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Report

TREE ROOT MAPPING AT SIRIUS BUILDING, GLOUCESTER WALK, THE ROCKS NSW

Date: 15 April 2021

Job Number: GBGA2437

SHALLOW GEOPHYSICAL INVESTIGATIONS

DETAILS

Project Number	GBGA2437
Document Title	Tree Root Mapping at Sirius Building, Gloucester Walk, The Rocks NSW
Site Address	Gloucester Walk, The Rocks, New South Wales
Client Details	Ben Wilderink Senior Project Engineer Richard Crookes Constructions
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DOCUMENT HISTORY

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1	Benjamin Wilkins	Cindy Giang	12 January 2022
2			
Etc.			

DISTRIBUTION

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Etc.				

1 INTRODUCTION

GBG Australia (part of GBG Group) carried out Non Destructive Testing (NDT) using Ground Penetrating Radar (GPR) on the 1st April 2021 at the SIRIUS building, along Gloucester Walk, New South Wales. We are pleased to present the findings of the investigation in the following report.

The object of the investigation was to locate roots emanating from two target trees under the Gloucester Walk.

2 GEOPHYSICAL INVESTIGATION SITE

The investigation was undertaken over two 20 m long stretches of the walkway on the eastern edge of the SIRIUS building basement carpark (see Figure 1 overleaf). The purpose of the survey was to assist an arborist in determining the location and depth of the tree roots larger than 50mm diameter associated with trees 50 and 51.

The Client requested that the GPR be trialed in the basement, but the reinforced concrete obscured the subsurface such that tree roots were impossible to be imaged.

The paved area of Gloucester Walk was generally well suited to GPR. The paving gave little interference and signal was relatively clear. As outlined in the scope of work, the garden areas were not surveyed because of the presence of the shrubs and other vegetation would impede the GPR signal.

The GPR profiles data were collected with lines set out at 0.25 m centres along the walkway, and 0.25 m centres where the walkway widened at the southern end. This gave full coverage of the walkway perpendicular to the expected tree root directions.

Figure 1: Ground Penetrating Radar equipment at Tree 2, looking south.

3 DATA ACQUISITION

Data collection involved moving the GPR system slowly and steadily along a series of longitudinal lines spaced at 0.25 m intervals within the survey area.

The GPR data profiles were collected with a 900MHz antenna at 100 scans per metre along the profile lines with 512 samples collected for each scan at 16-bit amplitude resolution. The GPR system was set to record a two-way travel time of 13 ns. Chainages along the profiles were logged by using a calibrated optical odometer connected to a survey wheel.

On site quality control of the data was achieved in real-time by viewing profiles during acquisition. The GPR data for this investigation was acquired using a GSSI SIR3000 GPR data collection system. Antennas of high frequency provide high-resolution data but only penetrate to shallow depths, whilst low-frequency antennas provide deeper penetration with decreased resolution. The depth of penetration achievable with an antenna of a particular frequency is also dependant on the local subsurface conditions. The 900 MHz antenna was found to provide the best combination of depth of penetration and resolution possible with a useful depth of penetration of approximately 0.7 m.

The profiles were recorded digitally for processing, analysis, and interpretation at our Sydney office. Data processing involved: static correction, to correct the signal to the surface; and background removal 2D filtering, to remove noise and hence enhance the returned signal.

The survey data trialled in the basement (see Figure 2 overleaf) was unsuccessful. Data showed significant reinforcement that obscured the tree roots below (see **Figure 3** overleaf) therefore the trial was abandoned.

Figure 2. Tree 1 visible next to the basement. The trial was conducted on the concrete ground slab and retaining wall.

