2.09 Existing Conditions: Fauna

The Subject Site contains a number of existing fauna habitats and potential wildlife corridors, the most significant being the following:

The Wallum Froglet habitat

A wetland formed by an unfinished excavation has created a certain environment that is subject to periodic inundation in which a number of Wallum Froglets have been found to be breeding.

Koala Habitat

The tract of coastal wetland forest in the south eastern corner of the Site is considered to constitute potential Koala habitat and contains preferred Koala food trees. North-south movement of Koalas through the Site is currently hindered by the fragmented nature of the canopy linking the south east to the open forest in the north. The Open Forest in the northern central section of the proposed residential area also provides potential habitat for Koalas but again, their movements are limited by the road and by the cleared site.

Other notable fauna for which there is existing suitable habitat are:

The Eastern Chestnut Mouse

This native rodent has been recorded in the dense native grass east of the drainage line in the south western corner of the Corridor. These live amongst native grassland, rushes and ferns.

The Common Planigale

This bird has also been recorded in the dense undisturbed vegetation of the same drainage line.

Grey Headed Flying Fox/ Squirrel / Glider

The existing site offers some limited suitable foraging habitat for these species in the form of flowering trees, and several individuals have been recorded.

Freshwater Aquatic Fauna

The Existing Lagoon supports a variety of aquatic organisms including Sea Mullet, Freshwater Mullet, Snake necked Tortoise, Gudgeon and Shortfin eel.

It also provides habitat for Waterbird species such as Chestnut Teal, Cormorants, Pacific Black Duck and Purple Swamphen.

Migratory Birds

Migratory bird species, Great Egret, Cattle Egret, White Breasted Sea Eagle, Fork Tailed Swift and Rufous Fantail have all been observed foraging within the Site.

Wallum Froglet Habitat

Potential Koala Habitat

2.10 Existing Conditions: Site Views

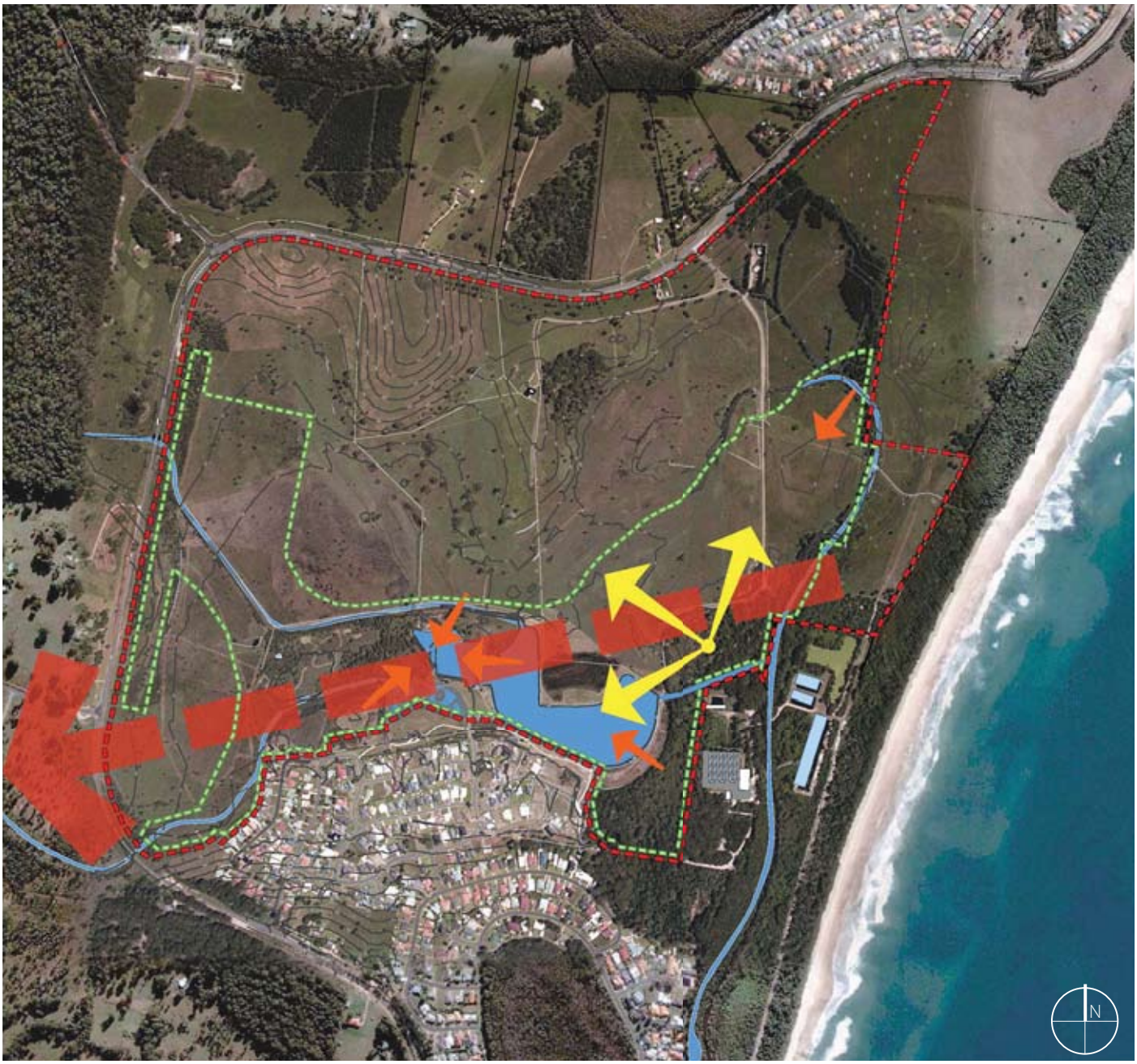
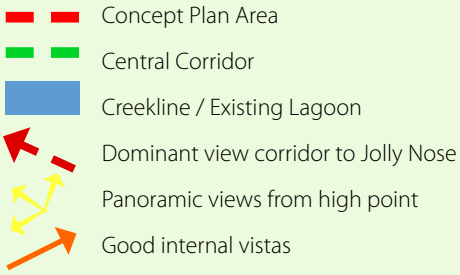


