Enhancing Our Dandenong Creek:
Monitoring and reducing pollution

July 2020

VICTORIA State Government

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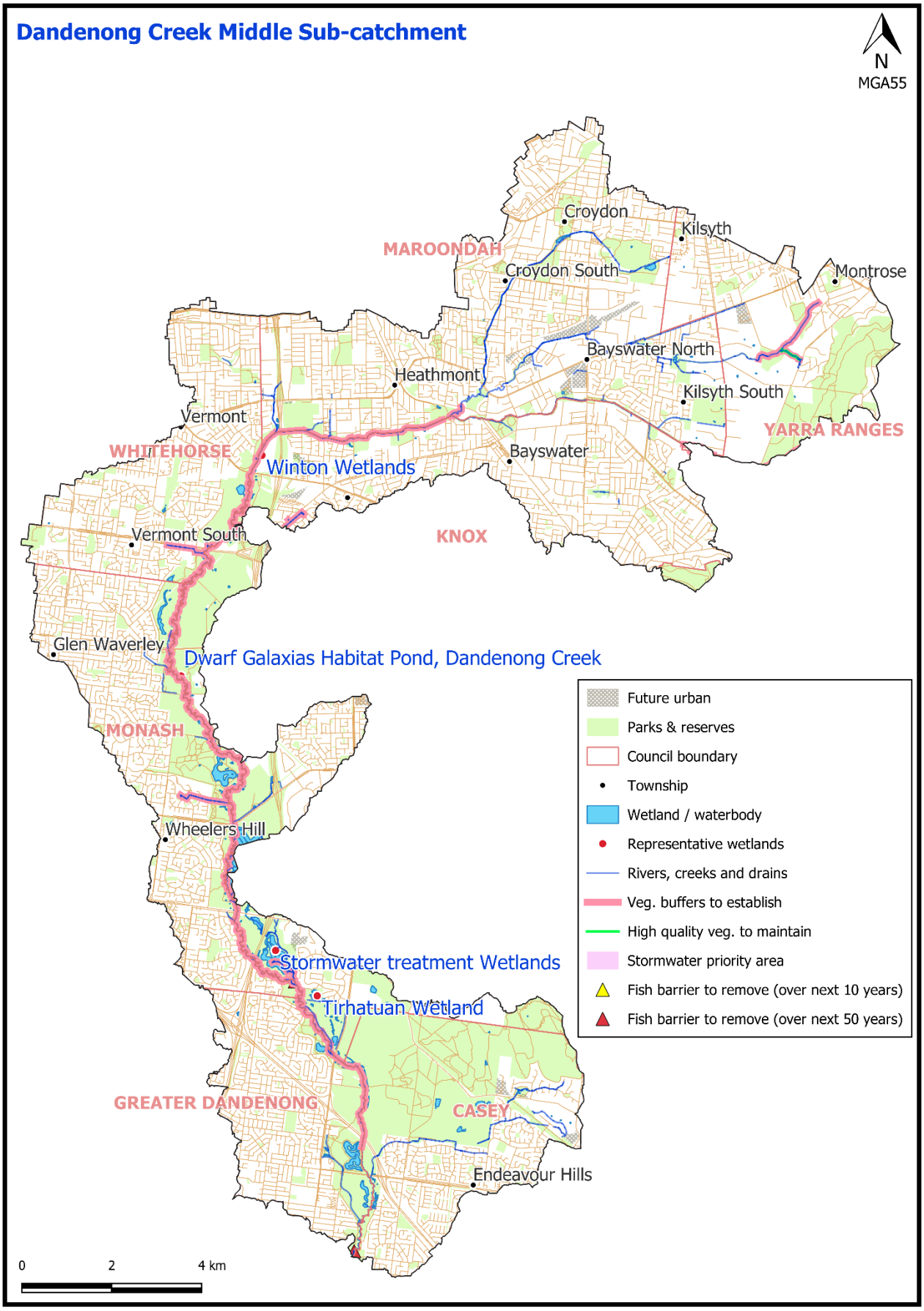
Melbourne Water
Enhancing Life and Liveability

Acknowledgement of Traditional Owners

Melbourne Water respectfully acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Owners and custodians of the land and water on which all Australians rely. We pay our respects to Wurundjeri and Bunurong, their Elders past, present and emerging, as Traditional Owners and custodians of the land and water on which Enhancing Our Dandenong Creek relies.

