



NARRABEEN LAGOON TRAIL

EVALUATION OF TRAIL COMPLETION

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EVALUATION OF TRAIL COMPLETION

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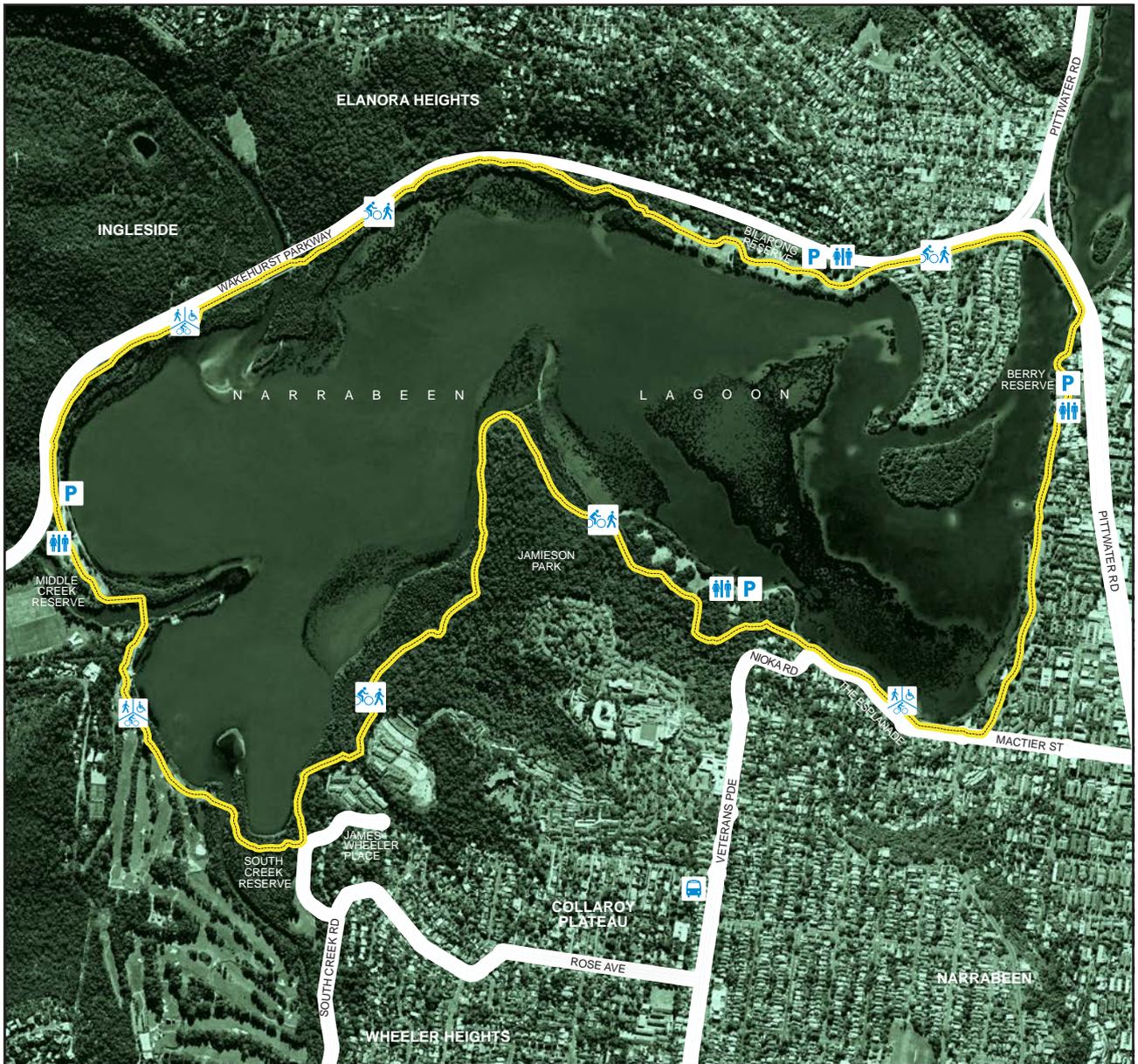
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LOCATION





EXECUTIVE SUMMARY

The Narrabeen Lagoon Trail has been undergoing development since 2010 with the final stage of the trail opening on the 25th February 2015. The most recently completed section of trail runs approximately 1.5km from Middle Creek Reserve to the South Creek entry on James Wheeler Parade and allows trail users to fully circumnavigate the Narrabeen Lagoon. In 2014, Warringah Council was approached by a researcher from the Physical and Activity, Nutrition and Obesity Research Group (PANORG) at the University of Sydney to conduct an evaluation of the completion of the trail. The project aimed to evaluate the impact of the trail completion on trail usage and users' physical activity.

Physical inactivity is linked with poor health outcomes, including chronic diseases such as diabetes, cancer and cardiovascular disease. In New South Wales, approximately 57% of the population do not meet physical activity recommendations to maintain health. Using recreational

trails has been shown to be linked with greater amounts of physical activity. The NSW Ministry of Health's Healthy Eating and Active Living strategy 2013-2018 states one of its aims is to increase physical activity among the NSW population by promoting creation and use of bike pathways and pedestrian amenities. The information contained in this report may be used as evidence of the impact of such an amenity.

The University of Sydney evaluation comprised three complementary components, namely an intercept survey of users of the trail on two occasions post-completion (n=249), visual counts of users pre- (two occasions) and post-completion (three occasions) detailing gender, adult/child, cyclist/pedestrian by direction of travel at existing and new sections of the trail, and an analysis of the electronic counter data from three locations collected by Warringah Council between 2012 and 2015.

INTERCEPT SURVEY

According to the intercept survey of 135 pedestrians and 114 cyclists which took place on the new section of the trail on two weekend days in March and May 2015, around 90 percent of users live locally in one of the councils of Pittwater, Warringah, Manly and Mosman. The survey found over 80 percent of trail users had been to the trail before, many using it weekly. As such, most had been made aware of the trail completion through previous visits well before it opened, although a sizeable number (29%) had also seen news of the loop opening in the newspaper.

For both pedestrians and cyclists, car was the main mode of transport to the trail, and almost half of those surveyed had gained entry at Middle Creek and South Creek (James Wheeler Parade). Those who actively travelled to the trail were more likely to have used the South Creek entry which is close to residential areas and has good connectivity to other suburbs via share paths. However, as the survey took place only on the newly completed part of the trail, a different distribution in terms of travel mode and entry/exit point may have been found should it have taken place elsewhere.

Safety at the trail was highly rated (rated 4 or 5 on a 5 point scale) and did not differ by subpopulation, including whether the respondent was a cyclist or a pedestrian. Cyclist-pedestrian conflicts and unpredictability of children were the main safety issues flagged among the minority who rated trail safety three or lower on the 5-point scale. The vast majority also felt that the trail was well-maintained by Council with only a small number of requests around path widening in areas on the western foreshore (by Wakehurst Parkway), the bridge on Pittwater Rd and some blind corners mentioned as potential areas for improvement.

With respect to physical activity at the trail, two-thirds of survey participants reported that they were doing the full 8.5km circumnavigation of the lagoon on the day they were surveyed, including almost 60% of pedestrian respondents. Almost half of those who had used the trail previously reported that since the new section was opened, they were doing more physical activity at the trail and this was additional activity rather than replacing that done elsewhere. Many people commented that they were spending longer at the trail since the new section was opened, demonstrating that completion of the loop was an added attraction even for established or regular trail users.

Significantly from a public health perspective, the survey showed that the trail is attracting people with a range of physical activity levels, not just those already meeting recommendations. Of those surveyed, a higher proportion (59%) were not meeting current physical activity guidelines when compared to the general NSW population (45%) perhaps suggesting that the trail attracts those who might be otherwise low active (although there may be some selection bias due to (perhaps fitter) people running on the trail being less likely to stop to do the survey). Further, a higher proportion of those not meeting physical activity guidelines said that they were doing more physical activity since the completion of the loop (56%) compared with those meeting recommendations (39%). For some, therefore, physical activity done at the trail represented a high proportion of their total weekly activity. Thus there is some suggestion that completion of the trail appears to be promoting activity among the low active.

VISUAL COUNTS

Visual counts conducted before and after loop completion, reflected the overall increases in trail traffic shown by the electronic counters (see below), but did not suggest that there have been large changes in the relative distribution of user subpopulations (male/female, adult/child) using the existing parts of the trail which neighbour the new section (South Creek to Jamieson Park and Middle Creek to Bilarong Reserve). The trail seems to be frequented by more women than men, although men constitute a larger proportion of cyclists as they do in the wider cycling population. There was some evidence of a proportionate increase (approximately 7%) in children on the trail between Middle Creek and Bilarong Reserve and concomitant decrease in adult males on the same section following trail completion. Comparing the new and existing sections after trail completion, the distributions of male, female and child users were similar at 36%, 42% and 22% respectively. The number of dogs observed on the trail also increased in tandem with the increase in human traffic on the existing sections, with the counts on new section indicating the highest dog traffic.

ELECTRONIC COUNTER DATA

Electronic counter data was made available by Warringah Council for the period between November 2012 and July 2015. Counters were located on two existing parts of the trail (Jamieson Park and Middle Creek Reserve) and on the new section once it was opened. Time series analyses showed that there was a dramatic increase in traffic on existing parts of the trail when the new section was opened to the public. Pedestrian and cycling traffic in both directions at Middle Creek increased by a factor of 200% in the 19 week period from February to July 2015 compared with the same period in 2013 and 2014. Adjusted for weather and holidays, between 1600 and 1900 passes per week were recorded. At Jamieson Park, the increases were even more dramatic with bike counts increasing by a factor of up to 280% and 340% for pedestrians. Passes by bikes in the direction South Creek to Jamieson Park were the most prevalent averaging almost 2000 per week.

Traffic on the new section was stable from opening (February 25th 2015) to July when the data were downloaded, with the highest counts occurring on public holidays. Ratios of cycling to pedestrian traffic did not change markedly from pre to post-opening on the existing sections, except for a small but statistically significant 4% increase in pedestrian traffic at Jamieson Park. The new section recorded a significantly higher proportion of pedestrian passes (over half of all traffic) compared with Middle Creek (46%) and Jamieson Park (44%).

CONCLUSION

Completion of the Narrabeen Lagoon trail, despite the considerable increase in traffic, was received positively by users of the trail. The safety and maintenance of the trail is considered by users to be more than satisfactory, and the trail is seen as accessible and a good place to undertake exercise and enjoy natural scenery. Both pedestrians and cyclists alike make frequent use of the trail and the newly completed section. There is evidence which suggests that completion of the loop is having a positive impact on the amount of physical activity taking place at the trail and perhaps on the physical activity of trail users in general. The facility is well-used by locals, especially those living in close proximity to the trail, consistent with previous research. Narrabeen Lagoon Trail appears to fit well with current state policy aiming to increase the wellbeing of NSW residents; young and old, female and male, cyclist and pedestrian alike.

Recommendations include maintaining the use of electronic counters on the trail for monitoring trends in use and the impact of changes at the trail, and supplementing routine data collection with surveys and observational data to clarify safety concerns and validly gauge impact of future modifications to the Narrabeen Lagoon Trail environment.



BACKGROUND

PROJECT DEVELOPMENT

The Narrabeen Lagoon Trail has been undergoing development since 2010. The final stage of the trail was opened on 25th February 2015 (warringah.nsw.gov.au/your-council/current-works-and-projects/narrabeen-lagoon-trail-project). The trail is located in a densely populated area of Northern Sydney, and runs through bushland, parks and areas close to amenities such as parking areas, other recreational activities (ie., watercraft hire) and cafes/restaurants. Completion of the final section means that the 8.5km trail fully circumnavigates Narrabeen Lagoon linking the suburbs of Narrabeen and Cromer from both directions providing a trail for pedestrian and cyclist use that is entirely off-road. Warringah Council spent \$11 million on the project which involved building two new bridges, 2km of new boardwalk, reserve and car park upgrades, a boat ramp, toilet upgrades, park furniture, rest stops, vantage outlook points, heritage restoration, environmental protection and substantial planting of local species. The trail was 60% funded by Warringah Council, with further support from a number of State and Federal grants programs.

In 2014, Warringah Council was approached by a researcher from the Physical and Activity, Nutrition and Obesity Research Group (PANORG) at the University of Sydney to conduct an evaluation of the completion of the trail. An agreement was reached whereby the Council provided support for the evaluation in terms of funding for research assistance, permission to access council owned electronic counter data, and in-kind assistance by Council staff. The University contributed the time of a senior researcher to carry out data collection, data analysis, and writing of a report and peer review publication(s). The Northern Sydney Local Health District Health Promotion Unit was also engaged to contribute to evaluation activities and scientific writing, with a view to building research capacity and knowledge exchange. The project primarily aimed to evaluate the impact of the completion of the trail on trail usage and users' physical activity.

