



## Engaging community, industry and government to reduce plastic resin pellets flowing into Port Phillip Bay

July 2018 – June 2020

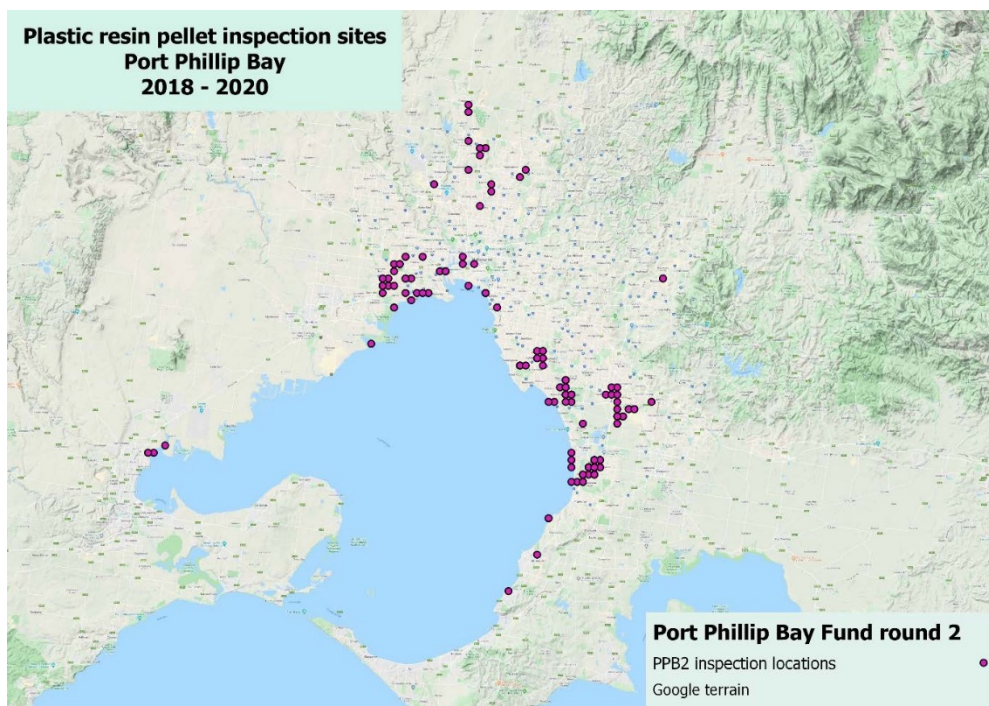
### Introduction

Plastic resin pellets (nurdles) are pre-production raw plastic that are lost into the environment through improper handling and spills during manufacturing and transportation. The most frequent way that plastic resin pellets enter the environment is through the stormwater system, where they are a known threat to wildlife through ingestion and have been recorded in significant numbers throughout the Port Phillip Catchment.

During July 2018 to June 2020, surveys of plastic resin pellet (PRP) ratings were conducted at various points between plastics industry facilities and Port Phillip Bay in Victoria. These surveys built a picture of pellet loss from point sources at plastics industry facilities across seventeen local council areas, through the environment and into the bay.

In this project, Tangaroa Blue Foundation built on the success of the Operation Clean Sweep® program that was introduced into Victoria in 2014, by continuing to engage community, industry and government in preventative measures that stop plastic resin pellets at the source. Survey results at facilities were used to assist in the engagement of plastic industry members (factory, transport and distribution owners and operators) in Operation Clean Sweep®, assisting members to make changes so that plastic resin pellets, flake and powder are contained, retained or disposed of properly.

*Map 1: Distribution of plastic resin pellet inspection sites throughout the Port Phillip Bay catchment*





## Background

This project was funded by the Victorian Government's Port Phillip Bay Fund, a grants program that supports organisations working to safeguard the environmental values of the Bay. The fund aims to enhance the amenity of the bay, address threats to the environmental health of the bay, and encourage partnerships across a range of interested groups and organisations.

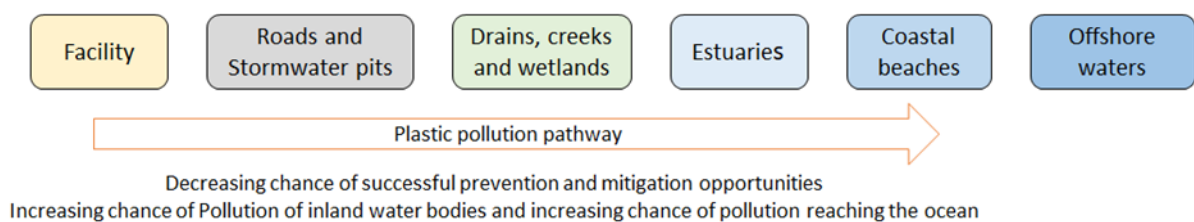
An initiative of Tangaroa Blue Foundation, this project was made possible through the support of partner organisations including Chemistry Australia, Streamline Media, City of Kingston, City of Wyndham, City of Greater Dandenong, Cleanwater Group, Operation Clean Sweep®, Victorian EPA and others.

## Methodology

In this report, the two periods July 2018 to June 2019 and July 2019 to June 2020 are referred to as period 1 and period 2 and the full project timeframe of 2018-2020 is referred to as the life of the project.

The transport of pellets from their point source to the sea is along a pathway consisting of roads, built drainage, natural drainage, creeks, rivers and estuaries and into the bay. This pathway is referred to as the "Plastic Pollution Pathway". Figure 1 is a schematic representation of the plastic pollution pathway concept which, together with the council areas, provides the structure for presenting the data.

