Document:	**Infrastructure Sustainability Rating Implementation: Costs and Benefits Assessment**
Project:	**North-South Corridor** **(Torrens Road to River Torrens Project)**
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EXECUTIVE SUMMARY

The ISCA Infrastructure Sustainability (IS) rating scheme has provided a means of enabling performance monitoring and measuring non-traditional project success factors and outcomes for the Torrens Road to Torrens River (T2T) project. This paper describes the learnings and summarises the costs and benefits of implementing the IS rating scheme on the T2T project. The purpose of this paper is to:

- Capture and share learnings allowing delivery teams on future projects to use the IS rating scheme more efficiently and encourage more value for money creation outcomes beyond DPTI business-as-usual;
- Inform DPTI on the merits and outcomes enabled by using the IS rating scheme on T2T, and
- Offer recommendations on how DPTI could benefit from the use of the IS rating scheme on future projects to drive improvements consistently in financial and non-financial project outcomes, better gauge project performance and risks during the delivery phase, and undertake its governance / assurance processes by Industry recognised external professionals at the lowest cost.

DPTI's trial of mandating verified IS Design and As-Built ratings as a contract requirement on T2T has been successful in creating a range of financial and non-financial benefits, which creates value for the State in the short and longer term, in addition to short term benefits to the T2T delivery consortium.

In particular, establishing a Sustainability Key Result Area (pain share / gain share arrangement) linked to the achievement of verified IS rating scores (KPIs) has had success in driving contractor decision making behaviours beyond cost, programme, quality and safety.

Key findings include:

- Total outturn costs for administering and resourcing the IS Design and As-Built ratings comprised ISCA registration fees, staff costs, specialist support costs, and assets purchased to enable cost effective IS rating KPI measures to be achieved.
- The delivery consortium received a lump sum reward from achieving the +100% gain share target associated with KRA 4 Sustainability.
- The IS rating process was confirmed as the primary driver for enabling two key cost saving sustainability outcomes (outlined in Appendix A):
    - Engineering optimisations of noise walls to better influence Crime Prevention Through Environmental Design (CPTED) outcomes which resulted in $128k CAPEX savings,
    - Accessing a recycled water network generating a forecast of $840k OPEX savings and some minor CAPEX savings.
- A number of other sustainability outcomes were also achieved on the project which saved costs and reduced risk though were primarily influenced by other factors beyond the IS rating (e.g. design optimisation).
- The outturn costs of implementing the IS Design and As-Built ratings was exceeded by the CAPEX financial gain from the CPTED initiative described above and the IS Rating gain share reward..
- Outturn costs associated with the Sustainability management resource costs for a similar sized and scoped project in the future could be reduced through the provision of staff employed

directly by the Contractor (rather than being outsourced). This would involve taking a more selective approach to target points/credits which enhance value, and undertaking more specialist tasks in-house. This is a strategy commonly adopted by contractors on other projects across Australia.

- If the opportunity of optimising specialist support expenditure as described in section 4.2 were available and applied to the project, additional savings might have been realised whilst still retaining the KRA Exceptional performance score of above 66 IS points.
- Several non-financial benefits have been attributed to the specification and implementation of the IS rating process on T2T, the key benefits comprising:

  (1) the IS rating process influencing relevant discussions which elevated sustainability factors in more decision-making outcomes within the delivery team,

  (2) increasing education and practical understanding of infrastructure sustainability throughout the duration of the project,

  (3) the appointment of sustainability champions in the form of a Sustainability Manager for the Design phase and Environment and Sustainability Manager for the As-Built phase, which encouraged and explored value enhancement opportunities with the team,

  (4) the provision of a set of performance metrics for reporting non-financial and non-tangible project success factors, risks, and outcomes, and

  (5) enabling better knowledge capture and sharing of lessons learnt for benchmarking and continual improvement purposes.
- The specialist nature and independent certification of the IS rating process could save DPTI and the State some governance and due diligence auditing costs on future projects. The ISCA verification process at least provides a better value for money due diligence outcome resulting from the deep and granular benchmarks than traditional auditing.
- The project achieved an independently verified IS Design 'Leading' rating (v1.1) of 76.3 points and 'Leading' As-Built rating of 81.9 points, exceeding the KPI Exceptional score (maximum gain share target) of 66 IS points with significant sustainability outcomes. This is a notable achievement which would not have been attainable from BAU practices and standard DPTI specifications.

The Infrastructure Sustainability Council of Australia (ISCA) launched v2.0 of their rating scheme in late 2018. This version includes new categories covering social and economic themes, and more mature credits and benchmarks rewarding beyond BAU practices and enhancing value for contractors, proponents, asset owners and broader society.

To optimise the value of sustainability and use of IS ratings on future projects, four recommendations are provided for the delivery consortium and ten recommendations are provided for DPTI, as contained in section 5 of this report.

A primary recommendation is made for DPTI to trial ISCA's Planning rating v2.0 on a project in the feasibility/planning phase in addition to mandating ISCA Design and As-Built ratings in future major projects. This is particularly relevant when economic analyses of prospective projects exclude Wider Economic Benefits and the value of social and environmental externalities: ISCA ratings can act as a proxy to inform decision making and help justify new projects. This recommendation is made in conjunction with several other complementary recommendations to encourage innovation and value enhancement on projects during the delivery phase beyond seeking lowest CAPEX solutions.

Abbreviations

Abbreviation	Definition
ALT	Alliance Leadership Team
AMT	Alliance Management Team
BAU	Business As Usual
CAPEX	Capital Expenditure
CER	Computer Equipment Room
CPTED	Crime Prevention Through Environment Design
DPTI	Department of Planning, Transport and Infrastructure
EPD	Environmental Product Disclosure
FTE	Full time equivalent
GAP	Glenelg Adelaide Park Lands
IS	Infrastructure Sustainability
ISCA	Infrastructure Sustainability Council of Australia
KPI	Key Performance Indicator
KRA	Key Result Area
MCOS	Minimum Conditions of Satisfaction
OPEX	Operational Expenditure
PAA	Project Alliance Agreement
PSTR	Project Scope and Technical Requirements
RAP	Reclaimed Asphalt Pavement
SDG	Sustainable Development Goals
T2T	Torrens to Torrens
WEB	Wider Economic Benefits
WPW	Water Proofing the West

CONTENTS

1.0 Introduction

Federal and state governments are increasingly recognising that the planning, design, construction and operation of transport infrastructure assets can have significant wider economic, environmental and social impacts and benefits than those associated with the direct scope of a project. Furthermore, they can also contribute to enabling a range of other government policies and commitments in addition to the delivery of resilient physical assets (refer Box 1). While some policies include explicit commitments, many allude to holistic management outcomes which enable business, community and environmental outcomes to better align to a sustainable development agenda without a practical means to achieve them within a contracting environment. Linking these policies and opportunities in a practical sense within competitive contract environments and project specifications of major projects is difficult and generally has not been done well to-date in any state or territory within Australia.

Box 1: Federal and State Policy Drivers

Federal

- United Nations Sustainable Development Goals (Australia became a signatory in 2017)
- Paris Agreement on Climate Change (Australia ratified in 2016)
- Infrastructure Australia's Business Case Assessment Framework

South Australia

- South Australian Strategic Plan
- SA Sustainable Procurement Guideline
- SA Industry Participation Policy
- Principles of Better Together
- SA Workforce Participation Policy
- SA's Climate Change Strategy – 2015 – 2025
- Carbon Neutral Adelaide
- SA Steel Procurement Policy

Evidence from a Transport for NSW[1] study has also recently indicated a positive link between the application of sustainability rating schemes and increased economic value of a greenfield public transport infrastructure assets over their intended lifetime. In short, the Transport for NSW study developed an economic evaluation method which included life cycle costs (CAPEX and OPEX), Wider Economic Benefits (WEB) and monetised externalities (social and environmental). The assessment using this method calculated a 42% reduction in the Net Present Value of the asset over 50 years using the highest rating level of a recognised NSW specific sustainability rating scheme. This compared to a 0.03% reduction if traditional economic analysis methods were used for the same asset. This disconnect in failing to value externalities in project planning and delivery was shown to undermine the effectiveness of sustainability ratings to facilitate decision making for whole of life economic, industry community and environmental outcomes.

