

Fieldra

The complete guide

The phone app, Fieldra Desktop and drone mapping —
step by step, in plain words, with pictures.

Version 0.5 · October 2026 · Luminex Ltd
fieldra.luminex-technology.com

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Good to know: Words in **bold** are explained right after them in grey, like this: **GPS** (= the satellite system that tells a phone or drone where it is). There is also a word list at the end of this guide.

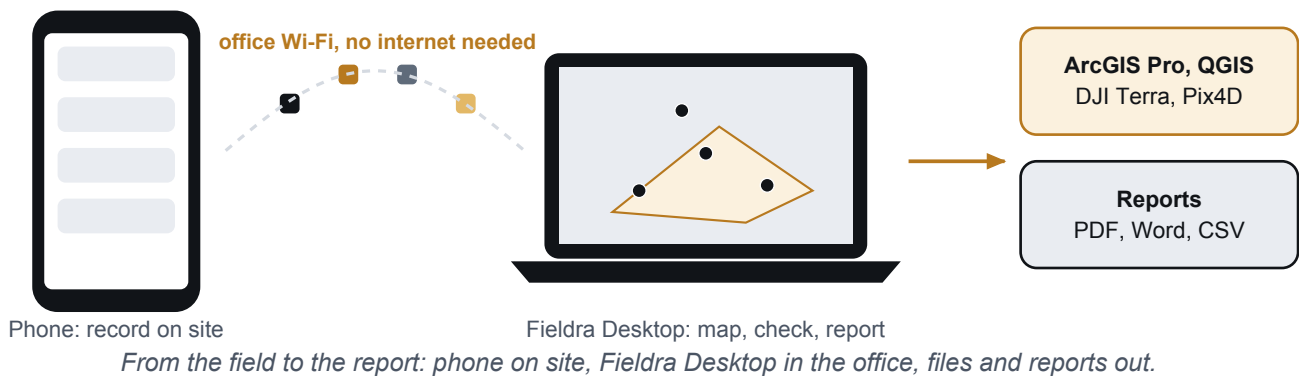
1. What is Fieldra?

Fieldra is two apps that work together: an app for your **phone**, used on site, and **Fieldra Desktop**, used on the office computer.

On site, the phone records what you find and where you found it. Every record saves:

- the place — as **coordinates** (= two numbers, latitude and longitude, that say exactly where a spot is on Earth) — and how exact it is;
- the date and time;
- your photos, answers and notes.

The phone works with no internet. This is called working **offline** (= without internet or mobile signal). Back at the office, the phone sends everything to Fieldra Desktop over the office Wi-Fi — still no internet needed. The desktop maps it, checks it, and makes the reports people need and the files other software reads.



The phone app, module by module

The phone app is split into **modules** (= separate parts, each for one kind of work). Open them from the side menu: tap the button in the top-left corner, or swipe from the left edge.

Module	What it is for
Dashboard	Start page: GPS, internet, sensors and quick buttons.
Terrestrial Survey	Drone and laser-scanner work: ground targets, flights, PPK, accuracy, scanner stations.
Environmental Survey	Notes about vegetation, waste, soil, air and noise.
Biodiversity	Counting animals and plants.
Land & Scene Analysis	Take a photo; the app says what kind of land it is and what covers it.
Compass & Azimuth	Measure and save directions.
Qibla	The direction of the Kaaba from where you stand.
Way Back	Find your way back to where you started.



Module	What it is for
Land Survey	Survey a plot of land with the phone's compass and any tape: boundary, area and a survey report.
Road Survey	Record a road and its damage.
Socio-economic Survey	Questionnaires for households and markets, like KoboToolbox.
Photo Gallery	Every photo in the project, grouped by what it belongs to.
Nearby Devices	Send whole projects to other phones and computers on the same Wi-Fi.
Water Survey	Water sampling points and measurements.
Field Tools	Measuring tools that use the phone's sensors.
Map · Records · Export / Sync · Settings	See everything, list it, send it, and change settings.

Part 1 · The phone app

Everything you do on site: setting up, recording, finding your way, and sending your work.

2. Getting started

1. Install Fieldra from Google Play or the App Store (links on fieldra.luminex-technology.com). Test versions, before they reach the stores, are on the website's **/beta** page.
2. Open it. A short **welcome survey** asks your name, email, organisation (optional) and what you will use Fieldra for. Fieldra is free: this is not an account. Your answers are kept on the phone and sent the next time it has internet.
3. The welcome page then asks you to **create your first project**: type a name, for example "River water survey", and tap **Create**.
4. Allow location when asked. On the road and transect screens, choose **Allow all the time** (Android) or **Always** (iPhone) so the line keeps recording with the screen off.
5. Open **Settings** and type your name under **Surveyor**. It is saved with every record.
6. On Wi-Fi, download the AI in Settings (once, about 250 MB) so photo suggestions work offline.

Projects

A **project** (= one job or one site, like a folder that holds all its records) keeps work separate. Open the side menu and tap the **Project** button at the top (it shows the project's name and **Switch**). There you can switch to another project, start a new one, **rename** the open project, or **delete** it. Press and hold any project in the list to open or delete it. Project names must be different from each other.

Be careful: Deleting a project removes it and everything in it from this phone (you are asked first). Copies already sent to Fieldra Desktop or other devices stay there.

Try the mobile sample site

On the welcome page or in **Projects**, tap **Open sample site**. Fieldra creates **Sample site (Freetown)** with fictional records: control points, observations, water sampling, biodiversity, a road track, survey plans, measurements and a flight area. The map opens at the sample site, even if your GPS is elsewhere. Tap its features to open normal record details and practise editing. These records are saved in their own project and can be exported or shared like other records.

Opening the sample again keeps your edits and its current name. Switching back to your own project shows only your own records. The map and its Contents sheet no longer add temporary example features to your field project. If you delete the sample project, Open sample site creates a fresh copy.

Photos in your phone's gallery

Photos you take in Fieldra are also saved to your phone's gallery, in an album called **Fieldra**. You can turn this off in Settings. Deleting a copy from the gallery does not remove it from Fieldra.

3. The basics (same in every module)

Projects

A **project** (= one job or one site, like a folder that holds all its records) keeps work separate. When you open the app the first time, you create a project. Switch, rename or delete projects with the **Project** button at the top of the side menu.

Phones, iPads and tablets

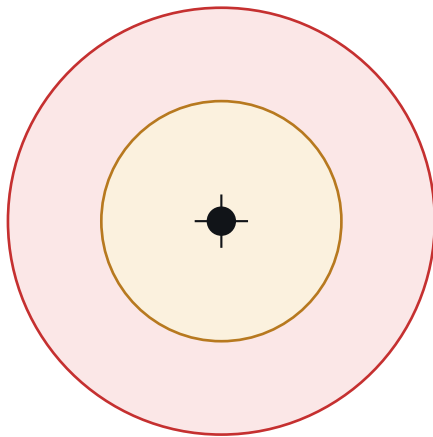
Bottom sheets use the available app width, including on iPad and in landscape or split view. Long options wrap. Body text uses a consistent 16-point base, while empty messages such as “No observations in this project yet” use a smaller 14-point base across modules. Text follows your device's text-size setting; map toolbar labels wrap and their buttons grow with the text. For larger text, use the phone or tablet's display and accessibility settings, then check that the whole label is visible.

Your position and how good it is

When a form opens, the phone starts looking for its position with **GPS** (= satellites that tell the phone where it is). You will see latitude, longitude and **accuracy** (= how far off the position might be).

Example: “Accuracy ± 4 m” means the true spot is probably within 4 metres of what the phone says.

Colour	Accuracy	What it means
Black (white in dark mode)	5 m or better	Good for most notes and photos.
Amber	5 to 15 m	OK, but wait a little if you can.
Red	worse than 15 m	Poor. Move to open sky and wait.



- Phone GPS alone**
true spot is somewhere inside about 3–5 m
- Drone GPS alone**
about 1–3 m
- RTK (with corrections)**
about 1–2 cm — smaller than a coin

The cross is the true spot. The circle is how far off the reading may be.

Phone GPS is only good to a few metres. Survey equipment with RTK is good to 1–2 centimetres.

Tip: GPS works best under open sky. Tall buildings, thick trees and being inside a car make it worse.

Saving

1. Fill in the form and take photos.
2. Tap **Save**. The app takes one more, fresh position at that moment.
3. Your record is now stored on the phone, even with no signal.

Photos

Tap **Take photo** to use the camera, or **From library** to pick a photo you already took. To remove a photo, tap the × on it; the app asks before removing it.

AI suggestions

AI (= a computer program that looks at a photo and guesses what is in it) can suggest an answer, for example “plastic bottles 72%”. The percentage is how sure the AI is.

Important: The AI only **suggests**. You decide the answer. Your answer is saved separately from the AI’s guess.

The AI must be downloaded once (about 250 MB) in **Settings**, over Wi-Fi. After that, it works with no internet.

4. How exact positions work (RTK in simple words)

This page explains the survey equipment. You need it for the Terrestrial Survey module.

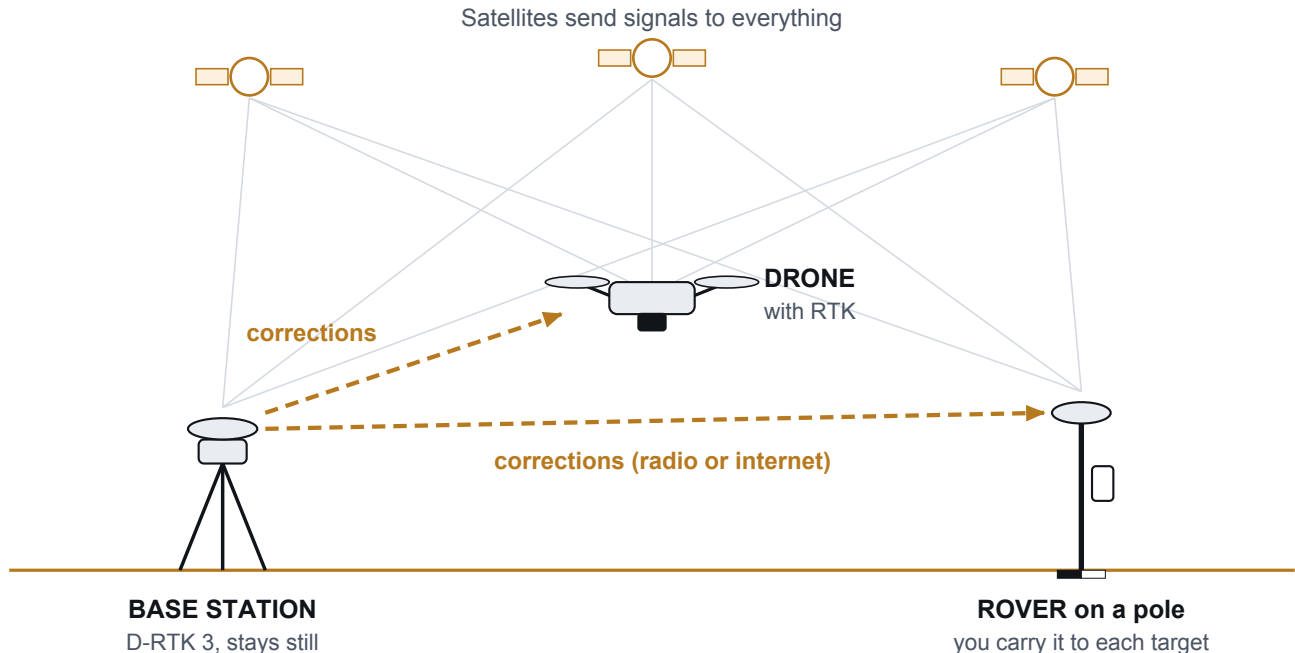
Why normal GPS is not exact

Satellite signals are slowed down by the air and bounce off buildings and trees. So every GPS reading is a few metres wrong, and the mistake changes all the time.

The trick: a base station

A **base station** (= a GPS receiver on a tripod that stays still on a spot whose position is already known) can see how wrong the satellites are, second by second. It sends a message: “right now the error is this much”. That message is called a **correction** (= a small, constant message that tells other receivers how to fix their GPS error).

The drone and the **rover** (= a second GPS receiver on a pole that you carry around) receive the correction and fix their own reading. Now they are accurate to about 1–2 cm. This method is called **RTK** (= Real-Time Kinematic: GPS fixed live using corrections from a base).



The base station sends corrections to the drone and to the rover. Both become accurate to about 2 cm.

Three ways to get corrections

Way	How it works	Works with
Own base station	A base receiver on a tripod (for example a DJI D-RTK 3) sends corrections by radio.	RTK drones and rovers that take radio corrections
Network RTK (NTRIP) (= corrections from a paid internet service)	The drone gets corrections over mobile internet. Needs signal.	All RTK drones
PPK (= Post-Processed Kinematic: positions are fixed later, in the office, from saved data)	No live link needed. Fix the data later in processing software such as DJI Terra (see PPK jobs in Part 3).	Useful where there is no signal

The “fix” message: read this every time

Survey receivers show a **fix status** (= a word that says how good the position is right now). Only measure when it says **RTK fixed**.

Fix status	How good	What to do
RTK fixed	1–2 cm	Measure now.
RTK float	10–50 cm	Wait. It is still working it out.
GPS / single	1–5 m	Corrections are not arriving. Check the base or the internet.

5. Terrestrial Survey (drones and laser scanners)

Terrestrial survey (= measuring the land surface, from the air with drones and from the ground with scanners) is the core of many survey jobs. This module helps with everything that happens on site around the drone flights and scans.

What it is for: Drone maps and laser scans only line up with the real world if some points on the ground are measured exactly. This module records those points, plans and logs the flights, and keeps the notes the office needs to process the data.

What you get: Measured targets (with photos), flight logs, scanner station logs, PPK jobs and files ready for DJI Terra, Pix4D, Metashape and scanner software.

Equipment it knows

Fieldra is not tied to one make of equipment. The flight calculator and the wind warnings know the DJI models below. Other drones, cameras, scanners and GNSS receivers work with the rest of the module: targets, stake out, flight logs, scan stations and exports.

Equipment	What it does	Works with
DJI Matrice 400	Large drone	Zenmuse L3, Zenmuse P1; D-RTK 3 base
DJI Matrice 300 RTK	Large drone	Zenmuse L1, Zenmuse P1; D-RTK 3 base
DJI Phantom 4 RTK	Small drone with RTK and its own camera	Network RTK, D-RTK 2 base, or PPK (the D-RTK 3 is not on DJI's list for it)
DJI Phantom 4 Pro	Small drone, no RTK	Needs ground targets (GCPs) for accurate maps
Zenmuse L3 (= laser scanner + two 100 MP cameras for the Matrice 400)	Makes 3D point clouds	Matrice 400 only
Zenmuse L1 (= older laser scanner + camera)	Makes 3D point clouds	Matrice 300 RTK
Zenmuse P1 (= high-quality mapping camera, 45 MP)	Photos for maps and 3D models	Matrice 400 and 300 RTK
D-RTK 3	Base station, or rover on a pole	Drones above; rover mode uses the DJI Enterprise app

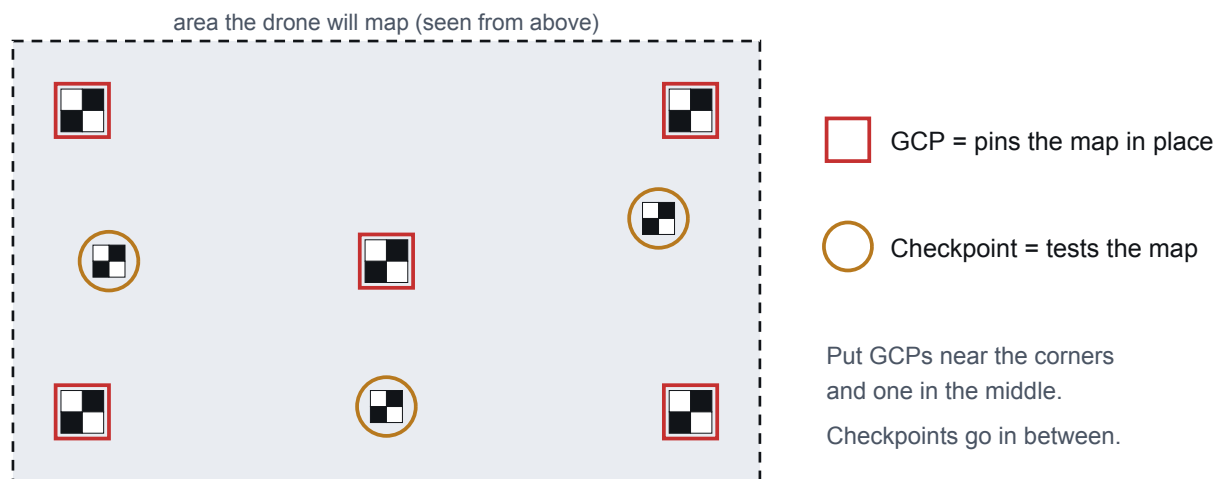
Equipment	What it does	Works with
DJI Terra Standard	Office software	Turns photos and laser data into maps and 3D
Terrestrial laser scanner (TLS) (= a scanner on a tripod that measures millions of points around it with a laser)	3D scans from the ground	Uses targets to join scans

Words used above: a **point cloud** (= millions of tiny 3D dots measured by a laser that together show the shape of the land and objects); **LiDAR** (= a laser that measures distance by timing light pulses).

Ground targets: GCPs and checkpoints

Before a flight, you put marked **targets** (= flat boards or painted marks with a clear centre, often black and white squares) on the ground. You then measure the exact centre of each target with the rover.

- **GCP** (= Ground Control Point — a target you give to the office software to pin the map in the right place)
- **Checkpoint** (= a target you measure but do NOT give to the software; later you compare it with the map to prove the map is accurate)
- **Scan target** (= a target used to join and place laser-scanner scans)

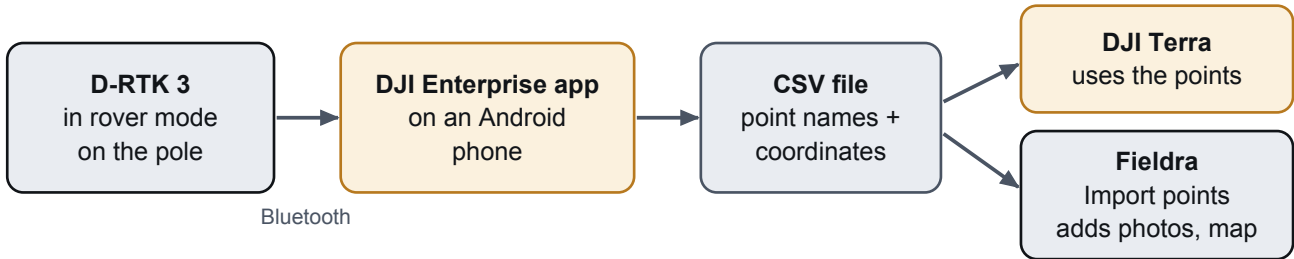


Spread the GCPs out: near every corner and one in the middle. Checkpoints go in between.

Good to know: Even when the drone has RTK, measure checkpoints. They are the proof that the map is accurate.

Measuring targets with a DJI D-RTK 3

If you use a DJI D-RTK 3: it can be used as a rover on a pole. In rover mode it connects only to DJI's own app, called **DJI Enterprise**, on an Android phone. That app measures the points and saves a file.



The D-RTK 3 connects to DJI's app. Fieldra then imports the file that app saves.

1. Measure each target with the D-RTK 3 and the DJI Enterprise app. Hold the pole on the centre of the target.
2. In the DJI app, export the points as a CSV file.
3. In Fieldra, open **Terrestrial Survey**, tap **Import points** and choose **Measured with D-RTK 3 / DJI Enterprise**.
4. Fieldra adds the points. If a point with the same name already exists, it is updated, so photos you took in Fieldra stay attached.

A **CSV file** (= a simple table file that Excel can open: one line per point) must have columns for the name, latitude and longitude. Height and accuracy columns are used if present.

Be careful: Use latitude and longitude in degrees when you export. Fieldra cannot read files that use metre grids for the position.

Measuring targets with other survey receivers

Some other RTK receivers can send their position straight to Fieldra over **Bluetooth** (= a short-range wireless link between two nearby devices).

