Mangawhai CWWTP

Stage 1 Summary Report

Contact Details

Name: Jessica Moser

Opus House, Princes Street
Private Bag 3057, Waikato Mail Centre, Hamilton 3240
New Zealand

Telephone: +64 7 838 9344
Mobile: 027 541 0573

Document Details:

Date: 10/09/2018
Reference: 1-13586.00
Status: Final

Prepared By

Jessica Moser
Graduate Environmental Engineer

Reviewed By

Andrew Springer
Principal Wastewater Treatment Engineer

Approved for Release By

Eros Foschieri
Team Leader – 3 Waters

Contents

1 Executive Summary

As outlined in the Offer of Service for Upgrade of Mangawhai WWTP, 20 June 2018, the technical support that WSP Opus will provide shall be broken into four stages; including Needs Assessment, Develop Solutions, Procurement and Delivery. This approach is based on determining the root cause of existing and future issues and understanding the associated risk in order to prioritise the required upgrades. This report summarises the findings of the Needs Assessment for the upgrade of Mangawhai WWTP and presents the finalised issues, risks and prioritisation. The assessment included an inspection of the plant, review of the influent and effluent data and a Root Cause Workshop. The minutes of meeting from the workshop have been included in Appendix A and provide the basis for this summary report.

2 Issues, Root Causes and Effects

The strategy for identifying the needs of the plant, included evaluating the existing performance data and inspection of the site. In this way, all the information on the existing condition of the plant and its performance could be assessed. To ensure that no issues would be missed, the assessment was conducted in the form of a workshop where all stakeholders could contribute to the identification of issues.

The issues were captured during the workshop held on 31st August and each issue was evaluated for its root cause and its potential effects. The results from the workshop are included in **Appendix 1** of the Minutes of Meeting (**Appendix A**).

3 Risks

The method for prioritisation of the identified issues involved evaluating each issue for its associated likelihood and impact. The key for each ranking is included in **Appendix 2** of the Minutes of Meeting. The table below summarises the risk rating for each issue as was agreed upon during the workshop.

Table 1. Risk Rating for Identified Issues

		Impact (I)				
		VL	L	M	H	VH
Likelihood (L)	VH			**2, 10, 11**		
	H			**4, 13**	**9, 14**	**5, 6, 12**
	M					
	L			**7**		
	VL					

4 Prioritisation

The issues have been listed below in their order of prioritisation from most important to least important as determined by the associated risk of each issue. The issues are labelled according to the number that each issue was recorded under during the Root Cause Workshop.

5 The decanter drives are wearing out and there is a long lead time for these to be replaced. This means that in the event of a drive wearing out, the process would be restricted to one tank for approximately 6 weeks or more while waiting for the replacement drive to arrive to site. The quality of the effluent would be compromised during the time that the plant would run on one tank.

6 The capacity of the existing aeration system is insufficient for consistently meeting the DO setpoint. This issue will continue to get worse as the population in the catchment increases.

12 The existing blowers sometimes run at peak demand. The forecasted continued growth in the catchment will increase the demand on the blowers and result in prolonged periods of peak demand and there is currently no standby blower provided.

9 The odour motor cover has corroded and left the moving machinery unguarded which is a serious safety concern.

14 There has been an increase in flow from the pump station TPS which has resulted in more flow being pumped to the WWTP. This increase exceeds the screen capacity and may also exceed the intermediate pump and transfer pump capacity and result in overspill of effluent.

2 Seasonal settlement problems have been leading to solids loss from the reactor.

10 There have been TDS exceedances recorded in some samples.

11 There is no RAS flow meter and therefore no method to control RAS flow rates if required.

4 There is no control of aeration in the anoxic zone. There is a need to both prevent solids build up in the tank and also establish anoxic conditions for nitrate removal.

13 High flow mode leads to short cycle and poor treatment. These incidences will increase in frequency with the expected 35% growth over the next ten years.

7 There is settlement occurring in the intermediate tank.

5 Conclusion

The needs assessment (Stage 1) has been completed and has resulted in the definition and prioritisation of existing issues with the Mangawhai WWTP as well as issues that are expected to occur within the next 10 years. The next stage of this project is to develop solutions that will meet these needs. The developed solutions will form the basis for supplier enquiry.

