HATCH™

Axio Power Canada Inc./
SunEdison Canada

Draft Construction Plan Report

For

Napanee TS Taylor Kidd
Solar Energy Project

H335467
Rev. D
August 26, 2011

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Project Report

August 26, 2011

Axio Power Canada Inc./SunEdison Canada - Napanee TS Taylor Kidd - Solar Energy Project

Draft Construction Plan Report

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1. Introduction

1.1 Project Description

Axio Power Canada Inc./SunEdison Canada ("Axio/SunEdison") is proposing to develop a 10-megawatt (MW) solar photovoltaic (PV) project titled Napanee TS Taylor Kidd Solar Energy Project (the "Project"). The Project Location[1] is situated on approximately 34 hectares (ha) of land on Part of Lots 27 and 28, Concession 1, Loyalist Township (lower tier municipality), County of Lennox and Addington (upper tier municipality).

The Project is proposed to be constructed on privately owned land that is currently undeveloped and predominately covered by woodland vegetation. The Project is located immediately north of Taylor Kidd Boulevard, approximately 5.4 km south of the Village of Odessa and 2.9 km west of the community of Amherstview.

The Project is a renewable energy generation facility which will use solar photovoltaic technology to generate electricity. Electricity generated by solar photovoltaic panels will be converted from direct current (DC) to alternating current (AC) by inverters and then stepped-up (via pad-mounted inverter transformers and a main substation transformer) to a voltage of 44 kV prior to being connected to the existing local distribution line. In order to meet Ontario Power Authority (OPA)'s Feed-In-Tariff (FIT) Program requirements, a specific percentage of equipment will be manufactured in Ontario.

The construction of the Project will begin once the Renewable Energy Approval (REA) has been obtained. The construction period is estimated to be approximately 8 months, with Project commissioning anticipated in October 2012. Operationally, the lifespan of the Project will be at least 20 years, which can be extended up to 30 years or more with proper maintenance, component replacement and repowering.

1.2 Renewable Energy Approval Legislative Requirements

Ontario Regulation (O. Reg.) 359/09 – *Renewable Energy Approvals Under Part V.0.1 of the Act*, (herein referred to as the REA Regulation), came into force on September 24, 2009 and identifies the Renewable Energy Approval (REA) requirements for renewable energy generation facilities in Ontario. The REA Regulation has since been amended by O. Reg. 521/10, which came in effect as of January 1, 2011. As per the REA Regulation (Part II, Section 4), ground mounted solar facilities with a name plate capacity greater than 12 kilowatts (kW) are classified as Class 3 solar facilities and require an REA.

Section 13 of the REA Regulation requires proponents of Class 3 solar facilities to complete a Construction Plan Report to identify:

- Details of any construction or installation activities.
- Location and timing of any construction or installation activities for the duration of the construction or installation.

[1] "Project Location means, when used in relation to a renewable energy project, a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project and any air space in which a person is engaging in or proposed to engage in the project" (O. Reg. 359/09, s. 1 (1)).

- Any negative environmental effects that may result from construction or installation activities within a 300-m radius of the activities.
- Mitigation measures in respect of any negative environmental effects identified.

A draft of the Construction Plan Report must be made available to the public, the local municipality and identified Aboriginal communities, at least 60 days prior to the final public consultation meeting in accordance with O. Reg. 359/09.

1.3 Purpose of Report

This Report serves several purposes. First, it details all anticipated activities during the Project construction phase so that all potential negative environmental effects may be identified and, second, it describes the actions that are anticipated to be taken to mitigate any potential significant negative environmental effects from the construction of the Project. Note, other separate reports have been prepared that describe the activities, potential negative environmental effects and mitigation for the design and operations, and decommissioning phases of the Project. Finally, the Report functions as a tool to communicate information about the construction activities to the public, agency, municipal and Aboriginal consultation groups.

Section 2 of the Report describes the Project development, construction and installation activities. The potential environmental effects and proposed mitigation measures are presented in Sections 3 and 4, respectively. Section 5 includes the environmental effects monitoring plan and Section 6 provides the references.

2. Construction Plan

2.1 Construction Overview

Major construction of the Project will begin once all applicable approvals and permits have been obtained. The construction phase includes site preparation activities such as vegetation removal and stripping, rough grading and excavations, road and drainage construction; the installation activities associated with the electrical equipment such as inverters and transformers, electrical cables, overhead power lines and electrical buildings; equipment testing and commissioning; and finally, the site restoration activities such as vegetation restoration, planting and reseeding of disturbed areas.

2.1.1 Site Plan and Project Drawings

Figure 2.1 provides a conceptualized depiction of the site plan and the proposed Project facilities that are discussed throughout this report. Figure 2.1 identifies the Project's property boundary (i.e., Project Site[2]), the Project Location, existing local roads, topographic contours, existing local electrical distribution line, land uses, cultural and natural features and waterbodies on and within 300 m of the Project Location. In addition, Figure 2.1 depicts the proposed facility components including the construction laydown areas, access roads, solar PV module arrays, inverter/transformer clusters, the substation yard and the connecting electrical line. Setback distances from identified significant natural features and waterbodies are also shown. For additional information regarding the design and operations of these components, please refer to the Design and Operations Report (Hatch, 2011c).

More detailed drawings of the Project facilities are provided in Appendix A and listed in Table 2.1.

Table 2.1 Project Drawing List

Drawing	Title	Information Depicted
G-001	Title Sheet	Project Location including existing land uses and roads.
ES-101	Existing Site Plan	Existing features including: topographic contours, Project Location boundaries, utilities, easements, roads, etc.
ES-102	Array Plan	Proposed facilities including: solar PV module layout, inverter locations, substation yard, construction laydown areas, site entrances, communications tower, interior roads, and perimeter
EP-701	Equipment Specifications	General equipment drawings and specification details for 500 kW inverter and inverter building enclosure.
EP-801	Single Line Diagram	Electrical wiring schematic.
S-101	Racking and Anchor Details	Solar PV module racking details, array spacing, foundation support and road subgrade construction details.
S-102	Racking and Anchor Options	Optional helical screw foundation support details.

[2] Project Site (upper case) refers to property boundary. Project Location includes the Project infrastructure footprint including lands temporarily required for construction such as vehicle parking and materials laydown. References to the 'site', 'construction site' are synonymous with Project Location in the context of this Report

2.1.2 Construction Schedule

The construction process of the Project consists of four phases:

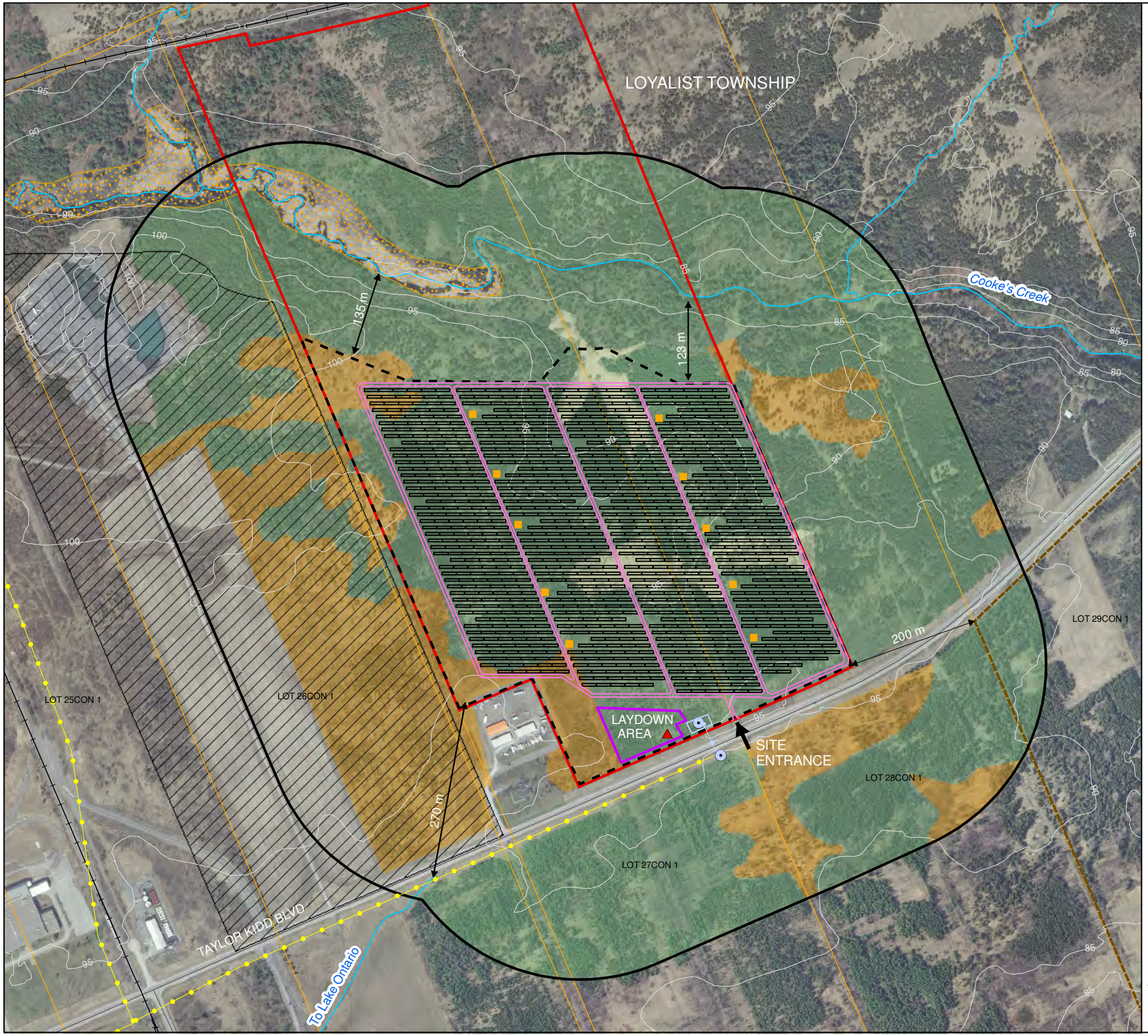
- Phase 1 – Site Preparation
- Phase 2 – Construction and Installation
- Phase 3 – Testing and Commissioning
- Phase 4 – Site Restoration

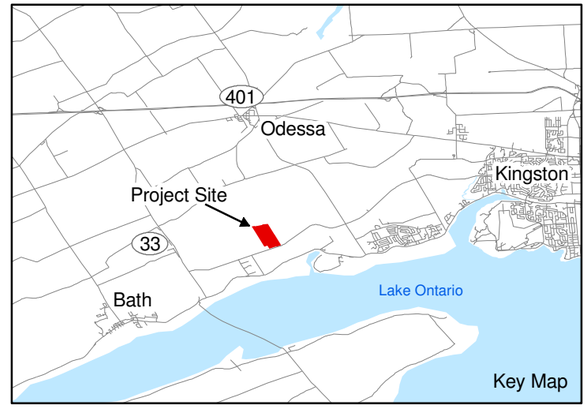
Table 2.2 lists the timeline and duration of the main construction activities.

The construction period is estimated to be approximately 8 months. The initial site preparation activities are anticipated to begin in early January 2012 and be completed by the end of March. Construction and installation activities are then anticipated to begin in April 2012 and continue to the end of September. Following testing and commissioning of the facilities, the Project is expected to achieve commercial operation by mid-October 2012.

Table 2.2 Project Timeline

Construction Phase and Activity	Approximate Timeline (2012)	Approximate Duration
Site Preparation		
Vegetation Removal and Site Clearing	January 1 – February 29	60 days
Site Entrance Road(s), Power & Communications	March 1 – March 15	15 days
Security Lighting & Entrance Fencing	March 15 – March 30	15 days
Laydown Area & Temporary Facilities	March 15 – March 30	15 days
Construction and Installation		
Foundation Construction	April 1 – May 15	45 days
Structural Support Installation	May 1 – June 15	45 days
Solar PV Modules Installation	June 15 – August 15	60 days
Electrical Collection System	August 1 – September 30	60 days
Testing and Commissioning		
Testing and Commissioning	September 1 – September 30	30 days
Site Restoration		
Landscaping and Vegetation	September 1 – September 30	30 days
In Service and Operating	October 10	





LEGEND

Existing Features

- Road
- Railway
- Transmission Line (new 44 kV by Hydro One)
- Topographic Contour (5 m interval)
- Watercourse
- Project Location
- Project Site
- 300 m from Project Location
- Parcel
- Authorized Aggregate Site
- Parrott's Bay Conservation Area

Significant Natural Features / Significant Wildlife Habitat (within 120 m of Project Location)

- Cultural Meadow / Significant Wildlife Habitat (Raptor Nesting / Milksnake)
- Cultural Thicket / Significant Wildlife Habitat (Raptor Nesting / Milksnake)
- Significant Wildlife Habitat (Amphibian Breeding / Waterfowl Nesting / Marsh Bird Breeding)
- Significant Woodland / Significant Wildlife Habitat (Area Sensitive Bird Breeding / Raptor Nesting / Milksnake)

Proposed Project Components

- Panel Layout
- Access Roads
- Fence
- Transmission Line
- Inverter
- Communication Tower
- Substation
- Connection Point
- Laydown Area

Notes:
1. OBM and NRVIS data downloaded from LIO with permission.
2. Spatial referencing UTM NAD 83.
3. Air Photos obtained from Cataraqui Region Conservation Authority, flown in 2008, scale 1:2000.
4. Significant natural features and wildlife habitat depicted within120 m of Project Location obtained from Ecological Services (2011c).

0 50 100 200 Metres

NORTH

Scale 1:6,000

Figure 2.1

Axio Power Canada Inc./SunEdison Canada

Napanee TS Taylor Kidd Site Layout Plan

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2.2 Construction Methodology

2.2.1 Safety Management

Safety is a primary objective for the Project. The goal is to maintain a safe working environment for workers and the public at all times. The Project will comply with all applicable Ontario Occupational Health and Safety Act (OHSA) requirements during the construction period.

The Contractor will prepare a site-specific health and safety plan and a safety and compliance officer will be assigned to the Project to implement and strictly enforce the plan. The Contractor will provide construction method statements and related Job Safety Assessments (JSA) for review by the Owner's Construction Manager, prior to commencement of work.

2.2.2 Workforce

The Project will employ a workforce recruited locally, to the greatest extent possible. The workforce will include construction supervision, general and skilled labour, equipment operators, technicians for electrical systems and commissioning, plant installation and operation, security and general maintenance. The construction workforce is estimated to be 50 workers on average for the 6-month construction period, with a peak of about 60 workers.

Construction hours will normally be from 7:00 a.m. to 6:00 p.m., Monday through Friday, in accordance with local municipal by-laws. Occasionally, when work may have to be continued after dusk and on the weekends, the Project will follow the local municipal requirements and minimize impacts to the local community.

2.2.3 Vehicle Access

The Project is situated about 7 km due south of Highway 401 and will be accessed from Taylor Kidd Boulevard via local municipal roads that include County Road 4 about 3.3 km west of the Project Location or County Road 6 about 2.7 km east of the Project Location. Based on the results of a traffic impact study (McIntosh Perry, 2011b), no adverse affects on local traffic are expected during construction.

A construction vehicle access plan will be prepared confirming the specific access route(s) to be used by construction vehicles, heavy equipment trailers (e.g., bulldozers, excavators) and the delivery of construction materials to and from the site. Any municipal 'half-load' requirements for roads will be confirmed through consultation with the municipality and any permits for overweight/oversized loads or vehicles will be obtained from the Ministry of Transportation (MTO). A single construction entrance into the Project Location will be established with proper signage. A flag person will direct the movement of large vehicles into and out of the site.

2.2.4 Temporary Facilities

Part of the Project Location will be used as a construction staging/laydown area (Figure 2.1). The laydown area will include construction offices, a first aid station, worker parking, truck loading and unloading facilities, and waste disposal/pick-up area. Portable construction trailers and other temporary facilities will be used for the offices and the first aid station. Portable, self-contained toilets and washing stations will be provided and maintained by the Contractor during the construction. The laydown area will be decommissioned and removed when construction is completed.

2.2.5 *Construction Materials*

Table 2.3 lists the principal construction materials and estimated quantities that will be transported to the Project Location for construction and installation. In addition, estimates of the number of vehicle loads required and where the material will be used and/or temporarily stored is provided.

