APPENDIX C

Horizontal Clearances

Climate Change Risk Register

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Inland Rail Climate Change Risk Register - Albury to Illabo and Stockinbingal to Parkes Project

Albury to Illabo and Stockinbingal to Forbes Packages

Revision Date: 12-05-21 Document: 2-0008-210-ESS-00-RG-0001

Risk Ref	Climate Hazard	Risk impact description	Direct/ Indirect Risks	Adaptation inherent in design / operations (inc. ARTC Operational Procedures)	2030 Initial Risk Assessment										2090 Initial Risk Assessment										Applicability					Additional Adaptation Actions (Inland Rail Climate Change Risk Assessment Framework)	A2I Design Adaptation Actions	2030 Reassessed Risk Assessment										2090 Reassessed Risk Assessment									
					Likelihood	Consequence								Initial Risk	Likelihood	Consequence								Initial Risk	Stockinbingal to Forbes	Albury	Lockhart / Greater Hume	Wagga Wagga	Junee			Likelihood	Consequence								Reassessed Risk	Likelihood	Consequence								Reassessed Risk
						Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence			Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence										Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence		Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	
IR CCR 1	Temperature increase - More hot days and warm spells	Risk to health and safety of staff or visitors working along the rail corridor through heat stress or heat related illness	Direct	Pre work brief Monitoring and responding to extreme weather events Access to corridor Night working across the Nullarbor Heat stress training Hazards and new miss reporting First aid training	C	2					1		2	LOW - 2C	C	2					1		2	LOW - 2C	X	X	X	X	X	Learning from other locations to ensure a consistent approach across the Australian Network (e.g. expanding night works) Apply learnings from hazard and near miss reporting	Not applicable to design	C	2					1		2	LOW - 2C	C	2					1		2	LOW - 2C
IR CCR 2	Temperature increase - More hot days and warm spells	Risk to business continuity as a result of heat event (e.g. increased incidence of delayed services	Direct	Monitoring and responding to extreme weather events Business continuity plans for each site ETM-06-08 Managing Track Stability ETM-06-08F-01 Misalignment/Buckle Report ETI-06-07 Responding to Buckles Put speed restrictions in place (more cautious in Jan and Feb due to uncertainty of how work upgrades will perform)	B		1	2					2	MED - 2B	A		1	2					2	MED - 2A	X	X	X	X	X	In future consider impacts on contracting and reliability criteria, adjusting level of service offering	Not applicable to design	B		1	2					2	MED - 2B	A		1	2					2	MED - 2A
IR CCR 3	Temperature increase - More hot days and warm spells	Increase in hot days resulting in track twisting (buckling) which could lead to derailment of trains along the rail line	Direct	Monitoring and responding to extreme weather events ETM-06-08 Managing Track Stability ETM-06-08F-01 Misalignment/Buckle Report ETI-06-07 Responding to Buckles Put speed restrictions in place (more cautious in Jan and Feb due to uncertainty of how work upgrades will perform)	D	3	3	1					3	LOW - 3D	C	3	3	1					3	MED - 3C	X	X	X	X	X	Ensure stress free temperature is monitored and issues are identified early. Recognising trigger points for speed restrictions when temp reached in the rail Designing for future extreme temperatures (e.g. turn outs and grade separations). Instrument the track. Ensure and enforce high quality of the build/ welds and track adjustment Stress Free Temperature monitoring instrumentation to the rails	Where track slewing or track re-construction is being undertaken, - Ensure stress free temperature is monitored and issues are identified early. - Recognising trigger points for speed restrictions when temp reached in the rail - Ensure and enforce high quality of the build/ welds and track adjustment - Stress Free Temperature monitoring instrumentation to the rails - Inspection and maintenance proceedure to observe and action throughout operation.	E	3	3	1					3	LOW - 3E	D	3	3	1					3	LOW - 3D
