ATTACHMENT 33

LTWP Niaqunguk (Apex) River Water Withdrawal Study

TECHNICAL MEMO

ISSUED FOR USE

To:	Richard Sithole	**Date:**	July 24, 2025
c:	Krishnan Ramesh	**Memo No.:**	01
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Subject: Desktop Study of Discharge in Apex River

1.0 EXECUTIVE SUMMARY

Tetra Tech has assessed the Apex River to determine how well it can serve as a supplementary water source for Geraldine Lake given increasing water demand from the City of Iqaluit. To complete this assessment, data was analyzed based on a Water Survey Canada (WSC) station along Apex River. Results from this analysis suggest that Apex River provides an annual discharge sufficient to meet future water demands until approximately 2035 assuming a water license amendment to allow 20% withdrawals is approved. If additionally accounting for available withdrawals from Qikiqtalik Lake, water demands may be met until approximately 2045. However, additional amendments to the water license will be required to ensure that demands until the year 2050 can be met. The viability of Apex River and Qikiqtalik Lake to serve as an ongoing source of water to the City of Iqaluit is dependent on the ability for the current water license to be amended.

2.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was requested to conduct a desktop study of Apex River to determine possible withdrawable volume for supplementation to Geraldine Lake. The purpose of this study is to quantify possible Geraldine Lake deficits arising from Apex River withdrawal under water license limitations. Presently, a Type A water license (3AM-IQA1626) permits the City of Iqaluit (the "City") to withdraw up to 10% of the instantaneous flows in Apex River when flows are greater than 30% of the Mean Annual Discharge (MAD). Additionally, a maximum withdrawal of 500,000 m^3 annually is stipulated. This water license is specified for monitoring station IQA-10 located upstream of the Confluence of the Qikiqtalik Lake tributary and Apex River. Tetra Tech has assumed that a new water license which increases withdrawal caps from 10% to 20% and removes the annual 500,000 m^3 will be approved. This technical memo summarizes likely contributions from Apex River to meet future water demand for two possible pumping locations.

Yearly volumes are assessed in this memo. To ensure a robust comparison between available data, a synthetic data set for Apex River was utilized based on measured data from WSC. For reference, Figure 2-1 presents summary statistics derived from WSC dataset at gauge station 10UH002 *Apex River at Apex*, which is located downstream of the present water license location. Outliers have been removed from the data presented in Figure 2-1, and maximum values are to be read from the 'Max Discharge (m^3/s)' vertical axis.

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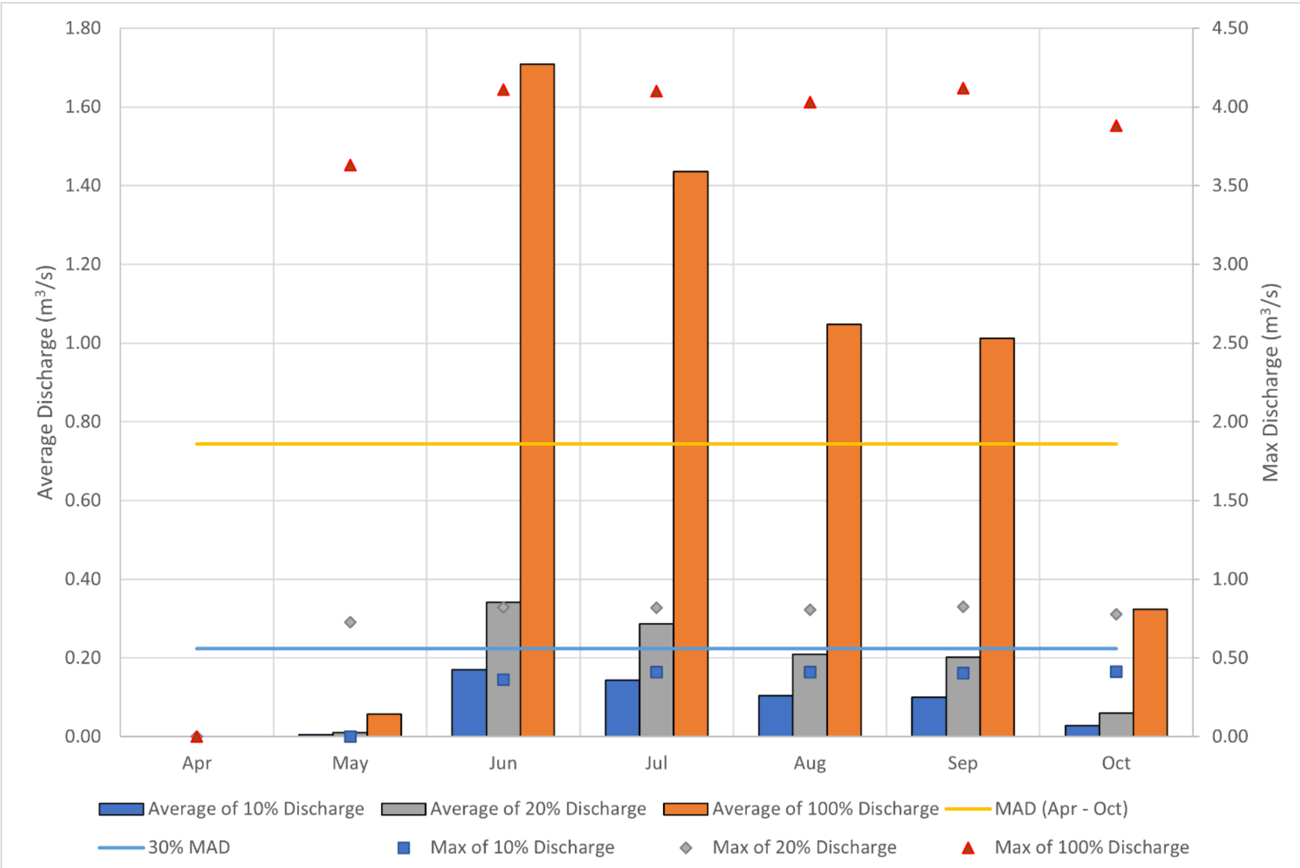

