FIGURE 9: NEIP PUBLIC TRANSPORT, WALKING AND CYCLING PLAN.
PSP Road Network

The PSP road network is clearly defined and provides a high level of accessibility and integration with the surrounding road network. The road network provides for direct and clear access to all properties.

The road network is illustrated in Figure 10.

The internal road network includes the following key features:

- Keystone Avenue and Gateway Avenue Entry Roads – major entry road from both Barwon Heads Road and the EWLR.
- Loop Road – A ring road providing a priority route circulating the site, in particular supporting larger commercial vehicles.
- Keystone Avenue – A central spine providing access to the Village and Retail Centre.
- Tannery Road – An east-west spine road providing access to the village centre and connecting to Marshalltown Road for efficient bus connections.
- Local Streets – Other streets that provide direct access to individual properties will also be provided, however are not generally shown in the PSP layout at present, and will be resolved as part of future subdivision layout.
- Sparrowvale Road (section between Keystone Avenue and Tannery Road) – Service street providing for vehicle movements, parking on the eastern side of the street, pedestrian movements and a continuous system of rain-gardens along the wider western verge of the street (driveway crossovers are permitted).

The external road network includes the following key features:

- Barwon Heads Road / Keystone Avenue (signalised intersection)
- EWLR / Gateway Avenue (signalised intersection)
- Barwon Heads Road / Secondary site access (unsignalised intersection)
- Barwon Heads Road / Tannery Road / Marshalltown Road / the Horseshoe Bend Road (unsignalised intersection), provide access for Public Transport only.

Road Hierarchy

The NEIP will be accessible via a main signalised intersection on Barwon Heads Road and the new Keystone Avenue. Keystone Avenue will be a key collector road that will establish a sense of entry to the business park and create a desire line that filters vehicles directly into the heart of the specialised activity centre. This entrance road will be designed to maximise exposure to Barwon Heads Road. This will be a fully signalised intersection.

Service roads will be located on Barwon Heads Road providing one way traffic movements and left in/left out access in accordance with the VicRoads Access Management Policy. These service roads will create a perceived sense of direct frontage for uses located along this interface within a managed road network that will avoid any impact on traffic flows on Barwon Heads Road.

In addition to the key access road, external access to the site will be provided in the south via connections to the EWLR, and potentially at the intersection of Tannery Road and Barwon Heads Road. As Tannery Road is outside of the precinct, the timing and delivery of an appropriate standard intersection in this location is uncertain. As such, the PSP proposes a left in/left out un-signalised intersection at this location providing access for public transport only (not commercial or associated vehicles).

A key element of the road network is the Loop Road which forms a ‘ring’ around the core of the precinct. This route enables separation of heavy vehicle circulation from the more pedestrian focussed areas inside the loop road. It thus ensures overall efficiencies without impeding movements of any user groups.

A series of key local roads provide the key north south and east-west connections through the precinct for local traffic. These local roads connect with the Loop Road enabling a high level of permeability and ease of movement through the precinct. Street and intersection design have been considered carefully to manage local road intersections with the Loop Road, and with all the proposed collector roads.
### TABLE 12: NEIP SITE INTERSECTION DETAILS

<table>
<thead>
<tr>
<th>Intersection Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A: Barwon Heads Road / Keystone Avenue</strong></td>
</tr>
<tr>
<td>Signalised T intersection with Barwon Heads Road.</td>
</tr>
<tr>
<td>Midway between Tannery Road and Reserve Road.</td>
</tr>
<tr>
<td>Spaced approx 550m from Reserve Road and 650m from Tannery Road.</td>
</tr>
<tr>
<td>Intersection could include a western approach to create a cross intersection</td>
</tr>
<tr>
<td>and connect to the adjacent residential precinct.</td>
</tr>
<tr>
<td><strong>B: East West Link Road / Gateway Avenue</strong></td>
</tr>
<tr>
<td>Locate approximately 600m from Barwon Heads Road</td>
</tr>
<tr>
<td>Achieve an alignment similar to the existing Sparrowvale Road alignment.</td>
</tr>
<tr>
<td>Provide for potential southern approach with the adjacent Horseshoe Bend Precinct.</td>
</tr>
<tr>
<td><strong>C: Barwon Heads Road / Secondary Access Road</strong></td>
</tr>
<tr>
<td>The secondary access is located midway between Tannery Road and Keystone Avenue.</td>
</tr>
<tr>
<td>Signalised T intersection catering for left in and left out movements only.</td>
</tr>
<tr>
<td><strong>D: Service Roads</strong></td>
</tr>
<tr>
<td>Provide along the Barwon Heads Road frontage.</td>
</tr>
<tr>
<td>Provide one way traffic movements and left in/left out access to Barwon Heads Road.</td>
</tr>
<tr>
<td><strong>E: Barwon Heads Road / Tannery Road / Marshalltown Road / Horeshoe Bend Road</strong></td>
</tr>
<tr>
<td>Provide public transport access only.</td>
</tr>
<tr>
<td>Continue to provide for local residential traffic until the NEIP fully transitions.</td>
</tr>
<tr>
<td><strong>F: Loop Road / Keystone Avenue</strong></td>
</tr>
<tr>
<td>Intersection to operate as a roundabout.</td>
</tr>
<tr>
<td>Two lanes required on each leg of the roundabout.</td>
</tr>
<tr>
<td><strong>G: Loop Road / Gateway Avenue</strong></td>
</tr>
<tr>
<td>Intersection to operate as a roundabout.</td>
</tr>
<tr>
<td>Two lanes required on each leg of the roundabout.</td>
</tr>
<tr>
<td><strong>H: Loop Road / Tannery Road (West)</strong></td>
</tr>
<tr>
<td>Potential long term signalised intersection.</td>
</tr>
<tr>
<td><strong>I: Loop Road / Tannery Road (East)</strong></td>
</tr>
<tr>
<td>Un-signalised intersection. Priority to Loop Road.</td>
</tr>
<tr>
<td><strong>J: Loop Road / Sparrowvale Road</strong></td>
</tr>
<tr>
<td>Un-signalised intersection. Priority to Loop Road.</td>
</tr>
<tr>
<td><strong>K: Loop Road / Keystone Avenue</strong></td>
</tr>
<tr>
<td>Un-signalised intersection. Priority to Loop Road.</td>
</tr>
<tr>
<td><strong>L: Tannery Road / Keystone Avenue</strong></td>
</tr>
<tr>
<td>Un-signalised intersection. North South Priority.</td>
</tr>
<tr>
<td><strong>M: Tannery Road / Sparrowvale Road</strong></td>
</tr>
<tr>
<td>Un-signalised intersection. Priority to Tannery Road.</td>
</tr>
<tr>
<td><strong>N: Keystone Avenue/Gateway Avenue</strong></td>
</tr>
</tbody>
</table>
East West Link Road (EWLR)

