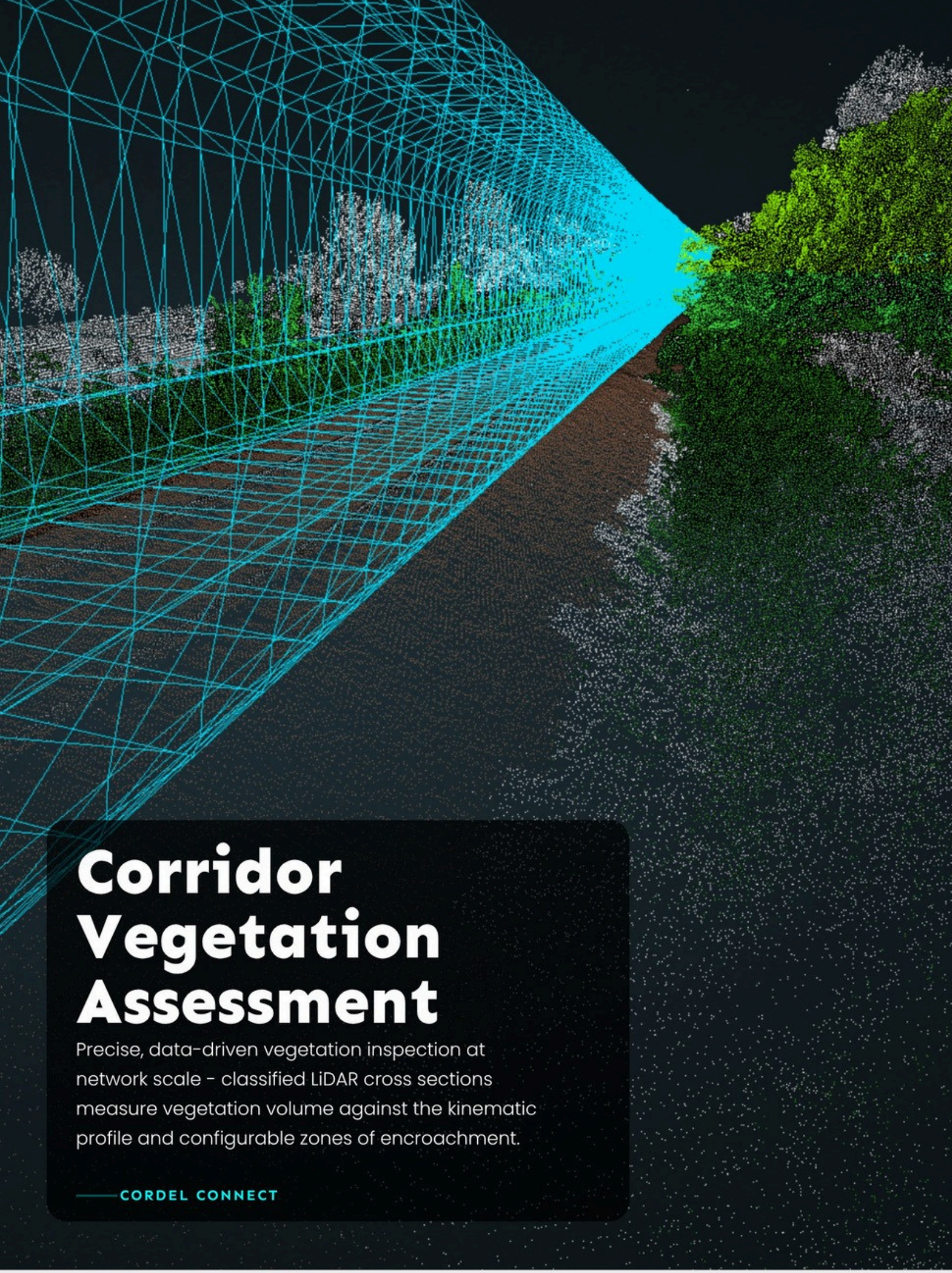


Corridor Vegetation Assessment

Precise, data-driven vegetation inspection at network scale - classified LiDAR cross sections measure vegetation volume against the kinematic profile and configurable zones of encroachment.