Appendix A: Minutes of Root Cause Workshop

Minutes of Meeting

File No:	1-13586.00	**Date**:	31/08/2018	**Time:**	11am-3pm
Subject:	Mangawhai CWWTP				
Location:	KDC Office, Mangawhai			**Minutes by:**	Jessica Moser

	Persons Present	Organisation
1	Brian Armstrong, BA	Kaipara District Council
2	Donnick Mugutso, DM	Kaipara District Council
3	Mark Bell, MB	Kaipara District Council
4	Robin Johnson, RJ	Trility
5	David Ollerton, DO	Trility
6	Andrew Springer, AS	WSP Opus
7	Eros Foschieri, EF	WSP Opus
8	Jessica Moser, JM	WSP Opus

Item	Discussion and Action
1	**Overview** AS presented an overview of the Mangawhai CWWTP which included site layout, flow, performance and growth forecast.
2	**Issues with the WWTP** AS went through each step of the plant methodically to capture the existing issues. The issues were discussed and agreed upon by all present. A summary of the issues which were collated are included in **Appendix 1.**
3	**Root Cause of the Issues** For each issue identified, the group discussed what the root cause for that issue might be as well as the effect of that issue at present and/or in the future (up to 10 years). These causes & effects were agreed upon by all present and listed in **Appendix 1.**
4	**Priority of Issues** Each issue was ranked according to likelihood and impact, a table for each of these factors is included in **Appendix 2** to detail the meaning for each score. The combination of each issues likelihood and impact scores determined where it sits on the risk table. The completed risk table is included in **Appendix 2** and was agreed upon by all present. The risk table was used to prioritise the issues in terms of which should be resolved first, the order of priority is included in **Appendix 2**.
5	**Possible Solutions** Potential solutions were briefly discussed by all present and suggestions are included in **Appendix 3**. The options for solutions will be confirmed at Stage 2 of the project.

Item	Discussion and Action		
6	Confirm site boundary limits **Completed**	MB	7/9/18
7	Confirm pressure of air in main at blower at bottom water level as indicator of change in diffuser performance	RJ	14/9/18
8	Assess sand filter condition and sand quantity by inspection	RJ	14/9/18
9	Replace cover on odour motor	RJ	ASAP
10	Issue workshop report for comment **Completed**	AS	7/9/18
11	Electrical and structural condition assessment by Trility next year.	DO	2019
12	Provide estimate of hours for Stage 2	AS, JM	20/9/18
13	Work up options then have a workshop to agree preferred options	AS, JM	12/10/18
14	Propose procurement strategy	ALL	19/10/18
15	Price options with Trility.	DO, AS	26/10/18
16	Specifications to be produced as needed	AS, JM	TBC
17	Complete specified work	TBC	TBC
	After meeting correspondence		
18	DM in discussion with Curt Martin (KDC) raised another potential issue that may need addressing. The issue relates to the possibility of overflows at the inlet works due to increased peak flows to the treatment plant. Further data analysis is required to understand duration of high flows currently and impact on wet well level at TPS. Growth strategy required for catchment upgrades to predict when increase in flow may occur.		

Appendix 1: Issues with the WWTP

		Likelihood	Impact
1.	Removed from notes as was combined in 4 below.	-	-
2.	**Issue:** Seasonal settlement problems leading to solids loss from reactor **Cause:** Floc loading & variable feed, limited control on RAS, intermediate not buffering adequately **Effect:** Impact on TSS, especially during high flows, but limited by sand filters	VH	M
3.	**Issue:** Inaccessible coarse air valve **Cause:** Valve installed outside handrail **Effect:** Safety is managed by not using the valve	-	-
4.	**Issue:** No control of aeration in anoxic zone, need to prevent solids build up in tank, but want anoxic condition to remove nitrate. **Cause:** Inaccessible manual valve installed outside handrail **Effect:** Safety RISK is managed by not using the valve	H	M
5.	**Issue:** Decanter drives wearing out. Long lead time item that will impact on performance of effluent as restricted to one tank only. **Cause:** 10 years old & running 2 tanks at once **Effect:** Would take ≥6 weeks to replace	H	VH
6.	**Issue:** Aeration capacity not meeting DO set point at times. Predictions indicate will get worse with growth. **Cause:** Design point exceeded due to growth **Effect:** Compliance, particularly ammonia and TN	H	VH
7.	**Issue:** Settlement in intermediate tank **Cause:** Solids settle in flat bottom tank below level of pumps, insufficient scour normally **Effect:** Manually managed (cleaning 3x per year)	L	M
8.	**Issue:** Media in sand filters unknown **Cause:** Has not been inspected since commissioning **Effect:** Not a compliance issue currently	?	?
9.	**Issue:** Motor cover corroded **Cause:** Some H_2S leakage at odour control **Effect:** Serious risk of Harm	H	H
10.	**Issue:** TDS exceedance of average standard in some samples **Cause:** More concentrated wastewater in summer **Effect:** Not within our reasonable control	VH	M
11.	**Issue:** No RAS flow meter so unable to control RAS flow rates if required **Cause:** Not included in design **Effect:** No control of RAS may impact on denitrification and sludge settlement	VH	M
12.	**Issue:** Blowers at peak demand at times. Growth will increase demand and require longer operation in this condition. No standby provided. **Cause:** Increase due to load growth, **Effect:** Possible blower failure will lead to non-compliance	H	VH

