Summer of ’64 on the Nelson River

Planning northern projects for southern beneficiaries

A PERSONAL MEMOIR BY BRIAN GROVER

This very personal note was prepared initially for my family: my siblings, children and grandchildren. It describes my situation half a century earlier, working during three summer months in 1964 as a young engineer in northern Manitoba. This note is about an historic, small part of the ongoing saga of Manitoba Hydro's planning and development of the Nelson River flows to generate electricity.

Brian Grover in 2016

I am also glad to share this reflection with the families of the four Cree workmen from Cross Lake, key members of our survey team, without whom we could not have undertaken this challenging task. This note is dedicated to them: Charles Osborne, Lazarus Monias, John Monias and Jack Miley McKay.

My hope is that some readers may be interested in this story and the accompanying photos from that period. Perhaps it will cause them to think anew, as I am, about the challenging conditions which affect First Nations in northern Manitoba.

~ Brian Grover, April 2017

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About this e-book

It began in mid-2016 as a binder with text explaining my old photos, written primarily for my family, as well as for the families of my Cree co-workers. Later I wrote a seven-page article titled "Hydrometric Surveys of the Nelson River in the 1960s", which was published in the Spring 2017 *Journal of the Manitoba Historical Society* (pp. 25-30).

This e-book would not have happened without the inspiration and support of others. My brother Richard helped awaken me to some of the environmental issues facing First Nations in northern Manitoba. He then introduced me to William Osborne, through whom I also met Jackson Osborne and John Angus Monias – all descendents of the Cree men with whom I had enjoyed working in 1964. My sister Sheila offered encouragement and editorial advice, as did Kirby Gilman of Manitoba First Nations Educational Resource Centre. My brother Paul provided the 1990 photo of Priscilla Island (now named Ship Island). Manitoba Hydro staffers Bruce Owen and Dale Hutchison kindly provided the maps in Section B of this document. My wife Patrice offered constructive and insightful comments. Jim Burgoyne (coincidentally a former worker on Nelson River power projects) worked his editorial magic by converting my amateurish, personal essay into this attractive e-book. Errors and omissions likely remain, however, and nobody but me is responsible for them.

This e-book can be obtained free of charge from the website of the Manitoba Historical Society at: www.mhs.mb.ca/docs/memoirs.

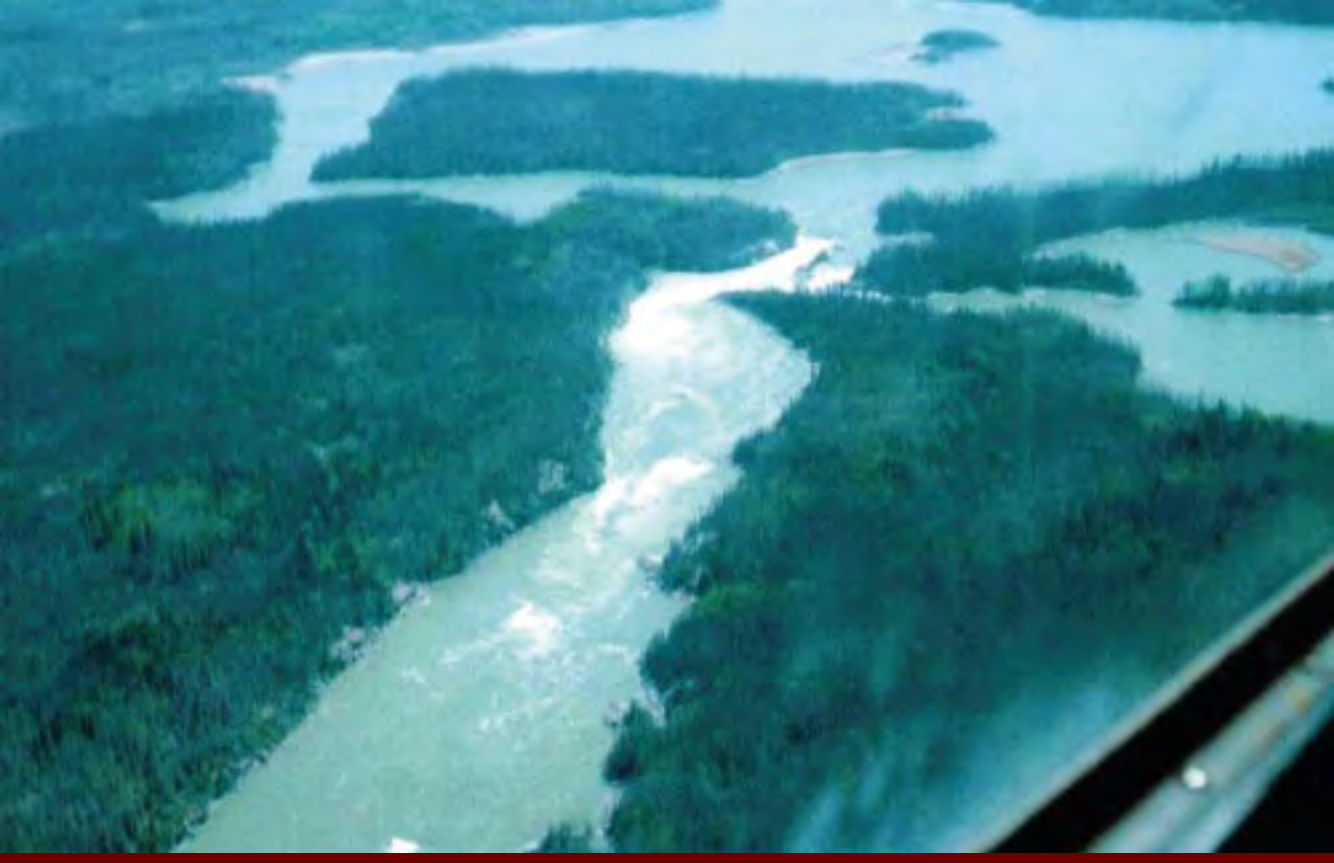
Brian tries on a moose rack at the start of the Nelson River survey in June 1964

