

# Stormwater Education Program and Pollution Assessment of Diamond Creek

2020

Reducing stormwater pollution





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**Reducing stormwater pollution**

**Final Report to**

**Nillumbik Shire Council  
29/01/2020**

Supported by





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Citation: Sharley, D.J., and Marshall, S.E. (2020). Stormwater Education Program and Pollution Assessment of Diamond Creek. Report to Nillumbik Shire Council, Bio2Lab Pty Ltd, Melbourne

## Scope of this Report

This report provides the Nillumbik Shire Council with results of a stormwater education program targeting business owners in Eltham and a pollution assessment of Diamond Creek above and below its confluence with the Karingal Yallock Drain.

Revision	Data issued	Reviewed by	Approved by	Revision type
1	08/01/2020	David Sharley	Steve Marshall	Internal
2	24/01/2020	Danielle Phyland		External
3	28/01/2020	Steve Marshall	David Sharley	Internal

## Acknowledgements

We would like to thank Nillumbik Shire Council for proving funding towards this project and especially Danielle Phyland who has been a local champion for the improvement of the health of Diamond Creek, and for increasing awareness about stormwater pollution in the local area. Lastly, we would like to thank the local business owners who participated in our education program and for the support they provided throughout the process.

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## Executive summary

A major challenge facing cities globally is how to manage stormwater. Stormwater pollution is one of Australia's great environmental challenges. With the expansion of urban landscapes, maintaining the ecological condition of waterways becomes increasingly difficult. Trace metals, pesticides, hydrocarbons and other pollutants all enter aquatic environments via stormwater runoff, and accumulate within local waterways and wetlands, leading to significant adverse impacts on the health and amenity of aquatic ecosystems. Protecting local waterways from toxicants such as these is critical in maintaining a healthy environment. Diamond Creek is home to a diverse biological community of fish, vertebrates, invertebrates and birds, and is a critical connection between the Yarra and the King Lake National Park at the top of the catchment.

The aims of this project were to:

- Carry out a pollution assessment of Diamond Creek by assessing sediment quality both upstream and downstream of the main outfall from the Bridge Rd industrial area in Eltham, both before and after the education program.
- Deliver a Stormwater Education and Awareness campaign to business owners in between the sediment sampling events

Results from the program indicate the stormwater education and awareness program likely had a significant impact on reducing levels of pollution being discharged from Karingal Yalloc Drain - the main stormwater drain connecting the industrial area with Diamond Creek.

In general, the discussions we had with business owners and managers in the Bridge Rd industrial estate through the door-door campaign and the Smoko and Stormwater event was very positive, with only a minority of businesses not interested in engaging with us. The results from the sediment monitoring program indicate that the education and awareness program may have had a positive impact on reducing stormwater pollution, improving the health of Diamond Creek. In our experience, education programs can have strong short- to mid-term benefits, with followup programs strongly recommended to reinforce the positive results from this program. Annual education and awareness programs are recommended over the next 2-3 years, with biennial programs recommended going forward.

The results of the program are extremely positive from an ecological perspective. The reductions in sediment pollution in Diamond Creek below Karingal Yalloc drain is likely to result in a short-term boost to local macroinvertebrate populations in the creek, leading to more food for other wildlife such as fish, birds and platypus, which if the low levels of pollution are maintained should result in population boosts to these important groups in the longer term. The next step is to ensure these reductions in pollution are maintained and further reduced through ongoing education and awareness programs and increased engagement with local business owners.

## Introduction

Presently, over 50% of the world's populations live within cities, with significant increases expected over the next 50 years. Thus, it is critical that improvements to social, economic and environmental sustainability of cities worldwide are included in future planning. Many chemical, physical and biological features of aquatic ecosystems are altered by changes in land use and human activities associated with urban living. Increases in urban populations intensify demand on aquatic ecosystems services, such as waste disposal and denitrification, affecting ecological, recreational and social values.

