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**Condition 73: Climate
Change Adaptation
Strategy**

Peabody Trust, Catalyst by Design
and Hill Residential Limited

St Ann's New Neighborhood

Final

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Executive Summary

The Climate Change Adaptation Strategy has been prepared in order to identify the potential climate hazards, assess the significance of the hazards, and evaluate the risks posed to St Ann's New Neighbourhood and how these risks have been managed within the design process. This study, submitted to support Reserved Matters Application 1 for Phases 1b and 2, will address the requirements set out in Condition 73 of the hybrid planning application (HGY/2022/1833) and BREEAM Waste 05 requirements.

After consideration of the potential climate hazards, those deemed significant to the development are solar radiation/heatwaves, precipitation/surface water flooding, and drought. As such, the proposed adaptation measures are outlined below:

Solar Radiation/Heat Waves:

- > Minimising the risks of overheating through passive measures, external shading, thermal mass within the RC frame, highly efficient insulation and an appropriate temperature control strategy.
- > Installing low-power appliances, electronics and lighting to minimise internal heat gains. Smart controls could also be installed.
- > Installing green infrastructure features including green roofs to help cool the local environment and reduce the urban heat island effect.
- > Considering appropriate building materials and façade-protection measures.

Precipitation/Surface Water Flooding:

- > Designing the drainage systems to help minimise flood risk, including smart attenuation and incorporating Sustainable Urban Drainage Systems (SuDS) to attenuate water and reduce the risk of surface water flooding.
- > Ensuring roof and façade materials are suitably fixed and weatherproofed for storm resistance and resistance to water penetration.
- > Elevating mechanical and electrical equipment above reasonable expected flood level where possible.

Drought:

- > Installing water meters and leak detection systems (commercial only) to control water consumption to reduce minor water leaks and unnecessary water consumption.
- > Where feasible installing rainwater butts to reduce demand, for irrigation purposes and incorporating a planting strategy that reduces reliance on non-potable irrigation systems.

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1. INTRODUCTION

- 1.1** This document has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development.
- 1.2** This document has been prepared to support the Reserved Matters submission related to hybrid application reference HGY/2022/1833 at St Ann's New Neighbourhood. It specifically addresses Condition 71 for phases 1B and 2 development, which is located in the London Borough of Haringey.
- 1.3** In their 2022 report, the Intergovernmental Panel on Climate Change (IPCC) asserted with high confidence that human-induced climate change has caused widespread and adverse impacts with related losses and damages to nature and people. These increases in extreme conditions are pushing natural and human systems beyond their ability to adapt.
- 1.4** Within the UK, the Climate Projections 2018 (UKCP18) provide in-depth climate data sets that should be used to guide decision-making and boost resilience. The UKCP18 outline that the UK is likely to experience hotter, drier summers, and warmer, wetter winters. Extreme weather events and conditions will likely become more frequent and will include heavy rainfall events and heatwaves.
- 1.5** These changes to the climate pose severe risks to natural and built environment as well as to people. Buildings must therefore be built with climate risks in mind to create healthy and habitable conditions for occupants. Specific concerns to buildings include overheating, flooding, drainage, water availability, material durability, and ground stability.
- 1.6** This report aims to identify the climate hazards posed to the developed that may arise as a result of climate change and the resultant extreme weather conditions. These risks will be estimated and evaluated, and where relevant, risk management measures will be proposed in order to increase the resilience of the development to climate change.

2. DEVELOPMENT DESCRIPTION

Site Location

- 2.1 The development site is located in the London Borough of Haringey, as shown in Figure 1 below.

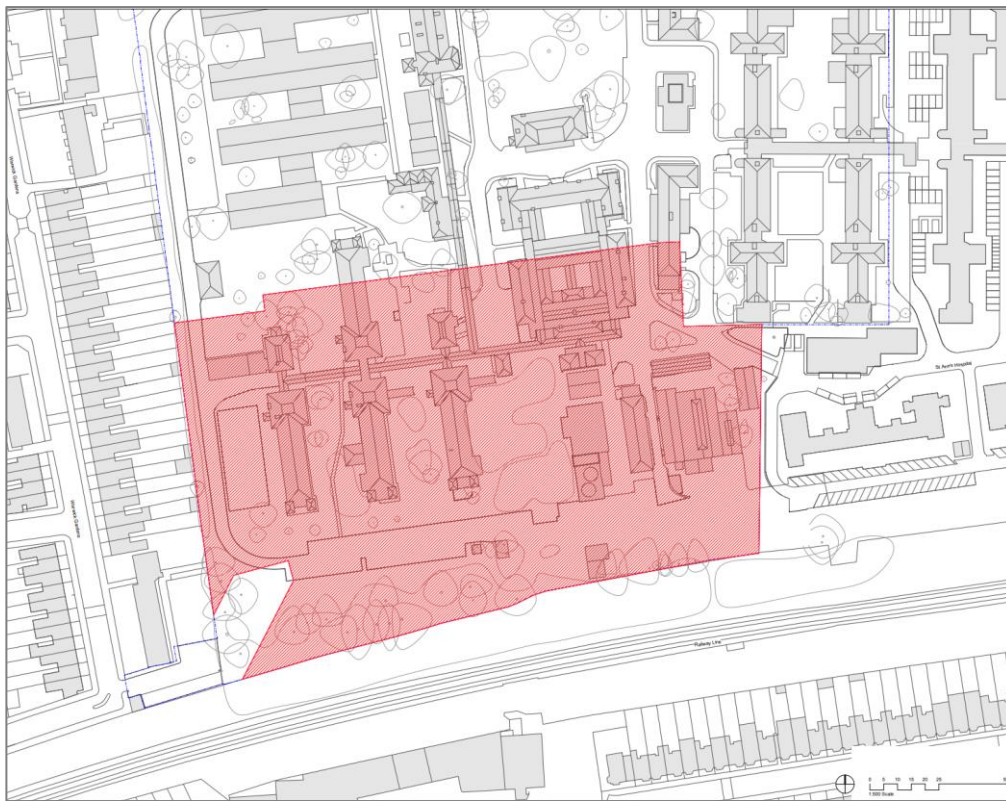


Figure 1: Site Location – Karakusevic Carson Architects (July 2023)

Development Description

- 2.2 RMA 1 seeks detailed approval of the appearance, landscaping, layout and scale of Phases 1B and 2 of the outline component of the hybrid application at St Ann's Hospital, which covers Plots E-J on the illustrative masterplan.
- 2.3 The proposed development is described as follows:

Application for the approval of reserved matters respect of appearance, landscaping, layout and scale relating to Phases 1b and 2 associated with the outline component of planning permission HGY/2022/1833 for "Outline planning permission (with all matters reserved except for access) for Phases 1B, 2 and 3, for: (a) the erection of new buildings for residential development (Use Class C3) and

a flexible range of non-residential uses within Use Class E, F1/F2; (b) provision of associated pedestrian and cycle accesses; (c) landscaping including enhancements to the St Ann's Hospital Wood and Tottenham Railsides Site of Importance for Nature Conservation (SINC); and, (d) car and cycle parking spaces and servicing spaces.”