A. Reflecting on the summer of ’64

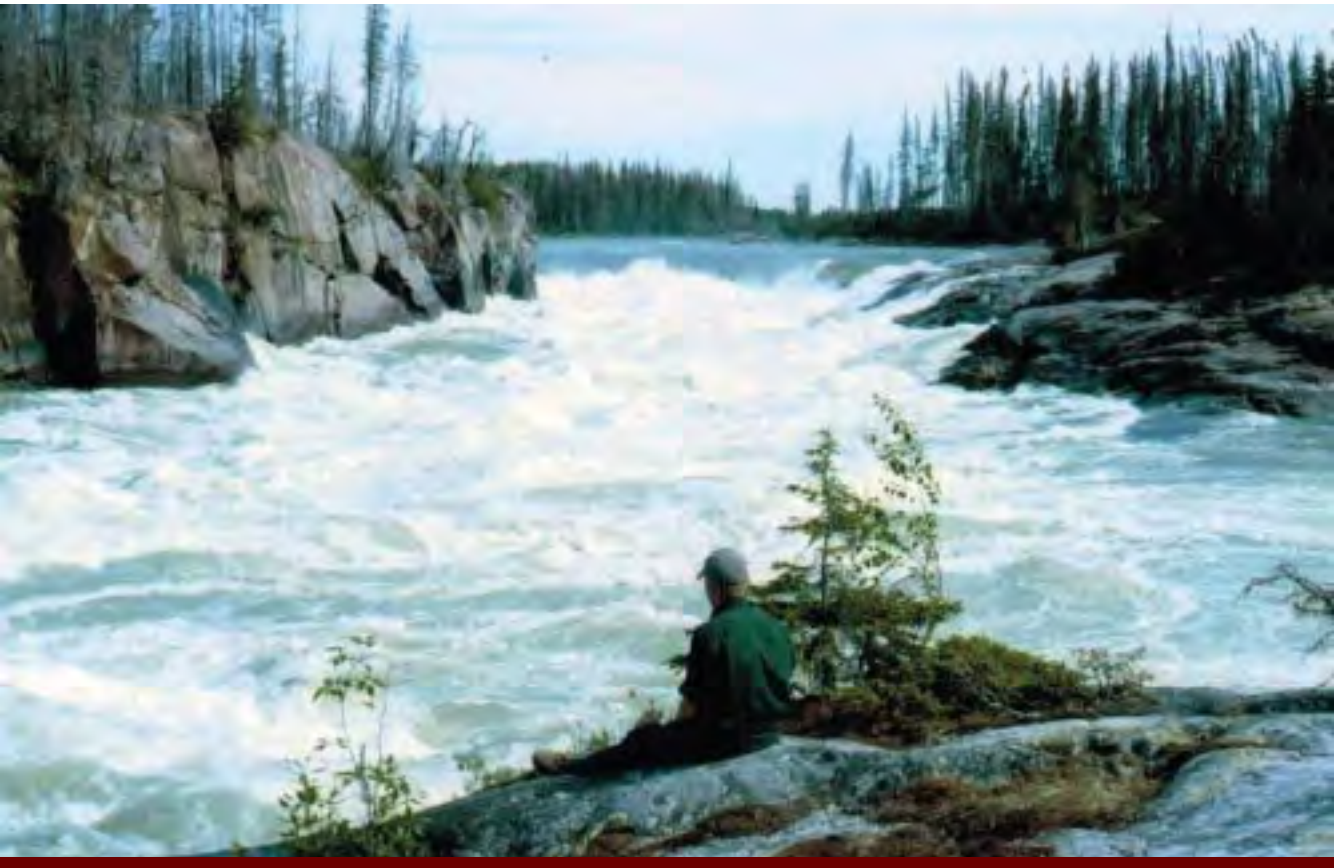
1. Introduction

The drainage basin of the Nelson River is huge, more than one million square kilometres (414,000 square miles) from four Canadian provinces and two USA states. This area is slightly larger than the combined area of France and Germany. The river flows northward about 644 km (400 miles) from Lake Winnipeg to Hudson Bay. Because of the difference in elevation between the lake and the bay (about 217 metres or 713 feet) and the large volume of water flowing (averaging about 2,300 cubic metres a second or 84,000 cubic feet a second), the river had been identified for many years as a future source of electric power.

Manitoba Hydro had already developed the Kelsey hydro plant in 1957 to provide power to an isolated mining operation and the associated town of Thompson. Surveys and studies about future



View from a float plane of Whitemud Falls in the upper Nelson River



Water-level view of the east channel at Whitemud Falls

At camp with pet goose: (l-r) Peter (cook), John W., John M, Jack, Lazarus, Peter Q and Charlie

prospective power sites along the rest of the Nelson were well underway in the 1950s and 1960s.

Hydrometric surveys are intended to augment planning data by exploring the profile and cross sections of the river bottom. Such surveys also measure flows, attempting to correlate flow volumes with water levels. Manitoba Hydro had been undertaking such surveys in previous years and was planning for the 1964 open water season when I learned about them.

In the summer of 1960 I had worked for Manitoba Hydro as an engineering student (third year at University of Manitoba). I was hired to work there again after graduating as a civil engineer in May 1961.

However, I left Manitoba Hydro in September 1961 because I was awarded an Athlone Fellowship for two years of post-graduate experience in the United Kingdom. I worked there during the first year (practical stages with English Electric re water turbines, and then with Binnie & Partners, consulting engineers). In my second year I studied at the London School of Economics, earning a post-graduate diploma in Business Administration.

I returned to Manitoba Hydro in 1963 and began working in the power production part of the utility, dealing with reservoir operations for hydro plants on the Winnipeg and Saskatchewan Rivers.

Charlie and Lazarus at Eve's Falls at upper Nelson River

Concurrently I began studying again at the University of Manitoba, taking two courses towards a Masters degree in water resources engineering. I was single, living at home and reconnecting with my family and friends after being away for two years.

In early 1964, I asked my employer for the opportunity to participate in that summer's hydrometric survey of the Nelson River, partly because of my graduate studies, and partly because I wanted more experience. In April the head of Engineering (Jim Rettie) approved me to lead the crew, and my bosses in Production (Len Bateman, Jack Atchison and Karl Renger) agreed to transfer me to a different part of the utility for the summer.

That summer became a very important stage in my life (then age 25). I learned a lot: about the geography and cultures in my home province of Manitoba; about survey work in the challenging environment of the Nelson River; and about myself. I particularly appreciated the chance to work in northern Manitoba with four Cree boatmen whom we hired at Cross Lake as key members of that year's hydrometric survey crew.

I recently discovered some photos from that era. Because my ten grandchildren (Sean, Colin, Sabrina, Owen, Norah, Johan, Nicole, Kirsten, Ruth and Jacquie) are all near the beginning of their own careers, I thought it might be interesting to reflect on that special

A rubber boat navigates the water above the rapids before a portage

summer, and to share some photos and ideas — especially with the youngest generation of my family and their parents (my four children – Steven, Sharon, Barry and Colleen), and also with my siblings (Paul, Sheila, Kathy, Jane and Richard).

While researching and writing this document I learned that families of the Cree members of our crew (all since deceased) were interested in photos and stories from that period. So this reflection has been explicitly prepared to be shared with them. In July 2016, I met with a few members of the Cross Lake (Pimicikamak) Cree people and provided them with copies of an earlier version of this document. It was a great pleasure for me (along with my brother Richard Grover) to meet these four individuals in Winnipeg: Jackson Osborne; William Osborne and his wife Joyce; and John Angus Monias. Jackson and William are the sons of Charles Osborne, and John Angus the son of Lazarus Monias.

My reflection (Section A of this document) continues after this introduction with two other parts. Part 2 summarizes our 1964 field work along the entire Nelson River. Part 3 comprises some emerging personal observations about what I have learned from this work along the Nelson River, a critical region of my home province, some five decades after these events took place.

The three components of this reflection are supported by my old

Baby beaver "Mojo" enjoys a snack in camp

photos (originally 35mm slides), plus two background documents: a personal journal in which I had recorded facts and ideas while in the field; and a recently discovered report which I had prepared within Manitoba Hydro at the end of the 1964 hydrometric survey.

Section B includes three maps, depicting the immense watershed of the Nelson River. Also depicted on the maps, provided by Manitoba Hydro, are the northern region of Manitoba, including the Nelson River, and all existing hydro power developments.

Section C, key excerpts from my 1964 report to Manitoba Hydro completes this reflection.

That summer's experiences have recently been interpreted by a much different Brian Grover than the young engineer who worked on the Nelson River in 1964. I am now 77 years old, having retired 17 years ago after a very satisfying career, mostly in managing and developing water resources in developing countries. My principal employers were the Canadian International Development Agency (CIDA) and the World Bank. Through the lens of my lifetime experiences, I am now trying to interpret and explain what I recall from working 52 years ago on the Nelson River.

I visit Manitoba regularly because four of my five siblings still live there, but I have not myself lived in Manitoba since I moved

Preparing to portage downstream

away in 1965. I have never returned to the Nelson River. Accordingly I am trying to describe the 1964 survey without any experience about how the northern Manitoba region has changed since then. Some of the names of locations and potential power sites are different today than they were in 1964. The place formerly known as the Cross Lake Indian Reserve, for example, is now referred to as Pimicikamak by people of the Cree First Nation who live there (population now about 8,000 — certainly much larger than when I visited in 1964).

Another change concerns the quality of the water in the Nelson River. When I was working there the water was clear, of high quality, so clean and fresh that we drank it directly from the river. We ate the fish we caught there without any second thoughts. In fact I was personally surprised by this reality, as I had known the waters of Lake Winnipeg to be turbid and murky in the populated southern portion of the lake, where the Red River enters the lake. I had been unaware of that lake's ability to act as a huge, natural sedimentation basin, allowing outflows into the Nelson River from the north end of the lake to be crystal clear.

As an occasional summer tourist to family cottages around southern Lake Winnipeg, I am aware that water quality in this large lake (especially the smaller southern portion) has decreased

Boats and crews arrive at shore at tea time

considerably in recent decades. Also erosion of the lake's shorelines continues, perhaps aggravated by water levels now controlled at the north end of the lake by the Jenpeg dam. Apparently dams and flow management at Jenpeg (and possibly other dams) have also jeopardized the quality of water in the Nelson River, with major impacts for northern residents.

Along the Nelson River are several rapids and waterfalls, treacherous for boats. At these locations we had to get out of the boats if they could not be pulled along the shoreline a portage was necessary. We had to carry everything, including the heavy boats and motors, around the dangerous water. This work of portaging was very hard and time consuming.

Tea time, late in the season: (l-r) Lazarus, Peter, John W., Charlie, Jack and Brian

2. Summary of 1964 hydrometric survey

In the previous year (1963) the hydrometric crew had been led by engineer Dave Pashniak. In 1964 he accompanied me to the field to introduce me to the practical realities of this job, and to help the current year's survey team get started. The chronological record of our work is explained in my 1964 report (in Part C of this document).

Five of us departed Winnipeg by CNR train on June 9: Dave, three engineering students (Peter Quinn, John Westdal and Al Millar) and myself. The next day we disembarked at Wabowden and were flown by Beaver float plane of the Manitoba Government Air Service (MGAS) to our first camp at Red Rock Rapids. There a separate Manitoba Hydro crew, led by John Veen and Jim Field, was exploring a potential dam site.