13.	**Issue:** High flow mode leads to short cycle and poor treatment. Will increase in frequency with expected 35% growth over 10 years. **Cause:** Increase flow exceeds threshold for high flow mode operation **Effect:** Resulting in short cycles at times of high summer loading.		H	M
14.	**Issue:** Increase in flow at TPS requires more flow to be pumped to WWTP. Increase exceeds screen capacity and may exceed intermediate pump and transfer pump capacity. Current peak daily flow at 1600 m3/d, but instant flow at 5500 m3 equivalent. **Cause:** Increase in flow from catchment growth at peak times. **Effect:** Resulting in higher instantaneous flows to treatment, potentially overloading systems and may result in overspill of effluent.		H	H

Appendix 2: Priority of Issues

Key for Likelihood Ranking

	Time	Descriptive	Frequency
VH	< 1 Year	Almost Certain	Nearly Continuous
H	1-5 Year	Likely	Common
M	5-10 Year	Probable	Occasional
L	10-20 Year	Unlikely	Infrequent
VL	>20 year	Rare	Rare

Key for Impact Ranking

	IMPACT				
	VL	**L**	**M**	**H**	**VH**
Safety	Injury not needing medical treatment	Injury Needing Medical Treatment, No lost time	Injury Off Work < 5 Days	Permanent Injury, Off Work > 5 Days, Health Issue	Fatality, Permanent Disability
Pollution	Event with potential occurs, but No impact	Cat 4, Local Impact, short duration, include discharge to ground	Cat 3 Short duration Impact, local effect only. Visual Impact	Cat 2 Substantial Impact- including downstream water extraction and use	Cat 1 Fish Kill, impact on downstream water extraction and use
Consent Compliance	No Impact	Sample Exceeds Operational Action Limit	Sample exceeds annual average	Sample Exceeds 90%ile	Consent Condition or Standard Breached
Customer/Community Nuisance	Occasional Nuisance, no complaints	Regular Nuisance, single property	Regular Affecting multiple customers	Widespread Nuisance Local Action Group	Enforcement Action
PR	No Impact	Local Complaint	Social Media Coverage	Local Media Coverage	National media Coverage
Microbial Impact on Water Use	No Impact	Recreational standard of 260 E coli/100ml exceeded < 1 day	Recreational Standard exceeded 1-2 days, can be managed	Recreational Standard Exceeded > 3 days, temporary food restriction	Long term unfit for recreation, food source contamination
Impact on Water Source	No Impact		Irrigation restricted	Water supply restricted take or additional treatment required	Water Supply shut down > 1 day
Irrigation Impacts	No Impact		Exceedance requires storage and Blending	Exceedance of Short term loading rates, within annual average	Pollution impacting on water supply/ exceed annual loading

Risk Table

		Impact (I)				
		VL	L	M	H	VH
Likelihood (L)	VH			**2, 10, 11**		
	H			**4, 13**	**9, 14**	**5, 6, 12**
	M					
	L			**7**		
	VL					

