Curtin University

"Taking Down the Fence": Wharf Street Next Generation Community Park

A Report for the City of Canning

School of Design and the Built Environment, Curtin University

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SCHOOL OF DESIGN AND THE BUILT ENVIRONMENT,

CURTIN UNIVERSITY

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Images courtesy of Courtney Babb, Reuben Black, Angelika Limmarja, Shohreh Nematollahi and Gary McCullough.

DISCLAIMER

This study has been approved by Curtin University Human Research Ethics Committee (Approval # HRE2020-0435). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. If needed, verification of approval can be obtained either by writing to Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au.

EXECUTIVE SUMMARY

This report details the implementation and initial community impact of the City of Canning's Wharf Street Next Generation Community Park (WSNGCP) ('the project'). The project received funding in 2018 in the second round of the Federal Government's Smart Cities and Suburbs to transform an inaccessible stormwater drain in the Canning City Centre into a Next Generation Community Park – a smart technology enabled community space that would function as a stormwater drain, recreational space, educational resource, and habitat for plant and animal species.

This report reflects research carried out by researchers from the School of Design and Built Environment at Curtin University. The research is the outcome of a two-year project that documented the process behind the planning and implementation of the project and assessed the various functional objectives of the park. This report tells the story of the creation of the WSNGCP using a place audit approach. An initial audit framework was established, comprising a range of indicators across three domains, which were drawn from the initial project goals:

- Productivity: the performance of the park against operations and management, innovation and activation economics.
- Sustainability: the quality of the park for ecological health and resilience.
- Liveability: the quality of the park for access, community fit, safety, and community health.

Several sources of primary and secondary data were used to inform the audit indicators and address the overarching research objectives: including desktop analysis, interview, participatory observation, a suite of surveys, and a reflective workshop. Key findings from the audit for each main indicator of the three domains were as follows:

Figure 1 Wetland vegetation thriving in the basin (Black 2021)

P. Productivity

P1. Operation and Management

The project used a non-standard access agreement between the City of Canning and Water Corporation (WC), whereby ownership of the land was retained by WC whilst the City of Canning held full responsibility for the site. This allowed for new opportunities to reimagine the management and maintenance of the site through design and implementation of technology: for example, the use of sensors for monitoring nutrient and pollutant levels. One of the main constraints on park design was the need to maintain water storage capacity in the basin and several features of the park were defined by this requirement.

P2. Innovation

The park incorporated several smart technological features in accordance with the requirements of the Smart Cities and Suburbs funding scheme, including WIFI and charging outlets centred around benches, smart bins, solar panels on the roof of the pavilion, environmental sensors producing real-time data, and augmented reality. The incorporation of smart technology into the site provided a steep learning curve for City of Canning. Although not all technology planned for the site was fully operational a year after the opening of the park, the incorporation of technology supported several important objectives of the project, including facilitating public learning about urban water infrastructure and catalysing a broader push toward developing a coherent digital strategy in the City of Canning.

P3. Activation Economics

Projects like WSNGCP have been shown to have broader economic benefits, stimulating investment and land value uplift in adjacent areas. Although, no direct measurement of increases in business activity, land values or investment attraction could be determined in the scope of this report, it is likely that the redeveloped Wharf Street Basin will contribute significantly to each into the future.

S. Sustainability

S1. Ecological Health

The redevelopment of the basin and landscaping around its perimeter lead to significant increases in biodiversity habitat, including the reintroduction of over 70 native flora species. Significant care and attention were given to the protection of the existing turtle population, while increases in array of bird species, insects and reptiles were also noted. Several measures to increase water quality at the site were incorporated, including sensors and filtration islands, however the full bio-filtration system was not yet fully implemented.

Figure 2 Water health signage in the park (Black 2021)

S2. Resilience

Along with features captured in the previous indicators, one of the key contributions of the redeveloped park to an adaptive catchment management approach was the generation of knowledge that comes with the public interacting with the ecology of the site. Community engagement in the planning stages was also attempted, albeit with mixed success due to challenges presented by COVID-19. Several links to broader sustainability initiatives were successfully created.

L. Liveability

L1. Access

Data on visitation to the site was captured through both observational surveys and mobile phone sensors. Visitation was found to be higher on weekdays with mild, fine weather. The most common type of visit (25%) was for access only, which reflected the central design motif of "taking the fence down" and was largely thanks to the inclusion of the bridge across the basin that facilitate passage between adjacent NW and SE areas. The inclusion of high-quality fencing for safety purposes within the park, universal access features like gradual sloping paths and handrails, as well as interpretative signage and wayfinding also contributed to enhanced public access to the site. In contrast, several deficiencies in the surrounding urban environment identified during the walkability survey likely limited this access.

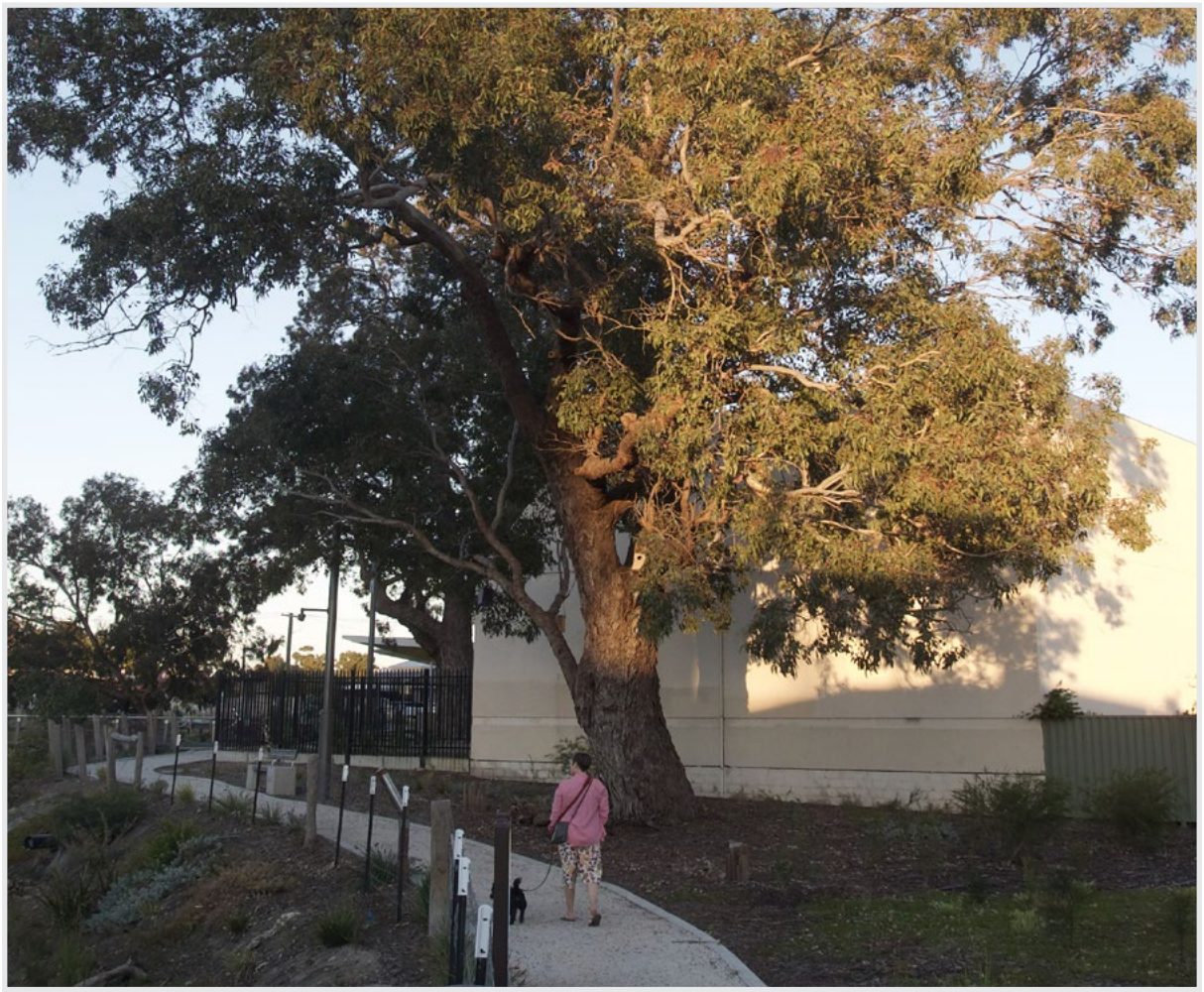

Figure 3 Remnant Eucalyptus rudis (Babb 2021)

L2. Community Fit

Park visitors were observed interacting with natural features in a range of contexts, most notably from the vantage points on the bridge and boardwalk. Observations also suggested visitors interacted with the digital features of the park, although not in high numbers. Visitors tended to be more attracted to informational signage around the park, with an additional education purpose being served by field visits to the "Living Lab" by TAFE and University students. The park was also observed being used by a diverse cross section of the community, both by age and ethnicity. One of the primary community objectives was collaboration with and recognition of Whadjuk Noongar knowledge, values and stories. While it was acknowledged by all parties that engagement with local Elders was not as extensive as was hoped, park features such as the mural, signage and endemic plants were incorporated to reflect their culture. Furthermore, actions have been undertaken in the City of Canning to ensure that engagement with Traditional Owners is more successful for similar projects in the future.

L3. Safety

Based on the results of a Crime Prevention Through Environmental Design audit, the park was determined to have made good use of crime prevention principles. The use of lighting was a part of this assessment, despite the decision to delay the incorporation of smart lighting features. As well as extensive passive surveillance from adjacent houses, direct surveillance was also provided through 16 CCTV cameras installed at strategic locations. The overall safety of the park during its first year was highlighted by few reports of safety incidents, with no reported incidents of users falling into the basin.

L4. Community Health

Despite limited activity space, the park was observed to be used regularly for some form of physical activity, with around a third of users observed in the site surveys doing at least one full circuit of the basin. The redeveloped park was also observed to provide a valuable social function, with three times more walkers observed in a group than alone. Due to the limited space for social gathering, there were fewer passive users observed in groups.

Reflections and Conclusions

The stakeholder group agreed that the project had been successful in transforming the previously inaccessible basin into a well-used and high amenity community park, as well as an asset to the broader Canning City Centre and water catchment. The multidisciplinary nature of the group and its extensive collaboration and knowledge sharing was considered crucial to this success. Challenges experienced during the process mainly related to the incorporation of smart technology to the extent originally planned, as well as the unavoidable loss of design elements and native vegetation due to stormwater management requirements.

ABBREVIATIONS AND TERMINOLOGY

Canning Activity Centre Plan (CACP)

Canning City Centre (CCC)

Canning City Centre Regeneration Program (CCCRP)

Crime Prevention Through Environmental Design (CPTED)

Cooperative Research Centre for Water Sensitive Cities (CRCWSC)

The Department of Biodiversity, Conservation and Attraction's (DBCA)

Design Working Group (DWG)

Department of Water and Environmental Regulation (DWER)

Local Water Management Strategy (LWMS)

Partner Working Group (PWG)

Urban Design and Public Realm Concept Master Plan (UDPRCMP)

Wharf Street Next Generation Community Park (WSNGCP)

CONTENTS

1. INTRODUCTION

In 2018, the City of Canning and partner organisations initiated a project that would transform the Wharf Street Basin – a fenced stormwater drain in the Canning City Centre – into an innovative, smart technology enhanced community park. In the City's words:

> "Canning will redefine the future of inaccessible water retention basins through the redevelopment of Wharf Street Basin into a Next Generation Community Park that embraces smart design and smart technology to deliver opportunities for recreation and education, and improvements to natural systems, within a piece of multifunction drainage infrastructure" (City of Canning 2018, pg 3)

A year before, the City of Canning had adopted the Canning City Centre Activity Centre Plan, a bold plan to revitalise the City Centre and "realise its potential as a Strategic Metropolitan Centre in Perth" (City of Canning 2021, pg 7). The Activity Centre Plan outlined how there was a deficit of public open space in the Activity Centre: thus, with the expected increase in demand from a growing local population, creative solutions were required. In May 2017 the City also adopted the Canning City Centre Regeneration Program (CCCRP) to enable delivery of the amenity building infrastructure to support the vision set out in the Activity Centre Plan for a vibrant Strategic Metropolitan Centre.

Figure 4 Wharf Street Next Generation Community Park: A park of the future (Babb 2021)

Figure 5 View over the basin of the pavilion (Black 2021)

At the same time, there was a growing recognition of the potential for stormwater infrastructure to be repurposed as multifunctional places that would serve a variety of social, ecological and economic objectives. The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) and the Water Corporation's Drainage for Liveability Program provided an important basis for unlocking the potential of stormwater drainage basins.

In 2018, the Federal Government's call for a second round of projects in the Smart Cities and Suburbs fund provided the opportunity for a new project. A partnership was formed between the City of Canning and the Water Corporation, along with other partner organisations, to put forward the Wharf Street Basin as a Smart Cities project. A proposal was developed and subsequently awarded the funding to develop the Basin into a smart technology-enhanced community park. Three key objectives for this smart community park were set out by the project Partner Working Group:

1. "Take the fence down". Importantly, the fence prevents people from entering the site, satisfying safety and security requirements, and its removal will need to be addressed.

2. "Make the invisible visible" and invite people to engage with it. The creation of a system that allows the community to observe and understand water quality and ecological health is a core objective.

3. "Interaction without water contact". Safety and public health are significant concerns and will need to be addressed using physical and smart interventions to create zones for managed access, habitat protection and education.

The project acts as a valuable case study for how similar stormwater drainage assets throughout the Perth metropolitan region can be unlocked for community use.

This report presents research carried out by researchers from the School of Design and Built Environment at Curtin University to document and capture the transition of the Wharf Street site from an inaccessible stormwater infrastructure space to an accessible community resource. The research examines how the park performed across multiple criteria, captured within a Place Audit Framework that reflects the overall project objectives.

This report begins by setting out the research methodology. Three key themes – or urban imaginaries – that informed the project are then presented. The broader context of the Wharf Street Basin is then outlined and is followed by the research findings, organised according to the Place Audit Framework. The report concludes with the key findings from the research.

Figure 6 Signage recognising the traditional owners and custodians of the land (Babb 2021)

2. METHODOLOGY

RESEARCH INTENT

This research project addresses three key areas of interest and sets of research questions, each aiming to generate knowledge of the specific outcomes of the Wharf Street Next Generation Community Park (WSNGCP). In doing so, it also informs future projects that seek to integrate goals of managing stormwater, improving the health of ecological systems, and providing benefits to communities within growing urban areas.

1. The first is to capture the transformation of the site from an inaccessible stormwater basin into a community park. The WSNGCP has the potential to play a key role in the regeneration of the Canning City Centre – acting as a resource for activity, social connection and interaction with its surrounding urban area. How is the park used by visitors? What features and elements contribute to the park achieving its goals? What features and elements challenge the park from achieving these goals?

2. The second is to trace the connections between the WSNGCP and the wider social and institutional actors. The transformation of the Wharf Street Basin into a multifunctional community park generates new capacity for individuals and organisations to connect and learn about the importance of water management, biodiversity, and natural systems in urban environments. What elements of the park support the planning for Canning City Centre? What social and organisational capital does the project build?

3. The third is to document the delivery and implementation of the project. Mapping the delivery of the WSNGCP informs our understanding of how innovation happens in cross-sectoral collaborative projects that challenge the status quo in the planning and management of stormwater infrastructure. What can others learn from this project? What are the unique factors of this project that others need to consider when drawing on lessons learned?

RESEARCH APPROACH AND METHODS

The transformation of the Wharf Street Basin into the WFNGCP is captured in this case study research. Document analysis, project mapping and a series of surveys were used to inform a suite of indicators, arranged according to a Place Audit Framework that represented the project objectives and the aspirations of the stakeholders. Collectively, the indicators describe the physical, policy and social features of the site with particular emphasis on the way the site supports different uses, functions and social and organisational capital. The focus has been placed on articulating what has changed through the transformation of an inaccessible space into a place that supports productivity, ecological sustainability and liveability goals.

The project objectives and research methods used are summarised in Table 1 on the following page.

Table 1: Study objectives and respective research methods

Study Objective	Research Approach
1. Contextualise the significance of the project within its spatial, social and policy context	Literature and policy review
2. Capture baseline built environment and behavioural data for the project site context	Built environment audit (baseline) Desktop analysis Site observations (Phase I)
3. Describe design and project implementation processes.	Project mapping, including: • Document analysis • Participant observation - meetings • Informal interviews with stakeholders
4. Identify the critical transition points in the shaping of the project design.	
5. Capture built environment and behavioral data at completion and post-completion stages	Place audit Site observations (Phase II, III)
6. Triangulate each method to draw out lessons for regenerative, water sensitive and smart cities.	All data

PLACE AUDIT METHODOLOGY

A place audit methodology was the central approach used in this study (see Figure 8). Audit methodologies essentially describe and evaluate how systems or sets of indicators function and perform against expectations or objectives. Audits share similarities with other evaluative methods, such as multi-criteria analysis and systematic social observation. Audits have been used in various ways in place-focussed research to measure the walkability and bikeability of streets (Moudon and Lee 2003), recreation in greenspace (Reynolds et al 2007), physical activities in parks (Giles-Corti et al 2005) and to document and classify coastal recreation environments (Middle, Tye and Middle 2018).

The use of an audit approach is useful for understanding projects with multiple objectives. Enhancing the multi-functionality of natural spaces in urban centres is increasingly being used as a strategy to address the increasing demand for green infrastructure in cities, created by the increased intensity of use and demand on services driven by urban consolidation and population growth (Hansen & Pauleit 2014). An audit approach captures a variety of indicators, rather than reducing success to a single factor. Audits also allow for an examination of the interaction between elements of a project, highlighting the synergies and tensions that may exist between project objectives and allowing an understanding of the trade-offs that may be necessary.

The place audit methodology developed for this study was based on previous approaches developed by the research team (See Tiwari 2018 and Creagh et al. 2016). An initial audit framework was established, comprising a range of indicators across three domains, which were drawn from the initial project goals:

- Productivity: this domain reflects the performance of the park against operations and maintenance, innovation and activation economics.
- Sustainability: this domain reflects the quality of the park for ecological health and resilience.
- Liveability: this domain reflects the quality of the park for access, community fit, safety, and community health.

The final audit framework was then developed collaboratively with the project partners. An initial list of indicators for each domain was established and refined through regular project stakeholder meetings, and an audit development workshop was held at the Canning River Eco Education Centre on 25 February 2020 (see Figure 7). Project partners were asked to contribute their own unique datasets to supplement the primary data generated by the research team.

Figure 7 Place Audit development workshop at Canning River Eco Education Centre (McCullough 2020)

Following the workshop, a final set of indicators was used to guide the data collection; describe the full context and inform an evaluation of the overall performance of the project; and inform the further cross-analysis, identifying supportive and constraining relationships across the three project domains. The final audit framework developed through this process is illustrated in Figure 8 and Table 2, with the full list of indicators explored in Chapter 5.

