

INTERNATIONAL MOUNTAIN BICYCLING ASSOCIATION AUSTRALIA

Trail Audit Documentation

Location:

Manly Dam (Manly Warringah War Memorial Park)

Services provided for:

- Warringah Council



Introduction

Situation

Manly Warringah War Memorial Park is located approximately 4km north-west of the beachside suburb of Manly on Sydney's North Shore. The park is roughly 3 square kilometres in area and is nestled between the suburbs of Manly Vale, North Balgowlah, Allambie Heights and French's Forest.

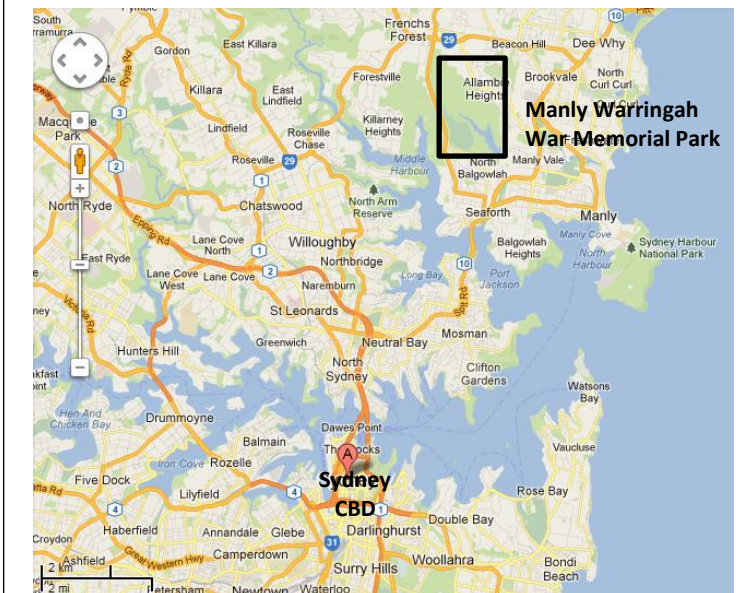
Its centrepiece is an historic dam wall that retains a 30 hectare water body that once provided the main water supply for the local area. It is this feature from which the common name for the park, Manly Dam, is derived. (For the purposes of this document the park is referred to as Manly Dam).

The park's boundary roughly encompasses the small catchment encasing the water body, and typical Sydney sandstone bushland occupies the majority of the space between the boundary and the water body edge. Wakehurst Golf Course occupies a substantial area in the south-west portion of the park and facilities for passive recreation and picnicking dominate the southern edge of the water body. There are several tennis courts, playgrounds, lawns and other minor recreation facilities dotted around the park's periphery.

The southern and eastern boundaries of the park are abutted by suburban development with a small section of the park's boundary at the south-east extremity adjoining a University of NSW research facility. An arterial road, the Wakehurst Parkway, forms most of the western boundary, while to the north a Sydney Water Pipeline easement separates Manly Dam from the Warringah Aquatic Centre.

Manly Dam is gazetted as Crown Land and managed by Warringah Council under a set of guiding principles that identify as priorities the protection and enhancement of the park's natural, cultural, and recreational values.

Location Map



Map image courtesy Google Maps

Manly Dam Trails

Throughout the park is an extensive network of management vehicle tracks and an even more extensive although less formalised single-track network. A loop that (roughly) circumnavigates the park has been formally designated as a mountain-biking trail after a long history of informal/unauthorised use. It is composed of a combination of existing management tracks and single-track trails, and combines both shared-use and mountain-bike only sections. The designated direction of travel is clockwise and it seems that there is a very high level of compliance to this protocol among users.

Another trail loop circumnavigating the interior of the park is a designated walking loop.

There are numerous other trails within the park, both vehicle track and single-track, which are generally designated as walking only. It would seem that at least some of these trails are not recognised or formalised as authorised trails at all. Anecdotal reports and very brief inspection of a small sample of these other trails suggest that some mountain bike riders are using these trails, although during the audit no evidence of heavy use or severe impacts was encountered.

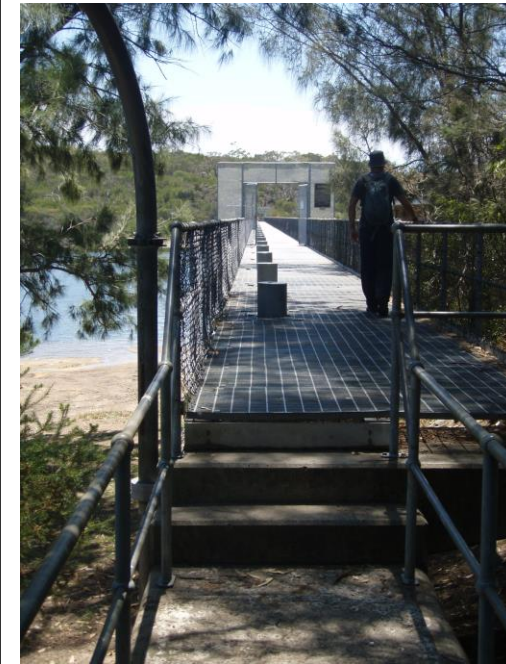
The approximately 11 km long existing designated mountain bike trail circumnavigating the park is the primary focus of this trail audit and report.

Manly Dam is one of very few authorised MTB trails in the Sydney region and is thus a very busy trail, attracting users from well beyond the boundaries of Warringah Council. Actual usage rates have been estimated (from extrapolating survey data) at approximately 150,000 passes per year. At peak times such as Saturday mornings, usage has been measured at 80 passes per hour and up to 500 passes per day. To IMBA-Au's knowledge these figures would make Manly Dam the most heavily used MTB trail in Australia. Rates of use at Lysterfield Park in Melbourne have been estimated at 140,000 per year with You Yangs Regional Park near Geelong slightly less than that. It is not surprising that Manly Dam is so busy given that it is the most proximal and accessible authorised MTB trail in Sydney, Australia's largest urban conglomeration, and a city that has a distinct under-supply of authorised MTB riding opportunities.



Glossary of Abbreviations and Terms

Term	Explanation
IMBA Au	International Mountain Bicycling Association Australia
Double-track	Track that is wide enough or has a bench wide enough along which a four-wheeled vehicle could pass (vegetation and surface permitting). These are often fire access or management tracks.
Fall Line	The prevailing slope and the direction (surface) water will naturally flow.
MTB	Mountain bike or mountain biking.
Outslope	A method of tread construction that leaves the outside edge of the tread of a hillside trail lower than the inside. This is done to help to shed water from the trail.
RGD	Rolling Grade Dip: specific drainage infrastructure. See pg 204 <i>Trail Solutions</i> (Felton, 2004).
Sideslope	The natural slope of hillside measured on the fall line.
Singletrack (Trail)	Trail so narrow that users must generally travel in single file
Social Trail	Unplanned or unauthorised trail that has developed informally by the action of some users. These are not designed by the land manager and hence are rarely maintained.
TDR/TDRS	Trail Difficult Rating/Trail Difficulty Rating System. Developed by IMBA, the TDRS "...is a basic method used to categorize the relative technical difficulty (and challenge) of recreation trails." See pg 72, <i>Trail Solutions</i> . The TDR is the Trail Difficulty Rating that is applied to a trail.
Track/Trail	These terms are used interchangeably in this report.
Tread	The actual surface upon the trail on which users travel.
TTF	Technical Trail Feature. An obstacle, either natural or deliberately placed / designed / built in the trail, that requires some degree of skill to negotiate. See pg 268, <i>Trail Solutions</i> .
WPs	Waypoints



Scope of Trail Audit Project

Project Meetings and Progress Reporting

- Project Start-up meeting
 - *Held Thurs 17/01/2013 at Manly Dam office*
- Consultation meeting
 - *Held Mon 21/01/2013 at Manly Dam office*
- Progress meeting
 - *Held Tues 19/02/2013 at Manly Dam office*
- Presentation

Background Research

Documents review

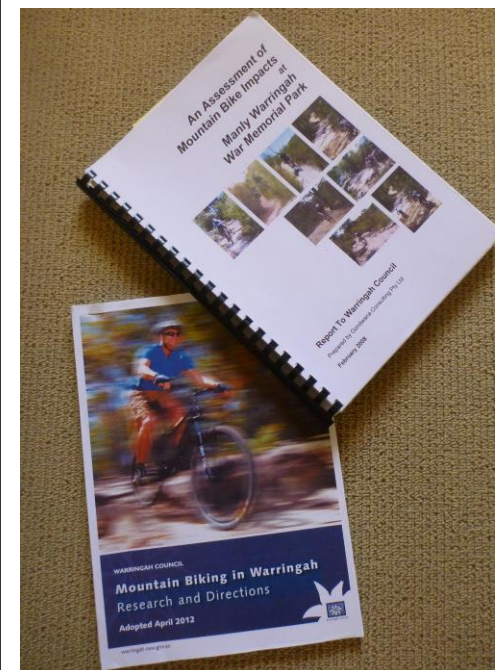
- Manly Warringah War Memorial Park Plan of Management Draft v7 – Dec 2011
- Risk Assessment Report - Manly Dam MTB Trail – Statewide Mutual – March 2011
- Assessment of MTB Impacts at Manly Warringah War Memorial Park – Gondwana Consulting – Feb 2008
- Mountain Biking in Warringah – Research and Directions – April 2012

Preliminary Audit

- User analysis
 - *Stakeholders consulted during consultation meetings and during audit*
- Site analysis and condition assessment
 - *Conducted 16th – 22nd Jan 2013, in accordance with procedure described in next section of this report*
- Preliminary Audit Report
 - *This document comprises the preliminary audit report*

Preliminary Design Report

- *This document comprises the preliminary design report*



Trail Audit Methodology

World's Best Practice

All trail assessments that IMBA Australia undertake are based on IMBA trail development and management guidelines, as outlined in:

Felton, V (2004) *Trail Solutions; IMBA's Guide to Building Sweet Singletrack*, Johnson Printing, Boulder, Colorado, US., and:

Webber, P (2007) *Managing Mountain Biking; IMBA's Guide to Providing Great Riding*, Publication Printers Corp, Denver, Colorado, US.

The guidelines as explained in these two texts are widely regarded as world's best practice in the provision and management of sustainable recreational trails.

Sustainable trails are trails that protect the environment, facilitate minimal impact human visitation to natural areas, are erosion-resistant, and require minimal maintenance. Sustainable trails meet the needs of users and minimise conflict between trail users and different user groups.

Audit process

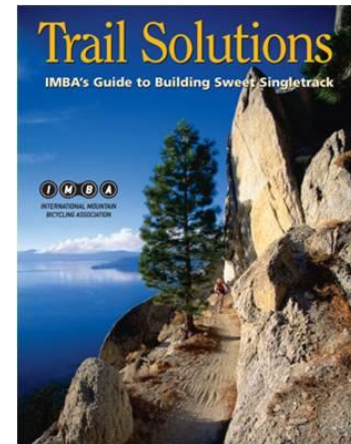
Field work for the Manly Dam trail audit took place between 16th and 22nd January 2013.

IMBA Australia staff covered the existing designated mountain bike trail loop and several other trails on foot, undertaking a detailed assessment of trail condition.

Using a Trimble GPS unit, waypoints were recorded wherever issues/problems with the trail were encountered, and in some cases to highlight examples of good quality sustainable trail sections and features. At each waypoint, notes were recorded and digital photos taken to capture the trail condition information as best as possible, and where gradient measurements were required, gradients were measured using a clinometer.

For each waypoint, recommendations about trail repairs and upgrades are provided. These recommendations are made on the basis of:

- Maximising the safety of park users.
- Minimising the ecological footprint of the trail ie maximise sustainability.
- Providing the land manager with the most cost effective and low maintenance solution.



'Trail Solutions; IMBA's Guide to Building Sweet Singletrack' (above) is a valuable resource for any land manager responsible for trails. Terminology used in this report is largely drawn from this text.



Generic photo of IMBA Australia conducting a Trail Audit at Eagle MTB Park (SA).

Priorities

Each recommendation is ascribed a priority rating based on the following criteria:

- **Priority 1 (P1):** Tasks recommended for immediate action (or as soon as reasonably possible). Relates primarily to addressing significant risk(s) to the safety of trail users, and/or to remediating or alleviating a specific and substantial environmental risk and/or environmental impact.
- **Priority 2 (P2):** Tasks recommended for action as soon as practicable (pending available resources). Typically relates to addressing a less significant risk to trail user safety, and/or to alleviating environmental impacts associated with the trail.
- **Priority 3 (P3):** Tasks recommended for action when possible. Usually relates to enhancement and quality control of the trail to provide high quality trail experiences. May relate to alleviating a minor risk to user safety or minor environmental impact.



Generic photo of IMBA Australia meeting with clients while conducting a Trail Audit at the Mt Remarkable Trails, Melrose (SA).

Trail Difficulty Rating System

The IMBA Trail Difficulty Rating System (TDRS) is "...a basic method used to categorize the relative technical difficulty of recreation trails." (For a complete description of the reasons for and the details of the TDRS, see pp 72-75 of *Trail Solutions*). It is an important risk management tool as it can help trail users make informed decisions and encourage them to use trails that are appropriate for their level of skill.

The TDRS is adapted from the internationally recognised ski area trail marking system and is becoming increasingly recognised throughout Australia and the world as the preferred classification system for MTB trails. IMBA Australia encourages all Australian land managers to adopt this system for classifying MTB trails and Warringah Council has confirmed it will adopt this system for all MTB trails within its boundaries.

As part of the audit process a Trail Difficulty Rating is ascribed to each assessed trail or section of trail based on the criteria set out on page 75 of *Trail Solutions*.

The four Trail Difficulty Ratings used in this report and their general meanings are:

- **Green Circle – EASY** (Easiest / Beginner) – Suitable for beginner/ novice mountain bikers. Basic mountain bike skills required. Suitable for off-road bikes.
- **Blue Square – MORE DIFFICULT** (Intermediate) – Suitable for skilled mountain bikers. Suitable for mountain bikes.
- **Black Diamond – VERY DIFFICULT** (Advanced) – Suitable for experienced mountain bikers with good skills. Suitable for better quality mountain bikes.
- **Double Black Diamond – EXTREMELY DIFFICULT** (Severe) – Suitable for highly experienced mountain bikers with excellent skills. Suitable for high quality mountain bikes (full face helmets and body armour recommended).

Works plan

For each trail section a table is provided summarising recommended actions in order of priority. Actions are described for specific waypoints or segments between waypoints. Recommendations are made on whether the action warrants implementation by professional trail construction contractors or if it is within the capacity of volunteer trail care groups to implement. In some cases issues required for follow up by the land manager are identified.

The recommended actions tables will form the basis of a Works Plan for the upgrade of the trail / trail network to a level commensurate with the IMBA sustainable recreational trail guidelines, and should be easily transferable into a format suitable for preparing job specification and tender documents.

mountain bike trail classifications

(based on the condition of terrain, gradient and obstacles and conditions of use)



BEGINNER

Suitable for beginners, families and children, gentle gradients and minor obstacles. Less than 10km. Shared use, walkers welcome.



INTERMEDIATE

Suitable for riders with some off road experience. Trails have obstacles, a variety of terrain, including some steep sections. Shared use. Caution: cyclists may be travelling at speed.



ADVANCED

Suitable for experienced riders. Challenging terrain and frequent obstacles. Trail designed for cycling one way and walkers are strongly discouraged from using these trails.

Application of IMBA Australia TDRS is varied across Australia but the basic information and rating is consistent. Source: Mawson Trail Loops, Cudlee Creek Native Forest Reserve (SA).

Trail Audit User's Guide and Disclaimer

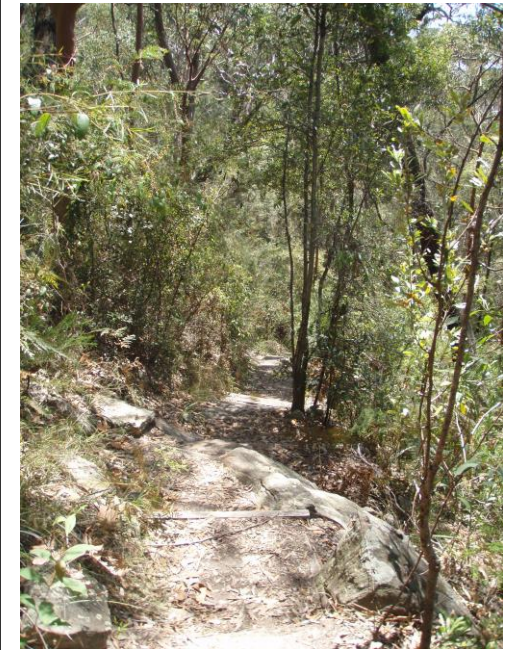
In regard to the interpretation of this Trail Audit Report and its use in setting work plans and implementing recommendations, the following clarification is offered.

This Trail Audit Report is ultimately designed to be a guide only with the intention to provide objective analysis of the trails and tracks at Manly Dam in reference to international best practice trail development and maintenance techniques.

Priority ratings are allocated on a trail section by trail section basis with highest priority ratings reserved for issues where the safety of trail users may be compromised or where the ecological impacts of the trail are particularly severe. For this reason, some Priority 1 tasks across the trail network may be considered more important than others. IMBA Au generally recommends that Priority 1 tasks related to user safety are more important for implementation than Priority 1 tasks related to environmental sustainability. This is specifically relevant to Manly Dam where the existing MTB trail loop is not causing any obvious significant environmental (ecological) impacts on a large scale. This assessment of environmental sustainability however is primarily related to impacts on soil erosion, water quality, endemic flora and overall ecological footprint. Assessment of the trail network in relation to impacts on endemic fauna is beyond the scope of this report. It is acknowledged that the land manager may have different perceptions and responsibilities and thus may wish to alter priorities accordingly.