2.4 Figure 2 below indicates the proposed site plan.



Figure 2: Proposed Site Layout – Lambert Smith Hampton (June 2023)

Existing Development

- 2.5** The Site currently comprises over 40 buildings, formerly part of St Ann's hospital. They vary in height from two to three storeys.
- 2.6** The Site has a relatively flat topography with a gentle fall west to east and north to south. It comprises a mix of natural landscaped elements including a Site of Importance for Nature

Conservation (SINC) to the south. The SINC comprises standalone mature trees covered by individual tree protection orders (TPOs) and a lawn in the centre known as the Peace Garden.

Typical Construction Details

- 2.7** The following typical construction details have been provided by the architect. Phase 1B and 2 will see the construction of plots E, F, G, H and J.
- 2.8** The external façade within Phase 1B and 2 will predominantly comprise brick walls. The type and colour of brickwork will vary between plots. The façade will also include balconies.
- 2.9** For each individual plot, external façade designs have been considered with the surrounding local context in mind. This includes considerations of the local conservation areas.
- 2.10** The commercial unit will be within Plot G.
- 2.11** Plot E comprises 14 3-storey 4-bedroom homes for London Affordable Rent (LAR) and they will be constructed using brick.
- 2.12** Plot F comprises a consistent 6 storey massing which continues the architectural language and brick tone of the Phase 1A mansion blocks located on the primary street west. This façade design can be seen in Figure 3 below.



Figure 3: Plot F West Elevation - Karakusevic Carson Architects (June 2023)

- 2.13** Plot H provides the primary backdrop to the Peace Garden and refurbished Admin building and comprises two buildings around a semi-private central courtyard. Building H2 provides 57 private sale homes, with 23 LAR homes to the south (H1). To the east, mansion building H3/H4 accommodates 33 shared ownership homes and 43 LAR homes within separate cores.

- 2.14** Plot G comprises two villas linked by a single storey element. Building G1 provides 25 Community Land Trust (CLT) homes and adjacent villa G2 provides 42 LAR homes. Plot G fronts onto the primary road and provides passive and overlooking over the SINC and forest garden.
- 2.15** Plot J comprises three individual villas of 9, 8 and 7 storeys. J1 provides 43 London Affordable Rent homes, J2 provides 38 London Living Rent homes, and J3 provides 33 CLT homes addressing the Eastern Orchard open space and NHS boundary.
- 2.16** An overview of all blocks in Phases 1B and 2 is outlined in Figure 4.



Figure 4: Proposed ground floor plan - Karakusevic Carson Architects (July 2023)

3. ASSESSMENT METHODOLOGY

- 3.1** This chapter sets out the methodology for the Climate Change Adaptation Strategy in accordance with the requirements of Condition 73 of HGY/2022/1833. This is outlined below:

Each application for the first reserved matters relating to Appearance, Layout or Scale submitted by phase/block shall be accompanied by annotated plans and details on what measures will be delivered

to the external amenity areas that will help adapt the development and its occupants to the impacts of climate change through more frequent and extreme weather events and more prolonged droughts.

- 3.2** As BREEAM is being undertaken on the Proposed Development, the BREEAM methodology for 'Adaptation to Climate Change' will be used to inform this adaptation strategy. Whilst meeting the requirements of Condition 73, following this methodology will also allow the BREEAM Waste 05 credit to be awarded.

Detailed Assessment Approach

- 3.3** The assessment is conducted in line with the above requires, as follows:

- > **Hazard Identification** – Conduct a review of evidence and information from relevant bodies to identify and understand the expected impacts of increased extreme weather events for climate change and use this to identify likely hazards on the buildings. Examples of potential hazards include:
 - Flooding.
 - Storms (including high winds).
 - Cold events.
 - Heat waves (including temperature increases).
 - Drought (including reduced summer rainfall).
 - Milder winters.
 - Wetter winters (including increased moisture and driving rain).
 - Warmer summers and increased solar radiation.
 - Temperature variation.
 - Precipitation, e.g. rain and snow; and
 - Subsidence or ground movement.
- > **Hazard Assessment** – Identify the likelihood and scale of the identified hazards.
- > **Risk Estimation** - Identify the risks presented by these hazards and the likely impact of the hazards. This should consider the following:
 - Structural stability.
 - Structural robustness.
 - Weather proofing and detailing.
 - Material durability.

- Health and safety of building occupants and others; and
 - Impacts on building contents and business continuity.
 - > **Risk Evaluation** - Evaluate the potential impact of these risks on the buildings; determine the tolerable risk threshold; check the sensitivity of the risk assessment; and identify areas where the risks are unacceptable (in terms of health and safety, life cycle assessment and financial risks).
 - > **Risk Management** - Identify risk reduction measures and mitigate the hazards as far as is practically feasible through adapting the development's design and specifications.
-

4. REFERENCES

- 4.1** In order to identify and understand the expected impacts of climate change and propose mitigation measures, the following documents from relevant bodies have been reviewed:
- > **IPCC AR6 Technical Summary 2022** – This document produced by the Intergovernmental Panel on Climate Change (IPCC) provides a technical summary to the IPCC's Sixth Assessment Report (AR6) on the impacts, adaptation, and vulnerability to climate change across the globe.
 - > **UK Climate Projections (UKCP09)** – This document was published by Defra in 2009 and provides annual, seasonal, and monthly projections on climate change for three emissions scenarios (low, medium, and high). All projections are based on 1961-1990 data, known as the baseline.
 - > **UK Climate Projections (UKCP18)** – These projections provide an assessment of how the climate within the UK may change over the 21st century. It delivers a range of UK climate projection tools designed to help decision-makers assess their exposure to change in the climate. It uses Representative Concentration Pathways designed by the Intergovernmental Panel to provide projections based on varying levels of atmospheric greenhouse gas concentrations.
 - > **UK State of the Climate report 2020** - This report provides a summary of the UK weather and climate through the calendar year 2020, alongside the historical context for a number of essential climate variables. It provides an accessible, authoritative, and up-to-date assessment of UK climate trends, variations and extremes based on the most up to date observational datasets of climate quality.
 - > **The UK Climate Change Risk Assessment 2022** – A five-yearly assessment of the major risks and opportunities from climate change to the UK. Provides reports to government on critical risks, and areas where progress has been made, and still required.

