THAMES COROMANDEL DISTRICT COUNCIL

VEOLIA WATER

Stormwater Monitoring Programme:

Ecological Assessment
Thames-Coromandel Urban Areas
2018

Kessels Ecology
survey, assessment, restoration

Table of Contents

Prepared by: Stella McQue

Reviewed by: Brenda Bart

Version: 1704

PWF ref: VW.005

Executive Summary

As part of their Comprehensive Stormwater Discharge Consents, Thames-Coromandel District Council and Veolia Water are required to carry out a monitoring programme of stormwater outlets, including an ecological assessment throughout the region every four years. Kessels Ecology was contracted to carry out the ecological assessment in 2018. The survey sites include 13 stormwater outlets around the Coromandel area, as well as two control sites where no stormwater is discharged. Most sites are situated in, or near, harbours, with one site (Site 9) in a freshwater stream.

The purpose of this study is to determine the general ecological health of the stormwater discharge receiving environment and assess general effects of stormwater discharge.

This report should be read in conjunction with a report on sediment contaminant concentrations which has been produced by Veolia Water.

In line with the recommendations of the 2014 report, the 2018 sampling took place 5 days after a major storm event, so that any ecological effects of stormwater discharge would be more obvious.

The general approach for the surveys is based on in-situ visual observation of three key biological indicators of ecological health. These three indicators are as follows:

- Aquatic plant growth composition and percentage cover;
- Benthic macroinvertebrate diversity and distribution; and
- Identification of potential native freshwater fish habitat and potential barriers to fish migrations.

Macroinvertebrate presence was highly variable. The fauna at each site probably reflected the diversity present in the wider estuary or the habitat available at the site, rather than the impacts of stormwater. In these mainly estuarine habitats, the invertebrate fauna is greatly dependent on the substrate and exposure to water currents, e.g. whether the site is muddy and sheltered or sandy/rocky and exposed. Only severe changes in benthic fauna would be likely to be detected using the current survey technique.

No effects of the stormwater discharges on aquatic plants were evident at the time of sampling. Few sites had aquatic plants present, partly due to the tidal fluctuations and habitat types at most sites being less suitable for plants. Mangroves and green filamentous algae were present at 2 sites each.

The stormwater discharges appears to have little impact on the ecology of the receiving environments, however these effects remain difficult to separate from the influence of tide and local habitat variation.

1 Introduction

As part of their Comprehensive Stormwater Discharge Consents, Thames-Coromandel District Council and Veolia Water are required to carry out a monitoring programme of stormwater outlets, including an ecological assessment. Kessels Ecology was contracted to carry out this assessment in 2018. The survey sites include 13 stormwater outlets around the Coromandel area, as well as two control sites where no stormwater is discharged. Most sites are situated in, or near, harbours, with one site (Site 9) in a freshwater stream.

The purpose of this study is to determine the general ecological health of the stormwater discharge areas and assess general effects of stormwater discharge. Monitoring is undertaken every four years.

This report should be read in conjunction with a report on sediment contaminant concentrations which has been produced by Veolia Water.

In line with the recommendations of the 2014 report (Price and Catlin 2014), the 2018 sampling took place 5 days after a major storm event, so that any ecological effects of stormwater discharge would be more obvious.

2 Methods

2.1.1 General Approach

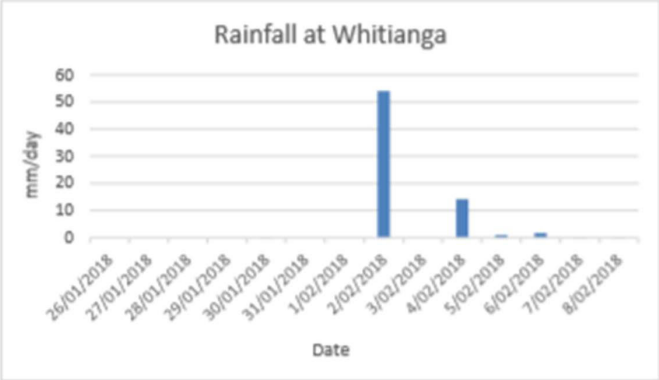
The general approach for the surveys is based on the visual observation of three key biological indicators of ecological health, as well as physicochemical water parameters. The three indicators are as follows:

- Aquatic plant growth composition and percentage cover;
- Benthic macroinvertebrate diversity and distribution; and
- Identification of potential native freshwater fish habitat and potential barriers to fish migrations.