A major challenge facing cities globally is how to manage stormwater. Stormwater pollution is one of Australia's great environmental challenges. With the expansion of urban landscapes, maintaining the ecological condition of waterways becomes increasingly difficult: degradation of aquatic ecosystems can be caused by both changed hydrology due to runoff from impervious surfaces, and by toxicity due to stormwater pollution. Trace metals, pesticides, hydrocarbons and other pollutants all enter aquatic environments via stormwater runoff, and accumulate within local waterways and wetlands, leading to significant adverse impacts on the health and amenity of aquatic ecosystems.

Diamond Creek is a tributary of the Yarra River that starts near the southern edge of the Kinglake Plateau and flows through the King Lake National Park into the Yarra, passing St Andrews, Hurstbridge, Diamond Creek and Eltham. The catchment is generally considered rural and it includes several tributaries including Running Creek and Arthurs Creek, as well as many smaller tributaries such as Watery Gully Creek. Grazing and horticulture are the main land-uses within the catchment, although urban expansion continues to occur downstream of Hurstbridge in areas such as Diamond Creek and Eltham.

### Environmental Values of Diamond Creek

Diamond Creek is home to a diverse biological community of fish, vertebrates, invertebrates and birds. It is a critical connection between the Yarra and the King Lake National Park at the top of the catchment. Around ten native fish species have been recorded in the Diamond Creek catchment. Diamond Creek is an important waterway for the endangered Macquarie Perch and other priority fish species such as the river blackfish, common galaxias and spotted galaxias. Threatened vertebrates such as the fishing bat (*Myotis macropus*) and the broad-shelled tortoise (*Chelodina expansa*) have been recorded in the catchment, as have iconic species such as the Platypus and the Water Rat. These animals rely directly on a healthy aquatic ecosystem for their survival. In addition, twelve frog species have been recorded, including the endangered and vulnerable Bibron's toadlet, growling grass frog and southern toadlet. Diverse and abundant macroinvertebrate (water insects) populations are found in the upper catchment, with populations becoming less diverse and abundant in the lower reaches. These aquatic invertebrates depend on clean water for their survival, and are an important food source for animals higher in the food chain (eg. platypus, fishing bat).

## Chemical pollution

Chemical pollution occurs in many forms, but is often invisible. With the exception of oils - which often occur as slicks on the surface of the water or on river banks after a large pollution event - most other pollutants remain out of sight, and will only become apparent when they are in high enough concentrations to cause acute fish or platypus kills. Many everyday activities produce chemical pollution: driving cars increases exhaust fumes and tyre and brake wear causes copper, zinc and oil pollution, garden pest control contributes to pesticide pollution, while manufacturing processes can generate vast amounts of heavy metal waste. If not contained appropriately, the majority of this waste will be transported to local waterways and wetlands in stormwater, where they may accumulate to harmful levels.

## Stormwater management

Often, stormwater strategies are developed with the sole focus on 'how to manage stormwater pollutants more effectively', rather than 'how to reduce the generation of pollutants in the first place'. For instance, Water Sensitive Urban Design (WSUD) forms the basis of most stormwater strategies across Australia. There are many benefits of incorporating WSUD into urban landscapes, including enhanced aesthetics, reduced erosion from peak flows, reductions in nutrients reaching the bay and enhanced natural environments that the community can enjoy. Yet, toxicant levels in Melbourne's major waterways continue to increase (Sharp et al 2017). And, while State Environment Protection Policies prohibit the pollution of stormwater, pollution reduction targets for heavy metals, hydrocarbons and pesticides are presently not directly mandated. Currently, stormwater best practice needs to meet performance objectives only for suspended solids, total phosphorus, total nitrogen, litter and flows. Current approaches to dealing with stormwater pollution have been far from effective at reducing stormwater pollution from reaching waterways across Melbourne, and just treating pollution at the end of pipe is not a sustainable option for many local governments.

## Stormwater Education and Awareness

In the past, numerous methods have been trialled to engage small, medium and large enterprises and encourage them in their role as responsible businesses to keep pollutants out of stormwater. These programs traditionally emphasize engagement with local businesses, and consist of voluntary activities such as letter box drops, stormwater educational material, posters and offers of free business audits. However, we suggest coupling environmental data with education and awareness activities to provide context as to why it is important to reduce the amount of waste going down stormwater pipes and into local waterways.



