Meagan Grabowski, MSc
1208 Pine Street
Whitehorse, YT Y1A 4G1

Yukon Fish and Wildlife Enhancement Trust
Box 31022
Whitehorse, Yukon
Y1A 5P7

Re: Final Report - Meagan Grabowski, Yukon Parks Internship

13 January, 2016

Dear Yukon Fish and Wildlife Enhancement Trust Manager Dennis Zimmerman,

Please find following the Final Report for my Yukon Parks Internship **Sharing results and improving monitoring of rapid vegetation change, and its implications to wildlife and park management on Herschel Island-Qikiqtaruk**.

1) **Project Activities**

Project background

The *Herschel Island–Qikiqtaruk Territorial Park Management Plan* prioritizes monitoring of representative vegetation communities and plant species on Herschel Island. Long-term permanent vegetation transects, were established on Herschel Island to track plant phenology (timing of life history stages) and growth for three indicator species (Arctic Willow - *Salix arctica*, Mountain Avens - *Dryas integrifolia*, and Cottongrass - *Eriophorum vaginatum*). The methodology follows the International Tundra Experiement (ITEX) protocol; numerous phenology and growth parameters are monitored for each species through the season by park rangers.

Project objectives

The primary objectives of this project were to conduct an evaluation, analysis, and report on the vegetation phenology monitoring at Herschel Island-Qikiqtaruk Territorial Park. The project involved a field component at Qikiqtaruk for 10 days in July/August; and an analysis component to include evaluation, analysis, and reporting.

Field component*:* I worked directly with the four park rangers at Qikiqtaruk on the phenology monitoring. Preparation for field work involved logistics planning, reviewing the protocols and comparing to protocols from other sites, and assembling both a list of goals for the field work and a short results highlights report and folder for the Rangers. The goal of this results report was to highlight their successes in creating a long-term dataset which demonstrates tundra plant

phonological change, and to begin discussions on their experiences with the monitoring protocol. In the field, I first assessed the field sampling design. I visited the sites with both shifts of rangers, with Yukon Parks biologist Cameron Eckert, and University of Edinburgh researcher Dr. Isla Myers-Smith (who has been working with the Rangers on the protocols annually). Secondly, I assessed the Rangers' implementation of the monitoring protocol. This included when visiting the plots, assessing their understanding of the protocols and the feasibility of implementation, as well as during discussions throughout the field work component on their experiences. Assessing the implementation was also done via assistance from the University of Edinburgh Tundra Ecology Lab (Team Shrub), who has entered and done preliminary analysis of the data. There were some gaps in the data largely due to the sampling design of certain species. Understanding why these gaps were present and creating/implementing changes to address them was an achieved goal of this project.

Analysis component: I conducted analysis and reporting on the long term database; as well as an evaluation of the statistical power of the sampling design and monitoring protocol both for Qikiqtaruk, and for its contribution to landscape-level monitoring on the North Slope. The report presents options for potential adjustments to survey design and protocol implementation to improve statistical power and trend detection. The report is still underway (due by late January – this deadline was shifted due to my time completing my MSc thesis in November/December 2015) includes a plain-language summary, and a comprehensive technical report. Presentations on the project via Cameron Eckert have included the North Slope Conference, and the WMAC-NS meeting in Vancouver, BC in December 2015. An additional presentation on the project was done at the ArcticNet Annual Scientific Meeting in December 2015, which included both Cameron Eckert, Meagan Grabowski, and rangers Edward McLeod and Paden Lennie. The Poster is below in Communications.

Contributions of Results

The results of this project that contribute to the protection and enhancement of wildlife or habitat are two-fold: 1) direct options for Yukon Parks to improve the quality of the tundra plant monitoring protocol, and 2) further communication and collaboration between Yukon Parks, university researchers, and especially the inclusion of the Rangers ideas into the ecological monitoring beyond data collection. As the Park Management plan comes up for renewal, demonstrating the importance of the plant phenology transects to not just informing vegetation change on the island and the relative influence of climate in driving this change, but also the contribution of this program to the international scientific community, is key.

