

DUNPAR HOMES

SHADOW IMPACT STUDY

1020,1024, 1028,1032, 1042 SIXTH LINE
ROAD, OAKVILLE

May 11, 2023





SHADOW IMPACT STUDY

1020,1024,1028,1032,1042 SIXTH LINE RD,
OAKVILLE

DUNPAR HOMES.

PROJECT NO.: CA0003366.6997 CA-SUN SHADOW STUDY

DATE: MAY 11, 2023

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SUBCONSULTANTS

None

INTRODUCTION

WSP Canada Inc (WSP) was retained by Dunpar Homes. to study the shadow impacts of a proposed development to be located at 1020, 1024, 1028, 1032 and 1042 Sixth Line Road, Oakville, 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 and adjacent neighbouring properties’ yards located on the north, east and west sides of the Development.

As outlined in the Oakville Development Application Guidelines –Shadow Impact Analysis¹ (TOR), 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 Development is immediately surrounded by the following land uses:

- North: Sunny Crest Ln, a residential area and Rancliffe Rd.
- South: North Service Rd E and QWE highway.
- East: Sixth Line Rd, a residential area and Bomorda Dr.
- West: A residential area and Sixth Mile Creek.

The Development consists of the construction of 57 townhouse units grouped into eight (8) 2-3 storey groups or blocks (Block A through Block G): Blocks A and B, located on the south side of the site, Blocks E and F, located on south-west side of the site, Blocks H and G, located on the west side of the site and Blocks C and D located on the middle of the site, north of Blocks A and B. All buildings are expected to extend to a height of 12.3 m.

Blocks A and B massing runs from south to north, Blocks C and D massing runs from east to west, while Blocks E and F massing runs from south-east to north-west. All blocks are designed as one podium. Furthermore, all buildings have a narrow floor footprint and slender levels to reduce the overall bulk of the Development and reduce shadow impacts and allow sun access to 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 the Oakville Development Application Guidelines –Shadow Impact Analysis, the areas of interests are:

- Residential private amenity spaces (see Criteria section of TOR). For this study, these areas are located east of the Development between Sixth Line and Bomorda Dr, north of the Development (2 dwellings) and between Sunny Crest Ln and Rancliffe Rd and west of the Development (2 dwellings) (see **Figure 1**).
- Public amenity areas (see Criteria section of TOR). These areas include school yards, public plaza, and public parks. For this study, the landscaping areas located north of Blocks C and D have been identified within the study domain and therefore will be included in the analysis (see **Figure 5**).
- Public realm is determined as sidewalks (see Criteria section of TOR). For this study, sidewalks on the east of the Development along Sixth Line, along North Service Rd E on the south-east side of the Development and on the north side of the Development along Sunny Crest Ln have been identified as areas on interest and will be included in the analysis (see **Figure 9**).
- Building faces have been identified to allow for possible use of solar energy (see Criteria section of TOR). These areas include the roofs, front, rear and exterior side walls. For this study, these areas are located east of the Development between Sixth Line Rd and Bomorda Dr, north of the Development (2 dwellings) and between Sunny Crest Ln and Rancliffe Rd and west of the Development (2 dwellings) (see **Figure 13**).

¹ <https://www.oakville.ca/getmedia/10df706c-a5ad-4863-8b5e-39a171045c65/planning-dag-ud-shadow-analysis.pdf>

METHODOLOGY

SOFTWARE USED TO PREPARE SHADOW ANALYSIS

For this assessment, Blender software (version 3.4.1)² 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 the Oakville Development Application Guidelines –Shadow Impact Analysis, and best practices are obtained. The computer-generated model illustrated the following dates and representative times, based on TOR from the City of Oakville:

1. **Spring Equinox | April 21st** at predefined intervals between sunrise and sunset. (7:56AM, 8:56AM, 9:56AM, 10:56AM, 11:56AM, 12:56PM, 1:56PM, 2:56PM, 3:56PM, 4:56PM and 6:39PM).
2. **Summer Solstice | June 21st** at predefined intervals between sunrise and sunset (7:08AM, 8:08AM, 9:08AM, 10:08AM, 11:08AM, 12:08PM, 1:08PM, 2:08PM, 3:08PM, 4:08PM, 5:08PM, 6:08PM, 7:08PM, and 7:33PM).
3. **Fall Equinox | September 21st** at predefined intervals between sunrise and sunset. (8:34AM, 9:34AM, 10:34AM, 11:34AM, 12:34PM, 1:34PM, 2:34PM, 3:34PM, 4:34PM, 5:34PM and 5:47PM)
4. **Winter Solstice | December 21st** at predefined intervals between sunrise and sunset (9:18AM, 10:18AM, 11:18AM, 12:18PM, 1:18PM, 2:18PM and 3:15PM)

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

Longitude | N 43° 46'

Latitude | W 79° 72'

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 12.34 metres. 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 the Oakville Development Application Guidelines –Shadow Impact Analysis, the shadow evaluations are established for each area of interest highlighted above. These criteria are summarised below:

RESIDENTIAL PRIVATE AMENITY SPACES

Shadow impacts from proposed development should not exceed two consecutive hourly test times after 12:00pm on April 21, June 21, and September 21 (or where the adjacent site is undeveloped, on at least 60% of that site).

² <https://www.blender.org/>

PUBLIC AMENITY AREAS

The shadow impact analysis must demonstrate that public plazas, public parks, and school yards receive at least 5 hours of continuous sunlight per day on April 21, June 21, and September 21.

PUBLIC REALM

The shadow impact analysis must demonstrate that public sidewalks receive at least 5 hours of continuous sunlight per day on April 21, June 21, and September 21.

BUILDING FACES TO ALLOW FOR THE POSSIBILITY OF USING SOLAR ENERGY

The shadow impact analysis must demonstrate that proposed development allows adequate sunlight on building faces and roofs for the possibility of using solar energy. Shadow impacts from proposed development should not exceed two consecutive hourly test times on December 21.

ASSESSMENT RESULTS

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 TOR are summarised below:

RESIDENTIAL PRIVATE AMENITY SPACES

Figure 2 through **Figure 4** show the shadow cast on the residential private amenity spaces for June 21, September 21, and April 21 respectively. As demonstrated in these figures, the shadow analysis shows that the shadow cast on the private amenity spaces located on the west, north (along Sunny Crest Ln and Ranccliffe Rd) and east (along Sixth Line Rd) of the Development linger for no more than two consecutive hourly test times after 12 pm. As such, the shadow criterion is met.

LANDSCAPING AREA

Figure 6 through **Figure 8** shows the shadow cast on the landscaping area for June 21, September 21, and April 21 respectively. For this study, the shadow analysis has shown that the shadow cast on the landscaping area located on the north of the development (north of Blocks C and D) linger for no more than five consecutive hourly test times during the day. As such, the shadow criterion is met.

PUBLIC REALM (SIDEWALKS)

Figure 10 through **Figure 12** shows the shadow patterns cast on the sidewalks for June 21, September 21, and April 21 respectively. The shadow analysis has shown that the shadow cast on the sidewalks located on the north (along Sunny Crest Ln), on the east (along Sixth Line Rd) and on the south-east (along North Service Rd N) of the Development linger for no more than five consecutive hourly test times during the day. As such, the shadow criterion is met.

BUILDING FACES TO ALLOW FOR THE POSSIBILITY OF USING SOLAR ENERGY

Figure 14 shows the shadow cast on the building faces for December 21. 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 shadow criterion is met.

CONCLUSIONS AND DISCUSSIONS

In conclusion, the proposed Development is expected to have minimal and acceptable shadowing impacts on adjacent neighbourhoods, private amenity areas, and public realm in accordance with TOR of the city of Oakville.

SHADOW IMAGES

A RESIDENTIAL PRIVATE AMENITY SPACES

Figure 1 identifies all private outdoor amenity areas in the vicinity of the Development (color blue in the **Figure 1**).

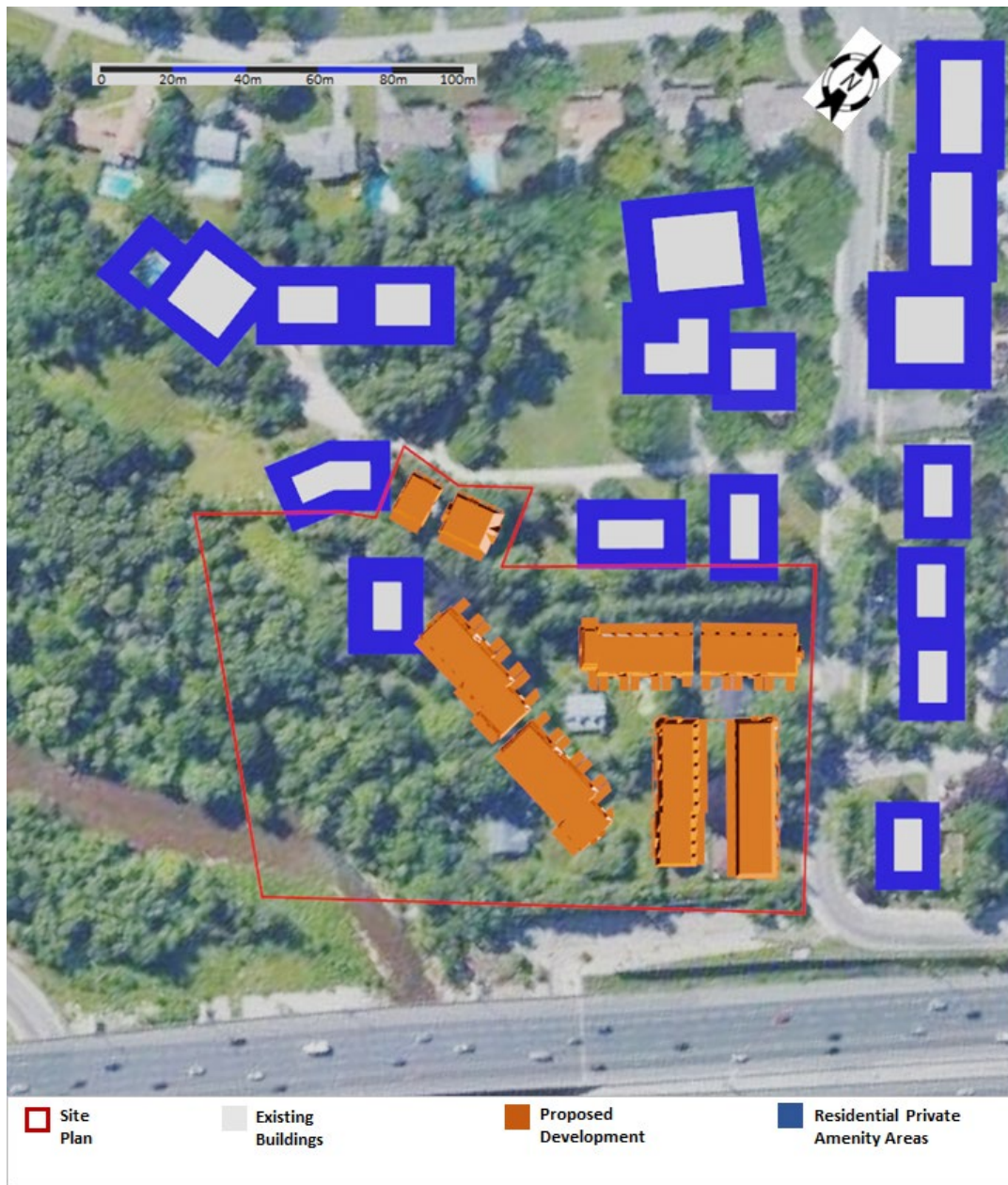
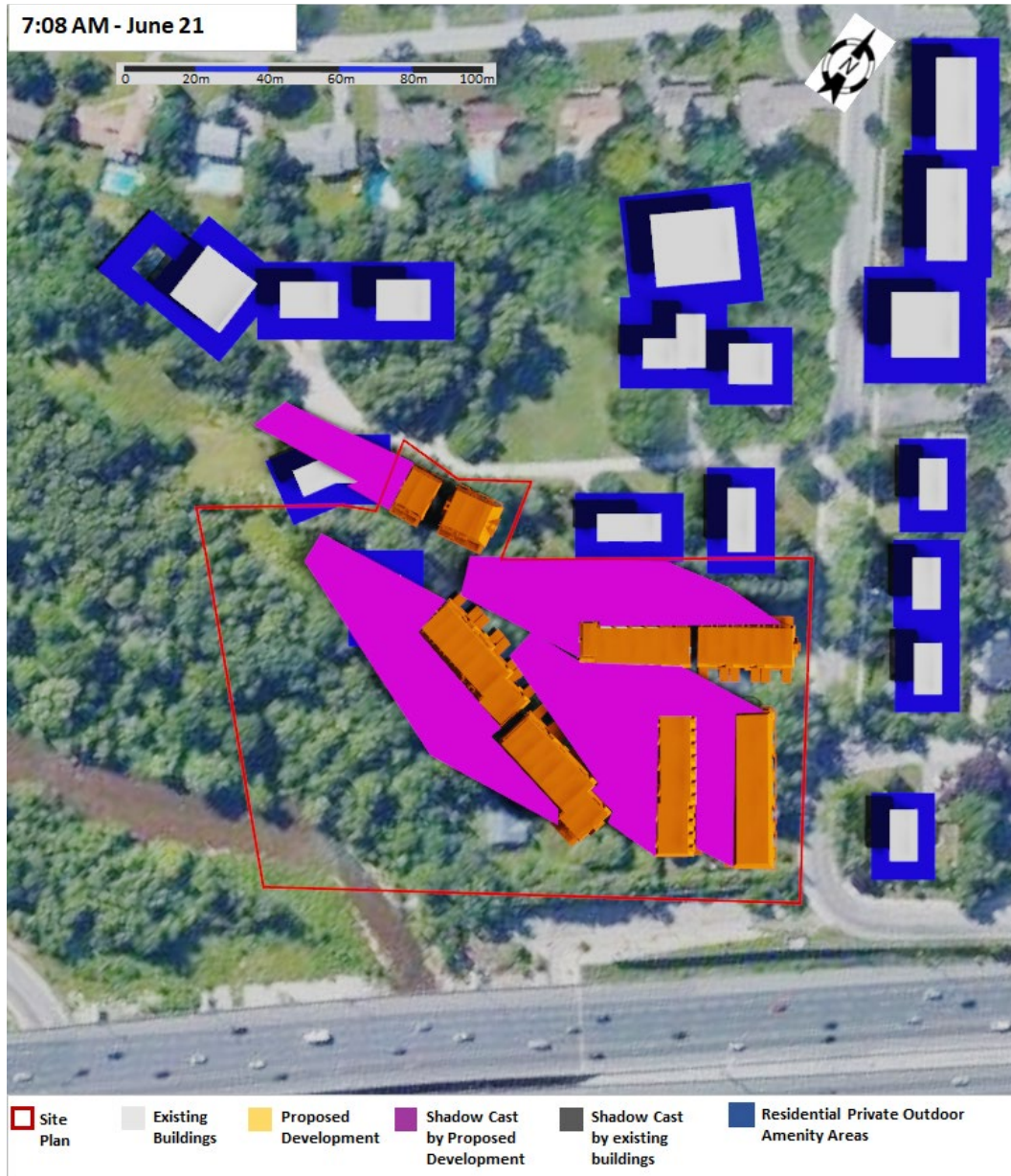
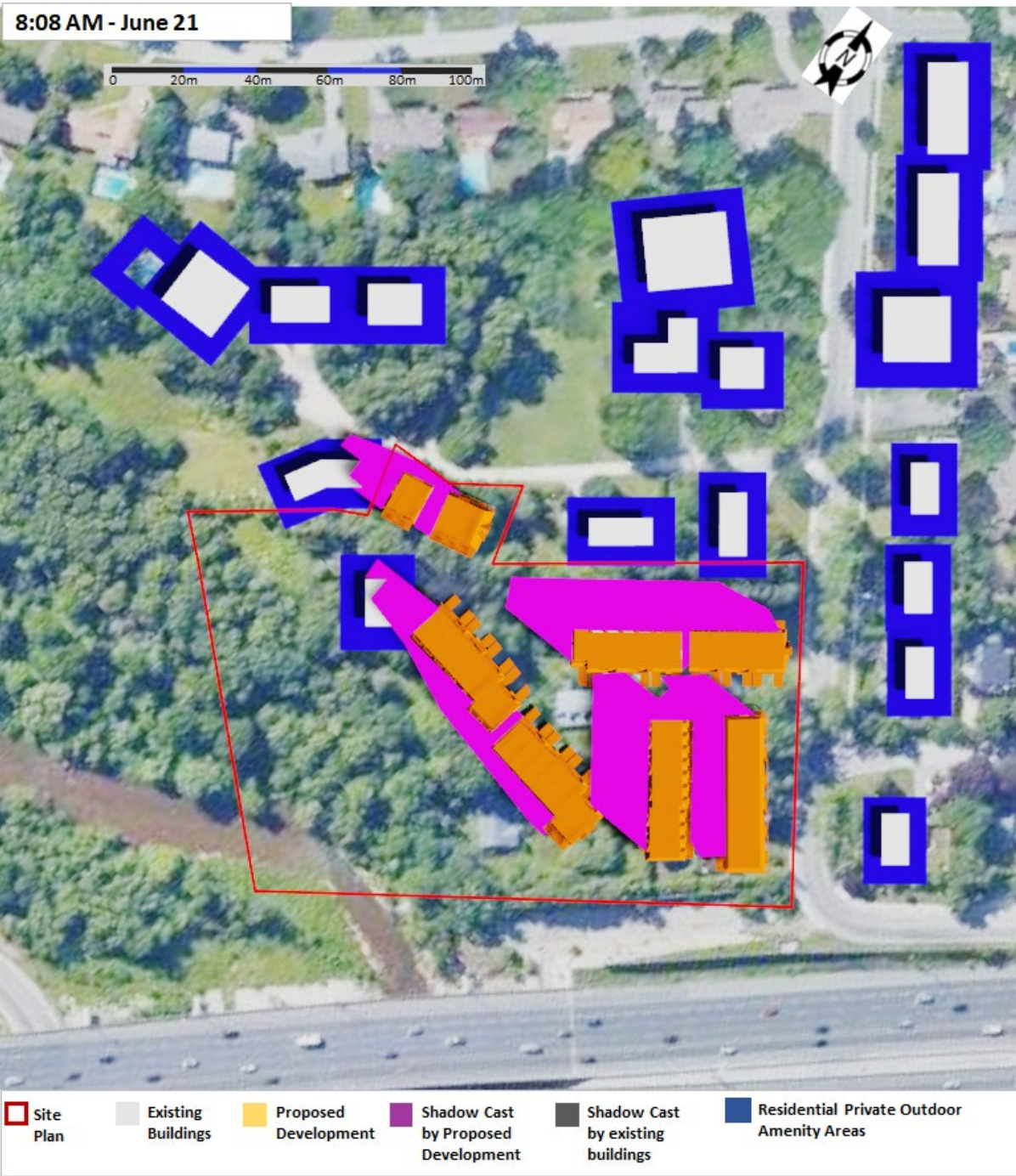


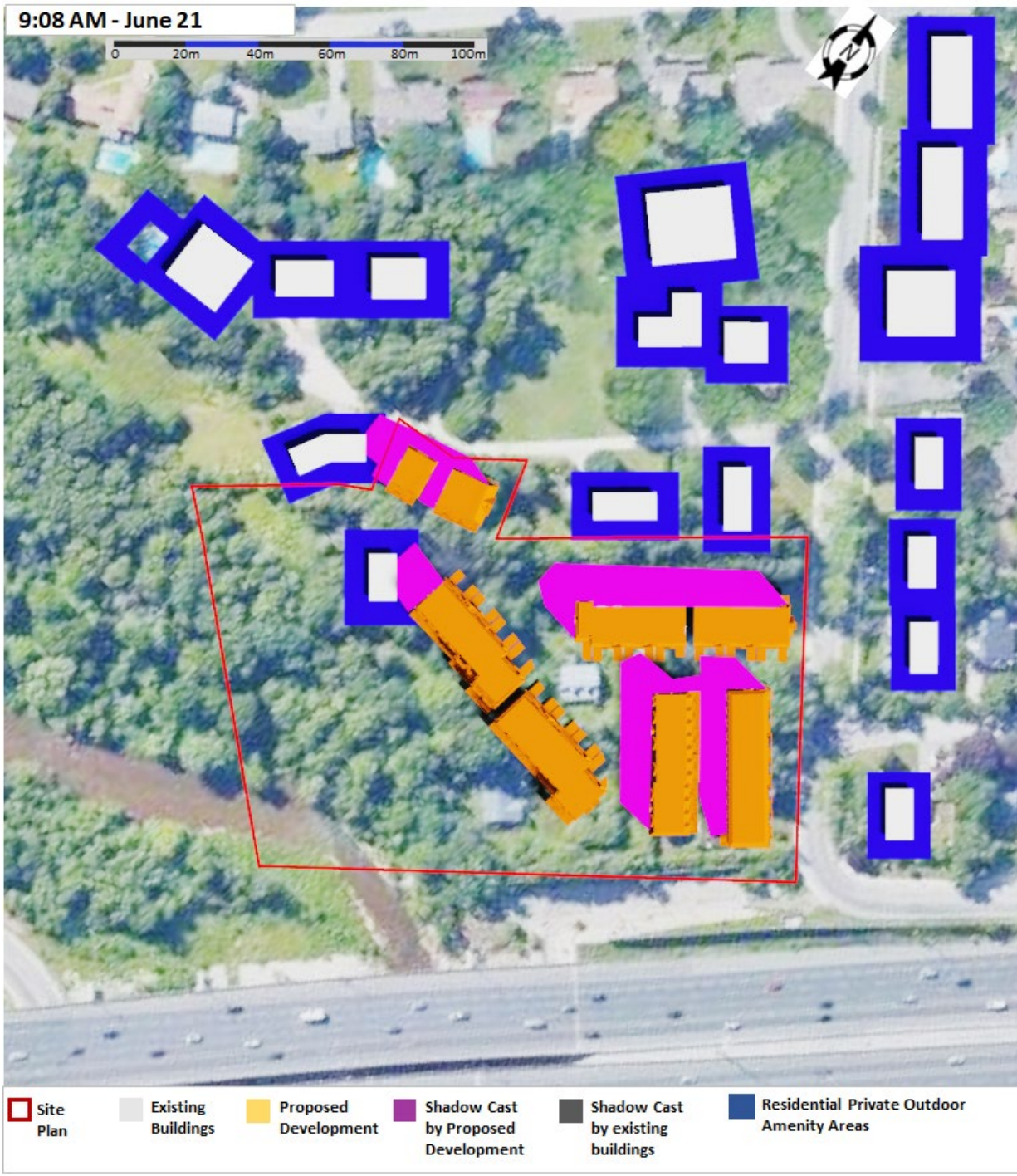
Figure 1: Residential private outdoor amenity spaces in the vicinity of the proposed Development.

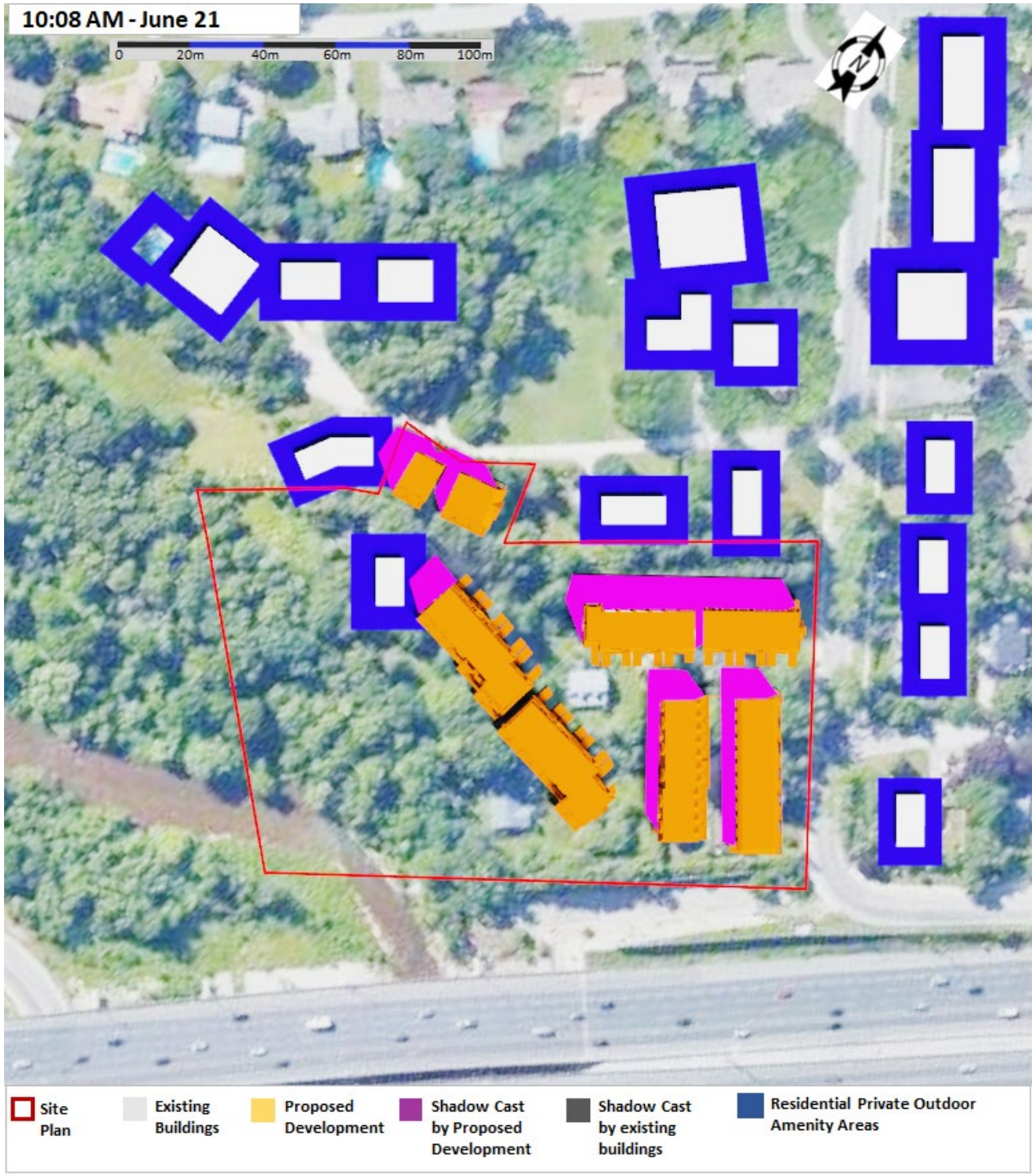
1.1 SHADOW ANALYSIS RESULTS FOR JUNE 21

The model results of shadow patterns for summer solstice from 7.08am to 7.33pm are shown in **Figure 2**. As shown in **Figure 2**, the new shadow (purple color) represents the shadow due to the Development. The footprint of the Development is represented by the orange color. For the summer solstice, the shadow patterns are characterized by a relatively longer cast or coverage on the north and west sides 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 south-east side of the Development to reach a maximum length near the sunset hours. However, the shadow length remains relatively short overall due to the short height of the Development.

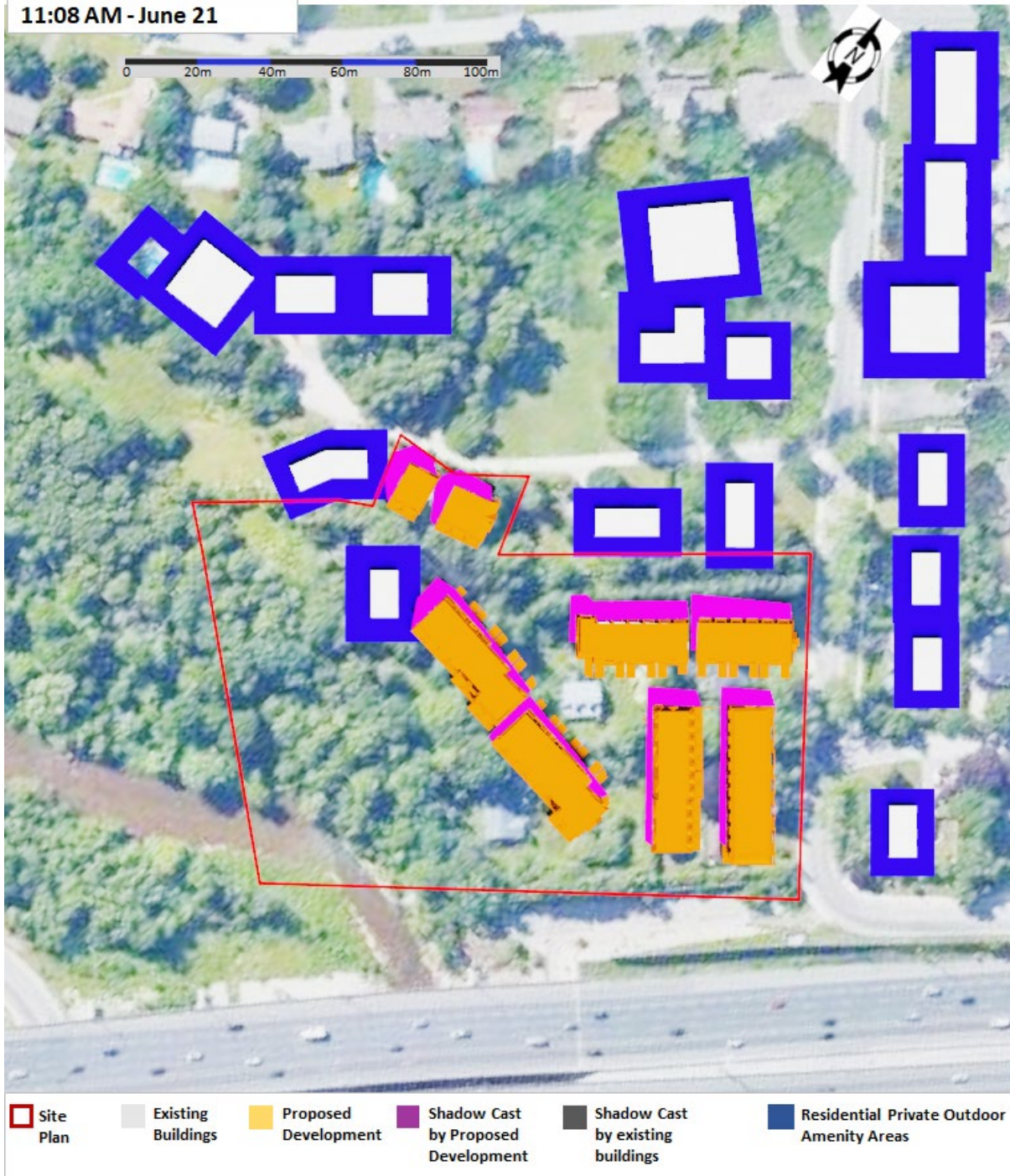




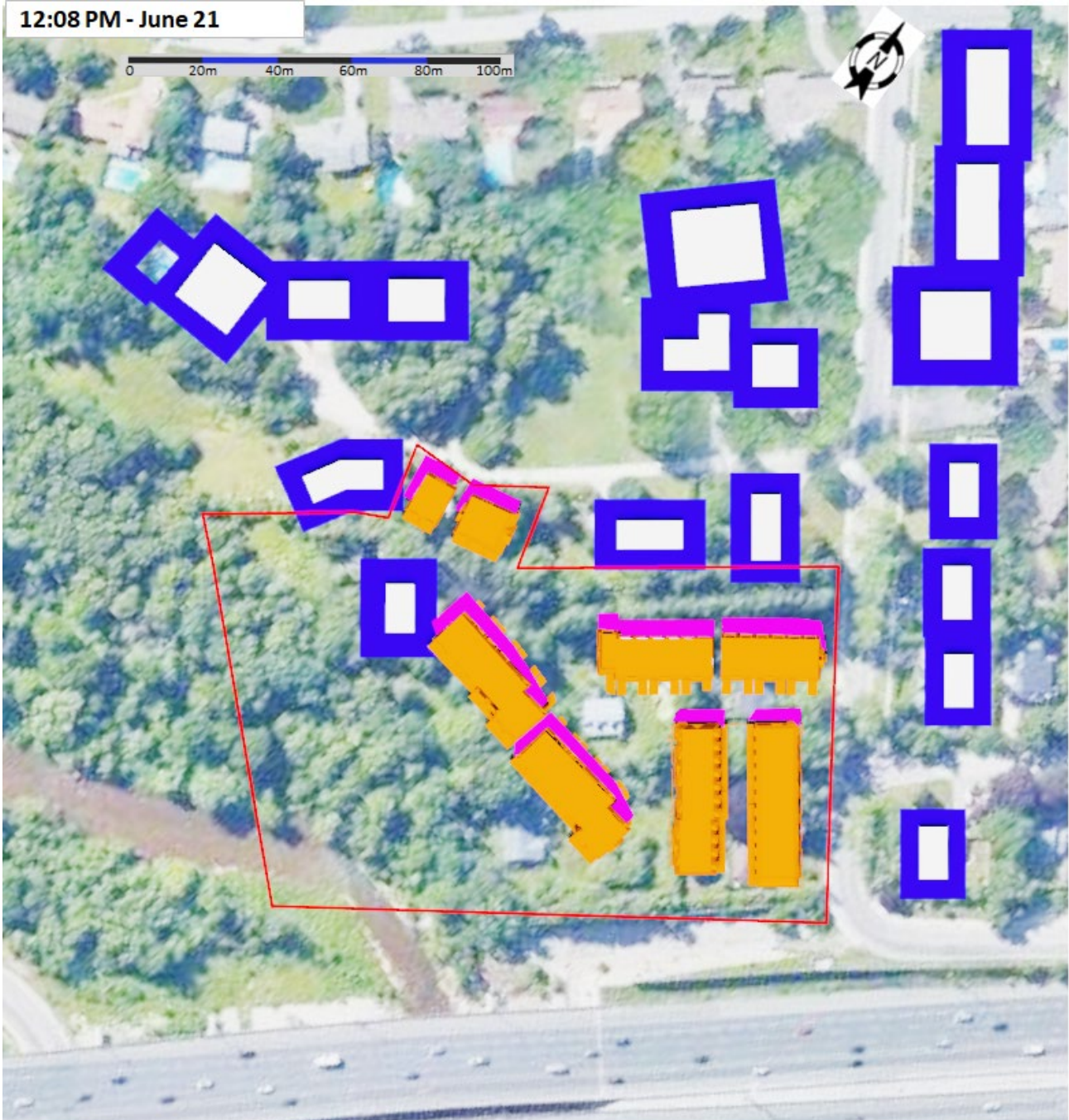
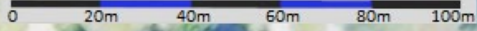




11:08 AM - June 21

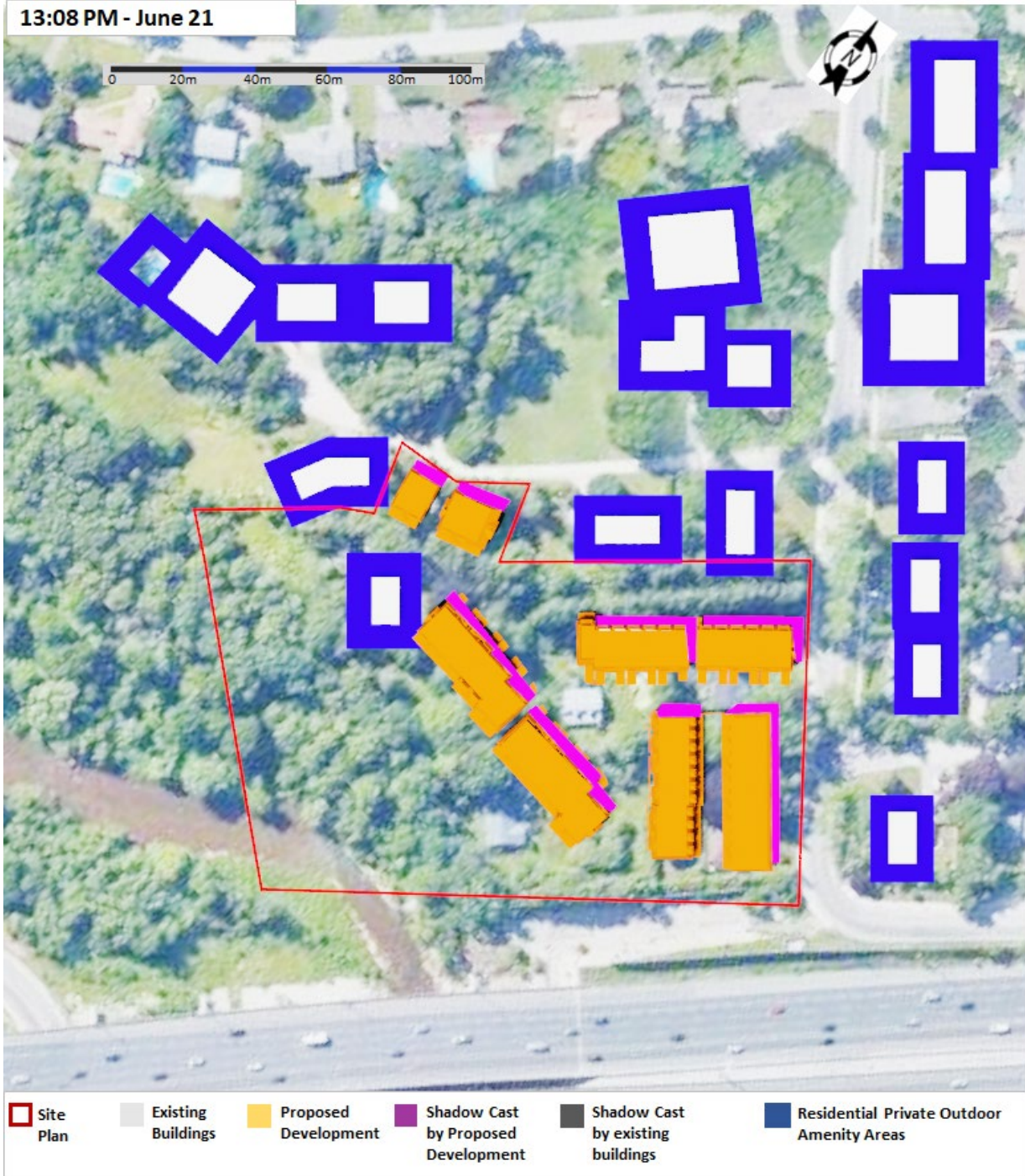


12:08 PM - June 21

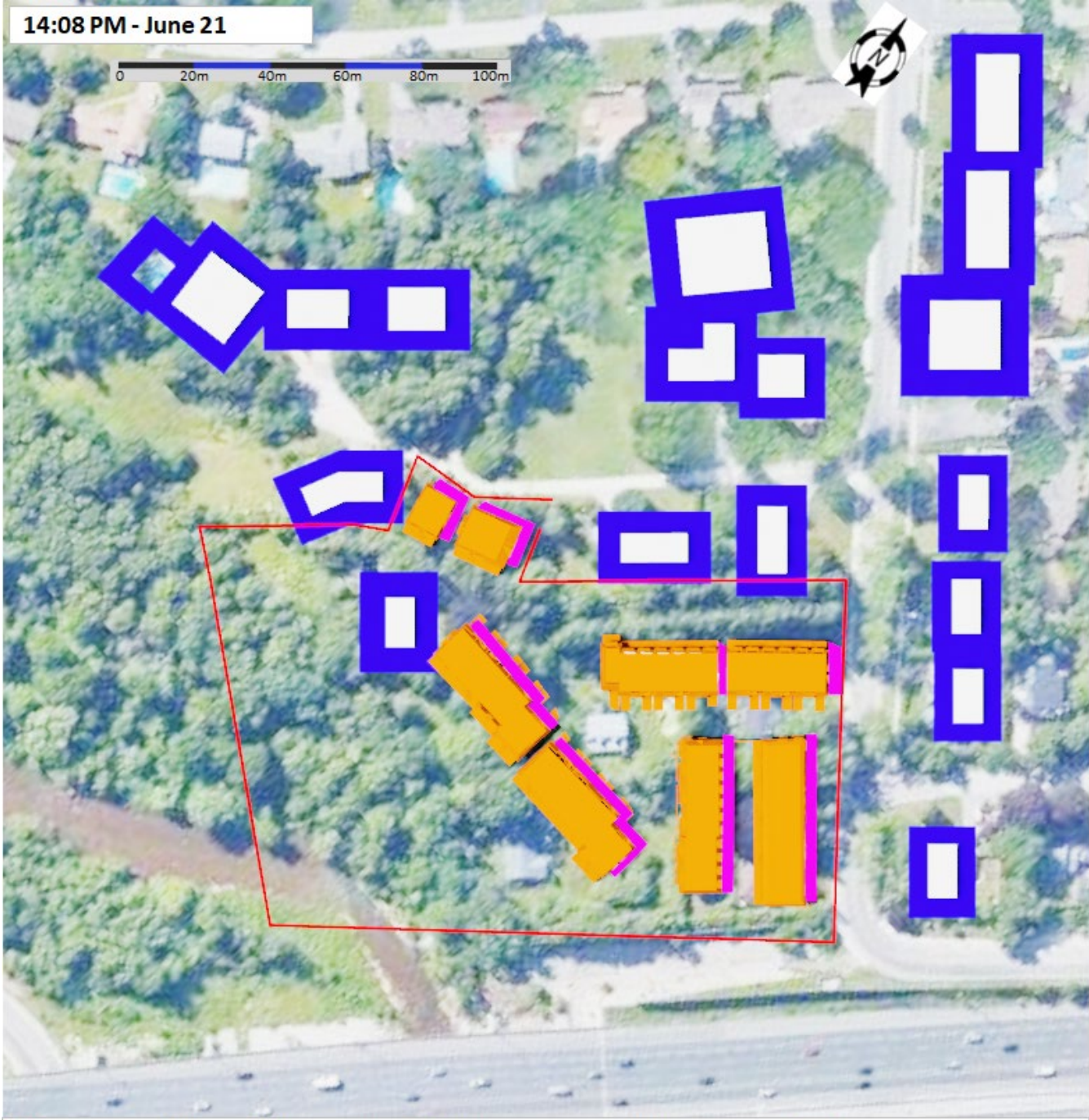
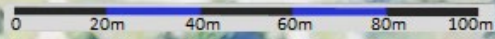


- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Residential Private Outdoor Amenity Areas

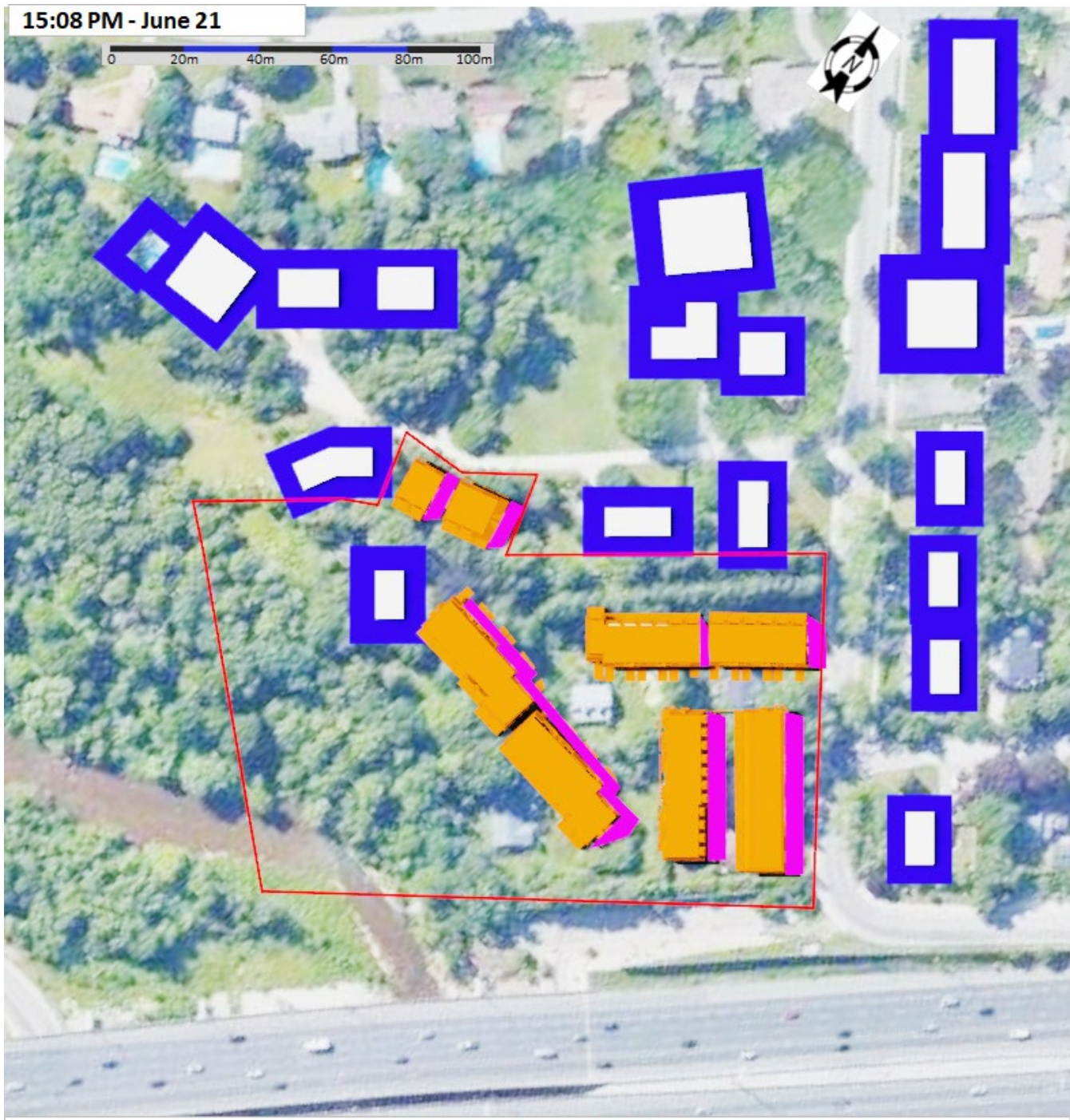
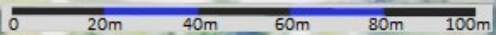
13:08 PM - June 21



14:08 PM - June 21



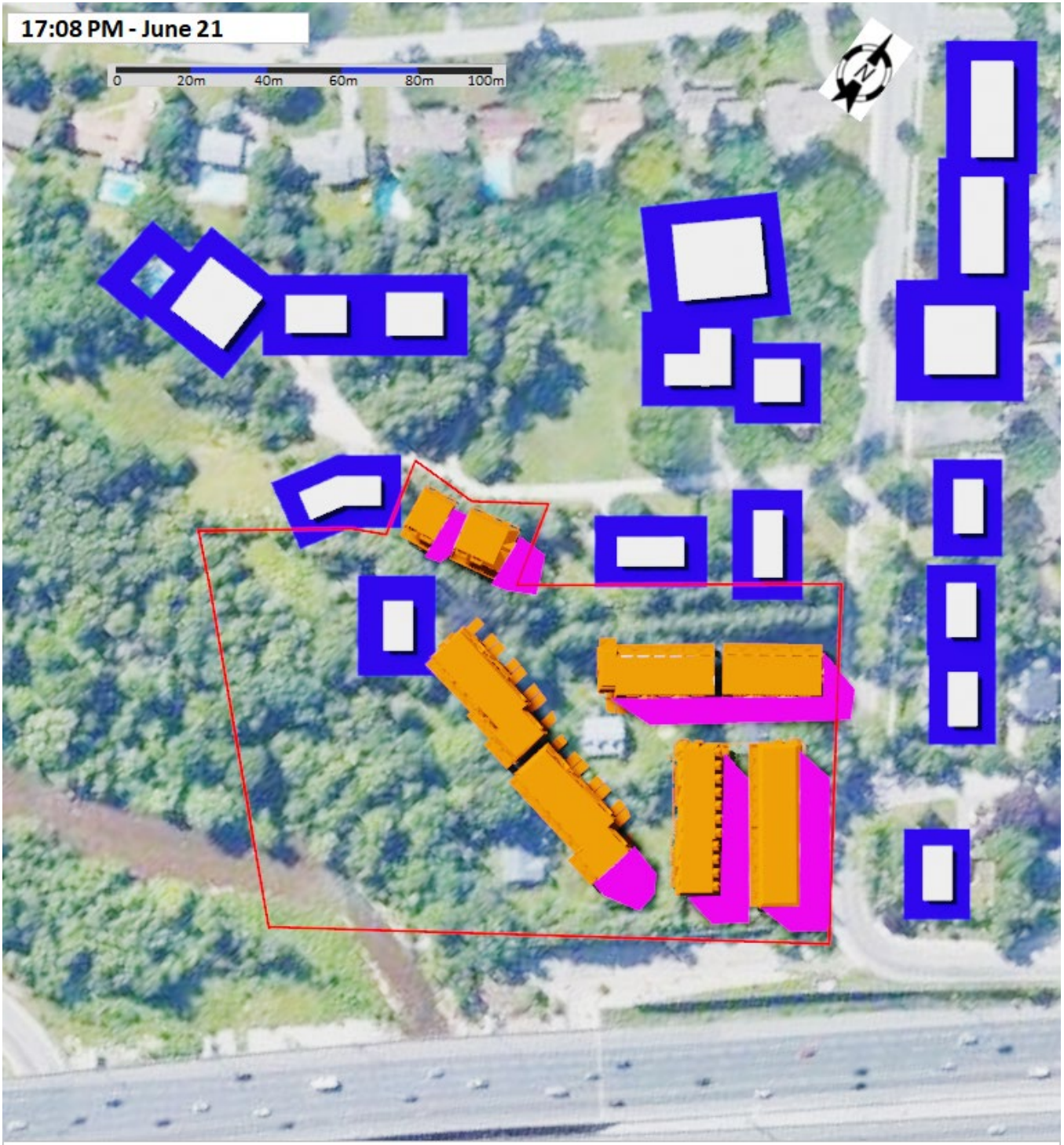
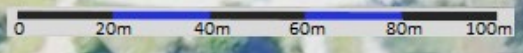
15:08 PM - June 21