IR CCR 4	Temperature increase - More hot days and warm spells	Decreased efficiency and more frequent outages of electrical (track switches, signalling, etc.) and communication systems	Direct	Standards and type approvals Redundancies and continuity plans Run under degraded conditions as per ARTC standards	C		1	1					1	LOW - 1C	B		1	1					1	LOW - 1B	X	X	X	X	X		N/A to Design scope. Signalling scope of works by ARTC	C		1	1					1	LOW - 1C	B		1	1					1	LOW - 1B
IR CCR 5	Temperature increase - More hot days and warm spells	Increased extreme temperature and solar exposure may lead accelerated degradation of materials and reduced life of structures (bridges, crossings, track) and specialist equipment (communications towers, signalling) resulting in increased capital cost due to the need for more frequent repairs and maintenance	Direct	Type approval process General standards	C			1					1	LOW - 1C	B			1					1	LOW - 1B	X	X	X	X	X		AS5100 Bridge Design standards incorporates maximum temperature. Recommend in Detailed Design stage that temperatures be reassessed for sensitivty to account for climate change projections. Protective coatings to account for higher UV ratings expected, and may have implications on reapplication schedule.	C			1					1	LOW - 1C	B			1					1	LOW - 1B
IR CCR 6	Temperature increase - More hot days and warm spells	Extreme heat leading to increased power demand and/or failure of power infrastructure (i.e. substations, LV/HV switchboards) resulting in interruptions to power mains supply with increased frequency and duration of power outages	Indirect	Redundancies and continuity plans Business continuity plans Remote sensing and remote monitoring Run under degraded conditions as per ARTC standards	C		2						2	LOW - 2C	B		2						2	MED - 2B	X	X	X	X	X	Review and retrofit for new technologies and improvements (ongoing), future proof to ensure alternative power sources are possible. Keep up to date. Consider asset replacement time horizons to ensure appropriateness and suitability for service. Forward maintenance strategy (trial, test and approval) and non-mandated review periods.	Not applicable to design	D		2						2	LOW - 2D	C		2						2	LOW - 2C
IR CCR 7	Temperature increase - More hot days and warm spells	Increased incidence of extreme heat limiting the ability for ARTC to attract workers due to undesirable conditions	Indirect	Staff survey and feedback process	C			2					2	LOW - 2C	B			2					2	MED - 2B	X	X	X	X	X	Attractive salary and workforce reward systems (competition with other industries i.e. mining companies in parts of the country) Common issue for many companies in response to heat so will be an industry wide response.	No design adaptation actions.	C			2					2	LOW - 2C	B			2					2	MED - 2B
IR CCR 8	Temperature increase - More hot days and warm spells	Rolling stock or hot works igniting fire due to hot, dry and windy conditions	Direct	Hot works procedure during extreme temperature (total fire ban, hot works application to go through) Welders qualified for managing heat and hot works (with rural fire brigade) Monitoring of noise and temperature of wheels and brake assembly. If temperature reaches a certain limit it will alert operating staff.	C	2	2				2		2	LOW - 2C	B	2	2				2		2	MED - 2B	X	X	X	X	X	In future stipulating requirements around rolling stock in customer contracts (however don't want to exclude those who can't afford new stock). Review wayside device placement and strategy for the future to include more at certain key points in the network.	No design adaptation actions, only operational adaptation actions.	B	2	2				2		2	MED - 2B	B	2	2				2		2	MED - 2B