As discussed previously, the EWLR will be an arterial road that serves the growth area and beyond. An 80m road reserve is required for the EWLR. The EWLR is proposed to have an 80km/h speed limit including on-road bicycle lanes with signalised intersections at regular intervals.

It is proposed that Gateway Avenue will intersect with the EWLR. A signalised pedestrian intersection will be provided at this point, enabling connection to the Horseshoe Bend Precinct to the south and a potential traffic connection via a possible south leg of the intersection. These details are to be resolved in the detailed design with VicRoads. This work will also determine the status of the interchange at the Barwon Heads Road/Reserve Road intersection.

The ACUGP indicates the requirement for allowance for an ultimate grade separated interchange at this intersection. The agreed reservation provides allowance for such an intersection. The exact location of on and off ramps and any modelling of this intersection will need to be further designed by VicRoads at such time as the grade separated interchange is required.

In the interim, a local road will be required to be provided in the EWLR reservation. An intersection is proposed as part of this local access function at Gateway Avenue, approximately 710 metres from Barwon Heads Road. This intersection will be located to achieve a similar alignment to the existing Sparrowvale Road alignment which is indicated in the ACUGP as operating as a major access point for the NEIP.

The agreed alignment of the EWLR is identified in the Figure 4 Future Urban Structure Plan.

Traffic Generation and Distribution

Based on the proposed land uses it is forecast that the road network will support in the order of 32,000 vehicle movements per day. The predicted daily traffic volumes are not expected to exceed 15,000 per day. The road network has been appropriately designed to accommodate for this level of traffic and to cater for the distribution of traffic as modelled by GTA Consultants as part of the structure planning process.

Traffic volumes along the Loop Road are not expected to exceed 10,000 vehicles per day, while traffic volumes along other internal roads would not be expected to exceed 7,500 – 5,000 vehicles per day. These traffic volumes are well within the road capacity of 18,000 vehicles per day.

In addition, it is noted that the Loop Road has a three lane carriageway providing a central turning lane along its length ensuring no obstruction is caused by turning traffic to the through traffic movements, further increasing two-way capacity.

Road Cross-sections

Road cross sections have been prepared for the design of the various categories of roads in the precinct. These cross sections vary to the CoGG Integrated Infrastructure Delivery Plan cross sections to respond to the specific needs of commercial and industrial traffic, as well as providing for walking, cycling and public transport movements into and through the site.

4.12.1 Objectives: Transport and movement

The transport and movement objectives are:

- To design a road network that provides for safe and convenient walking, cycling, and public transport.
- To provide direct links to Marshall Station for bus, walking and cycling.
- To provide early delivery of public transport.
- To provide visible and secure bike storage facilities at key public destinations throughout the precinct.
- To provide seating and shade along core walking tracks.
- To provide a road network that supports the business and industrial aspects of the site and is attractive and financially viable for businesses to locate within the precinct.
- To provide sufficient road network capacity through the site and at the key site intersections with the surrounding road network to minimise delays to vehicles accessing the precinct.
- To minimise through movements of traffic on minor streets by providing priority to the loop road at all opportunities.
- To provide legible and efficient connections to surrounding areas and road networks.

Through their implementation they support 3.2 Key Objectives:

- 2, 3, 4, 5 and 8.
4.12.2 Implementation strategies: Transport and movement

The objectives for transport and movement are met by implementation of all of the following:

- Figure 4 NEIP Future Urban Structure Plan.
- Figure 10 NEIP Road Network Plan.
- Table 12 NEIP Site Intersections Details.
- Figure 9 NEIP Public Transport, Walking and Cycling Plan.
- The Road Cross-sections included in Appendix 6.
- Provision of transport infrastructure and services indicated in the transport plans and set out in the North East Industrial Precinct Development Contributions Plan and the Precinct Infrastructure Plan in Section 6.
- Planning and design guidelines in this element.

4.12.3 Planning and Design Guidelines: Transport and movement

The following planning and design guidelines must be met:

- Develop a public transport ready precinct.
- Provide bus routes and stops in accordance with Figure 9 Public Transport, Walking and Cycling Plan and in consultation with the Department of Transport to provide maximum accessibility by public transport.
- Provide bus access only from the western end of Tannery Road outside the NEIP precinct boundary.
- Provide internal walking and cycling networks in accordance with Figure 9 Public Transport, Walking and Cycling Plan.
- Design regional walking and cycling networks in accordance with Figure 9 Public Transport, Walking and Cycling Plan (this will include the Barwon River proposed pedestrian/bike trails; and regional E-W connections).
- Design shared pathways/walking and cycling routes in accordance with the Road Cross-sections in Appendix 6.
- Construct the road network in accordance with Figure 10 NEIP Road Network Plan and Table 12 Site intersection Details.
- Design roads in accordance with the Road Cross Sections contained in this element and the Table 12 NEIP Site Intersection Details.
- Provide intersections in accordance with the NEIP Site Interaction Detail Table 12.
- Set land aside for the EWLR in the location designated in the Figure 4 Future Urban Structure Plan.