2) **Communications**

The report will be shared with Yukon Parks, as well as affiliated organizations with vested interest in tundra vegetation monitoring protocols and initiatives such as WMAC–NS and Environment Yukon. Beyond that, the plain language summary will be available for distribution

as Yukon Parks Biologist Cameron Eckert sees fit. I am also happy to provide a copy of both reports to YFWET when it is completed in January 2016.

The poster from ArcticNet has been made available to Edward McLeod, and he is putting it up in the Aklavik HTC office for reading. He also has print offs of the poster which he is distributing to the other Qikiqtaruk Park Ragners and other members of his community. Come Spring the poster will be put up in the Community Building on Qikiqtaruk, so that when Rangers show visitors to the island around they can talk about the work they do conducting scientific research on tundra plants. The YFWET logo is on the poster.

Advancing phenology of tundra plants at Herschel Island-Qikiqtaruk Territorial Park Yukon Territory, Canada

Meagan M. Grabowski[1], Cameron D. Eckert[2], Dr. Isla H. Myers-Smith[3], Santeri S. Lehtonen[3], Jakob Assmann[3], Paden Lennie[2], Edward McLeod[2], Samuel McLeod[2], Ricky Joe[2], and Richard R. Gordon[2]

[1]Department of Zoology, University of British Columbia, Vancouver, BC; [2]Yukon Parks, Yukon Department of Environment, Whitehorse, YT; [3]University of Edinburgh, Edinburgh, UK

Our Island

Qikiqtaruk, a Yukon Territorial Park and Canada's westernmost Arctic Island, features a unique combination of natural and cultural heritage.

The distinctly **Arctic ecosystem** is influenced by a cold, dry climate and the surrounding waters and ice of the Beaufort Sea. A thin active soil layer underlain by permafrost supports a mosaic of tundra vegetation and a rich diversity of birds and wildlife.

Qikiqtaruk is integral to **Inuvialuit culture**. Families travel to the island throughout the year to hunt, fish, and pass on ancient traditions to the next generation.

The Herschel Island **Ecological Monitoring Program** tracks the integrity of the park ecosystem through the dedicated involvement of the Park Rangers, who are themselves Inuvialuit – thus strengthening the connection to community concerns about the rapidly changing Arctic environment.

Photos (top to bottom): Historic whaling settlement on Simpson Point; Map of Herschel Island-Qikiqtaruk; a young Arctic Fox on Collinson Head; the late Elizabeth Mackenzie shares her traditional skills with young Jonas Brower; senior park ranger Richard Gordon has a rich knowledge of the island ecosystem and is a respected mentor to the younger park rangers.

Vegetation Monitoring

Climate change is **rapidly altering Arctic ecosystems** with profound changes in vegetation communities (variety of species) and phenology (timing of life history stages). **Long-term monitoring** on Herschel Island tracks phenology in three indicator species – Arctic Willow *Salix arctica*, Mountain Avens *Dryas integrifolia*, and Cottongrass *Eriophorum vaginatum*.

What we measured

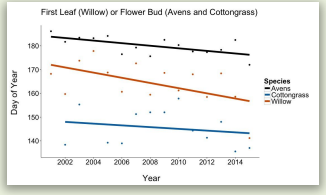
For three indicator species, **phenology measures** (e.g. dates of first leaf, flowering, senescence) are recorded by Park Rangers every 2-3 days from snow-off date to senescence. We established one transect per species, with 10 plots per transect.

Photos (clockwise from left): Cottongrass, Arctic Willow, and Mountain Avens. *Upper right:* Park Ranger Samuel McLeod measures Arctic Willow phenology plots with Meagan Grabowski and Isla Myers-Smith.

Acknowledgements: Vegetation monitoring on Qikiqtaruk has benefitted from the input and expertise of Dorothy Cooley, Jill Johnstone, Catherine Kennedy, Val Loewen, University of Edinburgh's Team Shrub, and the Herschel Island-Qikiqtaruk Park Rangers over many years.

What we found

2001 to 2015 – phenology advanced for all three species – spring is coming earlier on Qikiqtaruk. For willow and avens this change is significant, 15 days and 8 days earlier, respectively. For cottongrass it is earlier (5 days) but not significantly.



Advancing phenology on Qikiqtaruk has been observed by local Inuvialuit for many years, and this monitoring program **quantifies the magnitude of change**. As well, it shares the findings with the scientific community through the International Tundra Experiment (ITEX).

