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One Castlefield

EIA Climate Change Chapter

Climate Change Resilience Risk Assessment (CCRRA)

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Contents

1.0 Introduction 4
2.0 Methodology and Assessment Criteria 5
2.1 Assessment Approach 5
2.2 Sensitivity of Receptors 5
2.3 Probability Criteria 6
2.4 Consequence Criteria 6
2.5 Risk Rating 7
2.6 Limitations and Assumptions 7
3.0 Baseline and Future Climate 9
3.1 Current Baseline Climate 9
3.2 Climate Change Projections 10
4.0 Identification and Evaluation of Climate Change Risks 11
4.1 Climate Hazards and Risk Assessment 11
4.2 Site-Specific Considerations 12
4.3 In-Combination Climate Effects 12
5.0 Increasing the Resilience of the Proposed Development 14
6.0 Conclusion 15
7.0 References and Guidance 16

1.0 Introduction

This Climate Change Resilience Risk Assessment (CCRRA) has been prepared by Crookes Walker Consulting (CWC) on behalf of the Client, Kirindolam 8 Ltd, in support of the proposed No.1 Castlefield development in Manchester. It is intended to support the Climate Change chapter of the Environmental Impact Assessment (EIA) being prepared for the Full Planning Application.

The proposals comprise the redevelopment of a circa 0.72 hectare cleared site adjacent to the A57 Chester Road, bounded by Trentham Street, Ellesmere Street, Castlefield Locks, the elevated railway line and a small area of the Bridgewater Canal. The scheme provides 592 residential units (Use Class C3) across two blocks - Block A (ground and first floors plus 44 storeys, circa +168.00m AOD) and Block B (ground floor plus 8 storeys, circa +59.8m AOD) - together with amenity space, landscaping, cycle and car parking and associated works.

The assessment has been prepared in-line with the IEMA guidance Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (IEMA, 2020). It considers the vulnerability of the Proposed Development to a changing climate over its anticipated lifetime, and identifies the measures that have been, or would be, incorporated into the design to manage that risk to an acceptable level. Consistent with IEMA (2020), two related matters have been considered:

- Climate resilience risks - the vulnerability of the Proposed Development to future climate change, assessed using a risk-based approach; and
- In-combination climate effects - the influence that climate change could have on the significance of the development's environmental effects on other receptors.

This assessment is high level and is based on the scheme information available at the time of writing. It is anticipated that the assessment would be reviewed and updated as the design develops and as the EIA progresses. CWC's assessment is based on the validity of the information provided.

In summary, it is anticipated that the residual climate change risks to the Proposed Development would be in-line with typical expectations for a high-density urban residential development of this nature in the UK, subject to the resilience and adaptation measures set out in Section 5.0 being carried through the detailed design.

2.0 Methodology and Assessment Criteria

2.1 Assessment Approach

The assessment follows a risk-based approach as recommended by IEMA (2020). Risks are evaluated on the basis of their probability (likelihood and frequency of occurrence) and their consequence (severity of impact on the Proposed Development's amenity and function), with the two combined to give an overall risk rating. The assessment draws on the UK Climate Projections 2018 (UKCP18) and supporting project information, including the Flood Risk Assessment and the Environmental Sustainability/Standards Statement where available.

The assessment covers both the construction and operational phases. A 60-year Reference Study Period has been adopted from the anticipated opening year (circa 2029), in-line with BS EN 15978. This is considered a reasonable basis for assessing a residential building, although the physical asset would be expected to remain in use well beyond this period and the climate would be expected to continue to change accordingly.

2.2 Sensitivity of Receptors

In-line with IEMA (2020), the sensitivity of the receptors associated with the Proposed Development has been considered. The principal receptors are taken to be:

- residents and visitors, including more vulnerable groups (young children, older and less mobile people);
- the building fabric, structure and facade, including the slender 44-storey tower (Block A);
- the mechanical and electrical (M&E) services and the incoming utility supplies;
- external amenity space, landscaping and the public realm; and
- access, servicing and the adjacent transport network (Cornbrook Metrolink, mainline rail and the canal towpath).

Sensitivity is not uniform across these receptors. A residential population, including vulnerable occupants, is comparatively sensitive to overheating; a tall, slender tower is comparatively sensitive to wind; and the canal-side, city-centre location is of particular relevance to surface water and flood risk. These sensitivities have informed the consequence ratings applied in Section 4.0.

2.3 Probability Criteria

Table 2.1 sets out the criteria used to rate probability, adapted from IEMA (2020), over the 60-year lifetime of the project.