Figure 2.10 Existing Conditions: Site Views

NOT TO SCALE

Legend


Concept Plan Area
Central Corridor
Creekline / Existing Lagoon
Dominant view corridor to Jolly Nose
Panoramic views from high point
Good internal vistas

2.10 Existing Conditions: Site Views

The 'Jolly Nose' ridgeline (within the Queens Lake State Forest) to the west of the Site provides a strong visual focus and setting. It provides a potentially dominant visual backdrop to site features within a visual corridor that runs from the east to the west. Its prominence is evident in the recent site photographs taken within the view corridor.

The small elevated knoll in the south east of the Corridor provides a vantage point from which panoramic views of the Site and beyond can be achieved.

As demonstrated in Figure 2.10, there are numerous internal views of high quality which are worthy of retention through techniques such as framing and vegetation height management.

The view corridor and internal vistas are indicated on the diagram and will be explored further within the landscape master plan development.

View north of the Existing Lagoon looking toward the Jolly Nose

View across the Existing Lagoon toward the Jolly Nose

View from the slopes of the elevated knoll toward the Jolly Nose

View across the Wallum Froglet Habitiat toward the Jolly Nose

Internal view of the existing wetland and Forest backrdop

2.11 Existing Conditions: Drainage

Figure 2.11 Existing Conditions: Drainage

NOT TO SCALE

Source: Cardno (QLD) Pty Ltd - Water Engineering and Environment DGR Assessment Aug 2008

2.11 Existing Conditions: Drainage

The watercourses of the Duchess Gully and its tributaries extend through the Site in the form of deep drainage gullies and vegetated ditches. Most reaches of the Duchess Gully have been extensively modified by man made channel improvements and additions.

Catchments to the west of Ocean Drive drain into the upper reach of the Duchess Gully and the upper tributary entering from the north. Constructed channels direct flows into the Existing Lagoon which was built in the 1980s and is approximately 6.3ha in area.

Flows from this lagoon bypass the original upper reaches of Duchess Gully via a constructed culvert which discharges into a channel flowing directly into the middle reach of the Gully.

The Corridor is subject to periods of inundation after severe stormwater events which cause heightened flow conditions through the Gully and associated channels.

