REPORT

Power to Ontario.
On Demand.

System Impact Assessment Report

Connection Assessment & Approval Process

Issue 1.0

Final Report

Project: Young Davidson Project CAA ID 2008-312
Applicant: Northgate Minerals Corporation

IESO Market Facilitation Department

Date: September 30, 2009

-Page intentionally left blank-

System Impact Assessment Report

Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IESO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IESO controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IESO should issue a notice of conditional approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Conditional approval of the proposed connection is based on information provided to the IESO by the connection applicant and Hydro One at the time the assessment was carried out. The IESO assumes no responsibility for the accuracy or completeness of such information, including the results of studies carried out by Hydro One at the request of the IESO. Furthermore, the conditional approval is subject to further consideration due to changes to this information, or to additional information that may become available after the conditional approval has been granted.

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed facility to the IESO controlled grid. However, the conditional approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant and the IESO in accordance with Chapter 4, section 6 of the Market Rules. The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this report to the connection applicant, the connection applicant must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to the connection applicant. Although the IESO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that the most recent version of this report is being used.

Hydro One

The results reported in this report are based on the information available to Hydro One, at the time of the study, suitable for a System Impact Assessment of this transmission system reinforcement proposal.

The short circuit and thermal loading levels have been computed based on the information available at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed facilities on load and generation customers.

In this report, short circuit adequacy is assessed only for Hydro One circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One circuit breakers and identifying upgrades required to incorporate the proposed facilities. These results should not be used in the design and engineering of any new or existing facilities. The necessary data will be provided by Hydro One and discussed with any connection Applicant upon request.

The ampacity ratings of Hydro One facilities are established based on assumptions used in Hydro One for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades which are required to incorporate the proposed facilities have been identified to the extent permitted by a System Impact Assessment under the current IESO Connection Assessment and Approval process. Additional facility studies may be necessary to confirm constructability and the time required for construction. Further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

Executive Summary

Description

This System Impact Assessment (SIA) examined the impact on the reliability of the *IESO Controlled Grid* of the proposed Young-Davidson load facility. The assessment relies on the technical studies conducted by AMEC Americas Limited (the Consultant), an external consulting company retained by the Northgate Minerals Corporation.

The proposed facility is a *connection project* required to provide connection of a new load to the transmission system.

Northgate Minerals Corporation (the Applicant) is proposing to construct a new substation, Young-Davidson Project (the Project), in the Northeastern region in the City of Matachewan area approximately 60 km west of Kirkland Lake. A decommissioned 47.5 km section of 115 kV circuit K4 will be upgraded from Macassa Shaft No.3 to Matachewan Junction, and another 7 km of new 115 kV line will be constructed to complete the electrical connection. The substation will supply power to the gold mine, which includes several large synchronous and induction motors. The Applicant has advised that the commissioning date is in December 2010, with an initial station peak load of 1.8 MW, and with an ultimate peak load of 17.3 MW in December 2012.

The Young-Davidson substation will comprise two 120-13.8 kV transformers operating in parallel, supplying two 13.8 kV buses. The Project will include a reactive power compensation system consisting of one 8 Mvar switchable shunt capacitor and three SVC units, each with a minimum continuous capability of -2 / + 5.3 Mvar, a minimum short term capability of 12 Mvar for 10 seconds, and maximum initial response time of 500 milliseconds.

The capacitor bank will be installed on the Young Davidson's high voltage bus and operated normally in service. One SVC unit will be installed on the high voltage bus and the remaining two SVC units will be installed on the two main low voltage buses at the station. All three units will be configured to control the high voltage bus to a setpoint of 118 kV.

Findings

This SIA finds that no network additions or modifications are required to satisfy IESO's reliability standards for the incorporation of the Project.

The following conclusions were made.

(1) The incorporation of the Project does not cause any thermal concerns for the transmission system.

(2) With the proposed reactive power compensation system, pre-contingency and post-contingency system voltages in the area will be within acceptable range.

