
DIRTY WATER EVENT 22 OCTOBER 2022

Version 0 Last Updated 8/11/2022

1. EVENT DETAILS

On Saturday 22 October 2022 council received the first call from residents in Normanton regarding turbid and discoloured water in their household taps.

The event continued for 14 days and was closed on Friday 4 November 2022 when the council confirmed that the reticulation network water returned to clear.

2. RESPONDING PERSONNEL

The personnel who responded to the event are listed below.

Position	Responsibility
Manager Water and Waste	<ul style="list-style-type: none"> Overall responsibility for the water supply system.
Water and Waste Supervisor (Maintenance)	<ul style="list-style-type: none"> WTP jar testing and plant optimisation; Scheduling flushing, storage of records and review of regular flushing program.
Water and Waste (Maintenance) team members	<ul style="list-style-type: none"> Performing the flushing and recording relevant details.
External Water Quality Advisor	<ul style="list-style-type: none"> Northern Water Management Pty Ltd (NWM) was contacted to provide technical support during the event.

3. COMPLAINTS LOG

The council's general number was called by customers in Normanton. Approximately five calls were received from customers mostly within the immediate township area.

There were no calls received from customers in Karumba.

4. INVESTIGATION AND ACTIONS

4.1 ACTION NO.1 – RAW WATER TURBIDITY MONITORING

Raw water turbidity was reviewed and nothing out of the ordinary was found. The results are below.

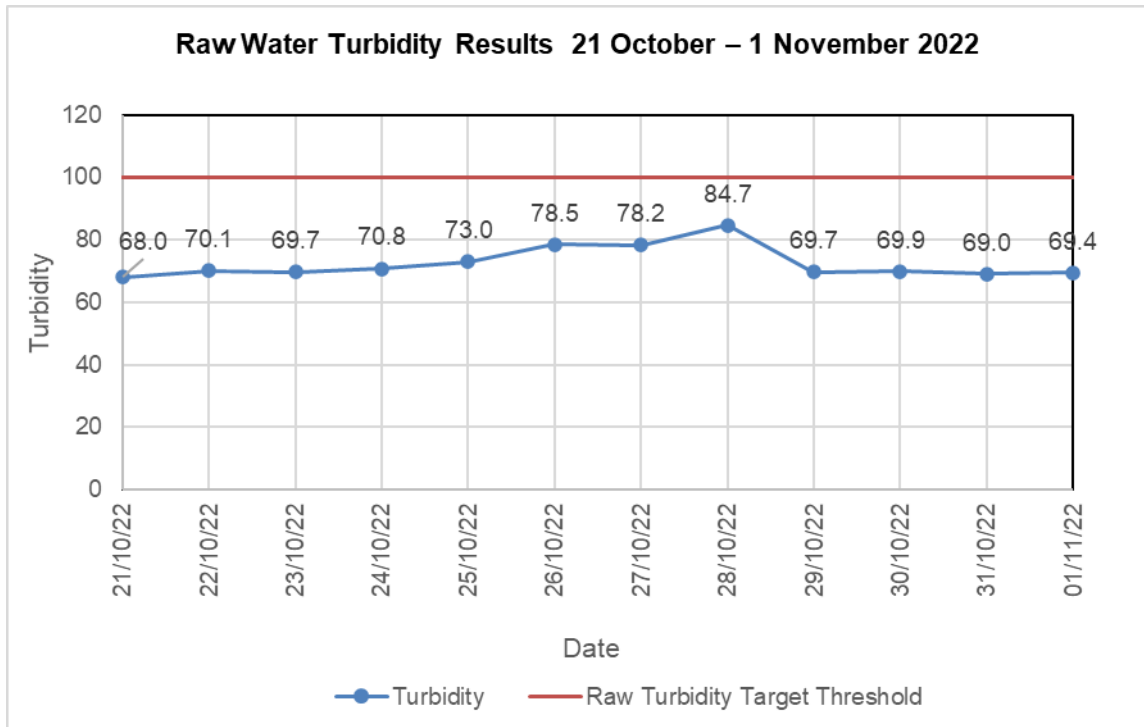


Figure 1 – Raw Water Turbidity Results 21 – 1 November 2022

4.2 ACTION NO.2 – TREATMENT PLANT OPTIMISATION

The council staff initially suspected that the water treatment plant (WTP) needed to be optimised to solve the issue and was the primary focus early in the event.

4.2.1 Jar Testing

Jar testing was undertaken at the WTP to check if the plant was running optimally.

It was found that the turbidity from the clarifiers (to the filters) was in the normal range. The results are below.

