

Stage 2B: Options Report

Narrabeen Lagoon Multi-Use Trail



FINAL

Jointly authored by
Warringah Council and
Thompson Berrill Landscape Design Pty Ltd



Warringah Council



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Executive Summary

The Narrabeen Lagoon Multi-Use Trail (**NLMUT**) Project has been established to design and construct the remaining trail and bridge infrastructure for the western and southern foreshores of the Lagoon, hence completing a continuous loop. The section of foreshore between Middle Creek and South Creek Reserve is known as Stage 2B of the Project and is the subject of this report.

This Options Report compiles the concept development work undertaken on Stage 2B since 2008 when the NSW Minister for Sport and Recreation confirmed support for the trail proceeding through the Sydney Academy of Sport (**Academy**) land. The purpose of the report is to present the technical background, Council considerations and alternative concepts explored in developing a solution and to provide a detailed explanation of the nominated scheme.

The process undertaken over this period has involved multiple rounds of alternative concepts being developed, comprehensive assessment and feedback from stakeholders and the community and then rejection, refinement or development of further options to build upon each round of reviews.

It is concluded that a scheme described as Option 3B provides the optimal concept for the trail based on the assessments and consultations completed over the past three years.

Option 3B involves generally (from north to south);

- A bridge over Middle Creek and a trail on-ground along the public foreshore Crown Land, fenced one side and open to the Lagoon. The existing Academy boatsheds are proposed to be relocated, with a resulting secure separation between trail users and Academy activities;
- A raised boardwalk through the vegetation bordering the Academy and Cromer Golf Club and then an on-ground path along the public foreshore Crown Land adjoining the golf course. The Cromer golf course will be required to be reconfigured, with their signature 15th hole being removed from the public foreshore land with the resulting separation of trail users and golf activities;
- A bridge crossing near the mouth of South Creek and an on-ground trail continuing along the Lagoon foreshore and built over existing tracks to join with the existing Jamieson trail and proposed South Creek cycleway. By containing the public access to a single route through South Creek reserve and with the golf course redesign, the opportunity arises to remove informal tracks, close off the unsafe weir access route, revegetate the western shore of South Creek and hence create a 4ha contiguous environmental protection zone at South Creek Reserve.

The funding available for the construction of Stage 2B is \$4.4 million, with the estimated cost of Option 3B being \$3.92 million and hence comfortably within budget limits at this conceptual stage. This cost estimate includes a sum of \$220,000 allowed for negotiations with the Academy over their boatsheds relocation, although no commitments have yet been made as to costs. The cost estimate also includes a sum of \$400,000 which has been offered to partially fund the reconfiguration of the Cromer golf course.

The adoption of the Option 3B concept by Council still requires a negotiated agreement to be reached with both the Cromer Golf Club and the Sydney Academy of Sport before it could be implemented. Both parties have broadly indicated to Council their acceptance in principle at the time of this report, however significant details remain to be further discussed and resolved.

The option assessment highlighted in this Report summarises a long and complex development and consultation process to determine an optimal trail alignment. Conclusions arising from this Options Report will be incorporated into a report to the elected Council. Council will then seek to formalise agreements with the Academy, Cromer Golf Club and NSW Crown Lands Division to enable design and construction and the ongoing management of the trail.

TABLE OF CONTENTS

1.	Introduction	1
1.1	Background	1
1.2	Structure & Purpose of the Report	2
1.2.1	Process.....	2
2.	Site Assessment	4
2.1	Key Users.....	4
2.2	Site Constraints.....	5
2.2.1	Sydney Academy of Sport	5
2.2.2	Cromer Golf Club.....	8
2.2.3	South Creek Reserve	11
2.3	Aboriginal and European Heritage	12
3.	Option Development Round 1.....	14
3.1	Preliminary Options	14
3.1.1	Flora and Fauna Assessment.....	15
3.1.2	Aquatic Ecological Investigations	16
3.1.3	Geotechnical Investigations.....	18
3.2	Exploratory Options.....	18
3.3	Council Conclusions from Round 1 Option Development	19
4.	Options Development Round 2.....	21
4.1	Four Selected Options - Overview	21
4.1.1	Academy Section Review	23
4.1.2	Cromer Golf Club Section Review	27
4.1.3	South Creek Reserve Section Review.....	31
4.2	Community and Stakeholder Engagement.....	35
4.2.1	Community Engagement Process	35
4.2.2	Community Workshop Results	35
4.2.3	Public Exhibition Comments.....	37
4.2.4	Community Engagement Outcomes.....	37
4.3	Cost.....	38
4.3.1	Project Funding Parameters	38
4.3.2	Budget	38
4.3.3	Cost of Options.....	38
4.3.4	Cost Summary.....	39
4.4	Environmental Assessments	39
4.4.1	Flora and Fauna Survey and Species Impact Statement	39
4.5	TBLD Risk Assessment.....	43
4.5.1	Summary	43
4.5.2	Risk Assessment Summary Table.....	44
4.5.3	Safety Risks – Operational Phase.....	44
4.5.4	Residual Risk Ranking for Total Project	45
4.5.5	Assumptions and Limitations	45
4.6	Council Conclusions from Round 2 Option Development.	48
4.6.1	Council comment on TBLD risk assessment.....	48
4.6.2	Council Conclusions at Round 2 Option Development:.....	48

5.	Option Development Round 3.....	50
5.1	Combination Option 3A	50
5.1.1	Option 3A through Academy.....	52
5.1.2	Option 3A through Cromer Golf Club.....	52
5.1.3	Option 3A through South Creek Reserve	53
5.1.4	Option 3A Cost Estimate	54
5.1.5	Combination Option 3A Summary	55
5.2	Preferred Concept - Option 3B.....	56
5.2.1	Academy Boatsheds.....	57
5.2.2	Environmental Risk Review	60
6.	Summary & Conclusion.....	67
6.1	Summary Table of Round 2 and 3 Option Assessments	67
6.2	Conclusion.....	68
	Acknowledgments	69
	Acknowledgments	70
	Appendices.....	71
	Appendix A: Preliminary Options Plans	71
	Appendix B: Stakeholder Submissions to Preliminary Options	71
	Appendix C: Flora and Fauna Assessment.....	71
	Appendix D: Aquatic Ecology Constraints Assessment	71
	Appendix E: Exploratory Options	71
	Appendix F: Exploratory Options Matrix.....	71
	Appendix G: Golf Course Layout and Alternative Re-alignments	71
	Appendix H: Community Information Packs for Workshop	71
	Appendix I: Selected Options Plans	71
	Appendix J: Selected Options Montages	71
	Appendix K: Selected Options Details	71
	Appendix L: Community Engagement Outcomes Report.....	71
	Appendix M: Selected Options Cost Estimate	71
	Appendix N: Geotechnical Report.....	71
	Appendix O: Risk Assessment Tools	71
	Appendix P: Risk Assessment Summary Table	71
	Appendix Q: Material Research	71
	Appendix R: Round 2 and 3 Option Maps with Environmental Constraints	71

1. Introduction

1.1 Background

Warringah and Pittwater Councils have long recognised the importance of establishing a continuous link around Narrabeen Lagoon. Community consultation also identified this opportunity in the development of the Sydney Metropolitan Strategy; Draft North-East Sub-Regional Strategy; Narrabeen Lagoon Estuary Management Plan 2002; Dee Why Valley and South Creek Open Space Corridor Plan of Management 2008, and the Warringah Council Regional Multiple-Use Trail Strategy 2007.

To complete the loop, the Narrabeen Lagoon Multi-Use Trail (**NLMUT**) Project was established to design and construct the remaining trail and bridge infrastructure for the western and southern foreshores of the Lagoon (Figure 1).

Warringah Council has recently completed Stage 1 of the NLMUT consisting of 850m of trail from Deep Creek to Middle Creek Reserve. This trail will connect with a new pedestrian bridge over Deep Creek which has recently been completed by Pittwater Council. For Stage 2A Warringah Council are finalising designs for upgrades to Middle Creek Reserve and construction is scheduled for early 2012.

Stage 2B of the NLMUT is from Middle Creek to South Creek Reserve through the Sydney Academy of Sport and Recreation (**Academy**) and the Cromer Golf Club (**Cromer GC**). For this Stage, Council required a detailed options analysis and risk assessment to establish the most viable trail alignment taking into account key considerations including safety, environmental impact, costs and impacts on the community and existing land users.

Landscape Architectural consultants Thompson Berrill Landscape Architects Pty Ltd (**TBLD**), and a team of specialist technical sub-consultants were engaged to investigate the study area, and assist Council in determining a preferred alignment.



Figure 1 – Context Map Narrabeen Lagoon Multi-Use Trail Project

1.2 Structure & Purpose of the Report

The conceptual development of Stage 2B of the Narrabeen Lagoon Multi-Use Trail has been occurring over a number of years, with the early focus being on stakeholder negotiations and ecological and other studies. This conceptual work accelerated over the past 12 months with the appointment of a design team and subsequent documentation and costing of the most promising route alignments. Ongoing community and stakeholder consultation throughout concept development has been used to refine the alternative schemes and in the development of a preferred option.

This Options Report compiles the work undertaken on Stage 2B from 2008 when the NSW Minister for Sport and Recreation confirmed support for the trail proceeding through the Sydney Academy of Sport. The purpose of the report is to present the technical background, Council considerations and alternative concepts explored in determining a preferred solution and to provide a detailed explanation of the nominated scheme.

The concept development process has been somewhat iterative, with initial options developed and then tested with the community, stakeholders, costing and various technical inputs before being refined or rejected and further concepts explored. For simplicity the development process in this Options Report is presented in the form of general site assessments and then three rounds of concept development and testing, and is illustrated in the flow-chart below.

1.2.1 Process

The initial round of the Options Development process involved a review of Council's Preliminary Options and the development of Exploratory Options in consultation with stakeholders, authorities and internal Council departments. Round Two covered Four Selected Options for presentation to the community and stakeholders. A risk assessment and cost estimates for these were completed together with further discussions with key stakeholders. The third and final round of concept development arose from feedback and assessment of the previous four selected options and further land-holder negotiations to refine the optimum trail concepts into a nominated scheme to be recommended for Council endorsement.

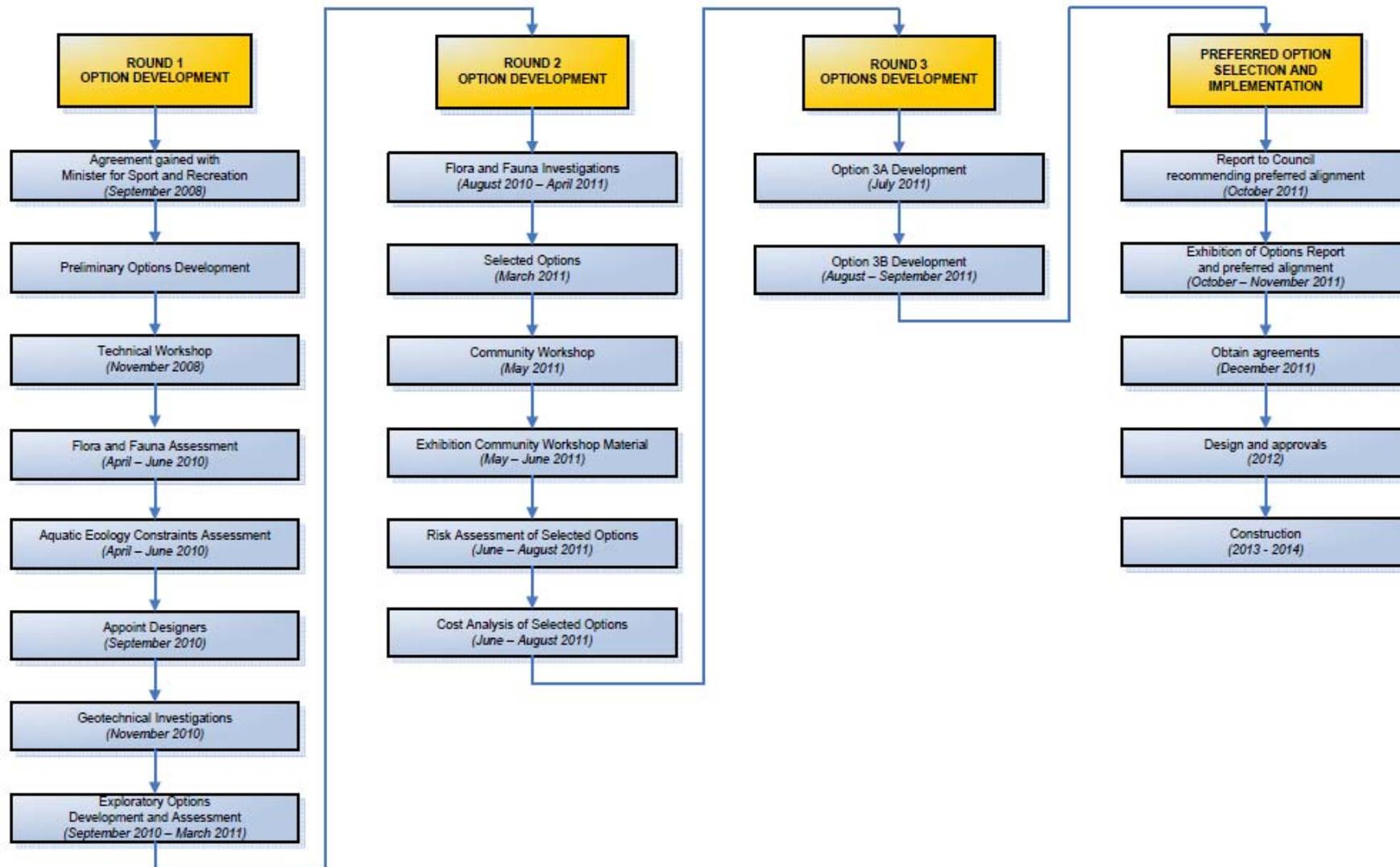


Figure 2 - Stage 2B Options Development Process

2. Site Assessment

Narrabeen Lagoon is an Intermittently Closed / Open Lagoon (ICOLL) located within Warringah Local Government Area on the Northern Beaches of Sydney between Elanora Heights and Collaroy Plateau. It has complex ecosystems, cultural values and is the one of the largest recreation attractions in the region.

This report is focused on Stage 2B of the NLMUT from Middle Creek to South Creek Reserve. The study area is illustrated in Figure 3 below.



Figure 3 - Study Area for Stage 2B

2.1 Key Users

Narrabeen Lagoon is used by a wide variety of community groups, clubs and commercial users. The Narrabeen Lagoon Plan of Management – Values, Issues and Options Paper (2010) identified a number of water and land based activities in and around the Lagoon.

Key water-based activities included:

- Sailing/catamarans/windsurfing
- Kayaking, canoeing, rowing and paddle-boarding
- Swimming
- Recreational fishing/prawning
- Model boat use

Note: Kayaking was found to be the most popular lagoon recreational activity.

Key land-based key activities included:

- Picnicking
- Cycling
- Bushwalking/Hiking
- Walking/strolling/jogging
- Bird watching
- Shore fishing
- Dog training/Dog walking
- Golf
- NSW Academy of Sport training
- Coastal Education Centre and Community Centre activities
- Scout activities
- Community Markets (on the third Sunday of every month)
- Community Festivals

The *Warringah Regional Multiple Use Trail Strategy (2007)*, the *Dee Why Valley and South Creek Open Space Plan of Management (2008)* and the *Warringah Bike Plan (2010)* have identified existing and proposed trails that would connect to the Narrabeen Lagoon Multi-Use Trail. As these trails are built it is envisaged there would be an increase in visitation to the Lagoon drawing people from further afield.

Future increases in population growth are also likely to increase the demand for natural areas and outdoor activities. Completion of the trail would create an 8.5km walkway/cycleway around the lagoon providing further opportunity for a wide range of users to enjoy the recreational and environmental merits of the lagoon and its surrounding areas. Implementation of this Project will see Council contribute to the vision of the Recreation Strategy (2009) being:

'A healthy and active Warringah community that has access to a wide range of appropriate, suitable, sustainable and quality recreational opportunities, both now and the future.'

2.2 Site Constraints

The constraints of the Stage 2B Study Area have been summarised below in terms of three broad areas being the Academy, Cromer Golf Club (Cromer GC) and South Creek Reserve.

2.2.1 Sydney Academy of Sport

The Sydney Academy of Sport and Recreation (Academy) is the largest of the NSW Sport and Recreation Centres in the State. The Academy runs a number of programs in sports development and provides facilities for clubs, schools, state and national sporting organisations. The Academy's accommodation and facilities are designed to cater for large numbers of participants including residential facilities for schools and people with disabilities.

The Academy partially occupies a strip of foreshore Crown Land containing boat sheds and other infrastructure. This land has been occupied under a Permissive Occupancy Agreement with the NSW Crown Lands Division, with the condition that the tenant shall not unnecessarily obstruct access by the public across the foreshore. Figure 4 below illustrates the Crown Land occupied by the Academy east of the red line. It demonstrates that any a trail route crossing Middle Creek will need to cross Academy land inside the Red area.

Up until 2008, the Academy did not support a multi-use trail through their site due to security concerns in line with the Child Protection Act 1999. These concerns mainly relate to the perceived increase in risk to Academy users as well as general security concerns. In September 2008 however, the NSW Minister for Sport and Recreation formally announced agreement for a ground-level track being built through the Sydney Academy. More information

on the Academy's concerns can be viewed in Appendix B: Stakeholder Submissions to Preliminary Options.

Like NSW Schools, the Academy's land is classified under the *Inclosed Lands Act* as the majority of their programs are child related. The Academy also partially occupies Crown Land and a lot of their activities are centred around the foreshore in their 'Activities Precinct' (Figure 4).

The 'Activities Precinct' has facilities for activities including high ropes, abseiling, archery, canoeing, rock climbing, camping and sailing. The main infrastructure constraints for the Narrabeen Lagoon Trail include the boatsheds and high risk activities including the climbing tower at the edge of Middle Creek, archery at the back of the escarpment and a high ropes course near the boundary with the Cromer Golf Club (Figure 5).



Figure 4 - Map Sydney Academy Foreshore

The main environmental constraints through the Academy Section includes the Warringah vegetation types Swamp Oak Forest (green) and Bangalay Alluvial Forest (maroon) which fall under the broader vegetation types listed as Endangered Ecological Communities (EECs) (Figure 6). Areas of high constraint are the Swamp Oak Forest in moderate condition along the foreshore and of good condition south of the boatsheds. The least represented seagrass *Zostera capricorni* is also present along the foreshore except in front of the boatsheds.

Non EEC Vegetation types in the Stage 2B study area include a patch of planted vegetation within and adjacent to the car park (blue) and Peppermint Angophora Sandstone Forest (orange) along the escarpment (Figure 6).



Boat Sheds



High Ropes Course and Archery



Climbing Tower

Figure 5 - Photos of Academy Infrastructure

The foreshore of the Academy contains a number of existing roads and pathways which could be utilised for the Narrabeen Lagoon Trail and thus reduce amount of clearing required. The ability to use this infrastructure however is subject to an agreement with the Academy.

