Omaha Wastewater Treatment Plant
Irrigation Bypass Incident Report

Final - August 2022

Watercare
An Auckland Council Organisation

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1 INTRODUCTION

1.1 Background

In July 2022, following a period of sustained rainfall, Watercare had to partially bypass the final treatment stage of its Omaha Wastewater Treatment Plant, discharging to stormwater rather than irrigation. Watercare had to partially bypass this final stage to protect the integrity of the site's storage dam.

1.2 Location and Site Description

The Omaha Wastewater Treatment Plant is on Jones Road, on the western side of the Whangateau Harbour (Figure 1). This treatment plant services the townships of Omaha, Point Wells and Matakana.

The treatment plant has resource consents that enable the discharge of treated effluent via irrigation. Per these consents, Watercare can irrigate to a nearby forestry block (DIS60050490) and onto the Omaha Golf Course (DIS60050606).

The treatment process comprises the following steps:

- Preliminary treatment for coarse material removal
    - Intake Screen
- Secondary treatment for nutrient removal
    - Aerated lagoon
    - Oxidation pond
- Tertiary treatment for additional pathogen removal and polishing to remove fine sediment
    - Storage dam
    - Low-rate sand filters
    - Ultraviolet light (UV) disinfection
- Discharge via drip irrigation

During the July incident, Watercare bypassed the sand filters and UV treatment for some of the water in the storage dam, and discharged this directly to stormwater, while continuing to irrigate as much fully treated wastewater as possible. The bypassed discharge had gone through screening and the nutrient removal process, but not the sand filter or UV. The bypass discharge thus comprised secondary-treated wastewater, rather than tertiary treated wastewater.

1.3 Scope

This report is a summary of the bypass event, focussing on the environmental consequences of the incident. As such, this report includes:

- A description of the incident
- Monitoring results
- An assessment of the possible environmental effects
- Watercare's response

Figure 1 Overview of the Omaha wastewater treatment plant catchment

2 BYPASS INCIDENT

2.1 Lead-up

In July 2022, the Auckland region received twice normal monthly rainfall, with a series of heavy rain events through the middle of the month. While there had been greater individual rain events through the year, in July the rain was heavy and sustained (Figure 2a). As shown in Figure 2b, Omaha received more rain in July than any month in the last five years. Across Auckland, it was the second highest July rainfall on record.

