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Case Study

Promoting a positive sustainability culture

NORTHLINK WA SOUTHERN SECTION

July 2019

CONTENTS

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Executive Summary

The NorthLink WA Southern Section (NLWA-SS) project delivered by John Holland on behalf of Main Roads Western Australia (Main Roads) is acknowledged to have set a new benchmark for 'Infrastructure Sustainability' in Australia, having:

- realised 11 independently verified sustainability innovations;
- reduced operational costs;
- demonstrably enhanced economic, social and environmental outcomes;
- achieved the highest ever IS Rating (95 points) to date; and
- won national awards for outstanding achievement and impact.

This case study explores what drove these outcomes and how success can be harnessed efficiently on the next round of Western Australian infrastructure projects. The case study takes a qualitative approach and compares the sustainability approach and outcomes realised on the NLWA-SS project against the Western Australian (WA) Business as Usual (BaU).

The case study suggests that the approach to sustainability used on NLWA-SS project was not typical. Several noteworthy strategic changes from the BaU were deployed. The differences that had the greatest impact were in the areas of:

- leadership
- knowledge sharing
- opportunities and
- decision making

Visible sustainability leadership was provided by Main Roads from the project development phase onwards. A focus on better economic, social and environmental outcomes was included in tender and contract documents. Following contract award, positive leadership behaviour was demonstrated by Main Roads and the Contractor, John Holland. Suitable resourcing and ambitious objectives enabled stretch targets to be set, and an ability to deliver against these targets.

Knowledge sharing through time (i.e. between planning, development and delivery phases) and across organisational boundaries (i.e. between internal departments, clients, contractors, designers, sub-contractors, stakeholders and community) was captured by Main Roads in tender information documents and adopted by John Holland in delivery. Wherever possible this was underpinned by face to face discussion.

Economic, social and environmental opportunities were proactively sought and prioritised by predicting the scale of their potential economic and environmental value. Opportunities developed with multidisciplinary input during the project development phase were carried through to delivery via contract requirements and other means.

Decision making for best-long-term outcomes. The process enabled input from Main Roads and John Holland and used a formal mechanism to properly consider more than just capital cost, also considering lifecycle environmental, social and cost impacts. Requests for Information, and variations were used to implement compelling opportunities as they arose.

Tangible sustainability outcomes attributable to these strategic changes include:

- Modelled operational cost savings – with the use of a lifecycle assessment tool software, dimming technology for streetlights, permanent solar variable message sign, a lower impact asphalt pilot, heritage interpretation artwork and signage, and a pavement design life study;
- Improved connectivity for pedestrian and cyclist network, beyond project boundary;
- High quality urban design and public art that enhances the local community and the user experience – through a common theme across NorthLink WA and with the urban art on the underpass at the school;
- Enhanced local Aboriginal heritage values - through significant artworks and interpretation;
- Retention of established trees in some locations, and landscape design that will increase extent and quality of vegetation in the road reserve;
- Significant reductions in carbon emissions, water use, material footprint and waste
- Improved flood attenuation and water quality via vegetated basins and onsite infiltration;
- Adaptation for climate change risks; and
- Implementation of innovations to improve sustainability.

This case study concludes that strategic changes the project made to the BaU approach were effective in improving economic, social and environmental outcomes on the project. With the correct knowledge and will, these changes could easily be applied to other projects. The case study provides a series of recommendations to this end.

However, it is important to note that the NLWA-SS sustainability outcomes were not realised in a vacuum – Client support and leadership is necessary to maximise outcomes. Main Roads' approach to sustainability is central to its Keeping WA Moving strategy, and Main Roads requires project teams to apply Infrastructure Sustainability

Council of Australia's (ISCA's) Infrastructure Sustainability (IS) Rating Tool. Main Roads required sustainability to be maximised from the Project Development stage of NorthLink WA. Ultimately, the application of this strategy over a prolonged period (on this and other projects), has laid the foundations for the changes and improvements implemented by the NLWA-SS project.

It should also be noted that, although the project achieved improved sustainability outcomes in relation to the BaU approach, there is still considerable improvement required from future projects if truly sustainable development is to be achieved. Again leadership, knowledge sharing, opportunities and decision making will be critical if the improvement seen here is to be accelerated.

Aim

The NLWA-SS project delivered by John Holland on behalf of Main Roads is acknowledged to have set a new benchmark for 'Infrastructure Sustainability' in Australia. This case study aims to examine why this is so, and how this success can be harnessed efficiently on future WA infrastructure projects.

Throughout this report we refer to 'infrastructure sustainability'. This is defined by the Infrastructure Sustainability Council of Australia (ISCA) as:

"Infrastructure that is designed, constructed and operated to optimise environmental, social and economic outcomes of the long term."

https://www.isca.org.au/infrastructure_sustainability

Introduction

The application of sustainability principles on infrastructure projects in WA has been distinctly *ad hoc*. This has been due to myriad issues, not least, industry finding it difficult to understand 'what' infrastructure sustainability is and 'how' it is delivered. Justifiably, there have been concerns about the cost effectiveness and value of infrastructure sustainability, with parts of the industry fearing infrastructure sustainability may introduce substantial additional administrative cost for little discernible benefit.

