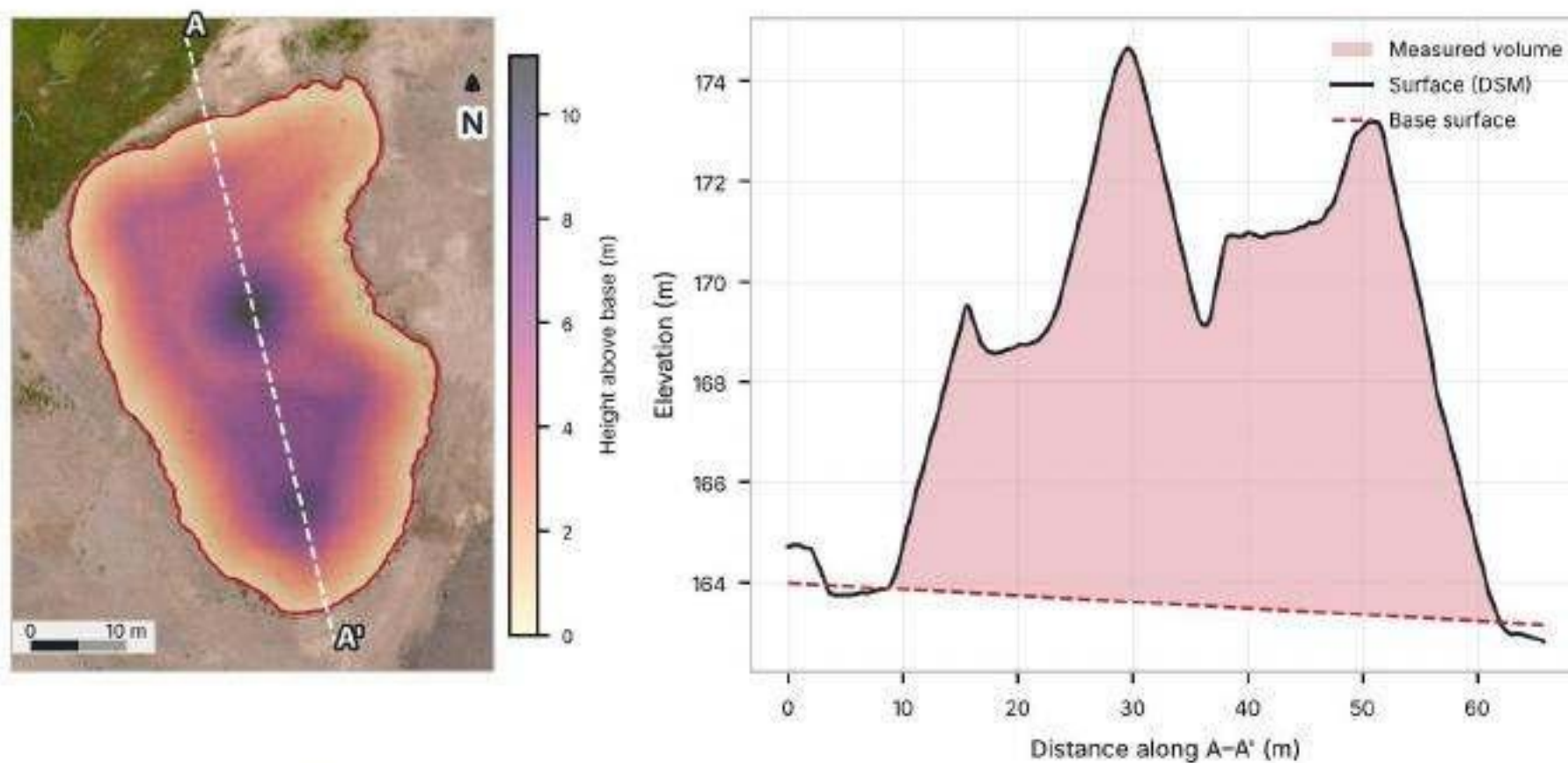


Figure 6.2 · SP1: height above base (left) and long profile A-A' (right)

Footprint 1,404 m² · perimeter 167 m

Toe elev.	Crest elev.	Max height	Fill above base	Cut below base	Base fit σ
163.54 m	174.74 m	11.12 m	5,762 m ³	0 m ³	13 cm

SP2 · 8,129 m³ (±463 m³ · 13,820 t)