2.0 Background

2.1 IS Rating Scheme

The Infrastructure Sustainability Council of Australia (ISCA) is a member based not-for-profit national industry association formed to improve the productivity of Industry and the liveability of communities (including natural ecosystems). This is made possible through the third party assured IS rating scheme, capability building and building a strong community of practice and thought leadership. CPB Contractors has been a founding member since 2008.

The key purpose of the IS rating scheme is to *measure and report whole of life* ***sustainability performance*** *and drive* ***better infrastructure outcomes*** *benefiting communities and industry.* As at

[1] Transport for NSW (2016) Triple Bottom Line Evaluation: Sustainable Design Guidelines Version 4.0. Edmondson Park Interchange Case Study

October 2018[2], 79 infrastructure assets (mostly transport related) valued at $82b have been certified or have registered for IS ratings in Australia and New Zealand. Four rating types will be provided under IS ver2.0 which was launched in August 2018: Planning, Design, As-Built and Operations. Ver2.0 will also include major upgrades and new categories to provide a more inclusive range of governance, economic, social and environmental themes aligned to accepted definitions of sustainable development (refer Figure 1) in comparison to ver1.1. It is anticipated that IS ver2 will reduce the reporting burden by projects by encouraging more targeted evidence. Note that T2T was registered to v1.1 and received a certified 'Leading' Design rating in early 2017.

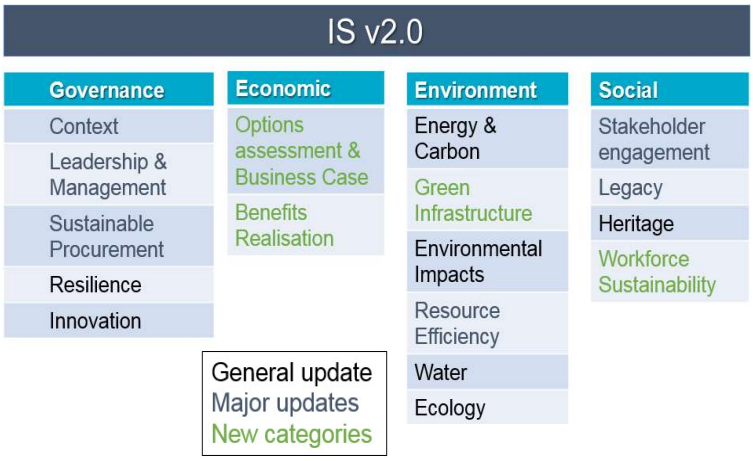

Figure 1: IS ver2.0 Category Overview

The key premise of the IS rating scheme is to encourage and reward project outcomes exceeding the legal minima and business-as-usual (BAU) according to pre-identified best practice benchmarks within each category. It is a points based system whereby points are allocated on materially relevant issues specific to the project according to three beyond BAU tiers, with more points being awarded for regenerative/ enhancement outcomes than measurement and no net impact outcomes.

Beyond the practical roadmap that IS provides industry in creating whole of life value, the IS rating process also:

- Operationalises the myriad of government economic, governance, social and environmental policies and commitments alluded to in the previous section,
- Provides a robust, transparent and auditable governance tool,
- Enables projects to track and report on their sustainability performance,
- Have their non-financial measures of project success and value creation benchmarked against other Australia and NZ infrastructure projects, and
- Enables continual improvement in the industry by capturing data, measuring delivery and operational performance and benefits over time, and linking these learnings back to the planning phase of future projects.

These collective benefits are understood to be the primary reason why the NSW Department of Planning[3], Transport for NSW[4], WA Main Roads[5], VicRoads[6], and the Queensland Department of Transport and Main Roads[7] have been including verified 'Excellent' IS ratings as a condition of approval

[2] www.isca.org.au
[3] Page 18 of https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/critical-state-significant-infrastructure-standard-secretarys-environmental-assessment-requirements-SEARs-2015-12.ashx
[4] https://www.transport.nsw.gov.au/industry/doing-business-transport/sustainability-at-transport
[5] https://www.mainroads.wa.gov.au/AboutMainRoads/AboutUs/Sustainability/Pages/governance.aspx
[6] 2016-2017 Annual report page 31 stated "*Our commitment to leadership took a significant step forward with VicRoads joining the Infrastructure Sustainability Council of Australia (ISCA), with a commitment a commitment to begin accreditation of all projects over $50 million.*"
[7] Extract from State Infrastructure Plan page 35 https://www.dsdmip.qld.gov.au/resources/plan/sip/sip-part-b2.pdf

or contract requirement for new major infrastructure projects valued over certain thresholds e.g. $50m or $100m.

2.2 Torrens Road to Torrens River Project

The Torrens Road to River Torrens Project will deliver a 5km non-stop roadway (incorporating a 4 km lowered motorway) along South Road between Torrensville and Croydon Park, providing significant travel time saving to commuters and freight.[8] The lowered non-stop motorway will provide three lanes in each direction, up to 8 metres below the existing surface of South Road.

The T2T Project was jointly funded by The Australian and South Australian Governments, both committing $400.5 million towards the project. The project commenced in 2015 and was opened to traffic in late 2018. The T2T project was delivered using an Alliance contract comprising partners CPB Contractors, York Civil, Aurecon Australia and the SA Department of Planning, Transport and Infrastructure (DPTI).

Other components of the project scope comprised:

- Parallel surface (at-grade) roads along the length of the lowered motorway to connect most local roads and arterial roads to South Road
- An overpass of the Outer Harbor railway line
- 5 intersection upgrades
- Service relocations, and three stormwater pump stations
- Improved cycling and pedestrian facilities
- Landscaping and noise barriers (where required)

3.0 Benefits of Implementing Sustainability on T2T

The adoption of the IS rating scheme by the T2T Alliance has generated several project sustainability outcomes and benefits which would not have been realised solely by complying with explicit contract requirements or DPTI technical specifications. These include measurable and direct financial costs and benefits as well as a range of indirect, non-financial and non-tangible outcomes and benefits. These are described below.

3.1 Monetised Costs and Benefits

The costs and benefits of engineering and management outcomes directly resulting from the use of the IS Rating tool on T2T beyond contract requirements and DPTI specifications have been monetised. A summary of the nature of these costs and are summarised in Tables 1 and 2 respectively and discussed in greater detail below. Specific financial references have been removed from this public version for confidentiality reasons.

[8] http://www.t2talliance.com.au

3.1.1 Delivery Phase Costs and Benefits

Table 1: Summary of Costs Incurred from Implementing the IS Rating Tool on T2T (and beyond current practice or standard DPTI Contract Requirements)

Cost Activity	***Cost Description***
IS Rating Registration Fees	Registration, Support and Verification fees payable directly to ISCA for Design and As-Built verifications based on $801m capital cost of project including scope extension. No additional costs were incurred relating to Dispute Fees, Additional Support Fees, additional Face to Face Verification Meetings or Innovation Challenges. It is noted that CPB's ISCA membership resulted in registration fee savings in order of $5k, though a further saving of $10k would have resulted if all Alliance partners were ISCA members. Further discounts in the order of $2k would have also been realised for ISCA training fees and Conference fees.
Sustainability Staff Overheads	Outturn costs of Sustainability Manager and Advisors during delivery (IS Design and IS As-Built) phase for managing and preparing the IS Design and As-Built rating submissions over a 46-month period (May15 to Feb19). Opportunities identified for reducing these costs on future projects are described in Section 4.1.
Other Specialist Support	An external resource was procured to support ISCA submission activities and documentation for credits Was-3 Deconstruction plan, Using Resources credits (Energy/carbon, Materials and Water), Eco-3 biodiversity management plan, and Cli-1 climate change assessment. Opportunities identified for reducing these costs on future projects are described in Section 4.1.
Sustainability Initiative Implementation Costs	For initiatives beyond contract requirements and driven by ISCA benchmarks: a rainwater tank for CER, and the supply and installation of possum nest boxes. The capital costs for initiatives which have resulted in construction or operational phase savings are captured in Table 2.

