GHDWOODHEAD

City of Mitcham
Sturt Linear Trail Report

May 2020

Blackwood Hill Reserve Zone 4 Trails

Trail Classification

Blackwood Hill Reserve

Mitcham Trail Network: Zone 4

BLACKWOOD HILLS RESERVE

Trail Difficulty Ratings

Green – Easy (Easier)
Suitable for children, families, novices, social groups and others seeking a relatively short (2 – 4 km) trail, requiring a basic level of skill and fitness.

Blue – Intermediate (More Difficult)
Suitable for individuals and social groups seeking a short to medium distance trail, requiring a moderate level of skill and fitness.

Black Diamond – (Bikes Only) Advanced (Very Difficult)
Suitable for individuals and social groups seeking a very challenging trail, requiring a high level of skill, fitness and endurance. Suspension bikes, body armour and full face helmets recommended on Green Hill trails.

Double Black Diamond – (Bikes Only) Extreme (Extremely Difficult)
Trails suitable for individuals and social groups that seek a extreme or an expert challenge with race style in mind. Full suspension bikes, body armour and full face helmets required.

Red Circle - Walking Only (No Bikes)
Trails are usually of a surface, trail and gradient with constructed steps in some areas. These trails have rough surfaces and are subject to rapidly changing and varying very. A good level of fitness is required and maintained in Australian Standards of a Class 4 hike (Walking only trail on rough and natural surfaces).

Double Red Circle - Walking Only (No Bikes)
Trails are usually of a surface, trail and gradient with constructed steps in some areas. These trails have rough surfaces and are subject to rapidly changing and varying very. A good level of fitness is required and maintained in Australian Standards of a Class 4 hike (Walking only trail on rough and natural surfaces).

Terms and Conditions of Use

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Executive Summary

The City of Mitcham have sought to investigate feasible options for the location of the Sturt Linear Trail, a continuous public open space link which connects areas between Craigburn Farm through to South Road in Bedford Park.

This project provides many opportunities to align with a number of Council strategic objectives and plans. Of particular relevance and importance to this project is the community identified goal for an Accessible and Connected Community as identified in the Council's Strategic Management Plan 2017-2027 (the Plan). The Plan also identified that transport, cycling and walking infrastructure were subjects that this community felt needed attention.

The Sturt Linear Trail provides a fantastic opportunity to create pedestrian and cycle connections for locals and visitors within this area, that not only accommodate the recreational needs of the community but also facilitate commuters. It also has the potential ability to create linkages between new residential areas such as Craigburn Farm, established communities, transport networks, retail, community centres and larger facilities like Flinders University and Flinders Medical Centre.

A key outcome for the study is the development of options which can be used to facilitate discussions with key stakeholders and the community and to assist Council in prioritising stages and secure funding for the development of the trail.

The options need to have a high level of readability and be easily understood by the community and stakeholders, yet at the same time they need to be ground truthed and technically sound.

To ensure all possible options for the location of the proposed trail were considered this study has reviewed both the route identified in the 2006 Masterplan which follows the Sturt River, along with routes identified by the Council officers within the City of Mitcham, who understand the area and the complexities relating to its topography.

The study included the review and consideration of these routes to understand the complexities relating its topography and to determine if a hybrid option could be developed.

The option development involved a series of investigations to determine the best alignments for the trail route. The development of options was guided and framed by many factors including the ability of the trail to successfully improve connectivity within the area, improvements to recreation and tourism offerings, avoiding where practicable adverse impact to the natural environment particularly relating to removal of remnant vegetation, minimising engineering treatments that have significant impacts to costs and the environment, such as cut and fill in Sturt Gorge and consideration of impacts to existing land uses, stormwater and traffic management.

Trail investigations were focused and guided by::

- Accessibility
  - Disability Discrimination Act (DDA) - Typography/gradient
  - Land tenure / Public Land
- Construction Costs:
  - Requires significant engineering treatments (cut and fill, retaining walls, fencing, bridges/culverts)
  - Length
  - Location relating to provision of services - electricity +water (lighting/toilets/drinking fountains)
- Connectivity with community and activity centres
- Legislative and Council Policies
  - Native vegetation removal
  - Zoning
  - Heritage
- Setting - scenery, user experience

A desktop analysis to review existing reports and Geographic Information System (GIS) data provided sufficient information to map out potential routes from Craigburn Farm through to South Road. An on-site trail audit was undertaken on the draft route using GPS to track the auditors course. The audit determined locations in the preliminary routes that were unsuitable for an accessible (DDA) compliant where possible) constructible shared use path.

The culmination of this audit was a series of trail route options, that were analysed using a Multi Criteria Assessment (MCA) feasibility table. Which assessed, ranked and weighted each trail option against selected criteria. The criteria included: length, significant engineering treatments, gradient, vegetation removal, and impacts to and from adjacent land uses.

The MCA table was then able to be used by The City of Mitcham as a meaningful stakeholder engagement tool, to eliminate options that were considered not viable and determine preferred options for the alignment as identified in Table 1.

The stakeholder engagement process also identified some key land access constraints regarding portions of the trail that had been located on the Department of Environment and Water's (DEW) land. As a result slight adjustments were made to trail routes within Section 4 and additional routes were investigated.

The preferred route options identified by the City of Mitcham and a steering group are shown in Table 1. Due to the length and repetitive nature of the trail, sections of the trail were chosen, based on typology and required engineering treatment to visually develop into concept designs.

A staged approach has been adopted for implementation. Sections that can be constructed with minimal impact to adjacent land uses, and offer the best outcome to connect the community and improve recreational offerings will be programmed first.

Cost estimates of the preferred trail route options have also been developed by Quantity Surveyors Rider Levett Bucknall and are provided in Stage 4 of this report.

The findings of this report and accompanying Option Plans and Cost Estimates will be used to consult with relevant stakeholders, prior to the commencement.

Table 1 – Preferred Trail Options

Section	Start	End	Sub-Option	Section sub-option ranking
1	A	B	1 Magenta	2.4
2	B	C	1 Magenta	2.85
3	C	D	2 Cyan	2.28
4	D	E	1 Magenta	2.54
			2 Cyan	2.21
5	E	F	1 Magenta	2.74
6	F	G	1 Magenta	2.49
7	G	H	1 Magenta	2.51
8	H	I	1 Magenta	2.65
9	I	J	1 Magenta	2.33
10	J	K	1 Magenta	2.56
			2 Cyan	2.42

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Method

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Method

Method

The Sturt Linear Trail program is comprised of five (5) stages:

- Stage 1 - Preliminary
- Stage 2 - Feasibility
- Stage 3 - Preferred Trail Route
- Stage 4 - Costings
- Stage 5 - Staging

Stage 1 - Preliminary

This stage located in Section 1 of this report, comprises a desktop analysis of background data and literature and an on-site trail audit. This stage was critical to formulate the desired, shared direction by Council for the trail options and to understand existing environmental, social, physical and geographical constraints.

The information obtained during the analysis was used to develop initial route options. These options were used to guide the on-site audit, where auditors, using GPS, followed the routes identified, changing course where required to avoid topography and obstacles that would hamper accessibility, increase engineering requirements and cost.

The audit determined locations in the preliminary routes that were unsuitable for an accessible (Disability Discrimination Act (DDA) compliant where possible) constructible shared use path.

Stage 2 - Feasibility Report

The culmination of Stage 1 was a series of trail route options, that were then able to be assessed for their feasibility, by relevant technical experts. The summary of which is located within Section 2 of this report.

The following were evaluated:

- Connectivity
- Land Access Requirements
- Heritage
- Vegetation
- Geotechnical
- Civil and Pavement Engineering
- Stormwater and Water Sensitive Urban Design (WSUD) opportunities
- Traffic and Carparking
- Lighting

As there were multiple route options, a Multi Criteria Assessment (MCA) feasibility table (Table 2, Stage 2 Feasibility) was developed to evaluate, rank, weight each option against selected criteria which included: length, significant engineering treatments, gradient, vegetation removal, impacts to and from adjacent land uses and the ability for the trail network to connect well with the community and activity nodes.

Stage 3 - Preferred Trail Route

The City of Mitcham developed a steering committee to provide recommendations on preferred route alignments based on the information pertained within the MCA table. The City of Mitcham then undertook engagement with key stakeholders, providing further insight into some of the challenges relating to options that were located outside of Council land. The option plans were updated to reflect these findings and present a series of preferred options. Concept designs were also developed to demonstrate unique elements within these options relating to landscape, urban design and/or engineering treatments. Both the preferred trail route options and concept designs are presented in Section 3 of this report.

Stage 4 - Staging

The proposed Sturt Linear Trail is over 12km long and traverses many different areas involving multiple land managers. These include the City of Mitcham, DEW, Flinders University and Colebrook Recreation Park under the care and control of Traditional Owners. In addition, there are areas that will require complex engineering solutions and designs that are expected to have a significant cost implication. Consequently a staged approach for both the development of detailed design and construction is required. The suggested staging has been outlined in Section 4 of this report.

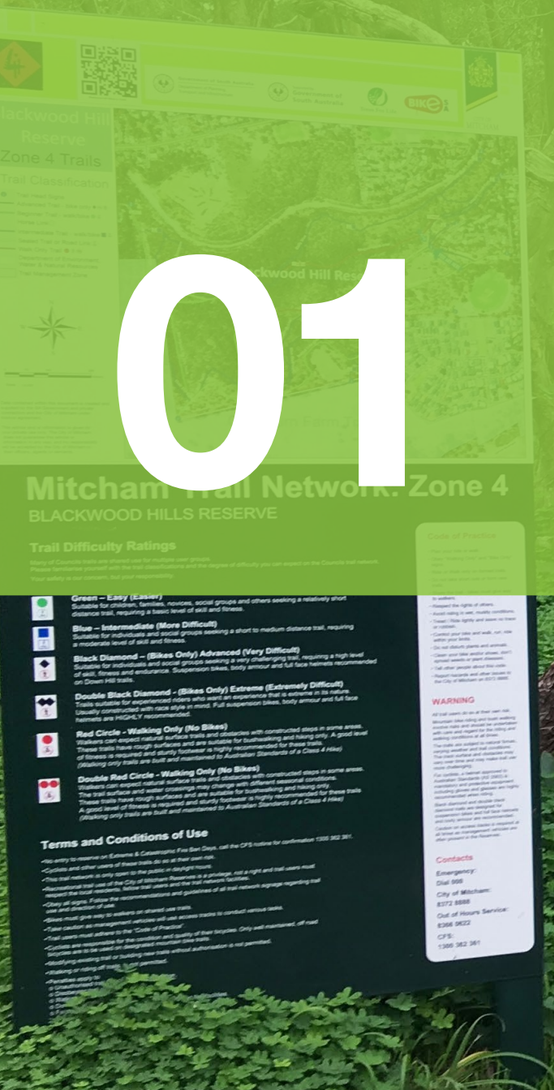
Stage 5 - Preliminary Cost Estimate

Rider Levett Bucknall have prepared a preliminary cost estimate on the preferred trail routes. The costings have been aligned with the proposed staging scenario and are presented in Section 5 of this report.



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Stage 1 Preliminary





Stage 1 Preliminary – Baseline Data and Literature

“The Sturt River Linear Park will provide an exciting recreational, cultural and natural link, linking the Yurrebilla Trail and Tjilbruke track from the Hills to the Sea.

As a key part of the Metropolitan Open Space System, the Park will provide links to regional networks facilitating access for a range of community users on treks, tracks and trails.

Working together we will take opportunities to improve the natural and cultural values of the river corridor.”

Sturt River Linear Park Master Plan Report

This chapter summarises the findings of a strategic review of documents relating to the Sturt River Gorge and Sturt River Linear Trail, between South Road and Coromandel Valley.

Documents Reviewed

- Sturt River Linear Park Trail Sturt Gorge & Craigburn Farm Feasibility Study Final Report, DEWNR, July 2011.
- Sturt River Linear Park Master Plan, Consultant Report, Patawalonga Catchment Water Management Board, January 2006.
- Sturt River Linear Park - Detailed Concept Plan: South Road to Sturt Gorge Recreation Park, Consultant Report, Patawalonga Catchment Water Management Board, January 2006.
- Sturt River Flood Retention Dam (SRFRD) Shared Trail Walker and Cyclist Bridge Stage 1A - Feasibility Study, Department of Environment, Water and Natural Resources (DEWNR), November 2015.
- City of Mitcham Strategic Management Plan 2017-2027 and Mitcham 2017-2027” “Let us build for posterity”.
- Austroads “Guide to Road Design Part 6A: pedestrian and Cycle Paths.

Key directions and considerations

- As outlined in the Strategic Management Plan 2017-2027 (the Plan), the City of Mitcham and its community have identified four goals:
  - Accessible & Connected Community
  - Sustainable City
  - Dynamic & Prosperous Economic
  - Vibrant & Rich Culture
- The community have identified:
  - That transport, cycling and walking infrastructure require attention.
  - History preservation and heritage tourism is important.
  - The strong sense of community spirit and the abundance of green open space, trees and nature are highly valued.
  - The importance of attracting more visitors, promoting tourism and creating destination opportunities.
- Council, with consideration to feedback provided by participants in the community consultation, has determined that it will direct funding to the following Strategic Initiatives over the next 10 years.
- In 2006, the Sturt River Linear Park (SRLP) Master Plan was endorsed by the steering committee established for that project by the then Patawalonga Catchment Water Management Board. The steering committee consisted of representatives from the Cities of Onkaparinga, Mitcham, Marion, West Torrens and Holdfast Bay as well as the State Government Departments of Planning and Local Government and DEW.
- The SRLP Master Plan report recommends the establishment of a continuous shared use pedestrian and bicycle path link (min 2.5m wide).
- Existing trails in the area are well used, community generally supports environmentally sustainable transport alternatives, and there is likely to be a high demand for trail networks such as the SRLP trail from local residents for commuting and other travel purposes in the future.
- The existing path along parts of the Sturt River Linear Park has been constructed as a shared use path, it is understood that many of these sections have been popular with recreational pedestrians and cyclists. Austroads Part 14 states that the acceptable range for shared use recreational paths is 3.0-4.0 meters wide, with a desirable width of 3.5 metres. The width of the existing shared use path is substantially less than this, generally along one side of the river in the lower reaches.
- Improving community accessibility and recreation opportunities.
- Provide an exciting recreational, cultural and natural link.
- Accommodation of a range of passive and unstructured recreation and leisure areas.
- Support and reinforce objective of Metropolitan Open Space System (MOSS) – Create a second ring of parklands within the Metropolitan Area.
- Opportunities to improve the quality of public land and open space.
- Potential to create a variety of interconnected open space experiences along the river corridor.
- Identification of a hierarchy of alternative trails to cater for multiple user needs and to connect with other recreational assets.
- Consistent Linear Park Signage that incorporates a hierarchy of directional and interpretative information (including route markers, cultural heritage and environmental interpretation) and could include public art components.
- Gateways:
  - South Road : the “Southern City Gateway” – this section of Sturt River is the key notable threshold to the inner suburban areas of Adelaide and is critical in terms of entry to the Linear Park. It is intended that the main vehicular entrance to the park will be via Sturt Road at the entrance to Warriparinga.
  - Craigburn Drive: “The Sturt Gorge ‘Bushland’ Gateway” – a significant future gateway for the Sturt Gorge Recreation Park. This gateway experience should extend to the intersection of Craigburn Drive with Coromandel Parade.
  - Horner’s Bridge : “The Foothills ‘Valley’ Gateway” – A historic meeting and picnicking point.
- Easily Identifiable shared use trail - There are many informal networks within existing sections of the Linear Park, which to varying extent lack definition and hierarchy.

Stage 1 Preliminary – Baseline Data and Literature

- Create clearly identifiable resting places or points at strategic locations along the Linear Park that incorporate picnic shelters, settings, seating and other park furniture.
- Select furniture and finishes that thematically links all improved reserves along the length of the linear park.
- Develop lighting at key nodes or gateways to improve visitor safety
- Adopt planting species for the individual reserves along the linear park that are in keeping with the identified biodiversity and water quality objectives. Plantings should include a variety of species to show seasonal variation.
- Provision for the integration of stormwater management in association with recreation, aquifer recharge and water quality management.
- Carry out stormwater infrastructure improvements, ranging from open swales for confined spaces in local parks to regional networks of swales and detention basins where land is / could be available. Potential sites include:
  - Riverside Reserve
  - Horner's Bridge
- Protection and enhancement of the natural environment (biodiversity and existing vegetation)- community objective relating to both aesthetics and biodiversity qualities - Preserve areas of existing remnant and indigenous vegetation.
- History and Culture - Conserve and promote both European and Aboriginal Cultural Heritage within the Sturt Linear Trail locality.
- Opportunities to recognise the overlaying of European cultural landscapes and stories on Kaurna land are explored and realised in ways that enable the multiple stories to be told and heard by future generations.
- Recognise the continuing association of the Kaurna people with the Sturt River and its environs.
- Seek to provide opportunities to value add to cultural experiences and generate employment and economic benefits for Kaurna people and local history and heritage groups.
- Kaurna people are actively engaged in the detailed design and implementation of concept plans as the Sturt River Linear Park is progressively established.
- The selection of materials and placement of signs, lighting, park furniture and landscaping/planting has been undertaken in a culturally appropriate way.
- Promote the cultural tourism opportunities connected to the Linear Park.
- Effective pedestrian and bicycle access along the length of the Linear Park, with linkages to future and existing recreational nodes.
- Activities such as mountain biking, orienteering and horse riding should be carefully managed to suit the surrounding environment.
- Consider opportunities to link the trail to tourism opportunities - Existing popular recreational trails, accommodation, tours, restaurants.
- Take advantage of views.
- Considered Landscaping - Ensure plantings consider Crime Prevention through Environmental Design (CPTED) and bushfire prevention principles. Replace existing exotic tree species with indigenous plantings.
- Maximise access to River Corridor.
- Consider opportunities for access to land currently in private ownership.
- Reinforced key linkages through improved path locations and signage to destinations, including;
  - Flinders University
  - Flood Control Dam / Flagstaff Hill
  - Blackwood Oval and Wittunga Botanic Gardens
  - Frank Smith Reserve
  - Belair National Park
- Existing tracks in Sturt Gorge Recreation Park are geared towards 'hiking' and short bushwalking trips presenting various safety and accessibility concerns.
- All weather access to trails restricted in some locations.
- Where possible use existing tracks/trails to avoid impact to areas of sensitive vegetation.
- Consider policies within the Sturt Gorge Recreation Park Management Plan.
- Shared paths need to comply where possible with relevant Austroads 14 guidelines.
- DEW is currently upgrading and establishing a network of dual-use walking and cycling trails through the Sturt Gorge Recreation Park. The identification of a suitable north – south access link trail through the centre of the park has been challenging due to the steep topography of the gorge. They have identified the Sturt River Flood Retention Dam as a preferred location.

Characteristics of the Sturt River and Surrounds

- In General:
  - Park furniture is old and inconsistent in style and materials.
  - Lack of defined nodal points.
  - Linkages between river corridor and other recreational and community facilities are unclear.
  - Cultural Significance to Kaurna people as part of Tjilbruke Dreaming and as a travelling corridor linking the Adelaide Hills to the plains, including camp grounds and ceremonial and burial sites. Yurrebilla Dreaming and Tjilbruke Dreaming are the two predominant creation stories in the region and the Sturt River Linear Park.
- Bedford Park and Darlington Area:
  - Significant site of European and Indigenous cultural heritage (Warriparinga).
  - Sites of geological significance – Sturt Tillite at base of the gorge.
  - Erosion of channel banks is a significant issue upstream of South Road. Several sites were identified with 'undercutting' of the bank and steep drops to the channel floor. Works are required to be undertaken in order to prevent further erosion and reduce risk of injury to park users.. Of particular concern is the Giles Landfill site, Brookside Road, Flagstaff Hill. Uncontrolled landfill on the site present risks to the river edge. It is likely that the EPA will require future landfill capping works or alternative remediation measures to appropriately manage the closure of the landfill.
  - The Warriparinga wetlands were successfully established in Sturt Triangle in 1998.
  - Visual access to river, but obstructed physically by incised stream bed and dense vegetation.
  - Variety of adjacent land uses including; Warriparinga Wetlands, Local Council Reserves, Caravan Park, Residential Development, Playgrounds, primary and extractive industries.
  - No current access into Sturt Gorge Recreation Park along river, minor trails through adjacent Flinders Uni.
  - Private land ownership along river corridor prohibits public access – current negotiations underway through City of Mitcham
  - Safety hazards and environmental concerns relating to stream bank erosion. Of note section of erosion adjacent to Brookside Drive and near the Sturt River Caravan Park.
- Sturt Gorge area:
  - Sturt Gorge Recreation Park (SGRP) is bounded by Flagstaff Hill, Blackwood, Bellevue Heights, Coromandel Valley and Craigburn Farm.
  - Relatively in tact natural bushland within steeply sloped terrain immediately surrounding the river corridor.
  - The upper reaches of the gorge, adjacent to Craigburn Farm is predominantly pastoral landscape with limited native vegetation and significantly degraded minor tributaries which feed into the main Sturt River Corridor.
  - The Sturt Gorge park can be accessed via steep trails from Broadmeadow Drive, Black Road and Bonneyview Road in Flagstaff Hill and The Boulevard in Bellevue Heights.
  - Sturt Gorge Recreation Park is internationally recognised as an area of conservation and geological significance.
  - There are 8 main trails through the park.
  - The park conserves the nationally threatened Greybox Grassy Woodland vegetation.

Stage 1 Preliminary – Baseline Data and Literature

- The park is home to Sturt tillite rock formation.
- Destination for mountain bike riding and hiking.
- High class network of new trails.
- Contains remnant native vegetation in moderate to good condition.
- Signs of woody weed infestation in stream invert - Biodiversity/ habitat value could be improved by targeted weed control to encourage natural regeneration of native plant species.
- There is an approved vegetation management plan for the Sturt Gorge.
- Numerous fire trails / walking tracks along spurs into valley floor – very steep.
- Intermittent walking trails along stream bank – subject to inundation.
- Mountain bikes currently access the Gorge through Flinders University and other access points.
- The only established off road shared-use trail along the river corridor in this section is within Warriparinga, within the City of Marion, which is also a key site of Aboriginal and European Cultural Heritage significance.
- A variety of walking tracks exist in part along the river within the Sturt Gorge Recreation Park.

- Upper Sturt Gorge and Craigburn.
  - Limited formal public access to river corridor – a minor walking track exists along the southern edge.
  - A wet detention basin to improve water quality is located immediately upstream of the Flood Control Dam wall within Sturt Gorge Recreation Reserve. The trash collection structure upstream of this location is reported to be difficult to maintain.
  - The water quality at the flood control dam is reported to be generally poor, though variable depending on seasonal factors.
  - Existing exotic tree species along the banks of the river would appear to have controlled the scour well in this reach.
  - Broadacre new residential development is located adjacent to this reach.
  - Access to the river closer to Horner's Bridge becomes increasingly difficult due to steepness of embankments and overgrowth of environmental weeds.
  - Just outside this area is the shared-use path connection to Belair National Park. This trail is often narrow and located alongside main roads through the established upper sections of the Sturt River Lineal Trail and Minno Creek. (CoM & Onkaparinga Councils Project)
  - There are a number of sites with European Heritage,outside of this area but opportunities to create linkages to this should be considered
  - The former Murray & Sons jam and biscuit factory (near the Sturt River at Coromandel Valley), The former Winn's Bakery and Winns Road Ford (located on Sturt River, quite close to where Minno Creek joins the Sturt, near Carr's Bridge), The Experimental Orchard, located in what is now known as Blackwood Forest.

Planning Context - Source Sturt River Linear Park Trail Sturt Gorge & Craigburn Farm Feasibility Study Final Report, Swanberry Penglase

Generally it is not anticipated that the establishment of the trail will require development approval as the interventions required to establish the trail do not classify as engineered structures. However, as the whole of Sturt Gorge Recreation Park is identified as having deposits of Sturt Tillite and is thus a listed item in the State Heritage Register of South Australia, it may be a requirement that planning consent be obtained due to this listing.

Austroads - Guide to Road Design Part 6A - Pedestrian and Cycle Paths

Shared Paths

A shared path is where pedestrians and cyclists share the same path space. A shared path may be appropriate where demand exists for both a pedestrian path and a bicycle path but where there is a low number of pedestrians or cyclists and the use is not expected to be sufficiently great enough to provide separate facilities.

Shared paths can be used for a variety of purposes including recreation, local access and providing feeder links between high capacity paths. However, if such a link is provided, it may need to be designed in a manner that moderates cyclist speeds to ensure the safety of pedestrians.

Shared paths that use existing pedestrian paths may be satisfactory where they provide a:

- Convenient and safe option for inexperienced cyclists, recreational cyclists and young cyclists Because pedestrian paths usually have narrow widths and driveway crossings or side streets intersecting at frequent intervals they are only suitable for low cycling speeds.
- Safer option for cyclists at squeeze points such as narrow, heavily trafficked sections of road, roundabouts, bridges, underpasses or railway level crossings In such cases it may be appropriate that the connections between the pedestrian path and the road be properly designed so that cyclists can leave and enter the general traffic stream safely and conveniently. Special ramps that have a flatter gradient and smooth invert can be provided to cater for bicycles.

A significant issue associated with shared paths is the variety of users who display various characteristics that can lead to conflict between them, and discomfort for all path users. These characteristics include differences in speed, space requirements, age, user expectation (as some users expect exclusive or priority use) and predictability (e.g. cyclists, pedestrians walking dogs, in-line skaters, and skateboard riders). Austroads (2006) describes the key conflict issues between pedestrians and cyclists on shared paths and pedestrian paths and provides guidance on key conflict minimisation strategies and options.

(Guide to Road Design Part 6A: Paths for Walking and Cycling Austroads



2017 | page 7).

Cyclists

The cyclist design envelope (Figure 3.5) and clearances to obstructions or hazards (see Section 5.5.1) may be used to construct the appropriate width of facility required for cyclists under various conditions. The envelope is assumed to be consistent over the range of operating conditions and allowance for higher speeds is provided through larger clearances to both other cyclists and fixed objects beside the path.

Appendix A provides guidance on how the envelope and clearances are applied to particular situations in order to determine satisfactory operating widths.

The 1.0 m width of the envelope shown in Figure 2 allows for the width of a bicycle and for variations in tracking. Not all bicycle riders can steer a straight line and when riding uphill experienced riders work the bicycle from side to side while inexperienced riders may wobble. To allow for this operating characteristic the 1.0 m envelope width should be increased to 1.5 m for uphill travel, refer also to Section 5.1.3 for guidance on path widths. Further guidance on uphill travel is contained in Section 5.4.

Bicycle riders also need adequate clearances to fixed objects and to passing vehicles in addition to the 1.0 m envelope; refer to Section 5.5.1 for guidance on clearances.

Space to Ride

Where data is available (e.g. census information and jurisdictional surveys) the space required for new major bicycle paths should be based on an estimation of the likely demand for cycling on the proposed facility.

However, where such information is not available the bicycle design envelope and clearances shown in Figure 2 provide the basis for the design of the bicycle facilities described in this part. It is important for designers to understand the basis of the design, including clearance requirements, so that they can make appropriate judgements in constrained situations where knowledge of minimum cyclist space requirements is needed. The envelope is relevant to the design of lanes on roads, off-road paths and bicycle parking facilities (AS 2890.3:2015).

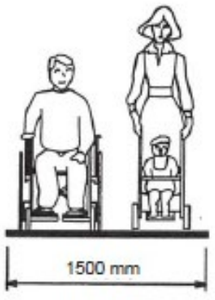
In some situations it may be appropriate to provide for alternative forms of pedal cycles in the design of facilities. For example, it may be appropriate on heavily used recreational paths to allow for the space (e.g. width, length, swept path) required by a bicycle trailer that is commonly used by parents to tow young children.



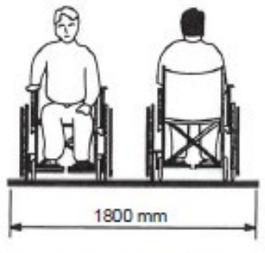
(a) A clear width of 1000 mm is adequate for people with ambulant disabilities, just allows passage for 80 per cent of people who use wheelchairs, and is in accordance with AS 1428.1



(b) People who use wheelchairs require a clear width of 1200 mm



(c) A clear width of 1500 mm allows a wheelchair and a pram to pass



(d) To allow two wheelchairs to pass comfortably, a clear width of 1800 mm is required

Source: AS 1428.2:1992.

Figure 1 – Pedestrian path width requirements for people with mobility impairment

Smooth Surface

A smooth, skid resistant, surface is desirable for bicycles to be used effectively, comfortably and safely. Surfaces used for cycling should desirably be smoother than those acceptable for motor vehicles and persons responsible for path construction and maintenance should be made aware of this requirement. Guidance on surface tolerances is provided in Section 5.10.

It is also important that the design restricts debris from accumulating on paths. Surface water should not flow across the path in situations where soil, mulch or other debris could be carried onto the path. It is generally preferable that water is collected and piped under the path. Similarly, a maintenance regime should be in place to enable the removal of any debris that could inconvenience cyclists or create hazardous conditions by placing a solid object in the path of cyclists or causing the surface to become slippery (e.g. broken glass, rocks, mud after inundation, loose leaves or berries etc.).

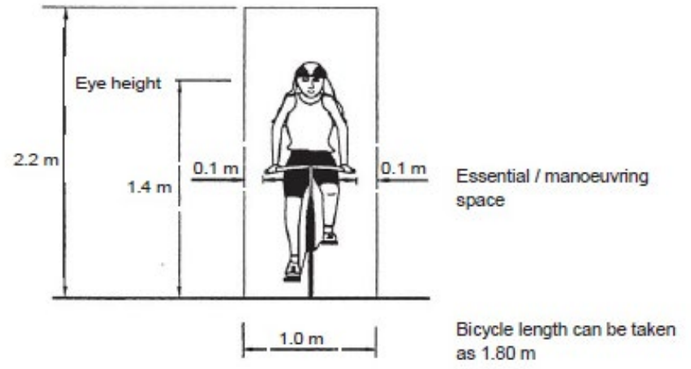


FIgure 2 – Cyclist design envelope

Speed maintenance

For bicycles to be most effective as a means of transport, cyclists must be able to maintain speed without having to slow or stop often. While many cyclists typically travel at speeds between 20 km/h and 30 km/h, a significant number of cyclists travel at speeds in excess of 35 km/h to 40 km/h on the flat and may reach speeds in excess of 50 km/h on downhill gradients. Once slowed or stopped it takes considerable time and effort to regain the desired operating speed.

In some locations, such as in commercial precincts or urban residential neighbourhoods, maintaining path speeds may be less important and higher speeds may be counter-productive to encouraging inexperienced cyclists to use the path and may also result in safety concerns involving pedestrians. The higher speeds may also be a deterrent in attracting or encouraging new cyclists. In these areas, the operating speed on the path may need to be moderated to take into consideration the experience levels and the number of the cyclists using the path.

Bicycle routes, especially off-road, should be designed for continuous riding, minimising the need to slow or stop for any reason including steep gradients, rough surfaces, sharp corners, obscured sight lines, intersections, or to give way to other people because the width available is too narrow.

Sight Lines

It is important that appropriate sight lines are provided between a cyclist's eye height and pedestrians to assist in minimising conflict, and between a cyclist's eye height and the path surface so that cyclists can stop in the event that a hazard exists on the path (e.g. mud deposited during inundation, potholes due to washouts, broken glass, and fallen tree limbs).

Designers should therefore resist the temptation to provide curves that are smaller than necessary (e.g. to create an artificially winding path for aesthetics or urban design reasons). It is much better for the safety of path users if larger curves with greater sight distance are provided.

The path width required depends on the envelope (i.e. space) occupied by pedestrians and/or cyclists using the path together with appropriate clearances. The clearances are required between path users travelling in the same direction or opposite directions, and also between path users and the edge of the path. Some allowance for the ability of cyclists to ride in a consistent wheel path (i.e. tracking of the bicycle within the envelope) is provided. Pedestrian and cyclist envelopes and examples of their application to determine the widths presented in Section 5.1 are contained in Appendix A.

While path width can be developed from cyclist and pedestrian envelopes and required clearances, the choice of a width in many situations is subjective because data is not usually available on the level and type of use that could be expected. Some jurisdictions systematically collect traffic data on existing path networks and some investigation has been done on the development of models to estimate the traffic flow on proposed paths (Land Transport New Zealand 2008). However, in the absence of a relationship between path width and parameters such as cyclist operating speed, volumes of pedestrians and cyclists, mix of pedestrians and bicycles, practitioners should consider a number of factors, such as the:

- Level of pedestrian and cyclist use
- Types of use expected e.G. Where pedestrians may travel in large groups
- Types of cyclists likely to be attracted to the path
- Objectives of the path (e.G. Provide a major link for cyclists including school children)
- Speed of cyclists
- Traffic regime
- Available clearances
- User envelopes

In many cases there will be more than one type of user to be accommodated and their requirements may differ. For example, where a path follows a scenic route but also is intended to attract cyclists from an alternative high speed road environment, it will be necessary to provide a good experience for cyclists and these cyclists wanting to minimise their travel time should be provided with an alignment and other conditions to minimise the travel time.

