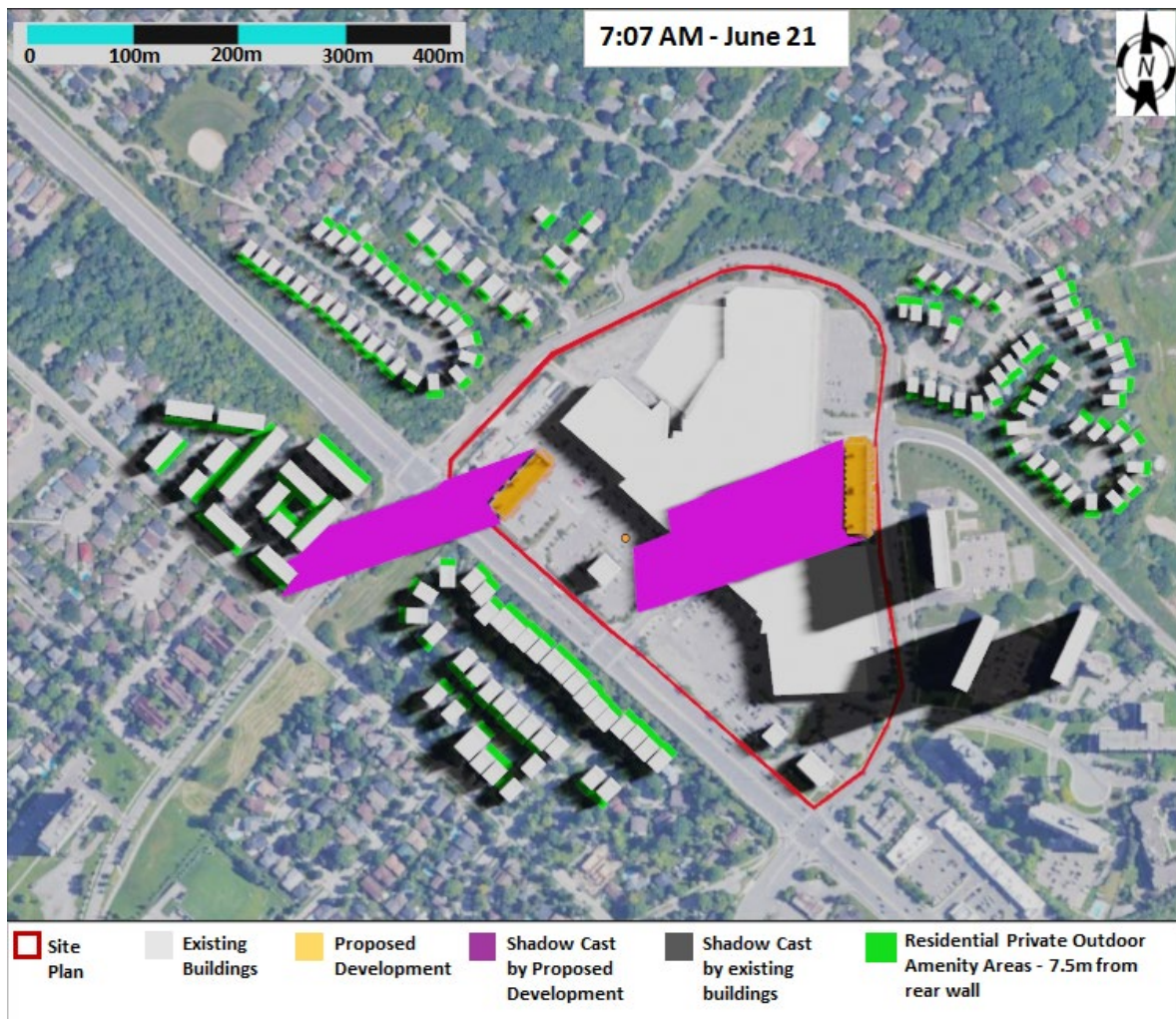


DUNPAR HOMES

SHADOW IMPACT STUDY

2225 ERIN MILLS PARKWAY, MISSISSAUGA

April 04, 2023





SHADOW IMPACT STUDY

2225 ERIN MILLS PARKWAY,
MISSISSAUGA

DUNPAR HOMES.

PROJECT NO.: CA0000748.5110-CA-SUN SHADOW STUDY

DATE: APRIL 04, 2023

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EXECUTIVE SUMMARY

WSP Canada Inc (WSP) was retained by Dunpar Homes. to study the shadow impacts of a proposed development to be located at 2225 Erin Mills Parkway, Mississauga, Ontario (the 'Development'). The objective of this assessment is to provide an evaluation of impact of the Development in terms of sun and daylight access to the surrounding area, particularly the public sidewalks, Sheridan Plaza, and adjacent neighbouring properties' yards located on the north, east and west sides of the Development.

As outlined in the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, the analysis is based on the sun locations for the first day of each season (fall equinox and summer/winter solstice) with a predefined increment from sunrise to sunset to determine the shadow coverage areas for the existing conditions (without the Development), and with the Development.

STUDY DOMAIN

The boundaries of the study domain are based on section 4 of the TOR, which identifies that the base mapping should be 4 times the height of development to the north, east and west; and 1.5 times to the south. The study domain is immediately surrounded by the following land uses:

- North: Lincoln Greenway and a residential area.
- South: Erin Mills Parkway, commercial buildings, and a residential area.
- East: Fowler Drive, commercial buildings, and a residential area.
- West: Erin Mills Parkway, commercial buildings, and a residential area.

The Development consists of the construction of two (2) 15 storey residential buildings: Building A, located on the north-west side of the plaza, and building G located on the north-east side of the plaza. Both buildings are expected to extend to a height of 52 m.

Building A massing runs from west to east and is designed as one podium, while Building G massing runs from north to south and is designed as one podium. Furthermore, both buildings have a narrow floor footprint and slender levels to reduce the overall bulk of the Development and reduce shadow impacts and allow the sun accessing most adjacent neighbouring properties' yards.

SPACES OF INTEREST

When examining shadow impacts, there are several locations or spaces of interest where shadow patterns can limit the daylight accessing these spaces. As outlined in Section 3 of the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, the areas of interests are:

- Residential private outdoor amenity spaces are determined as private rear yards, decks, patios and pools of surrounding residential dwellings (see section 3.1 of TOR). For this study, these areas are located west and south-west of building A, north of Lincoln Greenway and east and south-east of building G.
- Communal outdoor amenity areas are determined as public amenity areas and common outdoor amenity areas that are part of proposed or existing development (see section 3.2 of TOR). These areas include children's play areas, school yards, tot lots, and park features such as sandboxes, wading pools etc. It also includes outdoor amenity areas used by seniors and those associated with commercial and employment areas. For this study, no such areas have been identified within the study domain and therefore will not be included in the analysis.
- Public realm is determined as sidewalks, open spaces, parks and plazas (see Section 3.3 of TOR). For this study, sidewalks along Erin Mills Parkway, Lincoln Greenway and Fowler Drive have been identified as low and medium density residential streets and will be included in the analysis. In addition, the Sheridan Plaza, defined as an open public space, will be incorporated in the analysis.

- Turf and flower gardens in public parks within the public realm (see section 3.4 of TOR). For this study, no such areas have been identified within the study domain and therefore will not be included in the analysis.
- Building faces have been identified to allow for possible use of solar energy (see section 3.5 of TOR). These areas include the roofs, front, rear and exterior side walls of adjacent low rise (one to four storeys) residential buildings including townhouses, detached and semi-detached dwellings. For this study, these areas are located west and south-west of building A, north of Lincoln Greenway and east and south-east of building G.

METHODOLOGY

SOFTWARE USED TO PREPARE SHADOW ANALYSIS

For this assessment, Blender software (version 3.4.1, see reference section) was used for the analysis including 3D work, calculations, and final composite images. Astronomic north was determined by geolocating the 3D model in Blender software based on OpenStreetMap. The origin of the base plan is from architectural drawings provided by Dunpar Homes and Google Earth satellite imagery.

ANALYSIS PROCEDURE

The Sun Shadow Assessment is based on computer modeling of the sun location relative to the Development at a given hour of the day during a specific season. Consequently, the shadow movement and patterns during the day are assessed, and shadow outputs based on Section 3 of the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, and best practices are obtained. The computer-generated model illustrated the following dates and representative times, based on TOR from the City of Mississauga:

1. **Fall Equinox | September 21st** at predefined intervals between sunrise and sunset.
(8:35AM, 10:12AM, 11:12AM, 12:12PM, 1:12PM, 2:12PM, 3:12PM, 4:12PM, 5:20PM and 5:48PM)
2. **Summer Solstice | June 21st** at predefined intervals between sunrise and sunset
(7:07AM, 7:20AM, 8:20AM, 9:20AM, 10:20AM, 11:20AM, 12:20PM, 1:20PM, 2:20PM, 3:20PM, 4:20PM, 5:20PM, 6:20PM, 7:20PM, and 7:33PM)
3. **Winter Solstice | December 21st** at predefined intervals between sunrise and sunset
(9:19AM, 10:17AM, 11:17AM, 12:17PM, 1:17PM, 2:17PM and 3:15PM)

Note: Spring equinox (March 21st) is not included in the analysis since this later is considered similar to Fall Equinox and therefore criteria for Fall Equinox are deemed to apply to spring equinox.

In addition, the analysis is based upon the following requirements:

Longitude | N 43° 35' 20"

Latitude | W 79° 38' 40"

Time Zone: Eastern

Standard Time: UT - 5 hours (UT denotes Universal Time)

Daylight Time: UT - 4 hours (UT denotes Universal Time)

Base Plan: Google maps (north as per Google maps)

The modeling includes two simulated conditions. First, it predicts the shadow patterns for the existing condition (without the Development). Second, it establishes the shadow patterns with the presence of the Development based on the Development height of 52 metres (including the mechanical penthouse). With these two simulated conditions, one would be able to determine the net new shadows, which are incremental shadows that exceed the existing building shadows.

EVALUATION CRITERIA

As outlined in Section 3 of the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, the shadow evaluations are established for each area of interest highlighted above. These criteria are summarised below:

CRITERION 3.1: RESIDENTIAL PRIVATE OUTDOOR AMENITY SPACES

Section 3.1 requires the line of impact assessment or “no impact zone” for these private outdoor amenity spaces to be within 7.5m of the rear wall or other appropriate exterior building wall. In addition, testing times should include June 21st and September 21st to maximize the use of these spaces. Finally, the criterion is met if there is shadow impact for no more than two consecutive hourly test times within the space between the exterior wall of the dwelling that abuts the amenity space and the line of impact assessment.

CRITERION 3.2: COMMUNAL OUTDOOR AMENITY AREAS

Section 3.2 requires that the shadow from the proposed development allows for full sun on these areas at least half the time, or 50% sun coverage all the time. The Sun Access Factor (SAF) is a measure of the sun penetration to a given space during a specific time frame. The SAF is determined as the ratio of the average area exposed to the sun during the day to the total physical area of the location of interest. The higher the SAF is, the more the space is exposed to the sun. In addition, testing times should include June 21st, September 21st, and December 21st to maximize the use of these spaces. Finally, the criterion is met if the “sun access factor” is at least 50% or 0.5 on each of the test dates ($As(ave)/AT = 0.5$ or more).

CRITERION 3.3: PUBLIC REALM

Section 3.3 requires the shadow from the proposed development to allow full sunlight on the opposite boulevard including the full width of the sidewalk for “Low and Medium Density Residential Streets”. Testing times should be on September 21st. The criterion is met if the sunlight accesses these areas for a total of at least 4 hours between 9:12 am and 11:12 am, and between 3:12 pm and 5:12 pm.

Additionally, section 3.3 requires that the shadow from the proposed development should allow for full sun on “public open spaces, parks and plazas” at least half the time, or 50% sun coverage all the time. Testing times should be on September 21st. The criterion is met if the “sun access factor” is at least 50% or 0.5 on each of the test dates ($As(ave)/AT = 0.5$ or more).

CRITERION 3.4: TURF AND FLOWER GARDENS IN PUBLIC PARKS

Section 3.4 requires that the proposed development should allow for adequate sunlight during the growing season from March to October by allowing for a minimum of 6 hours of direct sunlight on September 21. The criterion is met if full sun is provided on any 7 test times on September 21.

CRITERION 3.5: BUILDING FACES TO ALLOW FOR THE POSSIBILITY OF USING SOLAR ENERGY

Section 3.5 requires that the line of impact assessment or “no impact zone” for these spaces should be within 3m of the front, the rear and the exterior wall of the building. In addition, testing times should include September 21st. Finally, the criterion is met if there is shadow impact for no more than two consecutive hourly test times in the “no impact zone”.

ASSESSMENT RESULTS

RESIDENTIAL PRIVATE OUTDOOR AMENITY SPACES

For both summer solstice and fall equinox, Section 3.1 requires the line of impact assessment or “no impact zone” for these private outdoor amenity spaces to be within 7.5m of the rear wall or other appropriate exterior building wall. The criterion is met if there is shadow impact for no more than two consecutive hourly test times within the space between the exterior wall of the dwelling that abuts the amenity space and the line of impact assessment. The shadow analysis has shown that the shadow cast on the private outdoor amenity spaces located on the west (along Erin Mills Parkway), north (along Lincoln Greenway) and east (along Fowler Dr) of the Development linger for no more than two consecutive hourly test times. As such, the criterion for section 3.1 is met.

COMMUNAL OUTDOOR AMENITY AREAS

For this study, no such areas have been identified within the study domain and therefore no shadow analysis was completed for these areas of interest.

PUBLIC REALM

Section 3.3 requires that the shadow from the proposed development should allow full sunlight on the opposite boulevard including the full width of the sidewalk for “Low and Medium Density Residential Streets”. The criterion is met if the sunlight accesses these areas for a total of at least 4 hours between 9:12 am and 11:12 am, and between 3:12 pm and 5:12 pm. The shadow analysis has shown that the sun accesses the opposite sidewalk that abuts residential side and back yards along Erin Mills Parkway for more than four hours between 9:12 am and 11:12 am, and between 3:12 pm and 5:12 pm. Therefore, the criterion for section 3.3 is met for this sidewalk. In addition, the shadow analysis has demonstrated that there is shadowing from the Development (Building A) from 8:35 AM until 10:12 AM on a small area of the opposite sidewalk that abuts residential side and back yards along Lincoln Greenway. This shadowing area is located at the intersection of Lincoln Greenway and Erin Mills Parkway. Since this sidewalk is exposed to more than 4 hours of sun, criterion 3.3 is met for the opposite sidewalk along Lincoln Greenway. Finally, the study has indicated that there is shadowing from the Development (Building G) from 15:12 PM until 17:48 PM on a small area of the opposite sidewalk that abuts residential side and back yards along Fowler Drive. This small area corresponds to the projected footprint of building G on the sidewalk which is relatively small when compared to the total area of the sidewalk. This corresponds to the sun accessing the sidewalk on Fowler Drive for more than 90% of the total area during the day, i.e. the overall Sun Access Factor is more than 90% on the sidewalk.

For the Sheridan Plaza, the shadow analysis has shown that the sun accesses this plaza for more than half times during the day (Sun Access Factor = 91%). Therefore, the criterion for section 3.3 is met for the Sheridan Plaza.

TURF AND FLOWER GARDENS IN PUBLIC PARKS

For this study, no such areas have been identified within the study domain and therefore no shadow analysis was completed for these areas of interest.

BUILDING FACES TO ALLOW FOR THE POSSIBILITY OF USING SOLAR ENERGY

Section 3.5 requires the line of impact assessment or “no impact zone” for these spaces to be within 3m of the front, the rear and the exterior wall of the building. The criterion is met if there is shadow impact for no more than two consecutive hourly test times in the “no impact zone”. The shadow analysis has shown that there no more than two consecutive hourly test times of shadow cast on the building faces during the day. Consequently, the criterion for section 3.5 is met.

CONCLUSIONS AND DISCUSSIONS

In conclusion, the proposed development will have minimal and acceptable shadowing impacts on adjacent low- rise neighbourhoods, private amenity areas, and public realm in accordance with TOR of the city of Mississauga.



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APPENDICES

A SITE PLAN

1 MANDATE

WSP Canada Inc (WSP) was retained by Dunpar Homes. to study the shadow impacts of the proposed development on 2225 Erin Mills Parkway, Mississauga, Ontario (the 'Development'). The objective of this assessment is to provide an evaluation of impact of the Development in terms of sun and daylight access to the surrounding area, particularly the public sidewalks, Sheridan Plaza, and adjacent neighbouring properties' yards located on the north, east and west sides of the Development. As outlined in the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, the analysis is based on the sun locations for the first day of each season (fall equinox and summer/winter solstice) with a predefined increment from sunrise to sunset to determine the shadow coverage areas for the existing conditions (without the Development), and with the Development.

1.1 STUDY DOMAIN

The Development is located at 2225 Erin Mills Parkway in Mississauga. **Figure 1** displays an aerial view of the Development location and surrounding area. An image of the site plan is shown in **Appendix A**. The boundaries of the study domain were determined based on section 4 of TOR in which the domain extents for the shadow analysis should be 4 times the height of development to the north, east and west; and 1.5 times to the south.



Figure 1: Proposed Development on Erin Mills Parkway (Source: Google Earth dated March 21, 2023)

The Development consists of the construction of two (2) 15 storey residential buildings: Building A, located on the north-west of the plaza, and building G located on the east of the plaza. Both buildings are expected to extend to a height of 52 m. The Development location is immediately surrounded by the following land uses:

- North: Lincoln Greenway and a residential area.
- South: Erin Mills Parkway, commercial buildings, and a residential area.
- East: Fowler Drive, commercial buildings, and a residential area.
- West: Erin Mills Parkway, commercial buildings, and a residential area.

Figure 2 displays the 3D rendering of Development and surrounding area.

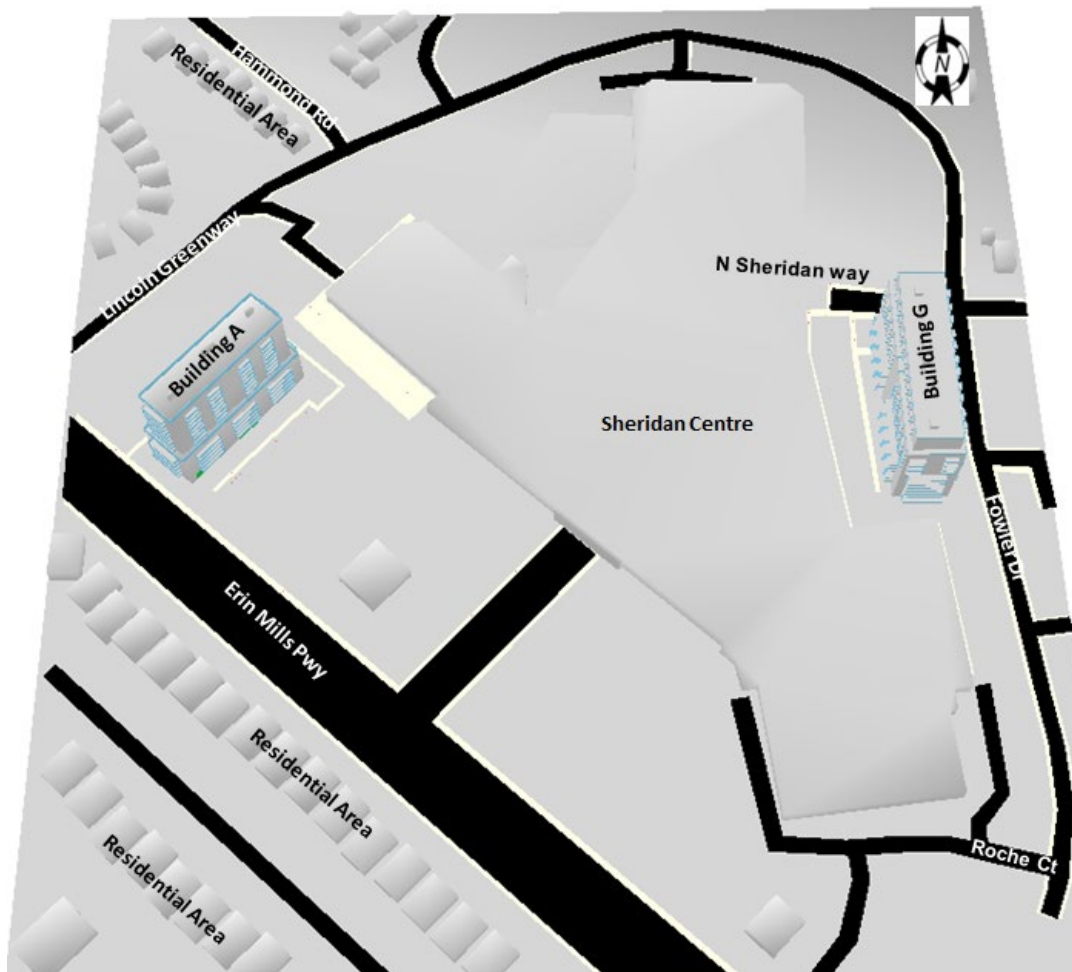


Figure 2: Top view of 3D Rendering model – Proposed development

As shown in **Figure 2**, the Development consists of the construction of two (2) 15 storey residential buildings: Building A, located on the north-west side of the plaza, and building G located on the north-east side of the plaza. Both buildings are expected to extend to a height of 52 m.

Building A massing runs from west to east and is designed as one podium, while Building G massing runs from north to south and is designed as one podium. Furthermore, both buildings have a narrow floor footprint and slender levels to reduce the overall bulk of the Development and reduce shadow impacts and allow the sun accessing most adjacent neighbouring properties' yards and public realm such as sidewalks and the Sheridan public plaza.

1.2 SPACES OF INTEREST

When examining shadow impacts, there are several locations or spaces of interest where shadow patterns can limit the daylight accessing these spaces. As outlined in Section 3 of the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, the areas of interests are:

- Residential private outdoor amenity spaces are determined as private rear yards, decks, patios and pools of surrounding residential dwellings (see section 3.1 of TOR). For this study, these areas are located west and south-west of building A, north of Lincoln Greenway and east and south-east of building G (see **Figure 3**).
- Communal outdoor amenity areas are determined as public amenity areas and common outdoor amenity areas that are part of proposed or existing development (see section 3.2 of TOR). These areas include children's play areas, school yards, tot lots, and park features such as sandboxes, wading pools etc. It also includes outdoor amenity areas used by seniors and those associated with commercial and employment areas. For this study, no such areas have been identified within the study domain and therefore will not be included in the analysis.
- Public realm is determined as sidewalks, open spaces, parks and plazas (see Section 3.3 of TOR). For this study, sidewalks along Erin Mills Parkway, Lincoln Greenway and Fowler Drive have been identified as low and medium density residential streets and will be included in the analysis. In addition, the Sheridan Plaza, defined as an open public space, will be incorporated in the analysis (see **Figure 6**).
- Turf and flower gardens in public parks within the public realm (see section 3.4 of TOR). For this study, no such areas have been identified within the study domain and therefore will not be included in the analysis.
- Building faces have been identified to allow for possible use of solar energy (see section 3.5 of TOR). These areas include the roofs, front, rear and exterior side walls of adjacent low rise (one to four storeys) residential buildings including townhouses, detached and semi-detached dwellings. For this study, these areas are located west and south-west of building A, north of Lincoln Greenway and east and south-east of building G (see **Figure 9**).

1.3 EVALUATION CRITERIA

As outlined in Section 3 of the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, the shadow evaluations are established for each area of interest highlighted above:

RESIDENTIAL PRIVATE OUTDOOR AMENITY SPACES

Section 3.1 requires that the line of impact assessment or “no impact zone” for these private outdoor amenity spaces should be within 7.5m of the rear wall or other appropriate exterior building wall. In addition, testing times should include June 21st and September 21st to maximize the use of these spaces. Finally, the criterion is met if there is shadow impact for no more than two consecutive hourly test times within the space between the exterior wall of the dwelling that abuts the amenity space and the line of impact assessment.

COMMUNAL OUTDOOR AMENITY AREAS

Section 3.2 requires that the shadow from the proposed development should allow for full sun on these areas at least half the time, or 50% sun coverage all the time. The Sun Access Factor (SAF) is a measure of the sun penetration to a given space during a specific time frame. The SAF is determined as the ratio of the average area exposed to the sun during the day to the total physical area of the location of interest. The higher the SAF is, the more the space is exposed to the sun. In addition, testing times should include June 21st, September 21st, and December 21st to maximize the use of these spaces. Finally, the criterion is met if the “sun access factor” is at least 50% or 0.5 on each of the test dates ($As(ave)/AT = 0.5$ or more).

PUBLIC REALM

Section 3.3 requires that the shadow from the proposed development should allow full sunlight on the opposite boulevard including the full width of the sidewalk for “Low and Medium Density Residential Streets”. Testing times

should be on September 21st. The criterion is met if the sunlight accesses these areas for a total of at least 4 hours between 9:12 am and 11:12 am, and between 3:12 pm and 5:12 pm.

Additionally, section 3.3 requires that the shadow from the proposed development should allow for full sun on “public open spaces, parks and plazas” at least half the time, or 50% sun coverage all the time. Testing times should be on September 21st. The criterion is met if the “sun access factor” is at least 50% or 0.5 on each of the test dates ($As(ave)/AT = 0.5$ or more).

TURF AND FLOWER GARDENS IN PUBLIC PARKS

Section 3.4 requires that the proposed development should allow for adequate sunlight during the growing season from March to October by allowing for a minimum of 6 hours of direct sunlight on September 21. The criterion is met if full sun is provided on any 7 test times on September 21.

BUILDING FACES TO ALLOW FOR THE POSSIBILITY OF USING SOLAR ENERGY

Section 3.5 requires that the line of impact assessment or “no impact zone” for these spaces should be within 3m of the front, the rear and the exterior wall of the building. In addition, testing times should include September 21st. Finally, the criterion is met if there is shadow impact for no more than two consecutive hourly test times in the “no impact zone”.

2 METHODOLOGY

2.1 SOFTWARE USED TO PREPARE SHADOW ANALYSIS

For this assessment, Blender software (see the references section) was used for the analysis including 3D work, calculations, and final composite images. Astronomic north was determined by geolocating the 3D model in Blender software based on OpenStreetMap. The origin of the base plan is from architectural drawings provided by Dunpar Homes and Google Earth satellite imagery.

2.2 ANALYSIS PROCEDURE

The Sun Shadow Assessment is based on computer modeling of the sun location relative to the Development at a given hour of the day during a specific season. Consequently, the shadow movement and patterns during the day are assessed, and shadow outputs based on Section 3 of the Mississauga Urban Design Terms of Reference (TOR) - Standards for Shadow Studies, and best practices are obtained. The computer-generated model illustrated the following dates and representative times, based on TOR from the City of Mississauga:

1. **Fall Equinox | September 21st** at predefined intervals between sunrise and sunset.
(8:35AM, 10:12AM, 11:12AM, 12:12PM, 1:12PM, 2:12PM, 3:12PM, 4:12PM, 5:20PM and 5:48PM)
2. **Summer Solstice | June 21st** at predefined intervals between sunrise and sunset
(7:07AM, 7:20AM, 8:20AM, 9:20AM, 10:20AM, 11:20AM, 12:20PM, 1:20PM, 2:20PM, 3:20PM, 4:20PM, 5:20PM, 6:20PM, 7:20PM, and 7:33PM)
3. **Winter Solstice | December 21st** at predefined intervals between sunrise and sunset
(9:19AM, 10:17AM, 11:17AM, 12:17PM, 1:17PM, 2:17PM and 3:15PM)

Note: Spring equinox (March 21st) is not included in the analysis since this later is considered similar to Fall Equinox and therefore criteria for Fall Equinox are deemed to apply to spring equinox.

In addition, the analysis is based upon the following requirements:

Longitude | N 43° 35' 20"

Latitude | W 79° 38' 40"

Time Zone: Eastern

Standard Time: UT - 5 hours (UT denotes Universal Time)

Daylight Time: UT - 4 hours (UT denotes Universal Time)

Base Plan: Google maps (north as per Google maps)

The modeling includes two simulated conditions. First, it predicts the shadow patterns for the existing condition (without the Development). Second, it establishes the shadow patterns with the presence of the Development based on the Development height of 52 metres (including the mechanical penthouse). With these two simulated conditions, one would be able to determine the net new shadows, which are incremental shadows that exceed the existing building shadows.

