Almaty International Airport

Environmental and Social Impact Assessment Report - Chapter 7

September 2025

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Acronyms and abbreviations

Abbreviation / Acronym	Definition
ALA	Almaty International Airport
CCRA	Climate Change Risk Assessment
EBRD	European Bank for Reconstruction and Development
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EWMP	Extreme Weather Management Plan
mm	Millimetres
NbS	Nature-based solutions
UNFCCC	United Nations Framework Convention on Climate Change
°C	Degrees Celsius

7 Climate resilience

7.1 Introduction

7.1.1 This chapter of the Environmental and Social Impact Assessment (ESIA) has been prepared with reference to the Climate Change Risk Assessment (CCRA) produced by WSP[1] for Project Horizon. This chapter outlines the climate baseline relevant to the Project, summarises the key findings of the CCRA, and presents an assessment of the likely significant environmental effects of climate change on the Project's operation.

7.1.2 Where necessary, mitigation measures have been identified and proposed to mitigate significant effects.

7.1.3 The construction phase has been scoped out, since construction is planned to be complete by 2028 and therefore will be subject to the current climate, not to additional impacts of climate change.

7.2 Methodology

Applicable guidelines and standards

7.2.1 This section outlines the key industry frameworks and best practice approaches that have informed the development of the CCRA. While the proposed developments are currently at an early design stage, the assessment has been undertaken to support climate-resilient planning and decision-making. These standards have guided the methodology to ensure consistency with recognised climate adaptation principles and support climate-resilient planning and decision-making for the Project.

7.2.2 Project Horizon's CCRA has been developed in alignment with key industry standards, including ISO 14090:2019 – Adaptation to Climate Change[2] and the European Bank for Reconstruction and Development (EBRD) Paris Alignment methodology[3].

National policy requirements

7.2.3 The CCRA acknowledges the current status of Kazakhstan's national climate adaptation policy framework. While a formal National Adaptation Plan is still under development, Kazakhstan has submitted periodic National Communications to the UN Framework Convention on Climate Change (UNFCCC), with the most recent published in 2017[4]. This report highlights increasing frequency and intensity of extreme weather events, noting that "*The frequency of extreme weather events and their overall intensity are gradually increasing and it poses a threat to the country in terms of higher pressure on the environment and potentially adverse effects on the economy*." The report also mentions the environmental and economic impacts, and outlines ongoing efforts to integrate climate adaptation into national strategies and programmes.

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[1] WSP (2025) Chapter 9: Physical Climate Change Risk Assessment, Draft Red Flag Report 10th July 2025. 2025UK383375.

[2] ISO (2019) Adaptation to Climate Change – Principles, requirements and guidelines. Available at: ISO 14090:2019 - Adaptation to climate change (accessed: September 2025)

[3] EBRD (2024) Methodology to determine the Paris Agreement alignment of EBRD investments. Available at: Green Economy Transition (GET) and Paris alignment (accessed: September 2025)

[4] Ministry of Energy of the Republic of Kazakhstan (2017) Seventh National Communication and third Biennial report of the Republic of Kazakhstan to the UN Framework Convention on Climate Change. Available at: 20963851_Kazakhstan-NC7-BR3-1-ENG_Saulet_Report_12-2017_ENG.pdf (accessed: September 2025)

7.2.4 In the absence of a formal National Adaptation Plan, the CCRA has taken a proactive approach by reviewing regional climate projections, identifying climate risks to the Project, and recommending adaptation measures. This ensures that the Project aligns with good practice in climate resilience, even in the absence of a fully defined national adaptation framework.

International policy requirements and guidance

7.2.5 The CCRA approach to ensure Paris Agreement alignment reflects the principles set out in the EBRD guidance[5] and draws on established best practice frameworks for climate vulnerability and resilience.

7.2.6 Established best practice frameworks include JASPERS Guidance – The Basics of Climate Change Adaptation, Vulnerability, and Risk Assessment[6], which provides foundational principles for evaluating climate-related risks and vulnerabilities in infrastructure projects. It also includes ISO 14090: Adaptation to Climate Change – Principles, Requirements and Guidelines[7], which sets out a framework for integrating climate adaptation into organisational decision-making and project design.

Area of influence for climate resilience

7.2.7 The study area for the CCRA is defined as the Project footprint and the physical assets such as runways and ancillary structures, and social receptors which include staff and passengers that will be present at the airport.