It is acknowledged that the Manly Dam trails have not for the most part been planned and designed following best practice procedures, but rather are social in origin. So in this context the remediation of trail safety and sustainability issues may seem daunting at this point in time. Upgrading the trail network to a standard commensurate with the best practice guidelines will require a significant effort by the land manager and/or community and will take some considerable time. Hence IMBA Au encourages the land manager to stage the implementation of recommendations over several years using their own priority ratings with guidance from those given here.

It should also be recognised that all trail networks need regular attention and maintenance, and that their state can be affected quickly by changes in user behaviour patterns or unpredictable environmental factors such as freak storm events. This report essentially provides a snapshot of the overall condition of the Manly Dam trails at the time of assessment and gives due consideration to information provided by land managers and user groups that have a regular and longer-term viewpoint of the network. In this context it is important to be adaptable and flexible in the implementation of this report's recommendations.



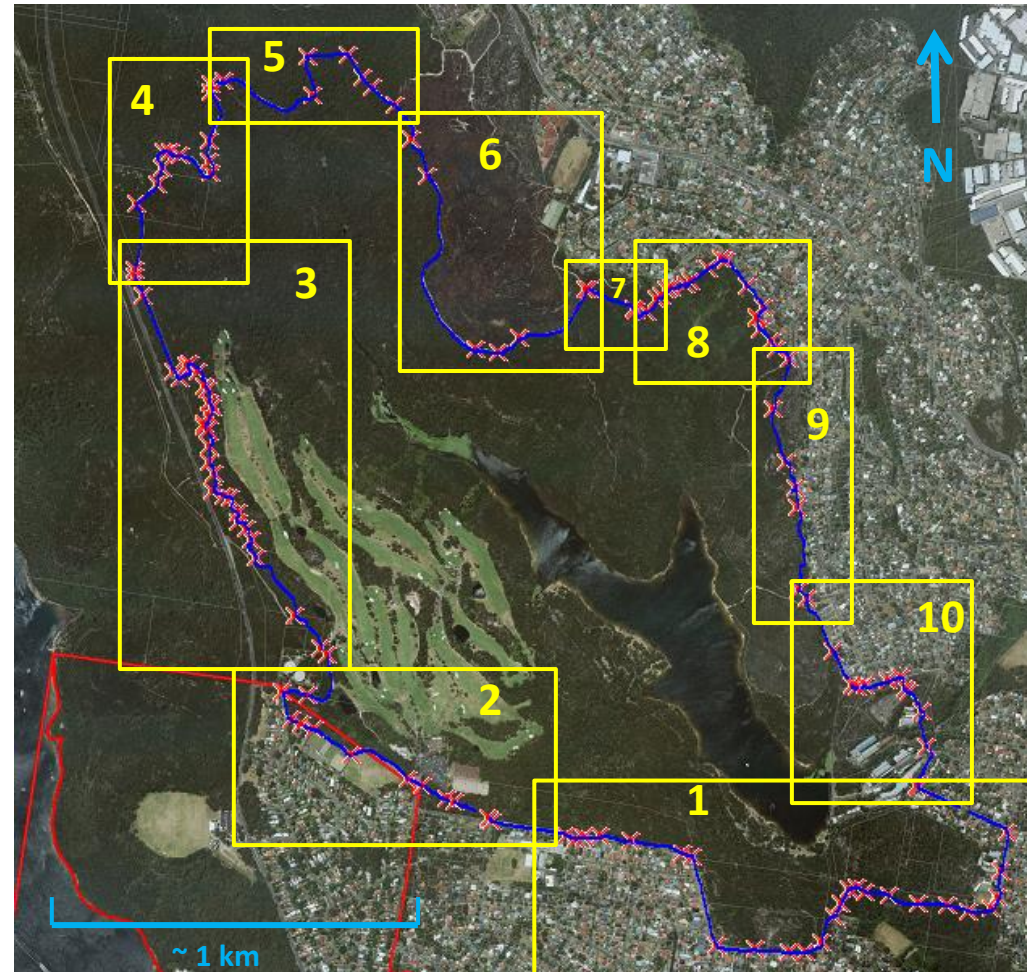
Overview of Manly Dam Trails

For the purpose of this assessment the Manly Dam MTB trail loop is divided into ten sections as shown in Figure 1 adjacent and described below.

- Section 1
Park Main Entry to Manning Street
- Section 2
Manning Street to Kirkwood Street
- Section 3
Kirkwood Street to Wakehurst Parkway gate
- Section 4
Wakehurst Parkway gate to Curl Curl Creek crossing
- Section 5
Curl Curl Creek crossing to 'Retirement Village' junction
- Section 6
'Retirement Village' junction to Allambie Heights junction
- Section 7
Allambie Heights junction to bottom of 19th Hole
- Section 8
End of 19th Hole to Southern Cross Drive gate
- Section 9
Southern Cross Drive gate to Nyrang Road gate
- Section 10
Nyrang Road gate to Park Main Entry

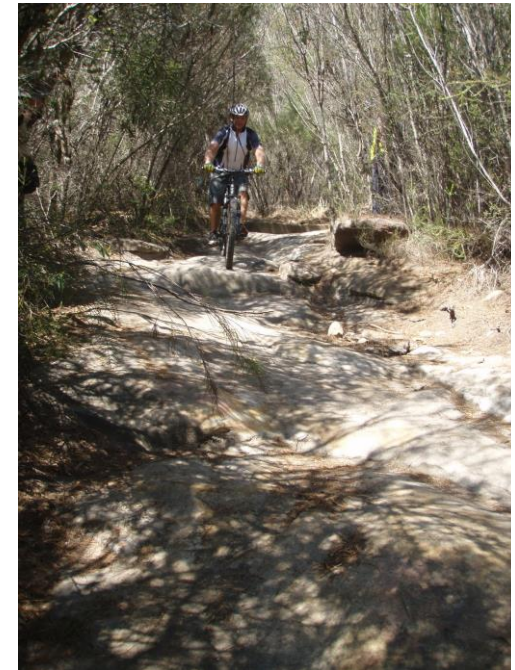
The sections are set out in sequence in a clockwise direction as this is the primarily riding direction.

Overview of Manly Dam MTB trail. Sections 1 – 10



Summary of Key Recommendations of this audit

- Develop and implement a signage strategy for the MTB trail loop (and ideally the entire Manly Dam park).
- Formalise and publicise the preferred ride direction of the loop.
 - *Both the above recommendations supported by Statewide Mutual Risk Assessment, 2011.*
- Designate Section 3 and proposed new trail sections in Sections 4 and 5 as MTB-only use. Designate all other sections as shared-use.
- Consider developing 3 re-routes to address risk issues - total distance of recommended new trail = 1.1 km.
- Consider developing 5 other re-routes to address risk and erosion issues - total distance of recommended new trail = 1.8 km.
- Consider developing 2 other (optional) re-routes as trail enhancement - total distance of suggested new trail = 2 km.
- If re-routes are to proceed, close approximately 2 km of existing trail.
- Engage professional trail construction contractor to implement Priority 1 upgrades at 19th Hole (Section 7) and 11 Priority 2 actions at various locations around loop.
- Formalise a volunteer trail maintenance program with user groups (and commit to providing it with on-going support) to:
 - Address/implement 3 Priority 2 and 13 Priority 3 actions on the existing trail loop.
 - Regularly monitor the condition of the MTB trail loop (this could occur in a formal manner eg undertake quarterly inspections with records kept, or informally ie establish points of contact to inform Council about trail condition by phone/email as required).
 - Undertake routine maintenance on as-needs basis, particularly to prune trail corridor, clean out knicks, Rolling Grade Dips and other drainage features on trail, clear fallen branches etc (eg after storms) and be Warringah Council's 'eyes and ears' in the field for managing the MTB trail loop.



General Comments about the Manly Dam MTB trail and its use

Diversity and intensity of (MTB) trail use

There are multiple user groups using the trail including MTBers, walkers and runners. There is clearly demand from all user groups for opportunities within the park for different activities. From a MTBing perspective, specific use is always desirable, especially for a trail that receives such high traffic volume as this. Much of the loop however is in close proximity to the urban fringe at the park's boundary and it would be unrealistic to deny pedestrian access onto the trail.

- IMBA Au recommends retaining the shared-use designation of most sections and manage the risk of user conflict through stronger signage and improved trail design.

Trail directionality – the trail is primarily used in a clockwise direction only and there is a high level of compliance to this protocol already, which is excellent.

- IMBA Au strongly supports retaining and formalising this protocol.

There is a relatively very high volume of traffic (esp. during peak periods) and a substantial diversity of rider skill levels.

- The provision of optional lines wherever possible is recommended to help better cater to the wide variety of user needs and wants.

Some trail sections are currently designated shared-use while other sections are designated single use. Anecdotal evidence suggests that there is some degree of shared-use occurring throughout the loop, although MTBers are the predominant user group.

- It is recommended to plan for shared-use in the urban fringe areas (Sections 1,2,7,8,9 & 10). Risk of user collision can be managed through trail upgrades to control user speed and stronger signage to set user expectations. There are some (minor) opportunities for trail separation.
- In the western portion of the loop (Section 3) the need for shared use access is less evident and the trail is by nature more technically challenging and thus less conducive to shared use. IMBA Au recommends strengthening signage and trail links in this area to direct all foot traffic onto existing walking trails (esp. the 'interior' walking trail loop) and designating the western section of the loop for MTB use only.
- In the northern area (Sections 4,5 & 6) the route is primarily management track and generally well suited for shared use. A proposed single-track re-route descent in Section 4 should be MTB only, pedestrians could still use the management track. A proposed single-track re-route climb in Section 5 could be shared use, and all users could still choose to use the management track if they like.



Quality of the MTB trail loop

Overall the trail quality is better than expected; quite poor trail conditions could reasonably be expected given the high intensity of use, diversity of user skill levels, and unplanned nature of the trails. There is much natural stone which is a great asset and trail gradients are reasonable in most areas. There are several obvious problem sections that would degrade during heavy rainfall events, and several problem sections that will continue to degrade with further use if not remediated.

The value of regular maintenance should not be under-estimated; there is plenty of 'low hanging fruit' in this trail network, ie great improvements that can be made by implementing relatively simple and easy measures.

- The establishment of a regular volunteer maintenance group to provide on-going monitoring and input is strongly encouraged. This has the added benefit of engaging the trail-user community, giving them an opportunity to increase their skills in trail maintenance, improve trail user ethics, increase community ownership and foster self-policing.

Several major projects will need contractors to implement. They create an opportunity however to not only improve sustainability and address safety concerns, but also greatly enhance the appeal of the circuit as a MTB experience and provide the Sydney MTB community with model examples of high quality sustainable trail development.

Quantity of MTB trail provided

It is clear from the 'Mountain Biking in Warringah' report adopted in April 2012, as well as from community consultations and anecdotal evidence, that there is high demand for MTBing opportunities generally in the region and that there is a wide range of skill levels among riders in the region. It could quite reasonably be argued that greater trail access is warranted relative to demand, although it is also acknowledge that Manly Dam may not necessarily be the appropriate location to meet that demand.

- IMBA Au encourages land managers to consider this regional context and endeavour to plan for MTBing opportunities on a regional scale. With MTB trail projects potentially emerging at Warringah Aquatic Centre (WAC), Bantry Bay and the Bare Creek Waste Management site there is a great opportunity in developing and linking these assets to help satisfy demand.

If the proposed WAC trail development proceeds, and assuming its focus remains on the provision of a 'green circle'/beginner level experience, then linking it to the Manly Dam loop would be highly desirable. It establishes the basis of a 'stacked-loop' network model (refer *Trail Solutions pp 95/96*) and reinforces Manly Dam as the 'blue square'/intermediate level experience.



- The proposed re-routes on the descent & ascent at Curl Curl Creek provide great opportunities for future trail linkages to the WAC loop trail.
- Development of the WAC trail would potentially alleviate pressure on the existing Manly Dam trail, especially from beginner-level riders. It would provide a more comfortable and enjoyable experience for beginner riders and greatly improve the experience of Manly Dam for intermediate-level riders; a win/win outcome.

Other trails at Manly Dam

The assessment of other trails at Manly Dam was outside the scope of this project but brief inspections and anecdotal evidence suggest some MTB riding is occurring on other trails, such as Eva's Track for example. A small sample of other (walking) trails inspected had significant shortcomings; they did not meet sustainability criteria particularly well. The particular trails inspected are probably not seeing much MTB use though so impacts are still relatively minor. Conversely, some existing 'other' trails look to be high quality and could be well suited to greater volumes and diversity of use.

- Making an assessment of all other trails in the park may be of value and could be considered by the Council. This could be considered in any proposal to investigate or establish new trail linkages to the WAC loop trail if developed.

Accessibility

The loop has a large number of entry/exit points, unsurprising given the location of the park on the urban fringe. From a risk management perspective there would be benefit in reducing the number of park entry points as it allows greater land manager control of user movement and ensures that all visitors are informed about user expectations via trail heads.

- It is recommended to reduce and consolidate the number of entry/exit points, which could be achieved with re-routes of trail sections inside the boundary of park (refer to recommendations for Sections 1, 2, 8).
- Trailhead signage should be upgraded and reinforced to set user expectations and enhance the experience for visitors.

Trail Difficulty Ratings

The vast majority of the existing loop could be considered to be at blue square / intermediate TDR level currently, with several short sections exceeding that criteria and falling into black diamond / difficult level.

It is recommended to retain the blue square/ intermediate TDR for the entire loop and provide black diamond / difficult options where warranted or where they already exist. There is potential to create linkages to the proposed WAC trails at green circle / beginner level.



Future directions – Management Regime, Stewardship and Opportunities

IMBA Australia commends Warringah Council for taking a pro-active approach to MTB management in its region. This trail audit is undertaken in the context of a review/update of the overall plan of management for the park so it is timely and an excellent opportunity to integrate trail management initiatives with broader management directions of the park.

Economic and tourism opportunities in relation to the trails should be considered in relation to the park's plan of management. It is important however that any such initiatives are well-managed. During the audit numerous riders were seen using rental bikes on the trails. While this is supported by IMBA Au in principle as a good initiative, the quality and type of bikes being rented seemed inappropriate for the terrain, which is a risk management concern.

A word of caution in relation to the implementation of this audit's recommendations. As trail re-routes and upgrades are implemented there may be an influx of high visitation levels, at least initially, which could have short-term impacts. This should moderate over time across the regional level as other new trail facilities are established and the interest generated by 'new' trails diminishes. This has been the experience of other new peri-urban MTB trails across Australia, a good example of which being the new trail network at Old Man's Valley at Hornsby. Two counters installed on the Manly Dam trail will provide valuable information about usage rates.

Community Engagement and Stewardship

The value of community engagement in good trail management should not be underestimated. Representatives of the Sydney North Shore MTB riding community have taken a strong interest in this and other trail projects in the region and they have demonstrated a high level of commitment and professionalism in supporting trail initiatives. There is already a strong sense of unity among them. It would be of great benefit to Manly Dam and potentially the region as a whole, to strengthen the existing volunteer trail care program with a commitment to on-going resourcing and perhaps formalisation of the group. This not only creates a resource to assist with trail management but also becomes a primary channel of communication between the land manager and the broader user group community.

Some elements to consider in developing a successful trail stewardship program include:

- Leadership – ideally the land management agency would provide some staff time to co-ordinate and support volunteer activities.
- Simple but sound administrative framework – provision of volunteer insurance is critical but 'red tape' should be kept to a bare minimum as many volunteers may view it as a strong dis-incentive.



- Training – provide volunteer groups with on-going opportunities for training in trail construction and maintenance which helps to build their capacity, ensure that the quality of outcomes is sound, and can in itself provide an incentive for greater volunteer involvement. IMBA-Au can provide this.
- Works Plan – working to an agreed plan helps to ensure the best possible and strategically valuable outcomes are achieved for the efforts contributed.
- Host regular work sessions and schedule them well in advance so volunteers can plan for them. Try to keep the sessions reasonably short (half-day) and be mindful to keep projects achievable, ie avoid ‘biting off more than you can chew’.
- Celebrate successes and provide incentives if possible (eg host a BBQ for volunteers after a work session, provide gift vouchers from a local bike shop, etc.)



Signage

IMBA Australia generally recommends using a 3-tier signage system for MTB trail networks. This can be adapted as required to fit the specific circumstances of just about any trail network.

Trail-head

Trail-head signage is a key risk management tool for land managers. Ideally every user entering a trail network should be captured by a trail head sign. Trail-head signage should convey at minimum the following information:

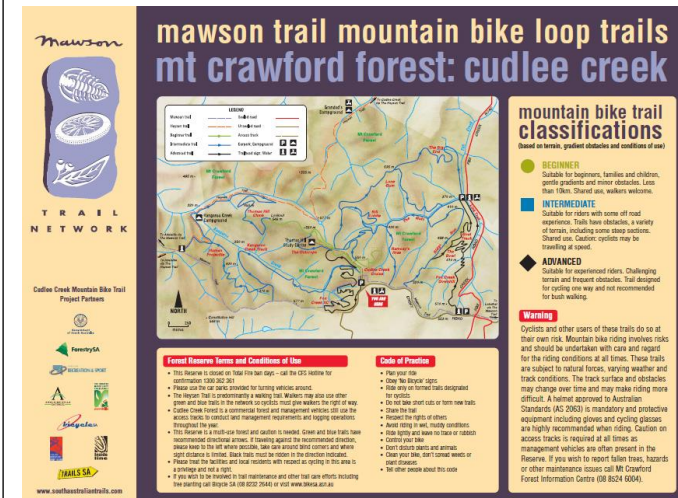
- An overall trail network map showing all trails, their usage designation (ie shared-use/specific-use), preferred direction of travel, Trail Difficulty Ratings, a 'You are here' marker, scale/distance.
- An explanation of the Trail Difficulty Rating System.
- Emergency information such as emergency services contact numbers and the location(s) of emergency assembly point(s).
- Rules and regulations relating to trail use and/or Code of Conduct for trail users to set expectations of user behaviours.
- Contact number for land manager to report problems/incidents.

