Kia ora

Ref: [Comments]
OIA 19-015 #6439956
David Down
David.down@poriruacity.govt.nz

11 March 2019

Brian Warburton

Via email: fyi-request-9598-0eb26a25@requests.fyi.org.nz

Dear Mr Warburton

Response to official information request for Investigation Report on discharge from sewerage treatment plant

I refer to your request for official information received 15 February 2019 relating to the Investigation Report on discharge from the sewerage treatment plant. We have processed your request under the Local Government Official Information and Meetings Act (LGOIMA) 1987.

The information you requested is enclosed.

Please note that content in the report relating to private persons has been redacted pursuant to the LGOIMA1987 s7(2)(a) and (c).

If you wish to discuss this decision with us, please feel free to contact David Down, Manager Water and Waste on telephone: 04 237 1503 or email: david.down@poriruacity.govt.nz.

Ngā mihi

Wendy Walker
Chief Executive
Kaiwhakahaere Matua

Attachment: Wellington Water Report

Wellington Water

FINAL REPORT for GRWC
REDACTED

Porirua Wastewater Treatment Plant Incident: 6 October 2018

Our water, our future.

Document Control

QUALITY ASSURANCE		
Prepared By		
Business Assurance Advisor		21.11.2018
Reviewed By		
Chief Advisor Wastewater		21.11.2018

REVISION SCHEDULE						
Current Status			Final version for GRWC			
No	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
1	2.11.18	Interim		Steering Committee		
2	21.11.18	Final version for GRWC				

Table of Contents

1. Executive Summary

The event

On Saturday 6th October 2018, between 12:10pm and 3:00pm, a dry-weather carryover of activated sludge left the Porirua Wastewater Treatment Plant (WWTP) and entered the coastal marine environment at Rukutane Point, west of Titahi Bay (see Figures 1, 2 and 3).

The carryover volume is estimated at 5,041m^3 (see attachment 1).

Wellington Water staff attended the site and took action to stop the carryover between 2:00pm and 3:00pm.

Cause and contributing factors

The primary cause of this incident was human error. One of the plant's three clarifier tanks was taken out of service for some upgrade work and the appropriate process adjustments were not made to compensate.

Other factors contributed to the incident, including:

- a failure to, plus lack of process for, properly taking a clarifier offline
- UV (ultra-violet) alarms indicating 'no dose' were only intermittently responded to
- inaccurate diagnosis of a UV plant fault
- relying on only one alarm to signal a sludge carryover
- communication issues among staff.

Resource Management Act considerations

The plant operates under resource consent WGN950083 [3805] which allows treated wastewater to discharge to the coastal marine area.

Photographs taken on the day of the incident show the plant breached conditions 13 (a) and 13(b) of the resource consent, with the plume clearly visible beyond a 200m radius of the Rukutane Point Outfall. This also breached condition 4, as the plant's maintenance was not to a standard that was adequate to meet the consent's conditions.

Condition 21 requires GWRC and Regional Public Health to be notified immediately if there is a plant malfunction. Wellington Water only partially complied with this.

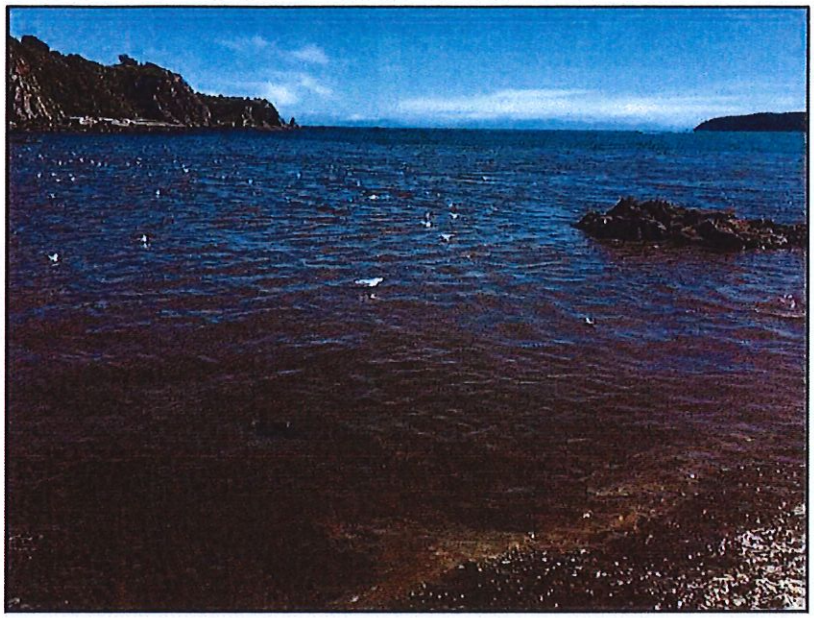

Figure 1: Close-up view of water at Rukutane Point, taken 6/10/2018. The plant's outfall is off-camera at the bottom right of the photo.