(3) With the proposed reactive power compensation system, the steady state and dynamic voltage performance during the motor starting is acceptable with all elements in service, and under one element out of service scenario.

(4) With the proposed power compensation system, the system transient stability and voltage performance are acceptable following a normally cleared local line fault.

Notification of Conditional Approval

The proposed connection of the Project, subject to the requirements specified in this report, is expected to have no material adverse impact on the reliability of the integrated power system.

It is recommended that a *Notification of Conditional Approval for Connection* be issued for the Project, subject to implementation of the requirements described below under the heading "IESO Requirements".

IESO's Requirements

A. Northgate Minerals Corporation

Provided the proposed facilities are designed and constructed to satisfy the Market Rules requirements, including the requirements specified in this report, and provided the proposed facilities are connected as described in this report, the Project will be granted final approval via the IESO Market Entry process to connect to the IESO controlled grid and to participate in the IESO-administered market.

Final connection of this project may also be subject to additional requirements specified in the Hydro One's Customer Impact Assessment.

The IESO has the following requirements:

1. The Applicant is required to maintain a power factor within the range of 0.9 lagging and 0.9 leading as measured at defined metering point at the Project.
2. Starting of the large motors at the Project must be staggered in order to prevent excessive voltage sag.
3. The reactive power control philosophy must provide for maximizing the spare dynamic reactive power at the Project to be available for motor starting and system contingencies. The Applicant must provide the IESO with the proposed reactive power coordination settings at least seven months before first connection to the IESO controlled grid. The settings must be configurable and any change in settings will require IESO's approval.
4. The capacitor auto-closing settings must take into account the capacitor's minimum discharge time. The transmitter may impose additional restrictions on capacitor tripping and auto-closing settings.
5. In order to prevent excessive voltage sag at the connection point, the Applicant must ensure that sufficient load is automatically disconnected at the Project following a trip of the K4 circuit before the line is re-energized through automatic reclosure.
6. The high voltage connection equipment must be capable of continuously operating in the range between 113 kV and 132 kV (Appendix 4.1, Reference 2 of the Market Rules). More specifically, this means:
    - connection equipment must have a maximum continuous voltage rating of at least 132 kV,
    - connection equipment must be able to interrupt rated fault current for voltages up to the maximum continuous rating, and
    - the equipment must remain in service, and not automatically trip, for voltages up to 5% above the maximum continuous rating.

    If revenue metering equipment is being installed as part of this project, please be aware that revenue metering installations must comply with Chapter 6 of the IESO Market Rules for the Ontario electricity market. For more details the Applicant is encouraged to seek advice from their Metering Service Provider (MSP) or from the IESO metering group.

7. The Transmission System Code (TSC), Appendix 2 establishes maximum fault levels for the transmission system. For the 115 kV system, the maximum 3 phase symmetrical fault level is 50 kA and the single line to ground (SLG) symmetrical fault level is 50 kA, as well. The TSC

requires that new equipment be designed to sustain the fault levels in the area where the equipment is installed.

The proposed high voltage breakers are adequate for the anticipated fault levels. If any future system enhancement results in fault levels higher than the equipment's capability, the Applicant is required to replace the equipment at their own expense with higher rated equipment capable of sustaining the increased fault level, up to the TSC's maximum fault level of 50 kA for the 115 kV system.

8. Connection equipment must be designed so that the adverse effects of their failure on the IESO controlled grid are mitigated.

9. Connection equipment must be designed so that it will be fully operational in all reasonably foreseeable ambient temperature conditions.

10. Faults within the facility must not trip the 115 kV circuit K4 except for a failure of the Project 115 kV main circuit breaker. If tripping of K4 occurs due to events within Project's facilities, the Project may be required to disconnect from the IESO controlled grid until the problem is solved to the satisfaction of the IESO.