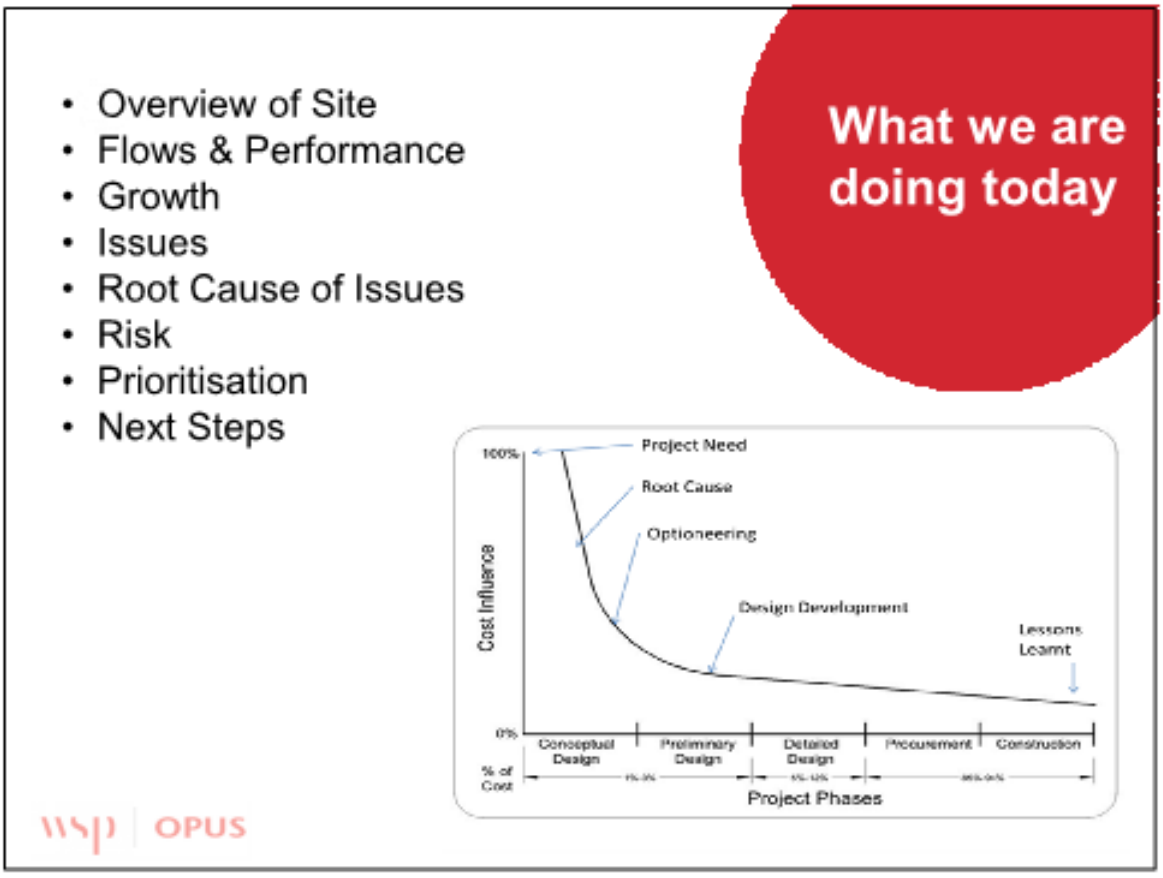
Order of priority: **5, 6, 12, 9, 14, 2, 10, 11, 4, 13, 7**

Appendix 3: Possible Solutions

A short review to identify potentially simple solutions was undertaken. The following will be considered in options. Other options may be considered.

2 & 11	RAS Flow Meter and RAS control to zone linked to SCADA
3 & 4	Automate valves to anoxic and move within reach
5	Buy spare drive as shelf spare
	Post Meeting Note: RJ is seeking pricing for decanter drive spare and will feedback to group once quote and lead time is known
6 & 12	Aeration design to be reviewed and upgraded/ flow balancing
7	Air mix or drain
8	Assess condition of sand filters. Remediate as needed
	Post Meeting Note: Trility will undertake this inspection and report back on the condition by the end of September
9	Replace cover for motor ASAP
	Post Meeting Note: The area has been barricaded off and the new cover has been ordered as well as an additional spare. To be installed as soon as delivery to site is achieved.
10	Do nothing- reverse osmosis not viable cost
13	Balance tank/ screen upgrade or TPS storage

Appendix 4: Workshop Slides



Flow Consent Conditions

Untreated Wastewater Quantity

1 Prior to being discharged to land, all wastewater shall be treated within a wastewater treatment plant located on Lot 1 DP 153155 PT Lot 3 DP 108638 Allot 369 Mangawhai Psh Blk II Mangawhai SD SUBJ TO EASE-RES, at or about location co-ordinates 1743192E 6005357N.

This wastewater treatment plant shall include a granular filtration system and disinfection system. The granular filtration system shall be designed to remove helminths. For the purpose of these consents, disinfection is defined as the use of a process designed specifically to reduce the number of viable, potentially infectious, micro-organisms in the wastewater.

