



EAPC
WIND ENERGY

**Pre-Construction Compliance Report
Crowned Ridge Wind, LLC
Shadow Flicker Study
Codington and Grant Counties, SD**

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2019

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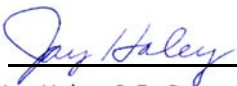

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Report Update

EAPC bears no responsibility to update this report for any changes occurring subsequent to the final issuance of this report.

Revision History

| Revision No. | Revision Purpose | Date | Revised By |
|--------------|------------------|-----------|------------|
| 0 | Original | 7/28/2019 | J. Haley |

Executive Summary

EAPC was hired to provide estimates of the potential shadow flicker impacts for a proposed wind turbine layout in Codington and Grant Counties of the Crowned Ridge wind farm project in northeastern South Dakota. The scope of this report includes all proposed turbines included in the Crowned Ridge project that will be permitted separately through the South Dakota Public Utilities Commission. Locations of area occupied structures and a wind turbine layout using a mixture of 142 wind turbines manufactured by General Electric (GE) were provided to EAPC by Crowned Ridge Wind, LLC. Wind turbine models and locations of 140 turbines for the adjacent Crowned Ridge II wind farm were supplied by Crowned Ridge Wind II, LLC and were included in the model. The wind turbine models and coordinates of 97 turbines for the adjacent Dakota Range I and II wind farms were also included in the model, with information gathered from permit filings. A computer model was built combining digital elevation data with the information gathered to generate shadow flicker models for the site. The resulting models were then used to perform shadow flicker calculations for the 379 turbines. Based on the calculations, site-wide realistic shadow flicker maps were produced to predict the shadow flicker at nearby residences within the Crowned Ridge Project area.

The model is based on a number of conservative assumptions. No credit was taken for the blocking effects of trees or buildings. The receptors were omni-directional rather than modeling specific facades of buildings, and the study assumes 100% turbine availability.

The scope of this study includes the shadow flicker impacts of the Crowned Ridge wind farm on the two counties it is located within, Codington and Grant. The shadow flicker ordinances of both counties limit the maximum number of shadow flicker to 30 hours per year at occupied structures.

For the shadow study in Codington County, the 73 occupied structures (22 participating and 51 non-participating) were represented in the model by omni-directional shadow receptors that simulate a 1 m x 1 m window at 1 m above ground level.

For the shadow study in Grant County, 60 occupied structures (34 participating and 26 non-participating) were represented in the model by omni-directional shadow receptors that simulate a 1 m x 1 m window at 1 m above ground level.

For the Crowned Ridge turbine array provided, no occupied structures experienced more than 30 hours of shadow flickering per year based on realistic assumptions regarding operational time and sunshine probability, with the exception of one non-participating structure. For the non-participating structure, the contributing turbine (which is an alternate turbine subject to terms in Condition No. 27), can only be activated per the terms in Condition No. 27. If activated under the terms of Condition No. 27, the turbine will be curtailed to less than 30 hours per year of shadow flicker. With this commitment, the Crowned Ridge wind farm is in compliance with the shadow flicker limitations set forth in both Codington County's Section

5.22.03 paragraph 13 of Ordinance #68, and Section 1211.04 paragraph 14 of Grant County's Ordinance 2016-01C, which is 30 hours per year.

1. INTRODUCTION

EAPC was hired to conduct shadow flicker studies for the regional development of the Crowned Ridge wind farm project located in Codington and Grant Counties in northeastern South Dakota. The layout consists of 129 GE 2.3 MW wind turbines with a hub height of 90 meters (including 18 alternate turbine locations) and 13 GE 2.3 MW wind turbines with a hub height of 80 meters for a total of 142 wind turbines. The array includes the six remaining Hessler turbines (CR1-16, CR1-19, CR1-23, CR1-60, CR1-67, and CR1-68) to ensure compliance in the event any of the Hessler turbines, which are now alternates, are constructed consistent with Condition No. 27. Also, to ensure compliance under all construction of turbine scenarios, CR1-49, also a Hessler turbine, has been permanently dropped. The locations of the proposed wind turbines were supplied by Crowned Ridge Wind, LLC.

From the database of occupied structures and coordinates supplied by Crowned Ridge Wind, LLC, 73 occupied structures (22 participating and 51 non-participating) in Codington County and 60 occupied structures (34 participating and 26 non-participating) in Grant County were found to be within 2 kilometers of a wind turbine and were included in the shadow models. Shadow flicker does not extend beyond a distance of approximately 1,700 meters from the wind turbine base.

The area of interest for this report is located in Codington and Grant Counties near the town of Watertown in northeastern South Dakota. The surrounding terrain has a change in elevation across the project site ranging from 475 to 621 meters (1,558 to 2,037 feet) at the wind turbine base. The region's vegetation is comprised primarily of prairie grass and agricultural land. The project overview map can be found in Appendix A.

2. BACKGROUND

Shadow flicker from wind turbines occurs when rotating wind turbine blades move between the sun and the observer. Shadow flicker is generally experienced in areas near wind turbines where the distance between the observer and wind turbine blade is short enough that sunlight has not been significantly diffused by the atmosphere. When the blades rotate, this shadow creates a pulsating effect, known as shadow flicker. If the blade's shadow is passing over the window of a building, it will have the effect of increasing and decreasing the light intensity in the room at a low frequency in the range of 0.4 to 0.78 Hz, hence the term "flicker." In this case, with a maximum rotational speed of 15.6 rpm for the GE 2.3-116, the frequency would be 0.78 Hz. This flickering effect can also be experienced outdoors, but the effect is typically less intense, and becomes less intense when farther from the wind turbine causing the flicker.

This flickering effect is most noticeable within approximately 1,000 meters of the turbine, and becomes more and more diffused as the distance increases. Beyond 1,700 meters, the shadow flicker effects are indistinguishable. There are no uniform standards defining what distance from the turbine is regarded as an acceptable limit beyond which the

shadow flicker is considered to be insignificant. The same applies to the number of hours of flickering that is deemed to be acceptable. For this study, in the interest of being conservative, any occupied structure within 2,000 meters of a wind turbine was included in the analysis.

Shadow flicker is typically greatest in the winter months when the angle of the sun is lower and casts longer shadows. The effect is also more pronounced around sunrise and sunset when the sun is near the horizon and the shadows are longer. A number of factors influence the amount of shadow flicker on the shadow receptors.

One consideration is the environment around the shadow receptor. Obstacles such as terrain, trees or buildings between the wind turbine and the receptor can significantly reduce or eliminate shadow flicker effects. Deciduous trees may block the shadow flickering effect to some degree, depending on the tree density, species present and time of year. Deciduous trees can lead to a reduction of shadow flicker during the summer when the trees are bearing leaves. However, during the winter months, these trees are without their leaves and their impact on shadow flicker is not as significant. Coniferous trees tend to provide mitigation from shadow flicker year round. For this study, no credit was taken for any potential shading effects from any type of trees or other obstacles that would reduce the number of shadow flickering hours at the structures which will make the shadow flicker prediction more conservative (higher than in reality).

Another consideration is the time of day when shadow flicker occurs. For example, it may be more acceptable for private homes to experience the shadow flickering during daytime hours when family members may be at work or school. Likewise, a commercial property would not be significantly affected if all the shadow flicker impact occurred before or after business hours.

The climate also needs be considered when assessing shadow flicker. In areas with a significant amount of overcast weather, there would be less shadow flicker, as there are no shadows if the sun is blocked by clouds. Also, if the wind is not blowing, the turbines would not be operational and therefore not creating shadow flickering.

3. STUDY METHODOLOGY

This shadow flicker analysis was performed utilizing windPRO, which has the ability to calculate detailed shadow flicker maps across an entire area of interest or at site-specific locations using shadow receptors.

Shadow maps which indicate where the shadows will be cast and for how long, are generated using windPRO, calculating the shadow flicker in varying user-defined resolutions. Standard resolution was used for this study and represents shadow flicker being calculated every three minutes of every day over the period of an entire year over a grid with a 20 m by 20 m resolution.

In addition to generating a shadow flicker map, the amount of shadow flicker that may occur at a specific point can be calculated more precisely by placing a shadow receptor at the location of interest and essentially “recording” the shadow flicker that occurs as the relative sunrise to sunset motion of the sun is simulated throughout an entire year. The point-specific shadow flicker calculation is run at a higher resolution as compared to the shadow flicker map calculation to utilize the highest precision available within windPRO. Shadow flicker at each shadow receptor location is calculated every minute of every day for an entire year. Shadow receptors can be configured to represent an omni-directional window of a specific size at a specific point (greenhouse mode) or a window facing a single direction of a specific size at a specific point (single direction mode). The shadow receptors used in this analysis were configured as greenhouse-mode receptors representing a 1 m x 1 m window located 1 m above ground level. This represents more of a “worst-case” scenario and thus will produce more conservative results since it assumes that all windows are always in direct line of sight with the turbines and the sun.

As a part of the calculation method, windPRO must determine whether or not a turbine will be visible at the receptor locations and not blocked by local topography or obstacles. It does this by performing a preliminary Zones of Visual Influence (ZVI) calculation, utilizing 10 m grid spacing. If a particular turbine is not visible within the 10 m x 10 m area that the shadow receptor is contained within, then that turbine is not included in the shadow flicker calculation for that receptor.

