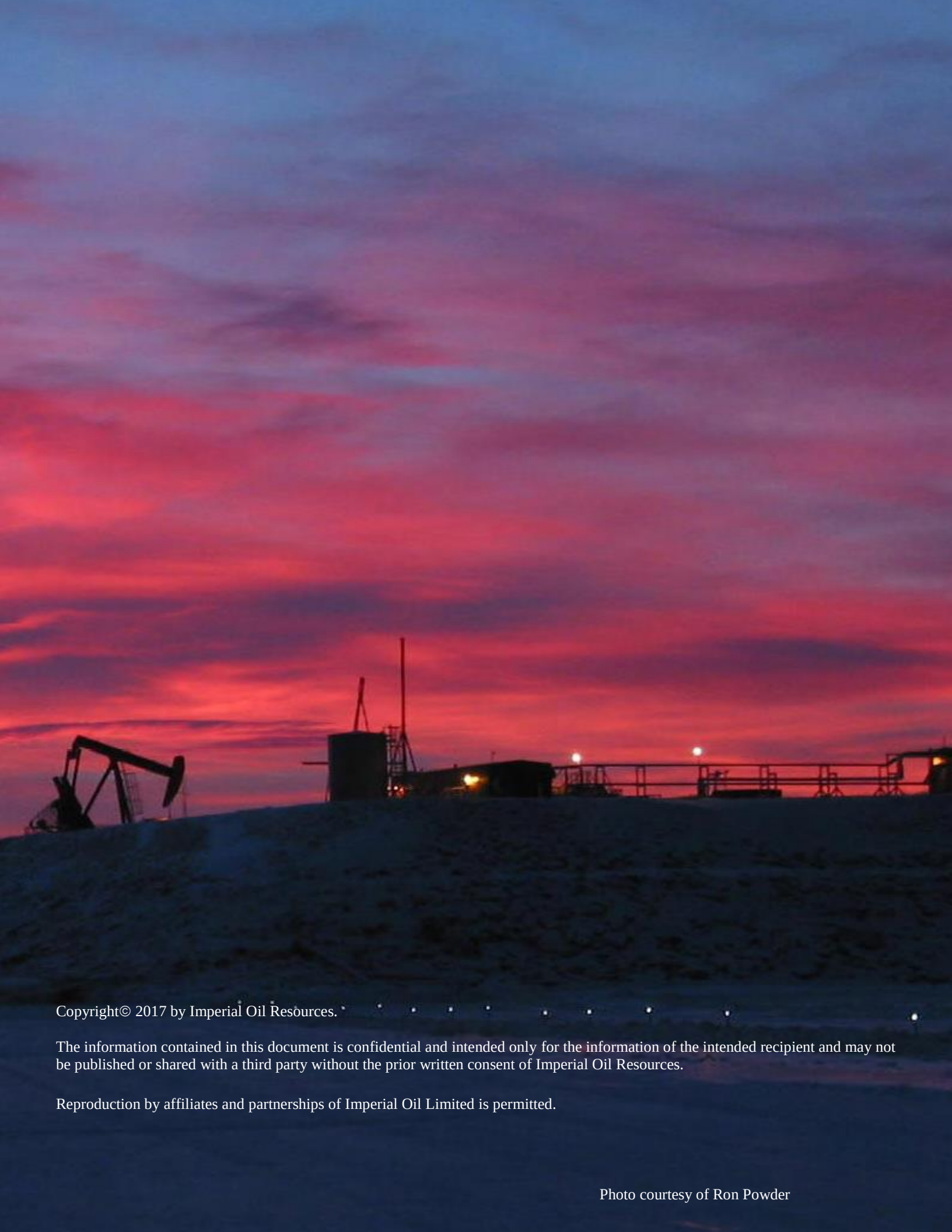
Norman Wells Operations Annual Flowline Integrity and Break-Up Report

October 2020

Imperial Oil Resources N.W.T. Limited
Bag 5000, 1001 Canol Drive
Norman Wells, Northwest Territories
X0E 0V0, Canada

Switch Board: (867) 587-3100



Copyright© 2017 by Imperial Oil Resources.

The information contained in this document is confidential and intended only for the information of the intended recipient and may not be published or shared with a third party without the prior written consent of Imperial Oil Resources.

Reproduction by affiliates and partnerships of Imperial Oil Limited is permitted.

Photo courtesy of Ron Powder

TABLE OF CONTENTS

List of Images, Figures, and Tables **5**
Acronyms **5**
1 Introduction **6**
2 2020 Break-Up Summary **7**
2.1 Annual Inspections 7
3 Break-Up Preparation **8**
4 2020 Bathymetric Survey **9**
4.1 Bathymetric Survey Results 9
4.1.1 Flowline Bundle Profiles 10
4.1.1.1 Island 1 to Mainland Flowline 10
4.1.1.2 Island 2 Mainland Flowline 10
4.1.1.3 Island 3 to Goose Island Flowline 10
4.1.1.4 Island 3 to Mainland Flowline 10
4.1.1.5 Island 4 to Goose Island Flowline 11
4.1.1.6 Island 5 to Bear Island Flowline 11
4.1.1.7 Island 6 to Bear Island Flowlines 11
4.1.1.8 Bear Island to Goose Island Flowlines 11
4.1.2 Surrounding Areas 11
4.1.2.1 Artificial Islands 11
4.1.2.2 Mainland Dock 11
4.1.2.3 Bear Island and Goose Island Causeway 12
4.1.3 Summary of Depth of Cover Readings 12
5 Protection Assessment And Maintenance **14**
5.1 Summary of Protection Assessment and Maintenance 14
5.1.1 2020 Repairs 14
5.1.1.1 Island 1 14
5.1.1.2 Island 2 14
5.1.1.3 Island 3 14
5.1.1.4 Island 4 14
5.1.1.5 Island 5 14

5.1.1.6 Island 6 14
5.1.1.7 Mainland Dock 14
5.1.2 2020/2021 Proposed Repairs 15
5.1.2.1 Island 1 15
5.1.2.2 Island 2 15
5.1.2.3 Island 3 15
5.1.2.4 Island 4 15
5.1.2.5 Island 5 15
5.1.2.6 Island 6 15
5.1.2.7 Goose Island 15
Flowline And Fuel Storage Tank Integrity 16
5.2 Fuel Storage Tank Integrity Inspections 16
5.3 Flowline Integrity 18

LIST OF IMAGES, FIGURES, AND TABLES

LIST OF IMAGES

Image A: Primary Survey Vessel (Imperial Boat 1) 20

LIST OF TABLES

Table A: Summary of Flowline Corridor Depth of Cover..... 13
Table B: Fuel Storage Tank Integrity Inspections..... 16
Table C: Flowline Integrity Inspections 2020..... 18
Table D: List of Bathymetric Survey Drawings 23

ACRONYMS

AANDC	Aboriginal Affairs and Northern Development Canada
BIT	Bear Island Terminal
cm	Centimeters
CER	Canada Energy Regulator
CPF	Central Processing Facility
DoC	Depth of cover
GIT	Goose Island Terminal
GPS	Global Positioning System
ILI	In-Line Inspection
IOR	Imperial Oil Resources
LT	Land Terminal
m^3	meters cubed
m	Meters
masl	meters above sea level
MFL	Magnetic flux leackage
N/A	Not applicable
NDE	Non-destructive evaluation
NWO	Norman Wells Operations
PM	Preventative Maintenance
RTK	Real Time Kinematic
SLWB	Sahtu Land and Water Board
SSSV	Subsurface Safety Valves

1 INTRODUCTION

Imperial Oil Resources N.W.T. Limited (Imperial) is required by the Sahtu Land and Water Board (SLWB) Water Licence S13L1-007 (Schedule 5, Item 1) and Canada Energy Regulator (CER) Operations Authorization OA1210-001 to annually submit a Flowline Integrity and Break-Up Report no later than October 31st of the year being reported.

Details on the Licence requirements for this report and the corresponding sections within the report can be found in the following concordance table.

Licence Requirement			Section of Report
a)	The results and inspections of the physical condition of each Artificial and Natural Island, including channel erosion, island scour holes and erosion, flowline landfalls, the condition of rip rap and the following information:		Sections 4 & 5
	i.	Locations, depth, and volume of channel scour in the vicinity of any Flowline(s)	Section 4
	ii.	Locations and magnitude of Artificial Island slope erosion	Section 5
	iii.	Locations and severity of Artificial Island rip rap disturbance	Section 5
	iv.	Structural integrity of the Artificial Islands, and other related structures	Section 5
	v.	Structural integrity of the Natural Islands where it is applicable to project activities	Section 5
b)	The dates and results of Flowline(s) and fuel storage tank integrity tests		Section 6
c)	Details on necessary repair and maintenance work along with a schedule for completing such work prior to the following spring Mackenzie River Break-Up period.		Section 4 & 5

2 2020 BREAK-UP SUMMARY

As required by Water Licence S13L1-007, Imperial shall undertake any necessary annual maintenance required to preserve the structural integrity of the islands (Part F, Item 2). Imperial inspects the riverbeds, channels, and banks of the Mackenzie River in the vicinity of the flowline(s). To determine structural integrity of the islands, Imperial conducts an annual artificial island inspection. The results of these surveys are included in this report.

The average water level during the Mackenzie River break-up at Norman Wells is approximately 9 m (44.5 masl) and typically occurs between May 10th and May 15th. In 2020, break-up occurred on Monday May 11th.

2.1 Annual Inspections

This year's bathymetric survey was completed in June 2020. The results of this survey are summarized in Section 4 of this report.

The annual artificial island inspection was performed in August 2020 and is summarized in Section 5 of this report.

3 BREAK-UP PREPARATION

Prior to each year's Mackenzie River break-up, a number of essential tasks must be completed. The key items are listed below.

- Spot heavy equipment on Bear and Goose Island
- Service equipment (e.g. compressors, operator trucks, etc.)
- Plug wells (e.g. wireline activity)
- Verify bunker lids and water intake hatch are secured and protected from ice flow
- Install and function test sub surface safety valves (SSSVs)
- Ensure adequate supply of chemical, fuel and potable water on island locations
- Remove equipment from low lying areas
- Inspect Bear Island purge equipment and review purge plan
- Finalize helicopter plans in preparation for ice road closure
- Execute weekly ice profiles
- Close ice road to equipment
- Remove ice road signage
- Monitor river levels and upstream break up conditions

4 2020 BATHYMETRIC SURVEY

The annual bathymetric survey was performed in June 2020 by GeoVerra. The purpose of the survey is to:

- Determine the amount of instream cover over Imperial's eight cross river flowline bundles located in the bed of the Mackenzie River
- Monitor the river bed immediately adjacent to eight cross river flowline bundles enabling interception of scour hole movement towards flowline bundles
- Monitor the river bed at the base of the six artificial islands and Bear and Goose causeways for possible erosion or scouring
- Monitor the build-up or movement of the sandbars over the flowline bundles
- Identify any changes in the shape and elevation of the river bed in the areas adjacent to the islands, causeways, and docks

Information on typical bathymetric survey equipment used for the Norman Wells survey can be found in Appendix A.

4.1 Bathymetric Survey Results

The scope of work for the annual bathymetric survey is to measure the elevation of the river bottom for the entire length of each cross-river flowline corridor and compare to the construction survey elevations of the flowlines to determine the depth of cover along the entire channel. Flagged monitoring sections that have been identified from previous surveys are further examined to determine whether the cover at these locations has decreased or remained constant compared to previous years.

The 2020 cross-river flowline bundle survey results are provided in the following sections. No depth of cover repair work is currently planned for 2020. Copies of the bathymetric survey drawings can be found in Appendix B.

A specific cross river flowline corridor depth of cover has not been identified for Norman Wells. The corridors are managed on a case by case basis. Cover material is intended to:

1) Provide protection against physical impact, and
2) Provide protection against failure modes due to pipeline free-span (e.g. vortex induced vibration, bending)

The primary intent of the bathymetric survey is to verify that flowline bundles are not exposed (i.e. depth of cover remains >0m), such that the risks outlined above are reduced to the extent possible. Areas which show relatively low cover (<1.0m) or significant increases or decreases in cover between surveys are flagged for review on an annual basis as monitoring locations.

A summary of the depth of cover measured over the last 4 years is included in Table A in Section 4.1.3, below.

In cases where exposure or near-exposure of the bundle is confirmed, appropriate remedial action is triggered.

Remedial action typically consists of deposition of armoring rock on the pipeline corridor. This armoring rock is sized to be stable during anticipated river flow rates and is not expected to be subject to scour. If armoring material is confirmed to be in place, the flowline corridor is considered to be protected from the risks described above.

4.1.1 Flowline Bundle Profiles

4.1.1.1 Island 1 to Mainland Flowline

The profile data indicates that the flowline corridor has adequate cover throughout its entire length, with no sections of the crossing showing less than 1.0 m of cover. Drawing Number 096-0179-700-801-71 in Appendix B contains the survey results overlaid with previous years' data.

4.1.1.2 Island 2 Mainland Flowline

The profile data indicates that the flowline corridor has adequate cover throughout its entire length, with no sections of the crossing showing less than 1.0 m of cover. Drawing Number 096-0179-700-801-72 in Appendix B contains the survey results overlaid with previous years' data.

4.1.1.3 Island 3 to Goose Island Flowline

The 2020 survey was successful in obtaining a larger dataset compared to the 2019 survey due to the increased water levels. A portion of the flowline from Goose Island to Island 3 was not able to be safely surveyed. A large sandbar immediately to the south of Island 3 prevented crews from working in this area (due to hazards associated with floating debris). Drawing Number 096-0179-700-801-73 in Appendix B contains the survey results overlaid with previous years' data.

It is recommended that the stations along this corridor remain flagged for future monitoring.

4.1.1.4 Island 3 to Mainland Flowline

The profile data indicates that the flowline corridor has adequate cover throughout its entire length, with no sections of the crossing showing less than 1.0 m of cover. Drawing Number 096-0179-700-801-74 in Appendix B contains the survey results overlaid with previous years' data.

4.1.1.5 Island 4 to Goose Island Flowline

The profile data is consistent with previous years' surveys and the flowline corridor has adequate cover throughout its entire length, with no sections of the crossing showing less than 1.0 m of cover where measurements were possible. Drawing Number 096-0179-700-801-75 in Appendix B contains the full survey results overlaid with previous years' data.

4.1.1.6 Island 5 to Bear Island Flowline

The profile data indicates that the flowline corridor has adequate cover throughout its entire length, with no sections of the crossing showing less than 1.0 m of cover. Drawing Number 096-0179-700-801-76 in Appendix B contains the survey results overlaid with previous years' data.

4.1.1.7 Island 6 to Bear Island Flowlines

The profile data indicates a decrease in the riverbed to 0.7m at Station 0+240m to 0+302m when compared with the previous years. The remainder of the flowline corridor has adequate cover throughout its entire length. Drawing Number 096-0179-700-801-77 in Appendix B contains the full survey results overlaid with previous years' data.

It is recommended that Station 0+240m to 0+302m along this corridor remain flagged for future monitoring.

4.1.1.8 Bear Island to Goose Island Flowlines

The profile data is consistent with previous years' surveys and the flowline corridor has adequate cover throughout its entire length, with no sections of the crossing showing less than 1.0 m of cover. Drawing Number 096-0179-700-801-78 in Appendix B contains the full survey results overlaid with previous years' data.

4.1.2 Surrounding Areas

The results of the bathymetric survey for the areas surrounding the artificial island locations, the mainland dock, and the Bear Island to Goose Island causeway are shown in the following sections. No depth of cover repair work is planned for 2020.

4.1.2.1 Artificial Islands

The results for the areas surrounding the artificial island locations indicate that there are no areas of concern. Drawing Numbers 096-0179-700-801-79 through 096-0179-700-801-84 in Appendix B contain the full survey results.

4.1.2.2 Mainland Dock

The area around the mainland dock was not surveyed as a result of COVID-19 crew restrictions. There have not been any issues noted at this area in previous years' surveys.

Drawing Number 096-0179-700-801-87 in Appendix B contains the 2018 survey results.

4.1.2.3 Bear Island and Goose Island Causeway

The results for the areas surrounding Bear Island and Goose Island Causeway locations indicate that there are no areas of concern. Drawing Number 096-0179-700-801-89 in Appendix B contains the full survey results.

4.1.3 Summary of Depth of Cover Readings

There was only a single section in the 2020 bathymetric survey showing flowline depths of cover below 1.0 m (listed below), with no areas of exposed pipe.

- Bear to Island 6 – Station 0+240m to 0+302.8m with a depth of cover of 0.7m.

The measured depths of cover at the monitoring locations are shown in Table A: below.

Table A: Summary of Flowline Corridor Depth of Cover

Corridor Name	Start (m)	End (m)	Initial Notification	Reason for Monitoring	Depth of Cover (m)					2020 Scour Volume (m^3)	Notes
					2020	2019	2018	2017	2016		
Mainland to Isl 1	1+498	-	2019	Low DoC	1.2	1.2	1.4	1.2	1.1		
Mainland to Isl1	1+620	-	2019	Low DoC	1.2	1.2	1.5	1.2	1.2		
Mainland to Isl2	1+550	1+559	2019	Low DoC	1.4	1.2	1.2	1.2	1.2		
Mainland to Isl2	1+575	1+594	2014	Scouring	1.2	1.2	1.2	1.0	0.9		
Mainland to Isl2	1+579	-	2016	Low DoC	1.2	0.9	1.3	0.8	0.8		
Goose to Isl3	0+550.0	0+700	2014	Low DoC	-	-	-	0.1	0.1		Unable to survey in 2020
Goose to Isl3	0+956	-	2020	Low DoC	1.4	-	2.8	2.4			
Goose to Isl3	1+080	1+124	2016	Low DoC	1.0	1.2	1.2	1.2	1.2		
Goose to Isl4	0+357	0+358	2011	Low DoC	-	-	-	-	-		Unable to survey in 2020
Goose to Isl4	0+475	0+485	2015	Low DoC	1.3	-	1.2	1.4	1.3		
Goose to Isl4	1+000	1+025	2010	Low DoC	1.7	1.8	1.9	1.8	1.8	$12m^3$	
Bear to Isl5	0+148.2	0+233	2015	Low DoC	1.2	-	1.5	1.3	0.9		
Bear to Isl5	0+334	0+350	2017	Scouring	1.4	1.9	2.1	1.5		$15m^3$	
Bear to Isl5	0+628	0+675	2015	Scouring	1.2	1.0	1.1	1.3	1.3		
Bear to Isl5	0+790	0+820	2014	Scouring	1.5	1.5	1.4	1.6	1.4		
Bear to Isl5	0+830	0+851	2019	Low DoC	1.8	0.8	1.5	1.6	1.4		
Bear to Isl6	0+125	0+205	2014	Low DoC	-	-	1.7	1.7	1.5		Unable to survey in 2020
Bear to Isl6	0+240	0+302.8	2017	Low DoC	0.7	1.7*	1.5	1.0	-		
Bear to Isl6	0+560	0+575	2019	Low DoC	2.4	1.4	2.6	2.6	2.6		
Goose to Bear	0+180	0+232	2014	Scouring	1.0	1.0*	1.3	1.3	1.7		
Goose to Bear	0+245	0+355	2016	Scouring	2.4	2.6	3.2	3.4	3.1	$211m^3$	
*Extrapolated data											

There were limited locations where the river bottom elevation was not able to be measured during the 2020 bathymetric survey. Although data was unable to be collected at these locations, overall results do not indicate an unacceptable risk to any infrastructure. A probing survey is under evaluation for execution in late Q4 2020. Safety and execution feasibility constraints are currently being evaluated. The results of this probing would be used to supplement the 2021 dataset.

5 PROTECTION ASSESSMENT AND MAINTENANCE

5.1 Summary of Protection Assessment and Maintenance

5.1.1 2020 Repairs

Artificial island repairs were completed in March 2020 as per recommendations in the 2019 Artificial Island Inspection Report. Approximately 249 m^3 of rip rap and residual limestone was used to repair the artificial islands as part of this work. Details of the repairs completed are described in the next sections.

5.1.1.1 Island 1

The inspection showed Island 1 to be in good condition; therefore, no maintenance was required in 2020.

5.1.1.2 Island 2

Repairs were completed on the south side scope, as recommended. An area of approximately 35 m x 5m was repaired by placing approximately 215 m^3 of Class C material.

5.1.1.3 Island 3

The inspection showed Island 3 to be in good condition; therefore, no maintenance was required in 2020.

5.1.1.4 Island 4

Areas around the north side corner blocks apron were filled with rip rap as recommended. Limestone and approximately 34 m^3 of call C & D material was used for this repair.

5.1.1.5 Island 5

The inspection showed Island 5 to be in good condition; therefore, no maintenance was required in 2020.

5.1.1.6 Island 6

The inspection showed Island 6 to be in good condition; therefore, no maintenance was required in 2020.

5.1.1.7 Mainland Dock

No work completed on mainland dock river water intake

5.1.2 2020/2021 Proposed Repairs

The 2020 Artificial Island Inspection was conducted from in August by Wim M. Veldman Consulting and Advisian. The 2020 recommendations put forth by the inspectors form the basis for the island repairs to be completed during the 2020/2021 winter season.

