Sydney Metro North West

Design and Construction of Surface and Viaduct Civil Works

Sustainability Management Plan

NWRLSVC-ISJ-SVC-PM-PLN-120300

Revision 8.0

29 May 2017

Document Control

A controlled copy of the Sustainability Management Plan will be distributed to the Principal's Representative, Independent Certifier and other relevant stakeholders and will be available to all ISJV employees in soft copy format through the digital document control management system.

The Sustainability Plan if printed will be uncontrolled and it will the responsibility of each user to confirm the currency of the plan through the digital document control management system.

Document distribution will be controlled in accordance with ISJV-SVC-PMS procedure MSP18 Document & Data Control.

Document Revision History

Doc No **NWRLSVC-ISJ-SVC-PM-PLN-120300**

Revision	Description	Prepared by	Reviewed by	Approved by	Date
A	Internal Issue	(WSP)	Omar Faruqi		25-Mar-14
1.0	Plan First Submission for Review	R Palmer WSP	Omar Faruqi	Sam Turnbull	31-Mar-14
2.0	Second Submission for Review	A Davis	Omar Faruqi	Graeme Tait	25-Aug-14
3.0	Third Submission for Review	A Davis	Tim Clarke	Graeme Tait	16-Dec-14
4.0	Fourth Submission for Review	Tim Clarke	Ian Stuart	Marco Alpini	30-Mar 15
5.0	Fifth Submission for Review	Tim Clarke	Ian Stuart	Marco Alpini	06-May 15
6.0	6 Monthly Review No changes carried out	Tim Clarke	Ian Stuart	Davide Vaggi	16-Feb 16
7.0	6 Monthly Review Updated Roles and Responsibilities- Section 2.2 Updated IS timings. Section 3.3 and 5.1	James Herbert	B Tucker	George Perdikaris	24-Jan-17
8.0	6 monthly review Updated sections 2 and 3 in light of	Antony Glambedakis	B. Tucker	George Perdikaris	25-May-17
Signature					

Plan Compliance

This Sustainability Plan complies with the response requirements of:

- SWTC Appendix 24 Section 24.5 Sustainability Plan
- SWTC Appendix 34 Schedule 1 – Issues to be addressed in the preparation of the Sustainability Plan

These requirements are confirmed in the following Tables.

Cl.	Description	Where Addressed
SWTC Appendix 24 Section 24.5		
24.5 (a)	The Sustainability Plan must identify how the SVC Contractor will comply with the sustainability requirements of the deed.	Sustainability Plan
24.5 (c)	The Sustainability Plan must:	
24.5 (c) (i)	be prepared and initially submitted to the Principal's Representative and Independent Certifier as required by clause 2.14(c) of the deed within 60 Business Days of the date of the deed; and	This Plan, Section 1.3
24.5 (c) (ii)	contain, as a minimum, the contents specified for the Sustainability Plan in the SWTC, including this Appendix 24.	This Plan
24.5(d)	Further to the requirements of the clause 2.14(h)(ii) of the deed, the SVC Contractor must undertake the ongoing development, amendment and updating of the Sustainability Plan throughout the duration of the SVC Contractor's Activities, including to take into account:	This Plan. Section 1.3
24.5 (d) (i)	new elements of the Project Works and Temporary Works not covered by the existing Sustainability Plan; and	This Plan. Section 1.3
24.5 (d) (ii)	changes in construction sequencing or methodology.	This Plan. Section 1.31.3
24.5 (e)	The Sustainability Management Plan must, as a minimum, address and detail:	
24.5 (e) (i)	the sustainability management team structure, including key personnel, authority and roles of key personnel, lines of responsibility and communication, minimum skill levels of each role and interfaces with the overall project organisation structure;	This Plan. Section 2

Cl.	Description	Where Addressed
SWTC Appendix 24 Section 24.5		
24.5 (e) (ii)	a sustainability policy statement and strategies for adaptation to climate change, resource management, workforce development and biodiversity enhancement;	This Plan. Section 1.6
24.5 (e) (iii)	sustainability initiatives to be implemented during the performance of the SVC Contractor's Activities and milestones for key sustainability initiatives;	This Plan. Section 3.3
24.5 (e) (vi)	processes and methodologies for tracking the identification and implementation of sustainability initiatives;	This Plan. Section 3.1.4
24.5 (e) (v)	processes and methodologies for embedding sustainability initiatives into design, procurement and construction processes;	This Plan. Section 3.1
24.5 (e) (vi)	processes and methodologies for assurance, monitoring auditing, corrective action , continuous improvement and reporting on sustainability performance;	This Plan. Section 3.1.4
24.5 (e) (vii)	a description of the overall approach to the identification of opportunities to reduce carbon emissions, energy use and embodied lifecycle impacts of the SVC Contractor's Activities;	Carbon and Energy Management Plan
24.5 (e) (viii)	processes and methodologies for ensuring that a "Design" and "As Built" rating score of least 65 under the Australian Green Infrastructure Council Infrastructure Sustainability Rating Tool for the design and construction of the Project Works and Temporary Works will be achieved;	This Plan. Section 3.1.4
24.5 (e) (ix)	processes and methodologies for implementing all of the "compulsory initiatives" identified for civil infrastructure and the "discretionary initiatives" that the SVC Contractor will implement to a achieve at least 80% of the discretionary points available for civil infrastructure in the Transport for NSW – NSW Sustainable Design Guidelines for Rail Version 2.0;	This Plan. Section 0
24.5 (e) (x)	processes and procedures for undertaking climate change risk assessments;	This Plan. Section 4.2
24.5 (e) (xi)	processes and procedures for the identification and implementation of climate change adaption measures;	This Plan. Section 4.2
24.5 (e) (xii)	current and future Workforce skill needs and Workforce profiles;	This Plan, Section 4.9
24.5 (e) (xiii)	methodologies for assessing current and future skill needs and Workforce profiles including a skills and Workforce gap plan;	This Plan, Section 4.9

Cl.	Description	Where Addressed
SWTC Appendix 24 Section 24.5		
24.5 (e) (xiv)	methodologies for implementation of Workforce skill development and Workforce training including: A. analysis of the Education and Training Facilities that can provide nationally recognised accredited qualifications to enable people to meet projected Workforce demand; B. details of formal programs and other arrangements for education and training to provide people with relevant nationally recognised accredited qualifications; and C. Monitoring and Reporting Mechanisms to measure achievement of targets.	This Plan, Section 4.9
24.5 (e) (xv)	methodologies for Workforce skill acquisition and use including: A. approaches to the provision of relevant Nationally Recognised Accredited training; B. analysis of possible Industry and skills Partnerships; and C. use of existing Government and Training Development Programs.	This Plan, Section 4.9
24.5 (e) (xvi)	strategies undertaken and outcomes of applications for Workforce Development Funding Subsidies and Grants;	This Plan, Section 4.9
24.5 (e) (xvii)	the approach for support of local small to medium enterprises and social enterprises;	This Plan, Section 4.9
24.5 (e) (xviii)	the approach to sustainable procurement including: A. the processes and procedures that will be used to provide environmental and social improvement; and B. the processes and environmental and social criteria that will be used for the selection of Subcontractors.	This Plan. Section 4.9.2
24.5 (e) (xix)	an outline of the systems that will be used to support sustainability management; and	This Plan. Section 3.2
24.5 (e) (xx)	interfaces with other Project Plans.	This Plan. Section 1.4
24.5 (f)	The Sustainability Plan must identify and establish sustainability targets for the design and construction of the Project Works, the Temporary Works and the performance of the SVC Contractor's Activities. The Sustainability Plan must include values and percentages, as applicable, for each of the sustainability targets identified Table 24.1 and identify how each of the sustainability targets will be met.	This Plan. Section 1.7

Cl.	Description	Where Addressed
SWTC Appendix 34.2 Schedule 1 - Issues to be addressed in the preparation of the Sustainability Plan		
1	**Other Project Plans -** the SP must recognise, be consistent with and address the requirements of each of the other individual Project Plans to the extent that they are relevant and applicable to the SP. Issues to be addressed in the preparation of each of the other individual Project Plans based on the initial Project Plans, as identified in Schedules 1 in each of Appendix 31.2, Appendix 32.2, Appendix 33.2, Appendix 35.2, Appendix 36.2, Appendix 37.2, Appendix 38.2, Appendix 39.2, Appendix 40.2, Appendix 42.2, Appendix 43.2, Appendix 44.2 and Appendix 45.2 of the SWTC, must, where relevant and applicable, also be addressed in the preparation of the SP	Within plans nominated in 'Description' section
2	**Sustainability Plan** must more fully address the SVC Contractor's obligations (including those obligations nominated in the Environmental Documents), processes, procedures and management systems in relation to sustainability. The processes, procedures and management systems nominated in the SP must recognise, be consistent with and comply with the requirements of the deed.	See Chapter 3
3	**Deed Requirements** — the SP must more fully address the sustainability requirements of the deed and include the processes that the SVC Contractor will use to ensure that the sustainability requirements of the deed are met.	See Section 3.1.4 and 3.3
4	Project Plan Requirements: SWTC — the SP must more fully address the sustainability requirements of the SWTC and include the processes that the SVC Contractor will use to ensure all the requirements of the SWTC are met, including section 3.7 - the development, implementation and maintenance of the Environmental and Sustainability Management System.	See Chapter 15 'Environment and Sustainability' of the Project Management Plan
5	Project Plan Requirements: SWTC Appendix 10 — the SP must more fully address the sustainability requirements of Appendix 10 to the SWTC and include the processes that the SVC Contractor will use to ensure that the sustainability requirements of Appendix 10 to the SWTC are met, including sections 10.13.1, 10.4 (b), 10.8, 10.1.9(d) & 10.15(c)(x).	See Section 4.9.1, Section 5.2, Section 4.5 and Section 4.7
6	Project Plan Requirements: SWTC Appendix 23 — the SP must more fully address the SVC Contractor's processes and procedures for the provision of the monthly sustainability reports required by section 23.1.5 of Appendix 23 of the SWTC, including section 24.5(f).	This Plan, Section 3.3
7	Project Plan Requirements: SWTC Appendix 24 — the SP must meet all the requirements of section 24.5 of Appendix 24 of the SWTC	This Plan

Cl.	Description	Where Addressed
SWTC Appendix 34.2 Schedule 1 - Issues to be addressed in the preparation of the Sustainability Plan		
8	Development, Amendment and Updating Requirements — the SP must fully address • the ongoing SP development, amendment and updating requirements of clause 2.14 of the deed and section 24.5(d) of Appendix 24 of the SWTC • the measurement, analysis and improvement requirements of AS/NZS ISO 9001 • the processes, procedures and personnel responsible for SP development, implementation, amendment, updating, measurement, analysis, improvement and corrective actions	This Plan. Section 1.3, and Chapter 15 'Environment and Sustainability' of the Project Management Plan

Contents

Definitions and Abbreviations

Abbreviation	Definition
CLIP	Community Liaison Implementation Plan
CM	Construction Manager
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESR	Environmental Site Representative/Project Environmental Manager
HP/WP	Hold Point Witness Point
IC	Independent Certifier
ICN	Industry Capability Network
IS	Infrastructure Sustainability
IS Rating Tool	Infrastructure Sustainability Rating Tool
ISJV	Impregilo Salini Joint Venture
ISJV-SVC-PMS	Joint Venture – Project Management System
KPIs	Key Performance Indicators
NSW SDG	New South Wales Sustainable Design Guidelines for Rail v2.0
NWRL	North West Rail Link
PD	Project Director
PMP	Project Management Plan
PMS	Project Management System
PQM	Project Quality Manager
PTMP	Project Training Management Plan (this plan)
RBTNA	Risk Based Training Needs Analysis
RTO	Registered Training Organisations
SCIPs	Site-Specific Stakeholder and Community Involvement Plans
SDG	Sustainability Design Guidelines
SI-BMS	Salini Impregilo – Business Management System
SME	Subject Matter Expert
SSR	Site Safety Representative/Project Safety Manager
Suppliers	Including service providers, subcontractors and suppliers of goods
SVC	Surface Viaducts and Civil
SWMS	System Works Methods Statement (incorporating the Safe Work Method Statement, Environmental aspects, impacts and actions and Quality/Business risk and controls)
SWTC	Scope of Works and Technical Criteria
TfNSW	Transport for New South Wales

1 INTRODUCTION

1.1 Purpose

This Sustainability Plan describes the processes, procedures and initiatives that the Impregilo Salini Joint Venture (ISJV) will implement to meet the sustainability obligations specified in the Project Deed ('the Deed') for the NWRL SVC Works. The Sustainability Management Plan describes how the ISJV will formally implement sustainably management techniques, which will achieve the ISJV policies, objectives and targets, as well as the project objectives, targets and Key Performance Indicators (KPIs).

The Sustainability Plan represents the overarching management plan for control of sustainability requirements and will be used as a guide to inform the development of the Sustainability Plan in the delivery phase.

1.2 Scope

This plan specifically addresses the requirements detailed in SWTC Appendix 24 Project Plan Requirements and Appendix 10 Sustainability Requirements.

The Sustainability Plan will be available to all the ISJV employees, suppliers, the Client including their representatives, Independent Certifier (IC) and other stakeholders. All employees and suppliers are required to comply with the Sustainability Plan, as well as ISJV management system requirements, and adhere to their nominated authorities and responsibilities.

The work methods, practice and controls contained within this plan will be applied to all processes and activities undertaken by ISJV on the Design and Construction of the Surface and Viaducts Civil Works Project.

The Sustainability Plan complies with ISJV-SVC-PMS, which is in turn is derived from the Salini Impregilo Business Management System (SI-BMS) (refer to PQP Appendix A – Project Management System Cross Reference).

1.3 Plan Preparation and Review

The Sustainability Manager is responsible for preparing and updating the Sustainability Plan. The Sustainability Plan must be prepared and initially submitted to the Principal's Representative and IC as required within 60 Business Days of the date of the Deed.

The Sustainability Manager will control revisions of this Plan, which will be authorised by the Project Director. In addition to complying with the requirements of the Deed, SWTC and Transport for New South Wales (TfNSW) policy requirements, including Appendix 24, the Plan will be reviewed and updated half yearly, as a minimum or as required, taking into account:

i) New elements of the Project Works and Temporary Works not covered by the existing Sustainability Plan
ii) Changes in design or construction sequence, staging, methodology or resourcing
iii) The status and progress of the SVC Contractor's Activities
iv) Changes in access to the Construction Site
v) Changes directed by Principal's Representative under the Deed

1.4 Relationship to Other Plans

The position of the Sustainability Management Plan to other plans within the ISJV Management System and overarching documentation framework is shown below. References to other plans have been provided within the body of the Sustainability Plan, and also in Chapter 6 Implementation Summary. ISJV's Management Plans Delivery Steering Committee facilitates the delivery of various Management Plans to improve interfacing.

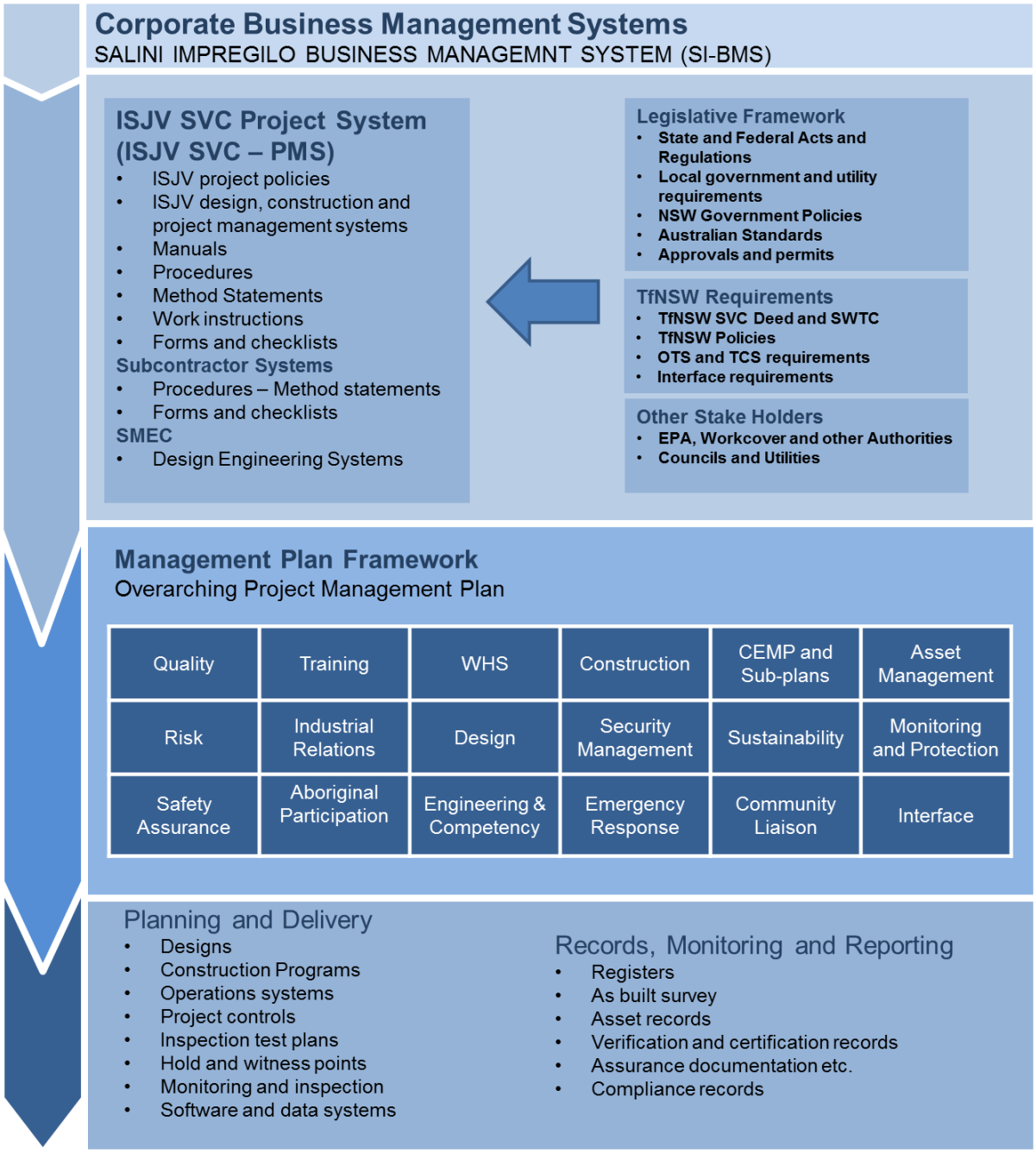


Figure 1 ISJV SVC Management Systems and Document Framework

This plan is to be read in conjunction with:

- Design Plan;
- Construction Plan;
- Training Management Plan;
- Project Management Plan;
- Project Procurement Management Plan;
- Project Procurement Management Plan;
- Carbon and Energy Management Plan (a sub-plan to this Sustainability Plan);
- Stormwater and Flooding Management Plan;
- Pollution Incident Response Management Plan;
- Spoil Management Plan;
- Waste Management and Recycling Plan;
- Visual Amenity Management Plan
- Construction Environmental Management Plan (CEMP) and sub-plans, including:
    - CEMP – Construction Compound Ancillary Facilities Management Plan;
    - CEMP – Construction Noise and Vibration Management Plan;
    - CEMP – Construction Flora and Fauna Management Plan;
    - CEMP – Construction Heritage Management Plan;
    - CEMP – Construction Air Quality Plan; and
    - CEMP – Construction Soil and Water Management Plan.
- Security Management Plan;
- Risk Management Plan;
- Community Liaison Implementation Plan (CLIP); and
- Stakeholder and Community Involvement Plan (SCIP).

Refer to the Project Management Plan for a plan interface matrix.

The relationship of the Sustainability Plan to the other plans is indicated in the figure below.

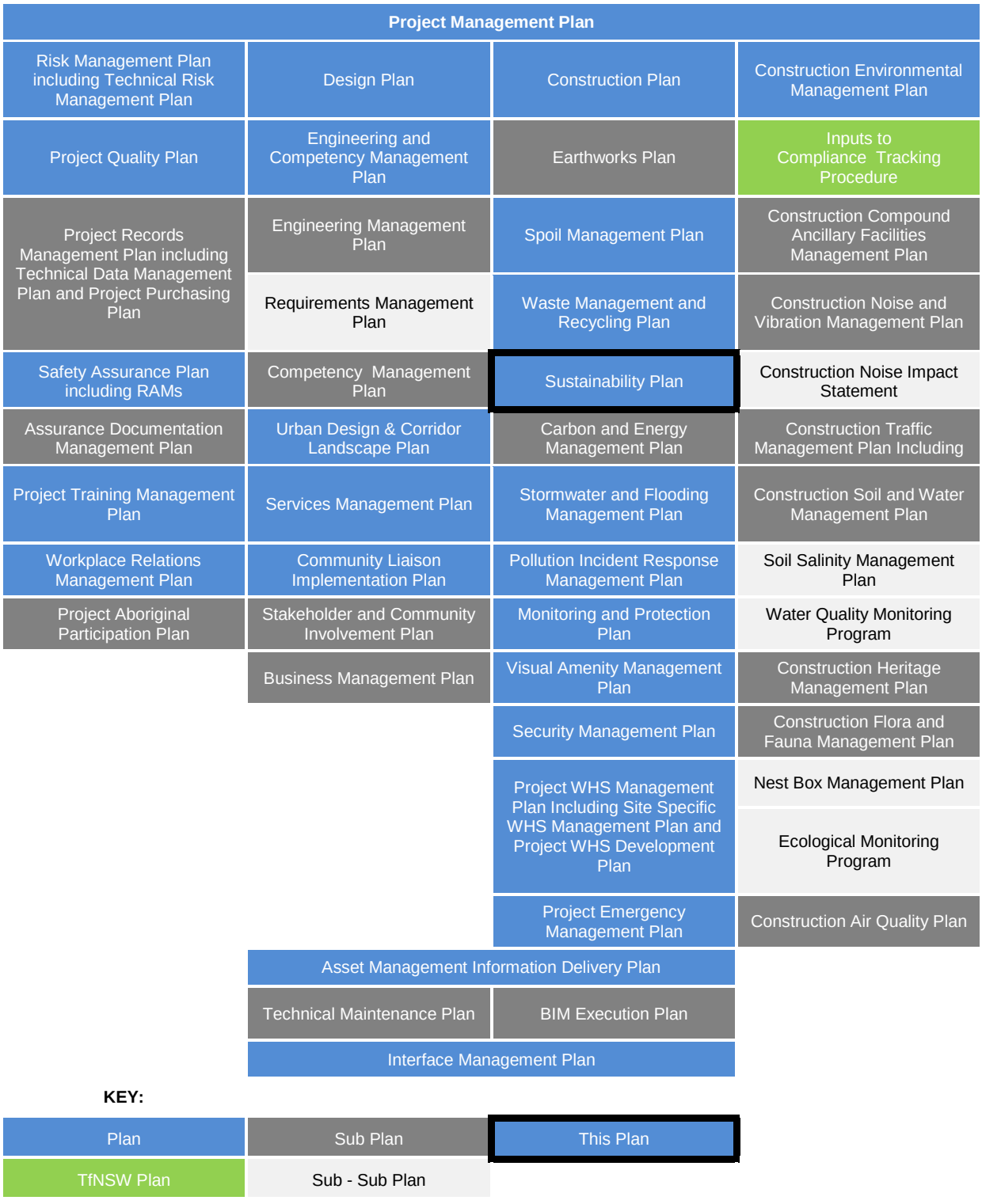


Figure 2 Hierarchy of SVC Management Plans

1.5 Project Description

1.5.1 Description of NWRL Project

The NWRL project is a key priority for the NSW Government. The NWRL will deliver a new high frequency single deck train system initially operating as a shuttle between Cudgegong Road and Chatswood. The project includes eight new stations, approximately 15.5km of tunnels from Epping to Bella Vista, a 4.5km elevated 'skytrain' (viaduct) between Bella Vista and Rouse Hill, and conversion of the Epping to Chatswood Rail Link to deliver high frequency rapid transit services.

Stations are planned at Cherrybrook, Castle Hill, Showground, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. Bus, pedestrian, cycling and easy access facilities will be provided at all stations, with approximately 4000 'Park and Ride' spaces spread across five sites.

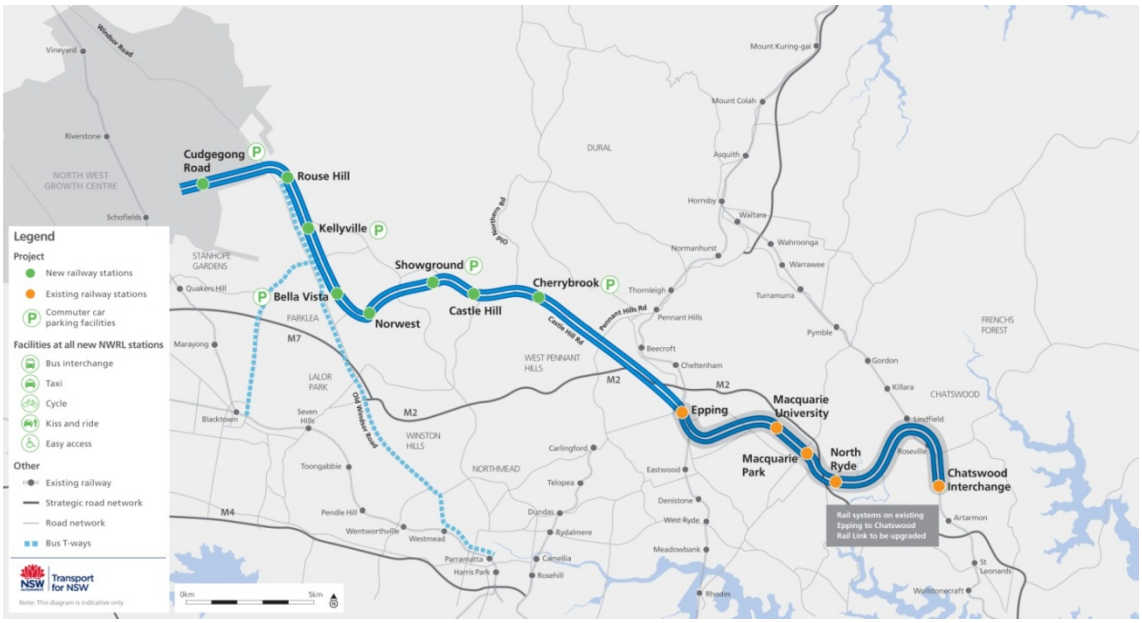


Figure 3 The North West Rail Link service proposed alignment

1.5.2 Description of the SVC Project works

The scope of the SVC Project works consists of the detailed design, construction and handover of the viaducts, bridges and associated civil works required for the NWRL between Bella Vista and Cudgegong Road, and includes establishment and reinstatement of worksites, spoil removal and disposal and all required utility relocations and adjustments at construction worksites.