*Figure 1: Plastic pollution pathway concept*



The plastic pollution pathway is a simple way of planning effective intervention for both monitoring and data collection, and source reduction activities with an emphasis on preventing pollution and loss at the source or near to it.

## Project outcomes

### Site inspections

Throughout the life of the project over 500 site inspections were conducted to monitor PRP presence (Table 1). Consultation with the Victorian EPA has resulted in the creation of a guidance



fact sheet to managing plastic resin pellets (Appendix 2), to fill the gap on a compliance response to the plastic resin pellet pollution issue.

*Table 1: Inspections by council area for each project period*

Inspections by council area		
	Period 1	Period 2
Bayside	6	6
Brimbank	2	0
Darebin	2	0
Frankston	80	98
Greater Dandenong	28	54
Greater Geelong	0	3
Hobsons Bay	33	37
Hume	13	13
Kingston	53	55
Knox	0	1
Maribyrnong	1	1
Melbourne	1	3
Moreland	0	1
Mornington Peninsula	0	4
Port Phillip	8	3
Whittlesea	2	2
Wyndham	6	8
<b>17</b>	<b>235</b>	<b>289</b>

## Stormwater Drain Trap Installation

Three stormwater drain traps were installed by the Cleanwater Group in each of the Cities of Greater Dandenong, Kingston and Wyndham. Each trap was installed in an industrial area in close proximity to an operating plastics factory of which previous surveys had shown plastic resin pellet loss occurring.

The data was also used by several industry members to measure the success of intervention measures implemented in their businesses. The analysis in Appendix 1 shows there was a decline in pellet loss over time for Dandenong where mitigation strategies were implemented following EPA visits. In Kingston one trap showed an increase in pellet loss after new machinery was installed, whilst the other two Kingston traps showed a decline in pellet loss following mitigation strategies. In Wyndham one trap showed increased pellet loss while the other two nearby showed a decrease. Mitigation strategies were being implemented following EPA visits.

During the sixteen months of the project an estimated 218,000 pellets and fine waste particles were intercepted and prevented from reaching the natural environment and eventually Port Phillip Bay.



See more detail in Appendix 1 – Analysis of materials collected in stormwater drain traps.

## Data collection

The data collection process for this project was unique. Each of the nine stormwater drain traps installed were emptied and macro items recorded in the Australian Marine Debris Initiative (AMDID) Database. Microplastics were manually removed and their weights recorded using a 40 plastic resin pellet per gram average to quantify the amounts from each trap.

## Industry Engagement

During the life of the project nine [industry pledges](#) and 20 employee pledges were made to join to Operation Clean Sweep®.

The Operation Clean Sweep® manual was downloaded from the website by people in Victoria 55 times during the life of the project in the following stakeholder groups.

*Table 2: Operation Clean Sweep® manual downloads*

Non-Government Organisations	2
Government: Local	3
Government: State	5
Other	9
Plastics Industry: Manufacturer	31
Plastics Industry: Supplier	2
Plastics Industry: Transporter	3
TOTAL Victorian Downloads	55
Additional interstate/international downloads	68
TOTAL Downloads	123

A series of industry engagement videos were also produced for the Operation Clean Sweep® website, including:

- [Operation Clean Sweep® Industry Rating Video](#)  
<https://youtu.be/yIIIE80dyuIE>
- [Nurdle Hunt 2020 video](#)  
<https://www.facebook.com/tangaroa.blue/videos/825987577876199/>
- [Nurdle Hunt 2019 video](#)  
<https://www.facebook.com/tangaroa.blue/videos/252224769012906/>
- [LyondellBasell industry video](#)  
<https://youtu.be/E6cjXq04aCM>
- [AMDID Database recording of plastic resin pellet pollution – How to Video](#)  
[https://youtu.be/\\_LUGaJGTfzk](https://youtu.be/_LUGaJGTfzk)

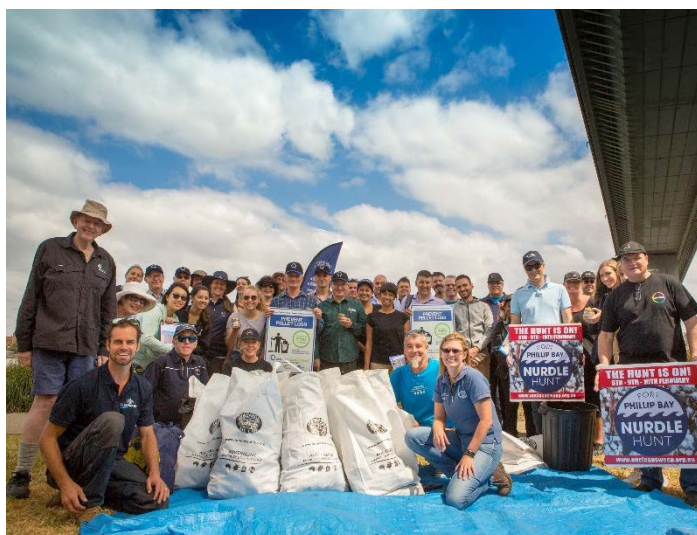




In addition to industry engagement this project involved volunteers, schools and community groups in the data collection and reporting of plastic resin pellet pollution throughout the life of the project. Volunteers assisted in the recording of material trapped by the stormwater drain traps. Material from emptied traps was then bagged and taken to a centralised point where volunteers sorted, counted and weighed collected material, recording results according to the AMDI Database. Citizen scientists were provided with training resources and a support network to enable them to collect and submit data, not only for plastic resin pellets, but for all litter/marine debris items as part of the AMDI Database.