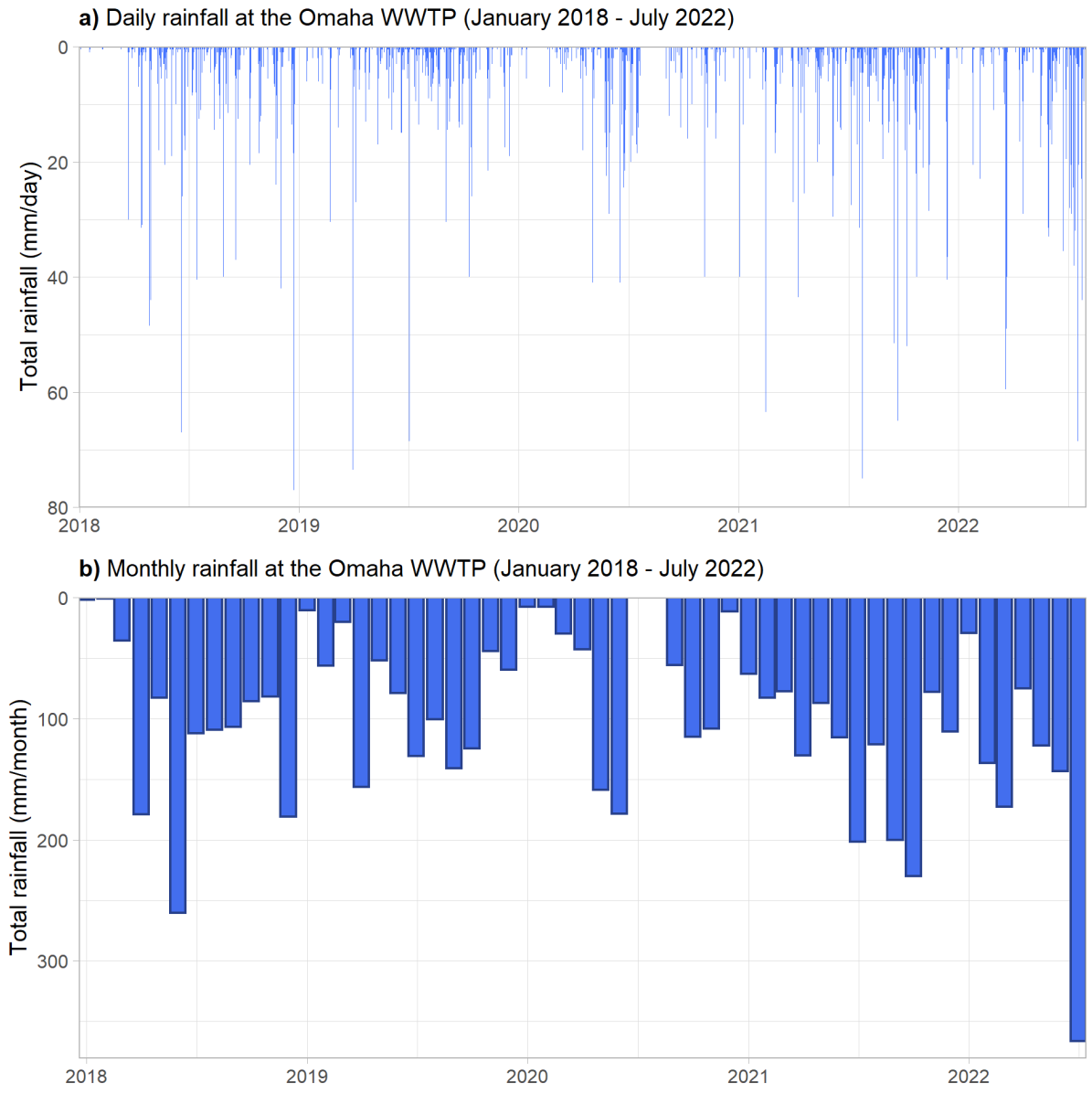

Figure 2 Rainfall data for Omaha at a) daily and b) monthly resolution

The sustained rainfall caused an increase in influent to the treatment plant (Figure 3a). Again, while influent spikes occur year-round, the duration of the spikes are normally over shorter timeframes than observed in July 2022.

The consent permits up to 2,200 m^3 per day to the forestry block and 2,100 m^3/day to the golf course area, rates higher than the influent volumes of July 2022. However, the actual throughput of the system is lower than the consent permits, and discharge rates are lower again when soils are at or near saturation, as occurred in July and August 2022. Particularly since mid-2018, flows out of the treatment plant have typically been 500-600 m^3/day, much less than comes into the treatment plant during wet weather (Figure 3b).