I flew with Jim Field and Dave Pashniak to Cross Lake on June 11 to recruit Cree boatmen for our summer's work. The four people we sought, based on their extensive previous experience, were all available: Charles Osborne, Jack Miley McKay, John Monias & his brother Lazarus Monias. I learned subsequently that only John had attended school (possibly St. Joseph's Residential

Dave Pashniak and an MGAS pilot as the survey season is set to begin

School) and was fluent in English, and that none of these four excellent workers ever had jobs under a roof. They had earned great reputations for being reliable, hard working and wise. All four arrived at our campsite in their own boats the next morning and our summer's work began.

Our surveyors were three engineering students plus myself (overall crew leader and sonar operator). Our crew also included an experienced bush cook, Peter Wilchovy, who could make wonderful food on his portable, wood-burning tin stove.

There were four main tasks for our field crew of eight (four hydrometric surveyors and our four boatmen):

- Estimating river flows by measuring the cross section of the river (by a sonar depth finder) and the speed of the water (by a current meter), usually done from a boat attached to a temporary cable across the river. Also done occasionally from a cable car on a semi-permanent cable across the full width of the river;
- Determining the bottom of the river by sonar depth recorder from the rubber boat (Zodiac type) with 35 HP motor. To indicate the location of each depth measurement obtained by sonar, we used a stadia board on the boat, in radio contact with the surveyor using a transit on the shore, to measure the distance to the moving boat as it crossed the river;

Depth-sounding crew: (l-r) Brian Grover, Charlie Osborne, Lazarus Monias and Peter Quinn

• Installing and reading automatic water level recorders at a few selected locations; and

• Determining the elevation along the shoreline at each water level recorder and cross section by means of a levelling survey crew (two surveyors and two boatmen). This levelling crew moved in a canoe with a 10 HP motor.

We would work long days (typically 10 to 12 hours, or occasionally more) from Monday to Saturday. When we worked near Cross Lake, our boatmen would return home for Sundays. Those of us southerners who stayed in camp would relax, go fishing (lots to catch), read, do laundry, write letters, or even go water skiing.

Initially we worked on the upper Nelson River in the general vicinity of Cross Lake, starting at the Red Rock camp, doing hydrometric surveys to complement the land-based explorations by separate crews. During the summer we worked from seven different camp sites, as explained in my 1964 report – Section C, which follows.

Each time we relocated to a new campsite we had some routine chores: build a temporary dock for boats and float planes; clear the campsite of unwanted trees; set up our three big tents on freshly cut poles (sleeping quarters for the surveyors and for the boatmen, plus a large cook tent and dining room); dig a sew-

Depth-sounding crew at work — note stadia board in the boat and transit surveyor on shore

Brian and Peter in the cable car while measuring river flows

age pit and erect an outhouse; and dig another pit in the shade, into the permafrost, to serve as our refrigerator. The Cree boatmen were such experienced woodsmen and strong workers that we completed all these tasks at each new site within a few hours. Breaking camp for the next move, and readying all materials for transportation to the next camp, took even less time.

We used our camp radio to arrange for periodic deliveries of food and fuel by float plane. Several of the “bush pilots”, very skilled aviators, were former members of the RCAF, some of whom had flown during World War II (which had ended 19 years earlier)

Our two survey crews mainly concentrated on shoreline levelling and boat-based river cross sections, typically about three sections per mile of river. We would gradually work upstream and downstream from our campsite. Experience showed that we could avoid excessively long travel times by boats on the river if we relocated the campsite approximately every two weeks. On relocation days we would arrange for float planes to take most of our equipment to the new camp. Hence the term “fly camps”. The Cree boatmen would then drive the boats to the new camp, portaging as needed around rapids and waterfalls.

After our arrival at the Red Rock camp on June 11 we relocated several times along the upper Nelson River: on June 30 to the

German tourists depart Gillam Island after paddling down the Nelson River

Whitemud Channel; on July 14 to the Ominawin Channel; and on July 31 to Bladder Rapids, where we stayed longer than usual because we were also requested to survey the “thalweg” (deepest line along the channel).

Treaty time at Cross Lake in 1964 was from August 21 to 23, during which time all of our Cree boatmen returned home. Some of us surveyors also visited Cross Lake then (discovering how difficult it was, without our experienced Cree boatmen, to navigate in the Nelson River). We were treated to wonderful hospitality by the Cross Lake residents during that festive time.

On August 25 and 26 we relocated to the lower Nelson River, near Kelsey, where we completed more detailed surveys of the river around the powerhouse. On August 31 and September 1 it took three loads on the big Otter float plane to deliver all our gear (including the two boats) to our next camp near Gillam Island. On September 5 we flew to our final camp at Gull Rapids.

Imagine our surprise on September 3 when we saw two German tourists in the lower Nelson who were awaiting a charter flight back south with Lamb Airways. Helga and Bernd Lindemann, on vacation from Frankfurt, had paddled their canoe down the Nelson River as far as Gillam Island. They did all their own planning and portaging along this huge river with all its rapids and water-

Preparing to move camp with Ilford Airways: (l-r) John, pilot, Jack, Lazarus and Charlie

falls. Brave and energetic people, for sure!

The weather in northern Manitoba deteriorated, giving us our first taste of winter: sleet and snow on Sept. 9. We finished our season's work soon thereafter, with John Monias and Jack Miley McKay flying back to Cross Lake on Sept. 13, while students John and Al headed to Kelsey, enroute to Thompson. Charlie, Lazarus, Pete and I flew back to Kelsey for some further sonar work there on Sept. 14. On Sept 15 we went our respective ways back to our homes, me by flying to Thompson and onwards to Winnipeg with Transair.

There were many features without names on the aerial photos and topographic maps on which we relied as we worked along the Nelson River. Occasionally we assigned arbitrary names to geographical features, usually for ease of reference related to our work. When we were working along the lower Nelson River near Gillam Island, there was a large island in the middle of the river which had no name on our maps. Its location is at Latitude 56 degrees, 55 minutes north and Longitude 92 degrees, 56 minutes west. I decided to name this Priscilla Island on our working maps, after my girlfriend Priscilla Matthes. She was then a gorgeous 21 year old, who was the receptionist guarding the entrance to the Executive Suite in Manitoba Hydro's head office in Winni-

Final departure from Kelsey on Sept. 15 aboard a Riverton Airways' twin-engined Beechcraft

peg. I met her at work in early 1964 and soon fell in love with her. I visited her office regularly, whenever I wanted to meet with Kris Kristjanson, the Economics Director who had visited Ghana (about which I was doing research in connection with my post-graduate studies at the University of Manitoba). Priscilla also controlled the flow of visitors to other senior executives there, including Board Chairman Don Stephens, Chief Engineer Tom Storey, General Manager Bill Fallis and lawyer John Fennell.

In 1965 I married Priscilla and we moved away from Winnipeg, never to live in Manitoba again. She was the mother of my four children, an amazing woman. She died in 2004. I regret that the former Priscilla Island has since acquired a more official name: Ship Island.

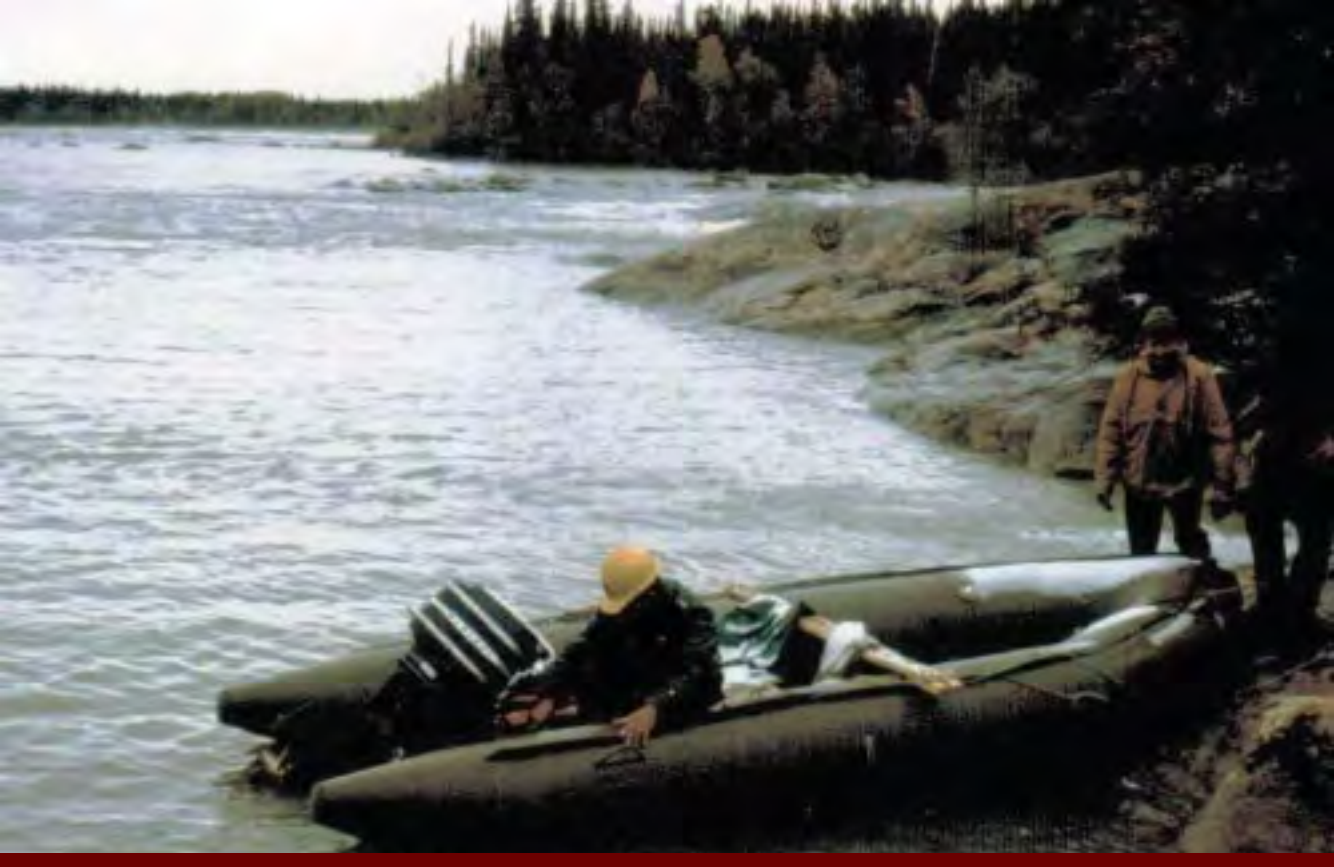
Peter (left) and Lazarus lining the rubber boat up the rapids