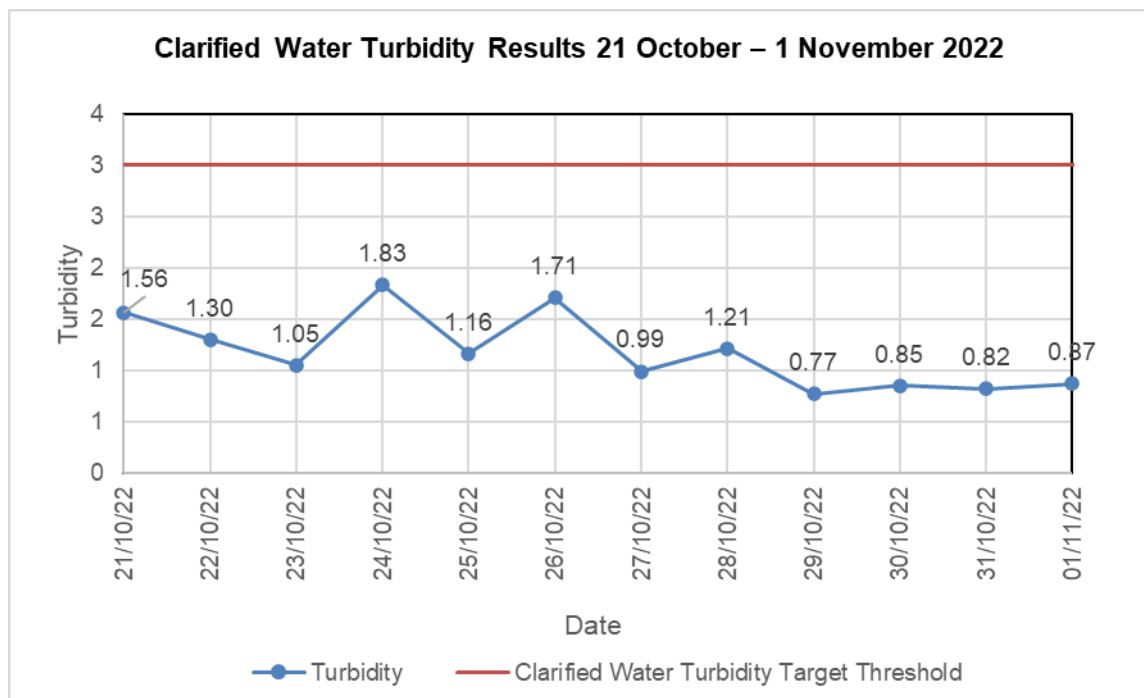


Figure 2 – Clarified Water Turbidity Results 21 October – 1 November 2022

It was found that the turbidity from the filters was mostly in the normal range and well below the issues found in the reticulation system. The results are below.

