# SafeGrid™ Tutorial

## Lightning Protection Module

26/10/2020

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# Introduction

The Lightning Protection Module in SafeGrid™ allows the user to overlay lightning protection systems (LPS) such as lightning masts and earth wires over a PDF schematic. Using the Rolling Sphere Method (RSM), the Lightning Protection Module calculates the area protected by the masts and wires based on factors such as mast height, placement and the protection level used which determines the sphere radius. To access this module, open the SafeGrid™ Earthing Software and select the **Add-ons** tab. Then, select the **Lightning Protection Module**.

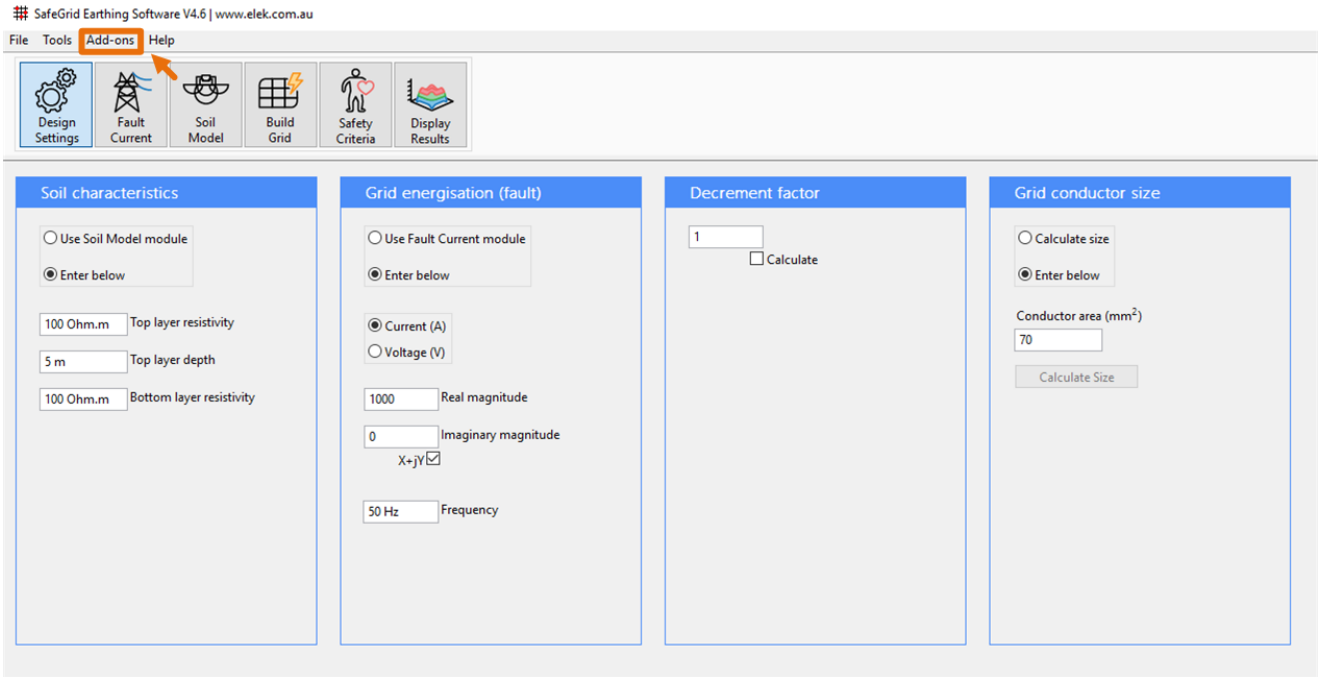


Figure 1 – Add-ons module

# Load a New Background

① Once the module has appeared, you can upload a PDF drawing by clicking on the **Load new** button. Figure 2 demonstrates this functionality using a 220 kV switchyard schematic as an example.

② The Lightning Protection Module provides the option of selecting your desired Protection Level (PL) ranging from level 1 (20 m) to level 4 (60 m). A custom rolling sphere radius can also be entered under the **User defined** option in the **Radius, R(m)** dropdown box. It is common to consider that PL III using a sphere radius of 45 m provides ‘standard’ protection [1]. PL I and II with a sphere radius of 20 m and 30 m provides higher degrees of protection and therefore these protection levels will require a considerably greater number of air terminals.