# Aims

This project aims to:

- Conduct a sediment quality assessment of Diamond Creek both upstream and downstream of the main outfall from the Bridge Rd industrial area in Eltham, both before and after the education program.
- Deliver an Education and Awareness campaign to business owners
- Make recommendations on future programs

## Methods

### Sediment Quality Assessment

As a medium - or long-term evaluation tool, sediment quality monitoring can provide a cost-effective strategy for assessing catchments that are under pressure from urbanisation, diffuse and point source pollution and alteration to aquatic ecosystems. Sediments are major sinks for hydrophobic toxicants such as heavy metals, hydrocarbons, pesticides and other organic chemicals that deposit and attach to sediments particles. For the first time, the recently amended [State Environmental Protection Policy](#) for Waters of Victoria (SEPP WoV) includes environmental quality objectives for aquatic sediments, which were not included in previous versions of the policy. Briefly, it is recommended that if pollutant concentrations exceed default guideline values, the risk to the local aquatic environment should be investigated further by the appropriate authorities. Pollutants exceeding the high guideline are more likely to cause toxicity to benthic fauna such as insect larvae, crustaceans, worms and snails. As sediments become more toxic, fewer species can survive, potentially affecting populations of platypus, fish, birds, frogs and turtles which depend on these animals for food. Persistent pollutants such as heavy metals can also accumulate in aquatic food webs, leading to long term impacts on wildlife.

Sediment was collected from the Diamond Creek on the 7th July 2019 and on 3rd December 2019. Sites were located upstream and downstream of Karingal Yalloc Drain, the main conduit for pollutants originating from the Bridge Rd industrial area (Figure 1). Standard assessment methods developed for long-term monitoring of waterways was used to collect the sediment (see Sharley et al 2016). Briefly, the upper 2 cm surface layer of sediment was collected using a shallow scoop from multiple locations at each site and composited to form one sample for analysis. All samples were transferred into cleaned glass jars and stored at 4 C and transported to the laboratory on ice for analysis. Chemical analyses was carried out by a NATA accredited consulting laboratory. Concentrations of Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc and Total Petroleum Hydrocarbons (C10-C36) were determined using standard methods.

## Business Education and Awareness Campaign

Through systematic door-to-door visits, 61 active businesses were visited over a 2-day period between the 23 - 26th August 2019. This excludes all unoccupied sites or businesses that were closed at the time of the visit. All businesses were treated equally with no prior assumptions made. All businesses were asked the same questions no matter the type of business visited. Both observations and survey answers were collected at each site. Where appropriate, photos were taken at the site. Data was collected and stored through a mobile data collection platform and custom form builder. On August 30th, a free education session (Smoko and Stormwater) was held outside Prossiutto Brothers with the aim of bringing the local business owners together to chat about stormwater while enjoying a free coffee and morning tea. Representatives from Bio2lab, Council and local community groups were in attendance to provide advice and information regarding stormwater management.

