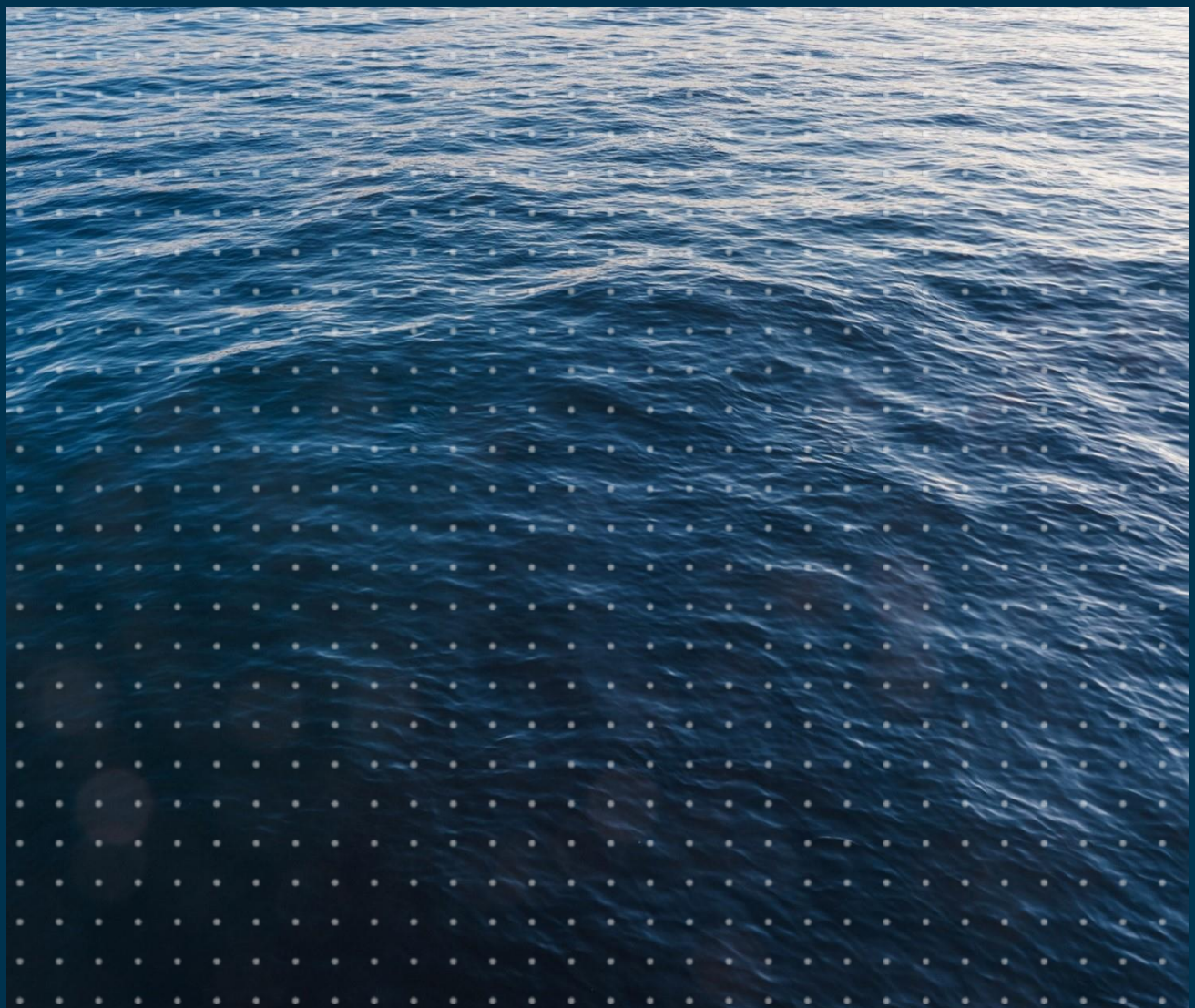
Environment Protection Authority

Litter Data Framework

Guidance notes for using EPA litter data



Published by:
NSW Environment Protection Authority
4 Parramatta Square
12 Darcy Street, Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124

Phone: +61 2 9995 5000 (switchboard)
Phone: 131 555 (NSW only – environment information and publications requests)
Fax: +61 2 9995 5999
TTY users: phone 133 677, then ask
for 131 555
Speak and listen users:
phone 1300 555 727, then ask for 131 555

Email: info@epa.nsw.gov.au
Website: www.epa.nsw.gov.au

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@epa.nsw.gov.au
See also www.epa.nsw.gov.au

ISBN 978 1 922963 15 4
EPA 2023P4368
September 2022
Updated February 2023

Contents

This document sets out the principles and approaches for making the best use of data that has been developed by the NSW Government and its partners to measure and monitor litter in NSW.

The NSW EPA presents the Litter Data Framework to help stakeholders deliver better litter prevention initiatives, programs and policies.

This framework includes guidance for users to understand the purposes of the different data sources and programs, how these are best used, how they relate to one another, and their key limitations.

1. Overview

Stakeholders will need to make concerted efforts, underpinned and informed by a well-founded and consistent evidence base, to achieve ambitious litter reduction targets.

Introduction

The NSW Government is serious about reducing litter. Since 2013, with the early development of the current EPA Litter Prevention Program, the government's efforts in litter prevention have steadily stepped up. In the first stage, $50 million was committed through the Waste Less Recycle More program to reduce the volume of litter in NSW by 40% by 2020 against a 2014 baseline. This was achieved in that year, with a measured reduction of 43%.

In 2021, on the back of this success, the NSW Government committed a further $38 million through to 2027 under the NSW Waste and Sustainable Materials Strategy 2041 (**WASM**), to reduce plastic litter items by 30% by 2025 and all litter items by 60% by 2030. Achieving these ambitious targets will require a concerted effort by all stakeholders, and this must be underpinned and informed by a well-founded and consistent evidence base. The NSW Litter Data Framework (the **framework**) is presented here as a shared resource to be used in this joint effort.

Purpose

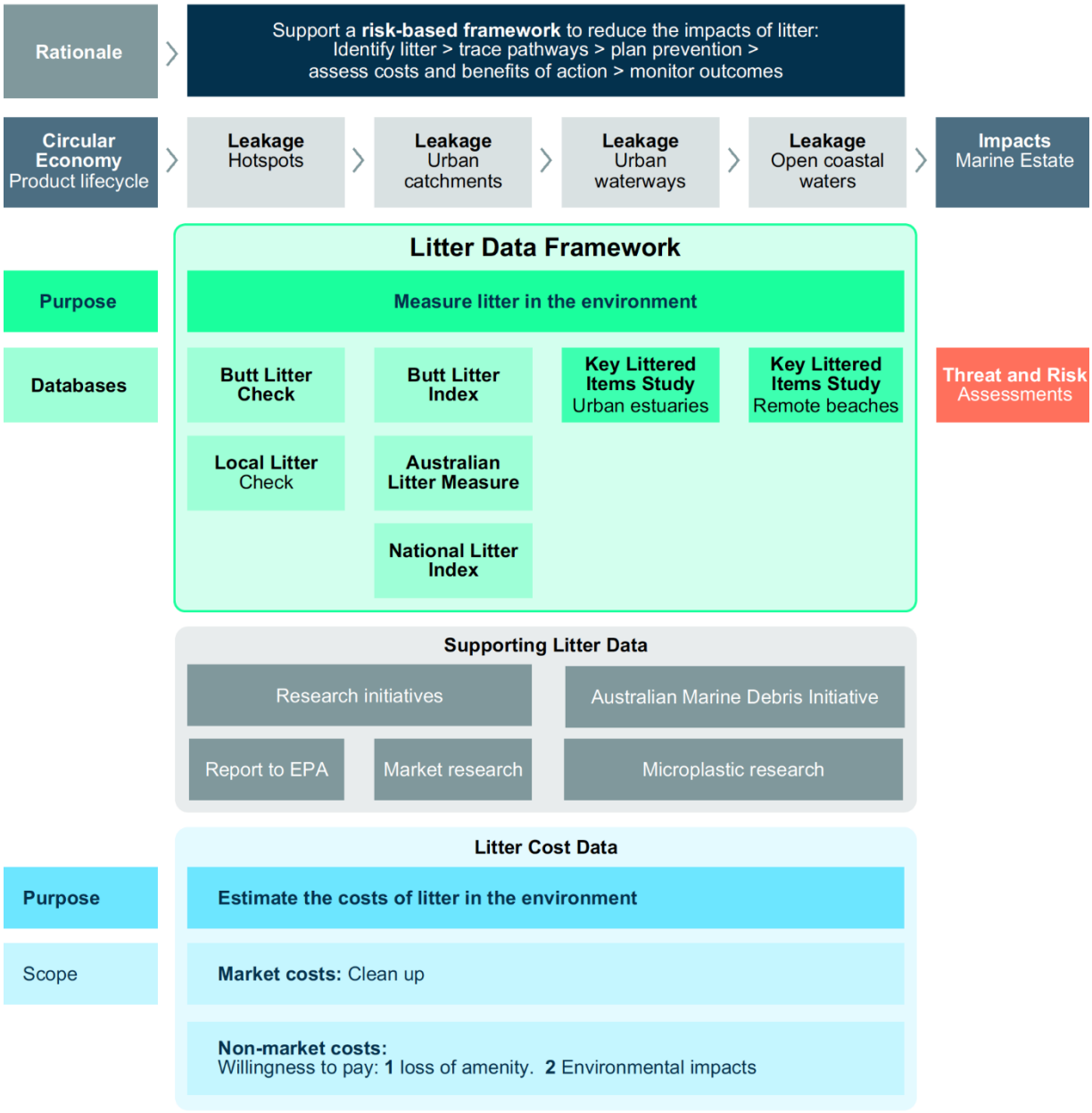
This document gives an overview of the framework for use by the NSW EPA and its partners to measure and monitor litter in NSW to better deliver litter prevention projects, programs and policies.

