Supporting Document 6

Solar Exposure Assessment

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WM Canada

Watford, Ontario

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Prepared by:

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REPORT

WASTE MANAGEMENT TCEC

SOLAR EXPOSURE ASSESSMENT

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PROJECT #2509597

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI AIR Inc. (RWDI) was retained to investigate the impact of the potential reduction in solar insolation from the proposed vertical landfill optimization at the Waste Management of Canada Corporation (WM) Twin Creeks Environmental Centre (TCEC) in Watford, ON (the Project). Two configurations were analyzed and compared: the currently approved Expansion Landfill and WM's Preferred Alternative (Alternative Method 2).

Impact on Solar Energy Access

As would be expected for any large obstruction, both configurations were predicted to cause shadows on the areas immediately around them at specific times and dates. However, when the two configurations are compared, the simulations predicted only a very small difference in the impact of those shadows.

The total solar energy received over the entire envelope of the greenhouses immediately east of the site (Phase 1-4) was predicted to be at most 0.09% lower under the Preferred Alternative (Alternative Method 2) compared to the approved Expansion Landfill during the colder months. During the summer months, the higher solar angles and generally stronger sunlight, resulted in differences in monthly solar energy of less than 0.03% between the two configurations.

The greenhouses further south (Phase 5-8) were predicted to be even less impacted due to their increased distance from the Project. The maximum difference in available solar energy on the envelope of these greenhouses did not exceed 0.04% in any month.

The areas where the reduction in solar energy were predicted were isolated to the west elevations of the greenhouses. Indicating any impact is limited to the evening when the sun is low in the western sky.

No reductions in solar energy greater than 1% were predicted at grade at any location beyond approximately 250m west of the Project.

TABLE OF CONTENTS

INTRODUCTION

This report provides computer modeling analysis results and commentary of the potential impact of the shadowing from the proposed vertical landfill optimization at the Waste Management of Canada Corporation (WM) Twin Creeks Environmental Centre (TCEC) in Watford, ON (the Project).

The Project is located near the intersection of Nauvoo Road and Zion Line (as shown in Figure 1) and simulations were conducted to quantify the potential reduction in solar energy (i.e., solar insolation) reaching the ground in the area around the landfill as well as the existing and potential future greenhouses immediately east of the Project due to the proposed vertical expansion of the landfill.

This analysis was conducted for both the currently approved Expansion Landfill (the "baseline" configuration), as well as WM's Preferred Alternative (Alternative Method 2) layout (the "preferred" configuration).

Graphical and tabular results are presented for both configurations, as well as the net change between the two configurations.

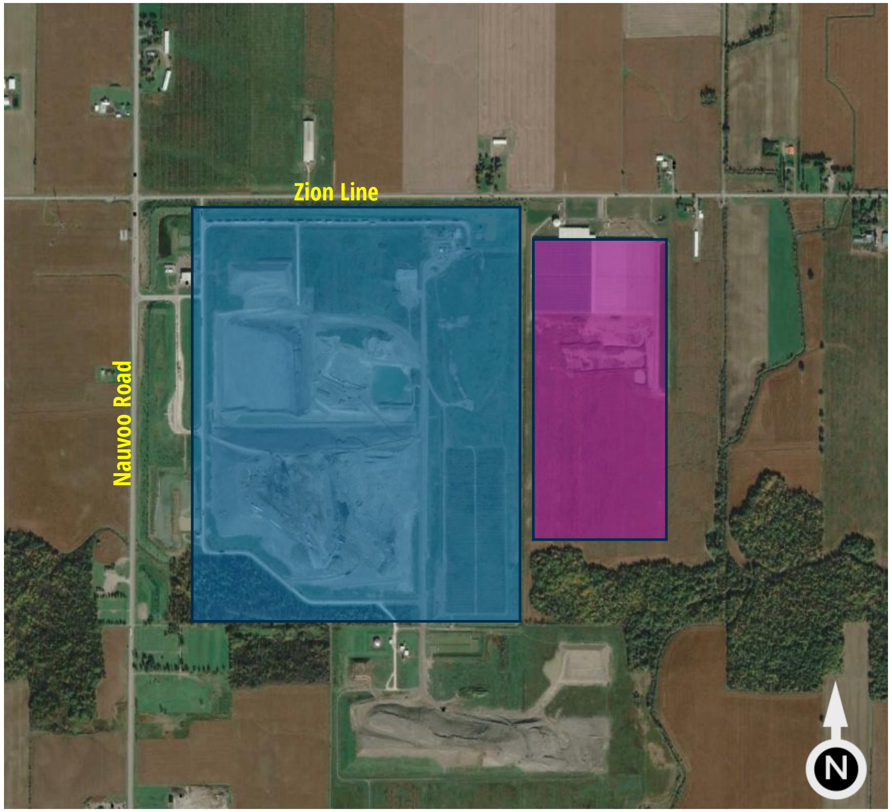

Figure 1: Approximate Location of the TCEC Landfill Expansion (Blue) and the Phase 1 through 8 Greenhouses (Magenta) (Map Credit: Google Earth)

Methodology

RWDI assessed the potential for reflection and shadow impacts using RWDI's in-house proprietary *Eclipse* software, as per the steps outlined below:

- The assessment began with the development of a 3D model of the area of interest (as shown in Figure 2). This was then subdivided into many smaller triangular patches (see Figure 3).
- At 10-minute increments over the five-year study period discussed on the following page, the expected solar position was determined, and "virtual rays" were drawn from the sun to each triangular patch of the 3D model based on the Project's longitude, latitude and elevation using standard equations.
- Any patch whose ray was intercepted by the mound, or existing or future buildings was assumed to be in shadow at that point in time. Diffuse energy from the sky was estimated based on the model of Perez[1] allowing the total solar energy received at the patch to be calculated.
- This process was repeated for every time step in the climate record to provide an estimation of the total solar energy received over the entire 5-year period under each configuration.

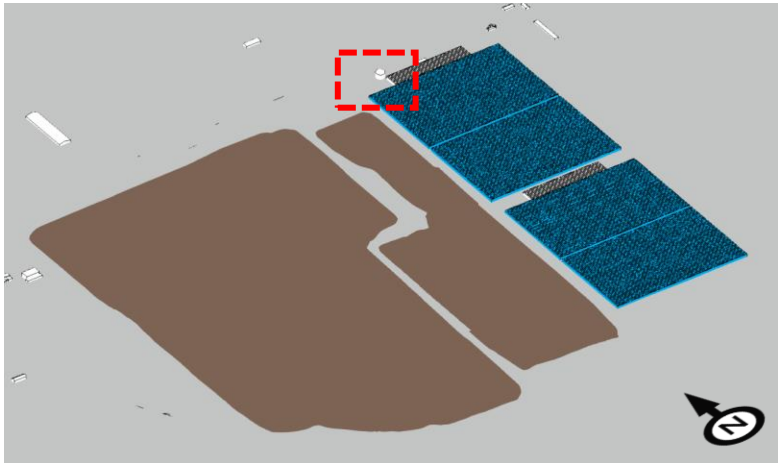

Figure 2: 3D Computer Model of the Proposed Development and Surrounding Context

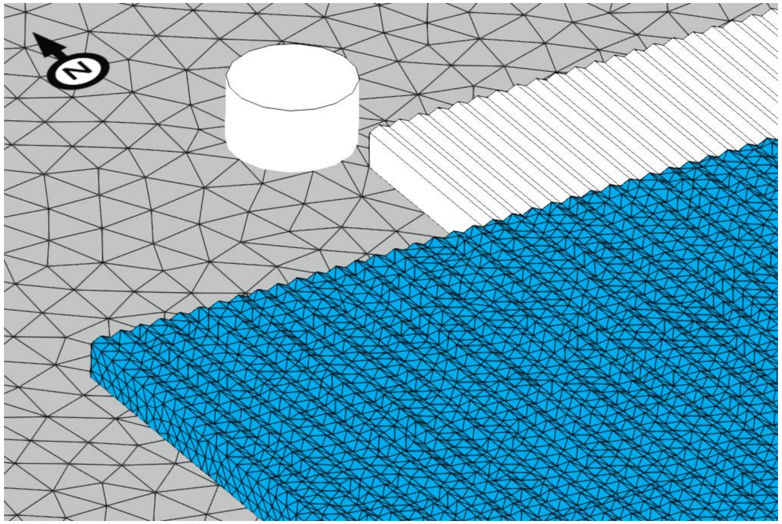

Figure 3: Close-up View of the Model, Showing Surface Subdivisions

1. Perez, R., Ineichen, P., Seals, R., Michalsky, J., & Stewart, R. (1990). Modeling daylight availability and irradiance components from direct and global irradiance. Solar energy, 44(5), 271-289.

Assumptions and Limitations

Meteorological Data

This analysis used data from the National Solar Radiation Database (NSRDB) measured at the location of the Project between 2019 and 2023 (inclusive). This database is managed by the United States National Renewable Energy Laboratory (NREL) and is a complete collection of solar radiation inputs, including the effects of cloud cover and other atmospheric properties measured at 10-minute increments.

Radiation Model

RWDI's analysis is only applicable to solar radiation falling on the greenhouses and surrounding agricultural lands. It did not consider the impact of the expansion related to any other forms of radiation, such as cellular telephone signals, RADAR arrays, etc.

Study Building and Surrounds Models

Based on the Development & Operations Report prepared by Henderson, Paddon & Associates Limited (dated March 2008) and the Conceptual Design Report prepared by WSP (dated June 19, 2024), a three-dimensional computer model of the TCEC buildings and the two landfill configurations were created by RWDI to represent the "baseline" and "preferred" configurations, respectively.

The ground surface and the surrounding buildings were topographically corrected based on a high-resolution LiDAR survey conducted by Natural Resources Canada in 2022[2].

The greenhouses were modelled as if they all are fully constructed as indicated in the drawing file "2016-627 Twin Creeks Greenhouse DET.pdf", meaning both the existing Phase 1-4 and future Phase 5-8 buildings were included.

