STRUCTURE CONDITION REPORT

Norman Well, NWT, CCG Wharf		**OUR FILE:**	
INSPECTED BY:	M. Liang/G. Reichhardt	**DATE:**	July 28, 2015 & July 29. 2015
WEATHER:	Clear/Mild	**TIME:**	July 28: 14:40 to 20:00hrs July 29: 08:30 to 10:30 hrs
TYPE OF INSPECTION:	Visual	**TIDE:**	N/A

Purpose of Inspection:

Request from Real Property, Central & Artic Region to conduct the condition inspection of the CCG wharf

General Description:

The structure is located on the North Bank of the Mackenzie River in Norman Wells, North West Territories at Latitude 65^{0}17'N, Longitude 126^{0}51'W. The structure consists of a steel sheet pile retaining wall which retains a rock filled area used as a wharf for storage and loading CCG crews and materials. Access to the site is from a public road at the intersection of Mackenzie Drive and Quarry Road. There is also an access ramp located on the west side of the wharf. The facility was originally constructed in 1975 with the following design loads:
Maximum wheel load = 10,000kg; MS 250-77 Truck load.

The transfer plan dated March 18, 1991 does not show any loading ramp on the west side of the wharf. Thus, it would appear that the ramp was added later by cutting the elevation of the steel sheet piles. The transfer plan shows the west face of the wharf to be 62.5m long and the south face to be 61.0 m long with a 13.1 m long sheet pile wall on the south east corner of the wharf. Refer to Drawing titled " Norman Wells, N.W.T Wharf – Plans and Description" in Appendix B. Survey drawings based on the site inspections are included in Appendix C for reference.

There are 4 bollards on the south face of the wharf and 3 bollards on the west face of the wharf. It would appear that the wharf on the west face has been reduced significantly and a ramp added at some point in time. The west face of the wharf was measured to be approximately 47m long only. The exact size is hard to determine as there are currently no distinct features which would indicate the start of the wharf along the west face. There is also a 5.8m diameter corrugated steel caisson with a bollard located 24.5m east of the southeast corner of the wharf. The caisson is filled with crushed shale.

Sheet Pile Wall:

The sheet pile appears to be made up of Type PZ-27 Section. The transfer plan does not show any sheet pile wall details for the structural connections or tie back systems. Review of the transfer plan indicate that the top of the sheet pile wall (deck elevation) is 3.7 m above local Water Level (LWL) with the ground level at approximately 2.4m below LWL on the south face of the wharf.

Bollards:

There are no drawings showing the bollard details. On site measurements indicate that the bollards are made up of 406mm diameter x 13mm thick steel pile filled with concrete. The depth or length of the bollard driven into the ground is unknown. There are a total of 7 bollards on the wharf and one on the large steel caisson.

Concrete Blocks:

Site inspection shows that there are remains of concrete blocks on the southeast corner and the southwest corner of the wharf where the sheet piles were cut for ramp access. It is unclear if these reinforcing blocks were originally installed or added at a later date. There are 25mm diameter anchor bolts connected to the top of the steel piles and embedded on the concrete block on the southeast corner of the wharf. The sizes of these concrete blocks could not be verified as they were buried in the rock infill on the wharf surface.

There are also concrete blocks on both sides of the ramps at the lower end where it meets the sheet pile wall. The sizes of these concrete blocks could not be verified as they were buried in the rock infill on the ramp surface.

Steel Caisson:

The 5.8 m diameter steel caisson is made up of corrugated steel sections. The steel sections appear to be 3.2mm thick steel but the design elevation is unknown as the caisson has failed and the fill materials have undermined/washed off. The steel caisson is filled with crushed shale. There is a 406mm diameter bollard in the center of the caisson.

Inspection Results:

Sheet Pile Wall:

Generally, the top 2m of the steel sheet piles are in extremely poor condition. Either the tops have been bent due to the ice force or sections cut out due to the damage. A majority of the area shows that the top 300mm of the sheet piles folds over 90 degrees. This would indicate that the elevation of the fill would have dropped by 300mm possibility due to scouring from the ice flows. This seems to be in agreement with AECOM's Inspection report dated February 6, 2009 which estimates a loss of deck elevation of approximately 300mm. Approximately 30m of the sheet pile wall on the south face have been cut lower by approximately 840mm. Similarly, approximately 8.5m of the west face have been cut lower by approximately 1.8m and concrete blocks added to both sides of the lower end of the ramp. Generally, there are damages up to 2m below the current deck elevation along the face of the wharf with the worst damage on the southeast corner of the wharf and the southwest corner of the wharf which have extensive damages up to 3.5m below the top of the steel sheet piles.

Bollards:

The heights of the 7 bollards on the wharf range from 0mm above wharf elevation to approximately 400mm above the wharf deck elevation. A majority of these bollards are too low to be any use. At least 3 of these bollards are not level, indicating either failure or bend in the pipe pile. The bollard on the steel caisson has failed.

Concrete Blocks:

The concrete blocks on the southeast corner and the southwest corner of the wharf are in poor condition. Steel anchor bolts are exposed on the concrete block at the southeast corner. Similarly, the concrete blocks at the lower end of both sides of the ramp on the west face of the wharf are in poor condition as well.

Steel Caisson:

By measuring the length of the folded/crushed section of the caisson, it is estimated that the top 1.0m (approx.) of the corrugated steel caisson has failed resulting in the loss of the shale infill and the steel sections bent and torn all around the caisson.

Conclusions and Recommendations:

As the wharf is subjected to excessive ice loads, and with increasing loads if there is an ice build-up/jam against the wharf, installing a massive rock berm upstream of the wharf to reduce damage is recommended. However, it should be noted that period maintenance of this rock berm will be required due to the excessive ice loads. Although the maintenance could be high, it would be less costly and easier to repair the rock berm than the wharf damages. Summarized below are the recommended repairs.

1. Repair the top section of the steel sheet piles as recommended by AECOM's inspection report dated February 6, 2009 using "Option A". A copy of the report is attached in the Appendix D. In most cases, the top 2.0m of steel pile section will need to be replaced (not 1.0m as suggested by AECOM) as the damages have extended to near 2.0m below the top of the sheet pile wall. In addition, replace top 3.5m of a section of the sheet pile (approx. 2.5m) at the southeast corner of the wharf.
2. Restore the wharf to its original elevation (i,e. 300mm higher than the current deck elevation)
3. Cap concrete deck with reinforced concrete slab overlay.
4. Replace all the steel bollards
5. Reinforce the ramp area on the west side of the wharf
6. Install a large rock berm upstream of the Southeast corner of the wharf to deflect the ice impact on the wharf.

The estimated cost "Class D" estimate for the above recommendations is $4,000,000.

Inspected and Prepared By:

July 8/2016
Date:

APPENDIX A

PHOTOS

Photo 1: West side of the wharf.

Photo 2: Northwest corner of the wharf

Photo3: Sheet pile cut out for ramp access

Photo4: Deck view of west side of the wharf

Photo 5: South face of the wharf. Note bent sheet piles at the top

Photo 6: Extensive damage on Southeast corner of the wharf. East wall buried in debris

Photo 7: Bollards on the west face of the wharf

Photo 8: Typical bollard on the south face of the wharf

Photo 9: Bollard on the southeast corner of the wharf

Photo 10: Concrete block/deck on southeast corner of the wharf in poor condition

Photo 11: Concrete block on north edge of access ramp on West face of the wharf

Photo 12: Concrete block on south edge of access ramp on West face of the wharf

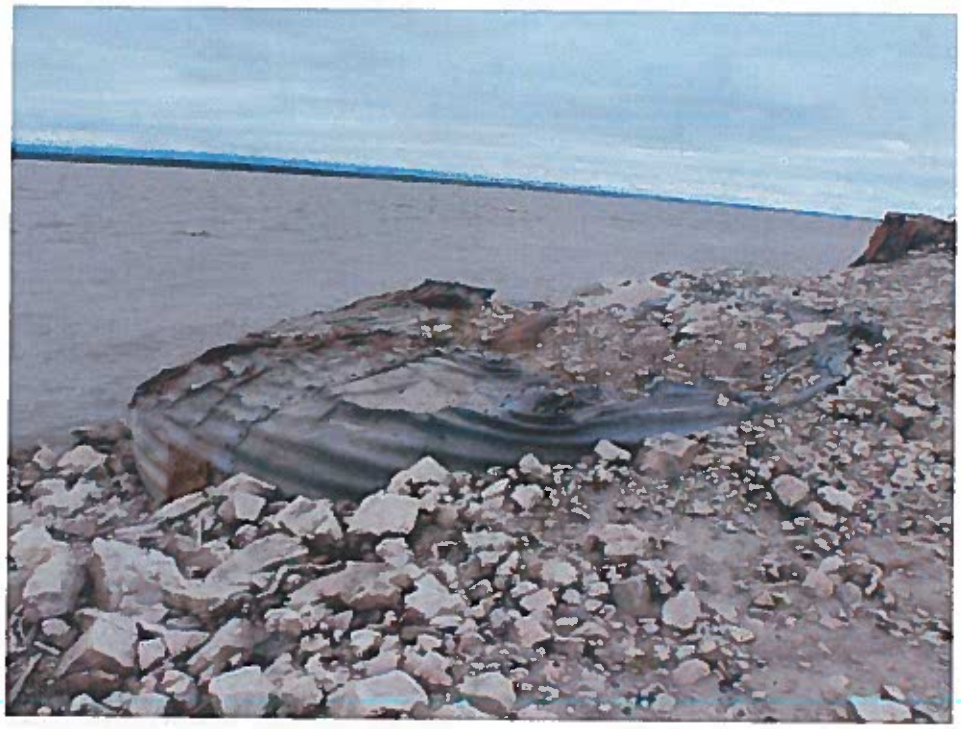
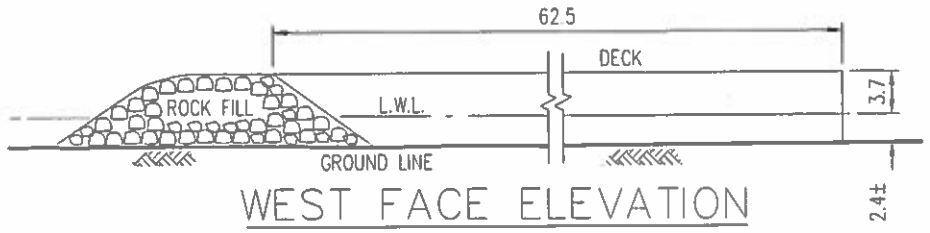


Photo 13: Failed steel caisson on the east side of the wharf

Photo 14: Failed bollard on the center of the steel caisson

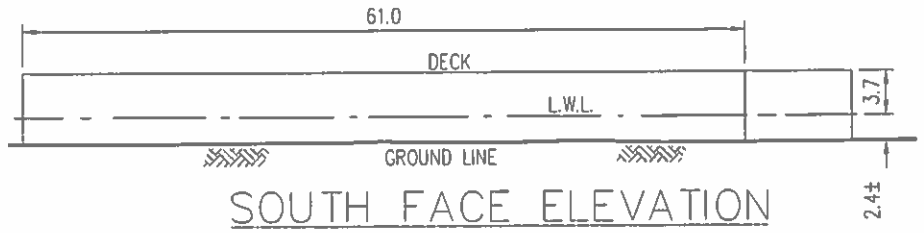
APPENDIX B

FIGURES



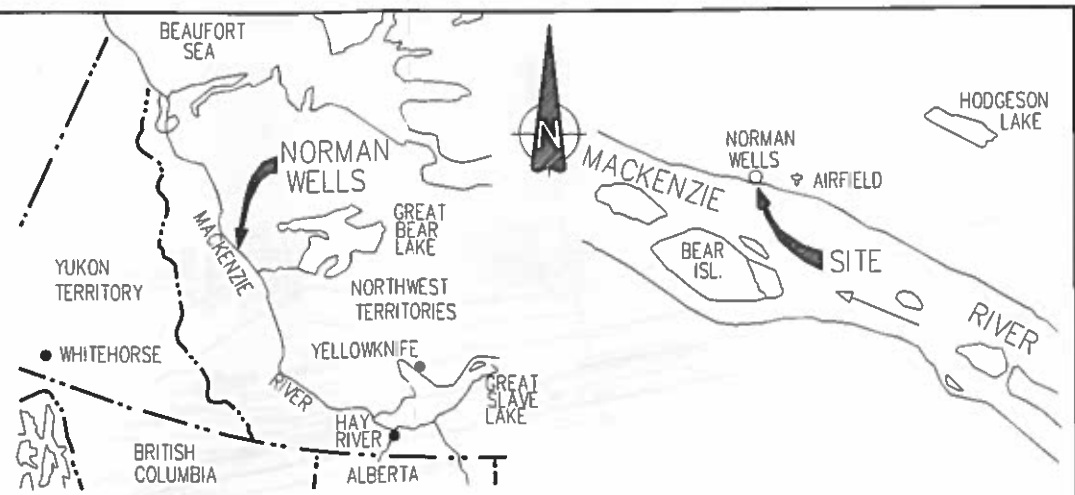
WEST FACE ELEVATION

SCALE-1:500



SOUTH FACE ELEVATION

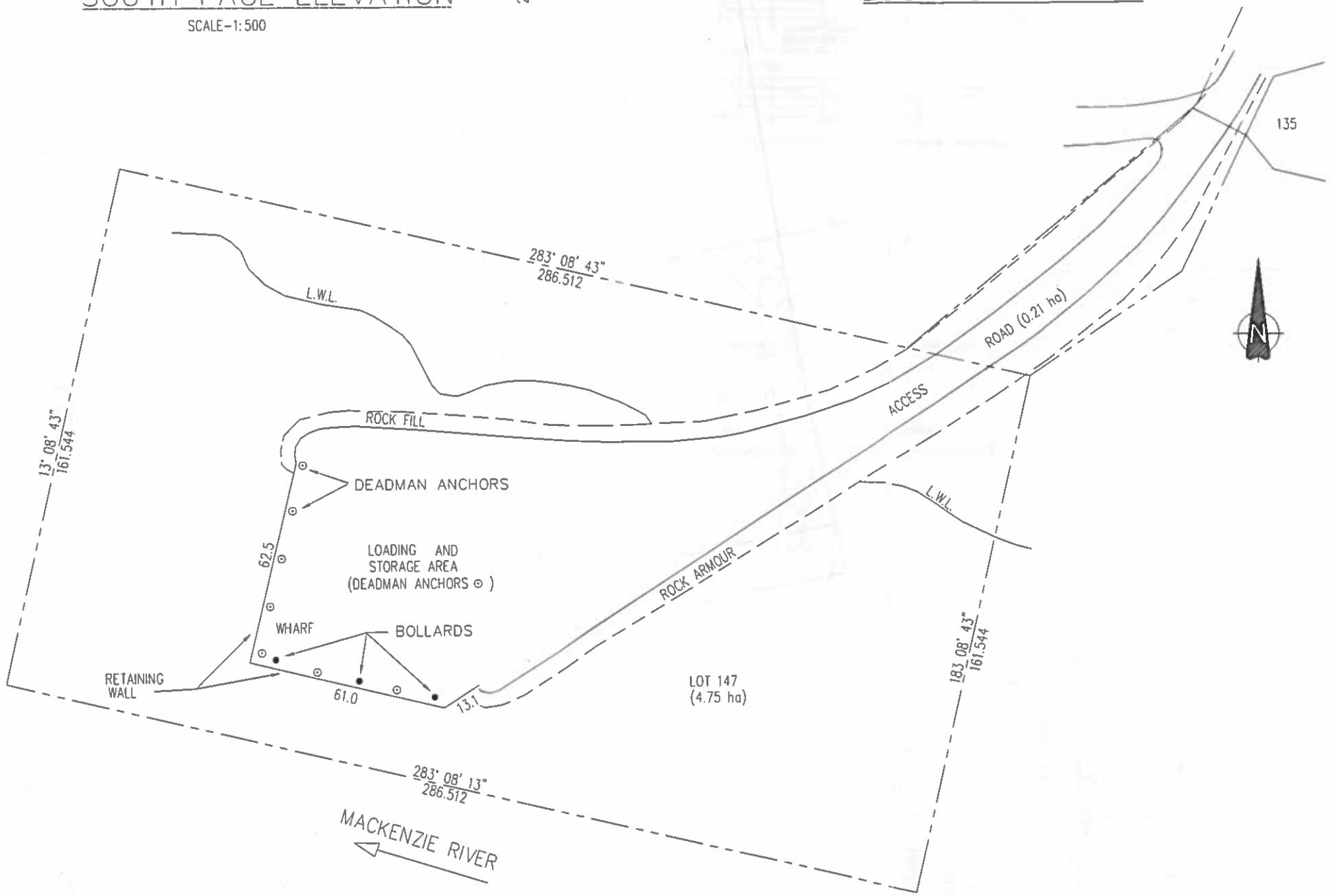
SCALE-1:500



SCALE-1:18,500,000 APPROX.