5.1.2.1 Island 1

The inspection showed a 20m x 8m area on south side of the Island with a loss of riprap protection. Class E riprap placement on south side of the island to fill the gap recommended.

5.1.2.2 Island 2

The inspection showed Island 2 to be in good condition; therefore, no immediate repairs are required during the 2020/2021 winter period.

5.1.2.3 Island 3

The inspection showed Island 3 to be in good condition; therefore, no immediate repairs are required during the 2020/2021 winter period.

5.1.2.4 Island 4

The inspection showed Island 4 to be in good condition; therefore, no immediate repairs are required during the 2020/2021 winter period.

5.1.2.5 Island 5

The inspection showed Island 5 to be in good condition; therefore, no immediate repairs are required during the 2020/2021 winter period.

5.1.2.6 Island 6

The inspection showed Island 6 to be in good condition; therefore, no immediate repairs are required during the 2020/2021 winter period.

5.1.2.7 Goose Island

During break-up, abandoned flowlines were observed to have become exposed on the north side of Goose Island. Repair work is planned over the fall and winter (2020/2021) to remove exposed flowlines and place fill material and Class D rip rap to prevent further erosion at this location.

FLOWLINE AND FUEL STORAGE TANK INTEGRITY

The operational integrity of all critical equipment is stewarded through Imperial's preventative maintenance program, which is derived from the OIMS Facility Integrity Management System (FIMS). FIMS is the system that identifies critical equipment and sets forth the required preventative maintenance programs and frequencies.

5.2 Fuel Storage Tank Integrity Inspections

Table B lists the fuel storage tanks on site, the type and frequency of inspection performed on each tank, along with the results.

Table B: Fuel Storage Tank Integrity Inspections

Tank Name	Type of Inspection	Results
Goose Island Diesel	5 Year External Visual	– Last completed in 2015; no issues – Next inspection due in 2020
	10 Year External Visual and UT Survey	– New vessel installed in 2015. Baseline UT survey completed in 2015; no issues
	1 Month External Visual	– Completed monthly; no issues
Goose Island Gas	5 Year External Visual	– Last completed in 2015; no issues – Next inspection due in 2020
	10 Year External Visual and UT Survey	– New vessel installed in 2015. Baseline UT survey completed in 2015; no issues
	1 Month External Visual	– Completed monthly; no issues
Bear Island Gas	5 Year External Visual and UT Survey	– Last completed in 2016; no issues – Next inspection due in 2021
	1 Month External Visual	– Completed monthly; no issues
Bear Island Diesel	5 Year External Visual and UT Survey	– New vessel installed in 2020
	1 Month External Visual	– Completed monthly; no issues
Mainland Diesel	5 Year External Visual	– New vessel installed in 2015 – Next inspection due in 2020
	10 Year External Visual and UT Survey	– New vessel installed in 2015. Baseline UT survey completed in 2015; no issues
	1 Month External Visual	– Completed monthly; no issues
CPF T-103 Diesel	5 Year External Settlement	– Last completed in 2017; no issues Next inspection due in 2022
	5 Year External Visual	– Last completed in 2016; no issues Next inspection due in 2021
	10 Year Internal	– Last completed in 2015; no issues Next inspection due in 2021
T-104 Emergency Generator Diesel	5 Year External Visual	– Last completed in 2019; no issues
	10 Year External UT	– Last completed 2017; no issues – Next inspection due in 2027
Mainland Heating Oil	1 Month External Visual	– Completed monthly; no issues.

CPF Heating Oil Double Wall Tank	1 Month External Visual	– New tank installed in 2018 – Completed monthly; no issues.
Warehouse Heating Oil Double Wall Tank	1 Month External Visual	– New tank installed in 2018 – Completed monthly; no issues.
Mud Plant Heating Oil Double Wall Tank	1 Month External Visual	– New tank installed in 2018 – Completed monthly; no issues.

5.3 Flowline Integrity

There are approximately 20 cross-river flowlines that are inspected using a combination of in-line inspection and non-destructive evaluation (NDE). Conservative assumptions coupled with an evaluation of inspection results are used to determine the inspections frequencies. Table C lists the planned flowline integrity (cross-river and land based) inspections that were completed in 2020, along with the inspection type for each of the flowlines, and the inspection results.

Table C: Flowline Integrity Inspections 2020

Flowline	Cross-river (Y/N)	Date	Scope	Comments
106 – Isl4 to GIT4	Y	August 2020	In-Line Inspection (ILI)	No areas of concern were identified. An integrity/verification dig is planned (as noted below).
147 – GIT7 to GIT4	N	August 2020	ILI	No areas of concern were identified. An integrity/verification dig is planned (as noted below).
106 – Isl4 to GIT4	Y	Q4 2020/Q1 2021 (Planned)	Verification Dig	NDE on notable features is planned to validate results, determine tool tolerance values, and perform repairs if required.
147 – GIT7 to GIT4	N	Q4 2020/Q1 2021 (Planned)	Verification Dig	NDE on notable features is planned to validate results, determine tool tolerance values, and perform repairs if required.
128 – Isl6 to BIT4	Y	Q4 2020 (Planned)	Verification Dig	Based on the results of the 2019 ILI, NDE on notable features is planned to validate results, determine tool tolerance values and perform repairs if required.
281/351/536/585 at BIT 3	Y	Q4 2020 (Planned)	Visual Riser Inspection	Inspections on air to soil transition locations is planned.

LIST OF APPENDICES

Appendix A. Bathymetric Survey Equipment
Appendix B. Bathymetric Drawings (2020)

Appendix A. Bathymetric Survey Equipment

SURVEY LAUNCH

The survey launches and boat captains for this project were supplied by Imperial. The primary launch (Boat 1) is a 7.3 m aluminum vessel equipped with a 250 hp, 4 stroke Suzuki motor equipped with a propeller (Image A).

Image A: Primary Survey Vessel (Imperial Boat 1)

The survey launch was equipped with the required survey gear and all instruments were interfaced into a central control platform running Hypack navigation and control software.

The R2Sonic 2020 multibeam system was used for the bathymetric survey at Norman Wells. The high frequency of the R2Sonic 2020 allows for accurate and clean data. In order to accommodate the multibeam system a revised fixed mount was fabricated in 2015. Offsets for the bathymetric sensors including the multibeam, IMU, and GPS antennas were accurately measured using conventional survey technology.

NAVIGATION AND POSITIONING

The GPS RTK (Real Time Kinematic) system utilized for the survey consisted of two Leica dual frequency geodetic quality receivers. The system also included a Pacific Crest radio system consisting of a 35 watt base radio and a rover radio. This system provided real-time horizontal and vertical accuracy to tolerances of 10 mm horizontally and 15 mm vertically.

The base receiver and radio gear were set up on a known control point (control point #7009) in the vicinity of the work area.

Northing = 7,241,611.945
Easting = 599,645.968
Elevation (Geodetic) = 51.668m

SONAR SYSTEM

The R2Sonic is a high quality multibeam sonar capable of producing very dense and accurate bathymetric data. Some of the key features of the R2Sonic 2020 are as follows:

- Over 20 x user selectable frequencies from 200 to 400 kHz
- Focused 1° x 1° beam widths
- 60 kHz signal bandwidth over entire frequency range
- True range resolution of 1.25 cm at all frequencies
- Selectable swath coverage from 10° to 160°
- 1 to 100 meter range

The effective swath width of the R2Sonic system is approximately 2 or 3 times the depth of water. The deeper the water, a larger footprint of the river bottom is covered during any one pass.

MOTION REFERENCE UNIT

The Applanix Pos MV is considered the highest rated MRU on the market today. This motion reference unit is the 'benchmark' for which all MRU's are compared to. The manufacturer's claimed accuracy is:

- Roll, Pitch Accuracy 0.02°
- Heading accuracy 0.02°
- Velocity accuracy 0.03m/sec

CALIBRATION, ACCURACY AND DATA VALIDATION

The sonar system must be calibrated for roll, pitch and yaw and the calibration values are entered in the Hypack software. Prior to or during the survey activity, the vessel proceeds to an area where there is both a flat seabed and a rapidly changing seabed to accommodate the 'patch' tests. A preset, pre-configured set of procedures are conducted to gain the calibration values which are used for the remainder of the day.

The accuracy of the final elevations from sounding data is dependent on several factors including:

- the accuracy of the sounder hardware
- speed of the survey launch
- attitude of the survey launch
- river current at time of survey
- wind at time of survey

The digital data produced during the survey was reviewed and checked prior to leaving Norman Wells. It was important to check the quality of the sounding data before leaving the field in case of poor or missing data that would have to be re-surveyed.

Appendix B. Bathymetric Drawings

The bathymetric survey plans listed in Table D below were produced following the 2020 bathymetric survey.

Table D: List of Bathymetric Survey Drawings

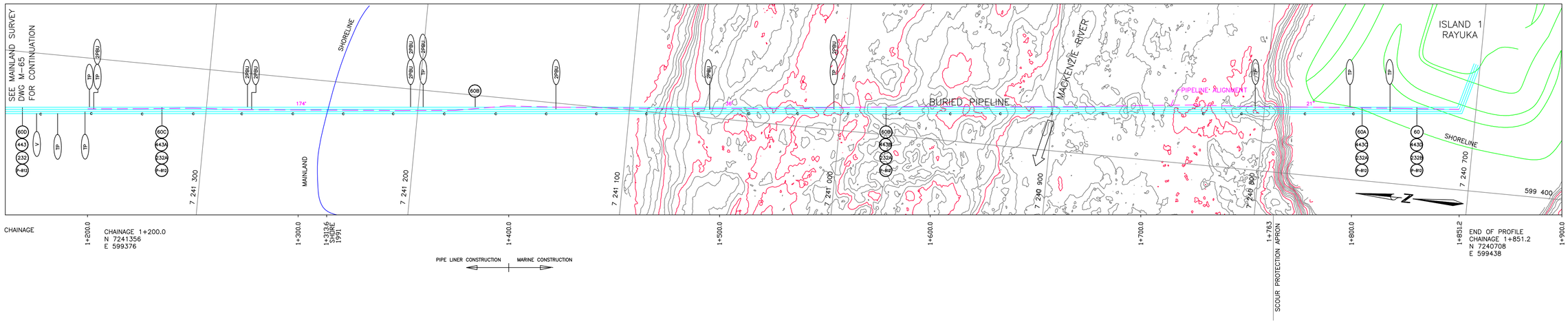
Location	Drawing Number
Island 1 to Mainland flowline	096-0179-700-801 71
Island 2 to Mainland flowline	096-0179-700-801 72
Island 3 to Goose Island flowline	096-0179-700-801 73
Island 3 to Mainland flowline	096-0179-700-801 74
Island 4 to Goose Island flowline	096-0179-700-801 75
Island 5 to Bear Island flowline	096-0179-700-801 76
Island 6 to Bear Island flowline	096-0179-700-801 77
Bear Island to Goose Island flowline	096-0179-700-801 78
Island 1 and surrounding area	096-0179-700-801 79
Island 2 and surrounding area	096-0179-700-801 80
Island 3 and surrounding area	096-0179-700-801 81
Island 4 and surrounding area	096-0179-700-801 82
Island 5 and surrounding area	096-0179-700-801 83
Island 6 and surrounding area	096-0179-700-801 84
River Bed and Island Contours	096-0179-700-801 86
Mainland Dock Area	096-0179-700-801 87
Bear Island to Goose Island Causeway	096-0179-700-801 89

096-0179-700-801 71

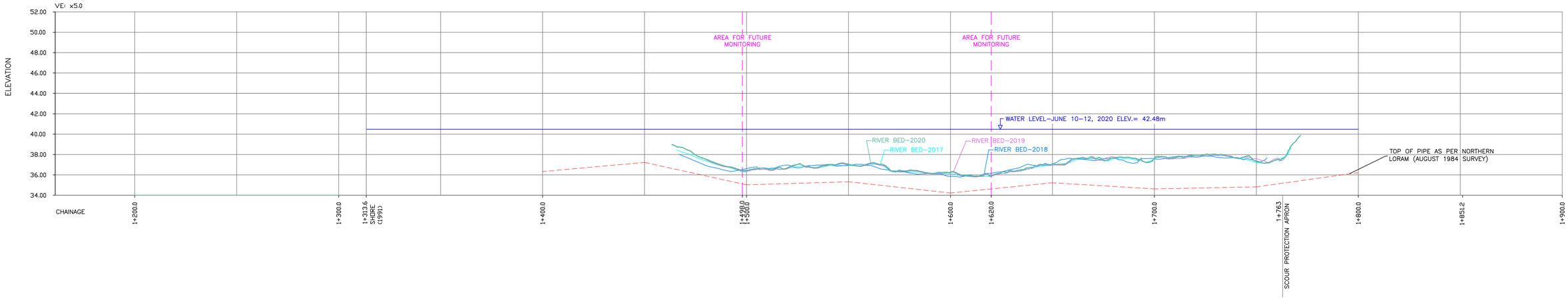
AutoCAD

CADD DRAWING NO MANUAL CHANGES

PIPELINE ALIGNMENT



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

SUBSTANCE DESCRIPTION

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
60	168.3 OE Is.1 to L.P.T.1, Glycol H.T. 60-60A
60A	168.3 OE Is.1 to L.P.T.1, Glycol H.T., Conc Coated 60-60A-60B
60B	168.3 OE Is.1 to L.P.T.1, Conc Coated 60-60A-60B-60C
60C	168.3 OE Is.1 to L.P.T.1, Dbl Sect H.T., Conc Coated 60-60A-60B-60C-60D M-75,65,55 H.T.261
60D	168.3 OE Is.1 to L.P.T.1, Sng Sect H.T. 60-60A-60B-60C-60D-L.P.T.1 M-75,65,55 H.T.261
	GASLIFT
232	88.9 NG (Gas Lift) L.P.T.1 to Is.1 (Buried) 232-232A M-55,65,64
232A	88.9 NG (Gas Lift) L.P.T.1 to Is.1 (Conc Coated) 232-232A-232B M-55,65,64
232B	88.9 NG (Gas Lift) L.P.T.1 to Is.1 (Buried) 232-232A-232B-L.P.T.1
	INJECTION WATER
443	88.9 INJ-SW L.P.T.1 to Is.1, Sng Sect H.T., Liner 443-443A M-55,65,75 H.T.262
443A	88.9 INJ-SW L.P.T.1 to Is.1, Dbl Sect H.T., Conc Coated, Liner 443-443A-443B M-55,65,75 H.T.262
443B	88.9 INJ-SW L.P.T.1 to Is.1, Conc Coated, Liner 443-443A-443B-443C
443C	88.9 INJ-SW L.P.T.1 to Is.1, Glycol H.T., Conc Coated, Liner 443-443A-443B-443C-443D
443D	88.9 INJ-SW L.P.T.1 to Is.1, Glycol H.T., Liner 443-443A-443B-443C-443D-L.P.T.1
	ELECTRICAL DESCRIPTION
P-B12	4160 H.V. From FS-15KV Switch Gear to Is.1 TR-B7 M-55,65,75

PROFILE ALIGNMENT COORDINATES

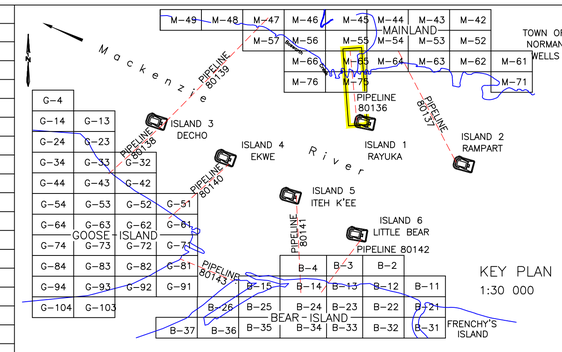
EASTING	NORTHING	
599376.000	7241356.000	START CHAINAGE 1+200.000
599378.450	7241330.830	
599381.120	7241306.470	
599382.783	7241280.956	
599385.000	7241256.880	
599387.300	7241231.860	
599389.510	7241207.170	
599391.970	7241182.390	
599396.470	7241157.620	
599398.220	7241132.800	
599402.340	7241083.120	
599404.860	7241058.020	
599407.190	7241033.180	
599409.890	7241008.400	
599415.390	7240958.570	
599417.640	7240933.640	
599419.980	7240908.890	
599422.370	7240884.060	
599425.310	7240858.970	
599428.020	7240833.790	
599429.700	7240809.420	
599431.820	7240784.450	
599435.910	7240734.650	
599438.000	7240708.000	END CHAINAGE 1+851.2

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 10 TO JUNE 12, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM
   (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
10	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	7	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	4	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	2	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
9	ADDED FUTURE MONITORING DEC. 2019: WSP	6	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	3	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	1	ADDED 2014 BOTTOM PROFILE AUGUST 2014: MMM Geomatics
8	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP	5	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	2	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LTD	0	ADDED 2013 BOTTOM PROFILE AUGUST 2013: MMM Geomatics
7	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	4	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	1	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LTD	1	ADDED 2012 BOTTOM PROFILE AUGUST 2012: MMM Geomatics
6	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	3	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	0	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LTD	0	ADDED 2011 BOTTOM PROFILE AUGUST 2011: MMM Geomatics
5	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	2	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	0	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	0	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN — c c
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
MAINLAND TO ISLAND 1
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