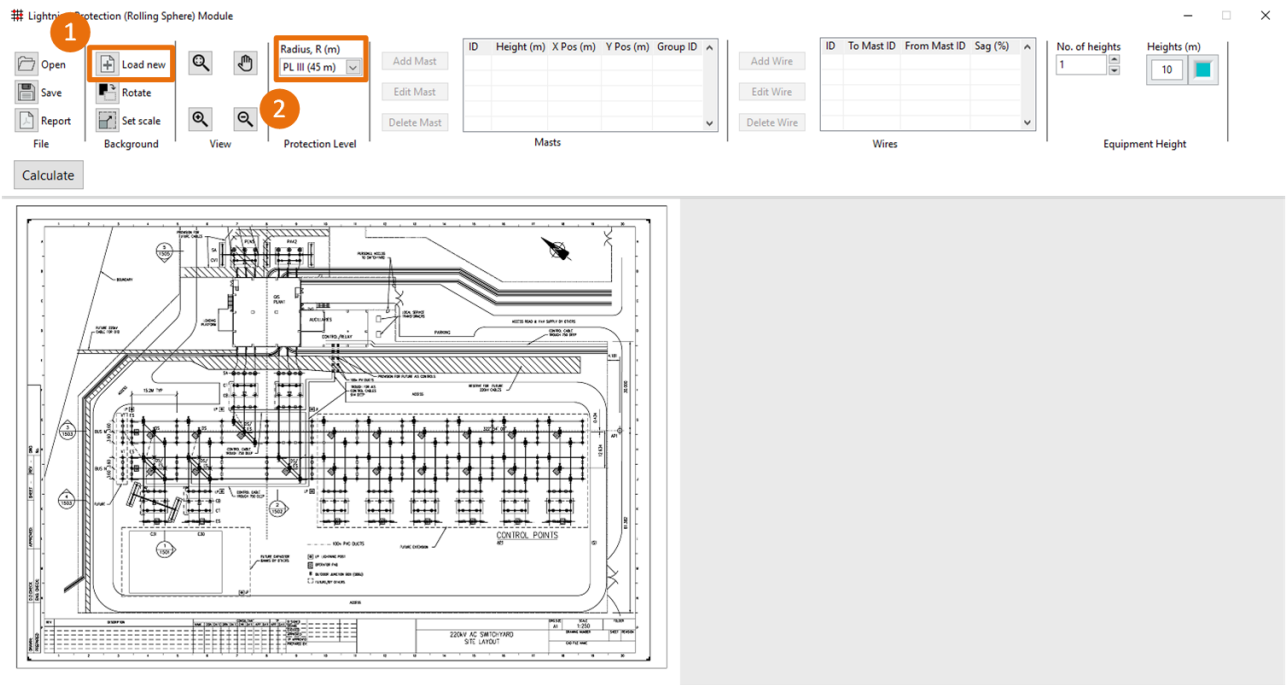


Figure 2 – Loaded background with a PDF schematic

# Set Height of Equipment

When considering your zones of protection, it is necessary to establish the maximum height of the equipment being protected by the LPS. In Figure 3, the substation layout drawing below the maximum equipment height for the protected zone has been established within the red boxes. Figure 4 provides a side view dimension that displays the height of lightning masts.