SCALE-1:250,000

LOCATION CHARTS



SITE PLAN

SCALE-1:250

DESCRIPTION

A. THE STRUCTURE IS LOCATED ON THE NORTH BANK OF THE MACKENZIE RIVER IN NORMAN WELLS, N.W.T.

LATITUDE: 65° 17' N
LONGITUDE: 126° 51' W

LOT 147, DISTRICT OF MACKENZIE, NORMAN WELLS, N.W.T.

B. THE STRUCTURE CONSISTS OF A STEEL SHEET PILE RETAINING WALL RETAINING A ROCK FILL LOADING AND STORAGE AREA PROTECTED BY ROCK ARMOUR.

C. ACCESS IS FROM A PUBLIC ACCESS ROAD.

D. THERE ARE NO ADDITIONAL FACILITIES ON THIS STRUCTURE.

E. THE STRUCTURE IS NOW IN ORDER FOR USE BY PUBLIC TRAFFIC.

F. LOADING
MAXIMUM WHEEL LOAD=10,000kg, MS 250-77

G. COMPLETED IN 1975
MAJOR REPAIRS-WHARF.
MAJOR REPAIRS STORAGE AREA: 1985,1986,1988,1989, 1990,1991

H. CANADIAN LAND SERVEY RECORDS NO. 5870 FEB.1974
LOTNo. 147 LTO No. 893
N.W.T. No. 125

REVISION	F	DATE	MAR.18,1992	REV. BY	HKC
REVISION	E	DATE	DEC.20, 1990	REV. BY	HKC
REVISION	D	DATE	FEB.14, 1990	REV. BY	HKC
REVISION	C	DATE	FEB. 6, 1989	REV. BY	HKC
REVISION	B	DATE	APR. 6, 1988	REV. BY	HKC
REVISION	A	DATE	AUG. 18, 1986	REV. BY	KMH
SCALE AS NOTED		DATE	APR. 9, 1984	DRAWN BY	RAN
COST CODE 8938		FILE No. 9664-3169			

TRANSPORT CANADA
HARBOURS AND PORTS
WESTERN REGION

NORMAN WELLS, N.W.T.
WHARF
PLAN & DESCRIPTION

R KSIAZEK — EDMONTON, ALTA — MARCH,18 1991
DATE

APPENDIX C

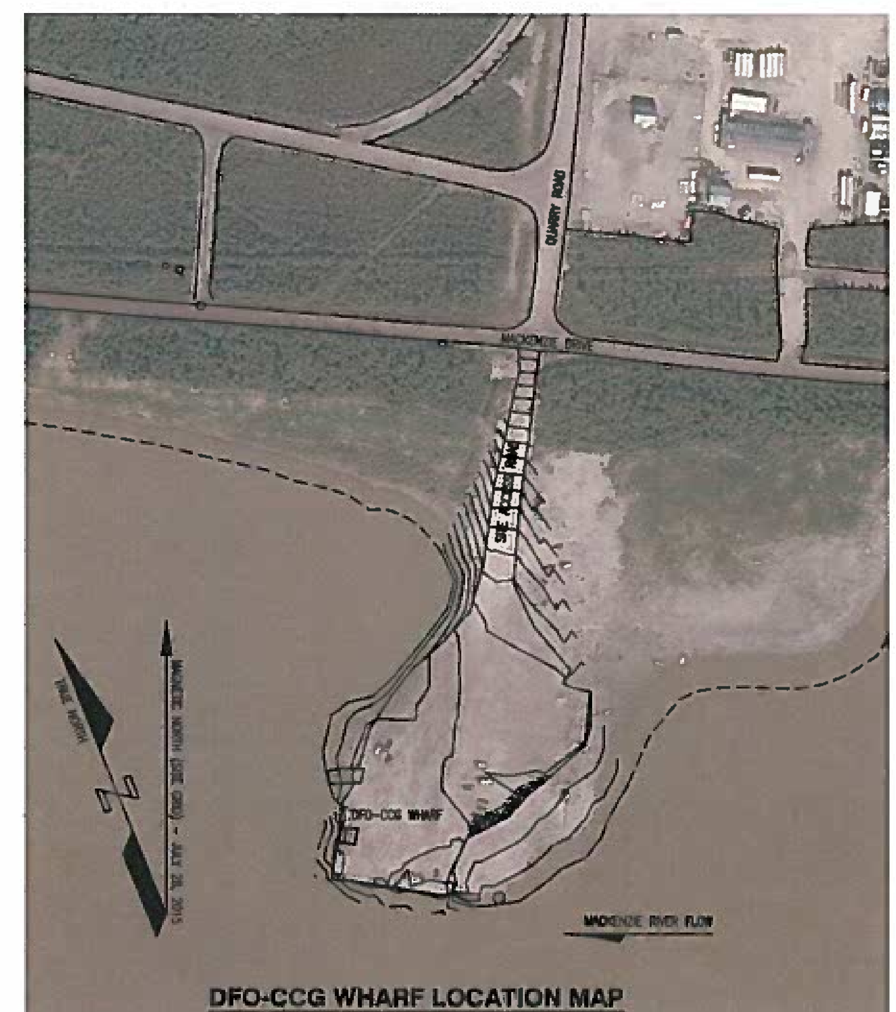
SURVEY DRAWINGS

NORTHWEST TERRITORIES MAP

NORMAN WELLS LOCATION MAP

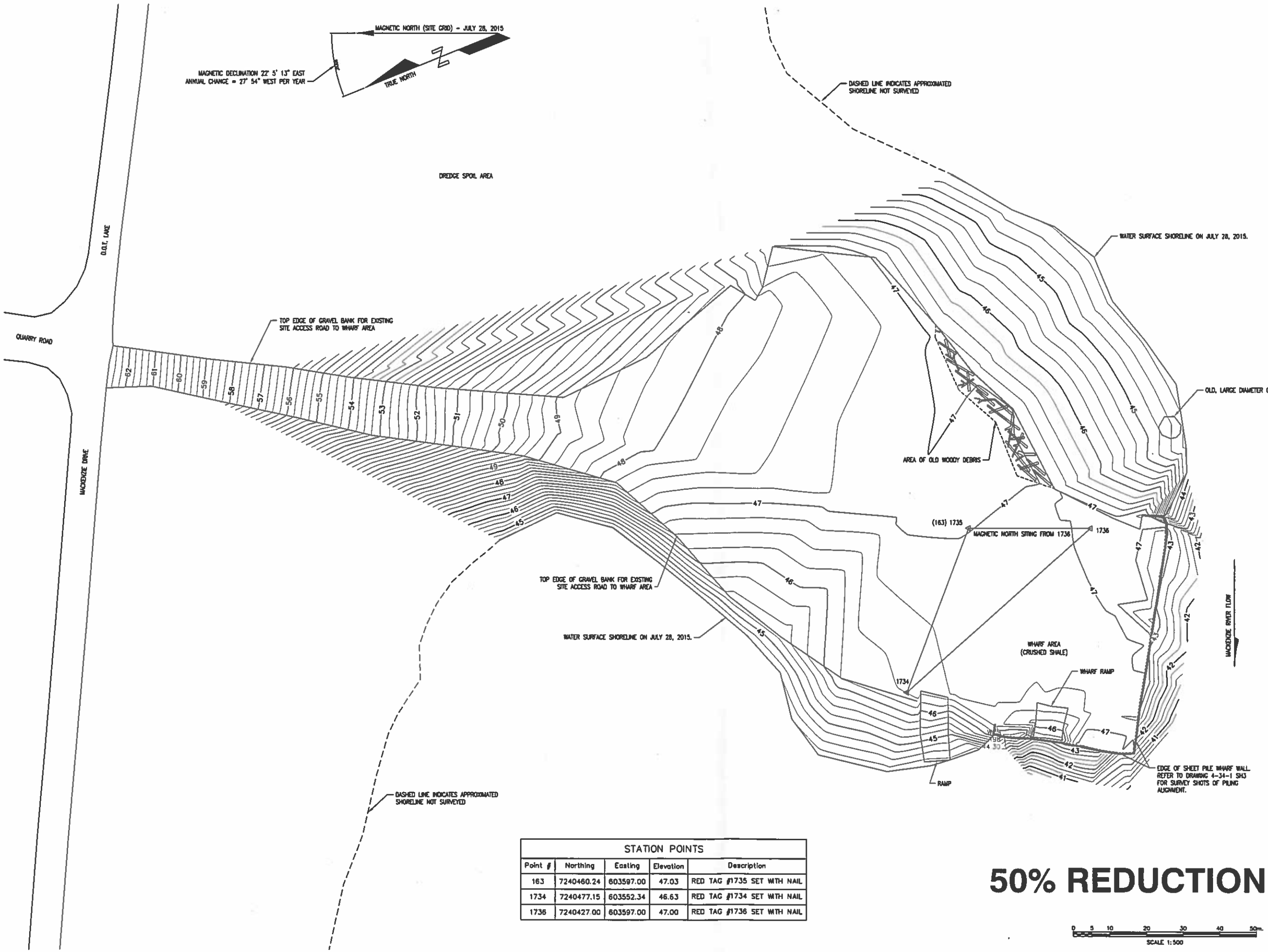
NORMAN WELLS VICINITY MAP

50% REDUCTION



DFO-CCG WHARF LOCATION MAP

CANADIAN COAST GUARD PACIFIC REGION	
DFO-RPTS TECHNICAL SUPPORT	
No: Revision:	Date: By:
A — Detail/Section No. / 1 — Sheet No:	
Project: NORMAN WELLS, NT. DFO-CCG WHARF SITE INSPECTION & SURVEY	
Drawing: SITE LOCATION MAPS	
AS BUILT Designed By:	2015-07-28 Date:
G. REICHHARDT Drawn By:	2015-08-05 Date:
Reviewed By:	Date:
Approved By:	Date:
Project Manager:	
CAD File:	
Drawing No: 4-34-1	
Sheet No: 1	



STATION POINTS				
Point #	Northing	Easting	Elevation	Description
163	7240460.24	603597.00	47.03	RED TAG #1735 SET WITH NAIL
1734	7240477.15	603552.34	46.63	RED TAG #1734 SET WITH NAIL
1736	7240427.00	603597.00	47.00	RED TAG #1736 SET WITH NAIL

50% REDUCTION

0 5 10 20 30 40 50m.
SCALE 1:500

CANADIAN COAST GUARD PACIFIC REGION

DFO–RPTS
TECHNICAL SUPPORT

NOTES:

1. CONTOURS, SPOT ELEVATIONS AND MEASUREMENTS ARE METRES.
2. MAJOR CONTOUR INTERVALS = 1m.
   MINOR CONTOUR INTERVALS = 0.25m.
3. GEOGRAPHIC DATUM AND POSITION FORMAT: NAD83, UTM ZONE 9, METER; CENTRAL MERIDIAN 129° W.
3. COORDINATE DATA DERIVED FROM HANDHELD GPS INSTRUMENT HELD AT SURVEY STATION 1736. POSITION - UTM ZONE: 9W, EASTING: 603597 NORTHING: 7240427, ACCURACY: 3 m. LAT/LONG CONVERSION– LATITUDE: 65.27051, LONGITUDE: -126.780301.
4. STATION 1736 ELEVATION SET AT: 47m. AS READ FROM HANDHELD GPS INSTRUMENT. ALL OTHER ELEVATIONS ARE RELATIVE TO STATION 1736.
5. MAGNETIC NORTH DERIVED FROM COMPASS SIGHTING JULY 28, 2015.

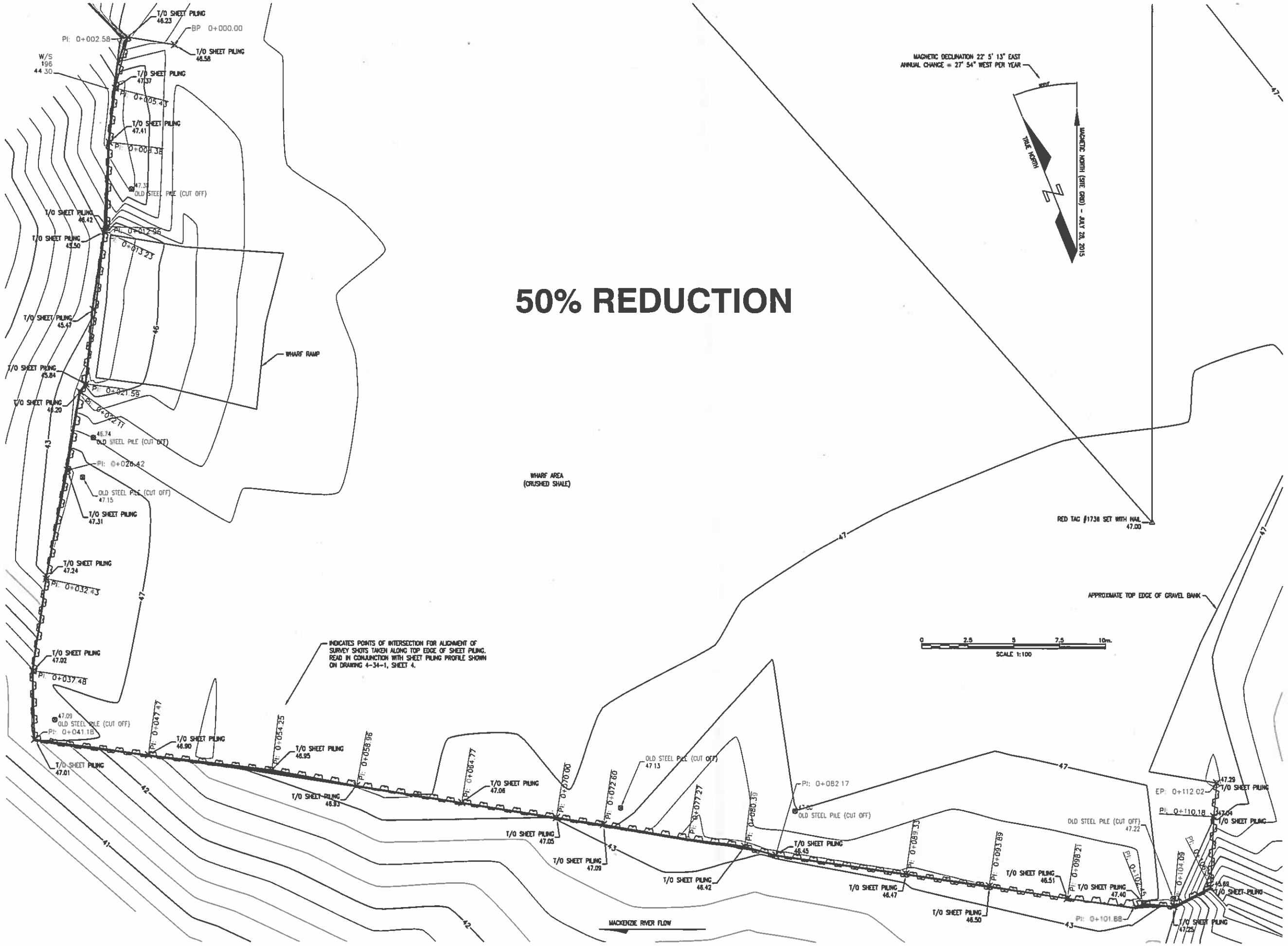
No:	Revision:	Date:	By:

A / 1 — Detail/Section No. / Sheet No:

Project:
NORMAN WELLS, NT.
DFO–CCG WHARF FACILITY
SITE INSPECTION & SURVEY

Drawing:
GENERAL SITE AREA
EXISTING CONDITIONS
TOPOGRAPHY AND
EARTHWORK STRUCTURES

AS BUILT	2015-07-28
Designed By:	Date:
G. REICHHARDT	2015-08-05
Drawn By:	Date:
Reviewed By:	Date:
Approved By:	Date:
Project Manager:	
CAD File:	
Drawing No:	4-34-1
Sheet No:	2



50% REDUCTION

CANADIAN COAST GUARD PACIFIC REGION

DFO–RPTS TECHNICAL SUPPORT

NOTES:

1. CONTOURS, SPOT ELEVATIONS AND MEASUREMENTS ARE METRES.
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5. MAGNETIC NORTH DERIVED FROM COMPASS SIGHTING JULY 28, 2015.