Using the shadow modeling, shadow distributions were predicted for the first day of each season. Using the criteria defined above, shadow impacts at each area of interest were analysed. The results of the shadow modelling for each area of interest as defined in section 3 of the TOR are reported in the following sections.

3 RESIDENTIAL PRIVATE OUTDOOR AMENITY SPACES

Figure 3 identifies all private outdoor amenity areas in the vicinity of the development. In this Figure, the line of impact assessment or “no impact zone” (color green in the **Figure 3**) for these private outdoor amenity spaces is within 7.5m of the rear wall.

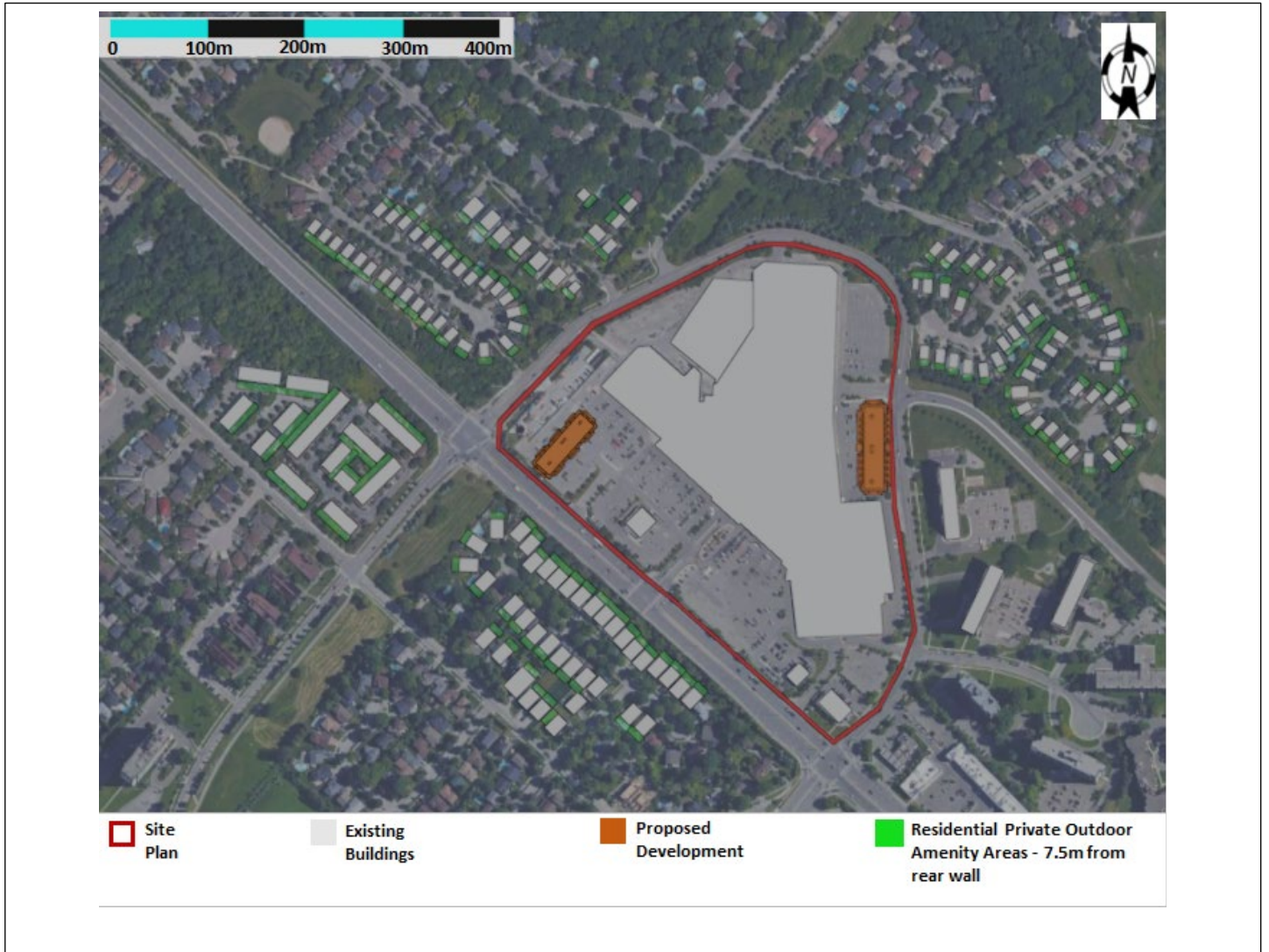
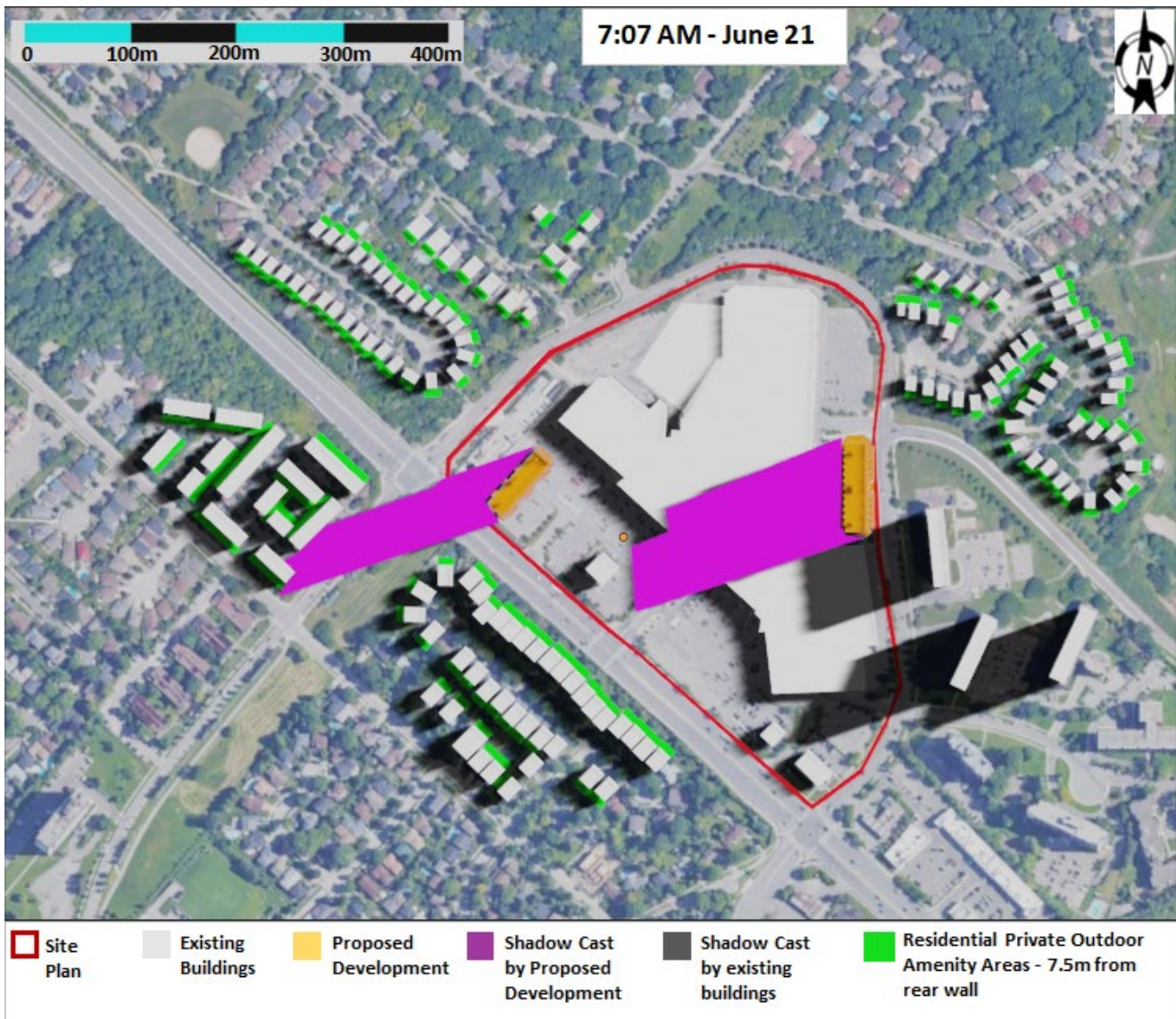
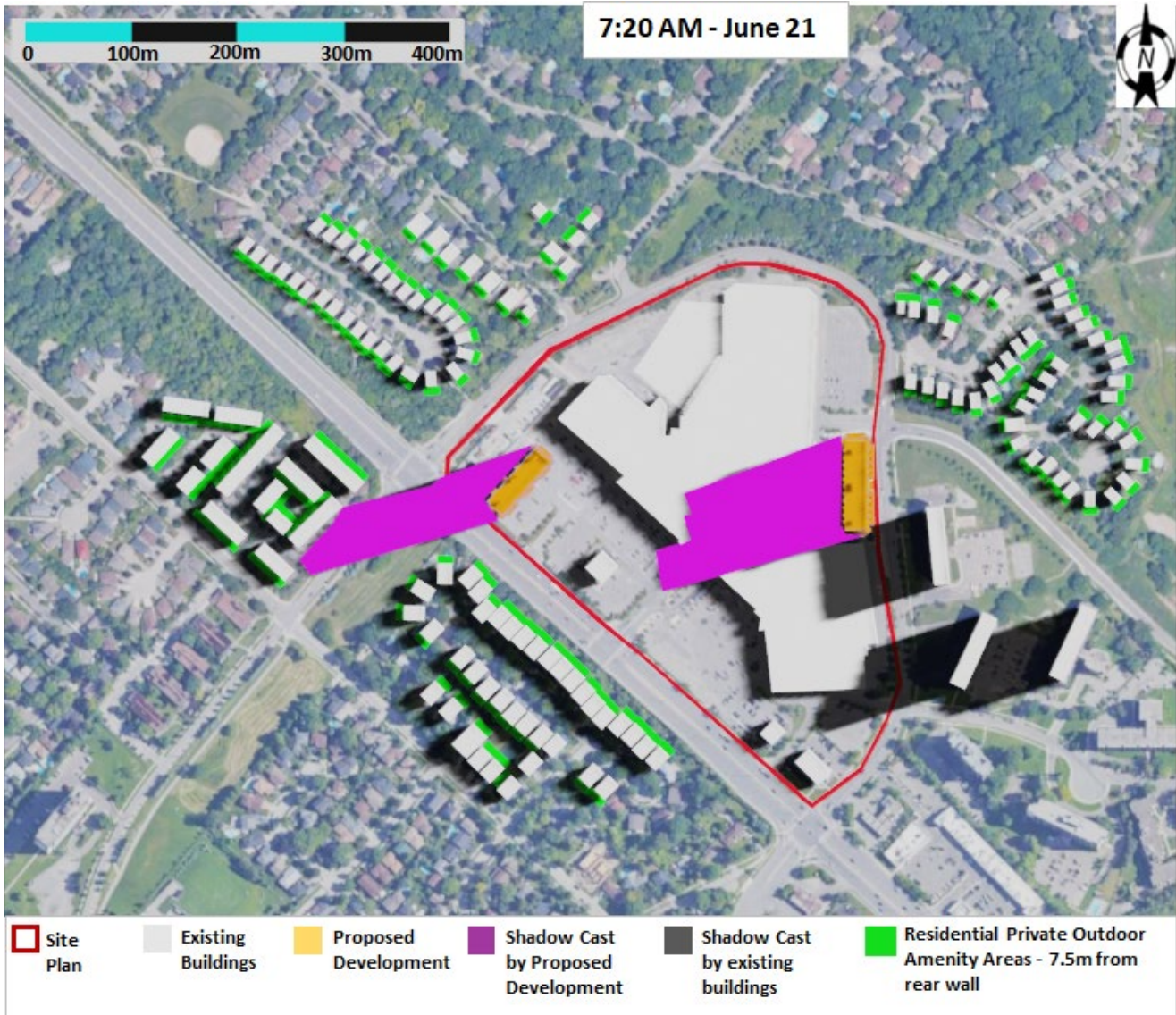


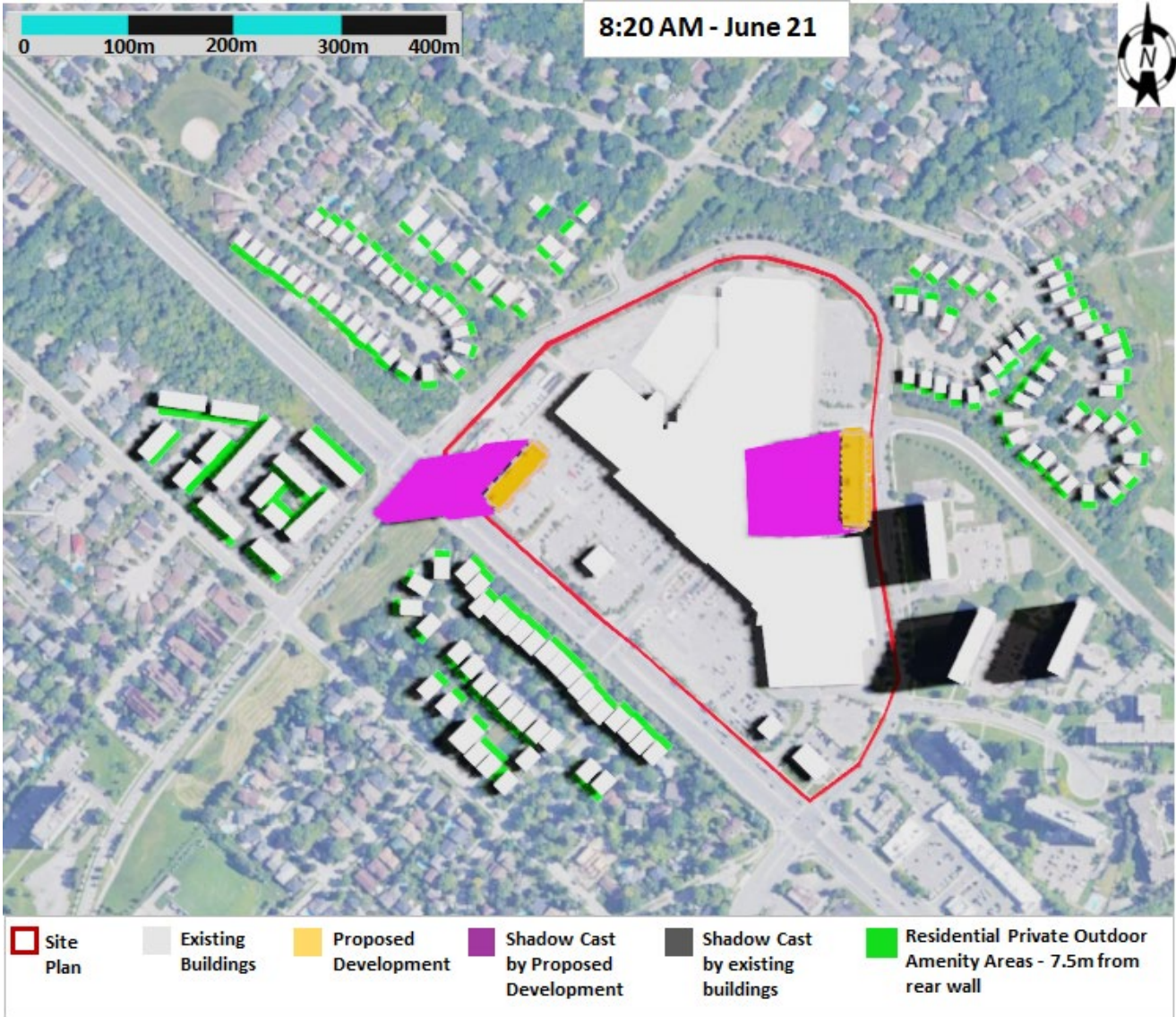
Figure 3: Residential private outdoor amenity spaces in the vicinity of the proposed development.

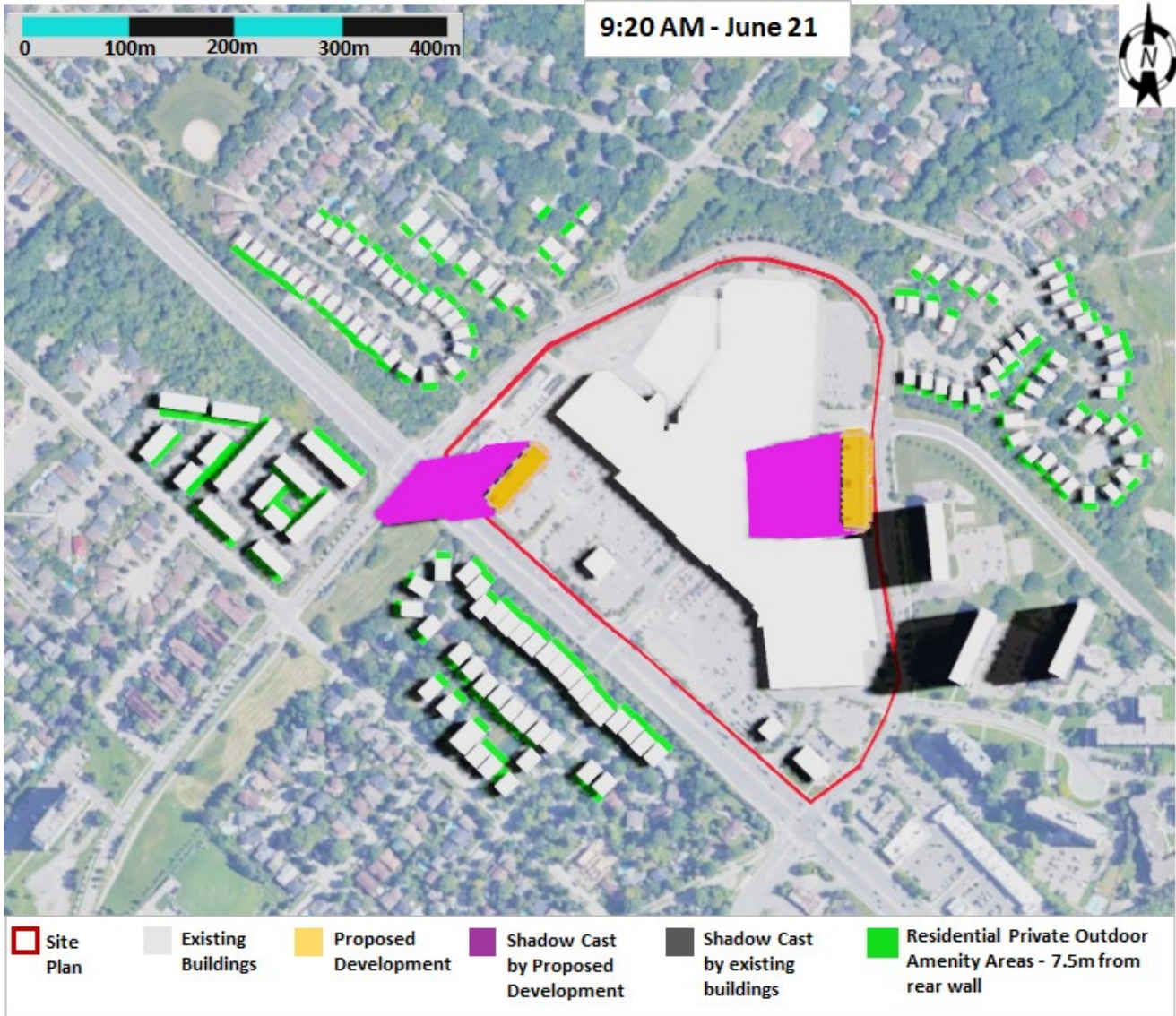
3.1 SHADOW ANALYSIS RESULTS FOR JUNE 21

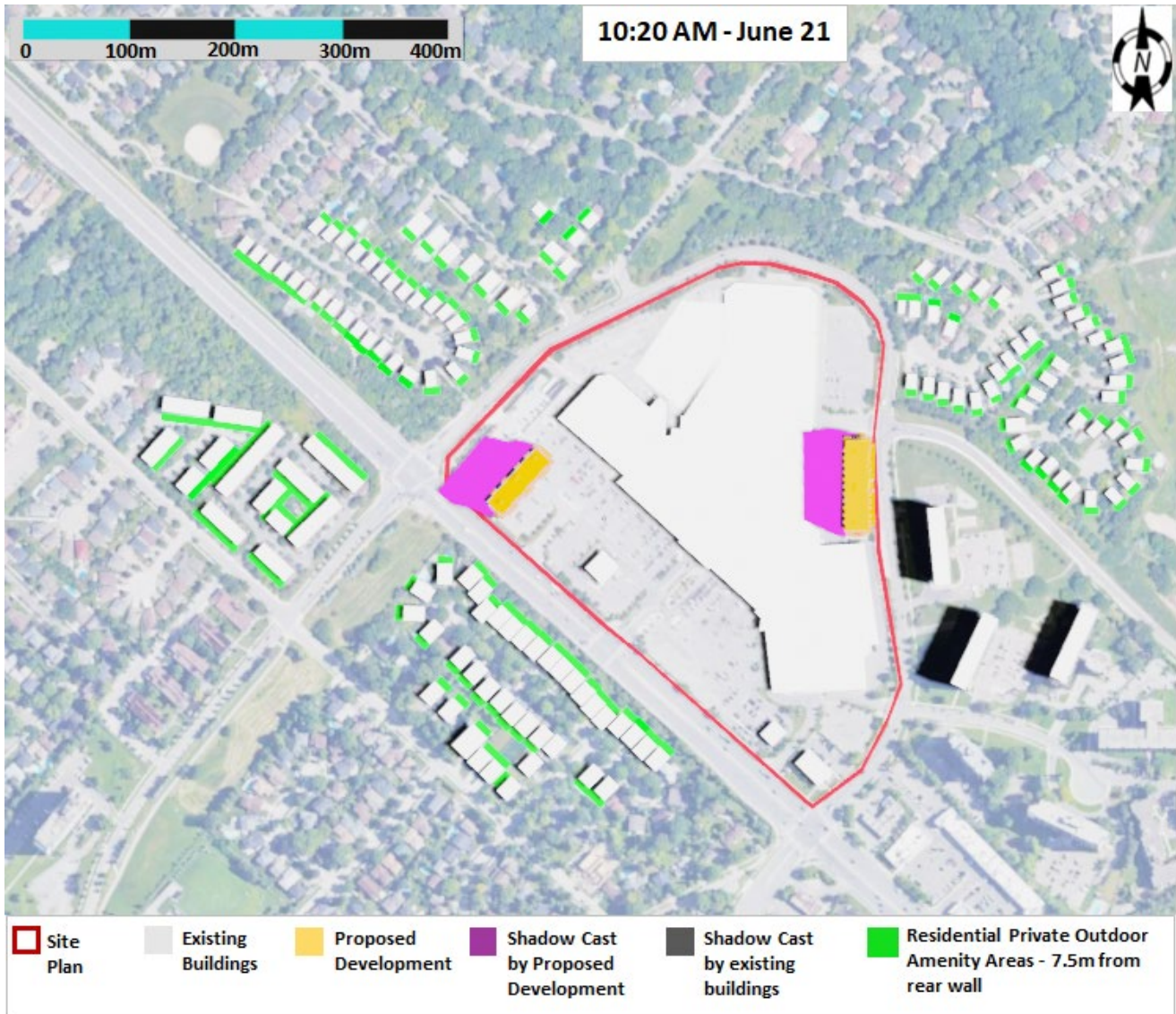
The model results of shadow patterns for summer solstice from 7.07am to 7.33pm are shown in **Figure 4**. In this **Figure 4**, the new shadow (purple color) represents the shadow due to the Development, while the existing shadow represent the shadow due to the existing buildings. The footprint of the Development is represented by the orange color. For the summer solstice, the shadow patterns are characterized by a longer cast or coverage on the west of the Development for the first hours in the morning. Then, this coverage shortened once the sun moves towards the noon hour. The shadow coverage extends on the east and south-east side of the Development to reach a maximum length near the sunset hours.