Trail-head signage may also include such elements as:

- Interpretive information;
- Temporary notices (eg a space for a volunteer group to pin notices about upcoming maintenance sessions);
- A pamphlet/map box;
- Donation box to help fund trail maintenance activities.

Typical size and orientation:

- Highly variable but a 1200mm wide x 900mm high panel is usually suitable; generally the larger the better, within reason.
- Trail-head signs are best oriented facing south if possible, so that the person viewing it is facing north and therefore oriented with the map when looking at it (assuming north is upwards on the map).



Trail-head sign at Cudlee Creek Forest Reserve, SA (above). A detailed map, the TDRS, MTB Code of Practice and other user information are all included on this 1200mm x 900mm panel.



Trail-head sign at Forrest, Vic. This stylised design includes a trail map with a description of each trail. User information and a TDRS description are provided on a separate panel.

Totem / navigational

The primary purpose of totem signage is to provide navigational information for trail-users. Totems are intended as a secondary level sign; presented on the assumption that the trail user has already absorbed the information conveyed on the trail-head, but more substantial and conveying more information than a trail marker.

Totems are useful for:

- Major junctions where multiple route options are available.
- Natural congregation points where trail users are likely to stop anyway.

Additional information may also be conveyed effectively on totems such as:

- Usage designation (shared or specific use).
- Distance of trails or to other points of interest or to trail-heads.
- Cautionary messages specific to particular trails.
- Depending on the specific situation, it can be worthwhile including location info (grid reference) and emergency phone numbers.

Typical size and orientation:

- There are good examples in Australia where totem signs are installed to be head-height, making them easily visible from a distance and not easily obscured by seasonal growth of tall grass or other vegetation
- Other good examples use a panel approx. 450mm across x 900mm high



Example of totem signage at Melrose, SA. The height means annual growth of seasonal grasses will not obstruct signage. Directions for multiple trails with differing TDRs are shown on the one sign, in some cases together with distances to specific local landmarks.

Trail markers

It is recommended that as a minimum, the entry point into every trail in the network, and every trail junction in the network should be signposted with a trail marker. The trail marker should display:

- Directional arrow of minimum width/diameter 100mm (to meet Australian Standards for walking trails).
- TDR symbol (ie green circle / blue square / black diamond / double diamond).
- Trail name.
- Designated usage and/or directionality (ie shared or specific-use, one-way or bi-directional).
- Any additional information or cautionary messages that might be specific to that particular trail or circumstance (eg delineation of optional ride lines, particularly where there are differences in degree of technical difficulty between trail options)

Typical size and orientation:

- 1 metre to 1.5 metres high.
- Wide enough to fit a 100mm wide arrow



Trail marker at Mitcham, SA. These signs, affixed to recycled plastic posts, are effectively a hybrid of a trail marker and trail totem.

Trail marker and caution sign on advanced trail at Whistler MTB Park, BC, Canada. Although the design is simple the message is very clear.



Trail marker at Mt Buller, Vic. These shared-use trails are referenced to the trail map with a number.

General signage recommendations

Consideration should be given to user safety when positioning and installing signage:

- Signposts should never be positioned in potential fall zones.
- Metal signs should be mounted in such a way as to avoid sharp edges being exposed.

Consideration should also be given to maximizing visibility:

- Appropriate colour choice providing contrast with surrounding environment (while being aesthetically pleasing)
- Appropriate signage height and orientation relative to sunlight, surrounding vegetation and other site-specific conditions.

Maximum simplicity minimum complexity:

- Use universally recognised symbols rather than wording wherever possible to ensure message is readily understood by any trail user.
- Use concise clear language.
- Ensure clarity of graphics and font.
- Maximise compliance with Australian (Walking) Trail Standards, Australian Road Sign Standards

Materials and styles

- Timber is still common in Australia and often the most cost effective. May have relatively shorter lifespan and is of course prone to damage in bushfire.
- Metal, recycled plastic and even concrete are becoming more commonly used in Australia.
- Consider using vandal-proof screws, particularly in peri-urban areas.

Estimation of Manly Dam signage requirements

12 locations have been identified as park entry/exit points where trail-head signage could be warranted. This is a substantial number and could be rationalised by prioritising say 5-6 locations as main trail-heads and installing totem style signage at the other 6-7 locations.

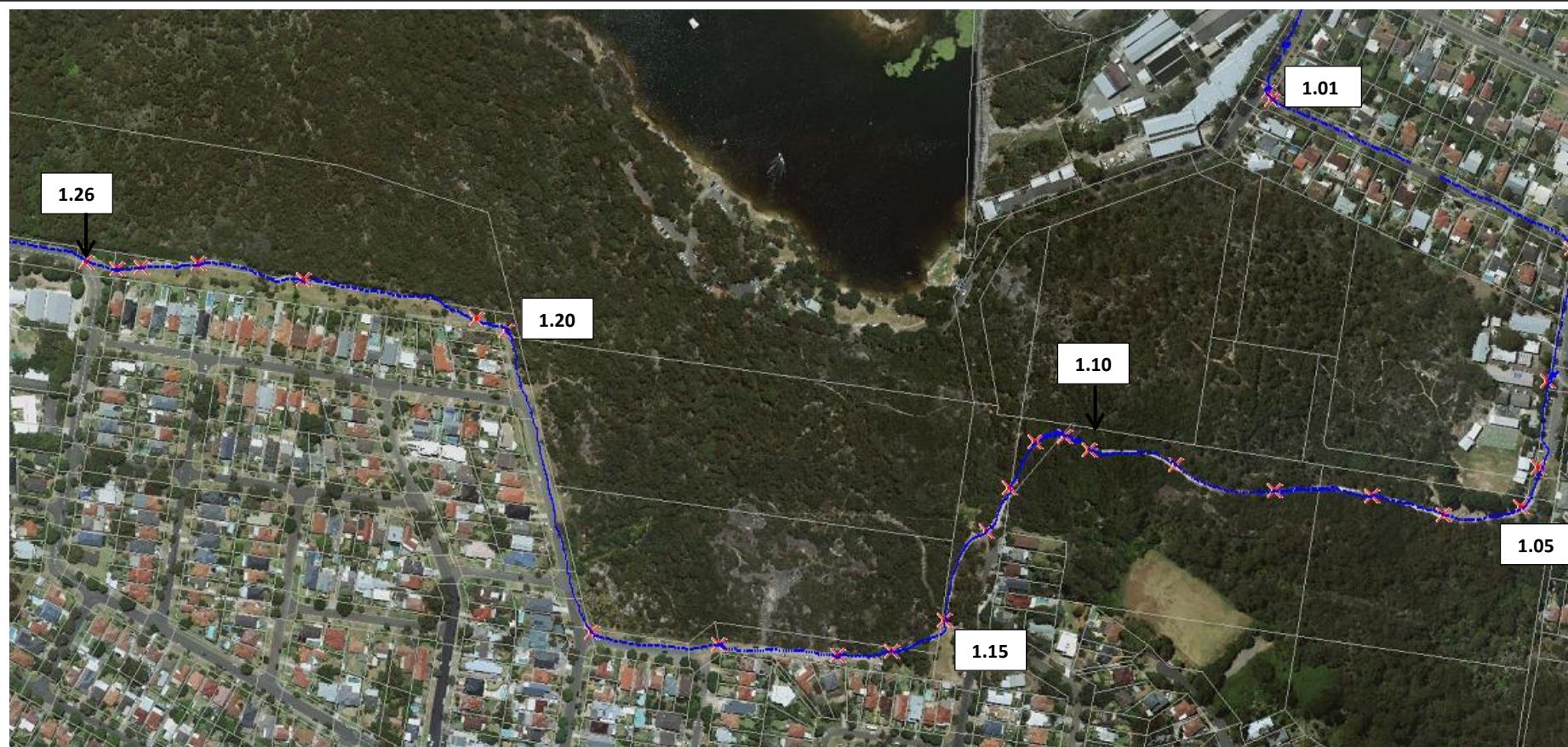
Approximately 50 locations have been identified where trail markers and/or cautionary signage is warranted. In most cases the cautionary signage could be done in a trail marker style; in a few cases where more detailed and specific information is required, the caution signage could be done in a totem-style.



Some of the existing signage at Manly Dam, such as this example above, is very good. There is however a lack of consistency and some considerable gaps in provision.

Section 1 – Manly Dam Main Entrance to Manning Street

Section 1 Map



Description

There is very little single-track in Section 1; it consists primarily of suburban streets, management track, natural surface trail immediately adjacent to suburban streets, and surfaced footpath adjacent to suburban streets.

The start point of the loop is the corner of King St and Arana St (WP1.01), close to the Main Entry of the park.

The first 400m (approx.) of the trail follows Arana St and Gibbs St to the Manly Vale Public School carpark.

From the carpark a natural surface management track enters bushland (WP1.04), climbing past McComb Hill to a gate at Water Reserve Rd (WP1.14).

The loop follows a management track along a fire break adjacent to houses to reach Kalauai St at WP1.18.

For a short section the loop follows Kalauai St and Bangaroo St then enters a firebreak behind houses on Warringah St (at WP1.20). The route exits the firebreak onto Manning St at WP1.26. Section 1 nominally ends at this point, approx. 2.2km from the start point.

Overall Condition

- Trail condition is reasonably good. Some relatively minor drainage problems on management track section.
- Signage is poor and is a key area in need of improvement.

Key Issues

- Lack of 'front door' into trail network is a problem that needs to be addressed. WP1.01 is one of the primary trail-head locations on the loop. At the time of the audit it had no signage or other indication of where to start the ride but new signage has since been installed by Warringah Council.
- Proximity of trail to Primary Schools is a risk management issue, particularly during peak hours. The risk of rider/pedestrian collision is real and should be addressed with trail signage as a minimum. A major re-route should be considered (*also refer final dot point*).
- A lack of single-track means the riding experience in Section 1 is not particularly appealing (although that's not to say it's specifically bad either). Much of Section 1 is really a transition part of the ride ie the commute to the beginning of the ride proper.
- Drainage problems on the management track are relatively minor but should none-the-less be addressed by contractors. The required remedies are simple to implement with machine work but would create a big laborious project for volunteers using hand tools.
- There would be considerable value in creating a new single-track trail within the boundary of the park, starting from the vicinity of the Park's main entrance linking to the end of Section 1 on Manning St.



WP1.05: Run-off from the carpark is causing erosion of the tread (above).



WP1.25 The original trail lacks drainage features and corrals so riders have worn in a new line. Drainage features and corrals are required on the new tread to avoid the same problem re-occurring.

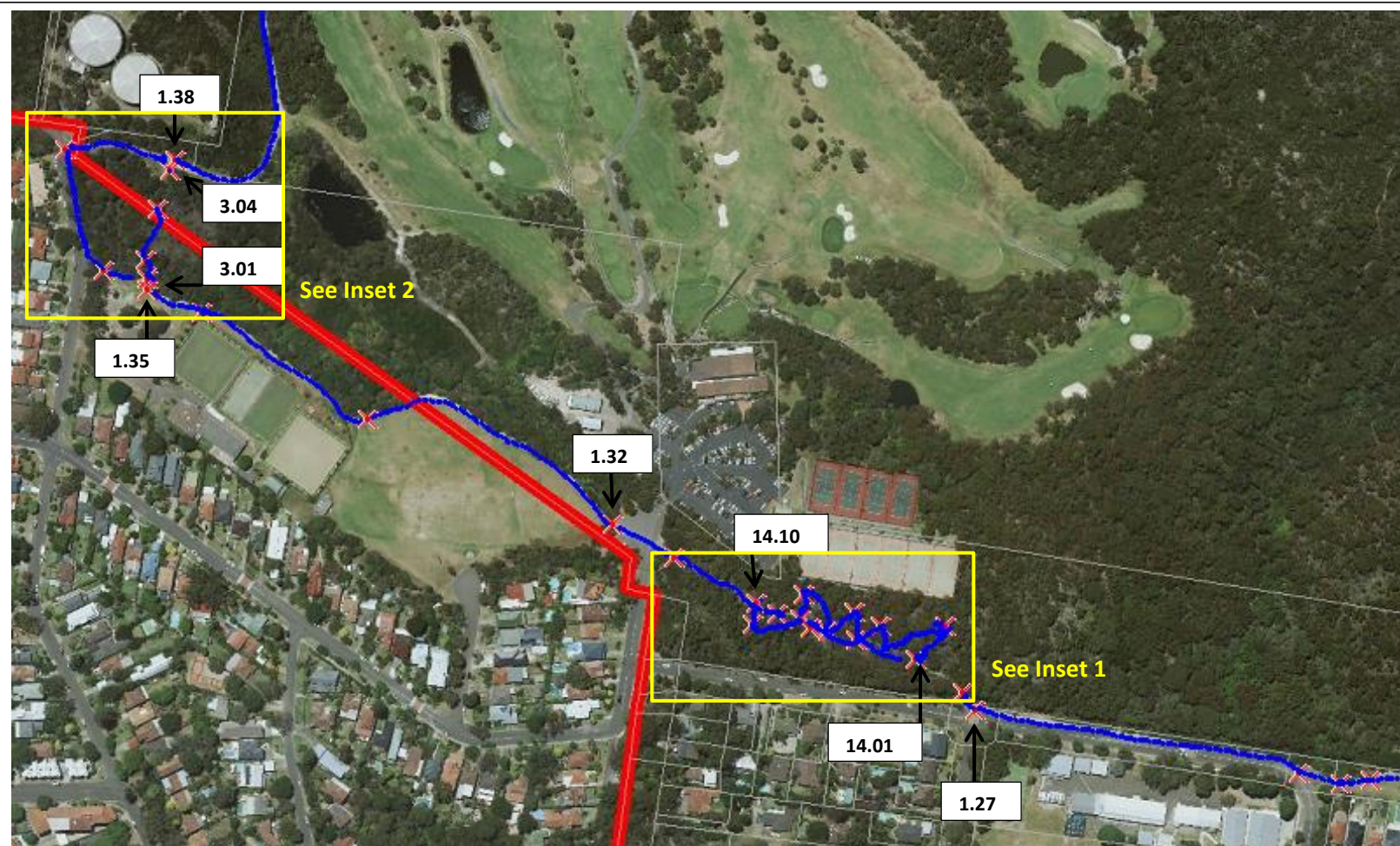
- This could potentially utilise sections of existing management track and single-track trail within the park to minimise the overall trail footprint.
- Such a re-route would address risk management issues outlined above, greatly enhance the overall riding experience, consolidate park entry points and bring the vast majority of the trail loop into the jurisdiction of the Manly Dam park.

Section 1 – Summary of Recommendations

Priority	Actions	Location	Who
1	Design and install signage	Prepare signage strategy for MTB loop &/or whole of Manly Dam park	Warringah Council to lead, contractor/consultant assistance if required.
		Install trail-head &/or trail-totem signage at 2 locations	
		Install trail-markers at 10 locations	
		Install caution signage (risk of collision with pedestrians near Primary School) at 2 locations	
2	Address drainage problems	Repair tread surface with road base, including RGD's in new tread in 3 sections @ av 10-20m long, 2-3m wide.	Trail contractor
		Install Knicks &/or RGD's at 8 locations	
		Install corrals & chokes (preferably large stone) in 3 sections @ av. 20m long	
3	Consider major re-route	<p>Investigate feasibility of developing new single-track trail within the boundary of the park (potentially linking with existing single-track trails and management tracks) to replace existing Section 1 trail.</p> <p>Suggested alignment:</p> <ul style="list-style-type: none"> • Start new single-track in vicinity of park Main Entry, link to vicinity of WP1.5. • Use existing management track WP1.5 to WP1.13. • Start new single-track in vicinity of WP1.13, link to vicinity of WP1.20. • Use existing trail WP1.20 to WP1.24. • Start new single-track vicinity of WP1.24 linking to WP1.27 (in Section 2). • Up to 1.7km of new trail could be considered, to replace approx. 1.5km of existing trail. 	Warringah Council to lead, contractor/consultant assistance if required.

Section 2 - Manning Street to Kirkwood Street

Section 2 Map



Description

The character of Section 2 is primarily urban, similar to Section 1. The trail follows suburban roadsides and a surfaced urban path, but there is some natural surface trail and bushland experience in this section too.

From WP1.26 the trail follows the northern side of Manning St for approx. 250m, opposite the Balgowlah North Public School.

At WP1.27 a natural surface trail leaves the road side and enters bushland, climbing on a fall-line gradient for a further 250m (approx.) to meet Judith St at the entrance to Wakehurst Golf Course (WP1.31).

A surfaced shared use urban path traverses from there along the boundary between the playing fields and tennis courts of Bantry Reserve and the bushland of Manly Dam, to meet Kirkwood St at WP1.36.

There is a very short road section (less than 100m) on Kirkwood St then the trail enters a management track at WP1.37 via a high, awkward (and ugly) gate. Less than 100m into this management track there is a junction with an informal single-track which is a well-used short-cut in the loop. The junction is the nominal end point of Section 2 which is approx. 1.1km in total length.

Overall condition

- The roadside and urban path sections are primarily sound. The natural surface section however is on an unsustainable alignment and is subsequently in poor condition and eroded.
- While some good signage is present (eg at road crossing) the overall level of signage provision is less than optimal.

