Grand Valley Wind Farms – Phase 3 Wind Project Wind Turbine Specification Report

Prepared for:
Grand Valley 2 Limited Partnership
222 3rd Avenue Southwest, Suite 900
Livingston Place, South Tower
Calgary AB T2P 0B4

Prepared by:
Stantec Consulting Ltd.
1 - 70 Southgate Drive
Guelph ON N1G 4P5

File No. 160960698
September 23, 2015

Sign-off Sheet

The Wind Turbine Specifications Report for the Grand Valley Wind Farms - Phase 3 Wind Project has been prepared by Stantec for Grand Valley 2 Limited Partnership. in accordance with Ontario Regulation 359/09 and the *Technical Guide to Renewable Energy Approvals* (MOE, 2012).

This report has been prepared by Stantec for the sole benefit of Grand Valley 2 Limited Partnership, and may not be used by any third party without the express written consent of Grand Valley 2 Limited Partnership. The data presented in this report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

Prepared by _____
(signature)

Robert Rowland, P.Geo.
Senior Project Manager

Reviewed by _____
(signature)

Mark Knight, MA, MCIP, RPP
Project Manager

Stantec

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

Grand Valley 2 Limited Partnership (GV2LP) is proposing to develop, construct, operate and decommission the 40 megawatt (MW) Grand Valley Wind Farms - Phase 3 Wind Project (the Project) in the Town of Grand Valley and Township of Amaranth, Dufferin County in response to the Government of Ontario's initiative to promote the development of renewable electricity in the province.

The Project Study Area is generally bordered on the north by Highway 89, on the south by County Road 109, on the east by 9th Line and on the west by East West Luther Townline. The proposed Project Location includes all parts of the land in, on or over which the Project is proposed (the 'construction area' for the Project). The proposed Project Location and Project Study Area are shown in Figures 1 and 2, Appendix A.

The basic components of the Project include:

- Sixteen (16) wind turbine generators (SWT 3.2-113 turbine) with a total maximum installed nameplate capacity of 40 MW. The turbines would be 'de-rated', generating less electricity per turbine to meet the contract nameplate capacity. A Noise Assessment Report has been completed as part of the Renewable Energy Approval (REA) process;
- A 34.5 kV underground power line collector system that would transport the electricity generated from the Project to the Hydro One Networks Inc. (HONI) transmission system;
- Fibre optic cabling laid with the underground collector lines;
- Turbine access roads;
- Crane pads;
- One connection point to the existing HONI electrical transmission system;
- Existing operations and maintenance facilities to be leased by the Project (joining the current facilities for the operation of the Grand Valley Phase 1 and 2 Wind Projects). The currently municipally-serviced office facility is located at 35A Main Street South, Grand Valley and the currently unserviced warehouse facility is located at 27 Mill Street West, Grand Valley;
- Existing parking (owned) and gravel quarry (leased) sites to be used for employee parking and temporary construction trailer sites (174321 and 173395 County Road 25, Grand Valley);
- A 34.5 kV/230 kV 45 MVA transformer station; and,
- Meteorological equipment, including an approximately 100 m MET tower or a ground mounted SoDAR unit.

Temporary components include:

- Work and storage areas during construction at the turbine locations and along the underground power line collector system; and,
- Office, parking and storage areas during construction for the work crews during the construction phase of the Project.

GV2LP retained Stantec Consulting Ltd. (Stantec) to prepare the REA application with input from Zephyr North Ltd., and Archaeological Services Inc. The REA application is a requirement under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the *Environmental Protection Act* (O. Reg. 359/09), as amended. According to subsection 6 (3) of O. Reg. 359/09, the Project is classified as a Class 4 Wind Facility and will follow the requirements identified in O. Reg. 359/09 for such a facility.

1.2 REPORT REQUIREMENTS

The purpose of the Wind Turbine Specifications Report is to provide the public, Aboriginal communities, municipalities, and regulatory agencies with an understanding of the technical specifications of the wind turbine generators to be utilized for the Project.

The Wind Turbine Specifications Report has been prepared in accordance with Item 13, Table 1 of O.Reg.359/09, and the Ministry of the Environment's (MOE's) *Technical Guide to Renewable Energy Approvals* (MOE 2012). O. Reg. 359/09 sets out specific content requirements for the Wind Turbine Specifications Report as provided in the following table (Table 1.1).