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					Likelihood	Consequence								Max Consequence	Initial Risk	Likelihood	Consequence								Max Consequence	Initial Risk	Stockinbingal to Forbes	Albury	Lockhart / Greater Hume	Wagga Wagga	Junee			Likelihood	Consequence								Max Consequence	Reassessed Risk	Likelihood	Consequence								Max Consequence	Reassessed Risk
						Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule					Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule												Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule				Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule		
IR CCR 9	Solar radiation	Increase in solar radiation, resulting from decrease in cloud cover may result in potential increase in periods of direct sunshine - potential glare issues during rail operation, reducing safety	Direct		C	1							1	LOW - 1C	B	1							1	LOW - 1B	X	X	X	X	X		No design adaptation actions.	B	1							1	LOW - 1B	B	1							1	LOW - 1B
IR CCR 10	Increased intensity of extreme rainfall events	Risk to health and safety of staff (e.g. conductor, emergency crews) working along the rail corridor due to velocity and flow of flooding (e.g. flash flooding events)	Direct	Monitoring and responding to extreme weather events procedure (code red, amber and black procedure)	C	2							2	LOW - 2C	B	2							2	MED - 2B	X	X	X	X	X	Connect with and learn from emergency services, establish communications channels and procedures. More training on emergency event response	Not applicable to design	C	2							2	LOW - 2C	B	2							2	MED - 2B
IR CCR 11	Increased intensity of extreme rainfall events	More intense rainfall (and increased runoff volume from catchment) could lead to flooding of tracks and assets, inundation of drainage infrastructure and damage due to scour	Direct	Monitoring and responding to extreme weather events procedure Inland Rail hydrological risk assessment framework inclusive of climate change impacts AAR16 Sensitivity analysis as part of the hydrological risk assessment framework Modelling verification in areas requiring flood works permits. Greenfield projects undertaking sensitivity analysis and risk modelling so design can be adjusted for climate change (if deemed necessary)	C	2	3	1			1		3	MED - 3C	B	3	3	1			1		3	HIGH - 3B	X	X	X	X	X		Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. **S2F:** The exisitng flooding at the Lachlan River Bridge is unchanged as a bridge modification works only. Works do not imapact the bridge waterway area. Existing immunity is therefore maintained. The exisitng flooding at the Forbes yard clearances is unchanged as local track works are minor track slew works only. Existing immunity is therefore maintained. All other Horizontal Clearance sites are not impacted by flooding and therefore existing immunity is unchanged.	C	2	3	1			1		3	MED - 3C	B	3	3	1			1		3	HIGH - 3B
IR CCR 12	Increased intensity of extreme rainfall events	More intense rainfall could lead to flooding of tracks and assets, inundation of drainage infrastructure reducing the safety of running conditions with resulting service disruption.	Direct	Monitoring and responding to extreme weather events procedure Inland Rail hydrological risk assessment framework inclusive of climate change impacts	C	2	3						3	MED - 3C	B	3	3							3	HIGH - 3B	X	X	X	X	X	Design for retrofit upgrade (e.g. raising track, glued ballast) - in 30 years time there will be additional rainfall and runoff data to assess climate change impacts. Review risks in line with updates to the ARR guideline (about every 30 years)/or in line with an extreme flooding event (e.g. overtopping, 1% event becomes a 5% event). Then multi-criteria analysis to determine what actions to take to reduce risk.	Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. Where identified, opportunities for improvements/adaptations is included in the design documention.	C	2	3						3	MED - 3C	B	3	3						3	HIGH - 3B
IR CCR 13	Increased intensity of extreme rainfall events	Increase in intense rainfall could result in overtopping leading to damaged infrastructure	Direct		C		3	3					3	MED - 3C	B		4	3					4	V HIGH - 4B	X	X	X	X	X	Climate change should be looked at upfront to inform designs (RCP8.5) rather than analysis at end. Non-greenfield projects should also consider RCP8.5.	Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. Where identified, opportunities for improvements/adaptations is included in the design documention.	D		3	3					3	LOW - 3D	C		4	3					4	HIGH - 4C
IR CCR 14	Increased intensity of extreme rainfall events	Longitudinal scour through water running along embankment, impacting on embankment.	Direct		C	2	2	2					2	LOW - 2C	B	3	3	3					3	HIGH - 3B	X	X	X	X	X		Drainage and flooding velocities at rail embankment considered in assessment, and appropriate protection provided. RipRap or other matress type erosion controlling systems used.	C	2	2	2					2	LOW - 2C	B	3	3	3					3	HIGH - 3B
IR CCR 15	Increased intensity of extreme rainfall events	Inundation of adjacent road network and signalling equipment causing potential isolation of assets due to flooding	Direct	Run under degraded conditions as per ARTC standards	C	2	2						2	LOW - 2C	B	2	2						2	MED - 2B	X	X	X	X	X	Similar to above Plus solar back-up on most level crossings and minimisation of number of level crossings	Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. Where identified, opportunities for improvements/adaptations is included in the design documention.	C	2	2						2	LOW - 2C	B	2	2						2	MED - 2B
IR CCR 16	Increased intensity of extreme rainfall events	More intense rainfall could lead to flooding of tracks and assets, inundation of drainage infrastructure, increasing maintenance and insurance premiums costs.	Direct	Monitoring and responding to extreme weather events procedure Inland Rail hydrological risk assessment framework inclusive of climate change impacts	B			1					1	LOW - 1B	A			2					2	MED - 2A	X	X	X	X	X		Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. Where identified, opportunities for	B			1					1	LOW - 1B	A			2					2	MED - 2A
IR CCR 17	Increased intensity of extreme rainfall events	Inundation of adjacent road network impacting on ability of emergency response to reach the corridor	Direct	Out of inland rail control	C						2		2	LOW - 2C	B						2		2	MED - 2B	X	X	X	X	X		Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. Where identified, opportunities for	C					2			2	LOW - 2C	B					2			2	MED - 2B
IR CCR 18	Increased intensity of extreme rainfall events	Water damage to signalling, substations and electrical circuitry may result in disruption to electricity supply thereby impacting the functionality of level crossings, signals and utility supply	Direct/ Indirect	All signalling equipment installed above 1%AEP Monitoring and responding to extreme weather events Operational procedures when level crossings fail Redundancy through two power supplies, solar / batteries, with up to 48hrs power.	D		2	1					2	LOW - 2D	C		2	1					2	LOW - 2C	X	X	X	X	X		Not applicable to design	D		2	1					2	LOW - 2D	C		2	1					2	LOW - 2C

