

UNDERSTANDING 'WHAT'S REALLY GOING ON' AS A BASIS FOR TRANSFORMING THINKING, ACTION AND OUR CITIES

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ABSTRACT

There is an unquestionable increase in the interest in sustainability within Australian society and internationally. While the heightened attention is recognition that our past approaches to development (including the form and function of cities) have failed to deliver enduring benefits to society, we still don't witness any significant departure from those methods of design and delivery of new or renewed infrastructure. A lot of effort is being placed into improving the efficiency of existing urban systems or responding to crises with quick fixes that largely reflect traditional thinking. In short we are continuing to invest in unsustainable development. Only by exposing this situation can we build interest in, desire and capability for transformation. This paper reveals the reasons for the continuing unsustainable development of our cities, and public infrastructure in particular, and presents one pathway for triggering useful change.

INTRODUCTION

Over twenty years ago the United Nations published the report *Our Common Future* (WCED, 1987) which was a clear and thorough statement on the need for sustainable development. Only now that we have irrefutable evidence of our unsustainable lifestyles (such as UNEP, 2005; IPCC, 2007) and the prospect of serious consequences within our lifetimes are we heeding that call. Responding to the challenge of sustainable development will require dedicated, collective action at many levels.

Making our cities more sustainable is an important component of that response. Cities are the primary source of global consumption – consumption that is rapidly exhausting the Earth's natural capital. For example, Foliente *et al* (2007) report that Australian cities have an 'ecological footprint' of 7.7 global hectares per person, which is well beyond the global carrying capacity of 1.8 global hectares (WWF, 2006). As the number and scale of cities grows to accommodate (a predicted) 60% of the global population by 2030, this situation has the prospect of only getting worse (The Johannesburg

Call, 2002; UN Habitat, 2004; Beeton *et al*, 2006; WRI, 2008).

Clearly, we must begin to substantially transform our cities, responding to immediate challenges (like drought) while also achieving major improvements in sustainability. As 'hotspots' of consumption, production and waste generation, cities possess an unparalleled potential to increase the energy efficiency and sustainability of society as a whole (WRI, 2008).

While many authors have articulated the principles of sustainable cities, either in their form, function or governance, few have examined how to overcome the basic barriers to their realisation. That is the purpose of this paper.

CITIES FACE COMPLEX CHALLENGES

Developed cities around the world face a similar set of challenges. Not only are the basic needs of housing, transport, water supply, sanitation and energy under strain, but demands for effective communication make the supply of broadband services (for example) an important part of infrastructure provision. And while climate change has emerged as a major threat to society, it is important to recognise that it is still only one of a spectrum of significant and inter-related sustainability issues.

Figure 1 provides a high level view of the complex interactions that characterise cities, and the emerging mega-trends that will shape our cities in future. Failure to recognise these trends and their interactions is a significant planning risk that would undermine the robustness of public and private investment. That is, there is real potential to invest precious public funds in infrastructure that will have limited future adaptability, usefulness and hence sustainability. Conversely, successfully navigating the landscape of emerging trends is central to 'cracking the code' of sustainable urban development.

