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Sludge Accumulation
Arctic Bay Sewage Lagoon, Nunavut

Dear Mr Roy:

A question has been raised regarding the rate of sludge accumulation in the lagoon proposed in Arctic Bay. There is very limited data regarding the operational behaviour of lagoons in arctic environments. Due to this lack of data, various assumptions, which are summarized as follows, were used to develop an estimate of sludge accumulation rates.

Assumptions

1. Individual suspended solids contribution is assumed to be 90 grams/capita·day (from Table 10-4 Characteristics of Basic Wastewater Categories: Cold Climate Utilities Manual). This is based upon the rate of suspended solids typically found in municipal sewage.

2. A complex set of mechanisms is responsible for removal of contaminants in a lagoon. These mechanisms include sedimentation, aerobic oxidation and anaerobic sludge volume reduction, which reduce the solids contribution from influent sewage. The biological processes also create solids in the forms of bio-mass (bio-solids). It has been assumed that the net outcome of the various biological process that both create and reduce solids leads to a rate of sludge contribution at the same rate as the individual suspended solids contribution.

3. The sludge that accumulates in the lagoon is made up of sedimented suspended solids and a large amount of water. These solids remain undisturbed in the bottom of the lagoon for several years. This provides the opportunity for gravity thickening of these solids over a protracted period of time. For the purposes of these calculations it has been assumed that an ultimate sludge density of 10% will be achieved.

The preceding assumptions lead to an annual per capita rate of sludge accumulation of 32.85 kg that represents a per capita volume of 0.329m^3. The following table summarizes the rate of sludge accumulation anticipated in Arctic Bay based on this rate.

Sludge Accumulation Estimate Arctic Bay			
Year	**Population**	**Sludge Generated (m^3)**	**Sludge Accumulation (m^3)**
2009	894	294.1	294
2010	916	301.4	595
2011	939	308.9	904
2012	960	315.8	1,220
2013	980	322.4	1,543
2014	1003	330.0	1,873
2015	1019	335.3	2,208
2016	1033	339.9	2,548
2017	1049	345.1	2,893
2018	1065	350.4	3,243
2019	1078	354.7	3,598
2020	1094	359.9	3,958
2021	1116	367.2	4,325
2022	1139	374.7	4,700
2023	1162	382.3	5,082
2024	1186	390.2	5,472
2025	1210	398.1	5,870
2026	1235	406.3	6,277
2027	1260	414.5	6,691
2028	1286	423.1	7,114
2029	1312	431.6	7,546

Based on the above calculations, it is estimated that the total quantity of sludge generated over the design life of the lagoon is 7,546 m^3. The lagoon design has a lower elevation of the active zone of 98.15m. Below this elevation is the sludge zone which provides storage for the settled solids. The available storage volume provided in the proposed Arctic Bay lagoon is 17,585 m3. Therefore the sewage lagoon should not require desludging within the 20 year design life of the

lagoon. It is recommended that sampling continue to be used as an indicator of the build up of sludge.

If you have any questions or require additional information please contact Steven Burden at (613) 225-9940 extension 257.

Yours truly,

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