Table 2.3 Construction Materials

Construction Material	Delivery Vehicle	Approx. No. of Vehicle Loads	Usage	On-site Storage	[1]Estimated Quantity
Solar PV Modules	Semi-Trailer	189	Solar photovoltaic modules	Laydown Area	45,320
Solar PV Module Racks	Semi-Trailer	30	Racking supports for PV modules	Laydown Area	1,030
Steel Support Piles	Semi-Trailer	15	Foundation supports for PV modules racks	Laydown Area	5,150
Inverters, Transformers and Enclosures	Semi-Trailer	12	Electricity inversion and voltage transformation and equipment weather protection	No	12
DC and AC Cables, and Conduits	Semi-Trailer	192	Electrical cabling and conduits	Laydown Area	736,000 m
DC Disconnects, Combiner Boxes and Connectors	Semi-Trailer	2	Electrical disconnect switches, wire combining and cabling connections	Laydown Area	Misc.
Concrete	Semi-Trailer	11	Precast foundations for inverter building enclosures (including transformers) and switchgear pad (including underground vault)	No	250 m^3
Granular A and B	Dump Trucks	606	Access roads, laydown area and substation yard	No	10,000 m^3
Topsoil (if required)	Dump Trucks	5	Site restoration of disturbed areas (assumed allowance)	No	60 m^3
	Total	**1,065**	[1]Quantities estimated by Blue Oak Engineering Canada.		

2.2.6 *Construction Equipment*

Table 2.4 lists the mechanized vehicles and equipment that are expected to be used in the construction of the Project. The operation of this equipment has the potential to generate noise and air emissions (exhaust) as well as potential dust emissions resulting from earth excavation, site grading and vehicle movements. These activities are not expected to result in significant negative effects to wildlife, nearby noise receptors or air quality as discussed in Sections 3.7, 3.8 and 3.9, respectively.

Construction vehicles and some types of mechanical equipment use a variety of petroleum based or synthetic chemicals including: fuel (diesel and gasoline) for engine combustion; lubricants (motor oils) for engine cooling and lubrication of mechanical parts; hydraulic fluids (mineral oil) for

hydraulic systems such as brakes, power steering, backhoes and excavators; and, coolants (methanol, glycol blends) used in vehicle radiators and windshield antifreeze. The potential effects of accidental spills or leakage of these fluids, along with mitigation measures to prevent and/or clean-up spills are discussed in Sections 3.18 and 4.15, respectively.

Table 2.4 Construction Equipment

Equipment	Power & Weight	Usage	Quantity
Track-Type Tractor (D8)	179 kW 37.6 T	Land Clearing and Grubbing; Spreading granular material for access road	2
Wheel Tractor-Scraper (615C)	198 kW 25.6 T	Excavating and moving topsoil	1
Hydraulic Excavator (325B)	125 kW 25.9 T	Excavating topsoil and placing backfill	1-2
Backhoe Loader (446B)	82 kW 8.9 T	Excavating topsoil and placing backfill	1
Wheel Loader (966F)	164 kW 20.5 T	Moving soil and granular material	1
Dump Truck (D25D)	194 kW 19.5 T	Transport and placement of granular for access road.	2-4
Motor Grader (14H)	160 kW 18.8 T	Grading of access road during construction (as necessary)	1
Drum Vibratory Compactor (CS-563C)	108 kW 10.9 T	Granular compaction for access road	1-2
Crawler Crane (LS-118)	267 kW 49.9 T	Pile driving or installation of screw piles	1
Pile Driving Equipment (B-6505 HD)	300 kJ 19.5 T	Mounted on the crawler crane, used for driving piles	4
Rough Terrain Crane (RT500C)	90 kW 23.4 T	Unloading and moving material and equipment	1
Telescopic Handler (TH83)	81 kW 10.0 T	Unloading and moving material and equipment	1-2
Concrete Transit Mixers (6-8 m^3 Capacity)	250 kW Loaded: 20-25 T	Transportation and placement of concrete mix for foundations	1-4
Container Box and Flatbed Semi-Trailers (12 - 17 m long)	Empty: 7-16 T Loaded: 40-70 T	Transportation of tracked machines (bulldozers, excavators), large electric equipment (inverters, transformers, building enclosures) and materials (precast concrete pads, solar PV modules and support racks)	1-2
Pick-up Trucks (F150 Super Crew)	300 hp 2.6 T	General transportation of small equipment, materials, and personnel	5
Diesel Generators, Air Compressors	175 kW	Power supply for electrical equipment (hand tools, etc)	3
Hand Tools - drills, saws, wrenches, concrete vibrators, welders		General construction and assembly activities	15+

Construction equipment will be transported to and from the Project Location using public roads. Tracked vehicles such as bulldozers, excavators and large pieces of electrical equipment (e.g., inverters, transformers and building enclosures) will be transported on flatbed trailers. Wheeled vehicles such as dump trucks, concrete mixers and tractor trailers will be driven directly to and from the site.

2.2.7 Fencing, Security Gate and Lighting

The perimeter of the Project Location will be fenced and the Project entrance from Taylor Kidd Boulevard will be gated. The fence will be galvanized steel chain link about 2.7 m high with barbed wire on top of the fence. Fence posts will typically be spaced every 2.5 m. During construction, the site will be monitored by the supervising construction staff. In addition, 24-hr on-site security will be utilized. For security and safety purposes, lights will be installed near the entrance to the facility and task-specific lights will be installed where required throughout the Project Location.

2.2.8 Fire Control Plan

The Project is very unlikely to be a source of fire, or a contributor to the spreading of an existing fire. However, there are some rare potential fire hazards due to electrical faults at the PV modules and ancillary equipment. The Contractor will prepare a fire control plan for the construction activities. This will include establishing procedures for specific types of possible fires, training staff accordingly, and keeping fire protection equipment on-site.

2.2.9 Drainage

The Project does not propose any major alteration to the existing surface drainage patterns for construction. Currently, the Project Location is predominately covered by woodland vegetation. The majority of the site drains northward by overland (sheet) flow, swales and ravine gullies towards Cooke's Creek (Figure 2.1). Based on the Water Body Site Investigation Report (ES, 2011a), there are no waterbodies (e.g., permanent or intermittent streams) on or within 120 m of the Project Location. The nearest water body is Cooke's Creek about 123 m north of the Project Location and an unnamed tributary to Lake Ontario about 270 m southwest of the Project Location. Cooke's Creek is under the jurisdiction of the Cataraqui Region Conservation Authority (CRCA).

2.2.10 Landscaping and Vegetation

To construct the Project, extensive tree and vegetation removal will be required across the Project Location. After installation of the Project facility components, all disturbed areas, with the exception of roads, the vehicle parking area and the substation yard, will be covered with a suitable, locally grown, low maintenance vegetation. This will aid in the prevention of soil erosion and the invasion of non-native plant species as well as present a natural appearance. Any temporary access roads built for construction purposes will be cleared, tilled, levelled and covered with vegetation.

2.2.11 Power and Communication

During construction, any electricity required for using heavy equipment such as welders and pumps will be provided from portable diesel generators supplied by the Contractor. A supply of electricity needed for construction offices, security lighting and other purposes will be obtained from the local electricity utility. Cellular phones and wireless connections will be used as means for communication, and therefore, telephone or internet cable line installation will not be necessary.

2.2.12 Water Usage

The Project will not require any surface water withdrawals or result in the installation of groundwater wells to supply water for construction. In order to meet the water demand during construction, the Contractor will have a temporary water storage facility on-site and bring the water from off-site sources using a tanker truck. The water will be used for construction, sanitary and dust control purposes.

2.2.13 Housekeeping and Waste Management

Construction wastes such as broken PV modules, electric wires, wood, scrap metal and material packaging as well as domestic waste such as food and sanitary waste will be managed and disposed of in accordance with local, provincial, and federal regulations. All waste material will be sorted and temporarily stored on-site in defined areas and within proper bins or containers as appropriate. The recyclable wastes will be returned safely to the recycle-centre for further processing and reuse. The Contractor will supply and maintain on-site portable self-contained toilets.

2.3 Construction Phases

2.3.1 Phase 1 - Site Preparation

Site preparation refers to all necessary activities prior to the construction of the support foundations and installation of the PV modules and electrical equipment. It includes surveying and staking, installation of sediment and erosion, construction of staging/laydown areas, site clearing and grubbing, surface grading and construction of access roads and drainage systems.

2.3.1.1 Site Survey and Staking

An Ontario land surveyor will provide a site survey, and will stake the exact location of the site perimeter for fencing, access road layout, and all foundations and substation. As part of this work, any buried utilities, infrastructure and their associated easements as well as any designated environmental features (e.g., waterbodies, woodlands, etc.) and their associated setbacks will be demarcated and protected by means of staking, flagging, fencing or signage to prevent any intrusion into these areas by construction vehicles.

2.3.1.2 Sediment and Erosion Controls

Prior to any vegetation removal, clearing and/or grading activities, sediment and erosion control measures (e.g., silt fence barriers and rock flow check dams) will be installed in accordance with the Sediment and Erosion Control Plan (McIntosh Perry, 2011a). Additional measures will be installed as required for specific Phase 2 construction activities, discussed in Section 2.3.2. All sediment and erosion control measures will remain in place throughout the construction period and will be routinely inspected and maintained by the Contractor.

2.3.1.3 Construction Staging / Laydown Area

Part of the Project Location will be graded and used as construction staging/laydown area as shown on Figure 2.1. Establishment of the laydown area will involve the removal of vegetation and the stripping and stockpiling of topsoil. A layer of granular material (possibly underlain by geogrid and/or geotextile) will be installed to provide an adequate base for construction vehicles, heavy equipment and material laydown. The laydown area will be decommissioned and all temporary facilities

removed when construction is completed, although portions of the area may be retained to provide vehicle parking for maintenance personnel and equipment storage.

2.3.1.4 Tree-Cutting and Vegetation Removal

To construct the Project, extensive tree and vegetation removal will be required across the Project Location, which includes red cedar forest, conifer plantation, young woodland and red cedar dominated thickets (ES, 2011d).

Tree cutting would be conducted using chainsaws. Stumps, roots and brush vegetation removed using an excavator or small bulldozer. During the clearing activities, merchantable timber, non-merchantable timber (e.g., firewood) and other cleared vegetation will be temporarily stockpiled adjacent to the access road(s). This material would be loaded on trucks and taken away by the buyer (i.e., merchantable timber), chipped for off-site composting or disposal, or used on-site as biodegradable erosion protection matting for exposed soil areas.

The Project will obtain all relevant tree-cutting permits as may be required by municipal by-laws passed under the Forestry Act (upper tier municipality) and/or the Municipal Act (lower tier municipality) as well as any other approvals that may be required by the Ministry of Natural Resources (MNR). Loyalist Township has enacted a tree-cutting by-law (2010-130) for which a tree inventory was prepared by a registered forester (retained by Axio/SunEdison) in preparation for permitting.

2.3.1.5 Excavations, Fill Placement and Surface Grading

The Project does not propose any major excavation works, fill placement or significant alteration of the existing landscape as determined by the preliminary site grading plans for the Project developed by McIntosh Perry (2011). As such, the primary excavation work will be limited to soil removal for building foundation construction (Section 2.3.2.1), access road construction (Section 2.3.1.6), and digging of trenches to run electrical cables (Section 2.3.2.5). The utilization of driven pipe piles to support the solar PV modules (Section 2.3.2.3) does not require soil excavation. No excavations, fill placement or grading activities will take place within 30 m of a watercourse since no waterbodies are present on or within 120 m of the Project Location. Sediment and erosion control measures will be implemented for areas with exposed soils to control soil erosion caused by wind or runoff.

Once completed, building foundation excavations and cable trenches will be backfilled and levelled to match the existing grade. Any excess subsoil will be used to infill low lying areas followed by general surface grading and redistribution of topsoil. Overall, the Project is not expected to result in any excess fill material. Following this, the entire Project Location, with the exception of new access roads, parking lots and the substation yard will be covered with low maintenance vegetation. Native plant species from local sources will be used if available.

2.3.1.6 Access Roads

A new site access road, about 5 m wide, will be constructed of asphalt from Taylor Kidd Boulevard into the Project Location to support construction activities and provide vehicle access into the site during the Project's operation (Figure 2.1). In addition, several smaller gravel roads, about 3.7 m wide each, will be constructed to allow transport of equipment and materials into interior areas of the Project Location to facilitate the installation of the foundations, supports and solar modules.

Following completion of the construction, the majority of these roads will remain as permanent roads to provide maintenance access during Project operation. Construction access roads that are not required will be removed and the areas restored by replacing the topsoil and seeding the area.

Road construction will involve vegetation clearing (if necessary) and topsoil removal prior to the placement of a granular base. Placement of soil maybe required to fill depressions in low lying areas followed by mechanical compaction to ensure a stable road bed. Geo-grid and geotextile fabric will be used where necessary. The roads will then be constructed with a granular 'B' base and a finished surface of granular 'A' material to a recommended total thickness of 350 mm (GENIVAR, 2011). The use of gravel will reduce water use for dust control during construction.

Culverts will be installed beneath the access roads at locations where conveyance of surface drainage is required. As part of the site drainage plan, parallel side ditches may be constructed along the access roads to collect and convey runoff. Design of roads, culverts, swales, and ditches will be in accordance with Ontario Provincial Standard Specifications (OPSS) and local municipal engineering guidelines. Sediment and erosion control measures (e.g., silt fence barriers, rock flow check dams) will be installed where required.

2.3.1.7 Surface Drainage

Preliminary site grading plans and a Conceptual Stormwater Management Report (McIntosh Perry, 2011a) have been prepared for the Project. The proposed site drainage is expected to consist of (i) overland runoff (i.e., sheet flow) on grassed and vegetated areas; (ii) existing and constructed shallow triangular shaped grassed swales 0.3 m to 0.5 m deep; and (iii) constructed ditches in the form of flat bottomed, trapezoid shaped, grassed swales 0.5 m to 1.0 m deep by 0.5 m to 1.0 m wide situated along the access roads and if required, around the perimeter of the site.

Construction of surface drainage features (e.g., grassed swales, ditches) would typically involve an a small bulldozer to remove topsoil and form the shape of the swale and a hydraulic excavator equipped with a bucket attachment to form the shape of any ditches, followed by hydro-seeding to establish a grassed lining to protect against erosion. Rip rap would be placed at locations in the ditches (e.g., culvert outfalls) to provide additional erosion protection.

Overall, major alteration to the existing surface drainage patterns is not expected as part of the Project's construction and operation.

2.3.2 Phase 2 - Construction and Installation

Construction and installation of the facility consists of constructing the substation transformer foundation, electrical building and inverter building foundations, installing structural supports for the solar PV module racks, installing the solar PV modules on the racks, installing electrical cabling, installing the inverters, transformers and associated electrical equipment and installing the electrical distribution line from the Project substation yard to the local distribution line.

2.3.2.1 Inverter Building and Electrical Equipment Foundations

Support foundations for the inverter buildings, pad-mounted transformers and the switching equipment will be precast or cast-in-place concrete pads. If precast concrete foundations are used they will be transported to the site by truck, unloaded and set into position by crane.

If cast-in-place concrete foundations are used, they will be constructed on-site by means of excavation and removal of in-situ material using a backhoe or excavator, placement of granular material using a front-end loader, formwork construction, installation of reinforcing steel (rebar), installation of electrical grounding grid, and pouring of concrete into the forms. Ready-mix concrete will be delivered to the Project Location by transit mixer truck from a local supplier. Foundations will require a minimum of 28 days to cure to allow for concrete to reach its specified compressive strength prior to erection of structural support and equipment installation. No wash station will be provided on-site for pressure washing concrete trucks and/or heavy construction equipment. All equipment will be cleaned off-site and is the responsibility of the Contractor.

Subject to the completion of the detailed design, it is expected that the Project will consist of:

- Ten 6.4 m by 4.0 m precast concrete pad foundations for the building enclosures that will house the inverters and pad-mounted transformers.
- A 9.0 m by 5.0 m precast concrete pad foundation for the substation electrical building.
- A 7.0 m by 7.0 m precast concrete pad foundation for the substation transformer pad.

Based on these quantities, the total amount of impervious area associated with concrete foundations will be approximately 350 m^2 corresponding to less than 0.10% of the 34 ha Project Location area.

