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Waterway Corridors Planning Methodology

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CONTENTS

FIGURES

TABLES

APPENDICES

1 INTRODUCTION

Water is essential for life and when we make space for water within urban environments, we create places for the community.

Waterway corridors provide an opportunity for active lifestyles within natural environments. They provide opportunities for walking tracks, bike paths and recreational trails away from the dangers of traffic and the noise of every day life. They also create unique opportunities for preserving and enhancing biodiversity, for connecting fragmented remnant habitat, and maximizing the opportunity for species preservation. Waterway corridors provide green space that is vital for mental health and well-being.

Fraser Coast Regional Council's Vision is that by 2031 the Fraser Coast will be a diverse, strong and well governed region of vibrant places connected as a whole by community spirit, respect for the natural environment and an innovative and diverse economy (Fraser Coast Community Plan). The region's natural environment, appealing lifestyle and affordable housing have been key factors underpinning sustained population growth. However, continued growth is placing significant pressure on local waterways, while increasing demand for parks, green spaces, roads and other infrastructure.

1.1 Context

The Fraser Coast population is forecast to maintain a 1.0% growth rate through to 2041, reaching a population of 132,289 persons under a medium case growth scenario (Urbis, 2021). Urban development is already expanding into the Bunya Creek catchment, and significant further urbanisation is expected in coming years.

In most parts of Australia, urbanisation has historically been associated with environmental degradation and loss of natural amenity, however this is an opportunity to proactively masterplan the Bunya Creek corridor to create community green space that preserves and enhances the existing natural assets.

In 2020 Council commissioned KPMG to prepare the report 'Insight into the Future of the Fraser Coast' which identified a number of considerations for the planning scheme review including preserving and enhancing the natural assets which underpin the lifestyle experience; the main driver of migration and tourism.

1.2 Purpose

The purpose of this planning scheme policy is to assist with the implementation of the Fraser Coast Planning Scheme, including:

a. outlining information Council may require for the assessment of a development application;

b. providing guidance for the achievement of outcomes for various planning scheme assessment benchmarks;

c. providing guidance for achieving development outcomes that are responsive to environmental values and natural hazards and achieve high quality design outcomes.

1.3 Overall outcomes

New development planned in accordance with this Planning Scheme Policy will have:

- Active and happy residents who benefit from living in proximity to the natural environment.
- A network of bike paths and walking trails to get around safely, sustainably and efficiently, away from major roads and enjoying natural scenery.
- Large tracts of good quality vegetation that provide a diverse and connected set of habitats.
- Open space and road layouts that provide a buffer between vegetated areas and residential areas.
- Healthy waterways teeming with life and supported by good water quality, a lack of erosion and dense riparian canopy.
- Efficiently designed utility networks making use of shared service corridors.
- An ongoing role in limiting the release of wastewater to the ocean, by using recycled water for irrigation.
- Street trees that enhance the function of waterway corridors and promote wildlife movement.
- Opportunities for constrained land to support ecological processes, habitat protection and locate environmental offsets.

1.4 Why plan waterway corridors

Our cities are experiencing the pressures of climate change, population growth and rapid urbanisation. As such, the shift toward more integrated approaches to urban water management is being recognised as a challenging but necessary direction to take.

The concept of a Water Sensitive City has become a driver of urban planning (refer Figure 1). A Water Sensitive City is based on holistic management of the integrated water cycle to protect and enhance the health of receiving waterways, reduce flood risk, and create public spaces that harvest, clean, and recycle water. It recognises that a water sensitive approach to urban development and regeneration processes can help deliver on a range of objectives critical to the liveability of a city, including: biodiversity, public green space, healthy waterways, connected communities, and cultural significance. Ultimately, a water sensitive approach is underpinned by a recognition that water can contribute to the creation of connected, vibrant, and liveable communities.

The waterways of the Fraser Coast region are essential for the realisation of the Fraser Coast Regional Council's Vision. Waterways are main landscape feature to orientate the urban form, narrative and identity. Along with the green bankside corridors, the creek lines provide the linking of local destinations, alignment of recreational activities and the ecological core of the natural environment.

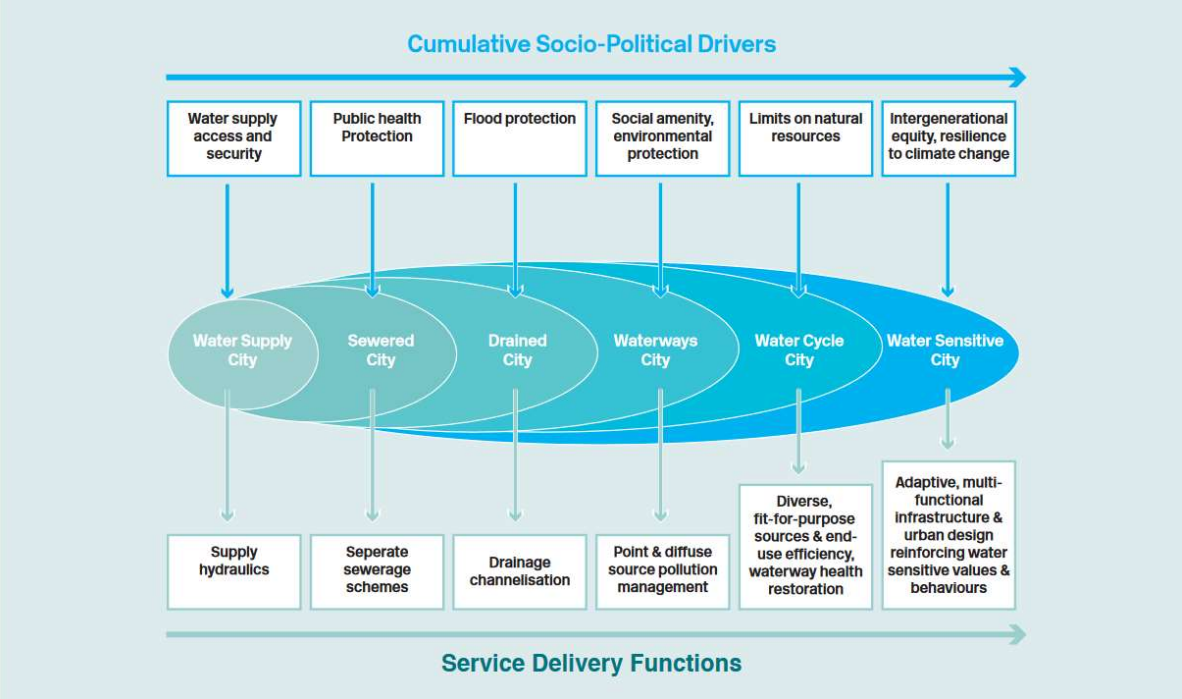

Figure 1 Urban Water Transitions Framework (Brown et al 2009)

The waterways of the Fraser Coast currently have a range of ecological values. Populations of native birds, fish, turtles, reptiles and mammals still thrive within parts of the catchment. Existing residential communities identify with the creeks and their values, and healthy waterways underpin local tourism.

Further urbanisation will drastically increase the flow of stormwater into the waterways of the region. In the long term, this will destabilise the creeklines causing ongoing erosion, degrading waterway health. In a business-as-usual urban development scenario, the creeks will become drains stabilised by concrete or other hard structures, losing much of their ecological and landscape values.

There are multiple benefits of well-planned waterway corridors, and conversely, many disbenefits when waterway corridors are unplanned. These are summarised in Table 1 below.

Table 1 Benefits of waterway corridors

Well planned corridors	Unplanned corridors
More efficient land use because key infrastructure can be co-located along waterway corridors.	Less efficient land use

Lower capital costs, typically resulting from a reduction in the need for on-site flood detention and stormwater quality treatment. This also has the potential of increasing development yield.	Higher capital costs: ▪ Flood detention systems typically required and occupy 3 – 7% of development sites (reducing development yield) and have a capital cost of about $10 - $50 per m². ▪ Bioretention systems typically required and occupy 1 – 3% of development sites (reducing development yield) with a capital cost of about $300 per m². ▪ These assets typically occupy land that might otherwise be developable, and sterilise that land for higher or better use in the future.
Lower maintenance costs, as greenspace can serve multiple functions, and there are fewer disparate stormwater quality assets to maintain.	Higher maintenance costs as there is piecemeal and poorly integrated infrastructure.
Greater certainty for developers, as land capability and development potential are more clearly documented at the time of land purchase, resulting in less speculative behaviour and greater certainty in the development assessment process.	Poorer certainty for developers, as it is unclear what the requirements may be in terms of flood extents, greenspace provision, vegetation protection, flood detention and stormwater quality management,
Greater equity for developers (costs and benefits are shared). This is particularly the case for structure planned areas and areas subject to infrastructure planning.	Less equity for developers, as the costs of providing lead-in infrastructure are borne by the first developer in an area, and the costs of providing waterway corridors are likely to be unevenly shared.
Better community outcomes in terms of liveability, amenity, microclimate and walkability	Poorer community outcomes

In addition to the above, there is a significant and growing body of evidence that demonstrates that well planned urban green space can have multiple benefits can result in a positive return on investment. For example, a study by SGS Economics (2016) on the benefits and costs of the Parramatta Ways green corridor and walkability strategy found the proposal would result in a Benefit-Cost Ratio (BCR) of 3.74, indicating that for every dollar spent on the proposal, benefits of $3.74 are returned to the society of the Parramatta local government area.

Further, there is a substantive and growing body of evidence supporting the health, social, and economic benefits of urban greening, as summarised in Table 2.

Table 2: Observed benefits of Urban Greenery (Source, Reeve, 2014[i])

Benefit	Key findings
Reduced stress	Viewing nature is found to speed recovery from stressful experiences[ii] [iii] [iv].
Reduced depression and anxiety	Short-term contact with nature, including viewing and undertaking physical activity in nature, is shown to reduce negative feelings such as anxiety and anger, while increasing positive feelings[v].