We acknowledge and respect the continued cultural, social and spiritual connections that all Aboriginal Victorians, and the broader Aboriginal and Torres Strait Islander community have with lands and waters, and recognise and value their inherent responsibility to care for and protect them for thousands of generations.

In the spirit of reconciliation, Melbourne Water remains committed to working in partnership with Traditional Owners to ensure meaningful ongoing contribution to the future of land and water management.



Source: Melbourne Water. 31/05/2018

About Enhancing Our Dandenong Creek

Enhancing Our Dandenong Creek (EODC) is an on-going collaborative project that is bringing the creek back to life. While its initial focus was sewerage management, it has since evolved into a broader environmental management program that is taking a multi-pronged and multi-stakeholder approach to improving the creek's health, its flora and fauna and natural amenity.

Working in partnership with Traditional Owners, government agencies, water utilities, scientists and researchers, and local councils and community groups, EODC has now entered phase 2 of the project. The first five-year pilot (phase 1) focused on improving natural amenity, uncontrolled sewage spills, reintroducing the threatened dwarf galaxias fish species, and preventing pollution from industrialised areas. Phase 2 is building on the success of phase 1 and focusing on improving biodiversity and reducing pollution.

Community engagement, participation and empowerment has been an important component to the success of the project. During phase 1, a natural amenity working group, a deliberative panel and an online consultation campaign enabled the community to not only voice its concerns, but to also share important local knowledge and expertise about the creek and its environment and what the community saw as priority areas for the creek. This vital input has helped shape both phases of the EODC project and shown how the best outcomes for waterways and communities can be achieved more efficiently through innovation and collaboration.

Why are we monitoring pollution?

Dandenong Creek is a highly urbanised waterway. Over time, several modifications have led to a decline in its ecological health. These include piping sections of the creek and modifying flows, urban stormwater and wastewater discharges, barriers to migration of aquatic life and a lack of streamside vegetation. Additionally, pollutants in the creek and surrounding environment continue to be a source of contamination and impairment for the creek's flora and fauna.

After learning that some wet weather sewerage overflows via the emergency relief structures (ERS) were not complying with EPA regulations, Melbourne Water carried out a series of studies to investigate the impacts on the waterway and potential ways of best managing the problem.

These investigations showed little evidence of these overflows having a major impact on the creek's health. However, studies revealed that other pollutants were. Research partners at the University of Melbourne's Centre for Aquatic Pollution Identification and Management (CAPIM) identified numerous sediment contaminants, including petroleum hydrocarbons, pesticides and metals. These contaminants, they found, were coming largely from the industrial areas along the catchment and were impairing the creek's aquatic animals and insects.

More specifically, it was found that Heatherdale Creek has high concentrations of the synthetic pyrethroids bifenthrin, permethrin and cypermethrin as well as the metals zinc, lead and nickel. Bungalook Creek remains a source of the synthetic pyrethroids permethrin and bifenthrin, as well as the fungicides tebuconazole and propiconazole. And Old Joes Creek remains a major contributor of pollutants in the creek, particularly metals including silver, lead, nickel, zinc and copper, hydrocarbons and the synthetic pyrethroid insecticide bifenthrin.

More information about the effects of these pollutants on the environment can be found in the FAQs on our Your Say page.

How have we been addressing this issue?

During phase 1, the focus was on pollution prevention; phase 2 is targeting pollution reduction.