Table 2: Summary of Monetised Direct Capital and Operating Savings Derived from the IS Rating Tool and would not have occurred because of BAU or DPTI contract requirements on T2T

Savings Activity	***Savings Description***
Use of recycled water	Savings during construction delivery phase and projected savings during operations phase associated with using recycled water rather than potable water. Refer Appendix A1 for details.
Noise wall modifications	Material savings associated with modifying the size and location of permanent noise walls resulting from CPTED risk assessment during the design phase without impacting operational noise impacts. Refer Appendix A2 for details.
Total CAPEX Savings $128,973, Total OPEX Savings $839,676	

3.1.2 Key Result Area

The Project Alliance Agreement (PAA) nominated performance pain/gain incentives for a range of non-cost related Key Result Areas (KRAs). Pain/gain incentives are mechanisms by which the KPIs are monetarily incentivised: falling below contractual requirement results in a monetary penalty, meeting contractual requirement is considered minimum acceptable performance, and achieving beyond contractual requirements results in a monetary bonus. The KRAs which had nominated pain/gain incentives included KRA 3- Relationships with Key Stakeholders, KRA 4 Sustainability and KRA 5 Workforce and Industry Participation. The Key Performance Indicators (KPI) related to KRA 4

Sustainability directly relate to the achievement of verified ISCA Design and As-Built ratings as illustrated in Table 3.

Table 3: KRA 4 Sustainability Performance Scores

KPI	***Fail (-100% pain share)***	***MCOS***	***Exceptional (+100% gain share)***
IS Design Stage Rating (33% weighting)	30 IS points	50 IS points	66 IS points#
IS As-Built Stage Rating (67% weighting)	30 IS points	50 IS points	66 IS points#

original PAA KRA +100% gain share spectrum was 80 points, though was renegotiated during the Design Phase at the Alliance team's request.

It is noted that the Alliance achieved a verified 'Leading' IS Design Rating of 76.3 IS points and 'Leading' IS As-Built Rating of 81.9 points. This exceeds the Exceptional performance score of 66 IS points entitles the delivery partners the full value of the KRA pool available.

It is also recognised that whilst these KRA pools are a cost incurred by the State and a financial benefit provided to the delivery consortium, several team members have indicated the KPI's provided significant motivation for the delivery team to achieve the Exceptional KRA performance outcomes and subsequent IS rating benchmarks, particularly where no direct costs or delays to program were incurred. The KRA financial pool was available to be used under certain circumstances to influence decision making by providing an alternate source of funding to be spent in areas which would normally not be supported under the budget funding. This allowed money to be spent to improve sustainability outcomes and in doing so improved performance in the defined KRAs, which are defined to be value for money, while also improving consortium returns and long term OPEX savings.

3.1.3 DPTI Governance Costs

It is recognised that the State incurs a variety of costs conducting a range of due diligence and self-governance checks to validate commitments and progress statements being reported. The outcomes of these due diligence checks are understood to be presented to DPTI Directors, State Ministers, and in the case where funding is provided by the Federal Government, to the Commonwealth Attorney General. ISCA verifications offer a credible and independent appraisal of a range of detailed governance, social, environmental, economic and innovation/continual improvement factors specifically related to infrastructure delivery. It is surmised that a greater adoption of ISCA verification reports could not only reduce these due diligence and governance costs incurred by the State, but also provide a more targeted and granular set of benchmarks with which to audit against.

3.2 Non-Monetised Benefits

This section describes a range of non-financial benefits from using the ISCA rating scheme on T2T. These benefits have been screened to only capture benefits to the project and its stakeholders which may not have occurred from undertaking contractual or BAU practices, or would have only occurred to a limited extent from contractual or BAU practices.

In short, these benefits included:

1. IS rating process influencing the decision-making culture of the delivery team to consider project success factors and risks beyond cost, budget, quality and safety,

2. Increased education and practical understanding of infrastructure sustainability with Design and Construction team members,
3. Appointing a sustainability champion through the role of Sustainability Manager as per Man-3 credit, to encourage and explore value enhancement opportunities,
4. Providing a set of performance metrics for reporting non-financial and non-tangible project success factors, risks, and outcomes,
5. Enabling better knowledge capture and sharing of lessons learnt for benchmarking and continual improvement purposes,
6. Other non-financial outcomes beyond the project agreement, PSTR and BAU practice, as per Section 3.2.6 of this report.

Each benefit will be discussed further in the sections below and will be framed in the context of recent research findings of what generates shareholder returns for construction companies. These research findings have been illustrated as a value flow framework in Figure 2, and illustrate the drivers of value creation for contractors at a project and organisational level from sustainability outcomes encouraged by ISCA.

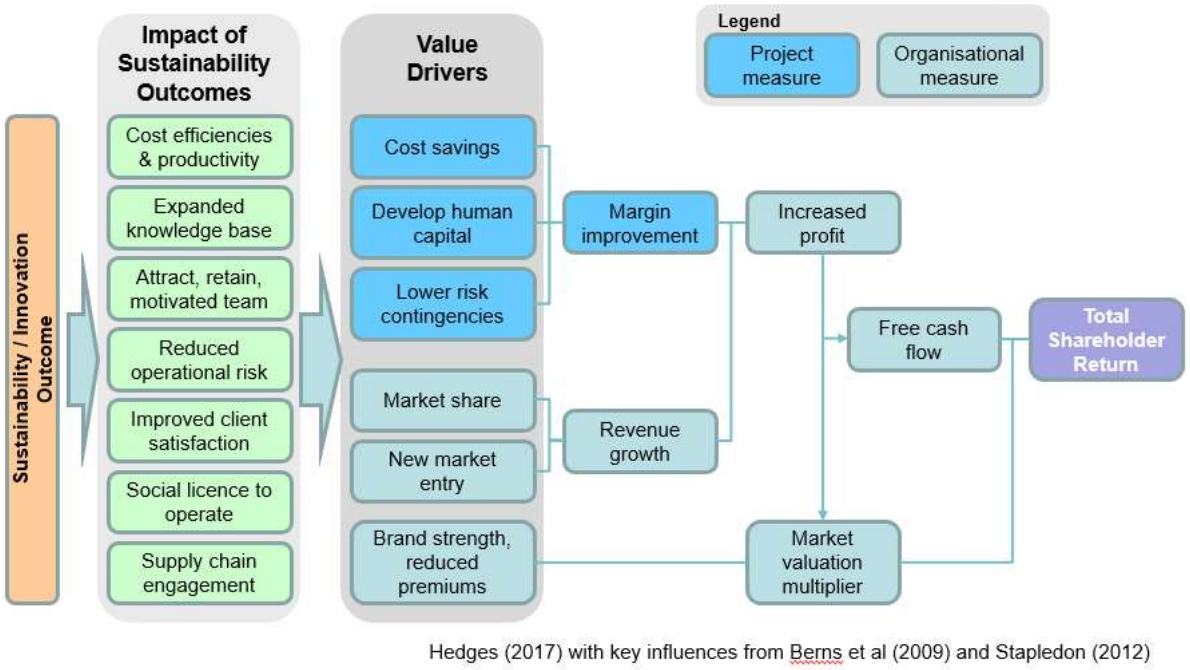

Figure 2: Value Flow Framework for Construction Companies

This framework nominates several business improvement mechanisms and value drivers that can generate free cash flow (via margin improvements and increased revenue) in the short and long term, influence market valuations, and ultimately create returns for construction company shareholders in addition to contributing to a broader sustainable development agenda. The business improvement found applicable to construction companies include cost efficiencies/productivity, intellectual capital, human capital, reducing operational risks, client satisfaction, social licence to operate, and supply chain engagement.