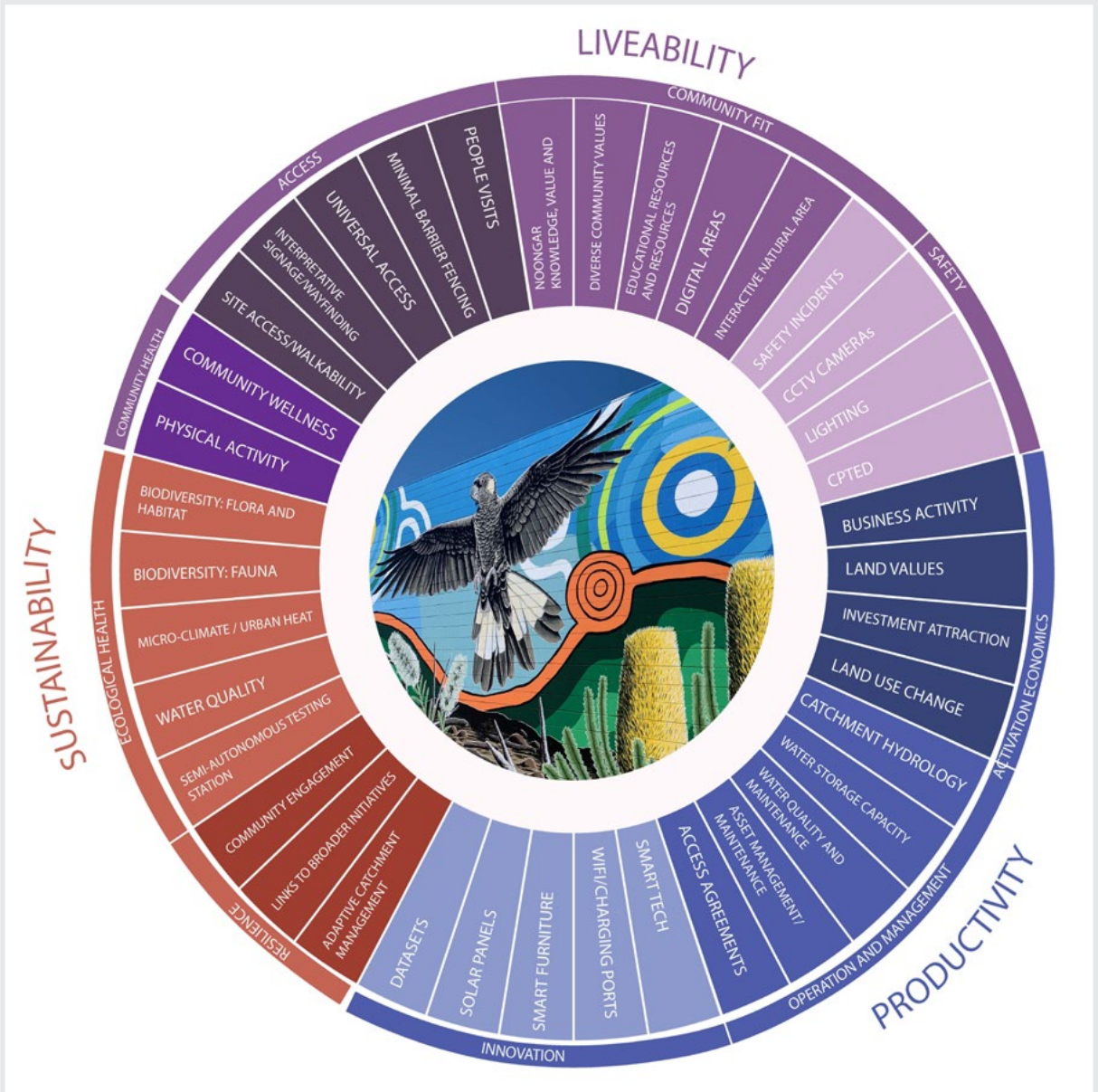

Figure 8 Place Audit Framework

Table 2: Summary of indicators for each domain (Table continues on following page)

Productivity

Operations and Management	P1.1	Access agreements
	P1.2	Asset management and maintenance
	P1.3	Water quality and maintenance
	P1.4	Water storage capacity
	P1.5	Catchment hydrology
Innovation	P2.1	Smart tech
	P2.2	Wifi and charging options
	P2.3	Smart furniture
	P2.4	Solar panels
	P2.5	Datasets
Activation Economics	P3.1	Business activity
	P3.2	Land values
	P3.3	Investment activity
	P3.4	Land use change

Sustainability

Ecological health	S1.1	Biodiversity: flora and habitat
	S1.2	Biodiversity: fauna
	S1.3	Microclimate/urban heat
	S1.4	Water quality
Resilience	S2.1	Adaptive catchment management
	S2.2	Community engagement
	S2.3	Links to broader initiatives

Liveability

Access	L1.1	People visits
	L1.2	Minimal barrier fencing
	L1.3	Universal access
	L1.4	Interpretive signage/wayfinding
	L1.5	Site access/walkability

Community fit	L2.1	Interactive natural areas
	L2.2	Digital areas
	L2.3	Educational resources and research
	L2.4	Diverse community values
	L2.5	Noongar knowledge, values and stories
Safety	L3.1	Crime Prevention Through Environmental Design
	L3.2	Lighting
	L3.3	CCTV cameras
	L3.4	Safety incidents
Community health	L4.1	Physical activity
	L4.2	Community wellness

SOURCES OF DATA

There were several sources of primary and secondary data that were used to inform the audit indicators and address the overarching research questions. This included a suite of three site survey techniques used to inform relevant place audit indicators.

Secondary data and document analysis

A range of secondary data sources and documents were used to inform the audit indicators. As explained above, the project stakeholders contributed their own unique datasets and documentation that were generated by their respective organisations. Documents that were relevant to informing the context and several of the audit indicators were also sourced through desktop research. The secondary data and documents that informed the research were analysed using a variety of statistical and qualitative techniques. A full list of datasets and documents included in the analysis are contained in the Reference list.

Interviews and participant observation

Interviews and participant observation of the project steering group meetings assisted in the mapping of the project process and informed a wide range of indicators. Six semi-structured interviews with key project stakeholders were carried out in early 2021. These interviews lasted from 45 minutes to 2 hours and were aimed at informing the audit indicators, cross-checking and verifying information about various indicators gathered through other methods, and capturing key reflections on the overall project process and performance of the park against project objectives. The interviews were also supplemented with an extensive set of shorter forms of communication with project stakeholders to cross-check and verify information.

In addition to formal interviews and informal one-on-one communications, the research team also attended and participated in Partner Working Group meetings from February 2019 to June 2020. This form of participatory observational research was important to map the progression of the project and to inform the analysis of the set of audit indicators. Data was generated through fieldwork notes and verified by ongoing communication between the researchers and the Partner Working Group.

The data generated by the interviews and participant observation was analysed using NVIVO, a qualitative analysis software program. The data was coded using the audit as the coding framework.

Observational Survey

An observational survey was used to capture the physical characteristics of the park, the number and types of visitors to the park, and the main activities visitors conducted whilst in the park. Three sets of observational surveys were carried out across different periods. One set of surveys was carried out before the opening of the park. The two other sets of surveys were carried out following the opening of the park. The research instrument used for the observational survey can be found in Appendix 1.

Observational surveys of the streets surrounding the Wharf Street Basin were planned for March and April in 2020. The surveys were intended to capture the level of use of the local streets surrounding the Wharf Street Basin before the public could access the site. However, the COVID-19 pandemic saw restrictions introduced to the Perth metropolitan area from March to May of 2020. Only two observational surveys were conducted in March immediately prior to the lockdown, and then four more surveys were conducted in May following the lifting of restrictions, in anticipation of the July opening of the park. Ongoing impacts from the COVID-19 pandemic likely influenced the findings in May, as many people remained working from home, or their usual schedules were disrupted.

The second and third surveys were carried out in two periods following the opening of the park in September 2020. The two surveys were conducted in morning and afternoon periods over twelve and nine days in September/October 2020 and January/February 2021 respectively. A summary of the sets of observational surveys is outlined in Table 3.

Table 3: Summary of observational survey approach

Survey Set #	Date range	# of Observations (1 hour each)	Days
1 (Baseline)	March-May 2020	6	Tuesday, Saturday
2	September - October 2020	12	Tuesday, Friday, Sunday
3	January - February 2021	9	Monday, Thursday, Sunday

The second and third surveys were designed to capture a wider range of data from visitors to the parks. An observational protocol was developed to capture the numbers of visitors; the age groups of visitors; types of activities conducted by visitors whilst at the park; and visitors' points of access to the park. Opportunities for capturing open-ended field notes were also provided in the protocol tool.

The protocol was piloted by the researchers and observers, who were briefed on the observation protocol and tool before conducting the observational survey. The observational protocol and instrument were approved by the Ethics Office at Curtin University. Age groups were estimated based on four categories – children, young adults, adults, and elderly. Estimates were made based on the age range for children 0-12; young adults 13-20; adults 21-64; and elderly 65+. We acknowledge that observations based on age are prone to error. Observers sought to minimise error and improve reliability by testing and comparing observations of ages before conducting the fieldwork.

Walkability Survey

A survey of the walkability of a 400-metre street network catchment surrounding the Wharf Street Park (representing a comfortable 5-minute walk) was conducted to capture indicators relating to access to the park and residents' and visitors' physical activity. Overall, 'walkability in the neighbourhood' for this research can be simply defined as a set of indicators that help promote walking rather than shift people away from walking. Six indicators were developed by Tiwari (2014; 2018) and refined based on literature review, stakeholder discussions, local context and professional judgment:

1. Availability of walking paths and modal conflict: this surveyed the footpath availability on both sides of a street/road, its width and evident conflict (if any) between pedestrians and other modes.

2. Obstructions on the walking paths: this surveyed the footpath for any physical obstruction or blocks (such as a signboard) likely to create barriers for pedestrians.

3. Availability of crossing points: this surveyed the availability of a formal place in a road where traffic must stop to allow people to walk across a street/road, thus a place designated for pedestrians to cross a street/road such as a zebra crossing.

4. Quality of crossing points: this surveyed the quality of crossing points infrastructure such as the provision of a pedestrian refuge island.

5. Amenities: this audited availability of amenities along the street such as street trees, seating, shelter, rubbish bins and signage to help pedestrians move without difficulty.

6. Special needs infrastructure: this surveyed the availability for street infrastructure that helps people with special needs move easily: such as lowered kerbs, tactile paving and central pedestrian refuges. These walkability indicators and their sub-indicators were used to survey the study area (see Figure 9). The research instrument used for the walkability survey can be found in Appendix 2.

Piloting and inter-rater testing was conducted on the walkability survey before data collection. The surveys were carried out during business hours on weekdays. Following the survey, results were verified using Google Earth.

Figure 9 Survey areas for walkability assessment (Basemap: Google Earth)

CPTED Survey

Crime Prevention Through Environmental Design (CPTED) refers to the design or modification of built environment elements to reduce fear of crime and/or opportunity for crime to occur (Cozens and Love 2015). A CPTED survey was carried out at seven locations within the boundary of the park to assess both opportunities for crime provided by the physical environment; inform a general sense of how safe the park could be perceived; and also indicate other factors that may increase the risk of safety from non-criminal activities, such as people entering the water body.

The survey used was developed by Cozens and Babb (2018) and has been used in a range of scenarios, although this is the first application within a park setting. The research instrument used for the CPTED survey can be found in Appendix 3. Six categories of indicators were used:

1. Initial impressions: recording the surveyors' first impressions of the site.

2. Territoriality: assessing how the site's physical spaces are designated.

3. Surveillance: recording passive (from onlookers) and active (from CCTV, for example) surveillance of different areas of the site.

4. Order maintenance: evaluates the orderliness and standard of maintenance of the park.

5. Environment: captures the broader land-use context.

6. CPTED after dark: measures the characteristics of the site at night including visibility and lighting.

The survey of indicator categories 1-5 was carried out during daylight hours by two researchers, while the survey of indicator category 6 was undertaken at night. The survey findings were verified through an inter-rater cross-checking process and indicators that received disparate measures between the two surveys were re-evaluated.

REFLECTIVE WORKSHOP

The final method used to inform the research was a reflective workshop held with project stakeholders. The aims of the workshop were to both report on the preliminary findings from the WSNGCP audit, and to provide a forum to synthesise critical success factors and challenges that could improve learning from the project. The workshop was held on the 30th August 2021 and attended by individuals representing all of the key project stakeholder groups.

The workshop began with a presentation communicating the preliminary findings of the place audit. Following this, attendees were separated into three groups and a discussion was facilitated focusing on the following questions:

- What project objectives were successfully met? What features of the project helped meet this objective? What were the elements/processes that contributed to the success of these features?
- What project objectives did not reach their full potential? What features of the project challenged this objective? What were the elements/processes that could be changed to improve this for future projects?

Following the breakout groups, a whole group discussion was facilitated, to synthesise points from the breakout groups and reach a consensus of the workshop aims. The outcomes of this workshop inform the discussion of research findings presented in Chapter 6 of this report.

Figure 10 Reflective Workshop held at Think Space, Curtin University (Nematollahi 2021]

RESEARCH ETHICS

The research was subject to an ethics review and Curtin University Human Research Ethics Committee (HREC) approved this study (HREC number 2020-0435).

LIMITATIONS

The research reflects the performance of the park up to one year following its opening. It is expected that some of the indicators in the audit framework will only be evident across a much longer time horizon. An example of these indicators is the Activation Economics sub-domain within the Productivity domain. These indicators, such as land value change and investment attraction, measure effects that only be apparent in the longer term. We have tried to indicate where these limitations might be relevant in the written analysis of the audit findings.

The research was disrupted by the COVID-19 pandemic from March 2020. The initial lockdown following the declaration of the pandemic in mid-March 2020, several shorter lockdowns, and various restrictions on social gatherings outside of lockdown periods disrupted data collection and is likely to have had an impact on some of the site surveys, particularly the observation survey. We have identified in the written analysis aspects of the research where we have considered COVID-19 may have influenced the findings.

3. REGENERATIVE, WATER SENSITIVE AND SMART CITIES

INTRODUCTION

Three key themes underpin the conception and design of the Wharf Street Community Park: the regenerative city; the water sensitive city; and the smart city. These themes can be understood as urban imaginaries, collective visions that drive and orientate action directed towards transforming cities and places. Each imaginary played an important part in laying the foundations for the Wharf Street Next Generation Community Park, drawing together key stakeholders and proponents and guiding its design and conception.

Figure 11 Construction for the new stormwater basin within the WSNGCP (Babb 2019)

REGENERATIVE CITIES

Cities are historically subject to cycles and patterns of investment, growth and decline. Whereas the rapid suburbanisation experienced in Australian cities in the second half of the twentieth century delivered many benefits, it has also challenged the sustainability of urban regions: including through the loss of biodiversity due to land clearing, increased reliance on car-based transportation, and increased infrastructure and servicing costs for new urban areas. Since the 1990s urban policy in Australian cities has sought to direct a proportion of new development in existing urban areas through an urban consolidation agenda. The strategic planning framework for the Perth Metropolitan Region has set a target of 47% of new development occurring within the existing urban boundary (WAPC 2018). Yet as cities evolve, the infrastructure, urban form and patterns of development that supported previous generations in existing urban areas, may no longer be fit for purpose and not match the needs and aspirations of new residents.

Urban regeneration has been proposed as a way of addressing increased urban consolidation, where deliberate strategies are used by government, private or community sectors to renew, revitalise and/or repair existing urbanised areas (Ruming 2018). Governments can use a range of policy mechanisms in urban regeneration schemes including master planning, infrastructure upgrades, and direct investment in improvements to the public realm. Governments also use subsidies and incentives to promote private sector investment, with the private sector playing an active role in regeneration schemes through providing upgrades to public places and community improvement benefits, usually to gain advantage through additional development concessions. The community sector is increasingly playing a role in urban regeneration through formalised participation in planning processes and through placemaking schemes and activities, where areas identified for renewal are activated through small scale community-led initiatives.

In the twentieth century, urban regeneration schemes tended to focus on ex-industrial and major waterfront areas in inner urban areas. These 'brownfield sites' were complex sites to develop, often constrained by issues such as contaminated soils, heritage values and the presence of legacy infrastructure – requiring significant public sector investment to prepare land for development. Claisebrook in East Perth was the first major urban regeneration project in the Perth Metropolitan Area. With funding assistance from the Federal Government and the powers of the newly legislated East Perth Redevelopment Agency (later to become the Metropolitan Regeneration Agency and Development WA), the declining industrial area around Claisebrook at the eastern edge of the city was transformed into a model of new urban regeneration – with multiple storey housing, a mix of land uses and high quality, and a walkable public realm. A few years later, the regeneration of the area around Subiaco train station followed. Industrial land that had serviced the growing city by providing access to the rail network, was redeveloped in line with a 'new urban' vision. The land was redeveloped in a model of transit-oriented development, with high-density housing and employment opportunities located within a comfortable walking distance of the train station.

Whilst large urban redevelopment schemes of high-value ex-industrial land – like East Perth and Subiaco, Docklands in Melbourne, and more recently Barangaroo in Sydney – steal the limelight, urban regeneration is increasingly occurring in ageing middle-ring areas of cities. Urban regeneration in these suburban contexts offers a different set of physical opportunities and constraints. Middle ring suburban areas – or 'greyfield' sites – are characterised by car parks and road infrastructure, low-density housing, fragmented land ownership and large shopping centres. The type of urban development that has been typically predominant in greyfield areas is knock-down-rebuild and 'background infill' (Bolleter 2016), subdivision of small lot housing that provide three to four dwellings on sites where previously there was one. This type of development has a negative impact due to the loss of urban tree canopy, loss of private green space, increased impervious surfaces and traffic issues (Newton et al 2020).

Regenerating greyfield sites requires a proactive local government, long-term strategic planning to support development, and investment in public infrastructure (Newton et al 2020). One important area of investment that governments can make is in improving the amenity and function of community spaces to support growing populations. Public spaces, such as parks and nature reserves in greyfield suburbs, are often limited or under stress from increased demand for use, and innovative ways of managing the collective resources offered by the public realm are needed. The range of ecosystem services afforded by suburban streetscapes can be enhanced through verge greening schemes and water sensitive urban design, to support the liveability of residents and offset any loss in greenspace and filtration caused by typical patterns of development (Bolleter 2016).

Figure 12 A natural place in a greyfield urban environment (Babb 2021)

WATER SENSITIVE CITIES

The sustainable planning and management of stormwater, wastewater, groundwater and water supply are now critical policy goals for cities across the globe. The impacts of increased urbanisation and climate change threaten the health of urban rivers and water systems and place cities at increased risk of flood, drought, and environmental degradation. The traditional approaches to the management of water in cities in the twentieth century emphasised the application of technological interventions to tame nature, with powerful bureaucracies established to manage water flows using a top-down, hierarchical managerial style (Karvonen 2011). This techno-managerial approach has gradually given way to a new paradigm for water planning, incorporating a holistic and integrated approach to water in urban landscapes. The new paradigm for the planning and management of urban water resources is based on an understanding that water systems are socio-ecological systems, and that good management of urban water resources should be informed by principles of adaptive management and resilience (de Haan et al 2015).

In Australia, the Water Sensitive City has emerged as a model to guide the transition to this new paradigm of urban water management. Figure 13 shows the stages in the transition from a techno-managerial water supply city to a water sensitive city. Wong, Rogers and Brown (2020) outline three principles of practice to enable the transition to a Water Sensitive City. The first is that Water Sensitive Cities require a diverse range of integrated water sources and infrastructure for water harvesting, treatment, storage and delivery. This diversity highlights the need to facilitate more multi-functional use of water infrastructure in cities. The second principle is that ecosystem services need to be enhanced through the integrating of water management goals in landscape and urban design. Finally, achieving water sensitive cities requires the cultivation of water sensitive communities. This principle requires communities of place and practice to develop knowledge and act in alignment with good water-sensitive management goals and practice.

The transformation of stormwater infrastructure into multi-functional spaces that accommodate a range of urban policy goals is an important component in the transition to a water-sensitive city. Effective stormwater drainage and management is a complex planning issue in Perth (Grose and Hedgcock 2006). The city of Perth is situated on the Swan Coastal Plain, with soil types characterised by highly permeable sands that can quickly see the groundwater table rise close to the surface during times of heavy rainfall. Filling the land was the traditional approach to this problem, however the increasing scarcity of sand made this approach prohibitively costly. Draining the land is now common practice and is achieved by laying 'leaky pipes' that intersect with the groundwater level, allowing stormwater to drain off. This leads to the problem of where to drain to. Direct flow of stormwater into receiver areas allows for almost no filtration to occur, causing potentially significant damage to ecological values.

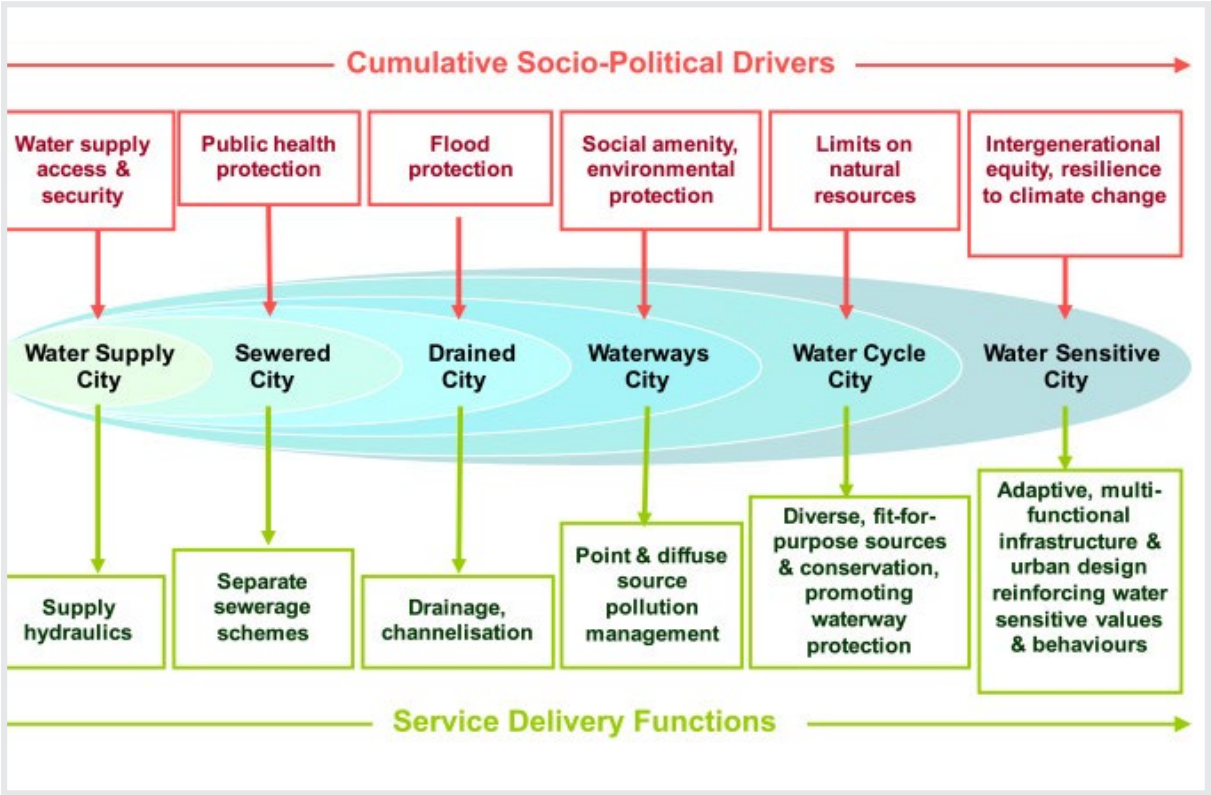

Figure 13 Principles for transitioning to Water Sensitive Cities (Brown 2009)

While still a feature of many residential areas in Perth, more innovative and functional stormwater management practices have been incorporated into public open space over the last two decades. These practices fall under a broader movement of progressive water management in urban planning referred to as Water Sensitive Urban Design (WSUD). WSUD has been broadly defined as the integration of all aspects of the urban water cycle: including water supply, wastewater, stormwater and groundwater management, urban design, and environmental protection (Water Sensitive Cities 2009). A key feature of WSUD approaches is the treatment of stormwater as a natural resource that not only requires conserving for ecological reasons, but that can also provide unique individual health and community benefits. For example, Vernon and Tiwari (2009) have discussed WSUD practice for their potential to contribute to a sense of place in master planned suburban areas. As well as their functional value, water in the urban landscape can satisfy different psychological needs, including local identity, aesthetics and symbology that allow an individual to create an attachment to their immediate environment. When integrated into public open space, it is important for stormwater infrastructure to be integrated in a way that promotes better environmental and liveability outcomes, whilst still maintaining the functionality of the landscape (Sparks and Brown 2018).