It is intended to help users of the framework understand the purposes of the different data sources and programs, how they are best used, how they relate to one another, and what their key limitations are. The aim is to ensure that the data is used in ways for which it is designed or intended, and that users do not try to 'fit square pegs into round holes'.

Where possible, users are also directed to more detailed information, such as published methodologies, guidelines, dashboards or websites.

The key user groups in mind include State and local government operators, community groups, non-government organisations and businesses that take an interest in litter prevention in NSW. The principal objective is to support the cooperative effort required to achieve the NSW litter prevention targets.

Figure 1 The context for the NSW Litter Data Framework



Background

When the Litter Prevention Program began in 2013 there were two kinds of ‘mass data’ available to monitor progress towards NSW litter targets. The National Litter Index (**NLI**) was launched by Keep Australia Beautiful in 2006, and the Australian Marine Debris Initiative (**AMDI**) by Tangaroa Blue began building its database in 2004. The NLI was the dataset chosen to monitor the 40% litter target, as it was in the form of a structured litter survey across all Australian states and territories that had produced an annual report since 2007. A baseline was set using the total volume of litter counted by the NLI in NSW in the 2013–14 financial year. The total volume counted by the NLI in the 2019–20 financial year was then compared to the baseline, showing a 43% drop in volume since 2013–14, with an overall clear downward trendline.

Between 2013 and 2022 the number of litter prevention projects and programs expanded rapidly and, with them, the range of litter data.

- From 2013 the EPA developed the Local Litter Check as a tool to guide investigations of littered locations (i.e. 'hotspots') that identified the potential factors for effective litter prevention. In 2018 this tool was redeveloped as a website.
- In early 2017 the Key Littered Items Study (**KLIS**) was introduced to corroborate the NLI for monitoring the impact on litter of the proposed Container Deposit Scheme that was to be introduced in December of that year – the program since known as *Return and Earn*. Originally intended to run until the end of 2019, KLIS was extended to become the principal data used for monitoring litter in NSW.
- Following a CSIRO review of the NLI completed in 2019, the Australian states and territories agreed to replace it with the Australian Litter Measure (**AusLM**) to meet the policy and program needs that had emerged since the NLI was developed. The AusLM methodology was completed and a preliminary pilot run in NSW in December 2021. A nationwide pilot in mid 2022 involved NSW, Queensland, Victoria and Western Australia. Other states and territories are expected to take part in litter counts from November 2022 onwards.
- In 2018 the Butt Litter Check was developed as a companion tool to the Local Litter Check, designed and piloted specifically to assess the factors leading to cigarette-butt littering in hotspots and the factors that would increase the binning of butts.
- In 2020 the Butt Litter Check was used to develop the Butt Litter Index, a survey of butt littering behaviour at 114 locations across NSW. A baseline report was developed by NSW EPA in 2020 which began a two-yearly cycle of reports.

Definitions

The Litter Data Framework counts litter as it is defined in the NSW Litter Prevention Strategy: generally, consumer items and/or their packaging discarded in the wrong place, up to the size of a full shopping bag. In NSW, litter is distinguished from illegally dumped items, which are generally larger and result from deliberate activity requiring a degree of planning to move – for example, large household goods or trailer-loads of garden waste.

Littering tends to be an in-the-moment disposal act that can arise from habit, accident or momentary thoughtlessness, such as flicking a cigarette butt out the car window or forgetting a takeaway coffee cup left on a window ledge.

Circular economy principles that are outlined in WASM help to shape the scope of litter prevention, treating litter as 'leakage' of otherwise valuable materials from economic and societal activities into the environment. This leakage includes a range of debris sources in the environment that are not littering, including:

- illegal dumping (noted above)
- poorly managed commercial or residential waste (e.g. overflowing bins)
- the erosion of materials in the built environment, such as the underlay used for artificial turf
- vehicle parts left from traffic accidents.

In the framework, litter is defined as items 'leaking' from the hands of people in local places, such as hotspots, after which the littered items can move to wider environments, such as urban catchments and urban waterways.

It is important that users of databases in the framework understand there are different sources of debris in the environment and, if possible, ensure these are acknowledged where appropriate. Some of the databases in the framework help with this by identifying some of the non-litter debris, including illegally dumped materials, building waste and commercial fishing waste.

Rationale and thinking about risk

The framework is a set of related databases. To some extent, the components of the framework were developed in an ad hoc fashion from individual programs developed by the NSW Government or its stakeholders over many years in response to emerging needs. In recent years, the development of data programs has become increasingly integrated. The framework now brings this data together with a coordinated approach and a shared rationale to drive its ongoing development.

Rationale

The EPA Litter Data Framework exists to support initiatives to reduce litter in NSW, initiatives driven mainly by the plastics and litter reduction targets set out in WASM. The framework's data helps to identify litter and its sources, trace its pathways through the environment, assess the possible costs and benefits of initiatives to reduce litter, and monitor the outcomes of those initiatives.

What risk does the framework help to manage?

It's important to establish how 'risk' is defined in the framework. The definition will vary according to what the framework's data is being used to manage. For example, management could be aimed at:

- the amenity of public space and how litter prevention action can be best targeted to preserve this quality. In this instance, the risk could be the loss of visual amenity resulting from litter, with the decreased value of the public space in the eyes of the user and flow-on negative reputation of the land manager responsible for the location
- the efficient use of financial resources in managing public space, and how litter prevention action can be best directed to keeping places litter-free, rather than relying on clean-up. The risk involved here could be the requirement for time-consuming litter-picking in the absence of effective litter prevention, representing poor use of staff hours and skills that could otherwise be directed to productive work, such as maintaining or upgrading public place infrastructure
- the value of environmental assets and how litter prevention action can reduce litter items in the environment that may harm those assets. Here, the risk could be animals ingesting litter, or plants and animals being entangled in, or smothered by, litter
- the conservation of the economic value of materials and how litter prevention action can be directed to decrease or eliminate the wasteful use of material that has a high tendency to become litter, or to increase the diversion of material back into productive use before it becomes litter. Here, the risk would be the permanent loss of materials leaking into the environment, such as the recyclable plastic and metal of beverage containers
- the achievement of litter reduction targets to which government agencies commit in response to community expectations to prevent litter. Here, the risk is lack of accountability or capacity, in the absence of reliable data, to monitor, evaluate, report and progressively improve the outputs of government initiatives directed at reducing levels of litter.

2. Litter data in the framework

Three scopes for litter data

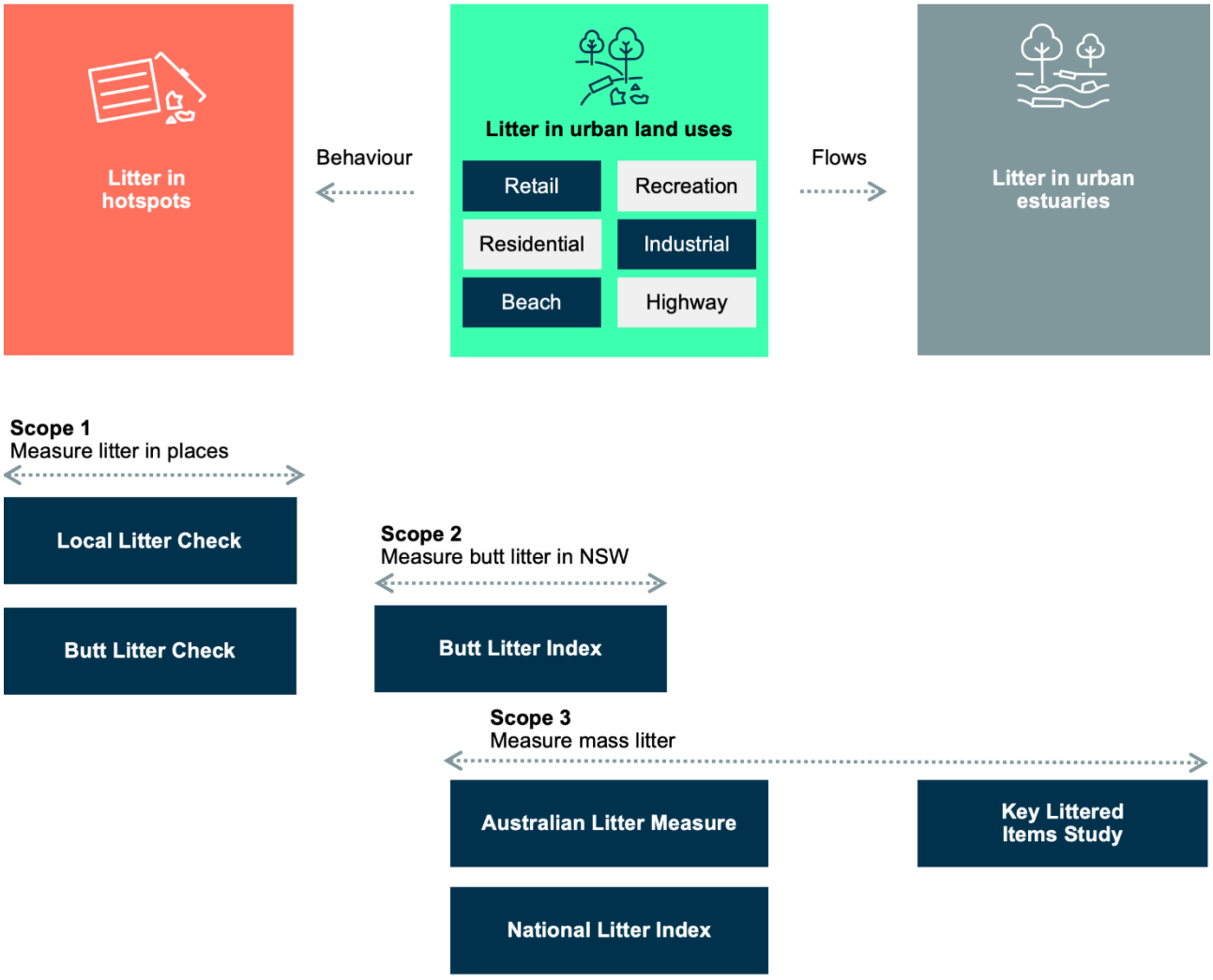
At the heart of the framework are six interacting datasets. These can be used separately or in combination with one or more others to address questions the user may have about litter in NSW.