Figure 2-1: Average Discharge by Month and 10% Instantaneous vs 20% Instantaneous Discharge from Apex River at Apex (Water Survey Canada Station 10UH002, Outliers Removed)

3.0 METHODOLOGY

This section provides an overview of the methods used to develop synthetic data sets representative of locations upstream of available data sources, as well as how these data sets were used to provide estimations of discharge and subsequent withdrawable volumes from the Apex River.

3.1 Development of Synthetic Data Sets

Daily mean flow (in m^3/s) data for Apex River just north of Apex ("*Apex River at Apex*") are available from WSC gauge station 10UH002. Additional stations exist upstream of 10UH002 such as 10UH015 "*Apex River 1km Above Bridge to Nowhere*", however flow data covering a sufficient period of record is not available from this station, only providing intermittent readings. Station locations with respect to Qikiqtalik Lake, as well as the Apex River Confluence location are shown in Figure 3-1.

Tetra Tech assessed discharge volumes at two locations shown in Figure 3-1. Due to insufficient data from all stations other than Apex River at Apex (10UH002), Tetra Tech developed synthetic data sets for each location based on the original techniques presented by Nunami Stantec Limited (Stantec) in their report "*Analysis of Fisheries and Hydrologic Information of Apex River*" (2023). Stantec analyzed data from 10UH002 and 10UH015 in their report and developed a seasonal scaling relationship between the upstream 10UH015 and downstream 10UH002 stations. Use of these season scaling factors allow 10UH002 flows to be represented as 10UH015 flows. These seasonal scaling factors were 0.513 for August and September and 0.746 for the rest of the year.

Figure 3-1: Locations of WSC Gauge Stations and Points of Interest

Due to no data being available for Apex Confluence, a synthetic data set for this location was developed by expanding the scaling factor relationship developed by Stantec. To do this, relationships were assumed to exist between the catchment size of both locations and scaling factors. Incremental catchment increases were determined for each location and are presented in Figure 3-2. For example, to create the synthetic data set for flows contributing to the Apex Confluence which does not include Qikiqtalik Lake contributions, the seasonal scaling factors were increased proportionally to the increase in catchment size. For the case of the Confluence, this corresponds to a catchment size increase of approximately 19%, and thus scaling factors were increased by the same amount from the upstream 10UH015 synthetic data set. The 10UH002 dataset was adjusted to exclude the years of 1973 through 1988 inclusive. This was done due to WSC transitioning from manual readings to digital in 1989. The quality and frequency of measured data significantly improves after 1988, and as such inclusion of the manual readings prior to 1989 would not result in an appropriate one-to-one comparison.

In summary, the following were completed to develop synthetic data sets:

- For station 10UH015 (Apex 1km Above Bridge to Nowhere): Stantec developed seasonal scaling relationships between the downstream WSC gauge 10UH002 (Apex River at Apex) to create a 23-year synthetic data set.
- For the Apex Confluence, Tetra Tech adjusted the seasonal scaling factors for 10UH015 based on catchment size. This means that this data set does not include Qikiqtalik Lake discharges. This synthetic data set also contains 23 years of generated data.

Each synthetic data set was cleaned through removal of outliers. Outliers were removed to provide a more representative dataset reflective of typical flow rates likely to be witnessed at the sites. The impacts of extreme flow events would skew projected capacity of the Apex River beyond what could be reasonably expected. The cleaned data was then analyzed to determine the MAD for each location. The MAD for all locations is provided in Table 3-1. A graphical representation of the process for deriving the data is provided in Figure 3-3. As discussed further detail in subsequent Section 3.1.1, the MAD results presented in Figure 3-1 is applicable only for the months April through October, inclusive.

Table 3-1: Mean Annual Discharge by Location

Location	Mean Annual Discharge[1] (m^3/s)	30% Mean Annual Discharge[1] (m^3/s)
Apex River 1km Above Bridge to Nowhere	0.554	0.166
Apex Confluence (Without Qikiqtalik Lake)	0.657	0.197
Apex River at Apex (WSC Total)	0.743	0.223

[1]*For months of April through October inclusive.*

Multiplication of the MAD provided in Table 3-1 by the number of days within April to October (214) will provide a number larger than the average of the observed annual total volume discharges provided by WSC (13,700,000 m^3 vs 11,200,000 m^3). This is due to WSC capturing flow on average only during 155 of these 214 days in the datasets. A summary of the number of days missing from the 1989 to 2021 dataset is provided in Table 3-2 below. These days are omitted from the total annual discharge volume and cause the average to be lower than that predicted by the MAD.