1. Open **Terrestrial Survey** and tap **Connect receiver**, then **Scan**.
2. Tap your receiver in the list. The screen now shows the fix status, number of satellites and accuracy.
3. Tap **Survey GCP**. Choose **External RTK** as the source.
4. Stand the pole on the target centre, keep it straight, tap **Start observation** and keep still.
5. The app takes many readings, one per second — each one is an **epoch** (= one single position reading) — and averages them.
6. Take two photos (close-up and wide), then tap **Save**.

Be careful: Enter the **pole height** (= the distance from the pole tip up to the receiver). If the receiver already removes the pole height itself, enter **0**, or the height will be taken off twice.

The control point form, box by box

Survey GCP opens a form for one target. Each box in plain words:

Box	What it means	What to put
Point name	The target's name, as it will appear in the office software.	Short and unique, e.g. GCP1, CP3.
Scan target ID	The code printed on a laser-scanner target, read with the camera.	Only for scanner targets.
Type	What the point is for: GCP (= used to pin the map in place), checkpoint (= kept back to test the map), scan target, validation point, or base (where a base receiver stood).	Usually GCP or Checkpoint.
Target	What is on the ground: a checkerboard board, an X, an L-shape, a sphere for scanners, a painted mark, a nail, or a natural feature such as a kerb corner.	The kind you laid, so the office knows what to look for in the photos.
Pole / antenna height	How high the receiver is above the mark. It is taken off so the stored height is the ground's.	The pole length, e.g. 2.000. Enter 0 if the receiver already takes it off.
Source	Where the position comes from: the phone's own GPS (a few metres) or an external RTK receiver (about 2 cm).	External RTK for real GCPs.
Averaging (epochs)	How many readings to average. An epoch (= one position reading; the receiver gives one a second) on its own wobbles a little; averaging 30 of them (30 seconds) gives a steadier, more trustworthy point. Readings that are too poor are left out and counted as rejected.	30 is usual; 60 or more for important points.
Accept RTK fixed only	Only use readings where the receiver says RTK fixed (= its best, centimetre state); "float" readings (decimetres) are left out.	On for GCPs.

After the averaging, the form shows the result:

- **Epochs:** how many readings were averaged (and how many were rejected).
- **Latitude, longitude, height:** the averaged position of the mark.
- **Spread H / V (1σ):** how much the readings varied sideways and up-and-down. 1σ (= one standard deviation: about two out of three readings are within this) Small is good (a centimetre or two with RTK).
- **Est. accuracy** and **Fix:** how good the receiver says the position is.

- **Offset from planned:** when the point was planned, how far the measured target is from where it was meant to be.

Planned latitude, longitude and elevation

A point can exist before anyone measures it: in the office you may plan where each target should go (from a flight plan or a map) and import those positions as **planned** points. Their **planned latitude**, **planned longitude** and **planned elevation** are those office positions. On site, stake out leads you to them. When you then measure the target, the measured position is stored as the point's own latitude, longitude and height, and the planned values stay so you can see how far apart the two are. Only measured positions should be given to the office software.

Finding a planned spot (stake out)

Stake out (= walking to a spot that was planned in the office) works like a treasure hunt. Import the planned points, tap one, and follow the arrow. The distance counts down. The ring around the arrow turns solid and the screen says **At point** when you are there.

Sending targets to the office software

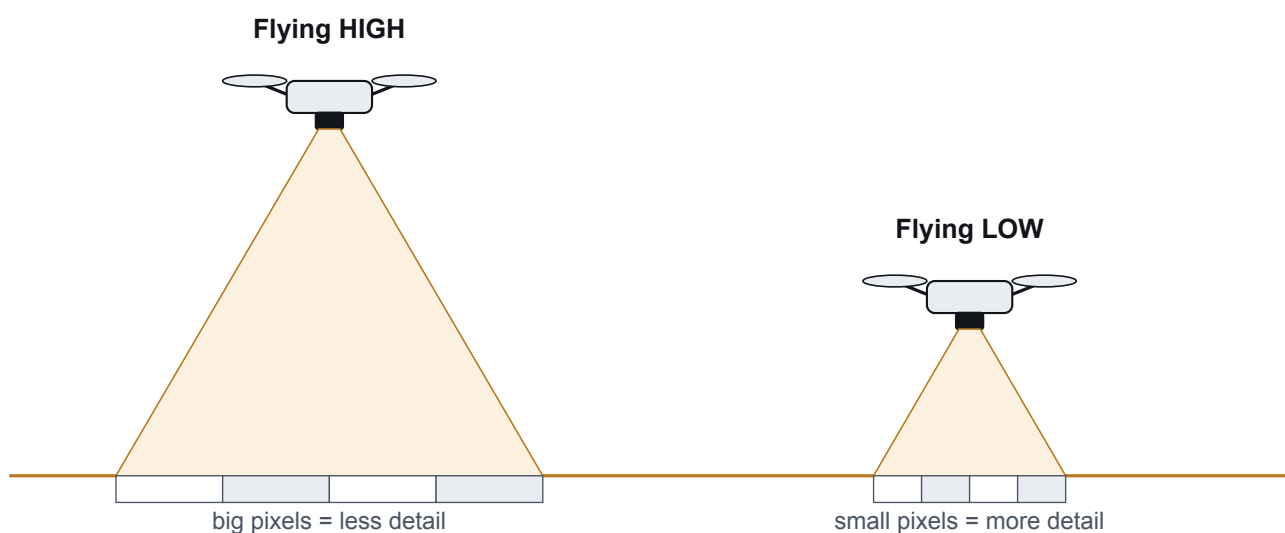
Tap an export button. The app makes a file and lets you send it (email, WhatsApp, Google Drive and so on).

Button	Use it for
DJI Terra	GCPs and checkpoints for DJI Terra.
Pix4D	GCPs for Pix4D.
Agisoft Metashape	GCPs for Metashape.
Export targets (UTM)	Targets for laser-scanner software, in metres.
Export targets (lat/lon)	Targets in latitude and longitude.

UTM (= a map grid in metres; Easting = metres to the east, Northing = metres to the north) is what most scanner software wants.

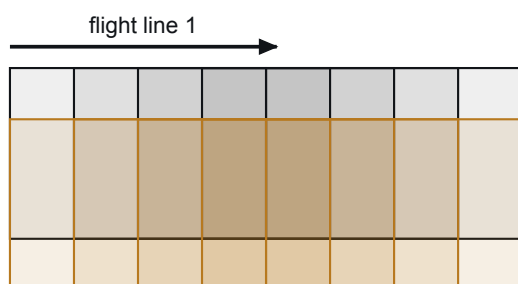
Planning a flight: the flight calculator

Choose the drone, the camera or laser, and the height. The app tells you how sharp the map will be and how the drone should fly.



The higher you fly, the more ground each pixel covers, so the map shows less detail.

- **GSD** (= Ground Sampling Distance — how much ground one pixel of the photo covers, for example 2 cm). **Smaller means more detail.**
- **Overlap** (= how much each photo shares with the next one). Maps need a lot, usually 80% front and 70% side.
- **Swath** (= the width of ground the laser covers in one pass).
- **Point density** (= how many laser points land on each square metre). More points means more detail.
- **Pulse rate** (= how many laser shots per second; the L3 can do 100 thousand up to 2 million).



Each box is one photo.

Front overlap = how much a photo shares with the next one (80%).

Side overlap = how much one flight line shares with the next (70%).

More overlap = better map, more photos.

Photos must overlap so the software can join them into one map.

Good to know: Examples: P1 with a 35 mm lens at 100 m gives about 1.25 cm per pixel. The Phantom 4 camera at 100 m gives about 2.7 cm.

Flight log

A **flight log** (= a written record of each flight) is a record of the work for whoever it is for, and for aviation rules. Tap **New flight log** and fill in:

- mission name and type, the area, and the pilot name;
- drone, payload and height (the calculator fills in the numbers);
- how the drone gets corrections, and the weather (wind in metres per second, or **m/s** (= metres per second; 10 m/s is about 36 km/h));
- the 12-point **pre-flight checklist**;
- **Log take-off** and **Log landing** buttons to record the times.

Important: The app warns you if the wind is too strong for the drone: 12 m/s for the Matrice 400, 15 m/s for the Matrice 300 RTK, and 10 m/s for the Phantom 4.

How to keep a flight log, step by step

1. Before you unpack the drone, tap **New flight log** and fill in the mission, pilot, drone and payload. If you used the flight calculator, the height and settings are already there.
2. Check the wind (a hand-held anemometer, or a weather app) and type it in. If the app warns that it is too strong, do not fly.
3. Choose how the drone gets its corrections: RTK (live), PPK (fixed afterwards in the office) or none.
4. Go through the 12-point checklist with the drone in front of you and tick each one as you check it.
5. Tap **Log take-off** as the drone leaves the ground and **Log landing** when it is down. One log per flight (per battery).
6. Save. If you chose PPK, a PPK job is made for the flight (see Part 3).

What you get: a dated record of each flight (who, what, where, conditions, checks and times) for the client, your company and aviation rules.

Good to know: Flights logged with **PPK** get a PPK job, and the **Accuracy** button grades the finished map with your checkpoints. Both are explained in Part 3.

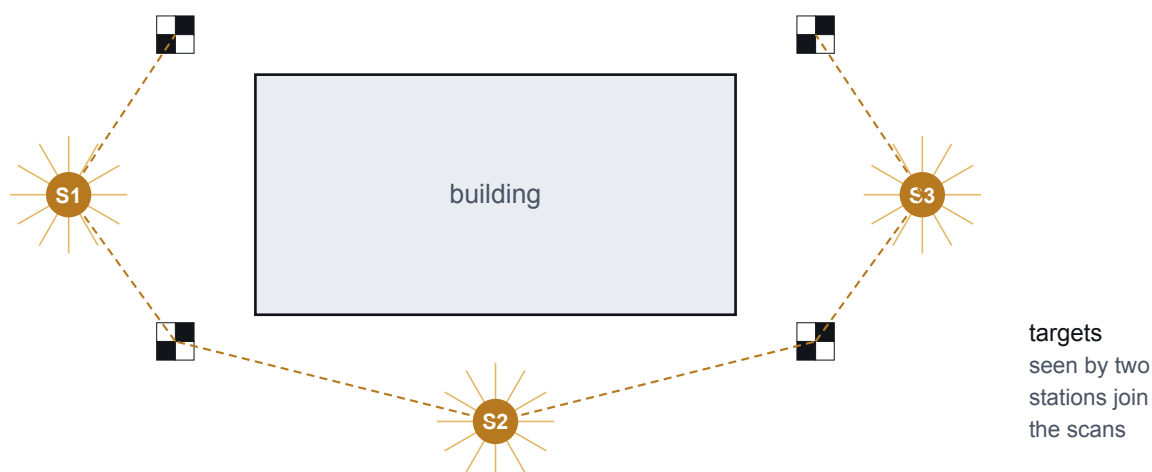
Mission area (boundary for DJI Pilot 2)

Walk around the site with **Field Tools** › **Area walk**. Then, in Terrestrial Survey, tap the area to export a **KML file** (= a map file that Google Earth and DJI Pilot 2 can open). Load it in DJI Pilot 2 as the flight area.

Laser scanning (TLS) station log

A laser scanner is set up many times around a site. Each setup is a **station** (= one place where the scanner stands and scans). Later the office joins all scans together. This is called **registration** (= joining many scans into one 3D model).

Scanner stations (S1, S2, S3) around a building, seen from above



Targets that are seen from two stations are used to join the scans.

Tap **New scan station** and record:

- station name (S01, S02 ... are filled in for you) and scanner model (remembered for next time);
- how it was set up:

The **setup method** says how the scanner's position will be known. The office software needs this to join and place the scans:

Setup method	What it means	When to use it	What you need
Set up over a known point	The scanner stands exactly over a mark whose position was already measured (like a theodolite). Its position is the mark's.	When there are survey marks on site and the scanner has a plumb or laser plummet.	The mark, and the instrument height (mark to scanner centre).
Resection to known targets	The scanner stands anywhere and works out where it is from targets around it whose positions were measured (e.g. with RTK).	When you can't set up over a mark but can see measured targets.	At least 3 measured targets in view, spread around the scanner.
Free station — register with targets	The scanner stands anywhere. Scans are joined to each other through targets that two stations both see. If some targets were measured, the whole set is then placed on the map.	The usual way for buildings and sites with targets.	At least 3 targets shared with the previous station.
Free station — cloud-to-cloud	No targets: the software joins scans by matching the shapes they both see (walls, trees, ground).	Quick work where targets are hard to place.	A big overlap with the previous scan (30–40 % or more).

- which targets the scanner can see (tick them);
- scan settings: **resolution** (= how close together the points are; higher is more detail but a longer scan), **quality** (= how many times each point is measured; higher is less noisy but slower), colour photos, **HDR** (= photos taken at several brightnesses so dark and bright parts both show);
- start and finish times, photos of the setup, and notes.

What you get: one record per station that tells the office where the scanner stood, how it was set up and which targets join it to the others, so the scans can be registered (joined) and checked.

6. Environmental Survey

Use this for general notes about the environment.

What it is for: Recording what you see about the environment at a place: plants, rubbish, soil, air and noise, with photos and the position.

What you get: Located records with photos, which show on the map and go to Fieldra Desktop for maps and reports.

1. Tap a category: vegetation, waste, soil, air, noise or general.
2. Fill in the extra boxes for that category (for example: waste type and amount).
3. Take photos. For waste and vegetation, tap **Suggest classification** to get an AI suggestion.
4. Add notes and tap **Save observation**.

Category	Examples of what you record
Vegetation	Main plant type, how much ground is covered (%), condition.
Waste	Type of waste, rough amount in cubic metres (m ³), where it probably came from.
Soil	Texture (sandy, clay...), colour, wetness.
Air	Smell, smoke, reading from an air meter.
Noise	Where the noise comes from, level from a proper noise meter, how long.

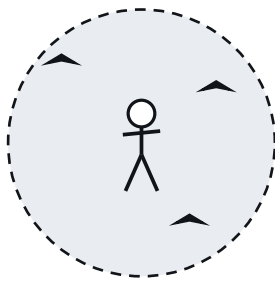
7. Biodiversity

Biodiversity (= the variety of living things — animals and plants — in a place).
This module helps you count them in a fair, repeatable way.

What it is for: Recording animals and plants: what species, how many, and where, using standard field methods (point counts, transects, quadrats) or single sightings.

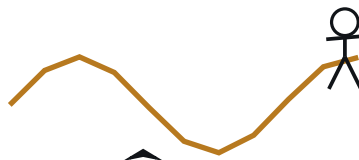
What you get: Sightings on the map, survey records, and scores for how varied the wildlife is (species richness, Shannon, Simpson).

Choose a method



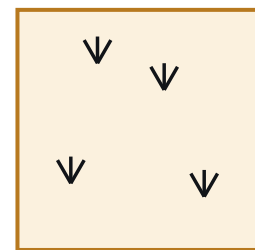
POINT COUNT

stand still, count for 10 min



TRANSECT

walk a line, GPS draws it



QUADRAT

a square plot, e.g. 1 m × 1 m

Three standard ways to count living things.

Method	What you do
Quick sighting	Record anything you see, at any time.
Point count (= standing in one spot for a fixed time and recording everything)	Pick a time (3–20 minutes) and a circle size. A timer counts down.
Transect (= a line you walk slowly while recording)	Start, then walk. Keep the screen on; GPS draws your path.
Quadrat (= a small square plot, for example 1 m by 1 m)	Take a photo straight down. The app estimates how much is covered by plants.

Recording a sighting

1. Take a photo and tap **Suggest taxon & count**. The AI guesses the group (bird, mammal...) and counts common animals.
2. Choose the group and type the **species** (= the exact kind of animal or plant, like “African grey parrot”). Names you used before will pop up.

3. Set the count with the – and + buttons, and choose how you know (seen, heard, tracks...).
4. Optional: **IUCN status** (= how endangered the species is on the world Red List, from LC (least concern) to CR (critically endangered)).
5. Optional: give the distance to the animal, point the phone at it and tap **Take bearing**. The app puts the animal itself on the map. On phones with LiDAR or depth sensing, tap **Measure** and point the camera at it to fill in the distance; on other phones type it (pace it, or use a tape or rangefinder).
6. Tap **Save sighting**.

The scores the app shows

Score	In simple words
Species richness (= how many different kinds)	10 means you found 10 different kinds.
Individuals	How many animals or plants in total.
Shannon score (= a number for how varied the place is)	Higher = more variety.
Simpson score (= the chance that two random animals are different kinds)	Closer to 1 = more variety.
Evenness (= how evenly the numbers are shared between kinds)	1 = all kinds are equally common.

Tip: Only compare scores between surveys that used the same method and the same time or distance.

8. Land & Scene Analysis

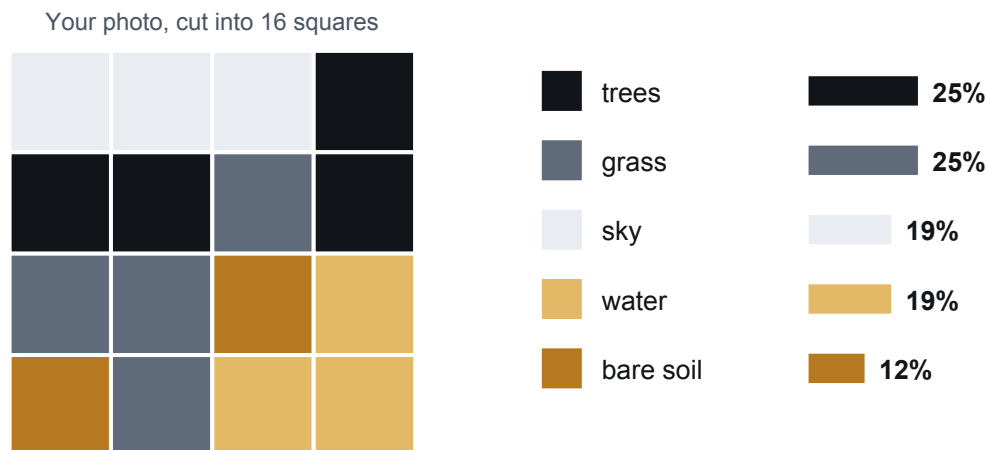
Take a photo of the land. The app tells you what kind of place it is, and what it is covered with.

What it is for: Estimating land cover (trees, grass, buildings, water, bare ground...) from a photo, with help from the offline AI, which you can correct.

What you get: A record with the share of each land-cover class, the photo and your own final class.

Pick the type of analysis at the top:

- Land cover (forest, farmland, buildings, bare land, mining...)
- Vegetation (forest, bush, grassland, mangrove...)
- Water body (river, stream, lake, swamp...)
- Road surface (tarmac, concrete, gravel, dirt) and condition



The app cuts the photo into squares, guesses what each square shows, and adds them up.

This is called **segmentation** (= splitting a picture into parts and naming what each part is). The result is the **cover %** (= how much of the picture each thing takes up).

1. Stand at the spot and take the photo the way the screen tells you.
2. Tap **Analyse photo**. Wait for the suggested class, the coloured squares and the % list.
3. Check or correct the answer under **Your classification**, fill in the extra boxes, and save.

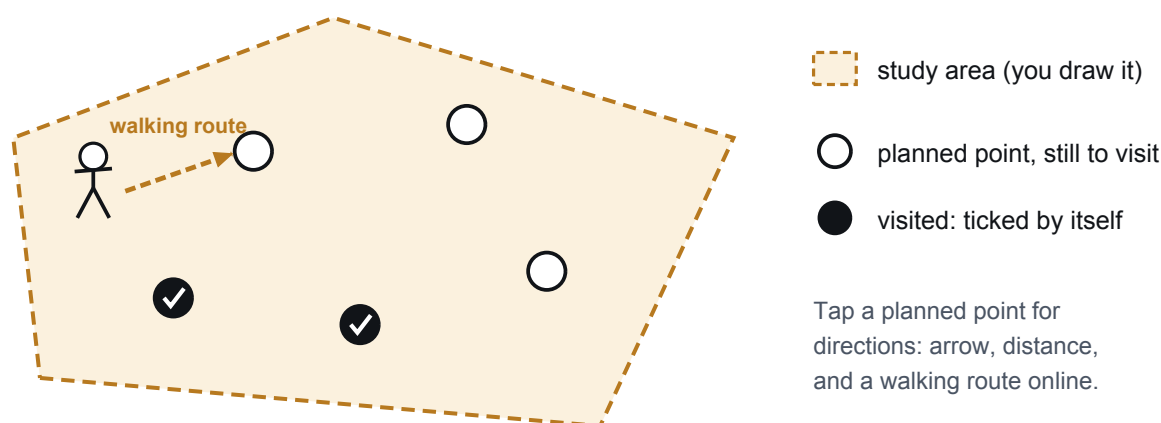
Good to know: These records are useful as **ground truth** (= what is really on the ground, checked by a person) when the office classifies drone maps.

