LITTER PREVENTION BUSINESS CASE FOR THE WAMBUUL-MACQUARIE RIVER IN THE DUBBO LGA

PREPARED BY CIVILLE
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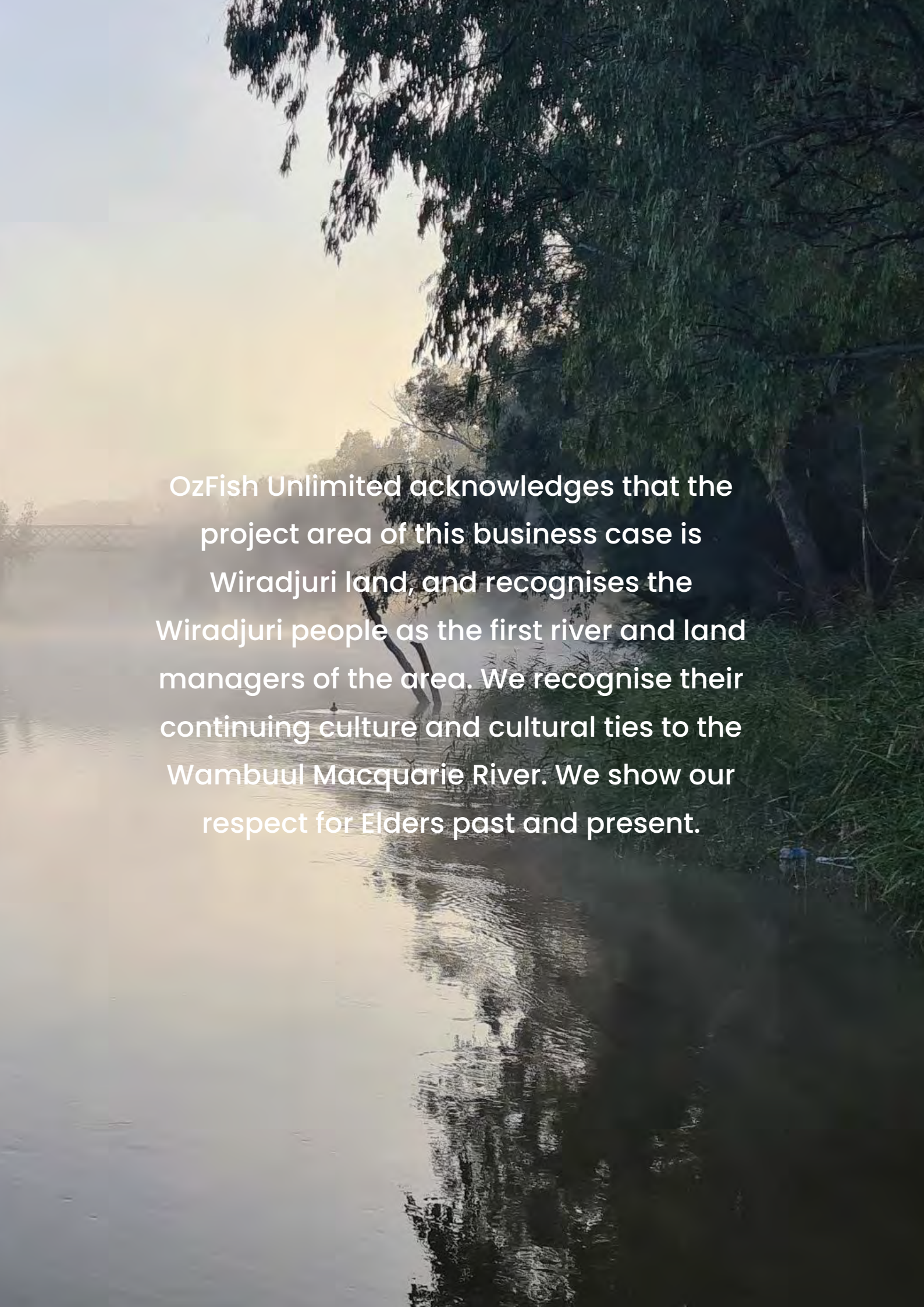

OzFish Unlimited acknowledges that the project area of this business case is Wiradjuri land, and recognises the Wiradjuri people as the first river and land managers of the area. We recognise their continuing culture and cultural ties to the Wambuul Macquarie River. We show our respect for Elders past and present.

CONTENTS

Image: Annette Teng 2013

1 INTRODUCTION

This **Litter Prevention Business Case for the Wambuul-Macquarie River** is a high-level document that OzFish can use as a starting point to reduce litter in the catchment of the Wambuul-Macquarie River. It is focused on litter prevention in Dubbo and Wellington, two major towns in the catchment.

This document makes a case for additional investment in litter prevention. It supports targets established in the *Waste and Sustainable Materials Strategy 2041*: a 30% reduction in plastic litter by 2025 and 60% reduction in litter by 2030 (NSW Department of Planning, Industry and Environment, 2021a). Future litter prevention activities in the Wambuul-Macquarie River catchment may also be supported by this State Government strategy, which makes a commitment to $38 million for litter reduction programs under Stage 1, intended to support a diverse range of litter prevention projects across NSW (NSW Department of Planning, Industry and Environment, 2021a).

1.1 ORGANISATIONS INVOLVED

OzFish is Australia's only fishing conservation charity, with a mission to protect and restore fish habitat. OzFish empowers and supports recreational fishers and their communities to enhance the health and habitat of rivers, lakes and coastal areas across Australia. OzFish has developed this business case because:

- Recreational anglers are passionate about protecting fish habitat.
- Fish are consuming microplastics (small pieces of plastic), and with more and more plastic waste entering the river, this problem will increase. Similar to sea birds, this can mean fish eat too much plastic and have no room left to eat proper food.
- OzFish is committed to making rivers clean for everyone to enjoy.

OzFish engaged Civille to prepare this document. Civille is a strategic design consultancy focused on making urban places more in tune with their natural surrounds.

The business case is focused on Dubbo and Wellington where OzFish has an established presence – one of OzFish's River Repair Buses is based in Dubbo. The River Repair Bus carries out habitat restoration work along the Wambuul-Macquarie River to ensure native fish stocks thrive.

Funding was obtained for this project as part of NSW EPA's Round 7 Community Litter Grants, under the NSW Government's Waste Less, Recycle More initiative. NSW EPA's Litter Prevention Unit has provided support during the development of this business case.

Several floods occurred during the development of this business case, providing an opportunity to report on litter issues particular to floods as well as regular flows.

1.2 STAKEHOLDERS CONSULTED

In preparing this business case, OzFish has engaged the local community of Dubbo and Wellington to gain a better understanding of the litter problem in the region and gather ideas about where litter prevention efforts should be focused. This included community surveys and several community forums in Dubbo and

Wellington. Community groups engaged included:

- Dubbo Rivercare
- Western Paddlers NSW
- Transition Dubbo
- Dubbo Field Naturalists
- Representatives from the Dubbo Local Aboriginal Land Council
- Years 7 & 9 of Dubbo College (Delroy Campus)
- Staff members of BCF Dubbo
- Wellington Local Aboriginal Lands Council
- Dubbo Aboriginal Lands Council
- Dubbo Aboriginal Community Working Party
- Garden Hotel Fishing Club
- See You in Dubbo
- Dubbo Sports Council
- Wellington Kayak Club
- Wellington Community Progress and Action Group

Other members of the community, not affiliated with any of the above, also attended the forums and completed surveys.

Dubbo and Wellington sit within the Dubbo Regional Council (DRC) Local Government Area (LGA). OzFish met with several staff from Dubbo Regional Council to discuss litter prevention, and staff provided some information on Council's litter management activities including bins, litter picking, and gross pollutant traps. Staff also outlined the arrangements in place with sporting clubs and event organisers to manage litter during their activities in public places.

1.3 NAVIGATING THIS DOCUMENT

This document includes the following:

- **Section 2:** Background information on litter, its impacts and costs to society.
- **Section 3:** information on local litter sources, hotspots and pathways from the catchment into the River.
- **Section 4:** Current initiatives to address litter by state government, local government and in the local community.
- **Section 5:** What could be achieved by investing more in litter prevention.
- **Section 6:** Who can contribute to litter prevention in Dubbo and Wellington.
- **Section 7:** Local opportunities for litter prevention in Dubbo and Wellington.
- **Section 8:** Next steps to follow this business case.

2 LITTER AND ITS IMPACTS

2.1 WHAT IS LITTER?

Litter is refuse, debris or rubbish deposited in a place. It is defined in NSW legislation (section 144A of the *Protection of the Environment Operations Act 1997*) as:

a) *"any solid or liquid domestic or commercial refuse, debris or rubbish including any glass, metal, cigarette butts, paper, fabric, wood, food, abandoned vehicles, abandoned vehicle parts, construction or demolition material, garden remnants and clippings, soil, sand or rocks, deposited in or on a place, whether or not it has any value when or after being deposited in or on the place*

and

b) *any other material, substance or thing deposited in or on a place if its size, shape, nature or volume makes the place where it has been deposited disorderly or detrimentally affects the proper use of that place."*

This business case is focused on litter up to the size of a shopping bag. This type of litter is a significant issue. DPIE states that "in FY 2020, an estimated 575 million items of plastic litter generated in NSW made its way into our waterways and terrestrial and marine environments" (NSW Department of Planning, Industry and Environment, 2021a, p. 16).

This business case does not specifically address illegal dumping, which consists of items which have been brought to a location for the purpose of dumping. The NSW EPA have recently classified illegal dumping by size, however, in the DRC LGA, litter and illegal dumping often occur together. It is also focused on litter in the public domain, where land management is a public responsibility and everyone can play a role in litter prevention.

2.2 THE LITTER JOURNEY

The transport and fate of litter in the environment can be thought of as a journey, "from its inception as something produced through a manufacturing process… [all the way] into the wider environment – into drains, waterways, estuaries, and perhaps out to sea." (Lavarack, 2021). At the beginning of the journey, litter is manufactured as packaging, for example, where it is then transported to stores and sold to consumers. Then, consumers use the product and the packaging litter associated with it is either thoughtfully disposed of or it becomes litter in the environment. Litter can be found anywhere in the environment but mostly litter concentrates in 'hotspots'. During storm events litter then flows into waterways as stormwater, at times travelling large distances. In this stage, litter can further break down into smaller pieces becoming a harm to aquatic and marine fauna and flora.

NSW EPA (NSW Environment Protection Authority, 2022b) describes litter's journey from production to the environment (Figure 1). This conceptualises the steps that litter takes throughout its life, including:

1. **Production** of goods including their packaging
2. **Supply** of goods to retailers
3. **Sale** of goods to consumers

4. **Use** of goods, at which point waste is generated
5. **Disposal**, which may follow an appropriate path towards landfill/recycling/reuse, otherwise there is the potential for waste to become litter
6. **Littering** occurs when waste is left in a place where it can enter the environment
7. **Hotspots** are places where litter is deposited in greater quantities
8. **Litter flows** from where it is transported into the wider environment, via wind, water, and other forces
9. **In the wider environment**, litter can persist for many years, where it may disperse widely, breaking up into smaller pieces and multiplying its impacts.

This Litter Prevention Business Case is focused on reducing litter in the Wambuul-Macquarie River and its riparian zone. This includes:

- Litter deposited in river reserves – river reserves are a key area of interest for OzFish as many of these are fishing spots used by recreational fishers.
- Litter that enters the river from other parts of the catchment – particularly from urban areas. Once in the river, litter is transported downstream, then it accumulates in other parts of the river system and its riparian zone, impacting on other fishing spots, fish habitat and water quality throughout the river system.

This is consistent with the OzFish mission statement: *To protect and restore fish habitat and support recreational fishers in these actions.*

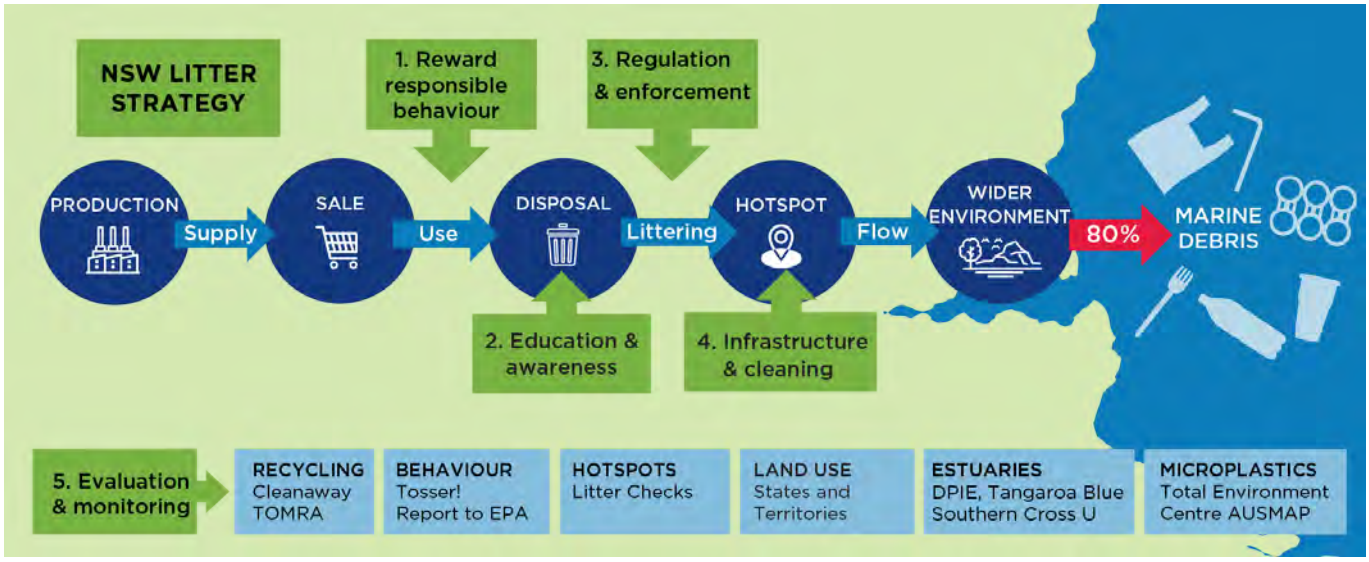

Figure 1: Five litter prevention strategies (NSW Environment Protection Authority, 2022)

Sources of litter in the catchment

The local litter journey takes place within the Wambuul-Macquarie River catchment, which is shown in Figure 2. The catchment is approximately 7.5M hectares and includes six major rural towns (>4,000 people). The catchment is part of the Murray-Darling Basin and the river joins the Barwon River upstream of Brewarrina.

During typical low-flow conditions, litter in the Wambuul-Macquarie River catchment is most likely to begin its journey in one of the catchment's major towns – where litter is more concentrated than in rural areas (see Section 3) and more easily transported into the river via stormwater runoff. Figure 3 shows an example of urban litter collected from a creek in Dubbo. Major towns in the catchment (shown in Figure 2) include Bathurst, Orange, and Mudgee in the upper catchment (upstream of Burrendong Dam) and Dubbo, Wellington, and Narromine in the middle part of the catchment. Litter from urban areas is transported in stormwater via the river's tributaries to the river itself.

During flooding, a greater variety of litter and debris is mobilised across the catchment including litter from rural areas. Figure 4 shows a plastic-wrapped hay bale in the river during flooding. The plastic wrapping from haybales gets caught in trees (Figure 4) and has been prevalent following recent flooding. Around Wellington, 40+ similar pieces of plastic were found in 1 km of river (Powell, 2023). Figure 5 shows some of the floating litter caught against Serisier Bridge in Dubbo in July 2022, including a mix of urban and rural litter.

Litter in the river system

It is likely that most of the litter in the Wambuul-Macquarie River at Wellington and Dubbo has its source in the mid-catchment towns downstream of Burrendong Dam. Litter from Bathurst, the major town on the Wambuul Macquarie River above Burrendong Dam, does not appear to make it all the way to the dam. Local observations indicate that the section of river along the Bridle Track generally does not have rubbish flowing down it nor caught in snags, eddies or rocks (Powell, 2023). Litter may be caught in aquatic and riparian vegetation closer to Bathurst. Even if some litter is transported further from the upper catchment towns, the dam is likely to be a barrier to litter travelling further downstream.

During typical low flow conditions, litter from Wellington, Dubbo and Narromine may also only travel a short distance along the river downstream of these towns. However, floods and high flows disperse litter a lot further downstream along the Wambuul-Macquarie River past Warren.

In floods, the Wambuul-Macquarie River rises high enough that any litter or debris flowing down the river becomes caught on the upstream side of low-level bridges (see Figure 5). Dubbo Regional Council's method for dealing with this build-up is to dislodge litter and debris from the bridge and let it flow downstream so that flows are no longer impeded. This practice is shown in Figure 6. However, this shifts the problem downstream.

With the floods on the Wambuul-Macquarie River in 2016, large woody debris jammed between the banks of the river in Warren forming a log jam or 'raft' (Figure 7). Warren Shire Council arranged contractors to push the debris downstream; the debris became lodged in the river again approximately 12 km downstream, reforming new rafts. These rafts restrict the flow of the river and trap litter and other debris from upstream towns, such as Dubbo and Wellington (Figure 8).

Figure 2: Wambuul-Macquarie River catchment

Where litter accumulates at bridges or is caught in rafts after floods, an opportunity is presented to remove the litter and debris from the river and dispose of it, rather than dislodging it to let it all float downstream. Allowing it to flow downstream means that litter and debris is able to eventually deposit in sensitive areas such as the Macquarie Marshes.

The Macquarie Marshes is a sensitive ecological area downstream of Dubbo and Wellington. Litter that is not properly managed in the towns upstream ultimately flows here where it can cause harm to the rich diversity of migratory water birds that inhabit the area. An example of the litter accumulating in the Macquarie Marshes is shown in Figure 9.

Large woody debris is protected fish habitat under the Fisheries Management Act 1994 (NSW) and removal of any large woody debris from the river requires permission from NSW Department of Primary Industries Fisheries.

The NSW EPA are proposing to remove the rafts from the river downstream of Warren. The rafts are currently playing the role of litter traps, holding back tonnes of litter from the Macquarie Marshes (although some litter would still get through); however once the rafts are removed, there are plenty of trees fallen across the river which will continue to catch rubbish, and the removal of rubbish and woody debris will need to continue with each flood.

Figure 3: Litter collected from Golf Links Creek in Dubbo (photo: Bron Powell)

Figure 4: Left: a plastic-wrapped hay bale in the Wambuul Macquarie River during flooding, July 2022 (photo: Ken Smith); Right: similar plastic wrapping seen in riparian vegetation after flooding, September 2022 (photo: Bron Powell)

Figure 5: Some of the litter and debris caught against Serisier Bridge in July 2022 (photo: Bron Powell)

Figure 6: Litter and debris being pushed downstream from Serisier Bridge in October 2022 (photo: Ken Smith)

Figure 7: A log jam/raft of debris in the river near Warren (photo: Hugh Duncan)

Figure 8: Visible litter caught in a log jam/raft of debris, December 2022 (photo: Bron Powell)

Figure 9: Litter in the Macquarie Marshes, June 2022 (photo: Bron Powell)

Litter in the environment

Once plastics and other materials enter the environment, natural weathering processes slowly break plastics into smaller fragments. In smaller fragments these pollutants can disperse across large distances. Not only are these smaller fragments harder to capture and dispose of, but they are also more readily taken up by aquatic and marine fauna, and humans. Fragments of certain materials can also become sharp, posing hazards risks to humans and wildlife. Harm can also be caused to humans and wildlife as litter leaches out harmful chemicals during the process of breaking down (Chen, Allgeier, Yin, & Hollert, 2019).

As plastic fragments break up into smaller and smaller pieces, they become a source of microplastics, which accumulate in aquatic organisms and pose threats to human health (Feng, et al., 2019; Karlsson, et al., 2017; Sharma & Chatterjee, 2017). Microplastics in freshwater ecosystems have not been as widely studied as microplastics in marine ecosystems, and there is very limited Australian data. International research indicates that microplastics are commonly present in freshwater ecosystems, including in the water, sediments and in freshwater fish (Sarijan, Azman, Said, & et al., 2021). Microplastics are derived from a range of sources and include many types, and freshwater ecosystems and their biota also vary widely. Therefore the impacts of microplastics in these ecosystems are diverse and differ from place to place. Microplastics are commonly ingested by freshwater fish, with ingestion patterns related to individual traits (e.g. body size, trophic level) and environmental factors (e.g. local urbanization, habitat features) (Parker, Andreou, Green, & Britton, 2021).

Once it reaches the river, litter (including fragments and microplastics) can then travel to the river's floodplains and wetlands, such as the Macquarie Marshes which contains Ramsar sites and is an important breeding site for migratory waterbirds.

2.3 IMPACTS OF LITTER

Major towns Dubbo and Wellington (as well as Bathurst, Orange, and Mudgee) are located in the upper and middle portions of the Wambuul-Macquarie River catchment, meaning that pollutants from these urban areas run down the river, where they have the potential to impact upon potable water supply, humans and wildlife downstream.

Social impacts

Surveys of the local community were conducted by OzFish in June-August 2022 and were completed by over 60 individuals. Generally, the community of Dubbo and Wellington agree that litter is a significant problem in the area (93%). Survey respondents were asked to note any areas that were particularly littered and of some concern to them. Some frequently mentioned locations include various riverside reserves such as John Oxley Reserve and Sandy Beach Reserve as well as the Tracker Riley Cycleway in Dubbo. There is more information in Section 3.3.

The presence of litter in popular recreational areas, such as riverside reserves, parks and shared paths, can reduce likelihood that locals will exercise or spend time in nature which directly impacts upon mental health and wellbeing. Litter in recreational areas also poses a heightened physical risk with the potential for sharp pollutants (such as glass, metal or syringes) to harm humans.

Economic impacts

Cleaning up litter is expensive. In NSW as a whole, it has been estimated that the annual cost of litter management in 2014/15 was $162.6 million (see Section 2.4 below). This includes clean-up costs borne by councils and others in the public

domain. Not included is the time spent by community volunteers cleaning up litter from public places. This involves significant time and effort (see Section 4.3) which could be spent on higher-value activities if litter was not such a problem.

As well as the rafts in the Wambuul Macquarie River downstream of Warren, local landowners have also noted that recent floods have deposited large amounts of anthropogenic litter mixed with natural debris on the floodplain downstream of Warren, which will require cleaning up (Connick, 2022).

Litter also has indirect costs on the economy. When litter is present in tourist locations, people are less likely to visit meaning there are impacts to the local economy through a reduction in tourist visitation and therefore a reduction in spending in towns.

Impacts on potable water supplies

The Wambuul-Macquarie River is a major source of potable water for Dubbo and Wellington. Typically, 70% of Dubbo and Wellington's potable water demand is met by water from the Wambuul-Macquarie River and the remaining 30% as bore water. Litter and its breakdown by-products contribute to poor water quality in the river, with potential impacts on town water.

Environmental impacts

A key downstream ecological site is the Macquarie Marshes, a wetland of national and international significance, and one of the largest wetlands in the Murray Darling Basin. Approximately 10% of the Macquarie Marshes are Ramsar sites. There is a high potential for floatable pollutants such as beverage or takeaway containers to travel to and impact upon the Marshes and the wildlife that rely on this ecosystem. The Marshes support more than 30 threatened species, including Silver Perch (*Bidyanus bidyanus*), Murray Cod (*Maccullochella peeli*) and the endangered Australasian Bittern (*Botaurus poiciloptilus*) and Australian Painted Snipe (*Rostratula australis*) (OEH, 2012) . Golden Perch (*Macquarie ambigua*) also move through the system from the Barwon River through to the mid Wambuul-Macquarie River.

2.4 COSTS OF LITTER

The annual cost of litter management in NSW in 2014/15 has been estimated as $162.6 million. Of this total, approximately $135.3 million (83%) was borne by councils (MRA Consulting Group, 2015, p. 5). This study could only utilise limited survey responses, so the true cost of litter both in 2015 and now in 2022 is likely higher. MRA said "The results are conservative, as they do not seek to estimate the cost of the sub groups for which data was not provided (e.g. private businesses: supermarkets), or for sub groups that robust extrapolation methods could not be derived for (e.g. community organisations)" (MRA Consulting Group, 2015, p. 5).

The annual cost of litter management in NSW in 2014/15 was estimated at $162.6 million. Of this total, approximately $135.3 million (83%) was borne by councils (MRA Consulting Group, 2015, p. 5). Net costs to non-coastal councils ranged between $25M (regulated councils) to $35M (unregulated councils). This study could only utilise limited survey responses, so the true cost of litter both in 2015 and now in 2022 is likely higher. MRA said "The results are conservative, as they do not seek to estimate the cost of the sub groups for which data was not provided (e.g. private businesses: supermarkets), or for sub groups that robust extrapolation methods could not be derived for (e.g. community organisations)" (MRA Consulting Group, 2015, p. 5).

The true cost of litter is wide and varied and has an array of externalities. In their analysis of international case studies, MRA found that some

countries have analysed costs of litter and have identified a wide array of direct impacts and externalities (MRA Consulting Group, 2015). These include:

- Loss of property value and amenity value of public space
- Loss of environmental capital
- Increases in crime
- Impacts on mental health
- Impacts on private property and infrastructure, such as damage to rail infrastructure, car punctures and indirect costs to businesses
- Residual greenhouse gas costs

The Centre for International Economics (CIE) estimated total costs of litter in Australia in 2021, estimating that in an Australian context, the costs of litter on the environment, both marine and from invasive weeds from illegal dumping approached $778 million to $2 billion (Centre for International Economics, 2021).

A second CIE report estimates that the total willingness to pay for NSW residents to reduce litter to zero would be $310 million per year, with a further $300 million to reduce illegal dumping to zero (Centre of International Economics, 2022). This report also determined that the community prefers reducing the number of sites that have noticeable litter over reducing the amount of litter at sites with noticeable litter, willingness to pay for reduced litter outcomes is highest in natural environments, and NSW in general has a higher willingness to pay for litter reduction initiatives compared to Victoria and Queensland.

3 LITTER IN THE LOCAL AREA

The following sections provide background information to understand the sources of litter, including:

- Why people litter and in what circumstances they are most likely to litter
- Where litter is most likely to be found
- The types of littered items found most often
- Local litter hotspots in Dubbo and Wellington

3.1 LITTERING BEHAVIOUR

Based on the community surveys conducted by OzFish for this business case, most respondents (96%) believe that litter issues in the area are caused by local people and that it is mostly the responsibility of people visiting littered places (83%) to keep these areas clean.

Figure 10 illustrates various sources of litter, and central to this picture is littering behaviour. Whether litter comes from dumping, events, vehicles or pedestrians, people's behaviour is at the heart of the problem. While some of the issues in Figure 10 include wildlife rummaging and wind or water transporting litter from one place to another, these issues can also often stem from human behaviour (e.g. piling rubbish in an overfull bin, where it can easily be picked out by birds or blown out in the wind). Therefore, to understand where litter originates and how to prevent it, it is important to understand littering behaviour, and behaviour change methods.

There is a significant body of research on littering behaviour. Based on this body of research, NSW EPA's Litter Prevention Kit includes a document "Things you should know about litter and litterers" (NSW Environment Protection Authority, 2013) to capture the important findings that are useful to understand when planning litter prevention projects. This makes the point that "Everyone litters – somewhere, some thing, some time", meaning that there are many causes of littering, which differ from place to place, person to person and depend on the type of litter. Littering behaviour research has found that different people have different ideas about what litter is, and their views can change depending on the context.

Table 1 summarises what the littering behaviour research has found about the contexts in which people are more likely to litter. This shows that littering behaviour depends on:

- The type of item
- The type of place and its cleanliness
- Whether bins are available and signage is clear
- What they understand about where their litter may end up
- What other people are doing

People are most likely to litter cigarette butts, as shown in Table 1, partly because they may be seen as 'only small'. NSW EPA explains that "size, mess and degradability are some factors that influence what people perceive as litter" (NSW Environment Protection Authority, 2013):

- Organic litter (such as apple cores, orange peel) can be seen as more acceptable than other types of litter.
- Messy rubbish (such as a cup with some coffee remaining in it) can be difficult to

carry, so is seen by some as more justifiable to litter.

- Small pieces of litter are more likely to be littered because they can be littered discreetly.

In addition to human mechanisms of litter spread, there are non-human mechanisms by which litter can enter the environment, such as:

- Rainwater and stormwater runoff moving litter from one place to another
- Wildlife rummaging in bins and dispersing litter
- Litter escaping from bins during kerbside collection
- Wind dispersing litter.

There are a range of local issues that contribute to the litter found at river reserves and in the Wambuul-Macquarie River itself. These issues are described with examples in Table 2.

.

Figure 10: Sources of litter (NSW Environment Protection Authority, 2019a, p. 5)

Table 1: Littering behaviour cues (NSW Environment Protection Authority, 2022a)

Behaviour cue	Outcomes
Type of item	People are most likely to litter cigarette butts, probably because there is no bin nearby or butts are seen as 'only small'
Type of place	People are more likely to litter in places such as bus stops or where they think they will not be seen
Cleanliness of the place	People are less likely to litter somewhere that is clean, with well cared-for street furniture and bins, and no graffiti or vandalism
Bins	People are less likely to litter if there is a bin nearby, however they are more likely to do so if the bin itself is dirty
Signs	People are more likely to put waste in the right place if there are clear, consistent and relevant signs nearby
Knowledge	People may be less likely to litter when they understand where their litter ends up
What others are doing	People will litter if others do. For example, people may leave litter piled next to a bin or under stadium seats because others have

Table 2 Local litter issues

Issue	Images (photos: Bron Powell)
Rubbish left on picnic tables Many picnic tables have bins 50m away on the nearest access road and this may be too far for some people to be bothered to walk (or even if there was bin right next to them, they still might not use it). Litter is often seen or beside picnic tables even in areas with high foot traffic. Dubbo and Wellington do not have a culture of 'personal responsibility' for litter (as described by Spehr & Curnow, 2015).	

Issue	Images (photos: Bron Powell)
Rubbish left beside the river Many river reserves have low foot traffic or are secluded meaning that people can easily litter without being seen, or think that riverside areas are OK to litter in – possibly due to the lower amount of use, being a natural area, etc. 'Care of place' is low (as described by Spehr & Curnow, 2015). Also, members of the community have expressed that bins at some river reserves are not located close enough to the riverside, which may encourage people to leave litter behind. Council does not put bins near the river due to limited vehicle access and because litter and bins could be washed away when river levels rise. Note that reserves that are Travelling Stock Routes (TSRs) and are managed by Local Land Services do not have bins at all, even though they are no different from Council-managed reserves in terms of the amount of recreational use.	
Litter left at river reserves and fishing spots by recreational fishers A widespread issue in the Wambuul-Macquarie River catchment is recreational fishers leaving behind litter from fishing. This includes bait packaging, lure packaging, fishing line and hooks; however, most litter from recreational fishers is from the food and beverages they consume while fishing.	

Issue	Images (photos: Bron Powell)
Council maintenance staff mowing over litter Dubbo Regional Council's maintenance staff are meant to pick up litter prior to mowing, but in practice this does not always occur, or they do not pick up all the litter. Litter that is left behind is fragmented by the mower. This means that litter is more readily distributed throughout the environment and more difficult to clean up.	
Bins not emptied frequently enough Where bins are not emptied frequently enough litter can easily escape the site and potentially cause harm to the environment	
Bins at river reserves can be swept away during floods During storms the river water level rises, and fast flowing water can sweep bins from river reserves into the river. During the first floods in 2022, bins were not removed; with frequent flooding they were removed for the remainder of the flooding period.	

Issue	Images (photos: Bron Powell)
Poorly maintained areas invite poor litter disposal behaviour Areas that do not appear well maintained do not encourage 'care of place' **(Spehr & Curnow, 2015)**, and therefore visitors may be less likely to dispose of litter appropriately.	
Bins vandalised Bins have been melted by vandals at some river reserves and then replaced by Council.	
Rubbish left where bins were removed Community forum participants pointed out that bins have been removed from riverside reserves, but people are continuing to leave rubbish at the posts where bins used to be. Some bins were removed temporarily during a series of flood events in 2022, with a lag period in their reinstalment. Bins at Thornton St boat ramp have been permanently removed and rubbish is often left in bags there.	

Issue	Images (photos: Bron Powell)
Carpark litter It is common for people in the Dubbo LGA to consume takeaway food in the carparks at river reserves. At reserves where bins are not provided, takeaway litter is prevalent.	
Construction litter Construction works such as new bridges use plastic mesh for erosion control or fencing an area off to the public. This mesh is often not removed and becomes plastic litter on top of or partly buried in the soil. Examples are the construction of the new bridge over the Little River at Terrabella and the strengthening of the LH Ford Bridge, Dubbo. In other places such as the Tamworth St footbridge, Dubbo, plastic mesh was used as a permanent part of the construction but was exposed and partly washed away in the 2022 floods.	
Chemical containers Chemical containers are commonly used on rural properties as a float attached to pipe (100mm polypipe) for stock and domestic pumps. These dislodge or are left on riverbanks and become litter in the river.	

3.2 LITTERED PLACES

Litter is not evenly distributed across the catchment but is more concentrated in some places than others. An understanding of the sources of litter helps identify where to focus litter prevention efforts.

Urbanised areas are generally the most significant sources of litter, expected to be more significant with higher populations.

A nationwide litter survey, the National Litter Index (NLI) has been conducted twice annually for 15 years. This has allowed the NSW Government to identify land uses that are particularly problematic for litter (NSW Government, 2021). The most littered land use types are shown in Figure 11 and include:

- Industrial areas
- Commercial areas including 'retail' and 'shopping centre' areas
- Car parks (which are also often located in commercial areas)
- Highways

Figure 12 and Figure 13 show where these land uses are located in Dubbo and Wellington respectively.

Whilst quantity and composition of litter differs spatially, industrial land is typically the most littered land use type. Industrial land in Dubbo is mostly located along the train line close to the town centre and in North Dubbo (Figure 12). Retail and parking land uses are located mostly between Fitzroy Street and the Wambuul-Macquarie River between 450-1000 m from the river (Figure 12). Other areas of retail land include Orana Mall and North Dubbo. Commercial land is scattered and proportionally low (Figure 12).

Wellington is a significantly smaller town than Dubbo. Figure 13 shows no land classified as industrial or commercial in Wellington (based on Open Street Map land use data). Retail and parking land uses are the most dominant in the town and are mostly confined to Lee Street and Nanima Crescent in Wellington (Figure 13).