Potential reductions of solar energy due to vegetation or other non-architectural obstructions were not included, nor are reflections.

Applicability of Results

The results presented in this report are highly dependent on the form of the proposed landfill expansion. Should there be any significant changes to the design, it is recommended that RWDI be contacted and requested to review their potential effects on the findings of this report.

2. https://open.canada.ca/data/en/dataset/7069387e-9986-4297-9f55-0288e9676947

Presentation of Results

This section presents the comparison of the solar exposure assessment of each of the two landfill configurations on the adjacent greenhouses and surrounding land. The following plots are presented:

Percentage Loss in Solar Insolation

Figures 4a to 4c graphically depict the average *reduction* in annual solar insolation on each subsurface on the greenhouse envelopes and at grade respectively. The results are presented as a percentage change between the preferred and baseline configurations.

Average Cumulative Insolation

To provide further detail, Figures 5a to 5b present the magnitudes of the average monthly solar insolation over the Phase 1-4 and Phase 5-8 greenhouses, respectively. These plots show for each month the average total amount of solar energy received across the entire building envelope under each of the configurations. The numbers above the bars indicates the percent difference between the two configurations.

Average Annual Percentage Loss of Solar Insolation Between Baseline and Preferred – Greenhouse Phase 1-4

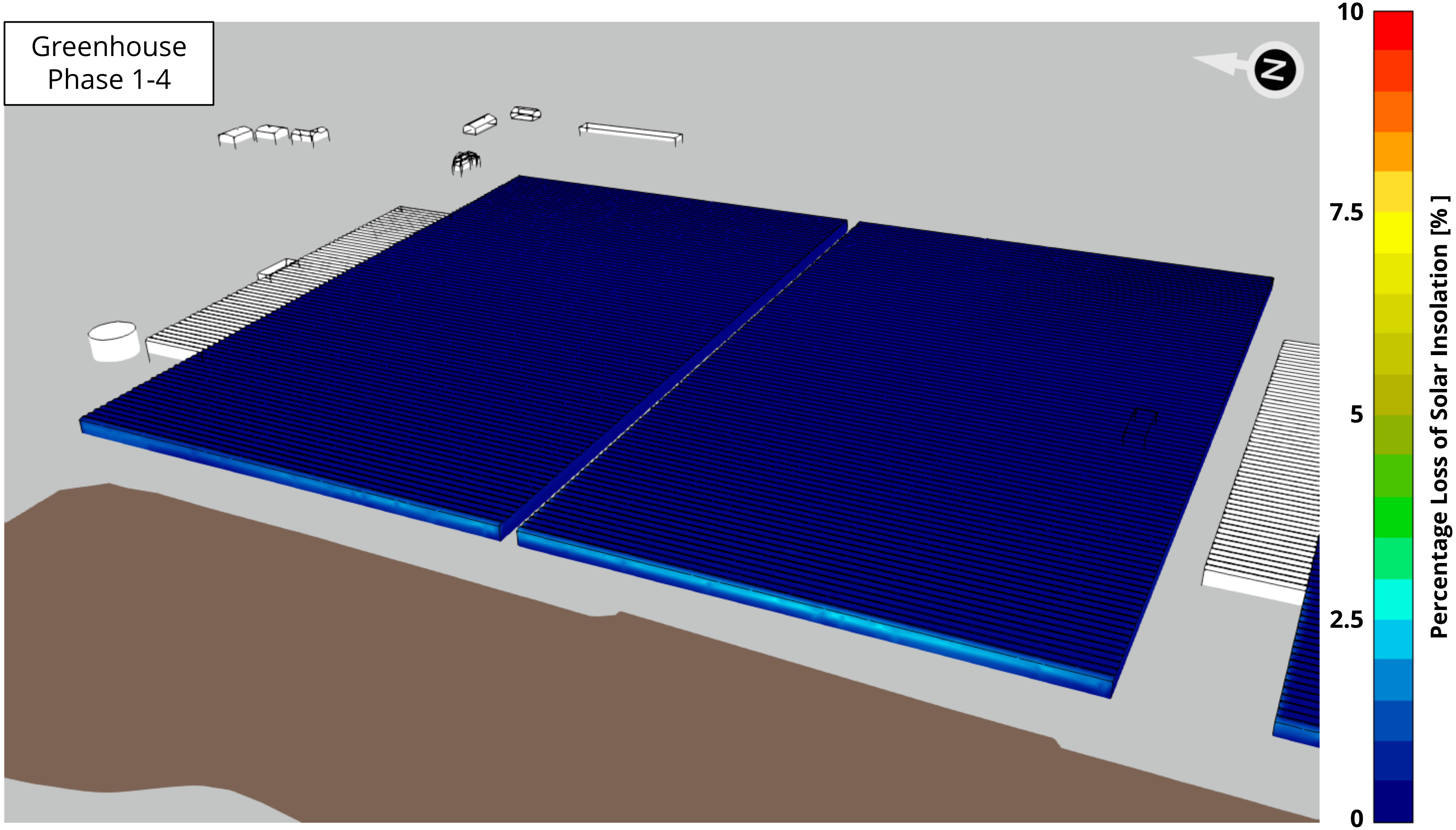

Figure 4a: Average Annual Percentage Loss of Solar Insolation Between Baseline and Preferred – Greenhouse Phases 1-4

Average Annual Percentage Loss of Solar Insolation Between Baseline and Preferred – Greenhouse Phase 5-8

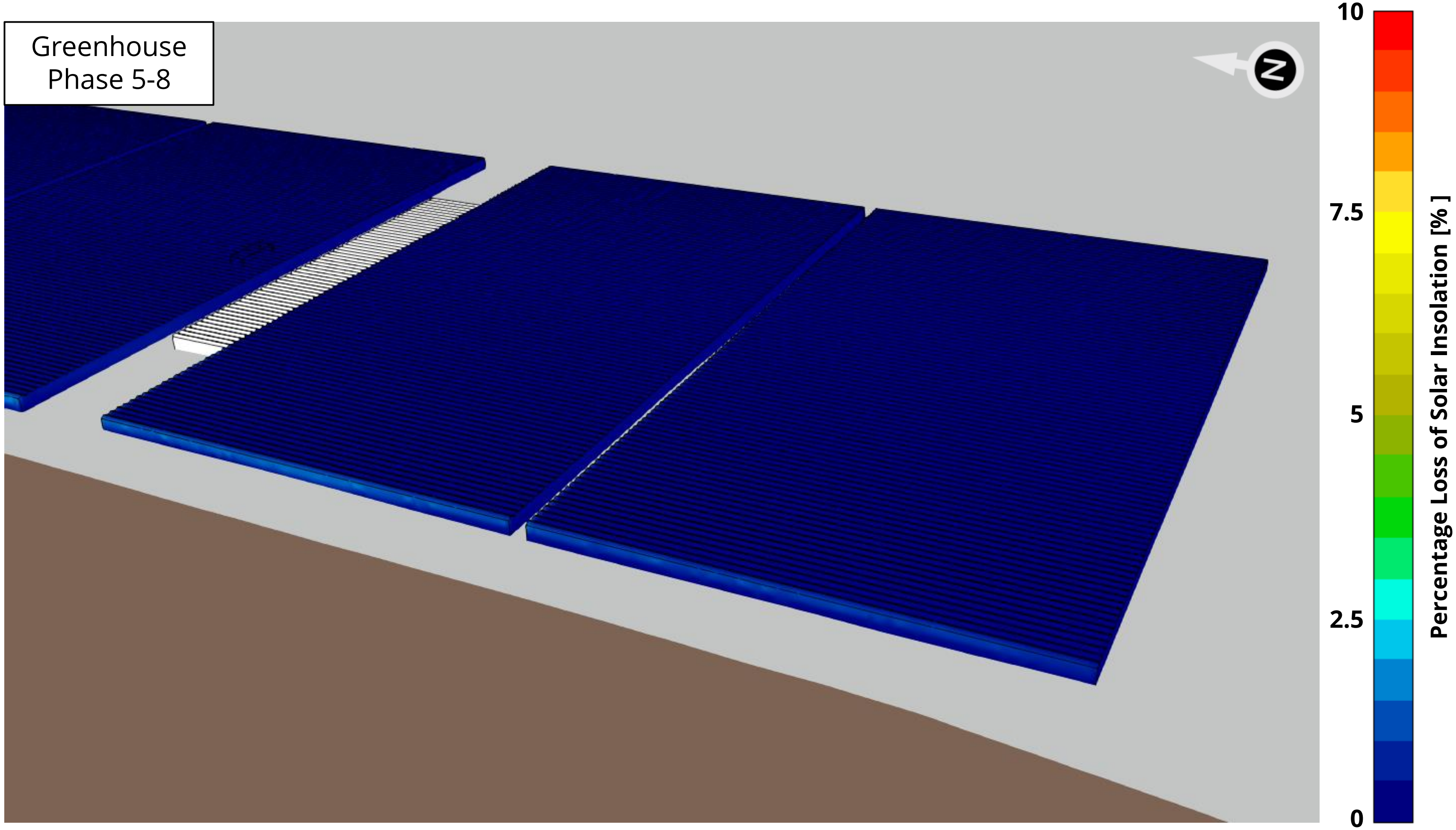

Figure 4b: Average Annual Percentage Loss of Solar Insolation Between Baseline and Preferred – Greenhouse Phases 5-8

Average Annual Percentage Loss of Solar Insolation Between Baseline and Preferred – Grade

