IRONPOT CREEK CORRIDOR PLAN

WORKS, PARKS & RECREATION DEPARTMENT

City of Ipswich

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Executive Summary

Project Overview

The Ironpot Creek Corridor (the corridor) is a relatively small (17 km^2) catchment which sits entirely within the Ipswich City Council Local Government Area. The waterway drains to the Bremer River through the suburbs of Pine Mountain, Blacksoil, Brassall, Karrabin and Wulkuraka. The waterway corridor is an important natural feature in this catchment which contains a mix of rural and urban land uses.

The corridor is characterised by a continuous riparian corridor which provides a buffer to the creek. Revegetation and weed control projects have been undertaken throughout the corridor to date. The creek has extensive erosion within the main channel and its tributaries as a result of past clearing, urbanisation and construction of infrastructure (such as roads, rail and power corridors). There have been a number of on-ground stabilisation works and a Drainage and Erosion Management Plan undertaken to help address this erosion. Planning for the open spaces within the majority of the catchment is currently underway as part of the Precinct Plan for Division 6 and the design and construction of a main bikeway through the catchment is also underway.

This Corridor Plan brings together these different activities occurring in the Ironpot Creek Corridor to provide a holistic understanding of the corridor activities to identify potential opportunities to coordinate investment and to address potential competing outcomes. This consolidation of information informed the development of a list of actions and implementation plan to guide future works throughout the corridor, reducing the risk of over-investment in ad hoc activities which deliver limited benefits.

This report presents the common vision for the catchment which was developed by a range of Council stakeholders. A summary of the corridor assessment is then presented and future actions are identified in an illustrative corridor plan.

Vision

A common vision was developed through a collaborative planning process, bringing together a range of stakeholders to identify the key objectives for the corridor transformation.

The vision developed by the collective stakeholder group is that:

“Ironpot Creek and its catchment is a well managed natural system providing high environmental and social values”

The key objectives for the corridor were developed to support this vision:

+ We all benefit
+ Making it happen
+ Embracing the environment
+ Working as one

Corridor Assessment

An assessment of the current condition and planned future for the corridor was undertaken to develop an understanding of the opportunities and constraints. Interviews, a full day site visit, workshops and review of existing reports were undertaken to gain a common understanding of the corridor condition, the impacts of past activities and the potential issues or opportunities associated with future activities.

This assessment identified seven key ‘thematic layers’ which require consideration:

+ Channel form and habitat
+ Native vegetation
+ Cultural and landscape values
+ Land use
+ Infrastructure
+ Open space and recreation
+ Flooding

This corridor assessment also identified 3 ‘sub-corridor areas’ which have different characteristics and management priorities:

SUB-CORRIDOR AREA	CORRIDOR CONDITION	ADJACENT LAND USES	DIRECTIONAL FOCUS
Upper Corridor	Steep ephemeral channel in a well vegetated corridor with active erosion and incision of the bed resulting in steep banks which are highly unstable and are susceptible to erosion and collapse.	Large residential blocks located directly adjacent to the waterway. Incorporates informal open space and parkland areas connected by pathways to the residential areas.	To support cooperative and complementary waterway improvement works to address channel erosion and instability
Middle Corridor	Flat and wide channel storing deposited materials which are being slowly moved through channels re-eroding into the floodplain.	Rural and urban residential (most of development is underway or already approved). Precinct Plan currently underway in this area for open spaces.	The creation of natural recreation experiences in a dynamic and healthy waterway corridor
Lower Corridor	Deeply incised steep channel. Woody weeds dominate riparian corridor.	Open space areas sit between waterway and established urban residential suburbs	Undertaking works which will control the bed level and involve the community to build resilience to upstream investments

Table 1. Sub-corridor areas

Corridor Plan

The Corridor Plan addresses the range of complex issues facing the corridor and provides a single vision for its transformation. This is the second corridor plan of this type for Council (the first being the Bundamba Creek Corridor Plan) which will help inform planning and investment decisions across the corridor to ensure the common vision can be delivered.

A range of actions have been identified which target areas which require works to be undertaken in a collaborative manner and in a sensible sequence to deliver the corridor vision. These actions include specific investigations and works to be undertaken within the 3 key areas across the corridor.

Implementation

Implementation of the Corridor Plan will require partnership and further investigations. The plan provides strategic guidance and identifies a range of small scale to large scale interventions which can be delivered across the corridor to drive and support its transformation.

An action list is provided (refer section 5), highlighting which project objectives are delivered and the stakeholders involved. This table can be used by Council to identify and prioritise key actions to take forward. To support this prioritisation, guidance has been provided in this document regarding the potential staging of channel works to manage risk and enhancement of waterway health values (refer Section 3.5.4).

To monitor and evaluate the implementation of the Corridor Plan, this document should be used as a reference document throughout the development of the corridor to ensure that all works undertaken help to deliver the common vision and project objectives.

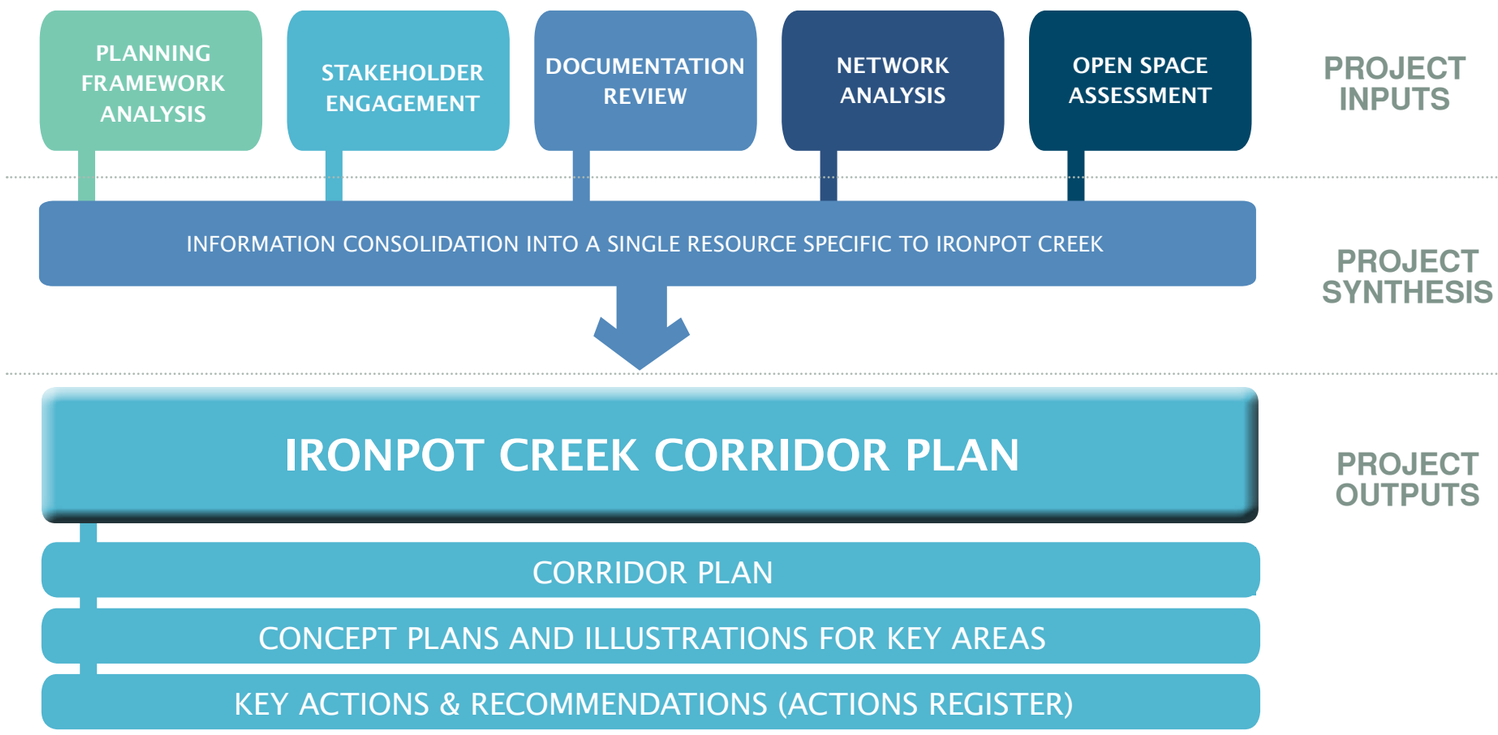


Figure 1. Project Development Diagram

1.0 Background

1.1 Introduction

This document presents a Corridor Plan to guide the long term management of the Ironpot Creek Corridor as a valued, accessible and understood natural system. To achieve this vision, consideration of the historic changes and current condition of the waterway is required to ensure that actions undertaken in the waterway corridor are resilient and provide value for money outcomes for Council and the community.

The Ironpot Creek Corridor is a well shaded and vegetated corridor which has actively eroding bed and banks. The catchment is a mix of rural lands and urban areas with development of the catchment almost complete. The waterway corridor provides an important natural feature in the catchment, but there is limited access and recreational opportunities for the community within the corridor.

A range of projects have already been completed within the Ironpot Creek Corridor, including waterway health assessments, Drainage and Erosion Management Plan and ad-hoc on-ground stabilisation and revegetation works. There are also a number of activities currently occurring including the development of a Precinct Plan for Division 6 which includes over half of the study area and the design and construction of a main bikeway through the catchment.

This Corridor Plan consolidates all of the corridor activities as layers to be considered holistically to identify areas which provide opportunities to coordinate investment to provide multiple benefits as well as areas where competing outcomes might occur. This consolidation of information and considered approach to the development of actions provides Council with a strategic framework to guide future works to reduce the risk of overinvestment in ad hoc activities which deliver limited benefits.

This document provides stakeholders, concerned with the future condition of the corridor, with a common vision and integrated plan to support a cooperative approach to the decisions and actions to be taken in the coming years.

1.2 Corridor Context

Ironpot Creek is located in Pine Mountain approximately 6.5 km north east of the Ipswich City Centre. The catchment is a relatively small (17 km^2) but steep catchment which sits entirely within the Ipswich City Council Local Government Area. The waterway drains to the Bremer River through the suburbs of Pine Mountain, Blacksoil, Brassall, Karrabin and Wulkuraka.

The waterway corridor is characterised by extensive erosion within the main creek and its tributaries as a result of past clearing, urbanisation and construction of infrastructure (such as roads, rail and power corridors). This erosion has resulted in the widening and deepening of the creek which can now carry larger volumes of high energy flows within the channel which leads to bank erosion, sediment transport and potential damage to private property and Council assets.

While historical clearing was likely throughout the catchment, there are large areas of natural native forest regeneration, creating a wide and continuous riparian buffer through the catchment. This green buffer also provides a visual break in the catchment between the urban and rural land uses which make up the catchment.

A Precinct Plan is currently underway for Division 6 which covers almost half of the catchment. This plan is investigating the open spaces within the catchment and is identifying any gaps and needs for future investment. This includes the continuation of a main bikeway through the catchment and the provision of a new sports park.

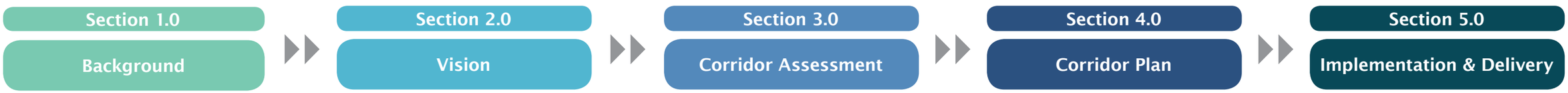
The community of the Ironpot Creek catchment has been involved in consultation and provided input over the past 3 years for both the current Precinct Planning process as well as the Drainage and Erosion Management Plan which was undertaken in the upper reaches in 2012. The broader community have also recently had an opportunity to be part of city-wide communication through the development of the Ipswich Futures community plan.

Figure 2. Context Map

Source: Design team adaptation of map from Health-E-Waterways

1.3. Document Structure

This document has the following information provided:



Introduction

Context

Document Structure

Document Purpose

+ about the plan
+ how to use this document

Plan Making Process

+ overview of the plan making process
+ stakeholder engagement

Vision and Objectives

+ vision and objectives for the corridor

Understanding the Corridor

+ baseline understanding of corridor attributes, condition and pressures and establishment of high level directional focus to guide the plan making

Sub-Corridor Areas

+ understanding of channel processes within each sub-corridor area

Corridor Plan Principles

+ thematic layers and associated principles used in the development of The Corridor Plan

Synthesis of Opportunities

+ integrated application of principles to deliver multiple benefits

Corridor Plan

+ integrated corridor plan and a series of locational cross-sections and key planning area plans

Recommended Actions

+ key recommendations for action within the catchment

Figure 3. Document Structure

1.4 Document Purpose

1.4.1. About the Plan

The Ironpot Creek Corridor Plan (the 'Corridor Plan') presents a common strategic plan for the corridor which builds from previous work and also the vision and objectives developed by the project stakeholders.

This Plan is the second of a suite of corridor plans to be developed for waterways within Ipswich, the first being the Bundamba Creek Corridor Plan. The need to undertake these corridor plans was identified through the development of the Open Space and Recreation Strategy 2014 and the Waterway Health Strategy 2009. These strategies build upon and align with Council's policy framework. This plan also acknowledges and reflects the work undertaken to-date on the Precinct Plan for Division 6 to ensure these 2 plans compliment each other.

This plan therefore serves as a multifunctional resource which consolidates waterway health and open space planning as well as infrastructure planning, stakeholder and community needs with a detailed analyses of the corridors existing condition and future requirements.

This document provides:

+ One clear direction
+ Corridor specific information captured into a consolidated and condensed plan
+ Strategic actions and implementation pathways for future corridor works

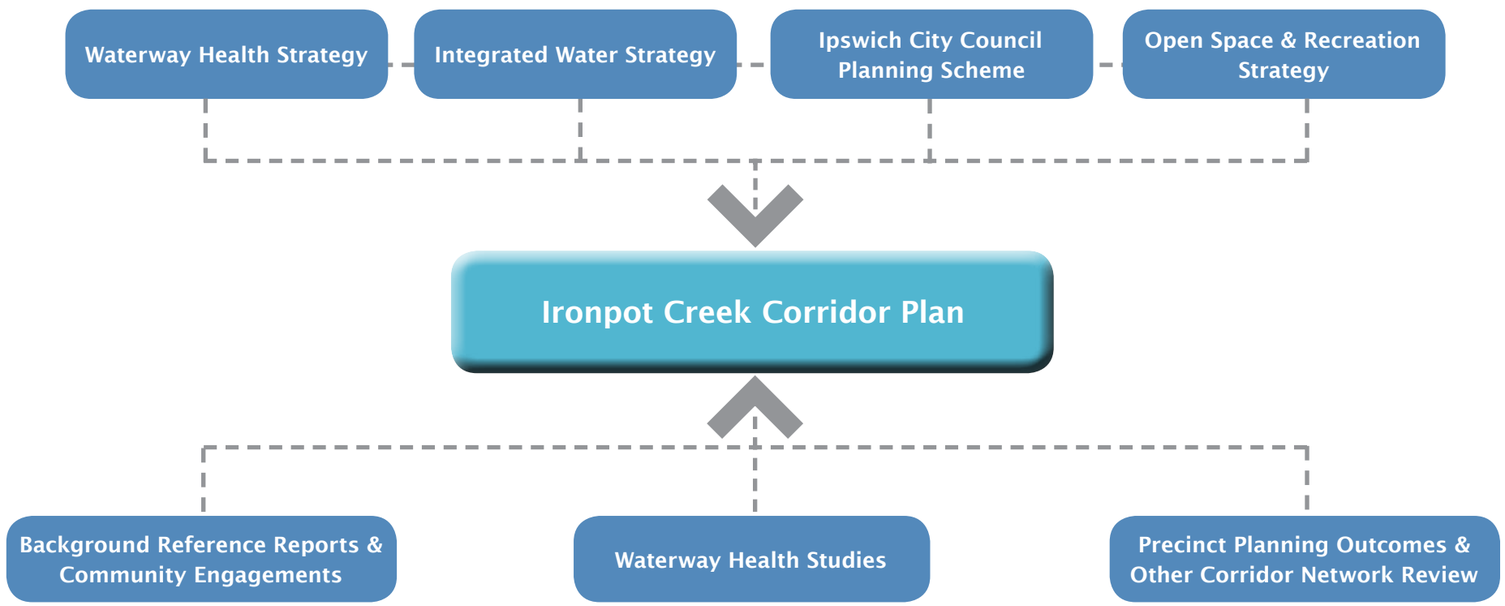


Figure 4. Document Hierarchy

1.4.2 How to Use the Plan

The plan is to be used to guide investment and works occurring in the catchment by all stakeholders to deliver the common vision for the corridor future. It provides clarity on the types of works which would be suitable for the different locations along the corridor, supported by a suggested approach to the delivery of these actions. For example, it is recommended that a combination of channel stabilisation works both upstream and downstream are required to ensure active erosion is addressed and channel works are protected. The most appropriate pathways to help implement these actions are also identified, including potential funding and partnership opportunities.

1.4.3 Associated Documents

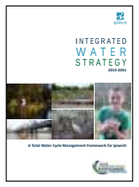
Council has a number of existing guidelines, strategies and technical reports which are key tools for the delivery of this project including:

+ Open Space and Recreation Strategy
+ Waterway Health Strategy
+ Integrated Water Strategy
+ Nature Conservation Strategy
+ Waterway and Channel Rehabilitation Guideline
+ 2014 Catchment Condition Assessment by Alluvium - including assessment of waterway values, condition, geomorphology and vegetation
+ Ironpot Creek Drainage and Erosion Management Plan (AWC and Bligh Tanner, 2013)
+ Precinct Plan for Division 6 (in progress)

There are also a number of industry guidelines such as Australian Rainfall and Runoff, Queensland Urban Drainage Manual and SEQ WSUD Technical Design Guidelines which are important resources for this project. The Corridor Plan is not intended to replace these guidelines but be used in conjunction with them to deliver the project outcomes.


Open Space and Recreation Strategy 2014


Waterway Health Strategy 2009



Integrated Water Strategy

Waterway and Channel Rehabilitation Guidelines


Ironpot Creek Drainage and Erosion Management Plan


Catchment Condition Assessment Report

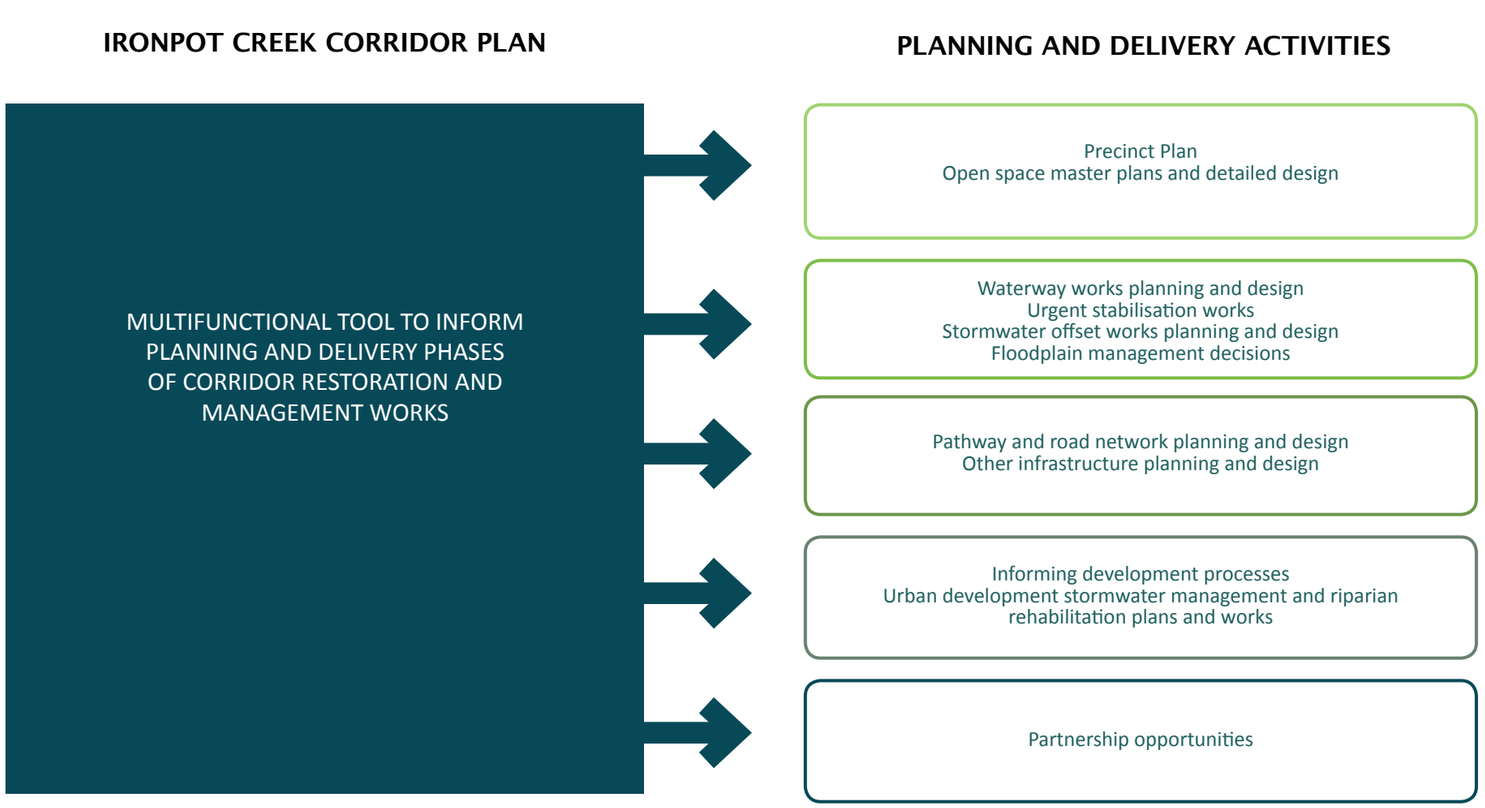


Figure 5. Document Function Diagram - highlights where the Corridor Plan can be applied as a high level directional document

1.5 Plan Making Process

The planning process was undertaken in partnership with Council, with input gathered from many different departments throughout the project timeline. This process was undertaken alongside the Division 6 Precinct Planning process with outcomes being shared across the projects.

A consultative planning process was employed as illustrated in the following figure.

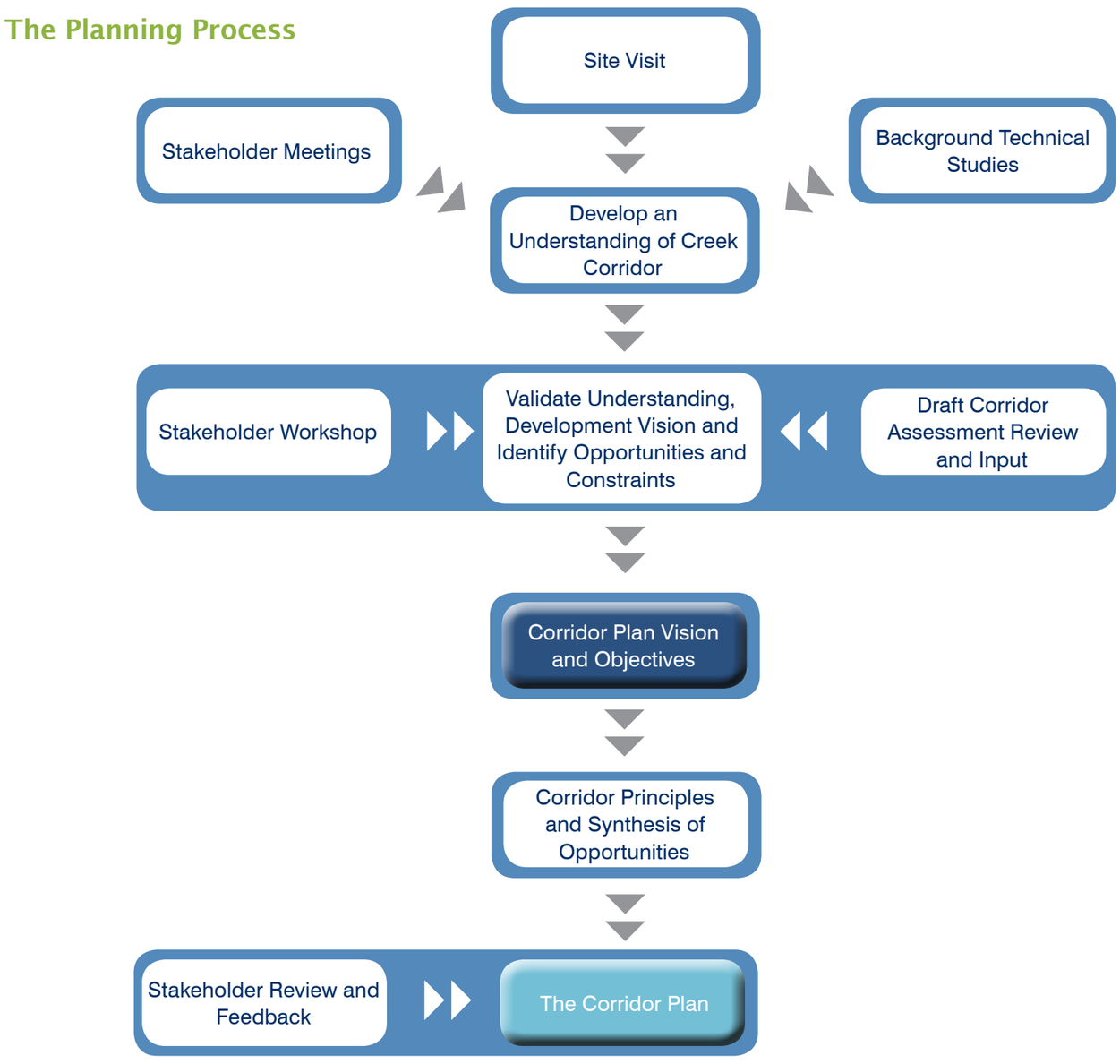


Figure 6. The Planning Process

1.5.1 Stakeholder Engagement

The knowledge, experiences and ideas for the creek corridor held by the key stakeholders was captured through the planning process via a series of meetings, workshop and review / feedback sessions.

As previously mentioned the community have been engaged significantly in the past about this corridor area through both the previous Ironpot Creek Drainage and Erosion Management Plan and the Division 6 Precinct Planning process. The community have also recently been broadly engaged regarding priorities through the Ipswich Futures project. Community consultation was therefore not undertaken for this project. Outcomes from these previous engagement activities which were considered in this plan included:

+ concern about loss of property due to erosion
+ need for more information to guide landholders on actions they can take to address erosion
+ identification that 'healthy waterways and catchments' was the top priority for the community with regard to caring for the environment, followed by 'protecting native flora, fauna and their habitats'

The stakeholders consulted as part of the development of the Corridor Plan included:

+ Council stakeholders including representatives from:
  - Integrated water management (including waterways and flooding)
  - Open space planning
  - Infrastructure planning
  - Strategic planning
  - Development assessment
  - Cultural heritage
  - Natural areas
+ Ipswich River Improvement Trust
+ Queensland Urban Utilities

Evident throughout the engagement process was the importance all stakeholders placed on the development of a coordinated strategy for the improvement of the environmental and social values of the Ironpot Creek Corridor.



