

 SNC • LAVALIN	CONSTRUCTION WORK PLAN		Document Code: 508955-0000-40EH-0001
			Revision 00
Client: City of Winnipeg	Project: MacLean Pumping Station Electrical Upgrades	Package / Area:	

Prepared By: V. Elimban / B. Clevon			
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REVISION REGISTER					
Rev.	Description	Date	By	Checked	Approved
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1.0 OVERVIEW

This document is intended to provide a guideline for construction activities relating to the MCC Replacement at the MacLean Water Pumping Station. It is written from a technical perspective, and is intended to be read along with the associated drawings.

1.1 Associated Documents

The associated single line diagrams and construction plan drawings are listed below.

Drawing Number	Description
1-0630M-E0003	Electrical Single Line Diagram, 600V Generators and Switchgear (existing)
1-0630M-E0004	Electrical Single Line Diagram, 600V Non-Essential Switchgear and Distribution (existing)
1-0630M-E0023	Electrical Single Line Diagram, MCC-M1
1-0630M-E0024	Electrical Single Line Diagram, DP-M2
1-0630M-E0025	Electrical Single Line Diagram, MCC-M3E Essential MCC
1-0630M-E0036	Construction Plan, Electrical Room, Phase 1
1-0630M-E0037	Construction Plan, Electrical Room, Phase 2
1-0630M-E0038	Construction Plan, Electrical Room, Phase 3
1-0630M-E0039	Construction Plan, Electrical Room, Phase 4

1.2 Definitions

MCC	Motor Control Centre
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
SCADA	Supervisory Control and Data Acquisition

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2.0 FACILITY REQUIREMENTS

The MacLean Water Pumping Station must remain in continual operation throughout the day, from 5:00am to 11:30pm. As such, station shutdowns are not permitted during day-time hours. Shutdowns are limited to night-time hours, pending approval by the Contract Administrator. Under no circumstance shall the station be taken out of service without prior approval.

Should the station be accidentally taken out of service, the Contractor is to immediately contact the City's Control Centre and the Contract Administrator. Emergency contact numbers are provided in Section 6.0.

CSA Approved safety footwear, hard hats, and safety glasses will be required at all times while working at the station.

Contractor personnel must acquire approval by the City of Winnipeg prior to using any City-owned equipment, such as hoists, cranes, and tools.

A Contractor sign-in book will be provided, which will be located in the electrical room. All Contractor personnel are to sign in upon arrival at the station and sign out prior to leaving the station each day.

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3.0 CONSTRUCTION PLAN

The work identified in the Construction Plan are deemed to be significant tasks, however the omission of any task in the Construction Plan does not eliminate the requirement for the Contractor to complete the work. Where work not identified in this plan requires coordination, it is the responsibility of the Contractor to identify the work and associated coordination requirements to the Contract Administrator.

The Work items identified are not necessarily sequential, and it is expected in many cases that work items will be carried out in parallel to meet the schedule requirements.

Legend:

- D Day
- N Night
- MP Minimum Pumping
- NG Natural Gas

3.1 Phase 1

The major components of Phase 1 of the construction sequence include relocating existing ductwork and 4160v cabling to make way for new cable tray, installation of the new essential MCC, MCC-M3E, and transfer switch, ATS-M3E, and transitioning loads from the existing Essential MCC to MCC-M3E.

Item	Description of Work	D/N	Facility Operation	Notes
1.1	Install cable tray in the electrical room	D	Normal	
1.2	Perform HVAC ductwork modifications.	D	Normal	Will eliminate electrical room cooling. Contractor to ventilate electrical room as required to maintain temperatures < 30°C.
1.3	Remove portions of existing 4160V cable tray and install new cable tray.	D	MP NG Pumps Only	Electric pumps to be locked out.
1.4	Re-route and shorten the P-21 4160V pump motor feeder cable.	D	MP NG Pumps Only	Electric pumps to be locked out.
1.5	Re-termination of P-21 4160V cable.	D	MP P-21 locked out	
1.6	Testing and final connection of P-21 4160V cable.	D	P-21 locked out	
1.7	Re-route and shorten the P-23 4160V pump motor feeder cable.	D	NG Pumps Only	Electric pumps to be locked out.
1.8	Re-termination of P-23 4160V cable.	D	P-23 locked out	
1.9	Testing and final connection of P-23 4160V cable.	D	P-23 locked out	

