Final

Summary of Facility Study and Interconnection Restudy for Aquila Interconnection Queue Customer

Generation Addition: 105 MW Wind Farm near Mullinville, Kansas

November 2005

Final

Introduction

This report summarizes the results of a Generation Interconnection Facilities Study performed by Aquila, Inc to evaluate a generation interconnection request by Clipper WindPower, Inc. for 105 MW of wind-powered generation on the Aquila, Inc. transmission system near Mullinville, Kansas. Prior to this Facilities Study, a Feasibility Study and a Generation Interconnection Study were completed. Included in this study was an evaluation of the customer's proposed use of the Clipper Windpower C-93 wind turbine instead of the wind turbines studied in the prior studies.

Project Description

The proposed project consists of 42, 2.5 MW Clipper Windpower C-93 wind turbines. The output of the project will flow into the Aquila system via a new 115 kV switching station located approximately 7.5 miles from the Greensburg Substation along the Judson Large to Medicine Lodge 115 kV line. The customer will own, operate, and maintain a 115 kV transmission line from the project substation to the new interconnection switching station. The customer will also be responsible for any required step down transformation and the project substation. Figure 1 illustrates where the proposed project electrically interconnects with the Aquila system. Figures 2 and 3 show where the proposed project and interconnection will be located geographically.

