



SPRING GULLY TRAIL NETWORK MASTER PLAN

PREPARED BY WORLD TRAIL PTY LTD

FOR CITY OF GREATER BENDIGO

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ABBREVIATIONS

BMBC – Bendigo Mountain Bike Club
COGB – City of Greater Bendigo
IMBA – International Mountain Bicycling Association
MTB – Mountain bike
MV – Management vehicle
PV – Parks Victoria
TDRS – Trail Difficulty Rating System
TTF – Technical Trail Feature
WT – World Trail

1 INTRODUCTION

In October 2016, World Trail Pty Ltd (WT) was appointed to undertake the development of a master plan for a network of mountain bike (MTB) trails located at Spring Gully, on the southern outskirts of Bendigo, Victoria.

Fieldwork was conducted over several trips at different points of the project, between November 2016 and March 2017.

The client for the project is City of Greater Bendigo (COGB). Key stakeholders for the project include the Bendigo Mountain Bike Club (BMBC) and Parks Victoria (PV), who are the land managers for the Bendigo Regional Park where the proposed trail network is located.

The objective of this project is to prepare a master plan for a network of MTB trails at Spring Gully, taking into consideration the extensive network of existing MTB trails already in place.

This project is the culmination of long discussions and negotiations between BMBC, PV and COGB to formalise the MTB trails of Spring Gully. With the completion of this master plan, this goal is one step closer to reality.

2 BACKGROUND

2.1 PROJECT CONTEXT

The following is taken from the project brief and explains the broader context for the project.

1.0 Overview and Project Background

The Bendigo Mountain Bike Club Inc (BMBC) have been working closely with Parks Victoria (PV) for a number of years to establish a new MTB trail network in the Spring Gully area of Bendigo.

There has been a strong history of mountain biking in the Bendigo region and there are many kilometers of existing tracks however, these tracks are poorly designed and are causing problems with erosion.

Spring Gully is a suburb of Bendigo, located to the south of the CBD of this central Victorian city. The proposed trailhead is approximately 4km from the city centre and railway station which is an important transport link to Melbourne. The site is easily accessible from the CBD via road and designated cycle lanes and shared walking/cycling tracks within bush reserves run between the trailhead and the CBD.

Spring Gully has been identified as a priority area for development as a MTB trail network through a concurrent development of Bendigo Mountain Bike Trails Development Plan in conjunction with PV, City of Greater Bendigo (CoGB) and Department of Environment Land Water and Planning (DELWP). The accessibility for local residents and visitors was a paramount consideration in determining this location. There is significant infrastructure already located between the CBD and the proposed trail network such as on-road cycle lanes and shared walking cycling tracks through nearby bush reserves.

The undulating topography in this area is ideal for creating challenging and varied experiences for mountain bikers. PV manages the area proposed for the network with only a small section at the north-eastern end of Zone 1 being managed by the CoGB.

The Spring Gully areas undulating topography and bushland vegetation that is well suited to the activity of mountain biking, providing the experiences that mountain bikers enjoy such as nature, fitness and the escape from every day life. The bushland extends to the periphery of the municipality enabling an extensive network to be developed without making the area exclusively for mountain biking.

The Spring Gully area also has a number of other major walking and cycling tracks in direct proximity including the Goldfields Track, an identified trail of state significance and the Bendigo Bushland Trail. Spring Gully Trail Network forms the Northern Gateway to the Goldfields Track and the Ride/Walk Goldfields strategic plan. Ride/Walk Goldfields is the connection of Bendigo and Ballarat with other towns such as Harcourt, Castlemaine and Daylesford with cycling and walking destinations. It includes a series of MTB hubs including Harcourt Mountain Bike Park and Creswick Trail Network.

The proposed trail network master plan is to provide a coordinated approach towards the SGTN as a world-class mountain biking facility, which caters to a wide range of rider capabilities and provides a diverse range of experiences.

The BMBC has developed a concept plan¹ that proposes three major zones for the new network, how the network might connect to other existing tracks and where opportunities might be for future expansion.

This project brief also provides some key deliverables to be incorporated into the proposed trail network. These are summarised below:

1. The location for the trailhead² has already been established – Muldoon Reserve on Wattle Drive. This small parcel of land is managed by COGB. At the time of preparing this report, the site already had a newly built pump track and skills track, with plans in place for the construction of a pavilion, shared path trail head signage (see Appendix 8.2);
2. The study site is broken into three zones – 1, 2 and 3. Zone 1 is to focus primarily on Easy trails. Zones 2 and 3 are intended to offer longer, more remote and more challenging trails;
3. The Goldfields Track passes through the area. It is a shared-use multiple day walking/cycling trail. The proposed trail network is to interact with the Goldfields Track in such a way that riders using the Goldfield Track can opt to detour onto the MTB trails if they choose, and conversely, riders using the MTB trails can use the Goldfields Track as an ‘express route’ to access more remote sections of the MTB trail network;
4. While the brief suggests the consultant take a ‘blank canvas’ approach to the study site, it also suggests using existing trails where they meet acceptable standards for sustainability and riding experience, to ameliorate impacts on native vegetation or cultural heritage values;
5. The trail network master plan should be designed to provide the best rider experience. In addition, it is desirable to highlight visual characteristics of the landscape such as rocky outcrops and views;
6. More Difficult³ (Blue Square) trails are the predominant classification within the proposed network. Some short sections of more technical trail will be provided as optional detours and shortcuts to extended loops will be incorporated to provide the challenges desired by the more advance riders;
7. It is crucial that the proposed network be suitable for event options. The BMBC run annual events including the Golden Triangle Epic, Summer Series, Victorian School Cycling Championships, the Bendigo MTB Womens Challenge and the Bendigo 6 Hour to support our local rider membership and provide a pathway to state and national mtb series and events.
8. Primarily the trail network will be designed to cater for cross-country and enduro riding styles but the aim is to be as inclusive as possible. The topography is not particularly suited to downhill riding and other networks nearby can already provide for this.

¹ See Appendix 8.1 for the BMBC Concept Plan.

² The trailhead is the main entry point into the trail network. It generally includes car parking, signage and access to the trail network.

³ The International Mountain Bicycling Association (IMBA) has published a system for rating MTB trails called the Trail Difficulty Rating System (TDRS). It is provided in Appendix 8.3. ‘More Difficult’ roughly equates to an ‘Intermediate’ rating.

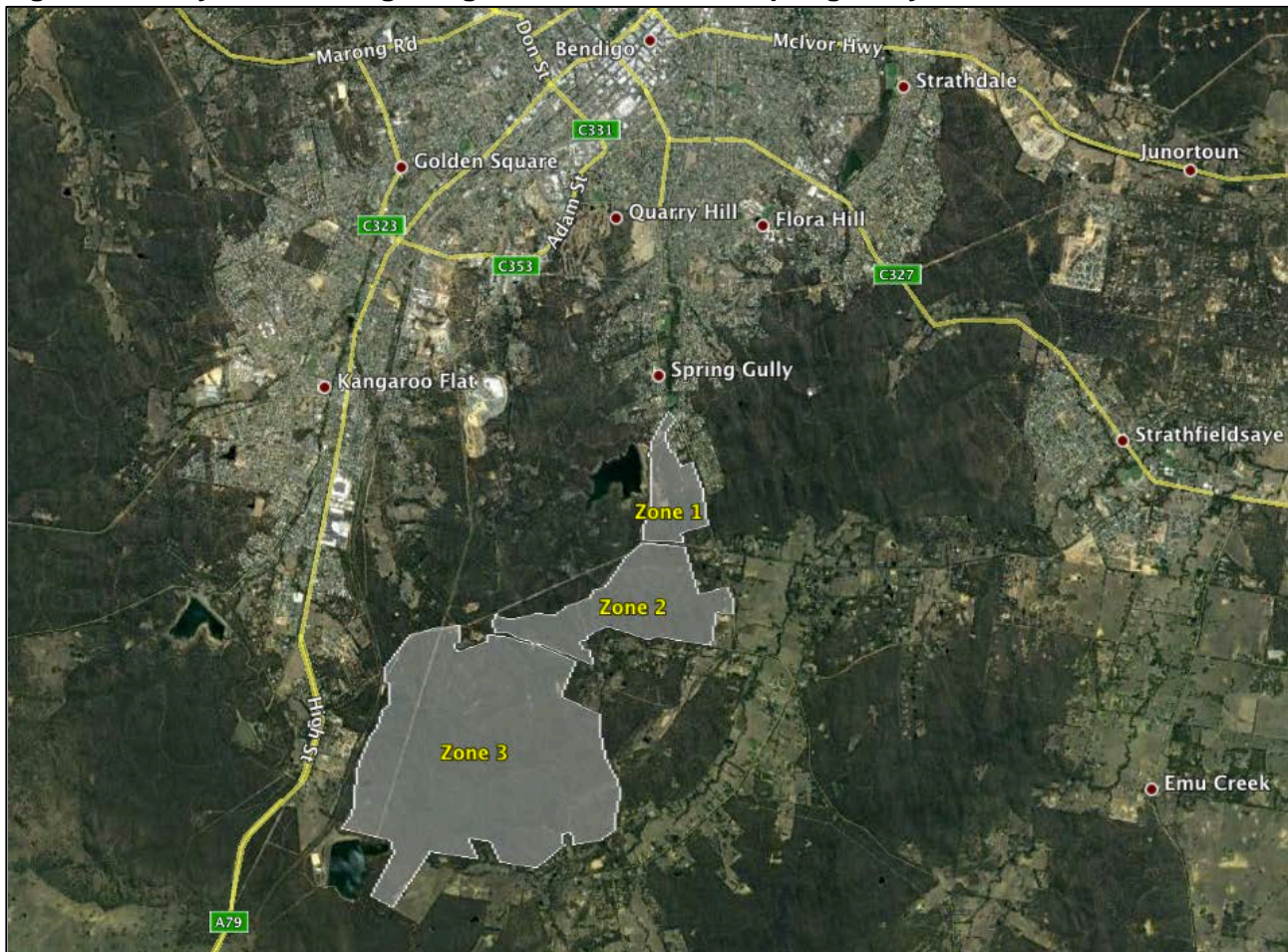
2.2 SITE DESCRIPTION

The study site for this project is the Bendigo Regional Park, but in particular the section of the park just south of Spring Gully (there are numerous different sections of the park located around Bendigo).

The study site consists of three zones within the Spring Gully area, as shown in Figure 1 below:

- Zone 1 – covering approximately 70 hectares within Muldoon Reserve and Bendigo Regional Park with primary access from Wattle Drive, Mandurang Road and Fire Road (extension of Tannery Lane);
- Zone 2 – covering approximately 170 hectares within Bendigo Regional Park with primary access from Fire Road (extension of Tannery Lane), Connellys Road, Holidays Road, Mandurang Road and Diamond Hill Road;
- Zone 3 – covering approximately 680 hectares within Bendigo Regional Park with primary access from Diamond Hill Road, Kangaroo Gully Road, Apeline Track, Sandhurst Reservoir Road, Callinan Lane and bounded by the Coliban Main Water Channel.

Figure 1. Study site - Bendigo Regional Park south of Spring Gully



As stated, the trailhead location has already been determined. It is located at Muldoon Reserve in the suburb of Spring Gully on the corner of Wattle Drive and Mandurang Rd. It is approximately 5km south of the centre of Bendigo, within easy riding distance from many parts of greater Bendigo. The site is well serviced by dedicated off-road cycling and walking paths that provide a safe riding alternative to the road.

Muldoon Reserve is located at the northern tip of the study site, is a small council-managed reserve, and sits directly to the north of the Bendigo Regional Park. While the two land tenures are different, for all intents and purposes, the land form, use and appearance is continuous from one tenure to the next, and for the purpose of this project can be considered as being part of the study site.

Features of note in or near the study site include:

- Spring Gully Reservoir – This large reservoir is located just to the west of the study site and is managed by Coliban Water. The reservoir is part of the local water reticulation system and access to this area is restricted;
- Sandhurst Reservoir – This reservoir is also managed by Coliban Water and lies at the southwestern end of the study site;
- Water races – a conspicuous feature of the study site is the extensive network of water races. This includes functional water races made from concrete and earth that carry large volumes of water as part of Coliban Water's reticulation system, old water races used in gold mining times, but now dry and empty, and small earthen water races that carry water from the reservoirs and Coliban Water channels and races to nearby farms;
- Koolamurt Park Scout Camp – Located on Mandurang Rd, this facility is used for camps and other events by Scouts Australia. It borders the park on the eastern side, but with no fences in place and few signs, it is difficult to tell where the land changes tenures;
- Greater Bendigo National Park – the Bendigo National Park lies directly adjacent to the Bendigo Regional Park in two locations:
 - In Mandurang, separated only by Mandurang Rd;
 - At the southern end of Bendigo National Park towards Sedgewick;
- Melbourne – Bendigo trainline – along the western edge of the park runs the train line between Melbourne and Bendigo;
- High voltage power transmission line – there is large cleared easement with high voltage power lines that runs through the western section of Zone 3;
- Tracks and trails – The study site is dissected by a large number of tracks and trails, including management vehicle (MV) tracks, four-wheel drive and motorbike tracks, old access tracks from gold mining activities and mountain biking trails. Many of the tracks are eroded and disused, and could ideally be closed and revegetated;
- Mining – the legacy of historic gold mining activities in the area is obvious and ubiquitous throughout the study site. Signs of former mining activity are clearly visible everywhere, including mine shafts, haphazard piles of over-burden dotting the landscape, access roads and machinery and debris left behind;
- Watercourses – There are no watercourses of any size within the study site, with the exception of some of the water races maintained by Coliban Water. There are many small ephemeral drainage lines that carry water for a short time after rain, but are otherwise dry for most of the year. There are numerous ponds and dams scattered throughout the study site, but the only one of note is located in Zone 1, about five minutes ride south from the trailhead. It is used by locals for fishing and swimming;
- Vegetation – The vegetation within the study site can be described as open woodland, dominated by various species of Eucalypts, and with a generally sparse understorey. Some

exotic, introduced species were evident throughout the study site, but the predominant character is of native vegetation. Large, old trees were fairly rare throughout the study site;

- Topography – The topography can best be characterised as ‘rolling hills’, with gentle to moderate gradients. The highest point is located towards the southern end of the study site and is approximately 340m above sea level, while the lowest point is located at the trailhead and is approximately 250m above sea level. While a few rocky outcrops were found throughout the study site, there were no cliffs or sections of excessively steep gradients;
- Soils – the site is quite rocky, with generally shallow soils. The existing trails are all very rocky – it is part of the character of the trails and a reflection of the rocky environment.

The landscape offers good opportunities for MTB trail development. It is fairly open vegetation, offering good long sight lines and fairly easy construction, although this is offset by the rocky soils. From a tourism and visitation perspective however, there are few features of outstanding scenic value – there are no waterfalls, rivers, mountain peaks, or lookouts. The landscape is very homogenous throughout the study site, with few features of significance. This is not to say that it isn’t a pleasing and enjoyable landscape – it is essentially Australian, birdcalls echo through the landscape, kangaroos and wallabies abound and at the right time of year wildflowers provide bursts of colour. This means that the success of the trail network will be largely driven by the experience offered by the trails, and less by the scenery.

2.3 SITE PHOTOS

Figure 2. New pump track at Muldoon Reserve, Spring Gully



Figure 3. Temporary 'crossover' structure used in Golden Triangle Epic 2017



Figure 4. Old stone bridge



Figure 5. Concrete water race

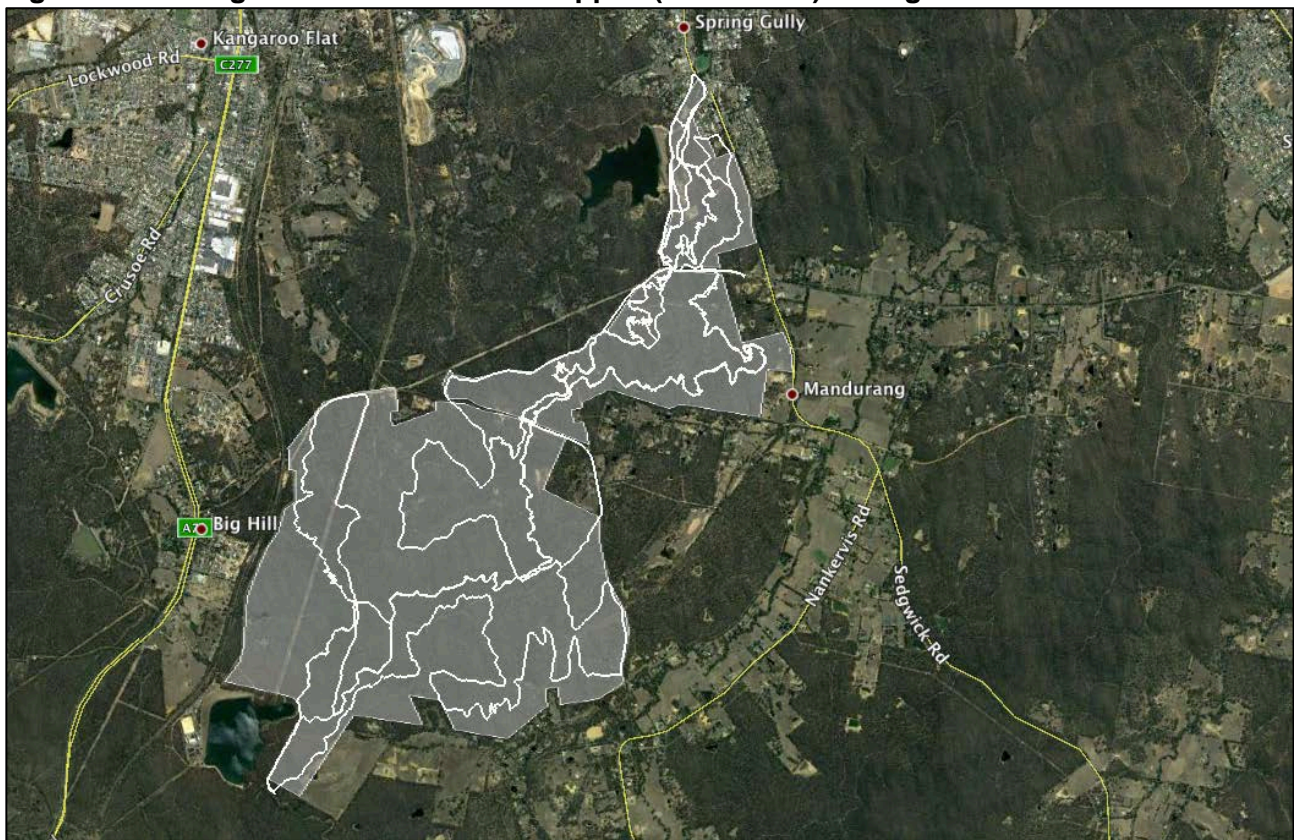


2.4 EXISTING MOUNTAIN BIKE TRAILS

It has already been stated that Spring Gully has an extensive network of MTB trails, but most of these haven't been formally approved and endorsed by the land manager, PV. Endorsement of the trail network by PV moving forward is one of the key objectives of this master plan. Although the trail network isn't yet formally endorsed, PV has allowed BMBC to run MTB events there for some time, some of which attract significant numbers of competitors and spectators.

Figure 6 below shows many of the existing trails throughout the site – most of these were mapped during initial fieldwork reconnaissance rides by WT. This figure is not a definitive illustration of all the trails on the site – WT only mapped the most heavily used and obvious trails.

Figure 6. Existing trails identified and mapped (white lines) during fieldwork



A useful tool to estimate the usage and relative popularity of these trails is the social fitness tracking application, Strava. Users of Strava upload GPS data of their rides and compare their speed and efforts to other users. Over time, the application has built up a vast database of information about where people ride which is freely accessible to the public in the form of the 'heatmaps'. These 'heatmaps' indicate the popularity of a route or trail by the brightness/vividness of the line – more popular routes are brighter, less popular routes are duller. Figure 7 on the next page shows a 'heatmap' of the study area. While the map doesn't differentiate between road riding and mountain biking, it appears that some of the trails within the study site are as popular with cyclists (presumably mountain bikers) as nearby Mandurang Rd (presumably road riders).

Figure 7. Strava Heat Map of Study Area

The study site is criss-crossed by a multitude of trails, formal and informal, far more than are required for management purposes or approved recreational purposes. There is an opportunity to rationalise the trail network – indeed this is a goal of this project but only in relation to the MTB trails. Beyond this project, there is a bigger scope to look at all other trails throughout the park and consider closing those that are unnecessary. Closure of all the unnecessary, duplicate, unused, unsustainable or eroded trails would result in a large area of land that could be revegetated, resulting in significant conservation improvements for the park. This would also no doubt assist in minimising anti-social and illegal behaviour such as rubbish dumping, as at the moment there are far too many easy points of access for vehicles.