DATE: 20-09-10

SCALE: H 1:1000 V 1:200

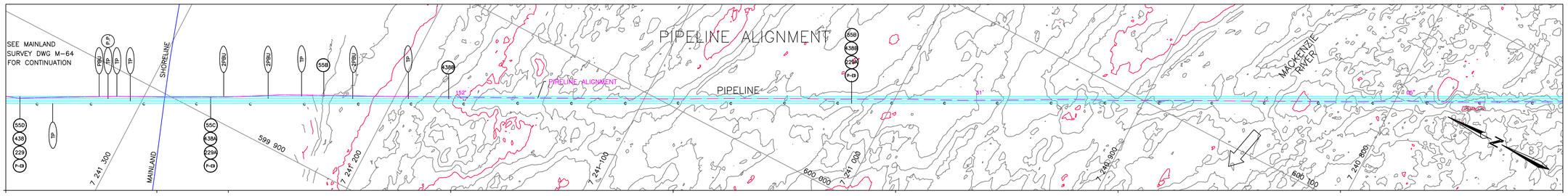
CONTRACTOR DWG NO. : 1196-C

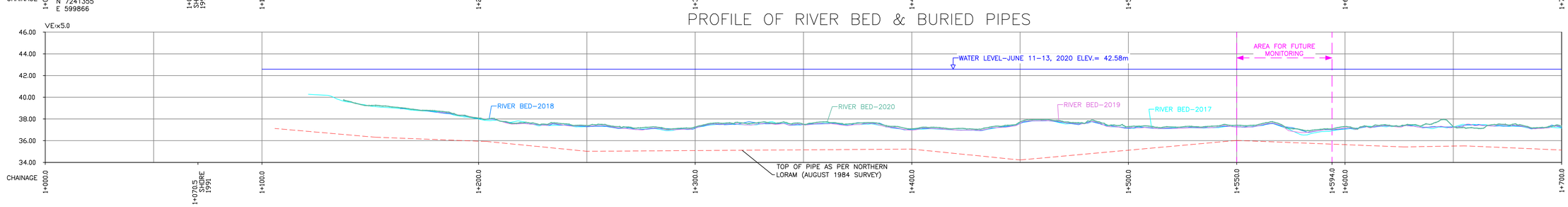
ESSO FILE No. 096-0179-700-801 71

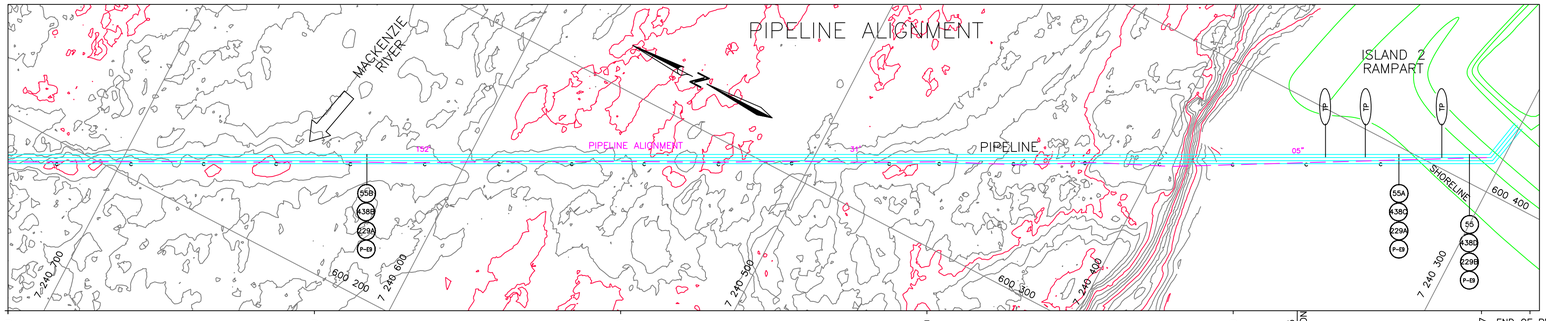
096-0179-700-801 72

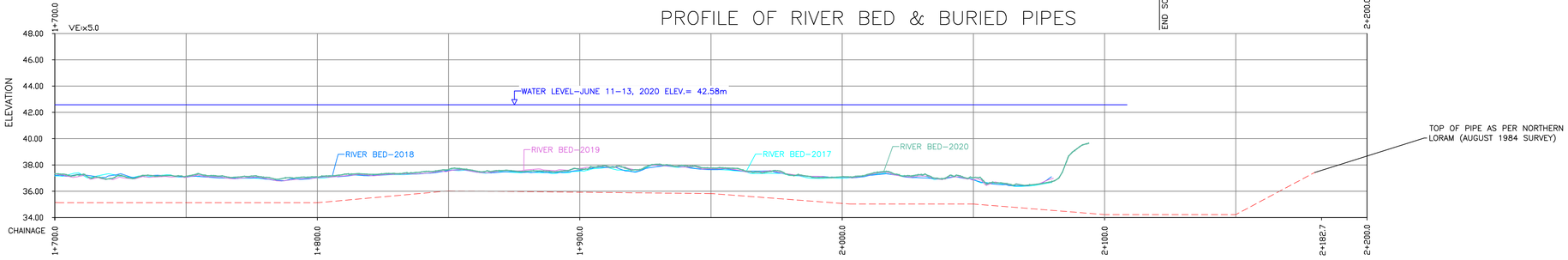
AutoCAD

CADD DRAWING NO MANUAL CHANGES









SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
55	219.1 OE ls.2 to L.P.T.1, Glycol H.T. 55-55A
55A	219.1 OE ls.2 to L.P.T.1, Glycol H.T., Conc Coated 55-55A-55B
55B	219.1 OE ls.2 to L.P.T.1, Conc Coated 55-55A-55B-55C M-64,65,55
55C	219.1 OE ls.2 to L.P.T.1, Dbl Sect H.T., Conc Coated 55-55A-55B-55C-55D M-64,65,55 H.T.263
55D	219.1 OE ls.2 to L.P.T.1, Sng Sect H.T. 55-55A-55B-55C-55D-L.P.T.1 M-64,65,55 H.T.263
	GASLIFT
229	114.3 NG (Gas Lift) L.P.T.1 to ls.2 (Buried) 229-229A M-55,65,64
229A	114.3 NG (Gas Lift) L.P.T.1 to ls.2 (Conc Coated) 229-229A-229B M-55,65,64
229B	114.3 NG (Gas Lift) L.P.T.1 to ls.2 (Buried) 229-229A-229B-L.P.T.1
	INJECTION WATER
438	114.3 INJ-SW L.P.T.1 to ls.2, Sng Sect H.T., Liner 438-438A M-55,65,64 H.T.264
438A	114.3 INJ-SW L.P.T.1 to ls.2, Dbl Sect H.T., Conc Coated, Liner 438-438A-438B M-55,65,64 H.T.264
438B	114.3 INJ-SW L.P.T.1 to ls.2, Conc Coated, Liner 438-438A-438B-438C
438C	114.3 INJ-SW L.P.T.1 to ls.2, Glycol H.T., Conc Coated, Liner 438-438A-438B-438C-438D
438D	114.3 INJ-SW L.P.T.1 to ls.2, Glycol H.T., Liner 438-438A-438B-438C-438D-L.P.T.1
	ELECTRICAL DESCRIPTION
P-E9	4160 H.V. From FS-25KV Switch Gear to ls.2 TR-E5 M-54,64

PROFILE ALIGNMENT COORDINATES

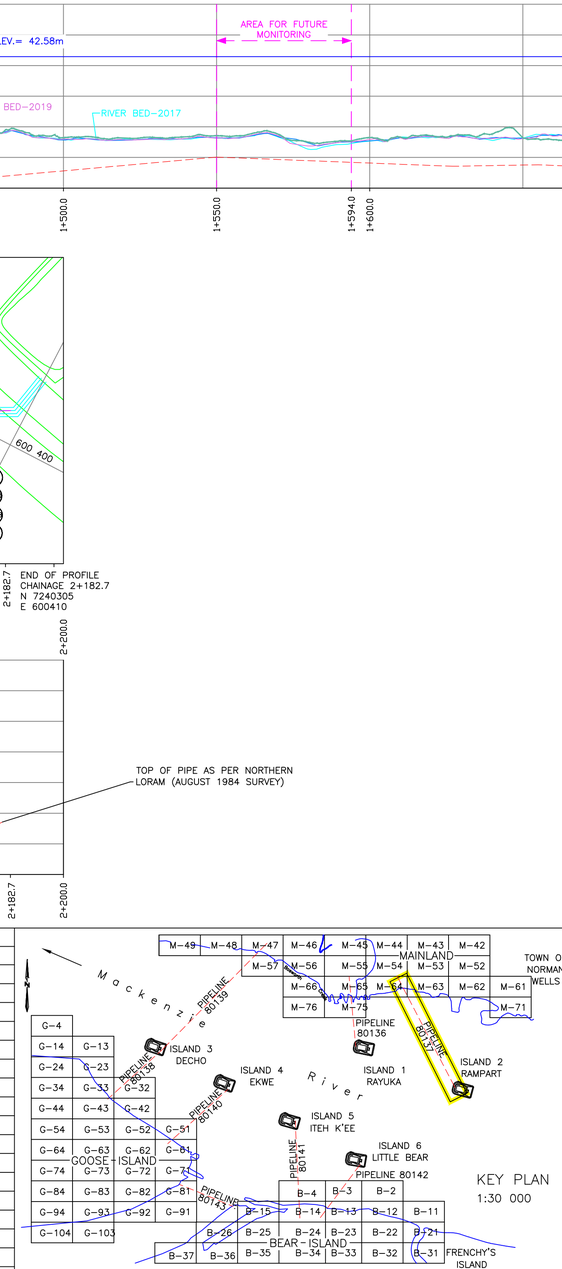
EASTING	NORTHING	
599866.000	7241355.000	START CHAINAGE 1+000.000
599867.750	7241350.020	
599877.070	7241332.840	
599888.830	7241311.060	
599900.050	7241288.670	
599911.540	7241266.730	
599923.760	7241245.240	
599935.170	7241222.640	
599946.190	7241200.430	
599957.710	7241177.750	
599968.910	7241155.590	
599980.380	7241133.100	
599991.630	7241110.940	
600002.980	7241088.660	
600014.910	7241066.250	
600026.790	7241043.290	
600038.900	7241019.240	
600050.790	7240996.510	
600062.340	7240973.070	
600073.970	7240950.940	
600085.570	7240929.100	
600096.790	7240906.500	
600108.190	7240884.690	
600119.470	7240862.340	
600130.870	7240840.070	
600142.390	7240817.410	
600153.930	7240795.670	
600165.200	7240773.220	
600176.830	7240751.230	
600186.326	7240732.711	
600188.291	7240728.880	
600199.801	7240706.940	
600211.441	7240684.550	
600222.851	7240662.280	
600234.411	7240640.240	
600245.651	7240617.900	
600257.421	7240595.870	
600268.931	7240573.770	
600280.381	7240551.930	
600292.091	7240528.740	
600303.921	7240506.690	
600315.191	7240484.280	
600326.881	7240462.120	
600337.481	7240439.550	
600349.651	7240417.660	
600359.971	7240395.040	
600410.000	7240305.0004	END CHAINAGE 2+182.7

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 11 TO JUNE 13, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM
   (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
13	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	13	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	13	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	13	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
12	ADDED FUTURE MONITORING DEC. 2019: WSP	12	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	12	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	12	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
11	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP	11	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	11	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	11	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
10	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	10	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	10	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	10	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
9	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	9	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	9	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	9	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics
8	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	8	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	8	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	8	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN — C C
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P.
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
MAINLAND TO ISLAND 2
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

CONTRACTOR DWG NO. : 1197-C

DATE: 20-09-10

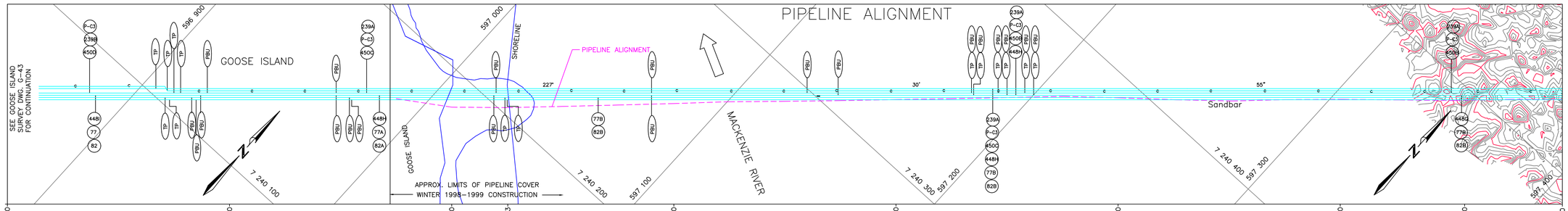
SCALE: H 1:1000 V 1:200

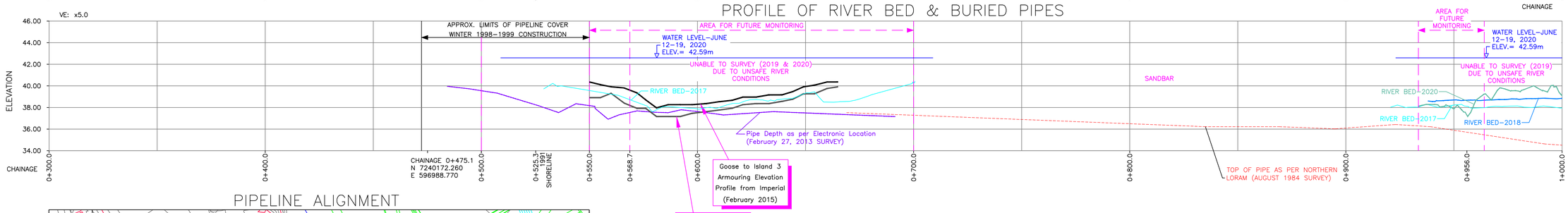
ESSO FILE No. 096-0179-700-801 72

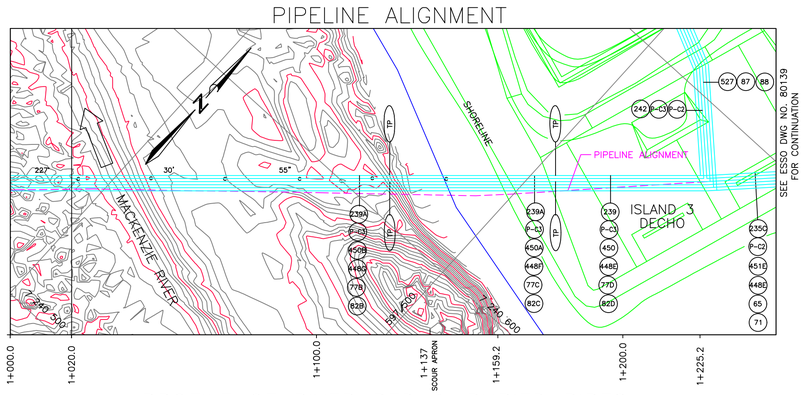
096-0179-700-801 73

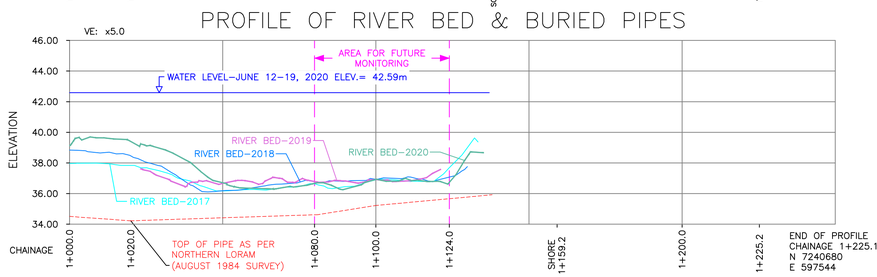
AutoCAD

CADD DRAWING NO MANUAL CHANGES









PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
596988.770	7240172.260	START CHAINAGE 0+475.1
597009.800	7240186.220	
597028.480	7240202.910	
597046.630	7240220.110	
597064.660	7240237.340	
597082.730	7240254.650	
597100.670	7240272.040	
597118.990	7240288.930	
597137.310	7240306.010	
597155.620	7240323.290	
597173.860	7240340.390	
597210.560	7240375.130	
597229.770	7240391.670	
597248.970	7240407.940	
597267.960	7240424.470	
597286.110	7240441.770	
597304.600	7240458.730	
597323.320	7240475.370	
597342.080	7240492.060	
597360.360	7240509.380	
597377.592	7240524.939	
597378.820	7240526.320	
597397.380	7240543.600	
597417.410	7240561.070	
597435.040	7240576.720	
597453.610	7240592.970	
597491.220	7240625.820	
597499.670	7240634.250	
597544.000	7240680.000	END CHAINAGE 1+225.1

Alignment includes Winter 1997 pipe locating data.

SURVEY CONTROL				
No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
65	273.1 OE Is.3 to C.P.F. Glycol H.T. 87-65-65A
71	355.6 OE Is.3 to C.P.F. Glycol H.T. 88-71-71A
77	273.1 OE GIT 4 to Is.3 Single Sect H.T. 77A-77B G-54,43,33,32 H.T.354
77A	273.1 OE GIT 4 to Is.3 Single Sect H.T., Conc Coated, 77A-77B-77C G-54,43,33,32 H.T.354
77B	273.1 OE GIT 4 to Is.3 Conc Coated, 77A-77B-77C-77D G-54,43,33,32
77C	273.1 OE GIT 4 to Is.3 Conc Coated, Glycol H.T. 77A-77B-77C-77D
77D	273.1 OE GIT 4 to Is.3 Glycol H.T. 77C-77D-65
82	355.6 OE GIT 4 to Is.3 Single Sect H.T. 82A-82B G-54,43,33,32 H.T.353
82A	355.6 OE GIT 4 to Is.3 Single Sect H.T., Conc Coated, 82A-82B-82C G-54,43,33,32 H.T.353
82B	355.6 OE GIT 4 to Is.3 Conc Coated, 82A-82B-82C-82D G-54,43,33,32
82C	355.6 OE GIT 4 to Is.3 Conc Coated, Glycol H.T. 82A-82B-82C-82D
82D	355.6 OE GIT 4 to Is.3 Glycol H.T. 82C-82D-71
87	168.3 OE Is.3 to C.P.F. Glycol H.T. 87-65-65A
88	168.3 OE Is.3 to C.P.F. Glycol H.T. 88-71-71A
	GASLIFT
235C	168.3 NG (Gas Lift) C.P.F. to Is.3 (Conc Coated) 235-235A-235B-235C-Is.3
239	168.3 NG (Gas Lift) Is.3 to GIT 4 (Buried) 235C-239-239A
239A	168.3 NG (Gas Lift) Is.3 to GIT 4 (Conc Coated) 239-239A-239B
239B	168.3 NG (Gas Lift) Is.3 to GIT 4 (Buried) 239A-239B-GIT 4 G-54,43,33,32
242	88.9 NG (Gas Lift) C.P.F. to Is.3 (Buried) 235C-242-Is.3

No.	SUBSTANCE DESCRIPTION
	INJECTION WATER
448E	219.1 INJ-FW C.P.F. to G.I.T.4, Gly H.T. 448 to 448F
448F	219.1 INJ-FW C.P.F. to G.I.T.4, Gly H.T., Conc Coated 448 to 448G
448G	219.1 INJ-FW C.P.F. to G.I.T.4, Conc Coated 448 to 448H G-32,33,43,54
448H	219.1 INJ-FW C.P.F. to G.I.T.4, Dbl Sect H.T., Conc Coated 448 to 448I G-32,33,43,54 H.T.352
448I	219.1 INJ-FW C.P.F. to G.I.T.4, Sng Sect H.T. 448 to 448I-G.I.T.4 G-32,33,43,54 H.T.352
450	168.3 INJ-SW Is.3 to G.I.T.4, Gly H.T. 451E-450-450A
450A	168.3 INJ-SW Is.3 to G.I.T.4, Gly H.T., Conc Coated 450-450A-450B
450B	168.3 INJ-SW Is.3 to G.I.T.4, Conc Coated 450-450A-450B-450C G-32,33,43,54
450C	168.3 INJ-SW Is.3 to G.I.T.4, Dbl Sect H.T., Conc Coated 450-450A-450B-450C-450D G-32,33,43,54 H.T.351
450D	168.3 INJ-SW Is.3 to G.I.T.4, Sng Sect H.T. 450-450A-450B-450C-450D-G.I.T.4 G-32,33,43,54 H.T.351
451E	168.3 INJ-SW C.P.F. to Is.3, Gly H.T. 451-451A-451B-451C-451D-451E-450
527	88.9 INJ-SW 451E Tee to Is.3, Gly H.T. 451E-527-Is.3
	ELECTRICAL DESCRIPTION
P-C2	4160 H.V. From SB-C1 to SB-C2 (Is.3) M-47,57 Refer to Dwg 096-0100-100-006
P-C3	4160 H.V. From SB-C2 (Is.3) to GIT 4 Trans TR-C18 G-54,43,33,32

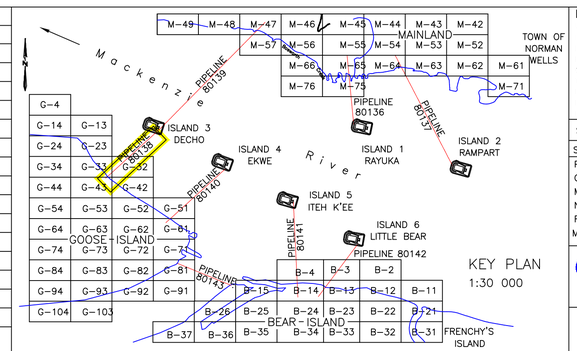
NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 12 TO JUNE 19, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM

(TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)

3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY 1996: UMA GEOMATICS	12	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	18	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics	24	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP
5	ADDED 1995 BOTTOM PROFILE JULY 1995: UMA GEOMATICS	11	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	17	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	23	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
28	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	10	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	16	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	22	ADDED 2014 BOTTOM PROFILE AUGUST 2014: MMM Geomatics
27	ADDED 2019 BOTTOM PROFILE AUG. 2019: WSP	9	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	15	ADDED 2006 BOTTOM PROFILE AUG 2006: USHER CANADA LIMITED	21	ADDED 2013 BOTTOM PROFILE AUGUST 2013: MMM Geomatics
26	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	8	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	14	ADDED 2005 BOTTOM PROFILE AUG 2005: USHER CANADA LIMITED	20	ADDED 2012 BOTTOM PROFILE AUGUST 2012: MMM Geomatics
25	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	7	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	13	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	19	ADDED 2011 BOTTOM PROFILE AUGUST 2011: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN
TRANSITION POINT
PULL BOX SHOWN
PULL POINT SHOWN
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE			
SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO ISLAND 3 SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

CONTRACTOR DWG NO. : 1198-C

DATE: 20-09-10

SCALE: H 1:1000 V 1:200

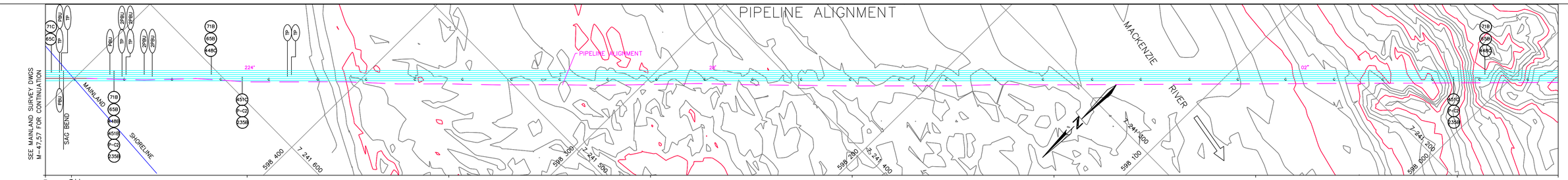
ESSO FILE No.