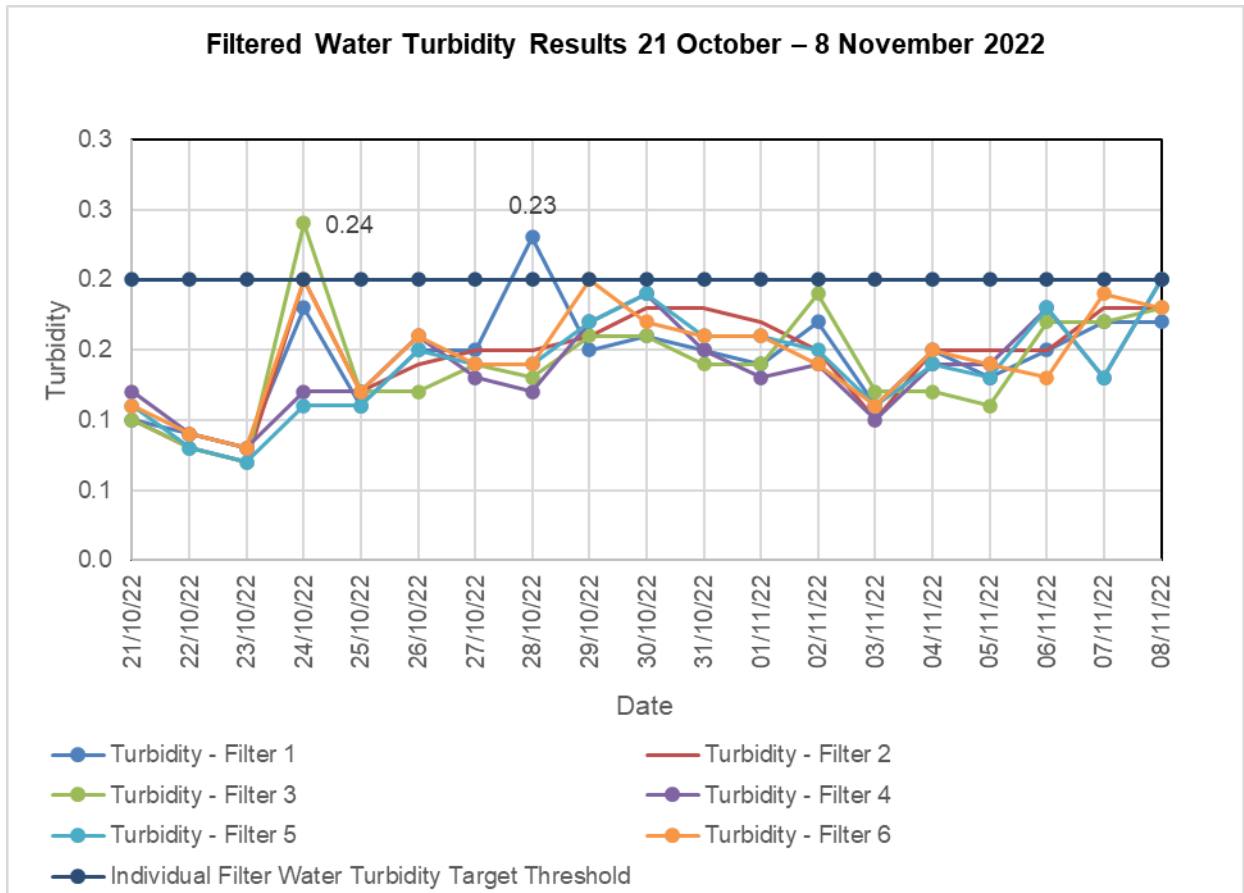


Figure 3 – Filtered Water Turbidity Results 21 October – 8 November 2022

It was found that the turbidity in the reticulation system was above the ADWG desirable level of 1 NTU but below the limit of 5 NTU. Under the state guidelines, the findings are not reportable to the regulator as they are not a health guideline, however, we recommend reporting above 5 NTU however this is not the case here. The results are below.

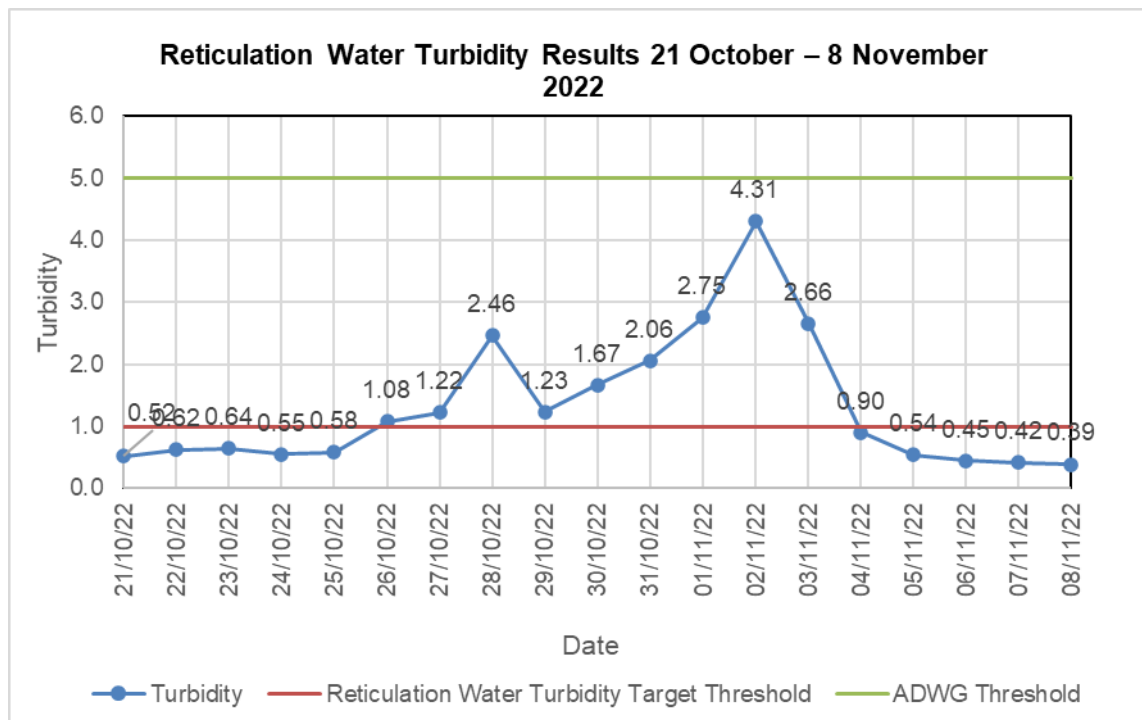


Figure 4 – Reticulation Turbidity Results 21 October – 8 November 2022

4.2.2 Chemical Change Trials

Whilst jar testing was undertaken several times during the event, given the complex chemical nature of water, this testing does not always reveal issues immediately. It can take time for chemical reactions to take effect and can therefore appear later in the water age, often in the reticulation system. This can be attributed to the dissolved chemical and physical elements in the water. Oxidant and pH levels play a role in such events.

Three trials were undertaken to determine if pH and chlorine were playing a role in the event:

Trial	Theory	Actions & Outcomes
1 – pH reduction by lowering soda ash levels, and decreasing oxidation by lowering chlorination	<ul style="list-style-type: none"> ▪ Reducing soda ash dosing will lower the pH closer to natural levels. This allows dissolved metals such as iron to stay in solution and avoid precipitation; ▪ Decreasing chlorination will reduce the oxidation of elements such as iron and will be more likely to stay in solution and avoid precipitation; ▪ The theory was to avoid suspended particles in the water which may cause turbidity issues. 	<ul style="list-style-type: none"> ▪ Changes were made for 4 days between Monday 24th – 27th October 2022; ▪ pH was changed from the normal operating set point (7.8) by -0.2; ▪ Chlorine was changed from the normal operating set point (1.4 mg/L) by -0.2 mg/L; ▪ Both parameters were still within ADWG and DWQMP ranges; ▪ The outcome was that the turbidity was higher than normal in the clear water storage, and the trial was abandoned. It was during this time that the most significant increase in discoloured water was experienced in the reticulation network. The trial took 3 days as the change in pH takes 2-3 days to take effect.
2 - pH increases by increasing soda ash levels, and increasing oxidation via additional chlorination	<ul style="list-style-type: none"> ▪ Increasing soda ash dosing will raise the pH. This allows dissolved metals such as iron to precipitate. This occurs in the coagulation stage and before filtration where these elements can be filtered; ▪ Increasing chlorination will increase the oxidation of elements such as iron and will be more likely to precipitate; ▪ The theory was that precipitated elements will be filtered due to pH lowering, and any remaining elements will settle in the clear water storage or the pipe network, reducing turbidity issues. The only issue with this theory is that the clear water storage and networks will require periodic cleaning/flushing. 	<ul style="list-style-type: none"> ▪ Changes were made for 4 days between Monday 28th – 30th October 2022; ▪ pH was changed from the normal operating set point (7.8) by +0.2; ▪ Chlorine was changed from the normal operating set point (1.4 mg/L) by +0.2 mg/L; ▪ Both parameters were still within ADWG and DWQMP ranges; ▪ The outcome was that the turbidity was slightly higher than normal in the clear water storage. The trial was abandoned and the set points returned to normal. The trial took 3 days as the change in pH takes 2-3 days to take effect.
3 – Chlorine addition prior to the filters	<ul style="list-style-type: none"> ▪ Increasing chlorination will increase the oxidation of elements such as iron and will be more likely to precipitate; ▪ The theory was that the additional pre-filtration oxidation will precipitate elements at the filters. This is additional to the normal operating practices. 	<ul style="list-style-type: none"> ▪ Changes were made for 2 days between Wednesday 2nd – Thursday 3rd November 2022; ▪ pH was set at the normal operating set point (7.8); ▪ Chlorine was set at the normal operating set point (1.4 mg/L); ▪ Additional chlorine was dosed at the clarifier outlet at 1.389 mg/L; ▪ The outcome was that the turbidity was lower in the reticulation and the

Trial	Theory	Actions & Outcomes
		dosage continued beyond the event closing date.

ADWG = Australian Drinking Water Guidelines
 DWQMP = Drinking Water Quality Management Plan

The pH and chlorination changes are displayed below with the corresponding turbidity results also shown.

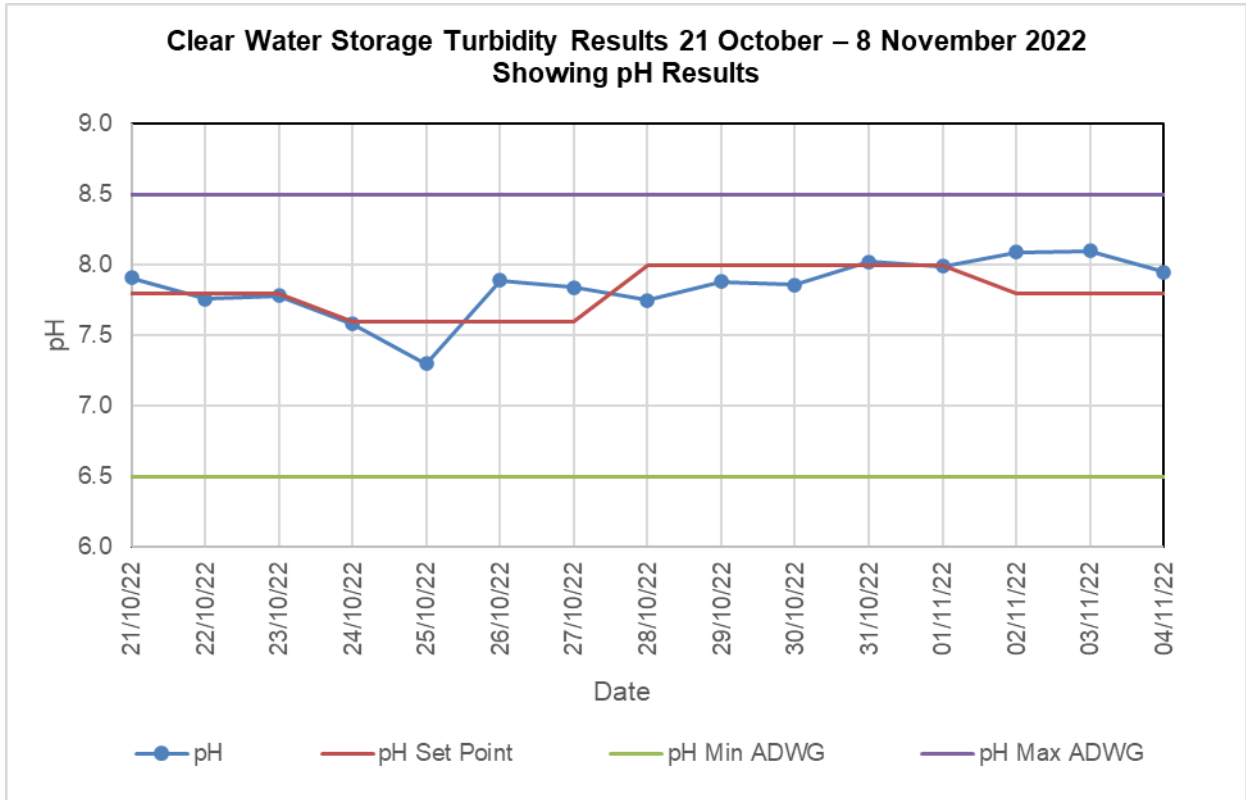


Figure 5 – Clear Water Storage Turbidity Results 21 October – 8 November 2022 Showing pH Results