Existing Lagoon

Overflow from Existing Lagoon to Duchess Gully - Temporary Outlet

Duchess Gully

3.0 Concept Development - Proposed Site

3.01 Concept Development: Proposed Site Water Management

Figure 3.01 Concept Development: Proposed Site Water Management

NOT TO SCALE

Legend

- Concept Plan Area
- Central Corridor
- Creekline / Existing Lagoon
- Existing Gully / Vegetated Drainage Ditch
- Drainage Line
- Collector Flow
- Grassed Swales and Buffer Strips to Remove Sediments & Nutrients from Hard Surfaces
- Overflow Points
- 100 Year Storm Event inundation Limit
- Catchment Boundary
- Wallum Froglet Habitat

Source: Adapted from Cardno (QLD) Pty Ltd: Rainbow Beach Estate Water Engineering and Environmental Report Aug. 2008

3.01 Concept Development: Proposed Site Water Management

The most prominent proposed feature of the development within the Corridor is the approximately 10.5 ha Constructed Wetland adjacent to the middle reaches of Duchess Gully. Flows from the Existing Lagoon will be re-directed to the proposed Constructed Wetland by a specific flow device.

The strategy is to provide an area of coastal freshwater lagoons, marshes and non-tidal freshwater constructed wetlands which will manage and treat stormwater whilst providing various levels of habitat for a variety of aquatic wildlife.

The Existing Lagoon has an approximate depth of 2.5m and a top water level of approximately 3.4m AHD. The proposed Constructed Wetland will have an average depth of 2m and a top water level of 3.0m AHD. The shape, size and depth of the proposed Constructed Wetland has been determined, among other aspects, by the amounts of fill required for the creation of the residential subdivision and the need to leave the underlying Acid Sulphate Soils undisturbed.

There will be some flow interchange between the Existing Lagoon and the proposed Constructed Wetland. In severe runoff events, water will be divided appropriately between the Constructed Wetland and an overflow to Duchess Gully.

The flow path of Duchess Gully will be adjusted to direct low-flows through the Constructed Wetland and into the upper reaches of the Gully via an overflow weir. The weir structure will be designed to enhance fish migration.

The proposed Constructed Wetland will have water treatment wetland areas along its northern edges which will form part of a water 'treatment train' for storm runoff from the proposed residential areas. This 'train' includes rain gardens and grassed swales within drainage corridors which will intercept and treat runoff through biofiltration. These will direct water through smaller wetlands either north-west of the Existing Lagoon or along the edge of the Constructed Wetland to ensure satisfactory water quality is achieved prior to discharge into the Duchess Gully.

The weirs will discharge stormwater runoff for all storms up to and including the 5 year ARI events via scour protected channels.

Overflow embankments to the east of each lagoon will manage storm water runoff in excess of the 1in 5 year event level.

Landscape master plan objectives:

The landscape master plan meets the following objectives in relation to stormwater management within the Central Corridor:

- Protect and enrich the biodiversity of the existing aquatic habitat, and provide opportunities for the creation of new habitat within the Constructed Wetlands. This can be achieved through appropriate supplementary planting of embankments and marginal zones and appropriate spatial design of walkways or boardwalks.
- Create a safe and controlled environment, limiting human and domestic animal access to the water bodies through structural planting and the design of safe circulation networks and wetland edge conditions.
- Provide appropriate passive recreational opportunities (eg. bird watching, educational signage, observational seating areas) for community appreciation of the waterside environment.
- Improve the landscape character of the waterside environment through design – providing a landscape setting - lakeside walks where appropriate and associated spaces that augment and enhance the visual qualities of the water bodies.
- Provide the interface between the ecology and public realm.