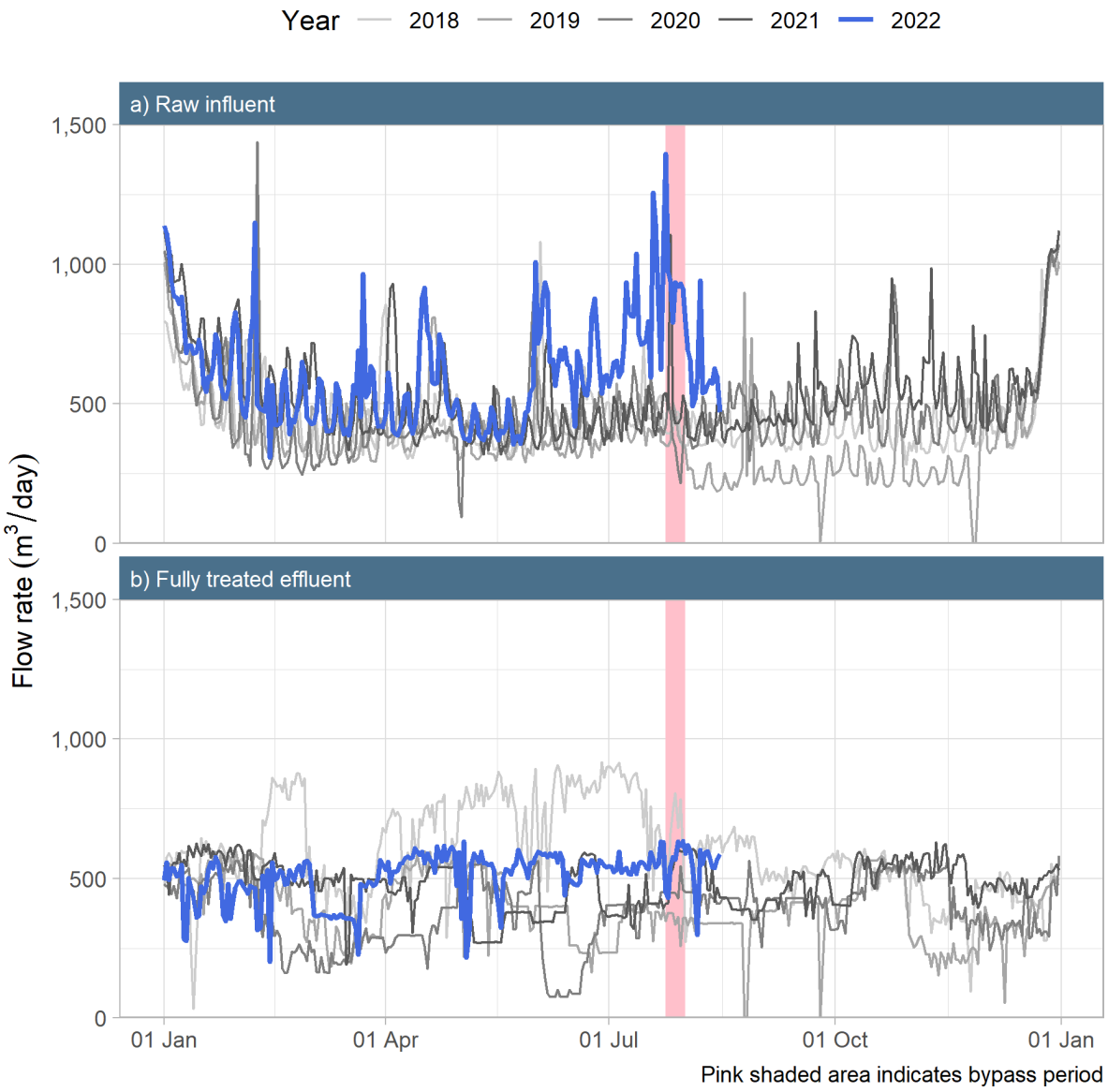

Figure 3 Flow rates of a) influent and b) effluent through the Omaha WWTP

The purpose of the storage dam is to provide a buffer for when the output is less than the input. However, through early July, levels in the dam started to rise on a trajectory that risked dam integrity unless Watercare took preventative actions (Figure 4). High levels significantly increased the risks of dam instability, and potentially an uncontrolled discharge of the stored effluent in the event of overtopping.

To protect the dam, Watercare pumped from the storage dam to stormwater, which was the only practicable option available. The volumes were too high to truck to another site, there were no other storage options, and irrigation rates were already at their practical maximum.

