BUROHAPPOLD ENGINEERING

TfL Landholdings at Northwood

Wind Assessment

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Glossary

Term	Definition
CFD	Computational Fluids Dynamics
LCC	Lawson Comfort Criteria

Executive Summary

This report details the findings of the Wind Assessment completed for the proposed development of TfL Landholdings at Northwood. The purpose of the study is to consider the potential impact of the proposed development upon local wind patterns within and around the Site, with an emphasis on the impact of wind on the comfort and distress of pedestrians.

The report provides full details of the methodologies, assumptions and limitations of this study. It also contains a full discussion of the predicted impacts and subsequent effects.

A qualitative assessment of wind effects has been performed for the development. The assessment is based on a desk study and is experience-based and reviews the most onerous prevailing wind directions. The assessment has been carried out to support the full and outline planning applications.

This report has been prepared to support the Hybrid planning application for comprehensive redevelopment of the site comprising full planning permission involving demolition of existing buildings to provide 94 residential units (C3) and associated car parking, 1,240 sq m of new commercial space comprising up to 250 sq.m A1 (food), up to 500 sq.m (A3), up to 50 sq.m (D1) and the remaining floorspace as flexible A1 (non-food)/A2 uses; a new operational railway station (sui generis) with step free access and associated station car parking; new bus interchange and a new piazza. Outline planning consent for up to 34 residential units, car parking (all matters reserved apart from access) and refurbishment works to existing retail units along Station Approach.

The development will bring new pedestrian activities into the Site in areas such as the public square and roof gardens; landscape is likely to ensure that these external areas are suitable for their intended uses, i.e. sitting or standing.

The introduction of the proposed development is not likely to result in considerable wind acceleration and providing shelter to areas to the east. Some areas are expected to result in wind corner accelerations and façade downwash, however these effects are not considered to be significant and are considered to be negligible. The wind speeds experienced on the site will generally be within acceptable limits for comfort and are not considered to be distressful.

Wind speeds will be within safe limits. Only in extreme gales will there be difficult conditions for pedestrians, however due to the moderately low height of the buildings that form the development it is unlikely that conditions will be above the safety threshold shown in Table 1-2.

When compared to the baseline, the effects of the proposed development are likely to be minor beneficial to negligible.

1 Introduction

1.1 Introduction

This wind desktop assessment has been prepared by Buro Happold Limited on behalf of Transport for London. A qualitative assessment of wind effects has been undertaken on the proposed Green Lane development in London. The assessment is based on a desk study and is experience-based. The proposed development is not expected to change conditions on site significantly as the buildings are low in height (i.e. below 10 stories). Corner accelerations and façade downwash, is likely to be minimal, these effects are not considered to be significant, i.e. there are not safety issues on site.

The development will bring new pedestrian activities into the site in areas such as the public open space and private courtyards; the landscape is likely to ensure that these external areas are suitable for their intended uses, i.e. sitting or standing.

The study was performed at the latest stage of design and considered the heights and massing of the proposed buildings.

1.1.1 National Planning Policy

There are no national codes of practice or legislative policies relating to the assessment of environmental wind flows in the built environment. The impact of environmental wind on pedestrian spaces and the subsequent suitability of these spaces for planned usage are described by the Lawson Comfort Criteria (LCC) (Ref 1), which are recognised by Local Planning Authorities (LPAs) as a suitable benchmark for wind assessments. LCC is applied in the wind assessment of the Application Site.

1.1.2 Regional Planning Policy – London Plan

Existing regional policies relate to Tall buildings, as the current and proposed buildings are not consider to be Tall buildings, no policies are referenced within this report.

1.1.3 Local Planning Policy

The London Borough of Hillingdon does not have a known policy that relates to tall buildings.

1.2 Design Criteria (Standards)

Locations within a development can be assessed for comfort and safety. Both are related to the pedestrian, the former relates to the activity, and the latter to the level of distress experienced. The methodology developed at Bristol University can be used in the detailed stage of the development by using quantitative analysis by means of Computational Fluid Dynamics (CFD) and/or Wind Tunnel studies. These criteria have been widely accepted for these types of studies and are comparable with international guidance. The criteria have been developed around the Beaufort scale, extending its applicability to environments in and around buildings. The comfort and safety scales are indicated in Table 1- 1 and Table 1-2 respectively.

Table 1—1 Comfort Scales

Comfort Scales		
Wind Speed Category	**Wind Speed Range (m/s)**	**Tolerable Activity**
A	0 - 4	Pedestrian sitting for extended periods, in the vicinity of entrance doors
B	4 – 6	Pedestrian standing i.e. standing/sitting for a short time
C	6 – 8	Pedestrian walking i.e. strolling
D	8 – 10	Business walking (walk through – i.e. walking from A to B), Includes cyclists

Table 1—2 Safety Criteria

Criteria	**Frequency of wind speeds occurrences**	**Mean wind speed**	**Activity**
Comfort	<5%	9.09 m/s	All pedestrian Activities
Safety	<0.1%	15.0 m/s	All pedestrian Activities

For every study, different pedestrian walking areas can be identified, for example:

- Roads;
- Pedestrian areas around buildings;
- Pedestrians walk through;
- Pedestrians standing; and
- Seating areas.

Comfort will strongly depend on the individual activity. For that reason, the table is defined separately for each activity in terms of an average or gust wind speed exceeded for no more than 5% of the time.

For safety, the scale is defined for no more than 0.1% of the time. This corresponds to 9 hourly occurrences within a year for a value of the mean wind speed not exceeding 15m/s.

1.3 Identification of Potential Issues

To identify any changes in the microclimate, the development, immediate surrounding environment and building structures need to be studied. This is a subsection of a larger region, which represents the broader urban environment. The elements of this type of study that will affect the wind environment are:

- Building form, shape, height, location and orientation;
- Surrounding areas and local terrain topography (photographs);
- Local wind climate;
- Landscape (trees, fences, hedges);
- Effects of the proposed development on the surrounding pedestrian areas; and
- Construction stages of the buildings that form the scheme and surrounding developments.

The assessments made are based on an assessment of the site wind conditions, coupled with an experience-based assessment of likely wind conditions. As such, the assessment is qualitative.

In line with common UK practice in Wind Engineering, the method used relates to the Lawson method (2001).