Figure 1: Modified Aquila Switch Map to Include Proposed Project

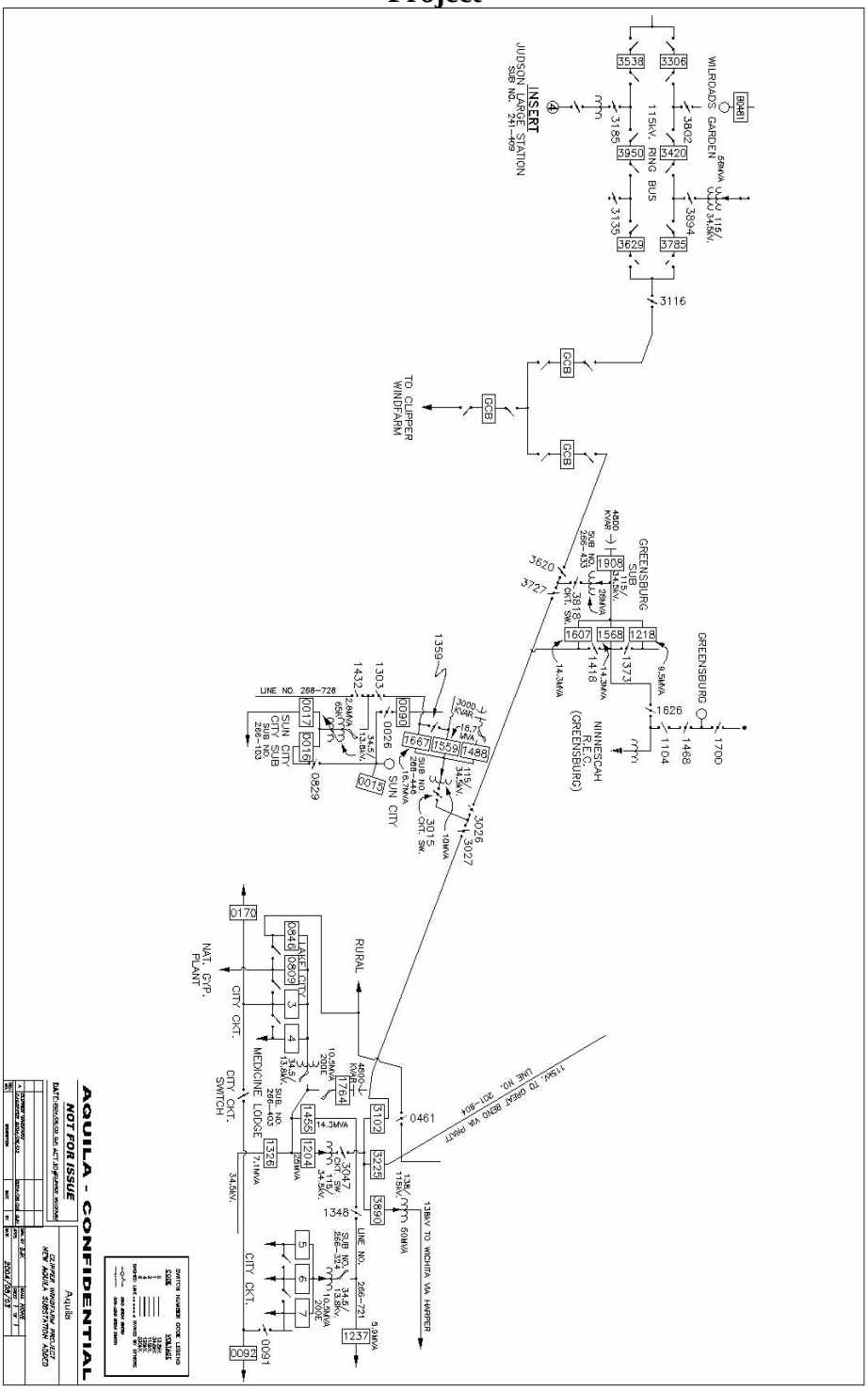