Table 3-2: WSC Missing Days by Year

Year	Missing Days (April – October)	Missing Days (Annual)
1989	0	0
1990	0	0
1991	0	0
1992	0	0
1993	60	60
1994	0	0
1995	41	41
2006	149	274

Year	Missing Days (April – October)	Missing Days (Annual)
2007	0	0
2008	0	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0
2013	0	0
2014	0	0
2015	0	0
2016	1	1
2017	0	0
2018	25	25
2019	33	34
2020	41	41
2021	41	41

It is critical to note that while each constructed data set contains 23 years of synthetic data, they do not necessarily represent the trends in the upstream locations over 23 years. The first development of seasonal scaling factors conducted by Stantec compared concurrent discharge for 10UH002 and 10UH015 for a single year: 2021. This means that any subsequent derived data set will be representative of the hydrological climate of 2021. It is expected that given a larger concurrent data set for comparison between 10UH002 and 10UH015, seasonal scaling factors could be different.

The approximate catchment sizes for each point of interest and increases in catchment size moving downstream are presented in Figure 3-2. As points of interest move downstream, catchment sizes increase. Total catchment sizes are presented in Table 3-3.

Table 3-3: Catchment Sizes for Points of Interest and Additional Contributions

Location	Total Catchment Area (ha)	Additional Contribution (ha)
Qikiqtalik Lake Outlet	634.37	N/A
Apex River 1km Above Bridge to Nowhere	3,602.07	N/A
Apex Confluence	4,906.10	669.7
Apex River at Apex	5,371.23	465.1

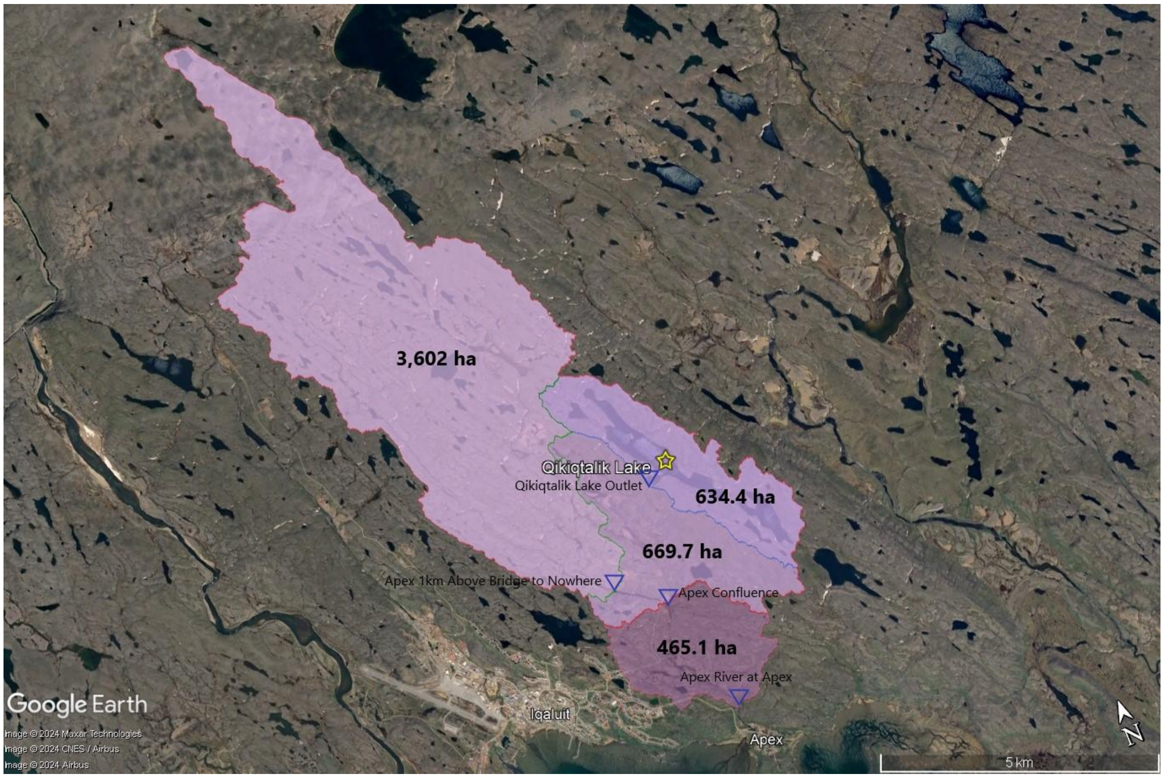

Figure 3-2: Catchments for Points of Interest (Numbers Represent Increase from Upstream)