The following planning and design guidelines should be met:

- Whilst no definitive local road network is established for the NEIP beyond that reflected in the Road Network Plan, include the following general principles for its design:
  - Road cross sections in the order of 12.6m carriageways within a 23m road reserve (approx) are considered to be reasonable to cater for commercial vehicle movements.
  - Certain areas of the NEIP not required for commercial vehicles may be designed with a smaller carriageway in the order of 7.0-10.6m depending on the provision of on-street parking.
  - Minimise any constraints from a sight distance perspective to the locating of local access road intersections to the collector road network.
  - Rear lane vehicular access in Precinct 6.
4.13 OPEN SPACE

The PSP proposes a network of open space including public parks, passive recreation areas and more formal active recreation areas.

The PSP proposes to provide passive open space in the order of 3.07% of the total developable land area. In addition to this, the NEIP will provide access to land outside of the precinct in the Barwon River Floodplain as part of a master planned regional open space network.

**TABLE 13: PASSIVE OPEN SPACE (POS) LAND USE BUDGET**

<table>
<thead>
<tr>
<th>NEIP – Passive Open Space Budget</th>
<th>% of NEIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gross Area</td>
<td>178.37 ha</td>
</tr>
<tr>
<td>2 Passive Open Space</td>
<td>5.47 ha</td>
</tr>
<tr>
<td>2.1 Plazas</td>
<td>0.39 ha</td>
</tr>
<tr>
<td>2.2 Parks</td>
<td>5.08 ha</td>
</tr>
</tbody>
</table>

* Passive open space accounts for unencumbered land only.

The PSP seeks to deliver a high amenity employment node that meets the needs of the range of businesses and employees located in the precinct.

A series of local parks are proposed throughout the precinct that will provide space for people to meet and engage in informal recreation.

The Village, Village Frame and Retail Centre will include more urban public open space areas that will be located within walking distance of most employees. These spaces will be integrated with the surrounding uses and will be designed to maximise solar orientation and will be well landscaped to enhance overall amenity.

A more formal open space is proposed in the northeast of the precinct to utilise an existing green space at the locally significant Sunnyside site. The proposed ‘homestead park’ will create a passive recreation asset in the campus business area of the NEIP and will be utilised formally for social gatherings, functions and organised activities.

Whilst outside of the precinct, the NEIP will take advantage of access to the environmental assets of the Barwon River corridor. The PSP proposes a network of open space and access options to improve the overall quality of this space and integration with the precinct where possible. The future management and evolution of these options will need to be resolved with the CCMA, Parks Victoria, DSE and Council.

In the short term, and based on land contained within the precinct, the PSP proposes the creation of potential through streets to allow for pedestrian access to the river banks once improvement details have been resolved. Development will be required to have a positive interface to the River and should be designed consistent with the cross sections in Figures 6 and 7.

Urban plazas are also provided in the Industry, Mixed Industry and Business, and Campus Business precincts (Precincts 1, 2 and 3) and form the basis of the proposed local service nodes. These urban spaces will act as destinations in their own right and provide for passive recreation opportunities and act as a meeting space. This will be a flexible open space that can achieve multiple objectives such as gathering, fundraising, informal recreation, etc.

These plazas will generally be hard surfaced spaces that will contain seating, strong landscaping and urban art to assist create a sense of place. The plazas will compliment the green open space offer in the overall NEIP. These are important localised place-making elements and will provide for a multifaceted open space typology across the NEIP to cater for the range of demographics.

In addition to formal open space areas, the PSP proposes a green street network and introduces a landscape hierarchy across the precinct to improve amenity and assist with overall way finding. This landscaping will enhance the walking & cycling networks provided within the road network.

### 4.13.1 Objectives: Open Space

The open space objectives are:

- To provide passive open space that is easily accessible and well distributed and connected across the precinct.
- To provide various forms of open space to improve interest and use and allow the open space to be responsive to the development precinct in which it is located.
To provide landscaping treatments throughout the precinct that maximise amenity.

To provide design legibility through spatial design and detailing.

To provide green relief through the development, within the open space and park areas and along streets.

To provide future pedestrian and cycle access to the Barwon River Corridor.

Through their implementation they support 4.2 Key Objectives:

• 4, 7 and 8.

4.13.2 Implementation strategies: Open Space

The objectives for open space are met by implementation of all of the following:

• Figure 4 NEIP Future Urban Structure Plan.

• Figure 11 NEIP Open Space Plan.

• Table 13 NEIP Passive Open Space Land Use Budget.

• Planning and design guidelines in this element.

4.13.3 Planning and design guidelines: Open Space

The following planning and design guidelines must be met:

• Unencumbered public open space must be provided generally in locations specified in Figure 11 NEIP Open Space Plan.

Unencumbered public open space is subject to equalisation. Each property owner in the North East Industrial Precinct must provide land or cash-in-lieu equal to 3.07% of the net developable area of the North East Industrial Precinct at a pro-rata rate equivalent to the net developable area of that property. Figure 11 and Appendix 7 of the North East Industrial Precinct, Precinct Structure Plan provide jointly the relevant details for each property. A property with greater than 3.07% unencumbered public open space will receive compensation for the value of the land above 3.07%. A property with less than 3.07% unencumbered public open space will be required to pay cash-in-lieu equal to the value of the land less than 3.07%.

A developer may elect to provide unencumbered public open space in addition to that shown on Figure 11 and Appendix 7 but it will neither be included in nor affect the equalisation scheme. It must be provided and embellished entirely at the cost of the developer.

Design open spaces according to Crime Prevention by Environmental Design (CPTED) Principles to ensure user safety.

Design open spaces to allow surrounding development to overlook the open space.

Design open spaces to convey a character appropriate to the development precinct they are located in.

Accommodate water treatment areas into the design of the open space as an amenity asset, where shown on Figure 11 NEIP Open Space Plan.

Provide a water tapping for recycled and potable water.

A building which is to be connected to a potable water supply must also be connected to a reticulated recycled water supply for toilet flushing and garden watering.

A masterplan for public open space to be transferred to Council must be prepared to the satisfaction of Council.

Guidelines for Specific Types of Open Space:

The following planning and design guidelines must be met:

Homestead Park:

• Prepare a contamination report and undertake mitigation works prior to ownership being handed over to the City of Greater Geelong.

• Provide for active recreation areas such as an AFL/ cricket oval, based upon the existing informal oval.