With many jurisdictions now allowing cycling on pedestrian paths, the increasing use of personal mobility devices and encouragement to increase cycling and walking, there is growing need to ensure path widths are provided that accommodate safe movements of path users, including passing or overtaking movements.

This is particularly the case for separated paths where legislation may restrict the use of the path to only the designated use.

Clear Width

The widths provided in this Part are for a clear width on a path (Table 5.1). Intrusions in or over a path, such as vegetation, signs, poles, fences or seats may become obstacles or hazards to path users, reducing the width of the clear path and should be removed wherever practicable. In locations where the intrusion is unable to be removed, path users need to be alerted to the presence of the intrusion with sufficient time to enable the obstacle or hazard to be avoided.

Pedestrian Paths

As a guide, the desirable minimum width of a pedestrian path that has a very low volume is 1.2 m with an absolute minimum of 1.0 m at constrained locations and with agreement by the relevant road agency. These widths should be increased at locations where:

- High pedestrian volumes are anticipated
- A pedestrian path is adjacent to a traffic or parking lane
- A pedestrian path is combined with bicycle facilities
- The pedestrian path is to cater for people with disabilities
- Overtaking of path users is expected

The crossfall of a paved pedestrian path may vary from flat (but achieving an adequately drained surface) to 2.5%. Provided that drainage is satisfactory, a lower crossfall is preferred (i.e. 1.0%) as a higher crossfall may cause problems for some people.

Notes:

While the minimum width may be used where volume is low it is generally desirable to provide a path that will accommodate two pedestrians side by side. Wider than the minimum width (e.g. up to 5 m) may also be necessary at locations where pedestrian flows are high or where pedestrians gather such as in the vicinity of schools and associated road crossings, at recreation facilities and at important bus stops.
Where volume is significant it may be necessary to provide adequate congregation areas clear of the path required for through movement of pedestrians. Where a path is < 1500 mm wide, the path should be widened at regular intervals to provide opportunities for wheelchair users to pass. Refer also to the Pedestrian Planning and Design Guide (NZ Transport Agency 2009).

In some instances pedestrian volumes will be very high and a path width corresponding to or greater than those suggested in Table 5.1 for high pedestrian volumes will be required. This may depend on the level of service the path is to provide and designers should also refer to any local planning requirements. Refer to Level of Service Metrics (for Network Operations Planning) (Austroads 2015f) for guidance on levels of service.

Constrained widths should be avoided or treated (e.g. by removal of obstacles) wherever practicable. However, where it is not possible to remove the obstacle an absolute minimum width can be used over a very short length at an obstruction (Table 5.2), and if a narrow pedestrian path cannot be avoided over a greater length passing areas should be provided wherever possible (Table 5.3).

It is also important that the edges of paths do not have a drop-off that may cause a pedestrian to slip or trip, or cause a wheelchair to overturn, such as along the back of a kerb. This consideration is critical where minimum path widths are used. In addition, any obstruction within the path should be highlighted (e.g. bright contrasting colour) to reduce the likelihood that pedestrians will collide with it, and have any aspects removed that could cause path users to be 'snagged' by it.

Stage 1 Preliminary – Baseline Data and Literature

Bicycle Paths

When the volumes of cyclists are not able to be determined, it is suggested that the widths shown in Table 5.2 provide acceptable ranges for bicycle paths. The upper limit of the acceptable range in the table should not discourage designers from providing a greater width where it is needed (e.g. very high demand that may also result in overtaking in both directions).

Table 5.1: Width requirements for pedestrian paths

Situation	Suggested minimum width (m)	Comments
General low volume	1.2[1]	• General minimum is 1.2 m for most roads and streets. • Clear width required for one wheelchair. • Not adequate for commercial or shopping environments.
High pedestrian volumes	2.4 (or higher based on volume)	• Generally commercial and shopping areas.
For wheelchairs to pass	1.8	• Refer also to AS 1428.1:2009.
For people with other disabilities	1.0	

1 *In constrained locations an absolute minimum of 1.0 m should be provided. In these situations, path users should be able to detect other path users with sufficient time to respond and take appropriate actions.*

Table 5.2: Bicycle path widths

	Suggested path width (m)	
	Local access path	Regional path
Desirable minimum width	2.5	3.0
Minimum width – typical maximum	2.0[1] – 3.0[2]	2.5[1] – 4.0[2]

1 *A lesser width should only to be adopted where cyclist volumes and operational speeds will remain low.*
2 *A greater width may be required where the number of cyclists is very high.*

Table 5.3: Shared path widths

	Suggested path width (m)		
	Local access path	Regional path[3]	Recreational path
Desirable minimum width	2.5	3.0	3.5
Minimum width – typical maximum	2.0[1] – 3.0[2]	2.5[1] – 4.0[2]	3.0[1] – 4.0[2]

1 *A lesser width should only to be adopted where cyclist volumes and operational speeds will remain low.*
2 *A greater width may be required where the numbers of cyclists and pedestrians are very high or there is a high probability of conflict between users (e.g. people walking dogs, in-line skaters etc.).*
3 *May be part of a principal bicycle network in some jurisdictions.*

Trail Audit

Prior to undertaking the Trail Audit, relevant reports including the 2006 Sturt Linear Trail Master Plan and spatial data including contours was reviewed. A draft trail route alignment was established to inform the route taken during the trail audit.

A two day trail audit was undertaken by a team of relevant professionals in the areas of Structural and Civil Engineering, Landscape Architecture, Trail Design and Urban Planning. The auditors walked the entire draft trail route with a GPS and adjusted alignment based on topography and other physical and construct-ability constraints on site.

The auditors used GPS to determine location points and logged data with notes and photos associated with location points of interest.

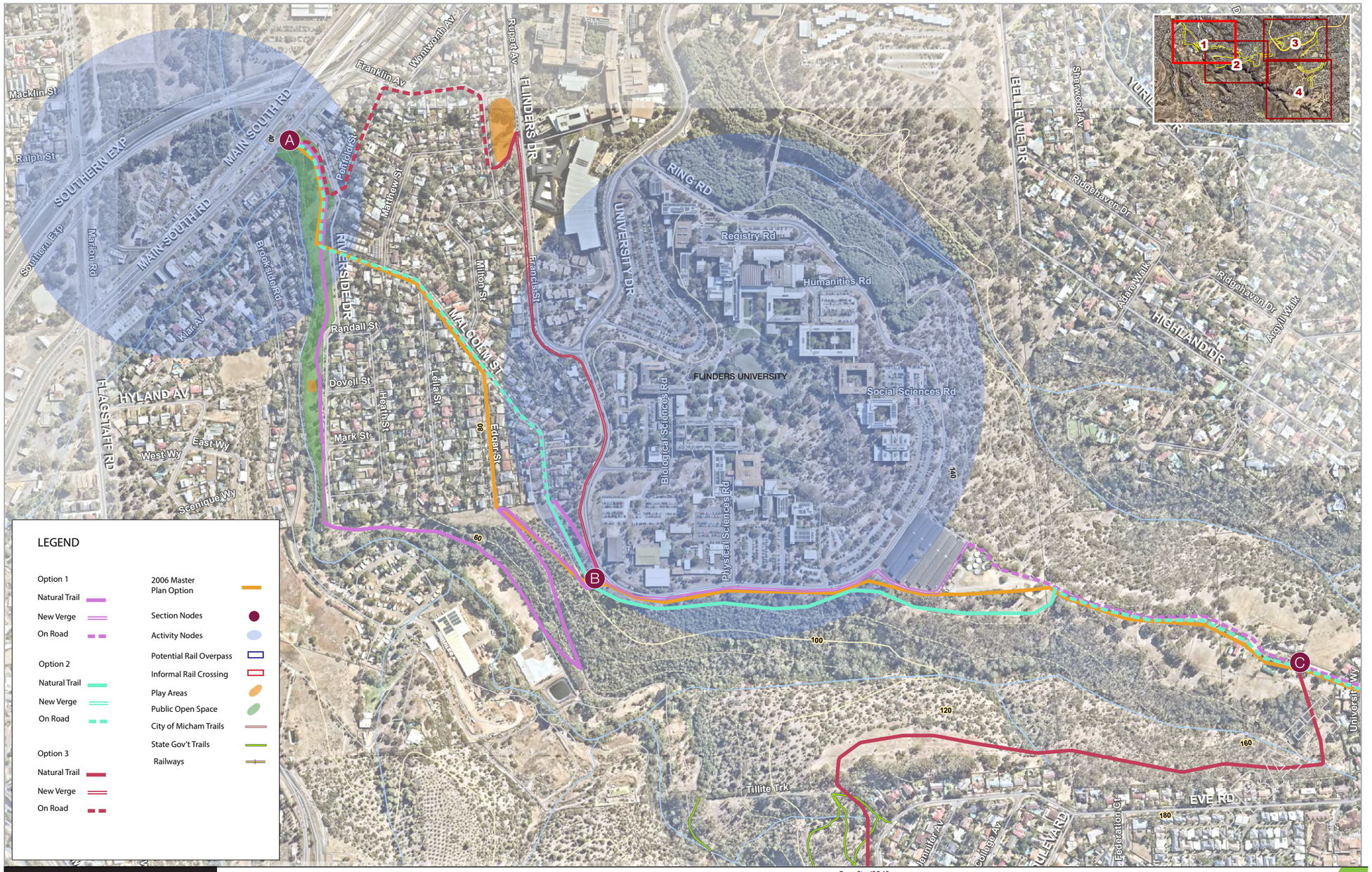
The key findings of this audit have been presented in Table 1, this information was used to develop a series of trail route options, connected to section nodes, locations determined important for the trail user to pass through in order to connect with activity nodes and/or avoid physical constraints. From one section node to another there was anywhere between 1 and 5 potential trail route options.

Stage 1 Preliminary – Trail Audit Summary

Table 1 – Trail Audit Summary

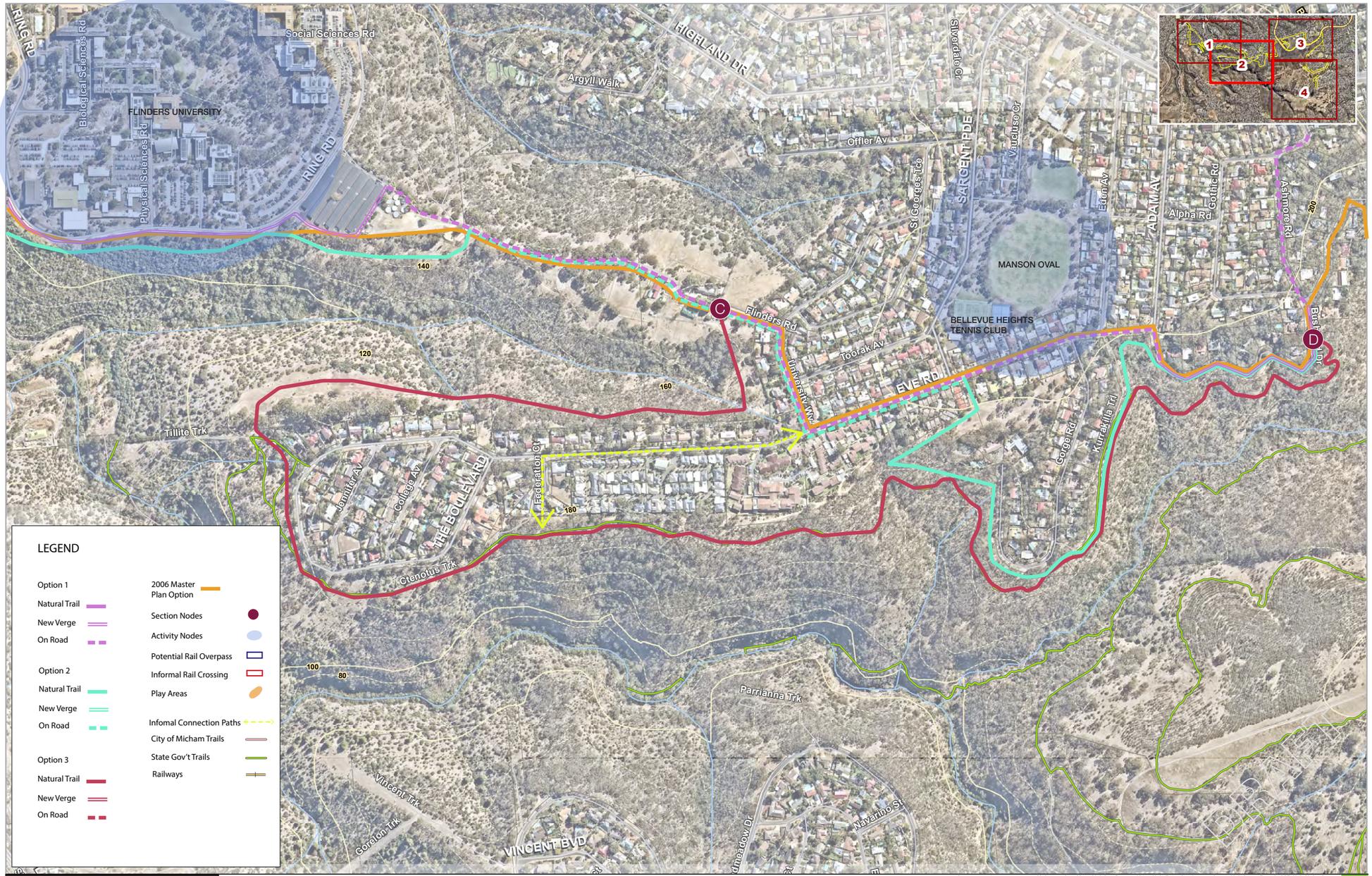
	Option 1 (Magenta)	Option 2 (Cyan)	Option 3 (Red)	2006 Master Plan Option (Orange)	Option 4 (Blue)
A to B (Bedford Park)	Appeared to be least steep option. Requires new trail. Kick backs to reduce gradient of trail. Removal of vegetation. More scenic. Connects with reserve and park.	On Road route. Steep. Diminished user experience. More direct.	Appeared less steep than Option 2. On Road option. Conflicts with parking on Flinders Drive. Good connections with park, Flinders University and hospital.	Similar to Option 2	N/A
B to C (Bedford Park & Bellevue Heights)	Includes Verge and on road path. Good Views. Conflicts with Flinders Signage on verge.	Uses existing narrow walking trail – would require widening.	N/A	Similar to Option 1	N/A
C to D (Bellevue Heights)	Includes On road and Verge. More Direct Route. User experience compromised (natural).	On road, natural trail and verge. Requires new path. Requires vegetation to be cleared. Good user experience. Good connections with residential.	Existing Mountain bike trail = conflicting uses. Would require widening + veg clearance. Indirect.	Same as Option 1	N/A
D to E (Bellevue Height & Blackwood) Belair Line Creates significant barrier	Includes On Road, Verge and new path. Road section is very steep. Shepherds Hill Road, Bellevue Heights verge option is poor user experience. (narrow path, busy/noisy due to traffic). User Safety issues along Shepherds Hill road with driveways. Good connection to residential development north of Shepherds Hill Road. New path required –some vegetation clearance.	Includes On Road, Verge and new path. Same issues relating to Ashmore Road (Steep) and Shepherds Hill Road as Option 1. Manson Avenue (On Road) steep. New Path required = vegetation clearance. Traverses through landfill site. Traverses Aboriginal Land (Colebrook Rec Park) – will require engagement with owners.	Option 3A is On road then utilises existing trail network but would require widening and therefore vegetation clearance. Steep incline out of valley to reach Rail corridor alignment – would require kickbacks. New path will require vegetation clearing. This option requires Future rail overpass (blue rectangle). Option 3B utilises existing trail network (requires widening and veg clearance) steep incline out of valley to reach rail corridor, therefore requires kick backs.		
E to F (Blackwood)	Predominantly verge. Verge on Beaconfield Road is wide and flat connects well with school and rec facilities.	Predominantly on verge, verge on Northcote Road is wide and not steep. Roseberry Avenue is steep. Scenic option.	Verge and new path. Roseberry Avenue is steep New path requires vegetation clearance. Scenic and natural landscape experience.	N/A	Utilises existing trail network, would require widening and veg clearance, disconnected from residential areas, recreational facilities and Blackwood High School. Potential Safety issues as a result of isolation.
F to G (Blackwood) F is location of rail overpass	New path, on road and verge options. User experience diminished due to on road option. Clematis Drive and Trevor Tce steep.	New path – requires kick back to get up from Valley to Rail overpass near high school. Requires veg clearance.	N/A	N/A	N/A
G to H (Blackwood)	New path, requires veg clearance. Good connection with Blackwood Oval.	Utilises existing trail, would require widening or veg clearance, more direct.	New path, requires consideration of interface with car park and oval, good connections to residential and oval, less direct.		
H to I (Craigburn Farm)	New path, requires veg clearance. Need to sit on contour ledge to avoid steepness of valley. Good Connections with residential. Yellow dashed lines indicate short cuts that could be used however to connect with community main path is longer.	N/A	N/A	N/A	N/A
I to J (Craigburn Farm)	Initial section along existing road very steep, new path with kick backs to avoid this. New path to connect with playground (orange circle.	Utilises existing trails rather than verge but will require widening and veg clearance.	Utilises existing trails, requires widening and veg clearance, does not connect with playground as well.		
J to K (Craigburn Farm)	New path utilizing existing trail, requires widening and veg clearance, existing trail. On road section (Access road for housing development very steep, however existing trail below was destroyed when making access road.				

Stage 1 Preliminary – Trail Route Options

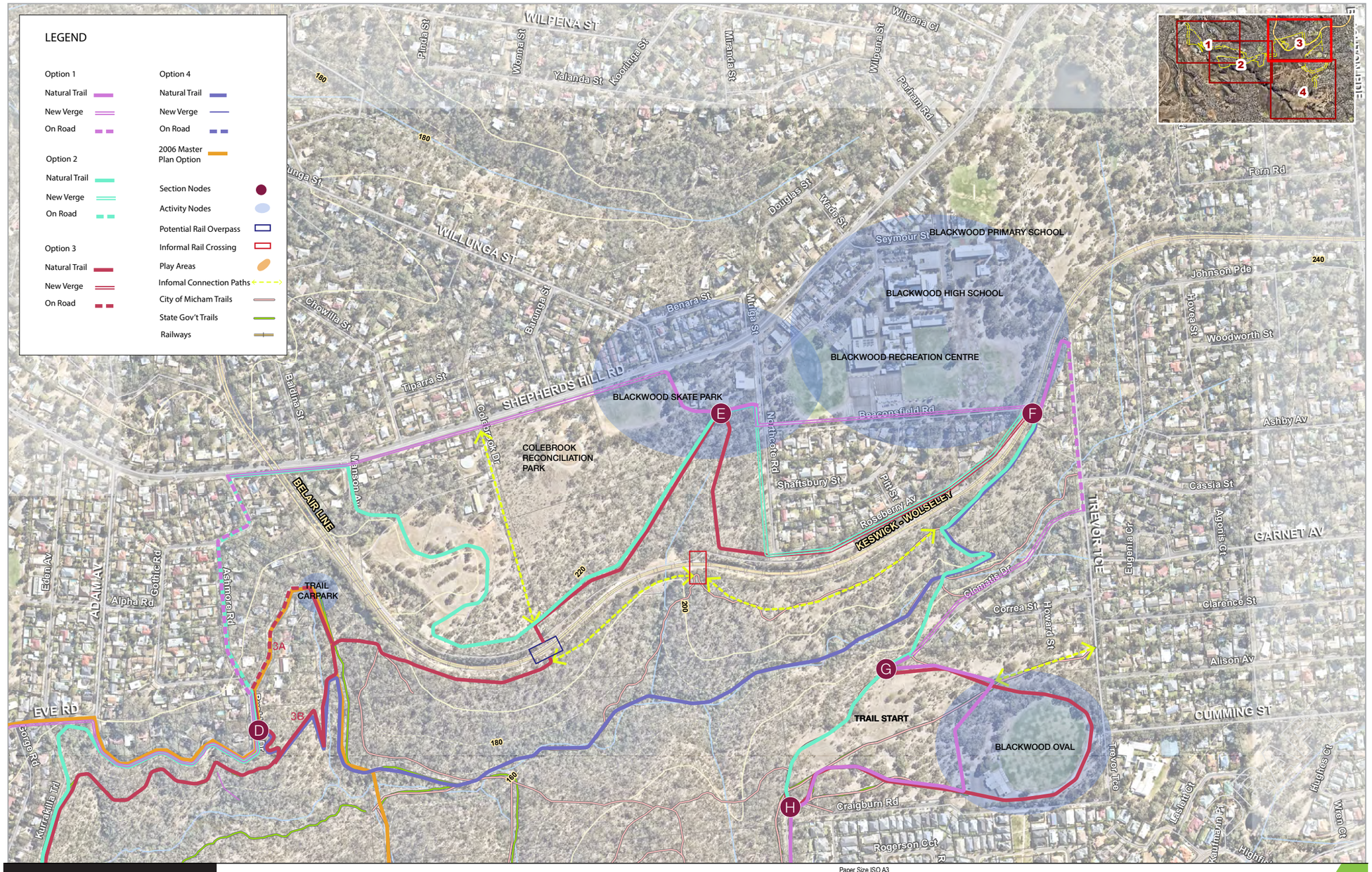


GHDWOODHEAD

Stage 1 Preliminary – Trail Route Options



Stage 1 Preliminary – Trail Route Options



GHDWOODHEAD

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

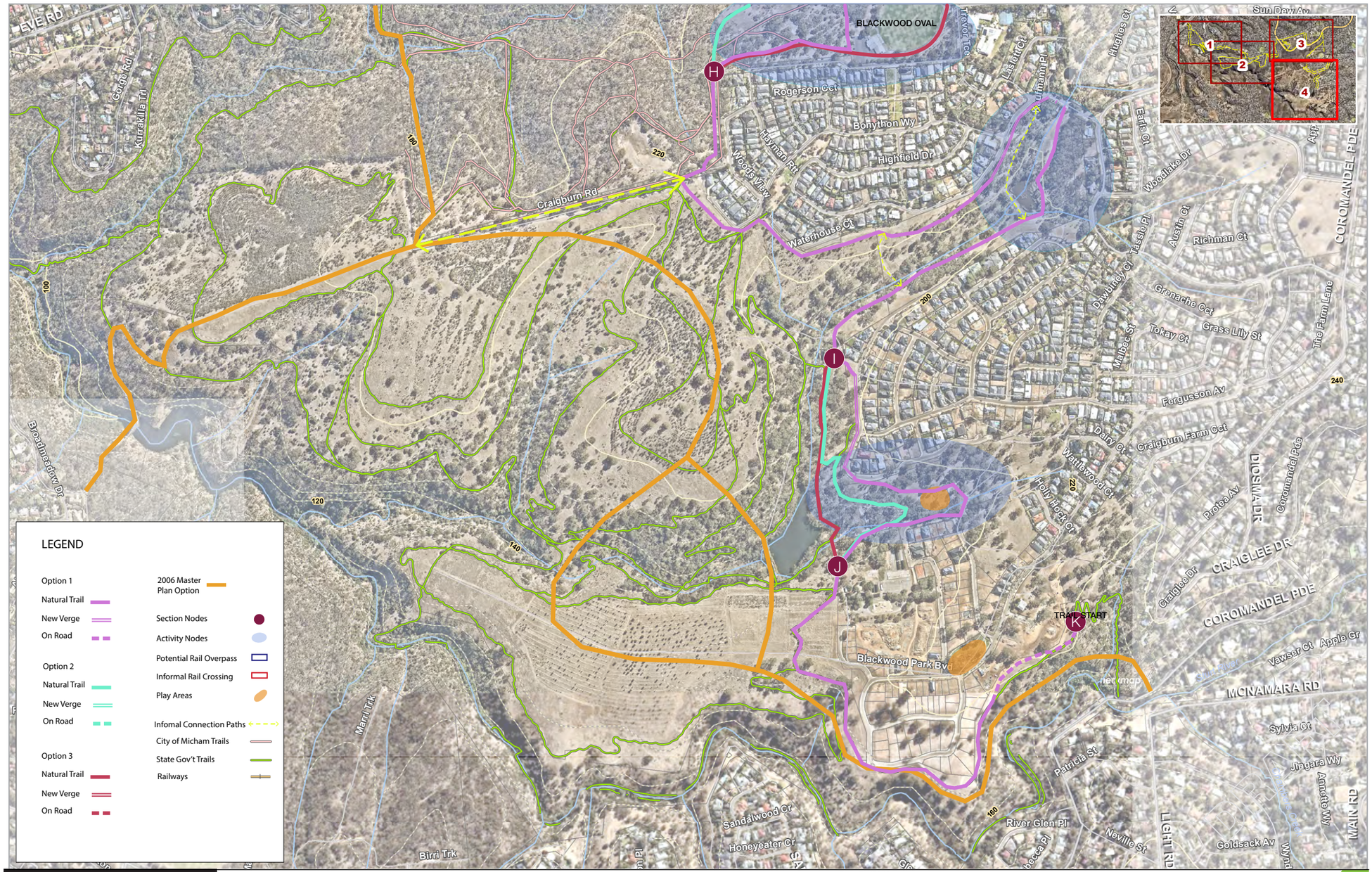
Project No. **33-19219**
Revision No. **A**
Date **2 Aug 2019**

Trail Route Options Page C

FIGURE 2C

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019), Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kyveiasco

Stage 1 Preliminary – Trail Route Options



GHDWOODHEAD

Stage 1 Preliminary - Additional Trail Route Options

Outcomes of Stakeholder Engagement

The Sturt Gorge Park is under the care and control of the Department of Environment and Water (DEW). The following sections of the proposed trail were located within this area:

- D to E Red (Figure C)
- J to K Magenta (Figure D)

During engagement undertaken by the City of Mitcham with relevant stakeholders. DEW asked the City of Mitcham to review these options and if possible identify alternate trail routes for D to E and J to K. Alternative options.

Two alternative trails were identified and evaluated using the same methodology and Multi Criteria Assessment Table used during the feasibility stage of this project.

Alternate Route 1 - J to K

The trail option indicated in cyan begins at K and is aligned to Council land, located on the verge of a newly developed road within a new subdivision.

The slope of land through this area is quite steep and the recent subdivision makes it difficult to adapt the path alignment to achieve DDA compliance.

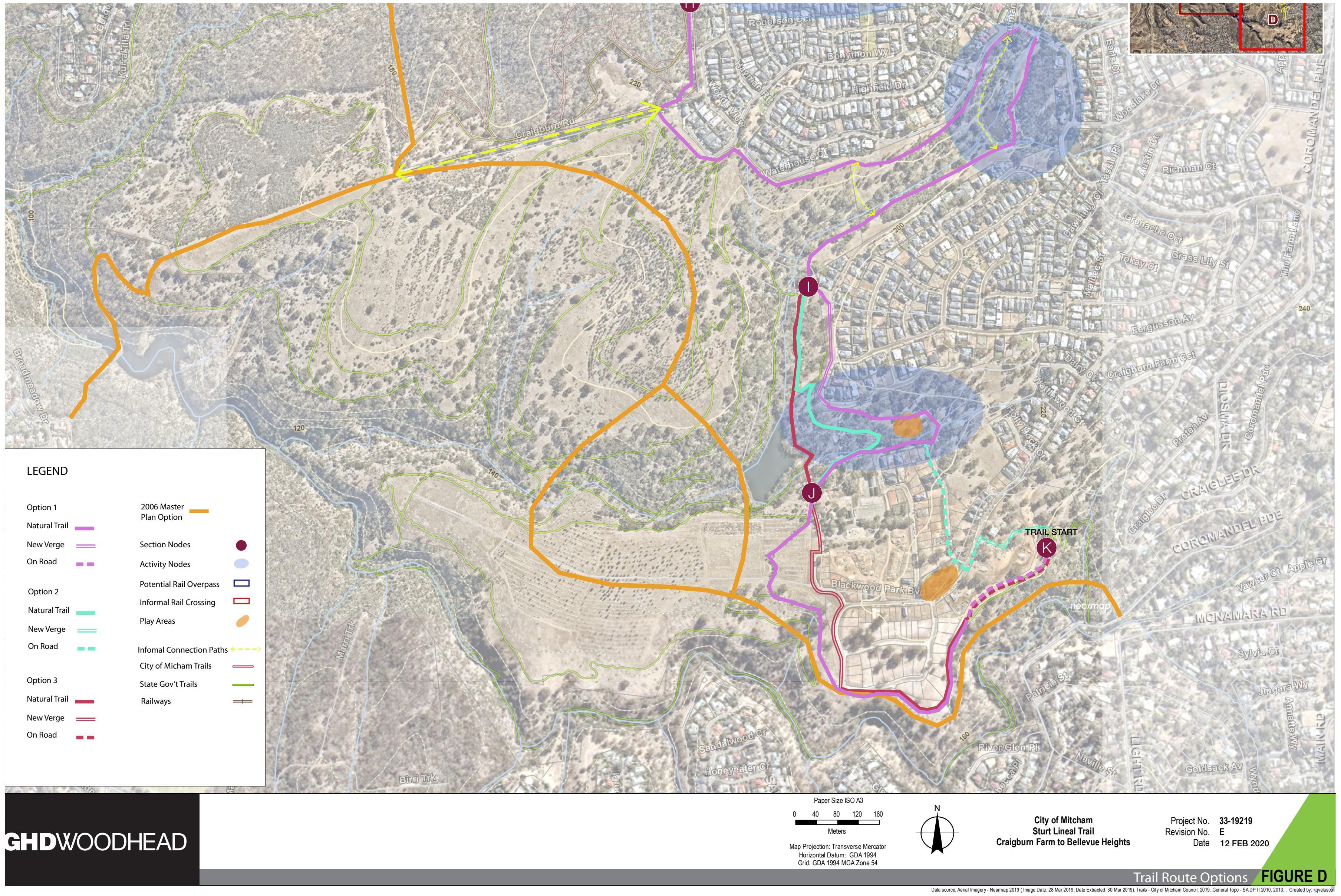
The recently constructed verges are also not wide enough to accommodate the trail so the trail will be predominantly shared on road through this section.

Alternate Route 2 - J to K

The red option aligns with the magenta option until it reaches Blackwood Path Boulevard, at which point it continues along that road. Both on the verge and shared on road.

Both options are steep, with gradients that do not complying with DDA requirements. These options will be considered as part of the community consultation process. The City of Mitcham Steering Group preferred option J to K Magenta.

GHDWoodhead



02

Stage 2 Feasibility

Stage 2 Feasibility – Technical Evaluation of Trail Options

Feasibility Assessment

Stage 2 - Feasibility included a high level technical evaluation of the following areas relating to the trail options:

- Connectivity - with Activity Nodes, Residential Areas, Educational Facilities
- Land Access Requirements - particularly relating to land ownerships or land managers
- Heritage
- Vegetation
- Geotechnical
- Civil and Pavement Engineering
- Stormwater and WSUD opportunities
- Traffic and Carparking
- Lighting

Through the trail audit and technical specialist review process certain options presented as problematic, methods used to rank and weight the options were developed to highlight these constraints.

A Multi Assessment Criteria Assessment (MCA) Feasibility Table (Table 2) was developed which assessed each trail option against selected criteria which included:

- Length
- Requirement for significant engineering treatments (retaining walls, cut and fill, culverts and bridges)
- Gradient
- Environmental Impact - native vegetation removal, cut and fill
- Lighting requirements
- Fall/protection fencing
- Setting locality (verge, on-road, natural)
- Land manager
- Construction Cost
- Accessability
- Interface with adjacent land uses.
- Setting Locality
- Community Connections

An Opportunity and Constraints workshop, was undertaken to rank the options against these criteria These rankings were then weighted in order of perceived impact. Attendees at the workshop included technical specialists from the City of Mitcham, GHDWoodhead, GHD and Birdseye Studio.

The outcome of these rankings was the elimination of certain options that were not feasible, particularly relating to cost, environmental impacts and community well being.