3.02 Concept Development: Opportunities & Constraints - Ecology

Figure 3.02 Concept Development: Opportunities & Constraints - Ecology

NOT TO SCALE

Legend

- Concept Plan Area
- Central Corridor
- Permanent Water Body
- Existing Gully / Vegetated Drainage Ditch
- Proposed creekline/drainage corridor
- Surrounding vegetation / habitat
- Vegetation / habitat - Existing or currently under revegetation
- 1 Coastal Forest - potential habitat for Koalas. Area to be protected.
- 2 Wallum froglet habitat - Area to be protected.
- 3 Swamp Sclerophyll Forest - EEC. Foraging habitat for Eastern Chestnut Mouse. Area to be protected.
- 4 Subtropical Coastal Forest - EEC. Area to be protected.
- 5 Densely vegetated drainage line. Habitat for Common Planigale, Eastern Chestnut Mouse & Wallum Froglet. Area to be protected.
- A Potential to increase arboreal habitat for Grey Headed Flying Fox and Squirrel Glider
- B Potential to provide habitat for Water Dragons, Tortoises and Water Fowl
- C Potential to create roosting / foraging habitat for migratory Osprey & Bitterns
- Opportunity to strengthen existing wildlife movement corridors
- Opportunity to increase plantings of Koala food trees
- Opportunity to increase / create aquatic habitat

Source: DarkHeart Eco consultancy - Ecological Survey and Statutory Assessments Report undertaken for Luke & Co. Sep 2008

3.02 Concept Development: Opportunities & Constraints - Ecology

The ecology services contained within the Subject Site and the long-term objectives for their protection and enhancement are the starting point for master planning the Central Corridor.

By pulling together all known existing or proposed ecological systems and objectives relating to:

> native fauna and habitat; protection or creation (Aquatic, arboreal and terrestrial); and

> native flora; protection and regeneration, enhancement and restoration of EECs and specific restoration of endemic vegetation communities for habitat value.

A framework of opportunities and constraints begins to dictate the layout of the landscape master plan.

Retention and enhancement of the ecological value of the corridor is the primary objective and the landscape design must firstly consider whether it is meeting the following long-term objectives:

> Protection and enhancement of existing fauna habitat.

> Restoration or revegetation of degraded EECs and endemic communities.

> Provision of structural complexity and cover for native fauna.

> Reinstatement and strengthening of wildlife movement corridors through the site.

> Protection of sensitive environments through control of human and domestic animal access and circulation.

> Increasing community awareness of the natural environment, its ecology and provision of appropriate opportunities for learning and interaction.

Specifically, the main areas which require consideration and provide both opportunities and constraints for the landscape master plan are: (as numbered in Figure 3.02)

1. Coastal Forest – potential habitat for Koalas

This area, in the south east corner of the corridor contains some preferred Koala food species-

> *Eucalyptus microcorys* (Tallowwood)

> *Eucalyptus signata* (Scribbly Gum)

> *Eucalyptus teriticornis* (Forest Red Gum)

These areas will be protected and ongoing regeneration is taking place to manage weeds and augment the existing forest with new plantings of Koala food species. There is an overall objective to strengthen and form movement corridors for Koalas in a north-south and east-west direction through the Site, and the planting of these species along the desired movement corridors will help achieve this. The landscape design needs to be mindful of this and allow appropriate space, control of access and design of structure planting etc.

2. The Wallum Froglet Habitat – breeding of the Wallum Froglet

Froglet breeding occurs within the shallow ephemeral water body after inundation. The existing environmental conditions of this wetland need to be retained, and no other landscape treatments are proposed that will compromise this habitat (such as tree planting within the depression which will take up water). People and animals are to have restricted access to this area. Controlled access to this visually and environmentally interesting area may be provided through a boardwalk or viewing platform.

Water Dragon- potential to create aquatic habitat

Osprey - potential to create roosting habitat

3. Swamp Sclerophyll Forest EEC

The degraded ecological community of Paperbark, Swamp Mahogany and Swamp Oak Forest in the western section of the Corridor is undergoing restoration in order to re create species diversity at the shrub and canopy layer. This EEC has been noted to provide potential habitat for the Eastern Chestnut Mouse. The landscape master plan needs to restrict human access through this site and create opportunities for improved habitat and foraging sites for native fauna.

4. Subtropical Coastal Forest EEC

The degraded ecological community of She Oak, Swamp Mahogany, Fig and Paperbark with predominantly sedge and rush groundcover understorey is undergoing regeneration to restore its natural canopy and shrub layers. The landscape master plan restricts human access through this site and creates opportunities for improved habitat and foraging sites for native fauna.

5. Drainage lines

The densely vegetated drainage gully – a tributary of the Duchess Gully in the south western corner of the Corridor provides habitat that may potentially support the Eastern Chestnut Mouse and Common Planigale. These areas provide relatively dense cover of Swamp Oak Swamp Forest and dense native grassland. These environmental conditions need to be retained and strengthened and access limited.