1.3.1 Baseline Studies

Baseline conditions have been assessed using the same criteria as the proposed development, as described below. The assessment is based on historical wind records and an analysis of the surrounding terrain.

1.3.2 Impact Magnitude

Likely wind conditions are judged based on experience of similar developments. This analysis includes an assessment of building form, layout and relative massing as well as site landscaping and topography.

1.3.3 Receptor Sensitivity

The key receptors in this case are pedestrians using the site. Sensitivity to strong winds is dependent upon activity and, in line with the Lawson method, the following activity classes are used, in order of increasing sensitivity:

Table 1—3 Urban Pedestrian Activities for Sensitivity Evaluation in Order of Increasing Sensitivity

Receptor Sensitivity	Activity
Low	Roads and car parks
Low	People around buildings
Low / Moderate	Pedestrian walk-through
Moderate	Pedestrian standing
Moderate / High	Entrance doors
High	Sitting

1.4 Significance Evaluation

Where wind impacts are identified, their significance is judged in terms of the likely effect on planned activities, in terms of the Lawson assessment method. This is a function of the receptor sensitivity and the magnitude of the impact and results in a classification as follows:

Table 1—4 Significance

Impact Significance	Description
None	No change in wind conditions
Negligible	Wind conditions are likely to be suitable for the intended activity
Minor adverse	Wind conditions are likely to be tolerable for the intended activity
Moderate adverse	Wind conditions are likely to be classed uncomfortable for the intended activity but safety is unlikely to be compromised
Major adverse	Safety concerns are likely.

The criteria used to assess the magnitude of the wind impacts are as follows:

Adverse – detrimental or negative impacts to an environmental resource or receptor compared with the baseline; and

Beneficial – advantageous or positive impact to an environmental resource or receptor compared with the baseline.

2 Methodology

This section defines the different aspects of this type of study. Consideration was given to the characteristics of the local area to facilitate assessment. A wind frequency analysis of the site was carried out. From this analysis wind directions are selected and analysed. The results of this assessment are then available to assist the overall design process.

A site survey has been carried out to facilitate appropriate site topography and building height of the baseline situation.

2.1 Wind Data Analysis

For analysis of wind behaviour, it is necessary to know the relevant wind data and temperature data for the case. Velocity fluctuation and directional variance are hard to measure with great accuracy.

Both wind speed frequency and its direction are required. This data is commonly presented in the form of wind speed and wind frequency distribution diagrams (wind roses). Site information for Heathrow airport is shown in Figure 2—1 (overleaf). Data is provided for average hourly wind speeds at 10m above ground level. This data is monitored and recorded from meteorological stations all over England and reported by the Met office.

Heathrow airport forms part of the national network of weather stations maintained by the UK Met Office, internationally recognised as one of the best sources of reliable meteorological information. To assess wind frequency, 10 years of historical wind speed data was used. The weather station at Heathrow has moved twice since 2002 so to obtain consistent results, data from 1992-2002 was reviewed.

The wind rose is shown in Figure 2—1 (overleaf). This shows the direction the wind is blowing from, with long bars representing frequent winds and colour representing magnitude of wind speeds.

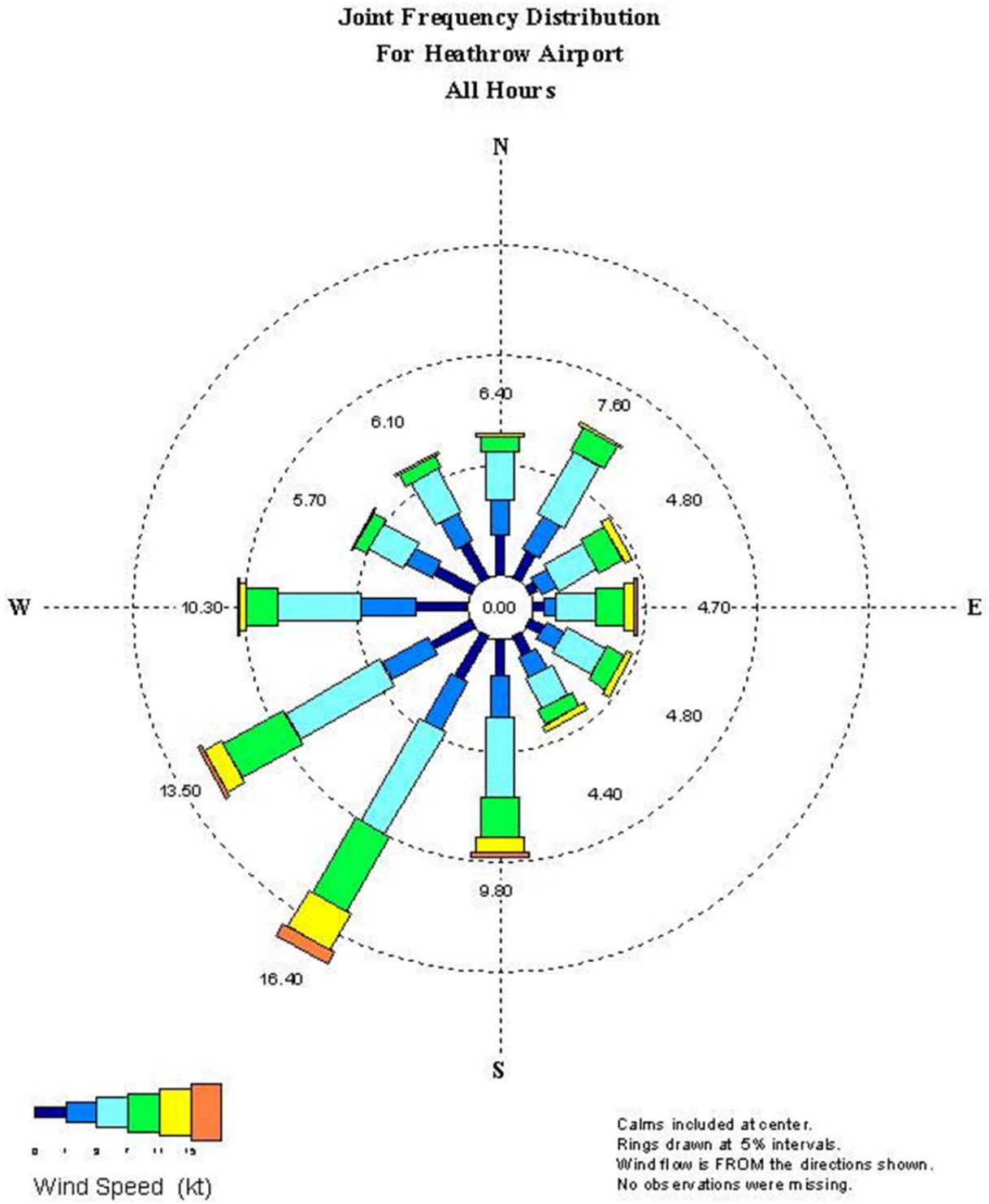

Figure 2—1 Annual Wind Rose for Heathrow at 10m.