Feasibility Assessment Ranking

The following information outlines the parameters and method used to develop the ranking system used in the Multi Assessment Criteria Table (Table 2)

Ranking 3, 2, 1. 3 being the best option, 1 being the worst

Construction Cost Impacts

Retaining Wall + Fall Protection Fencing Ranking
No retaining walls + fencing = 3
Length of retaining walls + fencing is < 50% of total route length = 2
Length of retaining walls is > 50% of total route length = 1

Cut and Fill Ranking
No cut and fill = 3
Length of cut and fill is < 50% of total route length = 2
Length of cut and fill is > 50% of total route length = 1

Bridge (culvert and minor bridge) Ranking
No Bridge = 3
0-2 Culverts or walkways = 2
3+ Culverts or walkways = 1

Rail Overpass
No Overpass = 3
Rail overpass = Red Flag = 0

Lighting
No lighting required = 3
Majority of trail route does not requires lighting = 2
Majority of trail route requires lighting = 1

Length
Shortest Trail Option = 3
Medium Trail Options = 2
Longest Trail Options = 1

Accessibility
Influence = Gradient

Ranking
0 metres gradient > 10% = 3
Majority gradient < 10% = 2
Majority gradient > 10% = 1

Interface with Adjacent Land Uses

Requires Removal of On street Carparking
Requires Negotiations with Land Owners
Trail User Safety
Rail Corridor
Capped Landfill
Cut and fill in Hills Face Zone
Through a car park

Ranking
Minimal interface impacts with Adjacent Land Uses = 3
Moderate interface impacts with Adjacent Land Uses = 2
Significant interface impacts with Adjacent Land Uses = 1

Environmental Impact
Native Vegetation Removal
No removal of Native Vegetation = 3
Removal of < 1000 linear metres of native vegetation = 2
Removal of > 1000 linear metres of native vegetation = 1
Cut and Fill
No Cut and Fill = 3
Length of cut and fill is < 50% of total route length = 2
Length of cut and fill is > 50% of total route length = 1

Setting Locality - rated based on perceived user experience

Ranking
Majority Natural = 3
Majority Verge with View = 3
Majority Verge = 2
Majority Verge on Main Road = 1
Majority on-road = 1

Community Connections
Connection to residential areas
Connection to activity nodes
Connection to parks and playgrounds

Ranking
Connects Well = 3
There is a connection = 2
No connection = 1

Assumptions

Minor bridges include culverts/walkways over known water channels e.g. creeks, streams.

Fall protection/fencing included at all retaining walls.

Vegetation removal include natural verges which will require some degree of vegetation stripping.

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 2 – Trail Options - Multi Assessment Criteria Feasibility Table

Section	Start	End	Sub-Option	Total Length (m)	Native Vegetation Removal (Y/N)	Gradient No. of Segments/ Metres			Significant Engineering Treatments (Y/N) No. of Segments/ Metres			Lighting Requirements	Fall Protection / Fencing (Y/N)	Setting Locality (by %)			Land Manager
					Metres	< 5%	5-10%	> 10%	Retaining Wall	Cut fill	Bridges	(Y/N)	Metres	Natural	Verge	On-Road	
1	A	B	1 Magenta	2117	N	1140	977	0	Y, 650	Y, 1222	N	Y	Y, 650	91	9	0	Flinders University / CoM
			2 Cyan	1024	N	423	0	600	N	176	N	Y	N	17	0	83	Flinders University / CoM
			3 Red	1601	N	901	240	460	N	93	N	N	N	6	53	41	Flinders University / CoM
			2006 Orange	1070	N	351	170	549	Y, 270	N	N	Y	Y, 270	35	0	65	Flinders University / CoM
2	B	C	1 Magenta	1356	N	173	1183	0	N	N	N	Y	N	0	53	47	Flinders University / CoM
			2 Cyan	1302	Y, 240	472	638	192	Y, 450	Y, 640	N	Y	Y, 450	19	45	36	Flinders University / CoM
			2006 Orange	1263	N	0	1263	0	N	N	N	Y	N	0	64	36	Flinders University / CoM
3	C	D	1 Magenta	1333	Y, 200	945	0	388	Y, 357	Y, 357	N	Y	N	0	26	74	CoM
			2 Cyan	2212	Y, 850	912	367	933	Y, 400	Y, 1617	N	Y	Y, 400	73	0	27	CoM / DEW
			3 Red	3949	Y, 2480	1814	1827	308	Y, 1000	Y, 3500	Y, 4	Y	Y, 1000	100	0	0	Flinders University / CoM / DEW
			2006 Orange	1333	Y, 330	945	0	388	Y, 357	Y, 357	N	Y	N	0	26	74	CoM

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 2 – Trail Options - Multi Assessment Criteria Feasibility Table

High Level Assessment Criteria Ranking												Section Sub-Option Ranking
Construction Cost						Accessibility (grade) 25%	Interface with adjacent land uses (10%)	Environmental Impact (Native Vegetation Removal) (7%)	Environmental Impact Cut and Fill (3%)	Setting Locality (15%)	Community Connections (15%)	
Lighting (5%)	Retaining Wall & Fall protection Fencing (3%)	Cut Fill (3%)	Culverts and Minor Bridges (3%)	Rail Over Pass Bridges (6%)	Length (5%)							
1	2	1	3	3	1	3	2	3	1	3	2	2.4
2	3	2	3	3	3	1	3	3	2	1	3	2.09
3	3	2	3	3	2	2	1	3	2	2	3	2.29
2	2	3	3	3	3	1	3	3	3	1	3	2.12
2	3	3	3	3	3	3	2	3	3	3	3	2.85
1	2	2	3	3	3	2	2	2	2	3	3	2.39
2	3	3	3	3	3	3	2	3	3	3	3	2.85
2	2	2	3	3	3	2	3	2	2	1	3	2.24
1	2	1	3	3	2	2	2	2	1	3	3	2.28
1	2	1	1	3	1	2	1	1	1	3	2	1.85
2	2	2	3	3	3	2	3	2	2	1	3	2.24

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 2 – Trail Options - Multi Assessment Criteria Feasibility Table

Section	Start	End	Sub-Option	Total Length (m)	Native Vegetation Removal (Y/N)	Gradient No. of Segments/ Metres			Significant Engineering Treatments (Y/N) No. of Segments/ Metres			Lighting Requirements	Fall Protection / Fencing (Y/N)	Setting Locality (by %)			Land Manager
					Metres	< 5%	5-10%	> 10%	Retaining Wall	Cut fill	Bridges	(Y/N)	Metres	Natural	Verge	On-Road	
4	D	E	1 Magenta	1328	N	991	337	0	N	Y, 132	N	N	N	10	52	38	CoM / DPTI
			2 Cyan	1989	Y, 510	1298	528	163	N	Y,1292	N	Y	N	65	16	19	CoM / DPTI / Privately Owned / Colebrook Rec Park
			3A Red	3A, 1386	N	1014	350	349	N	Y,1090	Y, 2	Y	N	79	0	21	CoM / DEW / ARTC / Colebrook Rec Park
			3B Red	3B, 1423	Y, 1380	886	506	358	Y,340	Y, 1423	Y, 2	Y	Y,340	100	0	0	CoM / DEW / ARTC / Colebrook Rec Park
			2006 Orange (D to K)	4500	Y, 1260	2004	779	1719	Y, 1600	Y, 4500	Y, 5	Y	Y, 1600	100	0	0	DEW / CoM
			4 Blue (D to F)	2180	Y, 1500	997	1253	256	Y, 450	Y, 2180	Y,5	Y	Y,450	100	0	0	DEW / CoM
5	E	F	1 Magenta	590	N	520	70	0	N	Y, 70	N	Y	N	12	0	88	CoM
			2 Cyan	810	Y, 330	603	207	0	N	Y, 70	N	Y	N	8	0	92	CoM
			3 Red	831	Y, 330	714	85	32	N	Y, 226	N	Y	N	100	0	0	CoM
6	F	G	1 Magenta	895	N	588	200	107	N	Y, 150	N	Y	N	17	50	33	CoM
			2 Cyan	656	N	107	200	349	Y, 200	Y, 656	Y, 1	Y	Y, 200	100	0	0	CoM

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 2 – Trail Options - Multi Assessment Criteria Feasibility Table

High Level Assessment Criteria Ranking												Section Sub-Option Ranking
Construction Cost						Accessibility (grade) 25%	Interface with adjacent land uses (10%)	Environmental Impact (Native Vegetation Removal) (7%)	Environmental Impact Cut and Fill (3%)	Setting Locality (15%)	Community Connections (15%)	
Lighting (5%)	Retaining Wall & Fall protection Fencing (3%)	Cut Fill (3%)	Culverts and Minor Bridges (3%)	Rail Over Pass Bridges (6%)	Length (5%)							
3	3	2	3	3	3	3	2	3	2	1	3	2.54
1	3	1	3	3	2	2	1	2	1	3	3	2.21
1	3	1	2	0	3	2	1	3	1	3	2	1.97
1	2	1	2	0	3	2	1	1	1	3	2	1.8
1	2	1	1	3	1	2	1	1	1	3	1	1.7
1	2	1	1	3	2	2	2	1	1	3	1	1.85
2	3	2	3	3	3	3	3	3	2	2	3	2.74
2	3	2	3	3	2	3	3	2	2	2	3	2.62
2	3	2	3	3	2	2	3	2	2	3	3	2.52
2	3	2	3	3	3	2	3	3	2	2	3	2.49
1	2	1	2	3	2	1	3	3	1	3	2	2.02

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 2 – Trail Options - Multi Assessment Criteria Feasibility Table

Section	Start	End	Sub-Option	Total Length (m)	Native Vegetation Removal (Y/N)	Gradient No. of Segments/ Metres			Significant Engineering Treatments (Y/N) No. of Segments/ Metres			Lighting Requirements	Fall Protection / Fencing (Y/N)	Setting Locality (by %)			Land Manager
					Metres	< 5%	5-10%	> 10%	Retaining Wall	Cut fill	Bridges	(Y/N)	Metres	Natural	Verge	On-Road	
7	G	H	1 Magenta	769	Y, 90	199	570	0	N	Y, 769	N	Y	N	100	0	0	CoM
			2 Cyan	336	Y, 120	222	114	0	N	Y, 336	N	Y	N	100	0	0	CoM
			3 Red	1008	Y, 90	501	507	0	N	Y, 600	N	Y	N	90	0	10	CoM
8	H	I	1 Magenta	2303	Y,430	2303	0	0	N	Y, 2303	Y, 3	Y	N	87	13	0	CoM / DEW
9	I	J	1 Magenta	956	Y, 580	440	455	61	N	Y, 700	Y, 1	Y	N	74	26	0	CoM / DEW
			2 Cyan	760	Y, 200	491	179	90	Y, 150	Y, 760	N	Y	Y, 150	100	0	0	CoM / DEW
			3 Red	518	Y, 490	121	355	40	N	Y, 518	Y, 1	Y	N	100	0	0	DEW
10	J	K	1 Magenta	1088	Y, 100	933	156	0	N	Y, 1088	N	Y	N	100	0	25	DEW / CoM
			2 Cyan	588	N	194	333	61	N	N	N	Y	N	0	34	66	CoM
			3 Red	1265	Y, 50	615	450	200	N	Y, 470	N	Y	N	38	41	21	CoM

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 2 – Trail Options - Multi Assessment Criteria Feasibiltiy Table

High Level Assessment Criteria Ranking												Section Sub-Option Ranking
Construction Cost						Accessibility (grade) 25%	Interface with adjacent land uses (10%)	Environmental Impact (Native Vegetation Removal) (7%)	Environmental Impact Cut and Fill (3%)	Setting Locality (15%)	Community Connections (15%)	
Lighting (5%)	Retaining Wall & Fall protection Fencing (3%)	Cut Fill (3%)	Culverts and Minor Bridges (3%)	Rail Over Pass Bridges (6%)	Length (5%)							
1	3	1	3	3	2	3	3	2	1	3	2	2.51
1	3	1	3	3	3	3	3	2	1	3	1	2.41
1	3	1	3	3	1	3	2	2	1	3	3	2.51
1	3	1	1	3	3	3	3	2	1	3	3	2.65
1	3	1	2	3	3	2	2	2	1	3	3	2.33
1	2	1	3	3	2	2	2	2	1	3	3	2.28
1	3	1	2	3	1	2	2	2	1	3	2	2.08
1	3	1	3	3	3	3	3	2	1	3	2	2.56
2	3	2	3	3	3	2	3	2	2	2	3	2.42
1	3	2	3	3	2	2	3	2	2	3	2	2.32

Stage 2 Feasibility – Technical Evaluation of Trail Options

Civil and Pavement

Introduction

This section includes a summary of the desktop analysis undertaken for Sturt Linear Trail alignment options selected during Stage 1 of this project.

Each option has been analysed to determine the extent of civil engineering construction works likely to be required. The main aspects of civil engineering assessed are:

- Earthworks and embankment retaining solutions
- Stormwater drainage
- Longitudinal grades
- Pavements
- Traffic engineering

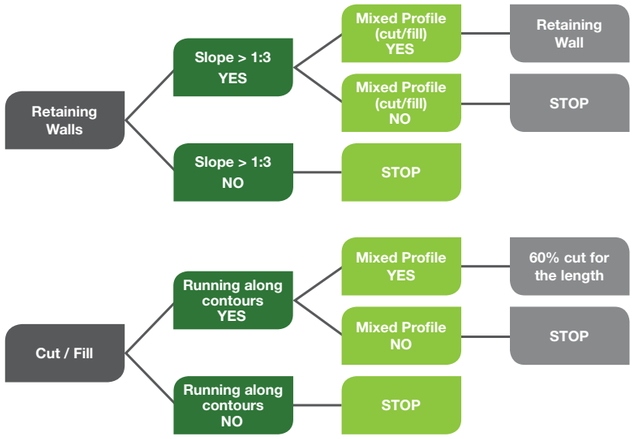
Process

The high level desktop assessment is based on a number of assumptions and processes applied uniformly for all options. It is recommended that the assumptions made for comparison of various options be verified during the following stages of this project.

The following sections of this report describe the process followed to determine extent of civil engineering works required for each options.

Retaining walls vs cut and fill

In order to determine the extent of retaining walls or cut/fill earthworks required for the construction of the Sturt Linear Trails we reviewed the topographic model and identified where the trail alignments are developed on terrain with a natural slope that will exceed 1 in 3 (Vertical:Horizontal). This is applicable for options proposed through the Sturt Gorge. We assume that due to the steepness of the existing slopes a retaining structure will be required for the construction of trails through these areas. Post and sleeper solutions have been considered to ensure uniformity of the assessment. This solution will also allow installation of full or partial barrier fences on top of the retaining structure. A barrier fence is required to protect the vertical drop or steep batters near the edge of the trail.



Where the trail alignments are proposed along the topographical contour levels, but on natural slopes not exceeding 1 in 3, we assume that retaining structures are not required. In this case we estimated the length of trail where a cut and fill typical section will apply. Earthworks in areas where access is difficult are considered to require significant engineering solutions. We assumed that approximately 60% of the trail through such areas would require earthworks to achieve the proposed typical section.

Typical cross sections for retaining walls and cut/fill engineering solutions are shown below:

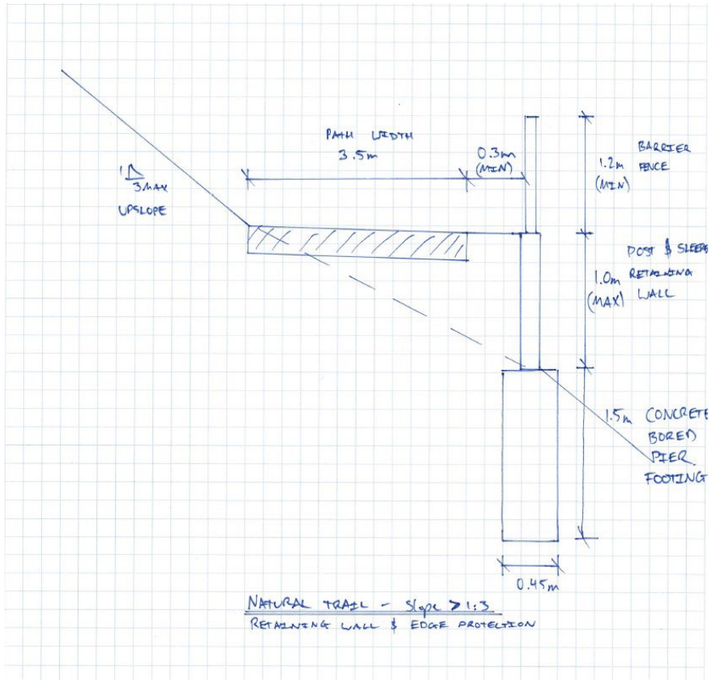


Figure 1 - Retaining wall - slope > 1 in 3

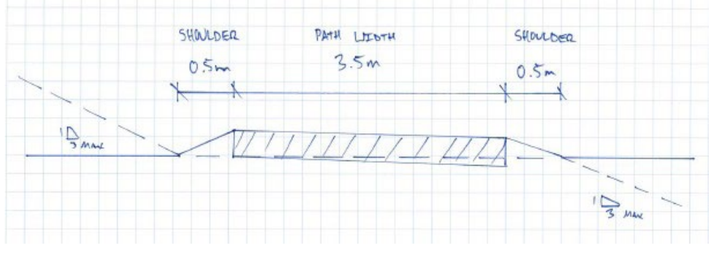
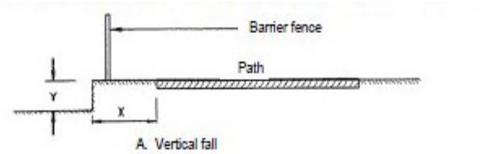


Figure 2 - Typical section - slope < 1 in 3

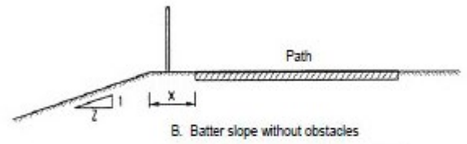
Requirement for fence barriers at batters and vertical drops



A. Vertical fall

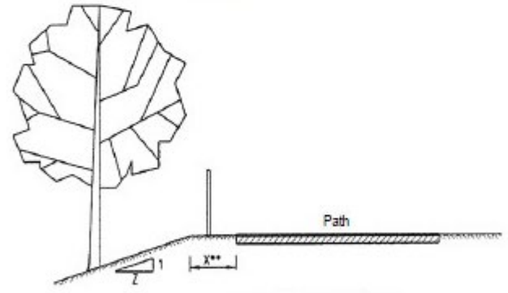
	X (m)	Y (m)
Fence not required*	<2	<0.25
Partial barrier fence required	<5	0.25 to 2
Full barrier fence required	<5	>2

* Batter off the surface where fall is within 1 m of path.



B. Batter slope without obstacles

	X (m)	Z (m)
Fence not required	<1 1 to 5	>8 >3
Partial barrier fence required	<5	1 to 3
Full barrier fence required	<5	<1

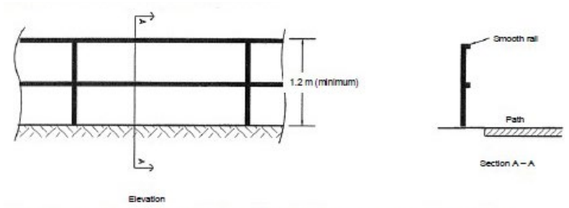


C. Batter slope with obstacles

	X (m)	Z (m)
Fence not required	<1 1 to 5	>8 >4
Partial barrier fence required	<5	3 to 4
Full barrier fence required	<5	<3

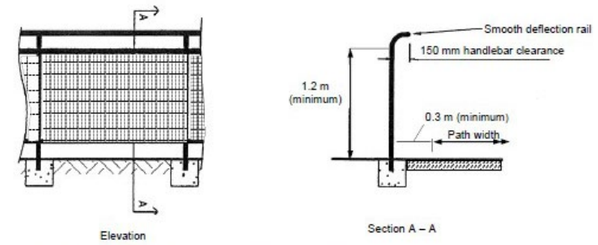
** Barrier fence required if obstacle within 1 m of path.

Stage 2 Feasibility – Technical Evaluation of Trail Options



Notes: Any fence placed in road-related area should also be assessed for roadside suitability.

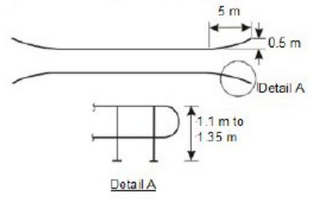
Figure 5.12: Example of a full barrier fence



1 *This may be reduced to 0.3 m where a fence has smooth features.*

Notes:
Cyclist deflection rails should be placed between 1.2 m and 1.4 m above path surface so that cyclists are able to use the part of the arm between the shoulder and elbow to glance against the smooth longitudinal rail. This prevents the cyclist handle bar located approximately 1.0 m above the path surface from being caught in the vertical components of the fence.
Any fence placed in road related area should also be assessed for roadside suitability.

Figure 5.13: Example of flared bicycle rail terminal



Source: Queensland Department of Transport and Main Roads (2015a).

Figure 3 – Example of a partial barrier fence

Longitudinal grades

The trails are proposed to cater for a large category of users, including less mobile or people with disabilities. The terrain through the study area is steep for some of the trail alignment options. Even if switchbacks are developed during the detailed design, some of the longitudinal gradients will exceed the maximum required to cater for all users. For option comparison, we assessed the alignments and we separated the trails in three categories based on longitudinal grade:

- Less than 5%
- Between 5% and 10%
- More than 10%

We assume that trails with a longitudinal grade less than 5% will be accessible for all users. Between 5% and 10% we assume that section of the trails will be difficult to access by people less mobile or with disabilities. Significant engineering solutions will have to be applied to improve the longitudinal grade and achieve DDA compliancy.

Where the trails have gradients, exceeding 10% we assume that access will be difficult for the majority of users. For such alignments, the engineering solutions required to improve the longitudinal grades are limited.

Stormwater drainage and Water Sensitive Urban Design (WSUD)

There are two distinct types of trails in regards with the engineering solutions:

- Trails within the road corridor
- Trails outside the road corridors

The trails proposed within the road corridor will likely required minimal stormwater drainage infrastructure. These trails are likely to be constructed on existing road verges. The majority of the roads are kerbed and the stormwater drainage is resolved using inlet pits and pipe systems.

There are opportunity for small rain gardens or WSUD treatments in the verge area, between the road and the new trails.

WSUD treatments includes:

- Storage, treatment and beneficial use of runoff (at building and street level, including stormwater);
- Treatment and reuse of wastewater; and
- Using vegetation for treatment purposes, water efficient landscaping and enhancing biodiversity and amenity.

Biorention systems, optimize existing basins, improve water quality and provide biodiversity and social benefits /recreational amenity.

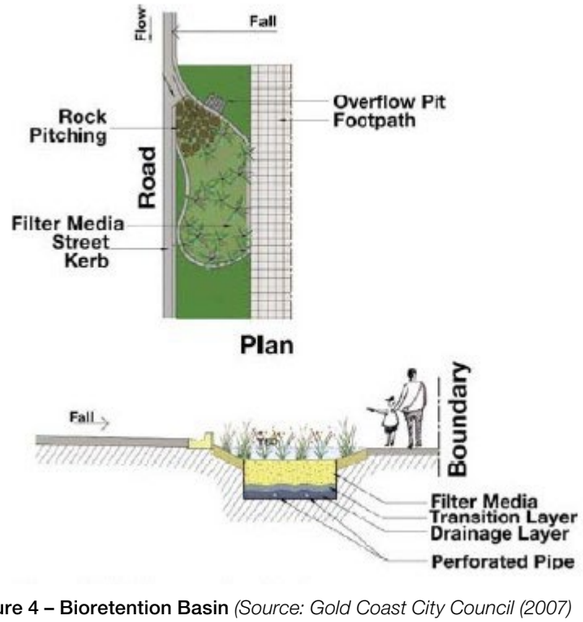


Figure 4 – Bioretention Basin *(Source: Gold Coast City Council (2007)*

For trail options proposed outside the road corridor, the management of stormwater drainage will be more complex and will include:

- Culvert crossings (watercourses or natural streams and valleys/gullies)
- Side and cross drains
- Erosion control measures (i.e. rip-rap, gabions, cement treated surface)

Where the trail alignment options are proposed alongside existing watercourses, the erosion protection works will be complex and with a significant impact on construction cost.

Pavements

The trails are proposed to be sealed to ensure safety and accessibility for all users. The type of pavements considered during this stage include:

- Flexible pavements
- Rigid pavements
- Segmental pavers

The flexible pavements include granular material on natural compacted subgrade and a sealed wearing course. Asphalt is often used as a wearing course for such infrastructure. Spray seal solutions can be considered. A fine asphalt (AC7) is preferred as it improves the quality of the ride for cyclists. In addition, the City of Mitcham has been trialling permeable road treatments and crushed rubber asphalt which could be considered for some sections of trail.

Stage 2 Feasibility – Technical Evaluation of Trail Options

Rigid pavements include a concrete slab installed on a layer of granular material. This solution is common for footpaths and shared used paths. Rigid pavements are susceptible to cracks and lipage at construction joints, especially where installed near trees. While the durability of such pavements may exceed the durability of flexible pavements, the replacement and maintenance may prove to be more costly and more technically difficult.

The segmental pavers are used for shared used paths and footpaths and are installed usually on a layer of granular material. This type of pavement can be constructed using minimal equipment and will not require complex civil works. Pavers can become slippery when wet and are subject to lippage due to poorly compacted subgrade or due to tree root encroachment. Segmental pavers can become a trip hazard.

Traffic engineering – impact on parking (kerbside) and on road solutions

For trail alignment options that are traversing areas outside the road corridor the traffic engineering solutions are limited to the connection points to the road and paths network or at crossing points. The connections to the existing road network do not involve significant works and traffic-engineering solutions have been developed and tested over time.

The alignment options proposed to be constructed within the existing road corridors include:

- On the verge – footpath
- On road – permanent or temporary bicycle lanes
- On road – using the carriageway shared with vehicles

One of the options proposed from point G to H will utilise some of the space allocated for the Blackwood Oval car park. In this case, it is recommended to consider options to offset any loss of parking or avoid impact on the existing car park.

Where the trails are proposed to be installed in the existing verge, it is recommended to consider a buffer between the edge of the trail and the kerb. This is important where kerbside parking is allowed. This will protect cyclists in particular from “dooring” and overhanging parked cars (where angle parking is permitted).

It is recommended that the trails be proposed where there is no or very few driveway accesses to properties. This will reduce the crashes between cyclists, pedestrians and vehicles entering and exiting adjacent properties.

For on road trails there are a number of technical solutions that include:

- Bicycle lanes – temporary or permanent delineated from general traffic by linemarking and signage
- Advisory bicycle pavement marking – Shared lane linemarking
- No delineation other than wayfinding

If new on road permanent bicycle lanes are proposed lane reconfiguration and change in parking arrangements is required. In residential streets, this will result in a loss of kerbside parking and may imply widening of existing roads.

The advisory bicycle pavement marking involves installation of sharrows in accordance to DPTI standards. Usually this treatment is applied on streets with low traffic volumes and low speeds. There is no impact on kerbside parking for such treatments.

On streets with very low traffic volumes and low speeds, it is expected that cyclists and pedestrians will share the road with other vehicles. This is applicable only on local streets. Wayfinding and warning/advisory signage is recommended to raise awareness for drivers that they may encounter other users on the road.



Figure 4 - Shared line marking (sharrows)

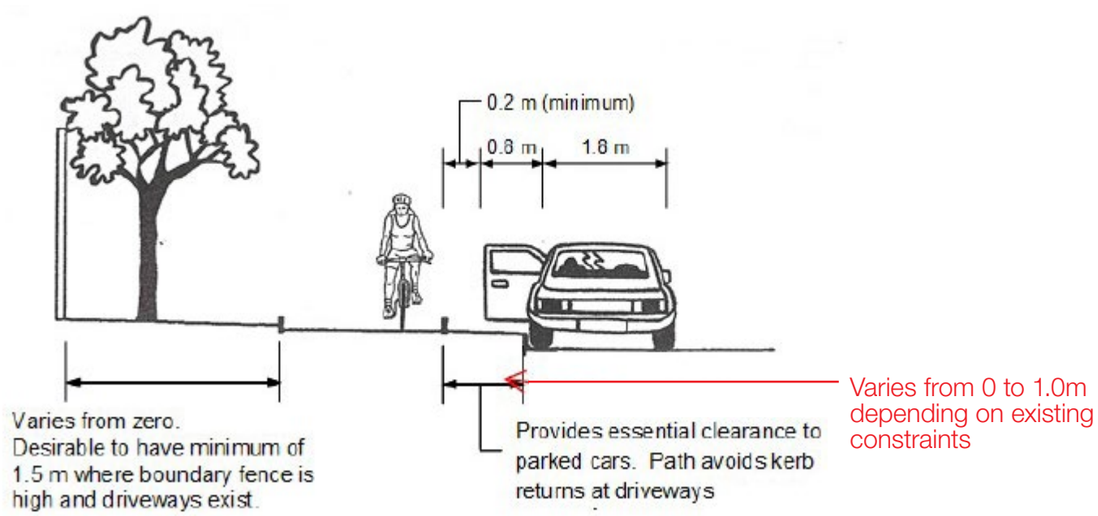


Figure 5 - Shared line marking (sharrows)

Conclusion and Recommendations

The processes and engineering solutions describe in the previous paragraphs have been applied to provide information required for the Multi-criteria Analysis.

One aspect that has been reviewed as part of the desktop study was the number of bridges, in particular over railway corridors. These structures will significantly increase the construction cost and will imply interfacing with the rail corridor and rail operations.

It is recommended that the processes and assumptions made to determine the type and extent of civil engineering works for each option are reviewed once additional information is made available. The extent of certain types of engineering solutions have been determined only for option comparison purpose.

Stage 2 Feasibility – Technical Evaluation of Trail Options

Geotechnical

Soils and Geology

GHD has undertaken a desk top review of the soils and geology over the extent of the project area, using published information.

An extract from the 1:50,000 scale "Soil Association Map of the Adelaide Region" (Geological Survey of South Australia, second edition, 1989) is reproduced as Figure 1. Overall, there is relatively little to distinguish one shared path route option from another in terms of the relative proportions of the various soil profiles and geological units that are expected to underlie the total length of a given route option

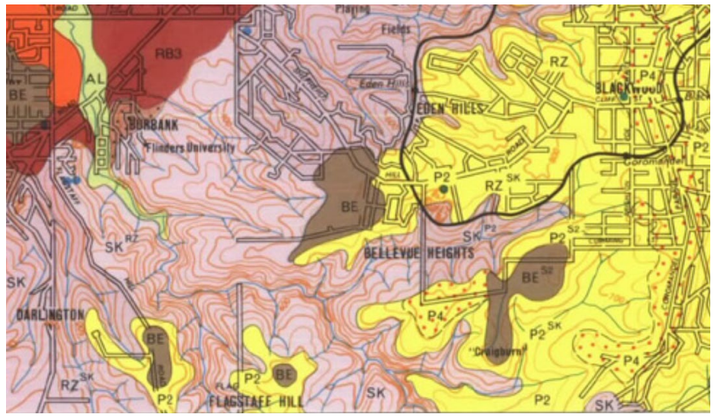


FIgure 6 – Extract from 1:50,000 scale soil map

Figure 6 shows that the dominant soil profile in the project area is a Skeletal type SK soil profile (light purple colour in Figure 6), which consists of very thin soils overlying rock, with rock outcrops generally present. In parts of the eastern end of the project area, a Podzolic type P2 soil profile (yellow colour in Figure 6) is indicated to be present, such as immediately north and west of the southern loop of the Belair rail line. This soil profile generally comprises a grey sandy surface, over yellow and mottled clay with a blocky structure (residual soil), over bedrock comprising slates, shales and/or quartzites. Adjacent to, or within, the mapped extents of the Podzolic soil profile, outcrops of a Black Earth type BE soil profile (brown colour in Figure 6) are indicated to be present. An example is further west of the southern loop of the Belair rail line, at and north of Eve Road. A Black Earth soil profile type is associated with very high or extreme reactive soil movements (shrink-swell soil movements in response to seasonal drying and wetting). The profile typically consists of black to dark grey clay soils with a coarse blocky structure, over brown or mottled clay with variable lime. At the western end of the project area, the soil profile may comprise one or more of the following:

- An Alluvial type AL soil profile (light green colour in Figure 6), running along the Sturt River corridor and comprising layered stream alluvium that may contain clay, silt, sand and/or gravel.

A Red Brown Earth type RB3 soil profile (red brown colour in Figure 1), comprising heavy red brown clay soils with a prismatic or blocky structure overlying clay with variable lime content. This soil profile type is associated with high or very high reactive soil movements.