SMART CITIES

Smart Cities is a widely used term that refers to the integration of digital technologies into the management and function of urban systems and places. There is debate and often confusion about what a smart city is. One of the early adopters of the term 'smart cities' was IBM, who trademarked the term "smarter cities" in 2011. According to IBM, smart cities are instrumented, meaning they can capture data in real-time through sensors and appliances; interconnected, meaning this data is integrated into various platforms to be made use of; and intelligent, meaning that these datasets are subject to analytics, modelling and visualisation (Albino et al 2015). Barns (2020, 12) on the other hand, defines smart cities, not as material components but rather as "…a broad rubric for the use of data-driven practices and initiatives oriented towards the management and governance of urban infrastructure and utilities".

Early models of smart cities often took shape as mega-projects. These were grandiose schemes for brand new cities that were built from scratch with digital technology fully integrated into their infrastructure and built form. For example, Songdo near Seoul in South Korea is a master-planned smart city, newly built on reclaimed tidal flats. Songdo has the highest concentration of LEED-certified green buildings in the world; high-speed internet infrastructure; water recycling systems; and a state-of-the-art Integrated Operations Centre – managing the vast amounts of data and video feeds from the city's network of sensors. In the U.S. Hudson Yards, a $20 billion real estate project in downtown Manhattan is touted to be the world's most ambitious smart city experiment – a living lab, quantified community and fully instrumented experiment that is the testing grounds for new urban informatics (Mattern 2016). It is designed to use a range of instruments and analytic capacity to monitor air quality, pedestrian movement, and traffic; collect data about people's health and activities; map and control energy use through a microgrid; and remove waste through pneumatic tubes removing the necessity for rubbish trucks.

The focus on these 'smart city' mega-projects however reflects a narrow view of the range of investment in digital urbanism that is currently evident across the globe. Framing the smart city as an overarching idea that underpins the more incremental roll-out of digital applications to assist in the provision and management of urban services, reveals a much more diverse and varied picture of the current state of the smart city. In Australia, the Federal Government's Smart Cities and Suburbs scheme provides a good example of how digital technologies are being implemented. In 2015, the Prime Minister at the time, Malcolm Turnbull, stated that every level of government must play a role in promoting the liveability of cities. To support this goal a smart cities agenda was established, and in 2016 a Smart Cities Plan was released by the Australian Government, promising smart investment, smart policy, and smart technology. As part of the Smart Cities Plan, the Department of Infrastructure, Regional Development and Cities introduced a $50 million grant program to support projects "that apply smart technology, data-driven decision making and people-focused design to deliver economic, social and environmental benefits in metropolitan and regional urban centres'' (Commonwealth of Australia 2016, pg 5). 81 projects located across cities and regional centres in Australia received funding through the scheme.

The projects funded under the Smart Cities and Suburbs span a range of urban issues, from housing to parking to community engagement. Many of the projects also aligned closely with the issues integral to the WSNGCP – water management, ecological regeneration, and community benefit. Wong et al. (2020) contend that the adoption of technological solutions in the planning, management and monitoring of urban water systems will be critical to the realisation of water sensitive cities. Smart technology solutions are also increasingly being applied as nature-based solutions through urban greening infrastructure programs. Smart sensing in nature-based solutions provides opportunities for real-time monitoring of environmental conditions, data for research, and adaptive management of local social-ecological systems. Concepts such as smart-parks and cyber-parks have been developed to describe the application of technologies within park environments used to improve park users' experiences, and to assist local governments in the management and provision of services (Smaniotto Costa et al 2019). Developing knowledge of the factors that shape and produce these technologically mediated public spaces is important to facilitate institutional learning and investment in future smart city projects.

Figure 14 Signage on display during the construction of the WSNGCP (Babb 2020)

4. THE WHARF STREET BASIN: LANDSCAPE, HISTORY AND PLANNING

This section outlines the historical, physical and planning contexts of the Wharf Street Basin. The themes of Regenerative, Water-sensitive and Smart Cities are central to the story of the Wharf Street Basin Project. This section begins by describing the historical landscape of the Canning City area, where the Wharf Street Basin is located. Important elements of the site context include the historical landscape, hydrological and ecological systems, and cultural characteristics that collectively inform an understanding of the evolution of the WSNGCP. An overview of the recent planning for the urban regeneration of the Canning City Centre (CCC) follows before the section concludes with a closer look at the Wharf Street Basin site, discussing its function as a stormwater drain and identifying its positioning within the broader planning for the City Centre.

THE HISTORICAL LANDSCAPE OF THE CANNING CITY AREA

The Wharf Street Basin connects to the Canning River, a tributary of the Swan River. The river extends from the Darling Scarp through to Melville Waters where it connects with the Swan River. The topography of the Canning City area is typically flat, with the soil profile characterised by clayey sands overlain with Bassendean Sand. The vegetation complex of the Wharf Street Basin area is Guildford Complex, with Swan Complex towards the Canning River.

Figure 15 Canning River Regional Park (Babb 2021)

The Aboriginal name for the Canning River is Djarlgarra Beeliar, meaning a place of abundance. The wetlands across the Canning area were important areas for ochre, food and water for the local Aboriginal groups, the Beeloo and Beeliar Noongars, before and following colonization. Djarlgarra Beeliar is recognised as a significant site for Aboriginal people due to its association with the Waugal, the Rainbow Serpent, who created the rivers in its journey from their source to the sea.

Following settlement, land in the CCC area began to be cleared and developed for homesteads, various agricultural and horticultural purposes, dairy farms, and industries such as sawmills and slaughterhouses. Settlers were attracted by the accessibility of the area to river transport and the access to water to sustain their industries. The importance of the river for cultural and recreational purposes was recognized early on and a six-kilometre area adjacent to the Canning River was set aside for public use as The Canning River Regional Park. The CCC and its immediate area have a significant regional open space at the bank of the Canning River, providing opportunities for passive recreation and nature-based activities (Department of Parks and Wildlife 2021). In 1927, the Kent Street Weir was constructed to create a partition between salt and freshwater.

The introduction of the rail line, the construction of Albany Highway and the population boom due to the gold rush in the late nineteenth century, saw an increase in demand for housing and the subdivision of the original large land grants across the Canning City Area and nearby suburbs such as Queens Park. During the twentieth century, development continued as the land was steadily subdivided. Schools and major sporting facilities were established. In 1957, the first major department store outside of Perth, Boans Waverley (now Westfield Carousel) was established.

Figure 16 Kent Street Weir (Babb 2020)

PLANNING FOR THE CANNING CITY CENTRE

An extensive planning process for the CCC plays an important role in explaining the motivations for the WSNGCP and in shaping key aspects of the project: including its design, its intended function, and its role in catalysing further regeneration projects within the CCC. The Canning City Centre Activity Centre Plan (CACP) was endorsed by the Council in September 2016. According to the plan, the CCC in 2016:

> "...is not a vibrant, attractive or user-friendly place at present. It is a car-dominated environment with most activities located in the Carousel Shopping Centre and bulky goods retail premises along Albany Highway. High quality urban development is lacking and large parcels of underdeveloped land, mostly near the train station contribute to its lack of intensity, diversity and place identity. The centre is far from being "mature" in terms of its role and function within the metropolitan context." (City of Canning 2021, pg 1)

An urban regeneration approach was adopted to achieve the vision of a "re-energised city centre with a community heart that is connected, accessible, vital and resilient" (City of Canning 2021, pg 15). CCC is identified as a Strategic Metropolitan Centre in the WA State Government's strategic planning framework – meaning that it will play an important role as an economic centre by providing employment and access to services and as a residential hub attracting higher density development. Other Strategic Centres in the Perth metropolitan region include Stirling and Morley, however the City of Canning is the only strategic centre within proximity to the river.

The plan was informed by a range of detailed planning studies for the CCC: including a Local Water Management Strategy (LWMS); Economic Development Strategy; Movement, Access and Parking Strategy; and Local Drainage Plan. The plan identified key precincts in the CCC targeted for investment. Cecil Avenue provides the central spine of the CCC. It is the CCC's main street and links Albany Highway in the south to the railway station precinct in the north. Adjacent land uses are intended to mix commercial and residential, with some retail within Cecil Square, the heart of the Centre (see Figure 17).

The protection and enhancement of drainage infrastructure are identified as strategic actions in the CACP to support the broader goals of the plan. Upgrades to the stormwater drainage systems are recommended to adapt to the increased intensity of development, and some drainage systems are identified for landscaping and increased amenity. The Wharf Street drain north of the basin is identified in the LWMS as providing additional capacity to compensate for any loss of capacity in the Wharf Street Basin when Leila Street is extended to connect to Wharf Street. These drains are recommended for landscaping and the creation of urban streams.

Figure 17 Canning City Centre Context Map

Accompanying the CACP is an Urban Design and Public Realm Concept Master Plan (UDPRCMP), titled the Riverine City. This document is one of the key documents that supports the implementation of the CACP, guiding landscaping, urban design, and built form design. According to the master plan, the stormwater and hydrological systems that permeate the CCC are a "technical system" that exists outside of the desired character and existing urban public realm (City of Canning 2017, p. 26).

The UDPRCMP identifies three ways that this technical system can be transformed into a "celebration of water": by 'daylighting' the current underground network of pipes; by increasing the range of uses of water infrastructure spaces; and employing water sensitive urban design response within the public realm. By combining these elements the document suggests that people will be informed and gain a greater appreciation of the way that water shapes the local environment, whilst also supporting the quality of life residents of and visitors to the regenerated centre.

There are also references to smart cities and investment in digital infrastructures in the suite of plans. The UDPRCMP states that the regeneration of the CCC is an opportunity to utilise smart technology and "go digital".

WHARF STREET BASIN

The WSNGCP is located opposite the intersection of Wharf and Bauer Streets, about 100 metres from Albany Highway and 200 metres from the western car park of Westfield Carousel shopping centre. The primary function of the basin is a stormwater drain, to protect surrounding areas from the impact of flooding. Historical imagery in Figure 18 shows the evolution of the site as the basin expanded in size to accommodate the increased urbanization of the Canning City area. The basin has the capacity to hold up to 18,000m3 of stormwater before flooding (City of Canning 2018).

Figure 18 Wharf Street Basin historical aerial images (Josh Byrne and Associates 2019)

The Wharf Street Basin now forms a part of the Water Corporation's stormwater drainage network, connecting the broader urban catchment to the northeast of the CCC to the Canning River. Wharf Street Wetlands and Liege Street Wetlands are two constructed wetland systems in the CCC that were designed to improve the quality of water flowing into the Canning River by removing pollutants and nutrients. The Wharf Street Constructed Wetland and Civic Parkland project became functional in 2008. Upstream of the Wharf Street Basin, there are several open and piped drains and additional compensating basins, including the Manley Street compensating basin, situated within Charles Treasure Park directly north of the Wharf Street Basin (Figure 19).

Before its transformation, the basin was fully fenced and inaccessible to the public. Drainage basins, like the Wharf Street Basin, were the typical method for addressing stormwater management and consequently are a common feature of the Perth urban landscape. Stormwater drainage basins are usually steeply graded excavations due to the limited land available to support their stormwater retention function. Many have inflow channels at their base to allow some degree of filtration to occur before the stormwater is returned to groundwater supplies.

Figure 19 Manley Street Compensating Basin (Babb 2021)

Although stormwater drainage basins facilitate an important function in protecting urban areas from flooding, their physical design characteristics limit the benefits they provide to plant and animal ecologies and to the liveability of surrounding urban areas. Basins commonly expose groundwater and therefore do not support endemic plants and animals that require more seasonal fluctuations in the presence of water in the landscape. Due to their steep gradients and often poor water quality, drainage basins require fencing that make them inaccessible to the public to ensure safety, even though they are often included within a suburb's public open space allocation. Basins therefore have the drawbacks of a loss of potentially usable green space, while providing limited amenity to the area.

These limitations were evident at the Wharf Street Basin and informed the project direction and design responses. The soil profile in the area is characterised by a thin surface layer of Bassendean sand over sandy clay. Groundwater is shallow and near the surface at maximum levels. This means that lots are directly connected to the drain system rather than using on-site retention.

The WSNGCP is a key component of the CCC Regeneration Program and the ambitions of the project are aligned within the overarching goal of urban regeneration that is set out in the CACP and UDPRCMP. Wharf Street Basin is in the Pattie Street Precinct in the UDPRCMP, and its future character is described as a "dense residential neighbourhood with a fine grain of laneways and landscaped water park centre" (p.21). The strategy recommends the widening and the landscaping of the Wharf Street Main Drain, from Wharf Street to Pattie Street.

The WSNGCP project also aligned with the objectives of other government agencies. The Water Corporation's Drainage for Liveability program supports the design and development of stormwater management systems that "integrate with the urban landscape, enhance land use function, improve urban microclimate and provide amenity." (Water Corporation 2018, p.1) The program integrates hydrological functionality of urban stormwater infrastructure with other important functions and qualities, encompassing urban ecologies, economies, and liveability. The Department of Water and Environmental Regulation defines a Living Drain as "a constructed or retrofitted waterway that mimics the characteristics of a natural stream" and identifies their benefits as erosion control, water quality improvement, habitat, education, and recreation.

The outline for planning sets out the steps or elements needed in place to support drainage for liveability. It also refers to the need for a set of landscape principles that are required to be in place that will inform desired natural systems functions and demonstrate that the development of stormwater infrastructure does not exceed probabilities of flooding. Some of the design considerations set out in the Drainage for Liveability (Water Corporation 2018) guidelines include:

- Incorporating access for walking and cycling.
- Providing a diversity of spaces with living streams within proximity.
- Linking drainage reserves into multi-use corridors.
- Providing additional amenity, cultural and educational facilities into living streams
- Preserving the landscape function to support stormwater management.

A key aspect of the design of WSNGCP was to align with WSUD principles as part of the City of Canning's overall vision to be a Water Sensitive City.

Figure 20 The basin during construction (Babb 2020)

5. WHARF STREET NEXT GENERATION COMMUNITY PARK AUDIT FINDINGS

This chapter reports on the findings from the primary research of this project and is presented in three parts. The chapter begins by presenting an overview of the project, from inception to delivery. Findings from the WSNGCP Audit are then presented, beginning with the baseline audit of the site before the audit findings are reported for each set of indicators across the Productivity, Sustainability and Liveability domains. The chapter concludes by presenting the key themes that emerged in the reflective workshop with project partners, held a year after the opening of the WSNGCP.

The findings of the audit draw upon a range of data sources, outlined in Chapter 2. The results are presented qualitatively in this chapter. Further analysis from the surveys and quantitative datasets informing these can be found in the Appendices. As the purpose of the Place Audit framework was to highlight interconnections between the different audit criteria, where a cross-connection to another audit criterion is notable, a reference to the audit criterion code is presented in brackets. For example (P1.3) is used to indicate Water Quality and Maintenance.

Figure 21 Smart Park (Limmarja 2020)

WSNGCP: FROM INCEPTION TO DELIVERY

"Everything backed onto it. No one made use of that water body as an asset. It was fenced off. No one could get through." Project Partner.

As outlined in Chapter 4, the planning for the Canning Activity Centre identified potential for the Wharf Street catchment to contribute to the urban regeneration of the area by enhancing liveability outcomes of the stormwater drainage network and assisting in the management of water quality and health of natural ecologies. However, it was the Federal Government's Smart Cities and Suburbs scheme that provided the catalyst for the WSNGCP. The $50 million grant program was part of the Australian Government's Smart Cities Plan, which aimed to support projects: "**that apply smart technology, data-driven decision making and people-focused design to deliver economic, social and environmental benefits in metropolitan and regional urban centres**" (Commonwealth of Australia 2016, 5).

The grant program was open to local governments working in partnership with other organisations across industry, research, and not-for-profit sectors. According to grant guidelines (https://business.gov.au/Grants-and-Programs/Smart-Cities-and-Suburbs-Program), priority areas for funding were infrastructure enhancement, precinct planning, service delivery, and land use planning and governance. Projects were to be selected according to their level of innovation with smart technology, sustainable outcomes, a focus on community and liveability, and the capacity of proponents to deliver the project. Projects were also required to be planned for, in development or ready to go and fit within an existing policy framework.

Figure 22 Signage on Wharf Street Basin pre-development (Babb 2019)

In May 2018, a call for the second round of the Smart Cities and Suburbs scheme was announced. The City of Canning responded to the call for funding by immediately looking to identify a project to put forward. As there was a requirement that the project was planned and already had funding allocated to it, options were limited. A decision was eventually made to put forward the Wharf Street Basin as a Smart Community Park. Over six weeks the project proposal was pulled together by the City of Canning and Urbaqua, with project partners the Water Corporation, CISCO, Innovation Central Perth, Curtin University, Department of Water and Environmental Regulation, and Department of Biodiversity, Conservation and Attractions. Later, landscape architectures Josh Byrne and Associates and landscaping contractor, Environmental Industries, joined as the project delivery partners. The prior planning for the Canning Activity Centre had put the City of Canning's bid in an advantageous position and on the 19th November 2018, the project was announced successful and awarded $1.09 million. Additional funding was matched by the City of Canning and Water Corporation and eventually over $3.5 million was allocated to deliver the project.

Figure 23 Wharf Street Basin proposed design concept (City of Canning 2018)

A Partner Working Group (PWG) was formed in early 2019, with members from each of the key stakeholder groups. The PWG met fifteen times from February 2019 to June 2020. The purpose of the PWG was to support the implementation of the project by providing a collaborative platform to encourage innovative practices, guide designs, complement consultation, and align policy requirements across the different project stakeholders. As well as sharing the common goal of delivering a successful project in line with the project proposal, it is important to recognise that the WSNGCP was a multi-functionality space and that the stakeholders that made up the Partner Working Group also had multiple priorities.

Figure 24 WSNGCP Partners (Babb 2021)

- Water Corporation: The WSNGCP represented "high profile" but also a "non-standard" project for the Water Corporation's Drainage for Liveability program.
- The City of Canning had multiple goals for the project. Primarily, the WSNGCP aligned with the objectives of the Canning City Centre Activity Centre Plan and to exemplify the high level delivery of projects by the CCCRP
- Urbaqua provided technical support for the project application and ongoing support through project management, hydraulic and environmental assessments.
- The Department of Water and Environmental Regulation (DWER) is a key partner in the Drainage for Liveability program. The innovative nature of the WSNGCP provided opportunities for insight into how amenity and water quality benefits can be achieved in similar projects.

- The Department of Biodiversity, Conservation and Attraction's (DBCA) interests aligned with the water quality outcomes. The Wharf Street Basin is an important part of the drainage nutrient intervention program and is one of several projects in the area that the Department has been involved in connected to the Canning River.
- Curtin Innovation Central provided technical support to the City of Canning for the application of smart technologies.
- The School of Design and Built Environment were involved in documenting the project through an applied research project.

A Design Working Group (DWG) was also formed to meet and progress the design of the Wharf Street Basin with an inception meeting on the 15th of April 2019.

- Josh Byrne and Associates were contracted as landscape architects to undertake the concept and detail design for the park.
- Environmental Industries were contracted to undertake civil works and landscaping of the site.