The datasets were developed for different purposes and were generated by different survey methods. They reflect the different dimensions of litter and have different scopes:

- **Scope 1**: place-based litter data focused on local factors that influence disposal behaviours
- **Scope 2**: statewide cigarette-butt litter data focused on butt littering behaviours
- **Scope 3**: mass litter data focused on geospatial factors that influence the presence of litter in urban environments and coastal waters over time.

Understanding the differences between the datasets will help the user to decide which one is most appropriate to use. In general, Scope 1 data is used to investigate litter hotspots and understand the factors that may lead to those places being littered or clean. Scopes 2 and 3 are 'mass data', reflecting what happens broadly across NSW or across regions, and are generally used to set, monitor and measure litter prevention targets.

Figure 2 The scope of data relationships in the Litter Data Framework



Scope 1: Place-based litter data focused on factors that influence disposal behaviour

There are two methods under Scope 1: the **Local Litter Check** (**LLC**) and the **Butt Litter Check** (**BLC**). These are guided by a social psychology perspective that focuses on the factors that drive or inhibit littering behaviour in specific littered locations (generally known as 'hotspots'). They are appropriate for someone developing a litter prevention project at a specific location – for example, a council officer or a community group member planning a litter prevention initiative at a local park. A person using one of these methods collects, collates and interprets the data with the help of resources provided by the EPA. Two key insights have informed the development of these resources:

1. Litter is local. It is influenced by the physical, social, cultural and economic dimensions of a place that can come down to how particular factors shape people's disposal behaviour there. The question of why one place is heavily littered and an adjacent place is not can only be answered by investigating at the local level.
2. The presence of litter on the ground is generally not a good indicator of why and how people litter, what they think about littering and what they accept as normal or 'OK'. It is easy to jump to conclusions that end up being unhelpful assumptions about what is needed to get littering behaviour to stop. The litter check methods capture that extra needed information.

Figure 3 Data relationships in Scope 1, and enquiry themes

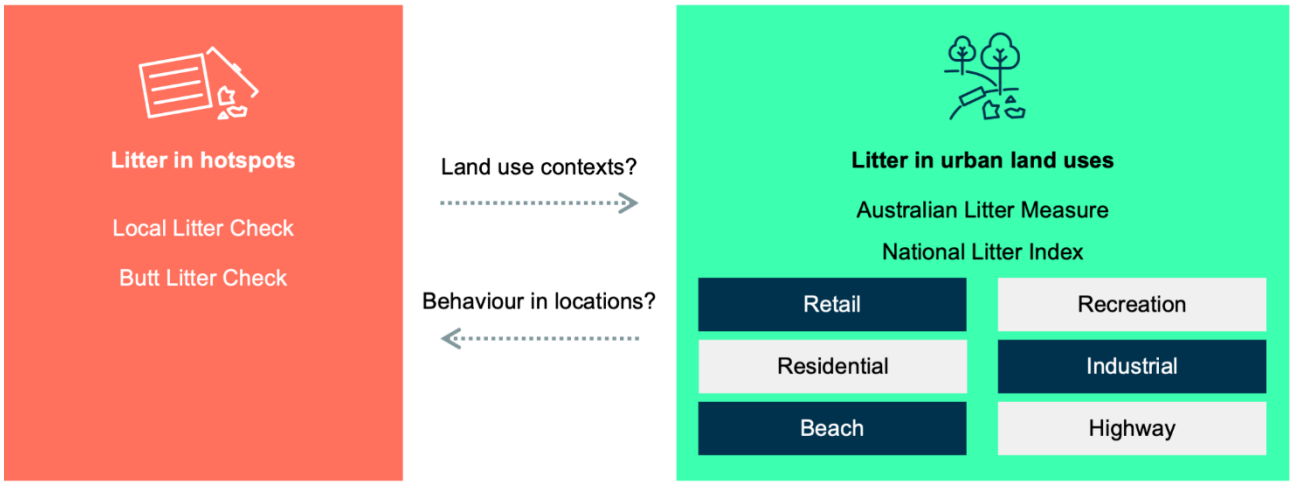
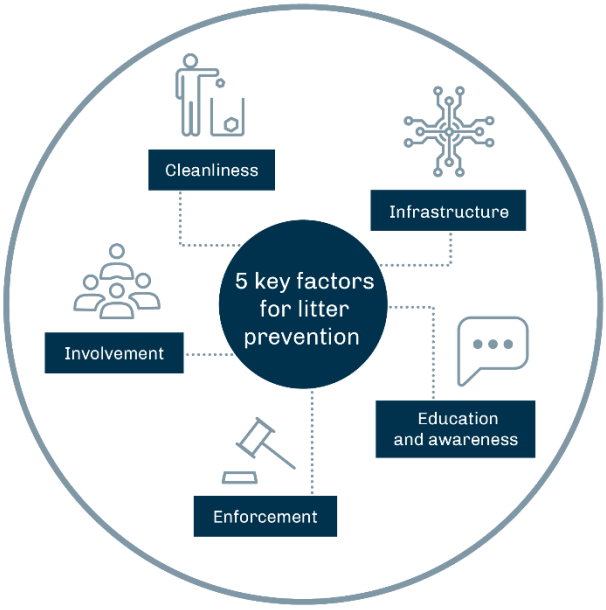


Figure 4 The five key factors influencing effective litter prevention



The LLC and BLC cover five of the main factors of effective litter prevention in local places, adapted from the NSW Litter Prevention Strategy. More information is available in the EPA Litter Prevention Kit.

The LLC and the BLC use standardised methods to guide the collection of data and to inform the thinking and discussion that draws conclusions from them. They allow different locations to be compared for planning litter prevention projects, or for evaluating changes at locations over time to see whether a litter prevention initiative has worked there.

While the LLC and BLC are designed for the general user, the quality of the data they generate will benefit from the scrutiny of experts, such as council officers, local residents, scientists and consultants. The EPA provides resources to standardise the data and format reports so they can be easily shared and discussed. This can help ensure that many viewpoints are applied in developing findings, to build the integrity and usefulness of the information.

Further information about data under Scope 1

Detailed guidance on use of the data is available on the EPA website: please visit Local Litter Check or Butt Litter Check.

Scope 2: Statewide butt litter data focused on smoking behaviours

There is one dataset under Scope 2, the **Butt Litter Index** (**BLI**).

The BLI was developed as a statewide measure of cigarette-butt littering behaviour. Cigarette butts are the most littered items in NSW and represent a particular behaviour that warrants a specialised approach. The BLI, like the Butt Litter Check that is used to collect the data, is distinguished from other litter measuring programs by including the observation of butt disposal behaviours. This focus can be more insightful than simply counting cigarette butt litter on the ground, and opens the opportunity to set behaviour-based targets.