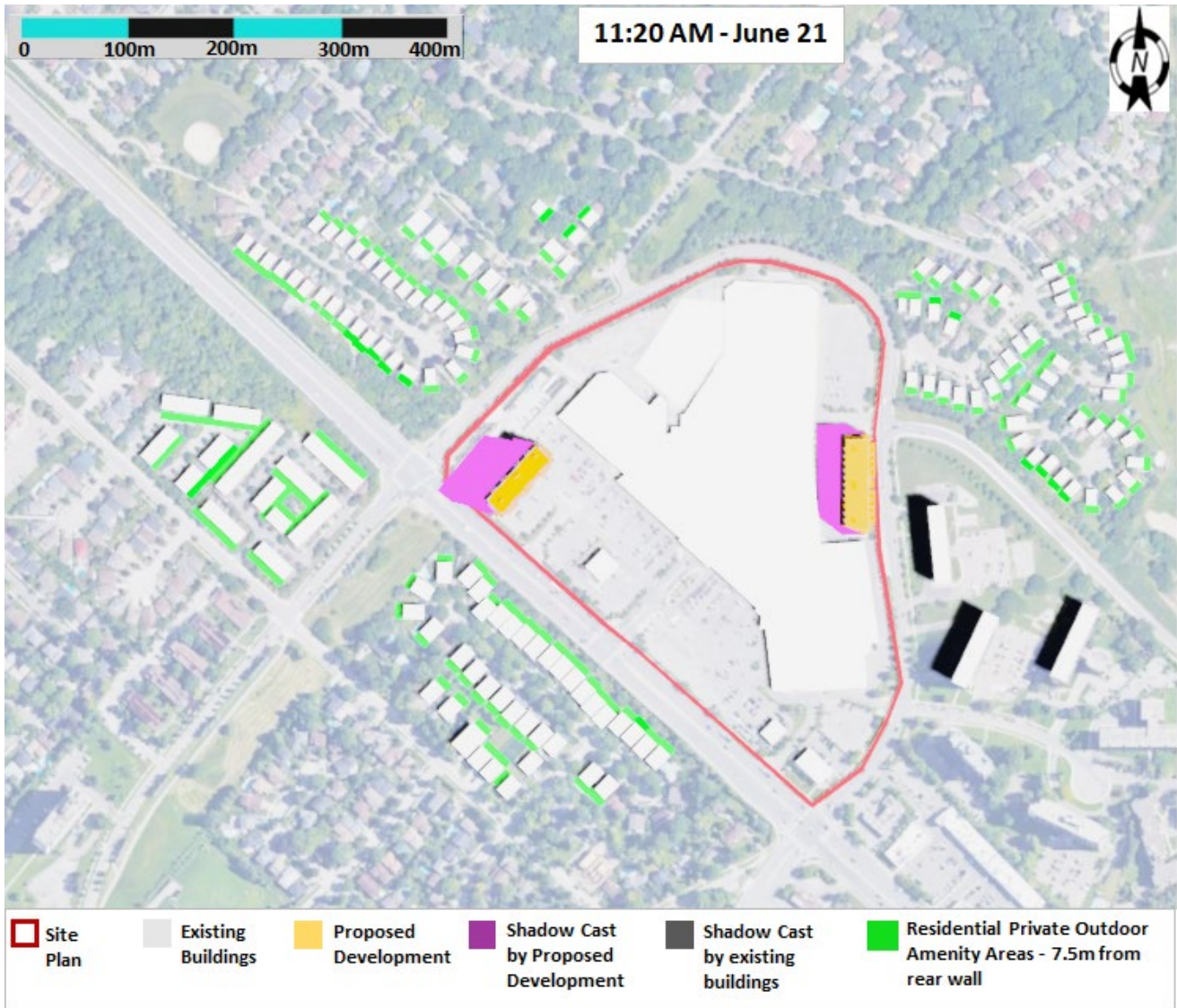


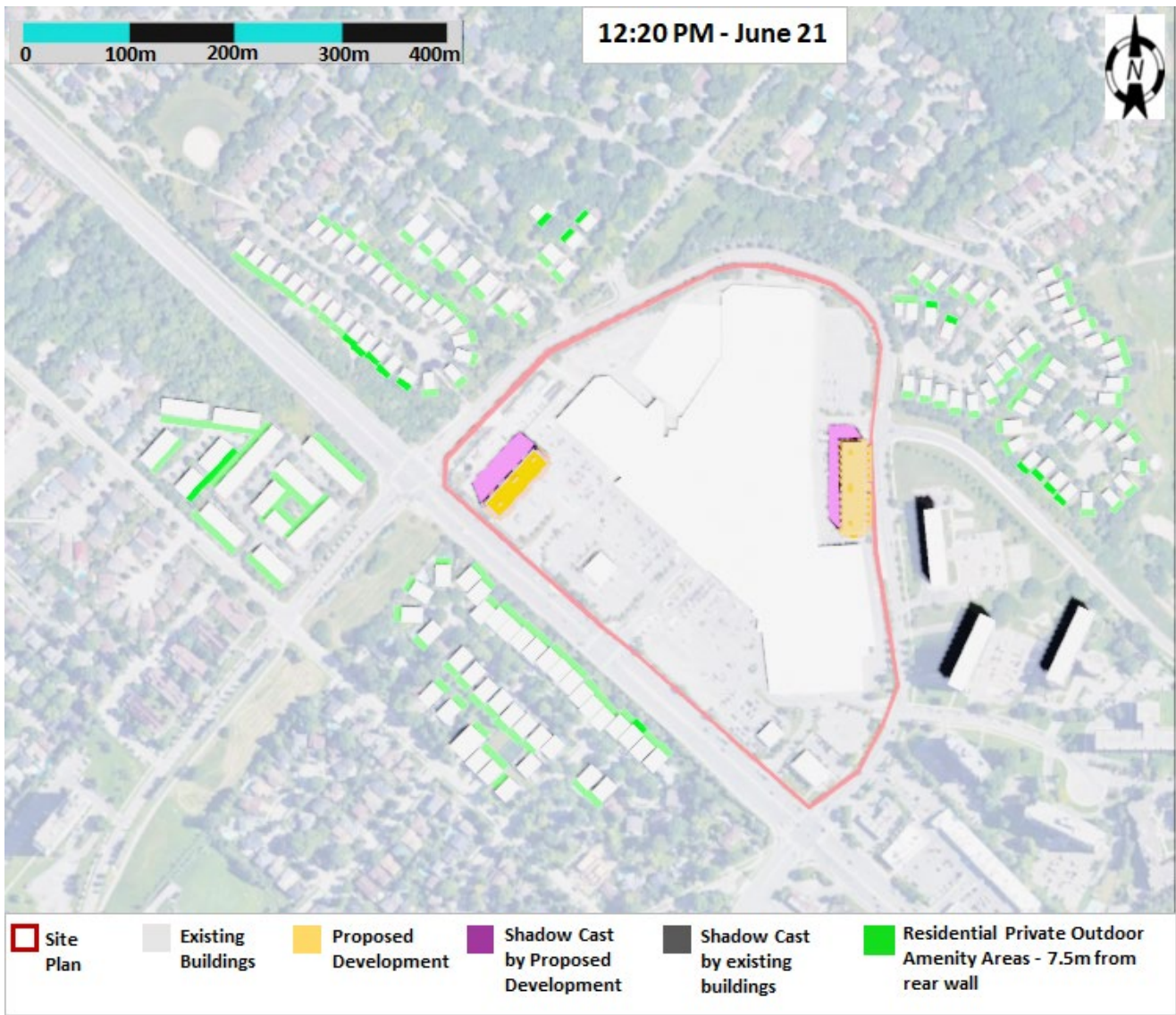


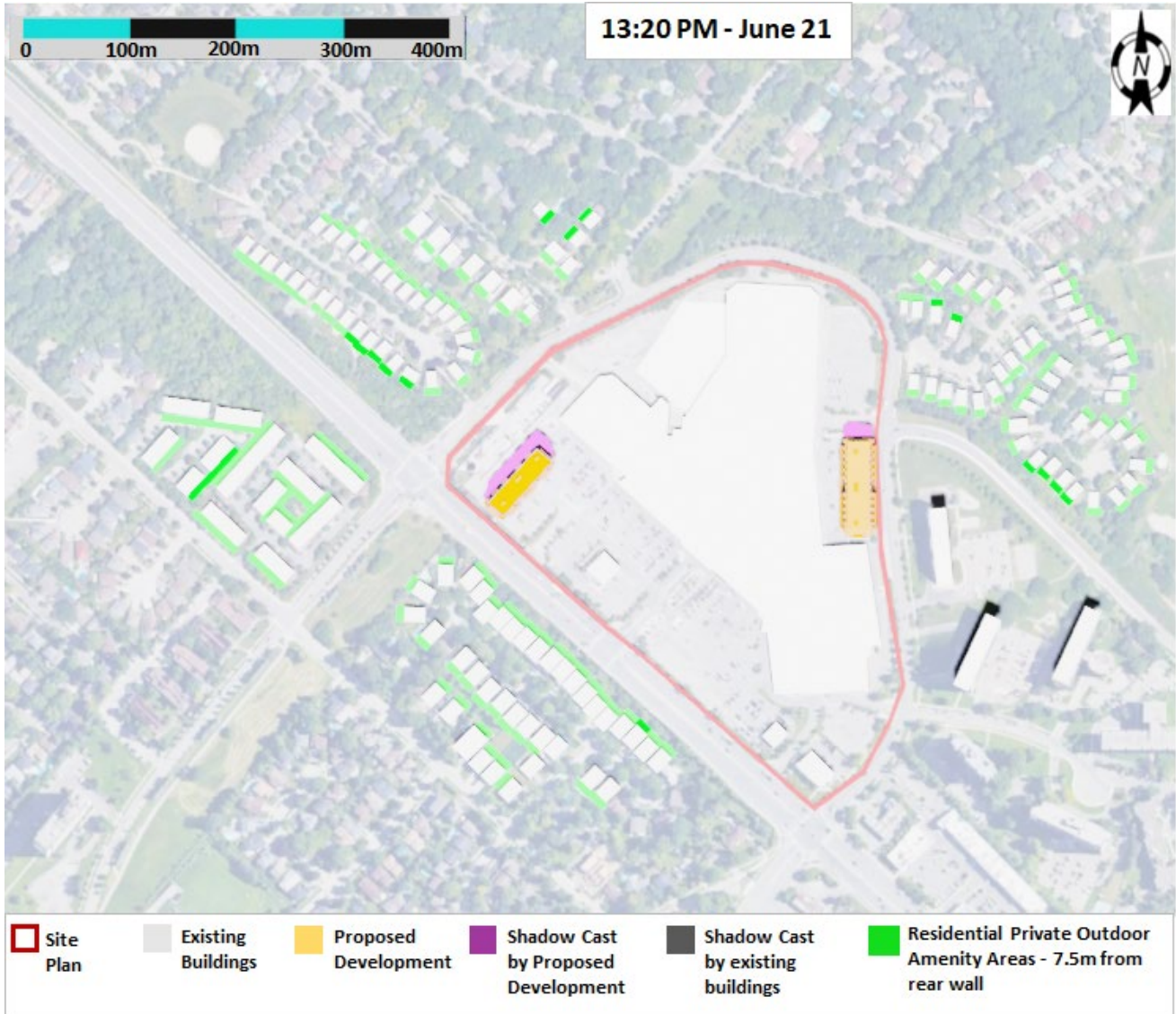


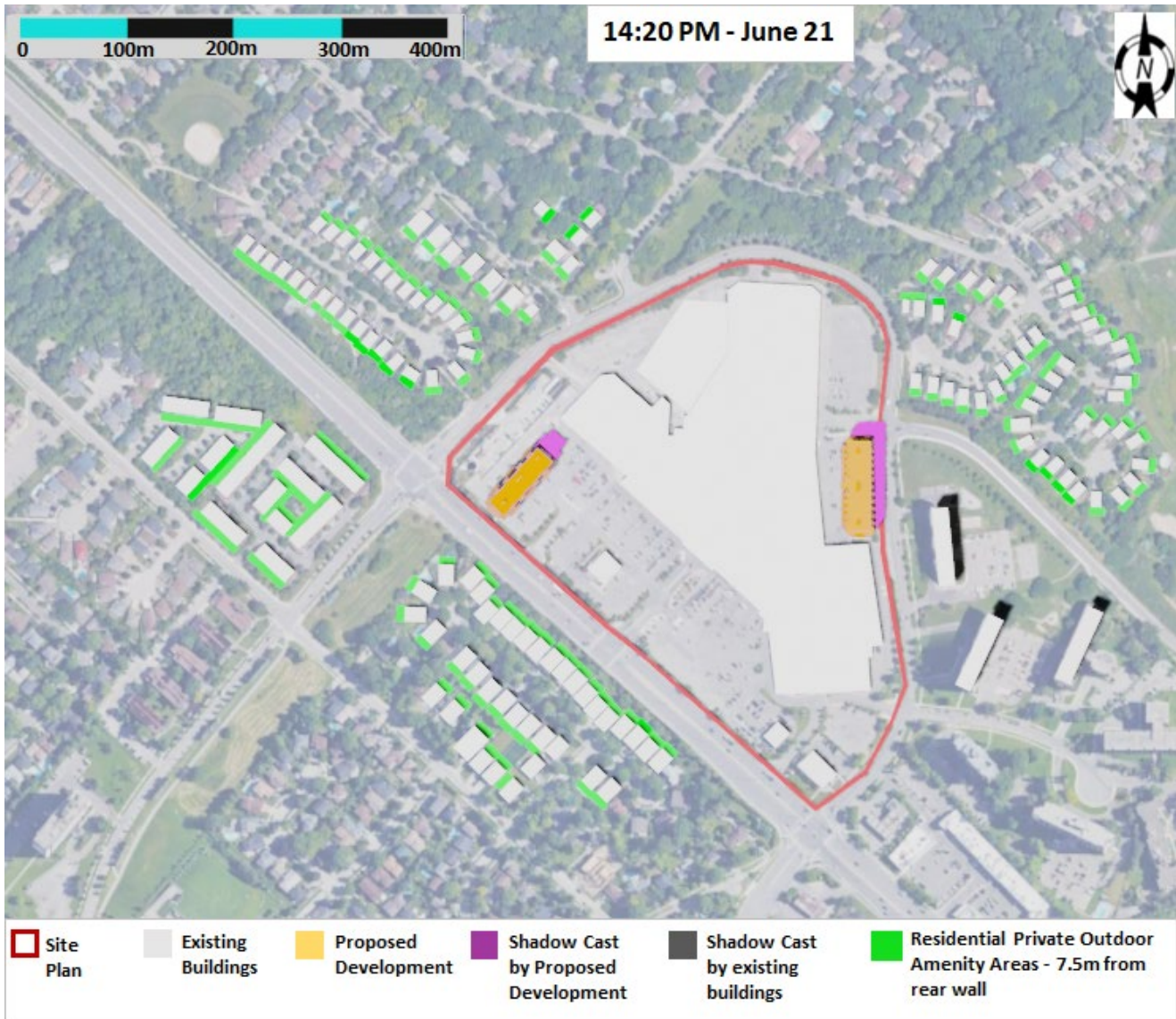


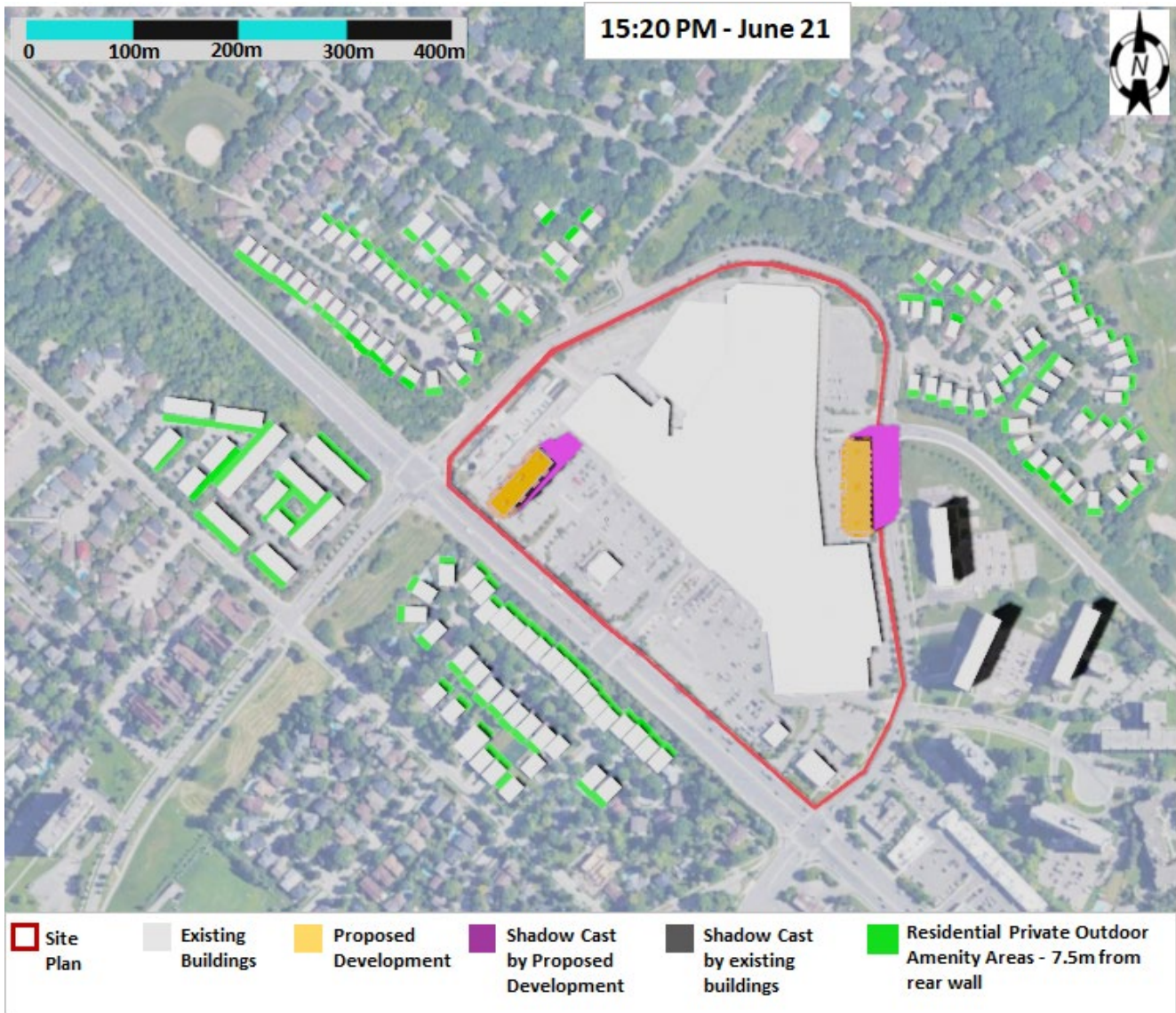


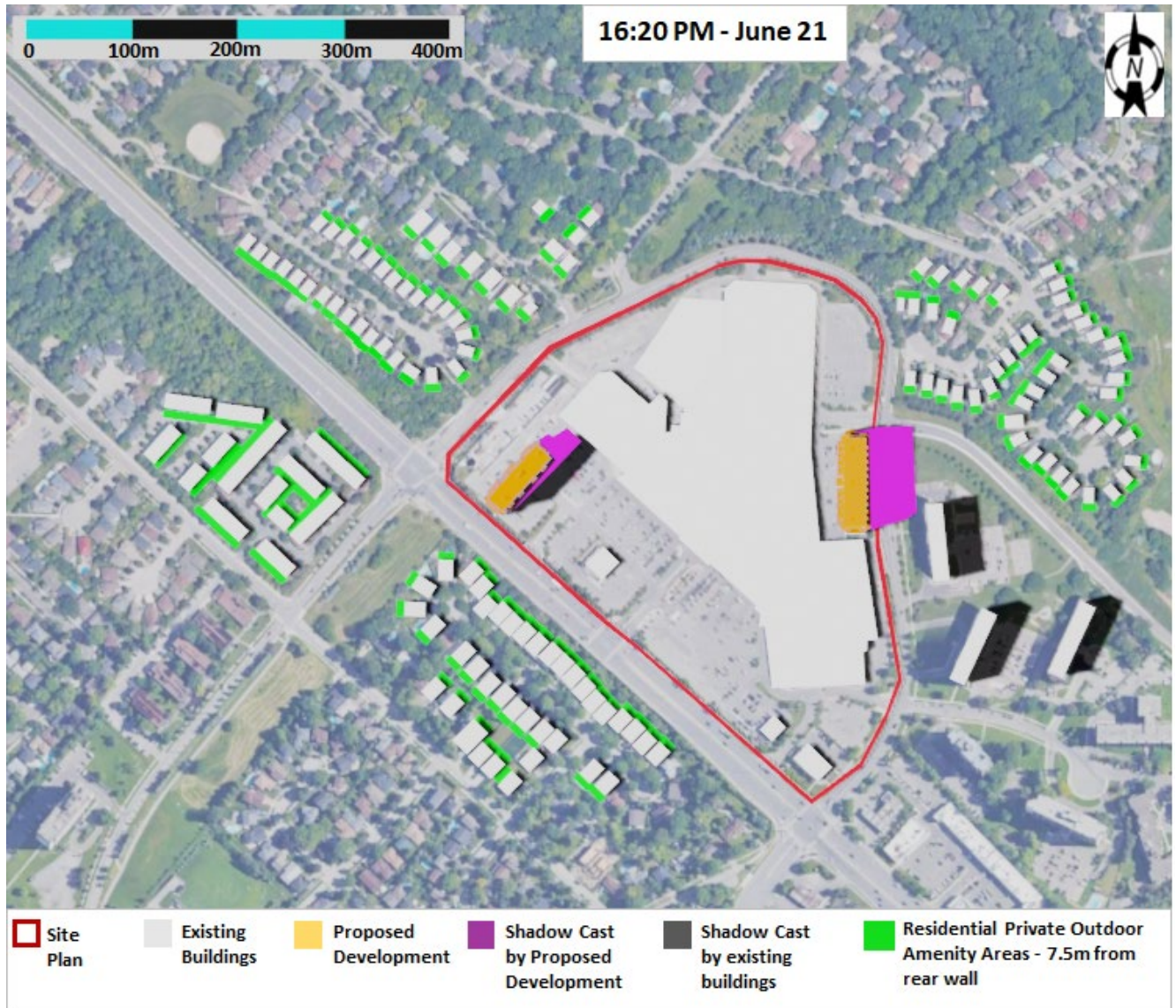


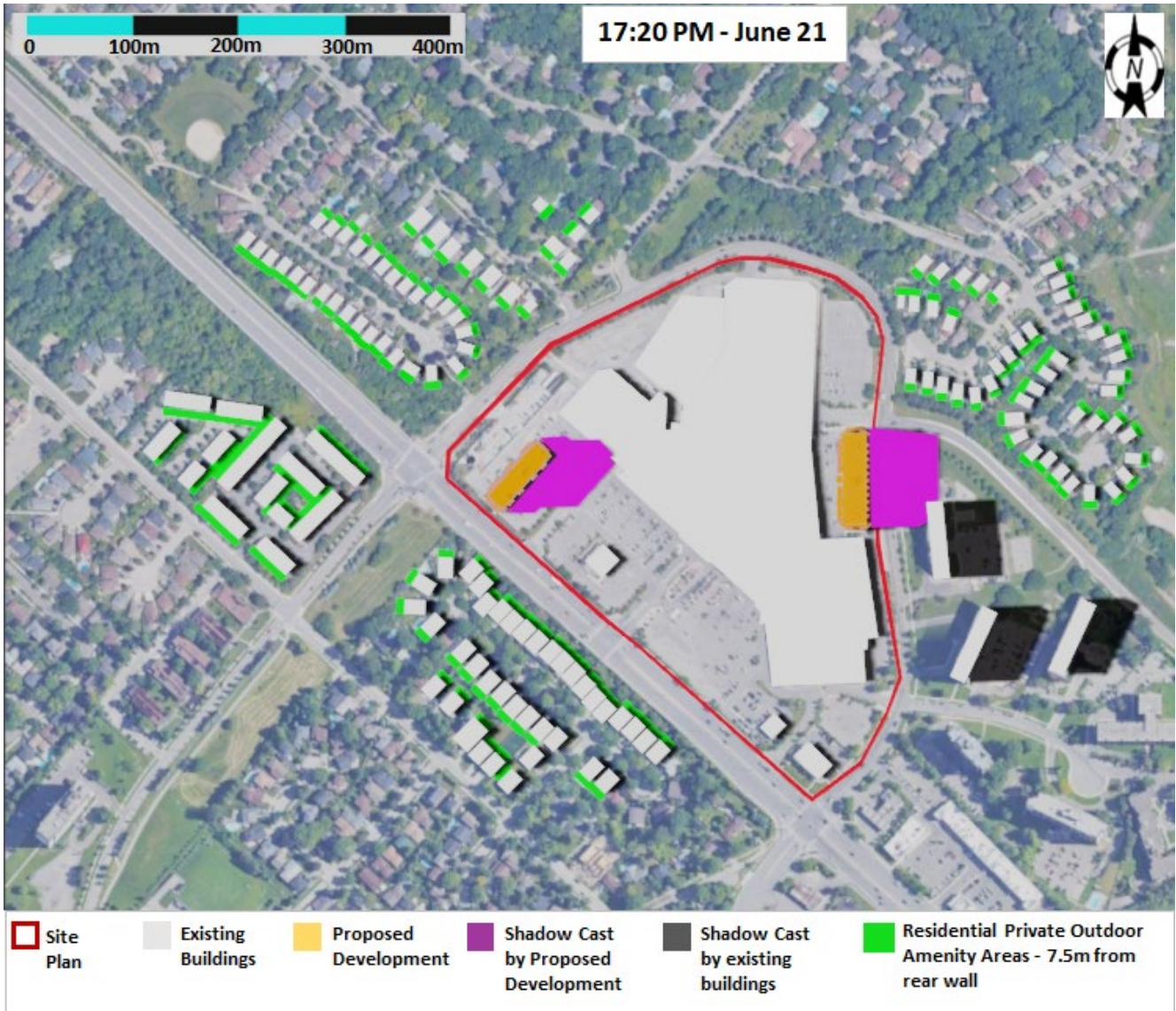


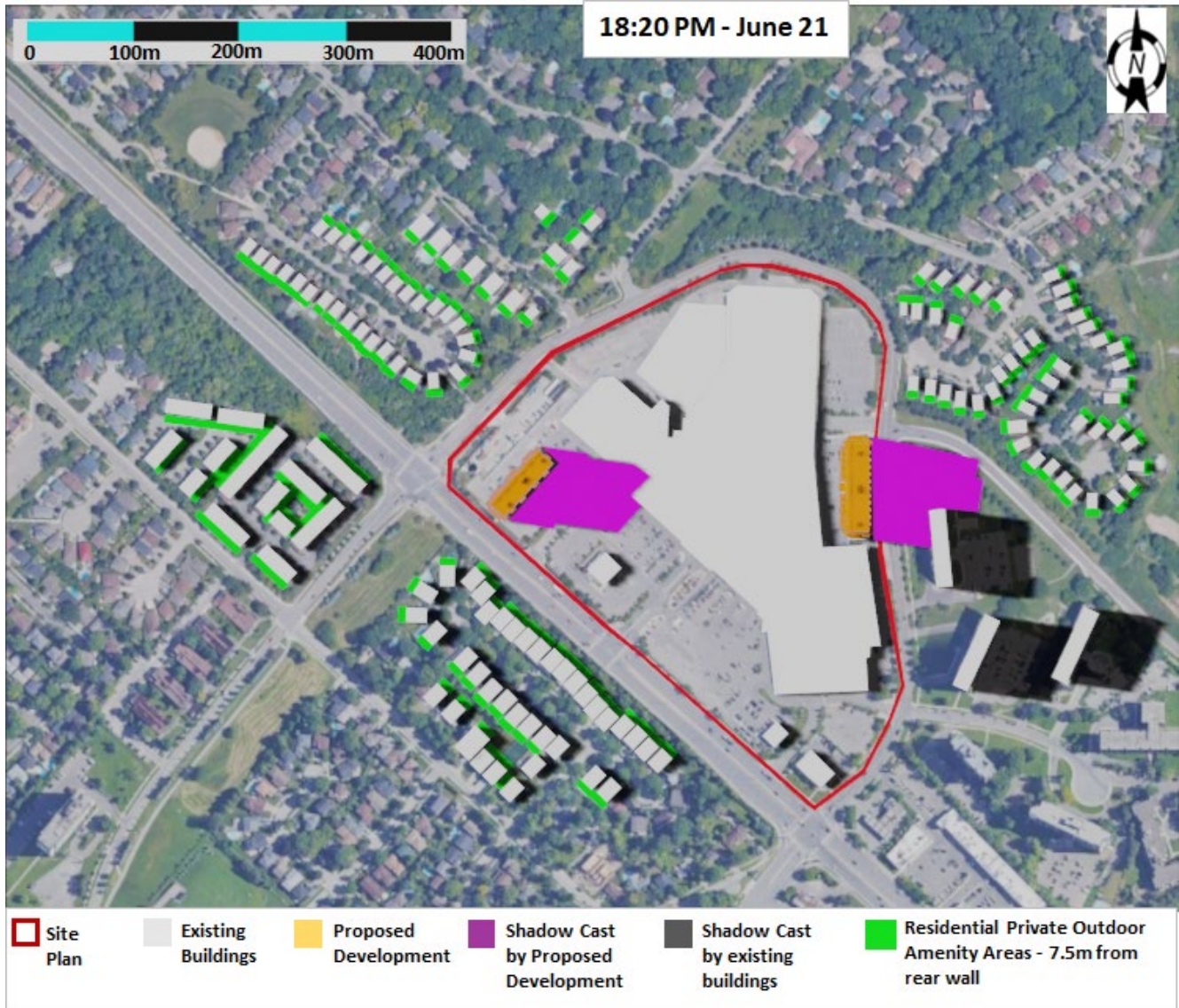


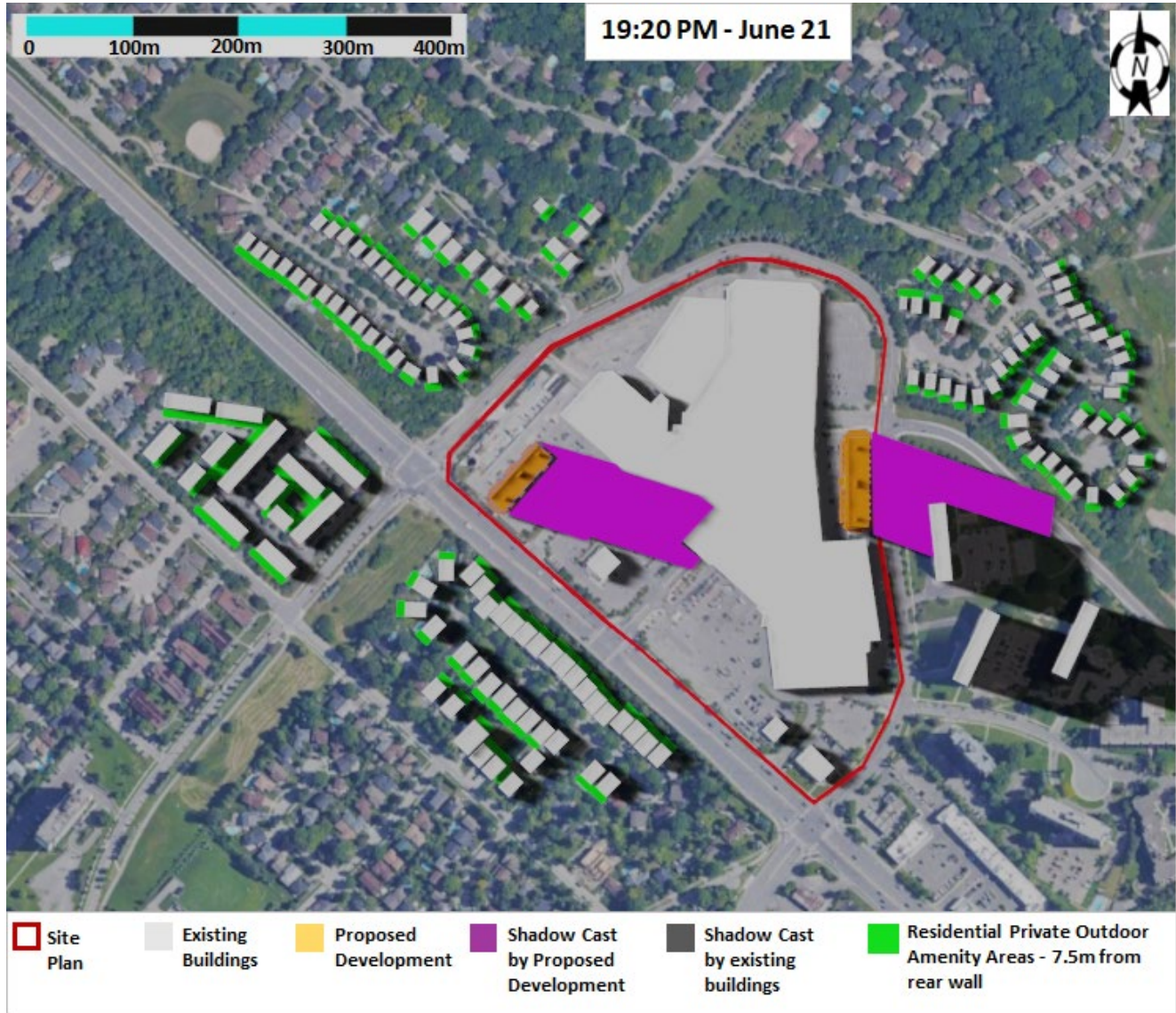












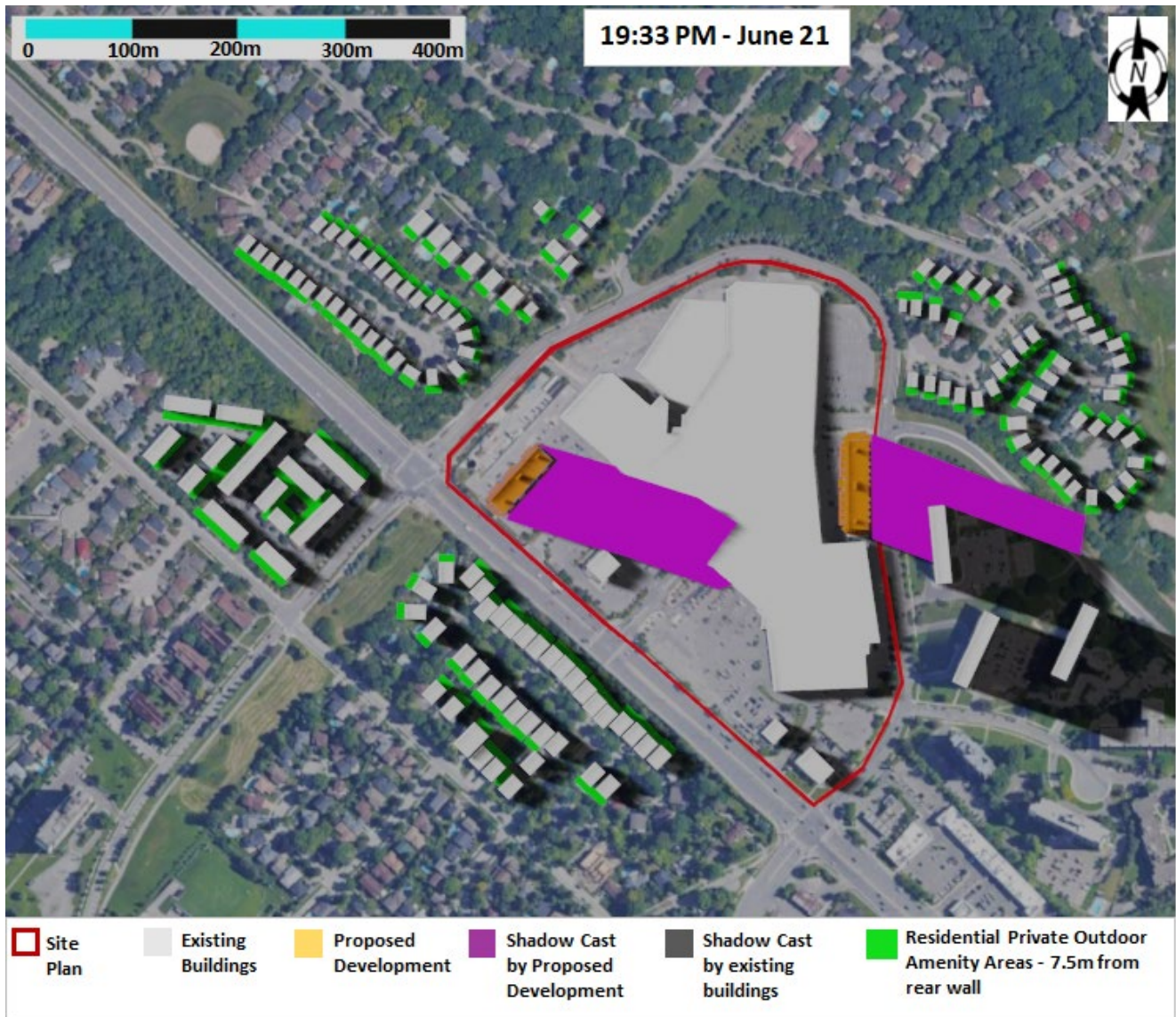
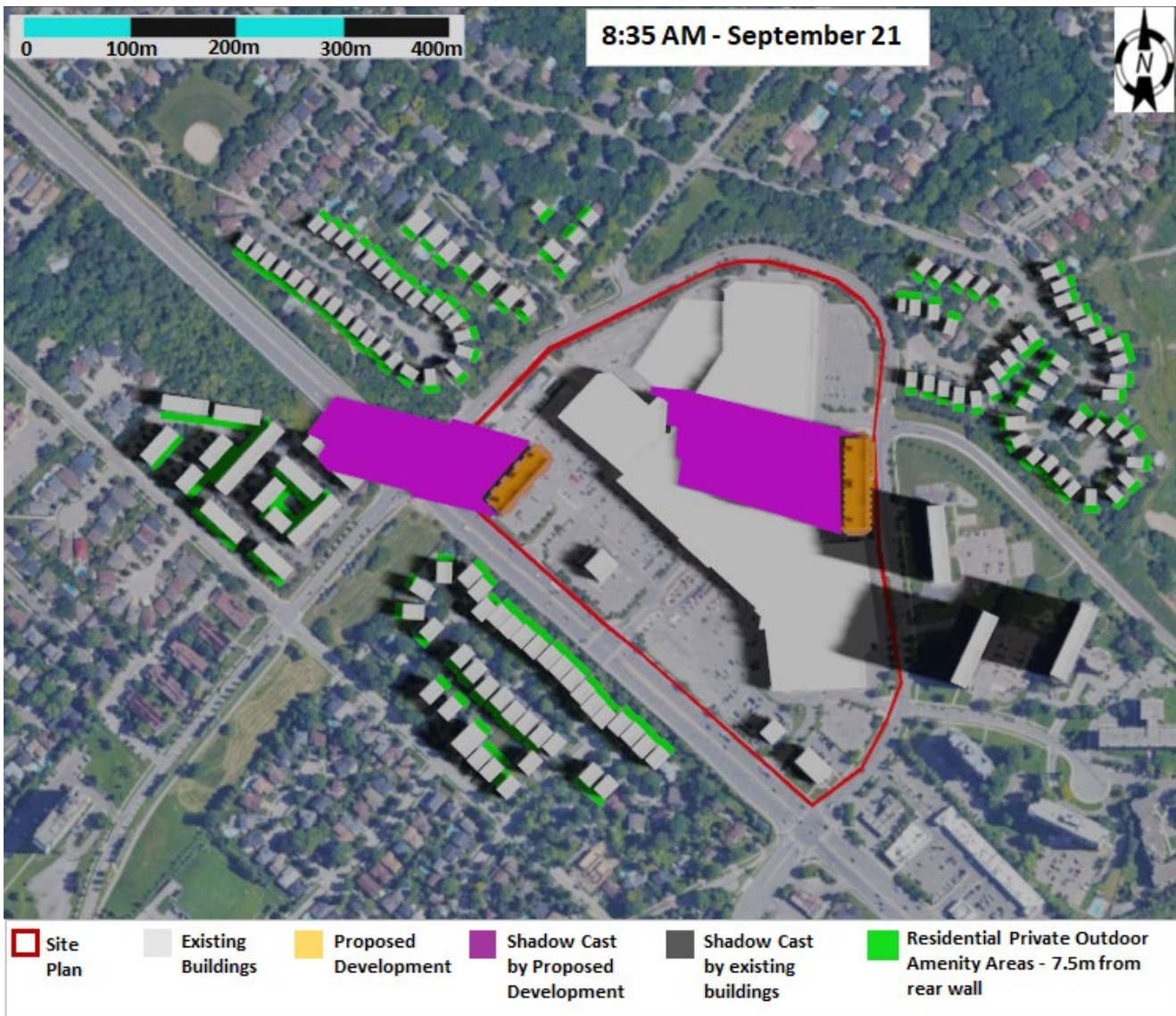


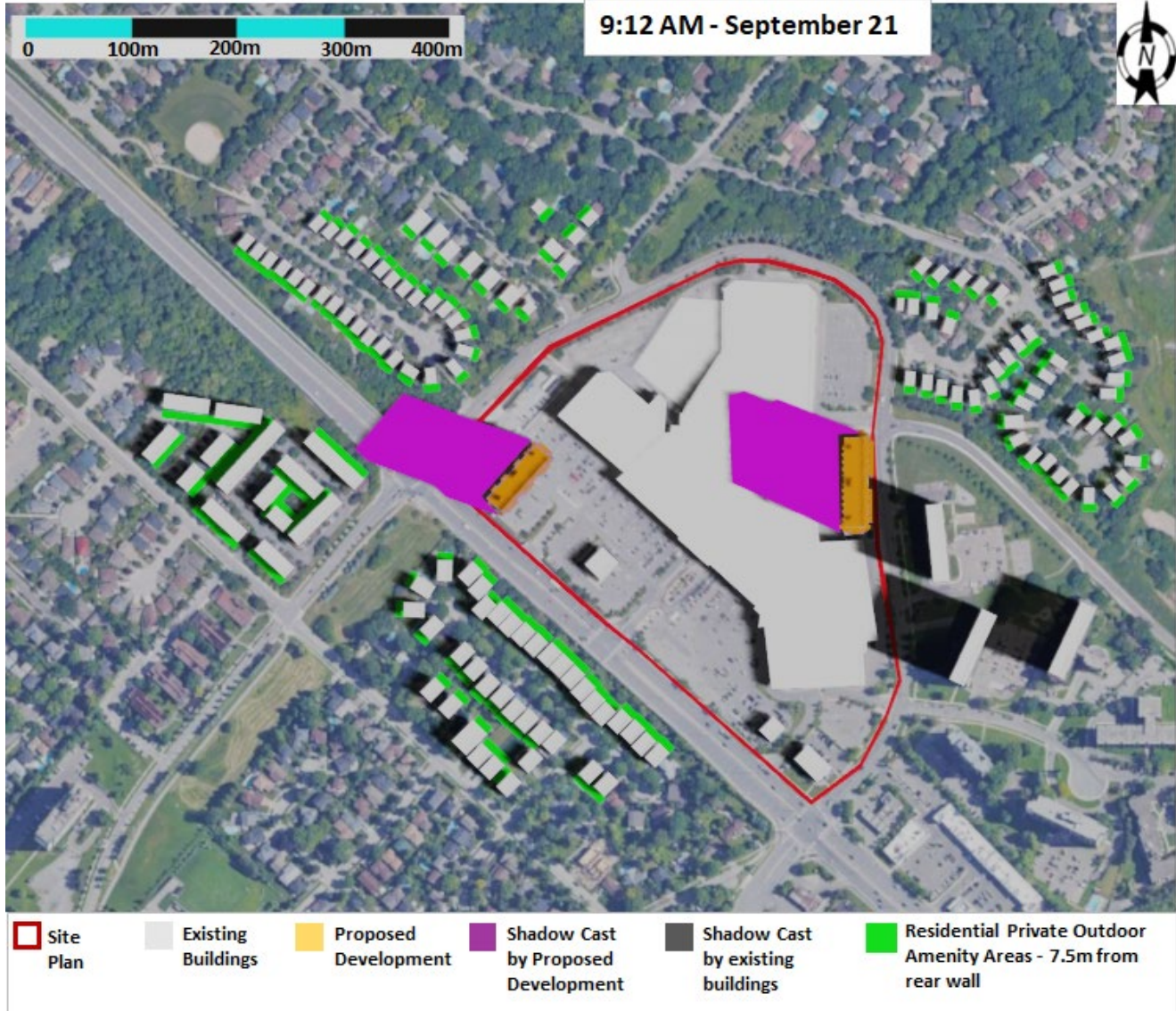
Figure 4: Shadow Patterns at Residential Outdoor Private amenity spaces – June 21st

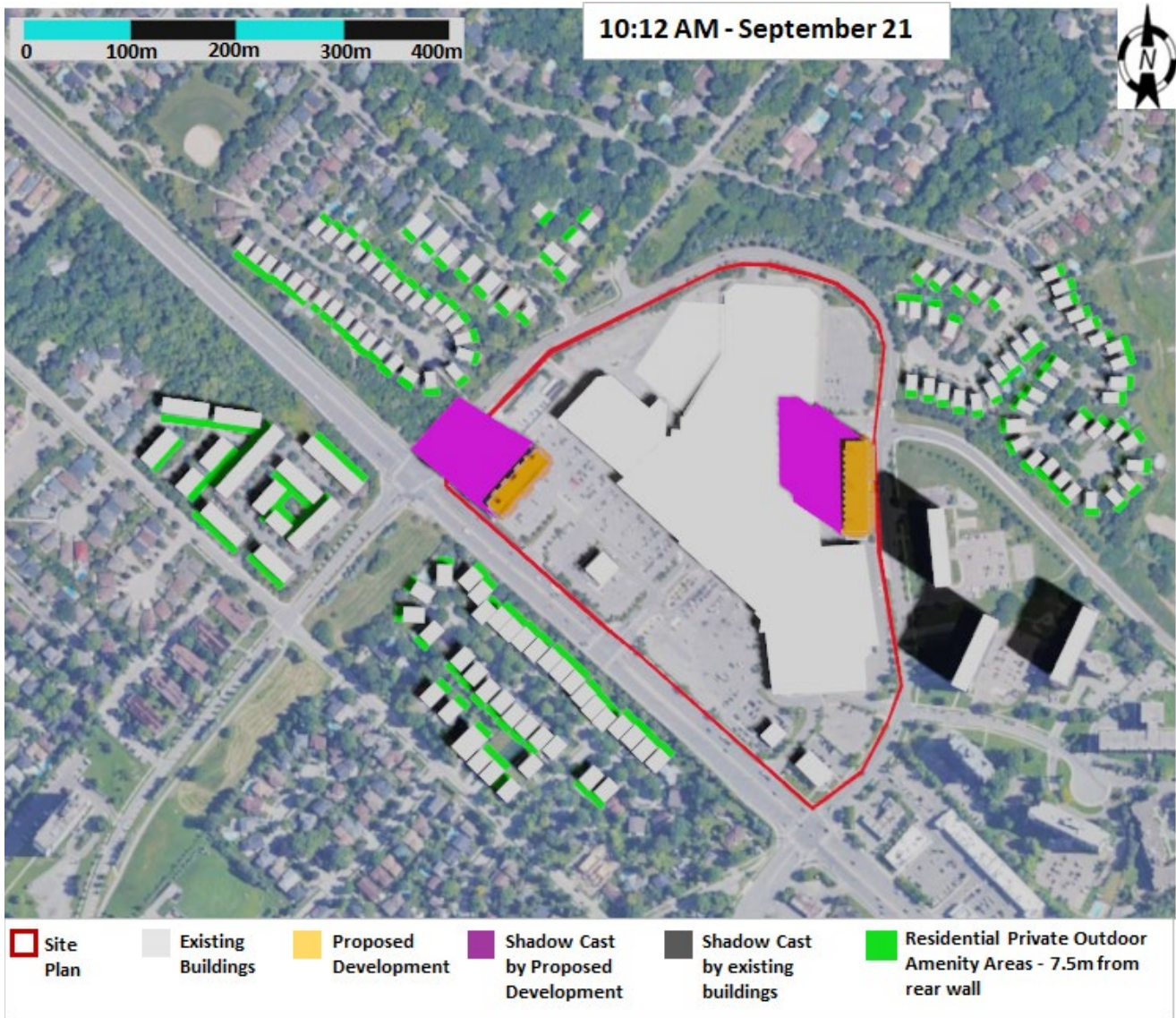
Section 3.1 of the TOR requires that the line of impact assessment or “no impact zone” for these private outdoor amenity spaces should be within 7.5m of the rear wall or other appropriate exterior building wall. The criterion is met if there is shadow impact for no more than two consecutive hourly test times within the space between the exterior wall of the dwelling that abuts the amenity space and the line of impact assessment. As