Benefit	Key findings
Increased general mental health	Time in parks and green space is found to generally improve mental wellbeing.[vi] Dose-response relationships suggest increases in self-esteem and mood from short term (5 minutes) of physical activity in nature, with diminishing but always positive benefits from ongoing exposure[vii]. Large scale studies have found that feelings of loneliness decrease as proximity to greenspace from one's home increases[viii].
Increased attention recovery	Being able to pay direct attention is an important function in people's ability to process information, however after periods of paying attention, the brain becomes fatigued. Experiences of nature, including being and/or walking in a natural setting and viewing images of nature, were found to have a restorative effect on participants' capacity to direct-attention[ix x xi xii xiii]
Enhanced productivity	Studies have shown that workers with views of nature are able to perform better and have greater satisfaction with their workplace due to enhanced psychological health and restoration[xiv].
Enhanced healing	Patients with views of trees in hospitals were found to have shorter post-operative hospital stays, to require fewer analgesics, and to generally have a more positive condition whilst in hospital compared to patients with a view of a brick wall[xv].
Enhanced physical wellbeing	Comparisons of and use data with self-reported health show a correlation between the amount of green space and overall health, controlling for socio-economic and demographic factors[xvi].
Increased community connection	Trees and grass appear to increase the use of outdoor communal spaces, the amount of social activity that takes place within them, and the proportion of social to non-social activities they support. Well-used urban green spaces are linked to stronger neighbourly connections in apartment buildings, enhanced sense of safety and well-adjustment, reduced graffiti, incivilities and crime[xviixviii]
Reduced crime	Greener surrounds are associated with reduced fear, fewer incivilities, and less aggressive and violent behaviour. Analysis of police crime reports shows that the greener a building's surroundings, the fewer crimes reported[xix]. Nature outside apartment buildings is found to improve concentration and reduce mental fatigue, which leads to reduced aggression and violence. These effects were found in a Chicago public housing development, with benefits achieved by even with a few trees and a patch of grass[xx].
Developmental benefits to children	Girls have been found to perform better on tasks requiring self-discipline, including concentrating, inhibiting initial impulses, and delaying gratification, when more nature can be seen from the home[xxi]. A study of children with Attention Deficit Disorder (ADD) found they performed better after activities in green settings and that the greener a child's play area, the less severe their ADD symptoms [xxii].

Benefit	Key findings
Stormwater management	Urban nature regulates hydraulic flow patterns by capturing and infiltrating stormwater, thereby delaying and reducing peak flows and total runoff, and reducing pollutant loads. Retaining water within the urban catchment can assist in groundwater recharge, provide water sources for irrigation and other uses, reduce the UHI effect through evapotranspiration, and reduce the impacts of urbanisation of receiving water bodies.[xxiii] In addition, trees draw moisture from the soil in between rain events, increasing the soil water storage potential,[xxiv] and tree roots maintain channels in the soil that has been found to increase stormwater infiltration by an average of 153 per cent in compacted urban soils[xxv]. Adding vegetated features to a relatively small proportion of a streetscape can result in close to pre-development hydrological flow conditions. In Seattle, residential streets redesigned with bio-swales, evergreen trees and shrubs reduced the stormwater runoff by 99 per cent with only an average of 11 per cent less impervious surface than conventional streets[xxvi]. A pilot green street project in Portland demonstrated that two curb extensions could capture 85 per cent of the runoff volume from a simulated 25-year storm event, and reduce peak flow by 88 per cent[xxvii]. Similar findings are evident in many US cities[xxviii]
Urban heat island mitigation	Urban nature can mitigate the urban heat island effect by capturing, retaining and evaporating rainwater (which converts solar energy to latent heat rather than sensible heat); by providing lower albedo surfaces than most constructed urban surfaces (which increases solar reflectance); by shading underlying surfaces (which reduces direct solar radiation and therefore heat gain)[xxix xxx xxxixxxii xxxiii xxxiv].Studies have found that tree plantings are amongst the most cost-effective UHI mitigation methods, reducing air temperatures by 2 to 4ºC in some observed cases. On average, air temperatures are reduced by 1ºC for every 10 per cent increase in canopy cover.[xxxv]
Reduced energy demand	Urban nature can reduce building energy demand through direct shading, by providing insulation (in the case of green roofs and green walls with substrate), and by reducing ambient temperatures through a combination of evapotranspiration, shading of surfaces.[xxxvi xxxvii]. For example, experiments with residential shade trees in California homes found that eight large and eight small shade trees could reduce cooling energy use by 30 per cent, or around 4KWh per day, with peak energy savings of 0.7kW[xxxviii]. In Florida, a similar experiment using a mobile trailer revealed reductions in air conditioning electricity consumption of 50 per cent[xxxix].
Carbon sequestration & GHG reduction	Urban nature can sequester carbon in above and below ground biomass, and in soils and substrates. Research also indicates that substantial greenhouse gas emission reductions can be achieved primarily through reduced building energy demand, and by encouraging walking & cycling (and therefore reducing car usage), as noted elsewhere in this table. Research in Los Angeles found that one urban shade tree can avoid the combustion of approximately 18kg of carbon while sequestering a further 4.5-11kg of carbon annually, providing between 3 and 5 times the greenhouse gas reduction benefits of a similar forest tree[xl]. Other research in the US and Australia has indicated that urban soils provide ideal conditions for increased soil organic carbon due to management input's and limited disturbances, however this varies significantly between climatic zones, vegetation types, and potentially between soil types. Soil carbon tends to increase in soils that are irrigated and fertilised, and mulched[xli]. [xlii].

Benefit	Key findings
Increased likelihood of walking and cycling	Walking and cycling rates are generally influenced by a wide range of factors, such as street connectivity, land use mix, distance to destinations, the amount of hills and inclines, neighbourhood safety, neighbourhood aesthetics, as well as the presence of street trees and the proximity to parks, trails and other facilities[xliii]. Greenery is generally found to increase the bikeability of urban areas,[xliv] and the number of parks in a community has been positively correlated with the degree to which people will walk or cycle for transport.[xlv] In Perth, individuals with access to large attractive public open space are 50 per cent more likely to undertake high levels of walking.[xlvi]. A study of adults living in European cities found that in areas with the highest levels of greenery, they were three times as likely to be physically active and 40 per cent less likely to be overweight or obese[xlvii].
Increased road safety	Incorporating greenery and landscape improvements into urban arterial and highway sites in Texas was found to reduce crash rates by 46 per cent[xlviii]. Similarly in Florida, a road section with "liveability" components (landscaping) had 11 per cent fewer mid-block crashes, 31 per cent fewer injuries, and no fatalities compared to a similar road without such features. Pedestrian and bicyclist injuries were also fewer in the landscaped road section[xlix].The addition of trees and planters in urban arterial roadsides has been found to reduce mid-block crashes by 5-20 per cent.[l] These findings may be related to observed stress reducing benefits of roadside greenery, with drivers observed to return to baseline stress conditions faster following a stressful driving incident when they could see greenery, and early research suggests that trees prevent accidents in ways such as by cutting glare, providing shade, keeping drivers alert and providing protection to pedestrians[li].
Air quality improvements	Urban nature improves air quality in various ways, including through direct uptake of gaseous pollutants by vegetation, interception of particulate pollution on vegetation, and by breaking down certain organic compounds in plant tissues or in the soil. Furthermore, by reducing surface temperatures through evapotranspiration and shading, the photochemical production of ozone and other pollutants is reduced[lii]. Gaseous pollutants are absorbed through leaf stomata, whilst water soluble pollutants are absorbed on moist leaf surfaces. Particulate matter is intercepted on leaf surfaces[liii]. In Modesto, California, annual air-pollutant uptake of the city's urban forest was estimated to be 154 metric tonnes (1.68kg/tree), which equated to an implied value of US$1.48 million ($16/tree)[livlv]. A study of five US cities found that the average US$13– 65 spent annually per tree was recouped with benefits of US$31 to $89 per tree (a return on investment of US$1.37 - $3.09 per dollar invested). Air quality benefits (combined with CO_2 reduction benefits) accounted for between $1 and $2/tree of this[lvi].
Biodiversity	Biodiversity in cities can be high due to the large number of habitat types, and humans creating spaces conducive to certain species and encouraging the proliferation of others[lvii]. [lviii] This can be particularly important where regional landscapes are degraded[lix], however non-native species in cities can contribute to a growing issue of certain species becoming dominant on a global scale[lx]. Biodiversity is enhanced through having larger tracts of habitat that can provide a refuge for species, and linking greenspace that allows species to migrate[lxilxii]. Parks in general are found to generally be the most species rich type of urban green space within cities[lxiii], however size does appear to be important. Others suggest that a variety of smaller-scale green spaces, such as backyard habitat, planted boulevards and utility rights-of-way through a city, are important components of a matrix of greenspace linkages that support biota found in the larger urban parks and wildlife refuges[lxiv].

Benefit	Key findings
Increased investment & property value	Property values have generally been found to increase with proximity to parks[lxv] [lxvi] [lxvii] [lxviii] [lxix], however this effect has not been found in low density areas[lxx] and for some highly-frequented parks that may have increased noise and disturbance to nearby houses [lxxi]. Well-designed parks can stimulate tourist activity and economic development. Research has found that parks can increase revenue and employment due to tourism and visitation, and that properties overlooking parks can increase in property values[lxxii]. These economic effects result in increased city tax revenue, which in some cases has repaid the initial investment in the park.

Many local governments across Australia are now investing significant funds dealing with the impacts of a drainage-centric approach to urban waterway management (See for example, Figure 2). Poor decisions about planning and design around waterways are expensive—and sometimes impossible—to reverse. Chapter 6 outlines several case studies where local governments have successfully embarked on this process.

Figure 2 Local Governments are investing significant funds reinstating natural waterways

2 CORRIDOR PLANNING METHDOLOGY

The recommended corridor planning methodology is outlined below.

Because every location will have a unique set of characteristics, opportunities and constraints, practitioners will be required to place the appropriate emphasis on those aspects of the methodology most pertinent to the location.

Step 1: Understand the physical geography

Understanding the physical geography is about understanding the natural features of the location and the opportunities and constraints of the site.

Data inputs:

- Lidar terrain data (FCRC data set, or sourced from ELVIS https://elevation.fsdf.org.au/)
- Aerial imagery (FCRC dataset, or sourced from Nearmap)
- Flood mapping, Local flood modelling study or flood risk assessment
- Coastal Hazard mapping (Permanent inundation and Erosion, and Storm Tide Inundation mapping)
- Agricultural Land

Outputs

Summary maps showing:

- Catchment boundaries
- Waterways and drainage lines
- Topography

Other considerations:

In areas known to have unique geological or hydrogeological conditions such as dispersive soils, acid sulfate soils, shallow rock etc, then these should also be addressed as part of the physical geography review.

Future flooding

Update flood mapping for the corridor to account for the future flooding risk.

Climate change will affect flooding by raising sea levels, which increases tail water levels in flood models, and by increasing rainfall intensity.

Sea level rise should adopt the Qld Government's projected sea level rise of 0.8 m by 2100. The projected sea-level rise of 0.8 metres by the year 2100 adopted by the Queensland Government is based on climate modelling for probable scenarios of world development presented in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report released in 2014 (AR5).

Rainfall intensity is to be based on Australian Rainfall and Runoff Interim Climate Change Guideline (Bates et al 2015), which notes rainfall intensities are expected to increase by 5% per degree of global warming. The typical service life for land use zoning should be based on 100 years.