2.1.2 Survey Sites

Fifteen sample sites were sampled within Coromandel and nearby communities or immediately upstream of most of the urban areas. Sites were investigated on the 10th and 11th of January 2018. The survey was undertaken after a storm event which resulted in heavy rainfall across the Coromandel on January 5 (Table 1).

Table 2: Example of rainfall patterns in the Coromandel over the two weeks prior to the 2018 survey.



Coordinates of the sample sites are given in Table 2. The sites are as follows (site descriptions from Baldwin 2013):

Site 1: Thames Marina. High risk catchment with commercial and industrial activities, making it susceptible to the build-up of contaminants in the sediments. Outlet flows into an area of mangroves.

Site 2: Sealey St South of Goldfields shopping centre – Thames. High risk catchment with commercial activities. Close to SH25. Outlet flows into a narrow channel which flows into the harbour.

Site 3: Burke St outlet – Thames. High risk catchment with commercial and industrial activities and close to SH25.

Site 4: **Control site**. Fergusson Dr – Moanatairi, away from stormwater outlets - Thames. Residential catchment associated with historical mine catchments. A floodgate controls stormwater flow at this site.

Site 5: Sheppard Avenue, Pāuanui harbour – Pāuanui. High risk catchment, stormwater flows directly into the estuary.

Site 6: Wharf Road, Whangarahi Stream – Coromandel. High risk catchment which encompasses most of the CBD.

Site 7: Marquet Place, Tairua harbour – Tairua. High risk catchment which envelops most of the CBD. Stormwater outlet flows directly into the harbour.

Site 8: Marina Hardstand – Whitianga. High risk catchment which envelops most of the CBD. The stormwater outlet flows into the marina where channels have been constructed.

Site 9: Moewai Road North, drain outlets – Whitianga. High risk catchment with commercial and industrial activities. SH25 is also close. The stormwater outlet at this site flows into a freshwater stream.

Site 10: Casement Rd drain Moana Anu Anu River – Whangamatā. High risk catchment with commercial and industrial activities. At this site the stormwater outlet flows into a short channel which then flows into the harbor.

Site 11: Hetherington Rd, south of marina – Whangamatā. High risk catchment with commercial and industrial activities. The stormwater outlet flows directly into the harbor.

Site 12: Aicken Rd – Whangamatā. High risk catchment with commercial and industrial activities. The outlet flows into a short channel which flows into the harbor.

Site 13: Lindsay Rd – Whangamatā. High risk catchment with commercial and industrial activities. Similar to sites 10 and 12, the stormwater outlet flows into a channel and then into the harbour.

Site 14: Kotuku St SW outfall, Otahu Estuary Kotuku Street – Whangamatā. This site is considered to be in a low risk residential area. The stormwater outlet flows into a raised concrete pond within the tidal zone of the estuary.

Site 15: Control site, Otahu estuary, away from SW outlets – Whangamatā. The site is situated in a residential catchment. As it is a control site, there is no stormwater outlet present.

Table 2: Coordinates (decimal degrees) for the stormwater stream sampling sites, February 2018.

Site	Location	Easting	Northing
1	Thames	175.324259	-37.84802
2	Thames	175.322644	-37.82414
3	Thames	175.315976	-37.75009
4	Thames (Control)	175.314992	-37.73042
5	Pāuanui	175.511939	-37.1264
6	Coromandel	175.294266	-36.453979
7	Tairua	175.504958	-37.0508
8	Whitianga	175.422053	-36.501537
9	Whitianga	175.402005	-36.495468
10	Whangamatā	175.515725	-37.12133
11	Whangamatā	175.515860	-37.115899
12	Whangamatā	175.515398	-37.12400
13	Whangamatā	175.515222	-37.12768
14	Whangamatā	175.522067	-37.133112
15	Whangamatā (Control)	175.522529	-37.133356

2.1.3 Aquatic Macroinvertebrates

Where possible, aquatic macroinvertebrate samples were collected in accordance with Environment Waikato's regional guidelines (Collier and Kelly 2005), which are based on protocols developed for the Ministry for the Environment by Stark et al. (2001). However, due to the estuarine habitat present at most sites, and the extremely low flow from the pipes at most sites, this method was not always appropriate as it was designed for freshwater streams. At estuarine sites, a thorough search was carried out for fauna species in the water, on the sediment surface and under rocks and logs etc. Samples were assessed for presence or absence of taxa and particularly abundant taxa were noted.