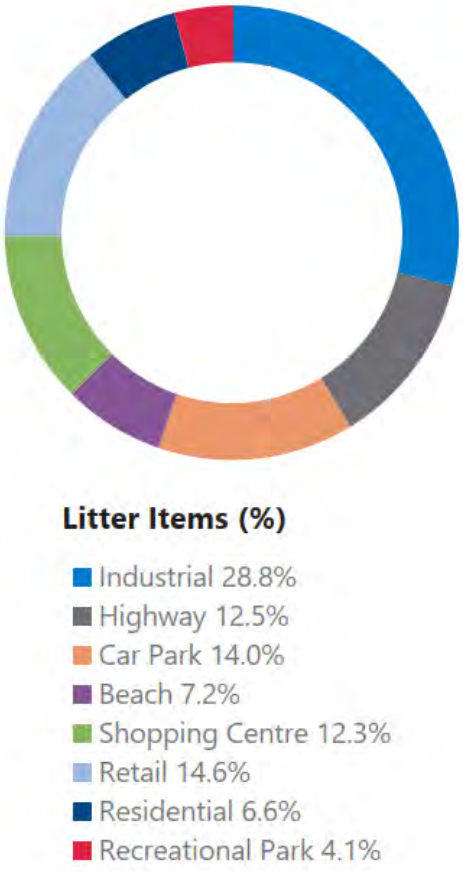

Figure 11: Composition of litter across site types in NSW in 2020 (NSW Government, 2021)

In the local community surveys, respondents reported that typically litter is present along roads and highways (96%), in car parks (84%) and in the Wambuul-Macquarie River, Bell River or one of their tributaries (82%) (Figure 14). These areas were also the three most significant areas of concern according to the community surveys.

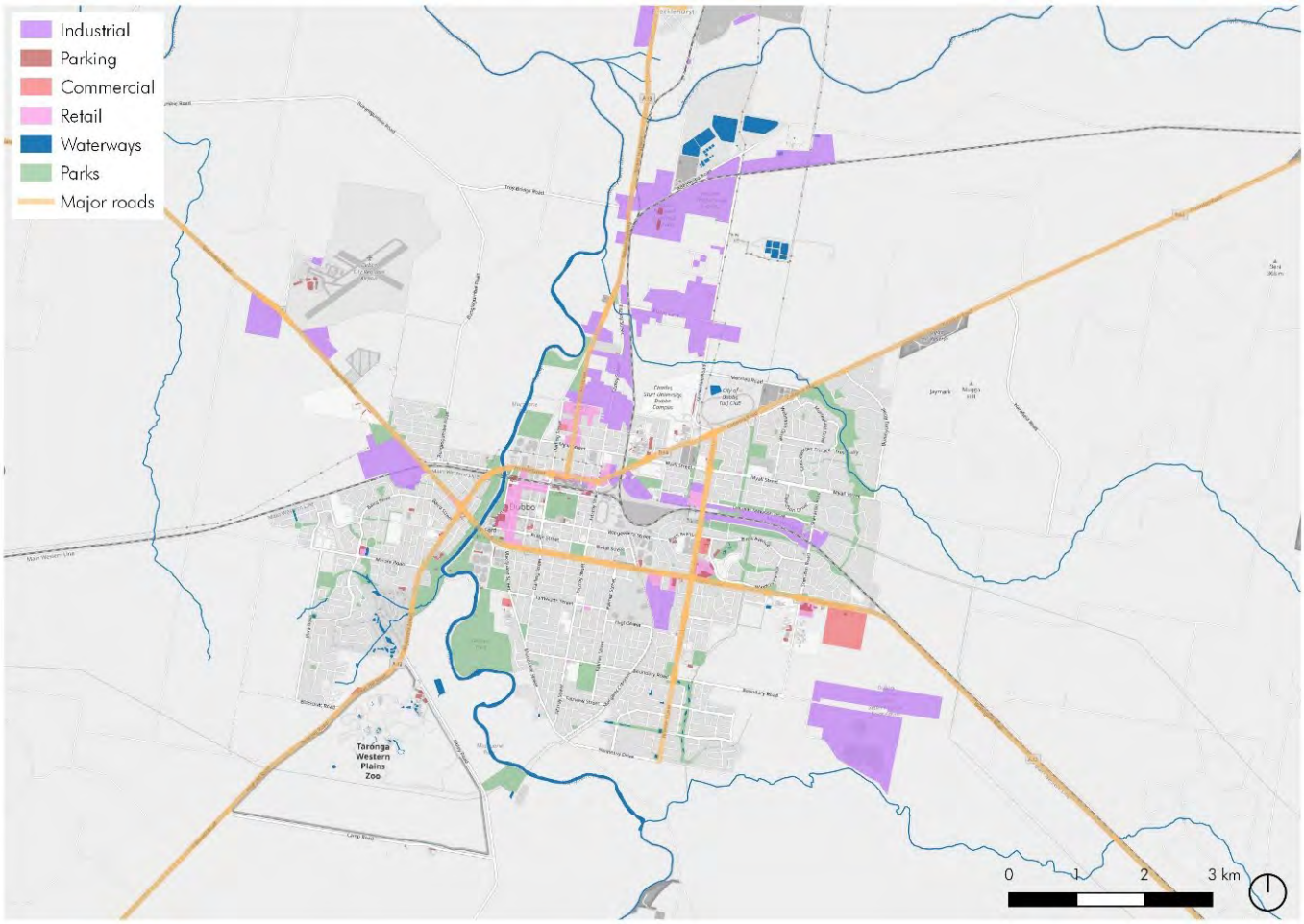

Figure 12: Land uses associated with greater litter quantities in Dubbo, NSW (data source: Open Street Map)

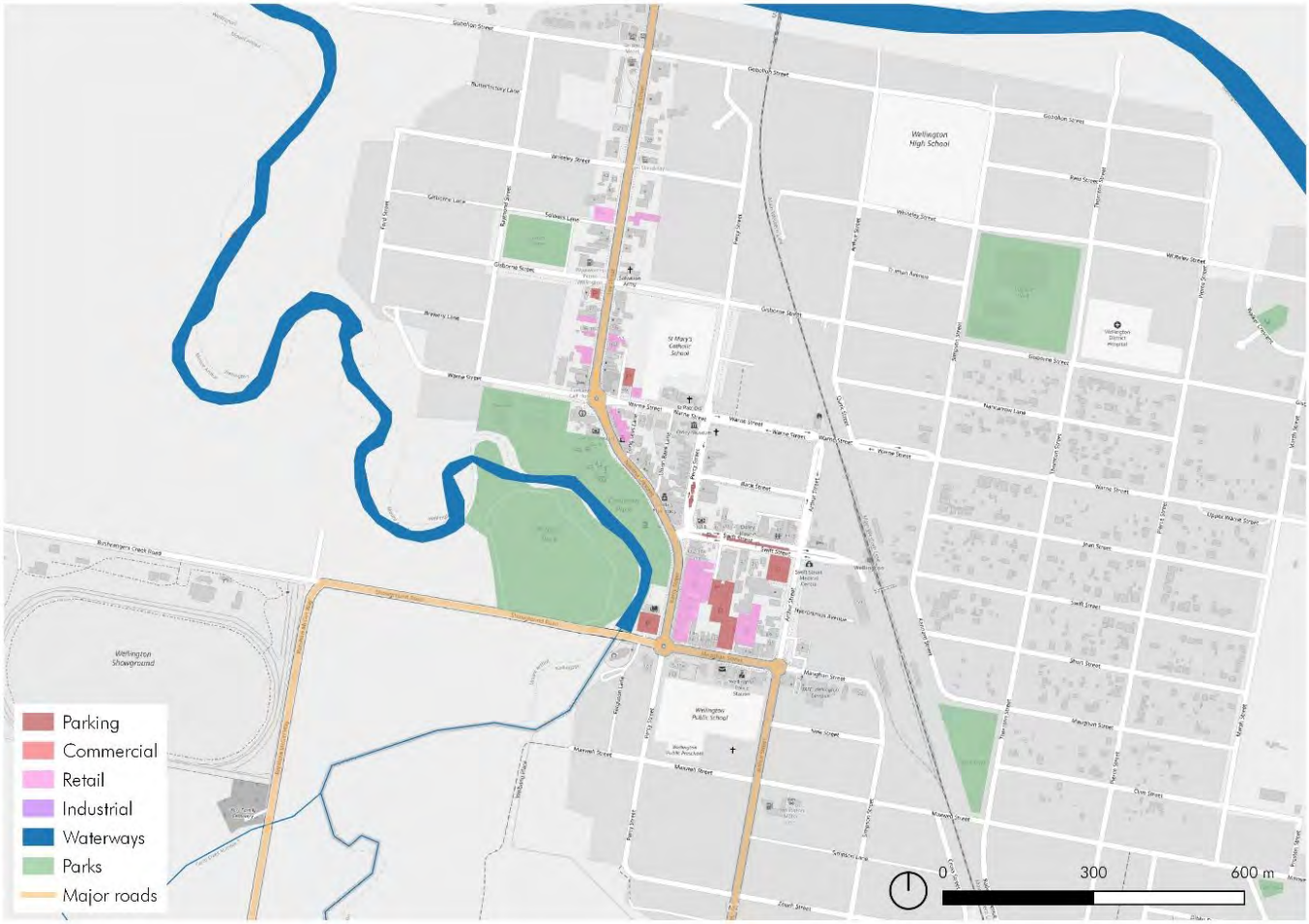

Figure 13: Land uses associated with greater litter quantities in Wellington, NSW (data source: Open Street Map)

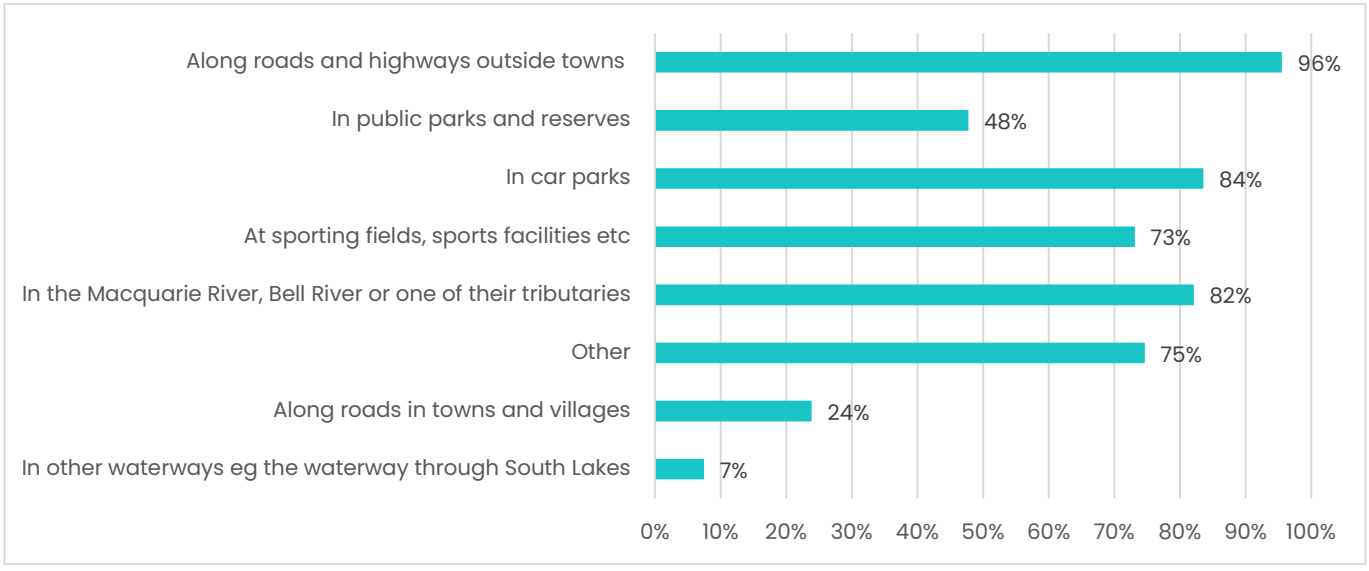

Figure 14: Observed littered places based on community survey responses

3.3 LOCAL LITTER HOTSPOTS

Local litter hotspots were identified via two main sources:

1. Community surveys, which asked respondents to identify places they knew where litter is a problem.
2. Local observations by OzFish staff.

Local litter hotspots in and around Dubbo, Wellington and Geurie (in between Dubbo and Wellington) are shown in Figure 15, Figure 16 and Figure 17 respectively.

These maps identify which hotspots were identified via the community survey and which were identified by OzFish. A third type of hotspot on each map are "OzFish surveyed" hotspots, where OzFish conducted Local Litter Checks -see below. The Local Litter Checks were focused on the hotspots in riverside reserves, as these were of key interest to OzFish.

Beyond the riverside reserves, other sites identified by the community represent places that are more visible and where people care about the place's appearance. There are other locations in the Dubbo/Wellington area with significant quantities of litter, which were not mentioned in the community surveys. OzFish identified some of these based on their local observations during the project, but the hotspot maps are not a comprehensive picture of all litter hotspots in the area.

Local litter checks

Local litter checks (LLCs) were conducted by OzFish for eight 'hotspot' sites and four 'clean' sites in and around Dubbo and Wellington.

The LLC sites in and around Dubbo were:

- Terramungamine Reserve
- Devils Hole Reserve (both the river foreshore and the picnic area were surveyed)
- Boat Ramp at Ollie Robbins Oval
- Sandy Beach Reserve
- Caroline Reserve
- Pilchers Reserve
- Butlers Falls Reserve

The LLC sites in and around Wellington were:

- John Oxley Reserve (both East and West)
- The Shallows/Thornton St Boat Ramp
- The Falls Reserve

The LLCs found that the most littered reserves by number of items (Figure 18) were the following:

1. **The Falls Reserve** (Wellington) was the most littered site with 101 items, of which 92% were classified as small and 8% as medium sized.
2. **John Oxley Reserve** (Montefiores/ Wellington) had 51 litter items, of which 88% were classified as small and 12% as medium sized. Some of the litter observed at John Oxley Reserve is shown in Figure 19.
3. **Caroline Reserve** (Dubbo) had 28 litter items, of which 54% were classified as small and 46% as medium sized. At this site most items (70%) were beverage related items.

Interestingly, Caroline Reserve was considered a 'clean' site prior to LLCs but after the litter counts it was found to be one of the top three most littered sites. This supports findings of community litter surveys which noted Caroline Reserve as a problem location for litter. Elsewhere, there is a general gradient from more littered to cleaner sites (refer to Figure 18), rather than a distinct difference between 'hotspot' and 'clean' sites. The LLC litter counts are a snapshot at a single point in time and the amount of rubbish can vary greatly week to week as it only takes 1 or 2 people to sit and fish for a few hours and leave a dozen beer bottles and pieces of food wrapping.

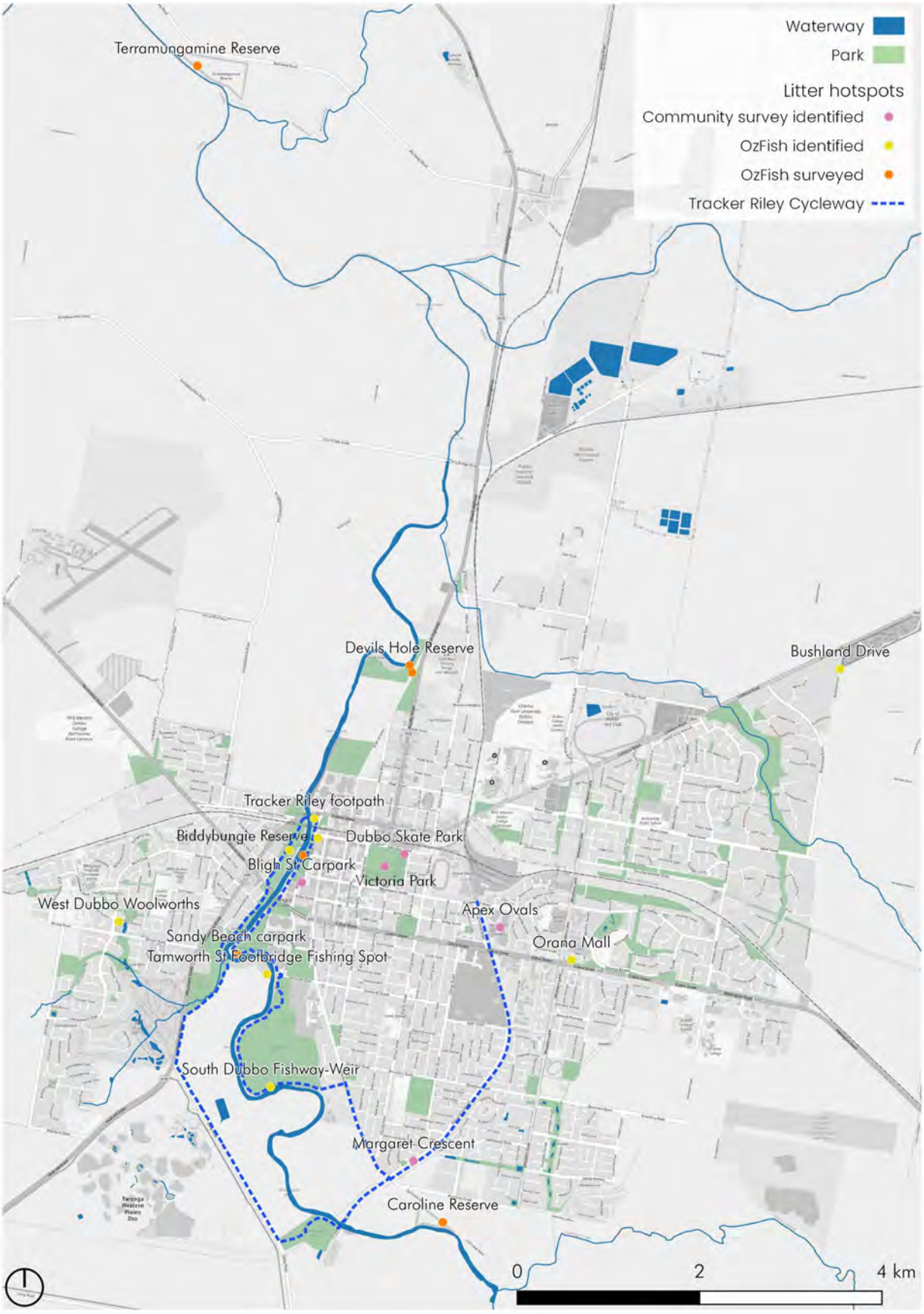

Figure 15: Litter hotspots in and around Dubbo, NSW

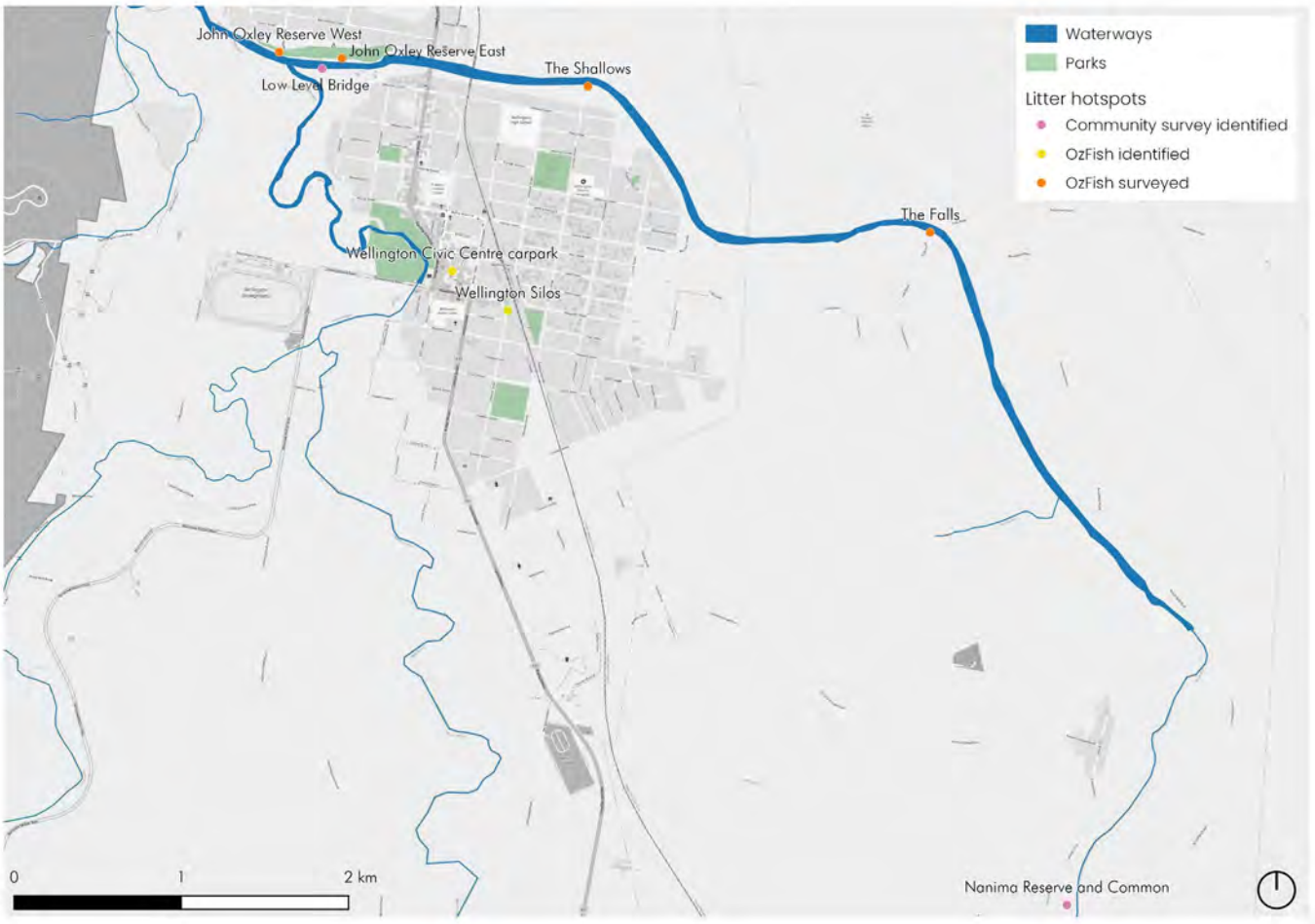

Figure 16: Litter hotspots in and around Wellington, NSW

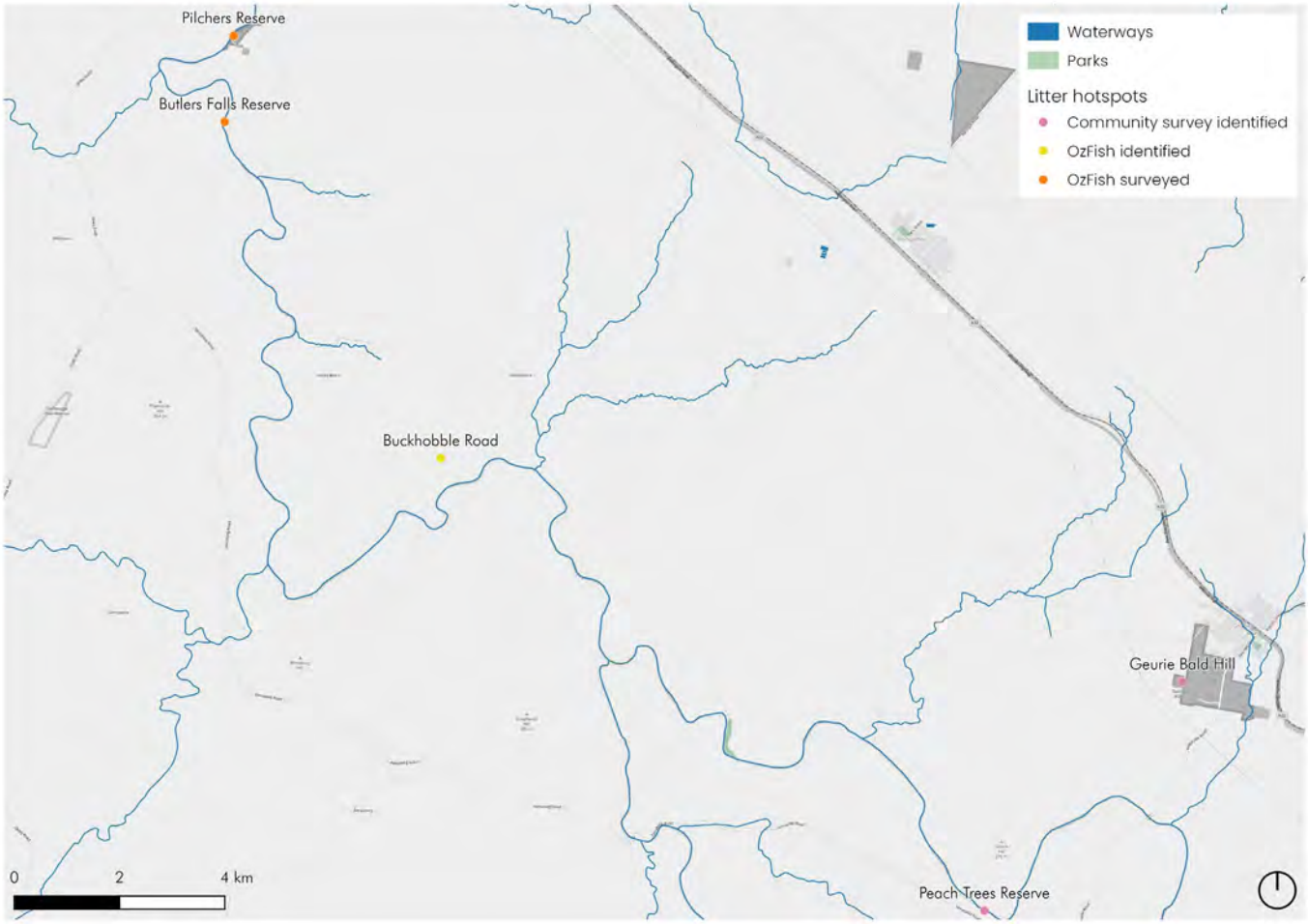

Figure 17: Litter hotspots in and around Geurie, NSW

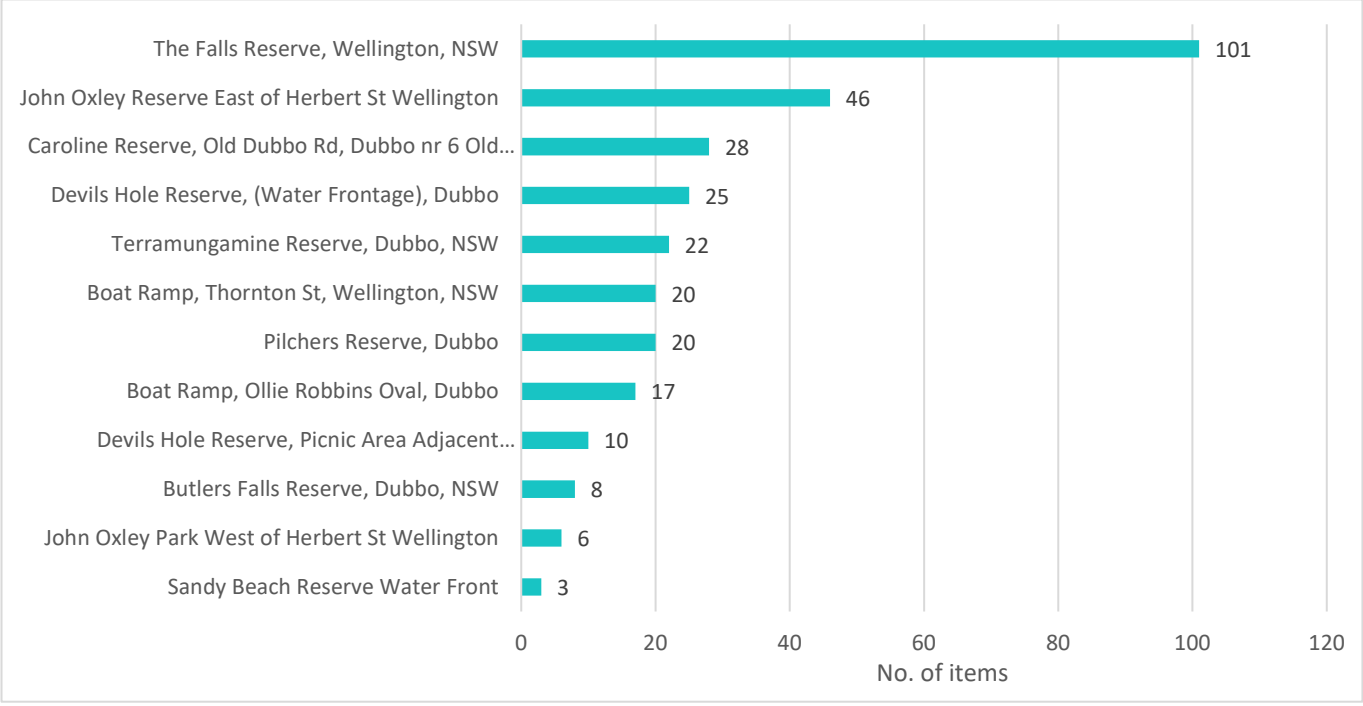

Figure 18: Litter counts from the 12 Local Litter Check sites

Figure 19: Example of the litter observed during Local Litter Checks - John Oxley Reserve, July 2022 (photos: Karen Hagan)

At most of the LLC sites, a location inspection and several user surveys[1] were conducted to understand the relative condition of the site, including perceptions by a range of users. These provide a score out of 100 for each site, as shown in Figure 20. The location inspections and user surveys also provide some information about the factors contributing to litter at each site. The score is broken down into four components in Figure 21.

Note that in Figure 20 and Figure 21, higher scores indicate a greater quantity of positive features at the site.

The results in Figure 21 indicate begin to indicate some of the factors that may be contributing to litter at each site:

- Infrastructure stands out with low or zero scores at the first five sites listed in Figure 21: Pilchers Reserve, The Shallows, The Falls Reserve, John Oxley Reserve east of Herbert Street and Devils Hole Reserve (water frontage).
- Cleaning scores were lowest at The Shallows, Pilchers Reserve and John Oxley Reserve east of Herbert Street.
- Enforcement scores were low across all sites.
- Education and involvement scores were mixed.
- The Shallows received the poorest score, but this was based on only one user survey, so this result should be treated as provisional.

Some of the participants at the community forums observed that Council's services appear to have declined since the merger between the City of Dubbo and Wellington Councils, with some public bins removed, and others serviced less often. The Thornton Street Boat ramp was mentioned, with participants noting that bins were removed, but people still pile rubbish where the bins used to be. Refer to Figure 22.

There are more detailed results from each of the Local Litter Checks included in Appendix A.

[1] Note that only one user survey was conducted at The Shallows and no user surveys were conducted for the Devils Hole Reserve picnic area adjacent Brisbane St. All the other results shown in Figure 20 and Figure 22 are based on 3-4 user surveys.