2.3.2.2 *Solar PV Modules, Racks and Support Foundations*

The Project will have a total of approximately 45,000 solar PV modules, each 265 watts to 295 watts (W) and weighing about 23 kg, with approximate dimensions of 1980 mm long by 990 mm wide by 50 mm thick. The modules will be installed on a fixed tilt, ground mounted racking system comprised of a steel and/or aluminum lattice structure by on-site labourers. Each lattice structure will be assembled on-site and it will typically hold 44 individual PV modules. An estimated 1030 racks will be required for the Project.

The racking system will be supported by steel uprights mounted on either driven steel piles or steel helical screw piles, depending on the soil conditions within the Project Location. An estimated 5,000 piles will be installed within the Project Location. Based on an assumed pile diameter of 300 mm, the total area occupied by the piles will represent less than 0.10% of the 34 ha Project Location area.

Driven piles, if used, will be installed using mechanical, hydraulic or vibratory pile hammer equipment mounted on a specialized rig, excavator or boom truck. Screw piles would be installed using a similar rig, but a hydraulic drive motor would rotate the screw pile into the ground. The steel support piles will be driven or screwed to a design depth up to 3 m below grade to support the racking structure and PV modules. Compared to traditional cast-in-drilled-hole (CIDH) foundation methods, driven or screw piles do not require earth excavation, soil disposal or the use of concrete.

2.3.2.3 *Inverters and Pad-Mounted Transformers Installation*

The Project will have a total of twenty 500 kW AC inverters and ten intermediate 1 MVA pad-mounted transformers. The inverters will convert the DC power collected by the solar PV modules into AC power and this voltage will be stepped up by the pad-mounted transformers to a voltage of 27.6 kV. Each inverter/transformer cluster installation will consist of two 500 kW inverters and a

single 1 MVA pad-mounted transformer installed together in one of ten prefabricated structures. The inverters, transformers and prefabricated building enclosures will be trucked to the site and installed on either a precast or cast-in-place concrete pad by means of a crane.

2.3.2.4 Electrical Cable Installation

Electrical cabling, including DC cables from the solar PV modules to the inverters and AC cables from the inverters to the switch house yard, will be run underground in trenches. Trenches will typically be 1 m deep by 0.5 m wide and will be excavated using a 'ditch-witch' plough, backhoe or similar equipment. The cabling will be buried to a minimum depth of 915 mm and caution tape will be buried in the trench above the cables to warn of the presence of the underground cables. Once the cabling is laid, the trenches will be backfilled and levelled to match the existing grade. Where necessary, high density polyethylene (HDPE) conduits will be installed beneath road crossings and in areas of shallow bedrock (if present) to house and protect the cables.

2.3.2.5 Substation Yard, Transformer and Electrical Building

The substation yard will be located in the southwest corner of the Project Location (Figure 2.1) and will include a 10 MVA transformer and the electrical building. Construction will include excavation of topsoil, installation of ground grid, foundation construction, covering of surface area with crushed stone, and installation of electrical equipment, including a main transformer to step up the voltage to 44 kV. Switchgear and protection and control equipment will be housed in a prefabricated, weatherproof building. The electrical building will be trucked to the site and installed on either a precast or cast-in-place concrete pad. Any outdoor electrical cabinets, not housed in the electrical building, will be NEMA 4X rated weatherproof cabinets.

The electrical cabling from the inverters will be run underground to the substation yard, where the main transformer will step power up to the local distribution voltage of 44 kV. Power will then be run overhead from the substation yard and connect to the existing Hydro One Networks Inc. (HONI) 44 kV distribution line situated along Taylor Kidd Boulevard.

2.3.2.6 Electrical Distribution Line and Interconnection Point

Connecting to the existing HONI 44 kV distribution line along Taylor Kidd Boulevard will require about 60 m long overhead 44 kV transmission line be constructed between the Project substation yard and the point of interconnection (POI) with the HONI distribution line (Figure 2.1). The Proponent will construct the overhead distribution line from the substation yard to the Project property line in accordance with the Ontario Electrical Safety Code. HONI will construct the section of the line from the Proponent property line to the POI.

2.3.3 Phase 3 – Testing and Commissioning

Testing and commissioning will be performed on the installation prior to start up and connection to the power grid. The solar modules, inverters, transformers and electrical cables will be checked for system continuity, reliability and performance. If problems or issues are identified, remedial corrections will be made prior to start up.

2.3.4 Phase 4 – Site Restoration

Site restoration will occur during and following the final stages of the Project construction and installation activities. The main objective will be to stabilize and re-instate vegetation within all areas disturbed by the Project construction. Site restoration will include the removal of all construction material, equipment, temporary facilities and waste from the Project Location. Topsoil will be redistributed where required, followed by finished grading and landscaping to achieve proper drainage. Re-vegetation will include planting of native plants and hydro-seeding where required.

3. Environmental Effects

This section describes the potential negative environmental effects that could occur during the construction and installation activities associated with the Project. With the exception of transporting construction materials and the workforce to and from the Project Location, all construction and installation activities are expected to occur at the Project Location, however, potential environmental effects are considered within 300 m of the Project Location. Information on the existing baseline conditions of the natural heritage, water body and other features, and environmental impact studies (EIS) can be found in the following documents:

- Natural Heritage Assessment Records Review Report (Hatch, 2011a)
- Natural Heritage Assessment Site Investigation Report (ES, 2011b)
- Natural Heritage Assessment Evaluation of Significance Report (ES, 2011c)
- Natural Heritage Assessment Environmental Impact Study (ES, 2011d)
- Water Body Records Review Report (Hatch, 2011b)
- Water Body Site Investigations Report (ES, 2011a)
- Design and Operations Report (Hatch, 2011c)
- Decommissioning Plan Report (Hatch, 2011d)
- Nose Study Report (Hatch, 2011e)
- Stage 1 and 2 Archaeological Assessment Report (TAI, 2010)
- Geotechnical Investigation Report (GENIVAR, 2011)
- Conceptual Storm Water Management Report (McIntosh Perry, 2011a)
- Traffic Impact Study Report (McIntosh Perry, 2011b)
- Phase I Environmental Site Assessment (McIntosh Perry, 2011c)
- Proposed Groundwater Monitoring Scoping Report (McIntosh Perry, 2011d).

Potential environmental effects are addressed by resource below.

3.1 Topography

Based on the preliminary site grading plans for the Project (McIntosh Perry), no major earth excavation, filling or regrading works are required that would result in significant alteration to the existing topography. As part of the site preparation activities, some infilling of low lying areas is expected, followed by general surface grading and contouring where required. Soils will be excavated for the construction of foundations and trenches will be dug for the buried cables. In both cases, these excavations will then be backfilled and levelled to match the existing grade, resulting in no impacts to topography. There will be no impacts to topography for lands adjacent to the Project Location since no landform alterations will occur on adjacent lands.

3.2 Soils

A number of construction activities could potentially result in negative effects on soil, including vegetation removal, soil stripping, excavations for building foundations and cable trenches, site grading, construction of access roads and laydown areas, stockpiling of materials and heavy equipment uses. Accidental spills from some of these activities could also impact the soil. These activities could potentially result in negative effects, as discussed below, on soil quality, soil structure (due to over compaction) and loss of soils due to erosion.

- Stockpiling of excavated materials may result in the development of anaerobic conditions or mixing of topsoil and subsoils (if present), which could negatively affect the soil's productivity.
- The use of gravel or granular materials as a base for access roads could result in the mixing of these materials with underlying soils, potentially impacting soil structure and/or texture, infiltration of surface water, and vegetation growth.
- Excessive soil compaction could inhibit vegetation growth by impeding root penetration within the soil, reducing aeration, and altering moisture intake (i.e., decreased infiltration due to decreased pore space within the soil structure) (DeJong-Hughes et. al., 2001). Decreased water infiltration into the soil could also potentially result in an increase in surface runoff which could increase soil erosion.
- Vegetation removal, topsoil and subsoil stripping, and excavations have the potential to increase soil erosion due to exposure of soil to the effects of runoff or wind. In addition, major changes to the existing surface drainage patterns and addition of impervious services (roads, buildings, etc.) could result in increased soil erosion due to increased runoff.

Potential adverse effects on soils due to accidental spills are discussed in Section 3.18.

The cumulative effect would be some minor impacts to soil quality, soil structure and loss of soils from the Project Location, which could potentially affect the quality of the remaining soil and its ability to support vegetation growth. Mitigation measures to address these impacts are described in Section 4.2.

3.3 Groundwater

The Geotechnical Investigation Report (GENIVAR, 2011) determined that the Project Location is underlain by limestone bedrock covered by a 0.1 m to 0.2 m thick layer of overburden comprised of topsoil or clayey silt to silty clay material. Bedrock was encountered a depths ranging from 0.1 m to 2.1 m below the ground surface within 6 investigatory boreholes and 14 of 15 test pits (GENIVAR, 2011). Groundwater seepage into the test pits was encountered in 9 of the 14 test pits. The other 5 test pits were dry upon completion. Based on the expected excavation depths, significant excavation dewatering is not anticipated. However, if required, dewatering should be controllable with sumps and filtered pumps within the excavations (GENIVAR, 2011).

Based on the information presented in the geotechnical report (GENIVAR, 2011), no significant negative effects to the local groundwater regime or the availability of groundwater are expected as no significant changes to groundwater conditions are expected. A groundwater monitoring scoping study by McIntosh Perry (2011d) also concluded that no negative effects to the local groundwater are expected. The use of driven steel piles or augered steel piles anchored into bedrock will not require

soil excavation since the piles will be hammered, vibrated or screwed into the ground (Section 2.3.2.2). As such, dewatering of excavations will not be required for the support foundations and therefore no significant effects to groundwater conditions are expected.

The excavations for the concrete slab foundations for the inverter and transformer buildings (Section 2.3.2.1) and the electrical cable trenches (Section 2.3.2.5) will be relatively shallow (less than 1.0 m deep). Given the small size of these excavations and the limited time they will be open (< 2 weeks), no significant impacts (if any) on groundwater conditions are expected. As noted in the geotechnical report, some possible minimal and localized groundwater dewatering may be required to provide dry working conditions. Pumping of highly turbid surface water entering an excavation during construction (i.e., if required following a heavy rainfall) directly to a receiving watercourse could potentially impact surface water quality.

Impairment of groundwater quality due to accidental spills during construction is considered a remote possibility and is discussed further in Section 3.18.

Soil compaction could also impact groundwater recharge by reducing water infiltration.

Overall, the above noted potential effects to groundwater conditions are expected to be temporary in duration, minor in magnitude and localized within the Project Location. Mitigation measures to address these impacts are described in Section 4.3.

3.4 Surface Water

No direct impacts to surface water body features are expected during construction since there are no waterbodies (e.g., permanent or intermittent streams) on or within 120 m of the Project Location. The nearest water body is Cooke's Creek about 123 m north of the Project Location.

No significant negative effects to the surface water runoff regime within the Project Location and/or off-site are expected during the construction and installation phase (McIntosh Perry, 2011a). Some minor increase in the rate and/or volume of runoff may occur from the removal of vegetation (i.e., decreased rainfall interception by vegetation), soil compaction (i.e., decreased storage of rainfall in soil surface depressions) and the addition of impervious surfaces (e.g., inverter buildings) and less pervious areas (e.g., gravel access roads) that would decrease the amount of rainfall infiltration into the soil. Further, alterations to some of the existing surface drainage patterns and construction of new drainage swales and channels is expected to result in some alteration of drainage conditions within the Project Location. Overall, these effects are considered minor and decreasing in effect as disturbed areas within the Project become stabilized with vegetation following the completion of construction. Mitigation measures to address these impacts are described in Section 4.4.

Indirect impacts to surface water quality in receiving watercourses (e.g., Cooke's Creek) could potentially occur as a result of changes to the surface water runoff regime (discussed above), erosion and runoff of sediment during construction activities (Section 3.2), pumping of turbid groundwater from excavations (Section 3.3) or accidental spills (Section 3.18). Mitigation measures to address these impacts are described in Sections 4.2, 4.3, 4.4 and 4.15.

3.5 Aquatic Habitat and Biota

Construction of the Project will not have any direct adverse effects on aquatic habitat and/or biota (e.g., fish and benthic invertebrates) since there are no waterbodies on or within 120 m of the Project Location. The nearest water body is Cooke's Creek about 123 m north of the Project Location.

Indirect impacts to aquatic habitat and/or biota in Cooke's Creek north of the Project Location could potentially occur as a result of changes in surface water quality (Section 3.4), sedimentation due to wind or water erosion of adjacent soils if exposed during construction (Section 3.2) or accidental spills (Section 3.18). Mitigation measures to address these impacts are described in Sections 4.2, 4.4, 4.5 and 4.15.

3.6 Vegetation

To construct the Project, removal of forested woodland will be required across the Project Location, which includes red cedar forest, conifer plantation, young woodland and red cedar dominated thickets, but not mature native mixed forest (ES, 2011c). These communities are part of a larger woodland of 218 ha that has been identified as significant by the municipality. The effects of this vegetation removal are summarized below and discussed in the Natural Heritage Assessment Environmental Impact Study Report (ES, 2011d).

Project construction will require the removal of approximately 28 ha of woodland from within the Project Location (Figure 2.1). The woodlands on and within 120 m of the Project location were assessed as significant based on considerations of size, diversity and potential corridor/linkage functions (ES, 2011c). In addition, the woodlands provide significant wildlife habitat for woodland raptor nesting, area-sensitive bird breeding and foraging habitat for milksnake (ES, 2011c). The effects of the removal of this vegetation were assessed in the Natural Heritage Assessment Environmental Impact Study (ES, 2011d) and found to be not significantly adverse given the vegetation removal represents only a 13% reduction to woodland size and a 3% reduction to interior woodland size. Further, this vegetation removal will not change the significance of the woodland feature in terms of size, interior forest habitat, forest edge effects and fragmentation (ES, 2011d). Potential effects to wildlife habitat are discussed in Section 3.7.

The removal of forest and vegetative cover from within the Project Location will temporarily expose soils within areas of the Project Location, which could result in adverse impacts related to soil erosion (Section 3.2) and surface water runoff (Section 3.4). Remaining, on-site vegetation could be impacted as a result of soil compaction caused by heavy equipment or stockpiling of materials (Section 3.2) or as a result of accidental spills, which is discussed in Section 3.18.

Vegetation communities in the vicinity of the Project Location such as the woodlands north, east and south of the Project Location may be indirectly affected by dust deposition on leaf surfaces generated from construction activities (e.g., vehicle travel on construction roads), possibly resulting in minor impairment of growth, but no significant long-term impact.

Overall, the Project will result in some negative effects associated with vegetation removal (e.g., reduction in woodland size and interior forest habitat that provides significant wildlife habitat for area-sensitive species. Other identified effects to the vegetation communities located adjacent to the Project Location, including indirect effects will be limited in extent and will result in only short-term

minor impacts (ES, 2011d). Mitigation measures to address these impacts are described in Section 4.6.

3.7 Wildlife

Impacts to wildlife could occur as a result of loss of habitat resulting from vegetation removal, barriers to wildlife movement, disturbance from construction activities, or incidental mortality as a result of collision with construction vehicles. These effects are summarized below and discussed in detail in the Natural Heritage Assessment Environmental Impact Study Report (ES, 2011d).

The removal of 28 ha of woodland vegetation from the Project Location will result in the loss of 2.0 ha (3%) of woodland interior habitat of the 66 ha of interior woodland habitat contained within the larger 218 ha woodland. The woodland is considered significant wildlife habitat for woodland raptor nesting, area-sensitive bird breeding and foraging habitat for milksnake (ES, 2011c). The effects that the removal of this vegetation will have on wildlife were assessed in the EIS (ES, 2011d) and found to be not significantly adverse as large areas of interior habitat will still remain accessible to species that may have previously used the Project Location for breeding and foraging purposes. Also, this loss of vegetation is not considered to represent a significant loss of woodland function or a significant impact to local wildlife populations (ES, 2011d).

The installation of fencing along the perimeter of the Project Location may trap small wildlife within the Project Location and will restrict wildlife movement of larger mammals across the Project Location. It is expected that larger wildlife will be driven from the Project Location during the site clearing activities and are unlikely to be trapped by the Project fence. Small mammals, birds, and some species of amphibians and reptiles known in the area will still be able to use the Project Location during operation (ES, 2011d). The fence is not expected to adversely affect wildlife movement around the Project Location given the amount of natural areas surrounding the Project Location (ES, 2011d).