The permanent infrastructure to be delivered includes:

- Approximately 4.5 km of viaduct between Balmoral Road and Rouse Hill Station including crossings over Memorial Avenue, Samantha Riley Drive, Windsor Road, Sanctuary Drive and White Hart Drive;
- Bulk earthworks requirements including all cut, fill and embankments between Balmoral Road and Cudgegong Road;
- A bridge over Windsor Road / Rouse Hill;
- A bridge over Second Ponds Creek;
- Allowance for station structures to be incorporated onto the viaduct at the Kellyville and Rouse Hill station sites;

- Adjustments to existing infrastructure and roads within the construction site and / or otherwise affected by ISJV activities;
- Safe, secure personnel access / egress into site areas including necessary temporary support services and site facilities, with hoardings, fencing and so on around worksites to be left in place upon completion;
- Construction traffic and transport management including temporary and permanent traffic management works; and
- Removal of all temporary work and site facilities not otherwise required for handover to subsequent contractors.

Activities associated with the temporary and SVC Contractor works required in order to complete construction include:

- Safe, secure personnel access / egress into site areas including necessary temporary support services and site facilities, with hoardings, fencing and the like around work sites to be left in place upon completion;
- Construction traffic and transport management including temporary and permanent traffic management works;
- Removal of all temporary work and site facilities not otherwise required for handover to subsequent contractors;
- Construction of temporary T-way car parking at Rouse Hill and Kellyville;
- Construction, removal and transportation of the gantry along the SVC construction zone;
- Temporary changes to site personnel access/egress;
- Signage, fencing and hoarding;
- Construction environmental management activities;
- Construction traffic management activities;
- Interface and communications within SVC Contractor team and across NWRL team;
- Stakeholder liaison activities; and
- Adherence to NWRL protocols and procedures.

1.6 Sustainability Policy Statement

Sustainability is an integral component of the ISJV's approach to design and construction of the Project Works and Temporary Works. ISJV fully endorses and supports the NWRL Environment and Sustainability Policy Statement. The commitment to sustainability is framed in a Sustainability Policy containing a series of objectives, as shown below in Figure 4. In liaison with TfNSW, ISJV will publicly state sustainability commitments identified as part of the Sustainability Policy Statement.

Figure 4 ISJV Sustainability Policy Statement

Sustainability Policy

Our Vision

Salini Impregilo is a global specialist in the construction of large, complex infrastructures, whose operations are based on the principles of sustainable development. On all infrastructure projects, the company seeks to contribute to economic development, social wellbeing and environmental protection of the countries where it works, by conducting its business according to ten overarching sustainability principles.

Our Principles

Salini Impregilo's local and global approach to business and sustainable development is guided by our commitments to the following principles: ethics and responsibility, sustainable growth, excellence and innovation, employee protection and development, supply chain engagement, local socio-economic development, environmental protection and restoration, dialogue and transparency, and accountability.

These principles form the foundation of our daily actions on all construction projects, including the North West Rail Link Surface and Viaduct Civil (SVC) Works package.

Our Objectives

In applying our principles, we are committed to involving all employees, sub-contractors, suppliers and consultants to:

- Operate with integrity with the highest ethical, professional and legal standards, making economic, social and environmental considerations an integral part of our decision-making, quality and governance processes.
- Develop infrastructures that help to improve the local communities, environments and economies
- Work with our supply chain, technical and financial partners to develop bespoke project proposals, innovative solutions, sustainable practices and materials, and identify and implement restorative actions
- Create stimulating and dynamic working environments, with priority given to health and safety, respect for diversity and human rights, and professional development, enabling us to attract and retain talent
- Contribute to local socio-economic growth by creating jobs, offering professional training, and using local suppliers
- Respect heritage and the natural environment through our Environmental Management Framework, and in line with ISO 14001, to embed best practice environmental and sustainable outcomes
- Adopt opportunities that mitigate negative impacts on the local environment, habitat and community, including risks associated with climate change
- Reduce, reuse and recycle construction waste as well as improve energy, water, fuel and resource efficiency in our construction activities, taking practical actions to minimise our carbon footprint and pollution.
- Develop and maintain good relationships with all stakeholders (including key project stakeholders) and contribute to the development of our communities by conducting our works in a safe, sustainable and environmentally sensitive manner
- Regularly monitor, review and evaluate performance against goals to ensure continuous improvement of our sustainability practices.
- Annually publish global sustainability reports in line with the Global Reporting Initiative's G4 guidelines, providing stakeholders with prompt, accurate information about our material economic environmental and social impacts.

Marco Alpini
Project Director
Review Date: 21st April 2015

NWRLSVC-ISJ-GN-POL-120300
Revision 2.0 – 21-April-15
Authorised By: MA

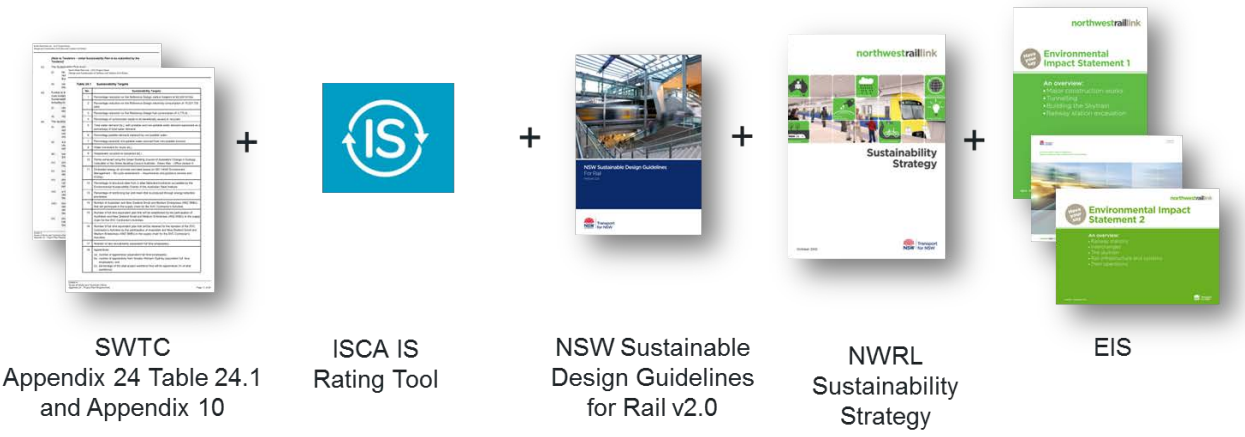
Commercial in Confidence

Page 1

As outlined in the NWRL Sustainability Strategy, sustainability means 'building a rail system for current and future generations that optimises environmental and social outcomes, transit service quality and cost effectiveness'.

A large body of research has already been undertaken to develop the EIS, NWRL Sustainability Strategy, IS Rating Tool, the NSW Sustainable Design Guidelines and the SWTC (see figure below), and it is the aim of ISJV to ensure that all targeted sustainability requirements are met.

Figure 5 Five key documents that have fed into the Sustainability Plan



The Sustainability Plan has been developed from a review of these documents, and ISJV will undertake works in accordance with the NWRL Environment and Sustainability Policy Statement. In particular, compliance with Section 4 of Volume 1A of the EIS is demonstrated by adhering to the requirements of the Environmental Management Framework as set out in the EIS (refer to Chapter 15 Environment and Sustainability of the Project Management Plan) and by undertaking monitoring and auditing of sustainability initiatives to ensure they are implemented (see Section 3.1.4).

1.7 Objectives and Targets

Exhibit A of the SWTC section 4.7 states that the SVC Contractor must ensure that sustainability is addressed throughout the performance of the SVC Contractor's Activities and must comply with the sustainability requirements set out in Appendix 10. Appendix 10 requirements have been cross-referenced in Chapter 6 Implementation Summary.

See Table 1 for a summary of the ISJV sustainability targets. During the design and construction process there will be a process of continual review of progress towards each of the targets. Once the targets have been achieved, the various teams will look for further improvements where it is cost effective and will not hinder the project program.

Table 1 – SWTC Appendix 24 Section 24.5 Table 24.1 Sustainability Targets

No	Sustainability Targets	Deed Target Value	Comment
1	Percentage reduction on the Reference Design carbon footprint of 82,420 tCO_{2e}	2.5%	-
2	Percentage reduction in the Reference Design electricity consumption of 15,027,720 kWh	5%	-
3	Percentage reduction on the Reference Design fuel consumption of 4,770 kL	5%	-
4	Percentage of construction waste to be beneficially reused or recycled	90%	-
5	Total water demand (kL); with potable and non-potable water demand expressed as a percentage of total water demand	143kL/day Potable: 24% Non-potable: 76%	Best case modelled performance: 14,652kL total Potable: 1% Non-potable: 99%
6	Percentage potable demand replaced by non-potable water	5-90%	Target 50% minimum
7	Percentage potential non-potable water sourced from non-potable sources	5-100%	Best case modelled performance is 100%; however, potable water top-up may be required when conditions for using non-potable sources are not suitable
8	Water harvested for reuse (kL)	108kL	Best case modelled performance: 14,325kL
9	Wastewater recycled or reclaimed (kL)	To be provided post contract award	5,062kL Best case modelled performance
10	Points achieved using the Green Building Council of Australia's Change in Ecology Calculator in the Green Building Council of Australia's Green Star Office v3 tool	0 points	Due to the presence of 2 threatened species, no points are achievable
11	Embodied energy of concrete and steel based on ISO 14044 Environment Management – Life cycle assessment – Requirements and guidelines (tonnes and t CO_{2e})	55,739 tCO_{2e}	Currently modelled at 50,588tCO_{2e}. Refer to Carbon and Energy Management Plan for further details
12	Percentage of structural steel from a steel fabricator/contractor accredited by the Environmental Sustainability Charter of the Australian Steel Institute	60%	60% is now being targeted

No	Sustainability Targets	Deed Target Value	Comment
13	Percentage of reinforcing bar and mesh that is produced through energy reduction processes	60%	-
14	Number of Australian and New Zealand Small and Medium Enterprises (ANZ SMEs) that will participate in the supply chain for the SVC Contractor's Activities	160+	Refer to the Project Training Management Plan for more details
15	Number of full time equivalent jobs that will be established by the participation of Australian and New Zealand Small and Medium Enterprises (ANZ SMEs) in the supply chain for the SVC Contractor's Activities	50+	Refer to the Project Training Management Plan for more details
16	Number of full time equivalent jobs that will be retained for the duration of the SVC Contractor's Activities by the participation of Australian and New Zealand Small and Medium Enterprises (ANZ SMEs) in the supply chain for the SVC Contractor's Activities	30+	Refer to the Project Training Management Plan for more details
17	Jobs		
	(a) Number of new Sustainable Jobs (equivalent full time employees);	550	Refer to the Project Training Management Plan for more details
	(b) Percentage of the total project Workforce that are new Sustainable Jobs; and	40%	
	(c) Percentage of the Workforce that are new Sustainable Jobs from Greater Western Sydney.	20%	
18	Apprentices		
	(a) number of apprentices (equivalent full time employees);	25	Refer to the Project Training Management Plan for more details
	(b) number of apprentices from Greater Western Sydney (equivalent full time employees); and	8	

No	Sustainability Targets	Deed Target Value	Comment
	(c) percentage of the total project workforce that will be Apprentices (% of total workforce, excluding specialist skills and short term duration contracts no longer than six months).	5	
19	Trainees		Trainee numbers are incorporated into the Apprentice targets
	(a) number of trainees (equivalent full time employees);		
	(b) number of trainees from Greater Western Sydney (equivalent full time employees); and		
	(c) percentage of the total workforce that will be Trainees (% of total workforce, excluding specialist skills and short term duration contracts no longer than six months).		
20	Workforce:		
	(a) number of personnel, excluding Apprentices and Trainees, from Greater Western Sydney (equivalent full time employees); and	136	Refer to the Project Training Management Plan for more details
	(b) percentage of the total workforce, excluding Apprentices and Trainees, from Greater Western Sydney (% of total workforce).	25%	
21	Percentage of the in scope workforce participating in Nationally Recognised Accredited Training	25%	Refer to the Project Training Management Plan for more details
22	Workforce Diversity		Refer to the Project Training Management Plan for more details
	(a) workforce diversity target (number of equivalent full time employees);	45	
	(b) workforce diversity target for Greater Western Sydney (number of equivalent full time employees); and	32	
	(c) workforce diversity target for total workforce (% of total workforce).		Workforce % replaced with actual number

No	Sustainability Targets	Deed Target Value	Comment
23	Workforce Disadvantaged Group		Refer to the Project Training Management Plan for more details
	(a) workforce Disadvantaged Group target (number of equivalent full time employees);	45	
	(b) workforce Disadvantaged Group target for Greater Western Sydney (number of equivalent full time employees); and	35	
	(c) workforce Disadvantaged Group target for total workforce (% of total workforce.		Workforce % replaced with actual number
24	Work Experience Placements, Education Placements, Graduate Placements (number of individual placements)	8	Refer to the Project Training Management Plan for more details

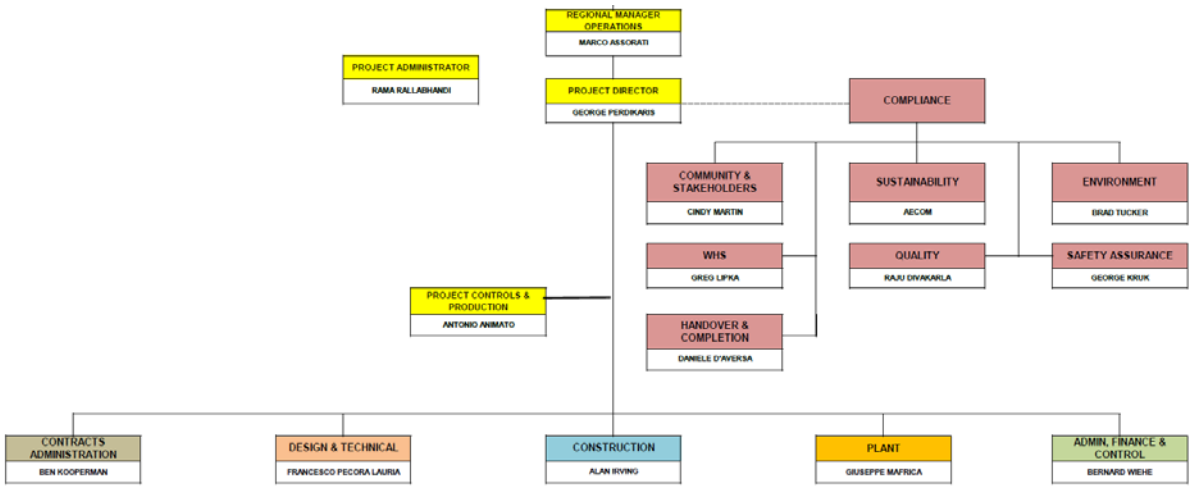
The above Sustainability Targets are subject to change.

2 ROLES AND RESPONSIBILITIES

2.1 Organisation Chart

The internal sustainability communication and process chart for the SVC project, identifying the function of integrating sustainability into the delivery team, is shown in the figure below. The Sustainability Manager directly reports to the Project Director. A 'Sustainability Status' update forms part of the standing agenda for the weekly ISJV management meetings. The Project Management Plan includes the overall ISJV Project Organisation Chart.

Figure 6 Organisation Chart



With respect to the integration of sustainability principles within the SVC package, ISJV has assigned the role of Sustainability Manager. The Sustainability Manager interfaces with the primary project delivery roles relating to design, procurement, construction and environmental management. At this stage of the project, the Sustainability Manager's position has become vacant.

2.2 Roles and Responsibilities

The roles, responsibilities and minimum skills level for the Sustainability Manager are outlined in Section 2.3 below. The Sustainability Manager is assigned to the project full-time.

One further role has been identified in Section 2.3 below, the Sustainability Support Officer. This position will be accommodated as and when required throughout the phases of the project. Their main task will be to assist in the documentation and collation of evidence for the Design and As-Built IS submissions and for the coordination of sustainability initiatives and their integration into the project.

2.3 Supporting Personnel

Role	Overview of Roles and Responsibilities	Stage
Sustainability Manager	***Minimum skill levels:*** • Possess a recognised qualification relevant to the position and the SVC Contractor's Activities • Have at least 5 years sustainability management experience • Be the primary SVC contact on sustainability matters • Be responsible and have authority to develop and implement the Sustainability Plan • Be engaged full time on or around the Construction Site during the construction phase of the works **Meetings/Workshops** • Attend regular management meetings to track the implementation of sustainability initiatives across the work-streams **ISCA** • Track ISCA rating requirements (including sourcing and reviewing documentation related to IS submissions) • Manage the IS Rating tool • Principal point of contact for ISCA in relation to the IS rating • Managing the achievement of the targeted ISCA IS rating of at least 65 points **Management Plans** • Update all management plans related to sustainability (including the Sustainability Plan, Carbon and Energy Plan and Waste Management Plan). **Auditing and Reporting** • Monitoring, reviewing and reporting against project sustainability targets on a monthly basis **Process** • Oversees the implementation of sustainability targets, strategies and initiatives • Works with project teams to embed sustainability initiatives within project delivery • Works with site supervisors and sub-contractors to implement sustainability targets and initiatives • Responsible for the addition of Sustainability content into Project Induction programme.	Design and Construction

Sustainability Support Officer	• Responsible for the documentation, development and coordination of the IS Design and As-Built rating • Tracks ISCA IS rating requirements • Attends meetings to track the implementation of sustainability initiatives across the work-streams • Works with the major delivery work-streams to embed sustainability initiatives and processes within the project delivery process • Reviews and audits energy use, water use, waste outputs, etc • Reports sustainability performance using ITwocx monthly	Design and Construction

In addition to the aforementioned roles and responsibilities, the following supporting personnel perform the following activities:

- Project Director is responsible for driving sustainability accountability throughout the project and ensuring relevant individuals are responsible for sustainability through performance targets;
- Designers are responsible for investigating sustainable options and incorporating into the design where feasible/cost-effective;
- Commercial Manager is responsible for ensuring that relevant sustainability requirements are considered in procuring materials and services;
- Procurement team is responsible for embedding sustainable procurement requirements into the supply chain management process, reporting on these requirements and attending sustainability workshops;
- Site supervisors are responsible for implementation of the sustainability plan on a day-to-day basis and providing verification documentation for construction-stage reporting;
- Stakeholder and Community Relations Manager is responsible for ensuring social and community goals are delivered;
- Site agents and engineers are responsible for attending project sustainability workshops;
- ISJV and their sub-contractors will be required to regularly monitor construction activities, e.g. monitoring of receipts, utility bills, waste outputs, etc.; and
- All employees are responsible for complying with the sustainability commitments in relation to the work they are undertaking.

2.4 Lines of communication internally and with Client

2.4.1 Design Stage Communication

During the design stage, the sustainability personnel will maintain regular contact with the broader project team in a number of regular and ad hoc meetings and workshops, including:

- The Sustainability Manager attends management meetings, as appropriate to the project stage;
- Sustainability Manager will facilitate workshops with design consultants (civil, structural and architectural) at key design milestones (in line with the methodology for embedding sustainability in the design – see section 3.2); and
- Sustainability Manager will facilitate thematic workshops relating to critical sustainability initiatives (such as procurement of concrete and steel) with the major relevant work-streams; including, but not limited to Design, Procurement, and Construction.

During the design stage, sustainability personnel will maintain regular contact with the Client:

- The Sustainability Manager will attend fortnightly sustainability meetings with the Client.
- The Sustainability Manager will attend monthly sustainability forum meetings with ISCA, the Client and representatives from the other NWRL Packages. and
- ISJV will provide monthly written reports to the Client on the progress of implementation of sustainability, as required by the Project Deed

2.4.2 Construction

During the construction stage, sustainability personnel will maintain regular contact with the construction team in a number of regular meetings:

- The Sustainability Manager will attend meetings as required and appropriate for project stage and completion to track performance against the sustainability requirements; and
- The Sustainability Manager will meet with the Construction Manager as required to review progress against sustainability targets.

During the construction stage, sustainability personnel will maintain regular contact with the Client via:

- Monthly reports of progress against the sustainability targets; and
- Sustainability Manger and Construction Manager to attend ad hoc meetings with the Client, as required and based on progress against the sustainability targets.

3 SUSTAINABILITY MANAGEMENT

3.1 Embedding Sustainability

The strategy for embedding sustainability within the NWRL SVC package is founded on three key work-streams:

- Design
- Procurement
- Construction

The targets and requirements identified within this plan will be addressed in the appropriate plans, documentation and processes for each of these work-streams, as well the broader environmental and community planning for the project.

Each work-stream has specific mechanisms and sets of documentation wherein the requirements for sustainability will be embedded – design reports, drawings and specifications, tenders and procurement contracts, site induction sheets and supplier pre-qualification checklists, among others.

Through a series of project stage (milestone) and thematic workshops, the sustainability requirements and aspirations for the project will be embedded within the relevant documentation packages for each work-stream and project stage.

As part of our commitment to excellence, we will put in place rigorous training, awareness and capacity building programmes at every stage to ensure everyone involved understands what the sustainability objectives are and what is required to deliver on these objectives. Due to the wide-ranging and integrated issues of sustainability, the implementation of sustainability targets and requirements is partly the role of everyone involved in the SVC Works. All members of the design team have attended a sustainability workshop where the aspirations, commitments and strategies for embedding sustainability into the SVC package have been presented. Everyone working on-site will complete an induction, which outlines the aspirations, commitments and strategies for sustainability. Throughout the project, regular workshops and presentations will be conducted to reinforce the actions which underpin the commitments.

3.1.1 Design

Sustainable Design Process Statement

Workshops are being held with key design team members to identify the opportunities and initiatives, which may be implemented to achieve the sustainability targets. The preliminary design-related sustainability initiatives responding to the sustainability targets and under consideration for the SVC Package will be documented in checklists appended to each design package.

The process by which initiatives will be tested, documented and coordinated with procurement is as follows:

- Due diligence LCA assessment of the Contract Design for comparison to the Reference Design;
- Workshops to assess all sustainability targets (SWTC Appendix 10 and Appendix 24, ISCA & NSW SDG);

- Iterative assessment and reporting of design progress against the targets during design development and integration with procurement, workforce and construction processes; and
- Final LCA of the detailed design to confirm performance of the design against targets for handover to the construction team.

The design considerations will be addressed through a series of workshops in the design process, quantifying and comparing the relative benefits of the proposals to the Reference Design.

The design interventions required to achieve the nominated targets will be communicated back to the NWRL via the Monthly Sustainability Reports as required by the Project Deed, and also via Sustainability Progress Meetings.

Design Documentation Reviews

The Sustainability Manager attends regular design workshops to embed sustainability within the documentation through each stage of the design.

Documentation reviews will be undertaken by the Sustainability Manager of the full documentation package to assess compliance with the IS and NSW SDG tools prior to submission for external assessment.

3.1.2 Procurement

The cornerstone of the ISJV procurement strategy is to ensure that ISJV operations are carried out to achieve the nominated sustainability requirements, and to embed the requirements of the sustainability strategy into the tender and contract requirements for service providers, suppliers and sub-contractors.

Many of the core sustainability targets (such as the sourcing and procurement of materials for construction) are directly related to the procurement strategy and will be reflected in the contract clauses and tender performance requirements in the Procurement Procedure.

Compliance with the Sustainability Plan will require regular communication with those team members responsible for procurement and the supply chain. Documentation of supply chain requirements have been identified in the sustainability matrix and will be checked in the documentation reviews.

The primary mechanism for embedding procurement principles is the ISJV Procurement Procedure, which includes details of how the Industry Capability Network (ICN) will be leveraged and SMEs engaged, and how the requirements are passed through to sub-contractors.

Furthermore:

- Environmental, social and economic aspects will be considered in the procurement process and will be publicly stated;
- Sustainability questionnaires will be supplied to each sub-contractor and they will be required to respond as part of the tender process;
- Integrated procurement checklists will be produced based on the IS Rating Tool, NSW SDG and SWTC requirements; suppliers will be assessed against these requirements (e.g. ISO14001 accreditation is preferable); and
- Sustainability workshops will be held with potential suppliers to explain the sustainability requirements of the SVC Works. Suppliers will be requested to provide details of their environmental and sustainability policies, and details of their implementation.

3.1.3 Construction

Embedding Sustainability in Construction

The primary mechanism for embedding sustainability in construction is through the procurement of goods and services that meet the requirements of the sustainability strategy. Once the procurement objectives have been achieved, the focus is on how the requirements are enforced in the day-to-day management of sub-contractors.

Beyond the high-level procurement contracts, an important tool in embedding sustainability in construction is the development of streamlined content for sub-contractor packages including:

- Pre-qualification checklists for suppliers;
- Supplier RFQ sustainability requirements; and
- Supply agreement sustainability clauses.

The final key element of construction stage sustainability is a short feedback cycle on ongoing sustainability performance reporting. To this end, a live reporting framework will be maintained which indicates:

- Ongoing performance of the project against the key sustainability targets;
- Overall 'budget' indicating the proportion of the target that has been "used up"; and
- Program-tied benchmark budget that indicates whether the current status is 'on track' or not.

Monthly data updates will indicate any red flags and meetings between the Sustainability Manager and the Construction Manager will provide a forum for addressing performance concerns.

Sustainability Plan

The Sustainability Plan will be updated as needed, to reflect changes in construction methodology or new elements of the Project Works and Temporary Works not currently covered by the Sustainability Plan.

The requirements of the Sustainability Plan, as detailed in the responsibility matrix, will be reviewed at regular intervals through the construction process. The NSW SDG requires 6-monthly reporting through the construction stage and the IS rating system requires certification at completion of the construction process.

Site Inductions and Inspections

Site inductions will be carried out for all of the SVC Contractor's personnel and sub-contractor personnel, and will include the project's sustainability objectives and requirements.

Regular audits and reviews against sustainability requirements will be as follows:

- Sustainability Manager to attend site every week (where permitting)
- Monthly inspections will be carried out by the Sustainability Manager, to ensure that construction initiatives are being followed;
- Monthly meetings between the Sustainability Manager and the site supervisors to audit construction documentation for reporting, as per the sustainability matrix (integrated requirements for the IS Rating Tool, NSW SDG Tool and other sustainability requirements);

- 6-monthly documentation reviews for NSW SDG reporting; and
- Detailed IS Rating review at practical completion. The review of IS Rating Tool documentation will be independently verified in a timely manner prior to submitting information to ISCA for formal IS verification.

3.1.4 Monitoring, Auditing and Corrective Action

Performance monitoring, corrective and preventative actions, resulting from audits or non-compliances are to be implemented as part of the continual improvement process. A joint audit program is being pursued with representation from ISJV, the IC and TfNSW, which will include the sustainability requirements and performance for the SVC package, as outlined in Section 8.3 of the Project Quality Plan and Appendix I of the Project Management Plan. All audits and reports will be made available to all relevant stakeholders and approval authorities with clear, transparent data and areas for corrective action and improvement. A compliance workgroup will audit and ensure that compliance with sustainability requirements has been achieved. The Sustainability Manager will track that requirements have been implemented.