3.2.1 Non-Financial Benefit #1: IS rating process influenced the decision-making culture of the delivery team to consider project success factors and risks beyond cost, program, quality and safety

Evidence exists of sustainability factors being considered in decision making where it was not required by the project agreement, PSTR or short-term interest of the delivery consortium and would arguably not have been included or their influence not as great as a business-as-usual activity. These factors included impacts to the community, Whole of Life cost outcomes, and environmental impacts. Examples include:

- Value engineering studies: the project used a multi-criteria approach which excluded cost as a weighted criteria and instead calculated a value ratio as a function of cost. Criteria used in the evaluation of value included a range of environmental (biodiversity, carbon sequestration), social (including road safety, crime prevention through environmental design (CPTED), and 'sense of place'), and whole of life economic factors (including maintenance costs). This approach to value engineering was adopted for a number of significant design issues when deciding between options for the Torrens Road grade separation, trees in verges and spoil management.
- Design review process: increased awareness of infrastructure sustainability by reviewers, the Design Manager and Sustainability Manager led to design reviews incorporating greater scrutiny of sustainability related risks and opportunities which were identified and discussed with design leads throughout the formal design review process. This increased awareness and scrutiny resulted in several conversations where CPTED, material and operational energy reduction options were considered in greater depth than BAU in addition to ensuring that minimum sustainability requirements in the PAA were being complied with in the most efficient way possible.
- Procurement evaluations: the procurement team adopted a multi-criteria assessment process for all supply chain contracts which included a 30% non-cost weighting which included environment, sustainability, safety and quality. Furthermore, 25% of the commercial weighting comprised local industry participation and workforce participation (training, disadvantaged and diversity) assessment criteria. These evaluation practices commenced before the CIMIC Group enacted its Procurement Policy in September 2016 which included a 30% weighting of non-cost criteria and exceeded ISCA's benchmark non-cost criteria weighting of 20%.
- Risk assessments at site and activity level: the targeting of various ISCA benchmarks and credits relating to environmental discharges, CPTED, and community/stakeholder engagement provided additional justification for construction and functional managers to ensure that risk assessments undertaken by subcontractors and work teams had sufficiently identified and mitigated against environmental and social risks, and sought to take advantage of opportunities when they were presented.

3.2.2 Non-Financial Benefit #2: Increase education and practical understanding of infrastructure sustainability in delivery team members

A range of education and awareness activities were undertaken on the project including a briefing and workshop with senior members by ISCA's Technical Director early in the project, tool box talks, regular communications of sustainability issues in prestart briefings, and one on one conversations with team members by the Sustainability team throughout the project. These were also complimented by regular reviews by the project's advisory Independent Sustainability Professional (a function encouraged by IS rating credit Man-3) who shared knowledge and learnings from other projects, recommended

approaches for increasing the integration of sustainability with the team, provided mentoring to the sustainability team, and advised on IS submission strategies.

These collective efforts led to some members of the team acting as sustainability advocates coming forward with prospective sustainability ideas and initiatives beyond BAU which the sustainability manager would have been less likely to identify on their own, such as:

- Temporary site lighting options with LED lights were nominated by engineers and used on rail embankment works, resulting in some minor fuel and emission savings.
- Engineers nominated a concrete waterproofing product (Xypex) which possessed an Environmental Product Disclosure (EPD) statement in the pump well under the lowered road. This saved costs and improved durability in comparison to traditional waterproofing and is relevant to the IS material credit Mat-2.
- The project team exhibited good office waste recycling and minimisation and site cleanliness behaviours using the comingled, green and general waste bins provided in the main office and satellite offices. These behaviours and resulting waste diversion statistics are expected the project to achieve full points available in the as-built waste credit Was-2.
- After the completion and commissioning of the Computer Equipment Room (CER), a DPTI engineer prepared a business case and succeeded in getting approval to install a small array of solar panels on the CER roof. This PV array is expected to have a positive impact on operational energy demand from the CER having a remarkably short return on investment period.

The effectiveness of these training and awareness events was not evaluated formally on the project, though anecdotal evidence suggests that some members of the design, commercial and construction teams were aware of the IS rating targets and sustainability requirements in the PAA early in the delivery phase. This evidence includes:

- The inclusion of sustainability feedback in design reviews beyond those provided by the Sustainability Manager,
- The early development of a new procedure by the Commercial Manager to accurately capture material purchases from suppliers (i.e. use of sub-ledgers in existing accounting software) and save a significant amount of time in data collection efforts.
- Improved CPTED awareness in design and construction teams, and
- 25% fly ash substitution for cement in several applications including some bridge decks, stormwater pump stations, fascia panels, barriers, abutments, parapets, Croydon station platform and L walls, retaining walls, underpass slabs and footings.

In preparing this report some members of the project team have noted that the visibility and reinforcement of sustainability and innovation by the ALT and senior members of the delivery team could be improved with more discussion on non-traditional issues such as sustainability rather than BAU components such as productivity & cost. Overall there exists an opportunity for improvement on future projects to increase education, awareness and culture outcomes within delivery teams which can subsequently unlock other value creation opportunities.

It is also noted that many Alliance representatives (design, construction and DPTI staff) were new to the IS rating process and sustainability concepts and so had limited appreciation to support or advocate sustainability outcomes beyond BAU. Indeed, in some instances, some members of the Alliance team were either unsure how best to derive value from the sustainability agenda or formed early opinions of

the sustainability agenda which limited their effectiveness. These perspectives may have undermined the overall intent of the ISCA KPI to create value from sustainability or measure the sustainability impacts of the project for future benchmarking or continual improvement purposes. Nonetheless, it has been noted on other non-DPTI projects that a client's understanding and advocacy of sustainability / the IS rating process has a positive influence on delivery team attitudes and decision-making cultures.

Being a new rating scheme with concepts that are non-traditional in the construction industry, it is understandable that the knowledge base for project participants was low, including the perception of how much value the IS rating process was adding to the project. The absence of a framework for developing clear business case for sustainability until recently (refer Figure 2) has hindered attempts to prepare a counter argument to this perception. Reasons which were commonly encountered which may have contributed to low value perspectives of IS rating process included:

- IS rating benchmarks reward projects for achieving outcomes which are not core areas of project delivery (such as community participation in decision making, ecology improvements in or around the project, ensuring temporary works are suitable planned to mitigate CPTED risks in addition to public safety risks, and improving local supply chain capabilities);
- IS rating process-driven assessments, if not carried out suitably early (some prior to the tendering phase), can be perceived to have been done to achieve IS rating compliance rather than to drive meaningful outcomes such as contribute to the design of the asset;
- IS rating process related elements would incur additional impost on the project with no obvious short-term benefits to budget, program, or safety (such as green site offices, or procurement of reinforced geopolymer concrete pipes shipped in from Melbourne);
- Collection of data which cannot be compared to existing benchmarking databases (e.g. water consumption activities during construction, waste generation and recycling).

Some of these reasons are preventable, such as preparing assessments with sufficient lead in time to inform decision making. In this instance, it is incumbent on project decision makers and the Sustainability Manager to be communicating sufficiently to plan these activities accordingly.