Yukon Parks · Yukon Fish & Wildlife · Yukon Research Centre · Yukon Environment

There have been two instances so far of media coverage on Qikiqtaruk that took place during this YFWET supported project. The first was when Yukon Government Ministers visited the island, and the second when I was interviewed by Chuck Tobin at the Whitehorse Star. I mentioned support from the YFWET to Mr. Tobin during the interview. Here are photos of the two articles (let me know if I should provide paper copies):

OPINION 19

The Whitehorse STAR, Friday, August 21, 2015

Protection, research are ongoing at Herschel Island

By ELAINE TAYLOR and WADE ISTCHENKO

As ministers for the Departments of Environment and Tourism and Culture, we were fortunate to visit Herschel Island recently and observe the excellent work taking place at Herschel Island-Qikiqtaruk Territorial Park.

COMMENT

The island is Yukon's most northerly point, approximately five kilometres off our northern coast, and is home to more than 100 species of birds along with caribou and muskoxen.

In addition to its fascinating flora and fauna, the park is of great historical importance to our territory.

The land has been used for centuries for hunting, shelter and as a meeting place by the Inuvialuit.

In the 1890s, whalers established a community at Pauline Cove due to its deep, safe harbour.

The park was created in 1987 as a result of the Inuvialuit Final Agreement.

Its purpose is to conserve and protect wildlife and habitat, protect heritage resources, and allow for ongoing traditional use by the Inuvialuit.

During our recent visit, with the assistance of the Yukon government's park rangers, we were able to see first-hand how the park is managed and hear directly from staff and visitors about their experience.

It was valuable to see the excellent collaboration of our two departments, with Environment administering and managing the park, and Tourism and Culture managing the heritage resources found there for the benefit of Yukon residents and visitors.

A team of park rangers from the department of Environment monitors natural and historical resources, conducts patrols and surveys, and provides interpretive services to visitors.

The park rangers also assist Parks Canada and the Canadian Coast Guard with search and rescue, and are true ambassadors for the island.

They collect data, such as weather conditions, ice conditions, bird migration, and the condition and abundance of vegetation within established sampling areas, which in turn the Yukon government shares with researchers around the world.

Staff from Tourism and Culture work at the park to restore, conserve and document the history and historical structures that remain on the island, which include 12 standing buildings (dating from 1893 to 1930), several subterranean ice houses and many burial sites.

Given that the average temperature in the Arctic has risen three to four degrees over the past 50 years, changes to the permafrost and ground temperature are carefully monitored.

Our departments work collaboratively to manage Herschel Island's precious heritage resources and monitor any effects that are caused by the changing climate.

The park also allows Yukon to provide important contributions to science at an international level.

During our visit, we met with researchers from the Alfred Wegener Institute of Germany.

They are doing field studies on the island to examine the rates of ground warming and deterioration of the permafrost.

Researchers from McGill and Carleton universities have also worked on projects at Herschel Island.

Other research includes collaboration between the Wegener Institute and the University of Edinburgh, with logistical support from Yukon government, to measure long-term vegetation plots to help understand growth trends.

The Department of Environment's Ecological and Landscape Classification Program is also undertaking a full mapping project this year on the island, in co-operation with the Wildlife Management Advisory Council (North Slope), to inform future wildlife management decisions.

One aspect of the strength and value of Herschel Island's contributions is that data have been collected continuously there for more than 20 years.

This longevity and continuity in scientific data collection can be seen in only a few areas of the circumpolar world, and it is part of what makes Herschel Island such an important contributor to research on an international level.

Last year, just over 400 people visited the park, which is accessible by boat and aircraft in the summer.

This year, two cruise ship visits are expected, in addition to commercially guided and private visits.

Site visits are strictly controlled – with staff monitoring the effects visitors are having on the environment and artifacts.

Visitors to the park normally include cruise ship passengers, Inuvialuit, researchers, tourists, Yukon government employees, sailboat travelers and Coast Guard staff.

This year, we were privileged to be among those visitors. Our trip to Herschel Island was a fascinating experience we won't forget.

We are proud that the Government of Yukon supports the important historical preservation and scientific research work taking place in this unique and remarkable place.

The writers are the minister of Tourism and Culture and the minister of Environment respectively.