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IR CCR 19	Increased intensity of extreme rainfall events	Extreme rainfall leading to flooding/standing water resulting in the increased presence/risk of disease and water-borne pathogens impacting the health and safety of employees	Direct	Pre work brief Work method statements
IR CCR 20	Increased intensity of extreme rainfall events	Extreme rainfall and flooding resulting in delays to construction schedule and cost impacts	Direct	Project planning for maintenance activities consider seasonal variables
IR CCR 21	Increased intensity of extreme rainfall events	Uncertainty of extreme rainfall events/flooding behaviour impacting on design conditions/requirements. [Over or under design risks]	Indirect	Sensitivity analysis as part of the hydrological risk assessment framework
IR CCR 22	Increased intensity of extreme rainfall events	Extreme rainfall and flooding causing damage to non-rail structures potentially impacting operations	Direct	Ability to comment on land developments on adjacent properties
IR CCR 23	Increased intensity of extreme rainfall events	Increase in intense rainfall could result in regional isolation and/or service interruption due to flooding along the 1,700-km route	Direct	Inland Rail hydrological risk assessment framework inclusive of climate change impacts Property strategy to deal with severance issues
IR CCR 24	Increased intensity of extreme rainfall events	The projected periodic extreme dry and wet periods may increase the potential for erosion of substrate and ballast materials, causing increase washout. This could cause infrastructure instability, train derailment and disruption in the event of collapse.	Direct	Track inspection procedure Review and update in accordance with any updates to standards
IR CCR 25	Increased intensity of extreme rainfall events	Increased intense rainfall and flooding resulting in scour damage to adjacent properties	Direct	Agronomy assessment in hydrology design Consultation as part of EIS
IR CCR 26	Increased intensity of extreme rainfall events	Potential blockages of drainage infrastructure caused by the movement of debris during flood.	Direct	
IR CCR 27	Increased intensity of extreme rainfall events	Increased rainfall leading to rise of groundwater, increase in salinity and reduced durability of materials.	Direct	No inherent design or operational adaptation
IR CCR 28	Increased intensity of extreme rainfall events	Increased rainfall intensities leading to greater discharges, which leads to increased hydraulic impacts (e.g. afflux) on adjacent properties	Direct	
IR CCR 29	Decrease in average rainfall	Structural deterioration, soil subsidence, erosion, movement and cracking as a result of increased variability of periods of wetting and drying, reducing integrity of tracks, bridges, embankments and signalling infrastructure with potential structural failure	Direct	Basis of design Real time monitoring of track conditions

