

Regenerative design: Why now?



Introduction

Executive introduction

“We’ve seen an evolution of sustainable design practice over the past 40 years. Regenerative design marks the next evolution of that.”

Rebecca Miller, Chair, Sustainability Council of Excellence, SJ Group

Significant leaps and gains have been made in engineering and construction around sustainability, efficiency and resilience. The sectors have responded admirably and at pace with innovative advancements and solutions in designs, processes and materials.

However, as the pace and impact of climate change picks up and merges with other pressing externalities such as biodiversity loss and rising levels of inequality, the current mindset around the minimisation of harm is shifting to another, more powerful one. To move beyond sustainability, how can engineers shift focus from impact reduction to net-positive outcomes?

Where sustainability seeks to remove negative environmental and social impact for communities, ecosystems and future generations, regenerative design goes one step further. Regenerative design asks how a project can give more than it takes.

This paper explores the concept of regenerative design from the practical perspective of engineering and construction. What does it mean in practice? How is it being applied right now in Australia and elsewhere?

“We’ve seen an evolution of sustainable design practice over the past 40 years,” says Rebecca Miller, Chair, Sustainability Council of Excellence, SJ Group (SJ), of which SMEC is a subsidiary.

“Regenerative design is that next evolution. It’s that next piece. It’s about leaving a positive legacy and delivering positive outcomes across climate and carbon, people, communities, nature and biodiversity.”

In an era in which infrastructure projects are becoming infinitely more complex, regenerative design introduces a framework that brings ecological health, cultural and societal wellbeing and engineering innovation into alignment. It is about taking all we have learned so far about sustainability in engineering and supercharging it.

Regenerative design represents a shift from minimising damage to maximising benefit. This paper discusses pathways and ideas to help this become a reality.



What is regenerative design?

Regenerative design is a process-oriented approach to design and development that goes beyond sustainability. It aims to restore, renew and transform human, social and ecological wellbeing.

Regenerative development poses a fundamental shift in how we deliver our projects and shape the built environment. It is about engineering improved outcomes that actively restore and enrich environmental and social systems.

So, where sustainable design focuses on the reduction of carbon emissions, other pollution and environmental and social degradation, regenerative design results in the active generation of positive outcomes. It doesn't aim to leave no footprint, instead designing for specific but broad-ranging effects, meaning it very much leaves its mark across cultural, social and environmental systems.

Importantly, rather than isolating specific systems and outcomes, such as carbon reduction, cost savings, community benefit, etc., regenerative design considers the entire system, including:

- Water cycles;
- Biodiversity;
- Carbon emissions;
- Cultural value;
- Community wellbeing;
- Material life cycles; and,
- Long-term resilience.

“We’ve got a convergence of multiple challenges and external drivers leading us to realise and understand that the way we have done things, even though we have been moving incrementally forward, still isn't enough to solve the converging crises we are being asked to respond to,” Miller says.

“That’s why there is a need to refresh our focus and pivot towards regenerative design. We have seen brilliant, innovative engineering get us where we are today. But particularly since the launch of the Kunming-Montreal Global Biodiversity Framework [see next page] a few years ago, there has been real growth in recognising the need to work with and for nature and to put people at the centre of the decision-making process.”

What are the defining features of regenerative design?

At the core of regenerative design are engineering and other principles that emphasise the importance of the alignment of various approaches. These include:

Systems thinking:
This relates less to systems engineering and more to the need for recognition of the interdependence of natural, human and built systems.

Ecological restoration:
Designing not to mitigate harm but instead to actively enhance ecosystems.

Cultural co-evolution:
Integrating Indigenous knowledge and related, place-based wisdom.

Material circularity:
All resources used are in a closed-loop system that produces little to no waste and regenerates value.

Community benefit:
Value, wellbeing and equity are delivered for people in the community over the long term.

Understanding regenerative design

What are current examples of regenerative design?

Success in regenerative design is not measured by the singular outcome of the project itself, nor by a single set of measures of performance during a particular build. Instead, it is measured in ongoing co-evolution. The system must improve over time in terms of benefit, resilience and performance.