TREASURED HERITAGE – Some of the historical structures on Herschel Island are seen above.

Photos courtesy GOVERNMENT OF YUKON

VISITING A VALUED SITE – Tourism and Culture Minister Elaine Taylor and Environment Minister Wade Istchenko (centre, holding flag) are seen with other members of a group which visited Herschel Island earlier this month. Also shown are Edward McLeod (far left), an Environment Yukon park ranger; Barbara Hogan, the Department of Tourism and Culture's manager of historic sites; Joe MacGillivray (centre), Environment Yukon's deputy minister; Barry Troke, the parks branch operations manager (South Yukon); and park ranger Paden Lennie (far right).

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The Whitehorse STAR, Friday, September 11, 2015

Student's thirst for knowledge remains unquenched

By CHUCK TOBIN
Star Reporter

Born in Dawson City and raised in Whitehorse, Meagan Grabowski knows the Yukon.

She wants to know more, much more.

The post-graduate research student of the University of British Columbia spent 2 1/2 weeks on Herschel Island last month reviewing plant research alongside Dr. Isla Myers-Smith, a professor at the University of Edinburgh, Scotland.

She's put in her time at the Kluane Lake Station over the years, has compared older aerial photos with current aerials of shrubs at specific tundra sites. The 27-year-old has conducted research up high in the alpine.

"Summers are longer and warmer than they use to be," Grabowski said in a recent interview. "So plants have a longer growing season."

She says not only are various plants and shrubs becoming more robust, they're moving, expanding their range – not just laterally, but also horizontally.

In the mountains, plants associated with lower elevations are climbing higher.

On the tundra, shrubs are growing faster and creeping further north.

While the changes may be imperceptible to some, Grabowski and her colleagues in the science community are documenting them.

The 2006 graduate of Vanier Catholic Secondary School says understanding the science behind changes to the environment is essential to inform policy discussions regarding landscape management.

The white crown sparrow, for instance, stands to benefit from lusher and expanding shrubbery because it feeds on bugs that live in the shrubs.

Birds like the Lapland longspur, on the other hand, stand to lose as plant life takes over their ground nesting habitat, she says.

The master's student who's basing her research on plants says encroachment of shrubs in the alpine may make it harder on Dall sheep who depend largely on grasses for food but may be good for browsers like moose.

"This year, I'm writing my thesis," says Grabowski, who hopes to defend her conclusions later this year.

"I have been observing that boreal shrubs have been growing taller, denser, and there's just more of them."

As shrubs move northward, people of the Mackenzie Delta are seeing more moose further north, just as deer have migrated further north into the Yukon in greater numbers over recent decades, she says.

"Range expansion of animals northward is happening all over the polar region."

Dr. Charles Krebs of the University of Victoria has been working in the Kluane region for more than 40 years, and is one of Grabowski's mentors.

Krebs blames the explosion of plant life for the rapid decline of the Arctic ground squirrel population in the area.

Because ground cover is so much thicker, the ground squirrels – or gophers – have a harder time seeing predators approach, whether it's from the air or on the ground, the 79-year-old Krebs insisted in a interview with the *Star* last November.

Grabowski was among four board members from the Canadian chapter of the Association of Early Polar Career Scientists who attended the association's first world summit in Sophia, Bulgaria, this past June. Some 66 early career scientists represented 25 countries.

While Bulgaria isn't exactly a polar country, interest in what's happening in the polar regions is strong around the world, says Grabowski.

Bulgaria, she points out, has a research station in the Antarctic.

The U.S. National Oceanic and Atmospheric Administration reported last month that July 2015 was the warmest month on record.

Grabowski says while she strives to achieve a greater understanding of the science behind changes to the environment, she also wants to do more to communicate that understanding to local communities. She wants to encourage others to become interested in the field.

"If we live here year-round, we are in a position to observe more," she says. "I want to do research in the Yukon if possible. I want to learn more about the Yukon on a landscape level."

As part of her work here this summer, she's involved with the Scientists Visiting Classrooms program at Yukon College and has organized meetings among other young local scientists.

Building local science capacity will help build the local knowledge base, she says.

Grabowski was accepted earlier this summer into the Jane Glassco Northern Fellowship, along with nine other northerners between the ages of 25 and 35 who will participate in a two-year development program sponsored by the Gordon Foundation.