7.2.8 The CCRA evaluates both current and future climate conditions relevant to the Project. The baseline climate has been assessed using historical data from the past three decades (1991–2020), covering temperature, precipitation, wind, and extreme weather events. For future climate projections, the assessment considers four distinct time horizons to reflect the likely operational lifetime of the Project. Consideration of these time horizons ensure climate risks are assessed appropriately across its lifecycle:

- **Short-term:** 2030s (2020–2039)
- **Medium-term:** 2050s (2040–2059)
- **Medium-term:** 2070s (2060–2079)
- **Long-term:** 2090s (2080–2099)

7.2.9 Given the uncertainty around the design life of individual project components, the assessment has applied a precautionary approach by evaluating operational climate risks across all future time horizons. In particular, the 2090s (2080–2099) have been used to assess long-term operational impacts, recognising that ongoing maintenance, repair, and replacement will occur throughout this period. This approach ensures that resilience measures are informed by the full range of projected climate conditions over the Project's expected lifespan.

7.2.10 For the Climate Resilience topic, receptors are elements of the Project. As such, the following receptors are assessed, as outlined within the CCRA:

- Taxiway and main runway (new taxiway and refurbishment of main runway);
- Apron and parking stand (new cargo and parking stands and apron refurbishment);
- De-icing pad (construction of a new de-icing pad);

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[5] EBRD (2024) Methodology to determine the Paris Agreement alignment of EBRD investments. Available at: Green Economy Transition (GET) and Paris alignment (accessed: September 2025)

[6] JASPERS (2017) The basics of climate change adaptation, vulnerability and risk assessment. Available at: The basics of climate change adaptation, vulnerability and risk assessment (accessed: September 2025)

[7] ISO (2019) Adaptation to climate change – Principles, requirements and guidelines. Available at: ISO 14090:2019 - Adaptation to climate change (accessed: September 2025)

- Fuel farm (new tanks and connecting infrastructure, improvement to the railway unloading bay);
- Drainage and wastewater treatment (new and upgraded infrastructure);
- New buildings (ground handling and aerodrome village (Storage buildings), technical centre (offices and warehouse), inflight catering facility, central warehouse, new head office).

Methodological approach

7.2.11 This section summarises the methodology for assessing climate risks to the Project.

7.2.12 The assessment involved a vulnerability analysis to identify the climate hazards that may affect the Project. This included evaluating both exposure (the likelihood of climate hazards occurring at the Project location), and sensitivity (how susceptible key Project components are to those hazards), where:

Vulnerability = Exposure x Sensitivity

7.2.13 The exposure analysis was informed by historical climate data and future projections, using sources such as the World Bank Climate Change Knowledge Portal[8] and other publicly available datasets. This approach enabled a qualitative assessment of potential climate risks under both current and future conditions.

7.2.14 Sensitivity of Project components to climate hazards was determined using a combination of literature review, engagement with Project representatives, and professional judgement. This initial sensitivity assessment was conducted independently of any existing design measures or adaptive capacity. These factors were considered later in the process, specifically within the physical climate risk assessment, and only for components identified as having potentially material climate risks through the earlier vulnerability assessment.

7.2.15 The matrix in Table 7.1 helps to identify which climate risks may be considered material based on the combined assessment of exposure and sensitivity, guiding the prioritisation of components for further risk assessment and adaptation planning. Note that Projects for which the sensitivity exposure combination is shaded grey are not considered subject to potential material physical climate risks.

Table 7.1: Vulnerability matrix using sensitivity and exposure from the EBRD Paris Alignment Methodology

Sensitivity \ Exposure	Not likely	Plausible	Probable
Very high		Potentially material physical climate risk	Potentially material physical climate risk
High			Potentially material physical climate risk
Medium			
Low			

Source: Project Horizon Physical Climate Change Risk Assessment (WSP, 2025), as taken from the EBRD Methodology to determine the Paris Agreement alignment of EBRD investments

7.2.16 Following the identification of potentially material climate risks through the vulnerability assessment, the CCRA evaluated the potential impacts that could result from climate change. Each impact was assessed based on its likelihood of occurrence and the severity of its

[8] World Bank Group. (2021) Climate Change Knowledge Portal. Available at: Climate Change Knowledge Portal | Climate Change Knowledge Portal (accessed: September 2025)

consequences. The assessment also considered existing design measures, actions, and Project commitments that contribute to climate resilience.

7.2.17 To guide this evaluation, the CCRA applied assessment criteria outlined in the JASPERS Guidance, presented in Table 7.2, ensuring a structured and consistent approach to determining the significance of climate-related risks and the effectiveness of proposed adaptation measures.