The existing MTB trails were, generally speaking, in reasonably good condition. It is obvious in some areas (particularly Zone 1), that the trails are receiving constant maintenance and improvement works. The nature of the work being undertaken is of a fairly good standard and is mostly compliant with the general principals of sustainable trail design. Some issues were identified however, including:

- Steep, eroded fall-line sections – some sections of trails went straight up/down the fall line⁴ and were eroded and deeply incised. It appears that BMBC has been working steadily through the trail network and trying to eradicate many of these sections and replace them with longer, less

⁴ The fall line is the shortest, steepest way down the hill, perpendicular to the contour lines.

steep routes that are more sustainable. It is suggested that many of these steep fall line sections were not deliberately designed and constructed by mountain bikers. Rather, these trails are the legacy of former uses – motorbike or 4WD tracks, logging tracks, farm access tracks or even animal tracks. Typically, many MTB trails are formed by riders using whatever other trails they can find, many of which were built with little regard for sustainability;

- Overly winding and twisty trails – some sections of the trails appear to have been built deliberately by mountain bikers and offer some fun and challenging sections. However, many sections have been made much longer than necessary by deliberately twisting the trails back and forth within a small space for no apparent reason. While some riders may enjoy this style of trail, typically the most popular trails move through the landscape with a sense of purpose and direction.

3 PROJECT METHODOLOGY

The project methodology used to complete this project is described in Table 1 below, which lists the various stages and phases of the project and describes the work undertaken in each.

Table 1. Project methodology

Stage	Phase	Notes
Stage 1 – Concept Development	a) Inception Meeting and Site Familiarisation	<p>The project commenced with a project inception meeting with COGB and stakeholders including BMBC, PV and DELWP. At this meeting, the project aims and objectives, methodology, timing, deliverables and other details were discussed.</p> <p>A site familiarization was then undertaken with BMBC to familiarize WT with access roads, gates, points of interest or other features of the study site.</p>
	b) Independent Fieldwork	<p>Independent fieldwork was then undertaken to further explore the site, identify sustainable trails to be retained, unsustainable trails to be removed/replaced/modified and assess different potential conceptual layouts.</p> <p>An important part of this step was to map as many trails as possible, and to categorise them as either:</p> <ul style="list-style-type: none"> Existing MVtrack; Existing MTB trail. <p>This was a key step in the developing an interesting and exciting trail network, as it was during this step that any key features for inclusion in the proposed trail network were identified.</p>
	c) Desktop review of environmental and cultural heritage values	<p>COGB engaged Practical Ecology and Tech Duinn to provide advice on environmental and cultural heritage values within the park respectively.</p> <p>The first step for both consultants was to undertake a desktop review. This desktop review looked at the respective records and databases for flora and fauna and cultural heritage to identify what was known about the environmental and cultural heritage values of the study site.</p> <p>Reports were provided to WT for consideration. The key findings produced by Practical Ecology are provided in the next section of this document.</p>
	d) Concept Development	<p>Using the reports provided by Practical Ecology and Tech Duinn, a number of no-go zones (i.e. any areas that should be avoided by the proposed trail network) were identified. These reports helped to shape the ultimate trail network, by identifying areas where new trails could be constructed and where it would be more practical and beneficial to retain the existing trails.</p> <p>Following this, a conceptual model for the proposed trail network was developed. A number of maps were produced including:</p> <ol style="list-style-type: none"> An overview map, showing the trailhead and all the proposed trails; The proposed trail difficulty rating of each trail; The estimated length of each trail; Location of any infrastructure and access points; Differentiating between new and existing trails.

	Concept Presentation	<p>WT met with COGB and other stakeholders to present the conceptual model for the proposed trail network and seek approval in principal.</p> <p>COGB and BMBC requested a number of changes to the concept.</p> <p>This resulted in the production of a second version of the conceptual model, which was accepted and approved in principal.</p>
Stage 2 – Ground-truthing	Ground-truthing fieldwork	<p>With the conceptual model agreed upon by the key stakeholders, the next step was to ground-truth the proposed trails. Ground-truthing is the process of determining in the field the exact on-ground location of a trail, to within say 5m of the final position when constructed. Further explanation of the ground-truthing process is provided in the following pages.</p> <p>Ground-truthing was undertaken by WT over the course of several days. BMBC personnel provided input and advice to this process, at times even accompanying WT in the field.</p> <p>Once complete, WT cleaned up the GPS data and produced a series of maps showing the final ground-truthed trail alignments – in particular, these maps showed where the trail network would use existing MV tracks or MTB trails or where new MTB trails would be constructed.</p> <p>The resulting maps and the cleaned up GPS alignments were provided to Practical Ecology and Tech Duinn for the second stage of their work.</p>
	Field Assessment of Trail Alignments	<p>Practical Ecology and Tech Duinn spent several days in the field assessing the ground-truthed trail alignments. In particular, their task was to identify any areas where the proposed trail alignment would have an impact on any areas of high environmental or cultural heritage significance.</p> <p>Practical Ecology found three locations where the proposed trail would have a significant impact on areas of high environmental significance. In these locations, the trail would need to be completely realigned. They found many examples where the trail would have an impact on plants with high conservation values, but where the impact could be completely or mostly removed by adjusting the trail alignment slightly to avoid those individual plant specimens. These areas are identified in Practical Ecology's final report, and would be dealt with at the construction stage using a technique called micro-siting. Essentially, micro-siting involves having a qualified botanist walk through the alignment with the machine operator just prior to commencement, and adjust the alignment sufficiently to avoid the plants in question.</p> <p>Tech Duinn assessed the entire proposed trail network, but found no areas of significant cultural heritage values that would be impacted by the proposed trail network.</p>
	Report writing	<p>With the final trail network ground-truthed and mapped, and feedback from both Practical Ecology and Tech Duinn, the final task was to adjust the ground-truthed trail alignments to reflect the advice from the other consultants, and then bring together all the data into a cohesive report.</p>

3.1 PRACTICAL ECOLOGY DESKTOP REVIEW

The key recommendations from Practical Ecology's desktop review were used to inform the development of the concept and later, to assist in the ground-truthed process. The key recommendations were:

- Avoid:
 - Areas of known records and potential habitat for Brown Toadlet/Bibron's Toadlet, particularly creeks, depressions, drainage lines and wetlands (e.g area south of dam within Zone 1);
 - Areas of potential habitat for Pink-tailed Worm Lizard specifically rocky outcrops and in particular, those with a north-facing aspect (NE to NW);
 - Areas of potential habitat for Eltham Copper Butterfly particularly patches of *Bursaria spinosa*. Avoidance of *Bursaria spinosa* populations can be fine-tuned in Stage 2 with ground-truthing of the nominated trail alignment;
 - Areas of known records for Brush-tailed Phascogale. Avoidance of hollow bearing trees can be fine-tuned in Stage 2 with ground-truthing of the nominated trail alignment;
 - Large old trees and trees with hollows. Avoidance of these features can be fine-tuned in Stage 2 with ground-truthing of the nominated trail alignment.
 - Known records and field records of Goldfields Grevillea. Given the widespread distribution of this species, and the location of records adjacent to tracks, avoidance of Goldfields Grevillea populations will need to be fine-tuned in Stage 2 with ground-truthing of the nominated trail alignment;
 - Areas of the highest elevations and ridgelines (typically EVC 20 Heathy Dry Forest);
 - Areas of EVC 47 Valley Grassy Forest (except area mapped adjacent to Connellys Road). A 'vulnerable' EVC, prone to degradation, good quality examples should be protected;
 - Areas of EVC 67 Alluvial Terraces Herb-rich Woodland and EVC 68 Creekline Grassy Woodland. Both 'endangered' EVCs with the former listed as 'threatened' under the FFG Act. Examples that occur in the study area are generally in poor condition, never-the-less new track construction should be limited in these areas;
 - No new track construction and close existing track network in the sector between Cahills Road and the Coliban Main Water Channel;
 - None or limited new track construction and close track network not nominated for trail network in the sector between Robbie Road (east), Munroe Road (north), the water race (west) and Cahills Road (south).
- Utilise:
 - Existing track network;
 - Areas of Low – Moderate Vegetation Quality;
 - Alluvial areas disturbed for mining (evidence of mullock heaps).

3.2 GROUND-TRUTHING METHODOLOGY

Ground-truthing is done using a GPS and clinometer (to measure gradient) and keeping in mind the intended difficulty rating of the trail. During ground-truthing, the local environmental conditions are assessed and the trail is designed accordingly. For example, if there is a creek to be crossed, the alignment is chosen so as to cross the creek at the narrowest point, or if there is a low-lying boggy area, the trail is aligned so as to avoid the boggy section if possible. Once complete, the trail is mapped by GPS and marked in the field using coloured flagging tape.

All the trails presented in this report have been ground-truthed. Their alignments have been recorded as a 'track log' with a handheld GPS as well as any relevant points of interest. Each trail alignment has also been tagged in the field by tying small strips of brightly coloured (in this case, pink) flagging tape to trees/shrubs along the trail alignment.

When attempting to follow a trail alignment in the field, World Trail recommends:

- Loading the GPS file of the recorded 'track' into a handheld GPS and using it to follow the 'track' in the field;
- Taking a hard copy map, showing the proposed trail alignments;
- Looking for the coloured flagging tape in the field.

In relation to the flagging tape, the following protocols should be understood:

- The flagging tape indicates roughly the middle of the proposed trail alignment;
- Generally, each strip of flagging tape should be visible from the next/previous strip, but this should not always be relied on as they can be removed by weather/animals. In thick vegetation, flagging tape will be placed more frequently and in sparse vegetation, tape will be used more sparingly;
- Where the trail performs a sharp turn or switchback, three pieces of tape tied around a single trunk or branch are generally used to indicate the apex of the turn (see **Figure 8** on next page);
- Switchbacks are often used in close succession to each other to help a trail climb up or descend a steep slope. In these situations, there can be multiple 'legs' of the trail running roughly parallel to each other. Anyone attempting to follow the proposed trail alignment needs to be aware of where these switchbacks might be (using a GPS and map) and ensure that they look forward along the contour to locate the next piece of flagging tape;
- Where the trail is proposed to follow an existing road or trail, flagging may be sporadic.

While the length of the trail as recorded during ground-truthing is more accurate than any trail lengths estimated during the conceptual phase, it may still not be 100% accurate to the actual final constructed trail. It is likely that the final constructed trail length may be up to 10% longer than the length recorded during ground-truthing. This is caused by the inability of handheld GPS devices to pick up small twists and turns and minor direction changes.

Figure 8. Triple taping to indicate switchback corner



4 SPRING GULLY TRAIL NETWORK

4.1 TRAILHEAD LOCATION AND LAYOUT

The trailhead for the Spring Gully Trail Network is located at Muldoon Reserve on Wattle Drive. At the time of writing this report, works were already underway to upgrade and improve this reserve, including the creation of a dedicated trailhead for the trail network. This is a suitable location for the trailhead, being easy to find, with good access and being located at the bottom of the trail network, allowing all rides to finish with a descent back to the trailhead.

The trailhead fulfils a number of important functions:

- It provides the essential pre-ride needs of mountain bikers – water, toilets, information and car parking. In addition however, it should encourage positive social use of the site. Some visiting riders may be accompanied by non-riders who may want to wait at the trailhead, so the trailhead should be an enjoyable place to wait, which means considering additional infrastructure such as seating, shelters, landscaping etc.;
- It is the starting and finishing point for all riders (except for any riders that live close by and may enter the trail network at a different point). As such it is the place where friends meet to begin their ride and where they socialise afterwards. It is also a location that can be signposted or advertised so that travelling mountain bikers can find it easily;
- It is the key information point about the trails. Trailhead signage must clearly provide all the information that is necessary for riders to plan their ride before leaving the trailhead, including distances and trail difficulty ratings for each trail;
- It should be a safe place to leave a vehicle while riding.

In order to fulfil its various functions and roles, a trailhead needs certain infrastructure items. The nature and extent of the infrastructure depends largely on the available budget, but there are certain items that must be included at a trailhead.

In 2013 WT surveyed approximately 1300 mountain bikers, asking what facilities and infrastructure should be present at a MTB trailhead. The responses are provided below, ranked in priority order:

1. Car parking	(96.38% of respondents selected this option)
2. Maps	(86.11% of respondents selected this option)
3. Toilets	(80.98% of respondents selected this option)
4. Drinking water	(72.14% of respondents selected this option)
5. Picnic tables	(46.97% of respondents selected this option)
6. Shelter	(45.03% of respondents selected this option)
7. Notice board	(42.51% of respondents selected this option)
8. BBQ	(32.74% of respondents selected this option)
9. Café	(28.28% of respondents selected this option)
10. Bike wash facilities	(16.75% of respondents selected this option)
11. Local business advertisements	(16.50% of respondents selected this option)
12. Bike shop	(14.81% of respondents selected this option)
13. Bike racks	(12.04% of respondents selected this option)
14. Change room	(7.24% of respondents selected this option)
15. Shower	(5.05% of respondents selected this option)

Based on these results, items 1-4 could be considered 'essential', items 5-8 'preferred' and items 9-15 'optional'.

The most important aspect of the trailhead is its location. When considering trailhead design locations, there are a number of principles to consider:

1. ***The trailhead should be located at the bottom of the trail network*** – Most mountain bikers ride for the descents, not the ascents. By locating the main trailhead at the bottom of the trail network, riders are guaranteed to finish their ride on a descent, which helps to ensure riders finish their ride on a 'high'.
2. ***The trailhead should be easy to find*** – Making the trailhead easy to find is important to the overall visitor experience, and will allow visitors to start from good first impressions.
3. ***The trailhead should be easily visible to passing traffic*** – Trailheads that are easily visible to passing traffic have two main benefits:
 - a. They are less likely to attract criminal or anti-social behaviour;
 - b. A full car park sends a positive message to the local community that mountain biking is a growing sport and a positive use of public land.
4. ***The trailhead should have plenty of space available for day-to-day recreational use, with overflow areas nearby for events*** – The ideal trailhead area would be large enough to accommodate the recommended facilities for independent day-to-day visitors, but would have large open spaces adjacent that could be utilised for car parking and event staging areas for large MTB events.
5. ***The trailhead should be an aesthetically pleasing space*** – Ideally the trailhead offers an attractive and aesthetically pleasing environment, with shade, trees and some connection to the natural environment in which the trails are located.

The location at Muldoon Reserve ticks all of these boxes, except:

1. Toilets – At this point in time, there is no plan to construct a toilet block, but toilets are available less than 300m away at the football oval;
2. Space for large events – Muldoon Reserve is lacking in car parking and large open spaces. There is enough car parking and open space to run small-medium sized mountain biking events, but larger events may be challenging given the limited space. While this is true, BMBC have hosted large marathon MTB events in the past and have successfully found solutions to these challenges.

4.2 TRAIL NETWORK DESIGN PRINCIPLES

Over years of working in the trail design and construction industry, WT has developed a number of principles that should ideally be incorporated into every trail network. These principles include:

1. **All trails should be given a trail difficulty rating.** WT recommend the International Mountain Bicycling Association's (IMBA) Trail Difficulty Rating System (TDRS) to rate the difficulty of MTB trails, which is provided in full in Appendix 8.3.
2. **The easiest trails should be located near the trailhead, with increasingly harder trails located further from the trailhead.** This is a basic risk management technique to prevent inexperienced riders accidentally ending up on very difficult trails. This design principal has been largely implemented to date by BMBC.
3. **All trails should be designed to be ridden in one-direction only.** This criterion is essential for risk management (prevention of head-on collisions) and to ensure a good visitor experience. The only exceptions to this rule are wide, flat trails that provide long forward sight-lines – fire roads, rail trails etc. which can be safely used in both directions. While there is no designated direction of travel on the trails currently at Spring Gully, most riders seem to prefer to ride the trails in the same direction of travel recommended here – clockwise (see maps in the following sections).
4. **The entire trail system should be easy to navigate and intuitive.** WT generally designs trail networks where all trails are offered as loops, and generally following the same overall direction of travel.
5. **It should be possible to ride one lap of the entire trail network, without backtracking, without crossing over any trails and without missing any large sections of trail.** This principle assists in creating an easy-to-navigate trail network. It also simplifies events as it eliminates crossover points where marshals are needed to manage traffic or crossover structures need to be built (see Figure 3 on page 7).
6. **The trail network should be sympathetic to the terrain and topography.** Trails should be sympathetic to the landscape, giving trail users a connection to the environment and a sense of purposeful, direct movement through the landscape.
7. **The trail network should maximise the use of any existing trails (if they provide the right experience and are sustainable).** This principle ensures good value for money by preventing unnecessary trail construction and also minimises unnecessary environmental impacts.
8. **The trail network should cater to a wide variety of riding styles and rider abilities.** Where possible, the trail network would include a variety of trail types, including cross-country, gravity (downhill and/or enduro), pump tracks, dirt jumps, etc., as dictated by the landscape. Furthermore, within each style, there would ideally be trails for all skill levels, from beginners to advanced riders. This principle is especially relevant on projects that have a tourism focus, as it allows the trail network to have the broadest possible appeal. Given the limited vertical range at Spring Gully, gravity trails are not really feasible.
9. **The trail network should be designed to avoid areas of high environmental significance.** The largest environmental impact of any trail occurs when it is constructed, in the clearing of vegetation and displacement of habitat. Therefore, it is a general design principle that trails should be located away from areas of high environmental significance. In practice, this is best

achieved in the ground-truthing stage, when the exact trail alignments are being determined, by engaging qualified ecologists to work with the trail designers, to ensure that the trails avoid any communities or species of concern. Where it is not possible to avoid areas of high environmental significance, then specialised construction methods can be used to ameliorate any impacts – for example, the use of elevated boardwalks through riparian or boggy areas. This principal has been carefully adhered to in this project.

10. ***All trails should be built to modern best-practice standards for sustainable trail construction.*** While there are no standards defining best practice, the work of the International Mountain Bicycling Association is generally accepted as best practice for sustainable trail construction. Sustainable trails have minimal ongoing environmental impacts and require minimal maintenance.

4.3 TRAIL NETWORK OVERVIEW

The proposed Spring Gully Trail Network is comprised of 14 trails.

Key features of the trail network are:


- All trails are rideable as individual loops;
- Each trail is single-directional;
- All trails are to be ridden in a clockwise direction, with the exception of XC Trail 8, which is anti-clockwise;
- The entire trail network can be ridden in one large loop, without doubling up or missing large sections of trails;
- The total length of the trail network is approximately 52.24km;
- There is one shared-use trail (Gravel Nature Trail);
- There is one jump trail (Jump Trail);
- There are 12 cross-country trails (XC Trail 1 – 12);
- The composition of the trail network is:
 - 9.91km (19%) is existing MV track;
 - 28.09km (54%) is existing MTB trail;
 - 13.54km (26%) is proposed new MTB trail;
- The Trail Difficulty Ratings of the trails are:
 - 5 trails rated Easy;
 - 9 trails rated More Difficult;
 - There are no Very Difficult trails included in the trail network on the basis that:
 - The terrain available doesn't present ideal opportunities for Very Difficult trails;
 - Very Difficult trails are generally steeper and are often unsustainable;
 - Very Difficult trails are less popular as fewer riders have the skill to ride them;
 - Very Difficult trails don't assist in BMBC's goals to develop and foster growth in the sport by attracting novices into the sport;
- It is recommended that some of the More Difficult trails include Very Difficult optional A-line (see Appendix 8.4 for a discussion of A and B lines) sections, thus catering to those advanced riders that seek these challenging features and obstacles. The following More Difficult trails are considered appropriate for the inclusion of Very Difficult A-line sections:
 - Zone 2 – XC Trail 6, XC Trail 8;
 - Zone 3 – XC Trail 9, XC Trail 10, XC Trail 11, XC Trail 12.

Note that throughout this report, the proposed trails are referred to using names such as Jump Trail and XC Trail 1 etc. In reality, many of the existing trails already have names known amongst the local riding community. The names used here are for identification purposes in this report only, and should not be used for the final completed trails. World Trail recommends that all trails should have their own unique name, rather than the names or numbers used here. Names help to create an identity and culture for each trail, and can assist in marketing and promotion of trails.