In November 2018-2019 a public facing event called "The Great Port Phillip Bay Nurdle Hunt" was created to engage citizen scientists in reporting plastic resin pellet pollution around the Port Phillip Catchment. Representatives from across the chemistry industry and plastics supply chain also joined to support Operation Clean Sweep's Great Port Phillip Bay Nurdle Hunt, held on February 8<sup>th</sup> 2019.

Employees from LyondellBasell, Qenos, Covestro, BASF, Chemistry Australia, FBT Transwest and Qube pitched in alongside Tangaroa Blue Foundation, Westgate Biodiversity, Victorian EPA, Sustainability Victoria, local students and community volunteers to scour the banks of the Yarra River beneath the Westgate Bridge for plastic resin pellet waste.



The Nurdle Hunt, which ran from February 8<sup>th</sup> – 10<sup>th</sup> and is a global annual event, is a unique environmental initiative that has been especially designed to help map and reduce pollution from plastic resin pellets across the world. During the Port Phillip Bay Nurdle Hunt and river clean-up, the group of 52 recovered over 1,500 nurdles and 52kg of litter from a 100 metre stretch of the Yarra River.

Unfortunately, due to COVID-19 the 2020 Great Port Phillip Bay Nurdle Hunt was cancelled.

## Site Visit Rating Analysis

During inspection visits, sites were rated using the PRP rating tool (Figure 2). Sites or parts of sites were rated 1 to 5 according to the level of pollution observed. Table 4 shows the number of inspections carried out in each council area for periods 1 and 2.



Figure 2: PRP rating tool



A frequency of at least 1 site inspection per period was required to measure improvement at any given site. Table 3 shows the number of sites which were inspected at least once in each period over the life of the project and then breaks this down into:

1. Number of sites where only one inspection occurred in one or both periods
2. Number of sites where two or more inspections occurred in both periods

Table 3: Number of inspections

Council	Number of inspections Period 1	Number of inspections Period 2	Total inspections 2018-2020
Bayside	6	6	12
Brimbank	2	0	2
Darebin	2	0	2
Frankston	80	98	178
Greater Dandenong	28	54	82
Greater Geelong	0	3	3
Hobsons Bay	33	37	70
Hume	13	13	26
Kingston	53	55	108
Knox	0	1	1
Maribyrnong	1	1	2
Melbourne	1	3	4
Moreland	0	1	1
Mornington Peninsula	0	4	4
Port Phillip	8	3	11
Whittlesea	2	2	4
Wyndham	6	8	14
<b>Total</b>	<b>235</b>	<b>289</b>	<b>524</b>



## Improvement in the overall PRP ratings around industrial areas

Table 4 shows the results from all sites having one or more inspections in each period. Approximately one third of sites were assessed as improving. When looking at only facility sites, one third of these sites are assessed as having improved.

*Table 4: All sites with inspections in both periods*

Pathway	Improved	No change	Regressed	Total	% Improved	% No change	% Regressed
Facilities	31	32	31	94	33.0%	34.0%	33.0%
Roads and pits	1	1	0	2	50.0%	50.0%	0.0%
Drains, creeks and wetlands	6	4	1	11	54.5%	36.4%	9.1%
Estuaries	1	2	1	4	25.0%	50.0%	25.0%
Coastal beaches	2	2	1	5	40.0%	40.0%	20.0%
<b>Total</b>	<b>41</b>	<b>41</b>	<b>34</b>	<b>116</b>	<b>35.3%</b>	<b>35.3%</b>	<b>29.3%</b>

Sites of companies signed up to Operation Clean Sweep® where these were eligible for assessment showed 2 improved, 4 no change and 2 regressed. This number of inspected sites was approximately 4% of all eligible inspected sites and not enough to determine any influence on improvement.

Continuation of site inspection and rating activity can provide data to form a guide for governance and industry bodies in their management of pellet loss. Combining the history of site ratings with the rating results can for example provide triggers to actions needed. Table 5 shows one possible model.