3. Personal Observations in 2016

Since we parted in mid-September of 1964, I have never seen any of the men with whom I had enjoyed working on the Nelson River. All four of our boatmen have reportedly died, probably our cook Pete, too. Who knows about those three students, who would all be in their 70s, if still alive.

Our nine man crew had spent just over three months together, working together very well in challenging circumstances, relying on one another for friendship as well as for our survival – especially us southerners, who could not possibly have completed the work without our excellent Cree boatmen. I continue to hold them in my memory with great respect. Charlie, Miley, John and Lazarus taught me much, especially about working hard and coping well in the tough environment of northern Manitoba, where few people lived.

I have since realized that Manitoba Hydro has been well served by many northern residents over many decades. In fact the Cree nation (and others) has been helping foreigners from Europe for more than three centuries, since the Hudson's Bay Company was



Crew prepares to portage on the lower Nelson River — note the snow on the boat

established in 1670. I feel very privileged to have enjoyed working in northern Manitoba with these reliable, friendly Cree workmen on our hydrometric survey crew. Now I realize that I was participating in a process of working with northern Manitoba residents that had begun many generations before, and still continues.

What I also recognize now, but did not fully appreciate in 1964, is that the standard of living in this remote, northern part of Manitoba is significantly lower than that enjoyed in the urban and rural areas of southern Manitoba. Standard measurements of the quality of life include shelter, education, income, diet, drinking water supply, sanitation, health services and life expectancy. By these standards, most northern Manitobans (especially First Nations people) live in much worse conditions than other typical Canadians. In fact the quality of life for residents in northern Manitoba – nowadays as in 1964 – is typical of the many poor, developing countries where I mostly worked in my engineering and management career.

We Canadians face huge challenges in creating a just society. First Nations people, who were present long before immigrant settlers arrived from many other countries, should be able to enjoy the high standard of living which most other Canadians have achieved. I scarcely understood this fundamental reality when I

Charlie leads the way on the downstream portage

worked along the Nelson River in 1964.

After departing from Manitoba Hydro in mid-1965, the next step in my career began in Kenya, where I lived and worked as a water supply manager for 3-1/2 years. Thereafter I moved to Washington DC where I worked for seven years with the World Bank as a sanitary engineer. During this decade and afterwards, I learned much more about the critical importance of enabling poor people to gain access to safe drinking water and proper sanitation, as vital pre-conditions for good health. Although this issue became the focus for most of my career, I was almost always dealing with situations in developing countries, but never in Canada.

When I retired from the World Bank in 1999 and returned to Canada (initially living on a lake in west Quebec, near Ottawa), my only real link with my previous career was though some voluntary service on the board of WaterCan, a non-governmental organization concentrating on water and sanitation services in developing countries. In other words, still no personal focus on the poverty, poor infrastructure and very low standards of living in First Nations communities across Canada, especially in Cross Lake where I had once worked. Why not? I sincerely wish that I had a good answer to this troubling question.

My belated awareness about the very important and complex

Two strong men portage one heavy boat

issues afflicting First Nations people has possibly been stimulated by three factors. The first was moving in 2010 to Vancouver Island in British Columbia, where First Nations people and issues are much more central in local politics and social consciousness than I can recall in either Ottawa or Winnipeg. Secondly, the recent work of the Truth and Reconciliation Commission, whose summary report was published in 2015, has compelled me (like many other Canadians) to recognize that racism and wrong-headed policies have guided decision making about aboriginal people in Canada from our nation's earliest days, and still do in many instances. The third possible factor in raising my awareness was the shocking news in March 2016 about the suicide crisis among First Nations youth in Pimicikamak.

In other words, my persistent lack of awareness about social and technical challenges facing First Nations people along the Nelson River was probably due to the fact that I had almost completely forgotten my experience and contacts there in 1964. Furthermore I had not lived in Manitoba since 1965, so had no awareness of the ongoing saga of hydro power developments by Manitoba Hydro, and their impacts on the environment and residents in northern Manitoba.

My recent exercise of thinking about this special stage in my

Cook Peter Wilchovy with crew: (l-r) Lazarus, Jack, Charlie, Peter Q., John W. and John M.

life has triggered a belated recognition about such critical issues. I am grateful to have been awakened about them – but unhappy with myself for not having been involved in understanding the challenges much earlier, and becoming involved in efforts to redress the problems which I have just begun to recognize.

Through my brother Richard, a retired teacher in Winnipeg, I have established contact with some of the sons of the Cree workers who participated in our 1964 survey (as well as much other work for Manitoba Hydro). Two of these men, Jackson and William Osborne, are the sons of Charlie Osborne, who passed away in 2006. Jackson and William have explained to me that their father was shocked, towards the end of his life, by the devastation and destruction of land and water resources in the region around Cross Lake. Charlie reportedly told his family that he regretted having done the work he did – with me and with many other technical people from southern communities. He stated that he would not have done this work if he had understood the consequences which followed. I found this testimony – from a man whom I greatly respected – very disturbing.

Richard has advised me that such comments by northern Manitoba residents have been heard repeatedly by the Interchurch Council on Hydro (formerly the Interfaith Task Force on Northern

Charlie Osborne pretends to be the camp cook

Hydro Development). Apparently the development and operation of hydro power projects in northern Manitoba has caused many environmental changes which were not anticipated by local people. One wonders whether staff or consultants of Manitoba Hydro, or the governments who have approved these many projects (depicted on the maps which follow in Section B), had predicted and understood such environmental consequences. If so, had they considered appropriate mitigation measures? Has the general public been made fully aware of both the potential (or actual) problems, as well as alternative measures to mitigate such problems?

Furthermore the massive power developments along the Nelson River, costing many billions of dollars so far (with still more plants planned for the future), provide their electric power benefits primarily for residents who mostly live in southern Manitoba. Northern residents suffer almost all of the environmental costs. An independent outsider can reasonably wonder whether this situation is deliberate, or accidental, or just. More importantly for present and future generations, what actions need to be taken now to remedy these apparently critical problems?

My hope is that all of our society will soon appreciate the unfair and unjust reality that too many people, especially the First Na-

A large quantity of supplies are ready to be stowed aboard an Otter aircraft to move camp

tions, are not yet participating in the prosperity and happiness that accompanies the relatively high standard of living enjoyed by most Canadians. In northern Manitoba there seem to be significant environmental consequences and costs which should warrant much public and governmental attention.