CORDEL CONNECT

Information

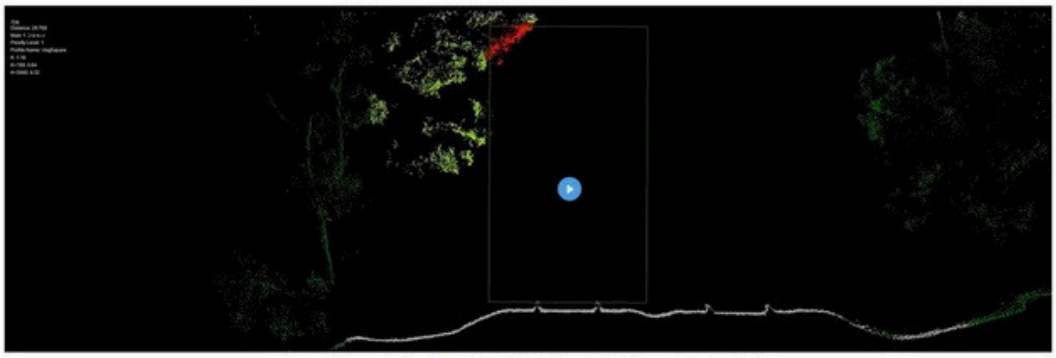
Summary

This solution delivers precise volumetric estimations of vegetation located within a certain proximity of the corridor. These measurements are calculated based on customer-defined kinematic profiles, as well as configurable 'zones of encroachment' that surround the profile. The measurements are presented as discrete points in the .CSV report, which can be aggregated and combined to create insightful visual representations. These visualisations allow rail networks to highlight priority areas that demand immediate maintenance attention, allowing for proactive and targeted vegetation control strategies.
A core component of the Cordel analysis is the generation of classified LiDAR cross-sections. This highly granular output is instrumental in determining the exact volume and value of vegetation, particularly when it breaches critical safety clearances. The system specifically identifies vegetation encroaching upon the controlling kinematic profile or extended zones of encroachment (configurable to client standards). Infringements are grouped into prioritised zones of encroachment, which are colour-coded based on the severity of each detected infringement.

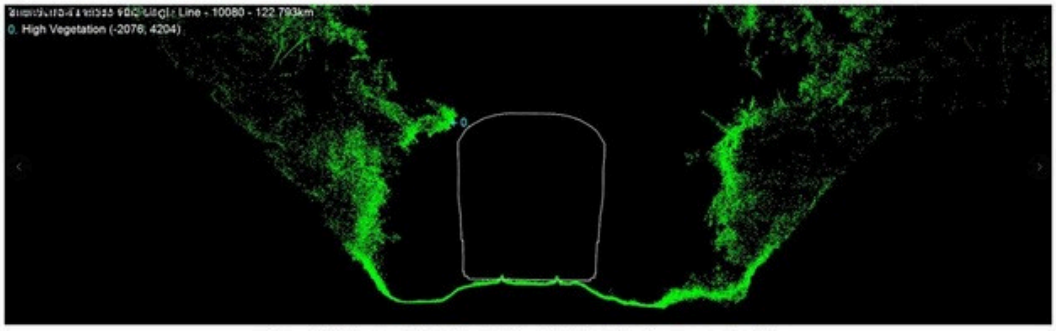
Zone	Colour	Description
K		Infringement onto the kinematic profile directly: This highest-priority threshold identifies actual penetration or direct contact with the kinematic profile.
K +1500		Infringement within 1500mm of the kinematic profile: This critical threshold pinpoints vegetation that is very close to, or almost touching, the kinematic profile.
K +3000		Infringement within 3000mm of the kinematic profile: This broad threshold serves as an early warning, identifying vegetation that may need to be monitored. This allows for proactive management of vegetation.
Outside		Vegetation detected outside the profile zones.
Excluded		Excluded from the zone of assessment.

How does this solution work?

Raw LiDAR data is uploaded and cut into 1 meter cross-sections. Advanced machine learning then classifies each element within the point-cloud, including the railheads and surrounding vegetation. The desired vehicle profile (configurable) is digitally affixed to the rail heads and aligned to the plane of rail.
Every 1m cross section is analysed, and the amount of vegetation found within the profile, as well as within customer defined proximity to the profile (E.G. within 1500 mm {K +1500} and 3000 mm {K +3000}) is measured, recorded and provided in the Corridor Vegetation Report.



A sample cross-section from the Corridor Vegetation Management QA Video



A sample infringement ticket from the Corridor Vegetation Management solution

Corridor Vegetation Payload Data

Accessed through the Mission Viewer, users can download a range of outputs included as standard in this solution.