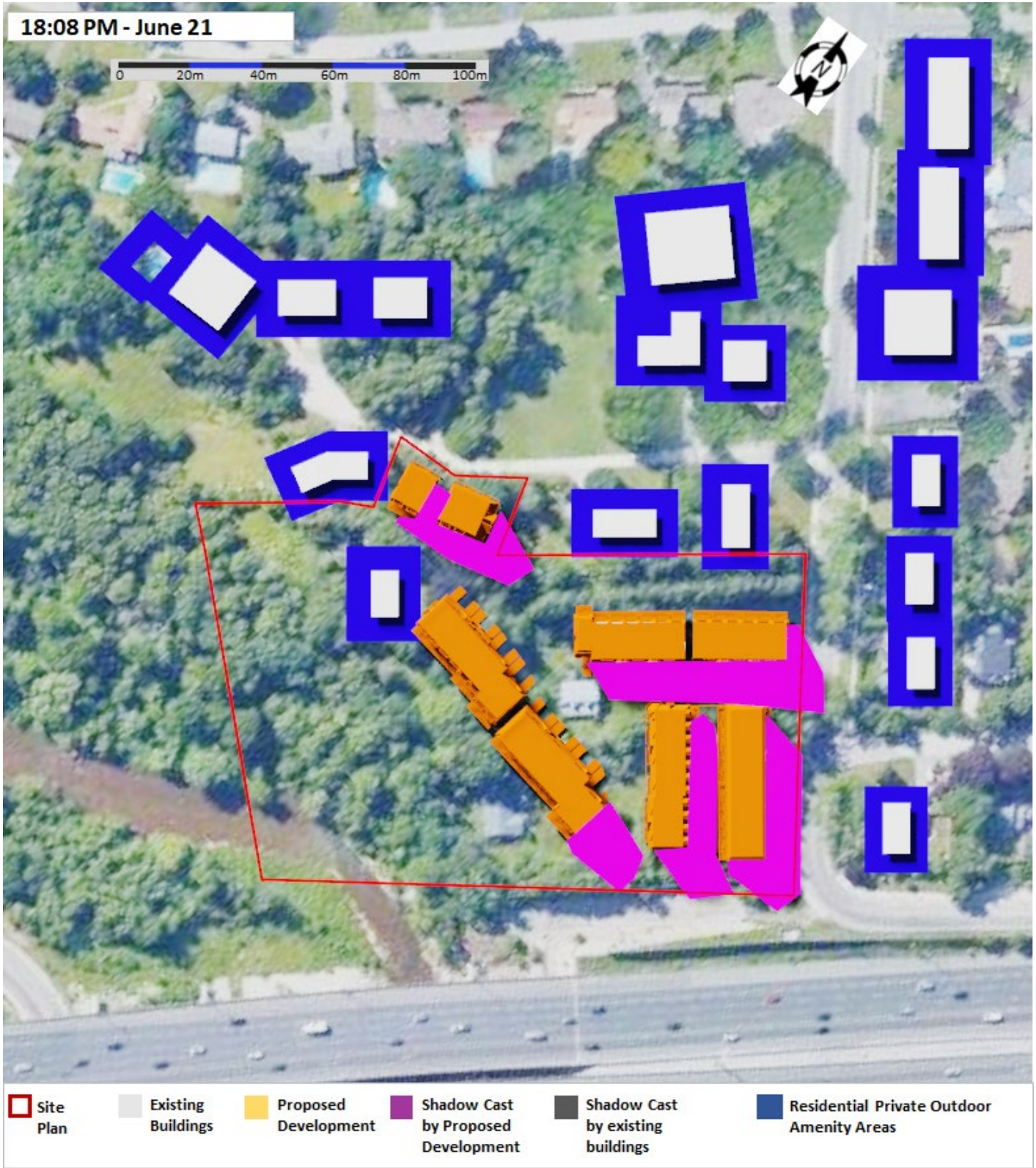
- Site Plan
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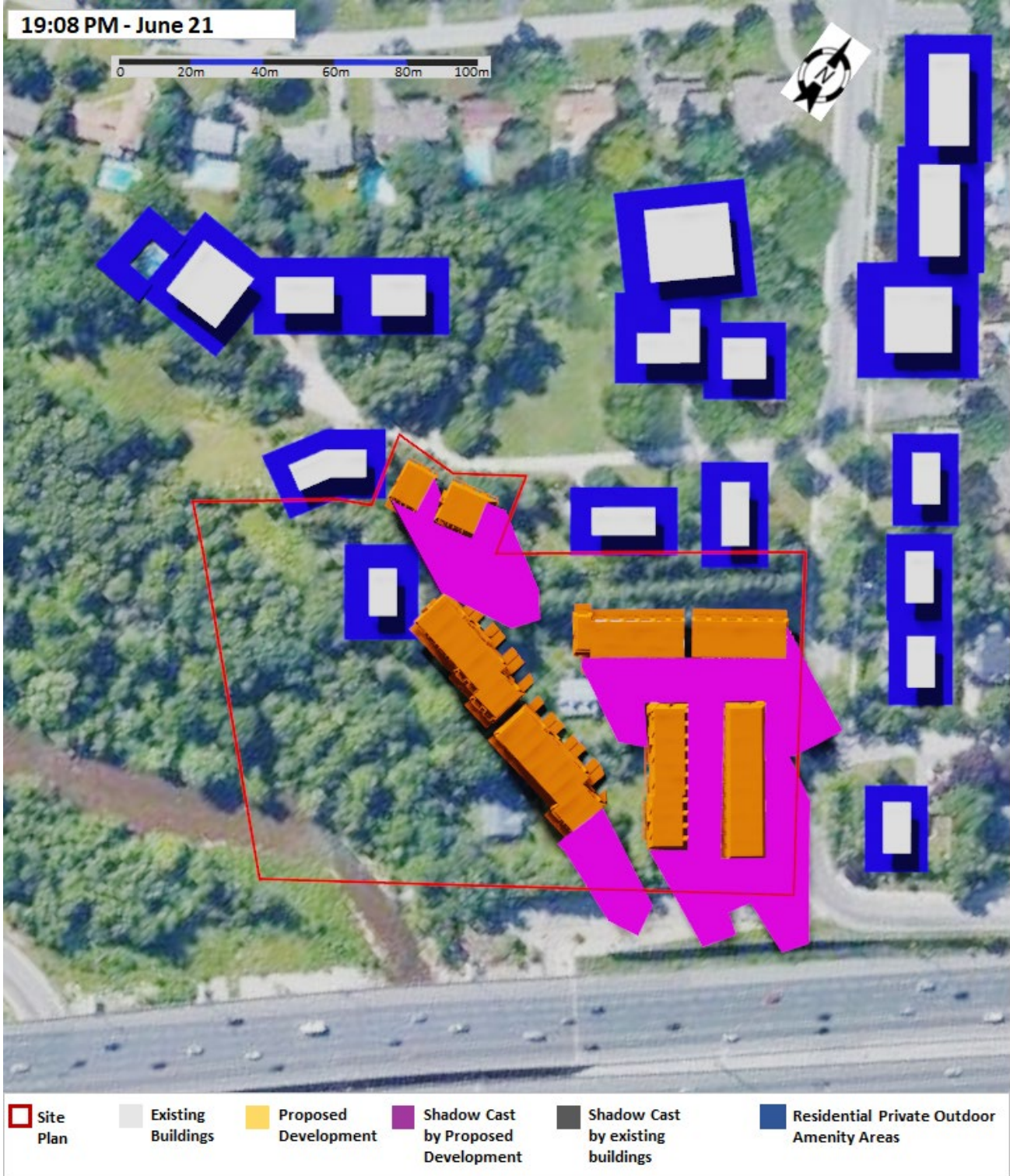


17:08 PM - June 21



- Site Plan
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- Shadow Cast by existing buildings
- Residential Private Outdoor Amenity Areas





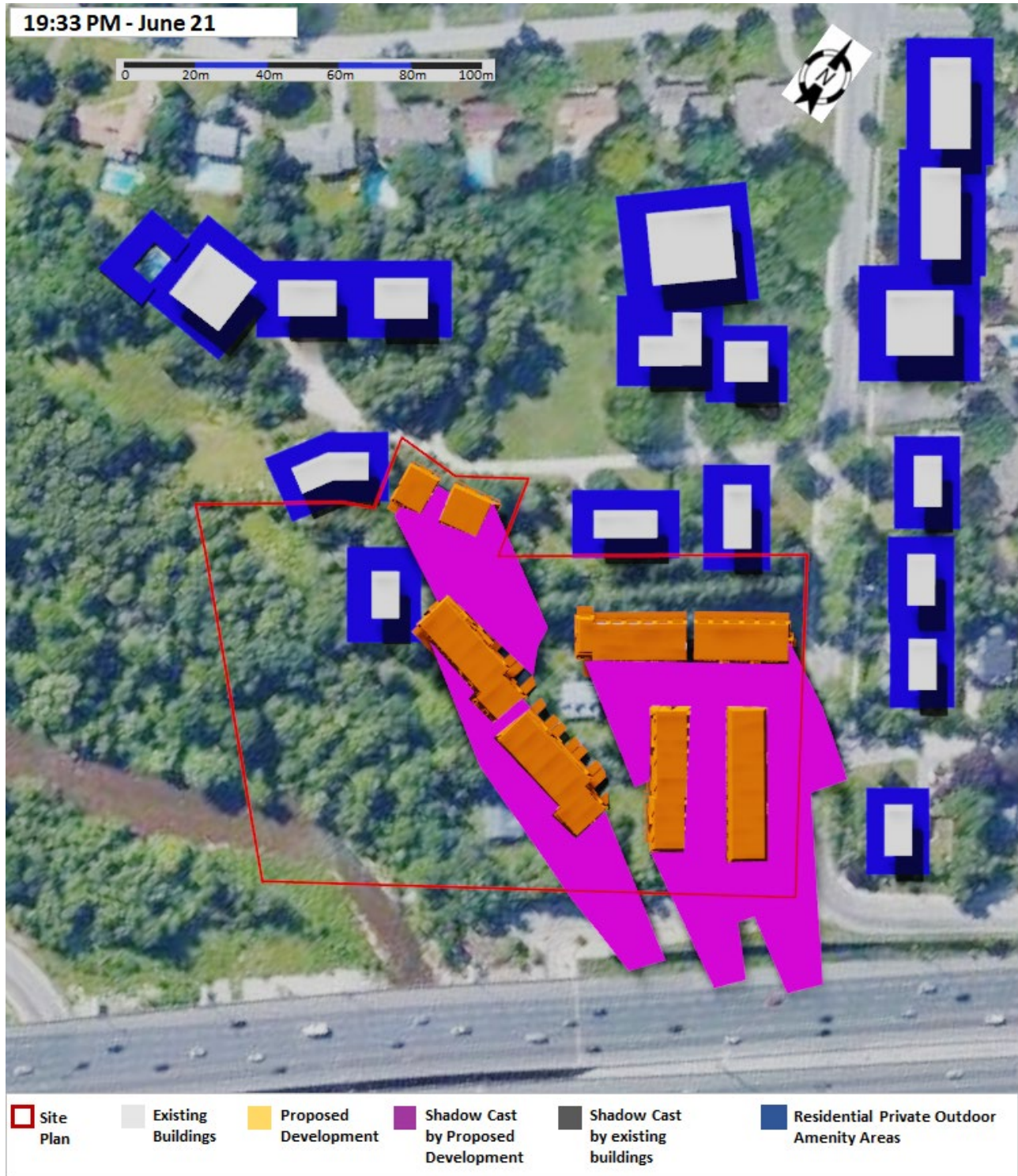
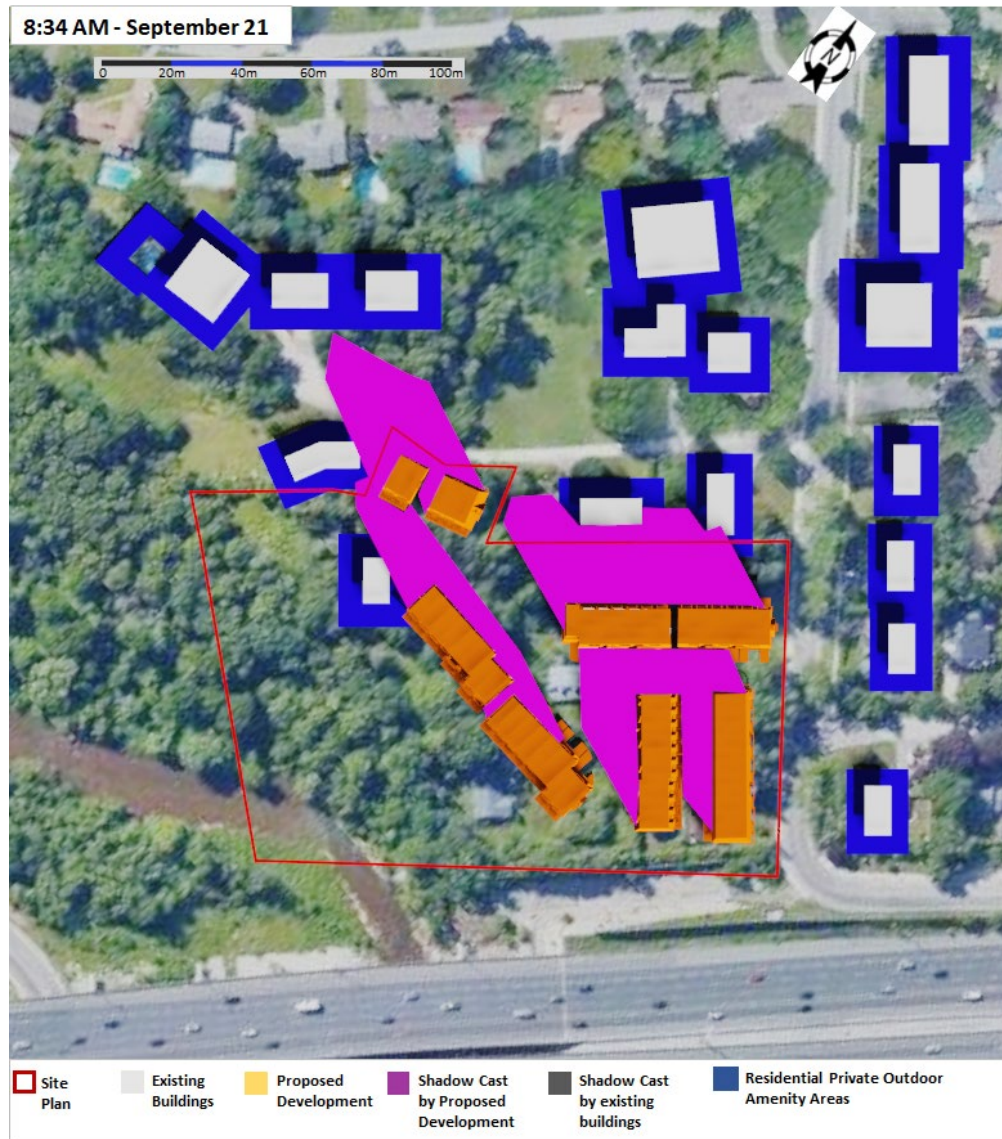


Figure 2: Shadow Patterns at Residential Private amenity spaces – June 21st

As per the TOR, the criterion is met if the shadow cast from proposed Development should not linger no more than two consecutive hourly test times after 12:00pm. As shown in **Figure 2** 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 criterion. As such, the criterion is met.

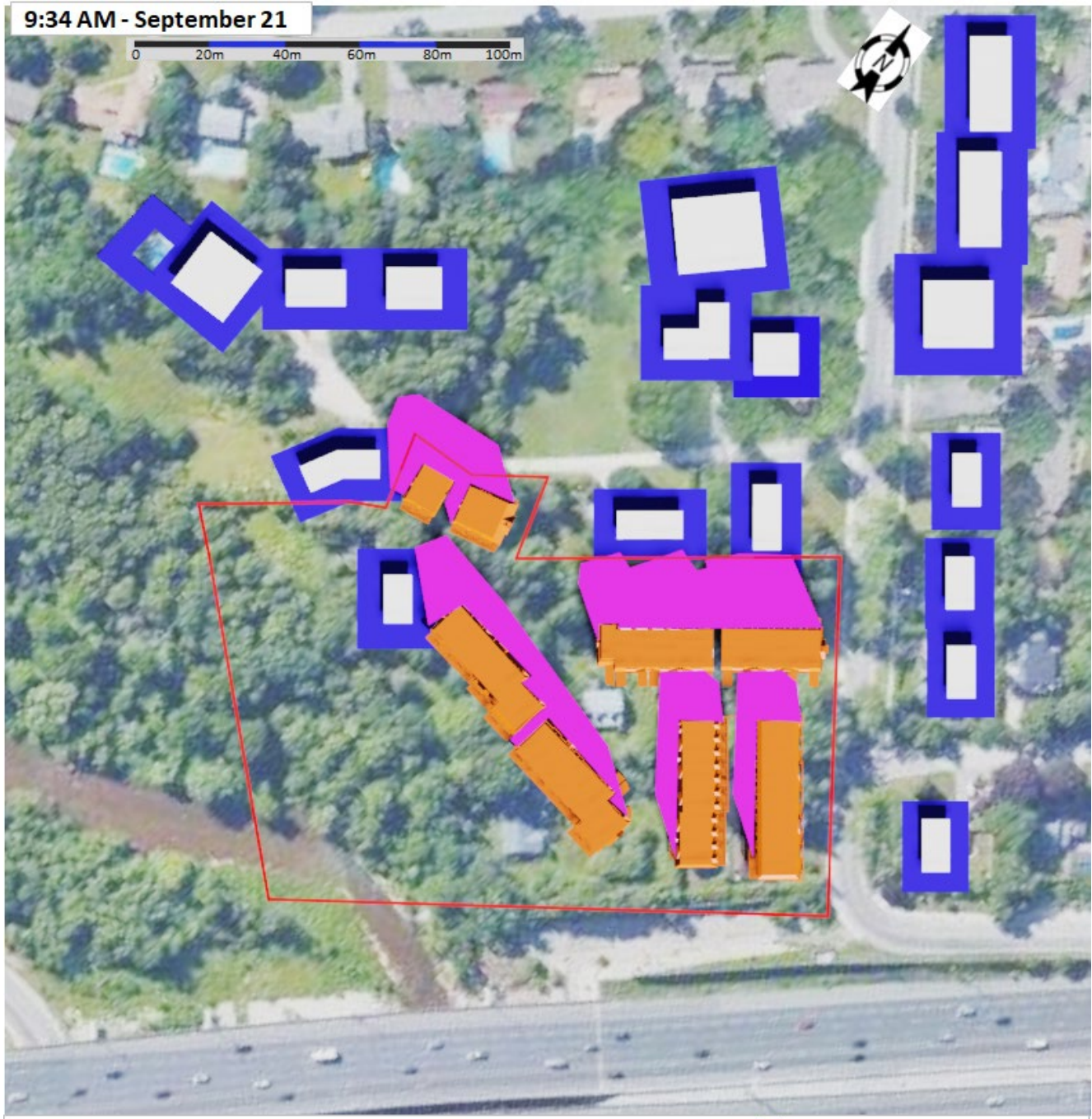
1.2 SHADOW ANALYSIS RESULTS FOR SEPTEMBER 21

The model results of shadow patterns for fall equinox from 8.34am to 5.47pm are shown in **Figure 3**. In this **Figure 3**, 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 slightly 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 south-east sides of the Development to reach a maximum length near the sunset hours. Overall, the length of the shadow remains short due the height of the Development.



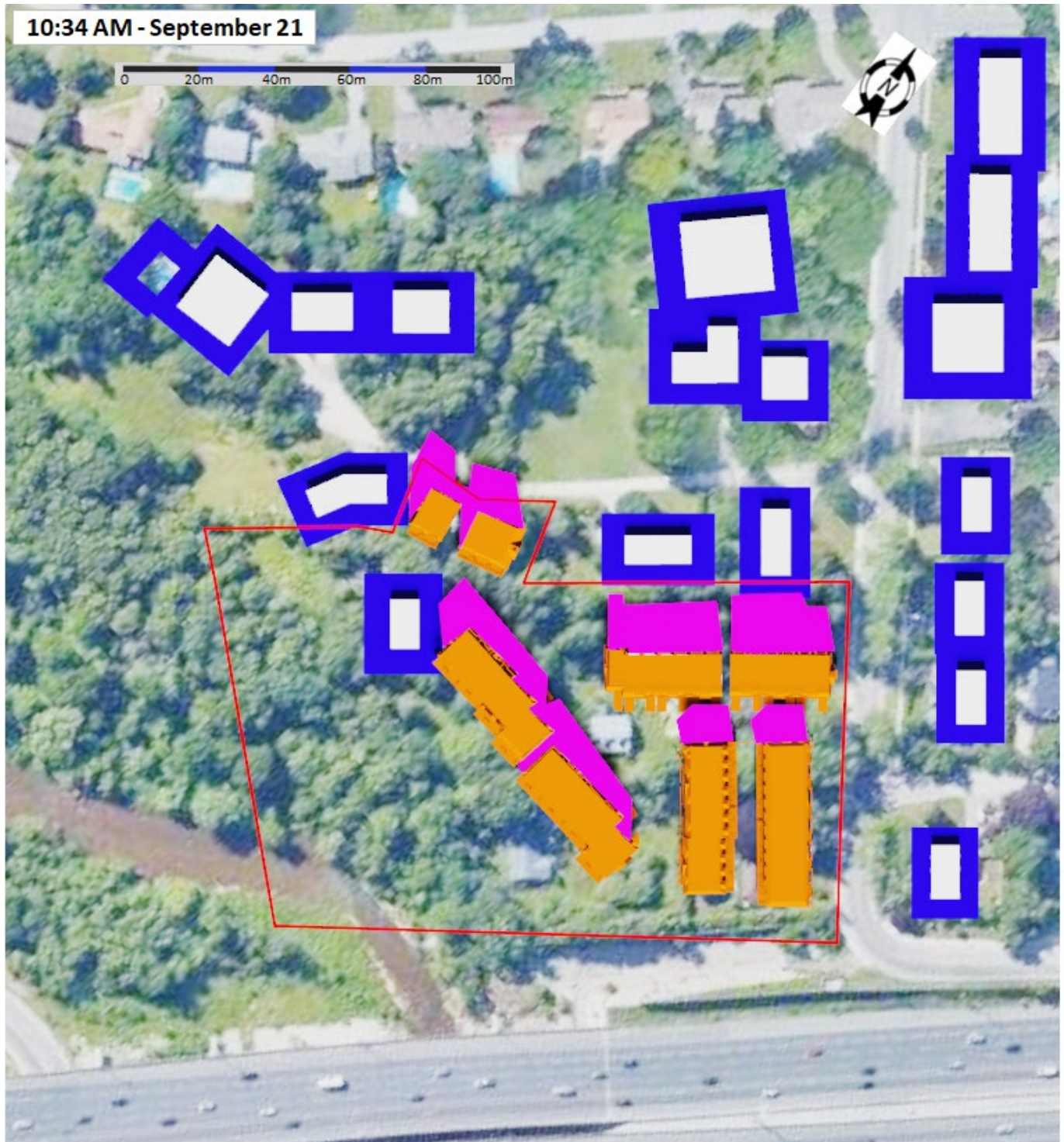
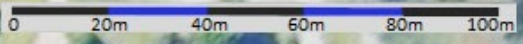
9:34 AM - September 21

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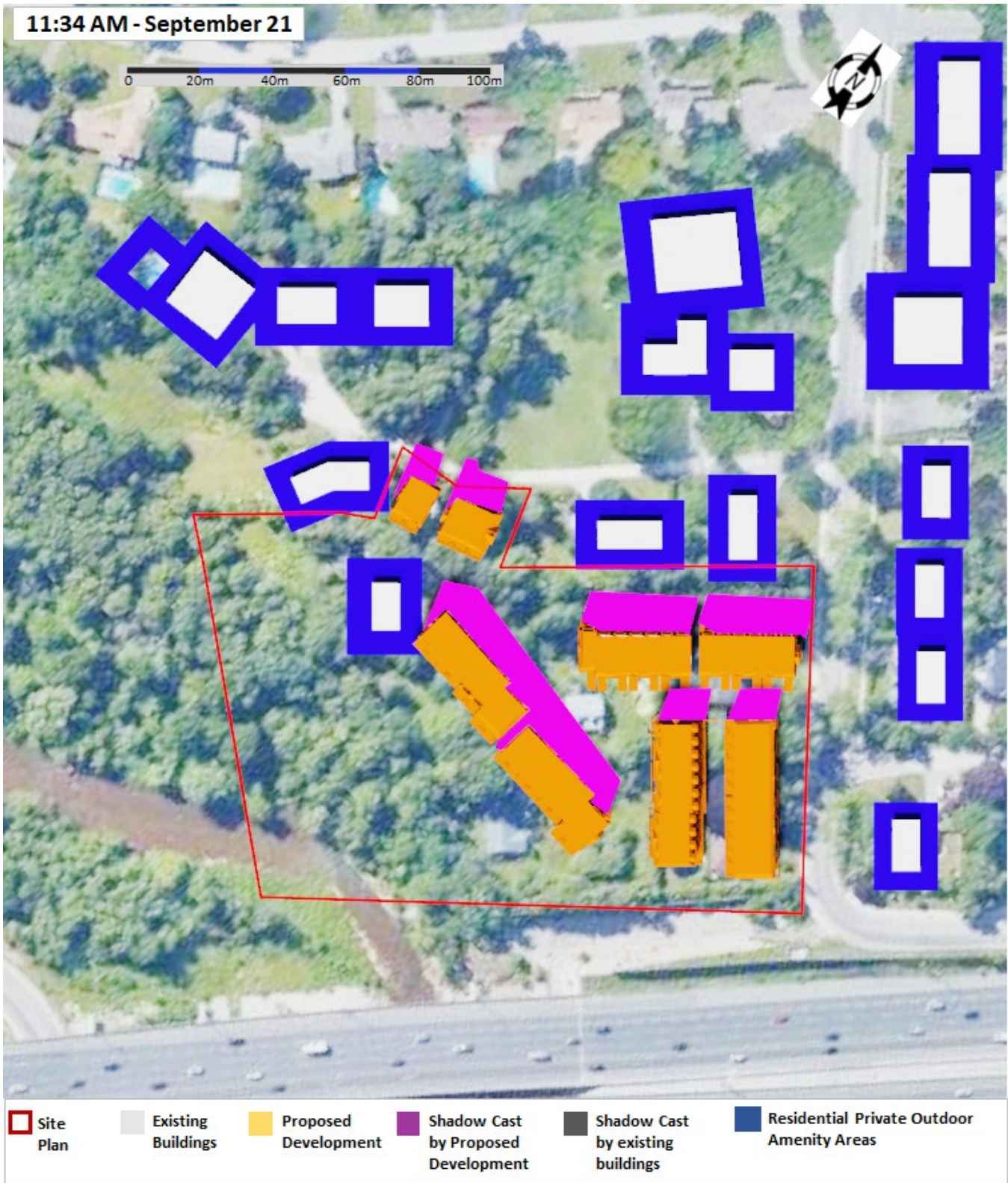
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Residential Private Outdoor Amenity Areas

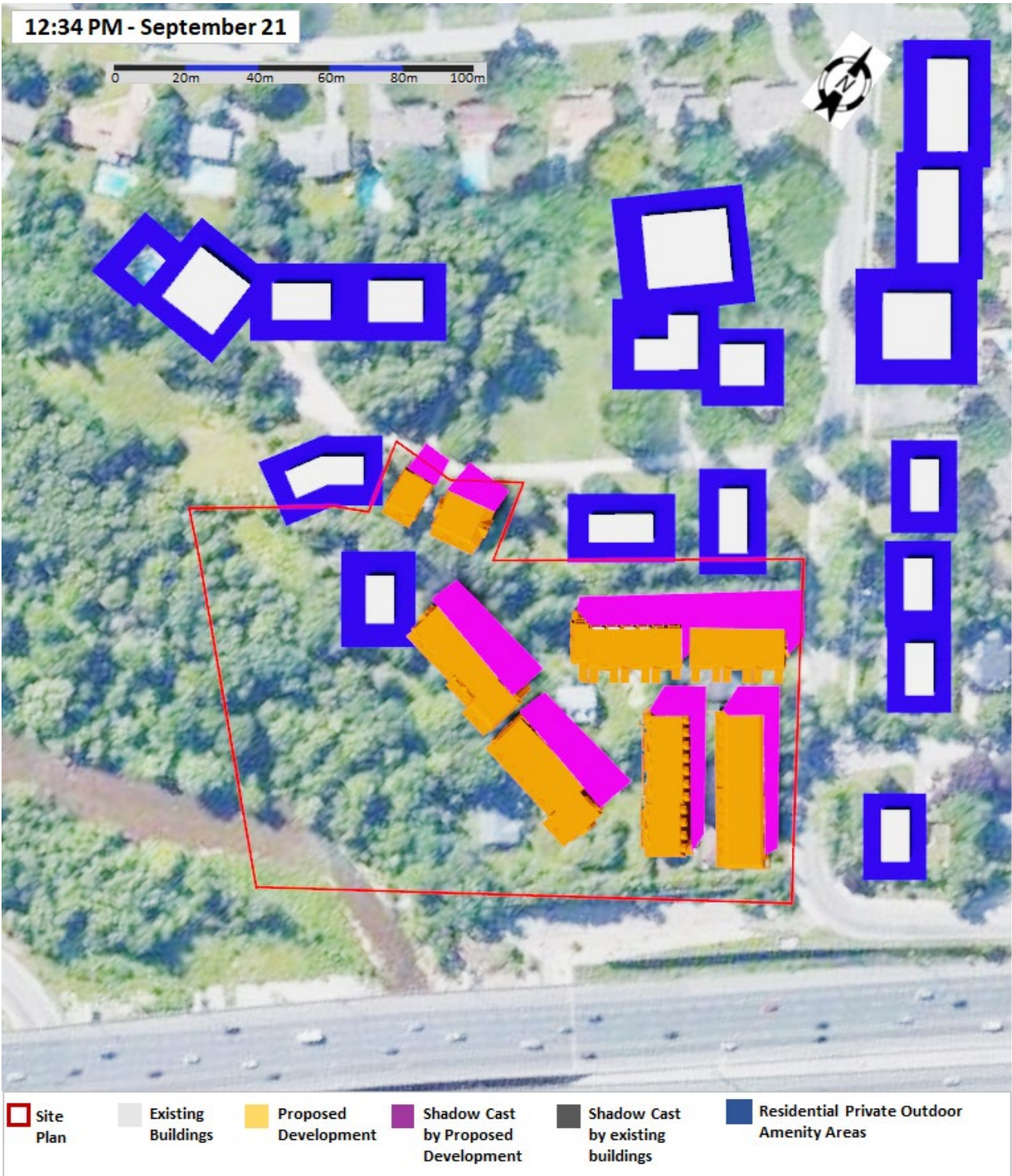
10:34 AM - September 21



11:34 AM - September 21

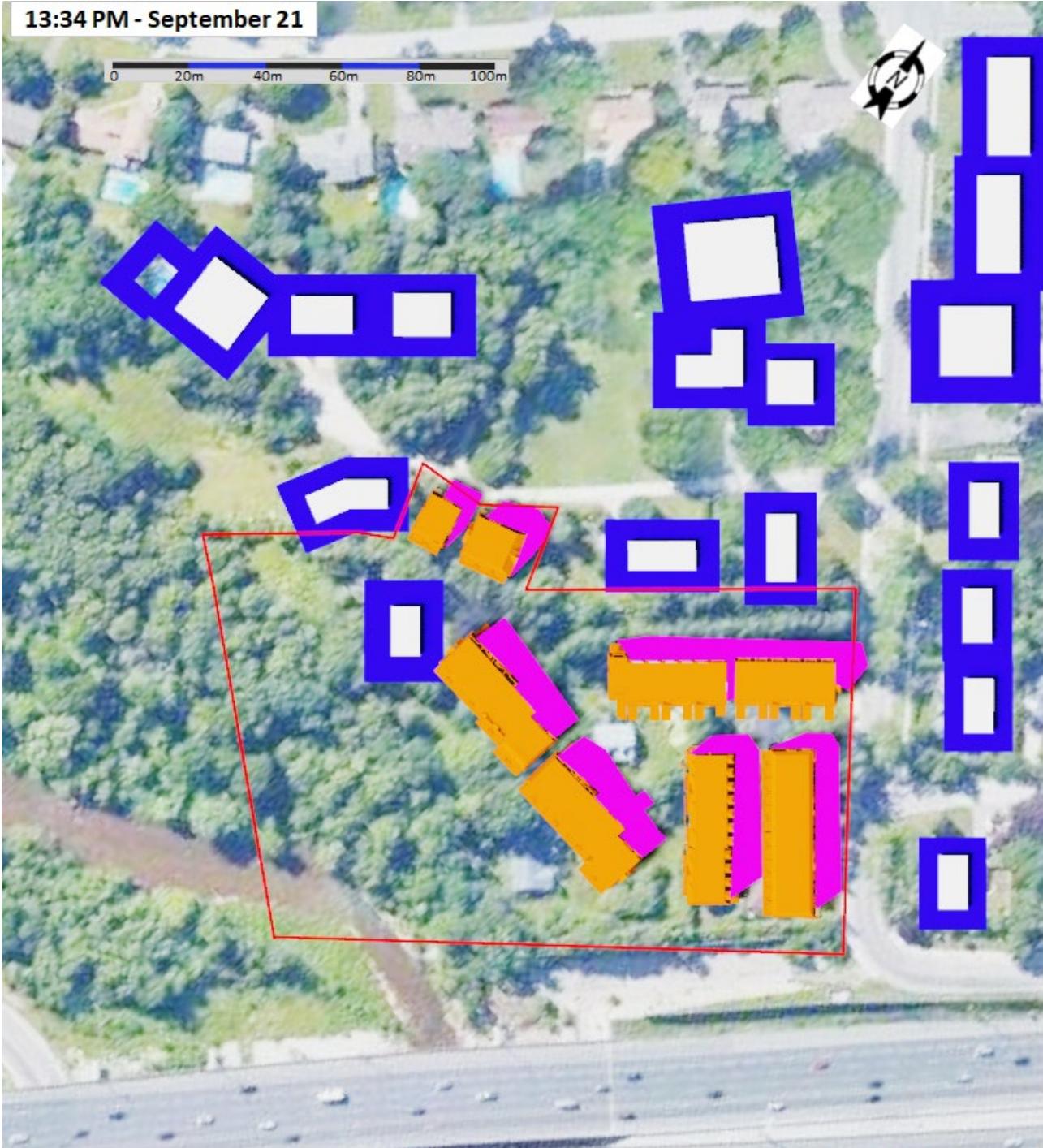
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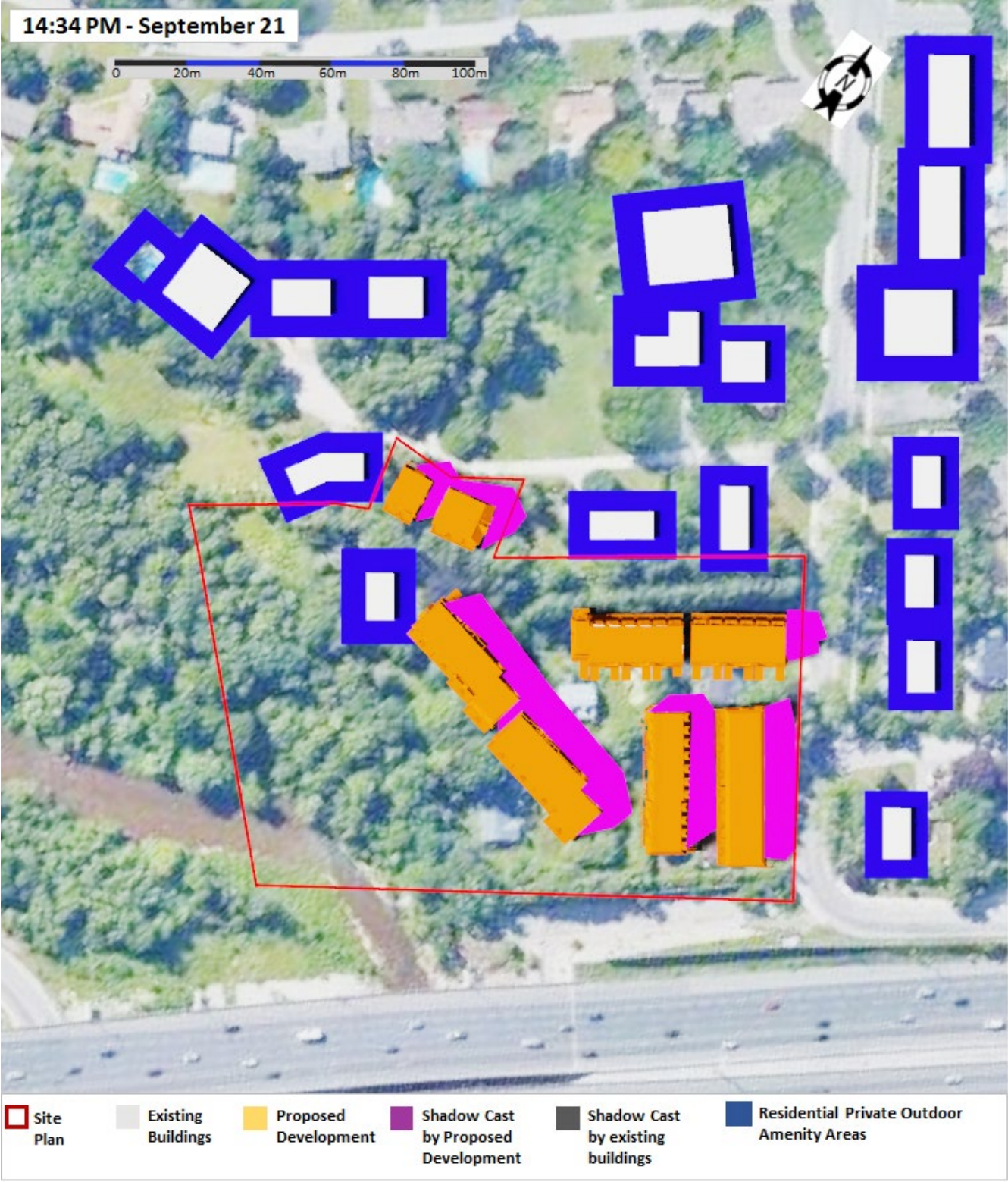


13:34 PM - September 21

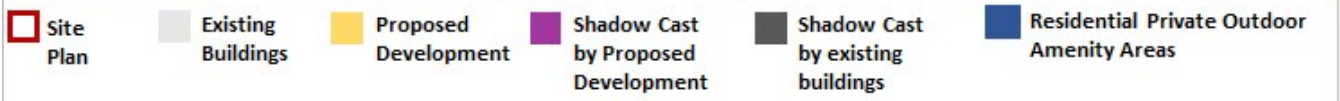
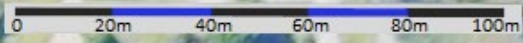
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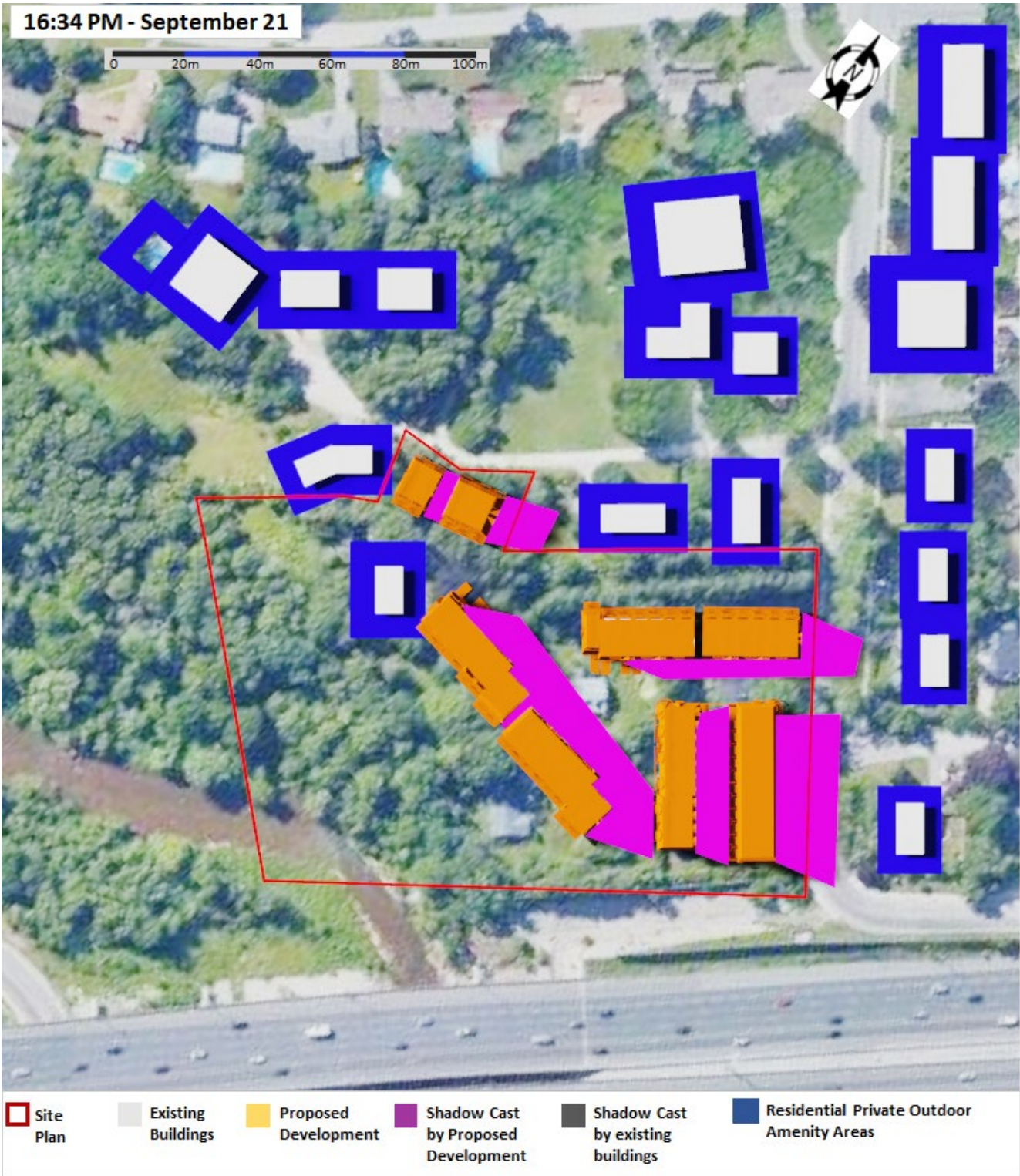


- Site Plan
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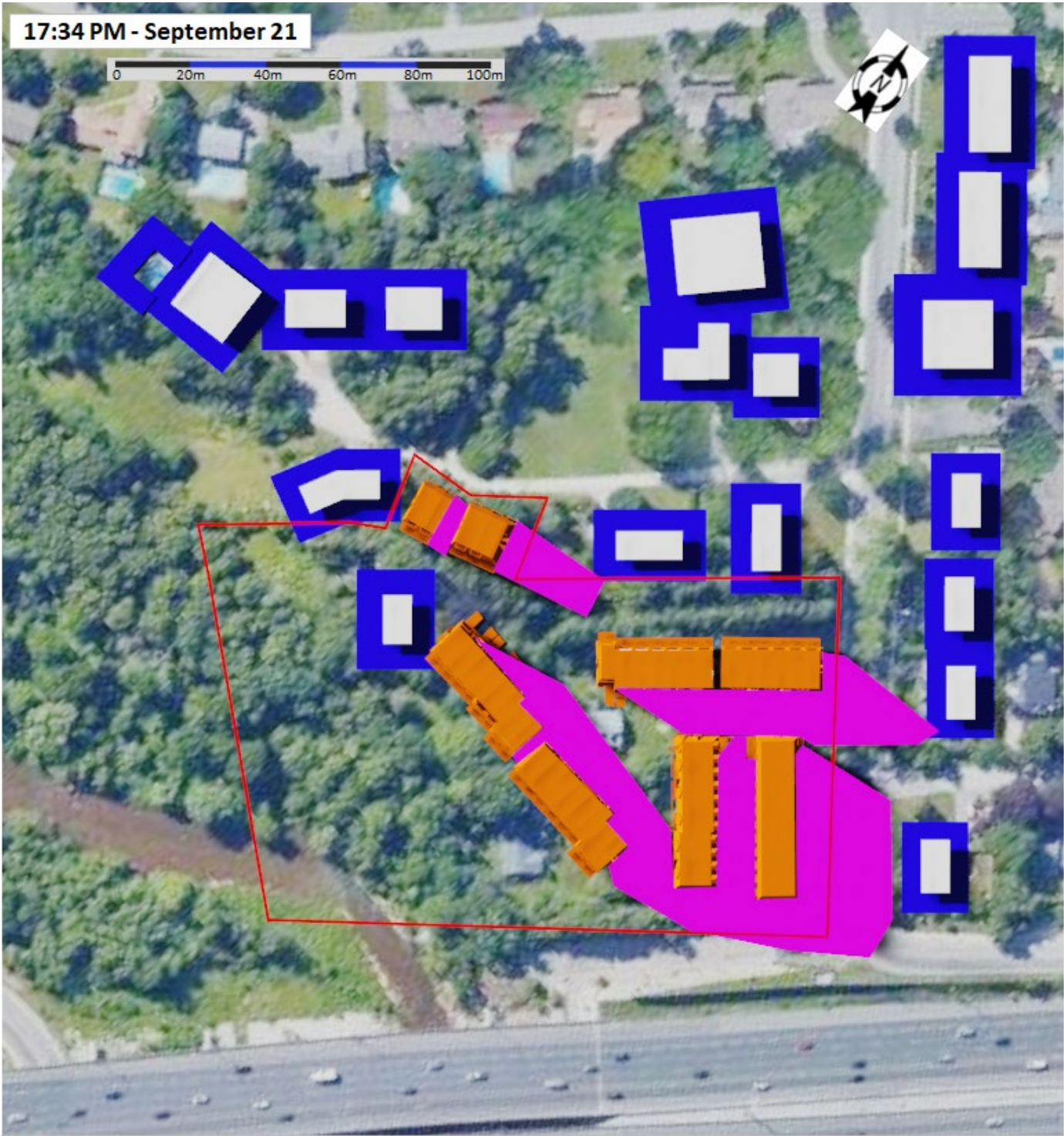
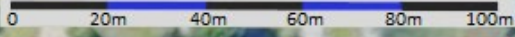


15:34 PM - September 21





17:34 PM - September 21



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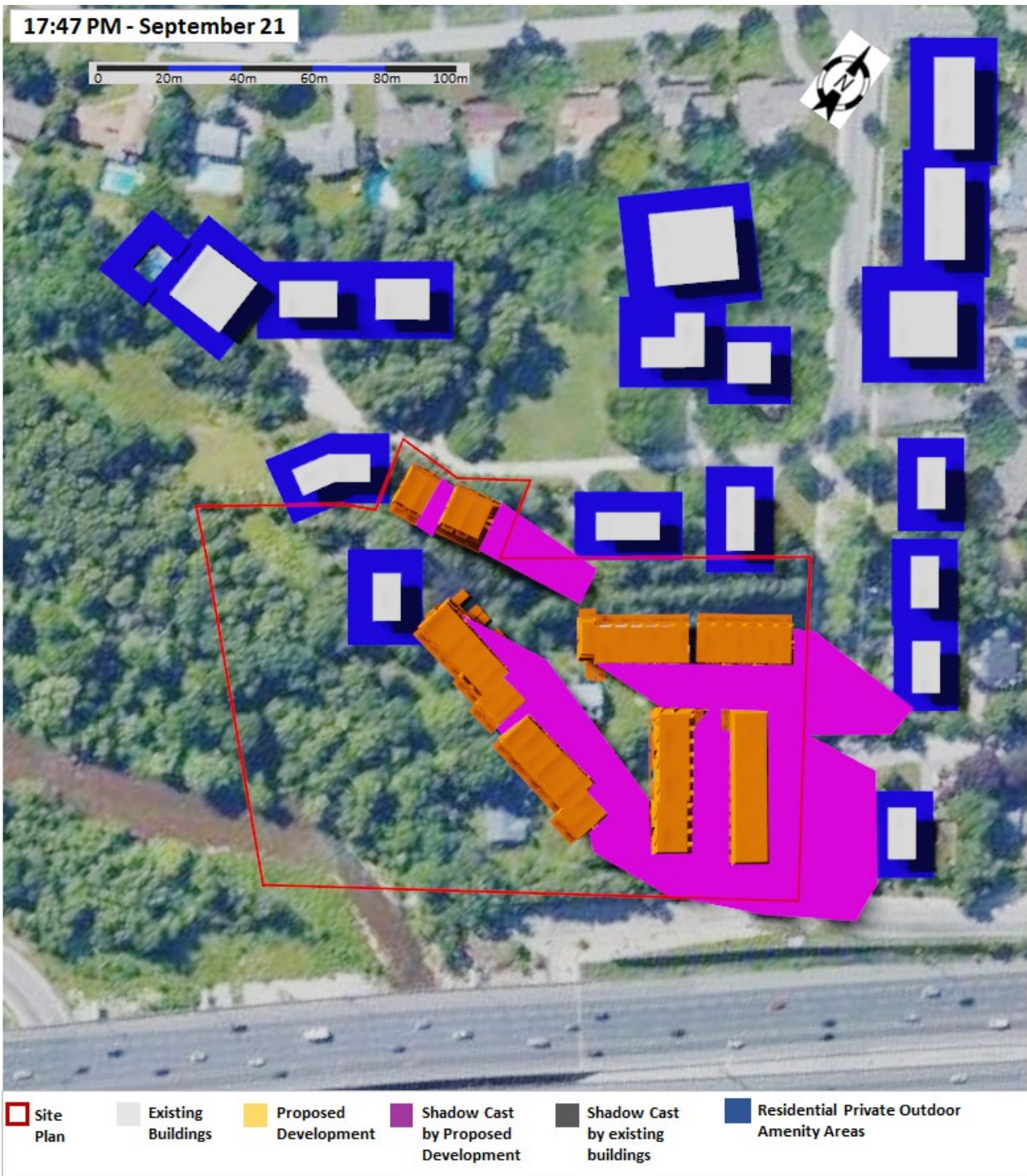
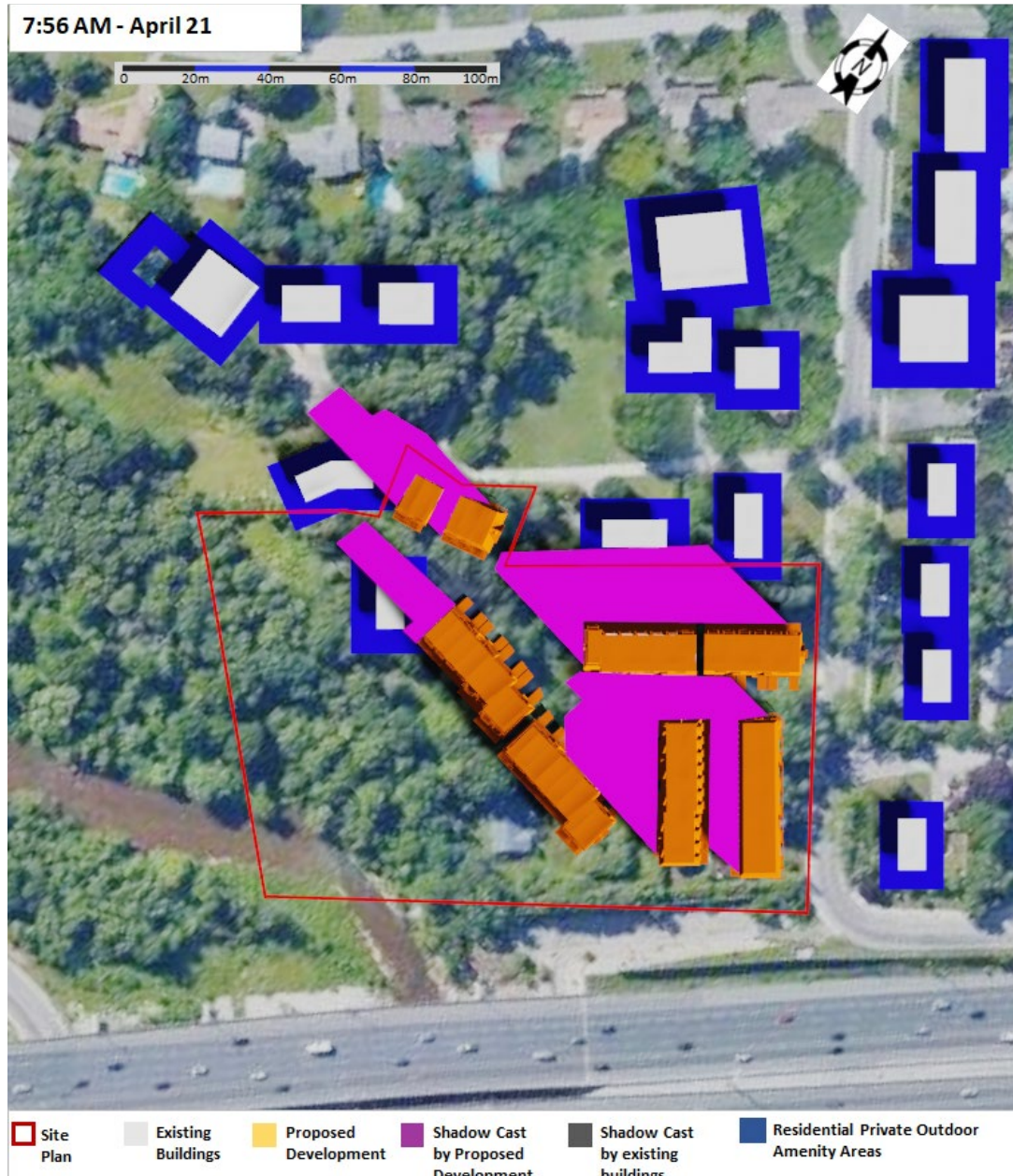


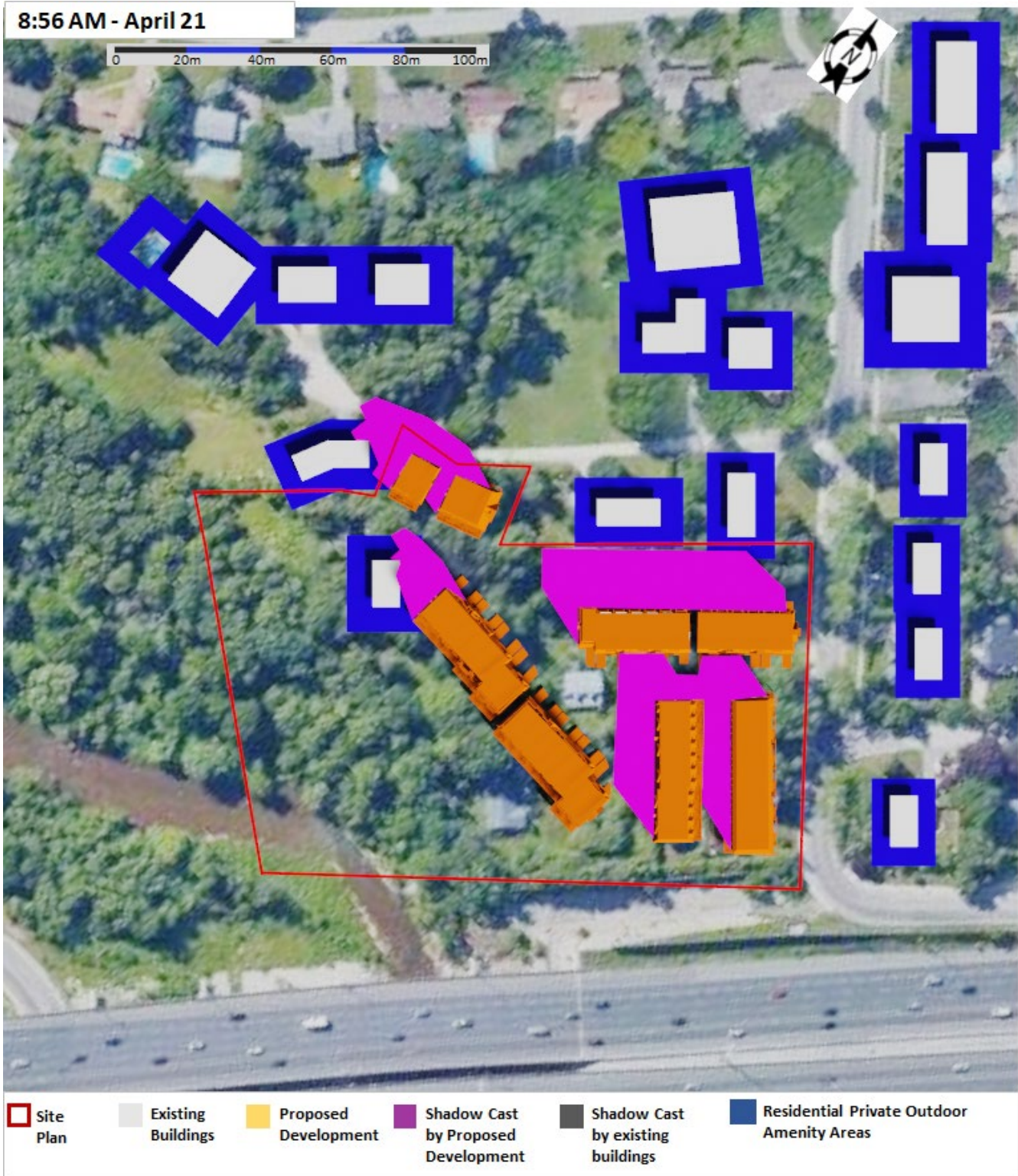
Figure 3: Shadow Patterns at Residential Private amenity spaces – September 21st.

