

# ASTERRA and National Highways

## BACKGROUND

National Highways has identified the use of ASTERRA's EarthWorks soil moisture mapping technique as having the potential to assist on problematic sites where a lack of intrusive investigation data can be augmented quickly and easily by the use of EarthWorks PolSAR imagery. The requirement for ongoing monitoring if needed, can be addressed using regular monthly or quarterly updates on a subscription basis with new insights uploaded onto the National Highways cloud for immediate access and use.

ASTERRA's Earthworks system uses L-Band Polarimetric Synthetic Aperture Radar (PolSAR) in ground engineering to determine the concentration of below ground soil moisture. It is well known that moisture content could be indicative of future earthworks or drainage problems particularly for geotechnical assets. Soil moisture maps are produced in GIS format and can be viewed through a client portal enabling data to be easily taken to site on handheld equipment enabling accurate positioning

during inspection. In addition, other topographical data such as LiDAR, can also be imported and overlaid to provide more detailed topographical evidence of how the areas of high soil moisture relate to topography.

National Highways approached ASTERRA to use the EarthWorks product on two sites in the southwest of England, both known to be problematic.

Both sites cover sections of major roads and the importance of keeping these strategic routes open was the key driver for the project.

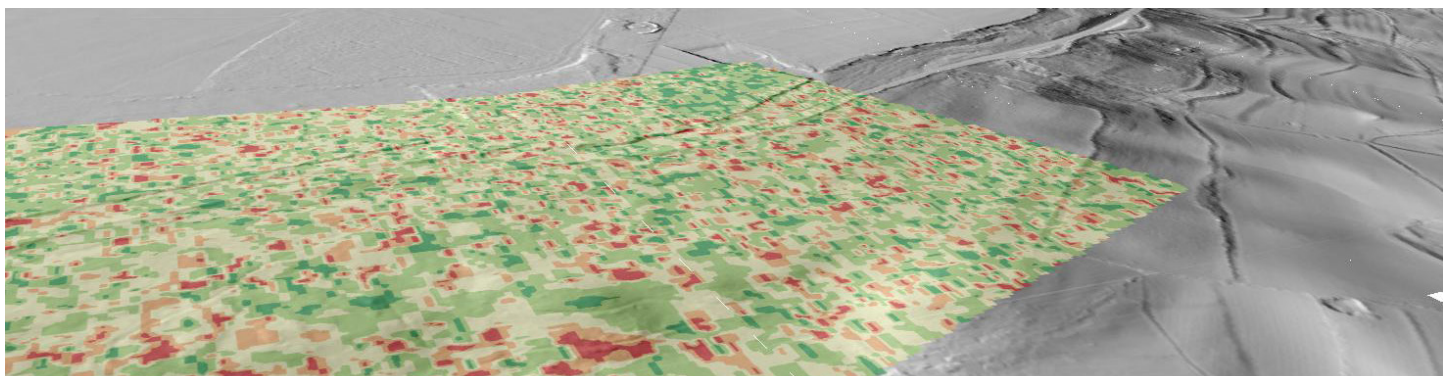


Fig 1. First site 3D image with full soil moisture map overlay onto LiDAR image.

The first site is subject to ongoing landslips and the geological map sheets depict the area being affected by mass movement deposits both upgradient and downgradient of the road which contours the calcareous sedimentary bedrock. Previous landslips have occurred and there remain tension cracks associated with movement on the upslope side. National Highways are concerned that there may be more to this site than meets the eye, however areas of woodland and other vegetation prevented detailed inspection

without significant costly traffic management and environmentally impactful de-vegetation. ASTERRA provided a soil moisture map from their EarthWorks product to provide insights into what may be happening on the site generically.

Soil moisture data was provided over the entire site including the road and the above and below slope areas. EarthWorks identified features known to the National Highways engineers, confirming the accuracy of the PolSAR data, but also depicting

areas of elevated soil moisture which were unknown and which had not yet manifested themselves at surface. To the National Highways engineers these new areas can now also be considered in the mitigation plans for upgradient surface water drainage. This will allow National Highways to intercept areas identified at surface and those which have not yet surfaced but which are identified as present close to the top of slope and which are therefore likely to cause future problems if left unattended.

