Gameti Water Treatment Plant

Responses to IR # 1 and # 2:

During the site visit on February 01, 2023, plant piping configuration were reviewed, for the possibility of disposing CIP wastes to wastewater Tank. It was determined that membrane tank could not be configured in a way to redirect CIP discharge to either the sump or the wastewater tank. Redirecting CIP discharge will require an extensive plumbing retrofit and reprogramming of the programmable logic controller (PLC) for the equipment.

Additionally, the plumbing retrofit will add a significant operational element to the water plant as the plant will not operate if the waste tank is full (to prevent potential flooding), which might also cause delays in filling the treated water tank and supply for the community, until the wastewater tank gets emptied by vacuum truck.

As noted in previous submissions, there are no specific guidelines available for the effluent discharges, specifically for very small municipality water treatment plant's effluent discharge to overland. The study conducted by Dalhousie on residual discharge in 2021 also has recommendation for further assessment of residual discharge parameters and their impacts on the environment. In Gameti, the total CIP discharge is 1.8 m^3, produced once after four months and discharged to the overland. Due to very small volume of CIP discharge in Gameti, the environmental impacts on overland, is likely be insignificant. But, until we have the final recommendations from Dalhousie research study, a plan can be developed to visually monitor the overland discharge area for any adverse environmental effects on vegetation.

GNWT with collaboration of MVLWB, will be completing (in 2023/2024) next phase of the Dalhousie research study, which will help provide clear guidelines values for all parameters to be monitored based on the volume of effluent overland discharge (size of municipalities), quantity of residuals, and environmental conditions of the site like mixing zone and water bodies.

The most recent CIP sampling results (May 04, 2023) are incorporated in table-1 below given in Dalhousie report, for comparison. The CIP for Citric Acid was not completed, due to unavailability of chemicals and will be done during the next visit in June 2023. Complete sampling tests results are given in table-2.

Table 1: Backwash and CIP Waste Compared with the Discharge Target stated in the Dalhousie Report.

	Discharge Target (Dalhousie Report)	**CIP (sodium hypochlorite)**	**CIP (Citric acid)**	**Backwash 1**	**Backwash 2**	**CIP (Sodium Hypo)**	**CIP (Citric Acid)**	**Raw Water**	**Backwash**
Sampling Date		**July 27, 2021**		**July 27, 2021**	**July 28, 2021**	**May 04, 2023**			
pH	6.5-9	7.02	6.88	6.78	6.81	6.63		8.09	8.02
TSS (mg/L)	20-30 mg/L or 5 mg/L over background	6.2	< 3.0	< 3.0	< 3.0	70		6	6
Total Iron (mg/L)	< 5 mg/L	1.21	2.49	0.262	0.233	0.370		0.014	0.036
Total Aluminium (μg/L)	100 if pH ≥ 6.5	563	695	99.8	91.7	21.8		3.4	4.5

Further information on sampling results and CIP process are given below;

- For the backwash, no additional chemicals are being added in the treatment process. The only chemical addition into the treated water is chlorine for disinfection which occurs post-filtration. All parameters in the sampling results are built-up from filtering of the natural raw water which is then being disposed back into the natural environment. As given in the table the Total Aluminium levels of sampling taken on May 04, 2023 came out very low as compared to the sampling conducted in 2021.
- For the clean-in-place (CIP) waste, the sampled parameters, besides Citric Acid and chloride, are not added to the water and are instead stemming from the de-scaling and disinfection of the membrane tank. Like backwash high parameters are from the natural source, particularly some of the trace metals results.
- Prior to discharge of the CIP waste, the pH of the water is balanced and tested to be between 6.5 – 8.5 for the acid bath and is dechlorinated and tested to be 0 mg/L of free chlorine for the hypochlorite disinfection. Both CIPs produce 1.8 m^3 of wastewater performed once every 4 months. This equates to 5.4 m^3 of being discharged in a full year (0.45 m^3/month or 0.015 m^3/day).

Table-2: Sampling tests results (May 04, 2023) of raw water, backwash water and CIP-Hypo.

	Units	**Raw Water**	**Backwash Water**	**CIP-Hypo**
Cations by ICP-MS				
Hardness	mg/L	183	182	181
Sodium	mg/L	5.5	5.6	903
Inorganics - Nutrients				
Organic Carbon, Dissolved	mg/L	4.6	9.4	1020
Organic Carbon, Total	mg/L	5.2	12.5	1030
Inorganics - Physicals				
Alkalinity, Total (as CaCO3)	mg/L	116	116	200
Colour, True	TCU	< 5	< 5	11
pH	pH unit		8.02	6.63
Solids, Total Dissolved	mg/L	180	188	3380
Solids, Total Suspended	mg/L	6	6	70
Turbidity	NTU	0.41	2.43	4.89
Subcontracted Inorganics				
Chloride	mg/L	7.44	7.67	877
Fluoride	mg/L	0.155	0.166	126
Nitrate as Nitrogen	mg/L	0.0235	0.0265	0.214
Sulphate	mg/L	54.1	54.8	51.7
Subcontracted Organics				
Cyanide, Total	mg/L	< 0.0050	< 0.0050	< 0.0050
Cyanide, Weak Acid Dissociable	mg/L	< 0.0050	< 0.0050	< 0.0050
Trace Metals, Dissolved				
Aluminum	µg/L	3.4	4.5	10.9
Arsenic	µg/L	0.3	0.3	0.9
Barium	µg/L	24	33.2	37.8
Cadmium	µg/L	< 0.04	< 0.04	< 0.04
Chromium	µg/L	< 0.1	< 0.1	0.4
Copper	µg/L	7	3.2	103

Iron	µg/L	14	36	220
Manganese	µg/L	5	11.3	559
Mercury	µg/L	< 0.01	< 0.01	0.02
Selenium	µg/L	< 0.3	< 0.3	0.5
Uranium	µg/L	1.4	1.5	1.3
Zinc	µg/L	2.1	2.7	14.2
Trace Metals, Total				
Aluminum	µg/L	3.4	4.5	21.8
Arsenic	µg/L	0.3	0.3	0.9
Barium	µg/L	24.0	33.2	37.4
Cadmium	µg/L	< 0.04	< 0.04	< 0.04
Chromium	µg/L	< 0.1	< 0.1	0.6
Copper	µg/L	7.0	3.2	104
Iron	µg/L	14	36	370
Lead	µg/L	< 0.1	0.2	0.7
Manganese	µg/L	5.0	11.3	510
Mercury	µg/L	< 0.01	< 0.01	0.01
Selenium	µg/L	< 0.3	< 0.3	0.7
Uranium	µg/L	1.4	1.5	1.5
Zinc	µg/L	2.1	0.4	13.8