- > **The Mayor's Climate Change Adaptation Strategy (Greater London Authority) 2011** – This document, published in October 2011, sets out a strategic framework for enhancing quality of life in London, protecting the environment, and making the city more sustainable.
- > **The London Plan (Greater London Authority) 2021** – This document provides the current overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for development within London over the next 20-25 years. Chapter 5 details London's response to climate change, with policies specific to climate change adaptation.
- > **The London Borough of Haringey Strategic Policies 2013** - This document forms part of Haringey's planning documents and outlines the long term vision of how Haringey should develop by 2026 and sets out the council's strategy for achieving that vision including high-level strategic policies used in determining planning applications.
- > **The London Borough of Haringey's Development Management DPD 2017** – This document form part of Haringey's planning documents and sets out planning policies to help determine which developments are granted planning permission.
- > **BRE Design for Future Climate – Developing an Adaptation Strategy** - This document, published in August 2012, sets out the adaptation strategy for each government department in accordance with the key risks posed by projected climate change.
- > **IEMA Guide to Climate Change Resilience and Adaptation 2015** - This guide provides a framework for the effective consideration of climate change resilience and adaptation.
- > **Guide A 'Environmental Design' (CIBSE) 2015** - This document is the reference source for designers of low energy sustainable buildings for creating buildings that are comfortable, healthy, and safe, when exposed to the varying conditions outdoors.
- > **Heatwave Plan for England (Public Health England) 2018** - This plan aims to reduce summer deaths and illnesses by providing guidance on how to prepare for and respond to a heatwave in England.
- > **Thames Catchment Flood Management Plan (Environment Agency) 2009** - This document is one of 77 plans which, for the first time, assessed inland flood risk across England and Wales. It then establishes sustainable flood risk management policies to assist decision makers.
- > **Thames Water Draft Drought Plan 2022** – This plan sets out Thames Water's strategy to deal with drought events within London.

5. HAZARD IDENTIFICATION

- 5.1 This chapter contains a review of evidence and information from the beforementioned documents to identify and understand the expected impacts of climate change on the development of the new St Ann's Neighbourhood, in the London borough of Haringey.
- 5.2 The below information outlines scientific findings of recent trends in climate data, as well as the projected changes likely to occur in the future in order to identify the threat posed to the development.

Solar Radiation

- 5.3 According to CIBSE Guide A 'Environmental Design' 2015, the summer mean cloud amount is predicted to decrease by up to 18% by 2080 in parts of southern England (for the medium emissions scenario). This will give an increase in downward shortwave radiation of up to 16 W·m⁻² (watts per square metre). During winter, the changes in cloud cover are predicted to be small (-10% to +10%).
- 5.4 To coincide with the predicted increase in solar radiation, summer temperatures are expected to be hotter. All regions of the UK experienced an increase in average temperatures, with the most recent decade (2008-2017) being an average of 0.3°C warmer than the 1981-2010 average, and 0.8°C warmer than 1961-1990 according to the UK Climate Projection 2018 (UKCP18).
- 5.5 London specifically has experienced a daily maximum summer season temperature increase of 2.23°C and a daily maximum annual temperature increase of 1.84°C.
- 5.6 Under a high emissions scenario, the summer temperature change is predicted to be 1.1 °C - 5.8 °C warmer while the winter temperature change is predicted to be 0.7 °C - 4.2 °C warmer (UKCP18).
- 5.7 Future projections from the UKCP18 findings suggest that London is expected to see a +1°C change in mean summer temperatures by 2029; a +1.9°C change by 2059; and +3°C by 2089 (based on a medium emissions scenario of RCP4.5 (Representative Concentration Pathway) and at 50% probability levels.
- 5.8 Figure 5 illustrates the predicted changes in summer mean temperatures between 2020-2039, 2040-2059, 2060-2079 and 2080-2099 across London compared to 1981-2000 temperatures (RCP4.5 and 50th percentile).

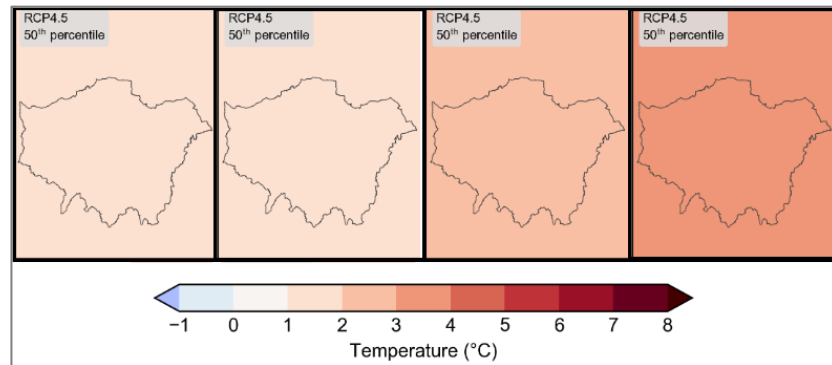


Figure 5: Change in Summer Mean Temperature (°C) in London. Source: UKCP18

Temperature Variation

- 5.9** According to UKCP09, winter temperatures are increasing at a faster rate than summer temperatures as London has experienced the following trends in temperature variation between 1961 and 2006:
- > **Summer:** A daily mean summer season temperature increase of 1.9°C; and
 - > **Winter:** A daily mean winter season temperature increase of 2.02°C which has resulted in less snow and a reduction in 13.5 days of frost.
- 5.10** Looking at future UKCP18 predictions, London is expected to continue to see an increase in both summer and winter temperatures, though winter temperatures are unlikely to increase as much as summer. In summer there is a pronounced north/south contrast, with greater increases in maximum summer temperatures over the southern UK compared to northern Scotland.
- 5.11** The 2020 State of the UK Climate Report stated that the highest daily minimum temperatures were generally in London, with these strongly influenced by the Urban Heat Island (UHI) effect. The Greater London Authority (GLA) acknowledge London's UHI as a key issue concerning summer overheating, with requirements for buildings to incorporate designs that reduce the likelihood of overheating.

- 5.12** Figure 6 illustrates the predicted increase in mean winter temperatures and mean summer temperatures in London from 2010 until 2099 (relative to years 1981-2000). This is based on a medium emissions scenario of RCP4.5 and at a 50th percentile change.