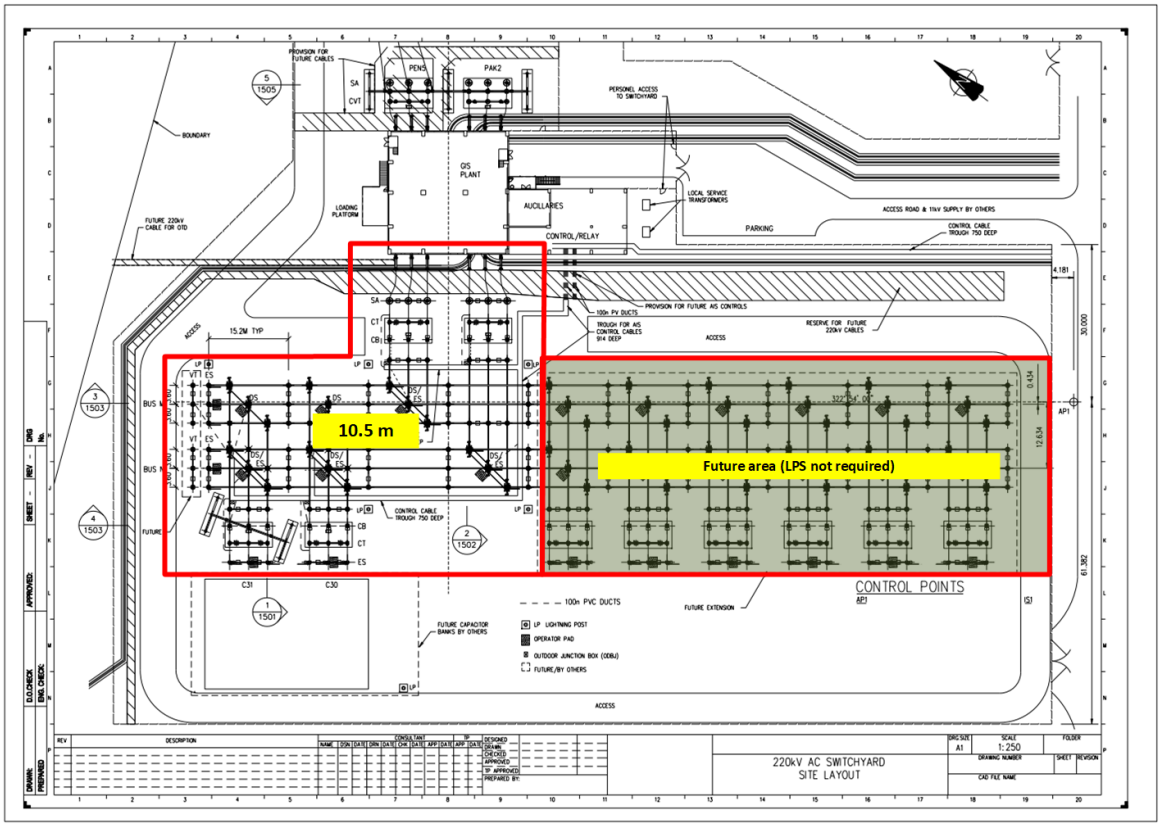


Figure 3 – Overall heights of equipment to be protected

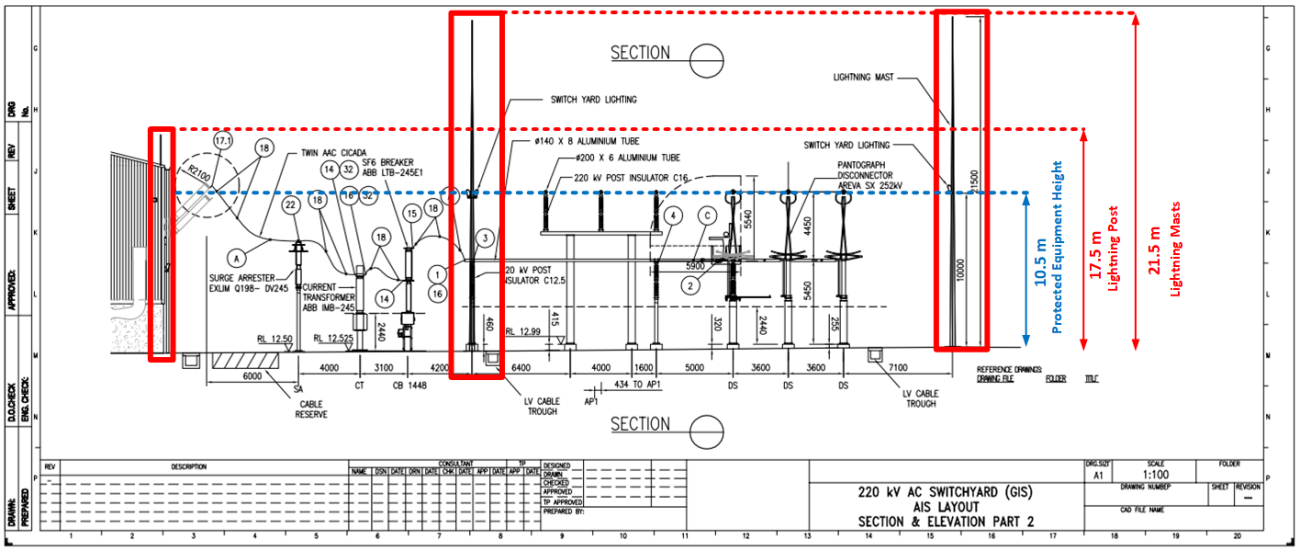


Figure 4 – Critical height of equipment to be protected

From Figure 5, the heights of the equipment can be input into the top right-hand corner of the Lightning Protection Module in SafeGrid™.

③ You can select the number of equipment heights by clicking on the up and down arrow keys.

④ Each equipment height is input in metres. For the 220 kV substation example, an equipment height of 10.5 m is given.

