Climate change risk assessment

Project

Timeframes

Risk ID	Climate hazard	Asset type	Construction/Operation Stage	Description of impact	Existing or embedded mitigation measure	Hazard Impact			Uncertainty Level		Level of Uncertainty	Proposed additional resilience measure (only if Risk Rating = 'High' (4) or 'Very high' (5))	Reference documenting relevant mitigation
						Likelihood	Consequence	Risk rating	CC Projection	CC effect on asset			
1	High temperatures	Buildings	Operation	Increased temperatures leads to increased HVAC system power demand and increased energy consumption to cool buildings	Expected temperature increase is within operational range of systems designed to current standards for 20-year design life of HVAC system. Energy efficient systems to be selected.	As likely as not	Minor	Low	Medium	Low	**Low**		
2	High temperatures	Buildings	Operation	Increased temperatures and extreme heat events lead to reduced thermal performance of buildings and reduce thermal comfort of occupants	Expected temperature increase is within operational range of systems designed to current standards for 20-year design life of HVAC system.	As likely as not	Minor	Low	Medium	Low	**Low**		
3	High temperatures	Buildings	Operation	Increased temperatures lead to accelerated degradation of building facade materials	Design of external building materials to current standards, monitored and maintained as per standard maintenance procedures.	Unlikely	Minor	Very Low	Medium	Low	**Low**		
4	High temperatures	Buildings	Construction and Operation	Extreme heat events lead to failure of sensitive equipment at high temperatures	Sensitive equipment to be located in temperature-controlled areas of buildings. Building design to meet guidance in Health Technical Memoranda.	Very unlikely	Moderate	Low	Medium	Medium	**Medium**		
5	High temperatures	Traffic and transport	Operation	Extreme heat events lead to damage to road surface, deformation of asphalt	Road construction to current standards, monitored as per standard maintenance procedures.	Very unlikely	Minor	Very Low	Medium	Low	**Low**		
6	High temperatures	Public realm	Operation	Opportunity: Increased temperatures lead to increased outdoor recreation opportunities for development occupants									
7	High temperatures	Public realm	Operation	Increased temperatures lead to accelerated degradation of materials in outdoor facilities and pavements	Facilties and pavement construction to current standards, monitored as per standard maintenance procedures.	Very unlikely	Minor	Very Low	Medium	Low	**Low**		
8	High temperatures	Utilities	Operation	Extreme heat events lead to overheating of overhead electricity transmission lines	Expected temperature increase is within operational range of transmission lines.	Very unlikely	Minor	Very Low	Medium	Low	**Low**		
9	Low temperatures	Buildings	Operation	Opportunity: Fewer frost days leads to decreased energy consumption to heat buildings									
10	Low temperatures	Buildings	Operation	Opportunity: Fewer frost days leads to improved thermal comfort of building occupants									
11	High precipitation	Buildings	Construction and Operation	Extreme rainfall events lead to localised flooding, causing damage to building structure, internal fit-out, and equipment and pumps	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change.	Unlikely	Moderate	Low	Medium	Medium	**Medium**		
12	High precipitation	Buildings	Operation	Opportunity: Extreme rainfall events lead to opportunity for rainwater harvesting									
13	High precipitation	Traffic and transport	Operation	Extreme rainfall events lead to localised flooding of roads and transport infrastructure, causing disruption to services and traffic	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change.	Unlikely	Moderate	Low	Low	Low	**Low**		
14	High precipitation	Traffic and transport	Operation	Extreme rainfall events causing damage to road surface (increased stripping rate, likelihood of potholing from moisture entering cracks in surface)	Road construction to current standards, monitored and maintained as per standard procedures. Resurfacing to occur within 10 - 20 years.	Unlikely	Minor	Very Low	Low	Medium	**Low**		
15	High precipitation	Public realm	Construction and Operation	Extreme rainfall events lead to localised flooding in public realm, causing disruption to users	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change.	Very unlikely	Moderate	Low	Low	Medium	**Low**		
16	High precipitation	Utilities	Construction and Operation	Extreme rainfall events lead to localised flooding of infrastructure, causing disruption to services	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change.	Very unlikely	Moderate	Low	Low	Medium	**Low**		
17	High precipitation	Utilities	Operation	Extreme rainfall events lead to sewer flooding	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change.	Very unlikely	Moderate	Low	Low	High	**Medium**		
18	High precipitation	Utilities	Construction and Operation	Increased average rainfall and extreme rainfall events lead to increased soil moisture levels, causing landslip and damage to utilities	Design and construction of utilities to current standards, monitored as per standard maintenance procedures.	Very unlikely	Moderate	Low	Low	Medium	**Low**		
19	High precipitation	Utilities	Operation	Extreme rainfall events leading to debris and sediment runoff, causing blockage to drainage systems	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change.	Very unlikely	Moderate	Low	Low	High	**Medium**		
20	Low precipitation	Buildings	Construction and Operation	Decreased average rainfall leads to drier soil conditions and soil shrinkage, causing damage to building foundation	Shinkage and dessication considered in foundation design however risk is low due to granular soils in local area.	Very unlikely	Major	Low	Low	Medium	**Low**		
21	Low precipitation	Buildings	Operation	Dry spells lead to desiccation of soils, causing reduced slope stability and potential earthworks failure following subsequent rainfall events	Shinkage and dessication considered in foundation design however risk is low due to granular soils in local area.	Very unlikely	Major	Low	Low	High	**Medium**		
22	Low precipitation	Buildings	Operation	Decreased average rainfall and dry spells lead to disruption to water supply to building	Buildings connected to mains water supply. Capacity checks have been undertaken with utilities to confirm capacity within network.	Likely	Minor	Medium	Low	High	**Medium**		
23	Low precipitation	Public realm	Operation	Decreased average rainfall leads to increased reliance on mains water for landscape irrigation during summer	Landscape Management Plan includes procedures for irrigation during establishment and ongoing maintenance.	Likely	Moderate	Medium	Low	Medium	**Low**		
24	Low precipitation	Public realm	Operation	Decreased average rainfall leads to loss of vegetation during summer	Landscape Management Plan includes procedures for irrigation during establishment and ongoing maintenance.	Very unlikely	Moderate	Low	Low	Medium	**Low**		
25	Low precipitation	Utilities	Operation	Decreased average rainfall leads to drier soil conditions and soil shrinkage, causing damage to underground service infrastructure and foundations	Shinkage and dessication considered in service infrastructure and foundation design however risk is low due to granular soils in local area.	Very unlikely	Major	Low	Medium	Medium	**Medium**		
26	Extreme winds	Buildings	Operation	High winds lead to increased stress and damage to buildings	Current standards include sufficient allowance for changes in wind patterns	Very unlikely	Major	Low	Medium	Medium	**Medium**		