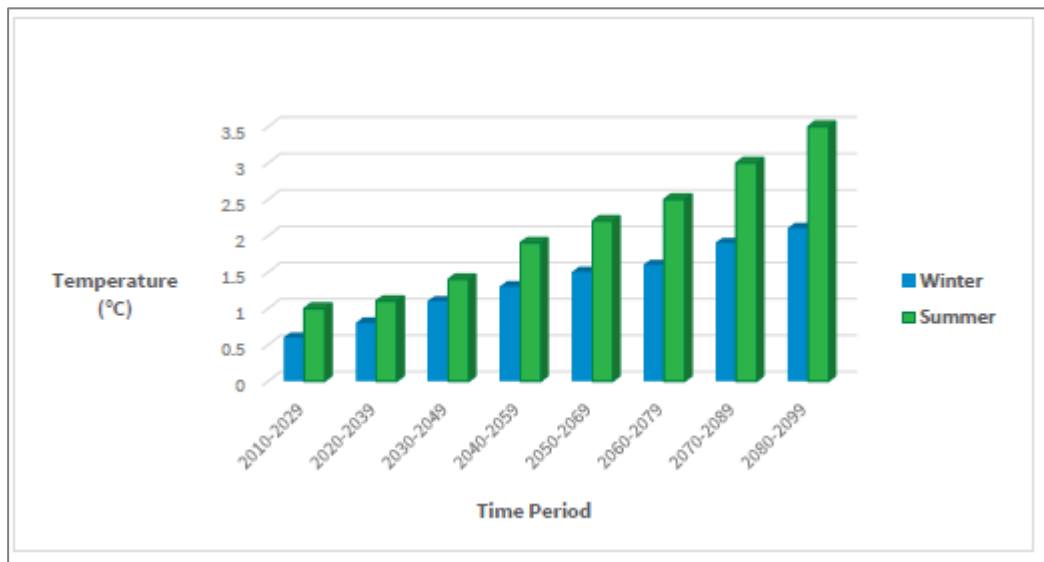


Figure 6: Future Predicted Change in Mean Winter and Summer Temperatures in London (relative to 1981-2000).
Source: UKCP18

Water/Moisture

- 5.13** Relative humidity is a function of surface air temperature as well as water vapour content, and therefore changes in relative humidity will be related to change in surface air temperature.
- 5.14** While projections show surface air temperatures will increase during both summer and winter months, relative humidity over land is decreasing – consistent with land warming faster than the oceans, where most evaporation occurs.
- 5.15** According to UKCP09, average annual relative humidity decreased in London by 4.3% between 1961 and 2006. The biggest difference is -5.2% in the summer months.

- 5.16** It is predicted that relative humidity will continue to decrease by 5-10% in the south up until 2080, as shown in Figure 7 below. This is based on a medium emissions scenario and at 50% probability levels, over the 1961-90 baseline.

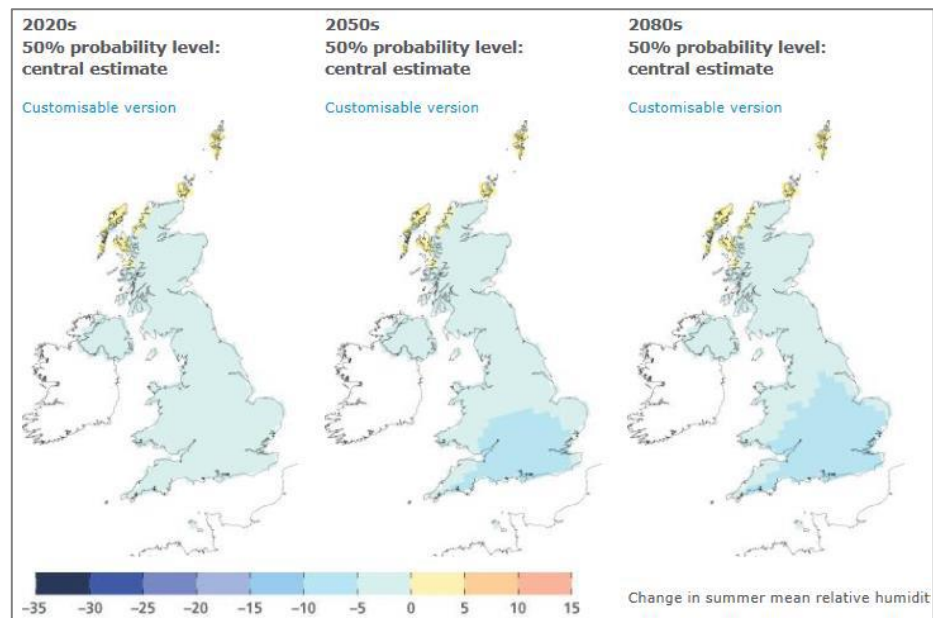


Figure 7: UK Change in Summer Mean Humidity (%) Medium Emissions Scenario. Source: UKCP09

Wind and storms

- 5.17** According to UKCP18, there are no compelling trends in storminess, as determined by maximum gust speeds, from the UK wind network over the last four decades.
- 5.18** The global projections over the UK show an increase in near surface wind speeds over the UK for the second half of the 21st century for the winter season when more significant impacts of wind are experienced. This is accompanied by an increase in frequency of winter storms over the UK. However, the increase in wind speeds is modest.
- 5.19** The Greater London Authority (GLA) have said that the impacts of wind will be kept under review for inclusion in future revisions of the strategy.
- 5.20** Compared to the rest of the UK, particularly Scotland and Northern Ireland, the southern and eastern areas of England have not seen, nor are expected to see a significant shift in wind patterns.

Precipitation

- 5.21** According to UKCP18, observations show a high level of variability in precipitation from year to year, with a slight overall increase in UK winter precipitation in recent decades.

- 5.22** UKCP09 shows that between 1961 and 2006, London experienced fewer days of rain in the spring and summer months but more rain in autumn and winter; an annual difference of +1.3 days of rain $\geq 1\text{mm}$.
- 5.23** Future projections show that winter precipitation is expected to increase, and summer precipitation is expected to decrease. The projections show a pattern of larger increases in winter precipitation over southern and central England and some coastal regions towards the end of the century. Summer rainfall reductions tend to be largest in the south of England.
- 5.24** Figure 8 below shows the future predicted mean precipitation (mm) percentage change in London during winter and summer months from 2010 to 2099 (relative to years 1981-2000). This is based on a medium emissions scenario of RCP4.5 and at a 50th percentile change.