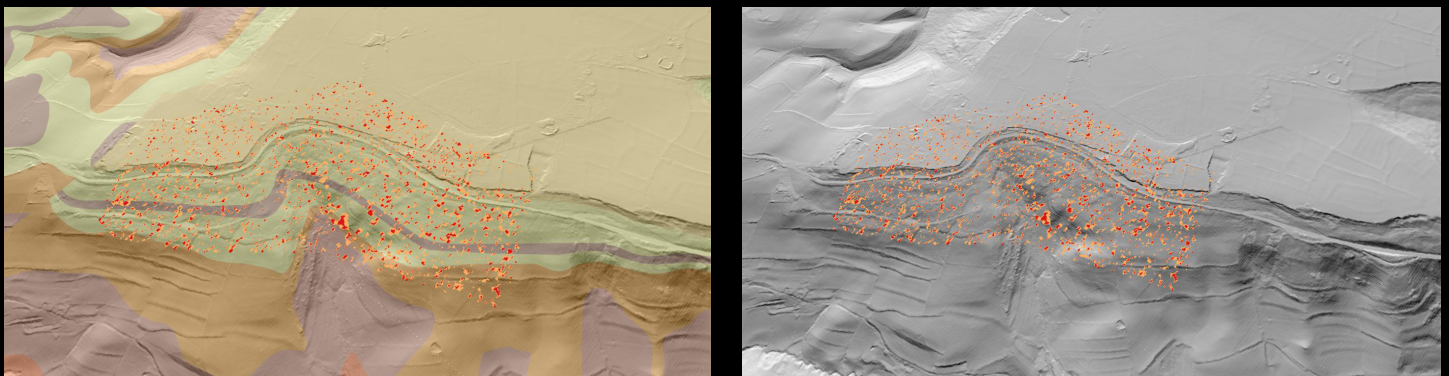


Fig 2. First site incorporating different views including LiDAR and geological information

The second site lies on a motorway where signs of slope movement are occurring on a 7.0m high embankment. This section of motorway predominantly lies on the Aylesbeare Mudstone Group. A geological fault traverses the site passing beneath the embankment

in an east-west direction and is associated with a spring line which historically fed a stream that was diverted during the motorway construction. ASTERRA's EarthWorks product was used to produce a sub-surface soil moisture map which was combined with available LiDAR data

to review topographical information. Areas of seepage known to National Highways were confirmed by EarthWorks, whilst other previously unknown non-surfacing areas of high soil moisture were also identified, further delineating the fault position and direction.



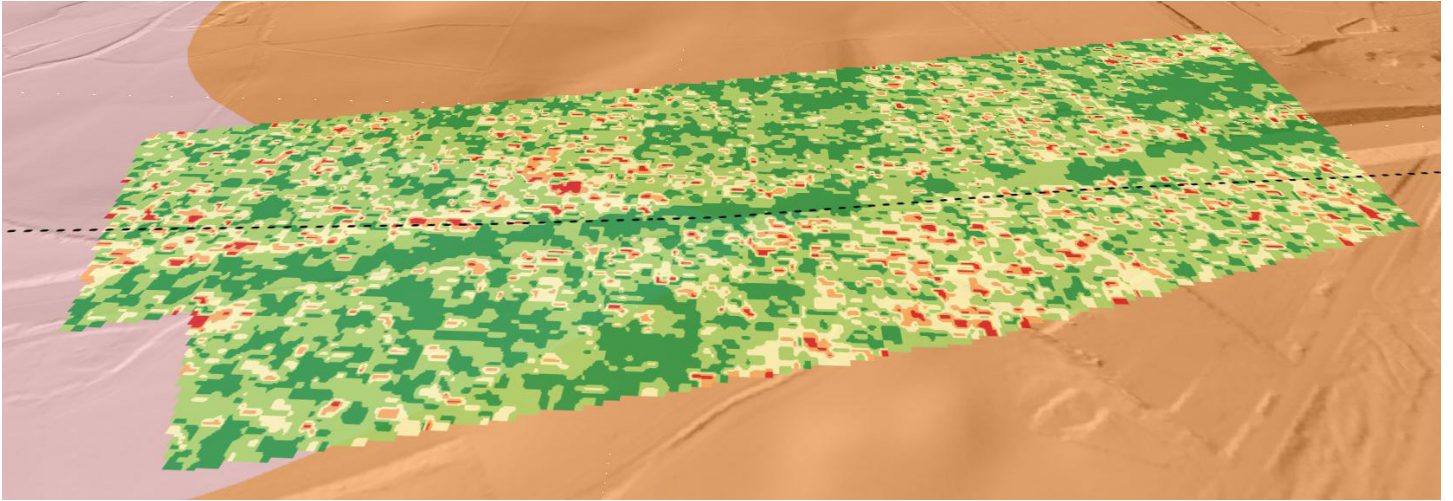



Fig 3. Second site soil moisture map and geological information showing conjectured fault line.

 The EarthWorks information has been instrumental in enabling National Highways to better appreciate problem areas, understand if intervention is necessary and to target spending to improve the drainage and stability of their earthwork assets.

The ability to view large areas or individual sites without setting foot on the ground reduces the need for site visits, keeping people safe while also reducing the carbon footprint and costs associated with any site works by enabling more efficient and targeted interventions.



Fig 4. Points of interest indicated based on high concentrations of soil moisture.



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