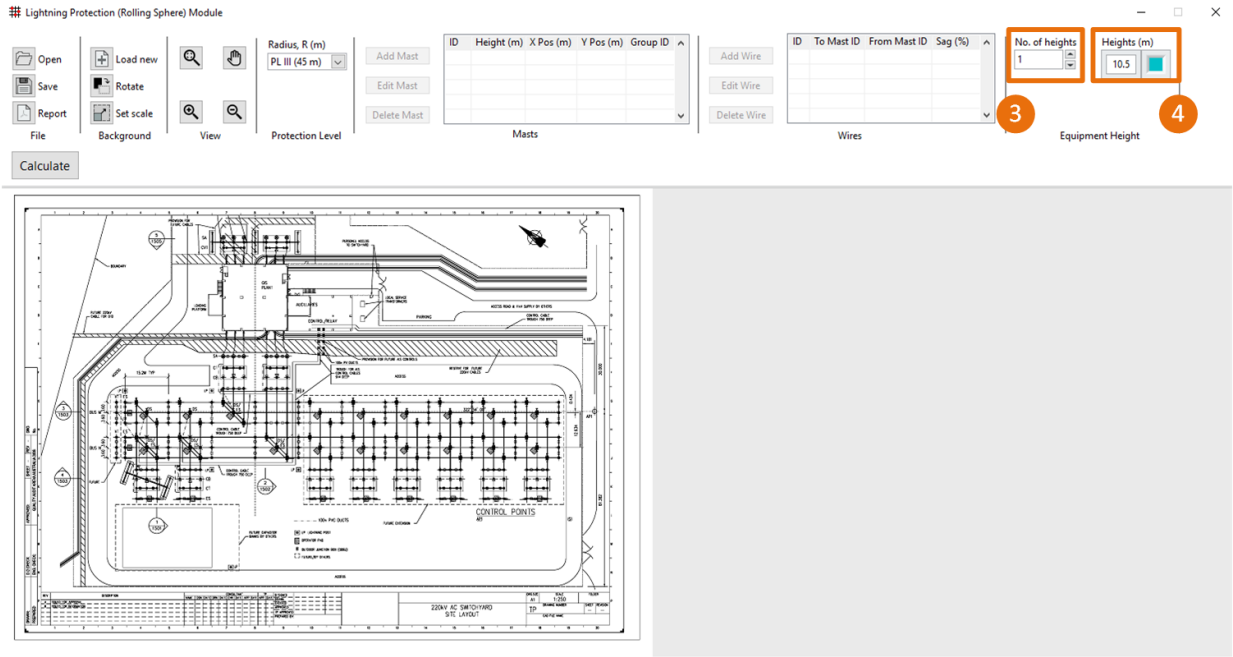


Figure 5 – Inputting equipment heights

# Define Masts and Set Positions

In Figure 6, the purple boxes represent the positions for the lightning protection systems, i.e. lightning posts (LP). Select the protection level you wish to use to cover your structure; in the case of the substation, a protection level of 2 is selected. Then, click the **Add Mast** button as per Figure 7. This will bring up a small window where you can define the air terminal height and structure height.