9. Survey plans: where to go, and what is left

Before or during a survey, you can plan it: mark the study area, and the points or households to visit. The plan works in Environmental, Biodiversity, Water, Land & Scene, Road and Socio-economic surveys.

What it is for: Planning fieldwork before you go: the area a survey must cover and the points to visit, then seeing what is done.

What you get: A study area and planned points that tick themselves off as you save records there.



The study area and the planned points. Visited points tick themselves off.

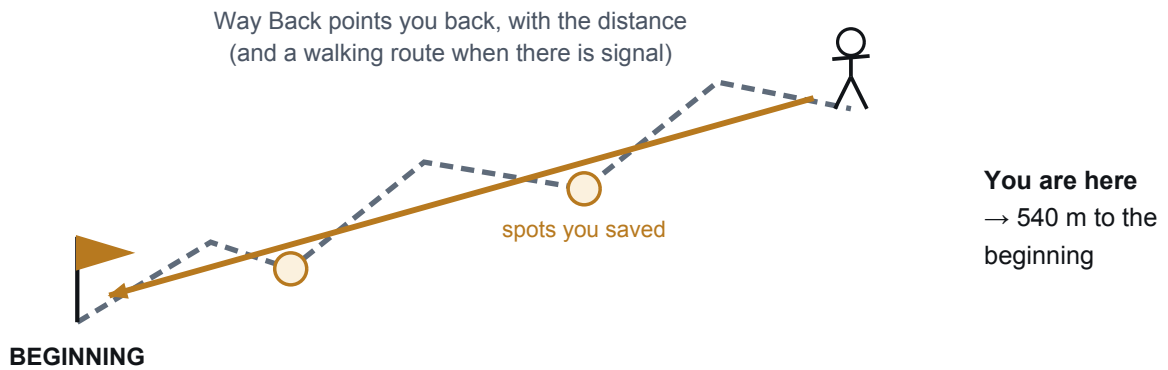
1. Open a module and find **Survey plan**. Give the plan a name (each name is used once per project).
2. Tap **Draw area** and tap the corners on the map. Tap **Add points** and tap where you need to go. You can also do this from the main **Map**.
3. On site, tap a planned point. The screen shows an arrow, the distance, and — with signal — a walking route.
4. Save a record within 25 m of a planned point and the point is ticked as **visited**. If you record outside the area, the app tells you.

10. Way Back

If you get lost, Way Back shows you the way to where you started.

What it is for: Finding your way back to where you started (a vehicle, a camp) without signal.

What you get: An arrow and the distance back, and spots you saved on the way.



Mark the beginning, save spots on the way, and follow the arrow back.

1. Before you walk off, open **Way Back** and tap **Mark beginning**.
2. On the way, tap **Save spot** at useful places (a junction, a stream crossing).
3. To go back, tap the beginning or a spot. Follow the arrow; the distance counts down.
With signal, a walking route is drawn too.

Tip: Way Back uses the phone's GPS and compass, so it works without signal. Keep the phone away from metal for a good compass.

11. Socio-economic Survey (questionnaires)

Ask households, traders or communities a set of questions, like KoboToolbox — with GPS, photos and no internet.

What it is for: Interviews and questionnaires, such as household surveys, made on the phone like KoboToolbox forms.

What you get: One response per interview with its position, as a table (CSV) and PDFs, on the map and on Fieldra Desktop.



A form, its skip logic, and the answers going out as a Kobo-style CSV.

Make a form

1. Open **Socio-economic Survey** and tap **New form**. Start from the household template, or from empty.
2. Add questions: text, long text, whole number, decimal, date, choose one, choose several, yes/no, and notes to read out. Group them under section headings. Questions are numbered 1, 2, 3... for you.
3. Add **skip logic** (= a rule that shows a question only when an earlier answer fits, for example only if consent is Yes) with **Show only if**.
4. Mark questions as required, and set limits (for example household size from 1 to 50).
5. To ask the same questions several times in one interview (for example once for each household member), turn on **Repeat this section** on the section heading. This is a **repeat group** (= a set of questions asked once per entry, as many times as needed, as in KoboToolbox).

Collect answers

1. Tap the form, then **New response**. The GPS starts by itself.
2. Ask the consent question first. If the answer is No, the rest is skipped.

- 
3. Answer, add photos, and **Save**. Choices are all listed: round buttons where you pick one, tick boxes where you tick all that apply. Answers are saved on the phone.
 4. In a repeating section, fill in the first entry, then tap **Add another** for the next (e.g. Household member 2). **Remove** takes an entry out.

Good to know: Several responses taken at the same house sit on top of each other on the map. Tap the dot and Fieldra lists every response there, so you can open the one you want.

Get the answers out

Export a CSV in KoboToolbox's layout (one column per question name; a repeating section gives a count column and a column listing its entries), or send the project to Fieldra Desktop, which makes summary reports as PDF or Word.

- **One response as a PDF:** press and hold a response in the list › **Share as PDF**. It has every answer, where and when it was collected, who asked, and its photos.
- **A paper copy of the form:** on the form's page, **Printable form (PDF)**. Numbered questions with boxes to tick and the skip instructions written out — a back-up if a phone fails.
- In the response list, each response shows a photo icon and how many photos it has.
- Forms can also be built on Fieldra Desktop (or imported there from KoboToolbox). They arrive on the phone with the project.

Good to know: Each question has a column name (for example household_size) that stays the same if you change the question text, so exports from different days line up.

12. Photo Gallery

All the photos in the project, grouped by what they belong to.

What it is for: Seeing every photo in the project in one place, grouped by what it belongs to.

What you get: Photos you can open, share, save to the phone or remove.



Every photo in the project, grouped by what it belongs to.

- 1 Tap the filter to show one category.
- 2 Tap a photo: full screen, swipe to the next.
- 3 Open record · Share · Save to gallery · Remove.

The gallery groups photos by category. Tap one to see it full screen.

Add photo (next to the category filter) takes a photo or picks one or more from your phone and adds it to the project itself, under **Project photos**, as on Fieldra Desktop. To add a photo to a record from the map, tap the record and choose **Add photo**. Photos are placed where the phone is, when it knows.

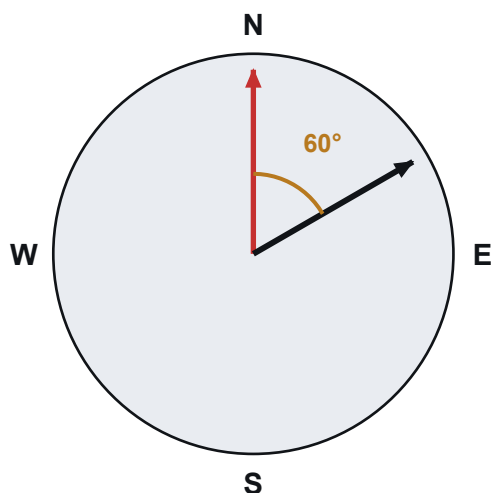
Good to know: To remove a photo, open it and tap **Remove**, or tap the × on the photo under a record. The app asks before removing. A copy in your phone's gallery stays there.

13. Compass & Azimuth

Use this to measure and save directions.

What it is for: Measuring and saving directions (bearings), e.g. to a landmark or along a boundary.

What you get: Saved bearings, magnetic and true, shown on the map as a dot with a line in that direction.



Bearing (also called azimuth)

= the angle from North, turning clockwise

North = 0° East = 90°

South = 180° West = 270°

The black arrow points at 60°
(between North and East).

A bearing is measured clockwise from North.

- **Magnetic north** (= where a compass needle points) and **true north** (= the direction to the North Pole on a map) are slightly different. The app shows both.
- **Pitch** (= how much the phone tips forward or back) and **roll** (= how much it tips to the side) are also shown.
- If the accuracy is poor, move away from cars and metal, and wave the phone in a figure of 8.
- Point the top of the phone at the target and tap **Record bearing**.

On the map, a recorded bearing is drawn as a dot where you stood, with a short line (60 m) going out from it in the direction you measured. The dot is the record's position; the line only shows the direction, not how far away the target is. Tap the dot to open the bearing.

Qibla

The **Qibla** module points to the Kaaba in Mecca from where you stand, on the compass dial, and tells you to turn left or right.

14. Road Survey

Record a road as you drive it, and mark damage.

What it is for: Recording a road as you travel it, with how rough it is, and marking damage such as potholes and cracks.

What you get: A road line on the map with its length and the defects along it, each with photos.

1. Type the road name. You can turn on the **bump indicator** (it uses the phone's movement sensor).
2. Tap **Start road survey**. The GPS draws the road as a line. Use **Pause**, **Resume** and **Stop**.
3. At damage, tap **Record defect here**: choose the type (pothole, crack, erosion, drainage, obstruction), how bad it is, add size and photos.

Tip: The line keeps recording with the screen off, if you allowed location **all the time**. The screen shows "Screen off: Keeps recording". On Android a notification shows while it records.

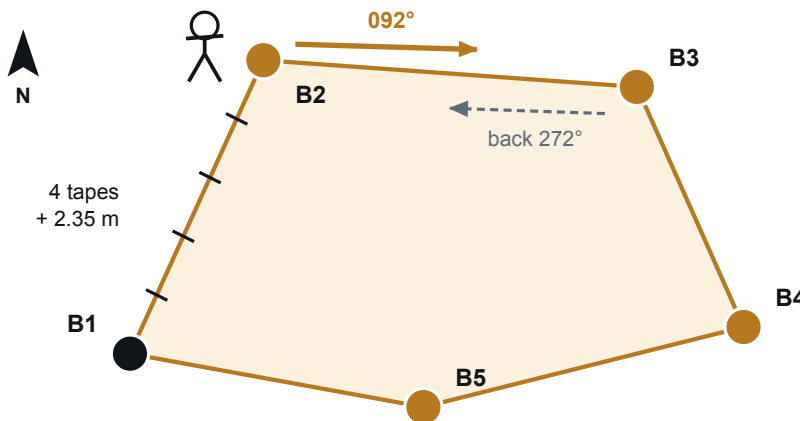
Be careful: The bump indicator only hints at rough road; it does not measure potholes.

15. Land Survey (compass and tape)

Survey a plot of land with the phone and **any tape or rule**: walk round the boundary from **beacon** (= a mark at a corner of the plot: an iron pin, a concrete pillar, a peg) to beacon. The phone takes the direction of each side and keeps the tape on line; you measure the length. Back at the first beacon, Fieldra checks how well it closes, corrects the corners and gives the area.

What it is for: Measuring a plot of land with the phone's compass and a tape, beacon to beacon, as a surveyor would with a compass traverse.

What you get: The plot's shape, area and how precisely it closes, a survey report (PDF) and a list of beacon coordinates (CSV).



At each beacon:

- 1 the bearing to the next one
- 2 the length with the tape:
full lengths + what is left
- 3 the back bearing, to check

Back at B1: the closure,
the corrected corners and the area.

Walk the boundary beacon to beacon: the bearing of each side from the phone, its length with the tape.

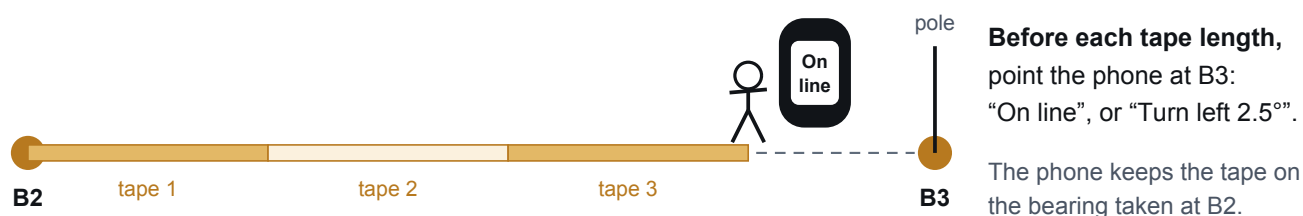
Start

1. Open **Land Survey** and tap **New land survey**. Type the parcel's name, its plot or title number, the owner and the place.
2. Enter the length of your tape or rule: a 30 m tape, a 5 m pocket tape, even a 1 m rule. You count how many full lengths each side takes.
3. Set the **declination** (= the angle between magnetic north (where the compass points) and true north on maps): **Use the phone's declination** where the phone knows it, or type it (east +, west -).
4. Stand on the first beacon and tap **Average GPS on this beacon**. It places the plot on the map; its shape comes from the compass and tape.

Measure each side

1. Stand on the beacon. Hold the phone flat and point its top edge at a pole on the next beacon. Tap **Take bearing** and hold still for 3 seconds.

2. Lay the tape towards the next beacon. Before each length, point the phone at the beacon: the **line guide** says **On line**, or which way to turn and by how much.
3. Tap **+1** for each full tape length, and type what is left over at the end. The total shows underneath.
4. On a slope, switch off **The ground is level**, lay the phone on the tight tape and tap **Take slope**. The length is reduced to the flat.
5. At the next beacon, turn round and take the **back bearing** (= the bearing from the far beacon back to the one you came from). It is averaged with the first one and catches a compass pulled off by metal nearby.
6. Choose what marks the beacon, record its GPS as a check, add a photo, and save. Carry on round the plot.
7. For the last side, switch on **Back to B1**. The plot closes.



The line guide: keep the phone pointing on the bearing while each tape length is laid.

The result

You see	What it means
Misclosure (= how far the end of the walk misses the beacon it started from, because of small measuring errors)	The gap, in metres.
Precision (1 in n)	The distance walked divided by the gap. 1 in 1,000 or better is good for compass and tape; worse than 1 in 300 means a side should be measured again.
Adjustment (= sharing the gap out along the sides, more on long sides than short ones (the Bowditch rule))	The corners are moved a little so the boundary closes exactly.
Area	Inside the corrected boundary, in m ² , hectares and acres.
Local attraction (= metal or power lines near a beacon pulling the compass off)	Shown in red when the bearing and back bearing differ by more than 2°.

Tap a side in the **Field book** to correct or delete it; everything is worked out again. **Survey report (PDF)** has the plan with each side's bearing and length, the field book, the corrected sides, the list of beacons with their coordinates and inside angles, and lines for signatures. **Beacon coordinates (CSV)** opens in a spreadsheet or GIS.

Tip: Keep the phone away from cars, fences, steel pegs and other phones when taking bearings, and move it in a figure of 8 if the compass warns.

Be careful: A phone compass and tape give an honest plan of a plot, but not a legal cadastral survey. For title deeds, follow the rules of your land survey authority.

16. Water Survey

Record places where you take water samples.

What it is for: Recording water samples: where, when, and readings such as pH, turbidity and conductivity, from a meter or typed.

What you get: Sample records on the map, flagged on the desktop dashboard when they are outside limits.

1. Tap **New sampling point**. The GPS starts on its own.
2. Type the site ID, or tap **Scan sample label** to read the code on the bottle.
3. Choose how the water looks, how fast it flows, and whether you see pollution.
4. Add measurements if you have them: temperature, **pH** (= how acid or alkaline water is; 7 is neutral), **turbidity** (= how cloudy the water is), and **conductivity** (= how much dissolved salt and minerals are in the water).
5. Take photos and save.

If you have a Bluetooth water meter: tap **Scan for instruments**, pick the meter, wait for readings, then tap **Use these readings**.

Important: A phone cannot measure water quality by itself. Numbers must come from a proper, checked meter.

17. Field Tools

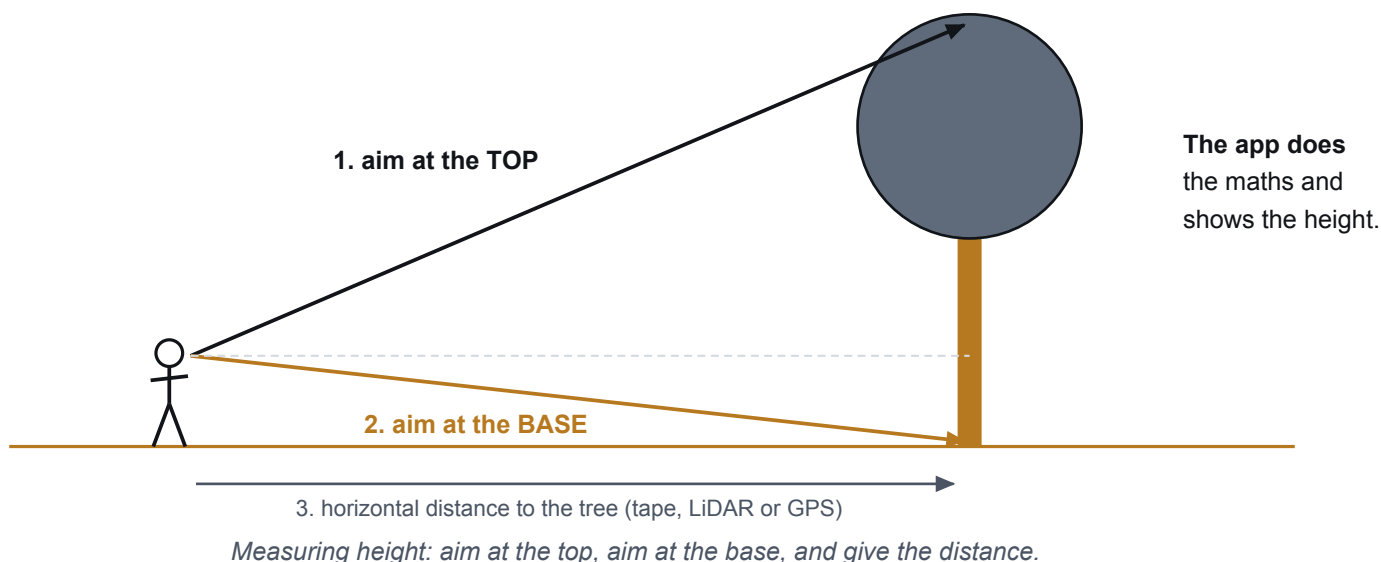
Handy measuring tools that use the sensors inside the phone, and survey calculators.

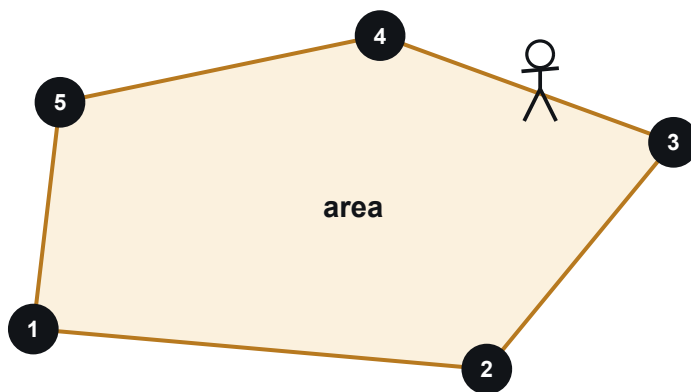
What it is for: Small measuring tools that use the phone's sensors: positions, distances, heights, areas, height from air pressure, noise, metal, codes and coordinate maths.

What you get: A reading on screen, which you can save as a measurement record.

Tool	What it does	How to use it
GNSS point averaging	Makes a GPS point more reliable.	Stand still, tap Start. It averages many readings.
LiDAR / Depth distance (= LiDAR on iPhone and iPad Pro; ARCore depth on Android phones that support it)	Measures distance to a surface, and between two points.	Aim the cross, tap Mark A, move, tap Mark B.
Height & slope	Measures tree or building height, and how steep a slope is.	See the picture below.
Record a track	Records a road, transect, boundary or patrol as a line, with its length and time.	Choose on foot or vehicle, tap Start recording, walk; Pause when you stop; Save. It keeps recording with the screen off when location is allowed all the time.
Area walk	Measures the size of an area.	Tap Add corner at each corner.
Barometric elevation (= uses air pressure to measure going up or down)	Shows height change, good to about 10–50 cm.	Set reference, then move. Reset every 20 minutes.
Sound level	Rough noise level in decibels (dB).	Choose a time and tap Start.
Magnetic field (= measures magnetism with the phone's compass sensor)	Finds buried metal or interference.	Set a baseline away from metal, then sweep slowly.
Label scanner	Reads QR codes and barcodes.	Point the camera at the code.