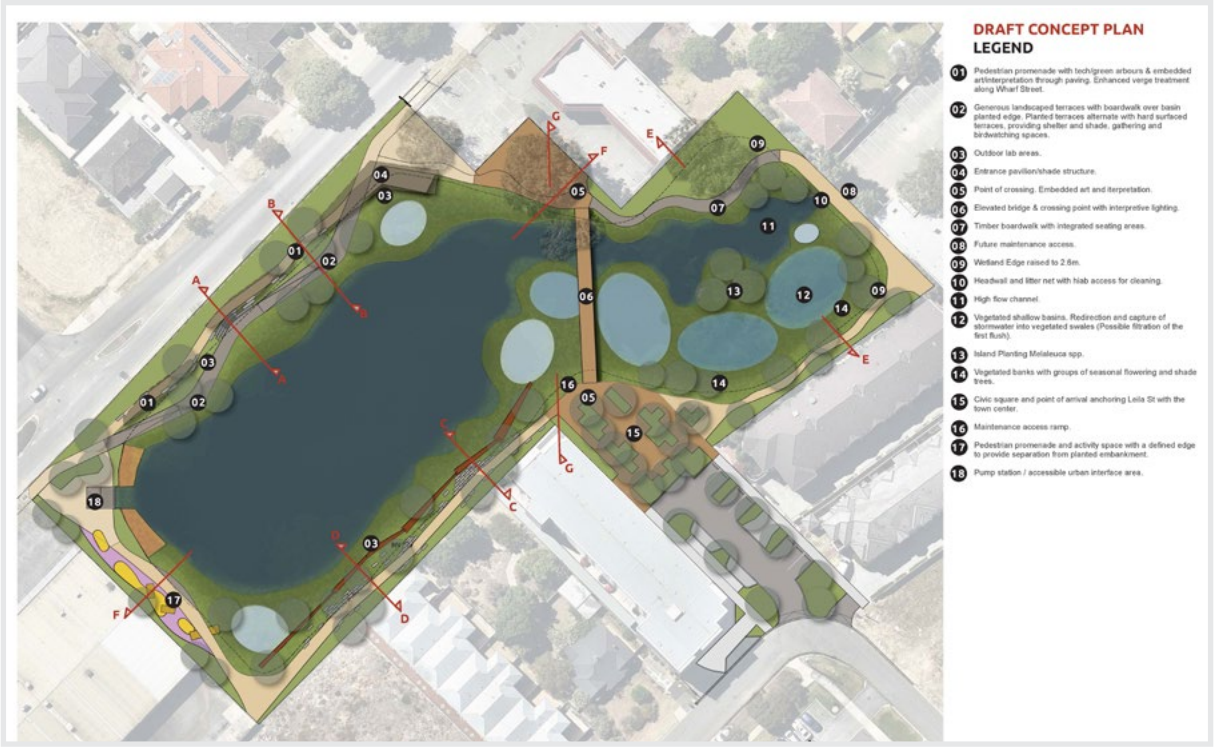

Figure 25 Wharf Street Basin Draft Concept Plan (Josh Byrne and Associates 2019)

The requirements set by the grant body created a "tight project timeline", with funding commitment dependent on the project meeting a series of deadlines (PWG Minutes 2/19). The key stages of the project were:

- Project initiation, formation of the partner working group and the design
- Community engagement – engagement workshops, over three months.
- Preliminary scoping – preliminary concept design; hydraulic modelling of the design
- Conceptual design
- Detailed design and development – engineering, landscaping and technological infrastructure review
- Tender design
- Construction/installation
- Commissioning and testing – and opening.

Despite the global disruption caused by the COVID-19 pandemic, the project progressed largely on-schedule. Although planned to open in July 2020, a short extension to the project deadline was granted by the Federal Government and, in September 2020 the park was opened.

Figure 26 Promotional Material (City of Canning 2019)

PLACE AUDIT: PRODUCTIVITY

The following sections set out the audit of the WSNGCP following its public opening, covering the three key themes of the place audit and each of the indicators sitting within each theme: commencing with Productivity as summarised in Table 3 below.

Table 4: Productivity Indicators

Operations and Management	P1.1	Access agreements
	P1.2	Asset management and maintenance
	P1.3	Water quality and maintenance
	P1.4	Water storage capacity
	P1.5	Catchment hydrology
Innovation	P2.1	Smart tech
	P2.2	Wifi and charging options
	P2.3	Smart furniture
	P2.4	Solar panels
	P2.5	Datasets
Activation Economics	P3.1	Business activity
	P3.2	Land values
	P3.3	Investment activity
	P3.4	Land use change

P1. Operation and Management

P1.1 Access agreements

Establishing agreements to allow access to the site for the project works and ongoing maintenance was a critical aspect of the project in the preliminary stages. Site access was complicated by the mix of property ownership and rights, the responsibilities of asset holders and by the tight project delivery timeline. The Water Corporation was the owner of the asset and responsible for managing the Wharf Street Basin. However, the physical space of the Wharf Street Basin consisted of several land parcels, including the Leila Street Road Reserve. Although a land tenure response to manage the transfer of access was preferred by the Water Corporation, the deletion of the road reserve would cause delays to the tight project schedule.

Through ongoing deliberations, it was eventually agreed that ownership of the land was retained by the Water Corporation, with an easement established to enable the City of Canning to access the site. The access agreement between the City of Canning and Water Corporation was reworded so that the City of Canning had responsibility for all areas of the site, and Water Corporation would only intervene if capacity was compromised. As described by one of the project partners, this was a non-standard approach. Resolving the issue of access to the site was placed under pressure due to the tight project schedule, yet ultimately did not place the timely completion of the project at risk. According to project partners, the negotiation towards this outcome was reflective of the good working relationship between the various project team members.

Figure 27 Boardwalk under construction (Babb 2020)

P1.2 Asset management and maintenance

One of the objectives of the project was to improve the productivity of the ongoing management and maintenance of the site. Historically, the Water Corporation had maintained responsibility for the base flow channel or the bottom of the drain, as this influenced water storage capacity (P1.4). With the increasing integration of stormwater assets in public open space, the responsibility of the Water Corporation was increasingly extending to the maintenance of water where algae or rubbish would be a problem. However, the ongoing management of drains was still not the normal practice of the Water Corporation due to the lack of resources and capacity to maintain sites regularly. The access arrangements highlighted in P1.1 assisted in transferring responsibilities for the management and maintenance of the WSNGCP from the Water Corporation to the City of Canning.

For the City of Canning, the WSNGCP provided opportunities to re-imagine the way the site was managed through design and the implementation of technology. The previous approach to clearing weeds, where they were left on the bank to dry, would be detrimental to the amenity of the park and new management and maintenance practices were required. These opportunities were seen by one of the project partners for the City of Canning to re-frame the way normal management practices were undertaken: "instead of going in there once a year, mechanically slashing, which uses carbon for all the trips out there, the mowers to run, then spraying with herbicides, which also use carbon in their production and their application...to actually look at decarbonising things".

Figure 28 Vegetation growing on the steep basin bank (Babb 2021)

The constraints of the site influenced discussions and decisions regarding maintenance of the park. A site design response to accommodate standard management practices was seen as counter to the multiple objectives the project sought to address. Early in the design process, the idea of a four metre trafficable maintenance track around the site was put forward and quickly dismissed as it would trade-off space for activity and vegetation, and potentially impact the capacity of the basin to accommodate stormwater. The steep slopes of the basin that were required maintain water-holding capacity also provided challenges to normal management practices. Consequently, responsibility for the management of the area inside the fence was outsourced due to safety issues for the City of Canning staff. Contractors were seen to be better set up to access steep banks with harnesses attached to anchor points (see Figure 28).

P1.3 Water quality and maintenance

In addition to improving water quality in the basin (S1.4) and contributing to water quality outcomes of the broader catchment (S2.1), one of the indicators of success for the project was that there were productivity efficiencies for the ongoing maintenance of water in the basin. One of the ways water quality outcomes were sought was to incorporate sensors to assist in the monitoring of nutrient and pollutant levels in the basin.

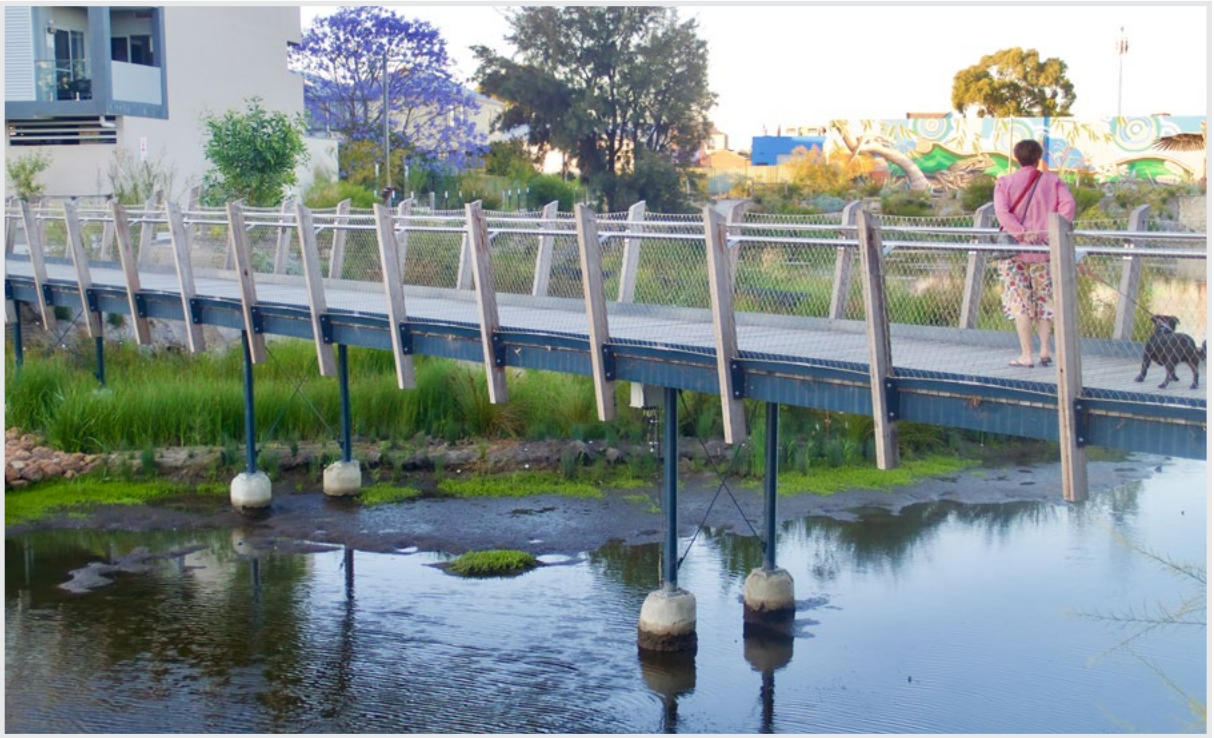

Figure 29 Water sensor located under the bridge (Babb 2021)

P1.4 Water storage capacity

Figure 30 Mural with the pump station in the foreground (Babb 2021)

Maintaining water storage capacity within the basin was a critical issue for the project and it emerged as one of the key themes for the project. The singular function of the Wharf Street Basin before this project was to protect the surrounding urban area from flooding by acting as a stormwater storage basin. Stormwater from the surrounding urban area and upstream catchment was channelled into the basin via a series of drainage pipes and inlets – when the water level reached designated levels, the pump would cut in and pump water through drains to downstream storage, with a one-way valve preventing backflow. Water Corporation has an operating licence with a condition that the basin maintains capacity for storage of the 10-year "ARI" event without flooding. ARI refers to "the average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration" (Bureau of Meteorology 2021). As stated by a representative of the Water Corporation on the role of the basin: "**capacity is the driver**".

Maintaining capacity within the constraints of the site significantly shaped the potential design responses for the WSNGCP. One of the key constraints of the Wharf Street Basin was that the basin area could not be made deeper to create additional capacity, because the water in the basin was intercepting with the groundwater. Bathymetric surveying conducted early in the project process also revealed that there was more sediment in the drain than earlier models had indicated, further constraining design responses due to the need to maintain storage capacity.

The requirement to maintain the capacity of the drain within these constraints impacted a range of factors relating to the eventual site design. These included the gradient of the embankments, the height and placement of fencing, the type of plants that could be used, the design of the wetland area within the basin and amount of movement, dwelling and activity space available around the edge of the basin.

Figure 31 Subject to flooding (Babb 2020)

The importance of the capacity of the drain to contain stormwater was highlighted during the translation of the concept design to detailed design of the site. Modelling was carried out of the capacity of the drain for the detailed design plans, which indicated a significant reduction in the required capacity. The issue was described by one of the project partners "a potential dealbreaker", given the need for the Water Corporation to maintain its required level of capacity to mitigate flood risk. However, for others, there were positive trade-offs in the reduction of capacity, as the more gradual gradient of the sloping banks supported some of the liveability goals: for example, enabling community interaction with the water body, and positive outcomes for water quality through the construction of islands within the water body to assist to the purification of water. Although, the issue was a critical point in the project process, a solution was eventually negotiated (see P1.5).

Figure 32 Stormwater collection in the park (Babb 2020)

P1.5 Catchment hydrology

As outlined in Chapter 4, the Wharf Street Basin operates within a chain of sites and drainage channels that support the broader catchment hydrology, connecting the area north of Wharf Street Basin to the Wharf Street Constructed Wetlands and on to the Canning River. Drainage areas north-west of the Wharf Street Basin were identified in the CACP and reiterated in the project planning for the WSNGCP as future sites for Liveable Drains and to accommodate additional capacity for stormwater mitigation.

The issue of the loss of storage capacity in the Wharf Street Basin described in P1.4 was resolved through an agreement between the City of Canning and Water Corporation to find capacity elsewhere in the upstream catchment. This agreement could see further catchment living drains and WSUD projects in the future.

Figure 33 Open drain upstream from Wharf Street Basin (Babb 2021)

P2 Innovation

P2.1 Smart tech

The transformation of the Wharf Street Basin into a smart, digital Next Generation Community Park was a key driver of the project, given the funding requirements from the Federal Government's Smart Cities and Suburbs scheme. According to the project proposal, the WSNGCP would offer a range of technologies: including real-time water quality monitoring; generate datasets for ongoing research and knowledge-building; minimise and target resources for ongoing management; assist with creating a safe environment for visitors to the park; educate the community about wetlands and water management; and, allow a better understanding about how the park is being used and valued to inform broader practices of water sensitive urban design (City of Canning 2018).

Figure 34 A smart park (Babb 2021)

Figure 35 Smart bench and lighting (Babb 2021)

The incorporation of smart technology in the project site provided a steep learning curve for the City of Canning. As one project partner noted, at the time the original bid was put in: "we didn't have a Smart Cities strategy; we didn't have a digital transformation strategy; they're only now evolving." WSNGCP was a pilot project for the City of Canning's move into the digital realm.

The 'smart technology' was implemented in two layers into the park. The first consisted of the baseline layer, which provides the infrastructure and architecture for the service layer of technology. According to the project partners, this layer was straightforward. The second layer, the service layer of technology, was noted as considerably more challenging and required more experimentation. A year after the opening of the park, several of the smart technology features are operational, with more being rolled out in the near future. The park offered free wifi (P2.2); charging stations (P2.2); CCTV (L3.3); an App with information about the park; water quality sensors (P1.3); and Augmented Reality frames that allowed visitors to play games, learn about the various animals that lived in the basin, and provided information about water quality.

Figure 36 Augmented reality frame #1 (Black 2021)

The application of the smart technology had not completely gone to plan. The issue of the water quality sensor has already been discussed in P1.3. Another issue that emerged related to the Augmented Reality (AR) Stations that were located at points around the park to tell the various water, plant and animal stories of the park. It was found the AR technology was not working as well as intended at certain times of the day:

"At twilight, there's not enough light for the camera to recognise the frame. Also, if you're looking at it and the sun is reflecting off the water that impacts the ability for the camera to read the frame as well." (City of Canning Project Partner)

These examples indicate the amount of the trial and error needed in applying unfamiliar technologies in a complex project with a tight timeframe.

P2.2 Wifi and charging options

Free WIFI and device charging outlets are now common features in public places, and encourage people to spend more time. The placement of the omni-directional antennas that enabled WIFI was based on prioritising areas, such as the sheltered pavilion, where there was an expected higher demand for use of the service.

Charging points were incorporated into the many benches around the park, although during the observational survey there was no evidence of charging points being used to charge devices. The location of all facilities are identified on the Smart Canning App.

Figure 37 Charging point (Babb 2021)

P2.3 Smart furniture

Smart furniture refers to a range of facilities that support various services through digital technological enhancements. Smart furniture in WSNGCP included benches that offered charging points for mobile phones (P2.2) and smart bins: able to communicate information about the amount of rubbish in the bin, and thereby facilitating a more efficient maintenance schedule. Smart lighting was originally planned for inclusion, which would have had motion sensor capacity and turn on when people entered the park or walked down a path. While this capacity was not operational a year after the opening of the park, it remained an aspiration for the City of Canning:

> "The lighting is all smart capable so it is something we can add on. We can add on the smart modules and start incorporating a bit more (capacity) in the way the site is lit." (City of Canning Project Partner)

Figure 38 Smart bin (Babb 2021)

P2.4 Solar panels

A modest solar panel array was incorporated on the roof of the pavilion as part of the original plan for the incorporation of technologies into the site. Late in the design process, it was discovered that one of the large trees retained from the original site would shade the solar panels at critical times during the day. This led to the City adopting a different approach and using panels with micro-converters, which meant that power would be generated even when some panels remained in the shade. This micro-grid system provides a more optimal solution than the original response, where the overall performance of the system would decrease when part of the system was shaded. The solar panels do not connect to any specific power generators on-site, but rather offset power produced by the site:

> "It was never going to provide energy to cover all energy consumption on-site and it also wasn't going to be providing energy when a proportion of energy was being used, like street lighting." (City of Canning Project Partner)

P2.5 Datasets

The plans for the WSNGCP sought to generate and make available datasets by monitoring elements such as water quality, water capacity and ambient temperature were intended outcomes of the WSNGCP. The datasets were intended to facilitate research and provide an important educational resource for schools and environmental managers. To achieve this, a range of sensors were planned into the park, which would be sent back to a central repository to allow public access to open data sets. According to one of the project partners, the datasets would supplement their knowledge of the park following a visit by 'datafying' elements of the park they had just experienced. A year after its opening, the full capacity of the park to generate datasets has not been realised to its potential primarily due to some unexpected issues that delayed the roll-out of the array of monitoring technologies. Nonetheless, once these technologies are in place, data collection is set to become a feature of the park in the future

P3. Activation economics

P3.1 Business Activity

The increased amenity and improved access afforded by the WSNGCP was anticipated to have a positive influence on economic activity by increasing the number of people in the area. Measures of actual business activity generated by the opening of the park were not included in the scope of this research. However, a report released by Urbis in 2020 provides a useful indication of the status of business activity in the City Centre area (Urbis 2020). The report indicates that since 2015 there has been about 28,700m2 of floorspace and approximately 1,150 jobs added to the area. Measurement of visitations to the CCC from mobile phone data shows the largest concentration of people, unsurprisingly visiting the shopping centre to the east of the WSNGCP. The Main Street, new development on Albany Highway and the Recreation Centre were also areas of concentrated visitations. With the current, proposed and potential development of employment floor space, the Urbis report (2020) predicts 10,748 more jobs will be supported in the Canning Centre City, with approximately $871 million in turnover in retail activity alone.

Figure 39 Canning City Centre development context (City of Canning 2018)

P3.2 Land Values

Nature-based projects like the Wharf Street Basin can lead increased uplift in value of adjacent nearby land as prices adjust to the increased amenity. A case study of another water sensitive urban design project, the Bannister Creek Living Stream in the Perth suburb of Lynwood, has shown this in practice: after eight years, there was an approximate 4.4% increase in the median housing price – above-trend values – within 200m of the living stream (CRC for Water Sensitive Cities 2018). Given this value uplift only became evident after four years though, it is too early to indicate whether the WSNGCP has had an impact on land values. There has been, however, a land value uplift from development in the CCC equivalent to 15% since the adoption of the CACP (Urbis 2020). While land value uplift is beneficial to existing land and property owners, it can negatively impact the affordability of housing. Capturing land value and reinvesting it into the public realm is one way to improve the distribution of benefits associated with green gentrification effects.

Figure 40 Apartments under construction and land for sale adjacent to WSNCGP (Babb 2020)

P3.3 Investment Attraction

One of the key goals of the Wharf Street Project, particular for the City of Canning, was to catalyse investment in the CCC and support the development objectives of the CACP. There is evidence of significant investment in the CCC. The Centre currently has the largest pipeline of apartment projects out of all Strategic Metropolitan Centres in the Perth Metro Region. Since 2016, about 368 apartment dwellings have been built in the CCC. According to Urbis (2020) 487 more apartments were in the pipeline, either in construction or planning phase. A challenge for assessing an indicator of investment attraction is that the transformation of the Wharf Street Basin is one of several major projects that have the potential to attract private capital investment. In addition to the investment in Wharf Street Basin, other catalyst projects included the upgrade of nearby Cecil Avenue and undergrounding of electricity infrastructure. Further projects are planned to be rolled out in a series of phases up until 2030. Although it is not clear what part the WSNGCP was playing in attracting investment, the park is now featured in local and international development marketing for the area.

P3.4 Land Use Change

The regeneration of the CCC set out in the CACP is well underway. As well as WSNGCP, there are several other significant capital works projects completed, in construction or in planning. These include the upgrades to Cecil Avenue West and East, the Lake Street Urban Stream, and major State Government projects like the Metronet elevated rail at Canning Station and the State Football Centre at the Queens Park Open Space. These projects signify major changes in the land use in the Canning City Area in coming years.

It is not yet apparent that any significant land-use change has occurred because of the transformation of the Wharf Street Basin a year since its opening. The range of investment attracted by the project described in P3.3 provides a good indication of the potential implications for land-use change in the CCC. However, land-use changes that can link to a catalyst project like the Wharf Street Basin will only become apparent beyond the time horizon of this project.

Figure 41 Apartments adjacent to WSNGCP (Babb 2020)

PLACE AUDIT: SUSTAINABILITY

Table 4: Sustainability principles that will be discussed in this section

Ecological health	S1.1	Biodiversity: flora and habitat
	S1.2	Biodiversity: fauna
	S1.3	Microclimate/urban heat
	S1.4	Water quality
Resilience	S2.1	Adaptive catchment management
	S2.2	Community engagement
	S2.3	Links to broader initiatives

S1 Ecological health

S1.1 Biodiversity: flora and habitat

Before its transformation into the WSNGCP, the Wharf Street Basin supported little biodiversity. Much of the vegetation in the Wharf Street Basin before construction was a mix of weeds and non-endemic Casuarinas, with some Flooded Gum (Eucalyptus rudis) in the north of the site. The banks of the basin were subject to a management regime of regular weed clearing and spraying of herbicides and pesticides. The site functioned as a "seed bank" for weeds, such as Brahmi, which flowed into downstream wetlands and eventually deposited into the Canning River area. The WSNGCP project provided an opportunity to enhance the capacity of the site to support greater biodiversity, and also created an opportunity to address biodiversity issues in downstream environments as well.