Real-world examples include:

- A stormwater system that doesn't just assist runoff and mitigate flooding, but that actively regenerates wetland habitat;
- A building covered in plants that not only acts as a carbon sink but also fosters social connection, creates wildlife habitats and promotes urban cooling; or
- A transport corridor that helps to restore Country through wildlife regeneration pathways, natural water flow solutions and Indigenous-led design.

In Amsterdam, for example, the Habitat Royale building is being designed to embed biodiversity into its fabric. The 94-apartment residential building, next to the green space of Beatrixpark, will weave greenery into the building design along with materials such as timber, to create microhabitats for wildlife. This will begin the making of a nature corridor and act as a carbon sink, meaning its positive effects increase over time.

What is the Kunming-Montreal Global Biodiversity Framework?

Adopted during COP15 in 2022, the Kunming-Montreal Global Biodiversity Framework lays out a global plan to live in harmony with nature by 2050. The 2050 goals are:

- 1 **Protect and restore the integrity of natural ecosystems**
- 2 **Prosper with nature by using, managing, enhancing and valuing nature's contributions to people**
- 3 **Share the benefits of nature fairly and equitably**
- 4 **Invest in capacity building and scientific cooperation**



Understanding regenerative design

Thinking outside the silo

Traditionally, and even currently in engineering design, outcomes are often siloed. A team's focus might be the environment, or the local community, or materials reduction, etc. Regenerative design resets this approach, instead demanding acceptance of the fact that all systems are interconnected.

This means biodiversity goals are linked to materials used, carbon emissions reduction is intimately related to community outcomes, and cultural renewal and engineering efficiency directly affect one another.

"Most engineers work on pieces of projects in their own speciality area, such as civil, structural, environmental, etc." Miller says. "Regenerative development demands that we collaborate wholly across disciplines to deliver integrated and life-giving projects."

The challenges are real

As with any change of mindset, regenerative design faces significant hurdles. These will be discussed in greater depth on page 12, but briefly they include:

Cost perception: Being perceived as an extra rather than an opportunity.

Feasibility/brief constraints: Convincing clients to go beyond usual limits can raise multiple challenges.

Capability gaps: Finding an ever greater number of engineers trained and experienced in systems thinking.

Client priorities: If short-term outcomes are prioritised, regenerative design could be a non-starter.

"Just as engineers have updated their practices around climate risk, we're asking them to think even more broadly," Miller says. "They have the skills, experience and capability. All we really need is a shift in mindset."



SJ's framework for regenerative design

How SMEC is integrating regenerative design

Rather than tagging it as a future ambition, SMEC is embedding regenerative design into current practice. This involves a suite of internal tools, training programs and collaboration across disciplines to re-think the way projects are scoped, designed and delivered.

Perhaps the most important ingredient in the recipe for regenerative success

is a network of over 50 ambassadors across SMEC and its parent company, SJ. These ambassadors will support significant and/or strategic project opportunities where the organisation believes sustainability outputs can be harnessed to provide a commercial edge and competitive advantage.