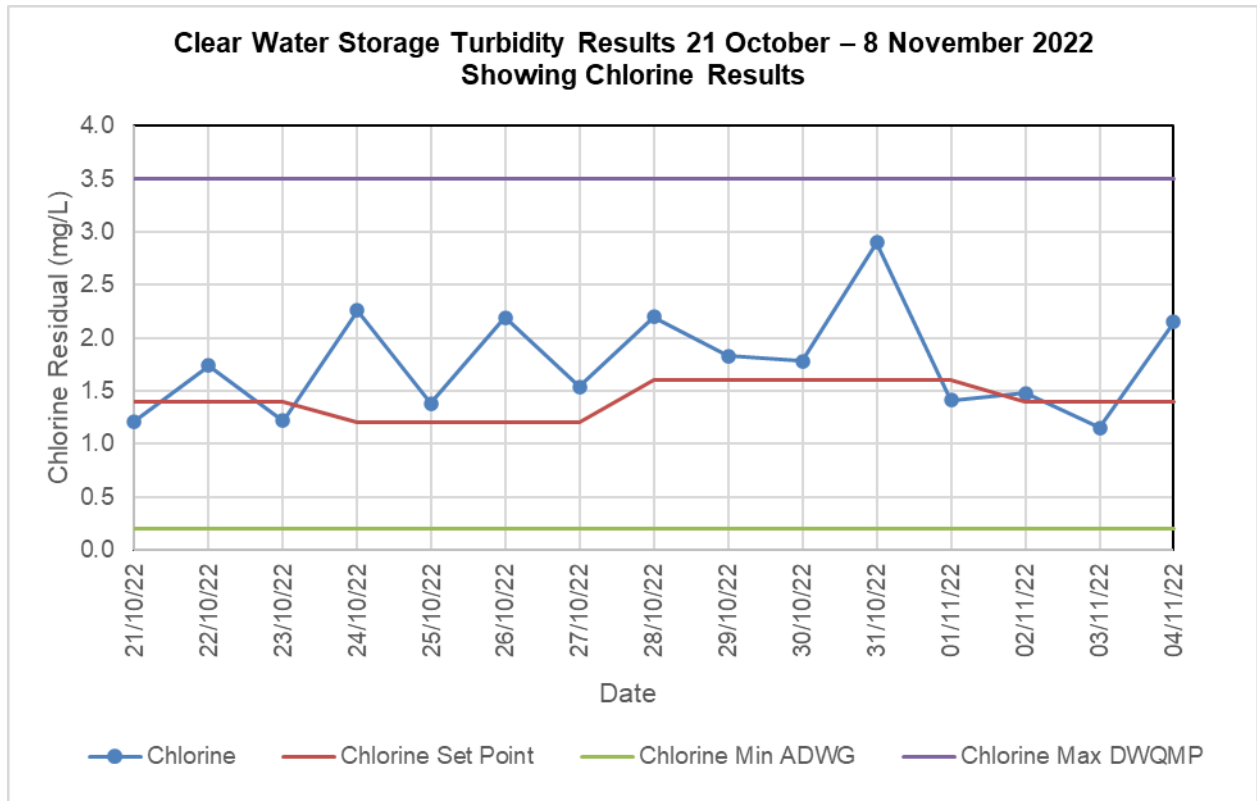


Figure 6 – Clear Water Storage Turbidity Results 21 October – 4 November 2022 Showing Chlorine Results

Water quality results showed that the plant was optimised in accordance with the plant operating manual, however, the additional chlorine dosing prior to the filters proved to be the main solution. This practice should continue subject to manganese concentrations in the raw water. In summary, the event was not from the normal WTP operations but attributed to an unusually higher concentration of manganese in the raw water. See later for flushing and other causes which are related to the cause and outcomes.

The chlorine concentrations were above the target set point, however, during the event, it was appropriate to have a higher disinfection level to counteract the higher turbidity in the reticulation network.

4.3 ACTION NO.3 – FLUSHING

In parallel with the WTP optimisation, flushing of the town network commenced on the day after the first complaints were received. The flushing occurred in 2 phases as described below.