shown in **Figure 4** above, the findings of the shadow analysis show that the proposal for no more than two consecutive hourly test times are in accordance with this standard. As such, the criterion for section 3.1 is met.

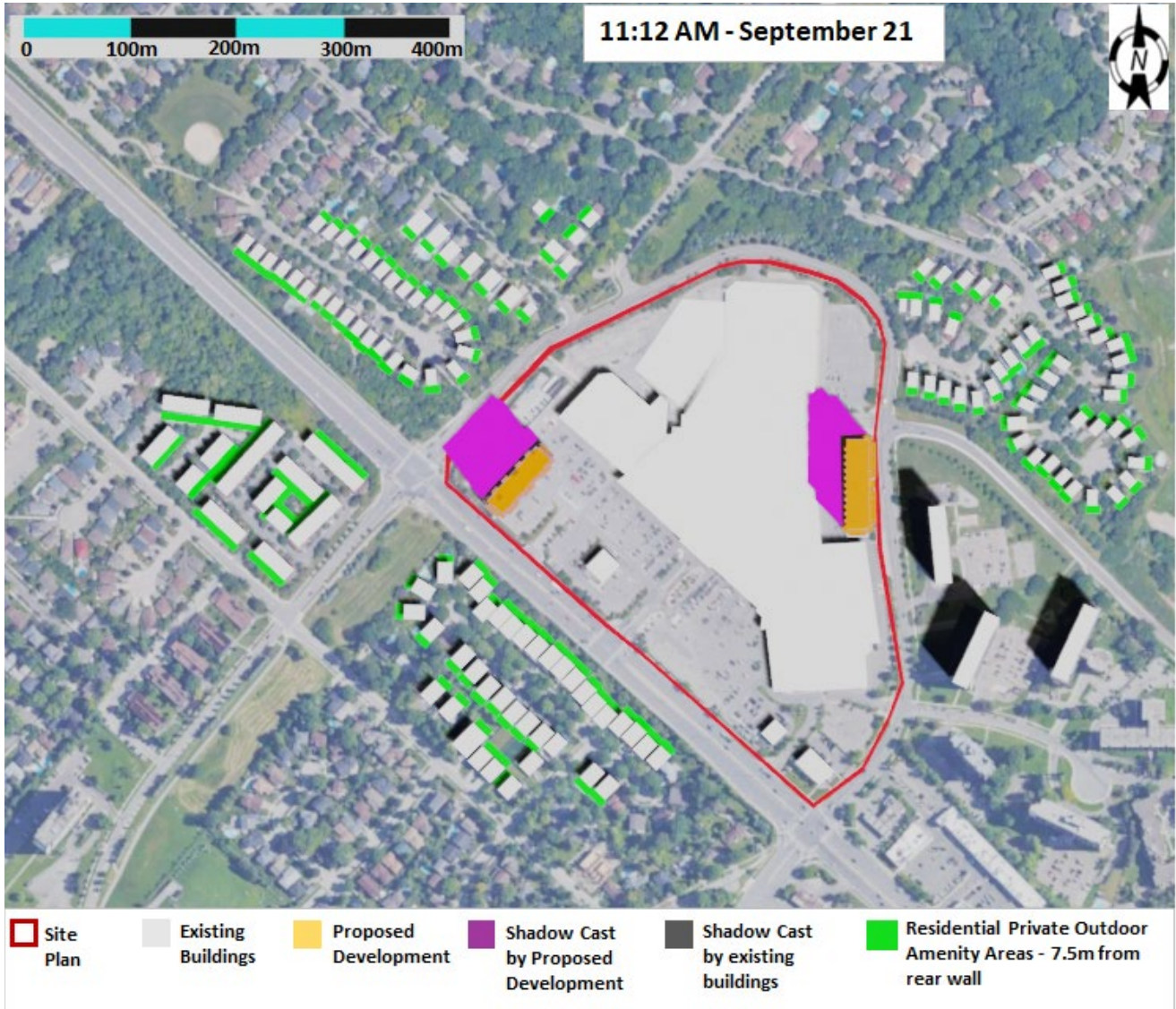
3.2 SHADOW ANALYSIS RESULTS FOR SEPTEMBER 21

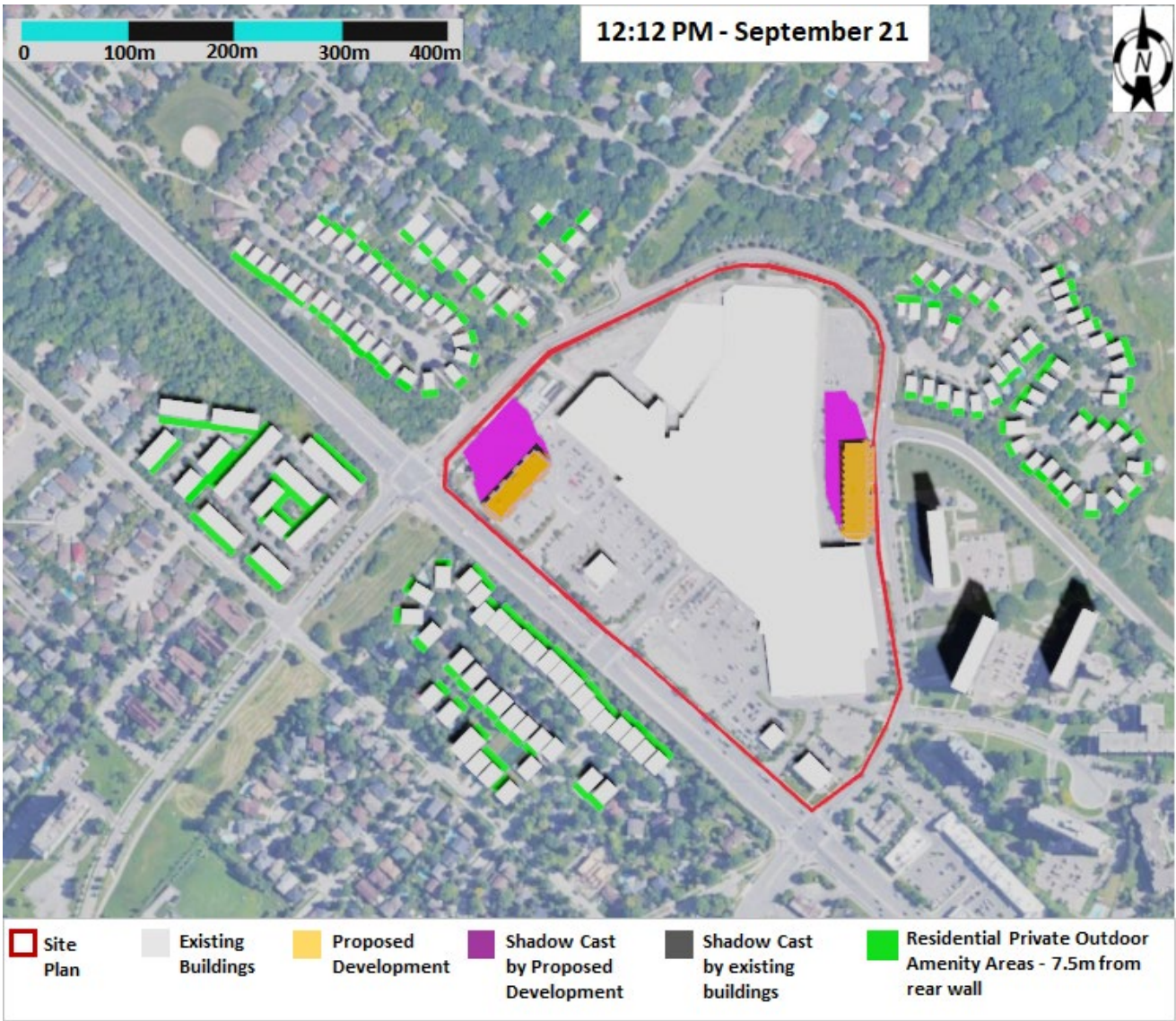
The model results of shadow patterns for fall equinox from 8.35am to 5.48pm are shown in **Figure 5**. In this **Figure 5**, the new shadow (purple color) represents the shadow due to the Development, while the existing shadow represents the shadow due to the existing buildings. The footprint of the Development is represented by the orange color. For the fall equinox, the shadow patterns are characterized by a longer cast or coverage on the north-west side of the Development for the first hours in the morning. Then, this coverage shortened once the sun moves towards the noon hour. The shadow coverage extends on the east and north-east sides of the Development to reach a maximum length near the sunset hours.