• Provide a formal, heritage themed landscape setting for the existing homestead ‘Sunnyside’.

• Provide a range of landscape areas suited to a range of activities including: small social gatherings; larger group functions; active recreation such as cycling, informal AFL and cricket matches and; lunchtime seating in small groups.

• Provide interpretive elements conveying the past uses, features and history of the area.
Local Parks:
- Provide smaller parks within the urban fabric for recreation, passive open space and green relief. These spaces shall provide areas suited to small to medium group functions, lunchtime seating, and some informal smaller scale active areas.

Urban Parks/Plazas:
- Provide a high quality hardscape environment including seating, paved thoroughfares, sculpture and water features.
- Provide civic and cultural spaces at appropriate scales, according to the size of the plaza.
- Provide a well designed urban gathering space for informal and formal social opportunities.
- Enhance pedestrian movements and safety through traffic calming and compliance with applicable standards for equitable access.
- Provide open lawn spaces for informal seating where appropriate to the scale of the Park/Plaza.

EWLR Drainage Corridor / Linear Park:
- Establish a linear park incorporating water treatment and flood storage areas as required in the Flooding and Drainage element of the PSP.
- Provide a shared pedestrian and cycle path as required in Element 4.12 Transport and Movement of the PSP.
- Provide landscaping of the corridor that supports its flooding and drainage functions, provides visual amenity for the shared pedestrian/ cycle path and is capable of completely screening the built form of adjoining development precincts when viewed from the East West Link Road.
- Design landscape treatments in order to maintain visibility/ passive surveillance of the shared path from the service road.

The following planning and design guidelines should be met:

Homestead Park:
- Maintain a heritage character through formal landscape design, for example: strong tree lined pedestrian axes and the use of Phoenix palms.
- Encourage a landscape character of rolling lawns and formal gardens, including interpretive elements.

Local Parks:
- Incorporate public art into park design where possible.
- Design local parks so that they are integrated with local service nodes where applicable such that the park functions as an extension of the circulation and outdoor dining areas of the node.
FIGURE 11: NEIP OPEN SPACE PLAN

LEGEND

- NEIP Boundary
- Adjoining Precinct Boundaries
- Area subject to 100 Year Flood Event
  Development of area is subject to offset. Flood storage to be determined subject to detailed design
- Priority Tree Lined Streets - Major Vehicle Circulation
- Priority Tree Lined Streets - Major Pedestrian/Cycle
- Local Tree Lined Streets
- Unencumbered Open Space
- NEIP Parks
- NEIP Urban Park/Plazas
- Local Node/Private Plaza
- Encumbered Open Space
- Barwon River Riparian
- Other Encumbered Open Space
4.14 BIODIVERSITY

The biodiversity assessment revealed that there is negligible native vegetation in the NEIP area. As a first principle, the PSP proposes to avoid any loss of native vegetation in the NEIP. However, due to the agreed alignment of the EWLR some native vegetation will be required to be removed. The Armstrong Creek North East Industrial Precinct Native Vegetation Precinct Plan illustrates the proposed retention, loss and off-set areas in the NEIP.

An off-set area is proposed immediately north of the precinct boundary, near the proposed rehabilitated dam.

A Biodiversity Plan, including Native Vegetation Precinct Plan, has been prepared for the PSP area. A Conservation Management Plan has been prepared to manage habitat requirements in the PSP area.

Land within the Barwon River floodplain that will be affected by the precincts proposed drainage outfalls has been subject to a native vegetation assessment and habitat hectare calculation (Refer to Barwon River Floodplain Assessment Report, August 2009, Ecology Partners). Where possible, the location of these outfalls has minimised vegetation loss. Any loss of vegetation as a result of drainage outfalls is proposed to be off-set within the Barwon River corridor.

The development of the NEIP is to be in accordance with the requirements of the Native Vegetation Precinct Plan (NVPP) and the Conservation Management Plan (CMP) set out below.

4.14.1 Biodiversity Plan

The Biodiversity Plan sets out the biodiversity vision for the Precinct. The Biodiversity Plan uses information from the flora and fauna background technical reports for the Precinct (Ecology Partners Keystone Business Park Precinct Structure Plan Technical Background Report: Flora and Fauna August 2008 and Keystone Business Park Precinct Structure Plan Technical Background Report: Flora and Fauna values within the adjacent Barwon River floodplain September 2009), and negotiated outcomes with the Department of Sustainability and Environment (DSE) and the City of Greater Geelong (CoGG), to develop actions required within the NEIP Precinct Structure Plan (PSP) to protect biodiversity. The Biodiversity Plan also includes the Native Vegetation Precinct Plan (NVPP).

The following Figure 12: NEIP Biodiversity Plan, which maps existing biodiversity values within and adjoining the Precinct, indicates there are no agreed biodiversity protection and enhancement measures located within the Precinct, as the majority of the Precinct has been modified from its original condition, and the vegetation is now dominated by introduced flora species, and planted windrows and gardens. However, as identified in the NVPP, immediately adjacent to the Precinct a revegetation off-set site is proposed and all of the remaining native vegetation within the Barwon River floodplain is proposed to be retained, post-construction of the drainage structures (see the Planning and Design Guidelines below).

4.14.2 Native Vegetation Precinct Plan (NVPP)

The purpose of the NEIP Native Vegetation Precinct Plan is to:

- Specify the native vegetation to be protected and the native vegetation that can be removed, destroyed or lopped;
- Ensure that areas set aside to protect native vegetation are managed to conserve ecological values in accordance with the NEIP NVPP and NEIP PSP;
- Ensure that the removal, destruction or lopping of native vegetation specified to be protected is consistent with conserving the ecological values of these areas and is in accordance with the three-step approach to net gain as set out in Victoria’s Native Vegetation Management – a Framework for Action 2002.
- Set out the works or other necessary actions required to off-set the removal, destruction or lopping of native vegetation.
- Streamline the planning approvals process through a landscape approach to native vegetation protection and management.