Tool	What it does	How to use it
Coordinate converter (= decimal degrees, degrees minutes seconds, UTM, MGRS and national grids)	Writes a position in every format, and in a national grid of your choice.	Type or paste one, or tap Use where I am. Under National grid, pick a system (those used where you are come first) to see it there, or type eastings and northings in it. Where the national datum shift needs a grid file, the converter is exact once Fieldra Desktop has sent it, approximate (a few metres) until then.
COGO calculator (= coordinate geometry: positions from bearings and distances)	Distance and bearing between two points; a point at a bearing and distance (e.g. a tree across a river); a point from bearings and distances to two or three known stations; a point from two taped distances; where you stand from bearings and distances to known points (resection).	Choose what to find, fill in the points (or Use where I am), bearings and distances. Save the result as a point.
Sampling points	Places sampling points in an area: a grid at a spacing, random points kept apart, or stratified across a desktop layer's areas; works out how many points you need.	Choose the area (study area, area walk, parcel or a desktop layer's area) and the design, then Add to the plan. Find each point with Guide me.





Walk to each corner and tap "Add corner". The app joins the dots and shows the area and the distance around it.

Save it, then export it as a KML file for DJI Pilot 2.

Area walk: tap at each corner and the app works out the area.

Good to know: The distance tool needs LiDAR (iPhone/iPad Pro) or ARCore depth (many Android phones; move the phone a little first). The sound level is only a guide, not an official measurement.

Bearings in the COGO calculator are compass bearings: type the declination for your area (east positive, west negative), or tap **Use this phone's declination** (the phone knows true and magnetic north), or 0 if your bearings are already true. For **resection**, take bearings from where you stand to two to four known points; for **a point from bearings and distances**, from two or three known stations to it. If you also measured distances (tape, rangefinder or total station), type them next to the bearings: a bearing or a distance can be left empty, as long as there are at least two measurements. All of them are adjusted together (least squares), each weighted by its accuracy: the result says how well the point is known — the 95 % error ellipse, e.g. $\pm 3 \text{ m} \times \pm 1 \text{ m}$, long way 40° — and with spare sightings how much each one misses by. Set **Sighting accuracy** to how close your bearings are (about 1° with a hand compass) and **Distance accuracy** to how close your distances are (about 0.1 m with a tape); **Measurements miss by** lists each bearing's and distance's misfit. Spread the known points around you: sightings that cross at a narrow angle give a long ellipse. Two taped distances meet in two places: pick the side (left or right of $A \rightarrow B$). The calculator works on a flat plane around the points, which is accurate over a few kilometres.

Sampling points with the same seed give the same points again; **Draw again** picks a new seed. A grid starts at a random place, so no part of the area is favoured. **Stratified** shares the number of points among all the areas of a desktop layer (e.g. land-cover types) by their size, at least one each; if the layer has a number field with how much the measured value varies in each area (its standard deviation, e.g. from a pilot survey), **Share points by** it to give the more variable areas more points (Neyman allocation: the most precise average for the same effort). The points are saved as planned points (P1, P2...) for the module you choose, shown hollow on the map until visited.

How many points? works out the number needed for the average to be within a chosen precision (e.g. $\pm 0.2 \text{ pH units}$) at 90, 95 or 99 % confidence, from how much the value varies (its standard deviation, from a pilot survey, earlier data or a best guess). With a stratified

design it uses each area's size and, when Share points by is set, each area's own spread. **Use N points** puts that number into the design. Allow extra for points you cannot reach.

18. Map, offline maps, records and export

What it is for: Seeing all the project's records on a map, measuring and drawing on it, using it offline, and getting the data out.

What you get: A map with your layers, printable layouts, offline areas and files (GeoJSON, CSV, KML, ZIP) for other programs.

Map

Shows everything you saved, in colours. Tap a dot to see its details and photos. The tools are in a bar along the bottom, in groups like Fieldra Desktop's ribbon; swipe it sideways for more. The maps in each module have the same tools when you expand them (the button at the top right of the map); tap a record there to open it, add a photo, be guided to it or see what is near it. The **Photos** layer shows where each photo was taken: tap one to open it.

Group	Tools
Navigate	My location , Full extent (everything in view), Go to XY (type latitude and longitude, degrees minutes seconds, UTM or MGRS, or search a place or address by name with internet; the spot is marked), Guide me (an arrow and the distance to a place, see below), Bookmarks (save the view you are looking at, with a name, and come back to it with one tap).
Layer	Layers opens Contents: tick each layer to show it, with its colour and how many records it has. Empty layers are listed apart. Streets or Satellite base map. Colour by colours points by a field, e.g. water condition, road severity or a form answer, with a legend. North up goes back to a flat map facing north. Time shows only records from today, the last 7 or 30 days or this year, or one survey day at a time (arrows step day by day).
Terrain	Relief shades the hills, Contours draws contour lines with heights, 3D tilts the map with hills in relief, with an orbit ball at the bottom right: drag inside it to turn and tilt the view, a side handle to only turn, the top or bottom handle to only tilt; double-tap for flat, north up. Profile : tap points along a line, then Profile , for the height along it: lowest, highest, climb, descent and steepest part. Terrain needs internet; heights are a guide (about ± 5 –10 m).
Measure	Distance : tap points along a path for its length. Area : tap the corners for the area and perimeter; Save keeps it as an area. Buffer : a circle of 25 m to 2 km around a place you tap, your location or the marked place, and how many records are inside (tap the card for the list).
Data	Records and Photos of the project.

Group	Tools
Edit	Draw a mission area, a study area or planned points. Snap : while on, taps when drawing or measuring jump onto the nearest corner or edge of what is on the map.
Share	Layout , Save image and Offline map .

Guide me: walk to a point

Tap a record on the map and choose **Guide me here**, or use Navigate › **Guide me** and pick the marked place, a planned point still to visit (nearest first) or a record. As in Way Back, with internet it follows a walking route along paths and roads, drawn as a blue line: a card at the top shows an arrow that turns as you turn the phone, which way to turn, the distance and walking time left. With no internet, the arrow points straight there along a dashed line. The phone buzzes when you are there (within the GPS accuracy, at least 5 m). Close the card to stop. The record sheet also has **What is near it (buffer)**.

Layout: the map on a page

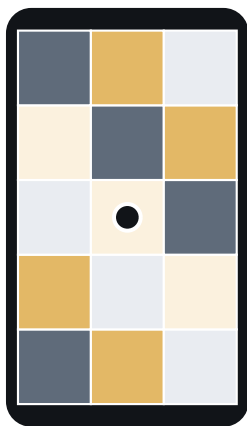
1. Tap **Layout**. A frame the shape of the page's map shows on the map; move and zoom the map until the frame holds what you want, and choose portrait or landscape.
2. Tap **Next**. The page appears: A4, A3 or Letter, with the title, subtitle, who prepared it, notes, the legend, north arrow, scale bar and date — each can be switched off.
3. Tap **Export PDF** (at the paper size) or **Export image**. **Change map view** goes back to move the map.
 - **Office layers**: areas, lines and points drawn or imported on Fieldra Desktop arrive with the project and show in their office colours — including colours by category or by value, as styled on the desktop (e.g. clear, turbid and polluted water). Tap one to see its name.
 - **Save image** shares a picture of the map as it is on screen.

Offline maps

Save the area you are looking at so the map works on site with no signal: Map › **Offline map** › **Download this area**. Do it on Wi-Fi before you go.

Your own orthomosaic as the map

An **orthomosaic** (= one big, measured map made by joining many drone photos) from your latest flight shows the site as it is today. Put it on the phone as an **MBTiles** (= a single file holding a map cut into small square images, ready for offline use) file:



Your latest flight as the map, with no signal

- 1 DJI Terra / Pix4D: export the orthomosaic as MBTiles.
- 2 Copy the file to the phone (cable, Drive, AirDrop).
- 3 Map › Offline maps › Add orthomosaic.

Navigate on your own drone map, with no signal.

Tip: Easier from Fieldra Desktop: add the orthomosaic (or DSM) on the computer and send the project to the phone with Nearby Devices. The desktop cuts it into map tiles and it arrives under **Offline maps** in that project, switched on.

Records

One list of everything in the project. Filter by type. Open a record to see everything saved with it, or press and hold it to delete it. Under each record, **SYNCED** means Fieldra Desktop has it; **PENDING UPLOAD** means it will go at the next sync.

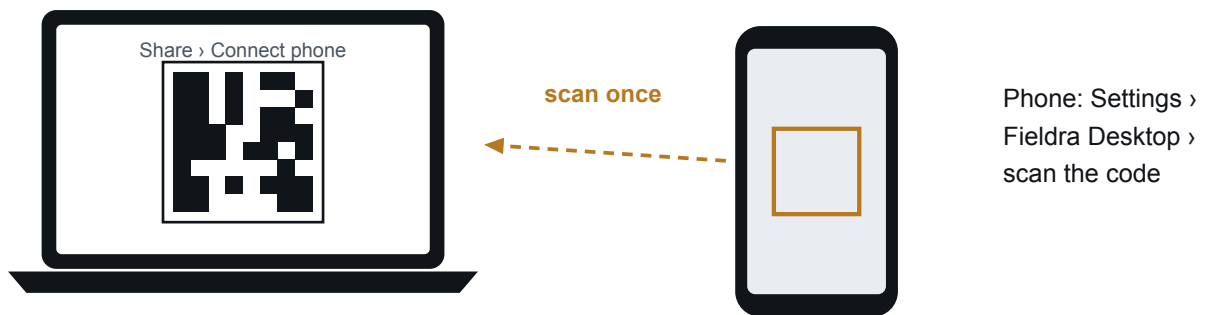
Export

File type	Open it with
GeoJSON (= a map data file)	QGIS, ArcGIS and other map programs.
CSV	Excel or Google Sheets.
KML	Google Earth.
ZIP	All of the above plus every photo, in one package.

19. Sending work: Fieldra Desktop and Nearby Devices

Two ways to move work between devices. Both use the Wi-Fi only — no internet.

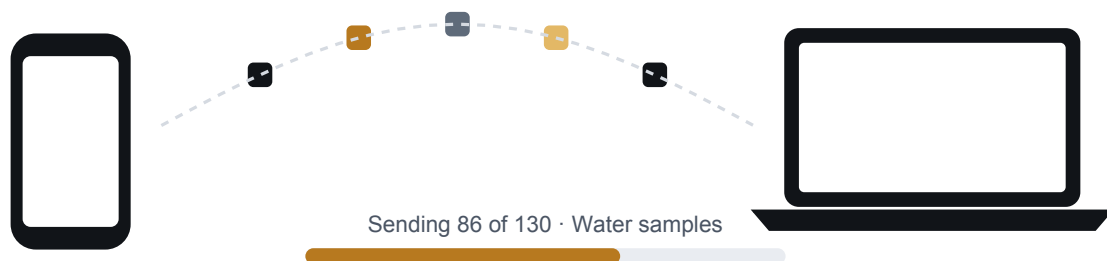
Connect to Fieldra Desktop (once)



Scan the code shown by Fieldra Desktop, once.

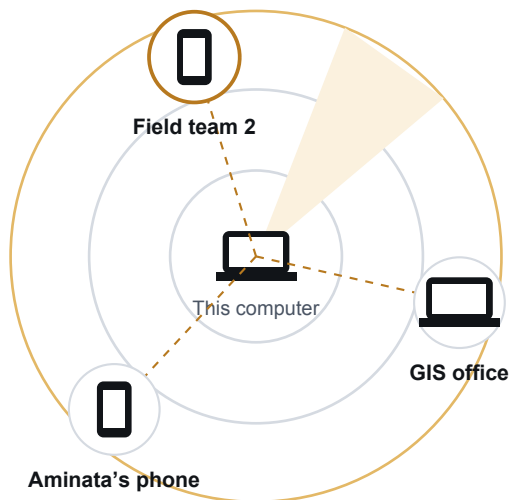
1. On the computer, open Fieldra Desktop and click **Share › Connect phone**. A QR code appears.
2. On the phone: **Settings › Fieldra Desktop › Connect**, and scan the code.
3. Everything already on the phone is sent. From then on, new records, answers and photos go by themselves whenever the phone is on that Wi-Fi.

Good to know: Working far from the office? If your organisation runs a **Fieldra team server**, connect to it the same way: **Settings › Fieldra Desktop › Connect** and type its address (<https://...>) and the 6-digit pairing code you were given. Records then go over the internet whenever the phone has data, and Fieldra Desktop collects them from the server.



While sending, both apps show the items flying across and how many are left.

Nearby Devices: send a whole project



Nearby devices

- 1 Devices with Fieldra on the same Wi-Fi appear by name.
- 2 Tap one, then Send next to a project.
- 3 Untick anything you don't want to send.
- 4 The other device taps Accept.
- 5 If the Wi-Fi drops, tap Continue: it picks up where it stopped.

Nearby Devices finds phones and computers with Fieldra around you.

- Open **Nearby Devices** on both devices. Give your phone a clear name at the top (for example “Field team 2 – North site”).
- If a device does not appear, type the address shown under its radar into **Add by address**.
- **Unfinished** lists sends that stopped; tap **Continue**. **Recent transfers** lists what you sent and received, with **Open**.

Be careful: A phone can receive only while its Nearby Devices screen is open. Keep it open until the transfer finishes.

Sending again only sends what changed. Records and photos you deleted are deleted on the other device too, and layers from Fieldra Desktop come along with the project.

Orthomosaics and elevation models from Fieldra Desktop come along too, as offline maps. A large one takes a few minutes over Wi-Fi; if the connection drops, **Continue** carries on where it stopped.

Data layers: desktop layers and your own files

Layers drawn or imported in Fieldra Desktop that came with the project (water points, parcels, roads...) can be corrected in the field. Tap one of their shapes on the map, or open **Map > Edit > Data layers** and pick a layer:

- **Change values:** the desktop's rules apply — pick-lists appear as choices (with their descriptions), required fields and number ranges are checked before saving.
- **Move to where I stand** puts a point at the phone's position (for example a borehole mapped in the wrong place).

- **Add a point where I stand** adds a new feature with the layer's fields; **Delete feature** removes one.
- **Reshape on the map** (lines and areas; **Reshape part 2...** for shapes in several parts): the corners show as numbered dots. Step through them with  , tap the map or **Here** to move the chosen corner (to a tapped spot or where you stand), **Add corner** after it or **Remove corner**. With **Snap on** a tap near another feature's corner or edge lands exactly on it. On a line, **Split here** cuts it in two at the chosen corner (both keep its fields). On an area (one part, no holes), choose a corner and tap **Split from here**, then choose another corner and tap **Split to here**: the area is cut along the straight line between them into two areas with the same fields (the line must stay inside the area). **Undo all** starts again; **Save shape** keeps it.

Changes go to Fieldra Desktop with the next sync, feature by feature: what you changed replaces the desktop's copy of that feature, and edits made at the desktop to other features are kept. The desktop keeps the layer as it was in its **History**, so a change can be undone there. If the desktop sends the layer again before your changes have gone, they stay on top of it.

Open a file (top of Data layers) brings your own data onto the phone: **GeoJSON**, **KML** or **KMZ** (points, lines and areas with their fields, from Google Earth or other apps), **GPX** (waypoints and tracks from a GPS, as two layers), **CSV** with latitude and longitude columns, a **Shapefile** (zip the .shp with its .dbf and .prj; any coordinate system) or a **GeoPackage** (each table a layer). Each becomes a layer you can see on the map, edit and reshape. In a layer, **Share as a file** sends it as GeoJSON, KML or CSV (email, messaging, Drive...). Layers made on the phone, including recorded tracks, go to Fieldra Desktop with the next sync.

Overlay (in a layer) makes a new layer on the phone: **Clip to an area** keeps the parts of this layer inside the areas of another layer (lines and areas cut at the edge), **Erase an area** keeps the parts outside, and **Count another layer in each of these areas** adds to each area how many points (or lines and areas, by their first corner) fall in it, with the total and average of a number field if you choose one (e.g. trees per plot and their total volume). The original layers are not changed.

Web map layers on the phone

Map › Layer › Web layers adds online maps under your data: an XYZ tile address, a WMS (choose its layer) or an ArcGIS MapServer or ImageServer. Switch each on or off, set how see-through it is, and hold one to remove it. Areas you look at are kept for offline use like the base map.

Download features (same screen): paste an ArcGIS FeatureServer layer, an OGC API – Features collection or a WFS address with its layer, and up to 20,000 features come in as a layer of the phone. It can be edited and reshaped like desktop layers, and goes to Fieldra Desktop with the next sync.



The layer stays linked to the service. Its **Web service** section shows what changed on the phone; **Save changes to the service** sends them (ArcGIS feature services, WFS-T and OGC API – Features services that take edits), and **Get the latest from the service** brings in what others changed. Before saving, Fieldra checks whether someone changed the same features on the service since you downloaded them; if so, choose **Keep theirs** or **Overwrite with mine**. Saving needs internet; services that need a sign-in are not supported yet.

Settings

- Your name (saved with every record).
- **Welcome survey**: your answers, whether they have been sent, and **Check now**.
- Save photos to the phone's gallery (on or off).
- Fieldra Desktop: connect, send now, disconnect.
- Download the AI (once, on Wi-Fi).
- Turn on the **simulated instrument** to practise without real equipment.

Part 2 · Fieldra Desktop

The office side: receive, map, edit, analyse, print and share — on macOS or Windows.

20. Install Fieldra Desktop

Get it from the **Mac App Store** or the **Microsoft Store** (links on fieldra.luminex-technology.com/desktop). The stores pick the right version for your computer and keep it up to date.

Test versions (direct download)

New versions can be tried before they reach the stores: download them from fieldra.luminex-technology.com/beta. Choose the file for your computer:

Computer	File to use
Any Mac (not sure)	macOS Universal (.dmg)
Mac with M1, M2, M3 or M4 chip	Apple silicon (.dmg)
Older Mac with Intel chip	Intel (.dmg)
Any Windows 10/11 PC (not sure)	Windows installer (.exe) — installs the right version
Windows on ARM (Snapdragon, Surface Pro X)	ARM64 installer
Old 32-bit Windows	32-bit portable (.zip): unzip and run

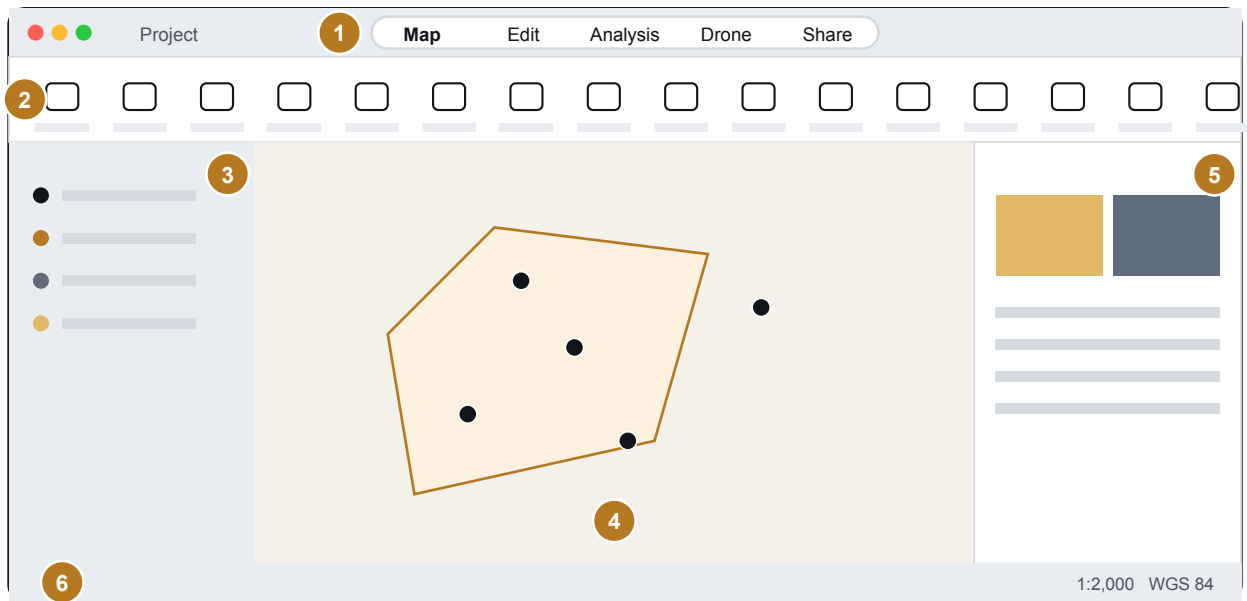
Mac (test version)

1. Open the .dmg and drag Fieldra into Applications.
2. Open Fieldra. When asked, **Allow** it to find devices on your local network — phones need this to send data.
3. Fill in the short welcome survey (as on the phone).