The landscaping of the basin has enabled the previously weeded banks to be replaced with native Western Australian local species (Figure 42). Although not all species originally planned for the site were available, due to limited nursery supply, over seventy native species were reintroduced to the site as part of the works and ongoing site management.

The design of the basin water body and the inclusion of habitat in the landscaping choices were critical factors for supporting the ecological health of the park. There were conflicting agendas around the inclusion islands and the wetland treatment system. The inclusion of the islands reduced the stormwater storage capacity of the basin but were important in the shaping of water flows and cycles to ensure water quality outcomes. As one of the project team members commented, the islands were "key to the biodiversity outcomes of the project".

Figure 42 Plant selection in the park (Babb 2021)

Native species were also used in the landscaping of the activity spaces and at the interface between the streets and the park. The entrance areas at Leila Street and the walkway along Wharf Street have been softened by the planting, which after a year are now showing signs of rapid growth (Figure 43).

Figure 43 Native fauna softening the landscape (Babb 2021)

Figure 44 Wetland vegetation thriving in the basin (Black 2021)

S1.2 Biodiversity: fauna

The WSNGCP also sought to achieve positive outcomes for the biodiversity of fauna living on the site through providing habitat and in other novel ways. A fauna assessment was carried out immediately before the project commencement and provided a baseline for progressive biodiversity assessments. According to the assessment, there was a low number of invertebrates found indicating potential toxicity in the sediment layer; only common bird species were present; and there was no indication of bats, although they were common to the area and the assessment was carried out on a single day.

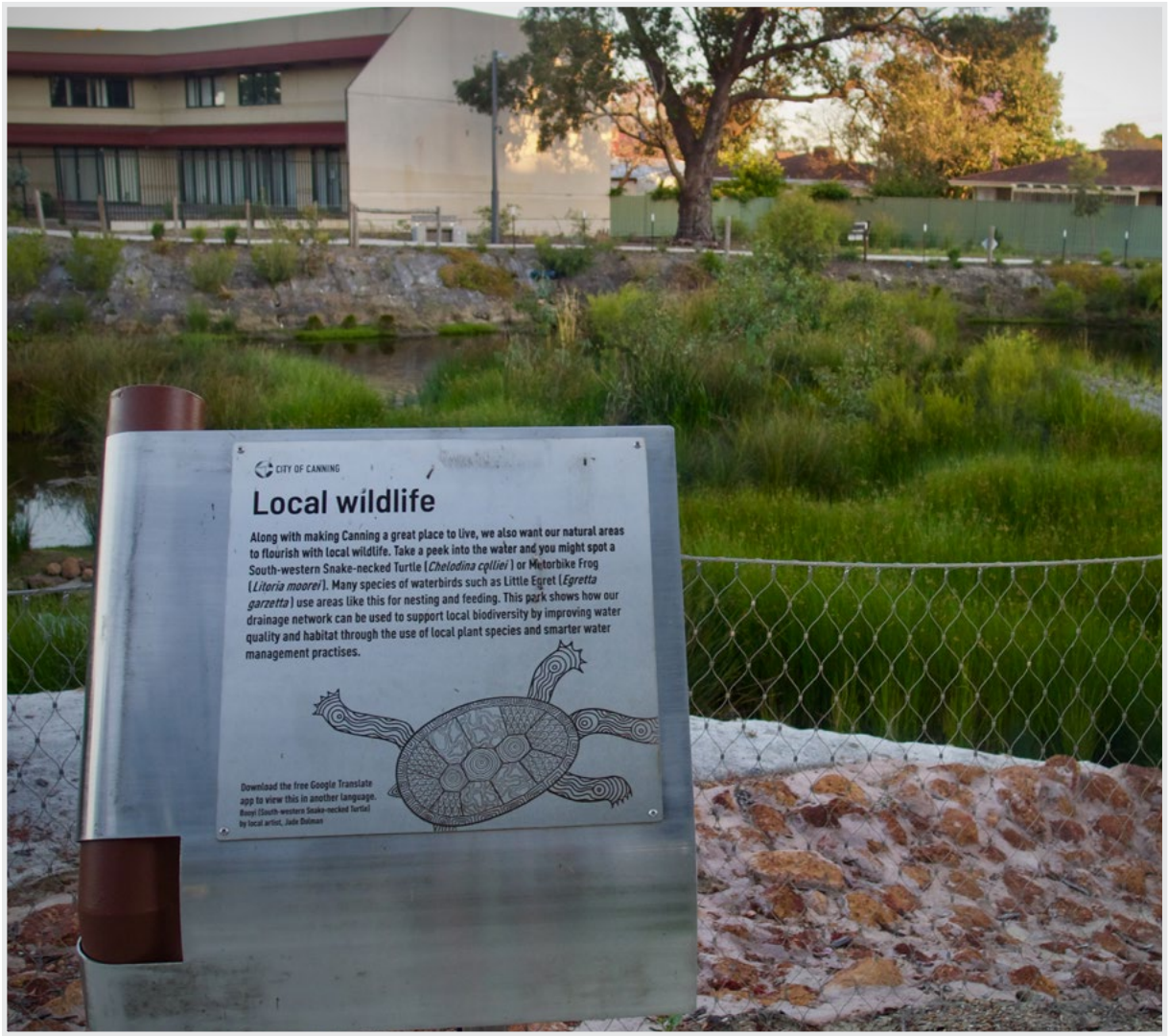

Figure 45 Local wildlife signage (Babb 2021)

One of the most noteworthy species present in the basin was the South Western Snake Necked Turtle, of which there were up to around forty adults likely present. The assessment suggests that the presence of the fencing had potentially reduced the number of road deaths and an even sex ratio suggesting potential for the population to be sustained in the new habitat. Turtles can live for many decades and the project team were concerned that the turtles could be impacted by the construction of the site. A proposal was made to trap the turtles, keep them off-site for the duration of the project, and then reintroduce them after the construction – receiving widespread support from the project partners. One of the City of Canning project partners noted that in other environmental projects, this level of care for fauna is not common. At the opening of the WSNGCP, the captured turtles were released back into the water and with the vegetation quickly maturing, their habitat is on the way to being well established.

Figure 46 Release of the turtles at the park opening (Babb 2020)

A year on and the WSNGCP is home to a thriving array of bird species, insects, and reptiles. Even during the construction process there was a notable presence of birdlife:

> "Before we'd finished construction, we had black-necked stilts nesting on the islands, having chicks out there". (City of Canning Project Partner)

There are a range of ways habitat and the health of fauna is supported by the site. Bat boxes are situated in mature trees around the pavilion area, providing a potential nesting site for the Gould's Wattled Bat, a common microbat in the Perth region. An insect hotel sits in the garden bed under a large Eucalyptus rudis. A colony of bees have also made their home in the hollow of one of the trees near the pavilion.

Figure 47 Insect Hotel (Babb 2021)

Figure 48 Bat boxes in Eucalyptus rudis (Babb 2021)

S1.3 Microclimate/urban heat

Shading provided by trees and structures can reduce ambient temperature significantly. In warmer months, this can have a significant impact on limiting urban heat effects, where exposed hard surfaces catch the heat and release it back over long periods. As discussed in S1.1, there is a mix of retained mature trees and newly planted endemic species that will take time to grow and offer shade in the various paved areas of the park.

Shade structures were originally planned to cover the walkways to the west of the park but removed due to alterations to the budget scaling back. As one of the design team noted:

> "...the original intent was that the shade structures create like a frame or a, like a face or a front to Wharf Street so it becomes like an arbour down and off that comes the boardwalk and it gets you out over the water." (Design Team Member)

Microclimate sensors were also incorporated into the park but had not been operationalised at the time this report was finalised.

S1.4 Water Quality

Water quality outcomes were important to the WSNGCP for several reasons. Stormwater basins collect runoff from surrounding areas – in the CCC, the surrounding area is characterised by light industry, roads, car parks and residential areas, meaning pollutants, weeds and rubbish flow into the basin. As the Wharf Street Basin is part of a chain of water bodies and infrastructure connected to the Canning River, the function of the drain influences the environmental quality of the downstream environments.

Water quality is also important to the function of the park as a community space. As discussed in L2.1, facilitating the interaction between park visitors and the natural environment was a central goal of the park. Poor water quality would detract from the amenity of the park and potentially have a detrimental impact on park visitors, or their experience of visiting the park. The sensors located under the bridge indicate the level of nutrients, Ph level and temperature to assist in motoring the water quality (P1.3)

There were several features of the park design, both proposed and eventuated, that sought to assist the water quality of the basin. The series of islands within the park act to filtrate the water as it circulates. However, as one of the design team explained, there are limitations to how effective this process could be in the basin:

> "The catchment actually comes into the lowest point in the Basin and then it is pumped out. So any notion of doing a gravity-fed water purification through reed systems or reed beds you can't achieve because...they are actually lifting water up and then pumping it out down to other wetlands." (Design Team Member)

Figure 49 Shade provided by large Eucalyptus rudis (Babb 2021)

A bio-filtration system, via an elevated rill, was incorporated into the park to assist in the circulation of water and contribute to improving the quality of the water in the drain (Figure 50). Water would circulate through the rill, into a series of vegetated ponds, so that even when the water was pumping it would still be filtered through the plants. The system was not fully implemented a year following the opening of the park due to restrictions within the Water Corporations about what can occur in stormwater basins.

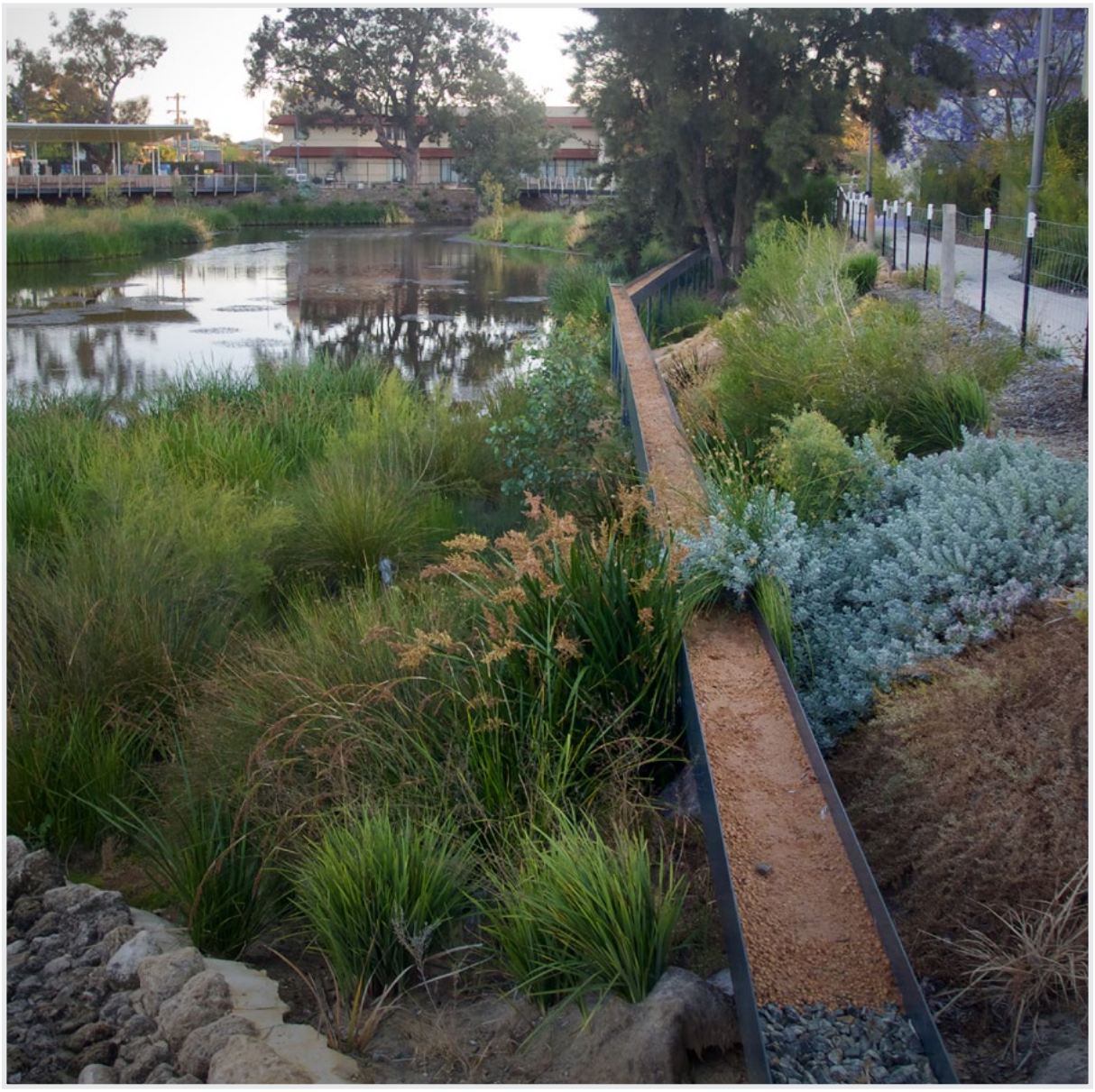

Figure 50 The rill (Babb 2021)

S2. Resilience

S2.1 Adaptive catchment management

A catchment refers to the landscape that collects and channels water: encompassing natural and artificial water channels, wetlands, and the soil. The series of open spaces and drainage infrastructure upstream and downstream from the Wharf Street basin collect and channel water from the broader urbanised catchment area, eventually connecting to Djarlgarra Beeliar.

Adaptive catchment management is an important means to ensure the ongoing resilience of our river catchments in the face of challenges due to climate change and increased urbanisation. Adaptive catchment management refers to a wide range of rules, practices and knowledge that support the hydrological, ecological, and social systems that depend on the catchment. Many of the features of the WSNGCP covered in the audit contribute to an adaptive catchment management approach: including maintaining the capacity for flood protection (P1.4), the removal of pollutants and nutrients before entering downstream drains and wetlands (P1.5), the management of water quality in the basin (P1.3), and the facilitation of natural water systems through the deliberate design of the landscape (S1.4).

Figure 51 Wharf Street compensating wetlands (Babb 2020)

One important element of adaptive management of river and water catchments is the cultivation of knowledge of catchment issues across a range of community and professional stakeholders (Fu et al 2019). Access to water afforded to the community by 'taking the fence down' would allow visitors to connect the quality of water in the basin to activities within the chain of stormwater spaces within the immediate catchment. According to one of the project partners, this connection would allow people to see that:

"...if they're not managing it properly it washes off into the stormwater drain and then ends up in this basin and all the litter that they can see has washed down off the streets. When we first started this project there were hundreds of soccer balls and tennis balls that had washed down from Coker Park I'm assuming in the stormwater drains. As they see things like that floating around they might think about their own behaviours." (City of Canning project partner)

The other aspect of WSNGCP that contributed to generating knowledge of adaptive catchment management practices was the data generated and the educational capacity of the park:

"They can see that the water flows in one end and out the other end and that once the site's vegetated and the water's moving around the site before it flows out, they can then start to think about the hydrological processes within the site and then relate that to the data that they can then go back to the school and download and then analyse and assess." (City of Canning project partner)

Figure 52 Water education at the Wharf Street wetland (Babb 2021)

S2.2 Community Engagement

One of the underlying principles of Water Sensitive Cities is that "community values and aspirations should govern urban design decisions and urban water management practices" (Wong, Rogers and Brown 2020). Authentic engagement with the community at all stages in the development of water sensitive projects like WSNGCP is fundamental to this principle.

Community engagement was planned at the outset to inform the design characteristics and provision of services offered in the park. However, the tight time frame for the delivery of the project was a challenge for achieving substantial and authentic engagement with various community stakeholders. Engagement with the Traditional Owners is discussed in L.2.5. A landowner consultation was advertised via the City's Your Say engagement page and social media sites – it was held on 25th February but with only four people attending. The improved health of the ecology of the basin and the increased amenity of the area was supported by the attendees: discussion points raised centred on the management of the project during construction; noise from the park from park users; access to the park via the cul-de-sac; and concerns that more people would bring more crime. A further online community survey was carried out but only received three responses. Several project partners considered the one-on-one consultation with surrounding landowners as more successful and ultimately having a very important impact on the overall project. For example, careful consultation with the landowner south of the site enabled the use of the wall for the mural, which became one of the most visually defining features of the site.

Figure 53 Long shot of park mural (Babb 2020)

Engagement with school groups was planned for the community engagement phase from early in the project. The Cannington Community College, located about a hundred metres from the park on Wharf Street, offered an ideal working partner for the project. Consultation with the Cannington Community College was held on 7th March 2019. The school previously had utilised the Kent Street Weir area for outdoor classrooms as there was a "good setup and equipment". There was strong support for the Wharf Street Park, with participants noting the opportunities for supporting teaching ecology, chemistry, and a range of HASS projects. Ideas for engagement with the students that were initiated included having art students contribute to the mural that was planned for the site.

Unfortunately, further engagements with the school were disrupted due to the outbreak of COVID-19 in early 2020. A series of workshops planned with school students to develop ideas for the mural had to change from face-to-face to video recordings. This disrupted the schedule and the planned outputs from the school were not ready in time to be incorporated into the mural. However, later artwork by the school children was included into the park design and is now displayed on one of the fences at the northern end of the park.

Figure 54 Students' paintings displayed on a fence (Babb 2020)

S2.3 Links to broader initiatives

Building institutional capacity by encouraging the interchange between networks of actors and organisations is critical to the success of advancing the water sensitive city agenda. Through linkages with broader initiatives, the lessons learned, and benefits offered by the WSNGCP builds this institutional capacity. The project is well connected to the Cooperative Research Centre for Water Sensitive Cities (CRCWSC) and the Water Sensitive Transition Network, which was an outcome of activities of the CRCWSC. The project also has ties with other community-focused resources within the water catchment, such as the Canning River Eco Education Centre located in the Canning River Park.

In the first year since opening, there had been numerous site tours (one project partner estimated approximately two hundred visitors from seven site tours) from engineering groups, community groups focused on water literacy, TAFE horticultural students, and a variety of water sensitive urban design interest groups. The park had also been the focus of many industry talks and presentations to national and local networks and organisations.

In the year since its opening, WSNGCP has also been recognised for its innovation and excellence at several State and National awards. These include the 2021 Western Australia Planning Institute of Australia Awards for Planning Excellence for Climate Change & Resilience and a Commendation for Technology & Digital Innovation; the 2021 Institute of Public Works Engineering Australasia Awards for Excellence in Water Projects and Excellence in Environment & Sustainability; the G.K. Watters Local Government Engineering Excellence Award; and runner up in the 2020 National Smart Cities Awards.

PLACE AUDIT: LIVEABILITY

Table 5: Liveability Indicators

Access	L1.1	People visits
	L1.2	Minimal barrier fencing
	L1.3	Universal access
	L1.4	Interpretive signage/wayfinding
	L1.5	Site access/walkability
Community fit	L2.1	Interactive natural areas
	L2.2	Digital areas
	L2.3	Educational resources and research
	L2.4	Diverse community values
	L2.5	Noongar knowledge, values and stories
Safety	L3.1	Crime Prevention Through Environmental Design
	L3.2	Lighting
	L3.3	CCTV cameras
	L3.4	Safety incidents
Community health	L4.1	Physical activity
	L4.2	Community wellness

L1. Access

L1.1 People visits

One of the main questions this research project sought to address was: how was the WSNGCP being used by the community? The 'people visits' indicator focuses on the number of visits, the duration of time people spent in the park, and the days and time they visited the park. Further information about what people did when they visited the park is explored in other audit indicators below.

The study commenced with an audit of the baseline conditions of the park, which would offer a point of comparison when the park was officially opened. As previously discussed, the original basin was fenced off, so the area within the Wharf Street Basin was not legally accessible to the public. Instead, the baseline audit sought to indicate how many people were using the streets around the Wharf Street Basin.

The number of people surveyed over a series of hour-long observations in March and May 2020 ranged from five to eleven people along Wharf Street near the basin. Most people observed (44 in total) were adults (35), with small numbers of elderly (5) and children (4). Information from the baseline survey is limited though. More surveys were planned but did not go ahead due to the ongoing impacts of the COVID-19 pandemic, with the construction at the site likely impacting the number of people who would normally use the streets.

The number of people visiting the park following its opening in September 2020 was captured by a series of observational surveys, as well as by sensors that recorded the presence of mobile phones in the park. Neither dataset is without limitations. Observational surveys were only conducted for an hour at each time. The anonymised mobile phone data did not capture visitors who did not have a mobile phone, potentially counted visitors twice when they left the vicinity of the park for a short time and re-entered, and potentially captured other people in the vicinity who were not visitors to the park. However, together they provide an informative indication of the amount of use generated by the park.