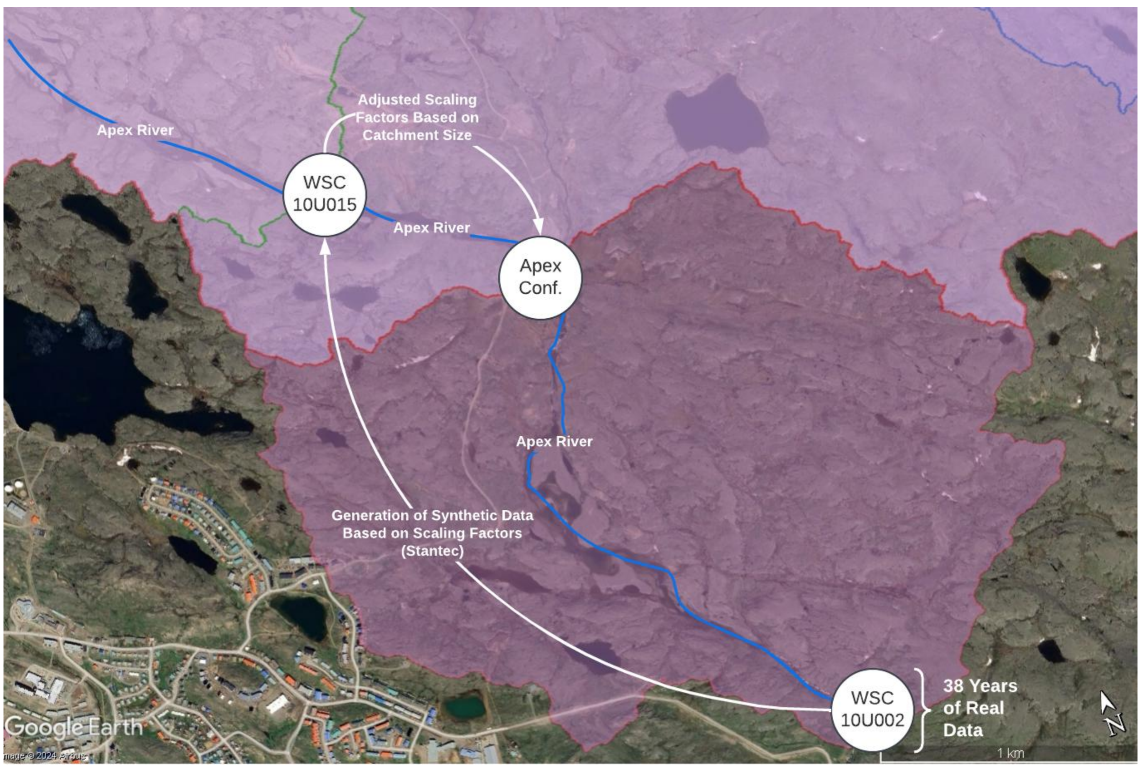

Figure 3-3: Process for Generating Synthetic Data Sets

3.1.1 Removal of Outliers from WSC Data

To prevent bias in datasets arising from extreme precipitation events, Tetra Tech removed outliers from flow measurements. These outliers were selected based on the Inter-Quartile Range (IQR), which defines an outlier to be a measurement which lays outside the third quartile (Q_3) plus 150% the IQR ($Q_3 – Q_1$). Values corresponding to the IQR are presented in Table 3-4 below. Outliers were removed prior to development of the synthetic datasets and are summarized in Table 3-5. It is critical to note that beginning around 1989, WSC Station 10UH002 began capturing transient discharge below surface ice during winter months. Data gathered prior to 1989 did not capture this. As such, calculation of the IQR was made based on data explicitly captured between April and October, inclusively. This is to prevent effectively non-withdrawable transient sub-ice flow data from skewing the IQR to unreasonably low values. Additionally, automated digital measurements began in 1989 which were of a higher quality than those prior. Thus, data collected before 1989 has been excluded from analysis.

Table 3-4: Calculated Quartiles and IQR for 10UH002

Quartile	Value (m^3/s)
First Quartile (Q_1)	0
Third Quartile (Q_3)	1.49
Inter-Quartile Range (IQR)	1.49
Lower Bound	0
Upper Bound (Q_3 + 1.5IQR)	3.725

Table 3-5: Summary of Outliers

Year	Number of Outliers	Outlier Volume (m^3)	Total Volume (m^3)[1]	O.V. / T.V.
1989	12	5,921,856	14,198,890	42%
1990	19	8,286,624	21,694,522	38%
1991	6	2,470,176	14,800,493	17%
1992	14	5,862,240	14,026,522	42%
1993	1	393,984	11,096,179	4%
1994	9	5,164,128	19,563,552	26%
1995	1	569,376	10,650,269	5%
2006[2]	0	0	8,676,720	0%
2007	19	9,396,000	22,075,114	43%
2008	6	2,772,576	17,281,210	16%
2009	21	10,522,656	21,196,166	50%
2010	14	6,854,112	23,512,118	29%
2011	14	6,566,400	18,603,475	35%
2012	11	7,025,184	21,469,882	33%
2013	13	12,835,584	25,611,984	50%
2014	22	10,252,224	24,443,942	42%

Year	Number of Outliers	Outlier Volume (m^3)	Total Volume (m^3)[1]	O.V. / T.V.
2015	17	11,260,512	21,635,424	52%
2016	20	10,013,760	22,864,378	44%
2017	17	5,746,464	21,668,602	27%
2018	12	7,079,616	19,628,179	36%
2019	0	0	8,842,867	0%
2020	2	825,120	12,404,189	7%
2021	11	5,598,720	20,278,080	28%
Average	*11.35*	*5,887,709*	*18,096,642*	*29%*

[1]*Throughout entire calendar year.*

[2]*Reflects low data quality and confidence.*

3.1.2 Summary of Synthetic Data Sets

To visually represent the relationships between the resultant synthetic data sets, the total annual discharge for each data set is plotted together in Figure 3-4.