Like the datasets that are described under Scope 3 below, the BLI is a ‘mass litter’ dataset that covers the whole of NSW. The EPA has used it to set a baseline in 2020 and will continue to report

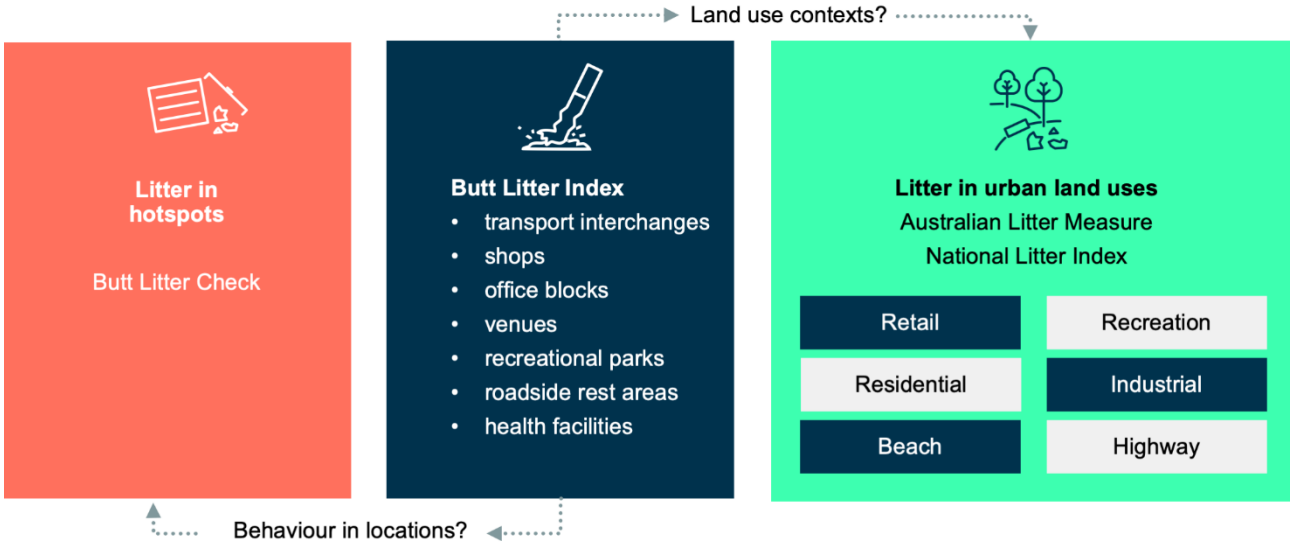
against this every two years. BLI data focuses on seven location types where butt littering is known to occur at the highest rates:

- transport
- shops
- office blocks
- venues
- recreational parks
- roadside rest areas
- health facilities.

Potentially, the data from the BLI can be related to some of the land-use litter data covered under Scope 3 (described below), especially for land uses that may show higher trends for smoking-related litter, such as retail areas. Specific locations where the data was collected are not identified in the BLI; however, the report provides generalised data related to the specific land uses noted above, and information on differences between regional and metropolitan areas.

The BLI report and other background information are available on the EPA Butt Litter Index webpage.

Figure 5 Data relationships in Scope 2, and enquiry themes



Scope 3: Statewide litter data focused on geospatial factors that influence the presence of litter

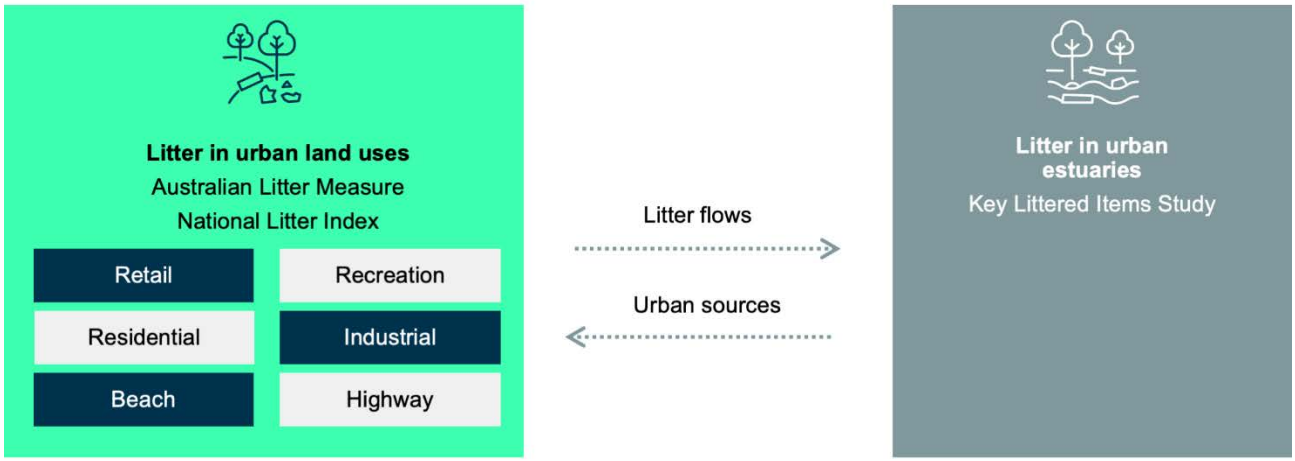
There are three datasets under Scope 3: the **National Litter Index** (**NLI**), the **Australian Litter Measure** (**AusLM**) and the **Key Littered Items Study** (**KLIS**).

Like Scope 2, Scope 3 of the Litter Data Framework covers ‘mass data’ – data resulting from litter monitoring for the whole of NSW. This data is generated using scientific methods (adapting ecological survey methodologies) to measure the densities, volumes and types of litter found on the ground and in coastal waters in NSW, and to assess the association between different types of

litter and different land uses. It can inform our understanding of litter as an urban pollution phenomenon that follows trends in time and space.

Unlike the surveys under Scopes 1 and 2, those under Scope 3 do not contain direct observations of littering behaviour or surveys of location users, but their data can be analysed to infer the sources of the litter, behavioural and otherwise. The data is used to understand the urban contexts of litter and how they influence where and when litter is generated, and how litter moves to urban waterways. It can show seasonal patterns, or changes that are associated with major events such as the COVID-19 pandemic. For monitoring progress against litter targets, the data is used to determine whether litter levels are following desired trends and if trends can be attributed to policy and programs supported by the NSW EPA and other stakeholders.

Figure 6 Data relationships in Scope 3, and enquiry themes



Two Scope 3 datasets, the NLI and AusLM, measure litter on the land in sites selected to represent different urban land uses. The third dataset, KLIS, samples litter that accumulates in mangroves along the shorelines of urban estuaries – sites that receive litter transported from land areas that have NLI or AusLM sites. The relationships between the datasets are explained in more detail below.

Critically, all three datasets in Scope 3 use the same, related, pair of metrics to report litter data:

- litter **density** is reported as the numerical abundance of **items per 1,000 square metres**
- litter **volume** is reported as **litres per 1,000 square metres**.

For more detail on these metrics, see Appendix A.

Litter in the context of urban land use: NLI and AusLM

The NLI and AusLM are land-based standing counts of litter, meaning the litter is counted where it is found and not removed. The NLI collected data from 2007 to 2020; the AusLM started in 2021. The litter categories in the AusLM were developed to relate to the litter categories in the NLI (Appendix B). Each sample is (or was) counted every six months across all sites.

The preliminary pilot of the AusLM was conducted in NSW in December 2021, with a full pilot undertaken by NSW, Victoria, Queensland and Western Australia in mid 2022. Other states and territories are expected to join the program later. The intention is that the AusLM will hold counts every May and November, as was the practice for the NLI. While the first round of AusLM data from 2022 will probably be of great interest and value to stakeholders, the program will need to run

for several years to establish a time series that can be meaningfully related to the historical time series of the NLI.

The two surveys use similar types of litter-counting sites: they represent land uses such as recreational parks, retail areas and beaches (**Appendix C**). The AusLM, having been developed since 2018, aligns more closely than the NLI with the 2016 Australian Land Use Mapping Standard (**ALUM**) that is managed by the Australian Government. While it is no longer current, the NLI remains valuable for the purposes of planning or setting targets because it is the only long-range land-based data that will be available until the AusLM has been up and running for several years. In 2021 the NLI was used, along with the KLIS (described below), for modelling the NSW litter targets, and for monitoring the impact of the *Return and Earn* program on beverage container litter levels.

Litter in the context of urban waterways: KLIS

To complete the picture of litter in urban environments, the Key Litter Items Study (**KLIS**) was developed in 2017. The KLIS was a collaboration between the NSW EPA, NSW Office of Environment and Heritage (now Department of Planning and Environment), NSW Local Land Services, Southern Cross University, the Tangaroa Blue Foundation (an Australia-wide charity that aims to protect and preserve the marine and coastal environment by reducing marine debris) and other organisations. The KLIS brings together land and marine litter categories. It incorporates categories from the NLI and AMDI but also has extra, unique categories, giving it 210 in total.

By counting litter in mangroves that are found along the shorelines of urban estuaries, KLIS samples litter that is unlikely to have been dropped there directly, because people rarely go into mangroves: it was probably carried there from nearby urban areas through rainwater run-off travelling through drains into waterways, and from there by currents, winds and tides. Mangroves are natural litter traps and have higher concentrations of litter than land-based sites.

The KLIS surveys all the litter items at low tide found between the waterline and the high tide mark along transects that follow the shoreline. It is what is known as an ‘accumulation study’, meaning that the litter at the sites is removed every three months and subsequently sorted, identified and counted. This means that KLIS captures data on what accumulates in the cleaned sample sites over the intervening months. When used together with AusLM data from the same broad location, the data can potentially be used to identify litter sources further up the catchment and show how litter moves through the catchment.

Further information about data under Scope 3

Information on the AusLM methodology is hosted by the Victorian Government, on behalf of Australian states and territories, on the Sustainability Victoria website. The *2020–21 Key Littered Items Study NSW Report* is available on the NSW EPA website. For more information on the NLI, contact Keep Australian Beautiful. To obtain the historical NSW NLI data held by the NSW EPA, email litter.prevention@epa.nsw.gov.au.