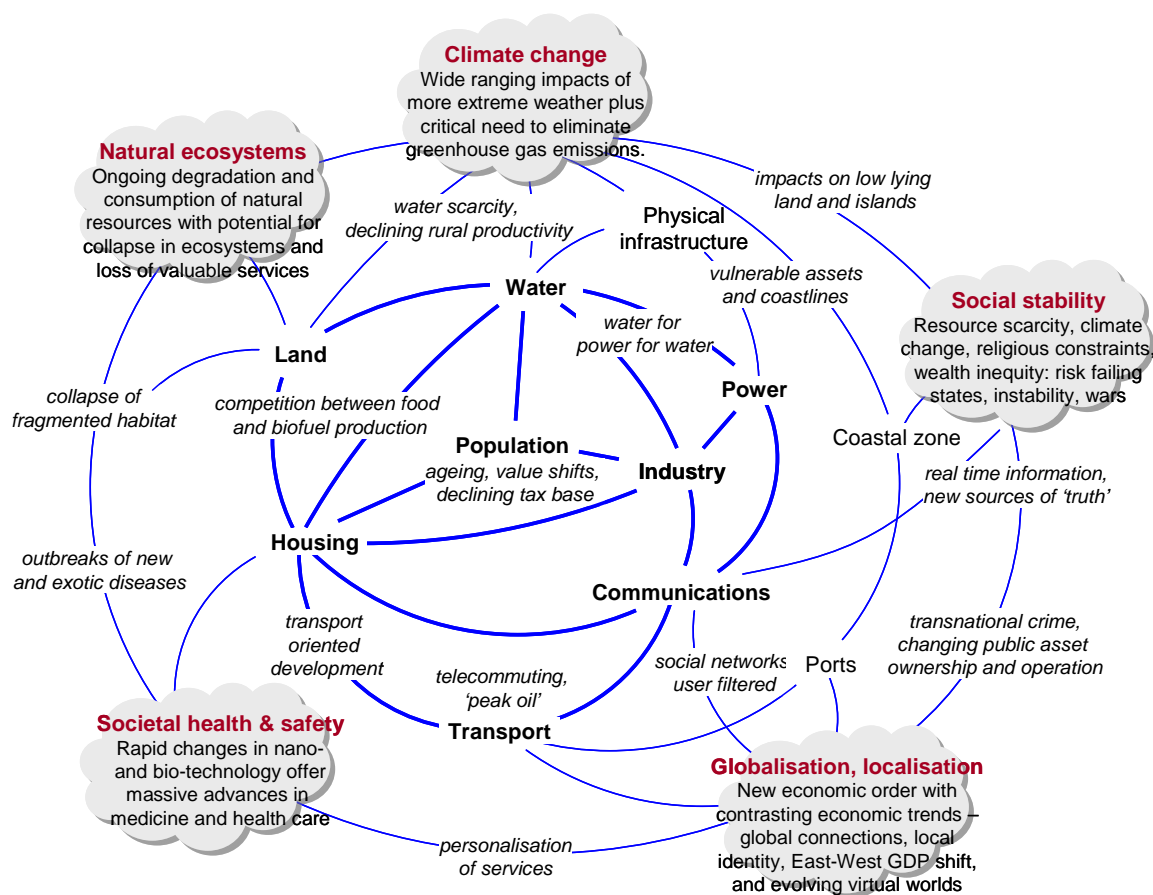


Figure 1 – Clouds of change influencing the form and function of cities (incorporating Panos, 1999; Levin et al, 2003; Teplova, 2006; Foliente et al, 2007a; WEF, 2007)

CAN CITIES BE SUSTAINABLE?

This question goes to the heart of this paper and notions of sustainability. What does sustainability mean in the context of a city, and is it even sensible to strive for? Certainly many reports have been written and inquiries conducted on the (often unquestioned) premise that cities can be sustainable, yet the sustainability outcome or 'end state' is rarely articulated. Often, it is implied to mean an improvement in the economic, social and environmental conditions within a city, or more specifically, ongoing economic and social development with reduced environmental impact. The current preoccupation with impact mitigation, while helpful in the short-term, is ultimately deficient because (a) it fails to deliver against core principles of sustainable development, (b) impact mitigation is regarded as a cost on business and is therefore avoided if possible, (c) it fails to question whether the traditional approach to city design and management is flawed or no-longer useful, and (d) it masks the enormous social and business opportunity that sustainable development presents. Furthermore, social sustainability and social insight is routinely the 'poor cousin' to environmental issues in these studies (Randolph, 2006; Rossel & Furth, 2006) despite the fact that cities are

fundamentally environments constructed by and for humans to fulfil basic needs and more advanced aspirations. Thus many plans and studies still fail to deal with this question.

Working from the premise that cities *can* be designed to support social sustainability, then it becomes necessary to examine the sustainability of resource flows that materially sustain a city. If sustainability means a city must be self sustaining within its physical boundary, then it is probably implausible now (if not in some future state) that a city can be fully self-sustaining. However, if the question is reframed as "can a city exist and operate within the carrying capacity of the ecological and physical systems that resource and enable it?" then arguably a city can be sustainable. What is almost certain is that cities can be much more sustainable than their current state.

Ultimately the design, function and sustainability of cities are a function of aspiration, imagination and choice, which is why sustainability is more a socio-political than environmental issue. We will get what we choose as a society, whether through passive inaction or proactive design.

CITIES AS RESILIENT SYSTEMS

Just as city planners must think systemically about the issues and trends that are faced by cities, so too must they recognise the systemic nature of cities. Cities are organisms that respond (dynamically and sometimes unpredictably) to external stimuli over which there is little direct control. It is not only governments that shape cities but the industries, businesses and citizens that inhabit them through an ongoing interplay of choices, actions and investments. Yet city planners and government agencies generally assume the role of 'managers' seeking to control and optimise the operation of the city features and functions over which they have authority. Indeed, planners and engineers have traditionally based the design and operation of cities on the (often unstated and unrecognised) assumption that they *can* be planned and operated according to the rules of mechanics and hierarchy. Quite simply, these assumptions are false. The problem is that accepting this reality presents a major challenge to the status quo. The question is "what's the alternative?"