RESEARCH EVIDENCE ON PHYSICAL ACTIVITY AND RECREATIONAL TRAILS

Physical inactivity has been shown in epidemiological studies to be linked with poor health outcomes, including chronic diseases such as diabetes, cancer and cardiovascular disease [1]. In Australia, approximately 57% of the population are estimated to not be meeting physical activity recommendations to maintain health [2]. Using recreational trails has been shown to be linked with greater amounts of physical activity [3]. The current NSW Ministry of Health's Healthy Eating and Active Living strategy 2013-2018 states that one of its aims is to increase physical activity among the NSW population by promoting creation and use of bike pathways and pedestrian amenities [4].

Research has shown that the built environment is important in promoting active living [5], and recreational trails provide safe and pleasant environments in which to be physically active. Other research has shown that improved neighbourhood connectivity through building a greenway/trail significantly increases total physical activity and walking compared with control neighbourhoods [6]. Moreover, provision of walking trails can increase physical activity among those who may be more at risk of inactivity [7]. This is particularly important for groups who would be less likely to use areas open to motorised traffic such as children, women and older people [7-9]. For example, while bike ownership is high in Australia, the number of bike trips made is still extremely

low when compared to other countries [10]. A general lack of separated (from motorised traffic) cycling infrastructure and related concern for safety have been cited in previous research as reasons for the low participation rates in Sydney in particular [11, 12]. Previous research has shown that building separated paths in locations close to urban areas have been shown to increase cycling in surrounding communities [13]. From another perspective, the image of cyclists can affect attitudes towards cycling, especially those of current non-riders and therefore reporting on the heterogeneity of bike users is important to improve the acceptability of cyclists and expenditure on cycling infrastructure [14].

There have been few evaluations of the impact of recreational cycling and/or walking infrastructure in Australia published in the peer review literature, and to our knowledge, none concerning the northern area of Sydney. Evaluations of infrastructure that support physical activity are important as they serve to build the evidence base for justifying investment in such developments and provide information to assist in local government planning and health promotion policy. The involvement of Warringah Council and the Northern Sydney Local Health District in this research promotes translation of research conducted by a university to real-world situations and encourages dialogue between stakeholders.



EVALUATION APPROACH

The approach taken to evaluate the impact of completion of the trail comprised three complementary components. First, there was a brief intercept survey that was undertaken on two occasions post-loop completion. Details of survey content are given below and the questionnaire is included in the Appendix. The survey was designed to provide a detailed demographic profile of the users of the trail and their perception of the trail's impact on their physical activity in general and that undertaken whilst at the trail. We also sought data on where from, and how, users of the new section of the trail were travelling to the trail on the day of the survey, and the distance travelled whilst at the trail for the purpose of informing the Council on usage patterns.

The second component of the evaluation was a series of visual counts of users undertaken before and after completion at two existing sites on the trail, and then additionally, at a point on the newly opened section. The visual counts were designed to provide greater detail about the profile of users at different

time and locations on the trail and a provide comparison point for the third evaluation component, electronic count data (see below).

The final component was electronic counter data taken from three locations on the trail. As with the visual count data, the locations were from two existing trail sites and one on the newly completed section post-completion. These data provided an excellent (interrupted) time series of counts since November 2012 to July 2015 which could be used to identify any trends in usage and changes associated with opening of the loop.

In combination, the three components of the evaluation have yielded information about how completion of the loop impacted usage both quantitatively and qualitatively which can inform not only Council plans for the trail, but more broadly, similar projects in other jurisdictions. Further, the data can be added to the body of evidence about the value of recreational infrastructure supporting physical activity.



EVALUATION FINDINGS

INTERCEPT SURVEY - METHODS

Intercept surveys with users of the Narrabeen Lagoon Multi-Use trail were undertaken on two separate (weekend) occasions (21st March and 9th May 2015) between the hours of 9am and 4pm after completion of the final trail section. The surveys took place on the newly completed section within approximately 150 metres of the electronic counters (see Figure 3). Intercept surveys are a cost-effective way to target research about the value of a new piece of infrastructure towards those who have experience using it [15]. The survey permitted detailed characterisation of the users of the trail on the day of survey, as well as a qualitative examination of how completion of the trail has affected usage. Only users aged 18 or older were included in the survey and participation

was entirely voluntary. After a short introduction outlining the purpose and content of the survey, the questionnaire (see Appendix) gathered information the basic demographics of users, their frequency of use in general of the trail and the new section since it opened, details of their use of the trail on the day of survey including how they came to the trail and who accompanied them, their physical activity and opinions of trail maintenance and safety. Data were collected by self-report only and answers were recorded by researchers either on paper surveys or directly entered into electronic questionnaires. Data were analysed using statistical software [16] overall as well as by subgroups.

RESULTS

CHARACTERISTICS OF PARTICIPANTS

	PEDESTRIAN (N=172)		CYCLIST (N=77)		ALL	
	%	frequency	%	frequency	%	frequency
Gender						
Male	39.0	67	61.0	47	45.6	114
Female	61.1	105	39.0	30	54.4	135
Age						
18-24	2.9	5	1.3	1	2.4	7
25-34	10.5	18	18.2	14	12.8	32
35-44	22.7	39	33.8	26	26.0	65
45-54	26.2	45	28.6	22	26.8	67
55-64	21.5	37	10.4	8	18.0	45
65+	16.3	28	7.8	6	13.6	34
Group size (adults + children)						
1 (adult only)	25.0	43	24.7	19	24.9	62
2	50.6	87	40.3	31	47.6	119
3	12.2	21	19.5	15	14.4	36
4	10.5	18	11.7	9	10.8	27
5	1.7	3	3.9	3	2.4	6
Residence						
Elanora Heights/Narrabeen, Collaroy, Cromer/Dee Why	54.4	93	38.2	29	49.2	122
Other SHOROC*	35.1	60	51.3	39	40.3	100
Not SHOROC*	10.5	18	10.5	8	10.5	26

*Shore Regional Organisation of Councils including Pittwater, Warringah, Manly and Mosman Councils

A total of 114 and 135 trail users respectively agreed to be surveyed on the 21st of March and 9th of May 2015 respectively.

Table 1 shows the distribution of the sample of trail users who were on the new section of the trail on the 21st of March and the 9th of May 2015 and who agreed to be surveyed.

The majority of respondents were female (54%), pedestrians (69%), and aged over 45 years (64%). Three-quarters of the respondents were visiting the trail with one or more other people, around half with just one other. The majority of pedestrians came from either from the suburbs immediately surrounding the trail and cyclists from further afield but within the Shore Regional Organisation of Councils (SHOROC) council areas of Pittwater, Warringah, Manly or Mosman.

Only 10 percent of users came from an area other than these. Cyclists were significantly more likely to be male (61% vs 39%, $p=0.001$), from another SHOROC suburb (51.3% vs 35.5%, $p=0.05$) and be younger than pedestrians (mean age 44.4 years vs 49.2, $p=0.012$). There was no difference in group size by user type. Just over one-quarter of participants (27.2%) were travelling with one child or more.

FREQUENCY OF USE

Almost one-third of those surveyed reported coming to the trail at least once or twice per week or more often, but for 17% it was their first time using the Narrabeen lagoon trail (See Figure 1). Of those who had been to the trail previously (n=208), for 29% it was their first time on the new section between James Wheeler Parade and Middle Creek Reserve. Of those who had used the new section previously (n=168), 47% had used it between one and three times since the opening of the trail, 28% had used it between three and 10 times and 25% more than ten times. As the surveys were taken on two dates,

one three and a half weeks after opening and one 10 weeks after opening, the accumulation of visits to the new section was higher among those spoken to at the second survey (mean visits 10.4) compared with the first (mean visits 5.9).

In terms of change in use since the opening of the new section, among those who had used the Narrabeen Lagoon Trail before (n=208), 52% reported using the trail more frequently since the loop had been completed, 36% used as frequently as before and a small number (n=6) said they used it less often.

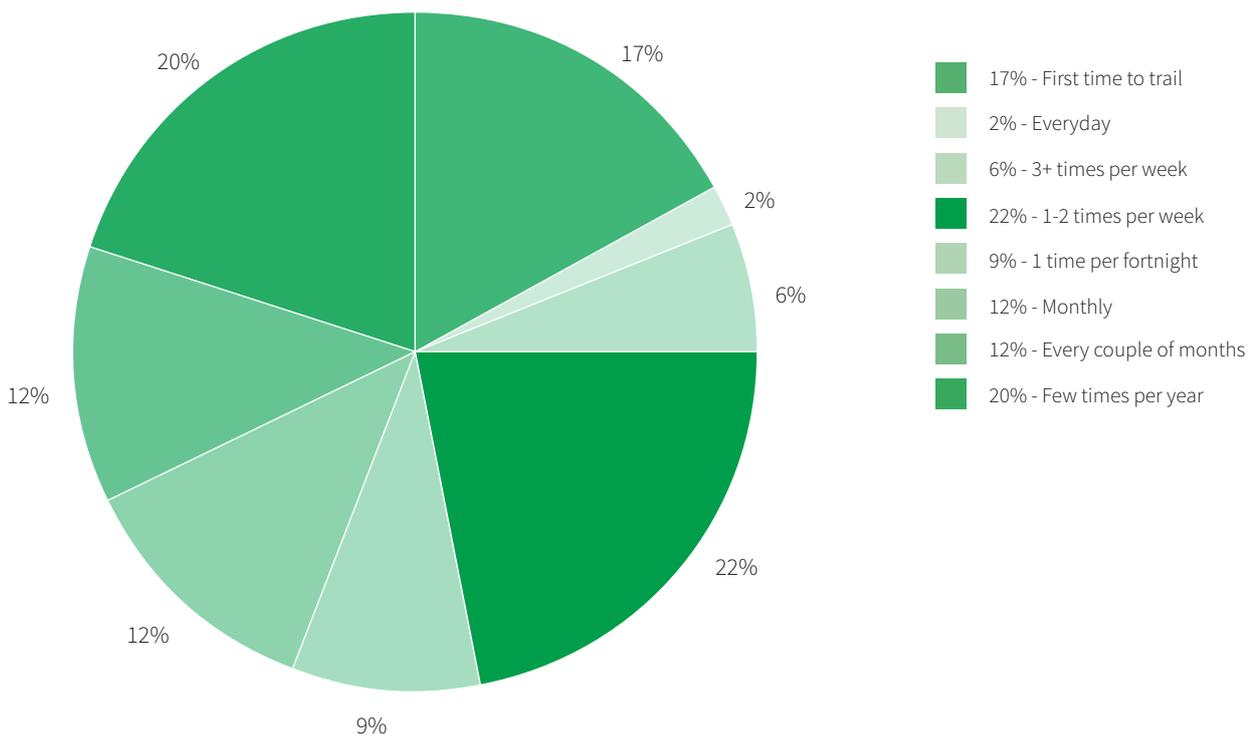


Figure 1: Frequency of use by survey participants (n=249)

COMING TO THE TRAIL

Of all those who took part in the survey, 37% had either seen a notice on the trail about completion of the new section or had seen the new part being built on previous visits. Twenty-one percent had seen a reference to the new section in the newspaper, and 22.2% had heard by word of mouth. A small number (n=15, 6%) had found out whilst using the trail on the day of the survey, and three people who lived out of the SHOROC mentioned seeing the trail on TV (Sydney Weekender – airing 19th April 2015).

Figure 2 shows the mode of travel for survey participants on the day they were surveyed. By far the majority of survey participants travelled to the trail by car (66%), with 72% of pedestrians (vs 52% of cyclists) using this mode. A quarter of the pedestrians had also walked to get to the trail, and 45.5% of cyclists had cycled to the trail. Of those who lived in suburbs neighbouring the trail (Elanora Heights/Narrabeen/North Narrabeen, Cromer/Dee Why, Collaroy) 46% had still travelled by car, with a third travelling for five minutes or less by this mode. Among those cycling to the trail, 40% had cycled more than ten minutes to the trail, and 17% for 30 minutes or more.