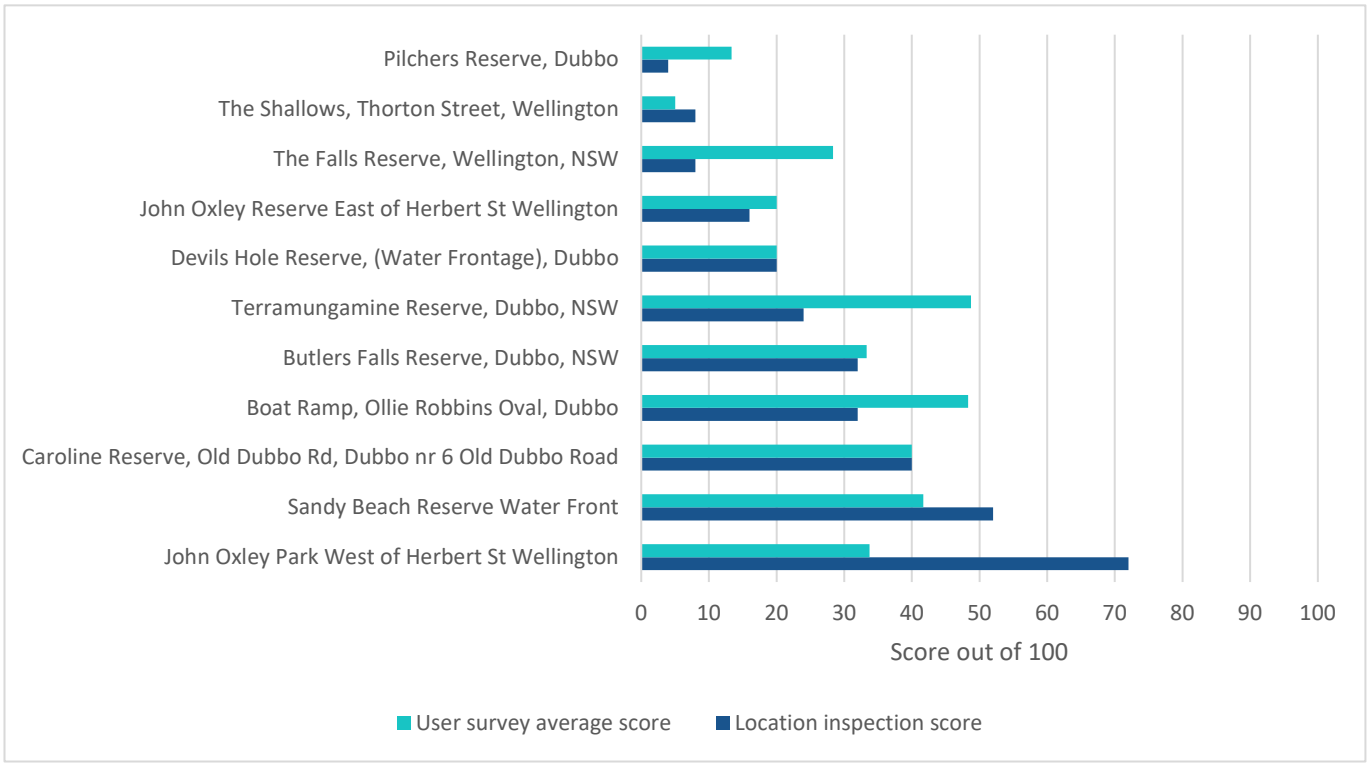

Figure 20: Location inspection and user survey scores from the Local Litter Check sites

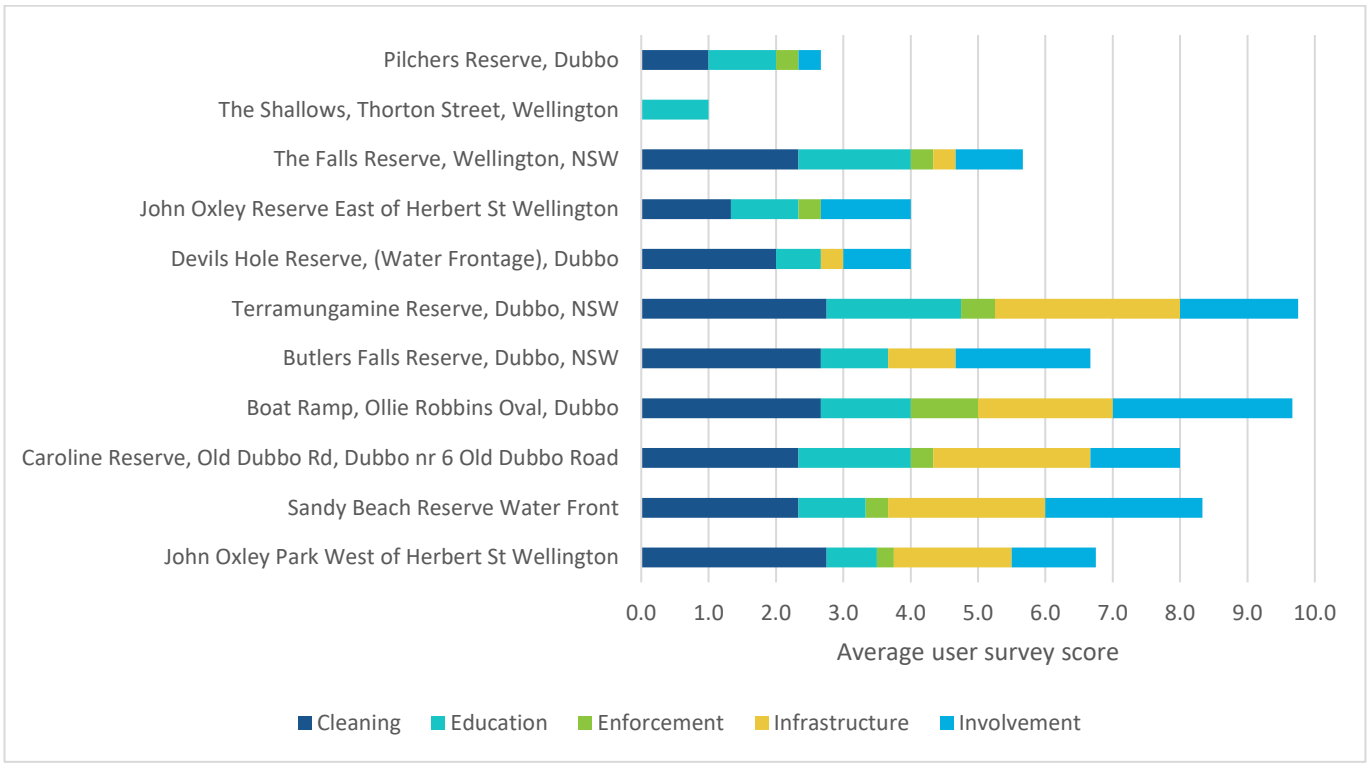

Figure 21: Components of the user survey scores for each site

Figure 22: Rubbish left at the location where a bin has been removed next to the Thornton Street boat ramp (photo: Emmalee Holmes)

3.4 LITTER TYPES

NLI and KLIS data for NSW

The NSW NLI data indicates that in terms of the number of items, the three most common litter types observed are cigarette litter, takeaway containers and beverage containers, as shown in Figure 23 (NSW Government, 2021).

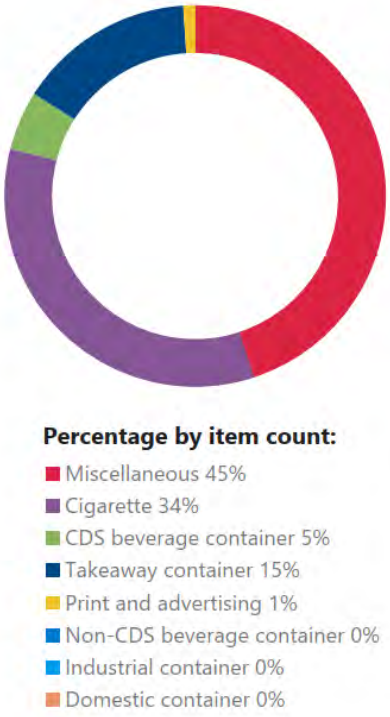

Figure 23: Composition of littered items (EPA categories) per 1,000 m² in NSW in 2020 (adapted from NSW Government 2021)

However, there are limitations to interpreting this data. This data classifies nearly half of the collected litter as "Miscellaneous" which provides very little information about litter composition. NSW is therefore moving to two new methods of monitoring litter, which both include a more detailed method of classifying litter types: the Key Littered Items Study (KLIS) and the Australian Litter Measure (ALM).

The NSW DPIE has conducted the KLIS annually since 2017. Whilst the project is focused on measuring litter solely at estuarine sites on the eastern cost of NSW, many of the litter items flowing down the Wambuul-Macquarie River are likely to be similar to those found at estuarine sites. The top three most common litter types identified in the KLIS to date have been 'Takeaway and beverage', 'Confectionary and snacks', and 'Miscellaneous plastic' (Figure 24).

The Australian Litter Measure (ALM) will measure land-based litter, as did the NLI. Results from the first ALM litter counts are not yet available.

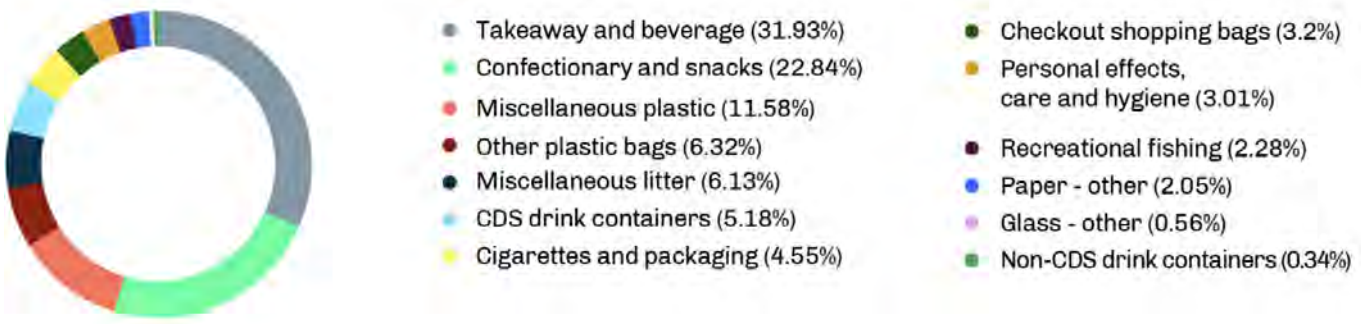

Figure 24: Littered item types from KLIS by category (NSW DPIE 2021)

Local observations of litter types are consistent with the NLI and KLIS data.

Litter types identified in Local Litter Checks

Similar types of litter were identified in Local Litter Checks (LLCs) conducted by OzFish for hotspots in Dubbo and Wellington. A summary of the total item count across all sites is shown in Figure 25. This groups items into four categories. The most observed litter types fell into the 'other' category (304 items), followed by beverage related items (82 items), takeaway items (30 items) and smoking related items (30 items). In terms of litter size, 'small' (<100mL) items dominated items surveyed, making up 86% of all items. 'Medium' (100mL-1L) items made up 14% of items across all surveyed sites and there were no recorded 'large' (>1L) items at any of the surveyed sites.

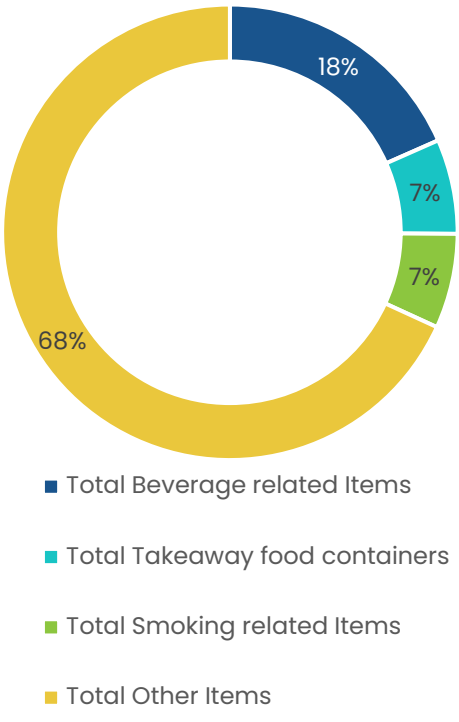

Figure 25: Littered item types and counts from LLCs in Dubbo and Wellington

Litter types identified by Western Paddlers

Western Paddlers are a kayak and canoe club that conduct clean ups along the Wambuul-Macquarie River from their canoes or kayaks and keep track of the litter types they collect. Based on data covering 22 clean-ups between August 2021 and July 2022, the most common litter items collected were:

- Food wrappers (102)
- Plastic bottles (100)
- Polystyrene / foam (79)

Over 13 river-only clean ups across two years, the top three most common items collected by Western Paddlers were:

- Plastic bottles (79 items)
- Polystyrene/foam (58 items)
- Food wrappers (39 items)

The Western Paddlers data differentiates between litter found on the river itself and litter found on the shore. The litter found in the river is the items that float – most commonly plastic bottles, polystyrene and chemical containers. Litter on the banks is a combination of litter deposited by people on land (the top items are food wrappers and bottles/cans) and litter that has washed up in high flows.

Across riparian land and river clean ups, fishing items (e.g. fishing line, hooks, bait containers, lure packaging, lures) made up 3% of all items collected. However, anecdotally it has been suggested that a large portion of beverage containers and food wrappers collected at river reserves and fishing spots are likely to come from fishers. When fishing, people will consume food and drink and have been observed leaving behind food and beverage packaging, or such packaging is found with fishing items among it.

Litter types identified in Golf Links Creek cleanup

The Golf Links Creek catchment consists of mostly residential land and a portion of green space associated with the Dubbo Golf Course. A recent rain event washed a significant amount of litter into Golf Links Creek where it accumulated just upstream of where the creek flows into the Wambuul-Macquarie River. OzFish conducted a river clean-up on the water here and categorised litter. The volunteers found that:

- Polystyrene / foam items dominated the litter collected (182 items)
- Balls were the next most common item - mostly dog balls and possibly some kids' play balls (31 items)
- These were followed by plastic bottles (24 items) and soft plastics (19 items).

This data is interesting because it presents an example of the composition of litter from residential catchments and shows items that come from stormwater outlets.

Figure 26: Cleaning up in Golf Links Creek, October 2022 (photo: Bron Powell)

Litter types identified in local community surveys

Community surveys and forums on litter asked community members of Dubbo and Wellington which types of litter they tend to see most frequently in the area. The top three most littered items observed by the community in Dubbo and Wellington were:

1. Beverage packaging
2. Takeaway containers
3. Smoking related items

3.5 UNCERTAINTIES AND QUESTIONS FOR FUTURE MONITORING

While there is good litter data available for NSW as a whole, much of the focus is on the state's eastern coast, where the state's major urban areas are located and where litter is being monitored in estuaries. There are clearly some differences when it comes to litter the Wambuul-Macquarie River, including:

- A notable proportion of litter from rural areas
- More opportunities for litter to be trapped within the river system itself (compared to coastal waterways which are shorter and steeper)
- Different processes mobilising and transporting litter during flooding (which can be more extensive and prolonged on inland rivers).

Figure 27 illustrates some of the key places that plastic pollution can be measured in inland waterways, however data is scarce. Worldwide, there has been more focus on litter, debris and plastic pollution in marine environments and a need for more information about transport and fate of these pollutants in inland rivers (Emmerik & Schwarz, 2019).

Participants at the public forums thought that litter in the area has been increasing, which contrasts to NSW statewide data. Based on NLI data, NSW EPA has met their previous target to reduce litter volume across the state by 40% by 2020. However, the NLI data isn't divided into inland areas vs coastal areas, and it's possible that litter reductions have been highly variable across the state. The new ALM data will hopefully

provide better information about litter sources, types and quantities in the catchment.

NSW's new litter prevention targets (including 60% reduction in total litter by 2030) are based on the KLIS, but all of the KLIS sites are in east coast estuaries. There will remain a need for better data on litter within inland rivers. OzFish is working with Professor Steve Smith of Southern Cross University to develop an inland river version of the KLIS. This will hopefully provide better information about litter quantities and types being transported and deposited within the river system.

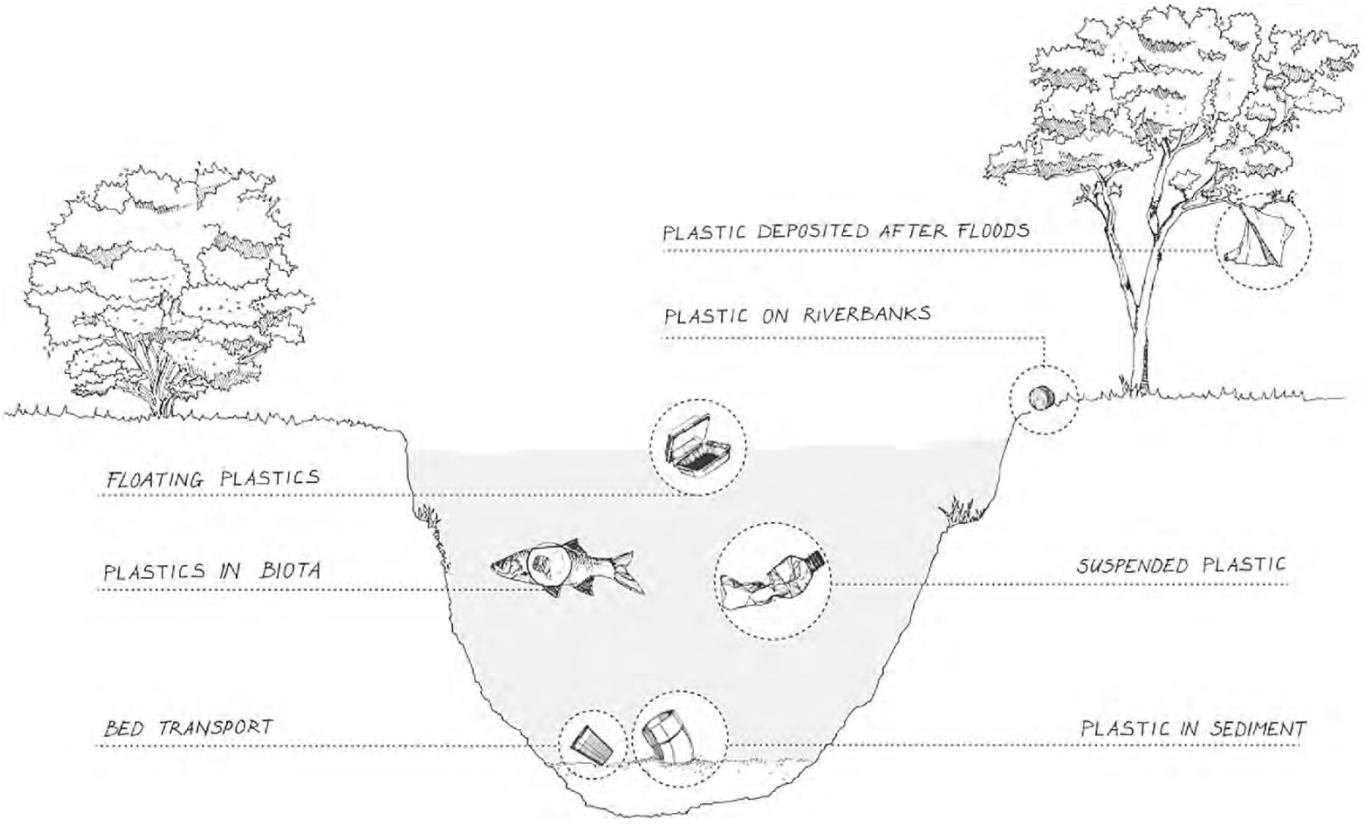

Figure 27: Plastic in river systems (Emmerik & Schwarz, 2019)

4 WHAT IS BEING DONE ABOUT LITTER?

4.1 STATE GOVERNMENT

Policy commitments

In 2015, litter reduction became a NSW Government commitment with a target set to reduce litter by 40% by 2020 (based on volume and a 2013-14 baseline). The 40% reduction target was exceeded in 2020, with a 43% reduction achieved (NSW Department of Planning, Industry and Environment, 2021a). To reach this goal, the NSW Government provided grant funding and developed tools to help people tackle litter in local places.

The NSW *Waste and Sustainable Materials Strategy 2041* (NSW Department of Planning, Industry and Environment, 2021a) sets new targets for litter reduction including:

- A new overall litter reduction target of 60% by 2030
- A plastic litter reduction target of 30% by 2025

The Waste and Sustainable Materials Strategy makes a number of commitments to support these targets including support for local litter prevention:

- $38 million for litter prevention programs over the next six years. The strategy indicates that this will be used to establish partnerships "designed to support capacity building and empower industry, community organisations and stakeholders to take ownership of local litter".
- Continued support for councils' litter reduction and illegal dumping prevention activities with more than $10 million in grants.
- A new litter data framework.

An updated Litter Prevention Strategy for NSW (NSW Environment Protection Authority, 2022a) has recently been published, including more detail about how the NSW EPA intends to meet the 2025 and 2030 litter reduction targets. The NSW Plastics Action Plan (NSW Department of Planning, Industry and Environment, 2021b) outlines specific measures focused on plastics.

Litter prevention strategy

The most recent NSW litter prevention strategy (NSW Environment Protection Authority, 2022a) outlines seven approaches to litter prevention (Figure 28):

1. Source control: This includes NSW Government bans recently introduced on single use plastics, including lightweight single-use plastic bags, plastic straws, stirrers, cutlery, plates, bowls and cotton buds, food ware and cups made from expanded polystyrene.
2. Diversion to a Circular Economy: This includes the Return and Earn container deposit scheme, which as helped reduce the quantity of beverage containers ending up as litter.
3. Education, awareness and engagement: This includes education campaigns, partnerships and engagement with the litter prevention community. For example, the NSW EPA's Tosser! campaign (see below) raises awareness of litter and aims

to influence decisions and action around disposal.

4. **Regulation and enforcement:** The main law concerning litter is the Protection of the Environment Operations Act 1997 (POEO Act). It can be enforced via litter penalty notices, which include fines. Penalty notices can be issued by state agencies and local government. Anyone can report littering from vehicles, and the EPA can issue penalty notices based on these public reports.
5. **Infrastructure and clean up:** This is about providing infrastructure such as well-designed, clean, well-maintained bins, that make it easy to dispose of waste correctly. It is also about 'cleaning up' littered sites - not simply to remove litter, but to invest in public infrastructure upgrades and maintenance (e.g. pavement cleaning, new furniture, graffiti removal, public art). This signals that these places are cared for and not places to leave litter. NSW EPA provides grants to local government and other public land managers for litter infrastructure and clean up.
6. **Targeted programs to stop litter dispersal**: This includes the cigarette butt litter prevention program, Operation Clean Sweep focused on nurdles, and the Streets to Sea program focused on litter in the stormwater system.
7. **Evaluation, monitoring and research:** This includes the EPA's litter data framework (see below) and research on litter and littering. Current litter research findings are also available on NSW EPA's website with the recent addition of reports into vaping and e-cigarette litter, as well as a report into the impacts that fines have on litter behaviour.

The draft litter prevention strategy includes more information on all the above.

Litter prevention guidance

The NSW EPA created a *Litter Prevention Kit* for those who are interested in reducing litter in the environment. This resource consists of four parts:

1. Information about litter and litterers
2. Information on running a litter prevention project
3. Guidelines for local litter checks
4. Guidelines for cigarette butt checks.

Part 2 *Delivering effective litter prevention projects* (NSW Environment Protection Authority, 2019a) is most useful for the present litter prevention business case. This resource provides five main steps for delivering an effective litter prevention project:

1. Gathering evidence about the problem and possible opportunities
2. Choosing actions that will succeed
3. Know how you will measure the effectiveness of the project
4. Involving the people who will be effective
5. Sharing results, celebrating success and providing feedback on projects

This resource is intended to assist community groups and local councils to reduce litter in their local area.

The NSW EPA also provides guidelines and case studies for applying for community litter grants, Council litter grants and cigarette butt litter grants.

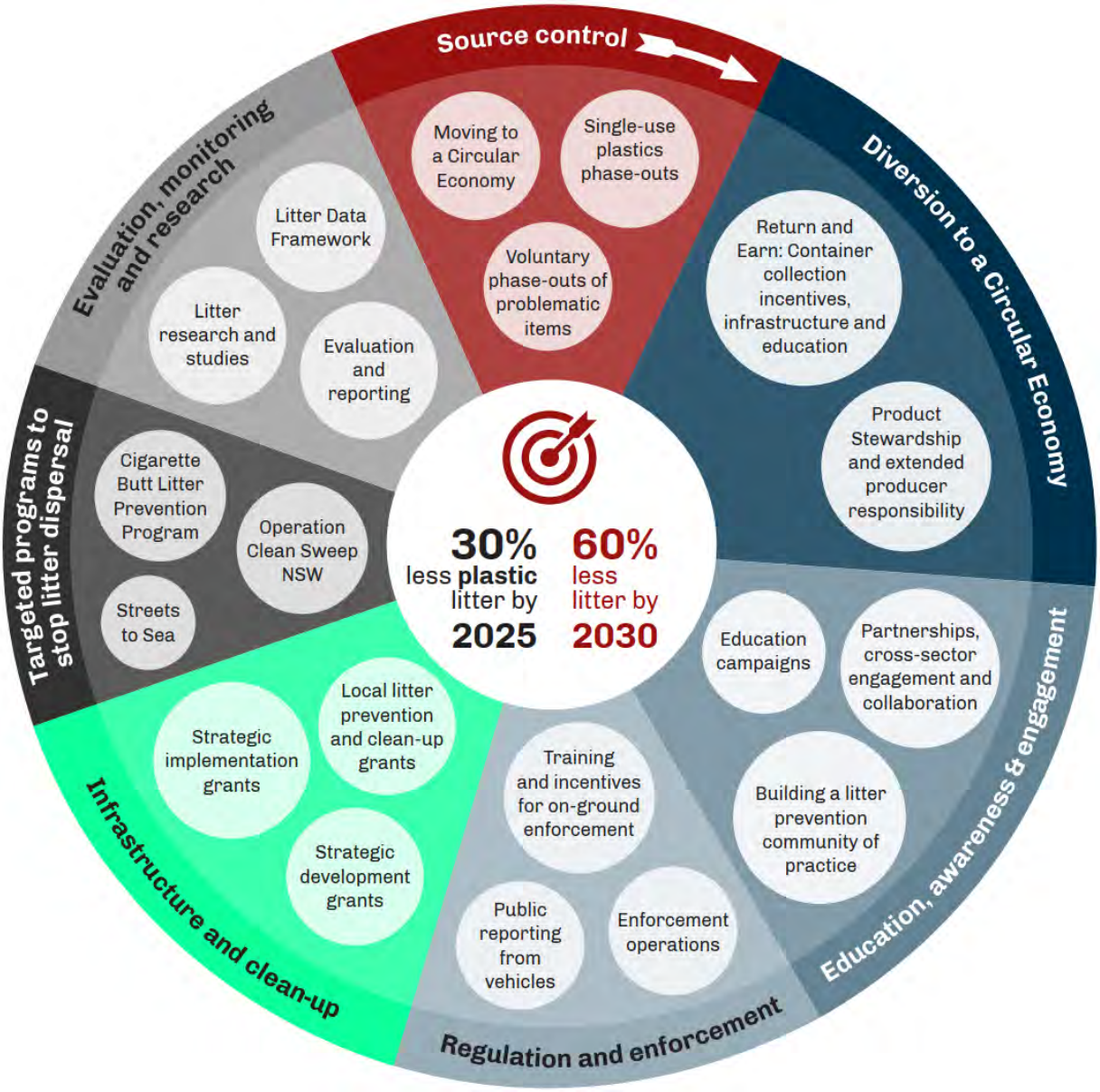

Figure 28: NSW litter prevention framework 2022-2030 (NSW Environment Protection Authority, 2022a)

Tosser campaign

In 2014 the NSW Government launched the *Tosser!* campaign, targeted at changing the behaviour of people who litter in NSW. The campaign applies five years (2012-2017) worth of behavioural research to prevent litter from entering the environment. The campaign is based upon the findings that everyone knows that littering is wrong but people litter items when they believe they are not being watched.

Litter data framework

NSW EPA has developed tools which are accessible to anyone to assist with evaluation and monitoring, including the Local Litter Check and Butt Litter Check. The new Key Littered Items Study measures litter in waterways and a dashboard has been created by the NSW EPA so that its partners, such as community groups and councils, can view and investigate the data. The Australian Litter Measure, which will measure litter on public land, is also currently in development.

Specialist waste services

While most waste services are organised locally, the NSW Government also provides specialist waste services such as the NSW Health NSP (Needle and Syringe Program). This includes provision of sharps bins as well as identifying hot spots, monitoring, and cleaning up.

4.2 LOCAL GOVERNMENT

OzFish met with Dubbo Regional Council (Council) representatives to understand how they manage litter, and their current litter management challenges. The following information was provided by Council staff.

Infrastructure and clean up

Council has public infrastructure in place for the community to dispose of litter appropriately. This includes public bins in town centres, parks and reserves, and residential waste services. Additional temporary skip bins are sometimes used for events (e.g. football games at Apex Oval) and peak visitation periods (e.g. at the Ponto Falls Reserve camping site at Easter).

Council staff noted that vandalism of bins is common, for example, people break the lids off wheelie bins and break into bin enclosures to access the wheelie bin inside. They suggested that the main culprits were people looking to retrieve beverage containers from the bins, to return for the 10c deposit. Therefore, staff said most bins are due for replacement and this is an opportunity to work out a better design to reduce issues with vandalism.

Council maintenance teams and contractors are meant to pick up litter from the ground:

- Around bins when they are emptying bins

- In areas they are about to mow or that they have to maintain (e.g. parks and some road verges).

However, staff advised that they tend to only pick up the large pieces of rubbish and the rubbish that can easily be seen in the long grass. Council staff also mentioned that litter picking used to be done regularly in playgrounds, but this may not have been occurring recently.

Council also collects litter with their street sweeper.

Education, awareness and engagement

Council works closely with sports clubs and other event organisers to manage litter at the sites they book via Council. Council encourages best practice by putting into place a framework to encourage event organisers to have a waste management plan.

Council can impose clean-up charges on sports clubs and event organisers if their sites are left littered after an event, but usually they manage litter well and leave event sites tidy because they have local pride. Maintenance staff have complained though about small pieces of litter such as lolly wrappers, suggesting an opportunity for sporting clubs to review what they sell in their canteens.

Council has conducted some targeted litter prevention projects in the past. This included a cigarette butt focused project in Dubbo CBD in 2014, a litter prevention project at two parks in 2017 and an education campaign for local schools in 2019.

The 2014 *Bin Your Butts & Bat for the Macquarie River* was a litter prevention project that was conducted to reduce the presence of cigarette butt litter in Dubbo CBD. The primary objective of the project was to change the behaviour of smokers, but it also looked at paper, paperboard, takeaway containers, and glass litter in the CBD. The project combined community education and engagement, enforcement, clean-up programs and the provision of new infrastructure (cigarette butt bins). (NSW Environment Protection Authority, 2022c).

A 2017 litter prevention campaign was conducted in partnership with *Netwaste,* a regional waste group based in central and western NSW and funded by the NSW EPA. The project focused on Victoria Park Skate Park and Elston Park, and consisted of installing CCTV, *Don't Be a Tosser!* signage and sensors (with lights and sounds). There was also a litter-themed education event held at the skate park that consisted of a skate competition to promote education and awareness of the impacts of litter (Dubbo PhotoNews, 2017).

The 2019 *It's Our Macquarie* education campaign conducted by Council was targeted at educating local primary school students on the impacts of stormwater and litter. The campaign consisted of an animated video which follows a fictional schoolteacher on his way to school and his encounters many sources of stormwater pollution. Following the video students were then asked to conduct a survey on what they had learnt and answer questions to earn prizes (Dubbo Regional Council, 2021).

Unfortunately, no information could be located documenting the success of these programs.

Enforcement

Council felt they possibly need an increased ranger presence to improve enforcement, suggesting that the presence is low given that Dubbo is a significantly-sized city.

Reducing the flow of litter into the environment

Dubbo Regional Council reports that they have a total of 67 Gross Pollutant Traps (GPTs) in the LGA (Dubbo Regional Council, 2022). Based on maps provided by Council, 44 of these GPTs are in Dubbo. These treat approximately 1700 ha of the

town and its surrounds – around 50% of the urban area. This includes the largest proprietary GPT system in Australia, installed in 2020/21, consisting of two CDS units treating a catchment of over 400 ha (Stormwater NSW, 2021). In Wellington, Council's map shows 15 GPTs that treat approximately 140 ha – around 30% of the urban area.

4.3 COMMUNITY GROUPS

Litter clean ups

There are several community groups in the Wambuul-Macquarie River catchment that have a passion for keeping the river free from litter and are actively involved in clean up events. This includes:

- Dubbo Rivercare
- OzFish's River Repair Bus
- Western Paddlers
- See You In Dubbo

The Dubbo Rivercare group is a member of NSW Landcare and aim to improve and retore riverbank habitat and water quality in the Wambuul-Macquarie River. The group consists of local residents, who work closely with Council and Western Plains Zoo and are involved in weed control, plantings, mulching, designing and installing Interpretive signs, maintaining plantings, rubbish removal, environmental training days and increasing community awareness surrounding river health. Since 2002, the Dubbo Rivercare group has spent **6,000 hours** collecting rubbish in the catchment. During this time the group has collected **21 tonnes** of litter, averaging **over 1 tonne per year**.

OzFish's River Repair Bus (RRB) is focused on habitat restoration around rivers, creeks, lakes, billabongs and wetlands to increase native fish abundance and diversity. The RRB participates in weeding, planting and litter clean ups, visiting several riverside parks and reserves along the Wambuul-Macquarie River between Dubbo and Wellington. The Dubbo RRB spent **395 hours** and collected **over 1 tonne** of litter from January to June 2022.

The Western Paddlers are a community group that participates in group canoe paddles along the Wambuul-Macquarie River and its tributaries. The group conducts clean-up paddles along the river. In the last year (2021-22 financial year), the Western Paddlers have spent **30 hours** collecting litter, including **45 x 12 L bags** of litter equating to **170 kg.** This represents over 700 littered items collected along the Wambuul-Macquarie River between Wellington and Dubbo.

Litter prevention

Currently, the community's litter prevention efforts are mostly focused on cleaning up, however OzFish is also active in preventing litter from recreational fishing, including messaging to its members to encourage them to prevent litter (e.g. 'know your knots' to reduce the quantity of rigs and lures lost while fishing), and provision of tangle bins for fishing spots in other areas of NSW. Locally, OzFish is leading the way for community groups to start taking on litter prevention activities.

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5 WHY INVEST IN LITTER PREVENTION?

The review of existing programs in Section 4 demonstrates that there is already a lot being done to reduce litter in the Wambuul-Macquarie River, however the information about the local litter problems in Section 3 suggests that litter is still a significant problem and more could be done.

Four reasons to invest in litter prevention are:

1. The local community cares about reducing litter and its impacts.
2. The local community is willing to help with litter prevention initiatives.
3. There is good evidence to support the effectiveness of litter prevention initiatives.
4. Funding is available from the NSW EPA to support future projects.

5.1 THE LOCAL COMMUNITY CARES

OzFish's community litter forums were attended by more than 25 people and surveys were completed by over 60 people. More than half of all the community survey respondents classified litter in the area as a major problem, identifying their top concerns as:

1. The impacts on wildlife and ecosystems
2. Human physical health concerns
3. The fact that litter attracts more litter – a location that is already littered looks unvalued and uncared for giving litterers an excuse to discard more litter
4. Pollution of drinking water
5. Mental health and general wellbeing concerns.

The effort put into cleaning up litter (see Section 4.3) also shows how much the community cares about litter in the Wambuul-Macquarie River.

5.2 THE LOCAL COMMUNITY IS WILLING TO HELP

Respondents to the survey indicated they would take some simple steps to help reduce litter, as listed in Figure 29.

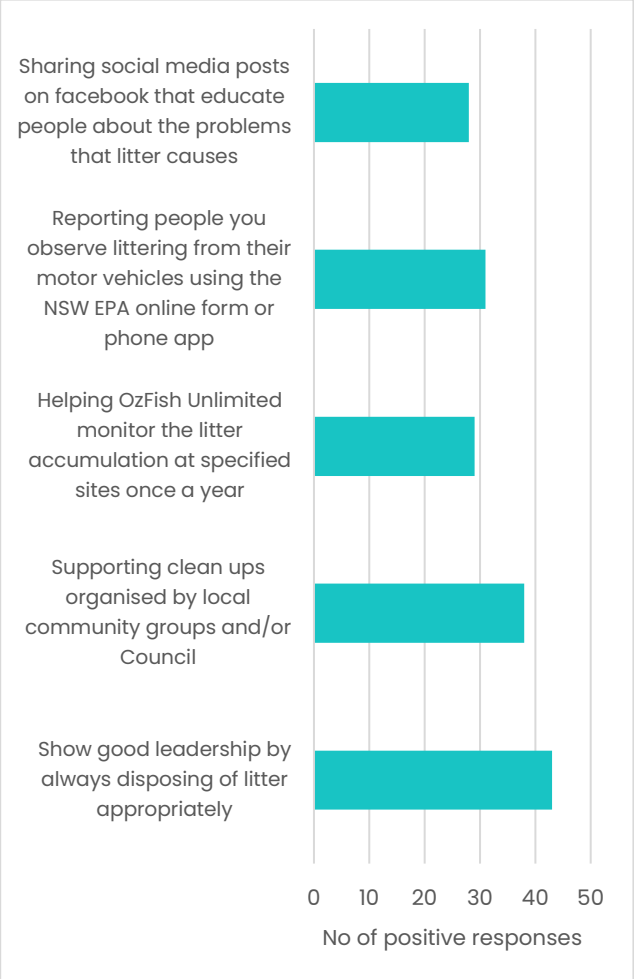


Figure 29: Community survey responses to the question 'How are you prepared to help reduce litter?'