No:	Revision:	Date:	By:

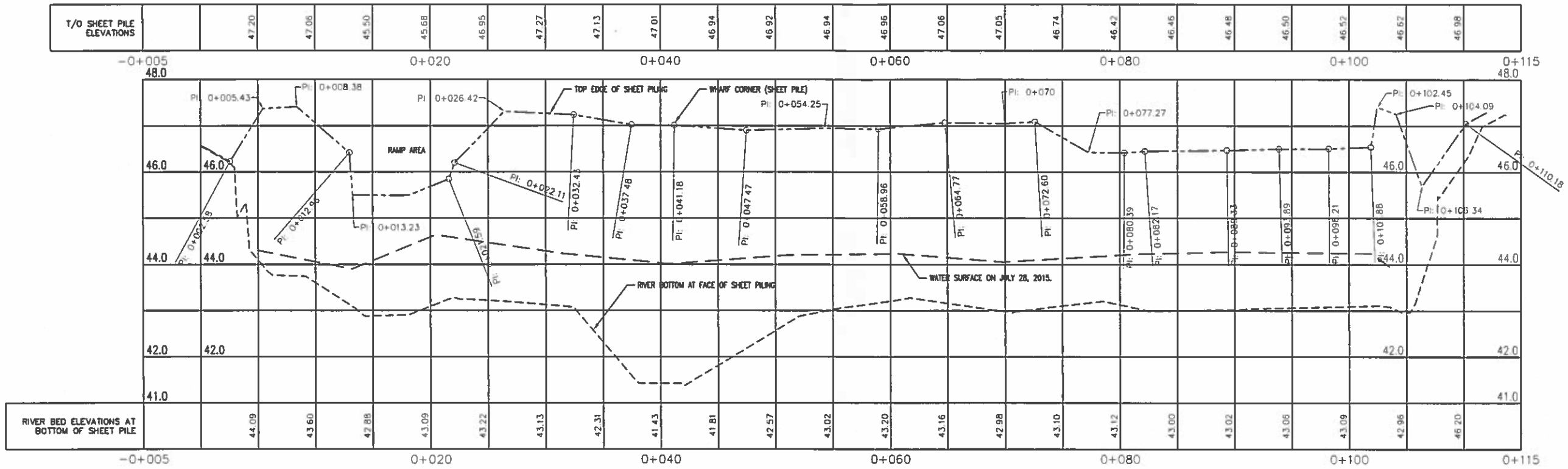
A / 1 — Detail/Section No. / Sheet No:

Project:
NORMAN WELLS, NT.
DFO–CCG WHARF FACILITY
SITE INSPECTION & SURVEY

Drawing:
WHARF AREA SITE
EXISTING CONDITIONS
TOPOGRAPHY AND
SHEET PILE STRUCTURE

AS BUILT Designed By:	2015–07–28 Date:
G. REICHHARDT Drawn By:	2015–08–05 Date:
Reviewed By:	Date:
Approved By:	Date:
Project Manager:	
CAD File:	
Drawing No:	4–34–1
Sheet No:	3

PROFILES - TOP EDGE OF SHEET PILING, WATER SURFACE AND RIVER BOTTOM AT SHEET PILING



HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:50

50% REDUCTION

CANADIAN COAST GUARD
PACIFIC REGION

DFO–RPTS
TECHNICAL SUPPORT

No:	Revision:	Date:	By:

A / 1 — Detail/Section No. / Sheet No:

Project:
NORMAN WELLS, NT.
DFO–CCG WHARF
SITE INSPECTION & SURVEY

Drawing:
WHARF AREA SITE
EXISTING SHEET PILING
PROFILES

AS BUILT	2015-07-28
Designed By:	Date:
G. REICHHARDT	2015-08-05
Drawn By:	Date:
Reviewed By:	Date:
Approved By:	Date:
Project Manager:	
CAD File:	
Drawing No:	4–34–1
Sheet No:	4

APPENDIX D

AECOM REPORT

AECOM

Government of Northwest Territories

Department of Fisheries and Oceans Canada (DFO) Wharf in Norman Wells, Northwest Territories

Inspection Report and Rehabilitation Strategies

Prepared by:

AECOM
17007 – 107th Avenue, Edmonton, AB, Canada T5S 1G3
T 780.486.7000 F 780.486.7070 www.aecom.com

Date:

February 6, 2009

Project Number:

G082-041-00-4.6.1

AECOM

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The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report:

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- represent Consultants' professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report and the Agreement;
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- in the case of subsurface, environmental or geotechnical conditions, is not responsible for variability in such conditions geographically or over time.

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- is to be treated as confidential;
- may not be used or relied upon by third parties.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report.

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	Charles Bradford	February 06, 2009	Final

Signature Page

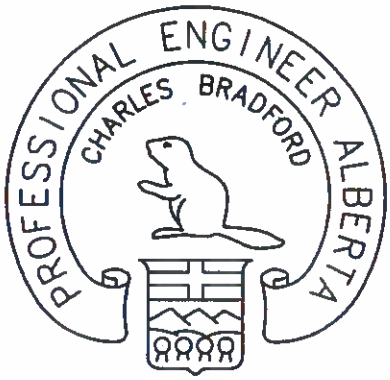
Report Prepared By:	Report Reviewed By:
	
Charles Bradford, P.Eng. (Alberta) Bridge Engineer	Michel Lanteigne, P.Eng. Manager, Structures

Table of Contents

Appendices

1. Introduction

AECOM Engineering was retained by the Government of the Northwest Territories to carry out a condition inspection and site survey of the Department of Fisheries and Oceans Canada (DFO) wharf (also known as the Canada Coast Guard Wharf) at the east end of Norman Wells, Northwest Territories on the Mackenzie River. This inspection was requested due to concerns about the structural integrity of the wharf due to the heavy ice damage that is evident on the sheet piles that retain the backfill material and that occurred during the spring ice breakup of 2008.

This Inspection Report has been prepared based on a site inspection carried out on December 4th and 5th, 2008 by Charles Bradford, P.Eng.(Alberta) and Michael Richardson EIT. It gives a description of the site and provides a summary of the structural deficiencies noted at the wharf at the time of inspection. It also provides an evaluation on a conceptual basis of the immediate and long term requirements to minimize structural damage to the wharf during spring ice breakups in the future. The recommendations made in this report are of the conceptual type, and additional detailed design of the wharf repair details will be required prior to tender and construction.

This report does not address costs for the given options as we have no reliable cost information for the Norman Wells NT area. Therefore it is advised that local contractors be contacted prior to finalizing the design of the repairs in order to obtain current costs estimates for the construction of the desired rehabilitation options.

2. Wharf Description

The Department of Fisheries and Oceans Canada (DFO) wharf was originally constructed in the early 1980's and is located at the east end of Norman Wells, Northwest Territories at approximately latitude (northing) 65.270 and longitude (easting) -126.779. The wharf can be accessed via a service road connecting to Mackenzie Drive at Quarry Road in Norman Wells or by river vessel.

No drawings of the constructed wharf were available and therefore assumptions about the original methods of construction have been made in this report.

The wharf is constructed of crushed shale infill throughout most of its area and is protected by ~113m in length of steel sheet piling at the river side and downstream edge. Dredge spoil has been used as infill at the northeastern upstream leading edge of the wharf. Figure 1 in Appendix "A" – Figures is an overview of the general layout of the wharf site.

The sheet pilings used for this wharf appear to be of type PZ 27 as shown in Appendix "A" – Figures. It is unknown how deep these piles have been driven into the streambed.

3. Environmental Considerations

The Mackenzie River is identified as a fish bearing stream and thus any instream activities to repair the wharf will be subject to any limitations imposed by Fisheries and Oceans Canada, the Government of the Northwest Territories Environment and Natural Resources and/or the Mackenzie Valley Land and Water Board.

4. Inspection Results

The photos and descriptions of the wharf obtained during the site inspection are attached to this report in Appendix "B" – Photos.

This inspection was limited and hampered by ice buildup and snow drifts at the wharf site with ice slabs ~100mm thick stacking up ~2.0m high above the wharf grade elevation at the upstream outer corner (southeast corner) of the wharf.

The elevation of the wharf as it currently exists appears to be ~300mm lower than originally constructed with distortions and buckling in the top ~1.0m of the sheet piles throughout the structure. The sheet piles are distorted out of vertical primarily into the infill areas by ~400mm

due to the impinging forces of the ice floes during spring breakup. According to local information, the infill area has been re-graded with ~100mm of new infill material every spring after breakup due to ice and water scour removing the top rock infill material from the surface of the wharf.

In general, there did not appear to be significant losses of fill through the sheet pile cofferdam with the exception of two areas of loss of fill up to a depth of ~1.0m along ~18m of river edge piling where the tops of the sheet piles have either been lost to ice damage or cut out by the Canada Coast Guard due to safety and mooring concerns after the piles sustained ice damage. Figure 2 in Appendix "A" – Figures outlines the areas of damage to the sheet piles and loss of fill at the perimeter of the wharf. There are 3 other small areas not shown on Figure 2 with a total length of ~1.5m that are experiencing loss of fill due to buckling and separation of the sheet piles along the river edge piles.

A subsill has been installed ~1.0m below the top of the sheet piles presumably in areas where the sheet pile tops have been replaced at some time in the past. This subsill extends east for ~22.5m in length along the river edge piles from the area removed by the Coast Guard to the upstream southeast corner of the wharf. It is uncertain exactly how far to the east the subsill extends due to ice coverage near the southeast upstream corner of the wharf. There does not appear to be an installed subsill at any other location around the wharf.

Concrete corner backing blocks of ~1.0m^2 have been installed at the outer upstream and downstream corners of the wharf. The concrete corner blocks appeared generally to be in good condition, but showed signs of minor erosion to their top surfaces presumably due to the scouring action of ice and water during high water events. The sheet piles attached to the concrete corner blocks showed a lesser degree of separation and damage than did the sheet piles which were backing onto soil infill areas.

Numerous cables of various diameters are distributed on the surface of the wharf in an area near the eastern (upstream) end of the wharf. Subsequent conversations with David Hodgson (Hodgson's Contracting) indicate that the cables are mooring cables and not tie back cables and therefore in and of themselves do not indicate a problem with the wharf. However, several tie back cables connected to the sheet piles at the wharf edges have been frayed and severed. Other tie back cables are exposed at the sheet piles and are at acute angles to the wharf edge indicating problems with the tie backs.

The Community wharf downstream (west) of the DFO wharf site shows a lesser degree of damage and also appears to be ~900mm lower in absolute elevation and ~600mm lower in elevation relative to the water level than the DFO wharf site.

A cursory inspection was performed at the water intake area located between the DFO wharf and the Community wharf just to the upstream side of the Community wharf. The water intake area has been recently armoured with a large rock riprap apron with rock up to ~2.0x3.0mx600mm thick which has been backfilled with smaller rock materials.

5. Discussion of Strategies

5.1 Additional Winter Inspection and Short Term Strategy

At the time of this inspection, it was not possible to observe and determine the condition of the sheet piles at the upstream leading edge corner (southeast outer corner) of the wharf due to ice build up. Only the top edge of the piles was visible with the lower portions of the piles completely obscured by ice buildup and snow drifts. Although it would be possible to remove the ice using available equipment to inspect the lower portions of the sheet piles in this area, there is the potential to create additional damage to the sheet piles during ice removal operations as well as creating a void and impact zone on the upstream corner of the wharf which would necessitate the installation of large rock armouring to protect the exposed sheet piles.

If the ice is removed in order to perform an additional inspection of the southeast corner of the wharf, two possible scenarios exist:

1. The deterioration characteristics of the sheet piles in this area are similar to the remainder of the sheet piles and they are in similar condition with the ice damage localized to the top ~1.0m of the piles.

2. The sheet piles in this area show additional damage below the top ~1.0m of the piles.

In scenario 1 above, if the lower portions of the sheet piles have not been significantly damaged since their original installation 20 years ago, they are not likely to incur more damage during the ice breakup of 2009 if the ice is not removed at the southeast corner location.

In scenario 2 above, permanent repairs and/or armouring would be required for the sheet piles at the southeast corner. This would not be undertaken until warmer weather and would require dewatering of the site. Any rock installed during the winter to protect the corner would need to be removed prior to repairing the sheet piles.

Based on the following observations:

- the damage to the sheet piles appears to be progressing from the top of the sheet piles down and is localized to the top ~1.0m

- the tops of the sheet piles located around the concrete corner blocks appear to be in better condition than the others

- there was no significant indication of loss of fill around the concrete corner block at the upstream southeast corner of the wharf

it can be assumed that the lower portions of the sheet piles at the southeast corner are in similar condition to the remainder of the sheet piles. Therefore, for the purposes of this report scenario 1 above is considered to be the more likely condition of the sheet piles.

If rock armouring is not installed this winter and some portion of the upstream southeast corner of the wharf is lost during the spring ice breakup of 2009, there is a possibility that the sheet piles along the river's edge of the wharf may sustain "unzippering" damage. If unzippering of the sheet piles occurs during ice breakup, the damage is expected to be constrained to the top ~1.0m of the sheet piles as it has been in the past and can be repaired during installation of additional sheet piles that will be installed as part of the long term solution for the wharf. Note that the incremental cost of the repairs is not expected to be significantly greater than the cost of ice removal for inspection, placement of rock armouring, removal of armouring to perform repairs and reconstruction of the wharf corner. Therefore an additional winter inspection of the southeast upstream corner of the wharf is not recommended.