### Education and Awareness target area and sediment sampling sites

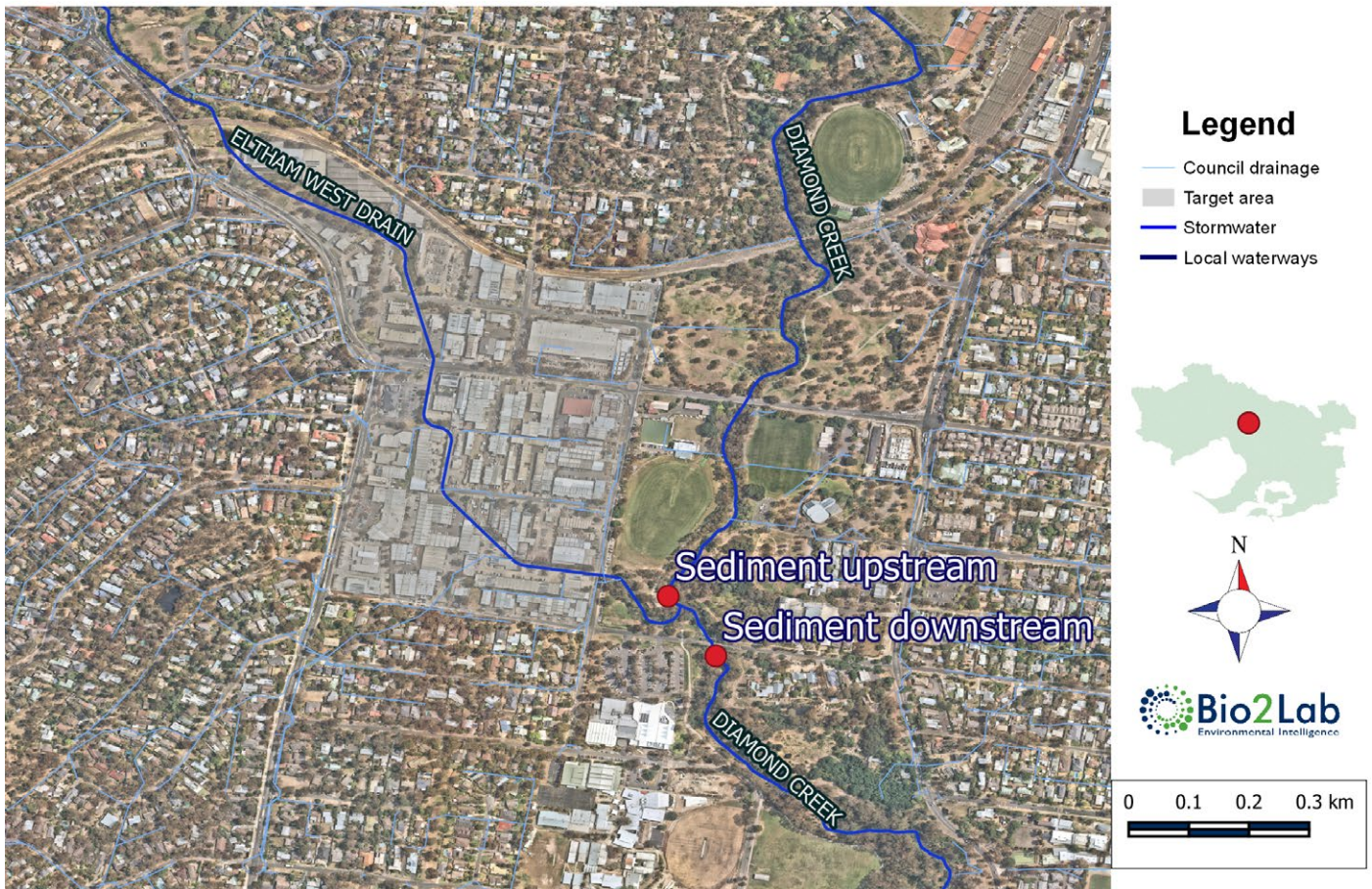


Figure 1 Sediment sampling sites and target area for the education and awareness program



# Results

## Sediment Quality Assessment

Sediment was collected from Diamond Creek both before and after the business education program. The time between sampling was approximately 6 months to allow time for businesses to either adjust their business practices or initiate stormwater management on their property to reduce pollutants entering stormwater drains. On both occasions, sediment was collected upstream and downstream of Karingal Yalloc drain. As the Karingal Yalloc drain is the primary conduit for pollutants entering Diamond Creek from the industrial area, this approach enabled us to directly assess the impact of the industrial area on pollution levels in Diamond Creek.

It was clear from the results that in general sediment quality in Diamond Creek was poor prior to the business education and awareness program, with Total Petroleum Hydrocarbons (Oils) and Zinc exceeding National Ecological Guidelines for sediment downstream of Karingal Yalloc Drain. However, results from the second round of sediment sampling in December showed large reductions in zinc, copper and oil concentrations in the sediment downstream of Karingal Yalloc Drain compared to the first round, despite seasonal fluctuations. While, concentrations of pollutants in sediment collected upstream of the drain remained fairly constant between sampling events, with slight increases in some pollutants such lead, chromium and nickel in round 2 (Figure 2).

These results suggest that the business education and awareness program likely contributed to the reduction in pollutants entering Diamond Creek via Karingal Yalloc Drain. It is likely that the door-door education and awareness campaign and the pop-up education session held on August 30th did have a positive impact on stormwater management practices in the area. The response the local business owners to the stormwater education campaign was in general very positive. See the results of the door-door education campaign.