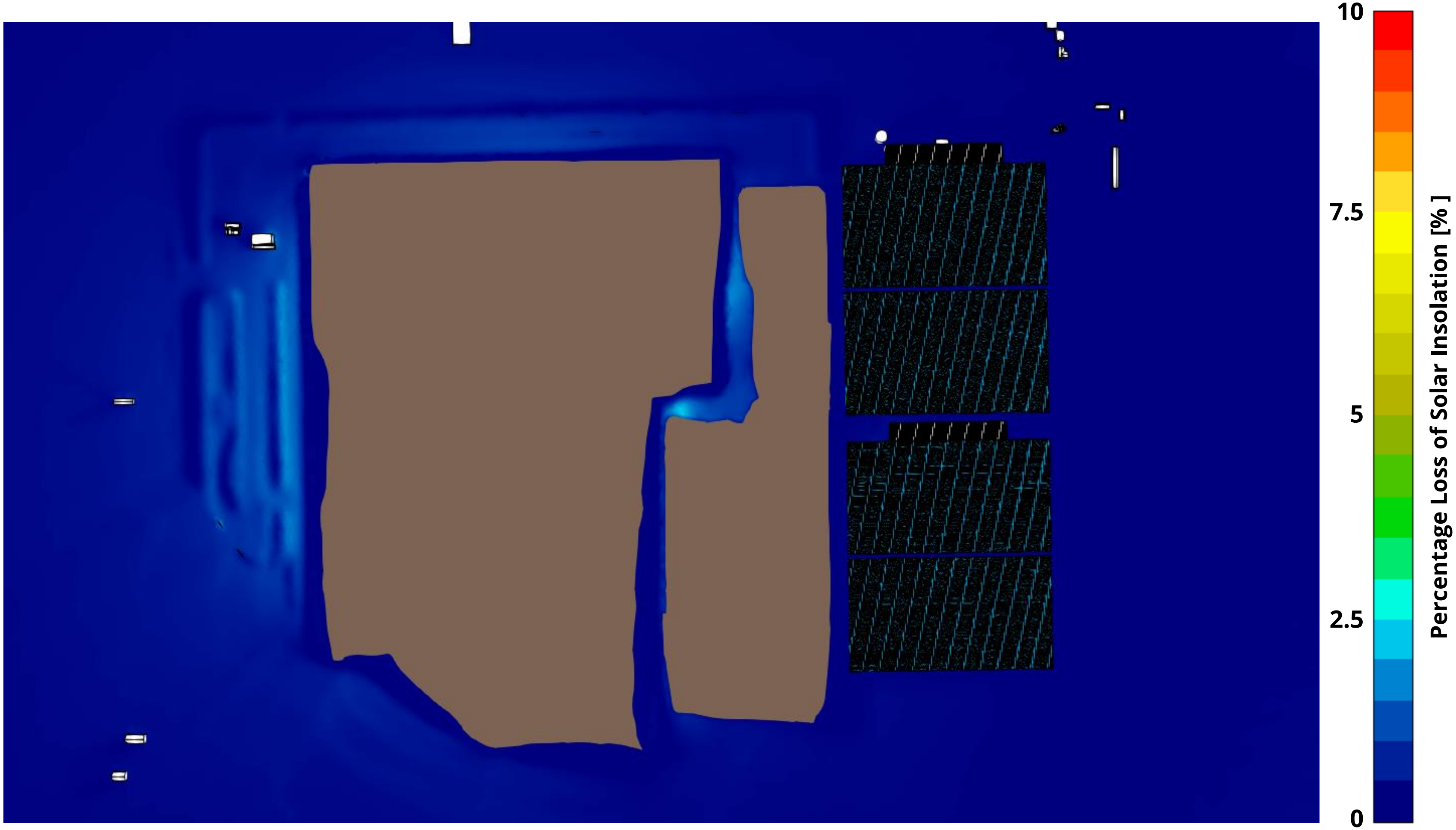

Figure 4c: Average Annual Percentage Loss of Solar Insolation Between Baseline and Preferred – Grade

Average Monthly Cumulative Insolation [MWh] – Greenhouse Phase 1-4

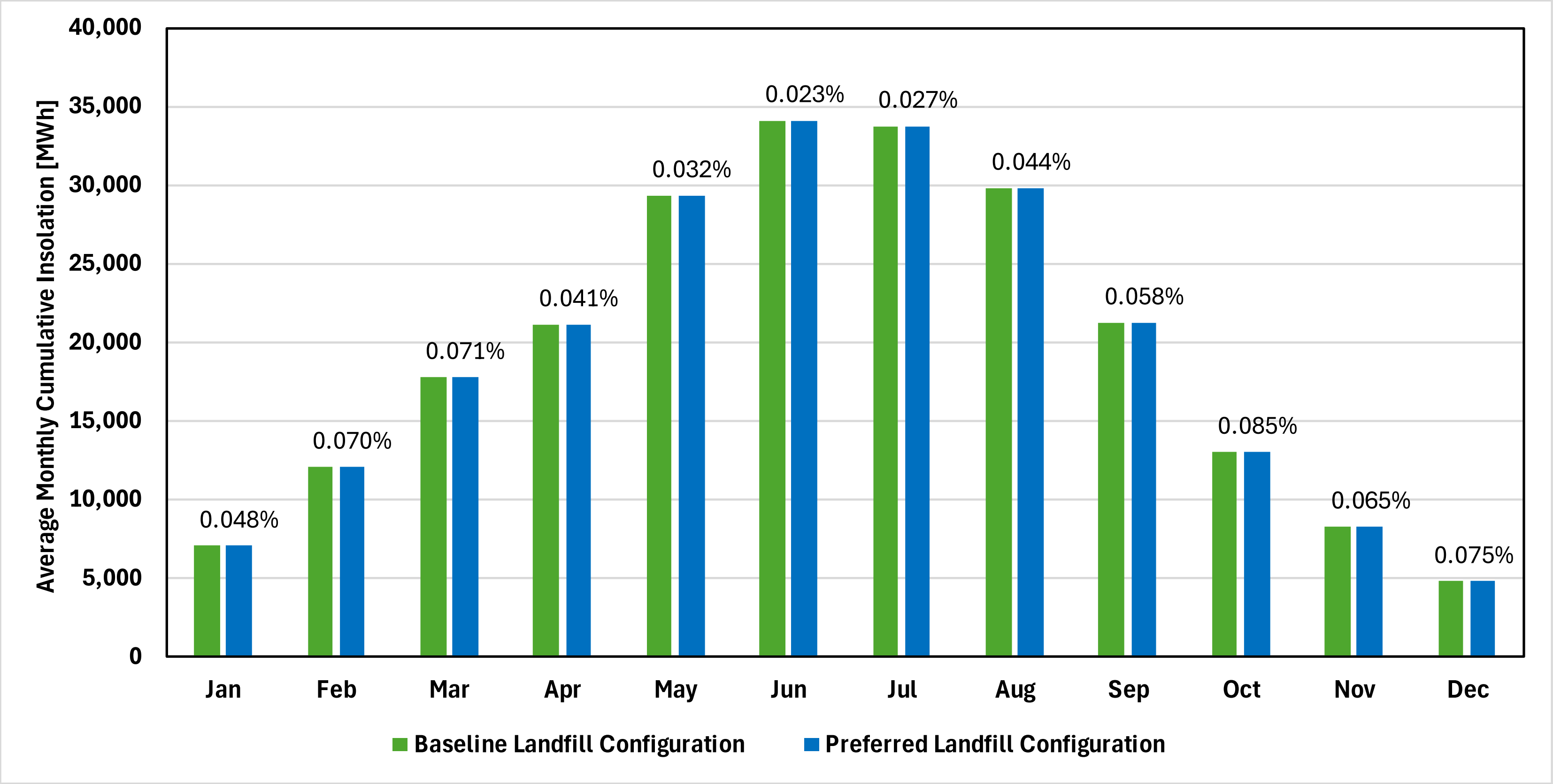

Figure 5a: Average Monthly Cumulative Insolation [MWh] & % Difference on Greenhouse Phase 1-4 Envelope

Average Monthly Cumulative Insolation [MWh] – Greenhouse Phase 5-8

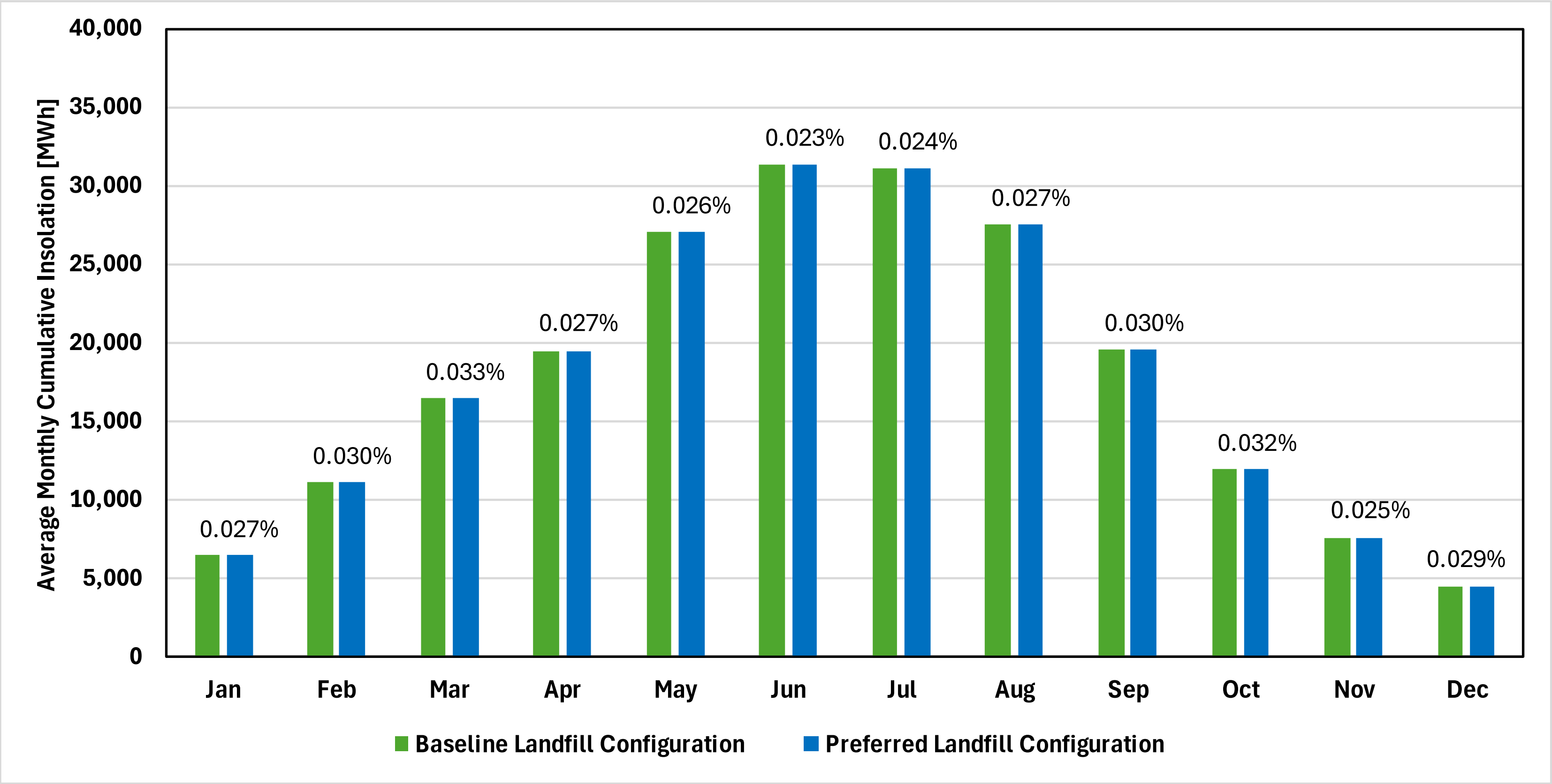

Figure 5b: Average Monthly Cumulative Insolation [MWh] & % Difference on Greenhouse Phase 5-8 Envelope