Figure 2: Geographical Location of Proposed Project

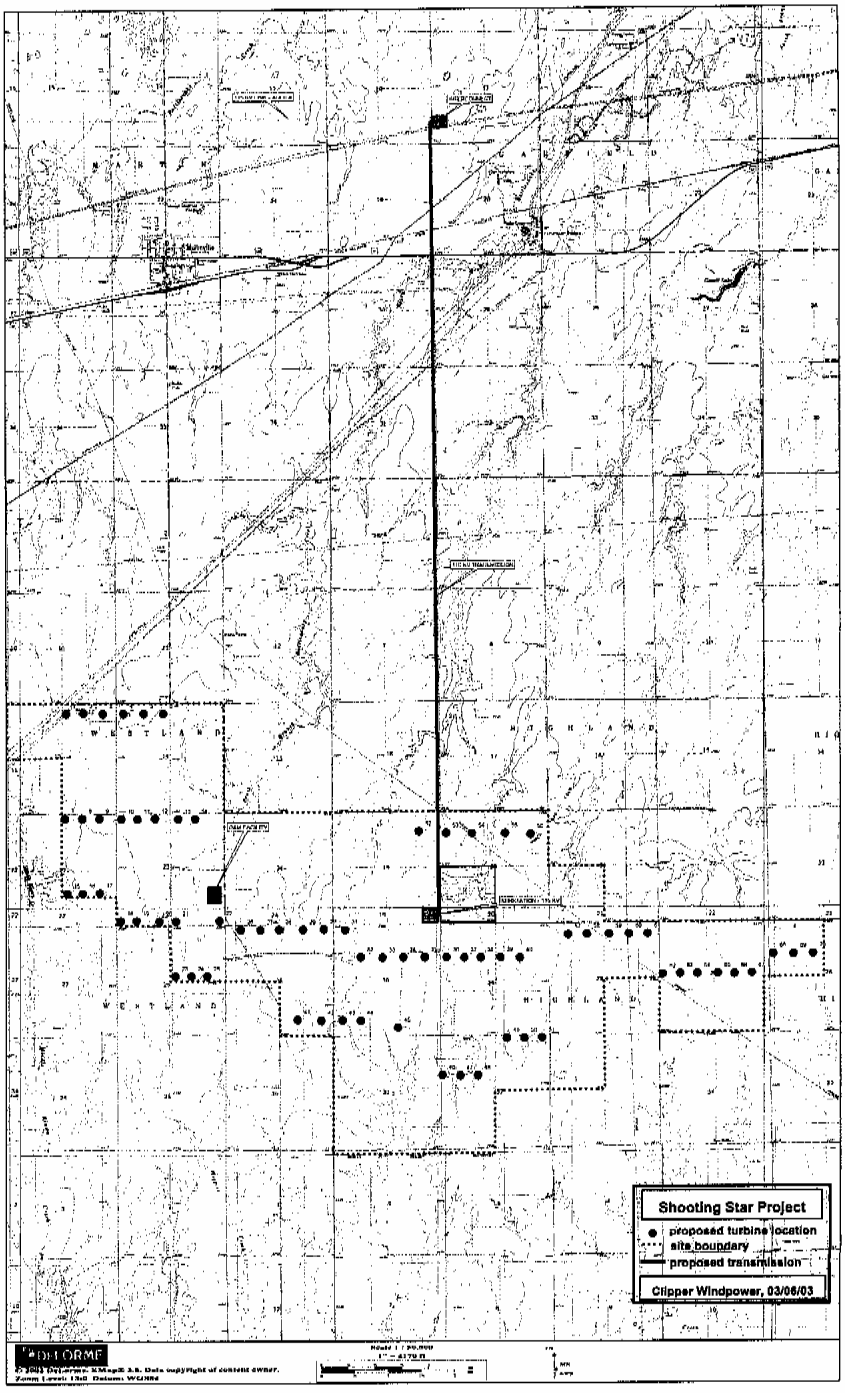
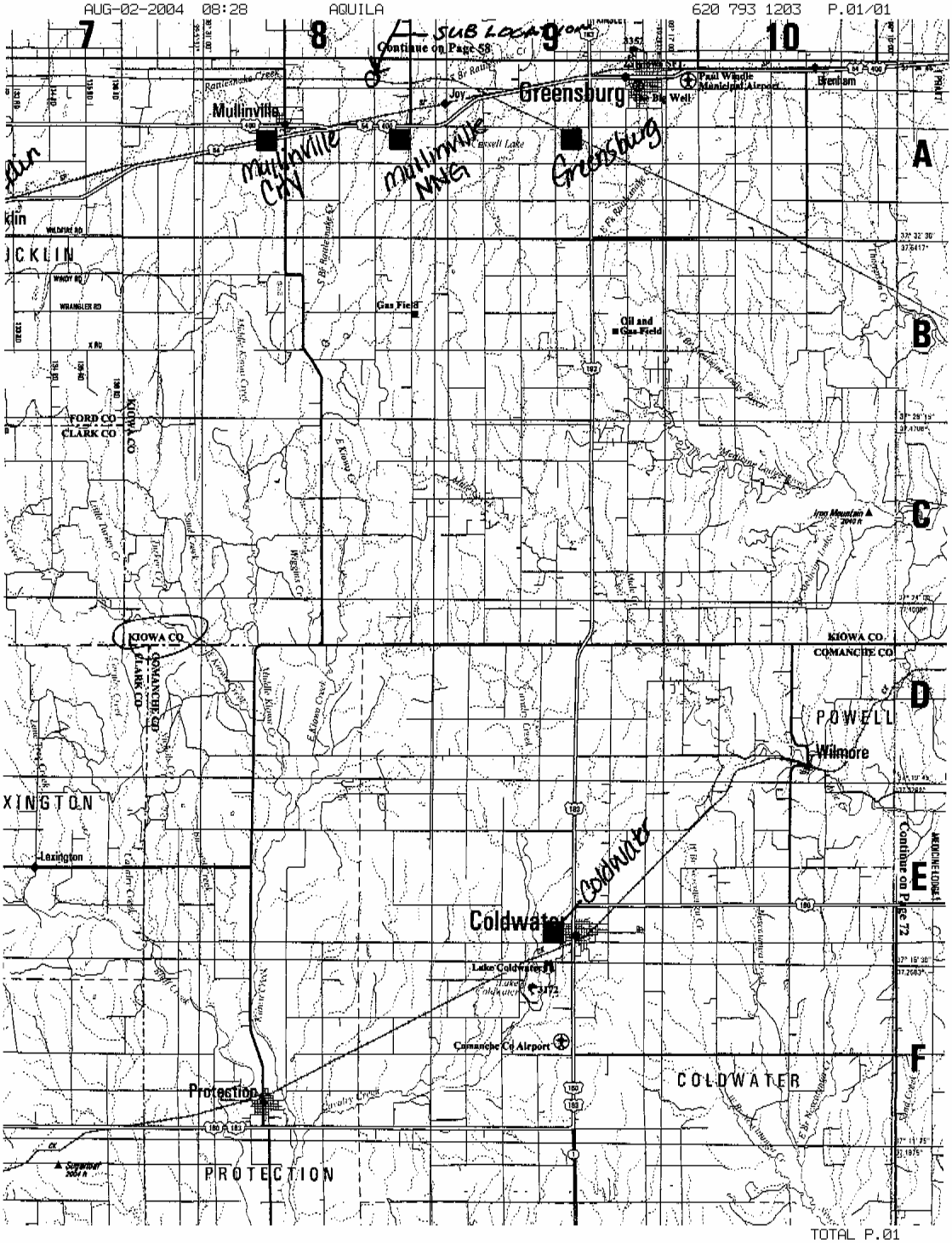