Figure 2: View of wastewater carryover at Rukutane Point, taken 6/10/2018.

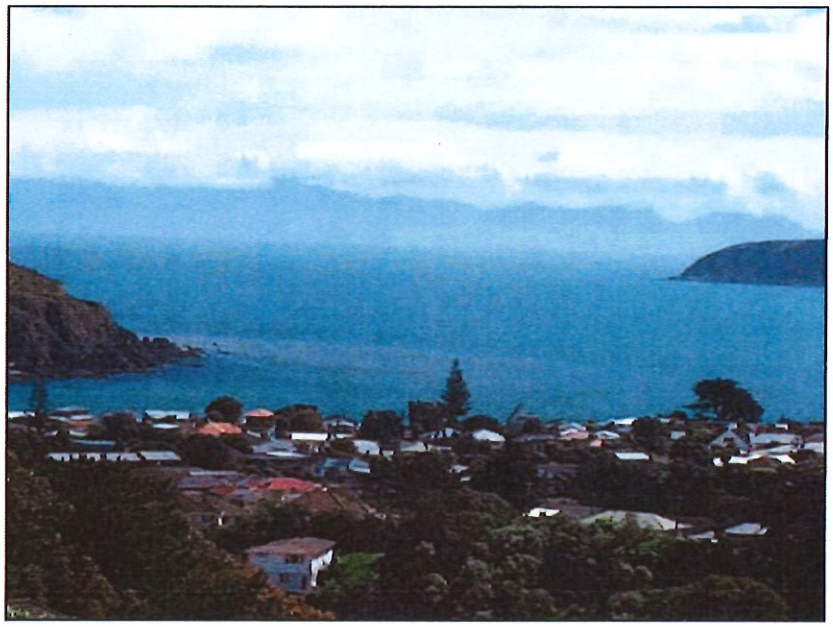

Figure 3: View of wastewater carryover off Titahi Bay, taken 6/10/2018.

One of Wellington Water's promises to its customers is to be respectful of the environment, and in this case, we failed to keep it. This is a disappointment that the organisation, as a whole, feels very keenly. Wellington Water's senior leadership have thoroughly supported this investigation, and are committed to making sure that our plant, processes and people are robust enough to prevent it from happening again.

2. Scope

The scope of this investigation includes:

- how the carryover occurred
- identifying steps for Wellington Water to prevent it from happening again.

The standard of proof used for this investigation is for the facts to be proved on the balance of probabilities.

Investigation team

Business Assurance Advisor: Lead Investigator

Chief Advisor Wastewater: Technical Lead

Manager Risk & Assurance: Investigation Oversight

Wastewater Process Analyst: Data/Information.

People interviewed

Porirua Wastewater Treatment Plant, Wellington Water

Porirua Wastewater Treatment Plant, Wellington Water

Porirua Wastewater Treatment Plant, Wellington Water

Wellington Water, Wellington Water

Petone Engineering Limited.

3. Sequence of events

Background

The Porirua Wastewater Treatment Plant ('the plant') is located on Moki Street, Porirua, and operates under resource consent from the Greater Wellington Regional Council (GWRC.) It's been treating wastewater since 1989 and has been upgraded to expand capacity and improve effluent quality. The local territorial authority and asset owner is the Porirua City Council (PCC). Wellington Water Limited manages and operates the plant.

See attachment 2 for a diagram of the plant's wastewater treatment process, and attachment 3 for a map of the area.

Before the incident

A couple of weeks before the incident, staff at the plant installed a Rotork actuator on a steel frame to run a penstock electronically, which controls the aeration basin flow to Clarifier 2. This would let the staff electronically control the balance of aeration basin flow between Clarifiers 1 and 2 from the Control Room, instead of turning the penstock manually with a flywheel (manual wheel).

The Rotork was too heavy for the steel frame, so staff planned to replace it with a stronger frame. Their workshop didn't have the equipment to drill the size of hole the Rotork's bushing (bush) needed in the stronger frame, so the contracted that work out to Petone Engineering.