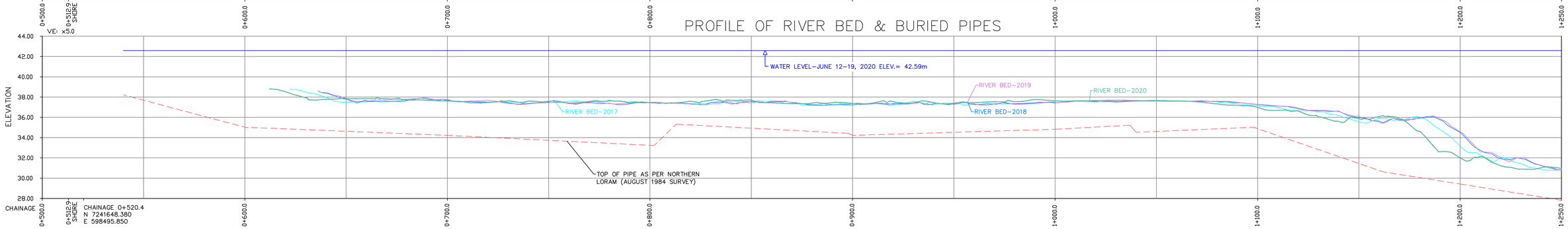
096-0179-700-801 73

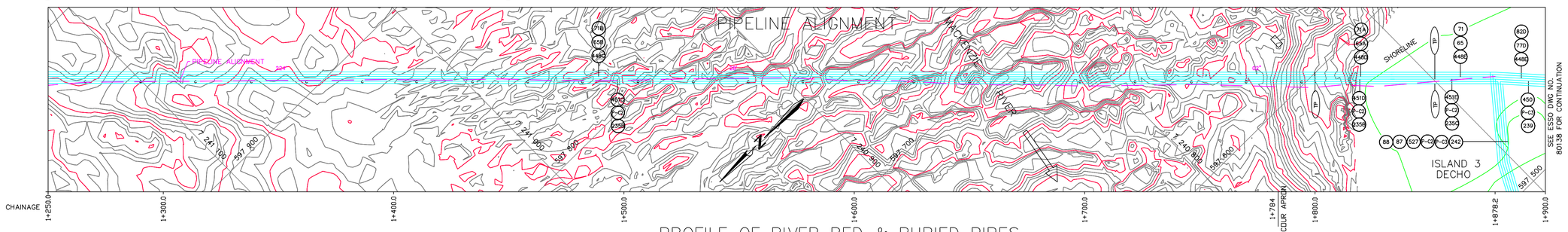
096-0179-700-801 74

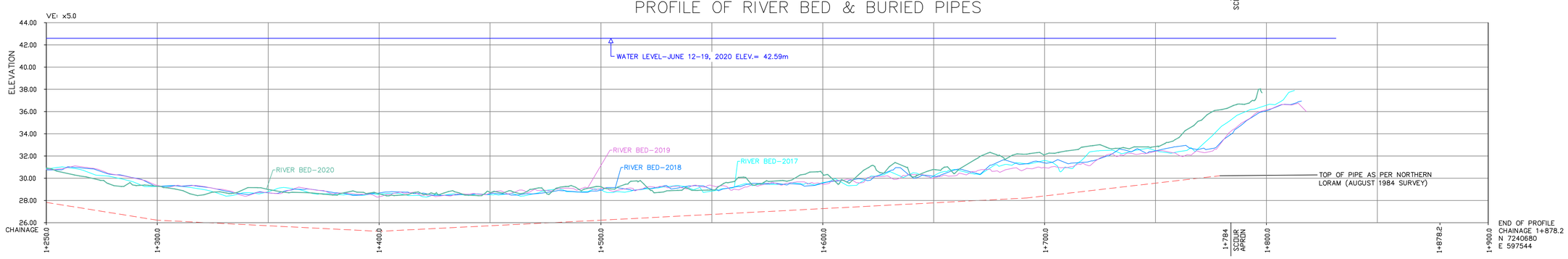
AutoCAD

CADD DRAWING NO MANUAL CHANGES









PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
598495.850	7241648.380	START CHAINAGE 0+520.4
598475.110	7241628.550	
598457.710	7241609.840	
598438.670	7241592.880	
598403.750	7241557.440	
598385.410	7241540.300	
598367.680	7241522.290	
598349.580	7241504.620	
598332.560	7241487.170	
598314.730	7241469.560	
598280.730	7241433.800	
598262.530	7241416.200	
598226.770	7241380.770	
598192.130	7241345.600	
598175.540	7241327.750	
598156.300	7241308.460	
597982.226	7241130.140	
597971.800	7241117.670	
597949.660	7241094.730	
597932.480	7241077.010	
597913.010	7241056.780	
597897.760	7241041.380	
597881.390	7241024.240	
597863.170	7241006.150	
597846.060	7240988.010	
597827.820	7240970.570	
597811.330	7240953.780	
597793.290	7240934.600	
597776.080	7240916.650	
597758.910	7240898.900	
597742.580	7240883.830	
597723.440	7240864.790	
597705.960	7240849.010	
597690.990	7240834.450	
597686.830	7240829.890	
597666.560	7240810.270	
597651.540	7240794.700	
597632.180	7240774.430	
597595.980	7240739.610	
597588.020	7240729.860	
597583.310	7240725.520	
597576.780	7240719.460	
597544.000	7240680.000	END CHAINAGE 1+878.2

Alignment includes Winter 1997 pipe locating data.

SURVEY CONTROL				
No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

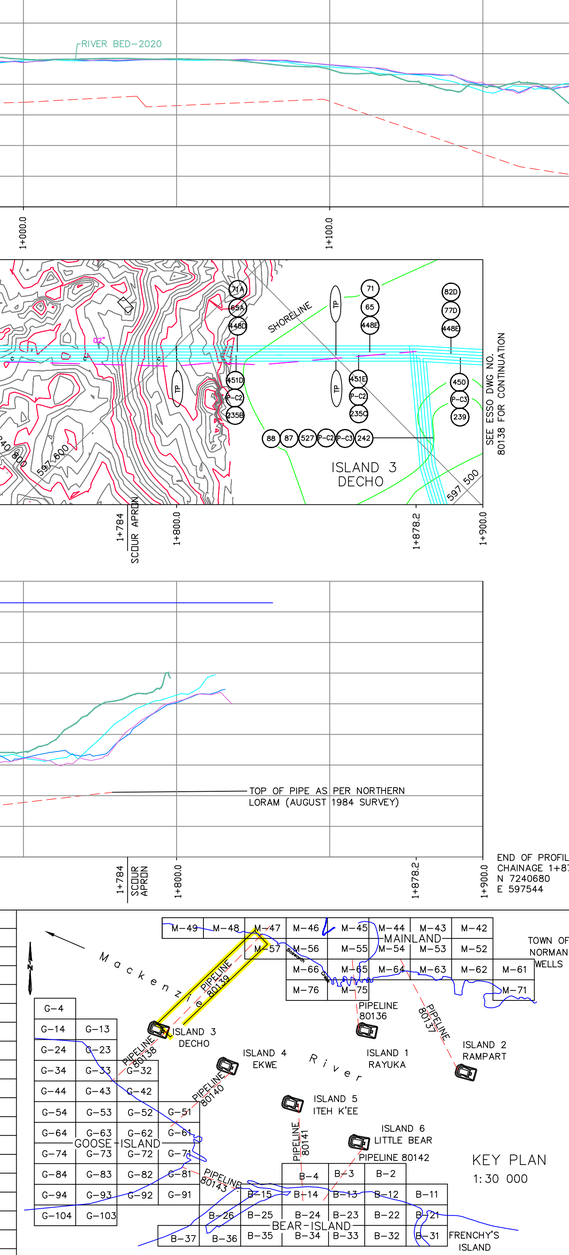
No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
65	273.1 OE Is.3 to C.P.F. Glycol H.T. 87-65-65A
65A	273.1 OE Is.3 to C.P.F. Glycol H.T., Conc Coated 65-65A-65B
65B	273.1 OE Is.3 to C.P.F. Conc Coated 65-65A-65B-65C M-57,47,46
65C	273.1 OE Is.3 to C.P.F. Sng Sect. H.T. Conc Coated 65-65A-65B-65C-65D M-57,47,46 H.T.224
71	355.6 OE Is.3 to C.P.F. Glycol H.T. 88-71-71A
71A	355.6 OE Is.3 to C.P.F. Glycol H.T., Conc Coated 71-71A-71B
71B	355.6 OE Is.3 to C.P.F. Conc Coated 71-71A-71B-71C M-57,47,46
71C	355.6 OE Is.3 to C.P.F. Dbl Sect. H.T. Conc Coated 71-71A-71B-71C-71D M-57,47,46 H.T.223
77D	273.1 OE GIT 4 to Is.3 Glycol H.T. 77C-77D-65
82D	355.6 OE GIT 4 to Is.3 Glycol H.T. 82C-82D-71
87	168.3 OE Is.3 to C.P.F. Glycol H.T. 87-65-65A
88	168.3 OE Is.3 to C.P.F. Glycol H.T. 88-71-71A
	GASLIFT
235B	168.3 NG (Gas Lift) C.P.F. to Is.3 (Conc Coated) 235-235A-235B-235C M-46,47,57
235C	168.3 NG (Gas Lift) C.P.F. to Is.3 (Conc Coated) 235-235A-235B-235C-Is.3
239	168.3 NG (Gas Lift) Is.3 to GIT 4 (Conc Coated) 235C-239-239A
242	88.9 NG (Gas Lift) C.P.F. to Is.3 (Buried) 235C-242-Is.3
	INJECTION WATER
448B	219.1 INJ-FW C.P.F to G.I.T. 4, Dbl Sect H.T., Conc Coated 448-448A-448B-448C M-46,47,57
448C	219.1 INJ-FW C.P.F. to G.I.T. 4, Conc Coated 448-448A-448B-448C-448D M-46,47
448D	219.1 INJ-FW C.P.F. to G.I.T. 4, Conc Coated, Gly H.T., 448-448A-448B-448C-448D-448E
448E	219.1 INJ-FW C.P.F. to G.I.T. 4, Glycol H.T., 448-448A-448B-448D-448E-527

No.	SUBSTANCE DESCRIPTION
	INJECTION WATER
448E	219.1 INJ-FW C.P.F. to G.I.T. 4, Glycol H.T., 448-448A-448B-448C-448D-448E-448F
451B	168.3 INJ-SW C.P.F. to Is. 3, Dbl Sect H.T., Conc Coated, Liner 451-451A-451B-451C Converted Spare Line H.T.226
451C	168.3 INJ-SW C.P.F. to Is. 3, Conc Coated Liner 451-451A-451B-451C-451D M-46,47,57 Converted Spare Line
451D	168.3 INJ-SW C.P.F. to Is. 3, Conc Coated, Gly H.T., Liner 451-451A-451B-451C-451D-451E Converted Spare Line
451E	168.3 INJ-SW C.P.F. to Is. 3, Glycol H.T., Liner 451-451A-451B-451C-451D-451E-450 Converted Spare Line
450	168.3 INJ-SW Is.3 to GIT 4, Glycol H.T. 451E-450-450A Converted Spare Line
527	88.9 INJ-SW 451E Tee to Is.3, Glycol H.T. 451E-527-Is.3
	ELECTRICAL DESCRIPTION
P-C2	4160 H.V. From SB-C1 to SB-C2 (Is.3) M-47,57 Refer to Dwg 096-0100-100-006
P-C3	4160 H.V. From SB-C2 (Is.3) to GIT 4 Trans TR-C18 G-54,43,33,32

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 19, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	4	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	4	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	4	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
5	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	3	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	4	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	4	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM GEOMATICS
4	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP	3	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	4	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	4	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM GEOMATICS
4	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	3	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	4	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	4	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM GEOMATICS
4	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	3	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	4	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	4	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM GEOMATICS
4	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	3	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	4	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	4	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM GEOMATICS

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN — e — e
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P.
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
MAINLAND TO ISLAND 3
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

CONTRACTOR DWG NO. : 1199-C

DATE: 20-09-10

SCALE: H 1:1000 V 1:200

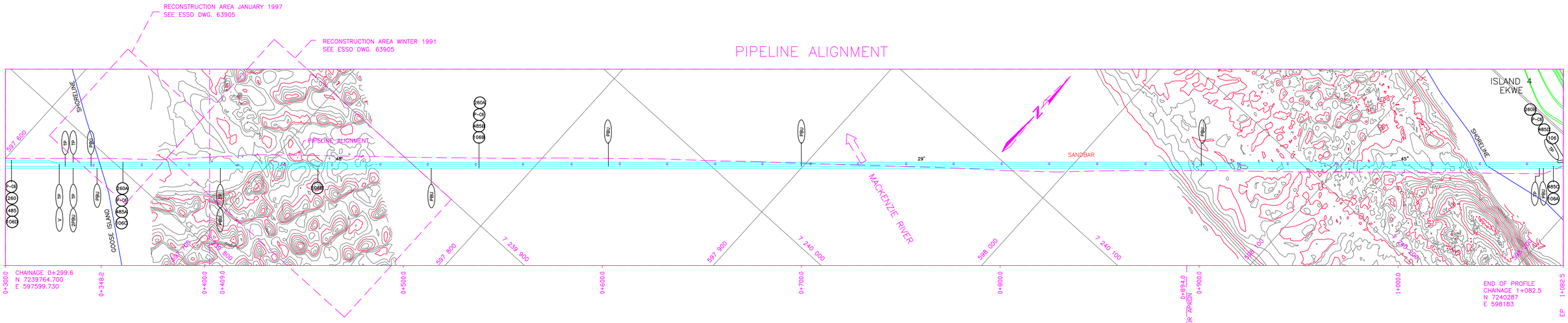
ESSO FILE No. 096-0179-700-801 74

096-0179-700-801 75

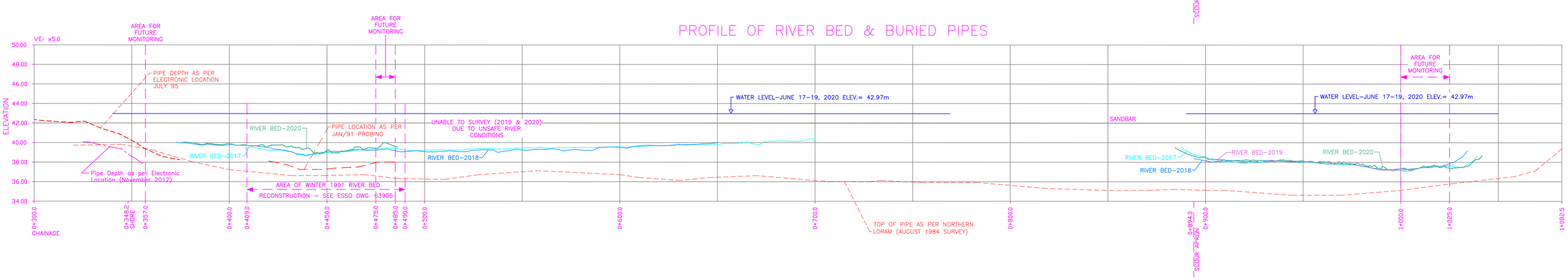
AutoCAD

CADD DRAWING NO MANUAL CHANGES

PIPELINE ALIGNMENT



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.W. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

SUBSTANCE DESCRIPTION

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
106	219.1 OE Is.4 to GIT 4, Glycol H.T. 106-106A
106A	219.1 OE Is.4 to GIT 4, Glycol H.T., Conc Coated 106-106A-106B
106B	219.1 OE Is.4 to GIT 4, Conc Coated 106-106A-106B-106C
106C	219.1 OE Is.4 to GIT 4, Sng Sect H.T., Conc Coated 106-106A-106B-106C-106D G-51,61,62,72,63,64,54 H.T.356
106D	219.1 OE Is.4 to GIT 4, Sng Sect H.T. 106-106A-106B-106C-106D-GIT 4 G-51,61,62,72,63,64,54 H.T.356
	GASLIFT
260	88.9 NG (Gas Lift) GIT 4 to Is.4 (Buried) 260-260A G-51,62,72,63,64,54
260A	88.9 NG (Gas Lift) GIT 4 to Is.4 (Conc Coated) 260-260A-260B G-51,62,72,63,64,54
260B	88.9 NG (Gas Lift) GIT 4 to Is.4 (Buried) 260-260A-260B-Is.4
	INJECTION WATER
485	88.9 INJ-SW GIT 4 to Is.4, Sng Sect H.T., Liner 485-485A G-51,62,72,63,64,54 H.T.355
485A	88.9 INJ-SW GIT 4 to Is.4, Sng Sect H.T., Conc Coated, Liner G-51,62,72,63,64,54 H.T.355
485B	88.9 INJ-SW GIT 4 to Is.4, Conc Coated, Liner 485-485A-485B-485C G-51,62,72,63,64,54
485C	88.9 INJ-SW GIT 4 to Is.4, Glycol H.T., Conc Coated, Liner 485-485A-485B-485C-485D
485D	88.9 INJ-SW Is.4 Is.4, Glycol H.T., Liner 485-485A-485B-485C-485D-Is. 4
	ELECTRICAL DESCRIPTION
P-C6	4160 H.V. GIT 4 5Kv Switch Gear Is.4 Tr-C3 G-51,62,72,63,64,54

PROFILE ALIGNMENT COORDINATES

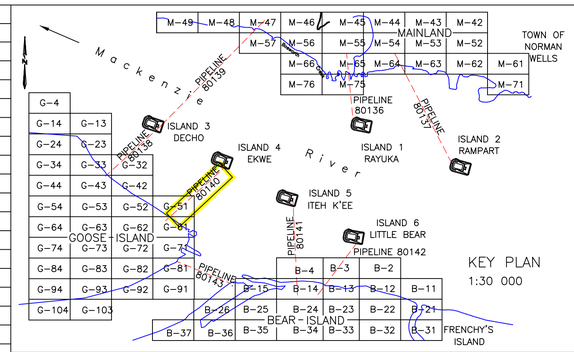
EASTING	NORTHING	
597599.730	7239764.700	START CHAINAGE 0+299.6
597620.330	7239783.340	
597638.850	7239800.100	
597657.950	7239816.460	
597675.810	7239834.160	
597693.470	7239852.120	
597712.360	7239868.620	
597750.070	7239901.480	
597768.890	7239918.080	
597787.670	7239934.740	
597806.100	7239951.640	
597843.510	7239984.930	
597862.720	7240001.070	
597881.690	7240017.520	
597900.880	7240033.650	
597919.950	7240049.830	
597939.050	7240066.100	
597958.080	7240082.260	
597977.390	7240098.090	
597996.440	7240114.330	
598014.690	7240131.690	
598033.130	7240148.630	
598051.700	7240165.310	
598070.430	7240181.730	
598089.120	7240198.220	
598098.390	7240206.570	
598107.670	7240214.920	
598126.290	7240231.630	
598144.980	7240248.190	
598163.770	7240264.700	
598178.650	7240277.920	
598183.000	7240287.000	END CHAINAGE 1+082.5

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 19, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 - TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) - UTM GRID/CM = 129°
4. VERTICAL DATUM - GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
7	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	14	ADDED 2005 BOTTOM PROFILE AUG 2005: USHER CANADA LIMITED	21	ADDED 2013 BOTTOM PROFILE AUGUST 2013: MMM Geomatics	28	ADDED FUTURE MONITORING DEC. 2019: WSP
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	13	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	20	ADDED 2012 BOTTOM PROFILE AUGUST 2012: MMM Geomatics	27	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP
5	ADDED 1995 BOTTOM PROFILE JULY, 1995: UMA GEOMATICS	12	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	19	ADDED 2011 BOTTOM PROFILE AUGUST 2011: MMM Geomatics	26	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP
4	ADDED 1994 BOTTOM PROFILE JULY, 1994: UMA SURVEYS	11	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	18	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics	25	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP
3	ADDED 1993 BOTTOM PROFILE JULY, 1993: UMA SURVEYS	10	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	17	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	24	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP
2	REVISED TITLEBLOCK APRIL 12/1993: UMA SURVEYS	9	ADDED 1999 BOTTOM PROFILE AUG. 1999: UMA GEOMATICS	16	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	23	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
1	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	8	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	15	ADDED 2006 BOTTOM PROFILE AUG 2006: USHER CANADA LIMITED	22	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN — c c
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P.
PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO ISLAND 4 SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