The pollution prevention program included regular sampling of water in the creek's drainage network, and a behaviour change program carried out in the Old Joes Creek industrial estate.

As part of this program, actions included sourcing of foaming events and labelling 130 stormwater drains to advise of system monitoring and raise awareness of the drainage network's connection to local waterways and ecosystems. While EPA carried out pollution blitzes in the upstream industrial estates, Melbourne Water has been working with Monash University to develop and trial new water quality monitoring technology within the industrial estate.

Water sampling, both before and after the behaviour change program, gave us a better understanding of the types of contaminants entering Dandenong Creek via the Old Joes Creek industrial area. It also helped us narrow down the source of pollutants responsible for discharging toxicants into the creek, as well as those potential businesses that were likely to be responsible for the discharges.

Both before and after sampling showed significant areas of pollution containing high concentrations of metals that pose an extreme risk to the environment. These metals include lead, zinc, silver, copper, chromium and cadmium. So, while the behaviour change program may have helped to reduce some metals (lead, zinc, cadmium), overall there was little change in concentrations of metals.

It was concluded that a number of factors limited the effectiveness of the behaviour change program in providing a significant decrease in waterway pollution. These varied from turnover of tenants, business' willingness to participate and some businesses already undertaking best practice within their property. It is important to note, too, that behaviour change cannot fix the catchment's historical legacy of contaminated land or any potential drainage infrastructure failures.

To this end, we carried out targeted drain surveys to investigate potential sewer cross connections. Results indicated potentially collapsed sewers or illegal connections within this area so we conducted CCTV works within the stormwater system and found a number of illegal connections, blockages and failed infrastructure. We reported this to the EPA and followed up during the pollution blitz; in addition we installed new pit lids and removed any blockages. Our focus then shifted to enforcement and an 'end of pipeline' solution, essentially diverting all dry weather flow into the sewer system for removal and treatment.

Monitoring pollution with sensor technology

Traditionally, monitoring the drainage network is done through visual inspection, CCTV cameras and dye testing. But these methods are costly, time-consuming and usually require on-site sampling by an on-the-ground labour force. These methods are often impractical when it comes to identifying the pollution event in real-time.

With this in mind, we worked with researchers at Monash University to develop and install an 'army' of low-cost water sensors in targeted stormwater catchments across the Old Joes Creek industrial zone. (See Figure 1.) These sensors provide real-time information on things like water depth, temperature and salinity within each stormwater pipe. In short, they enable us to see underground.

Real-time rainfall data is also recorded using information from a local weather radar. All this information is then sent to a webserver, which alerts the team whenever the system detects possible illegal dry weather discharges/events.

What is a dry weather discharge or event and why is this important for pollution detection?

Dry weather discharge is liquid that flows into a waterway via stormwater drains, despite no rain having fallen. So, if you see or hear liquid flowing from a drain and it hasn't rained in, say, the past 72 hours, it is possible it may be due to illegal dumping of waste somewhere in the drainage system. Dry weather screening and sampling is a much easier way of identifying illegal discharges than testing during wet weather. For one, the discharge isn't diluted by rain, which means we can more accurately detect the type of discharge and potentially identify its source.

Figure 1: Sensors needed to meet three fundamental criteria: (1) low cost (2) small size to place inside the drain without having assets on the ground, and (3) easy to install and relocate (avoiding confined space entry).

How did we select which locations to monitor?

The Old Joes Creek catchment consists of residential land use and industrial/commercial sites, including heavy industry and retail premises such as shopping centres and other commercial activities. And, some areas are both residential and industrial/commercial.

Sensor location was based on a variety of factors including the water/sediment quality from the previous sampling programs, site accessibility and current land use/industrial activities within each sensor's location. From our previous monitoring program, we had also identified a number of known hot-spot areas. (See Figure 2.)