Other potential ecological outcomes within the corridor are:

A Potential within the narrow corridor between the existing and proposed lagoons which connects the Southern Coastal Forest to the northern residential edge, to increase arboreal habitat for the Grey Headed Flying Fox and Squirrel Glider. This would be achieved through planting of winter and summer flowering trees within this pathway.

B Potential to create habitat for Water Dragons, Tortoises and Water Fowl within and around the proposed outlet which discharges water from the Constructed Wetland to the northern reaches of Duchess Gully. This would be achieved through the provision of large rocks, boulders and logs.

C Potential to create roosting and foraging habitat within the planted edges of the lagoons, through appropriate composition of tree and shrub layers, for migratory birds such as Osprey and Bittern.

The landscape master plan provides a structure which enhances the ecological value of the Subject Site whilst also providing amenity for the community and increasing awareness of the natural environment within the future neighbourhood.

The concept landscape master plan helps guide the structure and composition of the planting and regeneration works taking place on the Site.

Bittern - potential to create roosting habitat

Tortoise - potential to create aquatic habitat

3.03 Concept Development: Bushfire Asset Protection Zones

Figure 3.03 Concept Development: Bushfire Asset Protection Zones

NOT TO SCALE

Legend

- Concept Plan Area
- Central Corridor
- Permanent Water body
- 15m Asset Protection Zone Provided by the Perimeter Road
- 10m Asset Protection Zone Provided by the Perimeter Road
- 20m Asset Protection Zone Provided by the Perimeter Road
- 41 - 47m Asset Protection Zone Provided - within School Site
- 21m Asset Protection Zone Provided - within School Site
- Managed Parkland - acting as Asset Protection Zone between the existing residential development and the Site
- Bushfire Prone Vegetation

Source: Australian Bushfire Protection Planners Pty Ltd Report. 2008

3.03 Concept Development: Bushfire Asset Protection Zones

As a result of substantial revegetation proposed for the Subject Site, the Corridor will be classified as bushfire prone land, linking vegetation on the Site with existing vegetation adjacent to the Sewage Treatment Plant and Littoral Rainforest Vegetation on the coastal dunes.

In the light of this, Asset Protection Zones (APZ) are proposed between the future residential development and vegetation, but are wholly contained within areas of new urban development.

The main protection zones that will have an effect on the Corridor are as follows:

> The required APZ for the southern and south western edge of the future residential development is 15m. The proposed perimeter road and the proposed building setback will provide the APZ .

> The required APZ for the south eastern edge of the future residential development just north of the Constructed Wetland is 20m due to the forest vegetation along the eastern boundary.

> At the interface between the Corridor and the existing residential subdivision south of the Site, a 30m zone of protection is required to protect the existing houses. This zone will be required to be managed as park land in accordance with the following principles and no bush regeneration works are to be carried our within this zone. The existing council park between the existing subdivision and the corridor will provide an adequate protection zone.

Landscape areas that are required to be managed as parkland will use:

> Clear areas of low cut lawn

> No continuous tree canopies - trees in clumps, not in rows

> Vegetation without overhanging branches near residences

> Smooth barked trees

> Planted windbreaks in the direction from which fires are likely to approach

Source: Australian Bushfire Protection Planners Pty Ltd Report. 2008 Planning for Bushfire Protection - NSW Rural Fire Service, 2006