3. Using the litter data framework

Asking the right questions

To use data in the litter data framework you must first decide what sort of data relates best to the questions you have about litter. It's important to stress that, while we can set out broad principles about the approach to take, there's no single formula for interpreting the data. When deciding how to use the framework, first confirm **why** you need the data. For example:

- Do you want to design a local litter prevention project? In this case, you may need local site contextual issues and community insights obtained by doing a Local Litter Check or a Butt Litter Check. The Local Litter Check website contains all the records created by registered users, which can provide insights about what users have discovered or concluded from investigating litter hotspots.
- Do you want to establish a baseline in your region and track progress to a target over time? In this case local factors may be less relevant, and it may be more appropriate to use the methods and/or the published data associated with the Australian Litter Measure or Key Littered Items Study.
- Do you want to understand the impact of litter? In this case you may want to use litter data in conjunction with user surveys, cost of litter studies, or threat and risk assessments conducted by the Marine Estate Management Authority.

Using the framework

The data in the framework may be used for:

- gaining an overview of litter and understanding the main litter issues at local, regional or statewide scales
- understanding whether a litter type is rising or falling in density or volume
- understanding how significant a litter type is within the whole litter stream
- understanding what contextual factors lead to litter being found in a location or urban area
- understanding the factors that contribute to the likely success of a proposed litter prevention initiative
- monitoring and evaluating the impact of a litter prevention initiative.

Some users of the framework – such as council operators or community environment activists – may be addressing all the above purposes at once. They will need to decide where to start, what to prioritise and how to stage a program to tackle multiple litter issues.

More broadly, the framework data can also be used to:

- promote conversations and exploration of litter information
- challenge thinking and suggest alternative ways of seeing
- determine what additional data is needed for a specific purpose
- gain consensus on specific questions around litter.

Accessing and interpreting the framework data can be challenging if you're unfamiliar with some data types and reading tables and charts. For help, you can look at the websites, guidelines, reports and data-collection forms listed or linked in right hand column of the table below, or email the Litter Prevention Unit at the EPA: litter.prevention@epa.nsw.gov.au.

Table 1 **Summary of the Litter Data Framework core datasets**

Measure	Scope: Location	Scope: Land use	Scope: Time frame	Litter count	Litter metric	Site conditions	User surveys	Beha-viour	Investigator	Data access
Local Litter Check (LLC)	Litter hotspots	Location land use	As required by user	Yes	Items/litres per 40 m^2	Yes	Yes	-	Any LLC user	Open – online
Butt Litter Check (BLC)	Butt litter hotspots	Location land use	As required by user	Yes	Butt littering as percentage of butt disposal acts	Yes	Yes	Yes	Any BLC user	Limited; held in user files; guidelines online
Butt Litter Index (BLI)	NSW – ~120 BLC locations	6 land uses in metro and regions	Survey and report every 2 years (2020 onward)	Yes	Butt littering as percentage of butt disposal acts	Yes	Yes	Yes	EPA contractor	Report only – download online
National Litter Index (NLI)	NSW –151 locations	8 land uses (metro centric)	6-monthly counts averaged. Reported annually (2007–20)	Yes	Items/litres per 1000 m^2	Unavailable	-	-	Keep Australia Beautiful contractor	EPA dashboard on request
Australian Litter Measure (AusLM)	NSW – 14 locations	6 standard land uses in metro & coastal or inland regions	6 monthly counts. Reporting to be determined (2022 onward)	Yes	Items/litres per 1000 m^2	Yes – limited access	-	-	NSW Dept Planning and Environment	TBD – methodology online
Key Littered Items Study (KLIS)	NSW – 12 locations	Aligns with 12 AusLM coastal locations	3-monthly counts. Annual reporting against NSW litter targets (2017 onward)	Yes	Items/litres per 1000 m^2	Yes – limited access	-	-	NSW Dept Planning and Environment	EPA online dashboard on request

Data quality

The data in the Litter Data Framework comes from a variety of sources. Its quality is key to how useful it can be.

A primary requirement is that the data is accurate: that what is recorded in tables or data collection forms reflects the reality of what is being observed. Very often, judgements must be made in the field when collecting data, to account for variations. For instance, counting litter where an event has just taken place may not capture the location's normal condition, so the investigator notes this observation for later reference, to aid with subsequent interpretation. The critical principles applied are that the whole process of investigating, compiling, analysing and reporting findings on litter data is consistent, transparent, open to peer review and fit for purpose.

For the KLIS and the AusLM, the NSW data is collected by science teams led by the Department of Planning and Environment (DPE), along with volunteers working under an agreed peer-reviewed scientific protocol. The data is compiled and stored in databases managed by the DPE, using appropriate software to manage and run analyses. The data that is then given to the EPA to put into dashboards or other reports is not 'owned' by the EPA; the EPA can use and disseminate the data under agreed protocols. For instance, the EPA generally does not know or divulge the specific locations where litter is monitored.

Where data is collected by a contractor working for the EPA – as it is for the Butt Litter Index, for instance – the same kind of protocol applies. The data is collected independently of the EPA and the methods used are transparent and open to peer review.

For a user-generated database such as the Local Litter Check, quality assurance is up to the people who are familiar with the location where the litter has been recorded. In this case, the data needs to accurately reflect the condition of the location. It will be strengthened by your own 'peer review' – sharing the data records with people who know the site, to see if the records align with their perceptions. The Local Litter Check website gives several ways to share reports, online or in print form.

The framework itself, along with its constituent databases, is continually improved and periodically reviewed. As the survey methodologies and the data they yield become more refined, the framework will be adapted and improved. For more information, please contact the EPA at litter.prevention@epa.nsw.gov.au.

4. Other litter data that supports the framework

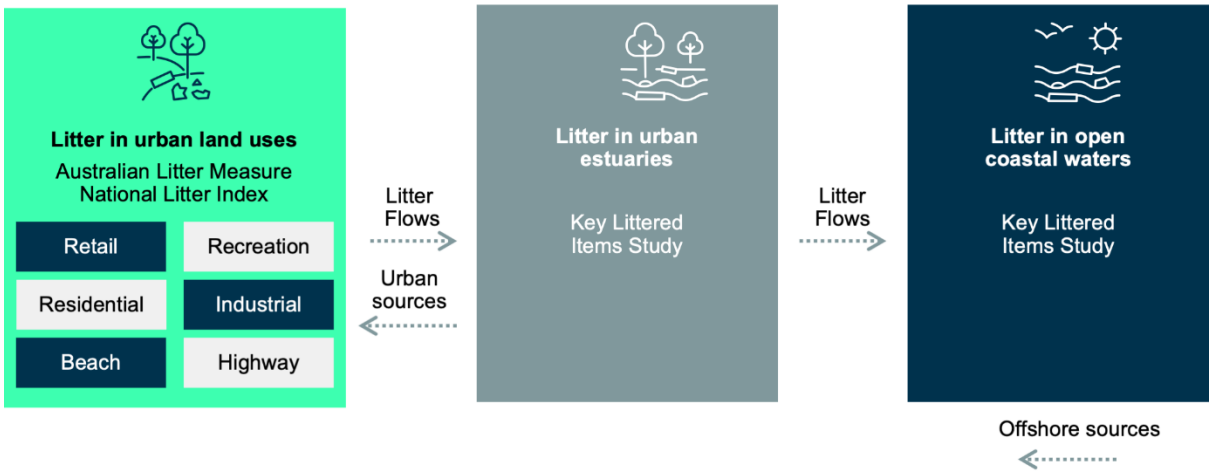
A wide range of litter data is available, from both NSW Government agencies and external partners. It can all be called upon to develop findings beyond the monitoring and evaluation of the NSW Litter Prevention program.

Key Littered Items Study – Remote Beaches

The Key Littered Items Study comprises two discrete sampling programs: one for urban estuaries (which forms part of the Litter Data Framework) and one for remote beaches. The remote beaches count supplements the estuary count and is conducted in December each year. It uses a subset of the litter categories used for urban estuaries, and a similar survey methodology: sampling at low tide – between the water line and upper beach in transects – along remote stretches of beach, well away from urban centres. Like mangroves, these are places where people rarely go and directly deposit litter. This means most of the litter there has been brought by waves, ocean currents, wind and tides.

Data from the remote beach study can be compared with that from urban estuaries or used to determine litter sources. For instance, beverage containers are found on these remote beaches. A large proportion of those that can be identified have been determined to have come from offshore, probably discarded from ships.

Figure 7 Key Littered Items Study – relating data in urban estuaries and open coastal waters with enquiry themes



Australian Marine Debris Initiative Data

The Australian Marine Debris Initiative (**AMDI**) was created by the Tangaroa Blue Foundation. The AMDI is developed as an on-ground network of volunteers, communities, organisations and partners. This citizen-science network contributes litter data to the AMDI database, and then uses this data to inform and monitor solutions that stop the flow of litter at the source. Tangaroa Blue aims to empower people, businesses and governments to make data-driven decisions to improve systems, processes and behaviours to stop the flow of litter at its source.

Tangaroa Blue was a partner in the early development of the KLIS in 2017, and many of the marine litter categories used in the AMDI database were included in KLIS. AMDI monitoring is done at a range of site types, including underwater sites, rivers, estuaries, coastal shorelines and stormwater infrastructure.