OBSERVATIONS AND CONCLUSIONS

1. Based on the simulations, it is likely that any impacts due to the preferred layout (Alternative Method 2) would be limited to the evening hours during the winter months and mainly on the western ends of the Phase 1-4, and to a lessor extent, the Phase 5-8 greenhouses.

Greenhouses

2. Compared to the baseline configuration (the currently Approved Expansion Landfill), the preferred (Alternative Method 2) configuration's primary impact was predicted to be limited to the western elevation of the existing and future greenhouses.
3. On average, *localized* energy losses on this elevation ranged between 2% and 3% at most on an annual basis as seen in Figures 4a and 4b. This was predicted to vary month to month, but all *localized* reductions were predicted to be under 7%, with the impacts on the Phase 5-8 greenhouses generally predicted to be approximately half of those at the Phase 1-4 buildings. These monthly results can be found in Appendix A.
4. However, because these *localized* impacts are limited to a small portion of the western elevation, the *total* energy loss across the entire envelope of each group of greenhouses was predicted to be less than 0.09% during all months. This is shown in Figures 5a and 5b, which compare the difference in *total* energy received by the entire envelopes of the Phase 1-4 and Phase 5-8 greenhouses, respectively.

Surrounding Ground

5. No reductions in solar energy greater than 1% were predicted at grade at any location beyond approximately 250m west of the Project.

GENERAL STATEMENT OF LIMITATIONS

This report entitled “Waste Management TCEC – Solar Exposure Assessment” dated September 19, 2025, was prepared by RWDI AIR Inc. (“RWDI”) for HDR Corporation (“Client”). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein (“Project”). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared.

Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

APPENDIX A

MONTHLY PERCENTAGE LOSS OF SOLAR INSOLATION

Local Percentage Loss of Solar Insolation – January

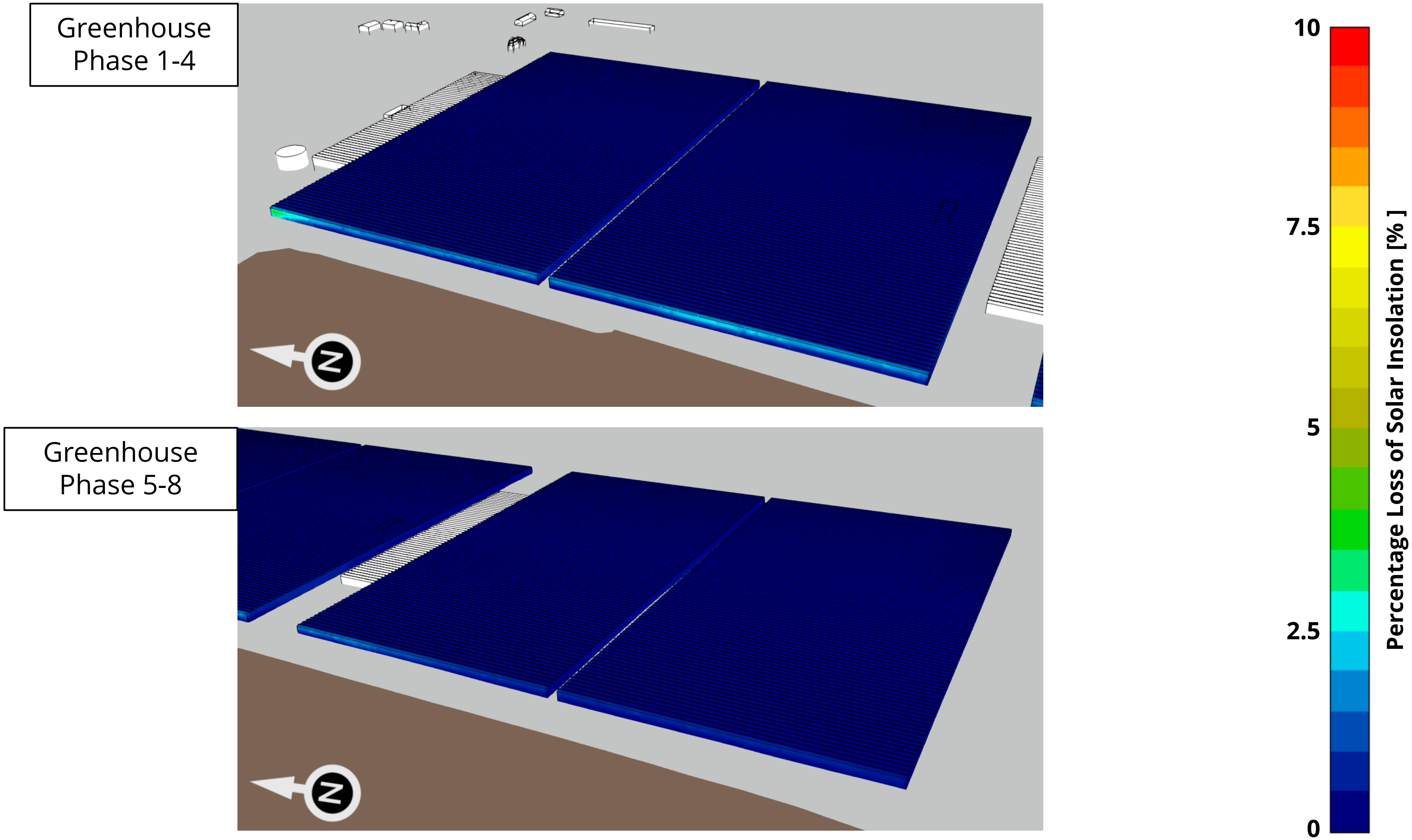

Figure A1: Percentage Loss of Solar Insolation for the Month of January– Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – February

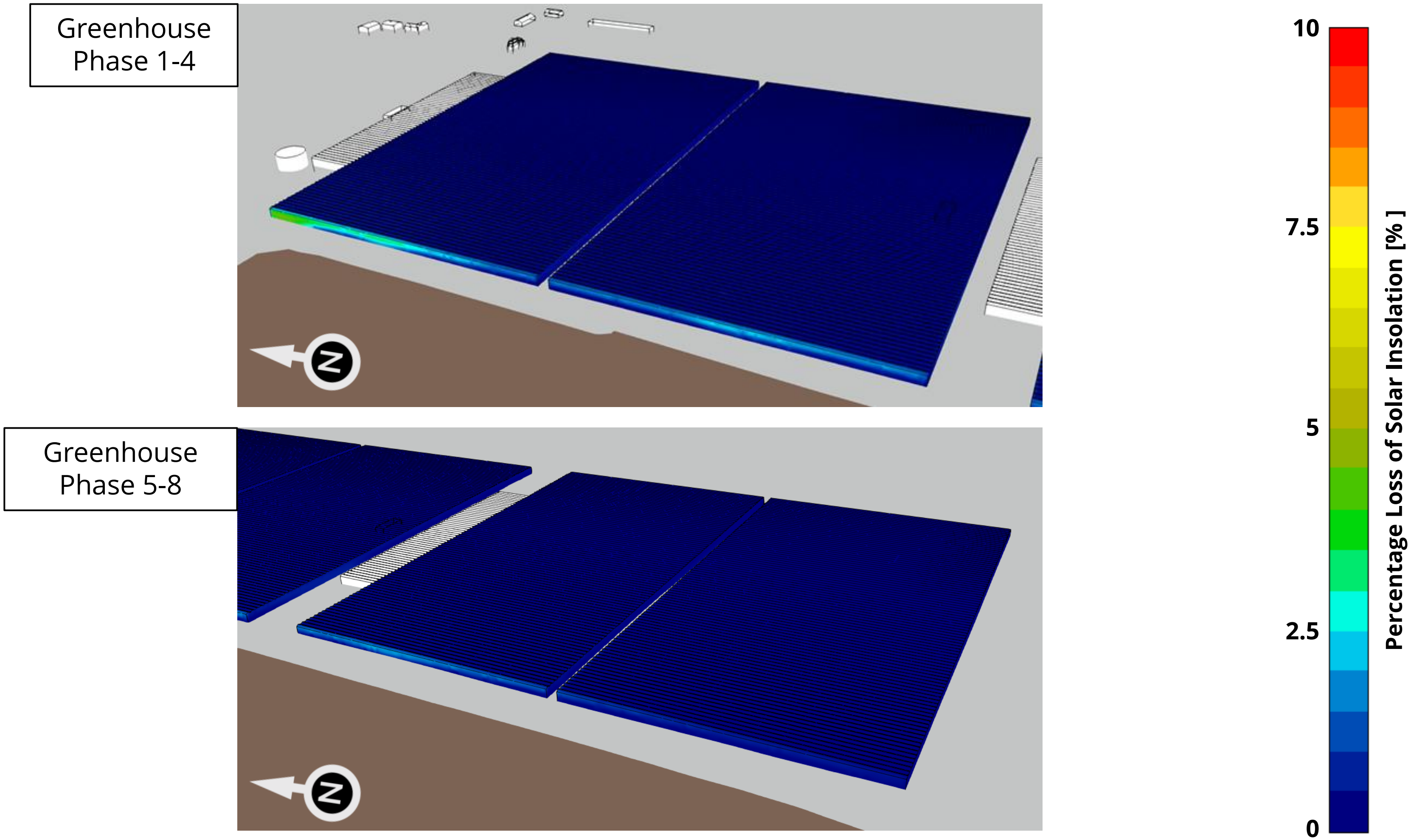

Figure A2: Percentage Loss of Solar Insolation for the Month of February – Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – March