27	Extreme winds	Public realm	Operation	High winds lead to damage to vegetation and trees	Site is exposed and strong winds currently occur, layout of buildings considers mitigation of wind impacts through creation of microclimates.	Very unlikely	Minor	Very Low	Medium	Medium	**Medium**		
28	Extreme winds	Utilities	Operation	High winds lead to increased stress and damage to above ground utility infrastructure	Current standards include sufficient allowance for changes in wind patterns.	Likely	Minor	Medium	Medium	Medium	**Medium**		
29	Lightning	Public realm	Operation	Increased lighting strikes lead to more frequent damage to trees		Very unlikely	Moderate	Low	Medium	Medium	**Medium**		
30	Lightning	Utilities	Construction	Increased lighting strikes lead to more frequent damage to above ground utility infrastructure, including overhead electricity transmission lines	Considered in standard design of above ground utilities.	Very unlikely	Moderate	Low	High	Medium	**High**		
31	All		Operation	Cascading failures due to interdependent infrastructure networks (e.g. power failure causing disruption to traffic signals)		Unlikely	Minor	Very Low	High	Medium	**High**		

Likelihood Rating

Level	Descriptor	Description
A	**Very unlikely**	Event only occurs in exceptional circumstances and would not be expected to occur in the lifetime of the development
B	**Unlikely**	Based on the current design, engineering and maintenance standards, the event is not excpected to occur more than once during the lifetime of the development
C	**As likely as not**	Event may occur at least once during the lifetime of the development
D	**Likely**	Event is expected to occur several times during the lifetime of the development
E	**Very likely**	Event is expected to occur many times during the lifetime of the development

Consequence Rating

Level	Descriptor	Disruption	Public Perception
1	**Minimal**	Minpr service disruption within a single day <30 mins	Short-term adverse local stakeholder reaction
2	**Minor**	Minor service disruption for multiple days or delays up to 2h on a single day.	Adverse local media reports over sustained period; localised stakeholder concern.
3	**Moderate**	Service delays of up to 2h for multiple days or major delays (>2h) in a single day	Significant local and /or regional reports including social media. National media interest creating public concern
4	**Major**	Service closed for 1 day or major delays for multiple days	Negative national reporting and public disputes with key stakeholders, utility companies or other government agencies such as the Environment Agency.
5	**Catastrophic**	Service closed for multiple days	Extensive and prolonged negative reporting nationally and or public disputes with key stakeholders.

Risk Rating

			1	2
			Minimal	**Minor**
	A	**Very Likely**	Medium	Medium
pod	B	**Likely**	Low	Medium

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	C	As Likely as Not	Low	Low
	D	Unlikely	Very Low	Very Low
	E	Very unlikely	Very Low	Very Low

Level of Uncertainty

Uncertainity Level - Climate Change Predicition

Level	Descriptor	Consequence
A	Low	>66% probability of climate change hazard occuring
B	Medium	33-66% probability of climate change hazard occuring
C	High	<33% probability of climate change hazard occuring

Uncertainity Level - Effect of Climate Change on Asset

Level	Descriptor	Consequence
1	Low	Climate Change event expected to impact scheme as described.
2	Medium	Climate Change event may impact scheme as described.
3	High	Climate Change event not expected to impact scheme as described.