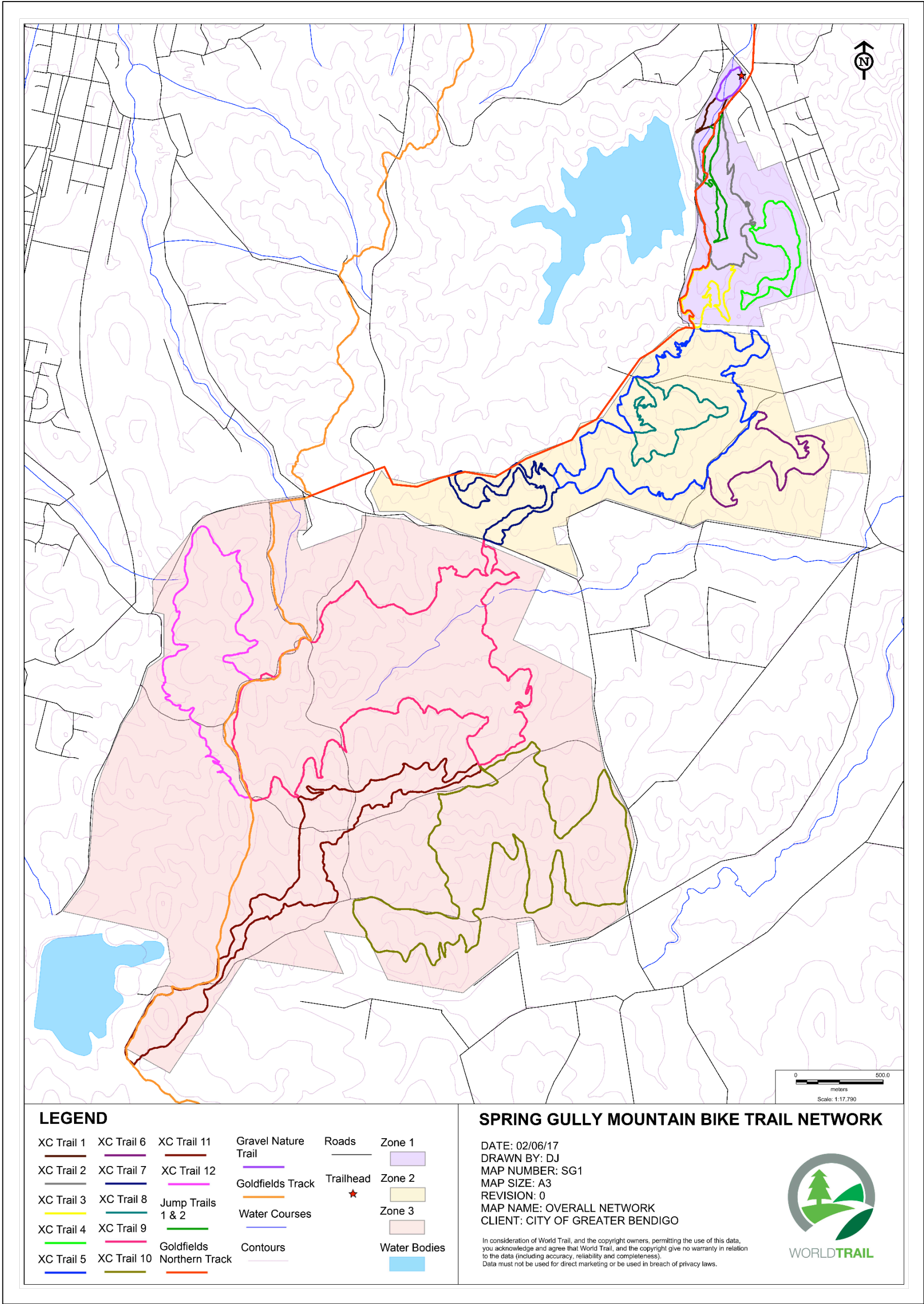
Table 2 on the next page provides a summary of the proposed trails. It includes the estimated length of each trail, breakdown of composition and the recommended trail difficulty rating for each trail.

Map 1 on the following page shows the entire trail network.

Table 2. Trail Distances

Trail	Length – Total (km)	Length – Existing MV Track (km)	Length – Existing MTB Trail (km)	Length – New MTB trail (km)	Trail Difficulty Rating
Gravel Nature Trail	0.52	0.00	0.30	0.22	Easy 
Jump Trail	1.70	0.84	0.54	0.32	More Difficult 
XC Trail 1	0.55	0.20	0.12	0.23	Easy 
XC Trail 2	2.48	0.00	1.78	0.70	Easy 
XC Trail 3	1.79	0.00	1.79	0.00	Easy 
XC Trail 4	2.26	0.28	0.00	1.98	Easy 
XC Trail 5	5.70	0.84	3.70	1.16	More Difficult 
XC Trail 6	2.51	0.10	2.11	0.30	More Difficult with Very Difficult optional A-lines  
XC Trail 7	3.51	0.14	1.77	1.60	More Difficult 
XC Trail 8	2.73	0.22	1.18	1.33	More Difficult with Very Difficult optional A-lines  
XC Trail 9	8.71	1.76	2.75	4.20	More Difficult with Very Difficult optional A-lines  
XC Trail 10	8.42	3.47	4.95	0.00	More Difficult with Very Difficult optional A-lines  
XC Trail 11	7.45	1.38	5.68	0.39	More Difficult with Very Difficult optional A-lines  
XC Trail 12	4.07	0.68	1.96	1.43	More Difficult with Very Difficult optional A-lines  
Total	52.40	9.91	28.63	13.86	

Map 1. Spring Gully Trail Network




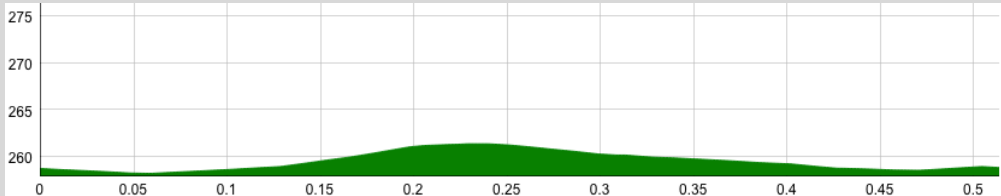
4.4 TRAIL DESCRIPTIONS

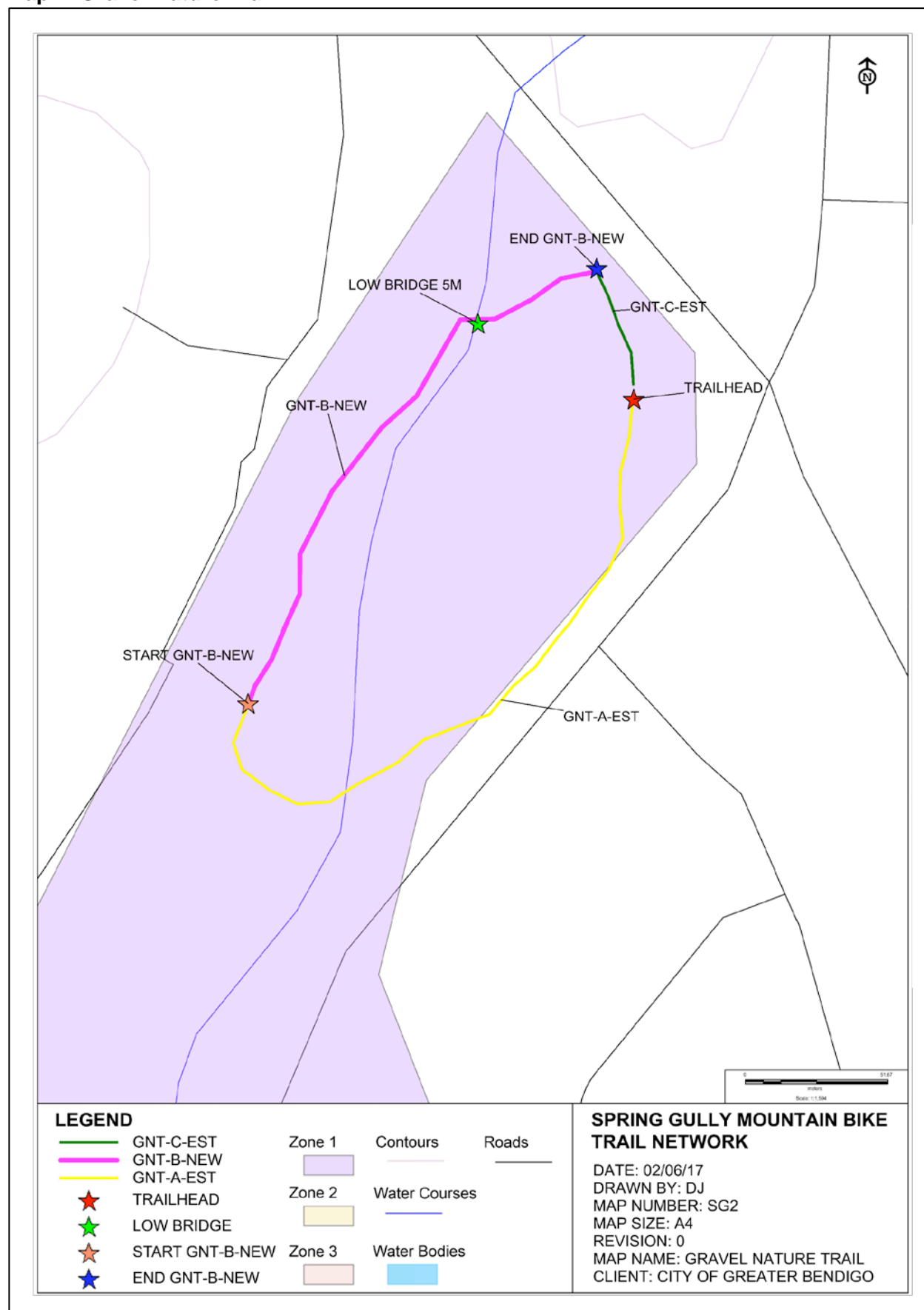
This section provides key information about each of the proposed new trails.

Please note:


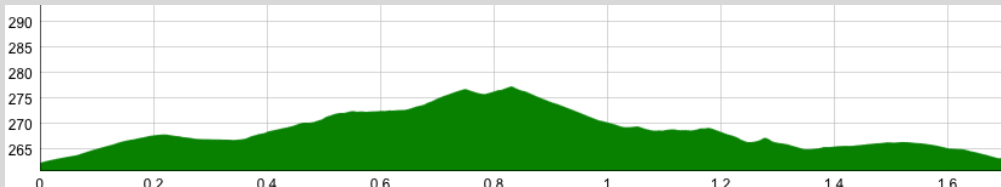
- The elevation profiles provided are generated using a digital elevation model. As such, they are only as accurate as the data within the digital elevation model and should be used as a guide only;
- Not all of the existing roads/MV tracks are shown in the in maps. Only those that were already mapped in the data layer provided by BMBC appear in these maps;
- Each trail is broken down into segments, where each segment represents a different type of trail – existing MV track, existing MTB trail or new MTB trail. Each segment is shown in a separate colour in the map legend;
- The labels used for each segment follow a simple naming convention as follows:
 - The first two or three letters are an abbreviation of the name of the trail. For example, GNT is the Gravel Nature Trail, JT is the Jump Trail, XC1 is XC Trail 1 etc.
 - The next letter is simply an allocated letter of the alphabet, where A is the first segment, B is the second, C is the third and so on. The order of the segments starts at the start of the trail with A and follows the proposed direction of travel.
 - The final three or four letters are an abbreviation of the type of trail that the segment belongs to. EMVT is existing management vehicle track, EST is existing singletrack (which is another name for existing MTB trail) and NEW is new MTB trail.

4.4.1 Gravel Nature Trail

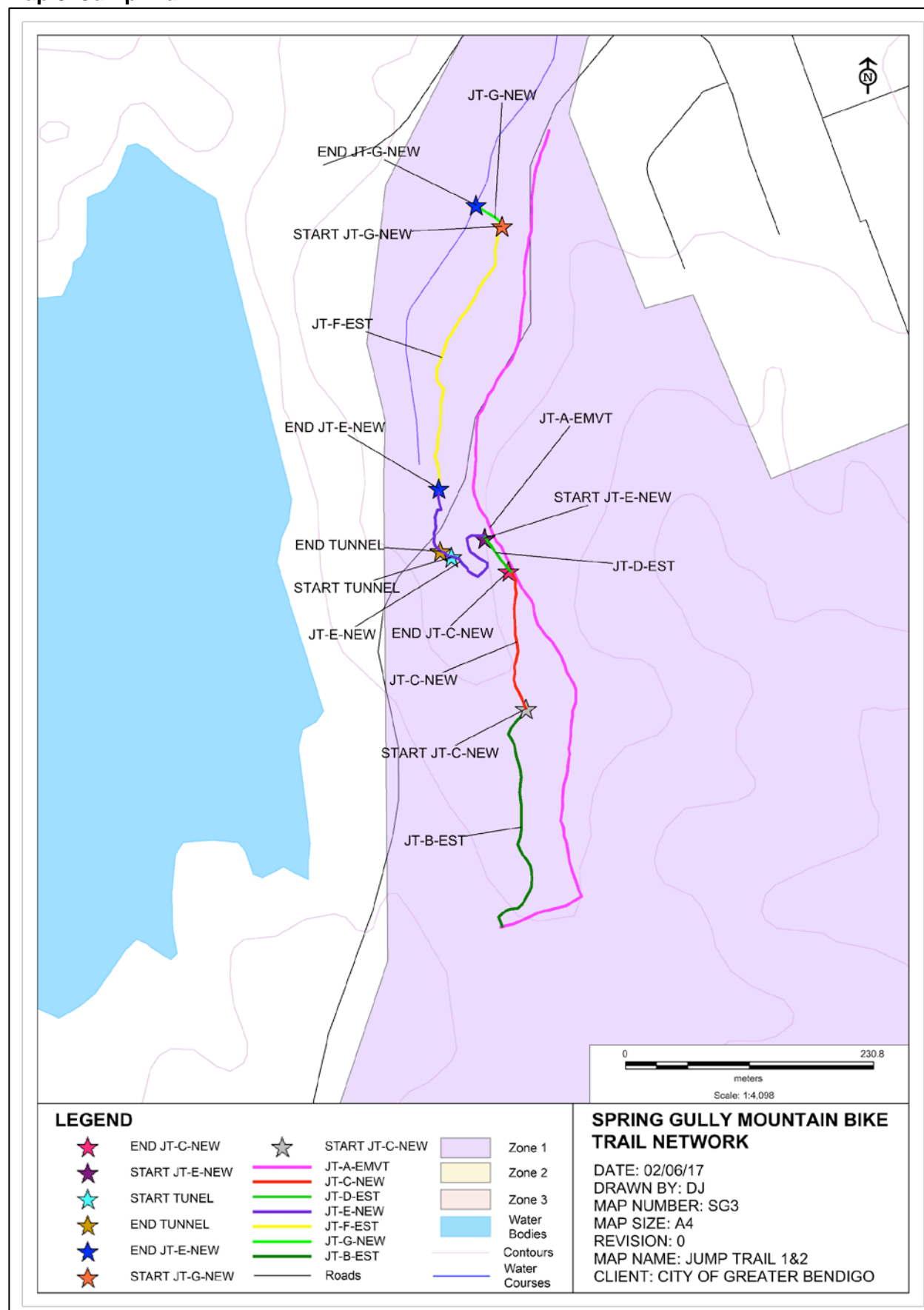
Trail Summary Information	
Overview:	<p>The Gravel Nature Trail is the 'home loop' that passes through the trailhead. As such, it will be the trail that all riders start and finish their rides with. All other trails are accessed via it.</p> <p>It is a shared use trail that forms a gentle, easy, smooth loop throughout Muldoon Reserve. It will also provide access to the recently completed pump track and skills loop located near the southern end of Muldoon Reserve.</p> <p>The trail crosses a drainage line near the northern end of the loop. This area appears to carry water from time to time and had wet, boggy soil. A low level bridge or boardwalk approximately 5m long will be required to cross this drainage line.</p> <p>It should be noted that this trail will most likely be designed and constructed through an another project which is upgrading Muldoon Reserve. As such, the alignment and details provided herein may differ to the trail that ends up being constructed. The alignment shown in the upgrade plans for Muldoon Reserve follows a similar alignment to the alignment presented here.</p>
Trail Difficulty Rating:	<div>Easy </div>
Estimated Length:	0.52km
Composition:	<p>Existing MV track: 0.00km (0%)</p> <p>Existing MTB trail: 0.30km (58%)</p> <p>New MTB trail: 0.22km (42%)</p>
Elevation Profile:	

Map 2. Gravel Nature Trail


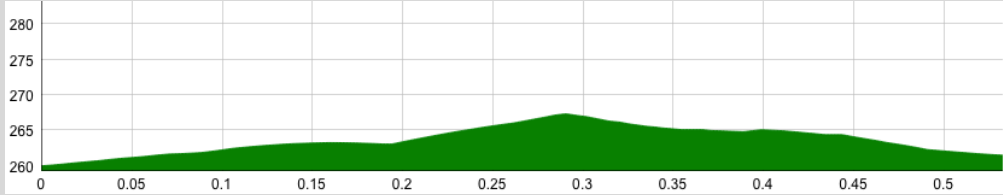
4.4.2 Jump Trail

Trail Summary Information	
Overview:	<p>The Jump Trail is a stand-alone loop, designed to cater to more gravity/jump orientated riders. It connects to all the other trails, so can be incorporated into bigger cross-country loops throughout the park or ridden separately.</p> <p>The defining characteristic of this trail will be its jumps, rollers and flowing berm sections. These should be constructed using fill material, preferably sourced from a quarry or borrow pit within the park somewhere. The trail passes through a stockpile of rubble and soil about half way down which may be a useful source of fill material, but includes large chunks of rock, concrete and asphalt that may need to be sorted through.</p> <p>All jumps should be rollable – no gap jumps.</p> <p>The first half of the trail uses existing MV tracks to reach the high point just near a medium sized dam. From here to the finish it follows MTB trail (some existing, some new) all the way to the finish. Approximately half way down the descent it will pass through an old tunnel/culvert beneath a bridge (see Figure 4 on page 9).</p> <p>This beautifully constructed stone bridge is a feature in its own right and adds an interesting historical aspect to the trail. The 10-15m section beneath the bridge will need to have some kind of treatment to elevate the trail, as the soil is often boggy and waterlogged. Suitable treatments include raised rock armouring or elevated boardwalk.</p>
Trail Difficulty Rating:	<p>More Difficult </p>
Estimated Length:	1.70km
Composition:	<p>Existing MV track: 0.84km (49%) Existing MTB trail: 0.54km (32%) New MTB trail: 0.32km (19%)</p>
Elevation Profile:	

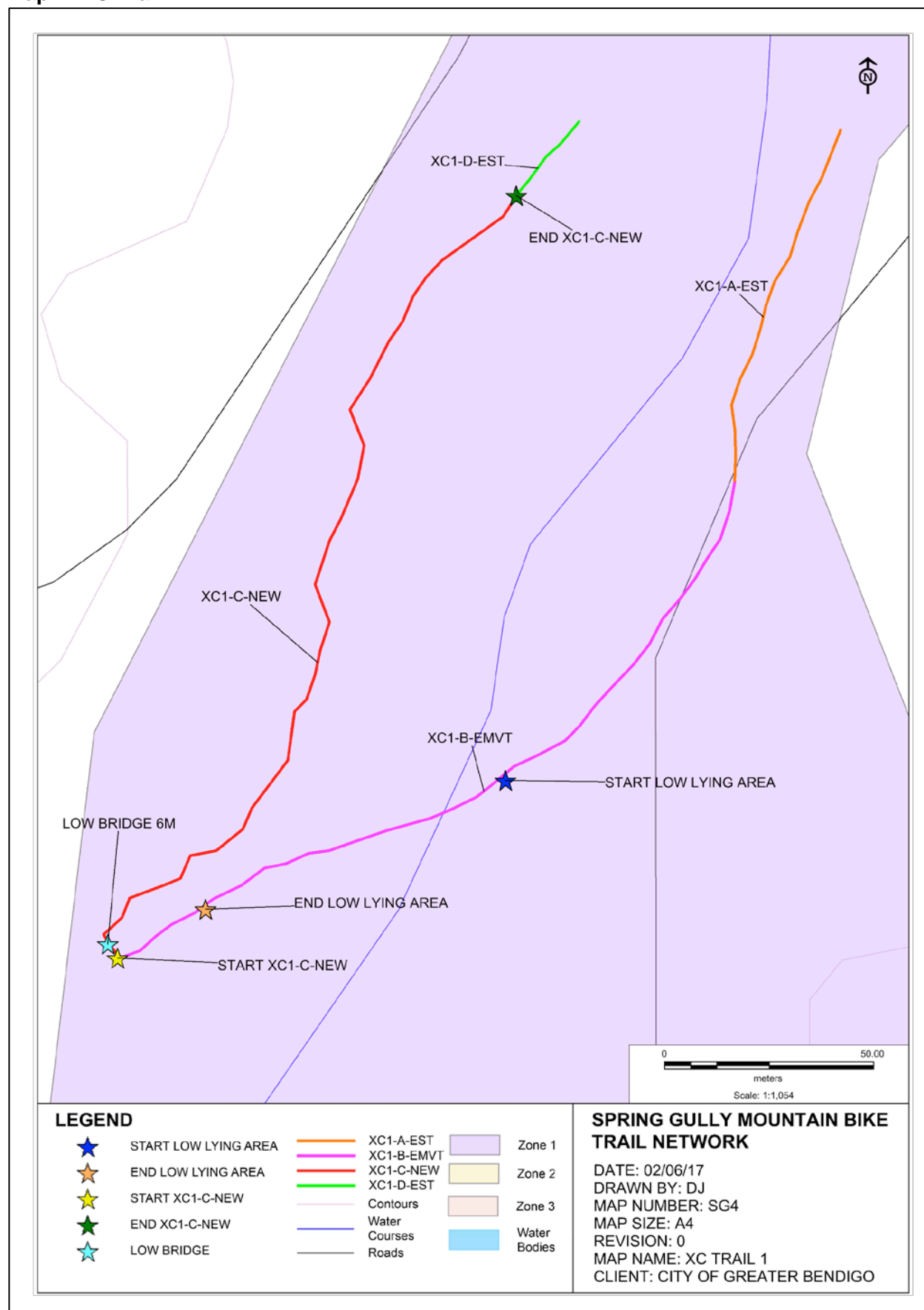
Map 3. Jump Trail




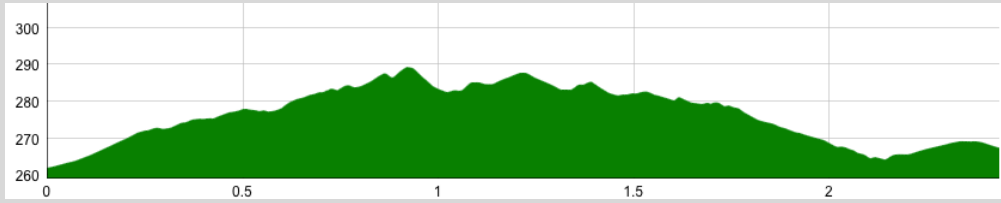
4.4.3 XC Trail 1

Trail Summary Information	
Overview:	<p>XC Trail 1 is the first cross-country loop encountered from the Gravel Nature Trail. It starts and finishes on the Gravel Nature Trail.</p> <p>A portion of the trail follows an open powerline easement. The easement has a MV track, which XC 1 follows for around 200m. About 70-80m of this MV track section is a very low-lying area which appears to hold water at times. The simplest solution would be to improve the MV track, through engineering solutions like culverts and fill materials to raise the MV track.</p> <p>Alternatively, the MTB trail could be adjusted and moved south about 30-40m outside of the powerline easement – it would still need to cross the same low-lying area, but could do so via its own dedicated low level bridge or boardwalk, which would be a feature in its own right.</p> <p>At the end of the MV track section, the trail intersects with the finish of XC Trail 2. At this point the trail turns right and crosses a drainage line (part of the overflow outlet from the adjacent dam, although apparently it is very rarely used), which will require the construction of a 5-6m low level bridge.</p> <p>From here, new MTB trail will head north, all the way back to the Gravel Nature Trail, passing above and to the west (and providing access to) the new skills trail and pump track.</p>
Trail Difficulty Rating:	Easy 
Estimated Length:	0.55km
Composition:	Existing MV track: 0.20km (36%) Existing MTB trail: 0.12km (22%) New MTB trail: 0.23km (42%)
Elevation Profile:	