A Terra Rossa type TR soil profile (light brown colour with black dots in Figure 1), comprising a shallow, uniform red to brown soil with a granular

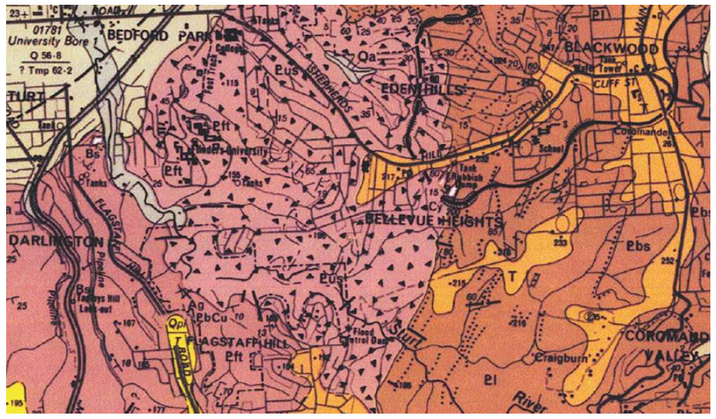


Figure 7

structure developed on highly calcareous parent material.

An extract from the 1:50,000 scale geological map "Noarlunga" (Geological Survey of South Australia, 1983) is reproduced as Figure 7.

Figure 7 shows that the surface and near-surface geology over the project area is dominated by Proterozoic age rock. Except for the eastern end of the project area, where siltstone and feldspathic quartzite is indicated (symbol Pl and light brown colour on Figure 7) the rock type comprises dark laminated siltstone of the Tapley Hill Formation (symbol Pft and light purple colour with black triangles on Figure 7). In some areas within the eastern part of the site, in particular along and adjacent to Shepherds Hill Road, a band of Tetiary age sands and gravels, which may be variably cemented, is indicated to outcrop (symbol T and orange colour on Figure 7). At the western end of the project site, two Quaternary age geological units are present: Alluvium of river terraces associated with Sturt River (symbol Qa and darker green colour on Figure 2), and Pooraka Formation of the Adelaide plain (symbol Q and lighter green colour on Figure 7).

Geotechnical Issues

There are four generic locations for a new shared path:

- Within the width of a road carriageway
- Within the verge near the edge of a road carriageway
- Through natural bushland that is flat or relatively gently sloping
- Through natural bushland that is relatively steeply sloping

Where the shared path is proposed to lie within the width of a road carriageway, there will be very few geotechnical issues to consider, since most geotechnical issues would already have been addressed by the design and construction of the road pavement and associated surface drainage system. The main residual geotechnical issue is management of ground cracking and differential movement in locations where the pavement subgrade comprises reactive clay.

Where the shared path is proposed to lie within the verge near the edge of a road carriageway, there will also be few geotechnical issues to consider, unless the verge is narrow and the ground surface slopes laterally beyond the outer edge of the verge. In that case, some cut or fill earthworks may be required. However, apart from that situation, the main residual geotechnical issue is again management of ground cracking and differential movement in locations where the pavement subgrade comprises reactive clay.

Where the shared path is proposed to lie within bushland that is flat, the main geotechnical issues are achieving a suitable pavement subgrade by removal of the topsoil zone and any loose or soft underlying soil, and managing surface water run-off from any higher areas to minimise the potential for erosion of the subgrade and/or wetting and softening of the subgrade. Where the ground surface has a slope of less than 1V:3H transversely to the line of the proposed shared path, some cut and fill earthworks will be required to achieve a horizontal subgrade over the width of the shared path. A balance between cut and fill is generally preferred, in order to minimise the extent of importation of fill from outside the project site, or disposal of spoil to outside the project site. Retention structures generally would not be expected to be required for relatively gently sloping bushland. This is because only relatively small cut batters and fill batters would be required and the batter slopes would not need to be excessively steep.

Where the shared path is proposed to lie within bushland that is relatively steeply sloping (1V:3H or greater, transversely to the line of the proposed shared path), then more extensive cut and fill earthworks will be required. It will generally also be necessary to provide retention structures on the downslope below the path, and on the upslope above the path unless the exposed cut face is mostly weathered rock, in which case an unsupported batter angle of 1V:1H or steeper may be acceptable. For the downslope below the path, several retention systems can be considered, such as dry stacked walls consisting of rocks of cobble or boulder size, or precast masonry blocks, or gabion baskets. Another type of retention system is a post and sleeper type retaining wall.

Stage 2 Feasibility – Technical Evaluation of Trail Options

The sleeper wall type is typically expected to be the most economical, based on its extensive use in sub-divisions and the like for retaining up to around 1.5 m height of fill. However, if strong rock is present at or near the ground surface, this retention system probably would not be preferred because of the difficulty in excavating the concrete bored piers in which the steel posts would be embedded. Instead, some form of dry stacked retaining wall would be favoured in that circumstance. Excavation in rock, as part of cut and fill earthworks, will also be more extensive for steeply sloping land, since the depth of cut will be greater. Excavation in rock may be difficult, and require use of a rock breaker (hydraulic hammer) if the rock is not weathered and/or does not contain closely spaced structural discontinuities such as bedding plane joints. Issues of erosion, wetting and softening of the pavement subgrade become more pronounced where there is a long or steep upslope above the edge of the path. (Global slope instability may also be an issue for long and/or steep natural slopes transverse to the line of the path.

It is apparent that in general, geotechnical issues, risks and costs progressively increase in the order that the four generic locations for a new shared path have been considered above. Therefore, those route options that have greater lengths of path in steeply sloping bushland are least preferred from a geotechnical perspective. However, there are no geotechnical issues that would preclude the adoption of any route option for the shared path. Rather, the geotechnical issues can be managed by conventional means such as by the path alignment following natural contours to the extent practicable, and by the provision of appropriate engineered slopes, retention structures and erosion protection treatments, albeit at some cost to the project budget and project work program.

Vegetation

Introduction and Scope

The following consists of a high level technical evaluation of vegetation constraints along each option. This should be read in conjunction with the feasibility report and mapping of the options.

Study Area

The project is located in Bedford Park, Bellevue Heights, Blackwood and Craigburn Farm, approximately 15 km south of Adelaide.

This high level technical evaluation memorandum refers to both the study area and track options. For the purposes of this assessment, there are five track options, which refer to:

- Option 1
- Option 2
- Option 3
- Option 4
- 2006 Master Plan Option

The term **study area** refers to a broader region surrounding both study sites (i.e. includes areas that are outside the proposed impact areas). The study area for this assessment includes private properties and roadsides within 10 km of the study site. This description covers a much broader area than the expected zone of impact, and the additional information captured has been used to provide context to determine the significance of ecological features identified within the track options (for example, whether they are part of a larger area, or whether there are potential impacts on ecological features outside the track options). Both the study area and the track options were only assessed at a desktop level.

Methods

A desktop assessment of ecological values known or predicted to be present within the study area was undertaken. The following government databases and spatial datasets were reviewed:

- *Commonwealth Environment Protection and Biodiversity Conservation (EPBC)* Act 1999 Protected Matters Search Tool (PMST) (maintained by the Department of the Environment and Energy (DoEE))[1] (10 km buffer of the study site)
- Atlas of Living Australia[2] (ALA) database for flora and fauna species recorded within the local area (10 km buffer of the study site)
- NatureMaps – which provides GIS mapping, maintained by DEW[3], including modelled mapping of SA Vegetation, Pre-European Vegetation and Native Vegetation Act 1991 Boundary
- Aerial imagery of the study site.

The extent of potential impacts to native vegetation for each option was estimated by measuring the length of each option which intersected with modelled native vegetation using NatureMaps and Google Earth[4].

Results

A search of the NatureMaps and PMST databases identified 102 rare or threatened species of flora listed under either the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *South Australia's National Parks and Wildlife Act 1972* (SANPW Act) that are either known, likely or may occur within the study area:

- A total of 16 species listed under the EPBC Act
- Total of 102 species listed under the SANPW Act

Additional listed flora may occur within the study area for which there are currently no local records on NatureMaps or the PMST database.

A search of the PMST database detected one threatened ecological communities listed under the EPBC Act that are either likely to occur or may occur within the study area:

- *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia* (Endangered)

[1] http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf (accessed September 2019)
[2] https://www.ala.org.au/ (accessed September 2019)
[3] http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps (accessed September 2019)
[4] https://www.google.com/earth/ (accessed September 2019)

Stage 2 Feasibility – Technical Evaluation of Trail Options

Naturemaps has one vegetation group modelled within the study area: Eucalyptus forest and woodland. This type of vegetation is described as a *Eucalyptus microcarpa* (Grey Box) mid woodland over an *Acacia pycnantha* (Golden Wattle), with *Olearia ramulosa* (Twiggy Daisy-Bush), *Acacia paradoxa* (Hedge Wattle) tall shrubs. With a ground storey of *Briza maxima* (Larger Quaking Grass), *Astroloma humifusum* (Cranberry Heath), *Lomandra densiflora* (Pointed Mat-rush) with a low tussock grasses of potentially *Themeda triandra* (Kangaroo Grass)

Native vegetation to be removed within the City of Mitcham is required to be assessed and follow the regulations of the Native Vegetation Act 1991, some of the study area is in an area mapped as Native Vegetation Act exempt area. Council planning scheme overlays or zoning may still be present within these areas and an assessment of these is beyond the scope of this report.

Maps of the native vegetation modelled within the study area are shown in Appendix A.

Table 3 shows the vegetation modelled along each track option is described by segments. The level of this desktop assessment allows only for the use of modelled vegetation mapping, however due to the nature of modelled mapping there maybe discrepancies between the modelled mapping and native vegetation on the ground. Once the final track option and construction method has been determine a detailed site assessment to map the native vegetation and habitat along the track should be completed. Vegetation present on the aerial mapping that is not indicated as modelled native vegetation has the potential to be either native vegetation, non native vegetation or planted native vegetation.

Conclusions and Recommendations

- Based on the modelled native vegetation, Option 1 will have the least impacts with 1300 m of the track intersecting with modelled native vegetation. The 2006 Master Plan Option is the second best option, intersecting with approximately 1590 m of modelled native vegetation, then Option 2 and Option 3. However it is noted the preferred trail alignment uses a combination of these 3 options and minimizes the need to remove native vegetation.
- The area of native vegetation impacted by the various options is likely to be greater than what is indicated by the modelled vegetation only. The aerial photos show vegetated areas adjacent to areas of modelled native vegetation, whist it is not possible to say whether these areas contain native vegetation, introduced vegetation or planted native vegetation it is likely that at least some of these areas would be native.
- Once an option has been chosen and the final design confirmed, a site visit is recommended to map and assess native vegetation on the ground. This will determine the requirement for a Clearance Application under Section 28 of the Native Vegetation Act 1991 to clear native vegetation for the changing land use.
- Further approvals may also be required under local planning schemes, for example when undertaking any tree damaging activity in relation to a significant or regulated tree; which would require a Development Approval from council.
- As all options pass through or near patches of modelled native vegetation, there is the potential that threatened flora and fauna and /or their habitat is present. The desktop assessment identified 102 rare or threatened species of flora listed under either the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the South Australia's National Parks and Wildlife Act 1972 (SANPW Act) that are either known, likely or may occur within the study area. Depending on the quality of the vegetation found on-ground, targeted surveys maybe required.
- One EPBC listed threated ecological community is predicted to occur within the study area, a site visit would need to confirm the presence of this community depending on the quality of vegetation on-ground.

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 3 – Vegetation modelled along the track options

	Option 1	Option 2	Option 3	Option 4	2006 Master Plan Option
Total Modelled vegetation intersected (metres)	1300 m	2250 m	3390 m (additional 1380 m via Option 3B)	1500 m	1590 m
Segment A-B	No modelled native vegetation present. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	No modelled native vegetation present. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	No modelled native vegetation present. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	N/A	Similar to Option 2
Segment B-C	Skirts along the edge of a patch of modelled native vegetation. Aerial imagery depicts vegetation along the track in areas not modelled.	Skirts along the edge of a patch of modelled native vegetation. Aerial imagery depicts vegetation along the track in areas not modelled.	N/A	N/A	Similar to Option 1
Segment C-D	Skirts along the edge of a small patch of modelled native vegetation, the majority of the segment has no modelled mapping. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	Skirts along the edge of a patch of modelled native vegetation. Aerial imagery depicts vegetation along the track in areas not modelled.	The majority of this segment intersects with two separate patches of modelled native vegetation. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	N/A	Same as Option 1
Segment D-E	Both position D and E are at a patch of modelled native vegetation, the majority of the segment has no modelled mapping. Aerial imagery depicts that this segment is mostly along a large road.	The majority of this segment intersects with one large patch of modelled native vegetation. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	The majority of this segment intersects with one large patch of modelled native vegetation. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	This segment skips past E and goes directly through to F. The majority of this segment goes through the centre of one large patch of modelled native vegetation. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	N/A
Segment E-F	Position E is within a patch of modelled native vegetation, the majority of the segment has no modelled mapping. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	Continues eastward along the edge of the patch of modelled native vegetation. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.		N/A
Segment G-H	Position H is within a patch of modelled native vegetation, the majority of the segment is not within a patch. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	Position H is within a patch of modelled native vegetation, the majority of the segment passes through this same patch. Aerial imagery depicts vegetation along the track in areas not modelled as native.	Position H is within a patch of modelled native vegetation, the majority of the segment is not within a patch and goes around a recreational oval. Aerial imagery depicts vegetation along the track in areas not modelled as native.	N/A	N/A

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 3 – Vegetation modelled along the track options

	Option 1	Option 2	Option 3	Option 4	2006 Master Plan Option
Segment H-I	Position H and I are within a patch of modelled native vegetation, the majority of the segment is not within a patch, but follows a large road. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	N/A	N/A	N/A	N/A
Segment I-J	The majority of this segment intersects with one large patch of modelled native vegetation. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	The majority of this segment intersects with one large patch of modelled native vegetation. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	The majority of this segment intersects with one large patch of modelled native vegetation. This segment passes the closest by a waterbody. In the small areas modelled vegetation does not cover the track, aerial imagery depicts vegetation.	N/A	N/A
Segment J-K	Position J is within a patch of modelled native vegetation, the majority of the segment is not within a patch, but finishes near a river. Aerial imagery depicts vegetation along the track in areas not modelled as native vegetation.	N/A	N/A	N/A	N/A
Segment D-K	N/A	N/A	N/A	N/A	The majority of this segment intersects with one large patch of modelled native vegetation. This segment passes the close by a waterbody and potentially crosses a river. In the areas modelled vegetation does not cover the track, aerial imagery depicts vegetation, some of this vegetation seems to be forestry planting.

Stage 2 Feasibility – Technical Evaluation of Trail Options

Lighting

It is likely that the majority of the proposed paths will require to be classified as P3 for lighting purposes. Where the path is aligned with an existing roadway provided with compliant road lighting the road lighting should provide sufficient lighting for the footpaths. The classifications are typically determined by the responsible authority (in this case the Council) in accordance with Table 2.2 of AS/NZS1158.3.1 (extract included right).

TABLE 2.2

LIGHTING CATEGORIES FOR PATHWAYS (INCLUDING CYCLEWAYS)

1	2	3	4	5	6
Type of pathway		Selection criteria[a,b]			Applicable lighting subcategory
General description	Basic operating characteristics	Pedestrian/ cycle activity	Risk of crime[f]	Need to enhance prestige	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads[d] and arterial roads[e], walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1[c]
		High	Medium	High	P2[c]
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

Lighting

Table 4 – Lighting Analysis

	Option 1(Magenta)	Option 2 (Cyan)	Option 3 (Red)	2006 Master Plan Option (Orange)	Option 4 (Blue)
A to B (Bedford Park)	Large portion of the length of section is along established roads and would likely not require lighting upgrades. The section where the track goes off road will need to be assessed for lighting. If required lighting may be difficult to install due to steep slope. Local power connection may not be available – maybe consider solar LED lighting.	Vast majority along existing roads and would likely not require lighting upgrades. Small portion of track will need to be assessed for lighting.	Runs along existing roads and would likely not require lighting upgrades.	Similar to Option 2	N/A
B to C (Bedford Park & Bellevue Heights)	Portion runs along existing roads – likely not to need lighting upgrade except around the back of the university carpark.	Part of the trail is likely to require new lighting. It is likely that local power supplies are available. Portion runs along existing roads – likely not to need lighting upgrade.	N/A	Similar to Option 1 and 2	N/A
C to D (Bellevue Heights)	Vast majority along existing roads and would likely not require lighting upgrades. Small portion of track will need to be assessed for lighting.	Some on existing roads not needing lighting upgrades and majority needing to be assessed for lighting. Some portions may be hard to service from existing power supply point.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	Same as Option 1	N/A

Stage 2 Feasibility – Technical Evaluation of Trail Options

Table 4 – Lighting Analysis

	Option 1(Magenta)	Option 2 (Cyan)	Option 3 (Red)	2006 Master Plan Option (Orange)	Option 4 (Blue)
D to E (Beleevue Heights & Blackwood) Belair Line Creates significant barrier	Runs along existing roads and would likely not require lighting upgrades.	Portion runs along existing roads and would likely not require lighting upgrades. Majority of the track will need to be assessed for lighting. Power supply locations likely to be problematic – maybe consider solar LED lighting.	Option 3A – small portion runs along existing roads and would likely not require lighting upgrades. Majority of the track will need to be assessed for lighting. Power supply locations likely to be problematic – maybe consider solar LED lighting. Option 3B - Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	
E to F (Blackwood)	Vast majority along existing roads and would likely not require lighting upgrades. Small portion of track will need to be assessed for lighting.	Similar to Option 1.	Large portion of the length of section is along established roads and would likely not require lighting upgrades. The section where the track goes off road will need to be assessed for lighting.	N/A	
F to G (Blackwood) F is location of rail overpass	Vast majority along existing roads and would likely not require lighting upgrades. Small portion of track will need to be assessed for lighting.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	N/A	N/A	N/A
G to H (Blackwood)	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.		
H to I (Craigburn Farm)	Not aligned with existing roads. Will need lighting assessment for the length.	N/A	N/A	N/A	N/A
I to J (Craigburn Farm)	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic for some sections – maybe consider solar LED lighting.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.	Not aligned with existing roads. Will need lighting assessment for the length. Power supply locations likely to be problematic – maybe consider solar LED lighting.		
J to K (Craigburn Farm)	Small portion aligned with existing road – likely not to require any lighting upgrade. Other sections are where not aligned with existing roads will need lighting assessment for the length. Power supply locations likely to be problematic for some sections – maybe consider solar LED lighting.				

Stage 2 Feasibility – Technical Evaluation of Trail Options

Land Access

High level land tenure and zoning review

The following process was undertaken to conduct a high level land tenure and zoning review of the trail route options.

- Each trail option was located using the South Australian Government Map tool https://maps.sa.gov.au/SAPPA/.
- Each affected allotment was identified and title information was considered. Crown Records and Certificates of Title were noted.
- Potential interactions with the Crown and private landholders were identified. Particular note was taken where a trail may cross or impact private land.
- Zoning information from both SAPPA and the City of Mitcham Development Plan consolidated 20 February 2018 was considered.
- All zones were identified with particular reference to Hills Face zone and Residential zone.
- The above information was used to inform the Multi Assessment Criteria Feasibility Table, identifying key issues for further investigation.

Overview

City of Mitcham Development Plan

Parts of the trail network are located in:

- Regional Activity Zone
- Open Space Zone
- Hills Face Zone
- MOSS Zone
- Institutional Zone
- Residential Zone

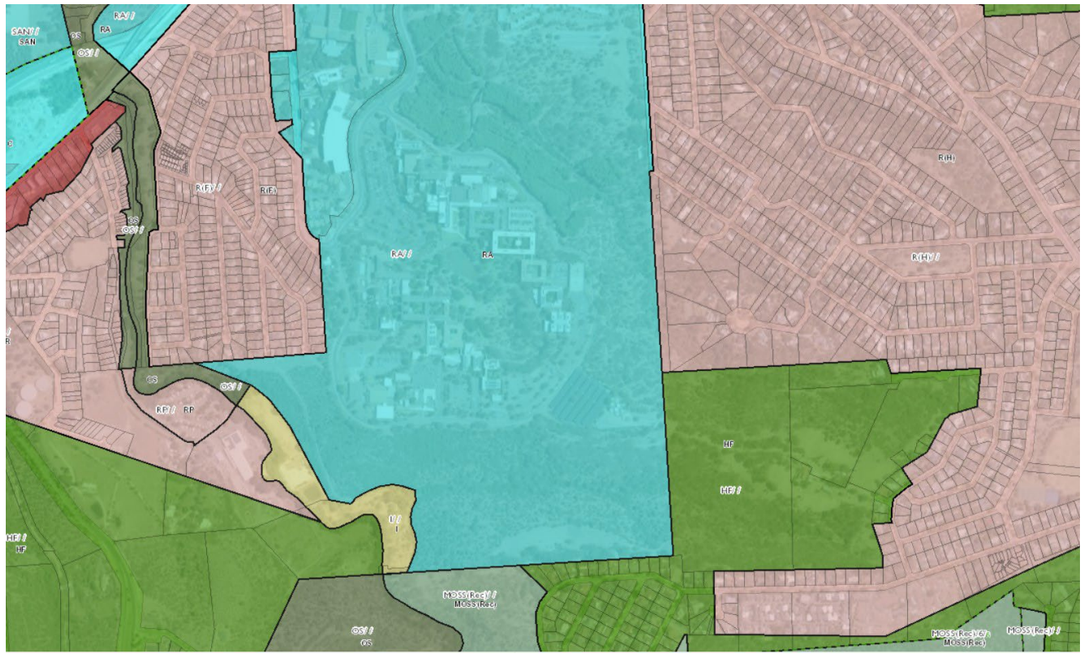
Cut and Fill within the Hills Face Zone is restricted.

Land Access and Tenure

While a detailed review of land ownership has not been undertaken trail options may be located on:

- University owned land
- Crown Land
- Council Owned land
- Road reserves
- Private land

Private land should be avoided, the residentially zoned areas on Map 2 and 4 should be reviewed to either remove trail access or confirm council ownership.



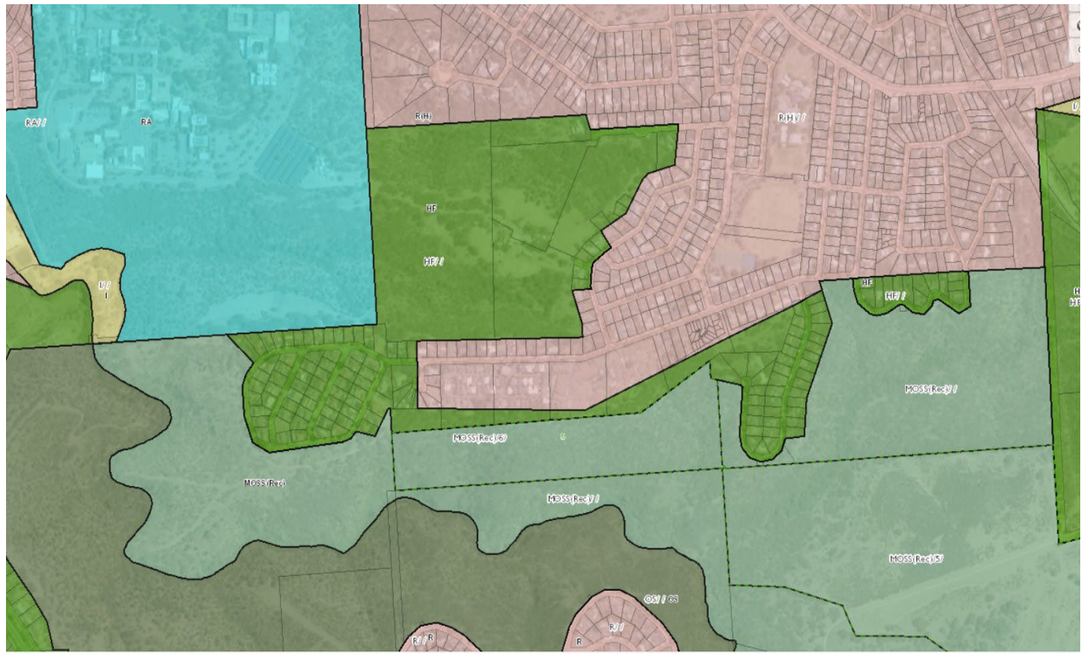
Map 1

The area indicated in blue, is Flinders University and is a crown record. Development of the trail on this site will require engagement and consent from Flinders University. Therefore access through this area is a key constraint.

Any paths on council roads are unlikely to represent a problem.

A section of Trail between B and C and C and D is located in Hills Face Zone, means cut or fill over 1m is problematic.

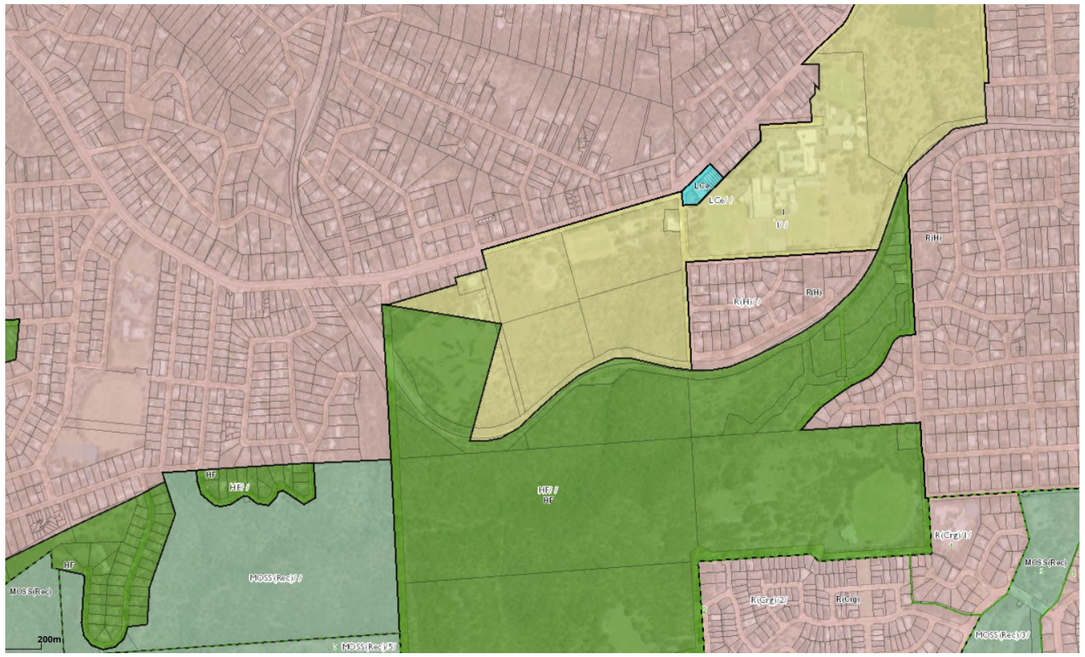
Stage 2 Feasibility – Technical Evaluation of Trail Options



Map 2

MOSS Zone should be suitable for trail development.

All MOSS zoned land is Crown Record, will likely require consent from DEW for trail construction and possibly vegetation clearance.



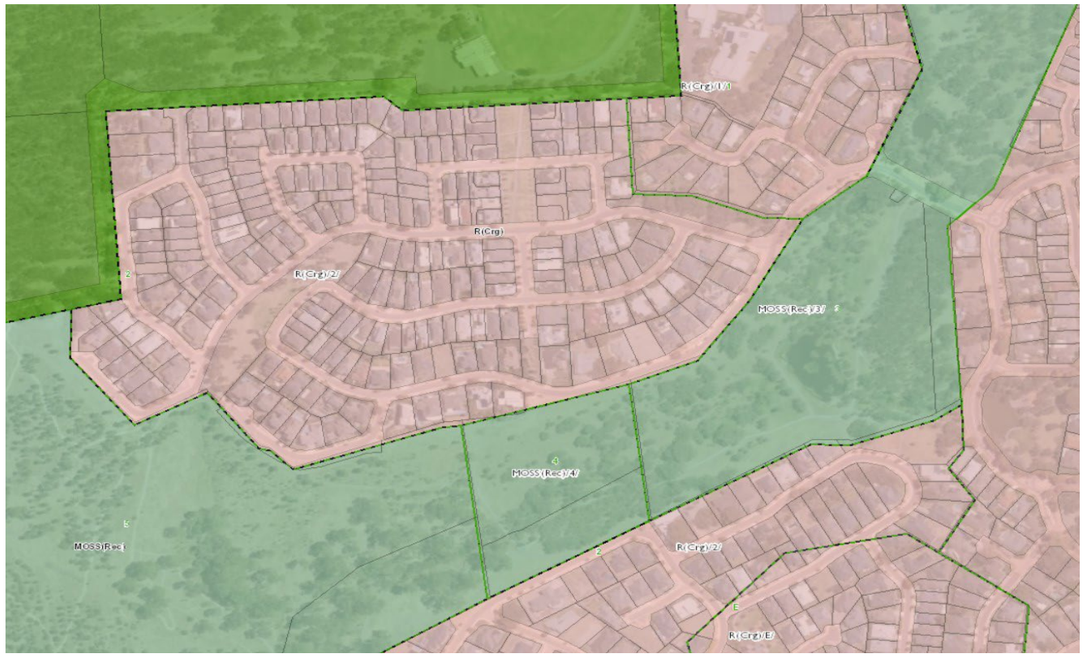
Map 3

MOSS Zone should be suitable for trail development.

All MOSS zoned land is Crown Record, will likely require consent from DEW for trail construction and possibly vegetation clearance.

Hills Face Zone is CT, meaning that it is either council land or privately owned.

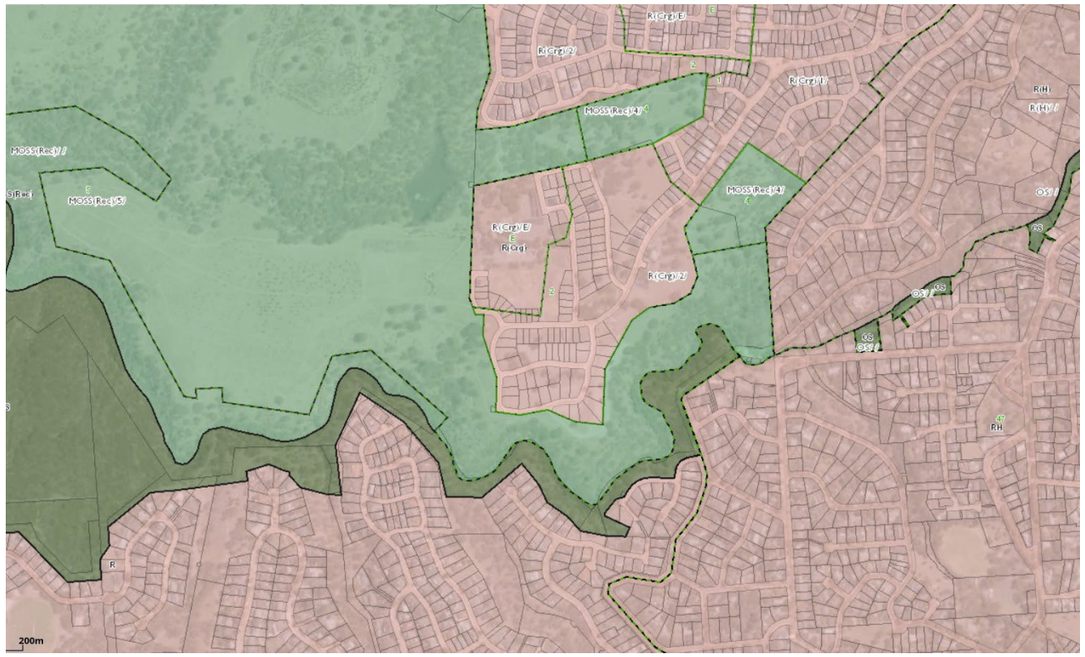
Stage 2 Feasibility – Technical Evaluation of Trail Options



Map 4-1

All MOSS zoned land is Crown Record, will likely require consent from DEW for trail construction and possibly vegetation clearance.

Hills Face Zone is CT, meaning that it is either council land or privately owned.



Map 4-2

All MOSS(Rec)/5 land is zoned Crown Record, will likely require consent from DEW for trail construction and possibly vegetation clearance

Stage 2 Feasibility – Technical Evaluation of Trail Options

Heritage

Key Findings

A desktop review was undertaken through the South Australian Property and Planning Atlas (SAPPA) to understand the Local and State Heritage Places located on and near the proposed Sturt Linear Trail. Location SA Viewer and the City of Mitcham Development Plan was reviewed to ensure the location and details of the Heritage Places are consistent and accurate. No Contributory items were identified through SAPPA, however there were three State items and five Local items.

State Heritage Place Sturt Gorge Recreation Park is recognized as an area of conservation and geological significance. Approximately 640m of Option 3 (red) between C and D is located within the park, the type of path proposed is a natural trail. The 2006 Master Plan (orange) also proposed approximately 450m of Trail located within the Recreation Park, the type of trail is not specified.

Railway Tunnels (Belair line) located on Shepherds Hill Road are listed as a Local Heritage Place. The listing includes the tunnels and entrance edging. Trail Option 1 (Magenta) proposes a natural trail along Shepherds Hill Road between D and E above the Heritage listed Tunnels.