Table 2.1 - Criteria Used to Determine Probability

Score	Description (probability and frequency of occurrence)
1	The event occurs very rarely during the lifetime of the project (60 years). For example, once every 60 years (1 event).
2	The event occurs a limited number of times during the lifetime of the project. For example, once every 25 years (2-3 events).
3	The event occurs regularly during the lifetime of the project. For example, once every 2-5 years (12-30 events).
4	The event occurs frequently during the lifetime of the project. For example, once per year (60 events).
5	The event occurs very frequently during the lifetime of the project. For example, multiple times per year (more than 60 events).

2.4 Consequence Criteria

Table 2.2 sets out the criteria used to rate the consequence of a climate risk, based on its potential impact on the Proposed Development's amenity (elements that enhance the user experience) and function (how well the development serves its intended residential purpose).

Table 2.2 - Criteria Used to Determine Consequence

Score	Description
1	Very low but measurable effect on site users and the Proposed Development. Slight negative change in amenity value and slight negative change in function.
2	Low but measurable effect on site users and the Proposed Development. Low negative change in amenity value and slight negative change in function.
3	Moderate effect on site users and the Proposed Development. Moderate negative change in amenity value and slight negative change in function.
4	Moderate effect on site users and the Proposed Development. Major negative change in amenity value and low negative change in function.
5	Moderate effect on site users and the Proposed Development. Major negative change in amenity value and moderate negative change in function.

Score	Description
6	Major effect on site users and the Proposed Development. Major negative change in amenity value and major negative change in function.
7	Extreme effect on site users and the Proposed Development. Loss of asset.

2.5 Risk Rating

The overall risk rating is the product of the probability score (1-5) and the consequence score (1-7), giving a value between 1 and 35. Table 2.3 presents the resulting risk matrix. For the purposes of this assessment the ratings are banded as: Low (1-6), Medium (7-14) and High (15-35). Resilience and adaptation measures have been considered for all items rated Medium or High, and are summarised in Section 5.0.

Table 2.3 - Risk Rating (Probability × Consequence)

Consequence ↓ / Probability →	1	2	3	4	5
1	1 - Low	2 - Low	3 - Low	4 - Low	5 - Low
2	2 - Low	4 - Low	6 - Low	8 - Medium	10 - Medium
3	3 - Low	6 - Low	9 - Medium	12 - Medium	15 - High
4	4 - Low	8 - Medium	12 - Medium	16 - High	20 - High
5	5 - Low	10 - Medium	15 - High	20 - High	25 - High
6	6 - Low	12 - Medium	18 - High	24 - High	30 - High
7	7 - Medium	14 - Medium	21 - High	28 - High	35 - High

2.6 Limitations and Assumptions

The principal uncertainty in this CCRRA relates to the climate change projections against which the scheme is assessed. UKCP18 presents a set of scenarios (Representative Concentration Pathways, RCPs) that capture the relationships between human choices, emissions, concentrations and temperature change. There are four RCP scenarios available (RCP 2.6, 4.5, 6.0 and 8.5). In-line with IEMA (2020), the most conservative, highest-impact scenario, RCP 8.5, has been used. These projections contain inherent uncertainty, reflecting the difficulty of quantifying future human activity (including technological change) and its influence on the climate.

The assessment is high level and reflects the emerging design at the time of writing. It is assumed that the information provided is accurate, and that the resilience measures described would be developed and confirmed through the detailed design and through the wider EIA technical chapters (in particular flood risk, energy and overheating). Further assessment would be required to confirm the conclusions as the design progresses.

3.0 Baseline and Future Climate

3.1 Current Baseline Climate

The current baseline climatic conditions have been taken from the nearest representative Met Office climate station. The site lies in central Manchester at low elevation (circa 35-40m AOD). The most representative long-term station is Manchester Airport (Ringway), situated circa 9km south of the site at 69m AOD. (CWC note that some earlier assessments have used the Buxton station; Buxton sits at circa 307m AOD in the Peak District, some 20 miles to the south-east, and records materially colder and wetter conditions than the city-centre site. The Ringway station is therefore considered the more representative baseline and has been adopted here.)

Table 3.1 summarises the 1991-2020 climate normals for the Ringway station, taken to be representative of the baseline year (circa 2025). On average, the warmest months are July and August and the coolest are December and January; the wettest month is October and the driest is March; and the sunniest month is May.