There will be no direct impacts to the significant wildlife habitats associated with the woodlands that surround the Project Location since the Project will not encroach within these woodlands. Potential indirect effects are expected to be primarily associated with disturbance due to noise from construction activities.

The presence of the construction workforce and operation of construction machinery on-site will result in temporary avoidance of the Project Location by species intolerant of these types of disturbances and could possibly disturb wildlife within the significant woodlands that are adjacent to the Project Location. This effect will result in a short-term, temporary reduction in wildlife abundance in the immediate vicinity of the Project (ES, 2011d).

The movement of construction machinery across the Project Location has the potential for collision and incidental take of wildlife species. Machinery operating on-site will be travelling at low speeds, and therefore the potential for incidental take is considered low, and likely restricted to small mammals and reptiles/amphibians that may be unable to move away from oncoming machinery. (ES, 2011d)

Overall, the EIS determined that there are some negative effects associated with the loss of the woodland that provides habitat for woodland raptor nesting, area-sensitive breeding bird species and

milksnake (ES, 2011d). Other identified effects to wildlife, including indirect effects will be limited in extent and will result in only short-term minor impacts to wildlife communities on and in the vicinity of the Project Location (ES, 2011d). Mitigation measures to address these impacts are described in Section 4.7.

3.7.1 Species at Risk

Species at Risk are discussed within a separate Approval and Permitting Requirements Document (APRD).

3.8 Air Quality

Air quality within and adjacent to the Project Location could be negatively affected by construction activities that result in dust generation and/or exhaust emissions from vehicles and equipment.

Dust may become airborne from soil moving activities (e.g., earth excavation, site grading) or vehicle movements within the Project Location. Dust in the air can have a range of potential negative effects including, but not limited to:

- impacts on human health as a result of irritation to lungs, eyes, etc., which could impact construction workers or nearby residents
- impacts on surface water quality and aquatic habitat if the dust is deposited into a water body on or adjacent to the Project Location (these effects are considered unlikely given the 170 m distance that the nearest watercourse is from the Project Location)
- impacts on vegetation if heavy dust loads build up on photosynthetic surfaces, thereby resulting in mortality of the plants.

Portable generators and a variety of construction, haulage and personnel vehicles will be used on-site during the construction period. The use of this equipment will result in exhaust emissions such as carbon monoxide, nitrogen oxides and sulphur oxides. These emissions could result in some minor decrease in air quality in the immediate vicinity of the operating equipment. However, this potential effect will be temporary as emissions will dissipate following the equipment shutdown or its movement out of the affected area.

Overall, these effects are limited in extent, temporary in nature and will result in only short term minor impacts on local air quality. Mitigation measures to address these impacts are described in Section 4.8.

3.9 Noise

Construction and installation activities have the potential to result in increased noise levels on and within the vicinity of the Project Location. Examples include noise emissions from bulldozers, earth excavators and pile driving equipment. Noise emanating from the Project Location could disturb nearby residents and local wildlife.

Overall, these effects are temporary in nature and will result in only short term minor impacts on local noise levels. Mitigation measures to address these impacts are described in Section 4.9.

3.10 Traffic

A Traffic Impact Study (McIntosh Perry, 2011b) was prepared, which assessed the potential traffic-related impacts on locals roads during construction, operation and decommissioning of the Project. The study concluded that the Project will have a negligible impact (i.e., delays to local community traffic flow) to the surrounding road network given the low anticipated number of vehicle trips generated by the Project, as well as the low existing traffic volumes. Mitigation measures to improve traffic-related safety conditions at the site entrance during Project construction are described in Section 4.10.

3.11 Municipal Roadways

The use of municipal roadways by heavy construction vehicle traffic may result in some minor roadway damage during the construction of the Project (McIntosh Perry, 2011b). The magnitude of this potential negative effect will correspond directly with the proximity to the Project Location. Most damage would be expected to roads which are highly travelled by construction traffic, especially in the vicinity of the construction vehicle entrance to the Project Location on Taylor Kidd Boulevard. Mitigation measures to address these impacts are described in Section 4.11.

3.12 Public and Construction Site Safety

Construction of the Project poses a potential risk to public and construction worker personnel safety and injury on and within the vicinity of the Project Location. Potential impacts include accidental injury to workers from construction equipment or activities and to the public if trespassing on the site. Mitigation measures to address these impacts are described in Section 4.12.

3.13 Waste Management

Construction activities will result in the generation of recyclable material, as well as construction and sanitary waste. Generation of such material will occur within the Project Location, and wastes and recyclables will be transported to the nearest approved facility for disposal or recycling. Mitigation measures to address these impacts are described in Section 4.13.

3.14 Land Use

Lands within the Project Location will be removed from their current woodland condition upon Project construction. Since these lands can be returned to woodland vegetation following decommissioning of the Project, this potential negative effect is considered to be negligible and reversible.

3.15 Protected Properties

No protected properties (e.g., property designated under the *Ontario Heritage Act*), as defined in the Table in Section 19(1) of O. Reg. 359/09, exist in the vicinity of the Project Location. Therefore, no adverse effects on protected properties will occur.

3.16 Built Heritage and Cultural Heritage Landscapes

Completion of the Ministry of Tourism and Culture (MTC) – *Check Sheet for Environmental Assessments: Screening for Impacts to Built Heritage and Cultural Heritage Landscapes* has determined that a heritage impact assessment for the Project is not required as no negative effects to

built heritage or cultural heritage landscapes are anticipated since these features were not identified within the Project Location.

3.17 Archaeological Resources

A Stage 1 and 2 Archaeological Assessment was conducted for the Project Location (TAI, 2010). No archaeological resources were identified and no further assessment is recommended by the Archaeologist. Therefore, no negative effect to archaeological resources is anticipated.

However, following a standard archaeological assessment there still remains a potential to uncover deeply buried heritage or archaeological resources (including human burial sites) which would not have previously been identified. In this instance, the MTC has specified mitigation that must be undertaken in the event of discovery of human remains or other archaeologically or culturally significant material. These mitigation measures are discussed in Section 4.14.

3.18 Accidental Spills

Spills of petroleum hydrocarbon materials from vehicles and power equipment operating on-site or spills of concrete materials from concrete trucks could occur during the construction process. Spills may occur as a result of leakage from vehicles and equipment, malfunction, leakage from storage areas, improper handling techniques, and/or improper refuelling techniques. Spills of these materials could result in the following negative effects:

- Impairment of soils, surface water and groundwater with materials inhospitable to the promotion of biological life.
- Uptake/ingestion by, or coating of, vegetation species or terrestrial and aquatic biota resulting in senescence or individual mortality.

The extent of these effects is highly dependent on the magnitude and location of the spills (i.e., larger spills or those in proximity to watercourses or areas of sensitive terrestrial or aquatic habitats are anticipated to potentially have greater effects). The effectiveness of the spill response has a strong bearing on the scale of potential impact. Spill prevention and response measures are discussed in Section 4.15.

4. Proposed Mitigation Measures

The following sections describe the proposed mitigation measures to prevent or minimize the potential negative environmental effects discussed in Section 3. Three types of mitigation measures were included and documented where applicable:

1. Modifying the types of construction activities
2. Installing treatment technologies (e.g., erosion and sedimentation control measures)
3. Changing the schedule.

4.1 Topography

As identified in Section 3.1, the preliminary site grading plan has been prepared with the objective of minimizing changes to the local topography. As a result, construction will not result in any significant alteration to the existing topography within the Project Location and there will be no impacts to topography for lands adjacent to the Project Location. As such, no specialized mitigation measures are identified for topography.

4.2 Soils

As identified in Section 3.2, soils within the Project Location may be negatively affected as a result of construction and installation activities. Potential negative effects were documented with respect to soil structure (e.g., over compaction), soil displacement, soil quality and sedimentation/erosion processes. Mitigation measures to prevent or minimize these effects are discussed below.

In order to assess if excessive soil compaction has occurred as a result of construction activities, disturbed areas will be visually monitored for evidence of rutting or flattened areas beneath stockpiles. Restoration efforts (e.g., mechanical discing or other soil loosening methods) will be undertaken as required to prevent significant long-term impacts due to excessive amounts of compaction.

In order to prevent mixing of topsoil and subsoils, these materials will be stored separately if excavation and stockpiling is necessary. The depth of topsoil stockpiles is to be limited to the greatest extent possible, with depths preferably restricted to <1 m. Stockpiling to depths >1 m may result in adverse effects on the health of the soils at the base of the stockpile by promoting the generation of anaerobic conditions (Harris and Birch, 1989; cited in Strohmayer, 1999). In addition, following the stripping of the topsoil and prior to the deposition of the gravel base along access roads, laydown and parking areas, a layer of geotextile fabric may be placed over the entire area to prevent mixing of gravel with the native subsoils.

A Sediment and Erosion Control Plan has been prepared for the Project (McIntosh Perry, 2011b), which identifies sediment and erosion control measures such as silt fence barriers, straw bale flow checks, rock flow check dams and rip rap protection at culvert outlets. These mitigation measures will be installed in accordance with Ontario Provincial Standard Specifications to prevent soil erosion from occurring and to ensure that receiving watercourses are protected from erosion and sedimentation.

The main mitigation measures and components of the Sediment and Erosion Control Plan include:

- Sediment and erosion control measures will be installed throughout the Project Location in areas subject to disturbance (e.g., vegetation removal, excavations, stockpiles) to minimize the potential for erosion, and in the vicinity of drainage features where there is the potential for off-site sediment transport in order to trap and retain sediment on-site.
- All necessary sediment and erosion control measures will be in place prior to the start of any earthworks and will remain in place until the disturbed areas are stabilized.
- An adequate supply of erosion (e.g., geotextiles, revegetation materials) and sedimentation (e.g., silt fences) control devices is to be provided on-site to control erosion and sedimentation and respond to unexpected events.
- The limits of the disturbed areas at the construction site will be minimized by demarcating the work area (e.g., flagging, fencing) to ensure that the Contractor does not work beyond the identified boundaries.
- Construction activities will be scheduled to minimize the duration that soils are exposed and exposed slopes and disturbed areas will be stabilized and re-vegetated as soon as possible after the work is completed.
- Sediment and erosion control measures (e.g., silt fence barriers, rock flow check dams) will be installed and maintained throughout construction in accordance with *OPSS 577 – Temporary Erosion and Sediment Control Measures*.
- Sediment control measures (e.g., filter bags) will be used during any dewatering of excavations in accordance with *OPSS 518 – Control of Water from Dewatering Operations*.
- Stockpiles will have appropriate barrier/covers to prevent wind erosion, as necessary.

With the implementation of the above noted mitigation measures, resulting effects on soils will be minor, temporary and localized to the Project Location.

4.3 Groundwater

As discussed in Section 3.3, no significant negative effects to the local groundwater regime are expected as a result of Project construction.

Should dewatering be required, groundwater will be pumped out of the excavated area and directed towards a minimum 15 m vegetative buffer strip for filtering prior to its discharge into any watercourse or surface drains that could be hydraulically connected to a watercourse. If necessary, a portable filter bag or a constructed temporary settling pond (designed to meet MOE water quality discharge criteria for total suspended solids) will be used to provide additional filtering.

Construction of the Project is not expected to have any effect on local well water quality (Section 3.3). As a precautionary measure, a groundwater monitoring plan has been prepared (McIntosh Perry, 2011d). While preparing the plan, the Kingston Regional Office of the MOE was consulted. The plan will involve testing the water quality of a select number of domestic wells located in close proximity to the Project Location. Monitoring wells may also be installed on the

Project Location. Sampling will be conducted prior to construction to establish a baseline reference and then again, during and following construction, to enable an assessment of any potential changes.

The findings will be reported to the MOE and to any individual well owners who participate in the well water sampling. Further details on the proposed water monitoring plan are provided in the McIntosh Perry report (2011d).

Rehabilitation of significant areas of soil compaction following construction (as discussed in Section 4.2) will ensure that soil compaction around the site is limited with no significant adverse effects on water infiltration, and hence groundwater recharge, is anticipated to occur.

Section 4.15 details the mitigation measures that will prevent or minimize the potential effects of accidental spills during construction.

4.4 Surface Water

As discussed in Section 3.4, some minor increase in the rate and/or volume of runoff may occur from the removal of vegetation, soil compaction, and the addition of impervious surfaces associated with construction and installation of the Project (McIntosh Perry, 2011a). As a means to manage the potential effects of site alteration on surface water runoff conditions during the construction phase, the following mitigation measures are provided:

- Existing drainage patterns on the site will be maintained to the extent possible and/or as required to maintain the common law drainage rights of upstream or downstream riparian landowners.
- New drainage swales or channels will be constructed as grassed swales to provide extended flow times, filtering of runoff and reduce the potential for erosion.
- Rainfall runoff from the solar modules, parking lots and access roads will be directed to grassed and vegetated areas, which will allow for infiltration into the soil and filtering of runoff by vegetation prior to its conveyance to receiving watercourses.
- All identified water body features will be protected and no solar modules will be installed within 120 m from a water body.

In addition, the following mitigation measures identified with respect to other biophysical components of the environment, will be effective at preventing impacts to surface water quality due to general construction activities:

- Mitigation for erosion/sedimentation is addressed in Soils (Section 4.2).
- Mitigation for surface water quality from pumping of turbid groundwater (if required) is addressed in Groundwater (Section 4.3).
- Mitigation for fugitive dust deposition is addressed in Air Quality (Section 4.8).
- Mitigation for surface water impairment from accidental spills is addressed in Accidental Spills (Section 4.15).

As a result of the use of effective mitigation measures, it is anticipated that there will be no resulting effect on surface water runoff conditions or water quality.

4.5 Aquatic Habitat and Biota

Since there are no waterbodies on or within 120 m of the Project Location, no potential direct impacts have been identified for aquatic habitat and biota (Section 3.4) and therefore no specialized mitigation measures are required.

Indirect impacts to aquatic habitat and biota in Crooke's Creek situated 123 m north of the Project Location could potentially occur as a result of changes in surface water quality and/or sedimentation due to wind or water erosion of exposed soils during construction. Mitigation proposed in Sections 4.2, 4.3, and 4.4 associated with preventing/minimizing negative effects to these biophysical components of the environment will ensure that there are no adverse effects on aquatic biota and habitat.

4.6 Vegetation

As noted in Section 3.6, natural vegetation will be removed from most of the Project Location. Mitigation measures to prevent/minimize adverse effects on vegetation are summarized below and discussed in the Natural Heritage Assessment Environmental Impact Study Report (ES, 2011d).

The layout of the Project facilities has been developed to reduce vegetation clearing to the extent possible. In order to minimize potential effects to on-site and surrounding vegetation communities, areas where clearing is required will be marked to ensure that the Contractor only works within these areas. In addition, cleared and grubbed materials will be piled away from areas of natural vegetation to avoid damage to adjacent vegetation (ES, 2011d). After installation of the Project facility components, all disturbed areas, with the exception of roads, the vehicle parking area and the substation yard, will be covered with a suitable, locally grown, low maintenance vegetation.

Vegetation communities may also be impacted by soil compaction caused by heavy equipment or stockpiling of materials, accidental spills or movement of dust within the Project Location and to off-site areas. Mitigation measures to restore compacted soils are addressed in Section 4.2 and potential impacts of accidental spills on vegetation communities are addressed in Section 4.15. Mitigation measures with respect to the movement of dust from the Project Location are described in Section 4.8. As a result of the effective use of the mitigation measures identified in these sections, potential impacts to remaining vegetation communities are expected to be fully mitigated.

4.7 Wildlife

As described in Section 3.7, wildlife could be impacted by loss of habitat, barriers to wildlife movement, disturbance due to construction activities and incidental take. Mitigation measures to prevent/minimize adverse effects on vegetation are summarized below and discussed in the Natural Heritage Assessment Environmental Impact Study Report (ES, 2011d).

In order to minimize the potential for habitat loss, work areas will be demarcated in order to ensure that the Contractor only works within these areas.

To minimize potential for disturbance to breeding birds that may be present on-site, major noise generating construction activities will be timed outside of the peak hours of breeding bird singing (approximately one half hour before sunset to approximately 8:30 am) during the breeding bird period, which is generally May to July (ES, 2011d).