11. Protection systems must be designed to meet all the requirements of the TSC and any additional requirements identified by Hydro One. The Applicant is required to initiate an assessment of the protection systems with the transmitter who shall identify any modifications to protection equipment or settings required to incorporate the new facility. The IESO will evaluate the impact of any protection modifications and associated changes to functionality, timing, or reach on system reliability. The IESO will not assess aspects of protection systems which are solely the accountability of the connection applicant (e.g. coordination of relay protections).

    To allow sufficient time to assess the impact on power system reliability, the Applicant must submit any proposed protection changes to the IESO at least six (6) months before any actual changes are to be implemented on the existing protection systems.

    The design of protection and control facilities at the Project must not preclude the installation of protection and control facilities for load rejection should the participation of the Project in a load rejection scheme be required in the future.

12. The Applicant is required to have adequate provision in the design of facilities to allow future installation of under-frequency load shedding relays (UFSL). In the event that the UFLS area load is insufficient in meeting the UFLS targets, the IESO may require the Project to participate in the UFLS scheme for the Northeast area at a later time. In that case, the Applicant in conjunction with Hydro One shall make arrangements to ensure that at least 35% of the total area load is connected to UFLS relays to trip.

13. The Applicant is required to install all the equipment needed to monitor the information as described in Appendix 4.17 of the *Market Rules*. The performance monitoring standards will be as specified in Appendix 4.22 of the *Market Rules.* The IESO requires that the above data to be available to the IESO on a continuous basis. The data is to consist of certain equipment status and operating quantities which will be identified during the IESO Market Entry Process.

    As part of the IESO Facility Registration/Market Entry process, the connection applicant must also complete end to end testing of all necessary telemetry points with the IESO to ensure that standards are met and that sign conventions are understood. All found anomalies must be corrected before IESO final approval to connect any phase of the project is granted.

14. The Applicant must complete the IESO Market Entry/Facility Registration process in a timely manner before IESO final approval for connection is granted. Models and data, including any controls that would be operational, must be provided to the IESO. This information should be submitted at least seven months before first connection to the IESO controlled grid to allow the IESO to incorporate the facility into IESO work systems and to perform any additional reliability

studies. If the submitted models and data differ materially from the ones used in this assessment, then further analysis of the Project will need to be done by the IESO.

15. As part of the IESO Facility Registration/Market Entry process, the connection applicant must provide evidence to the IESO confirming that the equipment installed meets the Market Rules requirements and matches or exceeds the performance predicted in this assessment. This evidence shall be either type tests done in a controlled environment or commissioning tests done on-site. In either case, the testing must be done not only in accordance with widely recognized standards, but also to the satisfaction of the IESO. Until this evidence is provided and found acceptable to the IESO, the Facility Registration/Market Entry process will not be considered complete and the Applicant must accept any restrictions the IESO may impose upon this project's participation in the IESO administered market or connection to the IESO-controlled grid.

    The evidence must be supplied to the IESO within 30 days after completion of commissioning tests. Failure to provide evidence may result in disconnection from the IESO-controlled grid.

16. Final connection of this project may also be subject to additional requirements specified in the *Customer Impact Assessment (CIA)* performed by the *Transmitter* (Hydro One). The *CIA* will evaluate the impact of this proposed connection on the customers connected to the transmission system. Any additional requirements resulting from the CIA will be included in the final SIA report or in an Addendum to the Final SIA report.

B. Hydro One

The IESO has the following requirement:

1. To incorporate the Project, Hydro One has to revise the existing protections and the protection impact of the new connection. The functionality and fault clearing times of the K4 protection systems must not materially change without prior consent from the IESO.

Table of Contents

1. Project Description

The purpose of this System Impact Assessment (SIA) is to examine the effect of the proposed Young Davidson Project (the Project) on the reliability of the integrated power system. The assessment relies on the technical studies conducted by AMEC Americas Limited (the Consultant), an external consulting company retained by the Northgate Minerals Corporation.

The report also provides the Applicant a list of requirements to the proposal to ensure that the new facility, when connected, will not have a material adverse effect on the reliability of the integrated power system, and also points out significant Market Rules requirements for connected wholesale customers.