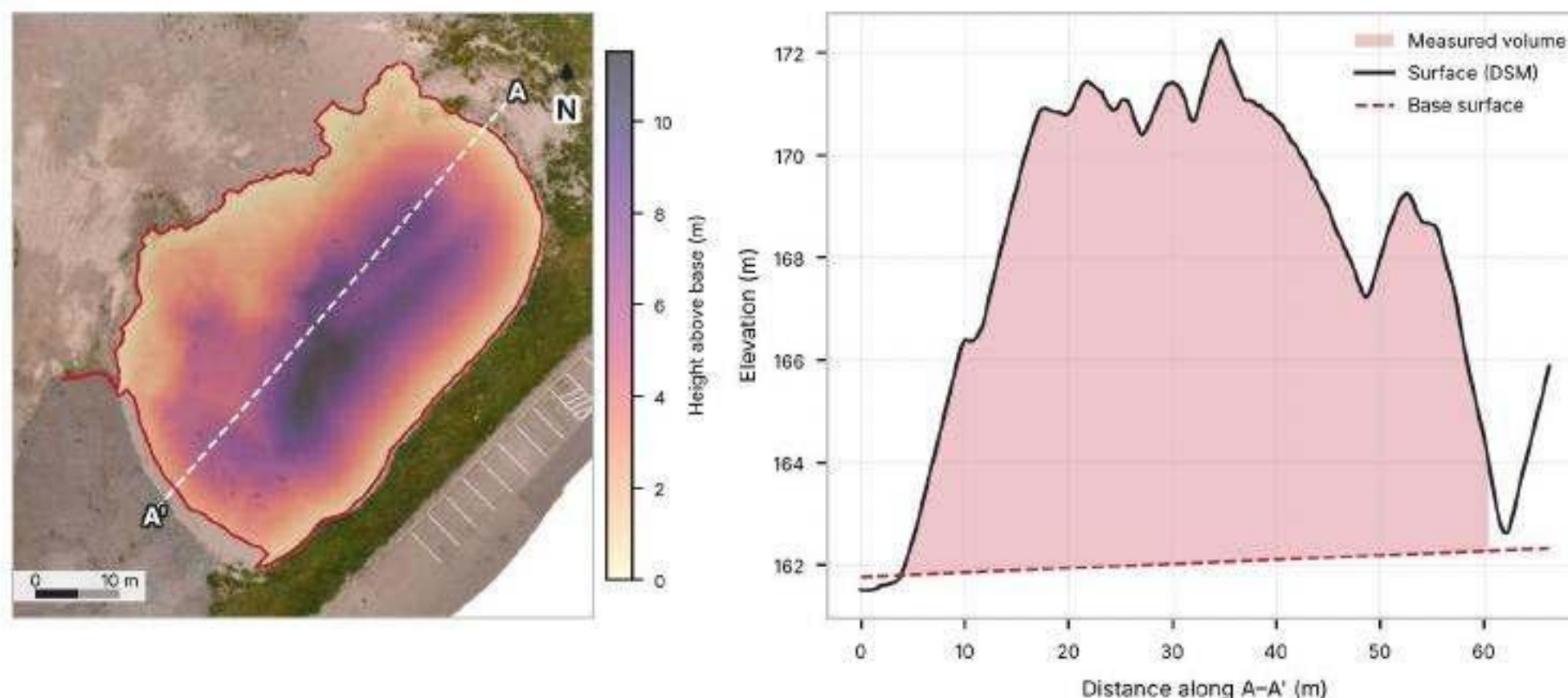


Figure 6.3 · SP2: height above base (left) and long profile A-A' (right)

Footprint 1,854 m² · perimeter 226 m

Toe elev.	Crest elev.	Max height	Fill above base	Cut below base	Base fit σ
162.02 m	173.47 m	11.52 m	8,129 m ³	0 m ³	28 cm

SECTION 6 · CONTINUED

Stockpile Detail

SP3 · 3,577 m³ (±277 m³ · 6,081 t)