**Sediment quality in Diamond Creek** ——— Upstream and downstream of Karingal Yalloc industrial Drain

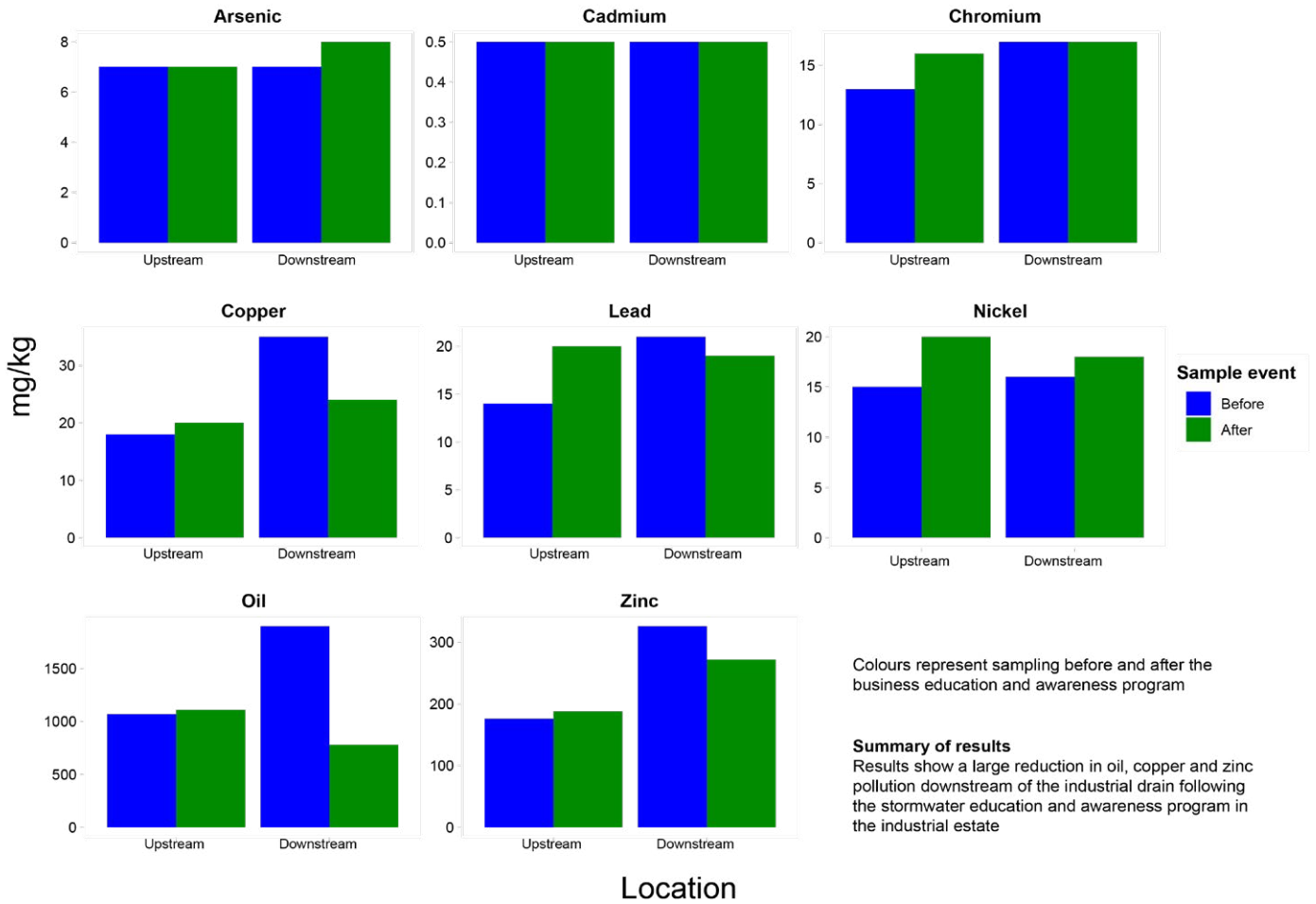


Figure 2 Sediment quality monitoring results from Diamond Creek upstream and downstream of Karingal Yallock Drain. Blue bars represent sampling from before the education and awareness program and green bars represent sampling 6 months after the education program.