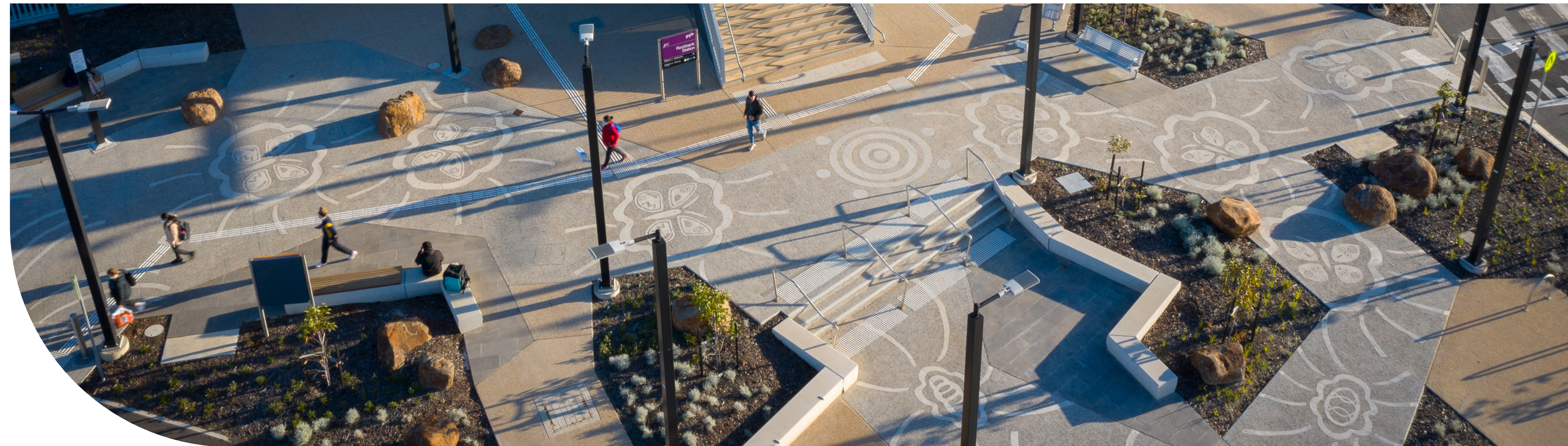
They will also work with sector and sub-sector leads to

identify criteria for determining which opportunities, clients and projects would benefit from a regenerative design workshop. Such workshops will explore the fundamentals around:

- Climate and carbon;
- People and communities; and,
- Nature and biodiversity;

to identify opportunities to address climate change, deliver a net benefit to people and restore and rehabilitate nature and biodiversity.

Ambassadors will also provide teams with self-guided resources, materials and tools that enable them to explore regenerative design ideas, actions and outcomes independent of the ambassadors.



From the earliest stage

Importantly, we foster an environment that encourages and recommends ambassadors are present during pre-project bid, proposal and early-planning stages.

"We're tasking them to work across the business to help our teams to consider, plan for and embed regenerative development principles in projects from the earliest possible stage," Miller says.

Opportunities that could be uncovered include:

- Minimisation of transport/haulage;
- Commitment to procurement of green power and onsite renewables;

- Exploration of radical reuse and repurposing;
- Exploration of the use of bio-based materials;
- Actively seeking out wasteful processes to improve them;
- Exploring greater opportunities for locally sourced materials;
- Designing with and for Country;
- Actions to reduce inequity and inequality and support community adhesion;
- Closely understand community networks;
- Assessment of natural capital;
- Biophilic and biomimetic design solutions;

- Understanding of full water cycle; and,
- Wetland rehabilitation and more.

From site selection to renewable energy options to the inclusion of local community members in early consultation, none of these processes are new to engineers.

The difference is in the scope and intended interconnectedness of the outcome.

What makes a successful example of regenerative design?

For SMEC, a successful regenerative project based on applying the internal framework demonstrates:

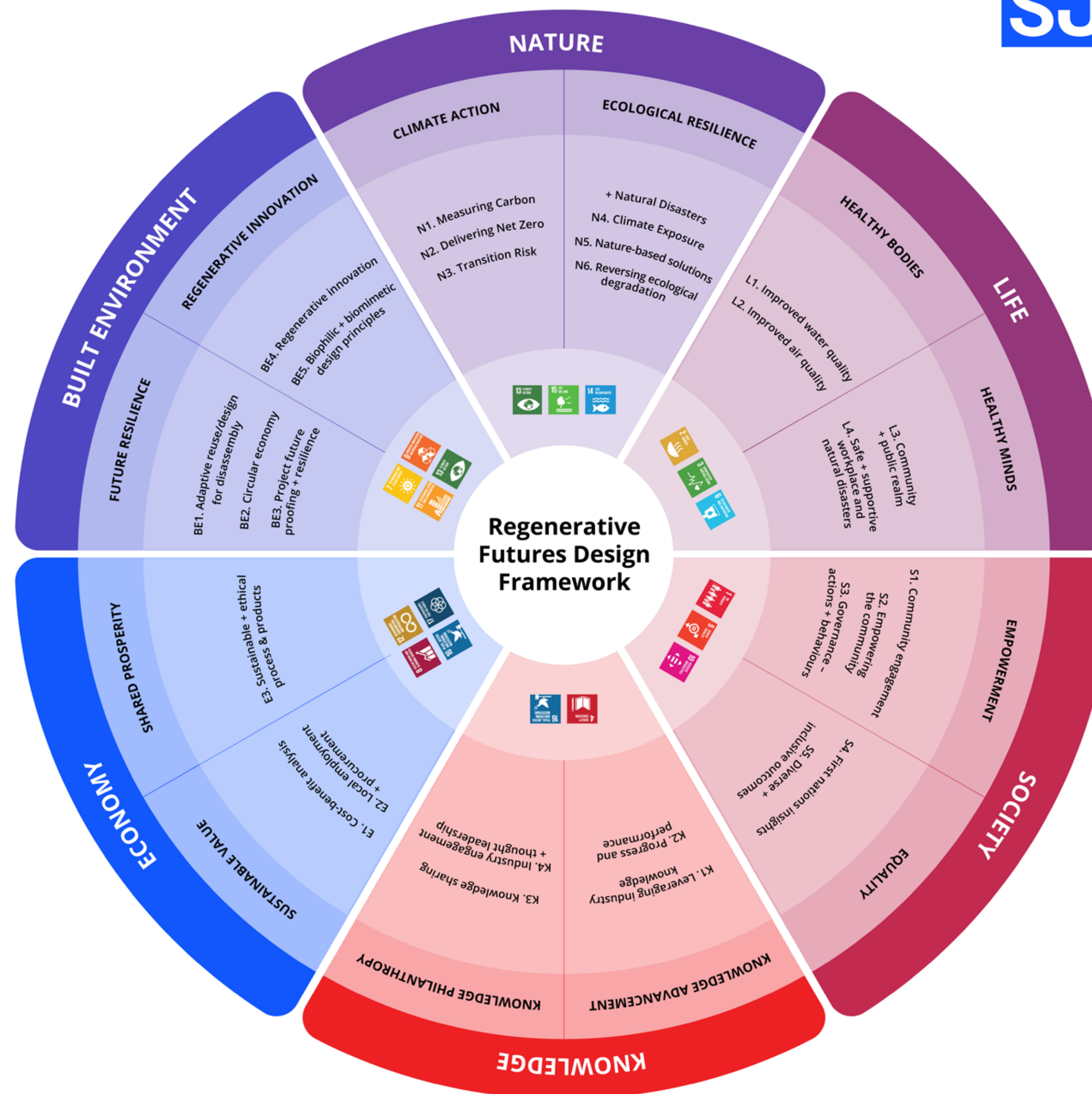
- A net-positive impact on the surrounding social and environmental systems;
- Holistic integration and boosting of culture, community, ecology and climate resilience;
- Early stage, interdisciplinary collaboration and planning; and,
- Systems thinking that extends well beyond the project's boundaries.

SJ's Regenerative Futures Project Framework

SJ's Regenerative Futures Project Framework has been developed as the cornerstone of implementing the Group's Sustainability Charter, it empowers the business to embed regenerative thinking across all scales of work.

It assists:

- Individuals in gaining a broader frame of reference around regenerative design;
- Individuals and teams in discovering how regenerative solutions can be introduced into their work; and,
- Project teams in supporting bid responses, early project planning and at any other phase of project delivery.



Case study 1

Porronggitj Karrong project

Porronggitj Karrong, meaning 'place of the brolga' in Wadawurrung language, is a large area of lignum swamp on the banks of the Barwon River at Breakwater, Geelong. Post settlement, the site was historically used for livestock grazing, with the heritage-listed Ovoid Sewer Aqueduct also spanning the landscape.