Table 3.1 - Baseline Climatic Conditions - Manchester Airport (Ringway), 1991-2020 normals

Month	Mean daily max (°C)	Mean daily min (°C)	Daily mean (°C)	Rainfall (mm)	Rain days (≥1mm)	Sunshine (hrs)
January	7.3	1.7	4.5	67.3	13.1	51.4
February	8.2	2.0	5.1	61.1	9.7	72.7
March	10.4	3.6	7.0	51.3	12.3	100.7
April	12.7	5.0	8.9	60.6	11.2	139.7
May	16.3	7.8	12.1	59.1	10.4	184.5
June	18.5	10.4	14.5	62.6	11.1	173.6
July	20.6	12.5	16.6	59.8	10.9	179.0
August	20.8	12.6	16.7	73.1	12.0	173.6
September	17.8	10.3	14.1	71.2	11.1	131.6
October	13.7	7.1	10.4	95.1	13.6	101.9
November	10.2	4.4	7.3	86.0	14.1	54.8
December	7.4	1.7	4.6	84.0	13.5	47.5
Annual	**13.7**	**6.6**	**10.2**	**831.2**	**142.9**	**1,411**

3.2 Climate Change Projections

UKCP18 uses RCPs to model future climate scenarios. Following IEMA (2020), RCP 8.5 (the highest-impact scenario) has been used. In broad terms, projected climate trends over UK land during the 21st century show warmer, wetter winters and hotter, drier summers, although natural variability means occasional cold or dry winters and cool or wet summers would still occur. The key trends are summarised below:

- Temperature - warming is projected across all seasons, with greater warming in summer than in winter; the frequency of hot days and heat waves is expected to increase.
- Precipitation - a clear shift towards a higher likelihood of drier summers is projected, although the likelihood of individual wet summers reduces only slightly; the risk of heavy, intense rainfall events is likely to increase.
- Sea level - sea levels have risen over the 20th century and are projected to continue rising; this is not considered a direct risk to this inland site, although it can influence regional flood behaviour.
- Snow - a decrease in both falling and lying snow is projected across the UK, consistent with warmer winters and the local urban heat island effect.
- Wind - there are no compelling trends in storminess from the observational record, although UKCP18 projects a modest increase in near-surface wind speeds and in the frequency of winter storms over the second half of the century. Storm-related winds remain among the most damaging and disruptive events for buildings, services and transport.

Table 3.2 presents indicative UKCP18 (RCP 8.5) projected changes for the North West England region relative to a 1981-2000 baseline, using the central (50th percentile) estimate. The figures are indicative only; UKCP18 presents the full probabilistic range (10th-90th percentiles), and the upper end of that range would represent a more onerous scenario.

Table 3.2 - Indicative UKCP18 (RCP 8.5) Projected Change, North West England (50th percentile, vs 1981-2000)

Season / Variable	2020-39	2040-59	2060-79	2080-99
Winter - mean temperature (°C)	0 to +1	+1 to +2	+2 to +3	+3 to +4
Winter - precipitation change (%)	0 to +10	0 to +10	+10 to +20	+10 to +20
Summer - mean temperature (°C)	+1 to +2	+1 to +2	+3 to +4	+4 to +5
Summer - precipitation change (%)	-10 to 0	-20 to -10	-30 to -20	-40 to -30

4.0 Identification and Evaluation of Climate Change Risks

4.1 Climate Hazards and Risk Assessment

Table 4.1 lists the potential climate hazards (and hazards exacerbated by climate change) considered for the Proposed Development, adapted from the C40 Cities Climate Change Risk Assessment Guidance. For each hazard a risk assessment has been undertaken **prior to the incorporation of mitigation**, taking into account the probability of the event and its potential consequence in-line with the methodology in Section 2.0. The risk column is colour-coded green (Low), amber (Medium) and red (High). 'P' denotes probability and 'C' denotes consequence.

Table 4.1 - Climate Change Risk Assessment (pre-mitigation)