The inputs for the windPRO shadow flicker calculation include the following:

- Turbine Coordinates
- Turbine Specifications
- Shadow Receptor Coordinates
- Monthly Sunshine Probabilities
- Joint Wind Speed and Direction Frequency Distribution
- USGS Digital Elevation Model (DEM) (height contour data)

A description of each input variable and how they affect the shadow flicker calculation are included below.

Turbine Coordinates: The location of a wind turbine in relation to a shadow receptor is one of the most important factors in determining shadow flicker impacts. A line-of-site is required for shadow flicker to occur. The intensity of the shadow flicker is dependent upon the distance from the wind turbine and weather conditions. The table of wind turbine coordinates can be found in Appendix B.

Turbine Specifications: A wind turbine’s total height and rotor diameter will be included in the windPRO shadow flicker model. The taller the wind turbine, the more likely shadow flicker could have an impact on local shadow receptors as the ability to clear obstacles (such as hills or trees) is greater, although in this analysis, no credit is taken for any such

blockage from trees. The larger the rotor diameter is, the wider the area where shadows will be cast. Also included with the turbine specifications are the cut-in and cut-out wind speeds within which the wind turbine is operational. If the wind speed is below the cut-in threshold or above the cut-out threshold, the turbine rotor will not be spinning and thus shadow flicker will not occur.

Shadow Receptor Coordinates: As with the wind turbine coordinates, the elevation, distance and orientation of a shadow receptor in relation to the wind turbines and the sun are the main factors in determining the impact of shadow flicker. EAPC was provided with coordinates for all participating and non-participating occupied structures found to be located within 2 kilometers of the 142 proposed wind turbine locations.

Monthly Sunshine Probabilities: windPRO calculates sunrise and sunset times to determine the total annual hours of daylight for the modeled area. To further refine the shadow flicker calculations, the monthly probability of sunshine is included to account for cloud cover. The greater the probability of cloud cover, the less of an impact from shadow flicker. The monthly sunshine probabilities for many of the larger cities across the United States are available from the National Climatic Data Center (NCDC). For this study, 18 years' worth of monthly sunshine probability data were retrieved for Huron, SD, which was the closest, most representative station, to create the long-term representative monthly sunshine probabilities. The long-term representative monthly average sunshine probabilities are presented below in Table 1.

Table 1: Huron, SD monthly sunshine probabilities

| Huron, SD Monthly Sunshine Probabilities (1965-1983) | | | | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|
| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Sunshine % | 0.62 | 0.62 | 0.62 | 0.59 | 0.66 | 0.69 | 0.76 | 0.74 | 0.69 | 0.59 | 0.51 | 0.51 |
| retrieved from: http://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos15.dat | | | | | | | | | | | | |

Joint Wind Speed and Direction Frequency Distribution: A set of long-term corrected wind distributions was provided by Crowned Ridge Wind, LLC to represent the annual wind speed and direction distribution for the project site. This data was used to estimate the probable number of operational hours for the wind turbines from each of the 12 wind direction sectors. During operation, the wind turbine rotors will always be assumed to face into the wind and automatically orient themselves as the wind direction changes. Shadow flicker can only occur when the blades are turning and the wind turbine rotor is between the sun and the receptor. Shadow flicker is most significant when the rotor is facing the sun.

USGS Digital Elevation Model (DEM) (height contour data): For this study, 3-meter resolution USGS National Elevation Database (NED) DEM's were used to construct 10-foot interval height contour lines for the windPRO shadow flicker model. The height contour information is important to the shadow flicker calculation since it allows the model to

place the wind turbines and the shadow receptors at the correct elevations. The height contour lines also allow the model to include the topography of the site when calculating the zones of visual influence surrounding the wind turbine and shadow receptor locations.

Wind Turbines from Adjacent Projects: The Crowned Ridge II project and the Dakota Range I and II projects are adjacent to the Crowned Ridge project. Because shadow flicker impacts are cumulative, there will be impacts from these other projects that will be additive to the impacts from the Crowned Ridge project. The Crowned Ridge II wind turbine array and the Dakota Range I and II turbine arrays were included in the model to capture the full shadow flicker impacts on the receptors.

The actual calculation of potential shadow flicker at a given shadow receptor is carried out by simulating the environment near the wind turbines and the shadow receptors. The position of the sun relative to the turbine rotor disk and the resulting shadow is calculated in time steps of one minute throughout an entire year. If the shadow of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow on a receptor window, then this step will be registered as one minute of shadow flicker. The calculation also requires that the sun must be at least 3.0° above the horizon in order to register shadow flicker. When the sun angle is less than 3.0° , the shadow quickly becomes too diffuse to be distinguishable since the amount of atmosphere that the light must pass through is 15 times greater than when the sun is directly overhead.

The sun's path with respect to each wind turbine location is calculated by the software to determine the paths of cast shadows for every minute of every day over a full year. The turbine runtime and direction are calculated from the site's long-term wind speed and direction distribution. Finally, the effects of cloud cover are calculated using long-term reference data (monthly sunshine probability) to arrive at the projected annual flicker time at each receptor.

4. RESULTS OF ANALYSIS

The term "realistic" as used in this report means that turbine operational hours and direction as well as local sunshine probabilities have been factored in, but no blocking or shading effects due to trees or structures have been accounted for. This means that the realistic estimates are still inherently conservative values. Also, the realistic shadow flicker hours predicted by windPRO assumes an availability factor of 100% which is very unlikely to be the case. Actual availability factors will likely be in the range of 95-98%, however, with a conservative approach to estimating shadow flicker totals, the realistic estimates are not discounted accordingly.

Crowned Ridge Codington County Turbines

For Codington County, a total of 73 (22 participating and 51 non-participating) occupied structures within 2 kilometers of a wind turbine were analyzed and standard resolution realistic shadow flicker maps were generated for the turbine array.

The 73 shadow receptors were then modeled as greenhouse-mode receptors and the estimated shadow flicker was calculated for the array. No occupied structures experienced more than 30 hours of shadow flickering per year based on realistic assumptions regarding operational time and sunshine probability, with the exception of one non-participating structure. For the non-participating structure, the contributing turbine (which is an alternate turbine subject to terms in Condition No. 27), can only be activated per the terms in Condition No. 27. If activated under the terms of Condition No. 27, the turbine will be curtailed to less than 30 hours per year of shadow flicker. With this commitment, the Crowned Ridge wind farm is in compliance with the shadow flicker limitations set forth in Codington County's Section 5.22.03 paragraph 13 of Ordinance #68, which is 30 hours per year. Of the 73 receptors, the number that registered no shadow flicker hours was 14 (19.2%).

With the exception of the one receptor mentioned, which will be brought into compliance through curtailment of the contributing turbine, the maximum modeled expected shadow flicker at a participating receptor is 29 hours and 29 minutes and the maximum modeled expected shadow flicker at a non-participating receptor is 28 hours and 25 minutes. Table 2 contains the realistic shadow flicker distribution of the 73 occupied residences.

Table 2: Codington County occupied structures realistic shadow flicker distribution.

| Realistic Shadow Flicker (hrs/year) | Number of Non-Participating Occupied Structures | Number of Participating Occupied Structures |
|-------------------------------------|---|---|
| 0 | 13 | 1 |
| 0 to 5 | 7 | 2 |
| 5 to 10 | 10 | 5 |
| 10 to 15 | 8 | 7 |
| 15 to 20 | 7 | 0 |
| 20 to 25 | 2 | 3 |
| 25 to 30 | 3 | 3 |
| 30+ | 1* | 0 |

* Will be brought into compliance through curtailment.

Crowned Ridge Grant County Turbines

For Grant County, 60 (34 participating and 26 non-participating) occupied structures within 2 kilometers of a wind turbine were found and analyzed. Standard resolution realistic shadow flicker maps were generated for the turbine array.

The 60 shadow receptors were then modeled as greenhouse-mode receptors and the estimated shadow flicker was calculated for the array. No occupied structures are

expected to experience more than 29 hours and 59 minutes of shadow flicker per year. Therefore, the Crowned Ridge wind farm would be in compliance with Section 1211.04 paragraph 14 of Grant County's Ordinance 2016-01C. Of the 60 occupied structures, the number that registered no shadow flicker hours was 20 (33.3%).

The maximum modeled expected shadow flicker at a participating receptor is 29 hours and 59 minutes and the maximum modeled expected shadow flicker at a non-participating receptor is 23 hours and 23 minutes. Table 3 contains the realistic shadow flicker distribution of the 60 occupied structures.

Table 3: Grant County occupied structures realistic shadow flicker distribution.

| Realistic Shadow Flicker (hrs/year) | Number of Non-Participating Occupied Structures | Number of Participating Occupied Structures |
|--|--|--|
| 0 | 14 | 6 |
| 0 to 5 | 6 | 6 |
| 5 to 10 | 3 | 6 |
| 10 to 15 | 0 | 6 |
| 15 to 20 | 2 | 4 |
| 20 to 25 | 1 | 3 |
| 25 to 30 | 0 | 3 |
| 30+ | 0 | 0 |

Crowned Ridge Turbines Summary

For the Crowned Ridge Project, with the one exception noted above, which will be brought into compliance through curtailment of the contributing turbine, no occupied structures are expected to experience more than 30 hours of shadow flicker per year, for both counties. The summary of results is shown in table 4 below. The full table of results from the realistic shadow flicker study can be found in Appendix C. Table C-1 lists the results sorted by receptor number. Table C-2 lists the results sorted by shadow flicker hours from highest to lowest. Table C-3 lists the results with 6 of the turbines recommended by Hessler removed. The Crowned Ridge II and the Dakota Range I and II turbine arrays were included in the model to capture the full shadow flicker impacts on the receptors. The maps showing the shadow flicker impact iso-lines for the Crowned Ridge wind farm are in Appendix D.