*Table 5: Using rating results to trigger intervention actions*

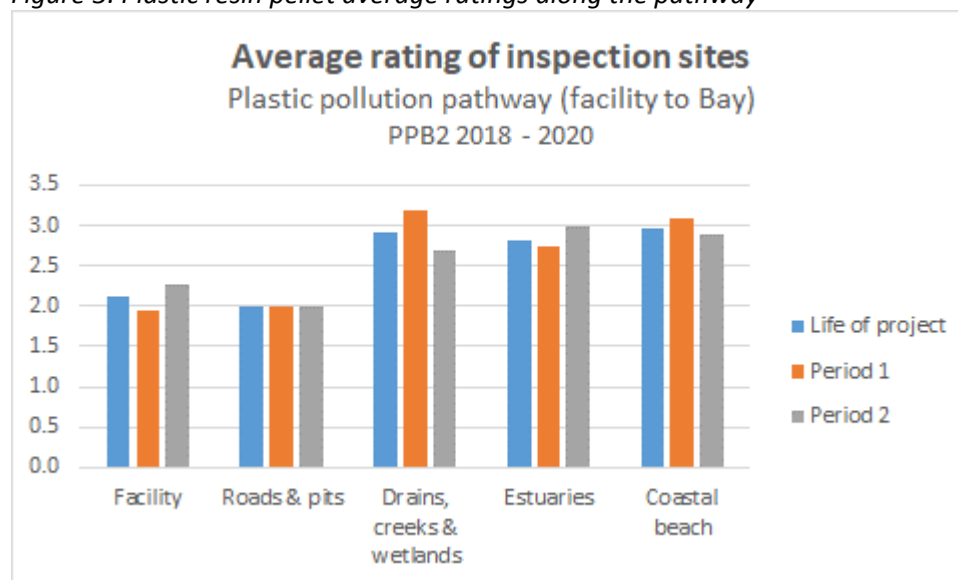
Level	Government	Industry
First in assessment high rating (3-5)	Trigger for regular monitoring and engagement	Trigger for addressing pellet loss
Persistent high ratings no improvement	Compliance intervention trigger	Trigger for addressing pellet loss
High rating improved	Continued monitoring and support	Continue mitigation actions and monitoring
First in assessment low rating (1-2)	No current action needed	Review or begin mitigation actions and monitoring
Low rating no improvement	Low level intervention trigger	Review or begin mitigation actions and monitoring
Low rating improvement	No current action needed	Continue mitigation actions
Minimal or zero loss	No current action needed	Monitor pellet loss, mitigate pellet loss as needed





## Plastic pollution pathway analysis

*Figure 3: Plastic resin pellet average ratings along the pathway*



In Figure 3 all ratings for each pathway sector have been averaged. The graph shows inspections at facilities (which sometimes included adjacent roads and stormwater pits) have a level of pollution of around 1 to 5 pellets every five metres. In the environment sectors of the pathway the level of pollution rises to around 10 to 50 pellets every one metre. Pellet density is lower around facilities involved in plastic industry activities and their immediate surrounds with respect to locations in the natural environment. Once in the natural environment the density of pellets is likely to be affected by the number of upstream point sources releasing pellets, spill events and the nature of water bodies they are deposited in and flow through. Vegetation, lack of water flow and enclosed water bodies will tend to trap and retain pellets. Stormwater outfall locations would be the ideal place to monitor pellet flows into these systems. The estimate of pellet density for facilities and environment sectors is based on the plastic resin pellet pollution rating scale shown in Figure 2 (PRP Rating Tool).

## Discussion

This project provides a collaborative framework and clear actions that all stakeholders can take which will contribute to reducing the loss of plastic resin pellets, and therefore improving the long-term health of the Bay. The rating analysis shows that approximately one third of PRP ratings at facilities have improved. Any change in the rating assessment between the two periods is influenced by variables such as weather and changes in commercial activity at both facility and market scales. Tracking these kinds of changes at the regional scale alongside the rating activities was outside the scope of the project. Whilst an improvement is indicated the effect of the project on that improvement remains difficult to show in data terms but the substantial changes in awareness, activity and commitment to addressing the problem from both industry and governance bodies will have a continuing positive impact on pellet loss provided momentum is sustained into the future.





The project demonstrated in a practical way that a combination of monitoring and source reduction intervention can effect change, evidenced by the uptake by industry of Operation Clean Sweep®, the beginnings of facility level changes aimed at stopping pellet loss and public engagement in the issue. Continuing regular site inspections at facilities is recommended. Ideally this would be carried out by facility owners or managers under Operation Clean Sweep® but the level of engagement would need to be high. There is therefore an ongoing need for government and other bodies to also continue monitoring both at facilities and their surrounds and the associated stormwater outfalls in waterways and wetlands. The latter could be undertaken alongside other water quality monitoring activities.

The strategic installation of stormwater quality improvement devices such as stormwater drain traps are recommended at locations where the incidence of high pellet and microplastic release is known. These are effective in preventing the microplastics from moving into the natural environment and may also be able to serve as a proxy for site inspections where these prove difficult to implement. Finally, efforts to realise a regional or State-wide litter prevention campaign in Victoria have to date achieved limited success. Plastic resin pellet litter could act as the keystone litter item for a coordinated plastic pollution monitoring program across local government and other relevant bodies, with the purpose to receive and analyse data, and advise industry and compliance bodies of the pollution status regarding pellets and other microplastic pollution around the bay.

## Acknowledgements

This project has been possible through a unique collaboration between the NGO, government and industry sectors all aligned on reducing the loss of plastic resin pellet, flake and powder into the environment.

We would like to thank the following partners who have contributed to the success of this project as well as their commitment to work towards the goal of zero pellet loss from the plastics and logistics industries.

BASF Australia	Operation Clean Sweep
Chemistry Australia	Plastic Stewardship Australia
City of Frankston	Qenos
City of Greater Dandenong	Qube Logistics
City of Kingston	Streamline Media
City of Wyndham	Society of Plastics Engineers
Cleanwater Group	Victorian EPA
Covestro	Victorian Government – Port Phillip Bay Fund
Dow Chemical	Westgate Biodiversity
LyondellBasell	

We also send our thanks to all the volunteers who assisted in reporting plastic resin pellet ratings, data collection and promoting the Operation Clean Sweep® program through their networks to assist of a goal of having this program adopted as an industry norm.