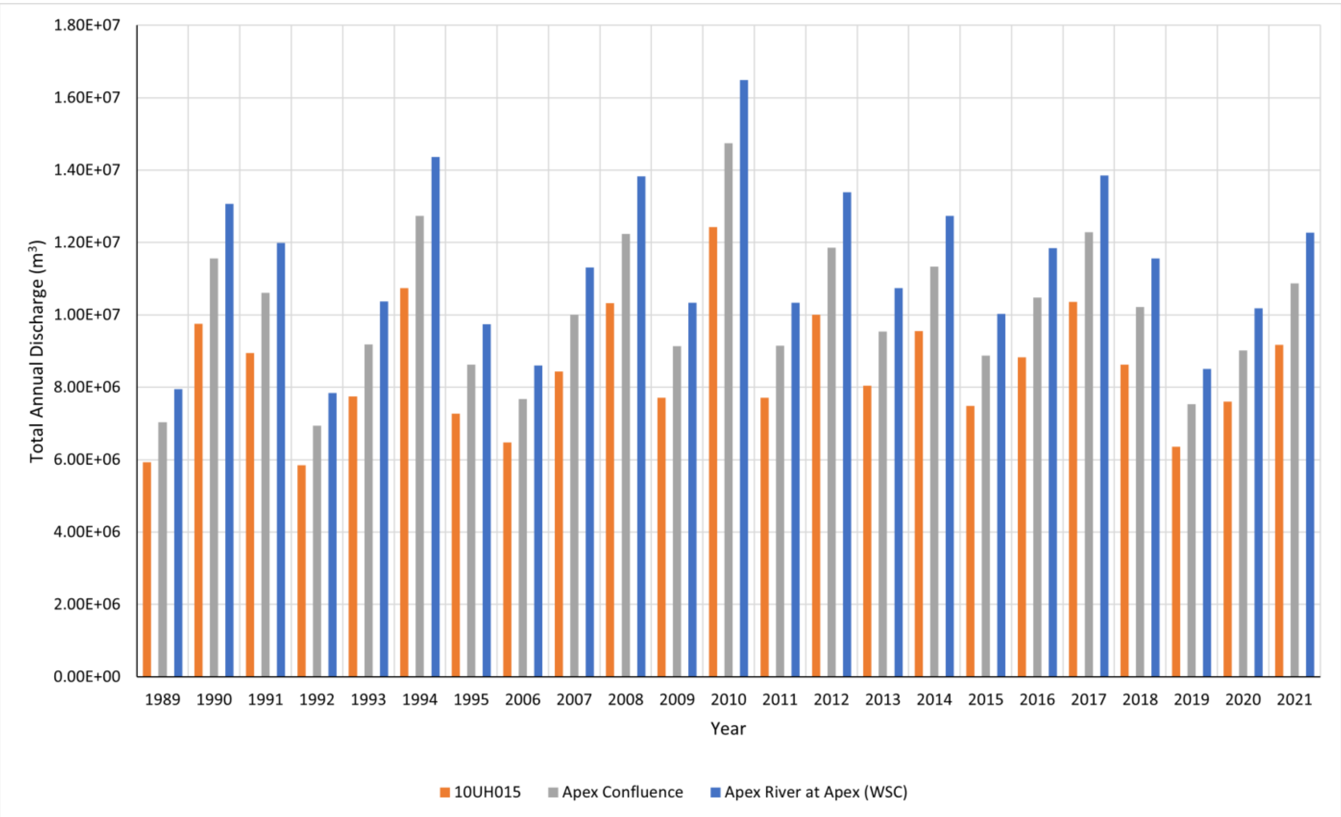

Figure 3-4: Synthetic Data Sets vs. WSC Apex River at Apex Data (Excluding Outliers)

3.2 Withdrawal Configurations

Presently, it is Tetra Tech's understanding that the proposed pumping station for withdrawing from Apex River will be located near WSC station 10UH015 (see Figure 3-1). Tetra Tech has also assumed that the monitoring station referred in the Type A water license (3AM-IQA1626) as IQA-10 is at the same location. Recall that the current water license limits the total withdrawal from Apex River to 500,000 m^3 annually. It has been assumed that this limitation will be lifted or removed for the purposes of this assessment.

Tetra Tech has considered two (2) possible withdrawal configurations. The first is maintaining the presently licensed withdrawal upstream of the Confluence at 10UH015 (and IQA-10) and separately supplementing this source with an additional withdrawal from Qikiqtalik Lake. The second assumes that the withdrawal point is moved to a new location at or downstream of the Apex River and Qikiqtalik Lake tributary confluence (see Figure 3-1). The assumptions of each configuration are discussed below.

1. The first withdrawal configuration assumes withdrawal first from Apex River at IQA-10. Qikiqtalik Lake is then used as a supplemental water supply when top-ups are required. This configuration provides for water withdrawal from the Qikiqtalik "dead storage" when the Lake outflow channel is normally dry.

2. The second withdrawal configuration assumes that withdrawals are occurring downstream of the Apex River and Qikiqtalik Lake tributary confluence. This means that withdrawals will necessarily include active discharge from Qikiqtalik Lake.

In both cases, the following points are assumed:

- These scenarios will be tested for the existing 10% instantaneous flow withdrawal (for discharges greater than 30% MAD) as well as a possible water license amendment which increases this limitation to 20%. The control point for achieving these assumed water license constraints is assessed at both 10UH015 (IQA-10) and just downstream of the Apex confluence.

- As prescribed by Stantec (2023), for a 20% withdrawal scenario, flows which exceed 30% MAD but are less than 33% MAD for the specified location may be pumped at 10% the instantaneous discharge value. Flows which exceed 33% MAD may be pumped at 20% the instantaneous discharge value. Tetra Tech has used 33% MAD as the lower bound for 20% withdrawal as this is proportionate to the value tested by Stantec (2023) to determine impacts on existing fish wildlife within the Apex River at WSC station 10UH015. In their report, Stantec set the lower bound for 20% withdrawal to be 0.156 m^3/s for a 30% MAD of 0.143 m^3/s, which is equivalent to approximately 33% MAD.

Please note that within this report, *Apex River 1km Above Bridge to Nowhere* and *Apex Confluence* are referenced frequently. These two locations correspond to Configuration 1 and Configuration 2, respectively.

Tetra Tech has assumed sustainable Qikiqtalik Lake supplementation volumes to be in line with values previously presented in Tetra Tech's report titled *"Unnamed Lake Water Balance for Withdrawals Interim Report"*, dated December 11th, 2023, and are separate from the study contained herein (Tetra Tech, 2023).