2.0 Vision

A vision statement giving expression to the aspirations for the future of the creek corridor was developed in consultation with the project stakeholders.
The vision, provided below, provides inspiration and guidance to the planning and management of the creek corridor.

2.1 Vision and Objectives

The vision articulates a desire to better connect people with the creek corridor to build an understanding and appreciation of this important natural system. There is also a desire for the creek to be understood for its environmental and social values. Underpinning this vision is a common goal to allow this waterway to be a dynamic system which is self-sustaining, requiring minimal management.

To support this vision a suite of objectives have been developed to provide a framework to test opportunities and actions against this vision and to monitor outcomes once delivered.

WE ALL BENEFIT

How

+ Increase accessibility for the community
+ Provide a range of experiences
+ Enhance the landscape, visual and social amenity
+ Promote increasing community awareness and understanding

MAKING IT HAPPEN

How

+ Common adaptive management approach using responsive natural channel design
+ Coordinate ongoing management
+ Reduce maintenance inputs
+ Create a self-sustaining system

EMBRACING THE ENVIRONMENT

How

+ Increase the habitat for native plants and animals
+ Accommodate dynamic waterway processes
+ Promote walkable and shaded public access
+ Enhance ecosystem services

WORKING AS ONE

How

+ Share resources and responsibilities
+ Establish a common vision and approach
+ Build partnerships with community and other stakeholders
+ Committed and proactive actions
+ The functions, aesthetics and dynamics of the system are well understood and communicated

3.0 Corridor Assessment

3.1 Understanding the Corridor

Previous reports were reviewed to gain an initial understanding of the waterway condition. Interviews with staff from Council departments were undertaken to gain an understanding of previous, current and planned works throughout the catchment including development, infrastructure, open space and waterway health improvement works. A full day site visit was also undertaken to gain an understanding of the current corridor condition, the impacts of past activities and the potential issues or opportunities associated with future activities. This information was consolidated into a base plan and presented at a stakeholder workshop for validation and to capture any additional information which was relevant for the corridor planning process. A review of the draft corridor assessment was also undertaken internally by Council staff for feedback.

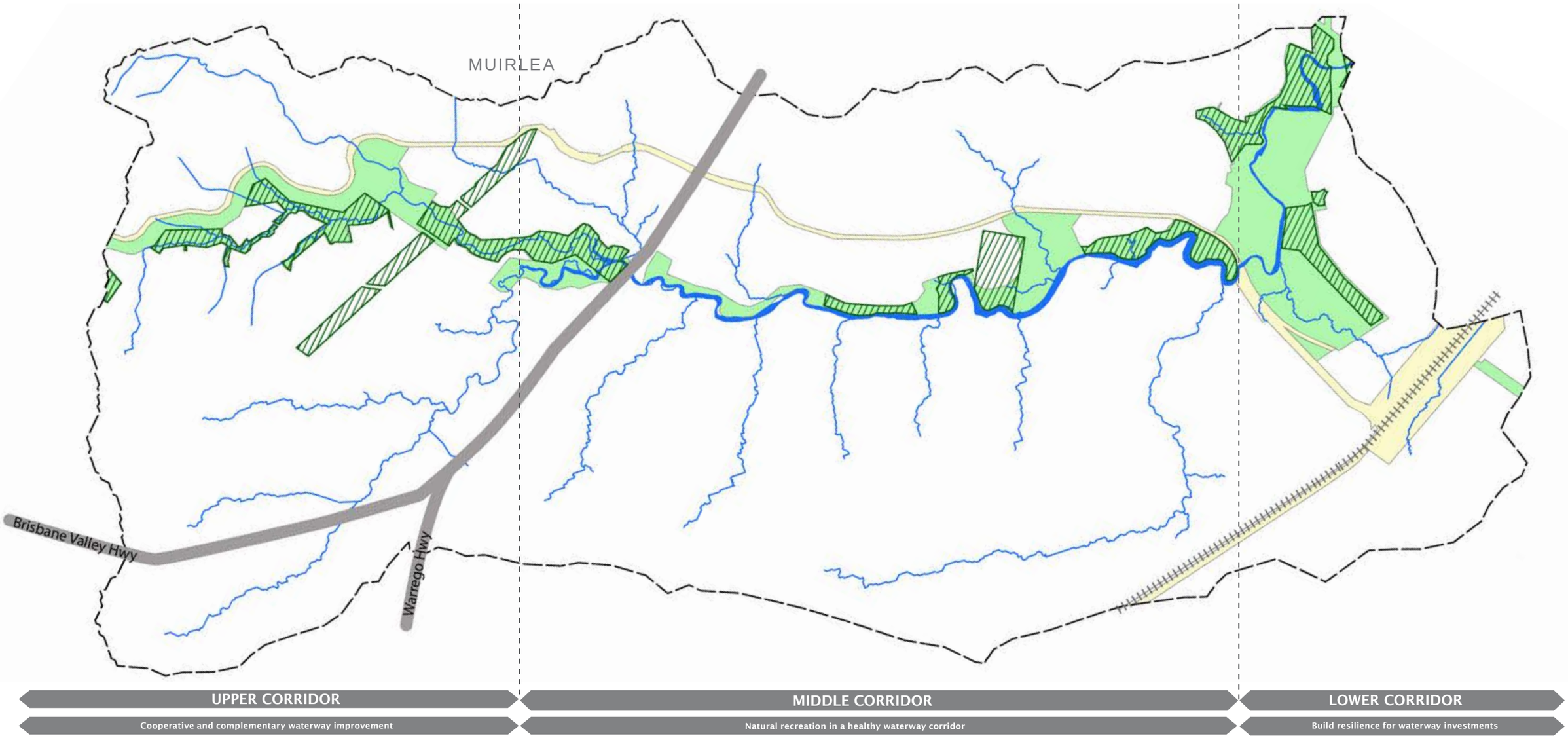
The outcome of this work was a common understanding of the waterway condition and agreement about its key values and issues which should drive the Corridor Plan development. This included identification of three sub-corridor areas and seven thematic layers to guide the development of spatially nuanced corridor management responses and interventions which respond appropriately to the current waterway condition.

3.2 Sub-Corridor Areas

The existing character of the waterway corridor is defined largely by the current channel condition and form. The surrounding land uses also have some influence on the channel characteristics along the corridor. Three high level sub-corridor areas were identified to describe the dominant corridor characteristics. These are presented in Table 2 and illustrated in Figure 7.

SUB-CORRIDOR AREA	CORRIDOR CONDITION	ADJACENT LAND USES	DIRECTIONAL FOCUS
Upper Corridor	The waterway corridor and contributing tributaries / gullies in the upper corridor are steep ephemeral systems within a well vegetated riparian corridor. Historic and recent erosion has resulted in considerable incision of the channel bed which now sits up to 4 m below the top of bank. The lowering of the bed level has resulted in steep, bare banks which are highly unstable and are susceptible to erosion and collapse. There is evidence of deposition in the channel and there is potential for large volumes of sediment to enter the waterway through the erosion of the banks. This reach remains highly active.	The upper catchment is characterised by large residential blocks located directly adjacent to the waterway. The instability of the waterway channel and its tributaries initiated by urban development and concentration of flows is now placing some of these land uses at risk. The creek alignment also incorporates informal open space and parkland areas connected by pathways to the residential areas.	“Cooperative and complementary waterway improvement” reflecting the desire to ensure works undertaken in this area are guided by an understood strategic framework, reducing the risk of over investment in ad hoc activities.
Middle Corridor	The waterway is relatively flat and wide in the middle corridor. The channel has experienced previous erosion and deposition in the floodplain. The deposited materials in the floodplain are relatively stable, with vegetation such as Lomandra establishing on it and a generally well-established canopy. However sub-channels are being re-eroded into the depositional material exposing approximately 1 m of sediment on the banks. It is likely that these exposed soils and deposits will continue to erode. While this reach is reasonably stable, active sediment transport can be expected to continue.	The western side of the majority of the waterway corridor is zoned Rural C. The eastern side of the corridor is zoned urban residential. Most of the residential development is underway or already approved. Open space and recreation land uses adjoin the creek corridor together with a shared pathway north of the motorway, and with limited access along the creek corridor south of the motorway corridor. Council are developing a Precinct Plan within this area and have identified a major sports park to be located along the waterway corridor as well as the new Brisbane Valley Rail Trail bikeway which will provide a key linear open space area away from the corridor.	“Natural recreation in a healthy waterway corridor” reflecting the desire to increase accessibility into this natural asset to build understanding of the corridor and provide natural recreational experiences which are connected to and compliment the new linear open space created with the Brisbane Valley Rail Trail bike path
Lower Corridor	The lower waterway corridor at the bottom of the catchment is characterised by a deeply incised steep corridor. It appears that the channel has eroded approximately 3-4 m below the natural bed level. The riparian corridor contains woody weeds which are currently being removed in sections resulting in large bare areas being exposed along the banks.	Open space surrounds the waterway which is a reflection of the flooding characteristics in this zone. Established residential suburbs border these open spaces. There is limited public or maintenance access to the creek corridor.	“Build resilience for waterway investments” reflecting the importance of channel works in this reach to stabilise the bed of the channel to protect upstream channel works from future erosion. Building awareness and community involvement with the waterway is also important to build ownership and resilience to waterway works.

Table 2. Sub-corridor areas



Legend

- Catchment outline
- Waterway
- Existing motorways
- Existing railway line
- Rail Corridor

  NB: Land area shown as corridor incorporates the former Brisbane Valley Railway Line which was removed in 1993
- The Corridor

  NB: Land area shown as corridor is based on the Recreation Zone from the Ipswich City Council Planning Scheme
- Existing ICC Open Space

0 250 500 1km 1.5km 2km

Source: Design team interpretation of corridor mapping supplied by ICC.

Figure 7. Sub-corridor areas

3.3 Channel Condition Summary

The current channel condition is a reflection of the waterway response to past impacts such as clearing of vegetation, urban development and the concentration of flows (e.g. from stormwater pipes or infrastructure crossings of the waterway). The level of impact can be estimated by identifying the likely pre-erosion condition for the waterway. This pre-erosion condition was estimated for Ironpot Creek based on field observations of the current surface levels of the banks and the age and locations of trees in the area. These observations have been used to inform the likely pre-erosion profiles for the three sub-corridor areas. These are presented in the following sections as a comparison to the existing profile conditions. A summary of the waterway response to impacts is also described, highlighting the processes which have impacted the channel condition. This understanding has been used to help develop suitable waterway improvement actions for each of these sub-corridor areas.

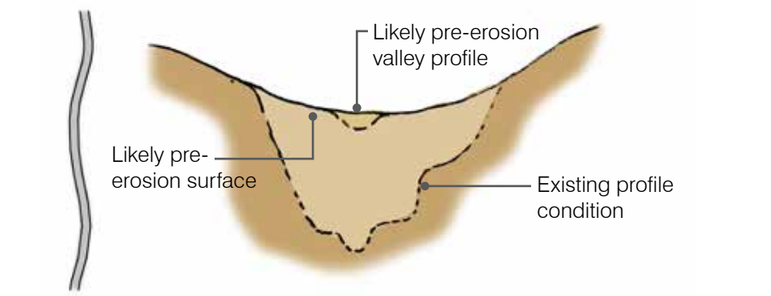
3.3.1 Upper Corridor

The likely pre-erosion valley profile for these upper reaches was probably ephemeral and may not have even included a defined channel.

Significant bed and bank erosion associated with urban development and the concentration of flows from infrastructure crossings has created a deep confined valley floor in this area. Erosion is still present which will remain active and continue to deepen and widen the creek until flows are directed away from the bank and the bank is either protected or re-vegetated.

SUB-CORRIDOR AREA	CURRENT CHANNEL CONDITION	LIKELY PRE-EROSION CONDITION
Upper Corridor	Relatively steep confined valley floor depression with a slight meander	Ephemeral depression with or without a small defined channel

There is evidence throughout the upper corridor that a number of interventions can start the observed erosion, from the clearing of vegetation for urban development to the construction of infrastructure. Clearing of vegetation and urban development results in increased volumes and frequency of stormwater runoff which causes waterway erosion. There are also a number of undeveloped, natural tributaries which are impacted from erosion which is caused by the concentration of flows through pipes and culverts associated with the construction of infrastructure and not urban residential development.



Character Zone 1: Upper Corridor

Figure 8. Existing vs likely pre-erosion condition of the Upper Corridor

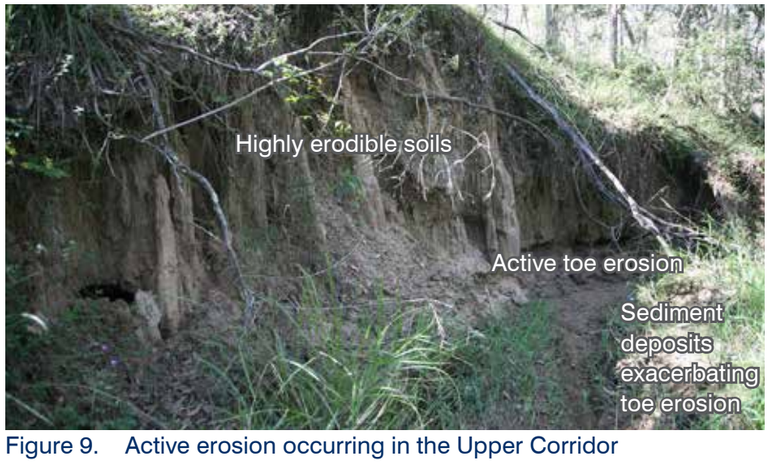


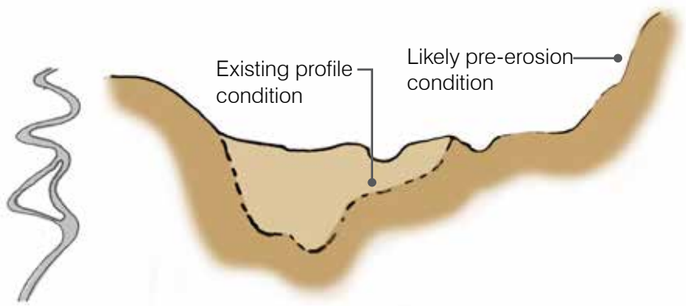
Figure 9. Active erosion occurring in the Upper Corridor

3.3.2 Middle Corridor

The likely pre-erosion profile for the middle flatter and wider reaches was probably a relatively small channel in a well vegetated floodplain. The current condition has a defined channel and shows evidence of both sedimentation and erosion with sites of active bed and bank erosion.

While the flow regime has changed, with a likely increase in stream power as a result of land use change, this impact has been partially counteracted by the increased sediment supply in this sub-corridor area. Natural recruitment of vegetation on the deposited sediments in these reaches has stabilised the banks in many locations. There are however areas being eroded and reworked by a series of small head-cuts. In such erodible sediments any break in vegetation cover can result in erosion without a series of floodplain wide grade control structures.

SUB-CORRIDOR AREA	CURRENT CHANNEL CONDITION	LIKELY PRE-EROSION CONDITION
Middle Corridor	Relatively flat floodplain with a meandering channel (including anabranches) in vegetated riparian corridor	Contained pools, runs and riffles within a relative small channel in a well vegetated floodplain



Character Zone 2: Middle Corridor

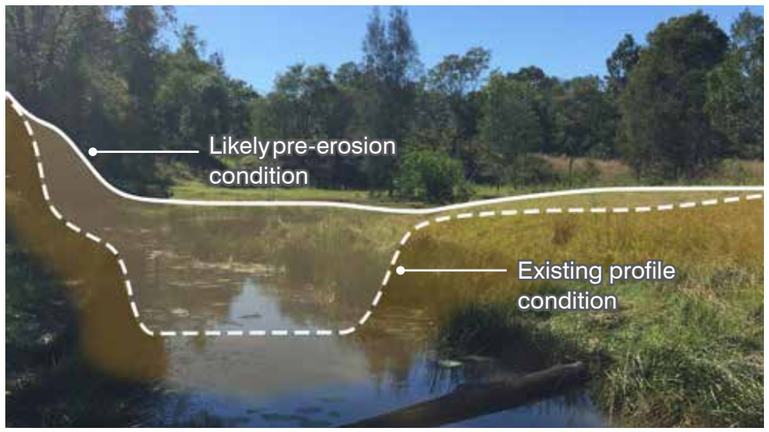


Figure 10. Existing vs likely pre-erosion condition of the Middle Corridor

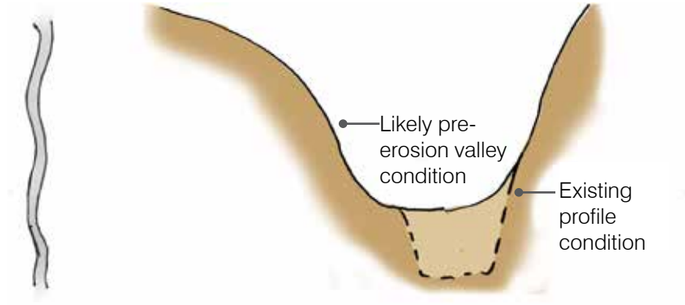
Figure 11. Stable banks (left), in-stream sedimentation (middle) and active head cut erosion (right) in the Middle Corridor

3.3.3 Lower Corridor

The likely pre-erosion profile for the lower reaches was probably a confined channel containing a series of pool and riffle habitats.

The current condition is a very deep, confined valley form showing several episodes of erosion.

SUB-CORRIDOR AREA	CURRENT CHANNEL CONDITION	LIKELY PRE-EROSION CONDITION
Lower Corridor	Relatively steep high confined reach with degraded bank vegetation	Fine gravel bed containing a series of pools and riffles with patchy stabilising vegetation



Character Zone 3: Lower Corridor

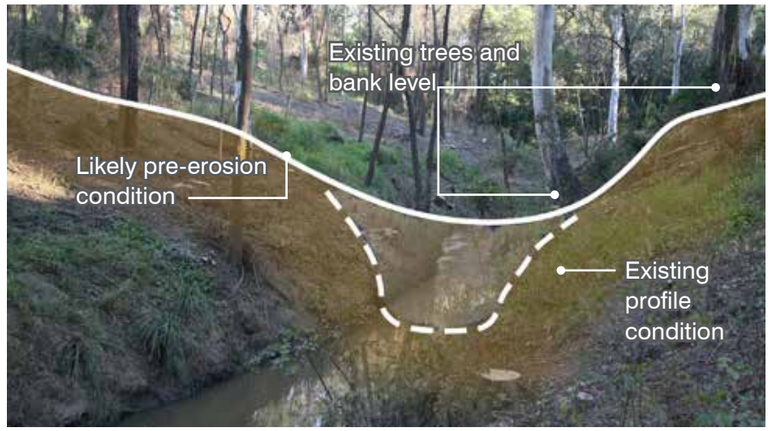


Figure 12. Existing vs likely pre-erosion condition of the Lower Corridor

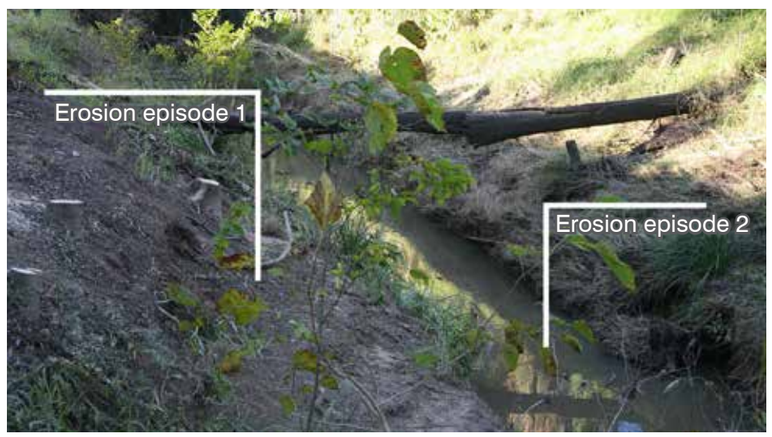


Figure 13. A number of erosion episodes were evident in the Lower Corridor

Channel form and habitat

Native vegetation

Cultural and landscape values

Land use

Infrastructure

Open space and recreation

Flooding

3.4 Corridor Plan Principles

A practical approach was employed to 'build-up' the Corridor Plan having regard to the current values, condition and pressures. The adopted approach established seven key 'Thematic Layers' for which specific corridor outcomes and principles were then identified. These principles were then used to guide the identification of opportunities across the corridor to deliver the high level directional focus established for each sub-corridor area.

3.4.1 Thematic Layers & Principles

Seven thematic layers were used to further define and characterise the corridor and to establish principles to guide the development of the Corridor Plan. The seven thematic layers are:

+ Channel form and habitat
+ Native vegetation
+ Cultural and landscape values
+ Land use
+ Infrastructure
+ Open space and recreation
+ Flooding

3.4.1.1 CHANNEL FORM AND HABITAT

The historic removal of vegetation in the catchment and the increased volume and concentration of catchment flows associated with development of buildings, roads and other infrastructure have impacted the health and condition of Ironpot Creek.

The form of the channel has been significantly impacted by the change in catchment conditions with major erosion and sedimentation evident along the corridor. The condition of this channel form and aquatic habitat were both classified as 'Moderate' in the Ipswich Waterways Condition Scorecard Results (Alluvium 2014). While channel form and aquatic habitat may be in moderate condition in some locations, our recent inspections suggest that the condition to be poor in many locations due to the presence of major channel geomorphic instabilities as a result of bed and bank erosion.

The soils in the upper sub-corridor are predominately Sodosols which have a weak structure with a firm, hardsetting surface. These soils can also sometimes have dispersive subsoils. The active erosion in the upper reaches is impacting adjacent properties. There are a number of these properties which have undertaken ad-hoc stabilisation works to protect their land. There was also investment in major stabilisation works at Walter Zimmerman Park and Wairuna Court.

The middle corridor is predominately Kandosols which are characterised as porous and friable soils with no structure. These are not dispersive but the reduced cohesion means they are susceptible to rill, sheet and stream bank erosion. There are areas which have stabilised in the middle corridor, largely due to the presence of woody debris creating snag dams in the channel and also the shade provided by the riparian zone cover supports microclimates suitable for epipelagic algae to stabilise the soils. However there is evidence that the deposited materials in the corridor are eroding in some locations.

Erosion episodes in the lower sub-corridor have created a deep channel with steep banks. There have been some stabilisation works undertaken near the confluence with the Bremer River. The soils in this area are predominately Dermosols which are typically well structured soils.

Overall, the erosion and aggradation of sediment within the channel has reduced habitat complexity and the water quality is likely to have been impacted from the rural and urban land uses in the catchment. The good riparian vegetation cover however does provide shade and woody debris which would be beneficial for the in-stream habitats. There is no water quality, macroinvertebrate or fish data available for Ironpot Creek, however studies in the Bremer River identified a mix of native and introduced species (FRC, 2014). The fish movement from the Bremer through the Ironpot Creek Corridor would however be limited by the change in bed levels and creek crossings.

Corridor Plan Principles

The following principles were identified to ensure waterway health is improved:

+ Adaptive management of eroding bed and banks using measures which can be practically achieved and respond to existing conditions and dynamic channel form
+ Protection and enhancement of riparian buffer to help support healthy in-stream conditions
+ Best practice erosion and sediment control to be adopted on all new developments and works within the catchment to manage construction phase stormwater runoff
+ Stormwater outlets and new infrastructure designed to ensure they don't concentrate flows which could lead to further bank erosion

Legend

- Catchment outline
- Waterway
- Kandosols
- Kurosols
- Rudosols (Stratic)
- Dermosols
- Sodosols
- Riparian (Eucalypt dominated)
- Riparian (Highly disturbed)