3 Results & Discussion

3.1 Site Descriptions

3.1.1 Site 1: Thames Marina

The outlet flows into a short channel then into the estuary. The channel banks are moderately steep with a narrowly incised channel. The marine mud substrate was deep, with some gravel in the base and no woody debris. Flow through the culvert was very low at the time of sampling.

Mangrove seedlings present at the 2014 survey have established and were 0.5-1 m tall. Tunnelling mud crab (*Austrohelice crassa*) burrows were abundant over all surfaces of the channel. Rock oysters (*Saccostrea glomerata*), mud snail (*Potamopyrgus* sp.) and whelks (*Cominella*) were abundant. One mudflat snail (*Amphibola crenata*) was also found. Fish access into the culvert was not impeded, but is tide dependent. Oligochaete worms and Tanypod fly larvae were present in the 2014 survey, but were not observed in 2018.

Photo 1. Site 1: Thames Marina.

3.1.2 Site 2: Sealey St- Thames

The outlet flows into a 100 m long, mangrove-lined channel then into the estuary. The substrate was gravel, sand and rocks, leading into deeper marine muds. No woody debris or aquatic plants were present and minimal organic matter or leaf litter. Flow through the culvert was low at the time of sampling.

The tunnelling mud crab burrows and mud snails were abundant, other fauna include estuarine mudflat snail, oligochaetes, chironomid non-biting midge larvae, and the pest fish *Gambusia affinis*. Fish access into the culvert was blocked due to the metal cones fixed into the culvert openings.

This site was physically very different to 2014. Built-up mud and debris present on the culvert apron at the previous survey have been removed or washed out, and metal cones had been fitted to the culvert openings.

Photo 2. Site 2: Sealey St, Thames.

3.1.3 Site 3: Burke St outlet – Thames

The outlet flows into a long tidal channel then into the estuary. The channel was wide and flat-bottomed; iron flocculates were conspicuous in the shallow water channels. The substrate was deep tidal mud with mangrove seedlings. Flow through the culvert was low at the time of sampling.

Tunnelling mud crab burrows and mud snail and tubificid oligochaete worms were abundant; and chironomid non-biting midge larvae were also present. Fish access was unimpeded.

Observations at this site were similar to the 2014 survey.

Photo 3. Site 3: Burke St outlet, Thames.

3.1.4 Site 4: Control site, Fergusson Dr – Thames

This stormwater outlet is controlled by a tide gate which opens directly onto the beach. At the time of survey, the concrete structure was buried in sand, almost to the top of the structure, possibly by the recent storm event, and could not be surveyed.

Photo 4. Site 4: Fergusson Dr, Thames in 2018 (left) and 2014 (right).

3.1.5 Site 5: Sheppard Avenue, Pāuanui harbour – Pāuanui

This outlet flows directly into the estuary. The culvert is constructed from several interlinked concrete pipes, the outer of which was coming loose. There was no flow from the culvert at the time of sampling. The substrate was sand with many empty marine shells.

No aquatic plants were present, and the inside of the pipe was lined with rock oysters (*Saccostrea glomerata*). Other fauna species present included; shrimp which were abundant as well as mudflat snail and spire shells (*Zeacumantus* sp.). Fish access was unimpeded.

Compared with the 2014 survey, observations at this site were very similar, excepting that bivalve shellfish (i.e. cockle (*Austrovenus stutchburyi*) and pipi (*Paphies australis*) were not detected.

Photo 5. Site 5: Sheppard Ave, Pāuanui.