Table 4: Summary of shadow flicker predictions.

| County | Feature | Shadow Limit (hr/yr) | Maximum Predicted (hr/yr) |
|------------------|---------------------------------------|----------------------|---------------------------|
| Codington | Participating Occupied Structures | 30 | 30:00 * |
| | Non-Participating Occupied Structures | 30 | 30:00 * |
| Grant | Participating Occupied Structures | 30 | 29:59 |
| | Non-Participating Occupied Structures | 30 | 23:23 |

* Will be brought into compliance through curtailment.

5. CONCLUSIONS

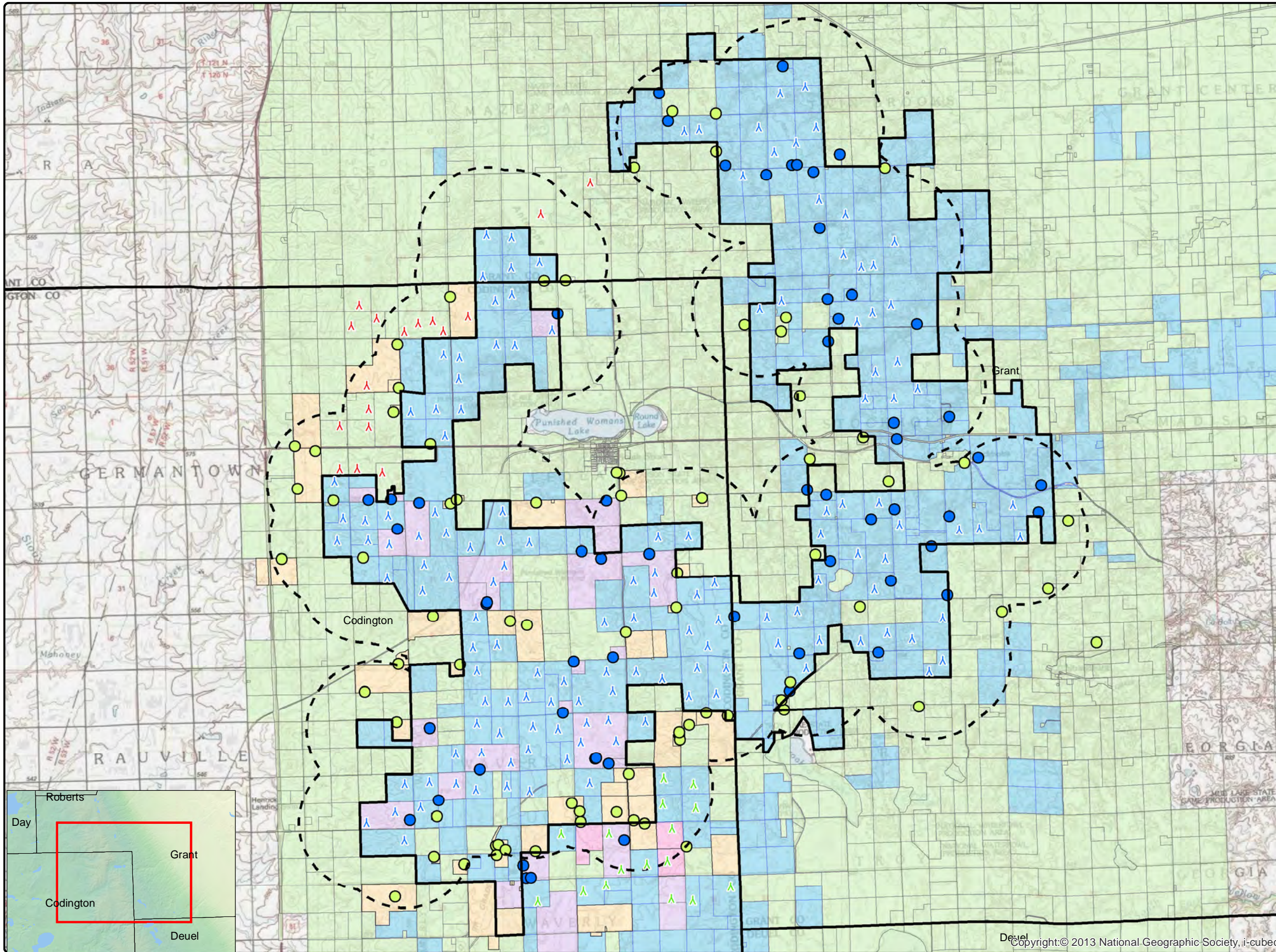
The shadow flicker impact on the receptors was calculated with reductions due to turbine operational direction and sunshine probabilities included. For both counties, with the one exception noted above, no occupied structures are expected to experience more than 30 hours of shadow flicker per year.

This shadow flicker analysis is based on a number of conservative assumptions including:

- No credit was taken for the blocking effects of trees or buildings.
- The receptors were omni-directional rather than modeling specific facades of buildings.
- Study assumes 100% turbine availability
- Study assumes all turbine locations, including alternates, are built and operating

The overall effect of using these conservative assumptions indicate that realistically, the number of hours of shadow flicker that would be observed will be less than those predicted by this study.

APPENDIX A: CROWNED RIDGE WIND ENERGY PROJECT SITE OVERVIEW MAP



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Crowned Ridge Wind Farm Overview Map

Client
SWCA Environmental Consultants

Project Description
Wind turbine layout with land parcels within the project footprint and existing occupied structures.

Codington County occupied land parcels within 2 km of a wind turbine.

Location: Watertown, SD
Project #: 20174430

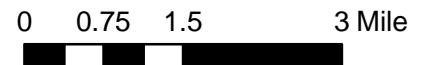
Issue Dates

| # | Description | Date |
|---|-------------|------------|
| 1 | Original | 2019.07.27 |

Drawn By: AS Checked By: JH

- Legend**
- ▲ Crowned Ridge Turbines
 - ▲ Crowned Ridge II Turbines
 - ▲ Dakota Range Turbines
 - 2 km Turbine Buffer
 - County Lines
 - CR1 Project Boundary
 - Non Participants
 - Participants
 - Non-Part. Occupied Codington Parcels
 - Participating Occupied Codington Parcels
 - Non-Participating Parcels
 - Participating Parcels
 - Pending Parcels

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APPENDIX B: WIND TURBINE COORDINATES

Crowned Ridge Wind Farm - Updated 7/27/19
 GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
 UTM NAD83 Zone 14

| WTG | Turbine Type | Easting (m) | Northing (m) | Base Elev. AMSL (m) | Sound Profile |
|--------|--------------------------|-------------|--------------|---------------------|---------------|
| CRI-1 | GE2.3 116RD 90HH r2.madE | 659,443 | 5,003,083 | 610.2 | LNTE |
| CRI-2 | GE2.3 116RD 90HH r2.madE | 660,185 | 5,003,010 | 598.1 | LNTE |
| CRI-3 | GE2.3 116RD 90HH r2.madE | 661,008 | 5,002,288 | 584.1 | LNTE |
| CRI-4 | GE2.3 116RD 90HH r2.madE | 660,173 | 5,002,120 | 602.5 | LNTE |
| CRI-5 | GE2.3 116RD 90HH r2.madE | 659,337 | 5,001,862 | 609.9 | LNTE |
| CRI-6 | GE2.3 116RD 90HH r2.madE | 660,193 | 5,001,329 | 610.5 | LNTE |
| CRI-7 | GE2.3 116RD 90HH r2.madE | 659,705 | 5,001,146 | 618.0 | LNTE |
| CRI-8 | GE2.3 116RD 90HH r2.madE | 661,380 | 5,000,282 | 588.3 | LNTE |
| CRI-9 | GE2.3 116RD 90HH r2.madE | 659,731 | 4,999,855 | 613.4 | LNTE |
| CRI-10 | GE2.3 116RD 90HH r2.madE | 660,280 | 4,999,837 | 615.0 | LNTE |
| CRI-11 | GE2.3 116RD 90HH r2.madE | 658,170 | 4,999,546 | 610.9 | LNTE |
| CRI-12 | GE2.3 116RD 90HH r2.madE | 658,644 | 4,999,460 | 615.0 | LNTE |
| CRI-13 | GE2.3 116RD 90HH r2.madE | 658,622 | 4,998,843 | 613.3 | LNTE |
| CRI-14 | GE2.3 116RD 90HH r2.madE | 657,947 | 4,997,935 | 618.3 | LNTE |
| CRI-15 | GE2.3 116RD 90HH r2.madE | 658,688 | 4,997,924 | 618.0 | LNTE |
| CRI-16 | GE2.3 116RD 90HH r2.madE | 657,203 | 4,997,856 | 611.9 | LNTE |
| CRI-18 | GE2.3 116RD 90HH r2.madE | 658,217 | 4,997,154 | 618.0 | LNTE |
| CRI-19 | GE2.3 116RD 90HH r2.madE | 654,954 | 4,995,804 | 601.1 | LNTE |
| CRI-20 | GE2.3 116RD 90HH r2.madE | 659,920 | 4,994,924 | 594.0 | LNTE |
| CRI-21 | GE2.3 116RD 90HH r2.madE | 657,925 | 4,994,896 | 617.1 | LNTE |
| CRI-22 | GE2.3 116RD 90HH r2.madE | 656,543 | 4,994,796 | 616.5 | LNTE |
| CRI-23 | GE2.3 116RD 90HH r2.madE | 655,208 | 4,994,717 | 594.7 | LNTE |
| CRI-24 | GE2.3 116RD 90HH r2.madE | 655,852 | 4,994,652 | 609.0 | LNTE |
| CRI-25 | GE2.3 116RD 90HH r2.madE | 658,251 | 4,994,286 | 605.5 | LNTE |
| CRI-26 | GE2.3 116RD 90HH r2.madE | 665,405 | 4,994,191 | 578.5 | LNTE |
| CRI-27 | GE2.3 116RD 90HH r2.madE | 657,442 | 4,994,187 | 621.0 | LNTE |
| CRI-28 | GE2.3 116RD 90HH r2.madE | 664,517 | 4,994,168 | 579.0 | LNTE |
| CRI-29 | GE2.3 116RD 90HH r2.madE | 655,940 | 4,994,069 | 606.9 | LNTE |
| CRI-30 | GE2.3 116RD 90HH r2.madE | 659,871 | 4,994,052 | 593.7 | LNTE |
| CRI-31 | GE2.3 116RD 90HH r2.madE | 655,030 | 4,994,051 | 603.0 | LNTE |
| CRI-32 | GE2.3 116RD 90HH r2.madE | 660,704 | 4,993,998 | 606.0 | LNTE |
| CRI-33 | GE2.3 116RD 90HH r2.madE | 656,566 | 4,993,941 | 618.0 | LNTE |
| CRI-34 | GE2.3 116RD 90HH r2.madE | 658,966 | 4,993,856 | 599.7 | LNTE |
| CRI-35 | GE2.3 116RD 90HH r2.madE | 657,602 | 4,993,347 | 607.4 | LNTE |
| CRI-36 | GE2.3 116RD 90HH r2.madE | 659,966 | 4,993,319 | 594.0 | LNTE |
| CRI-37 | GE2.3 116RD 90HH r2.madE | 664,419 | 4,993,110 | 587.3 | LNTE |
| CRI-38 | GE2.3 116RD 90HH r2.madE | 658,338 | 4,992,981 | 600.5 | LNTE |
| CRI-39 | GE2.3 116RD 90HH r2.madE | 656,507 | 4,992,958 | 609.0 | LNTE |
| CRI-41 | GE2.3 116RD 90HH r2.madE | 663,782 | 4,992,883 | 597.7 | LNTE |
| CRI-43 | GE2.3 116RD 90HH r2.madE | 666,181 | 4,992,815 | 577.9 | LNTE |
| CRI-44 | GE2.3 116RD 90HH r2.madE | 665,665 | 4,992,460 | 576.0 | LNTE |