To reduce the potential for incidental take of nesting birds, major construction activities involving vegetative clearing, excavation or grading will be timed outside of the breeding bird period to the extent possible. If this is not possible, the area(s) potentially impacted will be searched by a trained biologist within 48 hours of the proposed activity in order to determine if birds are currently nesting in these areas. If an active nest of a species covered under the federal *Migratory Birds Convention Act* (MBCA) or the provincial *Fish and Wildlife Conservation Act* (FWCA) is located within a proposed work area, a mitigation plan will be developed to prevent impacts on birds or their active nests, and submitted to Environment Canada (EC) (for MBCA species) or MNR (for FWCA species) for review prior to implementation (ES, 2011d).

The installation of the fence may trap small wildlife within the Project Location. Once the fence is completed, a visual search of the Project Location will be conducted to search for any trapped wildlife species. If species are observed, they will be either directed off of the Project Location (i.e., in the case of deer) or collected by a designated employee, who has been provided with protocols for the safe handling and transport of wildlife, and transported to the nearest available location off-site and released (ES, 2011d).

In order to minimize the potential for incidental take of wildlife by construction vehicles, speeds on access roads of the Project Location will be restricted. In addition, the construction workforce will be made aware of the potential for wildlife occurring on the Project Location and that measures should be taken to avoid wildlife wherever possible (ES, 2011d).

Even with the mitigation measures identified above, it is anticipated that there will be some disturbance of wildlife populations on and in the vicinity of the Project Location during construction, however these effects are minor, temporary and reversible. As well, it is possible that there may be limited incidental take of wildlife during construction, however species observed on the Project Location are common to the regional area and loss of one or a few individuals will have a negligible effect on population size at the local and regional levels (ES, 2011d).

4.7.1 Species at Risk

As noted in Section 3.7.1, *Species at Risk* (if present) are discussed within a separate Approval and Permitting Requirements Document (APRD). As discussed in the report, if necessary, a contingency plan will be developed prior to construction in order to identify procedures to be followed if any provincial or federal species at risk are identified on the Project Location during construction.

4.8 Air Quality

The use of standard construction best management practices and mitigation measures, such as those identified in "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo Services Inc., 2005), will be used. These mitigation measures will include (as required) the following:

- Dust suppression (e.g., water) on exposed areas including access roads, stockpiles and work/laydown areas. If necessary or appropriate, hard surfacing (addition of coarse rock) of access roads or other high-traffic work areas will be considered.

- Phased construction to limit the amount of time soils are exposed; avoid earth-moving works during excessively windy weather. If necessary or appropriate, stockpiles will be worked (e.g., loaded/unloaded) from the downwind side to minimize wind erosion.
- Stockpiles and other disturbed areas will be stabilized as necessary (e.g., graded, mulched and revegetated or watered to create a hard surface crust) to reduce/prevent erosion and escape of fugitive dust.
- Dust curtains on dump trucks hauling soil and/or vegetation material from the site.
- Workers will utilize appropriate personal protective equipment (e.g., masks, safety goggles).
- Vehicles and equipment will be equipped with proper exhaust emissions controls. All vehicles will be regularly checked for properly working mufflers and other exhaust emissions reducing equipment, and all construction equipment will meet MOE emission standards (NPC 115).

The use of these mitigation measures would be expected to mitigate most effects of dust and exhaust emissions on local air quality, with any residual off-site effects expected to be temporary in nature.

4.9 Noise

Construction and installation activities that produce a large amount of noise will be limited to daylight hours. Vehicles will also be regularly checked for properly working mufflers or other noise reducing equipment., and all construction equipment will meet MOE emission standards (NPC 115). Construction activities will comply with the noise control by-law of Loyalist Township (2011-6). The noise control by-law requires that the operation of any construction equipment be completed by 8 p.m. and may not commence until 7 a.m. the following day, and no construction equipment is to be operated on Sundays.

Even with implementation of the mitigation measures identified above, it is anticipated that noise from the Project will have some effect on local wildlife populations (addressed in Section 4.7) and possibly, nearby sensitive human receptors. To minimize impacts on sensitive receptors, receptors will be made aware of a contact person for complaints relating to noise during the Project construction. Overall, effects to nearby receptors are considered minor and temporary. Following the completion of construction, there will be no residual effects.

4.10 Traffic

As noted in Section 3.10, the construction of the Project will have a negligible impact to the surrounding traffic conditions (McIntosh Perry, 2011b). As such, no specialized mitigation measures have been identified to address traffic-related impacts. The following general mitigation measures are identified to improve traffic-related safety conditions at the site entrance during construction for the Project:

- Designated transportation routes and scheduling will be established for heavy construction vehicles and deliveries of materials to the site to minimize 'bottlenecks'. The traffic impact study noted that delivery vehicles carrying plant equipment to the Project Location could travel either: (i) east on Hwy 401, south on County Road 4 and east on Taylor Kidd Boulevard, or (ii) east on Hwy 401, south on County Road 6 and west on Taylor Kidd Boulevard (McIntosh Perry, 2011b). The study noted that the first option slightly shorter and vehicles enroute to the Project Location

may experience less delays since development is largely situated to the east of the Project Location.

- Flagmen will be utilized as required to facilitate traffic flow and control.
- Construction vehicles will be driven in a proper manner with respect for all traffic laws.
- Signage providing any detour directions will be prominently displayed.

As a result of the above noted mitigation measures and practices, impacts to traffic will be minor, temporary, and reversible following Project construction.

4.11 Municipal Roadways

Damage to municipal roadways caused by construction vehicle traffic may occur during the construction of the Project (McIntosh Perry, 2011b). The following mitigation measures are proposed to minimize this potential negative effect:

- Designated transportation routes will be established for heavy construction vehicles and equipment deliveries to the site.
- Construction vehicles will be driven in a proper manner with respect for all traffic laws.
- Any municipal requirements for half-load restrictions on identified roads will be adhere to.
- Damage to municipal roadways will be repaired by the Contractor as necessary during the construction period.

There will be no residual effect to municipal roadways following the use of these mitigation measures.

4.12 Public and Construction Site Safety

Implementation of the following mitigation measures will serve to minimize potential risk to public and construction staff safety within the Project Location:

- Public access to the construction area will be prevented through the use of fences, gates, and security procedures.
- Signage will be posted to notify the public of construction in the area.
- Workers will be required to adhere to prescribed safety procedures.
- Proper procedures for construction traffic will be developed, where required.

As a result of these mitigation measures, the risk to public and construction-site safety will be effectively minimized.

4.13 Waste Management

Solid wastes generated during construction will include construction waste such as material packaging and scrap material as well as domestic waste such as food and sanitary waste. Sanitary facilities on-site will include portable self-contained toilets and washroom facilities. The following

mitigation measures will serve to minimize any potential negative effects as a result of the generation of waste and recyclables:

- Construction waste will be properly stored on-site prior to disposal off-site at local registered disposal facilities.
- All sanitary waste is to be contained and hauled off-site by a designated hauler throughout the construction period.
- Hazardous wastes (e.g., paints, solvents) will be properly stored in secure containers and disposal off-site at a registered facility.
- Reuse and recycling will be practiced wherever possible.

The use of these mitigation measures will minimize any environmental effects resulting from the generation of waste.

4.14 Archaeological Resources

Following a standard archaeological assessment there remains a potential to uncover deeply buried heritage or archaeological resources (including human burial sites) during construction of the Project, which would not have previously been identified. In this instance, the Ministry of Tourism and Culture has specified mitigation that must be undertaken in the event of discovery of human remains or other archaeologically or culturally significant material:

- Should human remains or artefacts be identified during construction, all work in the vicinity of the discovery is to be halted immediately, as required under the Ontario Heritage Act.
- If human remains are found, notification is to be made to the Ontario Provincial Police (OPP), or local police who will conduct a site investigation and contact the district coroner.
- Notification is to be made to the Heritage Operations Unit of the Ontario Ministry of Tourism and Culture, Heritage Libraries Branch, Heritage Operations Unit, 400 University Ave, 4th Floor, Toronto, ON, M7A 2R9, and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit, Ontario Ministry of Consumer and Business Services.
- Work is to be halted in the immediate area where artefacts are found. Work will resume once the site has been investigated and cleared by a licensed archaeologist.

The mitigation measures identified above will effectively minimize impacts on archaeological resources of the study area.

4.15 Accidental Spills

As discussed in Section 3.18, accidental spills if they were to occur, could negatively affect surface water, groundwater, soils, terrestrial environments or aquatic habitat or biota. To reduce the risk of a spill during construction and to minimize the potential impact if a spill was to occur, the following spill prevention, mitigation and response measures will be implemented:

- A Site Environmental Inspector will be responsible for ensuring that the Contractor(s) has prepared a spill clean-up procedure/emergency response plan and appropriate equipment, with all staff trained in proper implementation in the event of a spill.

- Emergency contacts will be posted, including 911, Police, Fire Department, MOE Spills Action Centre, and contacted as required.
- All potentially hazardous materials, fuels and lubricants will be properly stored in the laydown areas in a designated area at least 30 m from watercourses, drainage ditches or other wet areas.
- All refuelling and equipment maintenance activities will be conducted at specified locations at least 30 m from watercourse, drainage ditches or other wet areas.
- Vehicles and equipment will be monitored and maintained to ensure they are free of leaks.
- Spill containment and cleanup supplies will be maintained on-site at all times and the Contractor's personnel will be trained in the applicable cleanup and reporting procedures.
- If a spill occurs, it will be cleaned up immediately and the information logged in the construction environmental monitoring report.
- If a reportable spill occurs, the MOE Spills Action Centre will be contacted immediately, as required by provincial regulations.
- Portable toilets will be located no closer than 50 m from a watercourse/drain and will be pumped out by an MOE approved hauler to an approved facility.

The effective use of the above noted mitigation measures will prevent or minimize adverse impacts (if a spill occurs) on soils, groundwater, surface water, vegetation, terrestrial or aquatic biota.

5. Environmental Effects Monitoring Plan

5.1 Environmental Effects and Mitigation Measures

Table 5.1 provides a summary of the potential negative environmental effects and proposed mitigation measures to prevent or minimize effects. Based on the assessment findings of potential effects conducted as part of this Design and Operations Report and implementation of the recommended mitigation measures, no significant residual negative effects are expected as a result of operation of the Project.

As previously noted, several other Project reports have documented potential negative environmental effects and mitigation measures. Persons seeking additional information on specific environmental resource features are referred to these reports. These reports and the context of the potential negative environmental effects are as follows:

- Project Description Report, which summarizes potential negative environmental effects for features within 300 m of the Project for construction, operation and decommissioning phases.
- Construction Plan Report, which identifies potential negative environmental effects caused by construction and installation of the Project for features within 300 m of the Project.
- Design and Operations Report, which identifies potential negative environmental effects caused by operation of the Project for features within 300 m of the Project.
- Decommissioning Plan Report, which identifies potential negative environmental effects caused by decommissioning the Project.
- Water Body Environmental Impact Study, which identifies potential negative effects to water body features including aquatic habitat and biota within 120 m of the Project for construction, operation and decommissioning phases.
- Noise Study Report, which identifies potential negative environmental effects (noise emissions) caused by the Project's electrical transformers and inverters during operation.
- Stage 1 & 2 Archaeological Assessment, which identifies potential negative effects to archaeological resources from construction activities.
- Natural Heritage Assessment Environmental Impact Study, which identifies potential negative effects to significant natural heritage features within 120 m of the Project for construction, operation and decommissioning phases.
- Conceptual Storm Water Management Report, which identifies potential negative effects to surface water runoff peak flows and water quality for construction and operation phases.
- Traffic Impact Study, which identifies potential negative effects to local traffic patterns from vehicles travelling to and from the Project Location for construction, operation and decommissioning phases.
- Groundwater Monitoring Scoping Report, which identifies a proposed groundwater monitoring program for water wells in proximity to the Project before and after construction.

5.2 Monitoring Plan

Table 5.2 presents the environmental effects monitoring plan for the Project construction, which includes the following information:

- The potential negative environmental effects, carried forward from Table 5.1, that have an ongoing risk of occurrence throughout the construction period.
- The performance objectives and mitigation strategies to address those effects.
- Monitoring protocols to confirm that performance objectives are being met.
- Contingency measures in the event that objectives are not met i.e., if monitoring reveals that negative effects are continuing to occur.

Mitigation measures identified in Table 5.2 are expected to either completely mitigate or reduce the scale of potential effects to such a minor level that quantifiable detection of residual effect(s) through specialized field measurements, sampling or laboratory analyses are not considered possible or necessary. Therefore, with the exception of the proposed well water sampling, the recommended monitoring methods are based solely on qualitative, visual inspections and reporting methods to ensure compliance with the performance objectives identified for the respective mitigation measures.

Monitoring will typically consist of weekly inspections of the Project Location during construction and installation activities by an environmental inspector. The inspector will be retained either by the Contractor with reporting responsibilities directly to the Proponent or will be retained by the Proponent. The inspector will ensure that all mitigation measures (e.g., sediment and erosion controls) described in this report are in place and functioning according to design specifications. If required, repairs will be made to mitigation measures and if necessary, remedial action such as implementing additional mitigation measures will be undertaken.

Table 5.1 Summary of Potential Negative Environmental Effects and Proposed Mitigation – Construction Phase

Environmental Component	Sources of Negative Effect	Potential Negative Effect	Mitigation Measures	Residual Negative Effect
Natural Environment Components				
Soils	Topsoil stripping for access roads, laydown, parking area, substation yard, and inverter and transformer building pads.	Loss of the quantity of topsoil resulting in reduced productivity of the soil to support vegetation growth.	Stripped topsoil will be stockpiled on-site for use during site restoration after construction.	No residual effect given effective mitigation.
	Wind and water erosion from exposed surfaces following vegetation removal and excavation activities.	Loss of soils from the Project Location, potentially affecting other environmental components (e.g., air quality, vegetation, surface water quality).	Sediment and erosion controls (e.g., silt fence barriers, rock flow check dams) installed and maintained during construction. Dense non-invasive vegetation ground cover planted throughout disturbed areas of the Project Location following construction.	Some minor soil erosion on-site within the Project Location may be unavoidable due to runoff from exposed soils during heavy rainfalls events or extremely windy days.
	Soil compaction from heavy equipment, construction vehicles and/or stockpiling of heavy materials.	Soil compaction resulting in changes to soil structure which could cause decreased productivity for plant growth, reduced infiltration and increased runoff.	Project Location will be assessed for soil compaction following construction. Areas of significant compaction will be restored using mechanical discing or other soil loosening methods.	No residual effect given effective mitigation.
Groundwater	Installation of support foundations (e.g., driven or screwed steel piles) into the ground to support the solar PV modules and racks.	No adverse effects on groundwater quantity or quality are expected since driven/screw piles do not require soil excavation and will not affect groundwater recharge conditions due to small area of supports relative to Project Location.	None identified. The Proponent will conduct well water quality monitoring within the Project Location and in selected local residents' domestic wells before and after construction. The findings will be reported to MOE and participating well owners.	None.
	Dewatering of excavations for foundations for inverter/transformers and trenching for electrical cabling to keep the work area dry.	No adverse effect on water table or nearby water wells since significant pumping of groundwater is not required. Some pumping of rainwater out of excavations may occur.	If pumping is required, water will be discharged to a heavily vegetated area or pumped through a filtration bag so that turbid water is not discharged directly to receiving watercourses.	No residual effect given effective mitigation.
Surface Water	Alteration of existing topography and surface drainage patterns from earth grading and excavation activities. Runoff from impervious (e.g., inverter buildings) and less pervious areas (e.g., gravel roads). Installation of new drainage swales, ditches and culverts.	Minor increase in surface water runoff from Project Location to off-site receiving drainage swales, ditches and/or watercourses resulting in erosion (McIntosh Perry, 2011a). Potential adverse effects to receiving water quality due to increased turbidity in runoff due to soil erosion.	Maintain existing drainage patterns as much as possible. Retain and/or plant dense vegetation as soon as possible following construction. Sediment and erosion controls installed and maintained during construction. Storm water management measures installed to control increases in runoff peak flows from the Project Location to pre-construction condition levels.	Minor potential for residual effects until disturbed areas become completely stabilized by vegetative cover and plant growth. No residual post-construction effects.
	Wind and/or water erosion of soils within the Project Location.	Erosion of soils from the Project Location could result in adverse effects on surface water quality in receiving waterbodies, with associated effects on aquatic biota and habitat.	Sediment and erosion controls installed and maintained during construction. Dense non-invasive vegetation ground cover planted throughout disturbed areas of the Project Location.	No residual effect given effective mitigation.
Aquatic Habitat and Biota	Erosion, increases in surface water runoff, accidental spills on Project Location.	Indirect effects to aquatic habitat and biota in receiving watercourses (e.g., Cooke's Creek) due to increased turbidity in runoff, sedimentation or accidental spills.	Mitigation measures for Soils, Surface Water and Spills will mitigate any potential adverse impacts to aquatic features located on or off-site.	No residual effect given effective mitigation.
Vegetation	Clearing of 28 ha of woodland vegetation within the Project Location.	Reduced size of the woodland and interior woodland habitat, and potential damage to adjacent trees/shrubs and/or disturbance to the rooting zone through soil compaction. Increased surface water and soil erosion, and potential indirect effects to receiving water quality due to vegetation removal.	Work areas will be demarcated in order to ensure that the Contractor does not work beyond those bounds. Trees will be felled into cleared areas. Soil loosening methods for compacted soils. Dense non-invasive vegetation ground cover planted throughout disturbed areas of the Project Location. Mitigation measures for: Soils and Surface Water will minimize potential for increased runoff and erosion.	Minor reduction in woodland and interior woodland habitat size, but no overall change to woodland significance.
	Generation of airborne dust from construction activities.	Indirect effects to adjacent off-site significant woodlands north, east and south of Project Location could include deposition of dust on leaves.	Mitigation measures for: Air Quality and Soils will minimize generation of airborne dust to adjacent off-site vegetation communities.	Minor potential for residual effect associated with generation of airborne dust from exposed soils during construction activities that occur on extremely windy days.
Wildlife Habitat	Clearing of 28 ha of woodland vegetation within the Project Location that supports significant wildlife habitats.	Loss of wildlife habitat associated with significant woodland (e.g., raptor nesting, area-sensitive breeding birds and milksnake). No adverse effects to off-site wildlife habitats in other significant woodlands surrounding the Project Location. No adverse effects to off-site wildlife habitats in other significant	Tree removal will be conducted outside the breeding period for birds (May through July). Felled woody debris will be used to create brush piles at the forest edge to create habitat for reptile hibernacula. Work areas will be demarcated in order to ensure that the Contractor does not work beyond those bounds. Retain and/or plant dense vegetation ground cover beneath solar panels to provide wildlife habitat for	Loss and alteration of existing wildlife habitats within Project Location. Long-term wildlife use of the Project Location will be altered, but no overall change in local composition or population is anticipated to occur. No residual negative effects to off-site wildlife