The alternative is to recognise and deal with cities as dynamic systems, where the objective is to sustain the human and ecological systems, and the physical, financial, ecological and human assets (or capital) they contain (SKM, 2003; Fleming, 2005). But here's the crunch – *how* do you shape and effectively manage cities as dynamic organisms that foster sustainability?

The answer lies in maintaining the attributes of the social, economic and environmental systems that sustain their health and continuity, and thus the capacity of these systems to provide services and resources into the future. Bossel (2001), SKM (2003) and Walker and Salt (2006) identify five key attributes of sustainable systems:

- good health and function (system integrity),
- diversity in system components and processes,
- resilience to short-term shocks,
- adaptability to longer term change,
- efficiency in securing and using resources (energy, matter, information) in production.

These attributes are relevant to human and environmental systems and have been practically applied to guiding urban development in a regional context (for example, see SKM, 2003).

The key message is that we must move beyond 'reductionist' thinking (breaking things into their parts) to deal with cities in their true complexity, acting as if we believe that the whole is actually more than the sum of its parts (SKM, 2006a).

WHY PURSUE SUSTAINABLE CITIES?

Some people may reasonably question 'Aren't we already doing enough to sustain our cities by

securing water supplies and reducing the carbon footprint of our energy use?"

Certainly these are useful and important steps, but hardly sufficient. There are many important social and economic reasons to act, including:

- Supporting the changing needs of a city's citizens (such as an ageing population and one requiring global connectivity).
- Dramatically reducing resource use per capita while improving people's quality of life.
- Meeting growing demands for investment in public infrastructure and services when the revenue (tax) base is declining.
- Improving the health outcomes available through good urban design.
- Ensuring cities are economically productive and competitively attractive to business and to the financial and human capital they require.
- Developing transferable (exportable) knowledge to assist developing countries that lack effective governance and skills (Kaufmann *et al*, 2007).

Quite simply, there are many compelling reasons why business and the community should be holding governments to account for their role in shaping and investing in the sustainability of their city.

IS ACTION MATCHING THE RHETORIC?

In short, no. Locally and globally, cities continue to be developed in ways that are unsustainable. Only a handful of cities exist (or are in planning) that could *legitimately* carry the tag of 'sustainable', such as Curitiba in Brazil, Dongtan in China, and Masdar in the United Arab Emirates. It's not so much that there's a lack of plans to enhance the sustainability of cities (such as SGS, 2008), but a lack of political will, inspiration, funding and delivery skills across all levels of government. Richardson (2007) reports that no Australian or New Zealand city has demonstrably committed to integrated policies or long term infrastructure plans in support of sustainability. And Forster (2006) states that "Overall the metropolitan planning strategies suggest an inflexible, over neat vision for the future that, however well-intended, sits dangerously at odds with the picture of increasing geographical complexity that emerges from recent research on the changing internal structure of Australian cities since the early 1990s." Trends in investment and urban development underscore this situation (for example, see Beeton *et al*, 2006).

It is also clear that there is a relative absence of data on the sustainability of cities in the international literature on city design and development (Short, 2004 in McManus, 2005), and where indicators are established they are often poorly aligned with the outcomes being sought (SKM, 2003; SKM, 2004).

The only reasonable conclusion to reach is that the current efforts to improve urban form and efficiency, however well intentioned, are sadly inadequate to achieve sustainable cities.

WHY ARE WE STRUGGLING?

People that are interested and bothered to look will not only find evidence of the rising unsustainability of cities but also of the tremendous wisdom and insight that exists to guide more sustainable development. So why is there so little evidence of this wisdom being put into practice in policy reform, program design and investment to achieve tangible change on-the-ground?

Many reasons can be offered, such as confusion over what sustainability means in practice, to a lack of interest or commitment, to powerful interest groups lobbying to retain the status quo, or simply because of a lack of funding. Whatever the reasons, they are particular to each stakeholder group.

This paper focuses on government and its role in infrastructure provision – an important topic because the infrastructure provided by government has a major flow-on effect on the nature, form and function of development that ‘fills in’ the city (SKM, 2003).