Crowned Ridge Wind Farm - Updated 7/27/19
 GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
 UTM NAD83 Zone 14
continued

| WTG | Turbine Type | Easting (m) | Northing (m) | Base Elev. AMSL (m) | Sound Profile |
|--------|--------------------------|-------------|--------------|---------------------|---------------|
| CRI-46 | GE2.3 116RD 90HH r2.madE | 664,387 | 4,992,505 | 591.0 | LNTE |
| CRI-48 | GE2.3 116RD 90HH r2.madE | 663,794 | 4,991,782 | 587.1 | LNTE |
| CRI-50 | GE2.3 116RD 90HH r2.madE | 662,930 | 4,991,655 | 612.0 | LNTE |
| CRI-51 | GE2.3 116RD 90HH r2.madE | 666,299 | 4,991,723 | 575.3 | LNTE |
| CRI-52 | GE2.3 116RD 90HH r2.madE | 665,426 | 4,991,398 | 575.6 | LNTE |
| CRI-53 | GE2.3 116RD 90HH r2.madE | 659,750 | 4,990,981 | 598.7 | LNTE |
| CRI-54 | GE2.3 116RD 90HH r2.madE | 665,979 | 4,990,946 | 573.7 | LNTE |
| CRI-55 | GE2.3 116RD 90HH r2.madE | 659,045 | 4,990,899 | 597.1 | LNTE |
| CRI-58 | GE2.3 116RD 90HH r2.madE | 665,663 | 4,990,303 | 585.0 | LNTE |
| CRI-59 | GE2.3 116RD 90HH r2.madE | 666,523 | 4,990,291 | 573.0 | LNTE |
| CRI-60 | GE2.3 116RD 90HH r2.madE | 659,155 | 4,990,208 | 594.0 | LNTE |
| CRI-61 | GE2.3 116RD 90HH r2.madE | 662,982 | 4,990,178 | 612.0 | LNTE |
| CRI-62 | GE2.3 116RD 90HH r2.madE | 660,954 | 4,990,155 | 600.7 | LNTE |
| CRI-63 | GE2.3 116RD 90HH r2.madE | 664,627 | 4,989,977 | 588.6 | LNTE |
| CRI-64 | GE2.3 116RD 90HH r2.madE | 663,858 | 4,990,188 | 604.3 | LNTE |
| CRI-65 | GE2.3 116RD 90HH r2.madE | 661,732 | 4,989,898 | 609.0 | LNTE |
| CRI-66 | GE2.3 116RD 90HH r2.madE | 663,165 | 4,989,613 | 614.7 | LNTE |
| CRI-67 | GE2.3 116RD 90HH r2.madE | 666,226 | 4,989,531 | 574.8 | LNTE |
| CRI-68 | GE2.3 116RD 90HH r2.madE | 665,420 | 4,989,461 | 585.0 | LNTE |
| CRI-69 | GE2.3 116RD 80HH r2.madE | 660,621 | 4,989,453 | 605.6 | LNTE |
| CRI-70 | GE2.3 116RD 90HH r2.madE | 662,171 | 4,989,319 | 611.0 | LNTE |
| CRI-71 | GE2.3 116RD 80HH r2.madE | 659,405 | 4,989,320 | 607.3 | LNTE |
| CRI-72 | GE2.3 116RD 80HH r2.madE | 660,087 | 4,989,309 | 606.0 | LNTE |
| CRI-73 | GE2.3 116RD 90HH r2.madE | 661,344 | 4,989,297 | 609.8 | LNTE |
| CRI-74 | GE2.3 116RD 90HH r2.madE | 663,041 | 4,988,744 | 615.0 | LNTE |
| CRI-75 | GE2.3 116RD 90HH r2.madE | 664,137 | 4,988,702 | 609.0 | LNTE |
| CRI-76 | GE2.3 116RD 90HH r2.madE | 662,399 | 4,988,667 | 615.0 | LNTE |
| CRI-77 | GE2.3 116RD 80HH r2.madE | 659,158 | 4,988,642 | 612.0 | LNTE |
| CRI-78 | GE2.3 116RD 80HH r2.madE | 660,811 | 4,988,558 | 604.1 | LNTE |
| CRI-80 | GE2.3 116RD 90HH r2.madE | 661,552 | 4,988,481 | 608.8 | LNTE |
| CRI-81 | GE2.3 116RD 90HH r2.madE | 659,825 | 4,988,365 | 606.8 | LNTE |
| CRI-82 | GE2.3 116RD 90HH r2.madE | 663,271 | 4,988,133 | 613.0 | LNTE |
| CRI-83 | GE2.3 116RD 90HH r2.madE | 662,227 | 4,988,103 | 606.6 | LNTE |
| CRI-84 | GE2.3 116RD 80HH r2.madE | 660,677 | 4,987,880 | 600.6 | LNTE |
| CRI-85 | GE2.3 116RD 90HH r2.madE | 659,295 | 4,987,798 | 612.0 | LNTE |
| CRI-86 | GE2.3 116RD 90HH r2.madE | 658,534 | 4,987,759 | 613.1 | LNTE |
| CRI-87 | GE2.3 116RD 90HH r2.madE | 661,830 | 4,987,596 | 609.0 | LNTE |
| CRI-88 | GE2.3 116RD 90HH r2.madE | 660,157 | 4,987,492 | 603.0 | LNTE |
| CRI-89 | GE2.3 116RD 80HH r2.madE | 657,758 | 4,986,926 | 614.9 | LNTE |
| CRI-90 | GE2.3 116RD 80HH r2.madE | 658,545 | 4,986,881 | 612.0 | LNTE |
| CRI-91 | GE2.3 116RD 80HH r2.madE | 657,023 | 4,986,868 | 612.0 | LNTE |