Phase	Period	Actions & Outcomes
1	<ul style="list-style-type: none"> Saturday 22nd October 2022 – Monday 24th October 2022 	<ul style="list-style-type: none"> Standard flushing in accordance with CSC procedure “Flushing of Water Networks”; 6 dead-end points were flushed: <ul style="list-style-type: none"> Gough St; Travers St; Old Croydon Rd; Rodeo Grounds; Hospital Rd; Burn Philip Residence. Flushing records are provided in Appendix A
2	<ul style="list-style-type: none"> Tuesday 25th October 2022 – Tuesday 1st November 2022 	<ul style="list-style-type: none"> Standard flushing in accordance with CSC procedure “Flushing of Water Networks”; The flowing streets were flushed: <ul style="list-style-type: none"> Landsborough St; Thompson St; Woodward St;

		<ul style="list-style-type: none"> ○ Noel St West; ○ Sutherland St; ○ Wurrup St; ○ Haig St; ○ Robert Walker Dr; ▪ Flushing records are provided in Appendix A
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In all flushing activities, the water mains were flushed until the water was clear.

4.4 ACTION NO.4 – RESEARCH OF OTHER CAUSES

Given that the WTP was optimised and that the flushing activity was taking longer than expected, the council and NWM discussed the extent of the flushing program before the introduction of the 2022 flushing program, as it was suspected that the new program had stirred up a larger issue. Council advised that flushing had occurred informally before this 2022 program and was unlikely the cause of the current issue. Given that the cause was not likely to be the flushing program, the discussion then led to the question of if anything had changed in the system recently.

Council advised that a water main had burst on around 8th October 2022. A standard repair was undertaken and the water main was flushed, which indicated that any dirt from the repair activity was purged from the system. Council advised, however, that the operators/maintainers had trouble isolating the main before being able to perform the repair. They had opened and closed approximately 12 valves to be able to complete the isolation. Upon repair completion, all valves were believed to be open. NWM advised that they had experienced a similar issue elsewhere previously where a main had been inadvertently isolated for several years, and upon opening a valve(s), the main released dirty water into the system. Council advised that this matched the event as the repair location was in a location where water could circulate throughout the water supply network, and could be closed and not be noticed. Upon review, given the additional pre-filter chlorine dosage had improved the reticulation water colour, it is unlikely that the event was due to an opened section, however it may have played a small role in exacerbating the issue.

5. CONCLUSIONS

A systematic process was used to determine the cause of the dirty water event. This troubleshooting process was consistent with common industry practice.

The event was likely caused by a higher than usual manganese concentration in the raw water. This is a common issue during dryer periods where contaminants become concentrated. The aged reticulation system may have played a role as a dirty water source but this is inconclusive. Further investigation may reveal issues with the aging assets.

The WTP team worked consistently with additional hours spent throughout the event to resolve the issue.

The drinking water quality at no time during the event breached the ADWG and met the DWQMP which was approved by the state government.

6. RECOMMENDATIONS

It is recommended that:

1. This event report be added to the operations and maintenance manual under a section for troubleshooting guides;
2. All mains repairs record the valves that were exercised and what position they were moved from and to i.e., clockwise or anticlockwise turns to close and then reopen, or vice versa. This provides information on whether a pipeline section was previously in an incorrect position;
3. Flushing occurs on either side of the isolated repair section to provide a check to ensure sections previously incorrectly isolated are also flushed;
4. The flushing program is continued indefinitely;

5. Operations commence quarterly monitoring for manganese;
6. Additional jar testing including overnight testing of chlorine effect on colour and turbidity should commence at regular intervals and at least annually in early October when raw water conditions concentrate contaminants such as iron and manganese. A turbidity trigger value consistent with the existing DWQMP can be used;
7. Additional temporary treatment via pre-chlorination dosing occurs when needed which is subject to manganese levels;
8. Council considers replacing some of the aging pipeline infrastructure as asbestos cement and cast iron assets can attribute to dirty water issues through leaching.

Performed By: _____

wd 13/2/22

Reason for flushing: (Reactive/Planned) _____

Time	Date	Point No.	Hydrant/Scour Location (adjacent street for no address)	Run Time (min)	Start Water Colour	End Water Colour	Comments (e.g., Air in line, Cloudy, Sediment type)
11:03 (am/pm)	25/10/22	NFP 7	corner of Green Sutherland	20 min	N/A	N/A	had a rusty look came clear after 20min
11:28 (am/pm)	25/10/22	NFP 2	corner of Noel and Travers	50min	N/A	N/A	was very dirty
1:25 am/pm	25/10/22	NFP 8A	52 Woodward	50min	N/A	N/A	was very dirty
2:20 am/pm	25/10/22	NFP 8B	257 Duffon	15min	N/A	N/A	had a rusty look came good after 15min
2:40 am/pm	25/10/22	NFP 9	14 Greenaway	20min	N/A	N/A	LIGHT BROWN COLOUR, CAME CLEAR 20 MINS LATER.
2:24 am/pm	26/10/22	NFP 10	26 NOEL	50mins	N/A	N/A	LIGHT BROWN COLOUR, CAME CLEAR 50MINS LATER. VERY DIRTY
3:14 am/pm	26/10/22	NFP 11	CORNER OF GREEN & PHILP ST.	50mins	N/A	N/A	VERY DIRTY
10:30 (am/pm)	27/10/22	NFA 6	CAROLINE ST	45mins	N/A	N/A	VERY DIRTY
11:20 (am/pm)	27/10/22	NFP 1	CORNER OF RUSSEL & MACDONALD ST.	46mins	N/A	N/A	LIGHT BROWN COLOUR AT START.
1:20 am/pm	27/10/22	NFP 7	CORNER OF SUTHERLAND & GREEN ST	5mins	N/A	N/A	CAME OUT CLEAR RAN FOR 5mins STILL CLEAR AFTER 5mins.
1:25 am/pm	27/10/22	NFP 2	CORNER OF TRAVERS & NOEL ST	7mins	N/A	N/A	YELLOW TINGE; CAME CLEAR AFTER 7mins