Local Heritage listed House and Sheds are located at 2 Flinders Road, Bellevue Heights. Option 1 (Magenta) and option 2 (Cyan) are proposed to go past the location, however it is indicated to be on the road so there will be no direct impact. The 2006 Master Plan option does not specify the location of the trail.

The remaining State and Local places are not directly impacted by the proposed trail options, however are located within proximity particularly Wittunga Botanic Gardens, Horners Bridge and Craigburn Cottage.

These findings are summarised in Table 5 and graphically presented in Appendix C.

Table 5 – Heritage

State	Detail	Significance	Location to Trail
Sturt George Glaciation Geological Site – Sturt Gorge Recreation Park	Recognised as an area of conservation and geological significance	The glaciation represented at this site is now recognized as having been of worldwide extent. As a type section it is highly significant for understanding the worldwide Precambrian glacial period through the correlation of contemporary rocks elsewhere.	Approx. 640m of Option 3 (Natural Trail) located within the Indicative State Heritage Footprint.
Shepherd's Hill Road Blackwood	Wittunga Botanic Garden	The Garden contains over one hundred Erica species and cultivars which is the largest collection in Australia. There is also an extensive collection of Protea and Australian plants.	Approx. 440m N of Section Node F. No direct impact to trail options.
Murrays Hill Road Coromandel Valley	Horner's Bridge (Stone Arch)	Architecturally significant as an intact and well-preserved example of a classic single span stone arch bridge.	Approx. 200m SE of Option 1 Track Start. Nearest to the 2006 Master Plan Option. No direct impact to trail options.
Local	**Detail**	**Significance**	**Location to Trail**
Local Heritage Indicative Footprint		N/A	Section Nodes H to K of Option 1 (Natural Trail) are located within the Local Heritage Indicative Footprint.
2 Flinders Road Bellevue Heights	House & Shed	N/A	Approx. 100m NW of Section Node C. Sits on on-road Options 1, 2 and 2006 Master Plan.
Lot 165 Bushland Drive Bushland Reserve Craigburn Farm	Ruin; Remaining Structure	N/A	Approx. 250m SW of Section Node D. Portion of Natural Trail (Option 3) located within the Indicative Local Heritage Footprint. No direct impact to trail options other than indicative Heritage footprint.
3 Wade Street Eden Hills	House	N/A	Approx. 330m NE of Section Node E. No direct impact to trail options.
Shepherds Hill Road Eden Hills	Railway Tunnels (complete tunnel including entrance edging)	N/A	Approx. 720m W of Section Node E. Located under the proposed verge of Option 2.
156 Coromandel Parade Craigburn Farm	Craigburn Cottage	N/A	Approx. NW of Option 1 Track Start. No direct impact to trail options other than indicative Heritage footprint.

Stage 2 Feasibility – Safety in Design Risk Assessment

Safety in Design

Risk Assessment

Safety in Design (SiD) is a review of the design aimed at avoiding and preventing injuries by considering hazards as early as possible in the planning and design process.

The risk assessment includes hazards and risks through all phases of the project and follows the process outlined below:

- Hazard identification
- Consequences of the hazard
- The likelihood of the hazard
- Initial risk rating determined based on the associated consequence and likelihood
- Mitigating measures identified to eliminate or reduce the risk
- Establish residual risk rating after mitigation.

Within each design life cycle stage, the consequence of each hazard identified is assigned using the GHD consequence descriptors in Table 5.

Following assignment of the consequence of the hazard, the likelihood of that hazard occurring is estimated using Table 6.

The consequence and likelihood factors of each hazard were then entered into the Risk Assessment Matrix and the initial Risk Rating determined. The Matrix is shown in Table 7. As an example, a hazard with a 'major' consequence, that is 'likely' to occur is a low risk.

The results of this SiD assessment should continue to be reviewed to be developed further and potential risks reduced or removed where possible by the appropriate organisation/person.

Specific key areas of risk are outlined below:

- Civil
- Stormwater
- Lighting
- Landscaping

Table 5 – Consequence Descriptors

Risk Consequence	Design Consequence Descriptors
E – Catastrophic	Could result in fatality.
D – Critical	Could result in permanent total disability.
C – Severe	Could result in permanent partial disability, injuries or illness that may result in hospitalisation of persons.
B – Major	Could result in injury or illness resulting in one or more lost work days(s)
A – Minor	Could result in injury or illness not resulting in a lost work day.

Table 6 – Likelihood Descriptors

Risk Consequence	Design Likelihood Descriptors
5 – Almost Certain	Industry experience suggests design failure is almost certain to occur during the life of the product.
4 – Likely	Industry experience suggests design failure is likely to occur during the life of the product.
3 – Severe	Industry experience suggests design failure is possible some time during the life of the design.
2 – Unlikely	Industry experience suggests design failure is unlikely to occur in the life of design.
1 – Very Unlikely	Industry experience suggests design failure is very unlikely. It can be assumed failure occurrence may not be experienced.

Table 7 – Risk Assessment Matrix

		Consequence				
Likelihood		Minor	Major	Severe	Critical	Catastrophic
		A	B	C	D	E
Almost Certain	5	Low	Moderate	Significant	Extreme	Extreme
Likely	4	Low	Low	Moderate	Significant	Extreme
Severe	3	Negligible	Low	Moderate	Significant	Extreme
Unlikely	2	Negligible	Negligible	Low	Moderate	Significant
Very Unlikely	1	Negligible	Negligible	Low	Moderate	Moderate

Stage 2 Feasibility – Safety in Design Risk Assessment

Table 8 – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
Paving	Investigation and Design	Slips/Trips/ Falls	Uneven paving	B - Major	3 – Possible	Low	Engineering Controls Selection of appropriate paving and paving installation	Designer	Construction/post opening	Open	B - Major	2 – Unlikely	Negligible
Paving	Investigation and Design	Maintainability	Rigid paving is more durable however more susceptible to cracks, replacement and maintenance may be more costly	A – Minor	3 – Possible	Negligible	Substitution -use non rigid paving types	Designer	Design	Open	A – Minor	2 – Unlikely	Negligible
Grading exceeding 10%	Investigation and Design	Community/ public interaction/access	Access becomes difficult for both able and non able bodied people	B - Major	3 – Possible	Low	Substitution - utilise alternate trail route where possible	Designer	Design	Open	A – Minor	2 – Unlikely	Negligible
Stormwater	Investigation and Design	Operations/ Interactions	Trails located on roads where kerbed flow widths could be hazardous	A – Minor	3 – Possible	Negligible	Engineering Controls - Flow widths to be controlled to authoritative requirements	Designer	Design	Open	A – Minor	2 – Unlikely	Negligible
Stormwater	Investigation and Design	Maintainability	Access to trail after storm events for repair or maintenance	A – Minor	3 – Possible	Negligible	Engineering Controls - Trail width, gradients and alignment for maintenance works	Designer	Design	Open	A – Minor	2 – Unlikely	Negligible
Stormwater	Investigation and Design	Ground conditions	Erosion of cut embankments or trail	A – Minor	3 – Possible	Negligible	Engineering Controls - Assess trail alignment with upslope catchment runoff flows and geographical locations for discharge	Designer	Design	Open	A – Minor	2 – Unlikely	Negligible

Stage 2 Feasibility – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
Stormwater	Investigation and Design	Extreme Weather	Flood hazard	C- Severe	3 – Possible	Moderate	Engineering Controls - Where trail crosses water courses or prone flood areas, flood hazard assessment is required for velocities and depths for pedestrian safety	Designer	Design	Open	C- Severe	2 – Unlikely	Low
Stormwater	Investigation and Design	Community/ public interaction/access	Existing natural water courses crossings	C- Severe	3 – Possible	Moderate	Engineering Controls - Depth markers of flood levels, elevate crossings higher than calculated major storm event flow depths	Designer	Design	Open	C- Severe	2 – Unlikely	Low
Stormwater	Investigation and Design	Community/ public interaction/access	Existing pedestrian road crossings	B - Major	3 – Possible	Low	Engineering Controls - To provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed velocity/depth limits.	Designer	Design	Open	B - Major	2 – Unlikely	Negligible
Stormwater	Investigation and Design	Slips/Trips/ Falls	Slippery surfaces when wet	C- Severe	4 – Likely	Moderate	Substitution - remove slippery surfaces or improve resistance	Designer	Design	Open	B - Major	3 – Possible	Low
Retaining Walls	Investigation and Design	Operations/ Interactions	Trails located through the Sturt Gorge exceeding 1 in 3	B - Major	3 – Possible	Low	Engineering Controls	Designer	Design	Open	B - Major	3 – Possible	Low

Stage 2 Feasibility – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
Cut and fill	Investigation and Design	Excavation	Earthworks in areas where access is difficult	B - Major	3 – Possible	Low	Engineering Controls	Designer	Design	Open	C- Severe	3 – Possible	Moderate
Landscaping	Investigation and Design	Isolated Location	Medical /safety emergency, person unable to get assistance due to isolated locality	A – Minor	1 – Very Unlikely	Negligible	Administrative Controls - design features such as signage, drinking fountains, lighting and seating	Designer	Design	Open	A – Minor	2 – Unlikely	Low
Landscaping	Investigation and Design	Visibility	Vegetation reduces visibility for trail users and crime	A – Minor	2 – Unlikely	Negligible	Administrative Controls	Designer	Design	Open	A – Minor	2 – Unlikely	Low
Landscaping	Investigation and Design	Falls	Paths adjacent to significant ground level height drop	D – Critical	3 – Possible	Significant	Administrative Controls - Fall protection Fencing	Designer	Design	Open	C- Severe	3 – Possible	Moderate
Vegetation	Investigation and Design	Biological	Removal of Native Vegetation, threatened species	B - Major	3 – Possible	Low	Administrative Controls	Designer	Design	Open	B - Major	3 – Possible	Low
Lighting	Investigation and Design	Services	Local power connection may not be available	A – Minor	2 – Unlikely	Negligible	Administrative Controls	Designer	Design	Open	B - Major	3 – Possible	Low
Lighting	Investigation and Design	Safety factor	Difficulty of lighting installation	A – Minor	3 – Possible	Negligible	Administrative Controls	Designer	Design	Open	B - Major	3 – Possible	Low
Lighting	Investigation and Design	Safety factor	Risk of Crime	A – Minor	2 – Unlikely	Negligible	Administrative Controls Determine correct level of lighting	Designer	Design	Open	B - Major	3 – Possible	Low
Traffic	Investigation and Design	Safety factor	Installation of trail on the existing verge	B - Major	4 – Likely	Low	Administrative Controls	Designer	Design	Open	C- Severe	3 – Possible	Moderate
Traffic	Operation	Impact on public roads/ traffic	Safety of Trail users particularly cyclists	B - Major	4 – Likely	Low	Administrative Controls	Council	Design	Open	D – Critical	3 – Possible	Significant

Stage 2 Feasibility – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
Construct	Setup, Construction and Commissioning	Innappropriate selection of trench support/walls of open excavations may collapse	Use of incorrect trench supporting method - failure of excavation works which can injury or cause fatalities to personnel from the collapse of open excavation	C- Severe	3 – Possible	Moderate	Contractor SiD Site plan	Contractor	Prior opening	Contractor responsibility	C- Severe	4 – Likely	Moderate
Construct	Setup, Construction and Commissioning	Working at heights	Person falling down, falling objects causing injury or death to workers.	C- Severe	4 – Likely	Moderate	Contractor SiD Site plan	Contractor	Prior opening	Contractor responsibility	D – Critical	4 – Likely	Significant
Construct	Setup, Construction and Commissioning	Construction interfaces	Construction risks to the community and public.	C- Severe	3 – Possible	Moderate	Contractor SiD Site plan	Contractor	Construction	Contractor responsibility	C- Severe	3 – Possible	Moderate

Stage 2 Feasibility – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
Construct	Setup, Construction and Commissioning	Change in conditions for traffic during the construction phase (including interaction with construction traffic and access to adjacent sites)	Movement of construction vehicles or change in traffic conditions may cause: • Injuries or fatalities to local road users, construction workers or pedestrians • Property damage if they collide with private property or government owned infrastructure onsite • Cause public nuisance if trucks entering or leaving the site works drop or track direct or other loose arterials onto public roads • This includes limited road visibility due to placement of temporary works (barriers, fencing) necessary to enable construction.	D – Critical	4 – Likely	Significant	Contractor SiD Site and Traffic Management plan	Contractor	Construction	Contractor responsibility	D – Critical	3 – Possible	Significant
Construct	Setup, Construction and Commissioning	Construction Interfaces	Working adjacent to road/arterial road	D – Critical	3 – Possible	Significant	Contractor to provide Traffic Management Plan	Contractor	Construction	Contractor responsibility	D – Critical	3 – Possible	Significant

Stage 2 Feasibility – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
Construct	Setup, Construction and Commissioning	Working near overhead and underground transmission lines	Risk of injury or death of personnel due to electric shock	D – Critical	3 – Possible	Significant	Contractor to provide SiD Management Plan	Designer	Design	Contractor responsibility	D – Critical	3 – Possible	Significant
Construct	Setup, Construction and Commissioning	Construction method	General Construction risks causing injury or death to workers	A – Minor	2 – Unlikely	Negligible	Contractor SiD Site plan	Designer	Prior opening	Contractor responsibility	B - Major	3 – Possible	Low

Stage 2 Feasibility – Safety in Design Risk Assessment

Design Ref	Design Life Cycle Stage (Select from Drop Down Box)	Hazards	Risk What could go wrong and what might happen as a result	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating		
				C	L	RR					C	L	RR
	Maintenance	Underground Services	Damage to asset or injury/death to personnel due to accidental contact with existing services (water, electrical, communication and sewer.	D – Critical	3 – Possible	Significant	Contractor to provide SiD Management Plan	Contractor	Design	Contractor responsibility	D – Critical	3 – Possible	Significant

03

Stage 3
Preferred Trail Routes

Stage 3 – Preferred Trail Routes

Using the Option Plans and Multi Criteria Assessment Table, The City of Mitcham identified their preferred route alignments. Part of this process included the development of a steering group to determine and make comment on what trail options are most feasible and beneficial and considered stakeholder feedback.

The preferred route alignments have been tabled in Table 8.

Following on from this, selected sections of the preferred trail routes were developed into concept designs to demonstrate unique landscape, urban design and engineering treatments.

These included the following sections of trail:

- Riverside Reserve – Section A - B
- Flinders University Olive Grove – Section A - B
- Trail on the verge of Bushland Drive - Section D - C
- Shared Use Zone on Trevor Terrace - Section G - F
- Gartrell Boulevard - Section J - I

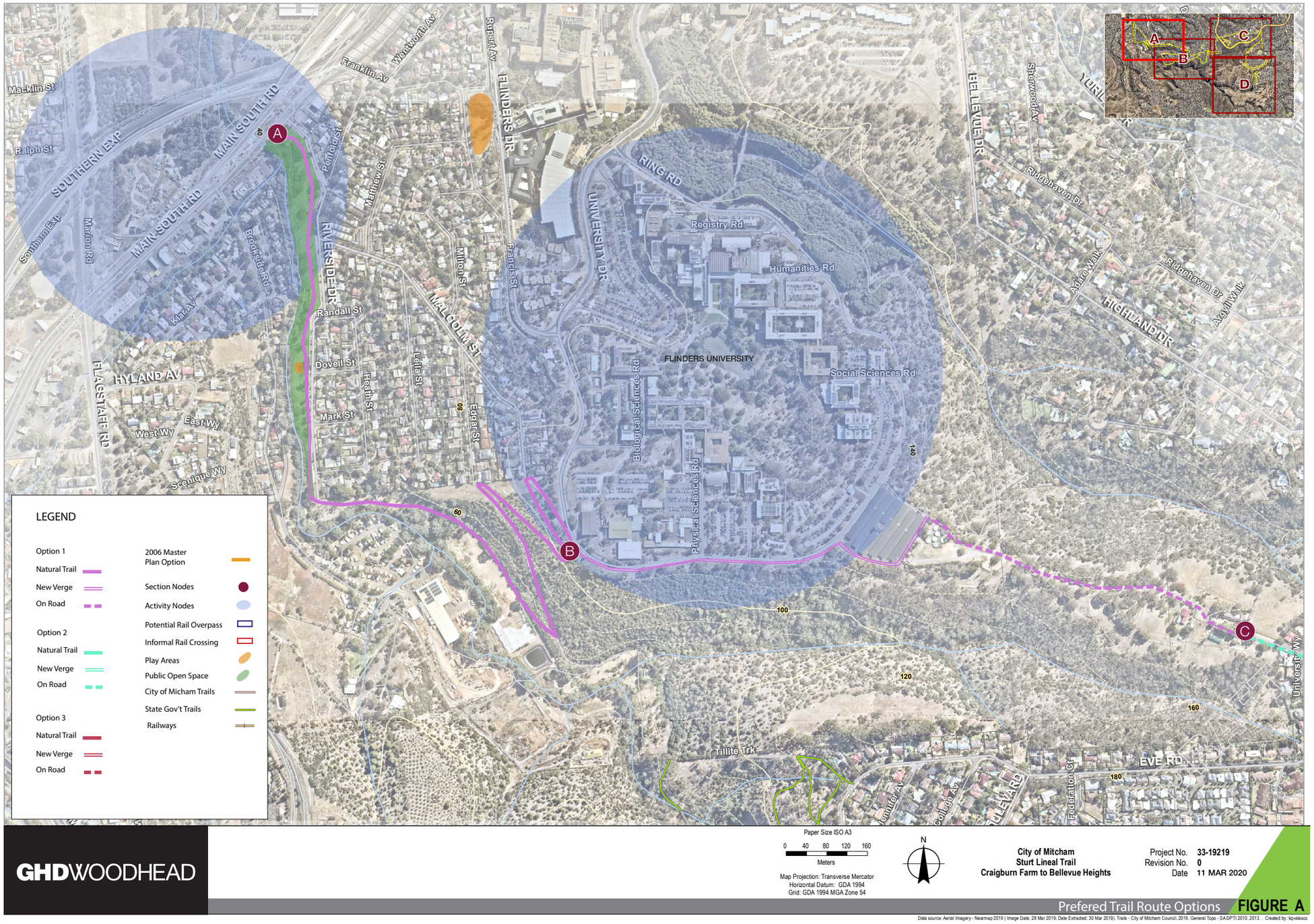
Section 4 between D and E and Secton 10 between J and K considered two potential options for the trail route. These options will be considered as part of the community consultation process. The City of Mitcham Steering Group preferred option J to K Magenta in section 10.

The preferred options and selected concept designs have been included within this section of the report.

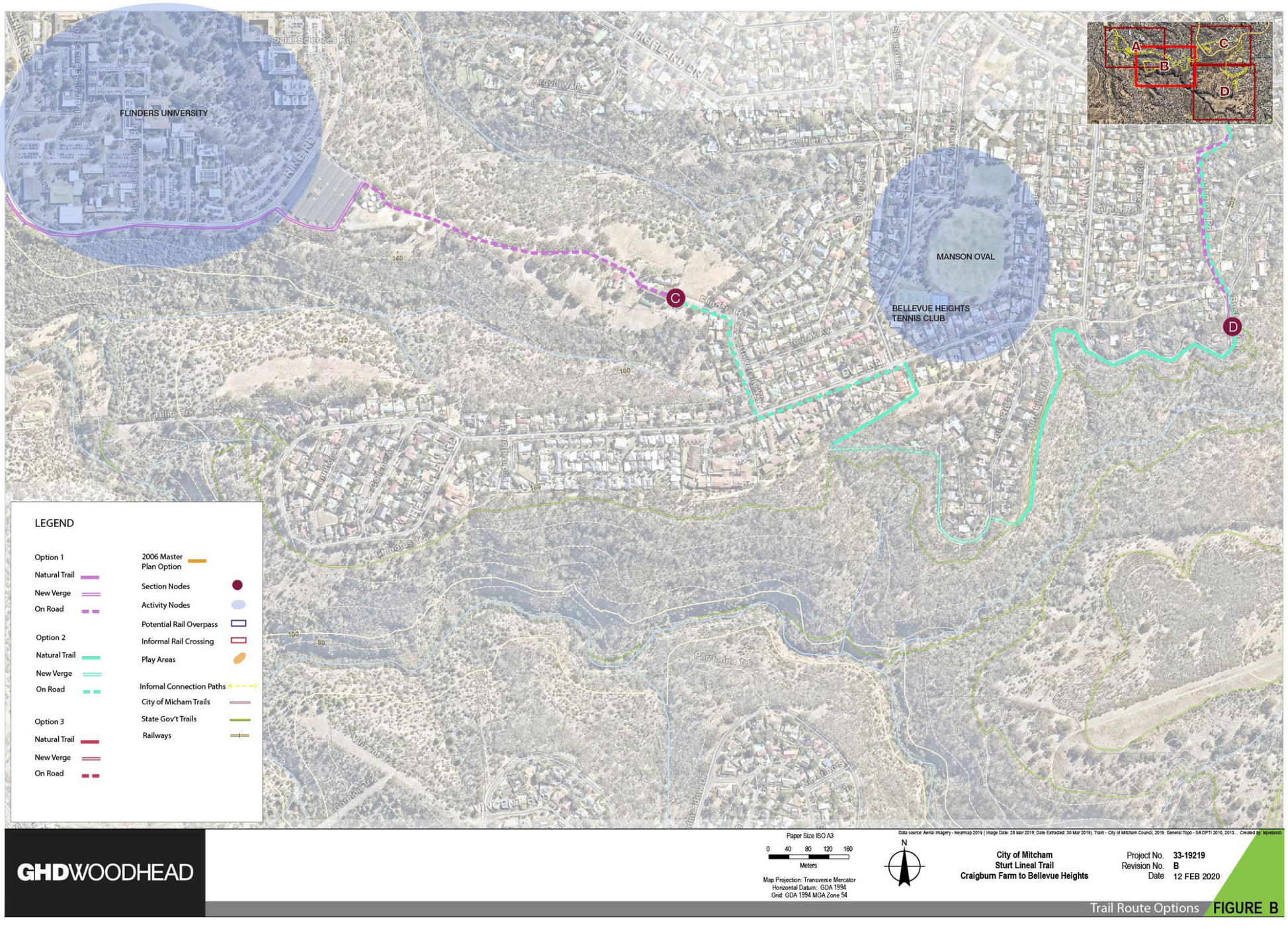
Table 8 – Preferred Trail

Section	Start	End	Sub-Option	Section sub-option ranking	Steering Group Comments
1	A	B	1 Magenta	2.4	
2	B	C	1 Magenta	2.85	Magenta and 2006 are effectively the same route
3	C	D	2 Cyan	2.28	Cyan is the preferred option and the existing 2006 road link is accessible
			1 Magenta	2.54	The Shepherds Hill Road section is not ideal but feasible
4	D	E	2 Cyan	2.21	The sections through Karinya, Colebrook and the landfill create multiple complications due to ownership and limitations
5	E	F	1 Magenta	2.74	Valuable link for school
6	F	G	1 Magenta	2.49	
7	G	H	1 Magenta	2.51	Any detailed design would consider how this interacts with the Blackwood Oval
8	H	I	1 Magenta	2.65	
9	I	J	1 Magenta	2.65	Avoids steeper terrain and impacts to current trail use in Cyan trail
10	J	K	1 Magenta	2.56	Within the DEW Reserve
			2 Cyan	2.42	Contains steep section, 61 metres and on road but feasible

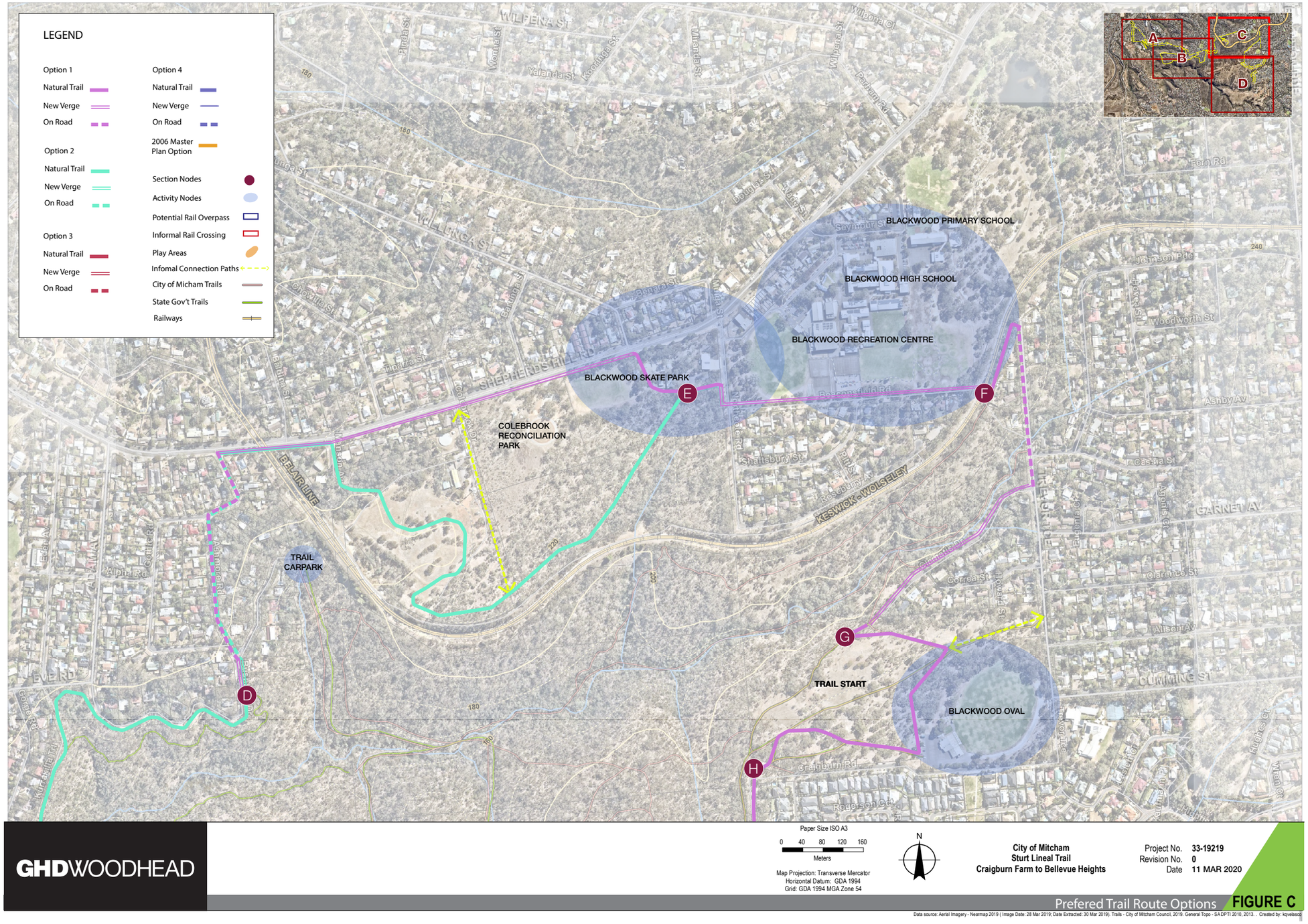
Stage 3 Preferred Route Options – Council Preference



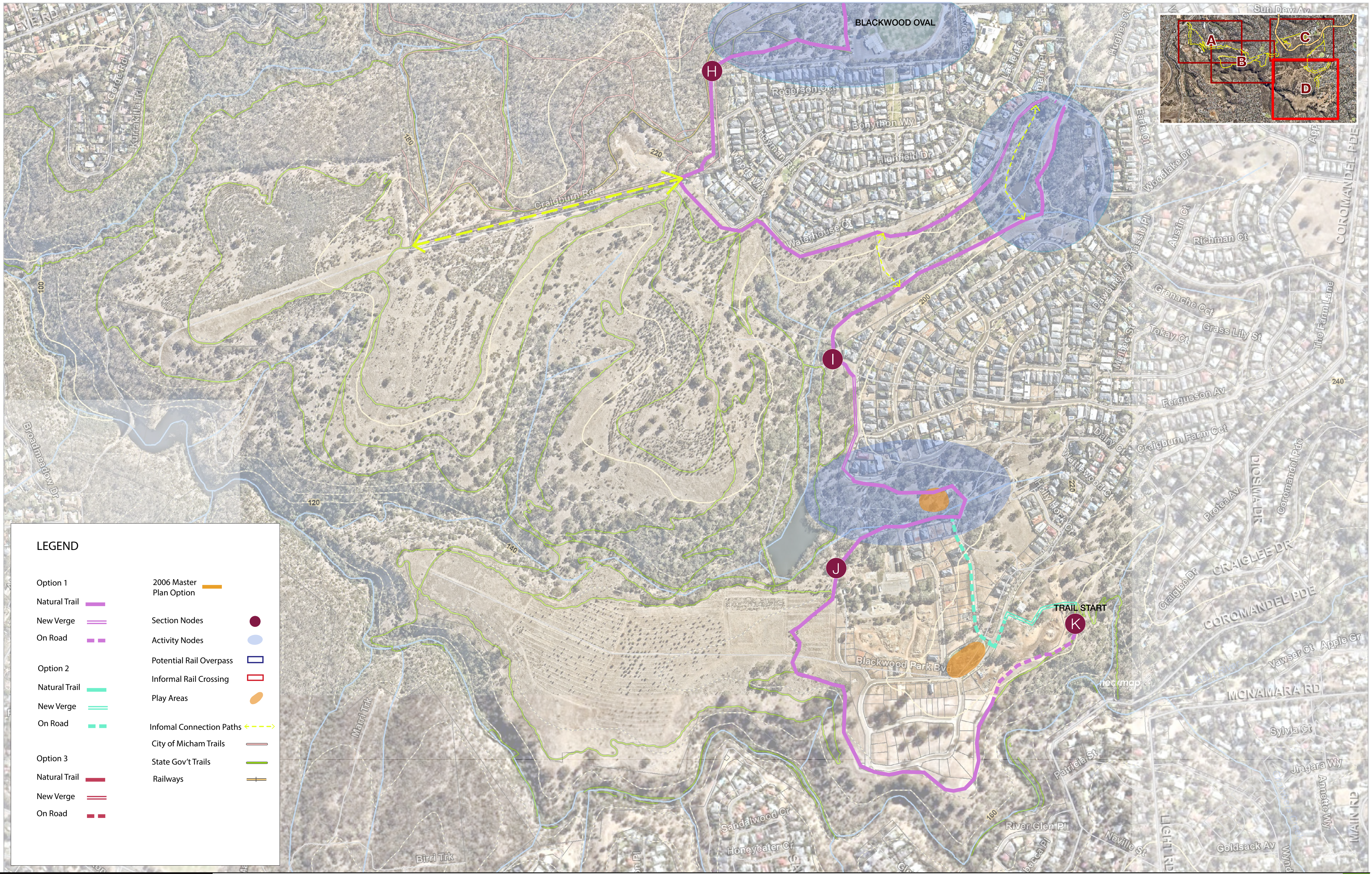
Stage 3 Preferred Route Options – Council Preference



Stage 3 Preferred Route Options – Council Preference



Stage 3 Preferred Route Options – Council Preference



LEGEND

Option 1		2006 Master Plan Option	
Natural Trail		Section Nodes	
New Verge		Activity Nodes	
On Road		Potential Rail Overpass	
Option 2		Informal Rail Crossing	
Natural Trail		Play Areas	
New Verge		Infomal Connection Paths	
On Road		City of Micham Trails	
Option 3		State Gov't Trails	
Natural Trail		Railways	
New Verge			
On Road			

GHDWOODHEAD

Paper Size ISO A3

0 40 80 120 160
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

Project No. **33-19219**
Revision No. **0**
Date 11 MAR 2020

Prefered Trail Route Options **FIGURE D**

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelasco

Stage 3 Concept Design - Riverside Drive

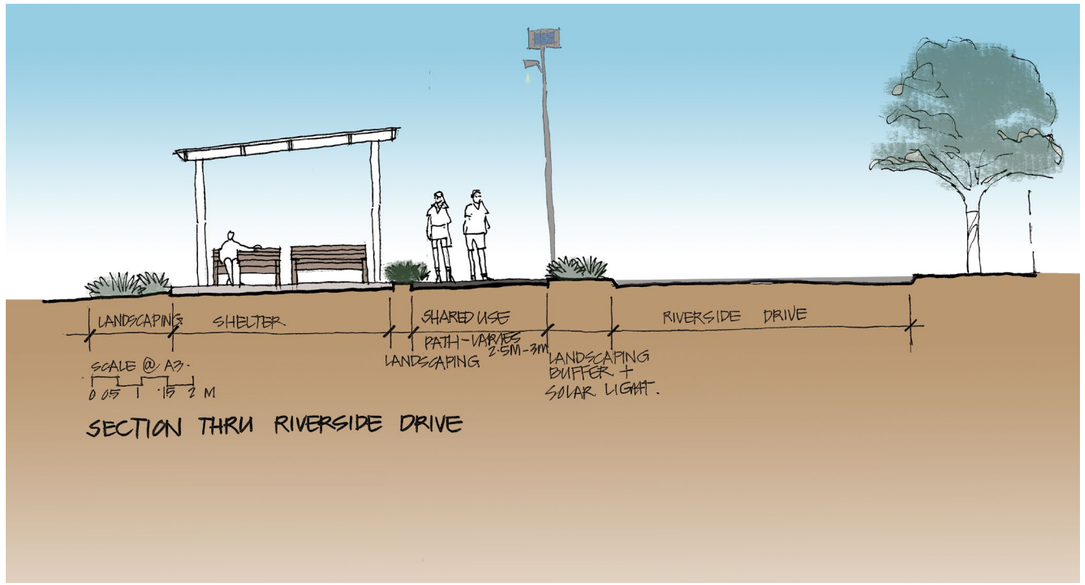
Concept Plan



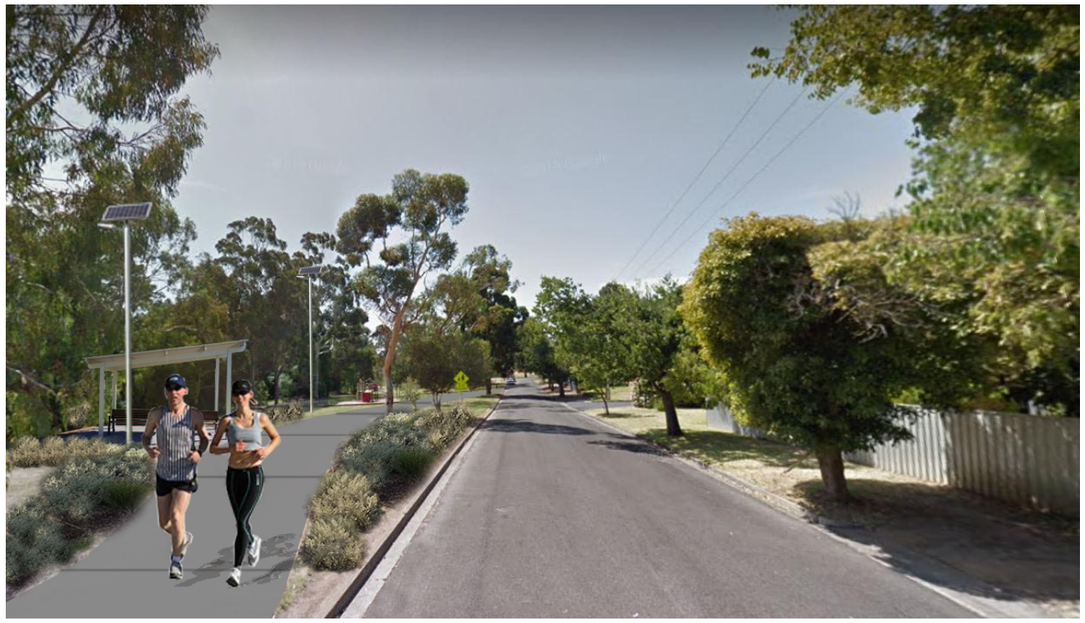
This portion of trail connects the olive grove to South Road, Bedford Park through Riverside Reserve.