3.04 Concept Development: Opportunities & Constraints - Community Open Space & Interaction

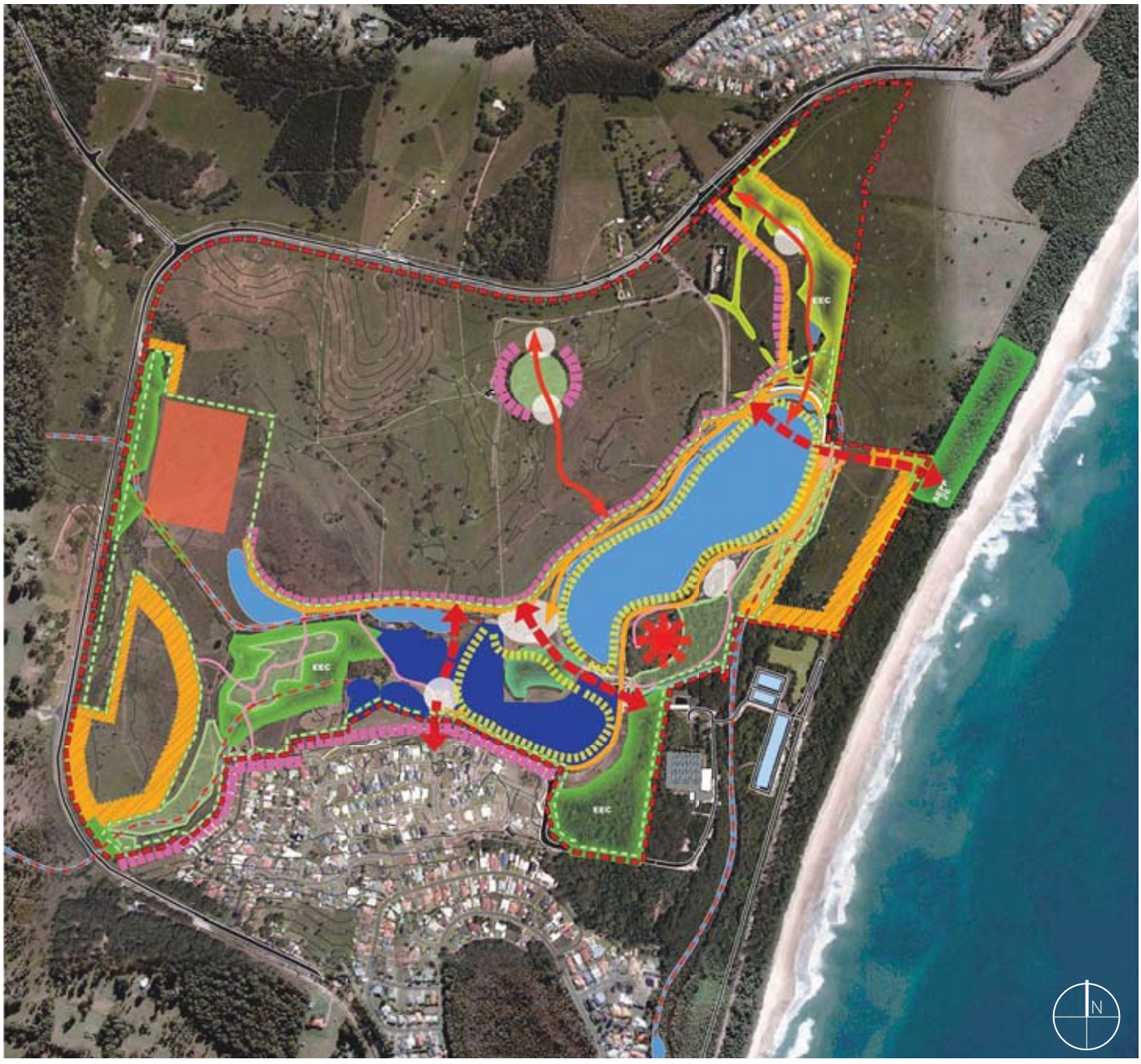


Figure 3.04 Concept Development: Opportunities & Constraints - Community Open Space & Interaction

NOT TO SCALE

Legend

- Concept Plan Area
- Central Corridor
- Exiting water body
- Proposed water body
- Existing Gully / Vegetated Drainage Ditch
- Urban edge
- Limited or no access to habitat / water's edge, potential restricted access to lake
- Primary cross site connection
- Green link to parklands
- Lake side walking opportunity
- Bushwalking opportunity
- Playing fields opportunity
- Park, focal point or structured open space opportunity
- Strongest vantage point
- APZ
- SEPP 26 Littoral Rainforest
- Vegetative screen buffer to SEPP 26
- Vegetative edge treatment to SEPP 26
- Wallum Froglet habitat
- Swamp Sclerophyll Forest EEC
- Swamp Oak Floodplain Forest EEC
- Other protected habitats

3.04 Concept Development: Opportunities & Constraints - Community Open Space & Interaction

There are limited opportunities to create overly expansive areas of 'landscaped' public open space within the Corridor due to the water management and ecological objectives that have been defined within this report. There are, however, numerous opportunities to create small pockets of open space, parks, clearings, viewpoints, boardwalks and linear connective spaces which can collectively provide a 'sense of place' and considerable public amenity. These spaces, articulated along a circulatory system, provide the 'connective tissue' which holds together the diversity of the landscape and its natural or constructed features.