As per the TOR, the criterion is met if the shadow cast from proposed Development should not linger for more than two consecutive hourly test times after 12:00pm. As shown in **Figure 3** above, the findings of the shadow analysis show that the proposal of no more than two consecutive hourly test times are in accordance with this criterion. As such, the criterion is met.

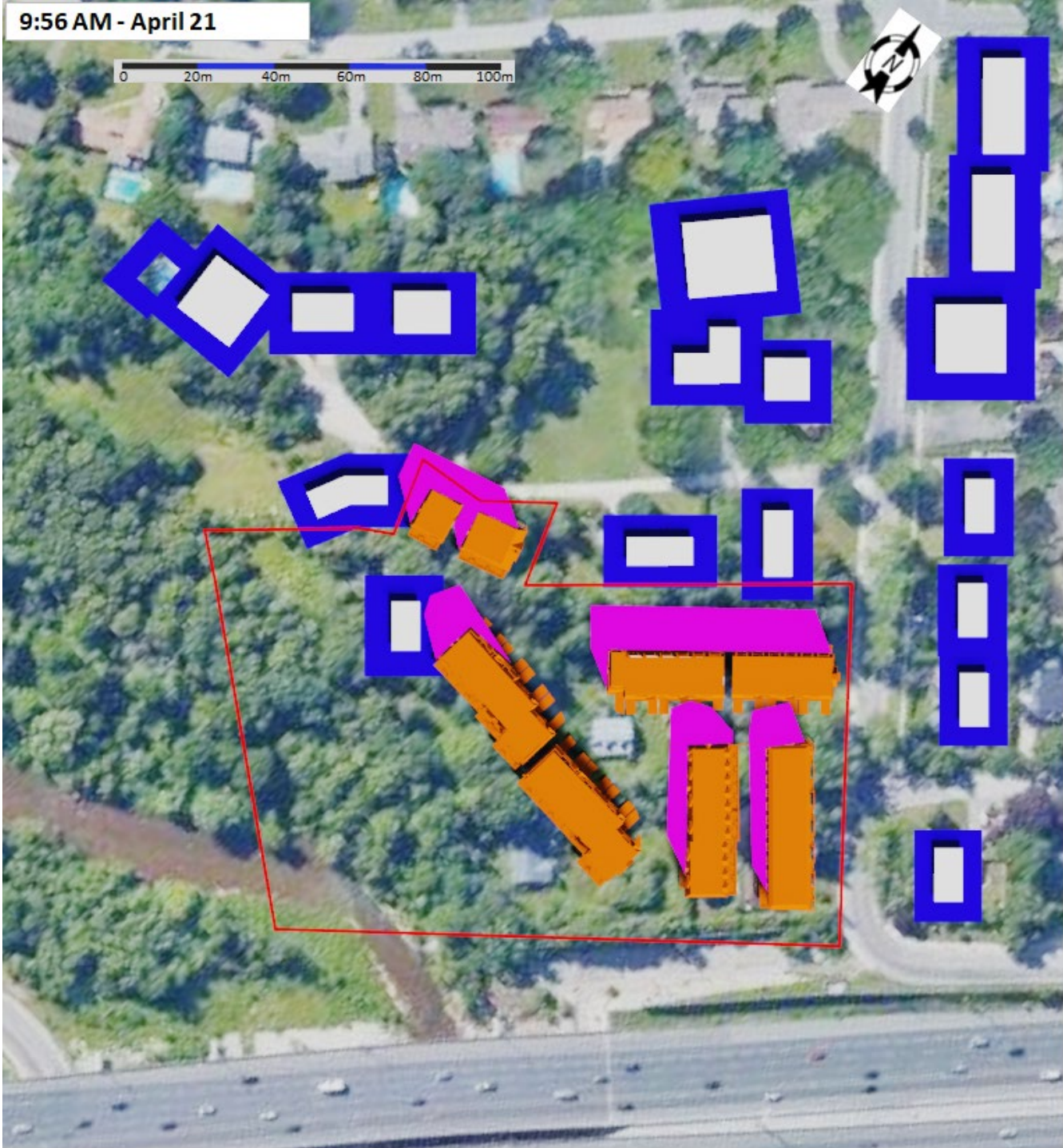
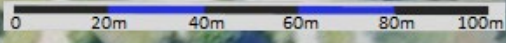
1.3 SHADOW ANALYSIS RESULTS FOR APRIL 21

The model results of shadow patterns for fall equinox from 7.56am to 6.39pm are shown in **Figure 4**. In this **Figure 4**, the new shadow (purple color) represents the shadow due to the Development. The footprint of the Development is represented by the orange color. For the spring 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 south-east sides of the Development to reach a maximum length near the sunset hours. Overall, the shadow length remains relatively short due to the lower height of the Development.





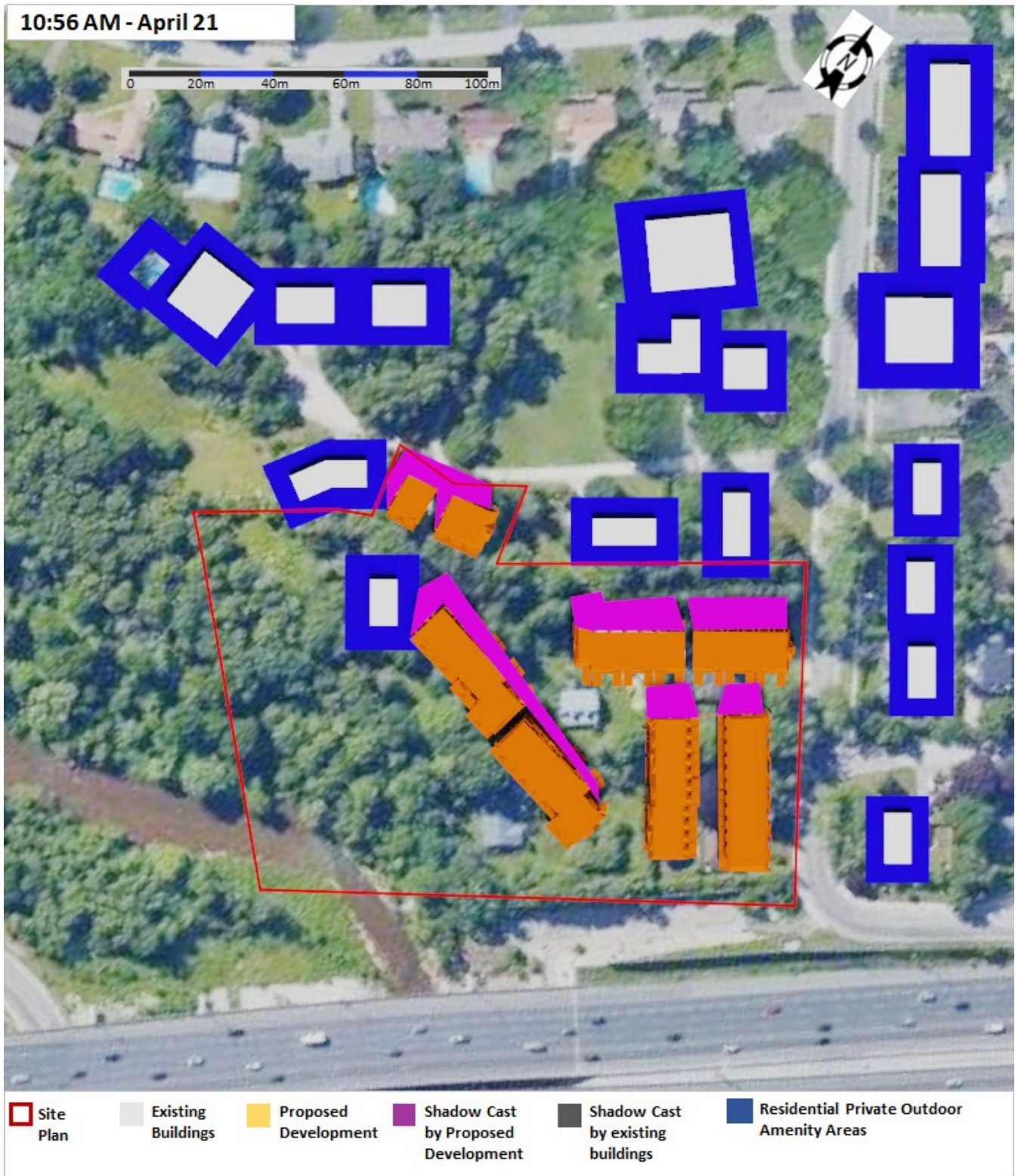
9:56 AM - April 21

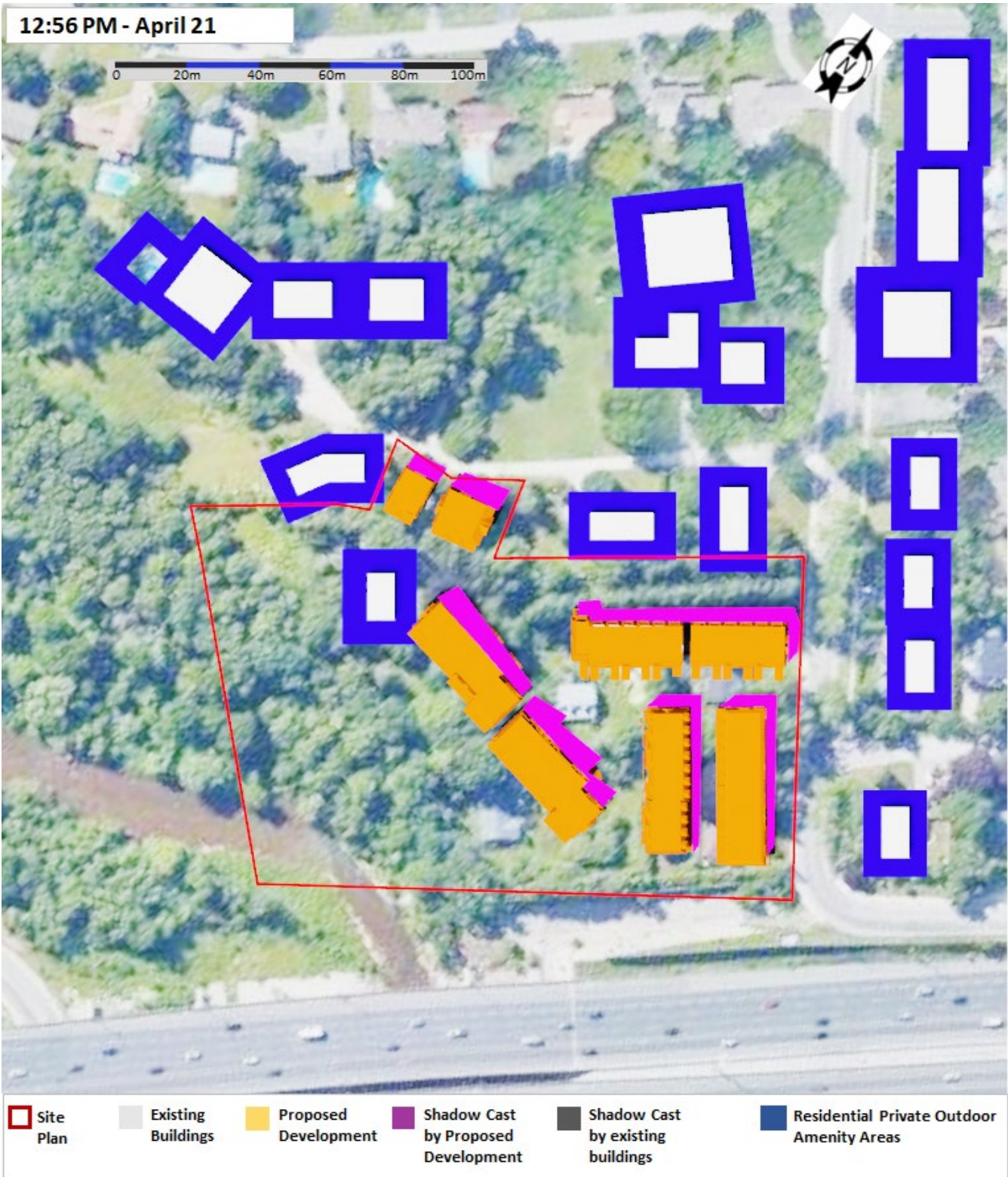


- Site Plan
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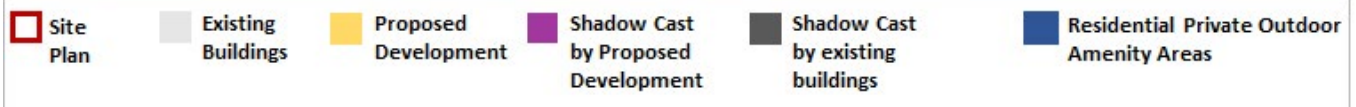
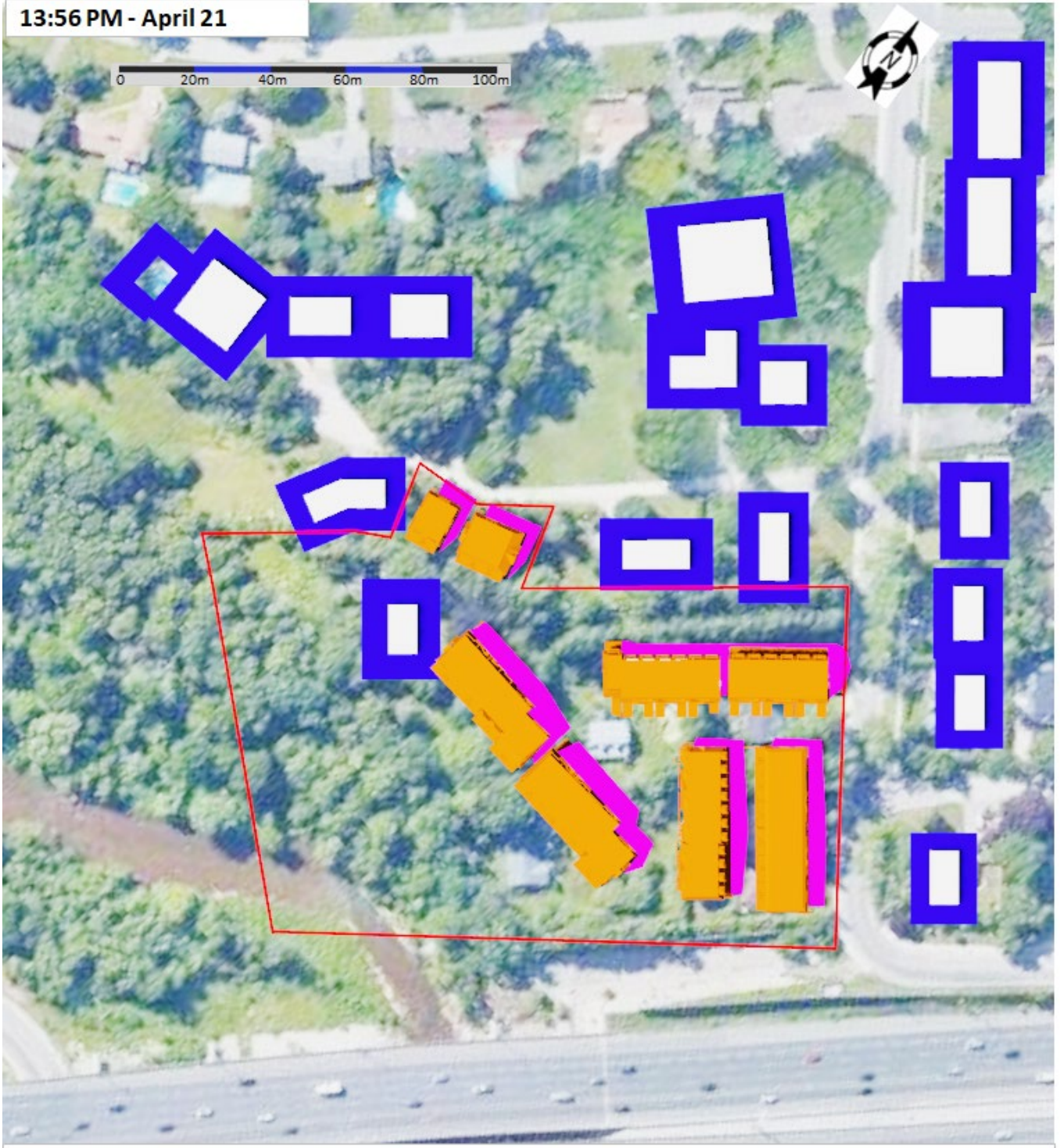
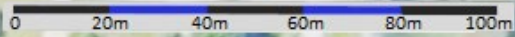
10:56 AM - April 21

0 20m 40m 60m 80m 100m



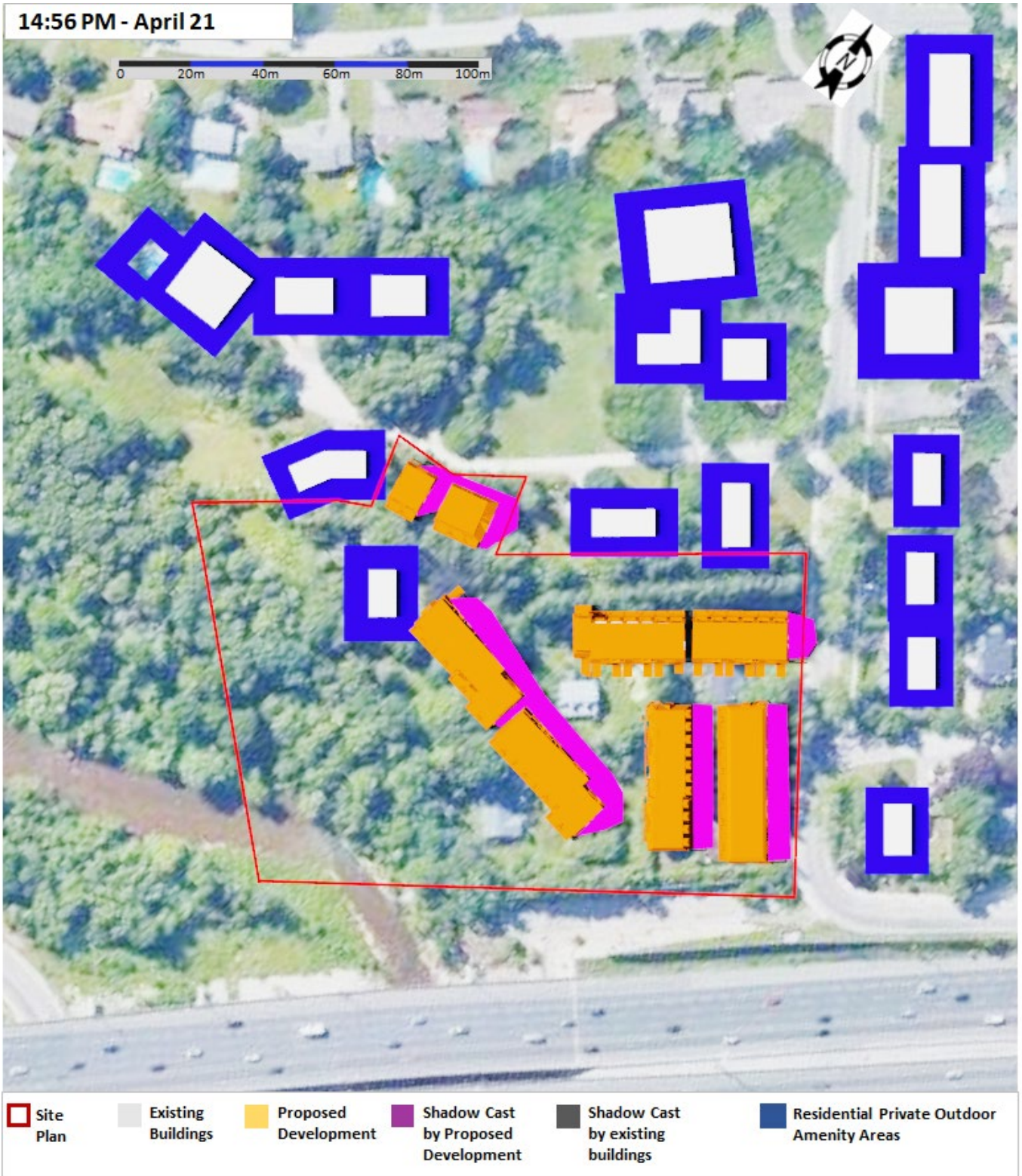


13:56 PM - April 21



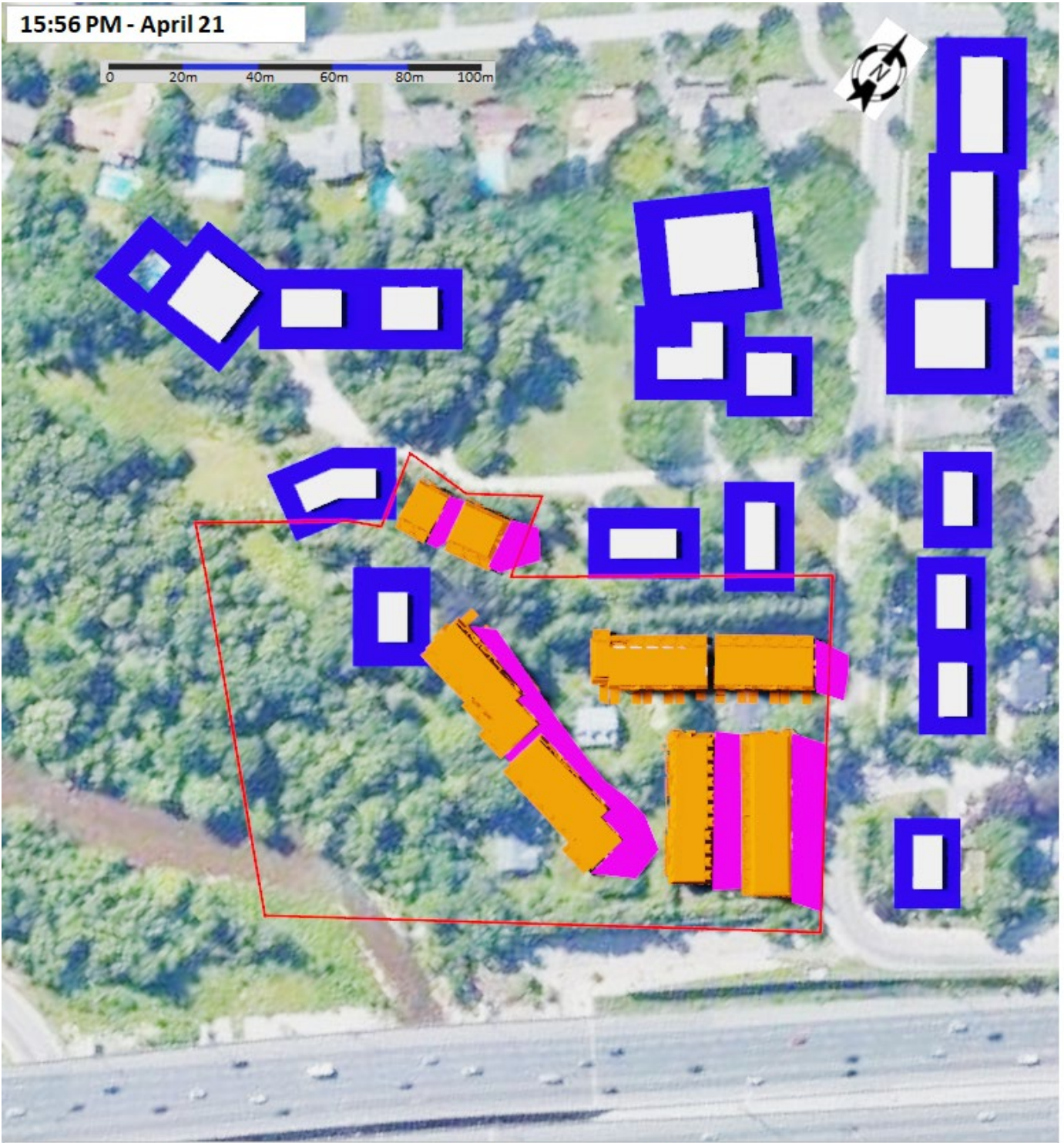
14:56 PM - April 21

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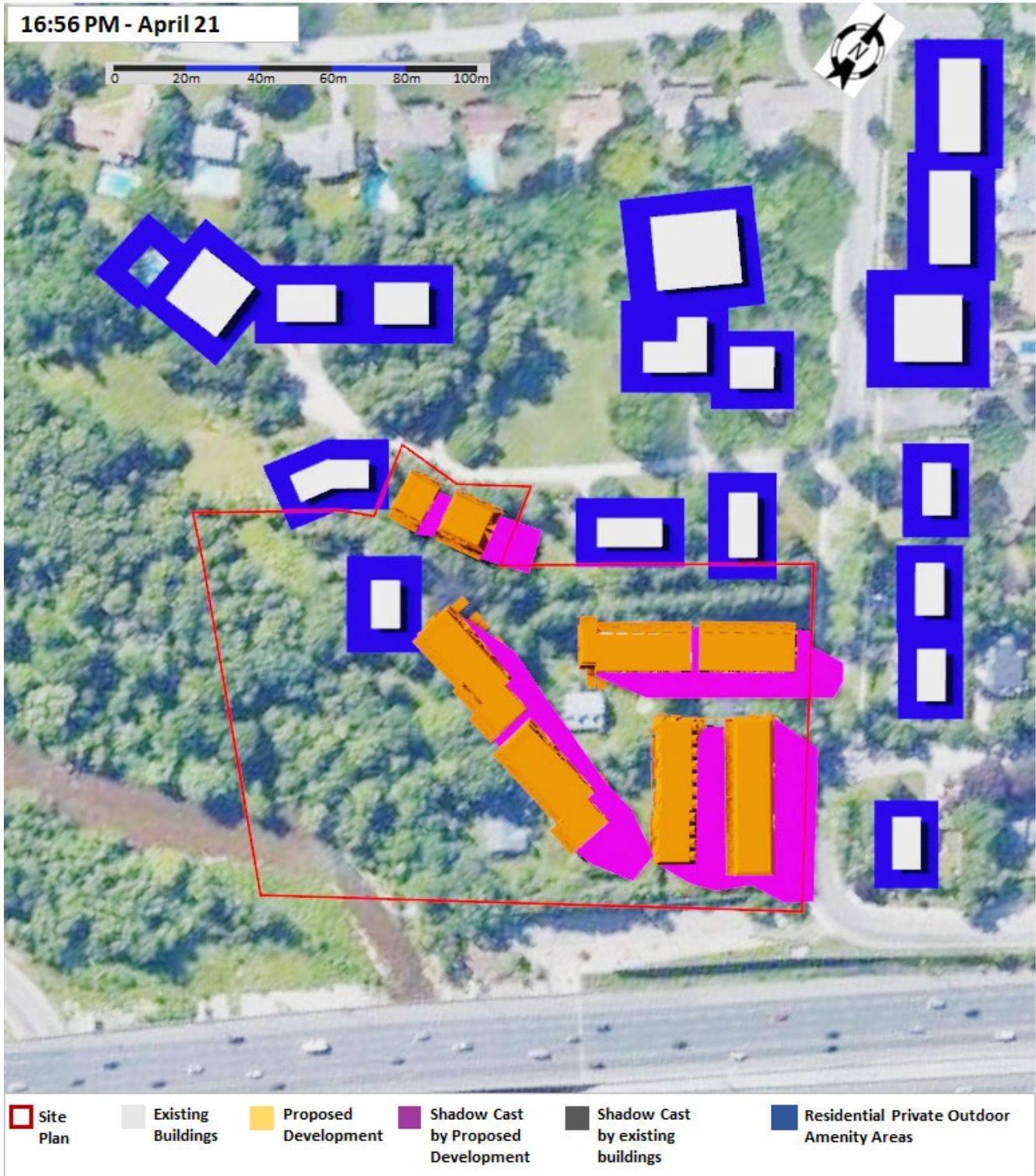


15:56 PM - April 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Residential Private Outdoor Amenity Areas



17:56 PM - April 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Residential Private Outdoor Amenity Areas

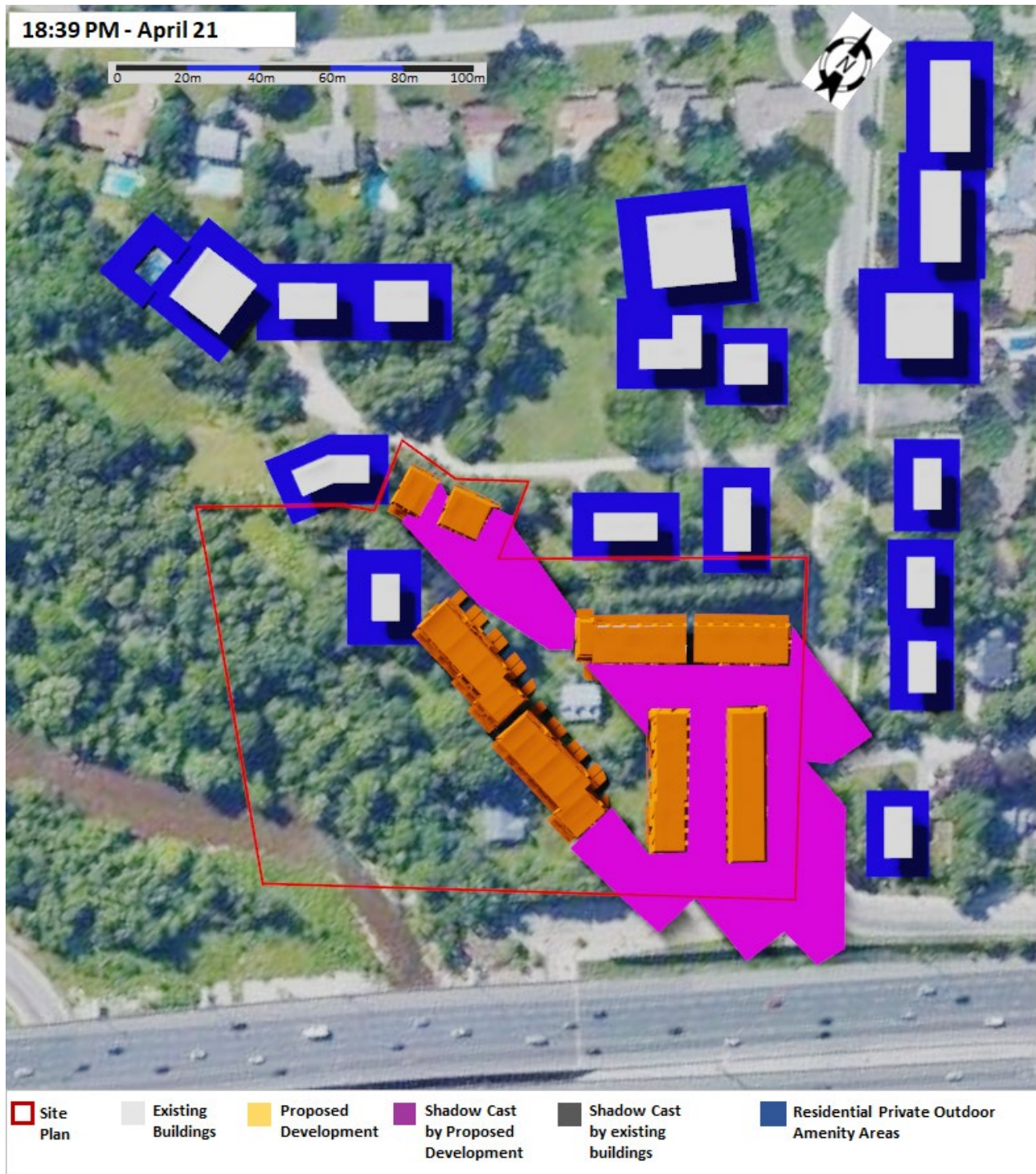


Figure 4: Shadow Patterns at Residential Private amenity spaces – April 21st.

As per the TOR, the criterion is met if the shadow cast from proposed Development should not linger for more than two consecutive hourly test times after 12:00pm. As shown in **Figure 4** above, the findings of the shadow analysis show that the proposal of no more than two consecutive hourly test times are in accordance with this criterion. As such, the criterion is met.

B PUBLIC AMENITY AREAS (LANDSCAPING AREA)

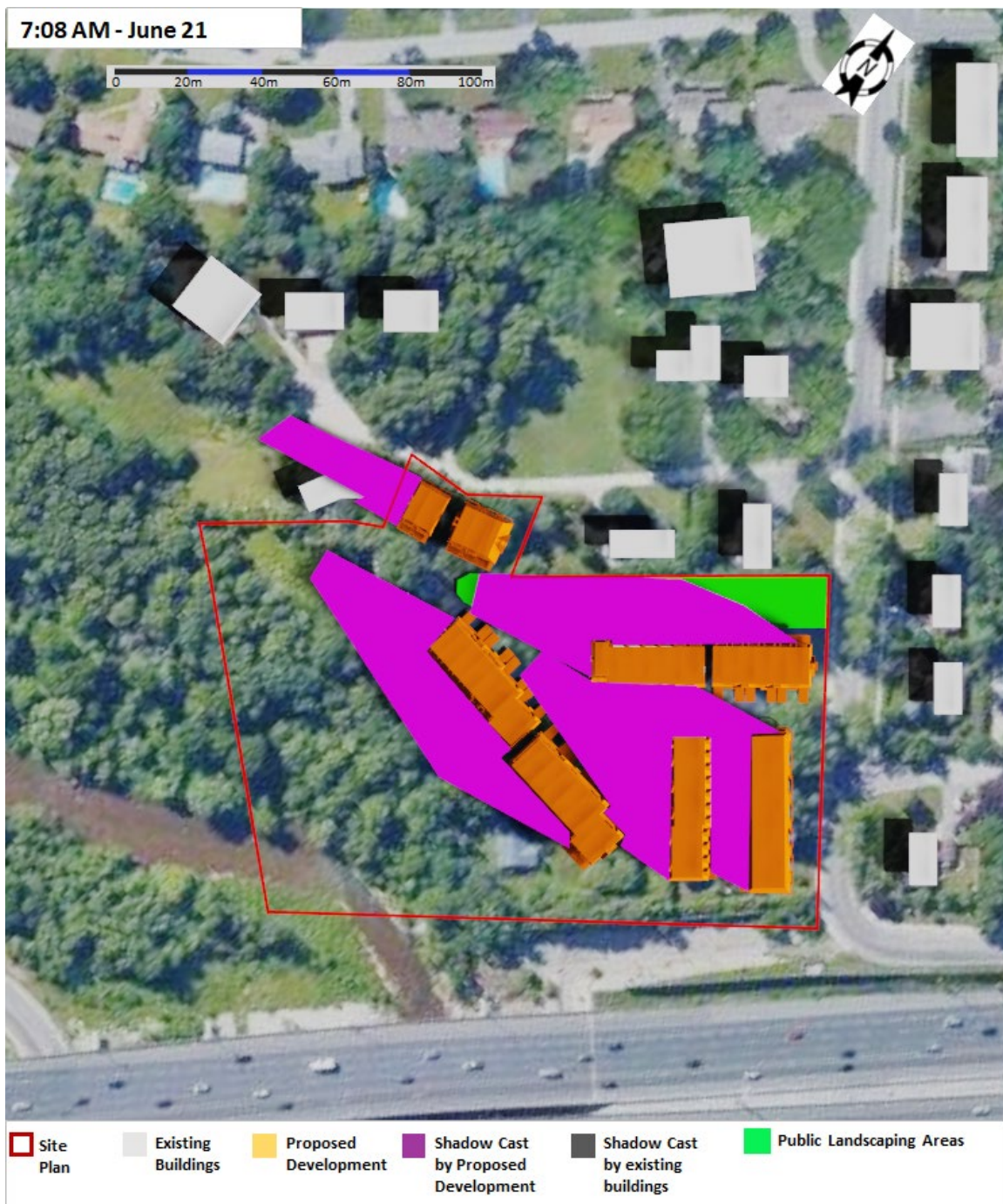
Figure 5 identifies all public amenity areas in the vicinity of the development (color green in Figure 5).



Figure 5: Public Amenity Areas in the vicinity of the proposed development.

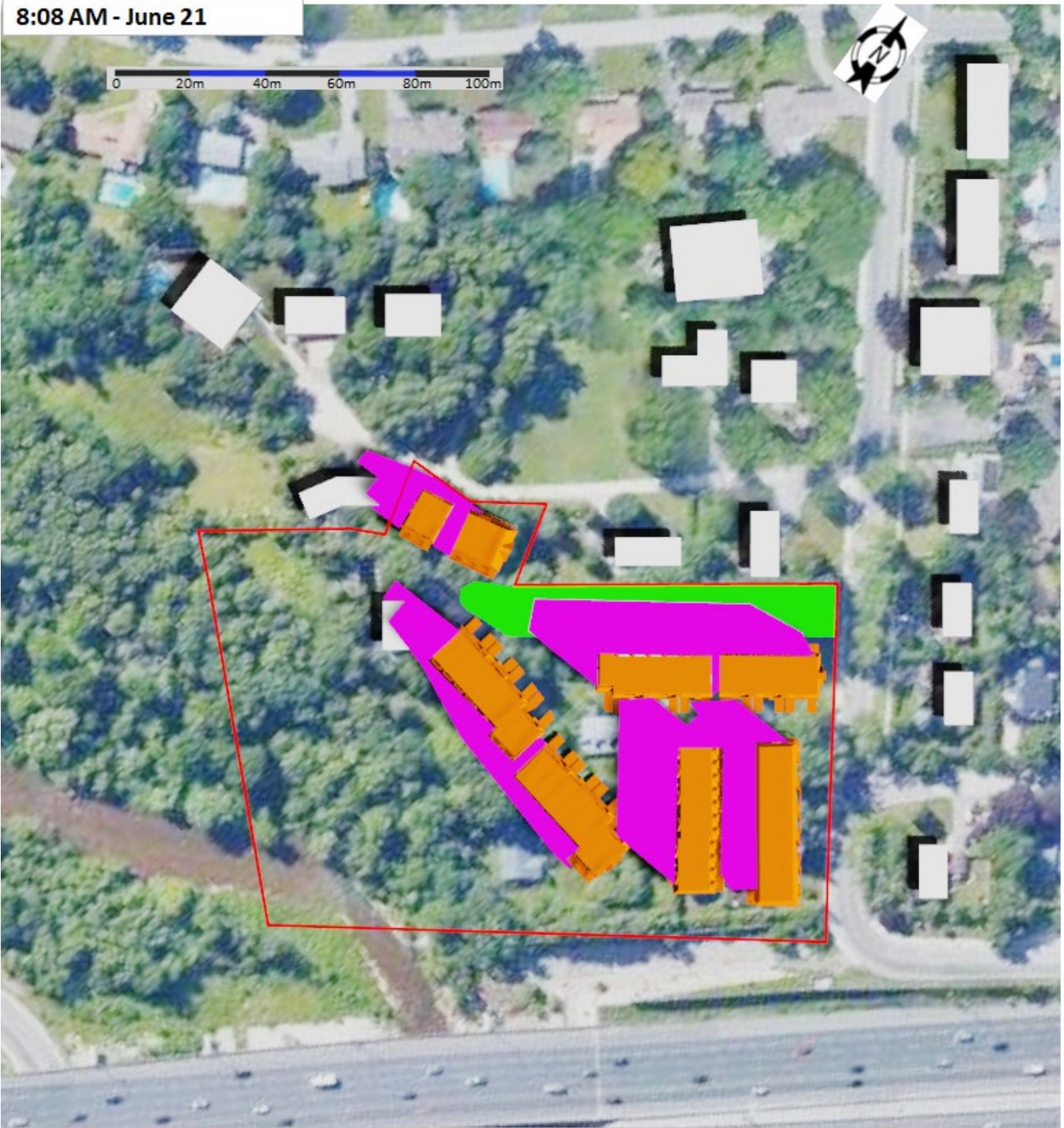
1.4 SHADOW ANALYSIS RESULTS FOR JUNE 21

The model results of shadow patterns for summer solstice from 7.08am to 7.33pm are shown in **Figure 6**. In this **Figure 6**, 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. This coverage shortens 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.

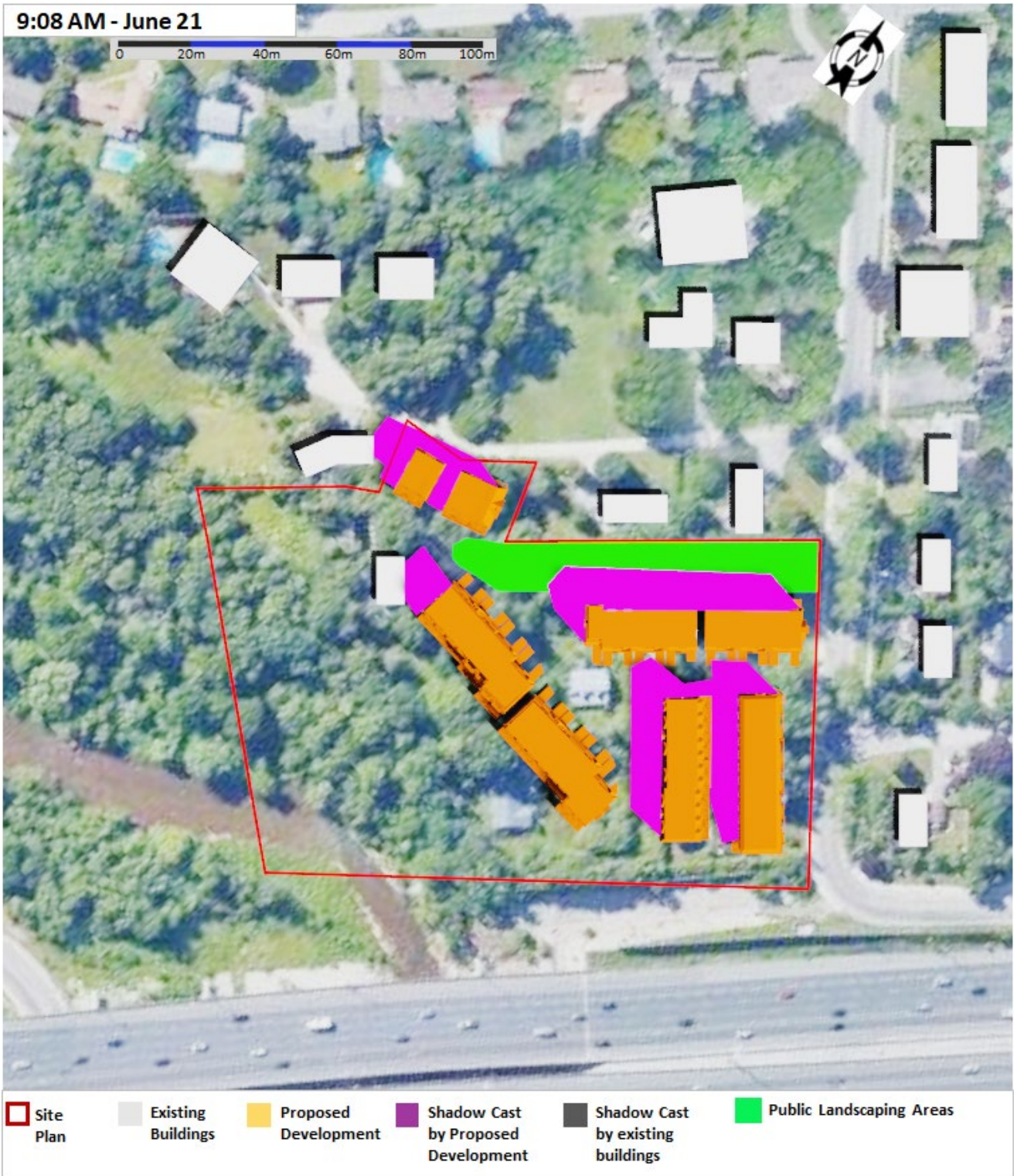


8:08 AM - June 21

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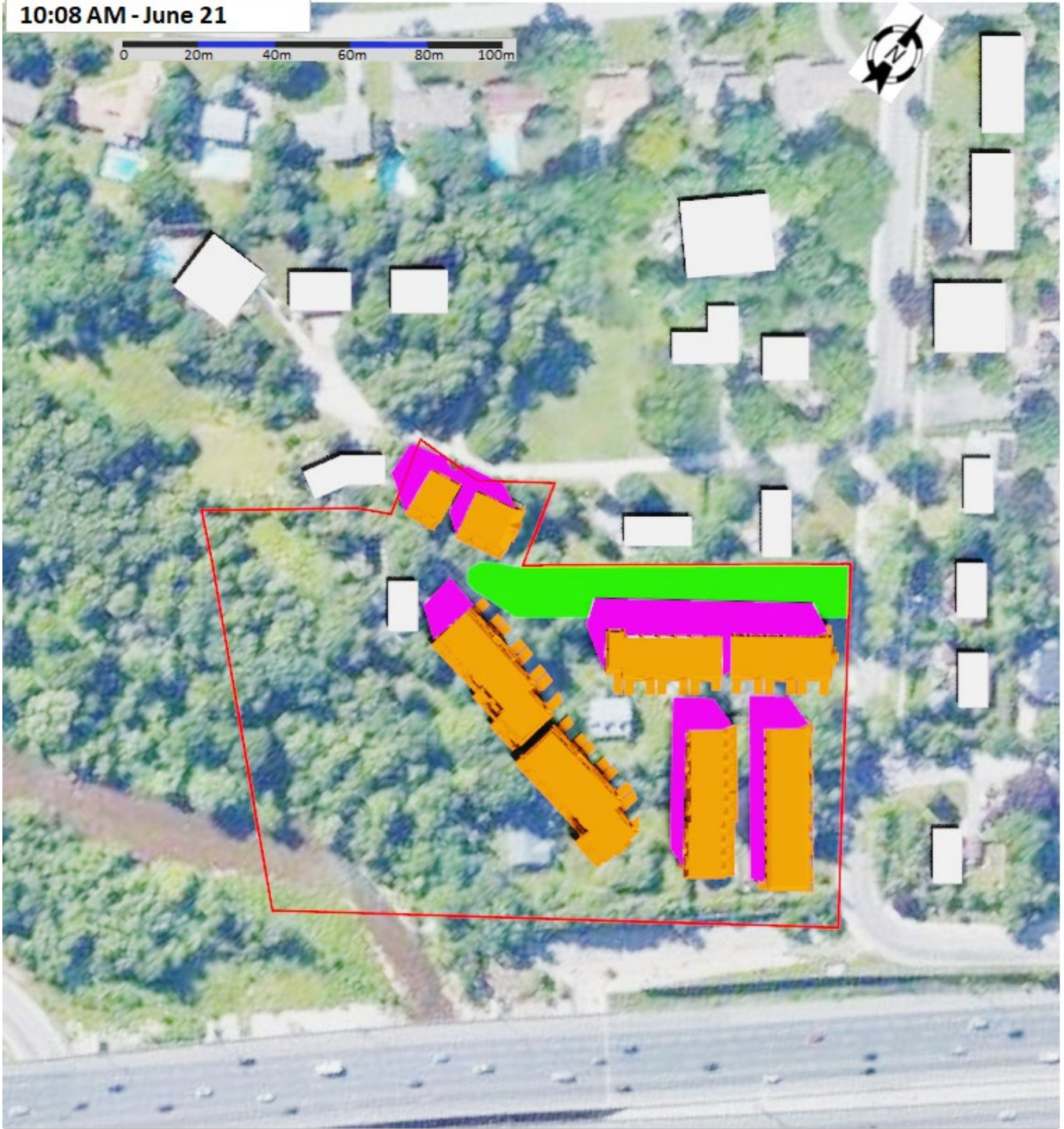


- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas



10:08 AM - June 21

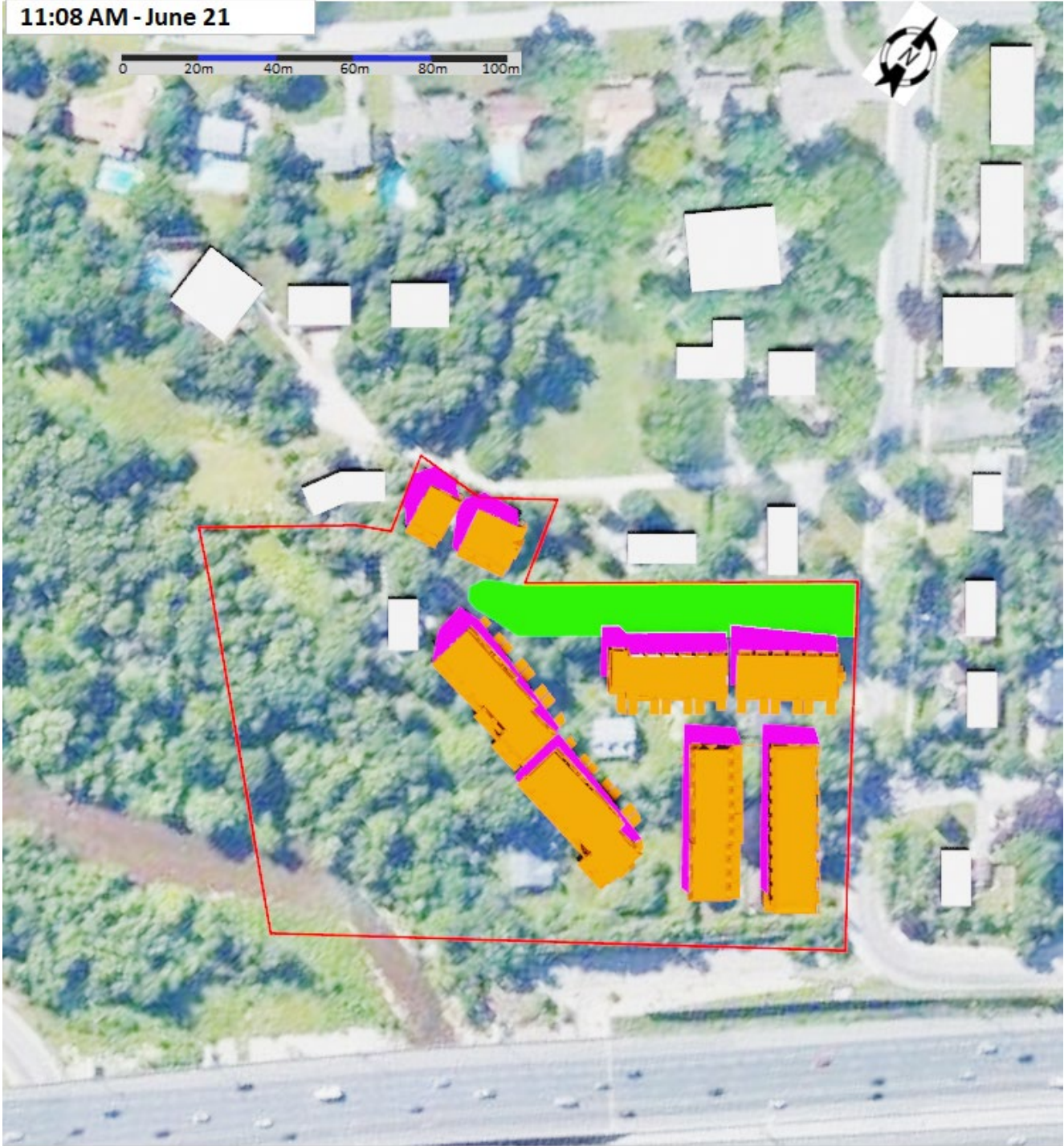
0 20m 40m 60m 80m 100m









- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

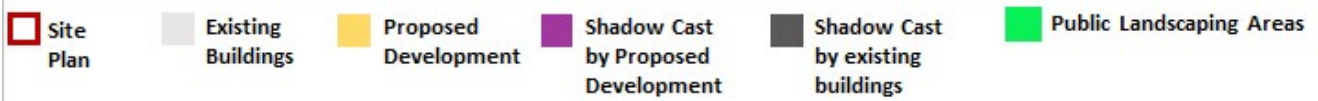
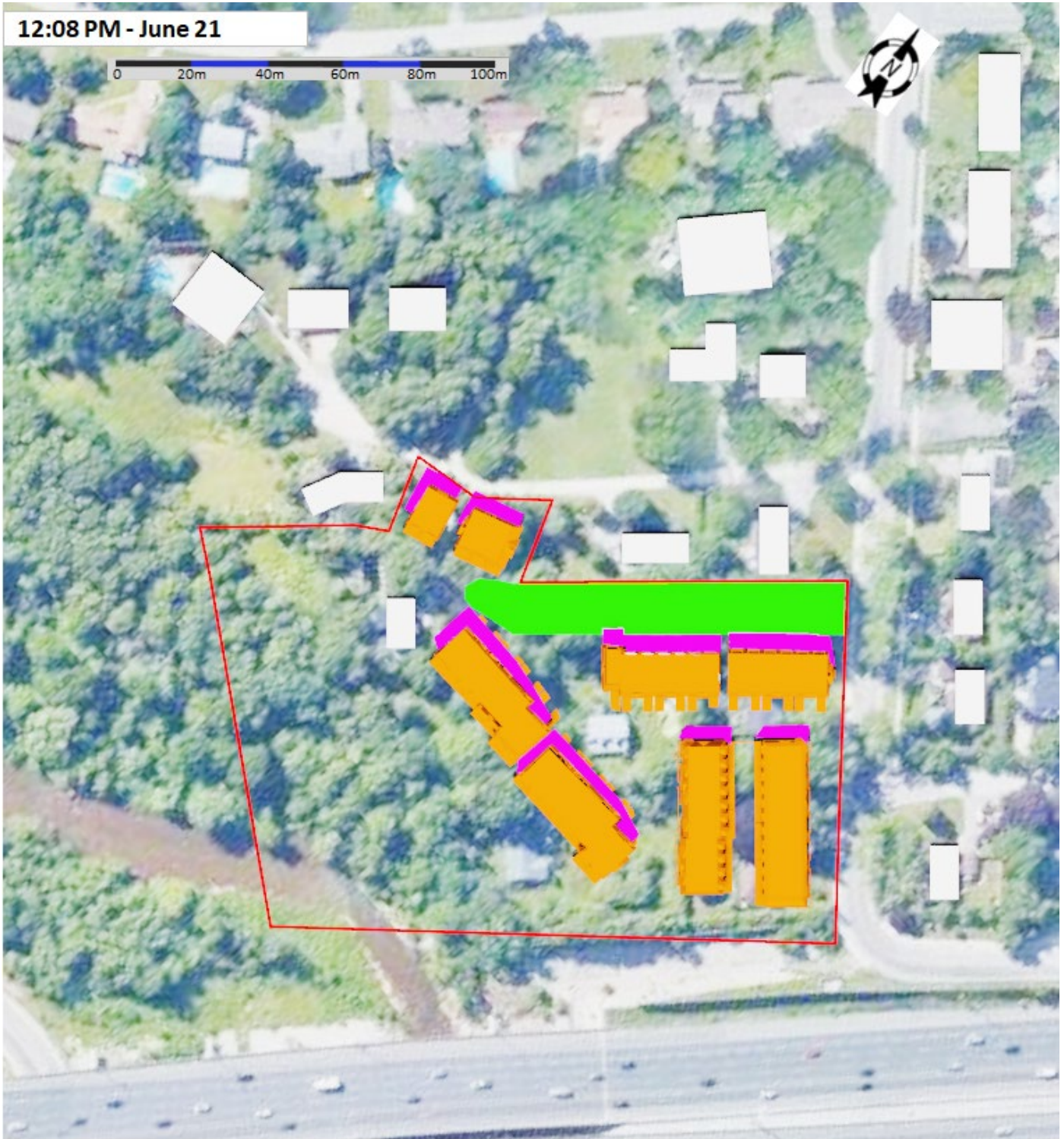
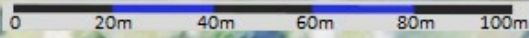
11:08 AM - June 21

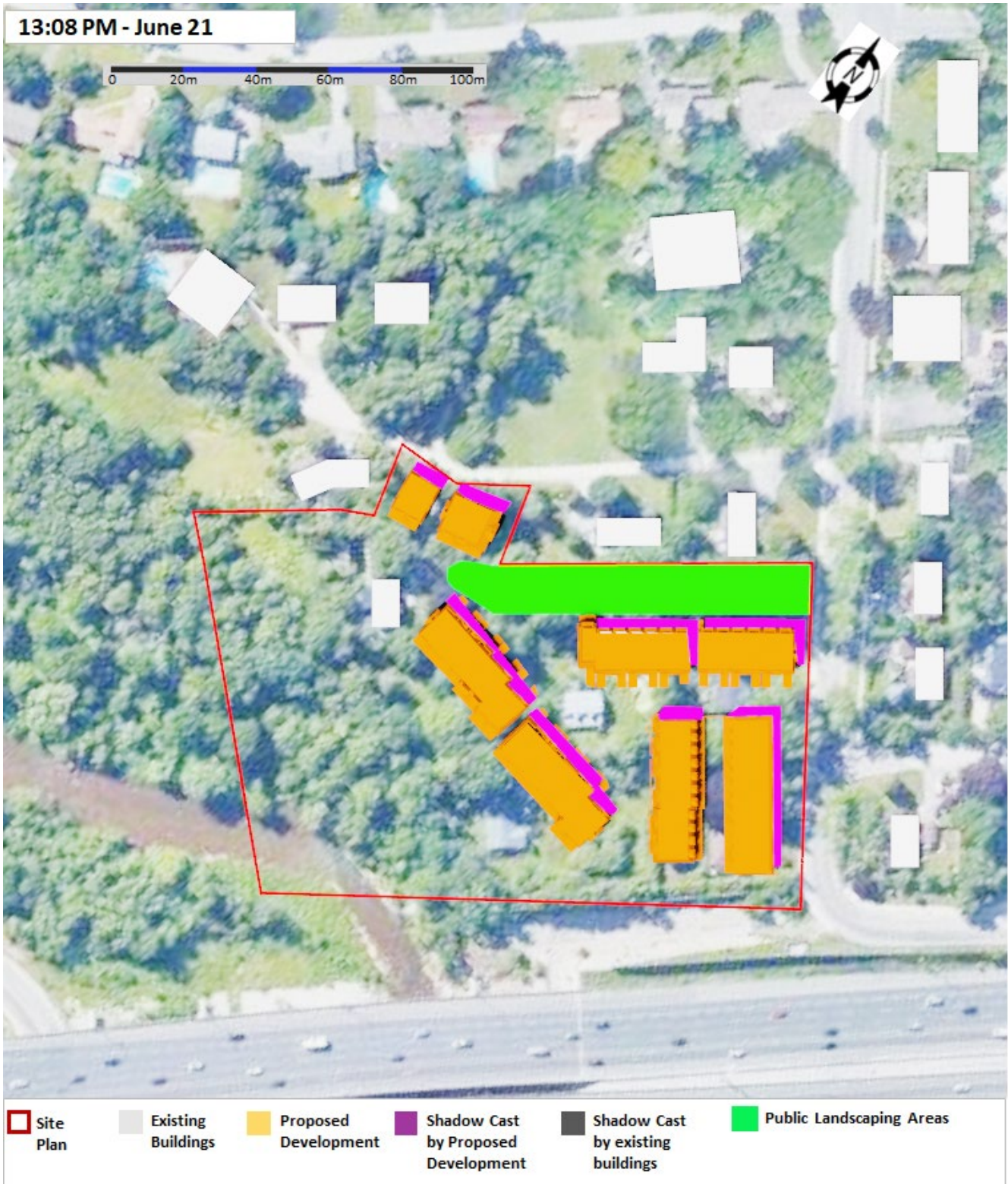
0 20m 40m 60m 80m 100m



-  Site Plan
-  Existing Buildings
-  Proposed Development
-  Shadow Cast by Proposed Development
-  Shadow Cast by existing buildings
-  Public Landscaping Areas

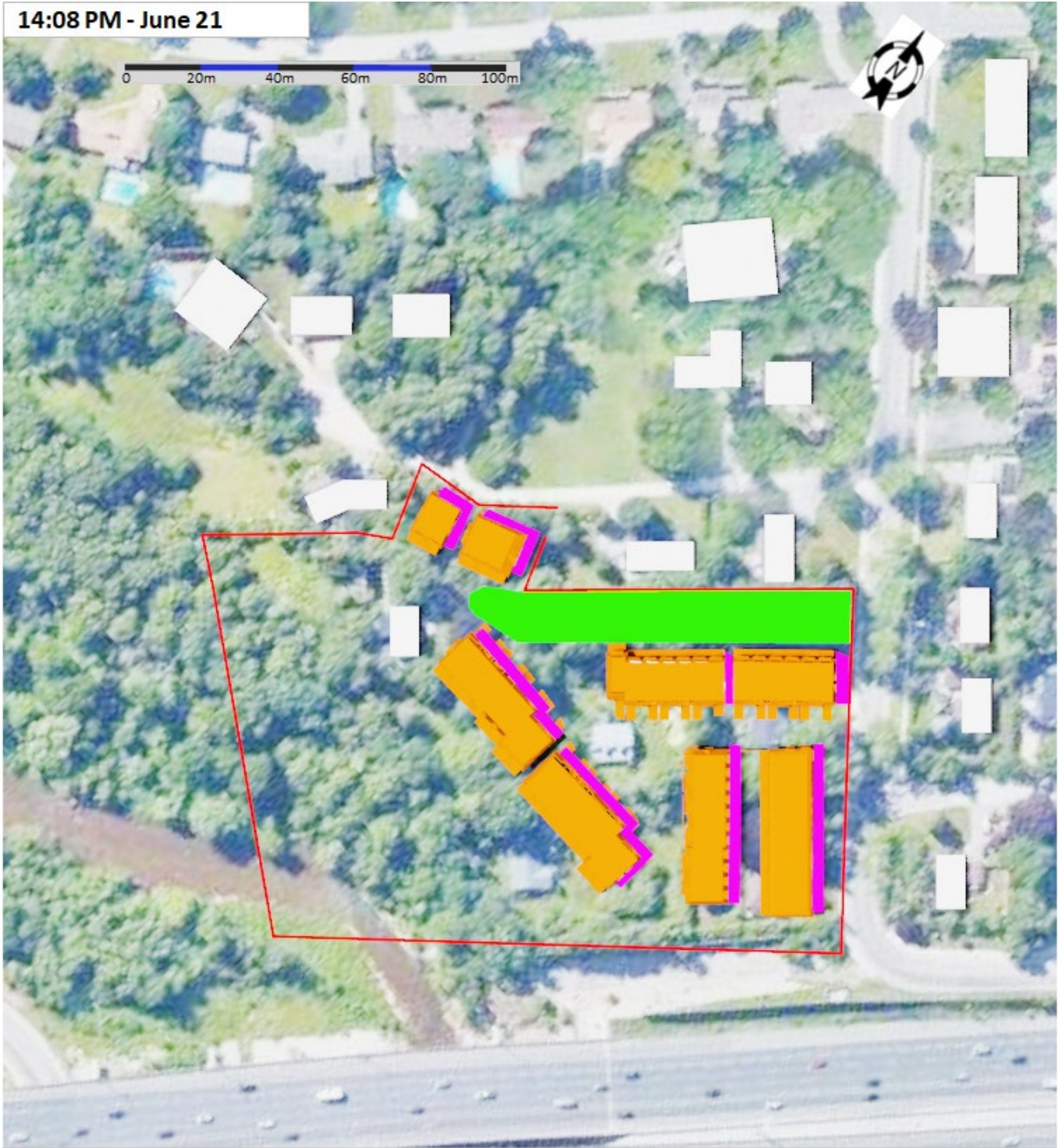
12:08 PM - June 21





14:08 PM - June 21

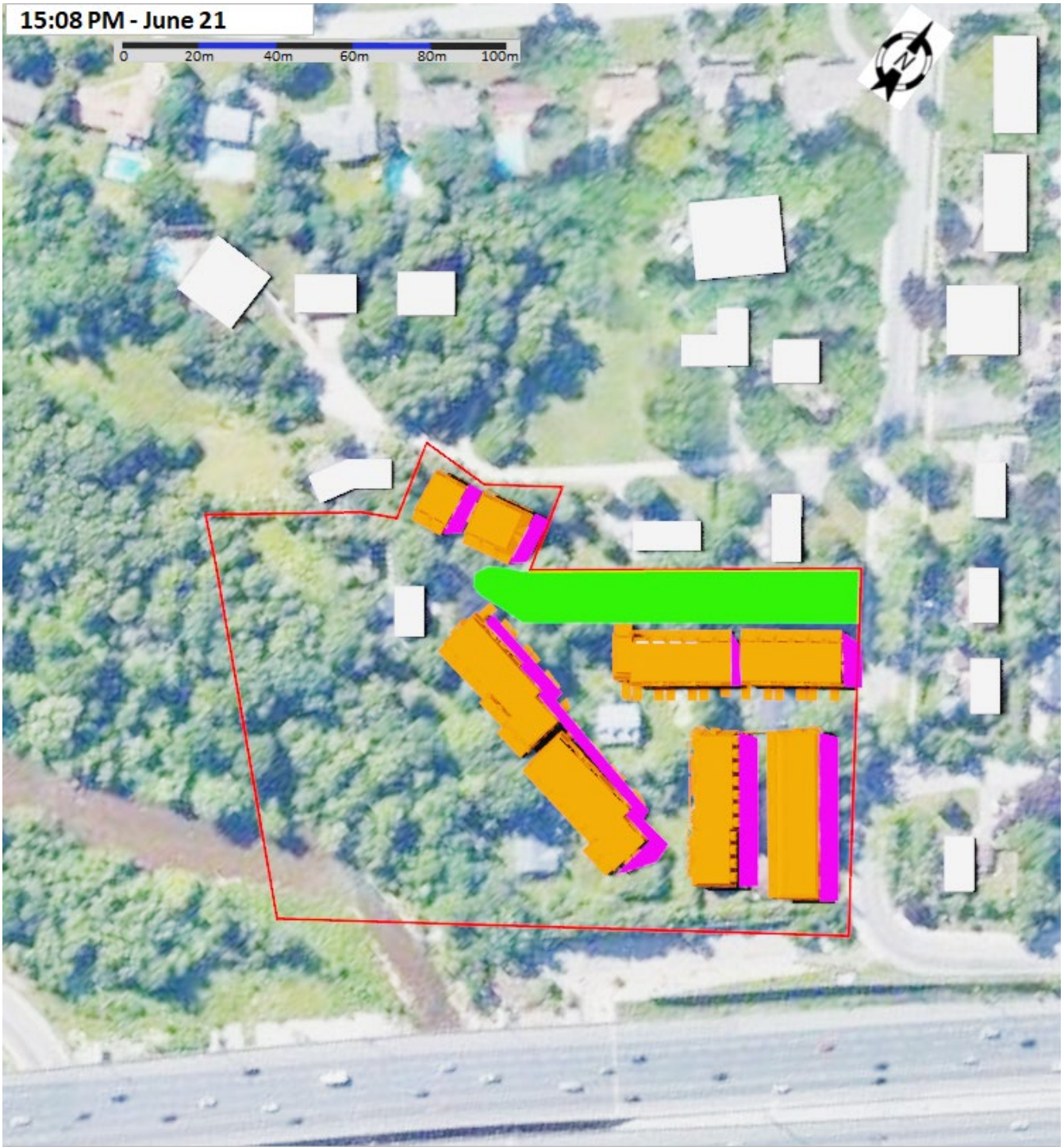
0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

15:08 PM - June 21

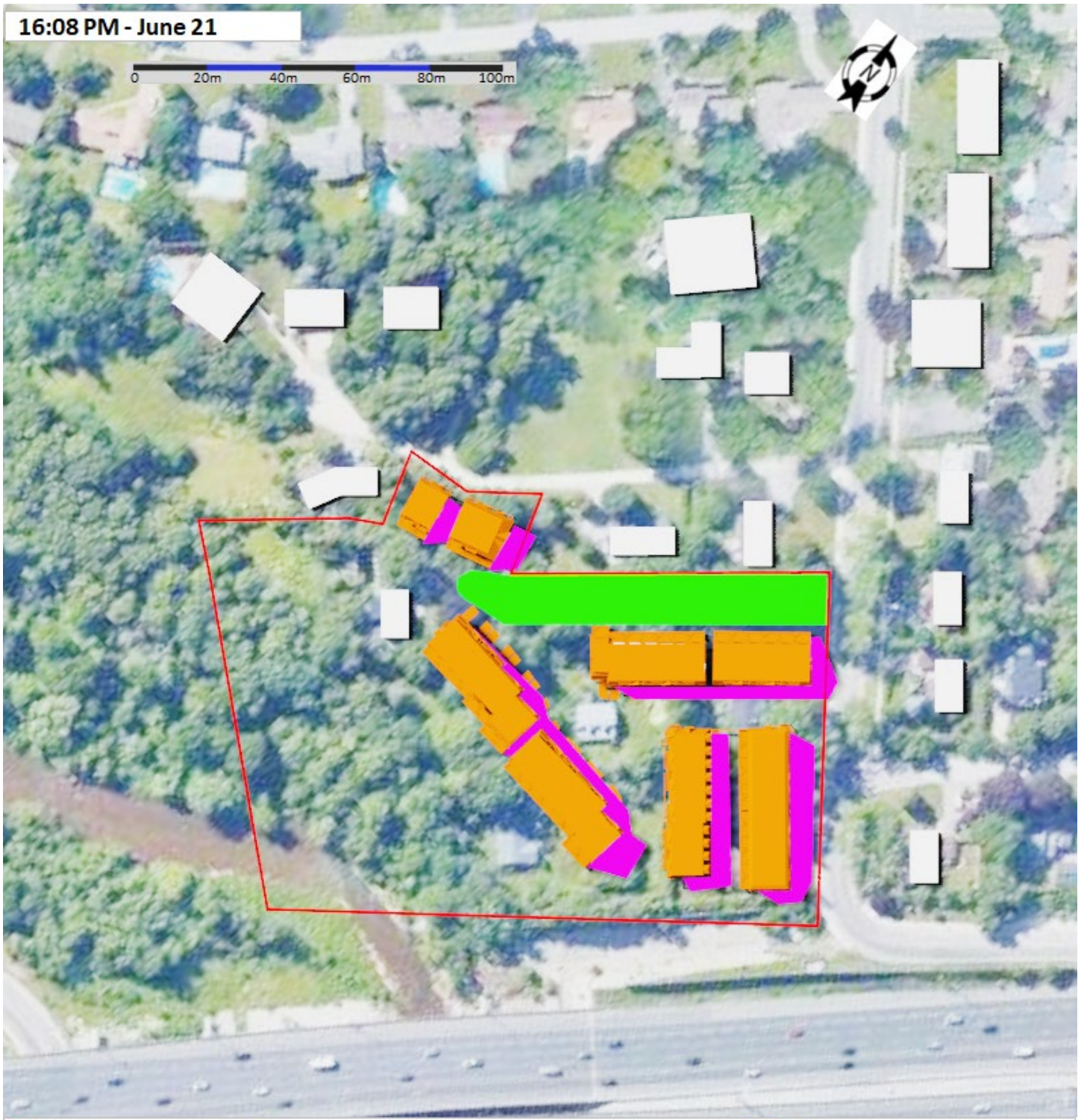
0 20m 40m 60m 80m 100m



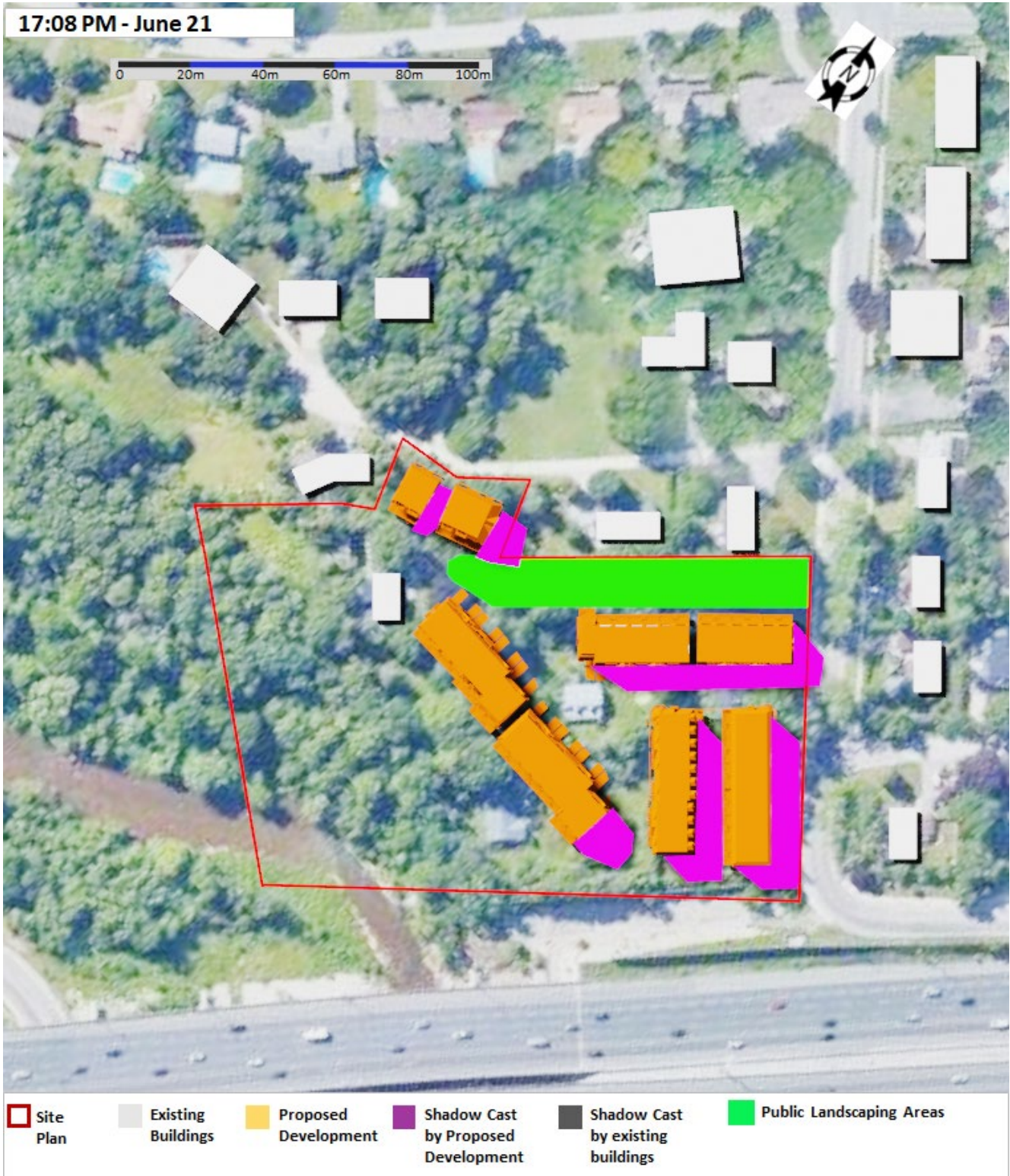
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

16:08 PM - June 21

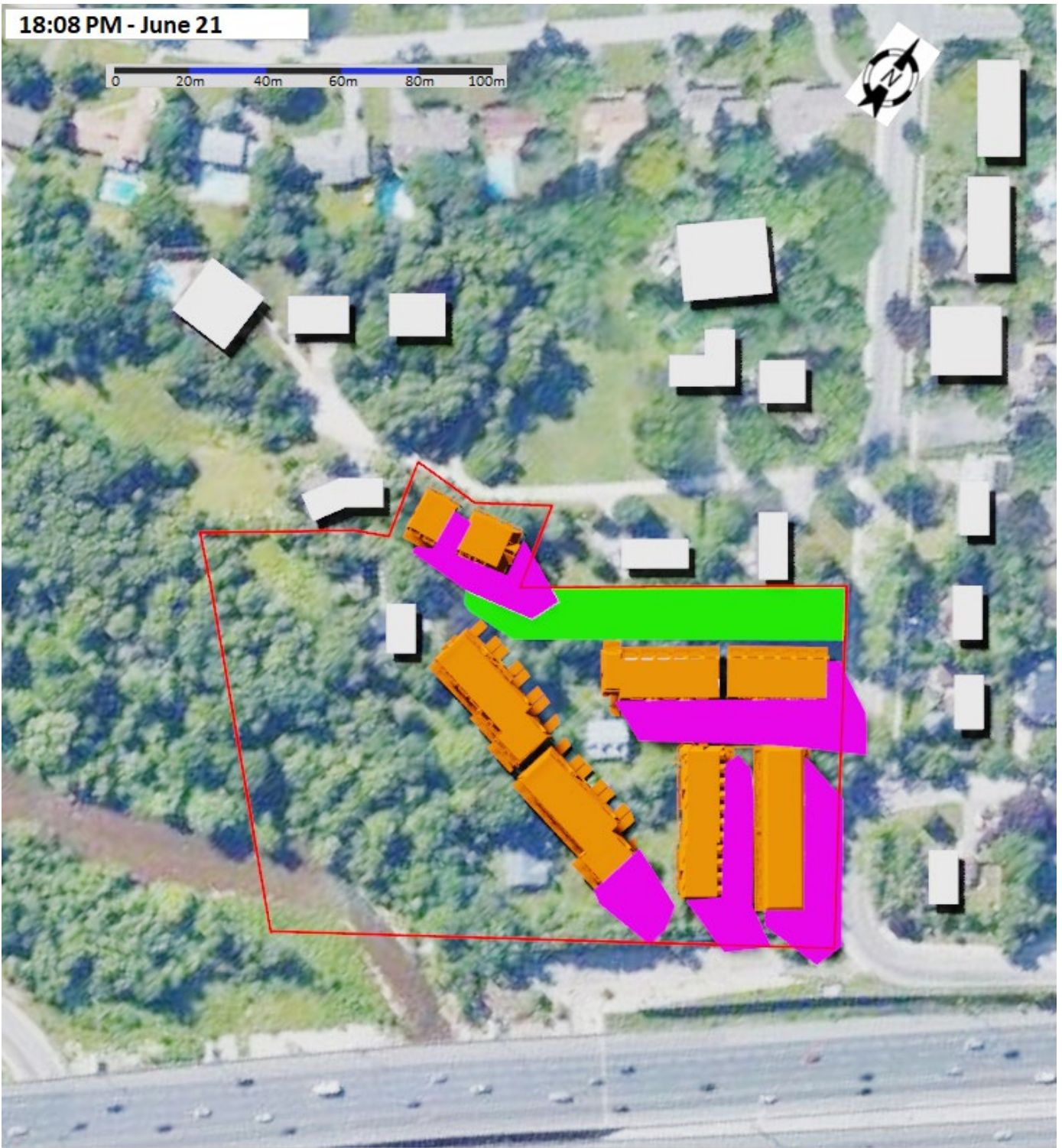
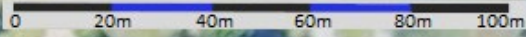
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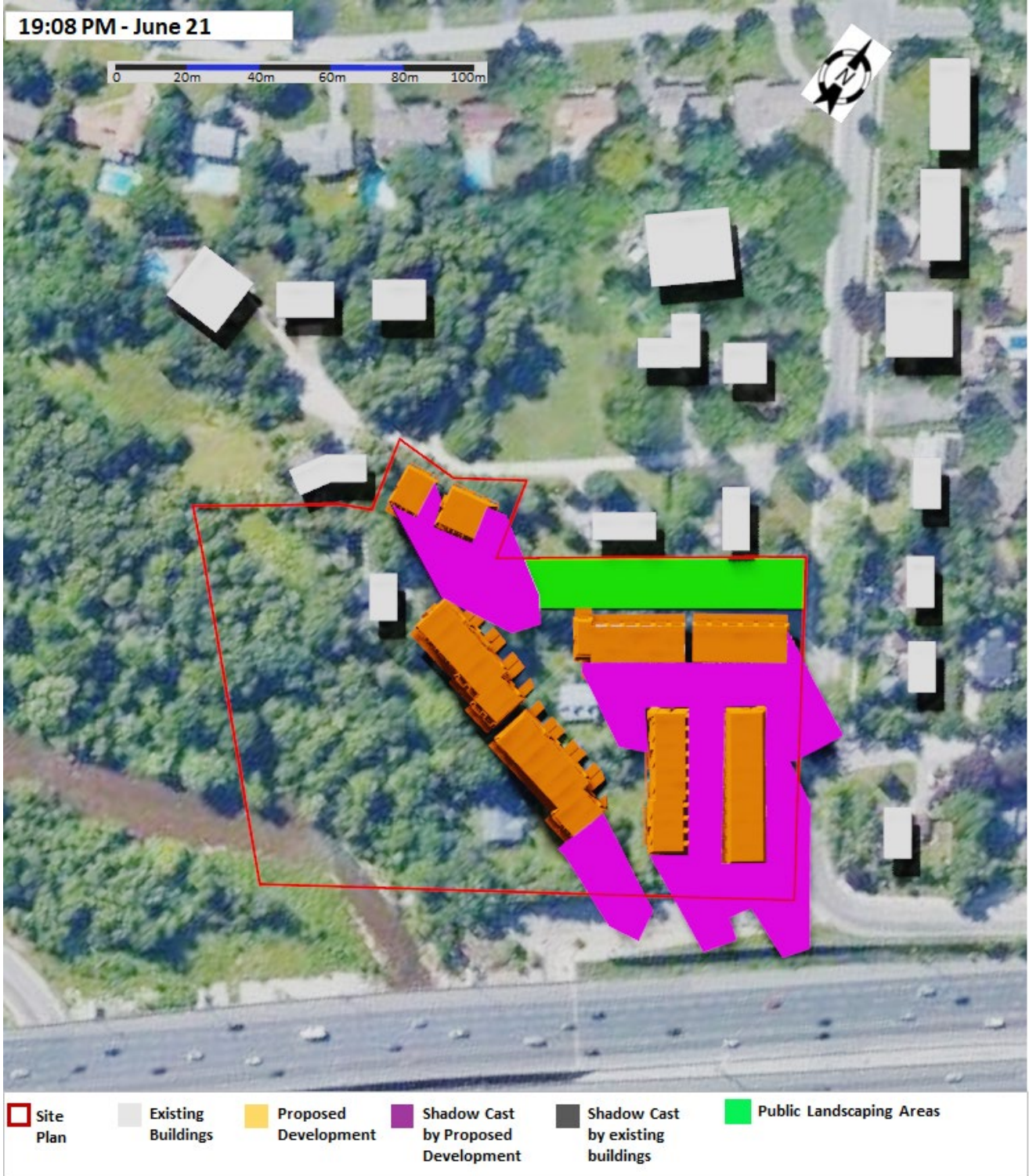
 Site Plan	 Existing Buildings	 Proposed Development	 Shadow Cast by Proposed Development	 Shadow Cast by existing buildings	 Public Landscaping Areas
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18:08 PM - June 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas



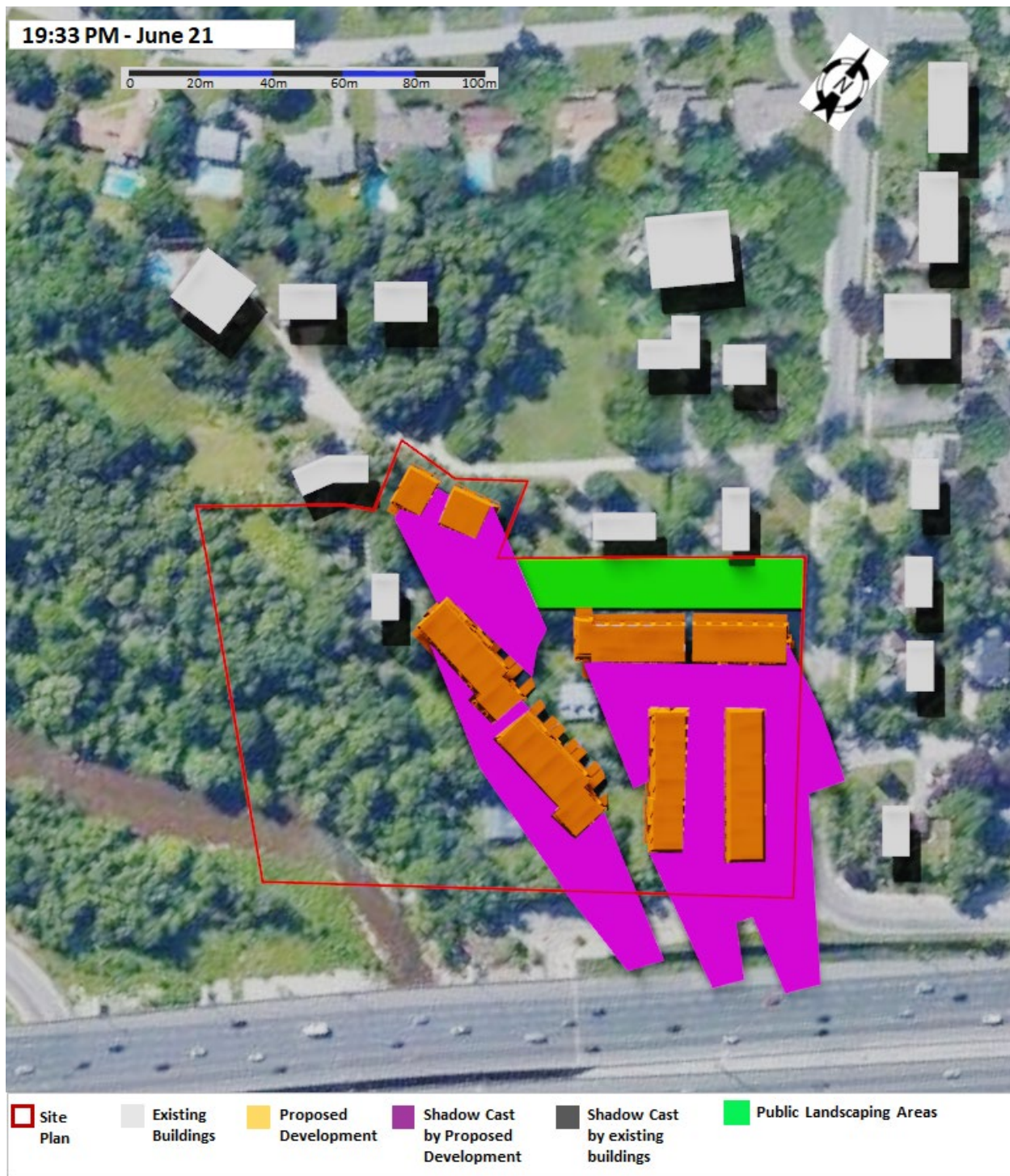
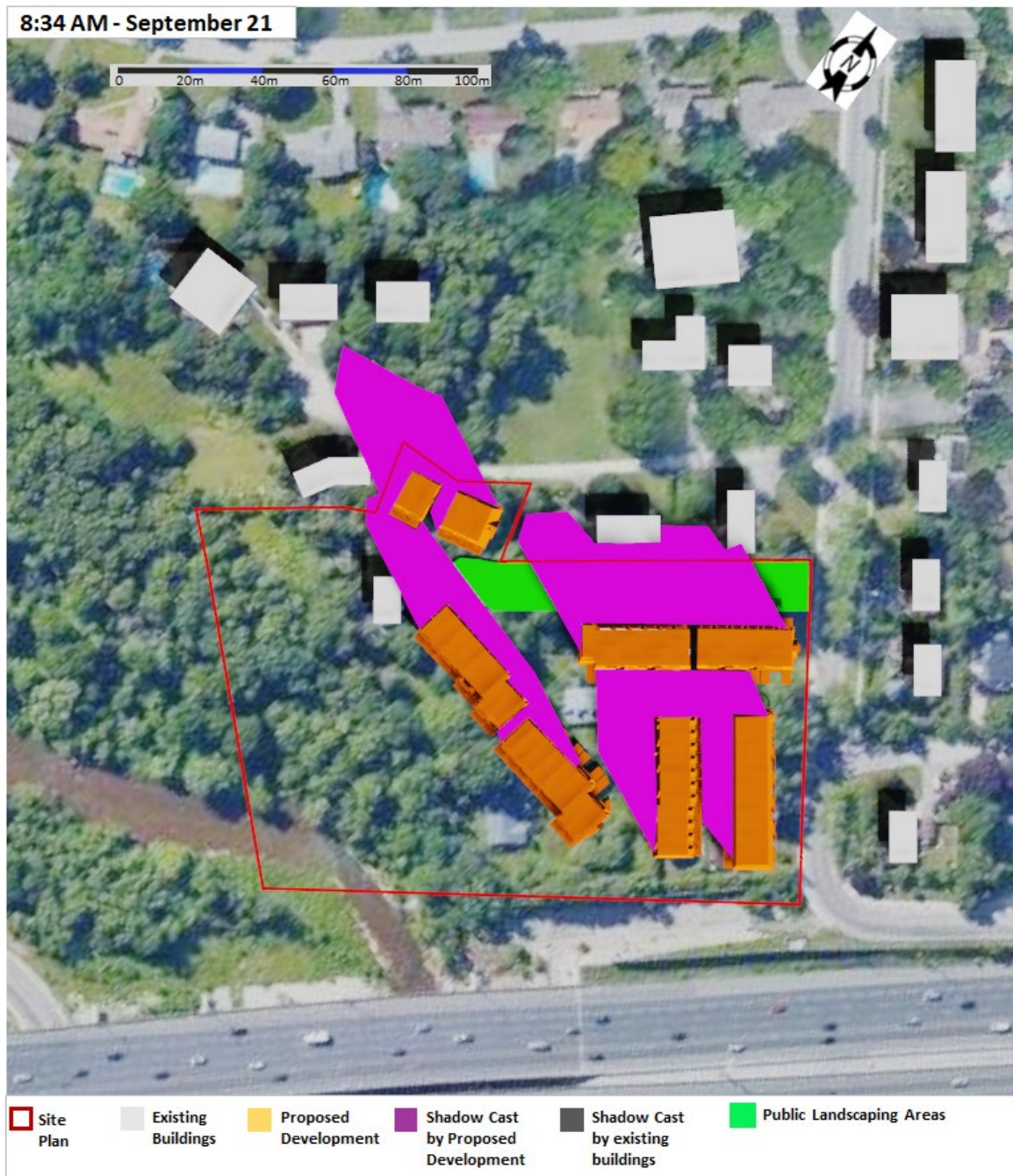


Figure 6: Shadow Patterns at Landscaping area– June 21st

As per the TOR, the criterion is met if the public park receives at least 5 hours of continuous sunlight per day. As shown in **Figure 8** above, the shadow impact analysis demonstrated that the landscaping area receives at least 5 hours of continuous sunlight per day. As such, the criterion is met.

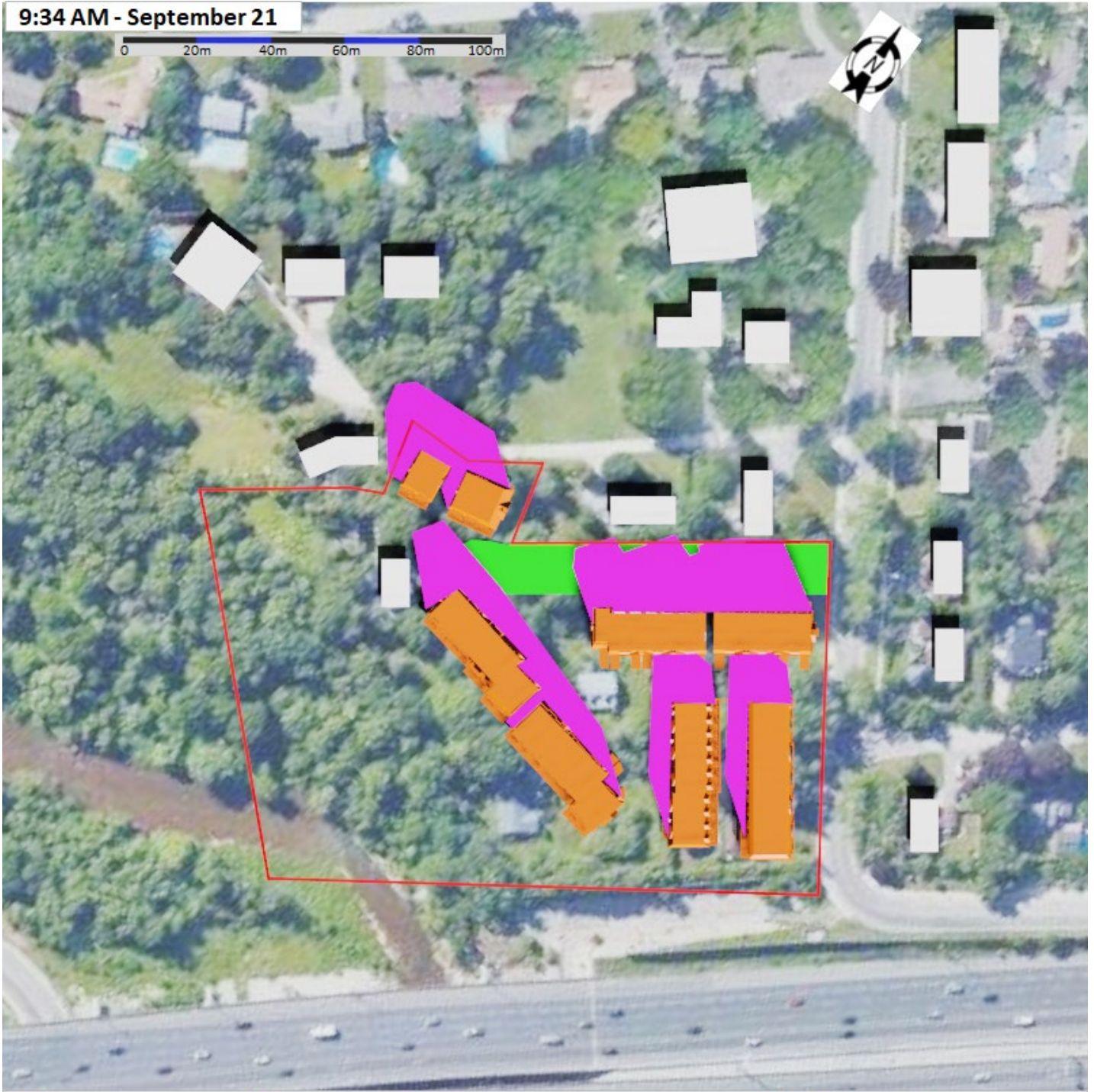
1.5 SHADOW ANALYSIS RESULTS FOR SEPTEMBER 21

The model results of shadow patterns for fall equinox from 8.34am to 5.47pm are shown in **Figure 9**. In this **Figure 9**, 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 south-east sides of the Development to reach a maximum length near the sunset hours.