Discussions at the forums also revealed other ideas about how the community could help, from public art projects to taking more ownership over maintenance of public open space.

5.3 LITTER PREVENTION HAS BEEN PROVEN TO WORK

Figure 1 showed how litter takes a journey from production into the environment, and litter prevention intervenes at multiple points in this journey to reduce the likelihood of litter entering the environment. Preventing litter further 'upstream' in its journey is generally expected to be more cost-effective than cleaning up litter once it has dispersed in the environment, however it does require some knowledge of effective litter prevention strategies.

NSW EPA has been running litter prevention grants since 2014 and has gathered significant information on strategies that work. Their guideline *'Delivering effective local litter prevention projects'* (NSW Environment Protection Authority, 2019a) recommends five key factors for litter prevention: cleanliness, infrastructure, education and awareness, enforcement and involvement.

NSW EPA has also published results of a trial which tested several different strategies for reducing cigarette butt litter (NSW Environment Protection Authority, 2019b).

Case studies of past litter prevention projects outline strategies that have worked elsewhere. Table 3 lists a selection of case studies focused on litter prevention in parks, reserves, riverbanks and waterway foreshores, similar to the local hotspots surveyed with Local Litter Checks as part of developing this business case. Note that there are many more case studies for other types of sites available on the NSW EPA's website.

One notable example of a litter prevention project in the region is Bathurst Regional Council's "Banishing Bathurst Butts" initiative. This received an EPA Round 1 Cigarette Butt Litter Prevention Grant to focus on 12 sites in the CBD, then a Round 2 grant to focus on 10 more sites beyond the CBD. Bathurst Regional Council reported that the first phase of the project increased binning rates by 88% and decreased cigarette litter by 94% (Bathurst Regional Council, 2022).

5.4 FUNDING IS AVAILABLE

With new targets in place for NSW to reduce plastic litter 30% by 2025 and all litter 60% by 2030, the NSW State Government is continuing to invest in litter prevention projects via grants programs. The NSW Waste and Sustainable Materials Strategy commits $38 million for litter prevention programs over the next six years (NSW Department of Planning, Industry and Environment, 2021a). NSW EPA's litter prevention strategy (NSW Environment Protection Authority, 2022a) provides some information about how funding will be allocated across three streams:

1. **Local litter prevention and clean-up grants** for targeted on-ground litter prevention projects that use an integrated approach to clean up litter hotspots, upgrade infrastructure, and deliver local campaigns and enforcement.
2. **Strategic development grants** to develop strategic initiatives that engage stakeholder networks and create business cases and approaches to link up and boost litter prevention action across whole regions, communities, industries or sectors.
3. **Strategic implementation grants** to implement litter prevention strategies developed in stream 2, including longer-term funding with more flexibility.

Other potential sources of government funding are currently limited, but may change in the future:

- The Australian Government's Environment Restoration Fund ends in 2023 but has been supporting projects in three relevant priority areas: protecting threatened and migratory species and their habitat, protecting Australia's coasts, oceans and waterways, and the clean-up, recovery and recycling of waste.
- Flood recovery grants have been available in affected LGAs including Dubbo, however they are geared towards reinstatement of built assets, rather than environmental recovery.
- NSW Government's Open Spaces Program has been funding new and improved public open spaces to swim, play, roam, ride and connect with nature. Grants are currently closed but may recommence following the NSW state election.

Corporate partnerships may offer another potential avenue with a growing trend in corporate sponsorship of community and environmental projects.

Table 3: Case studies – litter prevention in parks, reserves, riverbanks and waterway foreshores

Who	When	Name of project (links to case studies)	What was included	Reported reduction in litter
Queanbeyan-Palerang Council	2018-19	Yeddum Munni Nadyun - Ngunnawal for Good Running Water	Working with takeaway shops and local Indigenous groups to reinforce sustainable behaviour around litter disposal.	93% along the riverbank
Port Stephens Council	2018-19	Litter - "Pop Shove it" in the Bin, if you "No Comply" no WI-FI	Focused on a skate park (Boomerang Park), Council installed a Big Belly Wi-Fi-enabled bin using free Wi-Fi as a reward for users to keep the skate park clean.	94%
City of Canterbury-Bankstown	2013-2018	We Like Our Park Litter Free	Council officers visit local parks and reserves throughout summer, encouraging picnickers to make pledges to put their rubbish in the bin. They have also installed 78 new litter and 12 hot coal bins over this period.	>90% over 5 years
Queanbeyan-Palerang Council	2016-17	Clean waterways in Jerrabomberra	Community clean-up days, promotional stands at local shows, and new infrastructure such as benches and landscaping around Lake Jerrabomberra.	98%
Hunter Councils	2016-17	Hunter Councils recreational parks project	Hunter Councils developed relationships with parks' key user groups, including schools and sports clubs, to understand littering behaviour, and use local knowledge to tackle it at target sites.	13-100% across 3 different parks
Port-Macquarie-Hastings Council	2016-17	Port Macquarie-Hastings Council litter blitz	New bins along the foreshore, together with a community education and enforcement campaign.	86%

Who	When	Name of project (links to case studies)	What was included	Reported reduction in litter
Camden Council	2016-17	Cleaner car parks at sporting grounds in Camden	Installation of gates, signs and bins. Council also partnered with local clubs, associations and shops to clean up sites and promote litter reduction in the community	32-67% across four different parks
Tamworth Regional Council	2014-15	King Georges Paradise	Infrastructure, cleaning, user engagement to target anti-social behaviour and littering in a secluded tranquil area along the Peel River, not designated as a park but within 2 km of the city centre.	60%
Albury Council	2014	Albury City Litter Project	Focused on a walking track and park alongside a creek, the project included an advertising campaign, school education, a clean up event, new infrastructure and partnership with a Landcare group.	40% at targeted locations
Wyong Shire Council	2014	A foreshore fishing focus at The Entrance Reserves	Education, infrastructure, clean up and community engagement to address recreational fishing and related litter, at two locally iconic and high profile tourist destinations.	65%
Lismore Council	2014	Heritage Park Litter Reduction	Infrastructure upgrades, cleaning, community event, council staff engagement.	49%
Canada Bay Council	2013-14	Stop Litter in the Bay	At Cabarita Park, hot coal beads and cigarette butts were targeted with new infrastructure. Council also installed multi-lingual signage and ran an education campaign.	67%
Penrith Council	2013-14	Penrith Litter Prevention Project: Mark Leece Oval and Ched Towns Reserve	Focused on Ched Towns Reserve, Glenmore Park, the project included new infrastructure, signage, and local newspaper advertisements.	48-77% in different parts of the park
The Hills Shire Council	2013-14	Clean View	Focused on Porters Lookout in Dural, the project included infrastructure and signage to reduce litter around park furniture and from vehicles.	70%
Bathurst Regional Council	2021-	River Connections	A nature-based program to connect school students with the Macquarie Wambuul River. It includes a program of hands-on activities to learn about the river from a range of perspectives, including Wiradyuri culture, science, geography, and arts.	NA

6 WHO CAN PLAY A ROLE

Section 4 outlined action already being taken by the State Government, Dubbo Regional Council, and local community groups to tackle litter from the state to the local area. The following sections consider who has the capacity to play a greater role in litter prevention in the local area, what would motivate them to get involved, and what would lower the barriers to participation.

6.1 STATE GOVERNMENT

State government has policy, a strategic plan and resources for litter prevention, and plays a leading role as outlined in Section 4.1. However, state government lacks the local presence to achieve site-specific results at local scale. Therefore, they rely on partnerships with local councils and community groups to deliver litter prevention outcomes in local places.

6.2 LOCAL GOVERNMENT

Dubbo Regional Council has an essential role in managing litter in public places, by providing important infrastructure and routine maintenance services. In terms of the seven litter prevention strategies that were shown in Figure 28, local government plays an essential role in the following areas, which would all be considered core business for local government:

- Infrastructure (e.g. providing public bins)
- Clean-up (e.g. street sweeping)
- Stopping litter dispersal (e.g. by installing and maintaining GPTs).

Local government can also play a role in the other litter prevention areas shown in Figure 28, however these activities may not be considered core business. For example:

- Local government can support **source control** (e.g. by demonstrating the use of alternatives to single use plastics at council events) and **circular economy** measures (e.g. by providing infrastructure to support return-and-earn facilities).
- Local government can play a role in **education, awareness and engagement**. Dubbo Regional Council has done so in the past as part of previous litter prevention projects (see Section 4.2). However, this does not appear to have continued beyond these short-term initiatives.
- In terms of **enforcement**, council rangers can issue fines for littering, but rangers often report that it is rare to spot people littering, awkward to confront them about it and difficult to enforce a fine in locations where it is not clear how to dispose of litter appropriately or what the penalties are for littering.
- Council maintenance staff often have reasonable knowledge of litter hotspots, but do not always capture information about litter in a systematic manner which could be considered as **evaluation, monitoring or research**.

Councils are often well aware that litter is an issue the community cares about, but lack capacity to take more effective action, as they face competing demands and many other challenges. Dubbo Regional Council is no exception. Council's Community Strategic Plan included objectives and strategies "Waste management processes reduce our

environmental footprint and impact on the environment" and "The quality of the Macquarie, Talbragar and Bell river corridors are managed and enhanced" (Dubbo Regional Council, 2021a, p. 18), yet the current Delivery Program and Operational Plan includes just one action which would reduce litter, to "Undertake a litter, waste and food avoidance and minimization education program" (Dubbo Regional Council, 2022, p. 51).

A 2019 community satisfaction survey (Iris Research, 2019) identified 'waste management' and 'cleanliness' among 12 service delivery areas where respondents saw a need for improvement. Waste management was ranked 3rd behind 'Council administration' and 'road maintenance'. Cleanliness was ranked 9th. Council's Long-Term Financial Plan (Dubbo Regional Council, 2021b) notes that "Financial sustainability is a key challenge facing local government due to several contributing factors including increased demand for services beyond those traditionally provided (particularly in the area of community services), cost shifting from other levels of government, ageing infrastructure and constraints on increasing revenue." (Dubbo Regional Council, 2021b, p. 4). Recent flood events would be another factor contributing to increased costs.

In this context, Council may find it difficult to take on new litter prevention initiatives, even with grant funding being available from the NSW EPA. Yet, where infrastructure and cleaning are lacking (as identified at several of the hotspot sites surveyed for this business case – see Section 3.3), council involvement may be essential to address the fundamental issues behind the local litter problem.

Some positive factors that may motivate Council to get involved include:

- Council has previous experience with litter prevention projects, as documented in Section 4.2.
- There is alignment with objectives in the Community Strategic Plan.
- There is alignment with the proposed initiative to undertake a litter, waste and food avoidance and minimization education program.
- In developing this business case, OzFish has done some of the groundwork to identify and survey litter hotspots.
- Council could work in partnership with OzFish and other community groups to help deliver litter prevention outcomes.

6.3 COMMUNITY GROUPS

Community groups include social groups, environmental groups, youth groups, sports clubs, groups representing minorities and special interests.

Community groups are already active in **cleaning up** litter, as noted in Section 4.3. Cleaning up litter is an easy way for people to get involved, it can be social, fun, and satisfying for participants.

Community groups can also get involved in other areas of litter prevention, for example:

- **Education, awareness and engagement**: community groups are ideally placed to engage with their communities, and even though litter prevention may not be their first priority, a litter prevention project can be a means for them to meet other community-building objectives. On the EPA's website there are many examples of past projects which have received community litter grants, often with a focus on education, awareness and engagement.
- Community groups can get involved in **evaluation, monitoring and research** as part of citizen science programs. For example, AUSMAP (the Australian Microplastic Assessment Project) has

recruited citizen scientists to sample microplastics in the environment.

Community groups can also support circular economy outcomes (e.g. with advocacy and support) and enforcement activities (anyone can report littering from a vehicle).

Beyond cleaning up litter, a feature of most of the other examples above is that they involve more significant barriers to entry – for example, they require knowledge of litter prevention, training in sampling methods, and more coordination between individuals and groups.

Some positive factors that may motivate community groups to get involved include:

- Alignment with their purpose, or at least some opportunity for meeting their community-building or other objectives via involvement in litter prevention.
- Lower barriers to participation when there is an organised program in place, clear pathways to involvement and the potential to begin with simpler actions.
- A sense that their contribution is part of a coordinated effort and contributes to a greater outcome.
- Access to knowledge/training.

OzFish has identified an opportunity to establish a network of community organisations interested in litter prevention, as a first step towards building more involvement from this sector.

As part of the development of this business case, OzFish surveyed community organisations to understand their interest and capacity to get involved in litter prevention. The following organisations responded:

- OzFish Dubbo
- Wellington Kayak Club
- Dubbo Rivercare
- See You In Dubbo
- Wellington Community Progress and Action Group
- One individual community member.

Some of these organisations and the one individual respondent are active in cleaning up litter. These organisations and individual were asked whether they would take part in several specific litter prevention activities and they indicated:

- All 6 would attend litter prevention network meetings each 2-3 months.
- All 6 would help with litter monitoring (e.g., surveys of two sites in Dubbo, 2-4 times per year).
- 5 would be interested in adopting a section of river to pick up rubbish regularly and report any issues to Council.
- 4 would run a community bin (see Table 4 in Section 7).
- 3 would ask businesses to sponsor a community bin or other community initiative.
- 3 would write a grant application and run a project of their own.
- 2 would approach other businesses / organisations to adopt a section of river to pick up rubbish regularly and report any issues to Council.
- 1 would run litter prevention programs / waste awareness workshops in schools.

Some commented that they would take on some of these activities in partnership with others. There were also a few comments suggesting that Council should play a greater role, particularly when it comes to approaching businesses. Local community organisations are small, litter prevention is not their main focus, and their staff and volunteers have limited capacity to take on more projects.

In summary, there are local organisations interested to help with litter, but they need

opportunities where it is relatively easy to get involved, and they prefer to be working in partnership with others. Activities like cleaning up litter are attractive for their simplicity, while litter prevention requires some knowledge of litter prevention strategies and willingness to get involved in more complex tasks. Litter prevention requires sustained collaborative efforts which are more challenging to organise.

6.4 SCHOOLS

Schools typically have limited capacity to work beyond their physical boundaries, but there are many good examples of litter prevention, waste and stormwater education programs that run successfully in schools and may inspire students to take positive action to reduce litter beyond the school boundary.

Programs are most likely to appeal to schools when:

- The program meets certain curriculum objectives (e.g. as part of the geography syllabus).
- The program assists them to manage litter, waste and stormwater maintenance issues within the school.
- The cost for the school is low.

During the consultation undertaken for this Business Case, Dubbo Senior College - Delroy Campus indicated that they are interested in litter prevention programs. There may be the same interest in other schools; the Dubbo Senior College – Delroy Campus was the only school approached during the Business Case's development.

An organisation such as the Wambangalang Environmental Education Centre (located in Dubbo) could be a useful partner, with their understanding of how to run successful environmental education programs for schools.

6.5 BUSINESSES

Businesses are a diverse sector, and many would see litter prevention as a low priority, peripheral to their core purpose. However, some businesses may be motivated to get involved in litter prevention for a range of different reasons:

- The business may benefit from a cleaner environment with less litter (visitor economy businesses are a good example).
- The business may see a reputational benefit to taking action on litter prevention (either because they are seen as part of the problem - e.g. they supply packaging that ends up as litter – or simply to be seen as a good 'corporate citizen' in the local community).
- They may be looking for team building opportunities for their staff.

In the Dubbo-Wellington area, the construction industry has been suggested as one part of the business community who may have an interest in preventing litter in the vicinity of their work sites. BCF has also been suggested as a business who may get involved, due to their established relationship with OzFish and interest in facilitating their customers' enjoyment of outdoor activities.

6.6 NON-PROFIT SECTOR

OzFish is part of this sector and beyond the Dubbo LGA, the organisation is involved in a range of litter prevention initiatives focused on the recreational fishing sector across the country (litter prevention messaging and provision of tangle bins were mentioned in Section 4.3 above).

There are many other organisations in this sector whose purpose is well-aligned with preventing litter and minimising its harm. Examples are:

- Take 3 for the Sea is focused on reducing litter reaching the ocean. Their recent Ground Swell project provides practical

guidance to visitor economy businesses to help them reduce litter.

- **Conservation Volunteers Australia** has been running a litter program called #SeaToSource, which includes regular macro litter monitoring, community clean-ups, trialling of source reduction infrastructure, schools engagement, a National Day of Action and a leadership program (Riviere, 2021).
- **OceanWatch** is focused on advancing sustainability in the Australian seafood industry and operates community based coastal habitat restoration programs. Current programs include 'Litter Free Estuaries' focused on benthic litter in estuaries, two source reduction plans focussed on fishing-related bait bags and professional fishing-related light sticks, and Tangler bins for fishing line.
- AUSMAP (the Australian Microplastic Assessment Project), an initiative of the Total Environment Centre, has recruited citizen scientists to sample microplastics in the environment.

However, many of these organisations are small and lack a presence in the local area. While OzFish does have a presence in the local area, they are also a small organisation working across the whole country.

One other example of an organisation with a local presence is the Taronga Conservation Society, which is associated with Taronga Western Plains Zoo in Dubbo. Taronga Conservation Society runs initiatives focused on reducing litter in the environment, including:

- They have developed 'Litter Free Rivers' resources for NSW regional schools and businesses.
- They offer green grants, including grants for projects focused on plastic pollution. Past recipients include Seaside Scavenge, the Last Straw and Take 3 for the Sea.

Therefore, there may be partnership opportunities in the local area. However, perhaps the more significant opportunity for OzFish to form partnerships in this sector would be to work with other organisations who also operate across the country working on similar issues.

7 LOCAL OPPORTUNITIES

At the community forums, many ideas were suggested for litter prevention. Some of these were focused on actions for Council (e.g. to improve bin infrastructure, install more GPTs and maintain GPTs more frequently); however, this section focuses on ideas where the community could play a role.

Table 4 lists ideas that have been raised, suggests examples from elsewhere and includes a basic assessment of costs and risks. Most of these ideas could be tailored to suit local needs including budget and appetite for risk.

Table 4: Litter prevention ideas for the Dubbo and Wellington community

Issues	Ideas and potential benefits	Examples elsewhere	Costs	Risks
There are positive actions underway in the community but lacking coordination.	Establishing a network of organisations and individuals interested in working together on litter prevention.	Sustainable Snowies has recently completed a litter prevention strategy for their region.	Setup costs could be minimal.	Requires ongoing leadership and administration.
Some volunteers who collect litter would like to contribute to a better understanding of litter types, quantities, locations and impacts.	A version of the Key Littered Items Study for inland rivers, including a standardised sampling method and reporting system, with open access to data.	The NSW Government has established the 'Key Littered Items Study' at sites along the NSW coast.	Range of options possible to suit different budgets.	Requires technical expertise to establish and maintain.
	Standardised reporting for general clean-up data.	There are various options available including the AMDI database.	Most of the apps are free to use.	Requires leadership and coordination to get everyone using the same system. Access to the data is a potential issue - control of the data may be in the hands of the app developer, or the app may cease to exist in future.

Issues	Ideas and potential benefits	Examples elsewhere	Costs	Risks
Litter that remains in the environment becomes more dispersed and harder to collect.	Clean-ups could be more targeted, e.g. following events and prior to mowing.	Rather than quietly cleaning up, some community groups have made a case for change by collecting data on specific litter types, e.g. balloons, cotton buds, lollipop sticks (SoShire).	Low cost, potentially significant time involved.	Volunteers are asked to take on work they might reasonably expect event organisers or Council to be doing.
People using the riverside parks know littering is wrong but do it anyway.	Direct engagement with picnickers using the parks	Canterbury-Bankstown Council hands out litter bags and asks picnickers to sign a pledge not to litter.	Low cost if volunteers do the work.	Requires willing volunteers.
There are mixed views on signage as a method to change littering behaviour.	Public art could be a more positive option to encourage people to dispose of litter appropriately and create a sense of community pride and ownership in public places.	A litter-focused art mural was completed in Lakemba in 2015, to improve the streetscape of The Boulevarde and encourage the community to commit to litter-free zones.	Art projects could be tailored to suit a range of budgets.	Public art would require Council's support.
Fishing is a popular activity at the river.	OzFish is investigating ways to provide reusable bags for litter collection, including an incentive to bring them back.	Similar to the Return and Earn Container Deposit Scheme.	Return and Earn involved significant setup costs – this would need to be simpler.	Requires partner involvement.
More bins are required and standard bins are not suitable where access is difficult or where they are subject to frequent flooding.	"Community bins": community groups could manage additional riverside bins, including removing them ahead of flood events.	Bayside Council in Sydney's southeast has installed 18 lightweight beach bins, which can be collected by hand or using a small buggy.	Best to start with a low-cost trial to test options, learn what works and prove the concept.	Requires a robust design suitable for the local conditions, and a long-term commitment to maintenance.
Public places suffer a 'tragedy of the commons'.	Community groups or businesses could take some ownership over keeping parks, reserves or a section of river frontage clean.	Adopt a Park (Greater Dandenong); Adopt a Spot (Queensland, WA)	Moderate – examples elsewhere offer some equipment and support.	Requires someone to coordinate and a reasonably long-term commitment by adopters.

Issues	Ideas and potential benefits	Examples elsewhere	Costs	Risks
	Residents could take some ownership over keeping smaller public areas clean – e.g. a section of their street.	'Crabwalkers' clean up their local streets around the Cooks River in Sydney, and tally their efforts in a shared database.	Low – the Crabwalkers example is a lean operation.	Requires someone to coordinate.
	A Caring for Country approach could encourage more proactive engagement with public places.	Dharriwaa Elders on the Namoi and Barwon River have been the recipients of a past EPA community litter prevention grant.	Projects could be tailored to suit a range of budgets.	Requires a local Indigenous community group interested to get involved.
Litter is sometimes associated with other antisocial behaviours and bigger underlying social problems.	Involve organisations with broader health/community building objectives in litter prevention projects.	TAFE NSW Sydney Region has implemented cigarette butt litter prevention projects that are "part of a broader project… to raise awareness of the harmful effects of smoking on individual wellbeing and the environment"	Projects could be tailored to suit a range of budgets.	Requires willing partners.
There is a perception that young people are involved in littering.	Education programs for schools were seen as a beneficial opportunity.	Many examples of existing programs, e.g. Taronga's Litter Free Rivers.	Moderate cost involved in staff time.	Requires willing schools.
Single use plastics, particularly food and beverage packaging, are commonly littered.	Work with local businesses and event organisers to reduce single-use plastics.	Various NGOs working in this area, e.g. the Plastic Free Places program run by Boomerang Alliance.	Significant effort likely to be required to make an impact.	Plastic alternatives may still be littered and key littered items may be the hardest items to influence.
Hay bale plastic wrapping became a significant pollutant during recent floods.	Work with Local Land Services to educate landholders to remove plastic-wrapped hay bales and rectangular bales with plastic twine from the floodplain in La Nina seasons, or use alternative baling materials.	There are examples elsewhere of sisal string and biodegradable hay bale nets being used to bale hay.	A simple awareness campaign could be a low-cost beginning, but significant effort may be required to drive a change in practices.	While this plastic has been quite visible in recent times, it is probably less prevalent in more typical seasons and other types of litter may be doing significantly more harm.

Issues	Ideas and potential benefits	Examples elsewhere	Costs	Risks
Construction materials have been identified as a potential source of litter in the river (see Table 2). Construction sites are quite visible and can set an example to the community.	Approach construction companies with projects close to the river to pledge to keep their site free of litter. They could also be encouraged to take an additional step, for example to sponsor another initiative.	A MACROC project in 2017-18 targeted construction site litter. The City of Ryde has created an easy pathway for businesses to take an anti-litter pledge and to display anti-litter messaging.	Projects could be tailored to suit a range of budgets	Requires companies willing to take part. Council involvement would be preferable.

8 SUMMARY AND NEXT STEPS

This litter prevention business case for the Wambuul-Macquarie River in the Dubbo LGA has identified local litter issues and hotspots, and outlined the impacts of litter in the Wambuul-Macquarie River.

It has identified many potential opportunities to address local litter issues, and it has identified organisations who could play a role in implementing these or similar initiatives.

To progress litter prevention in the local area, the next step now is to bring these elements together so that local organisations are enabled to take action.

OzFish is also taking the findings from this project to their national audience of recreational fishers, and to their national program of initiatives to reduce the impacts of litter.

8.1 OZFISH'S NEXT STEPS

To develop this business case, OzFish has taken a deep dive into litter issues and opportunities in the Dubbo LGA. With a local presence in Dubbo, OzFish will continue their efforts to prevent litter here and minimise its impacts in the Wambuul-Macquarie River. However, OzFish has limited capacity to pursue an intensive focus on litter prevention in the LGA in the long-term.

OzFish has identified that their strengths as an organisation are aligned with their national presence, their focus on healthy waterways, and their strong relationship with recreational fishers across the country. Therefore, they are well placed to continue building their programs focused on source control of fishing litter and targeting recreational fishers across the country.

Therefore, five key steps of OzFish, outlined below, focus (1) on the Dubbo area and (2-5) on the recreational fishing sector across the country.

1. Local litter prevention network

In the Dubbo LGA, OzFish has identified other local organisations who are interested to work in partnership on litter prevention, and are prepared to initiate a litter prevention network to coordinate their efforts and to take action on initiatives including litter monitoring, coordinated clean ups and potentially one or more community bins. OzFish will continue working with this network in the local area.

2. Advocacy and engagement directly with recreational fishers

As part of their 'Inland Fishers Tackling Litter' project, OzFish has produced a video and a series of vodcasts about litter. The video and vodcasts are aimed at recreational fishers to raise awareness about litter and reduce littering in the recreational fishing community. The video and vodcasts will be aired on OzFish and BCF - Boating Camping Fishing social media channels.

The video will be released with a survey to recreational fishers. The aim of the survey is to gain insight into the attitudes and behaviours of recreational fishers regarding litter. The survey will be used by OzFish over the coming months to better inform OzFish litter prevention projects and messaging to recreational fishers.

3. Advocacy and engagement with industry

OzFish is investigating opportunities to reduce recreational fishing items that often become litter, such as plastic bait containers, plastic packaging around lures, and lead sinkers; plus reduce the amount of plastic packaging generally – such as unnecessary plastic bags around yabby nets and providing sustainable and reusable bait bags. As part of the Wambuul-Macquarie River project, OzFish commenced discussions with BCF about opportunities for source control of fishing litter, including:

- Reducing plastic packaging for lures: BCF advised this is something they are already working on, along with other suppliers.
- Creating an incentive scheme for fishers to bring in litter collected while fishing, and exchange it for a lure. BCF decided they were not able to run this due to the challenges in setting up such a scheme.

4. Engagement with other fishing organisations

OzFish is engaging with other recreational fishing organisations on litter prevention. At the 2023 World Recreational Fishing Congress, in collaboration with TierraMar, OzFish ran a workshop session "Tackling Litter: National Action Plan to address recreational fishing generated waste and ghost gear for Australia".

OzFish has also begun reaching out to other fishing organisations via the Australian Recreational Fishing Foundation (ARFF), which is is the peak representative body to the Australian Federal Government. It is a partnership between State peak fishing bodies, representative organisations and fish habitat groups. OzFish has reached out to the ARRF to seek:

- Connections with other ARRF members who may also be working on litter prevention initiatives.
- An opportunity to present to ARRF members about reducing litter in recreational fishing.

OzFish will continue this engagement to build broader support for litter prevention.

5. Continued advocacy for litter prevention in inland rivers

This business case has highlighted that inland rivers including the Wambuul-Macquarie River are experiencing significant impacts from litter, but litter prevention research, policy and action is mainly focused on coastal areas. OzFish will continue its advocacy for greater focus on inland rivers. The collaboration with Professor Steve Smith of Southern Cross University to develop an inland river version of the KLIS is an important initiative in this area. The first inland KLIS sites will be established in Dubbo in 2023.

8.2 NEXT STEPS FOR THE DUBBO LGA

While local organisations can make some headway on litter prevention by working together, many of the issues raised in this business case are beyond the capacity of community groups and local NGOs.

Effective litter prevention in the Wambuul-Macquarie River needs a coordinated approach throughout the catchment, including all the elements present in the EPA's litter prevention framework: source control, diversion to a circular economy, education, awareness and engagement, regulation and enforcement, infrastructure and clean-up, stopping litter dispersal, evaluation, monitoring and research. To work effectively across all these areas, state government leadership is key, and local government involvement is essential. With their roles in caring for public places, managing infrastructure and maintaining public facilities, Dubbo Regional Council has important responsibilities.

Dubbo Regional Council could use this business case to renew their focus on litter prevention. Potential next steps for Council would be:

- To take action at the litter hotspots identified in Section 3. At many of the sites where OzFish completed Local Litter Checks, there are clear needs to upgrade infrastructure and/or improve maintenance.
- To survey other hotspots beyond the river, and plan litter prevention initiatives at these locations as well.
- To undertake a review of public bins, update their design as necessary to minimise vandalism, and install new bins.
- To explore how they could take on more of a role in coordination of local litter prevention efforts, involving community groups, NGOs, schools, businesses and the broader community in litter prevention initiatives.

Council is eligible for grant funding under the Waste and Sustainable Materials Strategy 2041 (WASM) Litter Prevention Grants Program, including grants for on-ground projects and strategic development/capacity building.

9 REFERENCES

Bathurst Regional Council. (2022, May 19). *Media Release: Banishing Bathurst Butts Beyond the CBD*. Retrieved from https://yoursay.bathurst.nsw.gov.au/newscentre/news_feed/banishing-bathurst-butts-beyond-the-cbd

Centre for International Economics. (2021). *Measuring environmental costs from litter and illegal dumping.*

Centre of International Economics. (2022). *Willingness to pay for reduced litter and illegal dumping - Stated preference research.*

Chen, Q., Allgeier, A., Yin, D., & Hollert, H. (2019). Leaching of endocrine disrupting chemicals from marine microplastics and mesoplastics under common life stress conditions. *Environment international, 130*, 104938.

Connick, F. (2022, Sept 22). *700 metres of rubbish: farmers grapple with choked rivers amid Australia's third La Niña*. Retrieved from The Guardian - Australian edition: https://www.theguardian.com/australia-news/2022/sep/22/700-metres-of-rubbish-farmers-grapple-with-choked-rivers-amid-australias-third-la-nina

Dubbo PhotoNews. (2017). *Bid to stop littering at skate park and Elston Park*. Retrieved Nov 3, 2022, from Dubbo PhotoNews online newspaper: https://www.pressreader.com/australia/dubbo-photo-news/20170831/283862983403021

Dubbo Regional Council. (2021). *Stormwater*. Retrieved Nov 3, 2022, from Dubbo Regional Council: https://www.dubbo.nsw.gov.au/Our-Region-Environment/Water-sewerage-and-drainage/stormwater

Dubbo Regional Council. (2021a). *Towards 2040 Community Strategic Plan.*

Dubbo Regional Council. (2021b). *Long term financial plan.*

Dubbo Regional Council. (2022). *2022/2023 Delivery Program and Operational Plan.*

Dubbo Regional Council. (2022). *Annual Report 2021-22.*

Emmerik, T., & Schwarz, A. (2019). Plastic debris in rivers. *WIRES Water, 7*(1). doi:https://doi.org/10.1002/wat2.1398

Feng, Z., Zhang, T., Li, Y., He, X., Wang, R., Xu, J., & Gao, G. (2019). The accumulation of microplastics in fish from an important fish farm and mariculture area, Haizhou Bay, China. *Science of the Total Environment, 696*, 133948.

Iris Research. (2019). *Dubbo Regional Council Community Needs & Satisfaction Survey 2019.* Prepared for Dubbo Regional Council.

Karlsson, T. M., Vethaak, A. D., Almroth, B. C., Ariese, F., Van Velzen, M., Hassellöv, M., & Leslie, H. A. (2017). Screening for microplastics in sediment, water, marine invertebrates and fish: method development and microplastic accumulation. *Marine Pollution Bulletin, 122*(1-2), 403-408.

Lavarack, J. (2021). The Litter Journey: Big picture for litter prevention. *Proceedings of the*

Litter Congress 2021. Keep Australia Beautiful NSW.

MRA Consulting Group. (2015). *Litter Costs to the NSW Economy - a preliminary report.* NSW Environment Protection Authority.

NSW Department of Planning, Industry and Environment. (2021a). *NSW Waste and Sustainable Materials Strategy 2041.*

NSW Department of Planning, Industry and Environment. (2021b). *Plastics Action Plan 2021.*

NSW Environment Protection Authority. (2013). *NSW Litter Prevention Kit: Things you should know about litter and litterers.*

NSW Environment Protection Authority. (2019a). *EPA Litter Prevention Kit Part 2: Delivering effective local litter prevention projects.*

NSW Environment Protection Authority. (2019b). *Identifying effective strategies to reduce cigarette butt litter.*

NSW Environment Protection Authority. (2022a). *NSW Litter Prevention Strategy 2022-2030.*

NSW Environment Protection Authority. (2022b). *The Litter Journey: a closer look*. Retrieved Oct 5, 2022, from NSW EPA Don't be a Tosser website: https://www.dontbeatosser.epa.nsw.gov.au/litter-journey

NSW Environment Protection Authority. (2022c). *Council litter grants*. Retrieved Nov 3, 2022, from NSW EPA: https://www.epa.nsw.gov.au/working-together/grants/litter-program/council-litter-grants

NSW Government. (2018). *Marine Estate Management Strategy 2018-2028.*

NSW Government. (2021). *NSW Litter Report 2016-2020.*

NSW Office of Environment and Heritage. (2012). *Macquarie Marshes Ramsar Site: Ecological character description. Macquarie Marshes Nature Reserve and U-block components.*

Parker, B., Andreou, D., Green, I. D., & Britton, J. R. (2021). Microplastics in freshwater fishes: Occurrence, impacts and future perspectives. *Fish and Fisheries, 22*(3), 467-488. doi:https://doi.org/10.1111/faf.12528

Powell, B. (2023). Pers. Comm. . Dubbo, NSW.