Northgate Minerals Corporation (the Applicant) is proposing to construct a new substation, Young-Davidson 115 - 13.8 kV, in the Northeastern region in the City of Matachewan area approximately 60 km west of Kirkland Lake. A decommissioned 47.5 km section of 115 kV circuit K4 will be upgraded from Macassa Shaft No.3 to Matachewan Junction, and another 7 km of new 115 kV line will be constructed to complete the electrical connection. The substation will supply power to the Young-Davison gold mine.

The power delivered via the new transmission line is stepped down at the site via two120 kV-13.8 kV 12/16/20 MVA ONAN/ONAF/ONAF transformers. The Project will consist of a total load of approximately 17 MW that will be supplied through two 13.8 kV busbars. The largest load in the Project is the AG Mill, a synchronous machine with a capacity up to 6,000 kW.

The Project will include a reactive power compensation system consisting of one 8 Mvar switchable shunt capacitor and three SVC units, each with a minimum continuous capability of -2 / + 5.3 Mvar, a minimum short term capability of 12 Mvar for 10 seconds, and maximum initial response time of 500 milliseconds.

The capacitor bank will be installed on the Young Davidson's high voltage bus and operated normally in service. One SVC unit will be installed on the high voltage bus and the remaining two SVC units will be installed on the two main low voltage buses at the station. All three units will be configured to control the high voltage bus to a setpoint of 118 kV.

Emergency power for the Project will be supplied by two 2.2 MW back-up generators on site. These generators will not be paralleled with the IESO grid.

The Applicant has advised that the commissioning date is in December 2010, with an initial station peak load of 1.8 MW, and with an ultimate peak load of 17.3 MW in December 2012.