3.1.6 Site 6: Wharf Road, Whangarahi Stream – Coromandel

This outlet pipe is set in a retaining wall 1 m above the mud in a tidal section of the Whangarahi Stream. the top of the culvert pipe is submerged at high tide, which would allow fish access. The substrate was tidal mud with embedded cobbles and there was no flow through the culvert at the time of sampling.

No aquatic plants were present. Tunnelling mud crab burrows and mud snails were abundant during the survey, and shrimp and amphipods were present.

Observations at this site were similar to the 2014 survey.

Photo 6. Site 6: Wharf Rd, Coromandel.

3.1.7 Site 7: Marquet Place, Tairua harbour – Tairua

The outlet flows directly into the harbour. The substrate was rocks, concrete blocks, sand and marine mud. Several *Juncus* reeds were present on the edge of the banks and no aquatic plants were present. There was no or very low flow from the culvert, so the water chemistry measurements reflect tidal water at the mouth of the culvert.

Common fauna species observed were shrimp, estuarine triplefin (*Grahamina nigripenne*), tunnelling mud crab, mudflat snail, spotted whelk (*Cominella maculosa*), mud whelk (*Cominela glandiformis*) and top shell (*Diloma* sp.). Fish access is unimpeded, except possibly by the lip of the culvert apron at low tide

Observations at this site were similar to the 2014 survey.

Photo 7. Site 7: Marquet Place, Tairua Harbour.

3.1.8 Site 8: Marina hardstand – Whitianga

The outlet flows into the marina over a concrete weir only during times of high flows and high tides. Within the metal-grilled chamber, water flows out of a large culvert and diverts into a smaller culvert. The channel beyond the structure is lined with riprap which was embedded in sand. There was no flow of water from the culvert to the channel during the survey.

There were no aquatic plants present. Topshell snails (*Nerita* sp.) were clustered near the concrete block and mud whelks were also present. There was no fish access at this location. Bullies (*Gobiomorphus* sp.), a

common fish species, were abundant within the chamber. This fish species has an estuarine larval stage, and are likely entering from

Fewer fauna species were observed during this survey than in 2014.

Photo 8. Site 8: Marina hardstand, Whitianga.

3.1.9 Site 9: Moewai Road North– Whitianga.

The outlet flows into a freshwater stream. The stream was lined with rank grasses, *Convolvulus*, blackberry (*Rubus fruticosus*) and other low weeds on the true left bank, and pine (*Pinus sp.*), flax (*Phormium tenax*), tutu (*Coriaria arborea*) and reeds on the true right bank. The streambed was mostly clear of vegetation, with water pepper (*Persicaria hydropiper*) along the edge of the banks, and leaf litter and woody debris present in the stream. The water level in the stream was exceptionally low, with 40-50% of the substrate exposed. The water was slightly milky and algal mats were growing on the substrate. Water flowing from the outlet was clear and contained large amounts of iron flocculate.

A large longfin eel (*Anguilla dieffenbachii*) was hiding amongst detritus beside the culvert outlet. Mud snails and chironomid non-biting midge larvae were abundant; also present were oligochaete worms and a caddisfly larva (Hydroptilidae). Fish access was unimpeded at high water levels but could be impeded at low water levels by a slight drop at the mouth of the culvert.

Compared with the 2014 survey, the site has changed dramatically. In 2014, the stream channel was overgrown and partly obscured by weeds and rank grasses. Slightly fewer invertebrate groups were found in 2018 compared to 2014.

Photo 9. Site 9: Moewai Rd, Whitianga.

3.1.10 Site 10: Casement Rd drain, Moana Anu Anu River – Whangamatā

The outlet flows into a long, wide channel which then flows into the harbour. The substrate wa predominantly sand with fine gravel with some mud. The flow was very low, with plenty of built-up surfac scum and green filamentous algae.

No aquatic plants or mangroves were present at the site, weedy terrestrial vegetation along the bank provided some stream shade and cover in places. Mud snails were especially abundant. there were als non-biting chironomid midge larvae and burrows from tunnelling mud crabs.

The site was similar to the 2014 survey, however fewer invertebrate species were observed.