The NLWA-SS project counters these fears, having:

- realised 11 independently verified sustainability innovations;
- reduced operational costs;
- demonstrably enhanced economic, social and environmental outcomes;
- achieved the highest ever IS Rating (95 points); and
- won national awards for outstanding achievement.

Accordingly, the NLWA-SS project delivered by John Holland on behalf of Main Roads provides an important case study for industry about 'how' infrastructure sustainability can be delivered.

Main Roads Strategy

Main Roads' attitude to sustainability is central to its overall strategic approach. Main Roads' '*Keep WA Moving*' framework seeks to '*provide world class outcomes for the customer through a safe, reliable and sustainable road-based transport system*' and maintains '*sustainability*' as one of its four key focus areas. It aims to '*develop a sustainable transport network that meets social, economic and environmental needs*'. Ultimately, the application of this strategy over a prolonged period, and a policy requiring project teams to apply ISCA's IS Rating Tool on large projects has laid the foundations for the outcomes realised by the NLWA-SS project.

Infrastructure Sustainability Council of Australia

ISCA is the peak industry body for advancing sustainability in Australia's infrastructure environment. ISCA's IS Technical Manual (TM) and its IS Rating Tool are now widely accepted as the contemporary definition of 'what' infrastructure sustainability is and how success can be measured across economic, social and environmental outcomes on infrastructure projects.

Using the IS Rating Tool, projects are awarded points where levels of sustainability practice or outcomes have been confirmed. The table below demonstrates the spread of themes and categories assessed by v1.2 of the IS Rating Tool.

In mid-2018, version 2.0 of the IS Rating Tool was released that further expanded the scope of the tool to also include topics such as resilience, business case, benefits realisation, green infrastructure, legacy and workforce.

NLWA-SS was assessed under v1.2 of the IS Rating Tool.

THEMES	CATEGORIES
Management and Governance	Management Systems Procurement and Purchasing Climate Change and Adaptation
Using Resources	Energy and Carbon Water Materials
Emissions, Pollution and Waste	Discharge Land Waste
Ecology	Ecology
People and Place	Community Health, Wellbeing and Safety Heritage Stakeholder Participation Urban and Landscape Design
Innovation	Innovation

Project Scope

The $1.02b NorthLink WA initiative will provide a new transport link between Morley and Muchea, north of Perth:

- improving regional traffic flow, reducing travel times and congestion, improving freight efficiency and boosting productivity;
- creating strong connections, with economic and social benefits for the local community and visitors;
- saving lives by eliminating four of the state's most dangerous intersections; and
- providing a continuous connection from the Perth Airport to Muchea.

NorthLink WA is being constructed in three stages, of which the NLWA-SS was the first. Completed in mid-2018 by John Holland on behalf of Main Roads it was a $176m Design and Construct (D&C) contract. Key features of the work included:

- upgrading Tonkin Highway to a six-lane freeway;
- constructing new grade-separated interchanges at Collier Road and Morley Drive;
- constructing a flyover at Benara Road; and
- new cycling and pedestrian facilities

Methodology

This paper takes a qualitative view and compares the sustainability approach and outcomes realised on the NLWA-SS project against BaU. BaU described herein relates specifically to the WA context, and particularly the D&C contracts in WA at the time of writing. The BaU approach applies to the usual approach observed in the infrastructure sector generally as encountered by the author. Main Roads Western Australia is considered a leader in Western Australia,

The report and the BaU positions described have then been reviewed by experienced sustainability and construction personnel including:

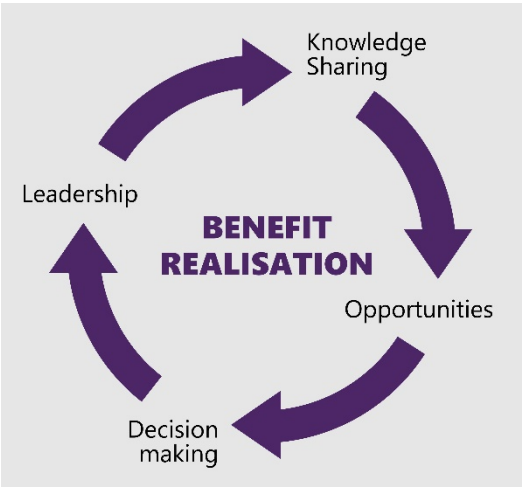
- Patrick Ilot — John Holland NLWA-SS Sustainability Manager, Author
- Mark Beiers – John Holland NLWA-SS Construction Manager
- Louis Bettini – Main Roads, Senior Sustainability Advisor
- Sophie Wallis – Upthink, Sustainability Consultant to Main Roads for NLWA
- Rob Arnott – Main Roads NorthLink WA, Senior Project Director

Strategic Approach

The sustainability approach on NLWA-SS was not typical. The project deployed several noteworthy strategic changes. Details of the most pivotal strategic changes were in relation to four key areas:

- Leadership;
- Knowledge Sharing;
- Opportunities; and
- Decision Making.

Management of these four issues has had a direct relationship upon the economic, environmental and social benefits that the project has been able to realise.