The seasonal wind rose plots are shown in Figure 2—2. South-westerly winds are the prevailing direction for all four seasons. The largest wind speeds occur during the winter.

During the winter there are some contributions from the north-east. Wind speeds are generally highest in the winter and spring with the seasonal pattern showing a very similar range of directions for winter, spring and autumn. Summer has southerly and westerly prevailing winds with the largest speeds from the south.

The data has not been translated to meteorological standard terrain (open country) as the project site is very close to the MET station. The project site is located around 15 km from Heathrow, it is assumed the Heathrow wind data will be representative to the conditions at the project site, it is a conservative assumption as Heathrow airport is likely to be more exposed to prevailing winds.

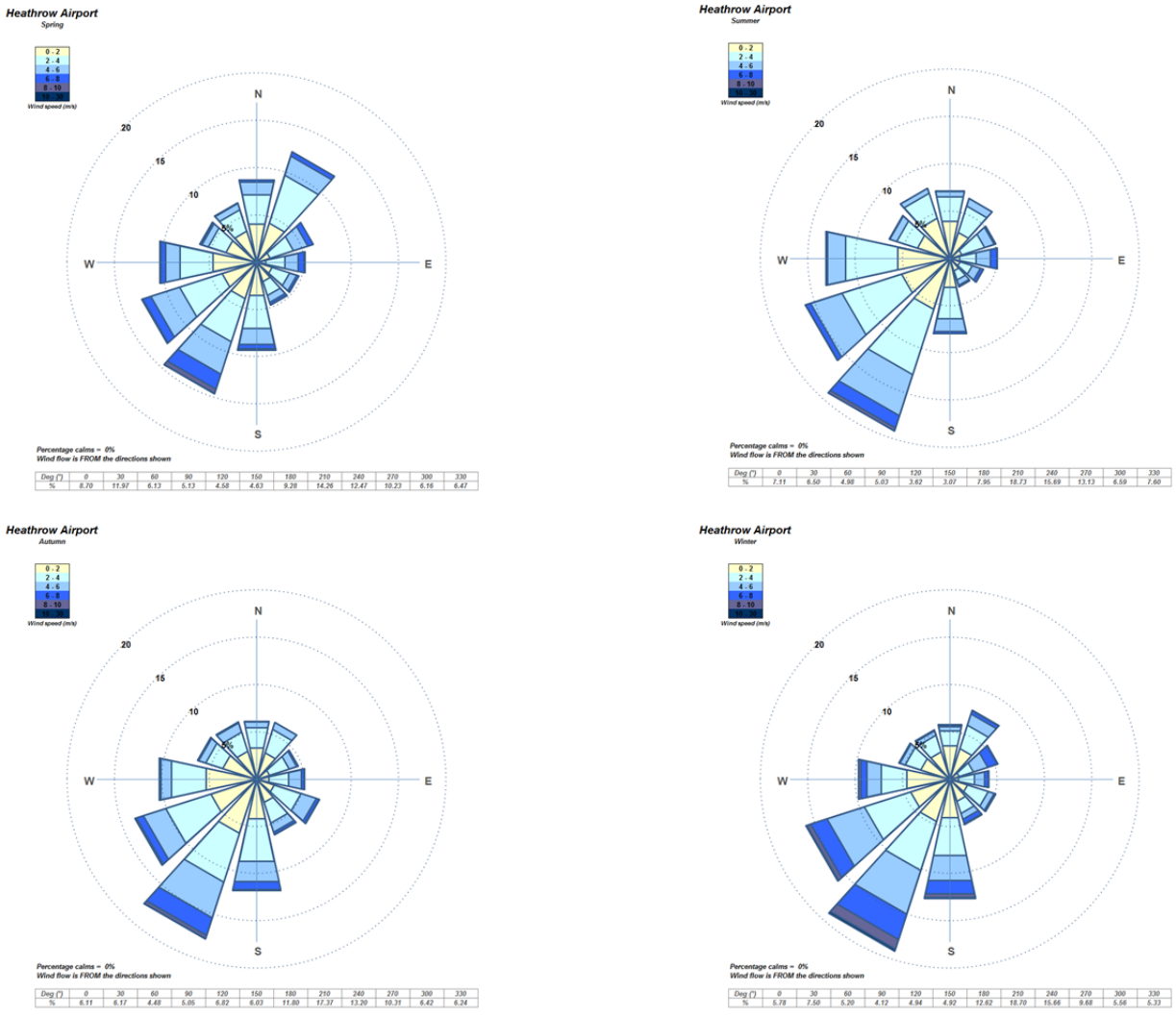

Figure 2—2 Heathrow Airport Seasonal Wind Roses.

2.2 Site Exposure

In the baseline condition, the site is surrounded by low height buildings between 1 to two stories in all directions. There is a change in ground height of 5 meters from the bottom of Station Approach to Green Lane, the site may be partially open to the south, and south-west resulting in possible exposure to strong winds from these directions. Northwood is surrounded by open land to the Southwest around 800m from the site. Analysis of wind speeds on site suggests that pedestrian level conditions in exposed areas can still be considered suitable for pedestrian walking for much of the year**.** It can be shown that the prevailing wind direction for the site is strongly from the south and southwest throughout the year (around 13% and 16.3 % of the time). There is also a moderate occurrence of wind from the northeast in the Winter.

3 Site Location and Topography

3.1 Site Location

The proposed development is located to the northwest of London. The site is located on the junction of Green Lane (B469) and Eastbury Road within the London Borough of Hillingdon (LBH).

The site comprises land north and south of Green Lane including part of the highway. The area of land north of Green Lane comprises a parade of single storey retail units located over the railway bridge with a two storey adjoining unit on the corner of Eastbury Road. The northern part of the site is bounded by the Eastbury Surgery to the north; Green Lane to the south; Eastbury Road to the east and the retail units on the bridge to the west.