The trail user experience through this area would be enhanced by the provision of views to the lagoon, access to the foreshore and minimising conflict and interaction with users of the Academy.

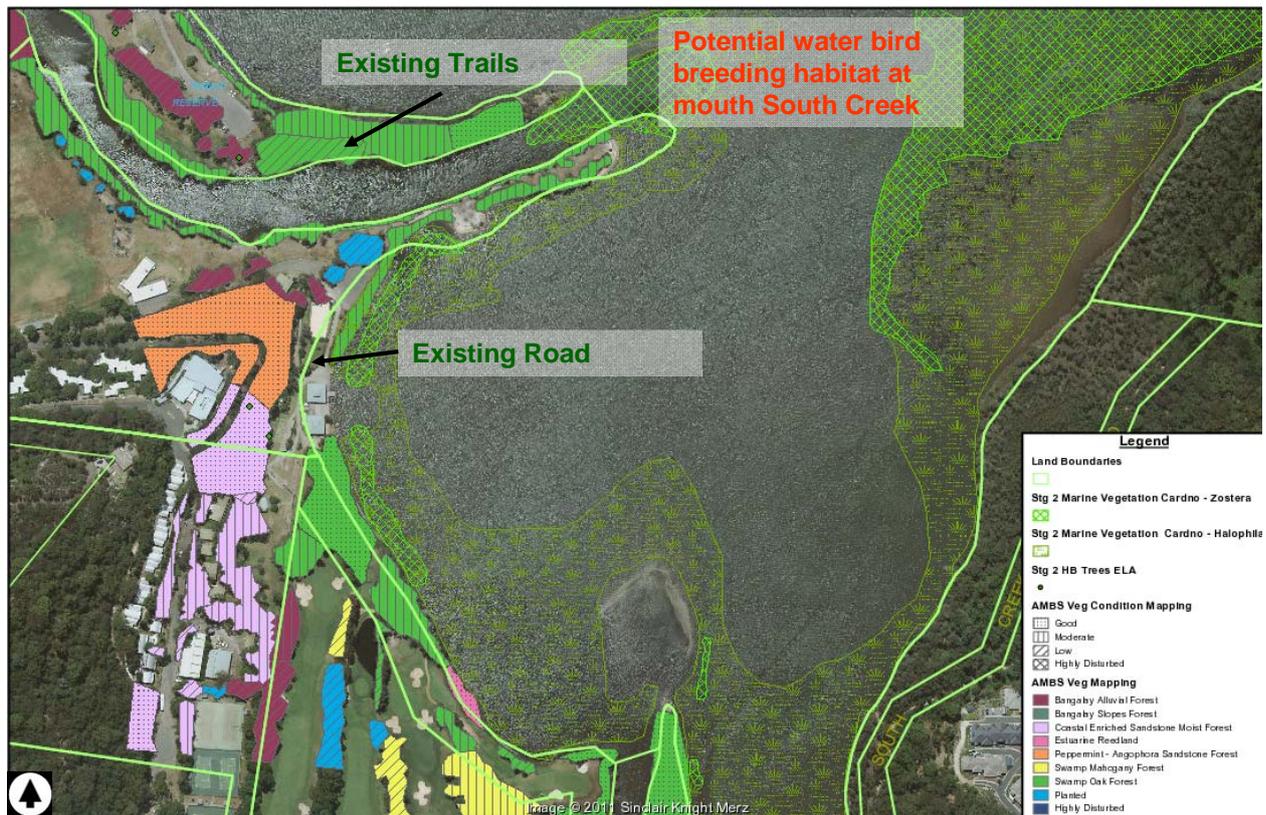


Figure 6 – Environmental Constraints Academy Section

Source: Marine Vegetation (Cardno Ecology Lab 2010 – Appendix D; Vegetation Community and Condition Mapping (GIS Data Australian Museum Business Services 2010-2011); Hollow Bearing Trees (Eco Logical Australia Appendix C)

2.2.2 Cromer Golf Club

The land occupied by Cromer GC along the foreshore of Narrabeen Lagoon and South Creek is Crown Land known as Lot 7141 DP 1124285. This land is part of Reserve 35736 which was gazetted on 09 May 1903 for public recreation and access.

The Cromer golf course was completed in 1929, after the public reserve had been established. The course has been constructed primarily on freehold land owned by the Cromer GC, but it also partially occupies the public foreshore reserve under a Permissive Occupancy agreement with the NSW Crown Lands Division (Crown Land Corridor). Their signature 15th hole, 13th tee and parts of the 16th hole are within the Stage 2B Study Area (Figure 7).

The terms of the Permissive Occupancy agreement include that it is terminable at will by the Minister and that the tenant shall not unnecessarily obstruct access by the public across the foreshore.

For many decades the public have been free to walk along the foreshore of South Creek and Narrabeen Lagoon adjoining Cromer Golf Course. The number of users has been small and most users are assumed to be locals who are more likely to understand the need for caution with golf balls in play. The entry points to this land are currently via a weir across South Creek (a potentially dangerous crossing) and from Toronto Avenue in the South.

A plan for a public access track was previously prepared and approved as a condition of Cromer GC's Development Consent 2003/0856 (DA approved public access alignment – see Preliminary Option C1 Figure 11). Construction of the approved track did not go ahead however as Council and the Cromer GC were concerned about the following safety risks:

- Passing behind the 14th Green
- Navigating around the 13th Tee
- Navigating between the 15th tee and 12th green
- Traversing along the 16th fairway

Council and the Golf Club therefore entered into a process to look at a number of options which are covered in this report.

The Cromer GC's main concerns relating to the Narrabeen Lagoon Trail include the risk of injury from golf ball strikes, protection from vandalism; preventing people from straying onto private property and retaining a high quality golf experience and in particular their signature 15th hole.



Figure 7 - Cromer Golf Club Map Land Boundaries and Layout

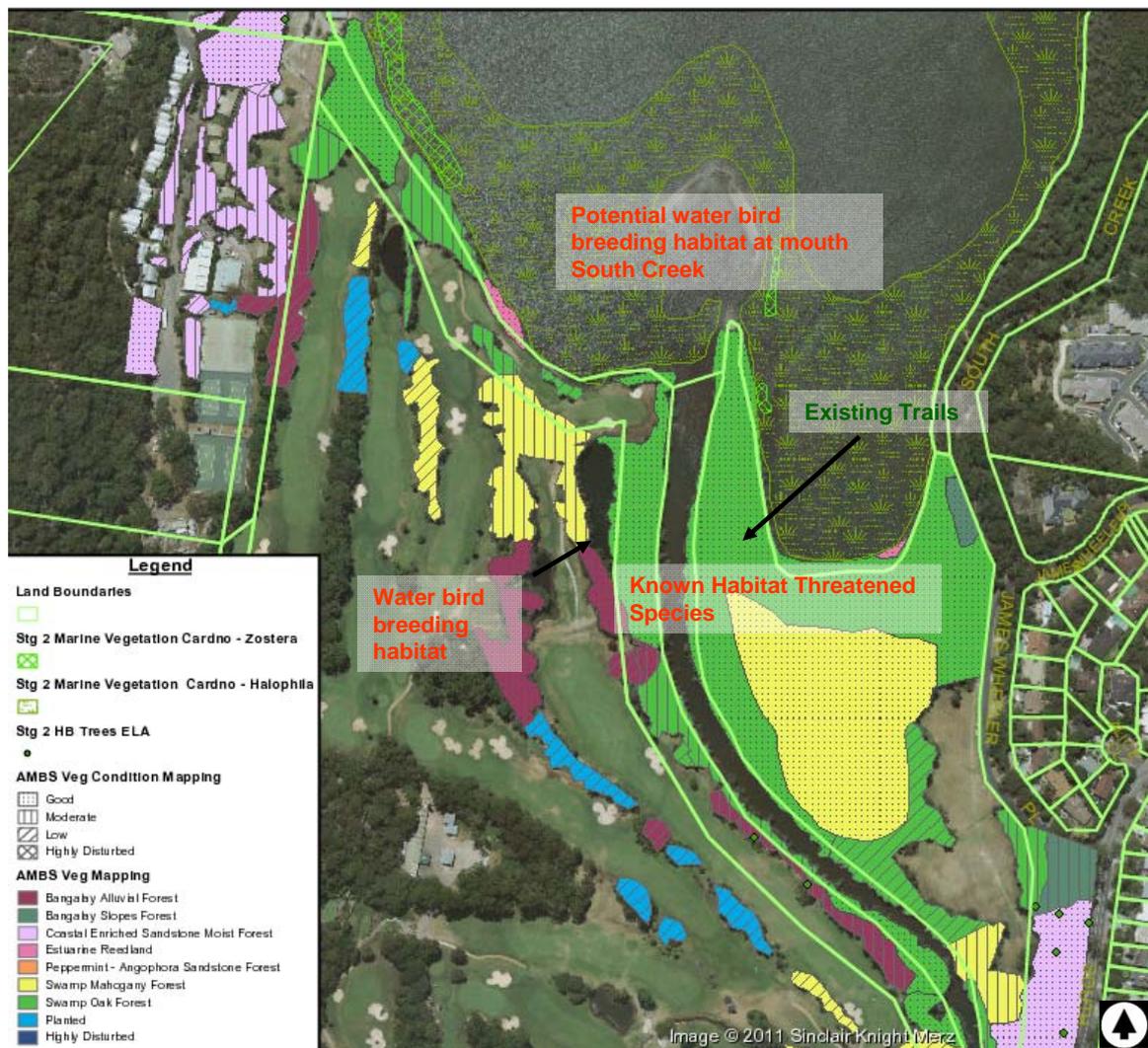


Figure 8 - Cromer Golf Club and South Creek Reserve Environmental Constraints North

Source: Marine Vegetation (Cardno Ecology Lab 2010 – Appendix D; Vegetation Community and Condition Mapping (GIS Data Australian Museum Business Services 2010-2011); Hollow Bearing Trees (Eco Logical Australia Appendix C)

The environmental constraints in the Cromer Golf Club include the Warringah Vegetation Types Swamp Oak Forest (green) and some Estuarine Reedland (pink) which fall under the broader vegetation types listed as Endangered Ecological Communities (EECs). Other EEC vegetation types are also present along the western edge of South Creek including Swamp Mahogany Forest (yellow), Bangalay Alluvial Forest (maroon) and more extensive Swamp Oak Forest (green). Most of these EECs are in moderate or good condition which demonstrates areas of high environmental constraint (Figure 8).

Several hollow bearing trees are also present along the edges of South Creek and water bird breeding habitat is identified south of the ponds and at the mouth of South Creek. The entire southern lagoon basin contains a large amount seagrasses including paddleweed (*Halophila* sp.) and a small amount of the least represented eelgrass (*Zostera capricorni*).

The 15th signature hole and the edges of the 16th fairway are mostly cleared. An opportunity exists to revegetate the western foreshore of South Creek as the foreshores of South Creek contain important habitat for threatened species including the Black Bittern.

The trail user experience through this area would be enhanced by the provision of views to the lagoon, access to the foreshore and minimising conflict and interaction with users of the Cromer Golf Club.

2.2.3 South Creek Reserve

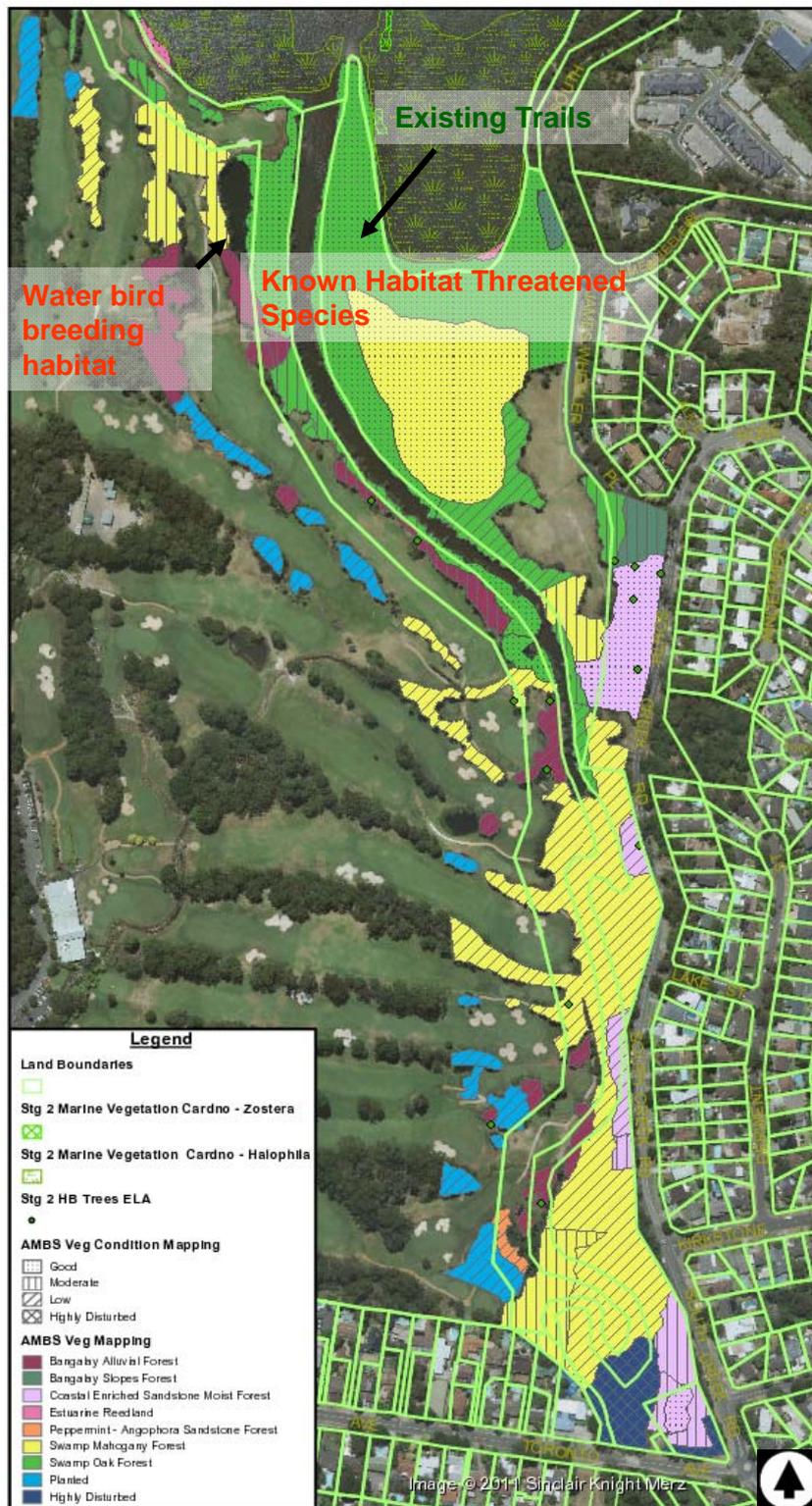


Figure 9 - Cromer Golf Club and South Creek Reserve Environmental Constraints North

Source: Marine Vegetation (Cardno Ecology Lab 2010 – Appendix D; Vegetation Community and Condition Mapping (GIS Data Australian Museum Business Services 2010-2011); Hollow Bearing Trees (Eco Logical Australia Appendix C)

South Creek Reserve comprises publicly owned land adjoining a quiet residential area on James Wheeler Place. This Reserve is currently used as an entry point to a bushland track to Jamieson Park. The objective of the Narrabeen Lagoon Multi-Use Trail is to link with this track and complete the loop around the foreshores of Narrabeen Lagoon. Council is proposing to build a new shared pathway to meet this track alongside South Creek Road, which is scheduled for construction in 2012 (South Creek Cycleway).

South Creek Reserve contains open grassed areas and dense vegetation close to the Lagoon edge. The dense vegetation comprises of Warringah vegetation types Swamp Oak Forest (green) and the more significant Swamp Mahogany Forest (yellow). A small portion of the Warringah Vegetation Type Estuarine Reedland exists close to the Lagoon's edge (pink - Figure 8). These Vegetation Types are in good condition and fall under the broader vegetation types listed as Endangered Ecological Communities (EECs) (Figure 8).

A number of existing tracks are dotted through the dense vegetation, one of which can be formalised to use with the Narrabeen Lagoon Trail allowing regeneration of the others. These tracks are currently used to access the lagoon edge (Figure 10).

The trail user experience through this area would be enhanced by the provision of views to the lagoon and experiencing the natural bushland setting. Interpretative signage can be utilised to educate trail users of the sensitive foreshore environment.



Figure 10 - Photos of South Creek Reserve - existing informal tracks and access points

2.3 Aboriginal and European Heritage

The southern edges of South Creek have high potential for unrecorded Aboriginal archaeological material and an Aboriginal site has been recorded (exact location cannot be disclosed). Advice from the Aboriginal Heritage Office confirms that none of the selected options (Part 4.1 Four Selected Options) will approach the site. The Aboriginal Heritage Office would support a crossing of South Creek so long as it is not in close proximity to the recorded site and the following conditions are met:

- A preliminary inspection is made of any proposed crossing point to determine whether there is bedrock exposed or shallowly buried by recent deposits of alluvium in the bed of South Creek at such a depth that it would have been exposed during the period when Narrabeen Lagoon was tidal.
- Any footings that need to be excavated/cut into original ground surface to be monitored by AHO and/or Metropolitan Local Aboriginal Land Council.

- Provisions included in contracts to allow for 'stop work' orders in case of Aboriginal heritage material being uncovered.

No European Heritage sites are identified within the Stage 2B Study Area.

Council will look into providing interpretive signage to highlight Aboriginal Heritage once the trail loop is completed.

3. Option Development Round 1

3.1 Preliminary Options

In 2008, the Minister for Sport and Recreation agreed to the establishment of an on-ground Narrabeen Lagoon Multi-Use Trail along the foreshore adjoining the Sydney Academy of Sport and Recreation, with conditions. This agreement was required as most of the potential trail routes required access to cross Academy land and the agreement permitted Council to enter into negotiations with relevant stakeholders over the remaining links of the trail.

To gain an understanding of the stakeholder impacts Council held a consultative workshop in November 2008 with Public Authorities, the Academy and the Cromer GC. Preliminary Options as set out below were presented and discussed and Council obtained written submissions from the various stakeholders outlining their issues and concerns (refer Figure 11 and Appendix B: Stakeholder Submissions to Preliminary Options).