SMEC is helping to transform the 66 hectares of land into a living Cultural landscape precinct to create a balanced ecological system incorporating values of Wadawurrung Culture. This will enable the community to connect with, listen to and learn from Country. The project's sustainability, social, economic and Cultural objectives stem from a partnership agreement between Wadawurrung Traditional Owners Aboriginal Corporation, Barwon Water and project partners, including SMEC. This agreement emphasises a Country-led approach to land management, respecting Wadawurrung rights to self-determination.

Shared project objectives include:

- Providing a healthy landscape for all to connect with and learn from Country;
- Care for land and water through Wadawurrung land management practices;
- Incorporating Wadawurrung values through genuine engagement; and,
- Creating employment and capacity-building opportunities aligned with Wadawurrung objectives and self-determined goals.



Aerial view of Barwon River floodplain.

Socially, the project reconnects Wadawurrung people with landscapes they have been locked out of, while providing the Geelong community with access to a culturally, historically and ecologically significant site.

Features of the new precinct will include wayfinding, educational signage, boardwalks, and bird-watching locations and a passive recreation river trail for kayaking. The project will also provide an open, continuous Barwon River corridor for the first time in 25 years.



SMEC and Wadawurrung conducting monthly site monitoring to identify species on the Porronggitj Karrong site.

Q&A

**Porronggitj Karrong
Project Director
Jenna Forbes**

How has consultation with the Wadawurrung people been organised?

Early on, we took direction from Barwon Water, which was on an established journey to reconciliation with Wadawurrung. We came to meetings with an attitude of openness and willingness to learn. Wadawurrung explained to us what was important to them and protocols for engagement, and we incorporated this into our meetings and communication going forward.

What were the surprise outcomes of this consultation?

Personally, I learned to spend more time building a working relationship. The work put in

early in the project creates efficiencies later in terms of getting deliverables approved by all parties, due to the trust that develops following the first weeks on the project. It also creates a sense of ‘one team’ and a shared vision which becomes more rich as the project progresses.

What are you most proud of, in terms of outcomes?

I am so happy that Wadawurrung are re-connected to the landscape and are achieving self-determined objectives through their works on site. I feel proud that the ecological data we’ve collected together over the years for the project will support management of the site for long-term conservation purposes for a range of species, including Brolga.

Case studies

Case study 2

Cannery Creek

While most wastewater and stormwater infrastructure projects are designed and engineered purely to mitigate flooding, improve flow and manage runoff, the Urban Utilities Cannery Creek Nature Based Solution (NBS) project in South East Queensland instead offers a vivid example of regenerative design thinking.

Booming urban development and increasing intensity of weather events meant the underground network was sometimes impacted, with stormwater flooding the wastewater network, causing overflows.

This project's design went well beyond compliance to deliver measurable value to the environment, to local communities and to the biodiversity of the region.

The goals were to:

- Reduce wet weather overflows onto property;
- Manage risk to the public and protect waterway uses;
- Deliver better environmental outcomes; and,
- Deliver benefits at a lower cost to the community.

The 'grey infrastructure' approach, the traditional method of building larger and more expensive pipes and other infrastructure, was compared very early in the design process

with a nature-based solution in the form of wetlands and bioretention basins. These natural kidneys will treat the overflow before it enters Kedron Brook.

At the same time, the nature-based solution would support native vegetation and biodiversity, boosting ecological resilience in the region and creating new native flora and fauna habitats.

The nature-based designs reduce the amount of concrete and steel required and, most importantly, would benefit ecosystems and communities outside of the project boundaries. Those benefits would increase as time went

on and as the wetlands matured, for decades beyond the project's delivery.

Outcomes include:

- Enhanced water quality via treatment of wastewater and stormwater offsets;
- Creation of long-term, biodiverse habitats and green corridors, including beautified access tracks and creek beds, and a public footbridge;
- Reduction in maintenance resources and costs as nature does most of the work; and,
- Enhancement of existing parkland with social, environmental and cultural value.