Leadership

Visible and demonstrable leadership from senior management is pivotal to sustainable infrastructure.

Project Development Phase

BaU: Project development phases do not typically consider sustainability issues in any great depth, no more than minimum requirements to obtain relevant planning and environmental approvals.

NLWA-SS: Main Roads ensured sustainability (economic, environmental and social aspects) was integrated during the 18-month project development phase. To do this an integrated team, marshalled by a dedicated Sustainability and Innovation Manager collaborated to produce a Sustainability Plan that allowed:

- Early registration of the project for an IS Rating by Main Roads;
- Main Roads to inform Tenderers about their sustainability priorities and the Project's progress against IS Rating credits; and
- Main Roads to identify and include sustainability initiatives within the concept (e.g. wider Principal Shared Path (PSP), roundabout interchange and adaptive lighting).

Recommendations for Future Projects:

- Integrate sustainability as a key consideration from the outset (i.e. during planning and project development stages).

Tender & Contract Documents

BaU: Tender and contract documentation for WA infrastructure projects generally:

- Remain silent in relation to sustainability; or
- Rebadge environmental compliance requirements as sustainability and environmental requirements; or
- Include details of the client's sustainability aspirations but no specific sustainability requirements.

NLWA-SS: Contract documentation included details of Main Roads' sustainability aspirations and the requirement to achieve an 'Excellent' IS Rating. Main Roads also signalled the importance of sustainability during the tender phase by requesting a Sustainability Management Plan (SMP) and a list of the proponents proposed sustainability initiatives. Tenderers were then evaluated on their sustainability knowledge, skills and experience along with their submitted documentation. Unusually, Main Roads also provided substantial sustainability information during the tender phase detailing sustainability initiatives that had been progressed during the Project Development phase.

Recommendations for future projects:

- Clearly articulate sustainability aspirations, objectives and desired outcomes within tender and contract documents.

Sustainability Leadership Committee

BaU: Generally, once an infrastructure project contract is awarded, management are occupied entirely with achieving compliance (legal and contractual) within allocated timeframes and budgets.

NLWA-SS: Senior management was involved with sustainability risks and opportunities throughout. A collective responsibility for sustainability was driven at a monthly Sustainability Leadership Committee (SLC) meeting. The SLC originally included the John Holland Project Manager, Design Manager, Construction Manager, Commercial Manager, Environmental Manager, Community and Stakeholder Engagement Manager and the Sustainability Manager. It quickly grew to also include the Main Roads Project Director, Project Manager, Sustainability Consultant and the Independent Certifier's Representative. The regular presence of these leaders at monthly committee meetings made it clear to all that sustainability was a priority. Importantly, the SLC allowed sustainability initiatives to be discussed with senior management, and enabled sustainability leadership in a collaborative environment.

Recommendations for future projects:

- Establish a sustainability leadership committee from contract award and this is to be attended by senior management; and
- Ensure design, commercial, construction, community and stakeholder, workforce development and environmental managers are held to account for relevant sustainability deliverables.

Sustainability Specific Roles

BaU: Sustainability roles often don't exist or are assigned to junior officers or merged with other positions.

NLWA-SS: The Main Roads Contract required a Sustainability Manager to be nominated by the proponent, approved by Main Roads and involved throughout the Design and Construction phase. John Holland appointed an experienced sustainability professional to sit within their management team as the Sustainability Manager reporting directly to the Project Manager. Critically, the Sustainability Manager worked within the hierarchy of the organisation with primary responsibility for delivery of the project.

The Main Roads dedicated Sustainability and Innovation Manager (an experienced and accomplished practitioner) from the project development phase was made available during delivery. This continuity capitalised on the project development team's earlier sustainability initiatives to the project.

Recommendations for future projects:

- Ensure sustainability managers report to and have access to project managers;
- Do not allocate responsibility for sustainability to an unsupported or underqualified resource; and
- Provide sustainability resources that allow continuity between project development and delivery.

Sustainability Objectives

BaU: Infrastructure projects have a range of time, cost and HSEQ goals. Generally, these are focused on profit margins, minimisation of incidents, system, contract and legal compliance.

NLWA-SS: In addition to the traditional objectives typically present with BaU, there were minimum and aspirational objectives established by John Holland for each of the IS Rating Credits. The minimum objectives detailed the outcomes that could be committed to by John Holland during the tender. The aspirational objectives represented best case objectives that could be reached if opportunities were able to be realised during the works. The use of aspirational targets was important because rather than taking a minimalist approach, whereby the project sought to deliver a basic level of compliance and nothing further, it continually sought out opportunities to go over and above. The net effect was a strong

sustainability culture which unlocked opportunities that had previously been dismissed by others as too hard.

Main Roads also set a project objective to maximise sustainability – this was included at project development stage and carried through to delivery. It is now common for Main Roads to include one or more project objectives that relate to sustainability, or to sustainability priorities for projects.

Sustainability 'focus areas' were identified very early in project development, with input from Main Roads specialists (including asset managers, Project Manager and Director, environmental and community engagement specialists) and the NorthLink WA team. The 'focus areas' were the material issues that were used to guide sustainability priorities, develop opportunities with most potential, and inform decision making. The focus areas were revisited and adjusted at key times, and passed on to tenderers for each of the three delivery contracts.