3.3 Projected Geraldine Lake Deficits

The applicability and effectiveness of each withdrawal configuration will be dependent on the withdrawal volumes at each site being sufficient to offset projected water deficits within Geraldine Lake. Presently, Geraldine Lake is the City's primary source of water supply and is replenished by natural inflows. The Lake is presently being depleted by water balance deficits that are expected to worsen as the City's population and water demands grow over time.

Although initial estimates by Golder (2021) stated possible annual demands of 620,000 m^3/year and 763,000 m^3/year based on low and high-water consumption rates of 100,000 m^3/month and 115,000 m^3/month respectively, Tetra Tech has utilized the projections presented in EXP Services Inc's (EXP)'s 2020 report "*Iqaluit Water Storage Pre-Feasibility Study'*. Based on EXP's study, by 2040 it is expected that median demand will increase to 2,512,000 m^3/year, and 3,505,000 m^3/year by 2050 (EXP, 2020).

In 2013, Golder Associates (Golder) submitted an initial water balance assessment of Geraldine Lake to the City. This report provides an assessment of historical rainfall runoff and snow accumulation for the catchment of the Lake. On average, annual surface runoff and snow accumulation are expected to contribute a total runoff volume of 977,000 m^3 (Golder Associates, 2013). Tetra Tech has used this value to represent the natural annual inflow volume into Geraldine Lake. This has allowed annual deficits to be calculated by finding the difference between the projected demands from EXP and available supply from Golder (2013).

Using this information as well as observed deficits provided by Stantec in their annual pumping reports, approximate trends were established to visualize projected demands and deficits which correspond to additional water demands. This relationship is presented in Figure 3-5.

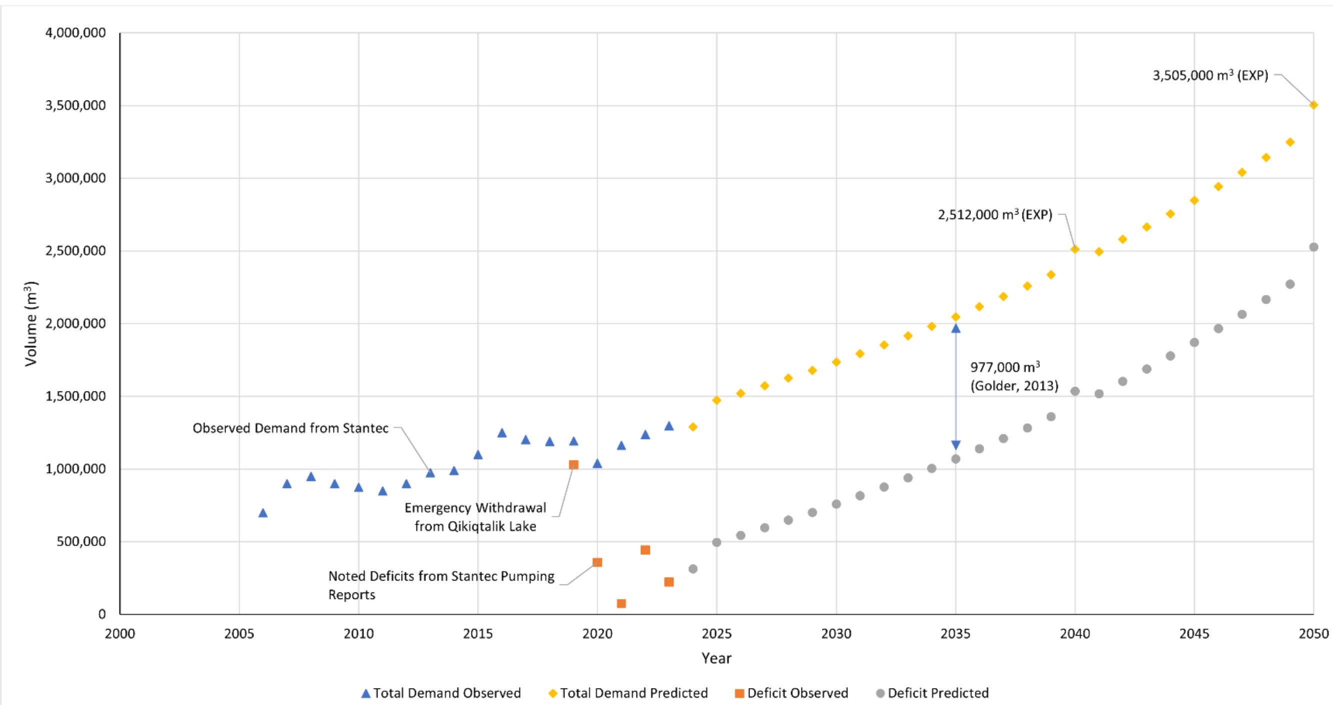

Figure 3-5: Projected Geraldine Lake Water Deficits

4.0 ASSESSMENT OF CONFIGURATION 1 (10UH015)

The current Type A water license 3AM-IQA1626 permits the City to withdraw from the Apex River at Monitoring Station IQA-10 (WSC 10UH015) up to a total of 500,000 m^3 of water annually for the supplementation of water levels in the Geraldine Lake Reservoir. The withdrawals are allowed only when the natural flow in the Apex River at Monitoring Station IQA-10 is above 30% of the MAD and the withdrawals will not exceed 10% of the instantaneous flow of the River.

The City would like to assess the scenario of increasing this maximum withdrawal amount to 20% of the instantaneous flows, and Tetra Tech has accordingly assessed the potential water supplies that would result for both the 10% and 20% withdrawal scenarios, ignoring the presently licensed maximum annual withdrawal.