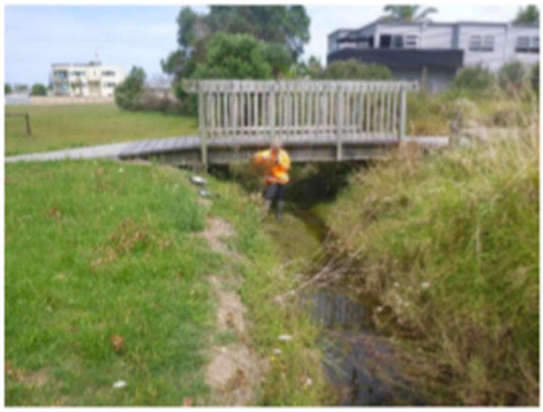


Photo 10. Site 10: Casement Rd, Whangamatā.

3.1.11 Site 11: Hetherington Rd – Whangamatā.

This outlet flows into a small saltmarsh on the edge of the harbour, although there was no flow at the tim of the survey. The sediment around the outlet was dry, soft sand and soil, densely vegetated with (*Juncu* sp.), and glasswort (*Salicornia quinqueflora*), oioi (*Apodasmia similis*), and the creeper (*Samolus* sp.). N aquatic plants were present at the site. Tunnelling mud crab burrows were present but no other fauna wer observed and there was no fish access to the culvert pipe.

Observations at this site were similar to the 2014 survey.

Photo 11. Site 11: Hetherington Rd, Whangamatā.

3.1.12 Site 12: Aicken Rd – Whangamatā.

This outlet flows into a short channel then enters the estuary. Water was flowing at a very low rate from the submerged pipe. The substrate was gravel and sand, with iron flocs and oily scum from iron bacteria were present. The banks of the channel were eroding, either actively or as the result of a very large rainfall event. There were no aquatic plants present.

There were a few mud snails, chironomid non-biting midge larvae and oligochaete worms present and fish access was unimpeded.

Observations at this site were similar to the 2014 survey.

Photo 12. Site 12: Aicken Rd, Whangamatā.

3.1.13 Site 13: Lindsay Rd – Whangamatā

This outlet flows into large scour pool, then a short channel and finally enters the estuary. Four pipes exit into the pool. The banks of the channel were eroding, either actively or as the result of a very large rainfall event. The substrate was gravel with a light covering of sediment, leaf litter and filamentous algae. Iron flocs and an oily scum from iron bacteria were present.

Shrimp and mud snail were abundant. Fish were observed in the pool – estuarine triplefins (*Forsterygion nigripenne*) were abundant and a 15 cm mullet (*Mudgil* sp.) was present. There were no aquatic plants and there was fish access into the lower outlets.

Observations at this site were similar to the 2014 survey.

Photo 13. Site 13: Lindsay Rd, Whangamatā.

3.1.14 Site 14: Kotuku St – Whangamatā.

This outlet flows into a raised concrete trough, which overflows into the estuary. The substrate was sand and gravel with gabion bank armouring and iron floc was present.

Cat's eye snails (*Lunella smaragda*) were abundant. Other species included shrimp, rock oyster (*Saccostrea glomerata*), limpet (Lottidae), oligochaete worms, amphipods, estuarine mud snail and whelk. No aquatic plants were present and fish access was not impeded.

Observations at this site were similar to the 2014 survey.

Photo 14. Site 14: Kotuku St, Whangamatā.

3.1.15 Site 15: Control site, Otahu estuary – Whangamatā.

Site 15 is the estuary control site, with no stormwater outlet present. The substrate at this site was sandy. Fauna present included tunnelling mud crab, little black mussel (*Xenostrobus neozelanicus*), whelk, amphipods, isopods, mudflat topshell (*Diloma* sp.), cat's eye snail and shrimp. The estuarine triplefin fish (*Forsterygion nigripenne*) was common. No aquatic plants were present.

Photo 15. Site 15: Otahu Estuary, Whangamatā.

3.2 Aquatic Macroinvertebrates

Aquatic macroinvertebrate communities were highly variable between sampling sites, potentially related to tidal fluctuations in water level and salt water, as well as the substrate site and level of disturbance at each site. The most widespread and generally abundant species were tunnelling mud crab and mud snail, found at eight sites each. Marine and estuarine molluscs were present at 12 of the 15 sites.