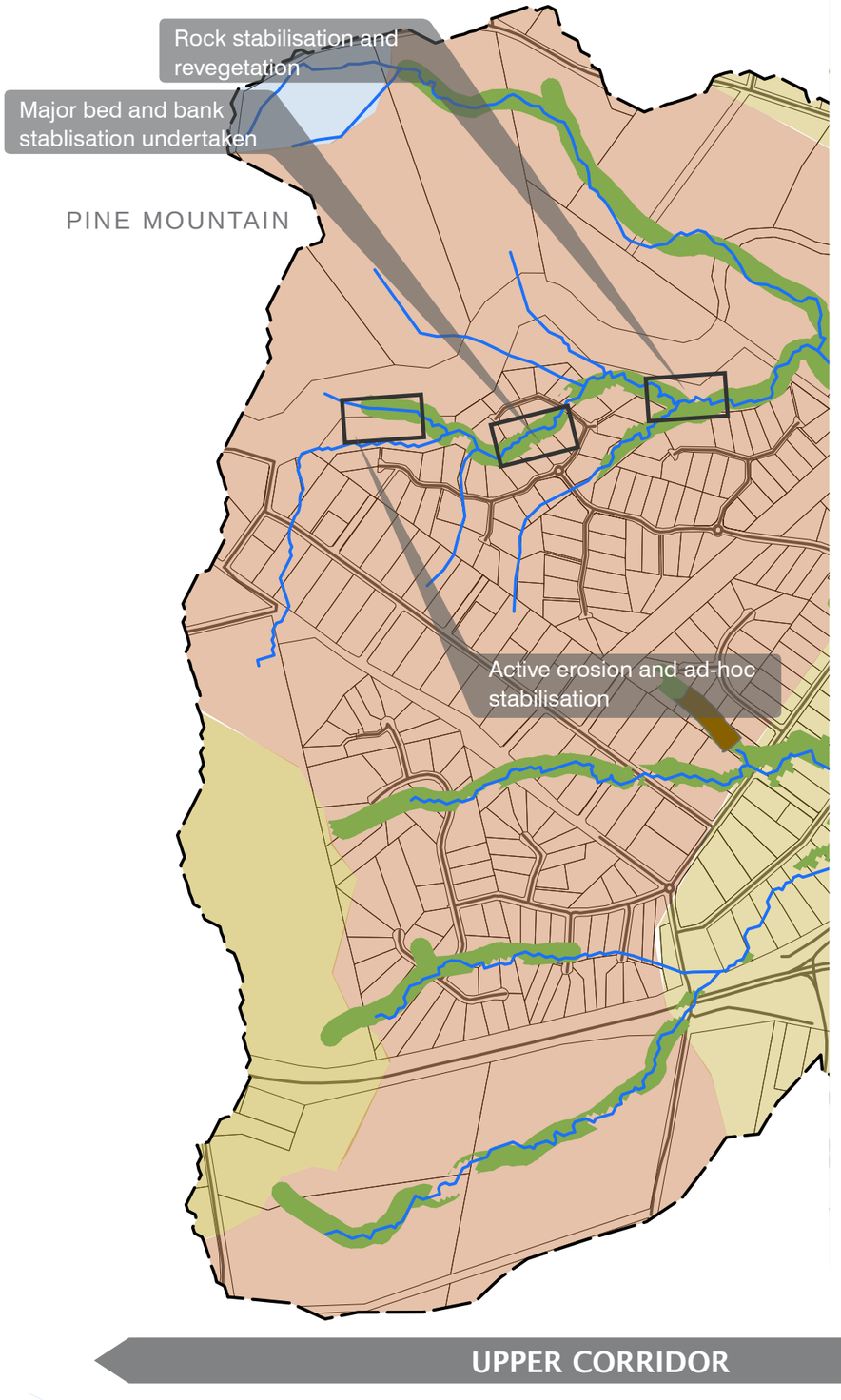
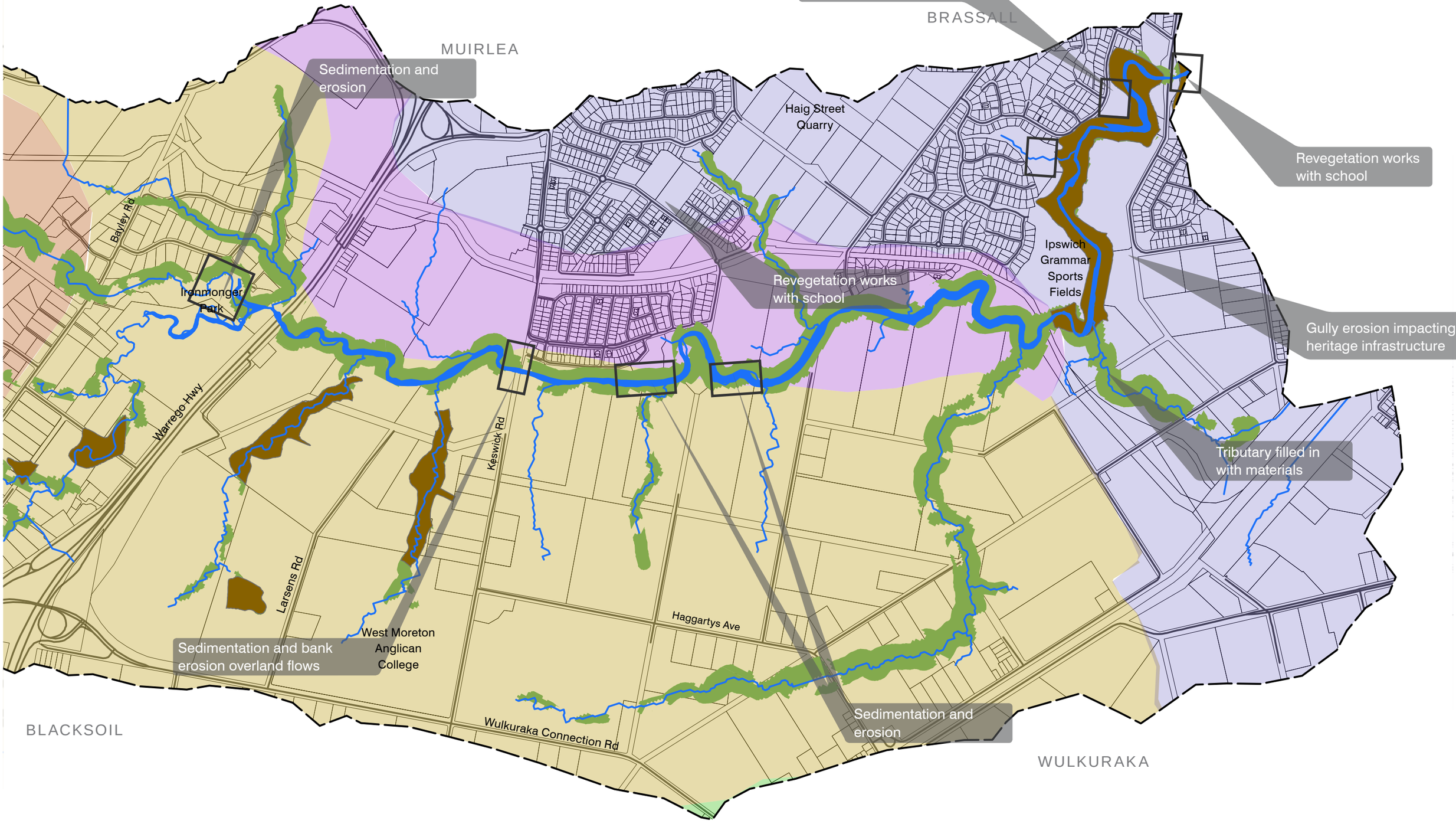


Figure 14. Ironpot Creek Channel Form and Habitat



MIDDLE CORRIDOR

LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.4.1.2 VEGETATION

The vegetation along the Ironpot Creek Corridor can be broadly described as Eucalypt woodlands to open forest. Remnant vegetation mapping by the State Government (2013) identifies that regional ecosystem 12.9-10.2 which contains ***Corymbia citiodora*** and ***Eucalyptus creba*** occurs throughout the area. This vegetation community is classified as 'least concern' in the ***Vegetation Management Act (VM Act)***.

The upper corridor catchment is dominated by dry sclerophyll forest types consistent with the RE mapping (mostly RE 12.9-10.2 and 12.9-10.3) which is classified as 'of concern' under the VM Act. This area is also identified In Council's Nature Conservation Strategy as a large habitat area and part of a 'priority system investigation area'. There are also a number of Class 2 and Class 3 declared species recorded in the upper reaches (Singapore Daisy, fireweed, groundsel, mother-of-millions and prickly pear) (AWC and Bligh Tanner, 2013).

In the middle corridor catchment between Bayley Road and Diamantina Boulevard there is a section of vegetation which is classified as endangered and is broadly consistent with RE 12.3.3 (***Eucalyptus teretcornis***). The lower corridor catchment also contains regional ecosystem 12.9-10.3 (***Eucalyptus moluccana***) which is 'of concern'.

Generally there is a good riparian buffer width along the corridor. The condition of this riparian vegetation was classified as 'Good' in the Ipswich Waterways Condition Scorecard Results (Alluvium 2014) which identified that the longitudinal connection, cover and structural complexity was good but there are weeds present which reduces the native species diversity. While the Eucalyptus species dominate the canopy along the riparian corridor, wattle species, red ash (***Alphitonia excelsa***) and scattered ***Allocarusarina littoralis*** make up much of the mid storey while the ground layer is sparse and comprises both native grasses and weed species (billygoat weed, lantana, Rhodes grass, paspalum) (AWC and Bligh Tanner, 2013).

The wide and continuous corridor provides a good ecological corridor and provision of habitat for native fauna, including koalas. Mapping identifies areas of bushland throughout the corridor which is good value and is suitable for rehabilitation. The middle and lower corridor catchments also lie within the 'Koala Assessable Development Area' and contains areas of bushland which is identified as suitable for rehabilitation.

There have been a number of revegetation and weed management works undertaken along the corridor including:

+ Walter Zimmerman Park weed management and planting in 2010
+ Woody weed removal by the Ipswich River Improvement Trust near Gregory Street Reserve in 2015
+ Community revegetation in Wallaby Ware Park (2014/2015)

It is understood there is also outstanding bonds associated with riparian rehabilitation works along Moonlight Drive in the middle corridor associated with the urban development in this area.

There are a number of vegetation management partnership sites through the Land for Wildlife and Habitat Garden programs across the catchment. These partnership programs provide important vegetation management outcomes on private lands.

Corridor Plan Principles

The following principles were identified to protect and enhance the vegetation:

+ Areas of remnant vegetation, especially areas of significant vegetation types and koala habitat are protected and enhanced
+ Riparian rehabilitation works to be undertaken as required as part of development
+ Weed management and vegetation works undertaken in partnership to enhance corridor vegetation values and maintain bank stability
+ Community involvement and ownership over revegetation works
+ Strategically target private landowners for waterway partnerships to enhance corridor connections

Legend

- Catchment outline
- Waterway
- C. citriodora / E. siderophloia / E. crebra
- Riparian (eucalypt dominated)
- Riparian (highly disturbed)
- E. moluccana
- Essential Habitat (***Nature Conservation Act 1992***)
  - Of Concern Vegetation
  - Endangered Vegetation
- Koala Assessable Development Area (KADA)
  As defined under State Planning Regulatory Provisions (SPRP)
  - High Value Bushland Habitat (SPRP)
  - Medium Value Bushland Habitat (SPRP)
  - High Value Rehabilitation Habitat (SPRP)
- Land for Wildlife
- Habitat Gardens

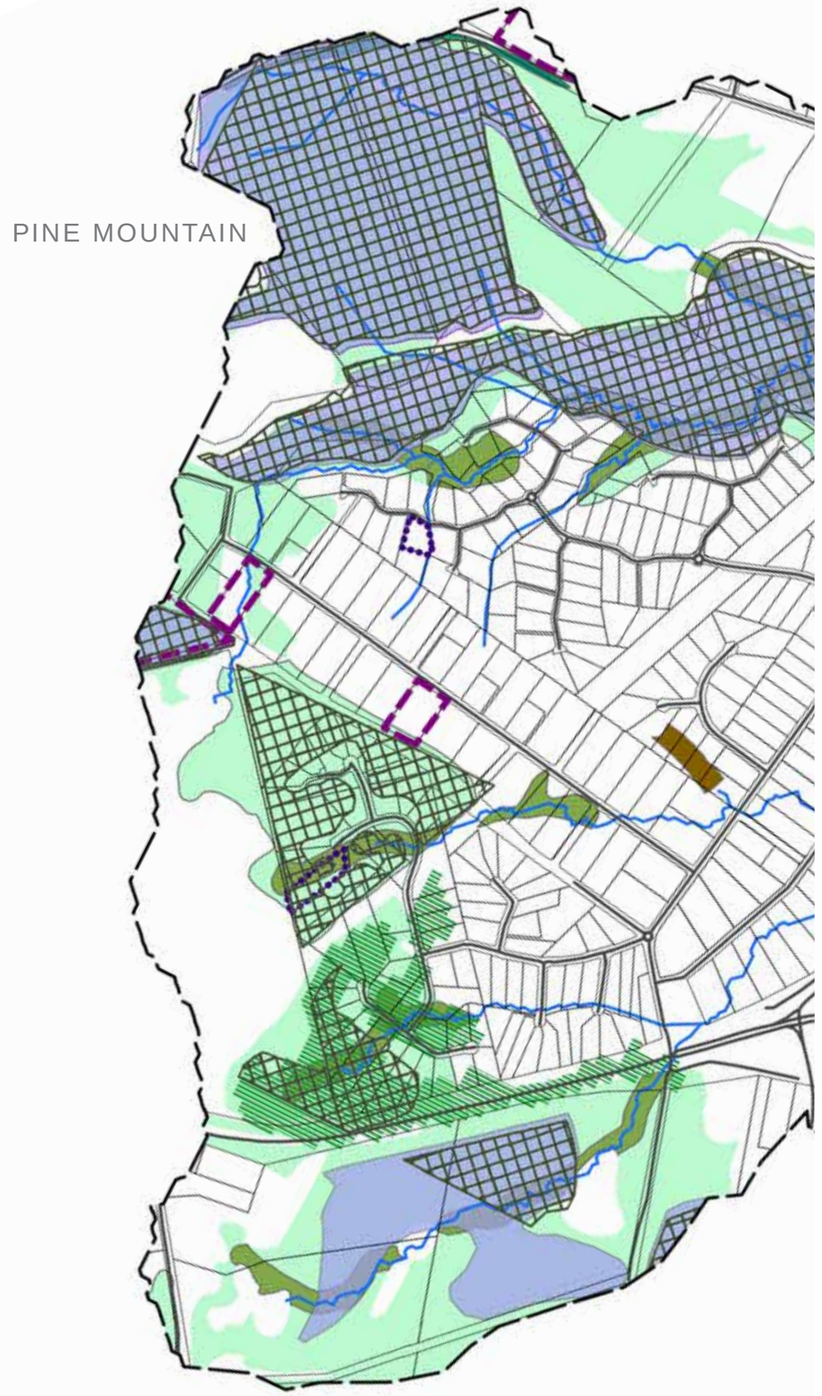
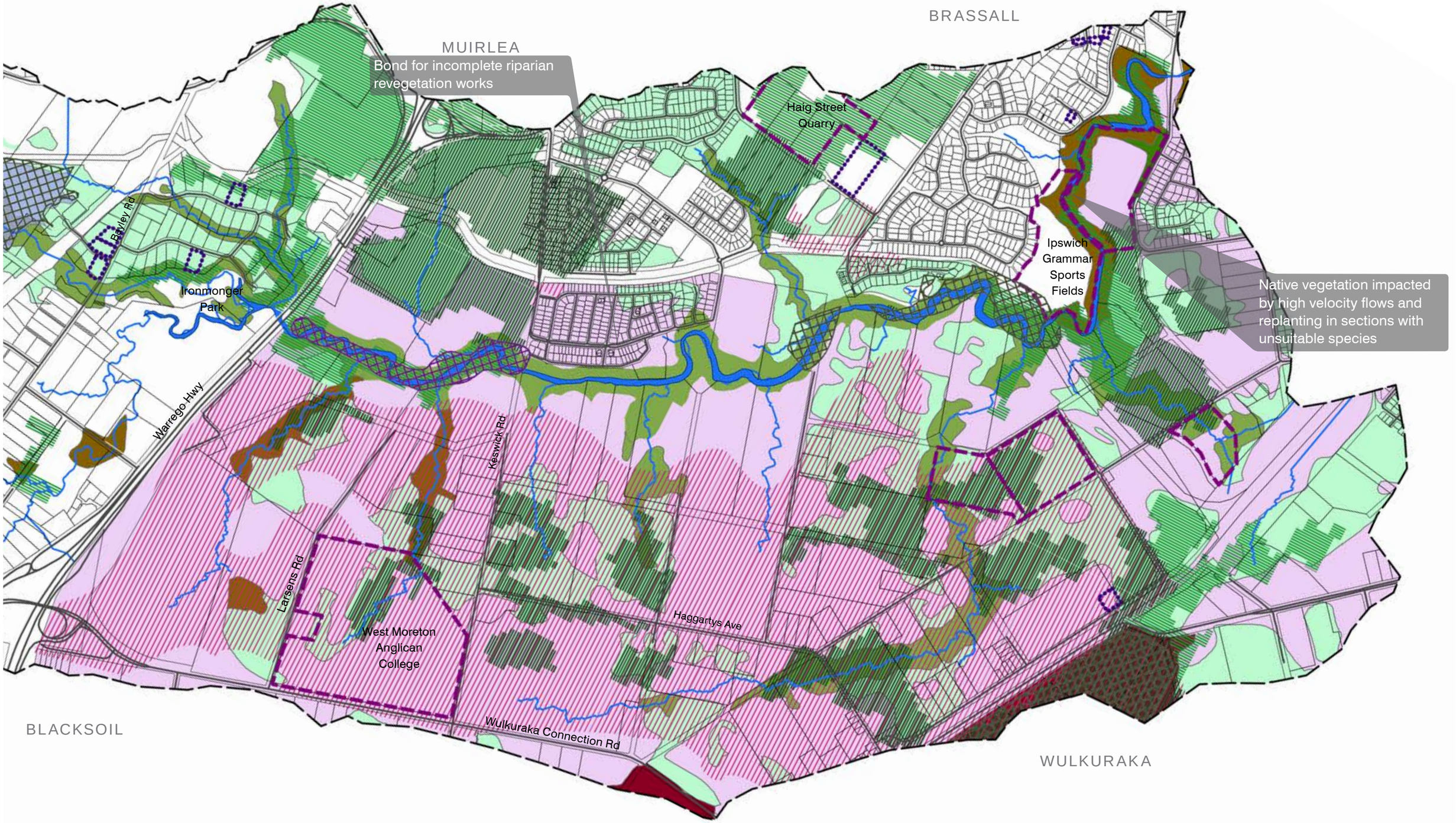


Figure 15. Ironpot Creek Vegetation

Prepared by E2Designlab, Bligh Tanner & Tract for Ipswich City Council



MIDDLE CORRIDOR

LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.4.1.3 CULTURAL AND LANDSCAPE VALUES

The Ironpot Creek Corridor provides a significant natural feature in the catchment, and contains important cultural and landscape values.

While the indigenous cultural history is currently undocumented for this creek, it is likely that this creek corridor was an important place for the local traditional owners. Historically it is also understood that there were popular swimming holes / rock pools in the lower reaches of Ironpot Creek. Anecdotal evidence also suggests that these rock pools are still used by the community.

Queensland's first railway passed through the catchment providing an important heritage trail. The Brisbane Valley Rail Trail follows this disused rail line that commenced construction at Wulkuraka in 1884. A remnant sandstone culvert in Wulkuraka which was constructed in 1864/5 is one of the few surviving remnants of this railway.

As a landscape feature, the corridor provides a visual framework for surrounding development and a resource for existing and future recreation and access. Although impacted through past clearing and the changes to the hydrological character of the original waterway, the associated vegetation contains some noteworthy mature trees and other vegetation of individual quality. Other areas of regeneration provide a semi-natural contrast to the adjoining suburban developments and a green edge to the boundaries of the corridor. Where roads and pathways cross the corridor there are views afforded of the creek alignment itself and occasional longer distance views. These provide a natural contrast and visual relief to the development areas which enhance the overall character of the area.

Corridor Plan Principles

The following principles were identified to protect and enhance the landscape and cultural values:

+ Sites of cultural heritage will be treated respectfully
+ Heritage sites will be understood and cherished by the community
+ Landscape values will be retained through the protection and enhancement of the riparian buffer
+ The corridor is valued for its landscape values, providing a visual break to adjacent land uses and offering a natural environment experience
+ Creation of a identity for the Ironpot Creek Corridor

Legend

- Catchment outline
- Waterway
- Brisbane Valley Rail Trail Route (unopened)
- Former Brisbane Valley Railway Stations (approximate location)
- Sandstone Railway Culvert and Remains (State Heritage Register)
- State Heritage Listing land parcel
- Identified Heritage Place Listing land parcel
- Historic Miscellaneous Heritage Listing land parcel
- Recreation
- Conservation

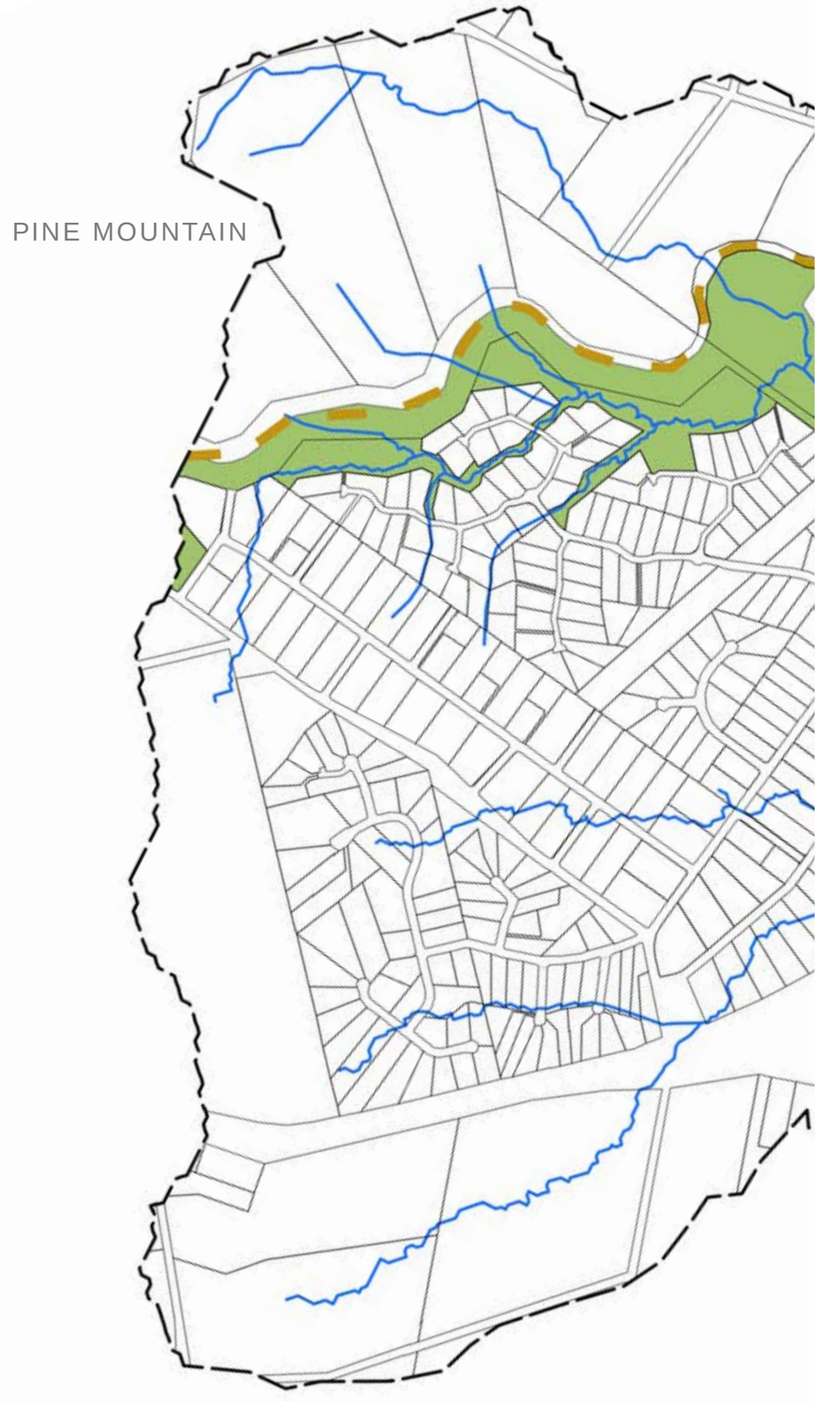
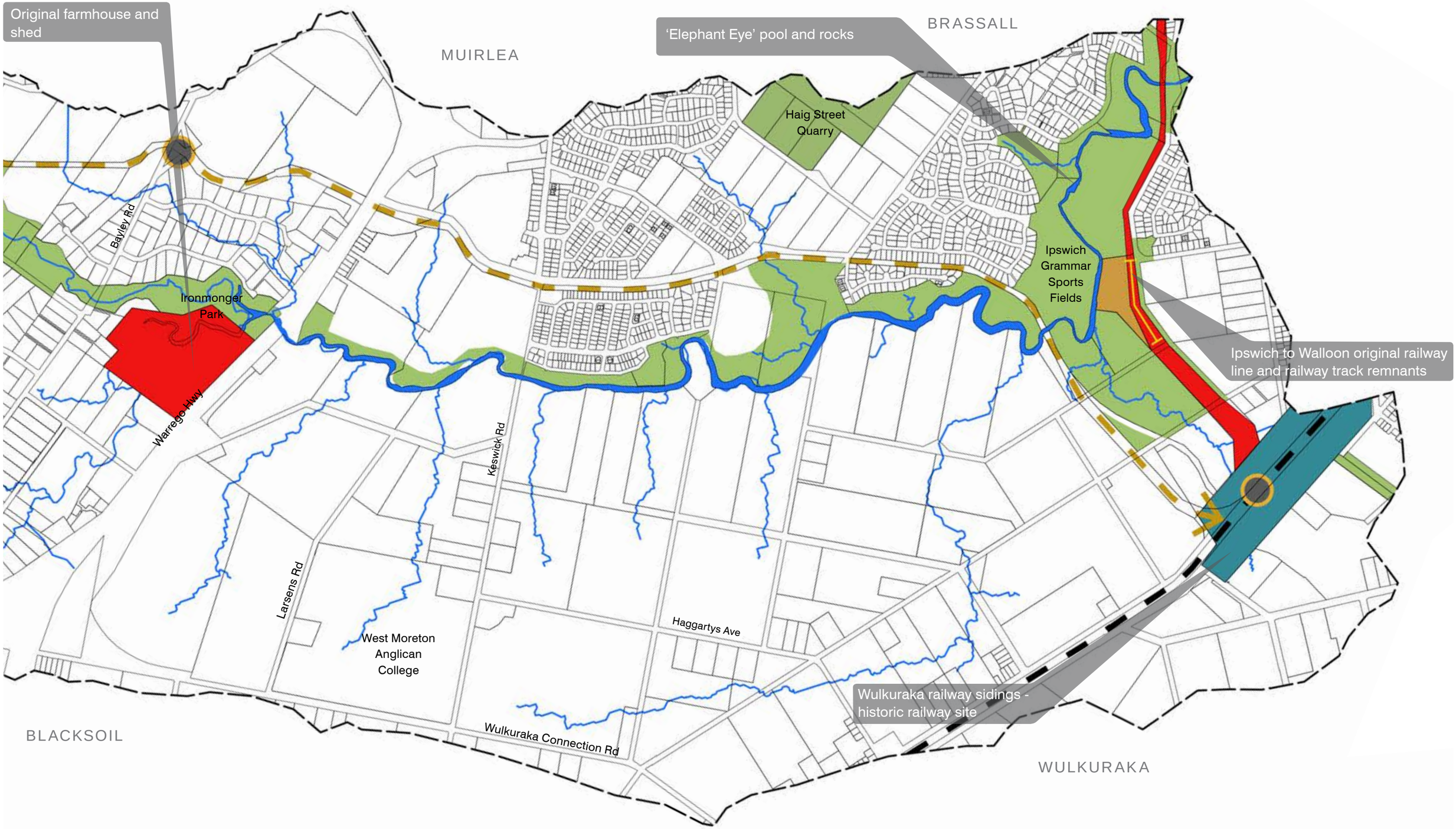


Figure 16. Ironpot Creek Cultural and Landscape Values



MIDDLE CORRIDOR | LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.4.1.4 LAND USE

Ironpot Creek traverses four main land use types – large lot residential, rural C, low density residential and recreation / open space. There are also a number of special use zones which include schools and the railway corridor.

The headwaters of the waterway drain through an open space corridor (drainage reserve) which is directly adjacent to large lot residential properties. There are a number of these allotments which are being affected by erosion associated with the waterway channel and its tributaries.

Downstream of the Warrego Highway, the waterway corridor is bordered by Rural C zoned land on the western bank and low density residential zoned land on the eastern bank. Much of this development on the eastern bank is underway or already approved with only a few lots which are yet to be approved for development. A linear recreation / open space corridor has been provided between this residential development and the waterway channel.

In addition to the zoning affecting land located in this catchment, a number of additional overlays are triggered under the Planning Scheme that may affect the further development of the rural zoned land on the western bank in the future. The overlays generally affecting the site is in response to the nearby location of the Amberley Defence Base and are to mitigate issues around, noise, height and light regulations. In addition to the mapping overlays provided within the Ipswich Planning Scheme, State Government mapping that identifies matters of state interest (such as Queensland Heritage Register, Biodiversity Mapping and Agricultural Land Classifications) would also need to be considered as part of any future development approvals.

Downstream of the old rail crossing, Ironpot creek moves through a large open space corridor which has a number of sporting fields and parklands located within it. Established low density residential suburbs surround this open space zone.