Insights to the struggle government endures with respect to sustainable infrastructure development have been developed using a technique known as Causal Layered Analysis (CLA), drawn from the field of strategic foresight and designed by Sohail Inayatullah (2002). CLA is based on the assumption that the way a problem is defined determines the solution and the people that must implement it. Specifically, CLA unearths four layers of a problem:

- 1) the **litany** – described by quantitative trends, problems, events and issues that are most visible, obvious, and rarely questioned;
- 2) **systemic causes** – the economic, cultural, political and historical factors that give rise to the litany;
- 3) the **worldviews** or mindsets that support and legitimate the litany and its causes, and finally
- 4) **myth/metaphor** – the stories, archetypes and values that unconsciously shape mindsets.

The value of CLA is reflected in comments made by city leaders from across the globe. When questioned about the development of sustainable cities, a majority of city leaders stated that “it is very important to know where you are now and where you want to go” to inform your actions (PWC, 2007). And it is for this very reason that CLA is so useful – it provides a much richer and deeper view of “what’s really going on now” as a foundation for designing transformative actions to achieve some desired future state. Too often our understanding of

problems, and inclination to leap straight to solutions, leaves us with pathways and action lists that are flawed from the start and doomed to fail. CLA moves discussion and debate beyond the superficial, obvious and disconnected to the deeper, more integrated and realistic.

The application of CLA to the struggle of developing sustainable cities revealed the insights presented in Figure 2. The insights are drawn from a range of relevant literature (including RECCEE, 2000; PoV, 2004; CoA, 2005; EA, 2005; Hamnett, 2005; SKM 2006b) and planning and engineering colleagues within Sinclair Knight Merz. In short, the key messages that emerge from the CLA are:

- Despite planning for sustainable development of (some) cities, the majority of current investment in public infrastructure simply maintains the inertia of unsustainability.
- The structure, functioning and effectiveness of government is not currently up to the task of overcoming this inertia to sustainably develop and manage cities.
- Outmoded ways of thinking drive tight political control and a focus on management over leadership, while hoping for a ‘techno-fix’ to sustainability challenges.
- The dominant values of our leaders and decision makers instil a penchant for short-term success, competition and economic efficiency.

The central message is that our leaders and decision makers generally lack the values and cognitive style to effectively envisage, lead and deliver meaningful change.

MAKING THE TRANSITION

So how do we trigger and drive the transformation our cities need? In short, by changing thinking.

Sustainability is fundamentally a challenge to the way we think and the choices we make. Our current mindsets and dominant values are inconsistent with sustainability, and if our cities are to evolve to be more sustainable then so too must our hearts and minds.

Emerging wisdom from the fields of evolutionary psychology (Wilber, 2000), change management (Rossel & Furth, 2006; Robinson, 2007) meta-history (Sarkar, in Inayatullah, 2002), ‘tipping points’ (Gladwell, 2000) and the wealth of leadership and management literature have been integrated into the suggested transformation pathway presented in Figure 2. It also reflects principles for sustainable cities such as those found in William McDonough & Partners (1992), UNEP & VEPA (2002), and Mondaymorning (2007).

FROM

the current situation

The litany of problems

Most infrastructure development and investment continues to maintain the inertia of unsustainability:

- Services and infrastructure are under stress from age, environmental factors, growing population, urban sprawl
- The form of residential development is driven by investors, not occupiers or planners
- Natural resources supporting cities are sourced further afield
- Investment continues into unsustainable infrastructure
- Investors favour physical solutions (infrastructure) over behavioural solutions (operational changes)
- Few cities have strategic growth plans that are supported and actually guide sustainable development
- Disconnect between rhetoric and action

Systemic causes

The structure, functioning and effectiveness of government is not up to the task of overcoming the current inertia:

- Deskilling of government
- Politicisation of government agencies driving short-termism
- Structures of government institutions don't match needs
- Fragmentation of planning within and across government
- Crises force rapid solutions and 'more of the same'
- Private ownership and/or operation of public facilities
- Duplication and/or lack of role clarity across govt agencies
- Shallow and/or one discipline view of 'the problem'
- Argued a lack of complete / accurate information
- Under-investment in maintenance, upgrading and renewal
- Inadequate engagement with stakeholders and public to shape and improve infrastructure delivery and operation
- Lack of catalytic personalities
- No compelling alternative to the status quo
- Things change slowly in the built environment

Mindsets shaping decisions

Outmoded ways of thinking drive tight political control and short-term thinking with an underlying 'hope' for a techno-fix:

- Corporatisation of government, focus on economic efficiency
- Focus on minimising political risk not creating future value
- Dominance of hierarchy as a mode of governance and operational control in planning and regulation
- Disempowering of government agencies with centralised political control and decision making around leader
- Lack of vision about what we're working towards and why
- Confusion over what sustainability means in practice
- Reductionistic engineering and professional mindsets (inflexibility of 'accepted wisdom' and ways of doing things.
- Homogeneity in thinking styles & values of decision makers
- Human preference for the local, immediate and tangible over the global, longer-term and intangible.
- Expecting (hoping for) a techno-fix to sustainability issues

Metaphors reflecting guiding values and beliefs

Dominant values of leaders reflect an interest in short-term success, competition and economic efficiency:

- "Freedom of choice" i.e. don't constrain people's activities
- "We'll take measured responses" or "evidence based decision making" i.e. no action without hard, irrefutable data
- "Fiscally conservative" i.e. government is about economic management first and foremost
- "Keep the economy strong" i.e. jobs and votes come first
- "There's a right way to do this" i.e. right/wrong, black/white, order, standards, hierarchy
- "Bigger and better" i.e. compete, succeed, don't collaborate

TO

the desired future state

Leaders embrace the existing wisdom and shift behaviours, conversations and investments to foster transformation to a more sustainable state:

- Cities functioning as largely self sustaining organisms that provide quality lifestyles while continuing to evolve in line with a shared vision and values.
- Government is structured, skilled and equipped to plan, develop policy and invest in programs to ensure the city is 'future ready'. Government also promotes citizenship and partnerships.
- Leaders (and decision makers) are guided by values and vision, recognising the importance of transparency, accountability, inclusiveness and equity.
- Ultimately, people believe in seeing the 'big picture', and value ongoing learning, flexibility alongside excellence, and in securing a prosperous future.

10. **Evaluate.** Monitor and transparently report progress, to demonstrate commitment, to build trust and accountability, and to inform the 'next steps'.
9. **Execute.** Foster excellence in program delivery, tailoring organisational structures, skills and partnerships between public and private enterprise for efficient delivery.
8. **Invest.** Modify investment rules to consider longer-term factors and the costs of action against those of inaction.
7. **Integrate.** Tailor organisational structures and processes to achieve 'people centred' land use and infrastructure planning.
6. **Focus.** Set targets to focus thought and action.
5. **Vision.** Provide hands-on experience in designing alternative pathways, creating a vision that is inspiring and responds to people's core values.
4. **Collaborate.** Engage business, industry and the community as knowledgeable partners (not just voters).
3. **Explore.** Expose plausible futures for cities through scenarios grounded in observable trends, and demonstrate systems thinking in action (and how it can be done) and the flaws, risks and opportunities it exposes.
2. **Challenge.** Use strong rational logic to openly challenge conventional thinking and the status quo, and in doing so, creating a language for a sustainability conversation.
1. **Engage.** Focus on people that can trigger and escalate change – knowledge holders, connectors, communicators.

VIA

a transformation pathway

Figure 2 – A transformative pathway to deliver infrastructure for sustainable cities

While it is not possible to articulate all the rationale underpinning the transformation steps here, it is important to recognise that:

- Honouring the past is critical to engaging people in making change, which means respecting people, their past achievements and the good that it has provided society, as well as the ongoing value of their existing skill sets.
- Shifts in thinking will always precede shifts in values, hence it is important to build people's ability to think in higher order (systemic) ways.
- People are unlikely to embrace change unless our current modes of thinking and operation cease to be effective and their dissatisfaction is matched with alternatives that are achievable.
- Actions to trigger transformation must be 'integral' – that is, simultaneously addressing all four levels of the CLA. No one action (or style of actions) will deliver results.

Thus to trigger dissatisfaction and enable change, it is important to:

- demonstrate current patterns of development are not working and threaten the current dominant core values,
- apply pressure to catalyse and drive change,
- support leaders and decision makers to make change at personal and professional levels.

In many respects, this is all about embracing the principles, mindsets and practices exhibited in leaders of modern organisations; that is, values-based leadership, support for collaboration and innovation, fostering of ongoing learning, and supporting the self organising capabilities of people (holarchy) to overcome the flaws and failings of mechanistic controls and hierarchy (Senge, 1990; SKM, 2006a; PWC, 2007).

Furthermore, the actions within the transformation pathway in Figure 2 have been tested and proven effective on a range of sustainability-related projects lead by SKM and others. A recent case study demonstrates these principles in action (after Fleming *et al*, 2007).