Friday 5th October 2018

Weather (from Past Weather in Wellington, New Zealand – October 2018 www.timeanddate.com/weather/new-zealand/wellington/historic?month=10&year=2018)

06:00	Broken clouds, 15°, northerly wind 21kph
12:00	Broken clouds, 17°, southerly wind 13kph
18:00	Overcast, 14°, southerly wind 16kph

Morning

The recorded the sludge levels for Clarifiers 1, 2 and 3. The maximum sludge level in Clarifiers 1 and 2 (the original 1989 clarifiers) is four metres, and Clarifier 3 (added in 2012) is five metres. The target sludge level during normal operation is 1 metre.

- Clarifier 1 = 1.1 metres
- Clarifier 2 = 0.4 metres
- Clarifier 3 = 3.5 metres.

Around lunchtime

The spoke to Petone Engineering, arranging to give them the bush and mounting plate for the Rotork's actuating valve so they could cut a hole in a replacement steel frame for the new Rotork. They would stop by later that afternoon to collect them.

Figure 4: Top view of bush (inner) and mounting (outer).

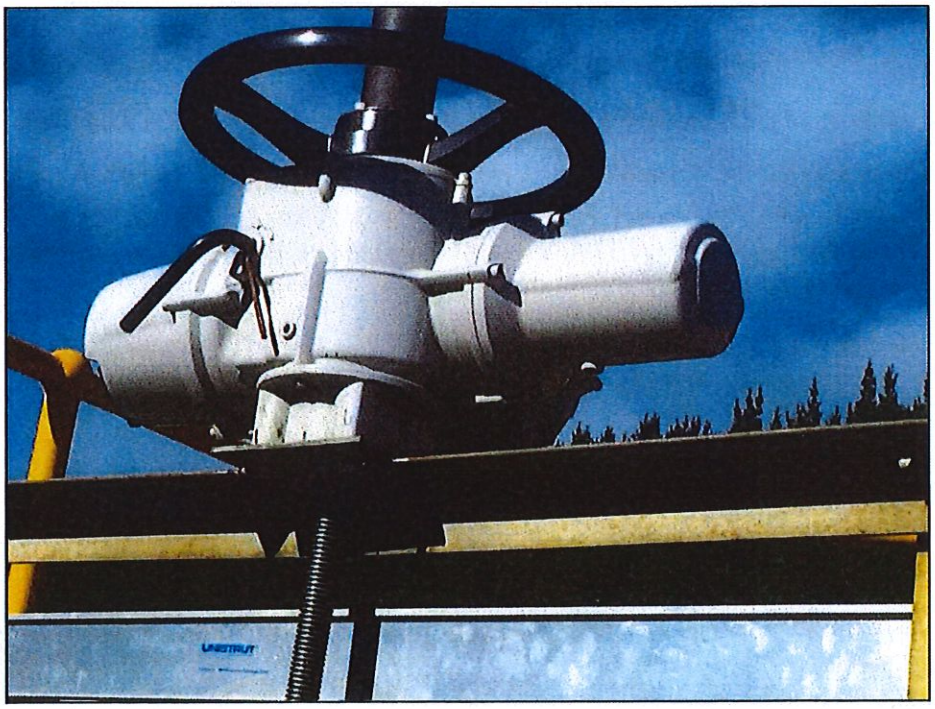

Figure 5: View of Rotork on top of the bush and steel frame.

After lunch (roughly 13:00)

The says he told the to get the bush and mounting plate ready for Petone Engineering to collect.

The thought the instructed him to remove the whole Rotork.

Around 14:00

The lowered Clarifier 2's inlet penstock so he could remove the Rotork from the frame. He and the removed the Rotork and attachments, took them up to the workshop, decontaminated them and left them outside for Petone Engineering to collect.

The penstock was left in the closed position, and the original manual control wheel was not reinstalled. This put Clarifier 2 was out of service. Clarifier 2 normally receives 30% of the flow from the aeration basin, but the RAS (Return Activated Sludge) pumps were not adjusted to compensate for Clarifier 2's isolation.

Around 15:00

The said Petone Engineering told him they couldn't come out to the plant after all; they would come on Monday, instead. He told the and the shortly afterwards.

Around 16:00

The said he spoke with the and electrical contractor about testing the set-up of the plant's new inlet channel overflow sensor. This work was not recorded in the site logbook.

The told the to abort the test as they'd run out of time, but he'd already organised the Pump Stations to send an increased volume of flow through.