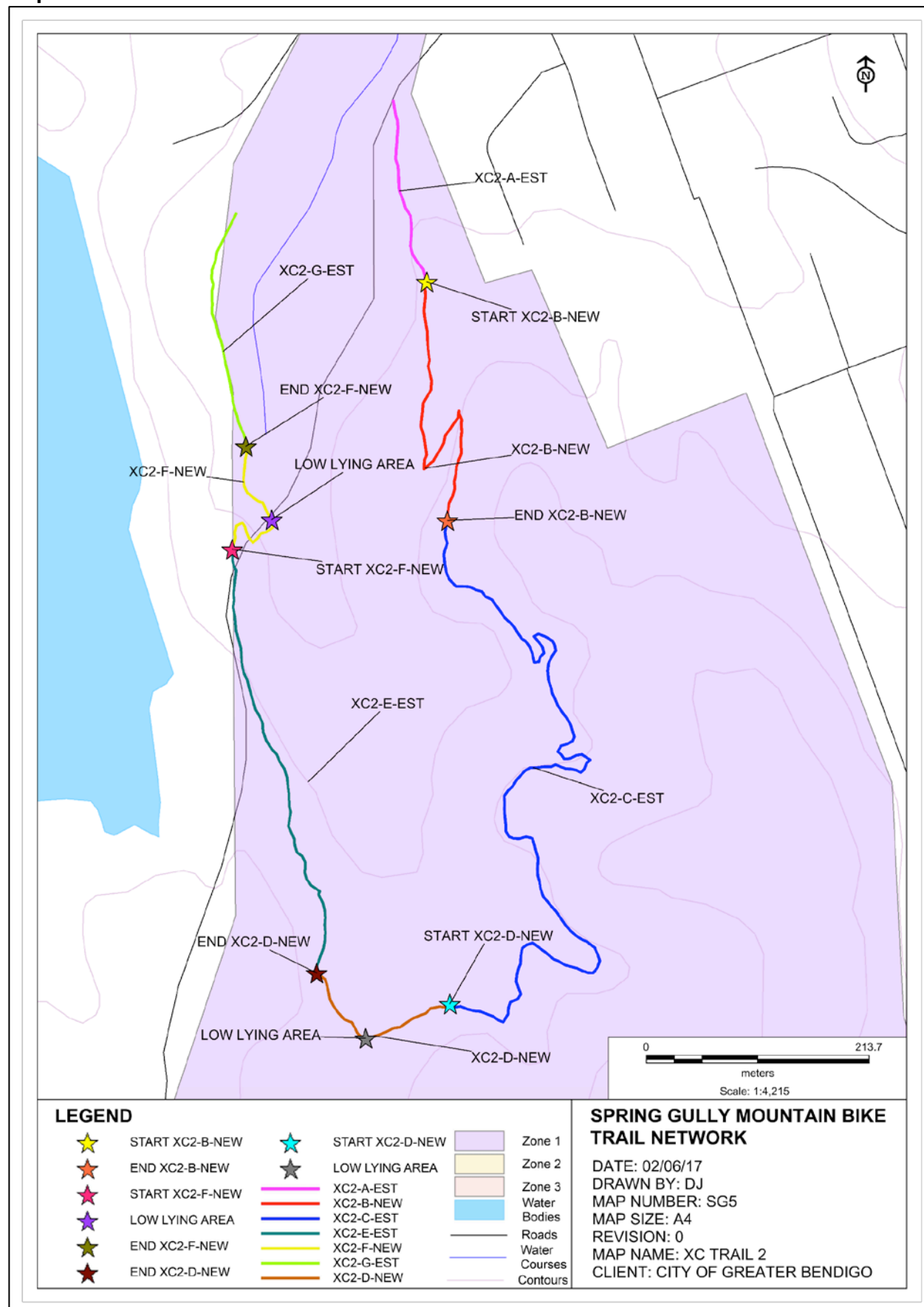
Map 4. XC Trail 1




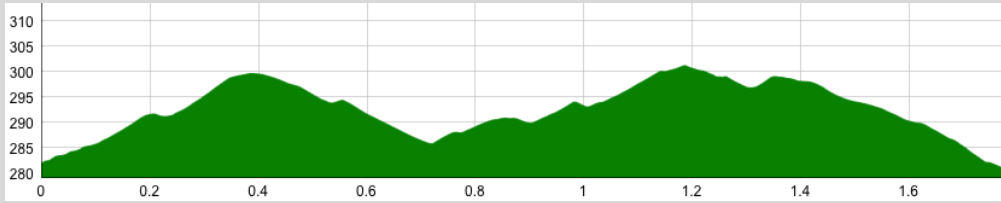
4.4.4 XC Trail 2

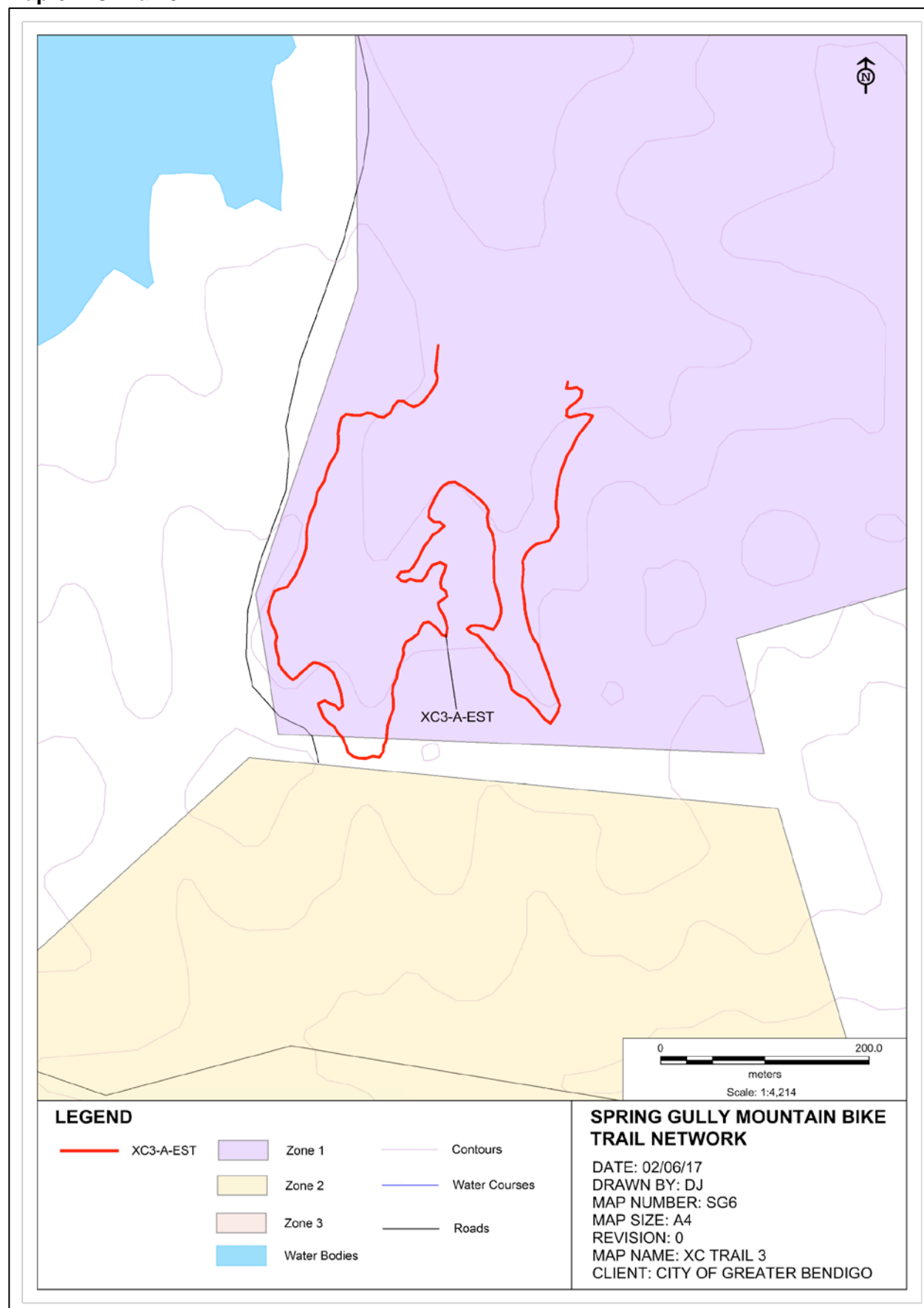
Trail Summary Information	
Overview:	<p>XC 2 starts and finishes on XC 1. It takes riders much further into the park than XC 1 and will be an excellent introduction into the trail network, providing examples of the rocky and technical terrain throughout the park.</p> <p>The profile is fairly typical – climb for half, descend for half.</p> <p>XC 2 is largely made up of existing MTB trail but with some new sections of MTB trail added.</p> <p>The first new section removes a steep, rocky fire road climb section that was too difficult for the Easy rating.</p> <p>The second new section cuts across around the south end of the dam, thus creating a shorter loop than was previously possible. There is some low-lying terrain in this area, which may require a low-level bridge or boardwalk of up to 10m length.</p> <p>The third new section takes in some interesting terrain that provides an opportunity for creative trail building and the addition of features like berms, rollers and jumps. It is an eroded, modified gully area that appears to have been mined, resulting in overburden piles, gullies, ridges and shallow basins. It passes very close to the end of the tunnel used by the Jump Trail. It may also require some culverts or other engineering solution to manage a small wet area near the end of the tunnel.</p>
Trail Difficulty Rating:	<div>Easy </div>
Estimated Length:	2.48km
Composition:	<p>Existing MV track: 0.00km (0%)</p> <p>Existing MTB trail: 1.78km (72%)</p> <p>New MTB trail: 0.70km (28%)</p>
Elevation Profile:	

Map 5. XC Trail 2





4.4.5 XC Trail 3

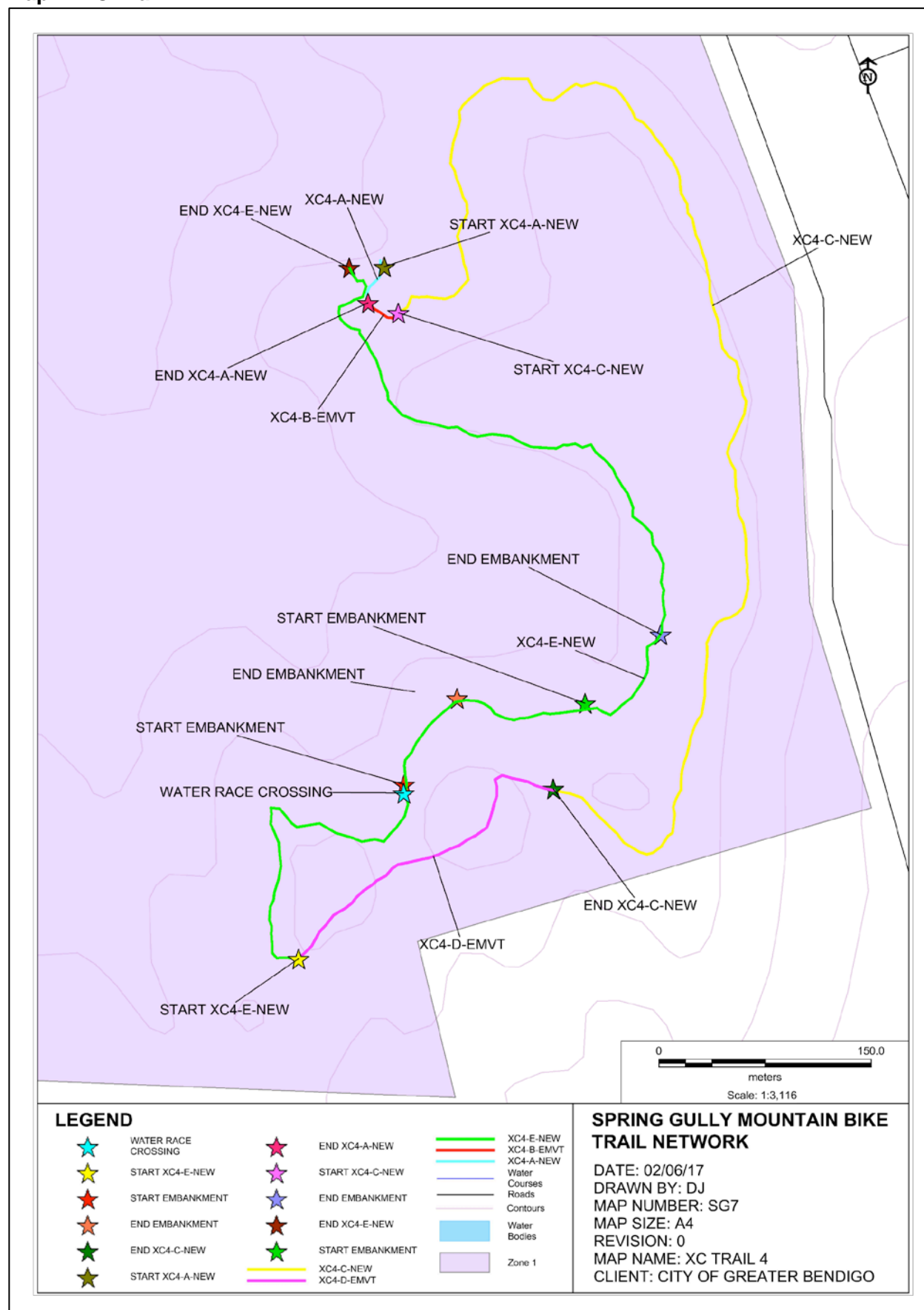
Trail Summary Information	
Overview:	<p>XC Trail 3 is an existing trail. It starts and finishes on XC Trail 2 and connects to the southern end of Zone 1, providing access into Zone 2 and XC Trail 5.</p> <p>It is comprised entirely of existing MTB trail. No new sections are proposed.</p> <p>This trail has been extensively worked on by BMBC and is in good condition. Some sections may not meet the rating for an Easy trail and would require some basic works to widen and smooth out some of the more challenging sections.</p>
Trail Difficulty Rating:	<p>Easy </p>
Estimated Length:	1.79km
Composition:	<p>Existing MV track: 0.00km (0%)</p> <p>Existing MTB trail: 1.79km (100%)</p> <p>New MTB trail: 0.00km (0%)</p>
Elevation Profile:	

Map 6. XC Trail 3


4.4.6 XC Trail 4

Trail Summary Information	
Overview:	<p>XC Trail 4 is a new loop, comprised mostly of new MTB trail. It starts and finished on XC Trail 2.</p> <p>It is located fairly high up in Zone 1, and circumnavigates a ridge that runs in a north/south direction, along the eastern edge of Zone 1. Consequently, it passes very close to the scout camp and Mandurang Rd – riders could actually enter the trail network via Mandurang Rd, directly into this trail.</p> <p>A key feature of this trail is the Axe Creek Channel, a functioning water race carrying a reasonable volume of water. The trail is proposed to cross this channel and run along the lower edge of the embankment for a short period. The channel provides a nice backdrop to the trail and a point of difference to other trails throughout the park. A short bridge will be required to cross the channel, but an excellent location was identified where a fairly minimal bridge (up to 3m long) could be constructed without extensive earthworks.</p> <p>As an Easy trail comprised of mostly new MTB trail, this trail presents an opportunity to construct an Easy trail from a 'blank canvas', rather than trying to reconfigure/adapt an existing trail into a MTB trail and achieve an Easy rating. The gradients have been kept minimal, and the entire loop should be fairly enjoyable and easy, while providing some fun, flowing descending sections.</p>
Trail Difficulty Rating:	<div>Easy </div>
Estimated Length:	2.26km
Composition:	<p>Existing MV track: 0.28km (12%)</p> <p>Existing MTB trail: 0.00km (0%)</p> <p>New MTB trail: 1.98km (88%)</p>
Elevation Profile:	

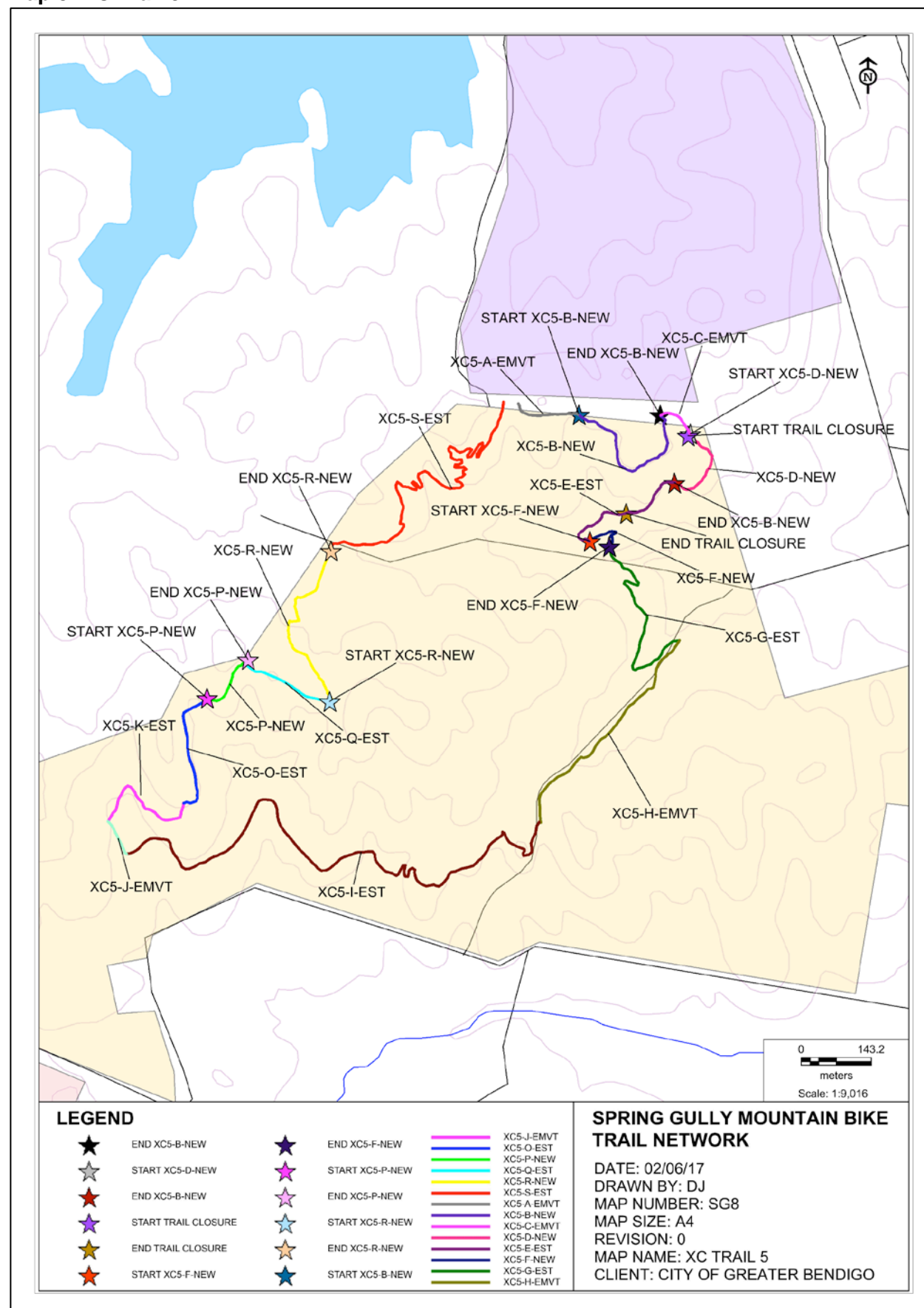
Map 7. XC Trail 4






4.4.7 XC Trail 5

Trail Summary Information	
Overview:	<p>XC Trail 5 is the first of trail in Zone 2. It starts and finishes on XC Trail 3, at the power line/service easement that marks the boundary between Zone 1 and Zone 2.</p> <p>XC Trail 5 is mostly existing MTB trail (65%), with some new sections of MTB trail added in (20%).</p> <p>The first new section (XC5-B-NEW) removes a steep, fire road climb up over a small hill and descent down the other side, replacing it with a descending rolling contour trail that traverses around the hill side.</p> <p>The second new section (XC5-D-NEW) removes an eroded, fall line section of trail and a slightly longer, newer alternative, replacing both with a longer, more sustainable alignment.</p> <p>The third new section (XC5-F-NEW) is only short, but makes better use of the landscape than the existing trail. The landscape in this section is very modified from mining and presents some good opportunities to add some interesting features.</p> <p>The fourth new section (XC5-P-NEW) removes a short steep pinch climb up a MV track (on the fenceline of the Spring Gully Reservoir), replacing it with a short traversing section of rolling contour trail.</p> <p>The fifth new section is probably the most exciting. It is about 400m long and descends the entire way, at a gradient of about 4-5%. The alignment curves back and forth across the hillside, swooping in and out of some mining diggings and dry erosion gullies. This new section replaces an extremely twisty and rocky section of hand built trail, which has instead been incorporated into XC Trail 8.</p> <p>Putting aside the new sections of trail, the addition of two short cuts along existing MV tracks, makes this loop smaller than it used to be, but adds greater flexibility to the trail network and will help to increase its appeal to riders looking to progress from Zone 1 to Zone 2.</p>
Trail Difficulty Rating:	More Difficult 
Estimated Length:	5.70km
Composition:	Existing MV track: 0.84km (15%) Existing MTB trail: 3.70km (65%) New MTB trail: 1.16km (20%)
Elevation Profile:	