AN URBAN WATER SYSTEMS EXAMPLE

For over two decades, the City of Salisbury (in Adelaide, South Australia) has been recognised as a national leader in urban water management – improving drainage, restoring watercourses, establishing wetlands and constructing aquifer storage and recovery systems – all to manage flood risk, improve urban amenity and to offer alternative water supplies. Yet many of the City's activities had been opportunistic and it was time to align future investment within a broader, integrated strategy for water management. The City of Salisbury had prepared a draft management strategy for the water resources available to it (principally stormwater and

groundwater), and wanted to have that strategy tested and refined so that it became a trusted guide for future investment and management activities of Council. In short, Council wished to achieve:

“... flood control, environmental protection and regional economic development through integrated management and efficient, productive use of the water resources available to the Salisbury local government area.”

In testing and further developing Council's strategy for water management several of the transformative actions (in Figure 2) were implemented as part of an innovative strategic process designed and lead by SKM on behalf of the City of Salisbury and the Northern Adelaide & Barossa Catchment Board (“the Client”). The process involved:

Engage. From the outset the project team recognised that it was necessary to open up thinking with the Client and other stakeholders that held both key insights and the influence to implement them, ensuring the collective experience was brought to bear in testing and refining the draft strategy. The project approach therefore included a strategic thinking phase that allowed critical stakeholders to engage in a constructive way.

Challenge. A dialogue with our clients and the key stakeholder group focused on mapping the extent of historical change in water management and associated urban, social and policy conditions (drivers of change). This provided a basis for challenging thinking about the future and the scale of change that may occur. It became clear that factors operating outside the City's control (such as government policy reform and climate change) are critical to the robustness of decisions and maintenance of returns on investment in water management measures over time.

Explore. Three alternative scenarios of the future were constructed using the seeds of trends observable today, to ensure that stakeholders recognised and regarded the scenarios as plausible. A systems diagram of the water resources available to the region, integrating those under the management and influence of the client, was prepared to assist holistic thinking, and the potential cause-and-effect relationships that could come into play under the three alternative scenarios of the future.

Collaborate. Through dialogue, inquiry and integrated simulation modelling engaging the client and key stakeholders, it was possible to examine the risks and opportunities associated with future water management, and in doing so, exposed some 'blind spots' in current thinking and potential flaws in the draft water management strategy. The scope of work was adjusted to incorporate new risks and

opportunities. Climate change, the provision of water for urban environmental flows, and shifts in urban form (such as the introduction of rainwater tanks in many households) were added to the agenda.

Vision. The Client and stakeholders (now including industry) built upon the map of the past and drivers of change (from 'Challenge') to explore the perceived 'probable future' and then to contrast that with their collective 'preferred future' from which they articulated a vision for water management in the City and region for 2025.

Focus. A strategic direction was defined and agreed that proved robust to each of the three future scenarios, which informed the development of a suite of targeted actions to effectively execute the refined strategy.

Integrate. The City's organisational structure for delivering water related services was entirely changed, forming a new business unit dedicated to integrated water planning and service delivery. And for the first time a policy was developed to help allocate manage stormwater across jurisdictional boundaries, recognising its resource value (SKM, 2005).

The subsequent stages of the transformative process (Invest, Execute, Evaluate) were not part of the project but did reside within the plan for the new water business unit being established by the City.

The trigger for shifting thinking

The strategic planning and integrated water modelling demonstrated the potential for a major reduction in stormwater yield, which coupled with uncertainty over the long-run demand from major water consumers for alternative sources of water, had the potential to significantly undermine the appetite of the City of Salisbury to invest further in new water harvesting schemes. However, when viewed in the broader context of the regional water cycle, climate change and environmental flow requirements could have an equivalent (and arguably greater) impact on the yield of Adelaide's metropolitan water supply catchments. As such, the harvested stormwater may become relatively more valuable over time.

This demanded some new thinking about the role of stormwater in the water cycle, suggesting the region's water resources may need to be allocated very differently in future. Relatively good quality groundwater (that is currently used unsustainably for horticultural irrigation) may need to be redirected to complement existing sources of raw surface water, feeding into the mains reticulation network. Reclaimed wastewater could then offset the diverted groundwater, which along with stormwater,

could achieve greater use in irrigation and industry. These results also brought the challenge of managing the surface- and storm-water resource across municipalities into clearer focus.

Fundamentally, the whole challenge of managing stormwater within the City of Salisbury, and indeed the broader region, had been entirely recast through a collaborative strategic planning process. Mindsets had been changed and public investment is arguably being directed into facilities that are more robust and sustainable in the urban environment.