Table 7.2: Criteria for assessing the probability of hazards affecting the Project

Likelihood	**Rare (1)**	**Unlikely (2)**	**Possible (3)**	**Likely (4)**	**Almost certain (5)**
Definition	Highly unlikely to occur	Given current practices and procedures, this incident is unlikely to occur	Incident has occurred in a similar country / setting	Incident is likely to occur	Incident is very likely to occur, possibly several times
Severity	**Insignificant (1)**	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Catastrophic (5)**
Definition	Minimal impact that can be mitigated through normal activity.	An event which effects the normal project operation, resulting in localised impacts of a temporary nature.	A serious event requiring additional actions to manage, resulting in moderate impacts.	A critical event requiring extraordinary action, resulting in significant, widespread or long-term impacts.	Disaster with the potential to lead to shut down or collapse of the asset / network, causing significant harm and widespread long-term impacts.

Source: WSP Physical Climate Change Risk Assessment, as taken from the JASPERS Guidance on the Basics of climate change adaptation, vulnerability and risk assessment.

Risk scoring

7.2.18 Once the likelihood and severity of potential climate impacts were determined, the CCRA applied a risk matrix to evaluate the overall level of risk as presented in Table 7.3.

Table 7.3: Risk Matrix

Severity	**Likelihood**				
	Rare (1)	**Unlikely (2)**	**Possible (3)**	**Likely (4)**	**Almost certain (5)**
Insignificant (1)	1	2	3	4	5
Minor (2)	2	4	6	8	10
Moderate (3)	3	6	9	12	15
Major (4)	4	8	12	16	20
Catastrophic (5)	5	10	15	20	25
Key					
	Negligible risk	Low risk	Medium risk	High risk	Extreme risk

Source: Project Horizon Physical Climate Change Risk Assessment (WSP, 2025)

7.2.19 Risks identified as ‘high’ or ‘extreme’ were considered significant and taken forward for additional mitigation to reduce potential impacts.

Limitations and assumptions

7.2.20 The assessment summarised in this chapter is based on the Project Horizon Physical Climate Change Risk Assessment (WSP, 2025). It reflects the methodologies, data sources, and timeframes applied at the time of analysis. As such, the findings and conclusions presented here are dependent on the scope and assumptions of that original assessment. Any updates to climate data, national policy developments, or Project design changes occurring after completion of the CCRA may not be reflected in this summary.

7.2.21 The CCRA is based on freely available climate data and information available from third parties for reporting purposes. The following limitations relating to the use of climate projection data should be noted:

- Climate projections are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions. The results, therefore, from the experiments performed by climate models cannot be treated as exact or factual, but projection options. They represent internally consistent representations of how the climate may evolve in response to a range of potential forcing scenarios and their reliability varies between climate variables.
- For a single emission scenario, projections can vary significantly as a function of the model used and how it is applied, so that there is a wide uncertainty band in the results. Scenarios exclude outlying ‘surprise’ or ‘disaster’ scenarios in the literature and any scenario necessarily includes subjective elements and is open to various interpretations.
- Further, the degree of uncertainty associated with all climate change projections increases for projections further into the future. Climate models and associated projections are updated on a regular basis, implying changes in the forecasted future climate.
- Validation of information: No independent verification of the observed or projected data has been undertaken, therefore responsibility or liability for any inaccuracies or shortcomings in this information will not be accepted by the authors. Should these information sources be modified by third parties we assume no responsibility for any of the resulting inaccuracies in any of our reports.

7.3 Baseline

Current baseline

7.3.1 This section outlines the current climate conditions in the Almatinskaya Region, where the Project is located. The information is based on long-term baseline data from 1991 - 2020 and provides a snapshot of temperature and precipitation patterns relevant to the area.

- The region experiences a warm to humid continental climate.
- The average annual temperature over the period 1991-2020 is 7.0°C, with July typically being the hottest month on average (30.6°C) and January the coldest (-15.5°C).
- The annual average precipitation is 256.4mm, with July being the wettest month (28.3mm), and September the driest (14.2mm).

Extreme weather events

7.3.2 Within the Almatinskaya region several severe and extreme weather events have been reported. In May 2025, forecasts indicated a high fire threat in western and central Almatinskaya with an extremely high fire threat in the northern part of the region. An unprecedented heatwave affected Central Asia in March 2025, with temperatures reaching summer-like highs of 30°C across cities in Kazakhstan, Uzbekistan, Kyrgyzstan, and Turkmenistan.