Impervious surfaces are to be based on ultimate catchment development. This should assume rural and undeveloped parts of the catchment are urbanised even if this is not reflected in current the land use zoning. The reason for this is that it prevents a scenario where future development is constrained because it would otherwise create unacceptable downstream flooding impacts.

Waterway corridors within the 1% AEP flood extent shall be modelled with a Mannings n of 0.12. This ensures that future revegetation of the corridor can occur without causing adverse flooding impacts. Further, it ensures Council is not obligated to undertake extensive maintenance of waterway corridors in order to maintain flood conveyance.

Step 2: Understand the biogeography

Biogeography refers to the distribution of species (both flora and fauna) and ecosystems within the study area.

Data inputs:

- Regional Ecosystem Mapping
- Regulated Vegetation
- Matters of National Environmental Significance (MNES)
- Matters of State Environmental Significance (MSES)
- Matters of Local Environmental Significance (MLES)
- QLD waterways for waterway barrier works
- National Park /Marine Park mapping
- Great Barrier Reef catchment and river basins mapping
- Essential habitat mapping
- Wetland Protection Areas
- Groundwater Dependent Ecosystems (GDE)
- Bushfire Hazard Mapping
- Fish Habitat Areas

Environmental Values and Vegetation

Mapping of environmental values and vegetation shows existing high ecological value areas that need to be protected.

Of particular relevance for corridor planning are areas where ecological values could be enhanced by protecting and enhancing areas of lower ecological value, and where fragmented habitats and pockets of vegetation are able to be connected to create interconnected corridors that provide for improved faunal movement and enhanced biodiversity.

Bushfire Hazard

Consider Bushfire Hazard based on Council's Bushfire Hazard mapping.

Future revegetation can change the bushfire hazard. If unplanned for, this can create future conflicts between revegetation and urban development. Where significant revegetation is envisaged as part of the corridor plan and where this is in proximity to current or future urban development, undertake a Bushfire Hazard Assessment in accordance with *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire' (QFES 2019).* The assessment should consider the proposed future revegetation and take that into account in setting any relevant setbacks to vulnerable land uses.

Step 3: Understand the social geography and planning context

Alignment with land use and infrastructure planning activities/strategies.

Corridors Planning is to consider and align with other Council and State Government infrastructure planning activities.

Key planning activities/strategies to be aligned with shall include those listed in Table 3.

Table 3 Key land use and infrastructure plans and strategies

Item	Relevance/Implications
Community Plan	The Community Plan is the key strategic planning document for Council. It creates a vision for the future of the region. It provides the foundation for residents, businesses, organisations and Council to work together to enhance the Fraser Coast. The Corridor Plan should align with the Vision Values and Several of the key themes of the Community Plan.
Fraser Coast Planning Scheme	Zoning, Overlays, Strategic Framework Plan, Local Area Plans, Planning Scheme Policies
Temporary Local Planning Instruments	Review on an as-needs basis.
Local Government Infrastructure Plan (LGIP)	LGIPS identify the infrastructure necessary to service the local area, and are required if a local government intends to levy infrastructure charges or impose development conditions for trunk infrastructure on development approvals. Look to the infrastructure plan to see if there is planned infrastructure in the area that can be integrated into the corridor. Consider whether aspects of the Corridor Plan constitute trunk infrastructure that should be included in the LGIP.
Active Travel Strategy	Integrate any relevant Signature Projects in the Active Travel Strategy into the Corridor Plan. Ensure the Plan considers Supporting Treatments to maximise utilisation of active travel networks Consider opportunities for integrating Local links, District Links, Regional Links, Special Links, Footpaths and Share Paths. Consider opportunities for addressing identified Footpath Network Gaps.

Item	Relevance/Implications
Open Space Strategy	Consider how the Corridor fits within the overall open space strategy, and how open spaces along the corridor can be best utilised with regard to the need for local, district and regional parks. Consider how the corridor can provide connections between local, district and regional parks.
Greening the Fraser Coast Strategy	The Greening the Fraser Coast Strategy aims to provide comfortable places and spaces through a range of tree planting projects across the region as part of an overall commitment to plant 100,000 trees by 2030. Consider whether there are synergies in terms of revegetation requirements along the waterway corridor.
Regional Water Quality Strategy	The Regional Water Quality Strategy provides a mechanism to consider regional solutions for water quality management, whereby developers may be able to make a financial contribution to Council in lieu of delivering stormwater quality assets (e.g. bioretention systems) within development sites. Waterway corridors create opportunities for water quality improvement through enhancing the function of riparian areas.
Water Body Management Strategy	If the Corridor contains exiting or proposed water bodies, ensure consideration is given to best practice water body management as outlined in the Water Body Management Strategy. Corridors create significant opportunities to treat and remove pollutants before they enter waterbodies, and ensuring there is maintenance access.
Coastal Futures Strategy	The Coastal Futures Strategy is a roadmap to guide the immediate, medium and long-term planning for the impacts of the changing coastline. It is particular relevance for corridor planning along lowland waterways and estuaries.
Water Supply Security Strategy	Will the corridor plan add additional demand to the regional water supply? Should any key regional water supply infrastructure be co-located within the corridor? Are the opportunities for using recycled water within the corridor? Are there opportunities for local alternative water supplies (e.g. stormwater harvesting, sewer mining etc)?

Walkable Neighbourhoods

Corridor Planning shall consider *Planning (Walkable Neighbourhoods) Amendment Regulation 2020*.

Of relevance to Corridor Planning is that when reconfiguring a lot:

> *The reconfiguration ensures access to areas for recreation, leisure, or exercise by ensuring that, to the extent topography and other physical constraints reasonably permit, a part of each block for the reconfiguration is within 400m of a park or another area of open space that is accessible to the public* (See Schedule 12A Part 2, 8(1)).

Corridors also provide a key opportunity to address Connectivity requirements of the regulation (see Schedule 12A Part 2, 4).

Connectivity

Delivering network connectivity from the perspective of natural wildlife corridors and community passive transport, recreation, and future transport.

Cultural Heritage Matters

Waterways have been significant places for Aboriginal peoples as places of settlement, meeting and sustenance and therefore there is a high likelihood of Aboriginal cultural heritage areas existing along waterways.

Protecting and Conserving Aboriginal Cultural Heritage

The *Aboriginal Cultural Heritage Act 2003* ("the Act") commenced on 16 April 2004. The Act binds all persons, including the State, and is intended to provide effective recognition, protection and conservation of Aboriginal cultural heritage.

The Cultural Heritage Acts define Aboriginal or Torres Strait Islander cultural heritage as anything that is:

- a significant Aboriginal or Torres Strait Islander area in Queensland, or
- a significant Aboriginal or Torres Strait Islander object in Queensland, or
- evidence of archaeological or historic significance, of Aboriginal or Torres Strait Islander occupation of an area of Queensland.

An area or object is significant because of either or both of the following:

- Aboriginal or Torres Strait Islander tradition
- the history, including contemporary history, of any Aboriginal or Torres Strait Islander party for the area.

(https://www.qld.gov.au/firstnations/environment-land-use-native-title/cultural-heritage/queensland-legislation)

Corridor Planning of itself generally does not result in any surface disturbance and it is generally unlikely that the activity will harm Aboriginal cultural heritage.

Enhancing and Restoring Aboriginal Cultural Heritage

Waterway corridor planning has significant potential to build stronger connections to Country, and to use the landscape as a tool to tell stories about the history of the area, and to create opportunities for local indigenous peoples to participate in the planning process. Care needs to be taken to avoid tokenistic gestures.

Parks Hierarchy

Understand how the open paces within the corridor fit within Council's Parks Classification System and desired standards of service.

Where possible seek to use land for the highest classification available. For example, waterway corridors could be considered 1) Recreation – Connecting Corridor; 2) Environment – Connecting Corridor , or 3) Constrained land – Drainage. The First option provides the best and highest use and should be explored in preference to the other alternatives, subject to available funding to achieve the desired standard of service.

Refer Appendix A for details of Council's Parks Classification System.

Construction and maintenance cost efficiencies and benefits.

Waterway corridor planning should have regard to the staging and timing of construction activity and whether there are any efficiencies to be gained through integrated and coordinated delivery of infrastructure.

For example

- it may be prudent to bring forward planning trunk infrastructure such as sewer or water supply pipelines to coincide with major earthworks
- they may be benefits in investing in pre-emptive waterway stabilisation works (to prevent channel incision/widening) ahead of upstream development
- designing the floodplain and waterway to maximise water quality outcomes, which can obviate the need for at-source stormwater quality treatments.
- designing infrastructure such as bridges and road crossings to accommodate a full developed upstream catchment (with climate change) and assuming full revegetation of the waterway corridor can minimise the need to upgrade infrastructure in the future or need to undertake otherwise avoidable vegetation management along the waterway.

Step 4: Integration, Consultation and Preparing the Corridor Plan

The process of preparing the corridor plan based on the above considerations is an adaptive task and will vary from location to location depending on the specific characteristics, opportunities and constraints. Key approaches to consolidating and synthesizing this information include:

- Generating overlay maps that combine the key opportunities and constraints to reveal spatial patterns in the data and key areas for further investigation.
- Undertaking a site visit with key stakeholders to develop a shared understanding of the locality.
- Workshops and interviews with key stakeholders and subject matter experts to gain a more in-depth understanding of the issues and considerations.
- Commission any supplementary studies or investigations.
- Preparation of a Draft Corridors Plan for review and comment
- Consultation with key stakeholders
- Finalisation of the Corridors Plan.

3 TECHNICAL STANDARDS

Note the technical standards below do not replace the requirements of the State Planning Policy.

3.1 Flood immunity standards

The benefits of allowing open space areas within areas of flood risk include:

- efficient land use for higher urban densities and reducing unnecessary greenfield expansion into natural areas
- assisting to reduce housing costs by maximising areas for residential land supply
- activating parklands with multiple uses and activities
- reducing maintenance costs for local government by having less land to maintain.

Traditional stormwater management infrastructure has been seen as compromising the functions of public open space because its purpose was only the rapid conveyance of water with little consideration for amenity or environmental impact. However, public open space is not necessarily compromised by flooding or stormwater infrastructure, provided a number of key principles are followed.

Areas where open space are subject to flooding, or which integrate WSUD elements, must:

- be fit for any intended active recreation in terms of size, slope and surface
- be sufficiently safe in terms of the duration, depth and velocity of any inundation
- rapidly recover from inundation, particularly for playing surfaces
- be designed to be attractive and allow for social interaction and interpretation when appropriate
- protect existing conservation features and values.

Delivery of effective outcomes requires clear provisions within the Planning Scheme codes, and an integrated design process including landscape architects, engineers, open space planners and asset owners.