A shade shelter, picnic setting, lighting and landscaping is proposed for this area to complement the existing playground.

Cross Section



Perspective



Stage 3 Concept Design - Olive Grove

Concept Plan

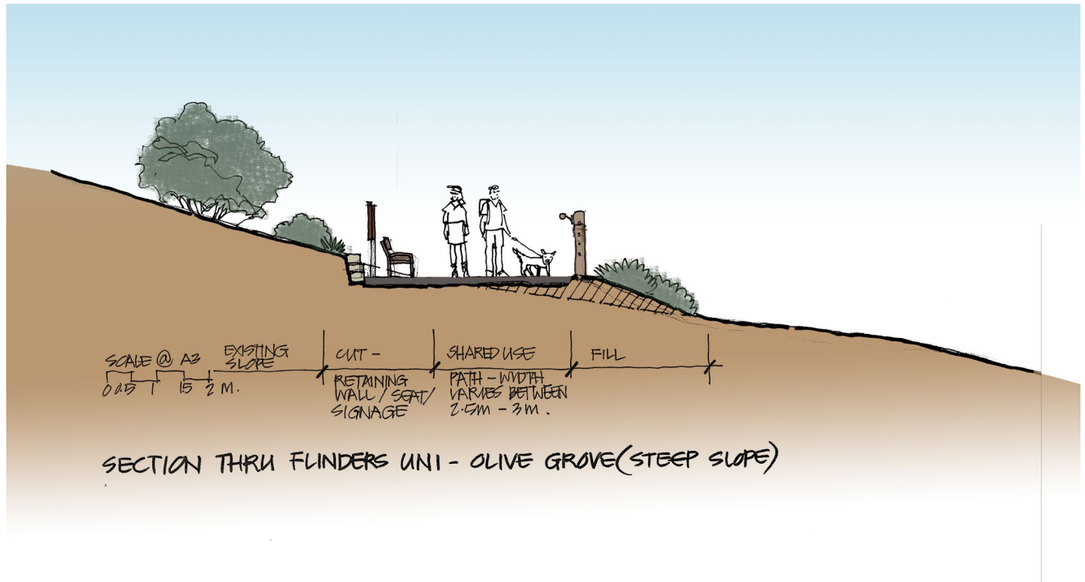


This portion of trail connects the Ring Road at Flinders University through to Riverside Drive, Bedford Park via an existing olive grove.

The terrain through the olive grove is very steep which requires the path to ramp down.

Due to the remoteness of this section of the trail, wayfinding signage, solar lighting and bench seating is important.

Cross Section



Perspective



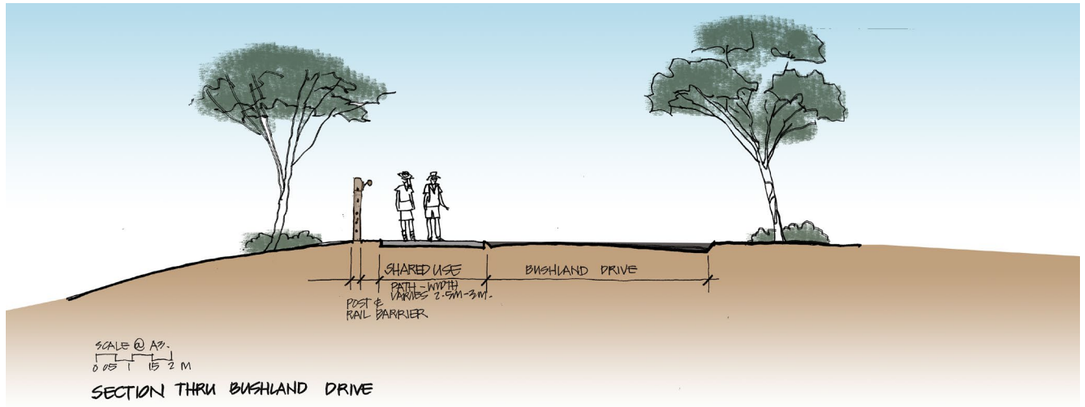
Stage 3 Concept Design - Bushland Drive

Concept Plan



This portion of trail runs along the verge of Bushland Drive, Bellevue Heights.
The trail varies between 3.5 and 2.5 metres depending on obstacles along the verge.
Fall protection fencing is required along a proportion of this area due to some steeper side slopes down into the Sturt Gorge.

Cross Section



Perspective

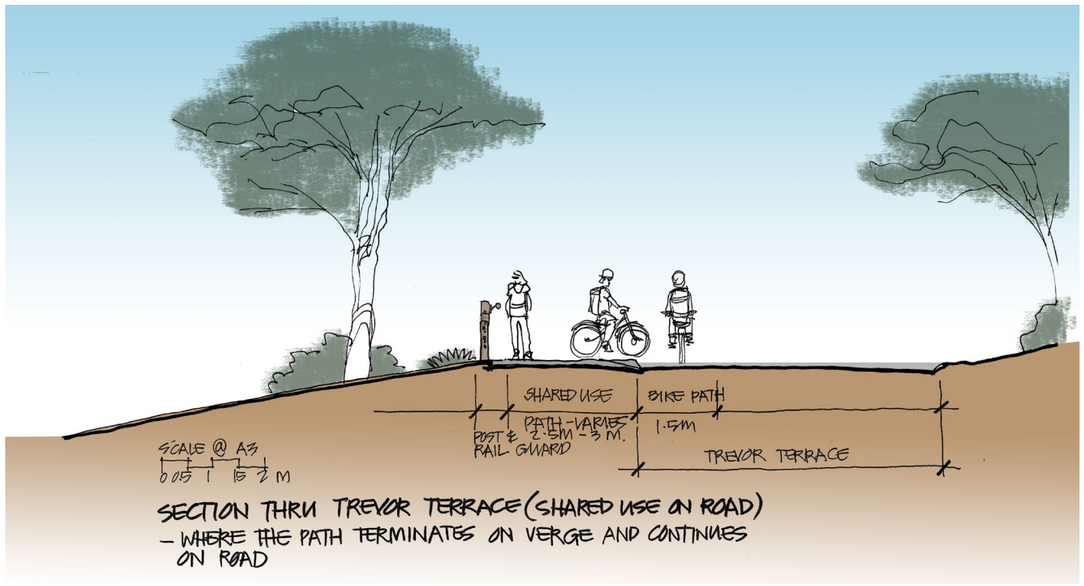


Stage 3 Concept Design - Trevor Terrace

Concept Plan



Cross Section



Perspective



This portion of trail connects Clematis Drive through to Beaconfield Road and the rail overpass, via Trevor Terrace, Blackwood.

The existing verge along Trevor Terrace after the intersection with Garnet Avenue is too narrow, so at this point pedestrians must continue along the footpath and cyclists continue on-road shared with vehicles.

Stage 3 Concept Design - Gartrell Boulevard

Concept Plan

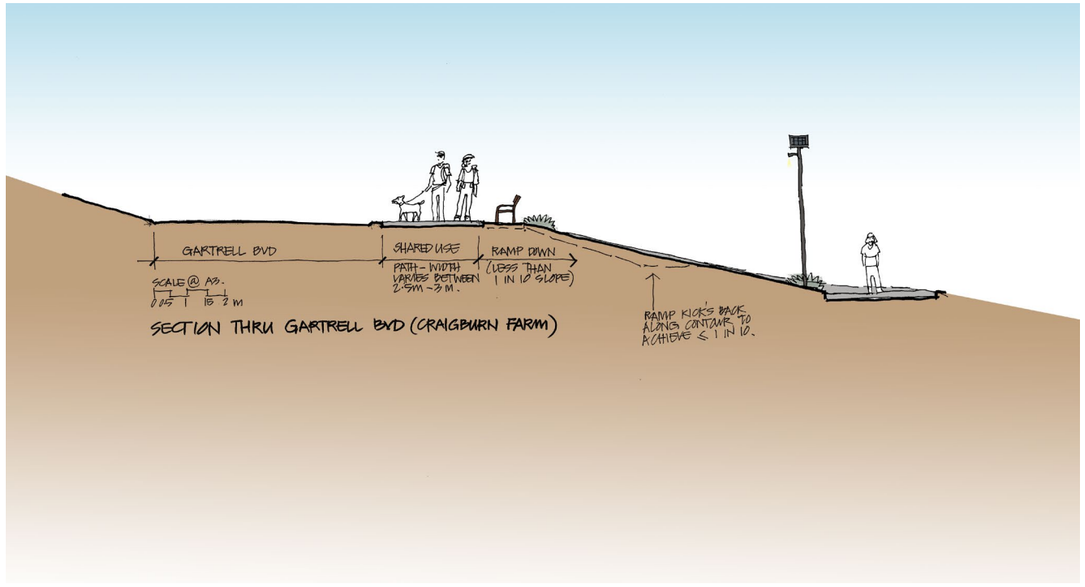


This portion of trail connects Gartrell Boulevard, Craigburn Farm to the existing path network below.

The gradient between the road and the path is significant which requires the proposed trail to ramp down to the path and fall protection fencing is required.

Landscaping has been proposed for this area to improve the aesthetic value.

Cross Section



Perspective



04

Stage 4 Costings

Stage 4 Costings - Preferred Route Preliminary Costings

A preliminary cost estimate for the preferred trail route options has been prepared by Quantity Surveyors Rider Levett Bucknall (RLB).

The Order of Cost Estimates are based upon measured quantities to which RLB have applied rates and conditions believed to be applicable as at April 2020 and that reflect the current status of the project. A summary of the Order of Cost Estimates is provided in Table 9 with the detailed breakdown contaned in Appendix D.

RLB have assumed the project will be procured by a suitably sized and experienced Civil and or Landscaping Contractor. The estimate is based on the documentation listed below and does not, at this stage, provide a direct comparison with tenders received for the trade works at any future date. To enable monitoring of costs this estimate should be updated regularly during the design and documentation phases of the project.

COVID-19 IMPACT

Our estimate has been prepared on the basis of normal economic and industry circumstances. The full impact of COVID-19 is unknown at this stage and changing daily. Our estimate makes no provision for the impacts of COVID-19 virus and we advise that an impact on the estimate is probable and could vary considerably depending on the extent of a variety of issues.

RLB has observed that, for key construction components, there is an increasing reluctance by contractors to commit to a definitive programme or cost for future projects. This estimate does not consider increased project costs due to potential programme delays, alternative procurement methods of materials and/or labour nor the wider potential impact of COVID-19 on construction activities.

BASIS OF ESTIMATE

The Order of Cost Estimates are based on the following documentation (or unless scope has been specifically excluded) provided to our office; Landscape works documents provided by GHD Woodhead;

- Sturt Linear Concepts
- Site Layout Figures A Rev. 0
- Site Layout Figures B Rev. 0
- Site Layout Figures C Rev. 0
- Site Layout Figures D Rev. 0
- Sturt Linear Trail Option Table

PROJECT EXCLUSIONS

The Order of Cost Estimates specially exclude the following items that may require further consideration

when preparing an overall Project feasibility study;

- Unknown impacts of Covid-19
- Excavation in rock
- Removal or remediation or contaminated material
- Escalation beyond end 2020
- Goods and Services Taxation

Table 9 Order of Cost Estimate Summary

Description	Section K - E	Section E - A
Trade Cost	$4,513,000	$6,524,000
Preliminaries	$315,000	$456,000
Design Contingency	$242,000	$349,000
Construction Contingency	$507,000	$733,000
ESTIMATED NET COST	**$5,577,000**	**$8,062,000**
MARGINS & ADJUSTMENTS		
Professional Fees and Charges	$335,000	$484,000
Superintendent & Project Management	$111,000	$161,000
Escalation Beyond 2020	Excl.	Excl
Goods & Services Taxation	Excl.	Excl
ESTIMATED TOTAL COST (EX. GST)	**$6,023,000**	**$8,707,000**

05

Stage 5
Staging

Stage 5 Staging

The proposed Sturt Linear Trail is over 12km long, and traverses many different areas, both on Council, State Government and in some instances private land. There are also areas that will require complex engineering solutions and designs that are expected to have a significant cost implication. Consequently a staged approach for both the development of detailed design and construction is required.

Two staging plans have been developed. The first outlines the sequencing for developing detailed documentation of the preferred trail route options. The second plan outlines the staging sequence for construction.

Staging Plan Detailed Design Development

The staging for this component has been split into two, the first stage K to E starts at Craigburn Farm Reserve boundary and finishes at Karinya Rotary Park. This section has been selected to be designed first as this portion of the trail is predominantly on Council land and has less sections that require significant engineering treatments. The development of this area will also have a significantly positive outcome for the community as it will connect new subdivisions in Coromandel Valley and Craigburn Farm through to key activity nodes, including:

- The lake and playground near Symon Cres
- The reserve and playground near Highfield Drive
- Blackwood Football Oval
- Blackwood rail overpass
- Blackwood High School and Primary School
- Blackwood Recreation Centre
- Blackwood Skate Park
- Eden Hills Scout Group
- Karinya Rotary Park and
- Bus Services and retail/commercial offerings on Shepherds Hill Road.

The second stage E – A, starts at Karinya Rotary Park in Eden Hills and finishes at Riverside Reserve in Bedford Park. This section has more complex issues relating to land ownership and engineering solutions.

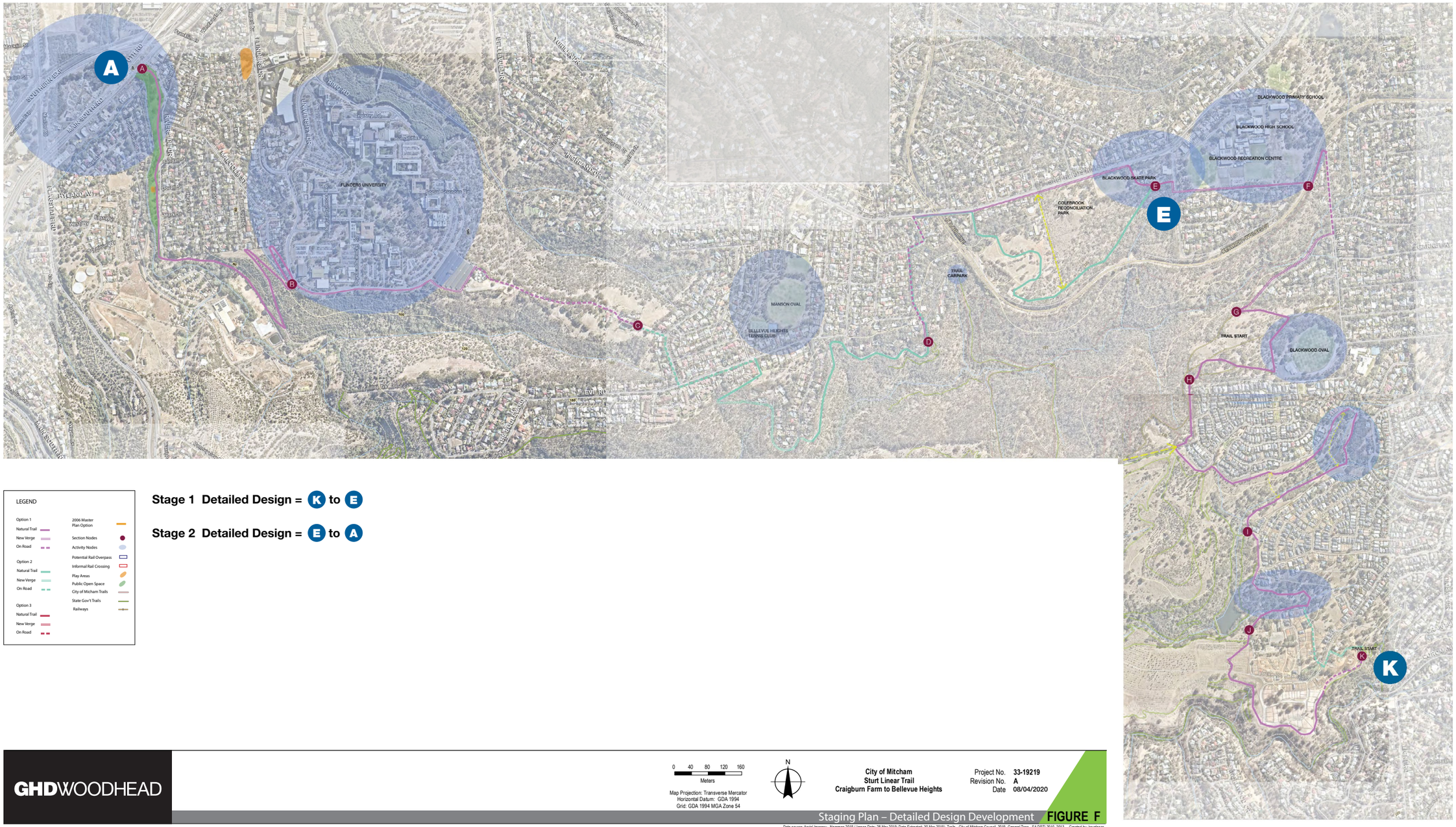
Staging Plan - Construction

The construction staging has been split into 3. The first stage K-E (Craigburn Farm through to Karinya Rotary Park) has been selected to be constructed first for the reasons outlined above.

The second stage A-C, starts at Riverside Reserve in Bedford Park and continues through to the Adelaide Veterinary Surgical Services on Flinders Road, near Flinders University. This section of trail has been selected as it travels through either Council or Flinders University land. Apart from the section through the Olive Grove this section has relatively minor engineering requirements and offers great community benefit by linking residential areas through to the University along a path network that is more accessible than current arrangements.

The third stage from C-E is the most complex, requiring agreements between numerous land owners, and significant engineering treatments.

Staging Plan – Detailed Design Development



LEGEND

Option 1	2006 Master Plan Option
Natural Trail	Section Nodes
New Verge	Activity Nodes
On Road	Potential Rail Overpass
Option 2	Informal Rail Crossing
Natural Trail	Play Areas
New Verge	Public Open Space
On Road	City of Mitcham Trails
Option 3	State Gov't Trails
Natural Trail	Railways
New Verge	
On Road	

Stage 1 Detailed Design = K to E

Stage 2 Detailed Design = E to A

GHDWOODHEAD

0 40 80 120 160
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

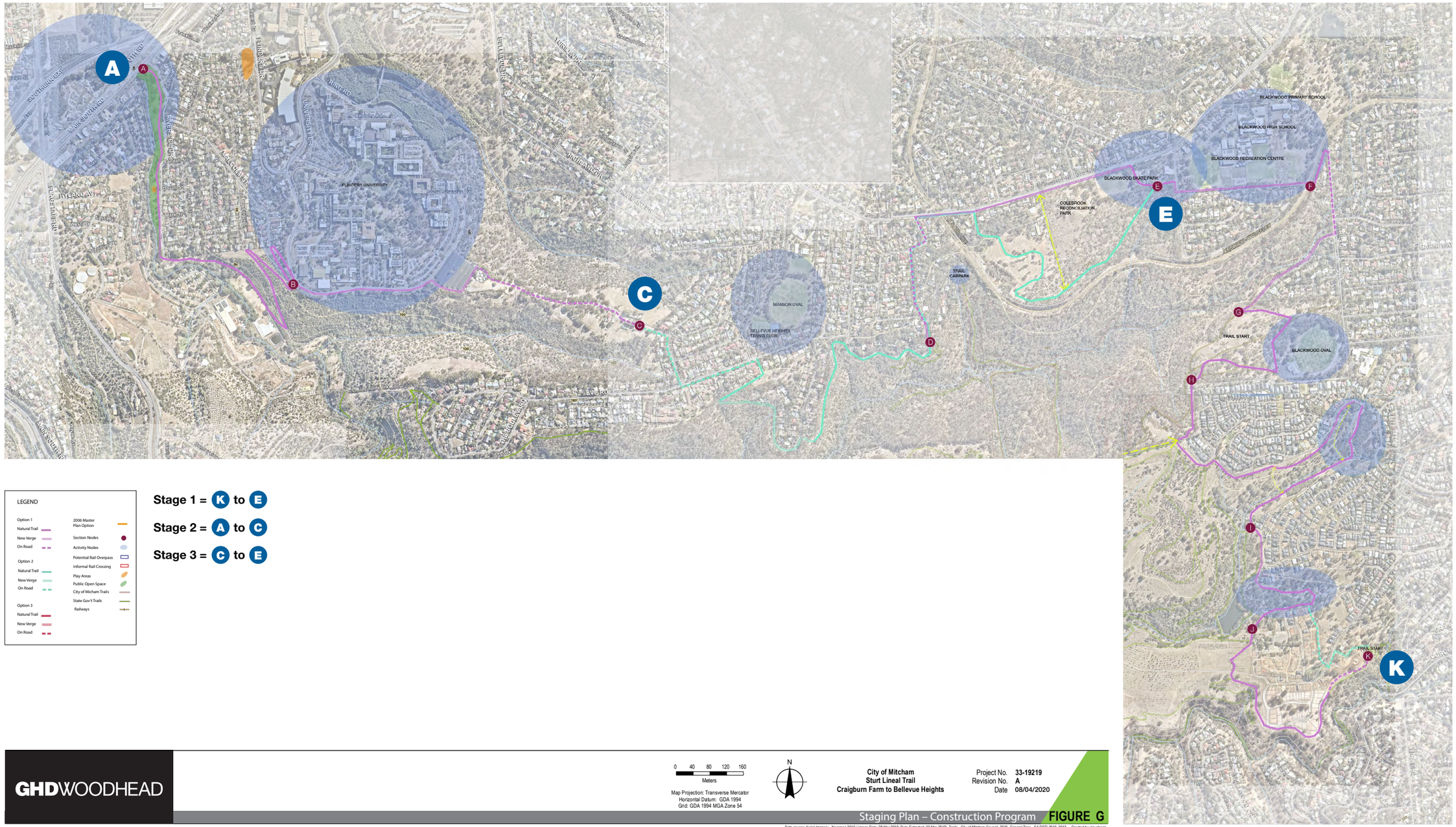
City of Mitcham
Sturt Linear Trail
Craigburn Farm to Bellevue Heights

Project No. 33-19219
Revision No. A
Date 08/04/2020

Staging Plan – Detailed Design Development FIGURE F

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelasco

Staging Plan – Construction



LEGEND

Option 1	2006 Master Plan Option
Natural Trail	Section Nodes
New Verge	Activity Nodes
On Road	Potential Rail Overpass
Option 2	Informal Rail Crossing
Natural Trail	Play Areas
New Verge	Public Open Space
On Road	City of Micham Trails
Option 3	State Gov't Trails
Natural Trail	Railways
New Verge	
On Road	

Stage 1 = K to E

Stage 2 = A to C

Stage 3 = C to E

GHDWOODHEAD

0 40 80 120 160
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

City of Micham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

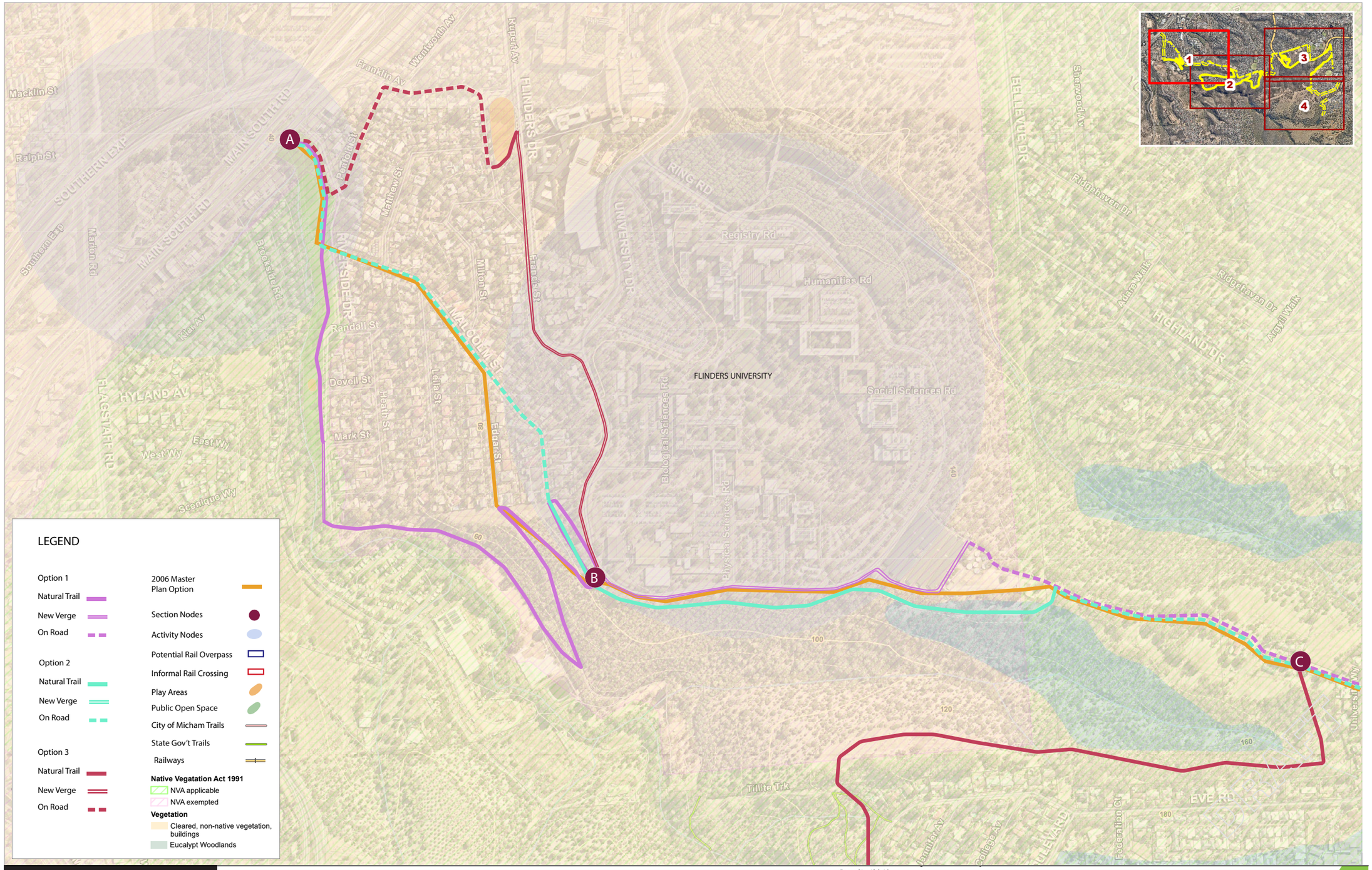
Project No. **33-19219**
Revision No. **A**
Date **08/04/2020**