Above: Sediment Basin 1, post-planting works

Challenges

Challenges and solutions

There is growing interest in regenerative design and momentum is building. However, while we have most of the required knowledge, materials and experience to make it a reality, entrenched priorities and ways of thinking and operating will pose some challenges to everyone involved.

Other challenges are systemic, as engineering and infrastructure projects tend to exist in an environment of rigid scopes, short-term and technical deliverables/outcomes and tight budgets.

In contrast, regenerative design demands a long-term focus, multidisciplinary collaboration and a deep understanding of, and focus on, positive outcomes across economic, ecological, cultural and social systems.

“For regenerative practices to work, you need everyone working together,” Miller says.

Causes of fragmentation

There are numerous factors working against such collaboration, Miller says. They include:

Competing priorities: teams and organisations already have to juggle issues such as climate adaptation and resilience, varying stakeholder priorities, compliance matters and more.



Challenges

Client priorities: As long as clients aren't requesting regenerative outcomes, it is difficult for engineers and others in construction to justify the time and cost of developing them.

Project briefs: Similarly, when clients don't request regenerative outcomes, project scopes don't specify or reward goals that allow for regenerative planning and design.

What it means for engineering culture

Enormous progress has been made across engineering in terms of the integration of sustainability and climate resilience measures, however, regenerative design asks even more.

The challenge is for engineers and others to reimagine what success means. The focus must move from program efficiency, risk mitigation, stakeholder engagement during the project and emissions reduction to net-positive impact across climate, carbon, people, communities, nature and biodiversity.

"We're now telling engineers that a focus on compliance and risk reduction simply isn't enough," Miller says. "That requires a mindset shift and marks a change in practice. To deliver regenerative project outcomes they also need to think about equity, ecology, community benefit and more. And they need to do it

collaboratively and to a level of ambition not previously identified, often without an increase in time allocation or budget."

That shift can seem overwhelming, Miller says. But she warns against framing it as a burden.

"Just as we did with the sustainability shift, we're bringing people on an important journey," she says.

Beyond the client's brief

When the funding model doesn't support it, stretching a project's scope and challenging a client to see what's possible can be uncomfortable. However, as discussion around regenerative design matures, new pathways,

incentives and opportunities will reveal themselves.

When clients begin to demand regenerative outcomes and evidence of an engineering firm's past performance in this arena, those firms will need to be ready.

As with sustainability, what was previously off-brief will soon be front-and-centre. Organisations with experience, insight and know-how in the field will have a competitive advantage.

"Regenerative design is often outside the brief," Miller says. "But it's what the future requires, so it won't be that way for long."

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Rebecca Miller, Chair, Sustainability
Council of Excellence, SJ Group



Looking ahead: Scaling regenerative design in Australia

Scaling regenerative design across Australia's engineering and construction landscape requires cultural and structural change.

Various tools and levers are available to support that transition. They include:

- **Ratings systems** and templates for assessment, such as SMEC's Regenerative Projects Framework, to ensure constant improvement.

- **Procurement incentives**, particularly at a government level, are beginning to appear.
- **Upskilling workforces** to ensure people at all levels are beginning to consider what changes can be made to create greater regenerative potential.
- **Collaboration** with all stakeholders, including Traditional Owners. This is a part of the process that could and should be occurring right now.
- **Knowledge sharing**, including through webinars, blogs, publicly available reports and via the resources of membership bodies such as Engineers Australia.

Far more than a new methodology, regenerative design requires a mindset shift across engineering and construction.

Importantly, it resonates with the very purpose that drives engineers, their dedication to serving communities and shaping a more sustainable built environment.

Now, regenerative design takes this concept one step further by ensuring the work of engineers has a purely positive effect not just on people, but also on place and on planet.

Regenerative design is a grand, but ultimately rewarding, outcome of decades of sustainability innovation.

"It represents the ultimate form of engineering," Miller says. "The outcome is a piece of infrastructure that gives back throughout its life, making each build far greater and more valuable than the sum of its parts. That's worth striving for."

What would change if every project gave more than it took? To find out more about SMEC's approach to real, positive change, visit:

smec.com