Corridor Plan Principles

The following principles were identified to enhance the connection of the corridor to the adjacent land uses:

+ The corridor is valued and enhanced as a continuous linear green network
+ Risk to adjacent land uses is minimised through waterway health improvement works
+ Partnerships with private landholders helps to deliver the corridor vision

Legend

- Catchment outline
- Waterway
- Rural A (Agricultural)
- Rural C (Rural Living)
- Residential Low Density
- Large Lot Residential
- Special Use
- Recreation
- Conservation
- Local Business and Industry
- Local Retail and Commercial
- Regional Business and Industry (Low Impact Sub Area)
- Regional Business and Industry Investigations (Medium Impact Sub Area)
- DA Approved Sites 2015 (urban residential)

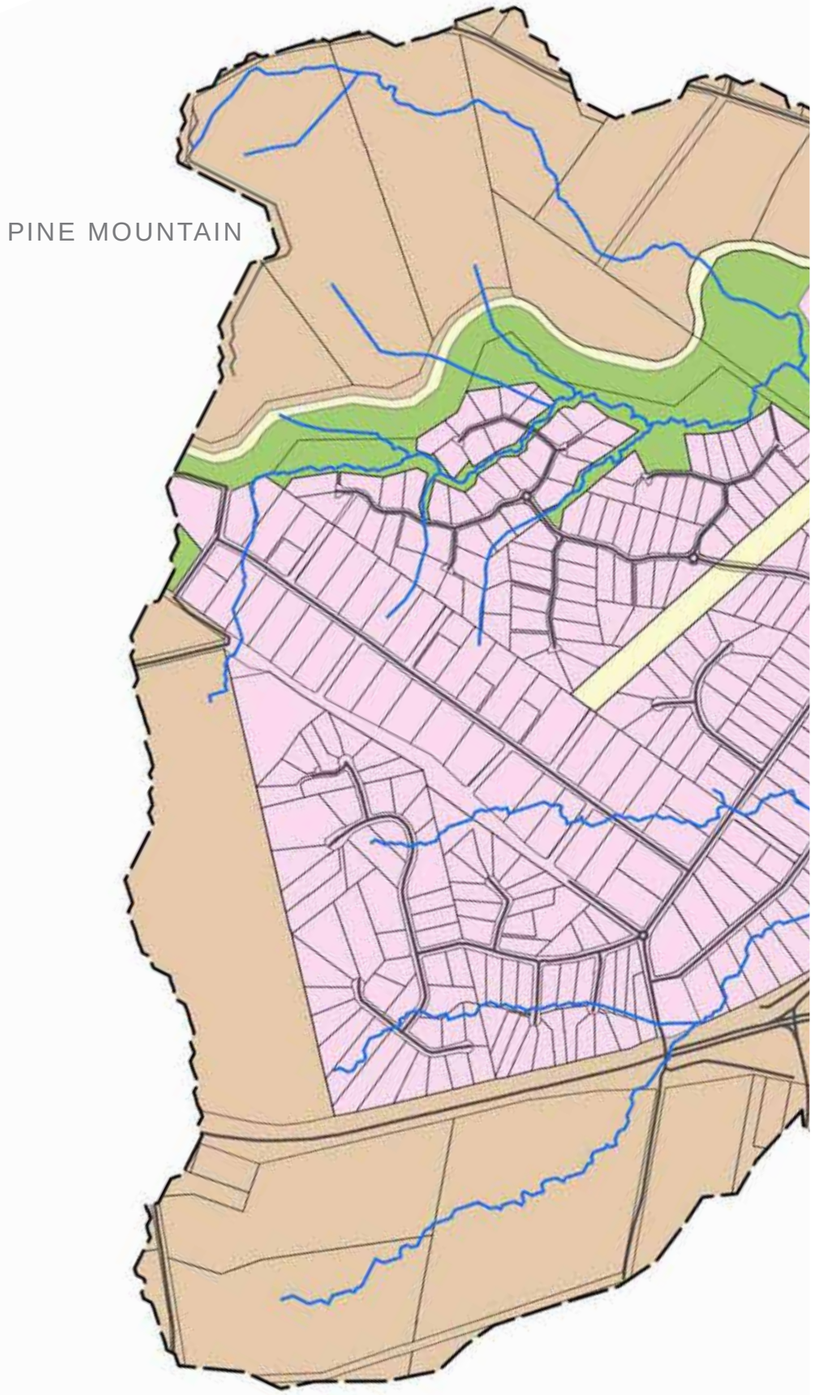
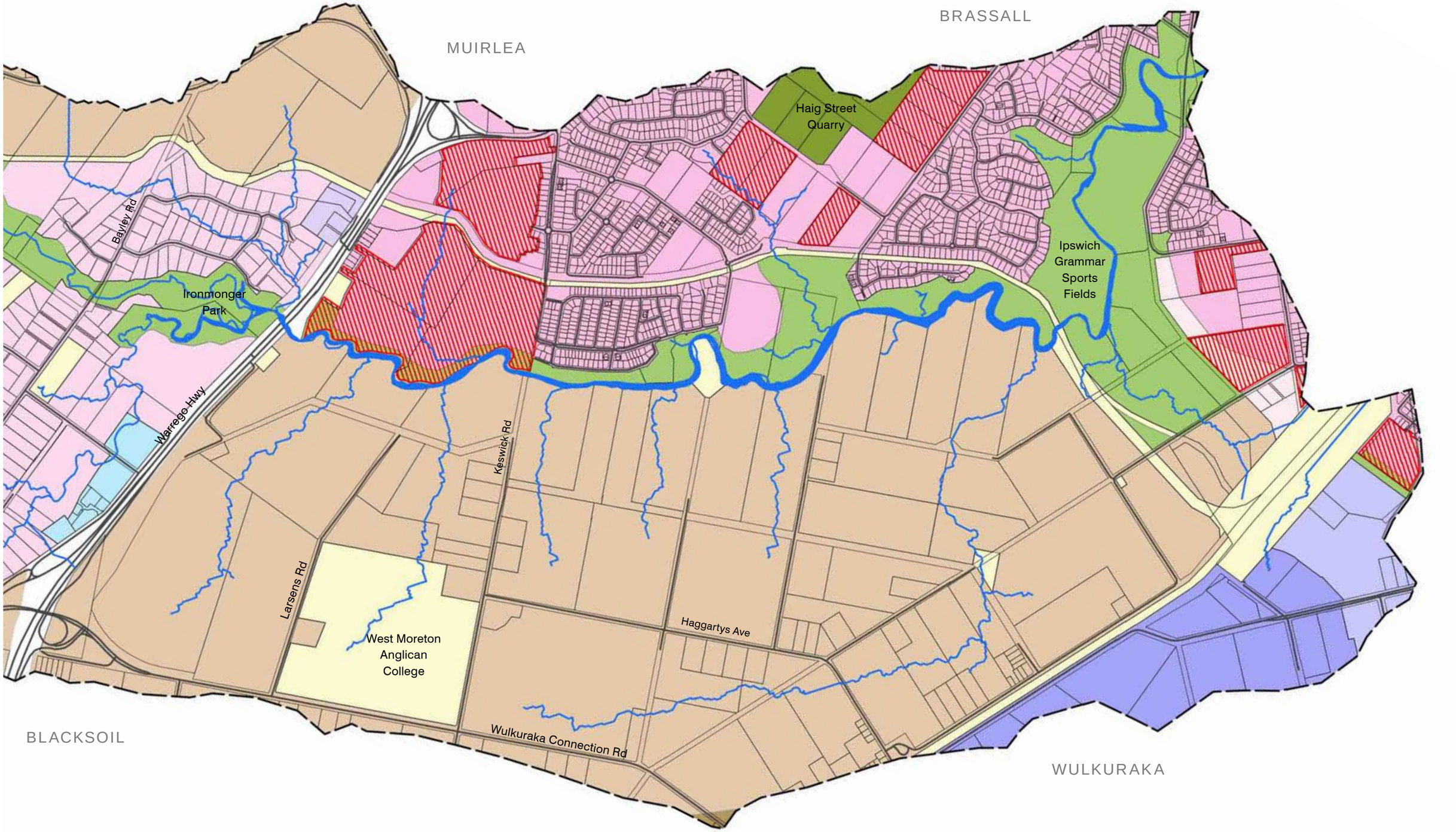


Figure 17. Ironpot Creek Land Uses



MIDDLE CORRIDOR

LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.4.1.5 INFRASTRUCTURE

There are a number of transport infrastructure projects planned for the catchment including road extensions and upgrades and the construction of a new bike path. The first stages of the new bikeway have been constructed. This bike path will follow the Brisbane Valley Rail Trail (BVRT) up into the upper catchment area of Ironpot Creek. This bikeway currently crosses Ironpot Creek at Sydney Street. Stage 4 of the bikeway has been designed (14/15) and will be constructed in 2015/16. This will incorporate two creek crossings – one over Ironpot Creek and one over a tributary. Stage 5 is planned to be designed in 15/16 and constructed in 16/17. This involves one crossing of Ironpot Creek. Stage 6 is planned to be designed in 16/17 and constructed in 17/18. This bikeway is a large investment by Council and will be a main active transport corridor with a 4 m wide path, supported by lighting, surveillance cameras and seating. The road projects are long-term, with planning studies currently underway for the Brassall-Karrabin Connection road which will cross the creek in the middle catchment. There are also long term plans for an orbital road system for the city which would involve an upgrade of the Sydney Street bridge.

The majority of the catchment is not currently serviced by a sewer network. A new sewer pipe has been recently constructed by the West Moreton Anglican College across the waterway where the future Brassall-Karrabin Connection road will be constructed. There is also a power easement in the upper corridor which crosses the catchment and Ironpot Creek. This corridor is managed and operated by Energex.

Stormwater infrastructure for new urban developments are required to manage stormwater runoff to achieve the targets presented in the State Planning Policy (and previously required from the SEQ Regional Plan 2009-2031 Implementation Guidelines No. 7 2009). Therefore any new urban development large enough to trigger the policy within the Ironpot Creek catchment since 2009/10 has needed to meet these requirements and this has resulted in a number of stormwater management systems being designed and delivered across the catchment. It is understood however that a number of these systems which have not been finished to an appropriate standard, leaving a bond with Council for these incomplete works. However, Council have started accepting stormwater quality offsets which provides a pathway for new developments not to deliver on-site stormwater quality treatment. It is recommended that the appropriateness of offsets in this location be reviewed given the impacts of urban development on waterway stability.

Corridor Plan Principles

The following principles were identified to ensure the corridor is considered in infrastructure projects:

+ Infrastructure crossing the waterway corridor is designed to consider waterway health improvement works (including sufficient bridge width to allow for the natural lateral movement of the channel, culvert depth to reduce risk of future head cut erosion and ensuring batters are well vegetated and protected at all times)
+ Identity / branding used to inform and connect road and bike path users with the corridor
+ Water Sensitive Urban Design principles adopted for all new developments and potential retrofit in existing urban areas to manage stormwater discharges to the creek

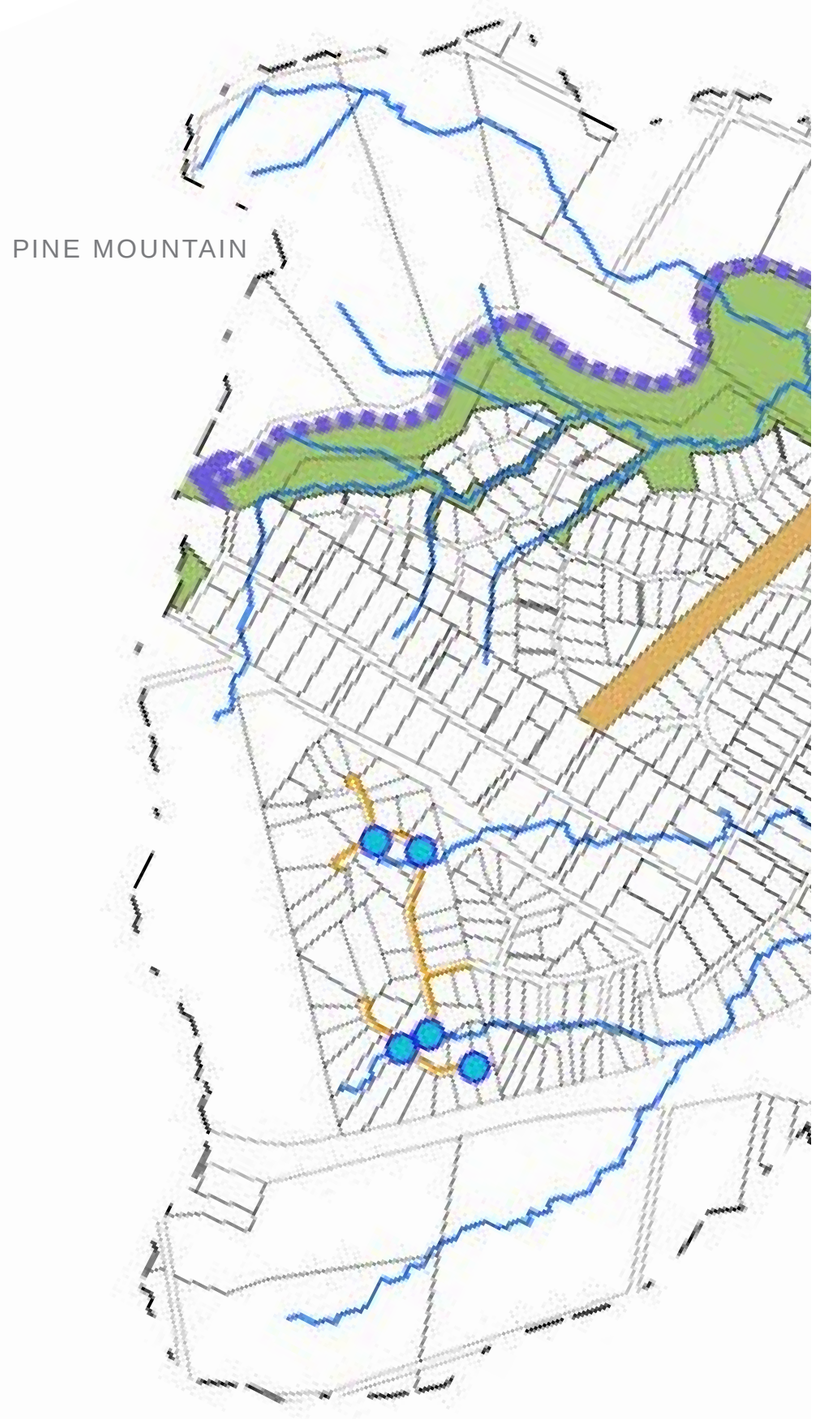


Figure 18. Ironpot Creek Infrastructure

Planned future Bayley Road Extension

MUIRLEA

Planned future local pedestrian connection

BRASSALL

Planned future Ipswich City Centre Orbital Road System western section

Haig Street Quarry

Bayley Rd

Ironmonger Park

Ipswich Grammar Sports Fields

Warrego Hwy

Keswick Rd

Planned future Brassall – Karrabin Connection Road (pedestrian/ bike crossing to come first)

Larsens Rd

West Moreton Anglican College

Haggartys Ave

BLACKSOIL

Wulkuraka Connection Rd

WULKURAKA

West Moreton Anglican College

MIDDLE CORRIDOR

LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.4.1.6 OPEN SPACE AND RECREATION

A recreation / open space corridor follows the waterway alignment, creating a central spine along the corridor. There are a number of existing Council parks within this corridor. There are also some high risk areas where these open spaces are adjacent to steep and deep unstable banks (e.g. in the upper sub-corridor area).

Council is currently developing a Precinct Plan for Division 6 which encompasses much of the middle and lower sub-corridor areas. This Precinct Plan assesses the urban areas to ensure that open space planning is informed by community needs and demographic profiles. This process identifies where and how open space embellishments can be distributed across the precinct to achieve better recreation outcomes.

This Precinct Plan has identified the location of a new sports park to be developed in the middle sub-corridor area. This local sports park will likely include two rectangle fields, one oval, some courts, a clubhouse and a playground. Preliminary bulk earthwork designs have been undertaken, but the master planning and detailed design of the parkland are still to be completed.

The Precinct Planning process also identified the importance of a new bikeway following the BVRT as a key linear open space. The Brisbane Valley Rail Trail (BVRT) provides North-South pedestrian movement parallel to Ironpot Creek. With the exception of the local sportsground, the BVRT alleviates pressure for the riparian corridor to function as a linear park reducing the need to accomodate park embellishment.

Corridor Plan Principles

The following principles were identified to ensure the corridor delivers amenity and user experiences which compliment other open space initiatives:

+ Corridor provides a natural recreation experience which has connections to the main linear open space provided by the new bike path
+ Local parklands provide destinations which allow for informal access into the corridor.

Legend

- Catchment outline
- Waterway
- Existing Pathways and Footpaths
- Local Ped/Cycle Connections
- Future BVRT / Brassall Bikeway
- Local Crossings (identified during site visit)
- Network Decision-Making Nodes
- ICC Open Space
- Recreation
- Conservation
- Special Use / Vacant
- Special Use / Corridor
- Special Use / School
- Special Use / Infrastructure Corridor
- Division 6 Precinct Plan Boundary
- Master Planning Investigation Area

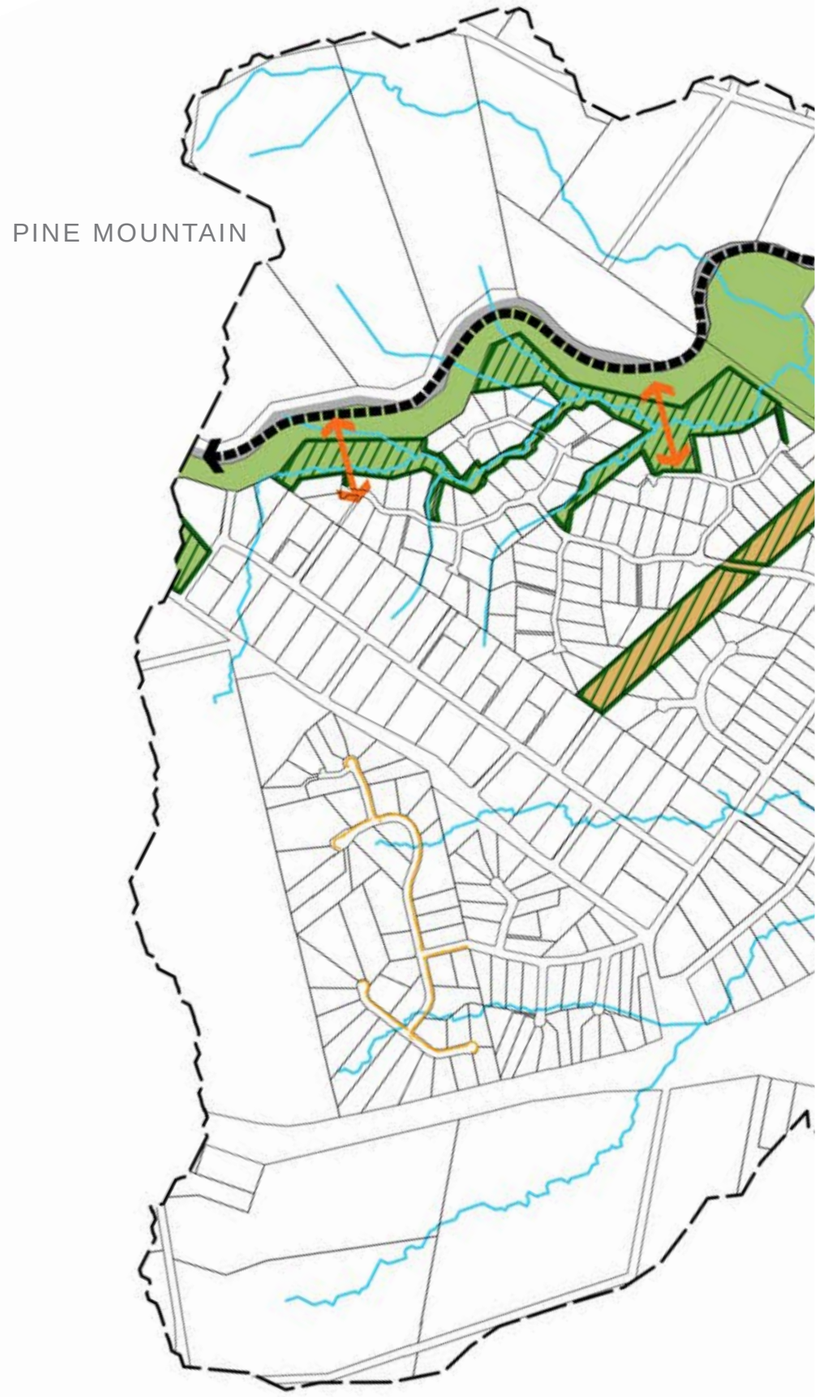
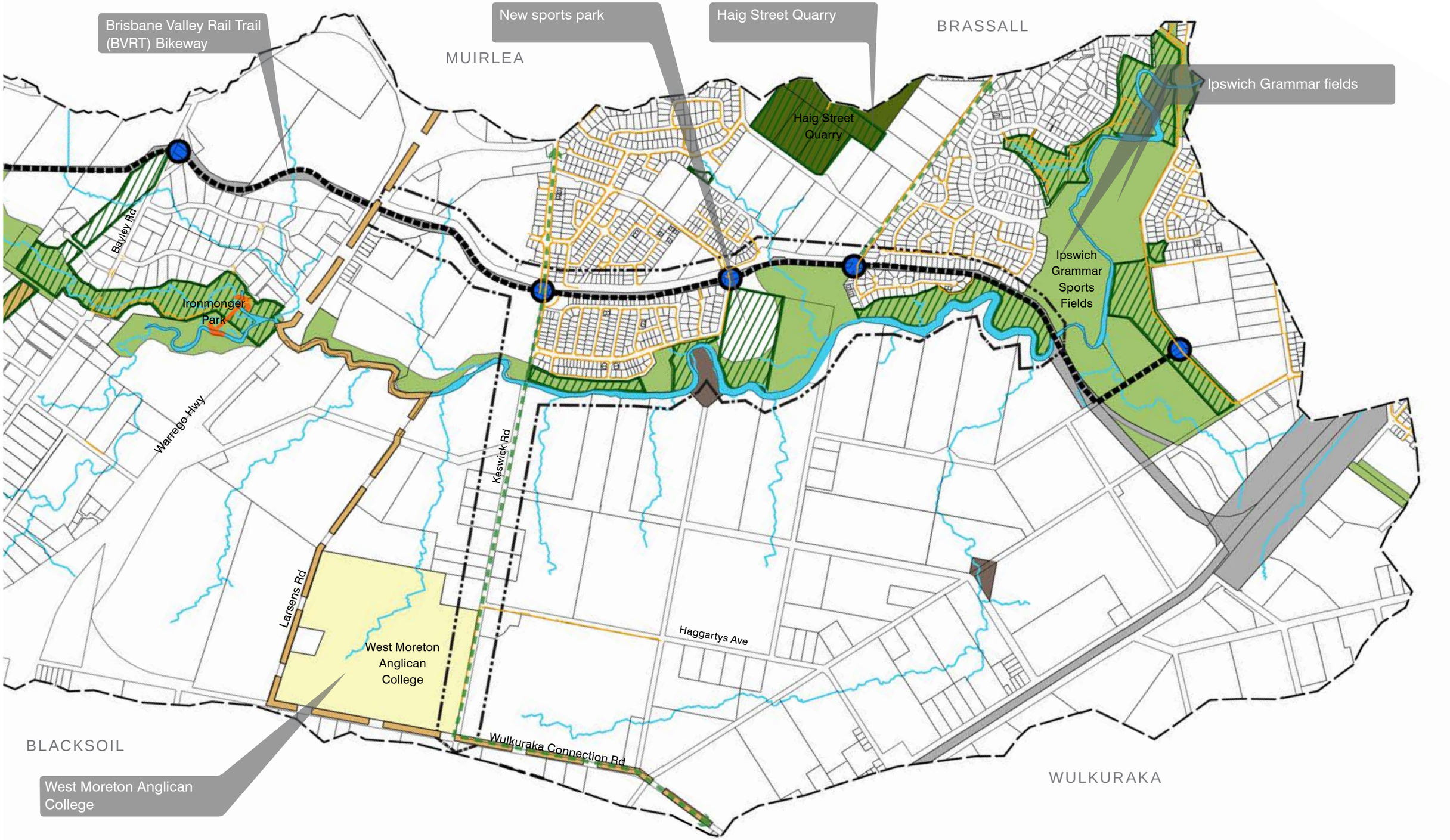


Figure 19. Ironpot Creek Open Space



MIDDLE CORRIDOR

LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.4.1.7 FLOODING

The Ironpot Creek Corridor is influenced by both local creek and overland flooding as well as flooding from the Bremer River. The last flood study undertaken on all of Ipswich waterways was in 2000 (SKM). The current flood mapping and flood regulation line for the corridor is therefore based on a combination of the recorded levels from the 1974 and 2011 flood events. This shows the flood extent was larger for the 1974 flood and that both events resulted in water entering the floodplain and affecting a number of properties in the lower corridor area. The catchment is also affected by overland flows.

Some hydrologic and hydraulic modelling was undertaken on the upper corridor by AWC and Bligh Tanner (2013). As there are no streamflow gauges available for calibration, this modelling was used conservatively to gain a general understanding of the channel capacity and in-channel hydraulics. This work confirmed that concentration of drainage paths, and urbanisation, has had an impact on waterway flows. There was general agreement from this modelling that the large flows (1% AEP) would be almost completely contained within the enlarged waterway channel in the upper corridor area. The work also identified that the waterway is flashy with some residents in the upper corridor area reporting hearing a roaring torrent during major storms.

The Brisbane River Catchment Flood Study (BRCFS) is ongoing and won't be complete until 2016. When it is completed, a new Ironpot model should be considered using the downstream boundary conditions from the BRCFS.