Windows (test version)

1. Run the installer.
2. If Windows says “Windows protected your PC”, click **More info › Run anyway**.
3. Allow Fieldra through the firewall on **private networks**.

21. The Fieldra Desktop screen



The main screen. The numbers match the list below.

#	Part	What it does
1	Title bar	Project picker, the tabs (Map, Edit, Analysis, Drone, Share), light or dark, and “Receiving” when phones can send.
2	Ribbon	The buttons of the chosen tab, in named groups.
3	Contents	Every layer: tick to show, drag to reorder, right-click for more.
4	Map	Drag to move, scroll to zoom, right-drag to tilt and turn.
5	Right pane	Details of what you clicked (with photos), Symbology, Phones and Offline maps.
6	Status bar	Scale, zoom level and the coordinates under the mouse.

22. Projects, phones and survey data

Receiving from phones

Click **Share › Connect phone** and scan the code with each phone (see Part 1). Records appear on the map as they arrive; a card shows what is coming in.

Team server (teams in different places)

For crews who are not on the office Wi-Fi, run the **Fieldra team server** — one small program (Fieldra-TeamServer for Windows, macOS or Linux, from the downloads page) on any computer or cloud machine the phones can reach. Start it with a 6-digit pairing code of your choice, for example `Fieldra-TeamServer -code 482913` (add `-cert` and `-key` for HTTPS).

1. Phones connect to it as they would to Fieldra Desktop (its address and the code), and send records, answers, photos and edits to desktop layers whenever they have data.
2. In Fieldra Desktop, **Share › Team server**: enter the same address and code, then **Connect**.
3. The desktop collects what is new every few minutes (or now, with **Pull now**), and shows when it last did and how many items came. **Disconnect** stops it.

Be careful: Ten wrong pairing codes from one place within 15 minutes lock that place out for a while. Use a code that is hard to guess, and HTTPS on the internet.

Projects

- Choose a project in the picker at the top, or **All projects**.
- Make a new one with **File › New Project** (Cmd+N on a Mac, Ctrl+N on Windows) or the picker's **New project...** Then send it to the field team with Nearby devices.
- **Contents** shows the project at the top with everything in it underneath: its **Layers**, **Drone mapping** files and **Survey data**.
- Click the project's name (or click an empty part of the map): the right pane shows the project, what is in it, and its own photos — add, view or remove them there.

Project packages: **Share › Export package** saves the open project — records, photos, layers and drone files — as one **.fieldra** file to copy to a USB stick or send by email. On the other computer, **Share › Open package** adds it (records already there keep the newer copy).

Layers you draw or import belong to the open project and travel with it to other computers and to phones. Layers made before this existed show in every project: right-click one › **Add to this project**.

Survey data layers

Each kind of record (water samples, sightings, GCPs...) is a layer in **Survey data**, in the same colours as the phone. Click a point to see all its details and photos.

Photos

Map › Photos shows every photo by category. Click one for full size; **Save** puts a copy anywhere; **Remove** deletes it (you are asked first). Add your own with **Add project photos**, or on a point with **Add photos** in its details.

Survey forms

Map › Survey forms: every questionnaire summarised question by question, every response, and reports as **PDF**, **Word** or **CSV** (KoboToolbox layout).

- **New form**: start blank, from the household survey template, or **Import XLSForm (.xlsx)** — a form built for KoboToolbox or ODK. Repeat groups come in as repeating sections; Fieldra lists anything it could not bring over (GPS, photo and calculation questions, complex skip rules).
- A section heading can be set to **Repeat this section**: its questions are asked once per entry (e.g. per household member). Reports summarise the entries together and list each one; the CSV has a count and an entries column.
- The editor: form name, the numbered question list (move, copy, delete), and for each question its text, answer type, hint, required, choices, number limits and **When to ask** (skip logic).
- **Edit form** changes a form; every save is a new version. Question names (the columns in exports) stay fixed once saved.
- Send the project to the phones to collect answers with the form.

Report designer

The **Report designer** tab decides what the PDF and Word reports contain and how they look, with a live preview of the page:

- the title and an introduction; whether to show the overview (dates, enumerators...), the section headings, and every response at the end;
- each question's result, in any order (arrows), shown as a **table**, **column**, **bar**, **pie** or **donut** chart, a table with a chart, a **line over time** for dates, or a **histogram** for numbers — or left out (eye);
- a title and a note under any result, and **Add text** for headings and paragraphs of your own (findings, methods, recommendations). The introduction, text and notes are rich text: headings, **bold**, *italic*, underline, colour, bullet and numbered lists and alignment, kept in the PDF and Word reports;

- **Add chart:** any kind (column, bar, line, area, pie, donut, histogram, scatter) of any question's answers — counts, or the total, average, lowest or highest of a number question by those answers (e.g. average household size by village) — with the order, top-N, dates by day, month or year, values, gridlines and a **trend line** (its slope and R^2 , how well the line fits);
- the colour of charts and headings (quick picks, or brand, grid, recent and custom colours from the shared palette), and portrait or landscape pages. Presets apply immediately. Select words to set their text colour or highlight in introductions, text blocks and compact notes; No highlight clears only the highlight. The design is kept for the form; the arrow-round button goes back to Fieldra's layout.

Land survey

Map › Land survey lists the parcels surveyed on the phones (chapter 15) and works each one up for the plan and documents: the field book with its back-bearing checks, the closure and precision, the adjusted sides, the area and the plan, and a **beacon schedule** in latitude/longitude and UTM, with the inside angle at each beacon.

- **Office settings:** change the declination, or type a surveyed position for the first beacon (degrees, UTM or MGRS) instead of the phone's GPS. Everything is worked out again.
- **Survey report** saves the PDF; **Beacons CSV** the coordinates; **Add to map** puts the boundary and beacons in a layer to edit, style, print and export.
- The phone and the desktop use the same arithmetic, so their figures agree.

Dashboard

Share › Dashboard (or Analysis › Dashboard): charts of the open project — records per day and by module, form responses by day and by enumerator, sightings by species, group and conservation status, and water samples against common drinking-water limits (pH 6.5–8.5, turbidity ≤ 5 NTU, conductivity ≤ 2500 $\mu\text{S}/\text{cm}$), with a table of every sample outside the limits. **PDF report** saves it all.

23. Maps, layers and ArcGIS files

Add data

Click **Add data** (or **File > Add Data**, Cmd+O / Ctrl+O) or drag files onto the window:

File	Notes
File geodatabase (.gdb)	Share > Open .gdb and choose the folder ending in .gdb (or open a .zip of it). Every feature class and table is added, and its relationship classes become related records.
GeoPackage (.gpkg)	Every layer inside is added. Best for ArcGIS Pro.
Shapefile	Choose the .shp with its .dbf and .prj, or a .zip.
Esri JSON, GeoJSON, KML/KMZ, GPX, CSV	CSV needs latitude and longitude (or X and Y) columns.
CAD drawing (.dxf, .dwg, .dgn)	Opens as areas, lines, points and text layers, keeping each entity's CAD layer and colour; blocks are drawn with their attributes. Choose the drawing's coordinate system when asked (or add its .prj alongside). DWG up to AutoCAD 2000 opens directly; save newer DWG as DXF.
MapInfo (.tab with .dat, .map, .id, or .mif/.mid), GML, OSM, S-57, Excel/ODS, FlatGeobuf	Opened with the GDAL that comes with Fieldra. Choose all of a MapInfo table's files together.
Images: Erdas IMG, GRIB, NITF, DTED, ENVI, SAGA, ASCII grids, georeferenced PNG/GIF	Opened with Fieldra's GDAL and added as GeoTIFF images.
netCDF, HDF, JPEG 2000, ECW, MrSID	Need the GDAL of a program on this computer (QGIS includes it): Fieldra finds and uses it by itself. A netCDF or HDF file with several variables (temperature, rainfall...) lists them: tick the ones to add, each becomes its own image.
LAS/LAZ, GeoTIFF, MBTiles, drone JPEGs	Point clouds, orthomosaics and flights: see Part 3.

Data in **UTM** (= a map grid in metres), Web Mercator or a national grid is converted to WGS 84 by itself.

Export for ArcGIS Pro

Share > Export for ArcGIS puts every layer in one GeoPackage; **Share > Export .gdb** puts them in one file geodatabase (a feature class each). Or right-click a layer > Export:

GeoPackage, file geodatabase, Shapefile, CAD drawing (.dxf), GeoJSON, KML or CSV.

Share > Export DXF puts every layer in one drawing, a CAD layer each, on the export grid in metres, with a .prj alongside.

The button next to it chooses the coordinates of exports: **WGS 84** (latitude/longitude), **UTM — the data's own zone**, or a WGS 84 UTM zone such as 28N. GeoPackages and Shapefiles record the system so ArcGIS Pro and QGIS place them correctly. KML is always WGS 84.

National grid or other system... in the same menu searches every EPSG coordinate system by name, country or code (e.g. a country's name, "UTM zone 28N", or a code such as EPSG:32628); the ones used where the map is come first. It shows the **datum shift** to WGS 84; **Change datum shift** takes other parameters, e.g. from the national survey authority.

Good to know: ArcGIS file geodatabases (.gdb) (= Esri's own format) can be opened and saved. Saved ones hold points, lines and areas (2D) with their fields, each layer's **pick-lists and number ranges as domains**, its **subtypes** (when the subtype field holds whole numbers) and a **spatial index**, so they open ready in ArcGIS Pro. Tables (layers without shapes) are saved as tables, and **relationships** between the layers saved (Layer properties › Related) as relationship classes. Domains and subtypes in a geodatabase you open become the layer's field rules, with the descriptions of the codes shown in the pick-lists; its relationship classes (one-to-one, one-to-many and many-to-many) become relationships, so each site lists its inspections. Curved edges (arcs, Bézier curves) keep their shape; 3D multipatch shapes and rasters are skipped.

Datums and heights (Share › Datums & heights)

- **Site grid:** for drawings on an arbitrary site grid (e.g. 1000 E, 5000 N at a station). Enter two or more points known both in the site grid and on the ground; the grid is fitted (shift, rotation, scale) with the misfit at each point, and saved as a coordinate system you can choose anywhere.
- **Definition:** paste a proj4 string or WKT, or open a .prj, for a system not in the EPSG list.
- **Grid shift:** where the survey authority publishes an NTV2 (.gsb) or GeoTIFF grid, use it for a system instead of its 7 parameters. NTV2 grids go to the phones with the project, so their converters are exact too (only files a phone doesn't already have are sent).
- **Geoid:** GNSS heights are above the ellipsoid (h); levels are above the geoid ($H = h - N$). Download EGM96 or EGM2008 once, or use a national geoid GeoTIFF; **Heights** then adds H (or h) to a point layer from its Z or a height field.

Web map layers

Map › Web layer adds a WMS or WMTS service (national imagery, cadastre, topographic maps) or an XYZ tile address. Paste the address, choose the layers, and they are drawn under your data. Tiles you look at are kept, so those areas also work offline. A WMS that only draws in WGS 84 or a national grid is fetched in it and warped onto the map (the list says so). For a service that needs a login, open **Sign-in** under the address: user and password, a token, or an API key (in a header or in the address); the password or token is kept in the computer's own keychain (Keychain on a Mac, Credential Manager on Windows) and sent only to that server.

Features (WFS, OGC API): in the same window, switch to **Features** and paste a WFS address (.../wfs) or an OGC API – Features page. Pick a layer, choose **Only the map view** or the whole layer and the most features to take (large layers come in pages). They come in as a layer of your own that stays linked to the service: the bar at the bottom left counts your unsaved edits, **Save** sends new, changed and deleted features back (WFS-T or OGC API transactions, where the service allows editing) and **Refresh** downloads the latest. **Unlink** keeps it as a plain layer.

Someone else edited the same features? Before saving, Fieldra checks the service: if a feature you changed was changed there since you downloaded it, it lists them and asks whether to **overwrite** theirs or **keep theirs** and save the rest. Nothing is lost without asking.

ArcGIS Online and ArcGIS Enterprise: paste a **FeatureServer** or **MapServer** address (.../rest/services/.../FeatureServer, a single layer such as .../FeatureServer/0, a services folder, or an ArcGIS Online item page). Under **Features** each layer and table is listed ("editable" when the service allows it); they come in whole however many features there are, with their dates, and edits are saved back to the service. Under **Map images** a MapServer or ImageServer is added as a background (its cached tiles when it has them). For a service that needs signing in, add its token under **Sign-in › API key in the address**, named token.

Related tables and attachments

Tables: a CSV without coordinates (or a GeoPackage table) opens as a table: records with no place, e.g. visits to water points. **Layer properties › Related** links two layers or a layer and a table by a shared key (e.g. site_id): each water point then lists its visits in its details, each visit shows its water point, and **+** adds a related record with the key filled in.

Attachments: in the details of a feature of your layers, **Attach** keeps any file with it (photos, PDFs, plans); click to open it in its usual program. Attachments travel in project packages.

Databases (Share › Databases)

Choose the **Database type** — **PostgreSQL / PostGIS** or **SQL Server** (including Azure SQL) — and connect (the password is kept only if you tick it), list its tables, and **Add** one to the map — all of it, or only the map view, up to a number of rows, as a copy. **Export a layer** writes a layer back as a new table, replacing one, or adding to one, in the export coordinate system, with a spatial index.

Edit live (tables with a primary key, of one column or several; tick **Only the map view** for big tables): edit as usual; the bar at the bottom left counts unsaved edits. **Save** writes them to the table; a row someone else saved since you read it is not overwritten — it is listed, and **Refresh** shows their version. With **auto**, others' saves come in every 30 seconds while your unsaved edits stay. Unsaved edits are kept if you close Fieldra.

History and review. Every save is kept in the database with who made it and when (type your name in the History window; otherwise the database user is used). **History** on the bar lists the changes, newest first, with the fields that changed; the pin shows the shape before and after, and **Restore** puts a row back as it was before that change. Instead of **Save**, **Propose** sends your edits for review with a title: the layer goes back to the table as it is, and your edits wait. A reviewer opens **History › Proposals**, **Previews** them on the map, and **Approves** (they are saved, under your name) or **Rejects** them, with a comment. Rows someone changed after the proposal was made are left as they are and listed.

In **History**: tick **Keep changes made by any program** to record edits from QGIS, ArcGIS or SQL too (a trigger on the table); **Put the table back as it was on** a date and time undoes everything since (rows added since are removed); **Remove history older than** some days keeps it small. In **Proposals**, the table's owner can list the **reviewers** (database users) — then only they can approve or reject — and an approved proposal can be **undone**.

Good to know: History, proposals and reviewers are kept in tables Fieldra adds to the schema (fieldra_history, fieldra_proposals, fieldra_reviewers), so the database user needs permission to create tables there.

SQL Server: host and port (1433), or a named instance as server\SQLEXPRESS; a SQL Server login (user and password). **Encryption** is on by default; tick **Trust the server's certificate** for an office server with a self-signed one. Tables with a **geometry** or **geography** column are listed with their coordinate system; Fieldra converts them to the map and back, so a table in a national grid stays in it. Export writes a geometry table with a spatial index. **Edit live** works as above (it needs a primary key of one column, such as `id INT IDENTITY PRIMARY KEY`); History, Propose and reviewers are for PostGIS only.

Going to a place, bookmarks and time

- **Map › Go to XY:** type a coordinate as decimal degrees (8.4657, -13.2317), degrees-minutes-seconds, UTM (28N 694667 936224) or MGRS (28P FQ 94667 36224). It shows the place in every format, flies there, and can add it as a point. **Also show a national grid** adds a system of your choice, and you can type coordinates in it. Type a **place name or address** instead (e.g. “Bo Government Hospital”) and pick it from the list (needs internet; places near the map come first).
- **Map › Bookmarks:** name the current view and come back to it later.
- **Map › Time:** a slider shows only the records made between two dates. Press play to watch the survey day by day.

Base maps and offline maps

Switch between street and satellite maps. **Share › Offline maps** downloads an area so the map works with no internet.

24. Editing, analysis and 3D

Edit tab

- Draw points, lines, areas, rectangles, circles and freehand shapes on an editable layer.
- Reshape: drag corners or whole shapes. Split multi-part shapes. Delete.
- **Snap** (on by default): new corners jump to the corners and edges of any visible layer, so shapes join exactly.
- **Trace:** click two points on a road or an area’s edge; a new line follows it between them.
- **COGO:** a boundary or line from bearings and distances (e.g. from a deed, or a compass-and-tape survey), with its misclosure.
- Undo and redo with Cmd+Z / Shift+Cmd+Z (Ctrl on Windows) or **Edit › Undo**. Undo acts on the text you are typing, or else on the last map change.
- Change values in the attribute table or the details pane; add or delete fields.
- **Tools** (on the selection, one undo step each): **Merge** features into one; **Split** areas or lines with a line (select it last); **Copy parallel** lines or grow/shrink areas by a distance; **Move, rotate, scale** by metres and degrees; **Generalise** (fewer corners, within a tolerance); **Extend** or **Trim** line ends to a line (select the target last).

Saved as you go, and layer history

Edits are saved as you make them, and anything not yet written is saved when Fieldra closes. Fieldra also keeps **earlier versions** of each layer as you edit (one every two minutes at most, the last 20), and they stay after Fieldra is closed: right-click a layer › **History: put back as it was...** lists them with the time and number of features; **Put back** restores one, and the state before is kept in the history too, so that can be undone as well. Edits received from phones are kept there first.

Analysis tab

- Measure distance and area.
- Buffer (a zone around shapes), convex hull, centroids, dissolve (merge areas).
- Box select, and the attribute table (sort, search, show selected).

Symbology

Colour, fill, line width, point size and labels from any field. Areas can be raised in 3D by a number field.

Style by an attribute: one colour per **category** (e.g. water condition: clear, turbid, polluted), **graduated colours** for numbers (natural breaks, quantile or equal interval, with a colour ramp), or **graduated point sizes**. The classes show under the layer in Contents and in print legends.

Rules: each rule is an expression and a colour, e.g. `[ph] > 8.5` in red and `[condition] = 'turbid'` in orange; each feature takes the first rule it matches. Untick **Show everything else** to hide features that match no rule.

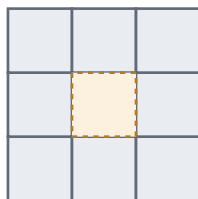
Labels: from a field, or from an expression (e.g. the site and its pH). **Label options** place them at the best spot around each point so fewer overlap (or above, centred, or along lines), give priority to bigger values of a field, and set the size, colour, halo and the zoom they appear from.

Layer properties (right-click a layer): a summary, source, date, contact and licence, and **field rules** — each field's type, whether it is required, a list of allowed values (shown as a drop-down when editing) and a number range. **Check data** selects the features that break a rule.

Subtypes (Layer properties): kinds of feature by one field, e.g. water point type: borehole, well, tap. Each kind can give new features default values (e.g. a borehole starts 30 m deep) and its own pick-lists (e.g. pump: hand or solar for boreholes, bucket or hand for wells).



Must not overlap
the shared part is an error



Must not have gaps
the hole between areas



Must not have dangles
a line end that joins nothing

Topology errors that Check data finds and draws.

Calculated fields (Layer properties › Calculated): fields that fill themselves in. Each has an expression, worked out again whenever a feature is drawn or changed — e.g. `area_ha = round($area / 10000, 2)`, a length, longitude and latitude, or a code made from other fields — or only once, when the feature is added (e.g. `added_on = today()`). Ready-made ones are one click: area in hectares or m², perimeter, length, coordinates, date added.

Topology (Layer properties): rules for how shapes relate — areas must not overlap or leave gaps, lines and boundaries must not cross themselves, line ends must join another line (within a distance you set), features must be inside an area of another layer, and no two features may be the same. Between two layers too: **points must lie on a line** (valves on pipes, culverts on roads), **line ends must have a point** (pipe ends at a valve), areas **must not overlap another layer** (fields and protected forest) and **must contain a point** (a label point in each parcel); and **lines must not overlap** (a road digitised twice) or **cross** except at their ends. **Check data** selects the features and draws each error in a layer called “Topology errors”. **Fix** then removes overlaps (they stay with the larger or smaller area), fills gaps into the neighbour with the longest border, untangles self-crossing areas, snaps dangling line ends onto the nearest line and deletes duplicates — one undo step each.