The 10, including two others from the Yukon, bring a variety of backgrounds to table, from Grabowski's environmental research to Jordan Peterson's involvement with youth through his work with Inuvik's community development office.

The intent of the Jane Glassco program is promote an exchange of information and ideas about the North and how the region could be better off.

The group had its first of four official meetings last month in Whitehorse.

"This is an opportunity to ask and look into questions that you have been thinking about but have not had the opportunity to pursue in a serious way," says Grabowski. "I'm jazzed about it."

Her quest is to delve into how relationships between communities and scientific research could be advanced, how to involve communities in choosing the areas of research and how to communicate the results.

For more than 20 years now, Herschel Island park rangers (if mostly Inuvialuit descent from the Mackenzie Delta have been studying the same 60 plots of three different shrubs. They've been visiting each plot three times a week to make observations and take measurements.

It is one of the most comprehensive research projects in the entire polar Arctic, she says.

Grabowski says it's clear plants on Herschel Island are greening up faster and flowering earlier.

Through her work over the next two years at a Jane Glassco Fellow, she wants to explore how to present that type of information to communities in a meaningful way. Beyond the numbers and scientific graphs.

"I happen to study habitat more than the animals, but it is all part of the big picture," she says. "A changing Arctic – what does that mean?"

Star photo by VINCE FEDORUFF

STILL LEARNING – Meagan Grabowski was accepted earlier this summer into the Jane Glassco Northern Fellowship, along with nine other northerners between the ages of 25 and 35.

Lastly, I wrote about the project in a blog post on the Team Shrub website. It can be found here: https://teamshrub.wordpress.com/2015/09/26/qikiqtarukmiut/

Here are photos by Cameron Eckert of the field work:

Photo 1. Ricky Joe, Meagan Grabowski, Isla Myers-Smith and Sam McLeod near the Artic Willow transect.

Photo 2. Meagan Grabowski, Isla Myers-Smith, and Sam McLeod resizing the Mountain Avens quadrats.