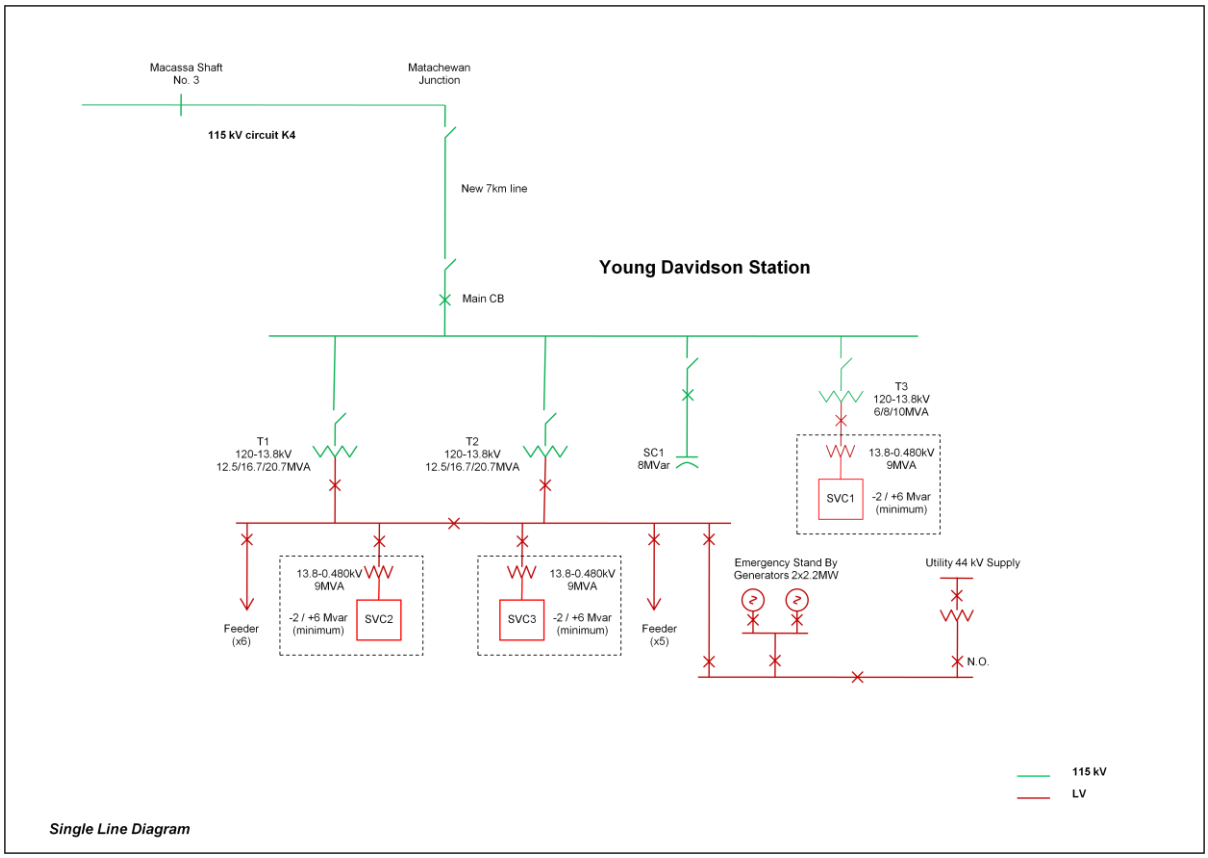
– End of Section –

2. Review of Connection Proposal

The simplified proposed connection arrangement of the Project is shown in Figure 1.

The proposed layout of the Project will not reduce the level of reliability of the integrated power system and is, therefore, acceptable to the IESO.

Figure 1



2.1 Connection Equipment

The connection equipment specifications are assessed based on information provided by Northgate Minerals.

Step-down Transformers T1 and T2 (load transformers)

Quantity	2
Thermal ratings	12.5 / 16.7 / 20.7 MVA
Rated voltage	120 kV / 13.8 kV
Impedance	6 %
Under-load tap changer (ULTC)	N/A
Transformer connections	D / yo (neutral grounded via 25A reactor)

Step-down Transformer T3 (SVC transformer)	
Quantity	1
Thermal ratings	6 / 8 / 10 MVA
Rated voltage	120 kV / 13.8 kV
Impedance	4 %
Under-load tap changer (ULTC)	N/A
Transformer connections	D / yo (neutral grounded)

115 kV Line Sections			
Nominal system voltage	115 kV		
Maximum continuous operating voltage	132 kV		
Continuous current rating	260 A		
R X B on 100 MVA and 118.5 kV base (pu/km)	0.003131	0.003249	0.0003559

115 kV Disconnect Switches	
Quantity	5
Maximum voltage rating	145 kV
Continuous current rating	1200 A
Short circuit current	38 kA

115 kV Circuit Breakers L and SC:	
Quantity	2
Voltage rating	145 kV
Continuous current rating	1200 A
Interrupting time rating	50 ms
Short circuit duty rating	31.5 kA

– End of Section –

3. General Requirements

Power Factor

The Market Rules require that the wholesale customers connected to the IESO controlled grid shall operate at a power factor within the range 90% lagging to 90% leading as measured at the defined meter point.

> The Applicant is required to maintain a power factor within the range of 0.9 lagging and 0.9 leading as measured at defined metering point at the Project.

Connection Equipment (Circuit breakers, Disconnects, Transformers, Buses)

> The high voltage connection equipment must be capable of continuously operating in the range between 113 kV and 132 kV (Appendix 4.1, Reference 2 of the Market Rules).

Some recognized contingencies (e.g. load shedding, open line end) can cause a temporary voltage increase above the maximum continuous voltage of 132 kV. For these conditions, connection equipment may be exposed to voltages slightly above the maximum continuous voltage for the short period of time.

> Therefore, the IESO also requires that the 115 kV connection equipment at Young Davidson have the following requirements:
>
> - connection equipment must have a maximum continuous voltage rating of at least 132 kV,
> - connection equipment must be able to interrupt rated fault current for voltages up to the maximum continuous rating, and
> - the equipment must remain in service, and not automatically trip, for voltages up to 5% above the maximum continuous rating.