.CSV Reports

TheCorridorVegetation Report

`CorridorVegetationReport.csv`

The data presented in this report highlights areas on the network where vegetation is encroaching on the pre-defined kinematic profile and the (configurable) surrounding encroachment zones. This solution also assigns a priority level to each infringement based on the closest zone where an infringement has been detected.

Column Name	Details
`PriorityLevel`	The number of the closest zone that is infringing
`VegetationVolume_K`	The volume of vegetation found within the profile
`VegetationVolume_K+1500`	The volume of vegetation found from the profile to 1500mm outside of the profile
`VegetationVolume_K+3000`	The volume of vegetation found from the profile to 3000mm outside of the profile

Video Files

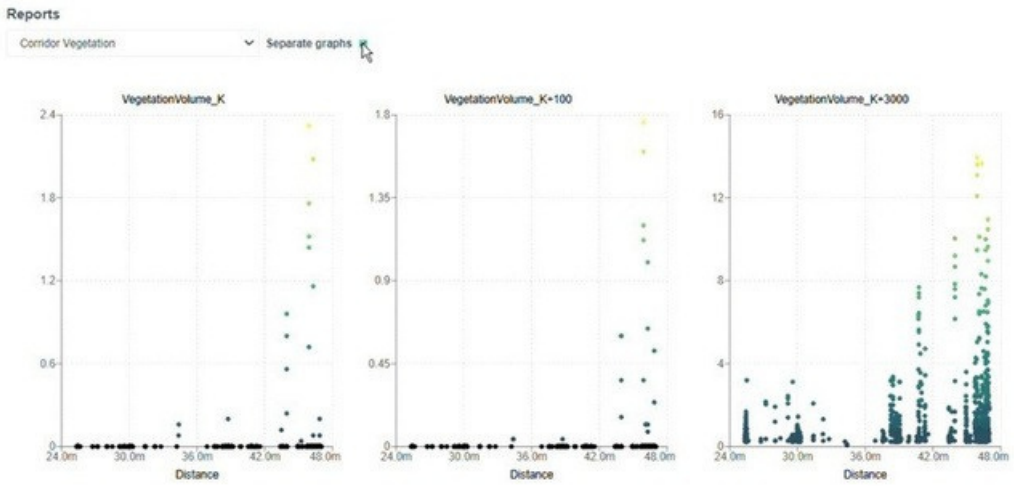
`corridor_vegetation_infringements.mp4`

The QA Video is also available for download as part of the Corridor Vegetation Infringement payload data.

Visual Tools

Report Graphing Tool

Cordel Connect provides a customisable graphing tool, which allows users to visually analyse the volume of vegetation detected in and around the kinematic profile.
Users can view all nominated data on a single graph, and data can be toggled on and off.
Users also have the option to view data in individual graphs using the 'separate graphs' option.
The example below shows corridor vegetation infringements as a scatter graph, which can be filtered by their proximity to the kinematic profile.



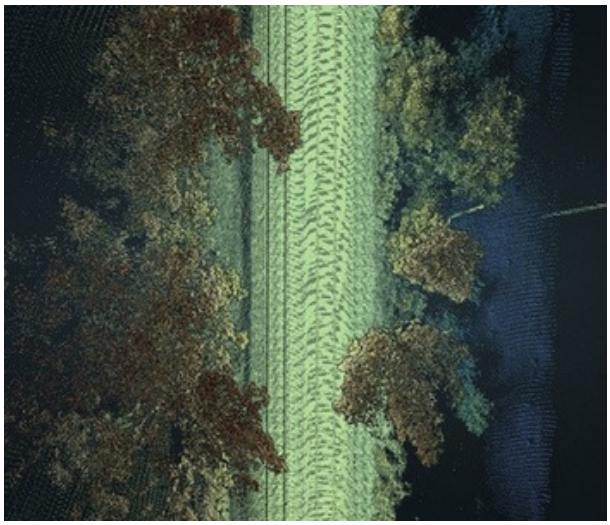
Other graphs can be configured by Cordel to display the data contained in the corridor vegetation reports.

LiDAR Viewer

For infringements that require detailed investigation or additional context, users can inspect the LiDAR point cloud in the LiDAR Viewer tool. This provides a 3D representation of the scene and includes measurement tools useful for digital inspections of encroaching vegetation. For Cordel clients who also use the Gauging module, the vehicle profile can be toggled on over the point cloud to provide additional context and visual information.