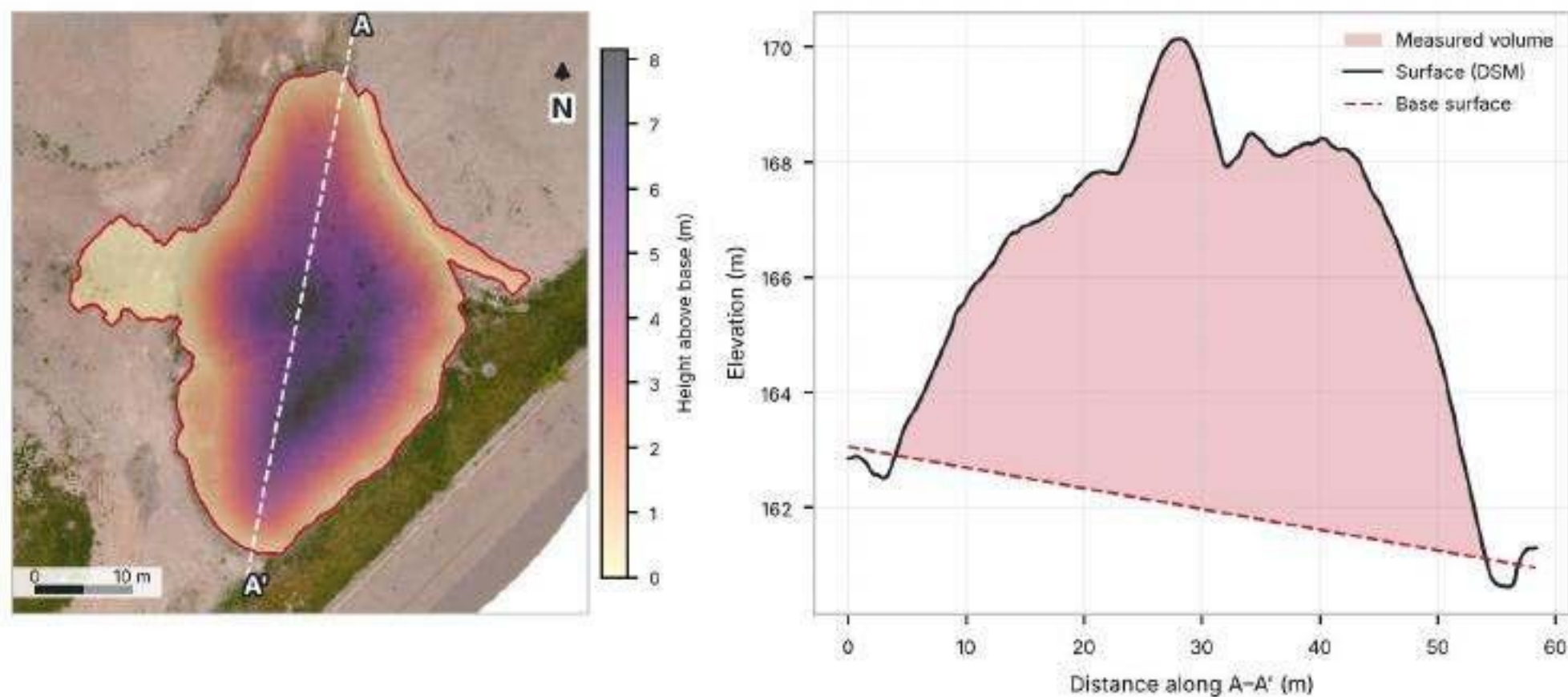


Figure 6.4 · SP3: height above base (left) and long profile A-A' (right)

Footprint 1,107 m² · perimeter 182 m

Toe elev.	Crest elev.	Max height	Fill above base	Cut below base	Base fit σ
162.01 m	170.15 m	8.15 m	3,577 m ³	0 m ³	32 cm

SP4 · 2,197 m³ (±166 m³ · 3,734 t)