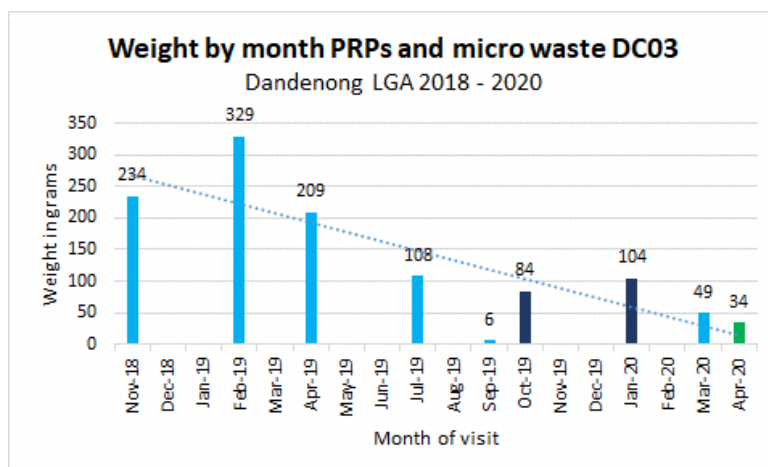
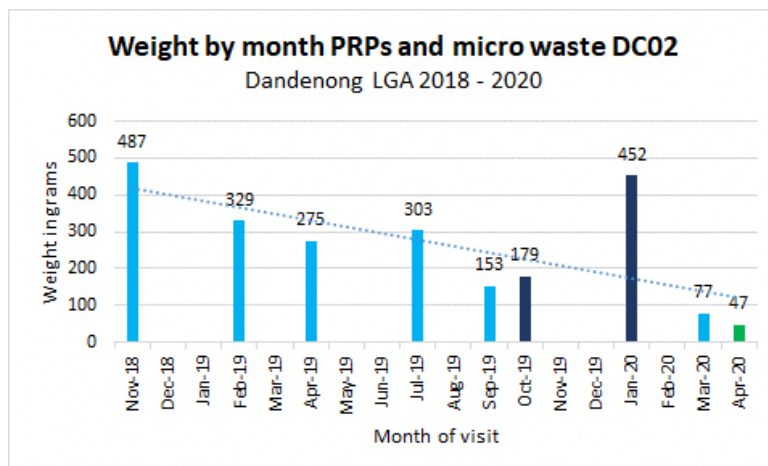
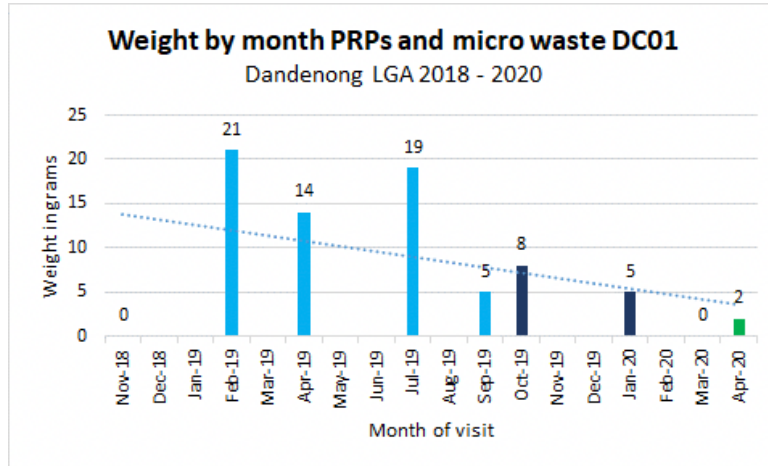
## Appendix 1. Analysis of materials collected in the stormwater drain traps

Three stormwater drain traps capable of retaining plastic resin pellets were installed by the Cleanwater Group in each of the Cities of Greater Dandenong, Kingston and Wyndham. Each trap was installed in an industrial area in close proximity to an operating plastics factory of which previous surveys had shown plastic resin pellet loss occurring. Nine rounds of servicing were completed in the life of the project. Each servicing cycle involved the cleaning of each trap, the contents of which were bagged and tagged. All organic matter and items larger than 5mm were removed. These larger items were counted and documented in the Australian Marine Debris Initiative (AMDI) Database. The microplastics and other items smaller than 5mm were then weighed and compiled in a data report also showing the timings of significant events including changes of production equipment, compliance report submissions and any other significant event. An industry approved average of 40 plastic resin pellets / plastic chips per 1 gram of product was used to estimate the number of microplastics being captured from each trap over the life of the project.

In the following analysis the average number of pellets and fine waste is shown, followed by a graph demonstrating the total pellets and fine waste particles intercepted and prevented from reaching the natural environment.