Environmental Component	Sources of Negative Effect	Potential Negative Effect	Mitigation Measures	Residual Negative Effect
		woodlands surrounding the Project Location.	bird, reptile and small mammal species. Sediment and erosion controls and storm water management mitigation measures implemented during construction will prevent adverse effects off-site effects to wildlife habitats.	habitats.
Wildlife	Construction activities and presence of workforce.	Avoidance of Project Location by wildlife due to equipment, noise and human presence. Possible noise disturbance to breeding birds in woodland east of Project Location.	Major noise generating construction activities to avoid peak hours of breeding bird singing (one half hour before sunset to 8:30 am) during breeding bird period (May through July).	Minor periodic disturbance of local wildlife during construction.
	Construction activities and vehicles travelling on access roads within Project Location.	Incidental take of wildlife due to construction activities and vehicles within Project Location.	To reduce incidental take of nesting birds, vegetative clearing, excavation or grading will be timed outside of the breeding bird period (May through July). If this is not possible, the area(s) potentially impacted will be searched by a trained biologist within 48 hours of the proposed activity to determine if birds are nesting. Daily visual monitoring of construction work areas prior to start or work. Limit on-site vehicles speeds to avoid incidental take.	Mitigation will effectively reduce risk of incidental take of wildlife, but not completely eliminate it. No long-term effects on species composition or local populations anticipated.
	Installation of perimeter fencing around the Project Location.	Trapping of larger wildlife within the Project fence.	Prior to fence completion, a visual search of the area within the fence will be completed. If species are observed, they will be directed off the Project site or collected by a designated employee using approved handling protocols and transported to the nearest available location off-site and released.	No long term residual effect on wildlife.
Socio-Economic Environmental Components				
Air Quality	Generation of airborne dust from land clearing and excavation activities, vehicle travel on dirt roads and exhaust emissions from construction vehicles and equipment.	Reductions in local air quality from airborne dust and exhaust emissions from construction vehicles and equipment.	Construction practices to suppress dust (e.g., limit soil exposure, road watering, stabilize and cover stockpiles) and restrict soil working activities during windy conditions. Contractor to ensure that all construction vehicles and equipment have properly functioning emission controls (e.g., mufflers and no excessive vehicle idling).	Some short term minor effects on local air quality due to fugitive dust generation and vehicle emissions.
Noise	Noise emissions from construction vehicles and equipment use.	Disturbances to nearby sensitive receptors (i.e., houses and institutions) due to noise emissions.	Contractor to comply with municipal Noise Control By-Laws for construction working times and ensure that vehicles and equipment have proper sound baffling equipment (e.g., mufflers). Notification to adjacent noise receptors to report noise complaints.	Possibly, some short-term, temporary 'nuisance' disturbance to sensitive nearby noise receptors during certain construction activities.
Public and Construction Site Safety	Construction equipment malfunction, fire or accidents resulting in injury to public or construction workers.	Personal injury to the public if trespassing on-site or to construction workers due to accidents, fire or equipment malfunction.	Public access to construction-site will be prevented by fences, gates and security procedures. Proper health and safety procedures for construction workers will be implemented as per provincial and federal regulations.	No risk to public safety unless trespassers obtain access to the site. Health and safety procedures will reduce risk of personal injury to workers, but some risk from accidents will remain during construction.
Traffic and Municipal Roadways	Construction vehicles and workforce commuters travelling to and from the Project.	No significant traffic-related impacts identified based on Traffic Impact Study (McIntosh Perry, 2011b).	Prepare transportation route plan and delivery scheduling to avoid potential bottlenecks of equipment deliveries to site. Construction flag-person to direct vehicles into and out of the site.	None.
	Construction vehicles travelling to and from the Project.	Heavy construction vehicles may damage local roadways (McIntosh Perry, 2011b).	Municipal 'half-load' requirements for roads will be adhered to. Any damage to local roadways will be repaired by the Contractor.	No residual effect given effective mitigation.
Archaeological Resources	Excavations for foundation construction and trenching for underground electrical cables.	Potential for adverse effects on buried archaeological resources not observed during the Stage 2 Archaeological Assessment.	Project Location is considered clear of any archaeological resources based on completed Stage 1&2 Archaeological Assessments (TAI, 2010). If construction results in discovery of human remains or archaeological resources, work will stop and the Police and Ministry of Tourism and Culture will be notified.	None. Mitigation will be effective in preventing residual negative effects to human remains or archaeological resources if discovered during construction.

Environmental Component	Sources of Negative Effect	Potential Negative Effect	Mitigation Measures	Residual Negative Effect
Protected Properties, Built Heritages and Cultural Heritage Landscapes	Construction and installation of Project facilities resulting in the loss (e.g., demolition of existing built structures) and/or alteration to significant cultural heritage features or landscapes.	No protected properties, as defined in Section 19(1) of O. Reg. 359/09, exist in the vicinity of the Project Location. No negative effects to built heritage and cultural heritage landscapes since such features were either not present in the Project Location or potential effects (if any) were assessed as not significant.	None required.	None.
Change in Visual Landscape	Presence of construction-site equipment, activities and personnel.	Portions of the facility will be visible from Taylor Kidd Boulevard and from adjacent properties. This may be perceived as a negative effect.	Existing vegetation around the Project Location will be maintained the extent possible during construction to provide visual screening.	Short term change in local visual landscape during construction. Visual disturbance reduced with retention of existing vegetation
Effects due to Accidental Spills				
Groundwater, Surface Water, Soils, Vegetation, Aquatic Habitat	Accidental spills or leakage of fuel, oil, hydraulic fluid, etc., from construction vehicles or equipment, on-site refuelling or storage of toxic liquids on-site.	Impairment of groundwater, soil and/or surface water quality due to contamination. Potential adverse effects to vegetation and aquatic habitats.	Visual monitoring and reporting procedures to identify spills. Spill control kits on-site and spill response procedures implemented in the event of an accidental spill. Contractors staff will be trained in spill response procedures. No refuelling or storage of toxic liquids on-site within 30 m of a watercourse.	No residual effect given effective mitigation (e.g., proper storage and handling of toxic liquids) and spill response and clean-up measures if a spill occurs.

Table 5.2 Environmental Effects Monitoring Plan – Construction Phase

Negative Effect	Mitigation Strategy	Performance Objective	Monitoring Plan					Contingency Measures
			Methodology	Monitoring Locations	Frequency	Rationale	Reporting Requirements	
Erosion and sedimentation resulting in loss of soil and increased turbidity in site runoff	Sediment and erosion control plan with standard practices to reduce exposure of soils to wind and water erosion. MNR timing window for work in water for culvert construction, fish salvage if required prior to dewatering.	No increase in soil erosion from site over and above existing conditions.	Visual assessment of stability of sediment and erosion control mitigation measures and identification of unintended impacts (e.g., rills, gullies).	Throughout Project Location.	Weekly site inspections and following major rainfall events.	Visual monitoring of erosion would identify potential areas of concern.	Reported in monthly construction monitoring report.	Erosion remediated as necessary to ensure no long-term erosion issues
Installation of support foundations resulting in changes to water table levels and/or water well quality concerns	Well water quality monitoring within the Project Location and in selected local residents' wells during and following construction.	No change to baseline water quality parameters due to Project construction.	Well water sampling and analysis.	At designated Project locations and adjacent residential wells as per Groundwater Monitoring Plan	Before and after construction for well water sampling. Monthly for well water levels.	Comparison to baseline (pre-construction) water quality will confirm whether or not there are impacts to off-site wells	Reported in monthly construction monitoring report.	If an impact is found to be related to Project then provide bottled water to water well users until water quality improves to baseline levels.
Incidental take of wildlife	Visual monitoring of construction work areas prior to start of work. Wildlife observed will be removed from areas of impact using established protocols. Speeds to be limited on Project Location and construction workforce to be made aware of potential for wildlife on the Project Location.	Avoid occurrences of incidental take.	Visual monitoring will be conducted by workers on foot for the areas to be worked on the given day. Any wildlife observed will be either directed off of the Project Location or collected by a designated employee and transported to the nearest available location off-site and released.	Throughout Project Location.	Daily, throughout the construction.	Incidental take will be reported by construction workforce to the on-site personnel responsible for environmental protection if incidents occur.	Reported in monthly construction monitoring report, unless the species is a species of conservation concern in which case reporting will be immediate to the MNR/Environment Canada.	If incidental take of species of conservation concern are recorded, work will be ceased until such time as a trained biologist can state that the species is no longer present in the area.
Dust generation and off-site transport	Standard construction site best management practices to prevent fugitive dust.	Minimize fugitive dust from the construction site.	Visual monitoring of visible dust plumes during construction.	Throughout construction site.	Periodically during all construction activities.	Visual dust monitoring would identify if dust plumes are an issue and where their source may be.	Reported in monthly construction monitoring report.	Dust control measures implemented as necessary to prevent/minimize dust generation.
Noise levels disturbing nearby noise receptors	Adherence to Noise Control By-Law. Proper mufflers on construction vehicles. Notification to adjacent noise receptors and call number to report noise complaints.	To minimize excessive noise emissions at nearby noise receptors.	Ongoing dialogue with adjacent noise receptors and follow-up response to noise complaints.	Throughout construction site with emphasis at the closest sensitive noise receptors.	Continually, throughout construction.	Auditory monitoring and feedback from nearby noise receptors will confirm that noise emissions are within reasonable levels.	Reported in monthly construction monitoring report.	If Project components are not meeting performance objectives with respect to noise emissions, possible compensation to affected noise receptors may be required.
Personal injury to public if trespassing on-site or to construction workers due to accidents.	Public access to site will be prevented by fences, gates and security procedures. Proper health and safety procedures for construction workers.	Elimination of risk of personal injury to public and workers due to accidents or mishaps.	Site security monitoring will confirm adequacy of security measures. Implementation of Contractor's health and safety procedures for worker safety.	Throughout the Project Location and facility perimeter.	Continually, throughout construction.	Site security monitoring will identify any breech in facility security. Contractor's safety inspections and accident reporting will identify unsafe working practices.	Incidents of trespassing or vandalism will be reported to local authorities. Reported in weekly construction health and safety monitoring report.	Additional security measures will be implemented as required. Unsafe working areas and/or practices will be identified and corrected by the Contractor.
Potential for adverse surface water, groundwater and soil quality due to accidental spills	Standard mitigation to prevent spills and minimize magnitude of spills if they occur.	No long-term environmental effects due to spills.	Visual monitoring where hazardous liquids may be stored, refuelling may occur and parking areas.	Throughout Project Location.	Weekly site inspections, during any on-site refuelling or handling of toxic liquids and immediately following any reported spills.	Visual monitoring would identify potential areas of concern and ensure that spill prevention and control measures are functioning as designed and protocols are being implemented as specified in plans.	Reported in monthly construction monitoring report.	Spill contingency measures implemented as necessary in the event of a spill. Following spill event, response will be reviewed to determine if additional or altered response protocols are necessary to meet performance objectives.

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Paul D. Holmes
PDH:ll

Appendix A

Project Drawings

NAPANEE TS TAYLOR KIDD SOLAR PROJECT

PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

SOLAR ELECTRIC SYSTEM PROJECT - 10.0 MW AC

VICINITY MAP:

PROJECT SCOPE:

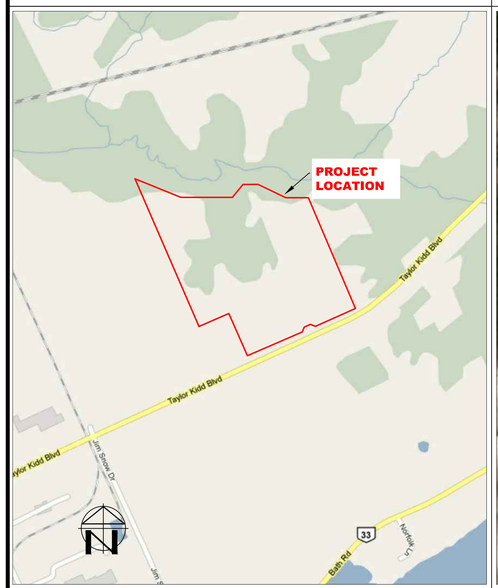
SOLAR ELECTRIC SYSTEM

THE PROPOSED PROJECT IS A RENEWABLE ENERGY GENERATION FACILITY WHICH WILL USE SOLAR PHOTOVOLTAIC TECHNOLOGY TO GENERATE ELECTRICITY. ELECTRICITY GENERATED BY SOLAR PHOTOVOLTAIC PANELS WILL BE CONVERTED FROM DIRECT CURRENT (DC) TO ALTERNATING CURRENT (AC) BY INVERTERS, WHICH WILL ALSO STEP-UP THE VOLTAGE TO 44 kV PRIOR TO BEING CONNECTED TO THE EXISTING LOCAL DISTRIBUTION LINE. TO MEET ONTARIO POWER AUTHORITY'S (OPA) FEED-IN-TARIFF (FIT) PROGRAM REQUIREMENTS, A SPECIFIC PERCENTAGE OF EQUIPMENT WILL BE MANUFACTURED IN ONTARIO. THIS PROJECT IS CLASSIFIED AS A CLASS 3 SOLAR FACILITY AND THEREFORE REQUIRES A RENEWABLE ENERGY APPROVAL (REA).

THE SYSTEM WILL BE INTERCONNECTED AND WILL BE OPERATED IN PARALLEL WITH THE ENERGY PROVIDER'S ELECTRIC GRID AS PER THE REQUIREMENTS OF THE ONTARIO ELECTRICAL SAFETY CODE (OESC).