Key Issues

- Proximity of the Manning St section of trail to a public school presents a risk management issue, particularly during peak hours. The risk of rider/pedestrian collision is real and should be addressed with stronger trail signage. A re-route by-passing Manning St altogether should be considered to eliminate this issue and improve the riding experience.
 - A follow up site visit was conducted by IMBA-Au staff on 11/6/2013 during which a proposed re-route alignment was flagged. Refer to 'IMBA_Au_Manly_Dam_site_visit_2013_06_11th_Report.pdf' for details.
- The natural surface trail section between WP1.27 and WP1.31 is in poor condition due to its alignment on the fall-line and remediation is required to avoid further degradation.
 - Option 1: A re-route is the preferred remedy and a sustainable alignment has been flagged, as shown in the Section 2 map. With a re-route the existing alignment could be closed and regenerated.



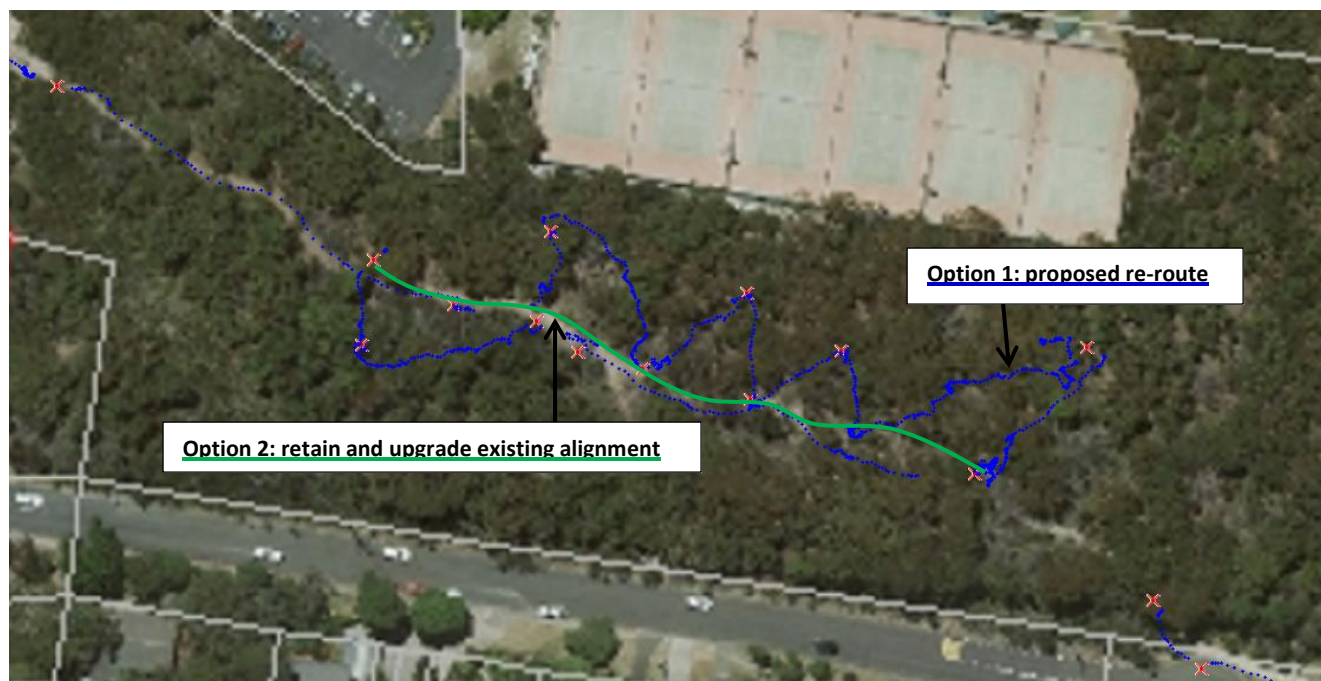
WP1.28 (above) – From this point the trail climbs on a fall line gradient and as a result is heavily degraded. Remediation is required to avoid further degradation.



WP1.31 – Trail junction with roadway should be consolidated with corrals to avoid development of social trails like the one on RHS. Bollards should be at appropriate width for MTB handlebars.

<ul style="list-style-type: none"> ○ Option 2 is to retain the current alignment and install rock armour, chokes and corrals to make it sustainable. This would probably be more costly than a re-route and arguably less desirable as a riding experience, but this option would contain the trail within the existing footprint which is desirable from a land management perspective. ○ <i>Refer to Inset 1 below for further detail.</i> ○ <i>A follow up site visit was conducted by IMBA-Au staff on 11/6/2013 and a re-route 'Option 3' was flagged. The re-route was effectively a compromise between Option 1 and Option 2 and minimises the overall trail footprint while improving the trail to as close to IMBA guidelines as possible. Refer to 'IMBA_Au_Manly_Dam_site_visit_2013_06_11th_Report.pdf' for details.</i> ● The Bantry Reserve area undoubtedly receives quite a high volume of recreation use for a variety of activities. The formalisation of a park entry/exit point and of the short-cut trail combined with some stronger signage would enhance the overall user experience and help minimise the risk of conflict between mountain bike riders and other recreational users in the area. <ul style="list-style-type: none"> ○ <i>Refer to Inset 2 below for further detail.</i> ○ <i>Following the completion of the audit it became apparent that the Bantry Reserve section of the trail is outside the boundary of Warringah Council and the preferred management arrangement is to re-route the trail to within the Council's boundary. During the follow up site visit conducted by IMBA-Au staff on 11/6/2013 a proposed re-route was flagged. Refer to 'IMBA_Au_Manly_Dam_site_visit_2013_06_11th_Report.pdf' for details.</i> 	
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Section 2 - Inset 1: proposed re-route



Although the side-slope gradient is modest (approx. 12%) the trail is eroding due to its alignment on the fall-line.

The re-route proposed in Option 1 is flagged at approx. 4-5% which would be a sustainable alignment. It would require approx. 250m of new trail (<1m wide) while approx. 100m of existing trail (>2m wide) would be closed.

Option 2 is to contain the trail within the existing footprint (which is desirable from a land management perspective) by using stone to armour the tread and create corrals and chokes to keep users on the trail.

Option 1 would most likely be less costly than Option 2 and potentially more appealing to riders.

Section 2 - Inset 2: Short-cut section

Bantry Reserve is an appealing recreational area and given the availability of car-parking space along Kirkwood St it is well suited as a trail-head location for visitors using the Manly Dam MTB loop trail.

The existing trail map encourages users to follow the urban path right to Kirkwood St, then along the street for a short distance and enter the management track via the large gate at WP1.37.

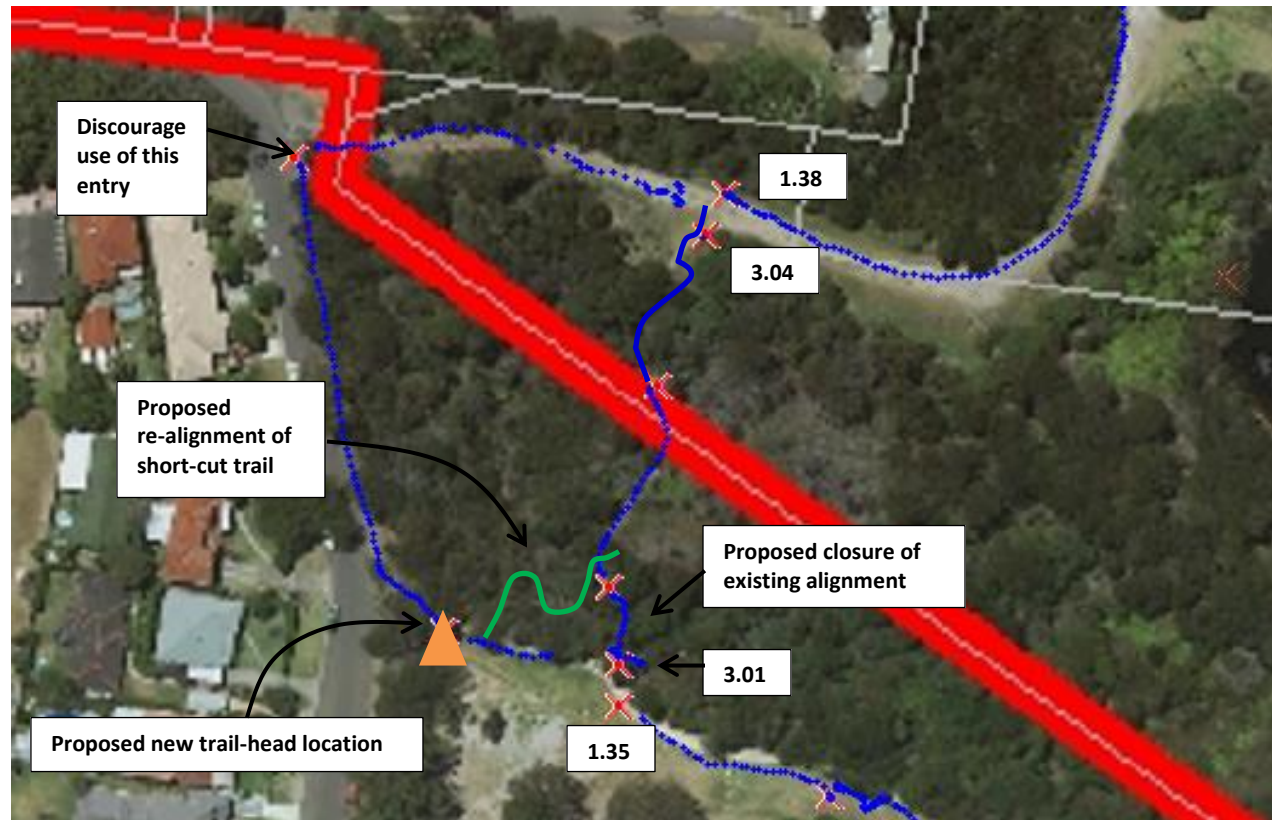
Although not substantially problematic this route is less desirable than the short-cut trail beginning at WP1.35.

Although informal, the short-cut is clearly heavily used and is in reasonably good condition. With a minor re-alignment at the southern end and some minor remediation works it can be upgraded to a good standard.

It is recommended to formalise the short-cut and encourage all users to use it.

A trail-head sign could be installed in the vicinity of WP1.36 drawing users into the existing short-cut trail and by-passing the Kirkwood St section.

If deemed necessary a totem sign could be installed at WP1.38 to capture any riders that use the Kirkwood St entry and by-pass the trail-head.



WP3.02 – This first section of the short cut trail has drainage problems, but a minor re-route is easily achieved and the rest of the trail is quite sound.

Section 2 - Summary of Recommendations

Priority	Actions	Location	Who?
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i>	Warringah Council to lead, contractor assistance if required.
		Install trail-head &/or trail-totem signage at 4 locations	
		WP1.27, WP1.32, WP1.35 (=WP3.01), WP1.38 (=WP3.04)	
		Install trail-marker at 1 location	
		WP1.31	
2	Remediate degradation of fall-line trail section	Install/upgrade caution signage (vehicle crossing) at 1 location	WP1.31
		Install/upgrade caution signage (risk of collision with other users) at 1 location	WP1.32
		OPTION 3: MINOR RE-ROUTE (Warringah Council preferred option)	
		Construct re-route from WP14.01 to WP14.10, as per doc: 'IMBA_Au_Manly_Dam_site_visit_2013_06_11 th _Report.pdf'	WP1.28 to WP1.30
		Trail contractor	
		OPTION 1: RE-ROUTE	
		Construct re-route from WP14.01 to WP14.10, as per flagged alignment (=250m of new trail)	WP1.28 to WP1.30
2	Formalise Bantry Reserve entry and short-cut trail.	Close and remediate old section of trail (100m)	Trail contractor or Volunteer trail care team
		OPTION 2: RETAIN AND REPAIR EXISTING ALIGNMENT	
		Install stone armour and chokes/corrals — 100m linear x 1m wide (av.) @ 10-12% gradient	WP1.28 to WP1.30
		Trail contractor	
		OPTION 2: RE-ROUTE (Warringah Council preferred option)	
3	Close short cut trail	Construct re-route to retain trail entirely within Warringah Council area boundary, as per doc: 'IMBA_Au_Manly_Dam_site_visit_2013_06_11 th _Report.pdf'	WP1.33 to WP1.38 (approx. – refer doc).
		Trail contractor	
		Construct minor re-alignment of short-cut trail to avoid flat boggy area at WP 3.02 (=30m new trail, close 20m old trail). • Close trail entry at WP3.01 • Establish new trail entry closer to Kirkwood St. • Link re-alignment to existing trail between WP3.02 & WP3.03	WP1.35 (=WP3.01) to WP1.38 (=WP3.04) Volunteer trail care team
3	Close short cut trail	Close trail	WP3.01 to WP3.04 Volunteer trail care team

3	Maintain urban path	Repair tread surface with road base – section 3m long x 1m wide	WP1.33	Warringah Council / (adjacent Council?)
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Section 3 - Kirkwood Street to Wakehurst Parkway gate

Description

Section 3 offers the first taste of sustained technically challenging single-track trail in the Manly Dam loop. It is a quality mountain-bike riding experience.

From the end of Section 2 (WP1.38) there is approx. 200m of management track to a trail junction at WP1.39.

A single-track trail section extends for approx. 1km northwards from here, featuring fast flowing sections interspersed with natural rock gardens and sandstone outcrops. There is much appeal in the technical nature and enclosed but 'flowy' feel of this trail section.

From a sandstone outcrop at WP2.02 the trail continues approx. 300m northwards along what was presumably once a survey easement; it retains a single-track trail feel although is pretty much dead straight. It meets a management track junction at WP2.04 which is also a park entry point from Wakehurst Parkway, the adjacent arterial road. This junction is nominally the end point of Section 3, total length of which is approx. 1.7km.

Overall condition

- Most of this section is in moderate condition. Localised erosion and substantial trail widening is widespread through this section but the level of degradation is not overly severe and in many cases looks to have reached its full extent ie is unlikely to worsen much further.
- Natural rock is a defining feature of this section. In some areas there is loose rock which should be remedied.
- Signage is less than optimal.

Section 3 Map



Key Issues

- Trail widening. Local riders attest that this section of trail has widened substantially over recent years with ever-increasing mountain-bike use. What was once a true single-track trail (approx. 0.5m tread width and 1m corridor width) is now in many sections 2-3m wide. The intermediate to high level of technicality of the trail forces many riders to seek easier ride lines, which leads to trail widening. Competitive riders seeking racing lines further exacerbate the widening, resulting in an overall increasing trail footprint. This can be remedied with installation of corrals, anchors and chokes to contain the ride line back to approx. 0.5m width. Where multiple ride lines exist or can be established within the existing trail footprint, they should be retained to provide options for the high volume and diversity of riders on this trail.
- Localised erosion looks to have been caused by a combination of intensive use in relatively weak skeletal soil sections, worsened by the impacts of heavy rainfall events. The extent of erosion however is not excessive and stone armouring can be installed to reinstate tread where it has eroded and to ensure it will resist future degradation.
- Timber (treated pine) and some steel features have been installed in the tread in numerous locations throughout this section to address erosion & trail degradation. In many cases the remedy has been successful but in some cases the riding surface can still be hazardous &/or slippery. IMBA Au recommends that over time timber and steel features should be phased out and replaced with stone features that, if built well, should never deteriorate.
- Between WP49 & WP50 is a steep chute that is probably the most technically challenging feature on the whole loop where there is no B-line option. While the entirety of the loop could reasonably be given Blue-square / intermediate TDR, this section pushes into the black diamond / difficult category. IMBA Au recommends adding a B-line option at blue-square level and a potential alignment has been flagged (approx. 50m of new trail). Signage should be installed to identify the 2 options. Without the B-line option, strong signage should be installed warning riders of the technicality and recommending walking the section if necessary. *Refer to Inset 1 below for further detail.*
- Section 3 is the only section where specific MTB-only use is reasonably feasible, as it is not on the urban fringe and there are alternative trails available for pedestrians entering at Kirkwood St or southeast of there. As such it is recommended to make this section MTB only and direct pedestrian traffic onto the walking only circuit track in the interior of the park.
- As with other sections, improvement of the trail signage is necessary.



WP1.44 – Classic example of trail widening. Installation of a substantially sized corral stone will consolidate the ride line, although in this particular example the problem is unlikely to worsen.



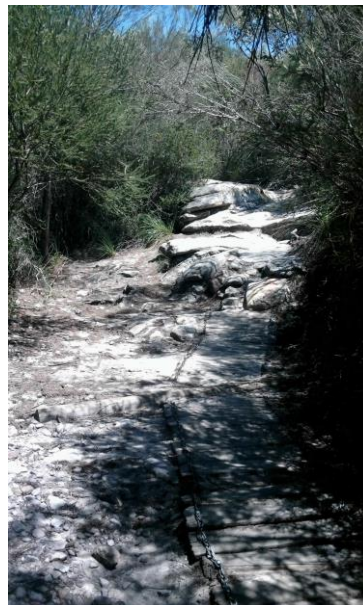
WP2.01 – Timber & chain 'Dutch ladders' have been used very effectively throughout the Manly Dam loop. Armouring their start & end points with stone should lengthen their life. In the long term however they should be replaced entirely with stone.

Section 3 - Inset 1: Proposed addition of a B-line trail around chute

The steep chute is between WP49 & WP50. An alternative alignment has been flagged on a sustainable gradient to provide a blue-square level B-line option around this technical section. Construction of the B-line option would require some stone armouring in the tread to ensure sustainability. Appropriate signage should be installed clearly identifying the technically less difficult and more difficult options.