According to the , the Pump Stations sent 1,100 litres per second (L/s) to the plant.

Attachment 4 shows that the five-minute flow recording from the Tangere and Rukutane pump stations spiked at roughly 900 L/s, but there was no matching spike in influent to the aeration basin. Those flows remained below 400 L/s. From previous observations, this alarm should activate around 1,300 L/s, so it would not have activated for these flows.

The alarm log shows the received a high flow alarm from Tangere and Rukutane (>1,000 L/s) at 15:51 (see attachment 5).

Friday evening/Friday night

Between 22:45 and 23:30, the was sent four alarms to his company cell phone, stating the UV plant's dose was low. Between this time, the also received and acknowledged two identical alarms.

The alarms sent to the on his phone received no response. He said he never received the alarms.

The acknowledged the alarms but did not contact the or attend the site that night.

Saturday 6th October 2018

Weather

00:00	Overcast, 11°, south sou'-easterly wind 21kph
06:00	Overcast, 15°, south sou'-westerly wind 6kph
12:00	Sunny, 17°, south sou'-westerly wind 15kph
18:00	[No data] 15°, northerly 11kph

Around 3:00am

Records show a complete loss of UV dose and UV intensity on the trends (see attachment 7).

Between 7:09 and 7:24 two UV dose alarms were sent to the but not acknowledged. One was sent to the

Around 7.30am

The arrived at the plant and recorded the sludge levels for Clarifiers 1, 2 and 3.

- Clarifier 1 = 2.6 metres, an increase of 1.5 metres since yesterday's measurement
- Clarifier 2 = 0.6 metres, an increase of 0.2 metres
- Clarifier 3 = 3.3 metres, a decrease of 0.2 metres.

There is nothing in the logbook to indicate concerns at Clarifier 1's sludge blanket level.

He discovered, either from the Control Room or at the UV plant itself, there was no dose reading on the UV sensors.

He looked at the UV lamps to see if they had debris on them and said that he cleaned them.

The did not adjust the RAS pumps as there 'was no need for it,' despite the high sludge blanket in Clarifier 1.

Between 7:39 and 8:51 the received five UV dose alarms. The received two.

Around 09:00

The phoned the and discussed a fault with the D.O. (dissolved oxygen) probe in the aeration basin. While on the phone, the told him that he had no UV dose.

At some point in the morning, the called the to discuss the UV alarms. The said this error had happened before, and the fault was electrical, because both sensor probes that serviced the two banks of UV lights weren't working. But later on, he blamed the high flow inlet alarm test for creating the problem.

The also said the told him he'd been to the UV plant to check it, and nothing was wrong that he could see.

Between 9:06 and 10:41, the I · received seven UV dose alarms. The Team Leader received four.

Around 11:40am

The finished work and went home.

12:10

The s::can instrument shows there was a recorded spike in Total Suspended Solids (TSS), signalling a carryover of the sludge blanket from Clarifier 1. There was no alarm in place for this event at the time. This marks the start of the incident.

13:00

An officer from GWRC saw a discharge plume from the plant's outfall at Rukutane Point. The weather was warm, almost calm, with a light easterly wind.

Around 13:30

The wind had changed to a south-west breeze and the plume started moving towards Titahi Bay. A GWRC Environmental Protection Duty Officer started contacting Wellington Water's after-hours numbers and left a message for the . She had problems with the contact numbers for PCC.

Around 14:00

The returned to the plant after he spoke to the GWRC officer. He says didn't receive a carryover alarm, which in reality is the same low UV dose alarm. The alarm log verifies that multiple alarms were sent to his phone.

He looked at the discharge point to confirm the discharge was occurring.

The phoned the and told him about the carryover. The told the . to increase the RAS flow from Clarifier 1 (see attachment 4).

The . arrived on site and saw that the second pump on RAS pump station #1 wasn't running, so he ran it manually.

The . fixed the manual flywheel to the penstock with clamps and opened the penstock to allow flow into Clarifier 2, reducing the loading to Clarifier 1 and stopping the carryover.

The went to the aeration basin to check on the sliding gates that control the flow from the aeration basin to the Splitter that connects to Clarifiers 1 and 2. Around eight to ten of the twelve gates were open. He closed them to direct the flow to Clarifier 3.

RAS pump station #2 (for Clarifier 2) was shut down.