## Business Education and Awareness Campaign

To better understand how much local business owners knew about stormwater management, the team at Bio2lab conducted a systematic door-to-door education and awareness campaign visiting 61 active over a 2-day period between the 23 - 26th August 2019. Of the 61 active businesses visited, 32 were considered high risk of polluting stormwater due to their business activity. The main industry types that fitted this category were smash repairers, mechanics, metal fabricators and other industrial businesses. Eleven businesses of the 61 were considered every low risk due to their business activity. Businesses in this category included homeware retailers, florists and other retail shops.

### Observations

Before entering each premise, general observations and photos where applicable were recorded. Observations included whether the premise looked clean, or had any obvious signs of pollution. Results show that in general, most of the premises looked clean or had no visible signs of pollution (Figure 3).

### Survey questions

As part of the survey a number of Yes/No questions were asked of all business owners or managers. Results are provided in Figure 3). The majority of business owners were willing to participate in the five-minute survey, with only 19 managers declining the opportunity. Reasons included, not enough time and lack of caring. One of the first questions asked was “do you know what happens to stormwater after it rains”? Most participants thought correctly that stormwater went to the creek and into the Bay. Some believed it went to sewer, while 8 participants did not know where it went. When asked whether they were aware about stormwater management, most of the participants (86%) had never heard of stormwater management and were unaware that there was such a thing. While this was somewhat surprising, in our experience, stormwater