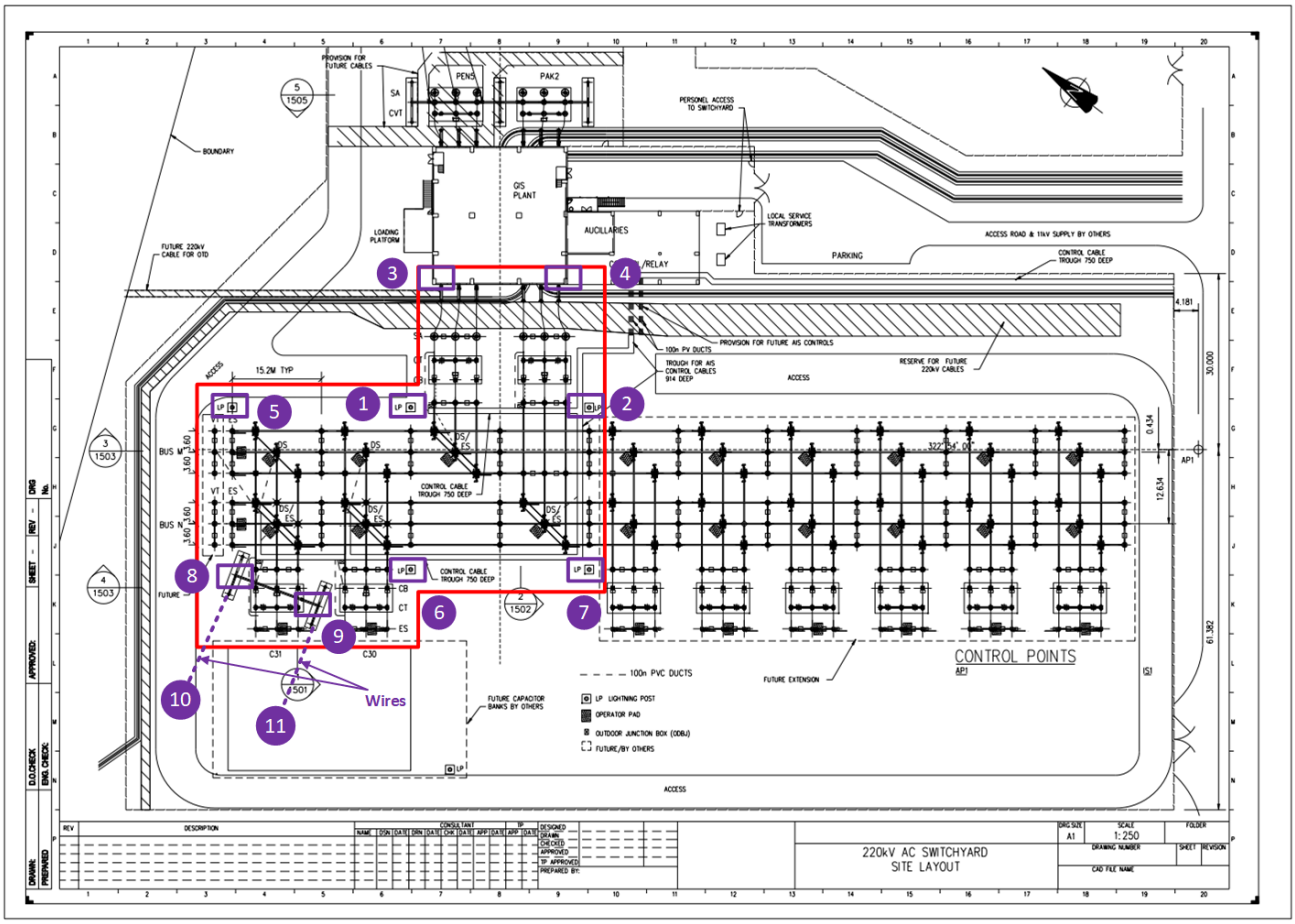


Figure 6 – Lightning masts at various positions

Each mast can be selected by clicking with the left mouse button and the masts can be moved into position using the mouse. For the substation example, the wires and masts used are listed in Table 1.