Figure 55 Augmented reality frame #2 (Black 2021)

Table 6: Park visitation data collected by mobile phone use

	Average daily number of visitors	Average number of people dwelling in the park for...		
		0-5 minutes	5-30 minutes	30+ minutes
Monday	67.5	36.7	10.9	6.6
Tuesday	75.8	45.9	11.8	6.6
Wednesday	74.8	42.9	10.7	7.0
Thursday	80	48.2	11.1	6.9
Friday	77.2	46.2	11.4	6.5
Saturday	70	42.9	8.3	6.2
Sunday	61.9	36.4	8.3	5.7

Table 6 shows data collected by mobile phone sensors. The numbers of visitors with mobile phones were captured over 168 consecutive days, from the 19th November, 2020 to 5th May 2021. The average number of visitors to the park 72.5 people per day, with the most recorded as 123 and the least 28. Thursdays and Fridays had more visitors on average. The weekends were quieter than weekdays, with almost twenty people fewer on average visiting on Sundays than Thursdays, the busiest day of the week. Fewer visitors tended to stay longer than 5 minutes on Saturdays and Sundays, than the weekdays. Visitor numbers were analysed to test whether daily maximum temperature was influential but the relationship between the two variables was not significant.

The observational survey visitation data is less comprehensive than the mobile phone visitation data but does allow some information that contextualises the visitation data overall. There were 186 visitors to the park recorded during the nineteen one-hour surveys. The period of observations in September and October 2020 had more visitors in total (n=131) and on average (10.9 people per observation period) than the period in January and February (n=55, 6.1 people per observation period). The difference in visitor numbers was likely due to the weather conditions. There was a clear pattern in the observation that linked higher rates of visitation to mild, fine days. Visitation was lowest on wet, raining days, but also low on days that exceeded thirty degrees centigrade. These types of correlations are to be expected, but as indicated in the mobile phone data, do not tend to have too much influence on the average numbers over a longer period.

About a quarter of the activities observed were the park being used solely for access, with a visitor recorded as entering the park and not conducting any other activities before exiting the park from the shortest path from point of access. The route across the park from Wharf Street via the bridge, to Leila Street, was most often used. A little under three-quarters of visitors to the park during the observational surveys conducted more than one of the designated activities in the observation protocol.

More information about the types of users and the activities they engaged in, is outlined in the other Liveability indicators below.

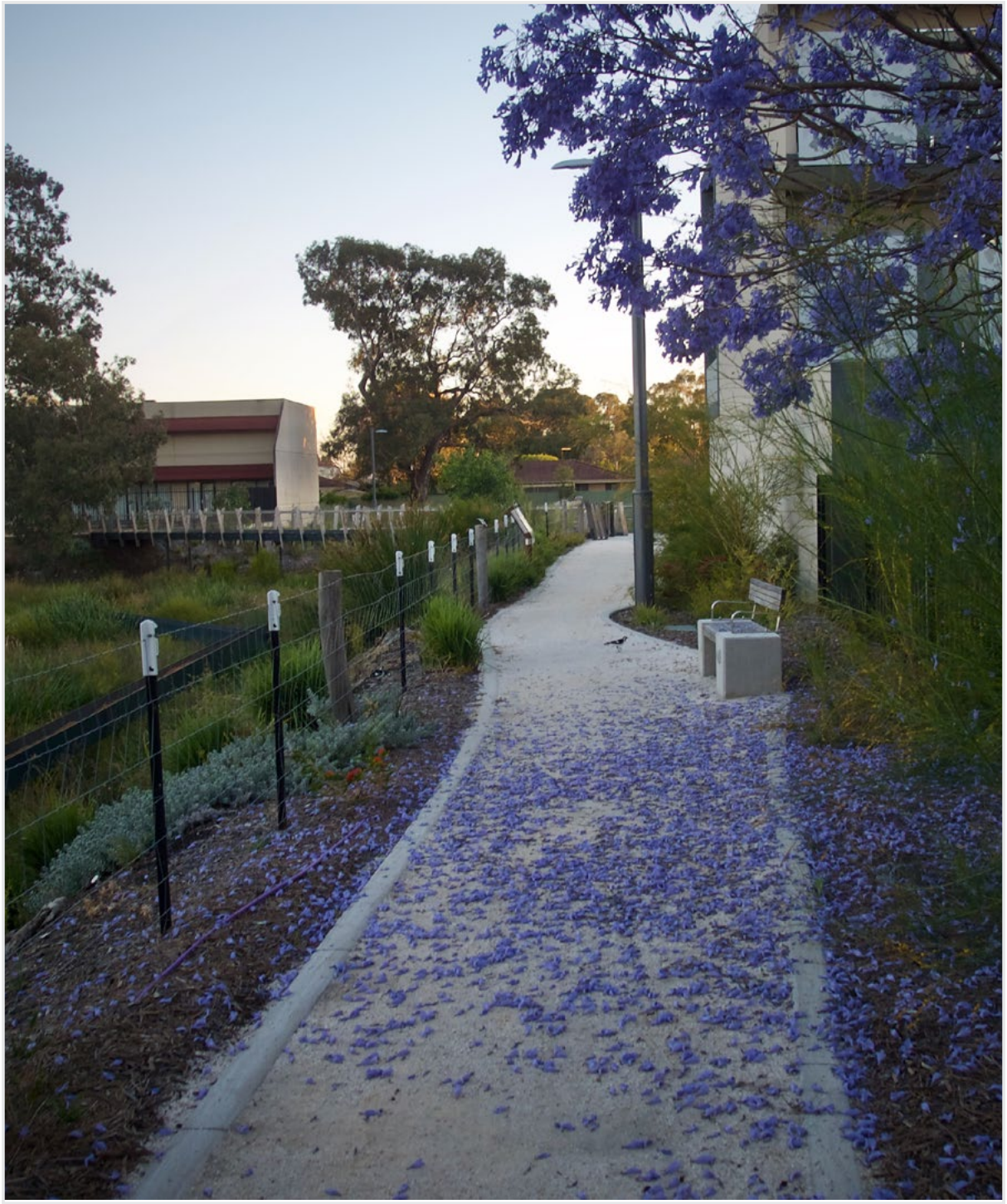

Figure 56 Jacaranda flowers on the park path (Babb 2021)

L1.2 Minimal Barrier Fencing

"Taking the fence down" was an important motif in the overall transformation of Wharf Street Basin from a single functioning stormwater drain to a multifunctional community, ecological and critical infrastructure space. The removal of the fence was described by a project team member as the "fundamental thing about the project". It represented a shift in the way of thinking about stormwater drainage as catering to a broader variety of purposes, needs and activities.

Figure 57 Previous fencing around Wharf Street Basin (Babb 2019)

Although “removing the fence” was an important catch cry for the project, the fencing of the water body was still an important aspect of the site design, and became a focal issue at several points in the development of the project. From a design perspective, the original intent of the fencing for the water body was that it would be unobtrusive and would sit within the vegetation, creating a more open and interactive space for visitors. The banks were originally conceived to be gently sloping towards the water body. These characteristics aligned with principles identified in the broader Drainage for Liveability program, where barriers can be designed on a basis of “minimal intervention” with a one in six gradient that would allow anyone moving towards a water body to stop easily. As one project member described, the fence was there to both prevent people from falling in, while also being designed in a way to allow anyone who did fall in to be able to safely get out.

Figure 58 Fencing along the boardwalk (Babb 2021)

Stormwater basins in the Perth metropolitan area are commonly situated in residential areas on spatially constrained sites, and therefore have steep sloping edges to maximise the capacity of the basin to store stormwater. As discussed in the background, this was the case with the Wharf Street Basin too. Given the requirement to maintain the holding capacity of the basin (see P1.3), the siting and design of the fences were impacted, with the original intent to situate the fencing down the sloping bank and blend the fencing in with the vegetation having to be adjusted. The outcome for the fencing of the site was therefore shaped by the requirements to provide safety, maintain the holding capacity of the basin, while also addressing budgetary constraints that emerged during the project – all of which were ultimately reflected in the selection of materials and design. Combined, these constraints resulted in a mix of fence designs: high-quality fencing in the prominent areas of the WSB, and the use of recycled jarrah posts and wire to "keep the cost down".

Figure 59 Simple jarrah and wire fencing around park perimeter (Babb 2020)

L1.3 Universal Access

Universal access is an essential element to ensure liveable places and the benefits they afford are accessible to all. Universal access requires that places accommodate people with a diverse range of needs and abilities through a range of factors: including the physical design of access-ways, signage that caters to people who speak languages other than English, and the design of legible spaces that are easy for people from a range of ages and abilities to use.

Access and movement around the site were supported in various ways: including level and gradual sloping paths to assist wheelchair movement, the provision of handrails, and seating options. The observational surveys noted four instances of people visiting the park in wheelchairs, and parents or carers with children in prams were noted on most days the observations took place.

Figure 60 Alternative access provided to boardwalk areas (Babb 2020)

Figure 61 View down Leila Street showing level of accessibility (Babb 2020)

L1.4 Interpretive signage/wayfinding

To support universal access, WSNGCP employed a range of approaches in signage and wayfinding. Interpretative signage was placed around the site to inform visitors about the various functions of the park – as a stormwater drain, the technology that was used in the park, the animals and plants that inhabited the park, and the importance of place, water and the local landscape to Whadjuk Noongar traditional owners. An option to translate signage using an online translator is incorporated into each of the signs in the park.

The bridge was located at the shortest access point across the basin, providing a legible sightline from Leila Street into the park. The choice to make the pavilion shade structure bright yellow was to help identify the park and link it visually to the nearby shopping centre area. As one of the designers noted:

> "We made it bright yellow underneath so you can actually pick it up as a wayfinder from the Carousel car park". (Design team member)

The mural was also highlighted by the project team members as contributing the visual imagery or legibility of the site.

Figure 62 View from the mural to the pavilion (Black 2021)

L1.5 Site access/walkability

Being able to walk safely and comfortably to WSNGCP is an important indication of the quality of liveability of the park. Walkable neighbourhoods have the potential to provide long-term cardio-metabolic health benefits to the residents and visitors (Chandrabose et al 2019). Walking is also one of the most equitable modes of transportation. Places that are highly accessible by walking can be accessed by the young, the old and people with disabilities. To assess the quality of access and walkability we surveyed streets within a comfortable five-minute walk of the park, and also observed where people entered the site to understand the general areas where people were walking from.

The opening of the basin and the inclusion of the bridge across the water body provided an important connection between the northwest and southeast areas adjacent to the park. This increase in accessibility was recognised by several project partners as a highly valuable aspect of the project. The site access survey showed that most visitors accessed the park via Wharf Street, with 40% entering from the pathway to the north, 24% from the west and only 2% from the middle entry point. A further 24% of people were observed accessing the park from the Leila Street entrance (Figure 63).

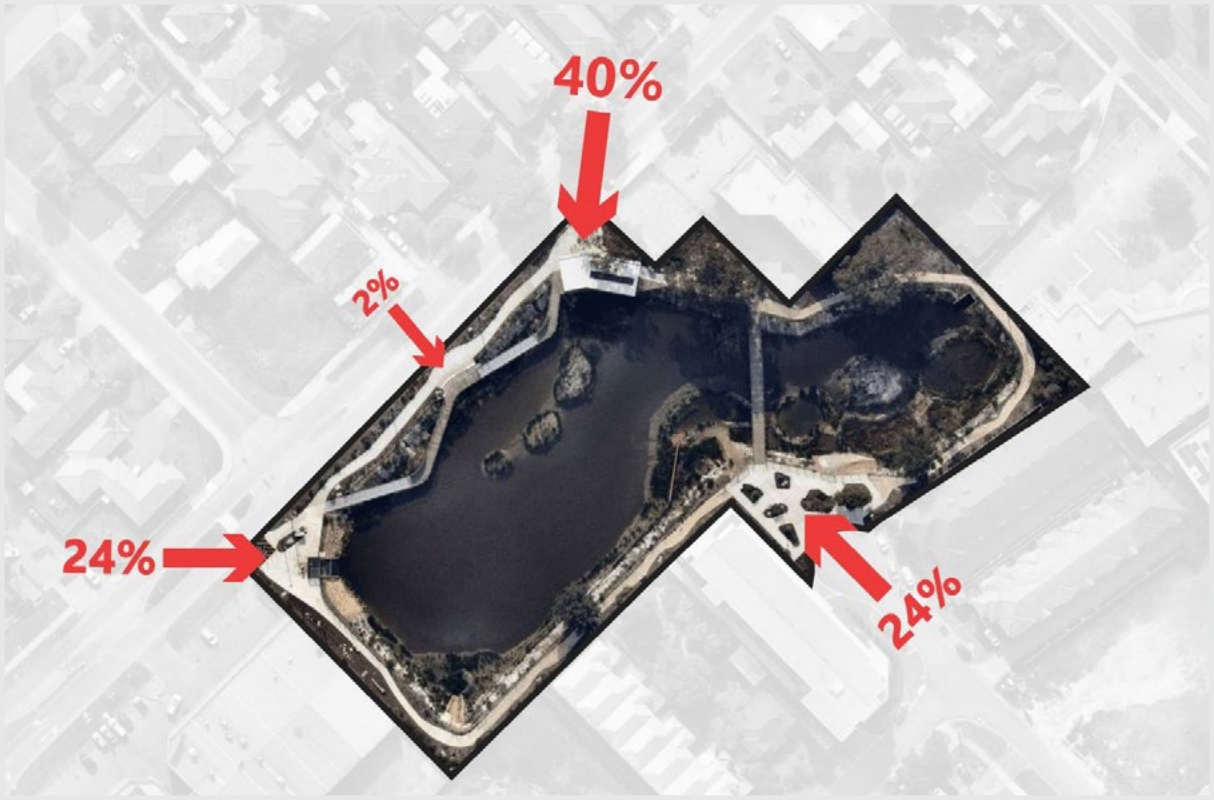

Figure 63 Summary of the proportion of us of each access point

Wharf Street was the highest-scoring precinct in the walkability survey compared to the other areas surveyed. This was due to it having a clean and well-maintained walking path with adequate width, no significant obstructions on the paths and providing high-quality amenities, like streets. The street scored more moderately against the safe crossing points and special needs infrastructure criteria.

The areas west and east of Wharf Street received mixed ratings in the walkability survey (Figure 64). The streets located east of Wharf Street to the Carousel Shopping area are adjacent to commercial and retail land use precincts. These streets scored moderately in the walkability audit as there is no significant walking path modal conflict, no substantial obstruction on the walking paths, provision of the walking path is good and amenities provision is moderate. Though, there is a lack of crossing points and special needs infrastructure in this precinct. Streets west of Wharf Street to George Way are part of a residential precinct. They scored poorly in the audit due to a high degree of walking path modal conflict and obstructions on the walking paths, lack of availability of walking paths, inadequate availability of special needs infrastructure and crossing points.

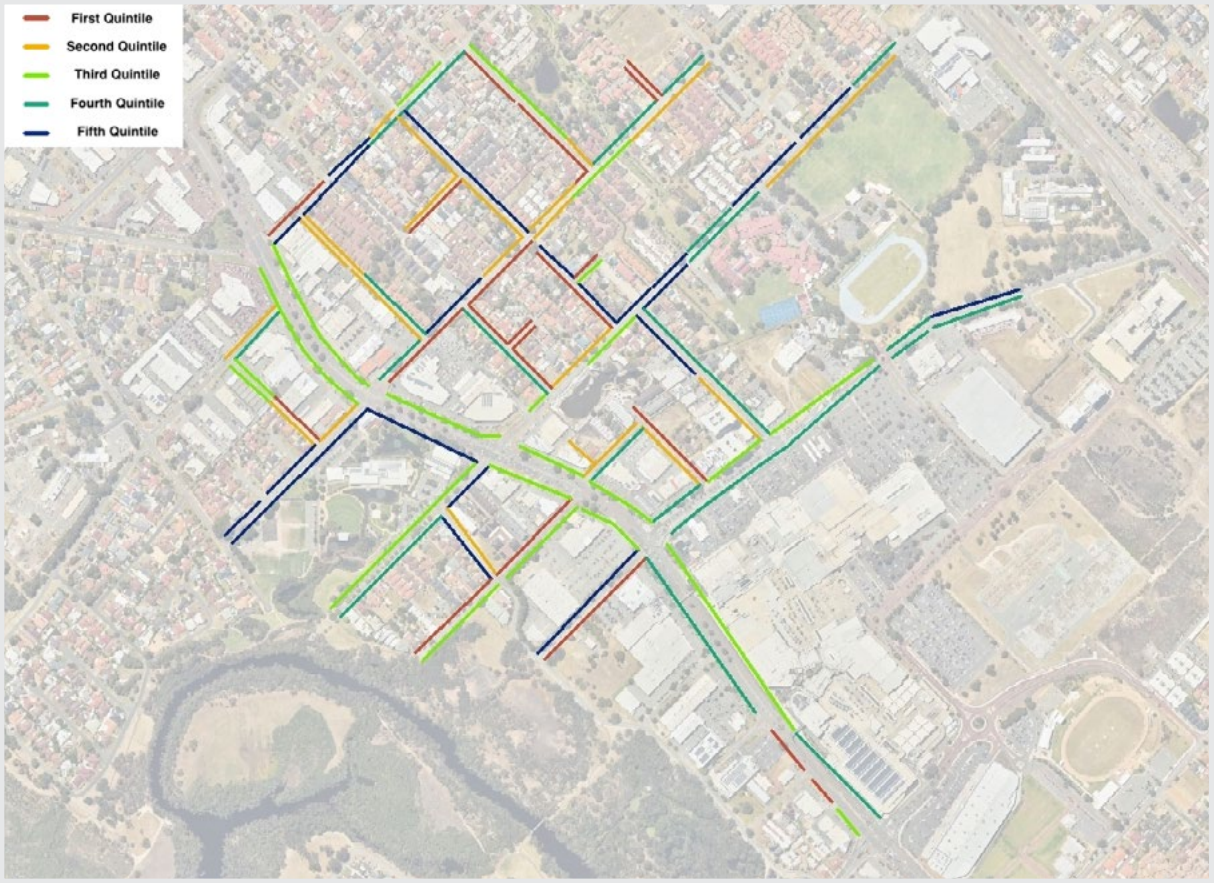

Figure 64 Overall walkability assessment scores for survey area

Albany Highway had adequate walking paths but performed poorly against most criteria due high degree of potential conflict between modes of transport, evidence of obstructions on the walking path, lack of availability of crossing points and amenities (such as shelter and seating) and poor special needs infrastructure. Albany Highway is a barrier to access to Wharf Street for people walking or cycling from the Canning River Park area (Figure 66).

The streets south of Albany Highway to the Canning Riverpark had ample walking paths, no evidence of obstructions on the walking paths was found, but the limited crossing points, areas of low amenity, and little special needs infrastructure meant that this area was isolated from the Wharf Street Basin.

Figure 65 Road crossing at Wharf Street (Babb 2021)

Figure 66 Albany Highway provides a significant walkability access barrier from the south (Babb 2021)

L2 Community fit

L2.1 Interactive natural areas

Natural places in urban environments provide space for 'mental restoration', where (re)connections to nature provide respite and refuge from the stresses of everyday urban environments (Hartig 2007). There were multiple ways that people interacted with natural elements within the park. In the observational surveys, people were observed stopping during their walks around the park to lean on the fencing and look over the water, watching the numerous species of birds and maybe looking for an elusive turtle. More serious bird watchers, armed with cameras on tripods, were observed several times over the survey period. People were recorded pointing to the beehive and on a couple of occasions, parents were seen pointing to the bat boxes in trees to show their children.

The boardwalk and bridge were popular spaces in the park for observers, families, and birdwatchers to stop and look over the water and the plant and wildlife it provided a habitat for. The placement of the boardwalk was one key element that supported this interaction. As a designer on the project noted: "...I think we achieved a lot by bringing the boardwalk out, so you can go down and you kind of feel like you are in the water or above it." Interaction with natural elements was also supported by the signage (L1.4) and digital elements (L2.2). The various habitats for fauna, such as the insect hotel, the reed islands and the bat boxes, will continue to support multiple species that live and visit the park.

Figure 67 View of decking over the basin (Black 2021)

Despite the scaling back of the original intent of bringing people closer to the water by having gentle sloping banks and inconspicuous fencing, there are good reasons to restrict close interaction with the water in the basin. Wharf Street Basin is an uncontrolled stormwater catchment drain in an area characterised by light industry. Due to the risk of noxious substances entering the water, close physical interaction with the water is not desirable.

Figure 68 WSNGCP is a bee friendly park (Babb 2020)

L2.2. Digital areas

There were several ways that smart, digital technologies were incorporated into the park (P2.1) to enhance liveability goals (also see L2.3, L2.4). Park users were able to access free wifi, extending the types of activities that the park afforded them and encouraging some to stay longer. Although the observational surveys were not able to ascertain whether people were making use of the free wifi, several people were recorded as sitting and interacting with phones or laptops in the park, primarily in the pavilion space.

The other digital spaces in the park were the Augmented Reality stations located throughout the park. The stations allowed park users with a mobile phone to access an app and view the frame through their phone to reveal a thematic story or feature of the park.

The augmented reality stations were only observed being used six times during the twenty-one hours that were surveyed. On four of these occasions, there were multiple people at the stations, mostly families with young children. More frequently, people stopped briefly to look at the stations but soon moved, perhaps curious as to what they were but not wanting to spend the time reading the information or downloading the app. One of the observers noted that people wandering around the park tended to be attracted to the informative signage rather than the AR stations.