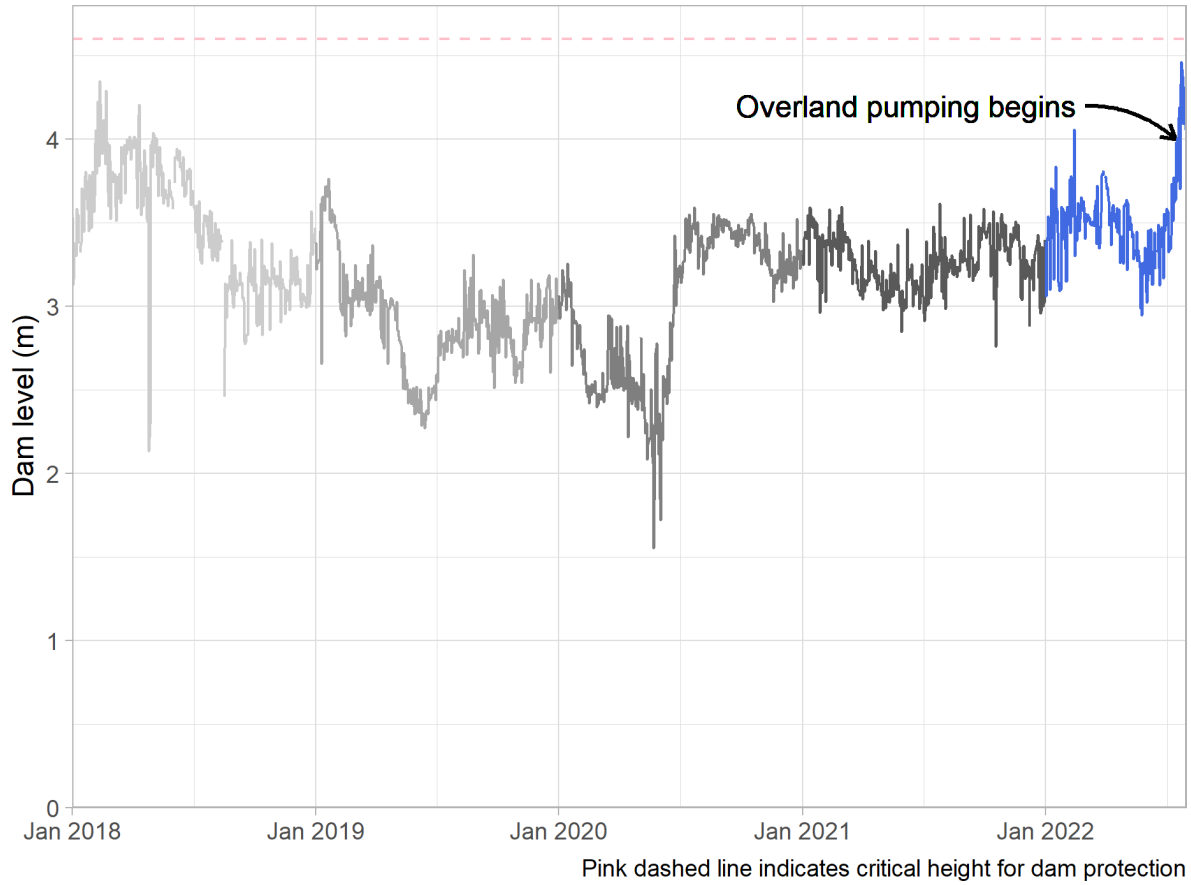

Figure 4 Average daily height of the Omaha storage dam from January 2018 to July 2022 (inclusive)

2.2 Incident

2.2.1 Duration and volume

Watercare commenced pumping at approximately 6 pm on Sunday 24 July 2022 and ceased pumping at approximately 10 am on Monday 1 August 2022. Influent volumes decreased towards the end of the pumping period, but weather models forecast heavy rain on 30 July – 1 August, Watercare elected to continue pumping as a precautionary measure. When the forecast rain did not arrive, Watercare ceased the bypass.

The pumping rate was 50 m^3/hour, equivalent to 1,200 m^3/day. The estimated total was 9,200 m^3. This volume is in addition to the 5,045 m^3 irrigated to land as shown in Figure 3b.

2.2.2 Location

To control the level of water in the dam, Watercare pumped secondary treated effluent from the storage dam to an engineered stormwater ditch. These ditches had flow throughout the bypass period (refer Section 3.1 for photographic evidence).