Preliminary Option C1 (DA approved public access alignment through Cromer GC)



Preliminary Option C2



Preliminary Option C3



Preliminary Option C4



Preliminary Option C5



Preliminary Option C7



Preliminary Option S2



Preliminary Option S3

Figure 11 - Preliminary Options (for larger plans see Appendix A: Preliminary Options Plans)

3.1.1 Flora and Fauna Assessment

Council engaged the services of Eco Logical Australia (ELA) to undertake a Flora and Fauna Assessment (including a review of the preliminary options) which was finalised in June 2010 (Appendix C: Flora and Fauna Assessment). A Flora and Fauna Assessment is a preliminary ecological assessment that is undertaken to determine whether a proposal is likely to have significant impact on threatened flora and fauna. The outcome of this assessment determines whether a more comprehensive Species Impact Statement is required. This Flora and Fauna Assessment included:

- A survey of the vegetation communities to inform the 7 part test (Figure 13). Note this map has been superseded by more recent mapping (see Part 4.4.1).
- An informal ranking of all preliminary options in terms of their potential short-term and long-term impact to known and potential habitat for threatened and migratory biodiversity as listed on the NSW Threatened Species Conservation Act 1995 (TSC Act) and/or Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and other native habitat (Figure 11);
- A Flora and Fauna Assessment assessing the impact of the proposed trail footprint shown in Option C7 (Figure 13). Option C7 was selected for the assessment as Council needed to determine the likelihood of significant impact for the trail route considered to have the most impact on foreshore habitat, in particular South Creek Reserve.
- Recommendations for (at least) 3 on-ground trail routes which aim to avoid and minimise the above potential impacts.
- Through ranking the impact of all preliminary options, ELA found that Option C3 had the most impact on foreshore vegetation.

Without mitigation measures, Option C1 (the DA approved public access track) and Option C2 had the least impact on foreshore ecology.

It was determined that Option C7 had a high impact on foreshore ecology mainly due to traversing through the vegetation within South Creek Reserve. However, the assessment of C7 found this alignment was unlikely to have significant impact on threatened flora and fauna if the design controls were implemented. Design controls included raising the trail and fencing to prevent predation on native fauna by domestic dogs. This outcome meant that Council may not have to undertake a Species Impact Statement if Option C7 was selected with the design controls.

This assessment demonstrates that Preliminary Options C1 and C2, as well as Option C7 (through the vegetation within South Creek Reserve), with appropriate amelioration measures, were the most viable terrestrial options to consider through the options development process.

3.1.2 Aquatic Ecological Investigations

Council engaged Cardno Ecology Lab to prepare an Aquatic Ecology Constraints Assessment Report which was finalised in June 2010 (Appendix D: Aquatic Ecology Constraints Assessment). This report included:

- a) A survey of the subject area (see Figure 12) which found extensive seagrasses including paddleweed (*Halophila* sp.) and eelgrass (*Zostera capricorni*). The *Zostera* was the least represented seagrass, and was found to contain the hairy pipefish which is protected under the NSW *Fisheries Management Act* (1994).
- b) A ranking of all Preliminary Options (Figure 11) in terms of their potential short-term and long-term impact to known and potential habitat for threatened and migratory biodiversity as listed on the NSW *Fisheries Management Act* (1994); the TSC Act and/or the EPBC Act and other native aquatic habitat;
- c) Recommendations for (at least) 1 trail route within the Lagoon which aims to minimise the above potential impacts;
- d) Recommendations for the most appropriate locations for bridge crossings across Middle and South Creeks.

The conclusion from this report was that Preliminary Option C7, which was the shortest in-water route, was found to have the least impact of all the in-water options. This was because Option C7 was considered to have the least impact on *Zostera capricorni*.

It was recommended that Preliminary Options C4, C5, S2 and S3 be excluded from further analysis as these options had the most impact on seagrasses and involved extensive in-water boardwalks resulting in greater environmental impacts and costs.

A potential boardwalk location was recommended by Cardno Ecology Lab in front of the Academy, as this location had the least impact on seagrasses. Despite this fact the option was not determined to be feasible as it restricted boat access.

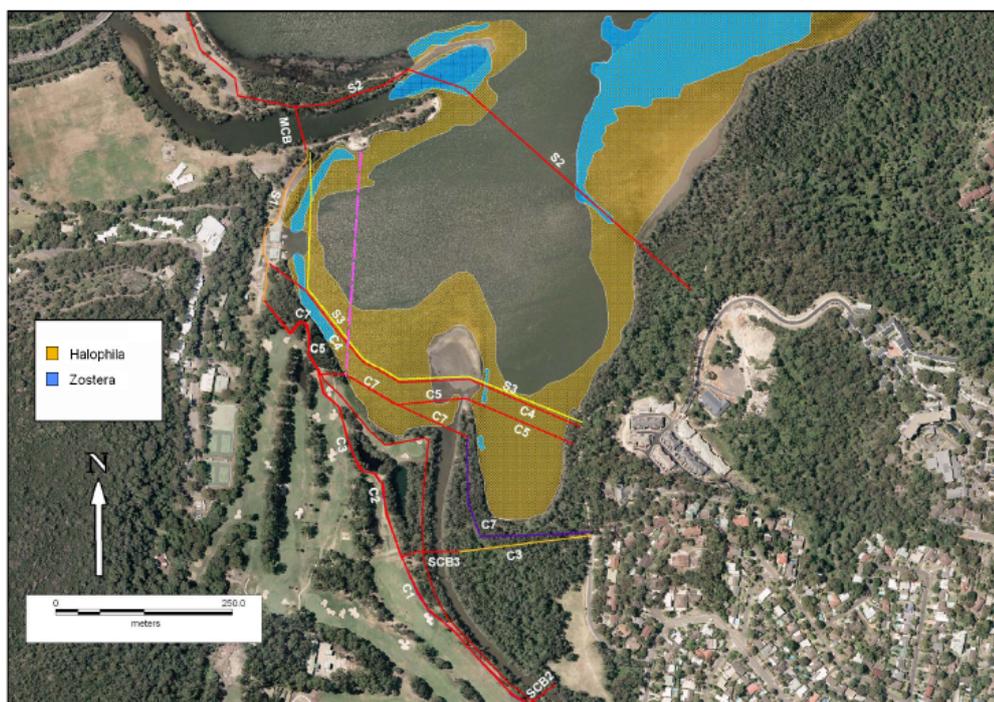


Figure 3. Seagrass distribution in the study area at Narrabeen Lagoon, mapped in the field by Cardno Ecology Lab on 27 April 2010. Red and yellow lines indicate trails C1 – C7 and S1 – S3; broken pink line indicates potential alternate boardwalk alignment.

Figure 12 - Seagrass Distribution Mapped by Cardno Ecology Lab June 2010

Option C7

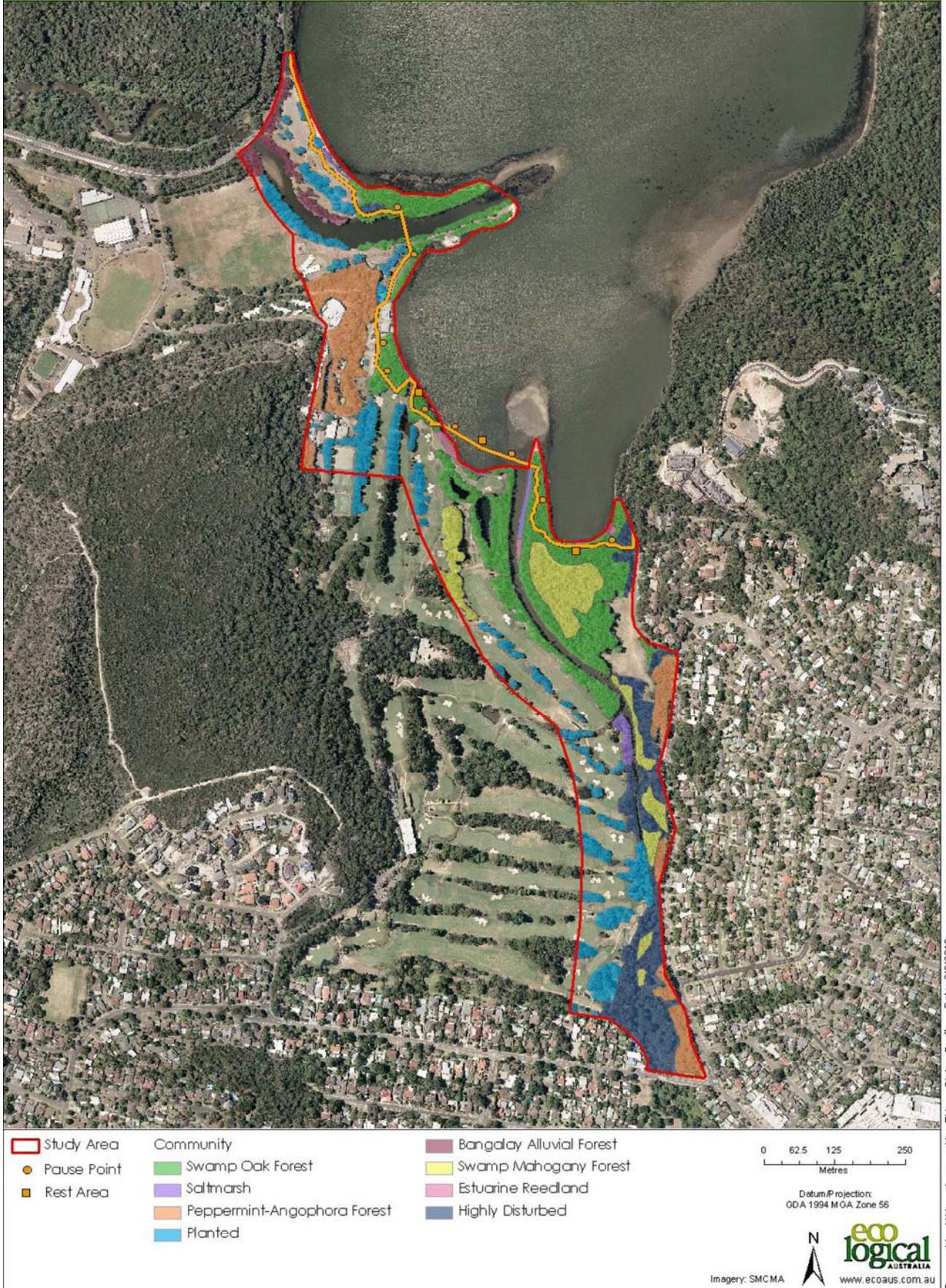


Figure 13 - Option C7 Assessed under Eco Logical Australia's Flora and Fauna Assessment (June 2010)

Source: Ecological Australia, Flora and Fauna Assessment June 2010, Figure 1 (refer Appendix C: Flora and Fauna Assessment)

3.1.3 Geotechnical Investigations

Jeffery & Katauskas (J&K) Pty Ltd (TBLD subconsultants) produced a ‘Desk Study and Geotechnical Walkover Survey Proposed Narrabeen Lagoon Multi-Use Trail – Stage 2B’ (November 2010 -refer Appendix N: Geotechnical Report). The report was based on Council’s Option C7 (1:7000 scale aerial photograph) and a site walk over with TBLD (29 October 2010) assessing geotechnical issues associated with potential proposals.

J&K divided the site into six sections (A-B, B-C, C-D, etc) identified on Figure 1 in their report, and site photographs were recorded in the Photography Portfolio. J&K made estimations of geotechnical subsurface site conditions, based on review of geological maps, and assessing previous subsurface information from nearby geotechnical investigations and geotechnical mapping. The results of these investigations are summarised in Table 1 of their report.

J&K also conducted geotechnical investigations for the proposed multi-use trail for Stage 1 which informed their geotechnical report. It was found that the natural soils presented a high risk of generating acid sulphate soil conditions if exposed to air. Additionally high ground water levels and collapsible nature of soil profile restricts the selection of suitable footing systems, hence driven timber pile footings were chosen for Stage 1 boardwalk construction and recommended for any boardwalk sections in Stage 2B. Also noted was the possibility of soft clay bands within the loose alluvial sands.

Once the Stage 2B Preferred Option trail alignment has been selected J&K will conduct detailed geotechnical investigations and prepare a report with recommendations for construction.

3.2 Exploratory Options

In September 2010 Thompson Berrill Landscape Design (TBLD) were appointed as Council’s principal design consultant for the NLMUT. TBLD, in conjunction with Council, undertook comprehensive site investigations and analysis to physically, functionally and visually assess the study area. Council’s Preliminary Options were reviewed together with the ecological assessments undertaken in early 2010 (discussed in Part 3.1.1 and 3.1.2). From this review TBLD prepared nine Exploratory Options (Figure 14) incorporating comments from stakeholders and specialist sub-consultants (geotechnical, structural and civil engineers).

A detailed analysis and stakeholder consultation was undertaken to evaluate the advantages and disadvantages of each Exploratory Option. The results have been provided in a comparison table in Appendix F: Exploratory Options Matrix.



Exploratory Option 1



Exploratory Option 2



Exploratory Option 3



Exploratory Option 4



Exploratory Option 5



Exploratory Option 6



Exploratory Option 7



Exploratory Option 8



Exploratory Option 9 (DA approved public access alignment through Cromer GC)

Figure 14 - Exploratory Options (see Appendix F: Exploratory Options Matrix for larger plans)

3.3 Council Conclusions from Round 1 Option Development

A substantial understanding of the opportunities for the trail route was gained by Council through the Preliminary and Exploratory Options development process, including the site constraints and the concerns of stakeholders.

The Cardno report on Aquatic Ecology for example highlighted sensitive seagrass areas and generally recommended against over-water structures or at least minimising encroachment into the lagoon and established seagrass areas.

It was also established after consideration of environmental factors that the route along the Lagoon edge to avoid the Swamp Oak Forest at the border of the Academy and Cromer Golf Club, as shown in Exploratory Options 2,3,4,6,7 & 8 is likely to have a higher impact than terrestrial routes through the Swamp Oak Forest. This is because the Lagoon edge provides important habitat for migratory birds and a trail along the edge would impact on two ecological zones, both aquatic and terrestrial. The aquatic ecology along here contains paddleweed (*Halophila* sp.) and the more significant eelgrass (*Zostera capricorni*) (Figure 12).

Such considerations shaped the selection of a limited number of Selected Options to take into more detailed concept development and consultation, as set out in the following section. In some cases, selected routes have retained over-water or other elements that might otherwise have been rejected, in order to provide a wider range of alternatives for consideration or to respond to the advocacy of key stakeholders.

4. Options Development Round 2

4.1 Four Selected Options - Overview

Following Council review of the Preliminary and Exploratory Options and feedback from stakeholders, four options were selected for further development and assessment. These selections were based on what appeared to be the most optimal trail configurations from the assessments completed to that time, or otherwise were selected to provide a range of alternatives for community consideration and benchmarking (see Figure 16).

An assessment of these Four Selected Options was undertaken and Information Packs were developed for the Community Engagement Process (refer to Part 4.2 Community and Stakeholder Engagement and Appendix H: Community Information Packs for Workshop).

For ease of describing and understanding the physical extent of the options, each option was divided into the following broad sections (see Figure 15);

- Academy
- Cromer GC
- South Creek Reserve



Figure 15 - Key Map of Stage 2B Sections

The following section of the Options Report provides a description of the four selected options and Council's review of the advantages and disadvantages of each. This is followed by a

summary of community consultation outcomes, cost estimates, environmental assessments and risk assessment.

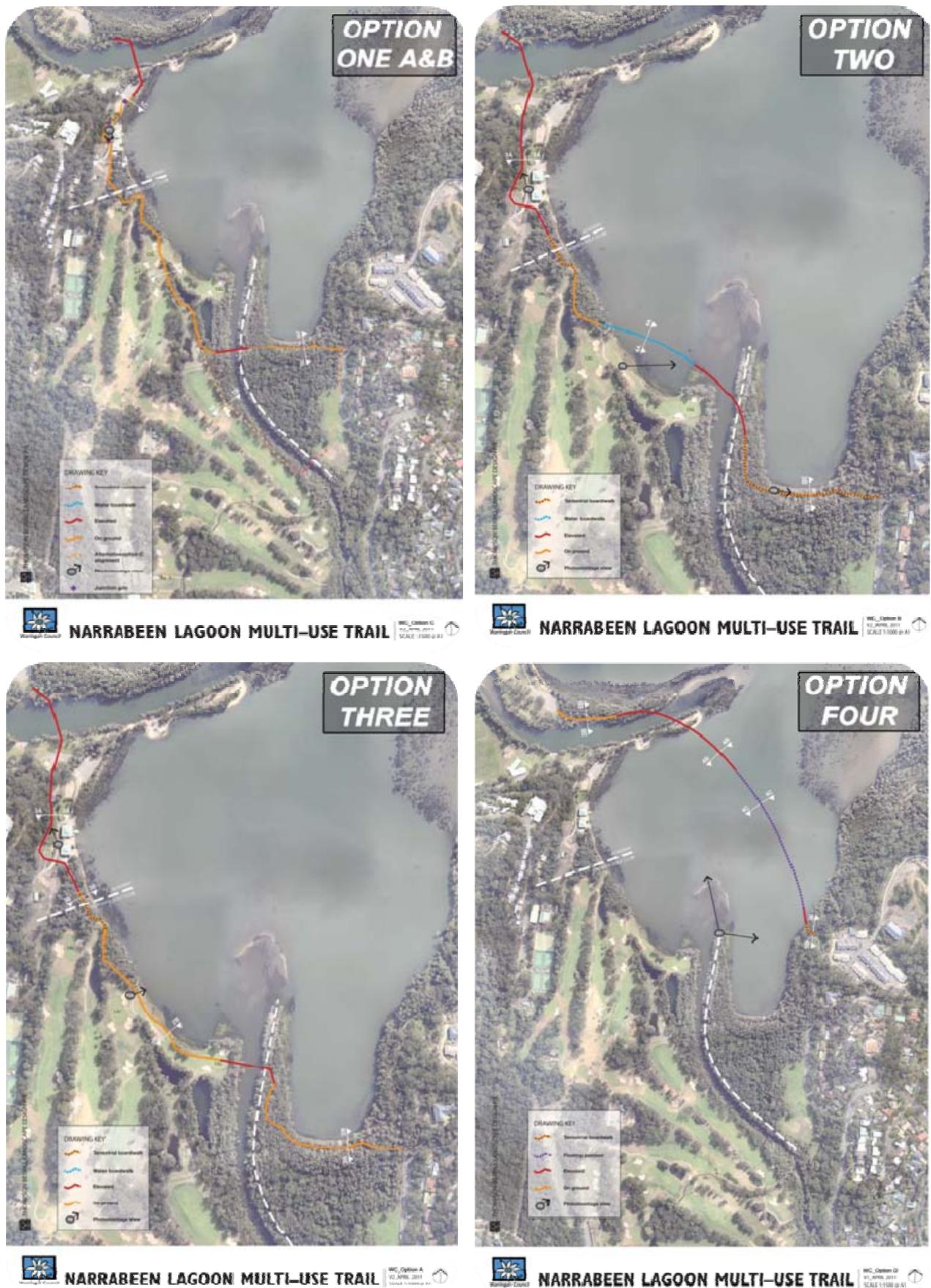
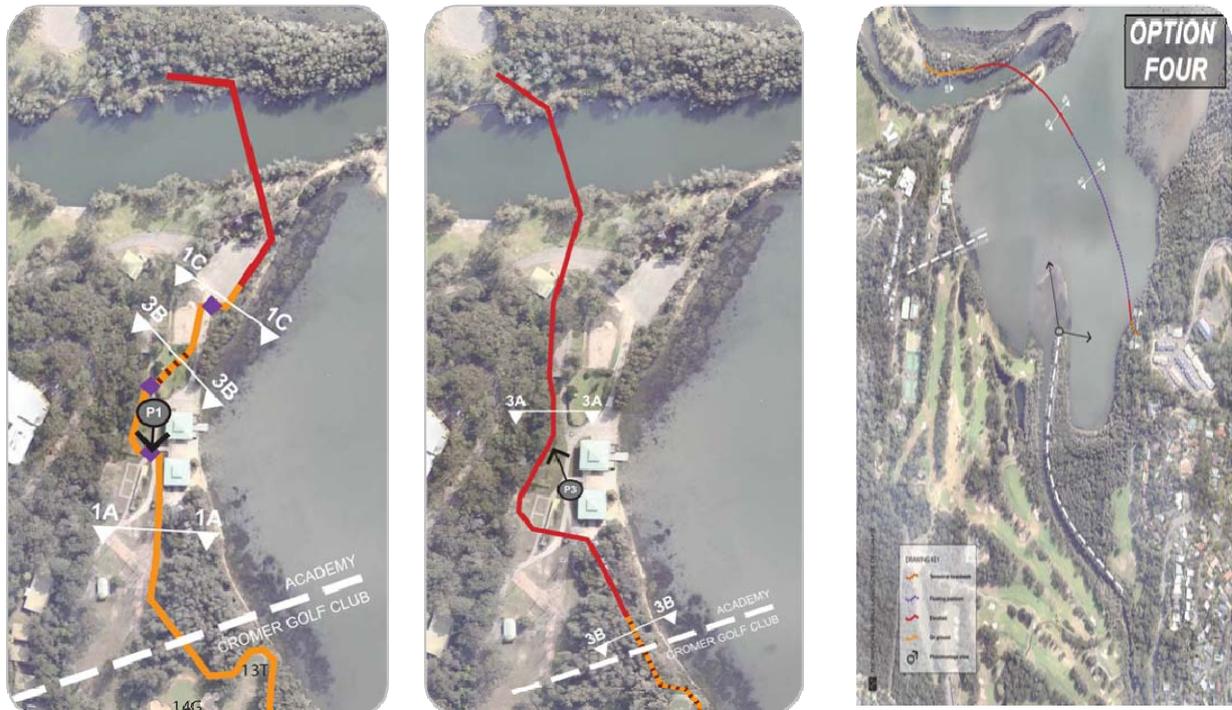


Figure 16 - Four Selected Options

4.1.1 Academy Section Review

Three options were considered for the Academy Section, as Options Two and Three had the same alignments through the Sydney Academy (see Figure 17). Option Four bypasses the Academy, Cromer GC and South Creek Reserve therefore it is discussed in this Part of the report and referred to in the Cromer GC and South Creek Reserve sections.