Figure 69 Park mural viewed through the Augmented Reality frame (Black 2021)

Figure 70 Seating in the pavilion (Black 2021)

L2.3 Educational resources and research

The creation of a multi-functional park integrating urban drainage with plant and animal ecologies offers opportunities for learning, both for students and researchers, about the way that natural processes function and how they are intricately bound together with the built environment. As one of the project team noted, the purpose of the WSNGCP was to allow people to:

> "...understand the context of the site". The space was designed so "they can see that the water flows in one end and out the other end and that once the site's vegetated as it's expected to be and the water's moving around the site before it flows out, they can then start to think about the hydrological processes within the site and then relate that to the data that they can then go back to the school and download and then analyse and assess." (City of Canning project partner)

A key feature of the initial concept planning for the park was the inclusion of a 'living lab' space to act as outdoor classrooms. Children are now less connected with natural systems than previous generations. A stronger integration and use of natural spaces in the school curriculum has been put forward as a way of addressing children's nature deficit, whilst also providing educational opportunities for enhancing environmental literacy (Largo-Wight et al 2018). Situating educational activities in outdoor classrooms in settings such as parks, rivers, and other natural reserves, has been linked to increased science-based learning (Eick 2012), greater social benefits (Fagerstam and Blom 2013), and reduced stress (Chawla et al 2014) for children and young people.

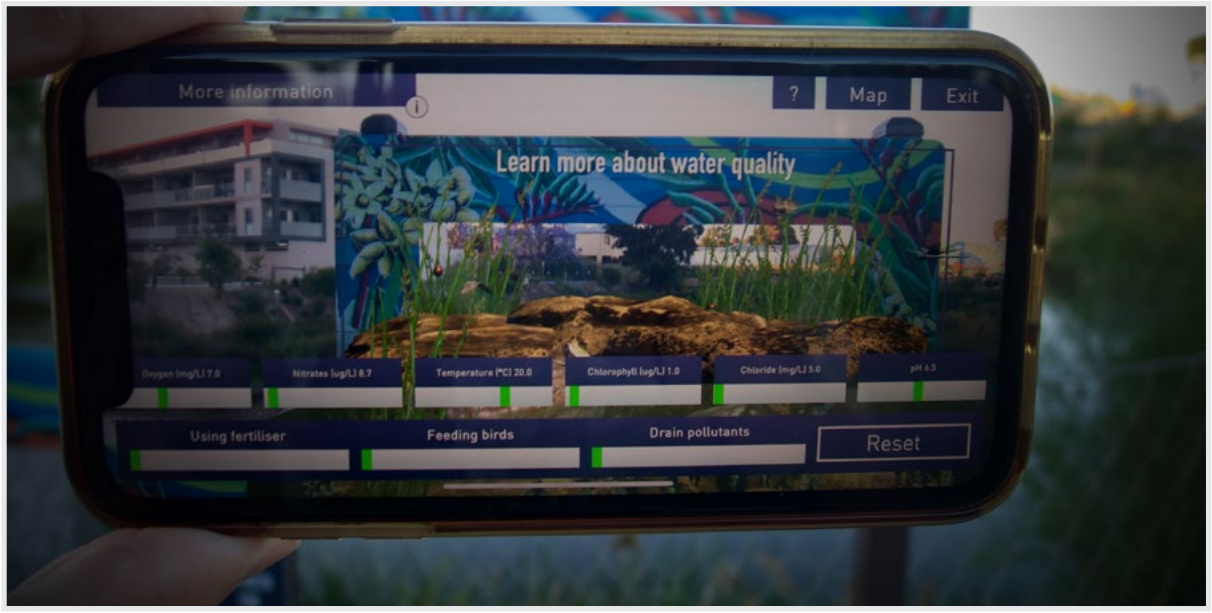

Figure 71 Water quality indicators via the App and the Augmented Reality (Babb 2021.)

The ‘living lab’ was situated in the Pavilion Space, which accommodates classes of students when they have field excursions to the site. As illustrated in S2.3 there have been several field trip visits to the site, including TAFE students, that have utilised the ‘living lab’ space. Although there was no report of the use of the space by school students in the first year, WSNGCP had been used to support the learning of students in the School of Design and Built Environment, Curtin University. Between March and June 2021, almost eighty students in the Urban Context unit as part of the Master of Architecture at Curtin University researched and studied the broader urban context of the site, assessing the qualities of the park and the streets that connect to it.

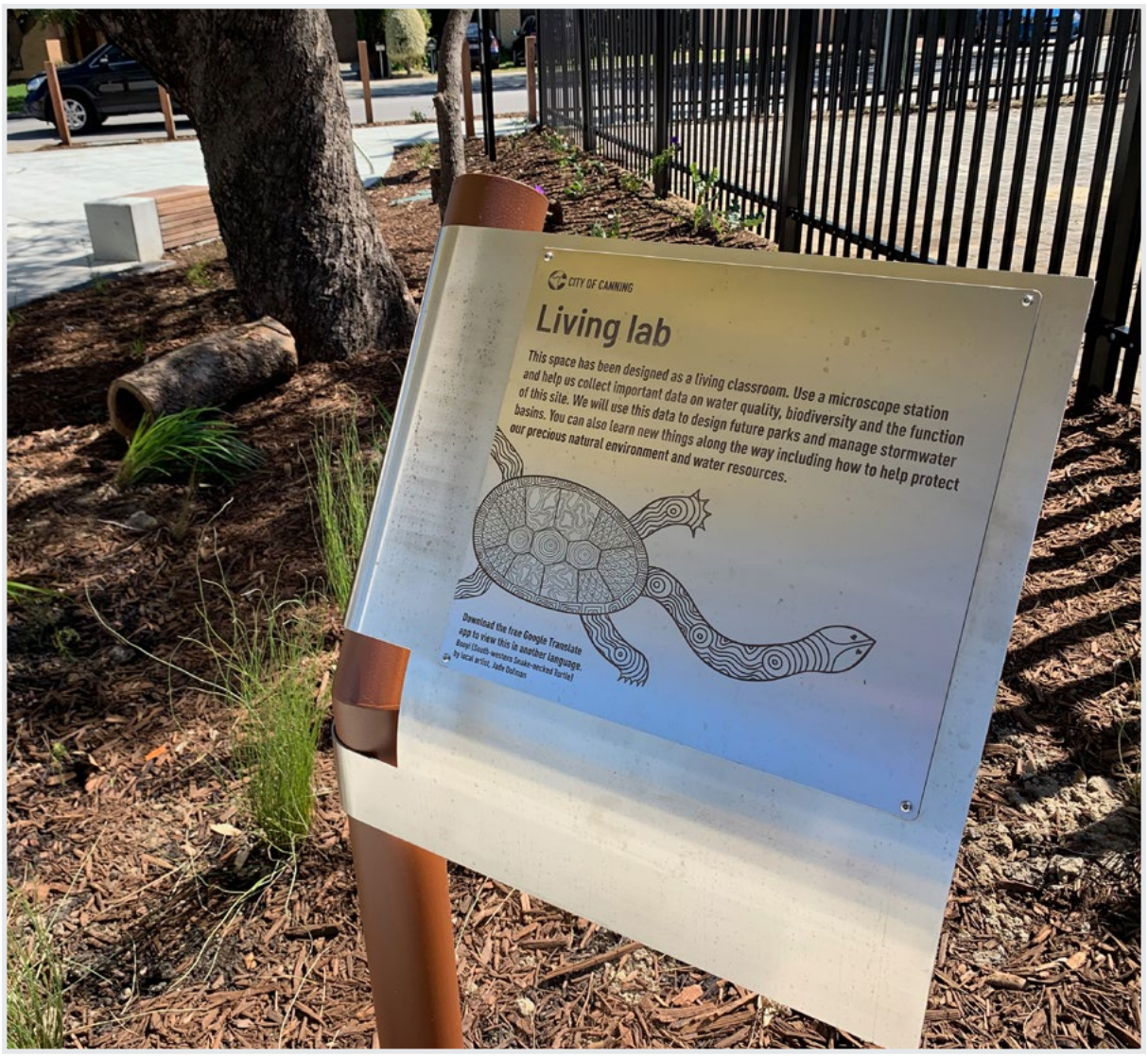

Figure 72 Living lab sign (Babb 2020)

L2.4 Diverse Community Values

The capacity for WSNGCP to offer benefits to a diverse range of communities was highlighted as an important indicator for the liveability of the park. Community parks were originally conceived and continue to function as one of the few places in the urban environment where strangers could interact regardless of often-discriminatory qualities such as background, financial status, and ethnicity (Ward Thompson 2002). To this end, they are valuable resources for facilitating social inclusion in youth from different cultures (Seeland, Dubendorfer and Hansmann 2009) and for facilitating social cohesion in ethnically diverse areas (Peters, Elands and Buijs 2010).

Figure 73 Curtin student research poster on park fence (Babb 2021)

The park was observed being frequently used by a range of age groups, with the exception of young adults. The observational surveys showed that the main age group visiting the park were adults (55.4%, n=103), with fewer young children (23.7% n=44) and elderly (14% n=27) visiting the park over the survey periods. Only twelve young adults visited the parks during our fieldwork. Most young children were accompanied by adults, but on two occasions, a group of three young children (under ten years old) with no adult accompaniment visited the park. The children visited the park from the nearby apartment building and spent their time in the park on scooters and running across the bridge.

The City of Canning is ethnically diverse and has a greater number of non-English speakers than the Perth metropolitan area average. Although the observational survey did not record the ethnicity of visitors, reflection from the observers did note that there did appear to be different ethnic groups reflected in the visitor numbers.

Diverse communities were also reflected in the planning for the park. As one of the project partners explained, the selection of the technologies underpinning the apps was partly based on the inclusivity of people from diverse socio-economic backgrounds [L2.5].

"...so rather than having a more Pokemon Go type of app where you don't have anything physical on-site that relies on a certain level of technology within your device, we wanted to make sure that the people who don't necessarily have the most up-to-date and current technology can still utilize the app and weren't disadvantaged." (City of Canning project partner)

Figure 74 View from the basin (Black 2021)

L2.5 Noongar knowledge, values and stories

Recognition and engagement with the traditional owners of the country, the Whadjuk people of the Noongar nation, was outlined as a fundamental aim of the community engagement in planning for the WSNGCP. However, the very short time frame of the project and a lack of existing capacity within the City of Canning to engage with Traditional Owners on a project like WSNGCP hampered these aspirations. Although meetings were held with Traditional Owners in early 2020 to provide input into the planting for the area and the signage and artworks, the Traditional Owners were unhappy that the meeting had taken place after the project was underway. Reflection from the City of Canning partners explained that previous engagement with Traditional Owners had not been focused on anything like this complex project with a tight timeframe. There was little organisational capacity to draw on existing relationships with Traditional Owners and others that might have appropriate cultural knowledge.

Members of the project team recognised that the collaboration with and recognition of the knowledge, values, and stories of the Whadjuk Noongar people could have been improved. One of the key project learnings that emerged from the discussion with the project team was the need for better processes within the City of Canning to engage with the Traditional Owners and that the City of Canning were now developing protocols and relationships as a result partly because of the difficulties faced in the Wharf Street Project.

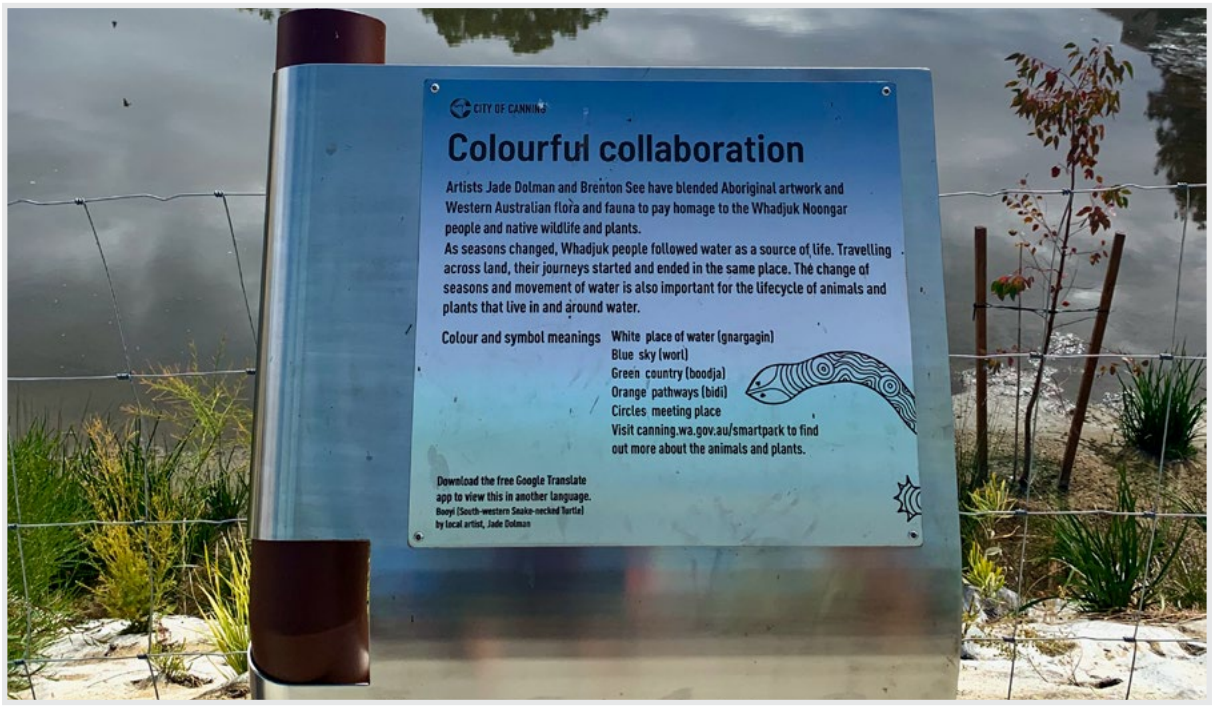

Figure 75 Colourful collaboration (Babb 2020)

Despite the issues engaging with Traditional Owners, there were other aspects of the WSNGCP that recognised the connections between the Whadjuk Noongar people and the land where the park was created. The mural painted on the southern wall facing the site has become an important signifier of the park. The mural artwork was co-designed by Jade Dolman and Brenton See. Jade is a visual artist with Whadjuk/Ballardong Nyoongar and Eastern Arrernte heritage. The artwork alludes to the seasons and the flora and fauna of the South West Australia region. The flow of water is depicted to represent the strong connection between Country and the Whadjuk Noongar people, who would follow the water in the landscape throughout the cycle of the seasons. The selection of endemic plants intentionally referenced Indigenous stories that relate to the flora and fauna of the site and were reflected in the species included in the mural. Jade also designed artwork for the various signs that were located around the park.

Figure 76 Acknowledging the traditional owners and custodians (Babb 2020)

L3. Safety

L3.1 Crime Prevention Through Environmental Design

A CPTED audit was carried out at seven locations within the park, measuring six categories: initial impressions; territoriality; surveillance; order maintenance; environment; and lighting (see Chapter 2).

The audit revealed that the park generally scored highly across the indicators at all locations in the park, demonstrating a range of environmental design features that supported crime prevention principles. The park scored highly against criteria relating to order and maintenance due to little evidence of litter, graffiti or vandalism and the general well-maintained facilities and landscape.

Active surveillance in the park was evident due to both the presence of CCTV cameras (see above) and a high degree of passive surveillance from surrounding apartments and buildings. There were a couple of areas in the park that lacked passive surveillance, primarily from the street or blocked views from surrounding properties, but were covered by the view from cameras.

The designated uses and boundaries between adjacent properties were clearly defined, indicating few grey areas. Pedestrian circulation was adequate and there were no areas that were secluded or underused. The smaller circular walk north of the bridge was obscured from view from some of the formal areas, such as the Pavilion, but had clear sightlines from other prominent positions in the park.

Figure 77 Passive surveillance over the park from adjacent housing (Babb 2020)

L3.2 Lighting

The park uses lighting in different ways. The lighting provided in the park was all LED and well distributed across the site to provide illumination. The bridge used different coloured lighting schemes to highlight events and seasons, such as Christmas as can be seen in Figure 78.

Early intentions were to have Smart Lighting that reduced energy use, with sensors identifying when people were in the park and initiating the lighting when required. Due to budgetary constraints, the smart lighting was not incorporated into the final designs, although it may be considered in future. The lighting, although energy efficient, lacks 'smart' capabilities although it does have the capacity to add features as 'smart modules' at a later stage. This could allow the lighting to initiate when people entered the park, reducing power usage and indicating water quality when connected to sensors.

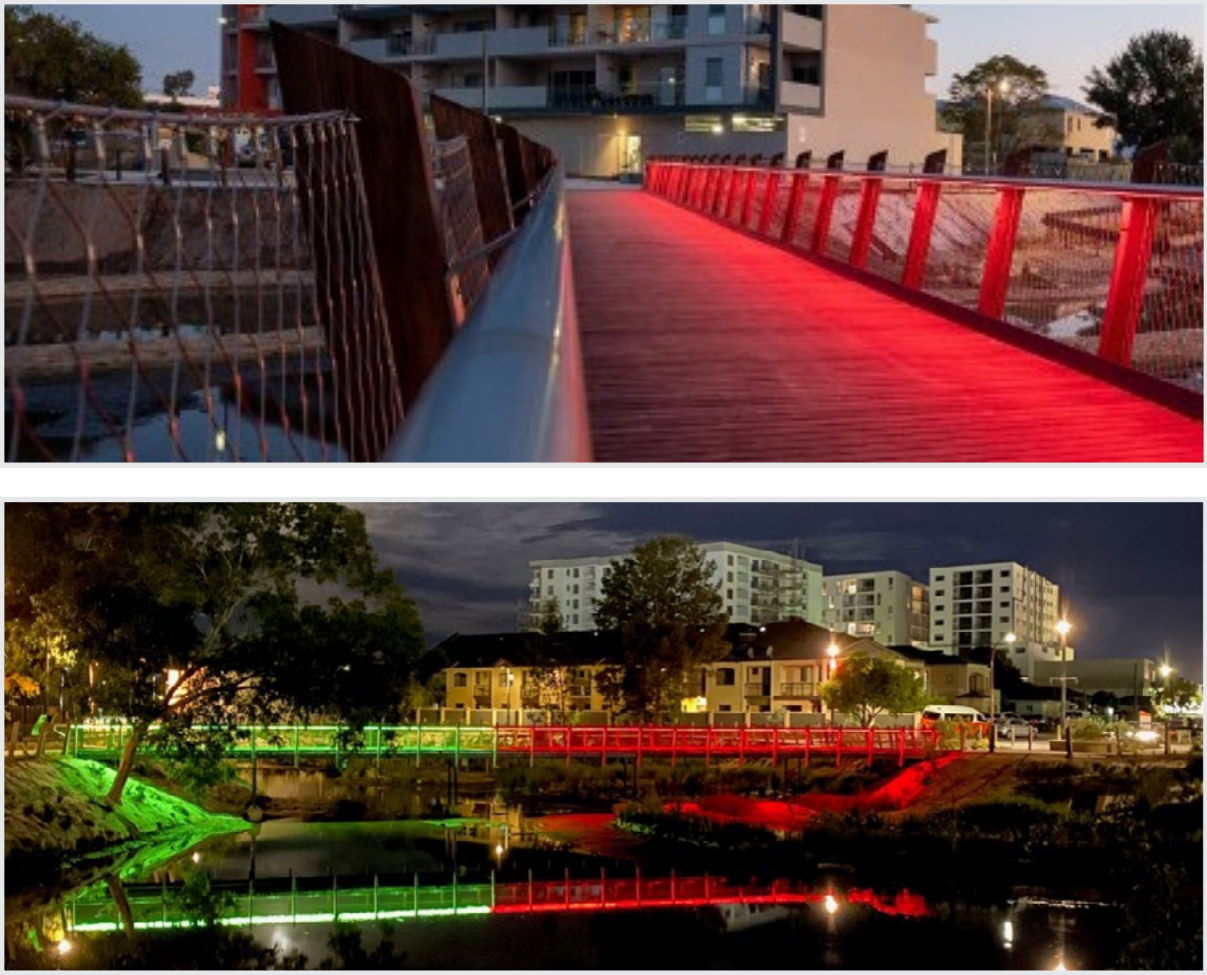

Figure 78 Images of the bridge lit up at night (Angelika Limmarja 2020)

L3.3. CCTV cameras

CCTV systems are now widely used in urban settings to address safety and crime prevention objectives. The capacity of CCTV has increased in recent years through the integration of smart digital technologies. Whereas standard CCTV offers basic monitoring of streets and public places, additional features of CCTV now include object identification and facial recognition. These enhanced capacities allow more active monitoring of spaces, different user types to be counted and preemptive policing.

Sixteen CCTVs are located in Wharf Street Next Gen Community Park. The CCTV used are for retrieving footage if an incident had occurred. The capacity of the CCTV system at WSNGCP is shaped by the City of Canning's policy on CCTV. One interviewee noted that there was concern in the council regarding how "big brother" the city might become with analytics and CCTV and consequently that there was no collection of personal data from the cameras or sensors in the park.

Figure 79 Lighting and CCTV (Babb 2020)

L3.4 Safety Incidents

Safety was a fundamental concern for many features across the project. Safety for the public was considered in the separation between the public access and the waterway. The traditional approach to safety employed by the Water Corporation was to fence off the site, however this approach was challenged in this project.

The objectives of the Drainage for Liveability program and WSUD more broadly challenge the traditional model of stormwater drainage, as interaction with the water body was a key component of the program. The design of fencing in typical Drainage for Liveability projects aimed to enable interaction with natural areas and limit the visual or physical barrier of fencing by taking an approach of protecting the most vulnerable through careful design and siting of fencing and vegetated banks.

As noted in L1.2, the depth of the basin, slope of the banks, and the potential presence of contaminants in the water meant that fencing was integral to maintain the safety of the site. There were no reported incidents of people falling into the Basin during the period. However, other safety incidents arose in the year following the opening of the park. In early 2021 CCTV captured details about an incident concerning a fire that was lit in the park.