Table 4 Flood Technical Design Parameters

Item	Performance Outcome	Acceptable Outcome
General	Open space areas below the 1% AEP flood extent are subject to a flood risk assessment, having regard to the nature of flooding, warning times, rate of rise of floodwaters, duration of flooding, debris loads, and impacts on public safety and infrastructure.	No acceptable outcome provided.
Playgrounds	Sand and soft fall areas are not contaminated by floodwaters and flood debris	Sandpits and soft fall areas are located above 20% AEP flood level.
	Children are unlikely to be swept off their feet by floodwaters at playgrounds and on main pathways	d.V <0.4 m²/s in 20% AEP event
Toilets	Floodwater and sewage are kept separate except in major flood events	Pedestals are located above 5% AEP flood level
Turf areas	Turf areas are safe and accessible, and not subject to boggy ground conditions	63% AEP (Q1) flood immunity, min 2% slope and well drained.
	Regional park network includes active open space areas that are flood free	No acceptable outcome provided.
Electrical infrastructure	Electrical infrastructure is safe and resilient	Switchboards are located above 1% AEP flood level or certified by a qualified Electrical Engineer
Pathways	Pathways are built from erosion resistant materials, having regard to the frequency of inundation and velocity of floodwaters	No acceptable outcome provided.
	Pathway network is designed to balance flood immunity with providing access to natural areas. Path network provides alternative safe routes in the event of flooding	No acceptable outcome provided.
	The risk of flooding is clearly communicated to the community	Paths below the 10% AEP flood level have flood depth indicators
General landscape	Landscape surfaces are erosion resistant	Velocities in general landscape areas < 1m/s

3.2 Cross sections

Typical cross sections along the edges of waterway corridors are shown below. Figure 3 shows a tyupical edge that includes a linerar park/open space, while Figure 4 shows a typical treatment where the waterway corridor extends up to the edge of the residential area.

Key details to note:

- Esplanade roads should run along the edges of waterway corridors in order to improve community access to the waterway corridor, improve maintenance access, improve CPTED outcomes (see also section 3.4), and provide a buffer for flooding and bushfire.

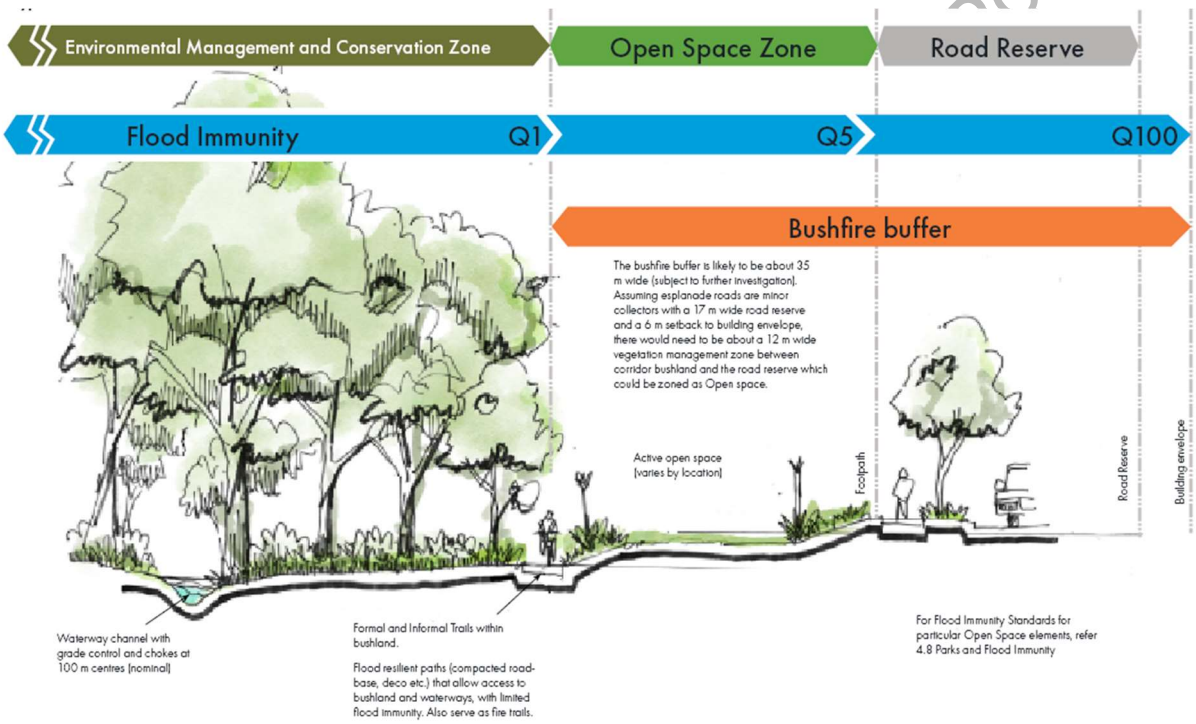

Figure 3 Cross Section 1

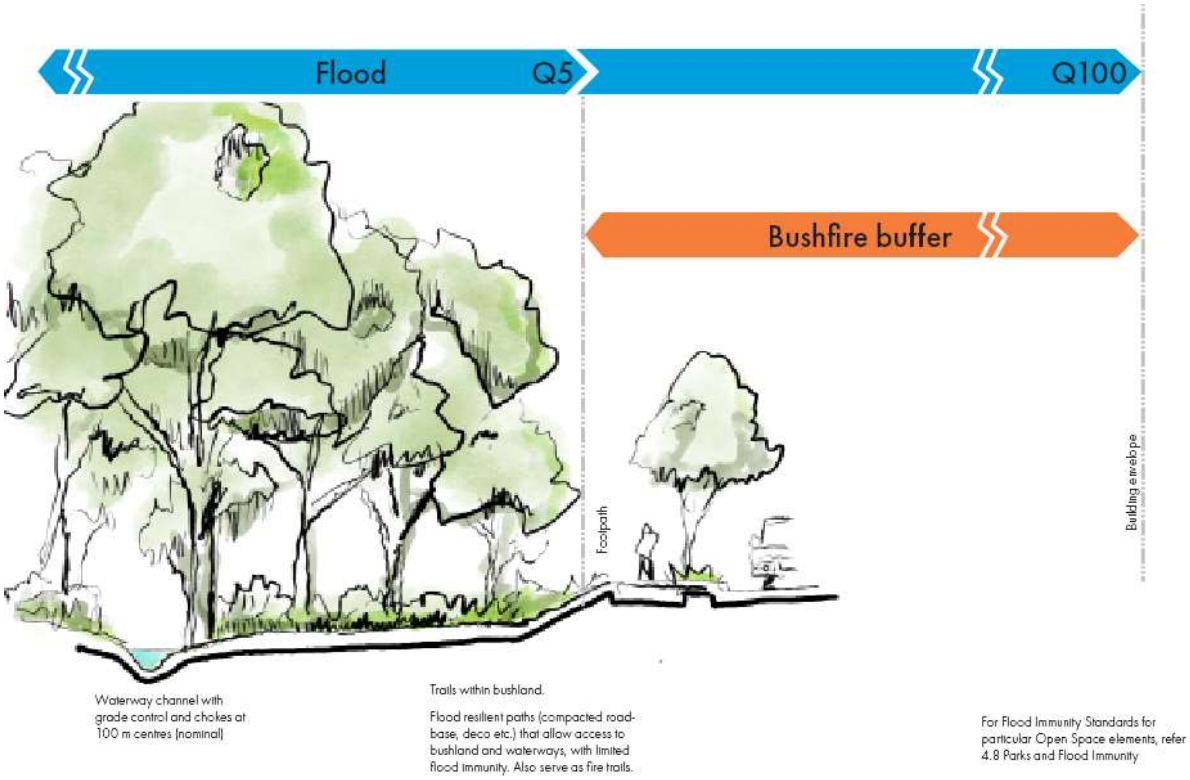

Figure 4 Cross Section 2

3.3 Waterway Styles

Waterways shall adopt a general style consistent with the geomorphic setting within the catchment. A specialist in fluvial geomorphology should be engaged to define the appropriate waterway style. Indicative waterway styles are outlined in Table 5 and sample images are provided in Figure 5 to Figure 8.

Table 5 Waterway styles

Zone	Waterway characteristics
Upland Zone	The waterways in the upland zone are relatively steep ephemeral first order gullies. Waterways should be designed using natural channel design principles, with an emphasis on erosion resistance through rock riffles and energy dissipation using in line rock drop structures, supplemented with good riparian vegetation.
Midland Zone	This zone is characterised by slightly meandering chain of ponds creeks located within broadening floodplains. Waterways should be designed to maximise floodplain engagement by preventing the waterway channels from widening and deepening. The waterway should have a densely planted riparian corridor that ensures shade over the waterway channel.

Zone	Waterway characteristics
Lowland zone	Waterways on lowland areas are characterized by meandering waterways over broad floodplains. They include wetland forests, with stands of melaleuca spp. and other species adapted to semi-permanent ponding. Flows typically have low velocities and less rock is needed to protect the banks from erosion. The waterway should have a densely planted riparian corridor that ensures shade over the waterway channel.
Tidal Lowlands	Tidal lowlands are typically meandering mangrove lined waterways. Management should have regard to the impacts of sea level rise and likely future increased extent of mangroves.

Figure 5 Upland waterways

Figure 6 Midland Waterway

Figure 7 Lowland Waterways

Figure 8 Lowland Tidal Waterways

Treatments to be avoided in waterways are as follows:

- Rock lined trapezoidal channels - poor ecological function, prone to weed infestations, difficult to maintain without using herbicides in waterway
- Hard-edged engineered drains - poor ecological function, often dependent on mowing to maintain conveyance capacity.
- Dumped rock - poor ecological function, prone to weed infestations, difficult to maintain without using herbicides in waterway
- Measures that create fish barriers (weirs, culverts without provision for fish passage)
- Geofabric – it is a synthetic material, looks unsightly when exposed. Use properly designed rock and rock bedding layers instead.

3.4 Residential Interfaces

Residential interfaces with waterway corridors should be designed with regard to best practice urban design and the principles of Crime Prevention through Environmental Design, as described below and examples of best practice is shown in Figure 9, acceptable practice in Figure 10, and poor practice in Figure 11.

The idea of designing for all to participate in the safe enjoyment of parks, seafronts and the like are complementary to the growing acceptance, indeed promotion, of carefully mixing slow-moving cars and cyclists with pedestrians in shared street and civic places.

Together, they are changing the way neighbourhoods and centres are being designed with respect to such community open spaces and civic assets. Contemporary thinking is moving away from allowing these assets either to be edged directly by private development or merely by a pedestrian walkway between that private development and the community asset of park, river and such. Such designing is, of course, not new and can be found in the great seaside and river esplanades of many Queensland towns.

So confident is the belief in the surveillance and accessibility outcomes of public streets with cars and with people on footpaths that increasingly civic spaces and assets are being edged by streets. It may be argued that failing to provide slow-moving vehicle access at a park edge could prevent people with disability from accessing those areas either by denying their access outright or making their journey from distant streets more arduous and unsafe.