3.2.3 Non-Financial Benefit #3: Appointed a Sustainability champion to encourage and explore value enhancement opportunities

The appointment of a Sustainability Manager was a contract requirement whose role was largely related to administering the IS Rating process and preparing the rating submissions on behalf of the delivery team. Another implicit function of this role was to encourage the team to identify and act on improvement opportunities resulting in sustainability benefits as well as improve productivity, reduce costs and risks, seek positive legacies for DPTI and local communities, and mitigate reputational harm to the SA Government during the delivery phase. This is unlike most project appointments where team size and selection is based on optimising construction with little to no allowance for 'blue sky thinking' around the feasibility or implementation of new ideas or technologies.

The success of a sustainability manager on a project is arguably down to these factors:

- Technical knowledge of IS rating process and sustainability principles, their application on construction projects and imparting this knowledge on those who have the ability to influence most;
- Knowledge of engineering technologies, processes, and project management practices;
- Technical writing ability in preparing IS rating submissions;

- Ability to integrate into and influence the team and relate sustainability into every day actions of the delivery team at all levels (and so influence decision making and enable all the team to be sustainability advocates).
- Being provided sufficient time and support on the project and deciding where best to focus energy (i.e. “pick your battles”, noting best value usually occurs in design phase).

The profession of a sustainability manager is a relatively new one in the construction sector and so the pool of experienced people to fulfil these skill and knowledge sets are limited. Nonetheless, T2T employed a capable and proactive Sustainability Manager during the design phase who undertook substantial on-the-job training to fulfil the role and enabled several positive outcomes which would not have been achieved without the role. This position led to several outcomes beyond BAU and included facilitating the team to receive a ‘Leading’ IS Design rating of 76.3 points and a ‘Leading’ IS As-Built rating of 81.9 points in addition to:

- The cost saving outcomes noted in section 3.1 above, and
- Contributing to making other initiatives and benefits occur as listed in this section.

During the construction phase, the role was reduced to a shared role with the environment team with the role focussing on data collection and preparing the As-Built submissions.

Some project participants noted that having the Sustainability Manager report directly to the Environment Manager during detailed design phase may have influenced team member attitudes relegating sustainability to an environmental compliance function.

3.2.4 Non-Financial Benefit #4: Provided a set of performance metrics for reporting non-financial and non-tangible project success factors, risks, and outcomes

The project reported progress on a monthly basis to Alliance Members using a variety of traditional units of measures (budget, programme, and quality) in addition to other performance measures important to the State in the form of KRAs. The State also nominated financial penalties and incentives against these KRAs comprising community and stakeholder, sustainability, traffic, completions, workforce development, industry participation, and safety. Each KRA was based on a range of quantitative Key Performance Indicators (KPIs) relating to the KRA, such as travel times and community satisfaction. IS rating KPI scores informed the Sustainability KRA.

Whilst these KRAs and KPIs provided some attempt to measure non-traditional units of project performance, it must be recognised that there is no general consensus on a complete range of measures defining project success by industry or academia[9]. It is difficult to nominate several measures of project success recognised as important for the general industry, government agencies and society beyond the selected KRAs such as team culture, contribution to innovation, knowledge sharing, supply chain capacity building, asset resilience to future climates, biodiversity, heritage, and whole of life resource commitments to maintain the asset. Requests for data and metrics associated with these factors are noted as increasingly being requested by other government agencies in reporting against State policies as listed in Box 1, the United Nations Sustainable Development Goals, and Zero Carbon Adelaide targets.

[9] Hedges, G. (2017). *Developing a business case for sustainability in the construction industry.* Masters by Research thesis, Queensland University of Technology.

The IS rating framework used by the project (ver1.1) acted as a quantitative proxy for a collective of these non-traditional units of measure which have not been captured in an existing KRA or in commonly accepted industry reporting metrics. Furthermore, the IS rating scorecard and resultant evidence used to create the IS rating submission summarised performance on each singular issue on a simple scale (levels 0-3) as well as providing details which would normally not be captured or condensed into an easily digested format or explanation. For example, IS rating credit Mat-1 at its simplest measures the material footprint of the project based on planned and then actual quantities of materially relevant resources such as concrete, steel, timber, asphalt, aggregate and plastic pipe. More points are awarded in this credit for comparing the actual quantities with a base case reference design and achieving improvements. While Mat-1 yields an aggregate % reduction in materials for the entire project, it is built on individual components which are quantified. These components can yield all sorts of interesting data, including material reduction data needed to quantify benefits of improvements such as the soil nail retention wall solution adopted on T2T which was used in case studies, technical articles, and other knowledge sharing documents. Obtaining this type of data on a non-IS-rated project could be quite problematic unless systems were established early in the project with the explicit task of data capture and analysis (which rarely occurs). Hence another value add of applying the IS rating process is its standardised approach to capturing useful non-traditional data sets.

It must be noted that the release of IS rating ver2.0 is anticipated to improve the maturity and value of performance measures which can accelerate continual improvement efforts by DPTI and the broader construction industry. These were discussed in section 2.

3.2.5 Non-Financial Benefit #5: Enabled better knowledge capture and sharing of lessons learnt for continual improvement purposes

The capture and sharing of explicit and formal knowledge sharing in the construction industry is uncommon and usually relies on tacit knowledge retained by individuals resulting from the exploration and execution of project specific tasks[10]. ISCA encourages and rewards projects which capture and share explicit and formal knowledge into, within and outside of the project. Discussions with project team members have indicated that whilst some explicit knowledge capture and sharing would have occurred regardless of the IS rating process, it nonetheless contributed to the motivation of authors preparing the material.

Examples of knowledge capture and sharing on T2T which was driven or partially motivated by the IS rating process, include:

- An Information Sheet created by T2T and shared amongst the team and parent companies ‘Use of JDE Sub-Ledgers to Track Actual Material Quantities’. The method described has since been adopted by other CPB projects to improve data capture efficiencies.
- Regular sustainability knowledge share online forums run by CPB Contractors and including practical case studies on Dustex dust suppression, IS rating submission preparation experiences, and renewable remote power solutions deployed on other projects.
- A T2T compiled Case Study on GRT Wet-Loc waterless dust suppressant trialled on the Princess Street carpark and distributed amongst Alliance members.
- A presentation by the T2T Sustainability Manager to a 2 day ISCA run training course on experiences, pitfalls and learnings from the use of the IS rating process on T2T, including

[10] Loosemore, M. 2014, ‘Innovate or Perish? Exploring some of the Myths of Construction Innovation’, *Australasian Journal of Construction Economics and Building Conference Series,* **2**(2), 44-55.

learnings on team engagement, technical examples of initiatives, and influencing sustainability in decision making.

- The release of a DPTI specification on geopolymer concrete early in the project was investigated though could not be implementation on the project due to supply chain limitations and cartage costs from Melbourne in the case of precast reinforced geopolymer concrete pipes. A lessons learnt workshop was facilitated to understand the barriers to implementation, the outcomes which were documented and shared to Alliance members.
- The efficient capture of some data types required for some IS rating credits has enabled more detailed learnings to be captured for other case studies, technical reports and Conference papers, such as the soil nail retaining wall design in unsaturated soils, and increased use of RAP in pavement design.
- A presentation on learnings resulting from the implementation of noise attenuation mitigations to Alliance Members, DPTI project managers and environmental officers, other industry professionals and EPA regulators was the catalyst for DPTI updating their Noise Mitigation Manual and Road Traffic Noise Guidelines. The presentation also included the innovative 'property treatment management' app that has been developed and trialled on T2T to manage design, agreements and implementation of house façade treatments and how industry will benefit from it once it is made available. This app enabled developers Resonate to receive a national award from the Association of Australasian Acoustical Consultants.

The final As-Built IS rating submission is also anticipated to generate additional explicit and formal knowledge sharing documents resulting from these and other initiatives and experiences on the project. Many of these could be used by the State and local councils in demonstrating their contribution to a variety of community and sustainability related topics of interest such as biodiversity improvements and monitoring.