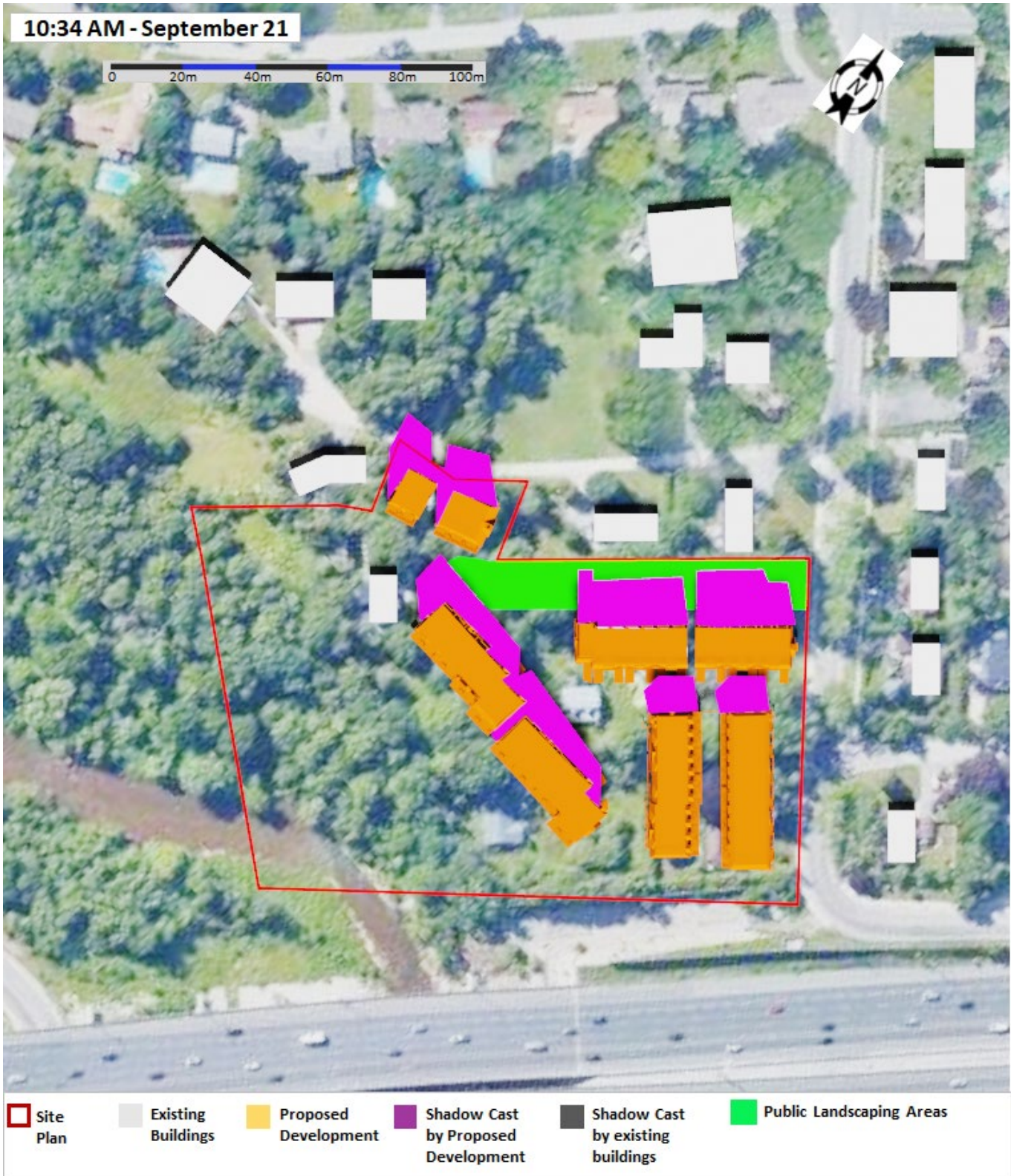


9:34 AM - September 21

0 20m 40m 60m 80m 100m

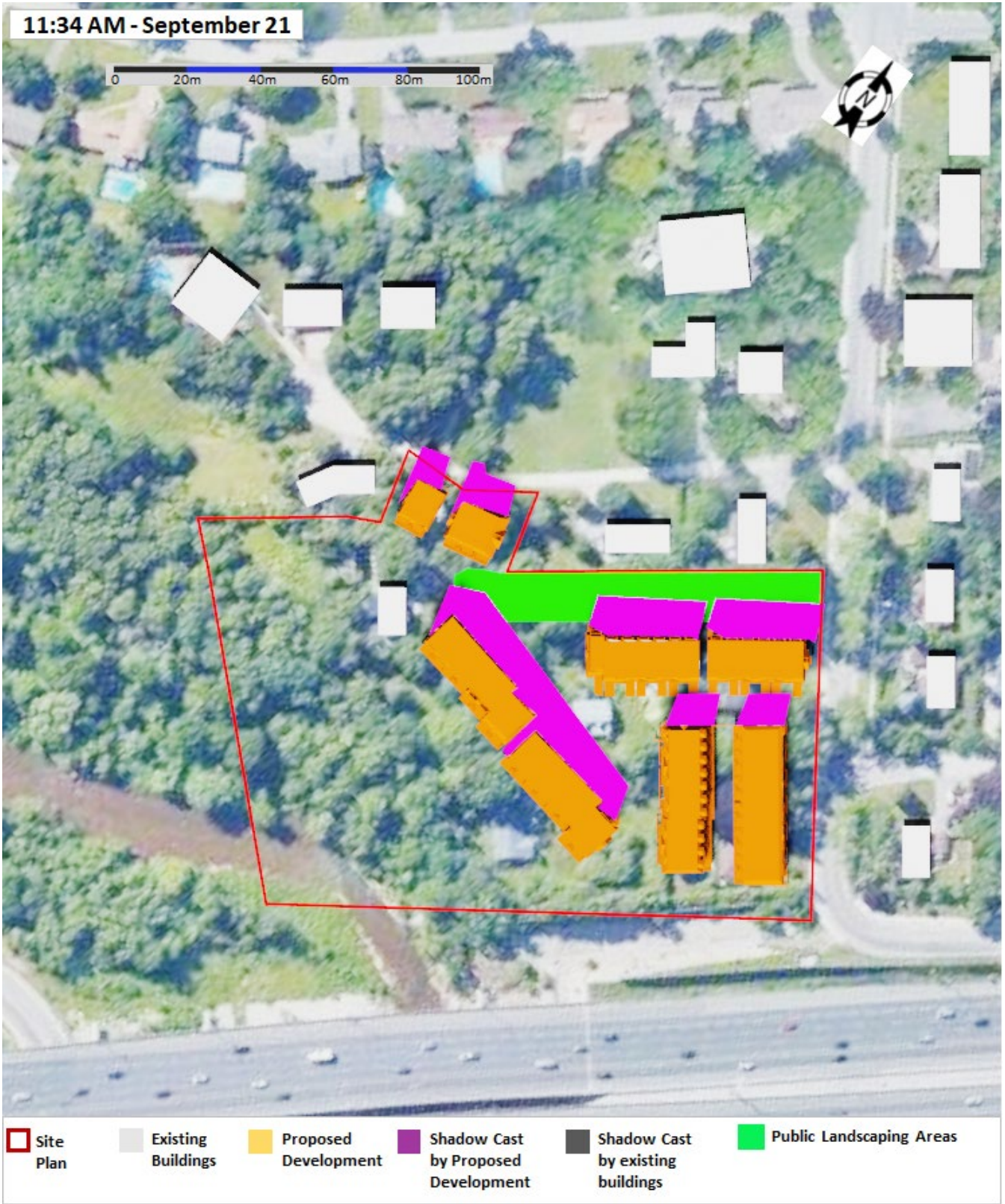


- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas



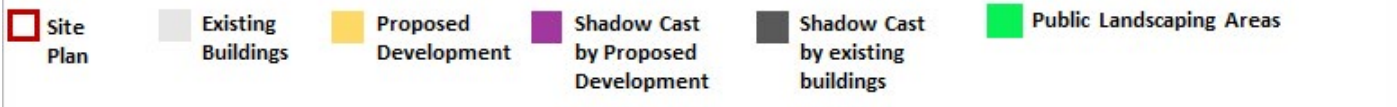
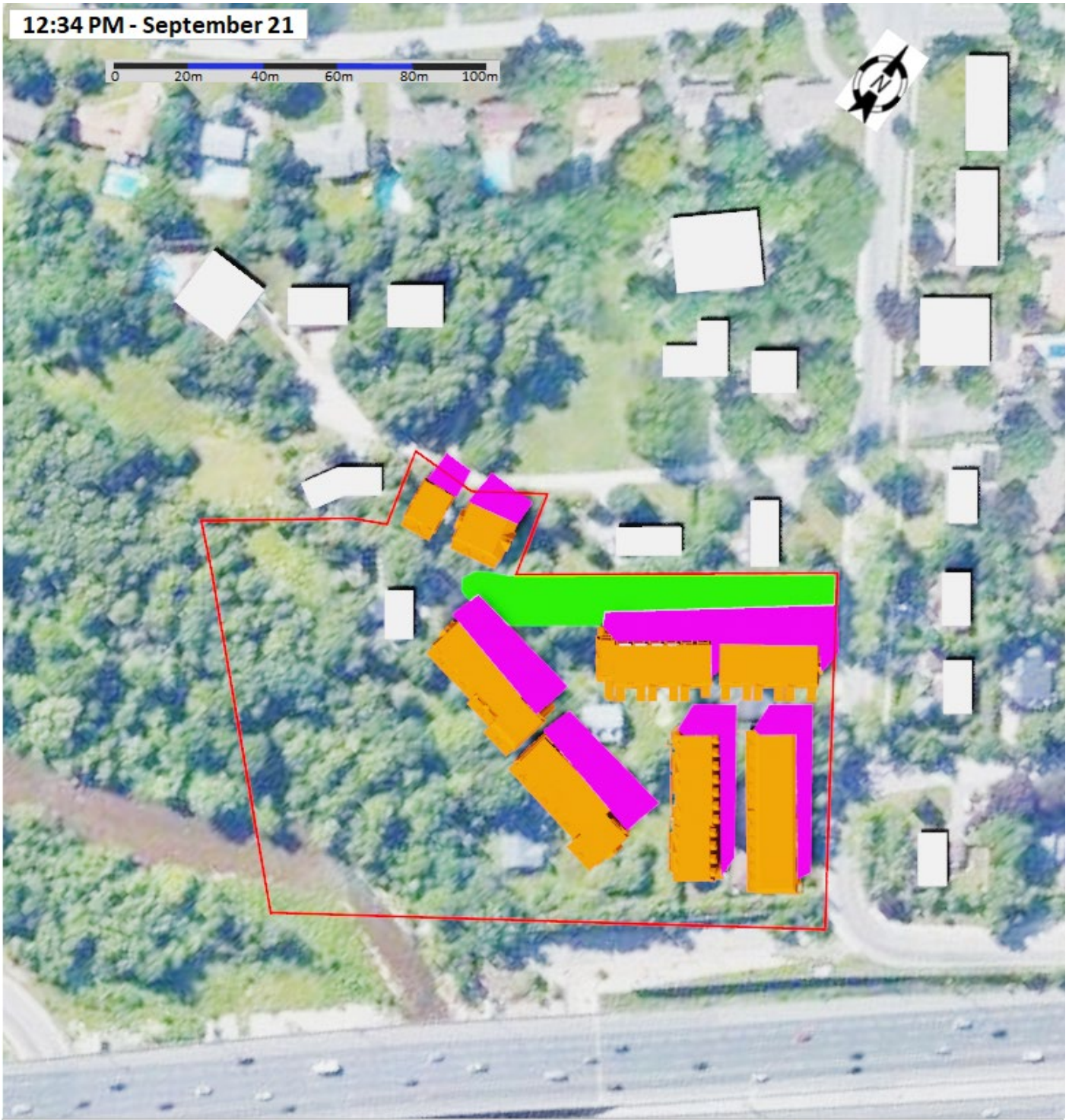
11:34 AM - September 21

0 20m 40m 60m 80m 100m



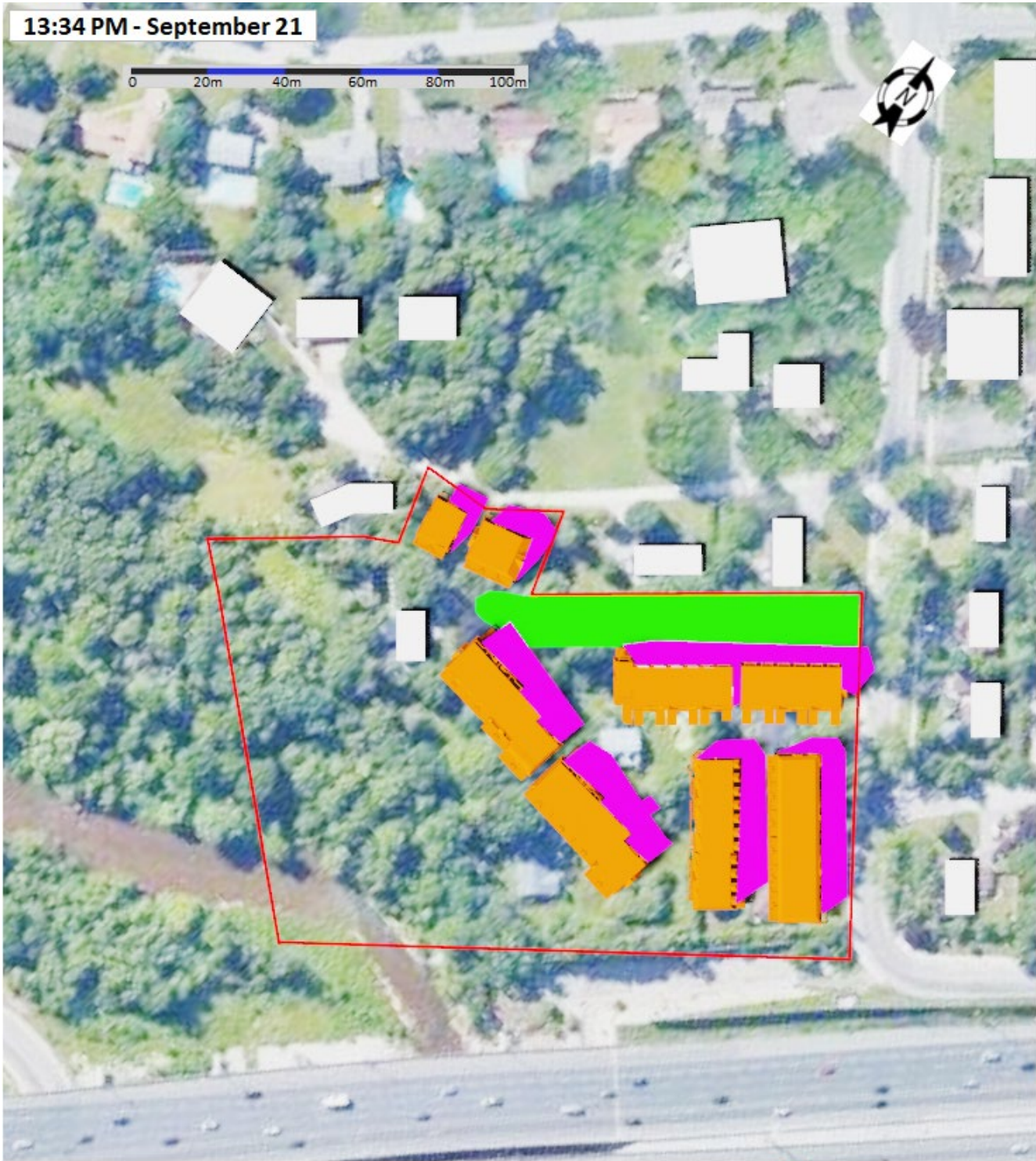
12:34 PM - September 21

0 20m 40m 60m 80m 100m



13:34 PM - September 21

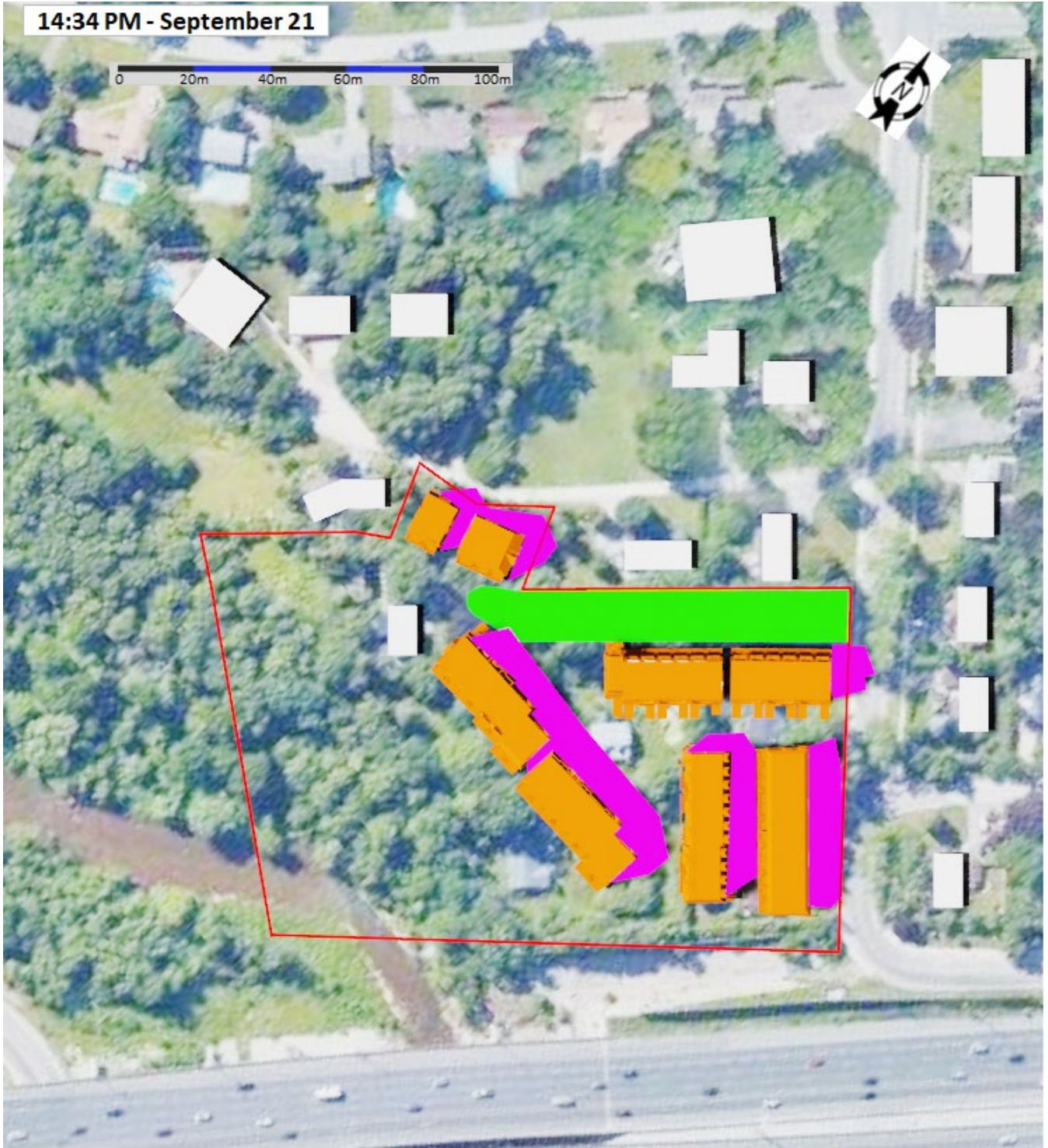
0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

14:34 PM - September 21

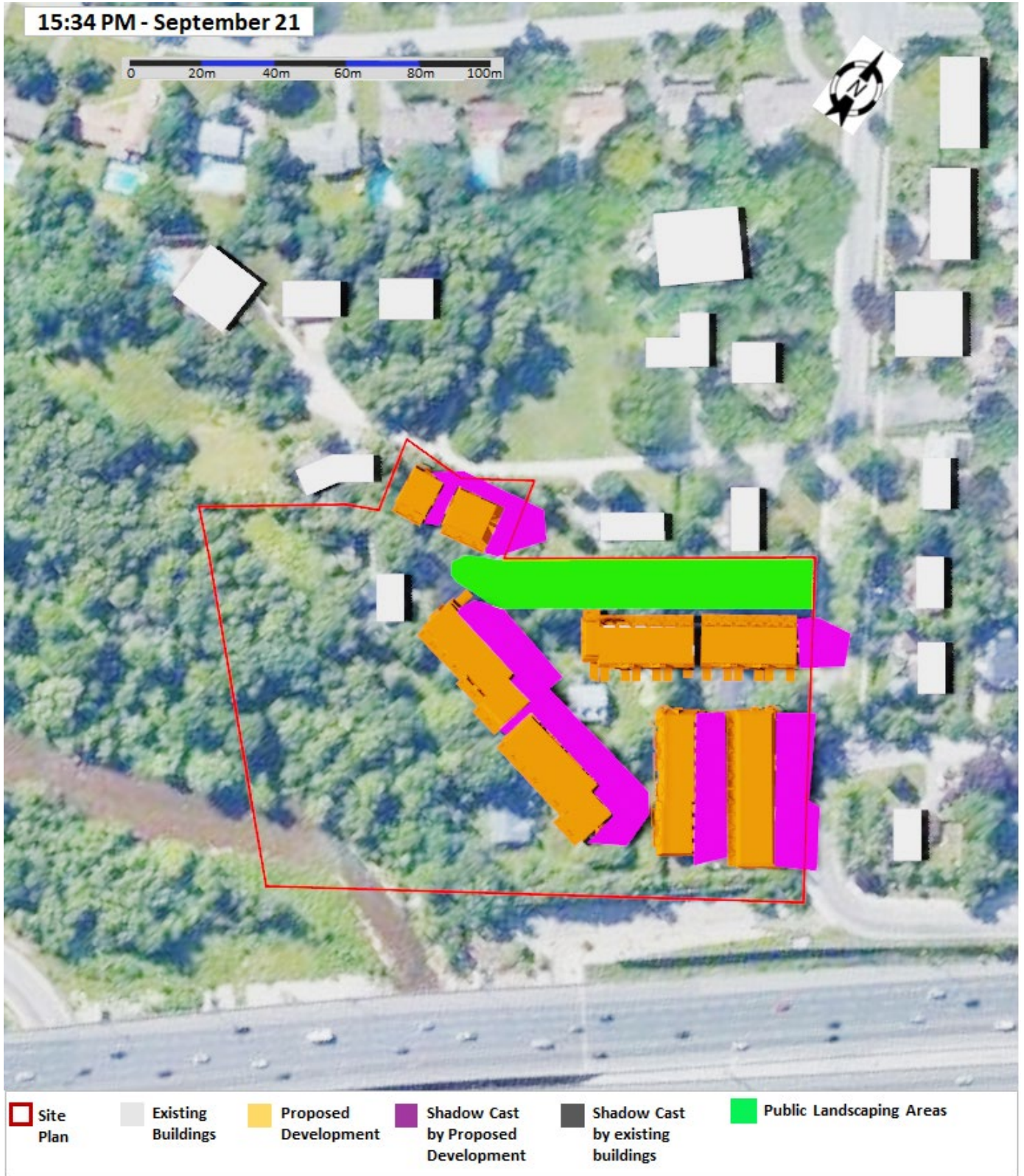
0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

15:34 PM - September 21

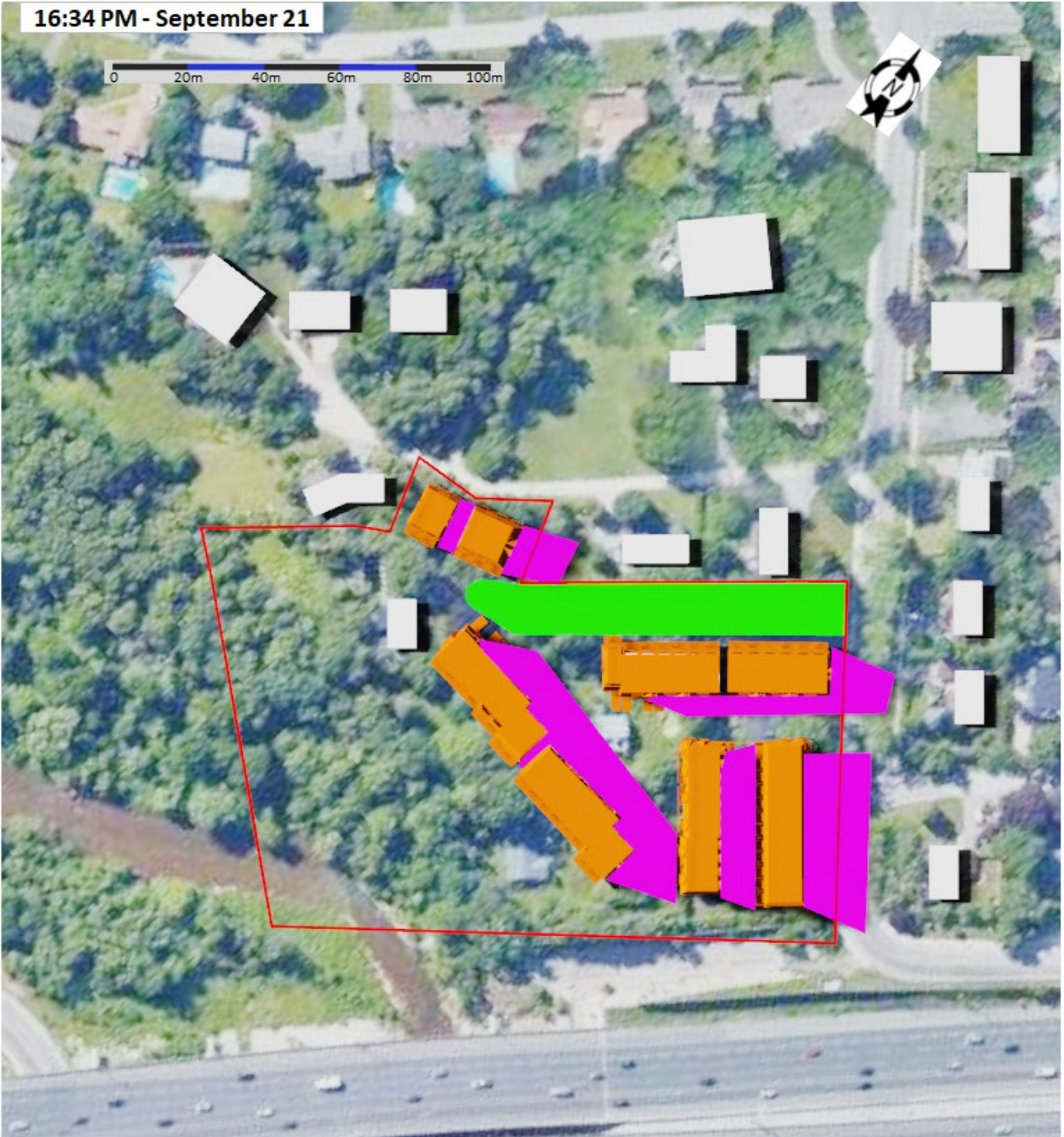
0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

16:34 PM - September 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

17:34 PM - September 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

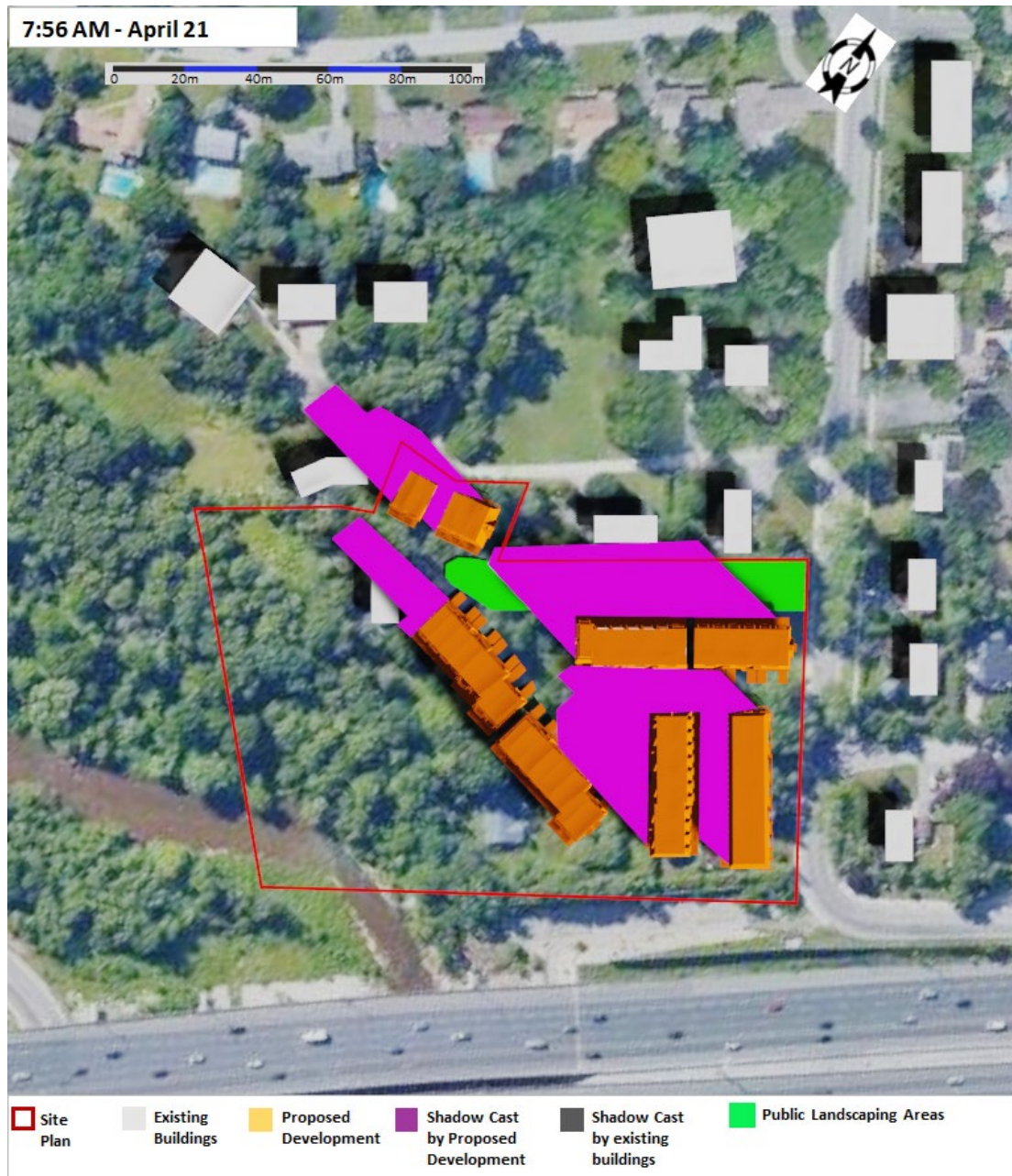


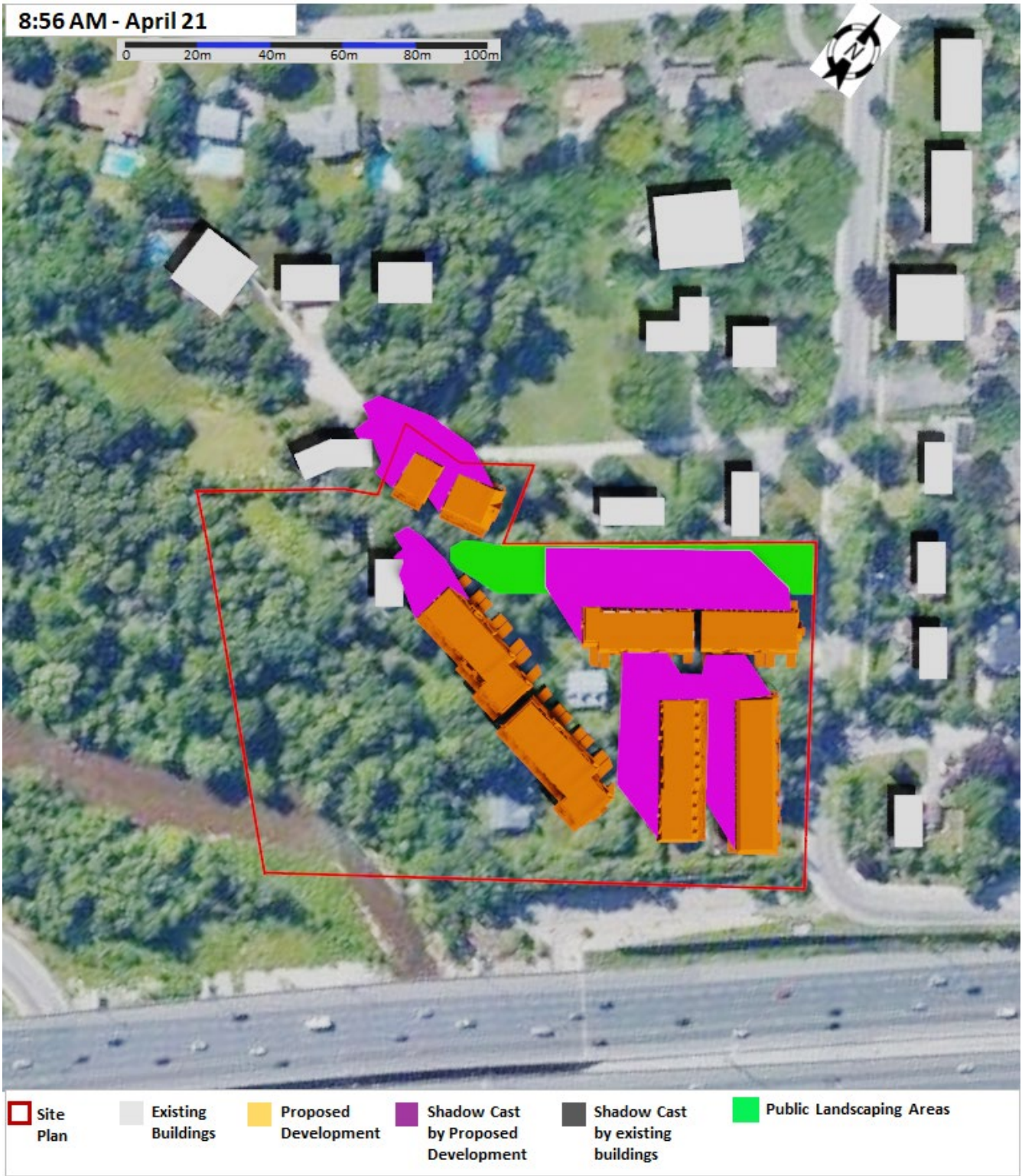
Figure 7: Shadow Patterns at Landscaping spaces – September 21st.

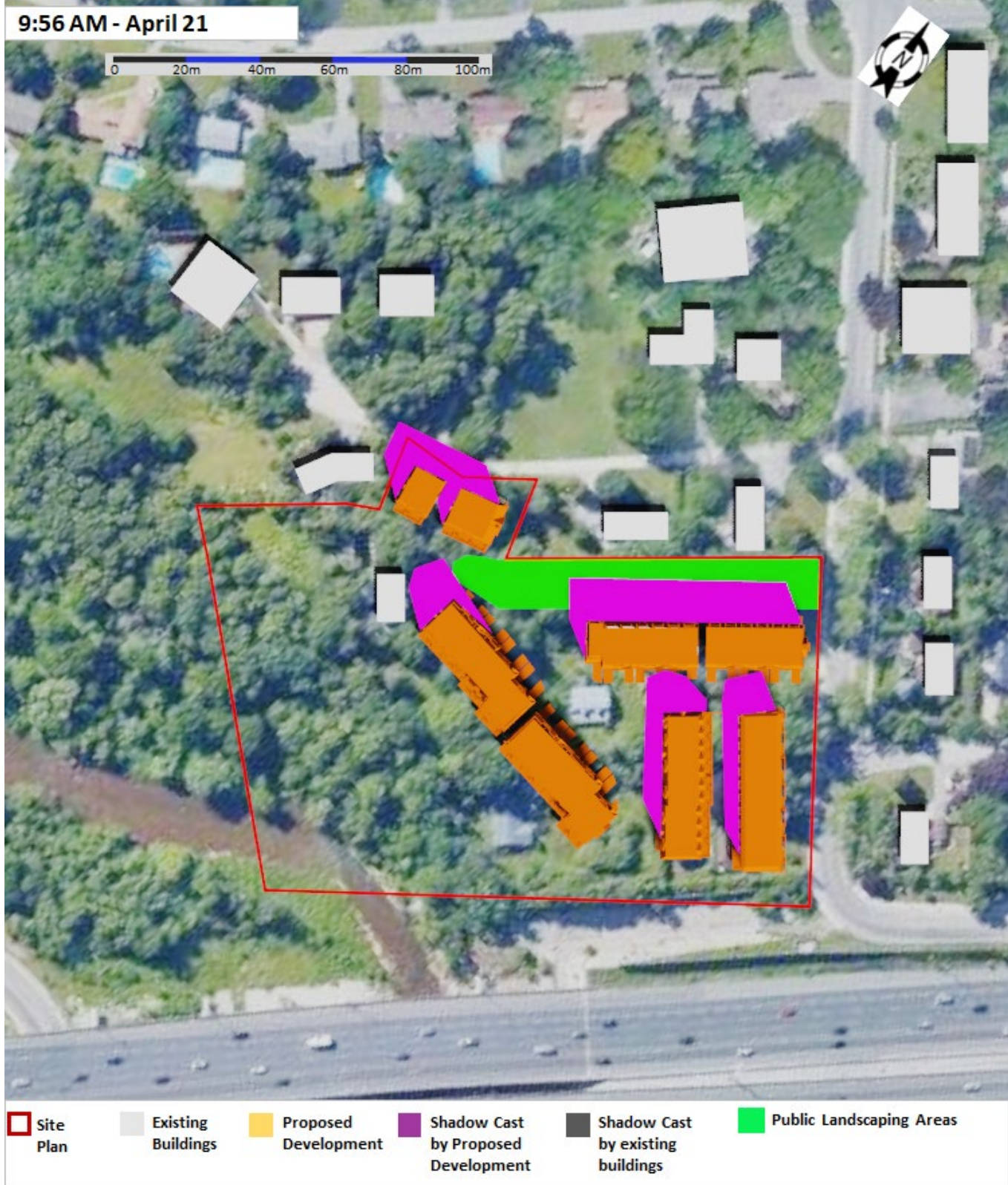
As per the TOR, the criterion is met if the public park receives at least 5 hours of continuous sunlight per day. As shown in **Figure 9** above, the shadow impact analysis demonstrated that the landscaping area receives at least 5 hours of continuous sunlight per day. As such, the criterion is met.

1.6 SHADOW ANALYSIS RESULTS FOR APRIL 21

The model results of shadow patterns for spring equinox from 7.56am to 6.39pm 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 represents the shadow due to the existing buildings. The footprint of the Development is represented by the orange color. For the spring 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 south-east sides of the Development to reach a maximum length near the sunset hours.

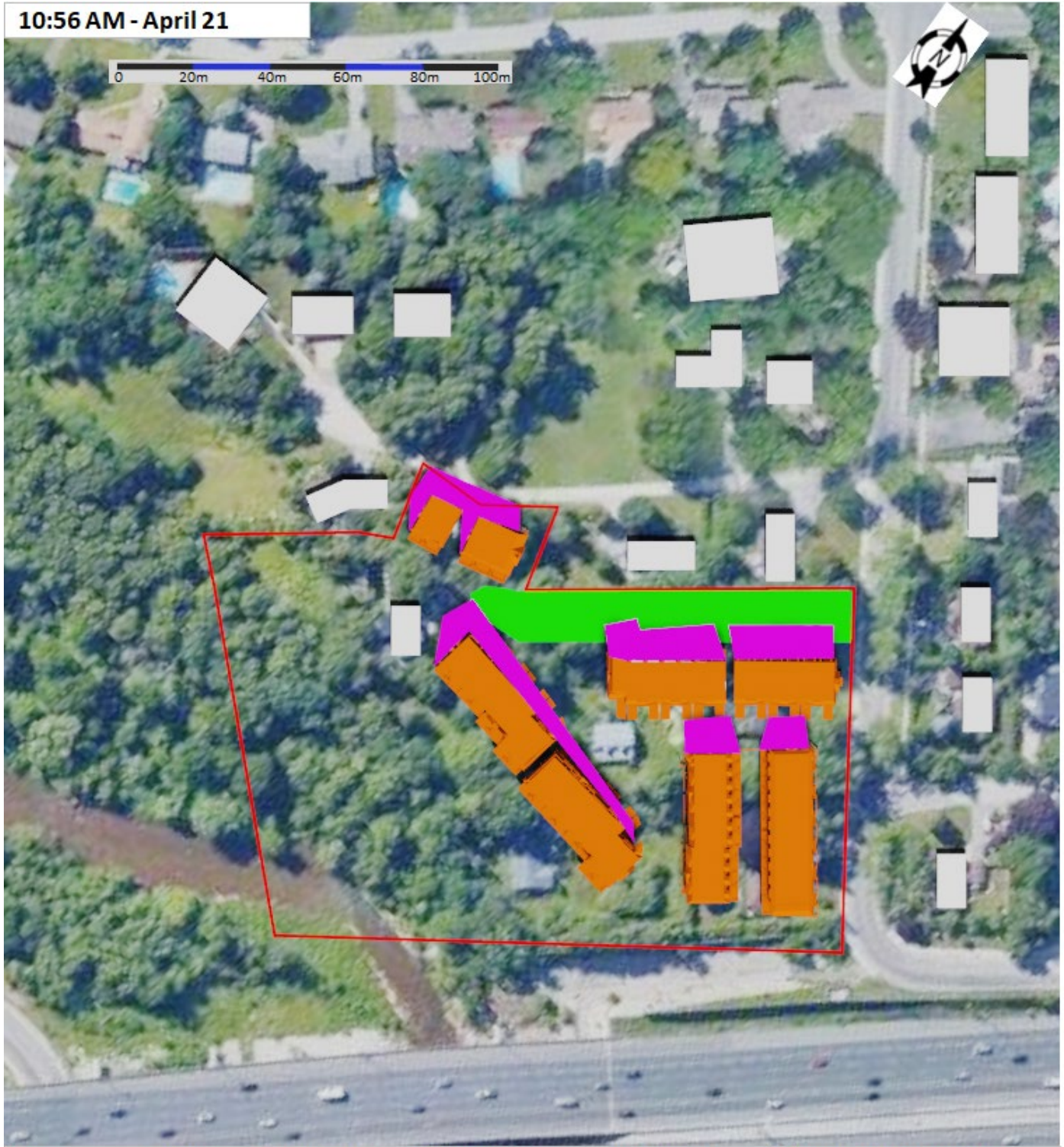




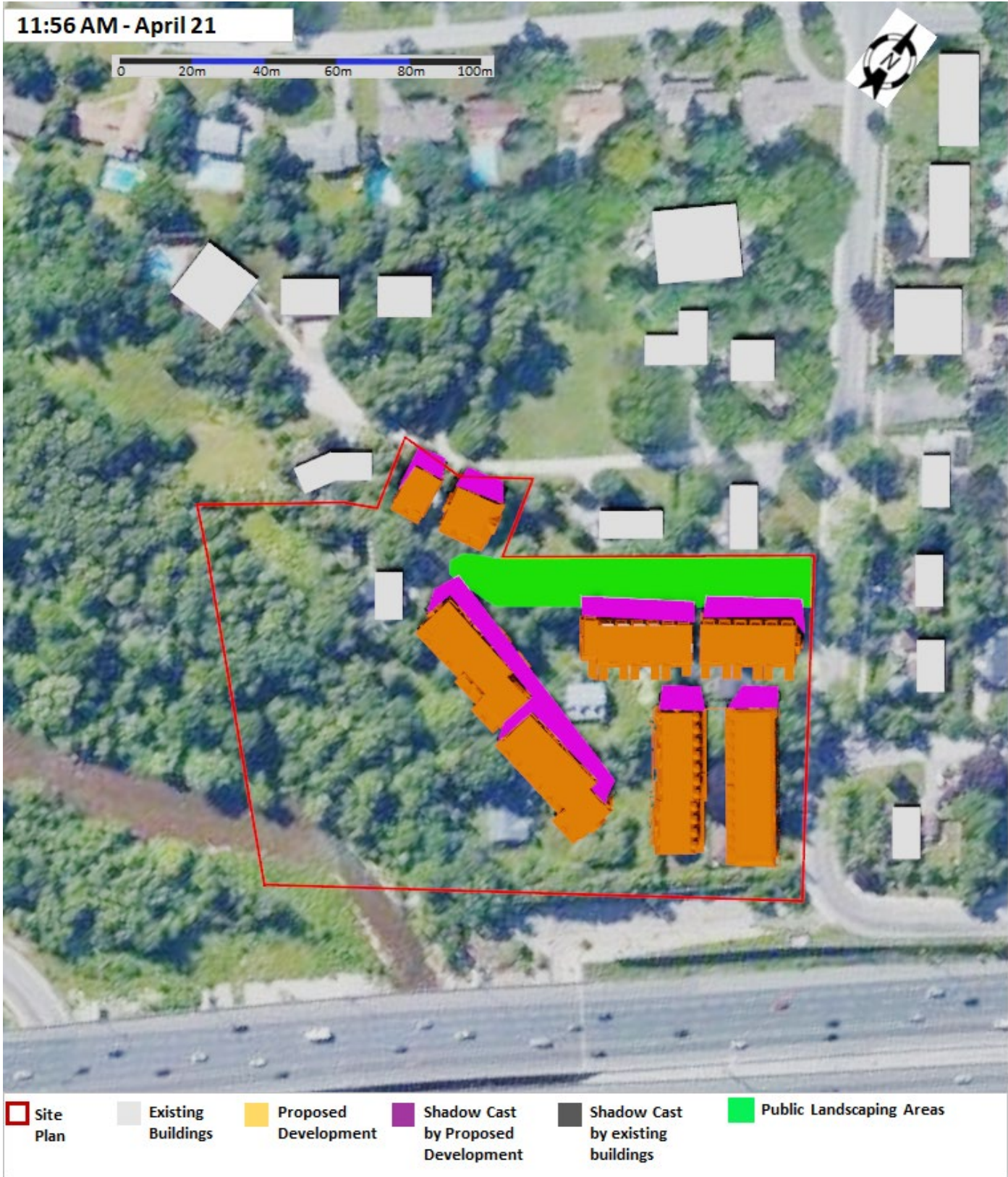


10:56 AM - April 21

0 20m 40m 60m 80m 100m

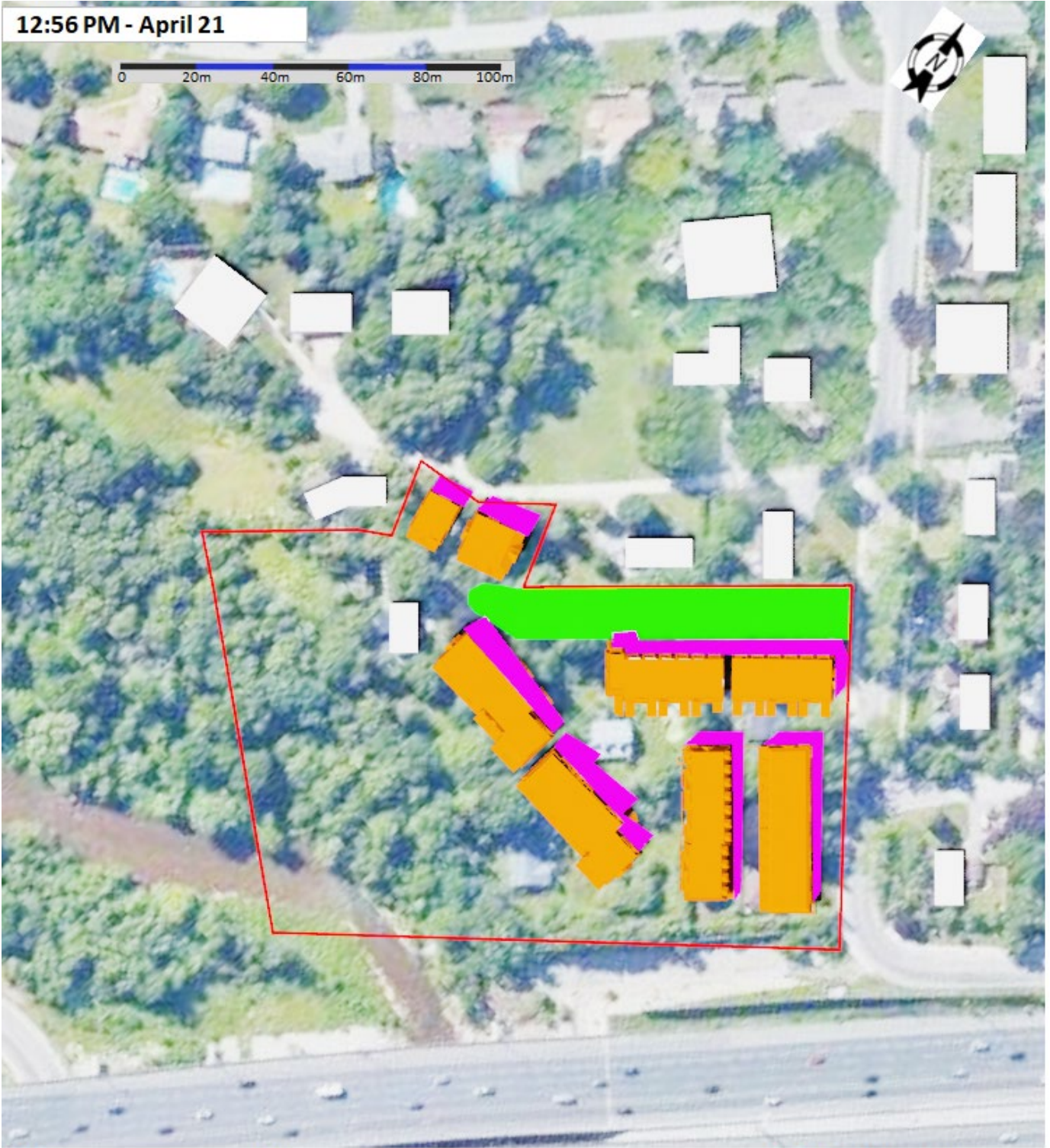








- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas



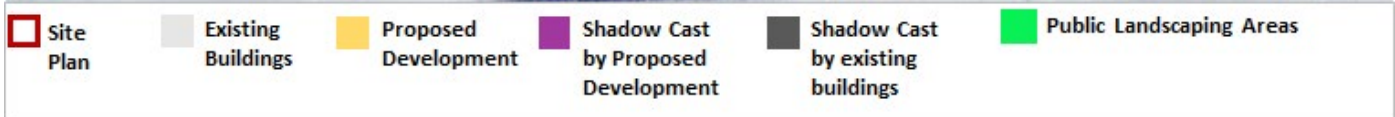
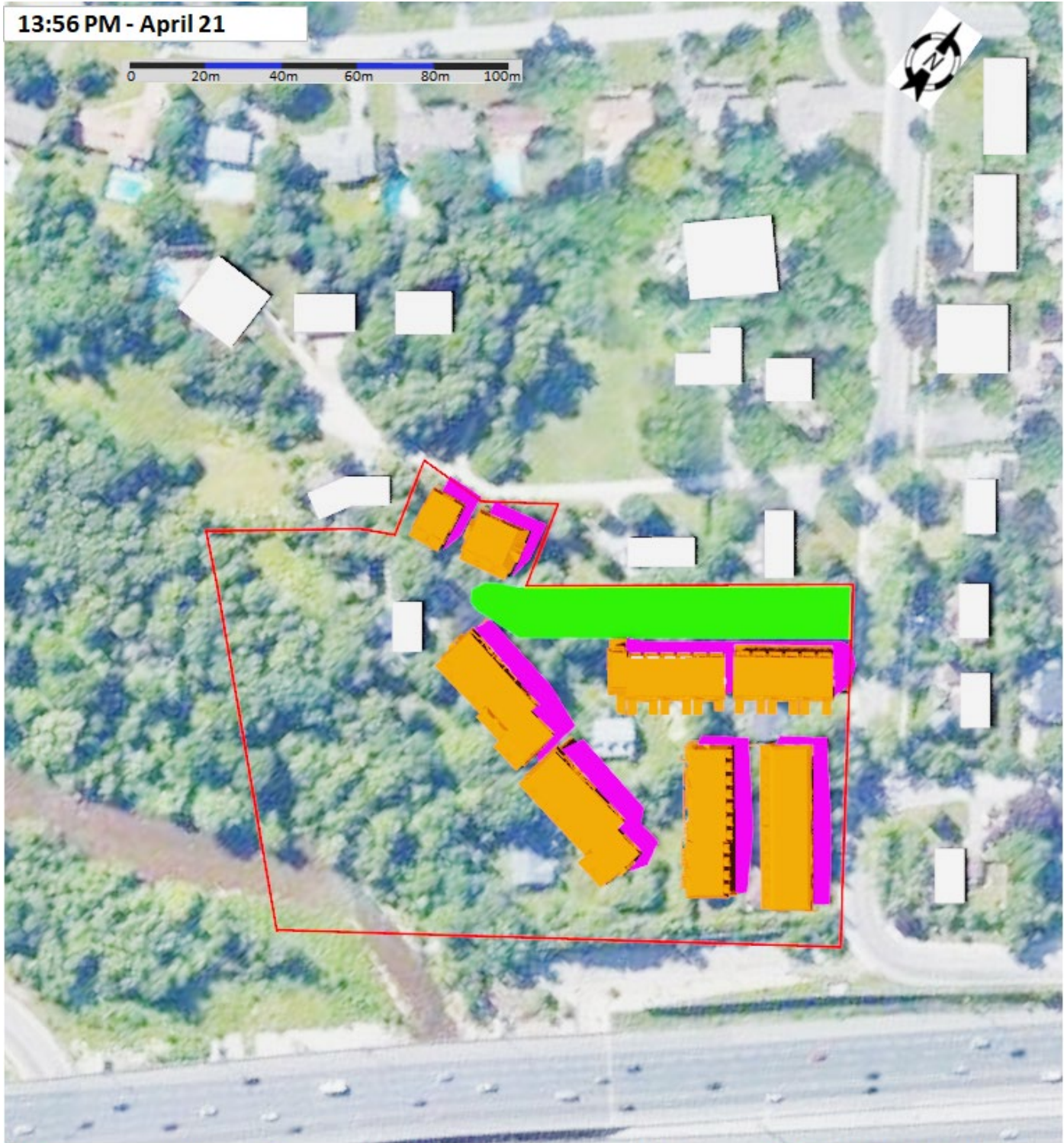
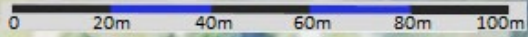
12:56 PM - April 21

0 20m 40m 60m 80m 100m



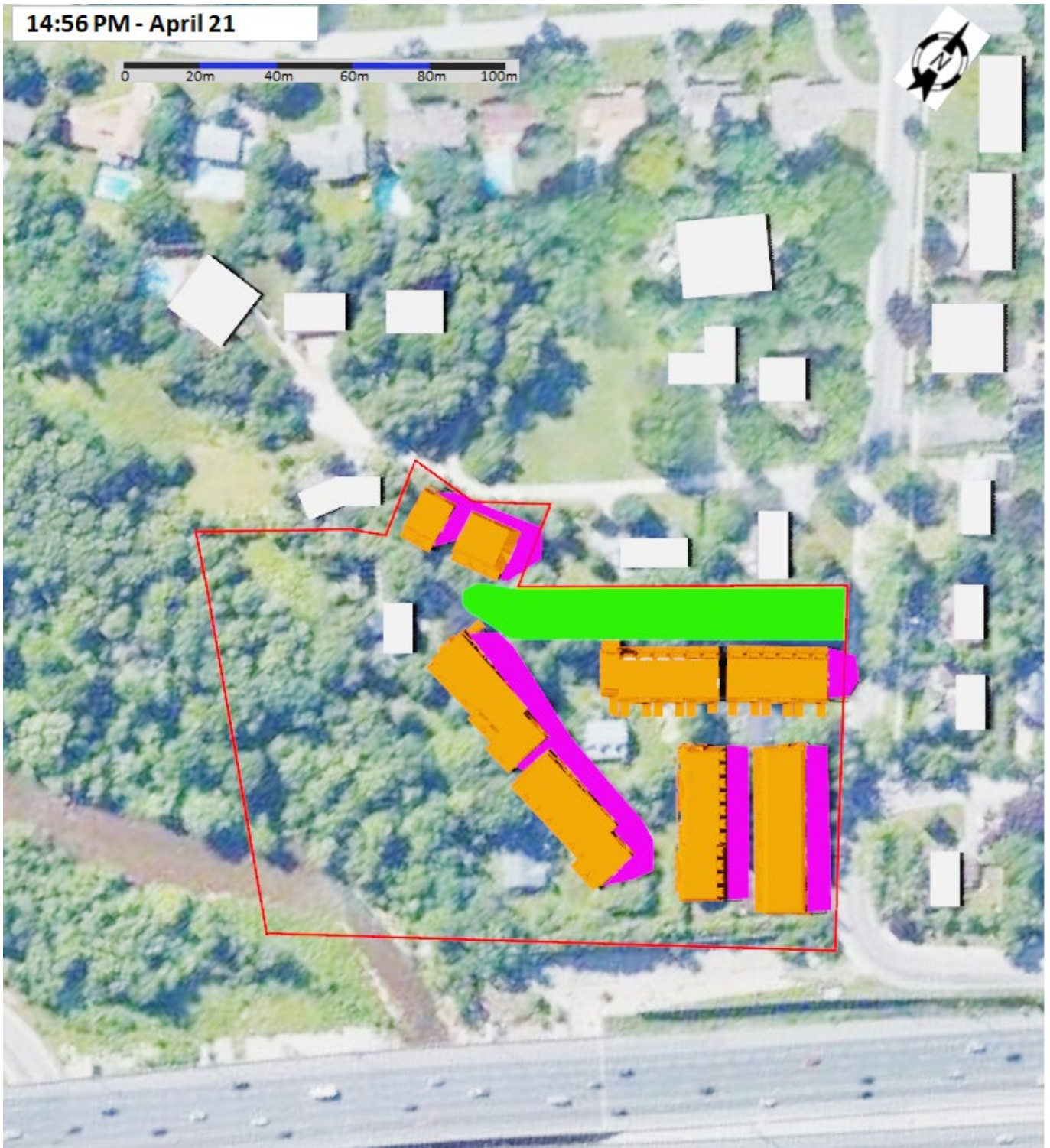
-  Site Plan
-  Existing Buildings
-  Proposed Development
-  Shadow Cast by Proposed Development
-  Shadow Cast by existing buildings
-  Public Landscaping Areas