Figure 5 shows the discharge location and stormwater path. The ultimate receiving environment was the Omaha River, north of the treatment plant. Discharges did not go direct to the inner Whangateau Harbour nor to Omaha Beach.

2.3 Environmental monitoring

To determine the environmental effects of the discharge to stormwater, Watercare took routine samples from the dam (SL1) and two downstream locations (SL3 = near-field and SL4 = far-field).

Watercare also took a baseline sample near the point of discharge prior to pumping start on 24 July 2022. Figure 5 shows the sampling locations.

In general, the sample analytes were ammoniacal nitrogen, biochemical oxygen demand, nitrate, total suspended solids, *Escherichia coli*, and, on Auckland Council request, faecal coliforms. Table 1 lists the analytical schedule.

Table 1 Sampling schedule during the bypass incident

Date	Sites	Parameters
24 July 2022	SL2 (Upstream)	All except faecal coliforms
25 July 2022	SL1 and SL3	All except faecal coliforms
26 July 2022	SL1 and SL3	SL1 = Nitrogen species only SL3 = All except faecal coliforms
28 July 2022	SL1, SL3, and SL4	All
29 July 2022	SL1, SL3, and SL4	All
1 August 2022	SL1, SL3, and SL4	All

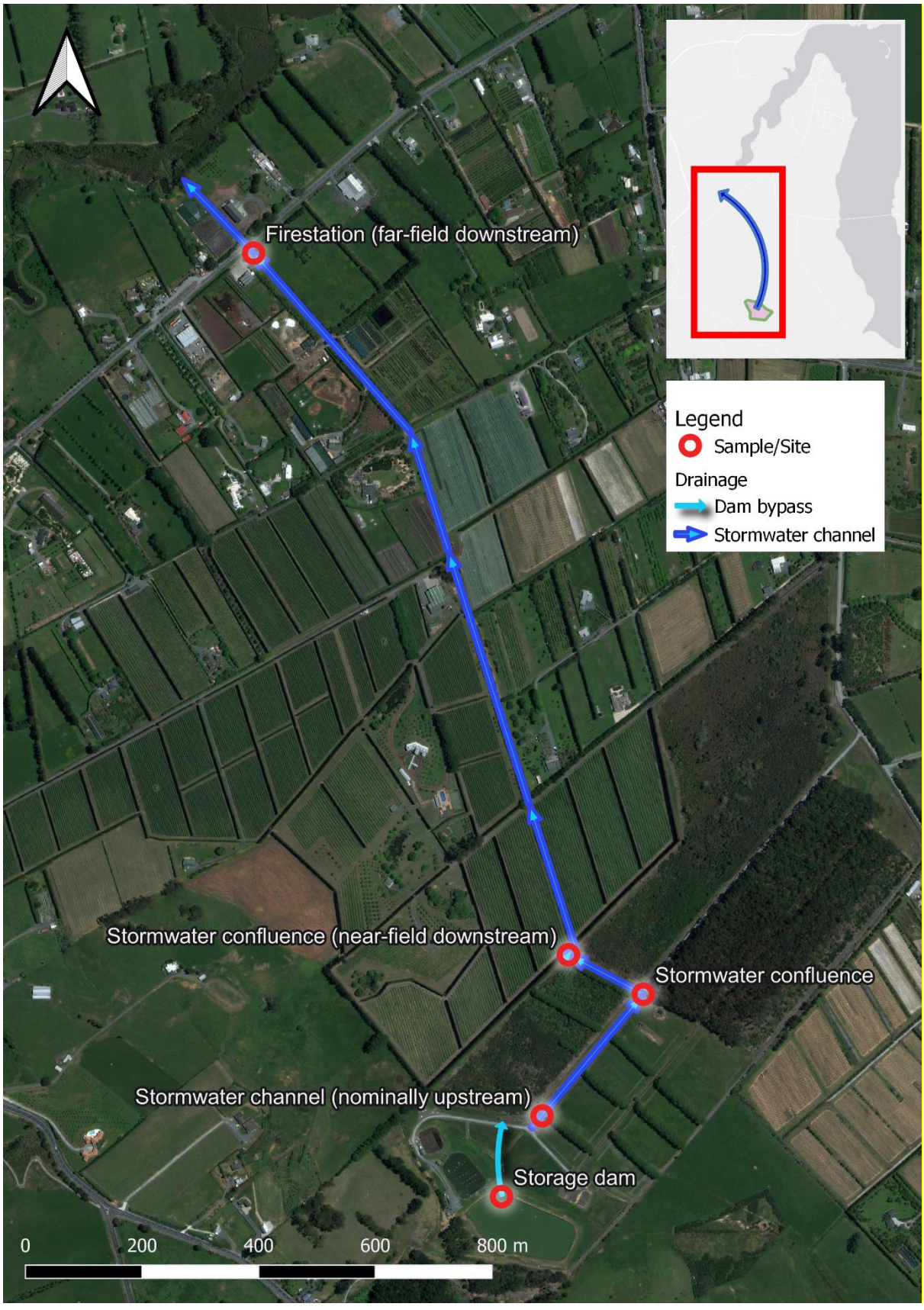

Figure 5 Secondary discharge location, stormwater path and sampling locations

3 ASSESSMENT OF EFFECTS

3.1 Physical effects

Photos taken on 26 July indicate that the discharge was clear, relative to the receiving stormwater. As Figure 6a shows, the channel that Watercare pumped to was clearer than the water it joined, having reasonable clarity (Figure 6b). The clarity of water at the near-field confluence was poorer again (Figure 6c).

The results indicate the catchment run-off and associated sediment loss are significant sources of stormwater in the immediate receiving environment. Such results are typical for semi-rural catchments across New Zealand after sustained rainfall.

a) Confluence between discharge and near field sampling point (looking southwest)

b) Pumped flow to stormwater above confluence

c) Near-field confluence looking southwest