The plans and montages are shown here as well as in Appendix I: Selected Options Plans and Appendix J: Selected Options Montages. Detailed sections can be viewed in Appendix K: Selected Options Details.



Academy Option One

Academy Options Two & Three

Option Four

Figure 17 – Academy Selected Options

Academy On-ground Option One

Brief Description: The trail alignment consists of an on-ground trail through the Academy, connecting to a Middle Creek bridge crossing east of the existing Climbing Tower. The on-ground trail alignment has been located to minimise impacts on the Academy operations. The trail has been designed with security palisade fences to both sides and a minor section of boardwalk. Junction gates are proposed to permit the Academy staff and users to cross the trail and prevent trail users from entering the Academy (see Figure 18 and Figure 19).



P1 – Photomontage of On-ground Trail with gates

Figure 18 - Photomontage of Academy On-ground Option One

Advantages

1. Lowest cost option (refer Part 4.3 Cost).
2. Agreement exists with the Minister for Sport and Recreation for an on- ground route.
3. Primarily utilises Crown Land.
4. Low terrestrial and aquatic environmental impacts.
5. Low geotechnical issues.
6. Minimal disturbance to fauna habitat.

Disadvantages

1. Agreement with Minister requires Council to provide security fencing and night closure, which has a negative impact on the trail user experience.
2. Moderate operating ongoing management costs due to junction gate operation and bridge closure.
3. Trail users are enclosed by high fences and required to stop when junction gates open.
4. Vegetation clearance of EEC in Middle Creek Reserve for bridge approach ramps.
5. Trail users brought in close proximity to high risk Academy activities including Climbing Tower and High Ropes Course, creating distractions/ disturbance to Academy users.



Figure 19 - Academy Option One Alignment

Academy Elevated Option Two & Three

Brief Description: The trail alignment utilises a westerly bridge alignment, with the elevated height maintained through the Academy section as an elevated trail from a bridge over Middle Creek. The trail alignment follows along the base of the escarpment to the back of the existing toilet block, traversing along the edge of existing tree line, before returning towards the lagoon foreshore through the existing Archery Range (which is to be relocated/ removed). The trail then descends to a terrestrial boardwalk through the existing boat storage area and the Swamp Oak Forest towards Cromer GC (see Figure 20 and Figure 21).



Figure 20 - Photomontage of Academy Elevated Option Two & Three

Advantages

1. Separation between Trail and Academy activities and users.
2. Trail users able to view Academy's activities from safe distance, with minimal interference.
3. Provides views over Lagoon from elevated deck, creating a good user experience.
4. Closure of trail at night may be avoided.
5. Least vegetation clearance in Middle Creek Reserve for bridge approach ramps.
6. Minor clearance of vegetation along Academy escarpment (not an EEC).
7. Low aquatic impacts.

Disadvantages

1. More expensive than on-ground option (refer Part 4.3 Cost).
2. Vegetation clearance of EEC in Academy south of existing boat storage area.
3. Terrestrial boardwalk in close proximity to lagoon edge (a 10m offset is recommended to reduce impacts).
4. Minor disruption to Academy's infrastructure.
5. Takes public away from foreshore and is located mostly on Academy land.



Figure 21 – Academy Option Two & Three Alignment

Academy Over-water Option Four

Brief Description: The elevated trail crosses the lagoon which connects to an existing walking trail leading to Jamieson Reserve. The trail alignment extends from Middle Creek Reserve to the end of the spit, ramping up to form a bridge crossing over Middle Creek. A 90m long section of elevated overwater boardwalk at the western extremity is included to allow limited boat access underneath (excluding sailing boats, as the clearance would not be sufficient). The elevated overwater boardwalk then ramps down to a floating pontoon to reduce visual impacts, which rises and falls with the varying lagoon levels, before ramping up to connect to the existing walking trail to Jamieson Reserve (see Figure 22 and Figure 23)



P5 – Photomontage of Bridge and Floating Pontoon

Figure 22 - Photomontage of Option Four

Advantages

1. Use of floating pontoons (if viable) to minimise visual impact.
2. By passes Academy, Cromer GC and South Creek Reserve.
3. Allows trail users to traverse 'over' the Lagoon.

Disadvantages

1. High cost for construction (refer Part 4.3 Cost).
2. High costs for ongoing maintenance.
3. Disturbance to EEC at Middle Creek Reserve and eastern foreshore.
4. Disturbance to water birds at mouth of Middle Creek.
5. Difficult construction.
6. High aquatic impacts on Lagoon ecology from erosion and during construction.
7. Requires lighting and creates obstruction for watercraft.
8. Visual impact on 'natural' vista of Lagoon.
9. Creates perception of 'private' section of Lagoon for Academy users.
10. May create potential conflicts between anglers and trail users.



Figure 23 - Option Four Alignment

4.1.2 Cromer Golf Club Section Review

A total of 5 options were considered for the Cromer GC Section, as Option One was divided into Option One-A and One-B (see Figure 25 which excludes Option Four detailed in Part 4.1.1).

Option 3 requires the relocation of Cromer GC's signature 15th hole. Before identifying this as a Selected Option, Council engaged the Cromer GC's nominated golf course architect to explore alternative course layout concepts. The purpose being to investigate and satisfy Council and the Cromer GC that alternative design configurations were available that could maintain the standard of the course if the 15th hole was relocated. (Appendix G: Golf Course Layout and Alternative Re-alignments). The alignment below was nominated by Cromer GC's Board as the most acceptable of those presented by Council, and this scheme has therefore been used for planning purposes (Figure 24). Once Council's position on the trail route has been confirmed the Cromer GC is expected to further investigate options for the redesign.

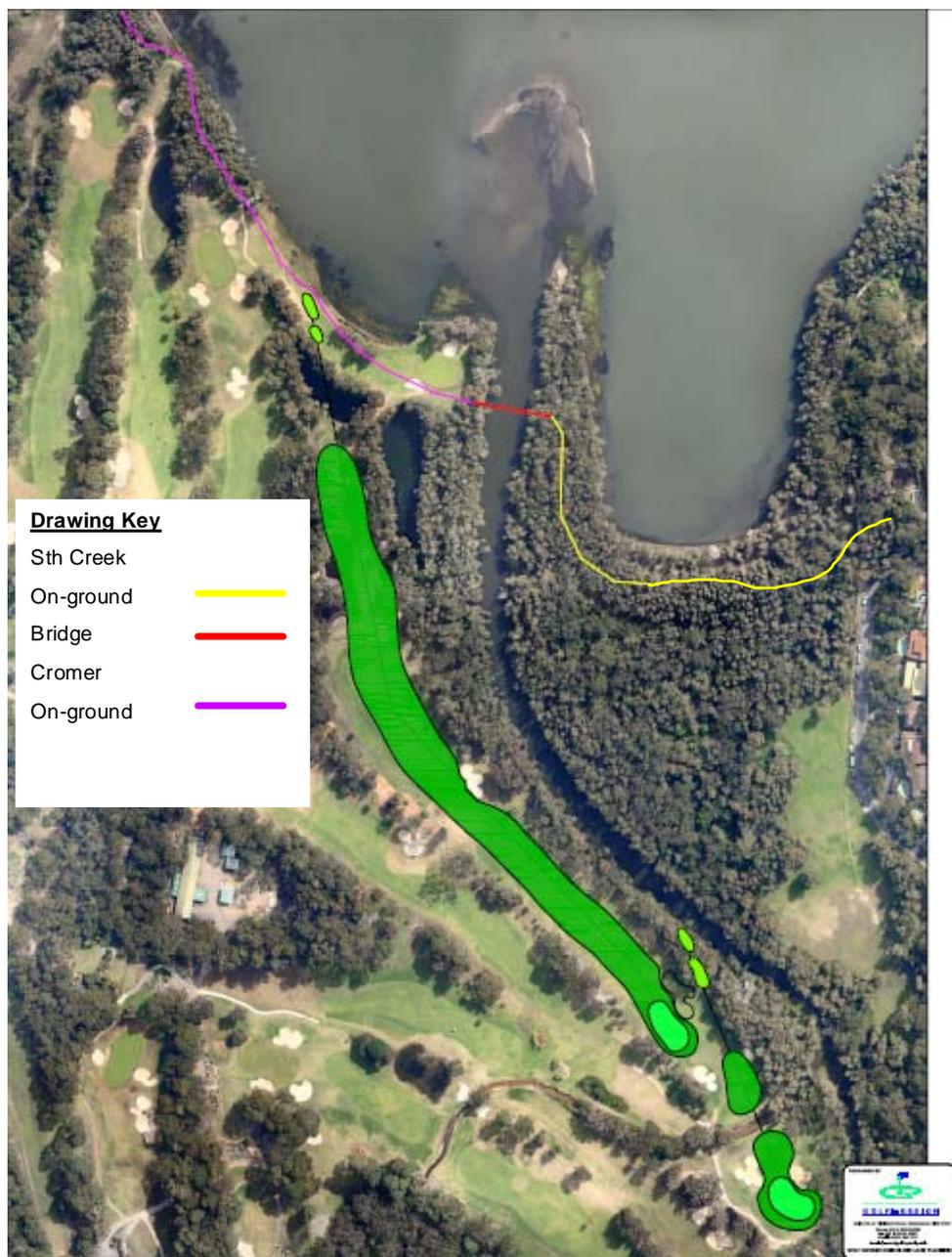


Figure 24 – One of the Cromer Golf Club's re-alignment options

Source: Golf By Design, Date 17/12/10, Dwg No 0210-10-06. Cromer Golf Club – Foreshore Walk – Conceptual Alignment Option 6

The plans and montages through the Cromer GC section are shown below as well as in Appendix I: Selected Options Plans and Appendix J: Selected Options Montages. Detailed sections can be viewed in Appendix K: Selected Options Details.



Figure 25 - Cromer Golf Club Selected Options excluding Option Four

Cromer Golf Club On-ground Option One-A

Brief Description: The trail alignment consists of an on-ground trail through the Cromer GC, following an existing informal track from the Academy boundary, to the back of the 14th green and 13th tee. It then continues along the approved public access alignment under the Cromer GC's approved Development Consent DA2003/0856. At the southern end of Cromer GC's largest pond near the 16th tee, the trail traverses through dense bushland, and ramps up to a bridge over South Creek (see Figure 26).

Advantages

1. On-ground is low cost (refer Part 4.3 Cost).
2. Low clearance of EEC at Academy/Club interface.
3. Utilises part of the existing approved public access alignment.
4. Low aquatic impacts and geotechnical risks.

Disadvantages

1. Dangerous golf course cross-over point between 12th green and 15th tee requiring trail users to stop.
2. Increases the risk of trail users wandering onto Golf Course and being exposed to golf ball strikes.
3. Moderate Impact on Water Bird Breeding Habitat at Golf Course Pond.
4. Trail departs from the lagoon foreshore.
5. High impact on EECs and dissection of existing fauna habitat on edge of South Creek.
6. Located in close proximity to fauna habitat areas.



Figure 26 - Cromer Option One-A Alignment

Cromer Golf Club On-ground Option One-B

Brief Description: The trail alignment consists of an on-ground trail through Cromer GC, following an existing informal track from the Academy boundary, to the back of the 14th green and 13th tee. It then continues along the approved public access alignment under the Cromer GC's DA2003/0856. The trail continues along the existing Golf Course 2003 DA approved public access alignment to ramp up to a bridge over South Creek just north of the 16th green (see Figure 27).

Advantages

1. On-ground is low cost (refer Part 4.3 Cost).
2. Low clearance of EEC at Academy/Club interface.
3. Utilises part of the existing DA approved public access alignment.
4. Low aquatic and environmental impacts
5. Requires less clearance of EEC on edge of South Creek.

Disadvantages

1. Dangerous golf course cross-over point between 12th green and 15th tee requiring trail users to stop.
2. Increases the risk of trail users wandering onto Golf Course and being exposed to golf ball strikes.
3. Moderate Impact on Water Bird Breeding Habitat at Golf Course Pond.
4. Trail departs from the lagoon foreshore.
5. Close proximity of trail to golf course, requiring a significant amount of fencing to protect trail users from golf balls.
6. Diverts public away from lagoon foreshore and lengthens route.
7. Located in close proximity to identified hollow bearing trees (2.2.3 South Creek Reserve).
8. Moderate cost (refer Part 4.3 Cost).

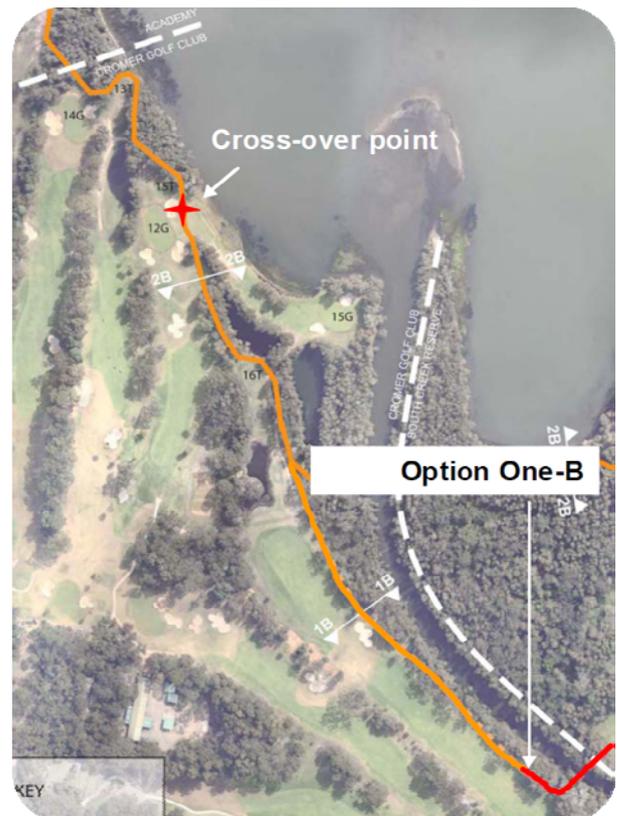


Figure 27 - Cromer Option One-B Alignment

Cromer Golf Club Over-water Option Two

Brief Description: The Trail alignment consists of a terrestrial boardwalk (set back from the Lagoon edge) to the back of the 13th tee, linking to the existing concrete on-ground path. The trail then diverts at the 15th tee to an over-water boardwalk which ramps up to a bridge over South Creek (see Figure 28 and Figure 29).

Advantages

1. Increased separation between trail and Cromer GC users, improving safety and reducing conflicts.
2. No golf course cross-over point, therefore trail users don't have to stop.
3. Enables trail users to go 'over' lagoon, enhancing trail user experience.

Disadvantages

1. High construction costs (refer Part 4.3 Cost).
2. High maintenance costs.
3. Difficult construction.
4. Minor impact on EEC in moderate condition at Academy/Club interface.
5. Higher disturbance to water birds at mouth of South Creek.
6. High aquatic impact on Lagoon ecology for over-water boardwalk.
7. Reduced, but not eliminated risk of golf ball strikes.
8. Visual impact of over-water boardwalk structure in a natural setting.



Figure 28 - Cromer Option Two Alignment



Figure 29 - Photomontage of Cromer Golf Club Option Two

Cromer Golf Club On-ground Option Three

Brief Description: Trail alignment consists of a terrestrial boardwalk (set back from the Lagoon edge) to the back of the 13th tee, linking to the existing concrete on-ground path. The golf course would require redesign (by suitable expert) to relocate the 15th hole to allow the trail to continue along the Crown Land corridor on the Lagoon's southern foreshore (see Part 2.2.2 Cromer Golf Club Section Review

From the existing 15th green location the trail ramps up to a bridge over South Creek (see Figure 30 and Figure 31).

Council engaged the Cromer GC nominated golf course design firm to explore course redesign options and to demonstrate that a course reconfiguration is achievable that still provides a high quality course. A number of possible layouts were presented to the Club's board and Council is

satisfied based on the response received and its own investigations that an acceptable alternative golf layout is achievable (see Appendix G: Golf Course Layout and Alternative Re-alignments).

Advantages

1. Moderate cost for trail construction (refer Part 4.3 Cost).
2. Good walking experience for trail users traversing along lagoon foreshore.
3. Provides an opportunity to revegetate foreshore land.
4. Separates Cromer GC and trail users, reducing conflicts.
5. Less risk golf ball strikes, increasing safety and reducing the need for safety fencing.
6. Less vegetation clearance of western foreshore of South Creek.
7. Utilises Crown Land corridor.
8. Good access for bridge and trail construction.
9. Low aquatic and terrestrial impacts, and low geotechnical risk.



Figure 30 - Cromer Option Three Alignment

Disadvantages

1. Minor impact on EEC in moderate condition at Academy/Club interface.
2. Some disturbance to water birds at mouth of South Creek.
3. Requires redesign and construction of golf course (estimated as \$550,000+), as 15th hole is required for trail alignment.