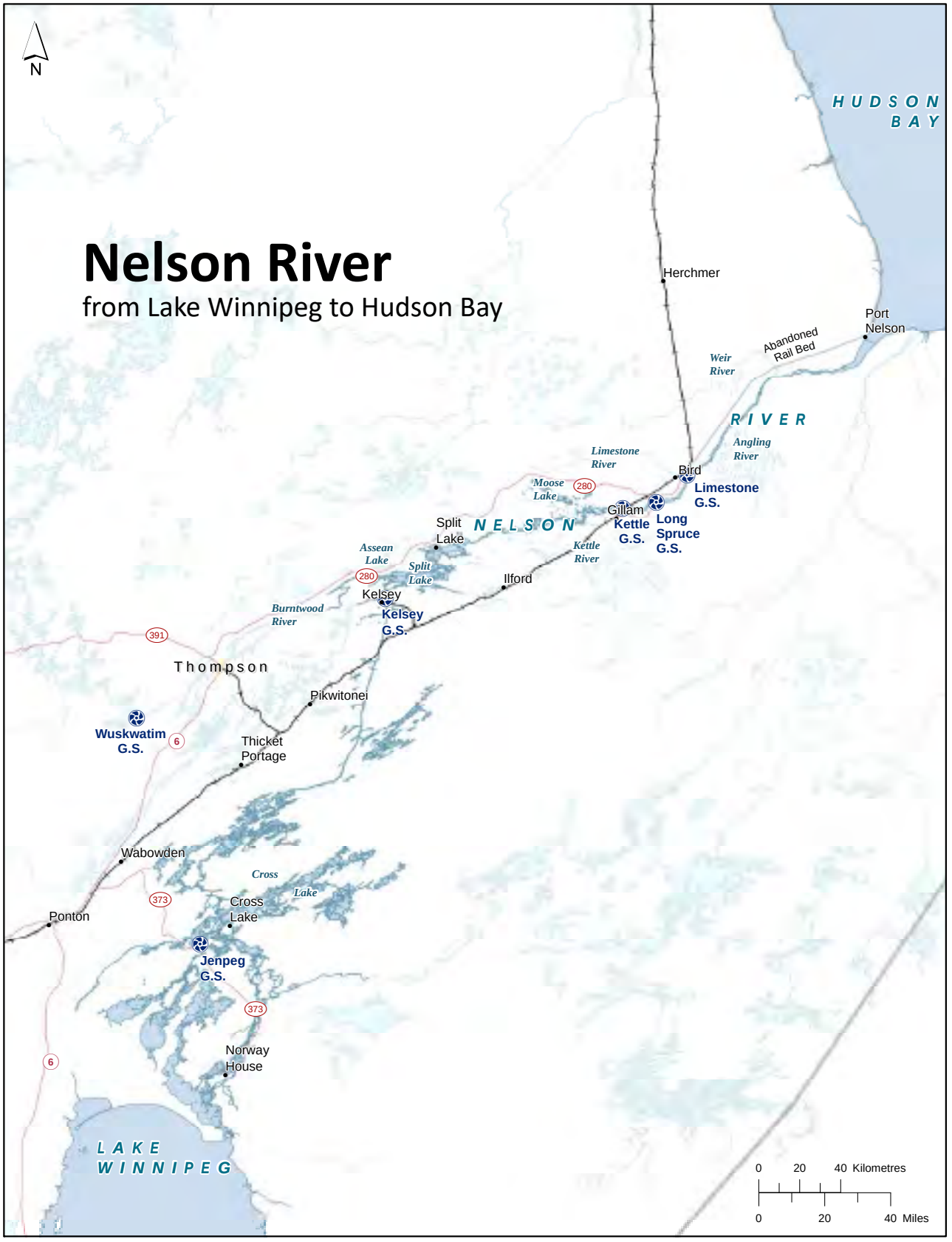
I am not sure what I can do personally about this issue, since I still know relatively little about the actual situation, which must surely be complex. Also I probably don't have enough time or energy to make any significant impact on these major issues at this late stage in my life. Nevertheless I do hope to find some constructive role which I can play.

Engineers like me have been trained in the scientific method of problem solving, of which the very first step is to recognize and define the problem. Hopefully some readers of this reflection, including my own children and grandchildren, plus their generation of leaders, will better recognize the issues and opportunities associated with power developments along the Nelson River. The obvious next step will be to take action to help deal with these problems. If such efforts are taken, my belated efforts to create and share this reflection may have been worthwhile.

Brian and Priscilla Matthes at Victoria Beach in September 1964

"Priscilla Island" on the lower Nelson River in February 1990, now officially Ship Island

B. Maps


N
Nelson River
from Lake Winnipeg to Hudson Bay
HUDSON BAY
Herchmer
Port Nelson
Abandoned Rail Bed
Weir River
RIVER
Angling River
Limestone River
Bird
Limestone G.S.
Moose Lake
280
Gillam
Kettle G.S.
Long Spruce G.S.
Split Lake
NELSON
Kettle River
Assean Lake
Split Lake
280
Ilford
Kelsey
Kelsey G.S.
Burntwood River
391
Thompson
Pikwitonei
Wuskwatim G.S.
6
Thicket Portage
Wabowden
Cross Lake
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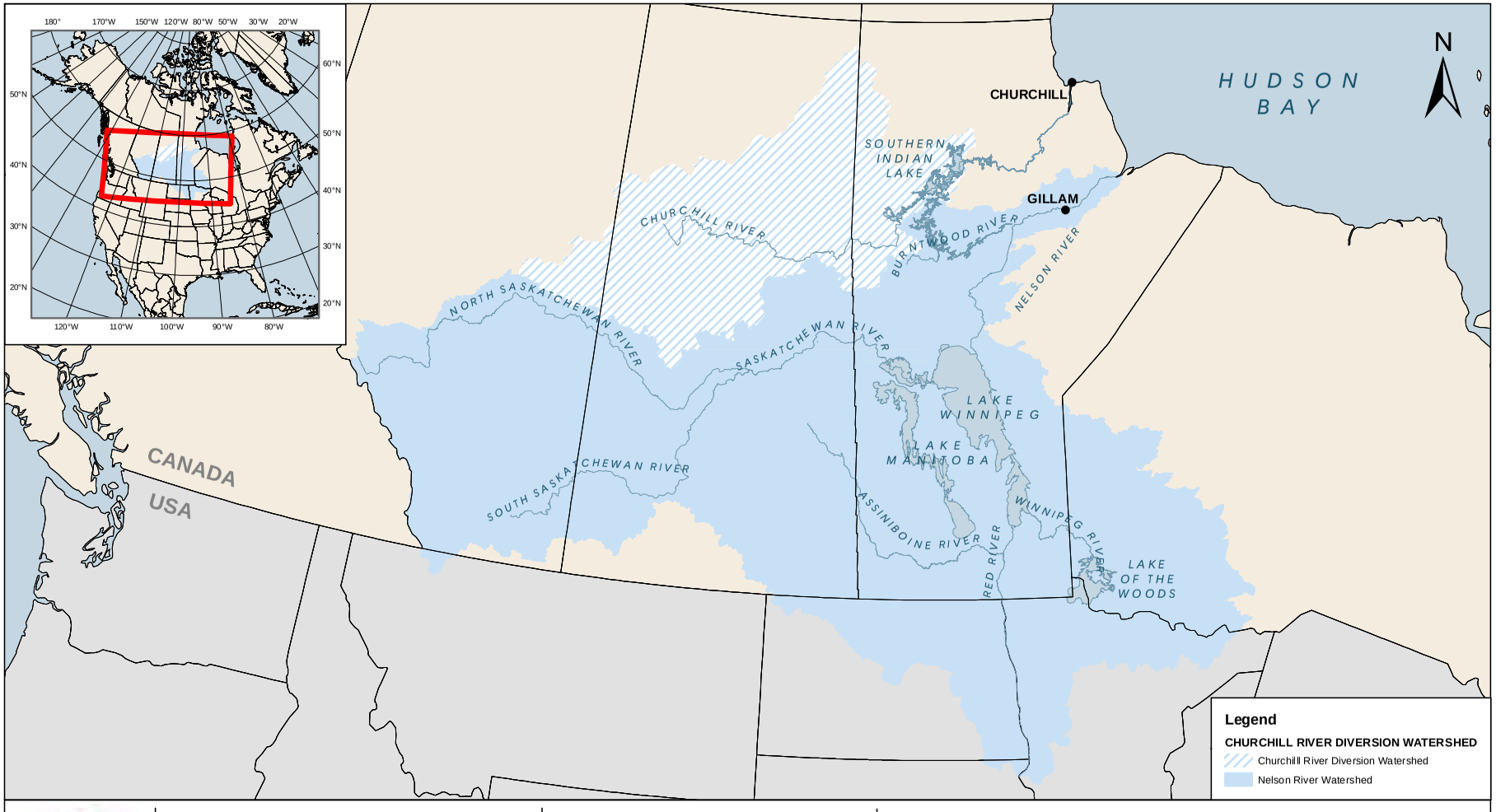
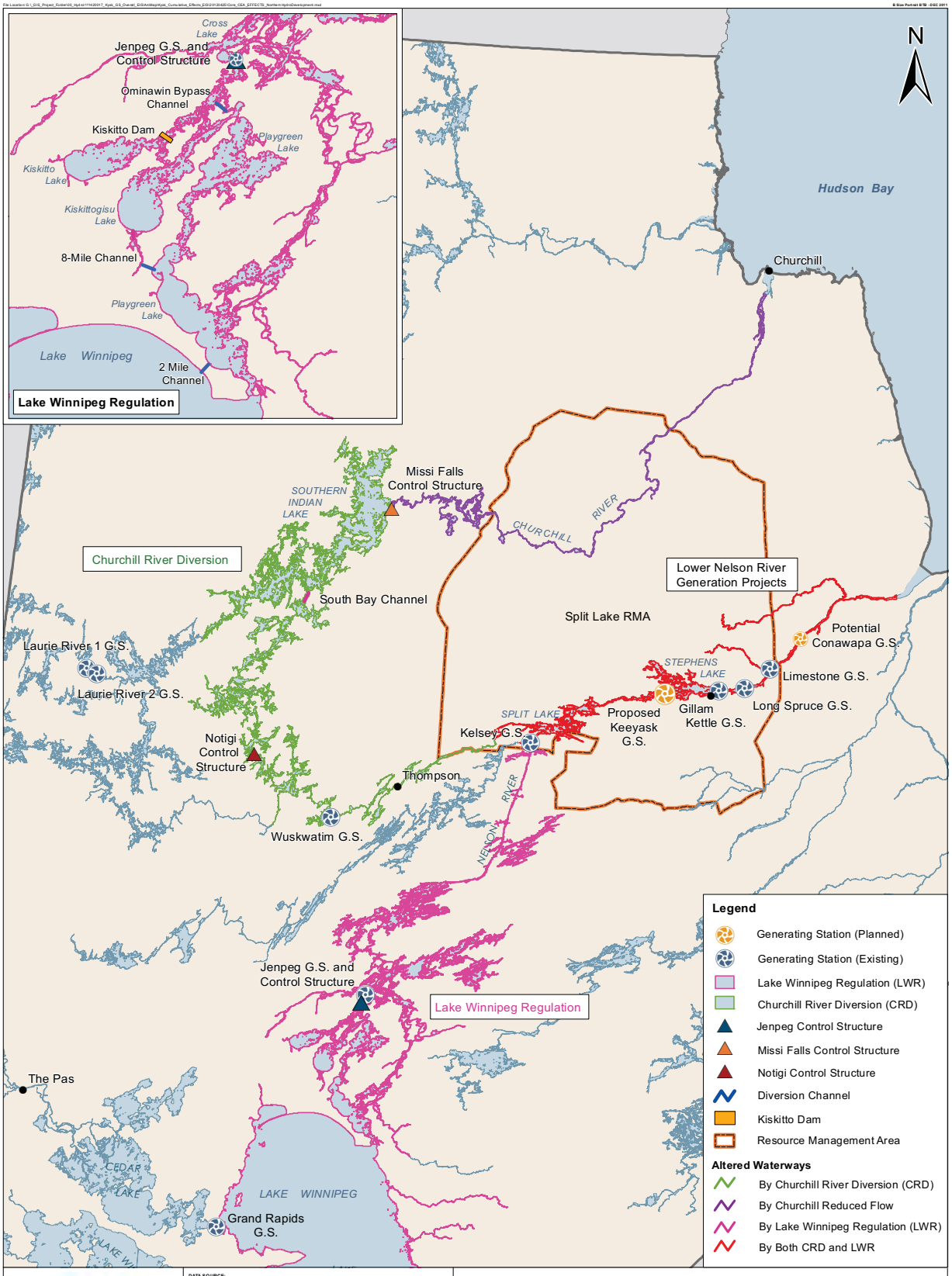
Cross Lake
Ponton
Jenpeg G.S.
373
Norway House
6
LAKE WINNIPEG
0 20 40 Kilometres
0 20 40 Miles