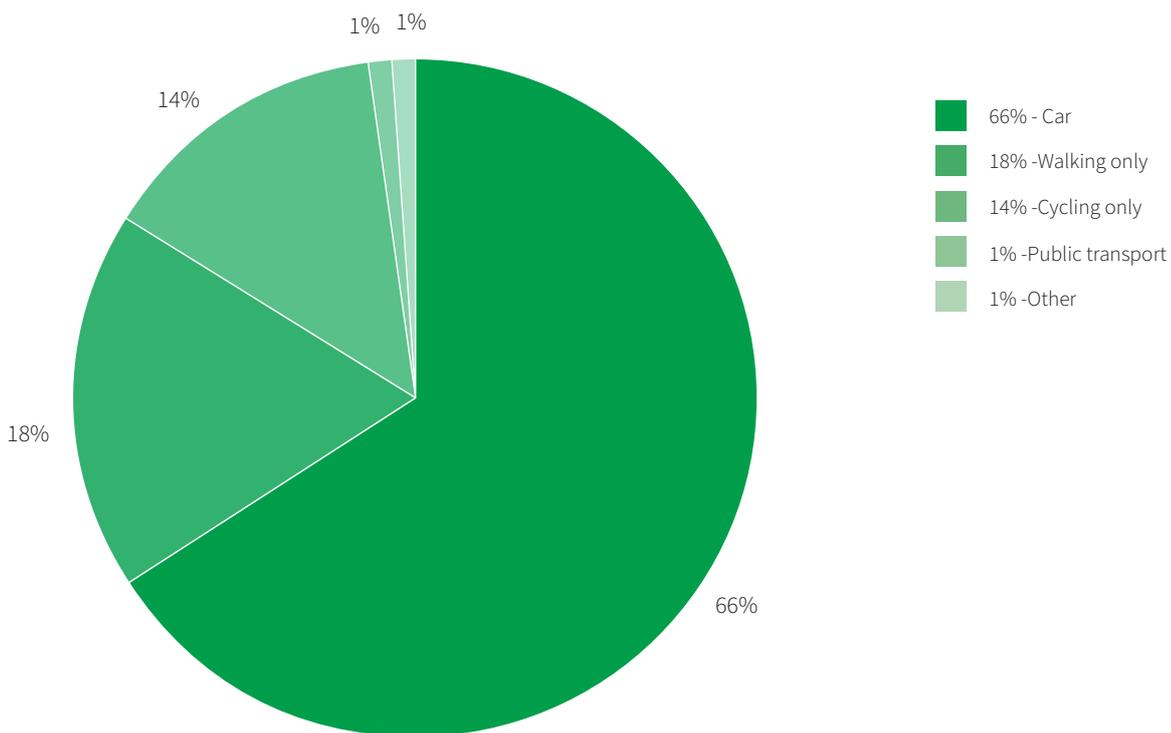


Figure 2: How participant travelled to the trail on the day of survey

ENTRY AND EXIT POINTS

There are multiple points of entry to the trail, some with dedicated car parking areas (Middle Creek Reserve, Jamieson Park, Bilarong Reserve, Berry Reserve) and others with street parking. Figure 3 shows the proportion of survey participants reporting the points at which they entered the trail.

Given the location of the survey site (just west of the South Creek bridge on the new section of trail – see area marked ‘Survey’ in Figure 3) unsurprisingly 48% of the participants had entered at either South Creek or Middle Creek Reserve (Figure 3). Bilarong Reserve was the next most popular point of entry (15%) followed by Berry Reserve (12%) and Jamieson park (9%). The distribution of the exit points was almost identical to entry points, consistent with almost all users being on the trail

for recreational purposes rather than as part of a commuting trip and needing to return to the same point to retrieve their car.

Figure 4 displays the distribution of residence of the survey participants by trail entry points. As may be expected, South Creek and the south eastern foreshore entries consisting of Narrabeen St, Devitt St, Wheeler Park and Walker Avenue/ The Esplanade were dominated by local users. Users from other local council areas preferred Middle Creek Reserve and Bilarong Reserve as their point of entry and the small number of users from elsewhere were distributed across all entry points except the south east foreshore group.

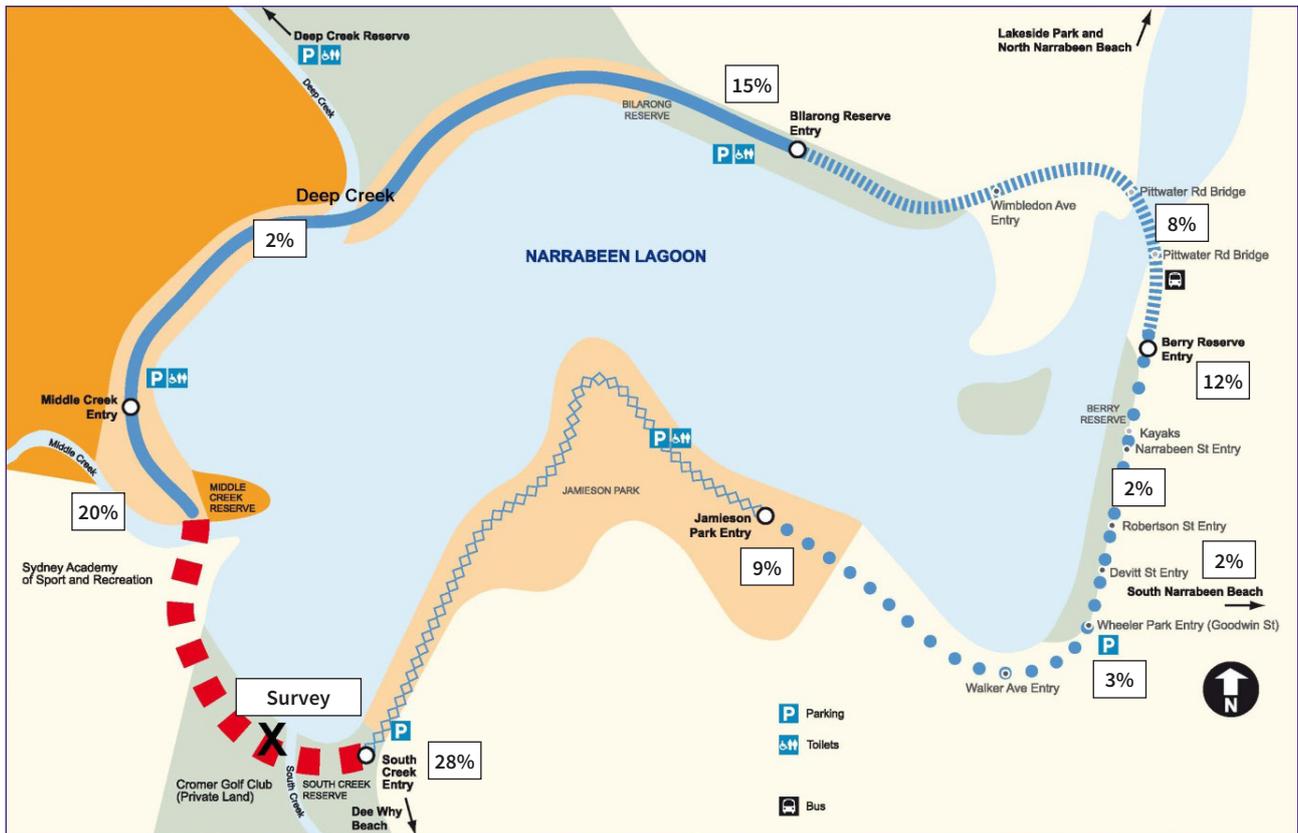


Figure 3: Points of entry to the trail on the day of survey

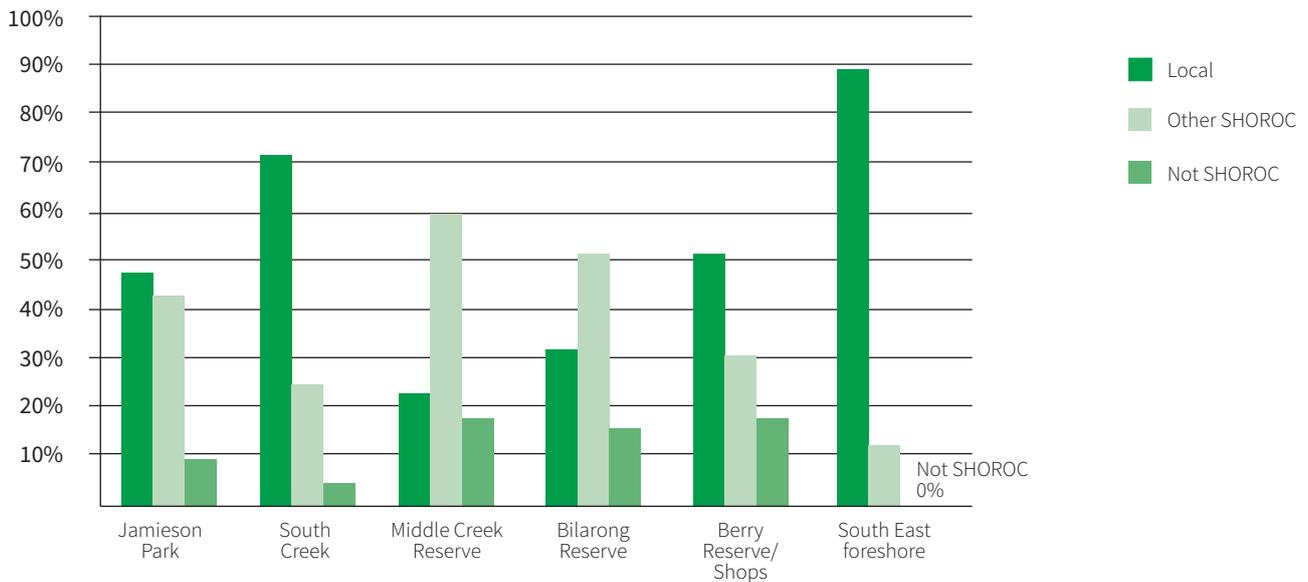


Figure 4: Six most popular locations of trail entry by place of residence

* 'Local' areas include postcodes for suburbs immediately bordering the trail, name Elanora Heights/Narrabeen, Collaroy, Cromer/Dee Why

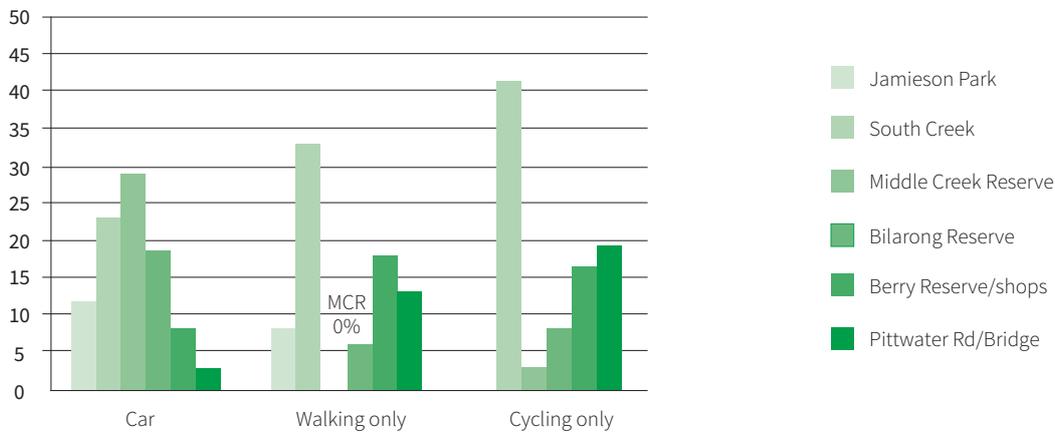


Figure 5: Distribution of the six most popular locations of trail entry by mode of travel to trail

Figure 5 shows the six most popular points of entry by mode of travel to the trail. The entry points showed significant variation by travel mode. Among car users, Middle Creek was the most popular point of entry but none of those walking to the trail and only one person cycling to the trail entered at Middle Creek Reserve.

Among respondents coming to the trail on foot or by bike, entering by South Creek was more prevalent. Again, due to the location of the survey, there is likely to be bias towards these two entry points in this sample. However, the distribution across entry points by user type is consistent with the availability of safe/pleasant means of access to the trail by those actively travelling. The eastern and southern foreshores where the South Creek, Jamieson Park and Berry Reserve

entries are located, have connecting share pathways, making those approaches more attractive for cyclists and pedestrians. The Middle Creek Reserve entry by comparison, is relatively distant from residential streets and is located directly at a busy road with fast moving traffic (80km speed limit), hence is convenient for those using motorised transport, but not those using active travel modes to get to the trail.