Recommendations for future projects:

- Contractors should be aware that they can realise greater value (for their companies, their clients and their stakeholders) by pursuing higher aspirational objectives; and
- Clients should set sustainability objectives as part of project objectives, based on clear expectations and project priorities.

Knowledge Sharing

The sharing of knowledge, be it about problems or solutions, is the key to finding a better way to deliver projects that benefit the broad community and environment in the longer term.

Between Project Phases and Contracts

BaU: Often knowledge sharing between project phases (i.e. project development, design and construction) can be limited to the provision of information documents. Knowledge sharing between different contractors is often limited due to perceived commercial sensitivities.

NLWA-SS: The provision of information documents was augmented with additional context from Main Roads' dedicated Sustainability and Innovation Manager from the earlier phases. This additional context was provided face to face in regular meetings and further context was readily volunteered when requested. In several instances face to face meetings were also facilitated with other key stakeholders (e.g. specifiers of lighting, asphalt) providing further context about their decisions.

Contractors from NorthLink WA Central and NorthLink WA Northern sections also participated in regular knowledge sharing events arranged by Main Roads, whereby each of the various contractors shared information and leveraged the knowledge of others.

John Holland also took care to pass relevant sustainability information to asset managers (e.g. climate change information, modelled energy savings, etc).

Recommendations for future projects:

- Provide sustainability resources that allow continuity between project development, delivery and asset management;
- Enable collaboration between contractors and internal departments;
- Realise knowledge sharing is reputation enhancing; and
- Always prioritise face to face discussions.

Influential Stakeholders

BaU: Knowledge sharing on infrastructure projects follows the health and safety model, and relies heavily upon inductions, toolbox talks and pre-start meetings.

NLWA-SS: The NLWA-SS project encouraged a 'sustainability' dialogue with the most influential people (i.e. managers rather than workforce). Proactive dialogue was encouraged within existing governance, design, procurement and stakeholder engagement systems with 'sustainability' translated to be relevant to the audience (e.g. energy efficiency for lighting engineers). For John Holland knowledge sharing led to an enhanced list of viable sustainability opportunities.

Knowledge sharing with suppliers and subcontractors was also augmented with awareness material and workshops from the Australian Supply Chain Sustainability School. Suppliers were invited to use the School's resources on a voluntary basis.

Recommendations for future projects:

- Knowledge sharing to target people with the power to make changes whilst focussing upon their material issues; and
- Contractors to use their existing processes to share important knowledge e.g. governance, design, procurement and stakeholder engagement processes.
- Knowledge sharing with suppliers and subcontractors to better educate them on sustainability.

Opportunities

Good management is essential to realising opportunities. Main Roads encourages projects to identify and deliver opportunities. Opportunities focused on adding real value to projects (either during construction or operation) should result in a better long term asset that has been constructed in a more sustainable way.

Risks and Opportunities

BaU: Contracting companies within D&C Contracts are normally focussed upon risks, rather than opportunities. Some commercial opportunities are managed (e.g. buying gains), but it is unusual for environmental or social opportunities to be proactively sought.

NLWA-SS: The desire to achieve John Holland's aspirational sustainability objectives necessitated a different approach to opportunities. The project's knowledge sharing allowed an Opportunities Register to be compiled in the project development phase and utilised throughout delivery in full view of Main Roads.

Opportunities need not be 'innovations' for them to add significant value to a project. Pursuit of innovations at the expense of developing sound, project-specific solutions with input from the broader project team can mean some benefits don't get realised.

Recommendations for future projects:

- Cast aside natural tendencies (at least temporarily) that consider everything to be a risk;
- Proactively identify and manage opportunities;
- Provide a forum for opportunities to be discussed and a mechanism for them to be realised; and
- Pursue opportunities that add most value to the project (based on known priorities) – some may be judged as 'innovations' in the end, but striving for innovations for their own sake may not be the best driver for good outcomes.

Materiality

The project endeavoured to deal with the most material issues (i.e. the significant economic, environmental and social issues which substantively influence stakeholders). The project used additional quantitative tools for predicting economic and some environmental outcomes, these are detailed below.

Lifecycle Costs

BaU: Once a D&C contract is let, if an opportunity is likely to add capital cost it won't normally be considered in any great depth, irrespective of potential lifecycle benefits.

NLWA-SS: The project made a habit of examining both capital and lifecycle cost impacts for sustainability opportunities. Often this involved some

rudimentary assumptions, however it enabled payback periods and lifetime savings to be contextualised. In turn this enhanced decision making. This approach identified where the biggest financial returns could be obtained with the least investment and improved decision making. It also allowed the overall dollar value of sustainability efforts to be quantified and discussed.

Recommendations for future projects:

- Measure the capital and lifecycle costs/savings of opportunities; and
- Don't assume sustainability costs more and use this as a justification for inaction.

Lifecycle Assessment

BaU: Effort is automatically focussed on fulfilling 'HSEQ compliance obligations' and occasionally tokenistic sustainability initiatives, whether or not this effort makes a meaningful difference to overall environmental outcomes is not factored.