Figure 6 Photos of the discharge to stormwater and the immediate receiving environment. Arrows indicate direction of bypass discharge

3.2 Water quality

3.2.1 Guidance

To put the results of water quality sampling into ecological context, the assessment used derived from three sources, as detailed in Table 2. These guidelines are deliberately conservative in accordance with precautionary principles, being designed for natural freshwaters not stormwater.

Table 2 Water guidelines for environmental context

Parameter	Guideline	Value	Justification
Biochemical oxygen demand	MfE (1992)[1]	2 g O2/m^3	Limit to prevent sewage fungus growth
Ammoniacal nitrogen	NPS-FM[2]	0.40 g N/m^3	Maximum – national bottom line
Nitrate		3.5 g N/m^3	95%ile national bottom line
Total suspended solids	McBride & Quinn (1993)[3]	4 g/m^3	No observable effects limit for macro invertebrates exposed to particulate organic matter
Escherichia coli	NPS-FM	540 E. coli /100 mL	95th percentile for Grade A class waters
Faecal coliforms	None cited	-	*Escherichia coli are* a subset.

3.2.2 Results

Figure 7 presents water quality monitoring results through the period of stormwater discharge. These results indicate:

- Biochemical oxygen demand
    - With a single exception, there was sufficient dilution and attenuation of biochemical oxygen demand at the near field site.
    - Biochemical oxygen demand concentrations were consistently low at the far-field site.
    - The results for the last sample (1 August) are anomalous. While a laboratory error is possible (e.g., mis-coded results between the dam and downstream), no similar anomalies presented for any other parameter.
- Nitrogen species
    - Concentrations of both ammoniacal nitrogen and nitrate were consistently higher in the dam than in the receiving environment.
    - The increases in both nitrogen species over time are likely a reflection of less dilution as heavy rain events transitioned to lighter showers and run-off volumes decreased.
    - Concentrations of ammoniacal nitrogen were above the NPS-FM bottom line for ammoniacal nitrogen, but less than two-fold dilution in the Omaha River would have been necessary to mitigate any effects.