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Item	Description of Work	D/N	Facility Operation	Notes
1.10	Re-route and shorten the P-25 4160V pump motor feeder cable.	D	MP NG Pumps Only	Electric pumps to be locked out.
1.11	Re-termination of P-25 4160V cable.	D	P-25 locked out	
1.12	Testing and final connection of P-25 4160V cable.	D	P-25 locked out	
1.13	Prepare floor penetrations below MCC-M3E.	D	Normal	
1.14	Install new 600V tray, except some sections below existing MCCs.	D	Normal	
1.15	Install disconnect switches, pushbutton stations, where practicable.	D	Normal	
1.16	Install and test sump pump level sensor and transmitter.	D	Normal	
1.17	Install sump pump local control panel LCP-M940.	D	Normal	
1.18	Coordinate minimum ventilation requirements with Contract Administrator and jumper existing motor starters accordingly. Replace existing ventilation H-O-A switches with new ventilation control panel LCP-M600. Temporarily terminate existing motor starter wiring in LCP-M600.	D	Limited Ventilation	
1.19	Install new automatic transfer switch, ATS-M3E.	D	Normal	
1.20	Install new MCC-M3E.	D	Normal	
1.21	Route the following cables: <ul style="list-style-type: none"> • C-MCC-M3E-A • C-ATS-M3E-A • C-ATS-M3E-B • Temporary cable from MCC-M3E to existing Essential MCC • C-XFMR-M30E • CA-M915-1 • Automation cabling associated with standby generators and transfer switches. 	D	Normal	
1.22	Test: <ul style="list-style-type: none"> • MCC-M3E • ATS-M3E • XFMR-M30E 	D	Normal	

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Item	Description of Work	D/N	Facility Operation	Notes
1.23	Terminate the following cables: <ul style="list-style-type: none"> • C-MCC-M3E-A • C-ATS-M3E-A (leave the LT1/LTG end loose) • C-ATS-M3E-B (leave the ATS-M1E end loose) • Temporary cable from MCC-M3E to existing Essential MCC (leave the existing Essential MCC end loose) • CA-M916-1 	D	Normal	
1.24	Shutdown <ul style="list-style-type: none"> • Remove existing cable from LT1/LTG to existing Essential MCC • Terminate C-ATS-M3E-A into LT1/LTG • Disconnect existing cable from ATS-M1E • Terminate C-ATS-M3E-B into ATS-M1E • Install Temporary Cable into existing Essential MCC • Terminate automation cabling associated with the standby generators and transfer switches. • Test MCC-M3E.ESL-M915 • Set the 600V Switchgear Transfer Auto/Manual switch to Manual. • Remove existing wiring to I/O points 10029 and 10056, and jumper to force on. City to update Station PLC and HMI for all I/O modifications. Commission the following I/O to Station PLC: <ul style="list-style-type: none"> • ZS-M916-1 • ZS-M916-2 • ESL-M915 	N	Complete Shutdown	Contractor to provide temporary lighting,