Decision Making

Sustainable infrastructure considers more than just capital cost.

Multi Criteria Analysis

BaU: Decision making normally results in the lowest capital cost option being selected (so long as several basic pre-requisites are also met).

NLWA-SS: Capital cost was also pivotal to the NLWA-SS approach. This after all is a basic premise of any D&C contract, but there were also examples of additional capital investment being made to release lifecycle value. This happened when opportunities were managed so that:

a) The biggest opportunities were identified and dealt with first – if the opportunities were immaterial they were abandoned;
b) Where the opportunities complied and were predicted to reduce capital cost, the decision was made to include them;
c) Where the opportunities were predicted to increase capital cost but reduce lifecycle cost or produce significant environmental or social value, the decision was made to discuss them with the Sustainability Leadership Committee (SLC). Where the SLC judged there was merit in these opportunities, they were formally documented via the RFI process and funded.

Accordingly, there were several instances where the project included 'valuable' environmental and social opportunities that:

- Added capital cost; and/or
- Were not considered within the original scope of works; and/or
- Were outside the standard specifications.

The use of Multi Criteria Analysis (MCAs) to aid decision making was also undertaken during the development phase, enabling environmental and social factors to be considered alongside technical and cost aspects. One of the key outcomes was in the adoption of grade separations other than the BAU diamond interchange configuration, resulting in better sustainability outcomes (particularly safety, and efficiency).

Recommendations for future projects:

- Provide a forum for opportunities to be discussed and a mechanism for them to be realised; and
- Clients to provide guidance (investment criteria) regarding things they value (in addition to capital cost).

Variations

BaU: By and large variations are seen within the contracting industry as a symptom of poorly planned and managed projects.

NLWA-SS: Variations were advocated by both Main Roads and John Holland as a way of facilitating valuable sustainability opportunities. Variations were normally agreed in principle within the SLC and included both positive and negative variations (with savings being shared when they were realised).

Recommendations for future projects:

- Consider sustainability variations from a different perspective, particularly where they can be used to facilitate valuable opportunities; and
- Consider a budget pot for value adding opportunities rather than just risk.

Administration

BaU: Sustainability outcomes are not regularly required, and therefore administration of sustainability management systems is *ad hoc* from one project to the next, often this causes inefficiency.

NLWA-SS: Care was taken not to create a prescriptive management system, rather an outcome focussed system was developed. Very lean management plans and reports were developed, freeing up time to explore the merits of value-adding opportunities. A web-based tracker was also used to quickly and easily delegate and track deliverables from several contributors/organisations.

The project proactively rationalised modelling, reporting and administration effort so that it did not fully occupy allocated resources and prevent them from effectively interacting with the wider project team.

Recommendations for future projects:

- Continually apply the 80/20 rule and focus on critical opportunities and moments, rather than everything;
- Proactively reduce administrative burdens associated with sustainability; and
- Don't expect onerous reporting regimes to generate more sustainability outcomes.

Benefit Realisation

Economic

Sustainability is often assumed to be about environmental issues however, it must also demonstrate economic viability.

Tender Costs and Savings

BaU: Sustainability requirements typically amount to additional risk and budget allocations within tender submissions.

NLWA-SS: Sustainability savings totalling 1 per cent of the total project value were incorporated into the winning tender offer. Informed by substantial client supplied information to tenderers, several sustainability opportunities were integrated e.g. use of site won fill, groundwater use, use of site won topsoil/ mulch, diversion of waste from landfill and onsite reuse of road base/ subbase.

Also included in the tender was approximately 0.1 per cent of the total project value for additional sustainability personnel. All other personnel required to deliver sustainability outcomes would have been allocated in any case.

Recommendations for future projects:

- Leverage sustainability leadership to pursue 'better' solutions with greater confidence; and
- Nominate a champion for sustainability and use personnel already allocated to get more value from sustainability.

Delivery Costs and Savings

BaU: Calculations for costs and savings associated with sustainability during delivery are rarely undertaken.

NLWA-SS: Additional savings were realised during detailed design by pursuing sustainability initiatives e.g. reduced the number of light poles based on optimised lighting design, rationalised pit and pipe drainage, and rationalised fencing.

Other sustainability initiatives which added capital cost were the use of a lifecycle assessment tool software, dimming technology for streetlights, permanent solar variable message sign, a lower impact asphalt pilot, heritage interpretation artwork and signage, and a pavement design life study. Many of these initiatives contribute to the realisation of operational savings during the 100-year design life of the infrastructure.

Recommendations for future projects:

- Sustainable cost savings should be considered and captured as part of value engineering in the detailed design phase.

Whole of life cost savings

BaU: Typically for D&C contracts, the contractor does not consider the whole of life cost savings, as this would be conducted by the client during the project development phase.

NLWA-SS: With Main Roads senior management driving sustainability, this guidance enabled John Holland to consider and present to Main Roads some whole of life cost savings through a few initiatives.

Modelled operational savings include:

- Reduced electricity consumption, due to energy efficiency measures and optimised lighting design; and
- Reduced mains water consumption, due to substitution with groundwater and replacement of reticulated verges with local vegetation.