HUDSON BAY
CHURCHILL
GILLAM
SOUTHERN INDIAN LAKE
CHURCHILL RIVER
BURNTWOOD RIVER
NELSON RIVER
NORTH SASKATCHEWAN RIVER
SASKATCHEWAN RIVER
SOUTH SASKATCHEWAN RIVER
LAKE WINNIPEG
LAKE MANITOBA
ASSINIBOINE RIVER
RED RIVER
WINNIPEG RIVER
LAKE OF THE WOODS
CANADA
USA
N
Legend
CHURCHILL RIVER DIVERSION WATERSHED
Churchill River Diversion Watershed
Nelson River Watershed
0 125 250 Kilometres
0 125 250 Miles
Projection: NAD_1983_UTM_Zone_15N
Data Source: Manitoba Hydro, NTDB, PFRA, ESRI
Watershed Area Contributing to the Lower Nelson River

Map 4.3-1



DATA SOURCE: Manitoba Hydro, Province of Manitoba

CREATED BY: Stantec Consulting Ltd.

COORDINATE SYSTEM: UTM NAD 1983 Z15N

DATE CREATED: 17-FEB-12

REVISION DATE: 14-MAY-12

0 25 50 Kilometres
0 20 40 Miles

VERSION NO: 1.0

QA/QC:

Hydro Development in Northern Manitoba

Map 7A-1

C. Report excerpts

MANITOBA HYDRO

ENGINEERING DIVISION

NELSON RIVER INVESTIGATIONS - 1964

REPORT

ON

HYDROMETRIC SURVEY

B. P. Grover
October, 1964

SUMMARY

Between June 9 and September 15 of 1964 Manitoba Hydro's Hydrometric Survey Party worked in various reaches of the Nelson River to obtain soundings and flow meterings needed for the continuing evaluation of potential power sites on the river.

The work accomplished is outlined as follows:

Cross Lake to Sipiwesk Lake: (3 camps, 60 days)
406 sounding lines (including 61 sounding lines run twice); 8 meterings; 36 staff gauges; detailed soundings at Red Rock, Manitou, Bladder, Bladder spillway, Whitemud and Eve's Falls spillway sites.

Kiskittogisu Lake to Cross Lake: (1 camp, 17 days)
144 sounding lines; 3 meterings; 18 staff gauges.

Kelsey Generating Station: (2 sojurns, 7 days)
54 sounding lines; 2 meterings; 11 staff gauges.

Upper and Lower Gull Damsites: (1 camp)
Lower Gull: (5 days;) 15 sounding lines; no metering; 3 staff gauges
Upper Gull: (3 days;) 19 sounding lines; no metering; 5 staff gauges

Gillam Island Damsite: (1 camp, 5 days)
32 sounding lines; no metering; 4 staff gauges.

The cost of obtaining this data is estimated at $26,650. This figure includes all wages paid to field personnel, all supplies used in the field and all transportation expenses associated with moving and supplying field personnel. Not included are the costs of the equipment used in the hydrometric survey and the overheads attributable to the survey (such as office engineering, draughting, etc.)

This report outlines the nature of the information obtained and th programme carried out in 1964. Suggestions for future parties are included together with lists of data and equipment.

CONTENTS

APPENDICES

BACKGROUND

In 1964 Manitoba Hydro continued its programme of investigating and appraising potential power sites on the Nelson River. One phase of this programme involved procuring hydrographic and hydrometric data along the river.

Engineering for the overall investigation on the Lower Nelson, that reach of the river from the Kelsey Generating Station to its mouth, was assigned to the consulting firm of G.E. Crippen and Associates Ltd. Engineering for the Upper Nelson sites (Whiskey Jack, Whitemud, Bladder and Red Rock) was undertaken by Manitoba Hydro personnel. The hydrometric crew, which was responsible for collecting hydrographic as well as hydrometric data, was composed of Manitoba Hydro personnel and worked in both the Upper and Lower reaches of Nelson River. Results from the Lower Nelson were made available to the consultant as soon as data was transcribed.

Data Required

The data required from the hydrometric survey consisted of the following:

1. Hydrometric

   Meterings to deduce the channel discharge are necessary for the following reasons:

a) To assist in the production of the natural stage vs discharge curves for a given channel which are used in hydraulic calculations. This also involved determining the division in flow which occurs at different stages at the many places where the total river flow is separated into two or more channels.

b) To determine the discharge in a reach of channel with known water surface slope and cross-sectional area in order to determine the roughness coefficient for backwater calculations.

2. Hydrographic

   Soundings of the bottom of the river or lake bottom to determine the underwater topography, are needed in connection with the following problems:

a) Damsite and Powerhouse Locations

   Comprehensive knowledge of the river bottom is needed over a relatively short reach of river in order to estimate volumes (and hence costs) of any structures to be built in the river channel.

b) Channel Improvements

For some hydro developments it is attractive to increase the effective head at a plant by lowering the tailwater elevation. This involves removal of downstream controls. In order to estimate the merits and the cost of such work fairly extensive soundings are necessary to define these controls.

c) Backwater Calculations

1. For the purposes of analysing river behaviour under various design discharges (in flood routing) typical cross-sectional areas of the river channel must be known. Two or three representative cross-sections per mile have been considered adequate in reaches where no obvious abnormalities in the river bottom occur.

2. To determine the roughness coefficient to be used in backwater calculations the exact cross-sectional area of the channel and the slope of the water surface over a given reach must be known accurately for a measured discharge.