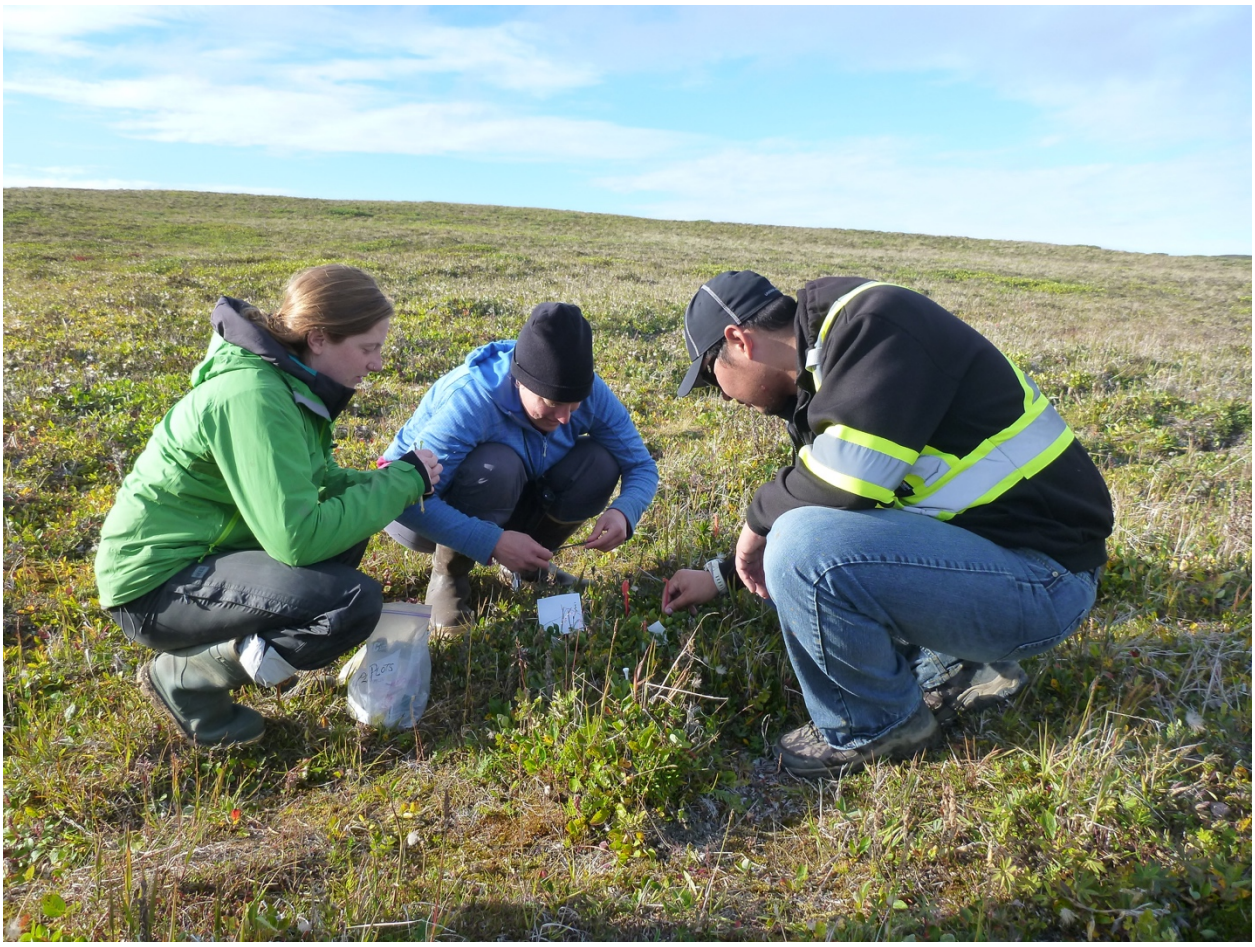

Photo 3. Meagan Grabowski, Isla Myers-Smith, and Sam McLeod resizing the Mountain Avens quadrats.

Photo 4. Isla Myers-Smith, Ricky Joe and Meagan Grabowski resizing the Mountain Avens quadrats.

3) **Financial Statements**

Qikiqtaruk Final Budget Report 2015:

Expenditure Categories	Item	Proj. Cost	Actual Cost	YFWET	Yukon College
1. Rental expenditures					
2. Wages/Contract	Project prep (25hrs @ $37.50/hr)	7,000	943	300	643
	Field wages (10 days @ $37.50/8-hr day)		3,000	3,000	
	Analysis / Report (15 days @ $37.50/8-hr day)		4,500	1,500	3,000
3. Office and admin					
4. Travel expenses	Whitehorse to Inuvik flight	2,100	400	400	
	Field per diem (10 days @ 103.20/day)		1032		1032
5. Materials/supplies		400	0		
6. Facility expenses					
7. Other – Yukon Parks money admin fee	Yukon College admin fee (15% of $5,500 from Yukon Parks)		825		825
TOTAL			**10,700**	**5,200**	**5,500**

Meagan Grabowski, MSc
1208 Pine Street
Whitehorse, YT Y1A 4G1

INVOICE

Yukon Fish and Wildlife Enhancement Trust

18 December, 2015

Re: YFWET Project Final Report, contract hours for Meagan Grabowski

Type	**Amount**	**Comments**
Project Prep	$300	25hrs* ($643 paid by Yukon Research Centre/Yukon Parks)
Field Wages	$3,000	10 days
Analysis/Report Writing	$1,500	15 days ($3,000 paid by Yukon Research Centre/Yukon Parks)
Whitehorse to Inuvik flight	$400	Attached receipts from Air North plus luggage fee receipt ($90.72)

*all wages calculated for $37.50/hr

Amount budgeted from YFWET: $5,200.00

Total amount due on this invoice: remaining 20% of $5,200.00

From: confirmation@flyairnorth.com
Subject: Air North, Yukon's Airline-Confirmation 00994847
Date: July 2, 2015 at 10:22 AM
To: MEAGANGRABOWSKI@GMAIL.COM

Your Air North, Yukon's Airline Itinerary

Thank you for booking with us!

Your itinerary number is 00994847.