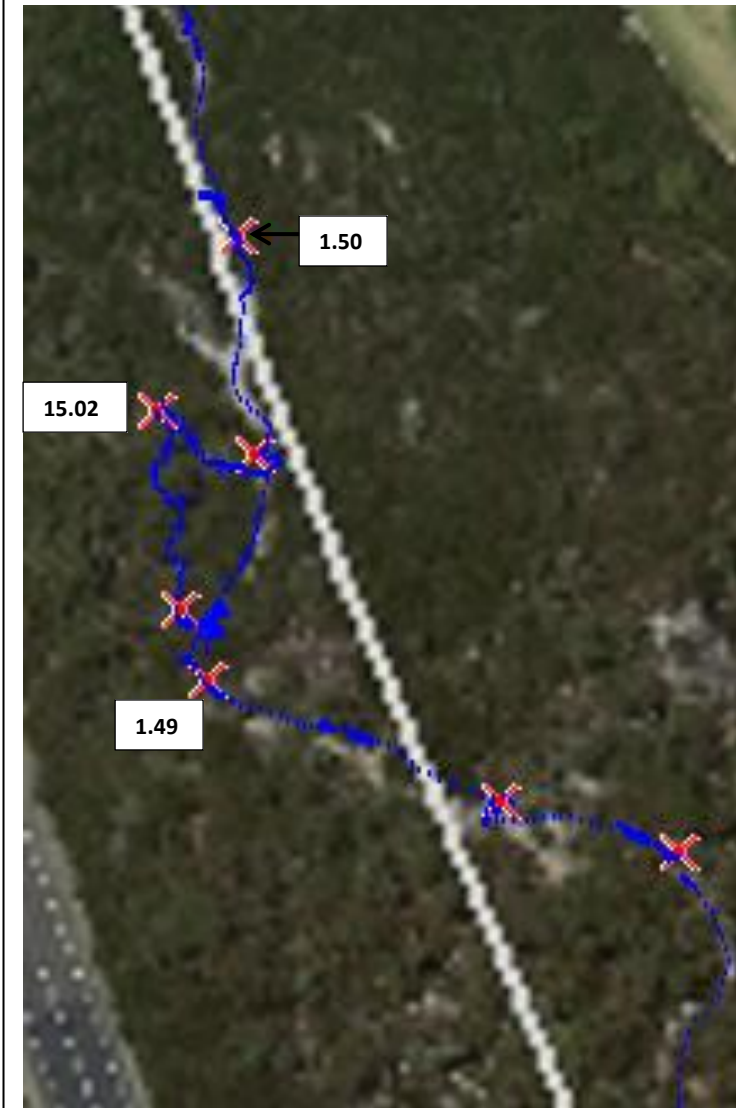


WP1.49 (above) – Entry into the chute is quite technically challenging and thus an effective filter. Signage is required to caution users of the technical challenge ahead, (and highlight the B-line option if it is approved / developed).



WP1.50 (right) – Exit of chute section. The Dutch ladder has been used effectively here to protect from braking impacts on the exit but trail widening has occurred. Again the long term recommendation is to replace all Dutch ladders with stone armouring eventually.

Section 3 - Inset 1: proposed B-line



Section 3 - Summary of Recommendations					
Priority	Actions		Location	Who?	
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i>		Warringah Council to lead, contractor assistance if required.	
		Install trail-marker at 3 locations			WP1.39, WP1.52, WP2.04
		Install caution & A/B line signage at 1 location			WP1.49
		Repair/remove old/misleading signage			WP1.62, 1.63
1	Address trail section with lack of blue-square level option	OPTION 1: ADD BLUE SQUARE B-LINE (Strongly preferred option)			Trail contractor
		Construct approx. 50m of new trail including approx. 10m stone armouring, (side-slope ~ 25%)		WP1.49 to WP1.50	
		OPTION 2: INSTALL SIGNAGE ONLY (less preferable option)			Warringah Council to lead, contractor assistance if required.
		Install signage to highlight increase in technical difficulty and encourage riders to inspect before riding and walk if not confident to ride.		WP1.49 to WP1.50	
		<i>Option 2 is very much less preferred and should only be considered if environmental &/or heritage issues prevent the possibility of adding the optional line.</i>			
2	Repair tread	Install stone armour in tread at 1 section: <ul style="list-style-type: none">5m x 0.5m	<ul style="list-style-type: none">WP1.49	Trail contractor	
2	Repair tread	Install stone armour & corrals at 6 locations: <ul style="list-style-type: none">10m x 1m, 4-5 corrals5m x 1m, 4-5 corrals5m x 1m, 8-10 corrals10m x 1m, 4-5 corrals10m x 1m, 4-5 corrals20m x 1m, 4-5 corrals	<ul style="list-style-type: none">WP1.47WP1.48WP1.62WP2.01WP2.02WP2.03	Trail contractor	
2	Repair tread	Secure loose stone	<ul style="list-style-type: none">WP1.52	Volunteer trail care team	
3	Repair tread	Install stone armour in tread at 5 sections: <ul style="list-style-type: none">10m long x 1m wide3m x 1m2m x 1m2m x 1m3m x 1m	<ul style="list-style-type: none">WP1.41WP1.43WP1.58WP1.60WP1.61	Volunteer trail care team	

3	Repair tread	Install stone armour & corrals at 3 locations: <ul style="list-style-type: none"> • 1m x 1m • 2m x 1m, 1-2 corrals • 5m x 1m, 4 corrals 	<ul style="list-style-type: none"> • WP1.42 • WP1.54 • WP1.57 	Volunteer trail care team
3	Repair tread	Install corrals only at 3 locations: <ul style="list-style-type: none"> • 2 corrals • 2 corrals • 2 corrals 	<ul style="list-style-type: none"> • WP1.44 • WP1.45 • WP1.46 	Volunteer trail care team
3	Repair tread	Install stone armour at entry / exit of Dutch Ladder – 3 locations (allow 3m x 1m total)	WP1.51, WP1.58, WP2.01	Volunteer trail care team
3	Address drainage issues	Install or repair knick &/or RGD	WP1.53, WP1.56, WP1.59	Volunteer trail care team
3	Monitor	Timber water bar with steel ramp feature	WP1.55	Warringah Council & Volunteer trail care team
3	Monitor	All 'Dutch ladder' sections – In longer term, replace Dutch Ladder section with stone armouring	WP1.49, WP1.51, WP2.01	
3	Monitor	Natural surface / rock section - monitor for degradation and repair with stone armour &/or corrals - only if required	WP1.44	



Section 4 - Wakehurst Parkway gate to Curl Curl Creek crossing

Description

Section 4 is comprised entirely of management track. Starting from the gate at WP4.01 adjacent to Wakehurst Parkway, it initially follows a generally contouring alignment northwards before descending quite steeply to the east/northeast. The descent is interspersed with some short contouring sections. Through much of the descent the tread surface is uneven bedrock. The track crosses Curl Curl Creek just past WP4.12 which is the nominated end point of the section. Total distance of the section is approx. 900 metres.

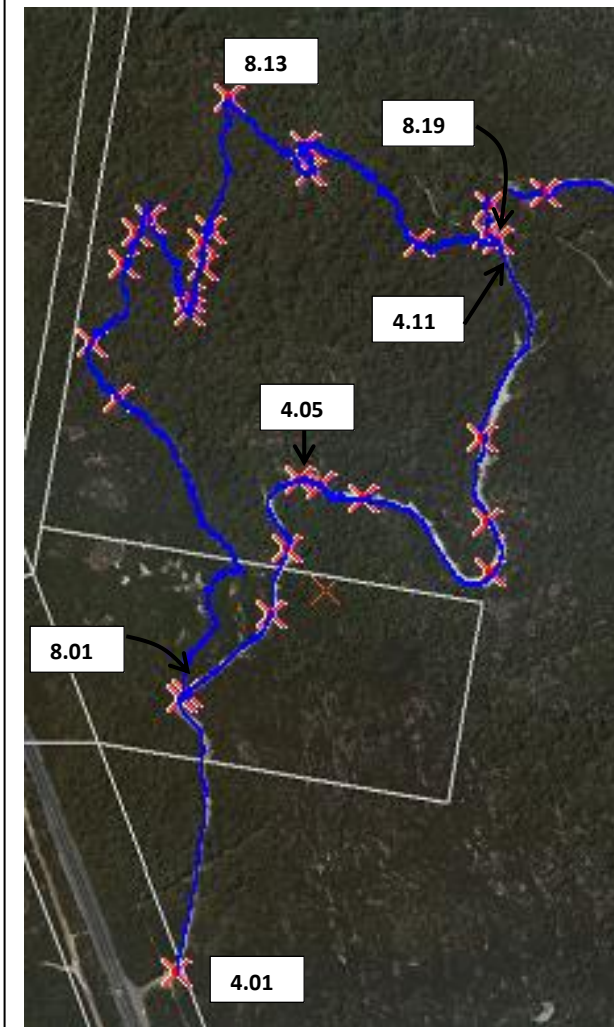
Overall Condition

- Overall it serves its purpose as a management track; while the alignment is very poor much of the tread is bedrock so it is quite erosion resistant. Non bedrock sections have suffered some erosion, both water and user-caused, and there is some trail widening as riders seek the smoothest lines around the rock.
- Contouring sections are generally in sound condition.



A typical scene (left) on the management track descent between WP4.02 and WP4.11. The tread consists of bedrock interspersed with natural surface sections, the gradient is often steep and sight lines on corners are quite poor in many cases. These factors combine to make it a priority project as there is a need to address risk to user safety.

Section 4 Map



Key Issues

- This descent is a significant user safety issue. The descending management track as a MTB trail is high speed and quite technically challenging due to the sometimes rough and unpredictable riding surface in some areas of the bedrock. There are several corners with quite poor sight lines relative to the potential speed of users and possibility for multiple types of users moving in opposite directions. Anecdotally this is the most accident prone section of trail at Manly Dam. It is not hard to see that bike accidents could happen or that consequences of crashing could be reasonably severe. At the least, some cautionary signage should be installed to ensure trail users ride within their ability.
- The alignment is quite environmentally unsustainable although the large amount of bedrock in the tread greatly reduces the severity of erosion.
- While the existing track would need to be retained for management purposes, the development of a new alternative single-track alignment was originally recommended:
 - Rationale was to eliminate this high risk section of the loop and establish a model example of purpose-built sustainable user-friendly MTB single-track trail.
 - A proposed new achievable single-track alignment was flagged at below 5% average, also creating an excellent opportunity for a potential future link to the proposed beginner level trail at Warringah Aquatic Centre.
 - It was recommended that all foot traffic be encouraged to use the management track with the new alignment being designated MTB only.
- *During 2013 Warringah Council undertook ecological and cultural heritage surveys of the proposed alignment. The proposed alignment was found to be incompatible with ecological and cultural values of the site and thus will not be developed in the foreseeable future.*
- Some upgrade work on the management track is in any case warranted to improve its function and lower future maintenance requirements.
- Some park visitors are parking cars adjacent to the Wakehurst Parkway gate as a start/end point for their ride (or walk/run). It is an 80kph limit arterial road and the parking area is not formalised so the land manager should consider whether or not this use is appropriate. If so some formalisation and signage is recommended. If not signage would be required to discourage use and explain rationale and alternative access points.



WP4.10 – Irrespective of the development of a single-track re-route the management track has drainage problems that should be addressed. The existing water-bars such as the one shown here should be rebuilt longer and higher to ensure they provide effective drainage but not become a hazard for MTB riders or problematic for management vehicles.

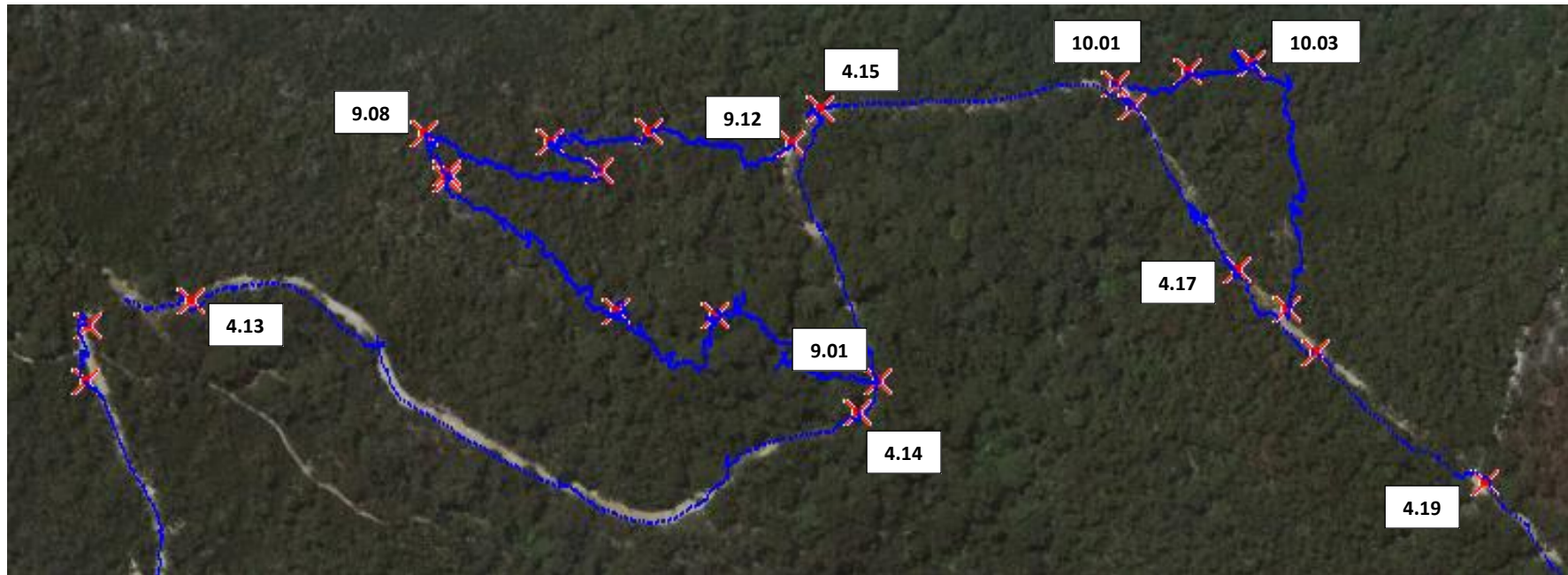


WP4.12 – The management track is very well armoured into the creek crossing which is itself natural bedrock. The armouring however has a rough finish and is potentially hazardous for riders travelling at high speed. With the proposed re-route riders would enter this section at greatly reduced speed thus reducing overall risk.

Section 4 - Summary of Recommendations					
Priority	Actions		Location	Who?	
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i>		Warringah Council to lead, contractor assistance if required.	
		Install trail-head &/or trail-totem signage at 1 location	WP4.01		
		Install/upgrade caution signage (steep technical descent ahead) at 2 locations	WP4.02, WP4.11		
		Install trail markers at 2 locations	WP4.02, WP4.11		
1	Address risk to MTB riders on descent to Curl Curl Creek.	OPTION 1: CREATE ALTERNATIVE MTB DESCENT TRAIL			
		Create alternative trail for MTB descent. Proposed single-track alignment is flagged to northern side of management track at sustainable gradients relative to side-slope (av. trail gradient = <5%). It is achievable but will require some stone armour work through sandstone outcrop sections. <ul style="list-style-type: none">• Total new trail length: 850m approx.• Allow for 40m x 1m stone armouring.• Length of management track bypassed: 580m approx.	Start point — new trail deviates with management track at WP4.02 (=WP8.01). End point — new trail meets management track at WP4.11 (=WP8.19).	Warringah Council to lead assessment, approvals & further trail planning. Trail contractor to construct.	
		<i>Please note that the alignment as currently flagged is a conceptual route only. Any assessment of natural and cultural heritage values of the route should assume the final trail alignment will be within +/- 5m of the flag line, ie within a 10m wide corridor. More detailed trail design is required prior to construction.</i>			
		OPTION 2: MANAGE RISKS TO USERS THROUGH MANAGEMENT TRACK UPGRADE (Warringah Council preferred option)			
		Install signage before steep sections and before blind corners to warn riders of potential hazards.	Warringah Council to lead, contractor assistance as required.		
		Surface upgrades (as per below) to minimise most hazardous sections of tread	Contractor		
		<i>Option 2 is the less preferred option but environmental and cultural heritage values prevent the possibility of a re-route. As such a significant upgrade to the management track surface is warranted.</i>			
		2	Remediate degradation of management track section	Install drainage improvement features in management track at 4 locations. (Because this is a management track, drainage feature will essentially be a water bar – recommend constructing water-bars as long as possible (1-2m or more and not too abrupt; more a ‘roller’ than a traditional water-bar).	WP4.04, WP4.09, WP4.10 (x2)
2	Consider use of Wakehurst Parkway entry point			Council should consider whether public use of the gate on Wakehurst Parkway is appropriate (potentially in consultation with RTA). Signage should be installed either to formalise use or discourage it altogether.	WP4.01

Section 5 - Curl Curl Creek crossing to 'Retirement Village junction'

Section 5 Map



Description

Section 5 is a continuation of the same management track onto the northern side of the valley. From the Curl Curl Creek crossing the track follows a contour initially before turning sharply northwards into the long steep climb locally known (for good reason) as 'Heartbreak Hill'. This is followed by another contour section before a short but quite steep and straight descent into a rock-bottomed creek-line at WP4.17. The track climbs quite steeply out of the crossing and shortly thereafter a junction of management tracks is reached at WP4.19. One track leads to Allambie Road adjacent to a retirement village, so for the sake of this report the junction is referred to as 'Retirement Village junction'. The section is approx. 800m long.

Overall Condition

- The contour sections are generally in fine condition.
- The Heartbreak Hill climb is quite degraded, although perhaps not as badly as might be reasonably expected, given the poor alignment and high volume of use.
- There is also milder erosion evident at the 2nd creek crossing on the entry and exit.