3.2.6 Non-Financial Benefit #6: Other non-financial outcomes beyond PAA/BAU

A range of other non-financial benefits were also anticipated to have been driven by a proactive sustainability agenda driven by the IS rating not already described in previous sections:

- Capture of some project data not normally captured nor comparable with existing benchmarking information: water consumption, energy in operations, and material Life Cycle Assessment improvements as illustrated in Box 2.
- Greater consideration of community impacts during construction: the IS rating process led to an increase in CPTED awareness / inspections, light audits at night, inspections looking at pedestrian safety and interruptions to local business from site activities.
- Climate change risk assessment and identification of prospective mitigations in the future.

Box 2: Other T2T Sustainability Highlights

Outcomes achieved (though not driven by ISCA benchmarks) not already described in this report include:

- Adoption of dimmable LED road lighting to save 51% of lighting power during operations,
- Soil nail retaining wall solution saved $20m, 87% concrete, 98% steel, 93% of construction CO2 emissions, and noise impacts to residents in comparison to piled wall solution,
- 25% replacement of cement by fly ash,
- Up to 20% use of recycled aggregate product (RAP) in asphalt,
- 16% reduction in scope 1 and 2 green-house emissions during construction,
- 439kL potable water saving
- Significant savings from diverting 3,312 tonnes general waste from landfill through recycling and generation of Process Engineered Fuel to replace natural gas for Adelaide Brighton cement kilns,
- Diversion of 245,000 tonnes Intermediate Waste classified soil from landfill saving $7.4m,
- Re-use of existing spoil and topsoil for other DPTI projects and manufacture of topsoil using on-site materials.

4.0 T2T Alliance Key Learnings

This section details the key learnings on how T2T was able to maximise value from sustainability, or could have improved its sustainability and value creation performance during the delivery phase associated with sustainability beyond those presented above in earlier sections.

4.1 Sustainability Resourcing and Expenditure Learnings

This section reflects on the resource allocations and expenditure relating to the achievement of PAA / PSTR sustainability requirements and IS rating outcomes in the context of:

1. Having almost completed the project noting how the project naturally progressed, and
2. Resource allocations and expenditure experiences from other CPB projects having gone through the IS rating submission verification process and having to comply with similar sustainability contract requirements and specifications.

4.1.1 Resourcing facts and reflections

- Experienced sustainability resources with construction experience supported the tender team on a part time basis to develop IS rating submission compliant roadmaps, identify and incorporate value enhancements wherever possible to match tender criteria, and contribute to the tender submission.

- An experienced Sustainability Manager from a consulting engineering house (and Alliance Participant) was appointed to the project team at commencement and demobilised when the IS Design rating was submitted.
- The role was subsequently shared during the construction phase by Alliance staff who had other environmental management responsibilities with a dedicated role being assigned nearer the project completion and reporting phase for the IS As-Built rating submission.
- The average resourcing for sustainability staff on CPB projects is illustrated in Figure 3. For projects with a capital value between $500-1000m, a Full Time Equivalent (FTE) between 1-1.2 is typical.

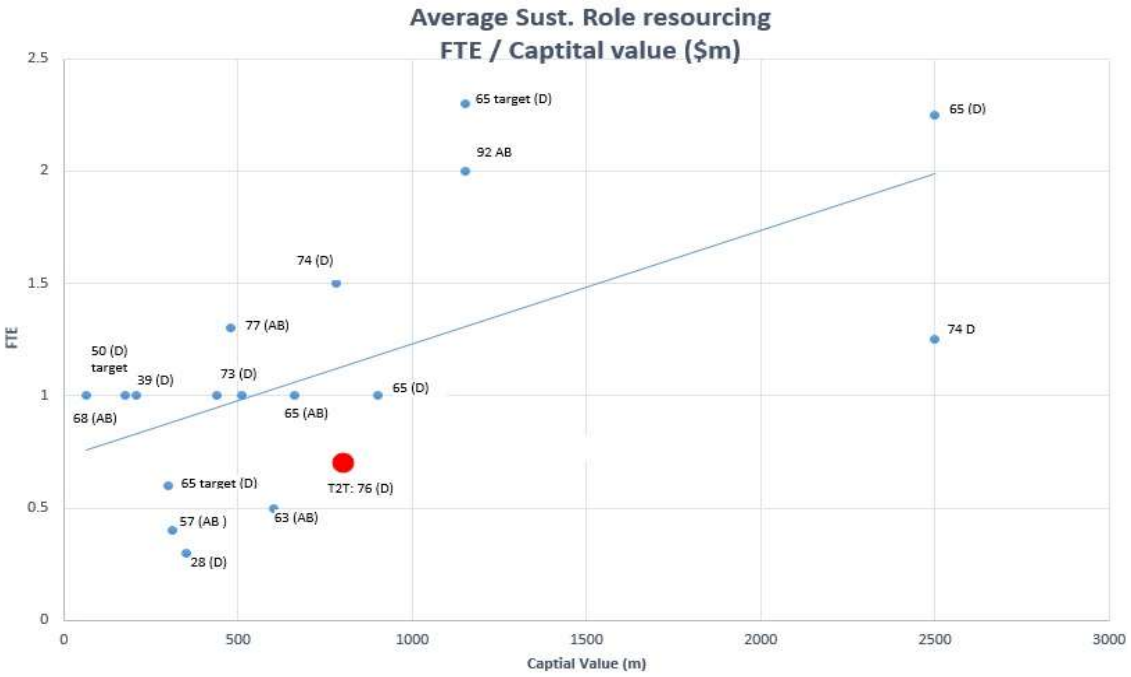

Figure 3: Average Sustainability Role Resourcing and Capital Value of CPB Contractor's Projects (Source: CPB Contractors, 2018. Excludes specialist consultant fees)

- The average FTE for sustainability staff on T2T over the 46-month period (May15 to Feb19) was approximately 0.7.
- It is recognised that the outturn costs for people provided by consulting engineers within the Alliance are higher than outturn costs for people provided by contractors within the Alliance (by a factor of 2-2.5). No experienced sustainability professionals were based in Adelaide by Alliance contractors at project commencement.
- The appointment of a sustainability professional employed by an Alliance contractor would likely have resulted in a reduced outturn cost (if any qualified staff were available) for the equivalent time.

4.1.2 Specialist sustainability support expenditure

- The compilation of a Deconstruction Plan (a document mapping material resource reuse, disposal options and methodologies to assist asset decommissioning or upgrades) by Alliance consultants resulted in T2T being awarded 1.3 points. Despite its sound intent, the value of this document in practical terms for DPTI asset management purposes is limited.

- A spend was incurred for the assessment of climate change risks and mitigations by Alliance consultants. It is noted that the value of this work was limited as it was conducted after many planning and detailed design decisions had been made and when mitigations could have been considered. Nonetheless, it has provided DPTI with a methodology of how climate change risks could be assessed and integrated into decision making on future projects (ideally in the planning phase). It is also CPB's experience that climate change risk assessments undertaken in the detailed design phase can be undertaken in-house and result in minimal additional direct cost for projects.
- Most CPB projects have avoided the need for technical writers to support submission preparation unless additional assistance is needed to meet a submission deadline. With sufficient planning, additional spending can be avoided.
- Most CPB projects seek to compare design and actual quantities of materials, water and energy and measure improvements against a reference design. In the case of T2T, the project sought to use the 5% Design provided at tender, though in doing so had to invest effort and cost in predicting these quantums in sufficient detail enabling a like-for-like comparison. An alternative method of reverse engineering design improvements from actual quantums of materials, energy and water has regularly been used on projects to measure improvements without requiring significant modelling or estimates. This method may allow future projects to reduce or avoid extra direct spending to enable these improvement calculations to be made.
- It is anticipated that by implementing the learnings from this paper earlier in the project life, that additional significant savings could be realised. It is anticipated that had the team the opportunity of implementing the above learnings on this project then additional savings might well have been realised whilst still retaining the Exceptional performance score of above 66 IS points for the KRA.