Passenger ID Number: HUAYG1ZZ
Address: 1208 PINE ST WHTIEHORSE, YT Y1A 4G1 CAN
Booked: July 02, 2015
Booked By: HUAYG1ZZ

WEDNESDAY JULY 29, 2015 › FLIGHT 307 - Whitehorse to Inuvik

DEPARTS 07:00 › ARRIVES 12:15 › STOPS 2 › Hawker Siddeley 748

MEAGAN M GRABOWSKI	**Confirmed**

Purchase Summary

Total Fare	174.75
Canada Goods and Service Tax #850279555	8.74
Itinerary Total	**CDN 183.49**
Payment	AIRPASS:HUAYG1ZZ

Questions, comments or concerns?

Please do not reply to this email as it was issued by an automated message system. If you're received this message in error, please call Air North, Yukon's Airline at one of the numbers below.

How to contact us

- Toll-free (in North America): 1.800.661.0407 ext. 1
- (867) 668.2228 ext. 1
- Via our website at **flyairnorth.com**

Rules and Conditions

UPDATED AUGUST 1, 2012

Identification & Check-in Information

- **For Domestic Flights** — Check-in a minimum of 90 minutes prior to scheduled departure. Although we will do our best to assist, passengers arriving less than 20 minutes prior to the scheduled departure boarding may be denied. Valid government-issued identification featuring clear and identifiable photo of passenger and including name, date of birth and gender is required for all passengers.
- **For Trans-Border Flights** — Check -in a minimum of 90 minutes prior to scheduled departure.

From: confirmation@flyairnorth.com
Subject: Air North, Yukon's Airline-Confirmation 00994852
Date: July 2, 2015 at 10:25 AM
To: meagangrabowski@gmail.com

Your Air North, Yukon's Airline Itinerary

Thank you for booking with us!

Your itinerary number is 00994852.

Passenger ID Number: 96GGOOOQ
Address: 1208 PINE STREET WHITEHORSE, YT Y1A 4G1 CAN
Booked: July 02, 2015
Booked By: 96GGOOOQ

TUESDAY AUGUST 18, 2015 › FLIGHT 308 - Inuvik to Whitehorse

DEPARTS 12:45 › ARRIVES 14:45 › STOPS 1 › Hawker Siddeley 748

MEAGAN GRABOWSKI	**Confirmed**

Purchase Summary

Total Fare	159.80
Canada Goods and Service Tax #850279555	7.99
Itinerary Total	**CDN 167.79**
Payment	AIRPASS:96GGOOOQ

Questions, comments or concerns?

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- **For Trans-Border Flights** — Check -in a minimum of 90 minutes prior to scheduled departure.

AIR NORTH
Yukon's Airline

BOARDING PASS

PASSENGER **GRABOWSKI/MEAGAN**
ITINERARY NUMBER **00994847**
TRAVEL ITINERARY
BOARDING GATE AT **06:30AM**
FROM **Whitehorse** TO **Inuvik**

FLIGHT	SEAT	DATE	DEPARTURE TIME	CLASS	SEQ
307K	-	29Jul15	07:00AM	Economy	010

AIRCRAFT TYPE	BAGGAGE	SPECIAL	REMARKS
Hawker HS7	2/98.0	0/0.0	-

AIR NORTH
Yukon's Airline

BOARDING PASS

PASSENGER **GRABOWSKI/MEAGAN**
ITINERARY NUMBER **00994852**
TRAVEL ITINERARY
BOARDING GATE AT **12:15PM**
FROM **Inuvik** TO **Whitehorse**

FLIGHT	SEAT	DATE	DEPARTURE TIME	CLASS	SEQ
308N	-	18Aug15	12:45PM	Economy	028

AIRCRAFT TYPE	BAGGAGE	SPECIAL	REMARKS
Hawker HS7	2/0.0	0/0.0	-

AIR NORTH
Yukon's Airline

BAGGAGE RECEIPT

PASSENGER
GRABOWSKI/MEAGAN
ITINERARY NUMBER **00994847**
FROM **Whitehorse** TO **Inuvik**

FLIGHT	SEAT	DATE	DEPARTURE TIME	CLASS
307K		Wed Jul 29	07:00AM	Economy

BAGGAGE 2/98 0P
SPECIAL 0/0 0

TOTAL BAGS 2 00
TOTAL CHARGES CAD 86 40
TAX CAD 4.32
TOTAL CAD 90.72

PAID BY
CREDIT VISA

AGENT
BOUTELLIES