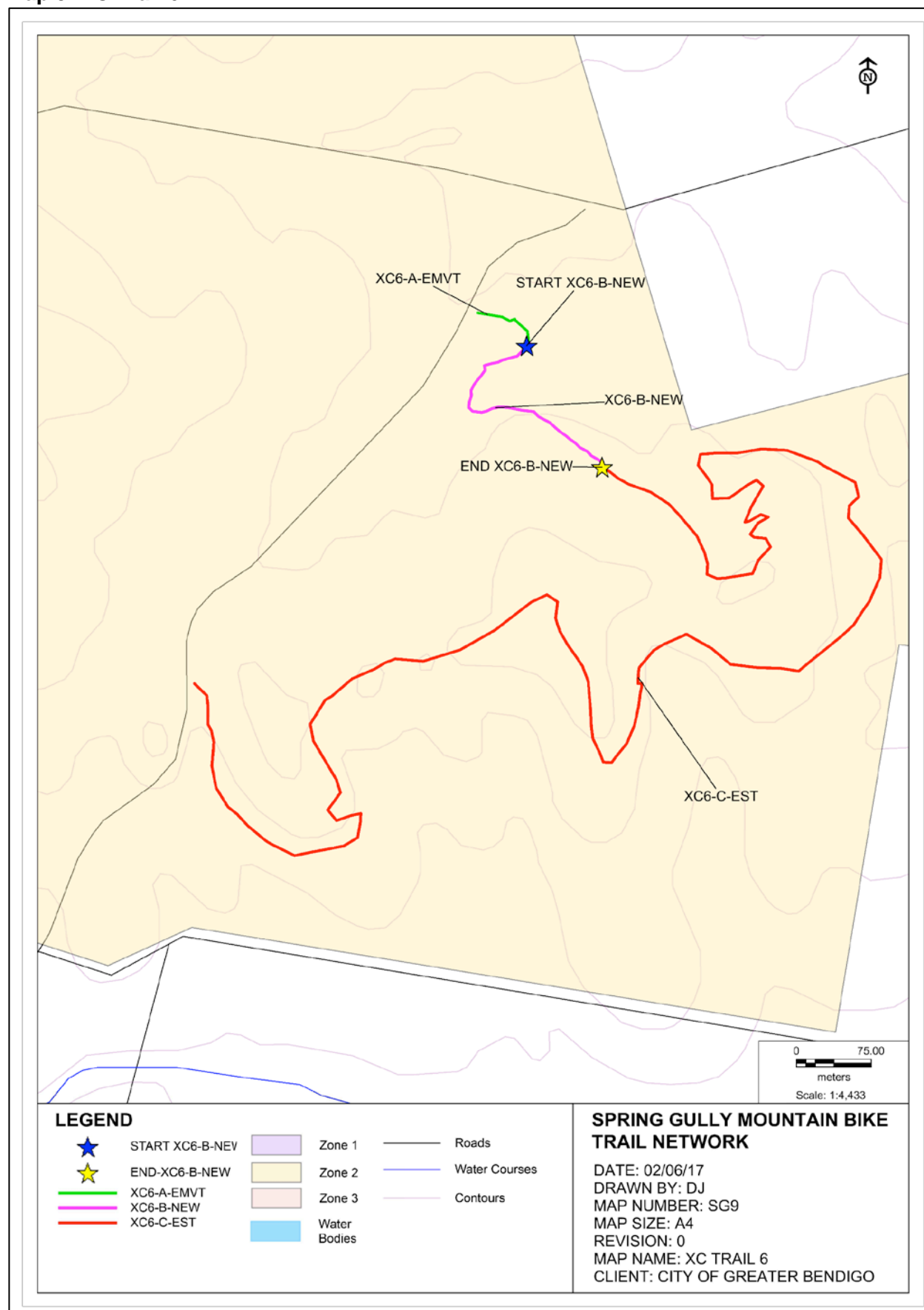
Map 8. XC Trail 5




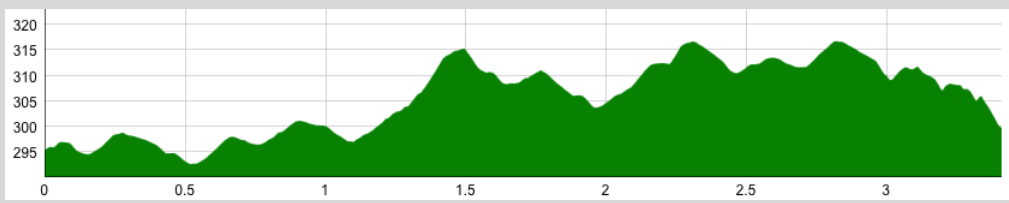
4.4.8 XC Trail 6

Trail Summary Information	
Overview:	<p>XC Trail 6 is comprised mostly of existing trail, with only one new section of MTB trail to be added. It starts and finishes on XC Trail 5.</p> <p>The new section of MTB trail is a short gently climbing piece of trail, replacing a constant uphill section of MV track.</p>
Trail Difficulty Rating:	<p>More Difficult with Very Difficult optional A-lines</p> <div>   </div>
Estimated Length:	2.51km
Composition:	<p>Existing MV track: 0.10km (4%)</p> <p>Existing MTB trail: 2.11km (84%)</p> <p>New MTB trail: 0.30km (12%)</p>
Elevation Profile:	

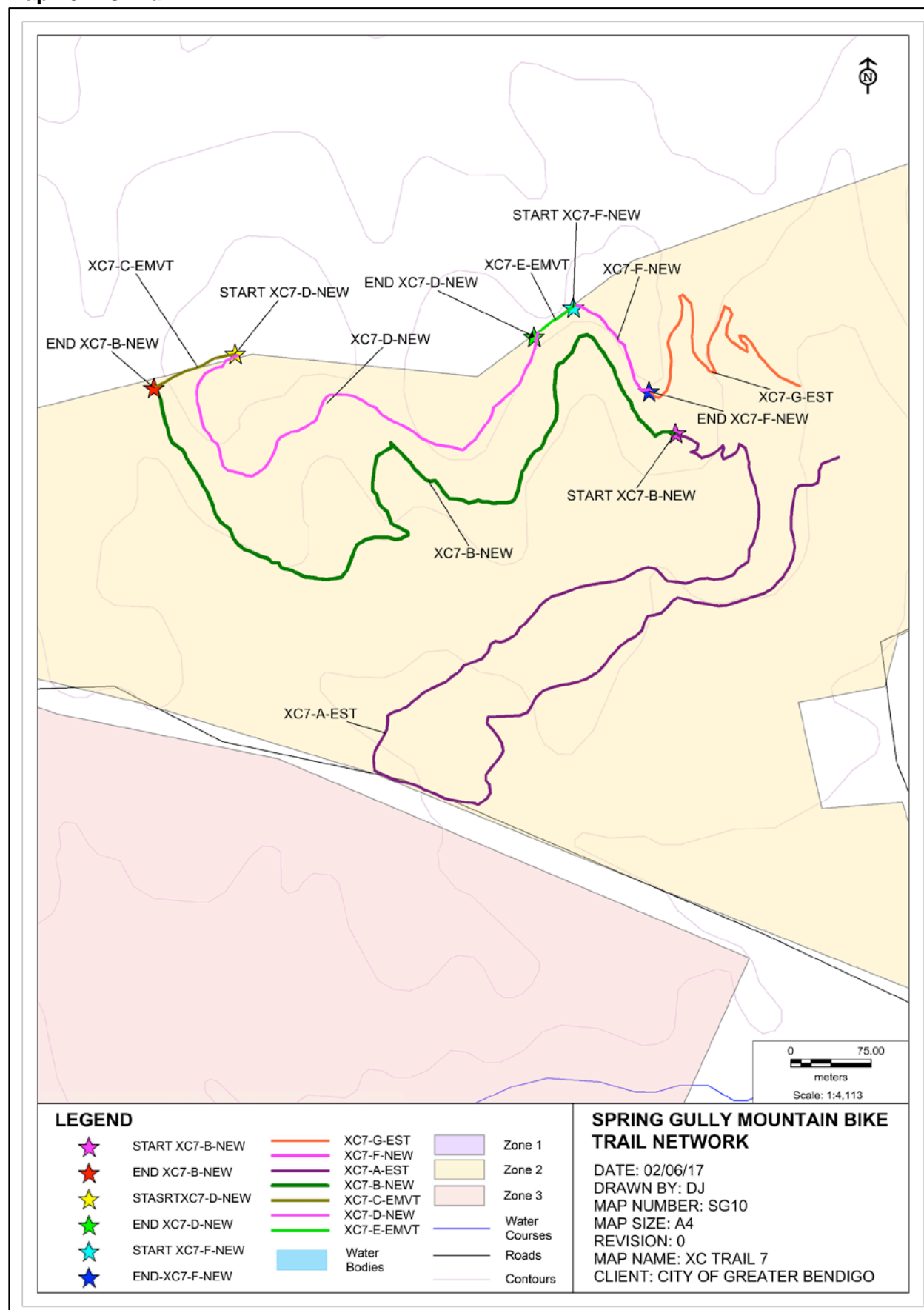
Map 9. XC Trail 6





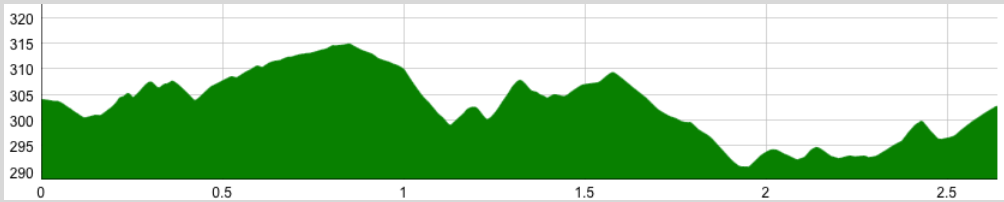
4.4.9 XC Trail 7

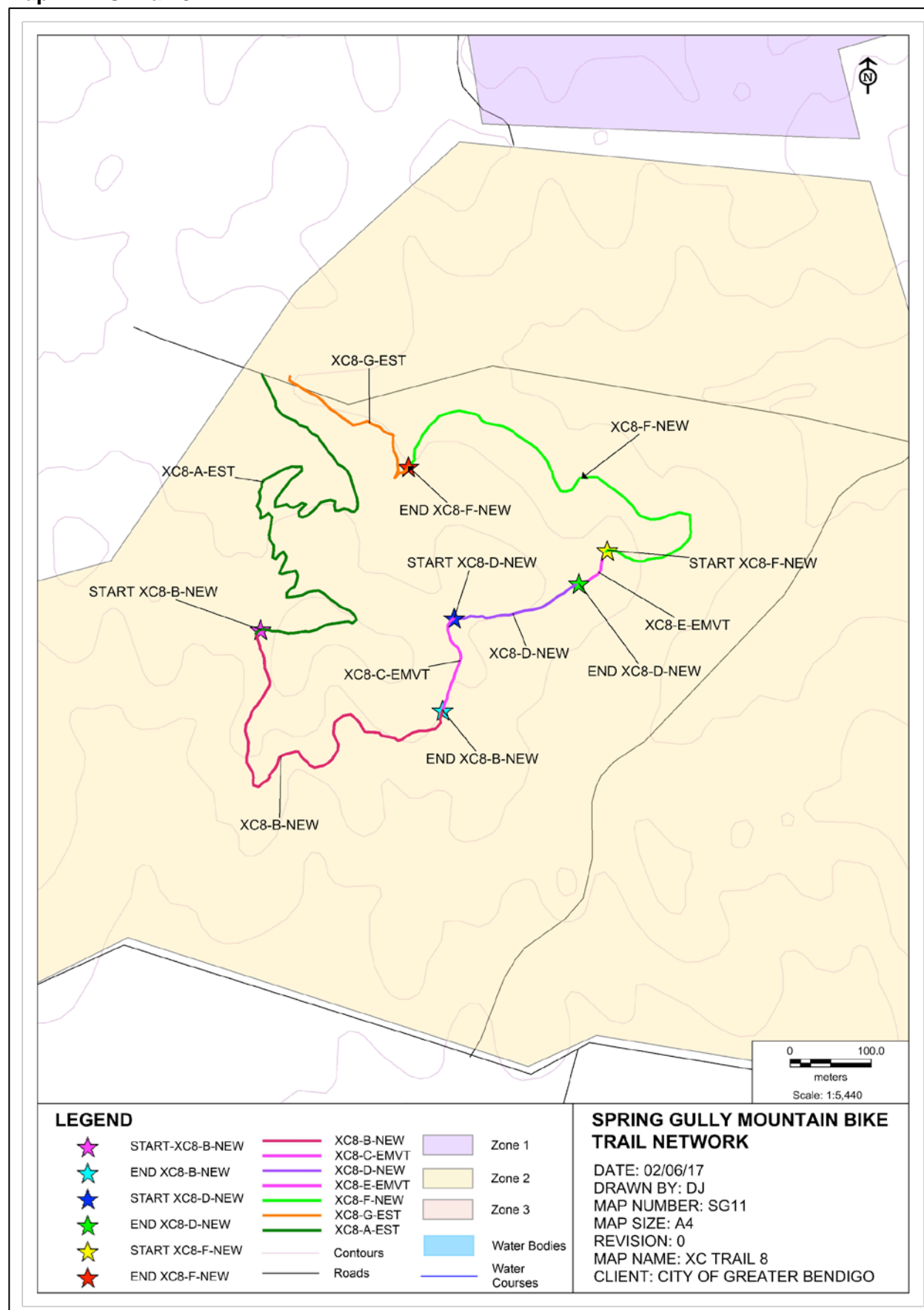
Trail Summary Information	
Overview:	<p>XC Trail 7 starts and finishes on XC Trail 5. About half of the trail is existing MTB trail, with the other half mostly new MTB trail.</p> <p>The three new sections are all clustered together in a fairly close space, separated by two short sections of MV track along the fence line with Spring Gully Reservoir. These new sections traverse around a series of gentle gullies and ridges, before turning and heading back to the original trail. These new sections could fairly easily be split off from the original existing trail as a separate optional trail – i.e. XC Trail 7 could easily be made into two separate loop trails instead of one.</p>
Trail Difficulty Rating:	<p>More Difficult </p>
Estimated Length:	3.51km
Composition:	<p>Existing MV track: 0.14km (4%)</p> <p>Existing MTB trail: 1.77km (50%)</p> <p>New MTB trail: 1.60km (46%)</p>
Elevation Profile:	

Map 10. XC Trail 7



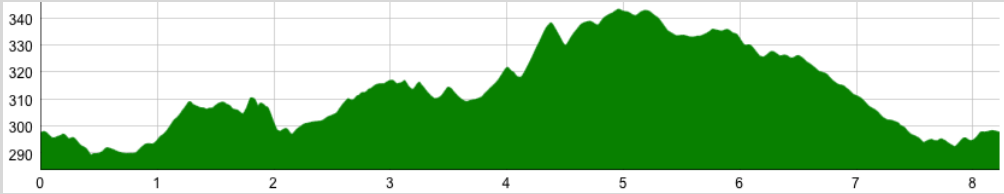


4.4.10 XC Trail 8

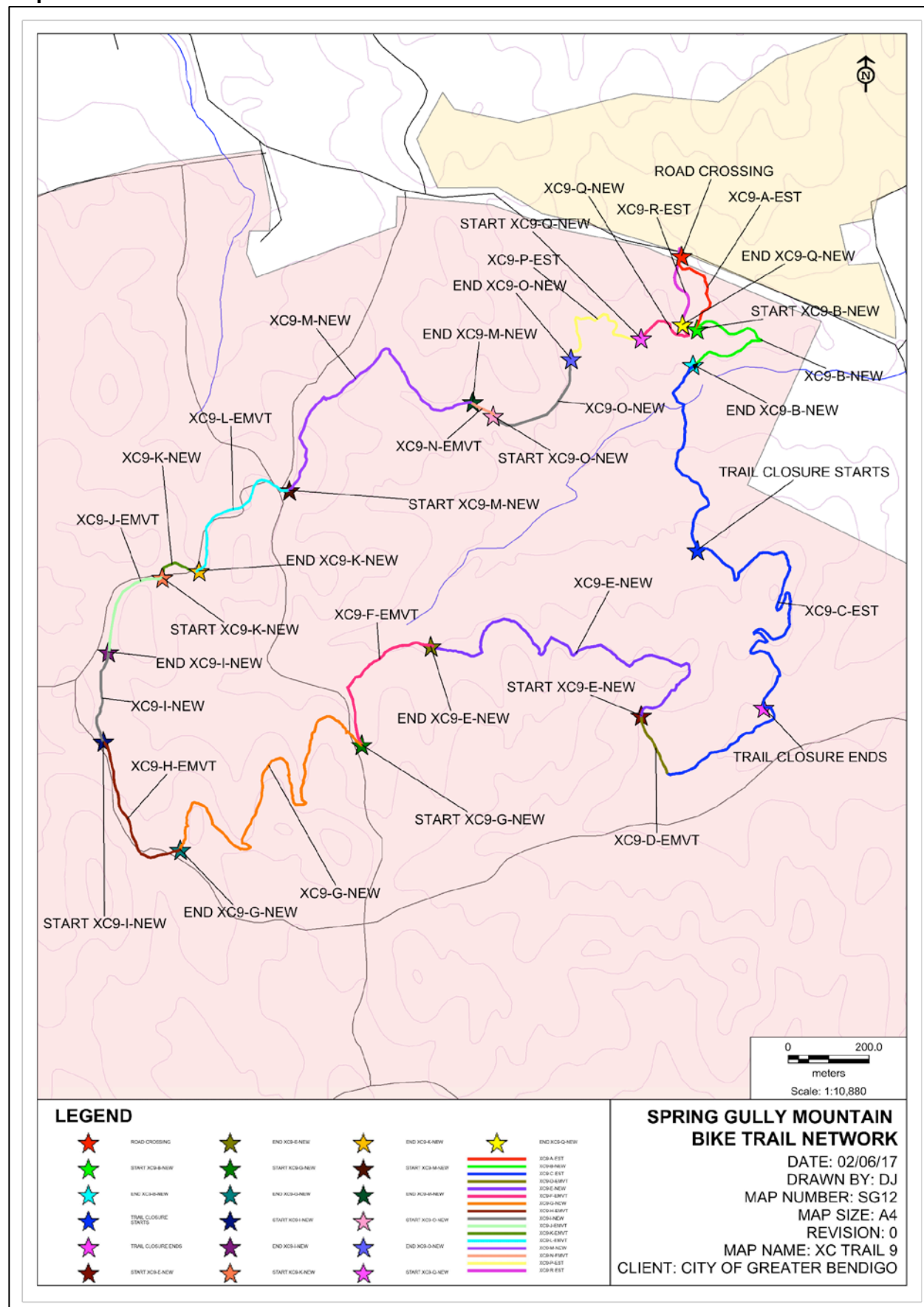
Trail Summary Information	
Overview:	<p>XC Trail 8 starts and finishes on XC Trail 5.</p> <p>It is the only trail that is located inside of another trail, and as such it needs to follow the reverse direction – anti-clockwise – to avoid any cross-overs.</p> <p>While the trail has been mapped and is described here as starting on XC Trail 5 just near Connelly's Rd, it actually connects to XC Trail 5 in two locations, offering two choices of where riders enter/exit this trail.</p> <p>It has three sections of new MTB trail, interspersed with sections of existing MTB trail and MV track.</p>
Trail Difficulty Rating:	<p>More Difficult with Very Difficult optional A-lines</p>  
Estimated Length:	2.73km
Composition:	<p>Existing MV track: 0.22km (8%)</p> <p>Existing MTB trail: 1.18km (43%)</p> <p>New MTB trail: 1.33km (49%)</p>
Elevation Profile:	