Internal sustainability audits of the management system are to be conducted at least quarterly in accordance with ISJVSVC-PMS MSP51 Auditing procedure. The Project Quality Manager will notify all ISJV internal audits and will facilitate attendance of representatives of the Principal, the IC and the Environmental Representative, if they wish. External sustainability audits will be undertaken at least annually. Environmental, social and economic risks and opportunities will be assessed at least annually.

Monitoring during Design, Procurement, Construction and Confirmation

The process of monitoring design and procurement initiatives during the construction process consists of four key steps:

- **Design:** During the design phase, sustainability related design initiatives are documented in the design packages. Design and procurement documentation is contractually binding for sub-contractors. The inclusion of sustainability requirements in contractually biding documentation is evidence of the commitment to including the initiatives in construction.
- **Procurement:** The procurement process includes the sustainability requirements in the requests for tender and procurement contracts for goods and services. Once tendered, the sustainability requirements are again embedded into the contract and committed to by both ISJV and their sub-contractors.
- **Construction:** During construction there are a number of processes to assess the ongoing implementation of the committed initiatives:
    - Sub-contractor takes on requirements and briefing packs;
    - Material quality checks and inspections (as required by the technical specifications);
    - Monthly reporting of progress against targets; reporting by sub-contractors to report against the sustainability requirements embedded into procurement and construction documents;
    - Audit trail of information provided by sub-contractors and entered centrally by ISJV for project performance monitoring and reporting;
    - Sustainable design initiatives committed to as part of the NSW SDG and the ISCA Rating Tool will be audited during the construction stage, both internally and externally, at 6 monthly intervals as part of the internal QA procedures and the external SDG and ISCA requirements;

- Weekly sustainability inspections will be carried out by the Sustainability Manager during the construction process to monitor the Sustainability initiative compliance and will be completed using the Sustainability Inspection Check List (Appendix 3).; and
- Findings from the inspections will be recorded in the Sustainability Action Register, where findings or innovations will be monitored and closed out.

- **Confirmation:** As Built IS certification and final NSW SDG submission provides an end-of-contract confirmation of performance.

Sustainable construction initiatives committed to will be assessed with regards to their ongoing implementation by:

- Weekly Inspections;
- Monthly reporting of progress against targets; and
- Audit trail of information provided by sub-contractors and entered centrally by ISJV for project performance monitoring and reporting, with annual auditing.

Data will be reviewed on a monthly basis prior to the monthly Sustainability Report to identify any clear anomalies or areas that are outside a reasonable bandwidth of consumption. Any anomalies at this stage will be investigated by the Sustainability Manager in discussion with the relevant sub-contractor, and if required, a correction made in the following month's report.

In March/April 2015 after contractors have been on site for approx. 6 months, the contractors making up 80% of the emissions to date will be audited to confirm the accuracy of their data and to review their data collection methods. Should incorrect data be identified, the issue will be rectified and the site supervisor responsible will be coached on methods to provide correct information and to improve their data collection processes. Where data is correct but improvements in their data collection processes are identified, recommendations will be made; the Sustainability Manager will work alongside the sub-contractor managers to work through whether the recommended improvements can be practically and cost effectively implemented.

Random audits of sub-contractors will take place, managed by ISJV, to ensure their compliance with sustainability requirements and targets. , the processes that make up 90% of the emissions for the period since the last audit. The same auditing and corrective action process will take place as that in March/April 2015.

Note: SVC Auditing Program was determined by the SVC Compliance Working Group and did not include the above proposed March/April 2015 audit to confirm accuracy of data. However, such a review was jointly undertaken by ISJV and TfNSW over 2016 of sustainability data collection and recording system (vis ISJV's iTWOcx) as reported in ISJV's November 2016 Sustainability Report.

3.2 Sustainability Management Systems

Sustainability performance monitoring of both internal and subcontractor performance will be carried out with the use of the iTWOcx Sustainability Module (see section 3.3.2).

Decision Making

Decision making will be made holistically, including consideration of environmental, social and economic perspectives. The Procurement Plan outlines procurement policy and decision making criteria. This is supported through MSP24 Procurement Management System Procedure. MSP 24 takes into account

tender risk and tender assessment protocols which a line sustainability deed targets and requirements with the tender process and decision making.

3.3 Milestones and Reporting

Key project milestones have been identified for the implementation of the Sustainability Plan:

- ISCA
  - Registration March 2014
  - Design Submission (Round 1) June 2015
  - As Built submission January 2017

- LCA Analysis
  - Due diligence of Tender Design April 2014
  - Iterative Concept testing April-June 2014
  - Final design LCA August 2014, subject to MOU being signed with preferred concrete supplier

- TfNSW Sustainable Design Guidelines
  - Stage 1 – Pre Concept Design
  - Stage 2 – Reference Design
  - Stage 3 – Detail Design
  - Stage 4 – Construction
  - Stage 5 – Finalisation
  - 6 monthly update and review
  - Progress reported in the Sustainability Monthly Report

- Monthly Sustainability Reporting
  - 7th of every month
  - Includes activities undertaken and progress against all sustainability targets and requirements

The ISJV sustainability management system includes two reporting mechanisms: internal, ongoing reporting within the ISJV; and external periodic reporting to TfNSW and rating system bodies.

3.3.1 Internal

The monthly internal review of progress against the sustainability commitments will be integrated with the ongoing project reporting. The submissions to TfNSW for the NSW SDG will be included in internal reports, as they occur.

Furthermore, sustainability performance will be reported at least monthly to the Project Director. This report will include an update on sustainability targets, and identify areas of improvement that are identified in the weekly inspection (appendix 3). The report will be formally reviewed by senior management and improvements and/or changes will be made to the management system in response to any actions/outcomes of the report.

3.3.2 External

Monthly Reporting

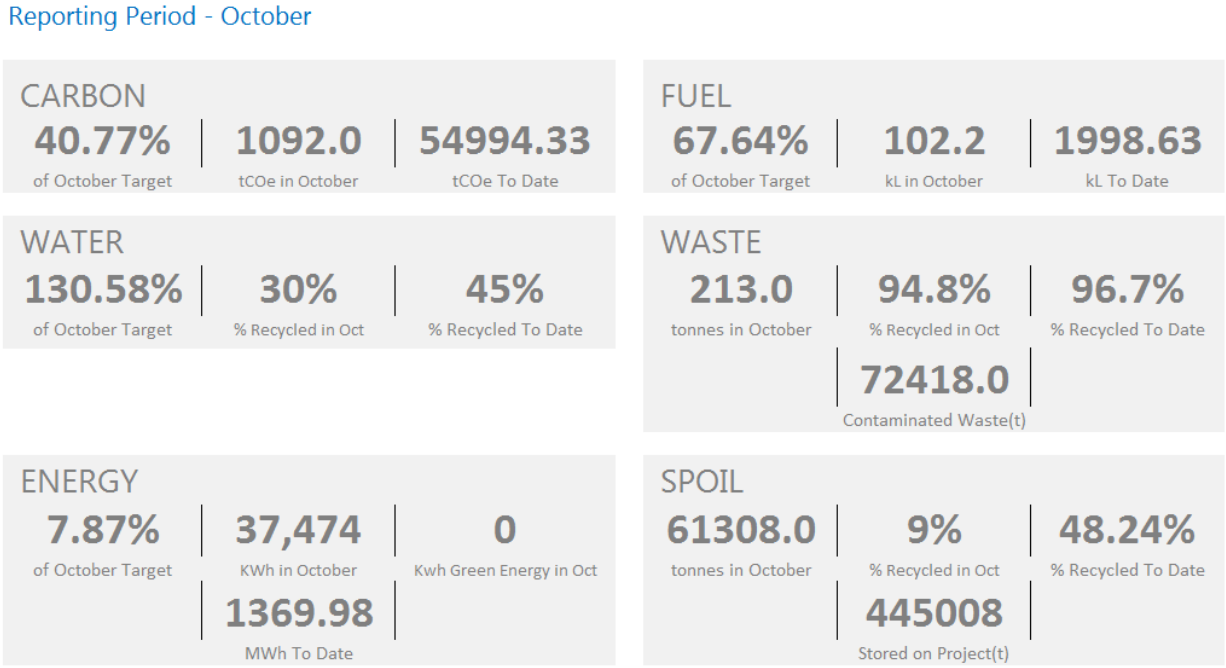
Monthly reporting will be undertaken in accordance with the requirements established in Appendix 23 of the Project Deed.

ISJV will collate sub-contractor data in relation to energy use, water use, fuel use, etc. and this will be consolidated and reported on a monthly basis to the Client via the Sustainability Monthly Report.

ISJV and their sub-contractors are required to complete several forms, (distributed via iTWOcx - an internal ISJV tracking system), requesting relevant data to their participation in the project. This data could include Concrete volumes, Steel, Fuel used, Waste Recycled or % of Non-potable Water used. An internal dashboard will track all the sent out forms and report when they have been returned. These forms also allow the recipient to submit scanned copies of key pieces of evidence such as energy invoices, waste receipts, etc. The program collates all data and evidence for that relevant month and displays a visual output through the Reporting Dashboard. .

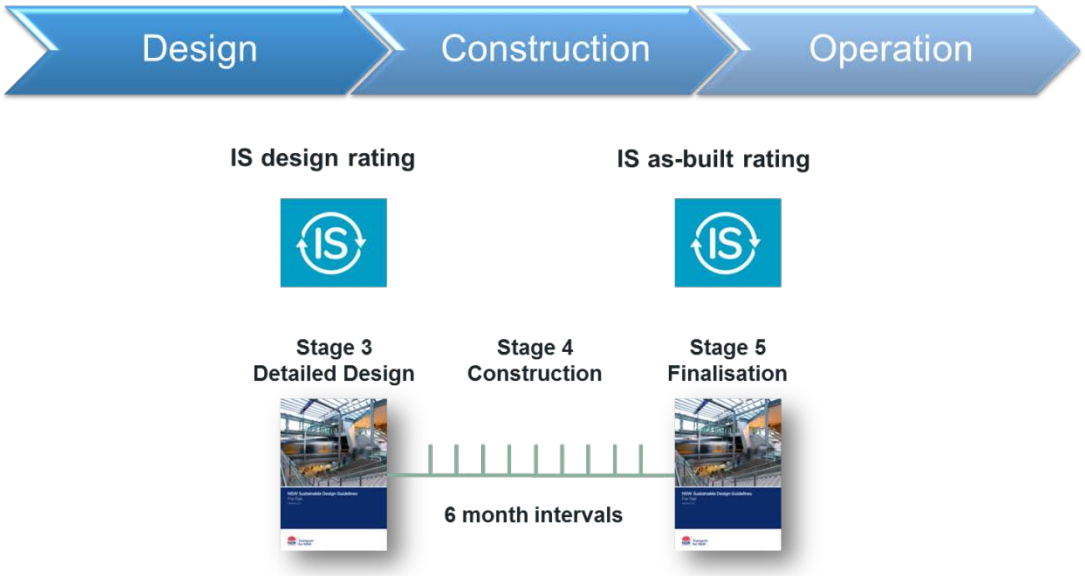
The Dashboard for tracking sustainability performance against Deed requirements via a graphical interface, is included in every month's Sustainability Report. An example is shown below in Figure 7.

Figure 7 Example of dashboard



The IS rating tool submissions will be made and reported at the conclusion of the Design and Construction processes.

Figure 8 External milestones and submittals



Impregilo Salini Sustainability Report

The Salini Impregilo 2015 Sustainability Report can be found at: http://www.salini-impregilo.com/static/upload/rep/report_sostenibilita-_salini-web/report_sostenibilita-_salini-web.pdf

This report has been externally assured by EY, which satisfies the Deed requirement for assurance. The report has been prepared in accordance with GRI G4 Guidelines, which were released by the GRI to replace the GRI G3.1 Guidelines, and therefore satisfies the Deed requirement for G3.1.

The report meets the aims of the AA1000 Accountability Principles in terms of inclusivity, materiality, and responsiveness, and Impregilo Salini's approach to materiality and stakeholder engagement has been clearly outlined in Sections 1.7 and 1.8 of this report.

4 SUSTAINABILITY STRATEGY

4.1 Introduction

ISJV has identified a number of focus areas in relation to sustainability and this section identifies the key initiatives in relation to each focus area. This is not a definitive list and further details regarding compliance with the NSW SDG and the ISCA rating tool are provided in Chapter 5. Compliance with the SWTC Appendix 10 Sustainability Requirements is summarised in Chapter 6 Implementation Summary.

ISJV have identified and addressed all of the climate change risks relevant to the ISJV's scope of work. Design responses included by ISJV have appropriately mitigated climate change risks to an acceptable level.

4.2 Climate Change

4.2.1 Deed Requirements and initial Climate Change Risk Assessment and Adaptation Study

Climate change is widely recognised as a significant concern in the construction and ongoing functionality of large scale infrastructure projects. The anticipated lifespan of the SVC Package spans beyond most of the scientific community's anticipated climate change calculations (IPCC commonly considers changes over 100 years in time steps of a decade); however, likely impacts of climate change can be predicted and anticipated. The SWTC Appendix 10 Section 10.4 identifies the Deed requirements in relation to climate change, which includes:

- Identification and implementation of climate change initiatives that ensure the Project Works and Temporary works are resilient to the effects of climate change;
- Undertake climate change risk assessment in respect to the Project Works and Temporary Works in accordance with the guidance and requirements included in the AGIC Guidelines for Climate Change Adaptation (Revision 2.1: October 2011), the ISCA IS Rating Tool Technical Manual – Climate Change Adaptation chapter and the Department of the Environment and Heritage Australian Greenhouse Office Climate Change Impacts and Risk Management (A Guide for Business and Government 2006);
- Identify and implement all necessary adaptation measures that comprehensively address risks rated using AS/NZS ISO 31000 Risk management – Principles and guidelines as 'extreme', 'high' and 'medium'. Residual risks must be mitigated to a level as far as is reasonable practicable, and
- Ensure that the climate change projects and guidance which underpin the SVC Contractor's climate change risk assessment are the most recent available and are consistent with industry best practice, including the NWRL Climate Change Risk Assessment and Adaptation Study V2.0 dated 28 March 2013.

TfNSW have completed a preliminary climate change risk assessment and adaptation study as part of Chapter 17 of the EIS, NWRL Climate Change Risk Assessment and Adaptation Study V2.0, 28 March 2013. It concluded that there are two medium climate risks, namely flooding damage to infrastructure, and extreme rainfall events causing failure of embankments. In response to these findings, the SWTC identified that drainage element design should respond to a 10% increase in design rainfall intensities to allow a nominal allowance for potential climate change impacts and this has been incorporated into the relevant design packages.

4.2.2 Due Diligence Review

Since completion of the 2013 study, changes were made to the NWRL design and new information relevant to climate change risk was released. These changes necessitated ISJV to carry out a Due Diligence review of the original risk assessment, which specifically focused on the SVC works package, and assessed the impact of design changes and key changes in climate change literature, specifically:

- The inclusion of a cable-stay bridge; and
- The latest climate change literature indicates a decrease in uncertainty associated with most climate change impacts. These include extremes in temperature (more frequent and extreme heat waves, increased annual temperature), extremes in precipitation (increased rainfall intensity, flooding, and an overall decrease in annual rainfall) and other weather related extremes (increased bushfires, wind, storms, lightning and hail).

The Due Diligence review was based on the contract design rather than the 'Detailed Design' as the contract design provided the material changes from the reference design. Also, it would have been too late to incorporate findings into the design if the Detailed Design had been assessed.

The Due Diligence review is appended to this Sustainability Plan in Appendix 1, and the review found that overall risk ratings would be maintained within tolerable levels (rated as C or D overall), contingent on the appropriate implementation of the recommendations.

4.2.3 ISJV Due Diligence Response and Implementation

The Due Diligence review identified a number of recommendations, which, if implemented, would maintain overall risk ratings to within tolerable levels (rated as C or D overall). The Due Diligence review was issued to the ISJV designers, and a workshop was held with the design team in July 2014. The designers responded against the recommendations of the Due Diligence review and responses are summarised in Appendix 2.

In addition, a number of climate change risks and adaptation measures have been addressed as part of the project risk management process, as outlined in the project Risk Management Plan. Identified Climate Change Risks are listed within ISJV Risk Registers (Appendix 5) and the risks are rated and mitigated.

As part of the Risk Management Process, Risks Management meetings are held on a monthly basis where risks are reviewed.

4.3 Carbon Management and Energy Efficiency

Refer to Carbon and Energy Management Plan.

4.4 Community

A large body of work has already been carried out through the production of the EIS, including engagement of local communities, potential customers and other stakeholders. ISJV acknowledge that TfNSW undertake the overall management and coordination of stakeholder engagement activities, therefore, ISJV take a supportive role where appropriate. The Community Liaison Implementation Plan (CLIP) guides the interactions between the ISJV and NWRL project teams, and facilitates a consistent and coordinated approach to community liaison during the life of the SVC works.

Refer to the Site-Specific Stakeholder and Community Involvement Plans (SCIPs) and Business Management Plan for further detail on community initiatives and strategies. The SCIPs are sub-plans of the CLIP, and identify affected residents and stakeholders within each construction zone and provide an overview of management strategies to inform, consult with and assist residents and stakeholders who are impacted during the construction of the SVC Works.

Table 2 – Summary of Community Initiatives

Summary of Initiatives	Reference
Community Liaison ISJV's approach to community liaison is underpinned by early and frequent communication to ensure that stakeholder concerns and impacts are addressed proactively. Community liaison activities will seek to identify ways to minimise disruption, delay and inconvenience to affected members of the community, road and public transport users, businesses and other stakeholders during the completion of the SVC works.	Community Liaison Implementation Plan
Communications Strategy Communication with the community will be carried out using the tools identified in Section 6 of the Overarching Stakeholder and Community Involvement Plan.	Overarching Stakeholder and Community Involvement Plan

4.5 Resource – Water Efficiency

The NWRL Sustainability Strategy policy objective in relation to water use is to minimise the demand for and use of potable water, as well as maximise opportunities for water re-use from captured stormwater and recycled water.

Opportunities to minimise potable water usage follow the following hierarchy:

1. Reduce potable demand and maximise efficiency – equipment selections that are water efficient and operating procedures to further reduce demand.
2. Utilise alternative water sources – such as recycled water or treated water from sedimentation basins and captured rainwater.
3. Recycle – a water recycling system at the off-site concrete production site supplies process water for use in concrete curing.
4. Disposal – wastewater from site compound will be discharged to sewer

A water balance study has been carried out (detailed in Appendix 3 of the Construction Soil and Water Management Plan) that describes the sources, uses and estimated quantities of potable and non-potable water that will be sourced and used in the performance of the SVC Works.

Methods to reduce potable water use during construction, as detailed in the Construction Soil and Water Management Plan, include:

- Using water-efficient fixtures and fittings, e.g. high WELS rated fixtures in temporary facilities;
- Collection of rainwater and stormwater for treatment and reuse at concrete batching and precast yards for concrete processing and other applications, such as dust suppression, wheel washing and site amenities;
- Water used to rinse concrete moulds will be reused (and potentially treated prior to reuse);

- Metering and recording of water consumed within temporary site facilities will be carried out to measure water used by all major plant or process equipment within the construction site; and
- Permeable and porous surfaces will allow for stormwater infiltration into the ground (preferably with other treatments such as vegetated swales).

The run-off, flood risk, and potential increased flood risk elsewhere as a result of the project have been assessed over their expected working life, in line with the requirements of 'Flood plain management in Australia: best practice principles and guidelines' as part of EIS2, Chapter 18 and the Climate Change Due Diligence assessment.

- The flood assessment has been tailored to the nature of the project. Identified flood resilience measures relevant to this package include water sensitive urban design and such measures have been included in the design. Flooding and drainage are addressed in the Flood Modelling Report (NWRLSVC-ISM-SVL-DRT-50100).
- Aquifers will not be depleted from or migrate away from existing groundwater regimes (e.g. contaminated groundwater migration, or lower existing water tables or water courses).
- The use of recycled water in concrete manufacturing has been included in the concrete procurement documentation and on-site water treatment at the batching facility for re-use has been included.
- ISJV is centrally contracting for the key materials such as concrete. The sustainability performance requirements are embedded within the procurement documentation.

4.6 Resource – Waste and Materials

ISJV will be centrally contracting for the key materials such as steel and concrete to all three of the SVC sub-contractors. The sustainability performance requirements for these materials will be embedded within the procurement documentation.

During the procurement process, the ability of the contractors to introduce innovative processes that further improve on the targets and efficiently manage their resource intensity will be included in the evaluation criteria, along with the other key factors such as quality, reliability and price.

Table 3 – Summary of Resource – Waste and Materials Initiatives

Summary of Initiatives	Reference
Diversion from Landfill The target of 90% is committed to in line with requirement 10.9.1 (o) of SWTC Appendix 10 Sustainability Requirements and a compulsory requirement (C.8) of the NSW SDG. This requires at least 90% of inert and non-hazardous construction waste (excluding spoil) to be recycled or alternatively beneficially reused. This target also aligns with Level 2 of Was-2 of the IS Rating Tool.	Waste Management and Recycling Plan
Construction Site Waste Recycling ISJV will provide recycling areas within the construction site. Waste segregation will be facilitated by the collection and segregation of waste with appropriate marking (e.g. signage) and controls (e.g. lockable lids), located away from sensitive receptors (e.g. water courses). All cleared vegetation (excluding weeds) will be mulched. The mulch will be stored on-site for future reuse or sent to an off-site compost facility. ISJV will reuse formwork and construction waste, where practicable.	Waste Management and Recycling Plan
Material Lifecycle Impacts Monitoring and modelling of materials lifecycle impacts will be undertaken post contract award using the IS Rating Tool Materials Calculator (or other suitable Lifecycle assessment technique) across the infrastructure lifecycle. A reduction in materials lifecycle impacts will be achieved based on a comparison to a reference footprint.	Carbon and Energy Management Plan
Environmental labelling If possible, at least one material or product will have: • Ecospecifier Green Tag labelling; or • Good Environmental Choice Australia Ecolabel (or GBCA BEP) labelling; or • Other ISCA approved Type 1 Environmental label; or • An ISEAL Alliance compliant whole supply chain Stewardship Scheme certification.	Project Procurement Management Plan
Deconstruction Plan A deconstruction plan will be developed, and reviewed and updated periodically. At least 10% (by value) of components or pre-fabricated units are to be easily separated for disassembly/deconstruction, where practical.	Deconstruction Plan
Spacing of Structural Members The spacing of structural members in beam and post type designs has been optimised to minimise material consumption, mass/volume/space use and above ground land take.	Design Packages
Stray Current Electrolysis Stray current electrolysis will be minimised as follows: • Segmental bridges will not have reinforcement across joints; and • Pot bearings mill contain an elastomer which assists in isolating the deck from the substructure.	Design Packages

Summary of Initiatives	Reference
Concrete ISJV will endeavour to source concrete from members of the Cement Concrete and Aggregate Association of Australia (CCAA), or a similar international association or organisation. ISJV will embed the requirements of the Green Star Mat-4 concrete credit criteria for cement replacement, aggregate and water use into the concrete procurement requirements. This requires the reduction of Portland Cement use by 30% compared to a reference case and mix water for all concrete used in the project to contain at least 50% reclaimed water (measured across all concrete mixes in the project). Another initiative being considered is: 1. At least 40% of coarse aggregate is crushed slag aggregate or other alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland Cement by over five kilograms per cubic meter of concrete; or 2. At least 25% of fine aggregate (sand) inputs in the concrete are manufactured sand or other alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete.	Concrete Mix Design Strategy
Timber ISJV will source all timber products used in the Project Works and Temporary Works from either re-used timber, post-consumer recycled timber or from Forest Stewardship Council certified timber suppliers, where practicable.	Project Procurement Management Plan
Low VOCs Low Volatile Organic Compound finishes, sealants and adhesives and low emission formaldehyde composite wood products will be used in the Project Works and the Temporary Works, where practicable.	Project Procurement Management Plan
Reuse of Materials ISJV will maximise the reuse of concrete, bricks, earthworks and other structural waste materials, where possible. Structural waste materials are likely to be minimal except for earthworks and excavation. Where possible, excavated materials will be reused.	Project Procurement Management Plan
Structural Steel Fabricated structural steelwork will mainly be used for the temporary works, and only minimally for the viaduct structure. A review has been carried out of steel fabricators/contractors accredited to the Environmental Sustainability Charter of the Australian Steel Institute as it is acknowledged that initiative 3.14 of the NSW SDG requires at least 60% to be sourced according to this accreditation.	Project Procurement Management Plan

Summary of Initiatives	Reference
Reinforcement Steel ISJV commits to source at least 60% of reinforcing bar and mesh to be produced through energy reduction processes. This aligns with the NSW Sustainable Design Guidelines discretionary initiative 3.15. In particular, OneSteel's 'Eco Bar' is proposed to be used, which is manufactured using Polymer Injection Technology. ISJV will source at least 15% of reinforcing steel from suppliers that use optimal off-site fabrication techniques such as engineered reinforcing bar carpet, engineered/customised mesh or prefabricated reinforcing cages, where practicable. ISJV will endeavour to source steel that is certified under the Australian Certification Authority for Reinforcing Steels or a similar international association or organisation.	Project Procurement Management Plan
Material Safety Data Sheets Material Safety Data Sheets will be used to avoid dangerous goods and hazardous materials.	Project Procurement Management Plan
PVC ISJV will endeavour to source PVC from suppliers that are signatories to the "Vinyl Council of Australia Product Stewardship Program" or a similar international program.	Project Procurement Management Plan
Spoil Management Methods to reduce spoil quantities generated during the performance of the SVC Contractor's Activities and maximisation of the beneficial reuse of spoil are discussed in the Spoil Management Plan. This Plan also describes how environmental and social impacts of spoil transfer and reuse will be effectively managed and minimised. It is noted that the NWRL Sustainability Strategy's target is for 100% of clean spoil to be beneficially reused.	Spoil Management Plan

4.7 Land Use and Biodiversity

The NWRL Sustainability Strategy's policy objective is to optimise above and below ground land use requirements. For both restoration and permanent landscape works, areas will be provided in accordance with Section 13.4 of the SWTC Appendix 13 – Architecture, Urban Design and Landscape Performance and Design Requirements. For temporary works, stabilising measures will be used.