If revenue metering equipment is being installed as part of this project, please be aware that revenue metering installations must comply with Chapter 6 of the IESO Market Rules for the Ontario electricity market. For more details the Applicant is encouraged to seek advice from their Metering Service Provider (MSP) or from the IESO metering group.

Transmission System Code (TSC), Appendix 2 establishes maximum fault levels for the transmission system. For the 115 kV system, the maximum 3 phase symmetrical fault level is 50 kA and the single line to ground (SLG) symmetrical fault level is 50 kA. The TSC requires that new equipment be designed to sustain the fault levels in the area where the equipment is installed. The TSC also requires that the 115 kV circuit breakers have a rated interrupting time of five cycles or less.

> The proposed high voltage breakers are adequate for the anticipated fault levels. If any future system enhancement results in fault levels higher than the equipment's capability, the Applicant is required to replace the equipment at their own expense with higher rated equipment capable of sustaining the increased fault level, up to the TSC's maximum fault level of 50 kA for the 115 kV system.

Connection equipment must be designed so that the adverse effects of their failure on the IESO controlled grid are mitigated.

Connection equipment must be designed so that it will be fully operational in all reasonably foreseeable ambient temperature conditions.

Protection and Control Systems

Faults within the facility must not trip the 115 kV circuit K4 except for a failure of the Project 115 kV main circuit breaker. After the facility connects, if tripping of K4 occurs due to events within Project's facility, the Project may be required to disconnect from the IESO controlled grid until the problem is solved to the satisfaction of the IESO.

Protection systems must be designed to meet all the requirements of the TSC and any additional requirements identified by Hydro One. The Applicant is required to initiate an assessment of the protection systems with the transmitter who shall identify any modifications to protection equipment or settings required to incorporate the new facility. The IESO will evaluate the impact of any protection modifications and associated changes to functionality, timing, or reach on system reliability. The IESO will not assess aspects of protection systems which are solely the accountability of the connection applicant (e.g. coordination of relay protections).

To allow sufficient time to assess the impact on power system reliability, the Applicant must submit any proposed protection changes to the IESO at least six (6) months before any actual changes are to be implemented on the existing protection systems. The design of protection and control facilities at the Project must not preclude the installation of protection and control facilities for load rejection should the participation of the Project in a load rejection scheme be required in the future.

Underfrequency Load Shedding

The Market Rules (Chapter 5, Section 10.4) require that each connected wholesale customer, in conjunction with the relevant transmitter, make arrangements to enable the automatic disconnection of up to 35% of its peak demand for conditions of system under-frequency. For the purposes of administrating this, the province is divided into five UFLS areas and the UFLS targets must be met for each of these areas. A detailed description of the UFLS requirements is given is Market Manual 7: System Operations, Part 7.4, Chapter 4, Section 4.5.

The Project will be part of the North East UFLS Area. Based on the latest UFLS evaluation, the North East UFLS Area meets the minimum UFLS requirements, with a 13% margin. Therefore, at this time there is no need to include Young Davidson in the UFLS program.

The *Applicant* is required to have adequate provision in the design of facilities to allow future installation of under-frequency load shedding relays (UFSL). In the event that the UFLS area load is insufficient in meeting the UFLS targets, the IESO may require the Project to participate in the UFLS scheme for the Northeast area at a later time. In that case, the Applicant in conjunction with Hydro One shall make arrangements to ensure that at least 35% of the total area load is connected to UFLS relays to trip.

IESO Monitoring and Telemetry Data

Appendix 4.17 and Appendix 4.22 of the Market Rules list the requirements with respect to the telemetry data that must be provided to the IESO and to the performance standards that must be achieved on a continual basis by all connected wholesale customers.

The Applicant is required to install all the equipment needed to monitor the information as described in Appendix 4.17 of the *Market Rules*. The performance monitoring standards will be as specified in Appendix 4.22 of the *Market Rules*. The IESO requires that the above data to be available to the IESO on a continuous basis. The data is to consist of certain equipment status and operating quantities which will be identified during the IESO Market Entry Process. As part of the IESO Facility Registration/Market Entry process, the connection applicant must also complete end to end testing of all necessary telemetry points with the IESO to ensure that standards are met and that sign conventions are understood. All found anomalies must be corrected before IESO final approval to connect any phase of the project is granted.