Drawing: transparency of the whole layer, and the **scales it shows at** (e.g. only from 1:25,000 in; “now” takes the map’s scale). Lines can be dashed, dotted or dash-dot; areas can have their own outline colour and a **hatched**, cross-hatched, lined or dotted fill (in each feature’s colour), or outline only. Points can be a square, triangle, diamond, star, cross or pin, or **your own picture** (PNG or SVG, e.g. a logo or an icon).

Label classes (Label options › Class): each class has a condition (e.g. `[type] = 'borehole'`), its own text, size, colours and the zooms it shows at; each feature takes the first class it matches. Use them to label boreholes with their depth and wells with their name, or to show district names only when zoomed out.

Drawing order (symbol levels): draw features in the order of a number field (bigger on top, or reversed) or of the categories (the first in the list on top), e.g. main roads over tracks.

Convert labels to annotation (Label options) turns each label into a point with its own text, size, colour and angle, which you can move, reword or rotate one by one; the layer’s own

labels are switched off. On a line layer each annotation follows its line (road and river names curve with them); select one to see the stretch of line it follows.

Points shown as: one by one, as a **heat map** (where points are dense — it can be weighted by a number field such as a sighting's count, and fades to the points close up), or as **clusters** (nearby points grouped with their count; click one to zoom in).

3D

3D buildings from your footprints (Symbology › Make 3D buildings): each area becomes a block with walls and a roof — flat, gable, hip, pyramid or shed, its ridge along the longest side. Select buildings (one or many) to set their wall height, base (for a part above the ground) and roof rise, or tap 1F, 2F, 3F or 5F for floors of 3 m; the panel shows their ground area, volume and highest point. The values are kept in the fields height_m, base_m, roof and roof_m, so the table can be edited too, and buildings without heights start from a height or floors field. **Export as a 3D model (.glb)** saves them for other 3D software.

Terrain shows real hills and valleys, **Buildings** in 3D, and **Globe** when zoomed out. Right-drag or Ctrl-drag to tilt. **Flat view** goes back to north-up. In 3D the **orbit ball** appears at the bottom right, as in AutoCAD: drag inside it to turn and tilt the view, drag a side circle to only turn or the top or bottom circle to only tilt; double-click it for flat, north up.

25. Selecting, filtering and fields

The everyday analysis of ArcGIS Pro: find the features you need, show only those, and work out new values.

Expressions

Selections, filters and the field calculator use the same short expressions. Fields are written in square brackets; text in quotes. The builder lists the fields and their values to click in, and shows how many features match as you type.

You want	Write
Samples over the pH limit	[ph] > 8.5
Sites starting with W, and turbid	[site] LIKE 'W%' AND [condition] = 'turbid'
One of several values	[species] IN ('Pied crow', 'Hooded vulture')
Empty values	[notes] IS NULL
Area in hectares	round(\$area / 10000, 2)
A label	[site] + ' (' + [ph] + ')'
A class	if([count] >= 10, 'large', 'small')

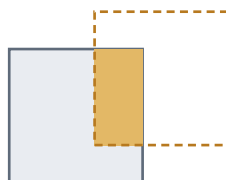
Select and filter

- **Analysis › By attributes:** select the features matching an expression — as a new selection, or adding to, removing from or narrowing the current one.
- **Analysis › By location:** select features that touch, are within, contain, or are within a distance of another layer's features (e.g. households within 500 m of a water point).
- **Filter** (right-click a layer, or Analysis › Filter): show only matching features. The map, attribute table, exports and analysis use only those; nothing is deleted. A funnel next to the layer shows it is filtered.

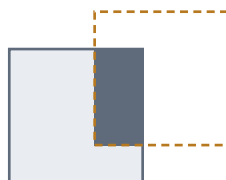
Calculate and join

- **Calculate field:** fill a field (existing or new) for every feature or the selected ones, from an expression. Survey data can't be changed, so the result goes into an editable copy.
- **Join:** add the columns of a CSV, an Excel sheet or another layer to a layer's features by a shared value — for example, laboratory results joined to water sampling sites by site id. Fieldra shows how many features match before you join.

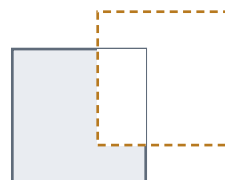
26. Overlay, raster and coordinate tools



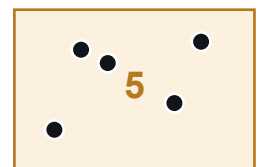
Clip
inside only



Intersect
overlap, both attributes



Erase
outside only



Summarize within
count per area

What the main overlay tools make of two layers.

Overlay (Analysis › Overlay)

Tool	Makes
Clip	The input inside the clip areas (like a cookie cutter).
Intersect	Where the input and the areas overlap, with the attributes of both.
Union	Two area layers combined into every overlapping and non-overlapping piece.
Erase	The input outside the erase areas.
Spatial join	Each feature with the attributes of the one it touches (or the nearest within a distance).
Summarize within	For each area: how many features are inside, and the sum, mean and range of a number field.
Near	The distance from each feature to the nearest one of another layer.
Identity	The input cut by the areas: pieces inside get both layers' attributes, the rest keep their own.
Symmetrical difference	Where only one of two area layers is, each piece with its own layer's attributes.
Update	The input with new areas put in place of what they cover, e.g. a resurveyed plot.
Tabulate intersection	How much of each class lies in each area: area and share (e.g. land cover per district), or length of lines, or number of points.
Split	One new layer per area of the second layer (e.g. per district or map sheet).
Distance matrix	Lines from each feature to its nearest features of another layer (how many, within what distance), with the distance.
Merge	Two layers in one, with the source of each feature.
Append	The second layer's features added into one of your layers (its fields kept).

Shape tools (Toolbox)

Simplify and **smooth** lines and areas, **densify** (a corner every so many metres), **points along lines** (e.g. every 50 m for sampling), **vertices to points**, **split lines at points**, **multipart to single part**, **area to line** and **line to area**, **random points in areas** (a number per area or per hectare), a **grid** of squares over a layer, **line crossings** (a point where two lines cross) and the **mean centre** of points (weighted by a field if you like).

Geocode addresses (Toolbox › Web): a table with an address field gets a point for each address found (with what it matched), using the free OpenStreetMap search. Add a country and a suffix (e.g. the town) for better matches. It looks up one address a second, up to 300 at a time, and needs internet.

Network analysis (Analysis › Geoprocessing › Network analysis)

Along a road layer of your own (lines joining at shared corners; a tolerance joins near misses), by distance or travel time (a speed field, or one speed), with one-way streets from a field (yes / FT / TF). **Roads join only at line ends** keeps crossings without a junction apart; **level** fields at each end (as ArcGIS's F_ZLEV / T_ZLEV) keep bridges and underpasses apart; a **forbidden turns** layer has a short line for each banned turn, drawn from the road in, through the junction, onto the road out:

- **Route:** the shortest or quickest way through stops in their order, or in the best order (first stop fixed, last one too if you like).
- **Service area:** the roads that can be reached within e.g. 5, 10 and 15 minutes of clinics or water points, and the area around them.
- **Closest facility:** for each household (incident), the nearest facility along the roads and the way there (or from the facility, e.g. an ambulance).
- **OD matrix:** the travel cost from every origin to every destination.
- **Location-allocation:** where to put new facilities among candidate sites, for demand points weighted e.g. by people: least total travel, most people within a time, or fewest sites that cover everyone. Existing sites (a yes / 1 field) are kept. It works on the roads or in straight lines; the result is the chosen sites with the demand each serves, and lines from each demand point to its site.
- **Vehicle routing:** shares orders (deliveries or visits) among vehicles from depots. Give each depot its number of vehicles and their capacity (or fields with them), the shift, and for the orders their load, minutes at each stop and time windows (Not before / Arrive by, as 08:30 or 8.5). The result is a route per vehicle with its length, time and load, the stops with their order and arrival times, and any orders that could not be served with the reason (too big, window can't be met, no room left). Orders can have **several windows** (a field like 08:00-10:00, 14:00-16:00) and **needs** (skills such as crane or cold) that only some vehicles have; vehicles can take a **break** (between two times, for some minutes — while waiting for a window when possible) and make **several trips**, reloading at the depot. Pick-ups can be paired with the stop their load goes to (same vehicle, pick-up first).
- **Rush hours:** with travel time as the cost, give the time you **leave** and add periods (e.g. 07:00–09:00) with their own speed field (morning speeds) or a share of the usual speed (e.g. 40 %). Each road is timed for when it is reached, so a route at 8 am can take the side streets that a route at noon doesn't need.
- **U-turns:** allowed anywhere, only at dead ends, or never — then a vehicle also leaves each stop the way it arrived (as a truck must), going on round the block if it has to.

Good to know: Vehicle routing finds good routes quickly, not always the very best: give it longer (Search for ... seconds) for big rounds. It handles up to 1,500 stops.

Toolbox: history, batch and models (Analysis › Geoprocessing › Toolbox)

Every tool with its settings. **History** lists each tool run (from the toolbox or the tool windows) with its inputs; **Again** opens it with the same settings. **Batch** runs a tool on several layers at once (e.g. clip every district layer to the study area). A **model** chains steps — a step's input can be an earlier step's output — e.g. select the deep boreholes, buffer them 500 m, clip the villages to the buffers; save it and run it again next month. Only the last step's result is added to the map, unless you tick **keep** on others. Raster tools are in the toolbox too (slope, reclassify, focal, calculator, resample, clip, zonal statistics, raster ↔ features, cost distance, NDVI), so a model can go from an elevation model to slope classes to areas in one run.

Scripts (Analysis › Geoprocessing › Script)

Python or JavaScript for anything the tools don't do in one step. Python ships with Fieldra and runs offline: `import fieldra`, then `await fieldra.layer('Wells')` gives a layer as GeoJSON, `await fieldra.run('buffer', input='Wells', meters=100)` runs any toolbox tool, and `add_layer` / `update_layer` write results. The whole standard library is there; packages a script imports (numpy, pandas, shapely, scipy...) are downloaded the first time, then work offline — or get them ahead of time with **Packages for offline use › Download now**. Python starts in a few seconds the first time and stays ready. **Run with › Python on this computer** runs the same script in a Python installed on the computer (found by itself), with its own libraries such as geopandas, rasterio or scikit-learn.

In JavaScript: `fieldra.layer('Wells')` gives a layer's features, `fieldra.run('buffer', {input: 'Wells', meters: 100})` runs any toolbox tool, `fieldra.addLayer` and `updateLayer` write results, `turf` measures and shapes, `print` shows output. Scripts run apart from the map (Stop ends one) and are saved; examples are in the list.

Plugins (Analysis › Geoprocessing › Plugins)

Plugins add tools to the toolbox and commands to the ribbon. Their tools work like the built-in ones: in the toolbox, in models and batch runs, in the history, and from scripts (`fieldra.run('my-plugin/tool', ...)`); their commands are under **Plugins** and in the command search (Ctrl/Cmd+K). **Plugins › Manage plugins** installs one from its .zip or .fieldraplugin file (a newer version replaces the old), turns each on or off, shows what it printed and removes it. Plugins run code on your computer with your layers: install only plugins from people you trust.

Create a plugin writes a starter in JavaScript or Python to the plugins folder and opens it. A plugin is a folder with a `plugin.json` (id, name, version, description, author) and its code. In JavaScript (`"main": "plugin.js"`), `fieldra.registerTool` adds a tool — its parameters (layer, image, field, number, text, expression, choice or yes/no) and a run



function given the parameters and the chosen layers and images, returning features or an image — and `fieldra.registerCommand` adds a command; the scripts' calls and `fieldra.notify` work in both. Python tools are listed in `plugin.json` under `tools` with their `.py` file: `fieldra.params` holds the parameters, `await fieldra.input('key')` gives a chosen layer and `await fieldra.output(name, features)` is the result. They run in the built-in Python, or with `"engine": "system"` in the computer's. Edit the files, then press **Reload**. To share a plugin, zip its folder.

Feature tools (Analysis › Geoprocessing)

- **Dissolve by field:** one feature per value (e.g. one area per crop or village), with counts, sums, means, minimums and maximums of number fields.
- **Eliminate:** merges slivers smaller than an area into the neighbour sharing the longest border (or the largest neighbour).
- **Delaunay:** triangles joining points.
- **Bounding geometry:** the smallest rectangle (with its width, length and direction), north-up envelope, convex hull or circle around each feature, all of them, or each group of a field.

Raster (Analysis › Raster)

- **Interpolate:** a surface between sample points — pH, turbidity, soil moisture or noise across the site. **Kriging** (the default) fits how values change with distance (the semivariogram, shown as a chart) and can add a **standard error** surface showing where the estimate is uncertain; it reports how well it predicts each point from the others (cross-validation). **Universal** kriging follows a trend across the site (linear or quadratic); **anisotropy** lets values change more slowly in one direction (e.g. along a valley), set by hand or found from the data. **Empirical Bayesian** kriging (EBK) splits the site into local groups of points, tries many semivariograms on simulated data in each and mixes their predictions: it needs no fitting by hand, follows places where the data is calm or rough, and its standard error includes the doubt about the semivariogram; it can work on the logarithm of skewed values such as concentrations. **Co-kriging** estimates a value measured at few places (e.g. lab nitrate) with the help of one measured at many that goes with it (e.g. field conductivity, or elevation), from the same layer or another; both need measuring together at 5 or more places, and the result says how much better it predicts than kriging alone. **IDW** is simpler and faster. At least 5 points; 10 or more is better.
- **Gaussian simulation (risk maps)** (Interpolate › Kind): instead of one smooth surface, many equally likely ones (realisations) that all honour the samples. Fieldra adds their **mean**, their **spread** (where the value is uncertain), one realisation (what a real field could look like) and, with a **threshold**, the **probability** of being above it — e.g. the chance that lead in soil is over 400 mg/kg. 50 realisations is a good start.

- **Satellite** (next to Web layer): finds **Sentinel-2** (10 m, a new pass every few days, since 2017) or **Landsat** (30 m, since 1982 — for how a site looked decades ago) scenes over the map view between two dates, clearest first with a preview, and adds the view as an image: true colour, the bands for analysis (blue, green, red, near infrared, SWIR) or NDVI. **Leave out clouds and their shadows** blanks them using each mission's own cloud classes. A **cloud-free composite** of the clearest scenes takes, pixel by pixel, the middle value of the dates that were clear there — the way to get one clean image of a cloudy coast in the rainy season. Free open data.
- **Pan-sharpen** (Toolbox): colour bands brought to a panchromatic image's detail (Brovey or simple mean).
- **Zonal stats**: the mean, lowest and highest value of an image inside each area (e.g. average height per plot, NDVI per field).
- **Raster tools**: slope, aspect and hillshade from an elevation model; a raster calculator (e.g. $A - B$); reclassify; viewshed (what can be seen from the selected point); and NDVI from a multispectral image.
- **Georeference**: place a scanned paper map or a photo of a plan on the map: click a spot on the picture, then the same place on the map, at least 3 times. Each point shows its error in metres. The result is saved as a GeoTIFF. The picture can be PNG, JPEG or TIFF; a TIFF with no map position added with **Add data** opens here by itself.
- **Focal statistics**: each cell from its neighbours: mean (smoothing), minimum, maximum, range, standard deviation or majority, in a square or circle.
- **Resample, clip to areas, mosaic**: another cell size; cut an image to a boundary; join several images into one.
- **Raster to polygons** (areas of equal whole-number value, e.g. after reclassify or classification) and **features to raster** (areas, lines or points burnt in by a field).
- **Cost distance**: the cheapest accumulated cost from source points over a cost image (cost per metre of each cell; empty cells are barriers), and the least-cost path to each destination point.
- **Suitability**: several images rescaled 0–1 and added with weights; tick “low” where lower values are better (e.g. slope, distance to water).
- **Classify**: unsupervised (k-means: the pixels grouped into a number of classes by colour) or from **training areas** you drew and named (maximum likelihood or minimum distance). Classes are drawn one colour each.
- **Change detection**: two dates of the same place (e.g. NDVI or heights): the difference, and classes of decrease, no change and increase beyond a threshold.

Results are added as images in Drone mapping, so contours, volumes and zonal statistics work on them too.

TIN surfaces (Analysis › Raster › TIN)

A triangulated surface from spot heights, with **breaklines** kept as triangle edges — kerbs, ridges, ditches, or contour lines (height from a field such as ELEV) to make a surface from contours. Clip it to a boundary area, or drop long triangles around the outside. It makes a **triangles layer** (slope, aspect, area), **contours**, an **elevation model** (GeoTIFF) and the **volume** above and below a level.

Editing a TIN. Each TIN comes with three drawing layers: **TIN edits** (a point with a height and an action: *add* a spot, set a vertex *height*, or *delete* the vertex within 0.5 m), **TIN breaklines** (lines kept as edges; a line without heights takes them from the surface) and **TIN holes** (areas left out, such as a pond or a building). Draw in them, then open TIN with any of its layers selected and choose **Rebuild**: the triangles, contours and elevation model are updated in place, with the same names and styles.

Hydrology (Analysis › Hydrology)

Where water flows on an elevation model: **stream lines** (with their Strahler order, 1 for the smallest) where more than a set area drains, and the **watershed** that drains to each pour point — a culvert, a bridge or a sampling point (points are moved onto the stream within a set distance). It can also add flow accumulation (upstream area in hectares), flow direction and the filled model as images. Small pits are filled first so water always runs off.

- **Watersheds** come with their **longest flow path** (drawn as a red line), the relief and slope along it, and the **time of concentration** (Kirpich), as used to size culverts and drains.
- **Stream lines** carry the Strahler order and the Shreve order (how many sources are upstream).
- **Basins**: every area that drains out of the model at one place, leaving out small ones along the edges.
- **Depressions**: hollows that would hold water before it runs off — ponds, or puddles on a graded platform — with the area, volume and depth of each, and a depth image.
- **Images**: flow accumulation and direction by **D8** (all water to one neighbour) or **D-infinity** (shared between two, in its true direction: smoother over open slopes); **flow length** downstream (how far water travels to leave the model) or upstream (the longest path from the divide); and the **wetness index**, high where water gathers on flat ground.
- The same tools are in the Toolbox under Hydrology, for batches and models.

Raster tools, interpolation, hydrology and topology checks run in the background: the map keeps working while they calculate. **Detail** (at the bottom of the raster windows) sets how finely large images are read: **standard** (2,048 cells a side, quickest), **fine** (4,096) or **full** (8,192, slower and needs memory). Smaller images are always used at full detail.

Road chainage (Analysis › Chainage)

Distances along a road or track: give features (e.g. road defects) their chainage such as **3+250** and their offset from the road (right +, left -), or put points at chainages or every 100 m. Tick **Measure from the other end** if the road was drawn the other way.

Routes and events (Analysis › Routes & events)

Linear referencing for a whole network: lines with the same **route id** (e.g. road number) join into one route, measured by length (in km or m), from from/to measure fields, or set by **posts** (km posts or chainage markers: points with the route id and their measure — measures are spread between them). Then:

- **Place point events** from a table of route id and measure (a pothole on road A1 at km 2.35), optionally offset to the right (+) or left (-) in metres.
- **Place line events** from a table of route id, from and to (surface condition from km 1 to 3.2); rows that miss their route are listed.
- **Locate features along routes**: points get route_id, measure and offset; lines get route_id, from_m and to_m.
- **Make routes** (to see and check them) and **measure ticks** every so many km.

Routes, point and line events, locating features and **Check topology** are also in the Toolbox, so they can be run in batches and models.

27. Survey design and statistics

Plan where to sample before going out, and report on what the survey found.

Sample design (Analysis › Sample design)

- **Random points** inside a study area (draw it with Edit › Polygon): a number in total, spread by area, or the same number in each area (stratified). Set a minimum distance between points. The **seed** makes the same design again, e.g. to check it later.
- **Grid of points** every so many metres (systematic sampling); a random start keeps it unbiased.
- **Square or hexagon cells** over the study area, e.g. quadrats, or to count sightings per cell (Overlay › Summarize within).

Send the project to the phones: the sample points show on their map as an office layer, so teams can find them in the field.

Thiessen polygons (Analysis › Thiessen)

The area closest to each point, e.g. the catchment of each water point or clinic. The polygons keep the point's attributes and can be cut to a district.

Hot spots (Analysis › Hot spots)

Where high values (hot spots) or low values (cold spots) cluster more than chance would give, e.g. turbidity along a river or pothole severity along roads (Getis-Ord Gi*). The result is coloured from 99 % hot to 99 % cold. It also says whether the layer as a whole is clustered (Moran's I). Use at least 10 features, better 30 or more. **Optimised** chooses the distance from the data (where clustering is strongest) and corrects for testing many features at once; with **no value**, it counts the points in hexagons first (incidents, sightings).