Figure 31 - Photomontage of Cromer Golf Club Option Three

Cromer Golf Club Over-water Option Four

Refer to Part 4.1.1 Academy Section Review Academy Over-water Option Four which discusses Option Four.

4.1.3 South Creek Reserve Section Review

A total of 5 options were considered for the South Creek section. These alignments were largely determined by the alignment through the Cromer GC and crossing point over South Creek. Option Two followed an alignment through South Creek Reserve using an elevated boardwalk over existing trails. Option One-A and Option Three followed essentially the same alignment as Option Two however these options were on-ground. Each of these options require a partial widening of an existing informal trail (see Figure 32 which excludes Option Four detailed in Part 4.1.1 Academy Section Review).

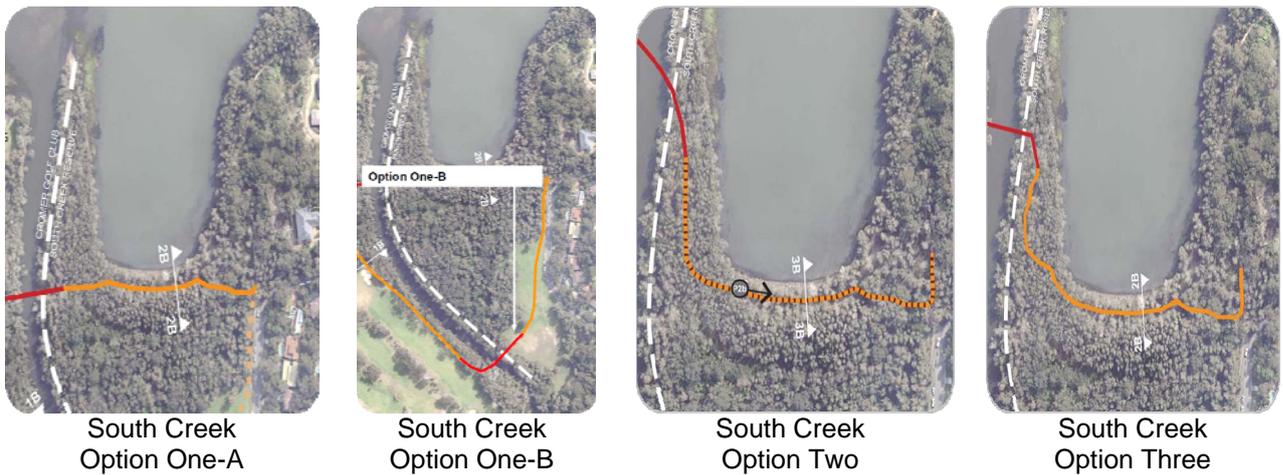


Figure 32 - South Creek Reserve Selected Options Excluding Option Four

South Creek On-ground Option One-A

Brief Description: Trail alignment consists of an on-ground trail (constructed on structural fill) raised to 1.3m AHD, with drainage culverts to allow natural surface water to flow between the reserve and the lagoon. The trail is positioned along an existing informal track through South Creek Reserve, through Swamp Oak Forest, with views to the lagoon. The trail then connects with the existing walking trail to Jamieson Park (see Figure 33).

Advantages

1. On-ground is low cost (refer Part 4.3 Cost).
2. Utilises existing trails.
3. Fencing can keep users to the path, restricting access to EECs.
4. Regeneration of existing informal trails can occur by formalising one defined trail route.
5. Pleasant walking experience close to lagoon foreshore.
6. Low aquatic impacts.
7. On-ground trail can be raised on fill with drainage culverts to reduce impacts to existing hydrology and EECs..

Disadvantages

1. Aligns with an unsafe route through the Golf Course.
2. Some clearance of EEC required to widen informal tracks and allow bridge construction.
3. Dissects existing fauna habitat on eastern side of South Creek.
4. On-ground trail needs to be raised on fill with drainage, with potential impacts to existing hydrology and EECs.
5. Increased traffic in South Creek Reserve has potential to disturb fauna.
6. Bridge construction access is required through vegetation via an on-ground trail.



Figure 33 - South Creek Option One-A Alignment

South Creek On-ground Option One-B

Brief Description: Trail alignment ramps down from a Bridge over South Creek to an on-ground trail through the open grassed area of South Creek Reserve. It then connects at the northern end of the reserve with the existing walking trail to Jamieson Park (see Figure 34)

Advantages

1. Utilises existing cleared areas.
2. Minimal vegetation clearance and disturbance to EECs.
3. Mostly avoids impacts to fauna habitat.
Lowest cost option (refer Part 4.3 Cost).
Good access for construction.

Disadvantages

1. Aligns with an unsafe route through the Golf Course.
2. Creates environmental disturbance to longer section of South Creek.
3. Takes trail users away from Lagoon foreshore edge.
4. Trail in close proximity to quiet residential area.
5. Aligns with a dangerous route alongside the 16th fairway of the Cromer GC.



Figure 34 - South Creek Option One-B Alignment

South Creek Boardwalk Option Two

Brief Description: Trail alignment consists of a terrestrial boardwalk (constructed on small diameter piles) raised to 1.3m AHD, allowing natural surface water flows and fauna movement. The trail alignment is positioned along an existing informal track through South Creek Reserve, through Swamp Oak Forest, with views to the lagoon. The trail then connects with the existing walking trail to Jamieson Reserve (see Figure 35 and Figure 36).



Figure 35 - Photomontage South Creek Reserve Option Two

Advantages

1. Utilises existing trails for boardwalk.
2. Elevated trail keeps users to path, restricting access to EECs and protecting threatened fauna.
3. Regeneration of existing informal trails can occur by formalising one defined trail route.
4. Pleasant walking experience close to lagoon foreshore.
5. Low aquatic impacts.

Disadvantages

1. High construction cost (refer Part 4.3 Cost).
2. Some clearance of EEC required to widen informal tracks and allow bridge construction.
3. Dissection of fauna habitat on eastern edge of South Creek.
4. Bridge construction access is required through vegetation via an on-ground trail.



Figure 36 - South Creek Option Two Alignment

South Creek On-ground Option Three

Brief Description: Trail alignment consists of an on-ground trail raised to 1.3m AHD, with drainage culverts to allow natural surface water to flow between the reserve and the lagoon. The trail alignment is positioned along an existing informal track through South Creek Reserve, through Swamp Oak Forest, with views to the lagoon. The trail then connects with the existing walking trail to Jamieson Reserve (see Figure 37).

Advantages

1. On-ground is moderate cost (refer Part 4.3 Cost).
2. Utilises existing trails.
3. Fencing can keep users to the path, restricting access to EECs and protecting threatened fauna.

4. Regeneration of existing informal trails can occur by formalising one defined trail route.
5. Pleasant trail user experience close to lagoon foreshore.
6. Low aquatic impacts.
7. Bridge construction access is required via an on-ground trail.
8. On-ground trail can be raised on fill with drainage culverts to reduce impacts to existing hydrology and EECs..

Disadvantages

1. Some clearance of EEC required to widen informal tracks and allow bridge construction.
2. Dissects existing fauna habitat on eastern side of South Creek.
3. Increased traffic in South Creek Reserve has potential to disturb fauna.
4. Bridge construction access is required through vegetation via an on-ground trail.



Figure 37 - South Creek Option Three Alignment

South Creek Over-water Option Four

Refer to Part 4.1.1 Academy Section Review Academy Over-water Option Four which discusses Option Four.

4.2 Community and Stakeholder Engagement

4.2.1 Community Engagement Process

In accordance with Council's Community Engagement Policy and Matrix, Stage 2B of the Narrabeen Lagoon Multi-Use Trail Project was considered to have a high-level impact on a large part of Warringah. A number of measures were undertaken to inform and involve the community including the establishment of the Narrabeen Lagoon Projects register for provision of regular project updates to registered community members. Project updates were regularly provided on Council's website, the Yoursay Warringah website, Council publications, the Manly Daily and emails to identified and registered stakeholders. A survey and online forum was also undertaken to seek information on trail usage (See Appendix L: Community Engagement Outcomes Report).

To involve the community in the selection of the Stage 2B alignment, Council held a Community Workshop on 5 May 2011 and publicly exhibited the workshop presentation material from 3 May to 3 June 2011. Further community engagement is proposed through the public exhibition of this Options Report.

4.2.2 Community Workshop Results

The aim of the Community Workshop was to gauge community opinion and capture community views on the proposed trail options for Stage 2B. At the workshop, TBLD presented an overview of the various constraints, advantages and disadvantages of the Four Selected Options, separated into the three areas of Academy, Cromer GC and South Creek Reserve. Each of eight tables was then given time to undertake facilitated table discussions identifying relevant issues with the various options and at the end of the workshop individuals preferences were collated for each section of the trail.

The presentation and facilitated discussions were largely guided by the Information Packs provided to workshop participants. The Information Packs provided a summary of the

comparative costs by way of a number of dollar symbols and a comparative environmental impact by indicating low, medium and high. The actual cost estimates were not provided as Council did not have sufficiently reliable information at that point in time. Council has included cost estimates and environmental reports within this Options Report. Community feedback gained through the workshop was therefore largely based on non-cost criteria.

Preferences obtained through the workshop as well as results from facilitated discussions highlighted the following information with respect to the 4 Selected Options as presented:

- **Option Four** – 23% of all workshop participants were in favour of this option, whilst 73% of participants were not. The main advantages of Option Four (boardwalk/floating pontoon) were thought to be that this option resolves the safety and security issues of the Academy and Cromer GC, and it would provide for an interesting walking experience. The main disadvantages of this Option were thought to be its adverse impact on existing boating activities; limited access to the western basin; adverse impact on the environment; negative visual impact and the associated high costs.
- **Academy:** Option Two & Three (elevated walkway) through the Academy was the most preferred option, with 69% of participants stating this as a preference. Facilitated discussions identified the advantages being the separation of trail users from the Academy, eliminating the need for gates, the interesting and varied walking experience and the potential to prevent night closure. Feedback also indicated that Option Two & Three were thought to be more acceptable to the Academy. Option One (on-ground with fences) was by far the least preferred option (7%) as this option required gates, night closure and was thought to create a sense of claustrophobia.
- **Cromer GC:** The preference results for the Cromer GC showed the most popular options through the Golf Course were Option Three (removing 15th hole - 30%) and Option Four (30%). Option Two was almost as popular (partial boardwalk - 24%) whilst Options One A (shorter on-ground - 14%) and B (longer on-ground - 3%) through the Golf Course were the least preferred. Given the number of participants however the results demonstrate a fairly even split between Options One, Two, Three and Four. Each of the Cromer GC options has varying impacts on user safety, the environment, cost and on the operational impacts of the Cromer GC. The relatively even distribution of preferences for this section reflects the mix of stakeholder representation at the workshop, with some support appearing to favour over-water options, existing paths through the course appearing to be favoured by local residents and general public nominating other alternatives. The main issues identified through facilitated discussions included the risk from ball strikes, maintaining access to public land, compensation for the Cromer GC in the event of selecting Option Three, the need for unattractive safety fencing, reducing the environmental impact and balancing the needs of the golfers as well as trail users.
- **South Creek Reserve:** Option Two was the most preferred option for South Creek Reserve (boardwalk - 49%). The facilitated discussions indicated that Option Two would create a better experience for the users due to its close proximity to the foreshore. Options One A (on-ground – 12%) and Three (on-ground – 10%) were the next preferred options as although they shared the similar route to Option Two they were promoted as having more environmental impact due to the use of fill for construction of the on-ground trail. Option One-B which was promoted as having the lowest environmental impact was the least preferred option for this section (longer on-ground trail - 2%).

Overall Council received positive feedback about the workshop, with 82% of participants being either satisfied or very satisfied in the workshop overall (see Appendix L: Community Engagement Outcomes Report). Some participants however outlined they would have preferred to have an opportunity to ask questions in an open forum and to see more technical information, in particular the environmental reports and costs.

Council invited a broad spectrum of the community to the workshop, however the participants who responded, although a diverse group, were nevertheless represented by particular

stakeholder interest groups and with members of the general public . The results of the facilitated discussions demonstrate that participants showed a good understanding of the issues associated with traversing through the Academy and the Cromer GC. The key themes or desires identified through this workshop were to maximise safety, minimise environmental impact, minimise conflict between trail users and the adjoining land uses and to provide for an interesting and aesthetic experience.

4.2.3 Public Exhibition Comments

To capture the views of those who were unable to attend the workshop, Council also undertook public exhibition of the workshop presentation material from 3 May to 3 June 2011. The workshop material was published online at www.yoursaywarringah.com.au and made available at Council's Customer Service Centre and all libraries. Council received 136 comments (exhibition comments) during this time via the online forum at Yoursay Warringah; the Narrabeen Lagoon Projects Register; letters; emails and feedback forms submitted during the workshop.

Approximately 70% of the exhibition comments were from Cromer GC members and/or supporters. This group was identified as largely objecting to Option Three (removing 15th hole), indicating the Cromer GC deserved compensation for Option Three or selecting Options Two and Four as preferred.

According to the above estimates, approximately 30% of the exhibition comments represented non-Cromer GC members or supporters. Broadly speaking, their main concerns were the impact on the environment, high costs, safety of trail users resulting from shared paths, risk of water-craft collision with over-water structures and access to public land. Generally there was sympathy for Cromer GC and Academy's position however the wider public good was considered to be a priority.

4.2.4 Community Engagement Outcomes

Consultation undertaken via the Community Workshop provided a clearer direction into community preferences, as participants were from a more diverse group of stakeholders than the exhibition comments. Preferences were also deliberately obtained through this format, unlike the exhibition comments which did not always state a particular preference. Community Workshop preferences were considered to be better informed than exhibition comments as participants were able to listen to views from a mix of stakeholders, ask questions directly to Council and their consultants and discuss options prior to selecting a preference.

Exhibition comments on Stage 2B of the Narrabeen Lagoon Multi-Use Trail were highly represented by Cromer GC members and supporters and indicated a strong preference for over-water options Four and Two. These preferences however are not representative of the entire community due to the high representation of a single, mobilised stakeholder group, being the Cromer GC members and supporters. Although the Cromer GC does have valid concerns it is Council's responsibility to ensure that a preferred option is chosen which will meet the needs of the whole community.

The main concerns highlighted through non Cromer GC members or supporters was to minimise impact on the environment, public safety, access to public land and to achieve lower cost, low key solutions.

To resolve the various issues highlighted through the exhibition comments, Council will continue to negotiate with key stakeholders in order to find a solution which will minimise impacts on their operations.

For a full analysis see Appendix L: Community Engagement Outcomes Report.

4.3 Cost

4.3.1 Project Funding Parameters

Funding for the project has been secured from a mix of sources as set out below (Table 1). The most significant funding comes from a Federal Grant as well as Section 94 Developer contributions. Council is contributing 19% towards the project from its own capital reserves. Note that the funding breakdown below covers all stages, including Stage 1 trail, Stage 2A (Middle Creek Reserve) upgrade and contribution to Deep Creek Bridge.

Table 1 - Narrabeen Lagoon Multi-Use Trail Project Funding (All Stages) and Stage 2B Budget

Funding Source	Total \$	Percentage
Warringah Council	2,000,000	19 %
NSW State Grants	528,750	5 %
Federal Grants	4,000,000	38 %
Developer S94 Contributions	4,050,000	38 %
Total Project Budget	\$10,578,750	100 %
Less committed to Date*	\$6,178,750	
Funds Available for Stage 2B (construction only)	\$4,400,000	

* Previous stages plus 2B design and investigations

4.3.2 Budget

For comparison purposes below, the total project budget component for the construction only of Stage 2B available to Council is **\$ 4.4 million**, with design, approvals and management costs being budgeted separately and have been largely already committed.

4.3.3 Cost of Options

The construction cost for each of the four Stage 2B options have been based on detailed analysis by MDA Australia (Quantity Surveyors - QS), with additional allowances added by Council as set out in the notes below. A summary table is provided below and more detail is included in Appendix M: Selected Options Cost Estimate.

Table 2 - Cost Summary for Various Options

Option	Academy	Cromer GC	South Creek	QS Estimate	Plus additions (refer notes 3, 4&5)	Total Project
One A	\$1,637,692	\$702,222	\$373,376	\$ 2,731,290	\$ 356,134	\$ 3,087,424
One B	\$1,637,692	\$940,084	\$286,561	\$ 2,864,337	\$ 349,755	\$ 3,214,092
Two	\$2,182,425	\$2,140,257	\$1,441,724	\$ 5,764,406	\$ 833,310	\$ 6,597,716
Three	\$2,182,425	\$858,755	\$476,824	\$ 3,518,004	\$ 906,934	\$ 4,424,938
Four				\$ 5,443,725	\$ 949,563	\$ 6,393,288

Notes

1. The costs shown above are for Stage 2B construction only, and are based on the concept designs developed in this report. When a preferred route has been selected, the detailed design phase of the project will commence, which will include updating the estimate of project cost.
2. All options are from Middle Creek Bridge to South Creek Reserve, inclusive.
3. Basic QS costs are based on a 2.5 m wide trail. "Plus Additions" column an additional amount to cover a potential 3m width for the on-ground sections of all options. The trail width decision will be made at the detailed design stage
4. 'Plus Additions' also includes a design contingency of 5% added to allow for any changes required during the detailed design phase. A price escalation allowance of 3 % per annum for two years has also been added to the basic QS figures to accommodate the proposed time of construction.
5. 'Plus Additions' for Option Three includes an additional allowance of \$ 400,000 to cover potential costs associated with golf course modification.
6. No maintenance, operational or whole-of-life costs have been estimated.

4.3.4 Cost Summary

Options Two and Four significantly exceed the available Budget and are considered unaffordable by Council. These Options were nevertheless selected following discussions with the Academy and Cromer GC. Subsequent discussions with the Academy and Cromer GC have confirmed that no financial contributions are available to progress Options Two and Four.

Options One A & B are lowest cost, but have unacceptable safety concerns around the Cromer GC Section (Part 4.5 TBLD Risk Assessment).

Council's Option Three can be funded although has some risk of exceeding the available budget through the detailed design or construction phases, as the cost estimates are based on early phase conceptual design.

4.4 Environmental Assessments

4.4.1 Flora and Fauna Survey and Species Impact Statement

In Round 1, Preliminary Options phase ELA's Flora and Fauna Assessment determined that Option C7 (through the vegetation within South Creek Reserve) was unlikely to have significant impact on threatened flora and fauna if the design controls were implemented (Part 3.1.1 Flora and Fauna Assessment). As the design controls included elevating the trail at considerable cost to Council it was determined that a Species Impact Statement may be required for Stage 2B.

Council subsequently engaged Australian Museum Business Services (AMBS) to carry out a more comprehensive flora and fauna survey in accordance with the Director General's requirements of the NSW Office of Environment and Heritage. The surveys were carried out from August 2010 until March 2011 and the results will be used to prepare a Species Impact Statement assessing the impact of the preferred option.