Staging Plan – Construction Program **FIGURE G**

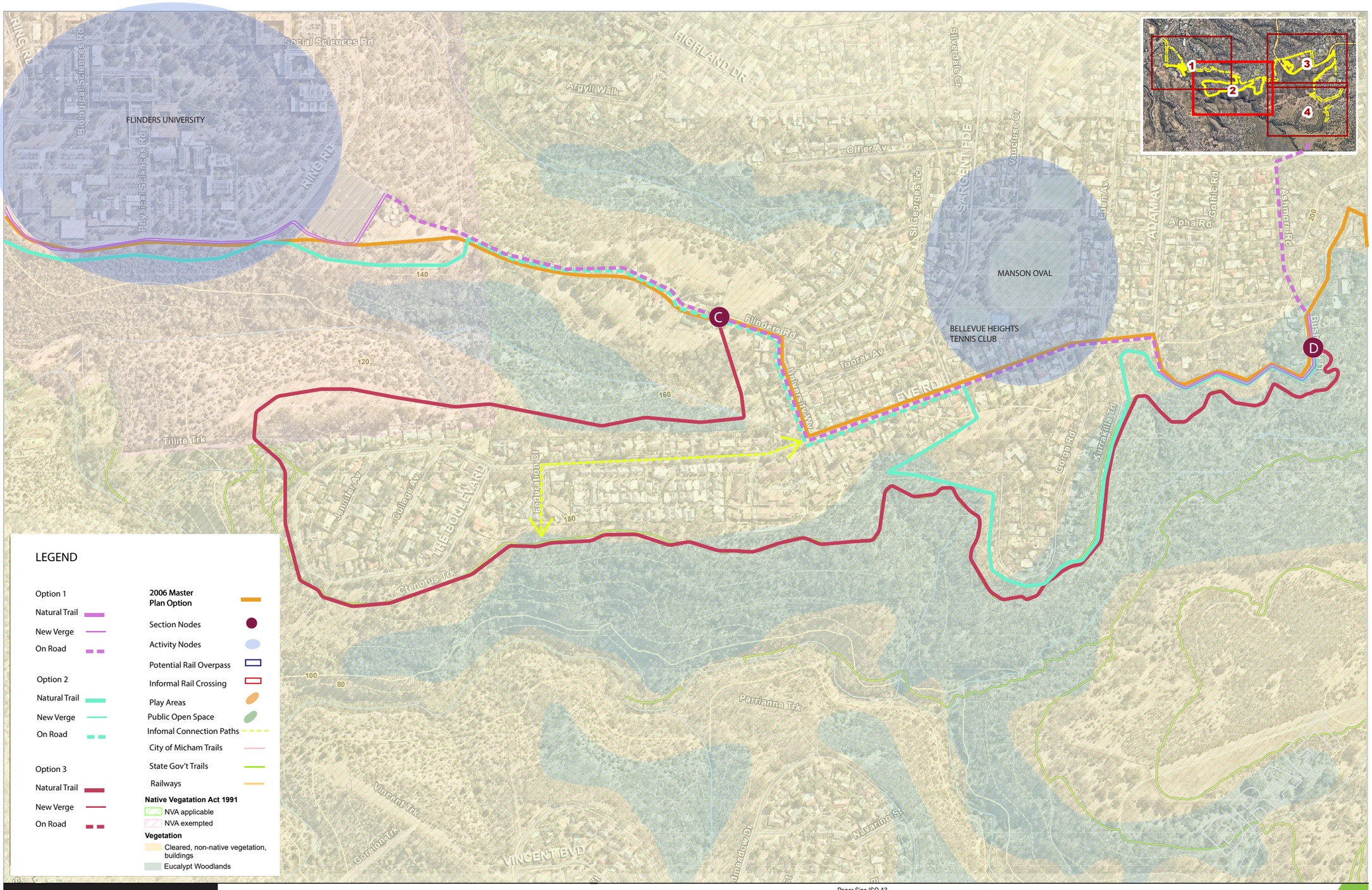
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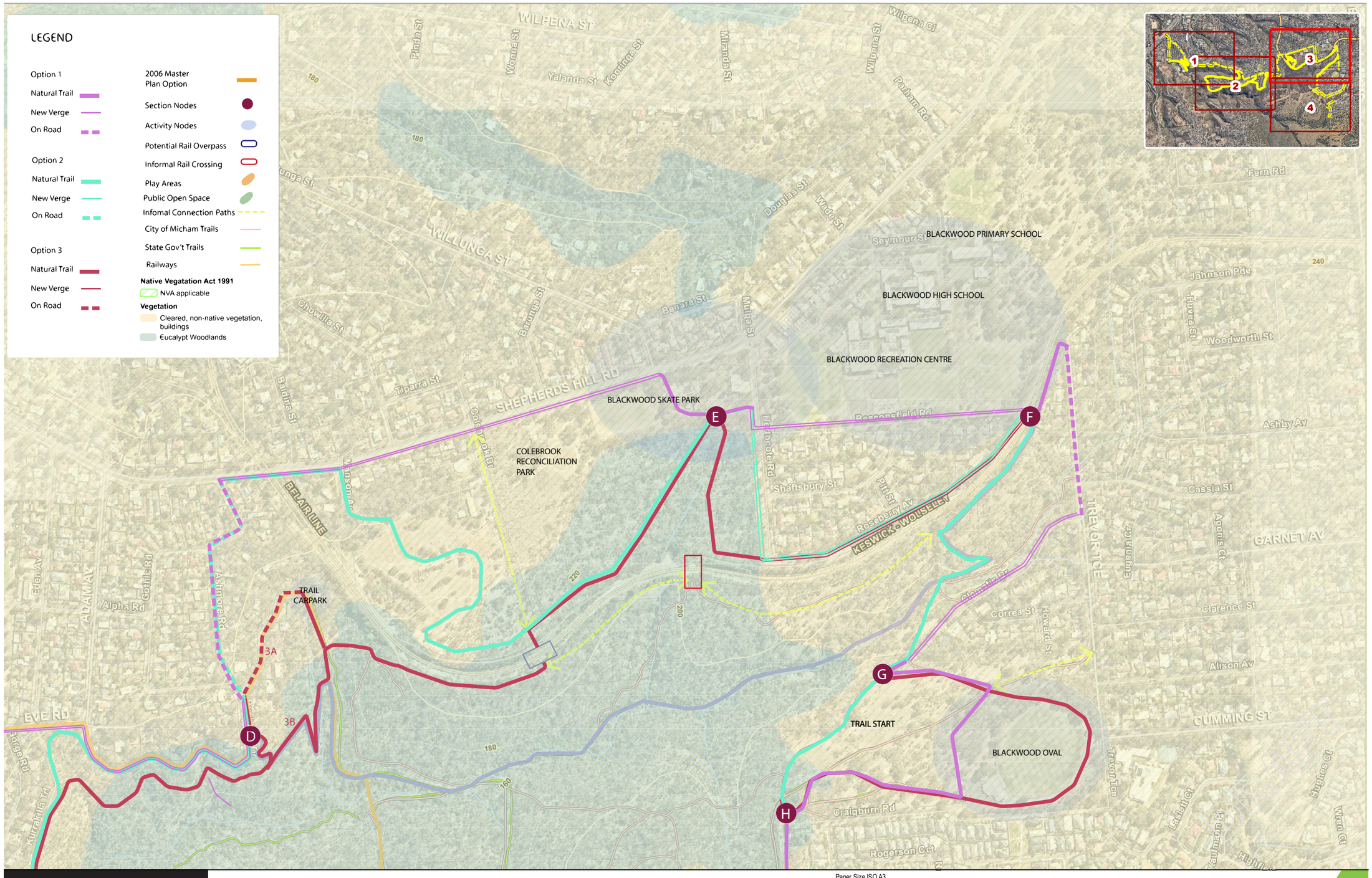
A

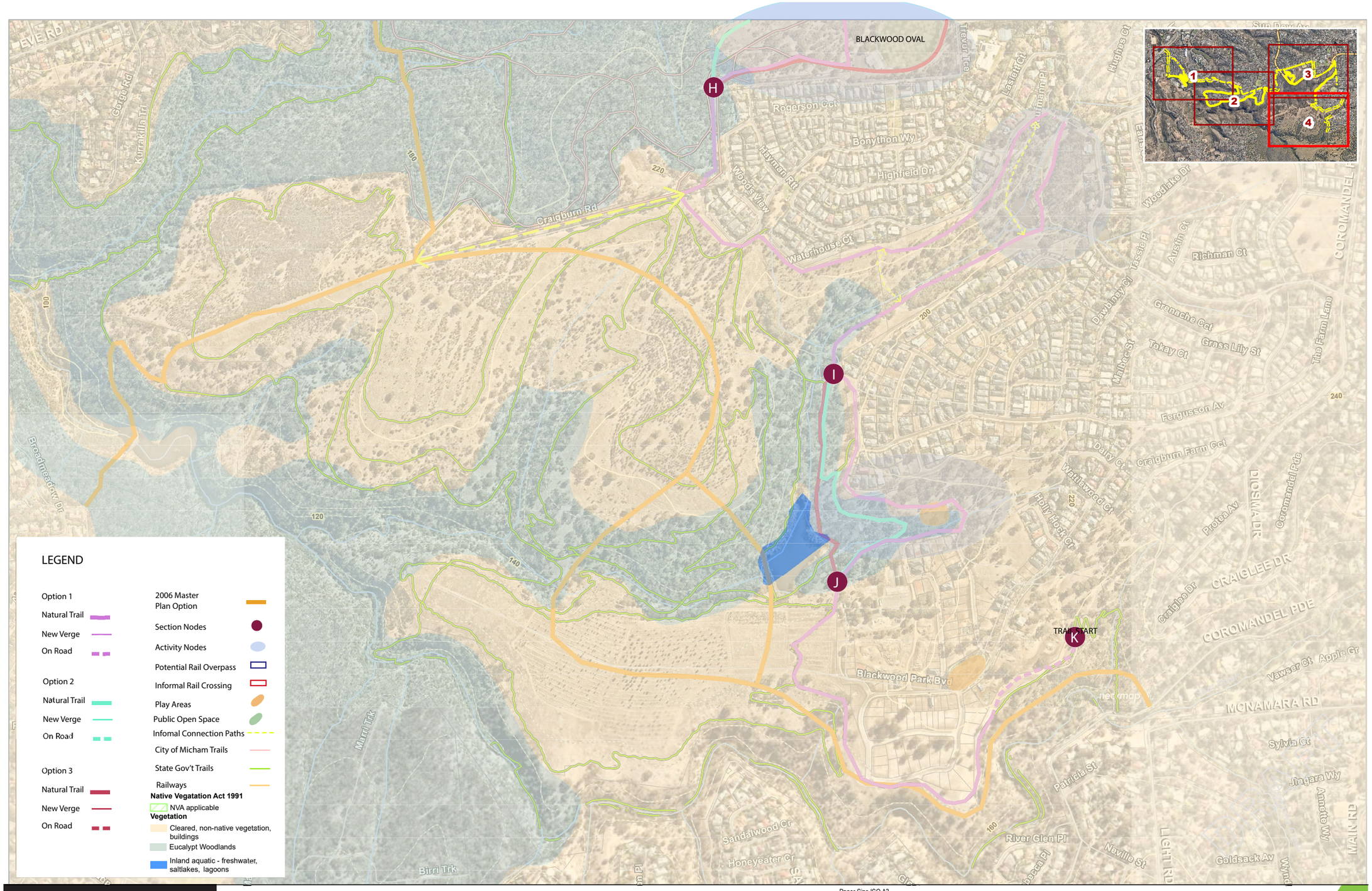
Appendix A
Vegetation



GHDWOODHEAD


FLINDERS UNIVERSITY
Social Sciences Rd
Biological Sciences Rd
Physical Sciences Rd
RING RD
HIGHLAND DR
Argyll Walk
Offler Av
Silverdale Cr
Vaucluse Cr
St Georges Tce
SARGENT PDE
Eden Av
ADAM AV
Alpha Rd
Gothic Rd
Ashmore Rd
MANSON OVAL
BELLEVUE HEIGHTS
TENNIS CLUB
Flinders Rd
University Way
Toorak Av
EVE Rd
Goods Rd
Kuraskille Trl
Tillite Trk
Jennifer Av
College Av
THE BOULEVARD
Federation Ct
Ctenotus Trk
Parrianna Trk
Vincent Trk
Corelon Trk
VINCENT BVD
Meadow Dr
Navarino St
140
120
160
180
100
80
200
C
D
1
2
3
4
LEGEND
Option 1
Natural Trail
New Verge
On Road
Option 2
Natural Trail
New Verge
On Road
Option 3
Natural Trail
New Verge
On Road
2006 Master Plan Option
Section Nodes
Activity Nodes
Potential Rail Overpass
Informal Rail Crossing
Play Areas
Public Open Space
Infomal Connection Paths
City of Micham Trails
State Gov't Trails
Railways
Native Vegatation Act 1991
NVA applicable
NVA exempted
Vegetation
Cleared, non-native vegetation, buildings
Eucalypt Woodlands
Paper Size ISO A3
0 40 80 120 160
Meters
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54
N
GHDWOODHEAD
City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights
Project No. 33-19219
Revision No. A
Date 25 Sept 2019
Trail Route Options Page B
FIGURE 2B


LEGEND
Option 1
Natural Trail
New Verge
On Road
Option 2
Natural Trail
New Verge
On Road
Option 3
Natural Trail
New Verge
On Road
2006 Master Plan Option
Section Nodes
Activity Nodes
Potential Rail Overpass
Informal Rail Crossing
Play Areas
Public Open Space
Infomal Connection Paths
City of Micham Trails
State Gov't Trails
Railways
Native Vegatation Act 1991
NVA applicable
Vegetation
Cleared, non-native vegetation, buildings
Eucalypt Woodlands
WILPENA ST
Pinda St
Woona St
Yalanda St
Kooringa St
Miranda St
Wilpena Cl
Wilpena St
Parham Rd
Fern Rd
Douglas St
Wade St
Seymour St
BLACKWOOD PRIMARY SCHOOL
BLACKWOOD HIGH SCHOOL
Johnson Pde
Hovea St
Woodworth St
WILLUNGA ST
Willunga St
Banara St
Mrrga St
Chowilla St
BLACKWOOD RECREATION CENTRE
Baldina St
Tiparra St
SHEPHERDS HILL RD
BLACKWOOD SKATE PARK
Beaconsfield Rd
Ashby Av
COLEBROOK RECONCILIATION PARK
Colebrook Dr
Manson Av
BELAIR LINE
Shaftsbury St
Pitt St
Rosebery Av
KESWICK - WOLSELEY
TREVOR ICE
Cassia St
Eugenia Cr
Agonis Ct
GARNET AV
Eden Av
ADAM AV
Alpha Rd
Goulia Rd
Ashmore Rd
TRAIL CARPARK
3A
3B
Clematis Dr
Correa St
Howard St
Clarence St
Alison Av
EVE RD
George Rd
Kurrakilla Trl
TRAIL START
BLACKWOOD OVAL
CUMMING ST
Craigburn Rd
Rogerson Cct
Trevor Ice
Ladakh Ct
Kaurna Av
Hughes Ct
Wren Ct
180
200
220
240
A
B
C
D
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F
G
H
1
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4
Paper Size ISO A3
0 40 80 120 160
Meters
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54
N
City of Micham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights
Project No. 33-19219
Revision No. A
Date 2 Aug 2019
GHDWOODHEAD
Trail Route Options Page C
FIGURE 2C
Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelasco



GHDWOODHEAD

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

Project No. **33-19219**
Revision No. **A**
Date 30 Sept 2019

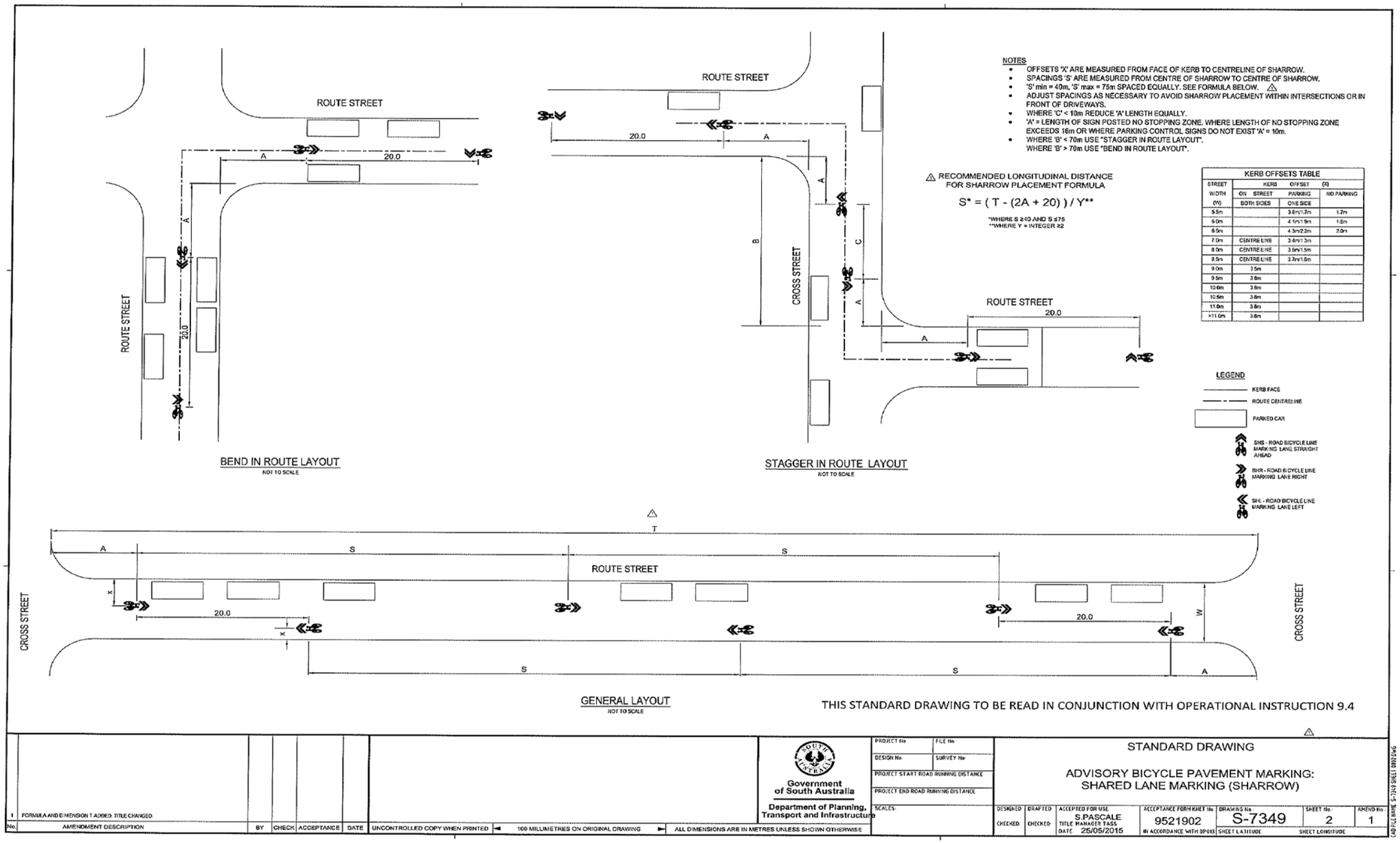
Trail Route Options Page D **FIGURE 2D**

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelascb

B

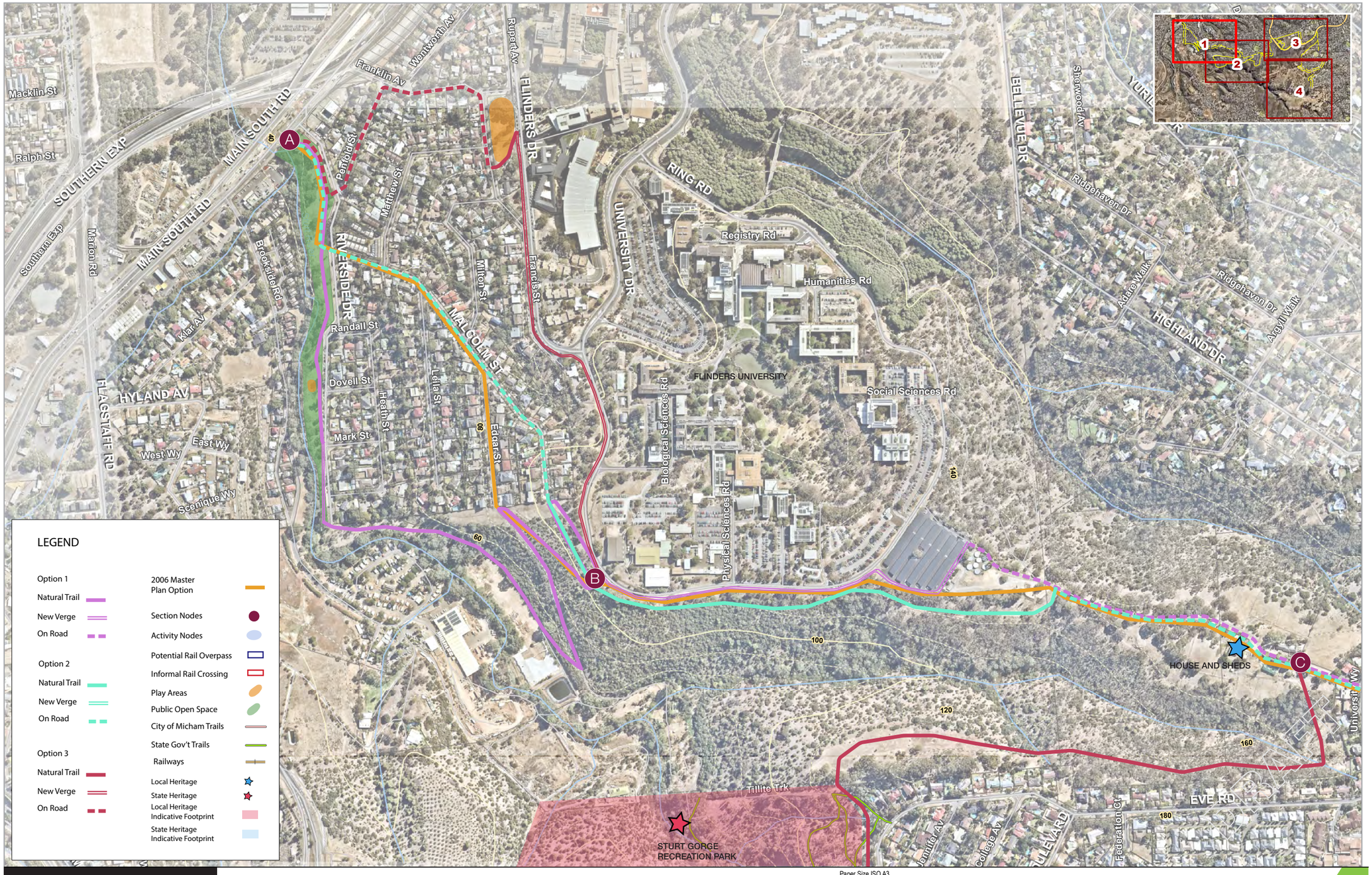
Appendix B
Civil and Pavement

Appendix B Standard Drawing S-7349 Sheet 2



C

Appendix C
Heritage



LEGEND

Option 1	2006 Master Plan Option
Natural Trail	Section Nodes
New Verge	Activity Nodes
On Road	Potential Rail Overpass
Option 2	Informal Rail Crossing
Natural Trail	Play Areas
New Verge	Public Open Space
On Road	City of Micham Trails
Option 3	State Gov't Trails
Natural Trail	Railways
New Verge	Local Heritage
On Road	State Heritage
	Local Heritage Indicative Footprint
	State Heritage Indicative Footprint

GHDWOODHEAD

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

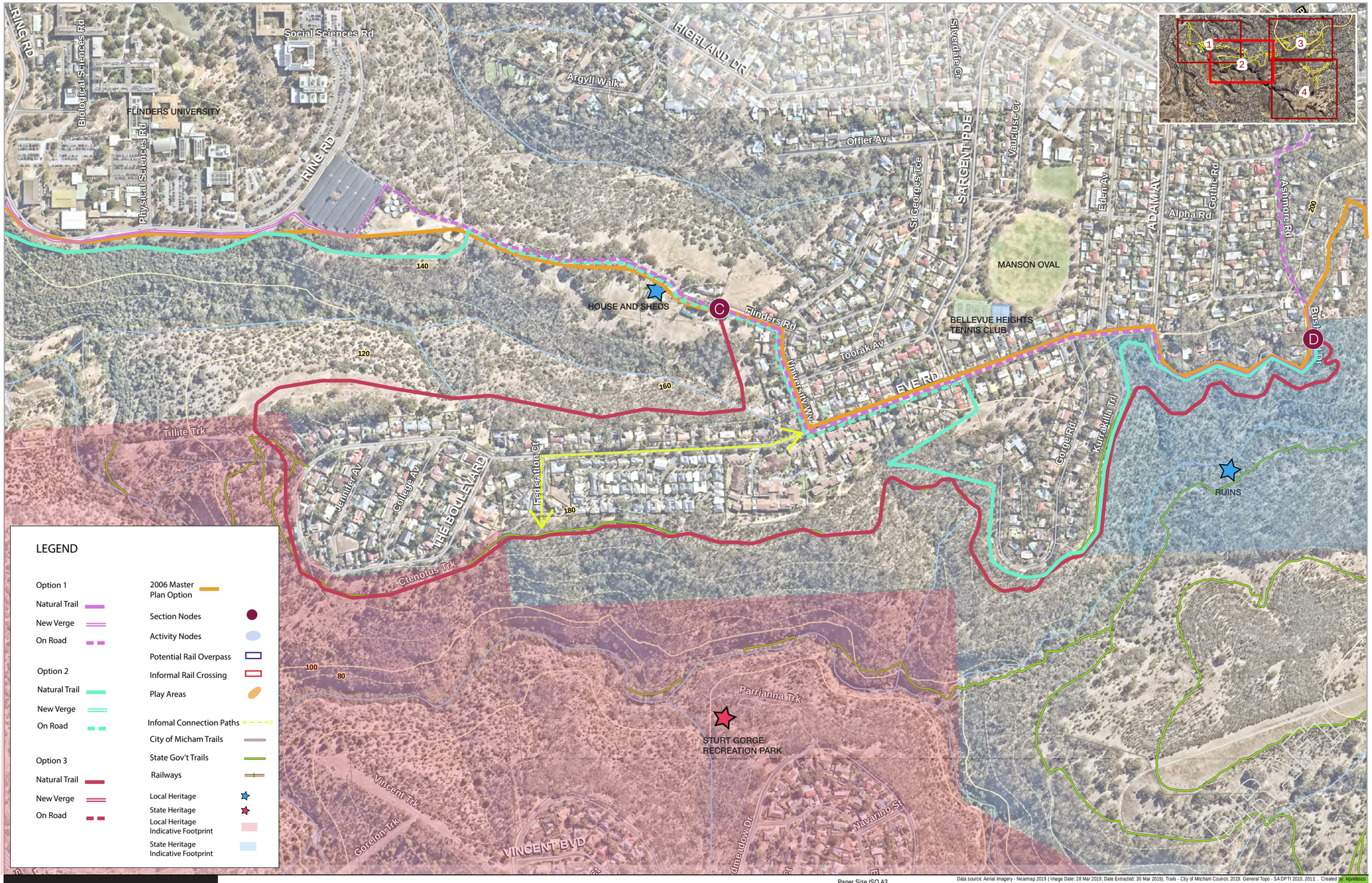
N

City of Micham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

Project No. **33-19219**
Revision No. **A**
Date **2 Aug 2019**

Trail Route Options Page A **FIGURE 2A**

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelasco



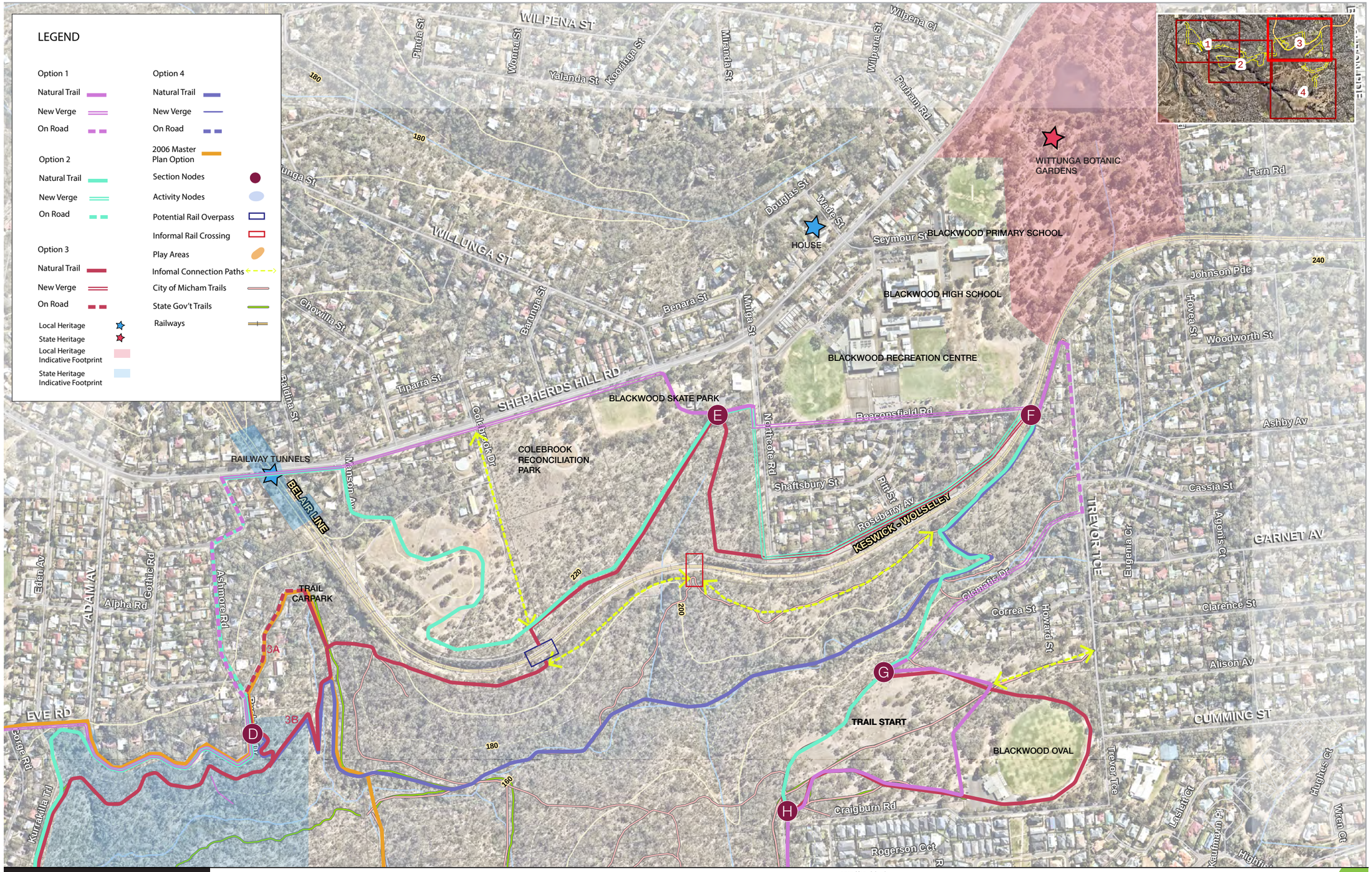
GHDWOODHEAD

City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

Project No. 33-19219
Revision No. A
Date 2 Aug 2019

Trail Route Options Page B

FIGURE 2B



GHDWOODHEAD

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

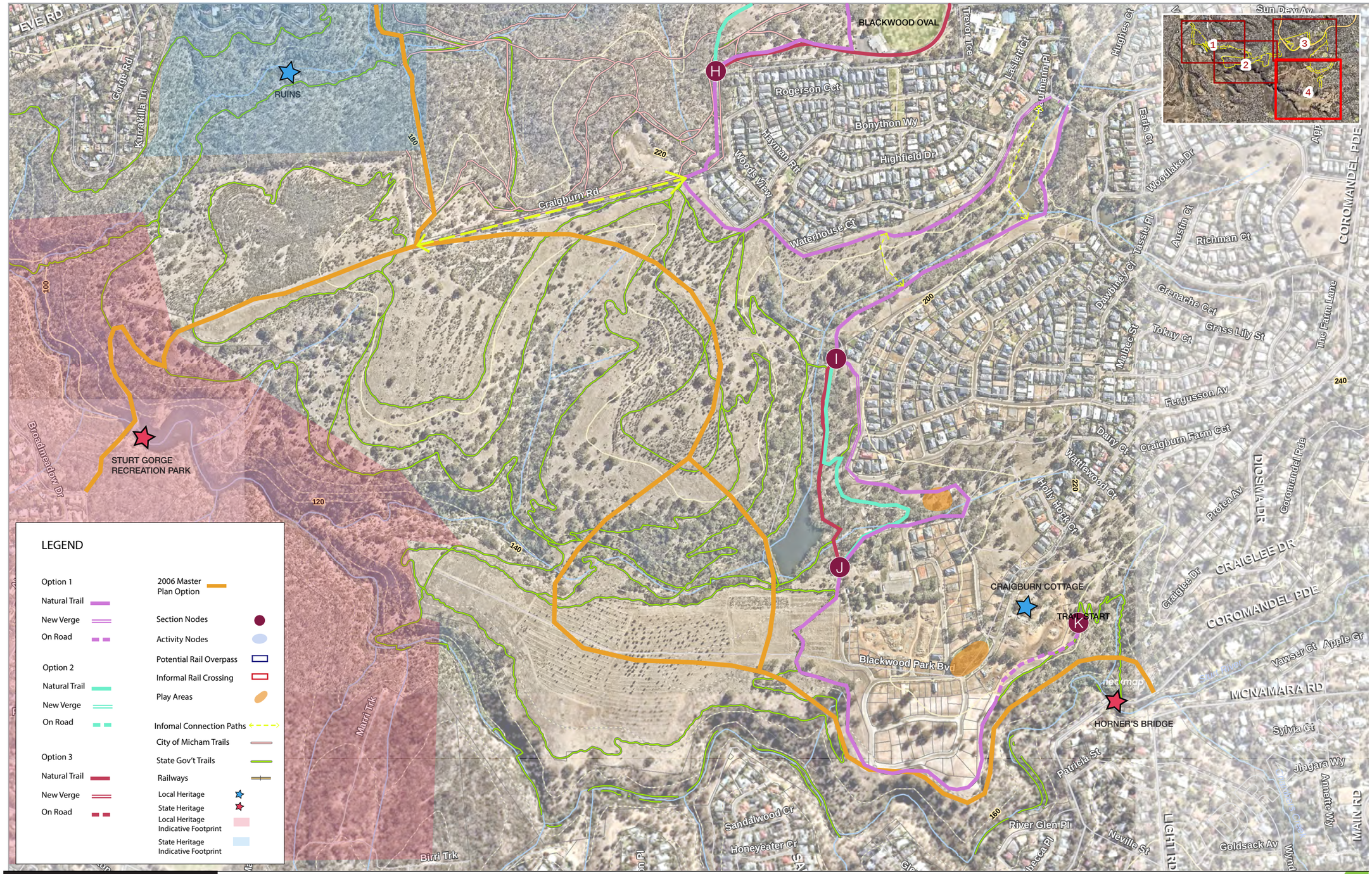
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City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

Project No. 33-19219
Revision No. A
Date 2 Aug 2019

Trail Route Options Page C FIGURE 2C

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelasco



GHDWOODHEAD

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54

N

City of Mitcham
Sturt Lineal Trail
Craigburn Farm to Bellevue Heights

Project No. 33-19219
Revision No. A
Date 2 Aug 2019

Trail Route Options Page D

FIGURE 2D

Data source: Aerial Imagery - Nearmap 2019 (Image Date: 28 Mar 2019; Date Extracted: 30 Mar 2019). Trails - City of Mitcham Council, 2019. General Topo - SA DPTI 2010, 2013. . Created by: kqvelasco

D

Appendix D
Costings

Rider Levett Bucknall SA Pty Ltd
ABN 96 008 129 324
Level 1, 8 Leigh Street
Adelaide SA 5000

T: +61 8 8100 1200
E: adelaide@au.rlb.com

29 April 2020

GHD Woodhead
Level 4, 211 Victoria Square
ADELAIDE SA 5000

Attention: **Guinevere Flavel**
Planner and Urbaner Design

Dear Guinevere,

STURT RIVER LINEAR TRIAL | CRAIGBURN FARM TO BELLEVUE HEIGHTS ORDER OF COST ESTIMATE

As requested, we have prepared an Order of Cost Estimates for the proposed Sturt River Linear Trail Masterplan options based on documents provided by GHD Woodhead. We refer you to the attached Order of Cost Estimates that further define the proposed scope of works for each option and the associated costs.