			Uncertainty Level - Effects of Climate Change	
			1	2
Uncerainty Level - Climate Change Prediction			Low	Medium
	A	Low	Low	Low
	B	Medium	Low	Medium
	C	High	Medium	High

Financial	Safety	Damage
Insignificant financial loss.	Minor harm or near miss -no adverse human health effects or complaints.	No damage to assets
Additional operational costs. Minor financial loss.	Lost time injury or medical treatment, short term impact on persons affected	No permanent damage. Some minor restoration work required.
Moderate financial loss.	Long-term injury or illness, porlonged hospitalisation or inability to work	Widespread damage and loss of service. Damage recoverable by maintenance and minor repair. Partial loss of local infrastructure.
Major financial loss.	Single fatality/ multiple long-term injuries-emergency response	Extensive damage requiring extensive repair.
Significantly high financial loss.	Multiple fatalities - emergency response	Permanent damage and/or loss of service Retreat and translocation of development.

Consequence		
3	4	5
Moderate	**Major**	**Catastrophic**
High	Very High	Very High
Medium	Very High	Very High

Medium	High	High
Low	Medium	Medium
Low	Low	Medium

on Asset

3

High

Medium
High
High

Take highest

Climate change risk identification

Project

Risk identification - resilience assessment		
	Mixed-use development	
Climate hazard + likelihood of changes	*High temperatures*	Increase in mean daily temperatures in the summer and winter, increase in the number of hot days (days when daily mean temperature is >25°C) and increased insolation
	Low temperatures	Decrease in the number of frost days (days when daily minimum temperature <0°C)
	High precipitation	Increase in mean daily rainfall in the winter, increase in the number of days with heavy rain
	Low precipitation	Decrease in mean daily rainfall in the summer, increase in the annual number of dry spells

Extreme winds	Increase in extreme wind events
Lightning	Increase in the number of lighting days, particularly in Autumn
All	

Construction	Operation	Construction and Operation	
Asset type			
Buildings	Traffic and transport	Public realm	Utilities
- Increased temperatures leads to increased HVAC system power demand and increased energy consumption to cool buildings '- Increased temperatures and extreme heat events lead to reduced thermal performance of buildings and reduce thermal comfort of occupants - Increased temperatures lead to accelerated degradation of building facade materials - Extreme heat events lead to failure of sensitive equipment at high temperatures Opportunity: Fewer frost days leads to decreased energy consumption to heat buildings - Opportunity: Fewer frost days leads to improved thermal comfort of building occupants	- Extreme heat events causing damage to road surface, deformation of asphalt	- Opportunity: Increased temperatures lead to increased outdoor recreation opportunities for development occupants - Increased temperatures lead to accelerated degradation of materials in outdoor facilities and pavements	- Extreme heat events lead to overheating of overhead electricity transmission lines
Extreme rainfall events lead to localised flooding, causing damage to building structure, internal fit-out, and equipment and pumps Opportunity: Extreme rainfall events lead to opportunity for rainwater harvesting	Extreme rainfall events lead to localised flooding of roads and transport infrastructure, causing disruption to services and traffic Extreme rainfall events causing damage to road surface (increased stripping rate, likelihood of potholing from moisture entering cracks in surface)	Extreme rainfall events lead to localised flooding in public realm, causing disruption to users	Extreme rainfall events lead to localised flooding of infrastructure, causing disruption to services 'Extreme rainfall events lead to sewer flooding 'Increased average rainfall and extreme rainfall events lead to increased soil moisture levels, causing landslip and damage to utilities 'Extreme rainfall events leading to debris and sediment
Decreased average rainfall leads to drier soil conditions and soil shrinkage, causing damage to building foundation Decreased average rainfall and dry spells lead to disruption to water supply to building Dry spells lead to desiccation of soils, causing reduced slope stability and potential earthworks failure following subsequent rainfall events		Decreased average rainfall leads to increased reliance on mains water for landscape irrigation during summer 'Decreased average rainfall leads to loss of vegetation during summer	Decreased average rainfall leads to drier soil conditions and soil shrinkage, causing damage to underground service infrastructure and foundations

High winds lead to increased stress and damage to buildings	High winds lead to damage to vegetation and trees	High winds lead to increased stress and damage to above ground utility infrastructure
	Increased lighting strikes lead to more frequent damage to trees	Increased lighting strikes lead to more frequent damage to above ground utility infrastructure, including overhead electricity transmission lines
		- Cascading failures due to interdependent infrastructure networks (e.g. power failure causing disruption to traffic signals)

Risk identification - in-combination assessment

Environmental topic

Chapter 4: Socioeconomic	Chapter 5: Traffic	Chapter 6: Noise and vibration	Chapter 7: Air quality

Chapter 8: Water resources

Chapter 9: Ground conditions

Chapter 10: Biodiversity

Chapter 11: Archaeology and Cultural heritage

Chapter 12: Landscape and Visual	Chapter 13: Health and Well-being
- Changes to areas of appropriate habitat	- Increase in summer mortality and morbidity