The site is 1.91 ha. The majority of the site lies south of Green Lane, in Northwood and comprises the existing underground station and a mix of A-Class uses, residential flats, a light industrial use, dental practice and area of surface car parking. The southern part of the site is bounded by Green Lane to the north; the London Underground compound to the south; the railway line to the east; and the rear boundaries of the Northwood Central Club, St John's United Reformed Church and residential properties fronting Hallowell Road to the west.

Most of the buildings that surround the site are within 2 to 4 storeys. Other roads close by are Murray Road to the west beyond the train tracks and Hallowell Road. We will also refer to the Station Approach as the road that is located across the site North- South. The redline application for the existing and proposed development can be seen in Figure 3—1 (overleaf) and Figure 3—2 (page 19) for the existing and proposed development. Figure 3-2 shows the full and outline planning application areas to the north (blue) and south (green) respectively.

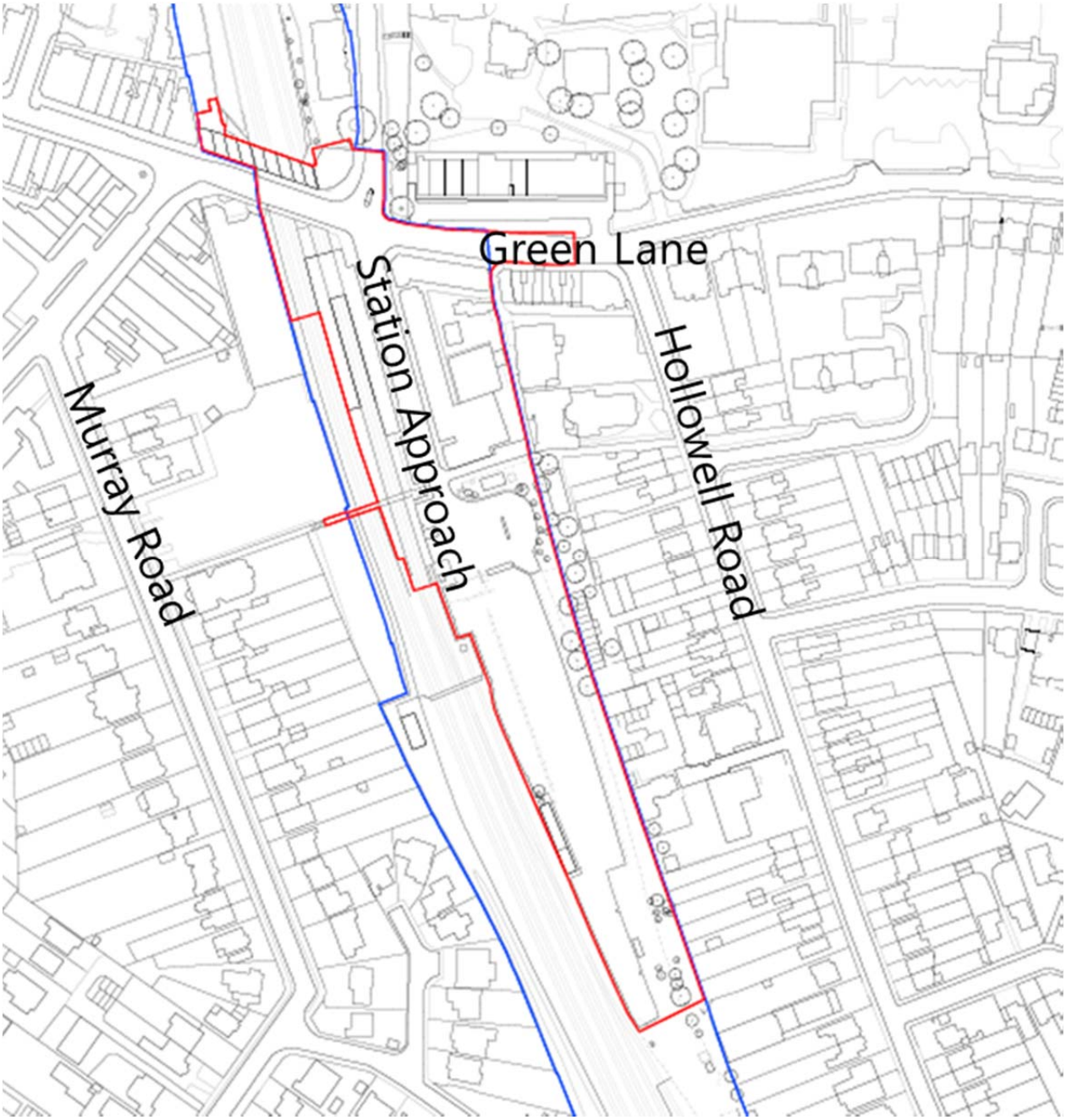

Figure 3—1 Site Location

Figure 3—2 Proposed Masterplan – Block Layouts

3.2 Terrain of the Site

The site is placed within a gentle slope downwards towards the south, difference level of around 5m. There is some open terrain on site designated for car parking.

4 Wind Effects

4.1 Baseline Condition

The baseline condition (i.e. the current site) contains smaller 2 storey buildings located to both sides of Station Approach, a car park is located at the end of the road outside the site boundary. Current conditions at the site will be windy along the Station Approach, however this will still be suitable for standing, walking etc. The windiest areas likely to be the East top of Station Approach, some wind acceleration is likely to be felt under westerly winds. The remainder of the base line condition site is likely to experience conditions suitable for all activities, and no safety issues are expected to occur. The entrance to the train station is located in a sheltered location in winter some wind acceleration is likely to occur similar to conditions in the surroundings.

Under north easterly winds, the site area may feel sheltered. However, this is again not expected to result in significantly uncomfortable conditions for pedestrians.

4.2 Proposed Development

The hybrid planning application for comprehensive redevelopment of the site comprising full planning application permission involving demolition of the existing buildings to provide residential units and associate car parking, retail and a new operational station with associated car parking, new bus interchange and a new plaza. Outline consent is for a number of residential units, car parking and refurbishment works to existing retail units along Station Approach.