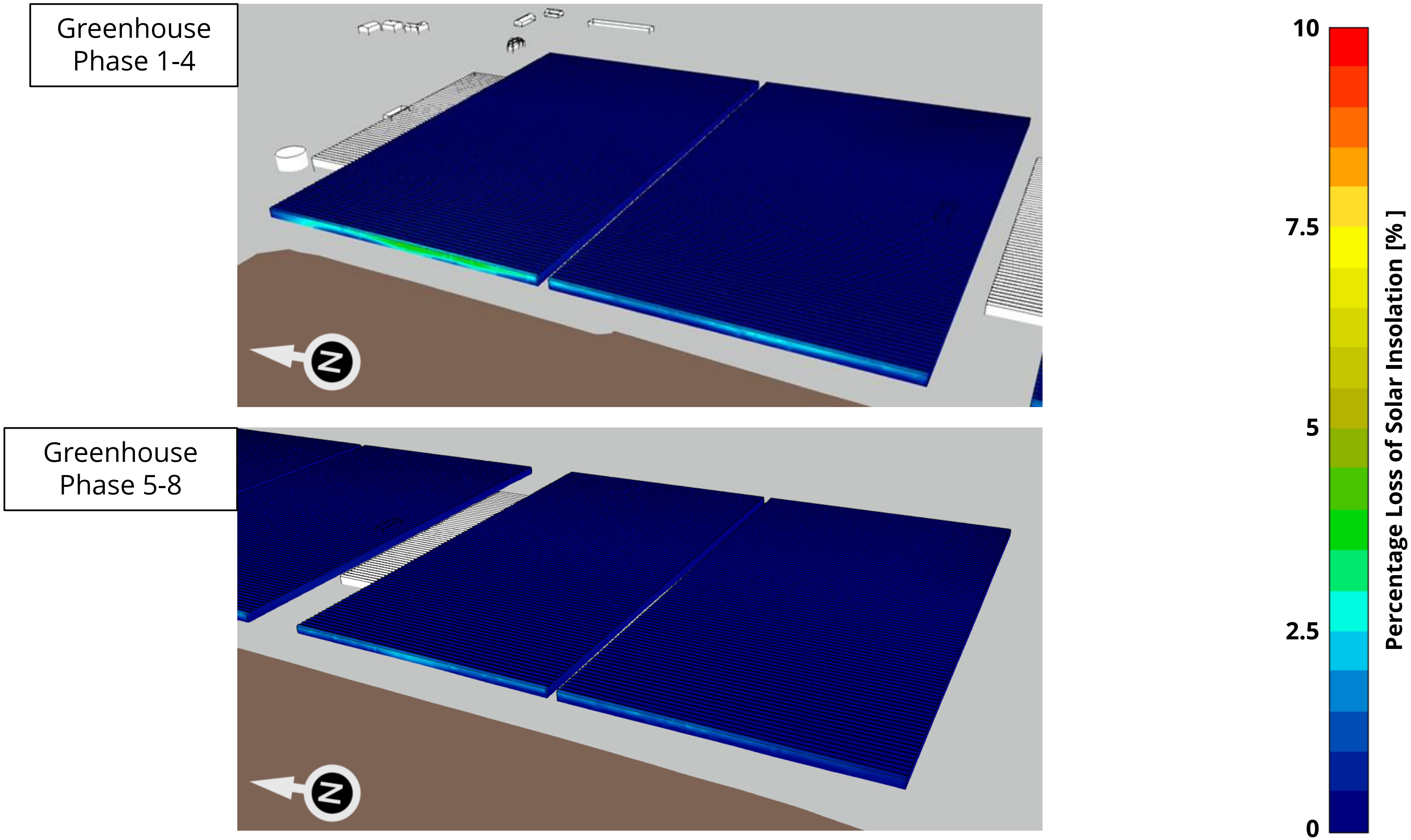

Figure A3: Percentage Loss of Solar Insolation for the Month of March – Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – April

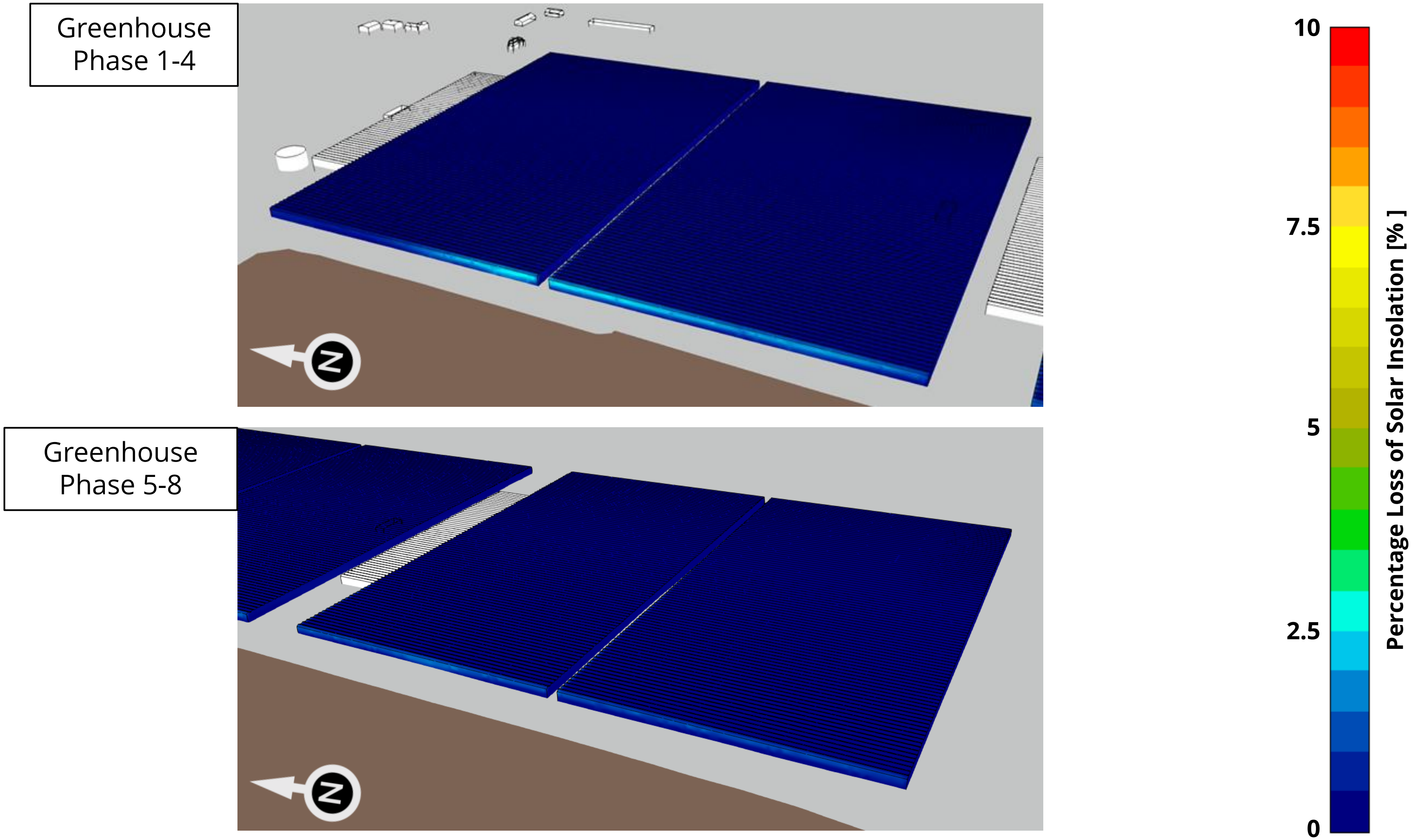

Figure A4: Percentage Loss of Solar Insolation for the Month of April – Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – May