The Armstrong Creek North East Industrial Precinct – Native Vegetation Precinct Plan (May 2010) is an incorporated document in the Greater Geelong Planning Scheme.
4.14.3 Armstrong Creek North East Industrial Precinct Growling Grass Frog Conservation Management Plan (CMP)

The Armstrong Creek North East Industrial Precinct Growling Grass Frog Conservation Management Plan (CMP) has been prepared in response to recommendations outlined in the previous targeted survey report undertaken by Ecology Partners within the study area and from discussions with DSE. The CMP provides detailed information relating to the conservation and future management of the Growling Grass Frog, as a precautionary measure, to ensure the species can persist within suitable habitats, such as the Barwon River and floodplain in the future. A monitoring program is also proposed in the event that the species is discovered on-site during any proposed works.

The CMP is an incorporated document in the Greater Geelong Planning Scheme.
FIGURE 12: NEIP BIODIVERSITY PLAN

Legend:
- Black Wattle
- Blackwood
- Golden Wattle
- Hedge Wattle
- Tangled Lignum
- Drain (Artificial)
- Dams
- Non-indigenous tree plantations & gardens
- Areas of scattered and isolated common indigenous flora species, but mostly introduced flora species are present, and therefore these areas do not meet DSE thresholds for native vegetation

- No native vegetation
- No Access
- Study Area
- Brackish Herbland
- Brackish Lignum Swamp
- Floodplain Riparian Woodland
- Plains Sedgy Wetland
- Saltmarsh
- Floodplain Reedbed
- Spiny Peppercress

Study Area
No Access
No native vegetation
4.14.4 Objectives: Biodiversity
The biodiversity objectives are:

• To plan for the long term conservation of areas of significant native vegetation and fauna habitat in accordance with the NEIP NVPP.
• To maximise the use of appropriate native vegetation with streetscapes, open space and landscaped areas.

Through their implementation they support 4.2 Key Objectives:
• 4, 7 and 8.

4.14.5 Implementation Strategies: Biodiversity
The objectives for Biodiversity are met by implementation of all of the following:

• Figure 4 NEIP Future Urban Structure Plan.
• Armstrong Creek North East Industrial Precinct – Native Vegetation Precinct Plan (NVPP) (May 2010).
• Armstrong Creek North East Industrial Precinct Growling Grass Frog Conservation Management Plan (CMP) (May 2010).
• Planning and design guidelines in this element.

4.14.6 Planning and Design Guidelines: Biodiversity
The following planning and design guidelines must be met:

• Retain and manage habitat features, such as planted introduced species, where appropriate;
• Enhance the habitat values within and surrounding the retained large dam in the north east of the NEIP if retained;
• Encourage the use of local indigenous species into nature strips, passive recreation areas, gardens and stormwater drainage and treatment facilities to reflect local environment/landscape and to augment adjacent natural areas; and
• Construct, where appropriate, wetlands and establish adequately vegetated and managed buffer strips adjacent to stormwater treatment facilities, which can also provide suitable habitat for fauna species, such as frogs.

The following planning and design guidelines arising from the Biodiversity Plan (including the NVPP and CMP) must be met:

General
• Offset any indigenous flora values within the Precinct that are removed.
• Offset native vegetation losses incurred for the construction of narrow drainage structures proposed to be located in the adjacent floodplain.
• Create and maintain additional biodiversity values within the Precinct by preparing landscaped/revegetated areas within scattered parks and nature strips, by creating a revegetation offset site, by creating landscaped drainage reserves, and by managing and minimising any impacts on the farm dam and the adjacent Barwon River floodplain.

Native Vegetation
The scattered shrubs on Sparrowvale Road and Tannery Road will be removed and off-set by revegetation in the proposed off-set site, north of the retained farm dam. The native flora species located within the low-lying area in the south east and within the proposed Homestead Park, are proposed to be off-set by revegetation within the proposed off-set site, north of the retained farm dam.

The thin strips of native vegetation that will be removed from the immediately adjacent Barwon River floodplain for the drainage structures will be off-set by protecting (securing) all of the remaining remnant native vegetation within the floodplain (adjacent to the Precinct).

Flora Species
There were no threatened flora species identified within the Precinct, and the scattered locally common flora species are proposed to be off-set by revegetation in the off-set area.

Fauna Species
There were no threatened fauna species identified within the Precinct. However, habitat for the threatened Growling Grass Frog is present within the study area, and fauna habitat within the farm dam will be enhanced, and stormwater structures will be created to be frog friendly. Further, non-native habitats, such as planted trees and shrubs, will be retained, where appropriate.
Conditions and Requirements for Subdivision, Buildings and Works Permits

Prior to the certification of plans of subdivision, Off-set Management Plan/s must be prepared, to the satisfaction of DSE and CoGG, off-setting all of the agreed losses of indigenous flora species. All flora species planted within the drainage reserves and passive recreation areas must be indigenous to the local area.

All recommendations outlined in the NEIP PSP Growling Grass Frog Conservation Management Plan (Ecology Partners, May 2010) must be incorporated into stormwater and drainage infrastructure, particularly if Growling Grass Frogs are located within the Precinct.

Impacts on native vegetation and fauna habitat within the immediately adjacent Barwon River floodplain should be minimised. Where native vegetation losses and fauna habitat are proposed (i.e., the proposed drainage structures), Off-set Management Plan/s, to the satisfaction of DSE and CoGG, must be completed, and all of the remaining native vegetation must be retained and protected. If significant fauna habitat, particularly fish and frog habitat, is disturbed within the Barwon River floodplain during and after construction, appropriate investigation, monitoring, and salvage (if required), must be undertaken.

Barwon River Corridor

Due to the proposed vegetation losses as a result of the location of drainage outfalls in the Barwon River floodplain, there is a requirement to generate an area from the Otway Plain Bioregion for off-sets. At this stage Off-set Management Plans have not been prepared, but the intention is to off-set the proposed vegetation losses by protecting the remaining remnant vegetation, which will also address the like for like criteria.

Based on the current design plans, the populations of the Spiny Pepperwax are being avoided and the Growling Grass Frog was not recorded.