For the full planning application, the effects of the proposed development is likely to be comparable to the existing situation and in some locations, like the South Plaza, will result in calmer conditions, see Figure 4-1 that shows the location of the public realm outdoor spaces. The entrance locations are shown in Figure 4-2, including the relocated Northwood London Underground Station entrance.

Figure 4-3 shows the likely impact caused by westerly winds. The western elevation of Blocks 1 to 4 are likely to be exposed to westerly winds, however due to the relative low height of the buildings the impact of this wind is likely to be negligible to areas to the west of the site. The North and South plazas are likely to be sheltered, a minor to moderate beneficial effect, this is likely to make them suitable for sitting, standing and walking for almost all the year. Some wind acceleration is likely to occur at the roof amenity area located to the southwest of Block 1, however conditions are likely to be suitable for sitting most of the time. Some corner wind acceleration is likely to occur to the southwest of Block 4, however this is likely to be of low impact or negligible.

Figure 4-4 shows the likely wind effects caused by south-westerly winds. The buildings to the west of the site (Blocks 1 to 4) are likely to offer protection to the south and north plazas from the prevailing wind. Some corner wind acceleration is likely to occur at the southwest edge of Block 4, the impact is likely to be negligible. The Roof amenity area to the southwest of Block 1 is likely to be exposed to wind acceleration due to its high position. If sitting is planned within this area, perimeter protection is likely to be required during high wind events. The area is likely to be suitable for all activities for large part of the year.

The train platform to the west of the development is likely to feel windy at times, but the impact is likely to be negligible due to the low height of the buildings that form the development.

In general some light façade downwash and corner accelerations may be experienced around west facades of the proposed development, however it is not anticipated that this acceleration will be high enough to cause pedestrians discomfort, due to the height of the proposed building and the angle to which the south-westerly wind approaches the west facade. When compared to the baseline, this effect can be considered to be negligible or beneficial. It is predicted that conditions will be suitable for standing, pedestrian walking and business walking.

Under north-easterly wind there may be downwash from the facade of the proposed development block 5 and 6 that is likely to be felt on the areas to the east of the proposed building, however this effect when compare with the baseline is likely to be negligible.

Due to the proposed height of the buildings and orientation, the proposed development is likely to be partially protected by the surrounding buildings and wind effects in general are likely to be negligible or beneficial.

The main entrances to the buildings and train station are likely to be suitable for entrances.