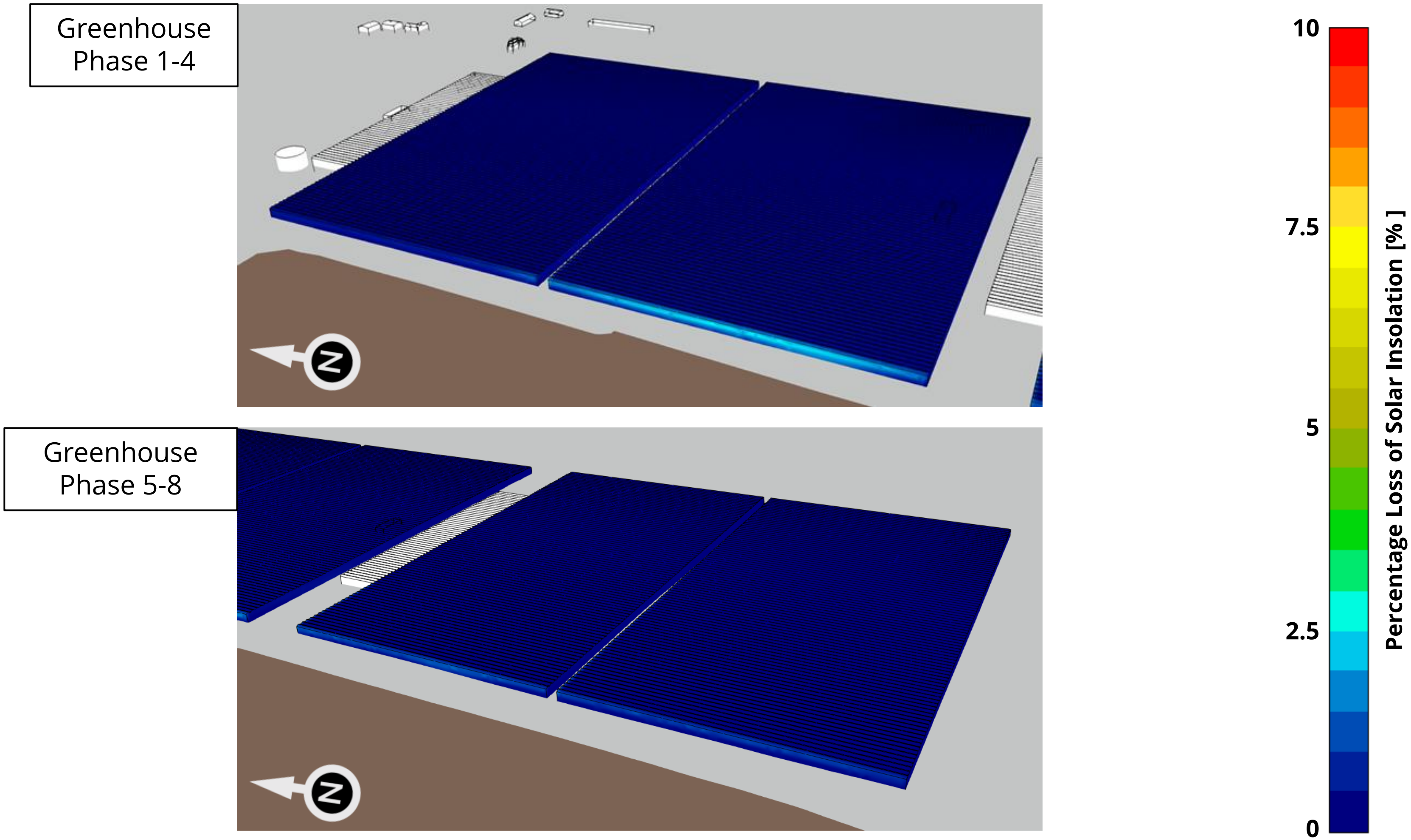

Figure A5: Percentage Loss of Solar Insolation for the Month of May– Greenhouse Phases 1-4 and 5-8

MONTHLY RESULTS

Local Percentage Loss of Solar Insolation – June

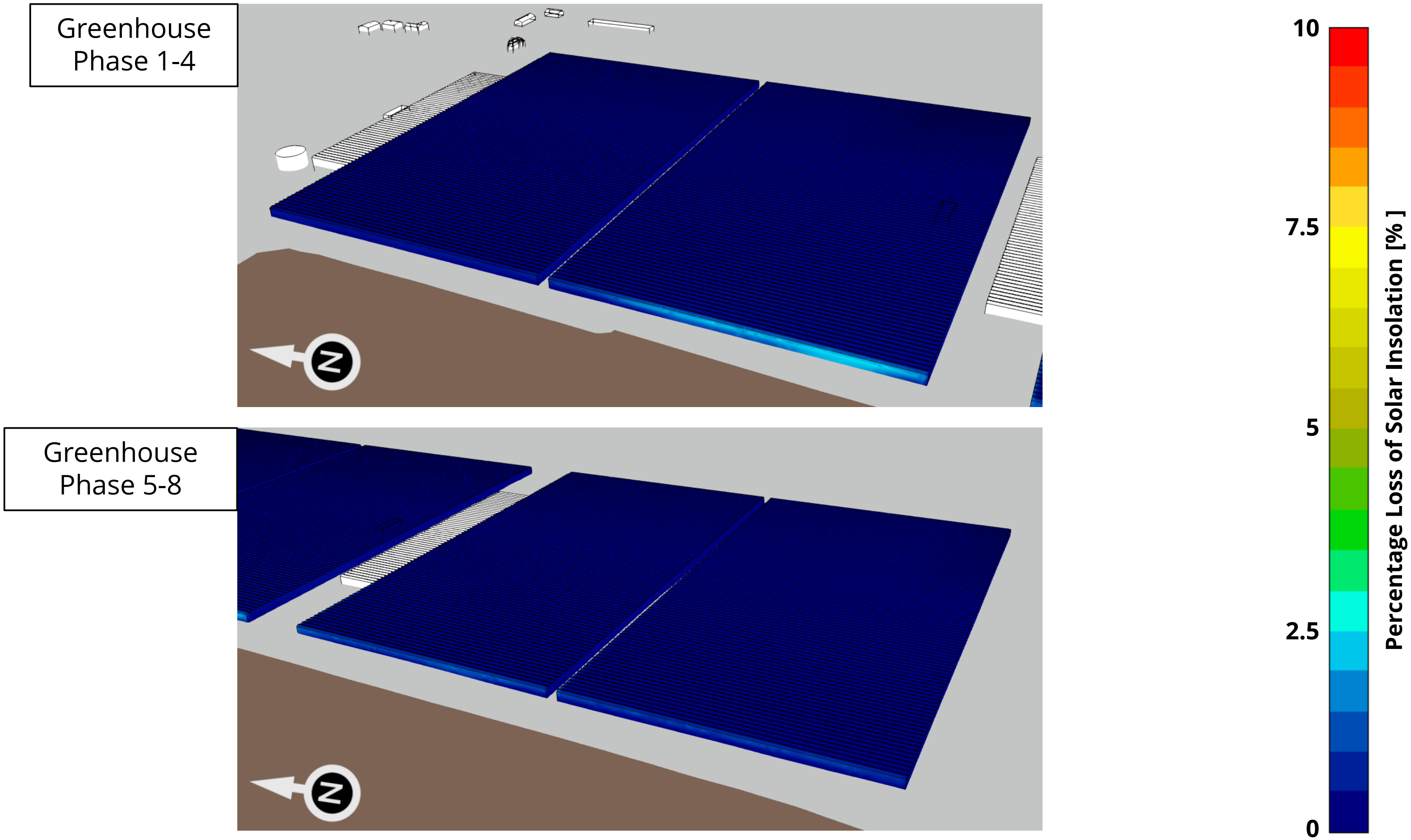

Figure A6: Percentage Loss of Solar Insolation for the Month of June – Greenhouse Phases 1-4 and 5-8

MONTHLY RESULTS

Local Percentage Loss of Solar Insolation – July

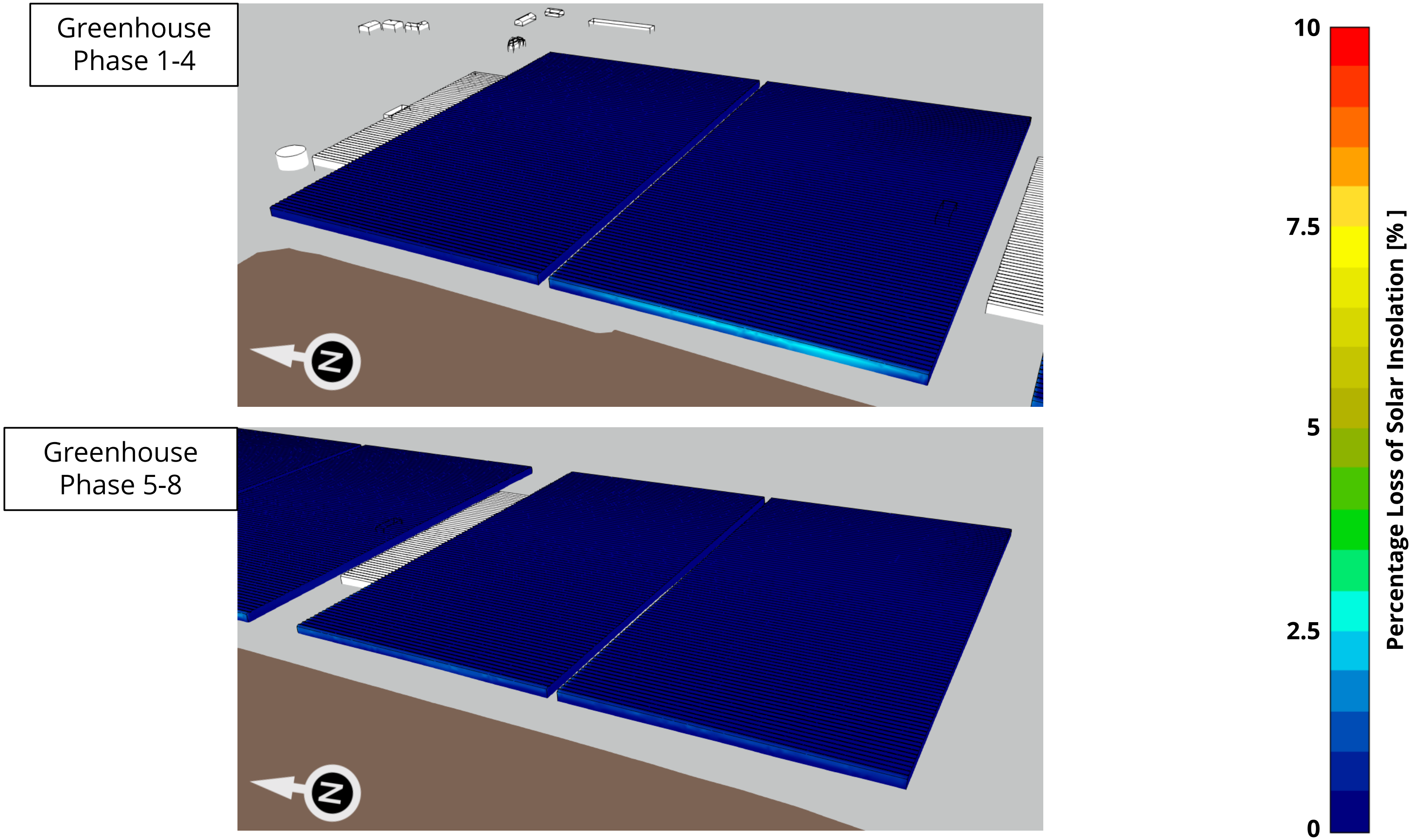

Figure A7: Percentage Loss of Solar Insolation for the Month of July– Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – August