Map 11. XC Trail 8


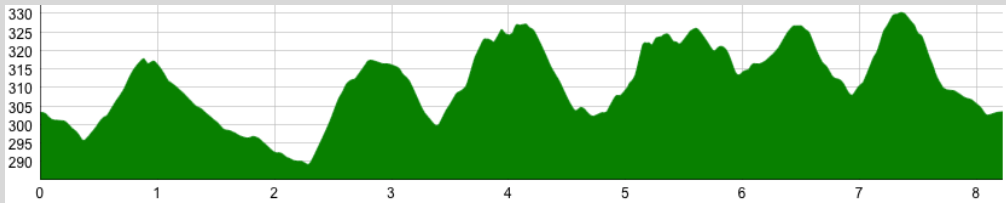
4.4.11 XC Trail 9

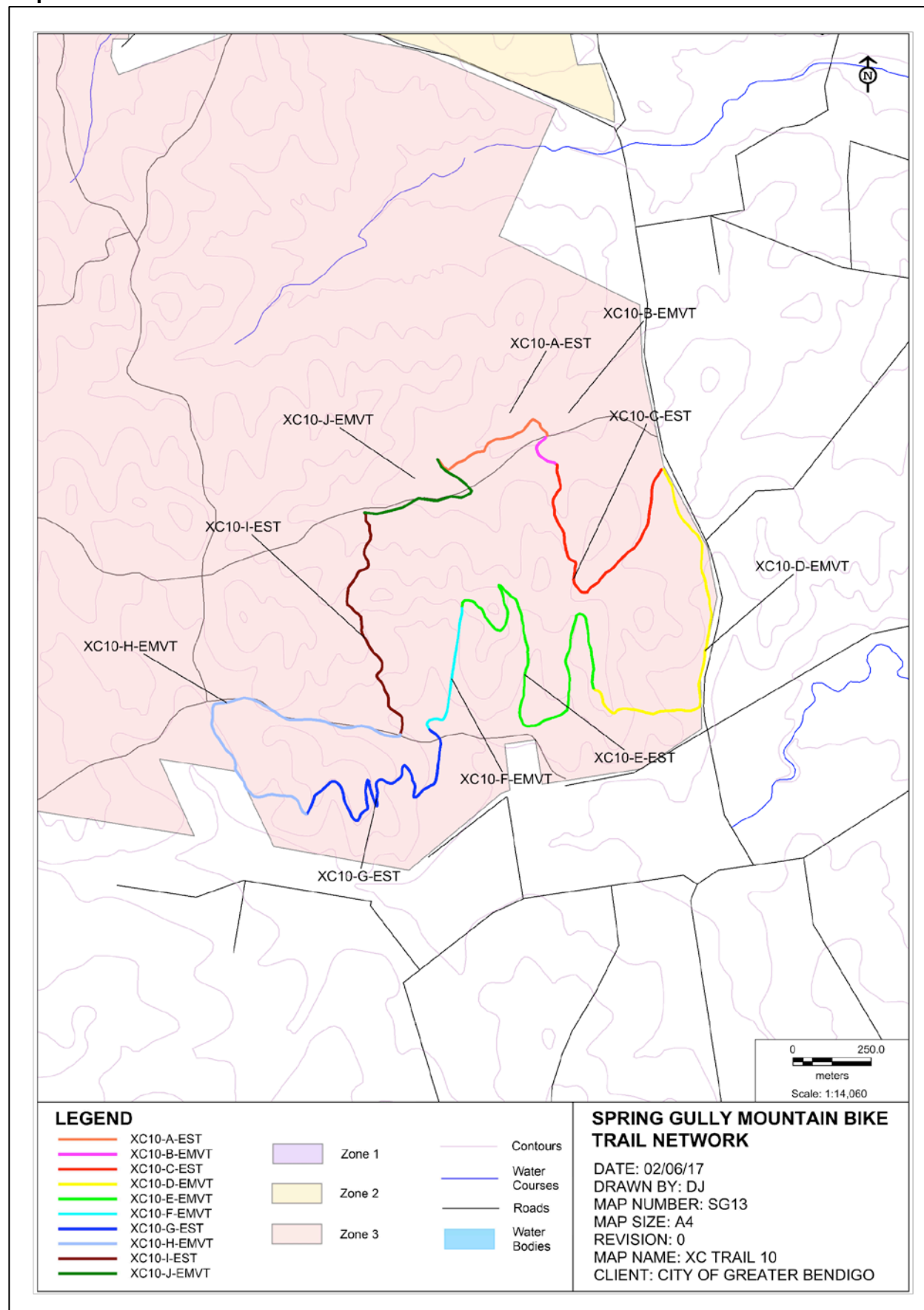
Trail Summary Information	
Overview:	<p>XC Trail 9 is the first trail located in Zone 3. It starts and finishes on XC Trail 7.</p> <p>XC Trail 7 is located on the northern side of Diamond Hill Rd. XC Trail 9 is located on the southern side. Currently, southbound (outbound) riders cross in one spot, and northbound (inbound, returning) riders cross in another spot about 100m further west along the road. This situation of two crossings is not ideal. While the road is not busy, it does carry fast moving traffic.</p> <p>The proposed alignment for XC Trail 9 presented here moves the two crossings to within 5m of each other, using the more westerly crossing point, which provides better visibility in both directions. With formalisation of the trails, this may require some discussions with VicRoads, and the installation of warning signs for motorists. Proper and thorough closure of the old eastern crossing point will need to be undertaken to change rider behaviour initially.</p> <p>XC Trail 7 features 7 sections of new trail. These new sections are primarily designed to remove unsustainable, steep, fall-line trails, add interesting new MTB trails accessing new areas, and to create the longest possible continuous descent at the end of the loop (about 2.8km from the highest point of the trail at the southwest extent on Munroe Rd, back down to near the crossing of Diamond Hill Rd and the end of the trail).</p> <p>With almost half of this loop being new trail, this trail has the opportunity to be one of the 'hero' trails within the Spring Gully Trail Network. Furthermore, while it isn't designed to be a gravity trail, it will be possible to 'shuttle' the long descending section using Channel Track, which is passable for two-wheel drive vehicles.</p>
Trail Difficulty Rating:	<p>More Difficult with Very Difficult optional A-lines</p> <div>   </div>
Estimated Length:	8.71km
Composition:	<p>Existing MV track: 1.76km (20%)</p> <p>Existing MTB trail: 2.75km (32%)</p> <p>New MTB trail: 4.20m (48%)</p>
Elevation Profile:	

Map 12. XC Trail 9


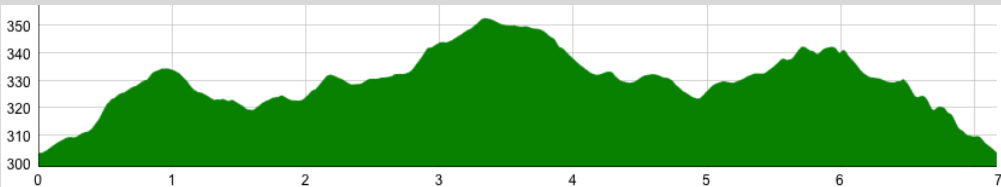


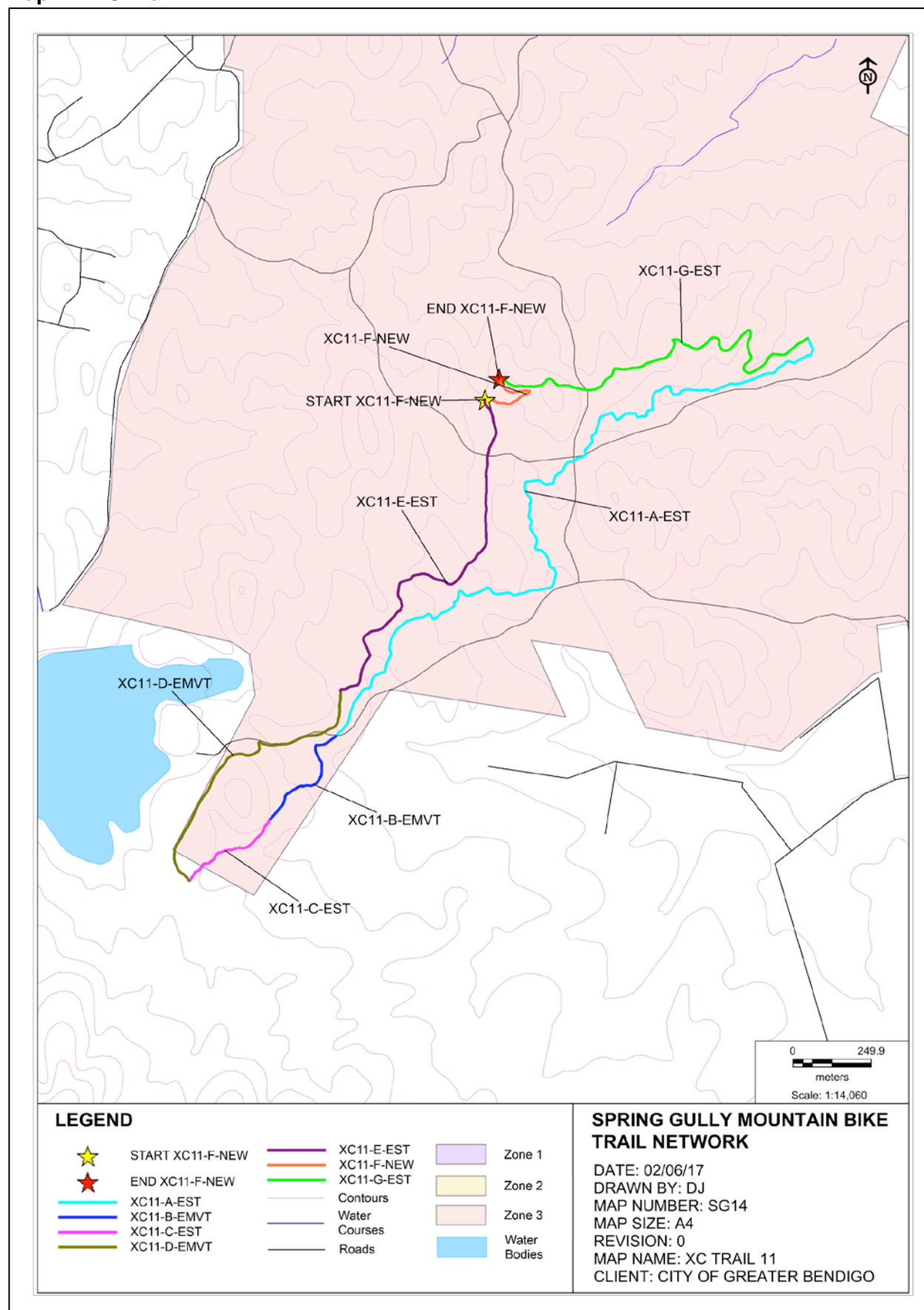
4.4.12 XC Trail 10

Trail Summary Information	
Overview:	<p>XC Trail 10 starts and finishes on XC Trail 9 at a key junction point – it is also the start and finish junction for XC Trail 11.</p> <p>XC Trail 10 and XC Trail 11 are the two most southerly trails within the network, extending right to the southern ends of the study site and Bendigo Regional Park. This area has the most intact and least disturbed vegetation communities in the park and contains some significant environmental values. As such, neither of these trails includes any new sections of MTB trail – both trails are comprised entirely of existing MTB trail or existing MV track.</p> <p>Both of these trails feature some excellent and challenging sections and feel the most ‘remote’ within the trail network.</p> <p>The elevation profile below provides a good indication of the inherent challenge in this trail – its profile is a jagged sawtooth of steep ups and downs, with very few flat sections to be seen.</p>
Trail Difficulty Rating:	<p>More Difficult with Very Difficult optional A-lines</p> 
Estimated Length:	8.42km
Composition:	<p>Existing MV track: 3.47km (41%)</p> <p>Existing MTB trail: 4.95km (59%)</p> <p>New MTB trail: 0.00km (0%)</p>
Elevation Profile:	


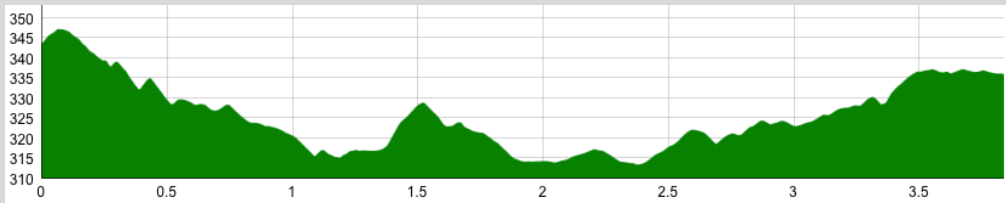
Map 13. XC Trail 10

4.4.13 XC Trail 11

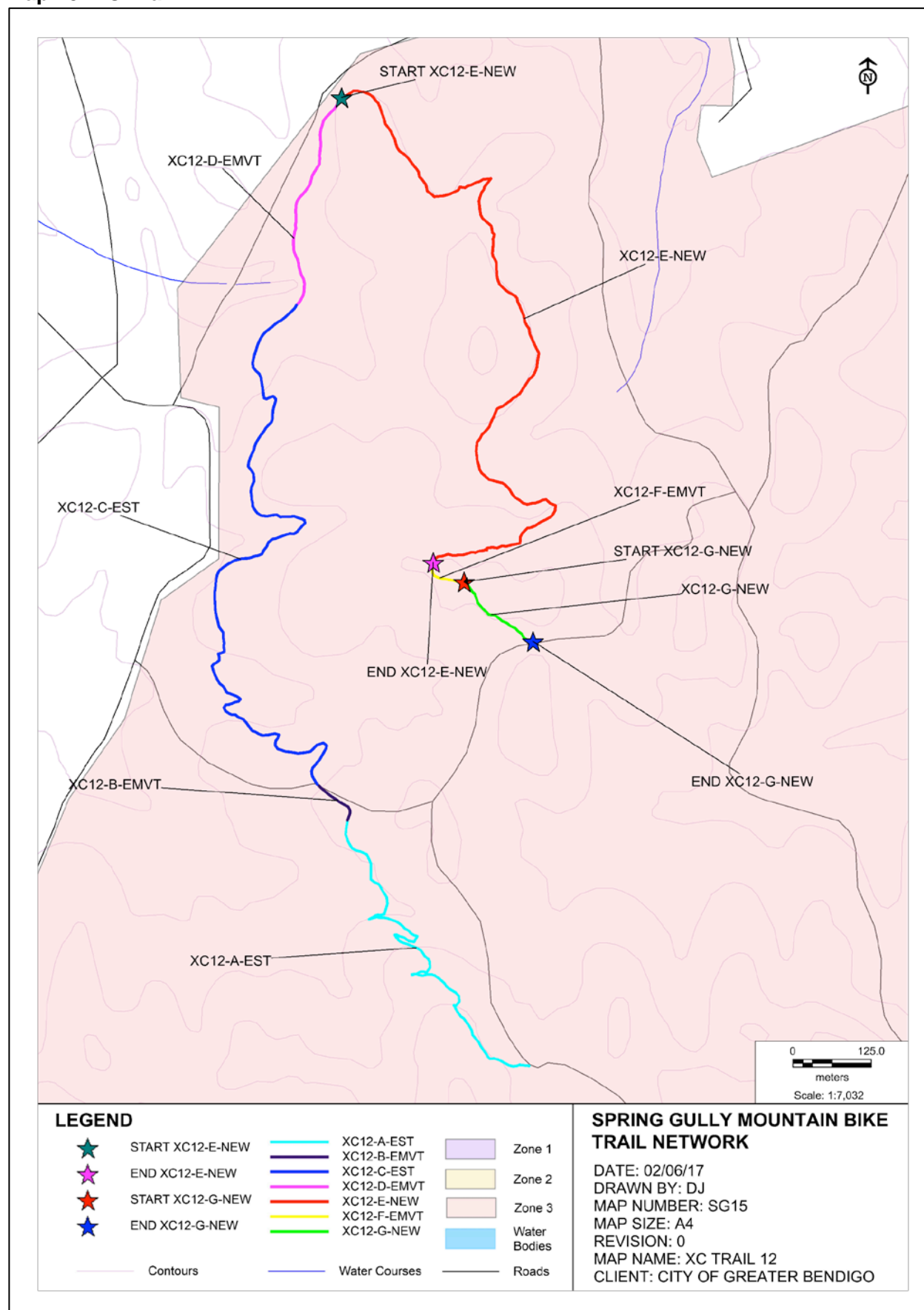
Trail Summary Information	
Overview:	<p>As stated previously, XC Trail 11 starts and finishes at a major junction on XC Trail 9, and is almost entirely comprised of existing MTB trail and MV tracks.</p> <p>The only exception is a short section of new MTB trail which replaces a steep eroded climb up an old MV track.</p> <p>At its southwestern extent, XC Trail 11 connects to the Goldfields Track and to a large water channel that feeds the Sandhurst Reservoir. This is an important junction, as it is the first opportunity for northbound riders on the Goldfields Track to enter the Spring Gully Trail Network. Conversely, it is also the point at which southbound riders would exit the Spring Gully Trail Network to continue south along the Goldfields Track.</p> <p>Another key feature of this trail is that it actually connects to XC Trail 9 in two locations. This feature offers choice and flexibility as to how riders seek to navigate these trails.</p>
Trail Difficulty Rating:	<p>More Difficult with Very Difficult optional A-lines</p> 
Estimated Length:	7.45km
Composition:	<p>Existing MV track: 1.38km (19%)</p> <p>Existing MTB trail: 5.68km (76%)</p> <p>New MTB trail: 0.39km (5%)</p>
Elevation Profile:	

Map 14. XC Trail 11

4.4.14 XC Trail 12

Trail Summary Information	
Overview:	<p>XC Trail 12 starts and finishes on XC Trail 9. It is the most westerly trail in the Spring Gully Trail Network.</p> <p>Passing very close to Reservoir Rd, it is possible that some riders could enter the trail network at this point, especially those living in the southern suburbs of Bendigo like Big Hill and Kangaroo Flat. The addition of secondary trailhead somewhere in this area could be useful – it would be unlikely to attract large numbers of users, so wouldn't require any facilities other than signage.</p> <p>Almost half of this trail is existing MTB trail, some of which is in excellent condition and offers a great mountain biking experience. It is let down by its isolation from the rest of the trail network, with only long and steep MV tracks to complete the loop. Two new sections of MTB trail have been added to remove these long MV sections, making the entire loop over 80% MTB trail.</p>
Trail Difficulty Rating:	<p>More Difficult with Very Difficult optional A-lines</p> 
Estimated Length:	4.07km
Composition:	<p>Existing MV track: 0.68km (17%)</p> <p>Existing MTB trail: 1.96km (48%)</p> <p>New MTB trail: 1.43km (35%)</p>
Elevation Profile:	

Map 15. XC Trail 12



4.5 SIGNAGE

Signage is an important component of a successful trail network. It performs an important risk management function of informing trail users about potential risks they will encounter along the trail. Effective signage aids navigation and can also be an important tool for educating users about specific risk issues, proper behaviour, designated uses and local flora/fauna. Essentially, signs must convey certain key pieces of information that riders need to know in order to navigate their way throughout the trail network safely and enjoyably.

The importance of signage can't be overstated. Many destinations spend large sums of money creating great trail networks, which end up being let down by poor signage. While it may seem a small and insignificant aspect of trail development, signage is the icing on the cake from the visitor's perspective – it doesn't matter how good the trails are if people can't find them! Over many years of working in this field World Trail has developed an excellent knowledge of what does and doesn't work for signage. The system outlined herein for signage is sound and functional and should form the base level for signage.

BMBC have already commenced developing a suite of trail signage for the Spring Gully Trail Network. This suite includes three different types of signs, which are explained in more detail on the following pages.

4.5.1 Trailhead Signs

As the name suggests, Trailhead Signs are installed at the main trailhead to inform trail users of all aspects relating to the use of the trails. These signs are an important risk management tool to communicate specific information that will enable users to make informed decisions about which trails to ride, based on their ability, skills and time available. The signs also detail important information that will assist users and rescuers in the case of an emergency.

As a minimum requirement, Trailhead Signs should include the following information:

- A map of the trail network;
- The name, distance and difficulty rating for each trail;
- A prominent logo for the trail network;
- Trail etiquette (e.g. IMBA Rules of the Trail);
- Safety information;
- What to bring / wear;
- Emergency / mobile phone reception points;
- Emergency contact information.

While not essential, the following information can be useful too:

- Tourism information, including contacts details for the local Visitor Information Centre and local hospitality and accommodation businesses;
- A noticeboard section where the local MTB club can post notices about upcoming events, working bees, races etc.;
- Interpretive information, outlining the environmental and cultural heritage values of the area.

Trailhead Signs should be as large as possible, well laid out, easy to read and visually appealing. Figure 9 below shows a concept design for the trailhead sign. Figure 10 and Figure 11 provide examples of trailhead signs from other mountain biking destinations.