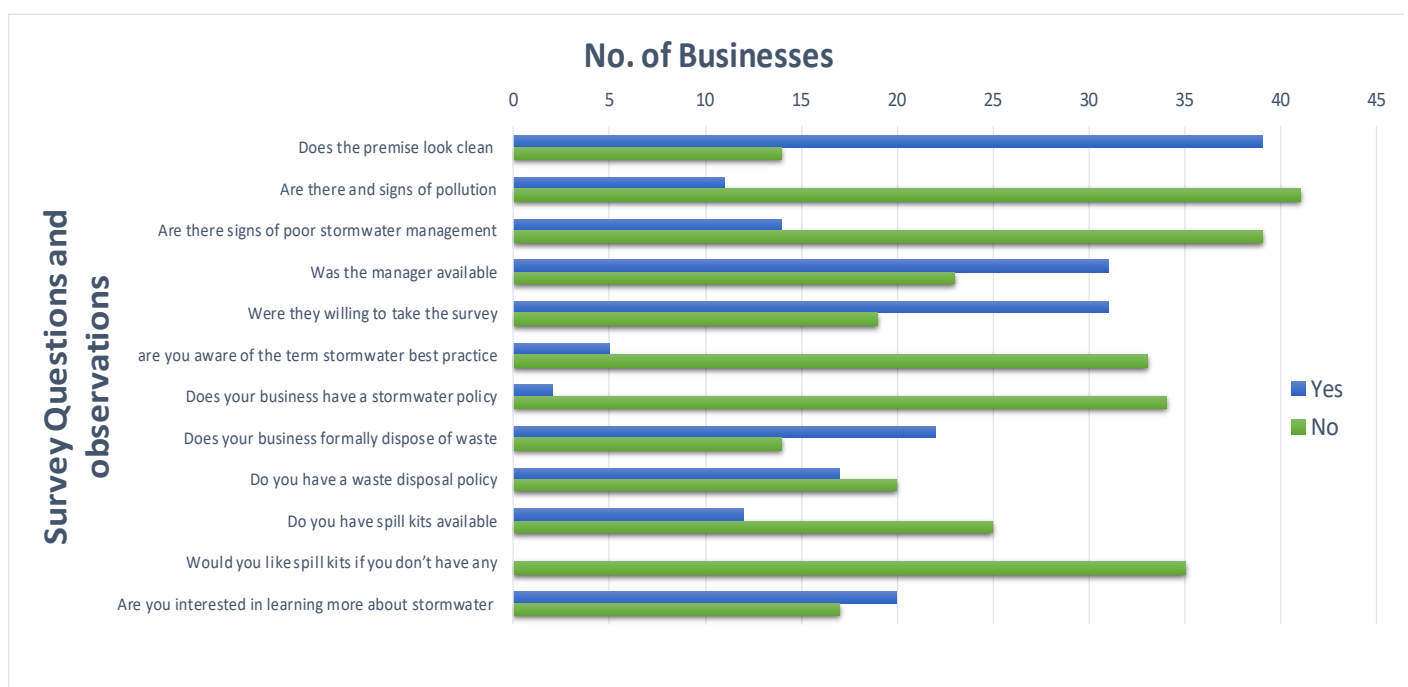


Figure 3 Observational and questionnaire results for the door-door education and awareness campaign

management policies are primarily adopted by bigger companies with formal environmental management plans. Similarly, 94% of businesses did not have formal stormwater policies that they follow, which again is not surprising given the size of the businesses surveyed. One of the biggest issues we have come across in our 10 years of working with businesses on stormwater management is the disposal of waste products. Disposal of chemical waste to stormwater is a major issue facing councils and waterway managers. Simply tipping old sump oils, radiator fluid waste etc down stormwater drains is often a simple solution to what is now an expensive and often time consuming process to formally engage a professional to collect and properly dispose of waste products. While 61% of business indicated that they did dispose of waste products, only 51% of businesses had a formal policy that they followed when disposing of waste. Waste products included, oils, coolants, acids, plastics, steel shavings, thinners, adhesives and paints. Often one of the simplest solutions to protecting stormwater from liquid pollution is the availability of spill kits to clean up spills. Surprisingly, 67% of high risk businesses did not have spill kits on their premise that could be used to clean up liquid spills. Of those businesses that did not have spill kits, none of them indicated they were interested in acquiring kits in the future. This was somewhat surprising given the cost to business would be negligible and are easy to find. Our final question was whether they were interested in learning more about stormwater management. 45% of participants said they were not interested in knowing more, while 55% thought it would be a good idea to know more about how to manage stormwater more effectively.

## **Smoko and Stormwater**

The response from local business owners to the 'Smoko and Stormwater' session was positive. Around 25 local business owners attended the session over the 1-1.5 hours. One of the best aspects of the session was being able to informally chat with business owners on their terms. Having representatives from council and community groups in attendance was also seen as a positive, with many conversations conducted. In our experience, face to face engagement with business owners is usually much more effective in eliciting honest responses about the issues important to them.

One issue raised by many business owners was the potential impact on litter loads of school students dropping fast-food wrappers and plastic bottles. There are several fast-food outlets along Bridge St, and Eltham High School is on the other side of the industrial area, leading to a steady traffic of students through the area, who are seen as a source of litter. Litter education programs tailored at local primary and high school students would be worth considering. We recently completed an environmental education program at a local primary school in Eltham, teaching students about the value of local waterways and the pressures on them. One week into the program, we saw students of their own volition collect over 9 rubbish bags of litter from around Diamond Creek, an excellent example of how targeted education at an early age can influence behaviours and attitudes towards local environmental issues.

Another issue raised repeatedly was the potential for flooding due to inadequate drainage from the large area of concrete car-parking around business on the south of Bolton St (254-294 Bolton St in particular). On inspection, we noted the side entry pits draining the car parking area were few in number, and designed in such a way as to be very easily blocked with litter. A review of the