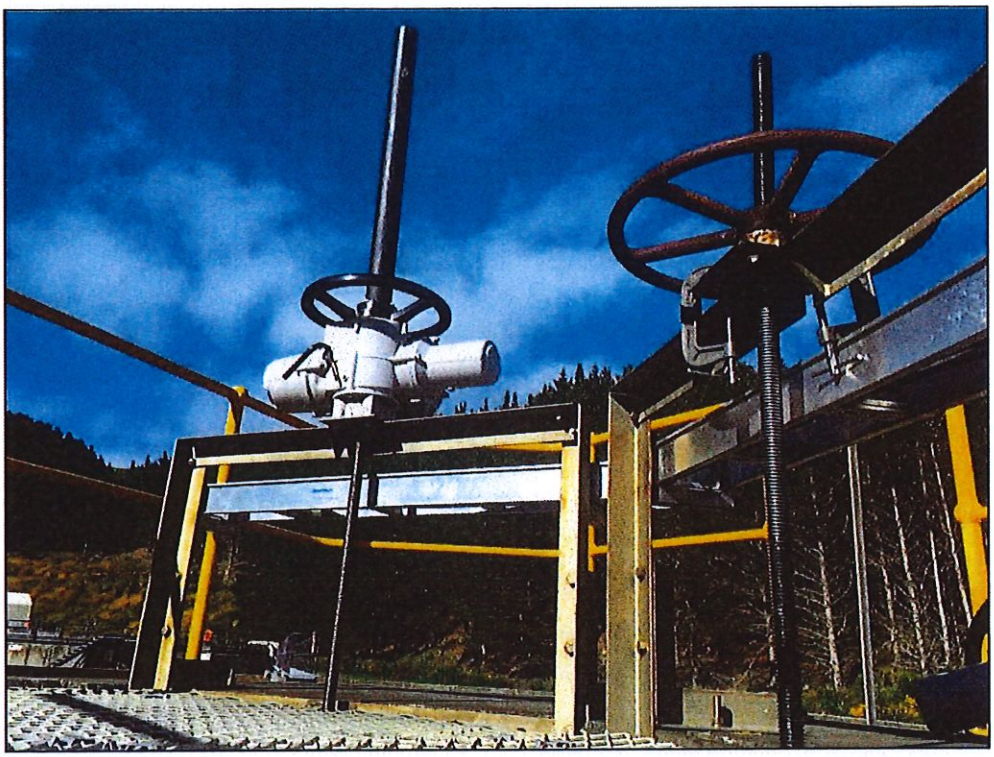

Figure 6: (L) Rotork-fitted penstock; (R) manual penstock attached to support frame with clamps.

14:20

PCC's Contact Centre sent an email notifying the carryover to selected personnel, including GWRC, and Wellington Water staff. Some of the contact addresses weren't correct.

Around 15:00

RAS pump station #3 (for Clarifier 3) was set to the maximum flow rate.

The s::can meter by the UV plant started recording low TSS, confirming the plant effluent was back to normal operation and resource consent conditions.

Around 15:30

The RAS pump station flow rates were further adjusted.

Around 16:00

All RAS pump stations were re-set at a higher rate than Friday's. The balance between the RAS pump stations was set to 36:24:40 for Clarifiers 1, 2 and 3 respectively. The total RAS pumping rate was increased to 200% of influent flow for the afternoon to reduce the sludge blankets in the clarifiers. Excess sludge was sent to the aeration basin.

The [redacted] went down to the beach and erected signs warning the public about the potential risk to their health.

Around 20:45

The RAS pump station flow rates were adjusted for the night. No further issues with high TSS were noted.

Sunday 7th October 2018

Morning

The recorded the sludge levels for Clarifiers 1, 2 and 3.

- Clarifier 1 = 2.2 metres
- Clarifier 2 = 2.0 metres
- Clarifier 3 = 1.9 metres.

The met the and at the plant.

They conducted tests on the UV plant. They checked the electrical parts but didn't find any faults. They conducted tests on both UV sensors and installed the spare one to check whether it was a fault with the instrument, but got no readings except 'Low UV light.'

The installed a new alarm from the s::can meter to notify the DUTY about high TSS in the UV channel.

The and the continued to receive UV low dose alarms until Monday morning.

4. Analysis

Several factors contributed to the incident.

They fall into three areas, and are noted next to each sub-heading. They are:

- **M**achinery/plant/equipment
- **S**ystems and processes
- **P**ersonnel.

UV plant alarms

M S P

The UV treatment plant is the final treatment process before the effluent leaves the plant and discharges into the sea. When the UV sensor probes didn't register the UV intensity and its dose, the system did what it was designed to do – it sent out alarms on Friday night.