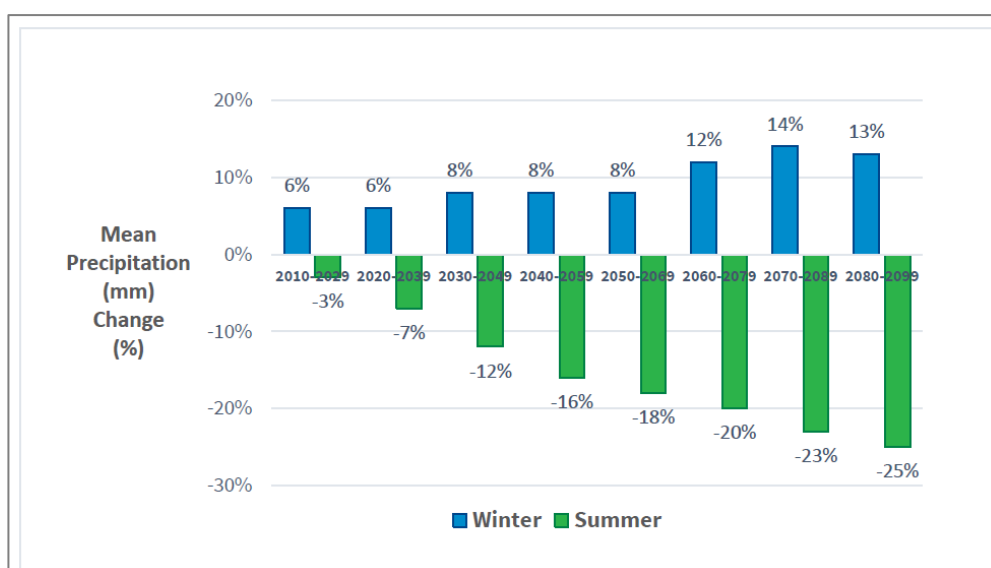


Figure 8: Future Predicted Mean Precipitation Change in London. Data source: UKCP18.

Extreme Weather Conditions

- 5.25** As stated in the GLA's Climate Change Adaptation Strategy (2011), the UK experienced significant flooding in 2002, 2004, 2005, 2007, 2008, 2009 and 2010, heatwaves in 2003 and 2006, a severe drought in 2006 and unusually cold winters in 2009 and 2010. Since then, there have been continued flooding (including flash-flooding) events, heatwaves, significant snowfalls, and unseasonably low temperatures year-on-year (Met Office).

Flooding

- 5.26** According to the GLA, London is at risk of flooding due to the projected sea level rise and the increased frequency and intensity of heavy rainfall events.

- > **Surface Water Flooding:** London has a relatively low standard of protection against surface water flooding, and this problem is growing due to the increase in impermeable areas across the city and growing pressure on the drainage system.
- > **Tidal Flooding:** London is currently well protected against tidal flooding from the North Sea, principally because of the Thames Barrier.
- > **Fluvial Flooding:** According to the Environment Agency's Flood Map shown in Figure 9 below, the development lies within Flood Zone 1 – meaning it is at low risk of flooding.

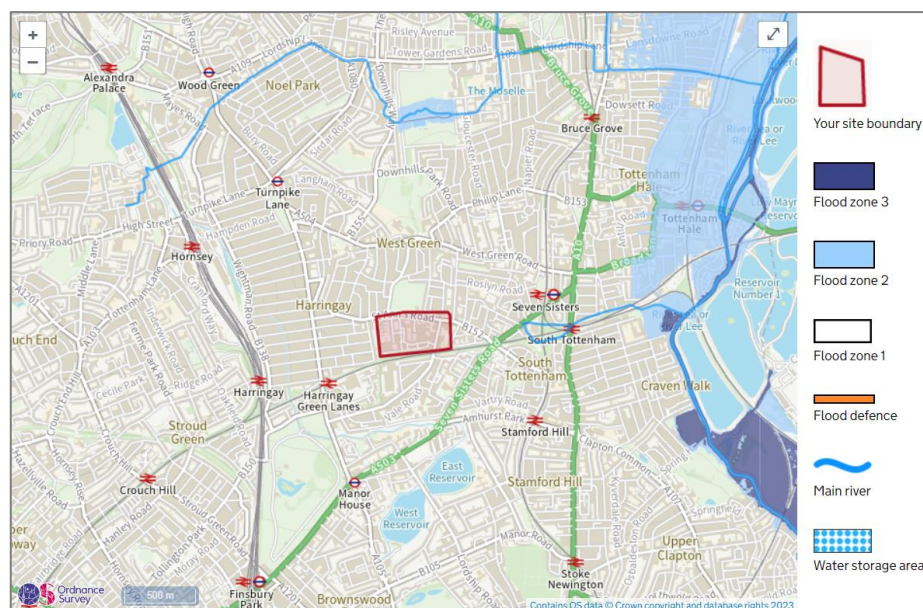


Figure 9: Flood Map for the Site. Source: Environment Agency 2023.

Heatwaves

- 5.27** The 2022 Climate Change Risk Assessment defines a heatwave as an event declared when a location records a period of at least three consecutive days with maximum temperatures meeting or exceeding a heatwave temperature threshold. The upper limit for heatwaves in the UK varies by county, with London having an upper limit of 28°C.
- 5.28** According to the England Heatwave Plan (2020), 2003, 2006 and 2009 saw unprecedentedly high temperatures. According to plans, a 10-day heat wave in August 2003 caused more than 2,000 deaths compared to the previous five years.
- 5.29** According to the latest UKCP18 statistics, the average hottest day of the year, in the most recent decade (2008-2017), has been on average 0.1 °C warmer than the 1981-2010 average and 0.8 °C warmer than the 1961-1990 average hottest day of 26 °C.

- 5.30** As part of their National Severe Weather Warning Service, the Met Office provides warnings of severe or hazardous weather that has the potential to cause danger or disruption. The maximum temperatures in London are 32°C for the day and 18°C for the night, above which are said to have adverse impacts on health. In 2019, the Met office recorded highest daily maximum temperature in the district of East Anglia, England to be 38.7°C.
- 5.31** In terms of predictions, England is increasingly likely to experience extreme summer temperatures in the future. In the recent past (1981-2000), the chance of a summer as hot as 2018 occurring was low (<10%). This probability has already increased due to climate change and is now between 10-20%. With further warming in the future, hot summers could become even more common by mid-century (~50%).