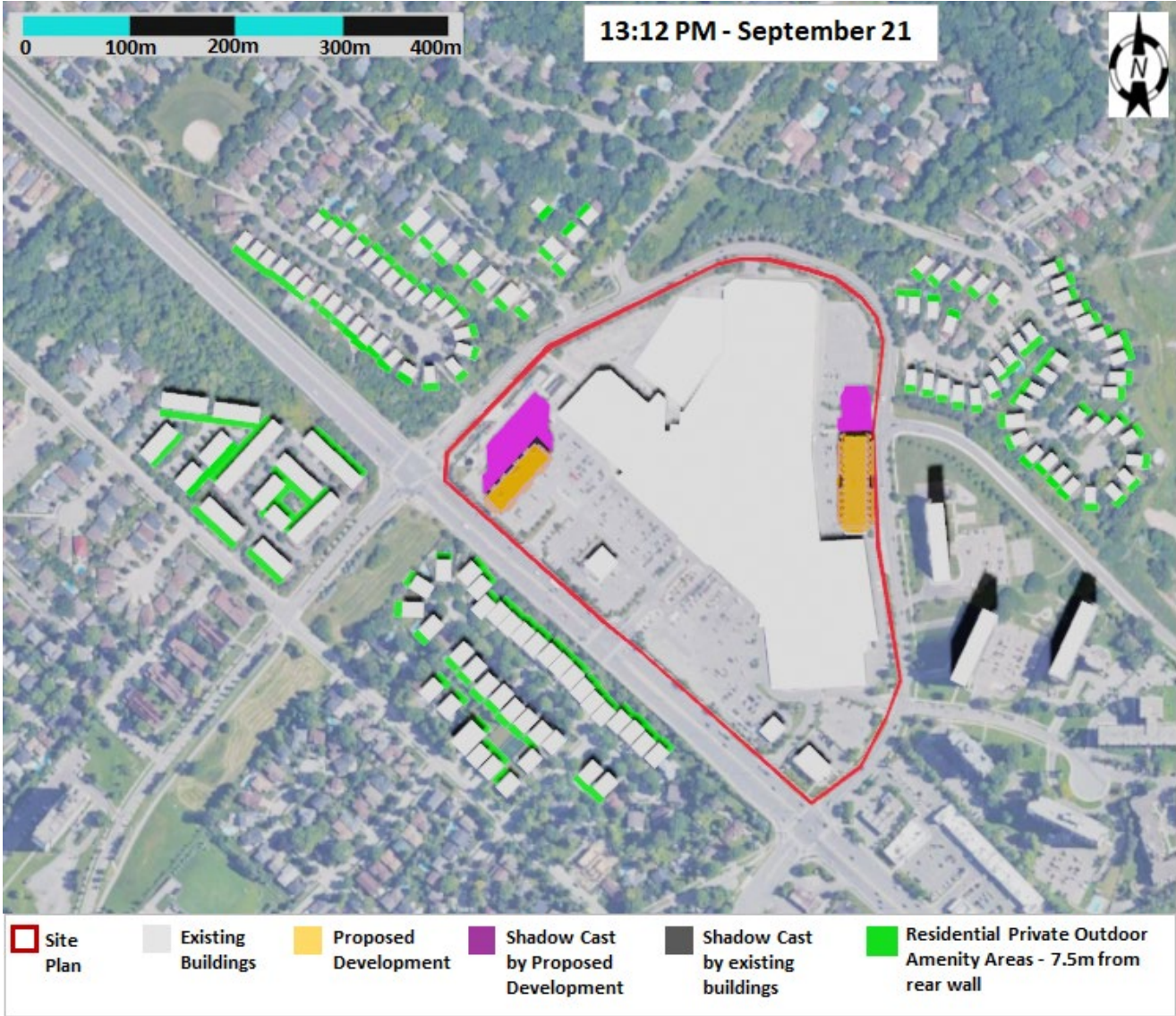


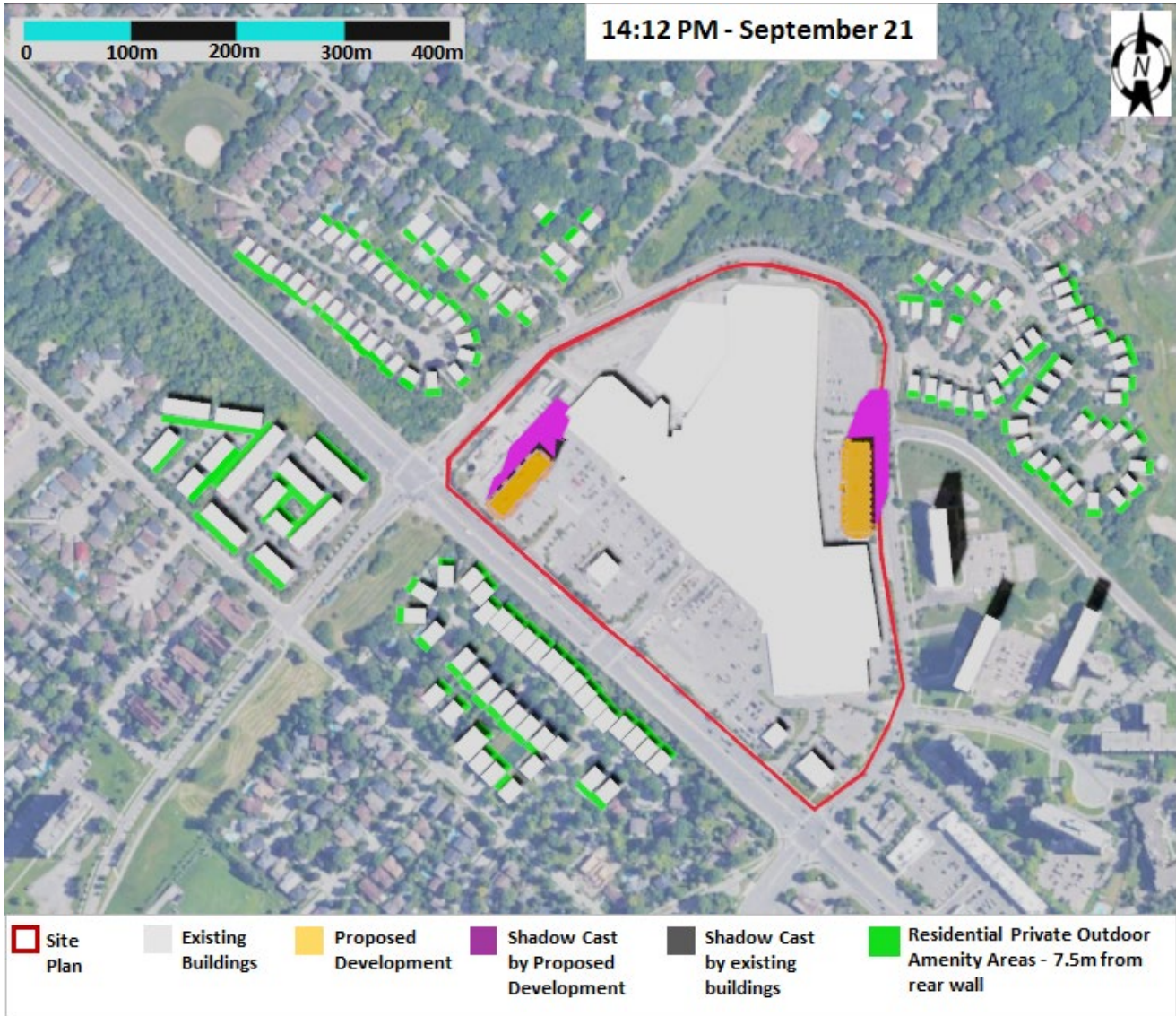


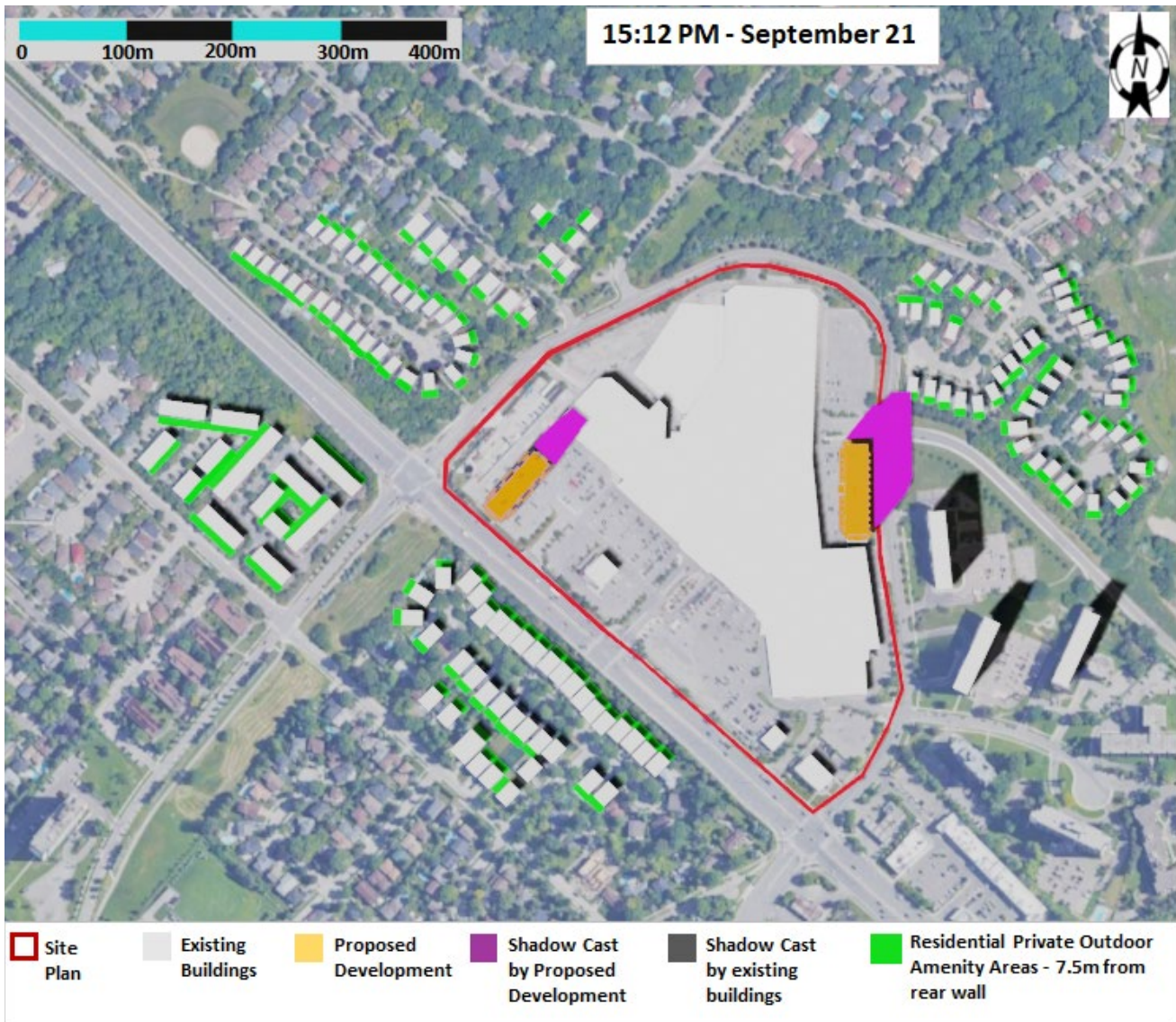


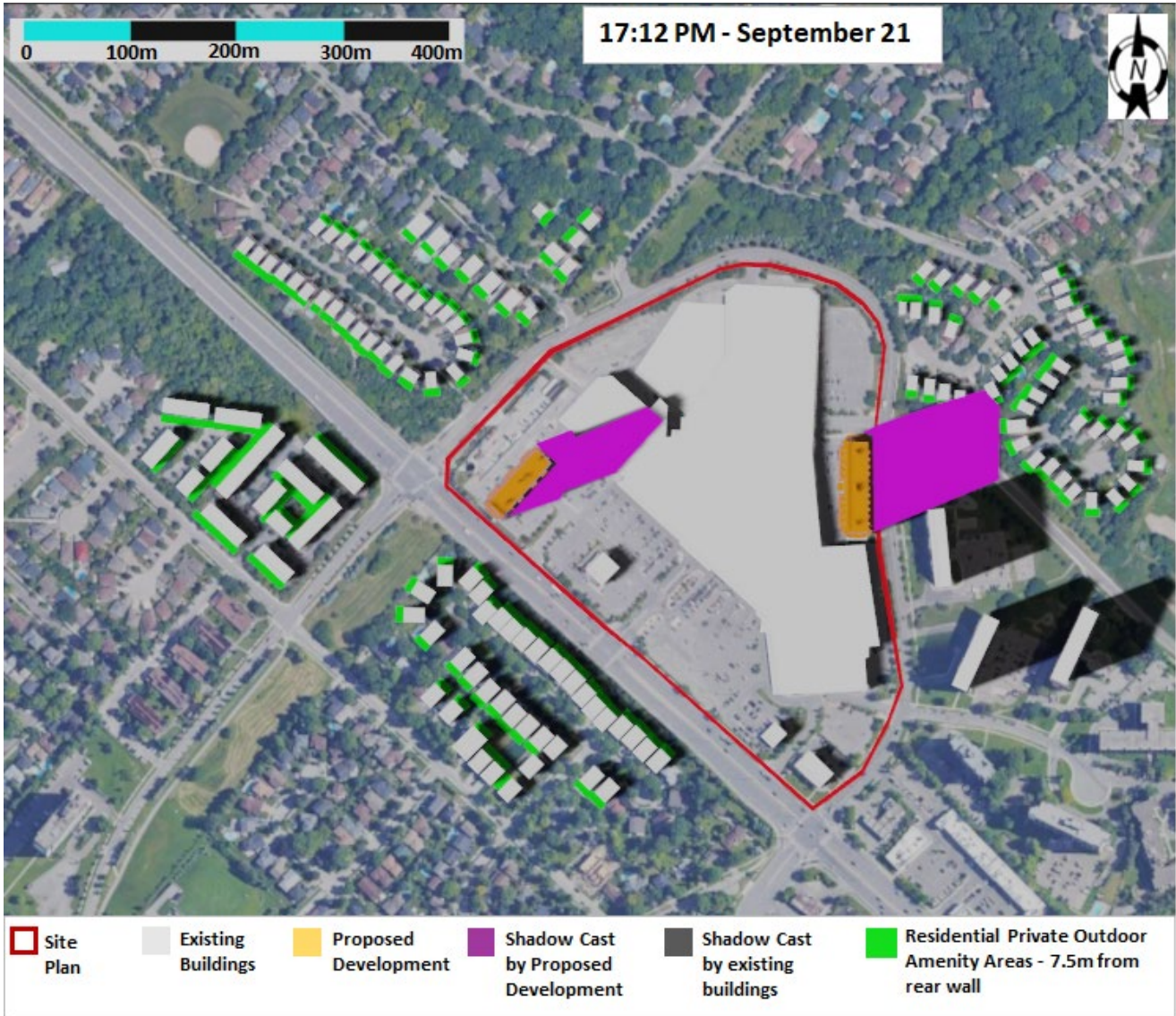












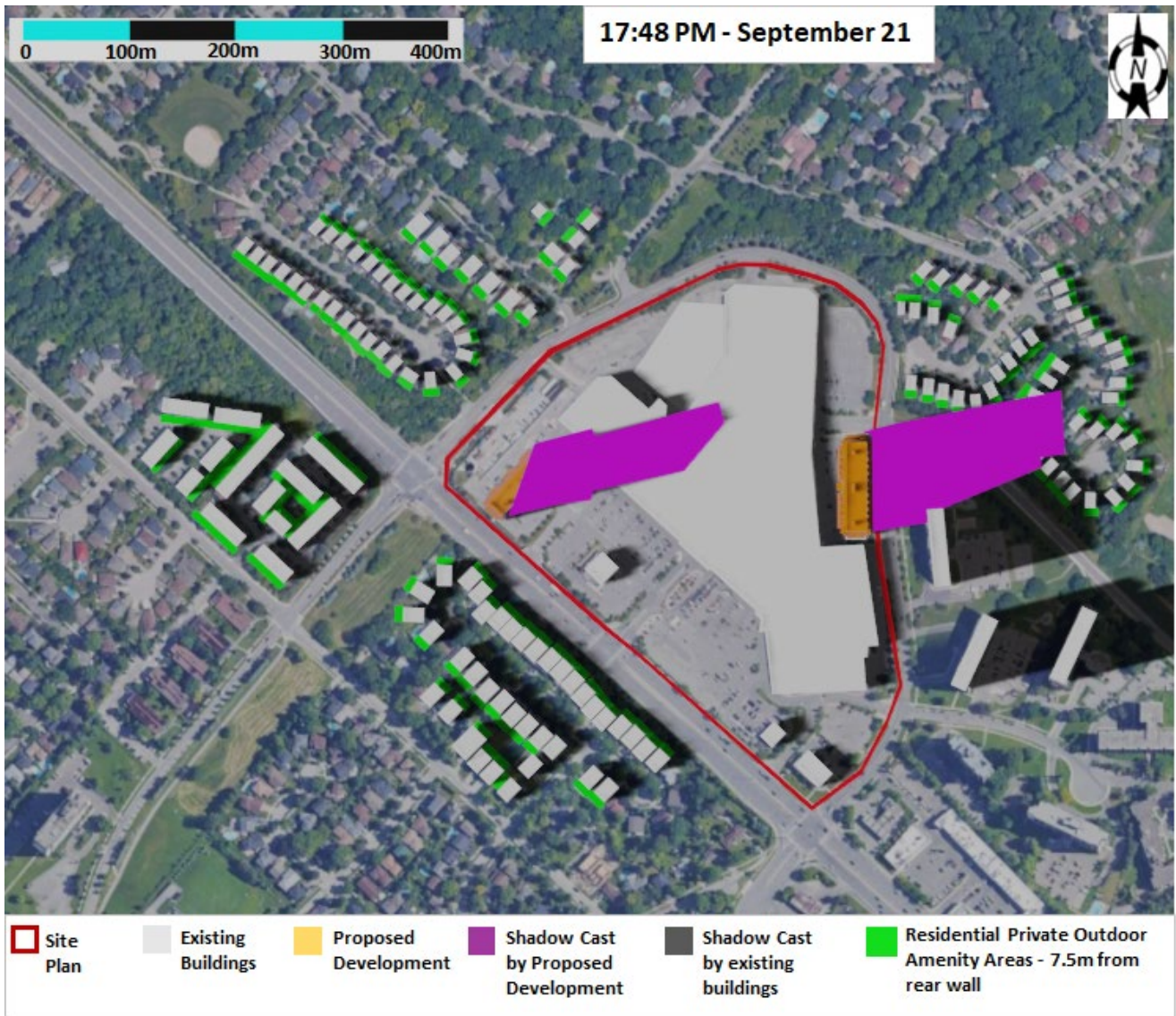


Figure 5: Shadow Patterns at Residential Outdoor Private amenity spaces – September 21st.

Section 3.1 of the TOR requires that the line of impact assessment or “no impact zone” for these private outdoor amenity spaces should be within 7.5m of the rear wall or other appropriate exterior building wall. The criterion is met if there is shadow impact for no more than two consecutive hourly test times within the space between the exterior wall of the dwelling that abuts the amenity space and the line of impact assessment. As shown in **Figure 5** above, the findings of the shadow analysis show that the proposal for no more than two consecutive hourly test times are in accordance with this standard. As such, the criterion for section 3.1 is met.

4 COMMUNAL OUTDOOR AMENITY AREAS

As mentioned above, no such areas have been identified within the study domain and therefore will not be included in the analysis.

5 PUBLIC REALM

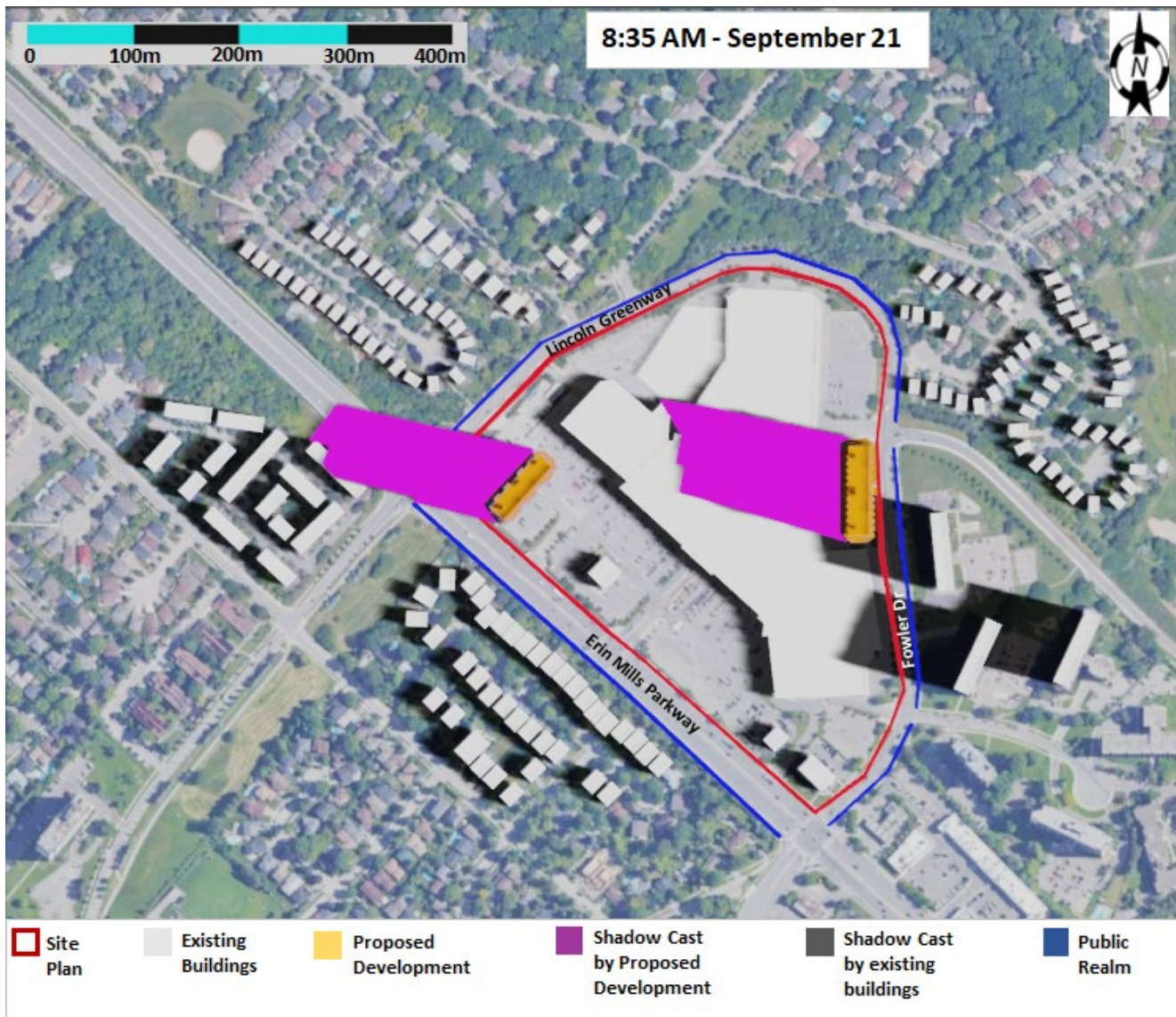
Figure 6 identifies all public realm in the vicinity of the development. For this study, the public realm is comprised of the public sidewalks along Erin Mills Parkway, along Lincoln Greenway and along Fowler Drive as well as the public Sheridan Plaza.

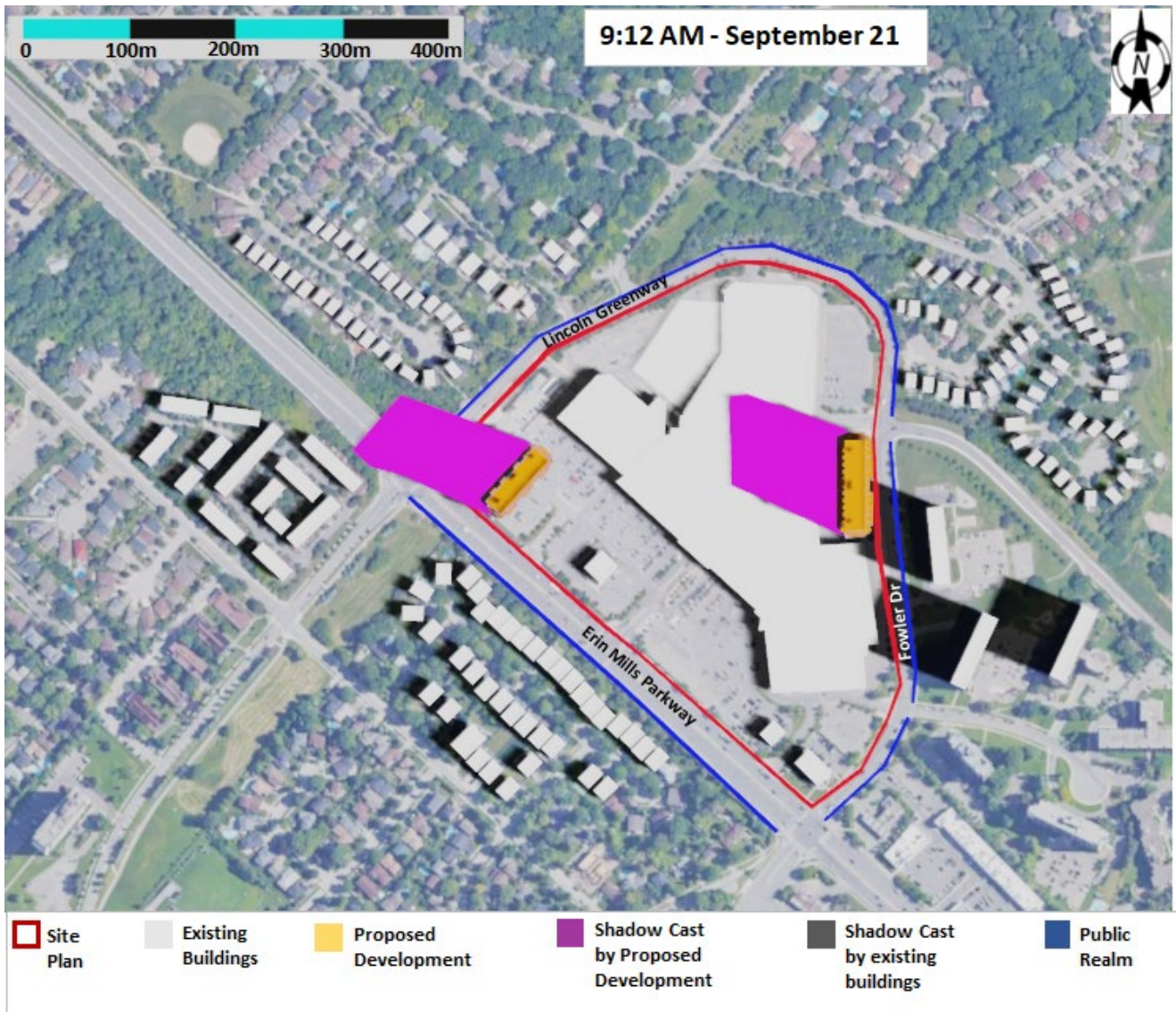


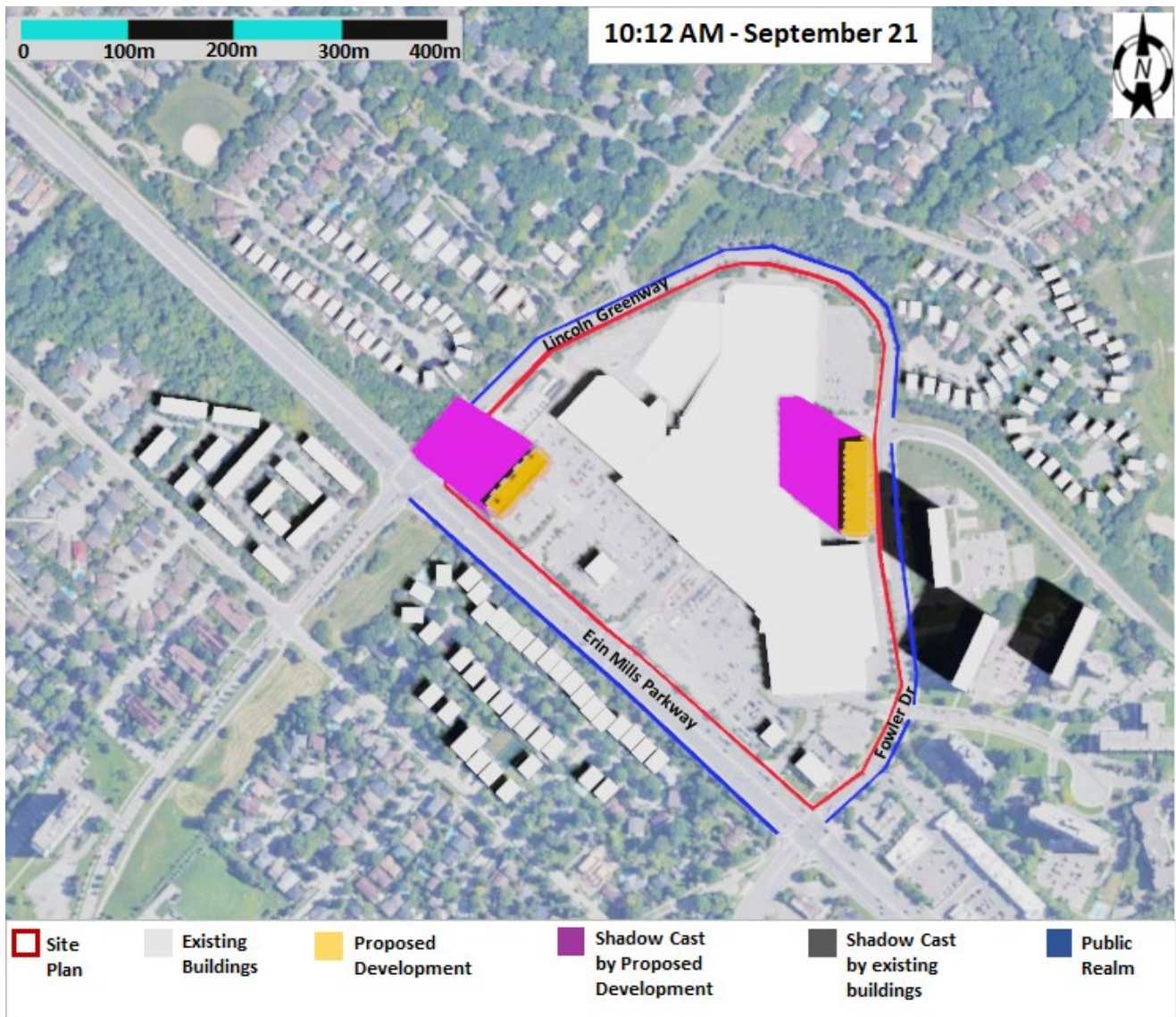
Figure 6: Public Realm in the vicinity of the Development.