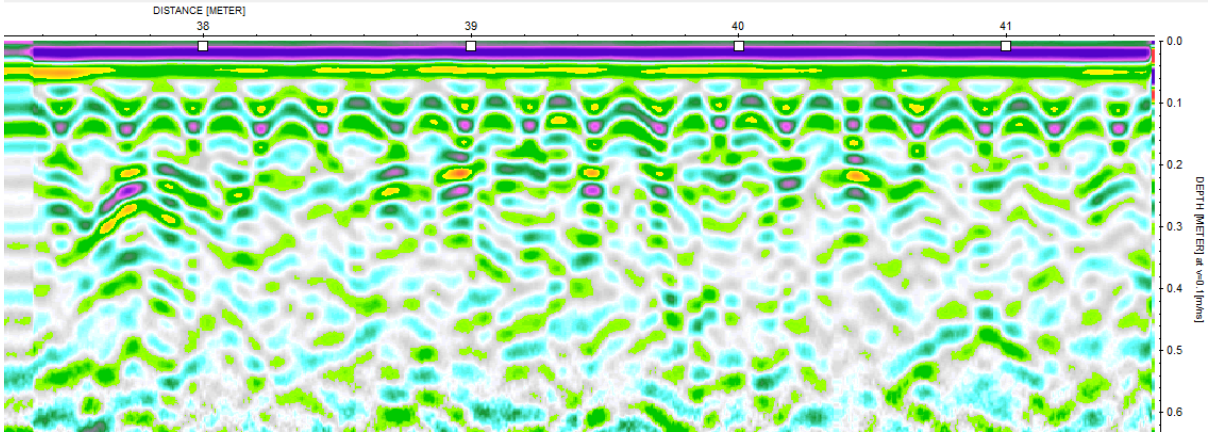

Figure 3: Reinforcement detail in the concrete obscuring tree root detail below.

4 GEOPHYSICAL DATA QUALITY AND PROCESSING

Data collected over the walkway was of good quality. The results were able to be imaged in 2D cross sections, and also 2D time slices. Data was processed by correcting the start time of the record, removing background noise, and modifying the files for time slice interpolation. The data was also processed by migrating the signal back to the source, and by running a subtracting average over 1 m lengths of the record. These various steps allowed the data to better show discrete tree root signals and reduce the effects of noise and construction and natural layering in the soil.

5 RESULTS AND INTERPRETATION

The results of the GPR investigation have been provided in the following drawing attached in Appendix A of this report:

- GBGA2437-01 – Tree Root Mapping
- GBGA2437-02 – Tree Root Mapping – Tree 1
- GBGA2437-03 – Tree Root Mapping – Tree 2

Survey lines are shown in green, and the interpreted tree root locations are shown in brown. Estimated depth to the top of the tree roots is shown next to the tree roots.

Interpreted roots have been mapped to the target Tree. These roots may emanate from the target tree, or possibly be roots from other trees near the survey area. Despite the analyst's best efforts in determining which root belongs to each tree, it must be noted that due to the nature of tree roots, it is not always possible to do so. It is not possible to gain information on the sizes (Diameters) of different tree roots. However, we know that the highest resolution system, 900MHz frequency, will not image targets less than 50 mm in diameter. As a result, only interpreted larger roots have been plotted. Depths to the identified tree roots in millimetres are shown alongside the plotted root in brown. Depths quoted in this investigation have been calculated using an un-calibrated radar wave velocity. The typical radar wave speed through the subsurface can vary considerably depending on the soil type, moisture content and various surface materials. As such without calibration, we would expect an accuracy of ± 20% of quoted depths.

6 CONCLUSIONS

A number of tree roots have been mapped. These appear to emanate from the respective target trees.

Should you have any questions about the report or the results, please contact the author of the report or Simon Williams (9890 2122).

For and on behalf of

GBG Australia

Benjamin Wilkins. BSc (Hons), MDiv.

Geophysicist

APPENDIX A. Tree Root Maps GBGA2437-01 to -03

ATHERDEN

KERB

KERB

+RL 13.03

+RL 12.94

8
DP 258

REA

+RL 24.81

GLOUCESTER WALK

EXISTING TREE

RL25.0

BOUNDARY

RL25.0

GLOUCESTER WALK

EXISTING TREE

RL25.0

RL24.5

NOTES:

RADAR LINE LOCATIONS

INTERPRETED TREE ROOT

300 ESTIMATED TREE ROOT DEPTH

CLIENT: RICHARD CROOKES CONSTRUCTIONS	DATE: 7 APR 2021	DATUM: N/A	
TITLE: TREE ROOT MAPPING AT SIRIUS BUILDING, THE ROCKS NSW	SCALE: 1:125 @ A3	DRAWN: B.W.	
	DRG No: GBGA2437-01	REV: DRAFT	