4.1.1 Total Annual Discharge Volumes at 10UH015

This section provides context with respect to the annual discharge volume for the synthetic data set corresponding to 10UH015. Table 4-1 provides the total annual discharge volume distribution for 10UH015.

Table 4-1: Annual Discharge Volumes from Apex River at 10UH015

Minimum Volume (m^3)	Mean Volume (m^3)	Maximum Volume (m^3)
4,385,864	8,012,069	12,426,873

4.1.2 10% Capped Licensed Withdrawable Volumes from 10UH015

The MAD from Apex River at 10UH015 is 0.554 m^3/s. This means 10% of instantaneous flow withdrawals are permitted at discharges greater than 0.166 m^3/s (30% of MAD). Table 4-2 provides the annual 10% withdrawable volume distribution for 10UH015, ignoring the license annual maximum 500,000 m^3 limit.

Table 4-2: 10% Capped Withdrawable Volumes from Apex River at 10UH015

Minimum Volume (m^3)	Mean Volume (m^3)	Maximum Volume (m^3)
395,170	790,016	1,228,881

4.1.3 20% Capped Withdrawable Volume from 10UH015

A 20% withdrawal scenario assumes that withdrawals up to 20% of the instantaneous flow are permitted to occur when instantaneous flow is greater than 0.181 m^3/s (33% of MAD) and that the 10% withdrawal is still allowed for instantaneous flows above 0.166 m^3/s (30% of MAD). Table 4-3 provides the annual 20% withdrawable volume distribution for 10UH015, again ignoring the license annual maximum.

Table 4-3: 20% Capped Withdrawable Volumes from Apex River at 10UH015

Minimum Volume (m^3)	Mean Volume (m^3)	Maximum Volume (m^3)
782,882	1,578,096	2,457,762

4.1.4 Capability of Apex to Meet Projected Water Demands

Per EXP's 2020 report "*Iqaluit Water Storage Pre-Feasibility Study*', by 2040 it is expected that median water demands will increase to 2,512,000 m^3/year, and 3,505,000 m^3/year by 2050. The ability for Apex River at 10UH015 to supplement the deficit experienced by Geraldine Lake is provided in Table 4-4.

Table 4-4: Potential Water Supply from Apex River at 10UH015

10% Withdrawal	Minimum	Mean	Maximum
10UH015 Withdrawal (m^3)	395,170	790,016	1,228,881
Meets Water Deficit Until (Est.)	2024	2030	2038
Remaining Deficit in 2050 (m^3)[1]	**2,132,830**	**1,737,984**	**1,299,119**
20% Withdrawal	**Minimum**	**Mean**	**Maximum**
10UH015 Withdrawal (m^3)	782,882	1,578,096	2,457,762
Meets Water Deficit Until (Est.)	2030	2041	2049
Remaining Deficit for 2050 (m^3)[1]	**1,745,118**	**949,904**	**70,238**

[1]To calculate the remaining deficit, the annual 2050 demand subtracts the contributions from Geraldine Lake and Apex River. For example: 3,505,000 m^3 – 977,000 m^3 – 395,170 m^3 = 2,132,830 m^3.

5.0 ASSESSMENT OF CONFIGURATION 2 (APEX RIVER CONFLUENCE)

The current Type A water license 3AM-IQA1626 permits the City to withdraw, from the Apex River at Monitoring Station IQA-10 (WSC 10UH015), up to a total of 500,000 m^3 of water annually for the supplementation of water levels in the Geraldine Lake Reservoir. The withdrawals are allowed only when the natural flow in the Apex River at Monitoring Station IQA-10 is above 30% of MAD and the withdrawals are not to exceed 10% of the instantaneous flow in the River.

5.1.1 Total Annual Discharge Volume at the Apex Confluence

This section provides context with respect to the annual discharge volume for the synthetic data set corresponding to Apex Confluence. Table 5-1 provides the total annual discharge volume ranges at the Apex Confluence.

Table 5-1: Annual Discharge Volumes from Apex Confluence

Minimum Volume (m^3)	Mean Volume (m^3)	Maximum Volume (m^3)
5,201,288	9,501,679	14,737,288

5.1.2 10% Capped Withdrawable Volume from Apex Confluence

The MAD at the Apex Confluence is 0.657 m^3/s. This scenario assumes that 10% of instantaneous flow withdrawals are permitted at discharges greater than 0.197 m^3/s (30% of MAD). Table 5-2 provides the annual 10% withdrawable volume distribution at the Apex Confluence.

Table 5-2: 10% Capped Withdrawable Volumes from the Apex Confluence

Minimum Volume (m^3)	Mean Volume (m^3)	Maximum Volume (m^3)
468,640	936,896	1,457,356

5.1.3 20% Capped Withdrawable Volume from the Apex Confluence

For the purposes of 20% flow withdrawal analysis, Tetra Tech has made the following assumptions. 20% withdrawals are permitted to occur when instantaneous flow is greater than 33% of the MAD. Water may continue to be withdrawn at a 10% limit for instantaneous flow between 30% and 33% of the MAD. Table 5-3 provides the resultant annual 20% withdrawable volume distribution for the Apex Confluence based on the above assumptions.

Table 5-3: 20% Capped Withdrawable Volumes from Apex Confluence

Minimum Volume (m^3)	Mean Volume (m^3)	Maximum Volume (m^3)
928,437	1,871,497	2,914,712

5.1.4 Capability to Meet Projected Water Demands

Per EXP's 2020 report "*Iqaluit Water Storage Pre-Feasibility Study*', by 2040 it is expected that median water demand will increase to 2,512,000 m^3/year, and 3,505,000 m^3/year by 2050. The ability for Apex Confluence to supplement the deficit experienced by Geraldine Lake is provided in Table 5-4.