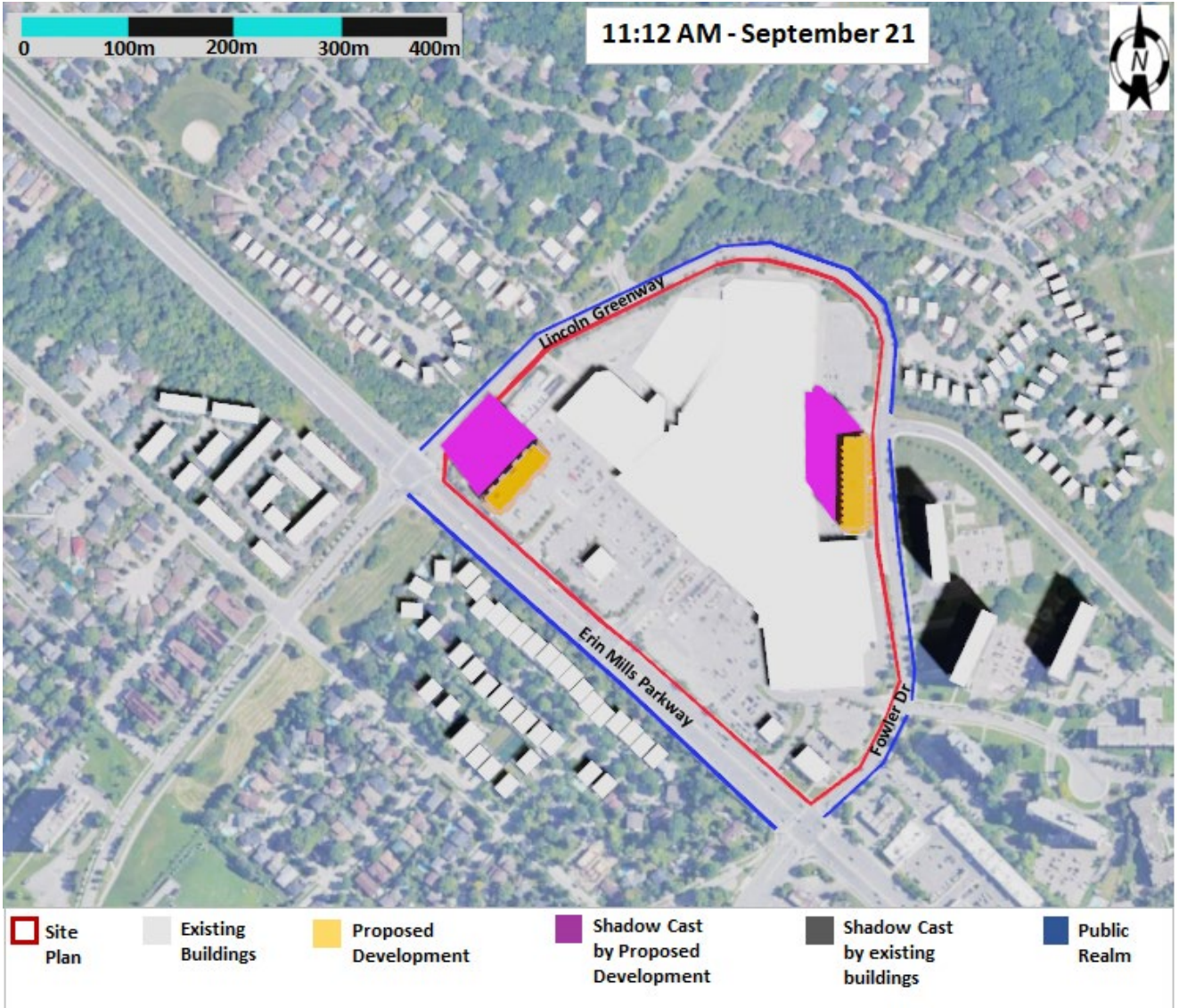
5.1 SHADOW ANALYSIS RESULTS FOR SEPTEMBER 21

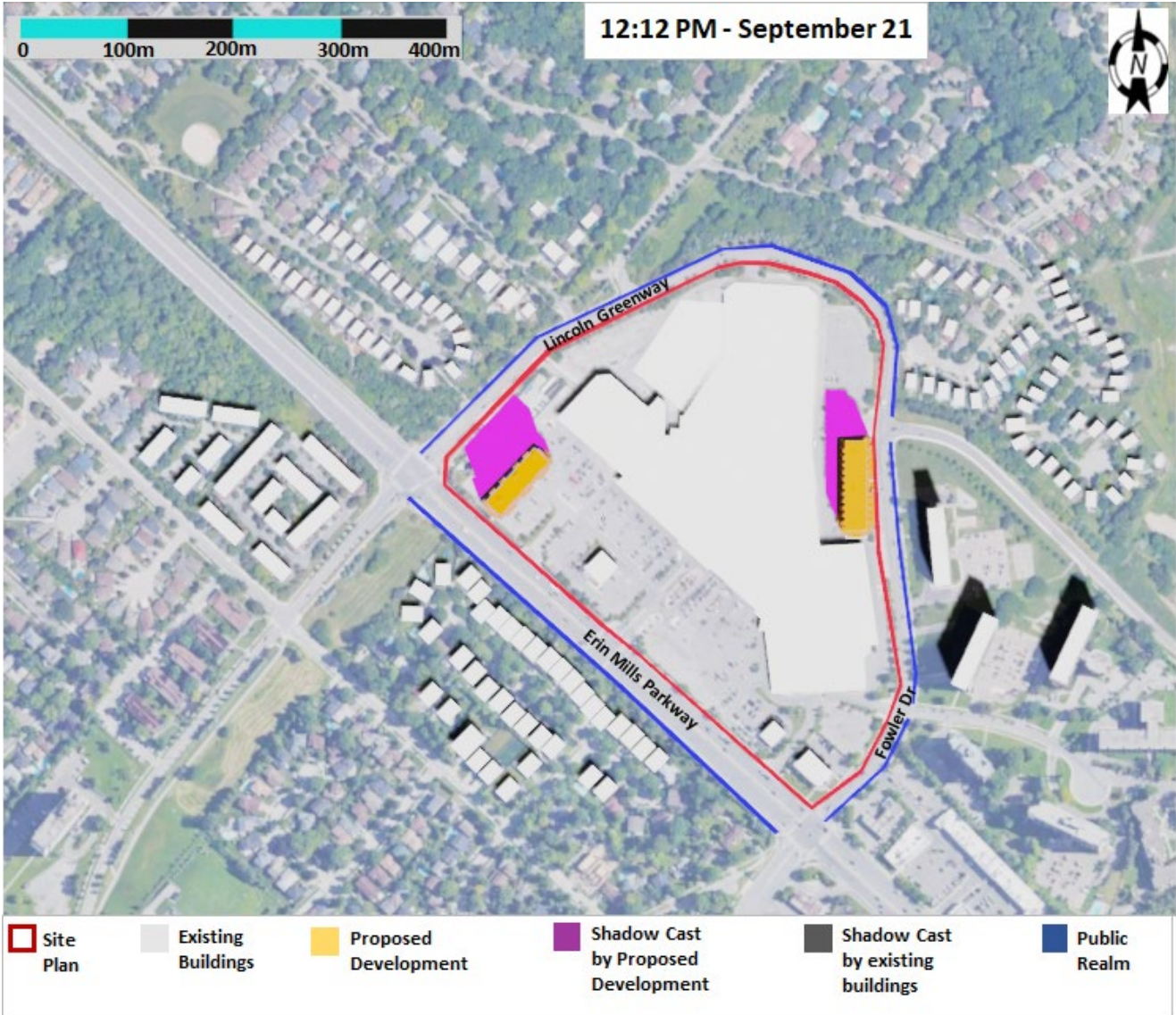
The model results of shadow patterns for fall equinox from 8.35am to 5.48pm are shown in **Figure 7**. As shown in this **Figure 7**, the new shadow (purple color) represents the shadow due to the Development, while the existing shadow represents the shadow due to the existing buildings. The footprint of the Development is represented by the orange color. For the fall equinox, the shadow patterns are characterized by a longer cast or coverage on the north-west side of the Development for the first hours in the morning. This coverage shortens once the sun moves towards the noon hour. The shadow coverage extends on the east and north-east sides of the Development to reach a maximum length near the sunset hours.

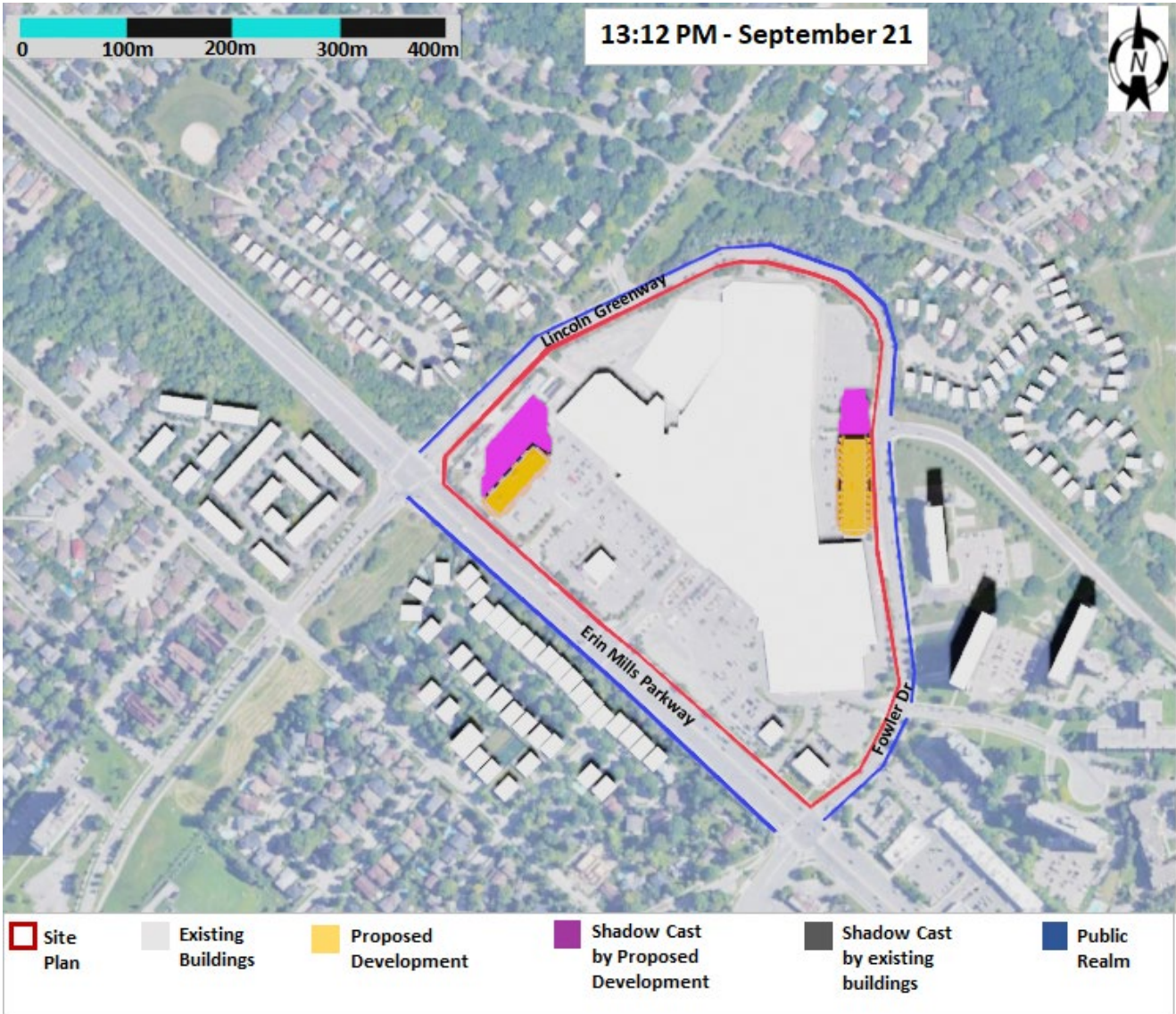


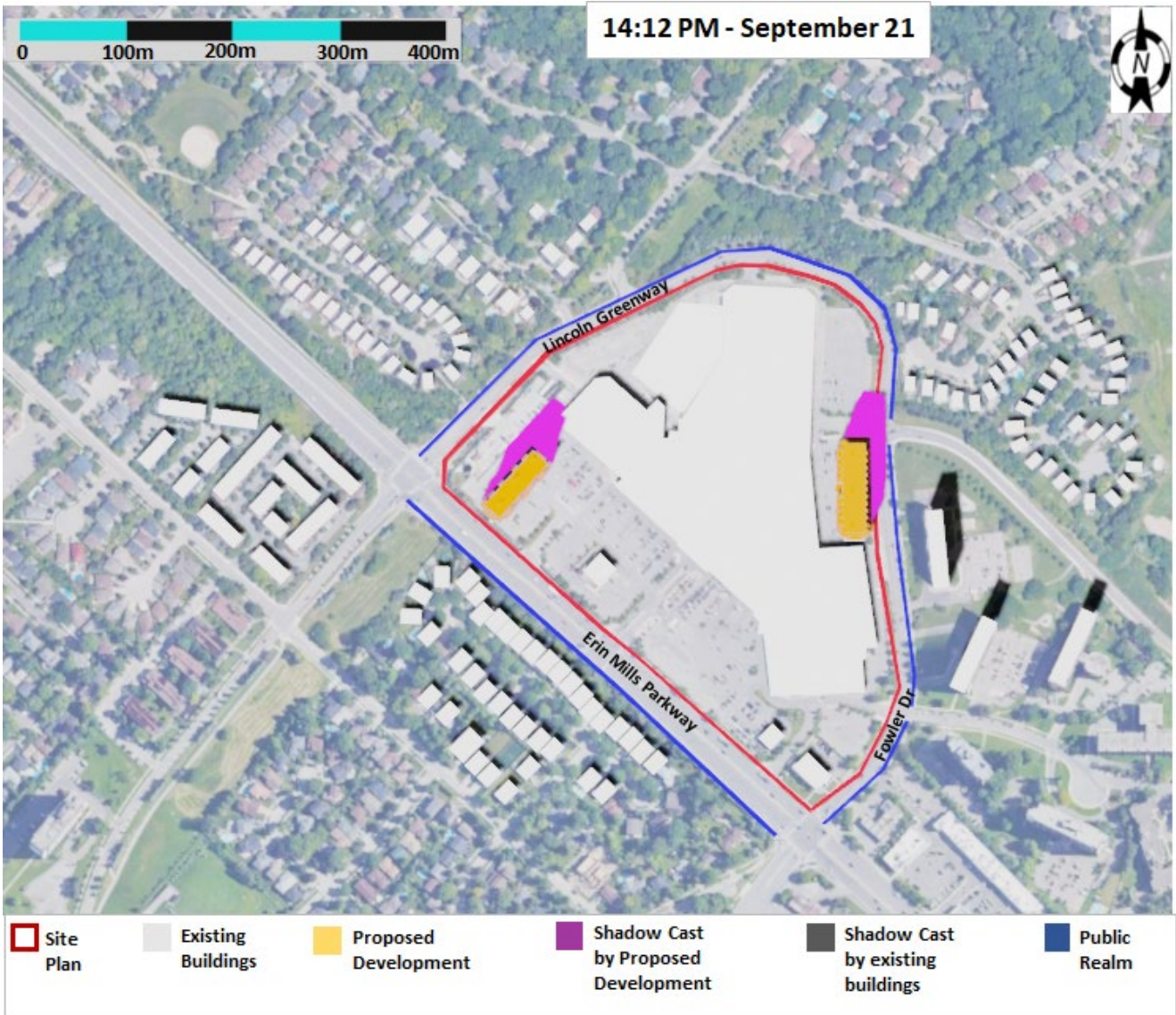


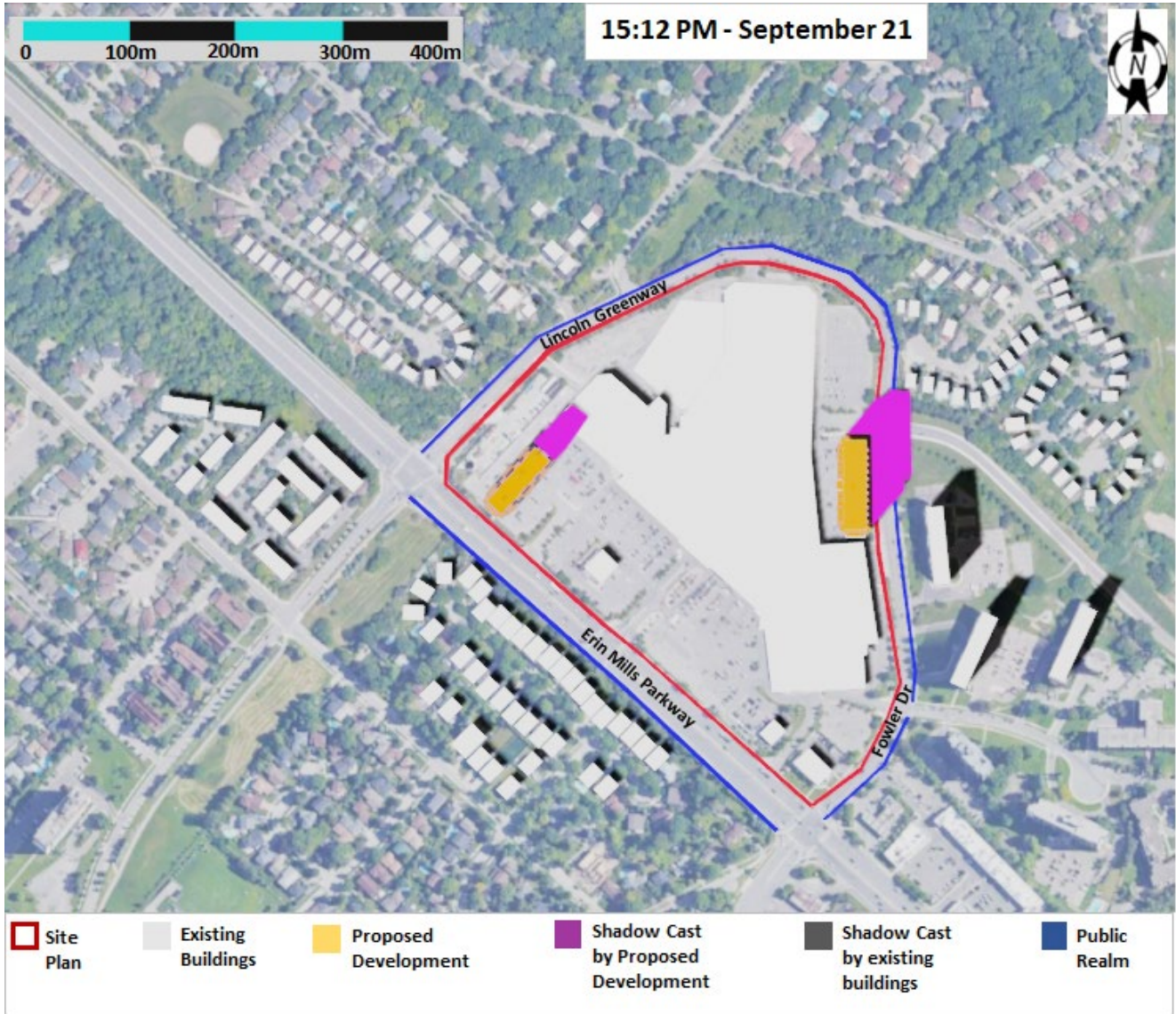


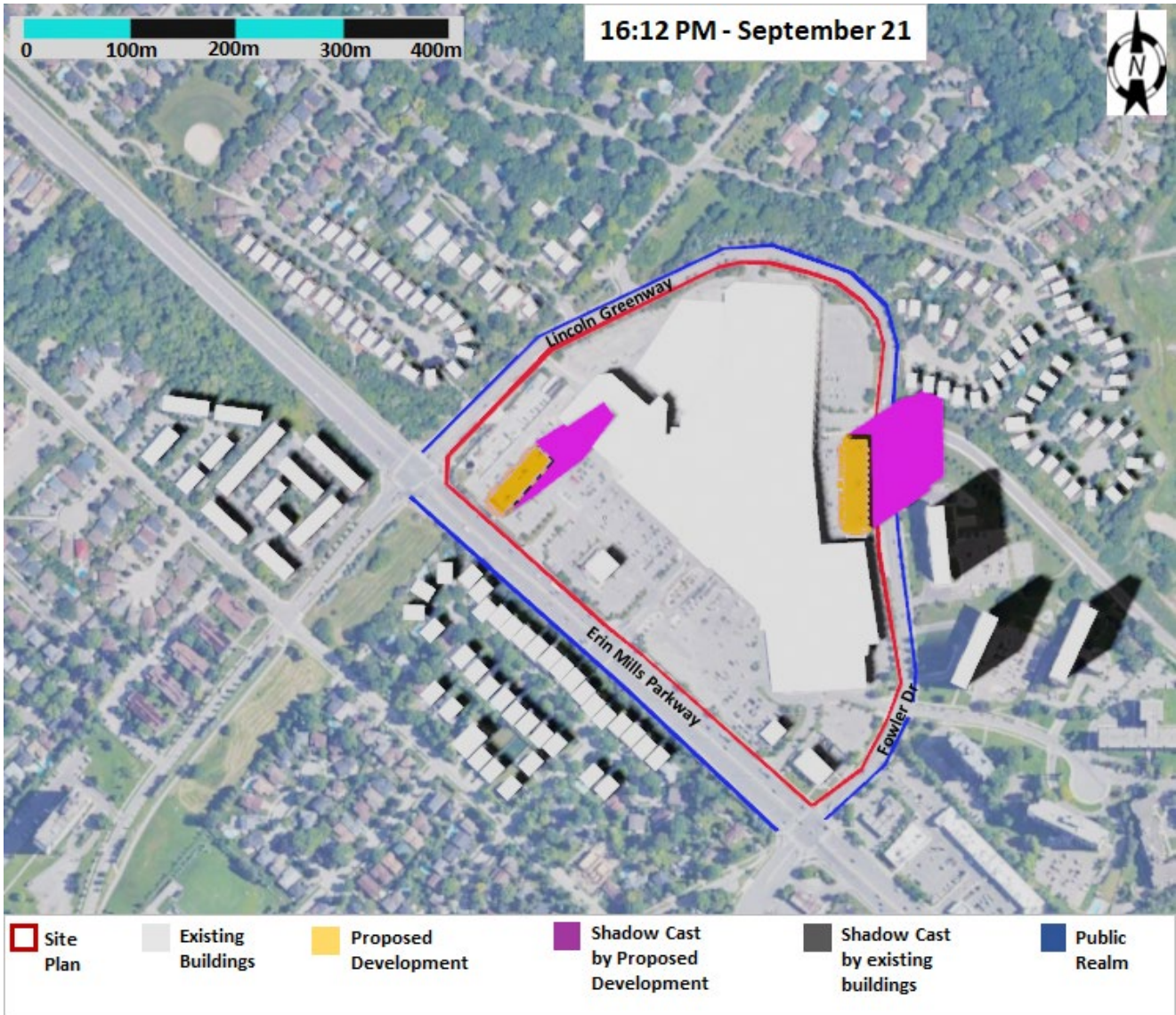


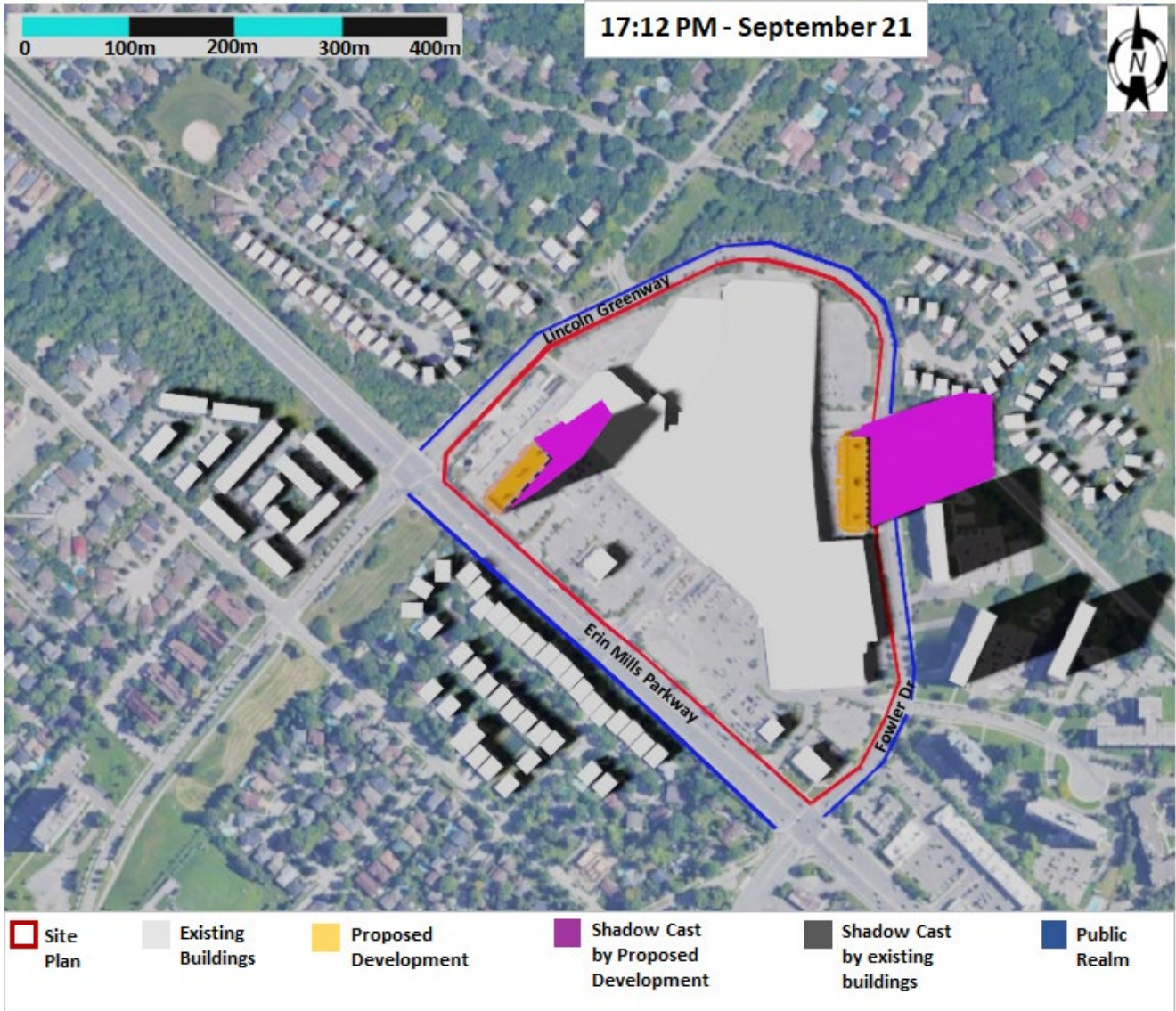












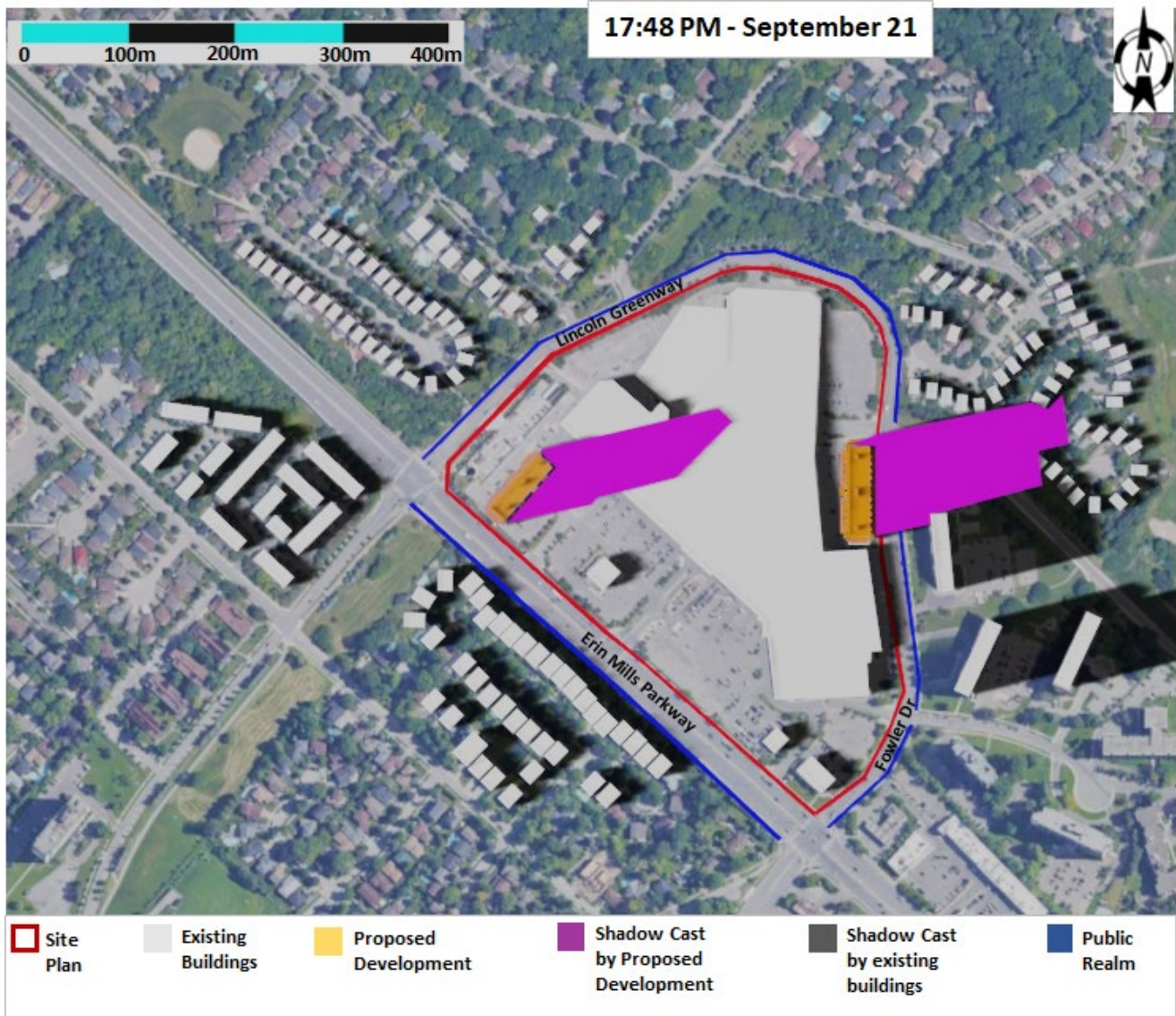


Figure 7: Shadow Patterns at Public Realm (sidewalks and open plaza) – September 21st.