Riviere, R. (2021). #SeaToSource – tackling one of the world's most solvable environmental issues. *Coast to Coast Conference Proceedings.* Retrieved from https://coasttocoastconference.com.au/3860

Sarijan, S., Azman, S., Said, M., & et al. (2021). Microplastics in freshwater ecosystems: a recent review of occurrence, analysis, potential impacts, and research needs. *Environ Sci Pollut Res, 28*, 1341–1356. doi:https://doi.org/10.1007/s11356-020-11171-7

Sharma, S., & Chatterjee, S. (2017). Microplastic pollution, a threat to marine ecosystem and human health: a short review. *Environmental Science and Pollution Research, 24*(27), 21530-21547.

Spehr, K., & Curnow, R. (2015). *Litter-ology: Understanding Littering and the Secrets to Clean Public Places.* Frankston Vic 3199: Environment Books.

Stormwater NSW. (2021). *Dubbo Council installs new stormwater management devices*. Retrieved Nov 3, 2022, from Stormwater NSW: https://stormwaternsw.asn.au/dubbo-council-installs-new-stormwater-management-devices/

APPENDIX A: LOCAL LITTER CHECK RESULTS

A Snapshot of Butlers Falls Reserve litter 2022

A Local Litter Check (LLC) was conducted in April-May 2022 at Butlers Falls Reserve in Cumboogle. The site is located between Dubbo and Wellington on the Wambuul-Macquarie River. LLCs are done in three steps to characterise the litter issues at a site:

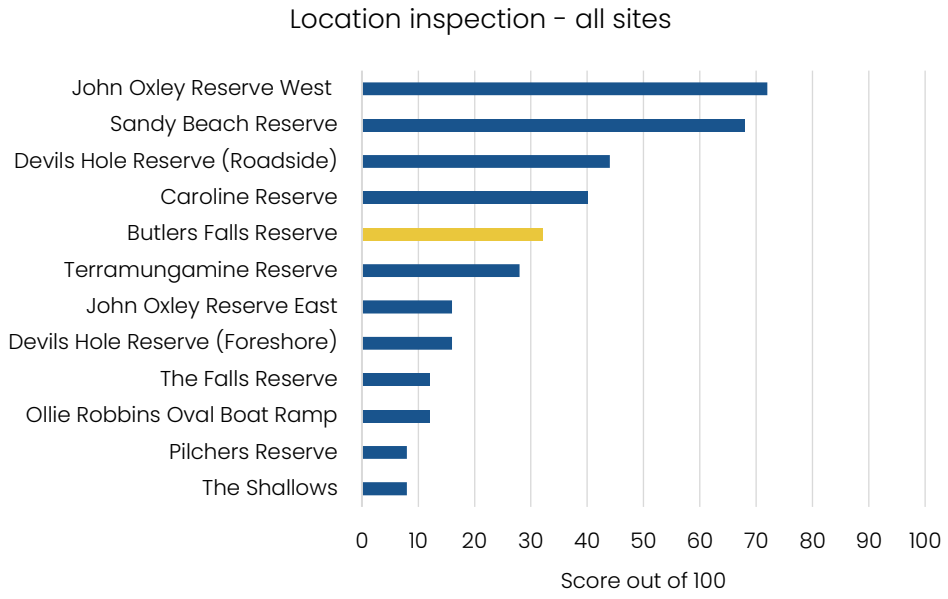
1. A location inspection
2. A litter count
3. User surveys

Location inspection

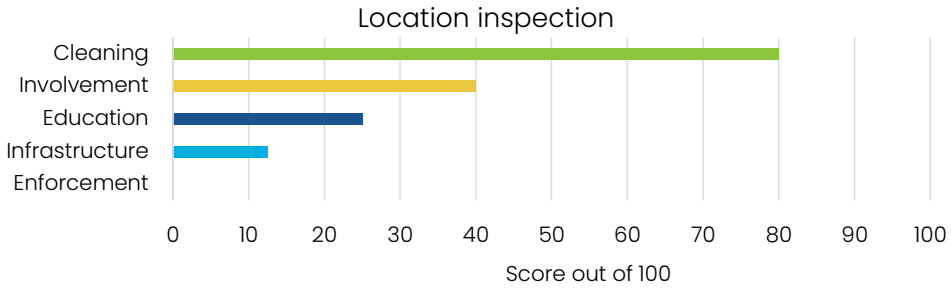
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLC location inspection surveys for Dubbo and Wellington, Butlers Falls Reserve had a score close to the median of other sites. The site had a **location inspection score** of **32 out of 100** (or 32%).



Butlers Falls Reserve's scores across the five main categories that make up the overall location inspection survey score are shown in the chart below. The chart shows that the site **scored highly in 'Cleaning' (80) and got no points for the 'Enforcement' category.** The site scored **relatively poorly in all other categories**.



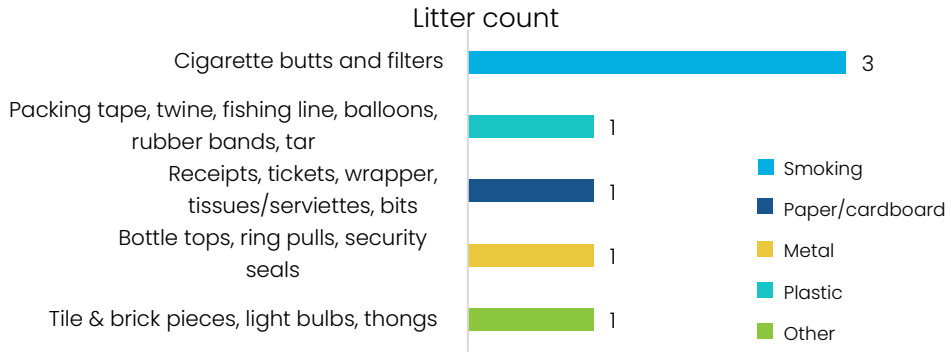
Other insights gained from the location inspection were:

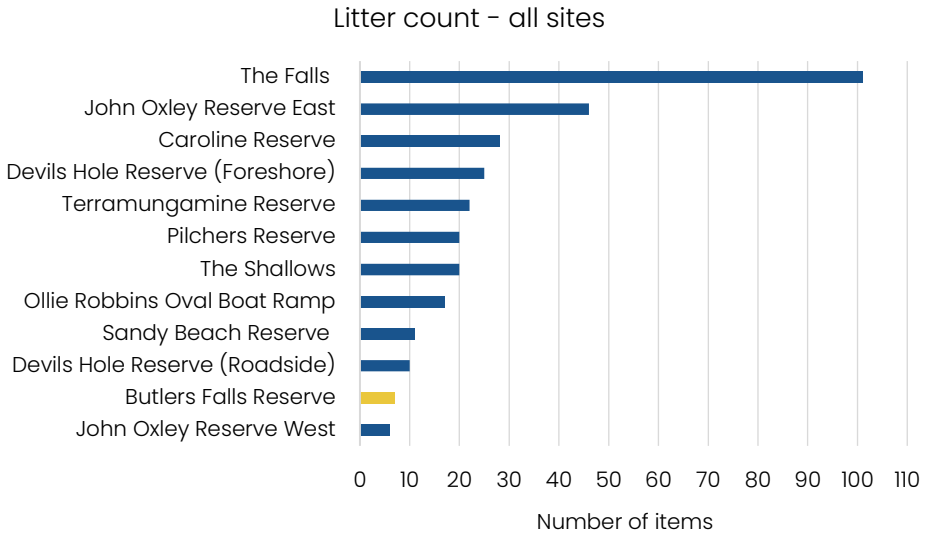
- "A large site with only two bins"
- "Site is regularly maintained by OzFish"

Litter Count

The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Butlers Falls Reserve, a 16m x 3m area was surveyed at the location marked on the map below, close to the Wambuul-Macquarie River.

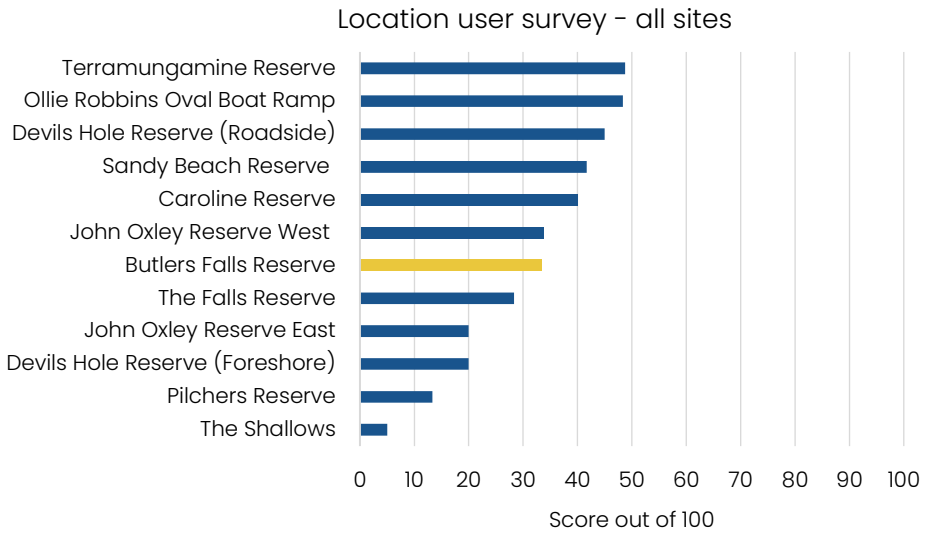
Butlers Falls Reserve had the **second lowest no. of items** recorded. The site had **7 items** across all item types. **Smoking related items** made up the bulk of items (3/7). Most items were considered **small items** (**<100mL**) and one item was considered a medium item (100mL-1L) (Tile & brick pieces...).



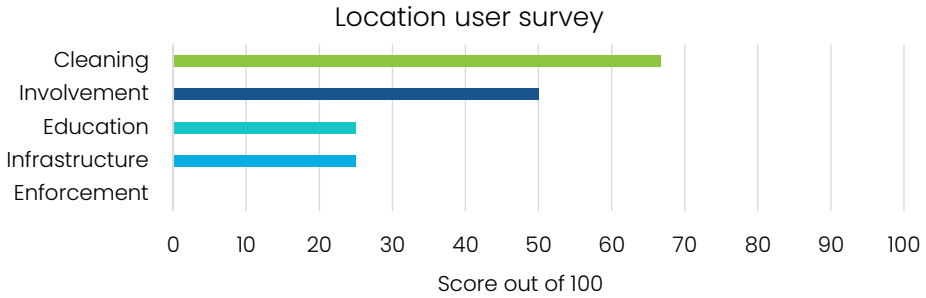


Location users

Three park users were asked to participate in the third component of the LLC, the location user survey at Butlers Falls Reserve. Users were asked a range of questions from the same five key categories of the Location Inspection Survey. Butlers Falls Reserve scored 33 out of 100 **(33%) overall**.



A breakdown of scores in each category is shown in the chart. Scores were summed across all three surveys and converted to a score out of 100. The chart shows that Butlers Falls Reserve scored **moderately well** in and **'Cleaning' (63)**, **'Education' (50)**, and **'Enforcement' (50)** and **relatively poorly in**. **'Involvement' (25)** and **'Infrastructure' (13)**.



Key comments from users of the reserve were:

- "There are not enough bins, and they are not placed in the right location"
- "There are many secluded spots where people could get away with littering"
- "Site is clean other than after floods"

Site photos

The following photos show evidence of vandalism at Butlers Falls Reserve, where bins have clearly been melted and then replaced by Council.


Pilchers Reserve
Pilchers Reserve
Pilchers Road
Old Dubbo Pioneer Cemetery
Wambuul-Macquarie River
Angle Road
Old Dubbo Road
Old Dubbo Road
Butlers Falls
Angle Road
Butlers Falls Reserve
0
250
500 m

A Snapshot of Caroline Reserve litter 2022

A Local Litter Check (LLC) was conducted in May 2022 at Caroline Reserve in Dubbo. LLCs are done in three steps to characterise the litter issues at a site:

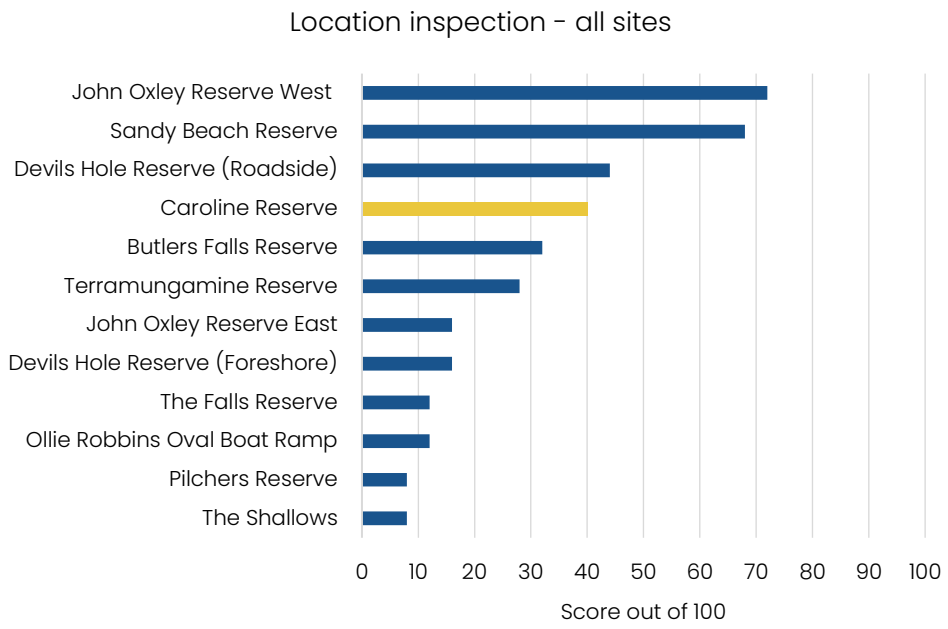
1. A location inspection
2. A litter count
3. User surveys

Location inspection

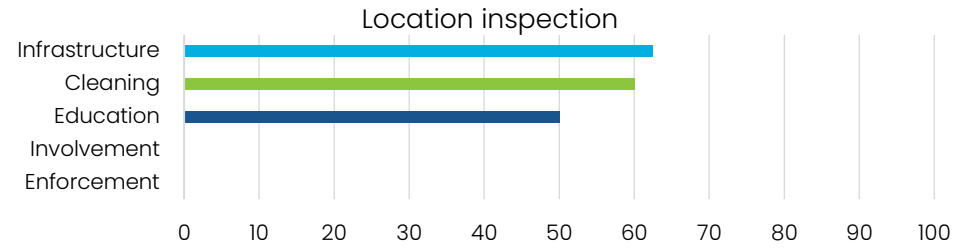
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLC location inspection surveys for Dubbo and Wellington, Caroline Reserve sat around the median score. The site had a **location inspection score of 40** out of 100 (or 40%).



Caroline Reserve's scores across the five main categories that make up the location inspection survey score are shown in the chart below. The chart shows that Caroline Reserve **scored relatively well in 'Infrastructure' (62.5)** and **'Cleaning' (60)**, and **poorly in 'Involvement' and 'Enforcement' (0)**.



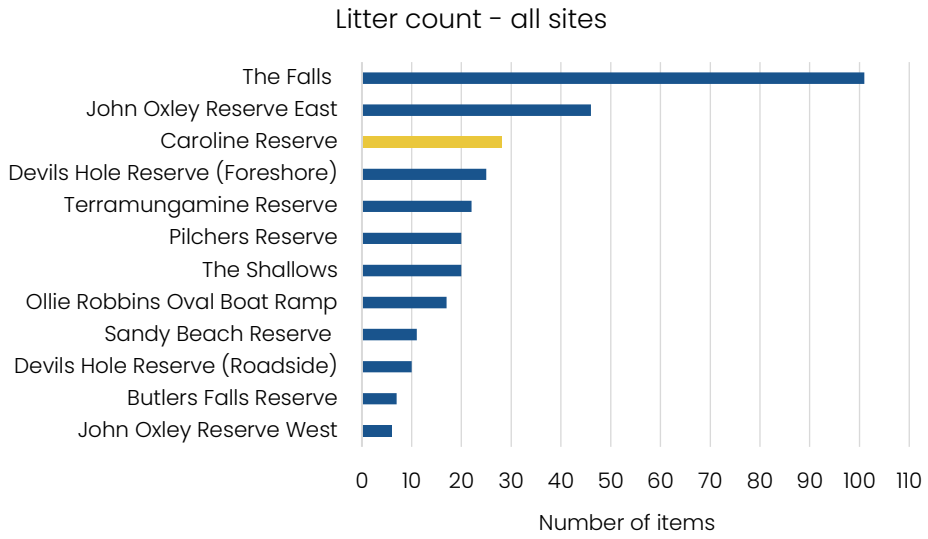
Other insights learned from the location inspection included:

- "Site is relatively clean, however, litter is concentrated at the carpark and fishing spot"
- "Bins are far from the carpark and are not visible at all from the fishing spot"
- "There is evidence of vandalism here including melted bins and damaged seating"

Litter Count

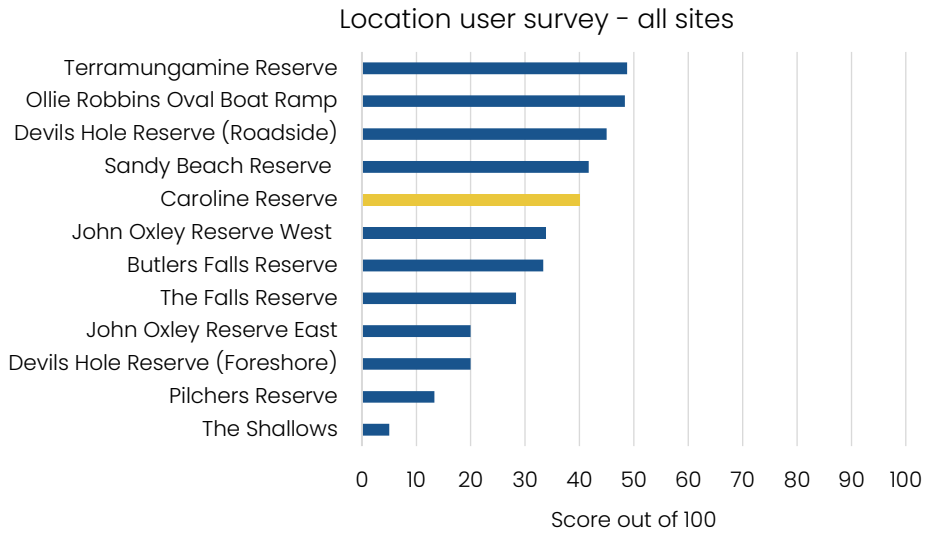
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Caroline Reserve, a 16m x 3m area was surveyed at the location marked on the map below, between the Old Dubbo Road and the Wambuul-Macquarie River.

The LLC litter count component found that Caroline Reserve was the **third most littered site** out of all sites surveyed across Dubbo and Wellington. The site had **28 items** which were either **glass, metal or plastic** items and ranged in size from **<100Ml up to 1L**..

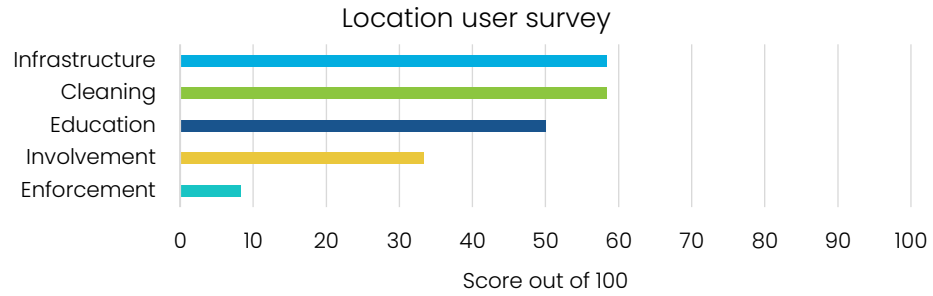


Location users

Three park users were asked to participate in the third component of the LLC, the Location User Survey. Users were asked a range of questions from the same five key categories of the Location Inspection Survey. Caroline Reserve scored 38 out of 100 **(38%) overall**.



A breakdown of scores in each category is shown in the chart. Scores were summed across all three surveys and converted to a percentage. The chart shows that Caroline Reserve **scored moderately in 'Infrastructure' and 'Cleaning' (58)**, and **poorly in 'Enforcement'** (8).



Key comments users had were:

- "The amenities are poorly maintained"
- "Litter accumulates at the waters edge on steep banks"
- "Not enough bins and existing bins poorly placed at the reserve"

Site photos

The following photos show Caroline Reserve during time of surveys in May 2022.


Macquarie Street
Margaret Crescent
Old Dubbo Road
Old Dubbo Road
Paterson Circuit
Holmwood Drive
Crossroads Drive
Noccundra Place
Hennessy Drive
Hennessy Drive
Gilgai Court
Caroline Recreation Reserve
Caroline Reserve
Wambuul-Macquarie River
Old Dubbo Road
0
100
200 m

A Snapshot of Devils Hole Reserve Local Litter Check 2022

Two Local Litter Checks (LLCs) were conducted in March-April 2022 at Devils Hole Reserve, one closer to the road side of the reserve and one closer to the river. This litter snapshot is for the site closer to the river. LLCs are done in three steps to characterise the litter issues at a site:

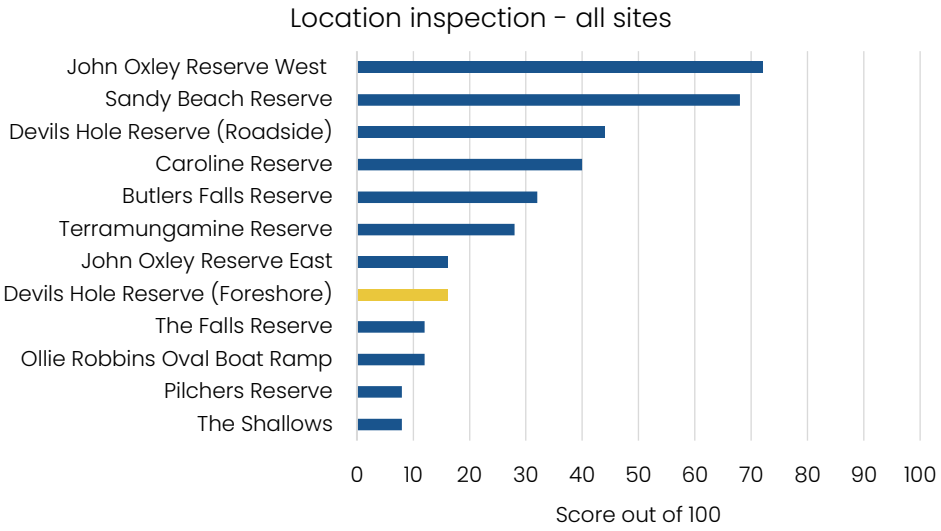
1. A location inspection
2. A litter count
3. User surveys

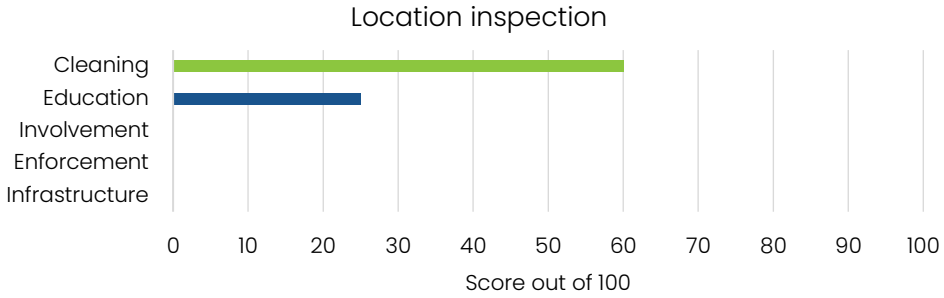
Location inspection

The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, the roadside site for Devils Hole Reserve had a **relatively low location inspection score**, **at 16** out of 100 (16%).



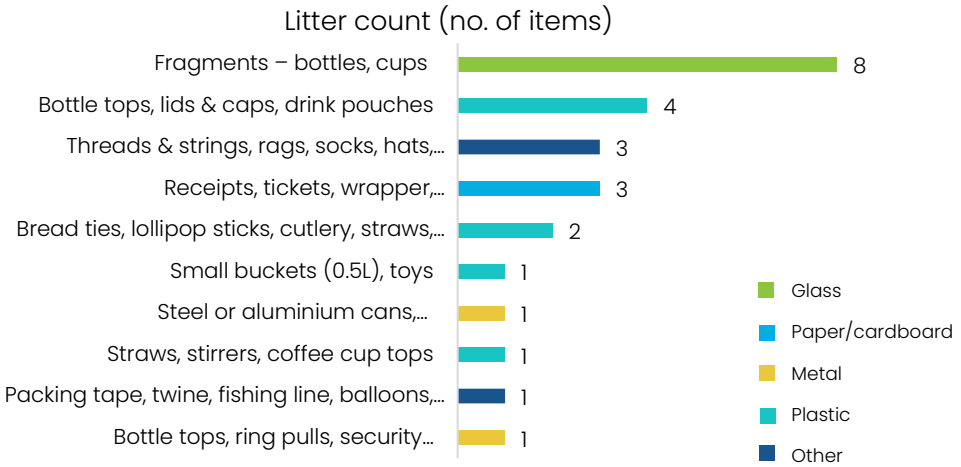


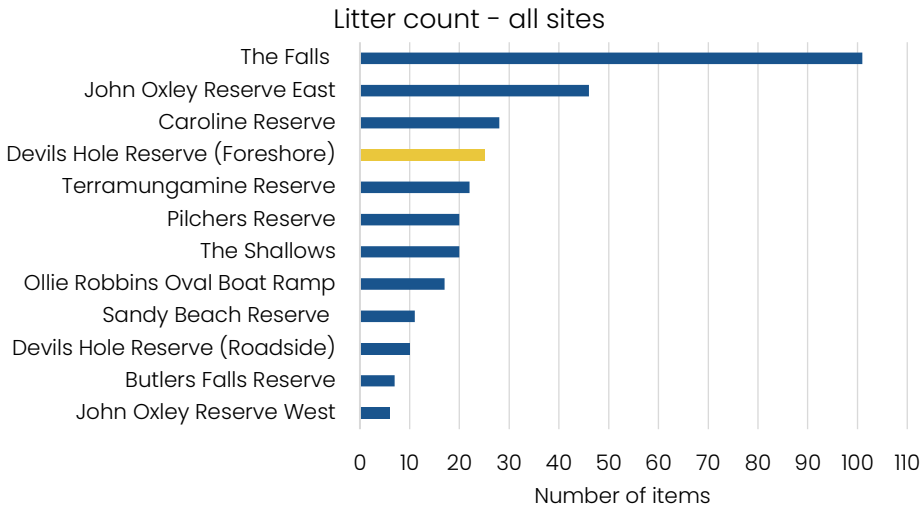
The chart above shows that Devils Hole scored **relatively well in 'Cleaning'** (60) and **low in 'Involvement'** (25)**.** The site scored **no points in 'Involvement', 'Enforcement' and 'Infrastructure'.** The site scored no points for the three categories because:

- There are no bins
- Litterers are unlikely to get caught or fined here
- The location does not seem to have a strong sense of community

Litter Count

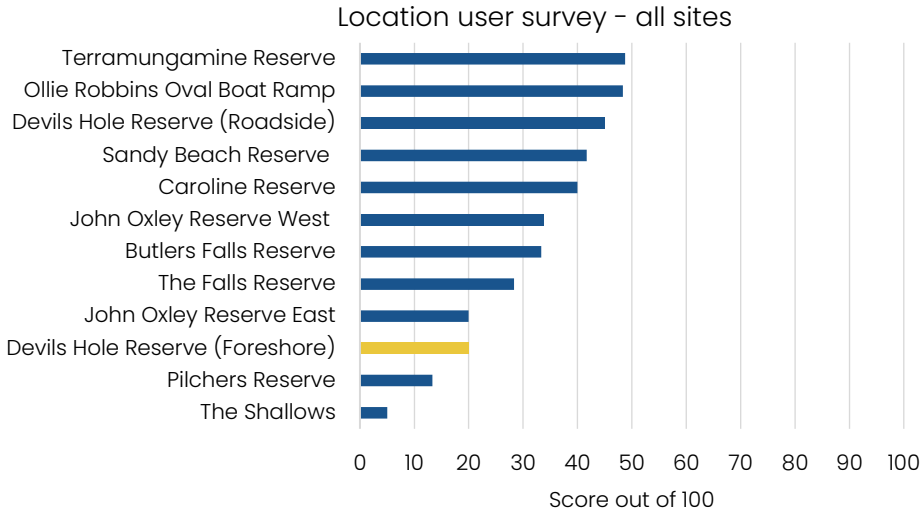
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Devils Hole Reserve, a 16m x 3m area was surveyed at the location marked on the map below. The litter count at Devils Hole Reserve recorded **25 items**, the third lowest across all sites in the area. These items were mostly considered **'small items'** (<100mL)(22 items) with **only 3 medium sized items** (100mL-1L). The bulk of items were glass items in the '**Fragments – bottles, cups' category.**



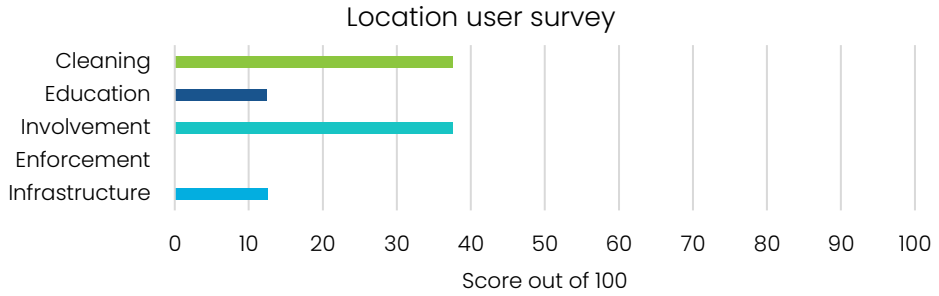


Location users

Two park users were asked to participate in the third step of the LLC, the Location User Survey. The users were asked a range of questions on the same five topics covered in the Location Inspection Survey. Devils Hole Reserve scored **20 overall,** according to users of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores converted to a score out of 100. Devils Hole Reserve achieved a **relatively high score in the 'Involvement'** (38) and **'Cleaning'** (38) categories and low in **'Education'** (13) and **'Infrastructure'** (12). The site scored **no points in the 'Enforcement'** category.



Additional comments users had about litter at the reserve were:

- "The river goes, up and down, leaving rubbish on the shoreline."
- "There are many secluded spots."

Site photos

The following photos show Devils Hole Reserve during the LLC in March-April 2022.


Wambuul-Macquarie River
Devils Hole Foreshore
Devils Hole Roadside
Brisbane Street
Bourke Street
Newell Highway
0
100
200 m

A Snapshot of Devils Hole Reserve Local Litter Check 2022

Two Local Litter Checks (LLCs) were conducted in March-April 2022 at Devils Hole Reserve, one closer to the road side of the reserve and one closer to the river. This litter snapshot is for the site closer to the road. LLCs are done in three steps to characterise the litter issues at a site:

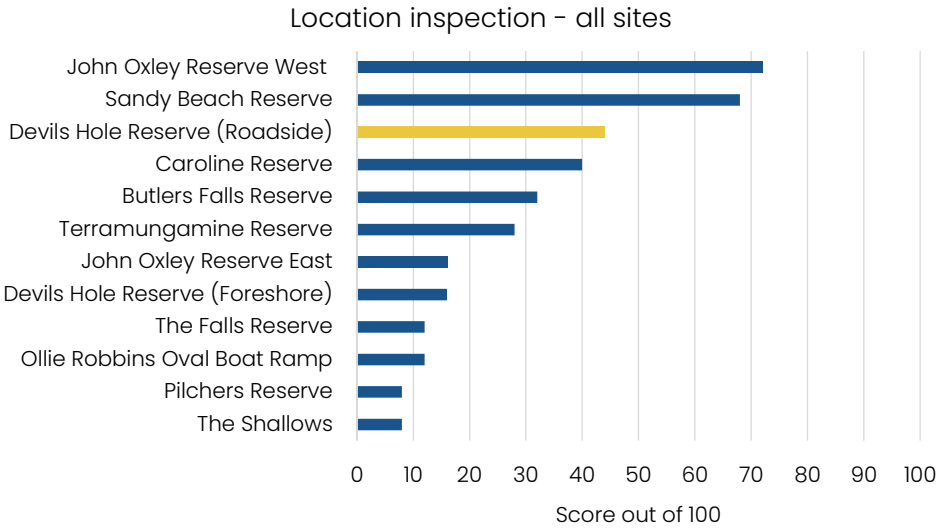
1. A location inspection
2. A litter count
3. User surveys

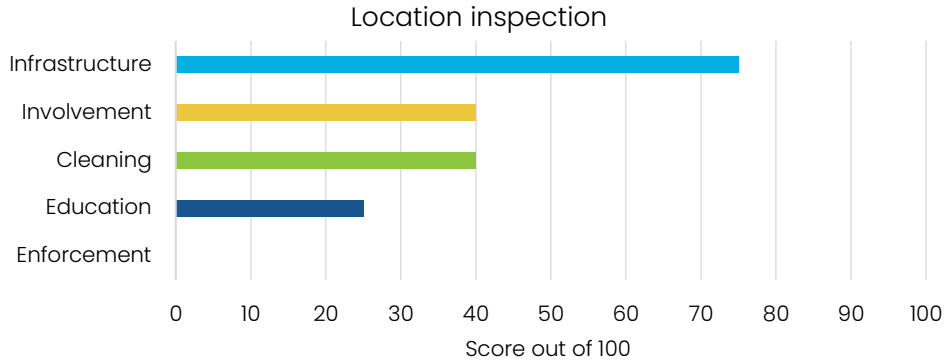
Location inspection

The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, the roadside site for Devils Hole Reserve had a **relatively high location inspection score**, **at 44** out of 100 (44%).