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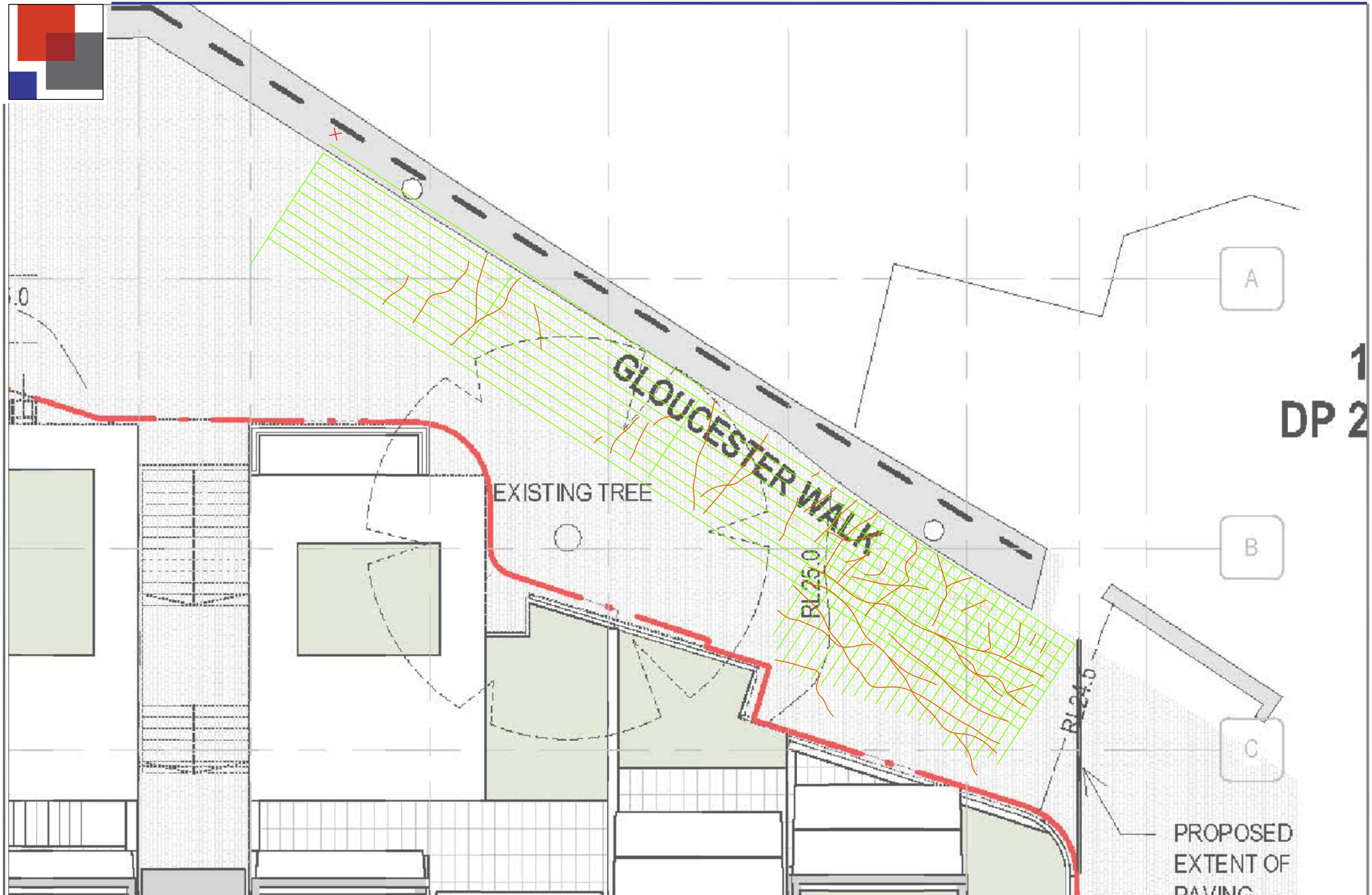

NOTES:

RADAR LINE LOCATIONS

INTERPRETED TREE ROOT

300 ESTIMATED TREE ROOT DEPTH

CLIENT: RICHARD CROOKES CONSTRUCTIONS	DATE: 7 APR 2021	DATUM: N/A
TITLE: TREE ROOT MAPPING AT SIRIUS BUILDING, THE ROCKS NSW	SCALE: 1:75 @ A3	DRAWN: B.W.
	DRG No: GBGA2437-02	REV: DRAFT