Figure 80 Safety signage at the park (Babb 2020)

L4 Community health

L4.1 Physical Activity

Community parks can be settings for a range of formal and informal physical activity, by enabling active transportation, sports, hobbies, and exercise. Although the WSNGCP was constrained for activity space, with the waterbody taking up a large area of the site, the observational survey did capture people engaging in a range of different types of physical activities. Physical activity was intentionally designed into the park through the figure-eight configuration of the perimeter pathway. A project landscape architect noted: "...this is about the movement of people. If you live across the road or locally you can come down and get your walk-in by doing figure eights."

Of the most common activities recorded by people who engaged in multiple activities, walking around the larger basin was most popular, with about a third of the total visitors on one day walking a complete circuit of the basin. For visitors overall, the full circuit was undertaken by people walking dogs, young families, and solo walkers. Several families with young children stopped to interact with the informative signage or the app stations located at intermittent points along the walk. Fewer people walked around the smaller circuit to the north east of the site.

The survey recorded thirteen people riding bicycles in the Wharf Street Basin across the twenty-one hours observed. All bicycle riders used the park as access from Leila Street to Wharf Street or vice versa. The observers reflected that at first, this seemed a low number, but there is little space for cycling. Ten children on scooters were also recorded, most using the smooth paths along Wharf Street, going back and forth across the bridge, or sometimes venturing onto the metal platform to revel in making a noise.

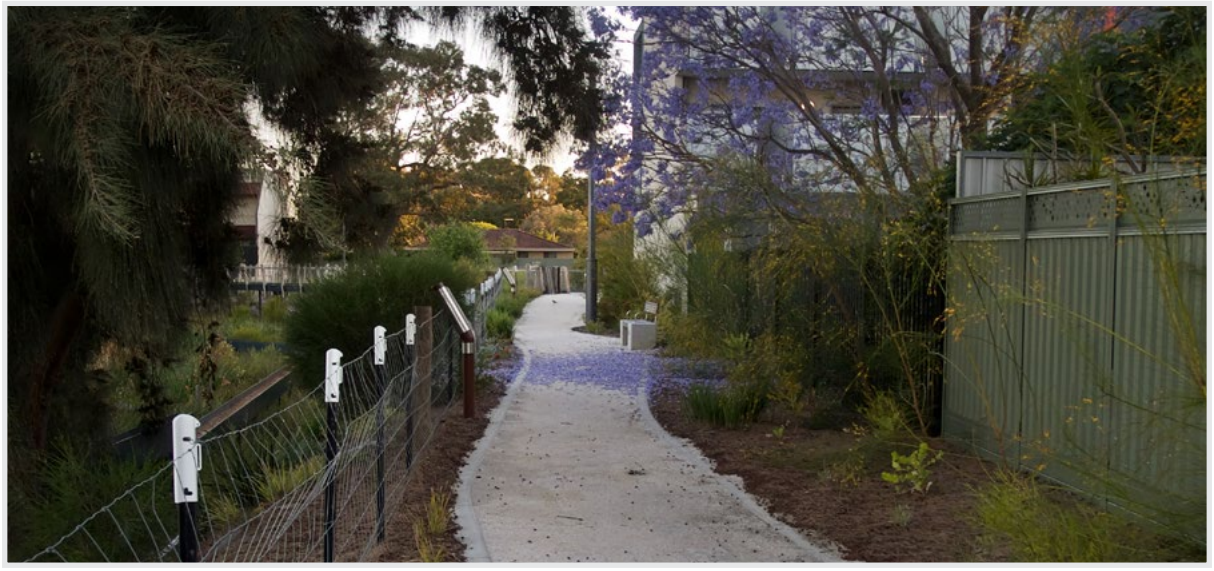

Figure 81 Pathway on the eastern side of the basin used for strolling (Babb 2020)

L4.2 Community wellness

Community places like the WSNGCP can support an increased intensity of activity and create the possibility of interactivity, allowing people to support and grow new social connections. The potential for high-quality public spaces in urban areas to improve community wellness is well documented (see review by Lachowycz and Jones 2013).

The observational surveys showed that WSNGCP is a social space. The surveys recorded whether activities were conducted alone or with groups of people. People strolling in pairs was recorded 3 times more and strolling with three or more people was 2.5 times more than the number of people recorded strolling alone. There were however fewer people who were recorded sitting in groups of two or more than those recorded sitting solo. This may be because, besides the pavilion space, there were few social gathering sites aside from benches.

Groups of people with small children were frequently observed through a variety of places within the park. Adults, possibly parents and grandparents of children, were observed pointing out elements within the park such as the beehive, the bat boxes, the Augmented Reality stations, and the wildlife that inhabited the basin area.

Figure 82 Mural and nature playground (Babb 2020)

Figure 83 Water fountain (Babb 2021)

REFLECTIVE WORKSHOP

In August 2021, a workshop was held at Curtin University with key project stakeholders. The objective of the workshop was to facilitate reflections on the project almost one year after it had opened to the public. All key stakeholders from the project partner and design working groups were represented at the workshop. The workshop began with a presentation of the preliminary survey findings from the research team. Small break-out group discussions followed aimed at informing the critical successes of the park and the challenges and lessons learned. The workshop concluded with a plenary discussion with all participants.

Success factors and best practices

The stakeholder group as a whole agreed that the project was an overall success as it had met the fundamental goal of transforming the basin into a well-used and high amenity community park. The project was considered by the City of Canning project partners as a milestone in the evolution of the Canning City Centre and in the way that water catchment planning was delivered to provide multiple benefits. For other partners, the project represented a potential shift in the wider urban landscape of the Perth region and demonstrated innovation in the way that the community was connected to natural spaces, biodiversity and water systems.

Figure 84 Reflective workshop with project partners and design team (Nematollahi 2021)

Several factors were highlighted in the workshop discussions that were considered vital to the successes of the project. The strong design elements of the park were frequently mentioned in the discussions. For example, the bridge was considered critical to access across the site as it linked the formerly disconnected Wharf Street to Leila Street; provided legibility and a focal destination within the park; and offered a means to connect the community with the water body and wetlands within the basin. The design had optimised the amount of high-quality public space within the park despite the challenge of balancing the needs to maintain storage capacity. Although there were setbacks with the landscape planting, a year on from the opening, it was noted that the vegetation was thriving. The design elements had delivered a net benefit to the community of the wider Canning City Centre and broader urban area by improving amenity of the site.

The delivery of a digitally enabled 'smart park' was a key requirement of the project funding. The discussions about the park's smart technology revealed that it was unexpected elements that were seen to be more successful in delivering this vision. The use of Augmented Reality to communicate the water story and the stories of the animals that inhabit the WSNGCP was one example highlighted, originally not planned but had become a key talking point for the park. CCTV was also mentioned as a success. Although it had not been used on many occasions in the first year of the park, a comment was made that its presence gave confidence to stakeholders that issues could be dealt with effectively and quickly.

Figure 85 View to the pavilion with rill in the foreground (Babb 2021)

There were several factors and examples that suggested best practice in the delivery of the project raised in the plenary. Overall, there was a sense that there was a strong shared vision amongst the team. This shared vision was linked to the overall intended goals of the park as a community space and resource for water education. The vision emerged from the goals of related projects such as the Drainage for Liveability program and the Canning Activity Centre Plan. The connection to these broader planning and policy goals – the regenerative and water sensitive city – helped sustain a strong narrative that brought stakeholders together.

The multidisciplinary nature was also considered very beneficial to the delivery of the project by enabling institutional learning through the project process. A high degree of collaboration helped develop the shared vision and also helped establish common goals and adaptive practices towards delivering the project, which helped overcome the governance and technical challenges. There was strong leadership shown by the City of Canning and Water Corporation that helped deliver key project elements and roles and responsibilities were clearly identified, which aided communication between stakeholders. Some elements that emerged in the project delivery phase are likely to be adopted. For example, the agreement regarding access rights helped in critical aspects of project delivery and maintenance, which looks to influence the development of new asset management and approval processes.

Challenges and lessons learned

As well as the successes of the project, the workshop also sought to highlight elements that challenged the delivery and outcomes of the WSNGCP, and to draw out lessons for other similar projects.

The requirement to maintain the water storage capacity of the basin was raised as an important influence on many elements of the project, as it limited the amount of community space and the type of vegetation available, and restricted other elements such as the ability to vegetate the basin to assist with water quality outcomes. Capacity was noted as being a consistent issue with the planning for similar stormwater assets.

As well as the benefits noted above, there were several challenges with implementing the smart technology in the park. For example, the placement of the water quality sensor had led to ongoing issues for water quality monitoring that needed to be resolved before the initial objectives could be achieved. There was also a lack of clarity on who would respond to issues concerning the sensors and maintain them once they had been implemented. Other institutional factors were noted as providing unexpected limitations. For example, stakeholders from the City of Canning expressed frustration that the full potential to maintain public safety such as the use of smart lighting and CCTVs was constrained by existing policies. A potential ongoing risk was recognised that the high-cost technology delivered as part of this project could become redundant in near future due to the advancement of technologies or weathering from the elements. Finally, the lack of clarity around the use of project data – how this data can be applied to improve the process and what inferences can be drawn from it – was also noted as an unexpected lesson learned.

A view was expressed in the plenary discussion that the need to provide and deliver a level of technology in the park had reduced the focus on more fundamental urban design elements and scaled back the size and amount of vegetation that could be incorporated into the park. This was noted that it will need to be better balanced in further projects that incorporate technology with parks to optimise the benefits that 'smart, green and blue' projects deliver.

With regard to the delivery of the project, budget constraints and unknowns challenged the delivery of project elements, specifically the geotechnical and design challenges raised by the site. Budget contingencies and financial risks were not correctly identified at the start of the project. However, the workshop participants recognised that these points were to be expected in a complex project like the WSNGCP. More procedural challenges were noted, like the lack of clarity regarding City of Canning policy and Water Corporation approvals processes.

The tight project timeline was raised as both a challenge but also a catalyst for expediency and experimentation. It highlighted deficiencies in standard practice and gaps in internal organisational processes. Examples given by the workshop participants included engagement with Traditional Owners, responsibilities about management arrangements of the site and of the data generated by the sensors on site, and the mitigation for construction vehicle traffic. A comment was made suggesting that the project management focused on the delivery of the project and was weak on maintenance and ongoing responsibilities. It was recognised that there were deficiencies in the way the project was set up and this created further challenges, such as the lack of coordination and collaboration between design team and project control group.

6. CONCLUSION

This research project provides a document of the creation and the first year of the Wharf Street Basin Next Generation Community Park. To address the research report has presented a primarily qualitative assessment of the WSNGCP using a place audit approach, informed by a variety of survey data, document analysis, interviews, and continued engagement with the partner working group. It responds to three overarching lines of questions that were formulated by the research partners at the beginning of the process.

KEY FINDINGS

1. How is the park used by visitors? What features and elements contribute to the park achieving its goals? What features and elements challenge the park from achieving these goals?

This research provides a strong indication that WSNGCP achieved its objective to become a 'liveable' community park. This is primarily evident by the number of visitors to the site and in its use as an access way. Although increased visitation was expected, given the park was previously inaccessible to the public, the evidence that people used the park for a range of recreational and social activities, and lingered in the park, is an indication of its success. The design of the activity space, the balance between providing interaction with nature and safety, and the accessibility of the park have created a place that people visit, walk through, stroll around and come to experience a natural space in the midst of a busy urban centre. Although the design intent for the site was challenged at various points due to tension between the multiple functions the park sought to serve, particularly the need to maintain stormwater storage capacity, a year following the opening of the park it is quite clear that it is a place that supports a range of liveability goals.

2. What elements of the park support the planning for Canning City Centre? What social and organisational capital does the project build?

The WSNGCP has unlocked a previously inaccessible asset within a rapidly developing 'greyfield' activity centre. It has provided a key access link for pedestrians and cyclists between the residential area west of the park and the Westfield Carousel Shopping Centre. Although it will take a few years to ascertain how the park has influenced the development economics of the Canning City Centre, the evidence of similar projects suggests there will be an uplift in activity and value of surrounding areas. What is clearer after the first year of the park being open to the public, is that there has been a significant degree of capacity building within social and professional networks due to the unique features afforded by the park and the collective experience of the partner organisations involved in the planning and delivery of the park. There is a renewed commitment towards processes and capacity building within the City of Canning regarding community engagement, engagement with Traditional Owners, and in digital technologies. The ambitions of the park to support water education and literacy about water sensitive urban design have also been realised to a large degree. The organised visits and tours of the site, the interest from schools and tertiary programs, and in the connections to non-government, community and professional groups linked to water sensitive cities, demonstrates the interest and indicates ongoing institutional learning is enabled by the project.

3. What can others learn from this project? What are the unique factors of this project that others need to consider when drawing on lessons learned?

There are both lessons to draw from the WSNGCP for other similar projects and also features of the WSNGCP that are quite unique to this site. The objective of maintaining water capacity was a major influence on and shaped many aspects of the park including the design interventions to achieve water quality outcomes, the availability of activity space for use, and the way visitors could interact with natural spaces. The challenges in balancing these various goals with the overarching need to maintain capacity will be applicable to other basins in the Perth Metropolitan area given the site constraints common to these stormwater infrastructures. WSNGCP was able to balance many of these goals with assistance from the Smart Cities and Suburbs funding and similar projects would need their own source of funding to overcome constraints.

For projects seeking to integrate smart technology into park or water sensitive urban design projects there are other lessons to glean from the WSNGCP. The steep learning curve that the project partners undertook to deliver the technology component of the park point to the need for existing organizational capacity to guide successful delivery of technological solutions to provide net benefit. Organisational capacity could be in the form of digital strategy or networks to support the planning and administration of smart technology embedded projects. There were clearly positive aspects related to the integration of smart technologies in WSNGCP. However, these positives occurred due to trial and error, and innovative individuals working to deliver positive project outcomes in the face of limited support and institutional support.

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APPENDICES

APPENDIX 1: RESEARCH INSTRUMENT - OBSERVATIONAL INSTRUMENT

Observation Template

Date	Observer	Start time	End Time
Weather	Temperature	Observer Location	

Activity	Number of times observed (once per person)
Strolling - solo	
Strolling - with one other person	
Strolling - with more than one other person	
Walking the dog	
Jogging	
Jogging - with one or more persons	
Sitting solo - observing	
Sitting solo – interacting with phone	
Sitting solo – reading	
Sitting with one or more people - talking	
Cycling	
Scootering	
Playing	
Using Smart Technology	
Interacting with informative signage	
Using the drink fountain	
Access only	
Other	
Other	

Type of user	
Children	
Teenagers/Young Adults	
Adults	
Elderly	

Notes

APPENDIX 2: RESEARCH INSTRUMENT - WALKABILITY INSTRUMENT

Wharf Street Walkability Audit

1. Audit section

2. Auditor's name

3. Date

Example: January 7, 2019

4. Start time

Example: 8:30 AM

5. End time

Example: 8:30 AM

6. Walking path modal conflict

Mark only one oval.

- ◯ Significant conflict with vehicles with high risk of accident, but walking possible.
- ◯ Walking is possible, with some inconvenience
- ◯ Conflict with other slow moving NMT modes
- ◯ No conflict with other modes

7. Availability of walking paths

Mark only one oval.

- ◯ Walking path essential but absent.
- ◯ Walking path not continuous
- ◯ Walking paths present but is in bad condition in places and/or not sufficient width
- ◯ Clean well maintained walking paths present.

8. Obstructions on the walking paths

Mark only one oval.

- ◯ Permanent obstructions block the walkway ex. Culverts, transformers, junction boxes, trees, light poles, sign boards, property entry exists, fences etc. and overhanging objects
- ◯ Temporary obstructions block the walkway (Parked Vehicles)
- ◯ Walkway width is more than 1.5m but still not sufficient due to obstructions.
- ◯ There are no obstructions

9. Availability of crossing points (grade separated/at grade)

Mark only one oval.

- ◯ No crossing points with vehicular speeds greater than 50 kmph
- ◯ Crossing points with vehicular speeds greater than 50 kmph
- ◯ No crossing points with vehicular speeds 50kmph or less.
- ◯ Crossing points with vehicular speeds 50kmph or less.

10. Quality of crossing points

Mark only one oval.

- ◯ No Crossing Point
- ◯ Crossing point is not manned, or signalized. No road marking/sign board to warn motorists.
- ◯ Safe grade separated crossing with escalator, with adequate lighting. Or at- grade crossing with pedestrian pelican signal facility providing more than 15s for 2 lanes and 30 s for 4 lane road
- ◯ Pedestrians can safely cross the road anywhere.

11. Amenities: appropriate to the street context

Mark only one oval per row.

	Not present and needed	Present but not adequate	Not present but not needed	Present and adequate
Street Trees	◯	◯	◯	◯
Seating	◯	◯	◯	◯
Signage	◯	◯	◯	◯
Shelter	◯	◯	◯	◯
Rubbish bins	◯	◯	◯	◯

12. Special Needs infrastructure

Mark only one oval.

- ◯ No amenities available, giving no access to for pedestrians with special needs
- ◯ Disability infrastructure present but not to appropriate standards
- ◯ Disability infrastructure in good, clean condition, but can be better placed
- ◯ Disability infrastructure well placed in excellent condition. For ex. Auditory pelican crossing/ elevator situated at height accessible to a wheelchair.

13. Motorists' behaviour

Mark only one oval.

- ◯ Motorists encroach pedestrian space
- ◯ Motorist do not or rarely slow down for pedestrians
- ◯ Motorists sometimes yield to pedestrians
- ◯ Motorists do not encroach pedestrian space and yield always, or pedestrian priority areas.
- ◯ Motorists and pedestrians are completely separated

14. Mechanical/formal surveillance

Mark only one oval per row.

	Not present and needed	Present but not adequate	Not present but not needed	Present and adequate
Lighting	◯	◯	◯	◯
CCTV	◯	◯	◯	◯

15. Passive surveillance: Building frontages

Mark only one oval.

- ◯ Inactive (openings/ entrances more than 30m apart, few/no windows to street and/or inside of building not visible from street)
- ◯ Average (openings/entrances every 15-30m, some windows to street, some internal parts of building visible from street)
- ◯ Active (openings/entrances every 10-15m, windows to street, inside of building visible from street and not obstructed with signage, integration of buildings with street such as alfresco areas)
- ◯ Not applicable

16. Passive surveillance: Pathway type

Mark only one oval per row.

	Yes	No	NA
Closed pathway (e.g. Under-passage, Closed staircase etc...)	◯	◯	◯
Complete Pathway visibility	◯	◯	◯

17. Territoriality: Maintenance

Mark only one oval.

- ◯ Poorly maintained physical environment
- ◯ Adequately maintained physical environment
- ◯ Well maintained physical environment

18. Territoriality: Public-Private interface

Mark only one oval.

- ◯ Many abandoned buildings/vacant lots/isolated places
- ◯ Some abandoned buildings/vacant lots/isolated places
- ◯ No abandoned buildings/vacant lots/isolated places

APPENDIX 3: RESEARCH INSTRUMENT - CPTED AUDIT

Date:	Time:	DAYTIME CPTED AUDIT Site number:				
Territoriality			3	2	1	N/A
Property boundaries are clearly defined						
It is clear whether spaces are public, semi-public or private						
The site is located in, or close to spaces with activities.						
The site is not in, or close to, a secluded or under-used area.						
The site is located in an area with adequate levels of pedestrian circulation						
Entrances to the buildings are clearly defined and visible						
The intended use of the site is clear						
		Territoriality Score / 21				% score
Surveillance			3	2	1	N/A
Building frontages address the street						
Building facades are visibly permeable (e.g. windows overlook the street)						
Advertising does not obscure surveillance from overlooking windows						
There is passive surveillance from surrounding land uses						
There is passive surveillance from passing pedestrians or other users						
There is passive surveillance from passing vehicle traffic						
There is CCTV in use						
Landscape topography (e.g. height / elevation) does not obscure surveillance						
Foliage does not obscure surveillance.						
		Surveillance Score / 27				% score
Order Maintenance			3	2	1	N/A
There is no evidence of litter / rubbish at or near the site						
There is no evidence of graffiti at or near the site						
There is no evidence of vandalism at or near the site						
The site and buildings are well maintained						
There is no evidence of abandoned buildings and/or vehicles						
There is evidence of the routine maintenance of properties and structures						
There is evidence of the routine maintenance of the natural landscape						
		Order Maintenance Score / 21				% score
Environment			3	2	1	N/A
There are no entrapment or ambush spots in or around the site						
The site is not adjacent to vacant or derelict land or property						
The site is not close to a pharmacy / chemist						
The site is not close to a supplier of alcohol						
The site is not linked to other land-uses via pedestrian access ways / laneways						
The site is not close to a pawn brokers or cash converters						
		Environment Score / 18				% score
		Total Daytime CPTED Score (max 87)				
(Note: divide total score by the number of categories counted to create %)		Total % score				
Date:	**Time:**	**CPTED Audit AFTER DARK**	3	2	1	N/A
I can recognise someone's face at a distance of 10 metres						
There are no locations with excessive bright spots (too much 'blinding' light)						
There are no locations where there are dark spots and shadows						
There are active land-uses nearby (e.g. 24 hours)						
Street lighting is well-maintained (e.g. all seem to be working)						
Lighting levels allow colours to be easily distinguished						
		Total 'After dark' CPTED Score (max 18)				
(Note: divide total score by the number of categories counted to create %)		Total 'After Dark' CPTED % Score				