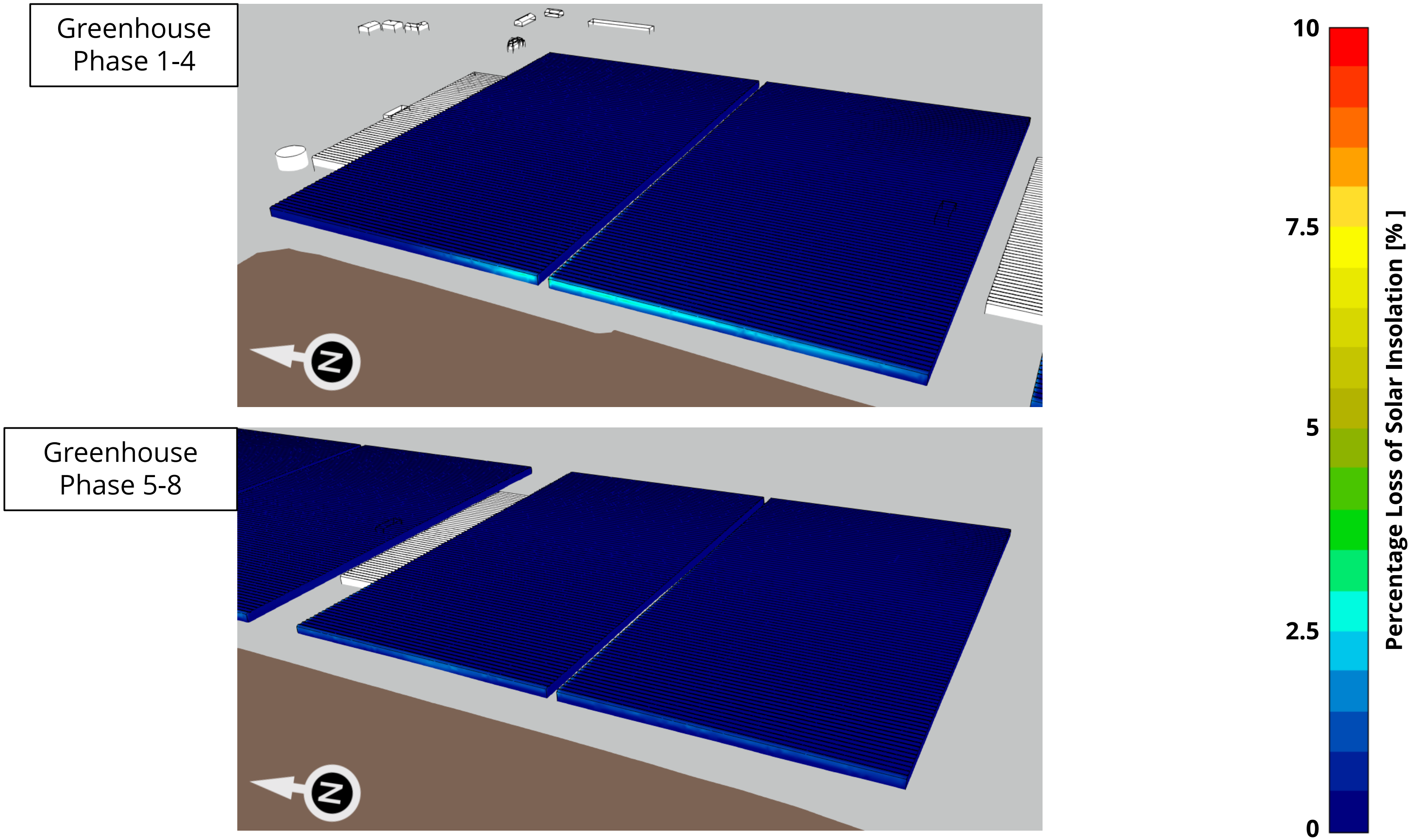

Figure A8: Percentage Loss of Solar Insolation for the Month of August– Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – September

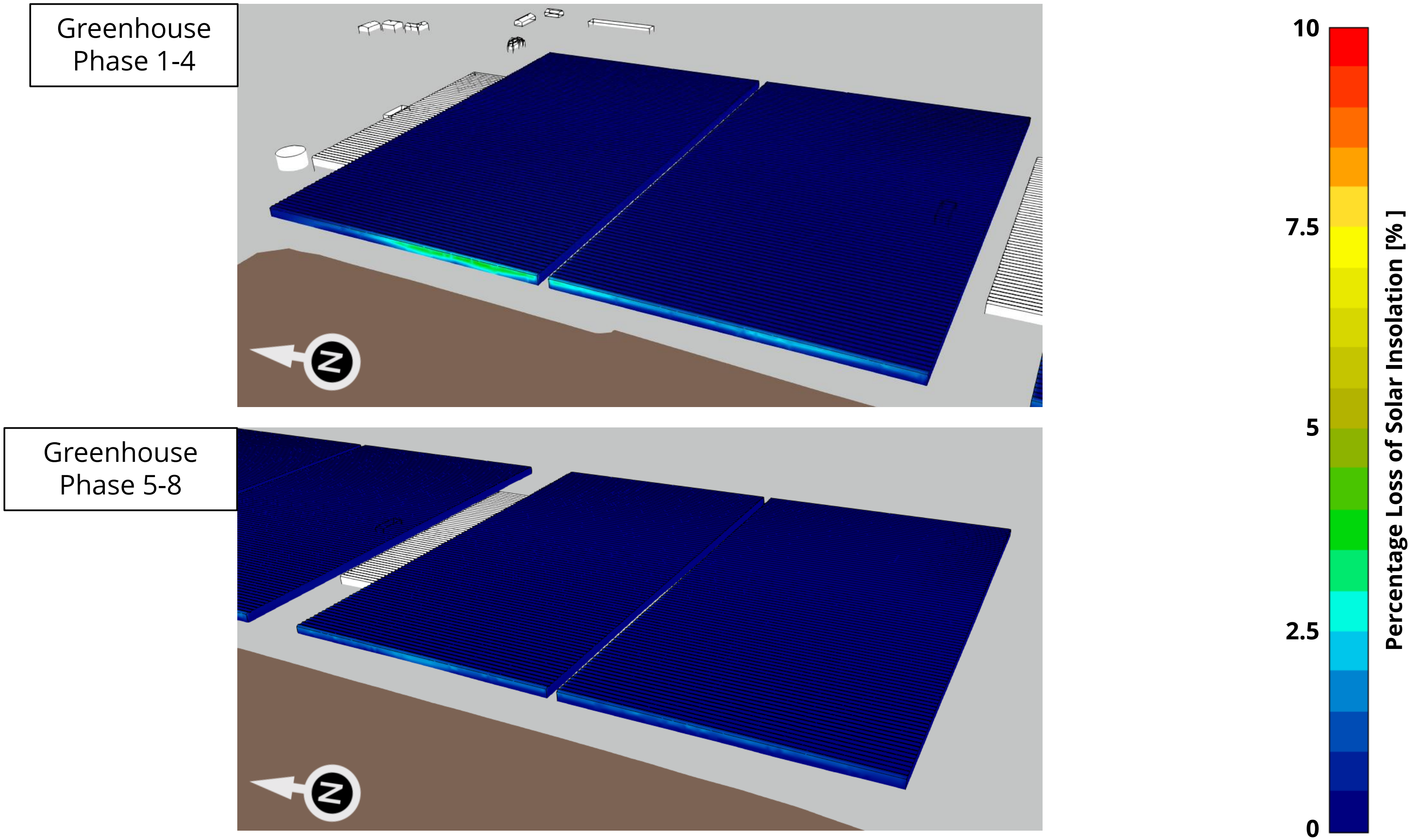

Figure A9: Percentage Loss of Solar Insolation for the Month of September– Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – October