Crime Prevention Through Environmental Design Guidelines for Queensland, Qld Police Service, 2021

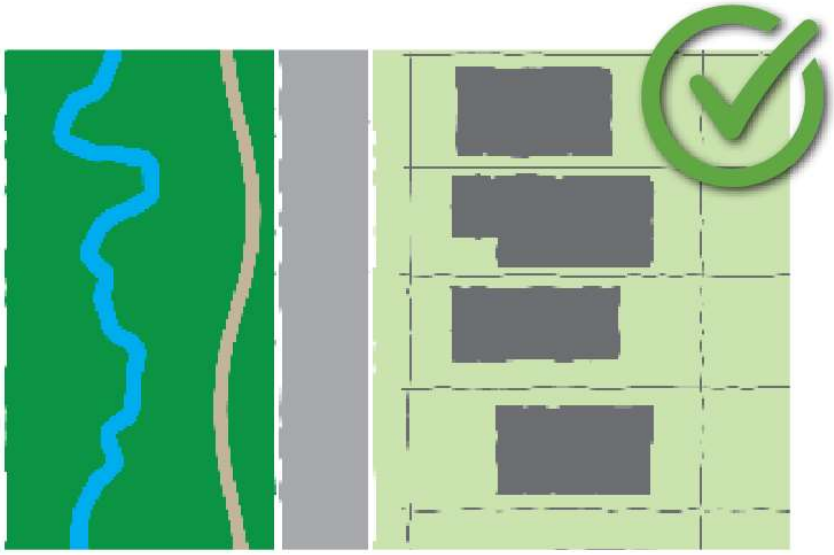

Figure 9 Urban design with esplanade roads along the edges of the waterway corridor provide the best overall community outcome.

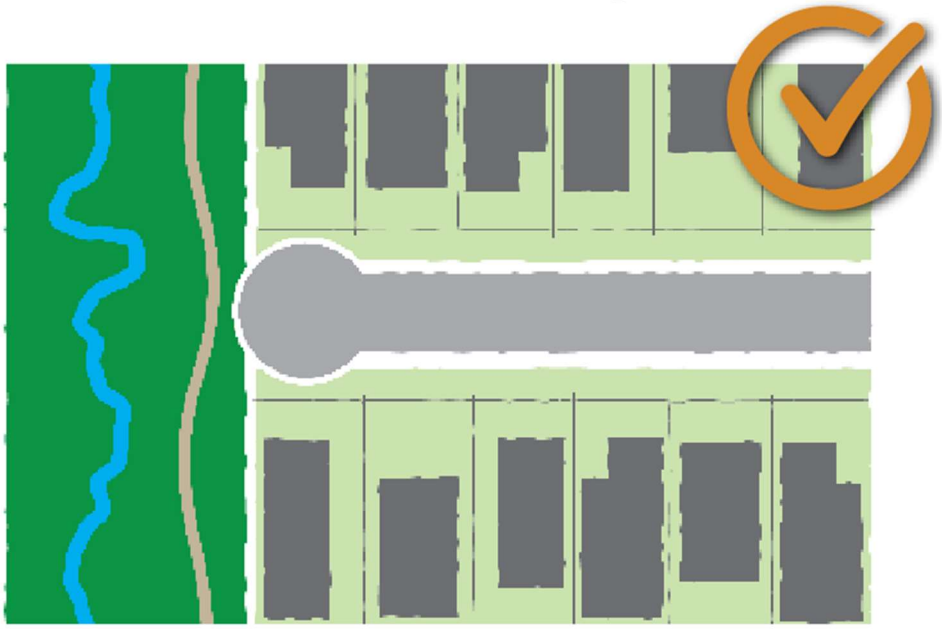

Figure 10 In limited locations where esplanade roads are demonstrated to be not feasible, Council may accept cul-de-sacs which still provide community access to the corridors, and which avoid lots backing on to the corridors.

Figure 11 Lots backing directly on to waterway corridors are inconsistent with the Queensland Police Service's guidelines on Crime Prevention Through Environmental Design (CPTED).

4 FUNDING

4.1 Funding options

There are several funding options available to Council as outlined below.

4.1.1 Land Acquisition

Land within the Environmental Management and Conservation Zone could be re-vegetated in several ways:

d. The land could remain in private ownership and be re-vegetated as a development condition associated with a relevant reconfiguration of a lot application. This option is not recommended because a developer is unlikely to have an interest in long-term ownership of those lands and Council would have limited control with regards to weed management, bushfire management, and public use of pathways and active transport routes, and providing certainty over discharge rights for upstream properties.

e. Council could condition that the land be re-vegetated by a developer as a development condition associated with a relevant reconfiguration of a lot application. The re-vegetated land could then be acquired by Council, who would be responsible for its ongoing management.

f. Council could acquire the land and directly manage its re-vegetation and ongoing management.

With options b. and c. above, acquisition of the land could occur by market purchase, compulsory acquisition, or dedication to Council without cost (via an infrastructure agreement). With regards to the latter option, the subject land is significantly constrained by flooding and of limited value other than for agriculture, and the value as agricultural land would be diminished due to fragmentation and loss of flood-free land associated with the adjacent urbanisation. This is likely to be able to an attractive proposition for developers, potentially further facilitated by trade-offs in terms of yield.

The rezoning of adjacent flood-free land for urban purposes would provide significant uplift in value to the landowners and, in most circumstances, this would provide significant financial benefit even if the undevelopable land were dedicated to Council without payment. This approach would allow Council, and the community, to capture some of the value associated with rezoning.

Under the Coastal Act, Part 6 ‘Land surrender and artificial waterways’, a land owner may be required to surrender all or part of prescribed land to the State for coastal management when applying to subdivide a lot. The Minister has the power to approve a land surrender requirement. The prescribed land must be in a coastal management district (CMD); and in an erosion prone area or within 40m of the foreshore; and be the subject of a development application for reconfiguring a lot (RoL). No compensation is payable for the land surrendered.

4.1.2 Offsets

A range of established, and nascent, offset schemes exist that could provide funding towards the re-vegetation of the waterway corridors:

- Vegetation offsets, associated with unavoidable clearing (significant residual impact) of certain regulated vegetation
- Biodiversity offsets, associated with unavoidable loss (significant residual impact) of specific habitat types (for example lowland wetlands).

- Carbon offsets: A reforestation and afforestation project involves planting forest trees in agricultural areas. In doing so, the project helps to reduce the amount of greenhouse gas entering the atmosphere, as carbon remains stored in the trees while they grow (referred to as 'carbon stock'). Net reduction in greenhouse gas emissions because of a project is referred to as 'net abatement'. The forest's carbon stock is estimated by collecting and analysing tree samples from different parts of the forest. Net abatement is determined by subtracting any emissions from fires and fuel use from the amount of carbon stock. The resulting net abatement can then be used to apply for Australian carbon credit units (ACCUs). As a sequestration activity, that is, an activity that stores carbon in vegetation or soil, a reforestation and afforestation project is subject to a permanence obligation. This means the sequestration must be maintained for the nominated permanence period (either 25 or 100 years) (Source: http://www.cleanenergyregulator.gov.au).

Water quality offsets, whereby floodplain restoration works could be eligible for:

- Local stormwater quality offsets, where Council could collect financial contributions in lieu of developers delivering on-site stormwater quality measures.
- Point source water quality offsets, which may be adopted as a voluntary option for managing environmentally relevant activities (ERAs) releasing wastewater containing prescribed offset contaminants (nitrogen, phosphorus and suspended solids) into receiving waters under the Queensland Government's Point Source Environmental Offsets Policy (for example, ERAs held by Council and its entities (for example, Wide Bay Water's sewage treatment plants)
- Emerging reef water quality offsets schemes.

Council could use the corridors to offset the activities of its own operations (for example, clearing of land associated with road works), or be a provider of offsets to third parties.

It may be possible to secure multiple sources of funding for the same activity where the activity leads to multiple benefits (e.g. biodiversity, carbon sequestration and water quality).

4.1.3 LGIP

Should the land be rezoned as urban, then Council should include it within its PIA and trunk infrastructure planning should occur and relevant infrastructure included in Council's Local Government Infrastructure Plan.

The waterway corridors are likely to meet the desired standards of service (DDS) for the trunk stormwater network as they:

'Provide natural waterways and engineered "natural" channels wherever possible to preserve and enhance natural drainage lines and to minimise construction and long-term maintenance costs.' (Planning Scheme v11.0.1 Table 4.4.3).

Further, if required, the LGIP stormwater DSS allows for the acquisition of land or easements for the purpose of stormwater conveyance to provide certainty over discharge and maintenance rights.

4.1.4 Infrastructure Agreements

Infrastructure agreements can be used for approved development that results in additional demand placed on existing or anticipated trunk infrastructure. It may be used by local governments who are unable to levy infrastructure charges as they do not have an LGIP in place. They can be used to facilitate outcomes on infrastructure matters:

- that may not have been appropriately resolved through development approval conditions and infrastructure charges notices (including extending or altering the terms identified in these notices)

- where the applicant wishes to provide or fund infrastructure that is not in an LGIP
- where a custom solution is preferred by all parties

Various works associated with the corridors could be undertaken by the developer as part of infrastructure agreements. For example, if Council were to undertake instream and downstream works in lieu of developers delivering on-site flood detention systems, those works could be made the subject of an infrastructure agreement.

Ipswich City Council, for example, uses Infrastructure Agreements as a way of implementing its stormwater quality offsets scheme. Development is conditioned to either enter an infrastructure agreement for payment of the stormwater quality offset fee, or deliver on site stormwater quality management.

The advantage of using infrastructure agreements compared to using the LGIP is that it is not necessarily subject to infrastructure charges caps.

4.1.5 Grants

Various Australian Government and Queensland Government grants are available from time to time.

For example, the Australian Government's Building Better Regions Fund (BBRF) offers grants of $20,000 to $10 million to cover 50% or more of eligible project costs for investment ready projects that provide economic and social benefits for regional and remote areas. Grants could be sought for a particular element of the corridor plan, such as the pathway network.

4.1.6 Rates and Levies

Waterway corridors provide benefits to residents across the local government area, and also provide a long-term benefit including to future generations. As such, there is a case for ratepayers contributing to investment in waterway corridors.

NSW and Victoria both have provisions for the collection of levies to cover the cost of waterway management. In NSW for example, the state government provides guidelines to local government wishing to levy a stormwater management services charge. In Victoria, the water act governs how the waterways and drainage charge can be implemented by Melbourne Water.