DRAWING INDEX:

STREET MAP:



AERIAL VIEW:

PROJECT TEAM:

PROJECT CONTACT:

PROJECT: NAPANEE TS TAYLOR KIDD SOLAR PROJECT
AXIO POWER CANADA INC.
945 PRINCESS STREET, SUITE 252
KINGSTON, ON, K7L 3N6
CONTACT: ROBERT BARKLEY
TEL: (613) 545-0215
FAX: (613) 545-0692
EMAIL: rbarkley@axiopower.com

DESIGN ENGINEERING FIRM:

BLUE OAK ENERGY CANADA CORP.
200 VINYL COURT, UNIT D
VAUGHAN, ON L4L 4A3
CONTACT: VINCE GREEN, PE
TEL: (905) 850-3200
EMAIL: vince@blueoakenergy.com

ELECTRICAL ENGINEER:

PRELIMINARY DRAWING
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BLUE OAK ENERGY CANADA

200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE: (905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON, ON K7L 3N6

PROJECT SITE:

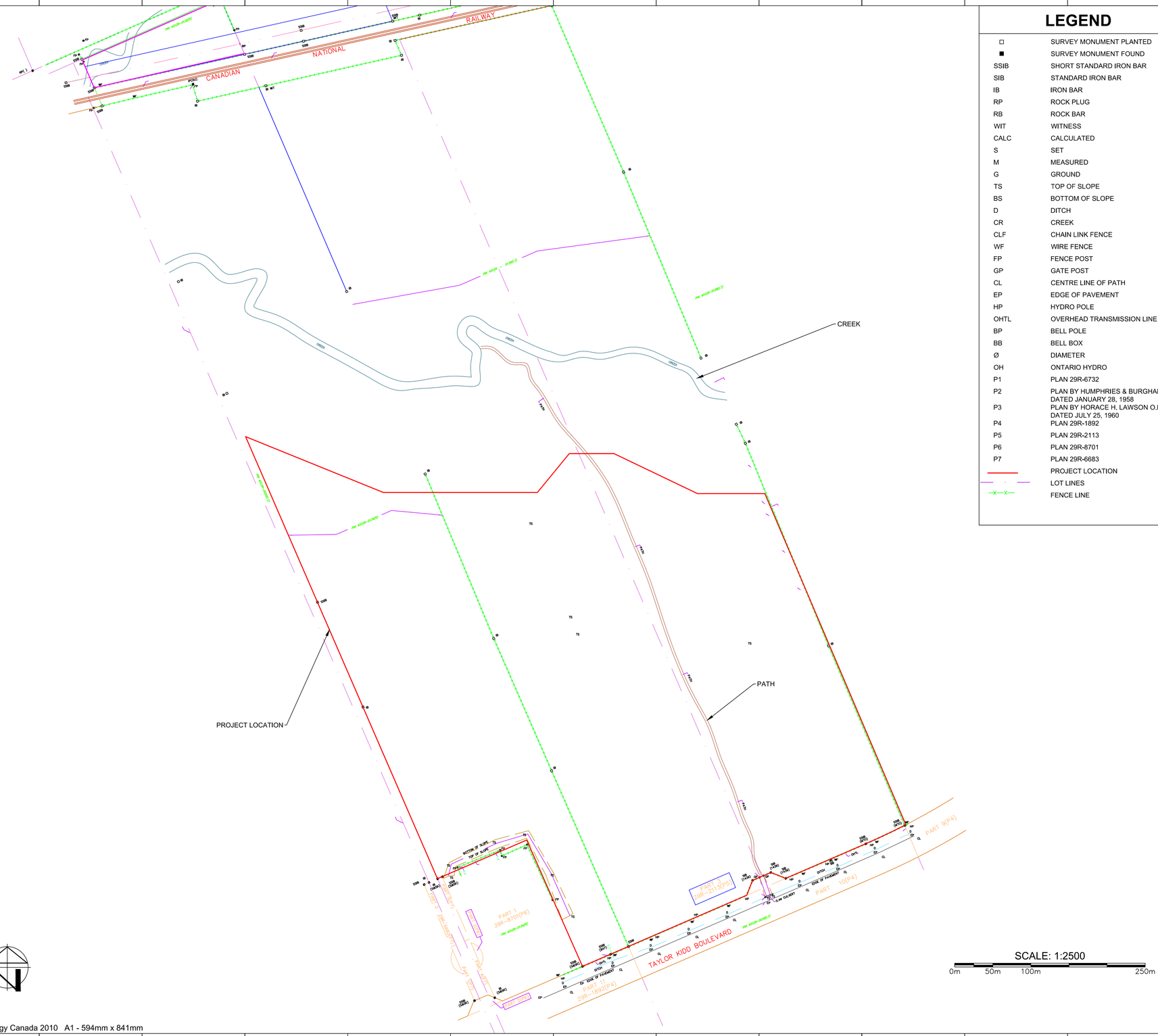
NAPANEE TS TAYLOR KIDD SOLAR PROJECT
PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

DRAWING:

TITLE SHEET

DRAWING NO.

G-001



LEGEND

□	SURVEY MONUMENT PLANTED
■	SURVEY MONUMENT FOUND
SSIB	SHORT STANDARD IRON BAR
SIB	STANDARD IRON BAR
IB	IRON BAR
RP	ROCK PLUG
RB	ROCK BAR
WIT	WITNESS
CALC	CALCULATED
S	SET
M	MEASURED
G	GROUND
TS	TOP OF SLOPE
BS	BOTTOM OF SLOPE
D	DITCH
CR	CREEK
CLF	CHAIN LINK FENCE
WF	WIRE FENCE
FP	FENCE POST
GP	GATE POST
CL	CENTRE LINE OF PATH
EP	EDGE OF PAVEMENT
HP	HYDRO POLE
OHTL	OVERHEAD TRANSMISSION LINE
BP	BELL POLE
BB	BELL BOX
Ø	DIAMETER
OH	ONTARIO HYDRO
P1	PLAN 29R-6732
P2	PLAN BY HUMPHRIES & BURGHAM DATED JANUARY 28, 1958
P3	PLAN BY HORACE H. LAWSON O.L.S. DATED JULY 25, 1960
P4	PLAN 29R-1892
P5	PLAN 29R-2113
P6	PLAN 29R-8701
P7	PLAN 29R-6683
	PROJECT LOCATION
	LOT LINES
-X-X-	FENCE LINE

NOTES:

1. SEE PROJECT CIVIL DRAWINGS FOR OFFICIAL LANDMARKS, SITE INFORMATION AND SURVEYING. SHOWN HERE AS REFERENCE ONLY.

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AXIO POWER CANADA INC

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KINGSTON, ON K7L 3N6

PROJECT SITE:

NAPANEE TS TAYLOR KIDD SOLAR PROJECT

PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

DRAWING:

EXISTING SITE PLAN

DRAWING NO.

ES-101

TYPICAL RACK
4 X 11 MODULE ARRAY

SCALE: 1:1600
0m 32m 64m 96m 128m 160m

SYSTEM SUMMARY

MODULE MODEL	CS6X 270P
MODULE STC DC RATING	270Wp
MODULES PER SOURCE CIRCUIT	11
MAX NO. OF SOURCE CIRCUITS PER OUTPUT CIRCUIT (COMBINER BOX)	TBD
RACKING SYSTEM MODEL	REPRESENTATIVE
TOTAL RACK COUNT	1030
TOTAL MODULE COUNT	45320
TOTAL STC-DC SYSTEM SIZE	12.24 MW
TOTAL AC SYSTEM SIZE	10 MW
INVERTER MODEL NO.	SUNNY CENTRAL 500 HE-US
INVERTER CEC EFFICIENCY	98%
SITE LATITUDE	44°13'23.35"
ARRAY AZIMUTH	180°(0°)
MODULE TILT	30°
AMBIENT TEMP: RECORD LOW/HIGH	-34°/ 34°
AMBIENT TEMP: AVERAGE LOW/HIGH	-7°/ 21°
INTERCONNECTION VOLTAGE	44 kV
INTERCONNECTION TYPE	GRID TIE PARALLEL CONNECTION

NOTES:

1. PV RACKS SUPPORTING FIXED TILTED PV MODULES WITH DC WIRING AND COMBINER BOXES ABOVE GROUND. DC CABLING FROM COMBINER BOXES TO ROUTE UNDERGROUND TO INVERTER / POWER ENCLOSURES.
2. INVERTER / POWER ENCLOSURES TO BE LOCATED WITHIN ARRAY AREA TO COLLECT DC POWER, CONVERT AND OUTPUT MEDIUM VOLTAGE AC POWER.
3. DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
4. SEE RACK DETAIL DRAWINGS IN S-101 FOR RACK ELEVATION AND TOLERANCES.
5. CONTACT, COORDINATE AND ATTAIN APPROVAL FROM AGENCIES HAVING EASEMENTS AND ROW SPACING IN PROJECT AREA.
6. PV MODULES TO BE CANADIAN SOLAR MODEL CS6X 270P OR EQUIVALENT.

KEYED NOTES:

1. PROJECT SECURITY FENCE. 2.7m (9 FT) TALL, SET APPROXIMATELY 2m INSIDE PROJECT LOCATION LINE.
2. DOUBLE SWING GATES, 2.5m EACH SECTION.
3. PERIMETER SERVICE ROAD, 5m WIDTH , SEE SECTION DETAILS IN S-101.
4. INTERIOR SERVICE ROADS, 3.7m WIDTH SEE SECTION DETAILS IN S-101.
5. 9m TURNING RADII AT ROAD CENTER LINES ON PERIMETER SERVICE ROAD AND ON TRANSITIONS TO INTERIOR SERVICE ROADS TO MEET TYPICAL SAFETY AGENCY REQUIREMENTS.
6. AREA AROUND GATES AND SWITCH HOUSE COMPACTED, SLOPED FOR DRAINAGE AND TOPPED WITH 'ROAD BASE' ROCK AND SAND MIXTURE. PROVIDES PARKING FOR APPROX. 10 VEHICLES.
7. LAYDOWN AREA TO BE COMPACTED NATIVE SOIL ALLOWING TEMPORARY PARKING, STORAGE, ETC. DURING CONSTRUCTION. TO BE FINISH GRADED AND SEEDED AT END OF CONSTRUCTION.

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BLUE OAK ENERGY CANADA
200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE: (905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON, ON K7L 3N6

PROJECT SITE:

NAPANEE TS TAYLOR KIDD SOLAR PROJECT

PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

DRAWING: ARRAY PLAN

DRAWING NO. ES-102

SUNNY CENTRAL 500HE-US INVERTER

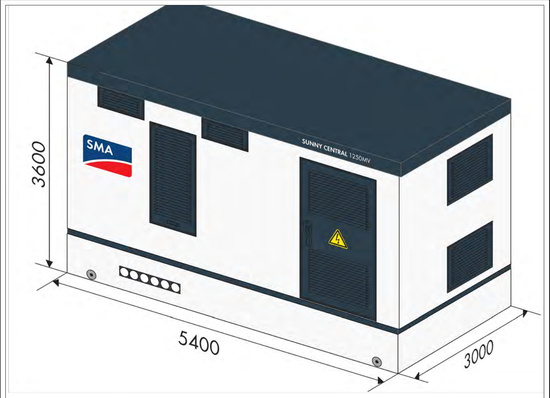
High Yields
- 98% CEC efficiency
- Suitable for ambient temperatures of up to 60 °C (140 °F)
- OptiCool™ intelligent temperature management

Low System Costs
- Outdoor-rated enclosure
- Couples to medium-voltage external transformer
- Available as integrated solution

Strong Peripherals
- Optional DC & AC disconnects
- Optional combiner boxes with string monitoring
- Sunny WebBox, Modbus® & OPC compatible

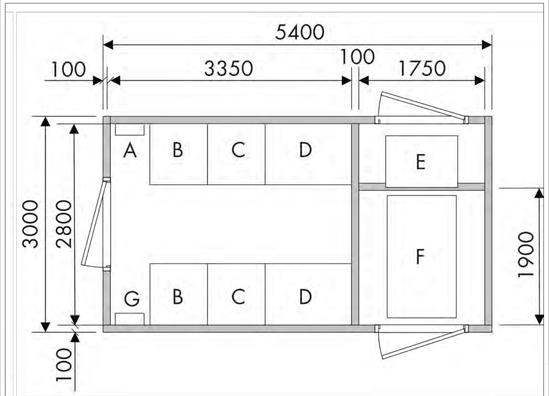
UL Certified
- UL 1741 / IEEE-1547 compliant

Technical data	Sunny Central 500HE-US
Input data	
Max. DC power	565 kWp [1]
MPP voltage range	330 V – 600 V
Max. DC voltage	600 V
Feed starting at [U] / [P]	380 V / 5000 W
Max. DC current	1600 A
Number of DC inputs	6 – 9
Output data	
Nominal AC power	500 kVA @ 45 °C (113 °F)
Max. AC current	1470 A @ 200 V
AC grid frequency	60 Hz
AC voltage range	180 V – 220 V
AC voltage range, full active power	196 V – 210 V
Power factor (cos φ)	> 0.99
Max. THD	< 5%
Efficiency [2]	
Max. efficiency	98.6%
CEC efficiency	98.0%
Euro-eta	97.9%
Ambient conditions	
Operating temperature range	–25 °C ... +60 °C (–13 °F ... +140 °F)
Max. temperature for nominal conditions	+45 °C (+113 °F)
Protection rating	NEMA 3R
Installation indoors / outdoors	●/●
Rel. humidity	15% ... 95%
Fresh air consumption	3000 m³/h
Internal consumption at nominal power	< 1600 W
Standby consumption (P_{night})	< 110 W
Dimensions and weight	
Height	2277 mm (90 in)
Width	2562 mm (101 in)
Depth	956 mm (38 in)
Weight	< 1800 kg (3970 lb)
Certificates / listings	
Certificates	UL 1741, UL 1998, IEEE 1547
EMC conformity	FCC, Part 15, Class A
Interfaces	
RS485 / Ethernet / analog	o/o/o
Display: text line / graphic	–/●
Communication protocols	Modbus / TCP
SSM-US connection	RS485
Plant monitoring	Sunny Portal



All figures in mm.

A COM-B, optional
C Sunny Central, inverter cabinet
E Medium-voltage switchgear
G Station sub-distribution



B Sunny Central, DC cabinet
D Sunny Central, AC cabinet
F Transformer

EQUIPMENT SPECIFICATIONS

SCALE: NTS

NOTES:
1. NONE.

KEYED NOTES:
1. NONE.