Table 1.1: Wind Turbine Specifications Report Content: O. Reg. 359/09

Requirements	Completed	Section Reference
Provide specifications of each wind turbine, including make, model, name plate capacity, hub height above grade, rotational speeds and acoustic emissions data, including the sound power level and frequency spectrum, in terms of octave-band power levels.	✓	2.0
The acoustic emissions data, determined and reported in accordance with standards CAN/CSA-C61400-11-07, "Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques:, dated October 2007, including the overall sound power level, measurement uncertainty level, octave-band sound power levels (linear weighted) and tonality and tonal audibility.	✓	Please see Noise Assessment Report, an Appendix of the Design and Operations Report

Please note for the second point in Table 1.1 - CAN/CSA-61400-11-07 is completely equivalent to IEC 61400-11. All turbine manufacturers, including Siemens, report on the basis of IEC-61400-11, not CAN/CSA-61400-11-07.

2.0 TECHNICAL SPECIFICATIONS

2.1 WIND TURBINES

The Project consists of sixteen (16) wind turbine generators (SWT 3.2-113) with a total maximum installed nameplate capacity of 40 MW. The turbine would be 'de-rated', generating less electricity per turbine to meet the contracted nameplate capacity. A Noise Assessment Report has been completed as part of the REA process and is provided in the Design and Operations Report.

A summary of the basic specifications of the turbine model is provided in Table 2.1 below. A complete description of the general specifications for the turbine model is found in the manufacturer's information provided as Attachment A. Acoustic data is also provided in the Noise Assessment Report contained within the Design and Operations Report.

Manufacturer	Siemens
Model	SWT 3.2-113
Name plate capacity (MW)	3.2 MW
Hub height above grade	99.5 m
Blade length	55 m
Full blade diameter	113 m
Blade sweep area	10,000 m^2
Speed range	6-15.8 rpm
Sound Power Level	Refer to Noise Assessment Report
Frequency spectrum	50 or 60 Hz

2.2 WIND TURBINE LOCATIONS

The wind turbines will be located at the locations and coordinates provided in Table 2.2 below.

Table 2.1: Turbine Coordinates

Turbine #	UTM Easting	UTM Northing
101	546165	4873538
102	546188	4872997
103	548193	4872750
104	548297	4872271
105	552907	4870024

Table 2.1: Turbine Coordinates

Turbine #	UTM Easting	UTM Northing
106	554074	4870311
108	555316	4869921
109	552688	4864238
110	552887	4863599
112	551622	4863426
113	551529	4861903
114	550852	4861687
115	550750	4860447
117	550194	4860468
118	550461	4859993
120	554159	4869801

ATTACHMENT A:
TURBINE SPECIFICATIONS

SWT-3.2-113 Technical Specifications - Ontario, Canada

Rotor
Type ..... 3-bladed, horizontal axis
Position ..... Upwind
Diameter ..... 113 m
Swept area ..... 10.000 m²
Speed range ..... 6-15.8 rpm
Power regulation ..... Pitch regulation with variable speed
Rotor tilt ..... 6 degrees

Blade
Type ..... Self-supporting
Blade length ..... 55 m
Tip chord ..... 0.63 m
Root chord ..... 4.2 m
Aerodynamic profile ..... Siemens proprietary airfoils, FFA-W3-XXX
Material ..... GRE
Surface gloss ..... Semi-gloss, < 30 / ISO2813
Surface color ..... Light grey, RAL 7035

Aerodynamic Brake
Type ..... Full span pitching
Activation ..... Active, hydraulic

Load-Supporting Parts
Hub ..... Nodular cast iron
Fixed shaft ..... Nodular cast iron
Nacelle bed frame ..... Nodular cast iron

Mechanical Brake
Type ..... Hydraulic disc brake
Position ..... Generator rear end
Number of callipers..... 3

Canopy
Type ..... Totally enclosed
Surface gloss ..... Semi-gloss, 25-45 / ISO-2813
Color ..... Light grey, RAL 7035

Generator
Type ..... Synchronous, PMG
Nominal power ..... 3.4 MW

Grid Terminals (LV)
Nominal power ..... 3.2 MW
Voltage ..... 690 V
Frequency ..... 50 Hz or 60 Hz

Yaw System
Type ..... Active
Yaw bearing ..... Externally geared
Yaw drive ..... 8 (optional 10) electric gear motors
Yaw brake ..... Passive friction brake

Controller
Type ..... Microprocessor
SCADA system ..... WPS
Controller designation ..... SICS

Tower
Type ..... Tubular steel tower
Hub height ..... 99.5 m
Corrosion protection ..... Painted
Surface gloss ..... Semi-gloss, 25-45 / ISO2813
Colour ..... Light grey, RAL 7035

Operational Data
Cut-in wind speed ..... 3-5 m/s
Nominal power at ..... 12-14 m/s
Cut-out wind speed ..... 25 m/s
Maximum 3 s gust ..... 59.5 m/s (IEC version)

Weights (approximately)
Rotor ..... 67 Metric tons
Nacelle ..... 77 Metric tons

Siemens Wind Power and its affiliates reserve the right to change the above specifications without prior notice.