SAFETY AND MAINTENANCE

Survey participants were asked to rate the safety of the trail on a scale of one to five where 1 was very unsafe and 5 was very safe. A clear majority (76.3%) rated the trail 4 or 5 and only three people gave a rating of 1 and a further nine a rating of 2. Those who rated the trail 3 or lower were further asked about what they felt was unsafe about the trail, with as many options marked as reported. Over half (54%) nominated fast cyclists, and 17% indicated trail users other than cyclists as safety hazards. Only a few participants indicated crime/violence (n=3) or physical hazards (n=2) as a concern. It was clear from the open-ended comments made that conflict between users arose especially where the trail is narrow or where there is restricted vision. Participants nominated both pedestrians (not keeping to the left, not paying attention) and cyclists (going too fast, not using bell) as needing to modify their behaviour on the trail. Some people also qualified their answers by saying that they were not concerned necessarily for themselves but for small children using the trail. The following comments were typical:

“Trail is safe but people are not; cyclists getting better; can’t walk two abreast”

Female pedestrian, age 65+ years

“Children are unpredictable - own and other people’s children”

Female cyclist, 35-44 years

“...pedestrians don’t hear you when you use your bell, and when I walk the cyclists come too fast, too narrow; ... northern and southern sides are the worst”

Male pedestrian, 35-44 years

“Width of trail - so popular, some not sharing”

Male cyclist, 35-44 years

Figure 6 shows a breakdown of safety ratings of 3 or lower across different subgroups of users. There were no statistically significant differences in ratings by user type, gender, age or whether the person was with children on the day they were surveyed thereby indicating some homogeneity in opinions across different user subgroups.

Maintenance ratings (on a scale of 1 to 5 with 5 indicating very well maintained, and 1 indicating not well maintained) showed little variation with over 95% rating maintenance a 4 or a 5. This is a significant finding given there were severe storms in the area in the preceding couple of weeks of the second survey.

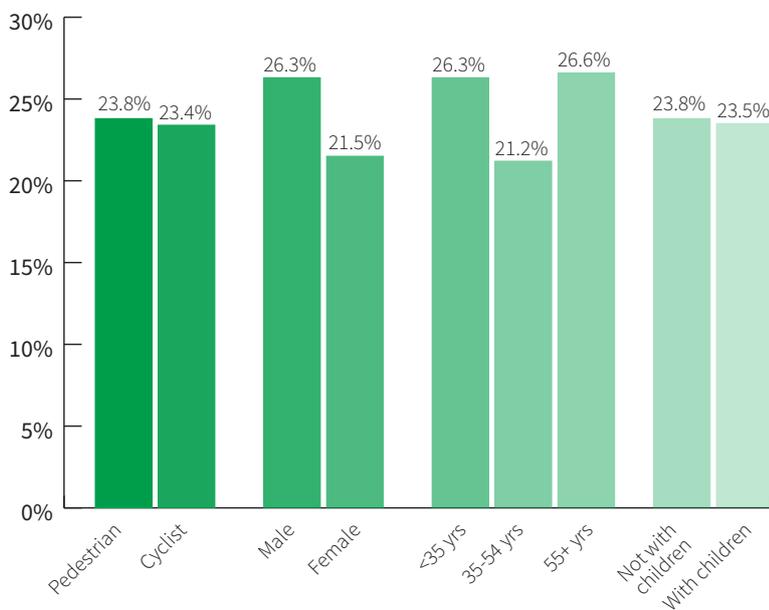


Figure 6: Proportion rating the trail 1-3 out of five by user type, gender, age and whether with children on the day of the survey

PHYSICAL ACTIVITY ON TRAIL

On the day of survey, 66% reported that they were travelling the full trail loop (approximately 8.5km), more commonly among cyclists (80.5%) than pedestrians (59%). Among those who had used the trail previously, 48% said that since the new section opened they were doing more physical activity at the trail and this was additional to their other physical activity. In other words, their total physical activity had increased since the loop had been completed. Only three people said they were doing less physical activity since the trail opened - two because they were now doing the full loop rather than a 10km 'out-and-back' route they used to take and one said he used to cycle more but the trail was now too busy to do this. The remaining 50% reported that on balance, they were doing the same total amount of physical activity post- as pre-completion of the loop.

A number of participants mentioned they were using the trail differently since the new section opened (which may or may not have translated to more total physical activity). Open ended questioning showed that some people were now riding bikes rather than going on foot, running instead of walking, and others were bringing their children and/or walking with other people which they did not do previously. There was a strong theme amongst these comments that the completion of the loop encouraged spending longer at the trail, with many people saying the difference was that they could now do a full circumnavigation of the lagoon.

We also asked participants about how much physical activity they had done in past week using a validated question (see Appendix, [17]). Figure 7 below shows the frequency of people reporting across the number of days in the past week on which they did at least 30 minutes of moderate to vigorous physical activity (MVPA).

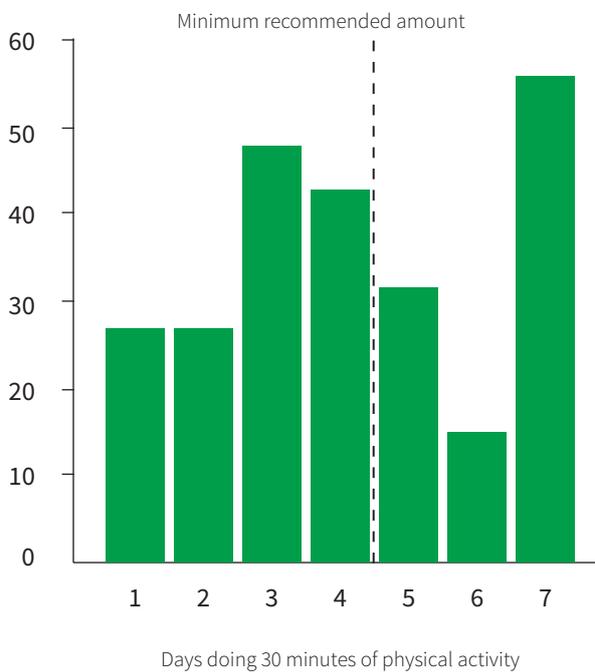


Figure 7: Number of days on which doing at least 30 minutes of moderate to vigorous physical activity in the past week (n=248)

Current guidelines recommend doing at least 30 minutes of MVPA on at least five days per week. Among our sample, 58.5% were not reaching the recommended amount of physical activity, somewhat higher than that estimated for the general NSW population aged 16 and over (44.8%)[18] (although the latter estimate uses a different question to estimate physical activity level and therefore is not directly comparable). Significantly, this finding demonstrates that, at least among those sampled on the day of our survey, the trail is being used by people with a range of physical activity levels and is not just attracting those who are already sufficiently active. However, these data should be interpreted with caution as there were quite a number of people running on the trail who declined to stop for the survey. Therefore our estimate prevalence of sufficient physical activity may be biased downwards because those who are more physically active may not have been prepared to stop their exercise for the survey.

Figure 8 below shows the percentage of those with data on the impact of the trail on physical activity (n=180) who reported doing more, less or the same total amount of physical activity since the new section opened by physical activity in the past week. Significantly, those who report levels of physical activity in the past week that do not meet current guidelines (ie., less than five days doing 30 minutes of MVPA) are more likely to report doing more total physical activity since the opening of the completed trail (55.5% vs 39.2%, p=0.031). Once again this suggests that trail completion may encourage those with lower overall physical activity levels to engage in more physical activity. Further, given that 14.5% of the sample reported being active only one or two days in the week, activity undertaken at the trail may contribute an important portion to the total physical activity of those people with very low levels overall.

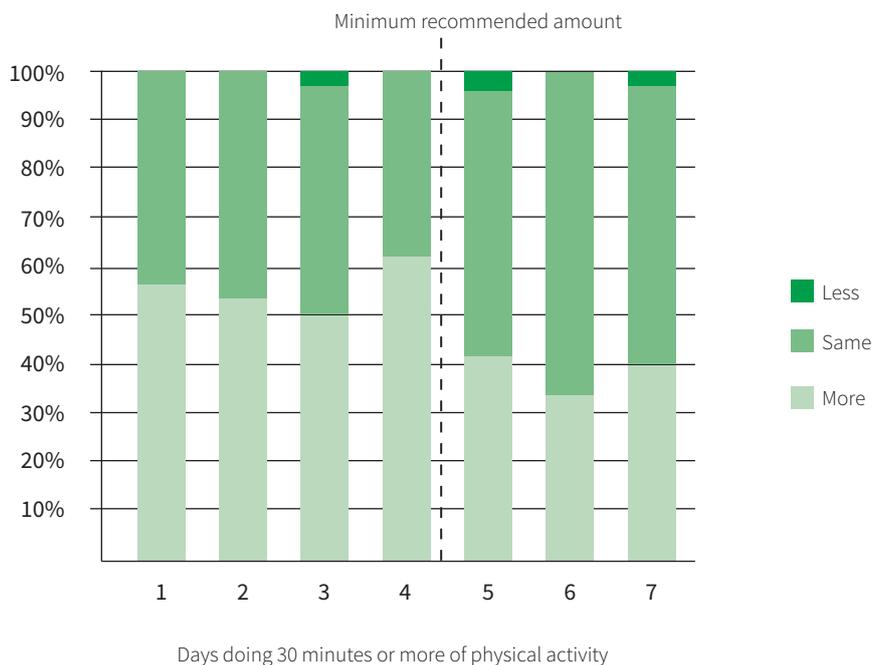


Figure 8: Distribution of reporting more, less or the same physical activity by days doing at least 30 minutes of moderate to vigorous physical activity in the past week (n=180)

MOTIVATIONS FOR USE

We asked participants what the main reason(s) were that they used the Narrabeen Lagoon Trail in particular and the responses were mix of purpose (what they used it for) and motivation/attraction. Table 2 shows the proportions mentioning the eight most prevalent responses (multiple responses were recorded where mentioned, but main reasons

were stressed when asking the question). As there were no significant differences by user type, the results for cyclists and pedestrians are presented together. Other reasons mentioned by a few participants not shown in Table 2 included that the trail is a loop, a good distance in length and that the participant was curious to see it.

PURPOSE/REASON	%	FREQUENCY
Exercise	51.8	129
Scenery/bushland/wildlife	43.4	108
Convenient (home/place of interest close to trail)	16.5	41
Relaxation	8.4	21
My kids can play here	8.0	20
Safe/secure/no traffic	8.0	20
Socialize with friends/family	7.2	18
Accessibility (flat/paved)	5.6	14

* Can select more than one answer

Table 2: Purpose/reason for using Narrabeen Lagoon Trail*

VISUAL COUNT - METHODS

Visual counts were conducted at two points on the existing trail sections pre- and post-completion, plus at a third point on the newly completed section (post-implementation only). Counts were undertaken on two separate (weekend) occasions prior to completion of the final trail section (11th of October and 7th December 2014), and two occasions approximately six weeks (21st March 2015) and 12 months post baseline (October 2015). Counts were also conducted on the new section on the days of the survey for the purpose of calculating survey response rates, but did not distinguish direction of travel. On the existing sections of the trail counts took place near the electronic counters placed by the Council. Visual counts were conducted in a similar fashion as those conducted by Bike Futures (<https://www.bicyclenetwork.com.au/general/for-government-and-business/3375/>) (see

Appendix for example of a count sheet). Specifically, only counts were recorded and data was collected by observation. Counts were broken down by gender of user, user type (pedestrian or cyclist), direction of travel (not on survey days), and adult or child. Counts in October and November 2015 were also broken down by hour to give greater granularity for comparison with electronic counter data (see Appendix). Following feedback from research assistants after the first count, dogs on the trail were also counted. A written Participant Information Statement was made available to any trail user approaching and making enquiries of the data collectors regarding the study. Otherwise, so as to not interfere with trail use, the researchers did not approach any trail user. The results of the visual counts are shown in Tables 3, 4 and 5 below, broken down by location.