Key Issues

- Heartbreak Hill – the steep climb is degraded and most likely will continue to worsen. The erosion is resulting from both water and user-action, and users are seeking easier ride lines on the track edges and meandering within the corridor, so widening is occurring. It is (arguably) a fairly poor riding experience.
- The development of a new single-track alignment as an alternative to Heartbreak Hill was originally recommended:
 - Rationale to avoid the steep section where users are causing erosion, also creating a good opportunity to establish a model example of purpose-built sustainable single-track.
 - A proposed achievable sustainable alignment was flagged at 5% average gradient. This route would create an excellent potential future link to the proposed Warringah Aquatic Centre loop trail.
 - The management track would need to be retained for management purposes and could be designated for foot-traffic only which would greatly reduce the severity of user-caused erosion.
- *During 2013 Warringah Council undertook ecological and cultural heritage surveys of the proposed alignment. The proposed alignment was found to be incompatible with ecological and cultural values of the site and thus will not be developed in the foreseeable future.*
- Some upgrade work on the management track including some re-surfacing and installation of drainage features (long gentle water bars) would reduce future maintenance requirements and is thus recommended.
- The creek crossing at WP4.17 is also a risk management issue. Riders enter it at high speed and the tread is largely bedrock and roughly textured. There is exposure to a steep edge through the creek crossing at WP4.17, although railing has been installed that mitigates that risk to a large degree. Anecdotally the rock crossing can be quite slippery particularly during winter months, and according to local riders the section is known for ‘catching a few riders out’ and being the scene of some bike crashes.
- Development of a new single-track trail to provide an alternative option at the creek crossing was originally recommended, to help mitigate risk by avoiding the high speed creek crossing through the bedrock tread, and reduce the prevalence of problematic erosion on the entry and exit sections of the management track. *The proposed alignment however was deemed incompatible with ecological and cultural heritage values as a result of surveys undertaken during 2013. Upgrade to the existing management track surface is thus recommended.*
- Signage upgrades are required in this section as per the entire loop.



A typical view of the ascending management track section between WP4.14 & WP4.15, ‘Heartbreak Hill’.



WP4.16 – Waterbars are providing a good drainage solution on the management track but could be upgraded to lengthen their life and increase their effectiveness. The track is quite steep and fast into a sometimes slippery creek crossing so a short re-route option is recommended.

Section 5 - Summary of Recommendations				
Priority	Actions		Location	Who?
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i> Install trail markers at 5 locations	WP9.01, WP9.12, WP10.01, WP10.04, WP4.19	Warringah Council to lead, contractor assistance if required.
1	Address risk to MTB riders on high speed descent into creek crossing.	<p>OPTION 1: CREATE ALTERNATIVE SINGLE TRACK OPTION</p> <p>Proposed single track alignment is flagged to northern side of management track at sustainable gradients relative to side-slope (av. trail gradient = <5%). It will require some minor stone armour work through the new creek crossing.</p> <ul style="list-style-type: none"> • Total new trail length: 160m approx. • Allow for 20m x 1m stone armouring. • Length of management track bypassed: 100m approx. <p>Please note that the alignment as currently flagged is a conceptual route only. Any assessment of natural and cultural heritage values of the route should assume the final trail alignment will be within +/- 5m of the flag line, ie within a 10m wide corridor. More detailed trail design is required prior to construction.</p> <p>OPTION 2: MANAGE RISKS TO USERS THROUGH MANAGEMENT TRACK UPGRADE (Warringah Council preferred option).</p> <p>Install signage before steep section and on approach to crossing to warn riders of potential hazards.</p> <p>Upgrades tread surface (as per last action below) to minimise most hazardous sections of tread</p> <p>Option 2 is the less preferred option but environmental and cultural heritage values prevent the possibility of a re-route. As such a significant upgrade to the management track surface is warranted.</p>		
2	Remediate degradation of management track section	On exit of creek crossing, repair surface of management track with compacted road base and possibly some stone armouring. 10 linear metres x 3m wide approx.	WP4.13	Contractor

2	Address degradation and poor riding experience on 'Heartbreak Hill' ascent.	OPTION 1: CREATE ALTERNATIVE SINGLE TRACK OPTION		
		Develop new single track trail for shared use (MTB ascent + foot traffic either direction). Proposed single track alignment is flagged to western side of management track at sustainable gradients relative to side slope (av. trail gradient = <5%). It is quite easily achievable and will require some minor stone armour work through sandstone outcrop sections. <ul style="list-style-type: none">• Total new trail length: 850m approx.• Allow for 20m x 1m stone armouring.• Length of management track bypassed: 100m approx.	Start point — new trail deviates with management track at WP9.01. End point — new trail meets management track at WP9.12.	<ul style="list-style-type: none">• Warringah Council to lead assessment, approvals & further trail planning• Trail contractor to construct.
		<i>Please note that the alignment as currently flagged is a conceptual route only. Any assessment of natural and cultural heritage values of the route should assume the final trail alignment will be within +/- 5m of the flag line, ie within a 10m wide corridor. More detailed trail design is required prior to construction.</i>		
		OPTION 2: UPGRADE MANAGEMENT TRACK TREAD SURFACE (Warringah Council preferred option)		
		Upgrades tread surface (as per last action below) to remediate and protect most degraded sections of tread	Contractor	
<i>Option 2 is the less preferred option but environmental and cultural heritage values prevent the possibility of a re-route. As such a significant upgrade to the management track surface is warranted.</i>				
2	Remediate degradation of 'Heartbreak Hill' management track section	Install drainage improvement features in Heartbreak Hill section of management track at 3-4 locations. (Because this is a management track, drainage features will essentially be water bars – recommend constructing water-bars as long as possible (1-2m or more and not too abrupt; more a 'roller' than a traditional water-bar).	WP4.14 to WP4.15	Contractor

Section 6 - 'Retirement Village junction' to Allambie Heights junction

Description

Section 6 covers the approx. 1.3km stretch of Management Track in the eastern half of the loop, from the 'Retirement Village Track' junction at WP4.19 to the 'Allambie Heights junction' at WP4.25, the top of the 19th Hole section.

Overall Condition

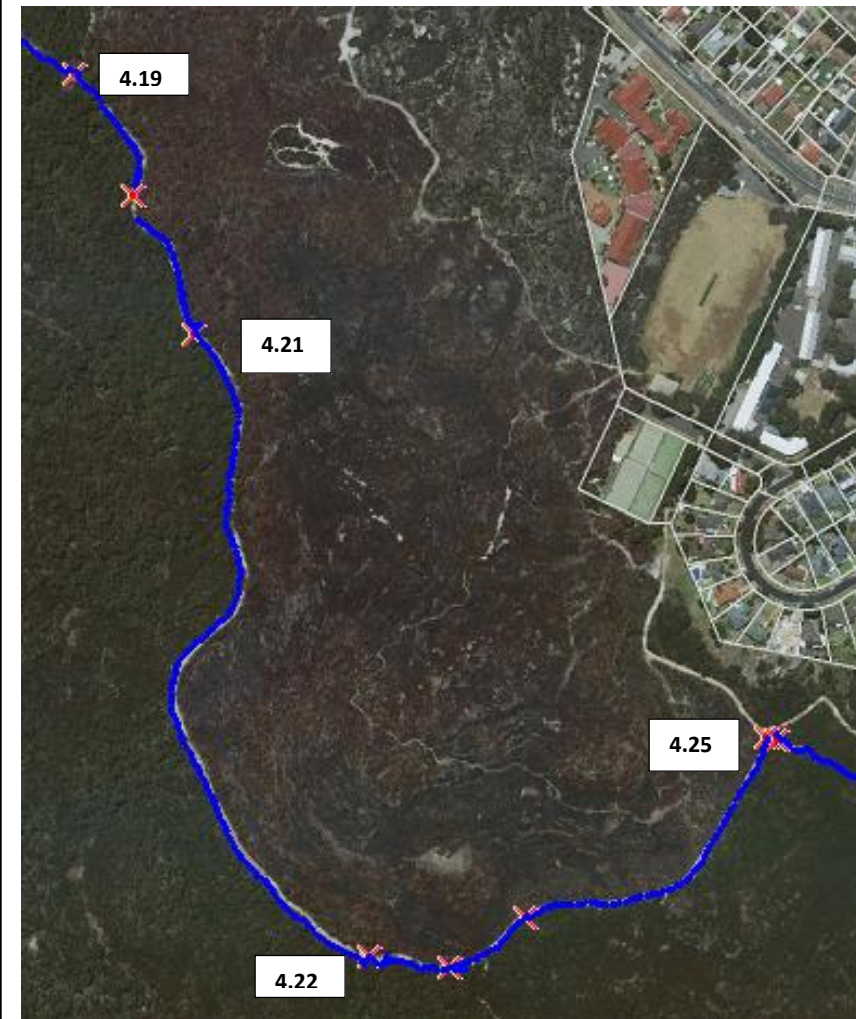
Generally the condition is good.

- There are several minor drainage problems that can be quite easily remediated by a contractor.
- The climb at WP4.22 is the main point in this section that requires attention in the shorter term.

Key Issues

- Signage is required at the several trail junctions in this section.
- At WP4.22 the management track ascends through a short steep section of bedrock and a defined ride line has emerged, snaking up the corridor and widening the edges of the track. There is some localised erosion but it is not excessive. A re-route would be quite challenging to build due to rocky outcrops and steep side-slopes; it's probably not worth the expense for the modest gains to be made. Some stone armouring and corralling of the ride line will minimise any further degradation and be relatively easy to implement.
- There are several minor drainage issues on the management track that can be easily and quickly fixed by a contractor on a small excavator.

Section 6 Map



Section 6 - Summary of Recommendations

Priority	Actions	Location	Who?
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i> Install trail-markers at 2 locations	Warringah Council to lead, contractor assistance if required.
2	Remediate degradation of management track section	Repair tread surface of management track with compacted road base. Install/repair water-bars to improve drainage. <ul style="list-style-type: none"> Allow for approx 50m of management track re-surfacing Water-bars should be incorporated and constructed as long as possible – 1-2m or more, with gentle entry and exit angles so it's more of a 'Roller' than a 'Hump' 	WP4.23, WP4.25
		WP4.20, WP4.21	Contractor
		Install stone armour and corrals in 1 section (ride line is worn into natural earth through a section of rocky management track ascent) <ul style="list-style-type: none"> Allow 10m x 1m stone-armoured tread, and 4-5 corrals 	WP4.22
		Repair outslope – approx. 30m section	Trail contractor
		WP4.24	Trail contractor



WP4.22 – Natural bedrock in a steep climbing section of the management track. The ride line snakes back and forth across the track and has caused widening in some sections. Some stone armouring would be an effective and relatively simple measure to remediate what are in any case relatively minor impacts.



Typical view of Section 6 management track. This photo shows that even on relatively gentle topography, trails without regular drainage features can still easily erode or in this case, become cupped. Fortunately it is quite easy to fix this kind of impact; some resurfacing and installation of drainage features will provide a sound tread for a long time to come.

Section 7 - 19th Hole area

Section 7 Map



Description

The rock outcrop feature known as the '19th Hole' is the central feature of Section 7. It has multiple ride lines ranging from intermediate level (blue square) to 'extremely difficult' (double diamond).

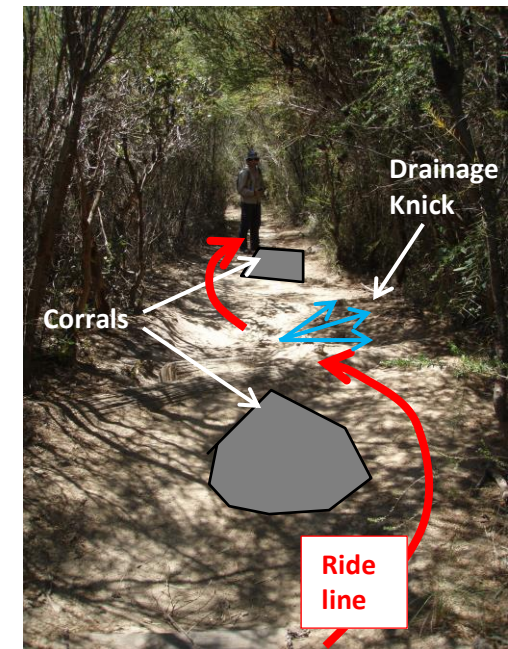
The start point of the section is 'Allambie Heights junction' at WP4.25, a key management track junction. At this point the management track continuing from Section 6 swings uphill to the northwest linking to the boundary of the park at Allambie Heights. Another management track heads east-northeast to what is a dead-end for vehicles but provides vehicle access to power-line pylons at the 19th Hole feature itself.

The MTB loop follows a single-track trail running in pretty much a straight line south-eastwards from the junction for about 150 metres. It opens out onto the top of the 19th Hole rocky outcrop at WP4.27 and from there it's about 40-50m to the exit of the feature (WP6.02) which is nominally the end of Section 7.

Although technically outside the scope of this project, the management track that extends from the junction (WP4.25) about 300m northwards to Allambie Heights tennis courts was also inspected.

Overall Condition

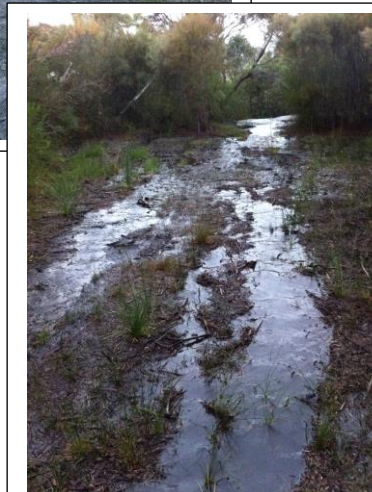
- From the junction (WP4.25) to the top of 19th Hole (WP4.27) the trail is in fairly poor condition. Although on a relatively mild gradient it follows the fall line and has no real drainage features so has eroded significantly. Water is the primary cause but users exacerbate the degradation and have caused trail widening as they seek to avoid the worst of the scouring.
- The 19th Hole feature itself currently has multiple ride lines ranging from moderately difficult (commensurate with blue square rating) to advanced (commensurate with double-diamond rating). Water is draining from the management track directly upslope (and north) of the feature and causing significant erosion at the base of it where riders exit. Some water is also draining into the 19th Hole from the single-track trail at WP4.27, albeit to a lesser extent.
- The lower section of the management track approaching the junction WP4.25 from Allambie Heights tennis courts is quite steep, rocky and a little eroded. While the degradation is not too bad currently, increasing usage of the trail would most likely have a negative impact.



Between WP4.25 and WP4.27 the trail is on a shallow sideslope but follows the fall line. It is recommended to retain the trail within the existing corridor and use rock and potentially road base to create RGDs and knicks. Stone corrals and chokes can be installed to add some 'wiggle' to the trail within the existing corridor. These actions will solve multiple issues: make this trail section more erosion resistant, reduce drainage impacts on both this section itself and on the next section, and moderate rider speed to enhance the user experience and improve safety.

Key Issues

- Degradation from the junction (WP4.25) to the top of 19th Hole (WP4.27) – (Refer to picture on previous page). To address the degradation on this section of trail and to prevent water draining from there into the 19th Hole, it is recommended to retain the alignment within the existing corridor and use rock and potentially some imported material such as compactable road base to create RGDs, knicks, corrals and chokes. There is enough space in the existing corridor to add some ‘wiggle’ to the alignment, enabling the incorporation of some drainage features into the trail to prevent water flow down the trail and harden the tread where necessary to resist erosion. This can be done in a way that will also much improve the quality of the riding experience, and minimising risks to users by moderating rider speed.
- While there are significant safety risks and environmental impacts to manage at the 19th Hole feature itself, it is also an iconic part of the loop and well loved by local riders for the optional technical challenge that the multiple lines provide. The most advanced level ride lines on this feature are genuinely at double diamond level and it seems that there is genuine demand for this level of riding in the Sydney North Shore region. Any attempt to close the more advanced lines will most likely fail, or at best encourage riders to seek such experiences in other public lands in an unauthorised context, ie move the ‘problem’ somewhere else. IMBA-Au has every confidence that the ride lines at 19th Hole can be re-designed in a way that retains and even enhances the technical challenge and appeal of the feature to riders, while greatly reducing the rider’s (and land manager’s) exposure to risk.
- Stone armouring is required at base of 19th Hole to remediate past erosion, mitigate against future erosion and improve the transition for riders exiting the feature.
- There is a substantial hollow space underneath the rock where the double-diamond line(s) are. While no particular reason arose during the assessment to doubt the structural integrity of the rock, it may be wise to have it inspected by a geotechnical professional to be certain.
- Drainage issues on the management track above (immediately north of) the feature should be addressed to substantially reduce the volume and velocity of water reaching 19th Hole, and thus reduce erosion potential. This should be done in consultation with the agency (electricity asset managers) responsible for that management track.
- There is a need to consolidate the ride line after the exit of 19th Hole at WP6.02. The trail, natural surface in that section, has been widened substantially by a combination of the development of ad hoc multiple ride lines and excess run-off from above reaching the site. Corrals and armouring should be installed to contain the tread back to a narrower footprint and allow regeneration of the site.