13:56 PM - April 21



14:56 PM - April 21

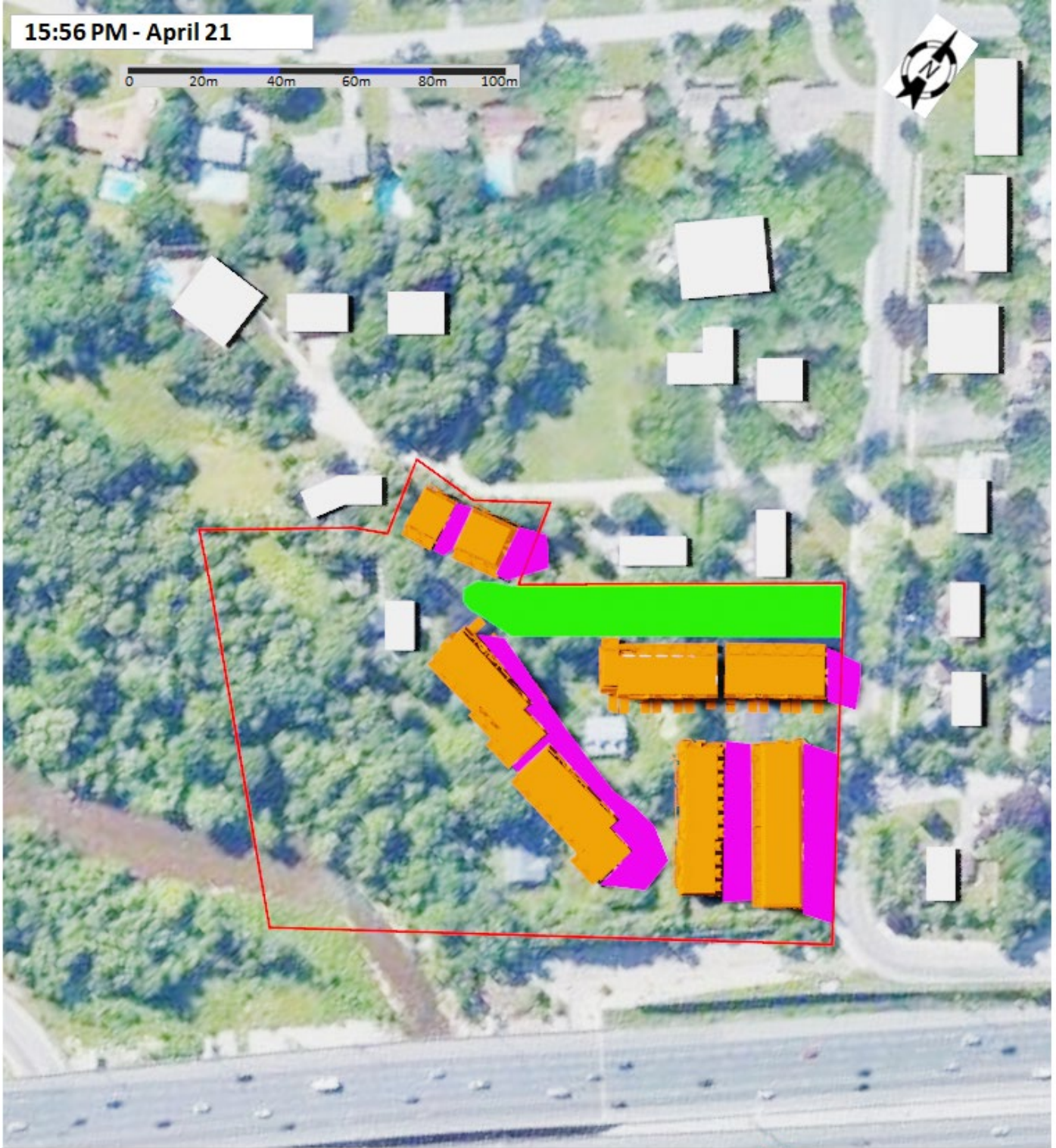
0 20m 40m 60m 80m 100m



-  Site Plan
-  Existing Buildings
-  Proposed Development
-  Shadow Cast by Proposed Development
-  Shadow Cast by existing buildings
-  Public Landscaping Areas

15:56 PM - April 21

0 20m 40m 60m 80m 100m



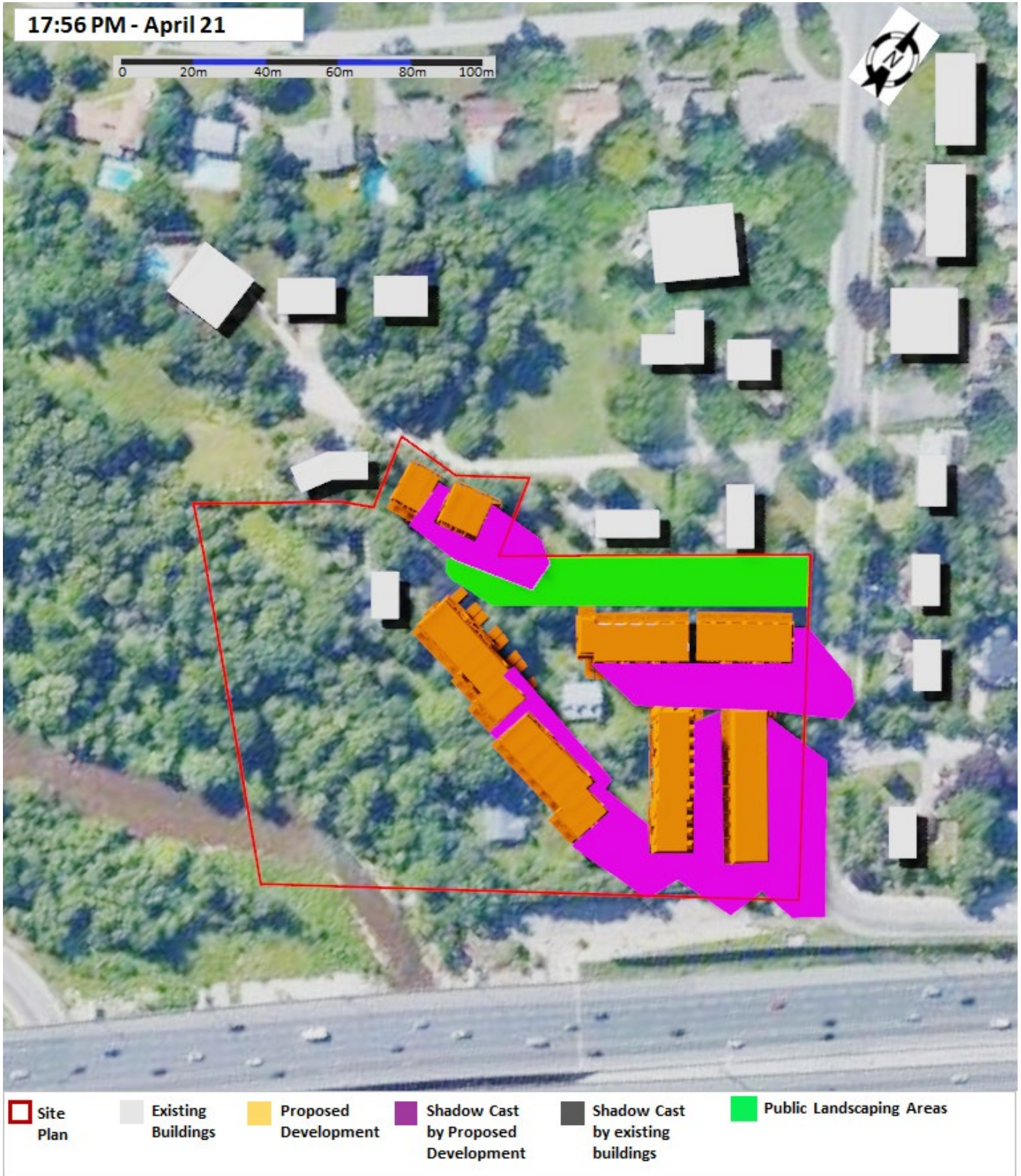
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas

16:56 PM - April 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Landscaping Areas



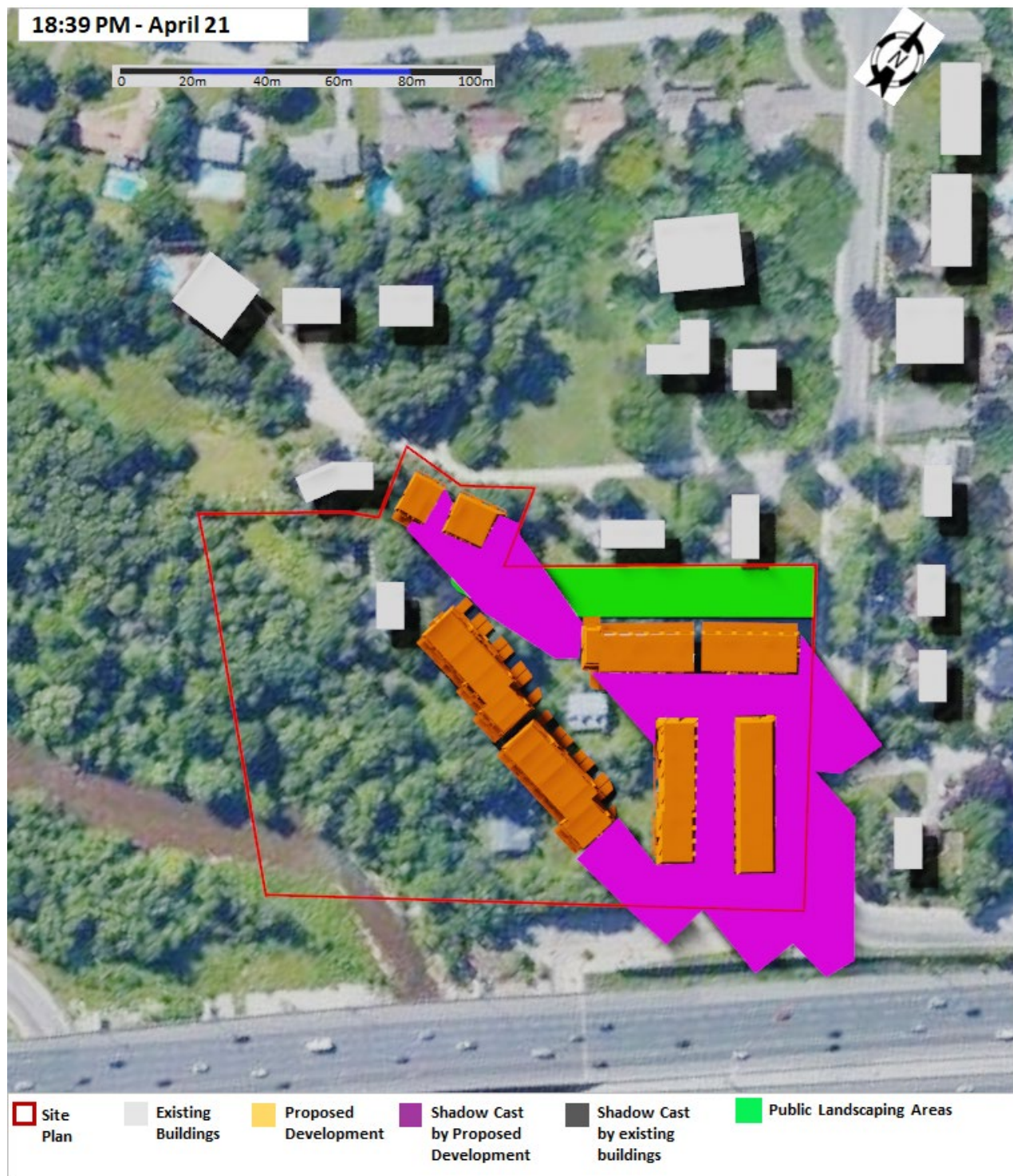


Figure 8: Shadow Patterns at Residential Private amenity spaces – April 21st.

According to the TOR, the criterion is met if the public park receives at least 5 hours of continuous sunlight per day. As shown in **Figure 10** above, the shadow impact analysis demonstrated that the landscaping area receives at least 5 hours of continuous sunlight per day. As such, the criterion is met.

C PUBLIC REALM

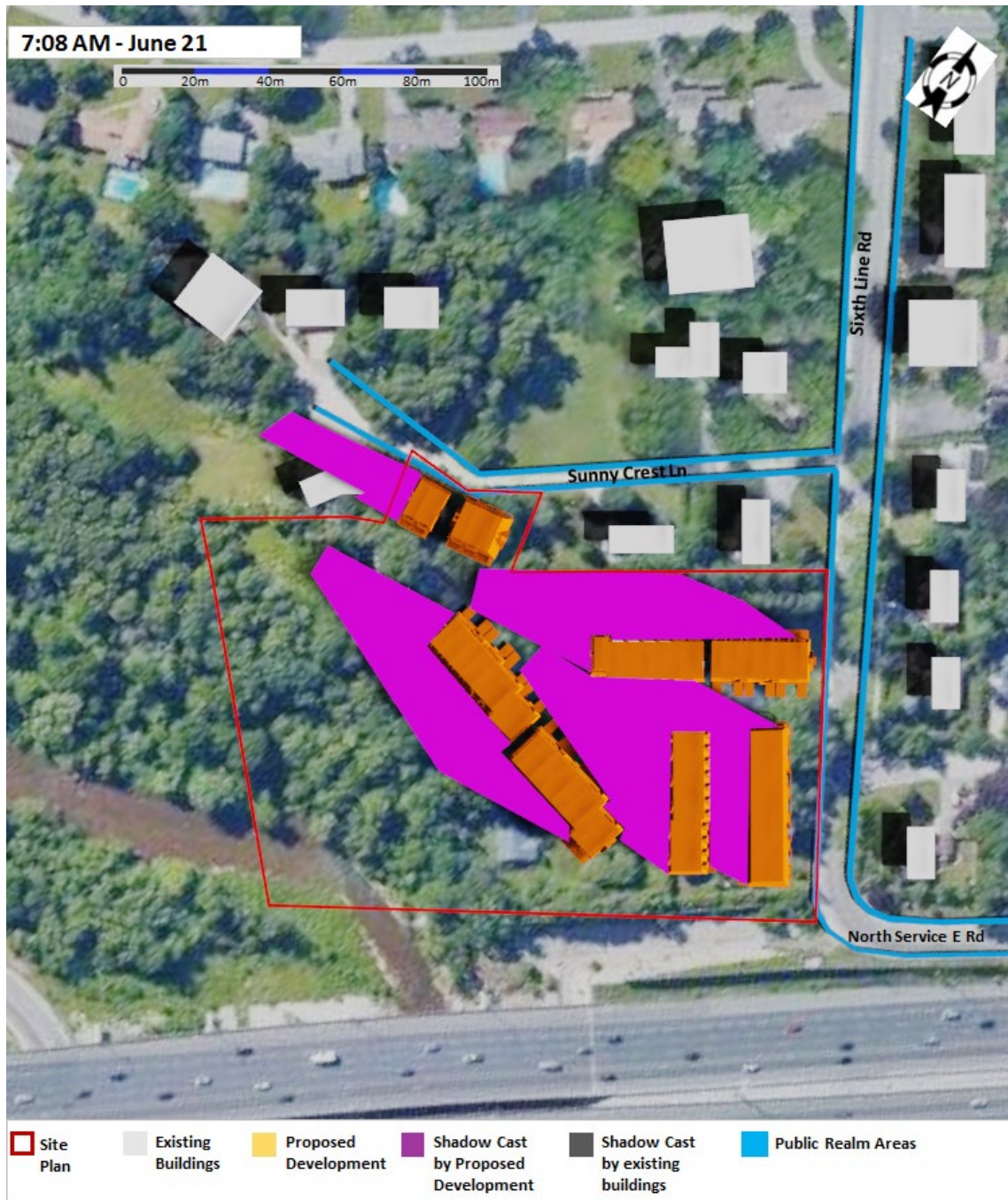
Figure 11 identifies all public realm in the vicinity of the development. For this study, the public realm is comprised of the public sidewalks along Sixth Line Rd on the east side of the Development, along North Service E Rd on the south-east side of the Development and along Sunny crest Ln on the north side of the Development (color blue in **Figure 11**).



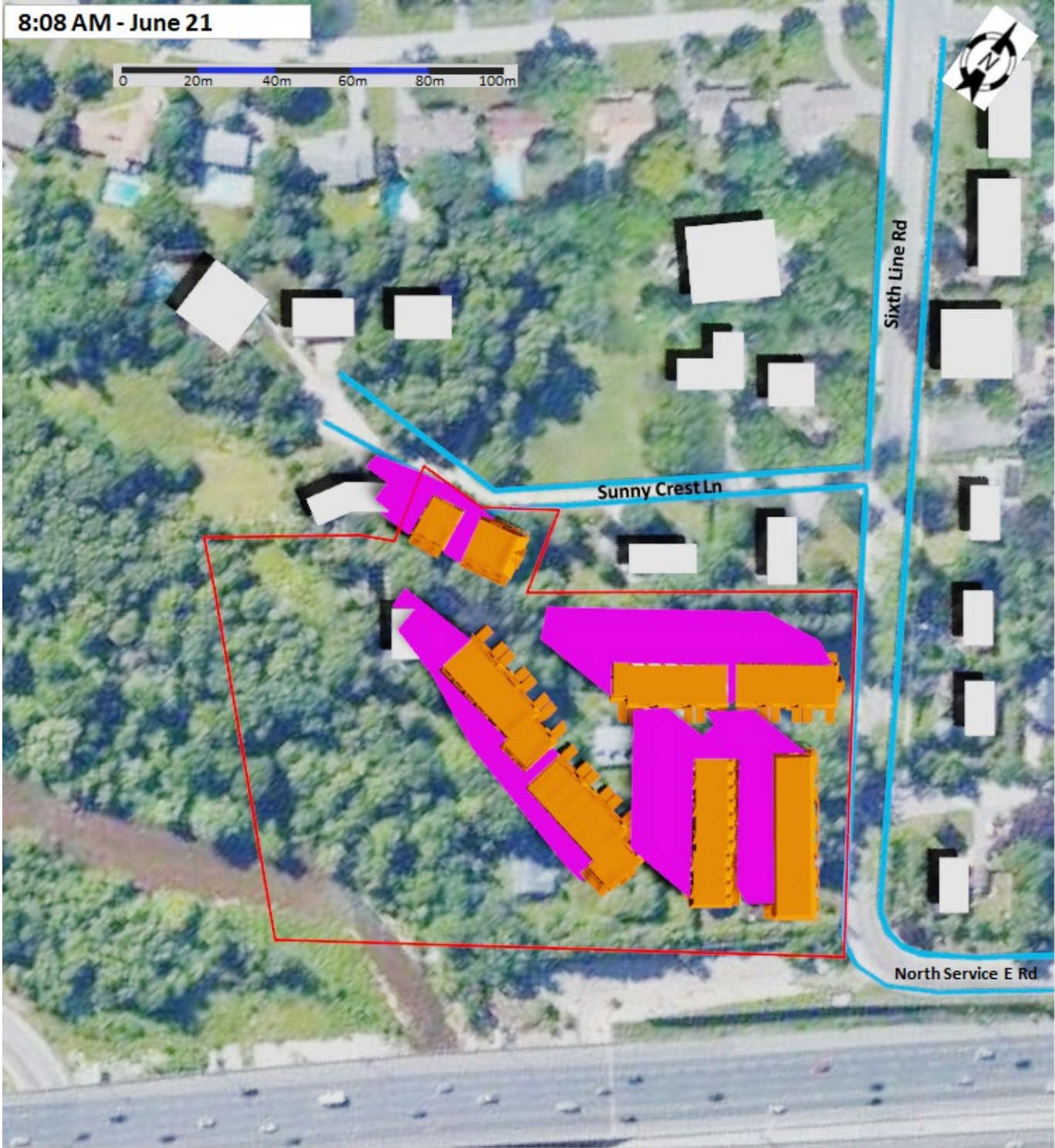
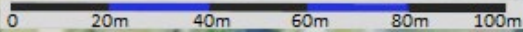
Figure 9: Public Realm in the vicinity of the Development.

1.7 SHADOW ANALYSIS RESULTS FOR JUNE 21

The model results of shadow patterns for summer solstice from 7.08am to 7.33pm are shown in **Figure 12**. As shown in this **Figure 12**, 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 summer solstice, 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 south-east sides of the Development to reach a maximum length near the sunset hours.



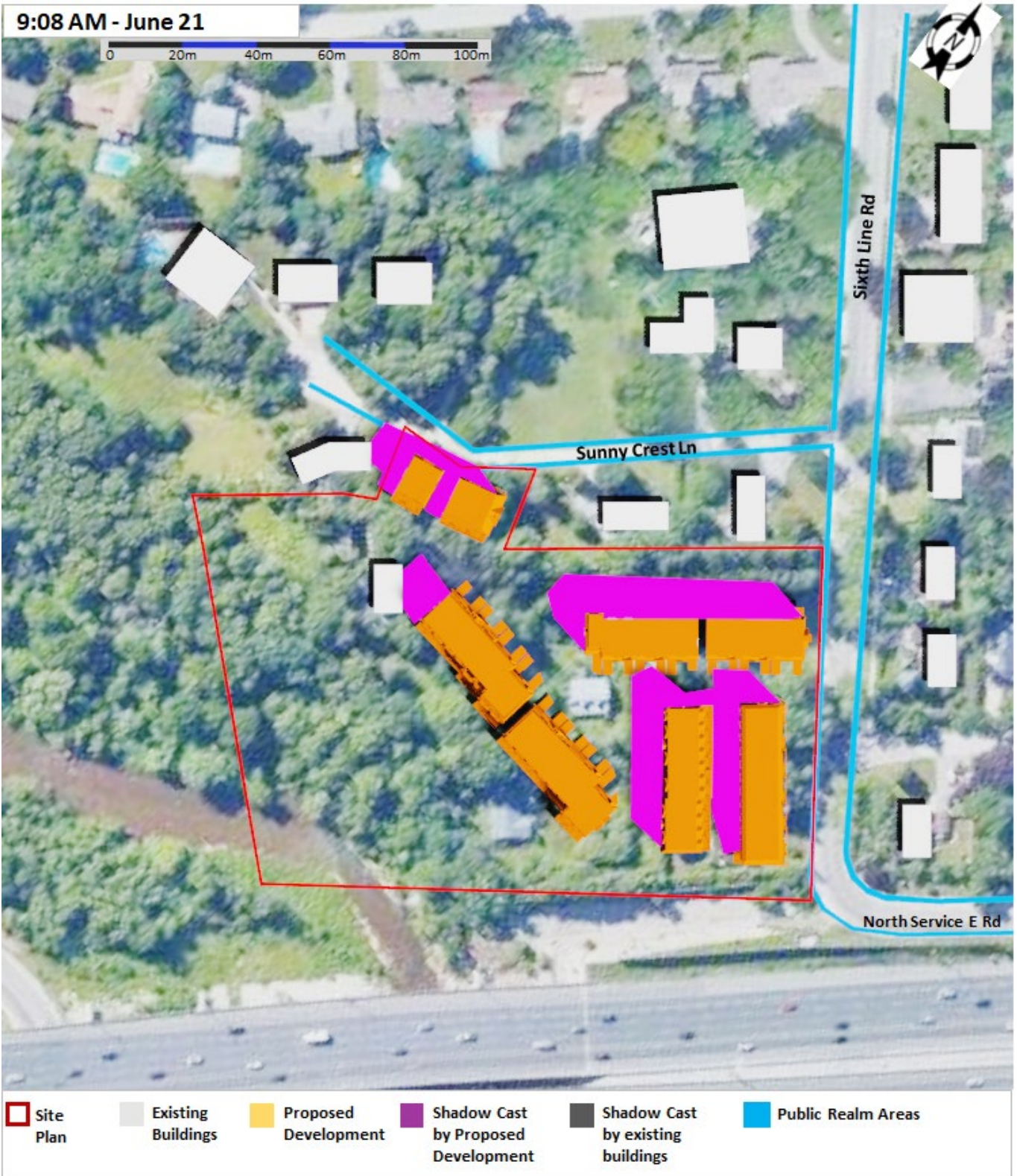
8:08 AM - June 21



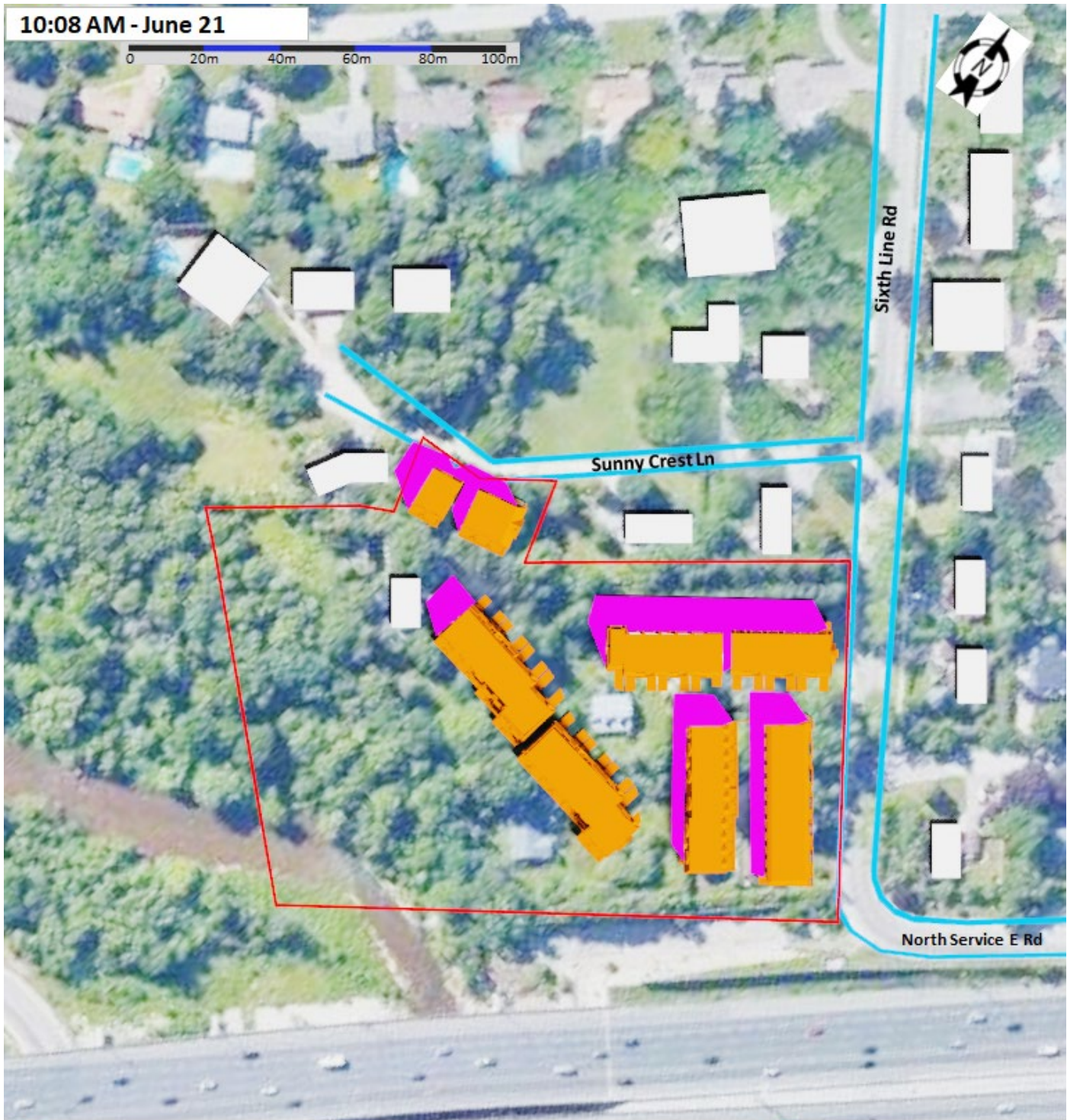
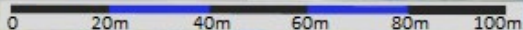
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

9:08 AM - June 21

0 20m 40m 60m 80m 100m

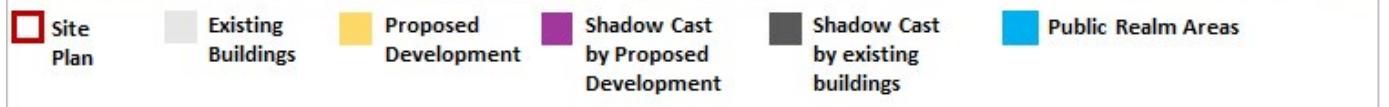
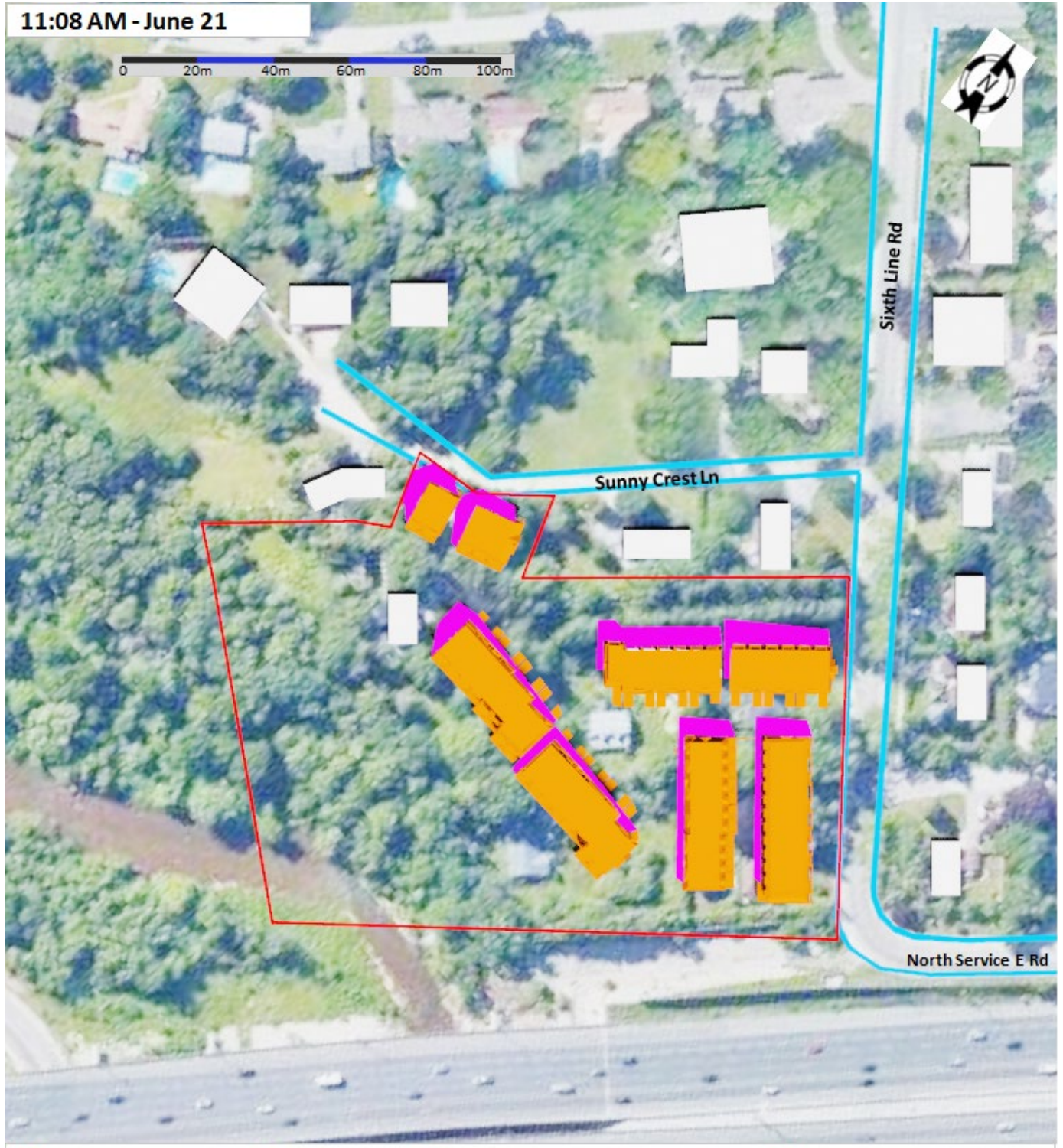
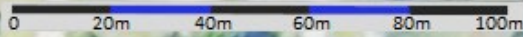


10:08 AM - June 21

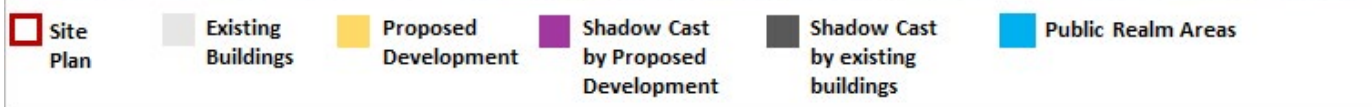
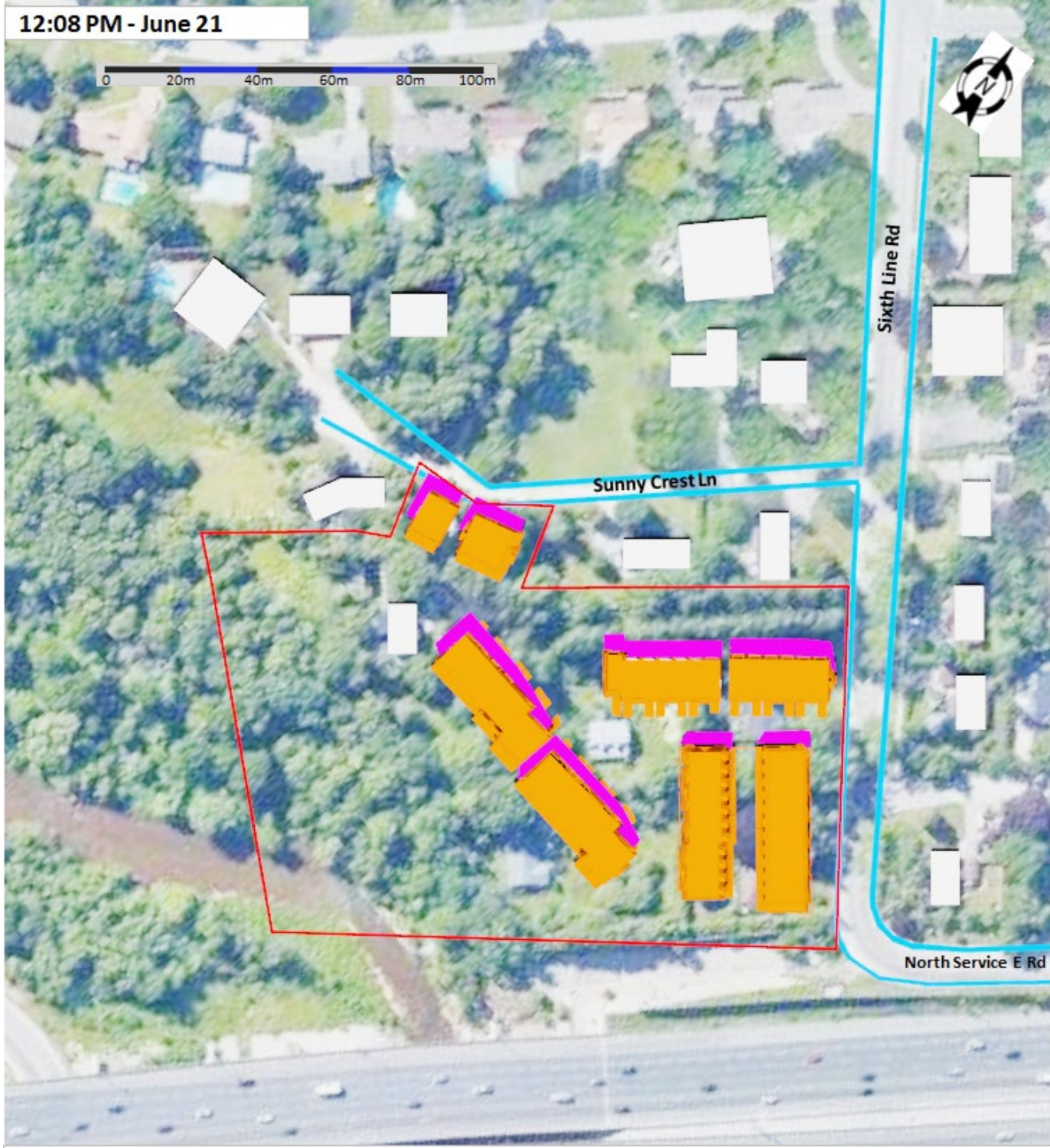
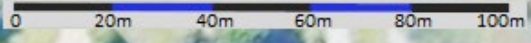


- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

11:08 AM - June 21

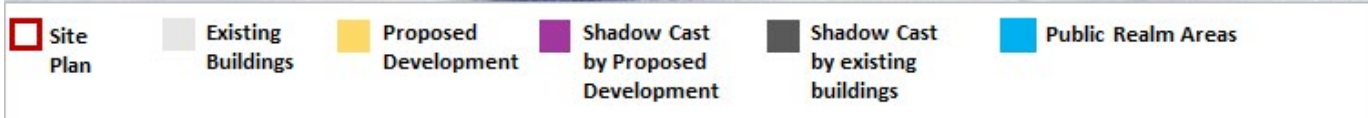
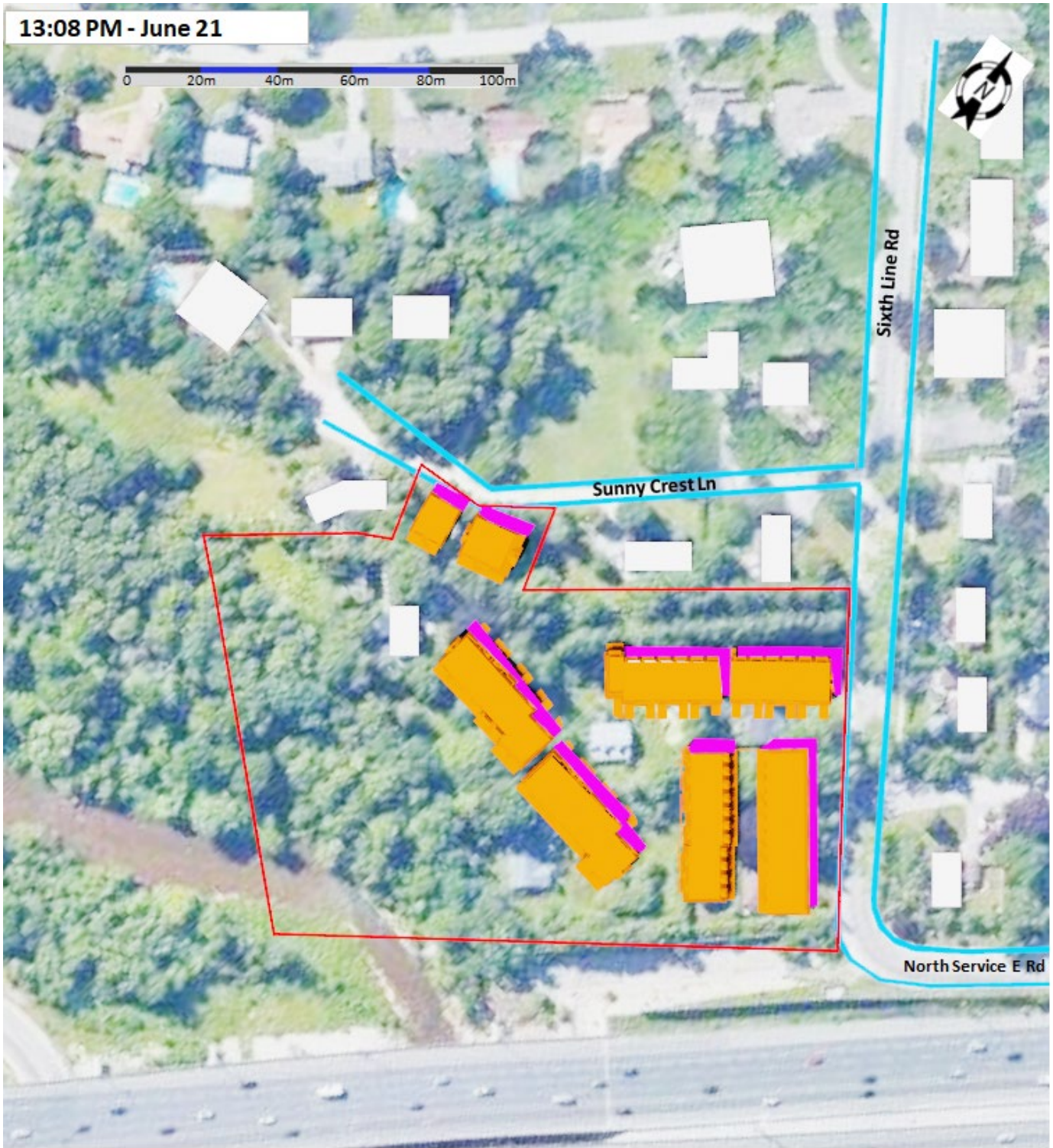


12:08 PM - June 21

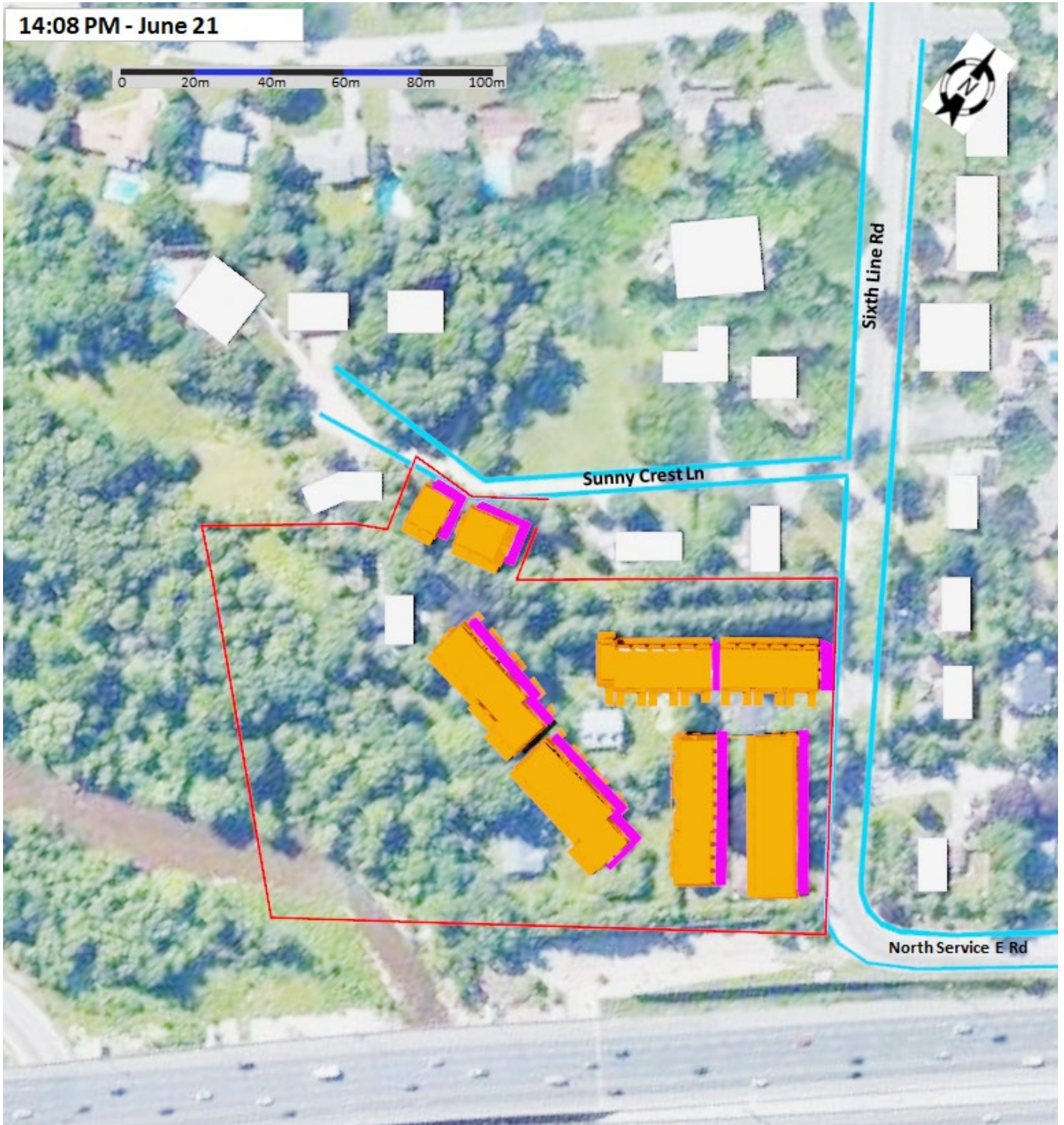
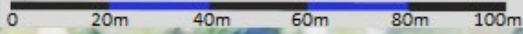


13:08 PM - June 21

0 20m 40m 60m 80m 100m

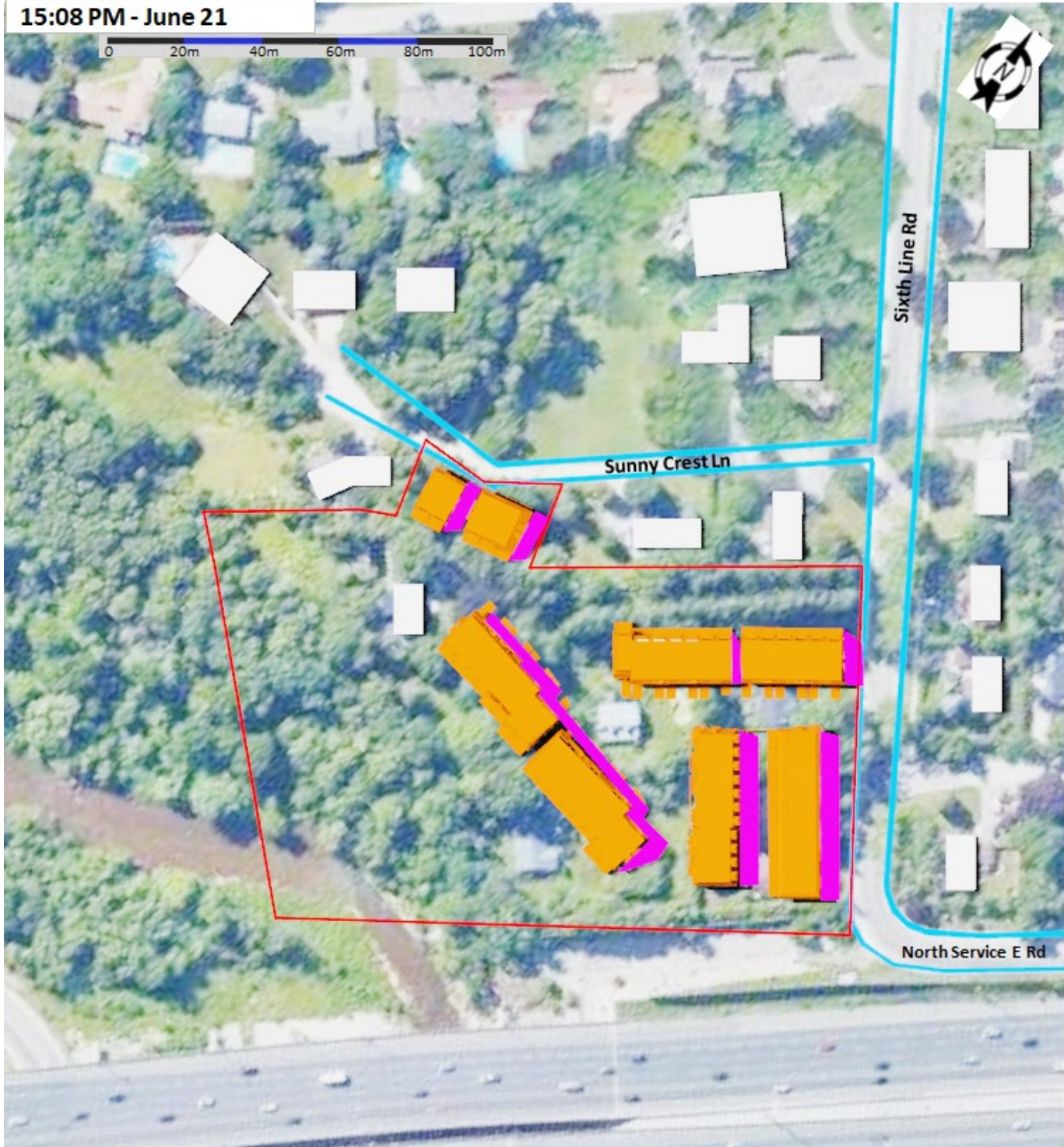
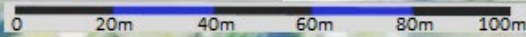