JAMIESON PARK 9AM – 1PM						
		2014 pre-completion		2015 post-completion		
	Subpopulation	11th Oct	7th Dec	7th Dec	10th Oct	1st Nov
Pedestrians to carpark	All	109	78	78	196	241
	Adult male	36	28	28	61	93
	Adult female	67	45	45	117	116
	Children	6	5	5	18	32
Cyclists to carpark	All	119	101	101	177	194
	Adult male	53	44	44	62	64
	Adult female	30	33	33	59	57
	Children	36	24	24	56	73
Pedestrians to Cromer	All	113	75	75	174	186
	Adult male	42	31	31	52	62
	Adult female	64	41	41	114	102
	Children	7	3	3	8	22
Cyclists to Cromer	All	102	94	94	132	213
	Adult male	45	42	42	57	82
	Adult female	22	30	30	37	50
	Children	35	22	22	38	81
		2 people on coast track (dogs not counted)	30 dogs 3 people on coast track	30 dogs 3 people on coast track	30 dogs 3 people on coast track	50 dogs 6 people on coast track

Table 3: Distribution of users Jamieson Park pre- and post-loop completion by visual count

MIDDLE CREEK RESERVE 9AM – 1PM						
		2014 pre-completion		2015 post-completion		
	Subpopulation	11th Oct	7th Dec	21st Mar *	10th Oc	1st Nov
Pedestrians to carpark	All	57	28	92	174	189
	Adult male	20	10	40	49	72
	Adult female	35	16	44	111	94
	Children	2	2	8	14	23
Cyclists to carpark	All	49	52	43	169	181
	Adult male	25	23	14	55	76
	Adult female	14	16	16	60	47
	Children	10	13	13	54	58
Pedestrians to Bilarong	All	39	25	91	139	147
	Adult male	15	11	40	42	46
	Adult female	22	13	47	91	81
	Children	2	1	4	6	20
Cyclists to Bilarong	All	59	59	66	125	216
	Adult male	33	31	34	58	83
	Adult female	16	16	20	36	47
	Children	10	12	12	31	86
		12 dogs	3 dogs	3 dogs	3 dogs	3 dogs

Table 4: Distribution of users Middle Creek Reserve pre- and post-loop completion by visual count

* There was light rain on this day

NEW SECTION (JAMES WHEELER PARADE) 9AM – 1PM				
	Subpopulation	21st March 2015*	10th October 2015	1st November 2015
Pedestrians to James Wheeler	All	108	221	261
	Adult male	41	76	92
	Adult female	52	124	129
	Children	15	21	40
Cyclists to James Wheeler	All	47	188	219
	Adult male	20	60	79
	Adult female	16	59	58
	Children	11	69	82
Pedestrians to Middle Creek	All	106	190	220
	Adult male	42	60	64
	Adult female	54	115	121
	Children	10	15	35
Cyclists to Middle Creek	All	60	126	211
	Adult male	29	52	75
	Adult female	16	31	43
	Children	15	43	93
		41 dogs	61 dogs	66 dogs

Table 5: Distribution of users on the new section (James Wheeler Parade) post-loop completion by visual count

* There was light rain on this day

The main purpose of the visual count was to examine whether the distribution of the different subpopulations using the trail varied from before loop completion compared with after. A secondary purpose was to compare the visual counts with those recorded by the electronic counters. Data collected in October/November 2015 is given by the hour for this purpose (see Table 5, Appendix).

In general, the trail seems to be frequented by more women than men, although men constitute a larger proportion of cyclists as they do in the wider cycling population [19]. The following discussion looks at changes and differences in subpopulation use pre- to post-loop completion and across count sites.

DISTRIBUTION OF USERS PRE- AND POST- LOOP OPENING AND BETWEEN SITES

An advantage of including a visual count of users in addition to the electronic counts is the opportunity to examine the impact of the completion of the loop on the broad profile of users including any changes in pedestrian/cyclist or adult/child ratios, and whether these characteristics differ by site on the trail.

As may be seen by Tables 3 and 4 above, the total number of people passing the visual count sites increased from pre to post-loop completion. However, there were no statistically significant differences pre- to post-opening at the Jamieson Park site across the subpopulations using the trail travelling clockwise (towards Cromer: males 41.7% vs 36.1%, females 40.9% vs 43.7%, children 17.5% vs 20.2% pre- to post-opening respectively) or anti-clockwise (towards Narrabeen: males 39.6% vs 35.0%, females 43.0% vs 43.5%, children 17.4% vs 21.7% pre- to post-opening respectively). However, the distribution at Middle Creek Reserve did change significantly in the clockwise direction with males reducing their representation by over 10% and children increasing by almost 7% (towards Bilarong: males 49.5% vs 38.7%, females 36.8% vs 41.1%, children 13.7 vs 20.3% pre- to post-opening respectively, $p=0.016$). A similar trend towards a higher proportion of children was seen in the anti-clockwise (towards Middle Creek Reserve: males 41.9% vs 36.1%, females 43.6% vs 43.9%, children 14.5 vs 20.1% pre- to post-opening

respectively) but did not reach statistical significance. When the data were collapsed to represent children vs adults, the ratios were also comparable pre- to post-opening for Jamieson Park, but for Middle Creek Reserve the clockwise direction again demonstrated a statistically significant increase in the proportion of children passing the count site (13.7% vs 20.3%, $p=0.043$).

For the analyses comparing user distributions between the sites, we collapsed the data over direction of travel to form totals for each subgroup counted at each site. There were no significant differences in the proportions of males, females and children using the Jamieson Park section vs Middle Creek Reserve prior to completion of the loop, with around 44% of users identified as male, 40% as female and 16% as children across both directions combined. Post loop completion there were no significant differences between the three sites (Jamieson Park, Middle Creek and the new section) with 36.6%, 42% and 21.6% identified as male, female and child respectively for both directions (clockwise and anti-clockwise combined). The lack of difference remained when tested separately for each direction, and when males and female adults were combined; the proportion of children at the three sites being approximately one-fifth of the traffic post-loop completion.

USE OF COAST PATH AT JAMIESON PARK AND DOG TRAFFIC

There was concern expressed by Warringah Council staff that the electronic counter at Jamieson Park may be undercounting passes at this section because trail users were utilising a foreshore path to and from the Jamieson Park entrance that bypassed the counter. There was no evidence to support this concern on the days on which the visual count was undertaken with less than 10 people per occasion using this route during the four hour count period, with no increase

post-loop completion other than might be expected with the general increase in traffic. The pattern of dogs varied, with an increase at Jamieson Park over the five count occasions, but fluctuations for Middle Creek Reserve in both directions. The new section at James Wheeler Parade appears to be the most popular for dog-walking, but more data points would be required to establish this definitively.



ELECTRONIC COUNTER DATA

METHODS

Electronic counters are useful for objectively monitoring pedestrian and bike traffic pre- and post-implementation in terms of counts, trend, and the examining influence of seasonal and weather variation. Warringah Council has passive infrared pyroelectric counters (EcoCounter, model Eco-Multi) placed in three locations (Jamieson Park, Middle Creek Reserve, and James Wheeler Parade (the new section) on the trail. The electronic counters are located such that trail users must pass them when using certain sections of the trail to ensure capture of all trail users, and only trail users. Counts should not be subject to bias if counters are functioning appropriately and can monitor use over long periods. The word 'bike' is used here rather than 'cyclist' as the counters detect bikes using metal detection rather than persons on bikes.

Warringah Council provided access to data from electronic counters for analysis for the period 3rd November 2012 to 14th July 2015 (Jamieson Park and Middle Creek Reserve) and 26th February 2015 to 14th July 2015 (James Wheeler Parade).

Electronic counter data were downloaded on 14th July 2015 by Warringah Council. Data published by the Australian Bureau of Meteorology from the closest measurement stations for daily total rainfall (Long Reef) and maximum temperature (Terrey Hills) were merged with the trail data. The counter data were in hourly format but were collapsed to daily (new section) and weekly (Middle Creek Reserve, Jamieson Park) format for analysis. Time series analyses were undertaken for each site (Middle Creek Reserve, Jamieson Park, and the new section) for each traffic type (pedestrian/bike) by direction. Counts were coded for weather conditions, public holidays, school holidays and trail closure (due to storm damage). Note that the counter can only record 'passes' and therefore the actual number of people using the trail is unknown. However, analysing passes separately by each direction can provide a proxy estimate of people assuming that they are less likely to pass in the same direction twice. Predicted values for all analyses have been adjusted for underlying trend, the change in trend post-loop completion, average daily rainfall, number of public holidays, and school holidays¹.

¹ Note that average maximum temperature, season, and when the trail was closed following storm damage in 2015 were also tested in the models but did not reach statistical significance in most models and therefore were not retained in the final model.

RESULTS - MIDDLE CREEK RESERVE



Figure 9 shows the time series counts per week for bike and pedestrian “passes” going in both directions (clockwise towards Bilarong Reserve and anti-clockwise is towards Middle Creek Reserve) using the predicted values from the time series models for the 19 weeks February 25th to July 14th for each year 2013, 2014 and 2015.

The adjusted count of passes in the period since the loop was completed (February 2015) varied between approximately 1600 (pedestrians travelling to Middle Creek) to around 1900

(bikes to Bilarong) per week. In terms of relative change over time, both modes (bike and pedestrian) and directions (clockwise and anti-clockwise) show a clear and significant increase in traffic following the completion of the loop by comparison with the two years prior to completion of the loop over the same time periods. The adjusted average number of passes by bikes on a weekly basis in 2015 almost doubled (196% & 199% anti-clockwise and clockwise respectively) and pedestrians by 204% (clockwise direction) the counts in 2014.

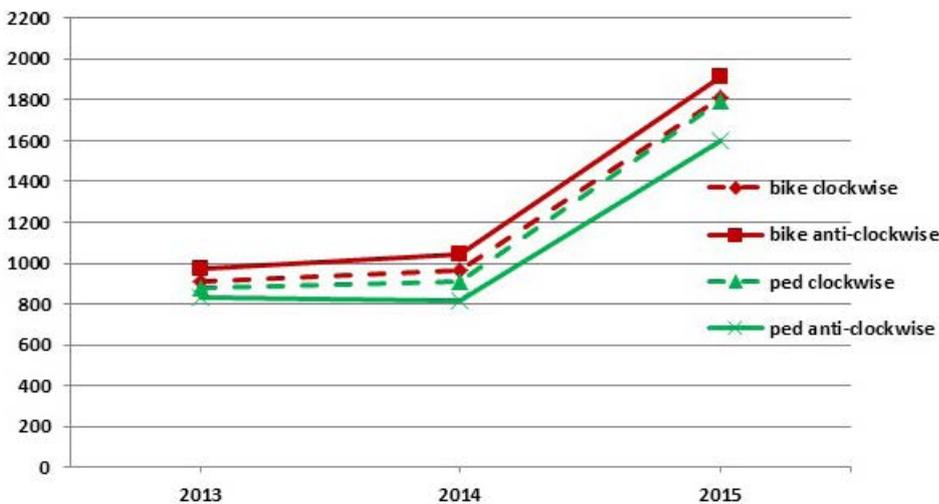


Figure 9: Plot of predicted passes by travel mode (bike or pedestrian) and direction (clockwise and anti-clockwise) for Middle Creek electronic counter for Week 9 to 28 2013, 2014, 2015.

RESULTS - JAMIESON PARK



Figure 10 shows the time series counts per week for bike and pedestrian “passes” towards the South Creek entry (clockwise) and towards Jamieson Park (anti-clockwise) using the predicted values from the time series models for the 19 weeks February 25th to July 14th for each year 2013, 2014 and 2015.

A similar pattern to Middle Creek was demonstrated at the Jamieson Park site in that there was a dramatic increase in traffic in the 19 week period measured post-loop completion

compared with the same period in the preceding two years. The increases were most pronounced for pedestrians with counts 312% and 341% for the anti-clockwise and clockwise directions respectively of the counts in 2013. Bike counts were between approximately 250% to 280% times higher in 2015 compared with the same periods in the two preceding years. There was, however, a notable data anomaly in the pedestrian data in February 2015 which is discussed in detail in the Appendix.

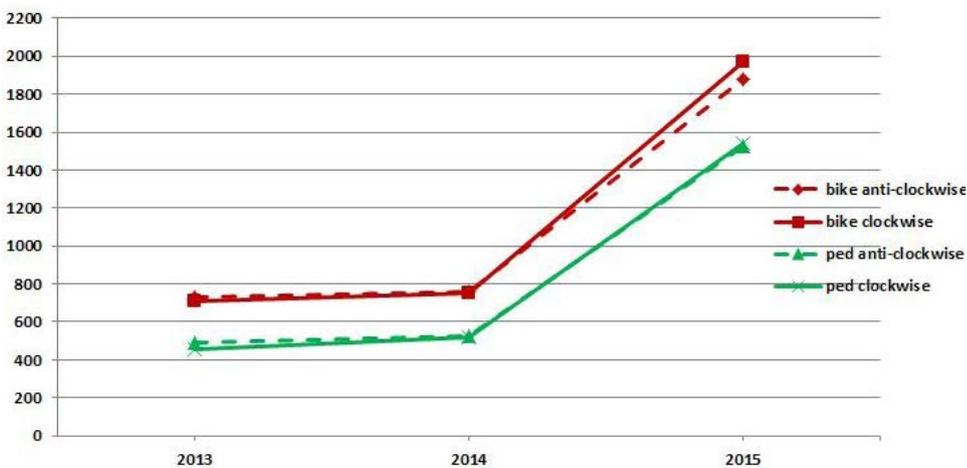


Figure 10: Plot of predicted passes by travel mode (bike or pedestrian) and direction (clockwise and anti-clockwise) for Jamieson Park electronic counter for Week 9 to 28 2013, 2014, 2015.