A Flora and Fauna Guarantee Act 1988 (FFG) permit is unlikely to be required as the majority of the site is private land, but if there was disturbance to FFG Act listed species, such as the Milky Beauty-heads from road reserves (Brearleys Lane), then an FFG Act permit would be required.

4.15 HERITAGE

Cultural Heritage

Artefacts found in the NEIP are not considered to be in situ. As such, the PSP recommends the salvage and re-location of these sites within an appropriate area determined in consultation with the Registered Aboriginal Party (RAP) and AAV. The PSP proposes to celebrate the local Aboriginal history of this site through public art and interpretive trails across the site. This interpretation will be resolved in consultation with the RAP to ensure a genuine level of interpretation is achieved.

A Cultural Heritage Management Plan (CHMP) will be sought where required under the Aboriginal Heritage Act 2006.

The PSP provides general recognition of these heritage sites and recommends future development proposals have regard to their significance.

European Heritage

The PSP provides general recognition of these heritage sites and recommends that future development proposals have regard to their significance.

4.15.1 Objectives: Heritage

The heritage objectives are:

- To provide an appropriate response to heritage items that responds to the existing policy framework.
- To respect and celebrate heritage or historic items in the precinct.

Through their implementation they support 3.2 Key Objectives:

- 4 and 7.

4.15.2 Implementation Strategies: Heritage

The objectives for Heritage are met by implementation of all of the following:

- Figure 4 NEIP Future Urban Structure Plan.
- Planning and design guidelines in this element.
4.15.3 Planning and Design Guidelines: Heritage

Aboriginal Cultural Heritage:
The following planning and design guidelines must be met:

- For proposed construction work that may effect the registered cultural heritage sites: 7221-0933 to 7721-0934 and 7721-0936, due to the low scientific value of these sites the artefacts that make up these sites must be collected, analysed and labelled according to type and province including site numbers and GPS co-ordinates. With the involvement from the RAP applicants within the area, these artefacts should be reburied in appropriate space near the Barwon River.

- For proposed construction work in the rest of the precinct these construction areas must be subject to further investigation through a Cultural Heritage Management Plan for that area.

European Cultural Heritage:
The following planning and design guidelines must be met:

- Site Cards for the following heritage sites must be lodged with Heritage Victoria by the Proponent of any development works upon land where the site is located:
  - the Australian Tannery Ruins;
  - the Sparrowvale Silo Ruins and Stables; and
  - the Barwonside Tannery Ruins.

4.16 DRAINAGE AND FLOODING

Figure 13 identifies the drainage proposals for the NEIP. The proposed NEIP development (Keystone Business Park) will increase the impervious area of the site. This increased impervious area will lead to increased stormwater flows and run-off. The stormwater drainage system for the site is designed to convey the 1 in 10 year storm event, with a provision of overland surcharge routes for 1 in 100 year storm events. It is considered that the proposed drainage system, including retardation basins and selected allotment filling will mitigate the need for the “Land Subject to Inundation Overlay” (LSIO) that currently exists within the precinct boundary. As developable areas will be above the 1 in 100 year flood levels, the existing LSIO will be amended as development occurs.

To determine the extent and impact of drainage and flooding on the site, and deliver an appropriate strategy response flood models were created by Water Technology (Flooding Consultant). This modelling and subsequent report detailing the modelling results was produced in collaboration with COGG and the Corangamite Catchment Management Authority (CCMA). This modelling has informed the overall response contained in the PSP.

Retarding Basins

A runoff routing model (RORB) and discussions with CCMA & COGG were used to determine that two (2) retarding basins are required to be provided for the NEIP.

It was concluded from the modelling and discussions with the CCMA that due to the proximity of the site to the Barwon River retardation of flows on-site during flood events would not be of great flood mitigation benefit. It was also concluded that it was more beneficial to allow flows to exit the site before the peak flood of the River arrived adjacent to the site. Flow retardation is hence only provided at two (2) locations in the drainage system.

One retarding basin is located in the north-west corner of the site south of Tannery Road. This retarding basin is required to contain storage of 7,120m3 to cater for the critical 1 in 100 year 2 hour storm event. An area of 1.12 hectares is required for this retarding basin.

The second retarding basin is located south of the proposed EWLR connecting the linear wetland to the outfall channel in Reserve Road. This retarding basin is to contain storage of 4,235m3 to cater for the 1 in 100 year 2 hour storm event. An area of 0.64 hectares is required for this retarding basin.

The southern retarding basin is proposed to be located in open space adjacent to the proposed EWLR south of Gateway Avenue. To allow Gateway Avenue to be extended to the Horseshoe Bend Precinct, the southern retarding basin will be required to be split.


The existing dam in the north east of the NEIP is proposed to be filled by localised run-off however it is not required for stormwater retardaging. It is also proposed for incorporating into Public Open Space and provides a suitable habitat for the Growling Grass Frog.
**Overland Flow Path**

No formal overland flow path is required in the NEIP.

The proposed pipe network is able to convey the peak 1 in 10 year ARI flow without surcharging. Flows from storms greater than 10 year ARI will be conveyed through the proposed street network and bio-retention swales.

**WSUD**

The pollutants produced by the development will need to be treated onsite to avoid degrading nearby waterways. Water Sensitive Urban Design (WSUD) features have been recommended for the site as they will treat the stormwater from the development before it re-enters the existing receiving waters. WSUD components are a preferred option to treat the stormwater as they limit the need for conventional pipe and drain systems and improve water quality through natural processes.

Water quality treatment of stormwater is achieved using a treatment train of proposed WSUD features. The treatment train includes some or all of the following depending on the catchment:

- Rainwater tanks;
- Bio-retention swales;
- Wetlands;
- Retention basins;
- Rain-gardens.

This type of treatment train is used to progressively detain flows and allow sedimentation and nutrient filtrations to take place.

One wetland is proposed to the north of the EWLR to provide water quality benefits and habitat for the region. This wetland is proposed to become an attractive water feature and should be designed accordingly.

**Stormwater Outfalls**

Each drainage catchment discharges at the site boundary to the adjacent Barwon River. In order to minimise adverse impacts from these discharges it has been necessary to develop conceptual designs for the outfalls across the floodplain. Analysis of impacts of drainage outfalls into the floodplain has been undertaken by TGM Consultants, Water Technology and Ecology Partners in consultation with the CCMA, CoGG and DSE.