Compared to a fixed stormwater tax, a more equitable, and arguably more sustainable solution to managing stormwater is through imposing a charge on the size of impervious surfaces connected to the drainage system (Ehrenfried et al 2018). A stormwater fee based on connected imperviousness has been applied to developments in Germany since the mid 1990s. Compared to a fixed stormwater tax, a more equitable, and arguably more sustainable solution to managing stormwater is through imposing a charge on the size of impervious surfaces connected to the drainage system.

5 PLANNING AND DEVELOPMENT

5.1 Planning Scheme Review

5.1.1 Strategic Framework

The strategic framework emphasises the importance of protecting and enhancing the region's natural features given their significance and importance in the success of the tourism industry. The strategic framework also highlights the need to protect the natural environment for its biodiversity and water management purposes, and seeks to provide connectivity and accessibility through and within green corridors. There are some references to balancing development within strategically important areas of connectivity and some corridors are identified in the strategic framework mapping.

5.1.2 Zones and Local Plans

Existing corridors are generally located within the Sport and Recreation Zone, Open Space Zone and Environmental Management and Conversation Zone Code. These zone codes denote an intention to protect the identified land for its specified recreation, open space and environmental management/conservation purposes. The Emerging Community Zone also identifies the importance of integrating development and sensitively responding to existing environmental constraints, however it appears that the scheme is reliant on a more detailed and nuanced assessment of these elements through Local Plans, which exist for a number of the identified emerging community areas.

Most of the land upon which waterway corridors sit is expected to be zoned as Environmental Management and Conversation Zone Code, with more structured open space areas zoned as Open Space Zone.

Constrained land—being land affected by flooding, regulated vegetation, bushfire hazard or other constraints—should preferably not be zoned for urban purposes. This provides greater certainty to developers and minimises disputes in the development assessment process regarding whether or not the constraints are material or can be resolved by performance outcomes.

5.1.3 Overlays

The Biodiversity areas, waterways and wetlands overlay code is the key overlay for ensuring the protection and enhancement of existing ecologically important areas, including waterways. This code contains relatively detailed provisions for buffers and setbacks for wetlands and waterways, however the code only applies where a site contains an identified wetland and waterway. The Water resource catchment overlay code similarly contains strong provisions and a detailed breakdown of the required setbacks to identified water assets, however it also only applies where the asset is identified in overlay mapping.

5.1.4 Local Government Infrastructure Plan (LGIP)

Waterway corridors are not explicitly included in Council's LGIP however waterway corridors are likely to meet the desired standards of service (DDS) for the trunk stormwater network as they:

> *'Provide natural waterways and engineered "natural" channels wherever possible to preserve and enhance natural drainage lines and to minimise construction and long term maintenance costs.' (Planning Scheme v11.0.1 Table 4.4.3).*

5.1.5 Riparian Zones

The Planning Scheme does not provide explicit spatial protections for waterway corridors.

These can be important because it is well understood that riparian corridors are important fort a range of flora and fauna, and to protect water quality and stream health. Brisbane City Council, for example, has a waterway corridors overlay which extends 30 m either side (60 m total width) of mapped water courses Figure 12.

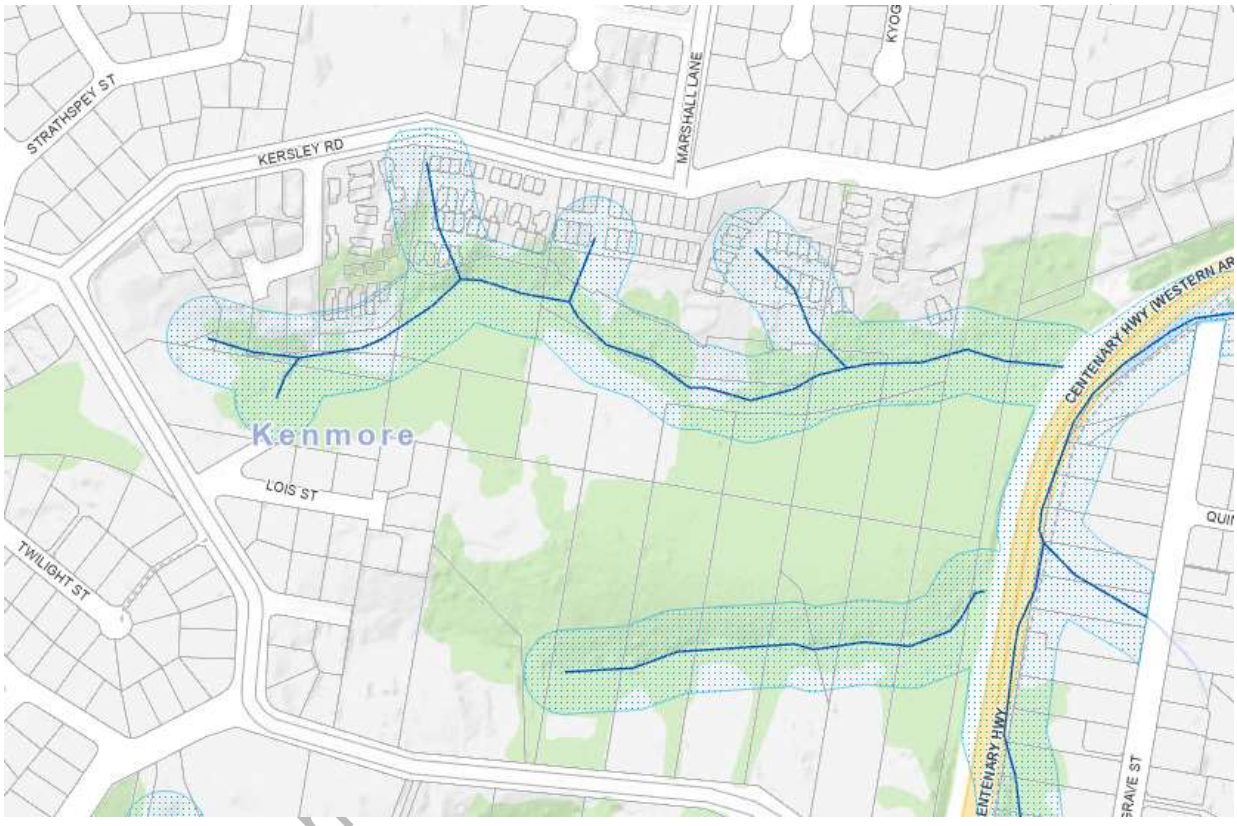

Figure 12Extract from the Brisbane City Plan showing the Waterway Corridors Overlay (30 m either side of a mapped waterway)

Western Sydney is one of the fastest growing urban areas in Australia, and is expected to add one million new residents over the next ten years. New planning provisions designed to protect overland flow paths and riparian corridors include specified setbacks based on stream order, as listed in Table 6. Note a first order stream is typically an upland watercourse with no tributaries, a second order stream has two tributaries.

Table 6 Recommended development setbacks from streams.

Stream order	Development Setback (m from top of bank on each side)
1	20 m
2	40 m
3	80 m
4	100 m
5	120 m

5.2 Delivering the corridors through the development assessment process.

5.2.1 Zoning

As discussed above, clear zoning provides increased certainly for developers and Council and minimises delays and disputes in the DA process. Zoning should clearly delineate waterway corridors, and ensure constrained land within waterway corridors is not zones for urban purposes.

5.2.2 Neighbourhood Plans and Structure Plans

Neighbourhood Plans and Structure Plans help provide clarity to developers regarding Council's preferred approaches to development in specific areas. Council should progress such planning in investigation areas prior to rezoning in order to provide increased certainty to the development industry.

5.2.3 Infrastructure agreements

As discussed in Section 4.1.4, Infrastructure Agreements (IAs) provide a mechanism for the delivery of some or all of the infrastructure within waterway corridors.

Council should consider using infrastructure agreements with regard to

- Providing flood resilient waterway corridors and floodplains, in lieu of on-side detention systems
- Providing waterway corridors that deliver water quality improvement functions, in lieu of on-side stormwater management systems.
- Contributing constrained lands along waterway corridors to Council
- Revegetating waterway corridors and delivering infrastructure such as trails and pathways.

Depending on the relevant park and open space provisions in the planning scheme, IAs may also be used for the provision of open space.

5.2.4 Development Conditions

Where Council is looking to condition developers to deliver waterway corridor works, Council should be mindful that the core business of most developers and associated contractors is in delivering traditional urban infrastructure. Council should consider whether training and capacity building is needed to ensure the desired on-ground outcomes are achieved,

6 CASE STUDIES

6.1 Small Creek

Small Creek was once a meandering stream that flowed into Deebing Creek. Today, it's a straight concrete channel in Raceview that offers very little value to the community or environment; but that is changing. Ipswich City Council is restoring Small Creek.

Small Creek was identified as a potential creek rehabilitation site while Council searched the city for sites to deliver offsite stormwater solutions. In 2016 Council commissioned a joint landscape architecture and engineering team to work with the local community, using a co-design process, to develop a concept for rehabilitating Small Creek. As of August 2017, Council has received tenders to complete the first phase of construction.

Project scale and objectives

The Small Creek project involves rehabilitating a 1.6km stretch of creek to provide cleaner water, wildlife habitat, better paths and bikeways, education opportunities and access to nature for play and enjoyment.

The co-design process employed to develop the concept design involved a week long, Design Your Creek Week. Unlike traditional consultation processes, which typically see a concept developed in isolation, then circulated to the community for feedback, the co-design processes allowed the project team to work with the community on-site, in real time, to develop concepts, without first putting pen to paper. Doing so allowed the community to meaningfully participate on the design process, and guide an outcome that they desire.

Design Your Creek Week ran from one Friday, to the following Wednesday. The project team set up onsite at Small Creek and over the course of the week ran workshops with residents, school children, Council officers, maintenance crews and Councillors, provided expert talks on creek naturalisation, established a scale model creek to demonstrate creek geomorphology and much more. The project team met with the community, and learnt about their experiences and desires for Small Creek. In the background, as concepts began to take form, flood modelling was completed. On the final day, a large sheet of paper was rolled out onto a table, and the first formal concept drawn up.

In total, over 180 people participated in Design Your Creek Week.

Site context

The concrete drain once known as Small Creek rises adjacent to Raceview St, in Raceview. It flows west under Whitehill Rd and Warwick Rd prior to entering Deebing Creek, the Bremer River and ultimately Moreton Bay. The 1.6km section from Whitehill Rd to Warwick Rd is the subject of Council's efforts to rehabilitate the creek.

Like most waterways, it was once surrounded by large iconic tree species such as the Queensland blue gum, with an understorey of native grasses and rushes. In the early days following European colonisation of the area, the waterway was cleared and grazing introduced, instigating a period of ongoing decline. This led to the creek being replaced in the early eighties with the concrete drain that we see today. The few trees that still exist are remnants of the original landscape along the creek that once upon a time would have had their roots in or close to the water.