Crowned Ridge Wind Farm - Updated 7/27/19
 GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
 UTM NAD83 Zone 14
continued

| WTG | Turbine Type | Easting (m) | Northing (m) | Base Elev. AMSL (m) | Sound Profile |
|---------|--------------------------|-------------|--------------|---------------------|---------------|
| CRI-92 | GE2.3 116RD 80HH r2.madE | 660,039 | 4,986,804 | 607.2 | LNTE |
| CRI-93 | GE2.3 116RD 80HH r2.madE | 659,133 | 4,986,700 | 607.9 | LNTE |
| CRI-94 | GE2.3 116RD 80HH r2.madE | 660,716 | 4,986,660 | 600.6 | LNTE |
| CRI-95 | GE2.3 116RD 90HH r2.madE | 657,488 | 4,986,184 | 612.0 | LNTE |
| CRI-96 | GE2.3 116RD 90HH r2.madE | 656,744 | 4,986,037 | 609.0 | LNTE |
| CRI-97 | GE2.3 116RD 80HH r2.madE | 655,899 | 4,985,715 | 592.7 | LNTE |
| CRI-98 | GE2.3 116RD 90HH r2.madE | 657,015 | 4,985,192 | 608.9 | LNTE |
| CRI-99 | GE2.3 116RD 90HH r2.madE | 672,521 | 4,990,188 | 556.7 | LNTE |
| CRI-100 | GE2.3 116RD 90HH r2.madE | 668,885 | 4,990,286 | 585.0 | LNTE |
| CRI-101 | GE2.3 116RD 90HH r2.madE | 672,921 | 4,990,513 | 544.6 | LNTE |
| CRI-102 | GE2.3 116RD 90HH r2.madE | 668,059 | 4,991,023 | 581.0 | LNTE |
| CRI-103 | GE2.3 116RD 90HH r2.madE | 669,279 | 4,991,115 | 582.0 | LNTE |
| CRI-104 | GE2.3 116RD 90HH r2.madE | 672,009 | 4,991,151 | 555.0 | LNTE |
| CRI-105 | GE2.3 116RD 90HH r2.madE | 670,488 | 4,991,091 | 571.6 | LNTE |
| CRI-106 | GE2.3 116RD 90HH r2.madE | 671,278 | 4,991,335 | 566.2 | LNTE |
| CRI-107 | GE2.3 116RD 90HH r2.madE | 667,723 | 4,991,800 | 582.0 | LNTE |
| CRI-108 | GE2.3 116RD 90HH r2.madE | 672,917 | 4,991,775 | 541.2 | LNTE |
| CRI-109 | GE2.3 116RD 90HH r2.madE | 670,897 | 4,992,616 | 557.4 | LNTE |
| CRI-111 | GE2.3 116RD 90HH r2.madE | 671,220 | 4,993,526 | 550.6 | LNTE |
| CRI-112 | GE2.3 116RD 90HH r2.madE | 670,419 | 4,993,665 | 561.0 | LNTE |
| CRI-113 | GE2.3 116RD 90HH r2.madE | 675,201 | 4,994,165 | 497.6 | LNTE |
| CRI-114 | GE2.3 116RD 90HH r2.madE | 669,318 | 4,994,256 | 561.0 | LNTE |
| CRI-115 | GE2.3 116RD 90HH r2.madE | 673,402 | 4,994,374 | 516.4 | LNTE |
| CRI-116 | GE2.3 116RD 90HH r2.madE | 671,642 | 4,994,527 | 531.4 | LNTE |
| CRI-117 | GE2.3 116RD 90HH r2.madE | 669,488 | 4,994,930 | 544.8 | LNTE |
| CRI-118 | GE2.3 116RD 90HH r2.madE | 669,961 | 4,995,134 | 540.4 | LNTE |
| CRI-119 | GE2.3 116RD 90HH r2.madE | 674,992 | 4,995,107 | 492.0 | LNTE |
| CRI-120 | GE2.3 116RD 90HH r2.madE | 671,034 | 4,995,179 | 536.2 | LNTE |
| CRI-121 | GE2.3 116RD 90HH r2.madE | 670,629 | 4,998,259 | 531.0 | LNTE |
| CRI-122 | GE2.3 116RD 90HH r2.madE | 671,475 | 4,998,261 | 517.4 | LNTE |
| CRI-123 | GE2.3 116RD 90HH r2.madE | 672,180 | 4,998,561 | 505.0 | LNTE |
| CRI-124 | GE2.3 116RD 90HH r2.madE | 670,926 | 4,999,036 | 522.8 | LNTE |
| CRI-125 | GE2.3 116RD 90HH r2.madE | 671,580 | 4,999,340 | 509.8 | LNTE |
| CRI-126 | GE2.3 116RD 90HH r2.madE | 670,382 | 5,000,519 | 516.0 | LNTE |
| CRI-127 | GE2.3 116RD 90HH r2.madE | 670,845 | 5,000,795 | 507.4 | LNTE |
| CRI-128 | GE2.3 116RD 90HH r2.madE | 671,388 | 5,001,034 | 498.2 | LNTE |
| CRI-129 | GE2.3 116RD 90HH r2.madE | 667,516 | 5,000,900 | 553.6 | LNTE |
| CRI-130 | GE2.3 116RD 90HH r2.madE | 668,158 | 5,001,149 | 546.0 | LNTE |
| CRI-131 | GE2.3 116RD 90HH r2.madE | 670,512 | 5,002,137 | 504.0 | LNTE |
| CRI-132 | GE2.3 116RD 90HH r2.madE | 670,875 | 5,002,186 | 499.9 | LNTE |
| CRI-133 | GE2.3 116RD 90HH r2.madE | 669,990 | 5,002,521 | 502.7 | LNTE |

APPENDIX C: TABLE OF SHADOW FLICKER RESULTS

Table C-1: Crowned Ridge Shadow Flicker Tabular Results Sorted by Receptor ID - Updated 7/27/19

Realistic case shadow results at occupied structures

Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's

UTM NAD83 Zone 14

Codington County

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|--------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-C1-NP | Non-P | 656,743.00 | 4,983,525.00 | 596.0 | 0:00 | 5,541 |
| CR1-C2-NP | Non-P | 658,791.00 | 4,984,483.00 | 602.0 | 0:00 | 6,273 |
| CR1-C3-NP | Non-P | 657,888.00 | 4,984,697.00 | 604.2 | 4:12 | 3,294 |
| CR1-C4-NP | Non-P | 659,744.00 | 4,984,749.00 | 606.0 | 0:00 | 5,981 |
| CR1-C5-NP | Non-P | 659,958.00 | 4,984,794.00 | 604.8 | 0:00 | 5,659 |
| CR1-C6-P | Participant | 662,989.00 | 4,995,228.00 | 599.8 | 0:00 | 6,102 |
| CR1-C7-NP | Non-P | 660,893.00 | 4,984,861.00 | 593.2 | 0:00 | 3,022 |
| CR1-C9-NP | Non-P | 665,352.00 | 4,985,004.00 | 609.0 | 15:07 | 2,280 |
| CR1-C10-P | Participant | 663,510.00 | 4,985,195.00 | 609.0 | 29:29 | 1,634 |
| CR1-C11-NP | Non-P | 664,111.00 | 4,985,679.00 | 609.0 | 10:30 | 2,615 |
| CR1-C12-NP | Non-P | 662,222.00 | 4,985,736.00 | 603.0 | 17:13 | 2,201 |
| CR1-C12-1-NP | Non-P | 662,199.00 | 4,986,047.00 | 606.0 | 10:38 | 2,818 |
| CR1-C13-NP | Non-P | 663,792.00 | 4,985,785.00 | 612.0 | 19:04 | 2,713 |
| CR1-C14-NP | Non-P | 657,982.00 | 4,985,894.00 | 609.0 | 10:02 | 1,880 |
| CR1-C15-NP | Non-P | 663,291.00 | 4,986,026.00 | 615.0 | 2:17 | 2,175 |
| CR1-C16-NP | Non-P | 661,960.00 | 4,986,288.00 | 606.0 | 6:18 | 2,648 |
| CR1-C17-P | Participant | 658,031.00 | 4,986,373.00 | 609.1 | 26:48 | 1,886 |
| CR1-C18-NP | Non-P | 663,651.00 | 4,987,157.00 | 610.4 | 6:00 | 3,409 |
| CR1-C19-P | Participant | 659,243.00 | 4,987,276.00 | 611.6 | 21:25 | 1,722 |
| CR1-C20-P | Participant | 663,054.00 | 4,987,455.00 | 606.0 | 14:42 | 2,336 |
| CR1-C26-P | Participant | 657,767.00 | 4,988,493.00 | 597.0 | 6:39 | 3,484 |
| CR1-C27-NP | Non-P | 656,876.00 | 4,988,683.00 | 583.0 | 0:00 | 5,974 |
| CR1-C28-NP | Non-P | 665,429.00 | 4,988,598.00 | 590.9 | 2:44 | 2,831 |
| CR1-C29-NP | Non-P | 666,572.00 | 4,988,867.00 | 575.9 | 6:56 | 2,457 |
| CR1-C30-P | Participant | 661,699.00 | 4,988,957.00 | 615.0 | 23:33 | 1,614 |
| CR1-C31-NP | Non-P | 665,939.00 | 4,988,950.00 | 585.4 | 0:00 | 2,126 |
| CR1-C32-NP | Non-P | 655,843.00 | 4,989,581.00 | 568.8 | 0:00 | 9,708 |
| CR1-C33-NP | Non-P | 656,839.00 | 4,990,404.00 | 569.8 | 0:00 | 7,418 |
| CR1-C34-NP | Non-P | 658,661.00 | 4,990,389.00 | 588.2 | 26:12 | 1,726 |
| CR1-C35-P | Participant | 662,025.00 | 4,990,475.00 | 609.0 | 11:49 | 2,123 |
| CR1-C36-P | Participant | 663,181.00 | 4,990,600.00 | 615.0 | 14:36 | 1,532 |
| CR1-C37-NP | Non-P | 663,563.00 | 4,991,342.00 | 605.1 | 15:55 | 1,631 |
| CR1-C38-NP | Non-P | 660,639.00 | 4,991,557.00 | 597.0 | 6:06 | 3,474 |
| CR1-C39-NP | Non-P | 660,144.00 | 4,991,670.00 | 588.0 | 6:57 | 2,605 |
| CR1-C40-NP | Non-P | 657,865.00 | 4,991,818.00 | 583.7 | 6:46 | 2,690 |
| CR1-C41-NP | Non-P | 665,053.00 | 4,992,084.00 | 576.1 | 12:30 | 2,356 |
| CR1-C42-P | Participant | 659,458.00 | 4,992,229.00 | 580.0 | 11:58 | 1,801 |
| CR1-C44-NP | Non-P | 665,076.00 | 4,993,095.00 | 578.2 | 28:25 | 2,155 |
| CR1-C45-NP | Non-P | 653,390.00 | 4,993,503.00 | 573.2 | 1:42 | 5,673 |