Clusters and outliers (Analysis › Clusters & outliers)

Which features belong to a cluster of similar values (high-high, low-low) and which stand out from their neighbours (a high value among low ones, or the reverse) — Anselin Local Moran's I, tested with 499 permutations.

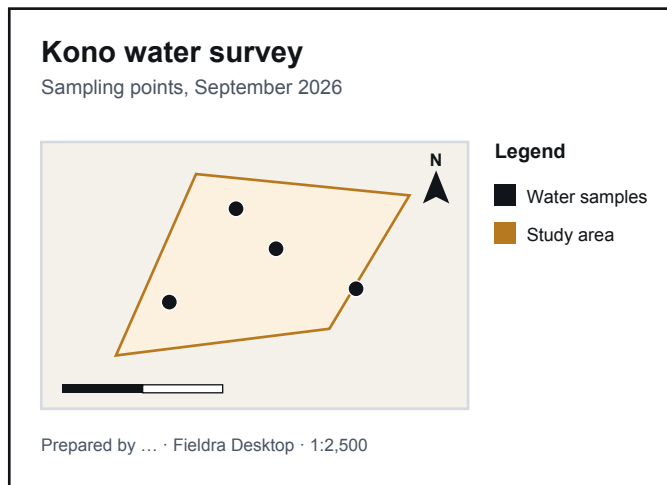
Regression (Analysis › Regression)

How much a value depends on others (least squares), e.g. turbidity against distance to a road and rainfall. The window shows each factor's coefficient and whether it matters ($p < 0.05$), and R^2 , the share of the variation explained. The map shows where the model is too low (blue) or too high (red).

Diagnostics under the table: **VIF** (over 7.5: two fields say the same thing — leave one out), **Koenker** (the error grows with the values: use the robust p-values shown), **Jarque–Bera** (residuals not normal: a variable is missing or a relationship isn't straight), the residuals' **Moran's I** (misses cluster in space: add a variable or use GWR) and **AICc** to compare models.

Geographically weighted (GWR) fits the model again around each feature with its nearest neighbours (how many is chosen by AICc), so an effect can be strong in one district and weak in another. The map shows how the first factor's effect changes; each feature gets its local coefficients and R^2 .

28. Print layouts



Layout (Share › Layout)

- 1 Page: A4, A3 or Letter
- 2 Title, subtitle and notes
- 3 Legend, north arrow, true scale bar
- 4 Export: PDF, or PNG/JPEG at 300 dpi

A layout page and its parts.

- **Coordinate grid:** latitude/longitude or UTM lines with labels.
- **Inset map:** a small overview showing where the page's map is.
- **Georeferenced PDF (GeoPDF):** PDF and GIS readers can read coordinates off the map (flat, north-up maps). **PDF layers** gives the base map and each of your map layers its own layer (up to 16) that PDF readers (Acrobat, Avenza Maps, QGIS) can switch on and off.
- **Attribute table pages** of a layer after the map.
- **Map series:** one page per feature of a layer (e.g. each village or plot), named from a field — up to 60 pages in one PDF.
- **Charts:** columns, bars, lines and areas (e.g. over dates), pies and donuts, histograms or scatter plots — counts, totals, averages, lowest or highest of a field, with values and a trend line (e.g. samples by condition, households by village, turbidity over the months). The first can go beside the map; the others go on pages after it.

Layout designer (Share › Designer)

Open **Share › Designer**, or choose **Open designer** from the Layout window. The designer is kept separately from the quick print layout.

Each project keeps its own working design. A new design starts from the current map view. Select a map frame and press **Use current map** to copy the main map's view, rotation and visible layers into it; with no map frame selected, the first map frame is used, or a new one is added. Linked overview insets recenter with it and keep their overview scale. **Refresh map previews** redraws the previews after map or styling changes without changing frame placement.

A free page for drawings, posters and plan sheets: A0, A1, A2, A3, A4, Letter, Tabloid or ANSI D, any colour, with an optional neat line round it. Start from a template (plan sheet with title block, simple map, or overview and detail) or save your own. Add any of these and set each one's look:

Element	What you can set
Map frame	Scale (e.g. 1:500), rotation, latitude/longitude or UTM grid, which layers it shows, base map on or off, border colour and width. Alt-drag moves the map inside the frame.
Text	Rich text: fonts and sizes, headings, bold, italic, underline, strikethrough, colours and highlight, lists, alignment; a fill, border and padding; top, middle or bottom. Fields filled in when printed: {date}, {time}, {scale}, {centre}, {title}, {project}.
Legend	Which layers, columns, feature counts on or off, text colour, a frame and fill.
North arrow	Two-tone, solid or a compass rose, any colour; it turns with a rotated map frame.
Scale bar	Black-and-white, line or ticks; metres/km or feet/miles; 2–8 parts; colour; 1:scale on or off.
Inset map	Choose a main map frame, then Insert > Inset map. The overview has its own view and scale, with the main map extent outlined inside it. Set the linked frame and outline colour in Extent indicator.
Image / logo	Choose a PNG or JPEG picture. Fit inside, fill (cropped) or stretch, with a border; move and resize it like any other element.
Shape	Rectangle, rounded rectangle or ellipse; line colour, width and dashes; fill colour and how see-through it is.
Line / arrow	Colour, width, dashes, arrow heads at either end, sloping either way.
Chart	From any layer: column, bar, line, area, pie, donut, histogram or scatter; count, total, average, lowest or highest; order, top-N, dates by day, month or year; values, gridlines, trend line.
Table	A layer's attributes: which fields, text size, how many rows (as many as fit).

- Drag to move. Use any of the eight edge or corner handles to resize; **Shift** keeps the proportions. Position and size can also be typed in millimetres. Hold **Alt** for free placement; Alt-drag a map instead pans its contents, following the frame rotation.
- For the element chosen: its name, position and size in mm, opacity, lock, hide (kept on screen, left out of the PDF), align to the page, bring to front or send to back.
- **Elements** lists everything on the page, top first: click to choose, move up or down, hide or lock. Undo and redo (Cmd/Ctrl+Z, Cmd/Ctrl+Shift+Z), duplicate (Cmd/Ctrl+D), arrow keys nudge 1 mm.
- **Export PDF** draws each map afresh at 100–300 dpi; every north-up map frame is georeferenced (GeoPDF).

Rulers, guides and zoom

1. Turn on **Rulers**. The top and left rulers start at the page edge and use millimetres; their tick spacing follows the page zoom.
2. Drag from the top ruler onto the page to add a horizontal guide, or from the left ruler for a vertical guide. Drag a guide to move it; drag it outside the page to remove it. **Clear guides** is in the page settings when no element is selected.
3. Turn on **Grid** and choose its spacing in mm. With **Snap** on, element edges and centres align to the page, other elements and saved guides; other positions follow the grid spacing, or half-millimetre steps when the grid is off.
4. Use the minus and plus buttons or a zoom percentage for detail, scroll to move around the page, and choose **Fit page** to see the whole sheet again.

Good to know: Placement guides, the dot grid and the rulers are editing aids: they are not printed. Guides are saved with the working layout and templates. A map frame's latitude/longitude or UTM grid is a separate setting and can be printed.

Inset maps and pictures

1. Select the main map frame, then **Insert > Inset map**. An overview starts near the top right of the page, centred on that map with a smaller map scale.
2. Move or resize the inset, set its own centre and scale, and choose its border. **Extent indicator** chooses which map frame is outlined; set it to None to remove the outline. The outline updates when the linked frame moves, changes scale or rotates, and is clipped to the inset frame.
3. Use **Image / logo** for a photograph, logo or other illustration. Choose Fit inside, Fill or Stretch; Shift-resize keeps the original shape. Use the element list to arrange which items cover others.
4. Export the PDF and inspect the main map, inset extent, pictures and text at the chosen paper size. The inset extent is included in the PDF; north-up map frames have GeoPDF coordinates, while rotated frames omit those coordinates and coordinate grids.

Colours in layouts and reports

Use brand, grid or recent presets for layout properties and report accents. They apply immediately; reopening marks the current colour. **None** clears an optional fill or border.

The bottom-left well opens the system picker. Colours apply immediately, as does a complete six-digit #hex value. **Use** or Enter also accepts short #hex values.

In report introductions, text blocks and compact notes, select words before choosing **Text colour** or **Highlight**. **No highlight** keeps the text colour.

29. Nearby devices, menu and shortcuts

Share › Nearby devices works like on the phone: the radar shows phones and computers with Fieldra, you rename this computer at the top, send projects (choosing what to send, including map layers), accept projects sent to you, and continue unfinished ones. Deletions travel too.

Keyboard shortcuts

Key	Does	Key	Does
H	Explore (move the map)	Cmd+Z / Shift+Cmd+Z	Undo / redo
S	Select	Cmd+N	New project
P / L / G	Draw point / line / area	Cmd+O	Add data
E	Reshape	Cmd+P	Print layout
M	Measure	Shift+Cmd+E	Export for ArcGIS
T	Attribute table	Shift+Cmd+D	Nearby devices
Z	Zoom to selection	Cmd+1 ... Cmd+5	Map, Edit, Analysis, Drone, Share tabs

On Windows, use Ctrl instead of Cmd. The Mac also has a full menu bar (File, Edit, View, Window, Help).

Light mode for older computers

Light / Full at the right of the status bar. Light mode draws the map at normal (not high-density) resolution without fades, simplifies shapes a little when zoomed out and draws fewer points of point clouds, so Fieldra stays smooth on a computer with 4 cores or 4 GB of memory or less — it is chosen by itself on such computers (“auto”). Click to switch it on or off, and again to go back to automatic.

Part 3 · Drone mapping

Checking a flight, viewing the results, and proving how accurate they are.

30. The drone mapping workflow

From the flight to the deliverable in Fieldra: check the flight, see a quick map straight after landing, process the photos into measured maps and models, and grade their accuracy. Results from DJI Terra, Pix4D or Metashape can be brought in too.

1. **On site (phone):** survey GCPs and checkpoints; log the flight; for PPK, fill in the PPK job.
2. **Straight after landing (desktop):** Drone › **Quick map** lays the photos on the map in a minute; Drone › **Flight photos** checks overlap and coverage while you can still fly again.
3. **Process:** Drone › **Photogrammetry** (chapter 33), with your ground control points. Or process in DJI Terra or Pix4D and add the results.
4. **After (desktop):** the orthomosaic, elevation models, point cloud and 3D model are on the map with your survey data, and ready for the phones.
5. **Measure:** volumes, cross-sections and contours on the elevation model; **Compare dates** with an earlier flight.
6. **Prove it:** Drone › **Accuracy report** — checkpoints against the model, ASPRS 2023.

31. Flight check (before processing)

Choose all the JPEG photos of a flight (Drone › Flight photos). Fieldra reads what the drone wrote into each photo — position, height, camera angle, lens and RTK status. The photos themselves are not copied.

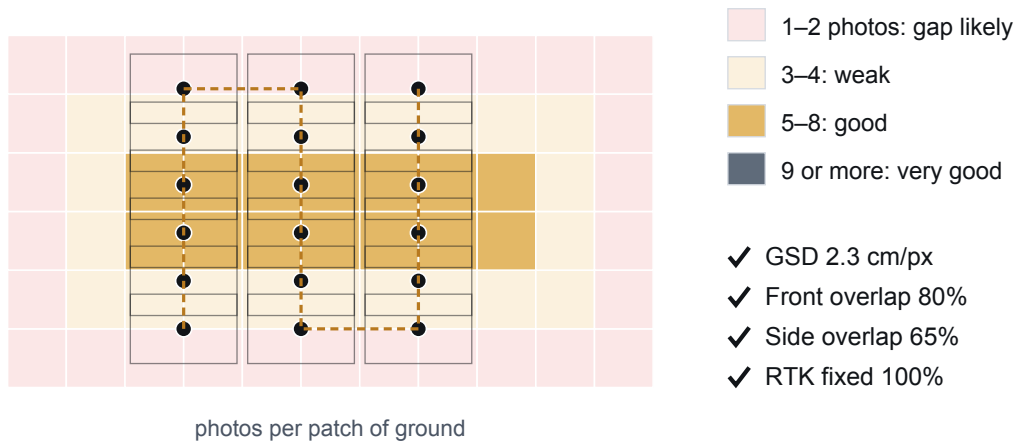


Photo positions, the flight path, and how many photos see each patch of ground.

Check	Aim for	If not
GSD (= how much ground one pixel covers)	What the job needs (often 2–3 cm)	Fly lower.
Front overlap	75% or more (80–85% over trees)	Slow down or take photos more often.
Side overlap	60% or more (70% over trees)	Put the flight lines closer.
Photos per patch	5 or more almost everywhere	Red patches are gaps: fly them again.
RTK fixed	95% or more	Rely on GCPs for the rest.

Be careful: The check assumes flat ground at the take-off height. On hills, overlap is less on high ground — plan extra.

Quick map, straight after landing

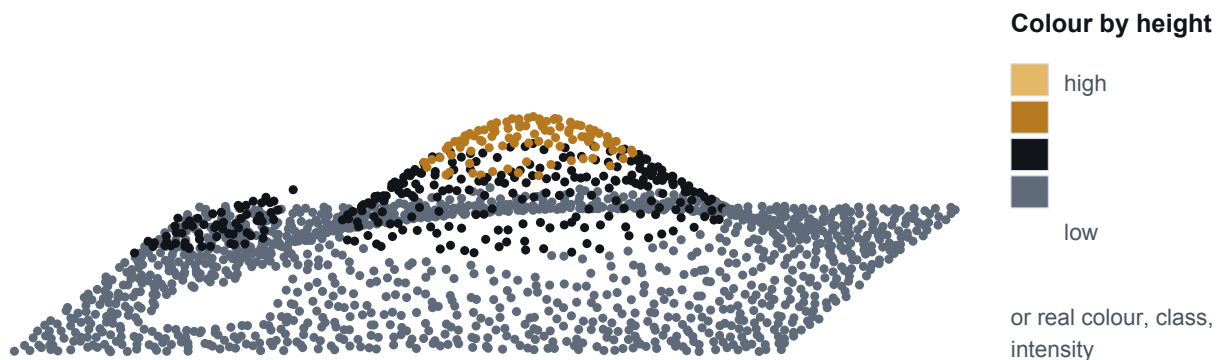
Drone › **Quick map**, then choose the folder of the flight's photos. In a minute or two Fieldra lays every photo that looks straight down on the map, from its GPS, height, heading and lens — like DJI Terra's quick 2D map, with no processing. Use it to check you covered the whole site and to see the site as it is today. It is saved in the project like an orthomosaic, so it also goes to the phones.

Be careful: A quick map is not stitched or measured: photos can be a few metres off and edges don't line up. For measuring, process the photos (Photogrammetry).

32. Point clouds (LAS / LAZ)

A **point cloud** (= millions of tiny 3D dots that together show the shape of the land and objects) comes from DJI Terra, Pix4D, Metashape or a LiDAR payload.

Drone › **Point cloud**, then choose the .las or .laz file.



A point cloud coloured by height, seen at an angle.

- Colour by **real colour**, **height** (choose the range), **class** (ground, buildings, vegetation, water...) or **intensity**.
- Click a point for its height and class. Right-drag to tilt and turn.
- **Clouds of any size, .las or .laz:** a cloud with more than 3 million points is shown at once, thinned evenly, while Fieldra prepares it for full detail (a few seconds per 10 million points; a message shows how far it is). After that every point is there: far away you see an even sample, and as you zoom in the detail fills in where you look.
- **Points drawn at most** (in the panel) sets how many are on screen at once: more for finer detail, fewer for a smooth map on a slower computer.
- If the file does not say its coordinate system, Fieldra asks and suggests the WGS 84 / UTM zone where the map is, which drone software usually uses; national grids can be searched too.

LiDAR tools

In the point cloud's panel (click it in Contents), **LiDAR tools** work on LiDAR and photogrammetry clouds alike:

- **Classify ground:** finds the bare ground under buildings, trees and vehicles (class 2). Set the steepest **ground slope** and the **largest building** on the site. With **Find noise first** (on unless you untick it), points far below the ground (multipath, reflections off water) are marked as noise and can't pull the ground down; points more than about a metre under the finished ground become low noise too.
- **Find noise:** marks points far below or above their surroundings (birds, reflections) as noise (classes 7 and 18), left out of models.
- **Set class in the selected area:** draw or select a polygon on the map, choose a class (building, vegetation, water, bridge, wire...) and, if you like, a height range.
- **Find buildings, trees and wires** (after Classify ground): reads the shape of the points around each one — flat roofs and walls, rough tree crowns, thin lines in the air — and sets buildings (6), low, medium and high vegetation (3, 4, 5) and wires (14). Set the **smallest building** in m² so sheds and cars are not counted.
- **Learn from my examples:** where the automatic classes are not right for your site, set the class by hand in a few areas of each kind (a roof, a tree, a road, a fence...), then press it. Fieldra learns from those points and classifies the rest, and says how often it was right on examples it had not seen. Mark more areas where it got it wrong and learn again.
- **Building footprints:** outlines of the buildings (class 6) as a layer, with area, roof and ground height and building height, drawn as blocks in 3D.
- **Make DTM** (bare ground) or **Make DSM** (top surface) at the cell size you choose. They are added as elevation models: volumes, contours, sections, planes.
- The tools work on the loaded points: for a big cloud, an even sample of up to 3 million. Until you save, the map shows that sample with your changes.
- **Save classes** writes them into every point of the file in the project (a .las is rewritten in full, quickly, and prepared for full detail again; a .laz is saved as .las from the loaded points). **Export LAS...** saves a copy.

Good to know: Raw data from DJI Zenmuse L1/L2 has to be turned into a point cloud in DJI Terra first (DJI keeps that format closed). Bring in the LAS it exports and continue here.

33. Orthomosaics and elevation models

Good to know: Big files: GeoTIFFs, MBTiles and point clouds of any size can be added. They are copied into Fieldra's data folder in pieces (the message shows how far it is) and read in pieces after that, so the computer never has to hold a whole file. Very large vector files (GeoJSON, Shapefile) are read whole: a GeoPackage is quicker for big layers.

Drone › **Orthomosaic**, then choose a GeoTIFF or an MBTiles file.

- **Orthomosaic GeoTIFF:** shown on the map under your survey data.
- **DSM** (= Digital Surface Model: the height of the ground and everything on it) or **DTM**: heights coloured from low (dark) to high (brown), with hill shading.
- **MBTiles:** shown from the file, sharp at every zoom.
- Everything is kept on the computer and works offline. Change the opacity to compare with the base map.
- **Full detail:** right after adding, Fieldra cuts the image into map tiles on every core of the computer (a large orthomosaic in under a minute). Then it is sharp at every zoom, down to the last pixel, and ready to send to phones.

Bands and colours

Click an image › **Display**: which bands make red, green and blue (e.g. **colour infrared** 4-1-2 for a 4-band multispectral image, so plants show red), and the stretch (2–98 %, minimum–maximum or ± 2 standard deviations). One-band images can be grey, in elevation colours, or one colour per class. **Reset** goes back.

Working with large data

For 16-bit imagery, contrast preparation samples image chunks instead of creating a full-image working copy. Tile preparation limits simultaneous large blocks to reduce memory pressure. Keep overview files beside large rasters: unusually large TIFF strips or windows can still need substantial memory.

Point-cloud viewing prioritises visible tiles within the points-drawn budget. Lower that budget on a smaller computer if navigation slows. Zonal statistics accept detailed polygon boundaries without the previous JavaScript argument-limit failure; processing time still depends on the number of cells and vertices.

Orthomosaics on the phones

Send the project with **Share › Nearby devices**. Under **Offline maps**, the send list shows each orthomosaic, elevation model and MBTiles file of the project: untick the ones the field team doesn't need. The first time, an orthomosaic is cut into map tiles for phones (a few minutes for a large one; the message shows how far it is). After that it is kept and sent straight away. On the phone it appears under Map › Offline maps, shown with no signal.

Good to know: Big GeoTIFFs open fastest as a Cloud-Optimised GeoTIFF (DJI Terra: GeoTIFF (COG)), or with their overview file: choose **dom.tif** and **dom.tif.ovr** together. A 1.5 GB orthomosaic then opens in seconds; on its own it takes a minute or two, because all of it has to be read.