[1] Ministry for the Environment (1992). Water Quality Guideline No 1 on control of undesirable biological growths in rivers.
[2] National Policy Statement for Freshwater Management 2020
[3] McBride GB & Quinn JM (1993). Quantifying water quality standards in the Regional Management Act. Prepared for Manawatu-Wanganui Regional Council. NIWA Consultancy Report No. MWR038.

- Nitrate concentrations in the receiving environment were consistently below the NPS-FM 95%ile bottom line.

- Total suspended solids
  - On 25 July, total suspended solids concentrations were lower in the dam than in the immediate receiving environment, but the receiving environment improved over time while concentrations in the dam were consistent.
  - Decreasing concentrations over time indicate that run-off was a significant source of suspended solids to the stormwater channels
  - Concentrations of total suspended solids at the far-field site were above the 4 g/m^3 threshold until 1 August but would have further decreased with dilution in the Omaha River (the ultimate receiving environment).
  - The 4 g/m^3 threshold applied in this assessment is for particulate organic matter (such as would come from the treatment plant), which is a subset of total suspended solids as measured in the collected samples.
  - Given run-off was a significant source, and much of the runoff would have been inorganic (soil etc.), it is very unlikely the elevated concentrations caused any environmental harm.
- Bacteria
  - Bacterial counts were high in the dam but decreased with distance.
  - Unlike the results for nitrogen, but like results for total suspended solids, bacterial counts decreased over time in the receiving environment. These declines indicate that run-off was a significant source of bacteria to stormwater and with decreasing run-off, the bacteria load also decreased.
  - *Escherichia coli* levels were consistently below the 95%ile for Class A recreational contact waters at the far-field site, and only above this threshold at the near-field site on the first day of pumping (25 July).

3.3 Conclusions

The results of water quality monitoring indicate that the environmental effects of the bypass were minor. Wet conditions, which triggered the incident, meant there was significant dilution available.

Although the discharge contained elevated concentrations of ammoniacal nitrogen above the NPS-FM national bottom line, the national bottom lines are for the protection of New Zealand's most sensitive aquatic species. Engineered stormwater drains, which can be dry, and designed to capture and concentrate rural run-off, are not expected to support such species.

Since the Omaha River is many orders of magnitude larger than the drain that Watercare discharged to, dilution would have mitigated any residual effects. In conclusion, there is no evidence to indicate that Watercare's discharge would have had any discernible effect, adverse or otherwise, on the natural environment.

Sustained discharges of nutrient rich water via the Omaha River would contribute to eutrophication in the Whangateau Harbour, which is why Watercare preferentially (and by consent) discharges to land. However, the bypass event was a short-term discharge to stormwater. Given the prevailing environmental conditions, being heavy rain and high volumes of catchment runoff, it is unlikely the incident will have any long-term effects on the Omaha River or the Whangateau Harbour.