Future baseline

7.3.3 The CCRA outlines projected climate trends for the Almatinskaya Region under the high-emissions SSP5-8.5 scenario. These projections are presented across four-time horizons: 2030s (2020–2039); 2050s (2040–2059); 2070s (2060–2079); and 2090s (2080–2099).

7.3.4 The projections are based on a historical baseline (1995–2014). They show the 50th percentile values, with ranges in brackets representing the 10th and 90th percentiles to reflect uncertainty across different climate models.

Temperature

7.3.5 Temperatures in the Almatinskaya Region are expected to rise significantly over time. Under the SSP5-8.5 scenario, annual average temperatures are projected to increase by 1.3°C in the short term (2030s) and up to 5.7°C by the long term (2090s) relative to the 1995-2014 baseline, based on the 50th percentile of climate model outputs.

7.3.6 The frequency of hot days is also expected to rise:

- Days over 30°C are projected to increase from 45 per year (baseline) to 53 per year by the 2090s.
- Days over 35°C will rise from 12 to 48 per year.
- Days over 40°C, currently rare (0.1 per year), are expected to reach 17 per year.

7.3.7 In contrast, the number of frost days is expected to decline by approximately 46 days per year, reflecting the overall warming trend.

Precipitation

7.3.8 Annual precipitation in the Almatinskaya Region is projected to increase over time. From a baseline of 432mm, annual average rainfall is expected to increase by 6.8mm by the 2030s and up to 39mm by the 2090s (50th percentile).

7.3.9 Seasonal averages show contrasting changes:

- Average summer precipitation is projected to decrease by 15mm by the 2090s.
- Average winter precipitation is projected to increase by 31mm over the same period.

In addition to overall changes in precipitation patterns, projections indicate an increase in intensity, with more frequent extreme rainfall events. Notably, both 1-day and 5-day rainfall totals are expected to rise. This is particularly relevant given the significant pluvial flooding event that occurred at Almaty International Airport (ALA) on 16 July 2024, which exposed vulnerabilities in the original drainage design[9].

Relative humidity

7.3.10 Relative humidity levels in the Almatinskaya Region are projected to decline gradually over time. By the 2090s, reductions of approximately 3.4% in summer and 2.7% in winter are expected (50th percentile), indicating a consistent downward trend across seasons.

Wind

7.3.11 Future changes in wind speed for the Almatinskaya Region are subject to high uncertainty due to natural climate variability and limitations in regional climate models. According to data from

[9] ALA (2025) The Lenders ES Monitoring Report – RFI030-031-032

the Copernicus Interactive Climate Atlas, the average daily wind speed over the period 1950-2020 in Kazakhstan was 3.5 m/s[10].

7.3.12 Projections under the SSP5-8.5 scenario suggest minimal change in average daily wind speeds across the short-, medium-, and long-term timeframes, with a slight decrease of 0.1 m/s (50th percentile). While these projections do not indicate significant changes in average wind speeds, they do not rule out the possibility of extreme wind events, although Almaty City is not typically exposed to severe storms such as cyclones or hurricanes.

Wildfire

7.3.13 The wildfire hazard risk in Almaty City is classified as 'High', meaning there is a greater than 50% chance each year of experiencing weather conditions that could support a significant wildfire, potentially resulting in loss of life and property.

7.3.14 With the influence of climate change, this risk is projected to increase over time, driven by both a longer fire season and greater severity fire events[11].

Flood risk

7.3.15 The river and urban flood risk in Almaty City is currently classified as 'Very Low', meaning there is less than a 1% chance of a significant, life-threatening river flood occurring in the next 10 years.[11] The Malaya Almatinka River, located about 50m west of the site and 20m below airport elevation, and the Kotyrbulak River, culverted beneath the runways, pose minimal fluvial flood risk, with no known history of flooding at the site[12].

7.3.16 However, future flood risk may increase in the short- and medium-term due to rising winter and annual precipitation and glacial melt, which feeds into nearby river systems. In the long-term, this risk reduces as glacial retreat may reduce river flow.

7.3.17 In the Almaty region, extensive efforts have been made to mitigate the growing flood risk associated with glacial melt[13]. These efforts are driven by the increasing formation and expansion of moraine-dammed glacial lakes due to climate-induced glacier retreat, which pose a significant hazard to downstream communities. Structural measures have been implemented, including the construction of spillways, drainage tunnels, and diversion canals to manage lake water levels and reduce the risk of sudden outbursts. These engineering solutions are complemented by non-structural strategies such as hazard and risk mapping, strategic land-use planning, and community-based disaster preparedness programmes.