Risk Ref	2030 Initial Risk Assessment										2090 Initial Risk Assessment									
	Likelihood	Consequence: Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Initial Risk	Likelihood	Consequence: Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Initial Risk
IR CCR 19	E	2							2	LOW - 2E	D	2							2	LOW - 2D
IR CCR 20	C			3				4	4	HIGH - 4C	C			3			4		4	HIGH - 4C
IR CCR 21	E			4					4	LOW - 4E	E			4					4	LOW - 4E
IR CCR 22	D		3						3	LOW - 3D	C		3						3	MED - 3C
IR CCR 23	C			2					2	LOW - 2C	C			2					2	LOW - 2C
IR CCR 24	D		3	3			3		3	LOW - 3D	C		3	3			3		3	MED - 3C
IR CCR 25	C			2			3		3	MED - 3C	B			2			3		3	HIGH - 3B
IR CCR 26	C		2						2	LOW - 2C	B		2						2	MED - 2B
IR CCR 27	D			2					2	LOW - 2D	D			2					2	LOW - 2D
IR CCR 28	C				2	2	2		2	LOW - 2C	B					3	3	3	3	HIGH - 3B
IR CCR 29	E		4	3					4	LOW - 4E	D		4	3					4	MED - 4D

Risk Ref	Applicability: Stockinbingal to Forbes	Albury	Lockhart / Greater Hume	Wagga Wagga	Junee	Additional Adaptation Actions (Inland Rail Climate Change Risk Assessment Framework)	A2I Design Adaptation Actions
IR CCR 19	X	X	X	X	X		Not applicable to design
IR CCR 20	X	X	X	X	X	Ensure planning for maintenance activities reflect seasonal variables. Ensure maintenance planning activities are reviewed and procedures modified over time to account for seasonal variables.	Not applicable to design
IR CCR 21	X	X	X	X	X		A blockage factor of 20% has been considered in design and no change to existing or proposed track immunity is predicted.
IR CCR 22	X	X	X	X	X	Ensure that the ability to comment on land developments is maintained through the asset design life.	Not applicable to design
IR CCR 23	X	X	X	X	X		Qualitative flooding assessment completed as part of the options assessment phase. Further consideration of flooding is to be undertaken in detailed design phase, including flood modelling at some sites to determine impacts of RCP8.5 scenario in accordance with ARTC Climate Change Framework. Where identified, opportunities for improvements/adaptations is included in the design documentation
IR CCR 24	X	X	X	X	X	Routine LIDAR runs to determine mass/soil changes/movements. Install track inspections and monitoring stations to check in on these changes especially in vulnerable areas. Proximity sensors.	Routine inspections to be undertaken throughout operation in accordance with ARTC standards.
IR CCR 25	X	X	X	X	X	Collect baseline photographic evidence of current conditions (visual monitoring/ dilapidation survey). Especially useful for new greenfield sites. Cameras on monitoring vehicles/trains (AK cars – three monthly). Updating commissions and operational monitoring. – Go-Pro on drones and GPS spot checks.	Flood assessment completed to demonstrate afflux, velocity and hazard are compliant againast the impact criteria to minimise site risks where possible.
IR CCR 26	X	X	X	X	X		A blockage factor of 20% has been considered in design and no change to existing or proposed track immunity is predicted.
IR CCR 27	X	X	X	X	X		Potential for coatings systems or increased cover of reinforced in concrete structures if evidence of incrreased salinty is probable and assessment of strucutres durbability iis instructed. TBC at detailed design.
IR CCR 28	X	X	X	X	X	Insurance only valid if not foreseeable so premiums will likely then go up, may need to renegotiate. Reassess rainfall data and re-run models to check what impacts are now likely to affect adjacent properties (number of properties in the 1% AEP floodplain may change).	Flood assessment completed to demonstrate afflux, velocity and hazard are compliant againast the impact criteria to minimise site risks where possible.
IR CCR 29	X	X	X	X	X	Ensure real-time monitoring of track conditions is maintained and future monitoring technology is considered to mitigate this risk.	ARTC to carry out asset maintenance regime.

Risk Ref	2030 Reassessed Risk Assessment										2090 Reassessed Risk Assessment									
	Likelihood	Consequence: Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Reassessed Risk	Likelihood	Consequence: Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Reassessed Risk
IR CCR 19	E	2							2	LOW - 2E	D	2							2	LOW - 2D
IR CCR 20	C			3				4	4	HIGH - 4C	C			3			4	4	4	HIGH - 4C
IR CCR 21	E			4					4	LOW - 4E	E			4				4	4	LOW - 4E
IR CCR 22	D		3						3	LOW - 3D	C		3						3	MED - 3C
IR CCR 23	C			2					2	LOW - 2C	C			2					2	LOW - 2C
IR CCR 24	D		3	3			3		3	LOW - 3D	C		3	3			3		3	MED - 3C
IR CCR 25	D			2			3		3	LOW - 3D	C			2			3		3	MED - 3C
IR CCR 26	D		2						2	LOW - 2D	C		2						2	LOW - 2C
IR CCR 27	D			2					2	LOW - 2D	D			2					2	LOW - 2D
IR CCR 28	D				2	2	2		2	LOW - 2D	C					3	3	3	3	MED - 3C
IR CCR 29	E		4	3					4	LOW - 4E	D		4	3					4	MED - 4D