The alarm log shows the did not acknowledge the alarms on Friday night. The acknowledged the escalated alarms but not investigate further that night.

Reliance on one alarm

M S

There was only one alarm set for the UV plant. It was based on low UV intensity, and indicated a low UV dose either from fouling on the lamps or poor-quality water.

Another alarm was added as a separate indicator on Sunday 7th October. Now, the recently installed s::can system will send an alarm if the TSS goes high, which provides more information about the cleanliness of the water. If that alarm goes off, it means the problem is almost certainly a sludge carryover.

Large number of alarms unacknowledged

S P

Over Friday evening and Saturday multiple alarms were sent about the low UV dose. Had the cause of the alarms been investigated, the carryover sludge entering the UV plant would have been quickly discovered and corrected, rather than having members of the public report the event.

Recommendation: Wellington Water to design and put processes in place that state required staff actions when high-priority plant alarms occur.

The says he did not receive any alarms

M P

The claimed he didn't receive any alarm texts on his phone over Friday or Saturday. He said that when an officer from GWRC phoned him about the carryover on Saturday afternoon, he checked his phone to see if he had received an overflow alarm, but hadn't.

Recommendation: Investigators to confirm (or otherwise) receipt of alarms with the DUTY OPERATOR.

Cleaning the UV lamps

S P

Attachment 2 shows the UV intensity started to drop around 20:00 on Friday. The first of the alarms (where the reading dropped below 40 milliwatts) started at 22:45.

Complete loss of UV intensity was recorded at 03:00 on Saturday, and continued until Monday morning. On the balance of probabilities, it seems this was because of an electrical sensor issue, rather than actual cleanliness of the UV lamps themselves.

According to the trends that weekend, there was a 12-minute UV bypass late on Saturday afternoon, after the incident. There weren't any bypasses on Saturday or Sunday morning, and there should have been if the UV plant was being properly cleaned. Having said that, the plant did not have a standardised process for cleaning the lamps (see attachment 7).

Recommendation: Wellington Water to develop for cleaning the UV plant, including a troubleshooting guide.

What made the UV sensors fail in the first place?

S P

The attempted overflow alarm test could theoretically have caused the UV sensors to foul in the first place, creating a delayed response to the incident – if the sensors weren't cleaned afterwards. Requesting 1,100 L/s flow is not best practice, as it creates an increased risk of a bypass, if not an overflow, happening. Records show at least 900 L/s (a brief spike lasting less than 10 minutes) was sent to the plant around this time, but did not appear to bypass the aeration basin. The data shows that the sensor alarms did not alarm until after 23:00, so it appears unlikely the spike at 16:00 had an impact on the sensor's quality.

The and said the test shouldn't have been done, as it isn't best practice to create an untreated wastewater overflow. However, there aren't any processes explaining how this alarm should be calibrated or tested.

However, investigators could not confirm the cause of the failing UV sensors.

Recommendation: 1) Wellington Water to decide the best method for calibrating the inlet sensor alarm.

2) Refer to later recommendation for 'RMA awareness.'

Isolating the penstock to Clarifier 2

S P

Attachment 1 does not show any change in RAS pump station settings associated with the Rotork removal on Friday.

The and removed the Rotork to the Splitter, isolating Clarifier 2. But it appears, on the balance of probabilities, the did not change the RAS pump settings and adjust the flow to compensate for the out-of-action clarifier. He only closed two to four aeration basin gates, causing Clarifier 1's sludge blanket to eventually overflow.

Recommendation: Wellington Water to develop processes for taking a clarifier offline.

The plant's logbook

S P

The plant keeps a logbook, an A4 diary, in the Control Room (see attachment 5). It's used by the staff, to write down what happened that day. There doesn't appear to be any guidance for what sort of information should be recorded.

The logbook should be a valuable source of information about parts of the plant that have problems. It can also be a valuable reference source.

The wrote down the sludge blanket levels on the clarifiers on Friday and Saturday. But the made no mention about the significance of Clarifier 1's readings increasing from 1.1 metres to 2.6 metres overnight.

Recommendation: 1) Wellington Water to develop advice for what information is significant enough for all staff to write in the logbook. 2) Logbook to become electronic and visible by Head Office.

Resource Management Act awareness

S P

The and have worked at the plant since Wellington Water took over operations four years ago. They received RMA (Resource Management Act 1991) training then, but there hasn't been any follow-up or refresher training. Other staff at the plant haven't received any RMA training.