John Holland also modelled the likely actual 'design life' for some key components of the project (pavement and noise walls). Modelling based on current maintenance regimes demonstrated extended workability of these components beyond the design life specified in the contract.

It is useful for asset managers and contractors to understand that the raw material savings, and associated savings in carbon emissions and other environmental impacts, are significant when comparing a component that is replaced in its entirety after (say) 50 years with one that is maintained in place for a much longer period. This understanding could inform future decisions about the value of extending the design life of a range of components.

Recommendations for future projects:

- Sustainability costs and savings should be routinely calculated;
- Whole-of-life cost calculations should be undertaken systematically;
- Client to provide guidance (investment criteria) regarding things they value (apart from capital cost); and
- Client to provide guidance on how externalities can be monetised systematically.

Social

Increasingly investments in infrastructure need to demonstrate improvements to the wellbeing of individuals, communities and society to be acceptable.

Stakeholder Engagement

BaU: Stakeholder engagement can be confused with community liaison and many projects assume that if they react to community complaints during construction, they have sufficiently engaged stakeholders.

NLWA-SS: Stakeholder engagement was proactive starting in the development phase by Main Roads and continuing into the delivery phase by John Holland. As is standard practice on Main Roads major projects, reference groups were developed consisting of a wide array of community members and interested parties. Reference Groups were then empowered to contribute their local and specialist knowledge to produce superior solutions. This enabled input to the concept design by freight and road users, cyclist representative groups, environmental, water quality and catchment management specialists among many others. Community / Construction reference groups enabled local knowledge of the area to inform the design and provide input during construction.

Recommendations for future projects:

- Engagement could inform the design of the solution.
- Stakeholder engagement should be proactive, early and ongoing;
- Stakeholder engagement should not be limited to the community; and
- Collaboration between sustainability and stakeholder engagement personnel should be prioritised.

Community Health and Wellbeing

BaU: The management of community health and wellbeing is highly variable and can depend on what the client perceives their 'Social Licence to Operate' requires.

NLWA-SS: The project was able to identify a series of priority issues that the community cared about. This was informed by effective stakeholder engagement throughout the project development phase and by reviewing community plans from Local Government Authorities to identify broad community priorities which the project could influence. Existing relationships were then used to workshop superior solutions, including an improved underpass at the local school, extensive new principal shared paths and connections, reductions in crime risk, education partnerships with local schools, additional green infrastructure and vegetation.

Recommendations for future projects:

- Community needs can be assessed, and can inform a design, and help manage construction impacts, to address local needs and priorities; and
- Community needs should be transitioned from the project development phase into the delivery phase by both the client and the contractor.

Urban Design

BaU: Urban design can sometimes be limited to a discussion about finishes.

NLWA-SS: During the project development phase Main Roads required a whole of NorthLink WA urban design strategy to develop a coherent approach to enhancing the local context. It was then used iteratively to inform design of other important features (e.g. drainage, structures, highways, noise walls, shared paths, soft landscaping, hard landscaping). The result is a higher quality experience for users, neighbours and operators of the infrastructure asset.

Recommendations for future projects:

- Coherent landscaping and urban design strategies should inform all other design.

Heritage

BaU: Projects are focussed on obtaining the relevant approvals, then once they are obtained cease to focus upon any heritage outcomes beyond the conditions of approval.

NLWA-SS: The interpretation and enhancement of heritage was a key focus. To this end an interface between the archaeologist who had arranged the approvals, the landscape designer and the public artist was facilitated. Realising the following improvements:

- a large-scale interpretive artwork at the former Aboriginal Site at Collier Underpass; and
- a heritage trail and signs.

Recommendations for future projects:

- Consider options beyond simply obtaining heritage approvals; and
- Set out to interpret and enhance local heritage values.

Environmental

Many and varied, the environmental impacts of infrastructure need to shift from negative to positive if sustainable outcomes are to be truly achieved.

Resources

BaU: Costs associated with materials, energy, water and waste are managed, with more attention being given to high value items. Other factors such as environmental impacts are not generally a priority.

NLWA-SS: Lifecycle environmental impacts associated with resource use were considered via Lifecycle Assessment (LCA) during the delivery phase. The LCA was used iteratively to inform design and procurement and led to better decision making. The LCA also enabled a better understanding of items already included from the project development phase (e.g. adaptive lighting, topsoil reuse). Ultimately, it was clear that a relatively small number of initiatives made a big difference. These included:

- Increasing street light spacing by using a luminaire with a better light spread. Lighting design was optimised by designing for required lighting levels rather than using standard design parameters;
- Increasing energy efficiency of street lighting luminaires (adaptive lighting and dimming);
- Demonstrating the extended design life of pavement;
- Demonstrating the extended design life of noise walls;
- Downsizing and optimising structures;
- Replacing portland cement in concrete mixes;
- Using recycled asphalt pavement in asphalt mixes;
- Using low impact steel with high recycled content;
- Designing out reticulated landscape treatments;
- Using non-potable water;
- Reusing spoil locally; and
- Diverting inert and office waste from landfill.