Techniques Used to Obtain Data

1. Hydrometric Data

Determining the discharge at a given section is not difficult. A metering section is selected across the channel at a point where the stream flow parallels both shorelines and no back-water exists. A cable can be strung at right angles to the streamflow. The section selected is usually as narrow as possible to make stringing the cable easy. This cable is used to hold the boat doing the metering in a stationery position. The cable can also be marked so the distance from shore can be determined. If the section is too wide for a cable to be strung an approximate value of the discharge can be obtained by using two boats braced in parallel, to hold the metering equipment stationery at each point while the metering is done.

At each section the depth and width are measured. The meter lowered in the water determines the current velocity at the respective section and the product of sectional area and velocity equals the discharge through the section.

2. Hydrographic Data

In most cases the depth of water at a given place is determined from a boat in the water. The older method of lowering a line with a weight attached has been replaced by devices based on the principle of echo sounding. A transducer placed in the water sends out a signal which is reflected by the river bottom. The same transducer picks up this echo and translates the time elapsed between the transmission and reception of the signal into the depth of water. One model (the Sonar Depth Indicator, model D60) indicates this depth on a circular scale.

A more refined machine (The Bloodworth Marine Portable Depth Recorder model ES-130AF) has a moving paper chart on which the depths are recorded.

To be useful the location of these soundings must be recorded. Cross-sectional soundings have to be fixed in two ways. The location of each specific section can be marked on the map or air photo of the area. At damsites where the location of sections must be known accurately shoreline traverses can be used to tie in the ends of each sounding line.

After a particular section is located the position of each depth reading along the section must be determined. This can be done in several ways. In extremely fast water a cable from shore to shore can be used. As the boat advances along the cable distances can be given by markings along the cable or by stadia.

Generally a cable is unnecessary. The most common method used to locate soundings is straight forward. The section across the river is selected and a transit placed at one end of the section. As the boat with the sounder proceeds toward the transit from the opposite shore it is kept on the correct line by signals (hand signals or by spoken signals over portable two way radios) from the transitman. The distances across the section are given by stadia readings to a rod in the boat. At sections too long for stadia distances (in excess of 3200' for the standard 16' stadia board) the width of section can be scaled from an air photo or map of the area. The boat is then run at constant speed and a stop watch is used to determine the time and hence location of the depth reading.

When the water is too fast or too shallow for a boat to run a straight line it is necessary to locate the soundings by triangulation. Two transits on shore are located at a known distance from each other. Upon a signal from the boat each transit determines the horizontal angle to the sounder in the boat. These angles can be plotted subsequently to locate each sounding.

Longitudinal sections in a river or lake are more difficult to locate. Two transits can be used to fix each shot but this is usually impractical because of the long distance involved. The direction of the line (not necessarily straight) can often be selected by the experienced judgement of the sounder and boatmen, as, for example, when a center line profile is run midway between each shore. The boat is run at fairly constant speed and fixes along the line can be procured by crossing known lines such as previous cross-sections or landmarks which are obvious on the relevant map or air photo.

2. Hydrometric Data (Cont'd)

At rapids and falls where a boat cannot operate fast water sounding gear must be used. Sturdy tripods on either shore at the section in question support a fairly heavy cable above the water. A lighter line strung from the cable is used to guide a heavy lead bomb out to different place across the section. By means of a pulley and winch at the shore this bomb is lowered at regular intervals across the section to determine the depth at each spot selected. This system obviously entails a good deal of time and labour.

3. Water Levels

The exact level of the water surface at each section sounded must be known to plot the absolute elevations of the bottom surface. For certain backwater computations the exact slope of the water surface between given sections must also be known. At rapids or falls the elevations of upstream and downstream water surfaces must be known to define the drop.

Water level gauges are used to determine exact elevations at the gauge location and to determine water levels between gauges by interpolation. The gauges are located at changes in the slope of the water surface, and should be read before and after any soundings are carried out in their reach of the river or lake.

The most common gauge is the staff gauge, a board marked in feet and tenths (occasionally hundredths) which is placed vertically in the water. A level crew running from the nearest benchmark established the gauge zero (the absolute elevation for the gauge reading) so that all readings can be referenced to the correct datum.

A more sophisticated device is a continuous water level recording gauge such as the Stvens A-35 automatic recording gauge. A float device in a stilling well activates a stYles which marks a spring operated moving chart to provide a continuous record of water levels at the spot. As in the case of a staff gauge the zero of the gauge must be determines by levelling before the absolute elevations can be known.

CHRONOLOGICAL REPORT OF FIELD WORK

Transitman Peter Quinn, Levelman John Westdal and Party Chief Brian Grover left Winnipeg by rail on June 9 in the company of Mr. Dave Pashniak. As Pashniak had been responsible for the crew in the previous summer he came into the field for about a week to advise and instruct this year's crew. Al Millar, used as sounding recorder, was already in camp. Peter Wilchovy, hired as cook for the hydrometric crew, had been among the first arrivals at Red Rock, cooking for the camp until the camp caterer arrived.

The first work was at Red Rock Rapids, to which the men were flown by Beaver Aircraft from Wabowden on June 10. On June 11 Jim Field, Dave Pashniak and Brian Grover flew to the Cross Lake settlement to hire men. Through previous experience the best qualified men were known and fortunately the desired men were available. The following day axemen-boatmen John Monias, Charles Osborne, Jack Miley McKay and Lazarus Monias arrived for work at Red Rock.

The hydrometric crew lived in the larger drilling and surveying camp at Red Rock while working in that area. During the stay there the Manitou and Red Rock channels were metered twice and the damsite reaches on each channel were sounded. An automatic water level recorder was placed below Chain of Rocks Rapids to record stages just above Sipiwesk Lake. A total of 14 staff gauges were established below the channel bifurcation around Bear Island.

Unfortunately the crew was without a sounding machine for 5 days following its breakdown. Assistance was given to the surveyors at Red Rock when the hydrometric crew were unable to do their own work.

On June 30, Cook Peter Wilchovy flew by Otter aircraft with a load of supplies to the second camp, above Whitemud Falls, while the rest of the crew moved with the boats over the three necessary portag While based in this camp work was done from below Bladder Rapids to Cross Lake. Some 20 staff gauges were established. Soundings covere the reach immediately downstream of Bladder Rapids, pertinent areas between Herb's Bay and Bladder Rapids, the Whitemud damsite, the Eve' Falls Channel damsite and all channels leading from Cross Lake to Whitemud Falls and Eve's Falls. Both Eve's Channel and the Ebb and Flow Channel were check-metered.

On July 14 a Norseman flight moved two loads of equipment and two men to establish the third camp, located below Metchanais Rapids on the West Channel of the Nelson River above Cross Lake. The remaining men and the boats travelled across Cross Lake to Whiskey Jack Portage where a truck was rented for the five mile crossing. The new camp was then reached by heading down the Ominawin channel.

From this camp soundings were completed in the Ominawin, Metchanais and Kisipachewuk channels leading out of Kiskittogisu Lake. The West Channel was sounded from its formation below the above mentioned channels to its entry into Cross Lake. On July 23 the Bloodworth Marine recording sounder reached camp. Until that time Al Millar had been taking notes from readings on the Sonar depth indicator. The new instrument automatically recorded these depth readings so Millar returned to the Red Rock camp.

Eighteen staff gauges were established between Kiskittogisu and Cross Lakes. Check meterings were completed within the shortest period possible (attempting to obtain the ideal of simultaneous meterings) on the Ominawin, Metchanais and Kisipachewuk channels.

Upon perusal of data supplied from the field Mr. Vic Dick had noted discrepancies between 1964 sounding results and earlier work done in the reach of the Nelson River between Weed Bay and Herb's Bay. Consequently the hydrometric crew set up its fourth camp on a island below Bladder Rapids in order to check the soundings in question. This move was made on July 31. Two Norsemen flights moved the canoe, most camp gear and four men while the sounding crew travelled by river doing work on Cross Lake while enroute to the new camp.

Increased emphasis on the Bladder Rapids scheme necessitated additional hydrographic work in the downstream reaches where channel improvements were contemplated. After spending three days in redoing sounding which had been done with a faulty power supply (giving incorr depths although the sounder itself had worked well), the sounding crew obtained additional soundings through the Manitou channel and Duck Lake to Duck Falls on the west side of Bear Island and through all reaches to Red Rock Rapids on the east side. The necessary staff gauges had for the most part been established previously by tying to local bench marks. On this return visit to the area the level crew improved vertical control through the area by check-levelling a circuit which tied in all benchmarks along the river from Chain of Rocks Rapids to Bladder Rapids. Both Manitou and Red Rock channels were check-metered.

The fifth location for the hydrometric crew was the Kelsey Generating Station. Two Otter loads moved men and gear there from Bladder Rapids on August 25 and 26. Work there entailed additional soundings to help appraise the possibility of gaining head at the Kels Station by improving the downstream channel. Soundings were run above and below both sets of Lower Rapids (South and North) and also at the junction of the Grass and Nelson Rivers around the islands below the powerhouse. Eleven staff gauges were established to determine water levels for these soundings.