Climate hazard	Description	Potential impact / receptors	Change in likelihood (climate change)	P	C	Risk	Mit.
Wind-driven rain / rainstorm	Heavy rainfall with strong winds	Facade water ingress; discomfort; material wear	Less frequent but more intense	5	1	5 - Low	No
Surface water / pluvial flooding	Intense rainfall overwhelming drainage in an urban catchment	Localised flooding of access, podium and basement/services	More frequent and more intense	3	3	9 - Medium	Yes
Canal / fluvial water level	Raised levels in the Bridgewater Canal / Castlefield Locks	Flooding to lower levels adjacent to the waterway	Uncertain / slightly more frequent	2	4	8 - Medium	Yes
Heavy snow	Rapid snowfall	Loading on roofs/balconies; access disruption	Less frequent	2	2	4 - Low	No
Fog	Low visibility from suspended droplets	Access and accident risk	Uncertain	5	1	5 - Low	No
Hail	Ice pellets during storms	Damage to glazing/finishes; discomfort	More frequent	5	1	5 - Low	No
Severe wind / storms	Winds >23 m/s, gusting around a tall tower	Structural and cladding loads; falling debris; pedestrian wind discomfort/safety	Stable to slightly increasing (winter)	4	3	12 - Medium	Yes
Lightning	Electrical discharge to a tall, exposed structure	Damage to structure/services; fire risk	Stable	2	6	12 - Medium	Yes
Extreme winter conditions	Heavy snow with strong winds and very low temperatures	Damage to fabric/services (e.g. frozen pipework); access	Less frequent	4	3	12 - Medium	Yes
Cold wave	Several days of very low temperatures	Frozen/burst pipework; cold discomfort; energy demand	Less frequent	4	3	12 - Medium	Yes
Extreme hot days (>30°C)	Single very hot days	Overheating; material wear; health impacts (esp. vulnerable groups)	More frequent	4	4	16 - High	Yes
Heat wave	Several consecutive hot days, often humid;	Overheating of dwellings; health risk to vulnerable	More frequent	4	5	20 - High	Yes

Climate hazard	Description	Potential impact / receptors	Change in likelihood (climate change)	P	C	Risk	Mit.
	amplified by the urban heat island	occupants; high cooling demand					
Drought / prolonged dry spell	Extended dry periods	Water scarcity; stress to landscaping/green infrastructure; potential ground movement	More frequent	3	2	6 - Low	Yes

4.2 Site-Specific Considerations

In addition to the generic hazards above, a number of site-specific matters have informed the assessment:

- Flood risk and the waterway - the site adjoins Castlefield Locks and a small area of the Bridgewater Canal. For an urban, largely impermeable catchment, surface water (pluvial) flooding is expected to be the predominant flood mechanism, with the potential for raised canal/dock levels to affect the lowest levels. The detailed flood mechanisms and levels are to be confirmed by the project Flood Risk Assessment, which should incorporate the Environment Agency climate change allowances for rainfall and river flow.
- Urban heat island - the dense, hard-surfaced city-centre setting elevates local air temperatures relative to the surrounding area, particularly at night. This amplifies the extreme-hot-day and heat-wave risks, which is of particular relevance given the residential use, the vulnerable occupants and the extensively glazed tall tower.
- Wind microclimate - the 44-storey tower (circa +168.00m AOD) has the potential to generate downdraughts and channelling effects at podium, entrance and public-realm level, with implications for pedestrian comfort and, in stronger winds, safety. A pedestrian wind microclimate assessment (wind tunnel or CFD, assessed against the Lawson comfort criteria) is recommended to confirm conditions and any mitigation.
- Other - the tall, exposed structure increases the likelihood of lightning strike (addressed by lightning protection); freeze-thaw action and frozen pipework remain relevant in cold spells; and prolonged dry periods raise water-efficiency and landscaping-resilience considerations.

4.3 In-Combination Climate Effects

In-line with IEMA (2020), consideration has also been given to in-combination climate effects - that is, how climate change could alter the significance of the development's environmental effects on other receptors over its lifetime. These are

matters to be carried into, and confirmed by, the relevant EIA technical chapters. The principal interactions identified are summarised in Table 4.2.

Table 4.2 - In-Combination Climate Effects

Environmental topic	Potential climate interaction	Consideration
Drainage & flood risk	More intense rainfall increases surface water runoff and flood risk	Drainage/SuDS strategy and FRA to be designed for future rainfall, incorporating climate change allowances
Overheating, energy & GHG	Hotter summers increase cooling demand and operational energy/carbon	Passive design, fabric and ventilation to limit cooling demand; overheating assessed to CIBSE TM59
Water resources	Drier summers increase water stress	Water-efficient fittings and drought-tolerant planting
Construction phase	More extreme weather (heat, wind, intense rainfall) during construction	CEMP to manage weather-sensitive activities, dust and surface water runoff
Air quality	Higher temperatures can worsen ground-level ozone and pollution episodes	Low-emission design and landscaping to support local air quality
Biodiversity & green infrastructure	Climate stress on planting and habitats	Climate-resilient, drought-tolerant species; blue/green infrastructure
Health & wellbeing	Heat and flooding disproportionately affect vulnerable occupants	Overheating mitigation, accessible cool/green space and resilient services

5.0 Increasing the Resilience of the Proposed Development

Table 5.1 summarises the resilience and adaptation measures that have been, or would be, incorporated for the Medium and High-risk items identified in Section 4.0, to increase the resilience of the Proposed Development to the likely effects of climate change. A number of these measures are already reflected in the emerging design; others would be developed and confirmed through the detailed design and the wider EIA technical chapters.