More information on the AMDI is available at www.tangaroablue.org.

'Report to EPA' data

The *Report to EPA* program enables the community to register and report littering from a vehicle online. Once verified, this report can lead to a fine being issued. There are currently more than 70,000 reporters on the system, and to date more than 82,000 reports have been received and 49,000 fines issued.

The system, managed by the NSW Government, includes information about each observation, such as what was littered, where and when. This data is monitored by the EPA using a PowerBI dashboard. Aggregated data is shared with partners, including local government, to help boost enforcement of littering laws. The data is geomapped, so it can be related to other litter data in the framework.

Data are available for observation location, postcode- or suburb-specific location, litter type, penalties per local government area, and number of reporters per local government area. Common litter types observed include cigarette butts, bottles and bottle caps, wrappers and plastic items. The commonest type of reported littering from vehicles is cigarette butt disposal.

For more information, visit Report littering at the EPA website.

Research commissioned by the NSW EPA and its government partners

The EPA periodically seeks information on littering that adds more detail or insight to existing data, particularly where it can provide a stronger base of evidence for key policy or program commitments. This is generally done through one-off research projects. However, the nature of research projects is such that they may raise questions or provide inconclusive data that require further research.

To review reports on litter research, visit Litter research on the EPA website.

A number of peer-reviewed papers from the Key Littered Items Study have also been published.[1]

---

[1] Smith SDA, Edgar RE, Davies P, Foulsham E, Taylor H & Hughes B 2017, *NSW Container Deposit Scheme Monitoring Program: Progress Report*, National Marine Science Centre, Southern Cross University, Coffs Harbour, NSW

Smith SDA & Edgar RJ 2018, *NSW Container Deposit Scheme Monitoring Program: 2nd Progress Report*, Southern Cross University, Coffs Harbour, NSW

Foulsham EL, Davies P, Edgar RJ, Smith SDA, Allen K 2018, *Key Litter Items Study: NSW State-wide assessment of CDS & Key Litter Items in Coastal Environments: Baseline and initial assessment, 3rd Progress Report*, NSW Office of Environment and Heritage, Sydney

Smith SDA, Edgar RJ, Davies P, Foulsham E, Taylor H & Hughes B 2019, *NSW Container Deposit Scheme Monitoring Program. Final Report*, Southern Cross University, Coffs Harbour

The Marine Estate Management Authority commissions and publishes reports on threats and risks to the marine environment, including from marine debris.

Microplastics

Microplastics are plastic fragments less than 5 mm in size down to dimensions measured in nanometres. They are the focus of a growing area of research.

- The Australian Microplastic Assessment Project (**AUSMAP**) is a national citizen-science initiative launched in 2018 by the Total Environment Centre and Macquarie University. The program has developed rapidly, with volunteers collecting samples from over 300 shorelines around Australia.
- NSW DPE has used the AUSMAP methodology to sample microplastics at some of the KLIS survey sites.
- Through the Marine Estate Management Authority (**MEMA**), the NSW Government supports research into microplastic distribution and abundance. Scientists from the DPE Water, Wetlands and Coastal Science Branch have sampled microplastics in over 50 estuaries along the NSW coastline and developed a rapid and cost-effective method to assess their distribution and abundance. This large-scale study creates a reference database to
    - fill data gaps
    - highlight hotspots
    - flag areas for future research
    - provide a baseline for ongoing monitoring.
- **Nurdles** are microplastic pellets from which plastic goods are manufactured. The NSW Plastics Action Plan, introduced in 2021, includes funding for the development of Tangaroa Blue's *Operation Clean Sweep* program, which is aimed at reducing the leakage of nurdles into the environment. The program will gather data during monitoring and evaluation.

Appendix A

The metrics used in the National Litter Index, Australian Litter Measure and Key Littered Items Study

Shared metrics under Scope 3

The consistent use of agreed metrics over the long term is critical to effective litter monitoring and evaluation.

A metric, in its simplest terms, is the use of a standard unit to ensure consistent and accurate measurement.

Table 2 Common standard units of measurement

Measured dimension	Standard unit of measurement (and abbreviation)	Common nested scales (and abbreviations)
Distance/length	Metre (m)	Millimetre (mm) = 0.001 m Centimetre (cm) = 0.01 m = 10 mm Decimetre (dm) = 0.1 m = 10 cm Kilometre (km) = 1,000 metres
Area	Square metre (m^2 or sqm)	Hectare (ha) = 100 m x 100 m = 10,000 m^2
Volume	Litre (L) = the volume of space bounded by a cube measuring 1 x 1 x 1 decimetre	Millilitre (mL) = 0.001 L = the volume of space bounded by a cube of 1 x 1 x 1 centimetres Kilolitre (kL) = 1,000L = the volume of space bounded by a cube of 1 x 1 x 1 metres
Weight	Gram (g)	Milligram (mg) = 0.001 g Kilogram (kg) = 1,000 g Tonne (T) = 1,000 kg

The metrics used to report litter data are normalised the same way across all three Scope 3 datasets, i.e. all measure quantities of litter against the same constant measure of land area (see the section below headed ‘Normalising data’). The metrics used are:

- numerical abundance of littered items per 1,000 square metres – the **density** metric
- litres of litter per 1,000 square metres – the **volume** metric.

These are abbreviated, respectively, as **items per 1,000m²** and **L per 1,000m²**.

Volume versus weight

An alternative to using volume would be to use weight, reported in kilograms or tonnes. Some programs that collect large amounts of litter do this, such as the Transport for NSW litter barge on Sydney Harbour, but do not record the different litter types. Weight is also relevant when it comes to disposal charges that must be paid to send waste to landfill. However, there are practical reasons for using a volume measure for monitoring litter.

Volume reflects the space an item occupies, which is relevant when considering solutions to managing litter. For instance, it can enable planning around bin capacities, which need to contain the anticipated number and size range of items without overflowing, from bits of confectionary wrapper all the way up to pizza boxes or larger. Furthermore, the volume reflects the likely visibility of the items in the environment, which has an impact on visual amenity.

On balance, when used alongside a count of the numerical abundance (i.e. density) of littered items, a volume measure captures some of the benefit lost by not using a weight measure. By reflecting the relative volume of different parts of the litter stream, along with a record of the materials (plastic, metal, glass, etc), we can build a rich picture of the relative contribution of the quantities of different littered items to overall litter.

Normalising data

In all three programs litter is counted in a measured-out area (e.g. 4 x 100 m) known as a transect, with several transects at each survey site. Either the length or width of the transect is prescribed according to what kind of location is being surveyed, with the other dimension dependent on the boundaries. For example, in KLIS, the transects are each 20 metres in length following the shoreline in mangrove habitats, with the boundaries to each side measured from the high-water mark to low-water mark at low tide. The areas in square metres, therefore, vary between transects and from location to location. For this reason, we need to account for differences in the area surveyed if we wish to run useful analyses. This is done by reporting metrics against a fixed area of 1,000 square metres, a process known as ‘normalisation’. These normalised measures are essential if survey findings are to be readily compared:

- in space – from location to location, region to region, state to state
- in time – from one quarter to the next, or one year to the next
- between datasets – KLIS, NLI and AusLM
- between the metrics – contrasting the density of litter items against their volume.

For example, if a transect runs for 100 metres along a road verge, and litter is counted within a 4 m strip across the transect, then the area surveyed can be expected to come to 4 m x 100 m = 400 square metres. In reality, however, the areas are rarely as ‘rounded’. For instance, for the AusLM count in retail areas, three transects of 100 metres each are measures along the footpath (Figure A1), with the count area bounded on one side by the property boundary and on the other by the outer edge of the roadside kerb. Each transect will have a slightly different area.

Figure A 1 Transects in a retail area

Source: Sustainability Victoria – AusLM specification

In this example, we could imagine the three transects in Figure A1 being a constant 100 metres in length, but with the varying width of footpaths resulting in the total area coming to 391m^2 + 352m^2 + 406m^2 = 1,149m^2. If a total of 257 littered items was counted across these three transects, the normalised litter density for this retail location would be 257 ÷ 1,149 = 0.224 items per square metre. In Scope 3 this normalised figure is multiplied by 1,000 to get a per 1,000 m^2 metric. The 0.224 per square metre result becomes 224 items per 1,000 m^2.

The AusLM adapts the same approach as the NLI by repeating surveys at the exact same sites. This way, the area for each transect remains consistent from one survey to the next, six months later.

For KLIS counts, which are done every three months in mangroves along the same transects following the shoreline at low tide, litter is collected at low tide between the water line and the high tide mark. Because tides vary in height, the area in square metres may not be the same from one count to the next, so the area is estimated and recorded at each transect at the time it is surveyed. This gives a reliable per square metre figure.

Reporting the density

In the example from the previous section, once the data has been reviewed and checked for quality, we can say that, for this count, the retail area surveyed had a litter density of 224 items per 1,000 m^2. The 1,000 m^2 measure has benefits when it comes to communicating results about litter. For most people it is easier to visualise 224 items spread over a 1,000 square metre area (i.e. 50 metres by 20 metres – equivalent to two modestly-sized suburban blocks) rather than the more abstract idea of a fraction of an item (0.224) in a square metre.