Overall the following improvements were verified under the IS Rating scheme;

- 23 per cent reduction in carbon impacts associated with construction and operation;
- 28 per cent reduction in water use associated with construction and operation;
- 99 per cent of water use from non-potable sources;
- 36 per cent reduction in material lifecycle impacts;
- 5 per cent of materials with approved environmental labels;

- 100 per cent of topsoil reused on-site; and
- 100 per cent of spoil, 99 per cent of inert and 73 per cent of office waste diverted from landfill.

Recommendations for future projects:

- Utilise lifecycle assessment to understand the value of environmental opportunities; and
- Utilise lifecycle assessment iteratively.

Discharges and Pollution

BaU: Management takes steps to reduce the risk of incidents and legal compliance is proactively sought.

NLWA-SS: Long term improvements were sought for sensitive and high-value receptors, interventions aimed not just to mitigate negative impacts but also to provide positive legacies. An intelligence-led approach to investigation and monitoring helped ensure the effectiveness of design and construction solutions. These included:

- Improved flood attenuation and water quality via vegetated basins and onsite infiltration;
- Achievement of noise goals associated with current and future traffic via road alignment and noise walls;
- Achievement of vibration goals for human comfort via road alignment;
- Achievement of local air quality goals associated with current and future traffic via road alignment and grade separated intersections; and
- Achievement of light pollution goals associated with shared path lighting, street lighting and traffic via lighting placement and screen walls.

Recommendations for future projects:

- Don't focus just on obtaining environmental approvals;
- Use information compiled for approvals to inform superior solutions; and
- When intervening set out to leave a positive legacy (e.g. reduce flood risk, improve receiving water quality, reduce operational noise and vibration, reduce air pollution, reduce light pollution, improve visual amenity, enhance topsoil, mitigate contamination, enhance/create ecological value).

Ecology

BaU Approach: Projects are focussed on obtaining the relevant approvals, then once they are obtained cease to focus upon any ecology outcomes beyond the conditions of approval.

NLWA-SS Approach: The creation of additional ecological value was a key focus for the landscape design. This involved creating an interface between the ecologists who had arranged the approvals and the landscape designer developing the onsite solution. This

included the replacement of 33 ha of degraded and highly fragmented vegetation with 35.6ha of onsite landscape treatments including endemic high value species. This is in addition to the substantial offsets that were added to the conservation estate as part of the approval process.

Recommendations for future projects:

- Set out to enhance ecological values on site for better economic, environmental and social outcomes.

Climate Change Adaptation

BaU: Occasionally some provisions for climate change are observed within client documents, the most often sighted is an allowance for sea level rise within drainage specifications.

NLWA-SS: Climate change risk assessment was undertaken during project development phase by a multi-disciplinary team and was revisited during delivery. The risk assessment used suitable climate change projections and has considered direct and indirect climate change risks. This risk assessment has been used to inform design and adaptation options to treat all extreme, high and medium climate change risks. Enhanced handover information has also been compiled regarding adaptations and provided to Main Roads to inform their ongoing operation and maintenance of the asset within a changing climate.

Recommendations for Future Projects:

- Climate change risk assessments to be proactive, early and ongoing;
- Climate change adaptation to be integral to the design process; and,
- Ensure that suitable details regarding risks and adaptation strategies are communicated to Asset Managers.

Innovations

BaU: There is a tendency to use tried and trusted methods with the lowest cost.

NLWA-SS: Innovation was unlocked by using sustainability to redefine the problems we needed to solve. Economic, social and environmental outcomes were all prioritised, and if another solution could deliver on more than one of these fronts, there was often enough incentive to risk a change from the tried and trusted.

Innovations were managed the same way as all other opportunities (i.e. leadership, knowledge sharing, opportunities, decision making). Verified innovations included:

- Lifecycle Assessment being used to inform design;
- Adaptive lighting being used to reduce electricity consumption;
- Dimming of lighting being used to reduce electricity consumption;
- Demonstration of a 100 year design life of pavement;
- Pilot of low impact (EME2) asphalt to reduce thickness;
- Increased use of recycled asphalt pavement from zero to 10 per cent with provision for 25 per cent;
- Three pin arch for pedestrian underpass improving connectivity and reducing crime risks;
- Sustainability day for suppliers co-hosted with Supply Chain Sustainability School;
- Principal shared path enhanced to a width of four metres;
- Grade separated roundabout to improve safety and traffic flow; and
- Solar powered permanent variable message signs;

Recommendations for future projects:

- Use sustainability to drive innovation by redefining the problem (i.e. problems aren't just capital cost problems); and
- Be aware that the best way to achieve innovation is by pursuing the biggest opportunities.

Conclusion

In conclusion, it appears that the strategic changes that the project made to the BaU approach were effective in improving economic, social and environmental outcomes on the project. Particularly pivotal were the changes implemented in relation to:

- Leadership;
- Knowledge Sharing;
- Opportunities; and
- Decision Making

The early and proactive management of these four issues empowered individuals and organisations to collaborate and unlock the economic, environmental and social benefits that the project has been able to realise. The tangible benefits have included:

- Improved cycling/ pedestrian network connectivity and access to adjacent school;
- Reduced energy and water use during operation;
- Use of materials with reduced carbon footprint;
- Enhancement of local Aboriginal heritage values;
- Trialling of innovative technologies with a view to enabling application on future projects.