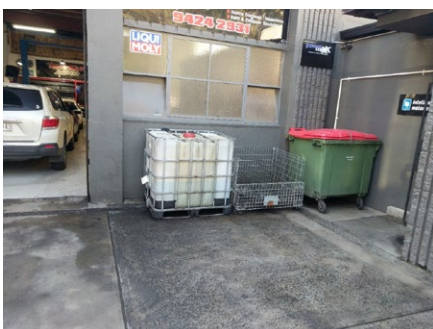
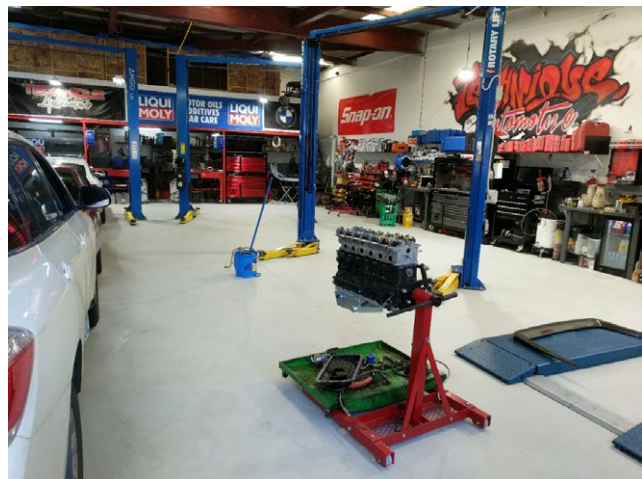
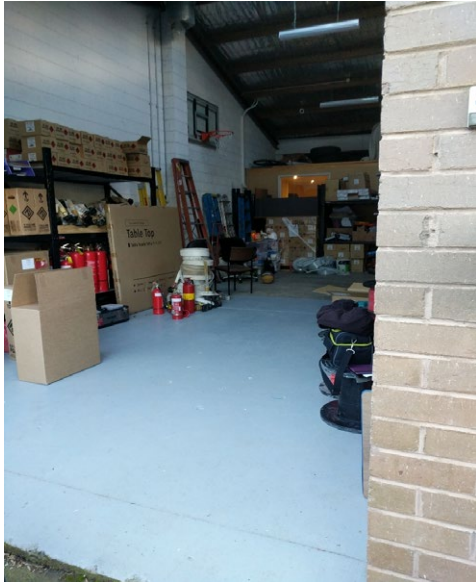
drainage infrastructure in this area is recommended.

## Summary

In general, the discussions we had with business owners and managers in the Bridge Rd industrial estate through the door-door campaign and the Smoko and Stormwater event was very positive, with only a minority of businesses not interested in engaging with us. The results from the sediment monitoring program indicate that the education and awareness program may have had a positive impact on reducing stormwater pollution, improving the health of Diamond Creek. In our experience, education programs can have strong short- to mid-term benefits, with followup programs strongly recommended to reinforce the positive results from this program. Annual education and awareness programs are recommended over the next 2-3 years, with biennial programs recommended going forwards.

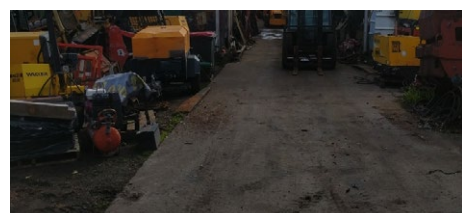
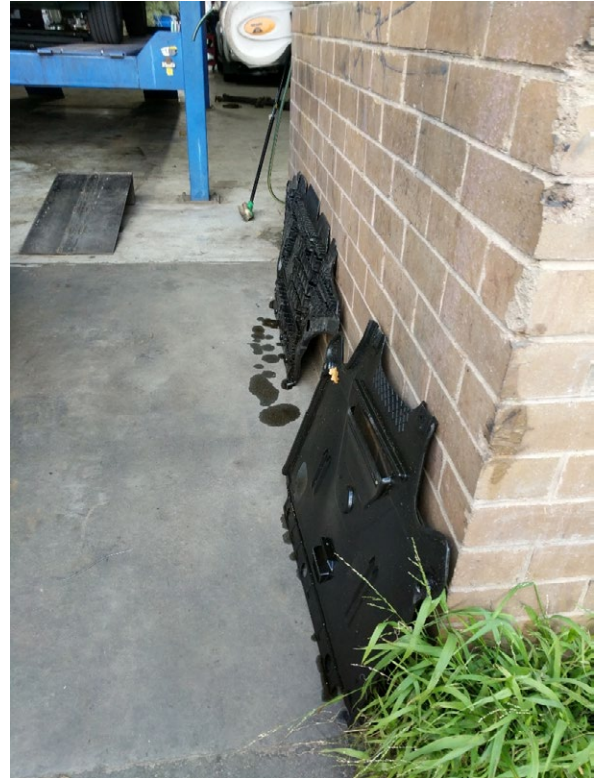
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# Examples of good business and stormwater management practices





## Examples of business practices that can lead to stormwater pollution





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