Table 4 – Summary of Land Use and Biodiversity Initiatives

Summary of Initiatives	Reference
Clearing Protocols ISJV will minimise clearance of vegetation during construction and, if clearance is undertaken, revegetation works will be undertaken as soon as is practicable. Clearing protocols will be implemented for habitat areas with the involvement of a qualified ecologist, including: • Preparation of an inventory of trees and hollows to be removed (including the number, age and structure of mangroves); • Checking hollow-bearing trees for fauna and nests prior to removal; • Implementing a two-stage clearing process to allow a natural transition of fauna species following the initial disturbance; and • Safely relocating any animals found	Flora and Fauna Management Plan
Biodiversity Offsetting TfNSW has developed a requirement for a biodiversity offset strategy to be developed as part of the Project Approval. Approximately 40 hectares have been identified as suitable offsets for the NWRL project in its entirety. Refer to the Flora and Fauna Management Plan for more detail.	Flora and Fauna Management Plan
GBCA Change in Ecology Calculator Due to the inherent site characteristics (i.e. there are two threatened vegetation communities) the SVC project is precluded from meeting the mandatory requirements of the Green Star Change in Ecology calculator; therefore 0 points are achieved.	Flora and Fauna Management Plan
Using Topsoil for Construction If topsoil is of adequate quality, it will be reused on site or potentially off-site.	Spoil Management Plan
Feral Animals and Weeds Feral animals and weeds will be identified, controlled, monitored and managed.	Waste Management and Recycling Plan; and & Flora and Fauna Management Plan
Reducing Land Take Land use is fixed for the SVC scope, however initiatives to reduce land take are: • Longer spans will be used (i.e. 4m instead of 3m), which requires larger piers, but fewer in number; and • On Windsor Road, a three metre pile will be used instead of a pile cap. This reduces the area required per pile, as shallow footings can go straight into the piers with no need for a pile cap.	Design Packages
Contaminated Land Assessment A contaminated land site assessment has been carried out for Phase 1 as part of EIS 1, and remediation options have been identified. Phase 2 contaminated land site assessments were required and remediation or containment options will be identified and selected using a sustainability hierarchy, and by multi-criteria analysis.	Waste Management & Recycling Plan; and Construction Soil & Water Management Plan

Summary of Initiatives	Reference
Runoff Quality The standard 'Australian Runoff Quality – A Guide to Water Sensitive Urban Design' has been used by ISJV to develop water sensitive urban design approaches. Streams will be retained along the route of the viaduct, and grass swales and bio-swales will be used to manage water runoff, filter pollutants and increase rainwater infiltration. The use of concrete channels have been minimised where possible to minimise the use of materials.	Design Packages

4.8 Pollution Control

ISJV will seek to have zero pollution incidents as identified in the Construction Environmental Management Plan.

Table 5 – Summary of Pollution Control Initiatives

Summary of Initiatives	Reference
Major Pollution Prevention Major pollution elements will be prevented by the use of various mitigation measures, such as paved bunded areas to park plant and store fluids, carefully designed runoff water catchments, control measures and sedimentation basins.	Pollution Incident Response Management Plan
Light Pollution Light pollution will be prevented by following the guidance and requirements of AS4282 'Control of the Obtrusive Effects of Outdoor Lighting" and AS1158 "Road Lighting".	Construction Environmental Management Plan
Air Quality Air quality will be monitored, as outlined in the Construction Environmental Management Plan. Level 2 of IS Rating Tool Dis-4 to be achieved.	Air Quality Management Plan
Noise Baseline studies of the existing noise environment have been carried out as part of the EIS. Noise mitigation measures have been developed in accordance with the DECC Interim Construction Noise Guidelines 2009, and includes the use of acoustic screens, low noise equipment and restricted hours of operation. The Construction Noise and Vibration Management Plan details monitoring to be conducted during the construction process. Key targets will be that construction noise should not go above 120dB at noise sensitive receivers, and noise levels should be below 75dB where practical. The viaduct has been designed to achieve 75dbA at a slant distance of 17.75m at a height of 1.5m above the ground using the viaduct mass and by installation of noise barrier frames.	Noise and Vibration Management Plan; and The Urban Design and Corridor Landscape Plan
Vibration Dilapidation surveys will be carried out post contract award. Vibration sensitive buildings will be identified and baseline monitoring will be conducted prior to commencement of construction. EIS 2 states	Noise and Vibration Management Plan

Summary of Initiatives	Reference
operation related vibration mitigation measures, and these are also outlined in the Construction Noise and Vibration Management Plan. Final inspection of vibration sensitive buildings will be required at the end of construction by a structural engineer.	
Receiving Water Quality Baseline studies of receiving water environments have been carried out as part of EIS2. Measures to minimise adverse impacts to local receiving water quality during operation are grass swales and bio retention swales. Drainage downpipes will be located at every pier, and there will be no carrier drains on the viaduct bridge girder, therefore the chance of sediment settling and maintenance will be reduced. Stormwater leaving the sites will be monitored during construction as detailed in the Soil and Water Management Plan. Water quality improvement devices have been included to treat runoff from station precincts, bus parking area and Macarthur Creek outlet. Bio retention swales and grass lined swales have been incorporated in most locations to provide natural approaches to improving water quality.	Construction Soil and Water Management Plan Construction Environmental Management Plan

4.9 Supply Chain

The NWRL Sustainability Strategy's policy objective is to influence contractors, sub-contractors and materials suppliers to adopt sustainable practices in support of the NWRL Environment and Sustainability Policy.

4.9.1 Workforce Development

ISJV will ensure that all Small & Medium Enterprises (SMEs) contribute to the goals and objectives of the project through the engagement and Supply Chain processes of ISJV's Project Procurement Management Plan and the Supplier Tender Package documents (SI-SVC-MSP24-3/V1R0). These ISJV processes and documents mandate relevant and proportional workforce obligations within all project tenders and contribute to the identified current and future skills requirements. To assist Suppliers in meeting their obligations, ISJV will provide support and information, where necessary. Please also refer to Section 3.5 of the Project Procurement Management Plan (NWRLSVC-ISJ-SVC-PM-PLN-120102).

Supplier compliance will be monitored through site meetings, site inspections and audits, reports and meetings. The SMEs will be required to submit monthly reports on participation and Sustainability targets, to ISJV for integration into its reporting to the Principal. Further information is capture on the Damstra Workforce Management System.

The workforce strategy is described in detail in the Project Training Management Plan. Project training priorities and targets will be based on:

- The objectives and targets identified in the Project Training Management Plan
- Project training needs and priorities as determined on a corporate level for each position

Training priorities for individuals will be determined on a case-by-case basis after reviewing project needs, legislative requirements, the worker's existing skills and the skill requirements of their position, their experience, interest in learning, and commitment to the project and career aspirations.

ISJV has identified the following training targets:

- 5% of the In Scope Workforce, (excluding specialist skills and short term duration contracts no longer than twelve months) are Apprentices and Trainees from the Greater Sydney area.
- at least 20% of the In Scope Workforce, excluding Apprentices and Trainees, are sourced from the Greater Western Sydney
- 35% of the ISJV and its Suppliers' workforce will participate in structured training, in accordance with the NSW Training Management Guidelines 2009

ISJV is committed to working with TfNSW to support local labour forces, assist in resolving skills shortages, encourage the next generation to pursue careers in the construction and engineering infrastructure sectors, facilitate training and educational opportunities, promote partnerships and encourage diversity and inclusion in recruitment programmes.

ISJV will leverage its relationships with local Employment Service Providers, Industry bodies and Government agencies to remain informed of labour market conditions and support diversity objectives. ISJV continues to participate in the bi-monthly Skills and Employment Advisory Group forum to develop these relationships and contribute to strategic and Policy direction. Please also refer to the Project Aboriginal Participation Plan for more information.

Strategies to address possible skill and labour shortages could include:

- Identifying and up-skilling local workers who possess the majority of competency required;
- Attracting interstate labour where workers cannot be drawn from the Greater Sydney and Greater Western Sydney Regions; and
- Engaging additional SME's, as defined in Section 3.5 of Project Procurement Management Plan (Revision 1).

Where local and up-skilling options are not timely or successful, ISJV may engage workers through 457 visas for highly skilled technical work in accordance with Department of Immigration and Border Protection requirements. Please also refer to the Project Training Management Plan for more information.

The training and workforce goals for this project, having been negotiated with TfNSW and identified in the Project Training Management Plan, are:

- To provide nationally accredited training to ensure employees are able to safely and competently perform their work so that the project can be constructed in the most effective and efficient manner whilst maintaining an excellent safety record; and
- To continuously improve the skills and capability of individual employees.

The training objectives for this project are to:

- Identify any skills gaps against project training requirements and provide training to address any potential skill shortages;
- Develop innovative training delivery methods to maximise learning;

- Provide comprehensive Health, Safety, Environmental, Heritage and Quality induction training to all site personnel. This will ensure employees understand and support the standards required on the project;
- Ensure 35% of the total project workforce participates in structured training; and
- Meet detailed targets as set out in section 1.7 of this Plan.

ISJV is committed to the training and development of all its staff and workers to ensure that we:

- Fulfil the needs of the Client and the Deed objectives;
- Possess the essential skills and competencies to support safe and efficient working; and
- Provide our people with opportunities for personal growth and career development through the acquisition of new or enhanced skills.

Table 6 – Summary of Workforce Initiatives

Summary of Initiatives	SWTC
A workforce strategy will be developed prior to construction commencing, including the following aspects: - Local employment - Training and education - Health and wellbeing - Diversity and equal opportunity (including gender, age, minority) - Partnerships with local universities and other educational institutes	
Excluding the items coming from offshore, the priority will be to engage local enterprises from Sydney CBD or NSW, where possible, to provide equipment and materials for the construction of the substructure. The SVC Contractor will identify ANZ SMEs for potential participation in the supply chain for the SVC Project Works, and alert these ANZ SMEs of potential tenders and supply opportunities. This is described in further detail in Project Procurement Management Plan. The SVC Contractor will develop and implement strategies to support local SMEs and social enterprises. The SVC Contractor will assess the capacity of local SMEs and social enterprises to deliver works, services or supplies that are required for the design and construction of the Project Works and the Temporary Works, where practicable.	✓ App.10
The SVC Contractor will develop and implement programs for engagement with local universities including internships and work placements.	✓ App.10
The SVC Contractor will develop and implement strategies to obtain workforce development funding, subsidies and grants, where practicable.	✓ App.10
The SVC Contractor will identify and implement workforce initiatives that provide for the acquisition and utilisation of new workplace skills. The SVC Contractor, will as minimum: • Provide relevant training to assist in re-skilling and up-skilling the workforce • Establish industry partnerships for workforce skill acquisition and utilisation • Make use of existing government training and development programs	✓ App.10

Summary of Initiatives	SWTC
The SVC Contractor will develop and implement workforce training and skill development programs. The SVC Contractor will, at a minimum: • Identify educational and training facilities that can provide the qualifications required for workforce participation • Identify formal programs and other arrangements for education and training that provide relevant qualifications for the workforce • Implement monitoring and reporting mechanisms to ensure workforce training and skill development targets are met	✓ App.10
The SVC Contractor will assess current and future workforce skill needs and must develop workforce profiles including skill categories required for the design and construction of the major elements of the Project Works and the Temporary Works.	✓ App.10
The SVC Contractor will identify and implement workforce development initiatives.	✓ App.10

4.9.2 Sustainable Procurement

In terms of Sustainable Procurement, ISJV will seek to negotiate and implement packaging take-back arrangements with suppliers, where practicable. Sustainability and environment performance criteria and the NWRL Environment and Sustainability policy will be passed on to all suppliers and materials will be sourced from accredited manufacturers and suppliers, where possible.

Procurement will be prioritised from local businesses, where possible. Registration on the Industry Capability Network (http://www.icn.org.au/) will be used to facilitate local procurement.

Social and environmental performance criteria will be passed through the supply chain. Potential suppliers will be required to provide details of their sustainability policy and its implementation, and forward commitment procurement will be used where possible to help stimulate innovation. Supplier evaluation will consider sustainability aspects through the use of multi-criteria analysis and supplier contracts will incorporate sustainability objectives/targets where possible.

Supplier sustainability performance will be monitored throughout the contract duration and poor performance will be managed.

Materials will be procured from sustainable suppliers, and guidance will be used from BS 8903: 2010 – Principles and framework for procuring sustainably.

4.10 Temporary Site Facilities

The temporary site facilities consist of site offices and associated amenities.

Table 7 – Summary of Sustainability Initiatives for Temporary Site Facilities

Summary of Initiatives	Reference
Water • Water efficient fixtures, fittings and controls will be implemented, where possible.	This Plan

Summary of Initiatives	Reference
Heating Ventilation and Air Conditioning • Natural ventilation will be incorporated, where possible • Seasonal temperature set points • Regular maintenance of HVAC equipment	This Plan
Equipment • Where reasonable and feasible, all plug-in electrical equipment within any temporary site facilities provided by the SVC Contractor, including the temporary site facilities provided for the Principal and the IC, will comply with Equipment Energy Efficiency Program (E3) "Minimum Energy Performance Standards" and will have at least a five star Energy Rating Label • Computers, photocopiers and other office equipment to have energy saving mode enabled	This Plan
Pollution Refrigerants and fire suppression systems will have low or zero global warming potential.	Carbon and Energy Management Plan
Waste At least 60% of the site office's operational waste will be diverted from landfill. Recycling bins and signage will be strategically placed to promote recycling.	Waste Management and Recycling Plan
Lighting • Access to natural daylight will be incorporated, wherever possible • Energy efficient lighting schemes, light fittings and electrical appliances will be used • Lighting control systems will dim or switch-off lights according to the amount of daylight the zone is receiving, and will be off when areas are unoccupied • LED and energy efficient lamps will be used, where available.	
Renewable and Low Carbon Energy Opportunities for on-site renewable and low-carbon energy will be identified and evaluated for suitability and cost effectiveness.	Carbon and Energy Management Plan
Other • Crime Prevention Through Environmental Design principles will be adopted	

4.11 Innovations

Opportunities to innovate, improve sustainability performance and improve the governance systems that surround infrastructure projects have been identified and captured during:

- Briefing workshops;
- Regular weekly design meetings;
- Regular internal management meetings between the project director and sustainability manager; and

- The commission of specialist studies; including the lifecycle analysis

Whilst the sustainability framework for the SVC package is defined by the SWTC, IS rating tool and NSW SDG requirements, ISJV has focused on a number of key areas not identified in the SWTC. These include:

- Re-use of major construction equipment from prior projects;
- Use of existing, rather than purpose-built concrete batching facilities;
- Using Salini International Workforce by recruiting through Salini Overseas Operations Office to import skill and innovation techniques;
- The use of a double gantry technique;
- Increase of segment length from 3m to 4m spans, which has wider benefits including reduced vehicle movement;
- Proactive engagement of both ISCA and TfNSW on the methodology for Life Cycle Assessment to inform the ISCA rating tool; and
- Development on real-time tracking and auditing platform in cooperation with RIB and the iTWOcx platform.

5 SUSTAINABILITY CERTIFICATION

The two certification tools to be used for the SVC Package are:

- NSW Sustainable Design Guidelines (SDG) for Rail v2.0; and
- ISCA Infrastructure Sustainability (IS) Rating Tool

5.1 NSW Sustainable Design Guidelines for Rail v2.0

Another tool to verify and validate the successful delivery of environmental and social sustainability initiatives through the full lifecycle of the project will be the use of the NSW SDG for Rail v2.0. All 'Compulsory' initiatives will be met, as well as at least 80% of the 'Discretionary' initiatives. TfNSW has supplied a checklist completed for the Reference Design. ISJV reviewed this checklist during the tender phase and confirmed a commitment to the achievement noted in SWTC Appendix 10. It is currently envisaged that the SVC Works will have an individual rating, which may (or may not) feed into an overall rating for the entire NWRL Project Works.

A responsibility matrix has been developed to track the processes and methodologies for implementing the nominated initiatives, and these will be communicated to the design and construction teams during a NSW SDG workshop. Commitments will be made by the responsible parties.

TfNSW SDG Milestones are:

- Stage 1 – Pre Concept Design
- Stage 2 – Reference Design
- Stage 3 – Detail Design
- Stage 4 – Construction
- Stage 5 – Finalisation
- 6 monthly update and review
- Progress reported in the Sustainability Monthly Report

The auditing and verification process for the SDG requirements has been advised by TfNSW.

5.2 ISCA IS Rating Tool

The IS rating tool, developed by ISCA, verifies and validates the successful delivery of environmental and social sustainability initiatives through the full lifecycle of the project. This will provide third party verification that the works have delivered a pre-defined environmental performance. The proposed IS rating tool timeline is identified below:

- March 2014 – Develop proposed ISCA pathway to achieve 65 points and communicate to project team and formalise registration with ISCA
- April – August 2014 – Embed ISCA requirements into design packages, procurement documentation, etc.
- June 2015 – Submit Design Submission R1
- June 2015 / August 2015 – Respond to verifier comments and submit Design Submission R2

- August 2015 – ISCA 'Design' Certification awarded
- 2014-2016 – Monitoring, auditing and corrective action during construction stage
- January 2017 – Submit As Built Submission

The NWRL IS Rating Implementation Plan v4.2 has been reviewed and ISJV is committed to delivering at least a 65 point 'Excellent' rating for the SVC scope of works at Design and As Built stages. Opportunities to achieve > 65 points have been identified to provide a points buffer.

ISJV's capabilities and experience will support advanced performance in issues such as: Discharges to Air Land and Water; Urban and Landscape Design; Community Health; Climate Change and Adaptation; Wellbeing and Safety; and Waste. Design and As Built ratings would be achieved within the scope of this project and this would effectively enable an Operation rating to be achieved after 24 months of operation by the OpCo. ISJV recognises that management of documentation is fundamental to the rating being obtained; therefore, a responsibility matrix and briefing notes have been developed to assign documentation requirements, regular workshops are being held to engage the project team with the ISCA requirements, regular monitoring will be carried out, and documentation will be thoroughly reviewed prior to submission to ISCA.

5.2.1 IS Rating across NWRL Packages

ISJV have also been working with TfNSW to develop the credit allocation across NWRL contracts and packages.

5.2.2 Tracking Implementation

The mechanism to track the implementation of the Design and As Built, IS rating will be the use of an ISCA responsibility matrix, as shown in Figure 9.

Figure 9 IS Rating Tool Responsibility Matrix

NWRL SVC Sustainability Related Targets/Requirements

Project Name: NWRL SVC Package

Project Number: STD/10749/P Date: 19/05/2014

Created by: HJG QA: LXC

Reference Filter: Infrastructure Sustainability Rating Tool Version 1.0, NSW Sustainable Design Guidelines for Rail V2.0, NWRL Sustainable Strategy Targets, Scope of Works and Technical Criteria Appendix 19 and Scope of Works and Technical Criteria Appendix 24

Reference	Targets/Requirements		Initiative/Implementation	Document	Topic/Discipline	Timing	Plan/TfNSW Interface/Package Interface	Responsibility Key Contributor
Mas-1 Sustainability Leadership and Commitment	There are commitments to mitigating negative environmental, social and economic impacts. AND There commitments are embedded into sustainability objectives and/or targets.	The requirements for Level 1 are achieved AND The sustainability objectives and/or targets are reflected in project contracts.	The requirements for Level 2 are achieved AND The sustainability commitments go beyond mitigating negative impacts to restorative actions (i.e. net positive benefit for society and the environment). AND The sustainability commitments are publicly stated. AND For operation, there is a commitment to continuous improvement in sustainability performance.	COMMENTS: - See Section xx of Sustainability Plan. - The NWRL has already published the NWRL Environmental and Sustainability Policy Statement, themes and objectives. The SVC Package is contractually required to meet these Sustainability objectives and targets. - ISJV have developed their own sustainability policy. ACTIONS: - Sustainability commitments to be included into all project contracts. - Level 3 is at risk, confirm if sustainability policy is to be made public.	ISCA RATING TOOL	Management	Design Construction	Sustainability Plan TfNSW	Sustainability Manager Project Director
Mas-2 Management System Accreditation	The project Management Systems have accreditation to all of: ISO14001 (Environment) ISO9001 (Quality) AS4801 (OH&S) or equivalent.	Not applicable	Not applicable	COMMENTS: - See Section xx of Project Management Plan. - ISJV have adopted an Integrated Quality, Environment and Safety Management System on a voluntary basis which comply with the relevant accreditations. ACTIONS: - Provide accreditation certificates. -Ensure accreditations are filtered down to all subcontractors involved in the project.	ISCA RATING TOOL	Management	Design Construction	Project Management Plan	Business Systems Manager
Mas-3 Risk and Opportunity Management	Environmental, social and economic risks are assessed. AND The risk assessment is updated at least annually.	The requirements for Level 1 are achieved. AND Environmental, social and economic opportunities are also assessed.	Not applicable	COMMENTS: - See Section xx of Risk Management Plan. - Risks will be managed on the project by the Business Systems Manager. ACTIONS: - Develop a Risk Register - ISJV to advise how risks will be managed in accordance with Level 2. - Keep minutes of risk assessment meetings and records of risk reviews.	ISCA RATING TOOL	Management	Design Construction	Risk Management Plan	Business Systems Manager

6 Implementation Summary

The purpose of this chapter is to identify where the requirements of SWTC Appendix 10 and the NWRL Sustainability Strategy have been addressed in the SVC Package.

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
SWTC Appendix 10					
10.2 (a)	General Requirements	The SVC Contractor must ensure that sustainability is addressed throughout the performance of the SVC Contractor's Activities and that sustainability is embedded into the design and construction of the Project Works and the Temporary Works.	See Section 3.1 of Sustainability Plan.	Design Construction	Sustainability Manager
10.2 (b)	General Requirements	The SVC Contractor must comply with, carry out and fulfil the requirements of and the commitments in the North West Rail Link Sustainability Strategy, including the requirements and commitments relating to targets and initiatives, but only to the extent that they relate to the scope and extent of the Project Works, the Temporary Works and the SVC Contractor's Activities.	See Chapter 6 of Sustainability Plan.	Design Construction	Sustainability Manager
10.2 (c)	General Requirements	The SVC Contractor must register with the Infrastructure Sustainability Council of Australia IS Rating Scheme to use the IS Rating Tool in consultation with the Principal's representative. The SVC Contractor must use the IS Rating Tool to calculate the "Design" and "As Built rating scores for the design and construction of the Project Works and Temporary Works.	See Section 5.1 of Sustainability Plan.	Design Construction	Sustainability Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.2 (d)	General Requirements	The SVC Contractor must achieve an Infrastructure Sustainability Council of Australia "Design" rating score of at least 65 for the design of the Project Works and Temporary Works and an "As Built" rating score of at least 65 for the construction of the Project Works and Temporary Works. The rating scores must be independently verified in accordance with the IS rating process described in the IS Rating Scheme, which is administered by the Infrastructure Sustainability Council of Australia.	See Section 5.1 of Sustainability Plan.	Design Construction	Sustainability Manager
10.2 (e)	General Requirements	The SVC Contractor must implement all of the "compulsory initiatives" identified for civil infrastructure as well as implement "discretionary initiatives" identified for civil infrastructure and achieve at least 80% of the discretionary points available in Transport for NSW – NSW Sustainable Design Guidelines for Rail Version 2.0.	See Section 5.2 of Sustainability Plan.	Design Construction	Sustainability Manager
10.3 (a)	Governance	The SVC Contractor must identify and implement governance initiatives.	See Chapter 2 and Chapter 3 of Sustainability Plan.	Design Construction	Project Director
10.3 (b)	Governance	The SVC Contractor must develop, implement and maintain governance structures, processes and systems that ensure integration of all sustainability considerations, initiatives and reporting.	See Chapter 3 of Sustainability Plan.	Design Construction	Project Director
10.3 (c)	Governance	Sustainability objectives and requirements for the North West Rail Link project must be allowed for and addressed in: (i) design briefings for all personnel involved in the preparation of Design Documentation; (ii) processes for the development of Design Documentation; and (iii) site inductions for all of the SVC Contractor's personnel and Subcontractor personnel engaged in the SVC Contractor's Activities.	See Section 3.2 of Sustainability Plan.	Design Construction	Project Director