Corridor Plan Principles

The following principles were identified to ensure flooding is considered in all works:

+ Improved understanding of flooding constraints and opportunities in the catchment
+ Awareness and input from community about trade-offs between potential increases in flooding to achieve stabilised bed and banks to protect private property

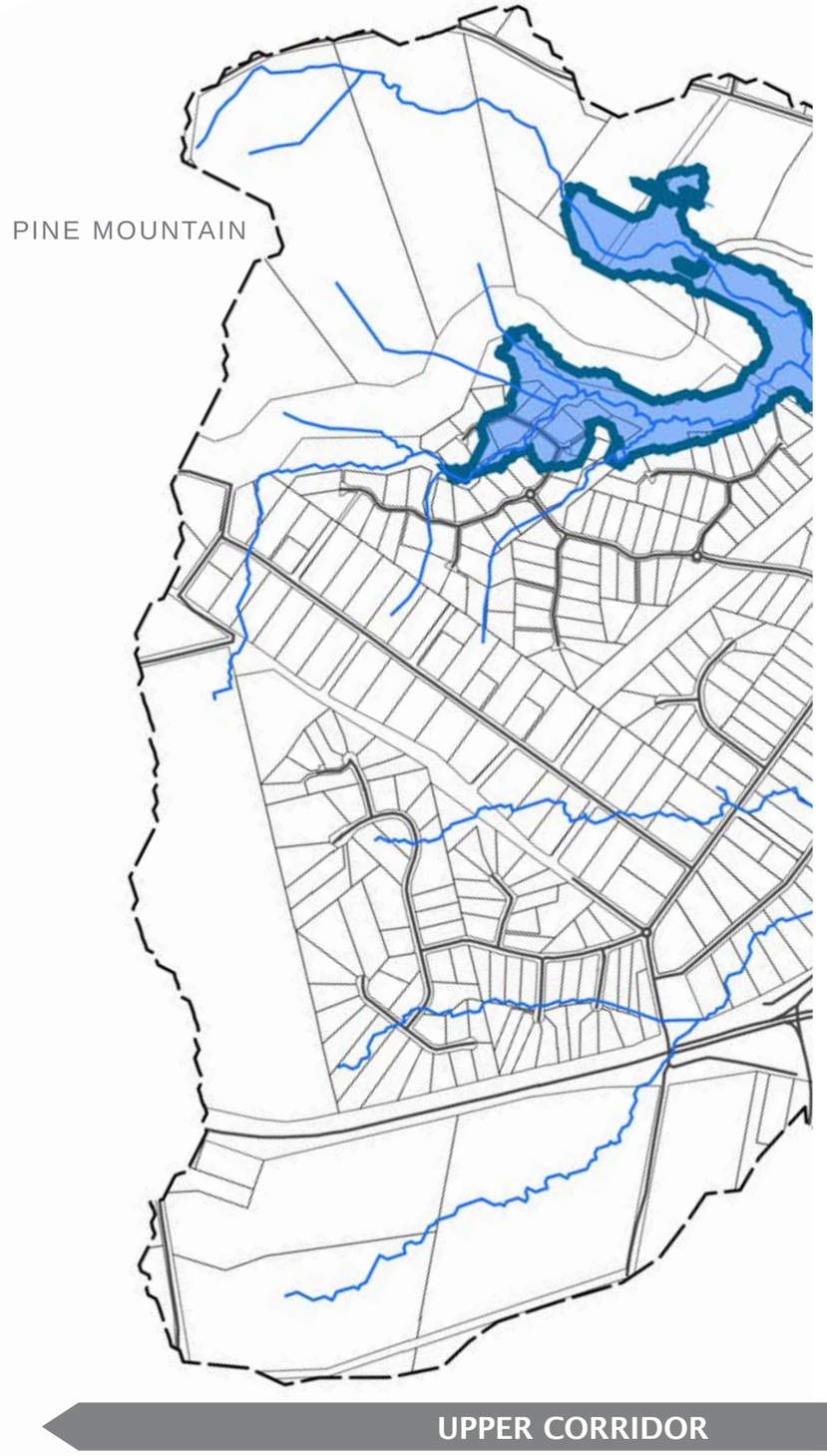
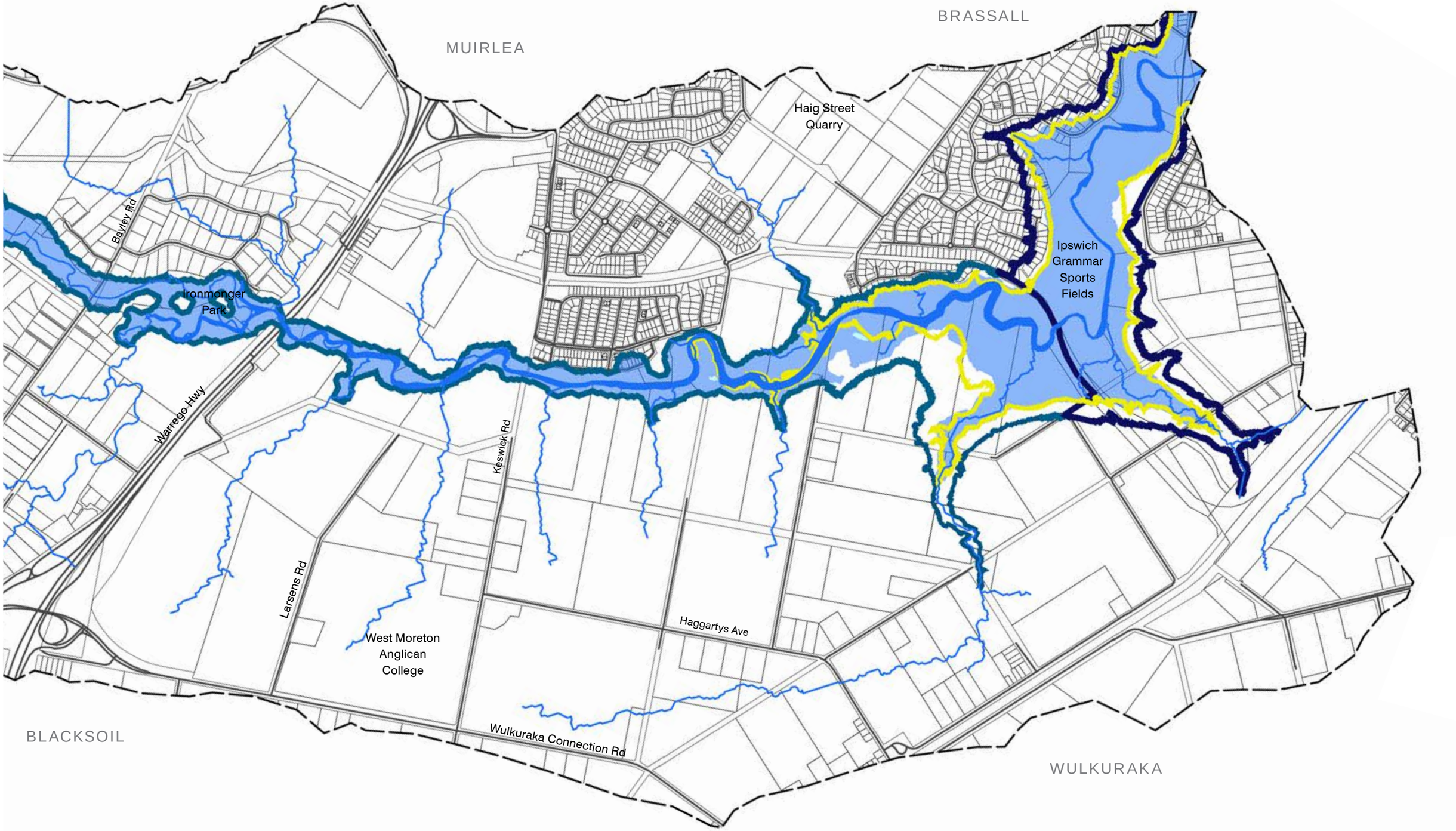


Figure 20. Ironpot Creek Flooding



MIDDLE CORRIDOR

LOWER CORRIDOR

0 250 500 1000 1500 2000m

Source: Design team interpretation of mapping supplied by ICC.

3.5 Synthesis of Opportunities

The process of developing the plan involved the synthesis of on-ground opportunities within each sub-corridor area to deliver integrated outcomes which responded to the overarching themes. The following subsections describe this process and provide the basis for the specific actions included in the Corridor Plan in Section 4.

3.5.1 Upper Corridor

Directional Theme: Cooperative and complementary waterway improvement

In the upper corridor, a key motivation is to manage the active erosion which is threatening private property and degrading waterway values by using an adaptive management approach. To-date much of the works undertaken to address this erosion has been ad-hoc, leading to Council preparing the Drainage and Erosion Management Plan in 2012/13 setting out a prioritised creek rehabilitation and management strategy for this reach of waterway with a focus on the protection of properties. The analysis of opportunities for this upper corridor focused on building a cooperative and complementary waterway improvement framework which included waterway stability works, implementation frameworks and community connectivity opportunities.

Waterway stability opportunities

The previous Drainage and Erosion Management Plan (2013) identified specific waterway rehabilitation works along the upper corridor aimed at addressing the observed erosion issues. These proposed works are all valid erosion remediation techniques and would help to stabilise the channel. However some of these techniques will stabilise the channel in the existing form which will continuously be exposed to high stream power and damage in large runoff events which would be largely still contained in the oversized channel. These works are typically applied in larger, perennial streams and require large machinery to install, meaning they are also relatively high cost solutions.

To support a more adaptive management approach in the smaller headwater valley, this report instead proposes that smaller interventions over a longer period of time are undetaken. The interventions proposed are designed to lift the bed and ultimately make bank stabilisation works less extensive and less capital expensive and thus more appropriate for this situation. Existing guidance on the rehabilitation of these smaller ephemeral systems is very limited, unlike larger perennial systems. The proposed solution is based on a combination of first principles understanding of hydrology and channel morphology and is supported by observed outcomes within the channel currently.

The proposed interventions are small wooden weirs which are laid across the channel at an angle which directs flows away from the steeper bank. These would be constructed with hardwood sleepers that were between 300-400 mm wide. They would need to be keyed approximately 50-100 mm into the bed and banks using rockwork (graded rock mixture) to protect the edges from scour.

These small weirs will trap larger sediments behind them, raising the bed level in that location. Vegetation will naturally establish, stabilising the trapped sediments. Existing channel works are demonstrating how this process will work. For example, rocks placed close together in the channel as part of stabilisation works upstream of Wairuna Court have trapped sediments which have built up to the height of the rock, raising the bed level up 400 mm in that location (see Figure 22).

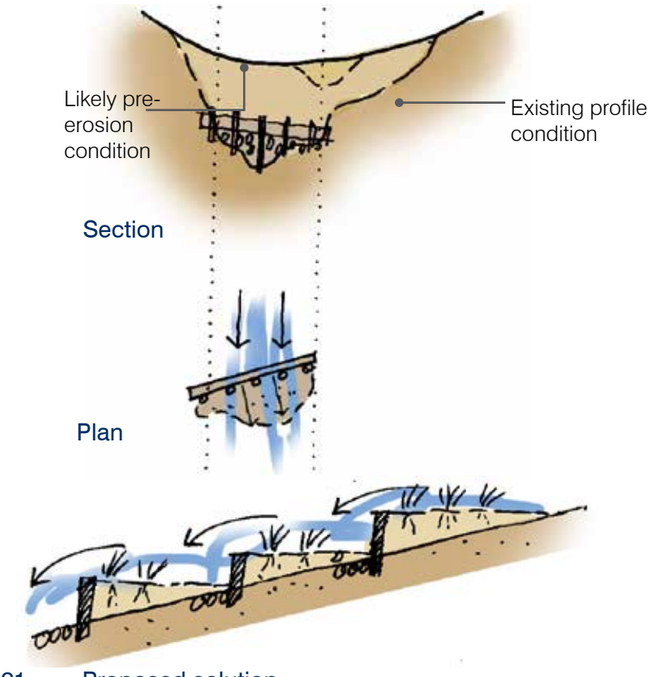


Figure 21. Proposed solution

Figure 22. Photo of current sediment trapping upstream of Wairuna Court

The wooden weirs can be installed by small machines that can work in the existing eroded channel. While this report doesn't provide the exact location of these structures, the below points should be used as guidance on how and where these should be located:

+ To mitigate the collapse of steep or undercut banks by locating the structures both up and downstream to help build up the channel bed levels at the locations of the unstable banks and help direct frequent flows away from the toe of steep banks.
+ To control active head cuts or major grade change zones where head cuts may occur in the future by locating the structures where the grade change occurs.
+ To build on existing sedimentation patterns to control how this sediment is trapped within the channel by placing the structures downstream of the accumulated sediment.
+ To augment existing vegetation patterns by placing structures downstream to protect currently stable areas from future erosion.
+ To stabilise any tributary confluence points by placing structures where grade changes may occur.
+ To capitalise on existing access points.

Once these initial weirs become stabilised, subsequent structures can be installed over these to continue to elevate the bed level. Having an overarching strategy for how these should be installed will be important to guide partnerships with the landholders to deliver these works. Each successive layer of works will need to respond to the performance of the preceding works and be adaptive.

This solution can provide water quality improvements as well as improving waterway stability. The vegetated coarse materials which are trapped behind the weirs creates a sandy hyporheic layer which smaller flows will pass through. Fine sediments and nutrients will be removed from these low flows as they pass through this vegetated sandy layer.

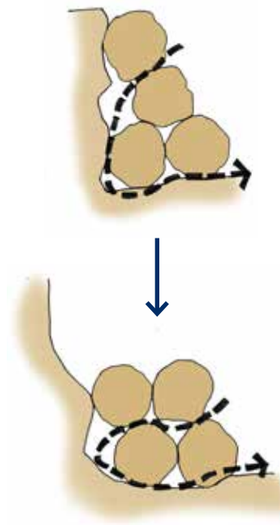
While this wooden weir approach will improve the waterway stability in an adaptive management approach which has lower capital costs, there are a number of risks that need to be considered:

+ Expenditure will be spread out over a much longer period of time. In periods of financial pressure this increases the risk of the progressive works program failing to be completed and the desired remediation outcome not being achieved.
+ Some hydraulic modelling will be required to determine how high the bed level can be raised without causing inappropriate frequency of inundation on private property.

Also undertaking these types of works in the waterway may require approval. The upper reaches are ephemeral and mapped as green in the Queensland Waterways for Waterway Barrier Works spatial data layer which could mean that if approval is required, waterway barrier works could be code assessable. If the code requirements cannot be met, development approval would be required.

Where banks require urgent stabilisation before the bed level is elevated, it is proposed that rocks can still be used to address this instability. However it is critical that these rocks are well graded and that works are undertaken on both banks (Figure 23). It should also be highlighted that 'big is not always better' so

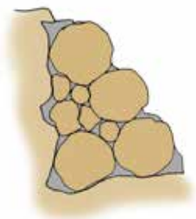
BAD EXAMPLE OF ROCK STABILISATION:



Large evenly graded rock allowing water through the rock to continue to weaken and disperse susceptible soils.

Continued dispersion of susceptible soils typically results in rock slumping, re-exposure of the upper banks and continued bed and bank erosion.

GOOD EXAMPLE OF ROCK STABILISATION:



Well graded rock placed in a filter matrix of gravel limits active movement of water through the rock protecting susceptible soils from dispersion and erosion.

Figure 23. Examples of good and bad rock protection approaches highlighting bed and banks erosion processes and the importance of well graded rocks

that works undertaken by either Council or the landholders that are delivered are resilient and will require reduced ongoing maintenance. It should also be noted that all of the proposed waterway stability improvement works will require some level of on-going maintenance and that both the rock works and wooden weirs cannot just be delivered and forgotten.

Implementation opportunities

Due to the amount of sediment and associated nutrients which could potentially be eroded and transported from this upper corridor area, stabilisation works could be considered for funding from the Council's stormwater offsets funds. Under a business-as-usual scenario there will be high on-going loads of fine and colloidal sediments delivered into the Bremer River as the unstable waterway and its lateral gullies continue to erode.

Estimating the amount of sediment generated by this waterway, in terms of both quantity and rate, is difficult due to the complexity of the erosion processes. This would require a technical geomorphic study supplemented by on-going monitoring.

The landholders in this area are already aware of the erosion and instability issues in this upper corridor, with many already investing their own money into addressing issues. There is a good opportunity for Council to capitalise on this interest and build a strong partnership with the landholders in this area to help deliver these works.

Community connectivity opportunities

The well vegetated character of the creek corridor in the upper corridor area provides an important landscape frame for the existing development, visible from many locations including points where access roads cross the corridor or its tributaries. This interlinked network of vegetation provides a valuable habitat and wildlife corridor role.

There is however limited physical access to the corridor as a result of the residential layout and the narrowness of the creek reserve, with Walter Zimmerman Park being a notable exception. Several points of access provide links across the creek corridor to the alignment of the proposed Brisbane Valley Rail Trail (BVRT).

Pedestrian links across the corridor to the BVRT should continue to be maintained and new opportunities sought where possible. The informal nature of these links is an important part of the character, however consideration could be given to identifying where there may be the opportunity to improve accessibility in order to widen patronage to less able members of the community.

An education / information programme for the whole of Ironpot Creek would provide a means for enhanced understanding and engagement in the ongoing management of the creek. At a basic level this could take the form of information points at pathway crossings and open space, which could be tied to a wider programme of community engagement and increased profile for an Ironpot Creek identity. This could then be supported by signage at points of engagement with the creek corridor such as road crossings, where there is currently little awareness of the creek interface.

Summary of opportunities

On the basis of the above synthesis, the following opportunities were identified for inclusion in the Corridor Plan:

+ Design and implementation of wooden weirs to lift the bed level over time and address waterway stability in an adaptive management approach.
+ Use of well graded rocks to stabilise any urgent bank erosion issues, with consideration for how these works will tie into the ongoing waterway stabilisation works aimed at lifting the bed level.
+ Consideration of use of stormwater offset funds to support delivery of stabilisation works, in collaboration with the local community.
+ Build understanding that waterway works will require some level of on-going maintenance.
+ Improve access and visibility of the waterway corridor at key points, linked with signage and accessibility along the BVRT.

3.5.2 Middle Corridor

Directional Theme: Natural recreation in a healthy waterway corridor

In the middle corridor, a key motivation is to work with the natural waterway processes to enhance the environmental and social values of the waterway in this area. The analysis of opportunities for this area focused on supporting a healthy waterway corridor which is accessible for natural recreation activities and is understood by the community. Opportunities included waterway and riparian corridor works to improve environmental values, implementation frameworks and community recreation.

Environmental enhancement

The coarser sediment eroded from the upper corridor in the past has moved down the corridor with much of it now sitting within the floodplain and channel in the middle corridor area. The sediments in the floodplain have been stabilised through the natural recruitment of vegetation. There is however a low flow channel through this which is re-eroding and continuing to move sediments. This dominant flow channel is now carrying the majority of the lower flows from the catchment which is exposing the bare banks (approximately 1 m) to the shear stress associated with these flows.

Fallen trees and large woody debris are currently creating some natural snag / log jams which are slowing flows and allowing sediments to re-deposit in the channel. These areas are already being colonised by Lomandra and other species, re-stabilising these sediments. It is proposed that these snag jams could be created with logs and other wooden debris placed strategically through the middle corridor to mimic this natural template and manage the sediment movement.

Similar to the wooden weirs in the upper corridor area, these snag jams could be installed by light track machines. While this report doesn't provide the exact location of these structures, the below points should be used as guidance on how and where these should be located:

+ To mitigate the formation of dominant flow pathways / channels by locating the snag jams downstream of any dominant channels to encourage sediments to deposit and form smaller channels.
+ To build on and capitalise existing fallen timber by building on this in-situ material to create a snag jam.
+ To spread flows to engage sand slugs (i.e. mobile sand deposits) to draw material into the channels rather than the sand slugs becoming highly stable elements which concentrate flows into a defined channel. This would require the snag jam to be located on the downstream edge of any sand slugs.
+ To protect the extreme edges of the channel / floodplain from erosion by placing the snag jams just downstream from the steep banks to encourage sediment to accumulate and increase the bed level above the structure.

These works will replicate natural log jams within waterways which provide important in-stream habitats and don't restrict flows and therefore these works should not trigger any waterway barrier issues.

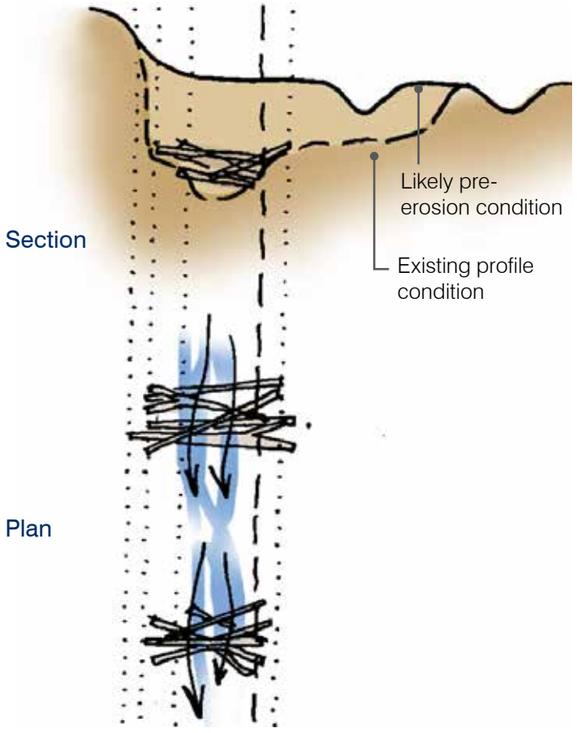


Figure 24: Snag jam solution

Figure 25. Picture from site of natural template

The existing sand slugs will continue to move through this reach over time. The proposed snag jam works will slow the rate of transport, mitigate against the formation of dominant channels and create a diversity of flow paths through this vegetated riparian corridor. It is important that the new bridge crossings consider this outcome to ensure the creek crossing design does not reflect or re-create a dominate channel.

There are a number of existing patches of bushland habitat within the rural properties to the west of the corridor. Re-establishing a vegetated corridor along the smaller tributaries to link these remnant patches to the riparian corridor would significantly improve the value of these habitat areas. Re-establishing these links along tributaries rather than as terrestrial links provides other benefits as well including bank stabilisation, surface water filtering, shade, woody debris and in-stream habitat.

Implementation opportunities

It is proposed that the re-establishment of the smaller tributaries is promoted through utilising existing Council Voluntary Conservation Agreement mechanisms currently funded through the Council's Environmental Levy.

These voluntary agreements between private land owners and Council provide financial and technical support to assist landholders in the management of natural features that may be of strategic importance to Council. Currently, Council has a number of different levels of Conservations Agreements available that offer support through annual land management payments, educational materials, weed control rebates and free trees. The conservation agreements are categorised as follows:

+ Nature Conservation Agreement
  - Highest level of support;
  - Land needs to be zoned conservation with large areas of high ecological value; and
  - Ideally suited to properties 1 hectare and above
+ Bushland Conservation Agreement
  - Land generally zoned within the Rural E (Special Land Management Zone);
  - Offers lower level of land management payment and caters for properties with medium ecological values existing on the property; and
  - Ideally suited to properties 1 hectare and above.
+ Waterways Conservation Agreement
  - Suitable for properties situated in a strategic linkage or waterways identified by Council's waterway mapping; and
  - Suitable for any property size within an adjoining waterway.
+ Nature Corridors Agreement
  - Suitable for properties situated in a strategic linkage identified in Council's Conservation Strategy; and
  - Suitable for any property size aimed at creating a nature corridor.

The nature of the agreement will be dependent on the current zoning and level of conservation value of the individual properties. Depending on the current zone, there are opportunities for land owners to voluntarily change the zoning of their land to enable receipt of the highest level of agreement and therefore higher land management payments and support.

In addition to the above, the Council also offers other voluntary schemes such as the Land for Wildlife Scheme and the Habitat Gardens Partnership which are ideal for properties that are located in an urbanised setting (such as those properties east of the water corridor) that are keen to provide natural habitat for wildlife.

New urban development in this area is also required to manage stormwater discharged from the development area (in terms of quality and quantity) and to rehabilitate the riparian corridor. To protect the environmental values of Ironpot Creek, it is important that these requirements are met and delivered by the developers. Most of the developable land has already been approved, including the requirements for stormwater management and riparian rehabilitation which now need to be delivered by the developers to an acceptable standard for Council. There are a number of developments which still have bonds held by Council as these works have not been completed to a satisfactory level. This includes a number of stormwater treatment basins which have had the earthworks done, but are not completed. A site investigation of one of these assets (located on Moonlight Drive) identified that remaining bond money could be used to provide minor earthworks and planting to convert this weedy basin into a wetland which would enhance treatment performance and the aesthetics of this asset.

Recreation opportunities

Within the middle corridor there continues to be ongoing development of new residential areas and recreation facilities, such as the proposed sports grounds. New bridge crossings for pedestrians and cyclists and in the future other vehicles are proposed. Existing paths and residential streets adjoin the corridor to the east, and private properties of a predominantly rural nature abut to the west.

The proposed BVRT provides the primary north/ south linear open space link in this area, which allows other path systems to be of a more localised and informal nature. The wider floodplains of Ironpot Creek within this middle corridor area provide the opportunity for local creekside destinations to be established at key locations. Strong links between the creek corridor and key decision-making nodes on the BVRT can therefore be created, which might, for instance, highlight the distance to the creek corridor, provide further information promoting Ironpot Creek and reinforce the value of the BVRT to users. Local access within the creek corridor would provide informal links between the destinations.

The proposed sports fields will be a destination for the local community that can also act as a portal to the creek corridor, providing access to some of the most attractive environs of the creek and the opportunity for management and creek rehabilitation works to be viewed and explained. Further amenity can be developed in the future through informal local trails, boardwalks, and bridges linking to the surrounding path network (Refer to the Division 6 Precinct Plan for a more comprehensive open space network assessment).

There is also a mapped heritage site (original farmhouse) north of the Warrego Highway. Subject to a development application or through negotiation with the property owner, there is an opportunity to integrate the land zoned 'Recreation' in this area into riparian corridor works and open space opportunities which could connect to the nearby Ironmonger Park and pathway network.

Summary of opportunities

On the basis of the above synthesis, the following opportunities were identified for inclusion in the Corridor Plan:

+ Design and implementation of log / snag jams to manage sediment movement through the corridor to provide a mix of meandering channels and habitat forms.
+ Build understanding and communicate that the waterway is dynamic and the channel may naturally move within the waterway corridor over time.
+ Ensure new creek crossings consider the dynamic nature of the waterway channel and the proposed works which will aim to remove the deeper dominant channel.
+ Re-establish riparian vegetation along tributaries to enhance habitat and movement corridors.
+ Work with private landholders and developers through appropriate voluntary agreements or development requirements to improve and protect vegetation, especially along Ironpot Creek and its tributaries.
+ Use of existing bonds to deliver riparian rehabilitation works.
+ Ensure stormwater runoff from new developments is managed for its water quality and quantity using best practice erosion and sediment control and water sensitive urban design practices to protect waterway values and investments, including the use of bonds to retrofit incomplete works.
+ Include signage / branding in new sports park and BVRT to enhance awareness and connectivity of the community to the creek.
+ Provide local access within the creek corridor to create informal links between destinations (such as new sports field, BVRT and new local Creekside destinations).

3.5.3 Lower Corridor

Directional Theme: Build resilience for waterway investments

In the lower corridor, a key motivation is to manage the bed level difference between Ironpot Creek and the Bremer River to protect upstream waterway investments. The other key motivation is to enhance the community understanding of Ironpot Creek and its connection and influence with the Bremer River. The analysis of opportunities for this area focused on providing resilience for waterway investments and included waterway health improvement works and community awareness and connectivity.

Waterway health

The level of the channel in Ironpot Creek is largely driven by the level of the downstream Bremer River. Therefore to protect the investments of the in-stream works to raise the bed level within Ironpot Creek, there needs to be grade control structures put in place within this lower corridor area to control this difference in level.

These grade control structures could be designed as rock chutes, or 'check dams' which were proposed as a stabilisation solution in the previous Drainage and Erosion Management Plan (AWC and Bligh Tanner, 2013). The structures would be constructed from rock with key elements up to 500-800 mm forming the skeleton and anchor for the structure with interstices of the larger rocks backfilled with well graded angular crushed rock (150-450 mm). The proposed works will require review to identify hydraulic impacts.

These structures are well-understood stabilisation structures for larger perennial streams and are therefore well-suited to be located in the lower corridor area which receives all of the flows from the catchment. Due to the volume and velocities of these catchment flows, these structures need to be well-designed to ensure they remain stable during flow events (i.e. requires large, well-graded rocks in the structure which are keyed into the bank). It is important to combine revegetation with these large structures to protect the areas where the structures are keyed into the banks.