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Item	Description of Work	D/N	Facility Operation	Notes
1.25	Shutdown <ul style="list-style-type: none"> • Remove existing XFMR-LP-B and cable between XFMR-LP-B and LP-B • Install XFMR-M30E • Replace PNL-B interior • Install and test cables C-XFMR-M30E and C-PNL-B • Replace power meter in SGR-M1 	N	Complete Shutdown	HVAC Control via Johnson Controls system out of service. Provide standby power to HVAC controls as required by conditions. Station lighting affected. Ensure adequate lighting throughout the Station.
1.26	Route and test the new MCC-M3E load cables. Connect the line-sides of the cables and leave the load ends unterminated.	D	Normal	
1.27	Transition loads (including testing): <ul style="list-style-type: none"> • AHU-M601 (was FC1) • AHU-M603 (was FC3) 	D	Normal	Loads to be out of service < 8 hours each. Loads are not to be taken out of service simultaneously.
1.28	Transition loads (including testing): <ul style="list-style-type: none"> • XV-M041 (was SHV-1) • XV-M043 (was SHV-3) • XV-M051 (was DHV-1) • XV-M054 (was DHV-4) 	D	Normal	Loads to be out of service < 8 hours each.
1.29	Transition loads (including testing): <ul style="list-style-type: none"> • UH-M657 (was E7) 	D	Normal	Monitor Chlorine Equipment Room temperature and provide temporary heating as required.
1.30	Transition loads and controls (including testing): <ul style="list-style-type: none"> • P-M941 (was P7) • P-M942 (was P8) 	D	Normal	Keep at minimum one sump pump in service at all times. Loads to be out of service < 8 hours each.
1.31	Install new air compressor control panel (LCP-M900) Modify controls for AC-M902. Transition AC-M902 (was R2) to new MCC-M3E.	D	Normal AC-M902 (was R2) out of service	
1.32	Shutdown Transition loads (including testing): <ul style="list-style-type: none"> • UPS-M1 	N	Complete Shutdown	
1.33	Transition load (including testing): <ul style="list-style-type: none"> • AC-M903 (was LZ-902-AC) 	D	Normal	Close tie valve between air supply systems prior to transitioning load.
1.34	Install new HVAC control cabling to MCC-M3E. Terminate MCC-M3E end only.	D	Normal	

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Item	Description of Work	D/N	Facility Operation	Notes
1.35	Install 600V junction boxes, JB-M1, JB-M2 and JB-M3.	D	Normal	
1.36	Install conduit and conductors to JB-M1.	D	Normal	
1.37	Transition loads (including testing): <ul style="list-style-type: none"> • EF-M681 (was F1) • EF-M682 (was F2) • EF-M686 (was F6) • EF-M689 (was F9) • EF-M690 (was F10) • EF-M692 (was F12) 	D	Normal	Ensure adequate ventilation throughout facility while transitioning exhaust fans. Loads to be out of service < 8 hours each. Chlorine Room fan loads are not to be taken out of service simultaneously. No work in the chlorine rooms during fan transitions.
1.38	Test MCC-M3E.PM	D	Normal	

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3.2 Phase 2

During Phase 2 of the construction sequence, the existing Essential MCC is to be demolished and the new non-essential MCC, MCC-M1 is to be installed. Existing loads will then be transitioned to MCC-M1.

Item	Description of Work	D/N	Facility Operation	Notes
2.1	Remove temporary feed from MCC-M3E (MCC-M3E.MCS-A) to the existing Essential MCC.	D	Normal	
2.2	Demolish the existing Essential MCC and provide an appropriate barrier for the Non-Essential MCC, as required.	N	600V Shutdown No Pumping	
2.3	Replace the existing cable tray beneath the existing MCCs.	N	600V Shutdown No Pumping	Shut down the existing MCCs when working on cable tray below. Take care to support existing cables during the transitions.
2.4	Install and test <ul style="list-style-type: none"> MCC-M1 MCC-M1.PM 	D	Normal	Jumper the Phase A CT connection for PFC-M1 within MCC-M1.
2.5	Install and test the following new cables: <ul style="list-style-type: none"> C-MCC-M1 (leave the Transformer T1 end loose), C-TIE-M1-M2 (terminate at MCC-M1 end only) CA-M913-1 (don't terminate PLC end) 	D	Normal	
2.6	Shutdown <ul style="list-style-type: none"> Remove existing cable from the secondary side transformer T2 to circuit breaker LT2 in the 600V switchgear Install C-MCC-M1 into secondary of transformer T2 (temporary cable) Test C-MCC-M1 Terminate CA-M913-1 Test MCC-M1.ESL-M913 Remove the existing cable from circuit breaker LT2 in the 600V switchgear to the existing Non-Essential MCC Install and test a temporary cable from the tie breaker in MCC-M1 to the existing Non-Essential MCC Commission I/O to Station PLC: <ul style="list-style-type: none"> ESL-M913 	N	600V Shutdown (Non-Essential) Minimize Pumping	Contractor to provide temporary lighting.