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.3 (d)	Governance	The SVC Contractor must develop, implement and maintain a sustainability assurance framework to track compliance with sustainability targets, which is consistent with and complies with the requirements in AA1000 Accountability Principles Standard and the requirements in Global Reporting Initiative G3.1 Guidelines.	See Project Quality Plan.	Quality	Quality Manager
10.4 (a)	Climate Change	The SVC Contractor must identify and implement climate change initiatives that ensure the Project Works and Temporary Works are resilient to the effects of climate change.	See Section 4.2 of Sustainability Plan.	Design	Sustainability Manager Design Manager
10.4 (b)	Climate Change	The SVC Contractor must undertake climate change risk assessments in respect to the Project Works and the Temporary Works in accordance with the guidance and requirements included in the Australian Green Infrastructure Council Guideline for Climate Change Adaptation (AGIC Revision 2.1: October 2011), the Australian Green Infrastructure Council Infrastructure Sustainability Rating Tool Technical Manual – Climate Change Adaptation chapter and the Department of the Environment and Heritage Australian Greenhouse Office Climate Change Impacts and Risk Management (A Guide for Business and Government 2006).	See Section 4.2 of Sustainability Plan.	Design	Sustainability Manager Design Manager
10.4 (c)	Climate Change	The SVC Contractor must identify and implement all necessary adaptation measures that comprehensively address risks rated using AS/NZ ISO 13000 Risk management – Principles and guidelines as 'extreme', 'high', and 'medium'. Residual risks must be mitigated to a level as far as is reasonably practicable.	See Section 4 of Risk Management Plan.	Design	Sustainability Manager Design Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.4 (d)	Climate Change	The SVC Contractor must ensure that the climate change projections and guidance which underpin the SVC Contractor's climate change risk assessment are the most recent available and are consistent with industry best practice, including the NWRL Climate Change Risk Assessment and Adaptation Study V2.0, dated 28 March 2013.	See Section 4.2 of Sustainability Plan.	Design	Sustainability Manager
10.5 (a)	Carbon Management and Energy Efficiency	The SVC Contractor must identify and implement low carbon and energy efficiency strategies and initiatives that minimise carbon emissions, energy use and embodied lifecycle impacts associated with the construction of the Project Works and Temporary Works.	See Carbon and Energy Management Plan.	Design	Environmental Manager
10.5 (b)	Carbon Management and Energy Efficiency	The SVC Contractor must undertake carbon footprint assessments in accordance with the requirements in ISO 14064-1:2006: Greenhouse gases - Part 1, ISO 14064-2:2006: Greenhouse gases – Part 2, ISO 14064-3:2006: Greenhouse gases – Part 3 that incorporate direct and indirect emissions associated with electricity and fuel consumption, on-site process emissions and embodied emissions for all concrete and steel used in the construction of the Project Works and Temporary Works.	See Carbon and Energy Management Plan.	Design Procurement	Environmental Manager
10.5 (c)	Carbon Management and Energy Efficiency	The SVC Contractor must undertake energy modelling that incorporates electrical energy consumption and fuel consumption as well as any on-site renewable energy generation and renewable energy sourced from the main electricity grid for the construction of the Project Works and Temporary Works. The energy modelling must establish a baseline against which the benefits of energy efficiency initiatives can be measured.	See Carbon and Energy Management Plan.	Design Procurement	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.5 (d)	Carbon Management and Energy Efficiency	The SVC Contractor must undertake life cycle assessments in accordance with ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines for all concrete and steel used in the construction of the Project Works and Temporary Works. The life-cycle assessments must be used by the SVC Contractor in selecting the most appropriate low-impact materials to be used in the construction of the Project Works and Temporary Works.	See Carbon and Energy Management Plan.	Design Procurement	Environmental Manager
10.5 (e)	Carbon Management and Energy Efficiency	The SVC Contractor must incorporate energy efficiency into all aspects of the Project Works, the Temporary Works and the SVC Contractor's Activities, including reducing fuel usage associated with the SVC Contractor's Activities.	See Carbon and Energy Management Plan.	Design Construction	Environmental Manager
10.5 (f)	Carbon Management and Energy Efficiency	The SVC Contractor must minimise construction and embodied carbon emissions and maximise energy efficiency for all aspects of the Project Work, the Temporary Works and the SVC Contractor's Activities.	See Carbon and Energy Management Plan.	Design Construction	Environmental Manager Construction Manager
10.5 (g)	Carbon Management and Energy Efficiency	The SVC Contractor must minimise carbon emissions using: (i) energy avoidance and reduction strategies; (ii) low carbon transportation options; and (iii) alternate fuels.	See Carbon and Energy Management Plan.	Design Construction	Environmental Manager
10.5 (h)	Carbon Management and Energy Efficiency	The SVC Contractor must ensure that refrigerants and fire suppression systems within temporary site facilities have low or zero global warming potential.	See Carbon and Energy Management Plan.	Construction	Construction Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.5 (i)	Carbon Management and Energy Efficiency	The SVC Contractor must incentivise public and shared transport use and develop and implement green travel plans for the SVC Contractor's personnel and Subcontractor's personnel engaged in the SVC Contractor's Activities.	Carbon and Energy Management Plan ISJV Motor Vehicle Policy	Construction	Human Resource Manager
10.5 (j)	Carbon Management and Energy Efficiency	The SVC Contractor must identify and implement opportunities for using on-site sources of renewable or low carbon energy.	See Carbon and Energy Management Plan.	Design	Environmental Manager
10.5 (k)	Carbon Management and Energy Efficiency	The SVC Contractor must ensure that, as a minimum, 20 % of the electricity needs of the SVC Contractor's Activities is offset through either one or a combination of the following: (i) purchase of Australian carbon offsets credits; and/or (ii) purchase of renewable energy from an Australian Government accredited renewable energy supplier.	See Carbon and Energy Management Plan.	Design	Commercial Manager
10.5 (l)	Carbon Management and Energy Efficiency	The SVC Contractor must ensure that all vehicles, plant and equipment, are: (i) selected and operated for optimum energy efficiency; (ii) not left idling when not in use; (iii) fitted with catalytic converters, diesel particulate filters or equivalent devices where reasonable and feasible; and (iv) well maintained and serviced in accordance with relevant equipment maintenance documentation to reduce emissions due to poor engine performance.	See Carbon and Energy Management Plan.	Procurement Construction	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.5 (m)	Carbon Management and Energy Efficiency	The SVC Contractor must ensure that, where reasonable and feasible, all plug-in electrical equipment within any temporary site facilities provided by the SVC Contractor, including the temporary site facilities provided for the Principal and the Independent Certifier, comply with the requirements of the Equipment Energy Efficiency Program (E3) "Minimum Energy Performance Standards" and has at least a five star Energy Rating Label.	See Carbon and Energy Management Plan.	Procurement Construction	Environmental Manager
10.6 (a)	Community Benefit	The SVC Contractor must develop and implement safety initiatives in accordance with the principles of Crime Prevention Through Environmental Design (CPTED) to reduce the likelihood of crime being committed within and around the Construction Site.	CPTED requirements outlined in Section 6.4 of Visual Amenity Management Plan.	Design Construction	Construction Manager
10.6 (b)	Community Benefit	The SVC Contractor must ensure that Temporary Works that are visible to or accessible to the public are graffiti resistant, vandal resistant and aesthetically pleasing.	Graffiti/vandal resistance located in Section 7 HR7 of Visual Amenity Management Plan.	Design Construction	Construction Manager
10.6 (c)	Community Benefit	The SVC Contractor must develop a digital model that visually demonstrates the progress of the Project Works and Temporary Works over time in consultation with the Principal's Representative.	Community liaison Plan	Community	Community Manager
10.7 (a)	Resource - Land	The SVC Contractor must identify and implement initiatives to reduce the construction footprint of the Project Works and Temporary Works.	Urban Design & Corridor Landscape Plan	Construction	Design Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.8 (a)	Resource – Water Efficiency	The SVC Contractor must undertake a water balance study that describes the sources, uses and estimated quantities of potable and non-potable water which will be created and used in the performance of the SVC Contractor's Activities.	See Appendix 3 of Construction Soil and Water Management Plan.	Design	Environmental Manager
10.8 (b)	Resource – Water Efficiency	Potable water must not be used as a substitute for non-potable water where on-site or local sources of non-potable water are available.	See Appendix 3 of Construction Soil and Water Management Plan.	Design Construction	Environmental Manager
10.8 (c)	Resource – Water Efficiency	The SVC Contractor must identify and implement initiatives to maximise water reuse from captured stormwater, groundwater and wastewater and minimise total water consumption and demand for and use of potable water.	See Appendix 3 of Construction Soil and Water Management Plan.	Design Construction	Environmental Manager
10.8 (d)	Resource – Water Efficiency	The SVC Contractor must minimise total water consumption and potable water consumption by: (i) using water efficient controls, fixtures and fittings; (ii) collecting, treating and reusing process water; (iii) using recycled water or treated water; (iv) harvesting and reusing rainwater; (v) using water from recycled water networks; and (vi) collecting, treating and reusing groundwater and stormwater.	See Appendix 3 of Construction Soil and Water Management Plan.	Design Construction	Environmental Manager
10.8 (e)	Resource – Water Efficiency	The SVC Contractor must meter and record water consumed within temporary site facilities and used by all major plant or process equipment within the Construction Site.	Appendix 3 of Construction Soil and Water Management Plan	Design Construction	Environmental Manager
10.9.1 (a)	Resource – Waste and Materials	The SVC Contractor must identify and implement waste minimisation initiatives and material selection strategies to minimise the embodied carbon and lifecycle impacts of waste and materials associated with the construction of the Project Works and Temporary Works.	See Section 8 of Waste Management and Recycling Plan.	Procurement	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.9.1 (b)	Resource – Waste and Materials	The SVC Contractor must reduce materials use through materials avoidance and reduction strategies and minimise construction materials volumes through design refinement, construction planning and construction methods.	See Section 4.6 of Sustainability Plan.	Procurement	Design Manager
10.9.1 (c)	Resource – Waste and Materials	The SVC Contractor must minimise embodied carbon and lifecycle impacts by using, where practicable: (i) blended cement that contains waste industrial products such as fly ash and ground granulated blast furnace slag; (ii) low carbon concrete; (iii) recycled steel, including in concrete reinforcing; and (iv) spoil generated on site.	See Carbon and Energy Management Plan. See Section 6 SP3 of Spoil Management Plan.	Procurement	Environmental Manager
10.9.1 (d)	Resource – Waste and Materials	The SVC Contractor must achieve a minimum of one point under the Green Star Mat-4 concrete credit criteria for Portland Cement.	See Section 4.6 of Sustainability Plan	Design Procurement	Construction Manager Environmental Manager
10.9.1 (e)	Resource – Waste and Materials	The SVC Contractor must achieve a minimum of one point under the Green Star Mat-4 concrete credit criteria for aggregate and water.	See Section 4.6 of Sustainability Plan.	Design Procurement	Construction Manager Environmental Manager
10.9.1 (f)	Resource – Waste and Materials	The SVC Contractor must use reinforcing steel which is produced using energy reducing processes in its manufacture, where practicable.	See Section 4.6 of Sustainability Plan	Design Procurement	Commercial Manager *Purchasing Coordinator*

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.9.1 (g)	Resource – Waste and Materials	The SVC Contractor must use post-consumer, post-industrial recycled material or waste materials, including crushed glass, recycled aggregate, tyre derived aggregate, and recycled materials for any noise attenuation devices, where practicable.	Refer to Construction Noise and Vibration Management plan and Project Procurement Management Plan.	Procurement Construction	Commercial Manager Purchasing Coordinator
10.9.1 (h)	Resource – Waste and Materials	The SVC Contractor must use reusable formwork and reuse construction and demolition waste, where practicable.	See Section 8 WR14 of Waste Management and Recycling Plan.	Procurement Construction	Construction Manager
10.9.1 (i)	Resource – Waste and Materials	The SVC Contractor must source all timber products used in the Project Works and Temporary Works from either re-used timber, post-consumer recycled timber or from Forest Stewardship Council (FSC) certified timber suppliers, where practicable.	See Project Procurement Management Plan.	Procurement	Commercial Manager Purchasing Coordinator
10.9.1 (j)	Resource – Waste and Materials	The SVC Contractor must use low Volatile Organic Compounds (VOC) paints, finishes, sealants and adhesives and low emission formaldehyde composite wood products in the Project Works and the Temporary Works, where practicable.	See Project Procurement Management Plan.	Procurement	Purchasing Coordinator
10.9.1 (k)	Resource – Waste and Materials	The SVC Contractor must avoid the production of hazardous waste.	See Section 8 WR11 of Waste Management and Recycling Plan.	Construction	Construction Manager Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.9.1 (l)	Resource – Waste and Materials	The SVC Contractor must use a minimum 5% bio diesel mix for all diesel powered plant and equipment and a minimum 10% blended ethanol mix for all petrol powered plant and equipment, where practicable.	See Project Procurement Management Plan.	Procurement Construction	Purchasing Coordinator
10.9.1 (m)	Resource – Waste and Materials	The SVC Contractor must endeavour to source fabricated structural steelwork from a steel fabricator/steel contractor accredited to the Environmental Sustainability Charter of the Australian Steel Institute.	See Project Procurement Management Plan.	Procurement	Purchasing Coordinator
10.9.1 (n)	Resource – Waste and Materials	The SVC Contractor must endeavour to source: (i) concrete used in the construction of the Project Works and the Temporary Work from members of the Cement Concrete and Aggregate Association of Australia (CCAA) or a similar international association or organisation; (ii) steel used in the construction of the Project Works and the Temporary Work from suppliers that are certified under the Australian Certification Authority for Reinforcing Steels (ACRS) or a similar international association or organisation; and (iii) PVC used in the construction of the Project Works and the Temporary Work from suppliers that are signatories to the "Vinyl Council of Australia Product Stewardship Program" or a similar international program.	See Project Procurement Management Plan.	Procurement	Purchasing Coordinator
10.9.1 (o)	Resource – Waste and Materials	The SVC Contractor must ensure that at least 90% of inert and non-hazardous construction waste, excluding spoil, and at least 60% of office waste is recycled or alternatively beneficially reused.	See Section 8 WR17 of Waste Management and Recycling Plan.	Construction	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.9.1 (p)	Resource – Waste and Materials	The SVC Contractor must negotiate and implement packaging take-back arrangements with suppliers, where practicable.	See Section 8 WR13 of Waste Management and Recycling Plan.	Procurement Construction	Environmental Manager Purchasing Coordinator
10.9.1 (q)	Resource – Waste and Materials	The SVC Contractor must select compostable or reusable temporary erosion control devices, where practicable.	See Appendix 6 of Construction Soil and Water Management Plan.	Procurement	Environmental Manager
10.9.1 (r)	Resource – Waste and Materials	The SVC Contractor must provide recycling facilities within the Construction Site, where practicable.	See Section 8 WR7 of Waste Management and Recycling Plan.	Construction	Environmental Manager
10.9.1 (s)	Resource – Waste and Materials	The SVC Contractor must mulch all cleared vegetation (excluding weeds). The mulch must be stored on-site for future reuse or sent to an off-site compost facility.	See Section 8 WR5 of Waste Management and Recycling Plan.	Construction	Construction Manager Environmental Manager
10.9.2 (a)	Resource – Spoil Management	The SVC Contractor must identify and implement initiatives to both reduce spoil quantities which will be generated during the performance of the SVC Contractor's Activities and maximise the beneficial reuse of spoil.	See Section 6 SP4 (describes the reduction of spoil quantities) and Section 6 SP3 (describes the reuse of spoil) of Spoil Management Plan.	Construction	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.9.2 (b)	Resource – Spoil Management	The SVC Contractor must ensure that the environmental and social impacts of spoil transfer and reuse are effectively managed and minimised.	Refer to Spoil Management Plan.	Construction	Environmental Manager
10.10 (a)	Heritage Conservation	The SVC Contractor must identify and implement initiatives that enhance heritage values and minimise heritage impacts.	See Construction Heritage Management Plan.	Design	Environmental Manager
10.10 (b)	Heritage Conservation	The SVC Contractor must document all heritage management initiatives.	See Construction Heritage Management Plan.	Design	Environmental Manager
10.10 (c)	Heritage Conservation	The SVC Contractor must protect items and places of heritage significance (indigenous and non-indigenous).	See Construction Heritage Management Plan.	Design	Environmental Manager
10.11 (a)	Biodiversity Conservation	The SVC Contractor must identify and implement initiatives for biodiversity enhancement and enhancing habitat connectivity.	See Flora and Fauna Management Plan.	Design	Environmental Manager
10.11 (b)	Biodiversity Conservation	The SVC Contractor must minimise the change in ecological value associated with the SVC Contractor's Activities, as calculated using the Green Building Council of Australia's Change in Ecological Value Calculator.	See Flora and Fauna Management Plan.	Design Construction	Environmental Manager
10.11 (c)	Biodiversity Conservation	The SVC Contractor must minimise clearance of vegetation during construction of the Project and Temporary Works.	See Flora and Fauna Management Plan.	Construction	Environmental Manager
10.11 (d)	Biodiversity Conservation	The SVC Contractor must undertake revegetation works as soon as is practicable.	See Section FF65-FF70 of Construction Flora and Fauna Management Plan.	Construction	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.12	Pollution Control	The SVC Contractor must identify and implement pollution control initiatives and target zero major pollution incidents.	See Construction Environmental Management Plan.	Construction	Environmental Manager
10.13.1 (a)	Supply Chain – Workforce Development	The SVC Contractor must identify and implement workforce development initiatives.	Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (b)	Supply Chain – Workforce Development	The SVC Contractor must ensure that 15% of the Workforce, (excluding specialist skills and short term duration contracts no longer than six months) are apprentices and trainees from the Greater Western Sydney area.	Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (c)	Supply Chain – Workforce Development	The SVC Contractor must ensure that at least 20% of the SVC Contractor's personnel and Subcontractor's personnel, excluding apprentices and trainees, are sourced from the Greater Western Sydney area, where practicable.	Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (d)	Supply Chain – Workforce Development	The SVC Contractor must ensure that Work Experience Placements, Education Placements, internships and Graduate Placements are provided as a part of the SVC Contractor's Activities.	Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (e)	Supply Chain – Workforce Development	The SVC Contractor must assess current and future workforce skill needs and must develop workforce profiles including skill categories required for the design and construction of the major elements of the Project Works and the Temporary Works.	Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (f)	Supply Chain – Workforce Development	The SVC Contractor must develop and implement Nationally Recognised Accredited Training and skill development programs.	Training Management Plan.	Design Construction	Human Resources Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.13.1 (g)	Supply Chain – Workforce Development	The SVC Contractor must, as a minimum: (i) identify ASQA recognised Educational and Training Facilities that can provide the Relevant Qualifications; (ii) identify formal AQF recognised programs and other arrangements for Education and Training Facilities that provide Relevant Qualifications for the Workforce; and (iii) implement Monitoring and Reporting Mechanisms to ensure Workforce training and skill development targets are met.	Project Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (h)	Supply Chain – Workforce Development	The SVC Contractor must identify and implement workforce initiatives that provide for the acquisition and utilisation of new workplace skills and contribute to relevant sectoral, state and national targets.	Project Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (i)	Supply Chain – Workforce Development	The SVC Contractor must as minimum: (i) provide relevant Nationally Recognised Accredited Training to assist in Re-skilling and Up-skilling the Workforce; (ii) provide relevant Nationally Recognised Apprentice Programs for the Re-skilling and Up-skilling the Workforce; (iii) provide work experience and education placements; (iv) establish industry and skills partnerships for workforce skill acquisition and utilisation; and (v) make use of existing government training and development programs.	Project Training Management Plan.	Design Construction	Human Resources Manager
10.13.1 (j)	Supply Chain – Workforce Development	The SVC Contractor must develop and implement strategies to obtain workforce development funding, subsidies and grants.	Project Training Management Plan.	Design Construction	Human Resources Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.13.1 (k)	Supply Chain – Workforce Development	The SVC Contractor must develop and implement strategies to support local small to medium enterprises and social enterprises.	See Section 3.5 of Project Procurement Management Plan.	Design Construction	Purchasing Coordinator Commercial Manager
10.13.1 (l)	Supply Chain – Workforce Development	The SVC Contractor must assess the capacity of local small to medium enterprises and social enterprises to deliver works, services or supplies that are required for the design and construction of the Project Works and the Temporary Works, where practicable.	See Section 3.5 of Project Procurement Management Plan.	Design Construction	Purchasing Coordinator Commercial Manager
10.13.1 (m)	Supply Chain – Workforce Development	The SVC Contractor must develop and implement programs for engagement with local universities including internships and work placements.	Project Training Management Plan.	Design Construction	Human Resources Manager
10.13.2 (a)	Supply Chain – Sustainable Procurement	The SVC Contractor must identify and implement sustainable procurement initiatives that provide environmental and social improvement.	See Project Procurement Management Plan.	Procurement Construction	Purchasing Coordinator Commercial Manager
10.13.2 (b)	Supply Chain – Sustainable Procurement	The SVC Contractor must develop, implement and maintain procurement processes that comply with the requirements of BS 8903: 2010 Principles and framework for procuring sustainably. Guide and use the Australian Green Infrastructure Council Infrastructure Sustainability Rating Tool in the selection of Subcontractors.	See Project Procurement Management Plan.	Procurement Construction	Purchasing Coordinator Commercial Manager
10.13.2 (c)	Supply Chain – Sustainable Procurement	The SVC Contractor must include environmental and social criteria in the selection process for Subcontractors.	See Project Procurement Management Plan.	Procurement Construction	Purchasing Coordinator Commercial Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.13.2 (d)	Supply Chain – Sustainable Procurement	The SVC Contractor must prioritise procurement from local businesses and suppliers, maximising opportunities for Australian and New Zealand (ANZ) small and medium enterprises (SME) participation.	See Project Training Management Plan.	Procurement Construction	Purchasing Coordinator Commercial Manager
10.13.2 (e)	Supply Chain – Sustainable Procurement	The SVC Contractor must ensure that all materials, products and services are sourced and produced in accordance with the requirements of Section 10.9.1(f) and (j) of this Appendix 10 and the requirements of BS8903: 2010 Principles and framework for procuring sustainability – Guide.	See Project Procurement Management Plan.	Procurement	Purchasing Coordinator Commercial Manager
10.13.2 (f)	Supply Chain – Sustainable Procurement	The SVC Contractor must identify ANZ SMEs for potential participation in the supply chain for the SVC Project Works, and alert these ANZ SMEs of potential tenders and supply opportunities.	See Project Procurement Management Plan.	Procurement	Purchasing Coordinator Commercial Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.14 (a)	Temporary Site Facilities	The SVC Contractor must ensure that any temporary site facilities provided by the SVC Contractor, including the temporary site facilities provided for the Principal and the Independent Certifier, incorporate where reasonable and feasible: (i) energy efficient lighting schemes, light fittings and electrical appliances; (ii) high performance thermal insulation in all walls, ceilings and floors that optimise thermal performance; (iii) natural daylighting; (iv) natural ventilation; (v) rainwater harvesting; (vi) water efficient fixtures, fittings and controls; (vii) air conditioning refrigerants with low or zero global warming potential; (viii) bicycle storage facilities, showers and changing room facilities ; and (ix) Crime Prevention Through Environmental Design (CPTED) principles.	Design Report for Temporary Works	Construction	Construction Manager Site Superintendent
10.14 (b)	Temporary Site Facilities	Any security and warning lighting used by the SVC Contractor must be installed so that light is not directed at neighbouring properties or in such a way that light reflects onto structures or neighbouring properties.	Addressed in Section 7 HR13 of Visual Amenity Management Plan.	Construction	Construction Manager Site Superintendent
NWRL Sustainability Strategy					
1.1	Governance	Target a high level of attainment in the Australian Green Infrastructure Council Infrastructure Sustainability Rating Tool.	See Section 5.1 of Sustainability Plan.	Design Construction	Sustainability Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
1.2	Governance	Target a high level of attainment in Transport for NSW Sustainable Design Guidelines.	See Section 5.2 of Sustainability Plan.	Design Construction	Sustainability Manager
2.1	Climate Change	Undertake a climate risk assessment. Identify and implement adaptation measures to address extreme, high or medium level residual climate risks on the project.	See Section 4.2 of Sustainability Plan. See Risk Register.	Design	Sustainability Manager Design Manager
N/A	Carbon Management	Overall approach to identifying opportunities to reduce carbon emissions, energy use and embodied lifecycle impacts of the SVC Contractor's Activities.	See Carbon and Energy Management Plan.	Design	Environmental Manager
3.3	Carbon Management	Offset 20% of the electricity needs for the construction phase of the project.	See Carbon and Energy Management Plan.	N/A	Commercial Manager
4.1	Energy Efficiency	Achieve 20% reduction in energy demand when compared to a reference case (including regenerative braking) to be achieved through the design.	N/A as this is an operational requirement that relates to the OTS package.	N/A	N/A
4.3	Energy Efficiency	Targets to be identified for energy efficiency/energy reduction during construction.	See Carbon and Energy Management Plan.	N/A	Environmental Manager
5.2	Land Use Intergration	Distance of cycleways created (metres).	N/A	N/A	N/A

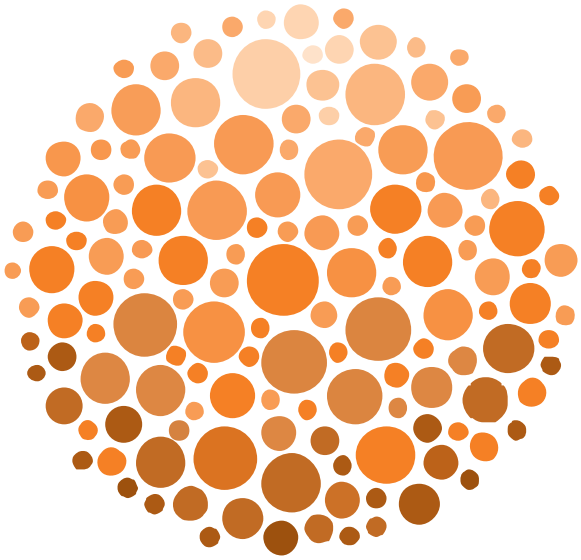
Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
5.4	Land Use Integration	Hectares of landscape/public open space created.	TfNSW to coordinate	Design	TfNSW
5.5	Land Use Integration	km or Ha of creek improvements.	N/A	Design	Environmental Manager
6.1	Customer Experience	Actively engaging local communities, potential customers and other stakeholders the development and implementation of the project.	See TfNSW Overarching Stakeholder and Community Involvement Plan and Community Liaison Implementation Plan.	Design Construction	Community and Stakeholder Manager
6.2	Customer Experience	Ensure there are place managers to cover all areas for the project during the planning and construction phases.	See TfNSW Overarching Stakeholder and Community Involvement Plan.	Design Construction	Community and Stakeholder Manager
7.1	Community Benefit	Number of community legacy projects provided.	See TfNSW Overarching Stakeholder and Community Involvement Plan as this is a NWRL requirement which is not specific to the SVC package.	Design Construction	Community and Stakeholder Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
7.2	Community Benefit	Demonstration of safety initiatives to deter crime.	CPTED requirements outlined in Section 6.4 of Visual Amenity Management Plan and the Safety Plan.	Design Construction	Construction Manager
7.3	Community Benefit	Number of community workshops to communicate deliver timeframes and receive input from community members from design development.	See Community Liaison Implementation Plan.	Design	Community and Stakeholder Manager
7.4	Community Benefit	Incorporation of public art at all stations.	N/A	N/A	N/A
7.5	Community Benefit	All local education facilities (schools, universities, institutes) to have access to project development and benefits for curriculum development.	See TfNSW Overarching Stakeholder and Community Involvement Plan.	N/A	Community and Stakeholder Manager
8.1	Resource - Land	Identify % reduction in efficient use of land (project footprint).	See Urban Design Analysis Report	Design	Design Manager
9.2	Resource – Water Efficiency	100% of non-potable water demand sourced from non-potable sources during construction.	See Appendix 3 of Construction Soil and Water Management Plan.	Construction	Environmental Manager
10.1	Resource – Waste and Materials	100% of clean spoil to be beneficially reused.	See Spoil Management Plan.	Construction	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
10.2	Resource – Waste and Materials	90% of construction and demolition recyclable waste to be recycled.	See Section 8 WR17 of Waste Management of Recycling Plan.	Construction	Environmental Manager
10.3	Resource – Waste and Materials	Identify reductions in embodied carbon emissions, compared to a reference design.	See Carbon and Energy Management Plan.	Design Construction	Environmental Manager
11.1	Heritage Conservation	Identify opportunities to enhance heritage values and show evidence of implementation.	See Construction Heritage Management Plan.	Design	Environmental Manager
11.2	Heritage Conservation	Develop partnerships with relevant stakeholders to utilise heritage places to promote local heritage values.	See Construction Heritage Management Plan.	Design	Environmental Manager
12.1	Biodiversity Conservation	Area of biodiversity legacy provided on site.	See Construction Flora and Fauna Management Plan.	Design Construction	Environmental Manager
12.2	Biodiversity Conservation	Offset biodiversity as determined by the Regulator.	See Construction Flora and Fauna Management Plan.	Design Construction	Environmental Manager
13.1	Pollution Control	Zero major pollution incidents.	See Construction Environmental Management Plan.	Construction	Environmental Manager

Ref.	Category	Requirement	How will ISJV address the Requirement?	Timing	Responsibility/ *Key Contributor*
14.1	Supply Chain	Develop a workforce strategy, prior to construction commencing including the following aspects: - Local employment; - Training and education; - Health and wellbeing; - Diversity and equal opportunity (including gender, age, minority); and - Partnerships with local universities and other educational institutes.	Project Training Management Plan.	Design Construction	Human Resources Manager
14.2	Supply Chain	Ensure sustainability and environment performance criteria and the NWRL Environment and Sustainability policy is passed on to all suppliers.	See Project Procurement Management Plan.	Procurement	Commercial Manager Purchasing Coordinator
N/A	Supply Chain	Materials to be sourced from accredited manufacturers and suppliers.	See Project Procurement Management Plan.	Procurement	Commercial Manager Purchasing Coordinator
N/A	Supply Chain	Prioritisation of procurement from local businesses.	See Project Procurement Management Plan.	Procurement	Commercial Manager Purchasing Coordinator

Appendix 1 – Climate Change Due Diligence Review



23 June 2014| REF: J/N 122547

WSP Group for Impregilo-Salini Joint Venture (ISJV)

Climate change risk review SVC works package - North West Rail Link

energetics

Executive summary

Overview

In 2013 Transport for NSW conducted a climate change risk assessment and adaptation study for the North West Rail Link (NWRL)[1]. This study examined the risks due to climate change and the current and planned controls to mitigate the impacts of these risks. The study was based on the reference design for the NWRL project.