Because the LiDAR viewer provides a 360 point cloud, a top down view can be utilised to better understand vegetation growth within the corridor.



Forward Facing Video

The video footage captured by Cordel hardware provides a powerful tool to assess vegetation encroaching on the corridor. Geosynced to the network, users are able to drag and drop their rover pin to a location of interest, automatically updating the video display to show the relevant location.



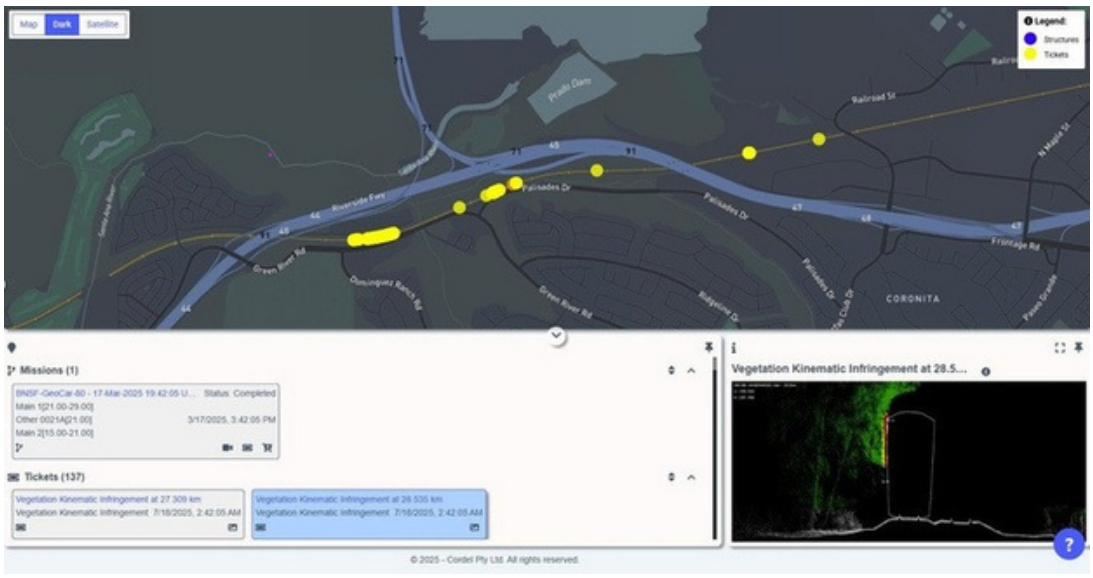


Infringements: Explorer

The Explorer page delivers a high level understanding of the volume of infringements and where they are located on the network. Corridor Vegetation Infringements are displayed on the Explorer page as yellow markers (or orange when an infringement ticket is selected). Where there are several infringements, these are grouped together, allowing users to identify areas that have multiple issues.



Each infringement also has a corresponding ticket in the search results section, which includes information such as the location, infringement type, and capture date and time.
The 2-D cross-section for each infringement is colour coded based on the zones of encroachment (E.G. K, K +1500, K +3000) and is linked to the ticket card, the map marker and the video footage that corresponds to that section of the network. Any time a user selects an infringement ticket, the relevant cross- section and video is displayed to give additional context and visual information.



Infringements: Mission Viewer

Where a more granular investigation is required, users can review infringement details on the Mission Viewer page using a range of intuitive tools.

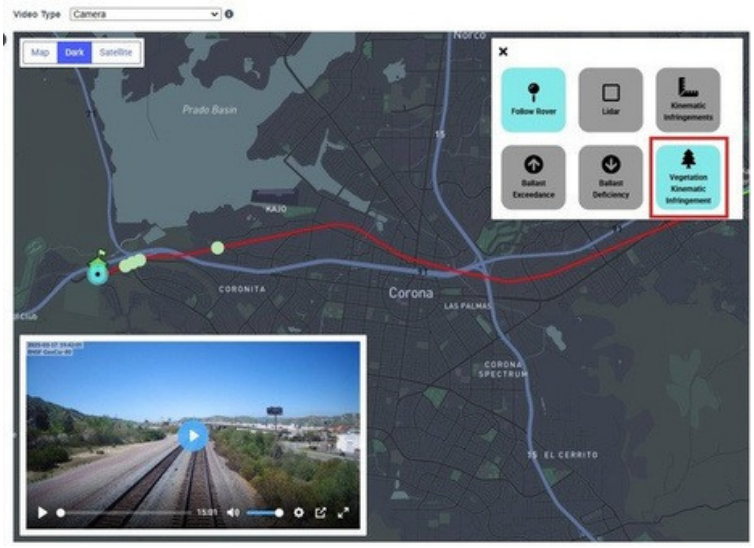
Map Layers: Report Heatmap Layer

Accessed through the Mission Viewer, The Report Heatmap analyses the values found in the selected .CSV report, applying a scale to the data and then plotting the scaled values on the network model.
This provides a visual representation of the location and severity of each datapoint in the selected .CSV report.