14:08 PM - June 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

15:08 PM - June 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

16:08 PM - June 21

0 20m 40m 60m 80m 100m



Sixth Line Rd

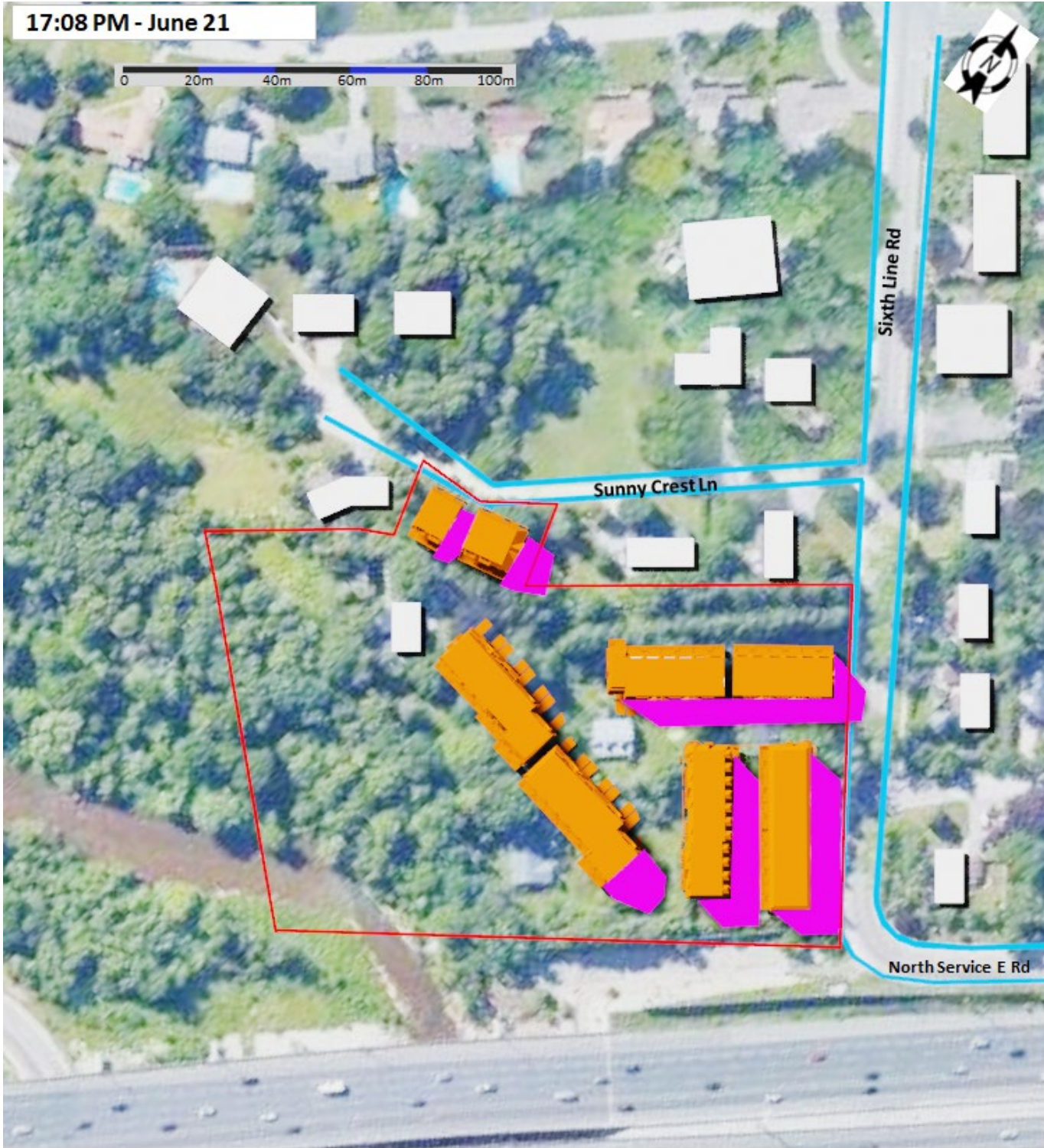
Sunny Crest Ln

North Service E Rd

- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

17:08 PM - June 21

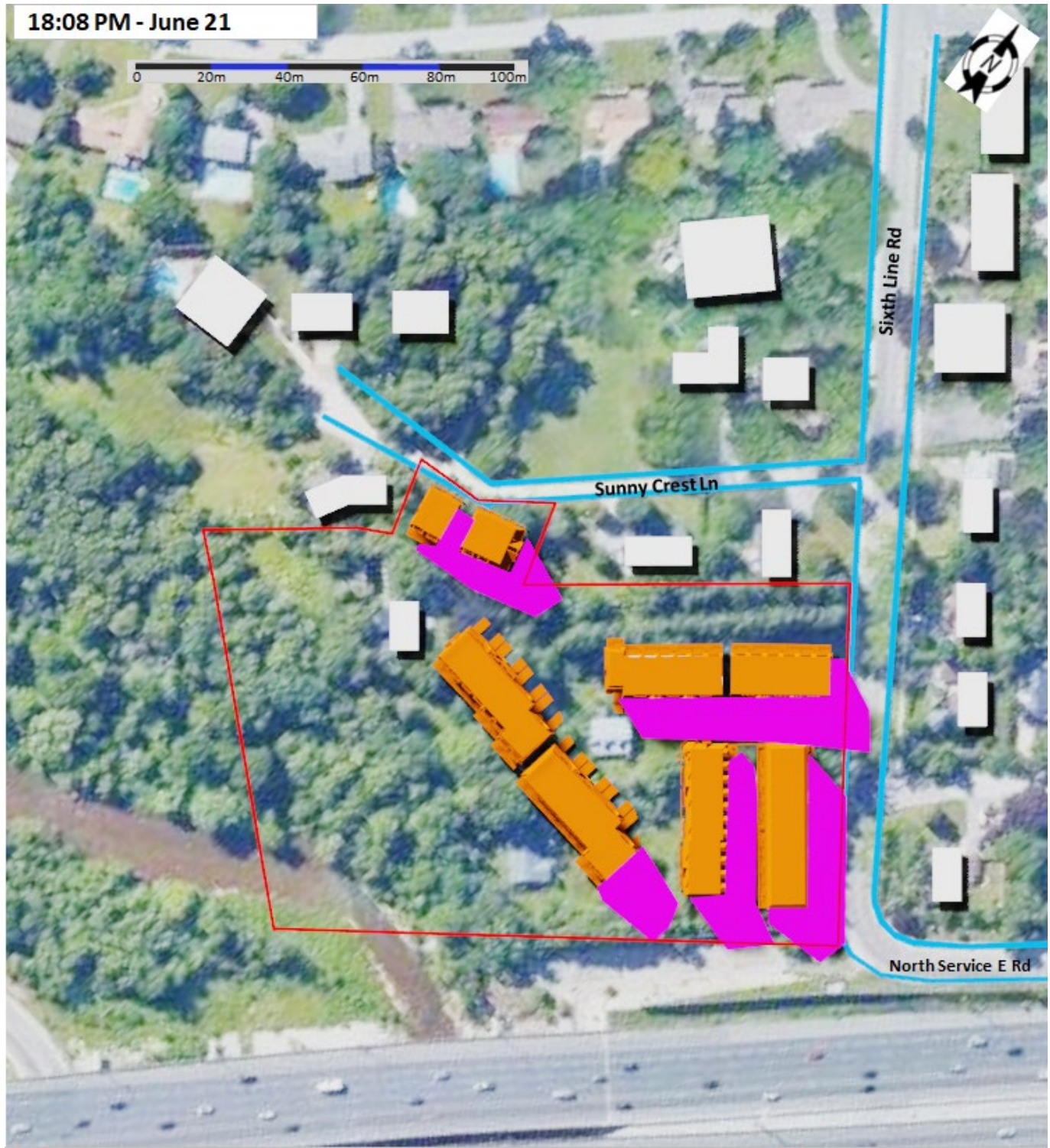
0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

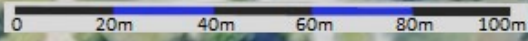
18:08 PM - June 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

19:08 PM - June 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

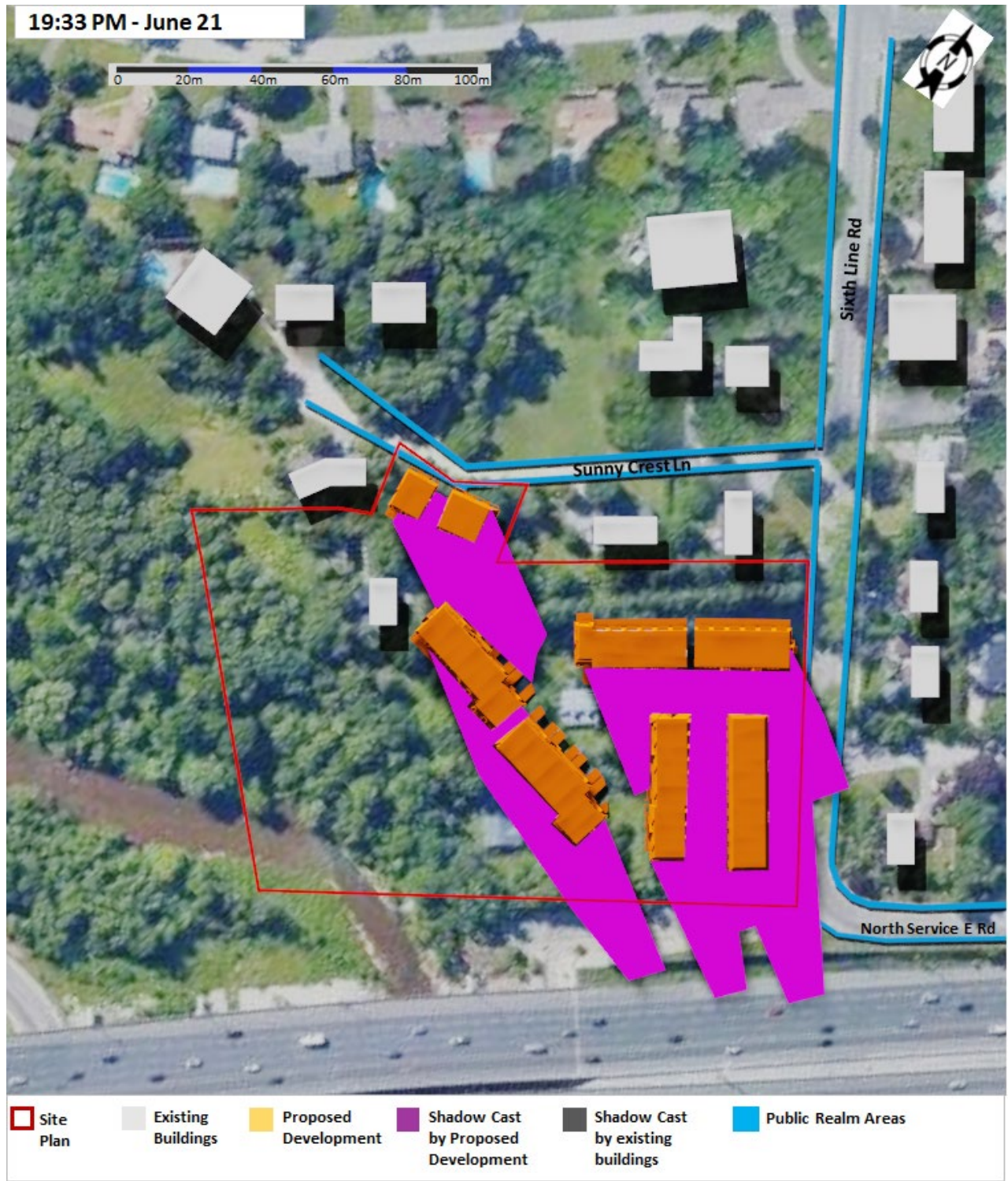
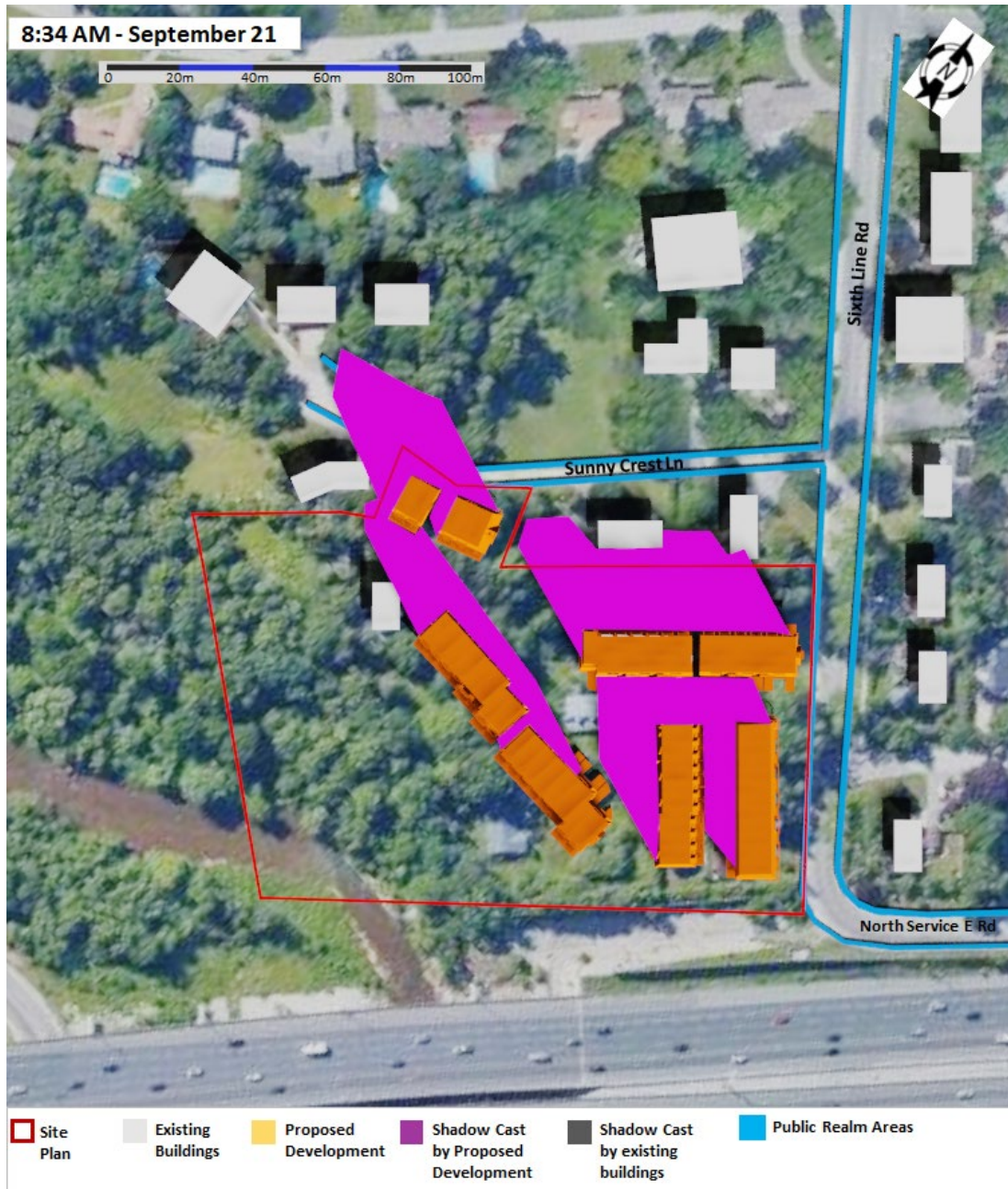


Figure 10: Shadow Patterns at Public Realm (sidewalks) – June 21st.

According to the TOR, the criterion is met if the public park receives at least 5 hours of continuous sunlight per day. As shown in **Figure 12** above, the shadow impact analysis demonstrated that the landscaping area receives at least 5 hours of continuous sunlight per day. As such, the criterion is met.

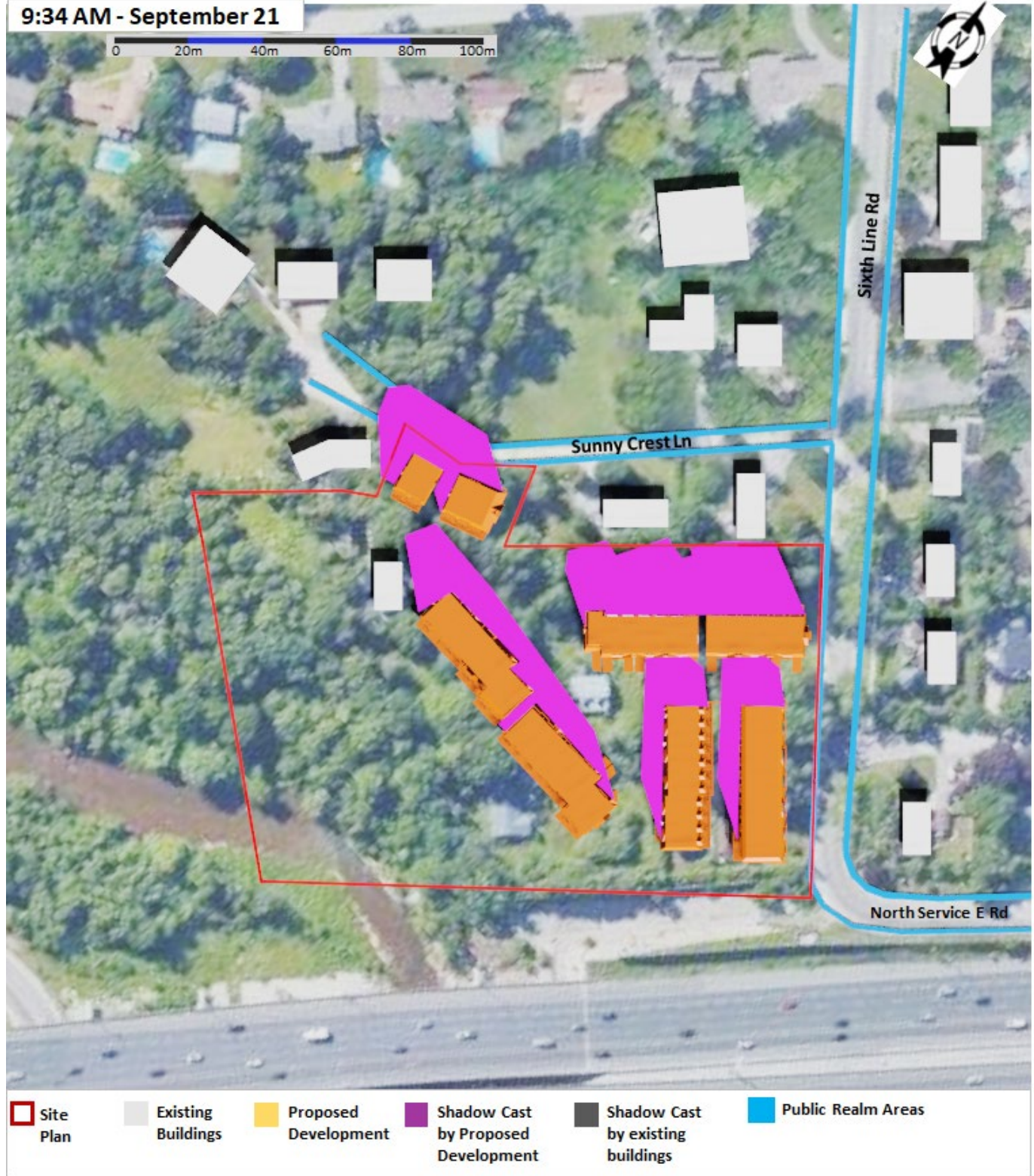
1.8 SHADOW ANALYSIS RESULTS FOR SEPTEMBER 21

The model results of shadow patterns for fall equinox from 8.34am to 5.47pm are shown in **Figure 13**. As shown in this **Figure 13**, 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 south-east sides of the Development to reach a maximum length near the sunset hours.

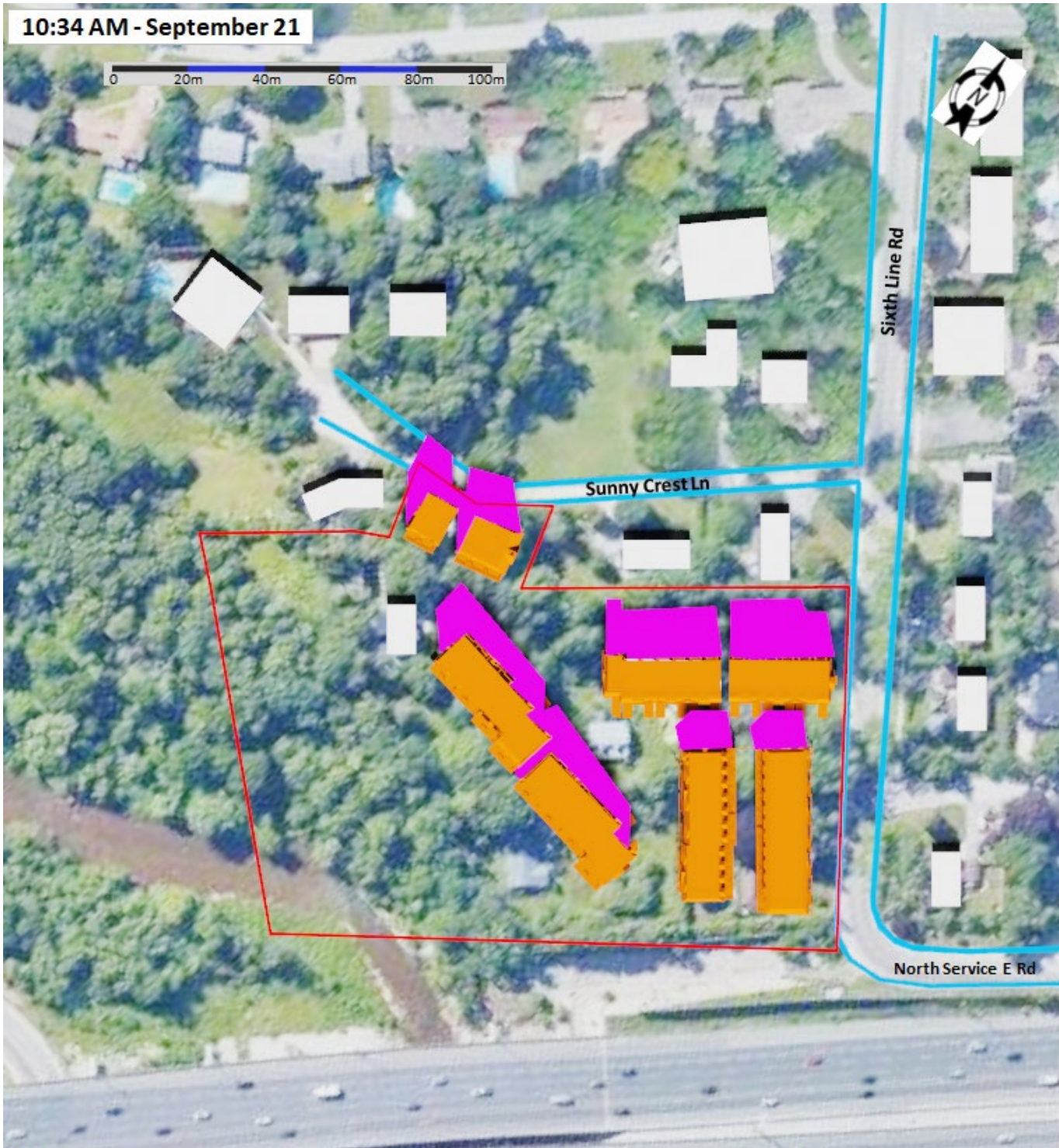
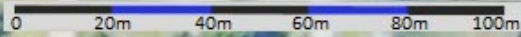


9:34 AM - September 21

0 20m 40m 60m 80m 100m



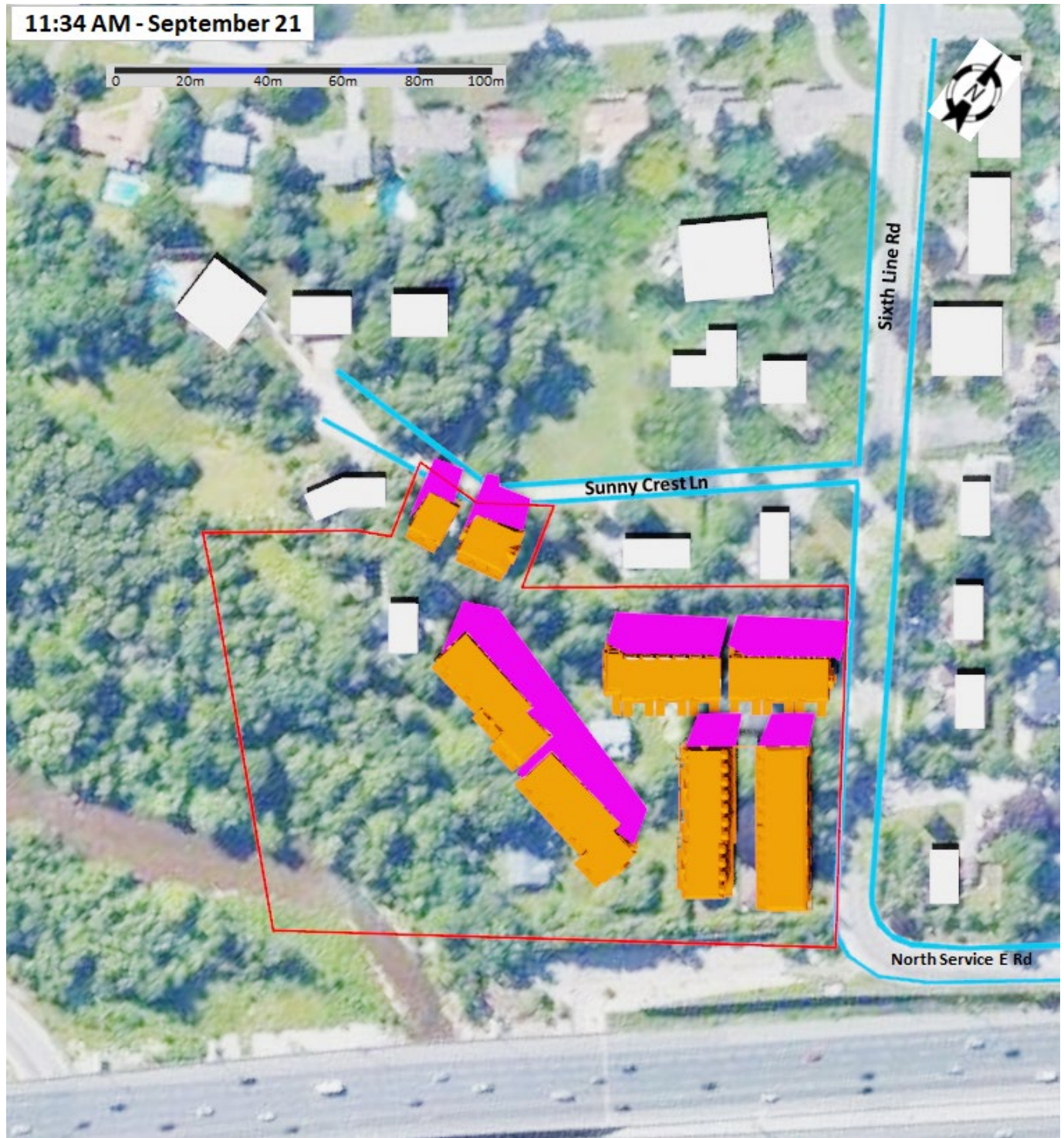
10:34 AM - September 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

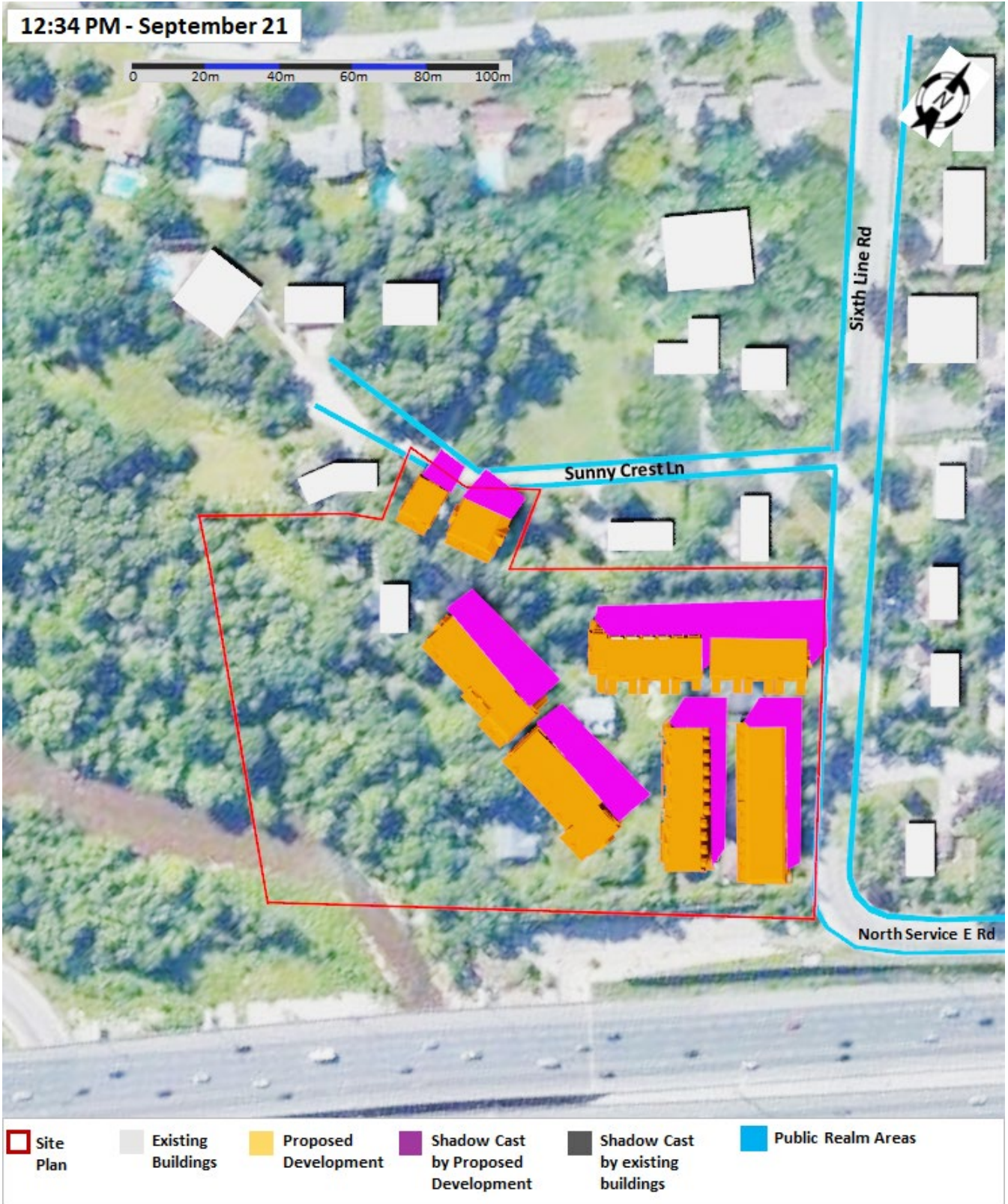
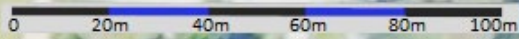
11:34 AM - September 21

0 20m 40m 60m 80m 100m



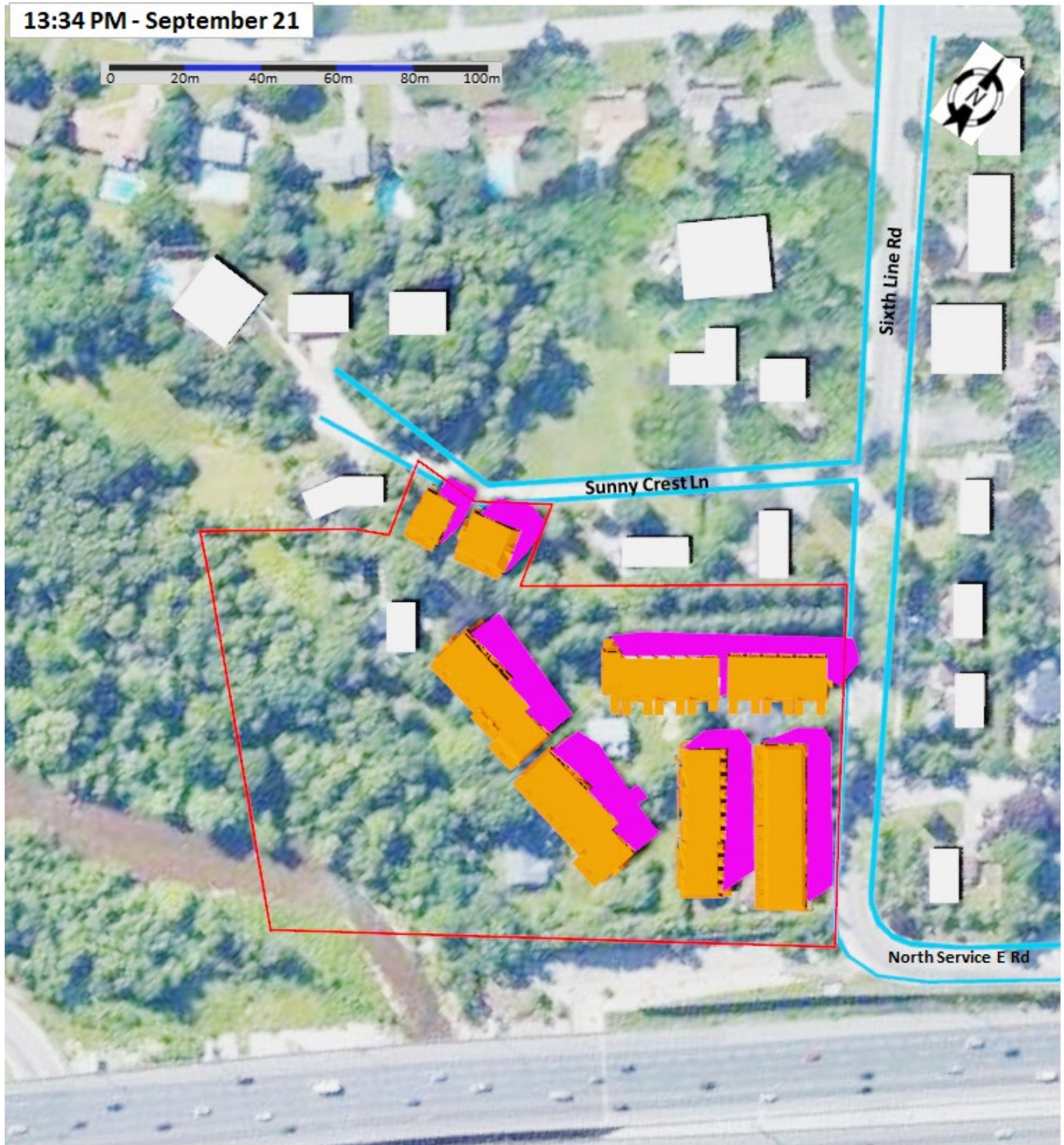
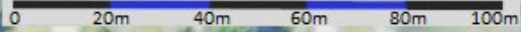
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

12:34 PM - September 21

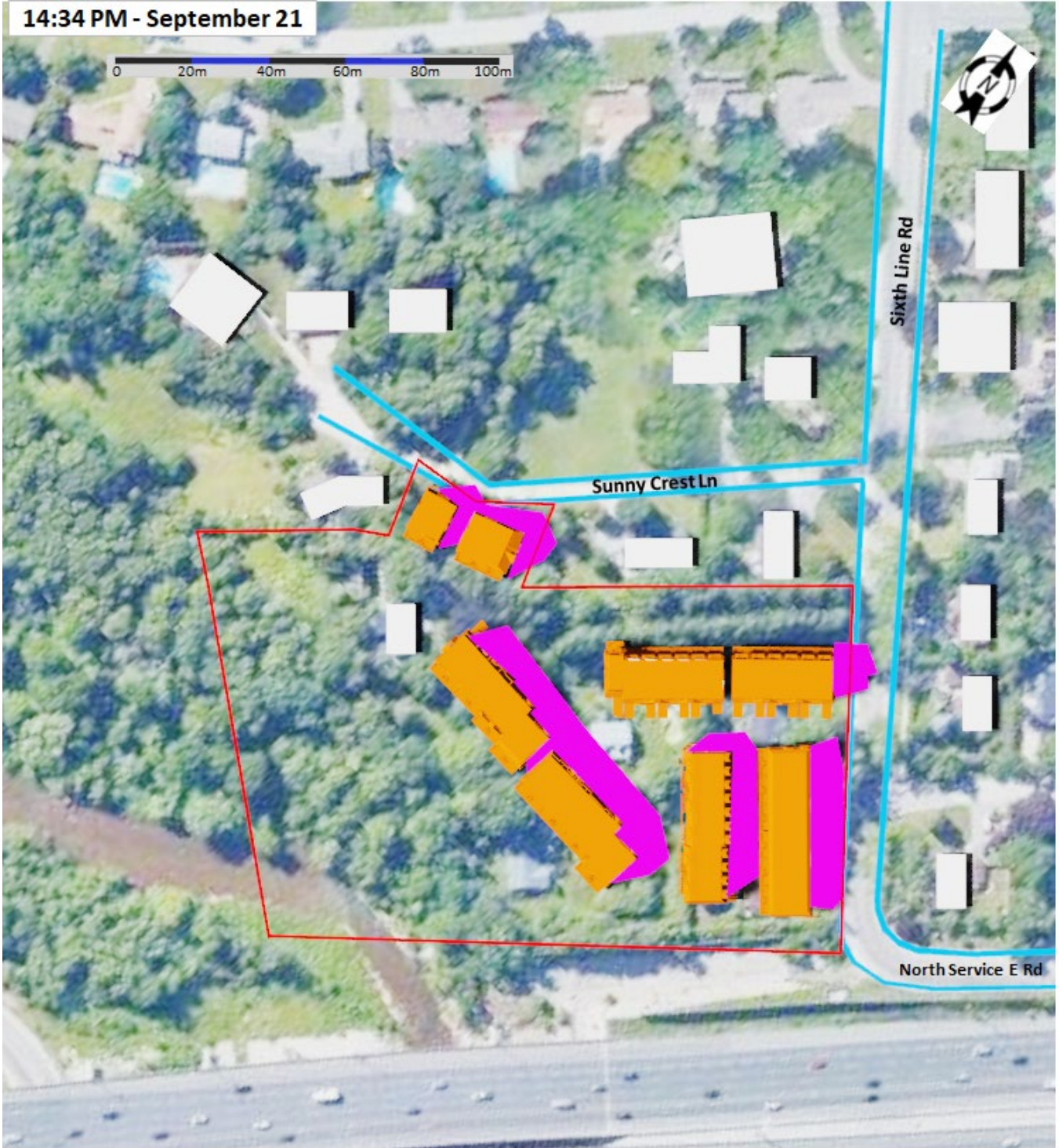


- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

13:34 PM - September 21

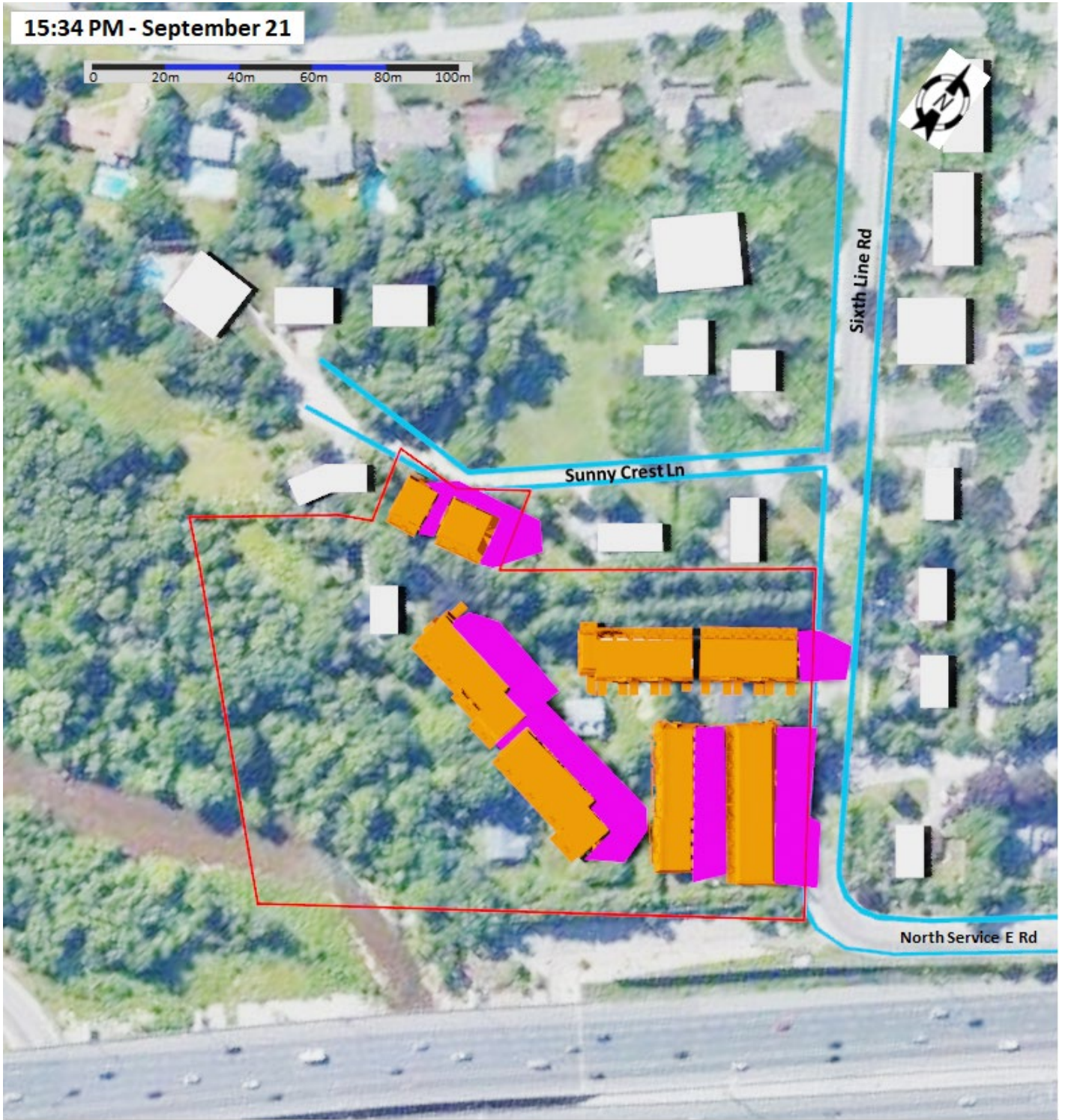
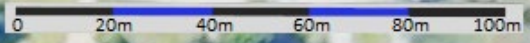


14:34 PM - September 21



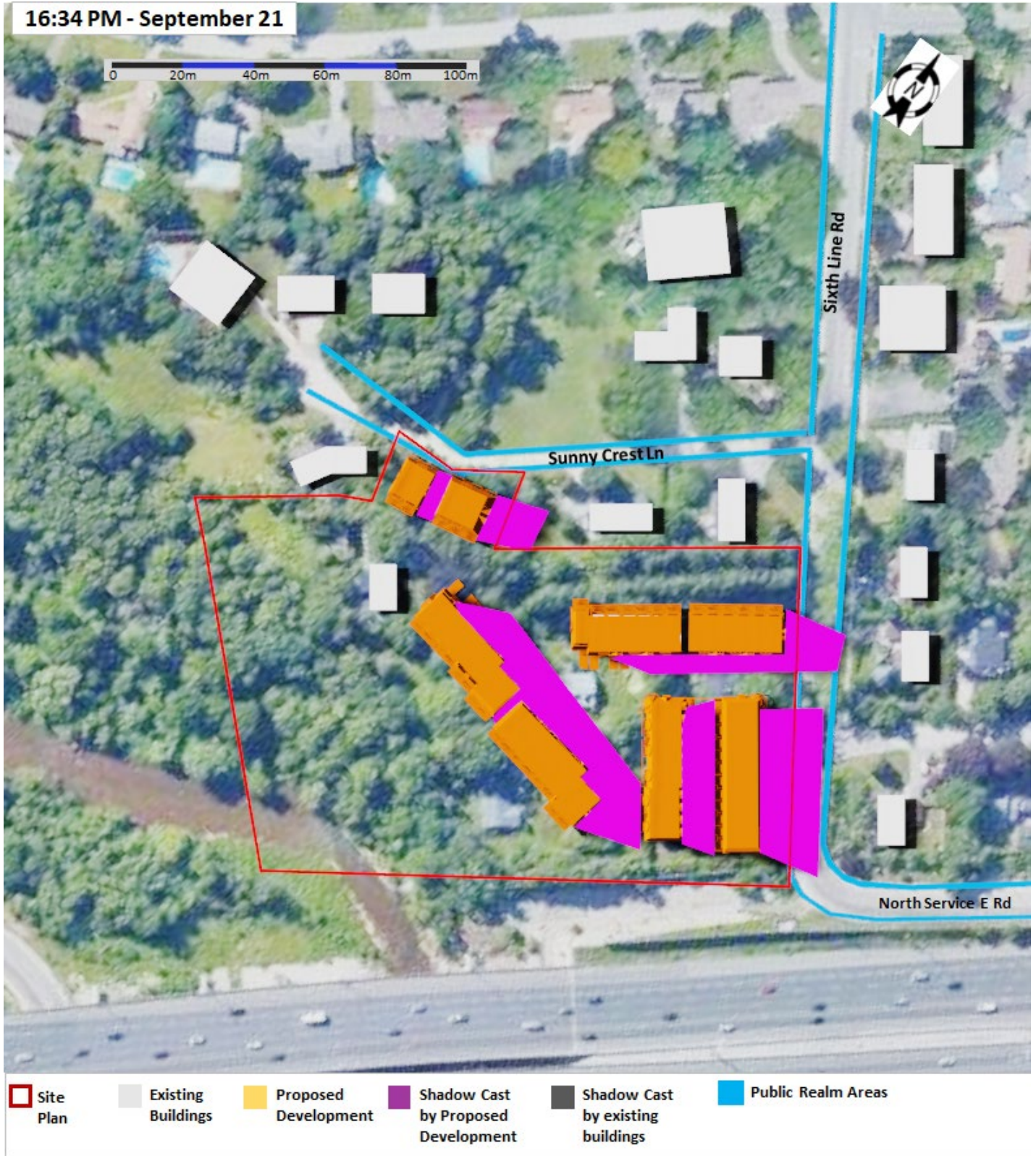
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

15:34 PM - September 21



16:34 PM - September 21

0 20m 40m 60m 80m 100m



17:34 PM - September 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

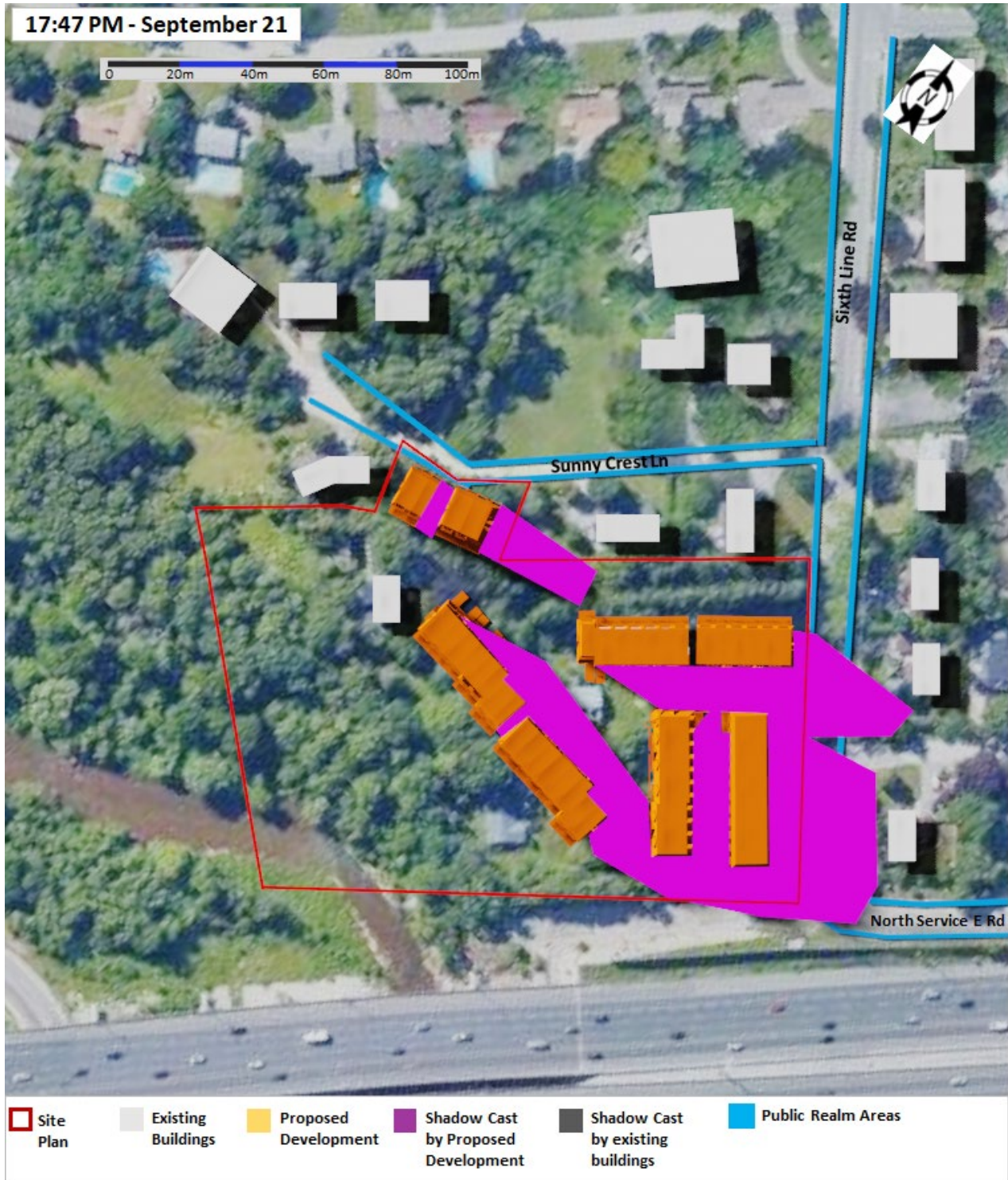
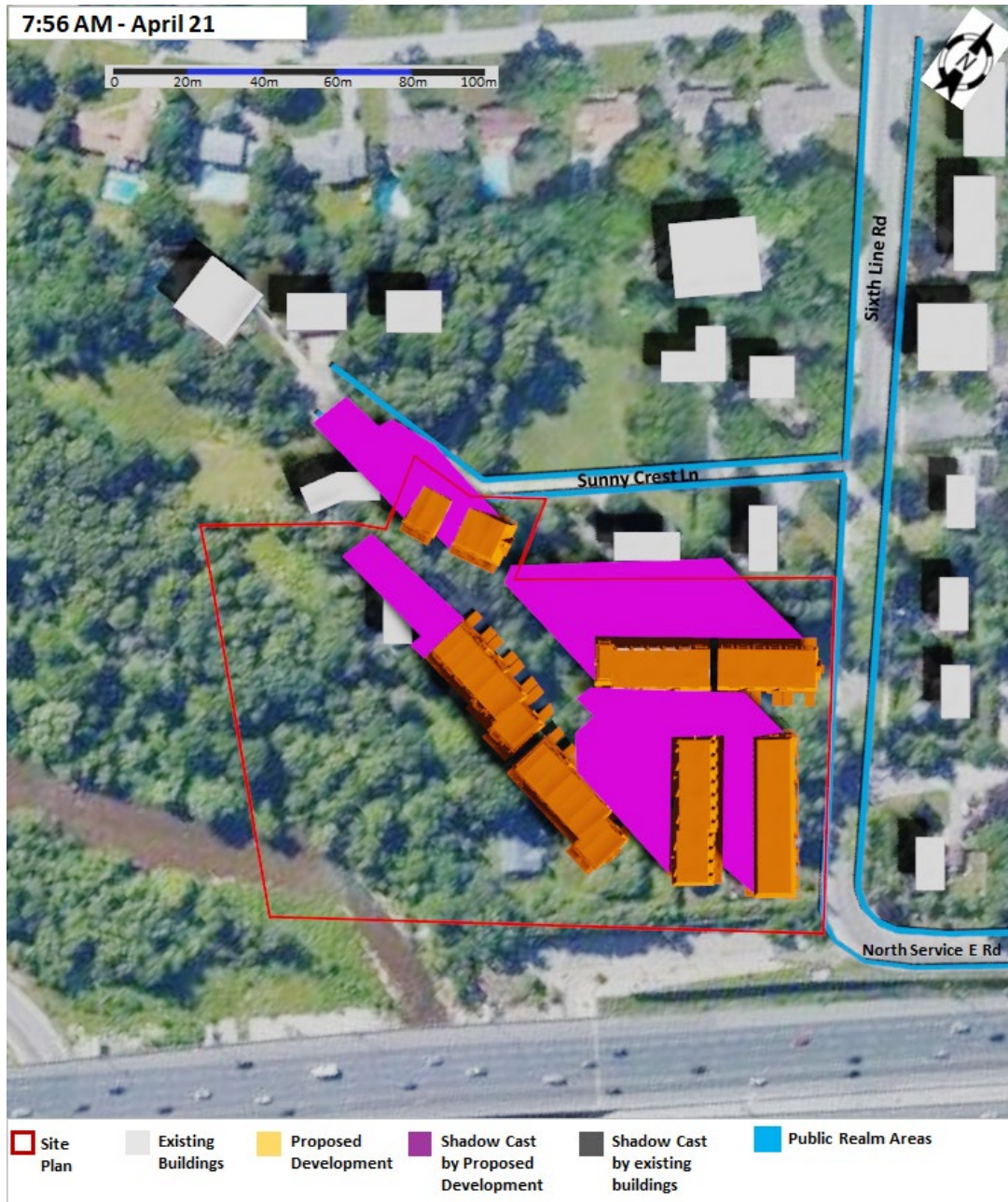


Figure 11: Shadow Patterns at Public Realm (sidewalks) – September 21st.