The important lesson

Proponents for sustainability typically strive for gains in efficiency in production and resource use, just as most organisations do every day. In this case, it was efficiency in the harvesting and use of stormwater. Yet the risk exists that our focus on 'doing things right' (i.e. pursuing efficiency) leads us to lose sight of whether we are 'doing the right things' (i.e. pursuing effectiveness). This study was very much about determining what was the 'right thing' to do, demonstrating that the original draft strategy was not robust and needed refinement. Quite simple, the answer we get (or provide) to the sustainability question depends entirely on how the problem is defined. Hence, we must question and improve our problem definition processes.

CONCLUSIONS

The days when the growth of a city can be planned without having a broad perspective and looking into the future are over. While our cities are a major contributor to society's sustainability woes, they can also be a major part of the sustainability solution. We are firmly in an era that demands new solutions, which must be achieved using less physical, natural and financial resources. Against no measure of the triple bottom line can we afford to continue investing in infrastructure that is unsuited to future societal needs. This requires new thinking.

Our leaders and decision makers must be supported to learn new ways of thinking, to recognise and embrace existing wisdom, while also being held accountable to execute that thinking through new strategies and governance models that implement sustainable development. In the process a new generation of urban leaders must be bred.

There is no one right or best pathway but many alternative paths. Hence we must also be guided by values and principles that are well established and about which we communities and governments the world over generally agree.

Finally, the process must be transformative – achieving a step change in thought and action. We must act now and decisively to deliver an improved

quality of life and amenity that communities will embrace, but which also take time to deliver. As Foliente *et al* (2007b) astutely observe “time is the ultimate non-renewable resource.”

REFERENCES

- Beeton R.J.S., K.I. Buckley, G.J. Jones, D. Morgan, R.E. Reichelt, D. Trewin (2006 Australian State of the Environment Committee) (2006) *Australia State of the Environment 2006*, Independent report to the Australian Government Minister for the Environment and Heritage, Department of the Environment and Heritage, Canberra.
- Bossel, H. (2001) Assessing viability and sustainability: a systems-based approach for deriving comprehensive indicators sets, *Conservation Ecology*, Vol. 5, No. 2, article 12.
- CoA (2005) *Sustainable Cities*, Report of the House of Representatives Standing Committee on Environment and Heritage, Parliament of the Commonwealth of Australia, Canberra.
- Teplova T. (2006) *World economy trends and their implications for the City of Calgary*, Research Report F64, Canadian Policy Research Networks Inc., Ottawa.
- EA (2005) *Australian Infrastructure Report Card*, Engineers Australia, Canberra.
- Fleming N.S. (2005) Systems-based planning and information networks for sustainability, In: *Working on the Frontier – Environmental Sustainability in Practice*, EIANZ Conference, 29 March – 1 April 2005
- Fleming N.S., K. Smith, C. Kaufmann (2007) Sustainability in practice – scoping the water futures for northern Adelaide, In: *SSEE international Conference on Engineering Sustainability*, 31 Oct – 2 Nov, Perth, Western Australia
- Foliente G., A. Kearns, S. Maheepala, X. Bai, G. Barnett (2007a) Beyond triple bottom line – sustainable cities RD&D at CSIRO, In: *State of Australian Cities National Conference*, Adelaide, 28-30 November 2007.
- Foliente G., A. Rodgers, H. Blutstein, X. Wang (2007b) Urban sustainability transition – a ‘tipping point’ approach, In: *State of Australian Cities National Conference*, Adelaide, 28-30 November 2007.
- Forster C. (2006) The challenge of change: Australian cities and urban planning in the new millennium, *Geographical Research*, Vol. 44, No. 2, pp. 173-180
- Gladwell M. (2000) *The tipping point: how little things can make a big difference*, Little Brown, New York.
- Hamnett S. (2005) 10 years of metropolitan strategic planning in South Australia, In: *State of Australian Cities National Conference*, 30 November – 2 December 2005, Brisbane.
- Inayatullah, S. (2002) *Questioning the future: methods and tools for organisational and societal transformation*, Tamkang University, Taiwan.
- IPCC (2007) *Summary for Policymakers of the Synthesis Report of the IPCC Fourth Assessment Report*, November 2007, Intergovernmental Panel on Climate Change, Washington.
- Kaufmann D., A. Kraay, M. Mastruzzi (2007) *Governance Matters VI: Aggregate and Individual Governance Indicators 1996-2006*, World Bank Policy Research Working Paper 4280, World Bank, Washington D.C.
- Levin R.S., E.J. Yanarella, T. Radmard, H. Dumreicher (2003) Sustainable cities – a strategy for a post-terrorised world, *Terrain.org*, No. 13, Summer/Fall.
- Mondaymorning (2007) *Copenhagen Agenda for Sustainable Cities: 10 Principles for Sustainable City Governance*, Danish Ministry of the Environment, Copenhagen.
- McManus P. (2005) Sydney sucks! (chews and spits): defining and measuring vortex cities and sustainable cities, In: *State of Australian Cities National Conference*, 30 November – 2 December 2005, Brisbane.
- Panos (1999) *Cities of the future – dream or nightmare?* Panos, London.
- PoV (2004) *Inquiry into sustainable urban design for new communities in outer suburban areas*, Outer Suburban Interface Services Development Committee, Parliament of Victoria, Melbourne.
- PWC (2007) *Cities of the future – global competition, local leadership*, Price Waterhouse Coopers, www.pwc.com
- Randolph B. (2006) *Delivering the company city in Australia: current trends and future implications*, City Futures Research Centre, Research Paper No. 6, June 2006, University of New South Wales.
- RECCEE (c2000) *Barriers to creating sustainable cities*, Regional Environment Centre for Central and Eastern Europe.
www.rec.org/REC/Programs/SustainableCities
- Richardson E. (2007) Sustainable transport and city development – vision, infrastructure and policy, Sinclair Knight Merz, In: *Transport – The Next 50 Years: Sustainability, Integration, Economic Growth*, 25-27 July 2007, Christchurch, New Zealand.
- Robinson L. (2007) *Introduction to the 7 doors model*, Version 1.3, February 2007.
www.enablingchange.com.au
- Rossell S.A., I. Furth (2006) *Listening to the public: understanding and overcoming barriers to sustainability*, Viewpoint Learning Inc., San Diego.
- The Johannesburg Call* (2002) A statement by local governments of the world at the World Summit on Sustainable Development, Johannesburg, South Africa, 30 August 2002