Table 5-4: Capability of Apex Confluence to Supplement Geraldine Lake Deficits

10% Withdrawal	Minimum	Mean	Maximum
Confluence Withdrawal (m^3)	468,640	936,896	1,457,356
Meets Water Deficit Until (Est.)	2024	2032	2039
Remaining Deficit for 2050 (m^3) [1]	**2,059,360**	**1,591,104**	**1,070,644**
20% Withdrawal	**Minimum**	**Mean**	**Maximum**
Confluence Withdrawal (m^3)	928,437	1,871,497	2,914,712
Meets Water Deficit Until (Est.)	2032	2044	2050+
Remaining Deficit for 2050 (m^3) [1]	**1,599,565**	**656,503**	**0**

[1]To calculate the remaining deficit, the annual 2050 demand subtracts the contributions from Geraldine Lake and Apex River. For example: 3,505,000 m^3 – 977,000 m^3 – 468,640 m^3 = 2,059,360 m^3.

6.0 DISCUSSION

Two water supply configurations have been assessed, both relying on withdrawals from the Apex River. The difference in available water supply between Configuration 1 and Configuration 2 is that the latter is withdrawing from a slightly larger basin that includes local runoff to the Apex River between the licensed location and the downstream confluence with the Qikiqtalik Lake outlet channel.

The results show that with increasing allowable withdrawals from 10% to 20% of instantaneous flows above a license threshold (30% of MAD) and ignoring the presently licensed maximum annual amounts (500,000 m^3), the Apex River may provide sufficient withdrawals to supplement water demands until approximately 2041 or 2044 for Configuration 1 and 2 respectively. If additional withdrawals of 1,300,000 m^3/year from Qikiqtalik Lake are considered in additional to an increase in allowable withdrawals, supplementation may meet water demands beyond 2050 in hydrologically average years. Should the water license remain limited to 10% withdrawal above the license threshold, Apex River is able to provide sufficient withdrawals to supplement water demands until approximately 2030 or 2032 for Configuration 1 and 2 respectively.

The annual water deficits with respect to projected demands in the year 2050 vary, ranging from 70,128 m^3 to 1,745,118 m^3 for the Configuration 1 - 20% withdrawal scenario. Per Tetra Tech's submitted final report titled *"Unnamed Lake Water Balance for Withdrawals Final Report",* Qikiqtalik Lake is expected to be able to provide approximately 1,300,000 m^3 annually of active storage in a hydrologically average year. Based on the findings of this study, it appears that Qikiqtalik Lake may be able to provide sufficient withdrawable volume to supplement Apex River beyond 2050 during average years if water license limitations are amended. Tetra Tech believes that most annual deficits not able to be met by Qikiqtalik Lake could be acquired from Apex River by adding an additional amendment to the proposed water license which allows withdrawals greater than 20% during the freshet season. As an estimate of average total discharge from Apex River is approximately 11,200,000 m^3 from April through October, an additional withdrawal increase may meet water demands on average for 2050, however this would need to be assessed to provide a specific estimate of additional water license requirements.

7.0 CONCLUSION & RECOMMENDATIONS

Tetra Tech has assessed two water supply configurations that rely on withdrawals from the Apex River. Configuration 2 encompasses a slightly larger basin than Configuration 1 by incorporating local runoff contributions between the licensed withdrawal point and the downstream confluence with the Qikiqtalik Lake outlet channel. Under scenarios allowing increased withdrawals from 10% to 20% of instantaneous flows above the license threshold (30% of the MAD) and disregarding the current annual cap of 500,000 m^3, the Apex River may adequately meet supplemental water demands until approximately 2041 under Configuration 1 and 2044 under Configuration 2. Further, if an additional annual withdrawal of 1,300,000 m^3 from Qikiqtalik Lake is integrated alongside the increased river allowances, projected water demands may be met beyond 2050 during hydrologically average years. However, maintaining the current 10% withdrawal cap limits Apex River's supply capacity to approximately 2030 and 2032 under Configurations 1 and 2, respectively, or 2047 and 2048 with 1,300,000 m^3 supplemented from Qikiqtalik Lake.

Annual water deficits projected for 2050 vary significantly, reaching up to 2,132,830 m^3 under the Configuration 1 scenario with 10% withdrawal. According to Tetra Tech's submitted final report, "*Unnamed Lake Water Balance for Withdrawals Final Report*", Qikiqtalik Lake is estimated to provide 1,300,000 m^3 annually of active storage under average conditions. The results suggest that with amendments to current license limitations, Qikiqtalik Lake may continue supplementing the Apex River beyond 2050 during hydrologically average years. To address residual shortfalls, Tetra Tech recommends considering an additional amendment to the proposed water license, permitting withdrawals in excess of 20% during the freshet season. Given Apex River's average discharge of approximately 11,200,000 m^3 from April through October, such an amendment may feasibly meet future water demands; however, a targeted hydrological assessment is needed to determine precise licensing requirements. Continued integration of Qikiqtalik Lake, along with adaptive license adjustments, is advised to support long-term water resource reliability and mitigate projected deficits through 2050.

8.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the City of Iqaluit and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the City of Iqaluit, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

9.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
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Signature
Date 2025-07-25
PERMIT NUMBER: P 018
NT/NU Association of Professional Engineers and Geoscientists

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