With the correct know-how these changes could easily be adopted and scaled to suit other projects.

It should also be noted that although the project achieved improved sustainability outcomes in relation to the BaU approach, there is still considerable improvement required from future projects if truly sustainable development is to be achieved. Again leadership, knowledge sharing, opportunities and decision making will be critical if improvement is to be accelerated.

Recommendations

Consolidated recommendations are detailed below.

Leadership

- Integrate sustainability as a key consideration from the outset (i.e. during planning and project development stages);
- Clearly articulate sustainability aspirations, objectives and desired outcomes within tender and contract documents;
- Establish a sustainability leadership committee from contract award and this is to be attended by senior management;
- Ensure design, commercial, construction, community and stakeholder, workforce development and environmental managers are held to account for relevant sustainability deliverables;
- Ensure sustainability managers report and have access to project managers;
- Do not allocate responsibility for sustainability to an unsupported or underqualified person;
- Provide sustainability resources that allow continuity between project development and delivery;
- Contractors should be aware that they can realise greater value (for their companies, their clients and their stakeholders) by pursuing higher aspirational objectives; and
- Clients should set sustainability objectives as part of project objectives, based on clear expectations and project priorities.

Knowledge Sharing

- Provide sustainability resources that allow continuity between project development, delivery and asset management;
- Enable collaboration between contractors and internal departments;
- Realise knowledge sharing is reputation enhancing;
- Always prioritise face to face discussions;
- Knowledge sharing to target people with the power to make changes whilst focussing upon their material issues;
- Contractors to use their existing processes to share important knowledge e.g. governance, design, procurement and stakeholder engagement processes; andKnowledge sharing with

suppliers and subcontractors to better educate them on sustainability.

Opportunities

- Cast aside natural tendencies (at least temporarily) that consider everything to be a risk;
- Proactively identify and manage opportunities;
- Provide a forum for opportunities to be discussed and a mechanism for them to be realised;
- Pursue opportunities that add most value to the project (based on known priorities) – some may be judged as 'innovations' in the end, but striving for innovations for their own sake may not be the best driver for good outcomes;
- Measure the capital and lifecycle costs/savings of opportunities;
- Don't assume sustainability costs more and use this as a justification for inaction;
- Don't take a scatter gun approach to sustainability opportunities;
- Utilise lifecycle assessment to understand the value of environmental opportunities; and
- Utilise lifecycle assessment iteratively.

Decision Making

- Provide a forum for opportunities to be discussed and a mechanism for them to be realised;
- Clients to provide guidance (investment criteria) regarding things they value (in addition to capital cost);
- Consider sustainability variations from a different perspective, particularly where they can be used to facilitate valuable opportunities; and
- Consider a budget pot for value adding opportunities rather than just risk.

Administration

- Continually apply the 80/20 rule and focus on critical opportunities and moments, rather than everything;
- Proactively reduce administrative burdens associated with sustainability; and
- Don't expect onerous reporting regimes to generate more sustainability outcomes.

Outcomes (Economic)

- Leverage sustainability leadership to pursue 'better' solutions with greater confidence;
- Nominate a champion for sustainability and use personnel already allocated to get more value from sustainability;

- Sustainable cost savings should be considered and captured as part of value engineering in the detailed design phase;
- Sustainability costs and savings should be routinely calculated;
- Whole of life cost calculations should be undertaken systematically;
- Clients to provide guidance (investment criteria) regarding things they value (apart from capital cost); and
- Clients to provide guidance on how externalities can be monetised systematically.

Outcomes (Social)

- Engagement could inform the design of the solution;
- Stakeholder engagement should be proactive, early and ongoing;
- Stakeholder engagement should not be limited to the community;
- Collaboration between sustainability and stakeholder engagement personnel should be prioritised;
- Community needs can be assessed, and can inform a design that addresses local needs and priorities;
- Community needs should be transitioned from the project development phase into the delivery phase by both the client and the contractor;
- Coherent landscaping and urban design strategies should inform all other design;
- Consider options beyond simply obtaining heritage approvals; and
- Set out to interpret and enhance local heritage values.

Outcome (Environmental)

- Utilise lifecycle assessment to understand the value of environmental opportunities;
- Utilise lifecycle assessment iteratively;
- Don't focus just on obtaining environmental approvals;
- Use information compiled for approvals to inform superior solutions;
- When intervening set out to leave a positive legacy (e.g. reduce flood risk, improve receiving water quality, reduce operational noise and vibration, reduce air pollution, reduce light pollution, improve visual amenity, enhance topsoil, mitigate contamination, enhance/create ecological value);
- Set out to enhance ecological values on site for the betterment of economic, environmental and social aspects;
- Climate change risk assessments to be proactive, early and ongoing;

- Climate change adaptation to be integral to the design process; and
- Ensure that suitable details regarding risks and adaptation strategies are communicated to Asset Managers.

Innovations

- Use sustainability to drive innovation by redefining the problem (i.e. problems aren't just capital cost problems); and
- Be aware that the best way to achieve innovation is by pursuing the biggest opportunities.