4.2 General Learnings

- The specification of IS rating outcomes within the contract and incorporation as a KRA with a financial pain/gain arrangement provided the delivery partners a clear objective and motivation for pursuing sustainability outcomes.
- Similarly, the nomination of sustainability requirements in a specific Appendix of the PSTR influences contractor decision making behaviours.
- The integration of these requirements into other components of the PSTR (e.g. energy efficiency requirements included in construction/civil PSTR and Mechanical & Electrical PSTR) was nominated by some disciplines as being beneficial as they had not familiarised themselves with the sustainability PSTR, thinking it would not be relevant to them. This was corrected in several instances by training and awareness which reinforced a message that everyone is responsible for sustainability (just like safety). Providing clear messaging about using sustainability to create value by delivering a project cheaper, faster, better, safer and greener may have assisted.
- It is recognised that T2T was a trial for DPTI in specifying the IS rating process as a contractual requirement. Early efforts to develop a framework and tracking tools to test the success of the trial and effectiveness of the PSTR in achieving DPTI's purpose of the trial has assisted efforts to measure the costs and benefits of implementing IS ratings on T2T.
- Early engagement by the Sustainability Manager with procurement and design teams to identify opportunities and establish efficient data collection methods and responsibilities as what occurred on T2T is considered best practice to maximise opportunities and streamline efforts.

- T2T and other IS rated projects have influenced CPB Contractors to evolve their management systems, procedures, templates, and tools to encourage achievement of IS rating benchmarks. These include templates such as subcontractor tender evaluations and sustainability related responsibilities in design and environmental management processes. The drivers for these evolutions has been based on maximising staff productivity, minimising risks, and sharing knowledge. The adoption of IS ratings on future projects is anticipated to provide motivation for other contractors to do the same.

5.0 Recommendations

5.1 Delivery Consortium Recommendations

The following recommendations are provided for the benefit of delivery consortiums delivering IS ratings on future projects:

R1. Contractors develop and support a pool of talented and experienced sustainability professionals who:

(i) possess good technical knowledge of the IS rating process and sustainability principles and their application on construction projects,

(ii) possess good technical writing and management abilities, and

(iii) can integrate into a delivery team and relate sustainability and innovation into every day actions and decision making where appropriate at all levels.

This is anticipated to reduce staff and IS rating submission preparation and administrative costs to future projects by reducing outsourcing.

R2. Contractors to be encouraged to adopt a culture where sustainability resources are integrated into the team to avoid the perception they are administrators of a rating submission disconnected from project delivery priorities and outcomes. As the value flow framework for contractors in Figure 2 illustrates, sustainability can be used to generate business value at the project and organisational level.

R3. The delivery team continue to take a proactive approach in responding to clients' sustainability requirements and agendas by involving a suitably experienced sustainability manager early in tender phase and on project award. This should involve road mapping IS rating process credits and onboarding the project team to achieve client requirements at the lowest cost.

R4. The collective experience of CPB sustainability professionals preparing IS rating submissions has yielded some suggestions for optimising efforts on future projects:

(i) develop a roadmap of target and aspirational credits,

(ii) outline a strategy for achieving each credit within the Credit Summary Form including responsibilities, actions and evidence,

(iii) champion opportunities and monitor progress,

(iv) report progress to senior management as a heat map of IS points based on probability to achieve and a function of contract requirements,

(v) prepare credit submissions on an ongoing basis, and

(vi) obtain peer reviews of credit submissions progressively.

5.2 DPTI Recommendations

This trial of mandating IS ratings as a mandatory requirement on a major project has noted some success in creating a range of financial and non-financial benefits which creates value for the State in the short and longer term. In particular, the selection of IS ratings as KPIs for a collective Key Result Area has had success in driving contractor decision making behaviours beyond cost, programme, quality and safety. To optimise the value of sustainability and use of IS ratings, the following recommendations are provided for DPTI and the State:

R5. DPTI to learn from Transport for NSW's experience in the incorporation of Wider Economic Benefits and cost of externalities in developing more informed business cases for selecting and scoping future projects in the feasibility/planning phase.

R6. DPTI to trial the IS Planning rating ver2.0 on a project in the feasibility/planning phase to better inform decision making and identify linkages with other government policies (and hence improve the cost benefit ratio of projects and contribute to achieving government policies more effectively). Transport for NSW and Main Roads WA are currently trialling Planning rating v2 on projects in the planning phase. The adoption of IS Planning rating ver2.0 will also enable the efficient provision of evidence for future v2 Design and As-Built ratings which rely on proponent decisions and evidence (noting that IS ratings are asset based, not stakeholder or phase based).

R7. DPTI to continue specifying IS Design/As-Built ratings for new projects. Furthermore, DPTI is recommended to trial IS rating ver2.0 consistent with road agencies in WA, Qld, NSW and Victoria as:

(i) a quantitative proxy for projects to measure and report progress on a range of project success, risk, and impact measures beyond cost, programme, quality and safety;

(ii) a framework to incentivise innovations which create value for the project and/or leave positive industry legacies to benefit future projects; and

(iii) a mechanism to reduce costs to the State in governance and due diligence audits of projects.

Noting that new projects can now register to v2.0 and there is some increased complexity and scope of IS rating v2.0 in comparison to v1.2, 60 points (Gold rating) is recommended to be adopted initially as a minimum rating requirement for future major transport projects using v2.0.

R8. DPTI to assist contractors integrate sustainability into decision making by integrating sustainability requirements into respective functional PSTR specifications rather than / in addition to a separate PSTR specification to maximise understanding and adoption by functional design leads and managers.

R9. Increased visibility of interest by DPTI for sustainability on projects is recommended.

R10. DPTI's investment in an organisational membership of ISCA will likely yield a direct payback based on discounts received from project registrations, training and conference attendance. This is particularly the case if DPTI register projects directly with ISCA on behalf of contractors to reduce registration costs.

R11. Consistent with other State government agencies outside SA, DPTI is recommended to mandate an experienced Sustainability Manager in future major project contracts for the duration of the project which is separate to the Environmental Manager with a description of role expectations (refer to suggestions in section 3.1 Non-Financial Benefit #3).

R12. No evidence was located to evidence DPTI promoting the 'Leading' IS Design rating awarded nor the highlights of what the achievements were (though a link was provided to the T2T website). Consistent with organisational theory and current best practice, DPTI are recommended to celebrate success as part of encouraging a culture of innovation and achievement of performance to key outcomes areas for DPTI.

R13. The value of assessing climate change risks and mitigations by Alliance consultants was significantly diminished as it was conducted after many planning and detailed design decisions had been made. On that basis DPTI should undertake Climate Change Risk Assessments during the planning phase with a Contractor review required early in detailed design to ensure whole of asset risks are identified and appropriate mitigations included in the scope of tenders. The assessment report has nonetheless provided DPTI with a methodology of how climate change risks could be assessed and integrated into decision making on future projects.

R14. The use of painshare/gainshare incentives for sustainability using the IS rating scheme as the KPI positively influenced Contractor behaviour on T2T. The provision of painshare/gainshare arrangements on future projects is recommended.

Appendix A

Appendix A1 Recycled Water Initiative

The use of potable water from mains utilities is considered business as usual for all construction (dust suppression, soil conditioning, landscape establishment, and sucker trucks) and operational uses (landscape maintenance).

Construction phase

The nearest (non-road reserve) standpipes for water carts and sucker trucks to readily access potable mains utilities was adjacent the project's West Thebarton compound near the southern end of the project. At the time of tender (pre-July 2015), the closer access points to the Glenelg Adelaide Park Lands (GAP) recycled water (treated sewage effluent) network was too far away (uneconomic turnaround times) and also incapable of meeting the project's water demands.