The wharf should be re-inspected after the spring ice breakup to verify the condition of the sheet piles at the southeast corner in the spring of 2009.

5.2 Long Term Strategy

5.2.1 Wharf Elevation

The Norman Wells Community wharf is downstream of the DFO wharf site and is ~900mm lower in absolute elevation than the DFO wharf. However, the MacKenzie River streambed profile indicates a loss of streambed elevation of ~300mm between the DFO wharf and the Community wharf. Therefore, in relative terms, the Community wharf is ~600mm lower in elevation relative to river levels than the DFO wharf. The lesser degree of deterioration noted at the Community wharf may be due to the Community wharf being ~600mm closer to water levels than the DFO wharf site causing the ice floes to float over the Community wharf rather than directly impacting the Community wharf.

Therefore, a comparison of river depths to DFO wharf elevation was performed in order to determine how reducing the elevation of the DFO wharf might influence the number of days of wharf inundation rendering the wharf unusable.

The current DFO wharf elevation of ~43.30m MSL corresponds to a water level of 7.81m. Using Water Survey of Canada (WSC) data for the Norman Wells gauge station (10KA001), Daily Water Levels were obtained.

Daily water levels exceeding a depth of 7.81m have been highlighted in the Daily Water Level table and a DFO wharf elevation line was added to the graphical representation of this data in Appendix "C" – Water Survey of Canada Data.

Only very limited data were available for Daily Water Levels (2002-2007 inclusive), however, Daily Discharge records from WSC are available from 1943 onward. Therefore, an equivalent

discharge rate was calculated using the Daily Water Level and Daily Discharge statistics for the period from 2002-2007 to increase the amount of available data.

Daily Water Level data points of approximately 7.81m were located in the data (circled in red in the Daily Water Level data) which occurred on June 22nd and 23rd. The corresponding Daily Discharge data points from June 22nd and 23rd were then located in the data (circled in red in the Daily Discharge data) and were linearly interpolated to determine a discharge rate that corresponds to a water level of 7.81m. The result of this analysis indicated that a water level of 7.81m corresponds to a daily discharge rate of 28,176m^3/s. This greatly expanded the amount of data available to determine inundation characteristics of the wharf based on maximum daily flow rates.

It can be seen from the Daily Discharge rates chart in Appendix "C" – Water Survey of Canada Data that maximum flows on the MacKenzie River will result in inundation of the DFO wharf in the months of May, June, and July under maximum flow conditions as indicated by the red DFO wharf elevation line on the chart. Therefore, reducing the elevation of the DFO wharf has the potential to increase the number of days that the wharf is inundated by several days each year during the months of May, June and July under maximum flow conditions.

Discussions with local users of the DFO wharf indicated that any significant increase in number of days of wharf disuse due to inundation would not be acceptable. Therefore, reduction of the DFO wharf elevation to try to reduce damage to the sheet piles is not advisable and the DFO wharf should be restored to its original elevation.

5.2.2 Upstream Rock Protection

The Community wharf is somewhat protected by the existence of the DFO wharf upstream and the ice floes impacting at the Community wharf would have a tendency to be of smaller size due to the breaking up of the ice upstream at the DFO wharf prior to impacting the Community wharf.

In consideration of the reduced damage being incurred at the Community wharf downstream likely due to the upstream protection offered by the DFO wharf, it is recommended that a rock berm extending out from the shoreline to ~1.0m beyond the exterior river edge of the DFO wharf be constructed with placed rock armouring to create a suitably sloped ice impact area. It is anticipated that this berm would be constructed of large rock riprap locally known as Class "E" rock to an elevation ~1.0m higher (ie: ~44.60m MSL) than the DFO wharf and approximately 3.0m upstream of the upstream side of the DFO wharf. The actual dimensions and exact location of the rock berm would be determined during the detailed design phase of the project.

5.2.3 Wharf Edge Reinforcement Options

Three possible protection strategies for reinforcement of the wharf cap edge areas are shown in Figure 3 in Appendix "A" – Figures.

Option 'A' – Concrete Slab involves removing and reconstructing the top ~1.0m of sheet piling by extending the existing sheet piles by means of butt welding new standard P27 sheet pile extensions to match the existing sheet piles if possible and installation of splice plates as shown in Appendix "A" – Figures – Pile Extension Connection Details. If damage to the existing sheet piles is such that butt welding of the pile extensions is not possible, a subsill may be installed at the cut-off level. The subsill should be cut out to be flush with the exterior faces of the sheet piles after the installation of the pile extensions to reduce the uplift and jacking forces on the face of the sheet piles as shown in Appendix "A" – Figures. A steel top sill would then be cut to match the corrugations of the new sheet pile extensions and welded to the tops of the sheet pile extensions. These top sill plate tabs would then be bent back under the top sill to an angle of ~135° into the sheet pile corrugations below to help prevent uplift on the top sill as shown in Appendix "A" – Figures – Steel Plate Sill Cut and Bend Sample Template. 25mm Ø tie back bars would then be installed and bolted to the sheet pile to help hold the pile extensions in place. A concrete slab with an anchor lip ~400mm thick would be cast in place for ~5m continuously around the perimeter of the wharf and keyed into the existing shale material.

Option 'B' – involves removing and reconstructing the top ~1.0m of sheet piling by extending the existing sheet piles by means of butt welding new standard P27 sheet pile extensions to match the existing sheet piles if possible and installation of splice plates as shown in Appendix "A" – Figures – Pile Extension Connection Details. If damage to the existing sheet piles is such that butt welding of the pile extensions is not possible, a subsill may be installed at the cut-off level. The subsill should be cut out to be flush with the exterior faces of the sheet piles after the installation of the pile extensions to reduce the uplift and jacking forces on the face of the sheet piles as shown in Appendix "A" – Figures. A steel top sill would then be cut to match the corrugations of the new sheet pile extensions and welded to the tops of the sheet pile extensions. These top sill plate tabs would then be bent back under the top sill to an angle of ~135° into the sheet pile corrugations below to help prevent uplift on the top sill as shown in Appendix "A" – Figures – Steel Plate Sill Cut and Bend Sample Template. A 305x305mm H pile waler would be welded to the interior of the sheet pile extensions and a 1.0x1.0m reinforced concrete blockout would be cast in place around the perimeter of the wharf.

Option 'C' – Colcrete Inlay involves removing and reconstructing the top ~1.0m of sheet piling by extending the existing sheet piles by means of butt welding new standard P27 sheet pile extensions to match the existing sheet piles if possible and installation of splice plates as shown in Appendix "A" – Figures – Pile Extension Connection Details. If damage to the existing sheet piles is such that butt welding of the pile extensions is not possible, a subsill may be installed at the cut-off level. The subsill should be cut out to be flush with the exterior faces of the sheet piles after the installation of the pile extensions to reduce the uplift and jacking forces on the face of the sheet piles as shown in Appendix "A" – Figures. A steel top sill would then be cut to match the corrugations of the new sheet pile extensions and welded to the tops of the sheet pile extensions. These top sill plate tabs would then be bent back under the top sill to an angle of ~135° into the sheet pile corrugations below to help prevent uplift on the top sill as shown in Appendix "A" – Figures – Steel Plate Sill Cut and Bend Sample Template. A 305x305mm H pile waler would be welded to the interior of the sheet pile extensions and 25mm Ø tie back bars would be installed and bolted to the sheet pile extensions and to deadman piles buried in the existing shale material

to help hold the piles in place. Colcrete or other Preplaced Aggregate Concrete (PAC) construction technique involves placing readily available large aggregate in the trenched area around the perimeter of the wharf and then infilling with the Colcrete or other PAC. PAC does not require the use of fine aggregate and exhibits approximately one half of the drying shrinkage of standard concrete. PAC has been used for the resurfacing of lock walls and dams and for the repair of tunnel linings, piers and spillways and appears to have good durability in these applications. PAC does require tight formwork and is sensitive to proper proportioning, but should be cost effective for this application.

Option "C" is the recommended repair option for this application given its ease of constructability and long term cost effectiveness in these types of applications.

Consideration could be given to capping the DFO wharf with a reinforced concrete slab in order to reduce the annual maintenance costs for the wharf, and in this case, Option "A" would be the recommended repair procedure.

6. Recommendations

Repairs to the wharf are not recommended for the winter of 2009, with the understanding that additional damage may be incurred to the top ~1.0m of the piles and additional fill material may be lost during the spring ice breakup.

After spring runoff, the wharf should be re-inspected to verify the condition of the piles at the southeast corner. Enough of the sheet piling should be visible at that time to verify that the lower portion of the sheet piling is indeed intact at the southeast corner

Detailed design of the ice protection berm and river training upstream of the wharf site should be undertaken as soon as possible in order to complete construction during the 2009 construction season.

It is recommended that the top ~1.0m of any structural steel sheet piling at the DFO wharf be designed to withstand severe ice loading.

It is recommended that Option 'C' – Colcrete Inlay be constructed to protect the DFO wharf edge based on ease of constructability and long term effectiveness.

Based on the distortions noted in the sheet piles, it is estimated that the original elevation of the DFO wharf was ~43.60m MSL. It is recommended that the wharf be restored to its assumed original elevation which will require that the current elevation be increased by ~300mm by using rock infill or by capping the wharf surface with a reinforced concrete slab to a depth of ~250-300mm.

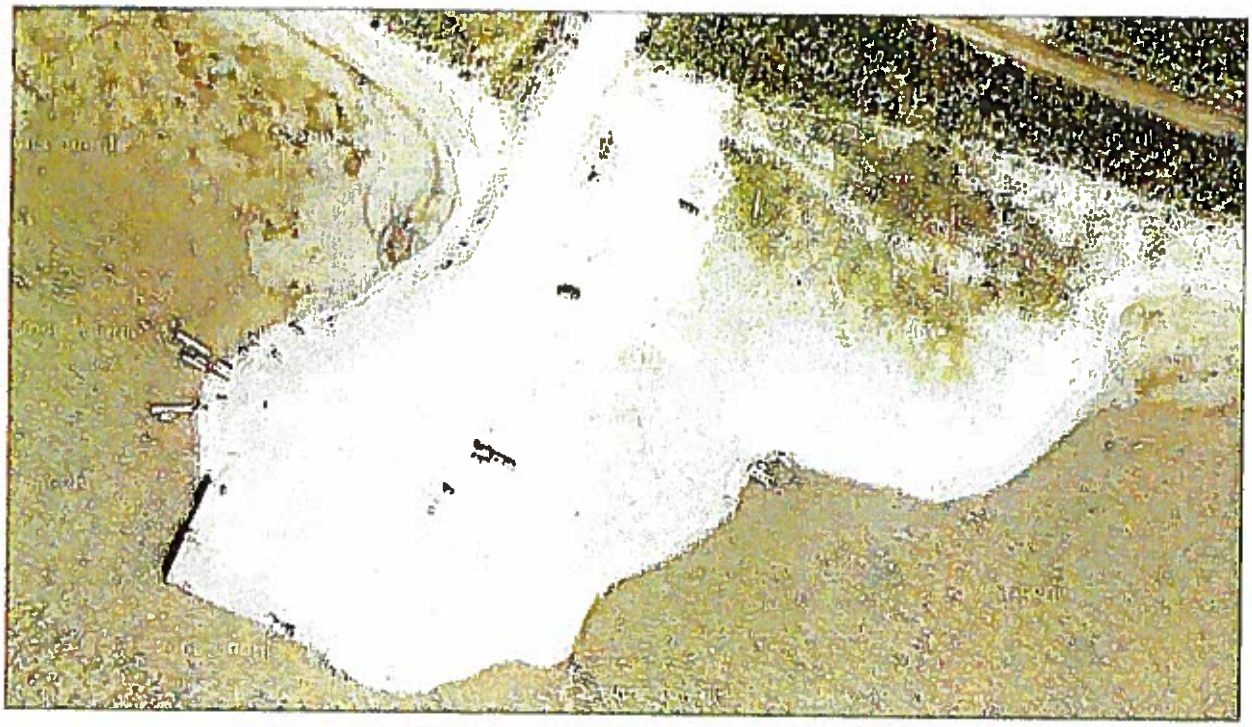
Consideration could be given to capping the wharf with a reinforced concrete slab ~250-300mm thick in order to preserve the elevation of the wharf and minimize the yearly maintenance costs of resurfacing the wharf. In this case Option 'A' – Concrete Slab with an extended slab would be the recommended ice protection for the wharf edge reinforcement, otherwise future budgeting should include amounts for regular maintenance to the wharf surface.

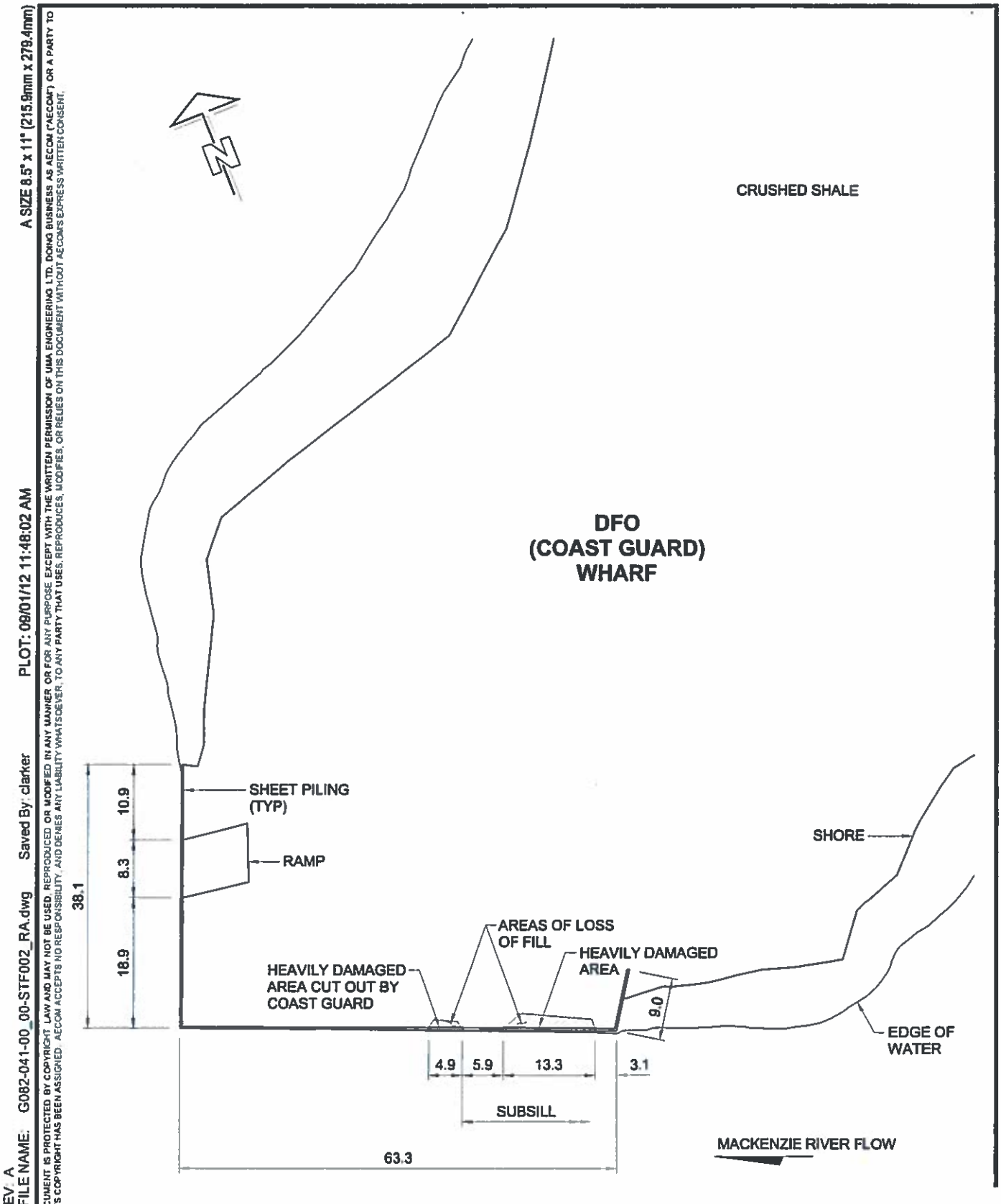
6.1 Synopsis of Recommendations

- Do nothing over the winter of 2009.
- Begin detailed design of large rock protection berm, winter 2009.
- Re-inspect the wharf after spring ice breakup.
- Begin detailed design for wharf edge reinforcement after inspection based on Option "C" – Colcrete (PAC) Inlay.
- Restore wharf to original assumed elevation.
- Consider capping wharf with reinforced concrete slab overlay. In this case wharf edge reinforcement should be Option "A" – Concrete Slab
- Budget for maintenance for the top edges of the wharf piles and the wharf surface.