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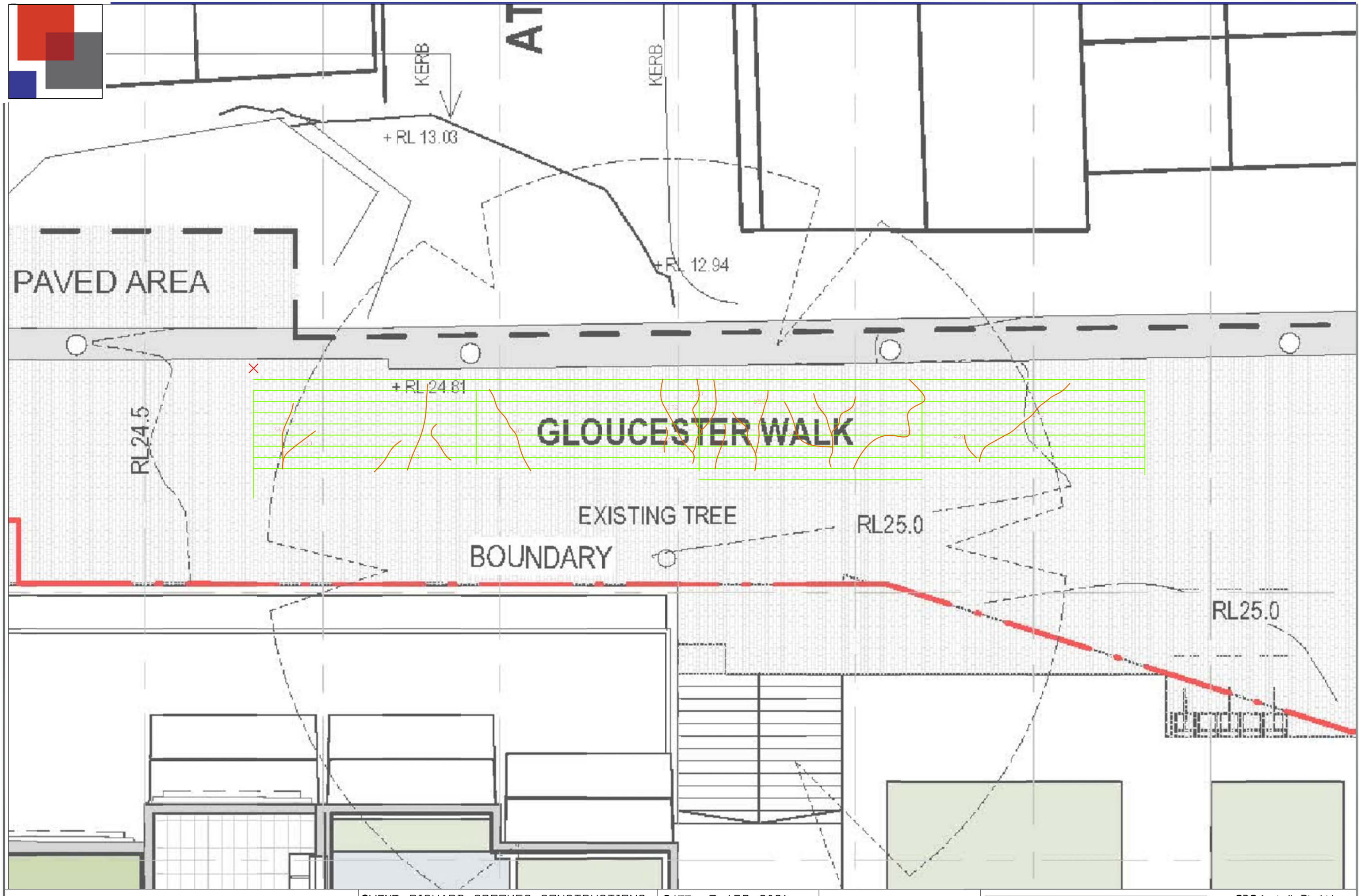

NOTES:

RADAR LINE LOCATIONS

INTERPRETED TREE ROOT

300 ESTIMATED TREE ROOT DEPTH

CLIENT: RICHARD CROOKES CONSTRUCTIONS	DATE: 7 APR 2021	DATUM: N/A	
TITLE: TREE ROOT MAPPING AT SIRIUS BUILDING, THE ROCKS NSW	SCALE: 1:75 @ A3	DRAWN: B.W.	
	DRG No: GBGA2437-03	REV: DRAFT	

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