Issues and constraints

The co-design process identified flooding and maintenance as two important topics for stakeholders. By working with stakeholders to develop the initial concept, the co-design process created opportunities to address concerns about both flooding and maintenance in the concept design. It also allowed the project team to respectfully and meaningfully challenge existing

perception as to the role of drainage, and present the idea that good drainage can look like a creek rather than concrete, and deliver multiple benefits. Ultimately, it was critical to ensure that the final product would be practical and affordable to maintain, and would not increase flooding.

An additional constraint came in the form of previous attempts at creek naturalisation in the local area. Several years prior to the Small Creek concept design, an unrelated, and poorly designed and delivered attempt had been made at creek naturalisation at a nearby site. That site was subsequently converted into a concrete channel. The project team identified the importance of distinguishing between previous attempts at creek naturalisation and the intent for Small Creek. The co-design process assisted with this.

Construction costs

The project was constructed on Council owned land. Construction cost of ~$9 million was funded through Ipswich City Council's Stormwater Quality Offset Fund. A five year maintenance contract was tied to the construction contract to help minimise the maintenance burden to Council during establishment.

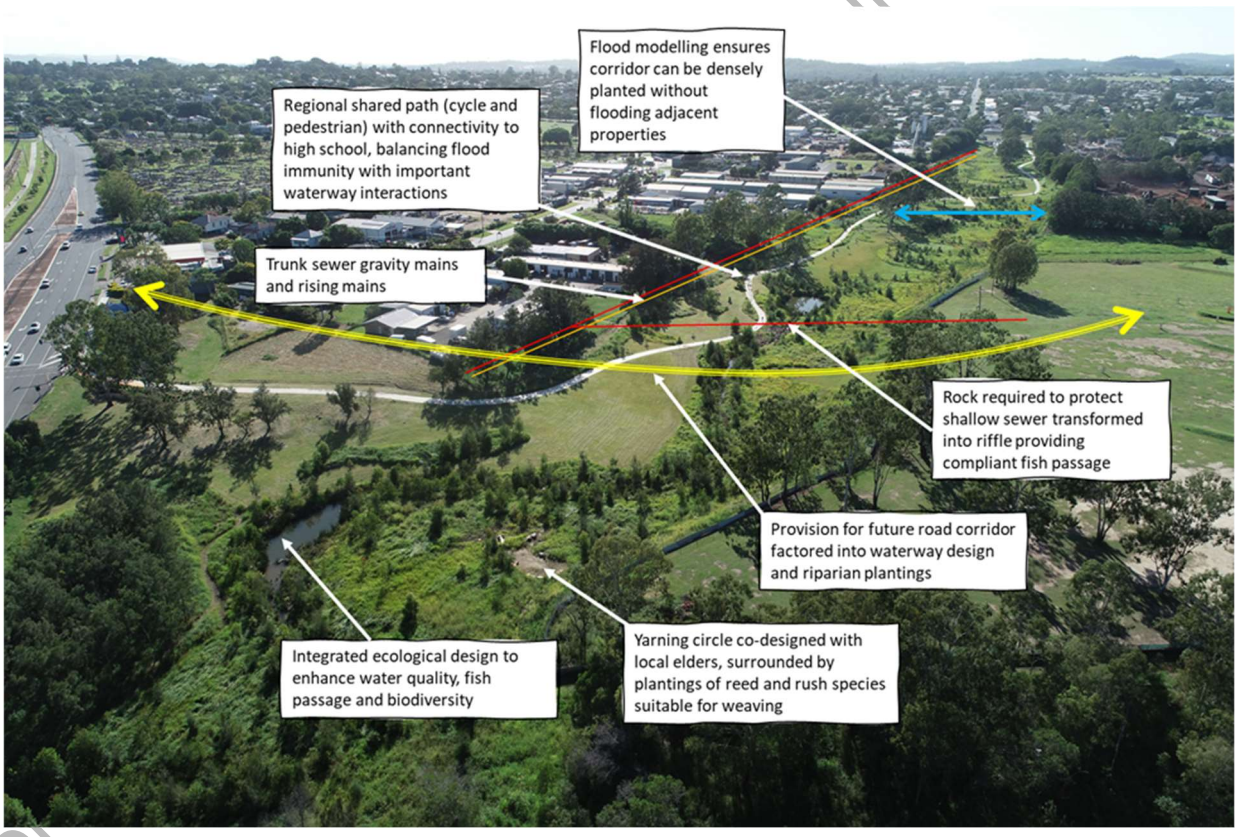

Figure 13 Small Creek, Ipswich

6.2 Hanlon Park/Norman Creek

Hanlon Park was a large, open green space in the heart of Stones Corner that has been revitalised by removing the concrete drain and returning Norman Creek to a natural waterway through the park.

The park has been transformed into an attractive and versatile public space that supports the growing Stones Corner Precinct – creating a vibrant urban oasis with more to see and do.

The Stones Corner Precinct - Hanlon Park Rejuvenation project:

- revitalises Norman Creek, which runs through the park
- enhances the environment with more trees and natural spaces
- increases recreational and social opportunities for residents and visitors
- enhances connectivity and accessibility within the park and local area
- boosts local economic vibrancy with a new place to relax and enjoy.

The concept plan was developed through community consultation in 2018, including a co-design workshop, online survey and extensive technical investigations. Design commenced in 2019 and construction was completed in 2022.

Planning

The Project is a flagship project of the Norman Creek 2012-2031 Master Plan.

The Norman Creek Master Plan Vision is:

- A catchment enjoyed for its subtropical open spaces, green transport options and healthy waterways.
- An urbanised place that celebrates water and is resilient during times of drought and flood.
- A creek reconnected with the Brisbane River and local waterways, bordered by safe and attractive wildlife corridors.
- Water smart communities who appreciate water's integral role in sustaining life and manage it sustainably.

The Master Plan outlines key initiatives aimed at rejuvenating the Norman Creek catchment. The Master Plan also aligns with other long-term Council plans and strategies delivered by 2031. The Master Plan guides key initiatives to revitalise one of the city's most urbanised catchments. Council is committing to this by partnering with residents, business, industry, government and community groups.

The Master Plan highlights priority areas and projects designed to achieve multiple outcomes for the city. These include strengthening Brisbane's economy, improving access and inclusion for all residents and making the city cleaner and greener.

Funding

The $20 m project was funded through Brisbane City Council's capital works program.

Ecological Outcomes

Monitoring has found a tripling of fish abundance, a doubling of species richness, and 40% of fish are now native whereas previously there were none.

Figure 14 Hanlon Park (2018 left, and 2022 right)

Figure 15 Hanlon Park Redevelopment - Opening Day

6.3 Logan River Vision

River Vision documents the community's 50-year vision for Logan's waterways, from 2017 to 2067. River Vision was developed from community ideas and feedback. It has three key themes:

- River Play– our rivers are places where the community can connect with water in a fun and playful way
- River Destinations –rivers as places to visit
- River Health –addressing the community's concern about long-term river health.

The vision is that in 2067, the Logan River is a world class environmental asset that is accessible to everyone, is celebrated and will connect people and places along its length from the mountains to the bay. Logan River is a place of spiritual significance and a natural resource for drinking, irrigation, leisure and recreation. It is also a key wildlife corridor from the mountains to the bay.

The Logan River Vision is a 50 year vision from 2017 through to 2067. It was developed from ideas and feedback from the community and will:

- support a healthy and clean river
- allow for continued urban and population growth
- create tourism and business opportunities
- provide access for all abilities

- inspire innovation and creativity for custodians now and for the future.

Since developing the River Vision Document, Council has reviewed its planning scheme to ensure it aligns with the overall river vision, and proceeded with multiple on-ground projects including riparian revegetation, bank stabilisation works, and development of a canoe and kayak trail.

6.4 Little McCready's Creek, Mackay

Project summary

Flat terrain and a sugar cane farming history are synonymous with the region around Mackay. Traditionally, on such flat terrain, drains across the region were designed solely for stormwater conveyance. Drains were concrete-lined, with turfed batters requiring maintenance for the life of the asset.

Mackay Regional Council identified Little McCreadys Creek in Rural View as a site suitable for developing and showcasing best practice methods for improving stormwater quality, rehabilitating waterways, enhancing aquatic habitat and improving ecological corridors. Council, with assistance from local natural resource management body Reef Catchments, used funds collected under Council's Voluntary Mechanism for Stormwater Quality Management to restore a section of Little McCreadys Creek. This was done by installing rock and timber bed and bank controls, fishways, benched wetlands and dense riparian vegetation.

Figure 16 Little McCready's Creek, Mackay

Project scale and objectives

A 720m stretch of Little McCreadys Creek between Bucasia-Mackay Rd and Dawson Blvd was rehabilitated. This stretch of waterway had in the past been heavily modified, including being straightened and formed into a trapezoidal channel. Sitting within a catchment with an existing catchment management plan, the project aimed to:

- improve water quality entering estuarine and Great Barrier Reef habitats,
- increase biodiversity, fish habitat and fish passage,
- provide a local example of a naturalised waterways, for comparison against traditional concrete and turf channels,
- improve visual amenity, and re-establish riparian vegetation and ecosystem service values.

Site context

Little McCready's Creek flows east through Rural View before joining with other local waterways and entering the Great Barrier Lagoon. The surrounding catchment is progressively transitioning from rural to urban residential. In the past, it was used for cane farming. During this period, the creek was generally shallow, boggy and filled with sediment from land clearing and agriculture.

Issues and constraints

Consultation with the community revealed most people to support the project, however concerns were raised about the potential for the works to increase local flooding and mosquito populations. Council undertook hydraulic analysis to ensure that there was no increase in flooding on private property. Mosquitoes were found to be an issue in the existing drain. Fish passage was incorporated into the design to, amongst other benefits, allow fish to move into the rehabilitated waterway to prey on mosquito larvae.

Fish passages must be constructed to tight tolerances if they are to function as designed. If constructed incorrectly, they can themselves become a barrier to fish movement. It took several attempts to appropriately key the rocks in the fish passage into the bed and bank.

Construction and ongoing costs

Restoring this section of Little McCreadys Creek, including all community consultation. civil design, landscape design and construction cost $350,000. All plants were provided in-kind. At present, long term ongoing costs are unknown.