CONTRACTOR DWG NO. : 1200-C

DATE: 20-09-10

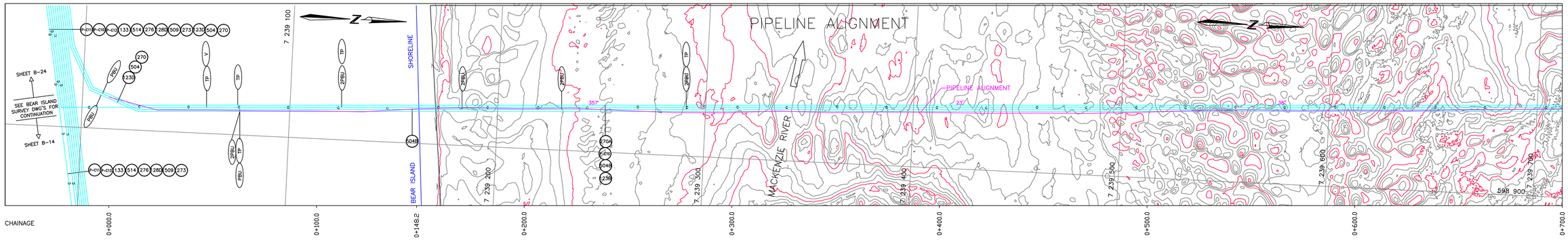
SCALE: H 1:1000 V 1:200

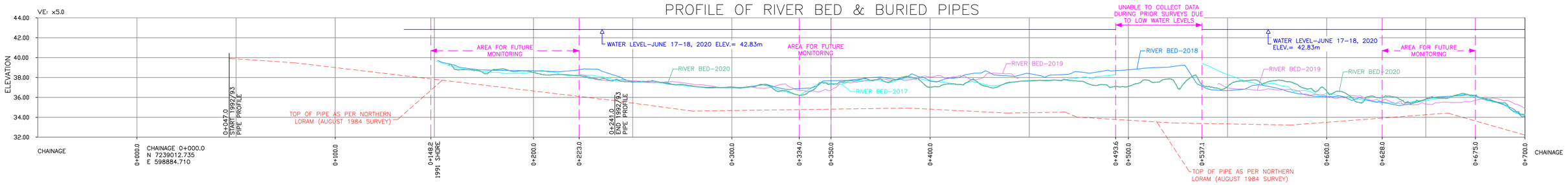
ESSO FILE No. 096-0179-700-801 75

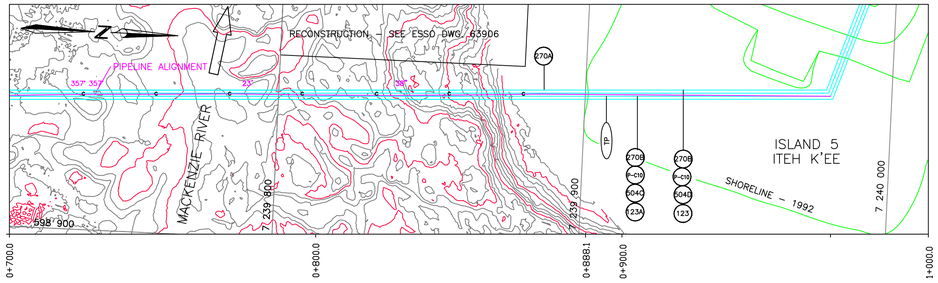
096-0179-700-801 76

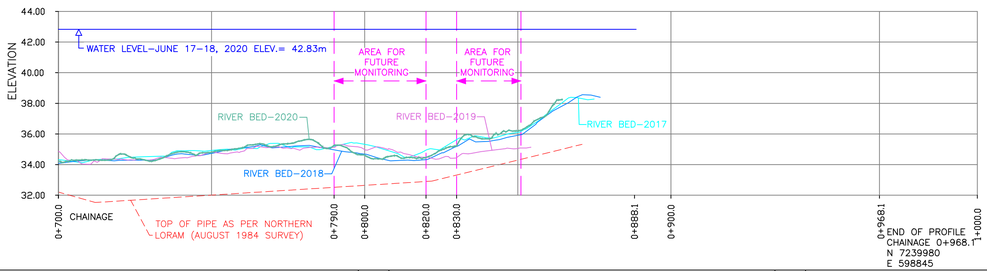
AutoCAD

CADD DRAWING NO MANUAL CHANGES









PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
598884.710	7239012.735	START CHAINAGE 0+000.000
598889.860	7239036.320	
598888.710	7239061.550	
598887.910	7239085.780	
598886.820	7239110.580	
598886.050	7239135.440	
598883.480	7239160.310	
598881.680	7239185.260	
598881.060	7239210.410	
598879.520	7239235.430	
598879.560	7239259.790	
598879.320	7239284.800	
598878.200	7239310.010	
598876.280	7239334.880	
598875.790	7239359.970	
598874.330	7239384.860	
598873.360	7239409.840	
598872.610	7239434.770	
598871.350	7239459.860	
598870.310	7239484.780	
598868.570	7239509.940	
598866.610	7239535.040	
598865.090	7239560.020	
598864.320	7239585.090	
598862.950	7239610.190	
598861.950	7239635.260	
598860.400	7239660.400	
598859.020	7239685.300	
598857.480	7239710.330	
598857.363	7239712.223	
598855.944	7239735.330	
598854.714	7239760.360	
598853.404	7239785.410	
598852.614	7239810.250	
598851.594	7239835.450	
598850.244	7239860.180	
598848.764	7239885.080	
598845.000	7239980.000	END CHAINAGE 0+968.1

Alignment includes Winter 1997 pipe locating data.

SURVEY CONTROL				
No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION
	MULTIPHASE LIQUIDS
123	219.1 OE Is.5 to BIT 4, Glycol H.T. 123–123A
123A	219.1 OE Is.5 to BIT 4, Glycol H.T., Conc Coated 123–123A–123B
123B	219.1 OE Is.5 to BIT 4, Conc Coated 123–123A–123B–123C B–14,24,25
123C	219.1 OE Is.5 to BIT 4, Dbl Sect H.T., Conc Coated 123–123A–123B–123C–123D B–14,24,25 H.T.443
123D	219.1 OE Is.5 to BIT 4, Sng Sect H.T. 123–123A–123B–123C–123D–BIT 4 B–14,24,25 H.T.443
128D	168.3 OE Is.6 to BIT 4, Sng Sect H.T. 128–128A–128B–128C–128D–BIT 4 B–3,13,14,24,25 H.T.441
133	219.1 OE BIT 3 to BIT 4, Sng Thermon H.T. B–22,23,13,14,24,25 H.T.428
	GASLIFT
270	88.9 NG (Gas Lift) BIT 4 to Is.5 (Buried) 270–270A B–14,24
270A	88.9 NG (Gas Lift) BIT 4 to Is.5 (Conc Coated) 270–270A–270B B–14,24
270B	88.9 NG (Gas Lift) BIT 4 to Is.5 (Buried) 270–270A–270B–Is.5
273	88.9 NG (Gas Lift) BIT 4 to Is.6 (Buried) 273–273A B–25,24,14,13,3
276	88.9 NG (Gas Lift) BIT 4 to BIT 3, (Buried) B–22,23,13,14,24,25
	INJECTION WATER
504	88.9 INJ–FW BIT 4 to Is.5, Sng Sect H.T. 504–504A B–14,24 H.T.444
504A	88.9 INJ–FW BIT 4 to Is.5, Dbl Sect H.T., Conc Coated 504–504A–504B B–14,24 H.T.444
504B	88.9 INJ–FW BIT 4 to Is.5, Conc Coated 504–504A–504B–504C B–14,24
504C	88.9 INJ–FW BIT 4 to Is.5, Glycol H.T., Conc Coated 504–504A–504B–504C–504D
504D	88.9 INJ–FW Is.5 Is.5, Glycol H.T. 504–504A–504B–504C–504D–Is.5
509	88.9 INJ–FW BIT 4 to Is.6, Sng Sect H.T. 509–509A B–25,24,14,13,3 H.T.442
514	88.9 INJ–FW BIT4 to BIT 3, Sng Thermon H.T. B–22,23,13,14,24,25 H.T.429

No.	SUBSTANCE DESCRIPTION
	ELECTRICAL DESCRIPTION
P–C10	4160 H.V. BIT 4 5Kv Switch Gear Is.5 Tr–C5 B–14,24
P–C11	4160 H.V. BIT 4 5Kv Switch Gear Is.6 Tr–C6 B–25,24,1413,3
P–C13	4160 H.V. BIT 4 5Kv Switch Gear BIT 3 5Kv Switch Gear B–25,24,23,22,13

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 17 TO JUNE 18, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. 8 – TOP OF PIPE AS PER NORTHERN LORAM (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS

No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
13	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	13	ADDED 2002 BOTTOM PROFILE AUG. 2002: UMA GEOMATICS	13	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	13	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
12	ADDED FUTURE MONITORING DEC. 2018: WSP	12	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	12	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	12	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
11	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP	11	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	11	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	11	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
10	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	10	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	10	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	10	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
9	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	9	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	9	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	9	ADDED 2011BOTTOM PROFILE AUG 2011: MMM Geomatics
8	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	8	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	8	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	8	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN — V
TRANSITION POINT — TP
PULL BOX SHOWN — PBU
PULL POINT SHOWN — P.P.
PIPE O/S DIA'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ–SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ–FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

BEAR TO ISLAND 5 SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

CONTRACTOR DWG NO. : 1201–C

DATE: 20–09–10

SCALE: H 1:1000 V 1:200

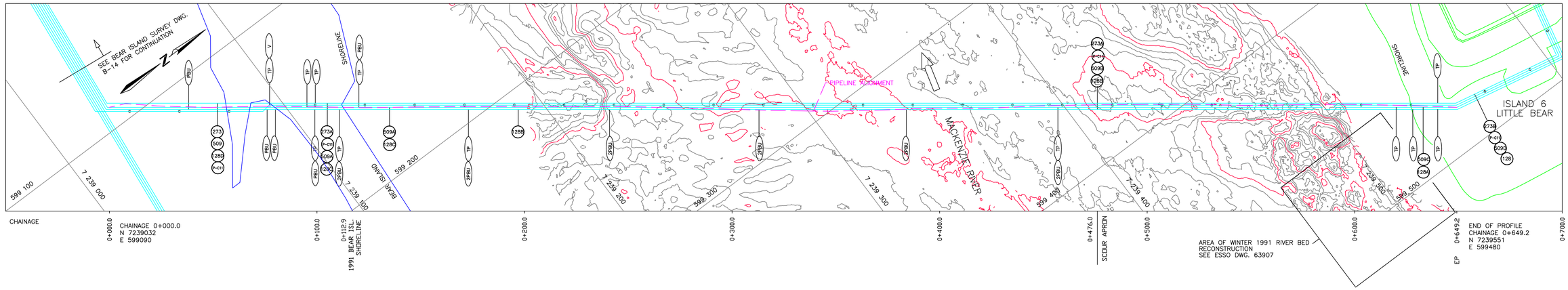
ESSO FILE No. 096–0179–700–801 76

096-0179-700-801 77

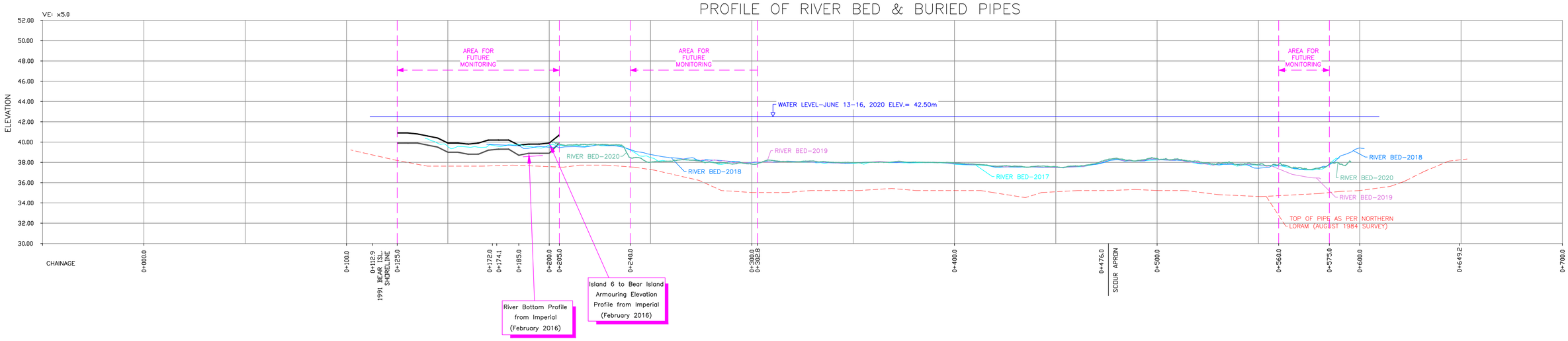
AutoCAD

DRAWING NO MANUAL CHANGES

CADD



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL					No.	SUBSTANCE DESCRIPTION
No.	DESCRIPTION	NORTHING	EASTING	ELEV.		**MULTIPHASE LIQUIDS**
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89		128	168.3 OE Is.6 to BIT 4, Glycol H.T. 128-128A
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90		128A	168.3 OE Is.6 to BIT 4, Glycol H.T., Conc Coated 128-128A-128B
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43		128B	168.3 OE Is.6 to BIT 4, Conc Coated 128-128A-128B-128C B-3,13,14,24,25
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97		128C	168.3 OE Is.6 to BIT 4, Dbl Sect H.T., Conc Coated 128-128A-128B-128C-128D B-3,13,14,24,25 H.T.441
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38		128D	168.3 OE Is.6 to BIT 4, Sng Sect H.T. 128-128A-128B-128C-128D-BIT 4 B-3,13,14,24,25 H.T.441
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36			**GASLIFT**
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08		273	88.9 NG (Gas Lift) BIT 4 to Is.6 (Buried) 273-273A B-25,24,14,13,3
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94		273A	88.9 NG (Gas Lift) BIT 4 to Is.6 (Conc Coated) 273-273A-273B B-25,24,14,13,3
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63		273B	88.9 NG (Gas Lift) BIT 4 to Is.6 (Buried) 273-273A-273B-Is.6
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14			**INJECTION WATER**
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56		509	88.9 INJ-FW BIT 4 to Is.6, Sng Sect H.T. 509-509A B-25,24,14,13,3 H.T.442
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79		509A	88.9 INJ-FW BIT 4 to Is.6, Dbl Sect H.T., Conc Coated 504-504A-504B B-25,24,14,13,3 H.T.442
					509B	88.9 INJ-FW BIT 4 to Is.6, Conc Coated 509-509A-509B-509C B-25,24,14,13,3
					509C	88.9 INJ-FW BIT 4 to Is.6, Glycol H.T., Conc Coated 509-509A-509B-509C-509D
					509D	88.9 INJ-FW BIT 4 to Is.6, Glycol H.T. 509-509A-509B-509C-509D-Is.6
						ELECTRICAL DESCRIPTION
					P-C11	4160 H.V. BIT 4 5Kv Switch Gear Is.6 Tr-C6 B-25,24,1413,3

PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
599090.000	7239032.000	START CHAINAGE 0+000.000
599093.250	7239039.250	
599103.320	7239050.850	
599118.870	7239070.340	
599133.430	7239090.700	
599149.930	7239112.080	
599163.950	7239130.100	
599178.670	7239150.250	
599193.510	7239170.290	
599208.340	7239190.310	
599223.420	7239210.200	
599238.330	7239230.020	
599253.750	7239249.580	
599269.330	7239269.230	
599285.010	7239288.900	
599290.520	7239296.040	
599294.190	7239300.800	
599300.310	7239308.730	
599314.720	7239328.900	
599329.050	7239349.520	
599344.090	7239369.280	
599358.010	7239389.800	
599372.550	7239409.930	
599387.300	7239429.980	
599402.270	7239450.020	
599417.930	7239469.890	
599432.740	7239490.140	
599447.530	7239510.210	
599462.960	7239529.870	
599468.430	7239536.780	
599480.000	7239551.000	END CHAINAGE 0+649.2

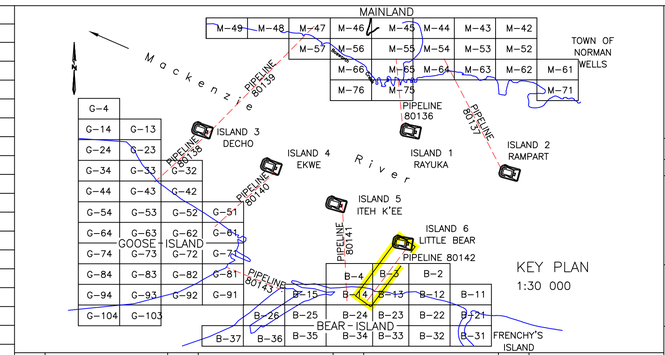
Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 13 TO JUNE 16, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80054 REV. B – TOP OF PIPE AS PER NORTHERN LORAM
   (TOP OF PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

LEGEND

- 2017 RIVER BED PROFILE SHOWN AS
- 2018 RIVER BED PROFILE SHOWN AS
- 2019 RIVER BED PROFILE SHOWN AS
- 2020 RIVER BED PROFILE SHOWN AS



No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
7	ADDED 1997 BOTTOM PROFILE JULY, 1997: UMA GEOMATICS	4	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	1	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics	5	ADDED FUTURE MONITORING DEC. 2019: WSP
6	ADDED 1996 BOTTOM PROFILE JULY, 1996: UMA GEOMATICS	3	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	1	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics	4	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP
5	ADDED 1995 BOTTOM PROFILE JULY, 1995: UMA GEOMATICS	2	ADDED 2002 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	1	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics	4	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP
4	ADDED 1994 BOTTOM PROFILE JULY, 1994: UMA SURVEYS	1	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	8	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics	3	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP
3	ADDED 1993 BOTTOM PROFILE JULY, 1993: UMA SURVEYS	10	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	7	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics	4	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP
2	REVISED TITLEBLOCK APRIL 12/93: UMA SURVEYS	9	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	6	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	3	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
1	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	8	ADDED 1998 BOTTOM PROFILE JUNE, 1998: UMA GEOMATICS	5	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	2	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics

LEGEND

- UTILIDORS SHOWN
- ROADS SHOWN
- BURIED PIPES SHOWN
- BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
- VENT SHOWN
- TRANSITION POINT
- PULL BOX SHOWN
- PULL POINT SHOWN
- PIPE O/S DIA.'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ-SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ-FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

BEAR TO ISLAND 6 SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

CONTRACTOR DWG NO. : 1202-C

DATE: 20-09-10

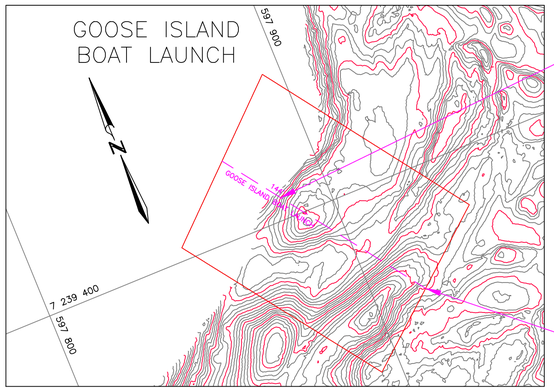
ESSO FILE No. 096-0179-700-801 77

SCALE: H 1:1000 V 1:200

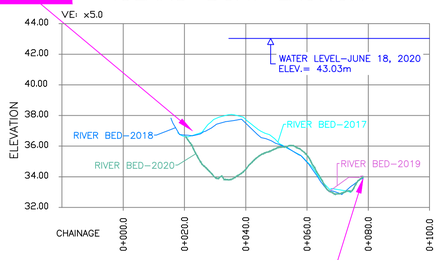
096-0179-700-801 78

AutoCAD

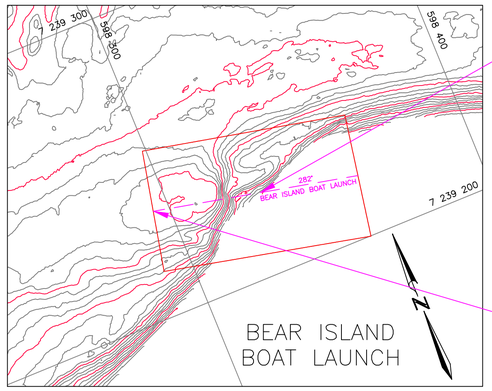
CADD DRAWING NO MANUAL CHANGES



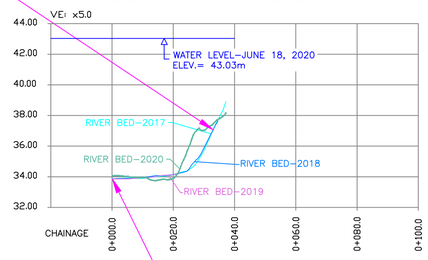
Coordinate (NAD 27):
N 7239411
E 597885



Coordinate (NAD 27):
N 7239366
E 597918

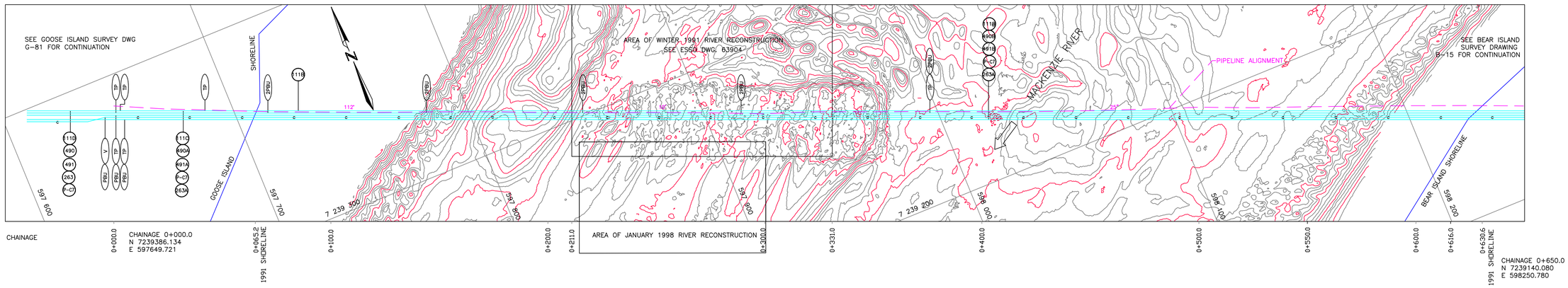


Coordinate (NAD 27):
N 7239231
E 598330

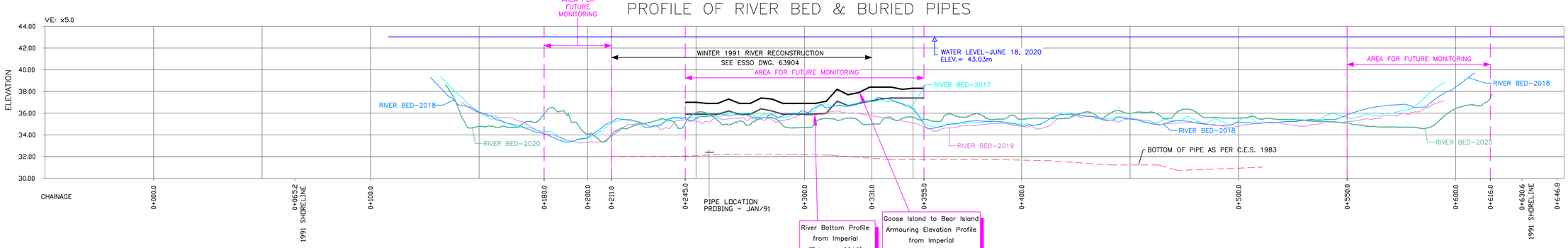


Coordinate (NAD 27):
N 7239239
E 598295

PIPELINE ALIGNMENT



PROFILE OF RIVER BED & BURIED PIPES



SURVEY CONTROL

No.	DESCRIPTION	NORTHING	EASTING	ELEV.
1000	REBAR @ N.E. OF ISL. 1	7240711.75	599540.89	
1004	REBAR @ N.W. OF ISL. 1	7240729.21	599459.90	
2	REBAR @ N.E. OF ISL. 2	7240301.75	600511.43	
2001	REBAR @ N.W. OF ISL. 2	7240324.34	600431.97	
27	REBAR @ N.W. OF ISL. 3	7240741.90	597423.38	
3000	REBAR @ N.E. OF ISL.3	7240716.18	597500.36	
26	REBAR @ N.W. OF ISL. 4	7240387.54	598100.08	
4000	REBAR @ N.E. OF ISL. 4	7240361.98	598175.94	
22	REBAR @ N.W. OF ISL. 5	7240016.98	598734.63	
5000	REBAR @ N.E. OF ISL. 5	7239993.12	598815.14	
21	REBAR @ N.W. OF ISL. 6	7239631.84	599382.56	
6000	REBAR @ N.E. OF ISL. 6	7239616.68	599465.79	