Figure 9. Concept designs for the proposed trailhead signage at Spring Gully

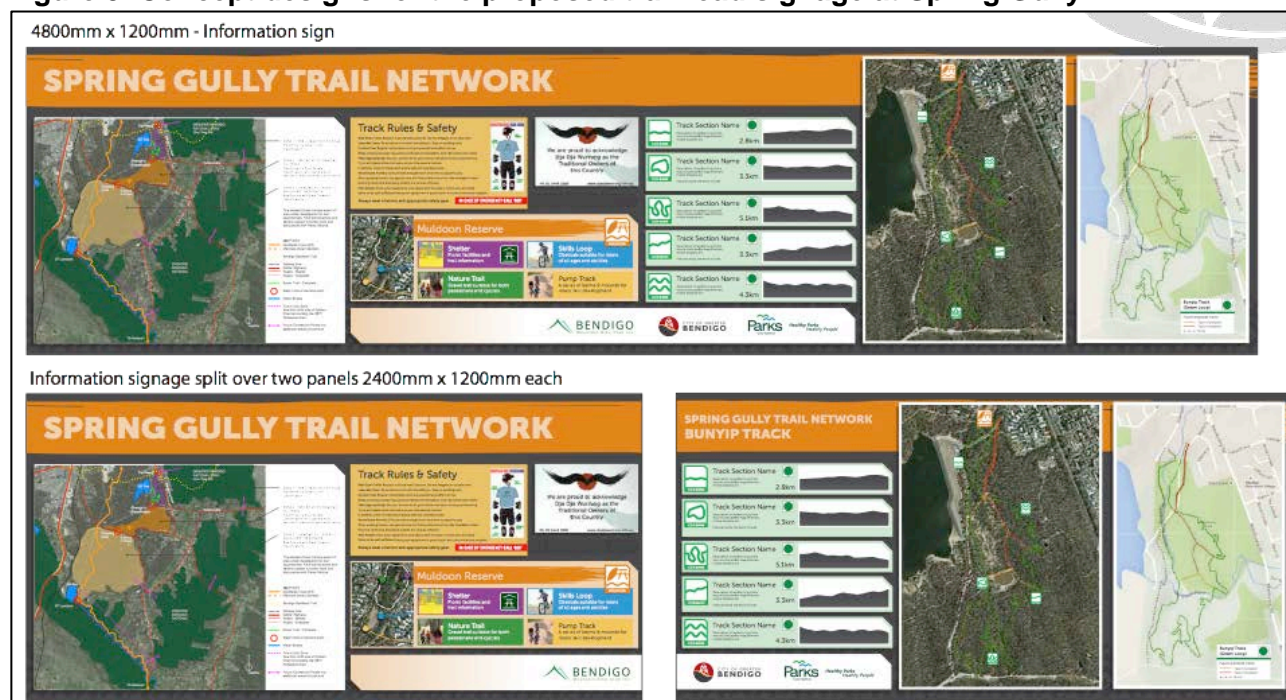


Figure 10. Trailhead signage and shelter at Atherton, QLD

(Photo from www.tablelandcyclesports.com)

Figure 11. Trailhead sign at Derby, TAS

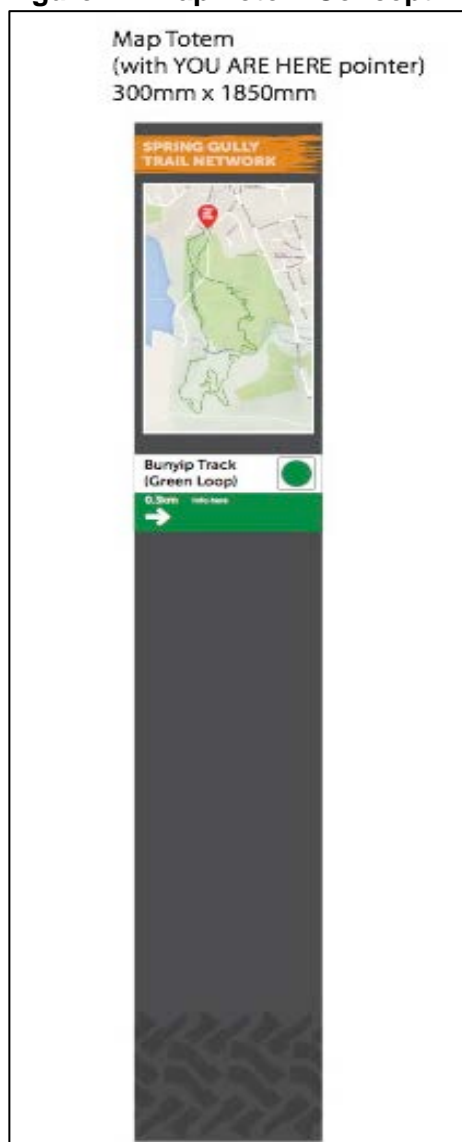
4.5.2 Map Totems

The second type of sign proposed for use on the Spring Gully Trail Network is called a Map Totem.

Map Totems are intended to be placed at key decision points – i.e. trail junctions or intersections where riders have to make a choice as to which way to go. This is generally at the start of every trail, at any major junctions, and at any alternate entry points into the trail network. Map Totems need to include all the information that a rider needs to make a decision – a map and information about the trail options available, including name, difficulty rating, length and possibly ride time.

Figure 12 below shows a concept design for a map totem.

Figure 12. Map Totem Concept Design



4.5.3 Waymarker Totems

The third and simplest of the signage types is the Waymarker Totem. It is a simple bollard or post with symbols on it to guide trail users in the correct direction at any point of uncertainty.

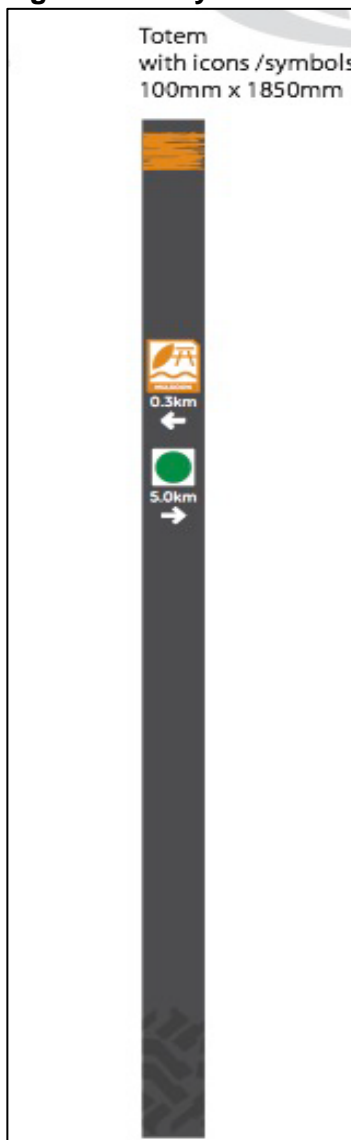
Examples of where a Waymarker Totem should be used include:

- Where a MTB trail crosses a road or vehicle access track;
- Where there have been no signs for a substantial distance.

Waymarker Totems can also be used to signify the wrong direction of travel, through the use of an 'X' symbol. For example, where a cross-country trail crosses over an MV track, a Waymarker Totem would be installed to advise riders to continue straight ahead rather than turn onto the MV track. An 'X' symbol can be placed on the back of the Waymarker Totem to discourage riders entering from the MV track against going the wrong way.

Figure 13 below shows the concept design for a Waymarker Totem.

Figure 13. Waymarker Totem Concept Design



4.5.4 Signage Location Map

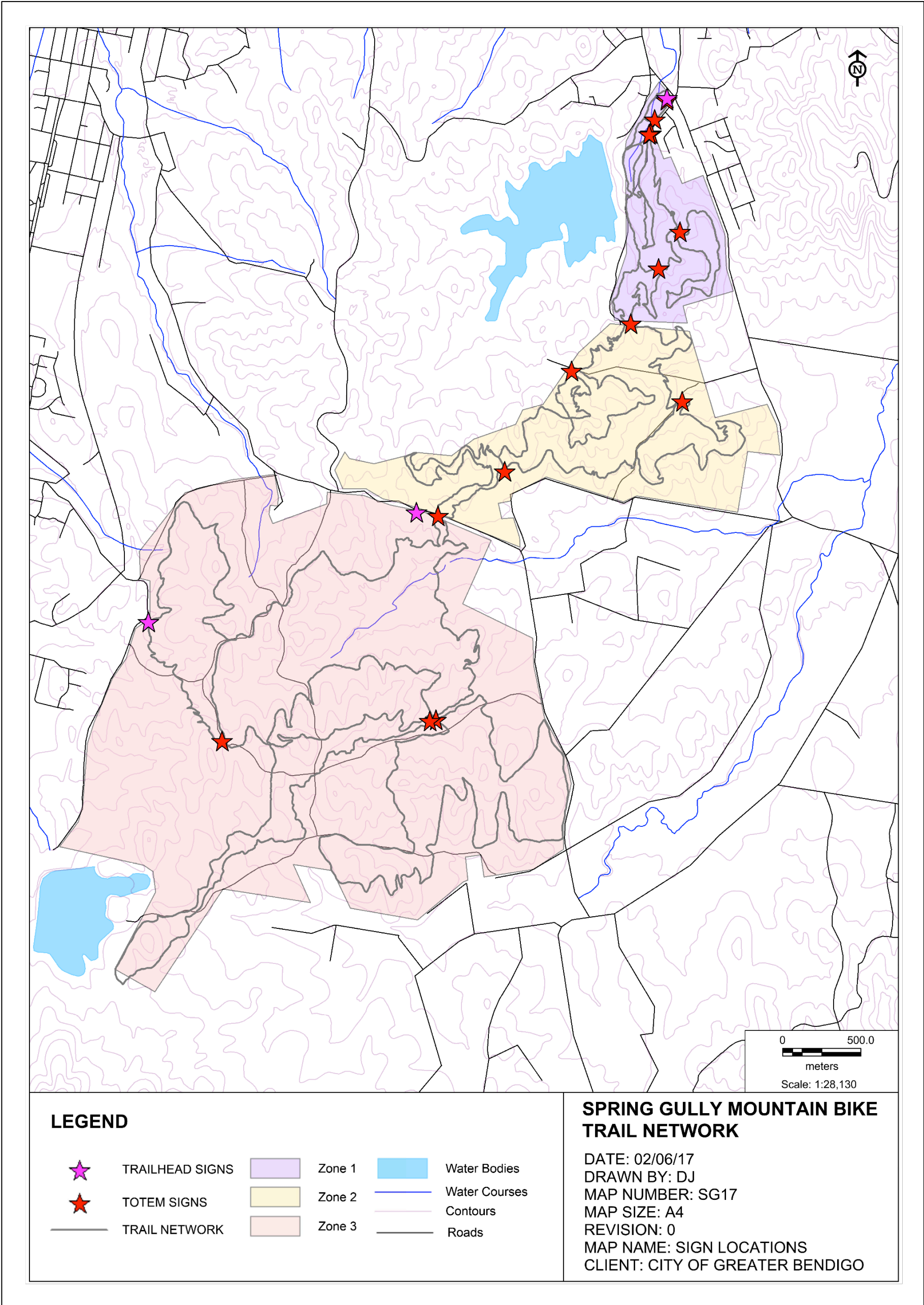
Table 3 below estimates the quantities of the different sign types that will be required once the trail network is completed.

Table 3. Signage Quantity Estimate

Type of Sign	Locations	Estimated Quantity
Trailhead Sign	<ul style="list-style-type: none"> Main trailhead at Muldoon Reserve; Any secondary trailhead locations. This could include a western entry point on Reservoir Rd and the entry into Zone 3 (XC Trail 9) on Diamond Hill Rd. There is an informal car park on Diamond Hill Rd very close to the start of XC Trail 9 and it is possible that some riders may park there and start/finish their rides at this point. 	3
Map Totems	<ul style="list-style-type: none"> At the start of each MTB trail 	14
Waymarker Totems	<ul style="list-style-type: none"> At the crossing of every road/MV track At the finish of each trail where it merges back onto another trail 	Approximately 100

Map 16 on the next page shows the approximate locations for these sign types. Note that the locations of Waymarker Totems are not shown due to the excessive number required. These signs are to be placed wherever a MTB trail crosses an MV track – given the highly fragmented nature of the park and the high number of MV tracks, it is not practical to try to identify via a desktop exercise the exact location of each Waymarker Totem required. It is suggested that a formal count be conducted once the trail network is almost complete.

Map 16. Signage Locations



4.6 TRAIL CLOSURES

Where any significant unsustainable sections of existing MTB trail were identified, a new alternative sustainable MTB trail alignment was designed.

While small issues relating to trail sustainability (for example, excessively steep gradients, lack of outslope, lack of grade reversals, insufficient drainage etc.) were reasonably common, most were not considered large enough or significant enough to warrant closure. This consideration was partly a practical one – while sections of the existing trail might not meet ideal sustainable trail design principals and may continue to erode, the environmental cost of constructing a new trail in terms of vegetation and habitat displacement, might well be greater than the environmental harm caused by maintaining the status quo. In these situations, the decision has generally been made to retain the existing MTB trail, but on the proviso that it would be subjected to improvement works during the implementation of this master plan.

Only 8 sites were identified that warranted closure. These have been mapped and are shown in Map 17 on the next page. The total distance of trail to be closed is 1,454m. The distance of each individual closure is shown below:

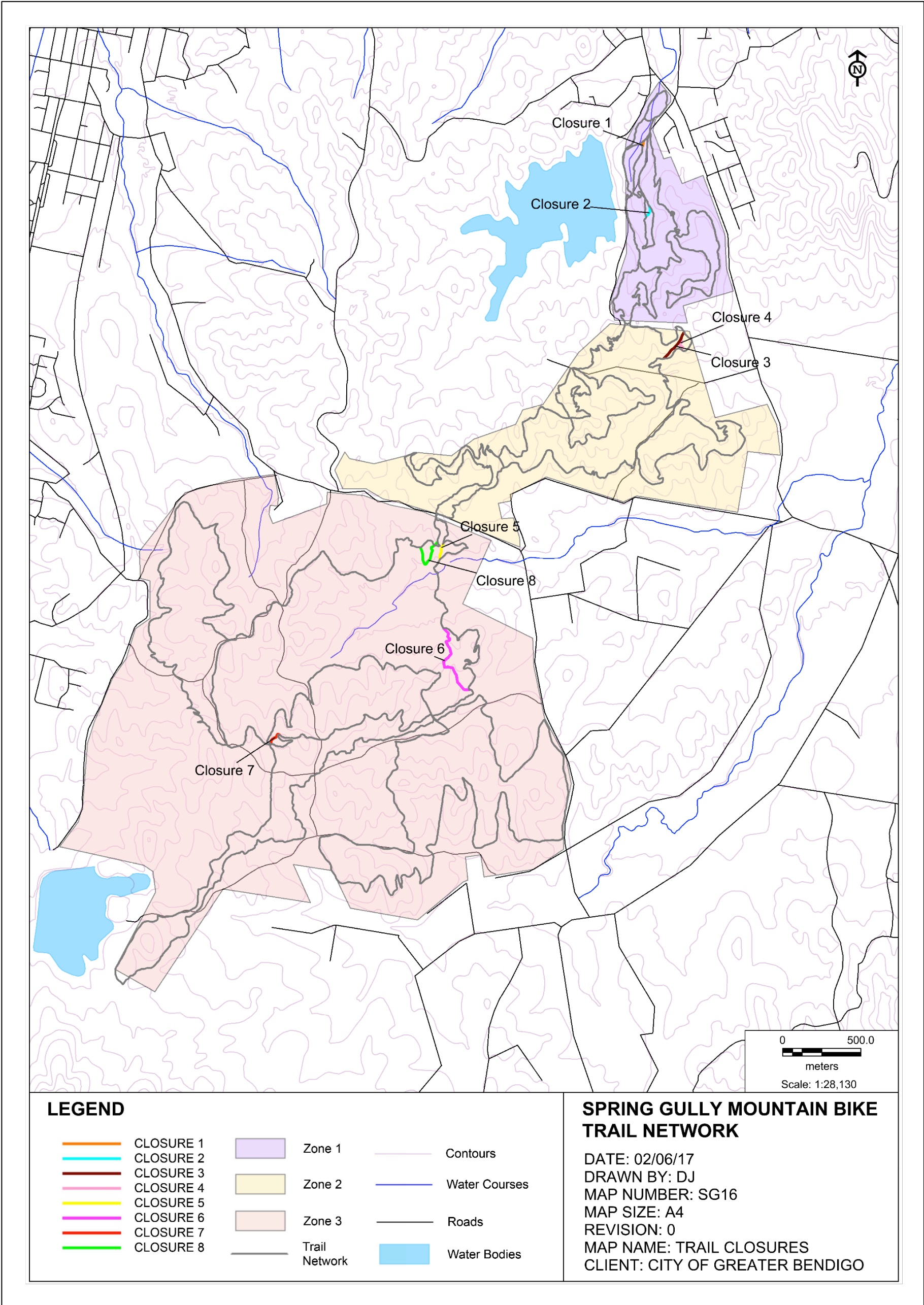
- Closure 1 = 32m
- Closure 2 = 75m
- Closure 3 = 211m
- Closure 4 = 82m
- Closure 5 = 103m
- Closure 6 = 563m
- Closure 7 = 96m
- Closure 8 = 292m

Please note that this Master Plan only assessed the existing MTB trails for potential closure. It did not include an assessment of all the MV tracks, 4WD tracks, motorbike tracks etc., many of which could ideally be closed, having a significant positive environmental impact on the park.

It is recommended that the trail closures suggested herein be undertaken at the same time as the construction of new MTB trails and upgrading of existing MTB trails.

Closures need to be undertaken to a high standard or there is a risk trail users may re-open them. An excavator should be used to thoroughly break up the tread of the trail and cut furrows across the trail, running parallel to the contours. Breaking up the tread discourages re-use and encourages plant growth. Furrows prevent water from flowing down the trail, discourage re-use and also encourage plant growth. Finally, sticks, branches, tree trunks, rocks, bark and mulch should be pulled over the trail.

Map 17. Trail Closures



5 TRAIL CONSTRUCTION

5.1 CONSTRUCTION GUIDELINES

In order to design and implement a successful MTB trail, one of the most important factors to consider is long-term sustainability. It is important to acknowledge the environmental impact that may occur from the construction and usage of mountain biking trails. Creating sustainable mountain biking trails starts in the design phase by ensuring that trails are located so as to avoid areas of high conservation (or cultural heritage) significance, and then continues in the construction phase through careful and sensible design that incorporates sustainable trail construction principals.

As trail construction is still a relatively small and new industry in Australia, there is no industry body, no defined standards or other guidelines to refer to for trail construction. In the absence of any Australian specific guidance, the practices and teachings of the International Mountain Bicycling Association are generally considered 'best practice' for mountain biking trail construction. The Spring Gully Trail Network should, therefore, comply with IMBA guidelines for trail design and construction (see www.imba.com).

The IMBA book *'Trail Solutions - IMBA's Guide to Building Sweet Single-track'* is generally considered to be the best reference about sustainable mountain biking trail construction. The following rules/techniques are taken from this book:

- **Trail Difficulty Rating System** – As discussed previously, all trails should all be given a trail difficulty rating using IMBA's TDRS. All the trails outlined herein have been given an aspirational trail difficulty rating – care should be taken during construction to ensure that the final, constructed trails achieve these ratings. The TDRS provides actual parameters for width, gradient, surface, obstacles and other aspects of trails;
- **Rolling contours concept** – When building MTB trails it is important to implement the rolling contours concept into the design. The rolling contours concept is the starting point for any sustainable trail and basically states that the trail should be built in a side-slope location, aligned along the contours of the hillside, generally with gentle, undulating gradients;
- **Outslope** – The trail should be outsloped. That is, it should slope gently (no more than 5%) down towards the lower, outside edge of the trail. This allows water flowing down the hillside to shed across the trail, rather than being channelled along the trail;
- **Trail gradient** – the trail gradient is how steep the trail rises or falls over a specific distance. In terms of trail gradient, there are two key guidelines to follow when building MTB specific trails:
 - The 'Half Rule', which states that the trail's grade shouldn't exceed half of the grade of the hillside or slope that the trail traverses. If a grade does exceed half the side slope, it is considered a fall-line trail. Instead of shedding across the trail, water will run along the trail, displacing soil and causing erosion;
 - The '10% Average Guideline' was first coined by IMBA and states that, generally an average trail grade of ten per cent or less is the most sustainable;
- **Grade reversals** – grade reversals are the dips and crests that are incorporated into the trail as it moves along the contour. Grade reversals are absolutely critical for sustainable trails and provide interesting features and undulations to the trail. A grade reversal is essentially a point where the trail changes from downhill to uphill. Any water flowing downhill along the trail reaches the grade reversal and is forced off the trail. At the lowest point of the grade reversal, the edge of the trail should be scalloped out to ensure that there is a wide, clear outlet for the water.

5.3 CONSTRUCTION SCHEDULE

As stated, the conditions at Spring Gully are quite good for trail construction, which should translate to reasonably good productivity rates for construction. Productivity rates are estimated at:

- Upgrades to existing MTB trail – 150m of finished trail per day;
- Construction of new MTB trail – 100m of finished trail per day.

Table 7 below shows the expected number of days required for construction of the three different categories of trail.

Table 7. Anticipated Construction Duration

Category	Length (km)	Anticipated Productivity Rate (m / day)	Duration (days)
Existing MTB trail ⁷	14.32	150	95
New MTB trail	13.86	100	139
Total	28.18		234

It is estimated that approximately 234 working days⁸ would be required to construct the Spring Gully Trail Network as outlined in this report. This equates to approximately 47 working weeks.