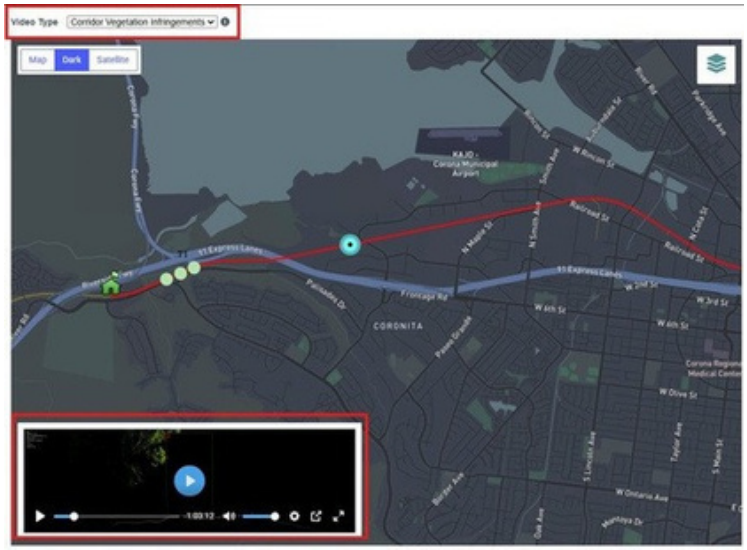
Map Layers: Vegetation Kinematic Infringement Layer

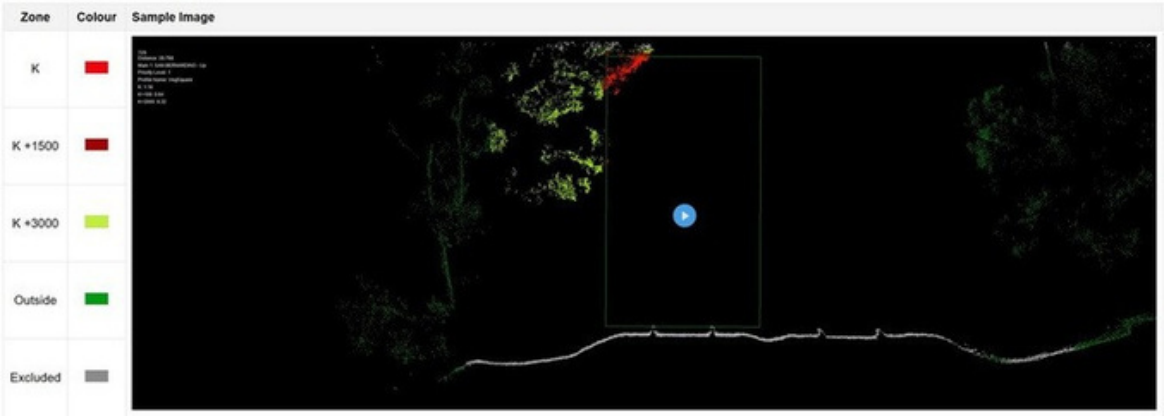
Cordel Connect users are able to view the location of vegetation infringements in the Mission Viewer using the layers functionality.



Corridor Vegetation Infringement QA Video

Each 1 meter 2D cross-section is 'stitched together' and presented in the Corridor Vegetation module as an infringement video. This video is synced to the Network Model and can be reviewed in the Mission Viewer by selecting the 'Corridor Vegetation Infringements' video type.





Users can view the QA video in full screen mode, and this artifact is also available for download as part of the standard payload data. Any vegetation that infringes the corridor is colour-coded according to its proximity to the kinematic profile.

Infringement Details

To review the exact details of a deficiency or exceedance, users can click the corresponding infringement marker. To view the classified cross section associated with a particular infringement, click ‘View’; or to open the infringement details select ‘Details’.