Models & Data

The Applicant must complete the IESO Market Entry/Facility Registration process in a timely manner before IESO final approval for connection is granted. Models and data, including any controls that would be operational, must be provided to the IESO. This information should be submitted at least seven months before first connection to the IESO controlled grid, to allow the IESO to incorporate the Project into IESO work systems and to perform any additional reliability studies.

If the submitted models and data differ materially from the ones used in this assessment, then further analysis of the Project will need to be done by the IESO.

As part of the IESO Facility Registration/Market Entry process, the connection applicant must provide evidence to the IESO confirming that the equipment installed meets the Market Rules requirements and matches or exceeds the performance predicted in this assessment. This evidence shall be either type tests done in a controlled environment or commissioning tests done on-site. In either case, the testing must be done not only in accordance with widely recognized standards, but also to the satisfaction of the IESO. Until this evidence is provided and found acceptable to the IESO, the Facility Registration/Market Entry process will not be considered complete and the Applicant must accept any restrictions the IESO may impose upon this project's participation in the IESO administered market or connection to the IESO-controlled grid.

The evidence must be supplied to the IESO within 30 days after completion of commissioning tests. Failure to provide evidence may result in disconnection from the IESO-controlled grid.

-End of Section-

4. System Impact Studies

The system impact studies have been carried out by the Consultant based on the scope of work defined by the IESO. The detailed report of the technical studies as produced by the Consultant is attached to this SIA report.

4.1 Methodology

The Consultant was required to perform a thorough investigation of Project's impact on the IESO controlled grid. Computation simulations included power flow, short circuit, and transient analyses under normal conditions, contingencies, and faults. If adverse impact on the transmission system was identified, some actions were to be proposed to mitigate the negative effects, including upgrading or installing new transmission facilities, installing static and dynamic reactive power facilities, or developing special protection schemes.

Sensitivity studies with up to one transmission element out-of-service were conducted.

4.1.1 Study Assumptions

The base assumptions were determined as per *Ontario Resource and Transmission Assessment Criteria*. This included the following:

- coincident peak load for the area was as forecast at Project's in-service date, and up to 10 years into the future, based on median growth forecast (normal weather);
- the power factor at the existing load facilities was assumed to be 0.9;
- the power factor at the planned facility was as per the Applicant's forecast;
- load was modelled as constant MVA for steady state thermal studies;
- load was modelled as voltage dependent for voltage change pre-ULTC action and transient performance;
- load was modelled as constant MVA for voltage change post-ULTC action;
- all existing transmission facilities were assumed in service;
- transmission ratings were as per owner's specifications (Hydro One);
- generation dispatch was based on the historical typical conditions.

4.1.2 Study Criteria

To assess the impact of the Project, technical criteria defined in the IESO's *Ontario Resource and Transmission Assessment Criteria* document were used.

4.1.3 Study Tools, Data & Models

The Siemens PSS/E software program was used to complete the load flow and dynamic response studies.

The IESO's Winter 2008-2009 base case was used as a starting point for the simulations.

The Project was modeled in PSS/E using data provided by the Applicant.

4.2 Short Circuit Assessment

In general, radial loads do not have a large impact on the system fault levels. However, because the Project includes large motors, a short-circuit impact evaluation has been conducted for this SIA.

The short-circuit assessment evaluated the maximum contribution to short-circuit current from the new connection into the ICG. The pre-contingency voltages were assumed to be at maximum levels. All Young –Davidson motors and local generation resources were assumed in-service.

Fault contribution was calculated for a three phase fault and for a line-to-ground fault in the transmission system, close to the connection point. Both symmetrical and asymmetrical values were determined.

The current contribution from the Young Davidson to a fault at Matachewan Junction, as calculated by the Consultant, is presented below.