7.3.18 Conversely, the risk of pluvial flooding may increase, especially in winter months due to increased precipitation, and in summer due to hardened ground from dry spells, which can lead to flash flooding during heavy downpours.

Landslide

7.3.19 Landslide risk in Almaty City is currently classified as 'Medium'[11], meaning landslides are infrequent but possible, influenced by factors such as rainfall patterns, terrain slope, geology, soil type, and land cover.

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[10] Copernicus Climate Change Service (2024) Copernicus Interactive Climate Atlas. Available at: Copernicus Interactive Climate Atlas (accessed: September 2025)

[11] Global Facility for Disaster Reduction and Recovery (GFDRR) (2020) Think Hazard. Available at: Think Hazard (accessed: September 2025)

[12] Geographical Research Letters (2025) Almaty Topographic Map. Available at: https://en-gb.topographic-map.com/map-5cg14/Almaty/. (accessed July 2025)

[13] Ahmed, R. (2024) Glacial Lake Outburst Flood (GLOF) Hazard and Risk Management Strategies: A Global Overview. [online] Available at: Glacial Lake Outburst Flood (GLOF) Hazard and Risk Management Strategies: A Global Overview | Water Resources Management (last accessed: August 2025)

7.3.20 With climate change, this risk may increase over time due to potential changes in precipitation and temperature, which can affect slope and bedrock stability.

Exposure appraisal

7.3.21 Based on the exposure appraisal as indicated in the Project Horizon CCRA, the Project components may be significantly impacted by the following climate hazards:

- High temperatures and heatwaves
- Cold spells
- Heavy precipitation and flooding
- Dry spells and water availability
- Decreasing relative humidity
- Wind and storm events
- Wildfire
- Changes in ground stability

7.4 Potential impacts

7.4.1 This section assesses the potential impacts of climate change on the operational phase of the Project. As noted in paragraph 7.1.3, the construction phase has been scoped out of this assessment. This is because construction is expected to be completed by 2028 and will therefore be subject to current climate conditions, rather than future climate change impacts.

Operation

Temperature

7.4.2 High temperatures may lead to surface degradation in hardstanding areas such as taxiways, runways, aprons, and parking stands. This includes risks of melting, cracking, and accelerated wear.

7.4.3 Extreme weather conditions may increase pressure in stored liquids and elevate fire risks within fuel storage systems. Snow and ice accumulation also pose risks to aboveground pipework and pumping equipment, potentially leading to damage or operational disruption.

7.4.4 Cold weather events, including ice, snow, and freezing fog, have the potential to disrupt airport operations, affecting both ground and airside activities.

7.4.5 Buildings and occupants may be affected by temperature extremes, which can accelerate material degradation and increase health and safety risks, particularly during heatwaves or cold spells.

7.4.6 Vegetated areas may deteriorate under extreme heat conditions, impacting their usability, visual quality, and maintenance requirements.

Increasing precipitation and flooding

7.4.7 There is a potential impact of drainage infrastructure overwhelm due to increased annual and winter precipitation, which could result in standing water; damage to infrastructure and buildings; spread of pollutants and access and egress disruptions.

Wind and storms

7.4.8 There is the potential for damage from wind-blown debris to impact the equipment at the de-icing pad and fuel farm, as well as buildings, which may require appropriate design and maintenance measures.

Wildfire

7.4.9 All components of the Project may be exposed to wildfire risk, which poses a potential threat to both infrastructure and safety. While the likelihood of such events may vary, their occurrence could result in significant disruption and damage.

Ground stability

7.4.10 Hardstanding surfaces and building foundations may be affected by ground movement resulting from prolonged wet or dry periods, combined with temperature extremes. These conditions can lead to subsidence, cracking, or frost-related damage due to changes in soil stability and moisture content.

7.4.11 Based on the assessment, several components of the Project are potentially subject to significant climate-related impacts. These are summarised below and should be considered in the context of long-term resilience planning and design adaptation.

- All Project components (excluding drainage and wastewater treatment) in relation to high temperatures, heatwaves, and cold spells.
- All Project components in relation to heavy precipitation and flooding.
- The fuel farm and new buildings, in relation to wind and storm events.
- The fuel farm in relation to wildfire.
- The taxiway, and main runway in relation to changes in ground stability.