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AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON, ON K7L 3N6

PROJECT SITE:
NAPANEE TS
TAYLOR KIDD
SOLAR PROJECT
PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

DRAWING:
EQUIPMENT SPECIFICATIONS

DRAWING NO.
EP-701

PV SYSTEM GENERATOR CALCULATIONS

MODULE	CANADIAN SOLAR CS6X-270 (TYPICAL)
MODULE STC POWER	270Wp
MODULE TILT	30°
ARRAY AZIMUTH	180°

	GENERATOR, TYPICAL OF 10	SITE TOTAL
GENERATOR MANUFACTURER	SMA	SMA
GENERATOR MODEL	SUNNY CENTRAL 500HE	SUNNY CENTRAL 500HE
NUMBER OF MODULES PER GENERATOR	4,532	45,320
DC RATING	1.2236 MW	12.236 MW
AC NAMEPLATE RATING	1.0 MW	10 MW
NUMBER OF SOURCE CIRCUITS	412	4,160
SOURCE CIRCUIT COMBINERS	26	260

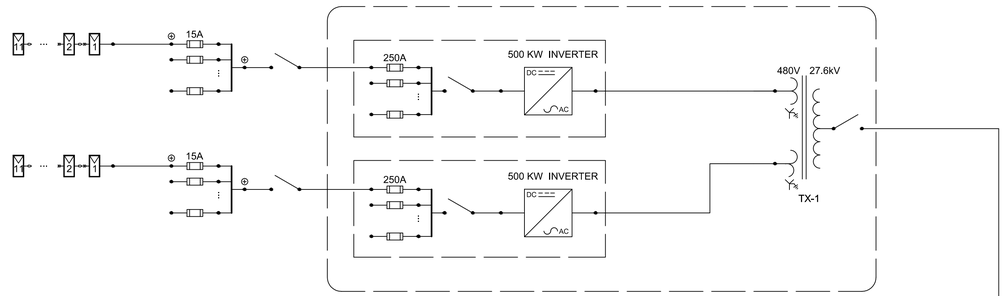
SOURCE CIRCUIT
CANADIAN SOLAR MODULES
CONFORMS TO IEC 61215
600VDC MAX
11 MODULES WIRED IN SERIES

16 STRING COMBINER BOX WITH INTEGRATED DISCONNECT
TYPE 3R MIN
600 VDC MAX FUSES

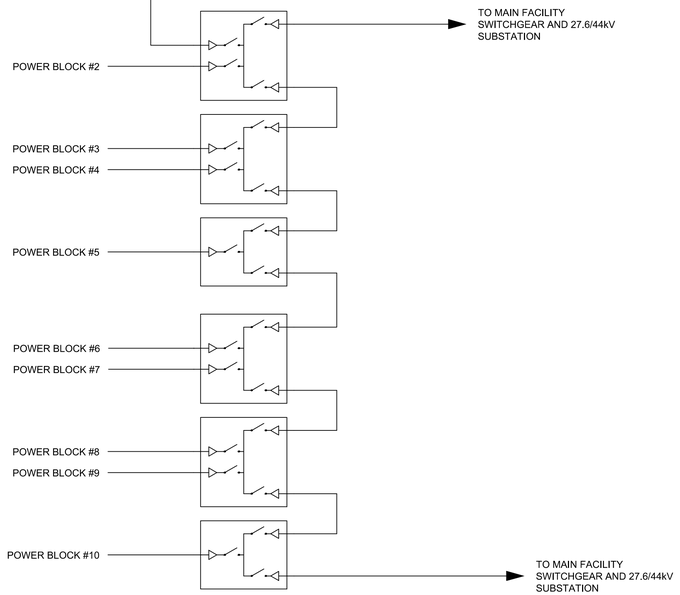
PV POWER CONDITIONING SYSTEM
IEEE 929 AND IEEE 1547 COMPLIANT
600 VDC MAX INPUT VOLTAGE
PRODUCTION METERING OCCURS AT INVERTER OUTPUT WITH GROUND-FAULT DETECTION

TRANSFORMER
1000 kVA, LV:27.6kV

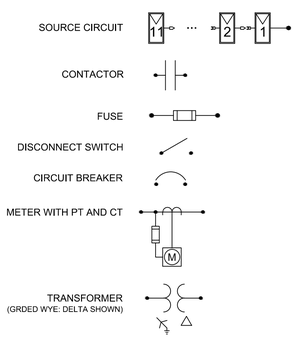
SECTIONALIZING SWITCHES
600A BUS, 200A LOAD RATINGS
PAD MOUNTED



POWER BLOCK #1
1.0 MVA AC TYPICAL OF 10



SYMBOLS AND ABBREVIATIONS



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BLUE OAK ENERGY CANADA
200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE: (905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON, ON K7L 3N6

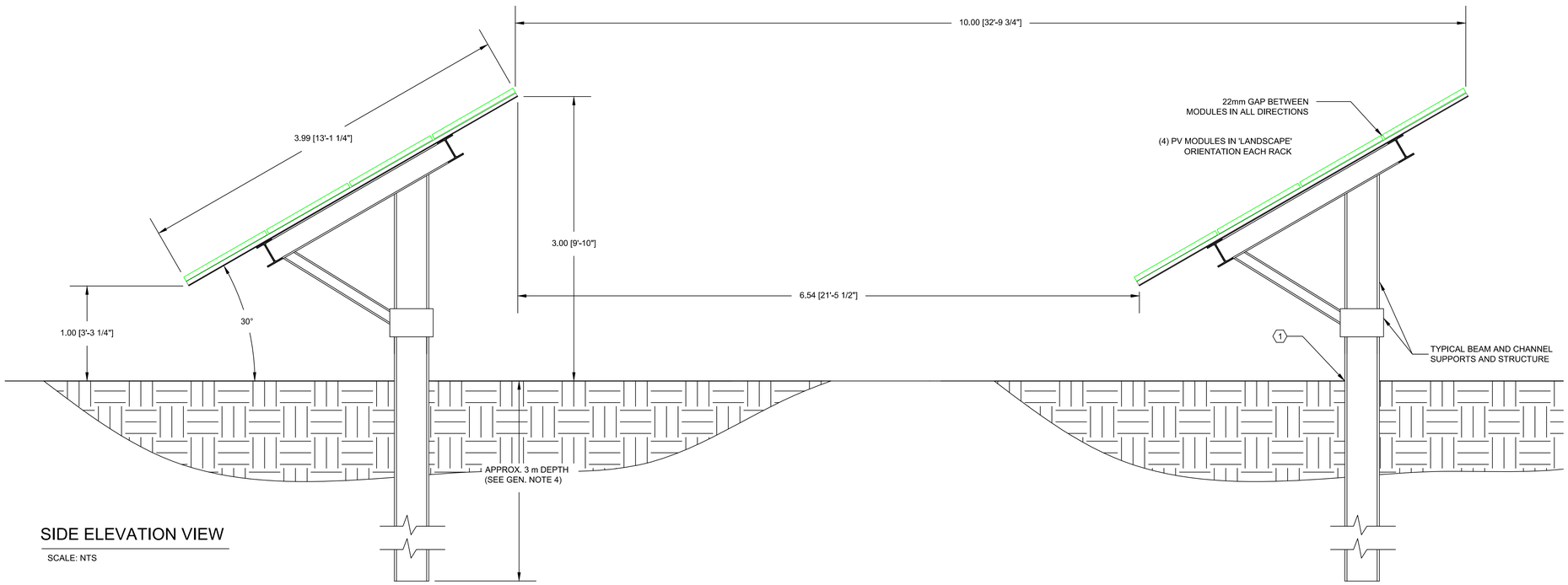
PROJECT SITE:

NAPANEE TS TAYLOR KIDD SOLAR PROJECT

PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

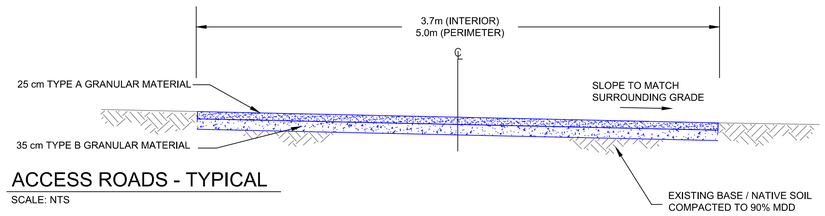
DRAWING:
SINGLE LINE DIAGRAM

DRAWING NO.
EP-801



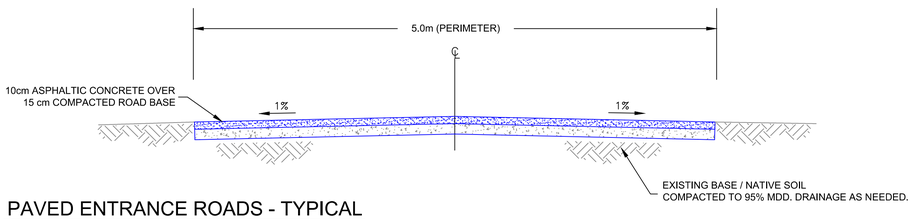
SIDE ELEVATION VIEW

SCALE: NTS



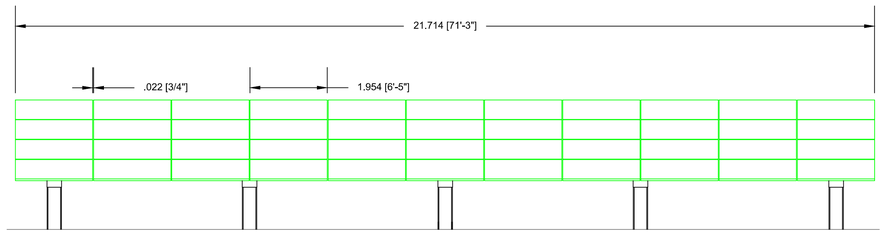
ACCESS ROADS - TYPICAL

SCALE: NTS



PAVED ENTRANCE ROADS - TYPICAL

SCALE: NTS



FRONT VIEW

SCALE: NTS

GENERAL NOTES:

1. EACH RACK INCORPORATES 44 CANADIAN SOLAR; CS6X 270P MODULES.
2. PV MODULES WIRED IN SERIES-PARALLEL COMBINATIONS ABOVE GROUND ALONG RACK STRUCTURES TO CREATE PV STRING CIRCUITS, 600V DC MAX. STRINGS TERMINATE IN PV COMBINER BOXES.
3. COMBINER BOX OUTPUT (50-150A DC EACH) IS ROUTED UNDERGROUND IN RIGID NON-METALIC CONDUIT OR DIRECT BURIAL 2-CONDUCTOR CABLE TO PV INVERTER STATIONS.
4. DEPTHS ARE APPROXIMATE, PENDING FINAL RACK AND STRUCTURAL ENGINEERING.
5. FOUNDATIONS AND DEPTH OF PILES/POST ARE REPRESENTATIVE ONLY. ACTUAL SPECIFICATION WILL BE DETERMINED BY A LICENSED STRUCTURAL ENGINEER BASED ON THE GEOTECHNICAL STUDY.
6. DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
7. APPROXIMATELY 5 PILES PER 44 MODULES

KEYED NOTES:

1. FOUNDATION OPTIONS INCLUDE DRIVEN PILE, HELICAL GROUND ANCHOR, DRILLED PILE WITH CONCRETE REINFORCEMENT. DEPENDS ON SOIL TYPE AND PROPERTIES.

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AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON, ON K7L 3N6

PROJECT SITE:

NAPANEE TS
TAYLOR KIDD
SOLAR PROJECT

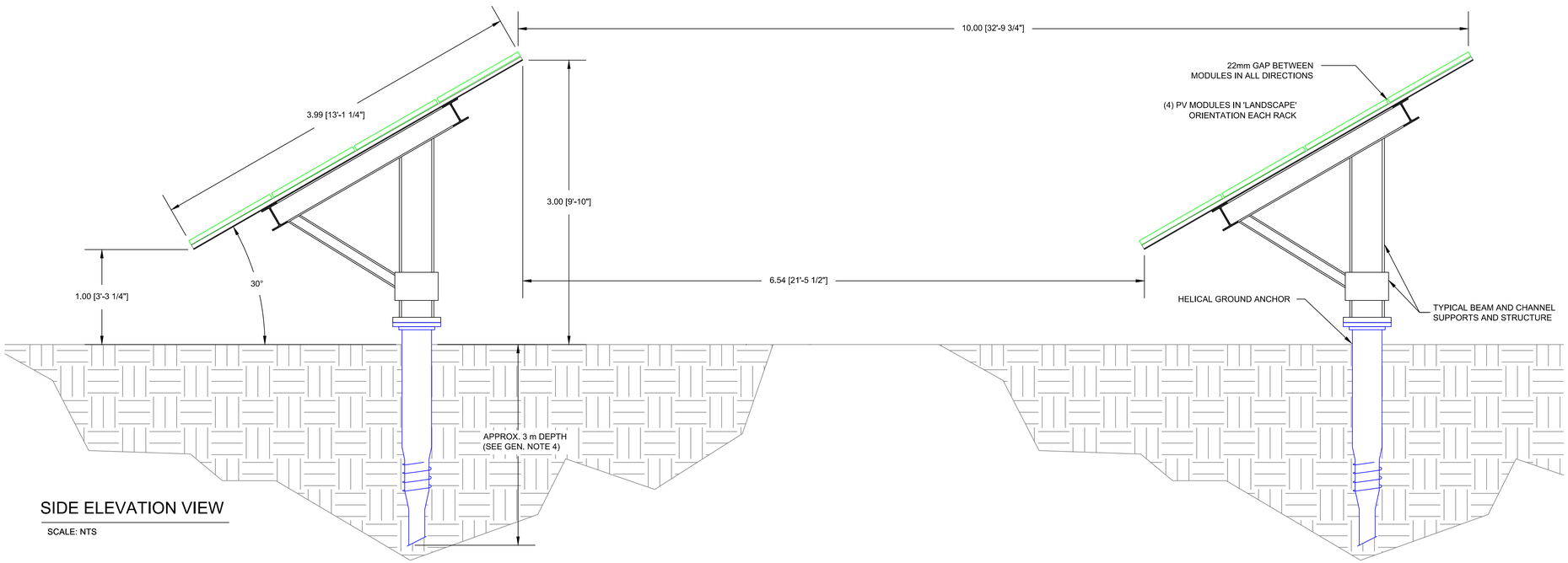
PART OF LOTS 27 AND 28, CONCESSION 1, TOWNSHIP OF LOYALIST, ON

DRAWING:

RACKING & ANCHOR DETAILS

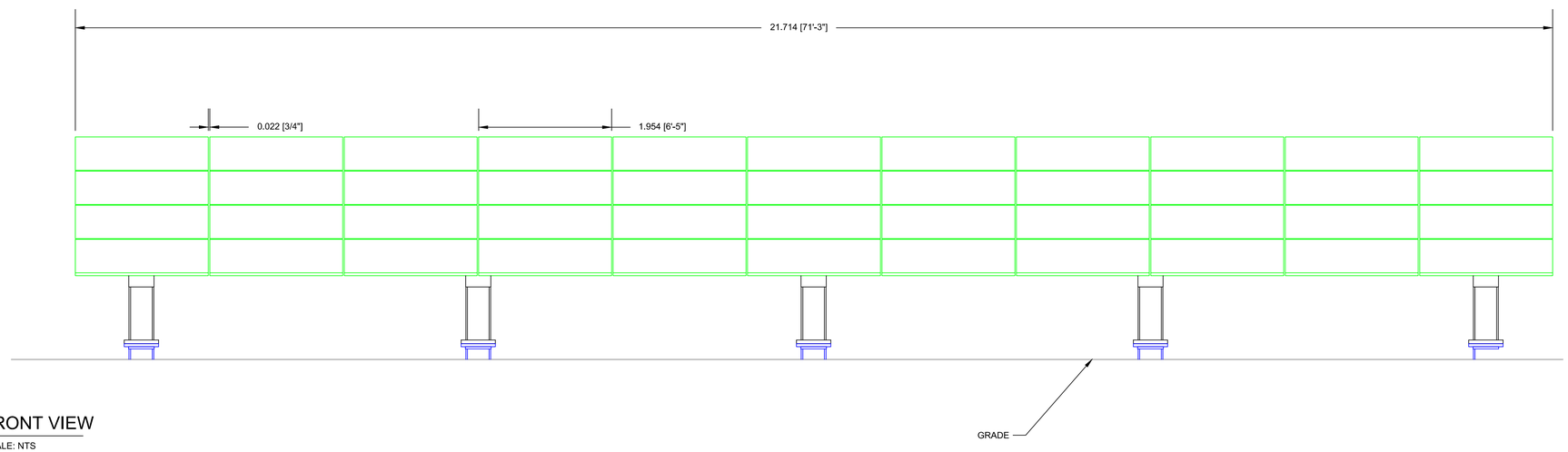
DRAWING NO.

S-101



SIDE ELEVATION VIEW

SCALE: NTS



FRONT VIEW

SCALE: NTS

GENERAL NOTES:

1. EACH RACK INCORPORATES 44 CANADIAN SOLAR; CS6X 270P MODULES.
2. PV MODULES WIRED IN SERIES-PARALLEL COMBINATIONS ABOVE GROUND ALONG RACK STRUCTURES TO CREATE PV STRING CIRCUITS, 600V DC MAX. STRINGS TERMINATE IN PV COMBINER BOXES.
3. COMBINER BOX OUTPUT (50-150A DC EACH) IS ROUTED UNDERGROUND IN RIGID NON-METALIC CONDUIT OR DIRECT BURIAL 2-CONDUCTOR CABLE TO PV INVERTER STATIONS.
4. DEPTHS ARE APPROXIMATE, PENDING FINAL RACK AND STRUCTURAL ENGINEERING.
5. DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. APPROXIMATELY 5 GROUND ANCHORS PER 44 MODULES.

ELECTRICAL ENGINEER:

PRELIMINARY DRAWING
FOR REVIEW ONLY
NOT FOR CONSTRUCTION

DATE: X-XX-XXXX

REV. NO.	DESCRIPTION	DATE	BY
	ISSUED	05/31/11	R.M

BLUE OAK ENERGY CANADA
200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE: (905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON, ON K7L 3N6

PROJECT SITE:

NAPANEE TS
TAYLOR KIDD
SOLAR PROJECT

PART OF LOTS 27 AND 28, CONCESSION 1,
TOWNSHIP OF LOYALIST, ON

DRAWING:
RACKING & ANCHOR OPTIONS

DRAWING NO.

S-102

HATCH™

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