Drought

- 5.32** The development will increase local water demand. This, in addition to lower levels of summer precipitation, threaten water security within London specifically.
- 5.33** According to the GLA, the likelihood of drought having a significant impact on London is currently low and most years there is sufficient water to meet demand. That said, the increasing water demand may threaten supply; therefore, it is important to reduce water use through appropriate measures.

Subsidence / Ground Movement

- 5.34** London's soils are predominantly comprised of London Clay, a soil type particularly vulnerable to shrinkage and movement. The increasing seasonal variation in rainfall will cause greater fluctuation in soil moisture content.
- 5.35** Wet clay expands, which causes local land levels to rise, whereas dry clay shrinks, causing land levels to fall. This ground instability can affect critical infrastructure including buildings, escalators, road surfaces, and water mains pipes.
- 5.36** It is recommended that specialist reports for ground investigations, soil tests and structural reports are used to inform the design criteria specific to the subsidence/ground movement for this development.

6. HAZARD ASSESSMENT

- 6.1** This chapter will identify the scale of risk for each of the identified hazards, in relation to Phase 1B and 2 of the development at St Ann's, in the London Borough of Haringey.

- 6.2 Solar Radiation** – The projected increase in summer solar radiation and summer temperatures, particularly in London, means that the scale of the risk is significant, and buildings will need to be designed to avoid overheating and increasing the urban heat island effect.
- 6.3 Temperature Variation** – Temperatures within London are expected to increase during both summer and winter seasons, measures are therefore required to ensure that the built environment is resilient to increased temperatures.
- 6.4 Water/Moisture** – London's humidity levels are expected to decrease by 5-10% up until 2080. This is not expected to be a significant risk to the built environment as the risk of condensation and mould growth caused by humidity will be reduced.
- 6.5 Wind and Storms** – The uncertainty projections with regard to wind, in conjunction with the southeast's high building standards for wind resistance, mean that wind is not considered a high risk posed to the develop at St Ann's in the London Borough of Haringey. Wind testing results for the site show that wind disturbance is not a concern.
- 6.6 Precipitation** – Given that by 2080, winter precipitation is predicted to increase by 19% and decrease by 23% during the summer, the scale of risks is deemed to be significant on the proposed development. The buildings and landscaping will therefore need to be able to withstand the effects of both wetter winters (heavy rainfall on saturated ground), and dryer summers (drought and water shortages).
- 6.7 Extreme Weather Conditions**
- > **Flooding** – The site at St Ann's lies within Flood Zone 1, which means it is at low risk from fluvial flooding. In regard to tidal flooding, the area benefits from the Thames Barrier Tidal Defence, which provides protection for up to the 1 in 1000-year event. The Flood Risk Assessment for the development finds that the surface water flood risk is low for the site, as well as risk from groundwater, reservoir and sewer flooding, with no history of flooding on the site. On site drainage will however be considered to mitigate against potential future surface water flooding. Smart attenuation will also be installed which will reduce the risk of flooding further.
 - > **Heatwaves** – The projected increases in solar radiation and summer temperatures means that overheating is a likely risk to the proposed development that should be mitigated against. The additional risk which comes with the UHI effect within London makes the development particularly vulnerable, and adaptation measures must therefore be taken to ensure the building is resilient to heatwaves.
 - > **Drought** – The development will increase local water demand, this combined with projected decreases in summer precipitation will pose a risk to the area.

6.8 Subsidence/Ground Movement – The development is expected to have strong foundations and Civil and Structural Engineering report incorporates structural considerations that account for movement; therefore, the risk of subsidence and ground movement is considered to be low.

6.9 In summary, the main hazards considered significant to the proposed development are solar radiation/heatwaves, precipitation/ surface water flooding, and drought.

7. RISK ESTIMATION AND EVALUATION

7.1 This chapter will identify the risks presented by the identified hazards and evaluate the potential impacts of these risks on the proposed development.

7.2 A copy of the Adaptation to Climate Change Risk Assessment Matrix can be found in **Appendix A** and should be referred to for the risk estimation below (low, medium, high).

Structural Stability

7.3 Structural stability refers to the capacity of the individual elements which together make up the structural system to withstand loads that are applied to them.

- > **Solar radiation/heatwaves:** Structural stability is unlikely to be affected by the increased air temperatures. The compressive strength of concrete is only affected beyond 100°C.
- > **Precipitation/surface water flooding:** Phase 1B/2 of St Ann's development will have significant foundations and should not be affected by the expansion and contraction caused by changing moisture levels. The approved masterplan Civil and Structural Engineering report by Price and Myers (April 2022) demonstrates that a consideration of measures to address these issues has been undertaken.
- > **Drought:** Subsoils with a significant clay component are often subject to shrinking as they dry out. Buildings may settle unevenly as shrinkage takes place which could cause cracking in brickwork and stonework. This problem is likely to be avoided at St Ann's through the deep and significant foundations.

Structural Robustness

7.4 In terms of structural robustness, the careful selection of building materials that can withstand events like fires, explosion and impact is key. The materials selected should be considered a reliable material with longevity capabilities which can be easily maintained.

- > **Solar radiation/heatwaves:** Increased temperatures will lead to thermal expansion of materials which may result in cracking. Therefore, appropriate measures need to be taken to protect the façade. The façades are predominantly brick so these are easy maintainable in comparison to other more bespoke materials that would require further treatment.
- > **Precipitation/surface water flooding:** To avoid excessive ponding following rainfall, roofs and paving should be sloped towards drainage channels. All façade materials should be designed to prevent water from accumulating and degrading materials over time.
- > **Drought:** Cracking may occur in façade materials (such as the facing brickwork) during prolonged periods of dry weather. However, this should not affect the structural robustness of the buildings.

Weather Proofing and Detailing

7.5 'Weather proofing and detailing' refers to buildings which are capable of withstanding exposure to all kinds of weather without damage.

- > **Solar radiation/heat waves:** Increased solar radiation may lead to fading and degradation of the buildings' facades and roofs. Therefore, consideration needs to be given to UV protection.
- > **Precipitation/surface water flooding:** Prolonged periods of wet weather, followed by cold weather, could result in freeze-thawing. Timber-based boards may also warp. In addition, spells of wet weather can cause problems with damp (rising damp, penetrating damp, and condensation). Such weather conditions can also affect mechanical and electrical systems if they are not shielded from contact with water.
- > **Drought:** Cracking may occur in brickwork during prolonged periods of dry weather, so measures should be implemented where possible to avoid having to replace façade materials.