Make one from the photos: Photogrammetry

Drone › **Photogrammetry** turns a flight's photos into an orthomosaic, a surface model (DSM), a terrain model (DTM), a point cloud and a textured 3D model, with a quality report. It is processed with OpenDroneMap, on this computer or on a processing server, and the results come back into the project.

1. **Processing:** on a Windows PC, choose **This computer** and click **Install the engine** (once, about 2 GB; nothing else to install). It starts with Fieldra and keeps working in the background; an NVIDIA graphics card is used when there is one. On a Mac, the engine runs in Docker Desktop (free for organisations under 250 staff and \$10 million revenue): install Docker Desktop, open it, give it 16 GB of memory or more (Settings › Resources), then click **Install the engine** (about 5 GB, once). Or choose **A server** and enter the address of a PC in the office that has the engine (with :3000), or a hosted service with its token.
2. **Photos:** choose the folder with the flight's photos, straight from the drone's card (at least 5; 70–80% overlap is best).
3. **What to make:** **Fast map** (orthomosaic in minutes, to check coverage on site), **2D maps** (orthomosaic, DSM, point cloud), **Survey** (adds the DTM and denser points), **3D model** (textured model, 3D Tiles, upright buildings) or **Multispectral** (reflectance for plant health).
4. **Resolution: As photos** keeps every detail the camera saw; 2, 5 or 10 cm is faster and lighter.
5. **Ground control points** (optional, to improve positioning and check accuracy): see below.
6. To process only part of the flight, select a polygon on the map and tick **Process only inside the selected area**. **More options** has the rolling-shutter correction (DJI Mini, Air, Mavic 2 Zoom), point-cloud density, KMZ and more.
7. Click **Process**. Keep working, or close Fieldra: it follows the job again when you open it.

When it is done, the orthomosaic, elevation models, point cloud and camera positions are added to the project by themselves, and the orthomosaic and models are cut into map tiles for phones at once. Click **Send to phones** to open Nearby devices and send the project.

Quality report shows photos used, ground resolution, reprojection error, GPS and control point errors, with plain warnings. Save the full PDF report, the 3D model (GLB or OBJ), 3D Tiles or KMZ with their buttons. **3D model on the map** puts the textured model in place: tilt the map (right-drag or the orbit ball) to look around it.

Progress, retries and keeping the results

The job shows which output is being added and how many files are saved. Results stay assigned to the project that started the import, even if you open another project. If adding a file fails, read the message, correct the cause (for example, free disk space), then click **Retry adding to map**. Files already recorded as saved are skipped.

Original downloads stay available after the layers appear on the map. Save the quality report, 3D model or 3D Tiles whenever you need them. **Remove** deletes the job and its retained downloads, so save any originals you want first. Removal is unavailable while results are being added.

An upload interrupted by closing Fieldra must be started again. A job already submitted to the processing engine can be followed after reopening. A rejected server token or a task removed on the server is shown as an error; check the server settings before starting a replacement job. A job producing only a 3D deliverable can still finish successfully.

Ground control points

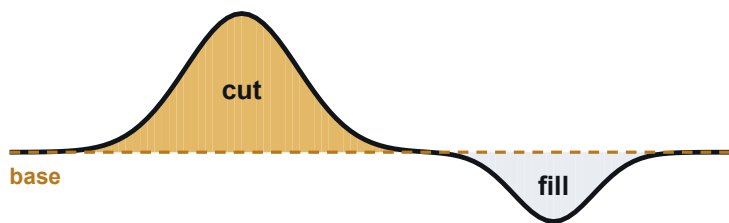
1. Survey the targets on the ground (RTK or total station) and save them as CSV or text: **name, easting, northing, elevation** (or longitude, latitude, elevation).
2. In Photogrammetry, choose the photos, then **Add ground control points... > Load points....** Choose the coordinate system used by the point file. Every point needs a unique name and a valid elevation; correct any missing heights or repeated names before importing.
3. Pick a point on the left. Fieldra lists the photos that see it and opens each one where the target should be (dashed circle). Click the centre of the target; scroll to zoom, drag to move, **N** for the next photo.
4. Mark each point in at least 3 photos (its dot turns green). Switch a point on to make it a **check point**: it is left out of processing so you can measure accuracy afterwards with the Accuracy report.

Tip: Marks are kept with the photo folder, so you can stop and continue later. Spread at least 5 control points around the edge and one in the middle.

Good to know: Processing needs a strong computer: about 16 GB of memory for a few hundred photos, more for large flights (Fieldra splits flights of over 1,500 photos into parts). A small flight takes minutes; a large one can take hours.

34. Volumes, cross-sections and contours

Open an elevation model (DSM or DTM) and click it in Contents. Its panel has three tools under **Measure**.



Volume inside an area

- 1 Cut: ground above the base (a stockpile).
- 2 Fill: space below the base (a pit).
- 3 Net = cut – fill.

Cut and fill between the ground and a base, inside an area.

Volume (stockpiles, pits, cut and fill)

1. Draw the area around the stockpile (Edit › Polygon), or click an existing area on the map.
2. In the elevation model's panel, click **Volume**.
3. Choose the **base**: a **best-fit plane** through the ground around the edge (best for piles on a slope), the **lowest** or **average** edge height, or a **height you choose** (a design level, for cut and fill to a platform).
4. Read **cut**, **fill** and **net**. **Save to the area's attributes** writes the volumes onto the area, so they go into exports and reports.

Tip: Draw the edge on bare ground just outside the pile: the base is taken from the ground along the edge.

Cross-section

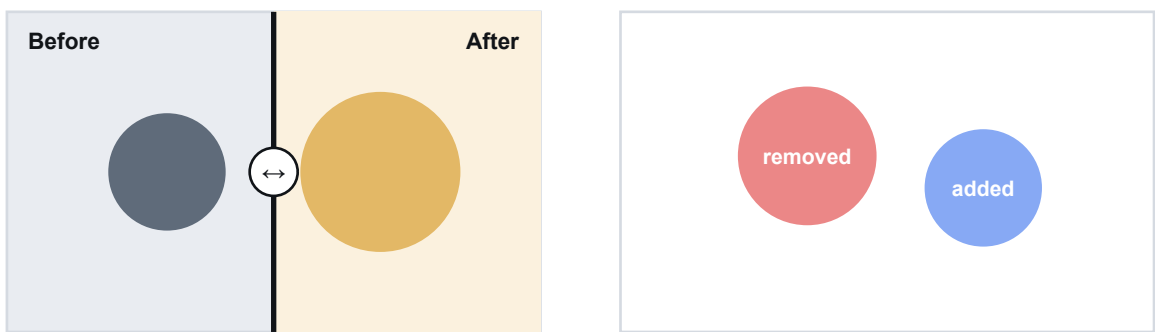
Draw a line (Edit › Line) or click one, then **Section**: the ground profile along it, with length, rise, lowest and highest points and the steepest slope. Move the mouse over the chart for the height at any distance. **Export CSV** saves distance, height and position for every sample.

Contours

Contours (= lines joining points of the same height) at an interval you choose (Fieldra suggests one). They are added as a new layer: style it, and export it from its menu as GeoPackage, Shapefile, GeoJSON or KML.

35. Compare two dates

Two flights of the same site, for progress, erosion or stockpile checks: Drone › **Compare dates**. Choose the **Before** and **After** images (orthomosaics or elevation models).



Swipe between two flights
Change between two DSMs
Swipe between flights, or see where the ground changed.

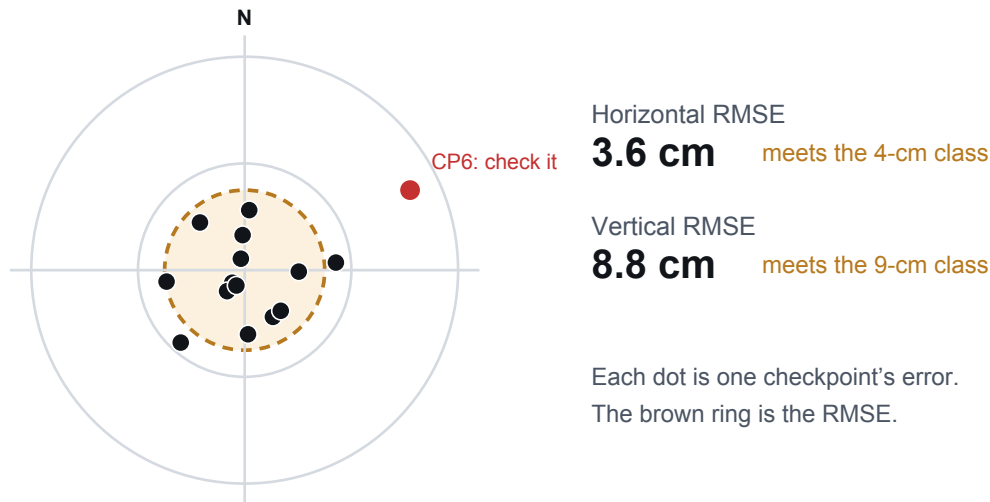
View	What it shows
Swipe	The two dates on top of each other; drag the divider across.
Side by side	Two maps that move and zoom together.
Change (two DSMs)	Red where ground was removed, blue where it was added, with the volumes added and removed and the net change. Changes under 5 cm are ignored as noise.

To measure one stockpile or pit only, select its outline on the main map before opening Compare dates.

Be careful: Both elevation models must use the same kind of height (both ellipsoidal or both above sea level), or the whole site shows as changed.

36. Accuracy report (ASPRS 2023)

Proves how accurate the drone map is, with the checkpoints the processing did not use. On the desktop: Drone › **Accuracy report**. On the phone: Terrestrial Survey › **Accuracy**.



Each checkpoint's error, the RMSE ring, and the accuracy class.

1. Surveyed checkpoints: the checkpoints recorded by the phones, or a CSV.
2. Model checkpoints: export the same points as measured in DJI Terra or Pix4D, as CSV (name, X, Y, Z). Names must match (CP1, CP2...).
3. Enter the survey's own accuracy and your targets (for example 5 cm horizontal, 10 cm vertical).
4. Read the result, check the warnings, and save the **PDF report**.

You see	What it means
RMSE (= root mean square error: the typical size of the errors)	The accuracy of the map. Smaller is better.
Accuracy class	"Meets the 5-cm class" = RMSE of 5 cm or less, the way ASPRS 2023 reports it.
Bias	All errors lean one way: check the coordinate system, geoid or antenna height.
Warning on a point	More than $3 \times$ RMSE out: probably the wrong target or a typing error.

Be careful: Heights must be the same kind in both lists. RTK gives ellipsoidal heights; DJI Terra and Pix4D often export heights above sea level (geoid).

Good to know: ASPRS recommends at least 30 checkpoints. With fewer, the report still works but says the result is only indicative.

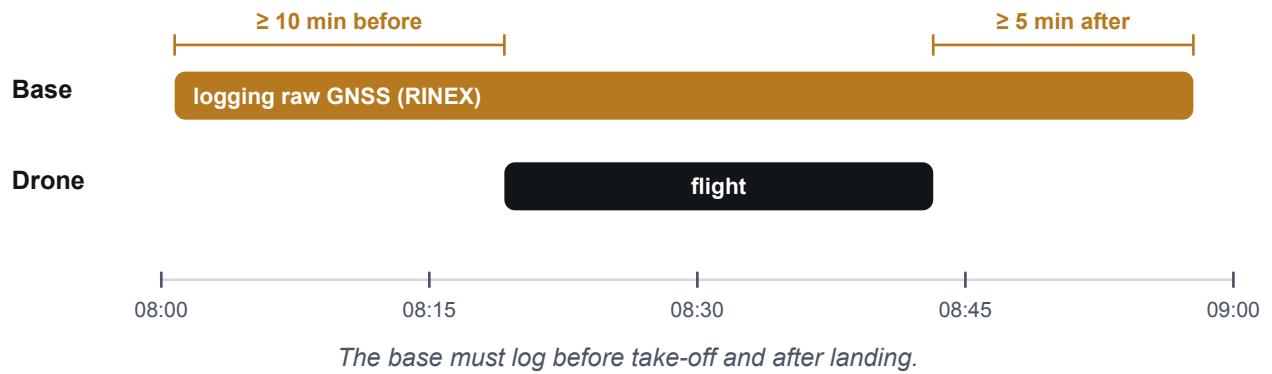
37. PPK jobs

With **PPK** (= Post-Processed Kinematic: positions are fixed later, in the office, from saved GPS data), the drone and a base station both save raw GPS data; software joins them after the flight. A PPK job keeps everything for one flight together.

What it is for: A drone's own GPS is only good to a few metres, so each photo's position is a little off. PPK fixes that afterwards: a base receiver sits still on a known point during the flight and records the same satellites as the drone. Because the base knows exactly where it is, the software can work out the GPS error at each moment and remove it from the drone's positions. You get centimetre photo positions without a live radio or internet link, which is why PPK is used where RTK corrections can't reach.

What you get: A PPK job per flight that holds the base point, antenna height, logging times and files, and a processing sheet that tells the office (or DJI Terra, Emlid Studio, RTKLIB...) everything it needs. After processing you note the result: how many photos got a fixed solution and how accurate they are.

Word	What it means
Base (base station)	A GPS receiver on a tripod over a known point, recording for the whole flight.
Rover	The receiver that moves: here, the one in the drone.
Raw data / RINEX	The satellite signals as recorded, before positions are worked out. RINEX is the standard file type for them (.obs, .nav, .24O...).
Timestamp.MRK	The DJI file that says exactly when each photo was taken, so each photo gets its corrected position.
Antenna height	From the mark on the ground to the base's antenna reference point. A wrong height shifts every photo up or down.
Fixed %	The share of photos whose position was solved to centimetres ("fixed"). Over 95 % is good; low values mean gaps or poor satellite view.



1. Log the flight with **PPK** as the positioning. A PPK job is made with it (Terrestrial Survey › **PPK jobs**).
2. Choose the base point (a control point of type Base), the receiver, antenna type and antenna height (and how it was measured).
3. Tap **Log start** and **Log stop** for the base logging.
4. Add the base **RINEX** (= a standard file format for raw GPS data) files and the drone files (.obs/.nav/.bin and Timestamp.MRK).
5. After processing, enter the software, the fixed %, and the accuracy. **Share processing sheet** sends everything the software asks for.

38. A typical job, start to finish

1. **In the office:** create the project (phone or desktop). Import planned targets. Plan the flight with the calculator. Download offline maps and your latest orthomosaic.
2. **On site:** set up the base (or use network RTK). Wait for **RTK fixed**. For PPK, start base logging 10 minutes before take-off.
3. **Targets:** lay GCPs and checkpoints; measure each centre; take photos of each.
4. **Flight:** fill in the flight log and checklist; log take-off and landing.
5. **Ground work:** environmental, biodiversity, water, road and questionnaire records, following the survey plan.
6. **Before leaving:** check the Map. Keep the base logging 5 minutes after landing. Export the GCP file.
7. **Back at the office:** the phones send everything to Fieldra Desktop over Wi-Fi. Run the flight check, then process in DJI Terra or Pix4D.
8. **Deliver:** open the point cloud and orthomosaic, measure volumes, run the accuracy report, make the dashboard report, print a layout, and export for ArcGIS Pro.

39. Limits and safety

- Test the app on your phones and equipment before real work. Some features (transfers, background recording, Android depth) need to be tried on your own devices first.
- Phone GPS is only good to a few metres. Never use phone positions or phone heights for GCPs.
- Some receivers, such as the DJI D-RTK 3 in rover mode, cannot send their position straight into Fieldra. Save the points in the maker's app and import the file.
- Background recording needs location allowed **all the time**. Some phones stop apps to save battery: allow Fieldra to run in the background.
- Sending to an online server over the internet is not built yet. Use Fieldra Desktop or Export.
- The flight check is an estimate from the photos' data; it assumes flat ground.
- AI answers are suggestions only.
- If free use of Fieldra ends, the apps say so the next time they are online and stop until Fieldra can be used again. Records, photos and projects stay on the device.
- Deleting a whole project only removes it from the device you delete it on.
- Volumes and contours are only as good as the elevation model: check its accuracy first (chapter 36).
- Always follow aviation rules and your organisation's safety rules. The checklist in the app is a reminder, not a replacement.

40. Word list

Word	Meaning
Accuracy	How far off a position might be. “± 2 cm” means within about 2 cm.
AI	A computer program that guesses what is in a photo.
ASPRS 2023	The American standard for how to measure and report map accuracy (Edition 2, 2023).
Back bearing	The bearing taken from the far end of a side back to its start; it checks the first one.
Base station	A GPS receiver that stays still on a known spot and sends corrections.
Beacon	A mark at a corner of a plot of land: an iron pin, a concrete pillar or a peg.
Bearing / azimuth	A direction, as an angle clockwise from North.
Bluetooth	A short-range wireless link between devices.
Bowditch rule	Sharing a survey’s misclosure along its sides in proportion to their length.
Checkpoint	A measured target used only to test how accurate the map is.
Cloud-to-cloud	Joining laser scans by matching their shapes.
Cluster	Nearby points shown as one circle with how many there are.
Contour	A line joining points of the same height.
Coordinates	Latitude and longitude numbers that give a position.
Correction	A message from a base station that fixes GPS errors.
Cross-section	The shape of the ground along a line, as a chart.
CSV	A simple table file, one line per record, opens in Excel.
Cut and fill	Ground above a base (cut, e.g. a stockpile) and space below it (fill, e.g. a pit), in cubic metres.
Declination	The angle between magnetic north and true north where you are.
DSM / DTM	Height maps: DSM includes trees and buildings, DTM is the bare ground.
Ellipsoidal height	Height measured by GPS from a smooth, math shape of the Earth. It is not the same as height above sea level.
Epoch	One single position reading (usually one per second).
Export	Making a file from your data to send or open elsewhere.
Fieldra Desktop	The Fieldra app for the office computer (macOS and Windows).
Fix status	How good the RTK position is: fixed (best), float, or single.

Word	Meaning
GCP	Ground Control Point: a measured target used to place the map correctly.
GeoJSON / KML	Map files for map programs and Google Earth.
GeoPackage	One file holding many map layers; opens in ArcGIS Pro and QGIS.
GeoTIFF	An image file that knows where on Earth it belongs (used for orthomosaics and height maps).
GPS / GNSS	Satellite systems that tell devices where they are. GNSS is the general name.
GSD	How much ground one photo pixel covers (for example 2 cm).
Heat map	Colours showing where points are dense.
LAS / LAZ	Point cloud files; LAZ is the compressed version.
LiDAR	A laser that measures distance with light pulses.
Local attraction	Metal or power lines near a beacon pulling a compass off.
MBTiles	One file holding a map cut into small square images, for offline use.
Misclosure	How far a walk round a plot misses the beacon it started from.
Nearby Devices	The screen that finds phones and computers with Fieldra on the same Wi-Fi and sends projects between them.
Network RTK / NTRIP	RTK corrections sent over the internet.
Office layer	Areas, lines or points made on Fieldra Desktop, shown on the phone map.
Offline	Working with no internet or mobile signal.
Orthomosaic	One big, measured map made by joining many drone photos.
Overlap	How much each photo shares with the next.
Point cloud	Millions of 3D points measured by a laser.
Pole height	The distance from the pole tip to the receiver.
PPK	Fixing GPS positions later, in the office, from raw data saved by the drone and a base.
Project	One job or site; holds all its records.
Quadrat	A small square plot for counting plants.
Registration	Joining many laser scans into one model.
Resection	A scanner working out its position from targets it can see.
RINEX	A standard file format for raw GPS data, used for PPK.

Word	Meaning
RMSE	Root mean square error: the typical size of the errors. The main accuracy number.
Rover	A GPS receiver on a pole that you carry to each point.
RTK	Real-Time Kinematic: live GPS correction to about 1–2 cm.
Segmentation	Splitting a picture into parts and naming each part.
Shapefile	An older map file made of several parts (.shp, .dbf, .prj).
Skip logic	A rule that shows a question only when an earlier answer fits.
Stake out	Walking to a planned spot using the app.
Station (TLS)	One place where the laser scanner stands.
Survey plan	The study area and the points to visit, drawn before or during a survey.
Sync	Sending data from the phone to Fieldra Desktop over the office Wi-Fi.
TLS	Terrestrial laser scanner: a scanner on a tripod.
Transect	A line you walk while counting animals or plants.
Traverse	A line of measured sides from beacon to beacon; closed when it ends where it started.
UTM	A map grid in metres (Easting and Northing).
XLSForm	The Excel form format used by KoboToolbox and ODK.