7.5 Assessment of effects

7.5.1 This section outlines the potential climate-related effects on the Project's operational phase across four future time horizons: 2030s, 2050s, 2070s, and 2090s. Risks have been assessed based on projected climate hazards and their potential impact on infrastructure, operations, and safety.

Operational phase effects

Short term (2030s)

7.5.2 Risks for the 2030s are rated as Negligible, Low, or Medium, with no additional adaptation measures required at this stage.

7.5.3 The identified Medium (4) risks included:

- Increasing temperatures and heatwaves leading to overheating in buildings, affecting comfort and health.
- Cold spells and snow and ice leading to access and egress issues.

Medium term (2050s)

7.5.4 Two High risks were identified, both related to overheating in new buildings due to rising temperatures.

7.5.5 The identified Medium risks (9) included:

- Temperature extremes leading to deformation of taxiways/runways.
- Pluvial flooding and standing water affecting airport operations.
- Heavy rainfall and flooding leading to overwhelm of drainage systems.
- Increasing temperatures and heatwaves leading to increased cooling demand for buildings.
- Cold spells with snow and ice-related access issues.

Medium term (2070s)

7.5.6 The same two High risks identified in the 2050s remain relevant for the 2070s period.

7.5.7 The number of Medium risks increase to 35, reflecting greater exposure to climate hazards over time.

Long term (2090s)

7.5.8 Three High risks are identified, consistent with those outlined in earlier time horizons.

7.5.9 The number of Medium risks increase to 39, including:

- Increased temperatures and heatwaves leading to surface deformation of aprons, parking stands, and de-icing areas.
- Increased temperatures and heatwaves leading to overheating and equipment failure within parking and apron stands.

7.5.10 In line with the methodology and as outlined in paragraph 7.2.18, risks assessed as 'high' or 'extreme' within the 2090s time horizon are considered significant. No *Extreme* risks were identified.

7.5.11 Risk scores account for embedded design measures identified at the current design stage and standard good practice operational measures.

7.5.12 Three *High* risks considered significant for the 2090s include:

- **(Risk score – 15)** High temperatures and heatwaves leading to overheating of buildings (new buildings) resulting in uncomfortable working conditions and health impacts;
- **(Risk score – 15)** High temperatures and heatwaves leading to overheating of buildings, resulting in uncomfortable working/amenity conditions and health impacts; and
- **(Risk score – 12)** High temperatures and heatwaves leading to deformation of taxiway or runway impeding airport operations.

7.6 Additional mitigation

7.6.1 This section summarises additional mitigation measures for the three climate-related risks considered significant to the Project. These measures aim to enhance resilience and reduce potential impacts associated with overheating and surface deformation under future climate scenarios.

7.6.2 As the design of the Project components progresses, projected climate trends should be integrated into the design process to manage risks such as overheating. Measures include:

- Incorporate nature-based solutions (NbS) for shading and cooling.
- Use natural or mechanical ventilation and cooling systems.
- Specify appropriate glazing and install awnings, canopies, shutters, or blinds to reduce solar gain.

7.6.3 For the third high risk, relating to high temperatures and heatwaves leading to deformation of taxiway or runway, impeding operations, the following additional mitigation measures are identified:

- Regular inspection and monitoring of taxiways and runways should be carried out to identify early signs of surface degradation.
- If any issues are detected, prompt and effective repair works should be undertaken to prevent further deterioration and extend the lifespan of the pavement infrastructure.

7.6.4 The following additional mitigation measure is identified as part of this ESIA, and is committed to by ALA, applicable across a range of risks:

- Update the Environmental and Social Management Plan (ESMP) to include a dedicated Extreme Weather Management Plan (EWMP). The EWMP should include protocols for:
  - Real-time rainfall monitoring
  - Flood risk mapping and infrastructure resilience assessments
  - Emergency response coordination
  - Preventative schedules for drainage systems
  - Contingency plans for prolonged or high-intensity rainfall events
  - Communication strategies and stakeholder coordination (e.g. air traffic control, emergency services)
  - Integration with broader airport emergency response frameworks.

7.7 Summary of residual effects

7.7.1 Following the application of mitigation measures proposed within Section 7.6, it is concluded that there will be no significant residual effects for the operational phase of the Project.

7.7.2 The recommended interventions are likely to effectively reduce potential impacts to a level that is not considered significant. Ongoing monitoring and adaptive management will ensure that any unforeseen effects are promptly identified and addressed, further supporting the conclusion of no significant residual effects.

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