2 The quantity of wastewater received at the treatment plant shall not exceed 5,500 cubic metres in any 24 hour period, as measured between 9.00 a.m. on one day and 9.00 a.m. on the following day. For compliance purposes, this condition shall be monitored in accordance with Schedule 1 (**attached**).

3 A meter with accuracy of ±5% shall be installed and maintained on the inlet to the wastewater treatment plant. The meter shall be used to measure the volume of wastewater entering the wastewater treatment plant. To determine the level of accuracy of the influent flow meter, the meter shall be calibrated at regular intervals in accordance with Schedule 1 (**attached**).

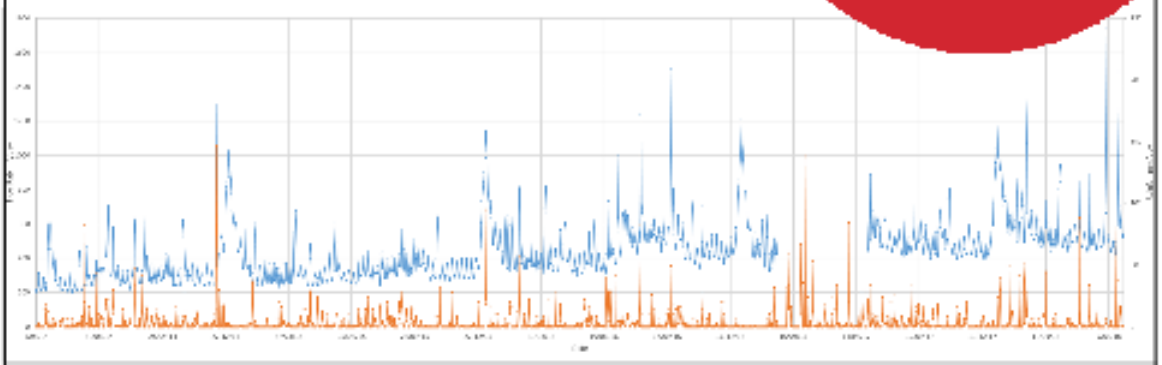
wsp OPUS

Inflow Statistics

Increase	Year	Qavg (All Year)	Qavg (Autumn/ Winter)	Qavg (Spring/ Summer)	Qavg (Xmas)	Qmax (All Year)	Qmax (Xmas)
		(m^3/d)					
	2012	301	306	275	598	894	925
	2013	296	262	293	664	971	971
11%	2014	332	297	329	681	1300	1024
6%	2015	354	318	420	701	1024	1142
28%	2016	492	465	473	737	1546	1204
	Total average 2013-2016	368	336	379	696	1210	1085
	L/s	4.265	3.883	4.381	8.053		

wsp | OPUS

Influent Flow Data



wsp | OPUS

Concentration of Inlet

Season/year	Average Values (mg/l)						
	TSS	BOD5	Total P	Total N	NH3-N	NO3-N	COD
2013							
Autumn/Winter	505	282	12	84	79	0.04	795
Spring/Summer	362	245	12	89	83	0.03	588
Xmas	401	469	15	109	101	0.05	900
All year	443	287	12	88	82	0.04	718
2014							
Autumn/Winter	362	213	14	84	73	0.02	657
Spring/Summer	333	412	11	62	51	0.003	333
Xmas	460	421	14	128	109	-	939
All year	364	363	13	82	71	0.03	564
2015							
Autumn/Winter	390	299	12	99	78	0.07	765
Spring/Summer	413	336	13	102	82	0.05	696
Xmas	444	417	14	128	110	-	966
All year	421	311	12	97	78	0.07	795
2016							
Autumn/Winter	569	333	12	80	60	0.08	938
Spring/Summer		418	12	84	68	0.10	917
Xmas	605	744	14	109	84	0.06	969
All year	568	371	12	81	64	0.08	929
Total average							
Autumn/Winter	457	282	12	87	72	0.05	789
Spring/Summer	277	353	12	84	71	0.05	634
Xmas	477	513	14	119	101	0.03	943
All year	449	331	12	87	74	0.05	752
Season/year	90%tile Values (mg/l)						
	TSS	BOD5	Total P	Total N	NH3-N	NO3-N	COD
Total average	667.2	446.5	14.65	108.8	96.8	0.1	1050

Notes:

A autumn / winter period includes sampling taken from March to August

B spring / summer period includes sampling taken from September to November and February

C Christmas / New Year period includes sampling taken from December and January of the following year.