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Item	Description of Work	D/N	Facility Operation	Notes
2.7	Install new MCC-M1 Teck and RW90 load cables, with load ends unterminated. Leave TC loads for now.	D	Normal	
2.8	Transition the following loads to MCC-M1 (including testing) <ul style="list-style-type: none"> • P-M631 (was CHWP-1) • P-M632 (was CHWP-2) • FN-M635-1 (was CT-1.FAN1) • FN-M635-2 (was CT-1.FAN2) • P-M633 (was CTP-1) • P-M634 (was CTP-2) • CHLR-M630 (was CH-1) • Welding Receptacle 	D	Normal	Loads may be out of service for up to one week, if during cool weather.
2.9	Transition the following loads to MCC-M1 (including testing) <ul style="list-style-type: none"> • AHU-M602 (was FC2) • AHU-M604 (was AHU-4) • HCE-M609 (was E1) • CRN-M991 (was H1) • CRN-M992 (was H2) • EF-M683 (was F3) • EF-M684 (was F4) 	D	Normal	Coordinate HCE-M609 transition during warm weather. Loads to be out of service < 8 hours each.
2.10	Install, power and test LCP-M608 and new HVAC controls.	D	Normal	
2.11	Transition load for HCE-M603 (was E3) Install, test and commission HCC-M603. Commission LCP-M608 control of HCC-M603.	D	Normal	Ensure transition during acceptable weather.
2.12	Modify controls for AC-M901. Transition AC-M901 (was R1) to new MCC-M3E.	D	Normal AC-M901 (was R1) out of service	
2.13	Transition Loads (including testing) <ul style="list-style-type: none"> • AHU-M605 (was F15/ACU-1) 	D	Normal	Will eliminate electrical room cooling. Contractor to ventilate electrical room as required to maintain temperatures < 30°C.

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Item	Description of Work	D/N	Facility Operation	Notes
2.14	Remove all existing decommissioned cables from the existing cable tray. Take care not to damage other cables.	N	Shutdown	Remove old cables at night to reduce risk of unintended impact on station operation. Perform operational testing between 3:00 am and 5:00 am, prior to station restoration.
2.15	Install new tray cables fed from MCC-M1: <ul style="list-style-type: none"> • C-M661-1 • C-M662-1 	D	Normal	
2.16	Transition the following loads to MCC-M1 (including testing) <ul style="list-style-type: none"> • UH-M661 (was E11) • UH-M662 (was E12) 	D	Normal	Loads to be out of service < 8 hours each. Monitor Chlorine Storage Room temperature and provide temporary heating as required.

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3.3 Phase 3

Phase 3 involves the removal of the existing 4160:600V transformers and 600V switchgear, and the installation of the new 4160:600V transformers.

Item	Description of Work	D/N	Facility Operation	Notes
3.1	Shutdown <ul style="list-style-type: none"> Disconnect C-ATS-M3E-A from the LT1/LTG breakers in the 600V switchgear and connect to the 250A breaker in MCC-M1. Isolate transformer high temp alarms. Demolish existing transformer T1 and 600V switchgear and associated cabling Provide a temporary barrier for existing transformer T2 	N	Complete Shutdown	Contractor to provide temporary lighting.
3.2	<ul style="list-style-type: none"> Install XFMR-M1 and associated cabling. Install terminations on XFMR-M1 end of C-XFMR-M1. Set appropriate XFMR-M1 tap. Test XFMR-M1. 	D	Normal	
3.3	Shutdown <ul style="list-style-type: none"> Replace 50A E-rated fuses with 100A, E-rated in 4160 V switchgear Prepare C-XFMR-M1 SGR-M1 end terminations. Test C-XFMR-M1 Disconnect C-MCC-M1 from secondary of existing transformer T2 Install C-MCC-M1 to secondary of XFMR-M1 Test C-MCC-M1 Commission I/O to Station PLC. <ul style="list-style-type: none"> TSH-M911 	N	Complete Shutdown	Contractor to provide temporary lighting.
3.4	Demolish existing transformer T2 and associated existing cabling.	D	Normal	
3.5	Install XFMR-M2 and associated cabling. Install terminations on XFMR-M1 end of C-XFMR-M1. Set appropriate XFMR-M1 tap. Test XFMR-M1. Test C-XFMR-M2	D	Normal	