Recommendation: Head Office staff to conduct more RMA training with the plant staff.

Confusion over notifying authorities about the incident

S

Incidents like this must be notified to certain personnel within Wellington Water, and to the following agencies:

- Regional Public Health (in this case, the Hutt Valley District Health Board, or 'HVDHB')

- GWRC
- PCC
- Interested parties as identified in the notification process.

The PCC Contact Centre raised an automated notice and sent it out, but some of the contact details were out of date. Wellington Water's . and . also followed up with emails to individual people at HVDHB and PCC.

Post-incident, at a meeting of Wellington Water staff, plus representatives from HVDHB, GWRC and PCC, they discussed the following issues:

- the Interested Parties list was out of date
- more information was needed about how call centres deal with calls from members of the public
- the section on erecting warning signs needs to be updated.

Recommendation: the notification procedure should be updated.

Work climate and communication issues

S P

There is a lack of written procedures at the site that define best practice and list the steps staff need to take to perform certain tasks safely, to a high standard and without affecting the environment.

Critical tasks need to be identified and processes designed for them, using worker input.

Poor communication is a key factor leading to the incident. On another day, this could just as easily lead to a serious accident or even a fatality. Good communication between all staff in a wastewater treatment plant, with its inherent health, safety and environmental risks, is essential.

While the introduction of written processes will help reduce confusion, it is essential that the culture at the plant improves so all employees can work in a pleasant, trusting and safe atmosphere.

Recommendation: 1) develop the necessary processes for the jobs required at the plant. 2) Engage a specialist to look into improving the workplace culture at the plant. Consider improved communication strategies; what sort of management style best suits the staff, etc. An Organisational Psychologist is to assist.

5. Effects on the environment

The carryover contained concentrations of partially-treated wastewater that discharged into the marine environment.

The plant operates under consent WGN950083 [3805], which allows for the discharge of treated wastewater to the coastal marine area. The consent also contains conditions for abnormal operation, such as bypass or overflow of partially-treated wastewater and plant malfunction.

This carryover is categorised as a plant malfunction, because Clarifier 1 did not perform their normal function of containing the sludge blanket.

Relevant consent conditions

The plant effluent monitoring appears to comply with condition 11(a) *Biochemical Oxygen Demand and Suspended Solids Concentrations*. Flow proportionate composite sample results were only slightly elevated over 6-7 October, which are lower than expected, but may reflect the short duration of the carryover - three hours of the 24-hour period.

A grab sample taken by GRWC staff during the discharge is provided in attachment 8 and shows faecal coliforms measuring 42,000 cfu/100 ml at the Rukutane Point outfall.

Visual observations and photographs taken on the day of the incident show that conditions 13 (a) and 13(b) were clearly breached. Condition 13 relates to effects on the receiving environment beyond a 200 metre radius (the mixing zone) of the Rukutane Point outfall. There was clearly a visible plume of suspended solids, which resulted in a conspicuous change in the colour of the water.

Condition 4 requires the design and maintenance of any works relating to the exercise of the consent to be of a standard adequate to meet the conditions of the consent. As condition 13 was not met, this condition was not met.

Condition 15 requires monitoring at 24, 72 and 144 hours after the discharge. Those monitoring results are included in attachment 9. They do not show any significant change in microbiological water quality resulting from the discharge. That monitoring indicates the microbiological effects of the discharge were localised and of short duration.

Condition 21 requires GWRC and Public Health Service (at the HVDHB) to be notified immediately in the event of a plant malfunction. As discussed elsewhere, that condition was only partially complied with, due to notification process issues on the day. Formal notifications were sent on Monday 8th October (see attachment 10).

Health warning signs were erected at Titahi Bay beach soon after the carryover was identified and stopped. Tests conducted of the seawater 24 hours after the carryover recorded no significant deterioration of recreational swimming quality, measured in terms of public health effect (see attachment 12).

Visual observations from the next day suggest no long-term effect, as the suspended solids had dispersed.

6. Recommendations and actions

The primary cause of this incident was human error. One of the three clarifier tanks was taken out of service for some upgrade work and the appropriate process adjustments were not made to compensate.

A number of other factors contributed to the incident, including:

- a failure to, plus lack of process for, properly taking a clarifier offline
- the UV alarms indicating 'no dose' were only responded to intermittently
- inaccurate diagnosis of the UV plant fault
- relying on only one alarm to indicate a sludge carryover
- communication issues among staff.