After completion of the 2013 study, changes were made to the NWRL design and new information relevant to climate change risk was released. These changes have necessitated a due diligence review of the original risk assessment.

This review focuses specifically on the Surface, Viaducts and Civils (SVC) works package including design changes. This report outlines the process, findings and recommendations from this due diligence review. This report was commissioned by WSP Group for Impregilo-Salini Joint Venture (ISJV).

Key changes in literature and project design 2013- 2014

The change to a cable-stay bridge design has the potential to introduce risks not previously identified.

A number of climate variables were identified in the 2013 study which would have an impact on the NWRL SVC project. The latest climate change literature indicates a decrease in uncertainty associated with most climate change impacts. These include extremes in temperature (more frequent and extreme heat waves, increased annual temperature), extremes in precipitation (increased rainfall intensity, flooding, and an overall decrease in annual rainfall) and other wether related extremes (increased bushfires, wind, storms, lightning and hail).

This focused on the review on the following areas:

- Vulnerability of viaduct and bridge structures due to change in NWRL design
- Increased probability of climate change impacts occurring
- The maintenance of appropriate controls identified in the 2013 study, particularly in the new bridge design

The following key changes were identified with the potential to impact the risk, likelihood and impact identified in the 2013 study:

- resilience of bridge to bushfires and mitigation of risks to staff and passenger safety
- resilience of bridge design to wind extremes
- resilience of bridge to prolonged heat extremes
- resilience of bridge to lightning strikes
- resilience to increased frequency and severity of extreme rainfall events

[1] Chris Royal - AECOM (2013) North West Rail Link Climate change risk assessment and adaptation study

- resilience of structures to wind extremes

This report outlines recommendations to ensure the risks are appropriately managed and mitigated considering the identified changes.

Changes in risks and risk ratings and recommendations

This review found that overall risk ratings would be maintained within tolerable levels (rated as C or D overall), contingent on the appropriate implementation of the recommendations outlined in section 5.

In summary these recommendations include:

- Ensuring that key controls in the bridge design have been maintained or are implemented to ensure risks resulting from bushfires, wind extremes, heat extremes and lightning strikes are managed to within a tolerable level. In particular, the cable design specifications, resilience and potential for cable damage would need to be considered. (See risk reference 1e, 5d, 6 and 7).
- Ensuring that controls identified in the 2013 study which were planned to be addressed as part of the finalisation of the design have been appropriately actioned to maintain risk to within a tolerable level. (See risk reference 4 and 5b).

Due diligence review

1. Objectives and scope

The objective of this project was to perform a due diligence review of the 2013 risk assessment to take into account changes in the reference design for the NWRL SVC project and updates to key climate change literature. This review focuses specifically on the Surface, Viaducts and Civils (SVC) works package including design changes. The scope included:

- Identifying material changes between the reference design (used for the 2013 study) and contract design (currently being finalised).
- Incorporating new climate information available in the public domain into the due diligence review.
- Assessing the impacts of these changes on the risks identified through the 2013 study.
- Providing guidance and recommendations for any actions as appropriate.
- Focusing on permanent works. Temporary works were not considered relevant to long term climate change impacts and were not considered here.

This review was completed in accordance with AS/NZS ISO 31000 Risk Management and AS 5334-2013 Climate Change Adaptation for Settlements and Infrastructure - A Risk Based Approach.

2. Key changes to the design

The key change between the reference and contract designs which impacts this risk assessment is the change to a cable-stay bridge. This bridge type is likely to be vulnerable to the impacts of fire, lightning, and extreme winds. An associated reduction in the quantity of concrete used for the piers of the bridge (compared to the original design) may also have impacts on the strength and thermal tolerance of the bridge.

In the absence of detailed information about the contract design specifications this report provides recommendations to ensure the final specifications are designed to be resilient against best current knowledge of predicted extreme weather events. This report also identifies the original controls which were being provided by the original bridge structure with recommendations to ensure the replacement design meets or exceeds these standards.

3. Key changes to climate change literature

During 2013 the first working group of the International Panel on Climate Change (IPCC) published their updated conclusions of the physical impacts of climate change based on the latest available peer-reviewed science[2]. This was followed in early 2014 with a chapter which specifically addresses the impacts in Australasia[3]. These documents are referred to collectively as Assessment Report 5

[2] Climate Change 2013 The Physical Science Basis, Working Group 1 Contribution to the Fifth Assessment Report of the International Panel on Climate Change (IPCC AR5)

[3] IPCC Working Group 2 AR5 Chapter 25 Australasia (currently released in the public domain as a final draft)

(AR5) throughout this document. Previous publications by the IPCC used in the 2013 assessment are referred to as Assessment Report 4 (AR4) and the Special Report on Emissions Scenarios (SRES) throughout this document.

Key features and conclusions from AR5 relevant to this assessment include:

- Change in methodology for developing climate change scenarios which impacts the ability to make direct comparison between AR5 and previous reports (refer to Appendix A).
- Higher sea level rise than previously predicted primarily due to improved modelling[4,5].
- More evidence and general consensus that adverse climate impacts will occur (reflected in decreased uncertainty[6]).

AR5 has concluded that projected impacts of climate change remain broadly unchanged between AR5 and AR4, once the differences in scenarios have been accounted for[7].

Review of other publications[8] found that most used AR4 as a basis or had not been updated since the original risk assessment study was completed.

The Australian Rainfall and Runoff (ARR) standards remain in draft form and are expected to be finalised in 2015. This information has not been incorporated into this review and should be reviewed when available. Best available information has been used to assess impacts of rainfall intensity and flooding.

3.1. Summary of predictions

The following table outlines the predictions for key climate variables for Australia based on AR5[9].

Climate variable	Summary of predictions
Temperature and extreme weather events	An increase in the frequency and duration of heat waves and warm spells *is very likely*. In Australia there is *high confidence* that more intense and frequent heatwaves will occur.
Bushfires	There is a predicted increase in the number of high and extreme fire risk days. There is *high confidence* that fire season will also be longer in high risk areas. High temperatures and increased droughts will continue to contribute to this risk.

[4] IPCC AR5 Technical Summary

[5] The location of the NWRL and predicted sea level rise makes it unlikely that the project will be impacted by these changes. As a result sea level rise and associated storm surges have not been considered a risk in this assessment.

[6] IPCC AR5 Summary for Policy Makers

[7] IPCC AR5 Summary for Policy Makers

[8] Including publications by CSIRO, Australian Green Infrastructure Council, Garnaut Climate Change Review, Productivity Commission and World Heath Organisation

[9] IPCC AR5 Working Group 2 Chapter 25 Australasia table 25-1, IPCC AR5 Summary for Policy Makers

Climate variable	Summary of predictions
Rainfall intensity and flooding	Rare daily rainfall extremes (current 20 year return period events) are predicted to increase in intensity *(medium confidence)*. Updated intensity frequency and duration (IFD) data published by the BOM indicate that there are no material changes for the North West Rail Link area.
Other extreme weather patterns (wind, storms, lightning and hail)	Increases in wind are predicted near the Sydney region (at latitudes of 20-30°S) with mean changes predicted to increase by more than 10% by 2100. Increases in the frequency and intensity of hail in the Sydney region are also predicted.

4. Focus areas of due diligence review

Based on the key changes outlined above the following areas of focus have been selected for this due diligence review.

In addition to these areas an overall sensibility check of the risks, likelihood and consequence from the 2013 study was completed.

Focus area	Relevant climate variables	Summary of impacts
Vulnerability of viaduct and bridge structures due to change in NWRL design	• High temperatures and heatwaves • Rainfall intensity • Wind, storms, lightning and hail • More frequent and severe bushfires	• Affects the availability and use of bridge and rail infrastructure in the aftermath of impact. • Has the potential to affect structural integrity longevity of bridge and rail infrastructure over the longer term and in an extreme short term event. • Likely to increase maintenance requirements and decrease operational reliability in the aftermath of impact. • Has the potential to increase costs through the shortening maintenance or replacement timeframes due to sustained wear and tear. • In the extreme circumstances it has the potential to impact the safety of staff and passengers, and cause significant financial loss and reputational damage.

Focus area	Relevant climate variables	Summary of impacts
Increased probability of climate change impacts occurring	The likelihood of the following events has been amended in recent literature: • Rainfall intensity and flooding • Wind, storms, lightning and hail • Increases in intensity and duration of drought (likely to contribute to bushfire risk).	• Affects the availability and use of bridge and rail infrastructure in the aftermath of impact. • Has the potential to affect structural integrity longevity of rail and associated infrastructure over the longer term and in an extreme short term event. • Likely to increase maintenance requirements and decrease operational reliability in the aftermath of impact. • In the extreme circumstances it has the potential to impact the safety of staff and passengers and cause significant financial loss.
The maintenance of appropriate controls identified in the 2013 study, particularly in the new bridge design	• High temperatures and heatwaves • Rainfall intensity and flooding	• Has the potential to cause fatigue of structural materials and accelerated degradation of surface materials. • May increase maintenance requirements with associated increase in cost. • If not well managed it has the potential to impact the safety of staff and passengers and cause significant financial loss.

5. Findings and recommendations

Recommendations made as a result of this review are listed below in **priority order**.

Risk references in this table correspond to the original 2013 study. A detailed appraisal of each of the risks from the 2013 study is provided in Appendix B.

2013 Risk ref	Findings	Recommendations
6	**Resilience of bridge to bushfires and mitigation of risks to staff and passenger safety** The latest climate change literature predicts an increase in the number of high and extreme fire risk days in Australia[10]. There is *high confidence* that fire season will also be longer in high risk areas. High temperatures and increased droughts will continue to contribute to this risk. Cable stayed bridges can be more vulnerable to the impacts of fire than other bridge designs.	The tolerance of the structure and in particular the vulnerability of cables to loss and damage as a result of fire damage should be reviewed to ensure that the risk is managed to an appropriate level of tolerance. The need for appropriate business continuity plans and evacuation procedures are not mentioned in the original study. This should also consider the safest locations to contain passengers and staff underground if the risk of evacuation is too high. Good practice business continuity requires plans to be regularly tested and revised as needed in order to mitigate safety impacts on passengers and staff in the event of a bushfire.
5d	**Resilience of bridge design to wind extremes** The 2013 study identified risks of derailment and to health and safety as a result of peak wind speeds destabilising rail cars. The study identified derailment protection included on the viaduct as part of the controls to manage this risk. The change in bridge design to a cable stay bridge may have changed the derailment protection from the original design which may impact this risk. In addition, the cable stayed bridge design may also be more vulnerable to extreme wind events than the previous bridge design.	ISJV should confirm that the final contract design has maintained controls originally identified in the 2013 study. This should include consideration of the bridge and viaduct design to prevent derailment as a result of rail cars being destabilised on the bridge in extreme wind events. The tolerance of the cable stay bridge structure and in particular the vulnerability of cables to loss and damage as a result of extreme winds should also be reviewed to ensure that the risk is managed to an appropriate level of tolerance.

[10] IPCC AR5 Working Group 2 Chapter 25 Australasia

2013 Risk ref	Findings	Recommendations
1e	**Resilience of bridge to prolonged heat extremes** The new bridge and supporting materials are expected to satisfy the requirements of the Australian Standards (AS5100 for bridges, AS3600 for buildings). The control description from 2013 indicates that the standards take into account extremes of temperature above those predicted over the life of the structure: *AS5100 requires that bridges in the project area are designed for a shade temp of 45°C. There is an additional factor of safety of 5-10% inherent in design, to take account for any irregularities in materials.* *The design of joints is such that any temperature increases will not lead to any major concerns with regards to their intended performance.* However, it is uncertain whether the standards or draft control design take into account more prolonged heat extremes in addition to isolated extremes in temperature. The latest literature indicates that more frequent and consecutive heat days in Australia is *very likely* with consecutive days over 35°C predicted to become 4 times as frequent by 2070.	ISJV should confirm that the final contract design adequately considers prolonged heat impacts on the bridge to an extent that risks to the structure are tolerable.
7	**Resilience of bridge to lightning strikes** The cable stayed bridge design may be more susceptible to damage from lightning strikes than the previous design. Risks to the bridge from lightning strikes were not previously identified in the 2013 study.	The tolerance of the structure and cables to lightning strikes will need to be considered in conjunction with the appropriate standards as part of finalising the contract design.
3a	**Resilience to increased frequency and severity of extreme rainfall events** Rare daily rainfall extremes (current 20 year return period events) are predicted to increase in intensity (*medium confidence*). The quantity of concrete used in the structure for the new bridge is understood to have decreased. The contract design should take into account any reduced stability in the footings and increased susceptibility to flood events.	ISJV should confirm that the final contract design has adequately assessed the risk of 100 year event based on best available information including updated IFD information from the BoM.

2013 Risk ref	Findings	Recommendations
5b	**Resilience of structures to wind extremes** The controls identified in the 2013 study included a recommendation to review the resilience of structures to wind loading at design stage. Factors to consider are those which would impact the tolerance to peak weather events. This includes: • A projected increase in mean wind speed of 10% by 2100 relative to the 1981-2000 period. • A possible increase in extreme wind speed as a result of the above increase in the mean. Specific predictions of mean wind speed are unavailable; however historical wind speed extremes peaked at 117km/hr in Sydney over the 1981-1992 period[11]. A tolerance in addition to the historical peak would be appropriate to account for potential increases in extreme wind events.	The resilience of structures to extreme wind events and sustained wind loading should be considered as part of finalising the contract design to ensure the risk is managed to an appropriate level of tolerance.

[11] Bureau of Meteorology http://www.bom.gov.au/jsp/ncc/cdio/cvg/av?p_stn_num=066062&p_prim_element_index=29&p_display_type=statGraph&period_of_avg=USER_SELECTED&normals_years=1981-2010&staticPage=

2013 Risk ref	Findings	Recommendations
4	**Stability of embankments and slopes due to drying and extreme rainfall** The controls identified in the 2013 study included a recommendation to review the design of embankments and slopes at design stage to ensure they are sufficiently conservative to take into account predicted extremes resulting from climate change. Factors to consider are those which would impact the susceptibility of embankments and slopes to erosion in extreme weather events particularly after prolonged periods of dryness. Climate change variables to consider include: • A reduction in annual rainfall of 8% is predicted by 2070 relative to a 1005mm base (2013 study). • Droughts are predicted to be up to five times more frequent in the Southern Australia region by 2070 (2013 study). • This may also be exacerbated by increase in wind. Latest data indicates mean wind speeds may increase by 10% in the period 2081-2100 relative to those experienced in 1981-2000[12]. • An increase in intensity of rainfall during extreme weather events (a 5% increase is predicted in total rainfall for 40-year events based on the 2013 study). Increased vegetation cover and/or geotechnical materials may be appropriate to increase embankment stability.	The stability and resilience of embankments and slopes to drying and increased rainfall intensity should be investigated as part of finalising the contract design to ensure the risk is managed to an appropriate level of tolerance.

[12] IPCC AR5 Working Group 2 Chapter 25 Australasia

Appendix A. Change in IPCC scenarios

The following table outlines the scenarios which were used in the 2013 risk assessment and their comparable scenarios in AR5.

Scenario	Scenario characteristics (societal)	Scenario characteristics (technological)	Use in original risk assessment	IPCC AR5 Equivalent[13]
A1B	Rapid economic growth, global population peak in mid-century and then decline.	Rapid introduction of new and more efficient technologies. Based on a **balance** of fossil intensive and non fossil fuel energy sources.	2030 scenarios	RCP 6
A1FI	As above	Rapid introduction of new and more efficient technologies. Assumes a higher weighting towards **fossil intensive** energy sources.	2070 scenarios	RCP 8.5
A2	Slow but continuous population growth, regional economic development, assumes economic growth on a per capita basis.	Technological change is more fragmented and slower than the A1 scenarios above. This is the closest approximate to business as usual.	2050 scenarios for Sydney region	RCP 6[14]

[13] Representative concentration pathways (RCPs), Jubb, Canadell and Dix, Australian Climate Change Science Program CSIRO

[14] This is based on the timeframe to 2050. The A2 scenario would be likely translate to outcomes in between RCP 6 and RCP 8.5 over a longer term time horizon

Appendix B. Climate change risk register and outcomes of due diligence review

The table below summarises the original 2013 risk assessment and outlines any recommendations, additional actions, or comments based on the 2014 due diligence review. Risk ratings below use the NWRL risk matrix which rates overall risk using the designations A (unacceptable), B (undesirable), C (tolerable), and D (acceptable).