Table C-1: Crowned Ridge Shadow Flicker Tabular Results Sorted by Receptor ID - Updated 7/27/19

Realistic case shadow results at occupied structures

Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's

UTM NAD83 Zone 14

Codington County

continued

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|-------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-C46-NP | Non-P | 655,802.00 | 4,993,540.00 | 609.1 | 25:44 | 1,795 |
| CR1-C47-P | Participant | 662,825.00 | 4,993,508.00 | 613.9 | 5:03 | 3,750 |
| CR1-C48-P | Participant | 664,247.00 | 4,993,646.00 | 588.0 | 3:48 | 1,847 |
| CR1-C49-P | Participant | 662,250.00 | 4,993,731.00 | 609.0 | 1:12 | 5,148 |
| CR1-C50-P | Participant | 656,806.00 | 4,994,388.00 | 621.0 | 28:38 | 1,591 |
| CR1-C51-P | Participant | 657,455.00 | 4,995,160.00 | 621.0 | 24:47 | 1,768 |
| CR1-C52-NP | Non-P | 654,924.00 | 4,995,231.00 | 603.0 | 11:16 | 1,883 |
| CR1-C53-NP | Non-P | 663,376.00 | 4,996,043.00 | 578.8 | 0:00 | 7,201 |
| CR1-C54-NP | Non-P | 663,421.00 | 4,995,376.00 | 583.4 | 0:00 | 5,351 |
| CR1-C55-NP | Non-P | 660,914.00 | 4,995,169.00 | 607.5 | 2:52 | 3,360 |
| CR1-C56-P | Participant | 655,953.00 | 4,995,244.00 | 606.5 | 28:54 | 1,972 |
| CR1-C57-P | Participant | 656,628.00 | 4,995,266.00 | 615.0 | 10:38 | 1,568 |
| CR1-C58-NP | Non-P | 657,781.00 | 4,996,906.00 | 615.0 | 17:05 | 1,647 |
| CR1-C59-P | Participant | 661,548.00 | 5,000,754.00 | 584.2 | 7:39 | 1,644 |
| CR1-C60-NP | Non-P | 656,855.00 | 4,998,565.00 | 613.5 | 14:18 | 2,592 |
| CR1-C61-NP | Non-P | 656,690.00 | 4,997,831.00 | 612.0 | 42:10 | 1,686 |
| CR1-C62-NP | Non-P | 658,375.00 | 4,995,138.00 | 615.0 | 18:10 | 1,676 |
| CR1-C63-NP | Non-P | 658,566.00 | 4,995,254.00 | 612.4 | 10:46 | 2,408 |
| CR1-C64-P | Participant | 659,436.00 | 4,992,174.00 | 581.0 | 19:54 | 1,614 |
| CR1-C65-NP | Non-P | 665,805.00 | 4,995,305.00 | 579.0 | 1:30 | 3,884 |
| CR1-C66-NP | Non-P | 659,718.00 | 4,985,032.00 | 606.0 | 0:00 | 5,800 |
| CR1-C67-NP | Non-P | 659,789.00 | 4,985,057.00 | 606.0 | 0:00 | 5,791 |
| CR1-C68-P | Participant | 662,652.00 | 4,987,606.00 | 609.0 | 6:46 | 2,146 |
| CR1-C69-P | Participant | 662,685.00 | 4,987,619.00 | 609.0 | 6:07 | 2,185 |
| CR1-C70-NP | Non-P | 665,135.00 | 4,988,293.00 | 595.9 | 12:05 | 3,540 |
| CR1-C71-NP | Non-P | 665,137.00 | 4,988,378.00 | 595.6 | 7:25 | 3,448 |
| CR1-C72-NP | Non-P | 665,158.00 | 4,988,170.00 | 594.6 | 7:41 | 3,776 |
| CR1-C105-NP | Non-P | 658,372.48 | 5,001,256.80 | 600.3 | 20:05 | 2,549 |
| CR1-C107-NP | Non-P | 656,810.99 | 4,999,855.15 | 598.8 | 9:58 | 1,401 |
| CR1-C109-NP | Non-P | 653,780.18 | 4,996,828.35 | 588.0 | 7:03 | 4,797 |
| CR1-C110-NP | Non-P | 654,384.54 | 4,996,685.57 | 593.9 | 20:47 | 2,910 |
| CR1-C111-NP | Non-P | 653,857.19 | 4,995,573.17 | 591.0 | 11:42 | 3,678 |
| CR1-C112-NP | Non-P | 660,001.53 | 4,984,907.81 | 604.6 | 0:44 | 5,627 |
| CR2-C150-P | Participant | 657,178.00 | 4,985,788.00 | 612.0 | 10:01 | 1,640 |
| | | | | | | |
| | | | | | | |

Table C-1: Crowned Ridge Shadow Flicker Tabular Results Sorted by Receptor ID - Updated 7/27/19

Realistic case shadow results at occupied structures

Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's

UTM NAD83 Zone 14

Grant County

continued

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|-------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-G12-NP | Non-P | 668,229.00 | 4,989,039.00 | 575.0 | 0:00 | 4,623 |
| CR1-G13-NP | Non-P | 672,216.00 | 4,989,142.00 | 558.0 | 0:00 | 3,576 |
| CR1-G14-NP | Non-P | 668,156.00 | 4,989,332.00 | 574.1 | 0:00 | 3,940 |
| CR1-G15-P | Participant | 668,396.00 | 4,989,607.00 | 576.0 | 0:00 | 2,746 |
| CR1-G16-NP | Non-P | 668,419.00 | 4,989,861.00 | 576.0 | 0:00 | 2,070 |
| CR1-G18-P | Participant | 668,678.00 | 4,990,722.00 | 585.0 | 22:34 | 1,585 |
| CR1-G19-P | Participant | 671,018.00 | 4,990,744.00 | 570.0 | 5:44 | 2,077 |
| CR1-G21-P | Participant | 666,766.00 | 4,991,807.00 | 577.1 | 29:12 | 1,555 |
| CR1-G22-NP | Non-P | 674,670.00 | 4,991,955.00 | 527.6 | 0:00 | 5,781 |
| CR1-G23-NP | Non-P | 670,471.00 | 4,992,104.00 | 560.0 | 5:11 | 2,185 |
| CR1-G24-P | Participant | 673,058.00 | 4,992,440.00 | 539.4 | 0:00 | 2,231 |
| CR1-G25-P | Participant | 671,391.00 | 4,992,858.00 | 549.0 | 14:41 | 1,804 |
| CR1-G26-P | Participant | 672,589.00 | 4,993,869.00 | 531.0 | 8:17 | 3,140 |
| CR1-G27-NP | Non-P | 676,630.00 | 4,994,642.00 | 480.8 | 2:55 | 4,944 |
| CR1-G28-P | Participant | 673,113.00 | 4,994,772.00 | 513.9 | 23:01 | 1,614 |
| CR1-G32-P | Participant | 669,477.00 | 4,995,401.00 | 546.0 | 20:01 | 1,545 |
| CR1-G33-P | Participant | 668,911.00 | 4,995,550.00 | 548.7 | 3:53 | 2,779 |
| CR1-G34-NP | Non-P | 671,320.00 | 4,995,798.00 | 531.0 | 1:28 | 2,238 |
| CR1-G36-NP | Non-P | 673,559.00 | 4,996,344.00 | 498.0 | 0:00 | 6,211 |
| CR1-G37-NP | Non-P | 668,998.00 | 4,996,452.00 | 549.0 | 0:00 | 5,246 |
| CR1-G38-P | Participant | 673,972.00 | 4,996,493.00 | 494.5 | 0:00 | 5,646 |
| CR1-G41-P | Participant | 671,563.00 | 4,997,050.00 | 497.6 | 0:00 | 3,983 |
| CR1-G42-NP | Non-P | 670,566.00 | 4,997,097.00 | 518.9 | 0:00 | 3,819 |
| CR1-G43-NP | Non-P | 661,141.00 | 5,001,721.00 | 583.6 | 18:26 | 1,909 |
| CR1-G44-NP | Non-P | 661,781.00 | 5,001,732.00 | 583.7 | 2:50 | 3,123 |
| CR1-G59-P | Participant | 675,755.00 | 4,994,888.00 | 487.7 | 12:50 | 2,605 |
| CR1-G60-P | Participant | 675,830.00 | 4,995,687.00 | 477.0 | 5:44 | 3,343 |
| CR1-G65-P | Participant | 671,496.00 | 4,994,973.00 | 537.0 | 29:59 | 1,539 |
| CR1-G66-P | Participant | 670,802.00 | 4,994,681.00 | 539.7 | 16:44 | 1,801 |
| CR1-G67-P | Participant | 669,597.00 | 4,993,440.00 | 556.1 | 11:58 | 2,106 |
| CR1-G68-NP | Non-P | 669,159.00 | 4,993,632.00 | 565.6 | 2:07 | 2,113 |
| CR1-G70-NP | Non-P | 677,464.53 | 4,991,043.11 | 492.0 | 0:00 | 12,651 |
| CR1-G77-NP | Non-P | 676,031.00 | 4,992,629.00 | 502.7 | 0:00 | 5,728 |
| CR1-G81-P | Participant | 671,478.00 | 4,997,523.00 | 508.8 | 0:00 | 2,421 |
| CR1-G105-NP | Non-P | 668,696.00 | 4,998,325.00 | 549.0 | 0:00 | 6,345 |
| CR1-G108-P | Participant | 669,516.00 | 5,001,186.00 | 522.2 | 11:40 | 3,586 |
| CR1-G109-NP | Non-P | 667,064.00 | 5,000,425.00 | 566.2 | 0:59 | 2,152 |
| CR1-G110-NP | Non-P | 671,218.00 | 5,005,064.00 | 456.2 | 0:00 | 5,889 |