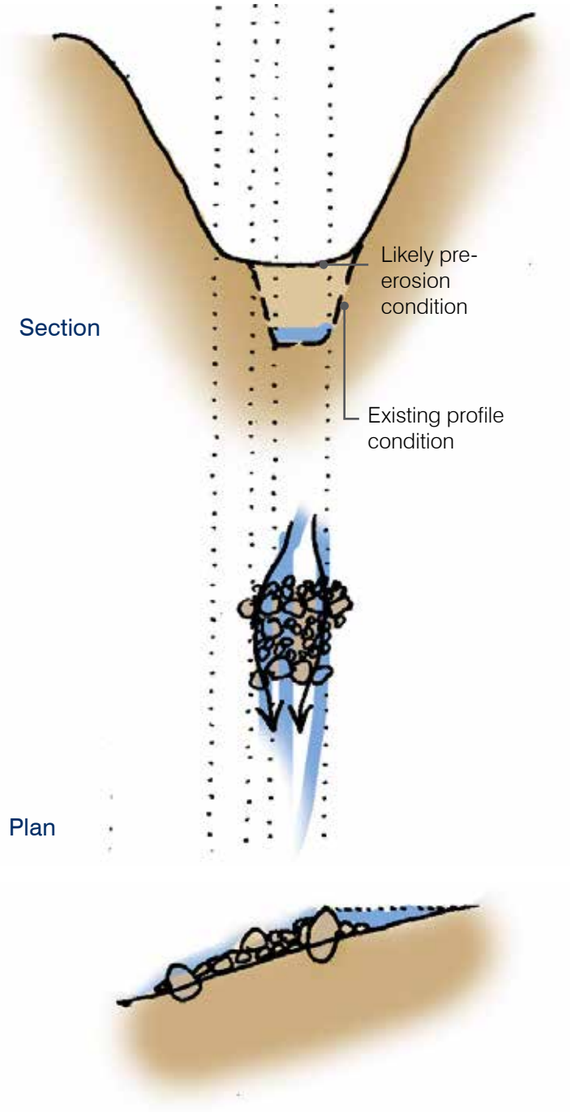


Figure 26: Rock chute solution

They can also be quite expensive due to the materials involved, including the machinery that is needed to move and place the rocks (which can be up to 500-800 mm diameter), especially in this deep and steep valley area. While this report doesn't provide the exact location of these structures, the below points should be used as guidance on how and where these should be located:

+ To stabilise any existing head cuts by locating the structure where the grade change is occurring.
+ To build on any existing or forming riffle structures in the channel by using the existing riffles as the spillway for a new structure.
+ To address any changes in levels between confluence (such as the one with the Bremer River or other Ironpot Creek tributaries) by locating the structure where the grade change is occuring.

These works can also be designed to have low grades on the spillway to ensure they comply with fish passage requirements.

The riparian zone in the lower corridor is mapped by Council as 'highly disturbed' and contains woody weeds which are currently being removed by the Ipswich River Improvement Trust. This process removes all of the woody weeds (which in some areas is the majority of the bank vegetation) and then keeps the area bare for up to 2 years to ensure the site can be maintained to ensure the woody weeds don't re-establish. It is recommended that a native ground cover grass hydroseed treatment should be used to stabilise the banks, but won't interfere with the woody weed management. Once the woody weeds have been controlled, revegetation works can then follow with understorey and canopy plantings. Due to the presence of the native grass groundcover, these planting stock will need to be more mature (for example 140 mm pots or greater). Younger seedlings should be avoided as they can be outcompeted by the established groundcovers. These plantings could be undertaken with the support of schools or local residents, providing ongoing establishment maintenance and weed control.

Council has identified the potential retrofit of a stormwater treatment device to treat the existing residential development in this location. A simple stormwater management system, focussing on daylighting stormwater pipes and making stormwater pathways more evident—in line with the Healthy Waterways' Living Waterways framework—may provide a good balance of outcomes in terms of community engagement.

Community awareness

Weed removal and replanting this section of the corridor has the potential to create a significant open space asset for the community. There may be advantages in addressing sections of higher visibility, such as those alongside the first stages of the BVRT, to enhance the appreciation and understanding of the need for and value of these works. Similarly the linking of existing path networks along the creek corridor, especially where linear movement will not be provided by the alignment of the BVRT, would be possible. It is suggested that possible links to the open space and shallows at Lynch' s Crossing could also be investigated.

Partnering with the local schools to manage access to the creek through the sports fields infrastructure would allow connected pathways to be established and perhaps opportunities to enhance the educational aspects of the restoration of the creek to be exploited.

In this zone the aspects of European heritage associated with the former rail line and associated culverts can be integrated into the development of an information and educational programme.

The challenging profile of the creek corridor in the lower corridor mitigates against access to the lower creek levels, however the experience of the incised corridor with mature existing vegetation is a unique and valuable local quality. This could be enhanced by providing points where safe access could be gained by linking the path network to lookouts or similar points of engagement within the creek profile. These ideally would be associated with the proposed channel work locations described above which will require some level of maintenance access to be provided.

Summary of opportunities

On the basis of the above synthesis, the following opportunities were identified for inclusion in the Corridor Plan:

+ Design and implementation of rock grade control structures to manage the bed level changes in this lower reach and protect upstream investments from head cut erosion.
+ Consider bank stabilisation and future planting as part of woody weed removal.
+ Design and implementation of retrofit stormwater management solution which is cost effective and engages the community with the stormwater offset strategy purpose.
+ Development of information and educational programme which provides information about the waterway corridor and heritage sites.
+ Provide safe points of access to the waterway corridor so it can be seen and valued as an important natural asset.
+ Consultation and partnership with Ipswich Grammar School to enhance linkages with the creek corridor and deliver corridor works.

3.5.4 Overall Staging and Design of Waterway Works

The staging and implementation of the proposed waterway works should reflect the main waterway processes occurring along the waterway corridor.

The upper corridor works are the most urgent as these are generating material which will be transported along the corridor and eventually into the Bremer River. This erosion is also putting properties at risk.

The lower corridor works should then be prioritised as they will be critical to control the propagating head cuts which are moving up along the corridor which will put the relatively stable middle section of the waterway corridor at risk.

The middle corridor is currently the main sediment storage zone however it will continue to 'dribble' out sediment to the lower corridor area as mentioned above. It is therefore important this downstream area is stabilised. The works in the middle area are not designed to stop this movement of materials, but rather to ensure these materials help to create a diversity of channel types within the corridor area.

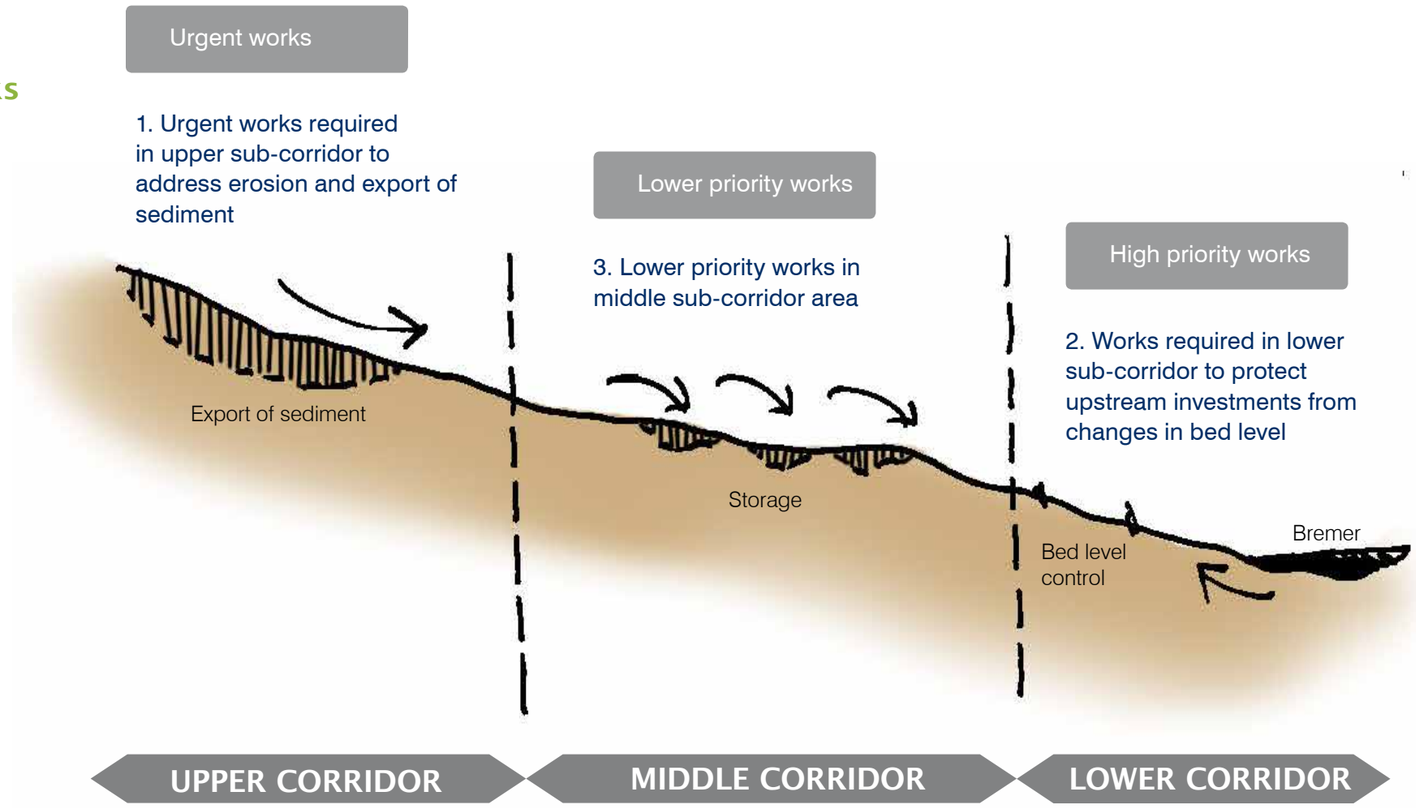


Figure 27. Overall staging of waterway works to respond to current waterway condition

4.0 The Corridor Plan

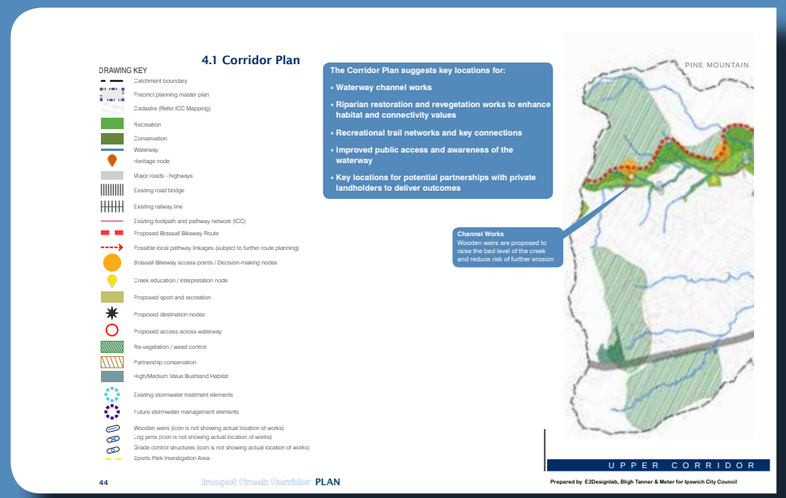
The Corridor Plan represents a long term transformative plan to deliver on the vision for the Ironpot Creek Corridor. It reflects the aspirational themes and guiding principles identified though the planning process.

The Corridor Plan is a schematic representation of actions and interventions that demonstrate how the Ironpot Creek Corridor and its catchment may be transformed into a healthy and dynamic creek system of high environmental and social value over time.

The Corridor Plan is presented herein as:

Corridor Plan

An overall integrated plan for the corridor (Corridor Plan)



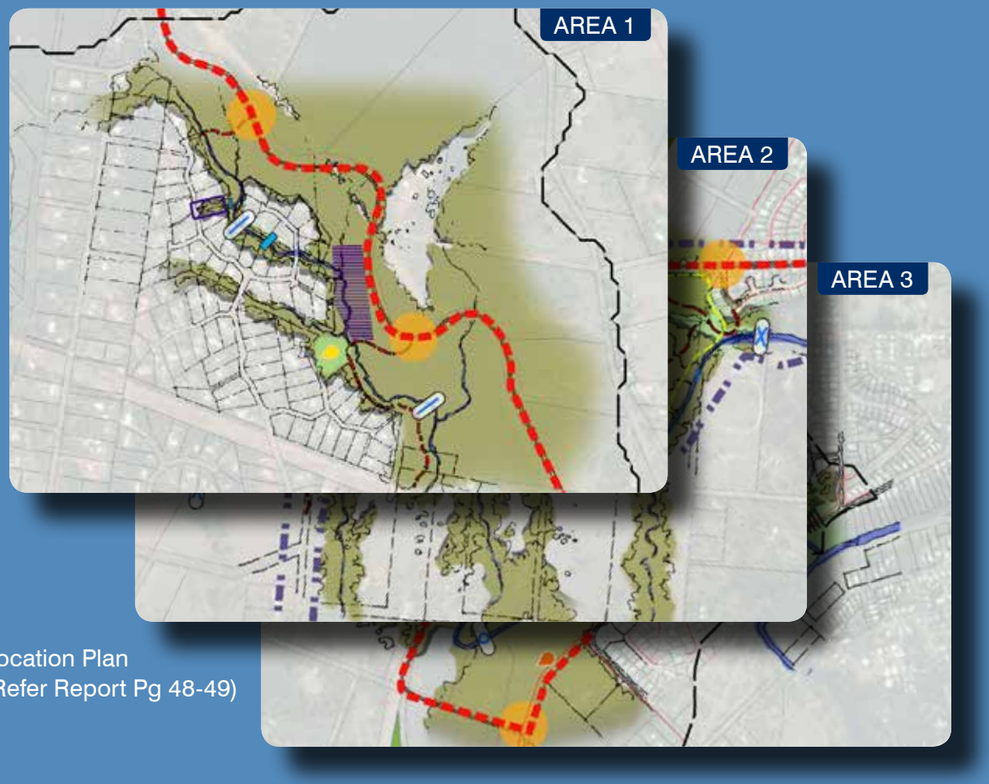
(Refer Report Pg 46)

Page Break

(Refer Report Pg 47)

Corridor Plan Detailed Areas

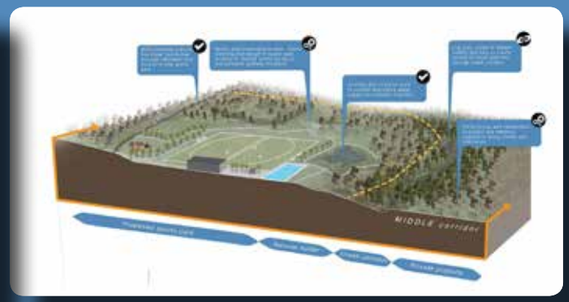
Three key planning area plans (Corridor Plan Detail Plans) to provide more resolution of key proposed actions.

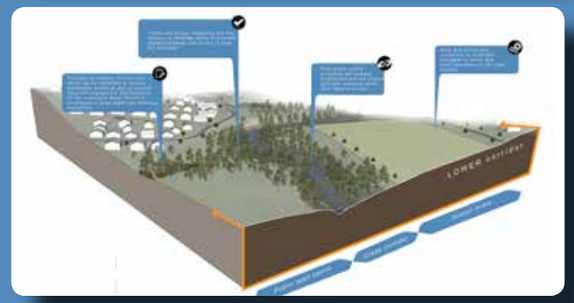


Location Plan
(Refer Report Pg 48-49)

Corridor Plan Illustrative Sections

A series of locational cross-sections providing additional detail for how the actions may come together within the three detailed plan areas.





(Refer Report Pg 54-61)

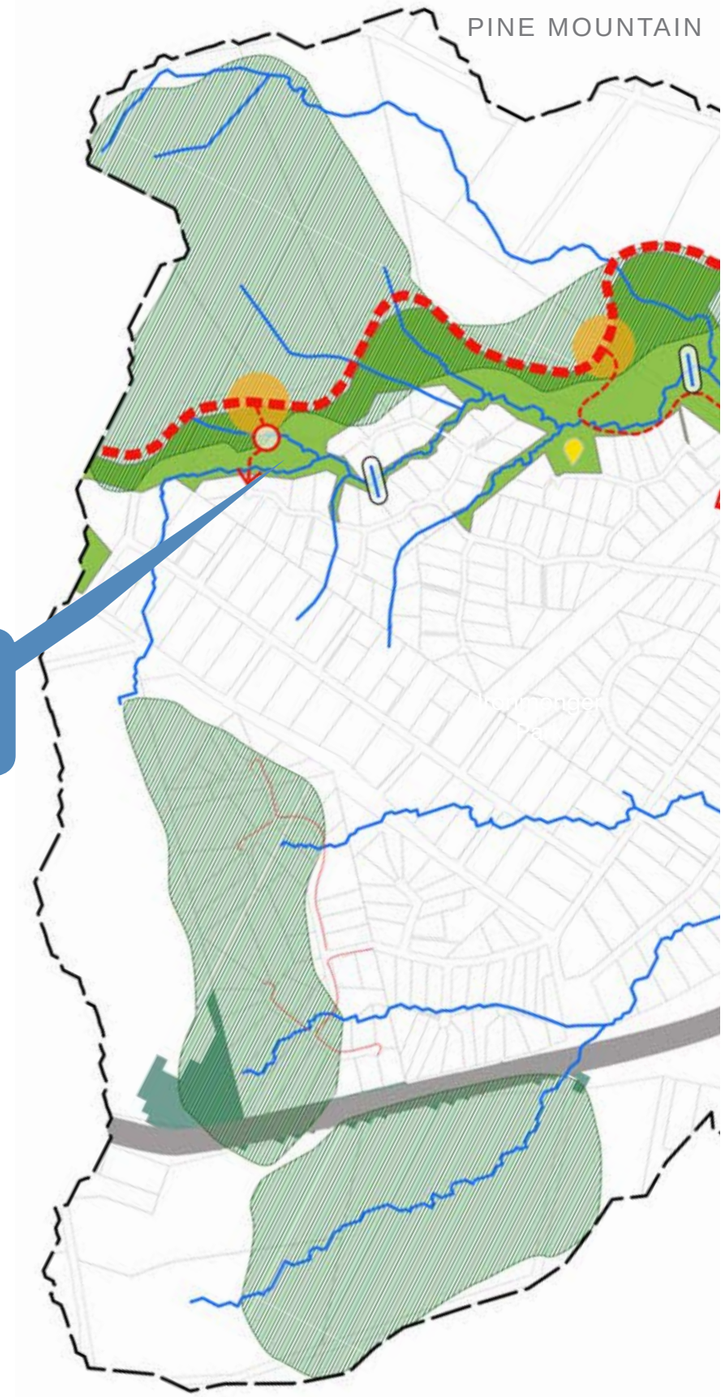
4.1 Corridor Plan

DRAWING KEY

- Catchment boundary
- Precinct planning master plan
- Cadastre (Refer ICC Mapping)
- Recreation
- Conservation
- Waterway
- Heritage node
- Major roads - highways
- Existing road bridge
- Existing railway line
- Existing footpath and pathway network (ICC)
- Proposed BVRT / Brassall Bikeway Route
- Possible local pathway linkages (subject to further route planning)
- BVRT / Brassall Bikeway access points / Decision-making nodes
- Creek education / Interpretation node
- Proposed sport and recreation
- Proposed destination nodes
- Proposed access across waterway
- Revegetation / weed control
- Partnership conservation
- High/Medium Value Bushland Habitat
- Existing stormwater treatment elements
- Future stormwater management elements
- Wooden weirs (icon is not showing actual location of works)
- Log jams (icon is not showing actual location of works)
- Grade control structures (icon is not showing actual location of works)
- Sports Park Investigation Area

The Corridor Plan suggests key locations for:

+ **Waterway channel works**
+ **Riparian restoration and revegetation works to enhance habitat and connectivity values**
+ **Recreational trail networks and key connections**
+ **Improved public access and awareness of the waterway**
+ **Key locations for potential partnerships with private landholders to deliver outcomes**



Channel Works
Wooden weirs are proposed to raise the bed level of the creek and reduce risk of further erosion

UPPER CORRIDOR

Precinct Planning Master Plan
The master planning of this area will consider the integration of the recreation and open space facilities with the waterway corridor activities. This area includes the sports park investigation area

Stormwater Management Retrofit
Potential location for stormwater management retrofit which could provide stormwater treatment as well as provide an important landscape and engagement element for the community.

Bremer River Connections
Potential to communicate the important link between Ironpot Creek and the Bremer

Floodplain Wetland
The floodplain could be enhanced to act as an ephemeral wetland to improve treatment of flows. The frequency of the current inundation of this area would need to be confirmed to identify if additional earthworks were required to lower the surface level to ensure regular inundation. These works could include broader revegetation and cultural heritage outcomes.

Ecological Corridors
Partnerships with landholders can help to deliver highly valuable links between remnant bushland and the creek corridor

BRASSALL

WULKURAKA

Haig Street Quarry

Ipswich Grammar Sports Fields

Ironmonger Park

Bayley Rd

Warrego Hwy

Larsons Rd

Keswick Rd

Haggartys Ave

Wulkuraka Connection Rd

0 250 500 1000 1500 2000m

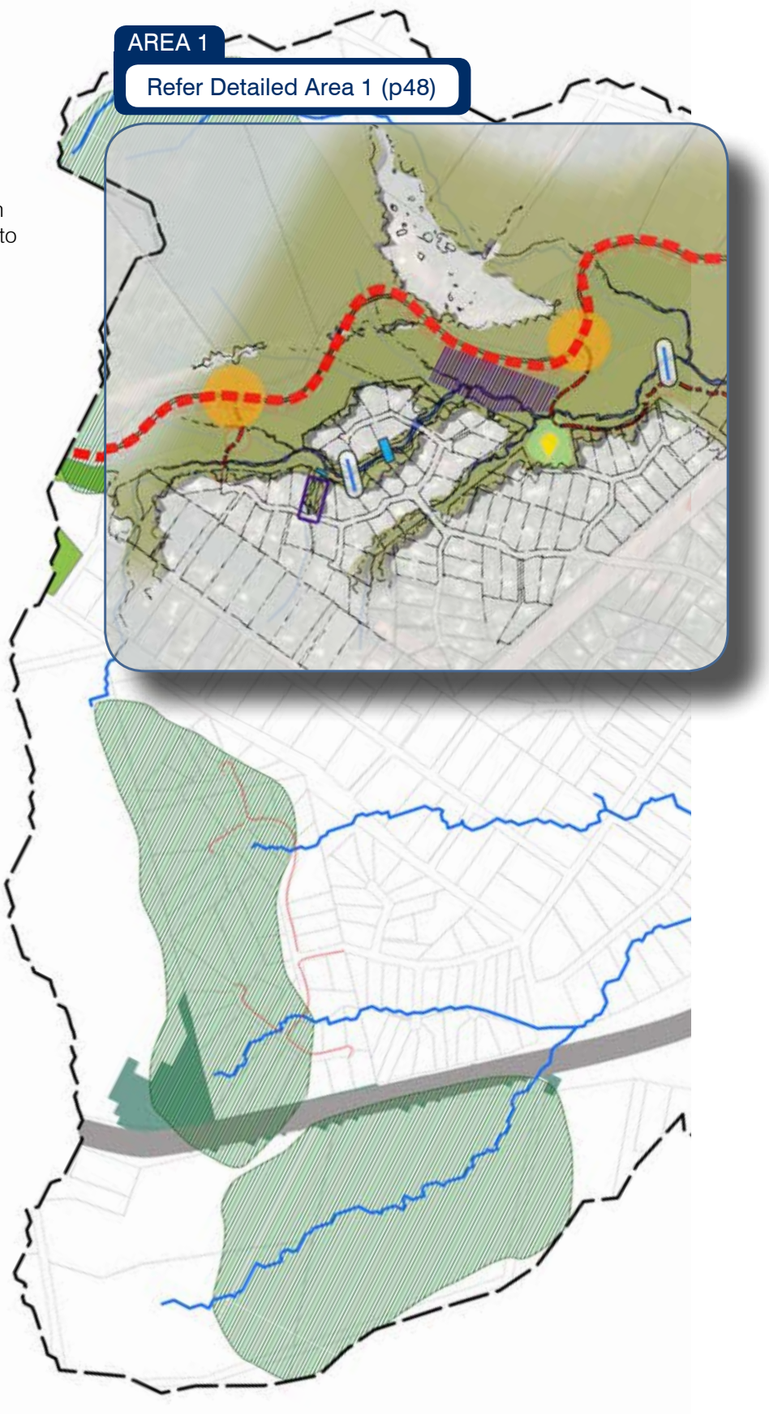
MIDDLE CORRIDOR

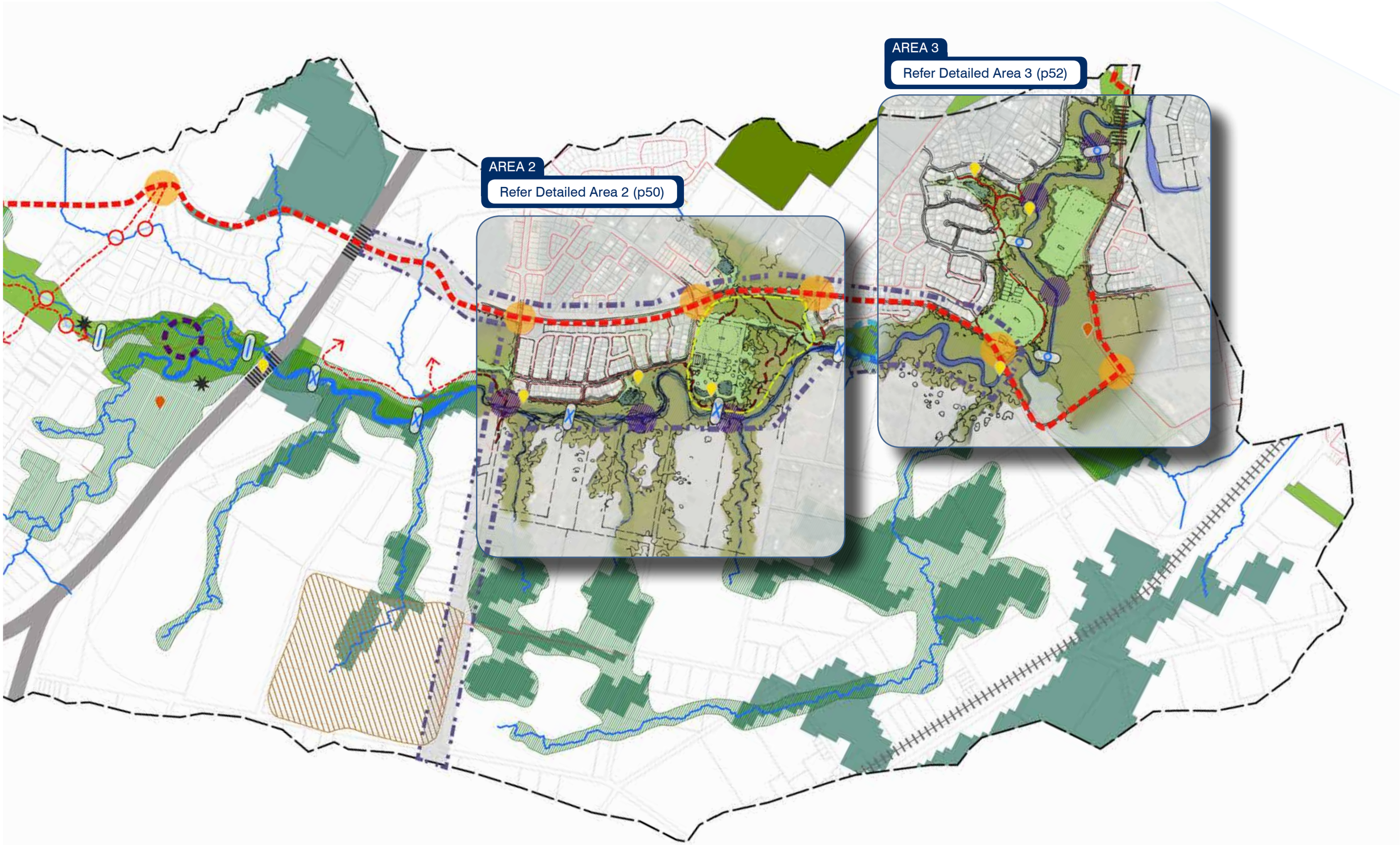
LOWER CORRIDOR

4.2 Corridor Plan Detailed Areas

Detailed Areas Reference Plan

The detail plans highlighted herein, represent a more in depth review of how outcomes offered within the Corridor Plan may be realised within each sub-corridor area. These are illustrative in nature and provide an indicative spatial arrangement for future planning and design projects to develop further. Further information has been provided within the Corridor Plan Illustrative Sections (page 56).