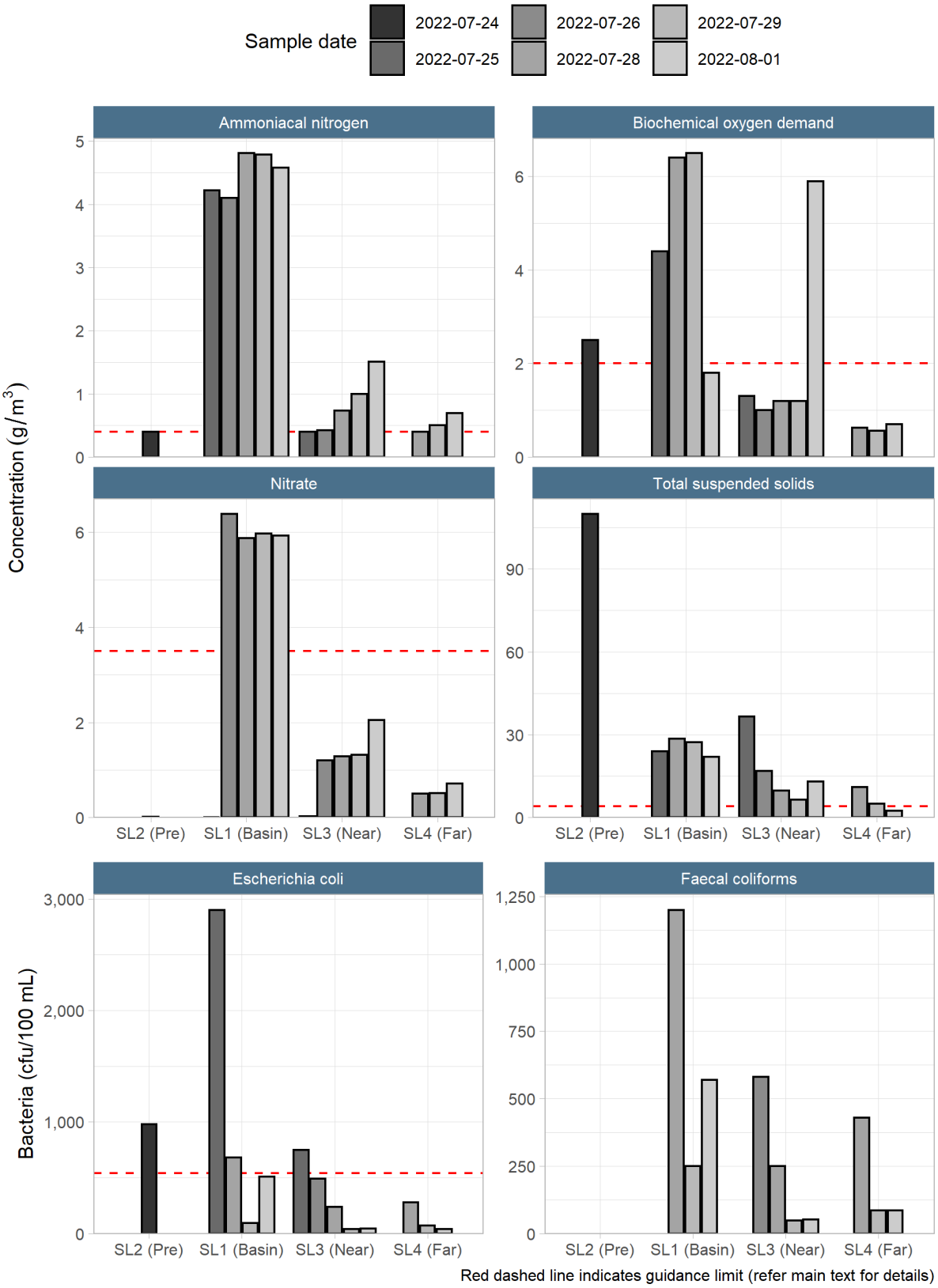

Figure 7 Receiving environment water quality results during the July 2022 bypass incident

4 SUMMARY AND RESPONSE

4.1 Incident Summary

Between 25 July 2022 and 1 August 2022, Watercare had to discharge secondary treated wastewater from its storage basin to stormwater. Watercare had to discharge to stormwater to protect the storage dam from overtopping and increased dam instability risks.

Over the course of the incident, Watercare discharged 9,200 m^3 of secondary treated wastewater. However, there was sufficient dilution in the engineered stormwater channels to mitigate the potential effects of discharging water with elevated concentrations of nitrogen, suspended solids, and bacteria. Consequently, the environmental risks to the Omaha River, which was the ultimate receiving environment, were low throughout the incident.

4.2 Response

The environmental monitoring results indicate the environmental effects of the discharge were localised and very minor. Nonetheless, the incident was a breach of Watercare's resource consent conditions and repeat instances could increase the potential for environmental damage, particularly the risk of eutrophication in the Whangateau Harbour.

The root cause of the event was very heavy rainfall. Although the occurrence such events are out of Watercare's control, an internal review is being undertaken on how the incident was managed and if there are any lessons Watercare can take from it.