The results of AMBS's vegetation surveys were mapped and can be viewed in Part 2.2 of this Report. This vegetation survey data has superceded the data in Part 3.1.1 Flora and Fauna Assessment as a more comprehensive survey was able to be carried out over a longer period of time.

AMBS carried out Fauna Surveys in August 2010, December 2010 and March 2011. Seven threatened species were recorded within the study area, with a further two microbat species

possibly recorded (see below), and one species (Glossy Black-cockatoo) recorded nearby (see below). All are listed as vulnerable under the NSW Threatened Species Conservation Act 1995 (TSC Act) . One species (Grey-headed Flying-fox) is also listed as vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

- Black Bittern *Ixobrychus flavicollis*;
- Little Lorikeet *Glossopsitta pusilla*;
- Powerful Owl *Ninox strenua*;
- Grey-headed Flying-fox *Pteropus poliocephalus* (also listed as vulnerable under the EPBC Act);
- Large-footed *Myotis Myotis macropus*;
- Little Bentwing Bat *Miniopterus australis*;
- Common Bentwing Bat *Miniopterus orianae oceanensis*.

Analysis of ultrasonic call recordings detected “possible” calls of two additional microbat species listed as vulnerable under the TSC Act:

- Greater Broad-nosed Bat *Scoteanax rueppellii*; and
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*.

The Glossy Black-Cockatoo *Calyptorhynchus lathami* was recorded during the August surveys, to the north of the current study area (Jamieson Park).

AMBS carried out a preliminary review of the four Selected Options to determine their impact without mitigation measures. As the Flora and Fauna survey was restricted to terrestrial vegetation only (i.e. not aquatic ecology), the overwater sections of Options Two and Four are excluded from the following discussion.

Environmental impact through the Academy

AMBS’s preliminary assessment found that Option One through the Academy had a relatively low impact on terrestrial flora, however it was recognised that there was some impact from the bridge ramp on the Swamp Oak Forest on the northern side of Middle Creek. Academy Options Two & Three (same option) was determined to have a medium impact on terrestrial flora with minimal disturbance on the northern side of Middle Creek and a relatively high impact on the EEC south of the boat sheds. Both Options through the Academy had minimal disturbance to fauna or fauna habitat (Figure 38).

For safety reasons Council considers it necessary to traverse through the vegetation south of the boat sheds. This is required to separate trail users from the Academy’s high ropes course near the existing gate between the Academy and Cromer GC. Participation in the high ropes course requires important safety inductions and concentration therefore the disturbance caused by trail users traversing past this facility can increase the risk of serious injury. The Academy have suggested that injury from such incidents has occurred in the past. Further, the alternative alignment of Option One requires Council to build on Academy’s land and it is not considered likely that permission will be granted by the Academy to authorise this.

Previous assessments have also ruled out traversing along the Lagoon edge as two ecological zones, being terrestrial and aquatic, are affected (Refer Part 3.3).

To mitigate the impact of traversing through the vegetation at Middle Creek Reserve and south of the boat sheds, a range of ameliorative measures can be implemented. These include fencing of sensitive foreshore habitat, ongoing bush regeneration and pest management. Further mitigation measures are discussed below.



Figure 38 - Academy Terrestrial Options

Environmental Impact through the Cromer Golf Club



Figure 39 - Cromer GC Terrestrial Options

AMBS's preliminary assessment of the Four Selected Options through the Cromer GC determined that Option One-A had the highest impact of all of the terrestrial Cromer GC options as it impacted on Swamp Oak Forest, Bangalay Alluvial Forest and Swamp Mahogany Forest (EECs), some of which is in moderate or good condition. Option One-A also caused disturbance to some water bird breeding habitat around the golf course pond; removal of some Black Bittern habitat; the introduction of disturbance to known foraging area and the dissection of existing fauna habitat on the western side of South Creek (Figure 39).

The remaining terrestrial options are Option One-B and Three. AMBS found that Option One-B had a medium relative impact, as there was impact on three EECs but the alignment avoided most areas in good condition. Option One-B also caused disturbance to water bird breeding habitat around the golf course pond, and along the edges of South Creek.

AMBS's preliminary assessment of Option One-A and One-B further supports the ranking results of ELA's Flora and Fauna Assessment (with One-B having the lowest impact and One-A having the highest impact of the Preliminary Options - see Part 3.1.1). Option Three is the remaining terrestrial Selected Option to be assessed and this option was not considered by ELA.

AMBS found that Option Three through Cromer GC had a minor impact on terrestrial flora being the Swamp Oak Forest (EEC) in moderate condition at the Academy/Cromer GC interface and good condition at South Creek. For terrestrial fauna, Option Three will cause some disturbance to water birds at the mouth of South Creek. An advantage of Option Three however is that it avoids water breeding habitat around the golf course pond.

As Council is excluding Options One-A and One-B for safety reasons (See Part 4.5 TBLD Risk Assessment), Option Three remains as the most viable terrestrial option through the Cromer GC.

Environmental Impact through South Creek Reserve

AMBS determined that Option One-B had the least impact through South Creek Reserve which supports ELA's Flora and Fauna Assessment. As Option One-B and One-A have been excluded for safety reasons, the Selected Options through South Creek Reserve are Option Two and Option Three.

Both Option Two and Three involve the widening of an existing 300m of trail through the vegetation within South Creek Reserve. AMBS considered these options to have a relatively high environmental impact (if not mitigated) due to the direct and potential indirect impacts on the EEC Swamp Oak Forest, the removal of Black Bittern habitat and introduction of

disturbance to known foraging areas. Another issue arising is from the dissection of existing fauna habitat on the eastern side of South Creek.

ELA's Flora and Fauna Assessment demonstrate that a route through South Creek Reserve is unlikely to have significant impact on Flora and Fauna if it were elevated and fenced, however the cost of elevating the entire trail is prohibitive.

Ameliorative measures for Option Three therefore could include fencing, bush regeneration, pest control and the establishment of a Wildlife Protection Area to protect approximately 4 hectares of Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek and within South Creek Reserve (see Figure 46, page 62). To facilitate fauna movement and drainage, Council can consider elevating sections of the trail, within the constraints of the available budget.



Figure 40 - South Creek Terrestrial Options

Ameliorative Measures and Environmental Assessment

Once Council has determined a preferred alignment AMBS will prepare a Species Impact Statement. This report will ultimately determine the extent and amount of ameliorative measures required to off-set the impact on the trail, and measures will be aimed to minimising the impact on the Black Bittern habitat along the foreshore of South Creek.

Council has had preliminary discussions with AMBS and established that the following ameliorative measures would assist in mitigating or offsetting the impact of Stage 2B. These include:

- Fencing areas for revegetation to restrict access by trail users and domestic dogs. This will act to limit the creation of informal tracks which can trample vegetation and introduce weeds. It will also protect fauna habitat by restricting access and noise.
- Option Three enables the protection of approximately 4 hectares of contiguous Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek and within South Creek Reserve (see Figure 46, page 62).
- Option Three enables the revegetation of the western foreshore of South Creek which is habitat for Endangered Ecological Communities and threatened and migratory bird species.
- The inclusion of elevated sections of trail within vegetation to facilitate drainage and allow fauna movement.
- Bush regeneration and noxious and environmental weed control including monitoring.
- Implementation of an integrated pest management program.
- Establishment of Wildlife Protection Areas restricting access to parts of South Creek Reserve for domestic and feral dogs and cats and enabling cat trapping.

Although there are impacts associated with traversing through the vegetation within South Creek Reserve, Council considers that recent discussions with AMBS and the results of ELA's Flora and Fauna Assessment demonstrate that suitable ameliorative measures can be found.

The impact of traversing through vegetation at Middle Creek Reserve, the Academy/Cromer GC interface and South Creek Reserve requires clearance and/or widening of approximately 430 metres of existing trails through Swamp Oak Forest (50m at Middle Creek; 80m at Cromer GC/Academy Interface; 300m in South Creek Reserve). This impact is less than the 850 metres of EEC clearance required for Stage 1 where no trails existed. Council obtained a Species Impact Statement for the Stage 1 which found that the trail, with the proposed ameliorative measures, was not likely to have significant impact on threatened flora or fauna.

The results of the previous assessments demonstrate that ameliorative measures can be implemented to reduce the likelihood of significant impact. On completion of the Species Impact Statement a vegetation management plan will also be prepared which provides mechanisms for ongoing management of the of Endangered Ecological Communities and threatened fauna habitat along South Creek and within South Creek Reserve.

4.5 TBLD Risk Assessment

4.5.1 Summary

A comprehensive risk assessment was carried out independently by Council's principal design consultant Thompson Berrill Landscape Design (TBLD) as part of the Options Development process. For each of the Selected Options, TBLD carried out detailed risk assessments for; Preconstruction, Construction and Operational Phases. The Selected Options were broken into the three geographical sections; Academy, Cromer GC and South Creek Reserve.

The Risk Assessment was assessed under project specific Risk Assessment Tools that were prepared in collaboration with Council (Appendix O: Risk Assessment Tools). The Risk Assessment Tools were set up with the following assessment criteria categories:

Preconstruction Issues:

- Time
- Community
- Landowners/ Managers
- Environmental, Soils & geotechnical information
- Approvals
- Accessibility/Public Safety
- Cost

Construction Issues:

- Time
- Landowners/ Managers
- Environmental
- Approvals
- Accessibility/Public & Community Safety
- Construction
- Methodology/ Risk
- Cost

Operational Issues:

- Ongoing Maintenance
- Landowners/ Managers
- Environmental
- Public and Community Safety
- Infrastructure Damage

The Risk Assessment tools were used to determine Risk Level from the consequence (or impact) and the likelihood of the hazard occurring. The inherent risk value illustrates the level of a risk arising out of circumstances, or existing in an environment, in the absence of any action to control or mitigate the circumstances. The residual risk value illustrates the risk level, after ameliorative risk mitigating controls have been implemented.

4.5.2 Risk Assessment Summary Table

The Risk Assessment Summary Table collated the results of the detailed risk assessment to determine the *Overall* and *Section Ranking* of the Selected Option's (1 being the lowest risk option, 5 being the highest risk option). The results are shown in Table 3 and were calculated as follows:

- The *Inherent Risk* and *Residual Risk* values were generated by calculating the average risk level for each Option (One-A, One-B, Two, Three & Four), in each Section (Academy, Cromer and South Creek Reserve), under each Phase [Preconstruction (Pre), Construction (Con), and Operational (Opp)].
- The *Average Inherent Risk* was generated by averaging the total inherent risks for Preconstruction, Construction, and Operational phases for each Option in each Section. This process was repeated for residual risk to generate the *Average Residual Risk*. The residual risk values demonstrate that most risks can effectively be mitigated, however, larger differences between *Average Inherent Risk Levels* and an *Average Residual Risk Levels* indicate a higher number of mitigation measures required to reduce the associated risk level.
- An *Overall Risk Ranking* for the Selected Options was generated by averaging the total of the *Average Residual Risk Levels* only for each option over the three sections. The values are to 2 decimal places due to the detail and complexity of the risk assessment. *Section Ranking* has been included for each option in each section to help inform an overall alignment.

4.5.3 Safety Risks – Operational Phase

Safety was assessed under the three categories of preconstruction, construction and ongoing operation. Public safety during ongoing operation was of primary concern, particularly for the safety of the Academy users through the Academy, and of the trail users through the Cromer Golf Club. These are outlined below.

Through the Academy, there are safety concerns related to the trail's proximity to high risk activities, particularly the high ropes and climbing tower areas. The options with a greater distance between the proposed trail and these high risk activities (Options Two and Three), decreased the ongoing operation risk to safety. One-A and One B display high residual safety risks (indicating risks difficult to mitigate) due to the close proximity to high risk activities, and risks associated with the required junction gates.

Through the Cromer GC, safety concerns related to risk from golf balls that could cause injury. Mitigation measures including screening, fencing and additional infrastructure provide some level of risk mitigation. Option One A and One B present the highest risk, as they pass in front of the 15th tee. By ensuring the trail does not pass in front of tees, or outside the line of play, the risk is reduced. This is the case for Option Two and Four, which by-pass the golf course, and Option Three, with the redesign of the golf course allowing the trail to pass behind the course. One-A and One B display higher residual safety risks (indicating risks difficult to mitigate) due to trail users crossing in front of the 15th tee.

Through South Creek Reserve, most safety concerns could be effectively mitigated. The alignment through South Creek Reserve is determined by the alignment selected through Cromer GC. For example, if Option One B is selected through the Cromer GC, Option One B alignment through South Creek Reserve must be selected.

Option Four by-passes the Academy and Cromer, and presents lower operational risks. However, higher preconstruction and construction risks result in a high average residual risk.

4.5.4 Residual Risk Ranking for Total Project

Residual risk for the total project was used for ranking purposes, as measures to mitigate risk would be implemented to all options. Options with the highest residual risk value demonstrate the lowest risk level for each section and option. The residual risk values were created and used for analysis and comparison of options. By analysing the options in sections, the alignment with the lowest risk could be determined. The results of this analysis identifies the alignment with the lowest residual risk as:

- Academy Section: Options Two and Three
- Cromer GC Section: Option Three
- South Creek Reserve Section: Option One-B

It must be noted however that Option One, Two and Three have a relatively similar residual risk ranking score.

Academy Section:

Option Two and Three had the lowest average residual risk through this section. This was due to the elevated structure increasing the separation, reducing conflicts between user groups. This was indicated by the lowest risk during the preconstruction phase, which would help to ease the process of finalising agreements and reduce project delays; and in the operational phase, due to the elimination of gates and associated reduction in ongoing management. However, the risk levels during the construction phase increased, as there were greater risks associated with the elevated trail, working with more complex infrastructure, requiring greater costs and increasing risks to site users during construction. The second lowest average residual risk level was Option One-A and One-B, which had a consistent medium 4 residual risk level throughout the three phases, indicating no major risks.

Cromer Golf Club Section:

Option Three had the lowest average residual risk through this section. Option Three had higher risk levels during the preconstruction phase, mainly associated with establishing an agreement with Cromer GC for the redesign of the golf course to permit a trail to continue along the lagoon foreshore, and timing impacts from the reconstruction of the Cromer GC. Option Three did not have the lowest risk during the construction phase due to disruption to Cromer GC during construction. Once an agreement is gained with Cromer GC, the risk levels during the operational phase are relatively low, due to the resolved safety concerns and separation of Cromer GC users from the trail users.

South Creek Reserve:

Option One-B displays the lowest average residual risk through this section, as it traverses through open disturbed areas. Option One-B also displays the lowest residual risk during the preconstruction phase (less approvals and environmental assessments required), and during the construction phase (due to ease of access). Option One-A, Two, and Three are located on existing informal tracks along the lagoon foreshore, with less environmental impact, and a higher quality walking experience for trail users.

4.5.5 Assumptions and Limitations

The following assumptions and limitations were made in the risk assessment:

- Detailed geotechnical information was not known along all trail alignments. Assumptions were made, based on the preliminary geotechnical assessment of site conditions.
- Detailed contours and feature level surveys were not available to accurately assess risk associated with trail construction and finished surface levels, materials, access and machinery required, and environmental impacts. These factors influence cost, approvals required and time.

- Limited hydraulic data was available to accurately assess risk associated with trail construction and finished surface levels, materials, access and machinery required, and environmental impacts. These unknown factors may influence cost, approvals required and time.
- Limited lagoon bathymetry data was available, limiting assessment of construction requirements and environmental impacts of over water components of options.
- Underground service identification data location plan was not available to accurately determine risks associated with conflicts with existing underground services.

Table 3 – Risk Assessment Summary Table showing Ranking of Residual Risk Levels per Section

RISK ASSESSMENT SUMMARY TABLE

SELECTED OPTION	INHERENT RISK			RESIDUAL RISK			AVERAGE RISK LEVEL		SECTION RANKING
	PRE	CON	OPP	PRE	CON	OPP	INHERENT	RESIDUAL	
Academy									
Option One	2.58	2.57	2.09	4.27	4.09	3.91	2.41	4.09	2
Option Two & Three	3.20	2.28	2.35	4.68	3.94	4.29	2.61	4.31	1
Option Four	2.13	1.88	2.33	3.41	4.34	3.83	2.11	3.86	3
Cromer									
Option One A	2.91	2.97	2.24	4.37	5.09	3.53	2.71	4.33	2
Option One B	2.78	2.94	2.06	4.31	5.06	3.29	2.59	4.22	4
Option Two	2.81	2.23	2.89	4.10	4.46	4.16	2.64	4.24	3
Option Three	3.00	2.66	3.00	4.29	4.94	4.28	2.89	4.50	1
Option Four	1.81	1.93	2.00	3.00	4.36	4.00	1.91	3.79	5
South Creek Reserve									
Option One A	2.39	2.68	2.83	4.22	4.94	4.58	2.63	4.58	2
Option One B	3.46	3.10	2.78	4.82	5.13	4.44	3.11	4.80	1
Option Two	2.72	2.65	2.79	4.31	4.74	4.43	2.72	4.49	3
Option Three	2.36	2.65	2.83	4.00	4.87	4.42	2.61	4.43	4
Option Four	2.68	2.30	2.38	4.26	4.67	4.13	2.45	4.35	5

Key

VERY HIGH 1
HIGH 2
MEDIUM 3
MEDIUM 4
LOW 5
VERY LOW 6

4.6 Council Conclusions from Round 2 Option Development.

4.6.1 Council comment on TBLD risk assessment

Under the TBLD matrix in section 4.5, risks are assessed and then collated to present an overall comparison of average risk scores between options. However, in some cases Council has considered certain specific risks to be unacceptable particularly in relation to public safety, which prevent the option being considered further. The detailed TBLD analysis underlying the Table 3 summary has recognised residual public safety risks with Option One A & B through both the Academy and Cromer golf course. Cromer GC have also verbally expressed their safety concerns with these options and combined with Council's own concerns of these operational risks, Option One A and B have been rejected.

Council also has had the benefit of subsequent discussions and negotiations with key stakeholders to determine the acceptability of options to these parties and hence may take a different view of preconstruction risks.

To mitigate preconstruction risks associated with Cromer GC Option Three Council is working with the Cromer GC to establish an agreement. The construction risks of Option Three will be mitigated through an agreed construction program which will aim to prioritise the readjustment of the Golf Course prior to construction of the trail.

To mitigate the pre-construction risks through South Creek Reserve, Council has undertaken an ecological survey in accordance with the requirement of the Director General of the Office of Environment and Heritage. This means that Council has the data to undertake a Species Impact Statement once the preferred option is endorsed by Council. Having this data will reduce project delays that would have resulted from environmental studies and thus reduce some preconstruction risk.

To mitigate the construction risks through South Creek Reserve, Council can use their experience in the construction of Stage 1. Stage 1 required the construction of an 850 metre trail through a linear section of Endangered Ecological Communities where no existing trails were present. As the trail through South Creek Reserve is approximately 300m, it is likely that the construction methodology for Stage 1 can also be used to reduce the impact of any trail alignment through South Creek Reserve.

4.6.2 Council Conclusions at Round 2 Option Development:

Options 1,2 & 4:

Four Selected Options have been investigated in detail in the foregoing assessments considering, community feedback, environmental reviews, cost, subjective positive and negative issues such as user experience and other factors. Some clear conclusions can be drawn from these assessments to distil the optimum potential alignments for the trail.