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
1a	Climate change causes increased frequency, severity and duration of extreme temperatures (days exceeding 35 C) leading to rail track movement/cracking/ buckling	Temperature increases More frequent and severe heatwaves	Derailment Increased maintenance cost Increased travel time (minor) due to speed restrictions	**Design:** RailCorp Engineering Standard Track (ESC200) specifies a rail temperature range from –10°C to 75°C and a neutral temperature of 35°C. This correlates to an operating air temperature range of -10°C to 45°C. Much of the track is within tunnels, so protected from extreme temperatures. The exposed area is limited to the approx. 4km viaduct and at-grade sections. Tracks in exposed areas are concrete slab track on the viaduct/cuttings /at-grade sections and ballast with concrete sleepers at the Tallawong Road Maintenance Facility (TMF), which are less vulnerable to heat- related movement. Derailment protection is included in the viaduct design. **Maintenance:** Rail track movement is controlled by undertaking regular pre-summer reviews to identify areas requiring special monitoring or maintenance and developing maintenance strategies. Under a good-practice maintenance strategy, heat patrols would be conducted to inspect track on very hot days. The areas most vulnerable to heat related impacts (e.g. crossovers in open cut sections) would be the subject of regular inspection and maintenance. **Operations:** In ballasted track sections (TMF and stabling) the trains will be operating at low speeds. On other sections, speed restrictions may be implemented on very hot days in accordance with good practice	C (S3, L5)	C (S4, L5)	**Comments** • Maximum annual temperatures would be expected to be close to or outside the recommended operating air temperature range for the track (45°C). This is based on its operating life, currently observed temperatures, and expected maximum temperatures in future years (42.3 - 44.9°C by 2070 based on data from 2013 assessment). • Controls in the design (to reduce movement and derailment) and process (routine inspections, speed reductions) are in place or would be expected to be put in place to reduce the likelihood. • Changes between the reference and contract design are known to impact the design of the bridge only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The inherent risk in a derailment event would be expected to have a higher impact to safety than the original study set (an S2 safety rating would be plausible considering the train carrying capacity). **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
1b	Climate change causes increased frequency, severity and duration of extreme temperatures (days exceeding 35 C) leading to increased difficulty/cost (incl. maintenance) to adequately ventilate and cool stations and tunnels and impacts on customers and equipment	Temperature increases More frequent and severe heatwaves	1. Impacts on thermal comfort of passengers, potentially leading to: i. Ill passengers ii. Increased crime rates, which may affect rail-related crime occurrence iii. Rail-related suicide iv. Effects on patronage	1a. Spot cooling is being included at underground stations to provide a level of thermal comfort for a number of passengers at platform level. This will help mitigate climate- change related impacts on thermal comfort. 1b. Use of vegetation in the new station precincts will help combat the urban heat island effect, and contribute passive cooling in the station precinct. 1c. Bus shelters and sheltered parking spaces on the top level of multi deck car parks are being included for customer comfort in the station precincts.	C (S2, L5)	C (S2, L5)	**Comments** • Based on data collected for the 2013 study, extreme heat days are expected to be more frequent (18 days per annum over 35°C by 2030 and 35 days by 2070) and prolonged (with consecutive days over 35°C predicted to become 4 times as frequent by 2070). • Controls in the design are in place to reduce the impact of increased heat on passenger comfort and patronage. • Changes between the reference and contract design are known to impact the design of the bridge only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The consequence rating for this risk seems reasonable based on financial impacts, largely expected to be driven by increased operating cost, maintenance and repair. **Recommendations/ additional actions** None
			2. Increased cost (operating, maintenance, retrofit) associated with providing adequate ventilation and cooling of tunnels and stations.	2a. Use of water cooled A/C systems for staff air conditioned spaces at new stations between Cherrybrook and Bella Vista, for spot cooling, and at the TMF. Water cooled systems are not specifically as a climate change response, but offer increased adaptive capacity. 2b.Deisgning tunnel ventilation systems and equipment for optimum energy efficiency across the range of temperatures predicted for the system's design life.	C (S5, L3)	C (S5, L3)	**Comments** • Based on data collected for the 2013 study, extreme heat days are expected to be more frequent (18 days per annum over 35°C by 2030 and 35 days by 2070) and prolonged (with consecutive days over 35°C predicted to become 4 times as frequent by 2070). • Controls in the design (air conditioning and tunnel ventilation) are in place to reduce the impact of increased heat on operating costs and maintenance. • Changes between the reference and contract design are known to impact the design of the bridge only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The likelihood and consequence ratings seem reasonable. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
			3. Air conditioning units on trains failing, affecting passenger thermal comfort	Tunnel temperatures will be less than 40°C for approx. 90% of the time, and up to 43 to 44°C for the remaining 10% of the time, considering climate change. Air conditioning units can operate in temperatures up to 55°C, so will not be affected.	C (S2, L6)	D (S5, L5)	**Comments** • Based on data collected for the 2013 study, extreme heat days are expected to be more frequent (18 days per annum over 35°C by 2030 and 35 days by 2070) and prolonged (with consecutive days over 35°C predicted to become 4 times as frequent by 2070). • Controls in the design for the tunnels and stations are in place to reduce the impact of increased heat on passenger comfort and patronage. • The original consequence rating seems abnormally high (severe) which doesn't seem to be justified by the financial, quality or reputational impacts. A consequence rating of S5 (safety: minor illness/ injury affecting > 1 person, and financial: loss or increased cost of $100k - $1M) seems more appropriate. **Recommendations/ additional actions** None
			4.Impacts on air conditioning of critical equipment in stations, TMF and in cross passages	At cross passages, air conditioning units for critical equipment will be able to function adequately in the temperatures which are anticipated there. At stations between Cherrybrook and Bella Vista, ECRL stations and the TMF, air temperatures may exceed 40°C more frequently considering climate change. Above 40°C, standard air cooled cooling systems may not be reliable. As a climate change response, the backup cooling system for critical equipment will be water cooled for stations between Cherrybrook and Bella Vista, and the TMF.	C (S5, L3)	C (S5, L3)	**Comments** • Maximum annual temperatures would be expected to be above 40°C based on operating life, currently observed temperatures, and expected maximum temperatures in future years (42.3 - 44.9°C by 2070 based on data from 2013 assessment). • Controls in the design (back up water-cooled system) will assist with the maintenance of temperatures in extreme weather. • Changes between the reference and contract design are known to impact the design of the bridge only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The likelihood and consequence ratings seem reasonable. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
1c	Climate change causes increased frequency, severity and duration of extreme temperatures (days exceeding 35 C) leading to more frequent interruptions to mains power supply	Temperature increases More frequent and severe heatwaves More frequent and prolonged brownouts/blackouts caused by increased air conditioning demands, reduced generation, conductor and transformer efficiency	Service interruption Power loss in stations	The complete NWRL electrical system is designed around diversity and redundancy, and emergency backup provision is a feature of the electrical design across all voltages. The main traction power and station power supply is provided via independent distribution systems. 3rd party power providers feed into the system for traction and station power supplies. Redundant supplies are designed to cater for the full system capacity. As an additional redundancy measure, batteries and UPS's are included to provide sufficient time to divert power supplies and co-ordinate emergency responses. The SCADA system will monitor and control the network.	C (S4, L4)	C (S4, L4)	**Comments** • While blackouts would be likely, controls in the design such as battery backup and alternative power sources to the mains are likely to minimise the impact of these disruptions. The effectiveness of these controls will depend on good maintenance practices to identify wear and replace aged backup batteries in a timely manner (see C1c below). • Changes between the reference and contract design are known to impact the design of the bridge design only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The consequence rating for this risk seems reasonable based on temporary service disruption. **Recommendations/ additional actions** None
1d	Climate change causes increased frequency, severity and duration of extreme temperatures (days exceeding 35°C) leading to failure of signalling and communication equipment and reduced functionality of electrical systems.	Temperature increases More frequent and severe heatwaves	**Electrical:** E1. Reduced lifespan and efficiency of electrical equipment. E2. Heat-related sag in overhead powerlines Results in safety and operational impacts, and maintenance and construction costs.	**Electrical:** E1a. All new critical electrical equipment is protected in evaporatively-cooled conditions (and double-skinned) E1b. Substation equipment is designed to work in ambient temperatures up to 50°C. E1c. Overhead wiring designs are regulated by strict standards (including thermal characteristics) and are designed for ambient temperatures up to 60°C . E2a. Regulated tension traction overhead wiring takes account of temperature-related sag. E2b. Routine maintenance inspections would identify any potential accelerated degradation of OHW, which could be addressed if and when it occurs.	C (S4, L3)	C (S4, L4)	**Comments** • Maximum annual temperatures over the operating life of electrical systems (approximately 30 years) are predicted to be around 41°C by 2030 and up to 44.9°C by 2070 (based on data from 2013 study). Controls in the design are expected to manage temperatures within this range. • Changes between the reference and contract design are known to impact the design of the bridge design only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The consequence rating for this risk seems reasonable based on potential temporary service disruption and safety risks. The likelihood seems high due to the controls in place but a revised lower likelihood does not change the overall rating. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
			Signalling: S1. Reduced functionality of signalling equipment. Results in safety and operational impacts, and maintenance and construction costs.	**Signalling:** S1a. Any signalling power rooms and signalling equipment rooms will be air conditioned where required, depending on equipment types (within stations or tunnels). S1b. The minimal trackside, signalling equipment is protected in signalling cases (double skinned with a roof and natural ventilation).	C (S4, L3)	C (S4, L3)	**Comments** • Maximum annual temperatures over the operating life of signalling equipment (approximately 25 years) are predicted to be around 41°C by 2030 (based on data from 2013 study). • Changes between the reference and contract design are known to impact the design of the bridge design only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The likelihood and consequence ratings for this risk seem reasonable based on the frequency and impact of potential temporary service disruption and safety risks. **Recommendations/ additional actions** None
			Communications: C1. Reduced functionality and life-span of computing systems and communications equipment Results in safety and operational impacts, and maintenance and construction costs.	**Communications:** C1a. All critical communications equipment is protected in air conditioned rooms at stations or in double skinned air conditioned structures trackside. Outdoor equipment (cameras, speakers, phones) is designed to operate in hot conditions, may need replacing sooner, but will be replaced as needed. C1b. Communications equipment in substations is not ventilated, but is designed to work in hot conditions. It may degrade faster, but if it does, will alarm, and will be replaced as part of normal maintenance. C1c. Back up batteries in substations will have their life span reduced if constantly operating in a warmer environment. Battery spaces in new stations are to be air conditioned. In ECRL, not all UPS systems are in air conditioned rooms, so will degrade faster. Current good practice maintenance regimes would identify when degraded batteries need to be replaced.	C (S4, L3)	C (S4, L3)	**Comments** • Maximum annual temperatures over the operating life of signalling equipment (approximately 25 years) are predicted to be around 41°C by 2030 (based on data from 2013 study). • Changes between the reference and contract design are known to impact the design of the bridge design only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The likelihood and consequence ratings for this risk seem reasonable based on the frequency and impact of potential temporary service disruption and safety risks. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
1e	Climate change causes increased frequency, severity and duration of extreme temperatures (days exceeding 35 C) leading to extreme heat- related impacts on materials (indoor and outdoor)	Temperature increases More frequent and severe heatwaves	Fatigue of structural materials Accelerated degradation of external materials at surface	Bridges, bridge materials and associated building infrastructure are designed to RailCorp and Australian standards (AS5100 for bridges, AS3600 for buildings), which have built-in tolerances. For example, AS5100 requires that bridges in the project area are designed for a shade temp of 45°C. There is an additional factor of safety of 5-10% inherent in design, to take account for any irregularities in materials. Good practice maintenance regimes would include inspection of bridges and structures at least annually. Any fatigue or degradation would be identified in maintenance inspections. Robust external materials for new stations and precincts are preferred, as documented in the project Design Guidelines. These materials will be resilient to heat-related impacts. Good practice inspection and maintenance regimes at existing ECRL stations will ensure that impacts to external materials are identified and replaced as necessary with resilient materials.	D (S4, L6)	D (S5, L5) assuming recommended actions are taken	**Comments** • Impacts on bridge and bridge materials can arise from both extremes in heat and prolonged increases in heat. • Based on data collected for the 2013 study, extreme heat days are expected to be more frequent (18 days per annum over 35°C by 2030 and 35 days by 2070) and prolonged (with consecutive days over 35°C predicted to become 4 times as frequent by 2070). • The maximum temperatures are also expected to be higher (based on operating life and currently observed temperatures predicted maximum temperatures may range from 42.3 - 44.9°C by 2070 based on data from 2013 assessment). • The new bridge design and supporting materials are expected to satisfy the requirements of the Australian Standards listed. The control description indicates that the standards take into account extremes of temperature above the maximum temperatures predicted by the latest literature. However, it is uncertain whether these standards take into account more prolonged heat extremes. **Recommendations/ additional actions** • ISJV should confirm that the final contract design adequately considers prolonged heat impacts on the bridge to a level of risk which is tolerable. The latest literature indicates that more frequent and consecutive heat days in Australia are *very likely* with consecutive days over 35°C predicted to become 4 times as frequent by 2070. The bridge design should take into account any potential impacts on the structure of these extremes.
2a	Climate change causes increase in annual average temperature leads to increased movement at bearings and expansion joints	Temperature increases	Damage to track and structures Requirement for increased maintenance	Bridges, bridge materials and associated building infrastructure are designed to strict Australian standards (AS5100 for bridges and AS3600 for buildings), which have built-in tolerances to temperature For example, AS5100 requires that bridges in the project area are designed for a shade temp of 45°C. There is an additional factor of safety of 5-10% inherent is design, to take account for any irregularities in materials. The design of joints is such that any temperature increases will not lead to any major concerns with regards to their intended performance.	D (S5, L6)	D (S5, L5) assuming recommended actions are taken	**Comments** • See 1e above. • The lower impact rating for this risk when compared to 1e assumes a lower financial cost of replacement and repair to track and structures when compared to structural materials. **Recommendations/ additional actions** • See 1e above.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
2b	Climate change causes increase in annual average temperature, leads to greater electrical resistance in conductors	Temperature increases	Greater losses and maintenance for conductors and transformers, with consequent increases in costs	A relatively short replacement/design life (typically 30 years) for cabling and transformers means that the consequence of extreme climate change-related events is reduced. Regular inspections in accordance with good practice will identify any need for maintenance / replacement.	D (S3, L6)	D (S5. L6)	**Comments** • The likelihood of climate change impacts on conductors and transformers is low given the short life. • Impacts would not be expected to be significant and would be driven by increased costs due to earlier replacement. The impact has been reduced compared to the 2013 study but has not changed the overall rating. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
3a	Climate change has potential to cause increased frequency and severity of extreme rainfall events leading to increased flooding of creeks and waterways and potential inundation of infrastructure.	Increased rainfall intensities leading to increased stormwater runoff.	Flooding of tracks in at-grade sections Flooding of tracks on viaduct sections Flooding of TMF Flooding of tunnels and tunnel portals Flooding of stations Flooding of electrical infrastructure Foundation instability and damage to infrastructure (e.g. damage to rail track from washout of ballast and subgrade). Flooding of precincts and car parks.	Flooding controls and sensitivity analysis conducted to consider climate change impacts are documented in the NWRL-10013-R-DR-00001. Adopted design flood levels to include an appropriate allowance for increased rainfall intensities due to climate change in accordance with current best practice and NSW Floodplain Risk Management Guideline – Practical Considerations of Climate Change. The levels for at-grade track have been set based on a 100 year ARI event, plus an additional 10% increase in rainfall intensity. The 10% margin reflects industry good practice. In terms of climate change response, the levels for the underside of viaducts and bridges have been set based on a 100 year ARI event, plus a 500mm freeboard and an additional 10% increase in rainfall intensity. The levels for track at the TMF have been set based on a 100 year ARI event, plus an additional 10% increase in rainfall intensity to provide a nominal allowance for potential impacts due to climate change. The levels for tunnel portals and entries have been set based on a probable maximum flood (PMF) risk to safeguard them and prevent risk of catastrophic failure. This is the absolute worst case scenario and therefore there is no need to account for additional climate change impacts. In terms of climate change response, the levels for open cut and cut-and- cover stations have been set based on a PMF. The levels for Kellyville, Rouse Hill and Cudgegong stations are based on a 100 year ARI event, plus an additional 10% increase in rainfall intensity to provide a nominal allowance for potential impacts due to climate change. The levels for electrical substations are set at a minimum of 500mm above the 100 year ARI, plus an additional 10% increase in rainfall intensity to provide a nominal allowance for potential impacts due to climate change. Design flood levels adopted for setting minimum track levels includes a nominal allowance of 10% increase in rainfall intensity due to climate change. Therefore potential for an incremental increase in ballast washout at the TMF due to climate change is reduced. Impacts on civil infrastructure would be identified as part of maintenance activities. The default levels for Reference Design of precincts have been set based on either a 100 year ARI event plus an additional 10% increase in rainfall intensity or PMF levels. Under these scenarios, minor flooding impacts to footpaths may be experienced at Norwest and Cherrybrook precincts, and half of one of the car parks at Kellyville would be inundated in the PMF.	D (S3, L6)	D (S3, L6)	**Comments** • Rare daily rainfall extremes (current 20 year return period events) are predicted to increase in intensity *(medium confidence)*. • ARR – the magnitude of a 1 in 100 year flood event has not yet changed - expect to update in 2015 • The quantity of concrete used in the structure for the new bridge is understood to have decreased. The contract design should take into account any reduced stability in the footings and increased susceptibility to flood events. **Recommendations/ additional actions** • ISJV should confirm that the final contract design has adequately assessed the risk of 100 year event. • Note that AEP (annual exceedance probability which measures the "probability that a given rainfall total accumulated over a given duration will be exceeded in any one year") is preferable to ARI (average recurrence Interval, which is "the average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration") when assessing these events.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
3b	Climate change has potential to cause increased frequency and severity of extreme rainfall events leading to failure of l°Cal drainage systems and l°Calised flooding of infrastructure	Increased rainfall intensities leading to increased stormwater runoff	Drainage and culvert inundation. Localised flooding of station precincts, with disruption to station access Potential worsening of flooding at Chatswood dive sump Increased maintenance of drainage outlets due to scouring	Drainage of at grade track sections, bridges and viaducts is designed to a 50 year ARI storm event, including a 10% increase in rainfall intensity to account for climate change. Drainage design in station precincts (immediate station precinct, roads and car parks) has not been completed in detail as part of the Reference Design. Recommended that contractors be directed to design drainage in these areas, at the detailed design stage, in accordance with local council guidance, making an allowance for climate change. Reference design allows for increasing the capacity of the Chatswood dive sump pump to mitigate a legacy localised flooding issue. The pumps will be sized to minimum 100 year ARI, and there will be sufficient capacity to cope with a 10% increase in rainfall intensity. Water sensitive urban design elements have been incorporated to help offset the potential for scouring at drainage outlets.	D (S5, L4)	D (S5, L4)	**Comments** Updated IFD data demonstrates no material changes to intensity at NWRL site. **Recommendations** Detailed design to be in accordance with local council guidance
3c	Climate change causes increased frequency and severity of extreme rainfall events leading to flooding or saturation of embankments and ground conditions	Increased rainfall intensities Increased stormwater runoff Increased fluctuation in groundwater levels	Ground stability issues, risk of landslides and embankment / slope failure due to higher water table and saturated slopes.	Embankments and slopes have been designed to be stable in extreme weather events, including factors of safety, in accordance with industry best practice. This may be sufficiently conservative to take account of climate change – related increases in rainfall intensity, but should be investigated at the detailed design stage. A good practice inspection cycle would identify potential issues relating to instability.	C (S4, L4)	C (S4, L4)	**Comments** Updated IFD data demonstrates no material changes to intensity at NWRL site. **Recommendations** Ensure embankments are stabilised.
3d	Climate change causes increased frequency and severity of extreme rainfall events leading to water damage to electrical circuitry, issues with rolling stock control and communications problems.	Increased rainfall intensities Increased stormwater runoff	**Electrical:** E1. Malfunctioning power supplies and traction problems. Result in disruption to service and maintenance issues.	A small portion of the alignment is exposed to rainfall, majority is within tunnel **Electrical:** E1a. Electrical cabling will be buried underground and / or within conduits / troughing to reduce vulnerability. No new overhead transmission lines are proposed for NWRL other than the 1500V DC OHW. High voltage reticulation networks will all be cable. E1b. Most cables are located in well-drained trays along the alignment and there are turning chambers and access pits to enable maintenance. E1c. Cables are well protected, insulated and have fail-safe mechanisms built in to ensure no safety issues. E1d. Much of the electrical circuitry operates autonomously, such that one failure will not mean the failure of entire systems.	C (S3, L4)	C (S3, L4)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
			Rolling Stock: S1. Loss of adhesion resulting in braking trains sliding past braking points. Result in disruption to service and maintenance issues.	**Rolling Stock:** S1a. Wheel slide prevention included in rolling stock reference design.	D (S3, L5)	D (S3, L5)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None
			Communications: C1. More frequent malfunctioning of communications and associated circuitry C2. Heavy rain can affect radio signal propagation. Result in disruption to service and maintenance issues.	**Communications:** C1. Design would ensure adequate drainage and good practice maintenance would include conducting routine inspections of cable routes, so would identify and rectify flooded cable conduits to minimise the likelihood of water- related malfunction. C2. Radio systems are designed with a rain fade margin that is sufficiently conservative to cope with projected increased rainfall intensity.	C (S3, L4)	C (S3, L4)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None
3e	Climate change causes increased frequency and severity of extreme rainfall events leading to effects on passenger comfort	Increased rainfall intensities Increased stormwater runoff	Impacts to customer comfort and experience in station precincts, at station entrances and at elevated stations Potentially reduced patronage	1a. Shelter is included at the interchange area (eg. bus shelters and sheltered parking spaces on the top level of multi deck car parks). 1b. Station canopy design for elevated and open cut stations aims to reduce exposure to the weather.	D (S5, L4)	D (S5, L4)	**Comments** • While rainfall intensity and other extreme weather events are predicted to increase the controls identified seem appropriate to mitigate risks to patronage. **Recommendations/ additional actions** None
3f	Climate change causes increased frequency and severity of extreme rainfall events, potentially impacting building roof drainage systems	Increased rainfall intensities, leading to increased stormwater runoff	Occasional overflow of roof drainage systems	Stormwater drainage design will be in accordance with BCA, which references AS3500.3, which indicates that most building drainage elements are designed for 100 year ARI rainfall event. If a rain event surpasses the capacity of the roof drainage system, there would be overflow to ground level and stormwater would follow overland flow paths.	D (S6, L4)	D (S6, L4)	**Comments** Updated IFD data demonstrates no material changes to intensity at NWRL site. **Recommendations** Detailed design to be in accordance with local council guidance.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
4	Climate change causes reductions in average annual rainfall leading to cracking and movement of ballast and failure of embankments	Reduced annual rainfall	Rail track movement, leading to increased risk of derailment, increased maintenance cost and increased travel time due to speed restrictions. Landslip risk and failure of embankments due to reductions in soil moisture	1a. Only a limited section of the track (in the TMF) is potentially vulnerable to ballast movement, as the majority is within tunnels or on bridge / viaduct. 1b. A good practice inspection cycle would identify potential issues relating to ballast movement. 2a. Embankments and slopes are designed to be stable in extreme weather events, including factors of safety, in accordance with industry best practice. This may be sufficiently conservative to take account of climate change – related reductions in rainfall, but should be investigated at the detailed design stage. 2b. Soil stability can be moderated by using geotechnical materials and vegetation. The need for these materials and treatments will be addressed at the detailed design stage. 2c. A good practice inspection cycle will identify potential issues relating to cracking and instability.	D (S4, L5)	D (S4, L5) assuming recommended actions are taken	**Comments** • An overall reduction in annual rainfall is predicted of 3% (2030) to 8% (2070). • The good practice maintenance and inspection cycles are considered to be appropriate to manage risks of track movement. • The consequence rating seems reasonable based on potential safety impacts, operational disruption and maintenance costs. **Recommendations/ additional actions** • As highlighted in the original study, the stability of embankments and slopes should be investigated as part of finalising the contract design to ensure the risk is managed to an appropriate level of tolerance. Factors to consider are those which would impact the susceptibility of embankments and slopes to erosion in extreme weather events particularly after prolonged periods of dryness. Climate change variables to consider include: – A reduction in annual rainfall of 8% is predicted by 2070 relative to a 1005mm base (2013 study). – Droughts are predicted to be up to five times more frequent in the Southern Australia region by 2070 (2013 study). – This may also be exacerbated by increase in wind. Latest data indicates mean wind speeds may increase by 10% in the period 2081-2100 relative to those experienced in 1981-2000 (based on AR5 Australasia Chapter). – An increase in intensity of rainfall during extreme weather events (a 5% increase is predicted in total rainfall for 40-year events based on the 2013 study). Increased vegetation cover and/or geotechnical materials may be appropriate to increase embankment stability.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
5a	Climate change causes increased frequency and severity of extreme wind events leading to debris, fallen trees and branches impacting customers	More severe storms Increased extreme wind events	Debris landing on trains, platforms and any area where passengers or general public may be on the NWRL network.	For stations and at the at-grade sections, RailCorp standards for setback for trees and other vegetation will be implemented, which are deemed to be conservative. The setbacks depend on the height and species of tree. The intention of these standards is to avoid vegetative debris, whilst maintaining visual aesthetics and soil stability. At the viaduct, there will be no vegetation above rail level.	C (S3, L4)	C (S3, L4)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. • The increase in probability and extent of extreme weather events is not considered sufficient to change the rating from the current L4 (once every 10 to 100 years, expected more likely not occur than occur during the project life) to L3 (once every 1 to 10 years, expected to occur more likely than not occur during the project life). **Recommendations/ additional actions** None
5b	Climate change causes increased frequency and severity of extreme wind events leading to debris, fallen trees and branches and potential damage to wind-exposed infrastructure.	More severe storms Increased extreme wind events	**Structures:** S1. Damage to structures (e.g. viaduct) signs, gantries, noise walls, station canopies. Leads to service delivery impacts and safety concerns.	**Structures:** S1a. The wind loading of each structural element, including station canopies, would be evaluated at the detailed design stage and extreme weather events would be considered. S1b. At the Reference Design stage, station canopies are being designed and orientated, where possible, to avoid the full impacts of prevailing wind.	C (S4, L4)	C (S4, L4) assuming recommended actions are taken	**Comments** • Latest data indicates mean wind speeds may increase by 10% in the period 2081-2100 relative to those experienced in 1981-2000 (based on AR5 Australasia chapter). These changes are within the design life for some structures and buildings. • Consideration of wind loading was a control in the 2013 study which was planned to be included at detailed design stage. **Recommendations/ additional actions** • As highlighted in the original study, the resilience of structures to extreme weather events should be considered as part of finalising the contract design to ensure the risk is managed to an appropriate level of tolerance. Factors to consider are those which would impact the tolerance to peak weather events. Relevant data includes: – A projected increase in mean wind speed of 10% by 2100 relative to the 1981-2000 period. – Data is not available on extreme wind speed however historical wind speed extremes peaked at 117km/hr in Sydney over the 1981-1992 period (Bureau of Meteorology). A tolerance should be built in to accommodate an expected increase in mean wind speed which may also result in an increase in extreme winds.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
			Electrical: E1. Dewirements, phase conductors swinging together, snagging of overhead lines. Leads to service delivery impacts and safety concerns.	**Electrical:** E1a. Overhead wiring on the NWRL is being designed to RailCorp standards to cater for wind loads up to 130km/h. E1b. If debris does land on wires or critical equipment, the NWRL rapid response system protects itself (e.g. circuit breakers deploy automatically). This significantly reduces safety risks. E1c. The NWRL will specify Railcorp standards for setback for trees and other vegetation from the rail corridor which are deemed to be conservative. The setbacks depend on the height and species of tree.. The intention of the standard will be to avoid vegetative debris, whilst maintaining visual aesthetics and soil stability.	C (S4, L4)	C (S4, L4)	**Comments** • Historical wind extremes peaked at 117km/hr over the period 1981-1992 (more recent data on wind extremes for the Sydney region was not available publicly). IPCC AR5 for the Australasia region predicts an increase in mean wind speed of 10% by 2100 relative to the period 1981-2000. This may result in an increase in extreme winds associated with the projected increase in the mean. • Controls in the design for overhead wiring to withstand wind loads of up to 130km/hr will assist to reduce the likelihood of impacts occurring. • Changes between the reference and contract design are known to impact the design of the bridge only and are not expected to change the cause, impact or controls originally identified for this risk in the 2013 assessment. • The likelihood and consequence ratings seem reasonable. **Recommendations/ additional actions** None
			Communications: C1. Damage to communications infrastructure (radio towers, CCTV poles, equipment on light poles) C2. Misalignment of radio antenna and CCTV camera due to wind. All lead to service delivery impacts and safety concerns.	**Communications:** C1. Regular inspections would identify any structural issues with radio towers or other infrastructure. C2. Problems will be identified through communications coverage tests complaints, phone equipment reports and observation of CCTV coverage, and would be rectified as they occur.	C (S4, L4)	C (S4, L4)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. • The likelihood and consequence ratings seem reasonable based on potential service disruptions and potential safety impacts. **Recommendations/ additional actions** None
5c	Climate change causes increased frequency and severity of extreme wind events leading to impacts to customer comfort	More severe storms Increased extreme wind events	Impacts to customer comfort in station precincts, at station entrances and at elevated stations. Potential impacts on patronage	1a. Some areas of shelter are included in the station precincts (e.g. bus shelters) 1b. Platform edge barriers at open and elevated stations will provide wind protection for passengers on station platforms.	D (S5, L4)	D (S5, L4)	**Comments** • While mean wind speeds and other extreme weather events are predicted to increase the controls identified seem appropriate to mitigate risks to patronage. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
5d	Climate change causes increased frequency and severity of extreme wind events leading to rolling stock blowing over.	More severe storms Increased extreme wind events	Derailment, delays, operational and safety risks.	National rail codes and standards (eg. AS 7509.3) ensure that rail cars are unlikely to be blown over by specifying a maximum height for the centre of gravity of the rail car. These rail standards define wind speed and wind loading, and have been adopted for NWRL rolling stock. The majority of the alignment is underground or at grade and often surrounded by buildings and other infrastructure (which can act as a wind break) and therefore there is minimal exposure to open areas where rail cars may be exposed to extreme wind events. Noise walls may be required for part of the viaduct section. Where needed, these will provide wind protection. Derailment protection is included on the viaduct.	C (S2, L6)	C (S2, L5) assuming recommended actions are taken	**Comments** • Historical wind extremes peaked at 117km/hr over the period 1981-1992 (more recent data on wind extremes for the Sydney region was not available publicly). IPCC AR5 for the Australasia region predicts an increase in mean wind speed of 10% by 2100 relative to the period 1981-2000. This may result in an increase in extreme winds associated with the projected increase in the mean. • The wind speed and wind loading allowed for in the rolling stock design is anticipated to be sufficient to manage the risk of increased wind speed based on the 2013 assessment. • The design of the viaduct may have changed between contract design and reference design stages and should be checked. **Recommendations/ additional actions** • ISJV should confirm that the final contract design has maintained controls originally identified in the 2013 study. This should include consideration of the bridge and viaduct design to potential impacts of: – Cable stress, damage and potential loss of cables in extreme wind or weather events. – Derailment as a result of rail cars being destabilised on the bridge due to extreme wind events. • The cable stayed bridge design may also be more vulnerable to extreme wind events than the previous bridge design. The tolerance of the structure and in particular the vulnerability of cables to loss and damage as a result of extreme winds should be reviewed to ensure that the risk is managed to an appropriate level of tolerance.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
6	Climate change causes increased frequency, severity and duration of bushfires	Temperature increases More frequent and severe heatwaves Increased frequency of lightening Reduced soil moisture Reduced average annual rainfall	Damage to above ground station elements, service buildings, signage, noise walls, fencing, signalling buildings. Increase in false alarms and spurious detections by fire protection systems, associated with increased incidence of bushfires. Consequence: Rail systems and ventilation systems shutting down, unnecessary evacuation, delays to service. Health and safety impacts on passengers. Connecting transport infrastructure closures and delays during bushfires, resulting in lower patronage	1a.Project assets directly exposed to bushfire risk are minimised as much of the project is underground. More vulnerable areas are Cherrybrook Station (close to Cumberland State Forest), and viaduct sections, elevated stations and the TMF. Buildings and structures are designed to be fire resistant in accordance with standards. Finishing materials will also be fire resistant 2a.Areas/rooms with smoke alarms which trigger critical service shut down can be configured to be confirmed by staff before shut down is initiated. All stations manned. 3a.Reference design provisions for emergency fire safety measures are based on international benchmarking and best practice. 4a. No controls within scope of design. **Additional adaptation steps** Risk of spurious detections and service interruptions could be reduced through detailed design by consideration of ventilation and detection strategies in these areas.	D (S3, L6)	C (S2, L5) assuming recommended actions are taken	**Comments** • The latest climate change literature predicts an increase in the number of high and extreme fire risk days in Australia (IPCC AR5 Australasia chapter). There is *high confidence* that fire season will also be longer in high risk areas. High temperatures and increased droughts will continue to contribute to this risk. • Cable stayed bridges can be more vulnerable to the impacts of fire than other bridge designs. The tolerance of the structure and cables to fire risk will need to be considered as part of finalising the contract design. • Both the impact and likelihood of this risk are considered too low in the original assessment. Bushfire is a significant risk to safety of staff and passengers and could be rated as an S2 or even S1 event. The remote rating given in the 2003 study ('you don't expect it to ever occur, less than once every 1000 years') also seems underestimated. The rating for this risk has been increased in this assessment from D to C. **Recommendations/ additional actions** • The cable stayed bridge design may be more vulnerable to bushfires than the previous bridge design. The tolerance of the structure and in particular the vulnerability of cables to loss and damage as a result of fire damage should be reviewed to ensure that the risk is managed to an appropriate level of tolerance. • Not mentioned in the original study is the need for appropriate business continuity plans and evacuation procedures. This should also consider the safest locations to contain passengers and staff underground if the risk of evacuation is too high. Good practice business continuity requires plans to be regularly tested and revised as needed in order to mitigate safety impacts on passengers and staff in the event of a bushfire.