Material Durability

7.6 'Material durability' is the ability of a product to remain functional, without requiring excessive maintenance or repair, when faced with the challenges over its design lifetime.

- > **Solar radiation/heat waves:** External fabric materials may be compromised by the increase in thermal expansion of bonded or connected materials.
- > **Precipitation/surface water flooding:** Materials that are susceptible to water penetration may be compromised. Particular attention should also be paid to junctions where the materials will be vulnerable to thermal expansion and water ingress.
- > **Drought:** Cracking may occur in some materials during prolonged periods of dry weather, so measures should be implemented where possible to avoid having to replace materials.

Health and Safety of Building Occupants and Others

- 7.7** All buildings should be designed to prevent illnesses and injuries and improve mental wellbeing for the building's users.
- > **Solar radiation/heat waves:** High proportions of glazing, thermal insulation, single aspect rooms, communal heating systems and inadequate ventilation can cause overheating. The health and wellbeing impacts of overheating can be significant resulting in stress, anxiety, dizziness, fainting, sleep deprivation and even early deaths. In order to achieve tolerable conditions, and ensure the development remains fit for occupancy, the solar and internal gains may need to be reduced through lower G-value glazing, internal or external shading, high thermal mass, limiting horizontal pipework and providing appropriate ventilation (natural and mechanical). High energy-consuming cooling technologies should be avoided, as they exacerbate the urban heat island effect by rejecting heat into the atmosphere.
 - > **Precipitation/surface water flooding:** Flooding may occur on the ground floor. If cleaning and drying out is not carried out appropriately after an event, it could present a number of risks to health through the spreading of bacteria or mould growth.
 - > **Drought:** Water shortages across London combined with hot weather could put building users at risk of heat-related illnesses (heat cramps, exhaustion, or stroke); therefore, measures to minimise internal and external water consumption should be implemented.

Impacts of Building Contents and Business Continuity

- 7.8** The impacts on the commercial units need to be minimised such that they are not prevented from operating normally, despite a change in climatic conditions.

- > **Solar radiation/heat waves:** Scientific studies confirm that indoor temperatures can significantly impact on occupant health and wellbeing and productivity. When indoor temperatures rise above 28° C, there is a 5% decrease in productivity and occupants can experience stress, dizziness, or fainting. The 'comfort zone' is said to be between 22°C and 25°C. Buildings should therefore be designed to be fit-for-use without relying on high energy-consuming and expensive cooling technologies. The CIBSE Guide A recommended operative temperature ranges and clothing levels for dwellings are shown below in Figure 10.

Building/room type	Winter dry resultant temperature range for stated activity and clothing levels*			Summer dry resultant temperature range† for stated activity and clothing levels*			Suggested air supply rate (L·s ⁻¹ ·person ⁻¹ except where stated otherwise)	Filtration grade‡	Maintained illuminance (lux)§	Noise rating (NR)¶
	Temp. (°C)	Activity (met)	Clothing (clo)	Temp. (°C)	Activity (met)	Clothing (clo)				
Dwellings:										
— bathrooms	26–27	1.2	0.25	26–27	1.2	0.25	15 L·s ⁻¹	G2–G4 (extract) ^[8]	100 ^[4]	—
— bedrooms	17–19	0.9	2.5	23–25	0.9	1.2	0.4–1 ACH to control moisture ^[8]	G2–G4	100 ^[4]	25
— hall/stairs/landings	19–24 ^[1]	1.8	0.75	21–25 ^[1]	1.8	0.65	—	—	100	—
— kitchen	17–19	1.6	1.0	21–23	1.6	0.65	60 L·s ⁻¹	G2–G4 (extract) ^[8]	300	40–45
— living rooms	22–23	1.1	1.0	23–25	1.1	0.65	0.4– ACH to control moisture ^[8]	G2–G4	50–200	30
— toilets	19–21	1.4	1.0	21–23	1.4	0.65	>5 ACH	G2–G4	100 ^[4]	—

Figure 10: Recommended comfort criteria (Source: CIBSE Guide A)

- > **Precipitation/surface water flooding:** A flooding event may put a temporary hold on business operations or even threaten business continuity. Water ingress from increased rainfall may also damage building contents such as plumbing work, electrics, fixtures, fittings and furniture. If a flooding event occurs, the affected areas and components should be thoroughly cleaned and dried; otherwise, it could present a number of risks through the spread of bacteria or mould growth. Additionally, wherever possible cables should be run on the mezzanine floor in order to prevent potential water damage.
- > **Drought:** Water shortages may threaten the irrigation of the site's vegetation. If vegetation is lost, then the cooling effect of plant transpiration will be lost, and the risk of overheating may be exacerbated.

8. RISK MANAGEMENT

- 8.1** This chapter identifies appropriate risk reduction measures to mitigate the identified hazards as far as practicably feasible.

Solar Radiation/Heat Waves

- 8.2 Minimising overheating:** The overheating strategy produced by Hodkinson Consultancy (November 2023) confirms that passive mitigation measures have been explored as far as practicable to avoid the need for active cooling, except for those dwellings with limitations on window opening due to external noise constraints.
- 8.3 Building Materials and Façade Protection:** The use of certain materials could help to adapt buildings to climate change, as follows:
- > Consideration should be given to appropriate UV protection and moisture façade protection, in the form of cladding systems or resin treatments.
 - > Cement mortar in the facing brickwork should be carefully mixed to prevent cracking.
 - > In compliance with BREEAM Mat 05, a study will need to be undertaken by the Client to ensure that all vulnerable materials are adequately protected from all forms of environmental degradation.
- 8.4 Appliances and Lighting:** Low-power appliances, electronics and lighting should be used to minimise internal heat gains. Smart controls could also be installed such as daylight sensors for lighting to reduce internal gains from lighting, as well as to save energy.
- 8.5 Landscaping:** A detailed landscaping strategy has been produced by Adams and Sutherland Architects. Native planting is being used to reduce water consumption and to provide transpiration cooling. There is an ongoing iterative design process working in close collaboration with the landscape architects which will identify opportunities for detailed design interventions that will contribute to creating a wildlife-rich landscape and the policy requirement of biodiversity net gain. There are opportunities for incorporation of features in the built environment (such as bird boxes and bee posts, for example) that will also contribute to achieving a wildlife-rich landscape.