Table 5.1 - Climate Change Resilience and Adaptation Measures

Risk	Resilience / adaptation measure
Surface water / pluvial flooding	Finished floor levels, drainage and SuDS designed in-line with the Flood Risk Assessment and drainage strategy, incorporating the appropriate climate change allowances; surface water discharge controlled to agreed rates; critical services and electrical plant located above flood-risk levels where practicable.
Canal / fluvial flooding	Layout and levels set with regard to the adjacent Bridgewater Canal and Castlefield Locks; lower-level and basement areas detailed to limit water ingress; to be confirmed against the Flood Risk Assessment.
Severe wind & wind microclimate	Structure and facade designed to the relevant wind loading standards (BS EN 1991-1-4); a pedestrian wind microclimate assessment (wind tunnel/CFD) is recommended for the 44-storey tower, with mitigation (canopies, screening, landscaping) at podium and entrance level as required.
Extreme hot days & heat wave (overheating)	Overheating assessed using CIBSE TM59 for the dwellings; passive measures prioritised (solar control glazing, external shading/balconies, thermal mass, openable windows and a defined ventilation strategy), with mechanical cooling provided where passive measures alone cannot achieve acceptable internal conditions; green/blue infrastructure and lighter surface finishes to help offset the urban heat island.
Cold wave / extreme winter conditions	Building fabric and insulation designed for cold conditions; frost protection (and trace heating where required) to exposed pipework and externally located plant.
Lightning	Lightning protection system designed to BS EN 62305, appropriate to a tall structure.
Drought / water scarcity	Water-efficient sanitaryware and fittings (targeting the optional Building Regulations water consumption standard) and drought-tolerant landscaping.
General severe weather & service resilience	Robust, well-detailed and maintainable facade, roof and drainage; resilient M&E services and utility connections; maintenance access designed in.

These measures are subject to detailed design and to confirmation through the relevant EIA technical chapters. Owing to the nature and scale of many climate hazards, some level of residual risk would remain in certain instances even after mitigation.

6.0 Conclusion

A set of climate change risks to the Proposed Development has been identified using the C40 Cities Climate Change Risk Assessment Guidance and assessed, in-line with IEMA (2020), on the basis of the probability of an event occurring and its consequence. The assessment has used UKCP18 (RCP 8.5) projections and a baseline drawn from the representative Manchester Airport (Ringway) 1991-2020 climate normals.

The risks rated Medium or High - principally overheating during extreme hot days and heat waves (amplified by the urban heat island), surface water and canal/fluvial flooding, severe wind and the tall-building wind microclimate, cold-weather effects and lightning - have been considered, and resilience and adaptation measures identified and, where possible, reflected in the emerging design.

It is considered that, subject to those measures being carried through the detailed design, the residual risks would be in-line with typical expectations for a high-density urban residential development of this nature in the UK. Nevertheless, owing to the nature and scale of many climate hazards, some residual risk would remain in certain instances. The risks should be reviewed and refined as the building design and the wider EIA progress, with additional or enhanced mitigation considered where appropriate.

7.0 References and Guidance

This assessment has had regard to the following principal guidance and reference documents:

- IEMA (2020) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation.
- IEMA (2022) Assessing Greenhouse Gas Emissions and Evaluating their Significance.
- Met Office UK Climate Projections 2018 (UKCP18).
- Met Office (1991-2020) Climate averages - Manchester Airport (Ringway) station.
- Environment Agency - Flood risk assessments: climate change allowances.
- CIBSE TM59 - Design methodology for the assessment of overheating risk in homes.
- CIBSE TM52 - The limits of thermal comfort: avoiding overheating in European buildings.
- BS EN 15978 - Sustainability of construction works - Assessment of environmental performance of buildings.
- BS EN 1991-1-4 - Eurocode 1: Actions on structures - Wind actions.
- BS EN 62305 - Protection against lightning.
- C40 Cities - Climate Change Risk Assessment Guidance.
- One Castlefield Project and EIA Crib Sheet (Deloitte, 08 June 2026).