No.	SUBSTANCE DESCRIPTION	
	MULTIPHASE LIQUIDS	
111B	273.1 OE BIT 4 TO GIT 4, Conc Coated 111A–111B–111C	B–25,15,80143,G–81,72,73,63,53,54
111C	273.1 OE BIT 4 TO GIT 4, Conc Coated, Dbl Sect H.T.	111A–111B–111C–111D H.T.358 B–25,15,80143,G–81,72,73,63,53,54
111D	273.1 OE BIT 4 TO GIT 4, Sng Sect H.T.	111A–111B–111C–111D–GIT 4 H.T.358 B–25,15,80143,G–81,72,73,63,53,54
	GAS LIFT	
263	114.3 NG (Gas Lift) GIT 4 to BIT 4, (Buried) 263–263A	G–54,53,63,73,72,81,80143, B–15,25
263A	114.3 NG (Gas Lift) GIT 4 to BIT 4, (Conc Coated)	263–263A–263B G–54,53,63,73,72,81,80143, B–15,25
	INJECTION WATER	
490	168.3 INJ–FW GIT 4 to BIT 4, Sng Sect H.T. 490–490A	G–54,53,63,73,72,81,80143, B–15,25
490A	168.3 INJ–FW GIT 4 to BIT 4, Dbl Sect H.T., Conc Coated	490–490A–490B G–54,53,63,73,72,81,80143, B–15,25
490B	168.3 INJ–FW GIT 4 to BIT 4, Conc Coated	490–490A–490B–490C G–54,53,63,73,72,81,80143, B–15,25
491	168.3 INJ–FW GIT 4 to BIT 4, Sng Sect H.T. 491–491A	H.T.359 G–54,53,63,73,72,81, 80143,B–15,25
491A	168.3 INJ–FW GIT 4 to BIT 4, Dbl Sect H.T., Conc Coated	491–491A–491B B–15,25 H.T.359 G–54,53,63,73,72,81, 80143,
491B	168.3 INJ–FW GIT 4 to BIT 4, Conc Coated	491–491A–491B–491C G–54,53,63,73,72,81,80143, B–15,25
	ELECTRICAL DESCRIPTION	
P–C7	From GIT 4 5 Kv Switch Gear to Bit 4 5 Kv Switch Gear	G–54,53,63,73,72,81,80143, B–15,25

PROFILE ALIGNMENT COORDINATES

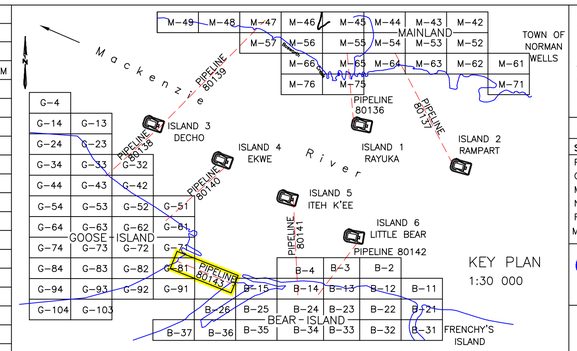
EASTING	NORTHING	
597649.721	7239386.134	START CHAINAGE 0+000.000
597671.510	7239375.720	
597694.360	7239365.650	
597717.320	7239355.580	
597740.330	7239346.000	
597763.530	7239336.350	
597786.920	7239327.070	
597809.940	7239317.690	
597832.860	7239307.890	
597856.150	7239298.350	
597879.180	7239288.940	
597902.340	7239279.360	
597925.180	7239269.500	
597948.810	7239260.830	
597971.850	7239251.360	
597995.020	7239242.080	
598018.150	7239232.440	
598041.300	7239223.030	
598064.660	7239213.950	
598088.100	7239205.000	
598111.620	7239196.410	
598134.900	7239186.640	
598158.230	7239177.540	
598181.400	7239168.400	
598204.620	7239159.090	
598227.940	7239149.630	
598250.780	7239140.080	END CHAINAGE 0+650.0

Alignment includes Winter 1997 pipe locating data.

NOTES

1. RIVER BOTTOM PROFILE FROM 2020 BATHYMETRIC SURVEY PERFORMED JUNE 18, 2020.
2. PIPE PROFILE AND CHAINAGES FROM ESSO DWG. 80056 REV. 8 – BOTTOM OF PIPE AS PER CANADIAN ENG. SURVEYS DRAWINGS OF 1983
(PIPE PROFILE ELEVATION REDUCED 0.776m IN 2008)
3. HORIZONTAL DATUM : NAD27 (SHORAN) – UTM GRID/CM = 129°
4. VERTICAL DATUM – GEODETIC BM 74T016 ELEVATION 60.189
5. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL
6. CONTOUR INTERVAL = 0.25 METRES.

2017 RIVER BED PROFILE SHOWN AS
2018 RIVER BED PROFILE SHOWN AS
2019 RIVER BED PROFILE SHOWN AS
2020 RIVER BED PROFILE SHOWN AS



KEY PLAN
1:30 000

No.	REVISION	No.	REVISION	No.	REVISION	No.	REVISION
23	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	22	ADDED 2003 BOTTOM PROFILE AUG 2002: UMA GEOMATICS	21	ADDED 2009 BOTTOM PROFILE JUNE 2008: MMM Geomatics	20	ADDED 2015 BOTTOM PROFILE GOOSE ISLAND BOAT LAUNCH PROFILE & BEAR ISLAND PROFILE AUG. 2015: WSP
23	ADDED FUTURE MONITORING DEC. 2018: WSP	21	ADDED 2001 BOTTOM PROFILE AUG 2001: UMA GEOMATICS	20	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics	19	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
22	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP	20	ADDED 2000 BOTTOM PROFILE AUG 2000: UMA GEOMATICS	19	ADDED 2006 BOTTOM PROFILE JUNE 2006: USHER CANADA LIMITED	18	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
21	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	19	ADDED 1999 BOTTOM PROFILE AUG 1999: UMA GEOMATICS	18	ADDED 2005 BOTTOM PROFILE JUNE 2005: USHER CANADA LIMITED	17	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
20	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	18	ADDED 1998 BOTTOM PROFILE JUNE 1998: UMA GEOMATICS	17	ADDED 2004 BOTTOM PROFILE AUG 2004: USHER CANADA LIMITED	16	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics
19	ADDED 2016 BOTTOM PROFILE SEP 2016: WSP	17	ADDED 1997 BOTTOM PROFILE JULY 1997: UMA GEOMATICS	16	ADDED 2003 BOTTOM PROFILE AUG 2003: UMA GEOMATICS	15	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics

LEGEND

UTILIDORS SHOWN
ROADS SHOWN
BURIED PIPES SHOWN
BELOW GROUND POWER,TELEPHONE, & COMMUNICATION SHOWN
VENT SHOWN
TRANSITION POINT
PULL BOX SHOWN
PULL POINT SHOWN
PIPE O/S DIA'S ARE IN MILLIMETERS AND DECIMALS THEREOF

SUBSTANCE/CATEGORY CROSS REFERENCE

SUBSTANCE	CODE	SUBSTANCE	CODE
PROPANE/BUTANE	HV	PRODUCED WATER	SW
CRUDE OIL	CO	FRESH WATER	FW
MULTIPHASE FLUIDS	OE	INJECTION (SW)	INJ–SW
NATURAL/LIFT GAS	NG	INJECTION (FW)	INJ–FW
FUEL GAS	FG	ABANDONED	ABAN
MISCELLANEOUS LIQUIDS	ML	MISCELLANEOUS GASES	MG

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO BEAR SURVEY PLAN

CONTRACTOR NAME: GEOVERRA

DATE: 20–09–10

SCALE: H 1:1000 V 1:200

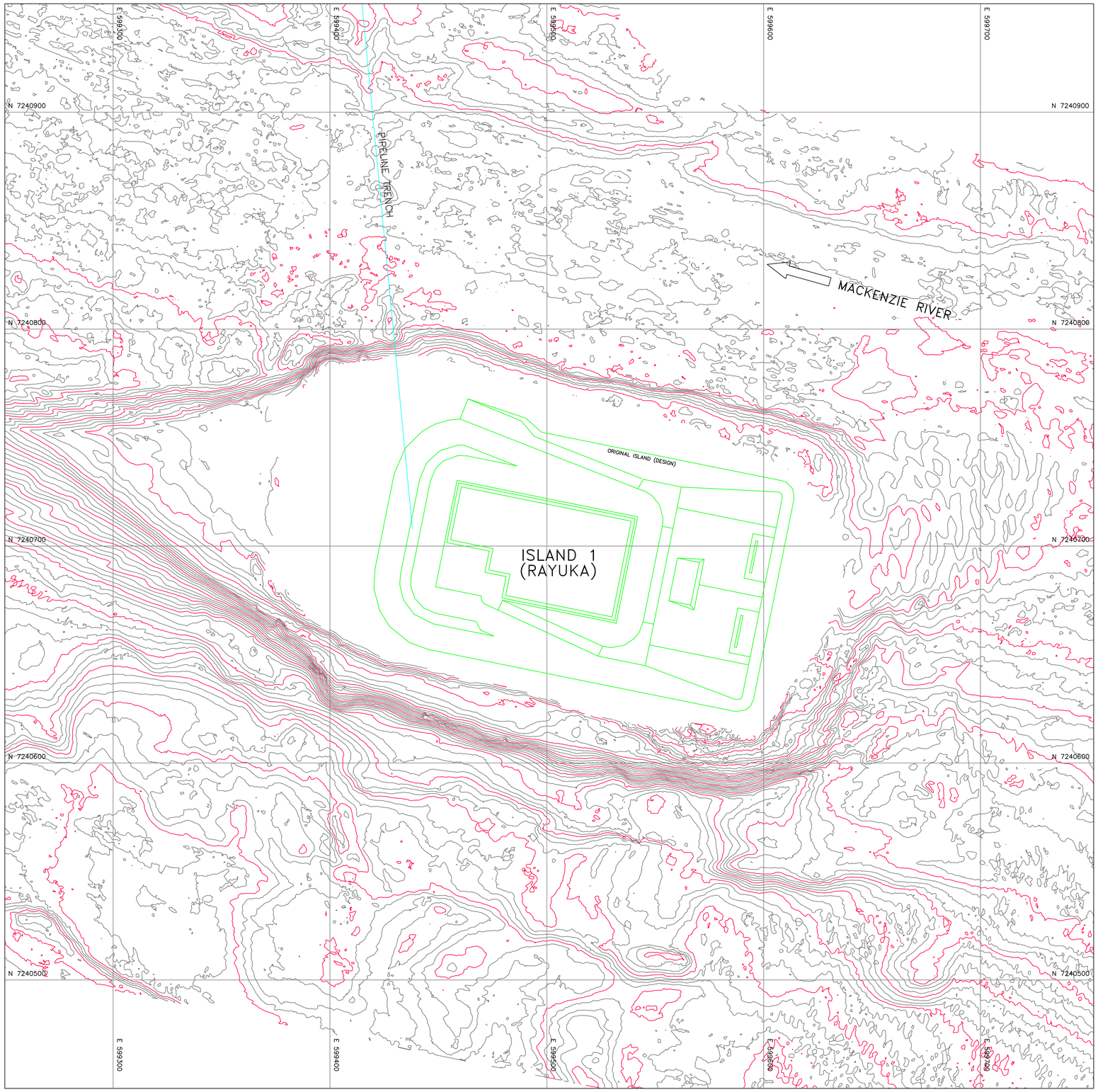
CONTRACTOR DWG NO. : 1203–C

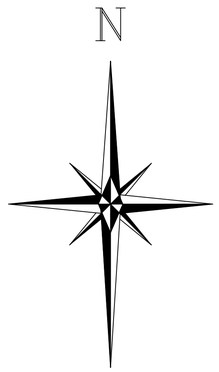
ESSO FILE No. 096–0179–700–801 78

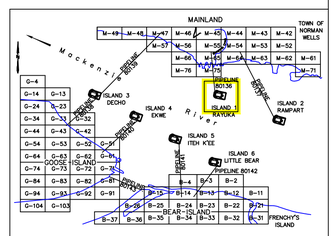
096-0179-700-801 79

AutoCAD

CADD DRAWING NO MANUAL CHANGES







KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 10 TO JUNE 12, 2020.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

11	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	22	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
27	2020 SURVEY CONTOURS SEP. 2020: GEOVERRA	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
26	2019 SURVEY CONTOURS SEP. 2019: WSP	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
25	2018 SURVEY CONTOURS NOV. 2018: WSP	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG.2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 1 & SURROUNDING AREA

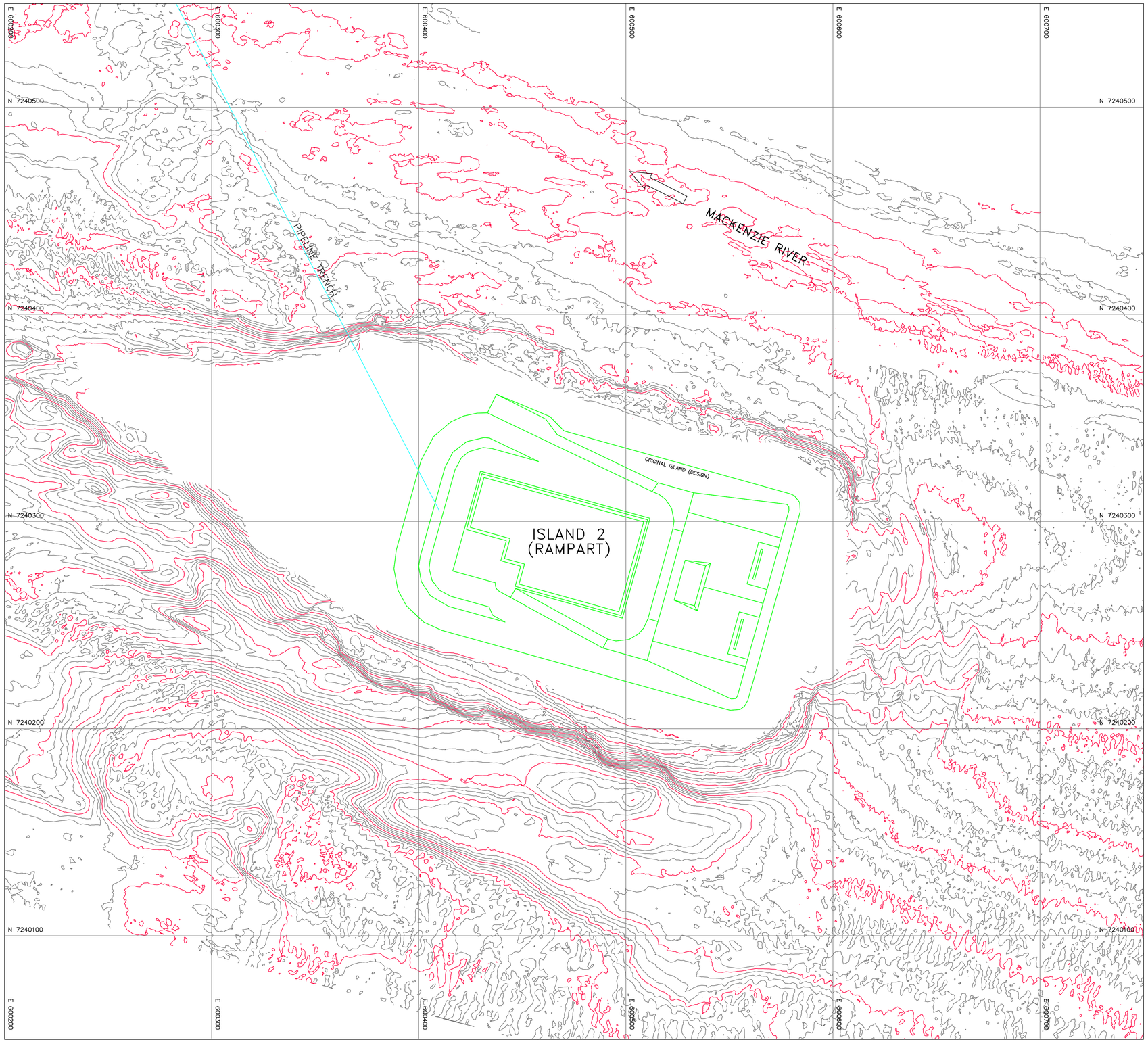
SURVEY PLAN

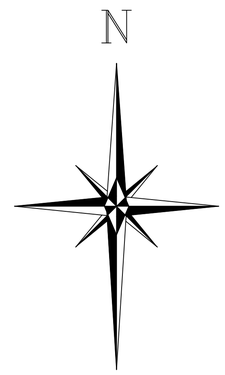
CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1204-C
DATE: 20-09-10	ESSO FILE No.
SCALE: 1:1000	096-0179-700-801 79

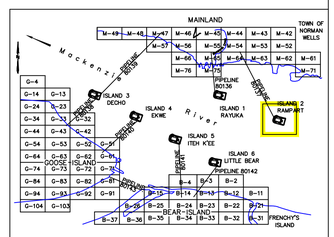
096-0179-700-801 80

AutoCAD

CADD DRAWING NO MANUAL CHANGES







KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 11 TO JUNE 13, 2020.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	20	2015 SURVEY CONTOURS AUG. 2015: WSP
1	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
3	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
3	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	19	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	7	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
22	2020 SURVEY CONTOURS SEP. 2020: GEOVERRA	18	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
20	2019 SURVEY CONTOURS SEP. 2019: WSP	18	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
20	2018 SURVEY CONTOURS NOV. 2018: WSP	4	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
20	2017 SURVEY CONTOURS SEP. 2017: WSP	3	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
20	2016 SURVEY CONTOURS SEP. 2016: WSP	2	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 2 & SURROUNDING AREA