Nine indicative outfall locations have been identified and will be required to be constructed through the floodplain to enable the stormwater to be discharged from the NEIP to the Barwon River.

Each outfall has been designed to incorporate an initial rock chute followed by an open channel. The purpose of the rock chute is to reduce the outfall velocities from the piped drainage system before flow is discharged to the open channel. The open channels have been designed to minimise impacts on the existing topography, flora and fauna and facilitate the staging of the development. Where possible the outfalls impacts on any remnant vegetation, discharging directly to the Barwon River to avoid flooding of any existing salt marsh area. Existing drainage channels have been incorporated into the design, to minimise additional works on the floodplain.

The indicative sizing and treatment necessary for each of the outfalls has been determined based on modelling undertaken by Water Technology, and is contained in Table 14. The design of outfalls and associated swales is contained in the Drainage Technical Report (August 2009) prepared by Water Technology, and must be complied with.
FIGURE 13: WATER SENSITIVE URBAN DESIGN PLAN

LEGEND

- NEIP Boundary
- Adjoining Precinct Boundaries
- Wetland in Drainage Corridor
- Bioretention
- Raingardens (as required)
- Retention Basin
- Subcatchment Boundaries

Subcatchments 1 - 7 respectively

Existing Dam
### TABLE 14: INDICATIVE OUTFALL SIZING

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Drop (m)</th>
<th>Length (m)</th>
<th>Top Width (m)</th>
<th>Depth (m)</th>
<th>Length (m)</th>
<th>Top Width (m)</th>
<th>Depth (m)</th>
<th>ARI Flow (year)</th>
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<td>151</td>
<td>3.4</td>
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<td>10</td>
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<td>4</td>
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<td>1A/1B/1C</td>
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<td>5.0</td>
<td>12.0</td>
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<td></td>
<td></td>
<td></td>
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<td>J1A/J1</td>
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<td>5.0</td>
<td>7.0</td>
<td>0.4</td>
<td></td>
<td></td>
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<tr>
<td>KA/KB (RB Outlet)</td>
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<td></td>
<td>359</td>
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<td>Southern RB Inflow</td>
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<td></td>
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<td>0.5</td>
<td>100</td>
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<td>Southern RB Outflow</td>
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<td></td>
<td></td>
<td>980</td>
<td>8.0</td>
<td>0.5</td>
<td>100</td>
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</table>

Notes:
- No chute required – Minimal grade and flow velocity
- Outfalls to outlet directly into Southern RB
FIGURE 14: OUTFALL PLAN
4.16.1 Objectives: Drainage and Flooding

The objectives for drainage and flooding are:

• To mitigate the impact of development on waterways and downstream environments.

• To provide a stormwater management system that restricts flows to predevelopment levels.

• To provide retarding basins that allow for ecological functions as well as detention.

• To incorporate WSUD as part of an integrated management system.

• To encourage water reuse throughout the precinct.

• To add amenity to the streets and open spaces of the NEIP through the landscaping of water treatment areas.

Through their implementation they support 3.2 Key Objectives:

• 4, 7 and 8.

4.16.2 Implementation: Drainage and Flooding

The objectives for drainage and flooding are met by implementation of all of the following:

• Figure 4 NEIP Future Urban Structure Plan.

• Figure 13 NEIP Water Sensitive Urban Design Plan.

• Appendix 8 WSUD Typical Verge & Tree Cross Sections.

• Planning and design guidelines in this element.

4.16.3 Planning and Design Guidelines: Drainage and Flooding

The following planning and design guidelines must be met:


• Ensure development is consistent with the Armstrong Creek Stormwater Management Policy (February 2009).

• Provide a retarding basin in the north-west of the precinct in accordance with Figure 13. This retarding basin must be designed to incorporate the features contained in Table 15.

• Provide a southern retarding basin and linear wetland along the Reserve Road reserve in accordance with Figure 13. This retarding basin must be designed to incorporate the features in Table 16.

• Incorporate WSUD in the road network as part of the integrated stormwater management system in accordance with typical cross sections contained in Appendix 8.

• Ensure Pioneer Developers develop solutions and catchment strategies that reflect the ultimate catchment strategy.

• Ensure developers design and deliver solutions that reflect ultimate catchment strategies.

• Temporary solutions will need to be negotiated with City of Greater Geelong on a case by case basis.

The following planning and design guidelines should be met:

• Ensure revegetation is consistent with the specifications outlined within the Growling Grass Frog Conservation Management Plan (May 2010) prepared by Ecology Partners.
4.17 UTILITIES AND ENERGY

Water Supply and Recycled Water

Hydraulic modelling undertaken by Barwon Water has determined that all proposed stages of the NEIP can be supplied with reticulated water from the existing Bellarine Transfer Main in Tannery Road without the need for Stage 1 and Stage 2 of the Bellarine Transfer Main Duplication.

If large water users are attracted to the NEIP this duplication may need to be undertaken earlier. This may be subject to a ‘bring forward contribution’ in accordance with Barwon Water’s Water Plan. Barwon Water has advised that the preliminary upper limit of this cost would be 40% of the ‘as constructed cost’ of the shared infrastructure.

Barwon Water will provide recycled water from the Black Rock Water Reclamation Plant. Provision of recycled water services to the Armstrong Creek Growth Area will require the construction of a new pump station at Black Rock, approximately 11.5 kilometres away, an 11ML recycled water tank to be located at Mount Duneed and a distribution network within the development.

The planned distribution network involves a dual pipe system, where the recycled water is intended to be used for toilet flushing, garden watering and public open space irrigation.

Barwon Water supports dual reticulation as a key component of sustainable urban development in new areas and would also encourage developers to explore water saving opportunities at the development scale through water sensitive urban design principles.

The PSP proposes to introduce a 3rd pipe across the site and has made provision for pipes that will accommodate the proposed integrated water cycle management options contained in Council’s water management plan.