Table C-2: Crowned Ridge Shadow Flicker Tabular Results Sorted by Real Case Shadow Flicker Hours/Year
Realistic case shadow results at occupied structures - Updated 7/27/19
Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
UTM NAD83 Zone 14
Codington County

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|--------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-C61-NP | Non-P | 656,690.00 | 4,997,831.00 | 612.0 | 42:10 | 1,686 |
| CR1-C44-NP | Non-P | 665,076.00 | 4,993,095.00 | 578.2 | 28:25 | 2,155 |
| CR1-C34-NP | Non-P | 658,661.00 | 4,990,389.00 | 588.2 | 26:12 | 1,726 |
| CR1-C46-NP | Non-P | 655,802.00 | 4,993,540.00 | 609.1 | 25:44 | 1,795 |
| CR1-C110-NP | Non-P | 654,384.54 | 4,996,685.57 | 593.9 | 20:47 | 2,910 |
| CR1-C105-NP | Non-P | 658,372.48 | 5,001,256.80 | 600.3 | 20:05 | 2,549 |
| CR1-C13-NP | Non-P | 663,792.00 | 4,985,785.00 | 612.0 | 19:04 | 2,713 |
| CR1-C62-NP | Non-P | 658,375.00 | 4,995,138.00 | 615.0 | 18:10 | 1,676 |
| CR1-C12-NP | Non-P | 662,222.00 | 4,985,736.00 | 603.0 | 17:13 | 2,201 |
| CR1-C58-NP | Non-P | 657,781.00 | 4,996,906.00 | 615.0 | 17:05 | 1,647 |
| CR1-C37-NP | Non-P | 663,563.00 | 4,991,342.00 | 605.1 | 15:55 | 1,631 |
| CR1-C9-NP | Non-P | 665,352.00 | 4,985,004.00 | 609.0 | 15:07 | 2,280 |
| CR1-C60-NP | Non-P | 656,855.00 | 4,998,565.00 | 613.5 | 14:18 | 2,592 |
| CR1-C41-NP | Non-P | 665,053.00 | 4,992,084.00 | 576.1 | 12:30 | 2,356 |
| CR1-C70-NP | Non-P | 665,135.00 | 4,988,293.00 | 595.9 | 12:05 | 3,540 |
| CR1-C111-NP | Non-P | 653,857.19 | 4,995,573.17 | 591.0 | 11:42 | 3,678 |
| CR1-C52-NP | Non-P | 654,924.00 | 4,995,231.00 | 603.0 | 11:16 | 1,883 |
| CR1-C63-NP | Non-P | 658,566.00 | 4,995,254.00 | 612.4 | 10:46 | 2,408 |
| CR1-C12-1-NP | Non-P | 662,199.00 | 4,986,047.00 | 606.0 | 10:38 | 2,818 |
| CR1-C11-NP | Non-P | 664,111.00 | 4,985,679.00 | 609.0 | 10:30 | 2,615 |
| CR1-C14-NP | Non-P | 657,982.00 | 4,985,894.00 | 609.0 | 10:02 | 1,880 |
| CR1-C107-NP | Non-P | 656,810.99 | 4,999,855.15 | 598.8 | 9:58 | 1,401 |
| CR1-C72-NP | Non-P | 665,158.00 | 4,988,170.00 | 594.6 | 7:41 | 3,776 |
| CR1-C71-NP | Non-P | 665,137.00 | 4,988,378.00 | 595.6 | 7:25 | 3,448 |
| CR1-C109-NP | Non-P | 653,780.18 | 4,996,828.35 | 588.0 | 7:03 | 4,797 |
| CR1-C39-NP | Non-P | 660,144.00 | 4,991,670.00 | 588.0 | 6:57 | 2,605 |
| CR1-C29-NP | Non-P | 666,572.00 | 4,988,867.00 | 575.9 | 6:56 | 2,457 |
| CR1-C40-NP | Non-P | 657,865.00 | 4,991,818.00 | 583.7 | 6:46 | 2,690 |
| CR1-C16-NP | Non-P | 661,960.00 | 4,986,288.00 | 606.0 | 6:18 | 2,648 |
| CR1-C38-NP | Non-P | 660,639.00 | 4,991,557.00 | 597.0 | 6:06 | 3,474 |
| CR1-C18-NP | Non-P | 663,651.00 | 4,987,157.00 | 610.4 | 6:00 | 3,409 |
| CR1-C3-NP | Non-P | 657,888.00 | 4,984,697.00 | 604.2 | 4:12 | 3,294 |
| CR1-C55-NP | Non-P | 660,914.00 | 4,995,169.00 | 607.5 | 2:52 | 3,360 |
| CR1-C28-NP | Non-P | 665,429.00 | 4,988,598.00 | 590.9 | 2:44 | 2,831 |
| CR1-C15-NP | Non-P | 663,291.00 | 4,986,026.00 | 615.0 | 2:17 | 2,175 |
| CR1-C45-NP | Non-P | 653,390.00 | 4,993,503.00 | 573.2 | 1:42 | 5,673 |
| CR1-C65-NP | Non-P | 665,805.00 | 4,995,305.00 | 579.0 | 1:30 | 3,884 |
| CR1-C112-NP | Non-P | 660,001.53 | 4,984,907.81 | 604.6 | 0:44 | 5,627 |
| CR1-C1-NP | Non-P | 656,743.00 | 4,983,525.00 | 596.0 | 0:00 | 5,541 |

Table C-2: Crowned Ridge Shadow Flicker Tabular Results Sorted by Real Case Shadow Flicker Hours/Year
Realistic case shadow results at occupied structures - Updated 7/27/19
Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
UTM NAD83 Zone 14
Codington County
continued

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|-------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-C27-NP | Non-P | 656,876.00 | 4,988,683.00 | 583.0 | 0:00 | 5,974 |
| CR1-C2-NP | Non-P | 658,791.00 | 4,984,483.00 | 602.0 | 0:00 | 6,273 |
| CR1-C31-NP | Non-P | 665,939.00 | 4,988,950.00 | 585.4 | 0:00 | 2,126 |
| CR1-C32-NP | Non-P | 655,843.00 | 4,989,581.00 | 568.8 | 0:00 | 9,708 |
| CR1-C33-NP | Non-P | 656,839.00 | 4,990,404.00 | 569.8 | 0:00 | 7,418 |
| CR1-C4-NP | Non-P | 659,744.00 | 4,984,749.00 | 606.0 | 0:00 | 5,981 |
| CR1-C54-NP | Non-P | 663,421.00 | 4,995,376.00 | 583.4 | 0:00 | 5,351 |
| CR1-C5-NP | Non-P | 659,958.00 | 4,984,794.00 | 604.8 | 0:00 | 5,659 |
| CR1-C66-NP | Non-P | 659,718.00 | 4,985,032.00 | 606.0 | 0:00 | 5,800 |
| CR1-C67-NP | Non-P | 659,789.00 | 4,985,057.00 | 606.0 | 0:00 | 5,791 |
| CR1-C7-NP | Non-P | 660,893.00 | 4,984,861.00 | 593.2 | 0:00 | 3,022 |
| CR1-C53-NP | Non-P | 663,376.00 | 4,996,043.00 | 578.8 | 0:00 | 7,201 |
| CR1-C10-P | Participant | 663,510.00 | 4,985,195.00 | 609.0 | 29:29 | 1,634 |
| CR1-C56-P | Participant | 655,953.00 | 4,995,244.00 | 606.5 | 28:54 | 1,972 |
| CR1-C50-P | Participant | 656,806.00 | 4,994,388.00 | 621.0 | 28:38 | 1,591 |
| CR1-C17-P | Participant | 658,031.00 | 4,986,373.00 | 609.1 | 26:48 | 1,886 |
| CR1-C51-P | Participant | 657,455.00 | 4,995,160.00 | 621.0 | 24:47 | 1,768 |
| CR1-C30-P | Participant | 661,699.00 | 4,988,957.00 | 615.0 | 23:33 | 1,614 |
| CR1-C19-P | Participant | 659,243.00 | 4,987,276.00 | 611.6 | 21:25 | 1,722 |
| CR1-C64-P | Participant | 659,436.00 | 4,992,174.00 | 581.0 | 19:54 | 1,614 |
| CR1-C20-P | Participant | 663,054.00 | 4,987,455.00 | 606.0 | 14:42 | 2,336 |
| CR1-C36-P | Participant | 663,181.00 | 4,990,600.00 | 615.0 | 14:36 | 1,532 |
| CR1-C42-P | Participant | 659,458.00 | 4,992,229.00 | 580.0 | 11:58 | 1,801 |
| CR1-C35-P | Participant | 662,025.00 | 4,990,475.00 | 609.0 | 11:49 | 2,123 |
| CR1-C57-P | Participant | 656,628.00 | 4,995,266.00 | 615.0 | 10:38 | 1,568 |
| CR2-C150-P | Participant | 657,178.00 | 4,985,788.00 | 612.0 | 10:01 | 1,640 |
| CR1-C59-P | Participant | 661,548.00 | 5,000,754.00 | 584.2 | 7:39 | 1,644 |
| CR1-C68-P | Participant | 662,652.00 | 4,987,606.00 | 609.0 | 6:46 | 2,146 |
| CR1-C26-P | Participant | 657,767.00 | 4,988,493.00 | 597.0 | 6:39 | 3,484 |
| CR1-C69-P | Participant | 662,685.00 | 4,987,619.00 | 609.0 | 6:07 | 2,185 |
| CR1-C47-P | Participant | 662,825.00 | 4,993,508.00 | 613.9 | 5:03 | 3,750 |
| CR1-C48-P | Participant | 664,247.00 | 4,993,646.00 | 588.0 | 3:48 | 1,847 |
| CR1-C49-P | Participant | 662,250.00 | 4,993,731.00 | 609.0 | 1:12 | 5,148 |
| CR1-C6-P | Participant | 662,989.00 | 4,995,228.00 | 599.8 | 0:00 | 6,102 |
| | | | | | | |
| | | | | | | |