The nature and form of these spaces will vary in visual character, amenity value and level of embellishment depending upon their location and relationship with the urban or natural environment. The level of active recreation provided for and degree of interaction with the environment of the corridor will be determined in many ways by how people are guided through the Site.

There are three primary cross connections (north-south) which are required to;

> connect the existing and proposed residential estates;

> provide a connection between the south side of the; proposed water body and the proposed residential estate; and

> provide direct access for the proposed residential estate to the beach.

Along the length of these or terminating them, there is the opportunity to create small parks or focal communal space.

The area between the proposed residential environment and the Corridor allows the opportunity to create a linear park which will provide the interface between the residential and natural environment. By utilising these primary areas to create the main 'active' amenity zones, the more sensitive environments are by-passed. Other more passive and experiential routes and 'moments' can be created outside of the primary zones such as lake side walks, bush trails, viewing platforms and artistic / interpretive features.

Interaction with habitat and areas of high ecological value can be limited to controlled footpaths or viewing platforms only. Interpretive and educational signage can be used to inform and guide the community in these areas.

The way people are managed within the Corridor needs to be well structured in order to meet the following objectives:

> protection of EECs and prime regeneration areas – access via defined pathways if not prohibited altogether;

> protection of habitat – people should be allowed visual interaction only with areas such as the Wallum Froglet area and restricted pathway access through core fauna habitat; and

> creation of high quality aquatic habitat in the existing and proposed water bodies – people should be allowed very limited access to the waters edge, and swimming, boating and fishing are discouraged.

3.05 Concept Development: Spaces, Features & Circulation

Figure 3.05 Concept Development: Spaces, Features & Circulation

NOT TO SCALE

Legend

- Concept Plan Area
- Central Corridor
- Proposed Bonny Hills and Lake Cathie Coastal Walking and Cycle Trail
- Primary Footpath
- Secondary Footpath
- Public Open Space Opportunity
- Bush / Forest
- 1 Structured View Corridor - Grasslands / Turf / Water - Jolly Nose Backdrop
- **2** Community Park / Play Area
- **3** Wallum Froglet Habitat
- **4** Prospect Hill - View Point
- **5** Clearing' - Interpretive Heritage Site
- **6** Beach Access - Entry Area
- **7** Rock Weir and Habitat Viewing Platform
- **8** Bushland Park
- **9** Bushland Park
- **10** Drainage Swales
- **11** Linear Park
- **12** District Playing Fields
- **13** Bushland Trails
- **14** Termination of View Corridor
- **15** Picnic Park and/or Playground
- **16** Pedestrian Bridge
- **17** Pedestrian / Cycleway Connection - trafficable in 1:20 year flood

3.05 Concept Development: Spaces, Features & Circulation

By working through the opportunities and constraints of the Site and its long-term objectives, a clear circulatory system begins to emerge. Desired landscape and visual character, size, location and treatment of potential public open spaces can begin to be explored within this system.

In addition, consultation with local residents and community groups has resulted in a proposed network that is coordinated with other plans and expectations in the local area.

The resulting plan communicates the beginnings of a landscape master plan that integrates the desired patterns of circulation, site features, the view corridor and opportunities for the creation of public space.

The main objectives of the circulatory system are to provide clear and safe walking tracks through the Site that connect features and spaces. The primary footpaths provide a circuit around the whole Site and provide the main north south connections. Secondary footways allow visitors a more intimate experience of the Site's natural features where appropriate. A lakeside walk will allow access all around the proposed water body but restrict access to the water. Pathways will connect the forest areas in the north to the Central Corridor via vegetated drainage corridors and alongside the Duchess Gully.