Appendix "A"
Figures

Google Maps Canada Address





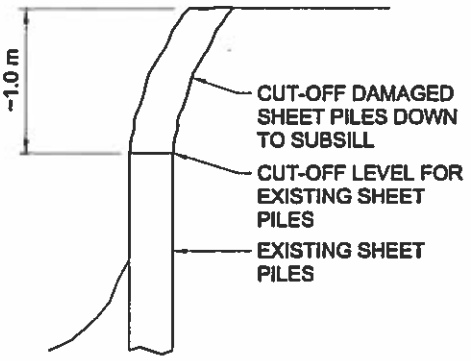
PLAN

DFO Wharf Norman Wells NT

0 7.5 15 m SCALE 1:750

AECOM

Figure - 2



SHEET PILE REMOVAL

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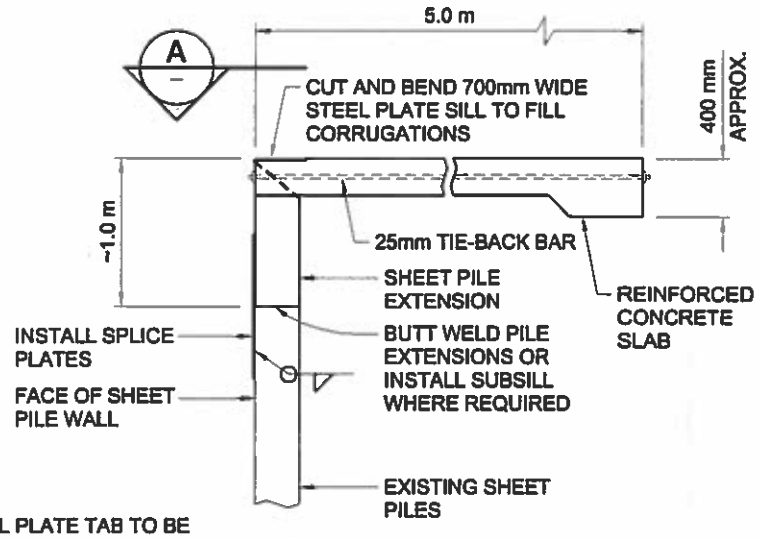

OPTION 'A' CONCRETE SLAB

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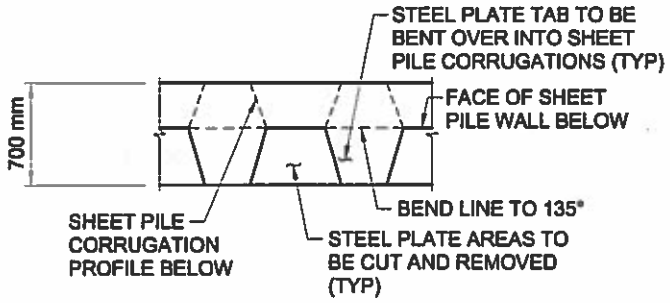

STEEL PLATE TOP SILL CUT AND BEND SAMPLE TEMPLATE A

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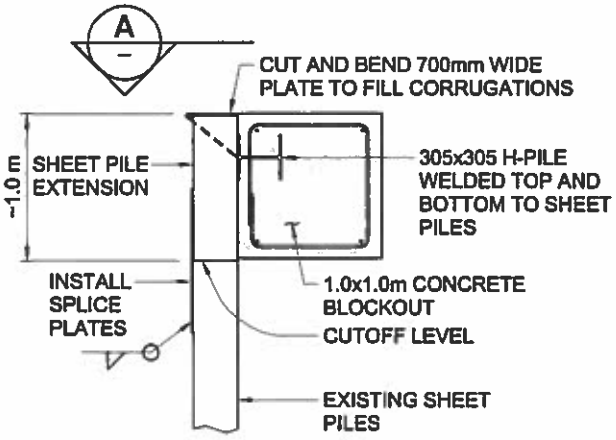

OPTION 'B' REINFORCED CONCRETE EDGE BEAM

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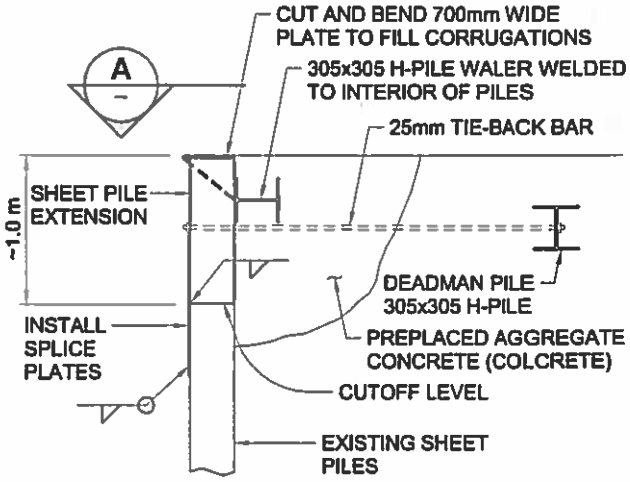

OPTION 'C' COLCRETE INLAY

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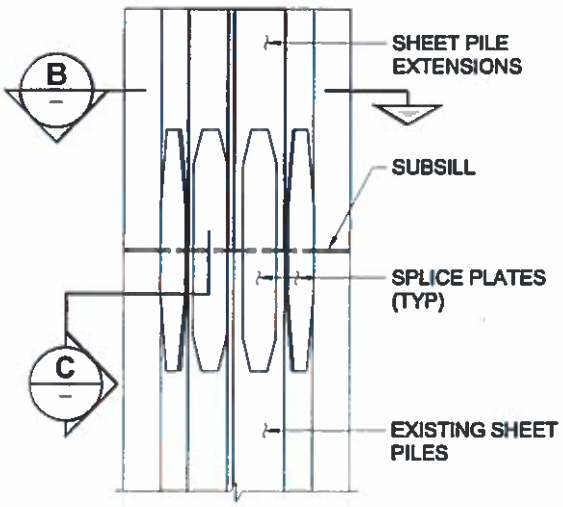
DFO Wharf Norman Wells NT

AECOM CONCEPTUAL DESIGN NOT FOR CONSTRUCTION

Wharf Edge Reinforcement Options

Figure - 3



SPLICE PLATE DETAIL

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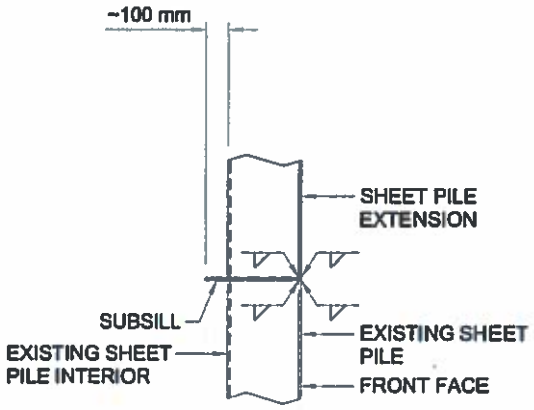
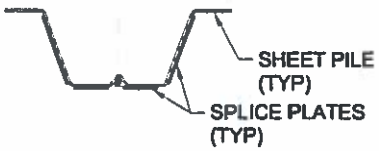


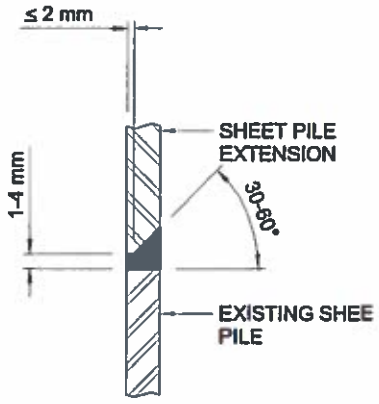
SUBSILL CONNECTION DETAIL C

mm SCALE 1:30



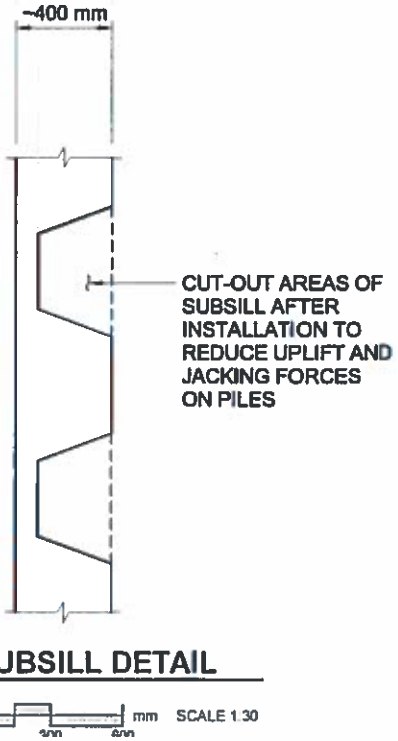
SECTION B

0 300 600 mm SCALE 1:30



BUTT WELD DETAIL C

mm SCALE 1:2



SUBSILL DETAIL

mm SCALE 1:30

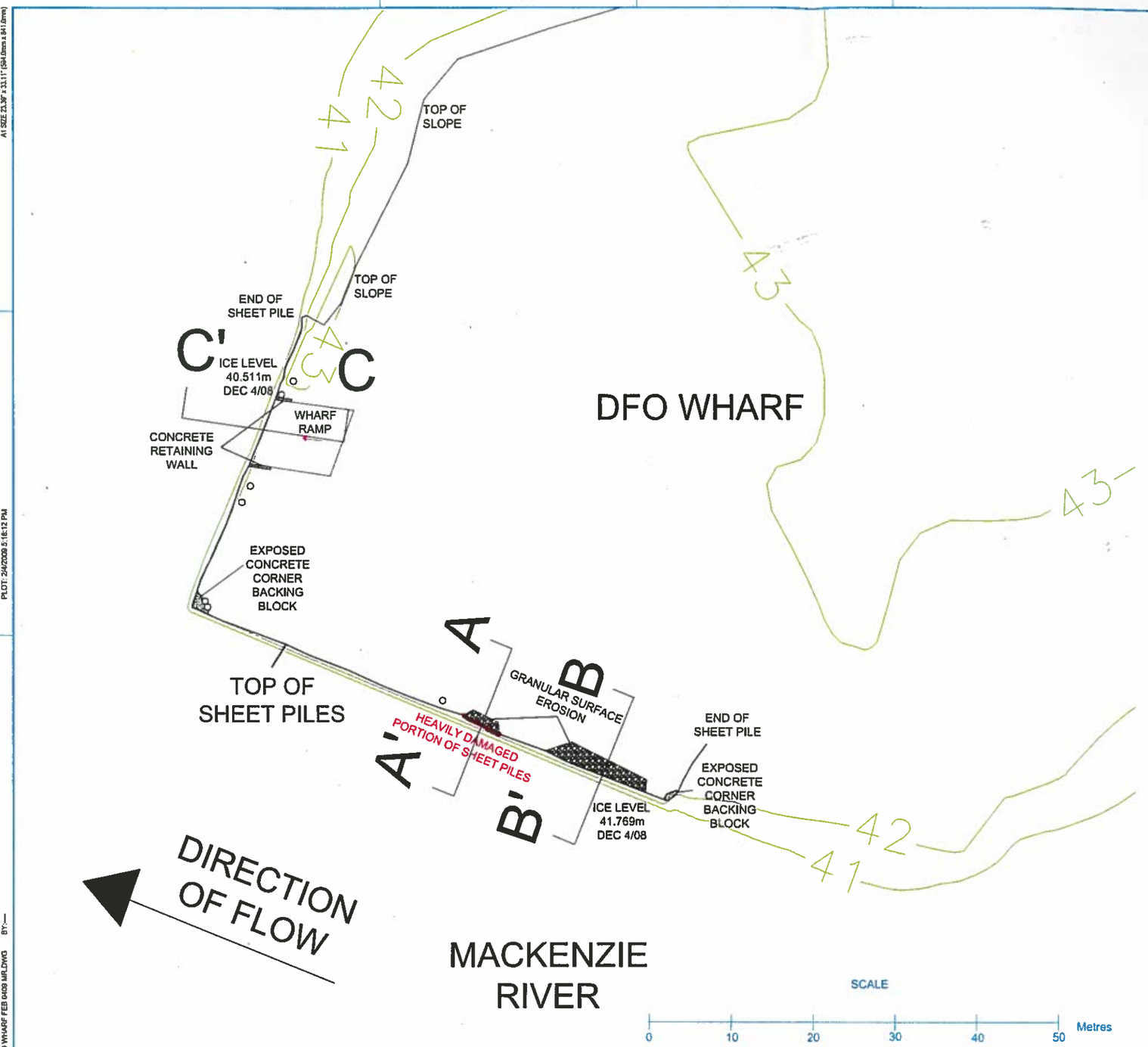
DFO Wharf Norman Wells NT

AECOM

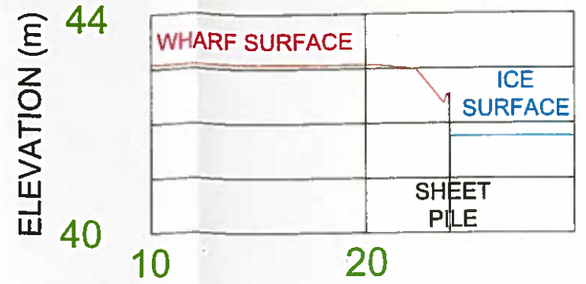
CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

Pile Extension Connection Details

Figure - 4



SECTION A-A'



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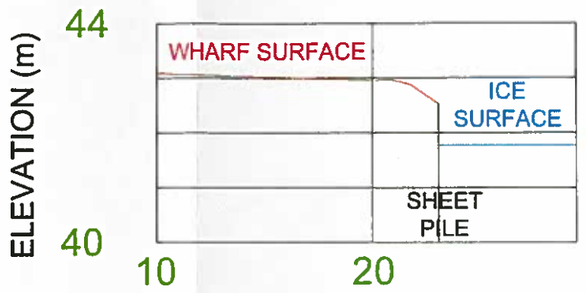
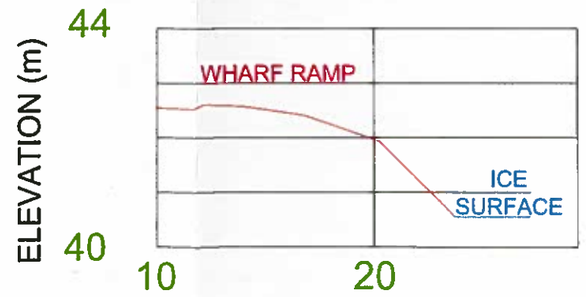