AREA 2
Refer Detailed Area 2 (p50)
AREA 3
Refer Detailed Area 3 (p52)

Area 1 - Upper Corridor

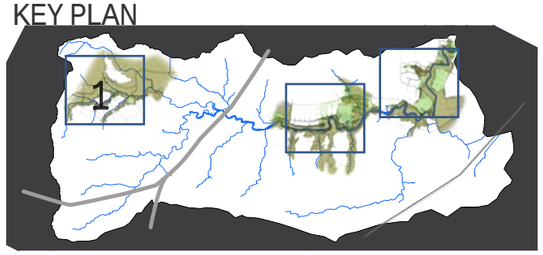
Cooperative and complementary waterway improvements

In the upper corridor area, a key motivation is to manage the active erosion which is threatening private property and degrading waterway values by using an adaptive management approach. The incised channel bed and steep banks need to be addressed in order to reduce the risk to adjacent properties as well as the risk of major erosion and sediment transport through the downstream corridor and eventually the Bremer River. There are good opportunities to deliver these works with continued local community involvement and funding through stormwater offset contributions.

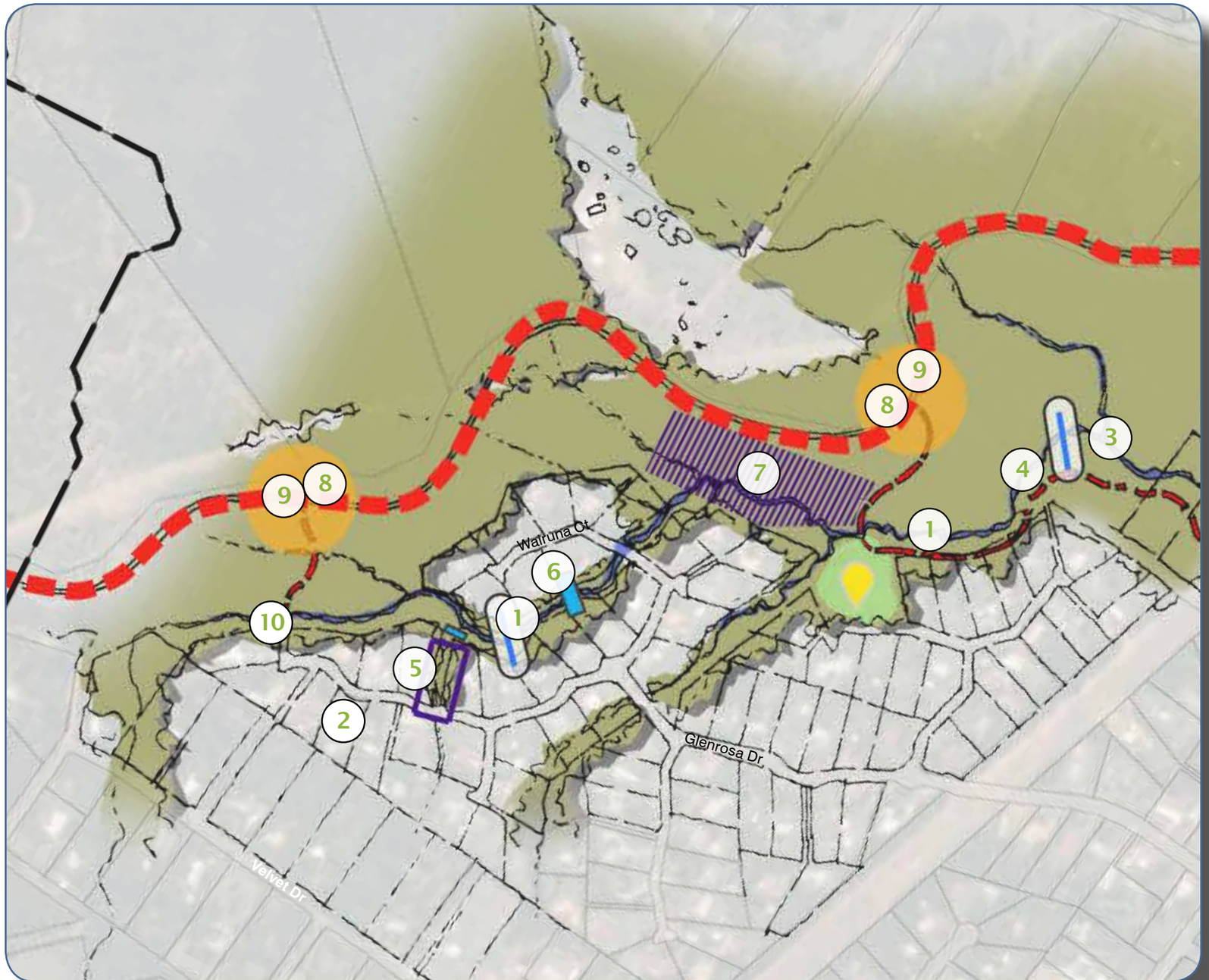
The nearby Brisbane Valley Rail Trail is a heritage route which is currently an informal dirt track through the well vegetated eastern side of the corridor. Current links should continue to be maintained and new opportunities sought where possible, including the possibility of improving accessibility of key sections to widen patronage to less able members of the community.

Key actions for 'Cooperative and complementary waterway improvement' in this area include:

KEY PLAN



	PROPOSED ACTION	OUTCOMES
1	Further develop the design and implementation strategy for wooden weir waterway solutions, identifying short term locations and long term strategy to build on the early works. Also include identification of bank battering which would be urgently required to address risk of bank collapse.	+ Bed and bank stability + High risk sites identified and managed + Long term plan for implementation of works
2	Develop an engagement strategy / factsheet which describes the proposed wooden weir strategy (and potential for in channel works to reinstate natural overbank flooding) for communication with local residents	+ Common understanding of issues and potential management approach + Partnerships for delivery and ongoing maintenance of works
3	Quantify potential benefits of waterway stability works to inform use of stormwater offset contributions to fund works	+ Bank stability + Stormwater filtering
4	Undertake review of works to ensure understanding of potential flooding impacts on proposed waterway works	+ Improved understanding of flooding in this deeply incised channel + Informed communication of risk trade-offs (i.e loss of land vs periodic flooding)
5	Use of well-graded rocks to stabilise any urgent bank erosion issues, especially in constrained sites, although this needs to be mindful of how the works will tie into the ongoing wooden weir strategy	+ Addressing high risk bank erosion which won't be addressed immediately by raising the bed level with the wooden weirs + Resilient bank works
6	Design and future delivery of grade control structures to manage the grade difference between current waterway works / culverts and the future raised bed level	+ Protection of waterway works from future head cut erosion driven by changes in bed level
7	On-going maintenance programs identified for any waterway improvement works to ensure they continue to function as designed	+ Resources allocated for on-going maintenance + Waterway health improvements are protected
8	Planning and design of the future BVRT works to connect with current and planned pathway works in the corridor and to provide improved accessibility to, and across the waterway corridor	+ Community connectivity through and across the corridor
9	Development of branding or signage which can be used at key locations to improve community awareness and understanding of the creek corridor.	+ Community understanding and awareness
10	Review management and maintenance of existing waterway crossings to check public health and safety requirements	+ Public safety

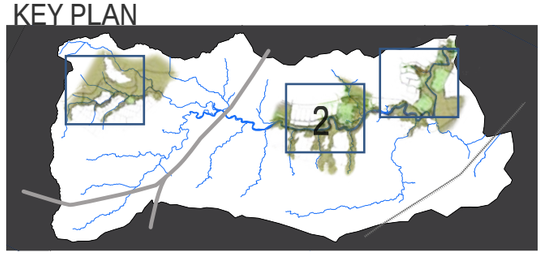


- Catchment boundary
- Cadastre (Refer ICC Mapping)
- Sport and Recreation (ICC Mapping)
- Existing vegetation / parkland
- Proposed BVRT / Brassal Bikeway route
- BVRT pathway access points / Decision-making nodes
- Possible local pathway linkages
- Wooden weirs (icon is not showing actual location of works)
- Rock stabilisation
- Interface treatment
- Creek education / Interpretation node
- Ironpot Creek
- Maintenance to protect existing works

0 100 200 500m

Area 2 - Middle Corridor

KEY PLAN



Natural recreation in a healthy waterway corridor

In the middle corridor area, a key motivation is to work with the natural waterway processes to enhance the environmental and social values of the waterway in this area. It is proposed that the use of snag jams can manage the transport of sediments through this corridor section to create a series of informal dynamic depressions in the vegetated floodplain, rather than a defined channel which carries the majority of flows and is at risk of further erosion. Also the enhancement of current incomplete stormwater management assets could also improve the quality of stormwater entering the waterway in this area.

There are also a number of existing patches of bushland habitat which would benefit greatly by re-creating connections to the creek corridor through the revegetation of tributaries. This could be delivered through partnership programs with the rural land holders.

There are a number of planned recreation facilities in this area including a new sports field and bike path (BVRT) which provide a good opportunity for the community to connect with and understand the dynamic nature of Ironpot Creek.

Key actions for 'Natural recreation in a healthy waterway corridor' in this area include:

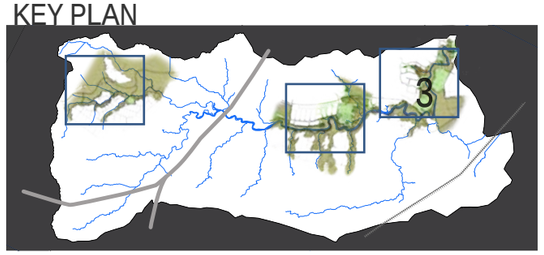
	PROPOSED ACTION	OUTCOMES
1	Further develop the design and implementation strategy for snag jams, identifying short term locations and long term strategy to build on the early works	+ Bed and bank stability + Creation of a diversity of channel forms and habitats + Long term plan for implementation of works
2	Design of retrofit works for incomplete stormwater management assets to use bond money to improve stormwater quality performance and landscape amenity	+ Stormwater quality improvements + Stormwater management assets become valued landscape element
3	Identify and work with key landholders to provide corridor links between Ironpot Creek and remnant bushland habitats	+ Partnership programs with landholders to deliver environmental enhancement projects + Improved habitat and connectivity + Waterway health improvements
4	Ensure creek crossings consider the future channel form and won't re-create a dominant channel	+ Reduced risk of erosion from creek crossing investments + Integrated design of infrastructure for waterway protection
5	Ensure new developments deliver stormwater treatment and riparian rehabilitation	+ Stormwater management + Riparian corridor protection and enhancement
6	Develop master plan for new recreation facilities and their interaction with the creek corridor	+ Provide coordinated vision and plan for integrated social and environmental outcomes
7	Future identification and design of local pathway linkages to provide natural recreation opportunities which are connected to the new recreation facilities (sports ground and bikepath) and also waterway works. These opportunities will be identified in the Precinct Plan or further master planning of the site	+ Multiple recreation experiences provided + Awareness of waterway corridor and its dynamic nature
8	Investigate possibility of using existing water body as a landscape feature and also part of stormwater treatment and harvesting strategy for new sports ground (this would likely need flows to be re-directed from advanced residential development to ensure there were enough flows)	+ Stormwater management + Use of stormwater for irrigation + Functional and aesthetic water body as part of sports grounds
9	Development of branding or signage which can be used at key locations to improve community awareness and understanding of the creek corridor	+ Community understanding and awareness

- Cadastre (Refer ICC Mapping)
- Sport and Recreation (ICC Mapping)
- Existing vegetation / parkland
- Existing footpaths
- Proposed BVRT / Brassal Bikeway route
- BVRT pathway access points / Decision-making nodes
- Possible local pathway linkages (subject to precinct planning)
- Creek education / Interpretation node
- Ironpot Creek
- Log jams (icon is not showing actual location of works)
- Precinct Planning Master Plan Area
- Sports Park Investigation Area
- Potential stormwater quality treatment system
- Possible co-location of works zone

0 100 200 500m

Area 3 - Lower Corridor

KEY PLAN



Build resilience for waterway improvements

In the lower corridor area, a key motivation is to manage the bed level difference between Ironpot Creek and the Bremer River to protect upstream waterway investments. The other key motivation is to enhance the community understanding of Ironpot Creek and its connection and influence with the Bremer River.

It is proposed that the grade control structures could be used to control the changes in bed level between the Bremer River and the middle corridor. The delivery of these works should be planned and designed to allow for future community access or engagement to be provided for at these locations. Ongoing weed management and revegetation works could be coordinated and delivered in partnership with local schools or local communities.

The community connection to the waterway corridor, its connection with the Bremer and also its cultural heritage in this area could be enhanced through the development of an information and educational programme and through the investigation of potential access and connectivity opportunities.

Key actions for 'Building resilience for waterway investments' in this area include:

	PROPOSED ACTION	OUTCOMES
1	Further develop the design and implementation strategy for grade control structures identifying short term locations and long term strategy to build on the early works	+ Bed and bank stability + Long term plan for implementation of works + Protection of upstream works
2	Investigate opportunities for stormwater retrofit project to be delivered through stormwater offset strategy, quantifying the potential benefits of different types of investment	+ Stormwater quality improvements + Improved community understanding of stormwater management and offset program + Stormwater management assets as a valued landscape element
3	Ensure bank stabilisation and future planting is part of woody weed removal planning and delivery	+ Improved habitat + Bank stability + Weed control + Partnership programs schools and local community for planting and ongoing maintenance
4	Design access required for waterway works to allow for future use of the area for community access / engagement with the waterway corridor	+ Community awareness and understanding of waterway and Council's commitment to its protection
5	Investigate opportunities to provide link between Ironpot Creek and Lynch's Crossing – due to the topography, this connectivity might be through signage and educational materials	+ Reduced risk of erosion from creek crossing investments + Integrated design of infrastructure for waterway protection
6	Development of branding or signage which can be used at key locations to improve community awareness and understanding of the creek corridor and its cultural heritage	+ Community understanding and awareness

Catchment boundary

Cadastre (Refer ICC Mapping)

Sport and Recreation (ICC Mapping)

Existing vegetation / parkland

Existing footpaths

Proposed BVRT / Brassal Bikeway route

BVRT pathway access points / Decision-making nodes

Possible local pathway linkages

Heritage node

Creek education / Interpretation node

Ironpot Creek

Grade control structures (icon is not showing actual location of works)

Lynch's Crossing link

Potential stormwater quality treatment system

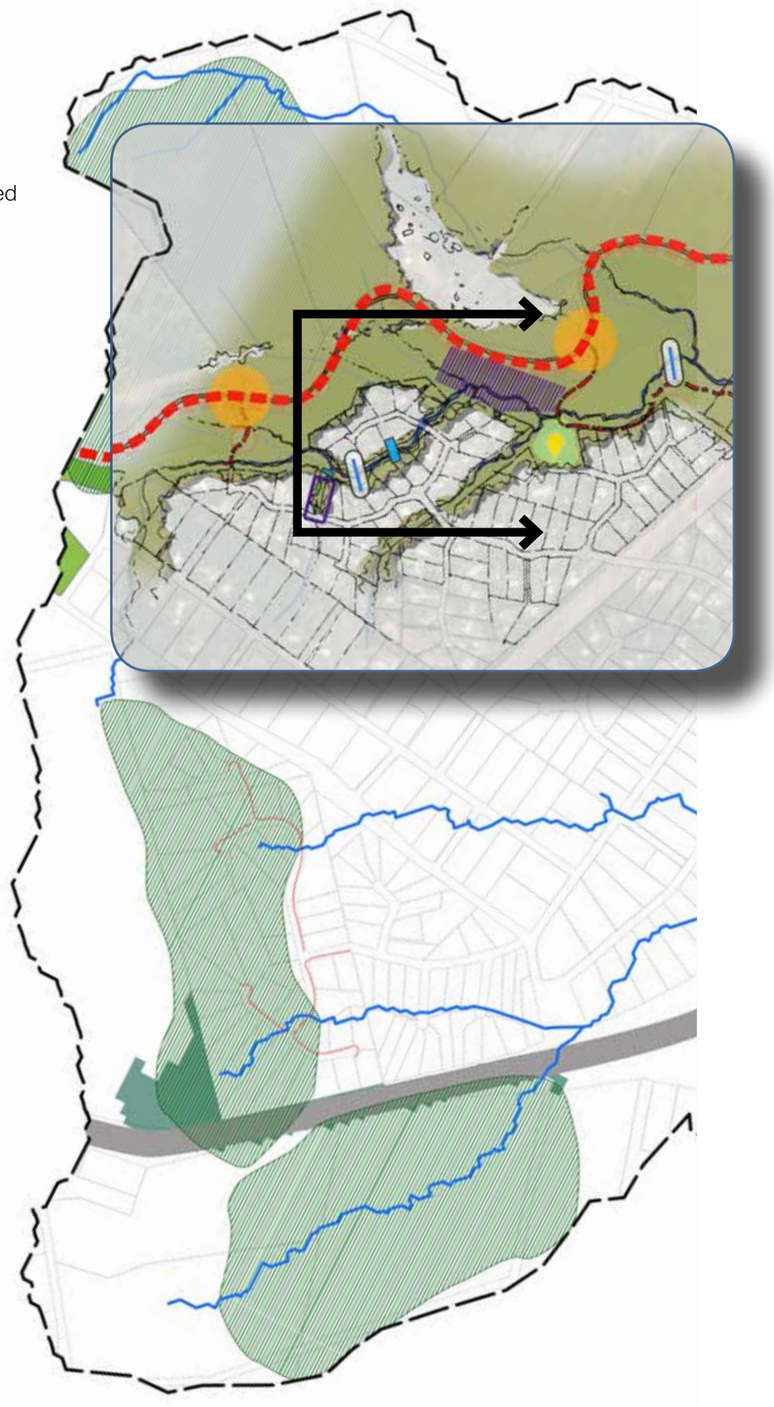
Possible co-location of works zone

0 100 200 500m

4.3 Corridor Plan Illustrative Sections

Section Areas Reference Plans

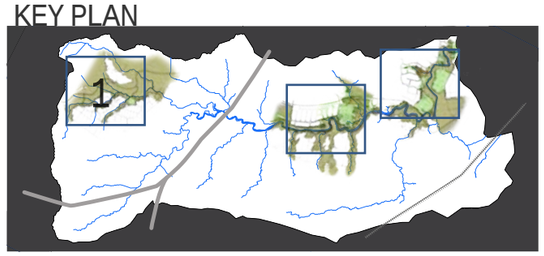
The Corridor Plan illustrative sections herein, represent a more in depth review of how actions identified within the Detail Plans may be realised within each sub-corridor area. These are illustrative in nature and provide an indicative spatial arrangement for future planning and design projects to develop further.



Section Area 1 - Upper Corridor

Cooperative and complementary waterway improvements

KEY PLAN



Stormwater offsets used to help fund works based on quantifiable benefits

Corridor Objectives Icon Key

These illustrative sections utilise the icons developed for the Ironpot Creek Corridor Plan to represent how the objectives may operate at a site scale.

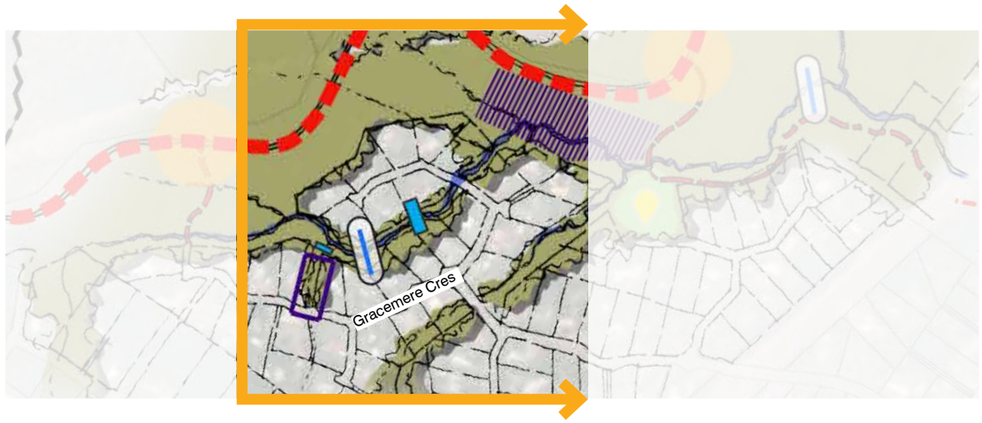
Working as One

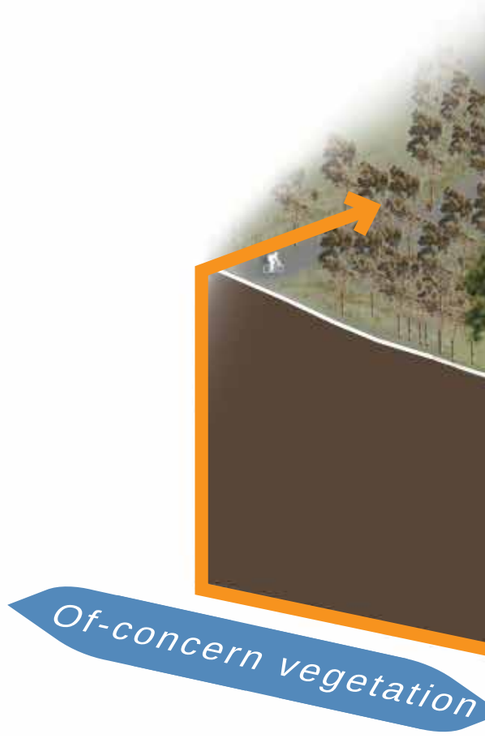
Embracing the Environment

Making it Happen

We all Benefit

REFERENCE PLAN





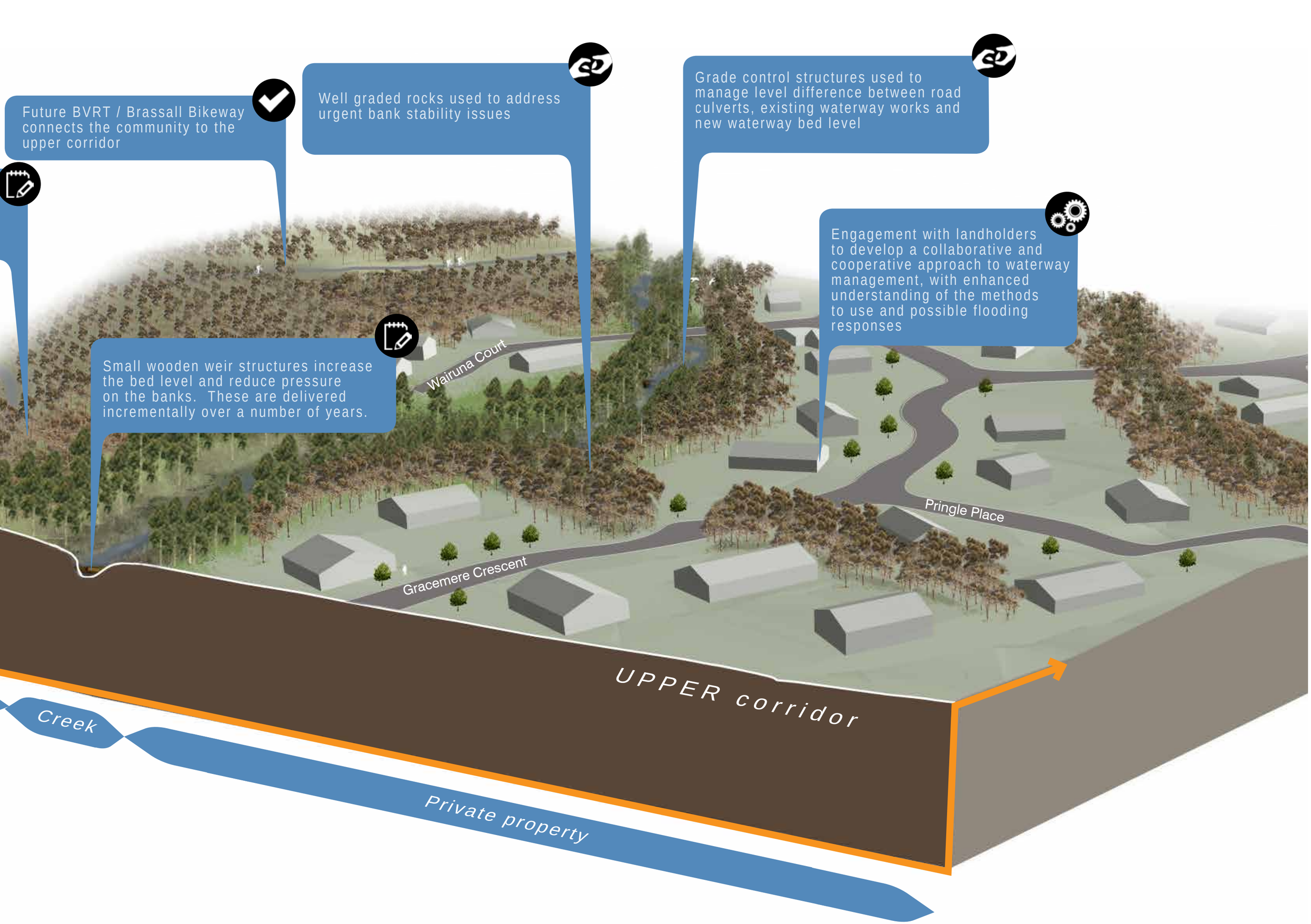
Future BVRT / Brassall Bikeway connects the community to the upper corridor

Well graded rocks used to address urgent bank stability issues

Grade control structures used to manage level difference between road culverts, existing waterway works and new waterway bed level

Engagement with landholders to develop a collaborative and cooperative approach to waterway management, with enhanced understanding of the methods to use and possible flooding responses

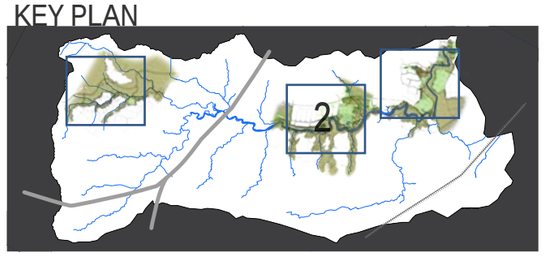
Small wooden weir structures increase the bed level and reduce pressure on the banks. These are delivered incrementally over a number of years.