SURVEY DRAWING

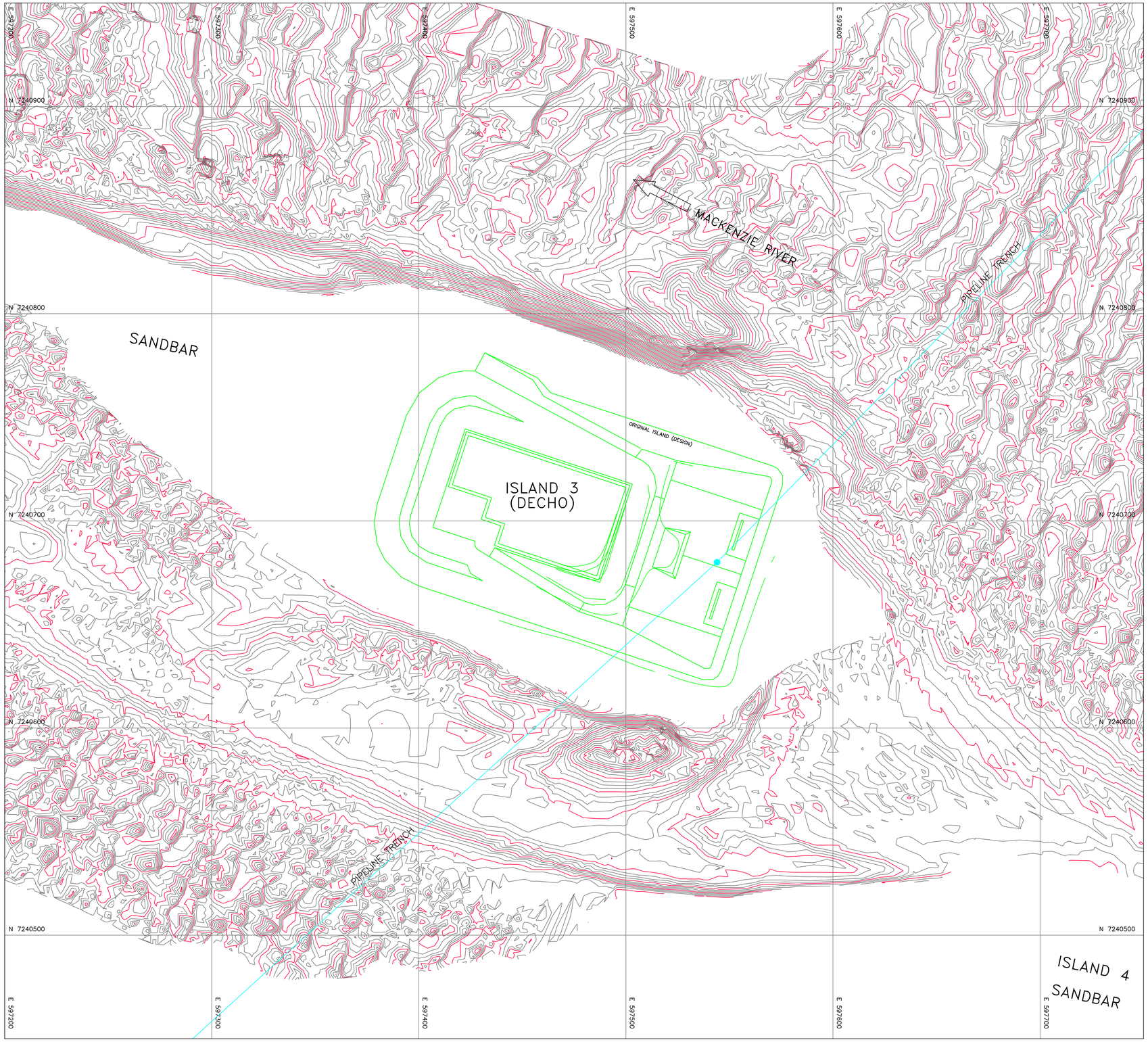
CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1205-C
DATE: 20-09-10	ESSO FILE No.
SCALE: 1:1000	096-0179-700-801 80

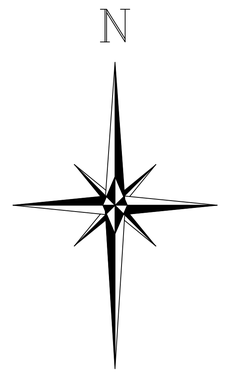
096-0179-700-801 81

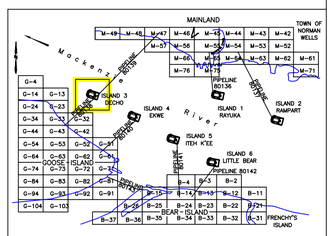
AutoCAD

DRAWING NO MANUAL CHANGES

CADD







KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 12 TO JUNE 19, 2020.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)–UTM GRID/cm = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	2	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
27	2020 SURVEY CONTOURS SEP. 2020: GEOVERRA	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
26	2019 SURVEY CONTOURS SEP. 2019: WSP	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
25	2018 SURVEY CONTOURS NOV. 2018: WSP	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 3 & SURROUNDING AREA

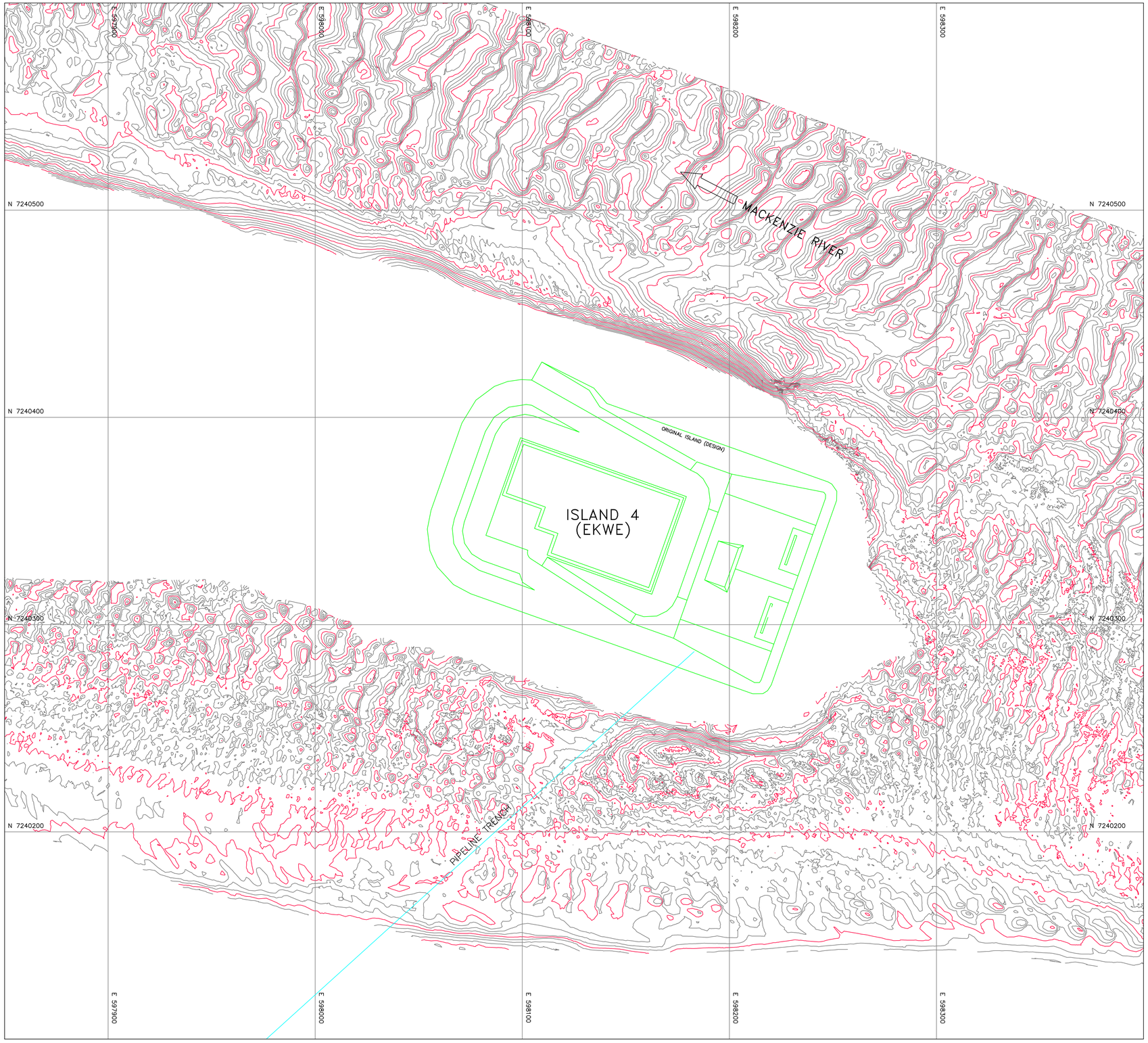
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1206–C
DATE: 20–09–10	ESSO FILE No.
SCALE: 1:1000	096–0179–700–801 81

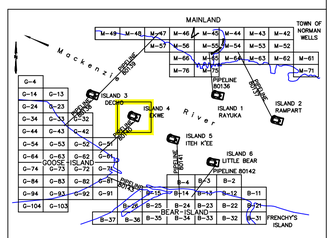
096-0179-700-801 82

AutoCAD

CADD DRAWING NO MANUAL CHANGES



N



KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 19, 2020.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)–UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	2	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
27	2020 SURVEY CONTOURS SEP. 2020: GEOVERRA	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
26	2019 SURVEY CONTOURS SEP. 2019: WSP	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
25	2018 SURVEY CONTOURS NOV. 2018: WSP	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Imperial Oil

IMPERIAL OIL RESOURCES

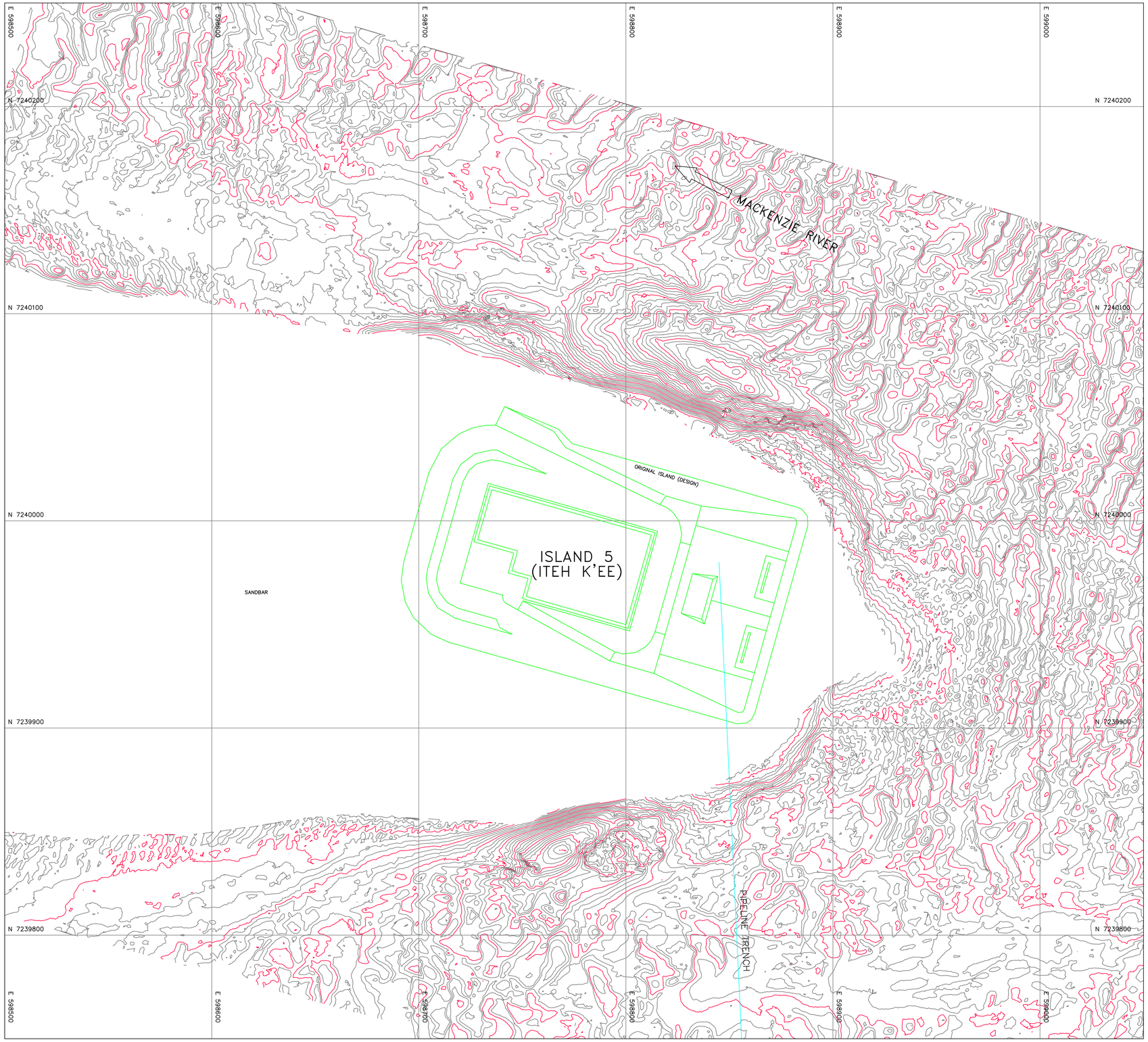
NORMAN WELLS FACILITIES

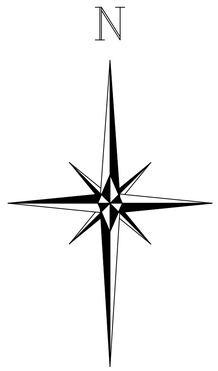
ISLAND 4 & SURROUNDING AREA

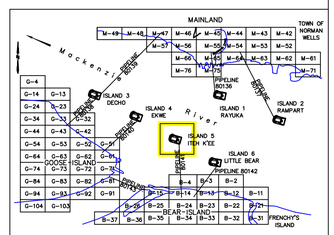
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1207–C
DATE: 20–09–10	ESSO FILE No.
SCALE: 1:1000	096–0179–700–801 82

CADD DRAWING NO MANUAL CHANGES | AutoCAD | 096-0179-700-801 83







KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 17 TO JUNE 18, 2020.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27 SHORAN-UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	22	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
27	2020 SURVEY CONTOURS SEP. 2020: GEOVERRA	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
26	2019 SURVEY CONTOURS SEP. 2019: WSP	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
25	2018 SURVEY CONTOURS NOV. 2018: WSP	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 5 & SURROUNDING AREA

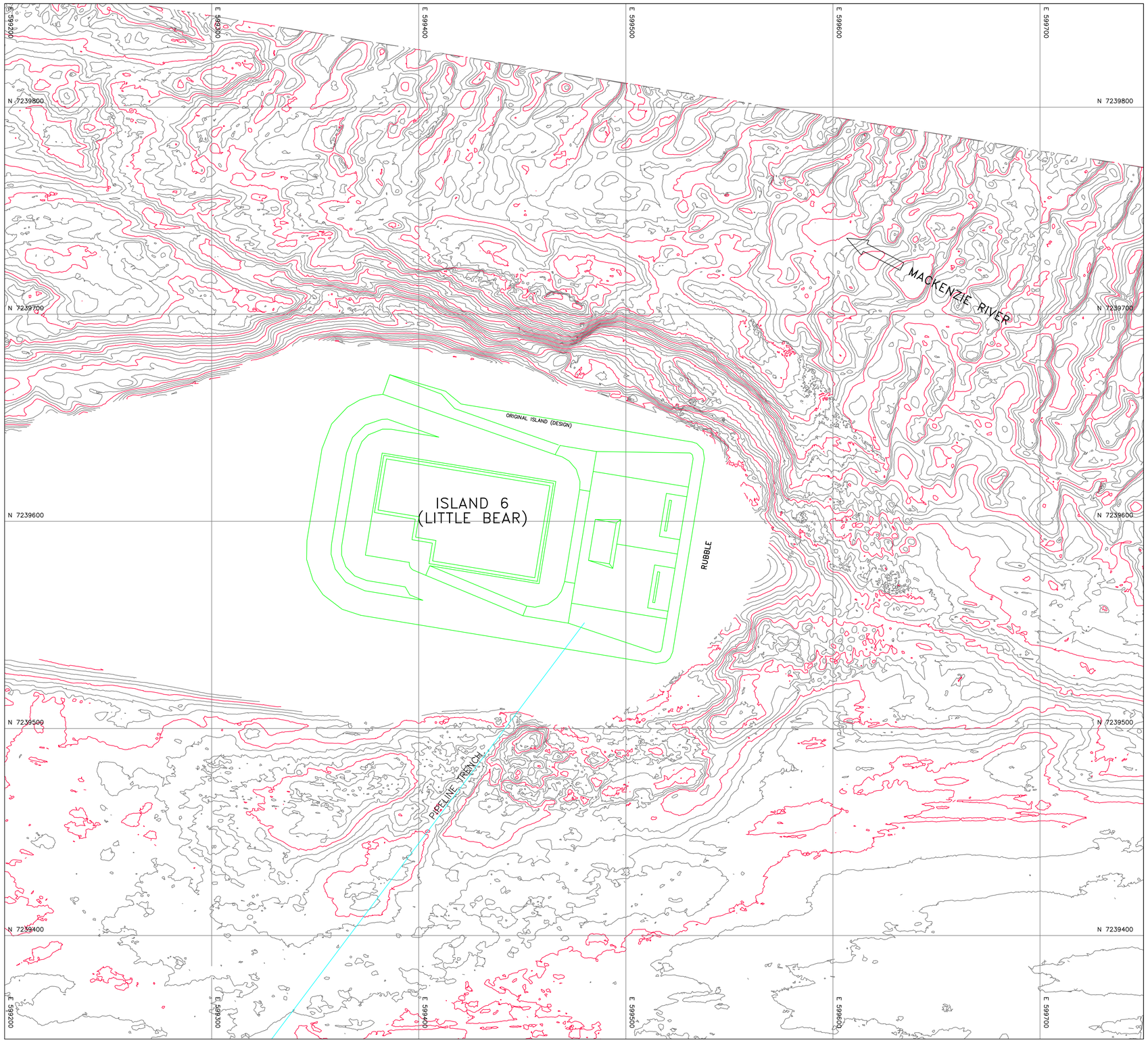
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1208-C
DATE: 20-09-10	ESSO FILE No.
SCALE: 1:1000	096-0179-700-801 83

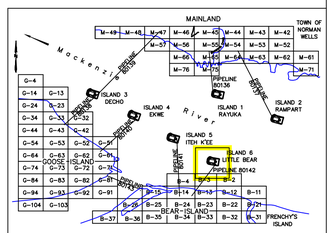
096-0179-700-801 84

AutoCAD

CADD DRAWING NO MANUAL CHANGES



N



KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 13 TO JUNE 16, 2020.
3. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
4. HORIZONTAL DATUM: NAD27(SHORAN)–UTM GRID/CM = 129°
5. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

LEGEND

1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	2	2015 SURVEY CONTOURS AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	2014 SURVEY CONTOURS AUGUST 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	2013 SURVEY CONTOURS AUGUST 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	2012 SURVEY CONTOURS AUGUST 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	2011 SURVEY CONTOURS AUGUST 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	2010 SURVEY CONTOURS JULY 2010: MMM Geomatics
27	2020 SURVEY CONTOURS SEP. 2020: GEOVERRA	16	2009 SURVEY CONTOURS JUNE 2009: MMM Geomatics
26	2019 SURVEY CONTOURS SEP. 2019: WSP	15	2008 SURVEY CONTOURS JUNE 2008: MMM Geomatics
25	2018 SURVEY CONTOURS NOV. 2018: WSP	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	2017 SURVEY CONTOURS SEP. 2017: WSP	13	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED
23	2016 SURVEY CONTOURS SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

ISLAND 6 & SURROUNDING AREA

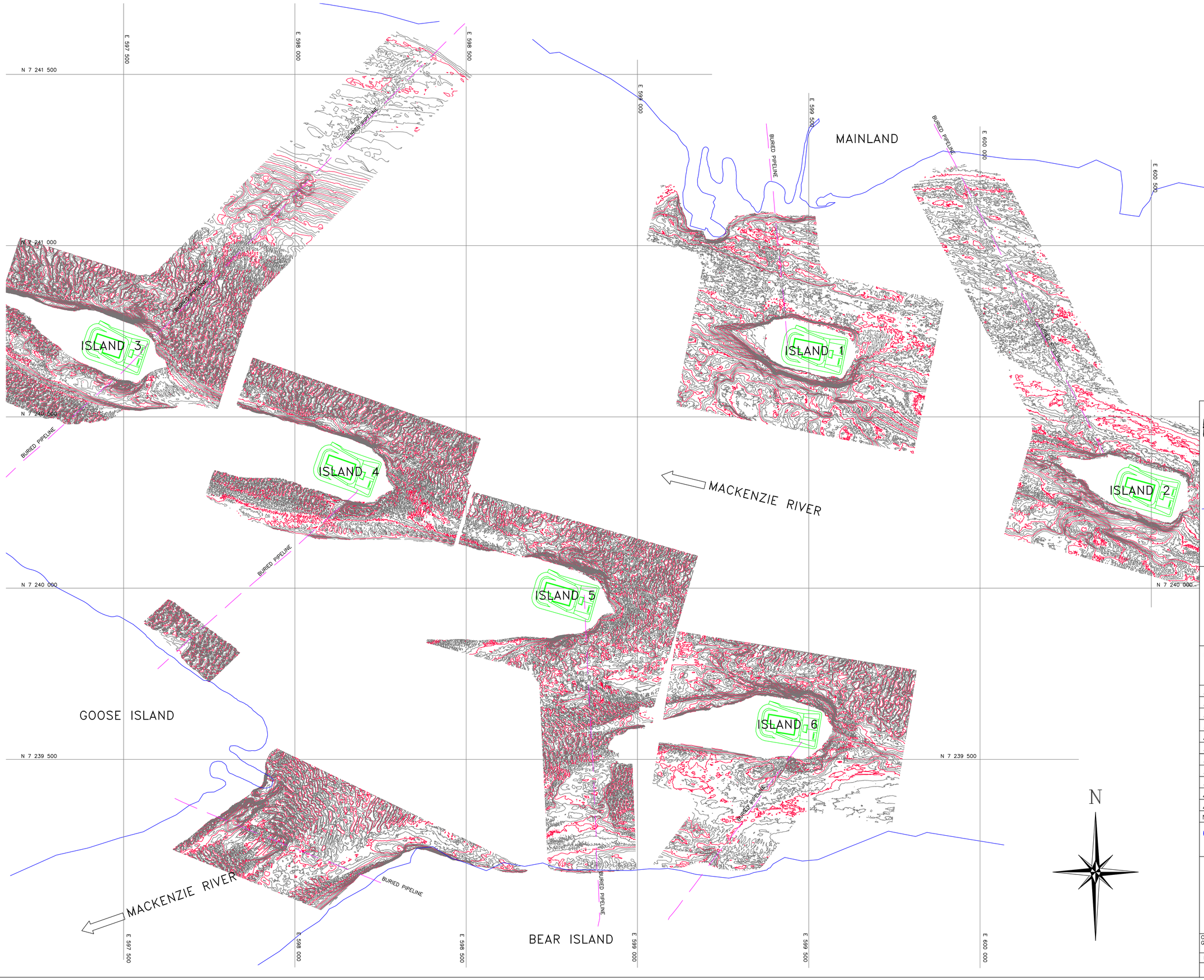
SURVEY DRAWING

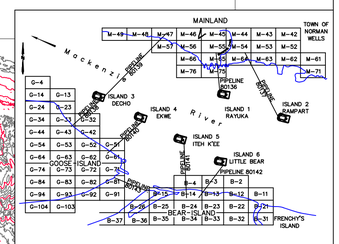
CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1209–C
DATE: 20–09–10	ESSO FILE No.
SCALE: 1:1000	096–0179–700–801 84