Also note that, when the calculation is done, the per 1,000 m^2 figure can still have decimal places: 257 divided by 1,149 and multiplied by 1,000 comes to 223.67 items per 1,000m^2 when reported to two decimal places. Such precision does not necessarily yield significant new information and the density can usually be reported without decimal places; however, in the dashboards used by the EPA, the general practice is to report normalised figures to two decimal places. For very small numbers, for instance where an item category comprises less than one item per 1,000m^2, it is often necessary to use two decimal places.

Reporting the volume

All the surveys in Scope 3 count litter items that are categorised and collated in tables: Appendix B provides more detail the categories. For the density measure, it is a straightforward matter of recording the number of items (e.g. 13 coffee cups) in a category that are counted in a transect. For the volume measure, volume is not measured item-by-item on site, which would be unfeasible. Instead, an estimate is made once the items are all identified, counted and tabulated in each category, by multiplying the number of items counted in the category (e.g. paper/cardboard takeaway coffee cups) by the average volume of litter in that category.

For some items calculating the volume factor is simple – a one litre beverage container has a set volume – but for others the average volume must be estimated based on a survey of a representative sample of that item. This involves calculating an average value from multiple measures of that item type. For instance, takeaway paper/cardboard coffee cups are estimated at 0.21 litres per cup, and cigarette butts are 0.00012 litres per butt.

While this approach provides an estimate rather than a direct measurement of volume, if it is applied consistently among datasets and from survey to survey, then the figures are reliable for monitoring and reporting purposes. From time to time, a volume factor can be reviewed where the related item is shown to have varied in size, though this is rare and would need to be done across all the datasets – and all jurisdictions, in the case of AusLM.

The different uses of density and volume metrics

The density metric tends to emphasise the littered items that are numerous, regardless of size. The volume metric emphasises the littered items that are larger, no matter how many there are. The reason to use the two metrics side-by-side is that neither captures the full picture, therefore one can corroborate the other.

Figures 2 and 3 illustrate this. They both show the composition of the ten largest litter item categories counted in the Key Littered Items Study from 2018 to 2019. (These years were used to set the baseline for the targets in the *NSW Waste and Sustainable Materials Strategy 2041*.)

In both charts the largest category (in grey) is *Other* (that is, a combination of categories that are not large enough to rank individually in the top ten). In Figure 2 the top ten items by density comprise 60.4% of all items counted; in Figure 3 the top ten by volume comprise 59.1%. In Figure 2, you can see that the *Confectionary wrappers & snack bags* category alone makes up 19.4% of all litter items (at 37.0 items per 1,000 m^2), followed by *Plastic straws* at 10.1% (19.2 items per 1,000 m^2). In Figure 3, showing relative volumes, plastic *Water bottles under one litre* account for 16.5% of total volume (at 3.0 litres per 1,000 m^2), followed by the *Other food packaging* (sauce sachets, etc.), which make up 9.4% of total volume (1.7 litres per 1,000 m^2).

If the volume measure were the only one used, *Confectionary and snack litter*, at 1.3% of volume, would not feature except as a component of *Other* in Figure 3, but it represents the single most significant litter item category by density in Figure 2. Likewise, if the density measure were used on its own, the mass of *Return and Earn*-eligible containers in the top ten (together accounting for 31.3% of the total) would have been missed.

The purpose in mind will determine the use of the metric. For instance, the density metric could be relevant to a public place manager who is responsible for the clean presentation of public places: snack bags and confectionary wrappers get noticed and must be picked up

one by one, no matter what their size. The volume metric could be relevant to someone who wants to understand the wastage of materials through littering: the large volume of drink containers represents significant leakage

Figure A 2 'Top ten' items by density (items per 1000 m^2) in *Key Littered Items Study 2018–19* (from the KLIS dashboard)

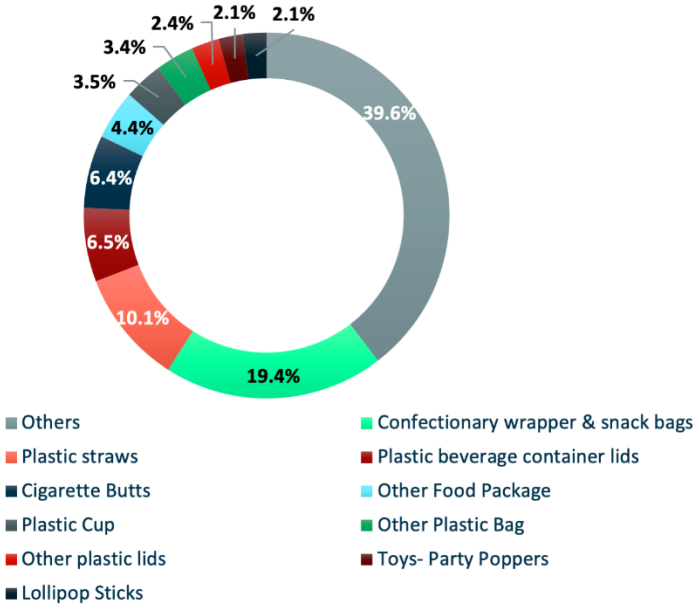
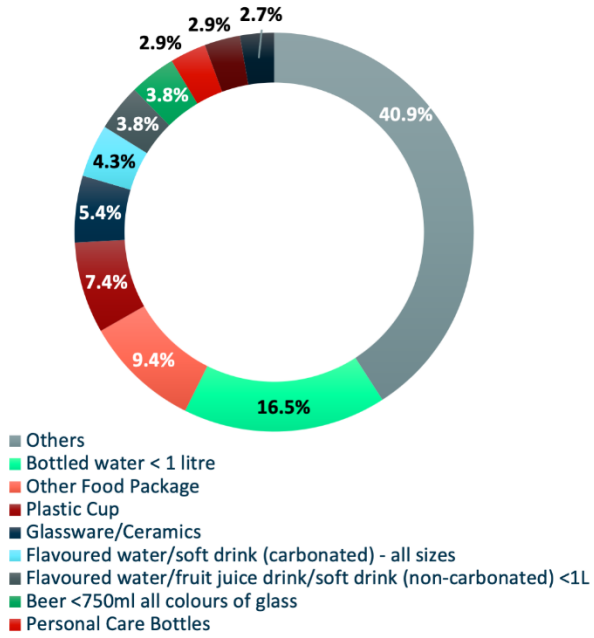


Figure A 3 'Top ten' items by volume (litres per 1000m^2) in *Key Littered Items Survey 2018–19* (from the KLIS dashboard)



Metrics used for the NSW litter targets

In 2015 the NLI was used to set the 2020 target for the Litter Prevention Strategy under *Waste Less Recycle More*. It used the volume metric to set the target – 40% of the 2013–14 NLI litter volume. This was done partly because a critical element of that first strategy was the introduction of the NSW Container Deposit Scheme (i.e. *Return and Earn*), planned for December 2017, which was expected help significantly in achieving the target. The density measure was still available and reported: it was important for managing small items such as cigarette butts, which represented at least 40% of items in the NLI litter count.

Under the *Waste and Sustainable Materials Strategy*, the new targets of 30% reduction in plastic litter and 60% for all litter were modelled and set in 2020, using both the NLI and KLIS. The NLI ended in 2020 and since then the target has been monitored and reported using the KLIS: its data will be corroborated by AusLM data when that comes into play from 2022 onwards.

The new targets use the density metric – items per 1,000 m^2. There are a few reasons for this choice.

- This is the most straightforward application of the data. It is the number of items counted and recorded in spreadsheets and normalised for the survey area, without the layer of interpretation required to estimate the volume.
- Litter density reflects what people experience when they see litter in the real world: items strewn where they are not wanted. To a degree, it can also represent the number of littering acts. (For instance, consuming one packet of 30 cigarettes generates up to 35 single-use disposable elements (plastic film pieces x 3, silver foil flap x 1, butts x 30, packet x 1). This has some bearing on why cigarette butt litter items have been so numerous.)
- Targets provide a focus for shifting littering trends in a set time. While either density or volume could be used to measure change, concerns about the amenity of public places may be best served by the density metric (the presence of litter in the environment) while circular-economy principles (i.e. reducing the leakage of otherwise material from the economy) may be best served by monitoring the volume of items. In the *NSW Litter Prevention Strategy*, visual amenity, environmental protection and circular-economy principles are all at stake and served by this multifaceted approach to litter data. While there will be a primary reliance on the litter density data, our ability to readily convert densities to volumes means we can comprehensively evaluate litter trends.

Appendix B

Litter categories in the National Litter Index, Australian Litter Measure and Key Littered Items Study

Litter categories

Sitting at the heart of databases under Scope 3 are tables showing the number of litter items counted. Each litter item has its own category, with a unique identifier, a descriptive term that distinguishes the litter items from other items – e.g. 'Bread bag tags', 'Fruit juice < 1 litre' or 'Heavy reusable 15c supermarket bag'. A code number and other categories are associated with each item. These are used as consistently as possible across all three datasets to ensure data relatability.

The categories associated with each item name – material, size and colour – represent unique identifying characteristics that are based on direct observation of the litter sample.

Litter material

This is what the litter item is made of – e.g. plastic, foam, metal. It is directly observable when the litter is sampled and recorded.

Litter size

Some litter items come in different sizes, such as the many kinds of beverage containers (e.g. categorised as larger or smaller than one litre). Litter size also relates to the dimensions of the object – for instance, if the litter is a fragment. Like material, size is directly observed by the surveyors sampling the litter.