We summarise the Order of Cost Estimates as follows;

Description	Section K - E	Section E - A
Trade Cost	$4,513,000	$6,524,000
Preliminaries	$315,000	$456,000
Design Contingency	$242,000	$349,000
Construction Contingency	$507,000	$733,000
ESTIMATED NET COST	**$5,577,000**	**$8,062,000**
MARGINS & ADJUSTMENTS		
Professional Fees and Charges	$335,000	$484,000
Superintendent + Project Management	$111,000	$161,000
Escalation Beyond 2020	Excl.	Excl.
Goods and Services Taxation	Excl.	Excl.
ESTIMATED TOTAL COST (EX. GST)	**$6,023,000**	**$8,707,000**

ORDER OF COST ESTIMATE

The Order of Cost Estimates are based upon measured quantities to which we have applied rates and conditions we currently believe applicable as at April 2020 and that reflect the current status of the project. We have assumed the project will be procured by a suitably sized and experienced Civil and or Landscaping Contractor. The estimate is based on the documentation listed below and does not, at this stage, provide a direct comparison with tenders received for the trade works at any future date. To enable monitoring of costs this estimate should be updated regularly during the design and documentation phases of the project.

COVID-19 IMPACT

Our estimate has been prepared on the basis of normal economic and industry circumstances. The full impact of COVID-19 is unknown at this stage and changing daily. Our estimate makes no provision for the impacts of COVID-19 virus and we advise that an impact on the estimate is probable and could vary considerably depending on the extent of a variety of issues.

RLB has observed that, for key construction components, there is an increasing reluctance by contractors to commit to a definitive programme or cost for future projects. This estimate does not consider increased project costs due to potential programme delays, alternative procurement methods of materials and/or labour nor the wider potential impact of COVID-19 on construction activities.

BASIS OF ESTIMATE

The Order of Cost Estimates are based on the following documentation *(or unless scope has been specifically excluded)* provided to our office;

Landscape works documents provided by GHD Woodhead;

- Sturt Linear Concepts
- Site Layout Figures A Rev. 0
- Site Layout Figures B Rev. 0
- Site Layout Figures C Rev. 0
- Site Layout Figures D Rev. 0
- Sturt Linear Trail Option Table

PROJECT EXCLUSIONS

The Order of Cost Estimates specially exclude the following items that may require further consideration when preparing an overall Project feasibility study;

- Unknown impacts of Covid-19
- Excavation in rock
- Removal or remediation or contaminated material
- Escalation beyond end 2020
- Goods and Services Taxation

We trust this report is of assistance, however should you require any further information or clarification please do not hesitate to contact our office.

Yours faithfully

Giulio Altamura

Giulio Altamura
Director
Rider Levett Bucknall
giulio.altamura@au.rlb.com

Section K - E Cost Summary

Subsections	Length	Trade Cost	Preliminaries	Design Contingency (5%)	Construction Contingency (10%)	Total Section Construction Costs	Cost per m	Professional Fees (6%)	Project Management + Superintendent Fees (2%)	Total Project Cost (incl. Fees)
Section K - J (Magenta)	1088	$ 477,865.00	$ 33,450.55	$ 25,565.78	$ 53,688.13	$ 590,569.46	$ 542.80	$ 35,434.17	$ 11,811.39	**$ 637,815.02**
Section K - J (Cyan)	588	$ 238,995.00	$ 16,729.65	$ 12,786.23	$ 26,851.09	$ 295,361.97	$ 502.32	$ 17,721.72	$ 5,907.24	**$ 318,990.93**
Section J - I (Magenta)	956	$ 481,325.00	$ 33,692.75	$ 25,750.89	$ 54,076.86	$ 594,845.50	$ 622.22	$ 35,690.73	$ 11,896.91	**$ 642,433.14**
Section I - H (Magenta)	2303	$ 1,204,305.00	$ 84,301.35	$ 64,430.32	$ 135,303.67	$ 1,488,340.33	$ 646.26	$ 89,300.42	$ 29,766.81	**$ 1,607,407.56**
Section H - G (Magenta)	769	$ 327,365.00	$ 22,915.55	$ 17,514.03	$ 36,779.46	$ 404,574.04	$ 526.10	$ 24,274.44	$ 8,091.48	**$ 436,939.96**
Section G - F (Magenta)	895	$ 367,245.00	$ 25,707.15	$ 19,647.61	$ 41,259.98	$ 453,859.73	$ 507.11	$ 27,231.58	$ 9,077.19	**$ 490,168.51**
Section F - E (Magenta)	590	$ 238,600.00	$ 16,702.00	$ 12,765.10	$ 26,806.71	$ 294,873.81	$ 499.79	$ 17,692.43	$ 5,897.48	**$ 318,463.71**
Node Facilities	-	$ 1,177,100.00	$ 82,397.00	$ 62,974.85	$ 132,247.19	$ 1,454,719.04	$ -	$ 87,283.14	$ 29,094.38	**$ 1,571,096.56**
Total	**7189**	**$ 4,512,800.00**	**$ 315,896.00**	**$ 241,434.80**	**$ 507,013.08**	**$ 5,577,143.88**	**$ 775.79**	**$ 334,628.63**	**$ 111,542.88**	**$ 6,023,315.39**

Section E - A Cost Summary

Subsections	Length	Trade Cost	Preliminaries	Design Contingency (5%)	Construction Contingency (10%)	Total Section Construction Costs	Cost per m	Professional Fees (6%)	Project Management + Superintendent Fees (2%)	Total Project Cost (incl. Fees)
Section E - D (Magenta)	1328	$ 100,645.00	$ 7,045.15	$ 5,384.51	$ 11,307.47	$ 124,382.12	$ 93.66	$ 7,462.93	$ 2,487.64	**$ 134,332.69**
Section E - D (Cyan)	1989	$ 833,645.00	$ 58,355.15	$ 44,600.01	$ 93,660.02	$ 1,030,260.17	$ 517.98	$ 61,815.61	$ 20,605.20	**$ 1,112,680.99**
Section D - C (Cyan)	2212	$ 1,280,235.00	$ 89,616.45	$ 68,492.57	$ 143,834.40	$ 1,582,178.42	$ 715.27	$ 94,930.71	$ 31,643.57	**$ 1,708,752.70**
Section C - B (Magenta)	1356	$ 537,695.00	$ 37,638.65	$ 28,766.68	$ 60,410.03	$ 664,510.37	$ 490.05	$ 39,870.62	$ 13,290.21	**$ 717,671.20**
Section B - A (Magenta)	2117	$ 1,420,230.00	$ 99,416.10	$ 75,982.31	$ 159,562.84	$ 1,755,191.25	$ 829.09	$ 105,311.47	$ 35,103.82	**$ 1,895,606.55**
Node Facilities	-	$ 2,351,200.00	$ 164,584.00	$ 125,789.20	$ 264,157.32	$ 2,905,730.52	$ -	$ 174,343.83	$ 58,114.61	**$ 3,138,188.96**
Total	**9002**	**$ 6,523,650.00**	**$ 456,655.50**	**$ 349,015.28**	**$ 732,932.08**	**$ 8,062,252.85**	**$ 895.61**	**$ 483,735.17**	**$ 161,245.06**	**$ 8,707,233.08**

Item	Description	Unit	Quantity	Rate	Total
1.00.00	Section K-E (6.6km)				
1.01.00	**Section K-J**				
	Magenta Path Option	m	1088		
1.01.01	Native Vegetation Removal	m	100	$15.00	$1,500.00
1.01.02	Path Gradient less than 5%	m	933	$65.00	$60,645.00
1.01.03	Path Gradient 5% - 10%	m	156	$70.00	$10,920.00
1.01.04	Cut/fill	m	1088	$25.00	$27,200.00
1.01.05	Lighting - 1 light per 30m	No	37	$9,800.00	$362,600.00
1.01.06	Linemarking	LS	1	$10,000.00	$10,000.00
1.01.07	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$477,865.00**
	Cyan Path Option	m	588		
1.01.08	Path Gradient less than 5%	m	194	$65.00	$12,610.00
1.01.09	Path Gradient 5% - 10%	m	333	$70.00	$23,310.00
1.01.10	Path Gradient greater than 10%	m	61	$75.00	$4,575.00
1.01.11	Lighting - 1 light per 30m	No	20	$9,800.00	$196,000.00
1.01.12	Wayfinding Signage	LS	1	$2,500.00	$2,500.00
				Total	**$238,995.00**
	Red Path Option	m	1265		
1.01.13	Native Vegetation Removal	m	50	$15.00	$750.00
1.01.14	Path Gradient less than 5%	m	615	$65.00	$39,975.00
1.01.15	Path Gradient 5% - 10%	m	450	$70.00	$31,500.00
1.01.16	Path Gradient greater than 10%	m	200	$75.00	$15,000.00
1.01.17	Cut/fill	m	470	$20.00	$9,400.00
1.01.18	Lighting - 1 light per 30m	No	43	$9,800.00	$421,400.00
1.01.19	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$523,025.00**
1.02.00	**Section J-I**				
	Magenta Path Option	m	956		
1.02.01	Native Vegetation Removal	m	580	$15.00	$8,700.00
1.02.02	Path Gradient less than 5%	m	440	$65.00	$28,600.00
1.02.03	Path Gradient 5% - 10%	m	455	$70.00	$31,850.00
1.02.04	Path Gradient greater than 10%	m	61	$75.00	$4,575.00
1.02.05	Cut/fill	m	700	$20.00	$14,000.00
1.02.06	Bridge	No	1	$80,000.00	$80,000.00
1.02.07	Lighting - 1 light per 30m	No	32	$9,800.00	$313,600.00
				Total	**$481,325.00**
	Cyan Path Option	m	760		
1.02.08	Native Vegetation Removal	m	200	$15.00	$3,000.00
1.02.09	Path Gradient less than 5%	m	491	$65.00	$31,915.00
1.02.10	Path Gradient 5% - 10%	m	179	$70.00	$12,530.00
1.02.11	Path Gradient greater than 10%	m	90	$75.00	$6,750.00
1.02.12	Retaining Wall (up to 1m)	m	150	$450.00	$67,500.00
1.02.13	Cut/fill	m	760	$20.00	$15,200.00
1.02.14	Lighting - 1 light per 30m	No	26	$9,800.00	$254,800.00
1.02.15	Fall Protection/Fencing	m	150	$500.00	$75,000.00
				Total	**$466,695.00**
	Red Path Option	m	518		
1.02.16	Native Vegetation Removal	m	490	$15.00	$7,350.00
1.02.17	Path Gradient less than 5%	m	121	$65.00	$7,865.00
1.02.18	Path Gradient 5% - 10%	m	355	$70.00	$24,850.00
1.02.19	Path Gradient greater than 10%	m	40	$75.00	$3,000.00
1.02.20	Cut/fill	m	518	$20.00	$10,360.00
1.02.21	Bridge	No	1	$80,000.00	$80,000.00
1.02.22	Lighting - 1 light per 30m	No	18	$9,800.00	$176,400.00
				Total	**$309,825.00**
1.03.00	**Section I-H**				
	Magenta Path Option	m	2303		

1.03.01	Native Vegetation Removal	m	430	$15.00	$6,450.00
1.03.02	Path Gradient less than 5%	m	2303	$65.00	$149,695.00
1.03.03	Cut/fill	m	2303	$20.00	$46,060.00
1.03.04	Bridge	No	3	$80,000.00	$240,000.00
1.03.05	Lighting - 1 light per 30m	No	77	$9,800.00	$754,600.00
1.03.06	Wayfinding Signage	LS	1	$7,500.00	$7,500.00
				Total	**$1,204,305.00**
1.04.00	**Section H-G**				
	Magenta Path Option	m	769		
1.04.01	Native Vegetation Removal	m	90	$15.00	$1,350.00
1.04.02	Path Gradient less than 5%	m	199	$65.00	$12,935.00
1.04.03	Path Gradient 5% - 10%	m	570	$70.00	$39,900.00
1.04.04	Cut/fill	m	769	$20.00	$15,380.00
1.04.06	Lighting - 1 light per 30m	No	26	$9,800.00	$254,800.00
1.04.07	Wayfinding Signage	LS	1	$3,000.00	$3,000.00
				Total	**$327,365.00**
	Cyan Path Option	m	336		
1.04.08	Native Vegetation Removal	m	120	$15.00	$1,800.00
1.04.09	Path Gradient less than 5%	m	222	$65.00	$14,430.00
1.04.10	Path Gradient 5% - 10%	m	114	$70.00	$7,980.00
1.04.11	Cut/fill	m	336	$20.00	$6,720.00
1.04.12	Lighting - 1 light per 30m	No	12	$9,800.00	$117,600.00
1.04.13	Wayfinding Signage	LS	1	$2,500.00	$2,500.00
				Total	**$151,030.00**
	Red Path Option	m	1008		
1.04.14	Native Vegetation Removal	m	90	$15.00	$1,350.00
1.04.15	Path Gradient less than 5%	m	501	$65.00	$32,565.00
1.04.16	Path Gradient 5% - 10%	m	507	$70.00	$35,490.00
1.04.17	Cut/fill	m	600	$20.00	$12,000.00
1.04.18	Lighting - 1 light per 30m	No	34	$9,800.00	$333,200.00
1.04.19	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$419,605.00**
1.05.00	**Section G-F**				
	Magenta Path Option	m	895		
1.05.01	Path Gradient less than 5%	m	588	$65.00	$38,220.00
1.05.02	Path Gradient 5% - 10%	m	200	$70.00	$14,000.00
1.05.03	Path Gradient greater than 10%	m	107	$75.00	$8,025.00
1.05.04	Cut/fill	m	150	$20.00	$3,000.00
1.05.05	Lighting - 1 light per 30m	No	30	$9,800.00	$294,000.00
1.05.06	Linemarking	LS	1	$10,000.00	$10,000.00
				Total	**$367,245.00**
	Cyan Path Option	m	656		
1.05.07	Path Gradient less than 5%	m	107	$65.00	$6,955.00
1.05.08	Path Gradient 5% - 10%	m	200	$70.00	$14,000.00
1.05.09	Path Gradient greater than 10%	m	349	$75.00	$26,175.00
1.05.10	Retaining Wall (up to 1m)	m	200	$250.00	$50,000.00
1.05.11	Cut/fill	m	656	$20.00	$13,120.00
1.05.12	Bridge	No	1	$80,000.00	$80,000.00
1.05.13	Lighting - 1 light per 30m	No	22	$9,800.00	$215,600.00
				Total	**$405,850.00**
1.06.00	**Section F-E**				
	Magenta Path Option	m	590		
1.06.01	Path Gradient less than 5%	m	520	$65.00	$33,800.00
1.06.02	Path Gradient 5% - 10%	m	70	$70.00	$4,900.00
1.06.04	Cut/fill	m	70	$20.00	$1,400.00
1.06.05	Lighting - 1 light per 30m	No	20	$9,800.00	$196,000.00
1.06.06	Wayfinding Signage	LS	1	$2,500.00	$2,500.00
				Total	**$238,600.00**

1.07.01	Magenta Path Option - toilet facility, drinking fountain, bin and shade structure	No	2	$250,000.00	$500,000.00
1.07.02	Magenta Path Option - bench seat	No	6	$2,850.00	$17,100.00
1.07.03	Magenta Path Option - post and rail Fencing	m	3300	$150.00	$495,000.00
1.07.04	Magenta Path Option - low level landscaping, 2m either side of path to 25% of area	m2	3300	$50.00	$165,000.00
1.08.01	Cyan Path Option - toilet facility, drinking fountain, bin and shade structure	No	2	$250,000.00	$500,000.00
1.08.02	Cyan Path Option - bench seat	No	6	$2,850.00	$17,100.00
1.08.03	Cyan Path Option - post and rail Fencing	m	3300	$150.00	$495,000.00
1.08.04	Cyan Path Option - low level landscaping - 2m either side of path	m2	3300	$50.00	$165,000.00
1.09.01	Red Path Option - toilet facility, drinking fountain, bin and shade structure	No	1	$250,000.00	$250,000.00
1.09.02	Red Path Option - bench seat	No	3	$2,850.00	$8,550.00
1.09.03	Red Path Option - post and rail fencing - 50% of area	m	1811	$150.00	$271,650.00
1.09.04	Red Path Option - low level landscaping, 2m either side of path to 25% of area	m2	1811	$50.00	$90,550.00
				Section K -E Magenta Total	**$4,273,805.00**
				Section K -E Cyan Total	**$2,439,670.00**
				Section K -E Red Total	**$1,873,205.00**
2.00.00	Section E-A (6.34km)				
2.01.00	**Section E-D**				
2.01.01	*Magenta Path Option*	m	1328		
2.01.02	Path Gradient less than 5%	m	991	$65.00	$64,415.00
2.01.03	Path Gradient 5% - 10%	m	337	$70.00	$23,590.00
2.01.04	Cut/fill	m	132	$20.00	$2,640.00
2.01.05	Linemarking	LS	1	$10,000.00	$10,000.00
				Total	**$100,645.00**
	Cyan Path Option	m	1989		
2.01.05	Native Vegetation Removal	m	510	$15.00	$7,650.00
2.01.06	Path Gradient less than 5%	m	1298	$65.00	$84,370.00
2.01.07	Path Gradient 5% - 10%	m	528	$70.00	$36,960.00
2.01.08	Path Gradient greater than 10%	m	163	$75.00	$12,225.00
2.01.09	Cut/fill	m	1292	$20.00	$25,840.00
2.01.10	Lighting - 1 light per 30m	No	67	$9,800.00	$656,600.00
2.01.11	Linemarking	LS	1	$10,000.00	$10,000.00
				Total	**$833,645.00**
	Red A Path Option	m	1386		
2.01.11	Path Gradient less than 5%	m	1014	$65.00	$65,910.00
2.01.12	Path Gradient 5% - 10%	m	350	$70.00	$24,500.00
2.01.13	Path Gradient greater than 10%	m	349	$75.00	$26,175.00
2.01.14	Cut/fill	m	1090	$20.00	$21,800.00
2.01.15	Bridges	No	2	$80,000.00	$160,000.00
2.01.16	Lighting - 1 light per 30m	No	47	$9,800.00	$460,600.00
				Total	**$758,985.00**
	Red B Path Option	m	1423		
2.01.17	Native Vegetation Removal	m	1380	$15.00	$20,700.00
2.01.18	Path Gradient less than 5%	m	886	$65.00	$57,590.00
2.01.19	Path Gradient 5% - 10%	m	506	$70.00	$35,420.00
2.01.20	Path Gradient greater than 10%	m	358	$75.00	$26,850.00
2.01.21	Retaining Wall (up to 1m)	m	340	$450.00	$153,000.00
2.01.22	Cut/fill	m	1423	$20.00	$28,460.00
2.01.23	Bridges	No	2	$80,000.00	$160,000.00
2.01.24	Lighting - 1 light per 30m	No	48	$9,800.00	$470,400.00
2.01.25	Fencing/Fall Protection	m	340	$400.00	$136,000.00
				Total	**$1,088,420.00**
	Orange Path Option	m	4500		
2.01.26	Native Vegetation Removal	m	1260	$15.00	$18,900.00

2.01.27	Path Gradient less than 5%	m	2004	$65.00	$130,260.00
2.01.28	Path Gradient 5% - 10%	m	779	$70.00	$54,530.00
2.01.29	Path Gradient greater than 10%	m	1719	$75.00	$128,925.00
2.01.30	Retaining Wall (up to 1m)	m	1600	$450.00	$720,000.00
2.01.31	Cut/fill	m	4500	$20.00	$90,000.00
2.01.32	Bridges	No	5	$80,000.00	$400,000.00
2.01.33	Lighting - 1 light per 30m	No	150	$9,800.00	$1,470,000.00
2.01.34	Fencing/Fall Protection	m	1600	$400.00	$640,000.00
				Total	**$3,652,615.00**
	Blue Path Option	m	2180		
2.01.35	Native Vegetation Removal	m	1500	$15.00	$22,500.00
2.01.36	Path Gradient less than 5%	m	997	$65.00	$64,805.00
2.01.37	Path Gradient 5% - 10%	m	1253	$70.00	$87,710.00
2.01.38	Path Gradient greater than 10%	m	256	$75.00	$19,200.00
2.01.39	Retaining Wall (up to 1m)	m	450	$450.00	$202,500.00
2.01.40	Cut/fill	m	2180	$20.00	$43,600.00
2.01.41	Bridges	No	5	$80,000.00	$400,000.00
2.01.42	Lighting - 1 light per 30m	No	73	$9,800.00	$715,400.00
2.01.43	Fencing/Fall Protection	m	450	$400.00	$180,000.00
				Total	**$1,735,715.00**
2.02.00	**Section D-C**				
2.02.01	*Magenta Path Option*	m	1333		
2.02.02	Native Vegetation Removal	m	200	$15.00	$3,000.00
2.02.03	Path Gradient less than 5%	m	945	$65.00	$61,425.00
2.02.04	Path Gradient greater than 10%	m	388	$70.00	$27,160.00
2.02.05	Retaining Wall (up to 1m)	m	357	$450.00	$160,650.00
2.02.06	Cut/fill	m	357	$20.00	$7,140.00
2.02.07	Lighting - 1 light per 30m	No	45	$9,800.00	$441,000.00
2.02.08	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$705,375.00**
	Cyan Path Option	m	2212		
2.02.09	Native Vegetation Removal	m	850	$15.00	$12,750.00
2.02.10	Path Gradient less than 5%	m	912	$65.00	$59,280.00
2.02.11	Path Gradient 5% - 10%	m	367	$70.00	$25,690.00
2.02.12	Path Gradient greater than 10%	m	933	$75.00	$69,975.00
2.02.13	Retaining Wall (up to 1m)	m	400	$450.00	$180,000.00
2.02.14	Cut/fill	m	1617	$20.00	$32,340.00
2.02.15	Lighting - 1 light per 30m	No	74	$9,800.00	$725,200.00
2.02.16	Fall Protection/Fencing	m	400	$400.00	$160,000.00
2.02.17	Linemarking	LS	1	$10,000.00	$10,000.00
2.02.18	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$1,280,235.00**
	Red Path Option	m	3949		
2.02.19	Native Vegetation Removal	m	2480	$15.00	$37,200.00
2.02.20	Path Gradient less than 5%	m	1814	$65.00	$117,910.00
2.02.21	Path Gradient 5% - 10%	m	1827	$70.00	$127,890.00
2.02.22	Path Gradient greater than 10%	m	308	$75.00	$23,100.00
2.02.23	Retaining Wall (up to 1m)	m	1000	$450.00	$450,000.00
2.02.24	Cut/fill	m	3500	$20.00	$70,000.00
2.02.25	Bridges	No	4	$80,000.00	$320,000.00
2.02.26	Lighting - 1 light per 30m	No	132	$9,800.00	$1,293,600.00
2.02.27	Fall Protection/Fencing	m	1000	$400.00	$400,000.00
2.02.28	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$2,844,700.00**
	Orange Path Option	m	1333		
2.02.29	Native Vegetation Removal	m	330	$15.00	$4,950.00
2.02.30	Path Gradient less than 5%	m	945	$65.00	$61,425.00
2.02.31	Path Gradient greater than 10%	m	388	$75.00	$29,100.00
2.02.32	Retaining Wall (up to 1m)	m	357	$450.00	$160,650.00
2.02.33	Cut/fill	m	357	$20.00	$7,140.00
2.02.34	Lighting - 1 light per 30m	No	45	$9,800.00	$441,000.00
2.02.35	Wayfinding Signage	LS	1	$5,000.00	$5,000.00

				Total	**$709,265.00**
2.03.00	**Section C-B**				
2.03.01	*Magenta Path Option*	m	1356		
2.03.02	Path Gradient less than 5%	m	1183	$65.00	$76,895.00
2.03.03	Lighting - 1 light per 30m	No	46	$9,800.00	$450,800.00
2.03.04	Linemarking	LS	1	$10,000.00	$10,000.00
				Total	**$537,695.00**
	Cyan Path Option	m	1302		
2.03.05	Native Vegetation Removal	m	240	$15.00	$3,600.00
2.03.06	Path Gradient less than 5%	m	472	$65.00	$30,680.00
2.03.07	Path Gradient 5% - 10%	m	638	$70.00	$44,660.00
2.03.08	Path Gradient greater than 10%	m	192	$75.00	$14,400.00
2.03.09	Retaining Wall (up to 1m)	m	450	$450.00	$202,500.00
2.03.10	Cut/fill	m	640	$20.00	$12,800.00
2.03.11	Lighting - 1 light per 30m	No	44	$9,800.00	$431,200.00
2.03.12	Fall Protection/Fencing	m	450	$400.00	$180,000.00
				Total	**$919,840.00**
	Orange Path Option	m	1263		
2.03.13	Path Gradient 5% - 10%	m	1263	$70.00	$88,410.00
2.03.14	Lighting - 1 light per 30m	No	43	$9,800.00	$421,400.00
				Total	**$509,810.00**
2.04.00	**Section B-A**				
2.04.01	*Magenta Path Option*	m	2117		
2.04.02	Path Gradient less than 5%	m	1140	$65.00	$74,100.00
2.04.03	Path Gradient 5% - 10%	m	977	$70.00	$68,390.00
2.04.04	Retaining Wall (up to 1m)	m	650	$450.00	$292,500.00
2.04.05	Cut/fill	m	1222	$20.00	$24,440.00
2.04.06	Lighting - 1 light per 30m	No	71	$9,800.00	$695,800.00
2.04.07	Fall Protection/Fencing	m	650	$400.00	$260,000.00
2.04.08	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$1,420,230.00**
	Cyan Path Option	m	1024		
2.04.09	Path Gradient less than 5%	m	423	$65.00	$27,495.00
2.04.10	Path Gradient greater than 10%	m	600	$75.00	$45,000.00
2.04.11	Cut/fill	m	176	$20.00	$3,520.00
2.04.12	Lighting - 1 light per 30m	No	35	$9,800.00	$343,000.00
2.04.13	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$424,015.00**
	Red Path Option	m	1601		
2.04.14	Path Gradient less than 5%	m	901	$65.00	$58,565.00
2.04.15	Path Gradient 5%-10%	m	240	$70.00	$16,800.00
2.04.16	Path Gradient greater than 10%	m	460	$75.00	$34,500.00
2.04.17	Cut/fill	m	93	$20.00	$1,860.00
2.04.18	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$116,725.00**
	Orange Path Option	m	1070		
2.04.19	Path Gradient less than 5%	m	351	$65.00	$22,815.00
2.04.20	Path Gradient 5%-10%	m	170	$70.00	$11,900.00
2.04.21	Path Gradient greater than 10%	m	549	$75.00	$41,175.00
2.04.22	Retaining Wall (up to 1m)	m	270	$450.00	$121,500.00
2.04.23	Lighting - 1 light per 30m	No	36	$9,800.00	$352,800.00
2.04.24	Fall Protection/Fencing	m	270	$400.00	$108,000.00
2.04.25	Wayfinding Signage	LS	1	$5,000.00	$5,000.00
				Total	**$663,190.00**
2.05.01	Magenta Path Option - toilet facility, drinking fountain, bin and shade structure	No	2	$250,000.00	$500,000.00
2.05.02	Magenta Path Option - bench seat	No	6	$2,850.00	$17,100.00
2.05.03	Magenta Path Option - post and rail fencing - 50% of area	m	3070	$150.00	$460,500.00

2.05.04	Magenta Path Option - low level landscaping, 2m either side of path to 25% of area	m2	3070	$50.00	$153,500.00
2.06.05	BBQ and shade structure at Riverside Reserve	LS	1	$50,000.00	$50,000.00
2.06.01	Cyan Path Option - toilet facility, drinking fountain, bin and shade structure	No	2	$250,000.00	$500,000.00
2.06.02	Cyan Path Option - bench seat	No	6	$2,850.00	$17,100.00
2.06.03	Cyan Path Option - post and rail fencing - 50% of area	m	3265	$150.00	$489,750.00
2.06.04	Cyan Path Option - low level landscaping - 2m either side of path to 25% of area	m2	3265	$50.00	$163,250.00
2.07.01	Red Path Option - toilet facility, drinking fountain, bin and shade structure	No	2	$250,000.00	$500,000.00
2.07.02	Red Path Option - bench seat	No	6	$2,850.00	$17,100.00
2.07.03	Red Path Option - post and rail fencing - 50% of area	m	3300	$150.00	$495,000.00
2.07.04	Red Path Option - low level landscaping, 2m either side of path to 25% of area	m2	3300	$50.00	$165,000.00
2.08.01	Orange Path Option - toilet facility, drinking fountain, bin and shade structure	No	2	$250,000.00	$500,000.00
2.08.02	Orange Path Option - bench seat	No	8	$2,500.00	$20,000.00
2.08.03	Orange Path Option - post and rail fencing - 50% of area	m	4083	$150.00	$612,450.00
2.08.04	Orange Path Option - low level landscaping, 2m either side of path to 25% of area	m2	4083	$50.00	$204,150.00
2.09.01	Red A Path Option - bench seat	No	1	$2,850.00	$2,850.00
2.09.02	Red A Path Option - post and rail fencing - 50% of area	m	695	$150.00	$104,250.00
2.09.03	Red A Path Option - low level landscaping, 2m either side of path to 25% of area	m2	695	$50.00	$34,750.00
2.10.01	Red B Path Option - bench seat	No	1	$2,850.00	$2,850.00
2.10.02	Red B Path Option - post and rail fencing - 50% of area	m	711	$150.00	$106,650.00
2.10.03	Red B Path Option - low level landscaping, 2m either side of path to 25% of area	m2	711	$50.00	$35,550.00
2.11.01	Blue Path Option - bench seat	No	2	$2,850.00	$5,700.00
2.11.02	Blue Path Option - post and rail fencing - 50% of area	m	1090	$150.00	$163,500.00
2.11.03	Blue Path Option - low level landscaping, 2m either side of path to 25% of area	m2	1090	$50.00	$54,500.00
				Section E-A Magenta Total	**$3,945,045.00**
				Section E_A Cyan Total	**$4,627,835.00**
				Section E-A Red Total	**$4,138,525.00**
				Section E-A Red A Total	**$900,835.00**
				Section E-A Red B Total	**$1,233,470.00**
				Section E-A Orange Total	**$6,871,480.00**
				Section E-A Blue Total	**$1,959,415.00**

3.00.00	Total $/m Rates				
3.01.01	E-K Magenta Path Option	m	6601	$647.45	$4,273,805.00
3.01.02	E-K Cyan Path Option	m	3150	$774.50	$2,439,670.00
3.01.03	E-K Red Path Option	m	3622	$517.17	$1,873,205.00
3.01.04	E-A Magenta Path Option	m	6134	$643.14	$3,945,045.00
3.01.05	E-A Cyan Path Option	m	6527	$709.03	$4,627,835.00
3.01.06	E-A Red Path Option	m	5550	$745.68	$4,138,525.00
3.01.07	E-A Red A Path Option	m	1386	$649.95	$900,835.00
3.01.08	E-A Red B Path Option	m	1423	$866.81	$1,233,470.00
3.01.09	E-A Orange Path Option	m	8166	$841.47	$6,871,480.00
3.01.10	E-A Blue Path Option	m	2180	$898.81	$1,959,415.00

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Rev No.	Author	Reviewer		Authorisation		
		Name	Signature	Name	Signature	Date
DRAFT A	G Flavel	J Howard	*J Howard**	J Howard	*J Howard**	10/10/2019
DRAFT B	G Flavel	A Sasu		A Sasu		08/04/2020
REV 0	G Flavel	A Sasu		A Sasu		27/05/2020

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