096-0179-700-801 86

AutoCAD

CADD DRAWING NO MANUAL CHANGES





KEY PLAN
1:50 000

NOTES

1. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 10 TO JUNE 19, 2020.
2. WATER LEVEL DETERMINED DIRECTLY FROM RTK OBSERVATIONS ON SURVEY VESSELL.
3. HORIZONTAL DATUM: NAD 27(SHORAN)-UTM GRID/cm=129°
4. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189

LEGEND

1	2003 SURVEY POINTS AUG 2003: UMA GEOMATICS	2016	2016 SURVEY POINTS SEP. 2016: WSP
10	2002 SURVEY POINTS AUG 2002: UMA GEOMATICS	2015	2015 SURVEY POINTS AUG. 2015: WSP
9	2001 SURVEY POINTS AUG 2001: UMA GEOMATICS	2014	2014 SURVEY POINTS AUGUST 2014: MMM GEOMATICS
8	2000 SURVEY POINTS AUG 2000: UMA GEOMATICS	13	2013 SURVEY POINTS AUGUST 2013: MMM GEOMATICS
7	1999 SURVEY POINTS AUG 1999: UMA GEOMATICS	12	2012 SURVEY POINTS AUGUST 2012: MMM GEOMATICS
6	1998 SURVEY POINTS JUNE 1998: UMA GEOMATICS	11	2011 SURVEY POINTS AUGUST 2011: MMM GEOMATICS
5	1997 SURVEY POINTS JULY 1996: UMA GEOMATICS	10	2010 SURVEY POINTS JULY 2010: MMM GEOMATICS
20	2020 SURVEY POINTS SEP. 2020: GEOVERRA	9	2009 SURVEY POINTS JUNE 2009: MMM GEOMATICS
19	2019 SURVEY POINTS SEP. 2019: WSP	8	2008 SURVEY POINTS JUNE 2008: MMM GEOMATICS
18	2018 SURVEY POINTS NOV. 2018: WSP	6	2006 SURVEY POINTS JUNE 2006: USHER CANADA LIMITED
17	2017 SURVEY POINTS SEP. 2017: WSP	5	2005 SURVEY POINTS JUNE 2005: USHER CANADA LIMITED
No.	REVISION	No.	REVISION

Imperial Oil

IMPERIAL OIL RESOURCES

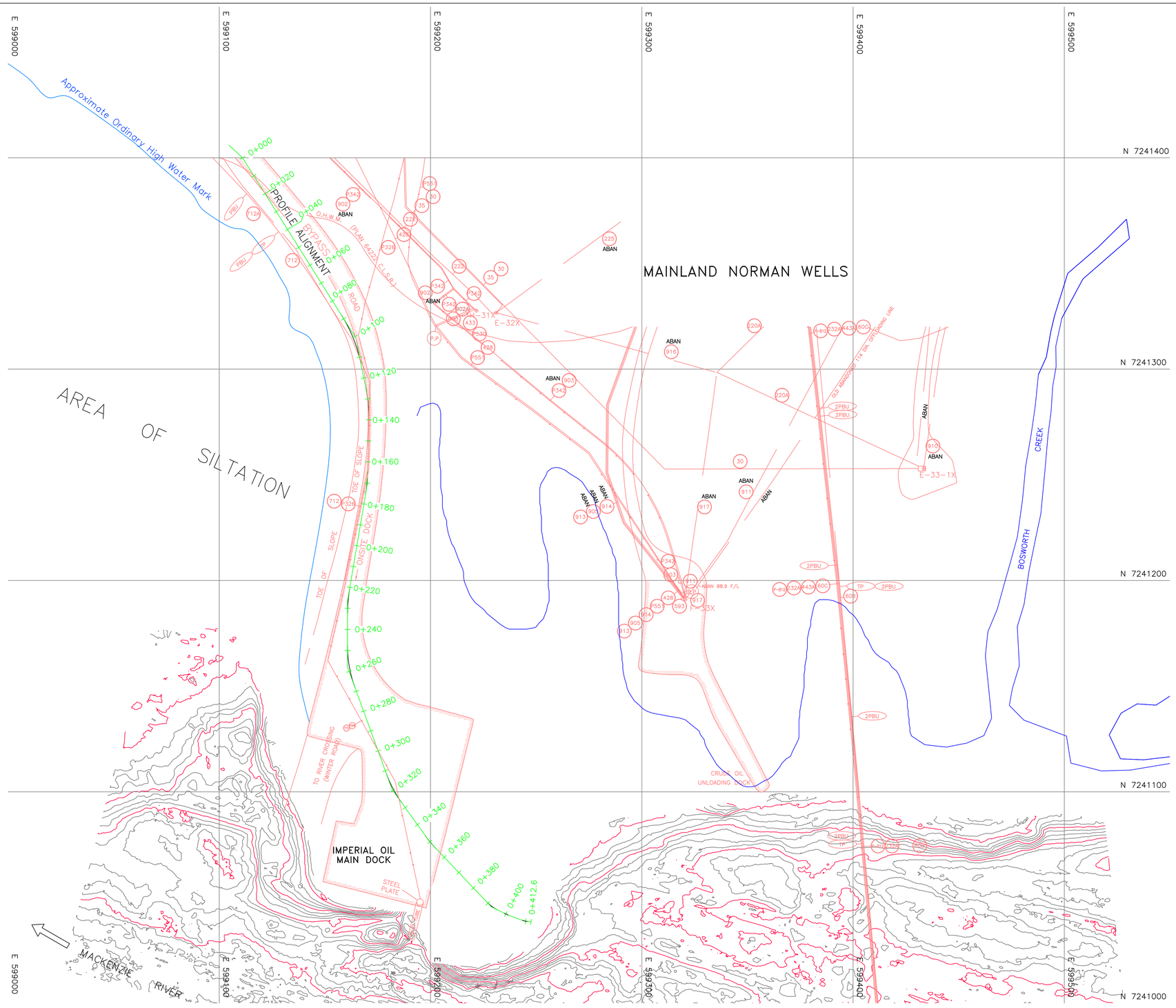
NORMAN WELLS FACILITIES

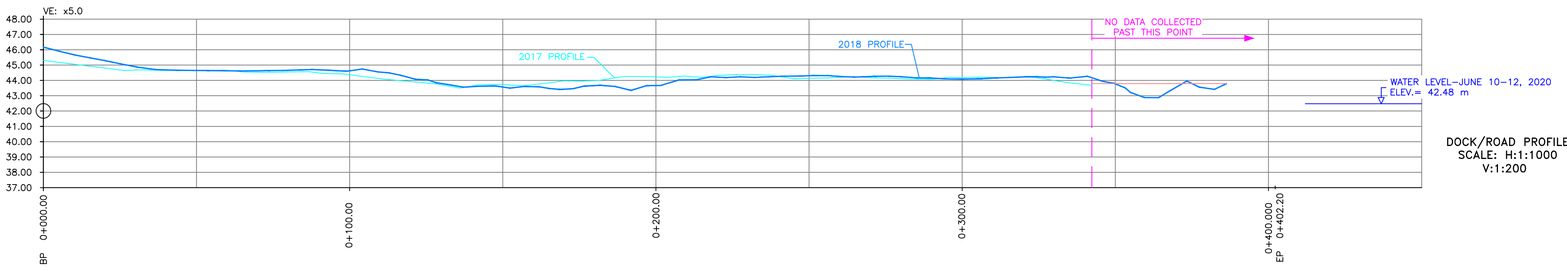
RIVER BED AND ISLAND CONTOURS

SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1213-C
DATE: 20-09-10	ESSO FILE No.
SCALE: 1:5000	096-0179-700-801 86

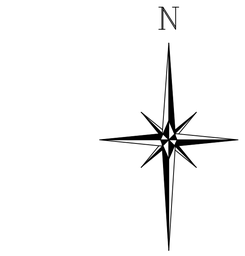
CADD DRAWING NO MANUAL CHANGES | AutoCAD | 096-0179-700-801 87

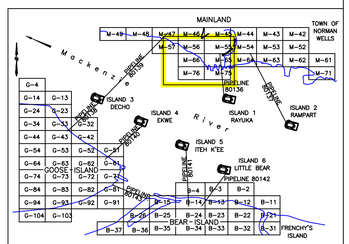




DOCK/ROAD PROFILE
SCALE: H:1:1000
V:1:200

ROAD PROFILE ALIGNMENT COORDINATES		
EASTING	NORTHING	
7241400.000	599111.029	START CHAINAGE 0+000
7241391.394	599116.437	
7241381.849	599122.435	
7241372.684	599128.195	
7241363.396	599134.031	
7241353.622	599140.173	
7241342.847	599146.944	
7241333.305	599152.941	
7241323.558	599159.066	
7241314.711	599164.625	
7241293.559	599168.857	
7241283.412	599170.888	
7241272.325	599170.657	
7241261.930	599170.440	
7241251.502	599170.223	
7241245.853	599170.105	
7241234.977	599168.266	
7241223.162	599166.268	
7241210.737	599164.167	
7241199.388	599162.248	
7241190.297	599160.711	
7241177.776	599160.711	
7241158.998	599160.711	
7241148.907	599164.395	
7241136.750	599168.832	
7241123.265	599173.755	
7241111.842	599177.924	
7241101.096	599181.847	
7241090.336	599189.584	
7241076.056	599199.852	
7241062.537	599212.701	
7241055.395	599219.489	
7241045.632	599228.768	
7241042.087	599235.774	
7241038.802	599244.598	
7241038.512	599247.564	END CHAINAGE 0+412.6





KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 10 AND JUNE 12, 2020.
3. WATER LEVEL = 42.48 m (JULY 10-12, 2020)
4. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
5. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/CM = 129°
6. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m
7. PIPELINE ALIGNMENT SURVEYED BETWEEN JUNE 17 TO JUNE 25, 2017.

LEGEND

- 2017 ROAD CENTERLINE PROFILE
- 2018 ROAD CENTERLINE PROFILE
- 2019 ROAD CENTERLINE PROFILE
- 2020 ROAD CENTERLINE PROFILE

No.	REVISION	No.	REVISION
12	2004 SURVEY CONTOURS AUG 2004: USHER CANADA LIMITED	22	2016 SURVEY PROFILE SEP. 2016: WSP
11	2003 SURVEY CONTOURS/PROFILE AUG 2003: UMA GEOMATICS	21	2015 SURVEY PROFILE AUG. 2015: WSP
10	2002 SURVEY CONTOURS/PROFILE AUG 2002: UMA GEOMATICS	20	2014 SURVEY CONTOURS AUGUST 2014: MMM GEOMATICS
9	2001 SURVEY CONTOURS/PROFILE AUG 2001: UMA GEOMATICS	19	2013 SURVEY CONTOURS AUGUST 2013: MMM GEOMATICS
8	2000 SURVEY CONTOURS/PROFILE AUG 2000: UMA GEOMATICS	18	2012 SURVEY CONTOURS AUGUST 2012: MMM GEOMATICS
7	1999 SURVEY CONTOURS/PROFILE AUG 1999: UMA GEOMATICS	17	2011 SURVEY CONTOURS AUGUST 2011: MMM GEOMATICS
6	1998 SURVEY CONTOURS/PROFILE JUNE 1998: UMA GEOMATICS	16	2010 SURVEY CONTOURS AUGUST 2010: MMM GEOMATICS
5	1997 SURVEY CONTOURS/PROFILE JULY 1997: UMA GEOMATICS	15	2009 SURVEY CONTOURS JUNE 2009: MMM GEOMATICS
4	2020 SURVEY CONTOURS/PROFILE SEP. 2020: GEOVERRA	14	2009 SURVEY CONTOURS JUNE 2009: MMM GEOMATICS
3	2019 SURVEY CONTOURS/PROFILE SEP. 2019: WSP	13	2008 SURVEY CONTOURS JUNE 2008: MMM GEOMATICS
2	2018 SURVEY CONTOURS/PROFILE NOV. 2018: WSP	12	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
1	2017 SURVEY CONTOURS/PROFILE SEP. 2017: WSP	11	2005 SURVEY CONTOURS JULY 2005: USHER CANADA LIMITED

Esso Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES
IMPERIAL OIL MAINLAND DOCK
SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA

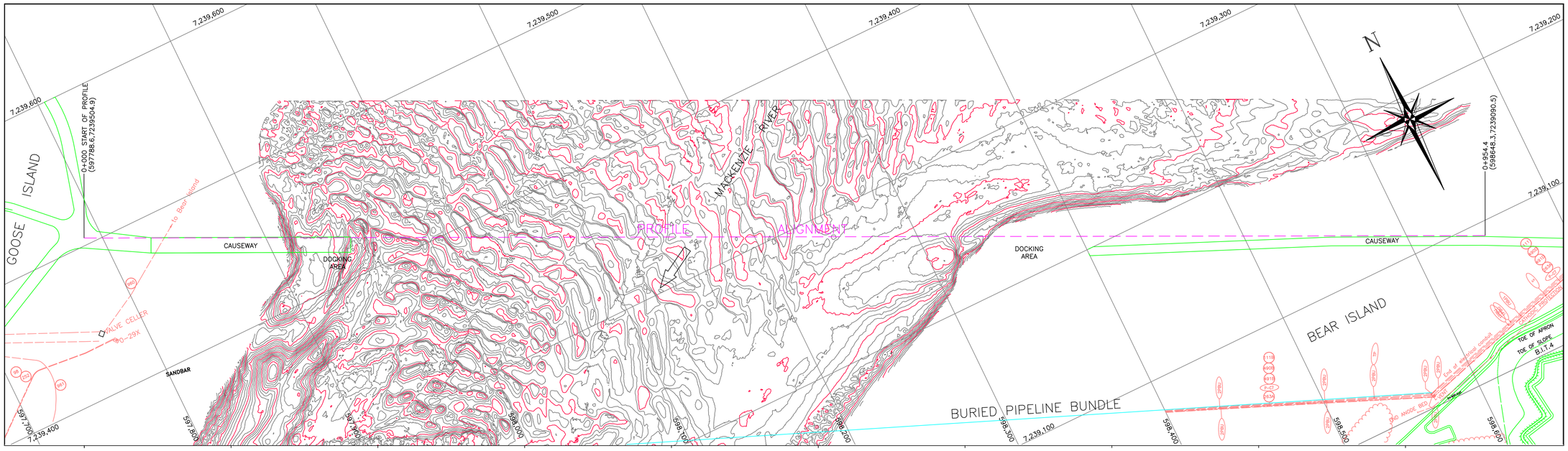
CONTRACTOR DWG NO. : 1214-C

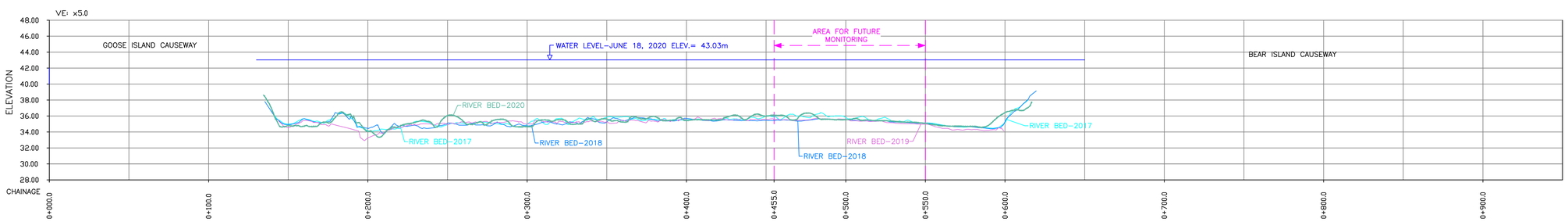
DATE: 20-09-10

SCALE: 1:2000

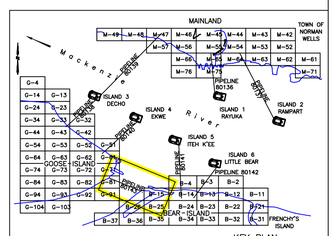
ESSO FILE No. 096-0179-700-801 87

CADD DRAWING NO MANUAL CHANGES | AutoCAD | 096-0179-700-801 89





PROFILE OF RIVER BED



KEY PLAN
1:50 000

NOTES

1. CONTOUR INTERVAL = 0.25 METRES.
2. BATHYMETRIC SURVEY PERFORMED BETWEEN JUNE 18, 2020.
3. WATER LEVEL = 43.03 m (JUNE 18, 2020)
4. WATER LEVEL DETERMINED DIRECTLY FROM RTK GPS OBSERVATIONS ON SURVEY VESSEL.
5. HORIZONTAL DATUM: NAD27(SHORAN)-UTM GRID/CM = 129°
6. VERTICAL DATUM: GEODETIC BM 74T016 ELEVATION = 60.189m

No.	REVISION	No.	REVISION
1	2003 SURVEY CONTOURS AUG 2003: UMA GEOMATICS	22	ADDED 2015 BOTTOM PROFILE AUG. 2015: WSP
10	2002 SURVEY CONTOURS AUG 2002: UMA GEOMATICS	21	ADDED 2014 BOTTOM PROFILE AUG 2014: MMM Geomatics
9	2001 SURVEY CONTOURS AUG 2001: UMA GEOMATICS	20	ADDED 2013 BOTTOM PROFILE AUG 2013: MMM Geomatics
8	2000 SURVEY CONTOURS AUG 2000: UMA GEOMATICS	19	ADDED 2012 BOTTOM PROFILE AUG 2012: MMM Geomatics
7	1999 SURVEY CONTOURS AUG 1999: UMA GEOMATICS	18	ADDED 2011 BOTTOM PROFILE AUG 2011: MMM Geomatics
6	1998 SURVEY CONTOURS JUNE 1998: UMA GEOMATICS	17	ADDED 2010 BOTTOM PROFILE JULY 2010: MMM Geomatics
27	ADDED 2020 BOTTOM PROFILE SEP. 2020: GEOVERRA	16	ADDED 2009 BOTTOM PROFILE JUNE 2009: MMM Geomatics
26	ADDED 2019 BOTTOM PROFILE SEP. 2019: WSP	15	ADDED 2008 BOTTOM PROFILE JUNE 2008: MMM Geomatics
25	ADDED 2018 BOTTOM PROFILE NOV. 2018: WSP	14	2006 SURVEY CONTOURS JUNE 2006: USHER CANADA LIMITED
24	ADDED 2017 BOTTOM PROFILE SEP. 2017: WSP	13	2005 SURVEY CONTOURS JUNE 2005: USHER CANADA LIMITED
23	ADDED 2016 BOTTOM PROFILE SEP. 2016: WSP	12	2004 SURVEY CONTOURS AUG 2004:USHER CANADA LIMITED

Imperial Oil

IMPERIAL OIL RESOURCES

NORMAN WELLS FACILITIES

GOOSE TO BEAR CAUSEWAY

SURVEY DRAWING

CONTRACTOR NAME: GEOVERRA	CONTRACTOR DWG NO. : 1215-C
DATE: 20-09-10	ESSO FILE No.
SCALE: H 1:1500 V 1:300	096-0179-700-801 89

LEGEND

- 2017 RIVER BED PROFILE
- 2018 RIVER BED PROFILE
- 2019 RIVER BED PROFILE
- 2020 RIVER BED PROFILE