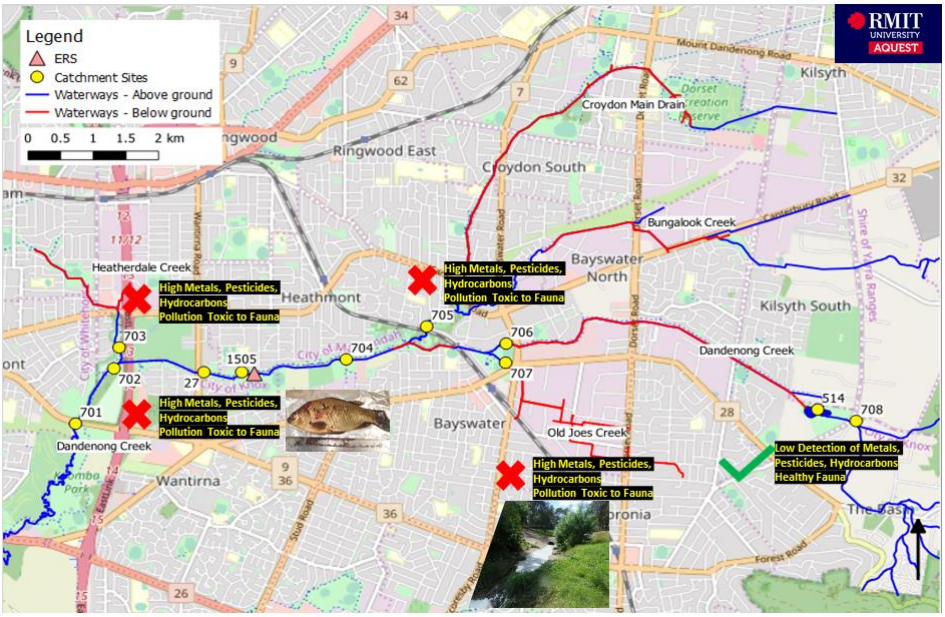


Figure 2: From our previous monitoring program, we had also identified a number of known hot-spot areas.

What did we find?

Between April 2019 and April 2020, we detected an average of 123 dry weather events within the sub-catchment. A number of sites were also identified that suggested pollution due to illegal activity.

Across all the sites, 61 per cent of the detected dry weather discharges occurred during daylight hours (6am to 6pm). Narrowing it further, in some sub-catchments the sensors detected a tendency towards afternoon discharges, while in others morning discharges were more frequent. There was also a higher probability of discharge events on Friday afternoons, and a significant spike in pollution around holidays or long weekends.

The data also told us that areas with higher commercial and/or industrial land uses had more frequent dry weather discharges, compared with areas that were largely residential.

Additionally, we noticed that the number of discharges was significantly reduced on weekends. Even so, locations with a higher number of commercial/retail trade businesses had more dry weather events on Saturday and Sunday. The graphs in Figure 3 illustrate this.

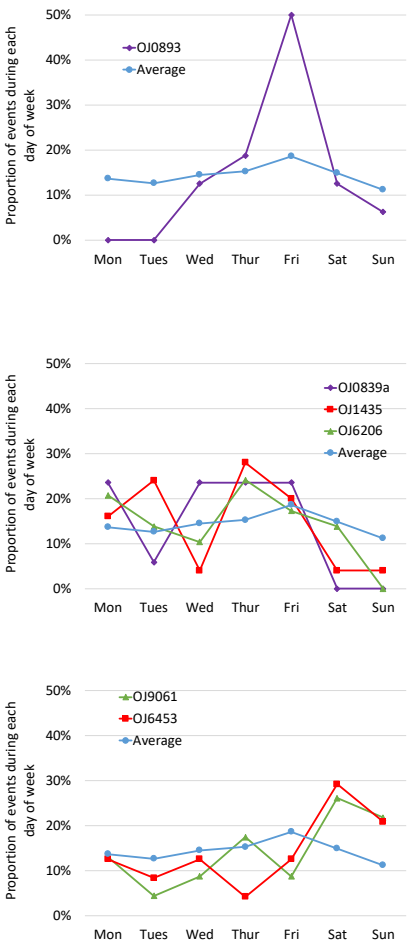


Figure 3: The three graphs show weekly variations in dry weather discharges. Blue lines represent the average across all sites, while the other colours represent different individual sites. Graph 1 shows a site with a distinctive Friday peak. Graph 2 shows sites that exhibit a weekend dip in discharge frequencies. Graph 3 shows two sites that exhibit weekend peaks.