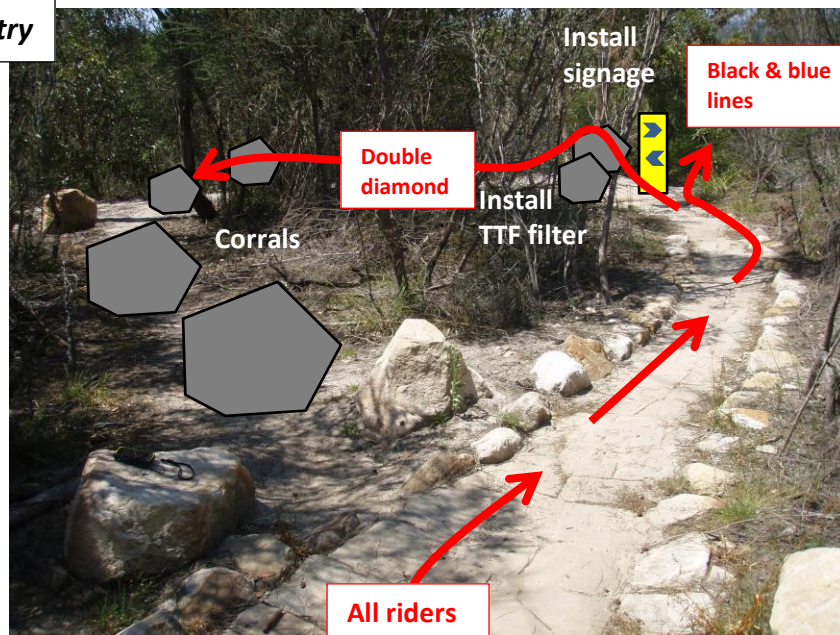


These photos (above) highlight the volume of run-off emanating from the management track directly north of the 19th Hole during rainfall events. Much of the erosion at the base of the 19th Hole is caused by a drainage problem that starts here. Waterbars &/or other drainage features need to be installed to address this problem.

- On the management track linking Allambie Heights tennis courts to WP4.25 junction, provision of an alternative single-track option to the west should be considered to avoid the steeper lower section. This would again minimise risk by moderating user speeds, reduce user-caused erosion by removing riders from the steeper lower section, and greatly enhance riding experience by providing purpose built sustainable trail at one of the park's entry points.
- Improved signage is required on this management track and through 19th Hole section as described above.

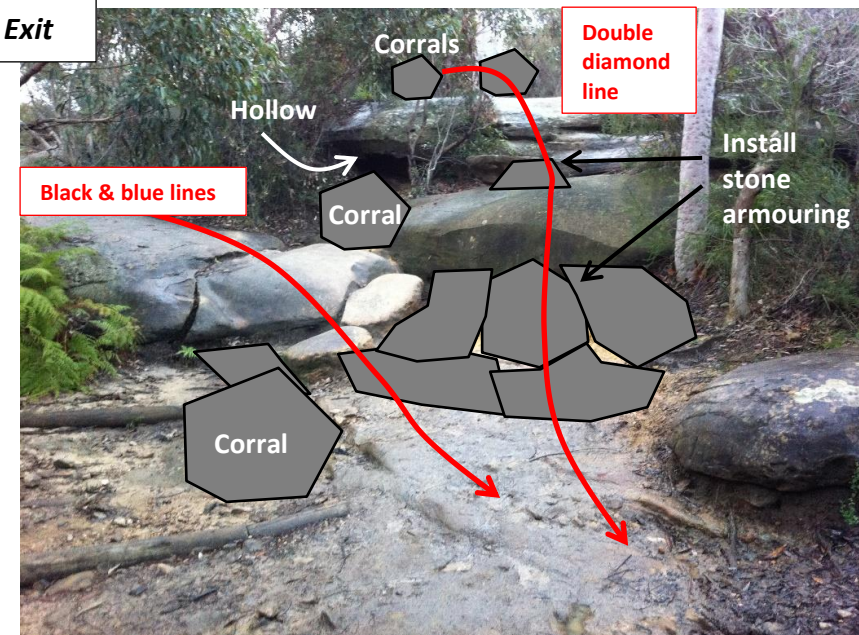
Recommended upgrades at 19th Hole

Entry



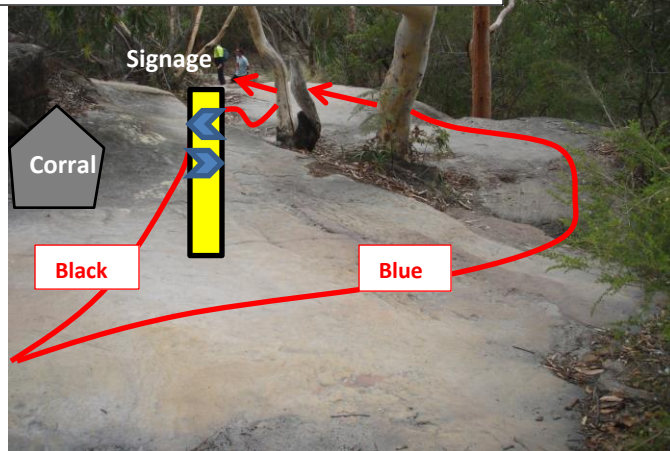
WP4.27 – 'Top of 19th Hole'. The stone armouring on RHS line is excellent. All riders should be directed onto the RHS line. The LHS (straight) line is the more obvious / natural line to ride yet leads directly to the most technically difficult feature. Very large un-movable corral stones should be placed to completely block the LHS ride line. A new junction should be created forcing riders seeking the double-diamond line to consciously choose it by deviating from the main ride line and riding a challenging Technical Trail Feature (TTF) that will act as a trail filter.

Exit



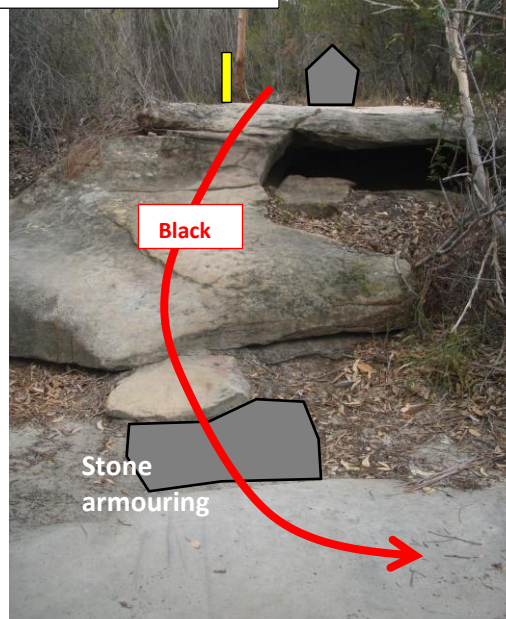
Exit of 19th Hole – Substantial stone armouring is required to improve the transition and protect the impact zone on the exit of all lines. Corrals are also required to consolidate the exit. The entry to the double-diamond line should be better defined with additional corrals.

Black-diamond & Blue-square Lines



(Left) – View looking down black-diamond and blue-square lines. Signage and corrals should be installed.

Black-diamond line



(Left) – View looking up black-diamond line. Some minor stone armouring will enhance this line.

Blue-square line



Exit



(Above) - 4-5 large corrals are required at the exit to consolidate the ride line and contain the trail widening. Some naturalisation will speed up the regeneration process.

(Left) – View looking up Blue-square line. Armouring is required to protect tree roots and corraling will contain the widening.

Section 7 - Summary of Recommendations				
Priority	Actions		Location	Who?
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i>		Warringah Council to lead, contractor assistance if required.
		Install trail-head &/or trail-totem signage at 1 location	(Entry to park from Allambie Heights tennis courts)	
		Install trail-markers at 2 locations	WP4.25, WP6.02,	
		Install 2 caution signs (black / double-diamond markers) at entry to advanced lines.	WP4.27	
		Install reminder caution / black / double-diamond markers x2 <i>Note that sign posts will need to be affixed to rock in this area</i>	(At entry to actual TTFs).	
1	Inspection / Assessment	<ul style="list-style-type: none"> As part of approval process have geotechnical professional inspect 19th Hole for structural integrity. 	WP4.27	
1	Upgrade the trail section WP4.25 to WP4.27	<ul style="list-style-type: none"> Approx. 150 metres of trail to re-build at av. 1m wide Install stone armouring – allow 50m x 1m Install corrals & chokes – approx. 15 corrals. Integrate 10 – 15 RGDs into re-build 	WP4.25 to WP4.27	Trail contractor
1	Re-design flow of trail at WP4.27	<ul style="list-style-type: none"> Re-design flow of trail at WP4.27 to direct riders into existing RHS (blue-square) line. <i>This will greatly reduce the risk of a beginner level rider inadvertently taking on an advanced ride line. The existing high quality stonework to the RHS from WP4.27 can be retained and in fact become the only line choice at that point.</i>	WP4.27	Trail contractor
1	Formalise 3 ride lines through 19 th Hole: <ul style="list-style-type: none"> Blue-square Black-diamond Double-diamond 	<ul style="list-style-type: none"> Completely close the entry into existing double-diamond line from WP4.27 – allow 4 large corrals. Construct TTF filter on LHS from existing blue square (RHS) line – allow approx. 2 cubic metres stone Use corrals to define entries into double-diamond & black lines – allow 4-5 large corrals Improve drainage on existing (armoured) RHS line – install stone roller. Armour gaps in natural rock in descents on all 3 lines – allow 2 cubic metres stone approx. 	WP4.27	Trail contractor

1	Armour base of 19 th Hole where riders exit.	<ul style="list-style-type: none"> Install stone armour – allow 3 cubic metres of stone 	WP6.02	Trail contractor
1	Rectify drainage on management track above 19 th Hole	Install water-bars along management track descent towards 19 th Hole to ensure track run-off is not flowing into 19 th Hole. <ul style="list-style-type: none"> 3-4 water-bars. 	(Management track above 19 th Hole)	Warringah Council to lead, in consultation with electricity asset manager; contractor assistance if required
1	Consolidate ride line after exit of 19 th Hole	Use stone and natural debris to corral riders from all 3 ride lines back into a single-track trail. Install stone armouring to reinforce tread. Regenerate / rehabilitate closed ride lines. <ul style="list-style-type: none"> Allow 5m x 2m stone armour 4-5 corrals 	WP6.02	Trail contractor; assisted by Volunteer trail care team
3	Consider developing new single-track trail for MTB-only use on Allambie Heights tennis court descent to 19 th Hole.	<div> <div> Investigate feasibility for single track alignment on south-western side of management track at sustainable gradients relative to side slope (av. trail gradient = <5%), to by-pass unsustainable management track section <ul style="list-style-type: none"> Length of management track bypassed: 70m approx. </div> <div> <i>Environmental and cultural heritage values prevent the possibility of a re-route. As such a significant upgrade to the management track surface should be considered. This may be appropriate as part of stage 2 works.</i> </div> </div>	WP5.01 to WP5.02	Warringah Council to lead, contractor assistance as required

Section 8 – End 19th Hole to Southern Cross Drive gate

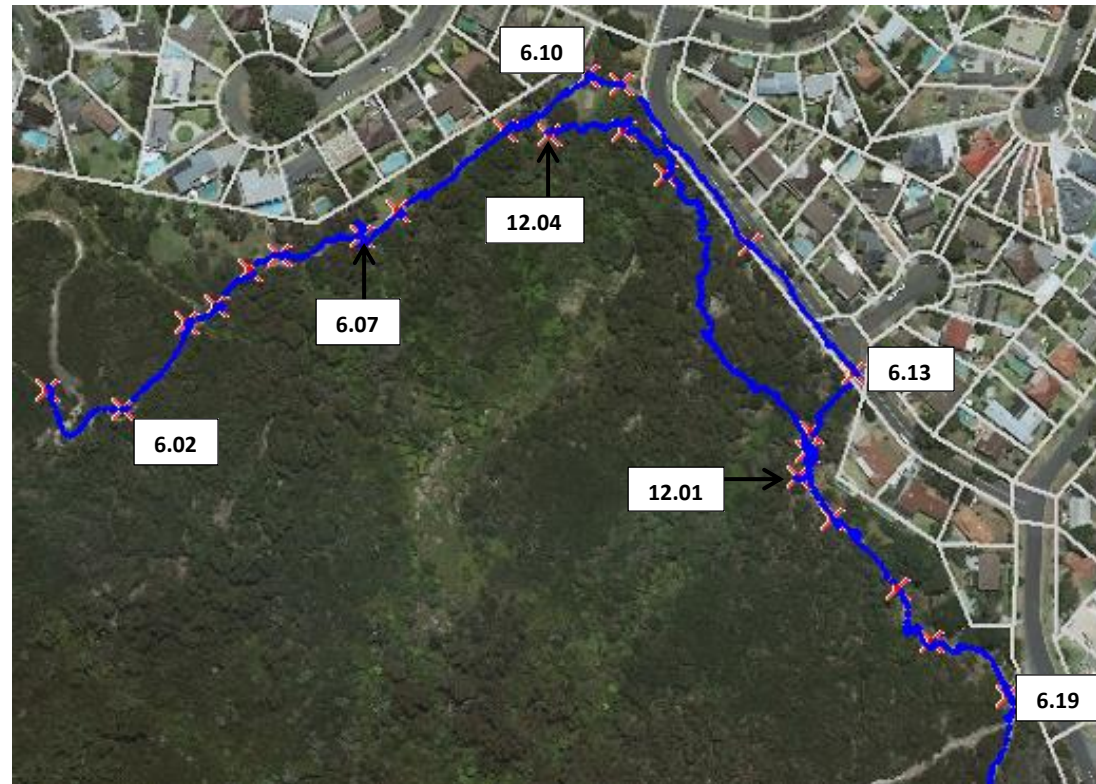
Description

From the exit of 19th Hole the trail follows a generally sound contour alignment on the very edge of the park boundary behind houses. It crosses several timber bridges (WP6.07, WP6.10) and passes by a lawned playground area (between WP6.09 & WP6.10). The trail joins Cootamundra Dve just after WP6.11 and traverses the very edge of the street for approx. 160 metres. It drops back into the park at WP6.13 and again hugs the boundary behind houses to reach Southern Cross Drive at a junction with a management track (WP6.19). The total length of the section is approx. 750 metres.

Overall Condition

- Section 8 is in fair condition. There are numerous localised erosion problems, none of which in their own right are overly substantial or detrimental, but in combination create a reasonable-sized project to rectify.

Section 8 Map



WP6.09 in dry conditions (left) and wet conditions (right). The trail is cupped and there is minimal sideslope with which to create outslope on the tread. The LHS ride line should be formalised but may need tread hardening over time to avoid the same fate as the RHS line, which should be closed with corral installation.



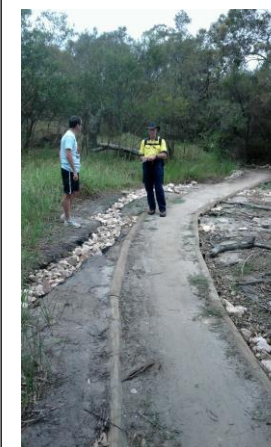
Key Issues

- Signage improvements are required to set user expectations and assist users with navigation.
- There are a few examples of trail braiding and widening which can be rectified with the installation of corrals and chokes. Minor erosion has resulted from short pinches of trail on excess gradients which can be remediated with stone armouring. Easily installed RGDs and knicks will vastly improve the trail's longevity.
- The 2 timber bridges on this section are quite narrow for mountain bikes / shared-use. Initially some caution signage would be worthwhile to encourage users to check their speed. In the longer term, widening of the bridges, or at least their handrails, would be ideal.
- The trail passes right by a playground near WP6.10 which creates a risk of collision between riders and particularly young children. Some cautionary signage is warranted.
- After the bridge at WP6.10, the trail squeezes into a tight section on the outside of a roadside guard rail. There are sharp edges on the back of the guard rail which has potential to be hazardous to riders.
- There is a fall line section after WP6.13 which is showing some degradation, although it is in better condition than what might reasonably be expected for such an alignment, largely thanks to the Dutch ladder installed there.
- A short re-route is recommended to address the above three risk management and sustainability issues in one swoop:
 - Construction of the re-route is within the capacity of a volunteer team, although there are 2 drainage crossings one of which is quite significant and may require contractor work.
 - The park entry point that provides access to the playground from Cootamundra Dve (WP6.11) could be retained and upgraded to better facilitate pedestrian (children, prams) to playground.
 - The park entry point at the opposite end of Cootamundra Dve at WP6.13 is not critical and could simply be closed altogether and rehabilitated. It is in close proximity to other park entry points at WP6.11 and WP6.19.
 - While the section alongside Cootamundra Dve (WP6.11 to WP6.13) is not overly problematic in its own right, it is a poor trail experience which adds weight to the argument for a re-route.
- *Warringah Council has undertaken a survey of this area during 2013 to re-design the entry, widen the bridge, develop a new playground and re-route the trail. As such this project will proceed as part of stage 1 works.*
- Beyond WP6.15 there are some minor drainage issues that can be rectified relatively easily. The raised tread section that was recently constructed by volunteers and Council staff at WP6.17 is well done and a good model of how to deal with boggy areas effectively.
- A short fall-line section at WP6.18 needs some remediation with stone armour and corral installation.



WP6.03 is typical of much of Section 8. Minor trail widening and erosion can be remediated with installation of stone armouring and corrals, achievable by volunteers in most cases.

WP6.17 – A well-constructed raised tread section. This technique is very effective. Stone is recommended rather than timber and this feature may need regular maintenance to prevent drain blockages.