5.1.1 LOW AND MEDIUM DENSITY RESIDENTIAL STREETS

Section 3.3 of the TOR requires that the shadow from the proposed development should allow full sunlight on the opposite boulevard including the full width of the sidewalk for “Low and Medium Density Residential Streets”. The criterion is met if the sunlight accesses these areas for a total of at least 4 hours between 9:12 am and 11:12 am, and between 3:12 pm and 5:12 pm. As shown in **Figure 7** above, the sun accesses the opposite sidewalk that abuts residential side and back yards along Erin Mills Parkway for more than four hours between 9:12 am and 11:12 am, and between 3:12 pm and 5:12 pm. Therefore, the criterion for section 3.3 is met for this opposite sidewalk. It is also shown in Figure 7 that there is a shadowing from the development (Building A) from 8:35 AM until 10:12 AM on a small area of the opposite sidewalk that abuts residential side and back yards along Lincoln Greenway. This shadowing area is located at the intersection of Lincoln Greenway and Erin Mills Parkway. Since more than 4 hours of sun this sidewalk is exposed to, criterion 3.3 is met for the sidewalk along Lincoln Greenway. Finally, **Figure 7** demonstrates that there is shadowing from the development (Building G) from 15:12 PM until 17:48 PM on a small area of the

opposite sidewalk that abuts residential side and back yards along Fowler Drive. This small area corresponds to the projected footprint of building G on the sidewalk which is relatively small when compared to the total area of the sidewalk. This corresponds to the sun being accessing the sidewalk on Fowler Drive for more than 90% of the total area during the day or in another word the overall Sun Access Factor is more than 90% on the sidewalk.

5.1.2 PUBLIC OPEN SPACES, PARKS AND PLAZAS

Section 3.3 of the TOR requires that the shadow from the proposed development should allow for full sun on “public open spaces, parks and plazas” at least half the time, or 50% sun coverage all the time. The criterion is met if the overall “sun access factor” is at least 50% or 0.5 on each of the test dates ($As(ave)/AT = 0.5$ or more).

For each hour of the day, the area at the Sheridan public Plaza covered by the sun is calculated. Using the calculated hourly coverage areas, the Sun Access Factor (SAF) is calculated. This SAF is then compared to the criterion from section 3.3 of the TOR . **Figure 8** shows the hourly SAF from sunrise to sunset at the Sheridan Plaza.

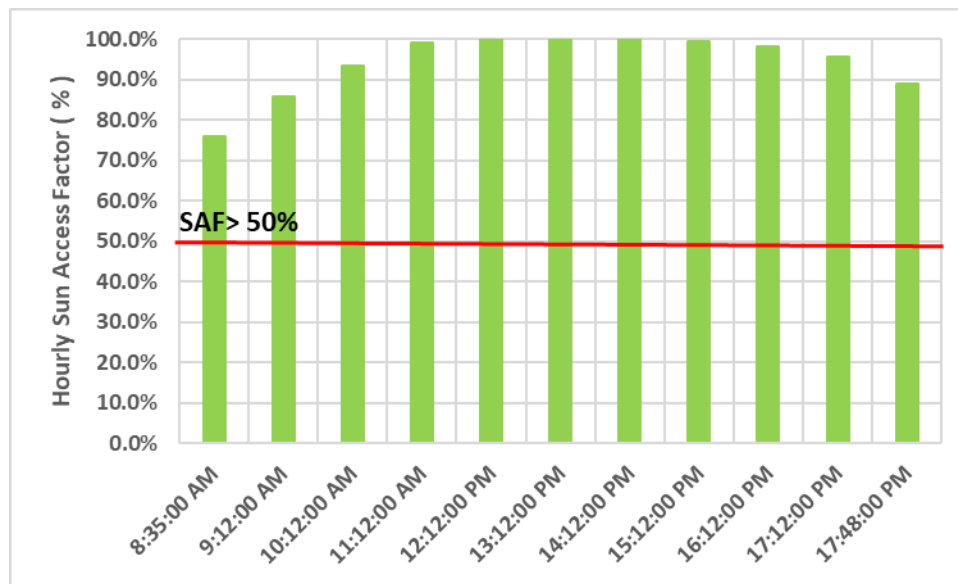


Figure 8: Predicted hourly SAF at the Sheridan Plaza–September 21st.

Furthermore, the overall daily average SAF for Sheridan Plaza was also calculated following the steps below:

Step1: Calculation of areas exposed to sunshine at each hourly test time (see **Table 1**).

Step2: Calculation of the average for the one-hour intervals (see **Table 2**).

Step3: Calculation of the overall daily average SAF (overall area/total physical area) and comparison with the shadow criteria (see **Table 3**).

Table 1 Areas exposed to sunshine at each hourly test time– Sheridan Plaza

HOURLY TEST TIME	AREA (m ²)	SAF (%)
8:35 AM	39,258	75.9%
9:12 AM	44,400	85.9%

10:12 AM	48,274	93.4%
11:12 AM	51,219	99.0%
12:12 PM	51,712	100.0%
13:12 PM	51,712	100.0%
14:12 PM	51,712	100.0%
15:12 PM	51,317	99.2%
16:12 PM	50,795	98.2%
17:12 PM	49,400	95.5%
17:48 PM	46,062	89.1%

Table 2 Overall average sun exposed area – Sheridan Plaza

AVERAGE	AREA (m ²)
The overall average area in sunshine As (ave)	48,715

Table 3 Overall daily average SAF – Sheridan Plaza

AREA	AREA (m ²)
Total area of adjacent residential amenity (AT)	51,712
Overall daily average Sun Access Factor: AS(AVE)/AT	0.94
Meet Shadow Criterion#3.3 (YES/NO) (SAF>=0.50)	YES

Based on predicted hourly SAF values and the overall value at the Sheridan Plaza, the shadow criterion 3.3 is met.

6 TURF FLOWER GARDENS IN PUBLIC PARKS

As mentioned above, no such areas have been identified within the study domain and therefore will not be included in the analysis.

7 BUILDING FACES TO ALLOW FOR THE POSSIBILITY OF USING SOLAR ENERGY

Figure 9 identifies all areas in the vicinity of the development with potential for using solar energy on the roofs, rear, front and side walls. In this Figure, the line of impact assessment or “no impact zone” (color yellow in the **Figure 9**) for these spaces is within 3.0m of the front, rear and side walls.

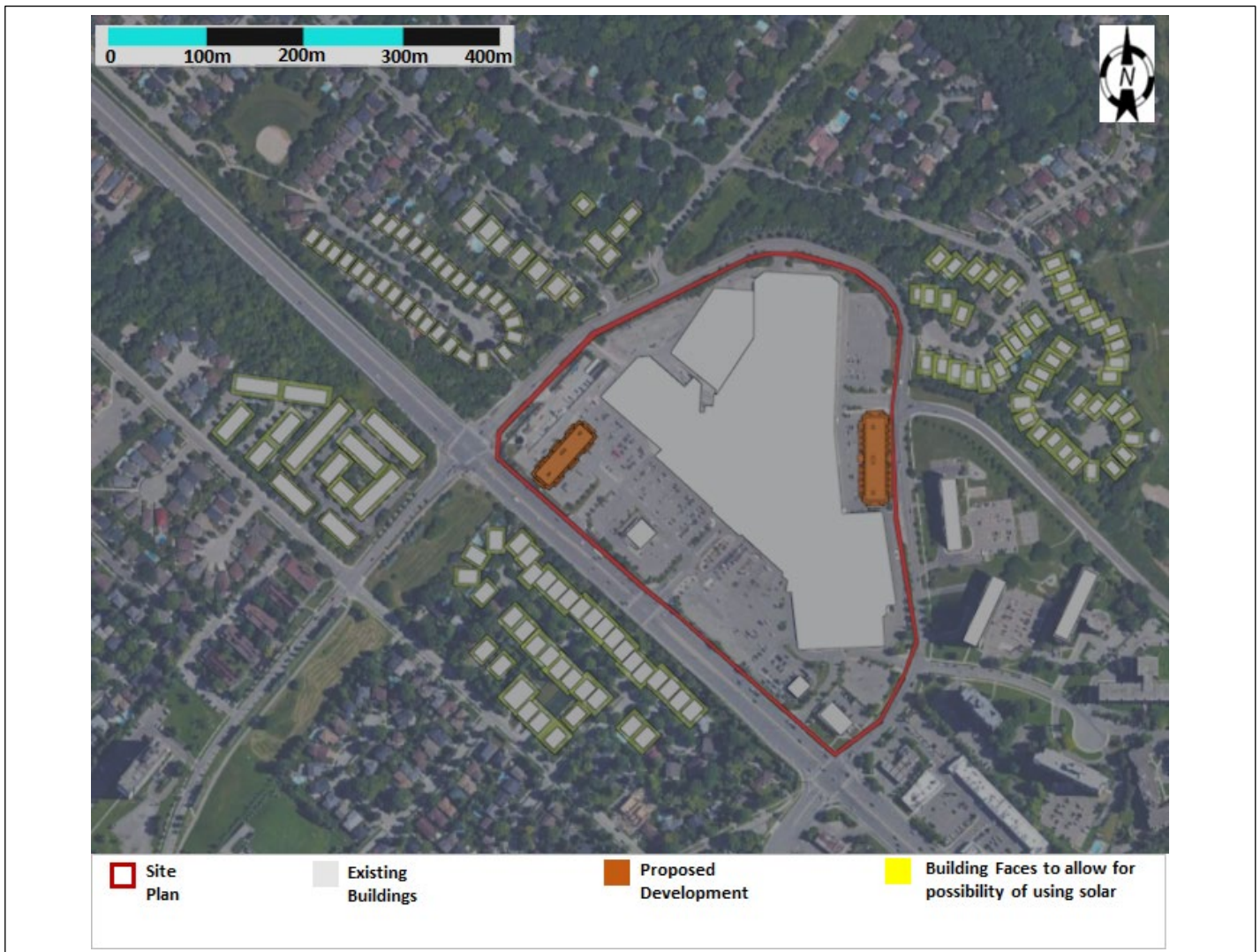
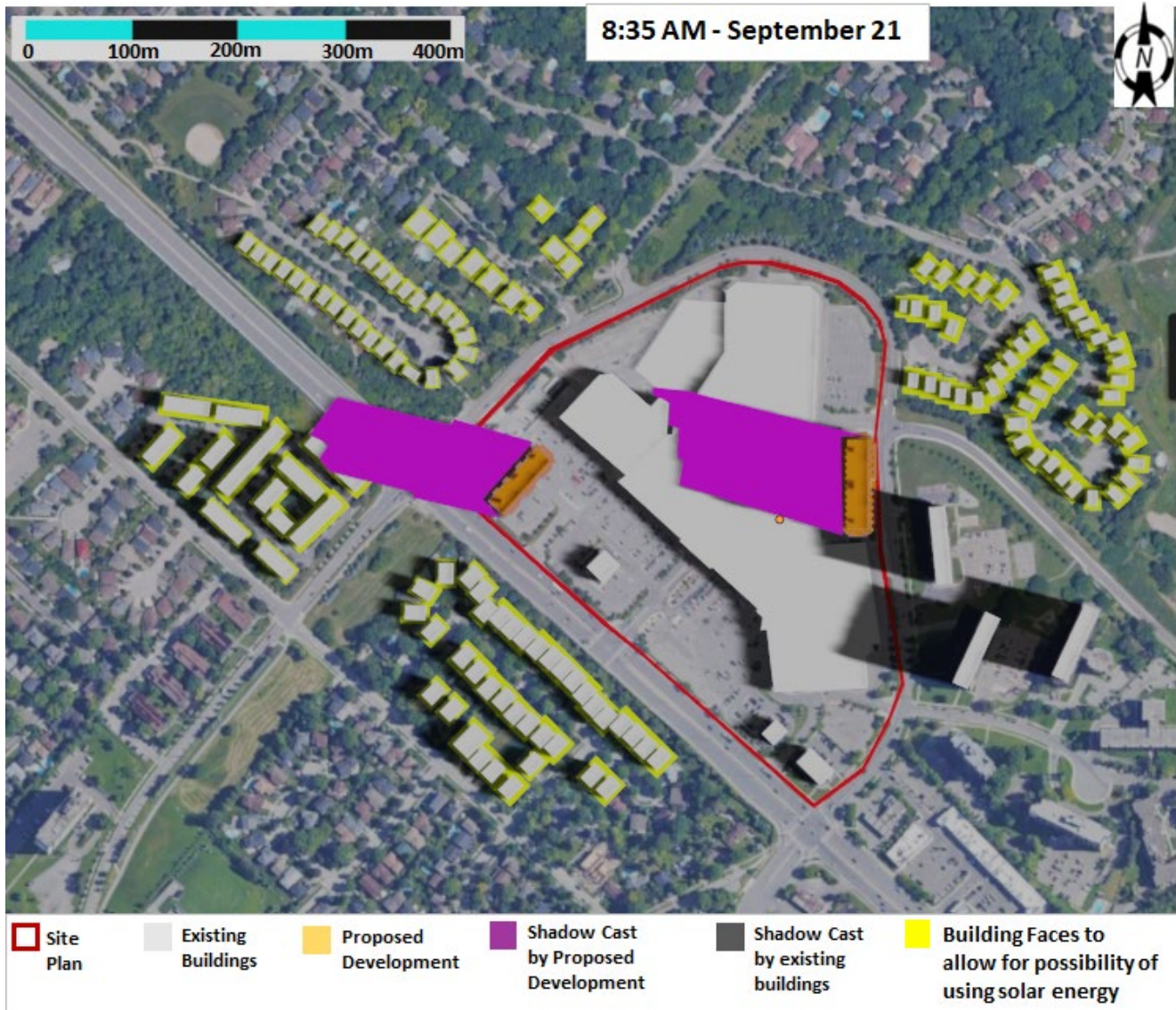
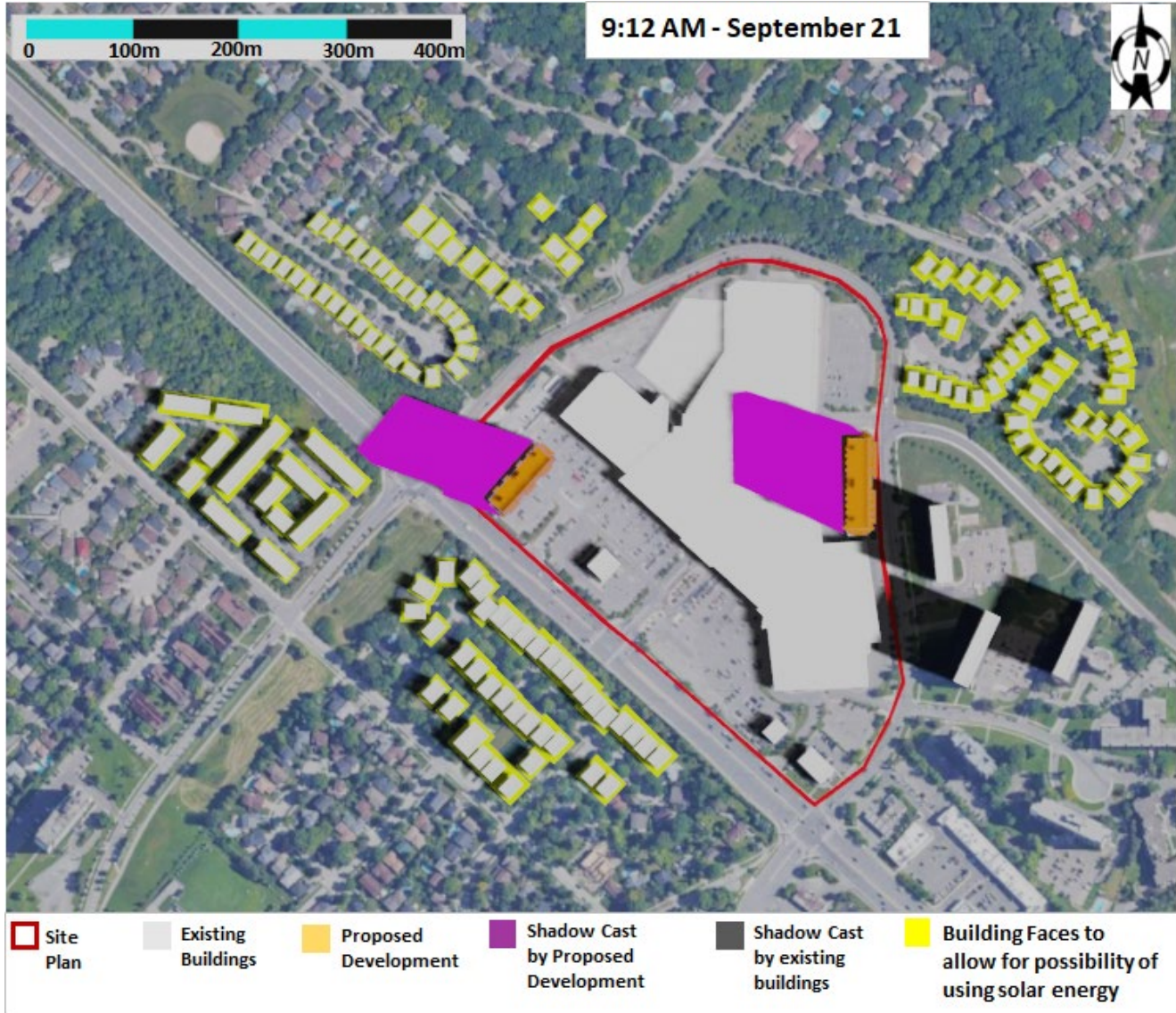


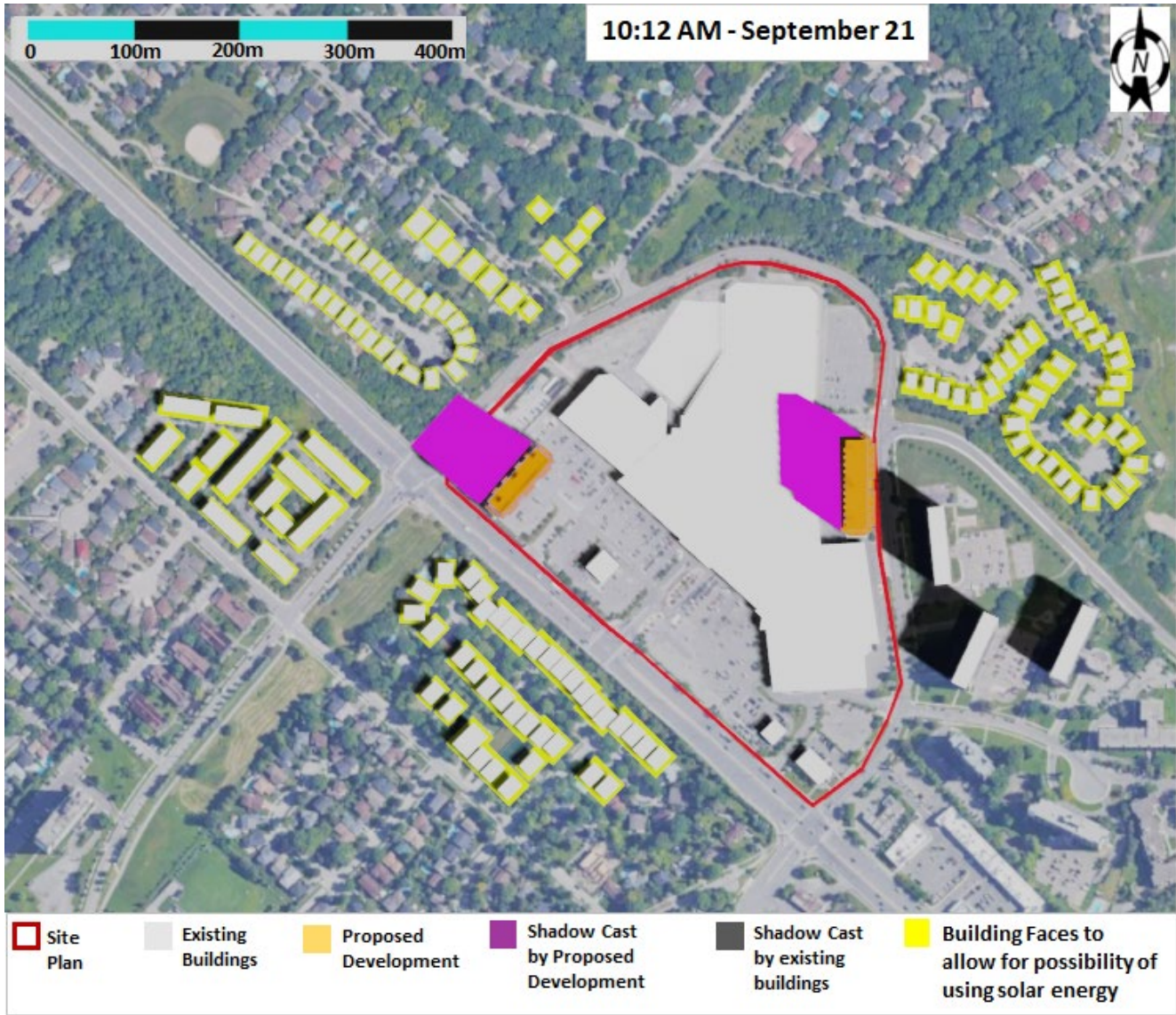
Figure 9: Building faces in the vicinity of the proposed development.