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BLIGH TANNER

APPENDIX A
PARKS CLASSIFICATION

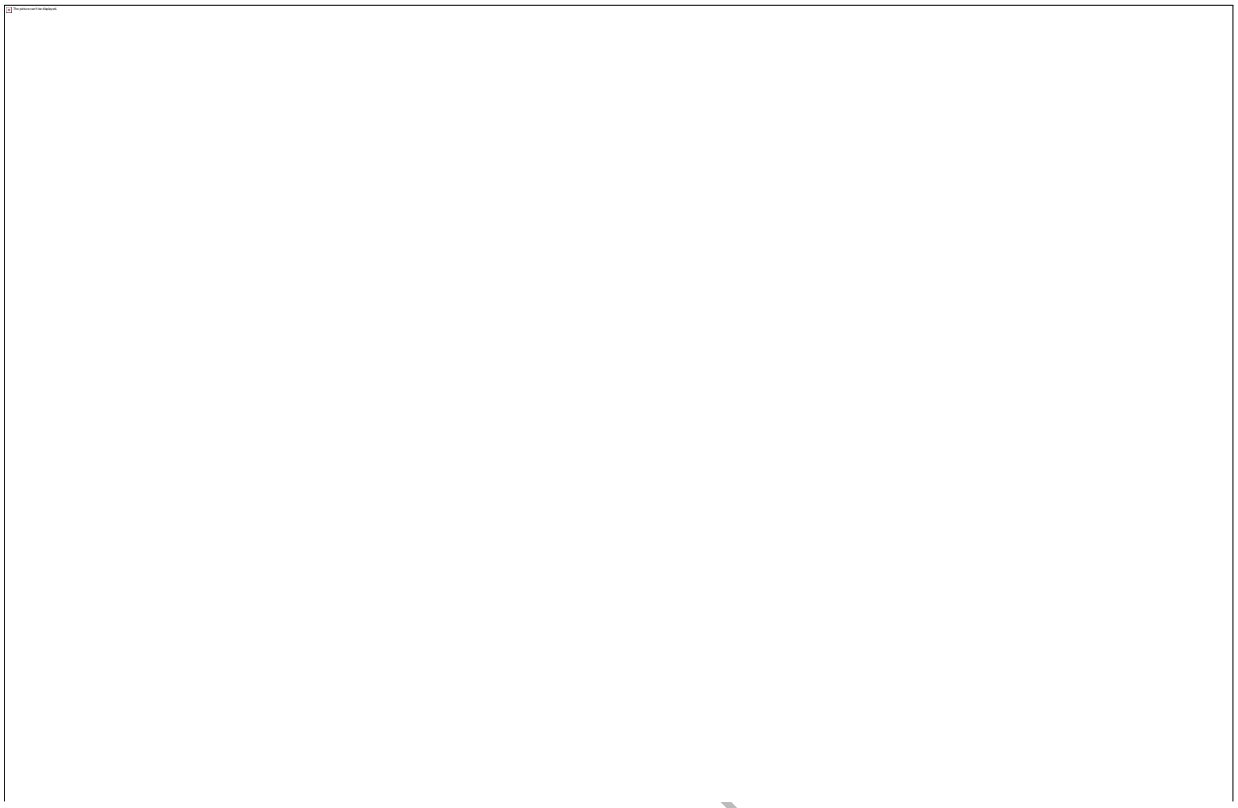
BLIGH TANNER

PARKS CLASSIFICATION

The Fraser Coast Parks Classification System is summarised below. Refer to the Parks Planning Scheme Policy and Open Space Strategy to ensure the most current version is used.

Park Classification

	What does this mean?
Function:	The first layer of classification is function. This is **the primary role or use of the park**. For our Open Space Strategy the function (or primary role of the park) is: • Sport • Recreation • Environmental • Constrained In many instances, parks may have a number of roles or uses, however for the purposes of the Open Space Strategy, each park will be categorised under its primary use.
Hierarchy:	The second layer of classification is the hierarchy. Put simply, this defines **the level of the park** within its function. Each park function (or park use) has its own hierarchy (level). For example, the hierarchy (or level) of a **sports park** in our Open Space Strategy is: • Regional – Services the whole city / LGA • District – Services a portion of the city / LGA • Specialised
Setting:	The third layer of classification is setting. This is the **main characteristics of the surrounding area of the park**. For example, is the park located in a highly developed areas surrounded by five story apartments and shops. For our Open Space Strategy we have the following settings: • Natural • Semi-natural • Semi-developed • Developed



Park Classification Definitions

Function	Hierarchy	Description	Catchment Accessibility	Size
Sport	Regional	Regional sports parks are established to provide the highest standard of spaces and facilities for playing and practising formal, organised sporting activities for both teams and individuals. These large parks can cater to a high number of visitors, accommodating both regional sport events as well as recurring sporting competitions. They accommodate a diverse range of formal sporting activities and include other physical activity ancillary infrastructure to support their primary use. Multi-use in nature, a number of clubs and organisations share facilities, fields, courts and spaces. Some district or local recreation spaces are provided to serve visitors to the park and residents within the local catchment. Regional Sports Parks are important to the community.	City Wide	15 ha
	District	District sports parks provide spaces and facilities for playing and practising formal, organised sporting activities for both teams and individuals. These parks are large in size and provide enough space for a variety of playing areas such as courts, playing fields and surfaces. They usually accommodate sports at a district and local function level. They may also provide necessary ancillary infrastructure such as court and field lighting, clubhouses, change rooms, toilets and basic spectator seating. In most locations they are to be multiuse and promote the shared use of facilities between a	5.0 km	10 ha

Function	Hierarchy	Description	Catchment Accessibility	Size
		number of clubs and sporting codes. Some local recreation opportunities may also be provided for visitors and local residents within the local catchment.		
	Specialised use	Specialised use sports parks are open space areas which may require affiliation or membership with a club or organisation to gain access. These areas are generally restricted for use by the public. The types of sports catered to include hard to locate and/or noisy sport areas and facilities that are not generally compatible with publicly accessible parks (e.g. archery club). These locations provide limited recreation opportunities.	N/A	N/A
Recreation	Regional	Regional recreation parks provide the highest level of recreation opportunities and facilities to service the whole of the council area. They are large parks that provide a significant range of recreational facilities and spaces. They are designed to support large numbers of people recreating and can cater to large events. Regional Recreation Parks are important to the community.	City Wide	10 ha
	District	District recreation parks provide an intermediate level of recreation opportunities and facilities to a district catchment. These parks and can cater to intermediate level of recreational visitors and provide areas for smaller community gatherings, performances and events.	5.0 km	5 ha
	Local	Local recreation parks provide informal passive and active recreation and leisure opportunities to a local community, appropriate to its setting and context. These parks are accessible and located to enable people to walk to their park. Local recreation parks provide visual amenity, small areas for kick-a-bout activities, seating, picnic spaces and shade cover. They may include some play equipment. These parks provide an important opportunities for social interaction and contribute the landscape amenity and biodiversity values of the local catchment.	500 m (walking catchment)	0.5 ha
	Connecting Corridor	Connecting corridors are linear shaped parks which facilitate connectivity between destination nodes, residential catchments and the open space network. They may provide informal recreation opportunities such as walking, cycling and incorporate areas for play equipment, fitness nodes, seating and shade trees. In some instances they may be co-located with other infrastructure or form part of a floodplain management or environmental area.	N/A	N/A
	Civic	Civic parks are often referred to as plazas, town squares or public spaces. They are located to town centre or prominent community infrastructure and provide important areas for people to relax, eat lunch, meet friends or attend events. They may also offer facilities such shade and seating. They are designed to provide amenity in our centres and create destinations that people are attracted. They are designed to facilitate small community events and gatherings.	Adjacent to town centres	0.2 ha

Function	Hierarchy	Description	Catchment Accessibility	Size
	Amenity	Amenity area are small spaces such as garden beds, planted and landscaped areas that provide visual relief from the urban form. They typically have limited infrastructure, such as a seat, and provide limited recreation opportunities.	N/A	< 0.5 ha
Natural Environment	Environmental	Environmental Reserves have conservation as the primary purpose and are defined areas with VERY HIGH RANGE ecological values. These reserves provide for the PROTECTION of the natural environment. Public access is NOT suitable in MOST areas due to sensitivity of ecological value and potential for disturbance. Nature based and commercial activities WILL NOT be suitable in these reserves. Environmental reserves have a prioritisation score > TBC	N/A	
	Conservation	Conservation Reserves have conservation as the primary purpose and are defined areas with the HIGH RANGE ecological values. These reserves provide for the MAINTENANCE of the natural environment. Public access is NOT suitable in SOME areas due to sensitivity of ecological value and potential for disturbance. Nature based and commercial activities MAY be suitable in these reserves. Conservation reserves have a prioritisation score between TBC and TBC	N/A	
	Bushland	Bushland Reserves have conservation as the primary purpose and are defined areas with the MID RANGE ecological values. These reserves provide for the ENHANCEMENT of the natural environment. Public access IS suitable in areas where impact to existing ecological values can be mitigated. Nature based and passive recreational activities ARE suitable in these reserves. Bushland reserves have a prioritisation score < TBC	N/A	
	Connecting Corridor	Corridor Reserves have conservation as the primary purpose and are defined connecting areas of HIGH RANGE ecological values. These reserves provide for the PROTECTION, MAINTENANCE and ENHANCEMENT of wildlife corridor functions within urban and rural areas. Public access is not suitable in MOST areas due to sensitive ecological value and potential for disturbance. Given their high biodiversity values, some nature based activities and commercial activities WILL NOT be sustainable in these parks. Corridor reserves are shown within the prioritisation ranking.	N/A	
	Coastal	Coastal Reserves have conservation as the primary purpose and are defined connecting areas of HIGH RANGE ecological values. These reserves provide for the PROTECTION, MAINTENANCE and ENHANCEMENT of coastal processes, including natural hazard protection. Public access is not suitable in MOST areas due to sensitive ecological value and potential for disturbance. Given their high biodiversity values, some nature based activities and commercial activities WILL NOT be sustainable in these reserves. Coastal	N/A	

Function	Hierarchy	Description	Catchment Accessibility	Size
		reserves are shown within the prioritisation ranking.		
Constrained Constrained open spaces are open space areas which provide limited recreational opportunities to the community. The recreation function is secondary to their primary purpose. They may be encumbered or constrained by physical characteristics such as topography or poor access. They may also be locations which are required for non-park related infrastructure, within a floodplain or for stormwater quality and quantity purposes.	Utility	In terms of open space utility reserve is land for utility infrastructure such as electricity transmission, telecommunications, water and sewage. Utility reserves will be designed using specific criteria from the type of open space the reserve is directly adjacent to, ensuring any proposal would not conflict with the primary function of the utility reserve.	N/A	N/A
	Drainage	In terms of open space parks, drainage reserves are land associated with waterways, creeks, drainage lines and stormwater infrastructure. The primary purpose is water flow and drainage. As a general rule, these types of parks should be designed to be maintained as a natural area.	N/A	N/A
	Unformed Road	In terms of open space, an unformed road is a road reserve that has no constructed road or no road assets and customarily used by the public for passive recreation activities. As a general rule, these areas have minimal embellishments and are often located adjacent to park land areas creating the assumption they are part of the park.	N/A	N/A

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