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
7	Climate change causes increased frequency of lightning leading to damage to electrical systems	Increased frequency of lightning	Damage to underground cable networks - underground cables take longer to repair than transformer damage. Damage to radio equipment, on-pole communications equipment, and electrically connected communications equipment. Failure of the train communications systems would result in stopping trains.	**Electrical:** All NWRL electrical assets will be protected in accordance with current standards, such as utilising a common earth system and frequent analysis and inspection by maintainers to ensure the integrity of earth connections. Good practice operators will have scheduled maintenance events following lightning strikes. The majority of NWRL project cabling is buried within trenches. Long cables have sacrificial surge arresters as standard, which ensures that safety is maintained at all times. **Communications:** Radio towers are protected by sacrificial surge arrestors, which are alarmed when struck by lightning and may require improved earthing. Used surge arrestors are replaced.	D (S5, L5)	D (S4, L5) assuming recommended actions are taken	**Comments** • The cable stayed bridge design may be more susceptible to damage from lightning strikes than the previous design. • Other controls listed in the 2013 study to prevent damage to underground cables and equipment seem reasonable and are not expected to be impacted by the change in design or increased likelihood of storm activity. • The consequence rating has been increased relative to the 2013 study due to potential financial and service delivery impacts due to potential bridge damage. Depending on the resilience of the structure and cables this consequence rating may be reduced through appropriate controls. **Recommendations/ additional actions** • The cable stayed bridge design may be more susceptible to damage from lightning strikes than the previous design. The tolerance of the structure and cables to lightning strikes will need to be considered in conjunction with the appropriate standards as part of finalising the contract design.
8	Climate change causes increasing CO2 levels in the atmosphere leading to Increased carbonation	Increasing CO2 levels in the atmosphere	Faster degradation of reinforced concrete through acidification.	The NWRL Durability Report indicates that carbonation is not of significant concern on the NWRL project. Good practice inspection and maintenance regimes will identify areas of degraded reinforced concrete as degradation occurs.	D (S4, L6)	D (S4, L6)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. • The likelihood and consequence ratings seem reasonable based on potential financial impacts of replacement and repair. **Recommendations/ additional actions** None
9	Climate change causes other extreme weather events leading to impacts on passenger comfort (Note: heat waves, increased rainfall and increased wind addressed above)	Increased solar radiation More severe storms Increased hail events	Discomfort at stations and customer complaints	Shade is being included at the station precinct (precincts includes shaded / covered areas and trees which will provide shade, station canopies deflect sun, rain, hail)	D (S4, L5)	D (S4, L5)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
10	Climate change impacts on passenger comfort affect patronage	Extreme weather events impact passenger comfort	Significantly more, or less, customers use the NWRL, resulting in changes to operating costs and service levels	Other than minimising impact on comfort (controls outlined above), no other controls are within the scope of design.	D (S4, L5)	D (S4, L5)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None
11	Climate change causes extreme weather events leading to construction impacts	Increased solar radiation Increased average temperatures More frequent and severe heatwaves Reduced average rainfall Increased rainfall intensities Increased stormwater runoff More severe storms Increased extreme wind events Reduced soil moisture Increased humidity Increased average evaporation Increased hail events Increased lightning effects Increased fire risk	Inundation of construction sites Wind and water damage to construction equipment, materials and compounds Worker comfort during extreme weather Disruptions to schedules and delays Changes to materials performance (e.g. concrete curing times) Impacts on groundwater levels, which may affect integrity of works. Increase in cost, higher impact on communities, reputation.	The likelihood of climate change resulting in a significant increase in extreme weather events by the construction phase (planned for 2015-2018) is extremely low. Standard controls at construction sites are likely to be sufficient to minimise the risks from extreme weather events. **Additional adaptation steps** Potential adaptation measures should be further evaluated by the design and construction contractor.	D (S6, L6)	D (S6, L6)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None
DE - 163	Climate change causes increased annual average UV radiation leading to accelerated degradation of external materials on station entrances at surface	Increased solar radiation More frequent and severe heatwaves	Poor performance of materials resulting in additional O&M work / cost	Preferred cladding, roof and canopy materials and precinct materials are described in the project Design Guidelines and comprise a range of robust materials (concrete, powder coated steel, terra cotta, glass, timber) which will be resilient to UV impacts. Good practice inspection and maintenance regimes at existing ECRL stations will ensure that impacts to external materials are identified and replaced as necessary with resilient materials. **Adaptation steps** Should be considered as part of detailed design. Performance-specification based solution for contractor to satisfy.	D (S5, L5)	D (S5, L5)	**Comments** • Impacts of UV damage would be minor and may increase the required frequency of replacement of some external materials however the controls identified appear sufficient to manage this risk. **Recommendations/ additional actions** None

Ref	Risk description	Cause	Impact	Controls and adaptation steps (where applicable)	Rating (2013) with adaptation steps	Rating (2014)	Recommendations, additional actions and comments (2014)
DE - 155	Climate change causes reduced average annual rainfall leading to soil movements and cracking of tunnel walls	Reduced average rainfall Increased evaporation	Delay to construction, rework, and potential cost increase. The only potentially vulnerable areas are where the structure intersects the soil / rock interface (i.e. at underground stations and for a 150-250m section to the west of Cherrybrook Station)	Tunnels team have assessed potential risks of seasonal variations (EBS Report, Instrumentation and Monitoring Report). There may be a need to provide remedial measures at some locations, but no additional controls are needed to mitigate climate change risk.	C (S4, L3)	C (S4, L3)	**Comments** • The controls appear sufficient to manage this risk. • Changes in contract design (relative to the reference design) are not expected to increase this risk. **Recommendations/ additional actions** None

Description	Prepared By	Reviewed By	Approved By	Approval Date
Version 1	Sally Cook	Peter Holt	Peter Holt	13 June 2014
Version 2	Sally Cook	Peter Holt	Peter Holt	23 June 2014

Contacts

Brisbane

Level 12, 410 Queen St, Brisbane Qld 4000
Ph: +61 7 3230 8800
Fax: +61 2 9929 3922

Canberra

Unit 2, 6 Napier Cl, Deakin ACT 2600
Ph: +61 2 6101 2300
Fax: +61 2 9929 3922

Melbourne

Level 6, 34 Queen St, Melbourne VIC 3000
PO Box 652, CSW Melbourne VIC 8007
Ph: +61 3 9691 5500
Fax: +61 2 9929 3922

Perth

Level 3, 182 St Georges Tce, Perth WA 6000
Ph: +61 8 9429 6400
Fax: +61 2 9929 3922

Sydney

Level 7, 132 Arthur St, North Sydney NSW 2060
PO Box 294 North Sydney NSW 2059
Ph: +61 2 9929 3911
Fax: +61 2 9929 3922

web www.energetics.com.au
abn 67 001 204 039
acn 001 204 039
afsl 329935

2014 Winners: BRW Client Choice Award for Best Professional Services Firm (revenue < $50M), Best Consulting Engineering Firm (revenue < $50M), Best Value Finalist: BRW Client Choice Award for Best Client Relationship Management

2013 Finalist: BRW Client Choice Award for Best Client Relationship Management and Leading in Sustainability Banksia Award

2012 Winners: Australian Business Award for Service Excellence and Recommended Employer

2011 Winner: The BRW Client Choice Award for Best Value

Energetics is a carbon neutral company

Copyright

Disclaimer

The information contained in this document is of a general nature only and does not constitute personal financial product advice. In preparing the advice no account was taken of the objectives, financial situation or needs of any particular person. Energetics is authorised to provide financial product advice on derivatives to wholesale clients under the Corporations Act 2001 AFSL No: 329935. In providing information and advice to you, we rely on the accuracy of information provided by you and your company. Therefore, before making any decision, readers should seek professional advice from a professional adviser to help you consider the appropriateness of the advice with regard to your particular objectives, financial situation and needs.

Appendix 2 – ISJV Responses to Climate Change Risks

In 2013 Transport for NSW conducted a climate change risk assessment and adaptation study for the North West Rail Link (NWRL). After completion of the 2013 study, changes were made to the NWRL design and new information relevant to climate change risk was released. These changes have necessitated a due diligence review of the original risk assessment.

The due diligence review focused specifically on the Surface, Viaducts and Civils (SVC) works package specifically, and assessed the impact of design changes and key changes in climate change literature, specifically:

- The inclusion of a cable-stay bridge
- The latest climate change literature indicates a decrease in uncertainty associated with most climate change impacts. These include extremes in temperature (more frequent and extreme heat waves, increased annual temperature), extremes in precipitation (increased rainfall intensity, flooding, and an overall decrease in annual rainfall) and other weather related extremes (increased bushfires, wind, storms, lightning and hail).

The review found that overall risk ratings would be maintained within tolerable levels (rated as C or D overall), contingent on the appropriate implementation of the recommendations. ISJV responses are summarised in the right hand column.

Table 8 - Findings, Recommendations and ISJV Responses

2013 Risk Ref	Due Diligence Review Findings	Due Diligence Review Recommendations	ISJV Response
6	**Resilience of bridge to bushfires** and mitigation of risks to staff and passenger safety. The latest climate change literature predicts an increase in the number of high and extreme fire risk days in Australia. There is high confidence that fire season will also be longer in high risk areas. High temperatures and increased droughts will continue to contribute to this risk. Cable stayed bridges can be more vulnerable to the impacts of fire than other bridge designs.	The tolerance of the structure and in particular the vulnerability of cables to loss and damage as a result of fire damage should be reviewed to ensure that the risk is managed to an appropriate level of tolerance. The need for appropriate business continuity plans and evacuation procedures are not mentioned in the original study. This should also consider the safest locations to contain passengers and staff underground if the risk of evacuation is too high. Good practice business continuity requires plans to be regularly tested and revised as needed in order to mitigate safety impacts on passengers and staff in the event of a bushfire.	The cable stayed bridge is located in a built up urban environment. There is a very risk of bushfire occurring as there is limited vegetation in the vicinity of the bridge. Notwithstanding this the design has considered the fire requirements of the SWTC such that the concrete deck section is designed for fire resistance. In addition the cable stayed bridge is designed to have one cable completely damaged should a localised fire event happen.
5d	**Resilience of bridge design to wind extremes**	ISJV should confirm that the final contract design has	The derailment protection is provided

2013 Risk Ref	Due Diligence Review Findings	Due Diligence Review Recommendations	ISJV Response
	The 2013 study identified risks of derailment and to health and safety as a result of peak wind speeds destabilising rail cars. The study identified derailment protection included on the viaduct as part of the controls to manage this risk. The change in bridge design to a cable stay bridge may have changed the derailment protection from the original design which may impact this risk. In addition, the cable stayed bridge design may also be more vulnerable to extreme wind events than the previous bridge design	maintained controls originally identified in the 2013 study. This should include consideration of the bridge and viaduct design to prevent derailment as a result of rail cars being destabilised on the bridge in extreme wind events. The tolerance of the cable stay bridge structure and in particular the vulnerability of cables to loss and damage as a result of extreme winds should also be reviewed to ensure that the risk is managed to an appropriate level of tolerance.	on the cable stayed bridge and the viaducts in the form of derailment kerbs. The risk of damage to the cables due to extreme wind gusts is not a high risk as dynamic excitation of the cables is not caused by extreme wind gusts. This is due to the large size and weight of the cables providing a high stiffness and hence not being sensitive to dynamic amplification.
1e	**Resilience of bridge to prolonged heat extremes** The new bridge and supporting materials are expected to satisfy the requirements of the Australian Standards (AS5100 for bridges, AS3600 for buildings). The control description from 2013 indicates that the standards take into account extremes of temperature above those predicted over the life of the structure: ■ AS5100 requires that bridges in the project area are designed for a shade temp of 45°C. There is an additional factor of safety of 5-10% inherent in design, to take account for any irregularities in materials. ■ The design of joints is such that any temperature increases will not lead to any major concerns with regards to their intended performance. However, it is uncertain whether the standards or draft control design take into account more prolonged heat extremes in addition to isolated extremes in temperature. The latest literature indicates that more frequent and consecutive heat days in	ISJV should confirm that the final contract design adequately considers prolonged heat impacts on the bridge to an extent that risks to the structure are tolerable.	The duration of temperature is not a variable that affects the design. The bridge has been designed for a maximum average bridge temperature of 49 degrees which is applied over a sustained period.

2013 Risk Ref	Due Diligence Review Findings	Due Diligence Review Recommendations	ISJV Response
	Australia is very likely with consecutive days over 35°C predicted to become 4 times as frequent by 2070.		
7	**Resilience of bridge to lightning strikes** The cable stayed bridge design may be more susceptible to damage from lightning strikes than the previous design. Risks to the bridge from lightning strikes were not previously identified in the 2013 study.	The tolerance of the structure and cables to lightning strikes will need to be considered in conjunction with the appropriate standards as part of finalising the contract design.	Lighting protection has been addressed within the earthing and bonding strategy.
3a	**Resilience to increased frequency and severity of extreme rainfall events** Rare daily rainfall extremes (current 20 year return period events) are predicted to increase in intensity (medium confidence). The quantity of concrete used in the structure for the new bridge is understood to have decreased. The contract design should take into account any reduced stability in the footings and increased susceptibility to flood events.	ISJV should confirm that the final contract design has adequately assessed the risk of 100 year event based on best available information including updated IFD information from the BoM.	The risk of instability of the foundations of the viaducts and the bridge are nil as these have been designed for a 2000 year flood event. In addition the culverts have been designed assuming a 10% increase in rainfall.
5b	**Resilience of structures to wind extremes** The controls identified in the 2013 study included a recommendation to review the resilience of structures to wind loading at design stage. Factors to consider are those which would impact the tolerance to peak weather events. This includes: ■ A projected increase in mean wind speed of 10% by 2100 relative to the 1981-2000 period. ■ A possible increase in extreme wind speed as a result of the above increase in the mean. Specific predictions of mean wind speed are unavailable; however historical wind speed extremes peaked at 117km/hr in Sydney over the 1981-1992 period. A tolerance in addition to the historical peak would be	The resilience of structures to extreme wind events and sustained wind loading should be considered as part of finalising the contract design to ensure the risk is managed to an appropriate level of tolerance.	The viaducts and cable stayed bridge are designed for an extreme gust wind, rather than a mean wind speed as a sustained load event. A 10% increase in mean wind speed will not impact the design as the extreme gust design wind speed is 173km/hr. The extreme gust design wind speed is 47% greater than the maximum recorded historical wind speed in Sydney and hence the structures are designed to be resilient.

2013 Risk Ref	Due Diligence Review Findings	Due Diligence Review Recommendations	ISJV Response
	appropriate to account for potential increases in extreme wind events.		
4	**Stability of embankments and slopes due to drying and extreme rainfall** The controls identified in the 2013 study included a recommendation to review the design of embankments and slopes at the design stage to ensure they are sufficiently conservative to take into account predicted extremes resulting from climate change. Factors to consider are those which would impact the susceptibility of embankments and sloeps to erosion in extreme weather events particuparly after prolongerd periods of dryness. Climate change variables to consider include: ■ A reduction in annual rainfall of 8% is predicted by 2070 relative to a 1005mm base (2013 study) ■ Droughts are predicted to be up to five times more frequent in the Southern Australia region by 2070 (2013 study) ■ This may also be exacerbated by increase in wind. Latest data indicates mean wind speeds may increase by 10% in the period 2081-2100 relate to those experienced in 1981-2000. ■ An increase in intensity of rainfall during extreme weather events (a 5% increase is predicted in total rainfall for 40-year events based on the 2013 study) Increased vegetation cover and/or geotechnical materials may be appropriate to increase embankment stability.	The stability and resilience of embankments and slopes to drying and increased rainfall intensity should be investigated as part of finalising the contract design to ensure the risk is managed to an appropriate level of tolerance.	The stabilisation of the embankments and slopes is undertaken in accordance with the proposed Hydromulch strategy, which will provide a more robust and resilient vegetation outcome. The diversity of species will also ensure resilience against various climatic conditions. The design of the embankments also includes the provision of catch drains at the base of batters sized to account for an increase in 10% rainfall intensity.

Appendix 3 – Sustainability Inspection Checklist

SUSTAINABILITY INSPECTION CHECKLIST

Management System Form

Project: NWRL SVC Date: **SIC No: 001**

Inspection

Area(s) inspected: Sam Riley Drive Compound (SRD), Temporary Car Park Area (TCPA), Adjacent Roads (AR), Terry Road (TR), Cudgegong Road (CR), Sam Riley Drive to Memorial Ave (SRMA), Pre-cast Yard (PCY)

Name: Company: ISJV

Name: Company:

Previous Inspection Date: Proposed Date Next Inspection:

Check List Key	Satisfactory	✓	Unsatisfactory risk category	I
	Not Applicable	N/A	Unsatisfactory risk category	H
	Not Inspected	NI	Unsatisfactory risk category	M
	Repeat non-compliance	R	Unsatisfactory risk category	L
	No. of repeats (list for each item)	2,3, etc		

Item No.	Description	Check (see above)	Area	Sustainability Action List Reference #	Comments
	Environmental				
1	Electrical Consumption				
2	A/C units operating sensibly				
3	Office waste separated and placed in appropriate bins for recycling				
4	Wastes separated into streams and placed in appropriately labelled bins for reuse, recycling and/or disposal				
5	Waste Register				
6	Spoil correctly stored for reuse or recycle				
7	Top Soil correctly stored for reuse or recycle				
8	Green waste mulched, composted and stockpiled for reuse on site				
9	Water usage monitored				
10	Correct use of water source				
11	Use of potable water minimised				
12	Concrete washout areas in place, sign posted and have capacity				
13	Water discharge meets water quality criteria				
14	No release of water except in accordance with Environmental Protection Licence				
	Community				
15	Residents informed as per Community Liaison Plan prior to commencing work				
16	Community Complaints Received				
17	Appropriate notifications made to client/EPA/ residents and approvals in place prior to commencing out of hours work				
18	Community Education activity taken place				
19	Monitoring of Construction equipment noise levels				
20	Contribution to local skills – TAFE/University visits				
21	Community Safety				
	Construction Activities				
22	Working hours within approved times				
23	Vibration producing activities undertaken within defined limits				

SUSTAINABILITY INSPECTION CHECKLIST

Management System Form

Item No.	Description	Check (see above)	Area	Sustainability Action List Reference #	Comments
22	Working hours within approved times				
23	Vibration producing activities undertaken within defined limits				
	Air Quality				
24	Measures to minimise adverse impacts are in place				
25	Visual inspections have taken place				
	Heritage				
26	Heritage items fenced & signposted as per CEMP.				
27	Approval obtained from NPWS and/or Heritage Office and controls implemented prior to disturbing or destroying any heritage items				
28	Procedures followed if unexpected heritage item found				
29	No disturbance of any identified areas of cultural heritage significance				
	Economic				
30	Sustainability and environmental aspects considered in the procurement process				
31	Suppliers have provided their sustainability and environmental policies and there implementation				
32	Materials sourced with environmental credentials				
33	Steel supply				
34	Concrete supply				
35	Timber Recycled				
	Fuels, Chemical & Oils				
36	Diesel				
37	Bio Diesel				
38	Unleaded				
39	E10 Unleaded				
40	Machinery left idling				
41	Machinery Maintained and Serviced				
	Workforce				
42	Number of sustainable jobs				
43	Number of trainees				
44	Diversity targets				
45	Personnel from GWS				

List all required actions in the Sustainability Actions Register

Category	*Consequence	Action
Immediate – significant	Tier 1 Fine, Loss of Licence/Permit, Irreversible Environmental Damage	Rectify Immediately
H (Major/high potential) – significant	Tier 2 Fine, Reversible environmental damage with substantial time, cost and difficulty.	Rectify within 1 day
M (Medium/moderate potential)	Tier 3 Fine, Reversible environmental damage with moderate time, cost and difficulty	Rectify within 2 days
L (Minor/low potential)	Reversible environmental damage with minor time, cost and difficulty	Rectify within 5 days

*For guidance only. Consider probability and ISJV-PMS procedures when determining action timeframes

Comments

Distribution:

☒ Project Director ☒ Construction Manager ☒ Superintendent ☐ Subcontractor
☒ Environment Manager ☒ Compliance Manager ☐ ☐ Other (list below)

 Commercial in Confidence ISJV
Authorised By: 2 of 2

Appendix 4 – Innovation Register

INNOVATIONS REGISTER
Project Management System Form

Project: SVC Viaduct

Innovation No.	Innovation By	Implementation Date	Innovation Stream #	Innovation Details (Summary)	Key Innovation Benefits & Outcomes	Comments
1	Design		Construction process	The lengh of the bridge spans has been maximised while the pier sizes have been minimised.	This combination reduces the footprint of the viaduct to minamise enviromental impacts and impacts to surface water drainage across the alignment. The proportioning of span lengh to pier height and pier slenderness, also serves to present a structure that has a slender aesthetically pleasing outline.	
2	Design		Construction process	The number of bridge segments have been minamised to reduce the lifting transporting requirements.	The handling of large concrete components can result in significant risk on construction sites such as fall from heights and personal injury from contact. The proposals to reduce segment numbers mitagate these risks by reducing the frequency of handling, transporting and placing operations that involve site labour	
3	Design		Construction process	Standardisation of segment sizes	Streamline production processes and standardisation of material requirements through prefabrication,resulting in a reduction in material usage	
4	Design		Construction process	Resusable form work	Resuable form work and molds have been developed to improve quality and acuracy of peirs and segments. Reduces the need for continual material usage to build form work.	
5	Design		Construction process	Maintenance access openings have been provided through the top flange of ever span	This permits greater flexibility for access and egress to the box girder voids	
6	Design		Construction process	The geometricarrangment of external pre-stressing tendons has been detailed to offer improved access for maintainance and inspection of bridge elements within the box girder voids.	Improved maintainance and inspection access	
7	Design		Construction process	Supporting the OHW mast on the viaduct, by thickening of the top flange of the box girder in place of steel anchor plate that would otherwise be required at the soffit of the flange	The thichening provides sufficent depth of concrete to permit the embeding of anchors required for an OHW Plinth. The alternative design is based on a reinforced concrete only solution and therefore provides a more durable element compared with the original steel plate.	
8	Design		Construction process	The stitch between the precast parapets and the bridge segments has been revised to include a larger, more robust stitch detail with improved access for the concrete stich pour	The improved access offers greater ability to place and cure concrete leading to better concrete compaction and therefore improved durability	
9	Design		Construction process	Intergral Pier at P113	The design of an intergral pier eliminates four bearings and a vertival tie that would otherwise be required for a conventional pier	
10	Design		Construction process	Reduced number of strands used in stay cables compared with DCD submission	A reduction in the number of strands has urban design benefits as it reduces the visual impact of the bridge. Fewer strands also reduces wind loading on the bridge and the sag in the cables due to its own weight. Reduction in strands also contributes to a reduction in carbon footprnt	
11	Design		Construction process	Use of large diameter bore piles and placement of a raft foundation and ground anchors	Bore piles provide a more durable solution to ground anchors and result in less onerous requirements for the construction team in implementing quality controls.	
12	Sustainability	Dec-14	Software	Development of a Sustainability Module for the iTWOcx platform	Development of iTWOcx software to aid in the monthly sustainability data collection from internal and external stakeholders, to meet the reqirements of ISCA, SDG'S, Deed requirements and monthly reporting obligations.	
13	Sustainability	Jan-15	Materials	The use of non-potable water for the production of grout	200,000 L of potable water replaced with non-potable water	
14	Sustainability	Jan-15	Materials	Secure supply of non potable water for Mulgrave Precast Facility and Batching Plant	Identified the supply of up to 100,000 L per week of non-potable water from Bettergrow, who are adjacent to the Mulgrove facility. The water can be piped across the boundry. This will be a legacy piece as this facility will be left in place for concrete production after the SVC project has completed.	
15	Daracon	17-Jan-15	Construction process	The lifting of reinforcing steel cages for Second Ponds Creek Viaduct Pier 8 and Pier 9 over Second Ponds Creek. Second Ponds Creek separates the steel prefabrication yard (adjacent Terry Road) from the pier locations (accessed from Cudgegong Road).	Due to the width of the reinforcing steel cages, movement of these loads must be undertaken out of construction hours, generally between 12 am to 5am, under pilot vehicle escort. This could have an adverse impact on surrounding residents. This proposed work method will alleviate some of the impact on residents, by reducing the number of out of hours (OOH) loads being moved from the Terry Road facility. As such by lifting the structures over Second Ponds Creek, two (2) night shift operations can be avoided, reducing the impact on residents and reducing the amount of community relations resources that would be required during these works. Additionally there would be no environmental monitoring required, eliminating the need to set up noise logging stations along property boundaries.	
16	Technical	17-Feb-15	Construction process	Significative reduction of bearings typologies.	Reduction of variability of set out in the Segment Precast and Pier plinth casting. Reduction of risk for human error.	
17	Technical	17-Feb-15	Construction process	Removal of bearings stud penetration in the piers headstock.	Speed up construction and set out of the piers.	
18	Sustainability		Sustainability	Instillation of Solar pannels on roof of Mulgrave Facility	Producing green energy to reduce Energy consumption	Not viable, Instillation costs approxamatly $400k. Pay back period too long.
19	Design	28-Apr015	Construction process	Soldier piles were chosen at Terry Road to avoid excavation through Second Ponds Creek. Although Soilder piles nosier than bored piles, this was not an issue at this site as the nearest residences were located over 200m away.	Decreased excavation of Second Ponds Creek to build the pile cap, reducing the risk of soil erosion and water pollution.	

Appendix 5 – Sustainability Risk Register

Identification				Categorisation					Risk Owner		Analysis			Current Risk			Treatment				Residual Risk		
Risk ID	Risk Description	ID'd by	Status	Contract Package	Location	Phase	Category	Sub-Category	Risk Owner/ Team	Responsible Delegate	Cause/Aspect	Impact / Consequence	Current Controls	C	L	Risk Rat	Planned or additional tasks to further reduce risk	Treatment Owner	Task Due Date	Priority for Resolutic	C	L	Risk Rat
ISJV-261	IS Design Rating of at least 65 points may not be achieved			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS Design Rating program and Responsibilities Matrix. Target 72 points v.s. 65 required to provide a buffer	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-262	NSW Sustainable Design Guidelines for Rail v2.0 (all compulsory initiatives and 80% of Discretionary initiatives) not achieved for Detailed Design phase			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, workshops, etc. Implement clear NSW SDG design program and Responsibilities Matrix	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-263	NSW Sustainable Design Guidelines for Rail v2.0 (all compulsory initiatives and 80% of Discretionary initiatives) not achieved for Construction phase			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, workshops, etc. Implement clear NSW SDG construction program and Responsibilities Matrix	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-264	IS As-Built Rating of at least 65 points may not be achieved			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities Matrix	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-265	NSW Sustainable Design Guidelines for Rail v2.0 (all compulsory initiatives and 80% of Discretionary initiatives) not achieved for Finalisation phase			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, workshops, etc. Implement clear NSW SDG construction and finalisation program and Responsibilities Matrix	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-266	NWRL Sustainability Targets from NWRL Sustainability Strategy not met			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, monitoring and auditing, corrective actions	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-267	NWRL Sustainability Targets not achieved in line with SWTC Appendix 24 Table 24.1			SVC			Environment & Planning		ISJV Project Director	Sustainability Manager		Breach of contract Sustainability aspirations of the project not met	Construction Environmental Management Plan Sustainability Plan	C4	L3	C	Management processes - regular briefing notes, monitoring and auditing, corrective actions	Sustainability Manager	Ongoing	< 3 months	C5	L4	D
ISJV-SuS-001	Climate Change			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-002	Resilience of bridge design to wind extremes			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-003	Resilience of bridge from frequency and severity of extreme rainfall events. Design for 2000 year flood event and design to 10% increase in			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-004	Resilience of bridge to bushfires			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-005	Resilience of bridge to light strikes – Earthing and bedding strategies			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-006	Resilience of bridge to prolonged heat extremes. Design for maximum average bridge temperature of 49•C.			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-007	Resilience of bridge to wind extremes – Derailment kerbs & large site weight of the cable (prorating stiffness)			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-008	Resilience of structures to wind extremes			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-009	Resilience of structures to wind extremes – Design gust extreme sun and winds (173km/hr)			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-010	Resilience to increased frequency and severity of extreme rainfall events			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS--011	Stability of embankments and slopes due to drying and extreme rainfall			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Climate change globally due to the project	Water levels rising and change in weather patterns increasing global disasters	Included in design	C2	L5	C	No futher control measures required	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-012	Construction method changes			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Design change	Fail to meet sustainability Targets	Sustainability Plan	C2	L4	B	Sustainability Workshops	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
ISJV-SUS-013	Design Changes			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager	Design change	Fail to meet sustainability Targets	Sustainability Plan	C2	L4	B	Sustainability Workshops	Sustainability Manager &	Ongoing	3 - 6 months	C2	L5	C
Sustainability Plan																							
ISJV-SUS-14	2.5% reduction on reference Carbon Design			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-15	5% reduction on Electricity Reference design			SVC			Design & Engineering		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-16	5% reduction on fuel design			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-17	90% of production waste t be recycled			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-18	Total water demand not to exceed 143 kL/day			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-19	50% Water to be non potable or recycled			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-20	50 % Non potable water sourced from non potable sources			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-21	Water harvested for reuse 108kL			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-22	Waste Water recycled or reclaimed 5062 kL			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-23	Embodied energy of Concrete and steel to be 2.5% below 55,739tCo2			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-24	60% of structural steel from ESCASI			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-25	80% of reinforcing Bar & Mesh produced through Energy Reduction Techniques.			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-0	Workforce Sustainability Targets			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet Sustainability Targets	Sustainability Plan	C4	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	3 - 6 months	C4	L4	C
ISJV-SUS-0	Deconstruction Plan			SVC			Construction		ISJV Project Director	Sustainability Manager		Fail to Meet ISCA Requirements	ISCA Technical Manual & Sustainability Plan	C3	L4	C	Management processes - regular briefing notes, workshops, etc. Implement clear IS As-Built Rating program and Responsibilities	Sustainability Manager &	Ongoing	4 - 6 months	C3	L4	C