For Options Two and Four which have over-water components, the cost of these at \$6,597,716 and \$ 6,393,288 respectively against a budget allowance of \$4,400,000 is prohibitive for Council. Further, a cost versus benefit consideration against the various other merits and issues with these options, does not justify Council seeking additional funding and hence this report does not propose to pursue these options further.

Options Option 1A and 1B were the lowest cost options and 1B in particular had lowest environmental impacts. However, there are clear safety risks that could not be satisfactorily resolved which precludes Council from considering these options further. Specific safety risks occur at the high-ropes course adjacent to the Academy and Cromer GC boundary; from the trail needing to cross in front of the golf course 15th tee for which it has not been possible to satisfactorily design around, and the general risks arising from moving high volumes of people through a golf course who may be unfamiliar with this environment and can wander off the

defined trail route. Note the cross over for golfers and trail users means that fencing cannot be continuous and gaps and/or gates will be required.

Option 3:

This leaves Option Three as the remaining viable option for consideration. There remains however significant costs associated with the elevated escarpment route through the Academy compared to an on-ground solution, as well as other issues of the public being diverted away from the foreshore here and the route being on Academy land rather than the public Crown Land.

Community workshop preferences stated Options Two and Three through the Academy are preferred as they resolved the potential for conflict between the Academy and trail users (e.g. gates, night closure). However, a number of public exhibition comments highlighted their concern for trail users being able to 'look-down' on Academy users and create a disturbance. Although it is recognised there are issues associated with Option One, the budget constraints have meant that Council needs to explore Option One further.

It is also noted, that the Academy section of the Option One can be made safe if this on-ground route is modified to avoid the high-ropes course and travels through the adjoining Swamp Oak Forest to combine with removal of the Cromer 15th hole proposed under Option 3. However, this does increase its environmental impact which will need to be mitigated and further reviewed as well as consideration of the environmental impacts of this route through South Creek Reserve.

It was concluded at this point that a combination Option One through the Academy section and Option Three through the Cromer GC and South Creek Reserve sections should be further assessed. This is considered in the following section of this report.

5. Option Development Round 3

5.1 Combination Option 3A

Assessment of the foregoing four Selected Options leads to the conclusion that further development of a combination Option Three A appears most likely to provide an optimal outcome for the Project (Figure 41). This is a combination of Options One (through the Academy section) as modified and Option Three (through the Cromer GC and South Creek Reserve sections). Option One through the Academy is altered to traverse through the vegetation south of the boatsheds, rather than being adjacent to the Academy's high-ropes course.

This combination Option Three A responds to the consideration of a number of issues, including:

- Feedback from the community following the Options Workshop and exhibition of the Workshop Presentation Material (Part 4.2 Community and Stakeholder Engagement)
- Finalising the costs for each Option based on information supplied by the Quantity Surveyor (Part 4.3 Cost)
- Value for money considerations, compared with the available budget.
- Discussions with key stakeholders
- A preference for a trail alignment that uses publicly owned land where possible
- Operational and safety considerations



NARRABEEN LAGOON MULTI-USE TRAIL

V2_JUNE 2011
SCALE 1:1000 @ A1

Figure 41 - Option Three-A Alignment

5.1.1 Option 3A through Academy

For the Academy section, the elevated Options Two and Three were significantly preferred in the Community Workshop results which identified advantages including the elimination of gates, the interesting and varied walking experience at height and the potential to prevent night closure. Community feedback and the reduction of conflict with the Academy also contributed to Option Two and Three as having the lowest residual risk within the Risk Assessment carried out by TBLD

Although it is appreciated that Options Two and Three create a separation between trail users and the Academy, community comments also highlighted their concern for trail users being able to 'look-down' on Academy users and create a disturbance. Options Two and Three also had a considerably higher cost, moved the public away from the foreshore and required Council to navigate over land controlled by the Academy. Council considered it necessary to investigate Option Two & Three in order to gauge community input and determine whether the Academy could contribute funding. Further consultation with the Academy has confirmed that no further funding is available for this Option.

Council therefore favoured further developing Option One through the Academy, with a slight variation to navigate through the vegetation south of the boat sheds. This variation is considered necessary to maximise use of public land and separate trail users from the high risk Academy high-ropes course.

The Academy section Option One is supported for the following reasons:

- An agreement exists with the Minister of Sport and Recreation for an on-ground route through the Academy.
- The trail alignment largely uses publicly owned land.
- Lowest cost option and which meets Council's available budget.
- Low aquatic environmental impact.
- Lowest risk to public safety during construction.

Option One has some environmental impact through the Swamp Oak Forest at the bridge ramp from Middle Creek Reserve and through the area south of the boatsheds, however with mitigation they have been considered more favourably than the alternatives reviewed.

Option One still locates the Middle Creek bridge in the vicinity of the Academy climbing tower. However it is considered that mitigation measures such as screening and increasing the separation of these elements can be effectively implemented in the design phase to the satisfaction of the Academy and to adequately address any safety concerns.

Option One is ranked 2 out of 3 in TBLD's overall risk assessment as a number of other operational issues impacting on the Academy, particularly crossing of the trail to access Academy boatsheds, remain to be resolved with Option 3A. Further negotiation with the Academy was proposed to consider whether an improved operational solution can be agreed upon that primarily utilises Crown Land.

5.1.2 Option 3A through Cromer Golf Club

Option 3A adopts the Option Three route through the Cromer GC section which requires the removal of the Cromer GC's 15th hole. Council received a large number of objections from Cromer GC members and supporters to this option. Most of these objections raised the issue of the unaffordable cost to the Cromer GC and believed that the Cromer GC should be compensated if this option were to go ahead.

In light of the alternatives however Council recommends the adoption of Option Three for the Cromer GC section for the following reasons:

- Second lowest terrestrial environmental impact after Option One-B (lowest impact) was excluded for safety reasons. An opportunity exists to revegetate the area adjacent to the western entrance of South Creek.
- Lowest cost solution after the safety risks excluded Options One-A and One-B.
- Lowest residual risk identified in TBLD's risk assessment.
- Provides a pleasant walking experience close to lagoon foreshore
- Lowest risk to public safety due to separation of the trail users and Cromer GC, reducing the need for safety fencing.
- Council has demonstrated that Cromer GC can be reconfigured in a way which can maintain the standard of the course.
- The trail alignment uses publicly owned land.
- Council will work with Cromer GC to minimise impact during construction and initial planning exercises indicate that continued golf operations during construction is achievable.
- The environmental impact will be mitigated through a range of measures including fencing to gain protection of at least 4 hectares of contiguous Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek. This will act to limit access to just one point on South Creek and have the added benefit of restricting access for vandals to Cromer GC.
- On completion of the Species Impact Statement a vegetation management plan will be prepared which provides mechanisms for ongoing management of the Endangered Ecological Communities and threatened fauna habitat along South Creek.

To resolve the financial impact on the Cromer GC of the selection of Option Three, Council has budgeted \$400,000 for the course reconfiguration and to negotiate for construction access across the Club's private land. Council has been in discussion with the Cromer GC on the basic principles of an agreement.

5.1.3 Option 3A through South Creek Reserve

Through South Creek Reserve, Option One-B was identified as having the lowest impact on aquatic and terrestrial ecology, the lowest cost and the lowest residual risk within TBLD's Risk Assessment. As noted previously however, Council has considered that an unacceptable risk to public safety for trail users through the Cromer GC warrants exclusion of Option One-B from further investigations. Option One-A has also been excluded as a viable option for the same reason.

The remaining viable option through South Creek Reserve is Option Three (on-ground). This Option is recommended for the following reasons:

- Lowest cost solution after the excluded Options One-A and One-B.
- Alignment with the preferred Cromer GC Option Three.
- Changes to hydrology can be mitigated by providing drainage culverts.
- An amount of fill is required to be brought in for bridge construction access and this fill can be utilised to create the on-ground trail.
- Provides a pleasant walking experience close to lagoon foreshore.
- The associated environmental impact will be mitigated through a range of measures including fencing to gain protection of at least 4 hectares of contiguous Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek and within South Creek Reserve. This will act to limit access to just one point on South Creek and have the added benefit of restricting access for vandals to Cromer GC.
- On completion of the Species Impact Statement a vegetation management plan will be prepared which provides mechanisms for ongoing management of the of Endangered Ecological Communities and threatened fauna habitat along South Creek and within South Creek Reserve.
- Utilises one existing path through South Creek Reserve with post and rail fence both sides, allowing regeneration of the rest.
- Meets Council's available budget.

5.1.4 Option 3A Cost Estimate

The total cost for Option 3A has been estimated at \$3,833,007 compared to the construction budget of \$4,400,000 and hence comfortably within the budget limit for this conceptual phase.

The breakdown of costs for comparison with Table 2 in Section 4.3.3 is:

Table 4 – Option 3A Cost Breakdown

Option	Academy	Cromer GC	South Creek	QS Estimate	Plus additions (refer notes 3, 4&5 in Table 1)	Total Project
Three A	\$1,680,602	\$858,755	\$476,824	\$ 3,016,181	\$ 816,826	\$ 3,833,007

Figure 42 below graphically represents the cost differentials between the Option 3A and the earlier concepts. The relevant components of the Four Selected Options are benchmarked against the Option 3A solution with costs representing the alternative components being added to this Option 3A. Option 1A and 1B through the golf course are not considered further here for safety reasons. Option 1 Academy section has assumed that cost savings can be achieved through lower cost fencing than those represented in the cost Table 2 in Section 4.3.3, after negotiations with the Academy.

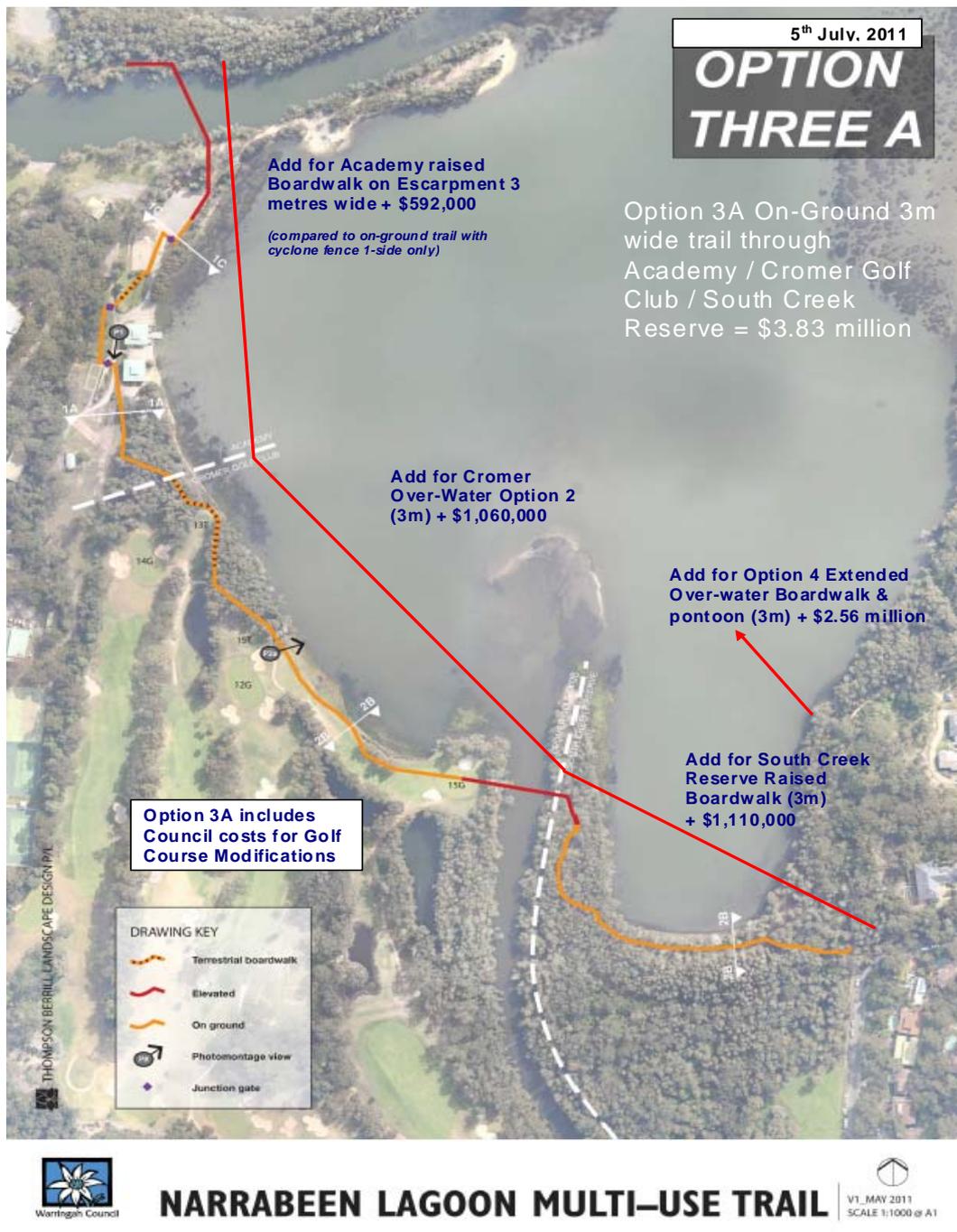


Figure 42 - Option 3A Costs

5.1.5 Combination Option 3A Summary

Option 3A, being a combination of Option One through the Academy with modifications and Option Three through Cromer GC and South Creek Reserve was therefore considered to be the most desirable route alignment arising from the investigations and assessments to date, as it respected the Academy section agreement reached in 2008 with the Minister for Sport and Recreation, allowed for removal of Cromer Golf Club's 15th hole from the foreshore, addressed golf course safety concerns and importantly could satisfactorily address most of the issues raised through the technical assessment and consultation processes, within Council's available budget.

However, Option 3A featured the Academy remaining in occupation of its boatsheds on the lagoon foreshore, with unresolved issues for both Council and the Academy from constructing the trail behind these boatsheds. The Academy have expressed their concern for the children who use their facilities and there are practical issues of maintaining an adequate separation of

the two groups with crossing of the trail required for Academy water-craft activities. The agreement with the Minister also placed some restrictions on trail users, including night time closure and fencing. Option Three through South Creek Reserve also requires further review of environmental impacts to ensure this solution effectively addresses and mitigates any impacts on South Creek Reserve.

These matters have been addressed in developing the Option 3B concept, which is outlined in the following section of this report.

5.2 Preferred Concept - Option 3B

Option 3B builds upon the development of Option 3A and responds to two outstanding matters (Figure 43).

- 1) **Academy Boatsheds:** The only change to Option 3A is that the Academy boatsheds are relocated under this Option 3B, however this has a significant effect on solving future operational issues and greatly improves the user experience through this section by allowing access to the foreshore here.
- 2) **Environmental Risk review:** The assessment of Option 3B has included a comprehensive review of environmental risks and the investigations completed to date, to consider this option in totality and ensure that any environmental impacts are either acceptable, can be avoided or can be appropriately mitigated.



Figure 43 - Option 3B

5.2.1 Academy Boatsheds

The opportunity to develop Option 3B has arisen from ongoing stakeholder discussions that involve the Academy relocating its water-craft activities away from the area currently occupied by their two boatsheds. Moving the boatsheds would result in a complete separation of Academy activities and trail users and allow the public to gain open access along the lagoon foreshore (Figure 44).

Academy management have indicated that a narrow foreshore zone would be acceptable to them for the trail route. However, they are concerned that the design should encourage the public to move through the area and not picnic or loiter outside of its fence and so a larger grassed area here would be problematic. Further negotiations are also required with the Academy over the potential alternative locations for the boatsheds and whether they can be moved or have to be rebuilt. Based on Quantity Surveyor estimates, an allowance of \$220,000 for the cost of relocation/rebuilding of the boatsheds has been included in the Project cost estimates.



NARRABEEN LAGOON MULTI-USE TRAIL



Figure 44 - Option 3B Concept Academy

Advantages

1. Allows open public access along the foreshore to maximise amenity for trail users;
2. Complete separation of public and Academy users to address safety and security concerns of the Academy;
3. Agreement exists with the Minister for Sport and Recreation for an on-ground route and verbal acceptance has been received in principle from Academy management;
4. Low aquatic environmental impacts and low geotechnical risk;
5. Lower maintenance requirements and avoids the ongoing operational management issues of alternative schemes;
6. Cost estimates are within budget;

7. Primarily utilises Crown Land with bridge cross-over of Academy land.

Disadvantages

1. Requires further negotiations with the Academy to relocate their operations and negotiations over the cost of this, estimated at approximately \$220,000 for moving and re-establishing two boatsheds to a new location. (This cost has been included in the Option 3B budget estimate below);
2. Some clearance of Endangered Ecological Community (EEC) in Middle Creek Reserve for bridge approach ramps and through the Swamp Oak south of the boatsheds

(refer also Cromer Golf Club On-ground Option Three, page 30 and South Creek On-ground Option Three, page 34)

Option 3B Cost Estimate

The total cost for Option 3B has been estimated at \$3,923,968 compared to the construction budget of \$4,400,000 and hence comfortably within the budget limit for this conceptual phase.

The breakdown of costs for comparison with Table 2 in Section 4.3.3 is:

Table 2 - Cost Breakdown

Option	Academy	Cromer GC	South Creek	QS Estimate	Plus additions (refer notes 3, 4&5 in Table 1)	Total Project
Three B	\$1,769,340	\$858,755	\$476,824	\$ 3,104,959	\$ 819,009	\$ 3,923,968

5.2.2 Environmental Risk Review

South Creek Reserve and Cromer GC

The Option 3B trail alignment through South Creek Reserve and Cromer GC is the same as for the previous Option 3A and Option Three in that it consists of an on-ground trail on fill with drainage culverts to allow natural surface water to flow between the reserve and the lagoon. The trail alignment is positioned along an existing informal track through South Creek Reserve, through Swamp Oak Forest, with views to the lagoon. The trail then connects with the existing walking trail to Jamieson Reserve.

The environmental impacts of this alignment have been discussed in earlier sections (refer Part 4.1 and Part 5.1). By locating the trail along the existing informal tracks in this location and confining public access to this single route, a large contiguous environmental protection area can be enhanced through South Creek Reserve and along South Creek. This includes the thickening of vegetation along the western shore of South Creek as part of the golf course modifications, fencing of the current unsafe weir crossing at South Creek and selective fencing around the EEC protection area to discourage further informal tracks being created.

West Bank Alternative Route

In reviewing environmental impact here, one of the alternative alignments considered for Option 3B was for the trail to travel through the Crown Land corridor along the western foreshore of South Creek and crossing a bridge located south of the main reserve habitat area. This is illustrated by the blue dotted line in Figure 45 and assumes that the golf course redesign and relocation of the 15th hole still occurs.

To test this alternative, Council sought further advice from environmental consultants ABMS.

AMBS have advised that the main disadvantages of the 'Alternative Route West Bank South Creek' (in terms of ecological impacts) are:

- It would be a direct impact on the endangered ecological communities on the western side of South Creek, parts of which are currently intact and in relatively good condition; and
- It would introduce increased human activity along most of the length of this part of South Creek and bring existing activity closer to the creek than at present.