wsp | OPUS

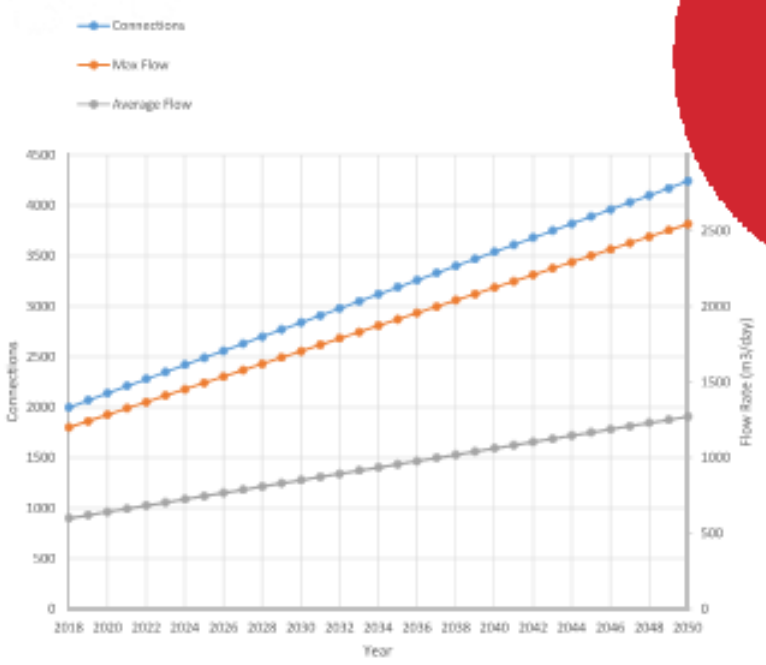
Plant Design

Parameter	Design Average*	Peak Week	Current Average	Current Peak	2023 Peak	2028 Peak
Average Flow m^3/d	600	2120	600	1200	1410	1620
BOD kg/d	180	636	210	840	990	1130
TSS kg/d	180	636	270	572	672	772
TKN kg/d	30	106	105	140	164	188
TP kg/d	7.2	25.4	7.2	13	16	19

*Based on EcoCare Design Report (2009)