During the delivery phase, two sources of recycled water were identified by the project's Sustainability Manager of which one was eventually adopted as a water source during construction:

- In early 2017, improved capacities and extension of the GAP pipeline to Brompton warranted re-evaluation of the source, but the proposed standpipe locations indicated difficulties of access; this and, to a lesser extent, a perception of poorer water quality due to its source, were primary reasons for not pursuing this option.
- Extensions of stormwater harvesting networks associated with the City of Charles Sturt's Water Proofing the West (WPW) became available, including one at Toogood Avenue in Beverly (approx. 4km from the Port Road intersection). This enabled non-potable recycled stormwater to be used by the project from May 2017 up until July 2018.

The project scope also includes a three-year landscape maintenance period post practical completion (nominally April 2019). The T2T scope involves the installation of an irrigation drip system in the constructed basins and parks. This will be connected to potable water utilities during the maintenance period. Water carts provided by landscaping subcontractors during this maintenance period are expected to source recycled water from WPW standpipe in Beverly for hand watering needs.

The construction phase cost comparison was between BAU Scenario (100% potable water use based on total actual water used to-date plus forecast for remainder of project) vs Actual Scenario (100% potable, then progressive partial replacement over time when non-potable sources would be used based on total actual water used up to October 2018). A forecast of projected water use by the construction team beyond October 2018 to Practical Completion has not been included.

A minor direct saving was achieved by the T2T Alliance during the delivery phase by switching to recycled water sources after financing the setup of a suitable standpipe. Savings were primarily attributable to a lower supply cost of recycled water. The methodology used to calculate these savings is shown in Table A1.

Table A1: Cost Comparison Methodology: Construction Phase

BAU Scenario: 100% Potable Water		**Actual Scenario: Potable plus Recycled Water**	
Total Actual Quantity of Water: Dust suppression, soil conditioning, site office/amenities, vactrucks, road clean-up and misc, and excluding landscape establishment.	120 ML	Potable Water Quantity WPW Non-Potable Water Quantity Total Quantity	111.8 ML 8.2 ML 120 ML
Total estimated quantity of water for landscape establishment 3yrs post Practical Completion (April 2019)	485 ML	80% potable (reticulated) 20% WPW non-potable (tanker)	68 ML 17 ML
Supply Cost from Standpipe $3.36/kL (120 ML + 85 ML = 205 ML)	$ 6888,800	Potable $3.36/kL WPW $2.50/kL Total Supply Costs	$ 604,464 $ 63,000 $ 667,464
Standpipe establishment fees	$ 3,000	Potable Standpipe access fee GAP installation/access fee Total standpipe access fees	$ 3,000 $ 20,323 $ 23,323
Water cart wet hire (including travel)	Same#		Same#
Total BAU D&C Cost	**$ 691,800**	**Total Actual D&C Cost** **D&C Savings**	**$ 690,787** **$1,013**

T2T Env & Sust Manager indicated travel times combined with traffic congestion issues were similar between the potable and recycled water options. Whilst access to the potable standpipe involved slower travel times per round trip, access to the recycled water standpipe was quicker. Actual distances travelled depend on where journey commences: from Port Road intersection, 6.5km round trip for recycled standpipe, 3.8km for potable standpipe.

Operations Phase

Arrangements have been negotiated whereby the City of Charles Sturt Council will inherit landscaping responsibilities of the T2T alignment and the irrigation drip system on Financial Completion around April 2022. The progressive expansion of WPW and installation of an expanded irrigation system to reduce the need of some water carts is anticipated to provide a direct connection to T2T's landscape irrigation system by 2027 though this has not been confirmed. As the expansion of the WPW system is dependent on demand, the demand associated with the project will add to the incentive to utilise the source. When the source is available in the area, Council has confirmed that WPW will be used as an alternative to potable water sources for all irrigation which is expected post Final Completion. Between 2022 and 2027 water carts are assumed to be used by Council.

The operations phase cost comparison will then be between BAU Scenario (100% potable water use based on annual forecasts) vs Planned Scenario as illustrated in Table A2. An NPV costing approach and adjusted water supply prices would be a more suitable and accurate financial assessment method.

Table A2: Cost Comparison Methodology: Operations Phase (50 years)

BAU Scenario: 100% Potable Water		**Predicted Scenario: Potable plus Recycled Water**	
Total estimated quantity of water#	3.98 ML/yr	Between 2022-2027 (5 years):	
- Landscape Drip Irrigation (potable)	199 ML	- 80% Landscape Drip Irrigation (potable)	15.9 ML
- Water Cart (potable)		- 20% Water Cart (recycled)	4 ML
		Post 2025 (45 years): Landscape Irrigation connected to WPW	179 ML
	-	Installation of purple pipe and connection to WPW in 2025 (allow)	$ 200,000
Water supply cost from standpipe $3.36/kL (assume no price changes)	$ 668,640	Water Supply costs: potable $X.XX/kL WPW $X.XX/kL^	$ 53,424 $ 225,540
Standpipe Installation/access fees	same		same
Tanker watering for lawns and trees: 10kL Water cart wet hire and travel (50 years) @ $1,000/day for 26 days/yr*	$ 1,300,000	Tanker watering for trees only: 10kL Water cart wet hire and travel (50 years) @ $XXXX/day for 13 days/yr*	$ 650,000
Irrigation Drip System maintenance (allow $XXXX/year for 50 years)	$ 200,000	Irrigation Drip and new purple pipe System maintenance (allow $XXXX/year for each system)	$ 200,000
BAU Total Operations Cost	**$ 2,168,640**	**Predicted Total Operations Cost**	**$ 1,328,964**
		Operations Savings	**$ 839,676**

Notes:
Wat-1l Water Calculator: 85ML over 3 years.
^ Council responsible for irrigation during operations, assumed water supply will be at cost, not commercial rates.
* Water Calculator estimates 199ML over 50 years, and WPW recycled water used for 45 years after establishment.

Appendix A2 Noise Wall Modifications

ISCA's Crime Prevention Through Environmental Design (CPTED) credit Hea-2 prompted the procurement of a CPTED consultant to review proposed permanent designs, construction site layouts, and identify opportunities to reduce hazards which may improve public safety and prevent crime. It was noted that the T2T contract and specifications did not include any specific CPTED requirements. The commission of this consultant enabled the project to achieve Level 2 of Hea-2.

The consultant identified several improvement opportunities which were adopted by the project which resulted in tangible cost savings to the project:

- A reduction in the layout of 111m^2 of noise wall panels along the alignment south of Port Road to reduce the risk of assault due to restricted sight lines at openings (ends) of noise walls. This was addressed by the inclusion of prickly plantings and reduced wall heights at these openings.
- The removal of an overlap noise wall panel and the addition of 11m^2 of panels near Bond Street, and
- Replacing the scope of applying graffiti resistant paint as a second layer with normal primer. Advice received noted the limited benefit of graffiti resistant paint with a better whole of life value achieved by simply painting over graffiti.

Other design related improvement opportunities implemented, though not costed included moving ITS cabinets further away from noise walls reducing the risk of entrapment, providing better end-to-end visibility on the shared user path on the Outer Harbour Rail Bridge (which resulted in minor material and labour savings) and minor additional fencing to fill gaps between the noise wall and buildings/existing walls in Grange Road.

The CPTED specialist also recommended improvements relating to construction phase activities, specifically changes to the layout of barriers and no-gawk screens to maximise visibility and reduce hiding places, and provided CPTED inspection checklists enabling site teams to manage CPTED risks better. Whilst no CPTED related incidents were recorded on or in the vicinity of work sites during construction, it is likely that improved crime prevention practices adopted on-site have contributed to this outcome. The exact degree by which these practices contributed to zero related incidents cannot be drawn with the information available.

The net saving to the Alliance generated by implementing recommendations associated with commissioning the CPTED consultant and which were directly attributable to achieving the IS rating Hea-2 credit was $128k (total costs saved minus additional costs for additional noise walls and CPTED specialist commission).