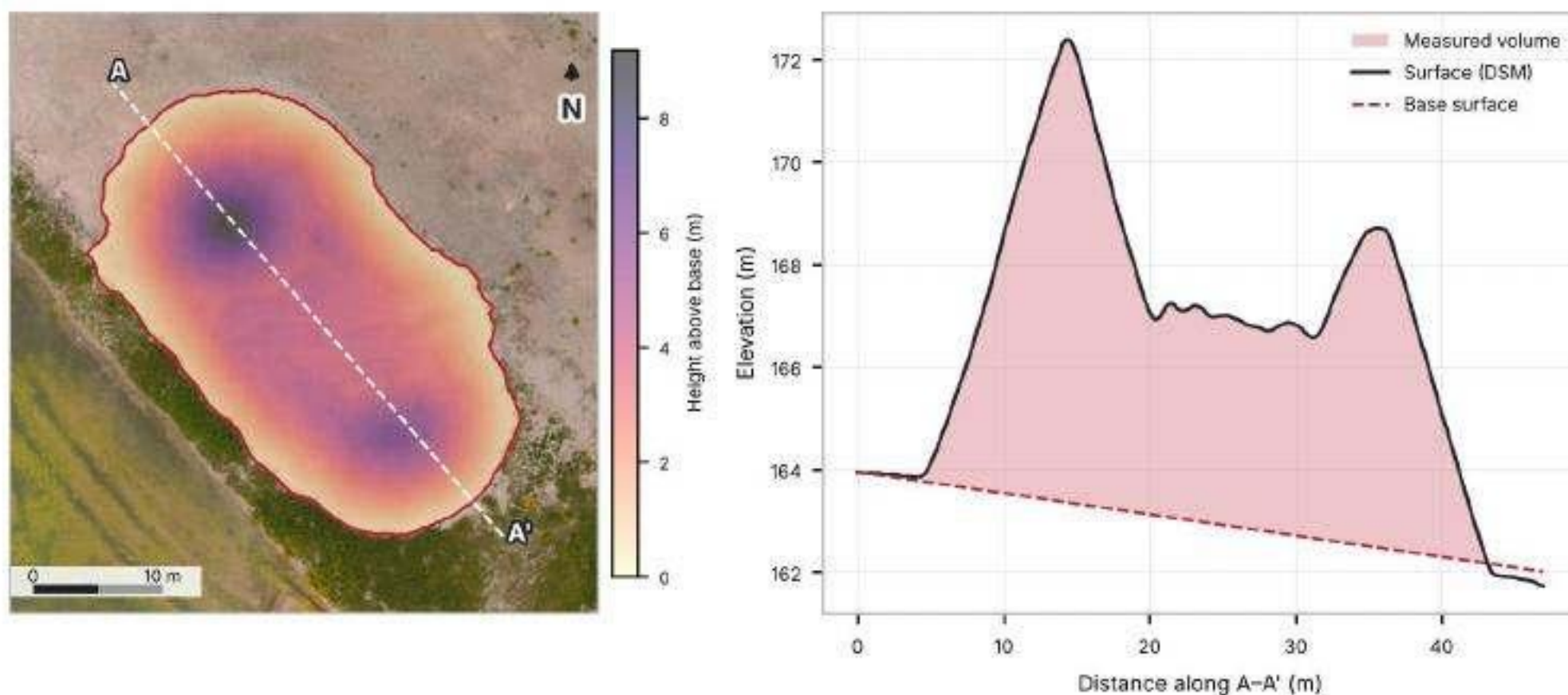


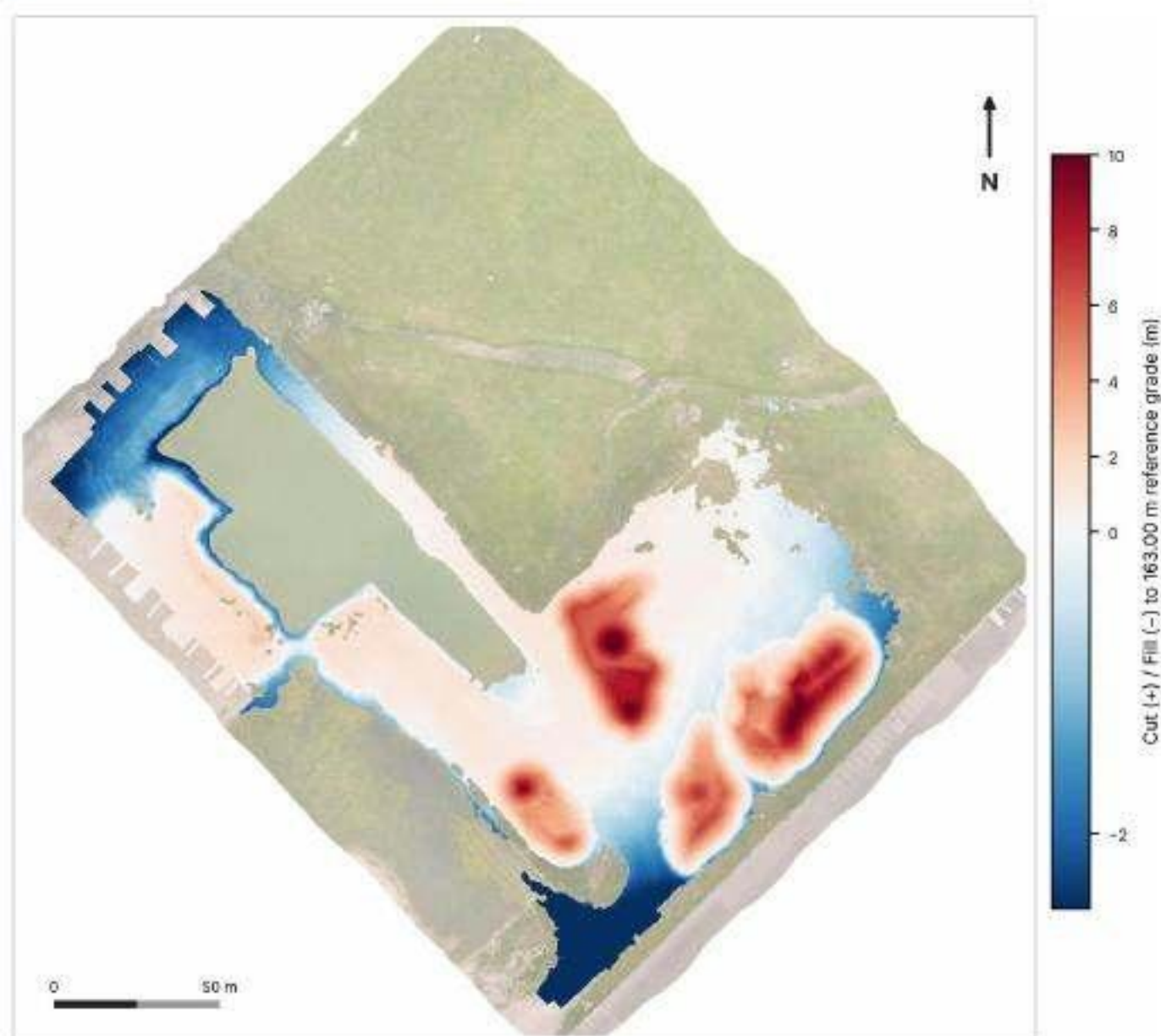
Figure 6.5 · SP4: height above base (left) and long profile A-A' (right)