Section Area 2 - Middle Corridor

Natural recreation in a healthy waterway corridor

KEY PLAN



Corridor Objectives Icon Key

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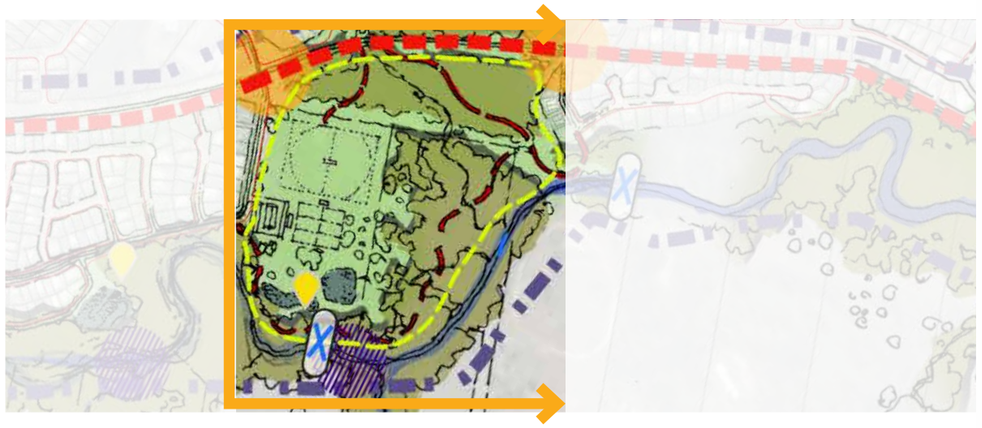
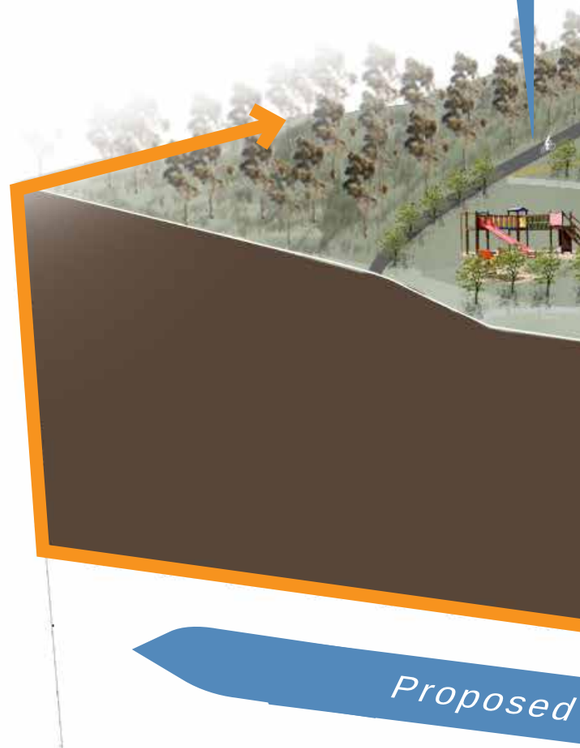
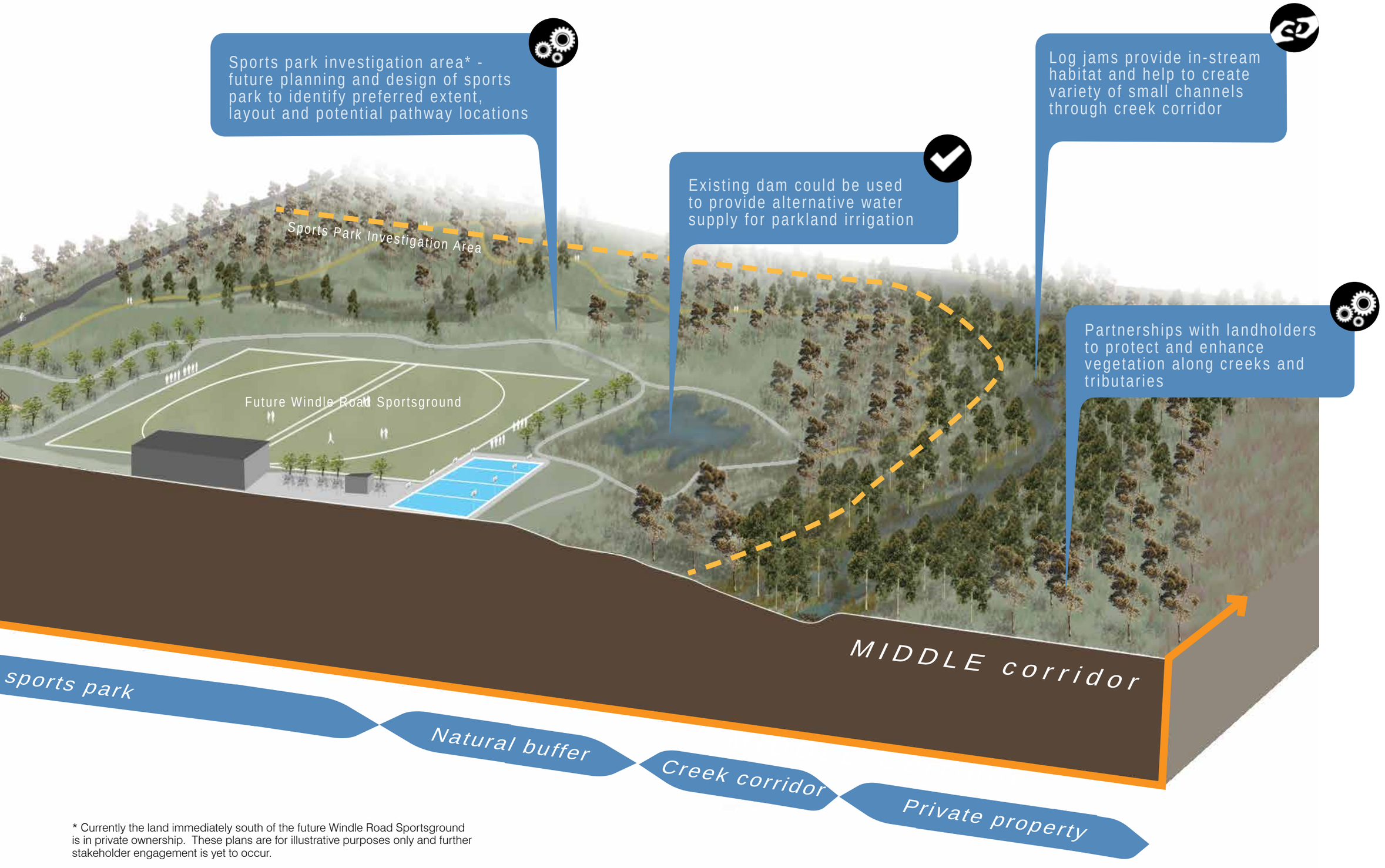


BVRT / Brassall Bikeway provides key linear connection through catchment and access to new sports park



Proposed

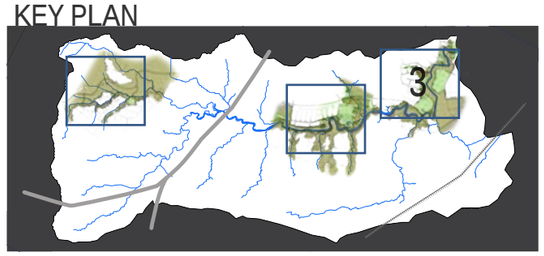


* Currently the land immediately south of the future Windle Road Sportsground is in private ownership. These plans are for illustrative purposes only and further stakeholder engagement is yet to occur.

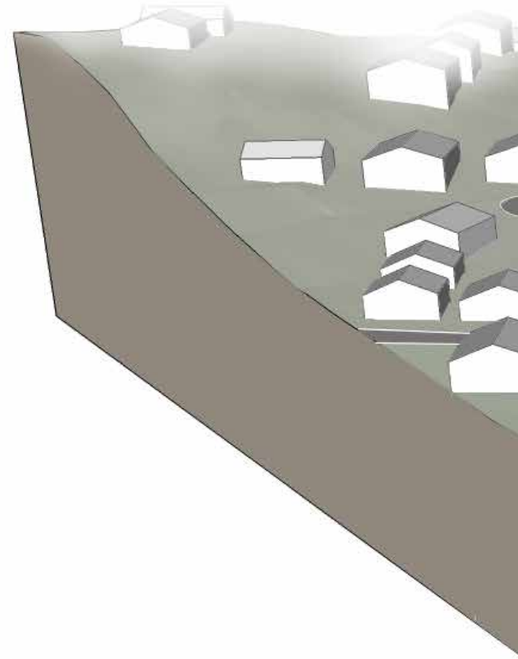
Section Area 3 - Lower Corridor

Build resilience for waterway improvements

KEY PLAN



REFERENCE PLAN



Corridor Objectives Icon Key

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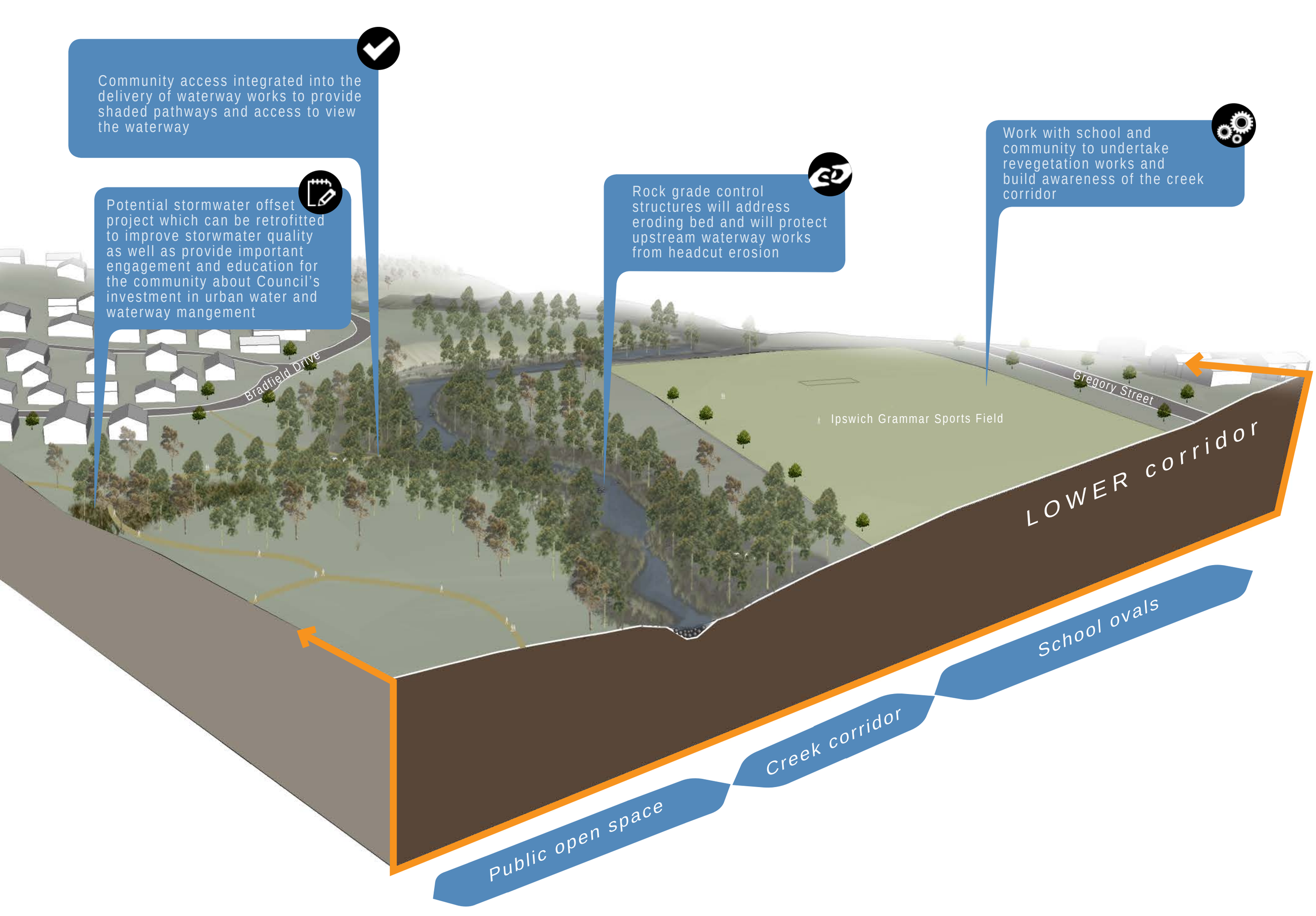
Working as One

Embracing the Environment

Making it Happen

We all Benefit


Community access integrated into the delivery of waterway works to provide shaded pathways and access to view the waterway
Potential stormwater offset project which can be retrofitted to improve storwmater quality as well as provide important engagement and education for the community about Council's investment in urban water and waterway mangement
Rock grade control structures will address eroding bed and will protect upstream waterway works from headcut erosion
Work with school and community to undertake revegetation works and build awareness of the creek corridor
Bradfield Drive
Ipswich Grammar Sports Field
Gregory Street
LOWER corridor
Public open space
Creek corridor
School ovals

5.0 Implementation

The Corridor Plan is a strategic guide to the long term transformation and management of the Ironpot Creek Corridor as a healthy and valued public asset. It identifies the vision and the range of opportunities available to deliver this vision. It also identifies specific actions to deliver this transformation at key locations (Detail Areas). These specific actions can also be supported through a range of small to large scale interventions which can be delivered across the corridor to drive and support its transformation.

A combined action list is provided on the following pages, highlighting the project objectives delivered and the stakeholders involved. The numbering in this plan does not reflect the proposed prioritisation of works. Instead, the information provided allows the table to be used by Council to help identify and prioritise key actions to take forward. The following criteria could be considered to inform this prioritisation:

+ Number of different objectives met
+ Timing and sequencing (i.e. some actions need to be undertaken initially to inform others, such as master plans and investigation areas)
+ Partnership opportunities to deliver actions
+ Strategic investment opportunities

To monitor and evaluate the implementation of the Corridor Plan, this document should be used as a reference document to ensure that all works undertaken across the catchment help to deliver the common vision and project objectives.

The following implementation table provides a detailed list of proposed actions and/or projects that have been developed based upon the objectives identified for the corridor (refer to the right).

The following implementation table provides a detailed list of proposed actions and/or projects that have been developed based upon the objectives identified for the corridor (refer below).

WE ALL BENEFIT

How

+ Increase accessibility for the community
+ Provide a range of experiences
+ Enhance the landscape, visual and social amenity
+ Promote increasing community awareness and understanding

MAKING IT HAPPEN

How

+ Common adaptive management approach using responsive natural channel design
+ Coordinate ongoing management
+ Reduce maintenance inputs
+ Create a self-sustaining system

EMBRACING THE ENVIRONMENT

How

+ Increase the habitat for native plants and animals
+ Accommodate dynamic waterway processes
+ Promote walkable and shaded public access
+ Enhance ecosystem services

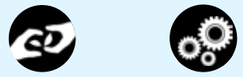
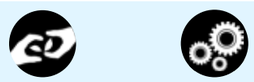
WORKING AS ONE

How

+ Share resources and responsibilities
+ Establish a common vision and approach
+ Build partnerships with community and other stakeholders
+ Committed and proactive actions
+ The functions, aesthetics and dynamics of the system are well understood and communicated

	PROPOSED ACTION / PROJECT	AREA	DESCRIPTION	TASKS AND OPPORTUNITIES FOR IMPLEMENTATION	OBJECTIVES	TIMING/ SEQUENCING	STAKEHOLDERS
1	Design and implementation strategy for waterway solutions (including wooden weirs, grade control structures and use of rocks where required), identifying short term locations and long term strategy to build on the early works	Whole corridor	A master plan which identifies the locations for short-term works (especially wooden weirs and grade control structures) to start to raise and control the bed level based on the waterway condition. It must also define how long-term works should build on this early investment to ensure these progressive works are well-informed and resourced going forward. This includes identifying the location and design of grade control structures to ensure the waterway works tie into existing waterway crossings and waterway works. This will also provide a good framework for coordinating and communicating works with private landholders.	+ Further develop the design of the wooden weirs and grade control structures including identification of materials and costs + Develop a master plan for how works will be implemented along the corridor + Identification of high risk areas which may require immediate rock work to protect the banks + Identify funding and implementation pathways to deliver waterway works (e.g. offsets, private landholder assistance, grants, green army programs)		The works in the upper and lower corridor are urgent and high priority respectively	ICC / Private landholders
2	Development of factsheet which describes the proposed waterway stabilisation for communication with local residents	Area 1	This material will provide landholders with an overview of the proposed strategy, including the benefits and risks of using the wooden weir solution to address bed and bank erosion and how they can help to undertake the works. This can also communicate how urgent rock works can be delivered if required but in context with these longer-term activities. This communication with the residents should also consider the potential for these works to reinstrate natural overbank flooding.	+ Development of community factsheet + Engagement with community to introduce the proposed solution and their potential involvement		These should be developed at the same time as the design of the upper corridor waterway works	ICC / Private landholders
3	Quantify potential benefits of waterway stability works to inform use of stormwater offset contributions to fund works	Area 1	The use of offsets for waterway stability works will be undertaken in accordance with Council's Stormwater Quality Offsets Implementation Plan.	+ Identify pollutant load reductions achieved with proposed works + Transparent use of stormwater offset funds		These should be developed at the same time as the design of the upper corridor waterway works	ICC
4	Review management and maintenance of existing waterway crossings to check public health and safety requirements	Whole corridor (mostly Area 1)	Waterway crossings should be identified on a register of assets to ensure that these are designed and maintained to protect public health and safety.	+ Monitoring and maintenance of assets		Inspections can be done when waterway works are carried out	ICC
5	Updated flood modelling to provide better understanding of creek flooding and influence design and delivery of waterway works	Whole corridor	Undertaking current flood modelling for the Ironpot Creek Corridor will improve the understanding of how flows are currently conveyed in the deeply incised and modified channels and will provide details on potential impacts associated with proposed works. Communicate and test these outcomes with residents (see 2).	+ Undertake flood modelling for creek based on current form + Test proposed waterway stability solutions to identify potential impacts to inform design and also facilitate communication with the community		These should be developed at the same time as the design of the upper corridor waterway works	ICC

	PROPOSED ACTION / PROJECT	AREA	DESCRIPTION	TASKS AND OPPORTUNITIES FOR IMPLEMENTATION	OBJECTIVES	TIMING/ SEQUENCING	STAKEHOLDERS
6	Development of on-going maintenance programs for any waterway improvement works	Whole corridor	It is important that everyone is aware that any waterway works will require some level of ongoing maintenance to ensure they continue to function as designed. Identifying this in an on-going maintenance program will allow resources to be allocated to these tasks.	+ Development of maintenance program with resources identified + Engagement with landholders or community members who help to deliver and potentially help maintain works		The maintenance program should be considered during the design and implementation of waterway works	ICC / private landholders
7	Protection and enhancement of well vegetated riparian corridor	Whole corridor	The corridor is currently well vegetated and contains some important vegetation communities. These should be protected and enhanced where possible.	+ Landholder partnership programs + Support creation of catchment group/s + Community planting days + Developers to provide riparian rehabilitation as part of development + Vegetation offsets (and potentially storrmwater offsets)		This is not urgent and can occur in-line with other planned related projects / programs	ICC / community
8	Planning and design of the entire BVRT / Brassall Bikeway corridor to connect with and to provide improved accessibility to, and across the waterway corridor	Whole corridor	The BVRT / Brassall Bikeway provides an important linear open space through the corridor which can be supported by natural recreational experiences delivered in the waterway corridor. Signage and connecting pathways at key destinations can provide this linkage.	+ Planning and design of pathways and destination nodes along BVRT and waterway corridor + Leverage off infrastructure funding to deliver waterway improvements and connect community to the wateway		This timing will be determined by the BVRT / Brasssall Bikeway timeframes	ICC / State Government
9	Co-locate community access and waterway improvement works	Whole corridor	Co-locating community access points into the corridor with waterway improvement works provides a good opportunity for the community to understand the dynamic nature of the waterway and also appreciate Council's investment into its management. These access points can also build off the access pathways which are provided to allow waterway works to be undertaken.	+ Coordinated planning of pathways and waterway works + Leverage off infrastructure funding where possible to deliver waterway improvements and connect community to the wateway		The design of community access should be considered when designing the waterway works	ICC
10	Recreation facility and local sportsground planning and design	Area 2	A master plan for the new Windle Road Sportsgound will provide clear strategic direction for how the planned recreational facilities from the Precinct Planning process will be integrated with the corridor works to provide a range of recreational experiences for the community. The design of the site will set a clear direction for this new sports field and should include details on how stormwater from the site is managed (including the possibility of using the existing water body for stormwater harvesting and irrigation) and how the park users can also interact with the corridor.	+ Development of master plan for key investigation area + Detailed master plan and design of sports ground + Works linked to the design and implementation of the Precinct Planning process - leverage off this work to deliver waterway improvement works		This timing will be determined by the new sports ground planning and design timeframes	ICC
11	Creation of an identity for Ironpot Creek	Whole corridor	Building awareness of the corridor as an important social and environmental asset will be important for ongoing investment into the corridor. A common signage or branding strategy for the catchment can be used at key locations to improve community awareness and understanding of the Ironpot Creek. This could be developed in collaboration with the community and / or local schools.	+ Develop a way-finding and signage strategy + Develop a community education and awareness process and activities (planting days, explore the corridor walks etc)		This is not urgent but would be good to have when there is alot of new investment occuring in the catchment for waterway works etc	ICC / community / schools
12	Design of retrofit works for incomplete stormwater management assets to use bond money to improve stormwater quality performance and landscape amenity	Area 2	Council currently holds bond money for the incomplete stormwater management assets. This money could be used to undertake works to improve the stormwater quality treatment of these assets (such as the conversion of existing basins to wetlands). These works should also aim to improve the landscape amenity of these assets.	+ Design and construction of retrofit works using bond money + Potential to involve the community or Green Army groups to help deliver and maintain works		Timing to be influenced by Council's works programs	ICC

	PROPOSED ACTION / PROJECT	AREA	DESCRIPTION	TASKS AND OPPORTUNITIES FOR IMPLEMENTATION	OBJECTIVES	TIMING/ SEQUENCING	STAKEHOLDERS
13	Ensure new developments consider Water Sensitive Urban Design principles and deliver the proposed and approved stormwater management devices and riparian works	Area 2	Ensuring WSUD and the appropriateness of offsets is considered will ensure developments incorporate the required on-site stormwater management systems to protect the local waterways. This includes the adoption of best practice erosion and sediment control during development. Ensuring the developer delivers the approved stormwater management assets and riparian rehabilitation works as required in the conditions of their development reduces the future burden on Council to have to undertake these works themselves using the bond money.	+ Delivery and handover of completed stormwater assets and riparian rehabilitation works from developers to Council + Ensure best practice erosion and sediment control is provided during development + Use of stormwater offsets where appropriate to deliver best environmental outcomes		This timing will be influenced by development approval applications	ICC / developers
14	Landholder partnerships to provide corridor links between Ironpot Creek and remnant bushland habitats	Whole corridor (mostly Area 2)	The Corridor Plan identifies key locations and properties which could provide important links between remnant bushland and the creek riparian corridor. These properties could be targeted for potential partnership programs (e.g. Land for Wildlife) to deliver revegetation on private property.	+ Identification and engagement with key landholders for potential partnership programs + Delivery of revegetation works as part of partnership programs (e.g. Land for Wildlife)		This is not urgent and can occur in-line with other planned related projects / programs	ICC / private landholders
15	Integrated design of creek crossings to ensure waterway works aren't compromised	Whole corridor (mostly Area 2)	There are a number of creek crossings planned for the corridor. It is important that the design of these crossings consider what the planned waterway works are aiming to do (e.g. lift the bed level or remove dominant channels) so they don't compromise them (e.g. if a culvert is delivered at the current bed level and works will eventually lift this level in the creek, additional grade control will be required to protect these waterway works from head cut erosion driven from the lower culvert level).	+ Coordinated design of creek crossings across Council departments + Ensure compliance with fish barrier legislation + Leverage off infrastructure funding to deliver waterway improvements and connect community to the wateway		This timing will be determined by the BVRT / Brasssall Bikeway timeframes	ICC / State Government
16	Investigate opportunities for stormwater retrofit project	Area 3	Undertake cost benefit analysis of potential retrofit solutions which could be delivered which considers stormwater quality improvements, community engagement opportunities and cost of delivery to ensure the most cost effective solution is delivered to demonstrate the use of stormwater offset contributions.	+ Cost benefit assessment of retrofit options + Design and delivery of retrofit work to demonstrate use of stormwater offset contributions		The timing of this will be influenced by the timing of Council's planned offsets works	ICC
17	Integrate bank stabilisation and future planting as part of woody weed removal planning and delivery	Whole corridor (mostly Area 3)	The use of hydroseed during woody weed removal will stabilise banks while also allowing ongoing woody weed maintenance to be undertaken. This can then be followed with planting of understorey and canopy vegetation once woody weed removal maintenance has been completed. This planting and ongoing maintenance could be undertaken with the local community and schools, including education on the appropriate planting species to be used in the riparian corridor.	+ Coordinated planning of woody weed removal and revegetation projects with Council and Ipswich River Improvement Trust + Partnerships with Ipswich Grammar School and local community and also potential for Green Amry groups to deliver and maintain plantings		The timing of this will be influenced by the timing of the weed removal program	ICC / IRIT
18	Improved connectivity between Ironpot Creek and Bremer River / Lynch's Crossing	Area 3	Investigate opportunities to provide link between Ironpot Creek and Lynch's Crossing. Due to the topography, this connectivity may not be a physical connection, but rather might be a virtual connection built through signage and educational materials in key open space areas near the confluence to describe how improvements in the Ironpot Creek are helping to improve the condition of the Bremer River.	+ Education signage (and potentially pathways) at confluence to build awareness of connection between Ironpot Creek and Bremer River + Potential to incorporate and leverage off Bremer River works / funding		This is not urgent and could link with other Bremer River works	ICC
19	Establish a waterway monitoring program	Whole corridor	Develop and implement a waterway monitoring program to measure waterway health (e.g. water quality and habitat)	+ Monitoring program could be undertaken with the assistance of community or school groups		This can link with a broader Council monitoring strategy	ICC / Schools and local community
20	Work with landowners to deliver lot scale improvements	Whole corridor	Council to seek opportunities to work with individual landowners to ensure impacts on the creek as a result of activities occurring at a lot scale are minimised wherever possible	+ Development of factsheets and private landowner engagement strategy		This can link with the engagement program, factsheets and partnership programs	ICC / local community