Description	Symmetrical Current (A)	Asymmetrical Current (A)
Three-phase fault	554	648
Line-to-ground fault	523	823

The actual maximum fault levels in the vicinity of the Project, specifically at Kirkland Lake TS, were provided by Hydro One. The new Kirkland Lake SVC was assumed to be in service for this study.

Description	Symmetrical Current (A)	Asymmetrical Current (A)
Three-phase fault	6420	7134
Line-to-ground fault	7500	8711

The minimum fault interrupting capability at Kirkland Lake TS is 10.5 kA symmetrical, and 11.4 kA asymmetrical, and Hydro One has plans to upgrade the breakers to 20 kA interrupting capability in the near future.

It can be concluded that the fault levels will slightly increase with the addition of the Project, but will not exceed the interrupting capabilities of the circuit breakers in the vicinity of the Project.

4.3 Thermal Analysis

The thermal assessment evaluated the impact of the Project on the thermal ratings of the existing transmission facilities, and any system upgrades that may be required to allow the Project to be accommodated.

The results of the thermal analysis show that the connection of the Project does not result in equipment thermal overloading and no additional transmission reinforcements are required.

4.4 Steady State Voltage Analysis

The voltage analysis determined the effect of the Project on the existing transmission system and the voltage performance at the Project. The study assumed that the local generation is out of service and simulated a number of transmission elements contingencies.

With the proposed reactive power compensation system, the study results show that the pre-contingency and post-contingency voltage magnitudes, as well as the post-contingency voltage declines are within the acceptable ranges.

4.5 Steady State Motor Starting Analysis

This analysis determined the effect of starting the most critical motor at the Project on the existing transmission system. In addition to all elements in service and local generation out of service, motor starting was also analyzed under one transmission element out of service scenario.

The technical assessment shows that voltage declines during motor starting are within acceptable ranges.

Starting of the large motors at the Project must be staggered in order to prevent excessive voltage sag.

4.6 Transient Voltage Analysis

This analysis examined the dynamic performance of the system and determined the reactive power compensation required to be installed at the Project to provide adequate dynamic voltage control.

First set of simulations was the starting of the most critical motor at Young-Davidson site with up to one transmission element out of service, with no local generation in service. With the proposed reactive power compensation system at the Project, the transient voltage sag is within the TSC prescribed values.

A second set of simulations was a line to line-to-ground (LLG) fault with normal clearing time at Kirkland Lake TS such that D3K and NP Kirkland GS were lost by configuration. The results of the simulations demonstrate that the system's oscillations are well dumped and the system remains stable.

The reactive power control philosophy must provide for maximizing the spare dynamic reactive power at the Project to be available for motor starting and system contingencies. The Applicant must provide the IESO with the proposed reactive power coordination settings at least seven months before first connection to the IESO controlled grid. The settings must be configurable and any change in settings will require IESO's approval.

4.7 Additional System Analysis

The 115 kV circuit K4 has the automatic reclosure function enabled. The automatic reclosure reconnects the K4 line at Kirkland Lake TS at 10 seconds after the line is tripped by protections. If the trip is caused by a temporary fault, the line re-supplies the loads connected to the circuit.

If the load to be supplied immediately after the line reclosure is large, the voltage performance at the connection point may become unacceptable. This is in special true if large motors remain connected to the line and try to start up on the reconnection of the line.

In order to prevent excessive voltage sag at the connection point, the Applicant must ensure that sufficient load is automatically disconnect at the Project following a trip of the K4 circuit before the line is re-energized through automatic reclosure.

Typically, when shunt capacitors are removed from potential, they require a minimum discharging time before they can be re-energized. Additional restrictions may be imposed on the line auto-reclosure if the capacitor remains connected to the line when the line trips at Kirkland Lake TS.

The capacitor auto-closing settings must take into account the capacitor's minimum discharge time. The transmitter may impose additional restrictions on capacitor tripping and auto-closing settings.

-End of Section-

-End of Document-