The following features and aspects of the Central Corridor (as numbered) will be built into the fabric of the landscape master plan and explored in more detail within the next section of the report:

1. Structured View Corridor

The identified visual corridor through the Site provides impressive backdrops of the "Jolly Nose' and Queens Lake State Forest. Planting is structured along this corridor to maintain the visual connection with these identified external views. The scale and density of planting will be manipulated to create a distinct corridor along which a series of viewing platforms and features can be inserted.

2. Central Community Park /Play area

At the northern edge of the Central Corridor, there is land between the two water bodies which lends itself to becoming a central communal space. Its proximity to the proposed residential edge and central position along the linear interface between the urban and natural environment gives it a prominence as the main hub within the Central Corridor. This could become a park with an active play or recreational focus.

3. The Wallum Froglet Area

This will be retained and protected from the proposed park area by dense shrub planting and fencing. There is potential to provide a viewing area and interactive signage at its extent.

4. 'Prospect Hill"- View Point

The existing hill can be used as a vantage point for panoramic views of the site and its surrounds, and /or a viewing platform can mark the beginning of the defined view corridor.

5. 'Clearing' - Interpretive Heritage Site

The aboriginal artefacts found within the Subject Site warrant permanent conservation. There is the potential here to structure the revegetation to retain a clearing in the bush – a contemplative space with seating and interpretive art or signage relating to the heritage significance.

6. Beach access - Entry Area

There is the opportunity to create a small feature area at the intersection of the lakeside walk and the proposed route to the beach. This will link into the future proposed Bonny Hills and Lake Cathie Area Coastal Walking and Cycle Track.

7. Rock Weir and Water Habitat Viewing Platform

The proposed overflow channel to the Duchess Gully provides a focal area where a pedestrian timber bridge can allow visitors to get a closer look at the rocky area (potentially habitat for Water Dragons etc) and allow views across the lake and beyond the Site.

8. Bushland Park

There is the opportunity to create a small bushland park within the remnant open forest area at the northern end of the Duchess Gully.

9. Bushland Park

Similarly, there is the opportunity to create a small bushland park in the Open Forest within the proposed residential area. This has a more central location within the proposed development and is close to the proposed Village Centre. This has the potential to become an important space but the size and activity of the park would need to be limited in order to avoid conflict with fauna movement corridors.

10. Drainage Corridors

These corridors will eventually take on a role which includes stormwater treatment from the proposed residential catchment. Pathways along these corridors will connect the bushland parks and residential zones to the Central Corridor in the future.

11. Linear Park

The land which forms the interface between the natural and urban environment is a linear space which can potentially take on a more formal structure at its urban edges. This space will provide amenity for the community in the form of a lakeside walk, seating and viewing platforms as well as break out areas for picnics and gatherings. Along the Constructed Wetland there should be opportunities for bird watching. The lakeside walk will connect the proposed district playing fields, the central community park and the proposed Constructed Wetland.

12. District Playing Fields

As part of this application, the Central Corridor will provide the land and associated earthworks for the creation of four public playing fields which are a much needed community asset. These playing fields will have a natural bushland setting to the west and a more formal interface with the future residential streetscape.

13. Bushland Trails

The EECs – Swamp Sclerophyll Forest and the Subtropical Coastal Forest are presently undergoing bush revegetation and restoration work. There are several unsealed pathways that are already established within these areas, and some of them are proposed to be formalised as part of the landscape master plan in order to clearly define access.

In areas where the ground is particularly wet and prone to inundation, boardwalks and bridges can be used. This area is naturally quite beautiful and these walkways will allow controlled access through the bush whilst providing an intimate experience for walkers.

14. Termination of View Corridor

There is the potential to create a feature in the landscape here that provides a focal point within the mid point of views out to The Jolly Nose.

15. Picnic Park

At the Site boundary of the existing housing estate where the pathway between the two estates is proposed, there is available land beside the Existing Lagoon to form an area of community open space. This will help to connect the existing parkland of the southern estate to the Central Corridor and provide a 'gateway' to the primary north south connection. This could take the form of an informal picnic park or small play area on the edges of the Existing Lagoon.

16. Pedestrian Bridge/ Trafficable Culvert

This area provides beautiful internal views across the Existing Lagoon with the distant backdrop of the hill behind. A pedestrian timber bridge is crossing the culvert and provides opportunities to enjoy the views, while the trafficable culvert provides connectivity for the maintenence vehicles.