Precipitation/Flooding

- 8.6** The approved masterplan flood risk assessment and drainage strategy report by Price & Myers (May 2022) has been produced and details the below risk reduction measures.
- 8.7 Site Drainage:** The drainage systems (including pipework) have been designed to minimise flood risk. External rainwater pipes will be located along the length of the building. The drainage system has been designed to accommodate the 100 year + 40 % climate change storm event. The surface water drainage is proposed to connect to the public surface water sewer in St Ann's Road via an existing connection and discharge from the entire site will be restricted to 29.2 l/s with attenuation provided by swales, a detention basin, attenuation tanks and bioretention tree pits. The proposals also include green roofs, rain gardens and permeable paving.

8.8 Sustainable Urban Drainage Systems: To allow reduce the likelihood of flooding, measures to store surface water and control the quantity of run-off have been implemented into the landscaping strategies. The possibility of implementing SuDS at the Site was assessed using a hierarchy of preferred surface water management methods displayed in Table 1 below.

Table 1: Summary of SuDS methods used on the St Ann's site. (Source: Price & Myers Flood Risk Assessment and Drainage Strategy Report, May 2022)

SuDS Method	Area Used on Site	Benefit
Green Roofs	Blocks C, D, F, G, H, J, L and M	Provides interception and improves biodiversity
Swales	Soft landscaping areas	Provides attenuation and interception, improves water quality and biodiversity
Detention Basin	South of the Peace Garden	Provides attenuation, improves biodiversity and amenity.
Permeable Paving	Parking bays and pedestrian hardstanding areas	Provides interception and improves water quality.
Bioretention Tree Pits	Adjacent/beneath parking bays	Provides interception, improves water quality, biodiversity and amenity.
Raingardens	External courtyard areas	Provides interception, improves water quality, biodiversity and amenity
Attenuation Tanks	External	Provide attenuation.

8.9 Water-resistant materials: Roof and façade materials should be suitably fixed and weatherproofed for storm resistance and resistance to water penetration. Any areas which might be prone to surface water flooding should consider raising site levels or at least dry-proofing solutions to prevent damage from short duration flood events.

8.10 Safe Installation of Mechanical and Electrical Wiring/Fixtures: Mechanical and electrical equipment should be installed reasonably above the expected flood level.

- 8.11 Surface water attenuation strategy:** This strategy has been designed to manage surface water run-off up to and including the 1 in 100 (1%) flood event with an 40% additional allowance for climate change.

Drought

- 8.12 Internal Water Efficiency:** Internal water consumption can be reduced through the use of water efficient fixtures and fittings in line with Part G of 105 litres per person per day.
- 8.13 Water Metering:** A water meter with a pulsed output should be installed on the mains supply. This will allow the water consumption to be monitored and managed, and therefore encourage reductions.
- 8.14 Leak Detection and Prevention:** A leak detection system should be installed (in the commercial units only) which will be capable of detecting a major water leak on the mains water supply within the building and between the building and the utilities water meter.
- 8.15 External Water Efficiency:** Rainwater storage and harvesting tanks could be installed to reduce the demand of potable water and promote effective use of water supplies. If installed, these should be appropriately sized (large enough to address seasonal rainfall fluctuations) and capable of harvesting rainwater for external irrigation across the development.
- 8.16 Occupant training:** User guides should be provided to the new building occupants, including tips on how to conserve water. The developers should also carry out appropriate handovers to the new occupants to ensure they know how to use the services and minimise water consumption where possible.
- 8.17 Drought-resistant Planting:** The landscaping strategy, where possible and appropriate, has prioritised native species planting and minimised the need for managed irrigation systems. Only a few key managed areas, will require irrigation. These will be fed by a drip system, or equivalent, to increase the efficiency of supply. There will be manually watering during establishment and thereafter in dry periods. This approach will reduce the overall potable water demand across the Site.

9. CONCLUSION

- 9.1** This Climate Change Adaptation Strategy has carried out a systematic risk assessment to identify and evaluate the impacts arising from climate change that may impact Phases 1B and 2 development at the St Ann's in the London Borough of Haringey over the projected life-cycle.

9.2 The main hazards considered significant to the proposed development are solar radiation/heatwaves, precipitation/surface water flooding and drought. The proposed climate change adaptation measures are outlined as follows:

9.3 Solar Radiation/Heat Waves:

- > Minimising the risks of overheating through passive measures, external shading, thermal mass within the RC frame, highly efficient insulation and an appropriate temperature control strategy.
- > Installing low-power appliances, electronics and lighting to minimise internal heat gains. Smart controls could also be installed.
- > Installing green infrastructure features including green roofs to help cool the local environment and reduce the urban heat island effect.
- > Considering appropriate building materials and façade-protection measures.

9.4 Precipitation/Surface Water Flooding:

- > Designing the drainage systems to help minimise flood risk, including smart attenuation.
- > Incorporating Sustainable Urban Drainage Systems (SuDS) to attenuate water and reduce the risk of surface water flooding.
- > Ensuring roof and façade materials are suitably fixed and weatherproofed for storm resistance and resistance to water penetration.
- > Elevating mechanical and electrical equipment above reasonable expected flood level where possible.

9.5 Drought:

- > Installing water meters and leak detection systems (commercial only) to control water consumption to reduce minor water leaks and unnecessary water consumption.
- > Where feasible installing rainwater butts to reduce demand, for irrigation purposes.
- > Incorporating a planting strategy that reduces reliance on non-potable irrigation systems.

9.6 The incorporation of the above measures, where feasible, will reduce the likelihood of damage caused by climate change risks and therefore demonstrate compliance with Condition 73.

APPENDICES

Appendix A

Adaptation to Climate Change Risk Assessment Matrix

St Ann's New Neighbourhood - Adaptation to Climate Change Risk Assessment Matrix															
		Hazards													
		Solar Radiation		Temperature Variation		Water / Moisture		Wind		Precipitation		Extreme Weather Conditions		Subsistence / Ground Movement	
		2030	2080	2030	2080	2030	2080	2030	2080	2030	2080	2030	2080	2030	2080
Risks to the Buildings	Structural Stability	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
	Structural Robustness	Low Risk	Medium Risk	Low Risk	Medium Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk	Low Risk	Medium Risk	Low Risk	Low Risk
	Weather Proofing and Detailing	Low Risk	High Risk	Medium Risk	Medium Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk	Low Risk	Medium Risk	Low Risk	Low Risk
	Material Durability	Low Risk	Medium Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk	Low Risk	Medium Risk	Low Risk	Low Risk
	Health and Safety of Building Occupants and Others	Medium Risk	High Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk	High Risk	Low Risk	High Risk	Low Risk	Low Risk
	Impacts on Bulding Contents and Business Continuity	Medium Risk	Medium Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Medium Risk	High Risk	Low Risk	Medium Risk	Low Risk	Low Risk