Recommendations to prevent a recurrence have been analysed and are detailed in the table overleaf. Most of these actions have been instigated since the initial investigation and several have been completed. The status of the recommendation as at 15 November 2018 is also summarised.

Issue	Recommendation or solution	Status
1. Reliance on one alarm to indicate sludge carryover (UV)	Install an alarm on the UV spectrum analyser to notify the of a sludge blanket carryover entering the UV plant.	COMPLETED
2. Unacknowledged alarms	Design, develop and implement processes that specify what action is expected from staff when high priority plant alarms occur.	In progress
3. . says he didn't receive the alarms	Investigators to confirm receipt (or otherwise) of alarms with the	In progress
4. Cleaning the UV lamps	Design, develop and implement processes for cleaning the UV plant, including a troubleshooting guide.	In progress
5. Lack of clear process for taking a clarifier offline	Develop a process for taking a clarifier offline.	COMPLETED
6. Inlet overflow alarm test too risky	Design, develop and implement a process for calibrating the inlet sensor alarm that doesn't generate a bypass risk.	In progress
7. Lack of site-wide processes	A contractor has been engaged to develop processes for the site.	In progress, several high-priority procedures have been completed.
8. Plant logbook	Guidance to be developed on what should be entered in the logbook and by whom. Electronic forms to be initiated for remote process monitoring.	COMPLETED

Issue	Recommendation or solution	Status
9. Some staff were not trained in Resource Management Act awareness; other staff had not undergone refresher training	Resource Management Act training for staff at the plant, including the specific consent conditions that the plant operates under.	In progress. Initial training completed; further training on plant-specific consent conditions to be conducted.
10. Wellington Water's notification process was out of date	Update the communication process for event notification.	COMPLETED
11. Staff culture	We have engaged an external party, skilled in workplace dynamics - to interview the team as individuals and as a group. He will provide advice to Wellington Water on how to progress with improvements.	In progress
12. Post-incident	Public relations with local residents to socialise investigation results/provide assurance	In progress. Apology issued on social media. Community Liaison Group meeting held. Further actions being considered following completion of internal investigation.
	Discuss report and recommendations with GWRC and PCC.	COMPLETED

7. Glossary

Word or phrase	Explanation
Aeration basin	The concrete tank containing the mixed liquor used in the extended aeration activated sludge process.
Balance of probabilities	Where facts are to be shown that they are more likely to have occurred than not. Known as the 'civil standard of proof.
Bush	A type of bearing designed to reduce friction and wear inside a hole.
Bypass	An alternative route around a treatment process.
Carryover	The state when a clarifier's sludge blanket is not contained within the tank and spills over to the effluent launders
Clarifier	A settling tank used in the activated sludge treatment process to separate the mixed liquor into activated sludge underflow and clarified effluent overflow.
Effluent	The wastewater leaving a treatment plant.
Influent	The wastewater entering a treatment plant.
Milliscreens	Stainless steel drum screens that sieve large and inorganic particles from the influent wastewater.
RAS pump	Pumps that convey the activated sludge settled in the clarifiers back to the aeration basin.
Rotork	A brand of actuator.
Sludge	Settled solids from a suspended growth wastewater treatment process.
Sludge blanket	The level of sludge in a clarifier, typically measured from the bottom of the concrete floor and halfway between the centre of the clarifier and the wall of the clarifier.
Total Suspended Solids (TSS)	A laboratory measurement of solids that are in suspension but not including dissolved solids.
UV plant	Ultra-violet disinfection equipment, comprising lamps that target the 254nm wave length to deactivate microbiological contaminants.
Valve actuator	An electrical or pneumatically powered mechanism to allow remote operation of a valve or penstock.
s::can	A brand of spectrophotometer which is used in water and wastewater monitoring. It measures the intensity of light absorbed after is passes through a solution.

8. List of attachments

Number	Description
1	Discharge volume calculation
2	Porirua WWTP process
3	Location of Porirua WWTP outfall and shoreline monitoring sites
4	Inlet and RAS pump station flows 5-6 October 2018 with commentary
5	Log of Porirua Wastewater Treatment Plant alarms 5-7 October 2018
6	Porirua Wastewater Treatment Plant logbook (extract)
7	UV channel data 5-6 October 2018
8	GWRC sample analysis 6.10.18
9	Eurofins ELS Ltd Analytical Report Interim
10	Contact Centre email notification of incident