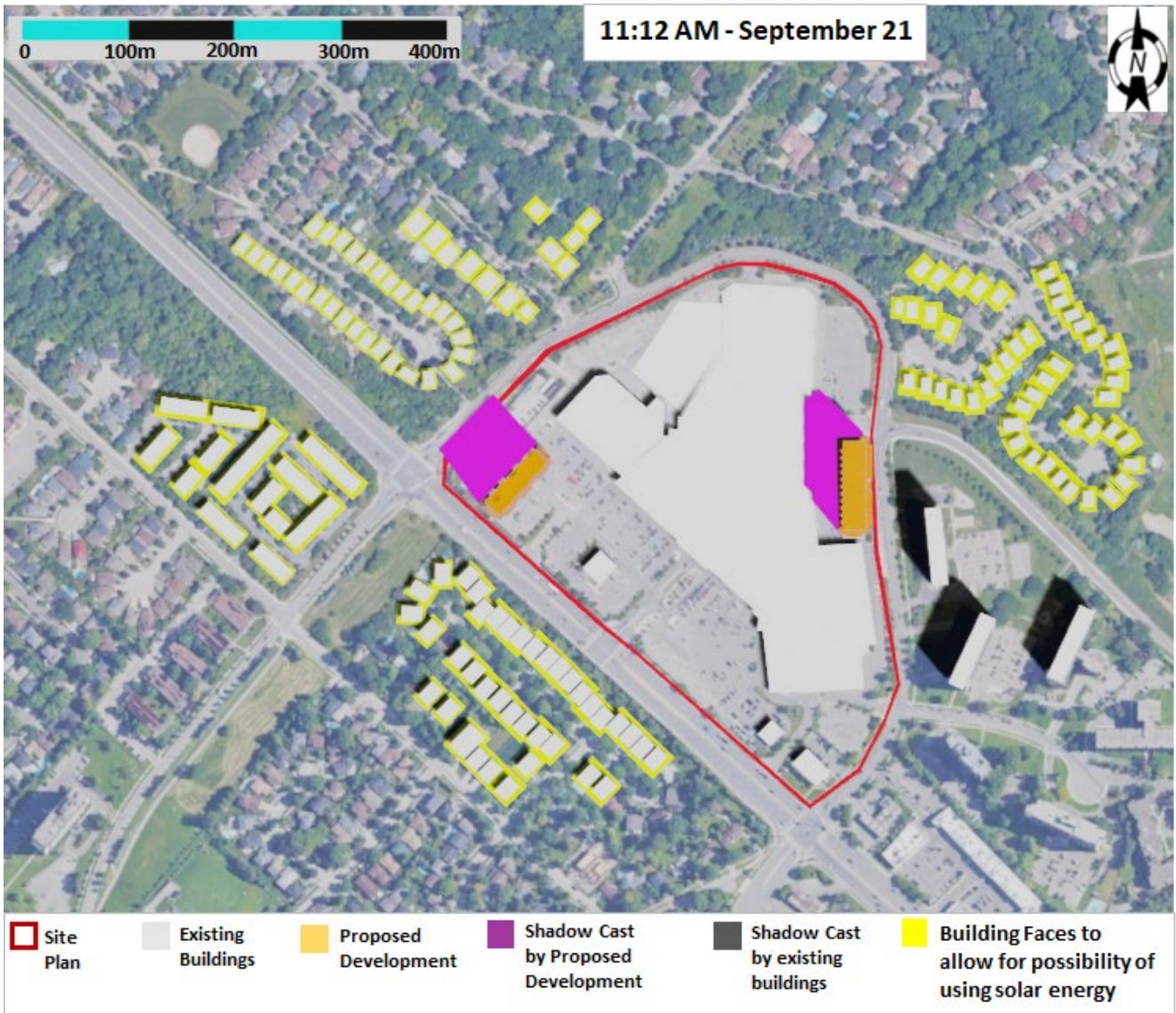
7.1 SHADOW ANALYSIS RESULTS FOR SEPTEMBER 21

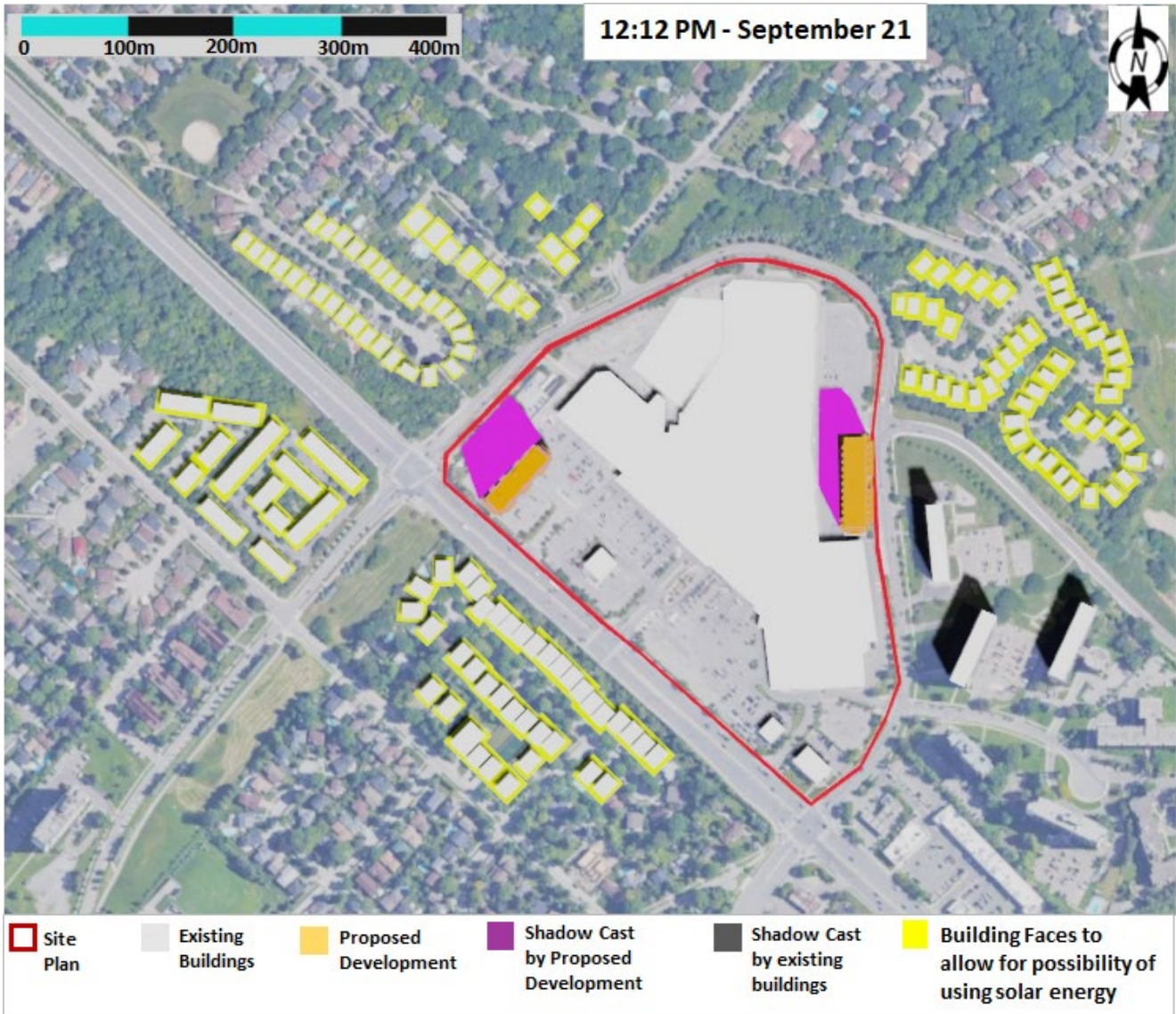
The model results of shadow patterns for fall equinox from 8.35am to 5.48pm are shown in **Figure 10**. In this **Figure 10**, the new shadow (purple color) represents the shadow due to the Development, while the existing shadow represent the shadow due to the existing buildings. The footprint of the Development is represented by the orange color. For the fall equinox, the shadow patterns are characterized by a longer cast or coverage on the north and north-west side of the Development for the first hours in the morning. Then, this coverage shortened once the sun moves towards the noon hour. The shadow coverage extends on the east and south-east side of the Development to reach a maximum length near the sunset hours.

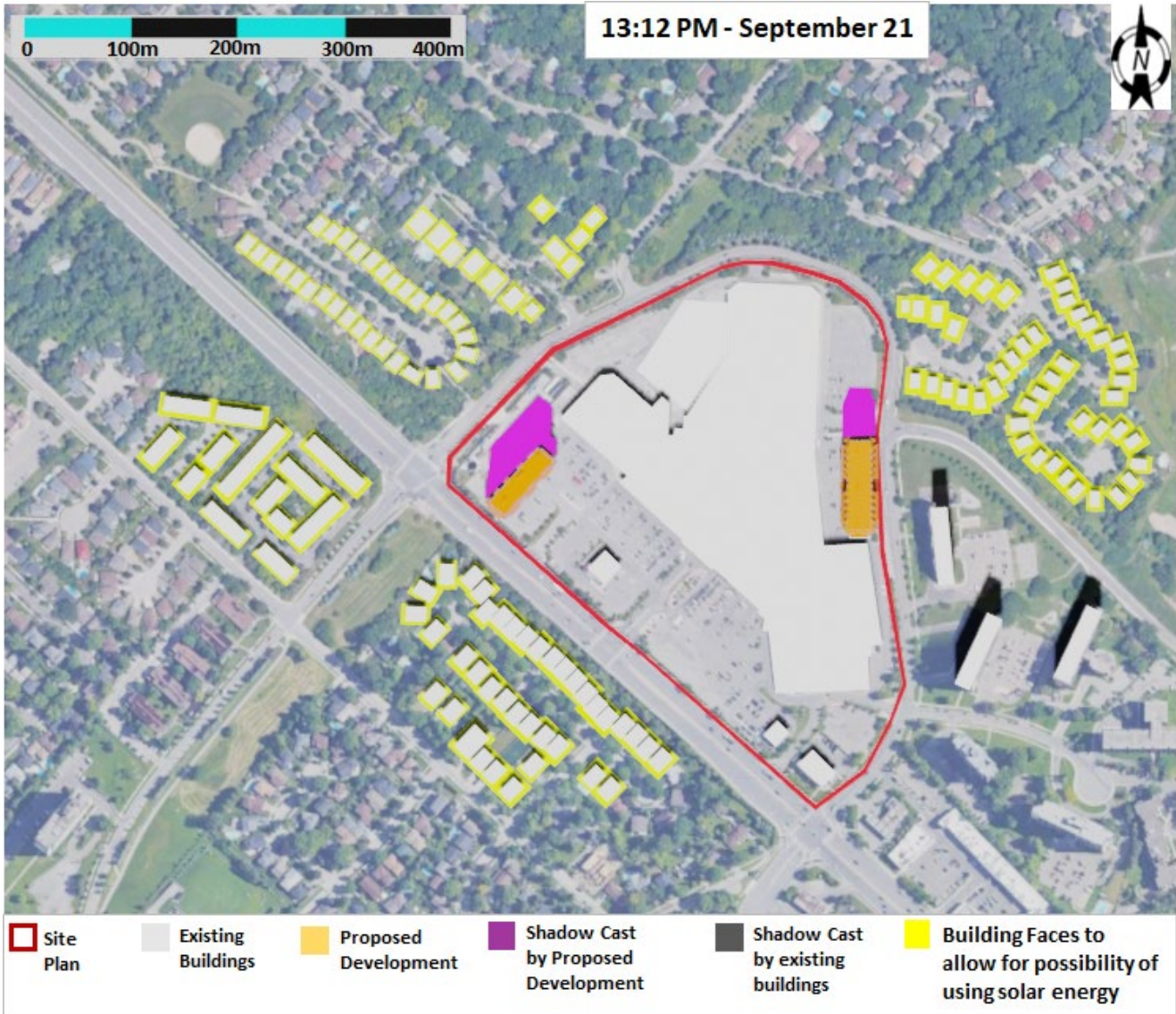


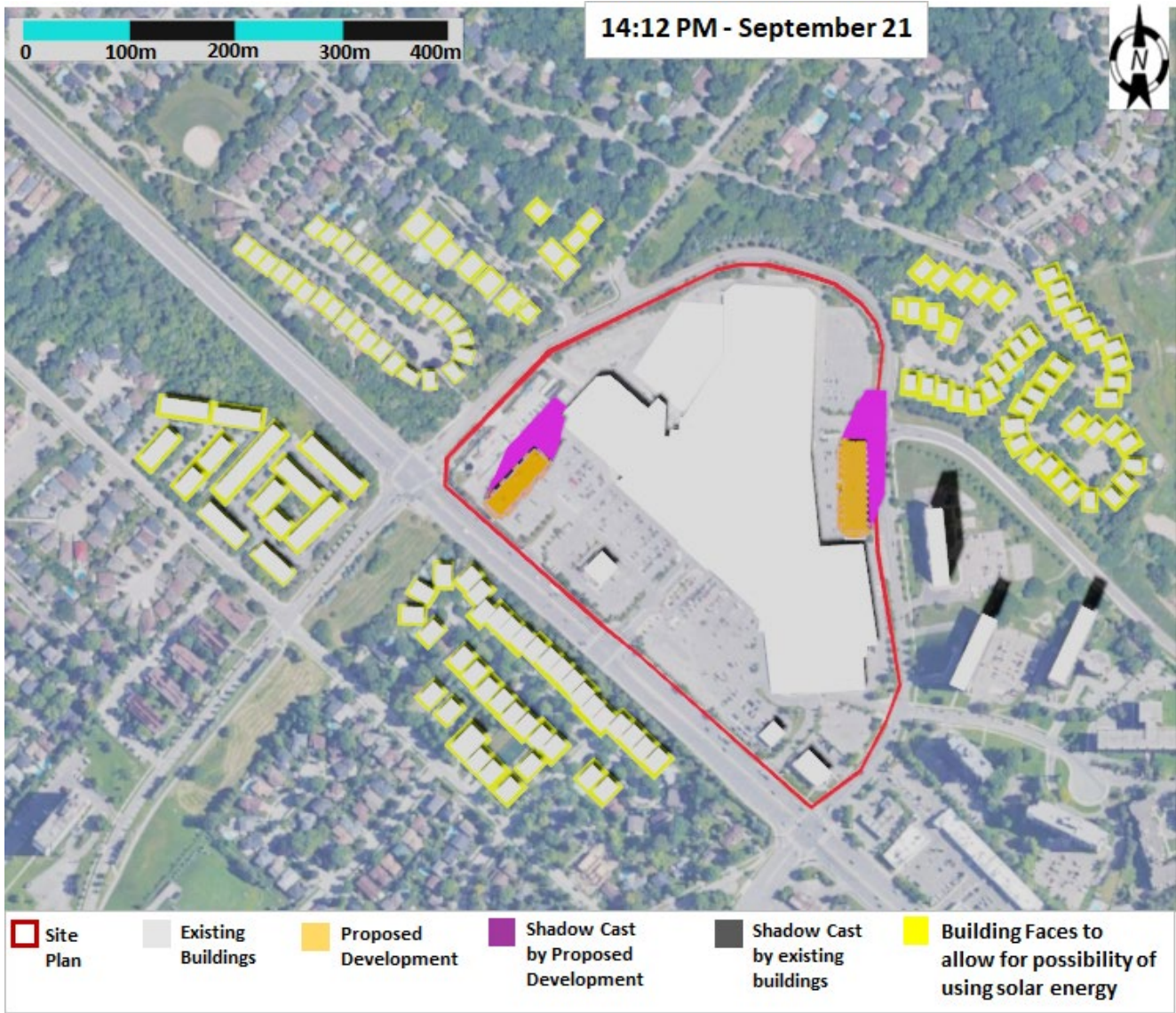


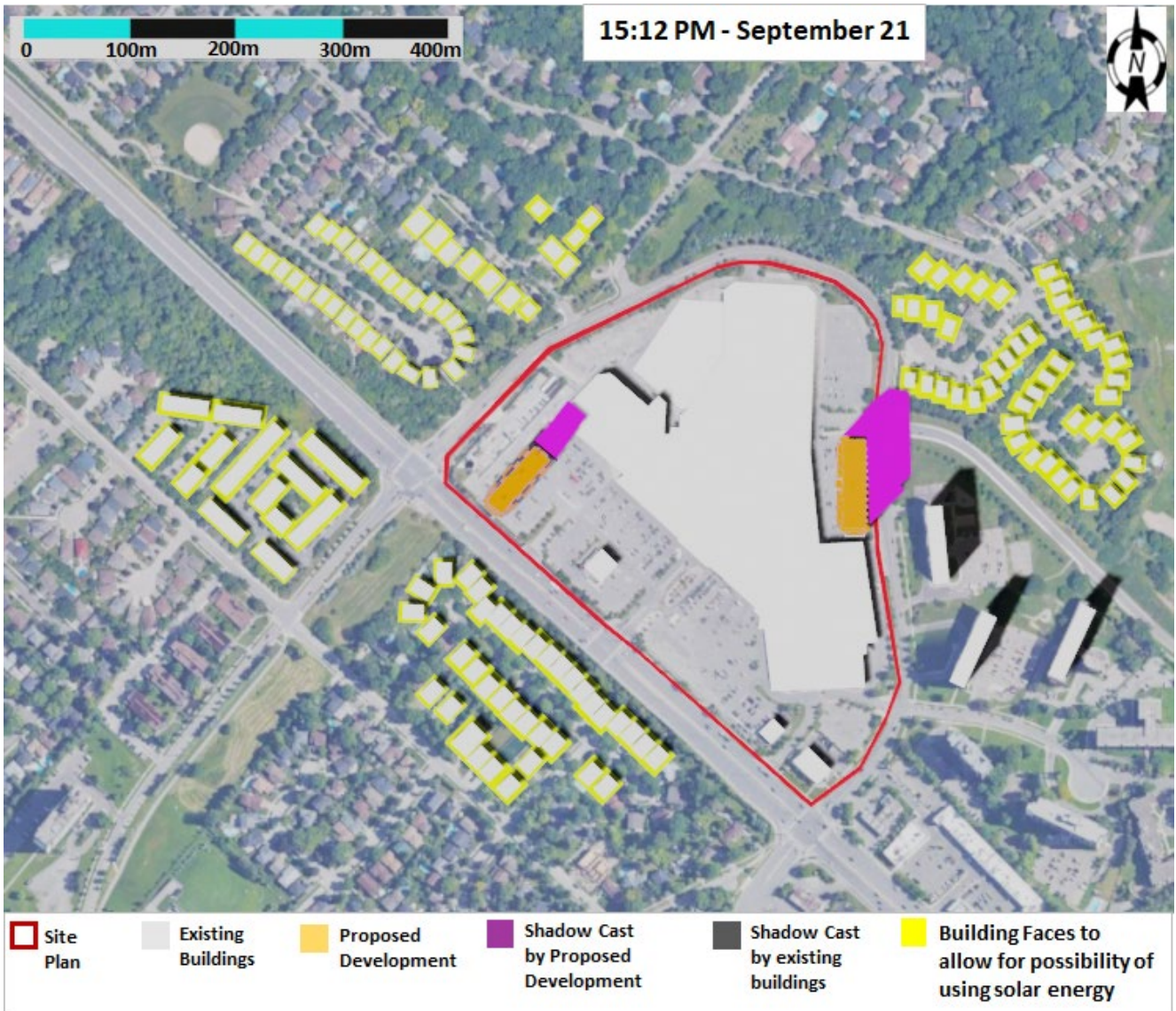


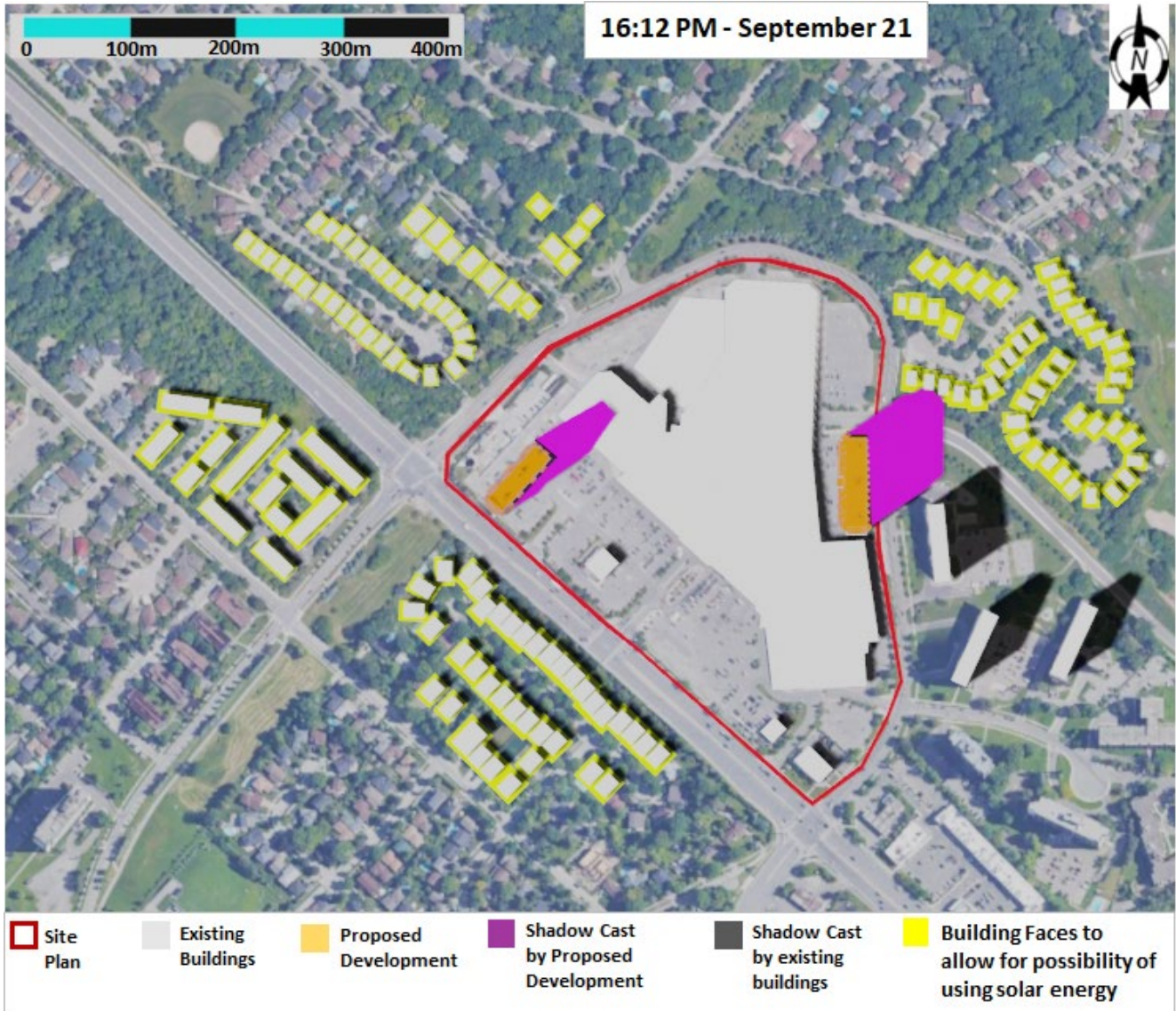


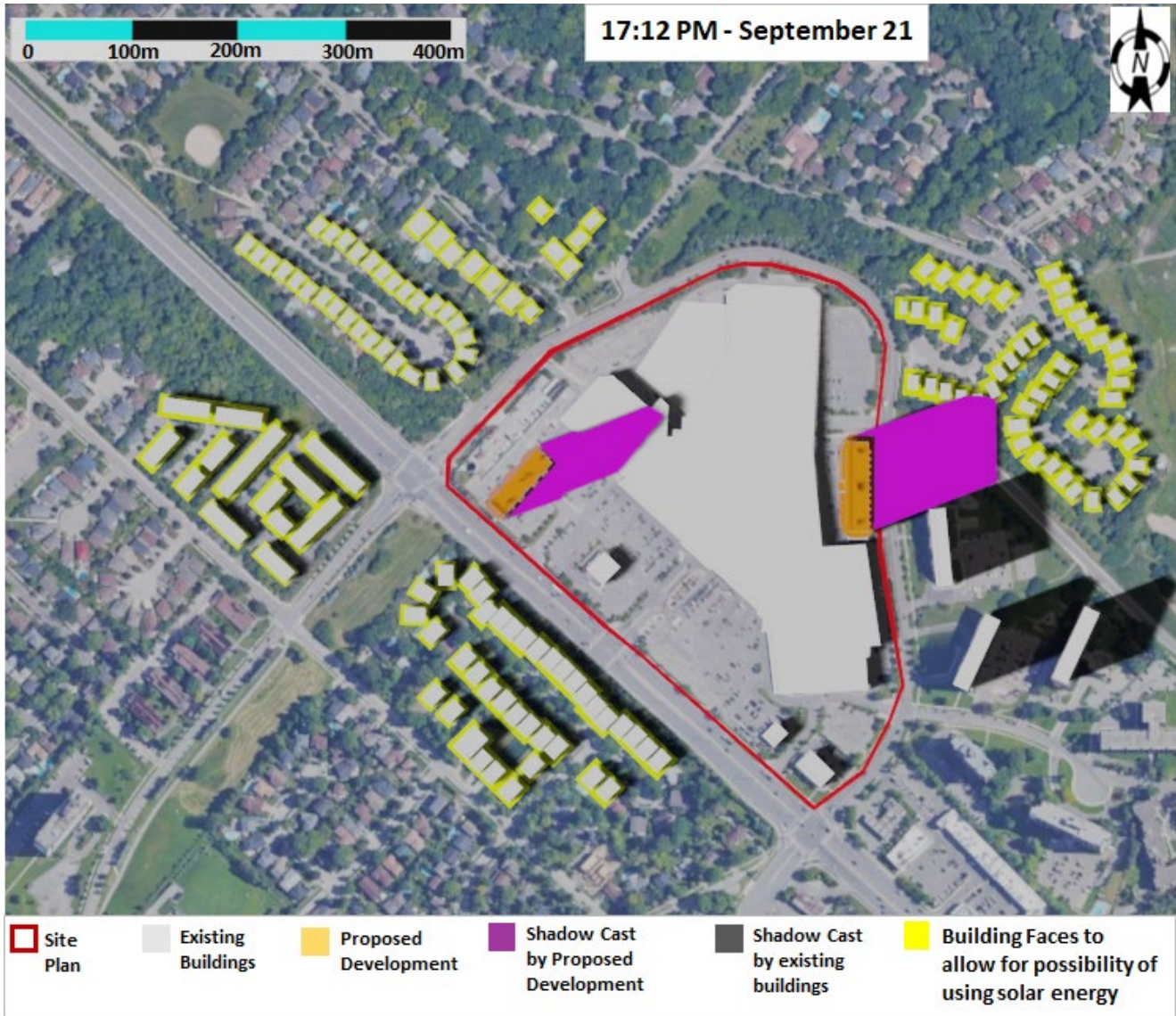












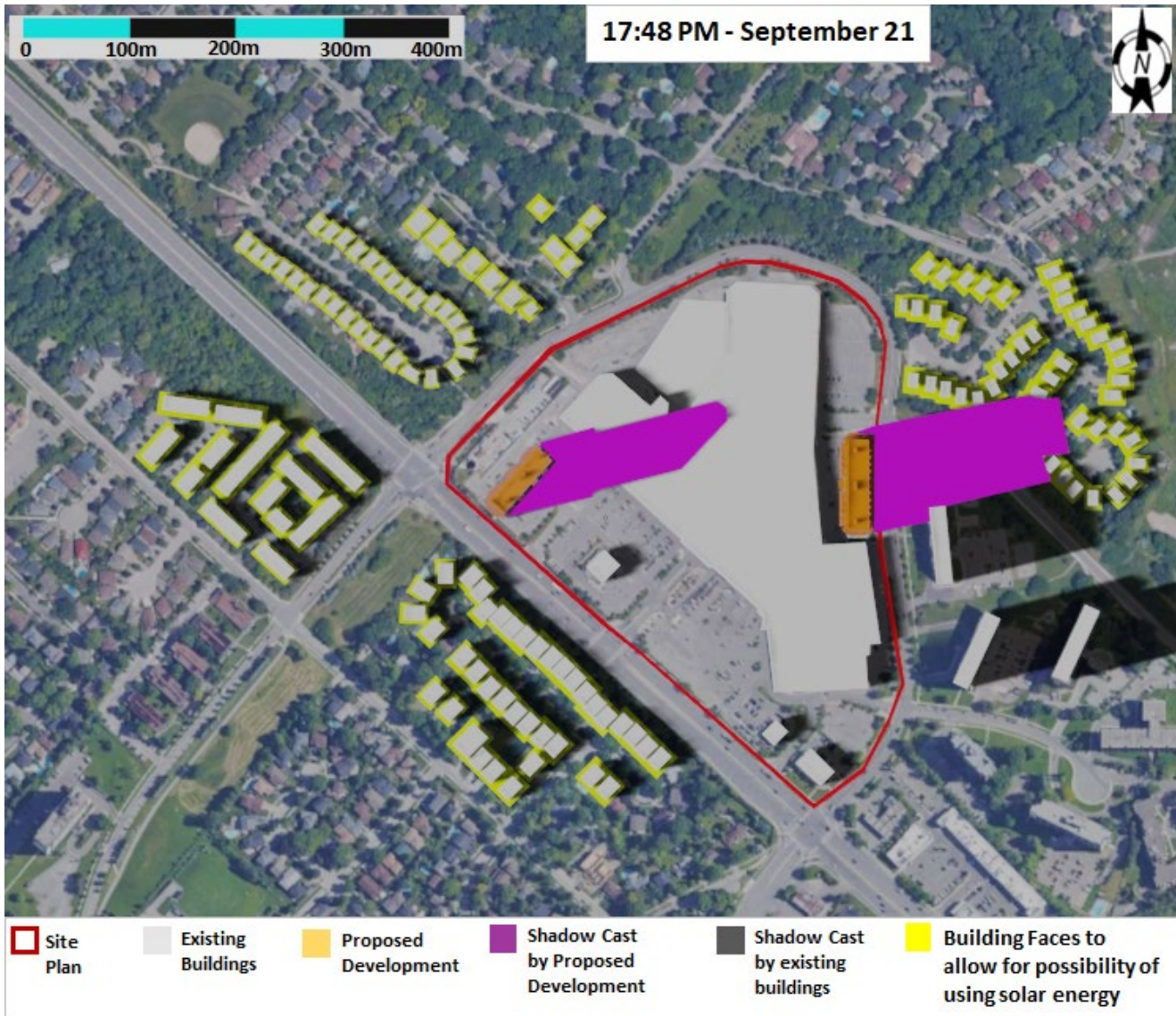


Figure 10: Shadow Patterns at Building Faces – September 21st.

Section 3.5 of the TOR requires that the line of impact assessment or “no impact zone” for these spaces should be within 3m of the front, the rear and the exterior wall of the building. The criterion is met if there is shadow impact for no more than two consecutive hourly test times in the “no impact zone”. As shown in **Figure 10** above, the findings of the shadow analysis show that the proposal for no more than two consecutive hourly test times are in accordance with this standard. As such, the criterion for section 3.5 of the TOR is met.

8 CONCLUSION

The shadow analysis has shown that the proposed development will create minimal and acceptable shadowing impacts on adjacent low- rise neighbourhoods, private amenity areas, and public realm in accordance with TOR of the city of Mississauga.

9 REFERENCES

- City of Mississauga Terms of References for Shadow study:
<https://www.mississauga.ca/publication/standards-for-shadow-studies/>
- Blender Software:
<https://www.blender.org/>

APPENDIX

A SITE PLAN



APPENDIX