SECTION C-C'



LEGEND

○ TOP OF HOLLOW STEEL PILE BOLLARDS

I/R	YY/MM/DD	ISSUE/REVISION DESCRIPTION	DRN	CHK	DES	ENG	IDR	APP
B	09/02/04	REVISED EXISTING SITE PLAN	MR	CB				
A	09/01/28	EXISTING SITE PLAN	MR	ML				

AECOM

GOVERNMENT OF THE NORTHWEST TERRITORIES
DEPARTMENT OF TRANSPORTATION
NORMAN WELLS DFO WHARF
EXISTING SITE PLAN

PROJECT NUMBER	DRAWING NUMBER	ISSUE/REVISION
107303	107303-100	1

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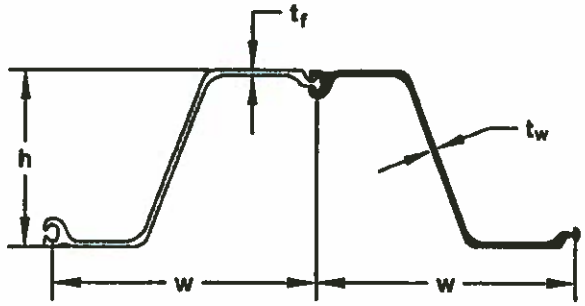
PZ/PS Hot Rolled Steel Sheet Piling

02/08



PZ

SECTION	Width (w) in (mm)	Height (h) in (mm)	THICKNESS Flange (t_f) in (mm)	THICKNESS Wall (t_w) in (mm)	Area in²/ft (cm²/m)	WEIGHT Pile lb/ft (kg/m)	WEIGHT Wall lb/ft² (kg/m²)	Section Modulus in³/ft (cm³/ft)	Moment of Inertia in⁴/ft (cm⁴/ft)	COATING AREA Both Sides ft²/ft of single (m²/m)	COATING AREA Wall Surface ft²/ft² of wall (m²/m²)
PZ 22	22.0 559	9.0 229	0.375 9.50	0.375 9.50	6.47 136.9	40.3 60.0	22.0 107.4	18.1 973	84.38 11500	4.48 1.37	1.22 1.22
PZ 27	18.0 457	12.0 305	0.375 9.50	0.375 9.50	7.94 168.1	40.5 60.3	27.0 131.8	30.2 1620	184.20 25200	4.48 1.37	1.49 1.49
PZ 35	22.6 575	14.9 378	0.600 15.21	0.500 12.67	10.29 217.8	66.0 98.2	35.0 170.9	48.5 2608	361.22 49300	5.37 1.64	1.42 1.42
PZ 40	19.7 500	16.1 409	0.600 15.21	0.500 12.67	11.77 249.1	65.6 97.6	40.0 195.3	60.7 3263	490.85 67000	5.37 1.64	1.64 1.64

PS

SECTION	Width (w) in (mm)	Web (t_w) in (mm)	Maximum Interlock Strength k/in (kN/m)	Minimum Cell Diameter* ft (m)	Area in²/ft (cm²/m)	WEIGHT Pile lb/ft (kg/m)	WEIGHT Wall lb/ft² (kg/m²)	Section Modulus in³/sheet (cm³/sheet)	Moment of Inertia in⁴/sheet (cm⁴/sheet)	COATING AREA Both Sides ft²/ft of single (m²/m)	COATING AREA Wall Surface ft²/ft² of wall (m²/m²)
PS 27.5	19.69 500	0.4 10.2	24 2400	30 9.14	8.09 171.2	45.1 67.1	27.5 134.3	3.3 54	5.3 221	3.65 1.11	1.11 1.11
PS 31	19.69 500	0.5 12.7	24 2400	30 9.14	9.12 193.0	50.9 75.7	31.0 151.4	3.3 54	5.3 221	3.65 1.11	1.11 1.11

* Minimum cell diameter cannot be guaranteed for piles over 65 feet (19.81 m) in length
* Minimum cell diameter cannot be guaranteed if piles are spliced
* 58 Piles are needed to make a 30 foot diameter cell

Appendix "B"
Photos

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP001.JPG - Looking upstream along river's edge at east end.

2008-12-03DFO Wharf Norman WellsP002.JPG - Looking towards shoreline along east leading edge upstream rock.

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP003.JPG - Looking west at main body of wharf.

2008-12-03DFO Wharf Norman WellsP004.JPG - Looking northeast at leading edge of outer wharf.

DFO Wharf Norman Wells NT

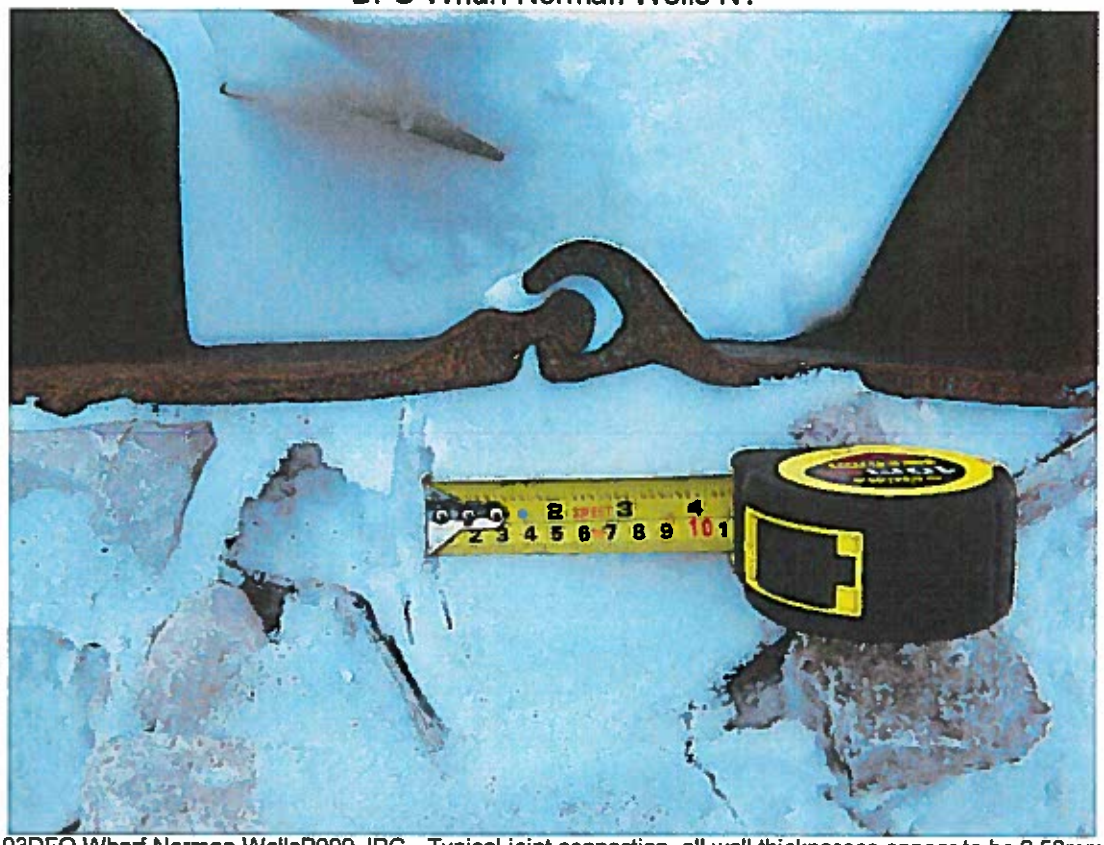
2008-12-03DFO Wharf Norman WellsP005.JPG - Numerous cables located ~6m inland of eastern leading edge of outer wharf area, unsure of origins.

2008-12-03DFO Wharf Norman WellsP006.JPG - Looking southwest at upstream corner of seawall, reinforced concrete was installed at corner.

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP007.JPG - Looking south at leading edge outer corner with reinforced concrete backing.

2008-12-03DFO Wharf Norman WellsP008.JPG - Looking west at riverside wall where ~12.0m of wall has been cut out down to lower subcap to ~1.0m deep ~3.5m from leading edge of upstream outer corner.



2008-12-03DFO Wharf Norman WellsP009.JPG - Typical joint connection, all wall thicknesses appear to be 9.50mm thick.

2008-12-03DFO Wharf Norman WellsP010.JPG - Sheet piles appear to be 450x300mm sections.

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP011.JPG - Looking west along riverside sheet piling, damaged areas extend down piles ~1.0m throughout.

2008-12-03DFO Wharf Norman WellsP012.JPG - Looking west along riverside sheet piling removed for ~5.0m by Coast Guard due to safety concerns to ~1.0m down.

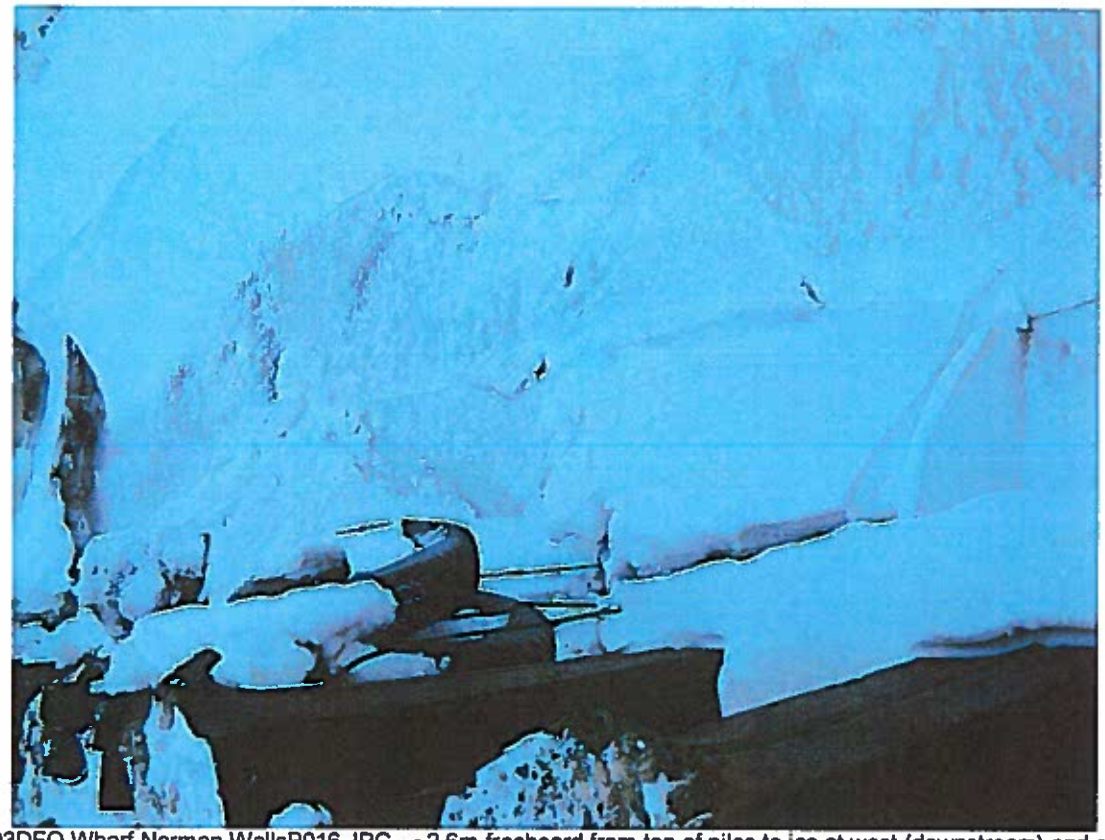
DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP013.JPG - Looking east along piles east of area removed by Coast Guard, piles appear to be intact at below subcap ~1.0m below pile tops, this subcap is not evident anywhere further west. Pile top elevation 44.2m MSL.

2008-12-03DFO Wharf Norman WellsP014.JPG - Typical ice damage to tops of piles, top ~1.0m distorted ~400mm, local information indicates that ~100mm of infill is added each year.

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP015.JPG - Separations between and tears to piles up to ~300mm wide losing fill at 3 locations, also note exposed tie back cables ~100mm below fill at this location.

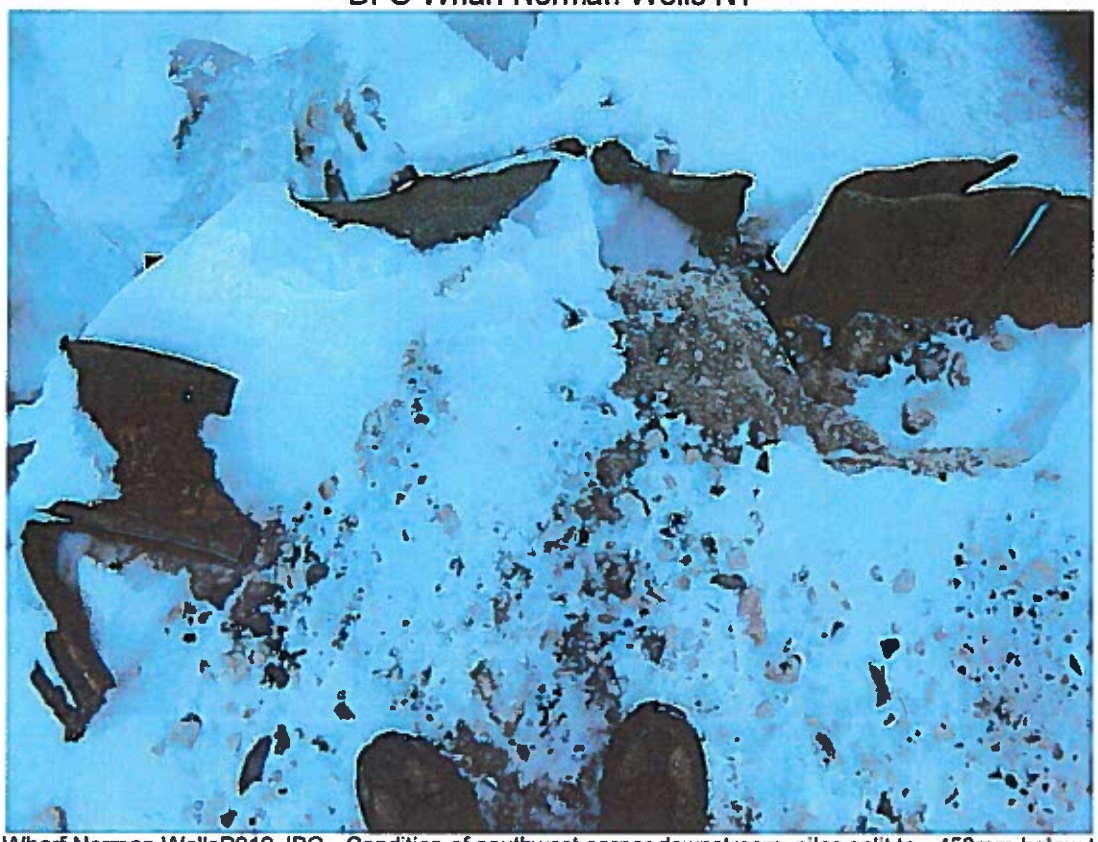


2008-12-03DFO Wharf Norman WellsP016.JPG - ~2.6m freeboard from top of piles to ice at west (downstream) end of wharf.