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						Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule				Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule										Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule			Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule		
IR CCR 30	Decrease in average rainfall	Structural deterioration, soil subsidence, erosion, movement and cracking as a result of increased variability of periods of wetting and drying causing increases in monitoring and maintenance programs	Direct	Basis of design Real time monitoring of track conditions	C			2				2	LOW - 2C	B			2				2	MED - 2B	X	X	X	X	X	Ensure real-time monitoring of track conditions is maintained and future monitoring technology is considered to mitigate this risk.	Routine inspections to be undertaken throughout operation in accordance with ARTC standards.	C			2				2	LOW - 2C	B			2				2	MED - 2B
IR CCR 31	Increase in extreme weather events and storms	Damage to tracks/siding, electrical, communications infrastructure and other structures due to higher wind speeds and falling debris requiring repair and/or replacement and an increase in capital costs	Direct	Vegetation management Extreme weather redundancies	C			2				2	LOW - 2C	C			3				3	MED - 3C	X	X	X	X	X		Assets to be in protective enclosures where necessary. Wind loading (AS1170) standard incorporated in design and sesnsitivity assessment to be undertaken with provided climate change projections. Landscape/civil scope to limit extent of objects that have potential to become falling debris (detailed design to consider).	D			2				2	LOW - 2D	C			3				3	MED - 3C
IR CCR 32	Increase in extreme weather events and storms	Storm events resulting in closure of rail line (due to damage to communications equipment, for safety purposes or loss of power supply/increased frequency and duration of power outages) with subsequent delays	Direct/Indirect	Monitoring and responding to extreme weather events procedure Land form procedure Run under degraded conditions as per ARTC standards	D		3					3	LOW - 3D	C		3					3	MED - 3C	X	X	X	X	X		Not applicable to design	D		3					3	LOW - 3D	C		3					3	MED - 3C
IR CCR 33	Increase in extreme weather events and storms	Storm events and subsequent higher winds resulting in derailment (loss of freight, rolling stock, cessation of operation) including damage to infrastructure	Direct/Indirect	Monitoring and responding to extreme weather events procedure Run under degraded conditions as per ARTC standards	D		3	3			2	3	LOW - 3D	C		3	3			2	3	MED - 3C	X	X	X	X	X		Not applicable to design	D		3	3			2	3	LOW - 3D	C		3	3			2	3	MED - 3C
IR CCR 34	Increase in extreme weather events and storms	Structural integrity of construction materials may be affected by extreme wind speeds.	Direct		D		2	2				2	LOW - 2D	D		2	2				2	LOW - 2D	X	X	X	X	X		TBC with structural engineer for wind loading and inclusion of climate change conditions in standards applied at detailed design stage. Wind loading (AS1170) standard incorporated in design and sesnsitivity assessment to be undertaken with provided climate change	D		2	2				2	LOW - 2D	D		2	2				2	LOW - 2D
IR CCR 35	Harsher fire-weather conditions	Smoke from bushfires limiting visibility resulting in increased risk of freight disruptions and/or cancellations	Direct	Monitoring and responding to extreme weather events procedure Run under degraded conditions as per ARTC standards	D		2					2	LOW - 2D	C		2					2	LOW - 2C	X	X	X	X	X		Not applicable to design	D		2					2	LOW - 2D	C		2					2	LOW - 2C
IR CCR 36	Harsher fire-weather conditions	Bushfire damaging rail infrastructure including trackside infrastructure (e.g. signals, communications equipment requiring increased operational costs)	Direct	Material durability Standards and type approvals (e.g. bury pipes not above ground) Vegetation management	D			3				3	LOW - 3D	C			3				3	MED - 3C	X	X	X	X	X		Designed in protective enclosures where necessary. Landscape/civil scope to limit extent of objects that have potential to increase bushfire danger for assets (detailed design phase to confirm).	E			3				3	LOW - 3E	D			3				3	LOW - 3D
IR CCR 37	Harsher fire-weather conditions	Risk to health and safety of staff working along the rail corridor due to inhalation of bushfire smoke and proximity to flames	Direct	Pre work brief Monitoring and responding to extreme weather events procedure	D	2						2	LOW - 2D	C	2						2	LOW - 2C	X	X	X	X	X		N/A to Design scope. Operational procedure to cover	D	2						2	LOW - 2D	C	2						2	LOW - 2C
IR CCR 38	Harsher fire-weather conditions	Bushfire events leading to damage to power supply infrastructure or a need to cut supply resulting in interruptions to power supply (particularly signalling and communications equipment) with increased frequency and duration of power outages	Indirect	Redundancies built in	D		3					3	LOW - 3D	C		3					3	MED - 3C	X	X	X	X	X		N/A to Design scope, ARTC in control of signalling and comms controls. Operational procedure to cover	E		3					3	LOW - 3E	D		3					3	LOW - 3D
IR CCR 39	Harsher fire-weather conditions	Bushfire event resulting in surrounding community using the rail corridor as access/egress	Indirect	Under direction of EMS	D		2				2	2	LOW - 2D	C		2				2	2	LOW - 2C	X	X	X	X	X		Not applicable to design	D		2				2	2	LOW - 2D	C		2				2	2	LOW - 2C
IR CCR 40	Harsher fire-weather conditions	Bushfire events resulting in closure of surrounding road network, impacting emergency access, rescue, community evacuation or maintenance	Indirect	Existing risk	E	4					4	4	LOW - 4E	E	4					4	4	LOW - 4E	X	X	X	X	X		Not applicable to design	E	4					4	4	LOW - 4E	E	4					4	4	LOW - 4E