- Senge P.M. (1990) *The fifth discipline: the art and practice of the learning organisation*, DoubleDay, New York.
- SGS (2008) *Sustainable Sydney 2030: City Vision – Draft Strategic Plan*, Final Consultation Draft, SGS Economics & Planning for the City of Sydney, Sydney.
- Short J.R. (2004) *Global metropolitan: globalising cities in a capitalist world*, Routledge, London.
- SKM (2003) *Vision for the Werribee Plains – Regional Sustainability Framework*, for Victorian Department of Sustainability and Environment, WC02454, Sinclair Knight Merz, Melbourne.
- SKM (2004) *Sustainability indicators to inform growth of south east Queensland*, Sinclair Knight Merz for Office of Urban Management, Queensland Government, Brisbane.
- SKM (2005) *Developing the stormwater resource in Adelaide – a robust approach*, WC02926, Sinclair Knight Merz for the City of Playford and Northern Adelaide & Barossa Catchment Board, Adelaide.
- SKM (2006a) *A systems approach to natural resource management – linking strategic thinking to strategic planning*, Sinclair Knight Merz for the Gippsland Lakes Research Group, Melbourne.
- SKM (2006b) *Melbourne's transport future – a discussion paper*, SF90165, Sinclair Knight Merz Pty Limited, Melbourne.
- UNEP (2005) *Living Beyond Our Means: Natural Assets and Human Well-Being*, Millenium Ecosystem Assessment, United Nations Environment Program, New York.
- UNEP, VEPA (2002) *Melbourne Principles for Sustainable Cities*, United Nations Environment Programme, Victorian EPA, ICLEI, City of Melbourne, Melbourne.
- UN HABITAT (2004) *The state of the world's cities: globalization and urban culture*, United Nations Human Settlements Programme, Earthscan Publishing, London.
- Walker B., D. Salt (2006) *Resilience thinking: sustaining ecosystems and people in a changing world*, Island Press, Washington.
- WCED (1987) *Our Common Future*, World Commission on Environment and Development, Oxford University Press, Oxford. 400 pages.
- WEF (2007) *Global Risks 2007*, Global Risk Network Report, World Economic Forum, Geneva.
- Wilber K. (2000) *A Theory of Everything: An Integral Vision for Business, Politics, Science and Spirituality*, Shambhala Publications, Boston.
- William McDonough & Partners (1992) *The Hannover Principles – Design for Sustainability*, prepared for EXPO 2000 (Hannover, Germany), William McDonough Architects, Charlottesville, Virginia USA.
- WRI (2008) *Urbanisation and environmental sustainability*, EarthTrends Update: February 2008, World Resources Institute.
- WWF (2006) *Living Planet Report 2006*, World Wide Fund for Nature (WWF), Gland, Switzerland.

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