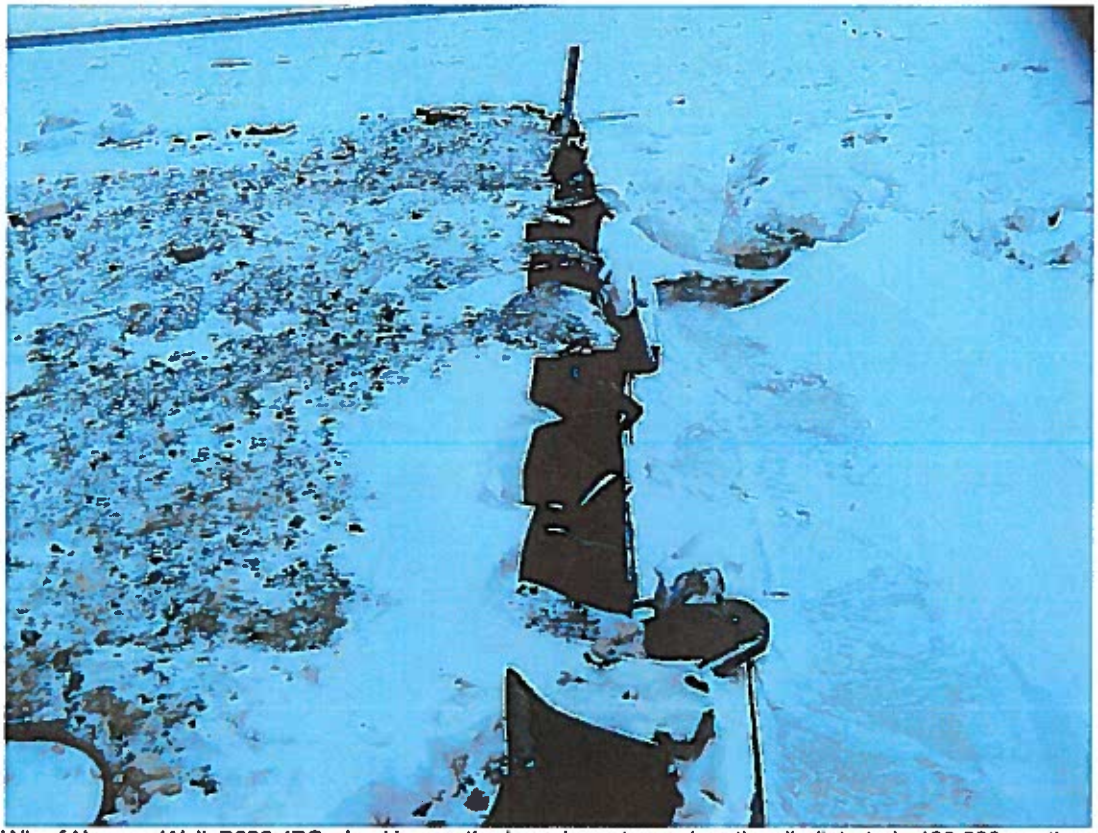
DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP017.JPG - Several tie back cables are exposed, frayed, and destroyed.

2008-12-03DFO Wharf Norman WellsP018.JPG - One of 3 locations with bad separations or tears in south riverside wall, ~1.0m deep and separated/torn ~300mm.



2008-12-03DFO Wharf Norman WellsP019.JPG - Condition of southwest corner downstream, piles split to ~450mm below top of concrete and concrete deteriorating.



2008-12-03DFO Wharf Norman WellsP020.JPG - Looking north along downstream (west) wall, distorted ~100-200mm throughout at tops.

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP021.JPG - Looking south along downstream (west) wall, distortion and buckling for top ~1.0m of piles, also note deterioration of concrete with exposed corroded rebar.

2008-12-03DFO Wharf Norman WellsP022.JPG - Looking north along downstream wharf to north side of loading ramp area, top ~1.0m of piles distorted.

DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP023.JPG - Looking south at downstream wharf to north of loading ramp area, buckling and distortions throughout.

2008-12-03DFO Wharf Norman WellsP024.JPG - Looking north at downstream trailing edge of wharf towards shoreline.

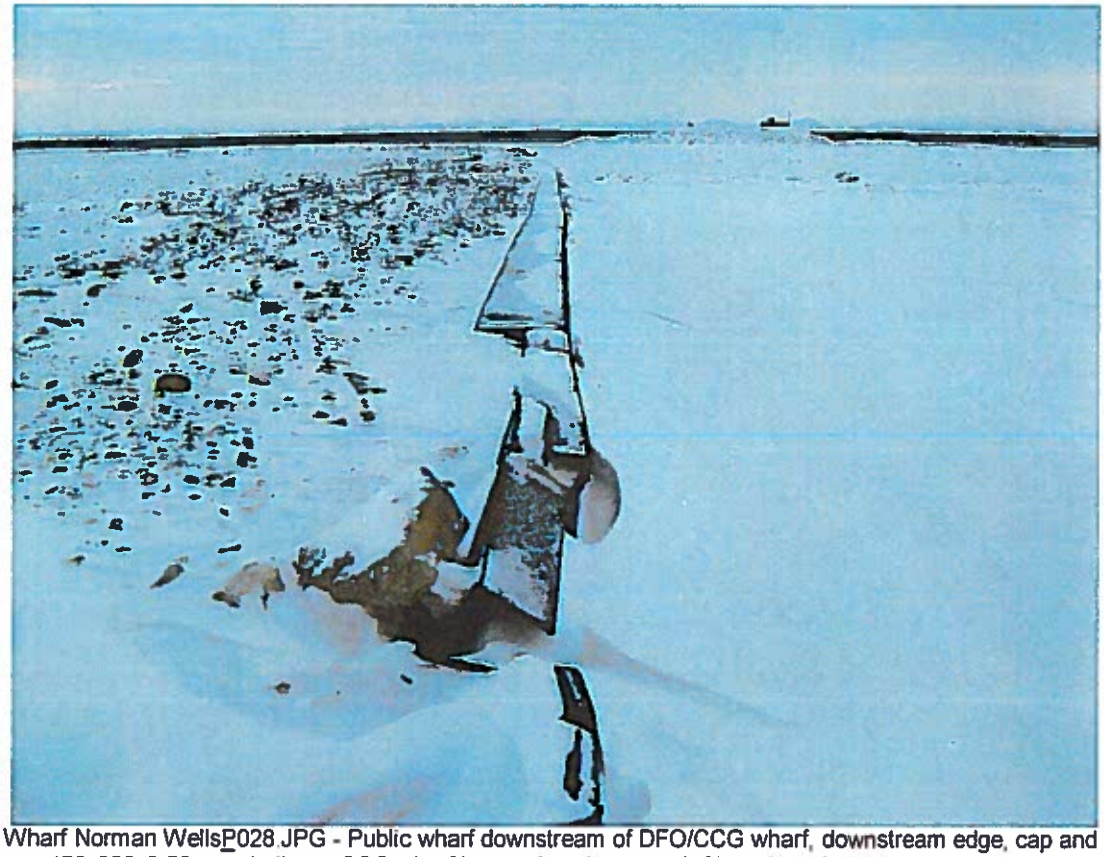
DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP025.jpg - Looking southwest at upstream corner, this corner will likely be damaged to some degree during next ice flow.

2008-12-03DFO Wharf Norman WellsP026.JPG - Looking east at upstream ice buildup that will impact the upstream southeast corner.

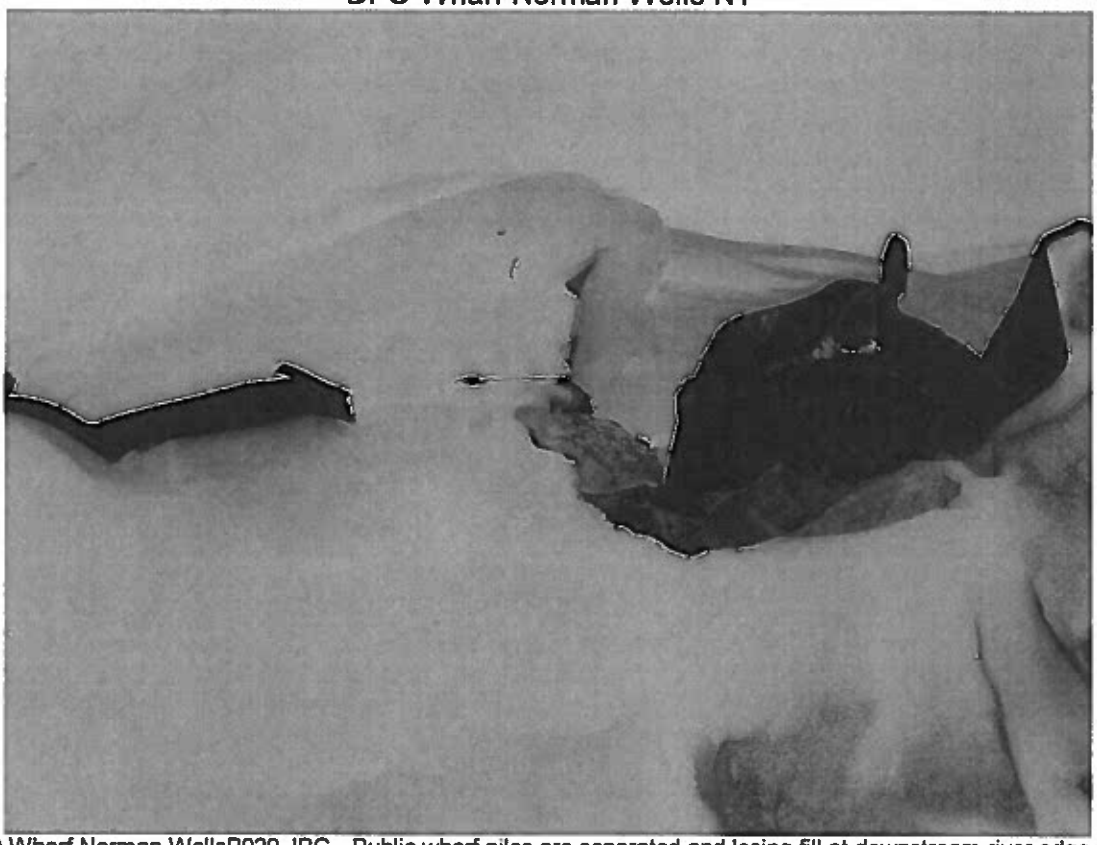
DFO Wharf Norman Wells NT

2008-12-03DFO Wharf Norman WellsP027.JPG - Water intake rock protection downstream of wharf, rock up to ~3.0x2.0mx600mm thick.



2008-12-03DFO Wharf Norman WellsP028.JPG - Public wharf downstream of DFO/CCG wharf, downstream edge, cap and piles, piles are 450x300x9.50mm similar to CCG wharf but at elevation ~43.3MSL (~1.0m lower than DFO wharf).

DFO Wharf Norman Wells NT



2008-12-03DFO Wharf Norman WellsP029.JPG - Public wharf piles are separated and losing fill at downstream river edge, also missing substantial length of caps due to ice damage.

Appendix "C"
Water Survey of Canada
Data

Environment Canada Environnement Canada

Canada

MACKENZIE RIVER AT NORMAN WELLS

Daily Water Levels Statistics in meters for the Period January 2002 - December 2007

Water Survey of Canada **Station No. 10KA001**

Yellowknife, Northwest Territories **826000 km²**

DAY	STATISTIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.990	4.639	4.637	4.540	4.636	5.740	5.418	4.735	4.122	4.102*	4.000	4.743
	MAX	5.679	5.701*	5.661	5.332	6.241	6.437	6.083	6.495*	5.067	4.916	4.857	5.919
1	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	5	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.984*	4.625	4.627	4.536	4.655	5.788	5.355	4.713	4.106	4.253	4.120	4.824
	MAX	5.690	5.724	5.649	5.319	6.311	6.478	5.999	6.297	5.093	4.934	4.896*	5.976
2	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	5	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.973	4.613	4.620	4.363	4.663	5.798	5.293	4.642	4.116	4.170	4.016	4.821
	MAX	5.710	5.708	5.653	5.309	6.718	6.492	6.111	6.133	5.128	4.966*	4.911	5.991
3	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.964	4.602	4.617	4.366	4.680	5.807	5.223	4.619	4.137	4.185	3.925	4.857
	MAX	5.738	5.683*	5.644	5.300*	7.093	6.532	6.334	6.135	5.157	4.998	4.935	5.969
4	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.959	4.590	4.600	4.371	4.702	6.067	5.144	4.622	4.117	4.177	3.890	4.905
	MAX	5.744	5.670	5.631	5.286	7.998	6.589	6.497	6.201	5.201*	4.973	5.695*	5.963
5	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.951	4.577	4.591	4.381	4.726	5.966	5.073	4.597	4.115	4.149	3.756	4.942
	MAX	5.762	5.680	5.628	5.276*	8.408	6.694*	6.624	6.205	5.222	4.952	5.695*	5.972
6	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.940	4.558	4.593	4.522*	4.756	5.957	5.023	4.582	4.129	4.140	3.668	4.937
	MAX	5.771	5.702	5.615	5.257*	8.452	6.863	6.858	6.169	5.192*	4.916*	5.630	5.979
7	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	5	6	6	6	6	6	6	5	6
	MEAN												
	MIN	---	---	---	---	---	---	---	---	---	---	---	---
	MAX	4.932	4.537	4.594	4.523	4.789	5.984	4.963	4.571	4.123	4.129	3.640	4.944
8	LWR QUART	5.767	5.701*	5.603	5.240	11.220	6.953	7.027	6.125	5.158	4.859	5.589	5.998
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	---	---	---	---	---	---	---	---	---	---	---	---

		6	6	5	5	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.927	4.523*	4.590	4.522*	4.820	6.002	4.969	4.565	4.104	4.134	4.160	4.948
	MAX	5.774	5.690	5.593	5.234*	12.990	7.056	7.088	6.093	5.124*	4.824	5.689	6.005*
9	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	5	6	6	6	6	6	6	5	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.919	4.507	4.582	4.522*	4.857	5.927	4.998	4.540	4.079	4.140	4.133	4.962
	MAX	5.785	5.689*	5.588	5.232	11.275	7.160	7.029	6.039	5.101	4.812*	5.934	5.968
10	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	5	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.911	4.492*	4.581	4.527	4.912	5.834	5.117	4.507	4.064	4.148	4.120	4.990
	MAX	5.780	5.690	5.573	5.230	9.173	7.199	6.925*	5.967	5.081*	4.778*	6.315*	5.888
11	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	5	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.904	4.480	4.574	4.439	4.979	5.842	5.117	4.487	4.057	4.135	4.162	5.015
	MAX	5.772	5.687*	5.568	5.225*	9.862	7.181	6.798*	5.884	5.026	4.731	6.215*	5.817
12	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.887	4.481*	4.567	4.437	5.038	5.922	5.092	4.456	4.064	4.118	4.194	5.029
	MAX	5.765	5.690	5.580	5.212	11.492	7.172	6.645	5.783	4.990*	4.685	6.121	5.739
13	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.875	4.480	4.573	4.445	5.153	5.978	5.068	4.429	4.075	4.120	4.170	5.039
	MAX	5.766	5.692*	5.572*	5.213	8.574	7.136	6.481	5.687	4.943	4.661*	6.276	5.670
14	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.871	4.466	4.571	4.452	5.331	5.966	5.062	4.407	4.101	4.106	4.327	5.047
	MAX	5.769	5.698	5.575*	5.216	7.510	7.036*	6.314	5.582	4.908	4.620	6.304	5.641
15	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	5	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.861	4.443	4.564	4.461	5.625	5.942	5.048	4.347	4.099	4.099	4.567	5.048
	MAX	5.761*	5.696	5.563*	5.225*	7.352	6.943	6.176	5.500	4.892	4.607	6.232	5.709*
16	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	5	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.842	4.427	4.562*	4.472	5.962	5.930	5.018	4.298	4.098	4.084	4.509	5.042
	MAX	5.761*	5.695	5.555*	5.224*	6.762	6.915	6.065	5.432	4.916	4.588*	6.215*	5.790
17	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	5	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.820	4.412	4.562*	4.475	5.931	5.896	4.950	4.253	4.067	4.085	4.458	5.035