wsp | OPUS

Timeline of growth



WSP | OPUS

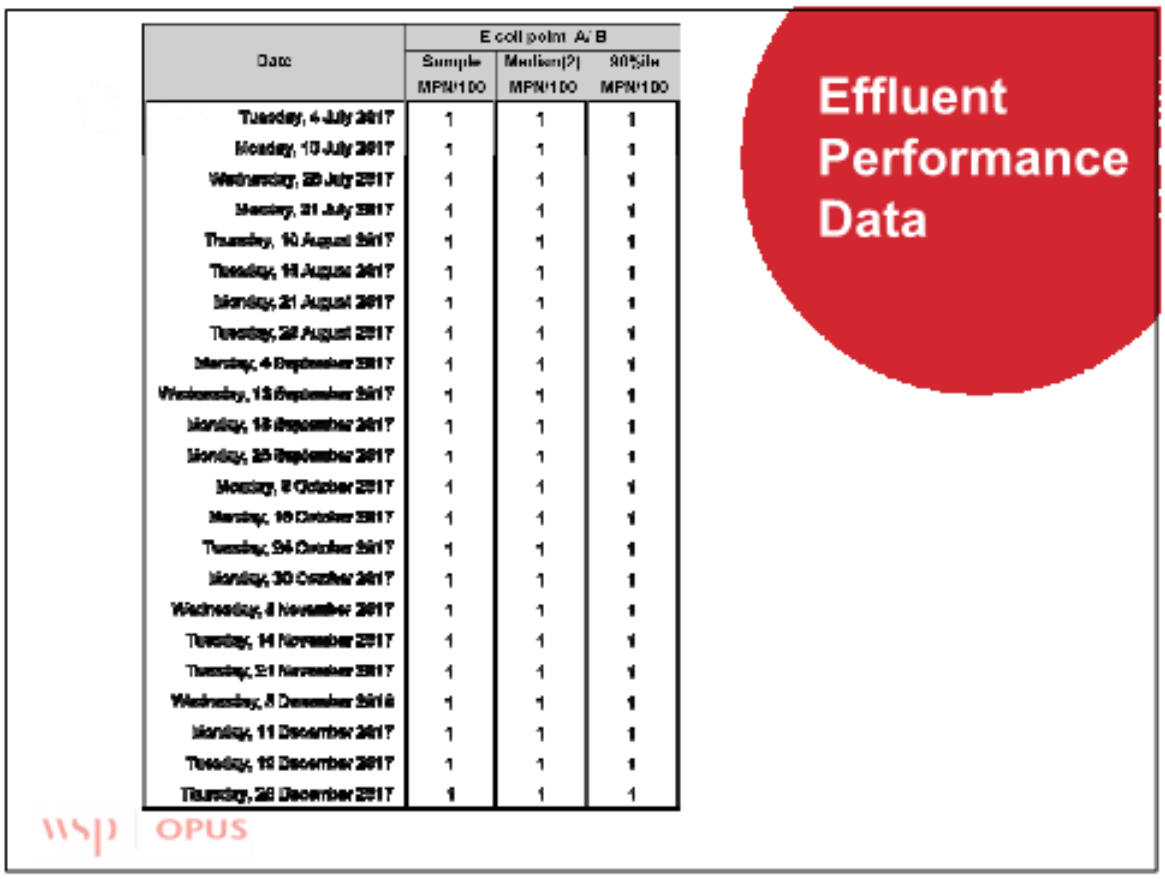
Consent Conditions

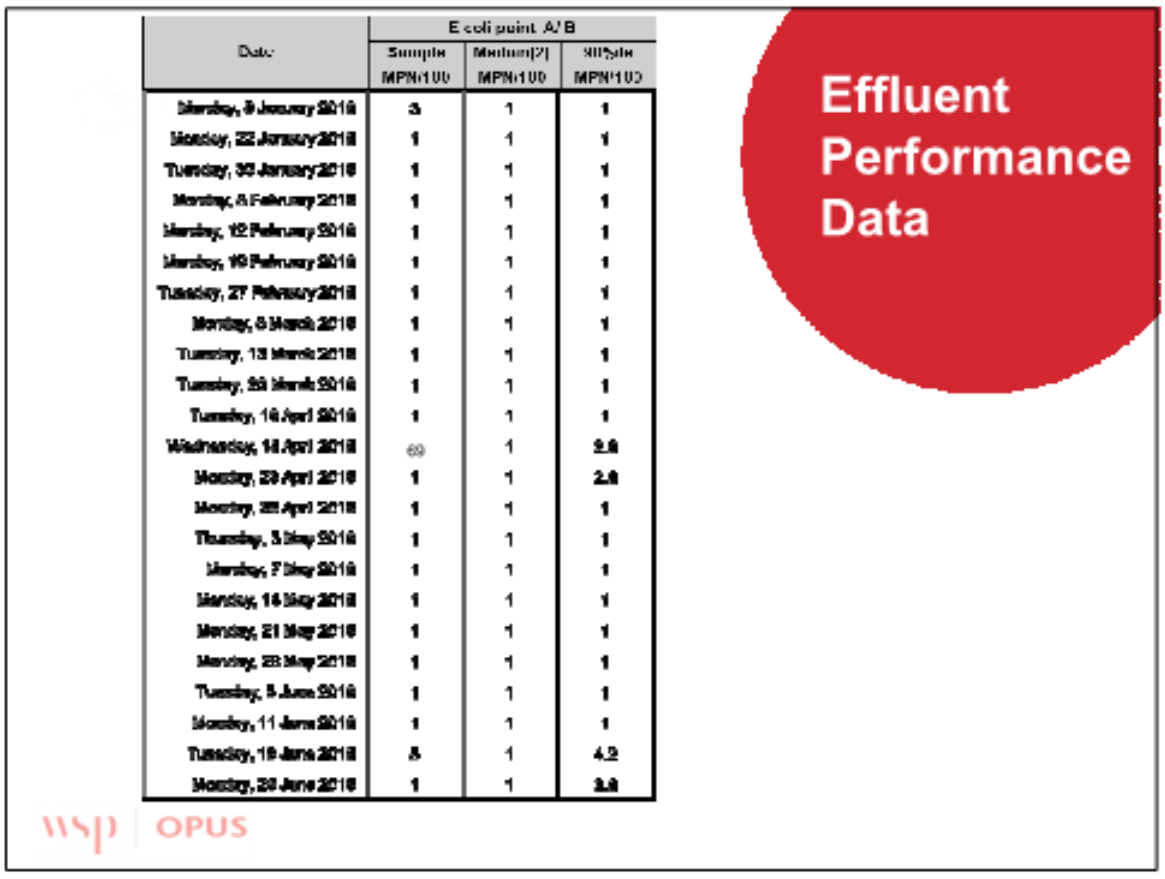
Colour Code Key:

- Average Exceeded
- Single Sample Exceeded
- No Issues

Parameter	Units	Performance Requirements		
		Median	Average	90th Percentile
Group A Parameters (Weekly Sampling)				
E. coli	MPN	10		100
Group B Parameters (15 day Sampling)				
Total Dissolved Solids	mg/L		500	
Total Nitrogen	mg/L		30	
Phosphorus	mg/L		15	
Total Suspended Solids	mg/L		10	
Carbonaceous Biochemical Oxygen Demand	mg/L		10	

WSP | OPUS


Effluent Performance Data
Date
E coli point A/B
Sample MPN/100
Median(?) MPN/100
90%ile MPN/100
Tuesday, 4 July 2017 1 1 1
Monday, 10 July 2017 1 1 1
Wednesday, 26 July 2017 1 1 1
Monday, 31 July 2017 1 1 1
Thursday, 10 August 2017 1 1 1
Tuesday, 15 August 2017 1 1 1
Monday, 21 August 2017 1 1 1
Tuesday, 29 August 2017 1 1 1
Monday, 4 September 2017 1 1 1
Wednesday, 13 September 2017 1 1 1
Monday, 18 September 2017 1 1 1
Monday, 25 September 2017 1 1 1
Monday, 9 October 2017 1 1 1
Monday, 16 October 2017 1 1 1
Tuesday, 24 October 2017 1 1 1
Monday, 30 October 2017 1 1 1
Wednesday, 8 November 2017 1 1 1
Tuesday, 14 November 2017 1 1 1
Tuesday, 21 November 2017 1 1 1
Wednesday, 6 December 2017 1 1 1
Monday, 11 December 2017 1 1 1
Tuesday, 19 December 2017 1 1 1
Thursday, 28 December 2017 1 1 1
wsp OPUS


Effluent Performance Data
Date
E coli point A/B
Sample MPN/100
Median(?) MPN/100
90%ile MPN/100
Monday, 8 January 2018 3 1 1
Monday, 22 January 2018 1 1 1
Tuesday, 30 January 2018 1 1 1
Monday, 5 February 2018 1 1 1
Monday, 12 February 2018 1 1 1
Monday, 19 February 2018 1 1 1
Tuesday, 27 February 2018 1 1 1
Monday, 5 March 2018 1 1 1
Tuesday, 13 March 2018 1 1 1
Tuesday, 20 March 2018 1 1 1
Tuesday, 10 April 2018 1 1 1
Wednesday, 18 April 2018 69 1 2.8
Monday, 23 April 2018 1 1 2.8
Monday, 30 April 2018 1 1 1
Thursday, 3 May 2018 1 1 1
Monday, 7 May 2018 1 1 1
Monday, 14 May 2018 1 1 1
Monday, 21 May 2018 1 1 1
Monday, 28 May 2018 1 1 1
Tuesday, 5 June 2018 1 1 1
Monday, 11 June 2018 1 1 1
Tuesday, 19 June 2018 5 1 4.2
Monday, 25 June 2018 1 1 2.8
wsp OPUS

Effluent Performance Data

Final effluent 24 hour flow weighted composite	TDS		TSS		TN		TP		CBOD	
	Sample mg/l	Average mg/l	Sample mg/l	Average mg/l	Sample mg/l	Average mg/l	Sample mg/l	Average mg/l	Sample mg/l	Average mg/l
Resource Consent Limit		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7.2	2.4	10.4	1.5	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	11.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7.8	[illegible]	11.4	7.1	[illegible]	[illegible]	8.7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7.7	[illegible]	[illegible]	10.4	[illegible]	[illegible]	7.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	11.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.4	[illegible]	[illegible]	8.7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22.1	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	8.7	17.8	[illegible]	8.1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7.7	[illegible]	[illegible]	7.7	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	8.7	17.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

wsp | OPUS

Process Unit Hydraulic Capacity

Description	Estimated Hydraulic Capacity (l/s)
Screen	70
Splitter Box	150 (if 2 reactors receiving flow)
[illegible] Decanter System	300 (4 hr cycle discharge in 1hr)
RAS pump	8.5
WAS pump	14
Intermediate Transfer Pump	45
Filtration System	25
UV system	25*
Belt Press System	4.18

wsp | OPUS

wsp | OPUS

www.wsp-opus.co.nz