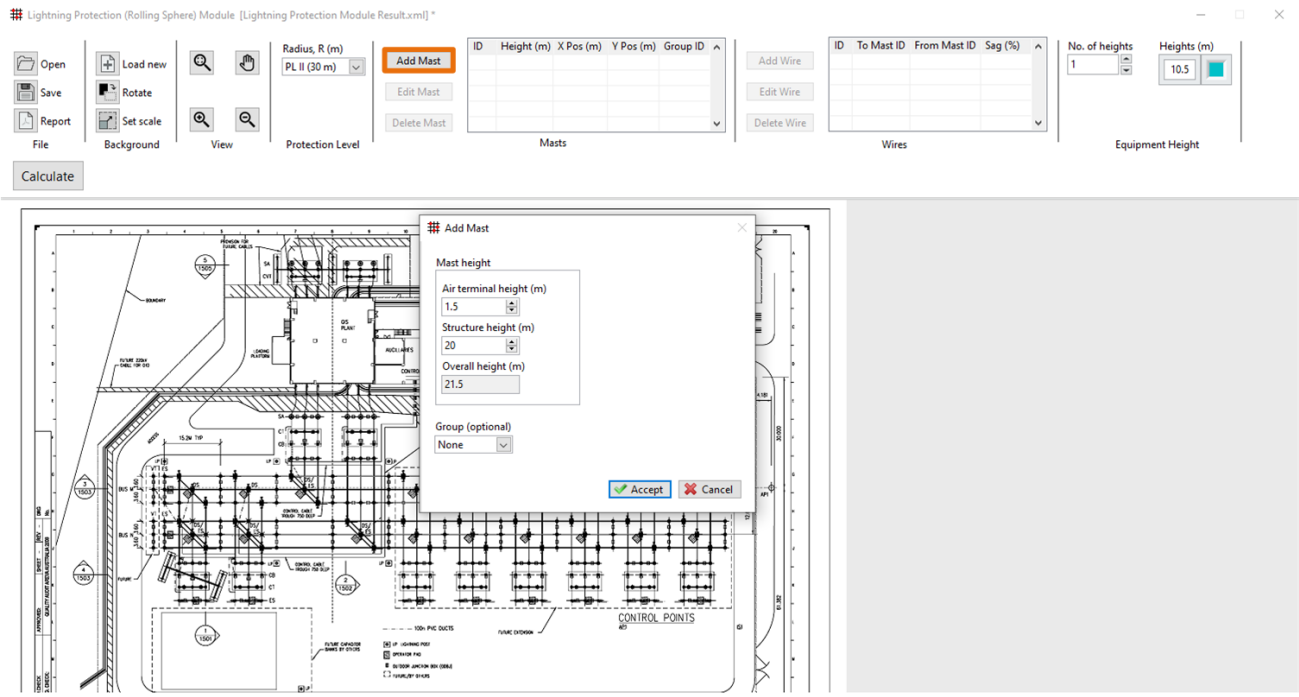


Figure 7 – Adding a mast

| ID | Overall Height (m) | Air Terminal Height (m) | Structure Height (m) | Description |
|---|---|---|---|---|
| 1 | 21.5 | 1.5 | 20 | Lightning mast |
| 2 | 21.5 | 1.5 | 20 | Lightning mast |
| 3 | 17.5 | 1.5 | 16 | Lightning post (Building mounted) |
| 4 | 17.5 | 1.5 | 16 | Lightning post (Building mounted) |
| 5 | 21.5 | 1.5 | 20 | Lightning mast |
| 6 | 21.5 | 1.5 | 20 | Lightning mast |
| 7 | 21.5 | 1.5 | 20 | Lightning mast |
| 8 | 20 | 0 | 20 | Lightning post (Gantry) |
| 9 | 20 | 0 | 20 | Lightning post (Gantry) |
| 10 | 20 | 0 | 20 | Earthing wire |
| 11 | 20 | 0 | 20 | Earthing wire |

Table 1 – Mast and wire data

# Calculating Protected Area

Once all masts have been positioned and defined, the **Calculate** button will compute the area protected by the masts based on the RSM. This is showcased in Figure 8 with the blue area indicating the area protected against lightning strikes. To extend the area of protection, earth wires can be added by selecting the **Add Wire** button where you can choose the wire's origin and destination based on the lightning mast numbers. When pressing the **Edit Wire** button, you can also define the percentage of sag for the wire. To save the overlay results, click the **Save** button. This will save the results as an XML file.