RESULTS - NEW SECTION (JAMES WHEELER PARADE)

A counter was installed on the new section of the trail and commenced operation on the 26th February 2015. A graph of the time series in daily format for bikes travelling towards South Creek Reserve is shown in Figure 11 with the observed counts shown by the red line and the adjusted counts shown by the blue line. The counts are daily as the period for which data were available was only 19 weeks and therefore more suited to a more frequent unit of time analysis.

The adjusted time series of predicted values are adjusted for the underlying trend, whether the day was a Saturday or Sunday total rainfall, average maximum daily temperature, public holiday and school holidays. The underlying trend was not statistically significant once adjusted for all other variables, demonstrating no significant increase or decrease over the 19 week period. Counts were increasing on school and public holidays and on weekend days as would be expected (with Sunday the most popular day). Further, the higher the maximum daily temperature, the higher the count; and the more rainfall the lower the predicted daily count.

The most popular days within the period were on the third Sunday following the opening of the loop in 2015, the Easter weekend and the public holiday Monday in June 2015 where the (unadjusted) passes for bikes (anti-clockwise) and pedestrians (both directions) each exceeded 1000 for Easter Sunday, and for bikes in both directions for the Monday in the June long weekend. The time series patterns and correlates were very similar for the opposite direction for



bikes and the pedestrian counts, although rainfall was not a significant predictor of counts of pedestrians in the clockwise direction. The predicted average daily passes according to the time series models ranged between 285 (bikes) and 315 (pedestrians), with weekend averages for both travel modes and directions exceeding 500 each.

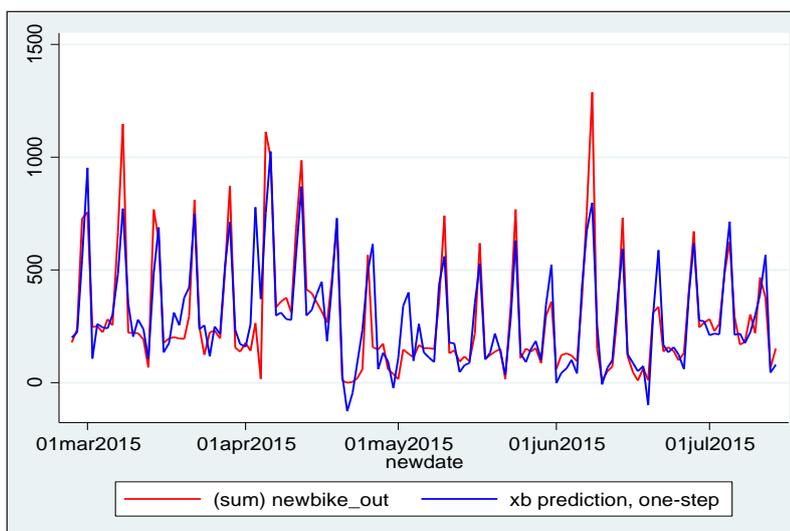


Figure 11: Unadjusted (red line) and adjusted (blue line) daily count of bikes travelling towards South Creek Reserve (anti-clockwise) on the new section from opening (Feb 25th 2015) to July 14th 2015

² Initially a term was tested for 'weekend' for Saturdays and Sundays but this left some periodicity unexplained and the model function improved with separate terms for Saturday and Sunday.

RATIO OF PEDESTRIANS TO CYCLISTS ACROSS EXISTING TRAIL SECTIONS PRE TO POST-COMPLETION

One area of interest in examining the impact of completion of the trail was whether the finalisation of the new section was associated with a change in the distribution of users across the existing sections of trail. The visual count data described above gave some insight into this in terms of the demographic break down of users (i.e., male, female child users). We used the electronic counter data to examine the proportional distribution (ratio of average weekly counts) of traffic type (bike/pedestrian) pre- and post-completion on existing sections of the trail. At Jamieson Park, there was a small but significant increase in the proportion of pedestrian traffic travelling anti-clockwise (towards Narrabeen) from pre (40.4%) to post (44.5%, $p=0.011$) completion, with similar results for the clockwise direction (39.9% vs 43.7%, $p=0.019$, pre to post respectively).

At Middle Creek there was no significant change in the ratio of bikes to pedestrians pre- (51.4% vs 48.6%) to post completion of the loop in the clockwise direction (50.2% vs 49.8%), or anti-clockwise direction pre- and post-completion (both approximately 54% vs 45% bikes vs pedestrians).

Therefore there seems to be only minimal variation of the distribution of travel mode with the opening of the new section in that more pedestrian traffic is occurring in the Jamieson Park section. Further analysis could be conducted to determine whether the results observed are maintained when examined separately for weekday and weekend use, as the current analysis used average weekly counts (weekday plus weekend) to examine distributional changes.

RATIO OF PEDESTRIANS TO CYCLISTS ACROSS EXISTING AND NEW TRAIL SECTIONS POST-COMPLETION

In order to examine whether the ratio of bikes to pedestrians post-completion was different between the new section and the two existing sections, the ratios of the two travel modes were compared using the observed data. Figure 12 shows the proportion of traffic at each of the sites that were bikes and pedestrians. Both Middle Creek and Jamieson Park demonstrated statistically significant differences in the ratio of bikes to pedestrians in both clockwise and counter-clockwise

travel directions when compared to the new section. Bikes were a smaller proportion of traffic travelling anti-clockwise at the new section (47.9%) compared with Middle Creek (54.4%, $p<0.001$) and Jamieson Park (55.5%, $p<0.001$). In the opposite direction, 49.1% of the traffic at the new section was bikes, comparable to 50.2% at Middle Creek, but significantly lower than 56.3% at Jamieson Park ($p<0.001$).

³ Observed values, rather than predicted values from the time series models, were used despite there being likely count inflation for Jamieson Park for some count dates (see Appendix); as the observed counts were adjusted for the ratio between pedestrians and bikes which is the parameter under assessment for this set of analyses.

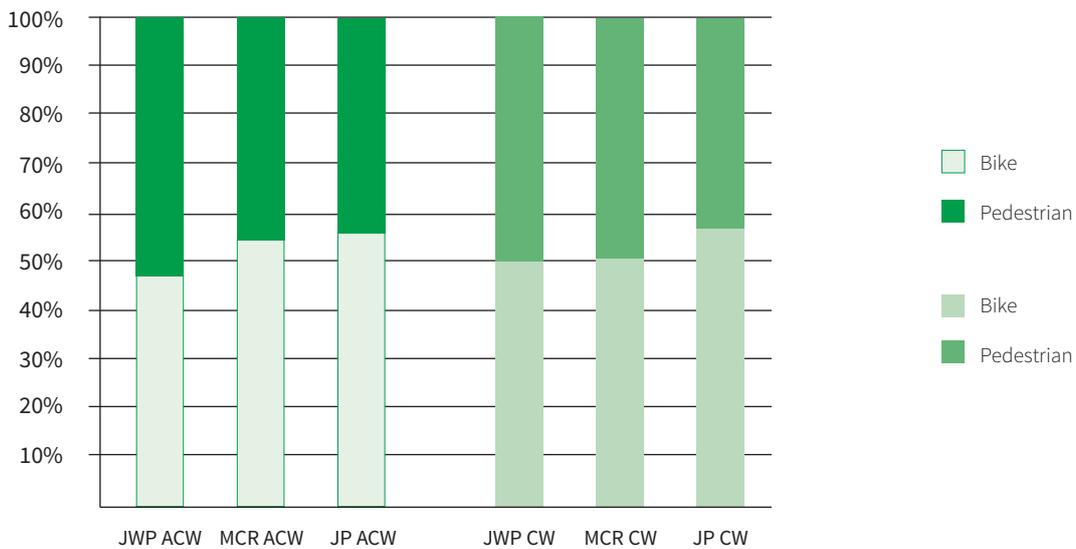


Figure 12: Proportion of traffic as bike or pedestrian for new section, James Wheeler Parade (JWP), Middle Creek (MC), and Jamieson Park (JP) in period since completion of loop (ACW - anti-clockwise; CW - clockwise)

Thus it appears that the new section attracts more pedestrians than cyclists when compared to the existing sections. One explanation may be that the existing sections are longer between entry and exit points (Jamieson Park to South Creek, 2.3km, Middle Creek Reserve to Bilarong Reserve 2.2km,

compared with Middle Creek Reserve to South Creek 1.2km) and the surfaces of the trail (more packed earth rather than concrete) making the new section comparatively more accessible for those on foot.

SUMMARY

This evaluation of the Narrabeen Lagoon Trail used a range of data sources to examine the impact of completion on usage. Electronic counter data showed no underlying trend (either increasing or decreasing) over the long term 2012 to 2015 but a dramatic increase in traffic on existing parts of the trail following completion of the new section in February 2015 to July 2015. The survey data suggest that the increase usage may be in part due to some local promotion of the trail which may have attracted new users, but the majority of the increase is likely due to being able to fully circumnavigate the lagoon and the ease of accessibility of most parts of the trail, but particularly the new section at James Wheeler Parade. The distribution of travel mode in terms of bikes versus pedestrians did not change markedly from pre to post-completion on the existing sections of trail, but the new section seems to attract proportionately more pedestrian traffic than the neighbouring sections of Jamieson Park and Middle Creek Reserve perhaps because of the accessibility to parking, being a relatively short section of path and having a regular surface accessible to all types of users.

Most of the users of the trail according to the survey are local residents in the neighbouring Council areas. A small number of visitors from other parts of Sydney use the trail, some of whom had seen it described on a leisure program on television. Whilst most of the users, whether pedestrian or cyclist, came to the trail by car, the data suggest that having good share-path facilities promotes active travel to the trail, with a not insubstantial number of users cycling some distance. The completion of the loop seems to have provided impetus for previous users to come more frequently, with many people stating that they are doing additional physical activity at the trail since it opened. By far the majority felt the trail was well maintained and safe. The main safety concern described by survey participants centred on the speed of some cyclists in the context of older pedestrians and children being unpredictable trail users. However, in general, the spontaneous responses recorded demonstrated an overwhelmingly positive assessment of completion of the trail among those surveyed. The accessibility, ability to use the trail 'as a family', being away from traffic and be able to go around the lake uninterrupted were all cited as positive outcomes of the loop completion and the trail in general.

LIMITATIONS

Despite using a range of data sources for this evaluation there are a number of limitations to this work. First, the intercept survey was conducted on only two occasions post-opening the loop. As such, estimates of changes in physical activity could only be assessed by retrospective self-report and therefore may be subject to recall bias. Further, the survey was conducted at only one site on the new section of the trail and if conducted elsewhere on the trail could have yielded a different picture. However, this site was chosen because the researchers primarily wanted to capture the opinions of those actually using the new section. Additionally, this part of the trail is accessed by those specifically using the trail as a trail whereas other parts of the path are also accessed by those solely using picnic areas, watercraft facilities or visiting surrounding shops. Surveying in these alternative areas would have made it more difficult to sample the target population of Narrabeen Lagoon Trail users, and in particular, users of the new section. Finally, the intercept survey could not gauge impact on the physical activity levels of the population resident in the areas surrounding the trail as would be possible with a household survey. However, resources did not support this option and therefore the impact on those actually using the trail was prioritised.

As mentioned in the Methods section, visual count and electronic counts can only pertain to 'passes' and may for that reason be sensitive to repeat traffic in certain areas where 'out and back' trips are more prevalent. However, the single direction data were fairly consistent in terms of broad trends and we can be confident that, while these are not counts of the number of individuals using the trail at these sites, they do reflect the amount of pedestrian and bike traffic passing those points irrespective of whether these are single or repeat passes. If unidirectional trips are more likely post completion of the new section because people can return to their point of entry without doubling back, then the estimates of relative increases in counts at any one site may be viewed as a lower limit.

There were some data anomalies evident in the electronic counter data where the magnitude of, and reason for, over or under-counting was not clear. We have, however, made adjustments to these anomalous values according to recommended procedures. Further, the time-series models allowed us to generate predicted values based on valid data adjusted for weather, day of the week, average ratio of direction of travel and whether the missing data occurred on a holiday. Hence the comparisons across comparable time periods are likely to be reliable despite the existence of some erroneous counter values for a limited number of time points.