It is therefore considered that Option 3B is a more favourable route from an ecological perspective to this West-bank alternative as it allows for a range of mitigation measures including fencing and revegetation to gain protection of approximately 4 hectares of contiguous Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek and within South Creek Reserve (EEC Protection Zone – see Figure 46).

The redesign of the golf course under Option 3B is anticipated to allow for the existing fairway to be shifted west sufficiently to provide an opportunity to revegetate this west bank zone.

Compared with the 'Alternative Route West Bank of South Creek' AMBS concurs that the 'Option 3B with fencing' is the better option. Whilst there are disadvantages associated with this option (as there are with all options), it does have the following advantages:

- Rehabilitation/revegetation of native plant communities along the western side of South Creek has the potential to provide a buffer between the creek and human activity; and
- Disturbance along South Creek would be confined to two points only (i.e. the bridge in the north and the any minor encroachments by the new golf course configuration).
- Ameliorative measures for Cromer GC could include re-vegetation along the western bank of South Creek and fencing.

A further ameliorative measure is the opportunity to raise sections of the on-ground trail through South Creek Reserve for fauna to pass under. Previous cost estimates suggest the cost of raising the whole trail is prohibitive, however it is anticipated that raising sections could be accommodated within the budget and this can be further developed in the design phase.

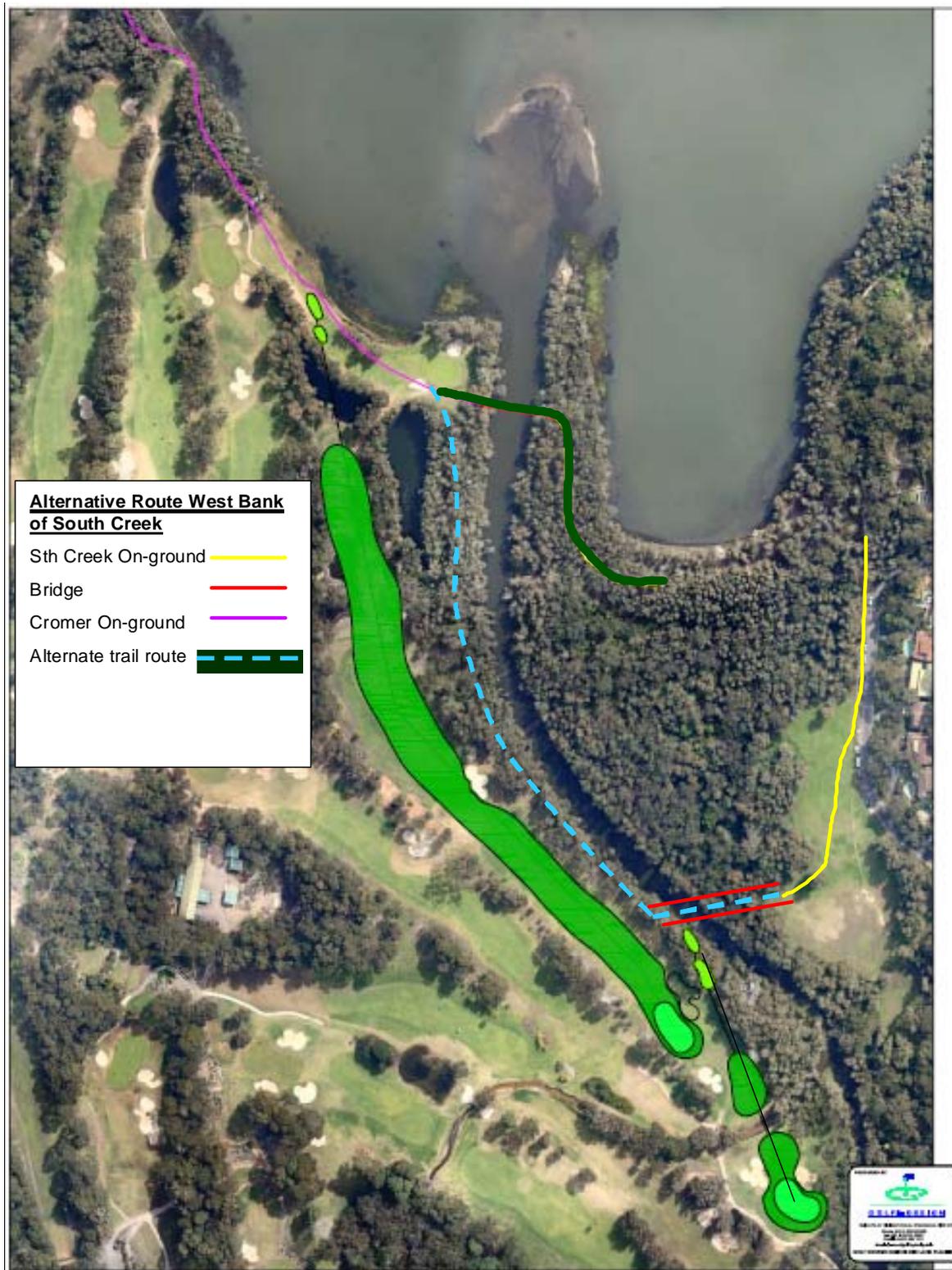


Figure 45 - Alternative Route West Bank of South Creek



Figure 46 - Option Three with EEC Protection Zone

Vegetation Mapping and Comparative Environmental Assessments

Environmental Comparison Tables

Option 3B impacts were further considered using a quantitative and qualitative assessment matrix in comparison to the Selected Options and including the above alternative route west bank of South Creek

The following tables show the results of this assessment.

Table 5 - Academy Section Options and Impacts

(refer Figure 6 – Environmental Constraints Academy Section, page 9 and Appendix R: Round 2 and 3 Option Maps with Environmental Constraints)

Impact	Condition	Option 1	Option 2 & 3	Option 4	Option 3A	Option 3B
Bangalay Alluvial Forest Total m2	Moderate		36			
Peppermint - Angophora Sandstone Forest Total m2	Good		252			
Swamp Oak Forest	Good	160	370	316	376	360
	Low	350	175	417	350	350
	Moderate	11	52	459	12	11
Swamp Oak Forest Total m2		521	597	1192	738	721
Grand Total Clearance EEC and Other Native Vegetation* m2		521	886	1192	738**	721
Relative Impact on EECs and Other Native Vegetation		Low	Moderate	High	Moderate	Moderate
Relative Impact on Water Bird Habitat mouth of Middle Creek		Low	Low	High	Low	Low
Area Impact of Seagrass <i>Halophila</i> m2		None	None	350	None	None
Area Impact of Seagrass <i>Zostera capricorni</i> m2		None	None	None	None	None
Comparative Environmental Impact Ranking (1 preferred)		1	2	5	2	2
Comparative Environmental Impact Ranking after consideration of Mitigation and Off-sets (1 preferred)		1	2	5	2	2

* Estimated area (m2) of EEC and other Native Vegetation clearance using Council's Geographical Information System. Actual areas will vary on site.

** Option 4 m2 includes clearance of areas outside of the Academy.

The preferred Option 3B goes through the vegetation south of the boatsheds which is in relatively good condition. The following measures are proposed to off-set the impacts:

- Elevating the trail to allow fauna movement and facilitate drainage.
- Selecting an alignment that minimises tree loss and avoids areas of high resilience

Table 6 - Cromer Golf Course Section Options and Impacts

(Option 4 not assessed here, refer Figure 8 - Cromer Golf Club and South Creek Reserve Environmental Constraints North, page 10 and Appendix R: Round 2 and 3 Option Maps with Environmental Constraints)

Impact	Condition	Option 1 - A	Option 1 - B	Option 2	Option 3	Option 3A	Option 3B	Opt 3B West Bank Alt Route
Bangalay Alluvial Forest m2	Good	97	0					
	Moderate		85					204
Bangalay Alluvial Forest Total m2		97	85					204
Swamp Mahogany Forest Total m2	Moderate	148	148					
Swamp Oak Forest m2	Good	230	112	97	151	151	151	887
	Low	0	0	0	0	0	0	0
	Moderate	0	0	53	0	0	0	380
Swamp Oak Forest Total m2		230	118	150	151	151	151	1,267
Grand Total Clearance EEC * m2		475	351	150	151	151	151	1,472
Area Available for Revegetation m2							3500	
Relative Impact on EECs and Other Native Vegetation		Low	Low	Low	Low	Low	Low	High
Relative Impact on Water Bird Breeding Habitat Golf Course Pond	Moderate	Moderate	Moderate	None	None	None	None	High
Relative Impact on Black Bittern habitat	Good	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Very High
Disturbance to Water Birds Mouth of South Creek		Low	Low	High	Moderate	Moderate	Moderate	Moderate
Area Impact of Seagrass <i>Halophila</i> m2		None	None	850	None	None	None	None
Area Impact of Seagrass <i>Zostera capricorni</i> m2		None	None	None	None	None	None	None
Comparative Environmental Impact Ranking (1 preferred)		3	1	3	2	2	2	7
Comparative Environmental Impact Ranking after consideration of Mitigation and Off-sets (1 preferred)		3	1	3	2	2	1-2	7

* Estimated area (m2) of EEC and other Native Vegetation clearance using Council's Geographical Information System. Actual areas will vary on site.

The preferred Option 3B avoids most areas of environmental constraint except at the mouth of South Creek. The following measures are proposed to off-set the impacts:

- Revegetation of the 15th hole and western foreshore of South Creek which is habitat for Endangered Ecological Communities and threatened and migratory bird species
- Fencing to restrict access of the western foreshore of South Creek from trail users and domestic dogs.
- The protection of approximately 4 hectares of contiguous Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek
- Establishment of Wildlife Protection Areas restricting access to parts of South Creek Reserve for domestic and feral dogs and cats and enabling cat trapping.

Table 7 - South Creek Reserve Section Options and Impacts

(Option 4 not assessed here, refer Figure 8 - Cromer Golf Club and South Creek Reserve Environmental Constraints North, page 10 and Appendix R: Round 2 and 3 Option Maps with Environmental Constraints)

Impact	Condition	Option 1 - A	Option 1 - B	Option 2	Option 3	Option 3A	Option 3B
Swamp Oak Forest m2	Good	1063	181	1409	1381	1381	1381
	Low		91				
Grand Total Clearance EEC * m2		1063	272	1409	1381	1381	1381
Relative Impact on EECs		High	Low	High	High	High	High
Removal Black Bittern Habitat	Good	Moderate	Low	Moderate	Moderate	Moderate	Moderate
Dissection of fauna habitat eastern side south creek	Good	High	Low	High	High	High	High
Relative impact on threatened fauna habitat	Good	High	Low	High	High	High	High
Area Impact of Seagrass <i>Halophila</i> m2		None	None	None	None	None	None
Area Impact of Seagrass <i>Zostera capricorni</i> m2		None	None	None	None	None	None
Comparative Environmental Impact Ranking (1 preferred)		6	1	6	6	6	6
Comparative Environmental Impact Ranking after consideration of Mitigation and Off-sets (1 preferred)		6	1	6	6	6	2

* Estimated area (m2) of EEC and other Native Vegetation clearance using Council's Geographical Information System. Actual areas will vary on site.

The preferred Option 3B traverses through Swamp Oak Forest in good condition. The following measures are proposed to off-set the impacts:

- Fencing to restrict access of the eastern foreshore of South Creek from trail users and domestic dogs. This will act to limit the creation of informal tracks which can trample vegetation and introduce weeds. It will also protect fauna habitat by restricting access and noise.
- The protection of approximately 4 hectares of contiguous Endangered Ecological Communities and threatened fauna habitat along the edges of South Creek
- Establishment of Wildlife Protection Areas restricting access to parts of South Creek Reserve for domestic and feral dogs and cats and enabling cat trapping.
- The inclusion of elevated sections of trail within vegetation to facilitate drainage and allow fauna movement.
- Bush Regeneration and noxious and environmental weed control including monitoring.
- Implementation of an integrated pest management program.

6. Summary & Conclusion

6.1 Summary Table of Round 2 and 3 Option Assessments

The following table shows a review of the various assessments undertaken for the Selected Options as well as Option 3A and 3B.

Constraint	Section	Option 1A	Option 1B	Option 2	Option 3	Option 4	Option 3A	Option 3B
Environmental Ranking After Offsets	Academy	Acceptable	Acceptable	Marginal	Marginal	Prohibitive	Marginal	Marginal
Aquatic Impact	Academy	Acceptable	Acceptable	Acceptable	Acceptable	Prohibitive	Acceptable	Acceptable
User Experience (views, amenity)	Academy	Marginal	Marginal	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Safety	Academy	Prohibitive	Prohibitive	Marginal	Marginal	Marginal	Marginal	Acceptable
TBLD Risk Assessment (4 Selected Options)	Academy	Marginal	Marginal	Acceptable	Acceptable	Prohibitive	Assessed separately	Assessed separately
Environmental Ranking After Offsets	Cromer	Marginal	Acceptable	Marginal	Acceptable	Prohibitive	Acceptable	Acceptable
Aquatic Impact	Cromer	Acceptable	Acceptable	Marginal	Acceptable	Prohibitive	Acceptable	Acceptable
User Experience (views, amenity)	Cromer	Marginal	Marginal	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
User Safety	Cromer	Prohibitive	Prohibitive	Marginal	Acceptable	Marginal	Acceptable	Acceptable
TBLD Risk Assessment	Cromer	Acceptable	Marginal	Marginal	Acceptable	Prohibitive	Acceptable	Acceptable
Environmental Ranking After Offsets	SC Reserve	Prohibitive	Acceptable	Prohibitive	Prohibitive	Prohibitive	Prohibitive	Acceptable
Aquatic Impact	SC Reserve	Acceptable	Acceptable	Acceptable	Acceptable	Prohibitive	Acceptable	Acceptable
User Experience (views, amenity)	SC Reserve	Marginal	Marginal	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
User Safety	SC Reserve	Acceptable	Acceptable	Marginal	Acceptable	Marginal	Acceptable	Acceptable
TBLD Risk Assessment	SC Reserve	Marginal	Marginal	Marginal	Marginal	Prohibitive	Marginal	Marginal
Cost Totals	All	\$ 3,087,424	\$ 3,214,092	\$ 6,597,716	\$ 4,424,938	\$ 6,393,288	\$ 3,833,007	\$ 3,923,968

Key: Outcomes

Acceptable	Marginal	Prohibitive
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6.2 Conclusion

The Option Development process highlighted in this report summarises a long and complex development and consultation process to determine a preferred alignment.

Based on the assessments and consultations completed over the past three years this Report concludes that Option 3B is the optimum solution for development of Stage 2B of the NLMUT from Middle Creek to South Creek Reserve.

Options Two and Four were found to be significantly higher cost and unaffordable by Council, principally due to their elevated or over-water components. Options One-A and One-B although favourable on cost and environmental grounds are dangerous through the Cromer GC section due to cross-over in front of the 15th tee as well as from directing large volumes of the general public through the golf course environment and were therefore excluded on safety grounds.

Option 3B involves generally (from north to south);

- A bridge over Middle Creek and a trail on-ground along the public foreshore Crown Land, fenced one side and open to the Lagoon. The existing Academy boatsheds are proposed to be relocated, with a resulting secure separation between trail users and Academy activities;
- A raised boardwalk through the vegetation bordering the Academy and Cromer Golf Club and then an on-ground path along the public foreshore Crown Land adjoining the golf course. The Cromer golf course will be required to be reconfigured, with their signature 15th hole being removed from the public foreshore land with the resulting separation of trail users and golf activities;
- A bridge crossing near the mouth of South Creek and an on-ground trail continuing along the Lagoon foreshore and built over existing tracks to join with the existing Jamieson trail and proposed South Creek cycleway. By containing the public access to a single route through South Creek reserve and with the golf course redesign, the opportunity arises to fence informal tracks, close off the unsafe weir access route, revegetate the western shore of South Creek and hence create a 4ha contiguous environmental protection zone at South Creek Reserve.

The funding available for the construction of Stage 2B is \$4.4 million, with the estimated cost of Option 3B being \$3.92 million and hence comfortably within budget limits at this conceptual stage. This cost estimate includes a sum of \$220,000 allowed for negotiations with the Academy over their boatsheds relocation, although no commitments have been made as to costs at this time. The cost estimate also includes a sum of up to \$400,000 which has been offered to partially fund the reconfiguration of the Cromer golf course and allow construction access. The adoption of the Option 3B concept by Council still requires a negotiated agreement to be reached with both the Cromer Golf Club and the Sydney Academy of Sport before it could be implemented, however based on discussions at the time of this report such agreement would appear achievable.

Option 3B is expected to provide a high quality user experience within Council's budget and with a separation of the public from the Academy and Cromer Golf Club activities. It has some environmental impacts however these can either be mitigated or are considered on balance to be acceptable, particularly in consideration of alternatives to minimise any impacts. Further work on environmental impacts will be carried out through the design development phase and ameliorative measures will be implemented to improve the management of this sensitive foreshore land.

Conclusions arising from this Options Report will be incorporated into a recommendation to a Council meeting for discussion and adoption. Council will then seek to formalise agreements with the Academy, Cromer Golf Club and NSW Crown Lands Division to enable design and construction and the ongoing management of the trail.

OPTION THREE B



DRAWING KEY

- Terrestrial boardwalk
- Elevated
- On ground
- Photomontage view
- Proposed building
- Building to be relocated
- Cyclone Fence
- Low post and wire fence
- Area to be revegetated

THOMPSON BERRILL LANDSCAPE DESIGN P/L



NARRABEEN LAGOON MULTI-USE TRAIL



V3, SEPTEMBER 2011
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Warringah Council

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Stakeholder: Authorities

- Roads and Traffic Authority
- Office of Environment and Heritage
- Office of Water
- NSW Department of Primary Industries (Fisheries)
- NSW Maritime
- NSW Department of Planning
- Sydney Metropolitan Catchment Management Authority (SMCMA)
- Aboriginal Heritage Office (AHO)
- Metropolitan Local Aboriginal Land Council (MLALC)
- NSW Crown Lands Division
- Eco Logical Australia (ELA)
- Australian Museum Business Services (AMBS)
- Cardno Ecology Lab
- Cromer Golf Club
- Sydney Academy for Sport and Recreation

Appendices

Appendix A: Preliminary Options Plans

Appendix B: Stakeholder Submissions to Preliminary Options

Appendix C: Flora and Fauna Assessment

Appendix D: Aquatic Ecology Constraints Assessment

Appendix E: Exploratory Options

Appendix F: Exploratory Options Matrix

Appendix G: Golf Course Layout and Alternative Re-alignments

Appendix H: Community Information Packs for Workshop

Appendix I: Selected Options Plans

Appendix J: Selected Options Montages

Appendix K: Selected Options Details

Appendix L: Community Engagement Outcomes Report

Appendix M: Selected Options Cost Estimate

Appendix N: Geotechnical Report

Appendix O: Risk Assessment Tools

Appendix P: Risk Assessment Summary Table

Appendix Q: Material Research

Appendix R: Round 2 and 3 Option Maps with Environmental Constraints