Footprint 707 m² · perimeter 110 m

Toe elev.	Crest elev.	Max height	Fill above base	Cut below base	Base fit σ
163.01 m	172.53 m	9.18 m	2,197 m ³	0 m ³	23 cm

SECTION 6 · CONTINUED

Cut / Fill to Reference Grade



Reference grade **163.00 m**

Work area analysed **1.73 ha**

Total cut **22,376 m³**

· of which stockpiles **17,767 m³**

· of which in-situ ground **4,609 m³**

Total fill **7,824 m³**

Net **14,551 m³ surplus**

The reference grade is the median ground elevation of the work area and is for illustration only. Send us the design surface (LandXML, DWG/DXF TIN or a pad elevation) and we will rerun cut/fill against it from the same scan at no extra flight cost.

Grassed fields, ponds, the road and the poorly covered flight edges are excluded. Volumes are in-place (bank) measurements; no bulking or shrinkage factors are applied.

Figure 6.6 · Cut (red) and fill (blue) needed to bring the bare-earth work area to 163.00 m

SECTION 7

Site Observations at a Glance

ID	Observation	Location	Severity
01	Waste, tarps and debris in the north drainage swale	North field drainage swale and north-west fence line	MODERATE
02	Stockpiles have no visible erosion and sediment controls	Stockpiles SP1-SP4; road frontage south-east of SP2/SP3	MODERATE
03	Sediment ponds: high water and heavy aquatic growth	North and south ponds	MONITOR
04	Utility access covers close to working areas	Boulevard strip about 4 m from the SP3 toe; grassed area to the north-east	LOW
05	Weeds establishing on stripped ground and pile toes	Southern work area and stockpile toes	MAINTENANCE

Severity scale

CRITICAL	Active failure or safety hazard (e.g. collapsed slope, open excavation, breach). Immediate action required.
HIGH	Likely to cause damage, runoff or a safety incident in the near term. Act within 30 days or before the next storm.
MODERATE	Developing issue that will worsen if left unattended. Address within 3–6 months.
LOW	Minor issue with limited short-term risk. Address within 12 months or with other work.
MAINTENANCE	Routine upkeep item (cleaning, cutting, debris removal).
MONITOR	Condition could not be confirmed from imagery. Verify at the next inspection.

These observations come from visual review of the orthomosaic, the raw images and the 3D model. They support the survey and do not replace a geotechnical, environmental or ESC compliance inspection.

SECTION 7 · DETAILED OBSERVATIONS

Site Observations

01 Waste, tarps and debris in the north drainage swale

MODERATE

North field drainage swale and north-west fence line

WHAT WE OBSERVED

A blue tarp, bags, scattered refuse and timber/pallet pieces lie in and beside the vegetated drainage swale that crosses the north field. A second cluster of debris sits along the north-west fence line, beside the north pond.

WHY IT MATTERS

Debris in a drainage swale can block flow during storms and be washed toward the ponds and outlets. It also suggests unauthorised access or dumping, which carries liability and safety exposure for the owner.

RECOMMENDED ACTION

Remove and dispose of the debris, then check fencing and gates along the north limit for gaps. Add signage or secure the access if dumping continues.

Timeframe: Within 3 months



01.1 – Tarp, bags and refuse in the north swale.



01.2 – Debris along the north-west fence line, beside the north pond.

SECTION 7 · DETAILED OBSERVATIONS

Site Observations

02 Stockpiles have no visible erosion and sediment controls

Stockpiles SP1-SP4; road frontage south-east of SP2/SP3

MODERATE

WHAT WE OBSERVED

No silt fence, filter sock, perimeter berm or cover is visible around any of the four stockpiles. The toes of SP2 and SP3 sit about 11-12 m from the road curb, with only the grassed boulevard as a buffer.

WHY IT MATTERS

Uncovered granular stockpiles shed fines in heavy rain. Sediment can reach the road and storm sewer. Municipal site-alteration and erosion and sediment control (ESC) permits typically require perimeter controls on stockpiles near a road.