CONCLUSION

Completion of the Narrabeen Lagoon Trail, despite the considerable increase in traffic, has been received positively by users of the trail. The distribution of user-subpopulations has remained relatively stable except for a slight trend towards a higher proportion of children using some parts. The safety and maintenance of the trail is considered by users to be more than satisfactory, and the trail is seen as accessible and a good place to undertake exercise and enjoy natural scenery. Both pedestrians and cyclists alike make frequent use of the trail including the newly completed section. There is some evidence which suggests that completion of the loop is having

a positive impact on the amount of physical activity taking place at the trail and perhaps on the physical activity of trail users in general. Good connectivity and safe, separated paths seems to be associated with greater likelihood of actively traveling to the trail. The facility is well-utilised by local residents, especially those living in close proximity to the trail consistent with previous research [13]. Narrabeen Lagoon Trail fits well with current state policy aiming to increase the wellbeing of NSW residents; young and old, female and male, cyclist and pedestrian alike.

RECOMMENDATIONS FOR FUTURE MONITORING AND EVALUATION

This evaluation demonstrates the value of routine (electronic counters) and targeted (surveys and visual counts) data collection to inform decisions about the use of community facilities such as the Narrabeen Lagoon Trail. In particular, having a long term, continuous objective dataset reflecting traffic volumes at different points on the trail is invaluable for examining the impact of a range of both purposeful and unforeseen changes.

In considering the issues raised in this report concerning data anomalies, increased traffic, safety and cyclist/pedestrian conflict, we recommend that:

- An examination of the concordance of visual and electronic counts be undertaken
- Large anomalies in Ecounter data be investigated and adjusted for according to established procedures
- Supplementary and detailed observational data collection at identified locations of concern and cyclist/pedestrian conflict

Before instituting significant changes to the trail environment, Warringah Council could also consider:

- Potential impact on physical activity conducted at the trail (will proposed changes hinder or promote physical activity?)
- Whether the surrounding environment and travel options encourage safe, active travel
- Collecting pre-implementation data as appropriate so that impact can be validly assessed
- Conducting (repeat) household surveys of local residents to gauge population-level use, opinion and impact

At a broader level, we would recommend that other, large scale built environment projects be monitored and evaluated for their impact on physical activity, active travel and health of the community.

APPENDIX

INTERCEPT SURVEY

NARRABEEN LAGOON MULTI-USE RECREATIONAL TRAIL USER INTERCEPT SURVEY			
Interviewer ID:	Study ID:	Interview time:	
SECTION A			
<p>Hello, we are conducting a short survey about this trail as part of an evaluation by the University of Sydney (School of Public Health). We would like to ask you few questions mainly about your use of the trail today, and it shouldn't take more than 5 minutes. Participation is voluntary and you may refuse to answer any question or stop the survey at any time and your answers will be kept anonymous. If you take part, your responses will be added together with those from other people we survey today and the results may be published and used to inform future initiatives by our partners Warringah Council and the Northern Sydney Local Health District.</p> <p><i>Are you willing to take part in the survey? Can I just check, are you aged over 18? (If no, do not continue. Say "I'm sorry, we are only permitted to survey people who are aged 18 years or older. Thank you anyway")</i></p> <p>If yes, tick <input type="radio"/> verbal consent given</p>			
<p>IMPORTANT - READ OUT: I will be asking you a few questions about your use of the 'new' section of this trail and the Narrabeen lagoon Trail in general. By new section, I am talking about the part that has just recently been completed and runs between the South Creek entry in Cromer (show map) and the Middle Creek entry near Wakehurst Parkway.</p> <p>Interviewer: complete either before or after interview</p>			
Q1	Gender	<input type="radio"/> Male	<input type="radio"/> Female
Q2	User type	<input type="radio"/> Pedestrian	<input type="radio"/> Cyclist
Q3	Group size (ask if not sure)	<input type="radio"/> Alone	<input type="text"/> Number of adults including respondent <input type="text"/> Number of children <18 years
SECTION B: SURVEY STARTS HERE			
Q4	How often have you visited the Narrabeen Lagoon trail in the last year (since March 2014)? By that I mean the whole trail or any part of it as shown on this map (show map again)? <i>(Tick one only. Interviewer note, use of facilities/attending markets/ shops alone without travelling on the trail do not count)</i>	<input type="radio"/> This is the 1st time (go to Q.9) <input type="radio"/> Everyday <input type="radio"/> 3+ times per week <input type="radio"/> 1-2 times per week	<input type="radio"/> 1 per fortnight <input type="radio"/> Monthly <input type="radio"/> Every couple of months <input type="radio"/> A few times this year
Q5	Is this the first time you have been on this new section?	<input type="radio"/> Yes (Go to Q7)	<input type="radio"/> No (Go to Q6)
Q6	About how many times have you used the new section since it opened on the 25 th February 2015?	<input type="text"/> Insert number	
Q7	Have you used the Narrabeen Lagoon trail more, less or about the same since the new section has opened?	<input type="radio"/> More	<input type="radio"/> The same <input type="radio"/> Less
Q8	Since the new section opened, do you use the trail differently? That could be in terms of, how long, for what purpose, who you come with, where on the trail you go, or the type of activity you do when you are here? <i>(IMPORTANT: If use more or for longer, also probe if this replaces other physical activity or is additional. If use less, probe if they make up for this doing other physical activity)</i>	<input type="radio"/> Using it the same way OR describe below	
Q9	How did you know about the new section? <i>(If didn't know about it, mark 'found out this time whilst using trail')</i>	<input type="radio"/> Found out this time whilst using trail <input type="radio"/> Saw notice when using path previously <input type="radio"/> Word of mouth <input type="radio"/> People accompanying me knew about it <input type="radio"/> Read in newspaper <input type="radio"/> Saw on council website	Other (specify)

Q10	How did you get to the trail today?	<input type="radio"/> Car (including other people's cars or taxi) <input type="radio"/> Cycling only <input type="radio"/> Other (specify) _____	<input type="radio"/> Walking only <input type="radio"/> Public transport
Q11	How long did it take you to travel to the trail from home/work/previous destination?	_____ minutes _____ hours	
Q12	Can you show me where you entered the trail today and where you are likely to exit on this map please? <i>(Interviewer records entry/exit point)</i> <i>(Interviewer: If entry and exit point the same, find out route. That is, if doing whole loop or doing an 'out and back' with a turn-around point and note below)</i>	Entry <input type="radio"/> South Creek, Cromer <input type="radio"/> Jamieson Park <input type="radio"/> Walker Ave/Esplanade <input type="radio"/> Wheeler Park <input type="radio"/> Devitt St <input type="radio"/> Narrabeen st <input type="radio"/> Berry reserve/shops <input type="radio"/> Pittwater Rd/bridge <input type="radio"/> Bilarong Reserve <input type="radio"/> Deep Creek (inc bridge) <input type="radio"/> Middle Creek reserve <input type="radio"/> Don't know <input type="radio"/> Refused	Exit <input type="radio"/> South Creek, Cromer <input type="radio"/> Jamieson Park <input type="radio"/> Walker Ave/Esplanade <input type="radio"/> Wheeler Park <input type="radio"/> Devitt St <input type="radio"/> Narrabeen st <input type="radio"/> Berry reserve/shops <input type="radio"/> Pittwater Rd/bridge <input type="radio"/> Bilarong Reserve <input type="radio"/> Deep Creek (inc bridge) <input type="radio"/> Middle Creek reserve <input type="radio"/> Don't know <input type="radio"/> Refused
	Route: If out and back ask: At what point did you/will you turn around? <i>(Tick one only)</i>	<input type="radio"/> Full loop	<input type="radio"/> South Creek, Cromer <input type="radio"/> Jamieson Park <input type="radio"/> The Esplanade <input type="radio"/> Wheeler Park <input type="radio"/> Berry reserve/shops <input type="radio"/> Other (describe) _____ <input type="radio"/> Pittwater Rd/bridge <input type="radio"/> Bilarong Reserve <input type="radio"/> Deep Creek (inc bridge) <input type="radio"/> Middle Creek reserve <input type="radio"/> Don't know <input type="radio"/> Refused
Q13	What are the main reason(s) you use this particular trail? <i>(Do not read list, tick as many options as applicable)</i>	<input type="radio"/> To get some exercise <input type="radio"/> To relax <input type="radio"/> To enjoy the scenery <input type="radio"/> To socialize/meet friends <input type="radio"/> To let my children play <input type="radio"/> Convenience (home close to trail) <input type="radio"/> Other (specify) _____	<input type="radio"/> As a short-cut for getting to destinations <input type="radio"/> Dogs allowed <input type="radio"/> Safe/Secure <input type="radio"/> Accessible by car <input type="radio"/> Availability of parking
Q14	In general, how would you rate out of 5 the safety of this trail during day time, where 1 is not safe at all and 5 is very safe? <i>(If answer is 1, 2 or 3 go to Q15, if answer is 4 or 5 go to Q16)</i>	Not safe at all 1 2 3 4 5 Very safe	
Q15	Why do you feel it is not safe? <i>(Do not read out options, do not prompt, just mark as many as appropriate)</i>	<input type="radio"/> Physical hazards (uneven surface/vegetation/ poor visibility structures unsafe)? <input type="radio"/> Wildlife <input type="radio"/> Other (specify) _____	<input type="radio"/> Crime or violence <input type="radio"/> Speeding cyclists <input type="radio"/> Other users (apart from cyclists)
Q16	In general, how would you rate out of 5 how well this trail is looked after by the Council (eg. cleaned or maintained by Council) where 1 is not very well and 5 is very well? <i>(Circle one only)</i>	Not very well 1 2 3 4 5 Very well	

SECTION C: I AM NOW GOING TO ASK YOU A QUESTION ABOUT YOUR PHYSICAL ACTIVITY IN THE PAST WEEK		
Q17	In the past week, on how many days have you done a total of 30 minutes or more of physical activity which was enough to raise your breathing rate? This may include sport, exercise and brisk walking or cycling for recreation or to get to and from places but should not include housework or physical activity that is part of your job.	_____ days <input type="radio"/> Don't know <input type="radio"/> Refused
SECTION D: NOW A FEW FINAL QUESTIONS ABOUT YOU.		
Q18	Can I just ask, what is your age please?	
Q18b	<i>(If hesitates then read)</i> Which age group would you be in:	<input type="radio"/> 18-19 years old <input type="radio"/> 45-54 years old <input type="radio"/> 20-24 years old <input type="radio"/> 55-64 years old <input type="radio"/> 25-34 years old <input type="radio"/> 65+ years old <input type="radio"/> 35-44 years old
Q19	What is the postcode where you live?	<input type="radio"/> Refused
Q20	Do you have any additional comments about this trail?	

EXAMPLE OF VISUAL COUNT DATA COLLECTION SHEET

Location: Jamieson Park

Your name:

Count date: 1st November 2015

PEDESTRIANS			2 → 1 FROM CARPARK		
TIME	MALE	FEMALE	BOY	GIRL	UNKNOWN
9-10					
10-11					
11-12					
12-1					
CYCLISTS			2 → 1 FROM CARPARK		
TIME	MALE	FEMALE	BOY	GIRL	UNKNOWN
9-10					
10-11					
11-12					
12-1					
Dog Count					
Comments (including count of use of path 3)					

VISUAL COUNT COMPARISON OF USER TYPE PRE- TO POST TRAIL COMPLETION

Although the main analysis of distribution of user type was derived from the electronic counter data as detailed in the main body of this report, a similar analysis was conducted for visual count data. According to these analyses, the ratio of user types (pedestrians to cyclists) on the existing parts of the trail neighbouring the new section changed significantly from before to after the closing of the loop. Specifically, the proportion of pedestrians using the trail on the day of the visual count increased significantly compared with cyclists at both Jamieson Park (towards Narrabeen pedestrians 49.0% vs 61.9%, cyclists 54.1% vs 38.1%; $p=0.001$) and Middle Creek (towards Bilarong pedestrians 35.2% vs 58.0%, cyclists 64.8%

vs 42.0%, $p<0.001$; towards Middle Creek Reserve: pedestrians 45.7% vs 68.2%, cyclists 54.3% vs 31.9%, $p<0.001$) pre- to post-completion respectively - with the exception of the clockwise direction at Jamieson park (towards Cromer pedestrians 49.0% vs 57.3%, cyclists 51.0% vs 42.8%, NS). The apparent discrepancy between these findings and those conducted with the Ecounter data may be explained by the fact that the latter were drawn from observations taken over a much longer time period and were adjusted for a range of other variables, whereas the visual counts were restricted to a very small number of days and times and are unadjusted for other contextual factors.

VISUAL COUNT DATA FROM 10TH OCTOBER 2015 AND 1ST NOVEMBER 2015 FOR COMPARISON WITH ELECTRONIC COUNTER DATA

The visual count data for Middle Creek, Jamieson Park and the new section on the two occasions where counts were recorded by hour are shown below. These may be compared to electronic count data. Assignment to hourly time intervals

is according to digital time shown on researchers' smart phones. Comparisons would need to take into account any discrepancy between this time and that of the electronic counter to make accurate comparisons.