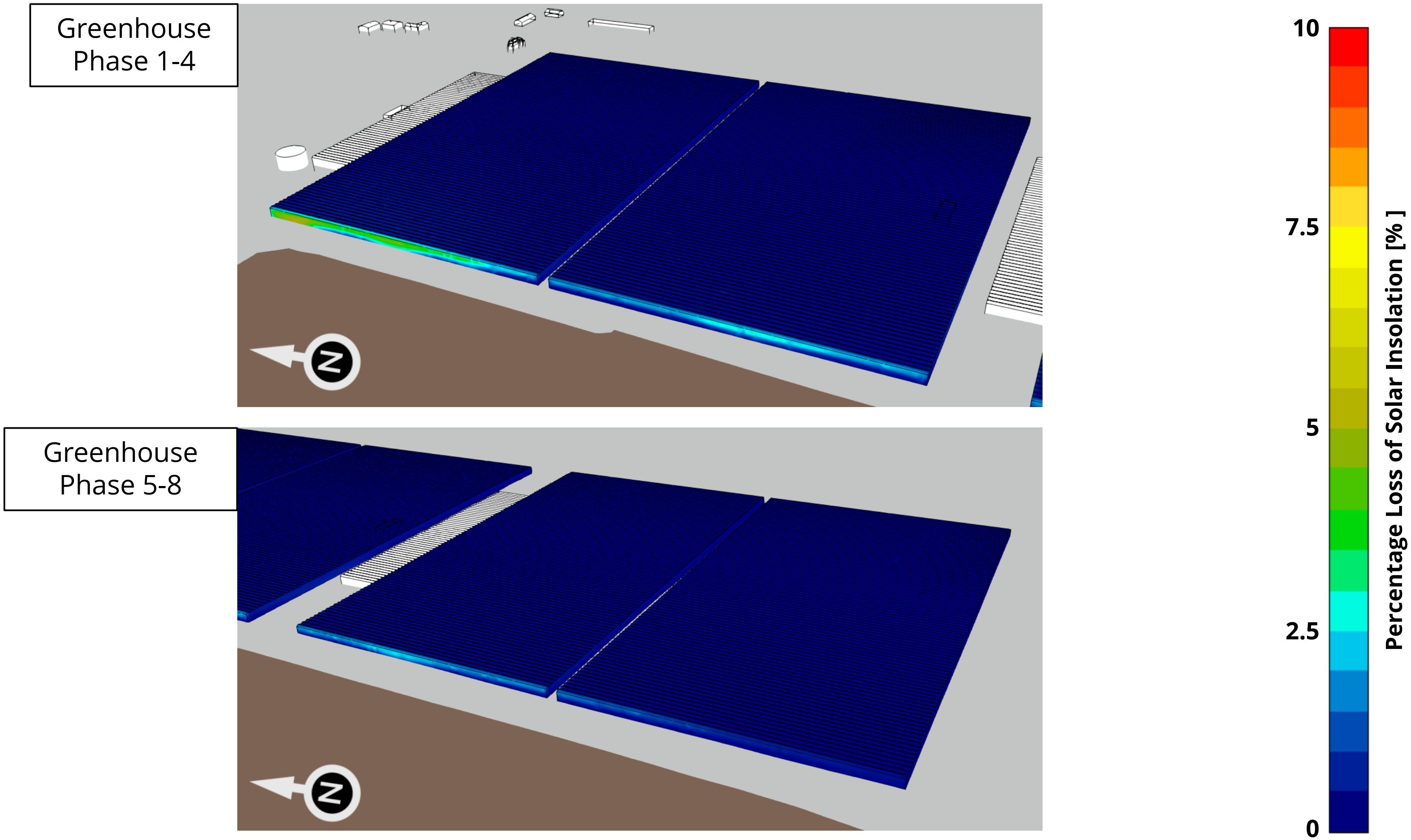

Figure A10: Percentage Loss of Solar Insolation for the Month of October– Greenhouse Phases 1-4 and 5-8

MONTHLY RESULTS

Local Percentage Loss of Solar Insolation – November

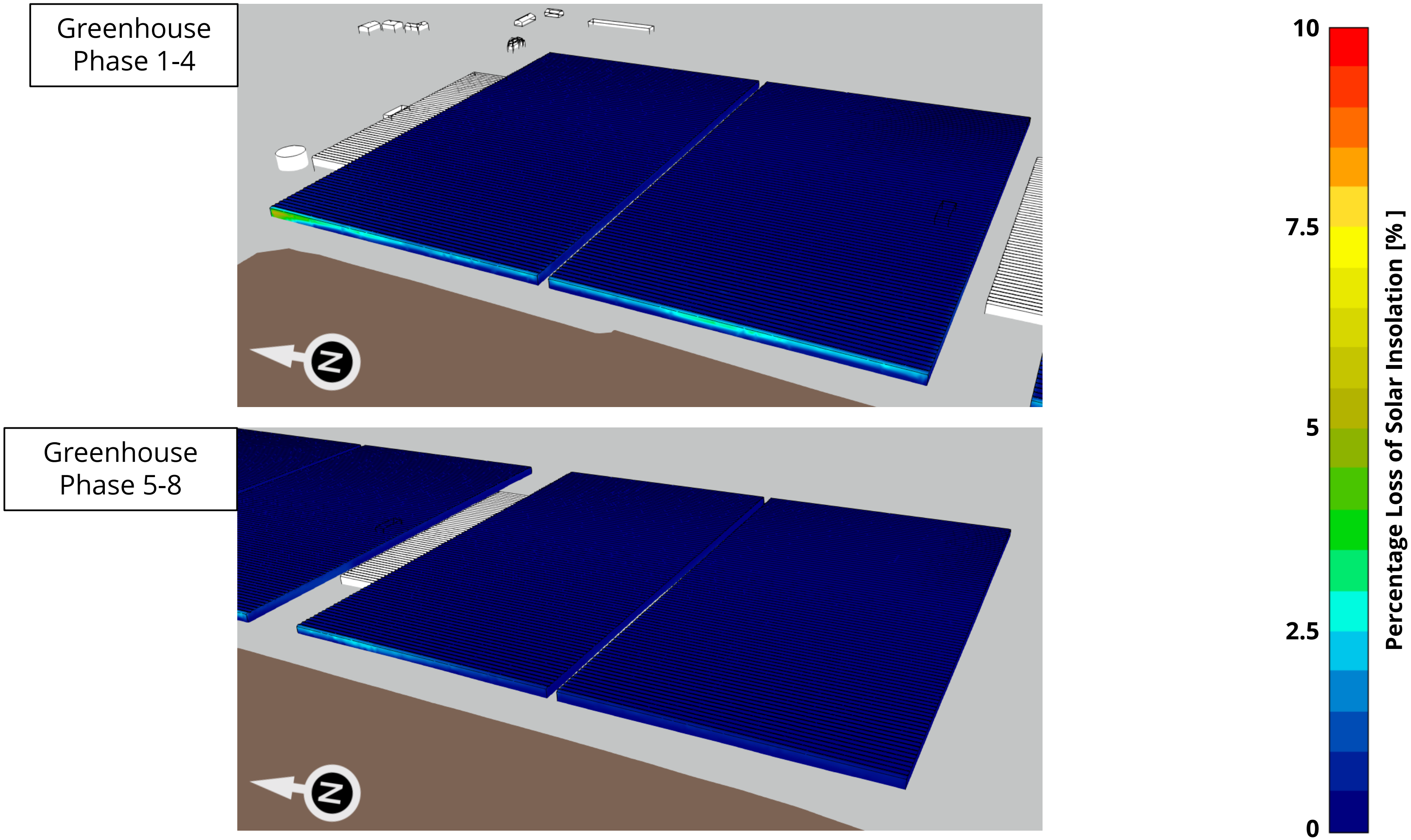

Figure A11: Percentage Loss of Solar Insolation for the Month of November– Greenhouse Phases 1-4 and 5-8

Local Percentage Loss of Solar Insolation – December

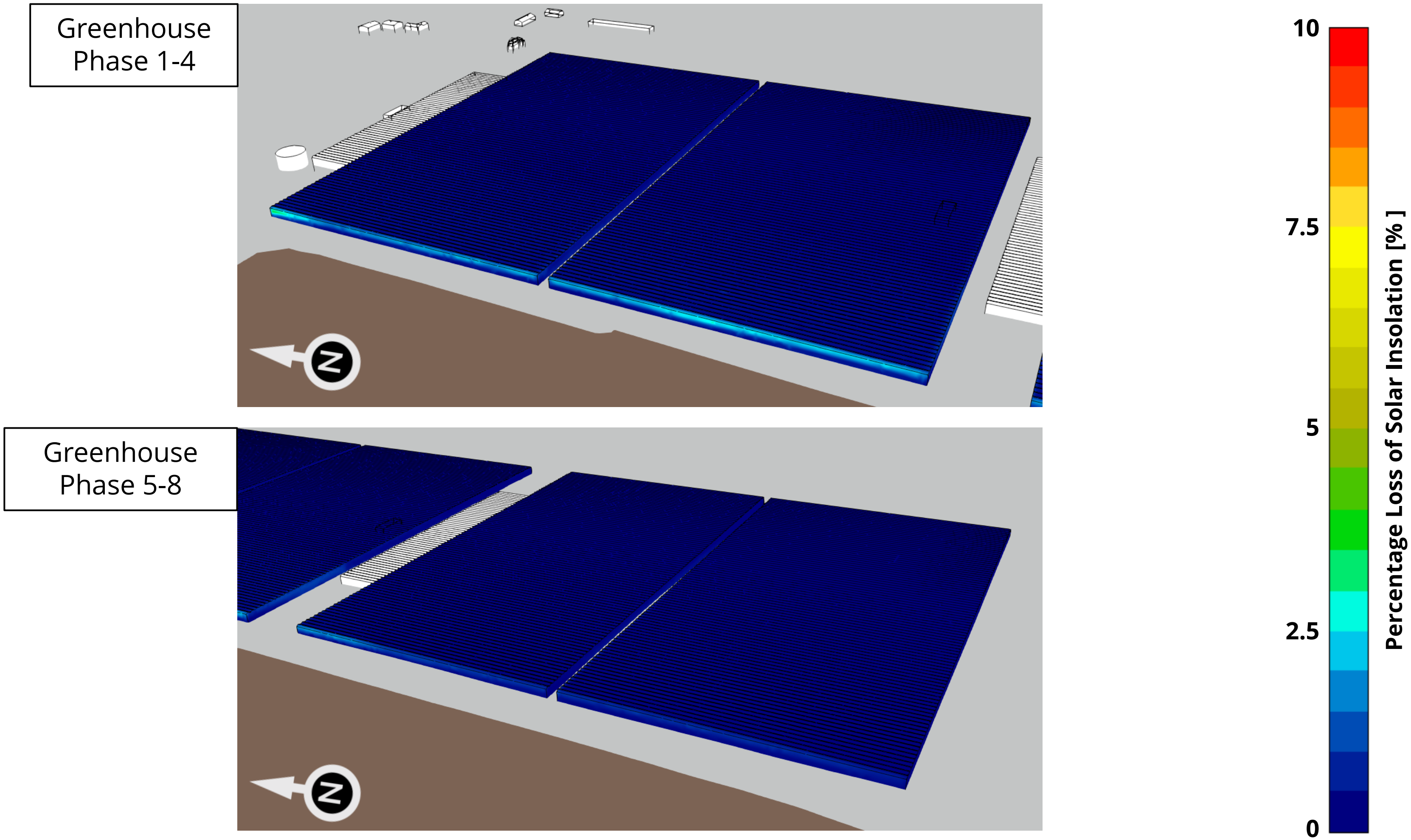

Figure A12: Percentage Loss of Solar Insolation for the Month of December– Greenhouse Phases 1-4 and 5-8