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Item	Description of Work	D/N	Facility Operation	Notes
3.6	Shutdown <ul style="list-style-type: none"> • Replace 50A E-rated fuses with 100A, E-rated in 4160 V switchgear • Prepare C-XFMR-M2 SGR-M1 end terminations. • Test C-XFMR-M2 Commission I/O to Station PLC. <ul style="list-style-type: none"> • TSH-M912 	N	Complete Shutdown	Contractor to provide temporary lighting.
3.7	In-fill floor openings below existing 600V switchgear and transformers.	D	Normal	

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3.4 Phase 4

Phase 4 of the construction sequence includes the installation of the new non-essential distribution panel, DP-M2, migration of loads from the existing Non-Essential MCC to DP-M2, demolition of the existing Non-Essential MCC, and installation of the power factor correction unit, PFC-M1. A new 600:120/208V transformer, XFMR-M10, and 120/208V panelboard, PNL-M10, will also be installed.

Item	Description of Work	D/N	Facility Operation	Special
4.1	Install new distribution panel, DP-M2.	D	Normal	
4.2	Install and test new cable C-DP-M2. Install cable to C-DP-M2.ESL-M914.	D	Normal	
4.3	Test <ul style="list-style-type: none"> • DP-M2 • DP-M2.PM • Test DP-M2.ESL-M914 Commission I/O to Station PLC. <ul style="list-style-type: none"> • ESL-M914 	D	Normal	
4.4	Install new DP-M2 load cables, with load end unterminated	D	Normal	
4.5	Transition Loads (Including testing) <ul style="list-style-type: none"> • MCC-R1 	D	Normal	The City will provide a 600V generator for powering the Reservoir Valve House (MCC-R1) while the feeder cable is being replaced.
4.6	Transition Loads (Including testing) <ul style="list-style-type: none"> • OD-M996 (was D1) • OD-M997 (was D2) • HCE-M605-1 (was E4) • HCE-M605-2 (was E5) • HCE-M616 (was E6) • UH-M658 (was E8) • UH-M659 (was E9) • UH-M663 (was E13) • XV-M042 (was SHV-2) • XV-M052 (was DHV-2) • XV-M053 (was DHV-3) 	D	Normal	Coordinate shutdown and duration of each load transition. Loads are not to be taken out of service simultaneously. Contractor to monitor facility room temperatures and provide temporary heating as required.
4.7	Transition load for HCE-M601 (was E2) Install, test and commission HCC-M601. Commission LCP-M608 control of HCC-M601.	D	Normal	Ensure transition during acceptable weather.