10/10/15	BIKES					
TIME	MCR – CW	MCR - ACW	JP - CW	JP - ACW	JWP - CW	JWP - ACW
9-10	37	43	37	37	24	48
10-11	28	67	35	58	34	59
11-12	35	38	32	50	37	55
12-1	25	21	28	32	31	26
	PEDESTRIANS					
9-10	39	79	52	56	66	75
10-11	55	48	46	71	55	62
11-12	22	22	44	29	29	45
12-1	23	25	32	40	40	39
01/11/15	BIKES					
Time	MCR – CW	MCR - ACW	JP - CW	JP - ACW	JWP - CW	JWP - ACW
9-10	36	33	35	25	36	37
10-11	50	45	47	57	53	51
11-12	90	62	77	61	73	80
12-1	40	41	54	51	49	51
	PEDESTRIANS					
9-10	50	66	56	63	70	90
10-11	31	48	43	83	56	61
11-12	46	47	67	40	58	76
12-1	20	28	20	55	36	34

Table 4: Visual count by hour for Middle Creek Reserve (MCR), Jamieson Park (JP) and the new section (James Wheeler Parade – JWP) on 10th October and 1st November 2015.

MCR = Middle Creek; JP = Jamieson Park; JWP = new section, CW = clockwise direction ACW= anti-clockwise direction

ELECTRONIC COUNTER TIME SERIES ANALYSES ON WEEKLY COUNTS

The electronic counter time series data for Middle Creek and Jamieson Park underlying the graphs in the main body of this report are presented below. Only those for the clockwise direction are shown as the time series were very similar for both directions at both locations.

MIDDLE CREEK RESERVE TIME SERIES DATA

There were a number of data anomalies where the count for one direction (Middle Creek to Bilarong) would report as zero and count added to the opposite direction for both pedestrians and bikes. In order to correct for this, on days when this would occur the average ratio of one direction over the other for the entire period for that hour was applied to the total of both directions to apportion the counts to each direction. For example, if the ratio was 47% in direction A, and 53% direction B and the total count for that hour was 100, 47 would be credited to direction A and 53 to direction B. The ratio between the two directions did not vary between pre- and post-completion, day of the week, month, or year, but it

did by hour, hence averaging over the whole period by hour to obtain the appropriate ratios. There were also five days (29th October 2014 to 2nd November 2014) where the data for both directions were zero (total Ecounter failure). These were imputed by taking the averages of the daily counts for the two preceding and succeeding corresponding days of the week as recommended by the Transportation Research Board [20].

Figure 13: Time series of unadjusted (red line) and adjusted* (blue line) weekly counts of passes by bikes from Middle Creek Reserve to Bilarong Reserve before and following opening of new section.

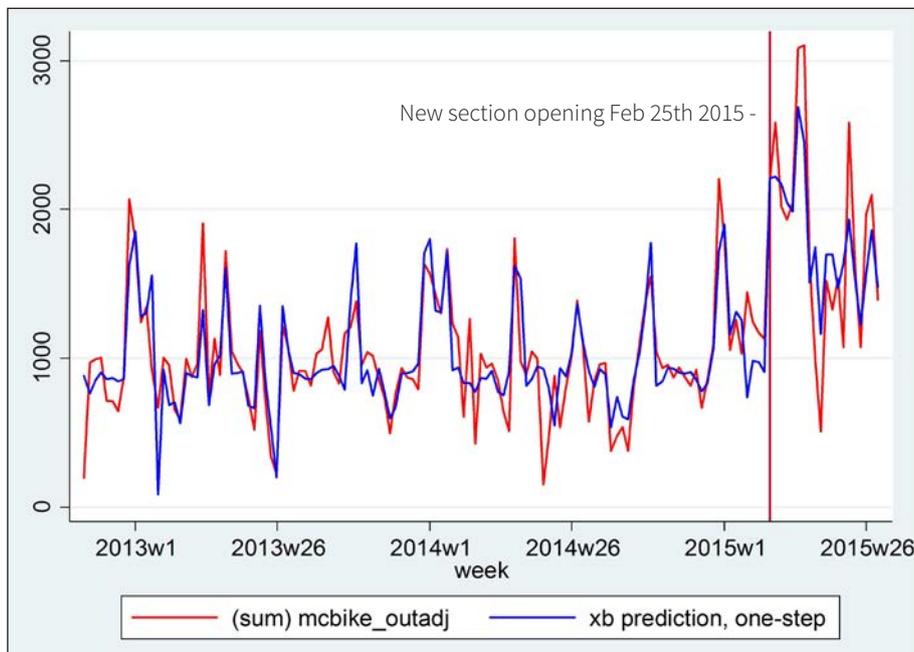


Figure 13: Time series of unadjusted (red line) and adjusted (blue line) weekly counts of passes by bikes from Middle Creek Reserve to Bilarong Reserve before and following opening of new section.

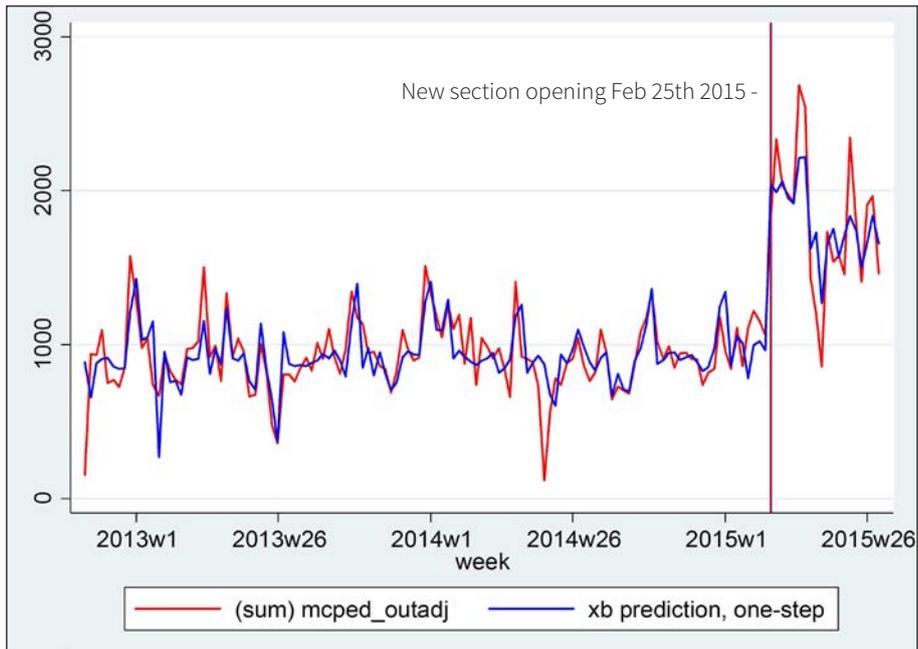


Figure 14: Time series of unadjusted (red line) and adjusted (blue line) weekly counts of passes by pedestrians from Middle Creek Reserve to Bilarong Reserve before and following opening of new section.

JAMIESON PARK TIME SERIES DATA

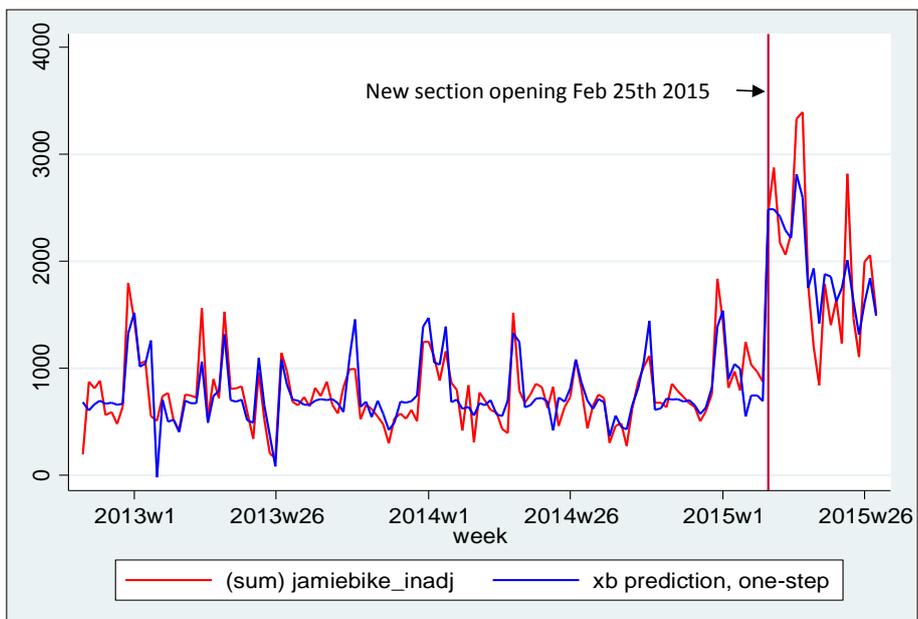


Figure 15: Time series of unadjusted (red line) and adjusted (blue line) weekly counts of passes by bikes from South Creek to Jamieson Park before and following opening of new section.

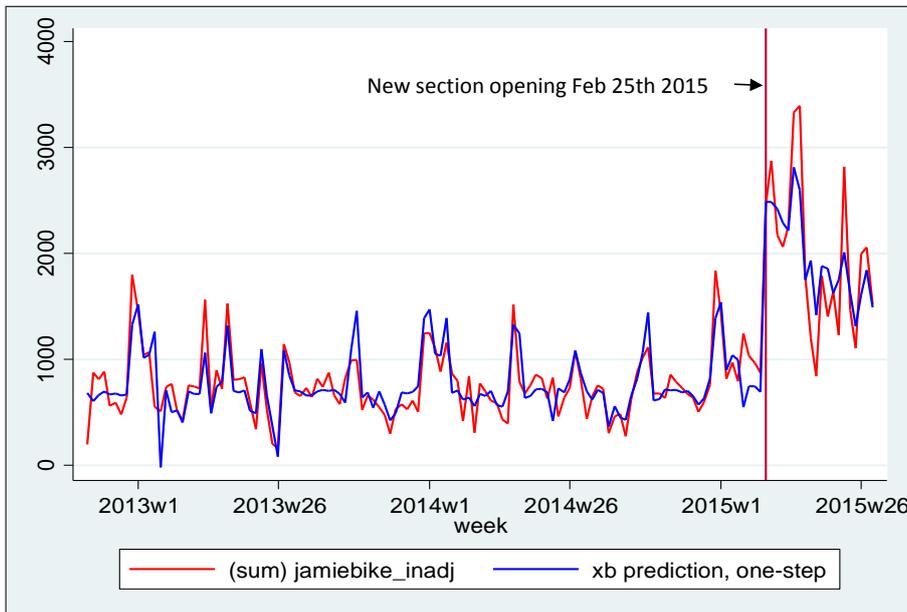


Figure 16: Time series of unadjusted (red line) and adjusted (blue line) weekly counts of passes by pedestrians from Jamieson Park to South Creek entry before and following opening of new section.

In a small number of observations there were anomalous hourly counts where even after correction as per methods the counts appeared to be significantly over-inflated (see Figure 16 above and Table 5 below). The table below list the anomalous data by date and time.

WEEK	Date	Time	Raw count (out)	Adjusted count (out)	Raw count (in)	Adjusted count (in)
2013 w11	18 mar 2013	07:00	327	178.6634	29	177.3366
2014 w11	18 mar 2014	07:00	321	176.656	31	175.344
2015 w4	24 jan 2015	12:00	179	92.81361	11	97.18639
2015 w6	8 feb 2015	11:00	200	103.072	11	107.928
2015 w6	10 feb 2015	11:00	177	89.83357	2	89.16643
2015 w6	11 feb 2015	12:00	236	122.4547	8	121.5453
2015 w7	13 feb 2015	11:00	196	100.8746	5	100.1254
2015 w7	14 feb 2015	11:00	248	132.87	24	139.13
2015 w7	16 feb 2015	12:00	242	122.4547	2	121.5453
2015 w7	16 feb 2015	11:00	349	180.169	10	178.831
2015 w7	17 feb 2015	11:00	827	418.5542	7	415.4458
2015 w7	17 feb 2015	12:00	721	362.8474	2	360.1526
2015 w7	18 feb 2015	11:00	602	304.1293	4	301.8707
2015 w7	18 feb 2015	12:00	268	139.0162	9	137.9838
2015 w8	22 feb 2015	12:00	514	260.8551	20	273.1449
2015 w8	22 feb 2015	13:00	178	91.34813	9	95.65187
2015 w8	23 feb 2015	11:00	154	84.31307	14	83.68693

Table 5: Table of anomalous values for Jamieson Park pedestrian count clockwise and anti-clockwise

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