According to the TOR, the criterion is met if the public park receives at least 5 hours of continuous sunlight per day. As shown in **Figure 13** above, the shadow impact analysis demonstrated that the landscaping area receives at least 5 hours of continuous sunlight per day. As such, the criterion is met.

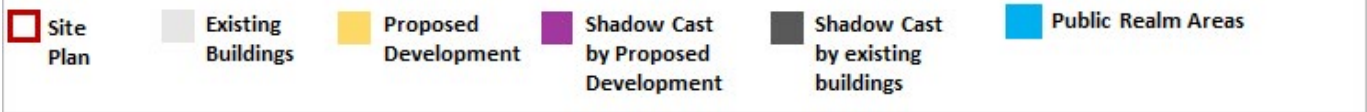
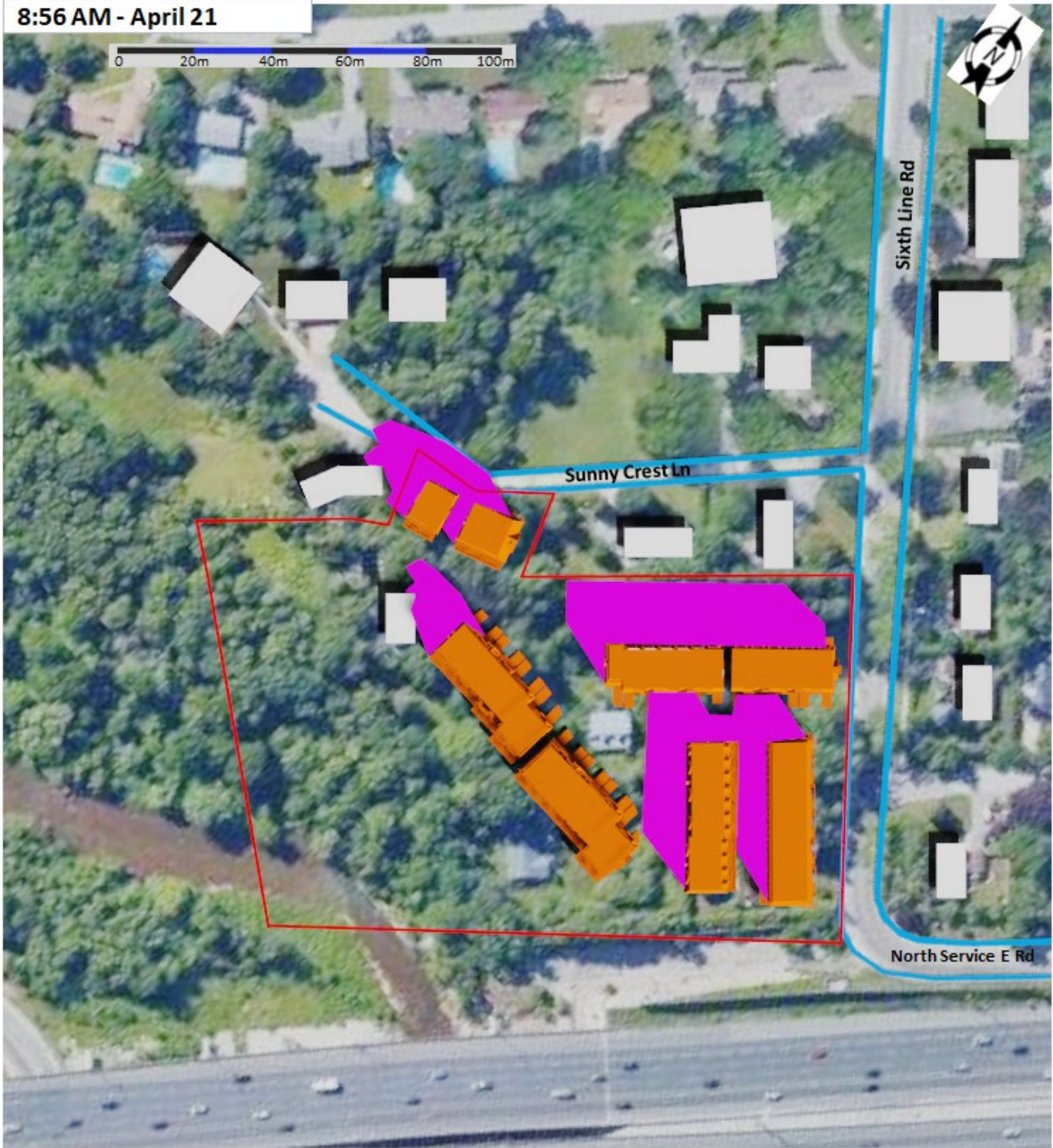
1.9 SHADOW ANALYSIS RESULTS FOR APRIL 21

The model results of shadow patterns for spring equinox from 7.56am to 6.39pm are shown in **Figure 14**. As shown in this **Figure 14**, the new shadow (purple color) represents the shadow due to the Development. The footprint of the Development is represented by the orange color. For the spring 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 south-east sides of the Development to reach a maximum length near the sunset hours.



8:56 AM - April 21

0 20m 40m 60m 80m 100m



9:56 AM - April 21

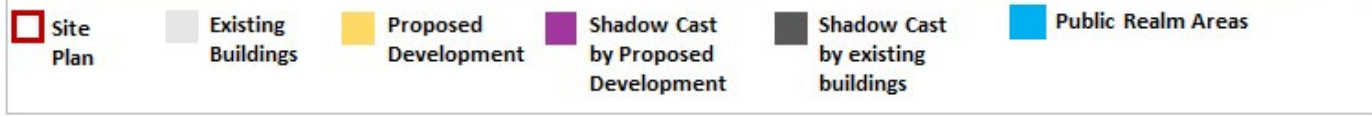
0 20m 40m 60m 80m 100m



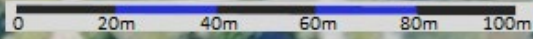
Sixth Line Rd

Sunny Crest Ln

North Service E Rd



10:56 AM - April 21



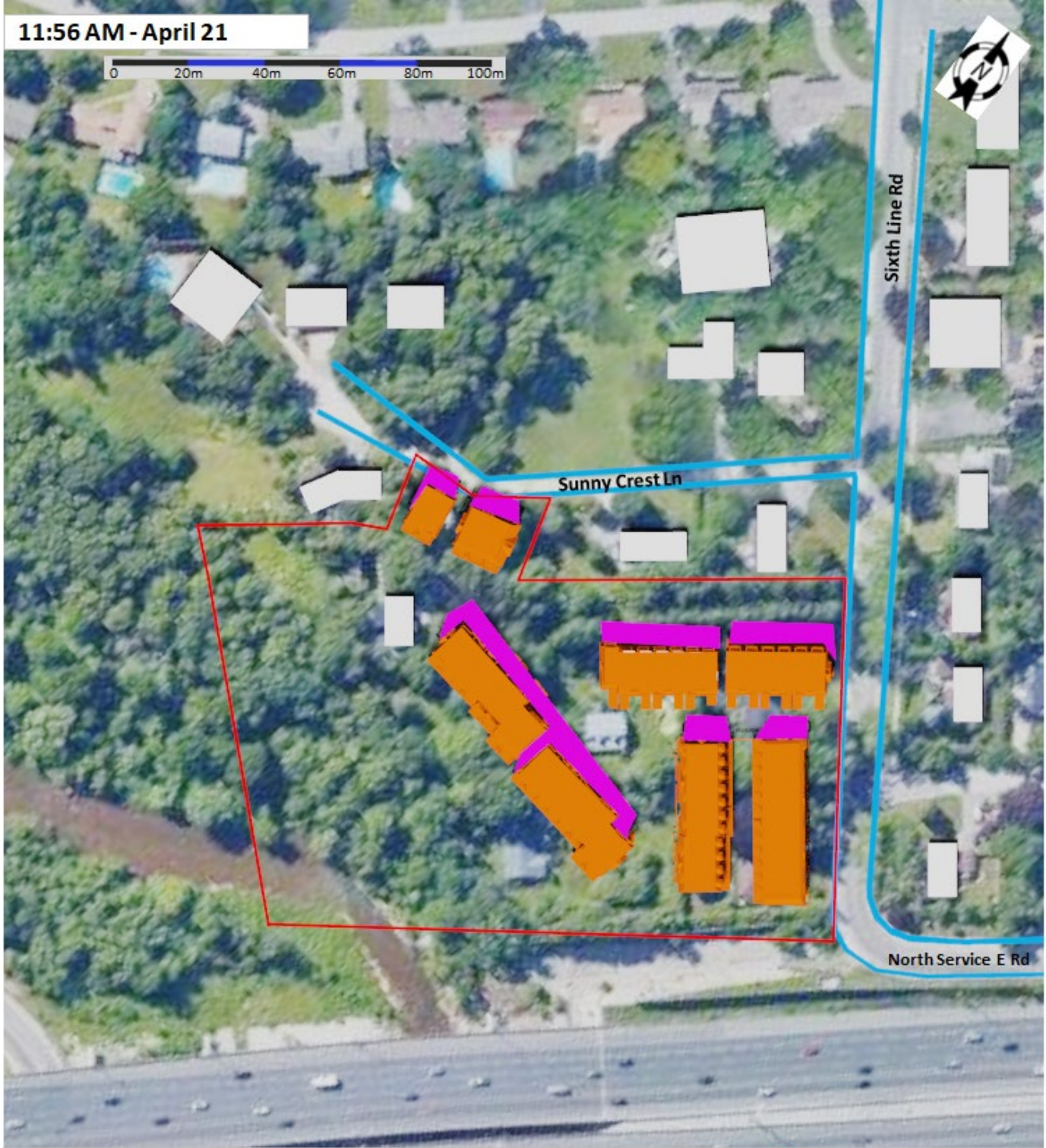
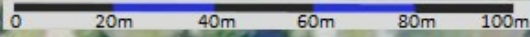
Sixth Line Rd

Sunny Crest Ln

North Service E Rd

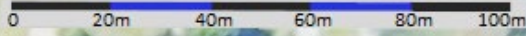
- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

11:56 AM - April 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

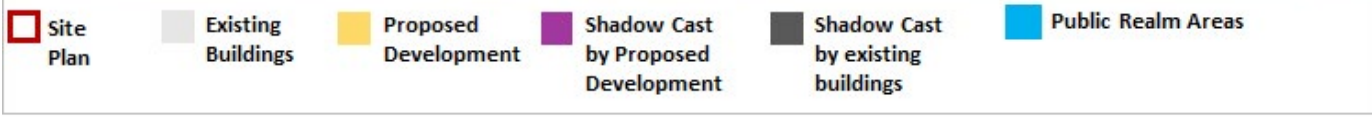
12:56 PM - April 21



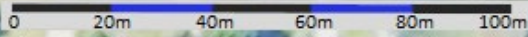
Sixth Line Rd

Sunny Crest Ln

North Service E Rd



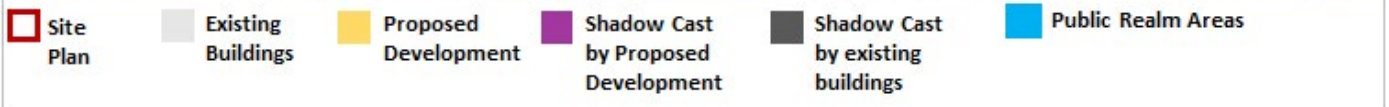
13:56 PM - April 21



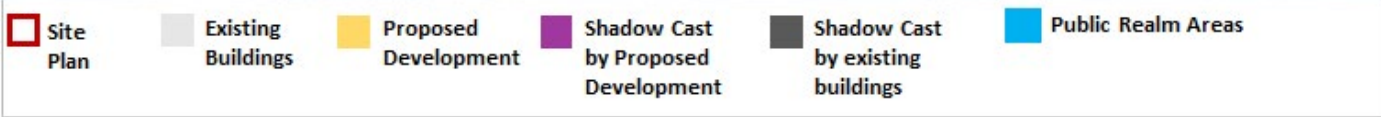
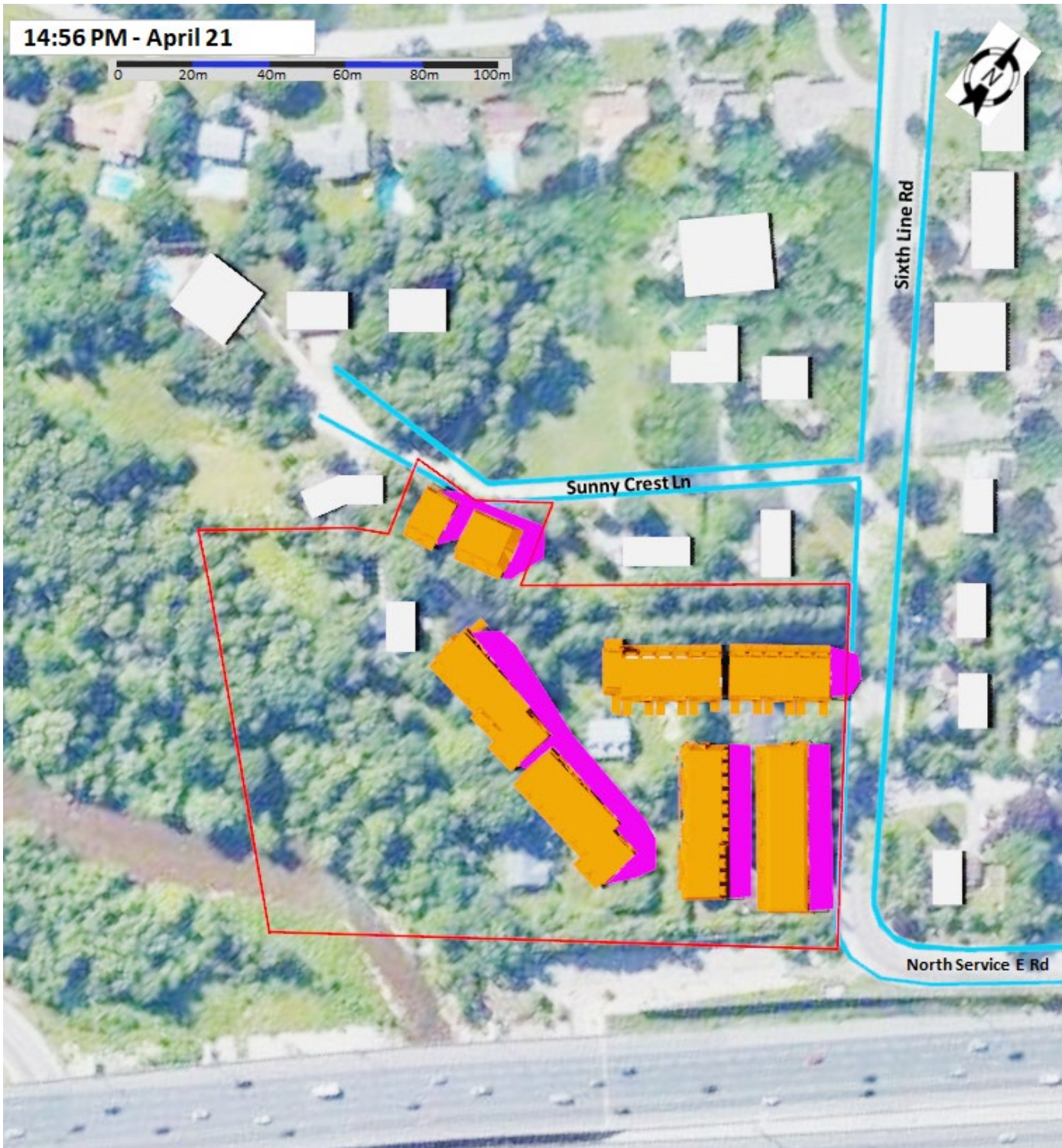
Sixth Line Rd

Sunny Crest Ln

North Service E Rd

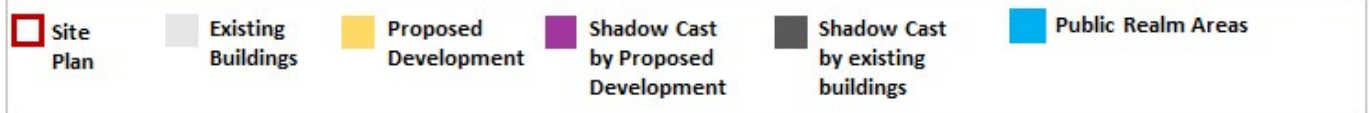
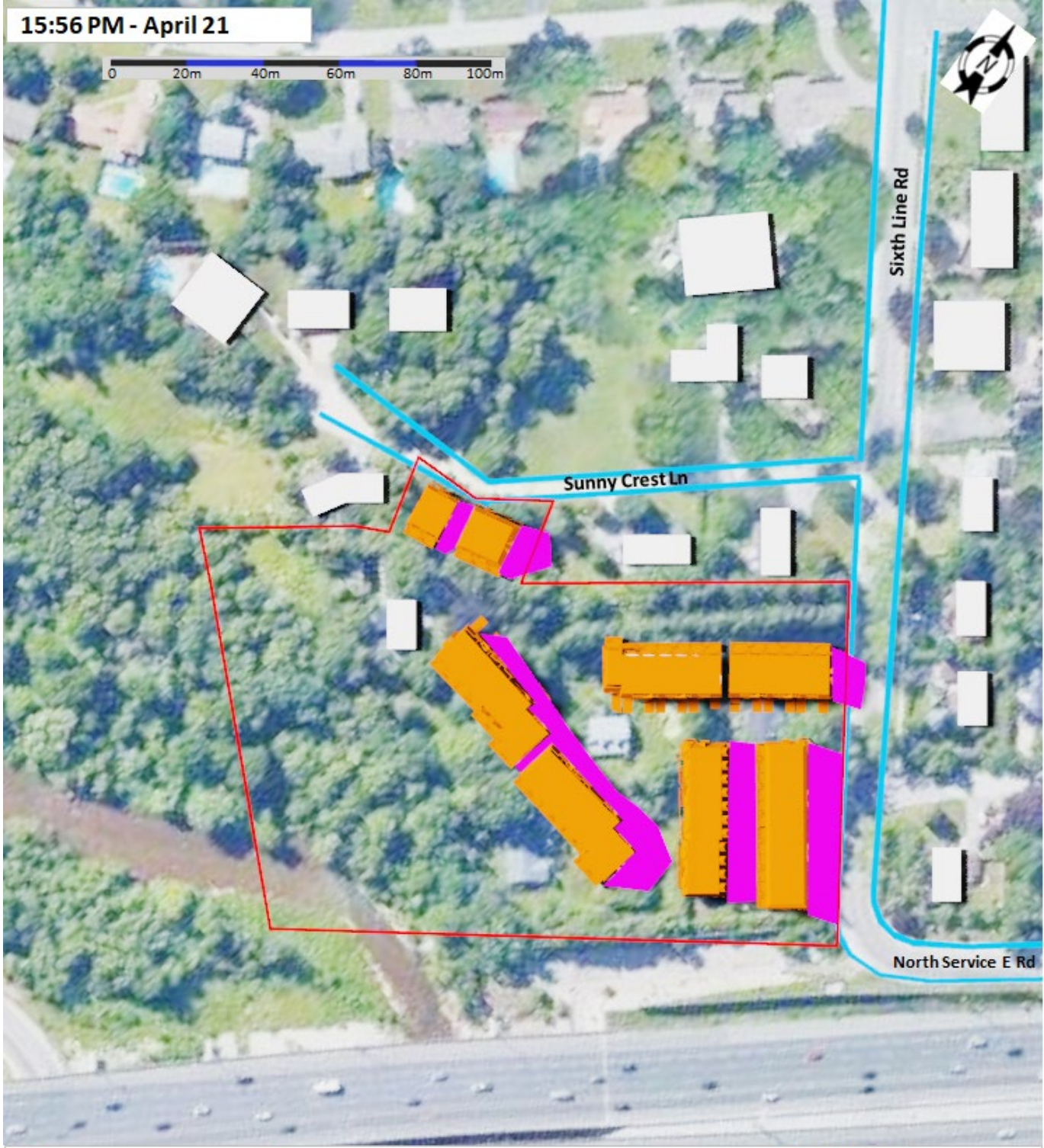


14:56 PM - April 21



15:56 PM - April 21

0 20m 40m 60m 80m 100m



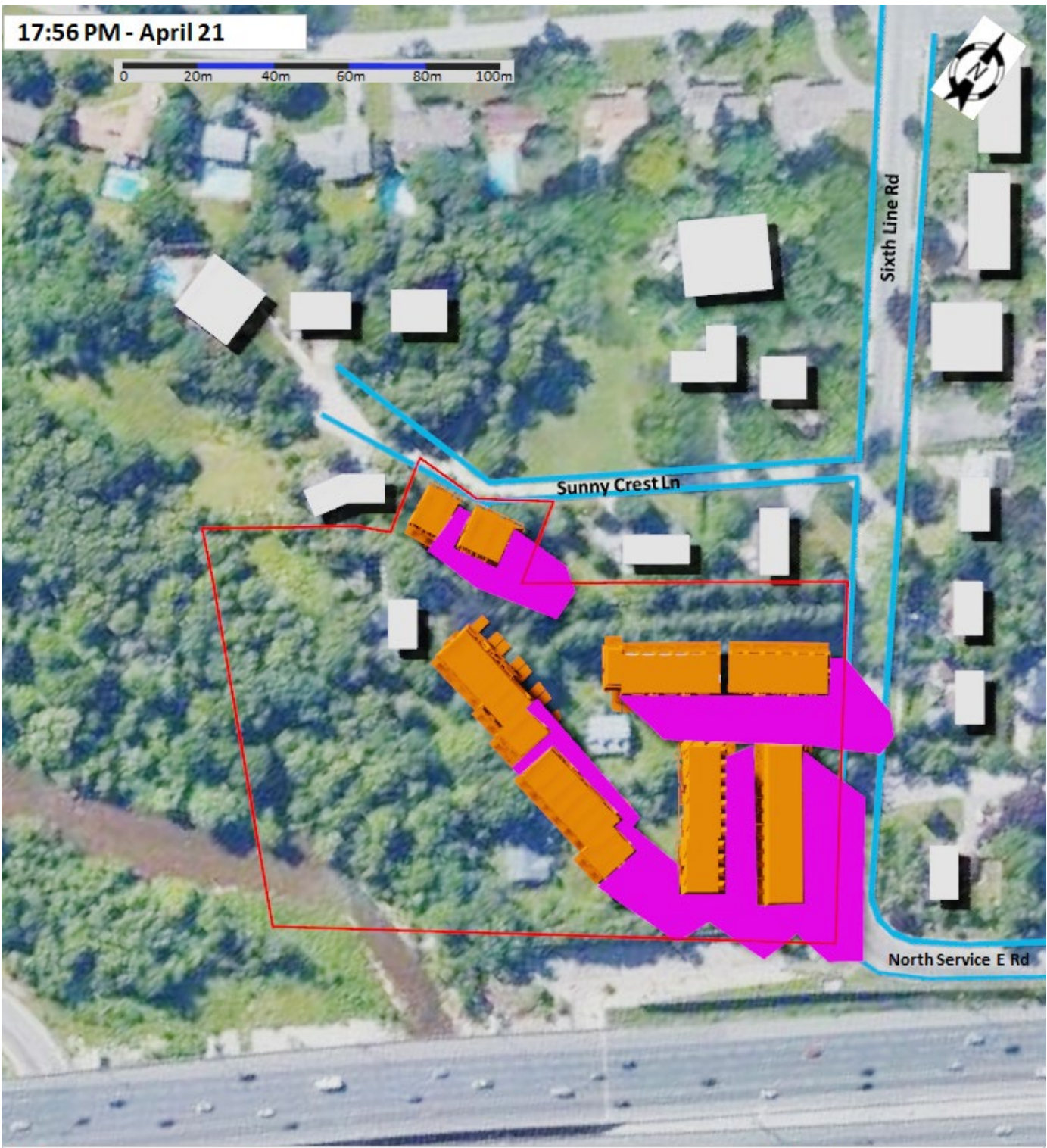
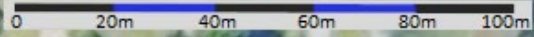
16:56 PM - April 21

0 20m 40m 60m 80m 100m



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

17:56 PM - April 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Public Realm Areas

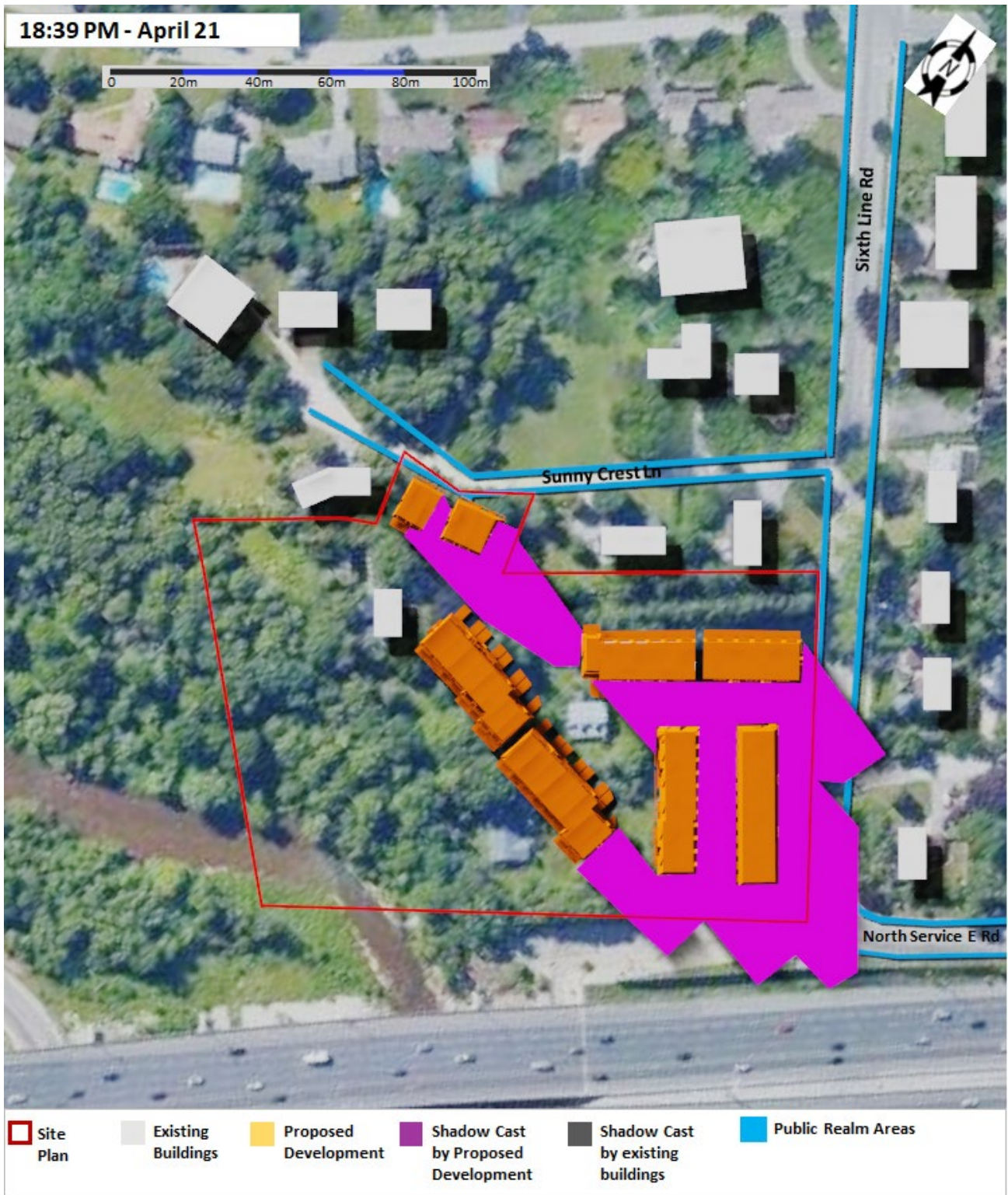


Figure 12: Shadow Patterns at Public Realm (sidewalks) – April 21st.

According to the TOR, the criterion is met if the public park receives at least 5 hours of continuous sunlight per day. As shown in **Figure 14** above, the shadow impact analysis demonstrated that the landscaping area receives at least 5 hours of continuous sunlight per day. As such, the criterion is met.

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

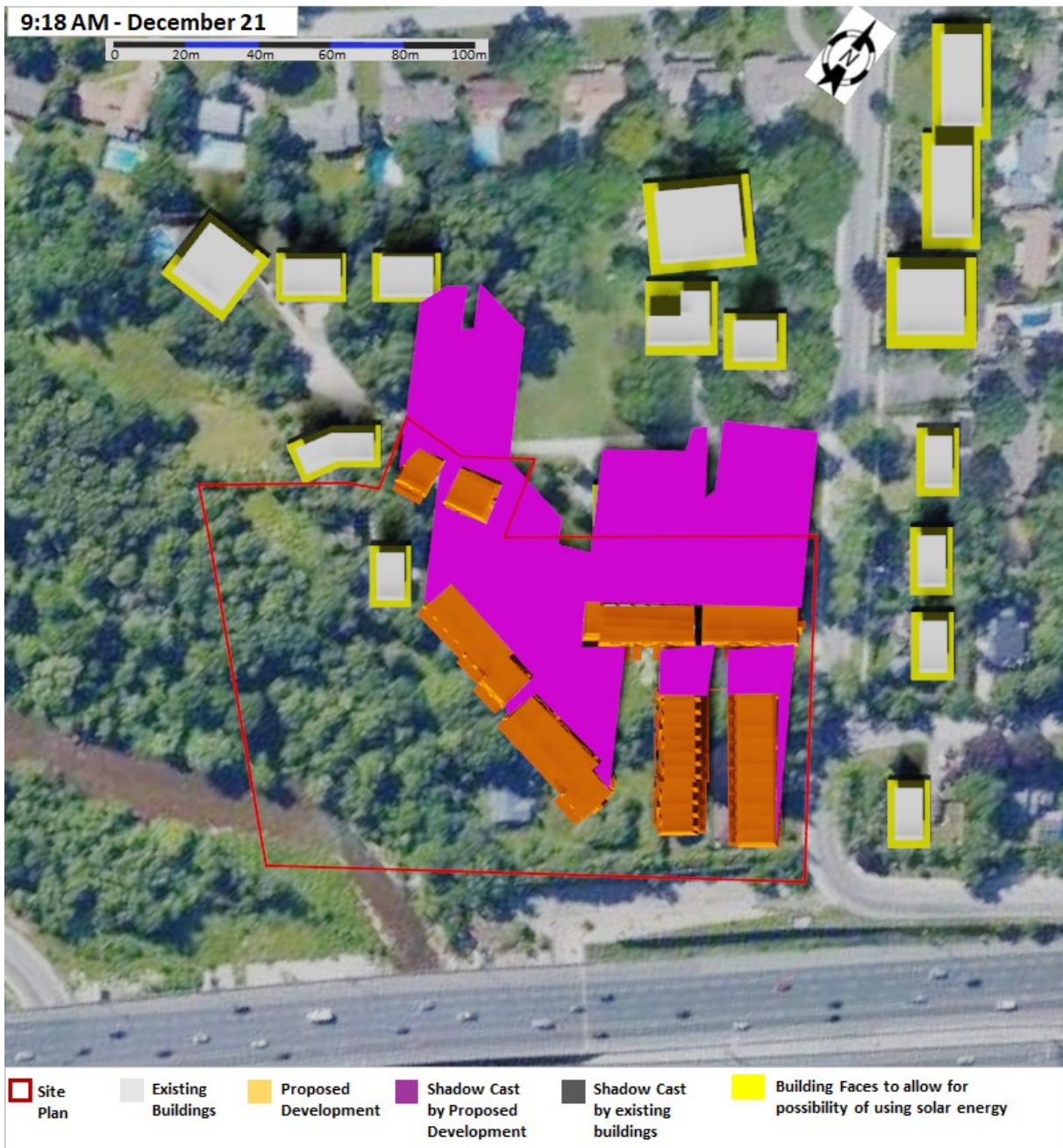
Figure 15 identifies all areas in the vicinity of the development with potential for using solar energy on the roofs, rear, front and side walls (color yellow in the **Figure 15**).



Figure 13: Building faces in the vicinity of the proposed development.

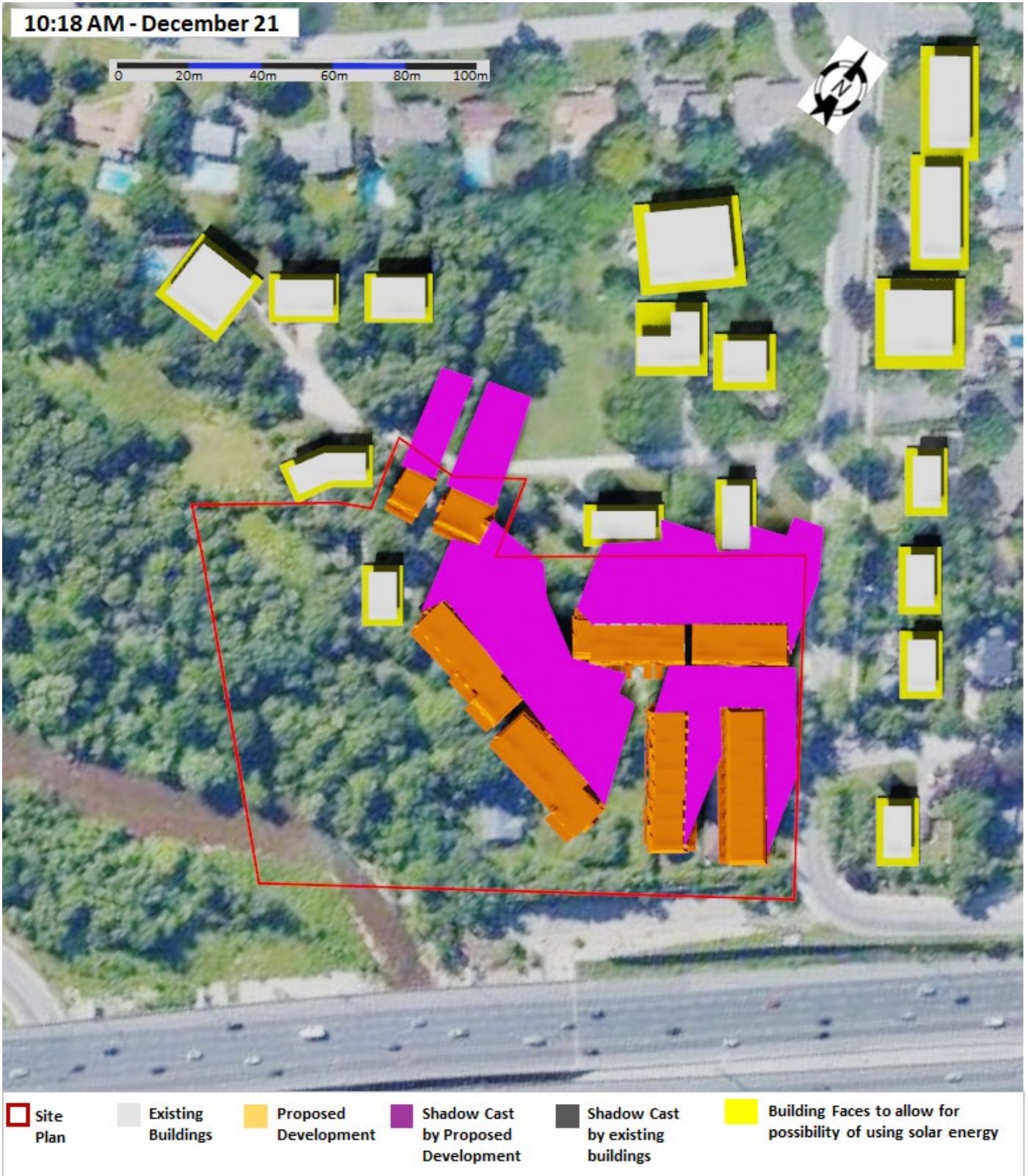
1.10 SHADOW ANALYSIS RESULTS FOR DECEMBER 21

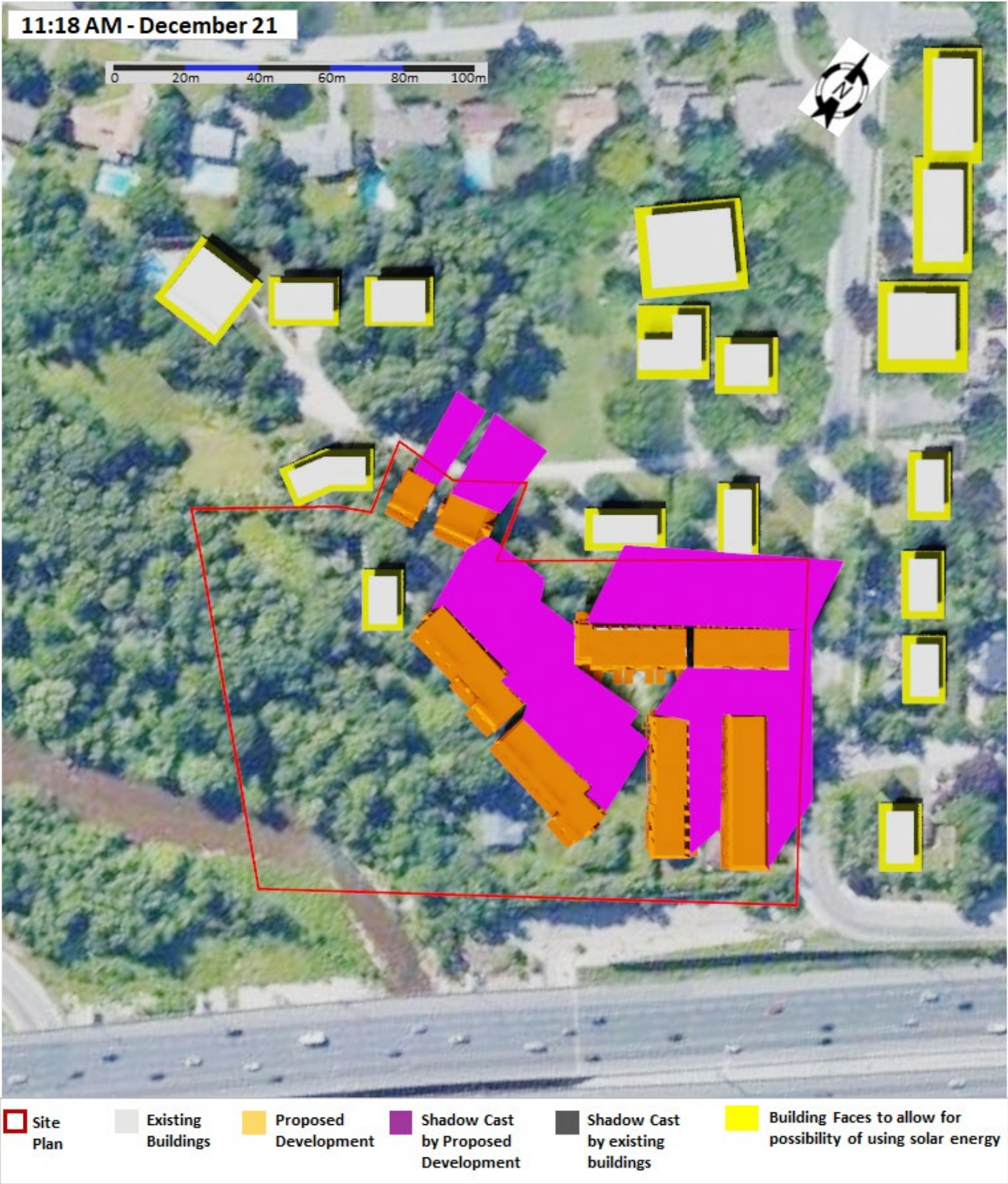
The model results of shadow patterns for winter solstice from 9.18am to 3.15pm are shown in **Figure 16**. In this **Figure 16**, the new shadow (purple color) represents the shadow due to the Development, while the existing shadow represent the shadow due to the existing buildings. The footprint of the Development is represented by the orange color. For the winter solstice, 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. This coverage shortens once the sun moves towards the noon hour. The shadow coverage extends on the east side of the Development to reach a maximum length near the sunset hours.



10:18 AM - December 21

0 20m 40m 60m 80m 100m





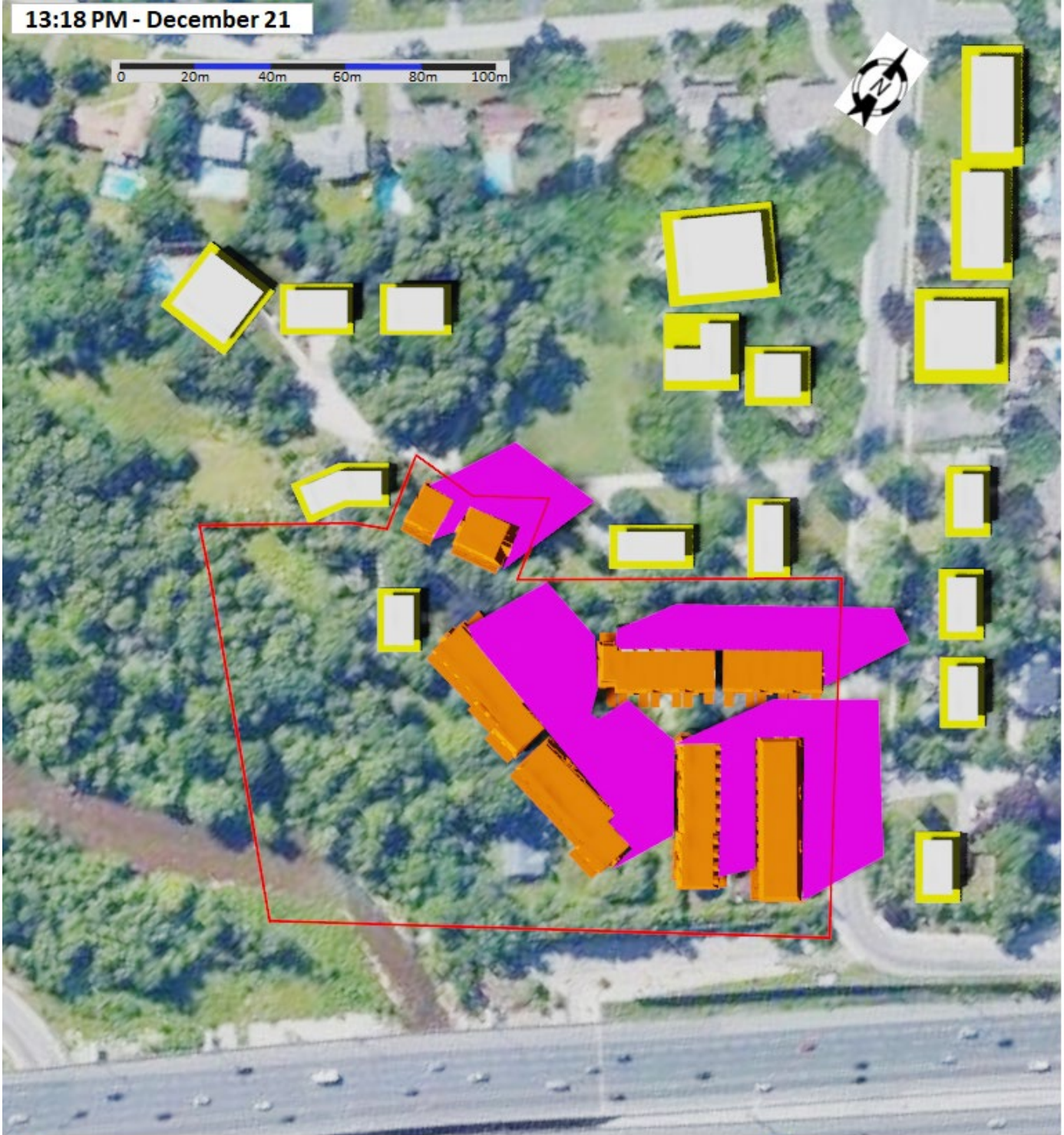
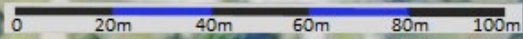
12:18 PM - December 21

0 20m 40m 60m 80m 100m

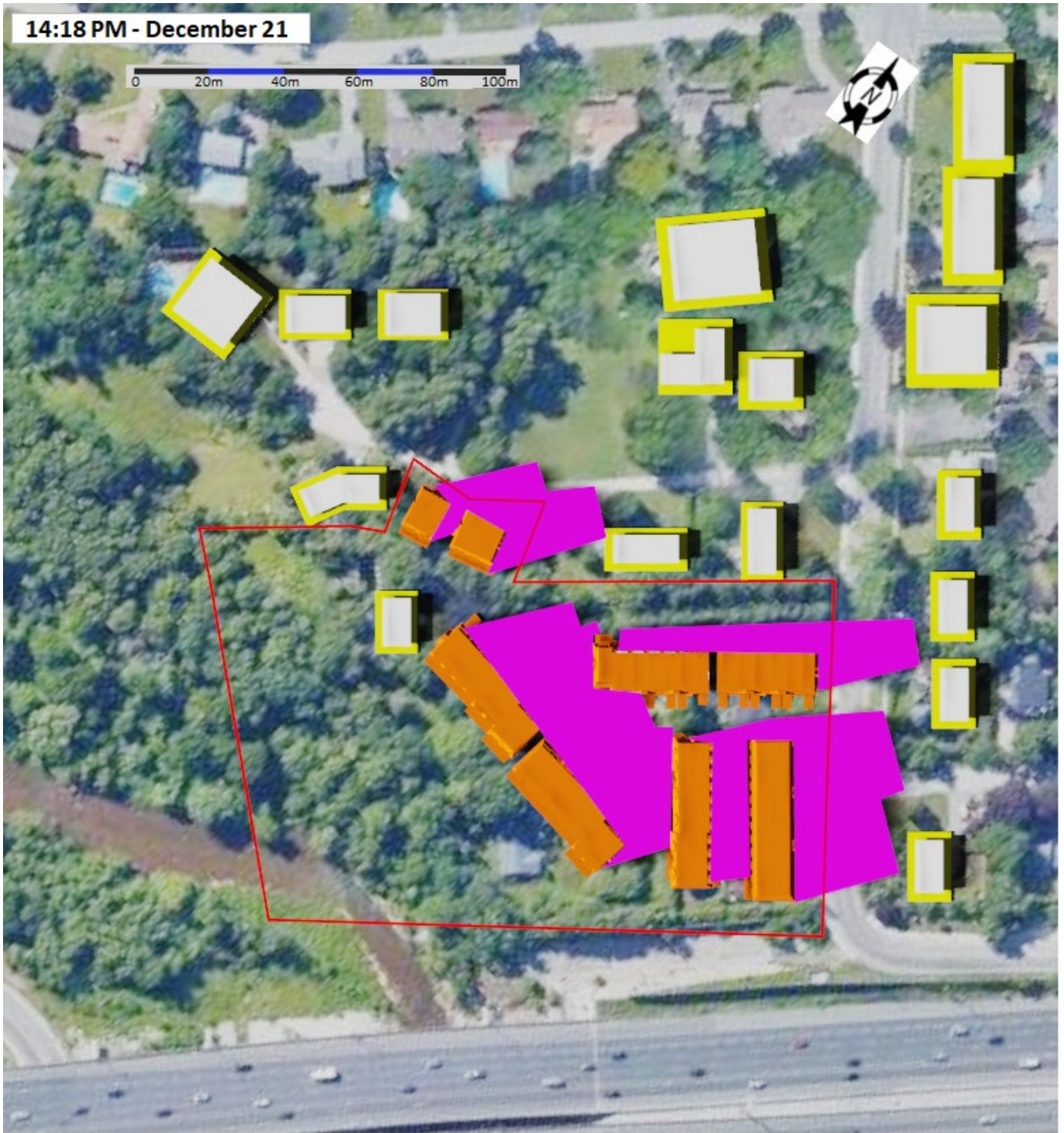
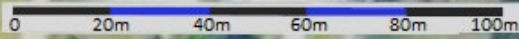


- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Building Faces to allow for possibility of using solar energy

13:18 PM - December 21



14:18 PM - December 21



- Site Plan
- Existing Buildings
- Proposed Development
- Shadow Cast by Proposed Development
- Shadow Cast by existing buildings
- Building Faces to allow for possibility of using solar energy

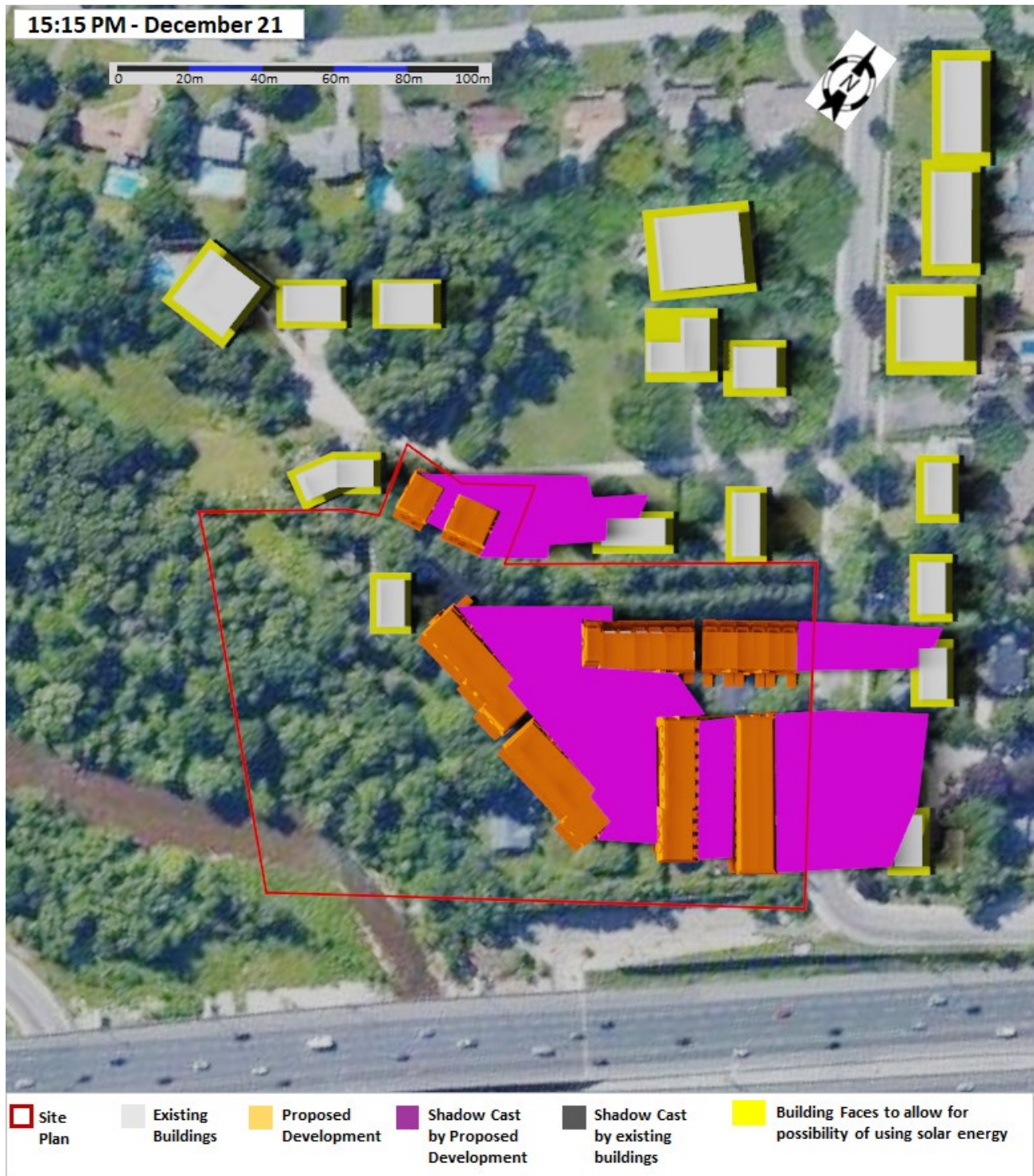


Figure 14: Shadow Patterns at Building Faces – December 21st.

As per the TOR, the criterion is met if the shadow cast from proposed development should not linger no more than two consecutive hourly test times during the day. As shown in **Figure 16** 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 criterion. As such, the criterion is met.