Sites 14 and 15 had seven fauna species present, followed by sites 1, 2, 5, and 7 having five species each. Sites 14 and 15 were close to each other, as were sites 1 and 2, and site 5 and 7. Each pair of neighbouring sites shared at least half of its species. This may indicate that the number of species at any one site is directly related to the number of species in the wider estuary, while the type of species present at a site may depend on local habitat conditions.

Sites 10, 11, 12 and 13 had very few fauna species. These sites also had the highest water temperatures, lowest water velocities and visually the water appeared stagnant.

Diversity and abundance of invertebrates was likely affected by the warm conditions and low freshwater flow at the time of sampling, with only tolerant species able to survive in the shallow water habitats near the outlets.

3.3 Aquatic Plants

Aquatic plant cover was low or absent at the stormwater outlets. Sites 1 and 3 had small mangrove plants or seedlings present. Some sites had occasional loose mangrove seeds but these were not rooted, and the sandy substrate at most of these sites means that mangroves are unlikely to establish. Green filamentous algae was present at Sites 10 and 13; large amounts of such algae can signal nutrient enrichment.

3.4 Fish Habitat and Passage

Five species of fish were observed at six of the sampling sites. The estuarine triplefin was seen at sites 7, 13 and 15. The euryhaline mullet was observed at site 13, and the freshwater bully and longfin eel were seen at sites 8 and 9 respectively. Gambusia, an introduced pest species, were seen at site 2.

As most sites surveyed were estuarine, the culverts would be freely accessible to fish at high tide. Few of the sites The areas around most outlets had little cover or habitat (i.e. aquatic plants, woody debris, stones or other structures) and would not be expected to provide more than occasional habitat for

fish. Fish would likely vacate the small tidal channels at low tide during periods of low dissolved oxygen, high temperatures and low water levels.

4 Conclusions

Ecological effects of the stormwater discharges remain difficult to separate from the influence of tide and local habitat variation, however they appear to be minor.

Macroinvertebrate presence was highly variable. The fauna at each site probably reflected the diversity present in the wider estuary or the habitat available at the site, rather than the impacts of stormwater. In these mainly estuarine habitats, the invertebrate fauna is greatly dependent on the substrate and exposure to water currents, e.g. whether the site is muddy and sheltered or sandy/rocky and exposed. Only severe changes in benthic fauna would be likely to be detected using the current survey technique.

No effects of the stormwater discharges on aquatic plants were evident at the time of sampling. Aquatic plant coverage was low at the time of sampling, partly due to the tidal fluctuations and habitat types at most sites being less suitable for plants. Mangroves and green filamentous algae were present at 2 sites each.

The 2014 survey report recommended that future sampling should take place after at least 10-50 mm of rainfall, so that any ecological effects of stormwater discharge would be more obvious (Price and Catlin, 2014). The 2018 surveys took place five days after a major storm event; however, the stormwater discharges had returned to low flow, indicating that the sites are flashy and the effects of stormwater discharge are likely only present during the actual rainfall events. Therefore, this stipulation to conduct surveys following rainfall is unnecessary for future surveys.

5 References & Bibliography

Baldwin, C. 2013. Stormwater Monitoring Programme: Thames-Coromandel Urban Areas, November 2013. Prepared for Thames-Coromandel District Council by KTB Planning.

Collier, K. J., and J. Kelly. 2005. Regional Guidelines for Ecological Assessments of Freshwater Environments: Macroinvertebrate Sampling in Wadeable Streams. Environment Waikato Technical Report TR2005/02.

Price, J., Catlin, A. 2014. Stormwater Monitoring Programme: Ecological Assessment, Thames-Coromandel Urban Areas 2014. Kessels Ecology Report prepared for TCDC.

Stark, J. D., I. K. G. Boothroyd, J. S. Harding, J. R. Maxted, and M. R. Scarsbrook. 2001. Protocols for sampling macroinvertebrates in wadeable streams. Ministry for the Environment.

Tulagi, A. 2015. Regional Rivers Water Quality Monitoring Programme: Data Report 2012. Waikato Regional Council Technical Report 2015.