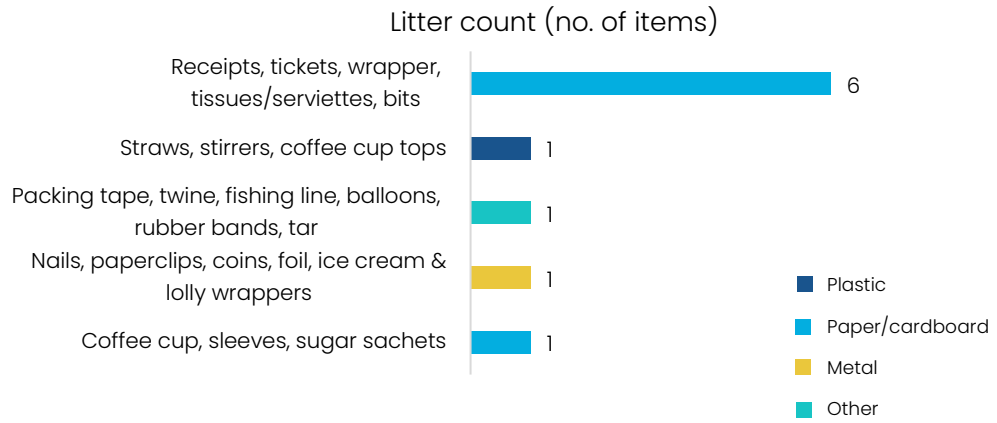


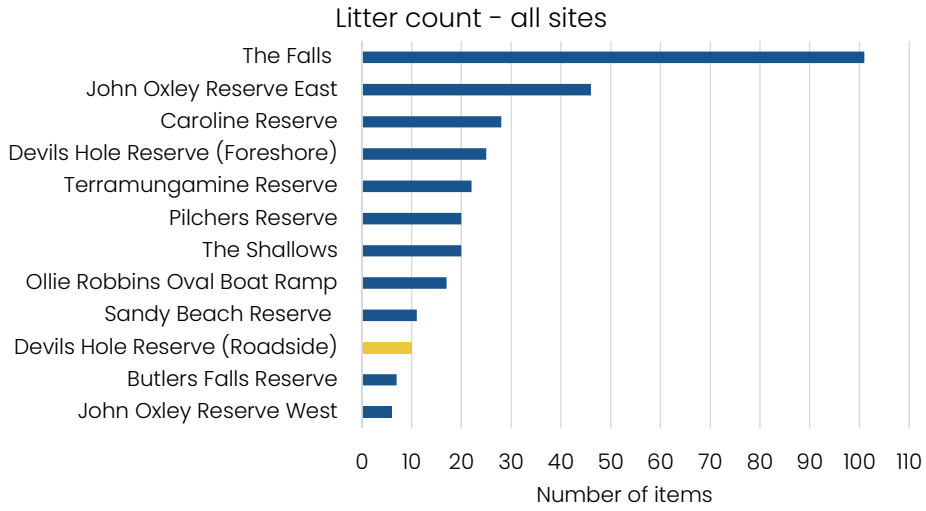
The chart above shows that Devils Hole scored **relatively well in 'Infrastructure'** (75%), moderately **well in 'Involvement'** (40) **and 'Cleaning'** (40) and **poorly in 'Education'** (25%) The site scored **no points in 'Enforcement'.** The site scored no points for the 'Enforcement' category because:

- There are no regular patrols here
- Litterers are unlikely to get caught or fined here
- The penalties for littering are unclear

Litter Count

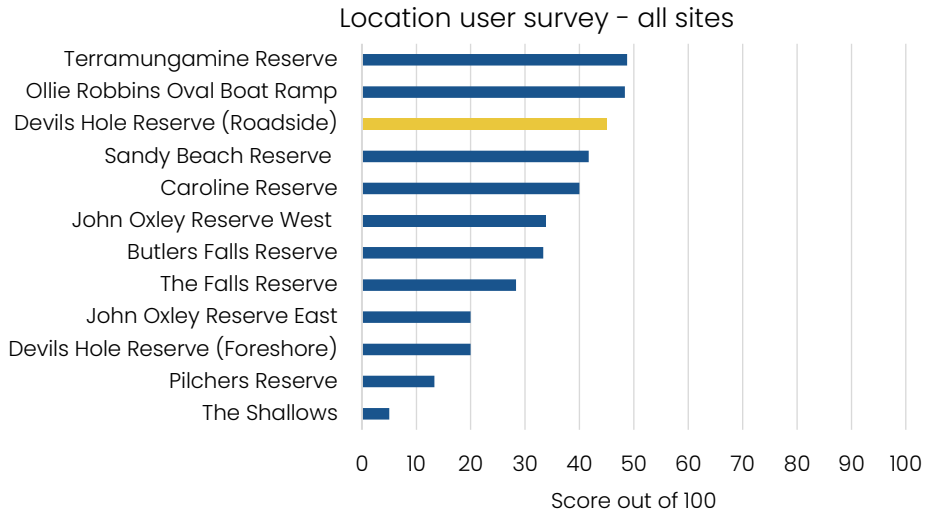
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Devils Hole Reserve, a 16m x 3m area was surveyed at the location marked on the map below. The litter count at Devils Hole Reserve recorded only **10 items**, the third lowest across all sites in the area. These items were mostly considered **'small items'** (<100mL)(9 items) with **only one medium sized items** (100mL-1L). The bulk of items were **Receipts, tickets, wrapper, tissues/serviettes, bits.**



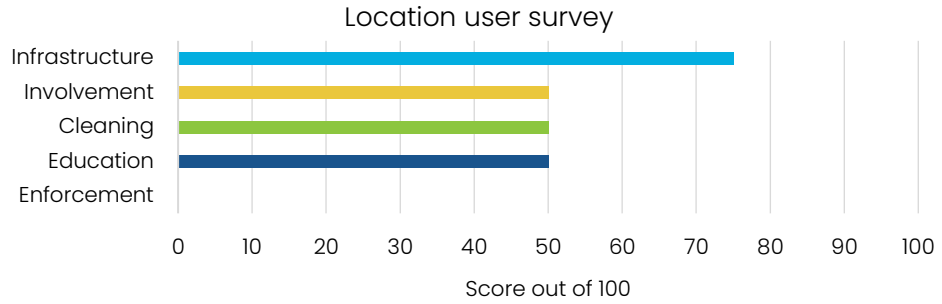


Location users

One park user was asked to participate in the third step of the LLC, the Location User Survey. The user was asked a range of questions on the same five topics covered in the Location Inspection Survey. Devils Hole Reserve scored **45 overall,** according to users of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores converted to a score out of 100. Devils Hole Reserve achieved a **high score for the 'Infrastructure'** (75) **and relatively high in 'Education'** (50), **'Involvement'** (50) and **'Cleaning'** (50) categories. However, the site scored **no points in 'Enforcement'** (25).



Site photos

The following photos show Devils Hole Reserve during the LLC in March-April 2022.


Wambuul-Macquarie River
Devils Hole Foreshore
Devils Hole Roadside
Brisbane Street
Bourke Street
Newell Highway
0
100
200 m

A Snapshot of John Oxley Reserve East Local Litter Check 2022

A Local Litter Check (LLC) was conducted in April 2022 at John Oxley Reserve East of Herbert Street. LLCs are done in three steps to characterise the litter issues at a site:

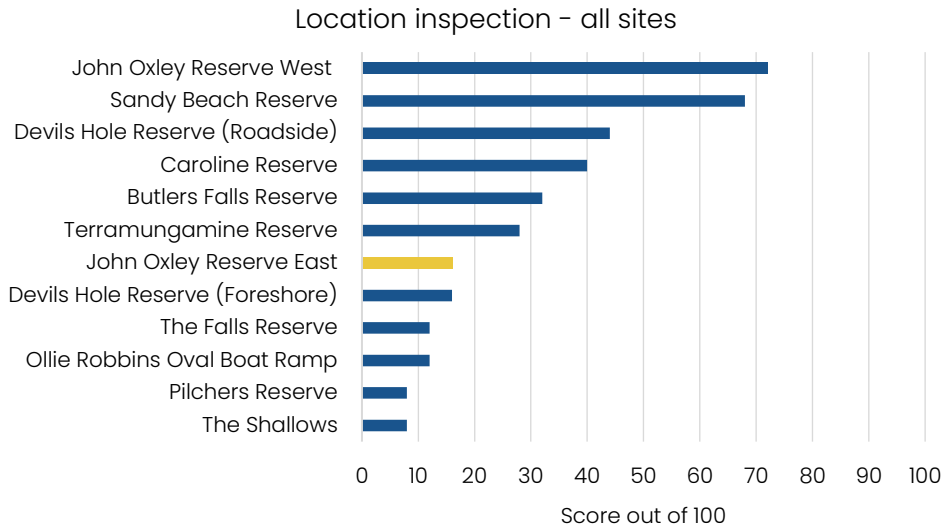
1. A location inspection
2. A litter count
3. User surveys

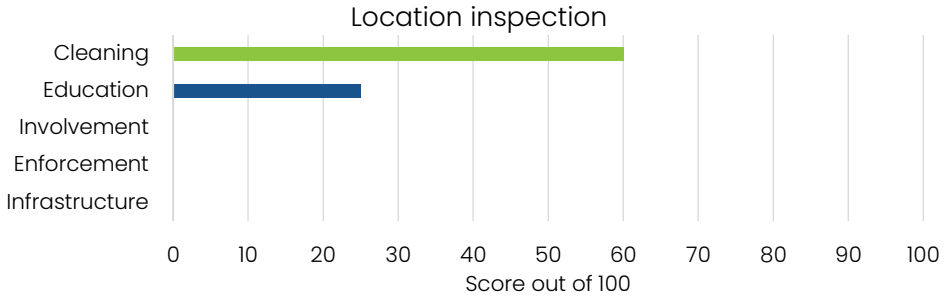
Location inspection

The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, John Oxley Reserve East had a score close to the median at the location inspection level, at 16 out of 100 (16%).





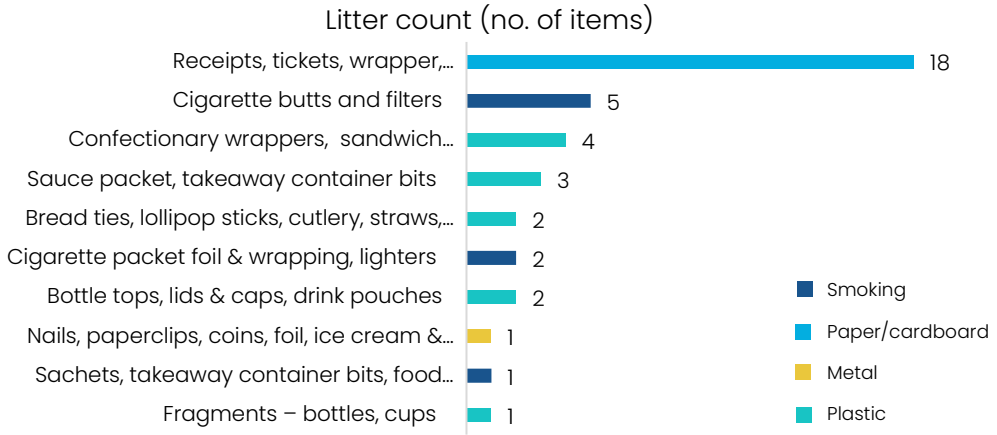
The chart above shows that John Oxley Reserve East scored **relatively well in 'Cleaning'** (60%), **poorly in 'Education'** (25%) and scored **no points in 'Involvement', 'Enforcement' and 'Infrastructure'.**

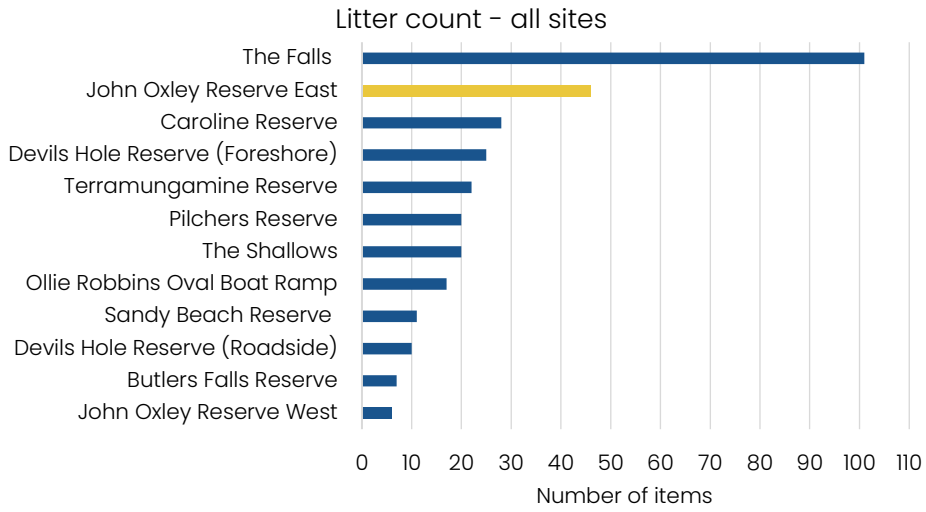
Additional notes underpin John Oxley Reserve East's location inspection score. The surveyor noted that:

- "There were no signs"
- "People should know that they should not drop litter here"

Litter Count

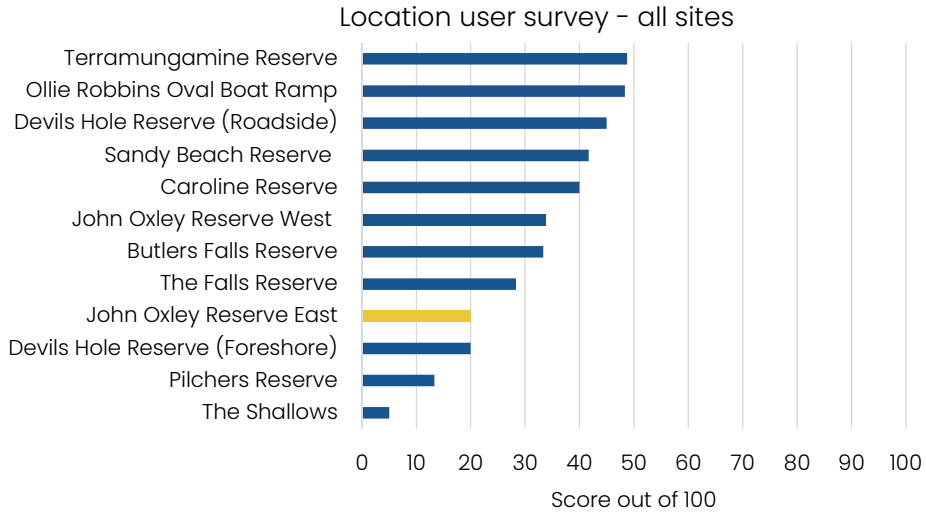
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At John Oxley Reserve East, a 16m x 3m area was surveyed at the location marked on the map below. The litter count at John Oxley Reserve East recorded **46 items**, the second-highest across all sites in the area. These items were mostly considered **'small items'** (<100mL)(39 items) with **some medium sized items** (100mL-1L)(7 items). The bulk of items were **Receipts, tickets, wrapper, tissues/serviettes, bits.**



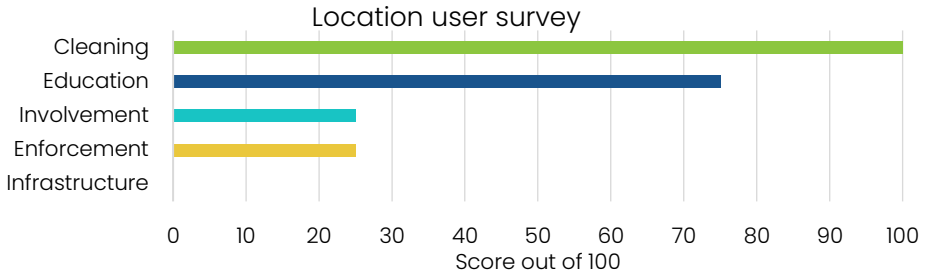


Location users

Four park users were asked to participate in the third step of the LLC, the Location User Survey. Users were asked a range of questions on the same five topics covered in the Location Inspection Survey. John Oxley Reserve East scored **20 overall,** according to users of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores were summed across all four surveys and converted to a percentage. John Oxley Reserve East achieved a **very high score for the 'Cleaning'** (100) **and relatively high in 'Education'** (75) but scored **poorly in 'Enforcement'** (25) and **'Involvement'** (25) categories. The site scored **no points in the 'Infrastructure'** category.



Users of the reserve did not score the site as highly as the location inspection surveyor due to these key issues:

- "Bins are needed."
- "Should stop cars entering the reserve."
- "Litter accumulates along treeline near water edge and in long grass."
- "There are many secluded spots."

Site photos

The following photos show John Oxley Reserve East of Herbert Street during the LLC in April 2022.


Lay Street
Nicholii Street
Nicholii Street
King Street
Mitchell Highway
Gipps Street
Queen Street
Montefiores Street
Sutton Street
Herbert Street
Wambuul-Macquarie River
John Oxley Reserve West
John Oxley Reserve East
Bell River
Gobolion Street
Raymond Street
Lee Street
Whiteley Street
0
200
400 m

A Snapshot of John Oxley Reserve West Local Litter Check 2022

A Local Litter Check (LLC) was conducted in April 2022 at John Oxley Reserve west of Herbert Street. LLCs are done in three steps to characterise the litter issues at a site:

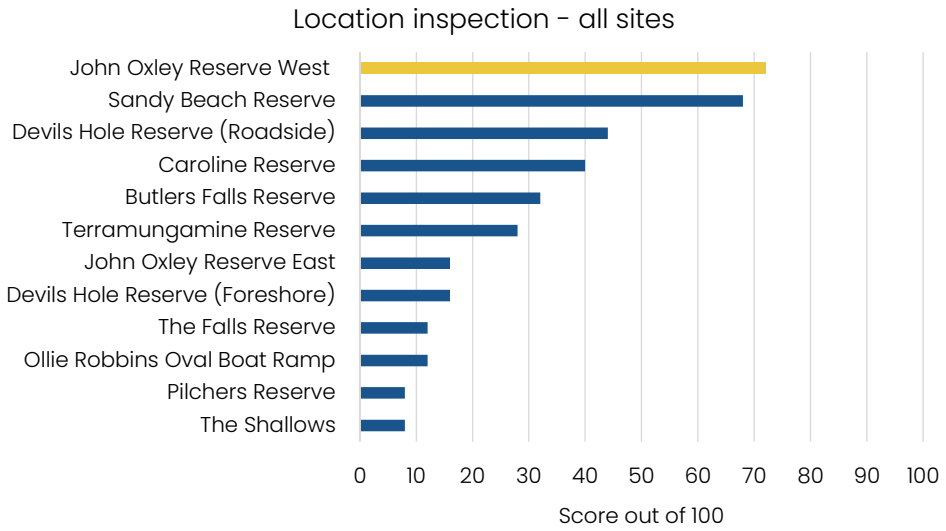
1. A location inspection
2. A litter count
3. User surveys

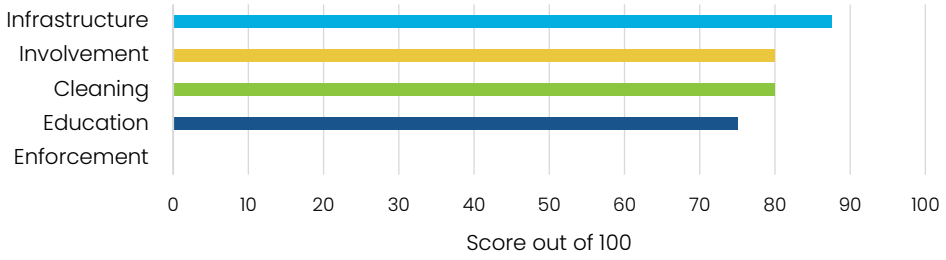
Location inspection

The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, John Oxley Reserve West had the highest overall score at the location inspection level, at 72%.





The chart above shows that John Oxley Reserve West scored very well in each category except 'Enforcement' (0%), achieving:

- Infrastructure (87.5%)
- Involvement (80%)
- Cleaning (80%)
- Education (75%)

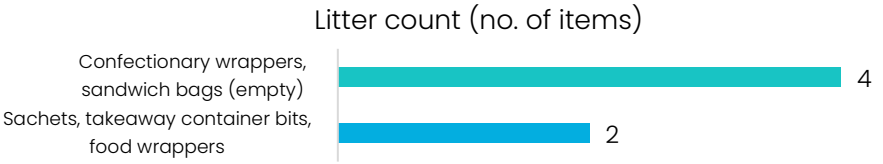
Additional notes underpin John Oxley Reserve West's high location inspection score. The surveyor noted that,

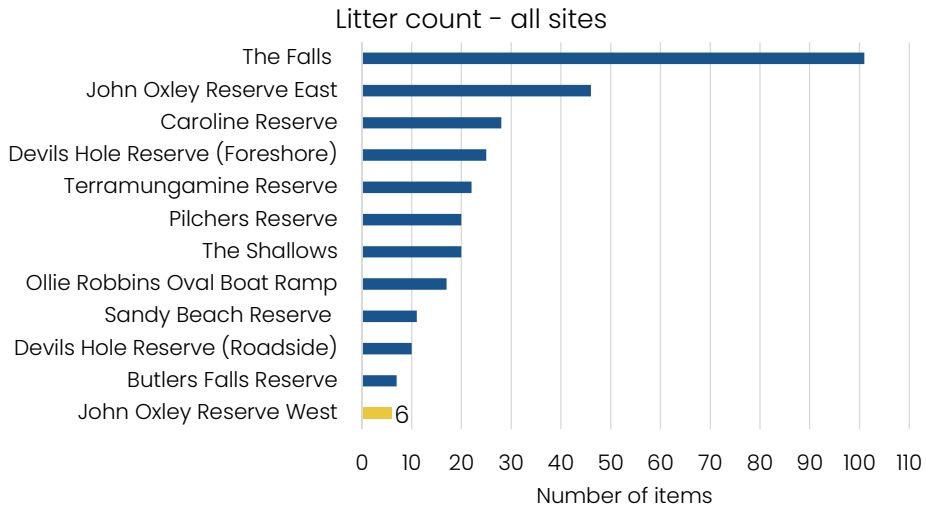
- "People are prompted by signage and bins"
- "Local people and OzFish do an awesome job at keeping this site litter free"

There is a notable score of 0 in the Enforcement' category. This can be explained as the surveyor noted that "no regular patrols by rangers occur at the reserve".

Litter Count

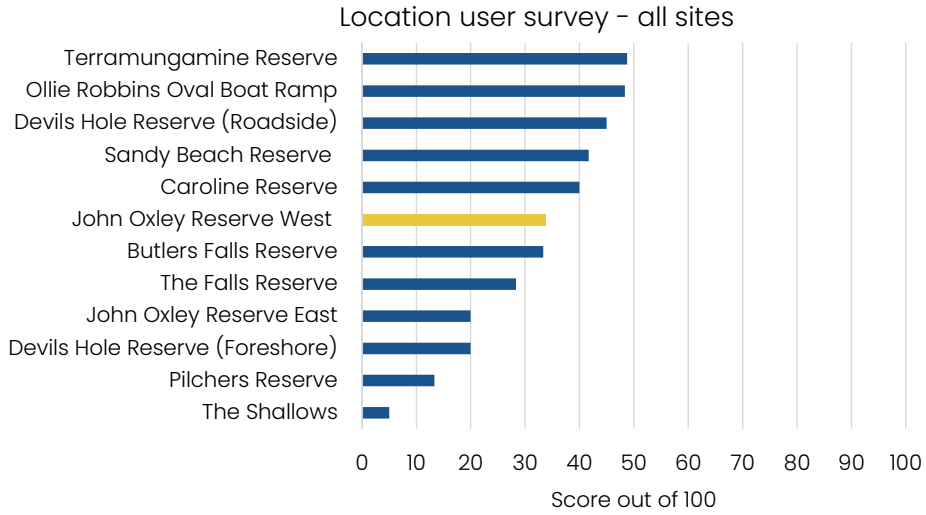
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At John Oxley Reserve West, a 12m x 4m area was surveyed at the location marked on the map below, between the access road and the river.
The litter count at John Oxley Reserve West was consistent with the high location inspection score as **only 6 items** were collected. These items were all considered **'small items'** (<100mL) and mostly consisted of **confectionary wrappers or sandwich bags.**



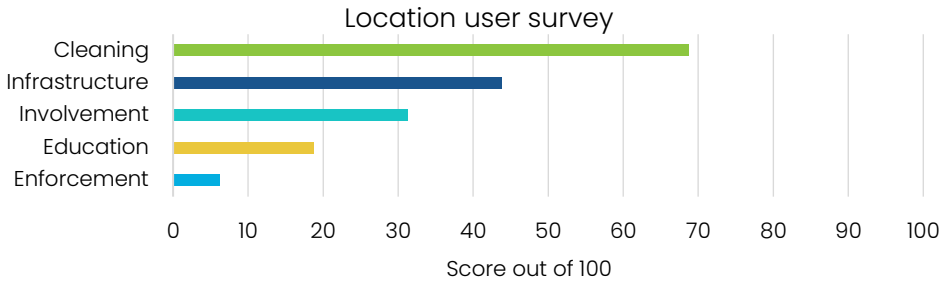


Location users

Four park users were asked to participate in the third step of the LLC, the Location User Survey. Users were asked a range of questions on the same five topics covered in the Location Inspection Survey. John Oxley Reserve West scored **34% overall,** according to users of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores were summed across all four surveys and converted to a percentage. John Oxley Reserve West achieved a relatively high score for the **'Cleaning'** (**68.75**) category but did poorly in the **'Enforcement'** (**6.25**) category.



Users of the reserve did not score the site as highly as the location inspection surveyor due to these key issues:

- "Lots of litter is thrown from cars as they cross the bridge going north."
- "Only two bins and they are both located in one end of the reserve."
- "Some signs are old and cracked, difficult to read, gives the impression that no one cares about the site."
- "Bins are not emptied regularly enough."

Site photos

The following images show John Oxley Reserve west of Herbert Street during the LLC in April 2022.


Sutton Street
Montefiores Street
John Oxley Reserve West
Herbert Street
John Oxley Park
John Oxley Reserve East
Wambuul-Macquarie River
Bell River
Gobolion Street
0
100
200 m

A Snapshot of Ollie Robbins Oval litter 2022

A Local Litter Check (LLC) was conducted in April 2022 at the boat ramp at Ollie Robbins Oval in Dubbo. LLCs are done in three steps to characterise the litter issues at a site:

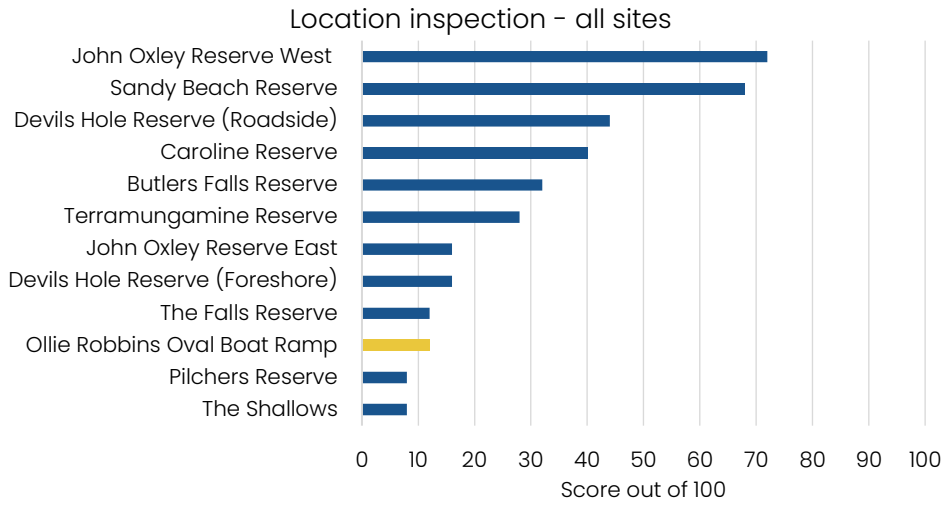
1. A location inspection
2. A litter count
3. User surveys

Location inspection

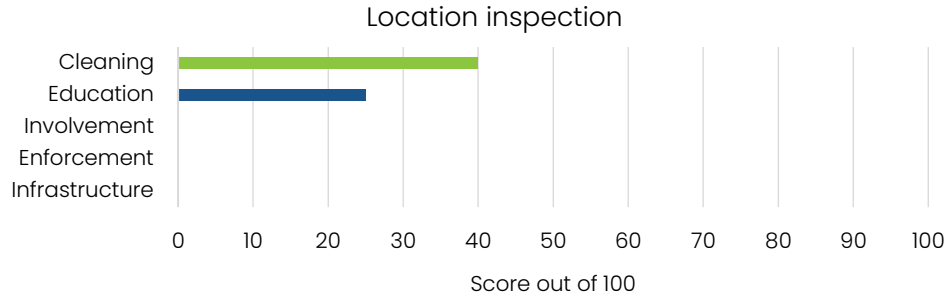
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLC location inspection surveys for Dubbo and Wellington, Ollie Robbins Oval boat ramp had one of the lowest scores. The site had a **location inspection score** of **12 out of 100** (or 12%).



The boat ramp's scores across the five main categories that make up the location inspection survey score are shown in the chart below. The chart shows that the site **scored poorly in all categories. The site scored no points in in 'Infrastructure', 'Involvement'** and **'Enforcement'**, and was relatively **poor in 'Education' (25) and 'Cleaning' (40)**.



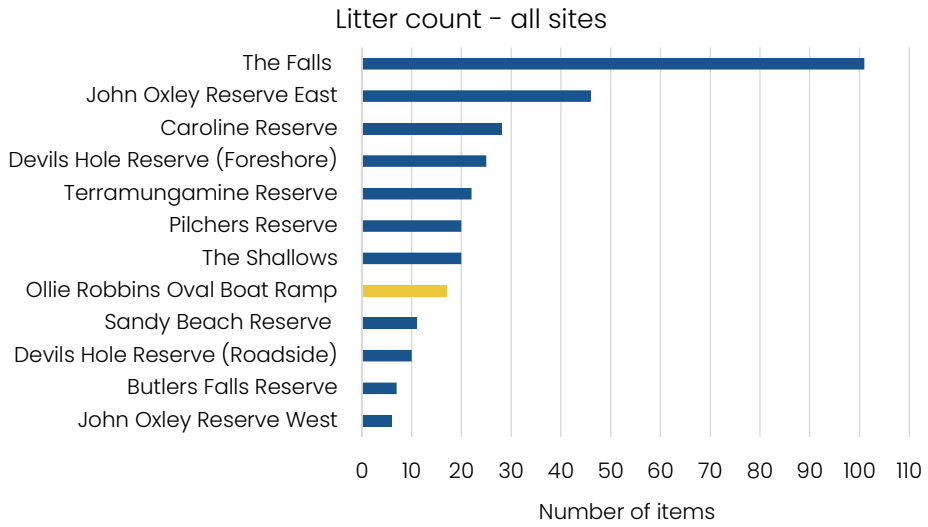
Other insights that can be drawn from the location inspection survey were:

- "No bins in the area"
- "Litter easily be blown into the river from the adjacent oval"

Litter Count

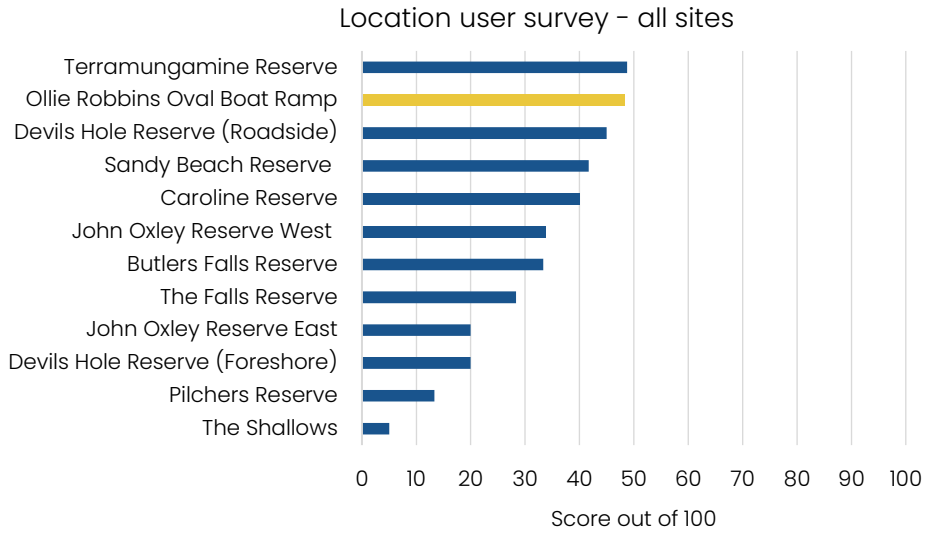
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At the Ollie Robins Oval boat ramp, a 16m x 3m area was surveyed at the location marked on the map below, between the boat ramp and the river.

Despite the location inspection scores, the litter count component found that Ollie Robbins Oval was among the **lowest littered sites** out of all sites surveyed across Dubbo and Wellington. The site had **17 items** which were either **glass, metal, paper/cardboard or plastic** items. Most items were considered **small items** (**<100mL**) and some items were considered **medium items (100mL-1L)**. About one third of all items were plastic.

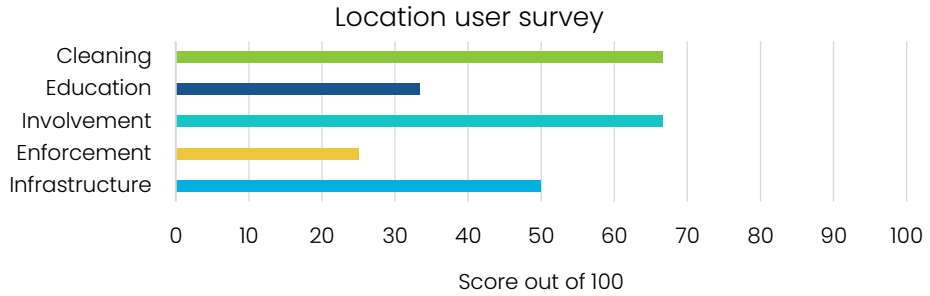


Location users

Three park users were asked to participate in the third component of the LLC, the Location User Survey at Ollie Robbins Oval Boat Ramp. Users were asked a range of questions from the same five key categories of the Location Inspection Survey. Ollie Robbins Oval scored 48 out of 100 **(48%) overall**.