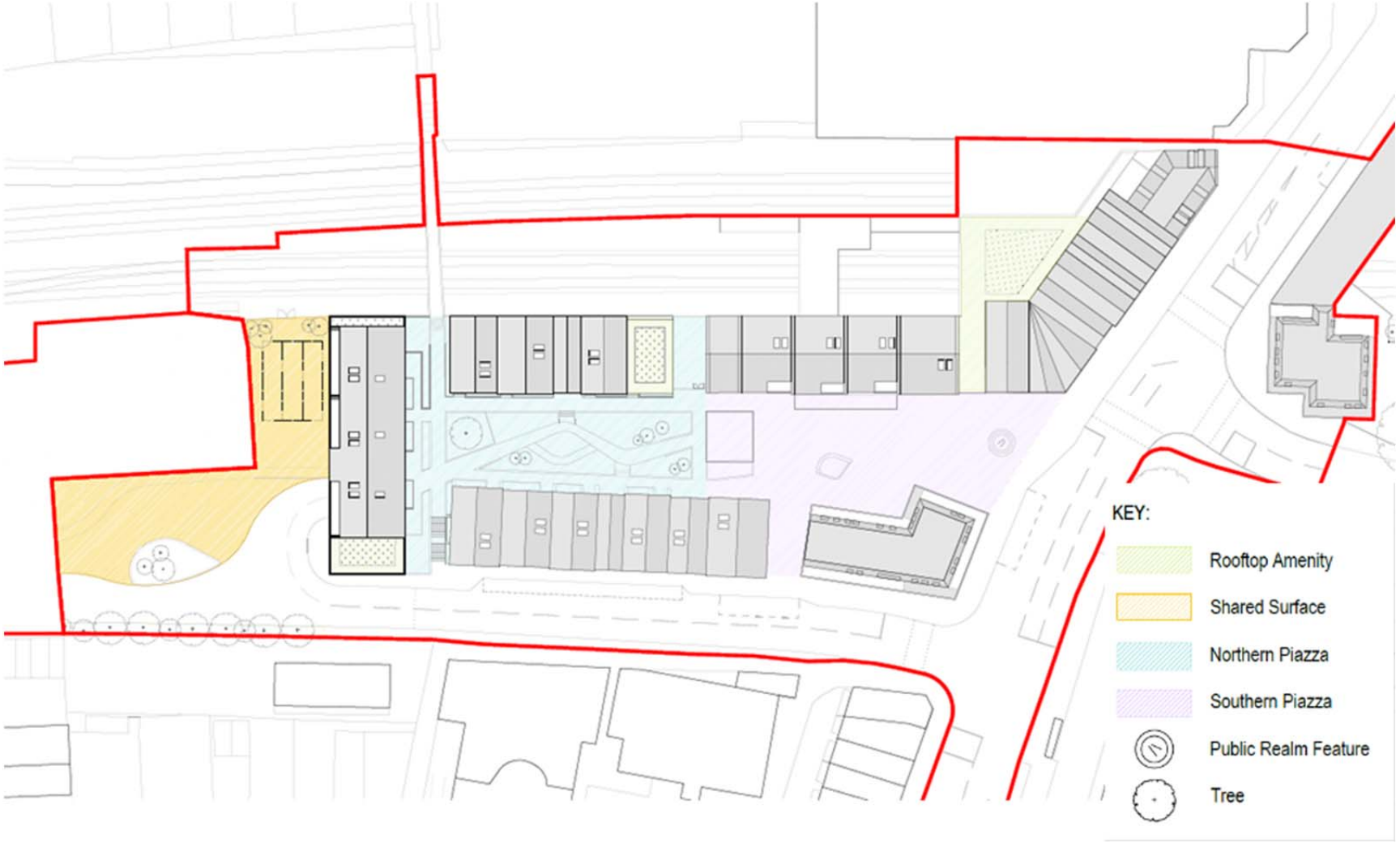

Figure 4—1 Public Realm

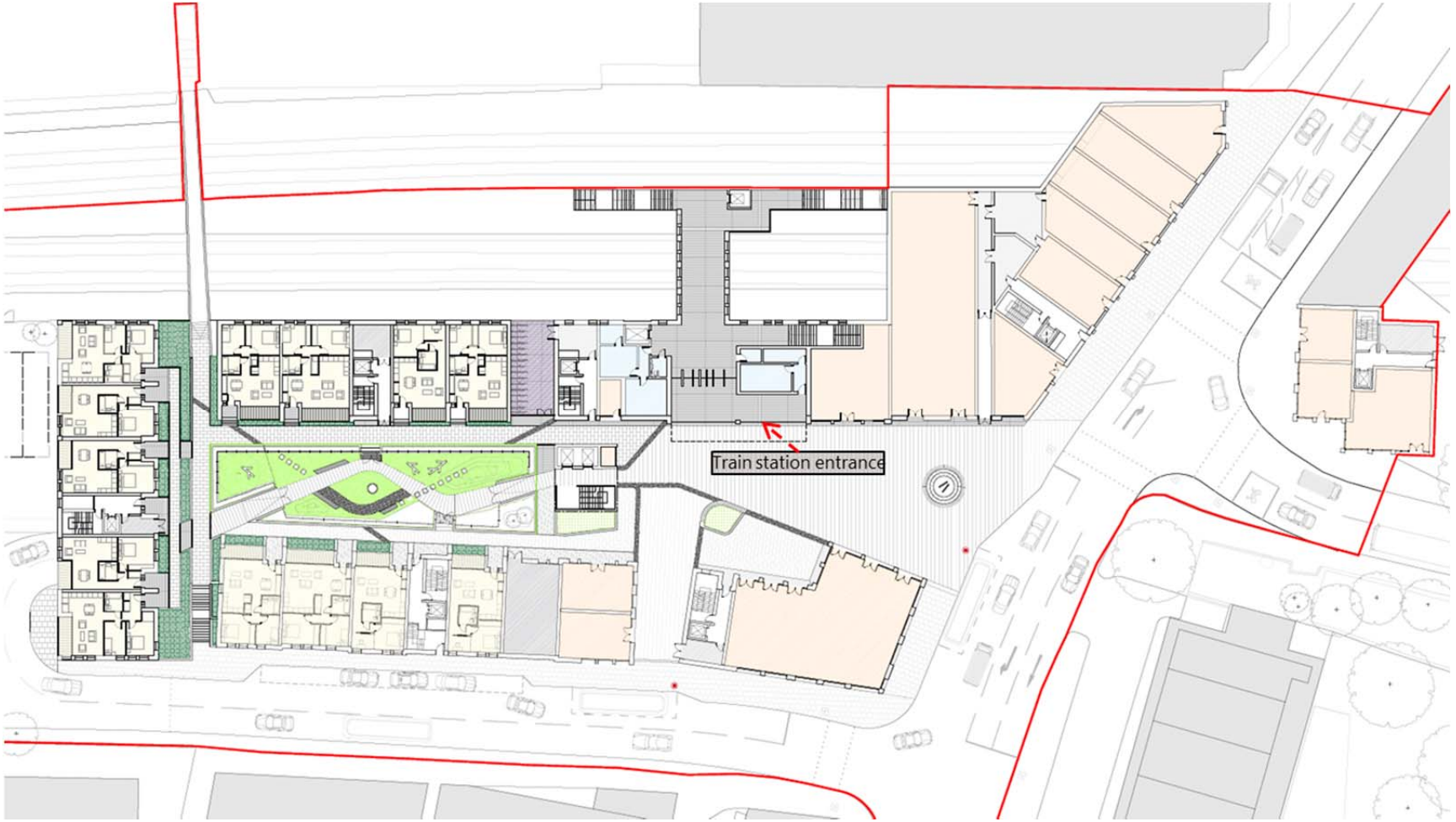

Figure 4—2 Entrance Locations

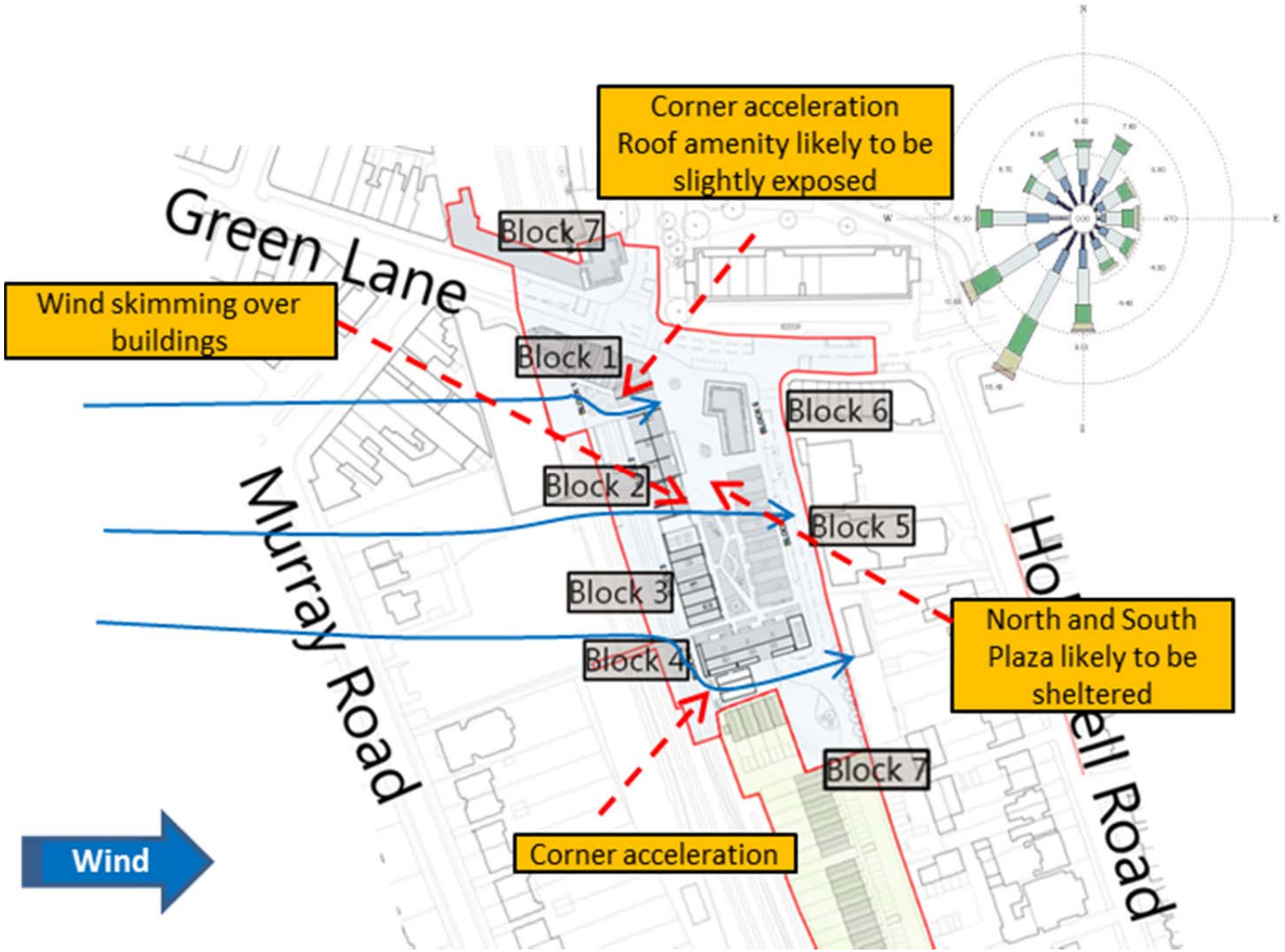

Figure 4—3 Wind Effects Around Buildings from Westerly Winds.

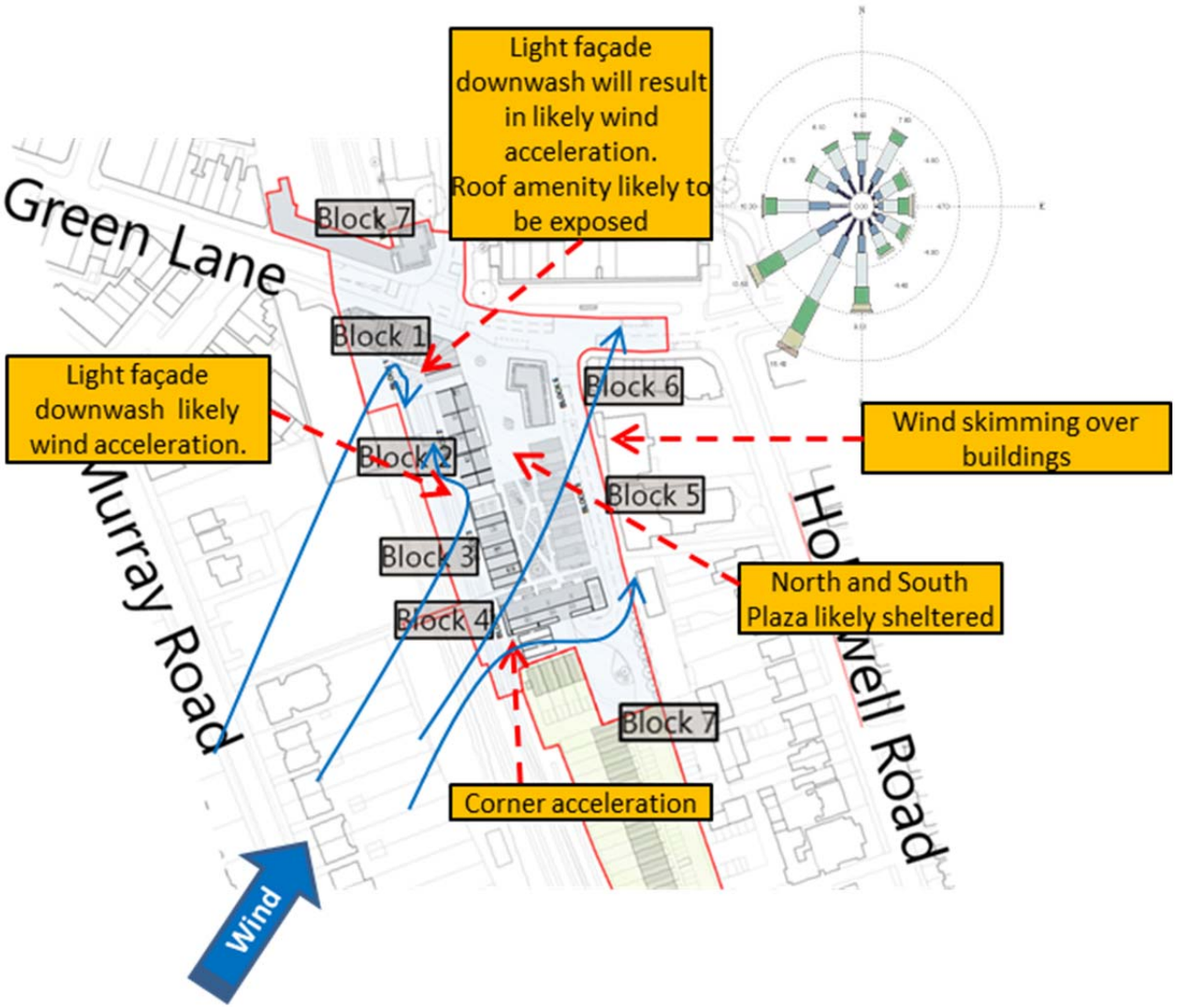

Figure 4—4 Wind Effects around Buildings from South-Westerly Winds

The southern part of the detailed application area is partially sheltered from North-easterly winds due to the terrain change in height towards the south. The North Plaza is likely to feel more exposed. The entrance to the train station is also likely to feel at times exposed to wind acceleration due to its orientation, however the impact is likely to be negligible when compared with the baseline and will be suitable for the people entering or leaving the station.