18	MAX	5.736	5.706	5.558*	5.224*	6.828	6.973	6.017	5.371	4.928	4.575	6.574	5.863
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	5	6	6	6	6	6	6	6
19	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.805	4.398	4.562	4.504	5.778	5.839	4.890	4.215	4.046	4.087	4.412	5.043
	MAX	5.723	5.714	5.552	5.221*	7.095	7.134	6.117	5.350	4.950*	4.573*	6.601	5.925
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	5	6	6	6	6	6	6	6
20	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.796	4.411	4.561	4.543	5.644	5.782	4.860	4.172	4.035	4.132	4.313	5.058
	MAX	5.698	5.689*	5.537	5.235	12.578	7.372	6.154	5.378	4.978	4.566	6.439	5.973*
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	5	6	6	6	6	6	6	6	6	6
21	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.790*	4.705	4.559	4.546	5.535	5.753	4.844	4.139	4.025	4.117	4.204	5.060
	MAX	5.690	5.691	5.522*	5.246	10.557	7.561	6.071	5.344*	5.012	4.557	6.217	6.005*
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	5	6	6	6	6	6	6	6	6	6
22	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.779*	4.688	4.556	4.542	5.385	5.726	4.822	4.110	4.034	4.114	4.110	5.068
	MAX	5.690	5.685	5.502*	5.267	12.871	7.740*	6.168	5.294	5.006	4.555	6.190	6.038
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	5	6	6	6	6	6	6	6	6	6
23	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.765	4.678	4.556*	4.553	5.250	5.692	4.799	4.105	4.032	4.105	4.075	5.066
	MAX	5.693	5.684	5.478	5.284	12.322	7.857	6.473	5.263	5.021	4.556	6.208	6.069
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	5	6	6	6	6	6	6	6	6	6
24	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.749	4.673	4.558	4.573	5.181	5.659	4.781	4.115	4.051	4.080	4.086	5.058
	MAX	5.688	5.683*	5.460*	5.293	12.110	7.741	6.577	5.237	5.035	4.618	6.236	6.093*
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	5	6	6	6	6	6	6	6	6	6
25	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.734	4.666	4.562*	4.575	5.118	5.626	4.780	4.111	4.088	4.061	4.126	5.048
	MAX	5.670	5.682	5.440*	5.300*	9.821	7.487	6.695	5.227	5.033	4.624	6.305	6.111*
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	5	6	6	6	6	6	6	6	6	6
26	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.722	4.658	4.300	4.577	5.109	5.607	4.787	4.118	4.083	4.070	4.202	5.024
	MAX	5.675	5.676	5.426*	5.310	6.961	7.221	6.808*	5.220	5.020	4.659	6.392	6.126
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	6	6	6	6	6	6	6	6	6	6
27	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.702	4.647	4.316	4.590	5.154	5.591	4.787	4.127	4.068	4.087	4.314	5.002
	MAX	5.683	5.671*	5.406	5.329	6.732	6.940	6.786*	5.157	4.996	4.661*	6.309	6.138
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---

	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	6	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.687	4.641	4.324	4.597	5.258	5.553	4.820	4.122	4.072	4.039	4.445	4.991
	MAX	5.699*	5.671*	5.387	5.533	6.604	6.653	6.659	5.101	4.942	4.621	6.115	6.155
28	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	5	6	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.674	---	4.333	4.603	5.418	5.523	4.853	4.138	4.049	4.006	4.556	4.993
	MAX	5.701	---	5.376	5.823*	6.534	6.406*	6.507	5.076	4.927	4.673	5.949	6.164
29	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	---	6	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.664	---	4.345	4.616	5.569	5.465	4.847	4.151	4.046	3.994	4.653	5.004
	MAX	5.699*	---	5.359	6.070	6.482	6.223	6.363*	5.059	4.911*	4.774	5.823	6.166*
30	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	---	6	6	6	6	6	6	6	6	6	6
	MEAN	---	---	---	---	---	---	---	---	---	---	---	---
	MIN	4.656	---	4.362	---	5.712	---	4.760	4.139	---	3.982	---	4.997
	MAX	5.702	---	5.344	---	6.452	---	6.485	5.063*	---	4.808	---	6.160
31	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	---	6	---	6	---	6	6	---	5	---	6

This report was produced on January 13, 2009 using the Water Level and Streamflow Statistics application located at http://www.wsc.ec.gc.ca/stafloindex_e.cfm?cname=main_e.cfm

Environment Canada Environnement Canada

Canada

MACKENZIE RIVER AT NORMAN WELLS

Daily Discharge Statistics in m^3/s for the Period January 2002 - December 2007

Water Survey of Canada **Station No. 10KA001**

Yellowknife, Northwest Territories **826000 km^2**

DAY	STATISTIC	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
	MEAN	3990	3910	3650	3610	6180	17800	15300	14300	10600	9630	7380	3340
	MIN	3470	3320	2920	3170	3810	15300	13800	11100	8320	8030	5560	2460
	MAX	4560	4540	4460	4350	8280	19300	17100	19400	12000	11300	8700	4730
1	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3990	3910	3630	3610	6660	18100	15100	14000	10600	9680	7230	3300
	MIN	3500	3300	2920	3190	3850	15500	13800	11000	8250	8400	5300	2400
	MAX	4560	4540	4450	4340	8770	19800	16600	18300	12100*	11400	8660	4470
2	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4010	3890	3630	3620	7290	18300	15100	13600	10700	9680	7030	3310
	MIN	3540	3290	2930	3200	3860	15600	13700	10600	8280	8090	5070	2410
	MAX	4590	4500	4480	4330	10400	19900	17200	17300	12300	11600	8540	4400
3	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4020	3850	3630	3630	8430	18400	15100	13500	10700	9690	6830	3320
	MIN	3500	3270	2920	3230	3900	15600	13600	10500	8350	8140	4800	2490
	MAX	4610	4470	4480	4330	13400	19600	18500	17400	12500	11700	8370	4250
4	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4040	3840	3620	3630	9460	18800	15200	13500	10700	9710	6680	3320
	MIN	3620	3250	2910	3250	3950	17900	13300	10500	8270	8110	4600	2580
	MAX	4620	4440	4480	4320	16300	20000	19400	17700	12700	11600	8210	4170
5	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4050	3830	3610	3640	10500	19100	15400	13400	10700	9680	6500	3350
	MIN	3620	3240	2900	3280	4000	17900*	12900	10400	8260	8010	4350	2720
	MAX	4650	4410	4490	4320	17800	20600	20200	17800	12800	11500	8120	4250
6	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4060	3820	3600	3650	11700	19300	15800	13200	10600	9620	6370	3380
	MIN	3610	3210	2890	3300	4070	17600	12700	10300	8300	7980	4190	2680
	MAX	4670	4370	4480	4300	18900	21700	21600	17500	12600	11300	8170	4280
7	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4060	3810	3600	3650	12900	19300	16200	13300	10600	9590	6210	3430
	MIN	3610	3170	2890	3340	4140	17300	12400	10300	8270	7940	3880	2610
	MAX	4690	4330	4480	4280	21900	22200	22700	17300	12500	11100	8150	4330
8	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4060	3800	3610	3660	13700	19400	16400	13200	10500	9520	6130	3500
	MIN	3610	3150	2890	3370	4210	17100	12400	10200	8190	7950	4120	2650
	MAX	4700	4280	4480	4280	23400	22900	23100	17100	12300	10900	8180	4390
9	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4070	3790	3600	3680	14200	19400	16400	13100	10500	9490	6030	3560
	MIN	3610	3130	2880	3400	4290	17300	12500	10100	8090	7980	4290	2760
	MAX	4690	4250	4490	4300	23700	23600	22700	16800	12200	10900	8200	4430
10	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4070	3780	3590	3700	14400	19600	16400	12900	10500	9370	5890	3610
	MIN	3610	3110	2880	3410	4410	17200	13000	9970	8030	8010	4370	2960
11	MAX	4680	4220	4480	4310	23300	23900	22000	16400	12100	10700	8010	4430
	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---

	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4060	3780	3590	3710	14300	19800	16400	12600	10400	9260	5690	3650
	MIN	3600	3090	2890	3430	4550	17200	13000	9880	8000	7960	4170	3200
	MAX	4670	4200	4480	4320	22600	23700	21200	16000	11800	10500	7810	4350
12	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4040	3770	3580	3720	14300	19900	16300	12300	10400	9190	5460	3680
	MIN	3580	3100	2880	3440	4680	17500	12900	9730	8010	7900	3790	3440
	MAX	4650	4180	4530	4310	24000	23700	20300	15500	11700	10300	7650	4260
13	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4030	3770	3580	3730	14100	19800	16000	12100	10400	9110	5260	3710
	MIN	3580	3100	2870	3450	4980	17600	12800	9600	8050	7900	3460	3430
	MAX	4640	4210	4540	4330	22000	23400	19300	15000	11500	10200	7580	4210
14	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4020	3760	3580	3760	14100	19500	15800	11900	10300	9030	5030	3730
	MIN	3580	3080	2860	3470	5450	17800*	12700	9500	8140	7850	3180	3250
	MAX	4630	4240	4560	4350	20400	22700	18400	14500	11300	10000	7390	4160
15	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4010	3750	3590	3780	14300	19300	15500	11800	10100	8990	4790	3760
	MIN	3570	3040	2880	3480	6280	17700	12700	9270	8120	7830	2960	3080
	MAX	4630	4260	4560	4390	19700	22100	17600	14100	11200	9970	6870	4130
16	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	4010	3740	3590	3810	14600	19000	15300	11700	10100	8920	4640	3800
	MIN	3550	3020	2880	3490	7350	17600	12500	9080	8110	7770	3000	2930
	MAX	4640	4280	4560	4400	19100	22000	17000	13800	11300	9890	6610	4220
17	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3990	3730	3590	3840	15000	18700	15100	11600	10100	8860	4470	3830
	MIN	3520	3000	2880	3490	8660	17400	12200	8910	7990	7760	3060	2840
	MAX	4630	4320	4590	4420	19000	22300	16700	13500	11400	9830	6290	4400
18	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3970	3730	3580	3880	15700	18600	15100	11400	10100	8790	4300	3880
	MIN	3510	2970	2880	3490	10600	17000	11900	8760	7910	7730	2890	2810
	MAX	4610	4360	4590	4430	19300	23400	17300	13400	11500	9820	5990	4570
19	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3950	3710	3580	3930	17200	18600	15100	11300	10200	8700	4130	3930
	MIN	3500	2980	2890	3490	14800	16700	11700	8590	7860	7650	2710	2860
	MAX	4600	4330	4580	4480	20000	25000	17500	13500	11600	9790	5820	4710
20	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3950	3710	3580	3970	18500	18800	14800	11200	10200	8600	3950	3970
	MIN	3500	3000	2910	3500	14300	16500	11600	8460	7810	7500	2520	2960
	MAX	4590	4350	4560	4530	20000	26400	17000	13400	11800	9750	5530	4830
21	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3950	3700	3580	4010	20600	18800	14800	11100	10200	8530	3850	4010
	MIN	3490	2990	2920	3500	13500	16200	11500	8350	7848	7400	2400	3100
	MAX	4580	4360	4540	4590	26800	27700	17500	13100	11700	9740	5290	4950
22	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3950	3690	3580	4050	20300	18700	14800	11100	10200	8430	3720	4030
	MIN	3480	2980	2930	3520	12900	16000	11400	8320	7820	7260	2310	3210
	MAX	4570	4380	4500	4630	26600	28500	19300	13000	11800	9750	4860	5070
23	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6

	MEAN	3950	3690	3580	4110	19900	18400	14700	11000	10100	8320	3660	4050
	MIN	3460	2970	2950	3590	12600	15700	11300	8350	7890	7100	2270	3320
	MAX	4580	4400	4480	4650	26300	27700	19900	12800	11900	9640	4900	5170
24	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3940	3680	3580	4190	19200	17900	14700	10900	10000	8210	3600	4060
	MIN	3450	2950	2960	3670	12300	15500	11300	8330	8010	6900	2290	3390
	MAX	4570	4420	4460	4660	24000	25800	20600	12800	11900	9610	4940	5260
25	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3940	3670	3580	4340	18400	17400	14700	10900	9960	8120	3570	4060
	MIN	3440	2940	2970	3670	12200	15300	11300	8350	7990	6750	2350	3460
	MAX	4550	4420	4440	4710	21600	24000	21300	12800	11800	9580	5000	5340
26	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3930	3660	3590	4580	18000	16900	14700	10800	9860	7990	3550	4070
	MIN	3410	2930	3000	3700	12400	14900	11300	8370	7930	6560	2470	3480
	MAX	4530	4440	4420	5060	20800	22100	21200	12500	11700	9350	4970	5410
27	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3930	3660	3590	4930	17900	16400	14500	10800	9780	7860	3510	4080
	MIN	3390	2920	3040	3720	12900	14500	11500	8350	7930	6370	2610	3500
	MAX	4530	4460	4400	5920	20000	20300	20400	12200*	11400*	9120	4940	5470
28	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	6	6	6	6	6	6	6	6	6	6	6
	MEAN	3920	3690	3600	5330	17900	15900	14300	10700	9740	7720	3440	4090
	MIN	3370	3690	3070	3730	13700	14200	11600	8400	7840	6200	2730*	3500
	MAX	4550	3690	4390	6820	19600*	18900	19500	12100*	11400	8920	4900	5490
29	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	1	6	6	6	6	6	6	6	6	6	6
	MEAN	3920	---	3600	5750	17700	15600	14500	10700	9650	7590	3380	4110
	MIN	3360	---	3110	3760	14400	13900	11600	8440	7820	5950	2570	3510
	MAX	4560	---	4370	7640	19300	17800	18600	12000	11300	8810	4840	5500
30	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	---	6	6	6	6	6	6	6	6	6	6
	MEAN	3920	---	3610	---	17700	---	14400	10600	---	7470	---	4110
	MIN	3350	---	3160	---	15200	---	11200	8390	---	5760	---	3470
	MAX	4560	---	4360	---	19100*	---	19300	12000	---	8750	---	5480
31	LWR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	MEDIAN	---	---	---	---	---	---	---	---	---	---	---	---
	UPR QUART	---	---	---	---	---	---	---	---	---	---	---	---
	DAYS	6	---	6	---	6	---	6	6	---	6	---	6

This report was produced on January 13, 2009 using the Water Level and Streamflow Statistics application located at http://www.wsc.ec.gc.ca/staflo/index_e.cfm?cname=main_e.cfm

Daily Discharge for MACKENZIE RIVER AT NORMAN WELLS (10KA001)