Inland Rail Climate Change Risk Register - Albury to Illabo and Stockinbingal to Parkes Project

Albury to Illabo and Stockinbingal to Forbes Packages

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					2030 Initial Risk Assessment											2090 Initial Risk Assessment											Applicability								2030 Reassessed Risk Assessment									2090 Reassessed Risk Assessment								
						Consequence											Consequence																				Consequence									Consequence								
Risk Ref	Climate Hazard	Risk impact description	Direct/ Indirect Risks	Adaptation inherent in design / operations (inc. ARTC Operational Procedures)	Likelihood	Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Initial Risk	Likelihood	Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Initial Risk	Stockinbingal to Forbes	Albury	Lockhart / Greater Hume	Wagga Wagga	Junee	Additional Adaptation Actions (Inland Rail Climate Change Risk Assessment Framework)	A2I Design Adaptation Actions	Likelihood	Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Reassessed Risk	Likelihood	Safety	Assets	Financial	Environmental	Regulatory	Reputational	Schedule	Max Consequence	Reassessed Risk
IR CCR 41	Harsher fire-weather conditions	Bushfire event along the Inland Rail corridor resulting in stoppage of freight along the rail and subsequent severing of community evacuation and CFA access/egress points	Indirect	Existing risk Monitoring and responding to extreme weather events procedure Under direction of EMS (signalling equipment is fire resistant) Reducing severance in considered in basis of design	D		4						4	MED - 4D	C		4							4	HIGH - 4C	X	X	X	X	X	Expand early warning network for fire (currently mainly used for flood). Trains advised to not leave major centres and if no assessment is possible then the network is shut down (more difficult in fire due to uncertainty of fire behaviour, this should improve with time with real-time data collection). Grade separations in high risk areas (over bridge).	Not applicable to design	D		4						4	MED - 4D	C		4						4	HIGH - 4C
IR CCR 42	Harsher fire-weather conditions	Bushfire event along the Inland Rail corridor resulting in stoppage of freight along the rail and subsequent impacts on customers good not being delivered	Indirect	Monitoring and responding to extreme weather events procedure Under direction of EMS (signalling equipment is fire resistant)	C						2		2	LOW - 2C	B						2		2	MED - 2B	X	X	X	X	X		Not applicable to design	C						2		2	LOW - 2C	B							2	2	MED - 2B
IR CCR 43	Multi-hazard (flooding and warmer days)	Changing climatic conditions leading to the spread of weeds and water-bourne pathogens, reducing the productivity of farms and subsequently the demand for ARTCs services	Indirect	Agronomist assessment	C			1					1	LOW - 1C	B			1					1	LOW - 1B	X	X	X	X	X		Not applicable to design	C			1					1	LOW - 1C	B			1					1	LOW - 1B