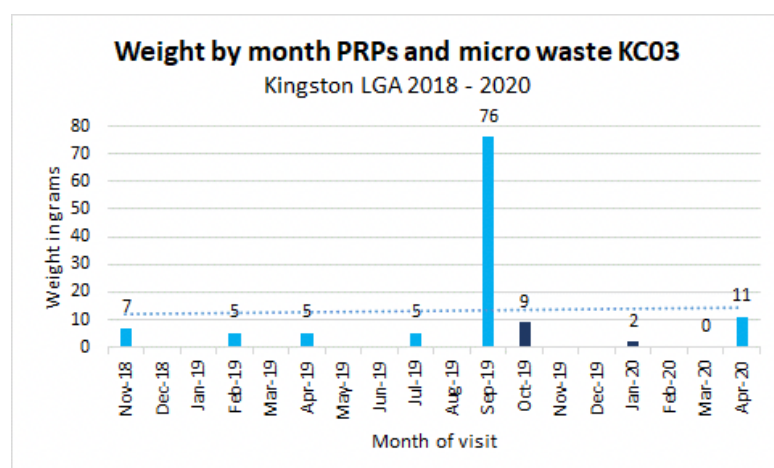
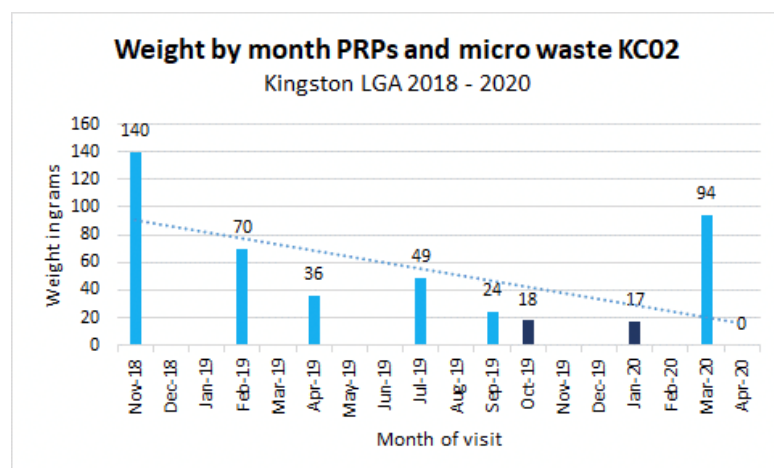
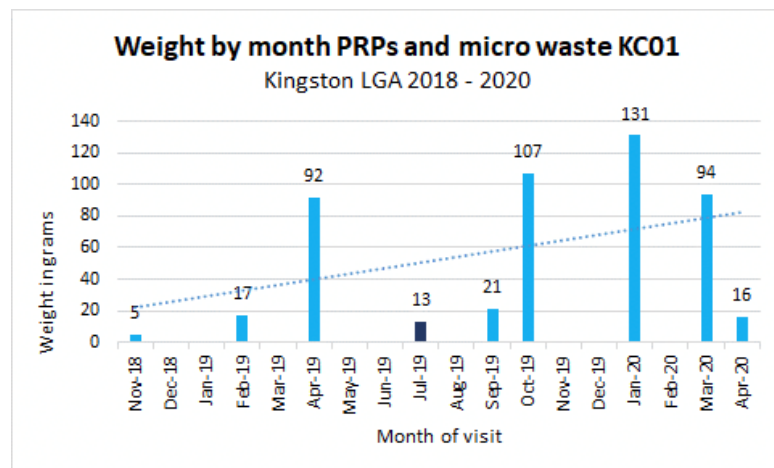


## Dandenong





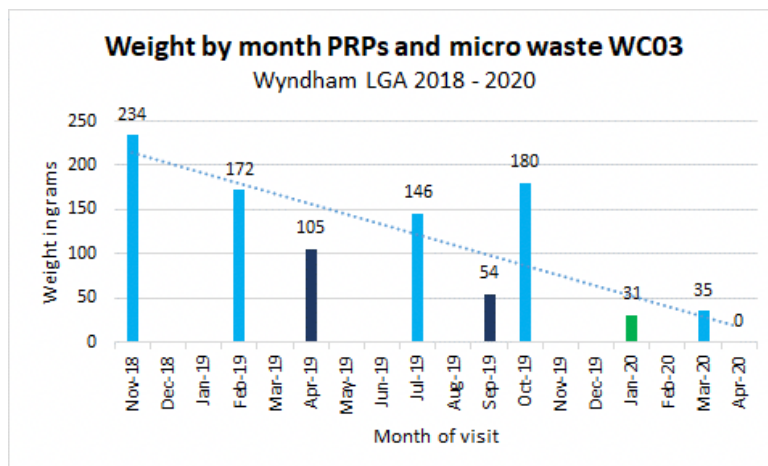
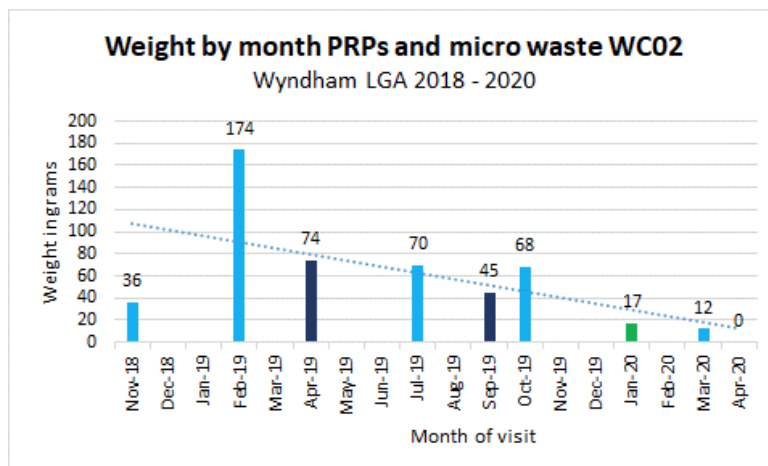
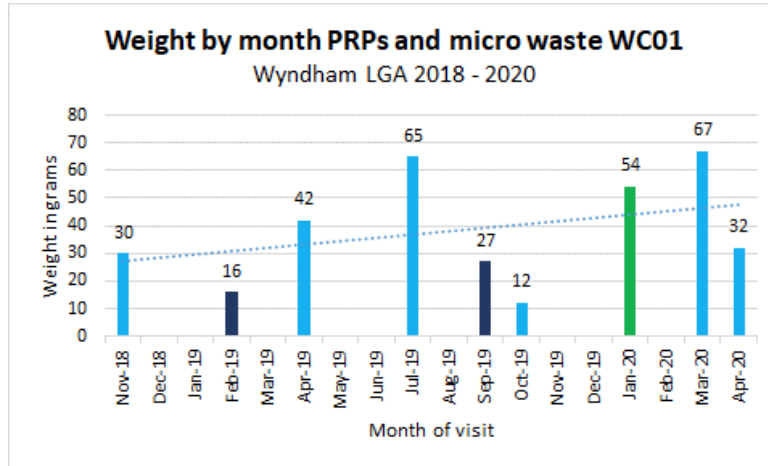
## Kingston