A servicing strategy has been prepared by TGM Consultants, outlining the construction requirements to appropriately service each stage of development (Refer to Background Report: Essential Services Servicing Report, Version 2.4, Sept. 2009). Subdivision applications should be consistent with these requirements.

**TABLE 15: NORTHERN RETARDING BASIN DESIGN**

<table>
<thead>
<tr>
<th>Spillway Data</th>
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<tbody>
<tr>
<td>Crest elevation (mAHĐ)</td>
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<td>Effective length (m)</td>
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<table>
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<th>Pipe Data</th>
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</thead>
<tbody>
<tr>
<td>Upstream invert elevation (mAHĐ)</td>
<td>3.00</td>
</tr>
<tr>
<td>Number of pipes</td>
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</tr>
<tr>
<td>Length (m)</td>
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</tr>
<tr>
<td>Gradient (%)</td>
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</tr>
<tr>
<td>Diameter (mm)</td>
<td>450.00</td>
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</table>

**TABLE 16: SOUTHERN RETARDING BASIN DESIGN**

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<table>
<thead>
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<th>Pipe Data</th>
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<tbody>
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<td>Gradient (%)</td>
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<td>Diameter (mm)</td>
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<th>Basin Data</th>
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<tr>
<td>Peak 100yr ARI Storage Level</td>
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<tr>
<td>Peak 100yr ARI Storage Volume</td>
<td>4235.00m³</td>
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<tr>
<td>Peak Outflow</td>
<td>1.50 m³/s</td>
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Sewer

Barwon Water’s overall sewerage servicing strategy for Armstrong Creek is to have a number of connections to their existing Southern Outfall Sewer Main that connects Geelong to the Blackrock Water Reclamation Plant (BWRP).

Barwon Water’s preference is for a gravity system to be constructed however it is acknowledged that a number of sewerage pump stations will be required where the topography of the land does not facilitate a gravity connection directly to the existing system.

The PSP proposes a sewerage servicing strategy that includes three gravity catchments that drain towards individual pump stations. The sizing and location of these sewer and pump stations will be resolved subject to the final layout, industry type and lot numbers.

Due to the location of the EWLR alignment, the sewer confluence south of Reserve Road will need to be relocated. The sewer confluence currently sits within the future diamond interchange required at the intersection of Barwon Heads Road. Barwon Water has advised that it agrees to the proposed location of the EWLR and agrees to the relocation of the sewer confluence.

The PSP also proposes to extend Sparrowvale Road north of Tannery Road within the old road reserve alignment. Barwon Water purchased this unused road reserve which contains the ovoid sewer. Barwon Water has advised that they are not opposed to the reserve being converted into a road reserve subject to a series of conditions to ensure protection and access to their assets.

Electricity

The precinct contains 220kV overhead transmission line that bisects the precinct in an east-west direction. A minimum 40m easement is required for these powerlines. As these powerlines are beside Powercor 66kV lines they are contained within a total 60m easement.

The PSP will ensure that the easement is maintained and that development does not impact on maintenance access to this easement.

Developments in the NEIP must demonstrate adoption of sustainable energy practices including, as appropriate:
- Good solar orientation and use of thermal mass and insulation to minimize heating and cooling.
- Use of solar hot water where practicable and short pipe runs between hot water services and taps and fittings.
- Use of renewable energy systems where appropriate.
- The incorporation of co-generation (co-gen) or tri-generation (tri-gen) technology where appropriate.

Gas

The precinct will be serviced from a strategic main extended north along Horseshoe Bend Road then east along Reserve Road. SP Ausnet has programmed the connection to the Mt Duneed main for year 2 of its program of works to supply the Armstrong Creek Growth Area with the extension to the NEIP being completed in year 6 of the program.

SP Ausnet has advised that a limited supply can be obtained by connection with existing infrastructure located at the intersection of Marshalltown Road and Barwon Heads Road. Owing to the staging and timing of the development of the precinct, adequate supply will be provided to deliver early stages of the precinct ahead of programmed extensions.

Telecommunications

Providing high speed, uninterrupted connections to telecommunications is integral to the success of the NEIP business community. Telstra have identified that the NEIP has the capability to be a Telstra ‘Smart Community’ via the upgrade of existing facilities and the utilisation of trenches for cabling. Alternative providers are available for the installation of optic fibre.

4.17.1 Objectives: Utilities and Energy

The objectives for utility and energy are:
- To ensure utility allocations reflect various infrastructure needs within road reserves.
- To ensure capacity of service infrastructure to enable the timely development of the precinct.
- To provide for the use of recycled water within the precinct through the introduction of a 3rd pipe system (reticulated recycled water).
- To avoid adverse impact on the electricity transmission easement and ensure access requirements are maintained.
Through their implementation they support 3.2
Key Objective:

- 8.

### 4.17.2 Implementation: Utilities and Energy

The objectives for utility and energy are met by implementation of all of the following:

- Figure 4 NEIP Future Urban Structure Plan.
- The planning and design guidelines in this element.

#### 4.17.3 Planning and design guidelines: Utilities and Energy

The following planning and design guidelines must be met:

**Water Supply**

- Provide water service infrastructure.
- Provide infrastructure to the satisfaction of the responsible authority for the delivery of recycled water to each lot.
- Roll out servicing as per the requirements contained in the relevant stage servicing strategy in the ‘NEIP Essential Services Servicing Report’, Version 2.4, prepared by TGM Consultants, Sept 2009.
- Each building must be connected to a reticulated recycled water supply system for toilet flushing and garden watering where connected to the lot.

**Sewer**

- Provide adequate Sewerage Pump Stations (SPS).
- Relocate the sewer confluence in accordance with Appendix 9.
- Enter discussions with Barwon Water to ensure the extension of Sparrowvale Road does not impact on the operation and access to the ovoid sewer infrastructure.

**Electricity**

- Provide power supply to the NEIP via extensions to the existing infrastructure.

**Gas**

- SP Ausnet will provide the field regulator and a strategic main network through the growth area. Individual developers will be required to provide the reticulation network throughout the precinct.

**Telecommunications**

- Provide for optic fibre connections in NEIP.