Litter colour

Some litter items have different colours that indicate they come from different sources e.g. grey, white and blue lightweight shopping bags are used by different kinds of retailers.

When the data are compiled in tables and analysed, the item name is critical, as are details of material, size and colour. The development of the datasets – from the start of the NLI in 2006, the KLIS in 2017 and AusLM in 2021 – has generally been associated with increasing detail in the list of items counted. The NLI has 71 litter item categories, the KLIS has more than 135 categories and the AusLM has up to 210. This kind of detail is sometimes called 'granularity' and is useful when a single litter item is the focus – for instance to measure the impact of a program that targets one item only, such as dog poo bags. At other times, granularity is a distraction and data are more usefully reported in aggregated categories, e.g. 'takeaway litter' or 'plastic litter'.

In relation to the material composition of litter, the three datasets show increasing level of detail. The NLI covers six main material types, which include cigarette butts and a miscellaneous material category. AusLM has nine material categories. KLIS also has nine, counting cigarette butts as plastic.

Table 3 Coverage of material categories across three datasets in the Litter Data Framework

Material categories	Number of NLI items per category		Number of AusLM items per category		Number of KLIS items per category	
-	Categories only	Including size options	Categories only	Including size options	Categories only	Including size options
Cigarette butts*	1	1	1	1	1*	1
Plastic	24	29	55	83	104	124
Metal	12	12	11	33	28	28
Glass	10	15	12	50	15	25
Paper/cardboard	15	18	17	35	16	19
Rubber	0	0	6	8	8	8
Polystyrene (foam)	0	0	5	7	7	12
Cloth	0	0	3	5	4	4
Wood	0	0	0	1	6	6
Other/miscellaneous	9	9	23	28	21	21
Total item categories	71	84	133	251	210	248

Note: Cigarette butts are counted as a plastic litter item in the KLIS. They are here shown separately for comparison.

Granularity of the data across NLI, AusLM and KLIS

The NLI, AusLM and KLIS count individual litter items using categories that directly relate across the three datasets. The KLIS data adds a further layer to the picture of litter by including many categories for litter fragments or other, non-litter items, such as building materials or commercial fishing gear. While these data are reported separately, to enable valid cross-comparison between AusLM and KLIS data, they can also be used to help provide information about the fragmentation of litter on its way from land to sea – noting that AusLM counts 24 categories of fragments.

Appendix C

Sampling strategies used in the National Litter Index, Australian Litter Measure and Key Littered Items Study

NLI sampling strategy

The NLI surveyed 151 undisclosed locations in NSW, and 983 nationally, with each site selected to be 'typical' for that site category. Eight land uses were represented. Counts were performed at the same sites every May and November, with all litter items counted in each, and averaged across the two counts to provide a report for each year (reported by Keep Australia Beautiful in financial years, covering November and the following May).

The area in square metres was recorded for each sample site, allowing for the data to be normalised across the dataset, using a density metric of **items per 1000 square metres**. A volume was then estimated using an average in each category to report against a volume metric of **litres per 1000 square metres** (see Appendix A).

Table 4 Land-use categories used in the National Litter Index and Australian Litter Measure

Land use	NLI	AusLM	Site type description used in AusLM	ALUM classification
Beach	Yes	Yes	A mostly sandy beach frequently visited by people for activities such as recreation and relaxation	6.6.0 Estuary/coastal waters
Residential	Yes	Yes	A street in a residential zone as specified by the jurisdiction's planning scheme that has homes/units/apartments on both sides of the street	5.4.1 Urban residential
Industrial	Yes	Yes	A street in an industrial zone as specified by the jurisdiction's planning scheme	5.3.0 Manufacturing and industrial
Retail	Yes	Yes	A street in a commercial zone as specified by the jurisdiction's planning scheme with retail stores on at least one side of the street	5.5.1 Commercial services
Shopping Centre	Yes	No	-	5.5.1 Commercial services
Recreational Park	Yes	Yes	A public outdoor space frequently visited by individuals and groups for recreation and leisure	5.5.3 Recreation and culture
Main Road	Yes	Yes	Main roads include open stretches of sealed road with wide verges and that… act as an arterial for traffic between and around population centres	5.7.2 Roads
Car Park	Yes	No	A supplementary methodology to sample car park boundaries is available in AusLM.	Unclassified

AusLM sampling strategy

The national sampling strategy for AusLM is being finalised at the time of writing; however, counts will follow the same May and November time frame as NLI. For each of the 15 AusLM locations in NSW there is a selection of sites covering up to six different land uses and, for each land use site, a series of transects – i.e. lines along which the surveyors walk and count and record every item of litter. At the time of writing, litter on highways is not yet counted due to unresolved concerns about surveyor safety, with an amended methodology being discussed with other states and territories.

With each count, specific information (e.g. weather conditions) is collected at the location, site type and transect levels to aid ongoing analysis of data. In NSW, the data from the 15 locations will be brought together into a statewide report. This information is used by the science teams collecting, compiling and reporting on the data to account for factors that may influence litter counts, e.g. whether there has been recent heavy rainfall, or recent major events or other activities in the vicinity.

The AusLM uses the same normalised metrics as NLI (i.e. items or litres per 1000 square metres), which facilitates comparisons between the datasets.

Time frames for NLI and AusLM

Data from the NLI and AusLM cannot be directly compared in the same time frame since the counts were never contemporaneous: the NLI ended in May 2020 and the AusLM began in December 2021. However, the NLI provides a historical baseline that will be continued through AusLM.

KLIS sampling methodology

The KLIS was developed initially to corroborate the NLI data for monitoring the impact of the Container Deposit Scheme, but was extended due to the value of the data that emerged. The KLIS is adaptable, partly because of the comprehensive scope of the litter categories counted, and partly because it has the potential to show how litter flows from urban catchments to urban estuaries.

The KLIS is an accumulation study, meaning the litter is collected, bagged and counted at a location away from the site, such as a laboratory. This approach allows the investigators to get a highly detailed picture of what accumulates at the sites in the time between samplings. The litter is collected from transects at 12 coastal locations every three months. The transects were selected based on their proximity to nearby urban areas, and the likely influence of those areas via drainage lines that enter the waterways near the mangrove sites.

Through a combination of rain run-off, currents, tides and winds, litter is transported to the monitoring sites where it becomes trapped in the mangroves. Occasionally, this can be old litter transported by various processes, such as flood or erosion events that sometimes scour a catchment (a recent find following heavy rainfall in 2022 turned up beverage lids with the Sydney 2000 Olympics logo). Litter in the mangroves can also include some debris carried in from the ocean, although this is generally a small proportion. Mangroves are areas where, in general, people neither go nor directly deposit litter, which means that litter found there has largely been carried there only by natural processes. In this way, the KLIS sites provide an early ‘signal’ of litter trends in nearby urban areas.

KLIS sampling strategy

The KLIS works best when it is coordinated with a land-based litter count such as the NLI or AusLM because it helps provide information on the flows of litter to urban estuaries. It measures flow by clearing the sample site of all litter every three months, meaning that whatever is found there for the next count is largely new litter.

With counts happening every March, June, September and December, the KLIS can evaluate seasonal changes. By sampling more frequently than the NLI and AusLM, it can more accurately pinpoint when change occurs. The KLIS may detect a 'lag effect', where changes on land lead to a delayed change in estuarine litter. As for all the datasets in Scope 3, interpreting KLIS data requires a careful, well-considered approach, recognising the range of factors that can affect accumulation rates of different litter items.

Comparison with remote beaches

A further count, using the same categories as the KLIS, is conducted by DPE and science partners at nine remote beaches once a year. Similarly to the mangrove locations, the litter in these remote locations is unlikely to have been directly deposited, and has instead being carried there by currents, tides and wind. This data is particularly useful for comparing litter trends between sites mostly influenced by urban processes – the mangroves – and ocean processes – the beaches.

Time frames for KLIS, NLI and AusLM

The KLIS has the benefit of running, or having run, at the same time as both the NLI and AusLM: the NLI and KLIS were concurrent from May 2017 to May 2020, and the AusLM and KLIS have been concurrent since December 2021. When the data from the KLIS are analysed together with that from either the NLI or AusLM, they can potentially provide a comprehensive picture of how litter moves in coastal urban landscapes from where it is deposited, and then carried by wind, gravity, rainwater run-off through drains, tides and currents, to where it washes up or sinks. We have been able to analyse the effects of the *Return and Earn* initiative in NSW in December 2017, with a steep drop in eligible containers evident from data in both the NLI and KLIS programs. The KLIS also detected changes following the voluntary plastic bag ban by national retail chains in June 2018, with the density of grey plastic shopping bags falling steeply in subsequent KLIS surveys. (The NLI did not count grey shopping bags as a separate litter item.)

The combination of recent data from the KLIS and AusLM, plus a historical baseline from the NLI, provides a strong foundation for assessing changes in litter trends associated with policy intervention (e.g. the NSW Plastics Plan), education and community action. The standardised methods of KLIS and AusLM can be applied at different scales, to monitor the effectiveness of different initiatives. For example, by using the same methods used in statewide programs funded by the EPA, local councils or community groups could assess the effectiveness of their own litter reduction efforts and compare local trends with ones over larger areas.