RECOMMENDED ACTION

Install perimeter sediment control on the downslope (road and pond) sides of SP2, SP3 and SP4, and check it against the approved ESC plan. Stabilise or cover piles that will stay in place long-term.

Timeframe: Within 3 months / before the next storm season



02.1 – SP3 toe beside the grassed boulevard, with no perimeter control visible.



02.2 – 3D view of the stockpile area from the dense point cloud.

SECTION 7 · DETAILED OBSERVATIONS

Site Observations

03 Sediment ponds: high water and heavy aquatic growth

North and south ponds

MONITOR

WHAT WE OBSERVED

Both ponds hold water across almost their full footprint. The south pond shows dense algae and aquatic vegetation. Outlet and spillway structures could not be identified in the imagery.

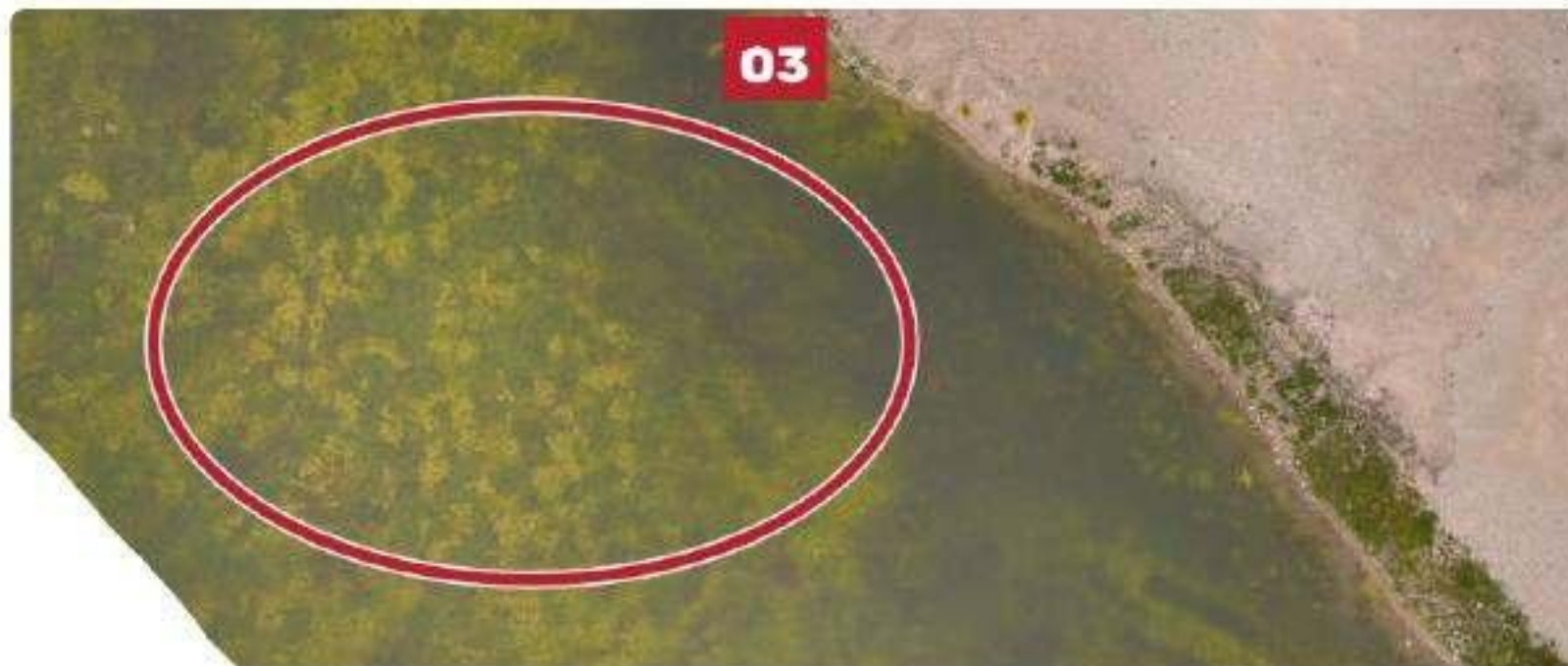
WHY IT MATTERS

Water depth and stored sediment cannot be measured by photogrammetry; the water surface returns no reliable 3D data. A pond that is full or heavily vegetated may have less settling capacity than designed.

RECOMMENDED ACTION

Check the water level against the design permanent pool, inspect the outlet structures, and consider a bathymetric (depth) survey if capacity needs to be confirmed.

Timeframe: Verify at next inspection



03.1 – South pond, showing dense algae and aquatic growth.

05 Weeds establishing on stripped ground and pile toes

Southern work area and stockpile toes

MAINTENANCE

WHAT WE OBSERVED

Weeds and grasses, including yellow-flowering plants, are colonising the stripped ground and the edges of the stockpiles.