Figure 3: Geographical Location of Proposed Interconnection



Re-Study of Project with Clipper Windpower Turbines

The original Generation Interconnection Study was performed utilizing both a GE 1.5/70.5 wind turbine and an NEG Micon NM72c wind turbine. The customer has subsequently requested that the project be evaluated using a Clipper Windpower C93 wind turbine. As the total wind park system design was anticipated to be at least equivalent in system impact to the original proposal, this request was honored without impacting the customers queue position.

To assess the impact of the change of wind turbine, the new wind turbine model was inserted in the original study data files in place of the original models. The previous load flow, transient stability, and short circuit analyses were subsequently performed with the modified system models.

The new stability simulations indicated that the system impacts with the Clipper Windpower turbine were identical to those reported in the original Generation Interconnection Study report. Therefore, shortening the breaker failure time delay time at the North Judson Switching Station from 15 cycles to 12 cycles will still be required.

According to modeling information supplied for the Clipper Windpower turbine, the C93 will not produce a short circuit current contribution for classic short circuit analysis. As such, the maximum fault current levels with the addition of the proposed project will still be within the rated capabilities of the equipment on the Aquila system, as determined in the original Generation Interconnection Study report.

Load flow analysis using the updated models confirmed that the same thermal overloads identified in the original Generator Interconnection Study were present using the new turbine. The other issue related to the new proposed turbine relates to required reactive compensation. Load flow analysis did confirm that the new turbine will require dynamic reactive capability as described in the previous studies (due to the need for voltage controllability to maintain voltage stability).

The Clipper wind turbine is not capable of providing variable dynamic reactive power but is capable of holding a set power factor. For purposes of this re-study, the power factor of the wind park was set to approximately unity at the turbine level with a variable var generator on the 34.5 collector bus. The var generator was set to hold a voltage schedule of 35.2 kV on the collector bus with an unlimited leading and lagging reactive range. The critical contingencies in the area were performed for a range of wind park outputs (15-105 MW in 10 MW increments) across all of the seasonal cases analyzed in the previous studies. For each iteration, the output of the variable var generator was recorded. The results of this analysis indicated that a reactive range of +30/-10 Mvar would be necessary.

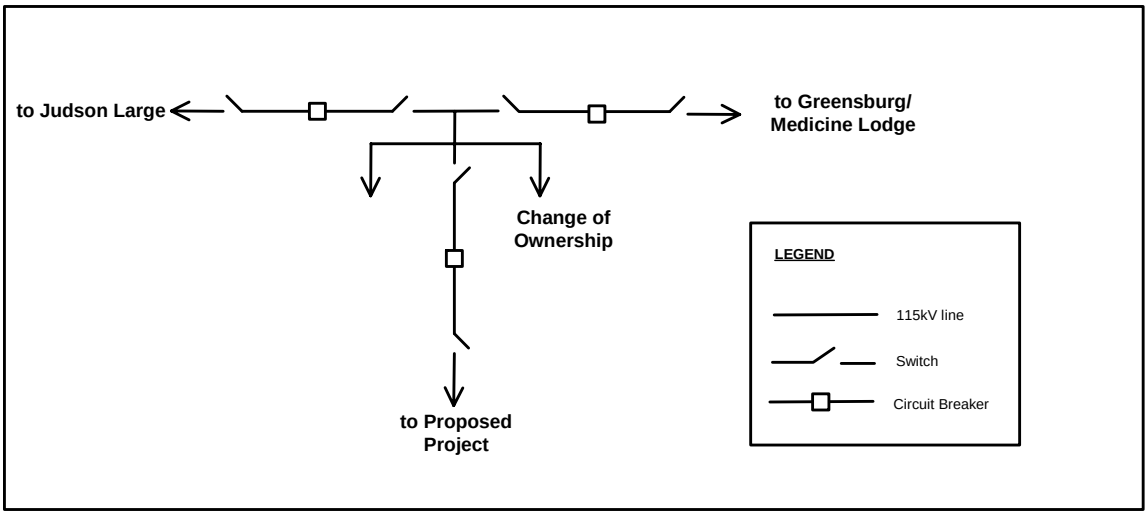
This analysis was also conducted with the variable var generator located at the 115 kV interconnection substation, holding a voltage schedule of 115 kV. For this case, the required range of compensation is +40/-15 MVar. There was some value to the transmission network in placing the reactive compensation at this location. If the