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Appendix A – Water Supply Flushing Record Sheet

Procedure: Flushing of Water Networks

Performed By: _____

Reason for flushing: (Reactive/Planned) _____

Time	Date	Point No.	Hydrant/Scour Location (adjacent street for no address)	Run Time (min)	Start Water Colour	End Water Colour	Comments (e.g., Air in line, Cloudy, Sediment type)
1 :43 am/pm	27/10/22	NFP 8-B	57 DUTTON ST	7mins	N/A	N/A	YELLOW TINGE AT START CAME CLEAN AFTER 7 MINS.
1 :53 am/pm	27/10/22	NFP 8-A	52 WOODWARD ST	30mins	N/A	N/A	YELLOW TINGE AT START CAME CLEAN AFTER 30 MINS.
2 :32 am/pm	27/10/22	NFP #12	5 BALONE ST	10mins	N/A	N/A	YELLOW TINGE AT START CAME CLEAN AFTER 10 MINS.
2 :48 am/pm	27/10/22	NFP #13	LITTLE BROWN ST	12mins	N/A	N/A	VERY DIRTY CAME CLEAN AFTER 12 MINS.
8 :59 am/pm	28/10/22	NFP #14	30 THOMPSON ST	50mins	N/A	N/A	YELLOW TINGE AT START CAME CLEAN AFTER 50 MINS.
10 :08 am/pm	28/10/22	NFP #15	25 BROWN ST	40mins	N/A	N/A	YELLOW TINGE AT START CAME CLEAN AFTER 40 MINS.
11 :05 am/pm	28/10/22	NFP #16	74 LANDBOROUGH ST	5mins	N/A	N/A	CAME OUT CLEAN, RAN FOR 5 MINS STILL CLEAR.
11 :23 am/pm	28/10/22	NFP #17	8 WOODWARD ST	30mins	N/A	N/A	VERY DIRTY CAME CLEAN AFTER 30 MINS.
1 :10 am/pm	28/10/22	NFP #19	WURRUP ST	10mins	N/A	N/A	YELLOW TINGE CAME CLEAN AFTER 10 MINS.
7 : 58 am/pm	31/10/22	NFP #20	112 LANDBOROUGH ST	60mins	N/A	N/A	YELLOW TINGE, CAME CLEAN AFTER MINS.
8 :26 am/pm	31/10/22	NFP #21	92 LANDBOROUGH ST	5mins	N/A	N/A	LIGHT YELLOW TINGE CAME CLEAN AFTER 5 MINS.

Performed By: _____

Reason for flushing: (Reactive/Planned) _____

Time	Date	Point No.	Hydrant/Scour Location (adjacent street for no address)	Run Time (min)	Start Water Colour	End Water Colour	Comments (e.g., Air in line, Cloudy, Sediment type)
8:36 am/pm	31/10/22	NFP #22	72 LANDBOROUGH ST	45 MINS	N/A	N/A	VERY DIRTY CAME CLEAN AFTER 45 MINS. (DARK BROWN)
9:13 am/pm	31/10/22	NFP #23	60 LANDBOROUGH ST	20 MINS	N/A	N/A	YELLOW TINGE CAME CLEAN AFTER 20 MINS.
9:36 am/pm	31/10/22	NFP #24	36 LANDBOROUGH ST	40 MINS	N/A	N/A	YELLOW TINGE CAME CLEAN AFTER 40 MINS.
10:14 am/pm	31/10/22	NFP #25	26 LANDBOROUGH ST	30 MINS	N/A	N/A	LIGHT YELLOW TINGE CAME CLEAN AFTER 30 MINS
10:47 am/pm	31/10/22	NFP #26	BARRA MOTEL LANDBOROUGH ST	1 W/10 M	N/A	N/A	LIGHT YELLOW TINGE CAME CLEAN AFTER 70 MINS.
12:37 am/pm	31/10/22	NFP #27	38 SUTHERLAND ST	10 MINS	N/A	N/A	YELLOW TINGE CAME CLEAR AFTER 10 MINS
12:46 am/pm	31/10/22	#14	30 THOMPSON ST	20 MINS	N/A	N/A	YELLOW TINGE CAME CLEAN AFTER 20 MINS
1:13 am/pm	31/10/22	NFP #28	CORNER OF DUTTON & THOMPSON ST	5 MINS	N/A	N/A	YELLOW TINGE CAME CLEAN AFTER 5 MINS
1:22 am/pm	31/10/22	NFP #29	FRONT OF S.E.S BUILDING	30 MINS	N/A	N/A	BROWN TINGE CAME CLEAR AFTER 30 MINS.
2:00 am/pm	31/10/22	NFP #30	CORNER OF THOMPSON DUTTON + ELLIS ST	10 MINS	N/A	N/A	LIGHT YELLOW TINGE CAME CLEAR AFTER 10 MINS.
2:11 am/pm	31/10/22	NFP #31	8 WOODWARD ST	15 MINS	N/A	N/A	LIGHT YELLOW TINGE CAME CLEAR AFTER 15 MINS.