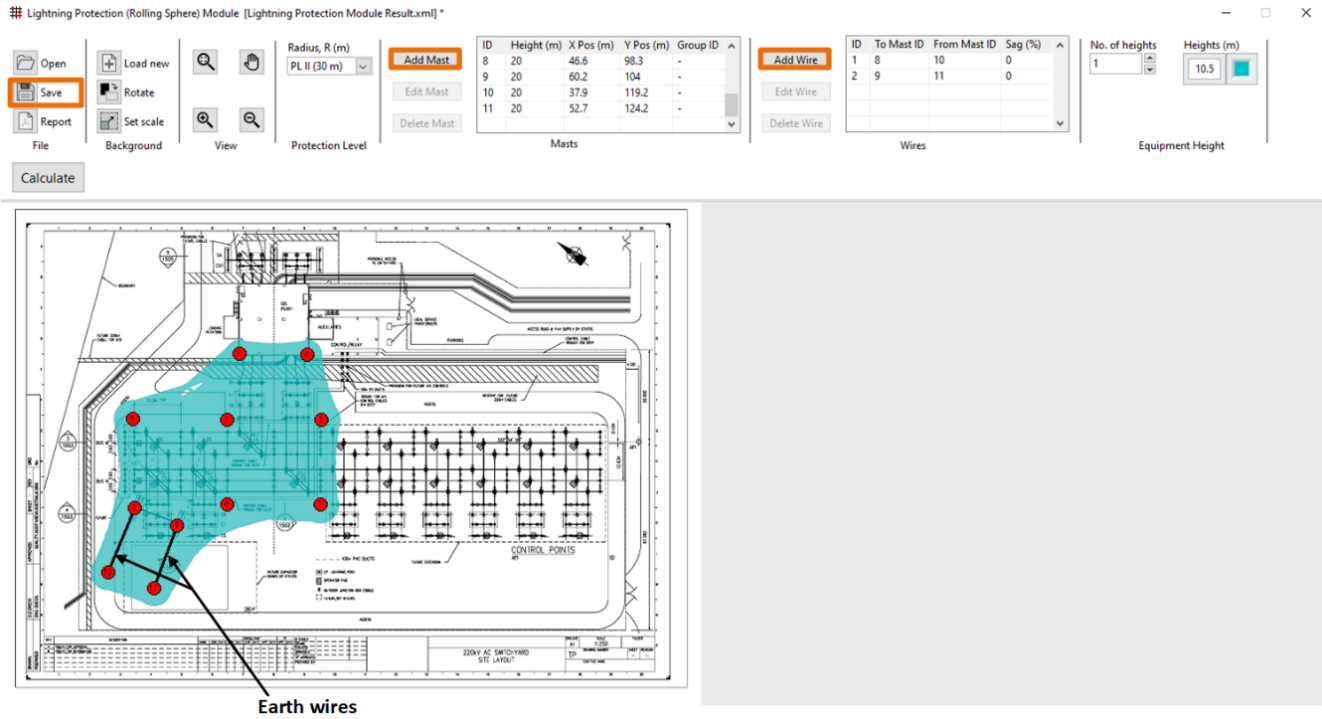


Figure 8 – Calculated results

# Report and Mast List

After calculating the area of protection, you can generate a report by clicking the **Report** button in the top left-hand corner. This will produce an image of the schematic including your overlay and equipment height. The second page will produce the lightning mast data displaying the heights and positions. Wire data will also be displayed showing the origin and destination of the wire including sag percentage.

# References

[1] AS/NZS 1768, Lightning Protection.

[2] IEC 62305, Protection Against Lightning.