A breakdown of scores in each category is shown in the chart. Scores were summed across all three surveys and converted to a score out of 100. The chart shows that Ollie Robbins Oval scored **moderately in 'Involvement'** and **'Cleaning' (67)**, and **relatively poorly in 'Enforcement' (25)**.

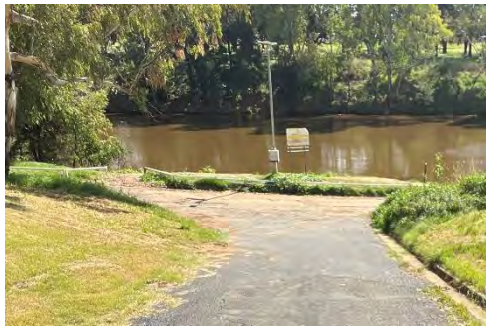


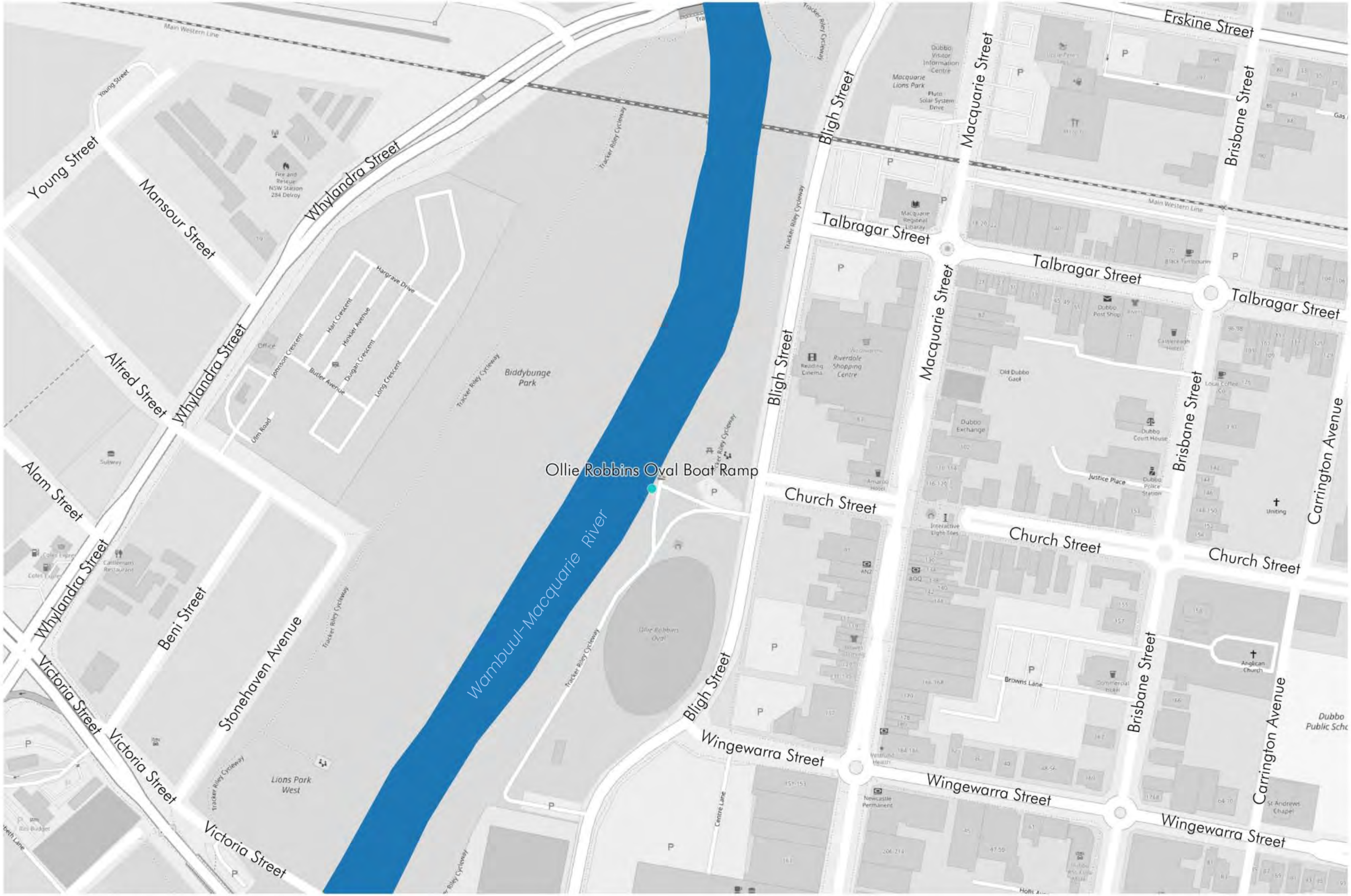
Key comments that users of the site had were:

- "More signage is required but too many signs negatively impact upon the visual amenity of the site"
- "Site could be better maintained. If a place looks well looked after people are less likely to litter"
- "Littering occurs mostly at night. CCTV would help"

Site photos

The following photos show Ollie Robbins Oval boat ramp during time of surveys in April 2022.




Ollie Robbins Oval Boat Ramp
Wambuul-Macquarie River
Erskine Street
Talbragar Street
Talbragar Street
Talbragar Street
Church Street
Church Street
Church Street
Wingewarra Street
Wingewarra Street
Wingewarra Street
Bligh Street
Bligh Street
Bligh Street
Macquarie Street
Macquarie Street
Brisbane Street
Brisbane Street
Brisbane Street
Carrington Avenue
Carrington Avenue
Young Street
Mansour Street
Whylandra Street
Whylandra Street
Whylandra Street
Alfred Street
Alam Street
Beni Street
Stonehaven Avenue
Victoria Street
Victoria Street
Victoria Street
Biddybunge Park
Lions Park West
Ollie Robbins Oval
Riverdale Shopping Centre
Old Dubbo Gaol
Dubbo Court House
Dubbo Exchange
Macquarie Lions Park
Main Western Line
Tracker Riley Cycleway
Justice Place
Browns Lane
Dubbo Public School

0 100 200 m

A Snapshot of Pilcher's Reserve Local Litter Check 2022

A Local Litter Check (LLC) was conducted in April-May 2022 at Pilcher's Reserve in Dubbo. LLCs are done in three steps to characterise the litter issues at a site:

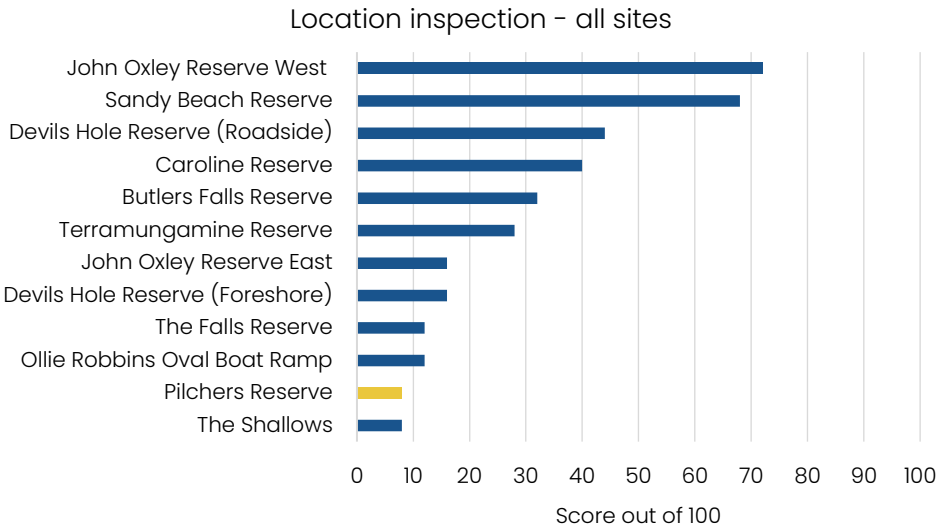
1. A location inspection
2. A litter count
3. User surveys

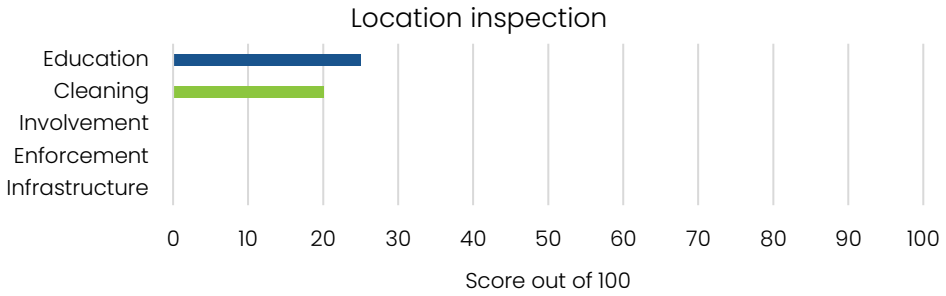
Location inspection

The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, Pilcher's Reserve had one of the lowest overall scores at the location inspection level, at **8 out of 100** (8%).



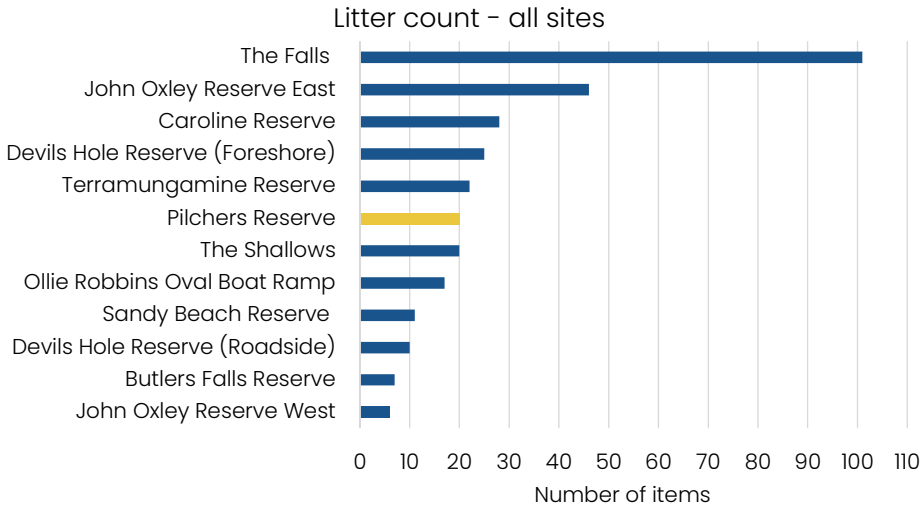


The chart above shows that Pilcher's Reserve **scored poorly in 'Education'** (25) **and 'Cleaning'** (20) and **scored no points in any other category.**
Additional notes underpinning Pilcher's Reserve 's low location inspection score were:

- "Building materials were illegally dumped"
- "Litter was worse in areas where cars were parked"

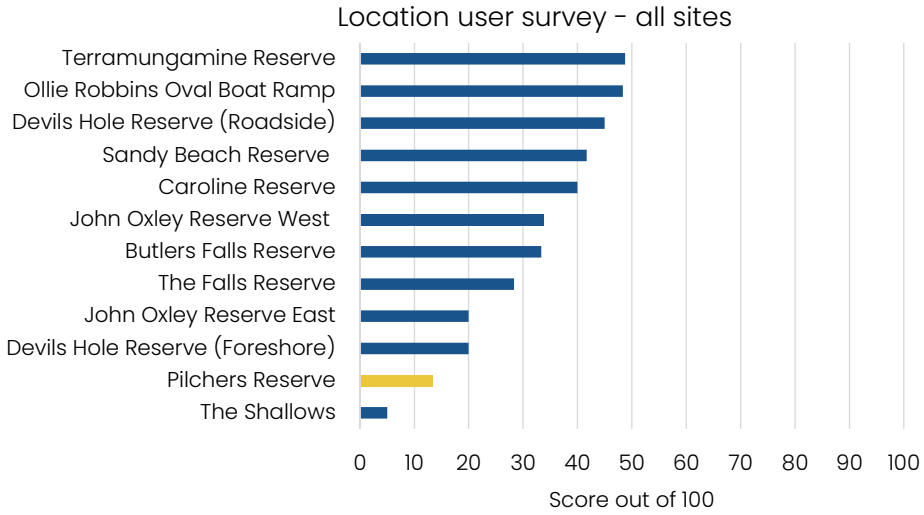
Litter Count

The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Pilcher's Reserve, a 24m x 2m area was surveyed at the location marked on the map below, between Pilcher's Road and the river.
The litter count at Pilcher's Reserve found **20 items** across **four item types**. These items were all considered **'small items'** (<100mL) and mostly consisted of **nails, paperclips, coins** (etc.).

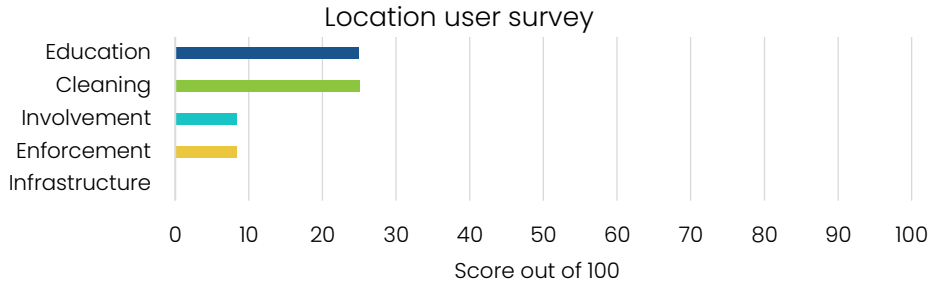


Location users

Three park users were asked to participate in the third step of the LLC, the Location User Survey. Users were asked a range of questions on the same five topics covered in the Location Inspection Survey. Pilcher's Reserve scored **13% overall,** according to users of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores were summed across all three surveys and converted to a percentage. Pilcher's Reserve achieved **moderate scores for the 'Education'** (25) **and 'Cleaning'** (25) and category but **scored poorly in** the **'Involvement'** (8) and **'Enforcement'** (8) categories



Key comments from users of the reserve were:

- "Bins that are not easily vandalised are needed"
- "Signs would help"
- "Bins are needed"

Site photos

The following photos show Pilcher's Reserve during the LLC in April-May 2022.


Pilchers Reserve
Pilchers Reserve
Pilchers Road
Old Dubbo Pioneer Cemetery
Wambuul-Macquarie River
Angle Road
Old Dubbo Road
Old Dubbo Road
Butlers Falls
Angle Road
Butlers Falls Reserve
0
250
500 m

A Snapshot of Pilchers Reserve Local Litter Check 2022

A Local Litter Checks (LLC) was conducted in April-May 2022 at Pilchers Reserve, a river reserve in Wellington. LLCs are done in three steps to characterise the litter issues at a site:

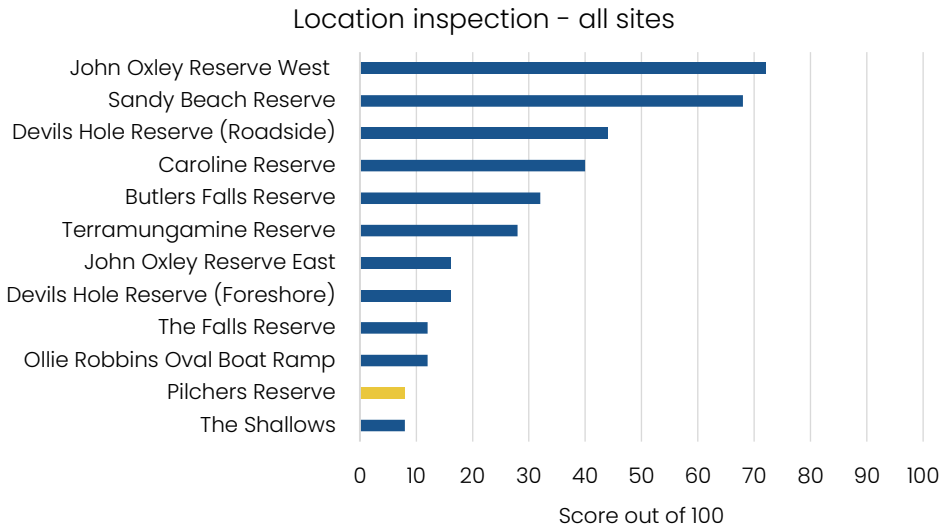
1. A location inspection
2. A litter count
3. User surveys

Location inspection

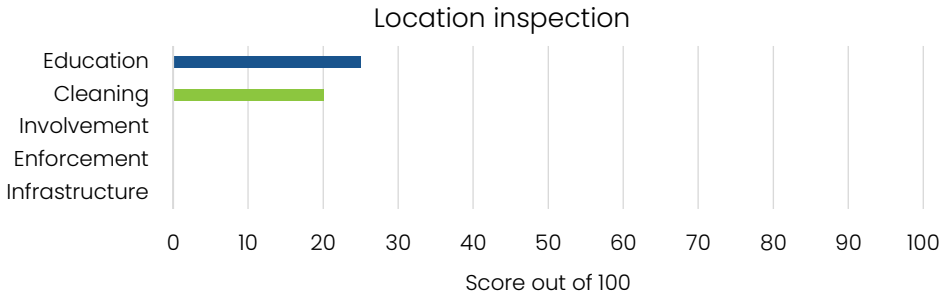
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, Pilchers Reserve was joint **lowest location inspection score**, **at 8** out of 100 (8%).



The following chart shows that Pilchers Reserve scored **poorly in 'Education'** (25) **and 'Cleaning'** (20) and scored **no points in 'Involvement', 'Enforcement' and 'Infrastructure'.**



The site scored no points for the three categories because:

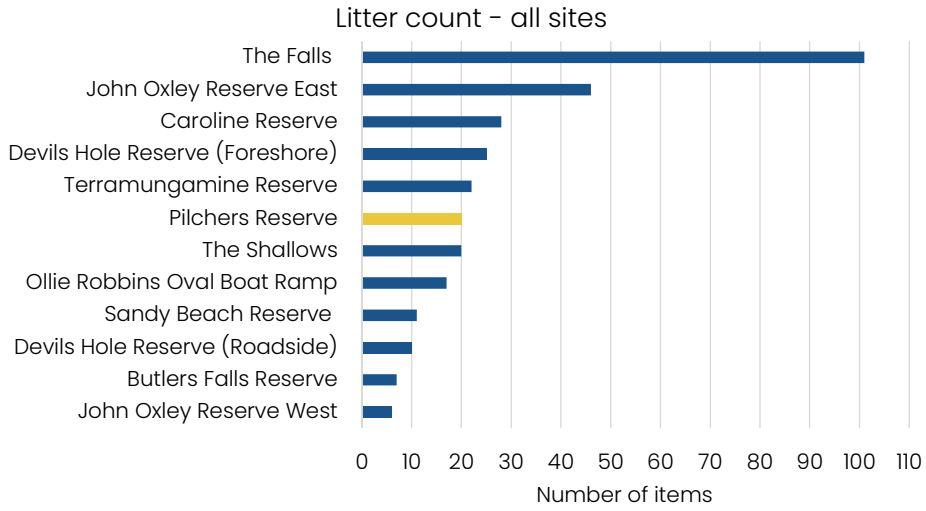
- There are no bins
- Litterers are unlikely to get caught or fined here
- The location does not seem to have a strong sense of community

Additional comments that underpin this low score were:

- "Carpet and building materials illegally dumped."
- "Litter was worse in areas where cars were parked."

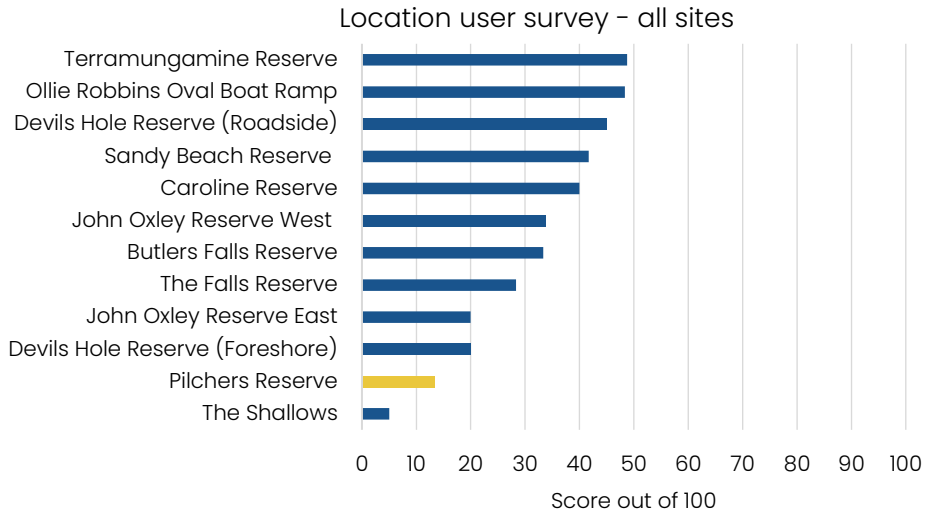
Litter Count

The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Pilchers Reserve, a 24m x 2m area was surveyed at the location marked on the map below.
The litter count at Pilchers Reserve recorded **20 items**, close to the median score across all sites in the area. These items were mostly considered **'small items'** (<100mL)(19 items) with **only 1 medium sized item** (100mL-1L). The bulk of items were glass items in the **'Nails paperclips, coins, foil, ice cream & lolly wrappers'.**

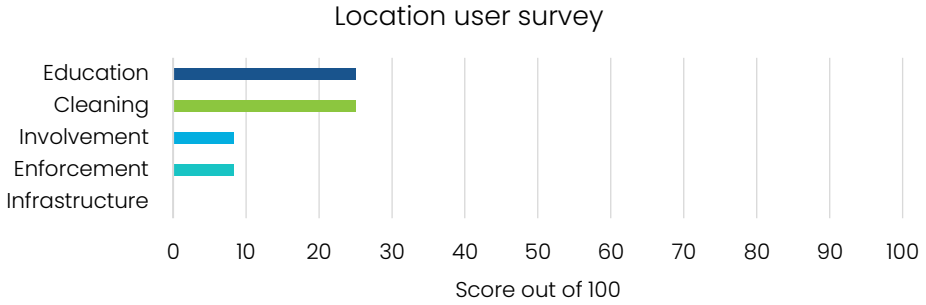


Location users

Three park users were asked to participate in the third step of the LLC, the Location User Survey. The users were asked a range of questions on the same five topics covered in the Location Inspection Survey. Pilchers Reserve scored the lowest across all sites, with **13 overall,** according to a user of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores were converted to a score out of 100. Pilchers Reserve achieved a **low score in the 'Education'** (25) **and 'Cleaning'** (25) categories and scored **poorly in the 'Involvement'** (8) **and 'Enforcement'** (8) categories. The site scored **no points in the 'Infrastructure'** category.



Pilchers Reserve scored poorly on the location user survey because:

- The site was littered and there are no bins
- It is not clear what people are expected to do with litter at the site
- The site is secluded and people are inulikely to get caught litering here
- No community groups or local agencies are working to clean up or prvent litter at the site

Key comments users had about litter at the Pilchers Reserve were:

- "Bins are needed."
- "People know they shouldn't drop litter but do so anyway."
- "Long grass may hide discarded syringes."
- "Signs would help."

Site photos

The following photos show Pilchers Reserve during the LLC in April-May 2022.


Old Dubbo Road
Pilchers Reserve
Wambuul-Macquarie River
Angle Road
Pilchers Road
Pilchers Road
Angle Road
0
100
200 m

A Snapshot of Sandy Beach Reserve litter 2022

A Local Litter Check (LLC) was conducted in April 2022 at Sandy Beach Reserve in Dubbo. LLCs are done in three steps to characterise the litter issues at a site:

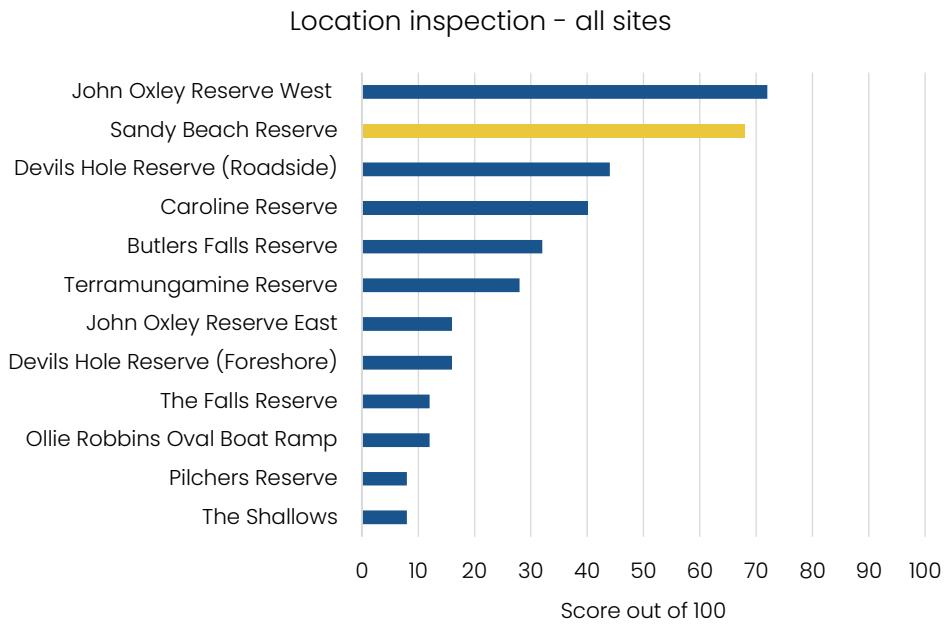
1. A location inspection
2. A litter count
3. User surveys

Location inspection

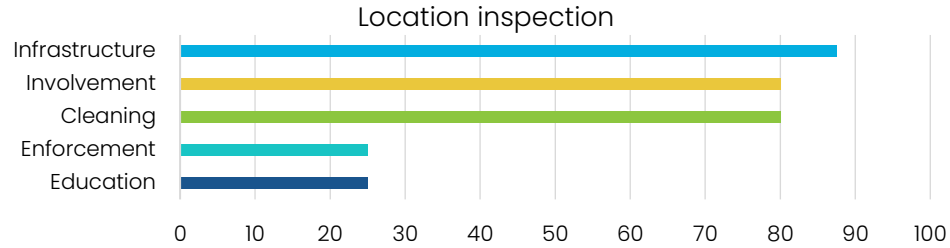
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLC location inspection surveys for Dubbo and Wellington, Sandy Beach Reserve had the second highest score. The site had a **location inspection score of 68** out of 100 (or 68%).



Sandy Beach Reserve's scores across the five main categories that make up the location inspection survey score are shown in the chart below. The chart shows that Sandy Beach Reserve **scored highly in 'Infrastructure' (87.5), 'Involvement' (80)** and **'Cleaning' (80)**, and relatively **poor in 'Education' and 'Enforcement' (25)**.



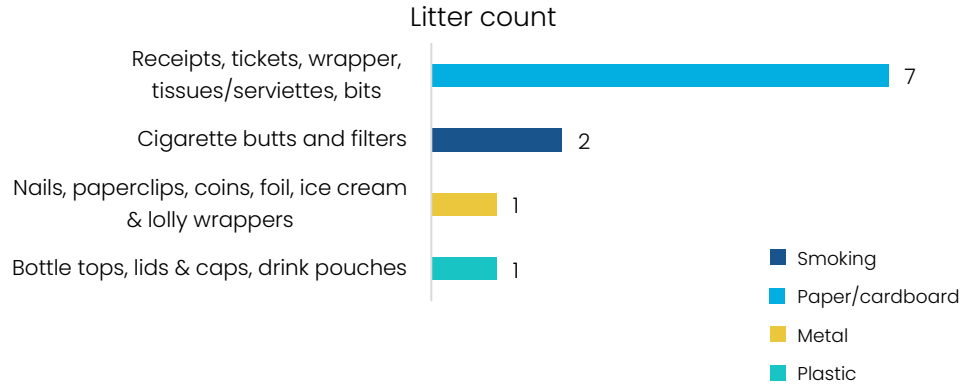
Other insights from the location inspection survey were:

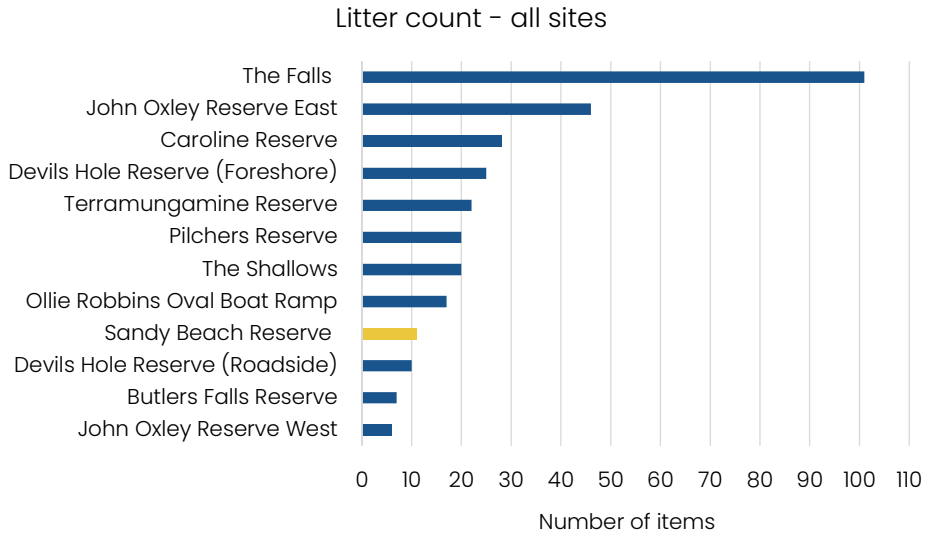
- "Adequate bins are provided at the carpark, but no bins provided at river frontage"
- "No signs"
- "Local volunteers clean up the site"
- "Litterers are unlikely to get caught at this site"

Litter Count

The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Sandy Beach Reserve, a 16m x 3m area was surveyed at the location marked on the map below, close to the Wambuul-Macquarie River.

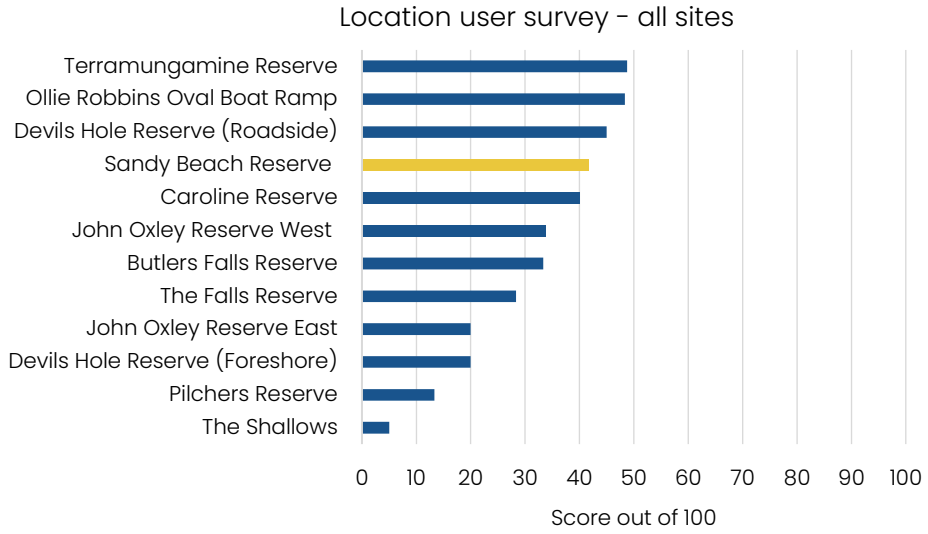
The LLC litter count component found that Sandy Beach Reserve was among the **lowest littered sites** out of all sites surveyed across Dubbo and Wellington. The site had **11 items** which were either **glass, metal, paper/cardboard or plastic** items and were all **<100mL**.



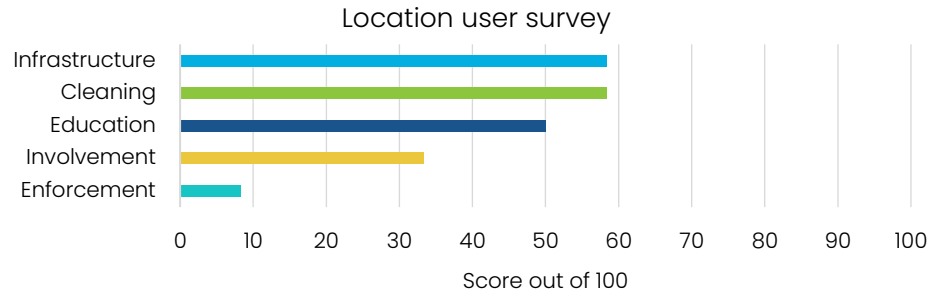


Location users

Three park users were asked to participate in the third component of the LLC, the Location User Survey at Sandy Beach Reserve. Users were asked a range of questions from the same five key categories of the Location Inspection Survey. Sandy Beach Reserve scored 38 out of 100 **(38%) overall**.



A breakdown of scores in each category is shown in the chart. Scores were summed across all three surveys and converted to a percentage. The chart shows that Sandy Beach Reserve **scored moderately in 'Infrastructure' and 'Cleaning'** (58), and **poorly in 'Enforcement'** (8).



Key comments that users of the reserve had were:

- "Bins should be closer to the picnic tables
- "Bins are often dirty"
- Users at this site felt that the reporting process could be more accessible and had feared that reporting could have repercussions for them

Site photos

The following photos show Sandy Beach Reserve during time of surveys in April 2022.