Performed By: _____

Reason for flushing: (Reactive/Planned) _____

Time	Date	Point No.	Hydrant/Scour Location (adjacent street for no address)	Run Time (min)	Start Water Colour	End Water Colour	Comments (e.g., Air in line, Cloudy, Sediment type)
2:33 am/pm	31/10/22	NFP #31	WOODWARD ST	5mins	N/A	N/A	CAME OUT CLEAR RAN FOR 5 MINS WAS STILL CLEAR.
2:44 am/pm	31/10/22	NFP #32	GOPHUP ST	10mins	N/A	N/A	BROWN TINGE CAME CLEAR AFTER 10 MINS.
6:45 am/pm	1/11/22	NFP #193	WARRUP ST	1hr 40m	N/A	N/A	VERY DIRTY CAME CLEAN AFTER 1hr 40 MINS
7:00 am/pm	1/11/22	NFP #33	WARRUP ST	50mins	N/A	N/A	LIGHT YELLOW COLOUR CAME CLEAN AFTER 50 MINS.
8:24 am/pm	1/11/22	NFP	4 FORSYTH ST	20mins	N/A	N/A	BROWN COLOUR CAME CLEAR AFTER 20 MINS.
9:17 am/pm	1/11/22	NFP #34	SCOTT'S YARD FORSYTH ST	25mins	N/A	N/A	BROWN COLOUR CAME CLEAR AFTER 25 MINS
9:35 am/pm	1/11/22	NFP #35	3 NORMAN ST	10mins	N/A	N/A	BROWN COLOUR AT START CAME CLEAR AFTER 10 MINS.
10:00 am/pm	1/11/22	NFP #36	Robert walker	10min	N/A	N/A	DARK BROWN AT START CAME CLEAR AFTER 10 MIN
10:15 am/pm	1/11/22	NFP #37	13 NOEL STREET WEST	30mins	N/A	N/A	DARK BROWN COLOUR, CAME CLEAN AFTER 30 MINS.
11:31 am/pm	1/11/22	NFP #38	16 PHILIP ST	10mins	N/A	N/A	DARK BROWN COLOUR, CAME CLEAN AFTER 10 MINS.
11:41 am/pm	1/11/22	NFP #39	20 TRAVERS PHILIP ST	5mins	N/A	N/A	RAN CLEAR, LET RUN FOR 5 MINS STILL CLEAR.

Appendix A – Water Supply Flushing Record Sheet

Performed By: _____

Reason for flushing: (Reactive/Planned) _____

Time	Date	Point No.	Hydrant/Scour Location (adjacent street for no address)	Run Time (min)	Start Water Colour	End Water Colour	Comments (e.g., Air in line, Cloudy, Sediment type)
11:48 am/pm	1/11/22	NFP #40	32 PHILP ST	5 MINS	N/A	N/A	RAN CLEAN AT START LEFT RUN FOR 5 MINS STILL CLEAN.
12:03 am/pm	1/11/22	NFP #41	56 PHILP ST	5 MINS	N/A	N/A	RAN CLEAN AT START, LET RUN FOR 5 MINS STILL CLEAN.
12:15 am/pm	1/11/22	NFP #42	FRONT OF HOSPITAL CORNER OF SIMPSON	40 MINS	N/A	N/A	LIGHT YELLOW ^{BROWN} COLOUR, CAME CLEAN AFTER 40 MINS.
1:05 am/pm	1/11/22	NFP #43	+ HENRIETTA ST	15 MINS	N/A	N/A	LIGHT YELLOW ^{BROWN} COLOUR, CAME CLEAN AFTER 15 MINS.
1:24 am/pm	1/11/22	NFP #44	FRONT OF WATER PLANT	10 MINS	N/A	N/A	LIGHT YELLOW CAME CLEAN AFTER 10 MINS.
1:40 am/pm	1/11/22	NFP #45	CORNER OF BRIDIE + BALONE ST	10 MINS	N/A	N/A	LIGHT YELLOW CAME CLEAN AFTER 10 MINS.
2:45 am/pm	1/11/22	NFP #46	32 WOODWARD ST	15 MINS	N/A	N/A	BROWN COLOUR, RAN CLEAR AFTER 15 MINS
2:53 am/pm	1/11/22	NFP #47	HARG ST	50 MINS	N/A	N/A	BROWN COLOUR CAME CLEAN ^{AS} YELLOW AFTER 50 MINS
3:01 am/pm	1/11/22	NFP #48	35 DUTTON ST	20 MINS	N/A	N/A	YELLOW COLOUR CAME CLEAN AFTER 20 MINS.
3:20 am/pm	1/11/22	NFP #49	HOLLINGSWORTH ST	20 MINS	N/A	N/A	BROWN COLOUR CAME CLEAR AFTER 20 MINS.
: am/pm	2/1/22	NFP #50			N/A	N/A	