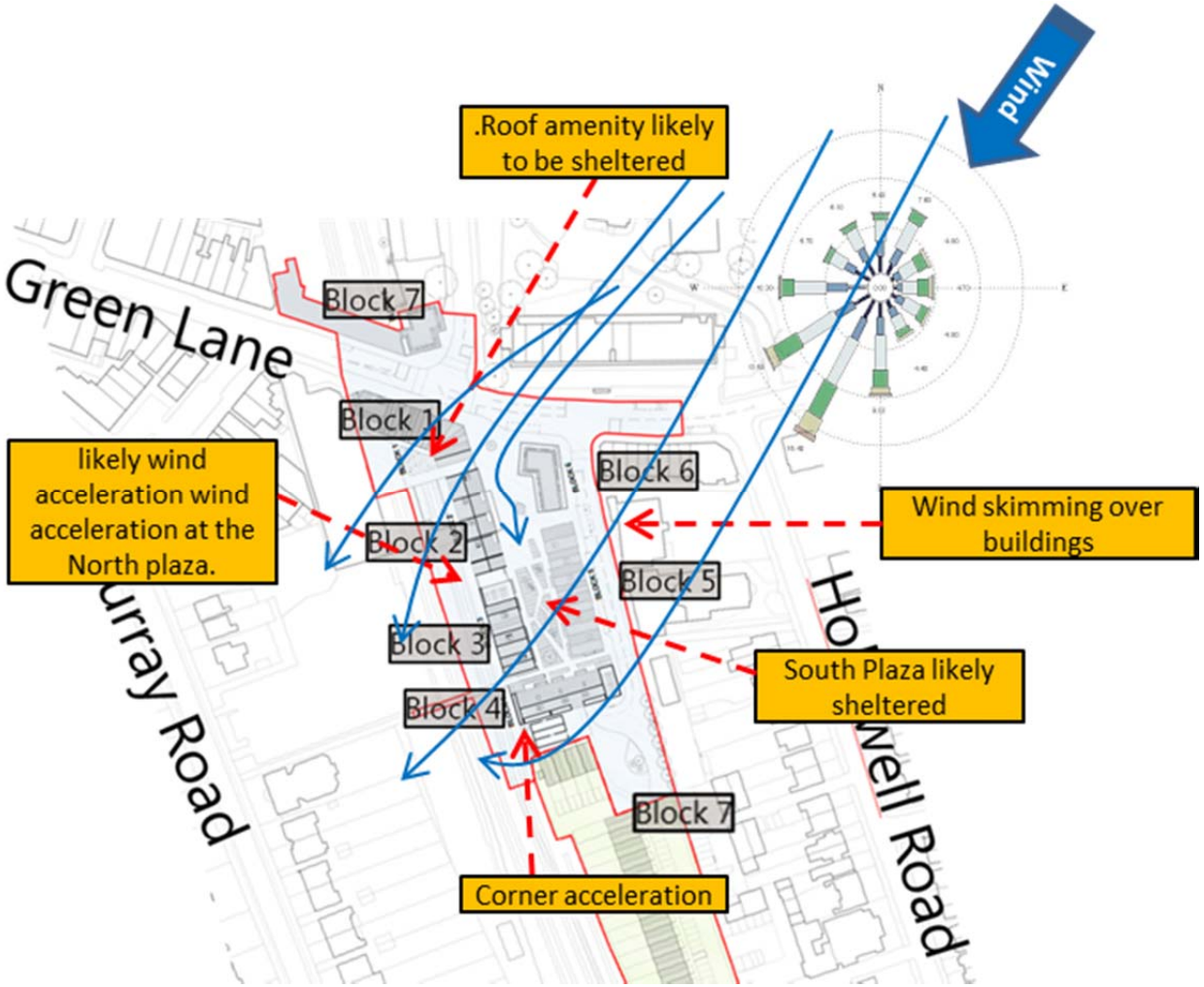

Figure 4—5 Wind Effects around Building North-Easterly Winds

4.2.1 Outline Application

The current design includes an Illustrative Masterplan that shows the maximum parameters of construction. Due to the low height it is likely the impact of the proposed development is likely to be negligible or beneficial. However, the following assumptions have been made with respect to the assessment of development parameters:

- Reduction in building heights - it is likely that reductions in building heights from those shown in the Maximum Parameters will reduce impacts further as it reduces the chance of façade down-draughts and corner acceleration;
- Increase in building heights **-** the increase in building heights within the development will potentially have a direct impact on wind speeds, and will likely increase them. However, variations in heights from 1 to 2 floors are likely to have a negligible effect on wind speeds;
- For the site development alternative configurations to that shown in the Illustrative Masterplan, within parameters set for each parcel, increased heights to the maximum and different building footprint extents within the limits being applied for in the parameter plans are unlikely to cause any effects in their immediate surroundings above those already addressed in the Illustrative Masterplan assessment; and
- Heights along the boundary are generally lower rise than the rest of the development and the parameters do not allow for any significant increases in heights that would create an impact on pedestrian comfort outside the development, hence receptors off-site have not been considered further;
- No areas have been identified as having the potential of adverse impacts beyond those identified in the Illustrative Masterplan assessment.

4.2.2 Comfort

The wind speeds experienced on the site will generally be within acceptable limits for large parts of the year, meaning that although conditions will sometimes be windier, people will not consider them distressful.

4.2.3 Safety

Wind speeds will be within safe limits. Only in extreme gales will there be difficult conditions for pedestrians, however due to the moderately low height of the buildings that form the site it is unlikely that conditions will be above the safety threshold shown in Table 1—2.

5 Cumulative Effects

This section of the report considers the effects of future developments on the proposed site.

There is no known future surrounding development that will impact on the site conditions.

6 Mitigation

No mitigation measures are suggested as conditions on the proposed development site are expected to be suitable for pedestrian walking and business walking for most of the year and other internal areas for the intended activity. On particularly windy days however, pedestrians may feel more uncomfortable in areas where façade downwash and wind acceleration are expected to occur.

The new plazas will incorporate some form of landscaping and are likely to be located in well sheltered areas, which is very likely to make conditions in these areas suitable for sitting, standing and walking also for most of the year.

7 Conclusions

The introduction of the proposed development is not likely to result in considerable wind acceleration. Some areas have been identified as being likely to experience corner accelerations and façade downwash. However the wind speeds experienced on the site will generally be within acceptable limits for large parts of the year, meaning that although conditions will sometimes be windier, people will not consider them distressful.

Wind speeds will be within safe limits all the time. Only in extreme gales will there be difficult conditions for pedestrians, however due to the moderately low height of the buildings that form the site it is unlikely that conditions will be above the safety threshold shown in Table 1—2.

When compared to the baseline, the effects of the proposed development are likely to be negligible.

8 References

Lawson, T.V (2001), *Buildings Aerodynamics*, University of Bristol, Imperial College Press

Cook, N.J. (1985), *Designer's Guide to Wind Loading of Building Structures, Part 1*

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