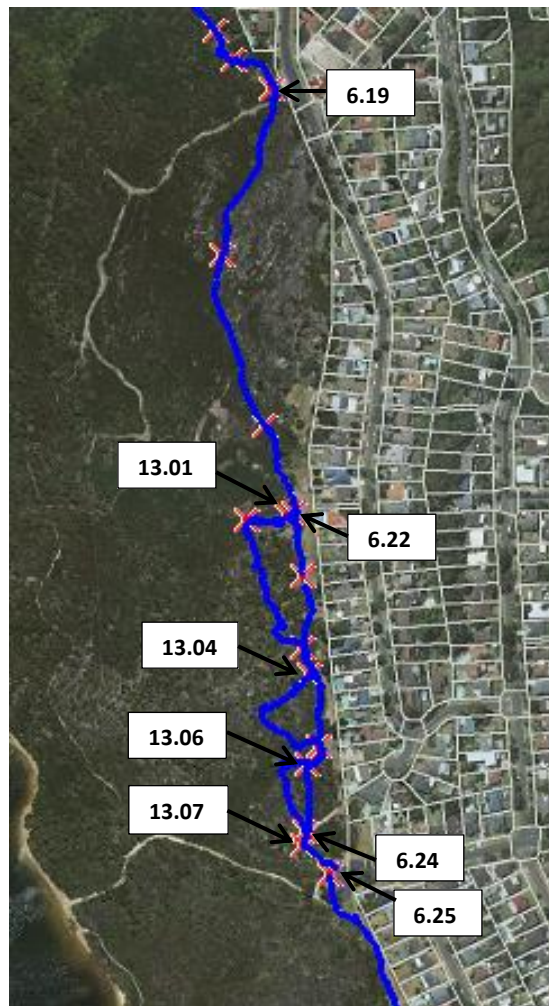
Section 8 - Summary of Recommendations

Priority	Actions		Location	Who?
1	Signage	In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:		Warringah Council to lead, contractor assistance if required.
		Install trail-head &/or trail-totem signage at 1 location	WP12.01 or in vicinity	
		Install trail-markers at 2 locations	WP12.04, WP6.11	
		Install caution signage (bridges) at 2 locations	WP6.07, WP6.10	
		Install caution signage (playground – children) at 1 location	WP6.09/WP6.10 (between)	
2	Repair tread	Install stone armour &/or corrals at 6 locations: <ul style="list-style-type: none">• 10m x 1m, 2-3 corrals• 5m x 1m, 2-3 corrals• 2m x 1m, 2-3 corrals• 2m x 1m, 2-3 corrals• 15m x 1m, 5-6 corrals• 1m x 1m, 4 corrals	<ul style="list-style-type: none">• WP6.03• WP6.04• WP6.05• WP6.06• WP6.18• WP6.19	Volunteer trail care team
2	Address drainage issues	Install drainage features - RGDs &/or knicks at 2 locations	WP6.09, WP6.10	Volunteer trail care team
2	Raise tread	Install raised tread section (preferably using stone armour) & add corrals at 2 sections <ul style="list-style-type: none">• 15m x 1m• 5m x 1m	<ul style="list-style-type: none">• WP6.08• WP6.16	Volunteer trail care team
2	Consolidate trail	Close RHS ride line and formalise LHS ride line. <ul style="list-style-type: none">• 2-3 corrals	WP6.09	Volunteer trail care team
2	Address risk management issues and trail degradation on Cootamundra Dve section	OPTION 1: DEVELOP NEW SINGLE-TRACK TRAIL FOR SHARED USE (Preferred option)		
		Proposed single-track alignment is flagged to southern side of existing trail at sustainable gradients relative to side-slope. It is quite easily achievable for volunteers to construct although there is a drainage crossing that will require some expertise to build. <ul style="list-style-type: none">• Total new trail length: 220m approx.• 1 drainage crossing (stone armour, culvert/pipe)• Length of old trail by-passed: 250m approx.	WP12.04 to 12.01	Volunteer trail care team
		<i>Please note that the alignment as currently flagged is a conceptual route only. Any assessment of natural and cultural heritage values of the route should assume the final trail alignment will be within +/- 5m of the flag line, ie within a 10m wide corridor. More detailed trail design is required prior to construction.</i>		

2	Address risk management issues and trail degradation on Cootamundra Dve section	OPTION 2: RETAIN AND UPGRADE EXISTING TRAIL (Less preferred option)		
		(As per action below), re-align trail from Cootamundra Dve to playground	WP6.11	Volunteer trail care team
		(As per first action), strengthen caution signage at playground: <ul style="list-style-type: none"> • Caution riders about playground and to reduce speed • Caution playground users of MTB trail 	WP6.11	Volunteer trail care team
		Re-align entry from Cootamundra Dve edge into park <ul style="list-style-type: none"> • Use stone armour if fall-line alignment cannot be avoided. 	WP6.13	Volunteer trail care team
		<i>Option 2 is less preferred and should only be considered if environmental &/or heritage issues prevent the possibility of a re-route.</i>		
2	Improve Bridges	Modify bridges to either increase its width to >1m or remove or lower height of handrails to allow easier bike use. (This may only be applicable at WP6.07 if the re-route goes ahead).	<ul style="list-style-type: none"> • WP6.07 • WP6.10 	Warringah Council to lead, contractor assistance if required
2	Improve access from Cootamundra Dve to playground	Re-align and formalise park entry point to better facilitate pedestrian access from Cootamundra Dve to playground, with particular consideration for young children and prams as well as bikes.	WP6.11	Warringah Council to lead; contractor assistance if required.
2	Close park entry point at Cootamundra Dve WP6.13	Remove signage, remove Dutch ladder (can be re-used elsewhere), close trail and rehabilitate. Temporary signage may be required to direct users to adjacent park entry points.	WP6.13	Volunteer trail care team
3	Pruning	Cut back low branches	WP6.15	Volunteer trail care team
3	Monitor	Monitor new raised tread section <ul style="list-style-type: none"> • Ensure drainage is working and clean out as required • Replace timber with stone in long term as required. 	WP6.17	Volunteer trail care team

Section 9 - Southern Cross Drive gate to Nyrang Road gate

Section 9 Map



Description

From the gate on Southern Cross Drive the trail continues southwards roughly parallel to the park's boundary. Technically this section is a management track although it's very narrow in some areas for vehicles. Part of this section of trail is aligned along the edge of or within the firebreak that separates houses from the park. It meets Nyrang Rd at WP6.25 where there is a gate for management vehicle access into the park. This gate is also a main access point for park visitors with some car parking available and a flat lawned area close by. The location lends itself well as a trail-head location and as such is nominal end point for Section 9. The total length of the section is approx. 750 metres.

Overall Condition

The condition of trail in Section 9 is variable.

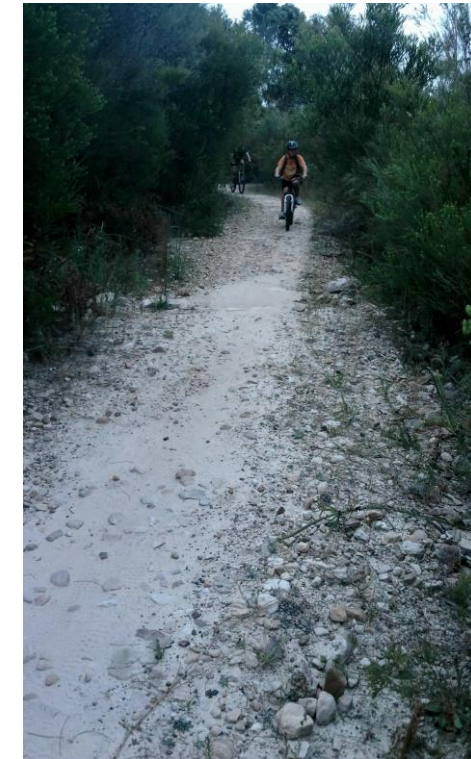
- The northern part is reasonable and can be brought up to a good standard of sustainability relatively easily with installation of drainage features like RGDs and knicks and some minor stonework to reinforce tread.
- There is more substantial degradation in the more southerly section as the alignment follows the fall line in some areas and the high usage volumes are causing some fairly significant degradation.



Sandstone outcrops are a distinguishing feature of the Manly Dam loop and entire North Shore Sydney region. There is scope to incorporate more of these natural outcrops into the trail loop to add interest to the trail as well as improve overall trail sustainability.

Key Issues

- In the northern section there is some risk of collision between users, as it is easy for riders to reach high speeds through this open and flowing section but the density of surrounding vegetation means sight lines are relatively poor. It appears to be a section favoured by other users, not just mountain bikers, which is unsurprising given the proximity and accessibility of this section to the surrounding suburbs. Some design features to moderate speed would thus be beneficial, as would some stronger signage.
- Considerable trail degradation has occurred in the southern section due to the fall line alignment, manifesting in water-caused erosion that is exacerbated with heavy usage rates. Riders would potentially reach quite high speeds through this section, not ideal in a high-use shared-use area. Combined with a relatively high level of technicality in a few areas, there is some risk of user collision or fall here too.
- A re-route is recommended to address both safety risks and environmental degradation by:
 - Providing a sustainable alignment and purpose built design to maintain the challenge and ‘fun-factor’ but reduce real speeds and thus reduce the real risk of user collision.
 - Taking advantage of the natural terrain to greatly enhance the user experience by providing an excellent viewpoint of the water-body. The proposed re-route would become the only real opportunity on whole loop where the park’s namesake is actually visible, making an excellent finale to the ride.
 - The preferred option is to align an alternative single-track route to the western side of the existing trail at sustainable gradients relative to side-slope. A quick inspection was made confirming such an alignment is feasible, utilising sustainable sections of existing trail where possible.
 - If development of such an alignment is not permitted an alternative option is to re-align the existing trail in the fire break corridor, utilising as much of the existing trail as possible. This option is certainly feasible but specific design for it was not undertaken as part of this audit.
- The lawn area at WP6.25, being adjacent to a carpark and quite flat, would be an excellent site for a skills park, pump track and/or dirt jumps. If Warringah Council has interest in providing these types of riding facilities in proximity to Manly Dam, IMBA Australia regards this site as the best-suited location on the MTB trail loop. It should be noted however that local MTB representatives were not enthusiastic about such a proposal.



WP6.20 – This part of Section 9 is quite fast for riders but is a high use area for pedestrians too. Some larger and longer rollers and possibly some corrals will improve drainage and add ‘wobble’ and texture to the trail to help moderate rider speed.

Section 9 – Summary of Recommendations

Priority	Actions		Location	Who?
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i>		Warringah Council to lead, contractor assistance if required.
		Install trail-head &/or trail-totem signage at 2 locations	WP6.19, WP6.25	
		Install trail-markers at 4 locations	WP6.19, WP13.01, WP13.04, WP6.25	
		Install caution markers – control speed – shared-use	WP6.20 (or vicinity)	
2	Install speed moderators and address drainage issues	Install/improve drainage features – RGDs &/or knicks with large rollers (suitable for vehicles to drive over) <ul style="list-style-type: none">• 3m long x 2m wide (x3-4)• Install corrals (in such a way as to not hinder vehicle access) x4-5	WP6.19 to WP6.21	Trail contractor
2	Remediate degradation of fall-line section and make good for shared-use	OPTION 1: RE-ROUTE (Recommended as preferred option)		
		Develop an alternative single-track route to the western side of the existing trail at sustainable gradients relative to side-slope, to bypass degraded section. <ul style="list-style-type: none">• Total new trail length: 360m approx.• Length of existing trail by-passed: 200m approx.	WP6.22 (=WP13.01) to WP6.24 (=WP13.07)	Trail contractor
		<i>Please note that the alignment is not currently flagged and the waypoints were marked very much as a conceptual route only. A more definitive concept alignment should be flagged using a clinometer. Any assessment of natural and cultural heritage values of the route should assume the final trail alignment will be within +/- 5m of the flag line, ie within a 10m wide corridor. More detailed trail design is required prior to construction.</i>		
2	Remediate degradation of fall-line section and make good for shared-use	OPTION 2: RE-ALIGN WITHIN EXISTING CORRIDOR (less preferable option)		
		Develop a sustainable trail using the grassed area that forms the fire break between the existing trail and the back of adjacent properties, and utilising the existing trail where possible: <ul style="list-style-type: none">• Length of existing trail to be upgraded: 200m approx.• Install RGDs & knicks, and stone armouring and corrals as required. Estimated volumes:<ul style="list-style-type: none">○ 40m x 1m stone armouring○ Approx. 40 corrals○ 20 RGDs &/or knicks	WP6.22 (=WP13.01) to WP6.24 (=WP13.07)	Trail contractor

Section 10 - Nyrang Road gate to Manly Dam Main Entrance

Description

The final section of the loop continues southwards along the fire break separating the park boundary from the back of houses on Maroa Crs. It is a descent almost the entire way back to the loop start/finish adjacent to the park's main entrance. At WP6.28 it tends eastwards and reaches a trail junction at WP6.31. From here there are two trail options:

It appears the vast majority of users are banking right (southwards) into a final descending single-track trail section that appears to be located on University of NSW land. At WP6.34 in the bottom of a gully the trail meets an urban commuter path that links Wandella Rd with King St. The MTB trail route follows that path back to the start point, completing the loop.

From the junction at WP6.31 the less used trail option continues eastwards adjacent to the boundary fence to meet Wandella Rd at WP7.03, then follows the urban commuter path to WP7.04 (=WP6.34) and same route to the end of the loop.

Section 10 is approx. 800 metres in total length.

Overall Condition

- The northern part of Section 10 is in reasonably good condition and some relatively simple minor remedial work can bring it to a good standard.
- In the south-eastern part the RHS trail to the end (much more heavily used) is quite severely degraded with both water-caused and user-caused erosion prevalent.
- The LHS alignment is also in poor condition and would probably be much worse if more riders were using it.

Section 10 Map



Key Issues

- Minor remediation in northern section can bring that area up to a good standard.
- In the southern section, both the LHS and RHS alignments are degraded and will continue to worsen if left un-remediated and so are unsustainable.
- The RHS trail is on a steep alignment close to fall-line in parts and suffering from water-caused erosion. The rocky technical terrain forces many users to brake heavily and seek easier lines so there is considerable evidence of user-caused erosion too. Having said that substantial work has been done to harden the tread and corral the trail which is quite well done and reasonably successful. Local riders have noted that despite its unsustainability the section is a well-liked among users for its technicality and fun.
- The LHS trail looks rarely used and is poorly aligned on the fall line, suffering from erosion despite receiving probably minimal use currently. Furthermore it is very narrow with a fence and bollards pinching the corridor in parts making a quite unsustainable trail that has minimal appeal as a riding experience.
- Management of the trail in this area is complicated somewhat by the lack of clarity about the park boundary. The RHS trail appears to be within University of NSW land while there is an easement of Manly Dam land linking to Wandella Rd which the LHS trail sits within.
- *Warringah Council has confirmed that as of November 2013 the boundary has been surveyed.*
- Signage upgrades are required.

WP6.33 (right) – Some excellent work has been done in this area such as the Dutch ladder combined with steps (background). User-caused erosion and trail-widening are still problems though (foreground). Clarity around land tenure should be sought with Uni of NSW to establish best management approach for this section of the trail.



This relatively open area to the south of WP6.25 (right - this picture looks northwards) would lend itself well to a skills park and dirt jumps, should the need for such riding facilities at Manly Dam be warranted.



WP6.28 (above) – Rolling Grade Dips are required through this section to ensure adequate drainage. A lack of pruning has contributed to the emergence of a ride line on the left. Some 'wiggle' in this trail reinforced with corrals would improve its flow and help moderate user speed.

Section 10 – Summary of Recommendations				
Priority	Actions		Location	Who?
1	Signage	<i>In accordance with a signage strategy for MTB loop &/or whole of Manly Dam park:</i>		Warringah Council to lead, contractor assistance if required.
		Install trail-head &/or trail-totem signage at 1 location	WP6.36 (=WP1.01)	
		Install trail-markers at 3 locations	WP6.31, WP6.34, WP6.35	
		Install caution markers – control speed – shared-use	WP6.34	
2	Address drainage problems	Repair tread surface with road base and compact, include drainage feature (roller) in new tread <ul style="list-style-type: none"> 15-20m long, 2-3m wide. 	WP6.27	Contractor
		Install 2-3 RGDs & knicks on trail tread, but maintain vehicle access through corridor. <ul style="list-style-type: none"> Install corrals (in such a way as to not hinder vehicle access) x2-3 per WP 	WP6.28, WP6.29,	Trail contractor
2	Consolidate ride line	Formalise into 1 ride line, add stone armour (3m x 1m) & 3-4 corrals	WP6.30	Trail contractor
2	Remediate degradation of fall-line section and make good for shared-use	OPTION 1: RE-ROUTE (Warringah Council preferred option)		
		<ul style="list-style-type: none"> Clarify location of boundary between Uni NSW land and Manly Dam land Create a new alignment from WP6.31 to the urban commuter path, wholly within the Manly Dam land Approx length new trail 150 metres. Close both existing alignments – total length of trail to close approx. 230 metres. 	WP7.01 (=WP6.31) to vicinity of section WP7.03 to WP7.04 (=WP6.34)	Warringah Council to lead, contractor assistance as required, Volunteer trail care team to assist.
		<i>IMBA Australia is confident that a sustainable alignment is achievable within the Manly Dam easement, assuming the boundary location as indicated is close to accurate. Greater clarity is required on the boundary location however to be certain of that. A sustainable alignment should be flagged using a clinometer. Any assessment of natural and cultural heritage values of the route should assume the final trail alignment will be within +/- 5m of the flag line, ie within a 10m wide corridor. More detailed trail design is required prior to construction.</i>		

2	Remediate degradation of fall line section and make good for shared use	OPTION 2: RETAIN EXISTING ALIGNMENT AND UPGRADE		
		<ul style="list-style-type: none"> • Consult University of NSW about facilitating trail access on their land parcel, and if they are agreeable to it: • Upgrade the existing RHS alignment <ul style="list-style-type: none"> ○ Install more drainage features ○ Install stone armouring and remove timber from tread — 10m x 1m ○ Install corrals x5-6 • Close existing LHS alignment 	WP6.31 to WP6.34	Warringah Council to lead, in consultation with Uni of NSW, contractor assistance as required.