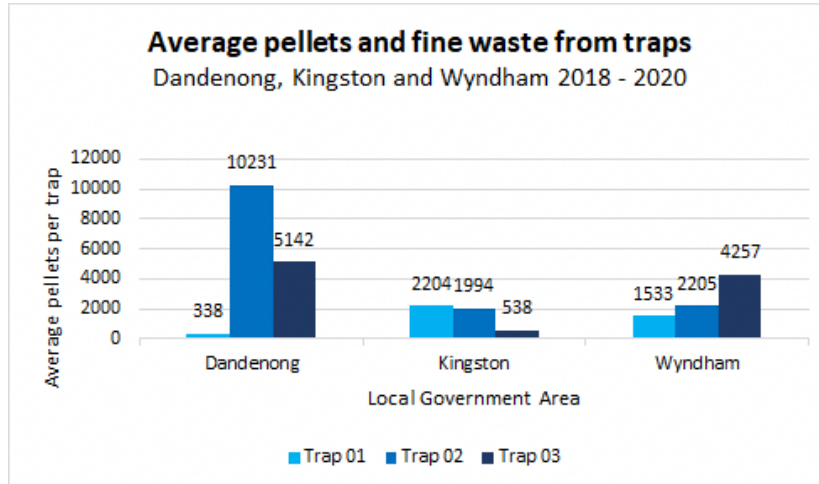


## Wyndham



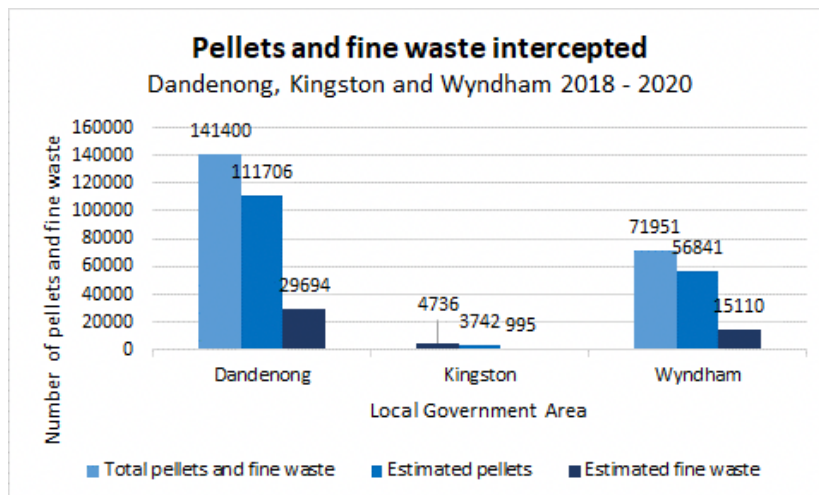


## Amount of material removed



For Dandenong where the traps were in close proximity there was a considerable difference between each trap, and this shows to a lesser extent in Kingston and Wyndham. Installing several traps is therefore a consideration if monitoring is one of the goals. Whilst capture is the main goal, installation could be targeted.

In the final graph below the total number of pellets and fine waste intercepted during the project is further broken down into the estimated pellets and estimated fine waste.





## Get Involved

### Operation Clean Sweep®

The goal of Operation Clean Sweep® is to help every plastic resin handling operation implement good housekeeping and pellet containment practices to work towards achieving zero pellet loss. These efforts can also help improve relations with stakeholder groups and community organisations that expect the industry to minimise its environmental footprint.

To learn more about Operation Clean Sweep® visit the website at <http://www.opcleansweep.org.au/>

If you are already following the Operation Clean Sweep® principles, or plan to, then take the Pledge and be recognised for your commitment at [Operation Clean Sweep pledge](#).

To conduct your own Operation Clean Sweep® audit, check out our videos

- [How to conduct an Operation Clean Sweep audit at your workplace](#)  
<https://youtu.be/yIIE80dyuIE>
- [How to use the AMDI Database – Plastic Resin Pellets](#)  
[https://youtu.be/\\_LUGaJGTfzk](https://youtu.be/_LUGaJGTfzk)

### Tangaroa Blue Foundation

Tangaroa Blue Foundation is an Australia-wide not-for-profit organisation dedicated to the removal and prevention of marine debris.

To successfully solve the problem, we created the Australian Marine Debris Initiative (AMDI), an on-ground network of volunteers, communities and organisations that contribute data to the AMDI Database, and then work on solutions to stop the flow of litter at the source. The AMDI helps communities look after their coastal environment by providing resources and support programs and collaborates with industry and government to create change on a large scale.