In theory, this means that the entire build could be completed by a single construction team in one year, where a construction team is typically comprised of 3-4 people. However, by deploying two teams on a project of this size, the build time could be reduced to around 117 working days or 23 working weeks.

Trail works would be carefully considered and prioritised to allow for continuous and ongoing usage of the existing trails while new trails are being constructed. While a trail is being worked on, it should be closed to riders with signage and barriers in place. However, with a total of 14 different trails, there would be plenty of alternatives available for riders to use while a trail is closed.

While weather conditions at Spring Gully are mild enough to allow construction works to occur year round, it would probably be more efficient to avoid the middle of winter, when works can be disrupted by wet weather. From a funding perspective it may be useful to split construction over multiple years, but it is certainly possible to build the entire proposed trail network within one year.

⁷ The previous section stated the assumption that only 50% of existing MTB trails would require upgrade works.

⁸ Based on a typical 8 hour day.

6 TRAIL MANAGEMENT AND MAINTENANCE

6.1 TRAIL MANAGEMENT

Once the Spring Gully Trail Network is complete and open to be the public, the operational phase begins. This is the beginning of the 'return on investment period' and the trail network needs to be carefully managed to ensure that it lives up to its fullest potential. Like any asset, it needs to be carefully managed, monitored and maintained.

Given that the majority of the Spring Gully Trail Network is to be located in the Bendigo Regional Park, PV will be the default manager of the trail network. However, the other two major stakeholders in this project, COGB and BMBC, should also play some role in managing the trail network into the future.

One way in which this partnership approach might work is to establish a Spring Gully Trail Network committee. The committee would include members of PV, COGB and BMBC, and they would be responsible for making all decisions relating to the network. This could include decisions about maintenance or upgrades of the trails, event application and timing, naming of trails, signage, grant applications and so on.

While the day-to-day on ground management responsibility would remain with PV, BMBC could take a role in assisting with maintenance, particularly trail inspections.

PV identified three additional options for the management of the site to manage future liabilities and support:

- Committee of Management land transfer to COGB,
- A licence of the trail asset (with a 1 or 2 metre buffer zone either side of the trail) between PV and the COGB; or
- A licence of the trail asset (with a 1 or 2 metre buffer zone either side of the trail) between PV and BMBC.

6.2 TRAIL MAINTENANCE

The Spring Gully Trail Network, when complete, will comply with sustainable trail design principals, thus minimising, but not eliminating, the need for maintenance.

Maintenance of the trail is important for the following reasons:

1. To achieve maximum usage by the intended users;
2. To make the trail last as long as possible;
3. To ensure that the trail does not become dangerous to users;
4. To exercise the land manager's duty of care to provide a safe environment for users;
5. To minimize the legal liability to the land manager.

6.2.1 Typical Maintenance Tasks

The purpose of trail maintenance is to limit physical changes that occur to trails over time. These physical changes can be due to naturally occurring processes or the impacts of trail users. Some of these changes are minor and unimportant and don't affect the experience, functionality or safety of the trails. Other changes have more significant impacts and can have a drastic effect on the experience, functionality or safety of the trails.

Typical changes that occur, and the maintenance tasks to prevent them, include:

1. The accumulation of organic material (leaves, twigs, bark etc.) on the surface of the trail. After heavy winds or storms, trees and branches may also fall on the trail, requiring considerable resources to clear. A moderate amount of leaf litter is acceptable on the surface of the trail, as it can slow the flow of water, thus protecting the actual trail surface, and it can also provide an enjoyable walking/riding surface and a more natural appearance. However, large sticks, branches or trees must be removed as soon as possible. Such items pose a hazard to the trail users and can also provide cause for users to detour around them, widening the trail or creating a new route.
2. Encroachment of surrounding vegetation into the trail corridor. The trail corridor⁹ should be kept clear of any encroaching vegetation. Although heavy trail use tends to discourage vegetation growth within trail corridors, over time vegetation growing beside the trail is likely to grow into the trail corridor. On trails that are rarely used, new plants can even become established in the trail tread itself. This vegetation poses a number of problems:
 - It can be dangerous to users if it protrudes into the trail corridor near eye height;
 - It can be annoying to trail users, detracting from the overall trail experience;
 - Some vegetation can be sharp or hard and can be painful to brush against;
 - It can block the line of sight for trail users;
 - It can push riders towards the outside edge of the trail, instead of the middle part of the trail. This part of the trail is often less stable than the middle and can lead to potential slumping of the lower batter.
3. Water damage – While the implementation of sustainable trail construction techniques and erosion prevention measures should minimise the potential for water to damage trails, extreme rainfall events can, due to the sheer volume of water, overcome some of these erosion prevention measures, eroding the trail surface and batters. Trails should be inspected for water damage after excessively heavy rainfall events.
4. Compaction of trails leading to a 'cupped' or concave trail profile – Over time, the trail profile can become 'cupped' or concaved. This 'cupping' is caused by two things:
 - The downward force applied by the tyres of mountain bikes or the feet of walkers causing the soil to compact in the middle of the trail;
 - The flow of water and the impact of trail users causing organic material and soil to migrate towards the lower edges of the trail, where it accumulates, causing the edge of the trail to become higher than the middle of the trail.
5. Blocked grade reversals – Grade reversals are a key sustainability feature. A grade reversal is essentially a point where the trail changes from downhill to uphill. Any water flowing downhill along the trail reaches the grade reversal and is forced off the trail. At the lowest point of the grade reversal, the edge of the trail should be scalloped out to ensure that there is a wide, clear

⁹ Trail corridor is the three-dimensional space above the trail, through which a trail user passes. The trail corridor should be as wide as the trail and high enough to accommodate the intended trail users (generally 2-3m for walkers and mountain bikers).

outlet for the water. This outlet must be kept clear of organic material (leaves, bark, sticks) and soil in order for it to continue functioning properly. This is a key maintenance task, as any organic material that falls anywhere on the trail will eventually be pushed towards the grade reversal outlet by the action of water and trail users. This is an ongoing and essential maintenance task. No matter how well constructed the trail is, in time the grade reversals will become clogged with organic material and soil. How quickly this occurs depends on the surface material of the trail, the amount of usage the trail receives, the volume and frequency of rainfall and even the surrounding vegetation.

6. Damage to signage – Signage plays an important role in risk management. Unfortunately, it is subject to damage, through both natural and human causes. Natural causes include branches/limbs of trees falling and damaging signs, bushfires, strong winds etc. Human caused damage to signage includes defacement, graffiti or theft. As it forms a key tool in communicating the potential risks to trail users, it is important that the signage is maintained so that it remains clear and legible.

The above points are just some of the changes that can occur to MTB trails with the passing of time. This is not an exhaustive list. The actions of water, wind, animals and trail users are difficult to predict over long periods of time, hence the need to monitor and inspect the trails regularly.

6.2.2 Trail Maintenance Plan

Once the trail network is complete, it is recommended that a thorough trail maintenance plan be produced and implemented, with sufficient resourcing allocated to ensure it meets its objectives.

There are two main components of a trail maintenance plan:

- Routine trail inspections;
- Trail maintenance works.

The objective of these routine trail inspections is to identify any defects that need to be repaired.

Routine trail inspections need to be undertaken regularly to be effective. The exact frequency of these inspections should be determined based on the available resources, but each trail should probably be inspected monthly *as a minimum*. Following storms, heavy rain, or strong winds, additional inspections should be undertaken. BMBC should be empowered to undertake this role. A formalised inspection schedule could be determined, with club members undertaking regular, rostered inspections and submitting a formal inspection report afterwards.

During a routine trail inspection, whenever a defect is identified, it is classified as either urgent or non-urgent. A defect would be considered urgent if:

- It poses a significant safety risk;
- It is likely to lead to further and significant damage if not rectified;
- It makes the trail un-usable.

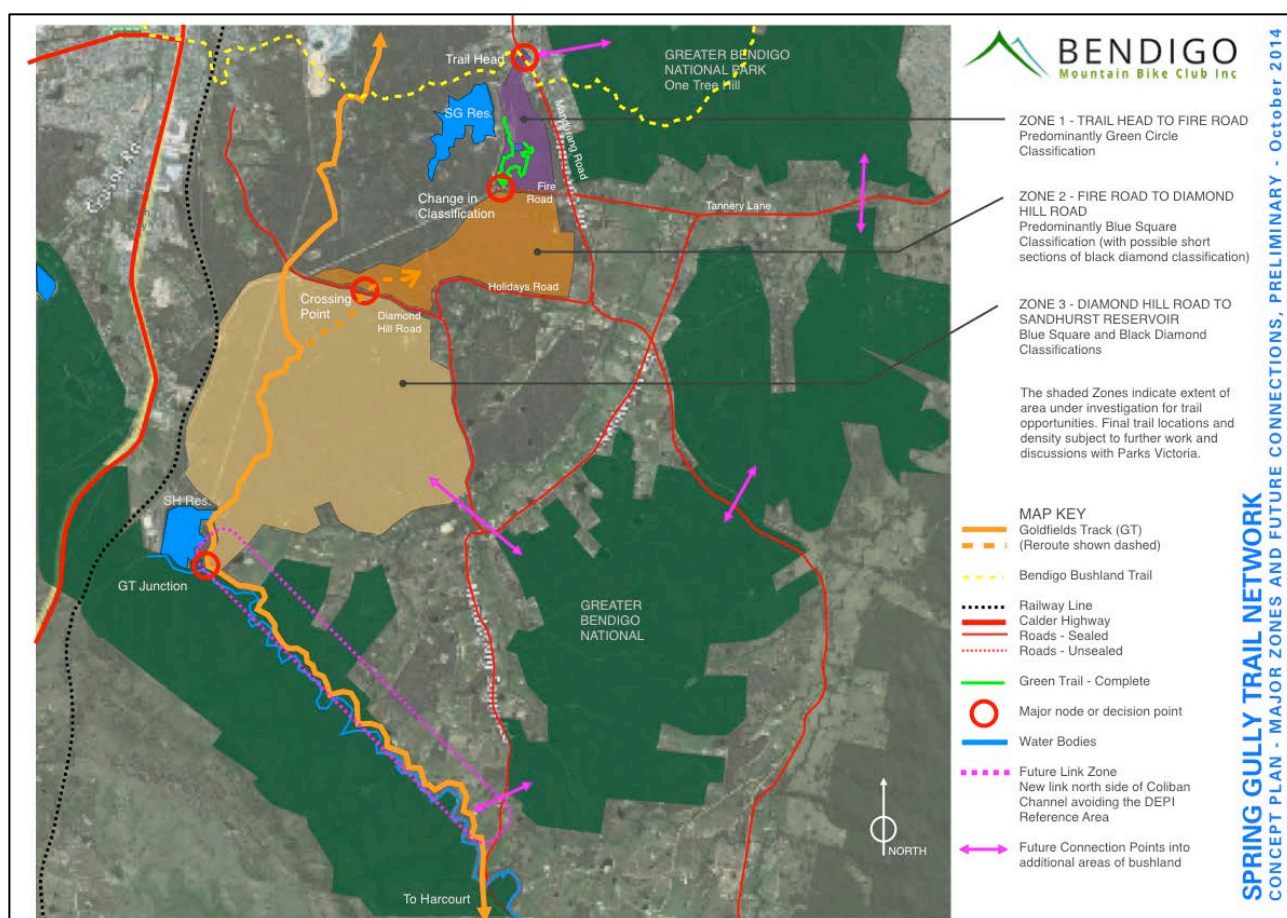
Urgent defects should be repaired immediately as a matter of urgency.

Non-urgent defects can be undertaken on pre-determined, scheduled maintenance days. Such days could even be open to volunteers.

When carrying out any trail maintenance works, either urgent or non-urgent, all necessary safety precautions should be taken. Appropriate personal protective equipment (PPE) should be used for all works. Any tasks requiring machinery operation (excavator, chainsaw etc.) must only be undertaken by suitably qualified and licensed individuals. All works should be undertaken to a thorough, professional, industry level standard.

7 APPENDICES

7.1 BMBC CONCEPT PLAN



7.2 MULDOON RESERVE UPGRADE

Muldoon Reserve Upgrade

Have your Say





A **shelter** is proposed to be constructed near the corner of Spring Gully Road and Wattle Drive. The shelter will be designed to be sympathetic with the surrounding natural character of the reserve and will incorporate picnic tables and information about the local trail network.



A gravel **nature trail** loop will be created around Muldoon Reserve, the trail will be wide enough for both pedestrians and cyclists.



A bicycle **skills loop** will be constructed in the southern section of the reserve and will allow riders of all ages and abilities to develop and hone their skills on a variety of obstacles.



A bicycle **pump track** will provide a fun and challenging series of berms and mounds for riders to develop their skills. The pump track will be located within the southern end of the existing clearing and will be landscaped with native plants.

Walking and cycling have the largest participation rates in Bendigo, to help facilitate the growth in these recreational activities the City of Greater Bendigo is working in partnership with the Bendigo Mountain Bike Club to establish some new walking and cycling facilities at Muldoon Reserve in Spring Gully.

Muldoon Reserve is located opposite the One Tree Hill Hotel on the corner of Spring Gully Road and Wattle Drive. The proposed works will help connect the existing trail network located within the Bendigo Regional Park with the Spring Gully shared trail. This will eventually allow users to access the Goldfields Trail and O'Keefe Rail Trail.

The proposed works include the construction of a nature trail, shade shelter, picnic tables, trail information signage, bicycle skills loop and pump track.

Please tell us what you think:

A listening post will be held at 6.00pm on Wednesday 21 October 2015 at Muldoon Reserve, corner Spring Gully Road and Wattle Drive.

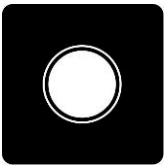
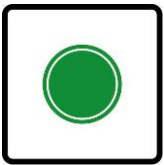


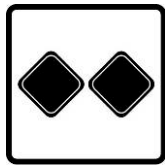
You can email us at:
ActiveCommunities@Bendigo.vic.gov.au
 phone (03) 5434 6000 or post your comments to:

Muldoon Reserve Upgrade
 Active and Healthy Communities
 PO Box 733, Bendigo VIC

Feedback is required by 23 October 2015.



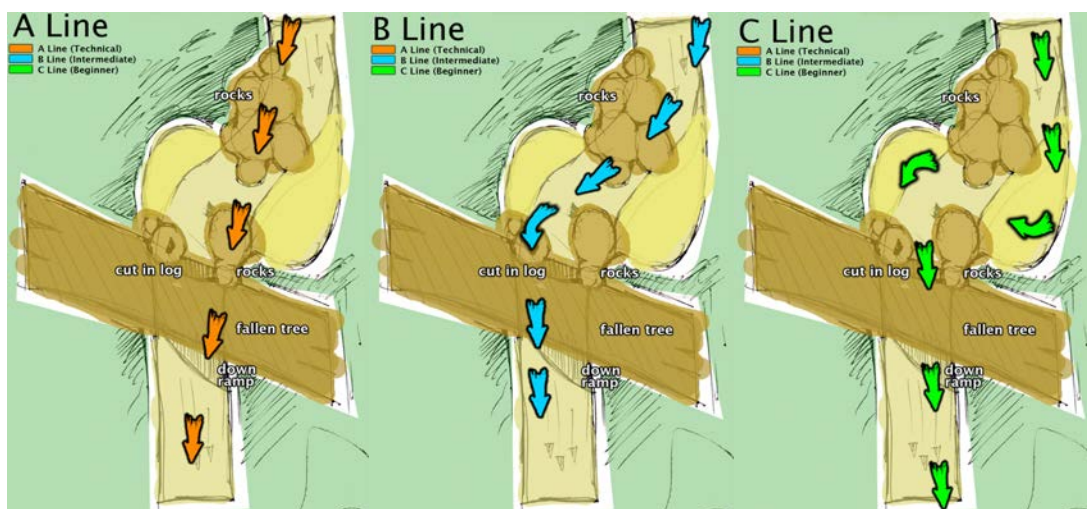
7.3 IMBA TRAIL DIFFICULTY RATING SYSTEM

Rating	Very Easy	Easiest	More Difficult	Very Difficult	Extremely Difficult
Symbol					
Description	<p>Likely to be a fire road or wide single track with a gentle gradient, smooth surface and free of obstacles.</p> <p>Frequent encounters are likely with other cyclists, walkers, runners and horse riders.</p>	<p>Likely to be a combination of fire road or wide single track with a gentle gradient, smooth surface and relatively free of obstacles.</p> <p>Short sections may exceed these criteria.</p> <p>Frequent encounters are likely with other cyclists, walkers, runners and horse riders.</p>	<p>Likely to be a single trail with moderate gradients, variable surface and obstacles.</p> <p>Dual use or preferred use</p> <p>Optional lines desirable</p>	<p>Likely to be a challenging single trail with steep gradients, variable surface and many obstacles.</p> <p>Single use and direction</p> <p>Optional lines</p> <p>XC, DH or trials</p>	<p>Extremely difficult trails will incorporate very steep gradients, highly variable surface and unavoidable, severe obstacles. Single use and direction</p> <p>Optional lines</p> <p>XC, DH or trials</p>
Trail Width	2100mm plus or minus 900mm	900mm plus or minus 300mm for tread or bridges.	600mm plus or minus 300mm for tread or bridges.	300mm plus or minus 150mm for tread and bridges. Structures can vary.	150mm plus or minus 100mm for tread or bridges. Structures can vary.
Trail Surface	Hardened or smooth.	Mostly firm and stable.	Possible sections of rocky or loose tread.	Variable and challenging.	Widely variable and unpredictable.
Average Trail Grade	<p>Climbs and descents are mostly shallow.</p> <p>Less than 5% average.</p>	<p>Climbs and descents are mostly shallow, but may include some moderately steep sections.</p> <p>7% or less average.</p>	<p>Mostly moderate gradients but may include steep sections.</p> <p>10% or less average.</p>	<p>Contains steeper descents or climbs.</p> <p>20% or less average.</p>	<p>Expect prolonged steep, loose and rocky descents or climbs.</p> <p>20% or greater average</p>
Maximum Trail Grade	Max 10%	Max 15%	Max 20% or greater	Max 20% or greater	Max 40% or greater
Level of Trail Exposure	Firm and level fall zone to either side of trail corridor	Exposure to either side of trail corridor includes downward slopes of up to 10%	Exposure to either side of trail corridor includes downward slopes of up to 20%	Exposure to either side of trail corridor includes steep downward slopes or free-fall	Exposure to either side of trail corridor includes steep downward slopes or free-fall

Natural Obstacles and Technical Trail Features (TTFs)	No obstacles.	Unavoidable obstacles to 50mm (2") high, such as logs, roots and rocks.	Unavoidable, rollable obstacles to 200mm (8") high, such as logs, roots and rocks.	Unavoidable obstacles to 380mm (15") high, such as logs, roots, rocks, drop-offs or constructed obstacles.	Large, committing and unavoidable obstacles to 380mm (15") high.
		Avoidable, rollable obstacles may be present.	Avoidable obstacles to 600mm may be present.	Avoidable obstacles to 1200mm may be present.	Avoidable obstacles to 1200mm may be present.
		Unavoidable bridges 900mm wide.	Unavoidable bridges 600mm wide.	Unavoidable bridges 600mm wide.	Unavoidable bridges 600mm or narrower.
		Short sections may exceed criteria.	Width of deck is half the height.	Width of deck is half the height.	Width of bridges is unpredictable.
			Short sections may exceed criteria.	Short sections may exceed criteria.	Short sections may exceed criteria.

7.4 A, B AND C LINES

Mountain biking can be a hazardous sport at times and risk management is highly important in designing a trail system. World Trail designs incorporate a number of risk management practices that aim to reduce injury and user risk. These practices include the A-B-C lines system as well as prominent trail signage.



The A-B-C lines system gives riders of varying riding abilities options when riding a specific trail. The system provides options for beginner, intermediate and advanced riders when a challenging section of terrain presents itself on a trail, while limiting any 'forced' accidents that could occur. A forced accident occurs when a difficult section of trail has no options available to the rider, and the rider is forced into a 'snap decision' on how to negotiate a difficult route. The rider may be forced into a position that is beyond his or her own skill level.

With an A-B-C lines system, the trail splits into two (2) or three (3) different options with varying degrees of difficulty designed to cater for all users. By employing A-B-C options on a particular trail users of different abilities can ride together in groups and still have a challenging and enjoyable experience.

The ABC lines system is beneficial as it reduces the rider's risk if they are not comfortable with a particular section of the trail. A-B-C lines can be implemented on natural technical areas such as rocky outcrops, fallen logs or gully crossings, or with specifically constructed obstacles.

A-B-C lines need to be signposted effectively to reflect the difficulty rating of the riding line that the user has chosen to negotiate.

There are some simple rules that should be applied when using the A-B-C Lines system:

1. The most difficult line is referred to as the A line;
2. The easiest line should match the overall trail difficulty rating of the trail;
3. The hardest line shouldn't be more than one rating category above the overall trail difficulty rating of the trail. For example, an 'Easy' trail should not have any 'Very Difficult' A-lines, but it could include 'More Difficult' A lines;
4. The most difficult line, should be the quickest route. The easiest line should be the slowest route. In a race situation, this means that the most skilled or most daring rider gains a time bonus.

8 WORLD TRAIL CONTACT DETAILS

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