On August 31 and September 1, the crew moved to its sixth camp at the Gillam Island damsite. Three Otter loads were necessary to move men, gear and fresh supplies of food and gas. Work here was straightforward. Thirty one sounding lines defined the river bottom in the damsite vicinity and four staff gauges were established to determine water levels. A stadia traverse was used to locate all sounding lines for mapping purposes.

On September 5 two Otter loads moved the crew to its seventh and final camp at Gull Lake. Work was down at both Upper and Lower Gull damsites from this location between the two. Directly above the very impressive but treacherous Lower Gull Rapids are two tentative dam axes. The water here was the most dangerous in which soundings were done, and in this reach two transits on shore were necessary to fix the sounding lines as they were run. A comprehensive set of damsite data could not be obtained because of the rapids both upstream and downstream of the alternate axes. Three staff gauges were established at the site.

The two Upper Gull damsites upstream of the Gull Lake camp were fairly easy to sound. Nineteen sounding lines were run and these lines were accurately located by a shoreline stadia traverse. Five staff gauges were established for this reach of the river.

On September 9 and 10 snow fell on the camp and remained on the ground for three days. When the work at Upper Gull was completed on September 12 all members of the crew were happy to move.

A brief conversation with Lawrence Haberman during work at Lower Gull resulted in four of the crew returning to Kelsey to do a metering before ending the season's work, Peter Wilchovy and John Westdal left for Ilford, and Winnipeg on September 12. John Monias and Jack Miley McKay flew home to Cross Lake on September 13. On the same day Peter Quinn, Charlie Osborne, Lazarus Monias and Brian Grover travelled to Kelsey in a twin-engined Beechcraft.

Metering of both channels below the powerhouse at Kelsey was completed on September 14. On the following day the 1964 hydrometric crew finally disbanded as the boatmen returned to Cross Lake (via Wabowden) and Quinn and Grover returned to Winnipeg via TransAir from Thompson.

REVIEW AND RECOMMENDATIONS

Certain ideas based on this year's experience may be of assistance to future parties. Some pertinent facts should definitely prove useful. Appendix 1 lists all benchmarks used in the various reaches of the Nelson River. Several benchmarks established previously have had elevations altered on the basis of levels done in 1964.

In Appendix 2 is a list of all drawings pertaining to the hydrometric survey. All sounding and metering sections are located on the plans and cross-sections and profiles can be found by making reference to this list.

Appendix 3 summarizes the metering results obtained in 1964 and Appendix 4 comprises the readings of all staff gauges established in 1964.

A list of the equipment used by the 1964 hydrometric crew is outlined in Appendix 5. Appendix 6 is a brief account of the expenses incurred in conducting this survey and may be useful in estimating the cost of future surveys.

A person not too familiar with the Nelson River and with the problems involved in establishing and maintaining a mobile camp in the area might appreciate Appendix 7. This appendix outlines available sources of supplies used in camps and points out the transportat facilities available in the area.

The nature of the work of a hydrometric crew involves frequent moves because the desired information in a given area seldom takes a long time to obtain. Chiefly due to the equipment used the crew can be thought of as a crew of specialists. Mobilization costs for this crew therefore from a significant part of their total costs. The importance of good communications becomes more obvious when this fact is understood. A detailed summary of the work required from a crew should be prepared and discussed before their embarking to the field. Possibly their assignment may vary as results are analyzed an new decisions are made in the office. Changes in assignment should b sent as early as possible and should be accompanied by enough explanation to allow field personnel to understand the rationale for the work they are doing. This close liason between field and office personnel is fundamental to the procuring of the desired data. It also helps to reduce the we vs they complex which tends to occupy the minds of some field personnel.

Communications facilities are important on the Nelson River. No independent crew should be without radio to contact aircraft and suppliers. Wages wasted on a workday lost due to lack of equipment o assignment amount to about $150.00 for an eight man crew. An acciden requiring immediate outside assistance can happen anytime. Manitoba Government Air Service rents radios operating on 4895 and 1775 KC.

A 40 Watt set should be the minimum equipment provided for a crew on the river.

After mid-August evenings on the river become quite cool. Heat is necessary in the tents, particularly since the field crews are expected to reduce their notes at night and supply finished data to the office regularly. This year Coleman catalytic heaters were purchased in an attempt to provide the heat without the need for a bulky stove and set of stovepipes. This heat source was inadequate. A Coleman cook stove was a better answer to the problem but it too was insufficient to cope with prolongued frost. Unless a larger gas-burning unit is available any crew intending to remain in the field after mid-August should be equipped with wood-burning airtight heaters.

The level crew this year used a 17' semi-freighter canoe with a 10 HP motor. This was adequate for their needs. The sounding crew worked in a 15½' long U-shaped pneumatic boat (Model 500 Explorer) powered by a 35 HP motor. This type of boat is probably the best available for sounding work. It proved useful in fast water and rapi Its stable shape coupled with a strong motor allowed the crew to work in more difficult water than has been attempted in years gone by. The major drawback to the boat's value is the fact that it wears out rather quickly, particularly along the keel at the front. Repeated landings along the shore eventually caused the fabric over the buckl containing the boat's tie line towear out, making it necessary to tie a line in an awkward fashion to the floorboards inside the boat. The floorboards themselves had been braced by longitudinal slats as they had tended to buckle and separate in rough water. These are the only criticisms of a very useful boat whose mobility made it attracti during moves by air.

The recording sounder used during the last half of the summer wa another excellent tool. No problems were experienced in its use (with the exception of occasional changes of stylus.) One tip which was found to be of help was the fact that liquid soap applied frequen along the bottom surface of the transducer seemed to strengthen the signal. This was particularly useful in very fast water where faint signals often resulted.

Although the sounder was never found to be working inaccurately it is wide to check it against a lead line (such as that used for met ing) at the start of each new job. The sounder's usefulness depends directly on the 12 volt battery supplying the power. It was found th the 70 amp. hours battery used in 1964 did not have enough capacity to power the recording sounder over particularly intensive work days. Therefore it is necessary to work with a larger capacity battery (eg. 120 amp hours) or carry a generator along during the day and recharge the battery over meal periods.

The generator used to recharge the wet cell was the Conyers Mode D350, Series 2 gasoline driven portable unit. This machine is vital to the survey as it provides the energy both for the basic tool used by the crew (the sounder) and for the vital communications link (the radio set.) To ensure that the battery receives the correct charge a voltmeter should be used to check the cell.

This year's sounding crew used lightweight portable transceivers (2-way radios in a single unit) operating on citizen band frequencies give distances and line from the transit to the boat. These radios facilitated the work and saved considerable time as compared to relying on visible signals only. The sets used (Sharp brand, 8 transistor were insufficiently robust to stand up to the conditions under which they were used. More rugged transceivers may be available; they woul be an improvement.

The hydrometric crew should carry two sets of the best available maps for an area. On the working set locations of all soundings, gauges and benchmarks are recorded. This data can be transferred to the second set of drawings and these can be sent to the office as dat is obtained or can be left in camp as insurance against the loss of a single copy.

APPENDIX #2

LIST OF DRAWINGS

Drawing Number	Title	
0500-B-0345	Map of Nelson River Showing Location of Developed and Potential Hydro Sites	
0500-A-0346	Key Plan: Nelson River Cross Lake to Sipiwesk Lake	
0500-A-0355	Key Plan: Nelson River West Channel Playgreen Lake to Cross Lake	
	Plans Showing Location of Soundings	
0500-E-0347	Manitou Channel, Duck Falls to Upper Manitou Rapids	(1" = 1320
0500-D-0348	Bladder Rapids to Junction of Manitou and Red Rock Channels	(1" = 500
0500-E-0349	Junction to Red Rock Rapids and Upper Manitou Rapids	(1" = 1000
0500-C-0361	Whitemud Falls to Bladder Rapids	(1" = 1000
0500-D-0350	Whitemud Falls to Cross Lake	(1" = 1000
0500-D-0351	Ebb and Flow Rapids to Cross Lake	(1" = 1000
0500-C-0352	Eve's Rapids Channel Entrance at Cross Lake	(1" = 1000
0500-C-0353	Red Rock Damsite	
0500-A-0354	Eve's Falls Channel Spillway Site	(1" = 1000
0500-R-0356	West Channel, Kiskittogisu Lake to Cross Lake, Sheets 1-8	(1" = 500
0500-C-0357	Gillam Island Damsite	(1" = 400
0500-B-0362	Upper Gull Rapids Damsite	(1" = 400
0500-A-0363	Lower Gull Rapids Damsite	(1" = 400
	CROSS SECTIONS	
0500-R-0358	Cross Lake to Sipiwesk Lake Reach	
0500-R-0359	Kiskittogisu Lake to Cross Lake Reach	
0500-R-0360	Kelsey Generating Station Reach	