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Item	Description of Work	D/N	Facility Operation	Special
4.8	Transition Loads (Including testing) <ul style="list-style-type: none"> • XFMR-LPA 	N	Minimize Pumping	Coordinate shutdown and duration of each load transition. Contractor to provide temporary lighting.
4.9	Shutdown <ul style="list-style-type: none"> • Disconnect the cable between the tie breaker within MCC-M1 and the existing Non-Essential MCC from the existing Non-Essential MCC. • Install and test C-TIE-M1-M2 • Disconnect C-ATS-M3E-A from MCC-M1 • Install and test cable C-ATS-M3E-A into DP-M2 • Install and test new cable C-MCC-M3E-B from MCC-M1 to MCC-M3E backup input breaker 	N	Complete Shutdown	Contractor to provide temporary lighting as required.
4.10	Demolish existing Non-Essential MCC.	D	Normal	
4.11	Demolish existing decommissioned cables in the cable tray.	N	Minimize Pumping	Perform as night-time work to minimize shutdown risk. Perform operational testing between 3:00 am and 5:00 am, prior to station restoration.
4.12	In-fill floor openings below existing Non-Essential MCC.	D	Normal	
4.13	Install PFC-M1 Install and Test C-PFC-M1 Test PFC-M1.	D	Normal	
4.14	Install, connect, and test: <ul style="list-style-type: none"> • XFMR-M10 • PNL-M10 	D	Normal	
4.15	Fire-stop all penetrations.	D	Normal	

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4.0 SCHEDULE

The Contractor is responsible for developing the detailed schedule to meet the specified dates identified in the Bid Opportunity document. The following dates are provided as a guideline of key expectations to meet the City's requirements. These dates do not necessarily correspond to the Critical Stage and Substantial Performance Dates, which are "at-latest" deadlines.

Description of Work	Expected Completion
Phase 1	March 1, 2013
Phase 2	April 5, 2013
Phase 3	April 26, 2013
Phase 4	May 31, 2013

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5.0 RISK ANALYSIS

The purpose of this section is to identify potential risks associated with the work, along with contingency plans to mitigate the risks. The Contractor is required to take an active role in the identification of risks and take all reasonable measures to reduce the risk of unintended impact on station operation.

Emergency contact information is provided in Section 6.0. Should an emergency situation arise resulting in equipment damage and/or failure, or an unplanned station shutdown, please contact the Control Center immediately, followed by the Contract Administrator. Contacts within the City of Winnipeg are also provided.

Risk	Utility Power Failure
Contingency Plan	The two generators provide essential power during failures, and the UPS provides uninterruptible power for the controls.
Contractor's Requirements	Stop all work associated with, or near the essential power system. Restore any critical loads associated with the existing essential MCC or MCC-M3E.

Risk	Unintended Impact on Equipment
Contingency Plan	In the event of an unintended impact, call the Control Center immediately followed by the Contract Administrator. Work to restore normal operation on an emergency basis.
Contractor's Requirements	As per the Construction Work Plan, provide a Detailed Work Plan for review and approval prior to proceeding with the work. Do not initiate unapproved work. Take care to avoid impact on existing equipment.

Risk	Issue Identified during Testing
Contingency Plan	Coordinate with the Contract Administrator to provide lowest risk solution to the issue, while maintaining normal station operation.
Contractor's Requirements	Perform comprehensive testing, as identified in the Specifications. Correct any deficiencies to the satisfaction of the Contract Administrator.

Risk	Issue During Shutdown
Contingency Plan	Notify the Contract Administrator immediately. Coordinate to make a decision whether to move forward or reverse the work. City personnel will be on site for all shutdowns.
Contractor's Requirements	Coordinate and provide data to allow for preparation of a detailed Shutdown Procedure and Work Plan. Follow procedures for shutdowns. Always perform work in a manner such that work may be reversed in the event of an issue.

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6.0 EMERGENCY CONTACT INFORMATION:

Contract Administrator – SNC-Lavalin:

Name	Role	Office Phone #	Cell Phone #
Curtis Reimer	Contract Administrator	(204) 786-8080	(204) 795-3779
Brian Cleven	Electrical Designer	(204) 786-8080	(204) 930-4265

City of Winnipeg:

Name	Role	Office Phone #	Cell Phone #
Rob Carroll	Project Director	(204) 986-8409	(204) 226-2237
Rolly Fournier	Foreman Electrician	-	(204) 471-7858
Mark Hoepfner	Maintenance Supervisor	-	(204) 470-4798
Mike Szmon	Process Control Engineer	(204) 986-2108	(204) 232-9314
David Minor	Operations Engineer	(204) 986-2090	(204) 795-8479
Control Centre	Emergency Contact	(204) 986-4781	-