customer is interested in pursuing this compensation location, the matter can be negotiated further in developing the interconnection agreement.

Interconnection Facilities

Interconnection to the Aquila transmission system will occur via a new 115 kV switching station inserted into the existing Judson Large to Medicine Lodge 115 kV line (see Figure 4). Construction of the new switching station will require acquisition of land.

Figure 4 - One Line Diagram of Interconnection Switching Station



The Interconnection Study identified several items as necessary to accommodate the interconnection. The original items identified, along with estimated costs are listed below:

1. Three-position, radial bus interconnection substation, as illustrated in Figure 4 – estimated cost of $3,025,000. The estimate includes all major substation equipment including switches, circuit breakers, potential devices, and revenue metering.
2. Replacement of wave trap and line relaying at Judson Large Substation - estimated cost of $148,000. The estimate includes cost to replace relay panel 14R on the Judson Large to Medicine Lodge 115 kV line. The new relay terminal is required to effectively protect the proposed new system configuration. Note that replacement of the wave trap at Judson Large was determined not to be necessary and therefore no cost has been included for this item.
3. Modification of breaker failure timing at North Judson Switching Station – estimated cost of $1,000. This item is needed to mitigate identified system stability impacts.
4. Replacement of wave trap and current transformers at Medicine Lodge Substation – estimated cost of $454,000. The estimate includes replacement of the existing

wave trap, line tuner and coupling capacitor potential device on the Medicine Lodge to Judson Large line as well as existing circuit breaker 3102.

5. Modification of Greensburg and Sun City Substations to address switching issues – estimated cost of $6900. Initially this item identified the addition of a circuit switcher at Greensburg and whips at Sun City. Subsequent improvements in these substations have reduced the required scope of this item to re-tuning, adjusting and calibrating the existing powerline carrier equipment at Greensburg.

This estimated costs listed do not include any line work required for terminating the customer's transmission line. The estimates include Kansas sales tax but no allowance for income tax consequences. It is understood at this time that there will be no income tax consequences. Should this change, the customer will be responsible for reimbursement of income tax consequences.

Estimated work schedule

The interconnection facilities will require approximately 12 months to complete from ability to proceed with procurement of equipment. This time line is based on Aquila's engineering time, average procurement time, good weather during construction, and favorable time of year for completing construction. If construction is commenced during times of the year when facility outages are more difficult to approve, some additional time may be required. Aquila reserves the right to utilize consultants to perform this work which may impact the estimated schedule.

Additional Considerations

The Generation Interconnection study additionally identified two system impacts associated with delivering the output of proposed project. Cost estimates for these items were developed as agreed to by the customer and are included for information. Note that this is not intended to be a complete list of delivery impacts as those will need to be determined by a transmission service study. The impacts and associated cost estimates are:

1. Replacement of existing 138/115 MVA transformer at Medicine Lodge with a minimum 70 MVA unit – estimated cost is $3,008,000. Project includes expanding the existing substation to the east of the existing substation to accommodate the expanded footprint of the new transformer. Estimate includes the 138/115 kV transformer, 115 kV gas circuit breaker, and bus work. Estimated time to complete this project is 18 months. Primary variable in construction time will be procurement of the transformer.
2. Modify 115 kV line from interconnection substation to Greensburg Substation to allow 100C rating – estimated cost is $163,000. Field surveys have revealed seven structures that will require replacement in order to allow this line segment to be rated for 100C operation. Estimated time to complete the project is 12 months.