You can [get involved](#) with the Tangaroa Blue Foundation by

- Participating in one of our beach or river clean-ups
- Organising your own beach or river clean-up
- Contributing to our administration
- Donating
- Adopting a more sustainable Lifestyle

To learn more, visit our website <https://www.tangaroablue.org>



# Fact sheet: Managing plastic resin pellets (nurdles)



Environment  
Protection  
Authority Victoria

Publication 1701 June 2018

Fact sheet

## What is the issue?

Plastic resin pellets (also known as nurdles) are small plastic pellets used in the manufacture of plastic products. These pellets have the potential to:

- easily enter freshwater and marine environments
- attract chemical pollutants to their surfaces
- be eaten by aquatic and marine animals who can become sick or die
- enter the food chain and impact human health.

Spills and mishandling by industry is the key source of pellets entering the stormwater system, waterways, and eventually, the ocean.

## What are industry's obligations?

If you are a business that produces, transports or uses plastic resin pellets you need to:

- keep them contained and under control
- keep them away from water and wind
- keep them away from stormwater drains.

If you don't control your pellets, you may be committing an offence of illegal dumping of industrial waste or creating an environmental hazard.

Discarded, rejected, unwanted, surplus or abandoned matter (such as plastic pellets) is defined as waste under the *Environment Protection Act 1970* and must be managed appropriately.

Pellets that are not properly managed and are discharged into the environment (for example waterways), can form the basis of such an offence. Any person that fails to contain their pellets faces a fine of more than \$7,500, or up to \$777,300 if prosecuted. Businesses involved in the production, transport, storage, handling, use or disposal of pellets may be liable to enforcement action if they fail to manage the risk of pellets escaping.

## What can be done about managing plastic resin pellets?

The release of pellets into the environment can be prevented by applying good industry management practices and risk controls in areas such as:

- transport, packaging, transfer and handling
- recycling and disposal.

And applying measures such as:

- training and process/site audits
- equipment maintenance
- spill capture, response and management.

## Further information

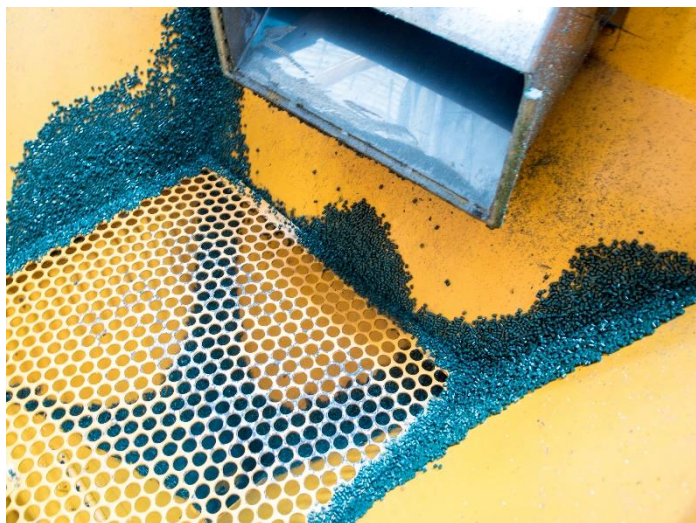
Contact EPA on  
**1300 372 842**  
(1300 EPA VIC)  
or [epa.vic.gov.au](http://epa.vic.gov.au)

Assessing and controlling risk:  
[epa.vic.gov.au/our-work/publications/publication/2018/may/1695](http://epa.vic.gov.au/our-work/publications/publication/2018/may/1695)

EPA thanks Tangaroa Blue Foundation for its support and supplying images



# Fact sheet: Managing plastic resin pellets (nurdles)



Wide mouth hopper funnel to prevent pellet loss

To avoid inappropriate discharge of pellets to the environment, businesses can follow the steps below:

## Step 1: Understand risk

If you are unsure of what risk, is or how to deal with it, see the business guide [Assessing and controlling risk: A guide for business](#) (EPA publication 1695).

## Step 2: Assess risk

Assess the operational processes within your business where environmental risk arises, including:

- ensure pellets are not released (or have the potential to be released) to the environment
- consider the pellet supply chain for points where control may be lost
- review site boundaries and exit routes where pellets may be escaping, such as slopes, concourses and unprotected drains
- check the awareness your staff have on the issues of pellet management
- speak to suppliers about the arrangements for receiving pellet deliveries
- consider other environmental hazards (for example, products or chemicals) within the operation.



Drain mesh guard

## Step 3: Control risk

Investigate and implement controls that are appropriate to the risks identified in Step 2:

- implement good house-keeping procedures
- provide training to your staff, and inductions to contractors on appropriate handling of pellets onsite
- install risk control measures to limit the loss of plastic pellets, like:
  - catch trays, bunded areas and wide mouth receivers for preventing and containing spills
  - portable vacuums and cleaning equipment
  - drain mesh guards, baffles, booms and skimmers for rainfall events
- consider relevant industry information on available risk controls:
  - Operation Clean Sweep® Australia provides a valuable and detailed guide on managing issues with plastic pellets. It is recommended that businesses operating with pellets include its recommendations in site environmental management plans.  
[www.opcleansweep.org.au](http://www.opcleansweep.org.au)
- consider that by controlling the risk for pellets, you do not increase other environmental risks in your operation:
  - this may include how you manage other solids or liquids onsite
  - consider a balanced approach to multiple risks
  - if a risk control for pellets might result in a significant increase in another risk, look for the best overall outcome
  - if you are unsure about how to go about this, you should seek advice from a suitably qualified professional.

## Management benefits

By ensuring that plastic resin pellets are managed appropriately, industry will:

- save costs
- reduce your impacts on human health and the environment
- meet the expectations of the community
- avoid fines and prosecution.