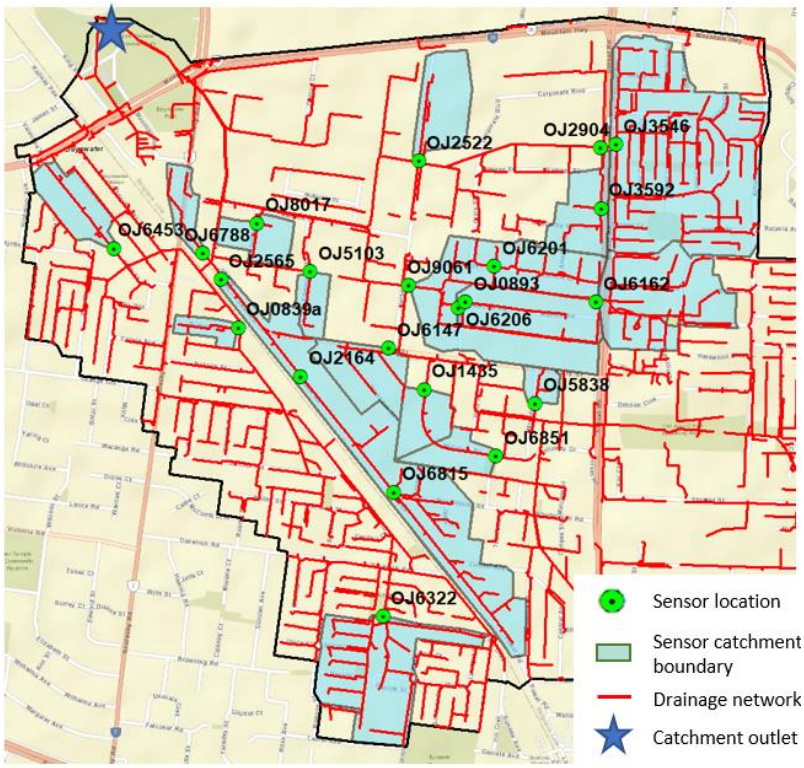
Why is this information important and where do we go from here?

Our phase 1 pollution program was broadly aimed at detecting and preventing pollution from entering Dandenong Creek. We know from earlier investigations that dry weather discharges originating from industrial activities, commercial/residential properties, and illegal discharges are a severe issue in Old Joes Creek. We also know that pollutants from industrial areas in the catchment are impairing the health of the creek and its aquatic fauna and flora.

More importantly, we know that these pollution events are driven by human behaviour.

The real-time monitoring program developed in collaboration with Monash University is helping us move into the next phase: pollution reduction.

Now that Melbourne Water and its partners have 'eyes underground' we have a much stronger understanding of the source and timing of potential pollution events, are identifying those sub-



catchments that need further investigation, and pinpointing where additional sensors need to be placed for more in-depth detection. For example, Figure 4 presents one of the sensor location maps used during the program.

Our focus for phase 2 is on further monitoring, as well as compliance and inspections, treatment and design, and citizen science.

Phase 2 will see more sensors and targeted placement around the catchments. This includes two sensors mainly targeting commercial activities (shopping mall, restaurants and community leisure activity centre), three sensors focusing on the water input from an upstream residential area, and the remaining sensors monitoring the industrial-related dry weather discharges.

Figure 4: One of the sensor location maps in the Old Joes Creek industrial area; the blue shaded area is the sub-catchment boundary for all the sensors based on the drainage network.