WHY IT MATTERS

Weed cover hides the ground surface and can spread seed into finished areas. On the other hand, some cover reduces dust and erosion while the site sits idle.

RECOMMENDED ACTION

Decide whether to treat the cover as temporary stabilisation or to cut or remove it. Keep haul routes and pile toes clear.

Timeframe: Routine maintenance



05.1 – Weeds establishing on the southern work area.

SECTION 7 · DETAILED OBSERVATIONS

Site Observations

04 Utility access covers close to working areas

LOW

WHAT WE OBSERVED

Round utility access covers are visible about 4 m from the toe of SP3 and in the grassed area next to the parking frontage.

WHY IT MATTERS

Covers near stockpile toes and haul routes can be buried, damaged or driven over by equipment.

RECOMMENDED ACTION

Mark the covers, confirm the owner, and keep them clear of stockpile toes. Obtain utility locates before any grading near them.

Timeframe: Within 12 months / before grading



04.1 – Access cover in the boulevard, about 4 m from the SP3 toe.



04.2 – Access cover in the grassed area near the parking frontage.

SECTION 8

Recommended Action Plan

Within 3 months	O1 Waste, tarps and debris in the north drainage swale	MODERATE
	O2 Stockpiles have no visible erosion and sediment controls	MODERATE
Within 12 months	O4 Utility access covers close to working areas	LOW
Routine maintenance	O5 Weeds establishing on stripped ground and pile toes	MAINTENANCE
Next inspection	O3 Sediment ponds: high water and heavy aquatic growth	MONITOR

Have the site superintendent or ESC inspector confirm each item on the ground. Item O2 should be checked against the approved erosion and sediment control plan for the site.

Conditions Noted as Satisfactory

- ✓ All four stockpiles appear stable, with no visible slumping, tension cracks or failed faces.
- ✓ No standing water is visible on the haul roads or work areas outside the two ponds.
- ✓ No sediment deposits are visible on the curb, sidewalk or road surface along the south-east frontage at the time of the flight.
- ✓ No breaches or overtopping scars are visible on the pond embankments.
- ✓ The haul road between the ponds and the stockpile area is continuous and appears passable.

SECTION 9

Progress Comparison Baseline

This survey is the **baseline (Visit 01)**. Flying the next visit with the same parameters gives a like-for-like comparison: change-in-elevation maps, stockpile volume change and earthworks progress, all side by side.



Figure 9.1 · Recommended ground control (6) and checkpoint (3) layout for the next visit:

Locked flight parameters

Mission type	Double grid (crosshatch), nadir
Flight lines	20 (10 per direction)
Height above ground	≈67 m
Photo spacing	≈8.6 m along track
Ground pixel	1.2 cm native · 3 cm ortho
Camera	XT705 20 MP, ISO 100, 1/160 s, f/2.8
Images	485 over ≈20 min

What Visit 02 will show

- Stockpile volume change for each pile (m³ and tonnes)
- Elevation change map (cut/fill since baseline)
- Side-by-side orthomosaic comparison
- Progress on the action-plan items in Section 8

To reach survey grade on Visit 02: place 6 GCPs and 3 checkpoints as shown, surveyed with RTK GNSS to NAD83(CSRS) / CGVD2013, or fly an RTK/PPK-equipped aircraft. Both visits can then be tied to the same datum.

SECTION 10

Accuracy & Quality Report

Processing quality

Images aligned	485 / 485 (100%)
Tie points	219,417
Mean reprojection error	0.67 px
Mean track length	8.8 images
Image overlap (median)	26 images per point
Area seen by ≥9 images	88%

Camera self-calibration

Focal length	2,697 px (at 2,736 × 1,824)
Radial k1 / k2	0.0617 / -0.0153
Tangential p1 / p2	0.0011 / -0.0018

Georeferencing (drone GNSS, no GCPs)

Camera position RMSE E / N	0.37 m / 0.53 m
Horizontal RMSE	0.65 m
Vertical RMSE	1.06 m
Independent height check	Parked sedan measured 1.42 m (typical 1.45–1.50 m)

Accuracy statement

Measure	This survey (no control)	With 6 GCPs + RTK (survey grade)
Relative horizontal (distances, areas)	≈5–10 cm	≈2–3 cm
Relative vertical (heights, volumes)	≈10–15 cm on hard ground; volumes ±5–8%	≈3–5 cm; volumes ±1–3%
Absolute horizontal	±1–2 m (consumer GNSS)	≈2–3 cm, checked against checkpoints
Absolute vertical	±2–3 m or more; datum unverified	≈3–5 cm, CGVD2013

Accuracy figures are estimates based on ground pixel size, model residuals and the independent vehicle-height check. No checkpoints were available on this flight, so absolute accuracy is not independently verified.