Gowrie Avenue
Stonehaven Avenue
Leavers Street
North Street
Whylandra Street
Wambuul–Macquarie River
Ian Drake Drive
Sir Roden Cutler Park
Lady Cutler Oval
Sandy Beach Road
Minore Road
Sandy Beach
Tracker Riley Cycleway
Lady Cutler Oval South
South Street
Golf Links Park
Lady Cutler
0
100
200 m

A Snapshot of Terramungamine Reserve litter 2022

A Local Litter Check (LLC) was conducted in April-May 2022 at Terramungamine Reserve in Terramungamine, north of Dubbo. The site is located between Dubbo and Wellington on the Wambuul-Macquarie River. LLCs are done in three steps to characterise the litter issues at a site:

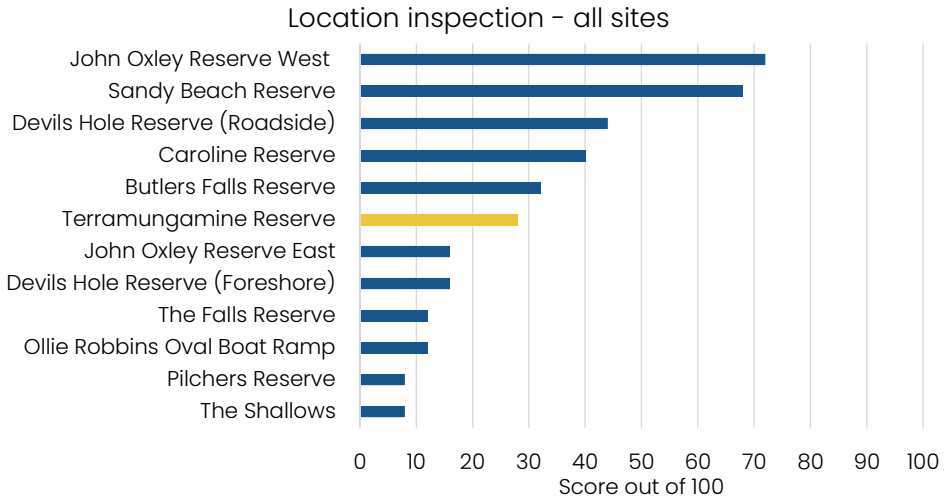
1. A location inspection
2. A litter count
3. User surveys

Location inspection

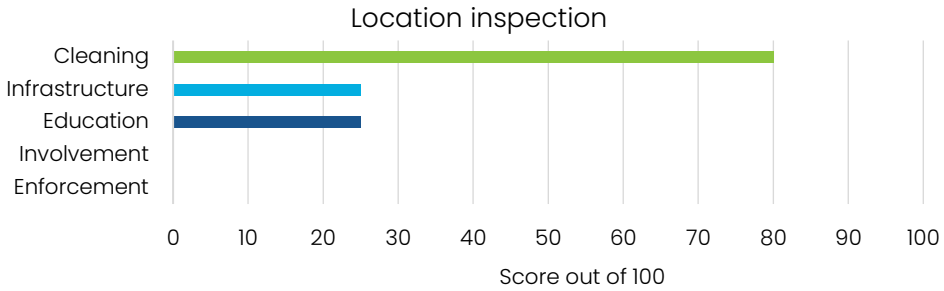
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLC location inspection surveys for Dubbo and Wellington, Terramungamine Reserve had a score close to the median of other sites. The site had a **location inspection score** of **28 out of 100** (or 28%).



Terramungamine Reserve's scores across the five main categories that make up the overall location inspection survey score are shown in the chart below. The chart shows that the site **scored highly in 'Cleaning' (80)** and got **no points** in the **'Enforcement'** and **'Involvement'** categories. The site scored **relatively poorly 'Infrastructure' (25)** and **'Education' (25)**.

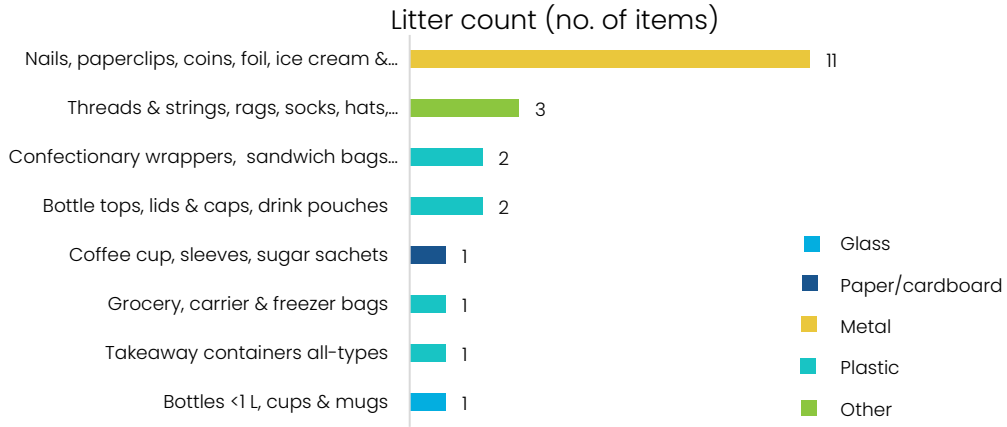


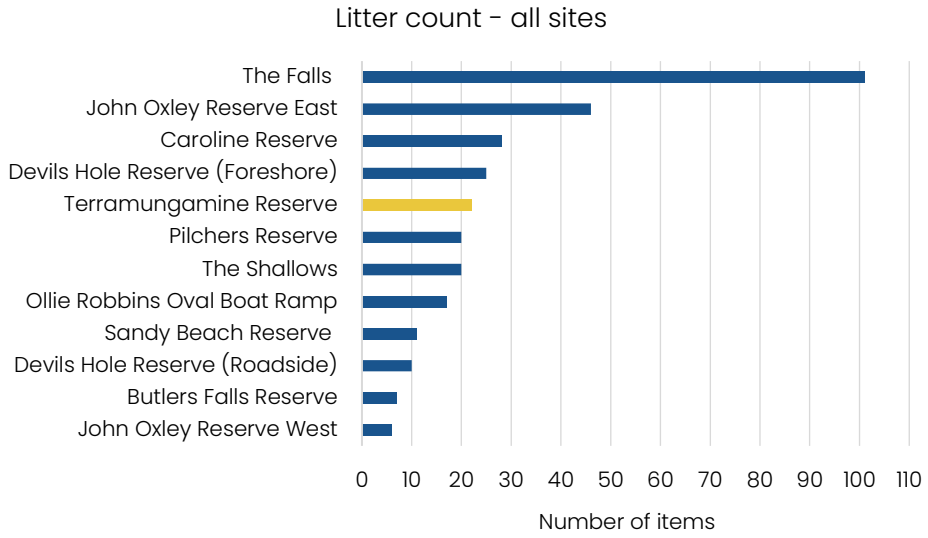
Other insights to be gained from location inspection surveys are that:

- "There are no bins next to the picnic tables (bins are in carpark)"
- "One of the bins bins was damaged causing litter to escape"
- "OzFish maintain this location"

Litter Count

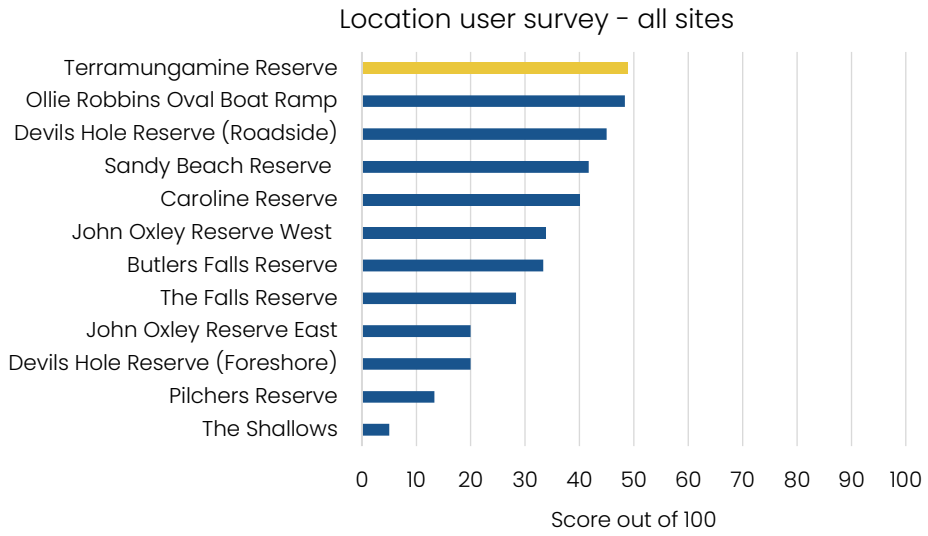
The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At Terramungamine Reserve, a 16m x 3m area was surveyed at the location marked on the map below, close to the Wambuul-Macquarie River.
Terramungamine Reserve was close to the median of all sites surveyed. The site had **22 items** across all item types, except smoking related items**. Metal items made up the bulk** of items (1/2). Most items (3/4) were considered **small items (<100mL)** and the rest were considered medium items (100mL-1L).



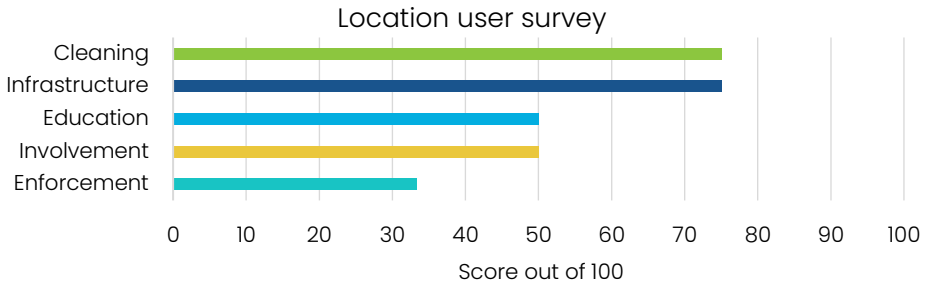


Location users

Three park users were asked to participate in the third component of the LLC, the location user survey at Terramungamine Reserve. Users were asked a range of questions from the same five key categories of the Location Inspection Survey. Terramungamine Reserve was the highest scoring site in the LLC user survey and scored **49 out of 100** (49%) overall.



A breakdown of scores in each category is shown in the chart. Scores were summed across all three surveys and converted to a score out of 100. The chart shows that Terramungamine Reserve scored **moderately well** in and **'Cleaning' (63)**, **'Education' (50)**, and **'Enforcement' (50)** and **relatively poorly in**. **'Involvement' (25)** and **'Infrastructure' (13)**.



Key comments that users had about litter at the reserve were:

- "Signage is lacking here"
- "Adequate bins but they need to be closer to the picnic tables"
- "I would pickup the litter of others, especially if it were 'return & earn' litter"

Site photos

The following photos show Terramungamine Reserve at time of LLC in April-May 2022. It is evident that at least one bin is in poor condition and needs to be replaced or repaired.


Burraway Road
Terramungamine Reserve
Wambuul-Macquarie River
Terramungamine Reserve
Grinding Grooves
Terramungamine Reserve
Terramungamine Reserve
Dubbo
Terramungamine
Terramungamine Reserve
Terramungamine Reserve
Dubbo
Terramungamine
0
100
200 m

A Snapshot of The Falls Reserve litter 2022

A Local Litter Check (LLC) was conducted in April 2022 at The Falls Reserve in Wellington. LLCs are done in three steps to characterise the litter issues at a site:

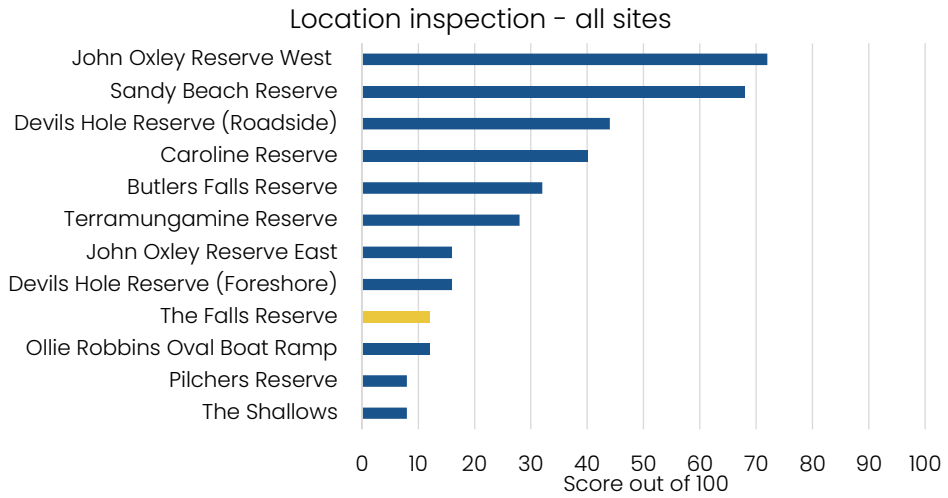
1. A location inspection
2. A litter count
3. User surveys

Location inspection

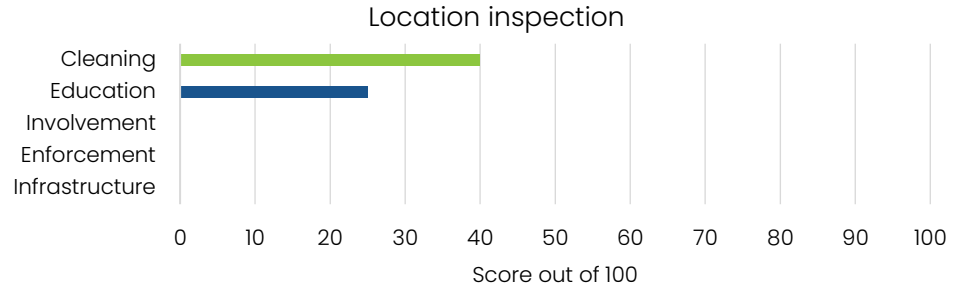
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLC location inspection surveys for Dubbo and Wellington, The Falls Reserve had one of the lowest scores. The site had a **location inspection score** of **12 out of 100** (or 12%).



The Falls Reserve scores across the five main categories that make up the location inspection survey score are shown in the chart below. The chart shows that the site **scored poorly in all categories.** The site **scored no points in 'Infrastructure', 'Involvement'** and **'Enforcement'**, and was relatively **poor in 'Education'** (25) and **'Cleaning'** (40).



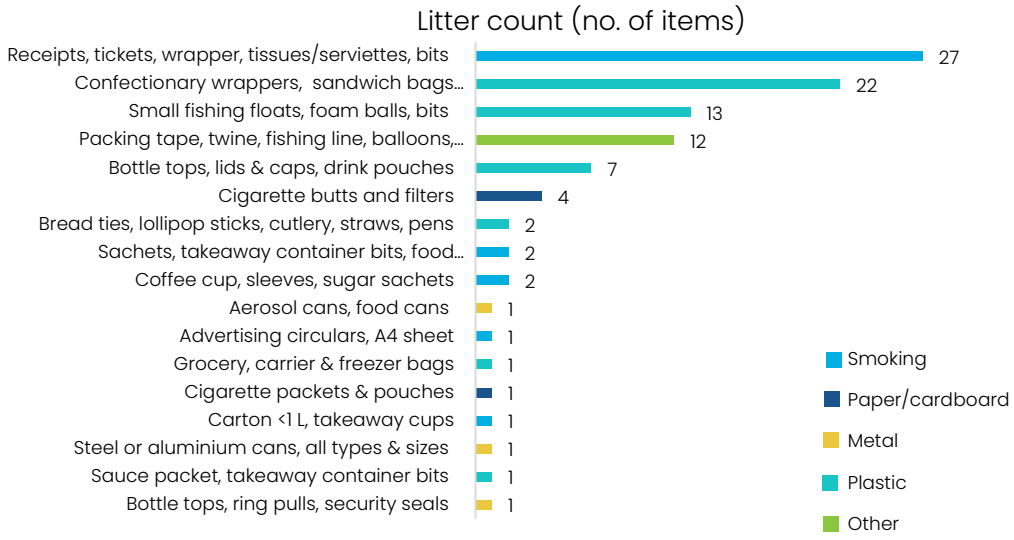
Other insights from the location inspection survey were:

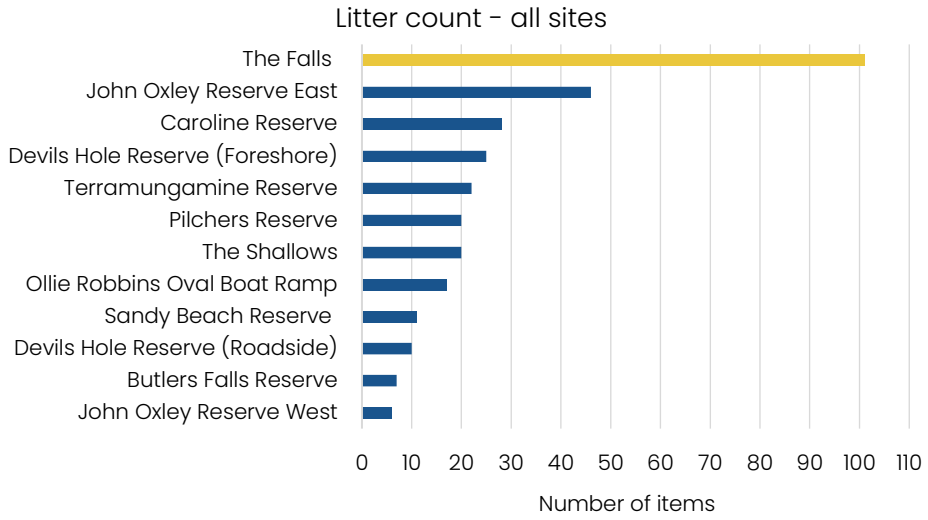
- "No bins at the site"
- "Picnic bench is difficult to access as the vegetation around it is overgrown"
- "Site not regularly maintained"

Litter Count

The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At The Falls Reserve, a 12m x 4m area was surveyed at the location marked on the map below, between the access road and the river.

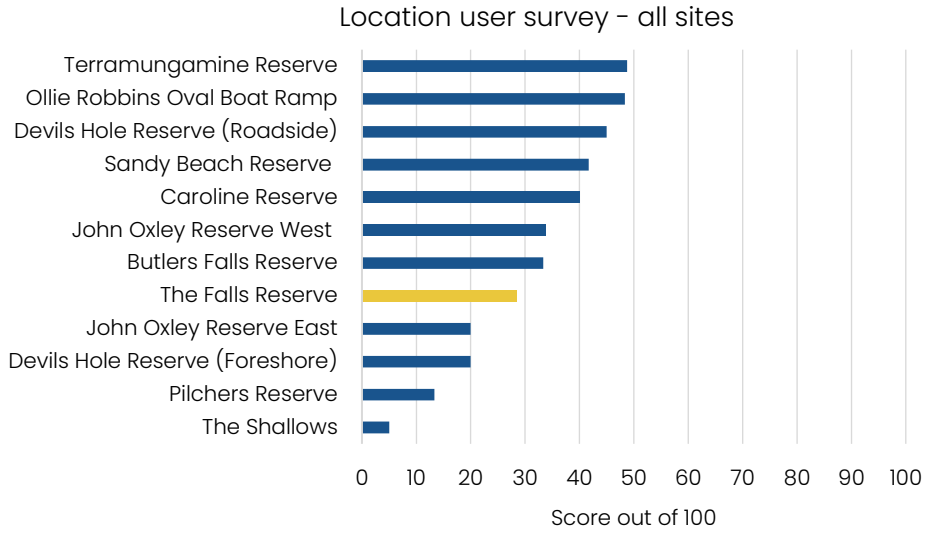
The location inspection scores reflect the litter count component of the LCC, whereby The Falls Reserve had the highest no. of items recorded. The site had **101 items** across all item types. Plastic and smoking related items made up the bulk Most items were considered **small items (<100mL)** and some items were considered **medium items (100mL-1L)**. About one third of all items were plastic.



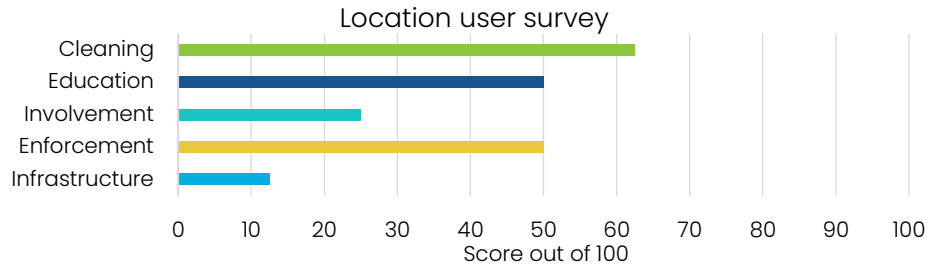


Location users

Two park users were asked to participate in the third component of the LLC, the Location User Survey at The Falls Reserve. Users were asked a range of questions from the same five key categories of the Location Inspection Survey. The Falls Reserve scored 28 out of 100 **(28%) overall**.



A breakdown of scores in each category is shown in the chart. Scores were summed across all three surveys and converted to a score out of 100. The chart shows that The Falls Reserve scored **moderately well** in and **'Cleaning'** (63), **'Education'** (50), and **'Enforcement'** (50) and **relatively poorly in**. **'Involvement'** (25) and **'Infrastructure'** (13).

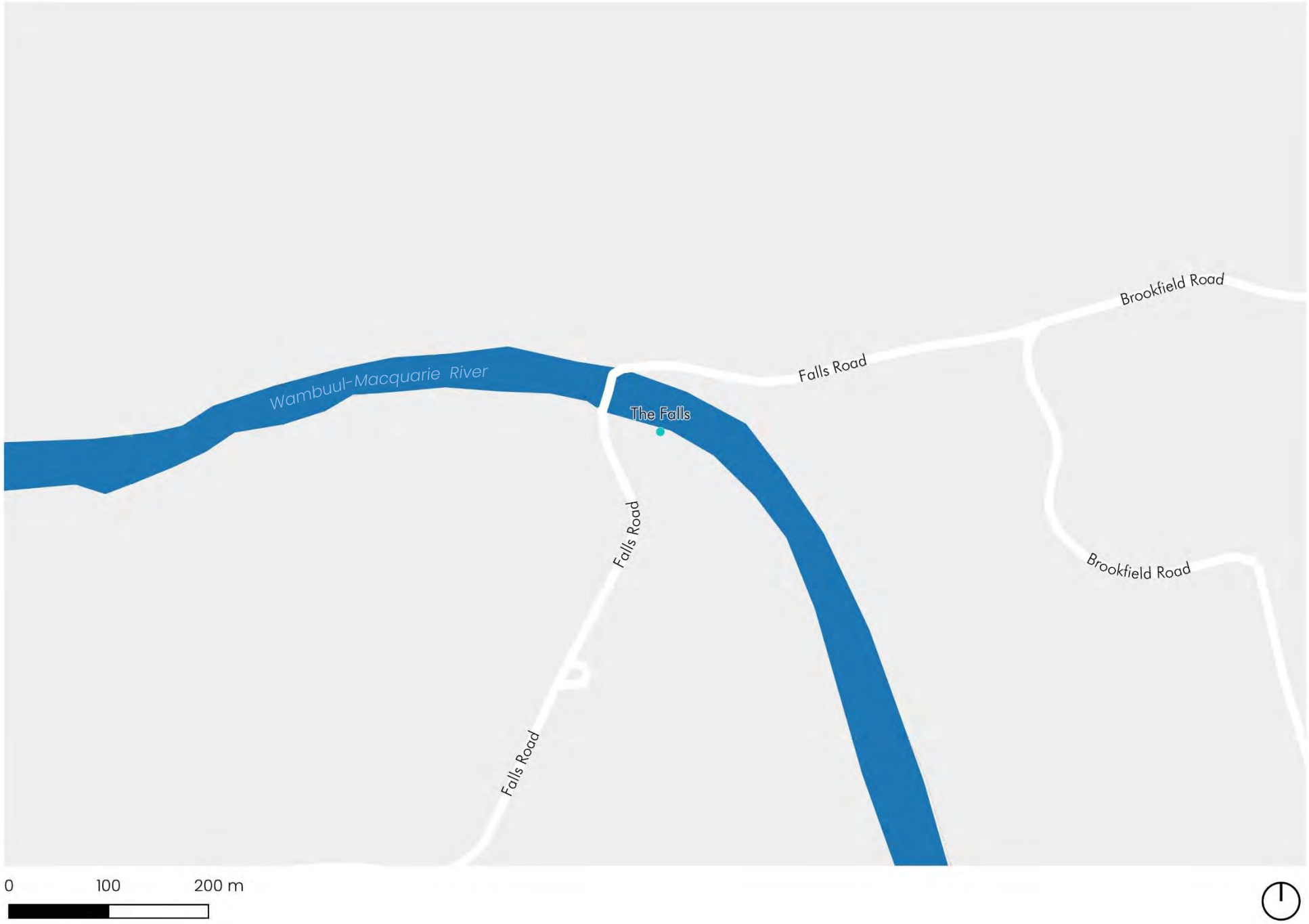


Key comments that users of the reserve had were:

- Area is not well-maintained, long grass and weeds
- Fishing line a problem here
- No bins
- Users would not pickup other people's litter because there are no bins

Site photos

The following photos show The Falls Reserve during time of surveys in April 2022.


Wambuul-Macquarie River
The Falls
Falls Road
Brookfield Road
Falls Road
Brookfield Road
Falls Road
0
100
200 m

A Snapshot of The Shallows Local Litter Check 2022

A Local Litter Checks (LLC) was conducted in April-May 2022 at The Shallows, a river reserve in Wellington. LLCs are done in three steps to characterise the litter issues at a site:

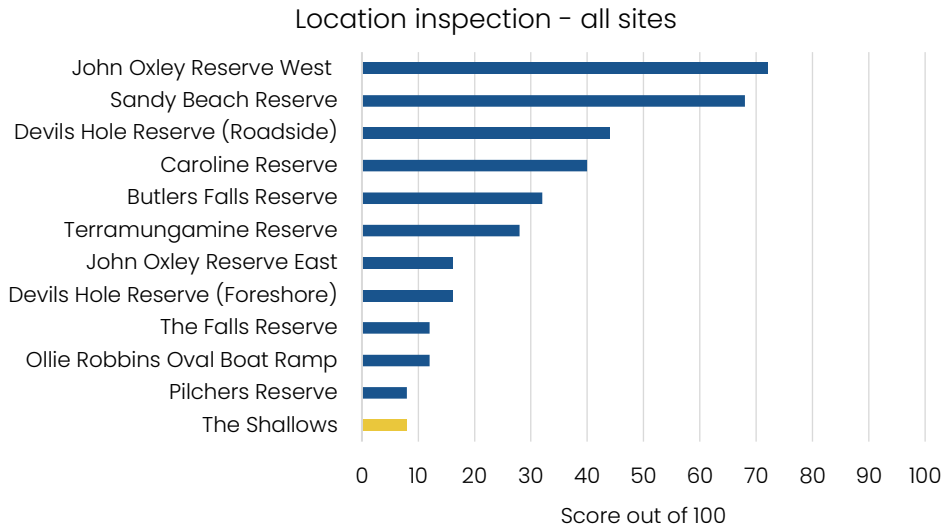
1. A location inspection
2. A litter count
3. User surveys

Location inspection

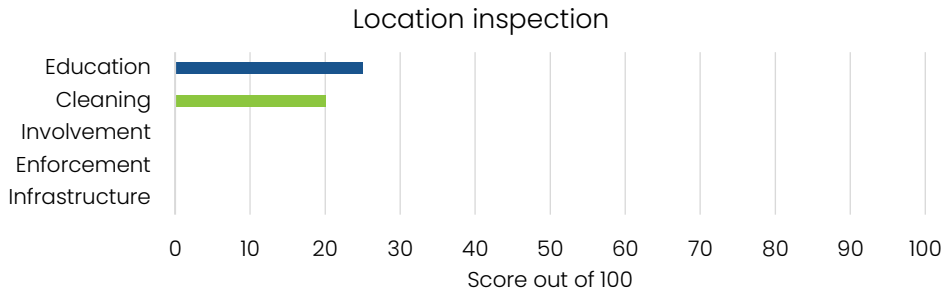
The location inspection characterises a site based on features it has in place to prevent litter entering the environment. There are five categories that make up the location inspection score:

- Cleaning
- Infrastructure
- Education
- Enforcement
- Involvement

Among all LLCs for Dubbo and Wellington, The Shallows had the **lowest location inspection score, at 8** out of 100 (8%).



The following chart shows that The Shallows scored **poorly in 'Education'** (25) **and 'Cleaning'** (20) and scored **no points in 'Involvement', 'Enforcement' and 'Infrastructure'.**



The site scored no points for the three categories because:

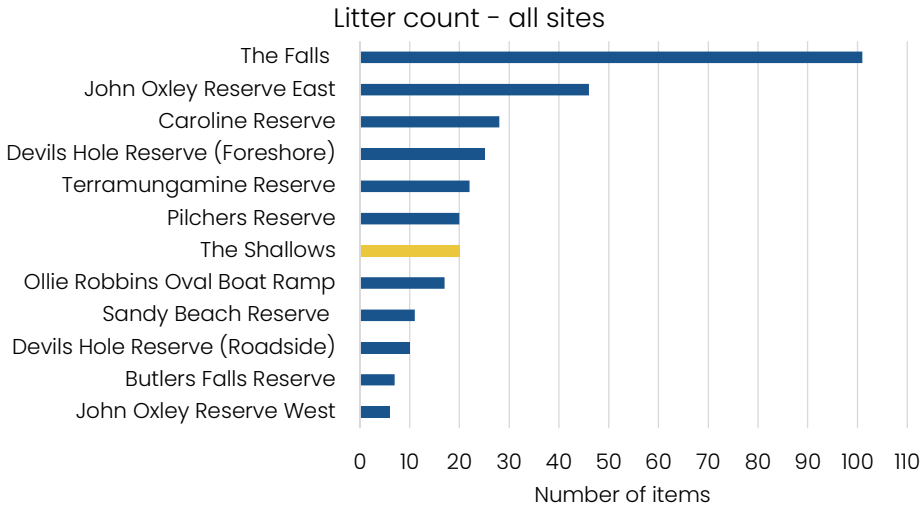
- There are no bins
- Litterers are unlikely to get caught or fined here
- The location does not seem to have a strong sense of community

Additional comments that underpin this low score were:

- "Discarded syringes at the site. Looks like site is popular with drug users. Clean up is hazardous."
- "This site is on the edge of Wellington town - very quiet."

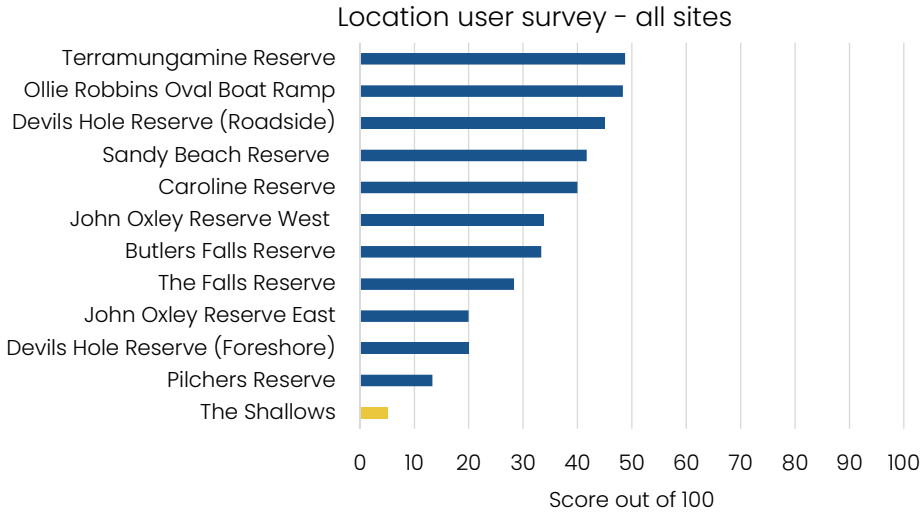
Litter Count

The LLC litter count is a survey of all litter within a selected 48 m^2 area at the site. At The Shallows, a 16m x 3m area was surveyed at the location marked on the map below.
The litter count at The Shallows recorded **20 items**, close to the median score across all sites in the area. These items were mostly considered **'small items'** (<100mL)(15 items) with **only 5 medium sized items** (100mL-1L). The bulk of items were glass items in the '**Receipts, tickets, wrapper, tissues.**

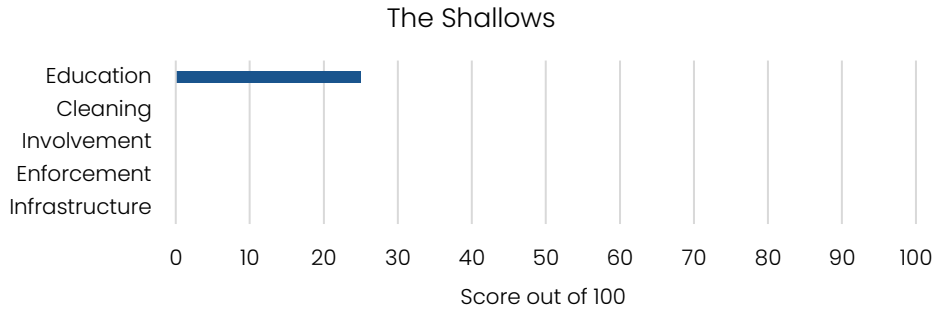


Location users

One park user was asked to participate in the third step of the LLC, the Location User Survey. The user was asked a range of questions on the same five topics covered in the Location Inspection Survey. The Shallows scored the lowest across all sites, with **5 overall,** according to a user of the Reserve.



A breakdown of scores in each category is shown in the chart below. Scores were converted to a score out of 100. The Shallows achieved a **low score in the 'Education'** (25) category and scored **no points in the 'Involvement', 'Enforcement' , 'Cleaning'**, or **'Infrastructure'** categories.



The Shallows scored poorly on the location user survey because:

- The site was littered and there are no bins
- It is not clear what people are expected to do with litter at the site
- The site is secluded and people are inulikely to get caught litering here
- No community groups or local agencies are working to clean up or prvent litter at the site

Key comments users had about litter at the The Shallows were:

- "Could clean up with a group of people but waste is hazardous."
- "Bins are needed."

Site photos

The following photos show The Shallows during the LLC in April-May 2022.


Wambuul-Macquarie River
The Shallows
Gobolion Street
Simpson Street
Thornton Street
Reid Street
Pierce Street
0
100
200 m