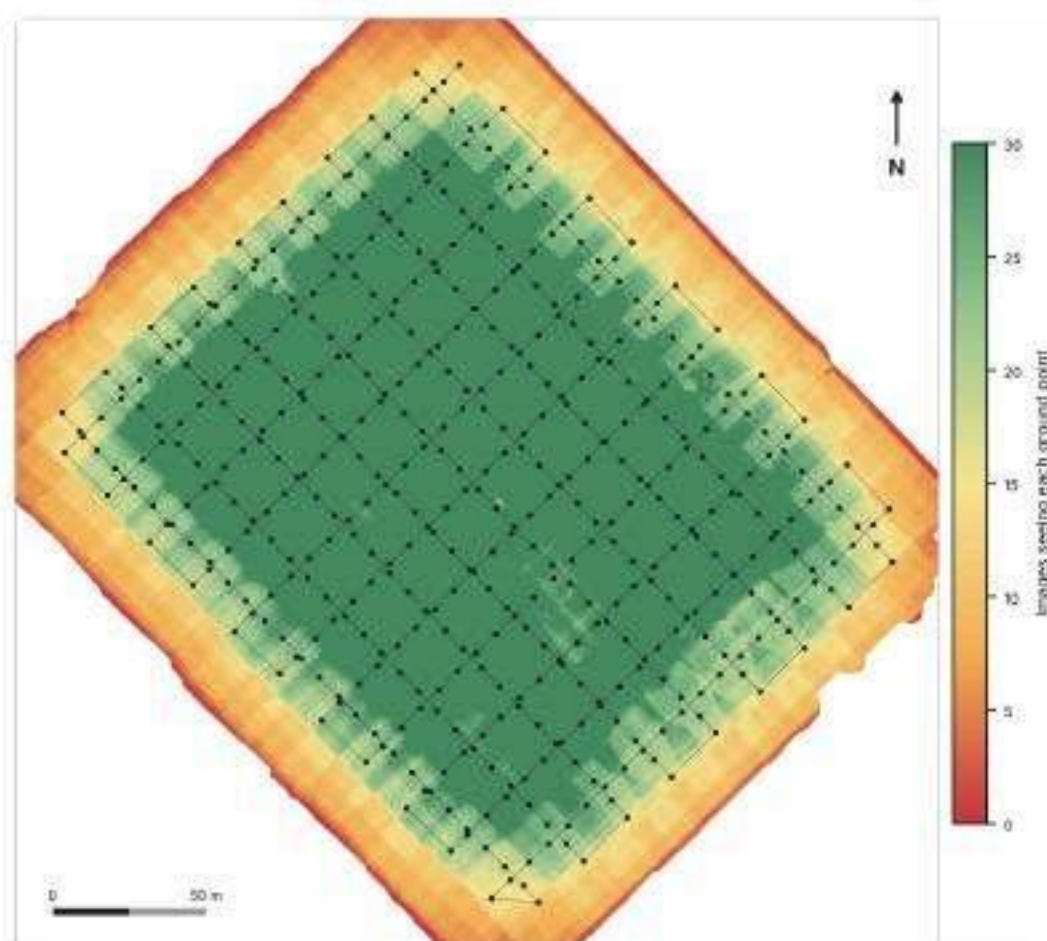


Figure 10.1 - Image overlap and camera positions

APPENDIX A

Flight & Photo Log (40 of 485)

Every 12th image of the 485-image mapping flight, in capture order (local time). The full raw image set is included in the data package.



APPENDIX B

Scope, Limitations & Disclaimer

This report presents mapping products and a visual site assessment derived solely from drone imagery captured on the flight date stated. It records conditions at that time; the site may have changed since.

The survey is mapping grade. No ground control points or checkpoints were used, and coordinates and elevations come from the aircraft's onboard GNSS. Relative measurements are suitable for planning, quantity tracking and progress reporting. Absolute coordinates and elevations must not be used for legal boundaries, construction layout or design without a control survey by an Ontario Land Surveyor or qualified survey technician.

Stockpile volumes depend on the chosen base surface, and materials are identified visually only. Tonnages use an assumed density and are estimates. Photogrammetry cannot measure below water, beneath vegetation, or in areas hidden from the camera.

Observations in Section 7 reflect the professional judgement of DroneHubX based on what is visible. This report is not a geotechnical, environmental, structural or regulatory compliance assessment.

This report was prepared for the client named on the cover and may not be relied upon by third parties without written consent from DroneHubX. Flights were conducted in accordance with Transport Canada RPAS regulations (CARs Part IX).

Prepared by

DroneHubX – Aerial Exploration Services
dronehubx.com

RPAS pilot / data analyst

Date