Table C-2: Crowned Ridge Shadow Flicker Tabular Results Sorted by Real Case Shadow Flicker Hours/Year
Realistic case shadow results at occupied structures - Updated 7/27/19
Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
UTM NAD83 Zone 14
Grant County
continued

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|-------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-G114-NP | Non-P | 666,214.00 | 5,006,667.00 | 521.1 | 23:23 | 2,205 |
| CR1-G43-NP | Non-P | 661,141.00 | 5,001,721.00 | 583.6 | 18:26 | 1,909 |
| CR1-G125-NP | Non-P | 668,289.00 | 5,000,643.00 | 543.0 | 15:49 | 1,716 |
| CR1-G115-NP | Non-P | 664,933.00 | 5,006,731.00 | 544.6 | 8:01 | 2,188 |
| CR1-G113-NP | Non-P | 666,228.00 | 5,005,549.00 | 537.0 | 7:09 | 2,746 |
| CR1-G23-NP | Non-P | 670,471.00 | 4,992,104.00 | 560.0 | 5:11 | 2,185 |
| CR1-G27-NP | Non-P | 676,630.00 | 4,994,642.00 | 480.8 | 2:55 | 4,944 |
| CR1-G44-NP | Non-P | 661,781.00 | 5,001,732.00 | 583.7 | 2:50 | 3,123 |
| CR1-G68-NP | Non-P | 669,159.00 | 4,993,632.00 | 565.6 | 2:07 | 2,113 |
| CR1-G117-NP | Non-P | 663,801.00 | 5,005,084.00 | 581.3 | 1:54 | 4,501 |
| CR1-G34-NP | Non-P | 671,320.00 | 4,995,798.00 | 531.0 | 1:28 | 2,238 |
| CR1-G109-NP | Non-P | 667,064.00 | 5,000,425.00 | 566.2 | 0:59 | 2,152 |
| CR1-G12-NP | Non-P | 668,229.00 | 4,989,039.00 | 575.0 | 0:00 | 4,623 |
| CR1-G16-NP | Non-P | 668,419.00 | 4,989,861.00 | 576.0 | 0:00 | 2,070 |
| CR1-G14-NP | Non-P | 668,156.00 | 4,989,332.00 | 574.1 | 0:00 | 3,940 |
| CR1-G22-NP | Non-P | 674,670.00 | 4,991,955.00 | 527.6 | 0:00 | 5,781 |
| CR1-G13-NP | Non-P | 672,216.00 | 4,989,142.00 | 558.0 | 0:00 | 3,576 |
| CR1-G77-NP | Non-P | 676,031.00 | 4,992,629.00 | 502.7 | 0:00 | 5,728 |
| CR1-G37-NP | Non-P | 668,998.00 | 4,996,452.00 | 549.0 | 0:00 | 5,246 |
| CR1-G42-NP | Non-P | 670,566.00 | 4,997,097.00 | 518.9 | 0:00 | 3,819 |
| CR1-G36-NP | Non-P | 673,559.00 | 4,996,344.00 | 498.0 | 0:00 | 6,211 |
| CR1-G105-NP | Non-P | 668,696.00 | 4,998,325.00 | 549.0 | 0:00 | 6,345 |
| CR1-G110-NP | Non-P | 671,218.00 | 5,005,064.00 | 456.2 | 0:00 | 5,889 |
| CR1-G130-NP | Non-P | 668,147.00 | 5,000,233.00 | 549.0 | 0:00 | 3,005 |
| CR1-G70-NP | Non-P | 677,464.53 | 4,991,043.11 | 492.0 | 0:00 | 12,651 |
| CR1-G600-NP | Non-P | 674,300.70 | 5,005,772.78 | 393.0 | 0:00 | 13,186 |
| CR1-G65-P | Participant | 671,496.00 | 4,994,973.00 | 537.0 | 29:59 | 1,539 |
| CR1-G21-P | Participant | 666,766.00 | 4,991,807.00 | 577.1 | 29:12 | 1,555 |
| CR1-G138-P | Participant | 664,809.00 | 5,006,456.00 | 549.0 | 25:26 | 1,824 |
| CR1-G28-P | Participant | 673,113.00 | 4,994,772.00 | 513.9 | 23:01 | 1,614 |
| CR1-G18-P | Participant | 668,678.00 | 4,990,722.00 | 585.0 | 22:34 | 1,585 |
| CR1-G32-P | Participant | 669,477.00 | 4,995,401.00 | 546.0 | 20:01 | 1,545 |
| CR1-G124-P | Participant | 669,843.00 | 5,000,605.00 | 525.0 | 19:27 | 1,791 |
| CR1-G137-P | Participant | 666,501.00 | 5,005,136.00 | 529.3 | 18:42 | 1,939 |
| CR1-G66-P | Participant | 670,802.00 | 4,994,681.00 | 539.7 | 16:44 | 1,801 |
| CR1-G128-P | Participant | 670,242.00 | 5,001,314.00 | 513.0 | 15:02 | 2,612 |
| CR1-G25-P | Participant | 671,391.00 | 4,992,858.00 | 549.0 | 14:41 | 1,804 |
| CR1-G59-P | Participant | 675,755.00 | 4,994,888.00 | 487.7 | 12:50 | 2,605 |

Table C-3: Crowned Ridge Sound Level Tabular Results Sorted by Real Case Shadow Flicker Hours/Year Updated 7/27/19
6 turbines removed as suggested by Mr. Hessler
Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
UTM NAD83 Zone 14
Codington County

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|--------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-C61-NP | Non-P | 656,690.00 | 4,997,831.00 | 612.0 | 42:10 | 1,686 |
| CR1-C44-NP | Non-P | 665,076.00 | 4,993,095.00 | 578.2 | 28:25 | 2,155 |
| CR1-C46-NP | Non-P | 655,802.00 | 4,993,540.00 | 609.1 | 25:44 | 1,795 |
| CR1-C110-NP | Non-P | 654,384.54 | 4,996,685.57 | 593.9 | 20:47 | 2,910 |
| CR1-C105-NP | Non-P | 658,372.48 | 5,001,256.80 | 600.3 | 20:05 | 2,549 |
| CR1-C13-NP | Non-P | 663,792.00 | 4,985,785.00 | 612.0 | 19:04 | 2,713 |
| CR1-C62-NP | Non-P | 658,375.00 | 4,995,138.00 | 615.0 | 18:10 | 1,676 |
| CR1-C12-NP | Non-P | 662,222.00 | 4,985,736.00 | 603.0 | 17:13 | 2,201 |
| CR1-C58-NP | Non-P | 657,781.00 | 4,996,906.00 | 615.0 | 17:05 | 1,647 |
| CR1-C37-NP | Non-P | 663,563.00 | 4,991,342.00 | 605.1 | 15:55 | 1,631 |
| CR1-C9-NP | Non-P | 665,352.00 | 4,985,004.00 | 609.0 | 15:07 | 2,280 |
| CR1-C60-NP | Non-P | 656,855.00 | 4,998,565.00 | 613.5 | 14:18 | 2,592 |
| CR1-C41-NP | Non-P | 665,053.00 | 4,992,084.00 | 576.1 | 12:31 | 2,356 |
| CR1-C70-NP | Non-P | 665,135.00 | 4,988,293.00 | 595.9 | 12:05 | 3,540 |
| CR1-C52-NP | Non-P | 654,924.00 | 4,995,231.00 | 603.0 | 11:16 | 3,586 |
| CR1-C63-NP | Non-P | 658,566.00 | 4,995,254.00 | 612.4 | 10:46 | 2,408 |
| CR1-C12-1-NP | Non-P | 662,199.00 | 4,986,047.00 | 606.0 | 10:38 | 2,818 |
| CR1-C11-NP | Non-P | 664,111.00 | 4,985,679.00 | 609.0 | 10:30 | 2,615 |
| CR1-C14-NP | Non-P | 657,982.00 | 4,985,894.00 | 609.0 | 10:02 | 1,880 |
| CR1-C107-NP | Non-P | 656,810.99 | 4,999,855.15 | 598.8 | 9:58 | 1,401 |
| CR1-C34-NP | Non-P | 658,661.00 | 4,990,389.00 | 588.2 | 8:38 | 1,726 |
| CR1-C72-NP | Non-P | 665,158.00 | 4,988,170.00 | 594.6 | 7:41 | 3,776 |
| CR1-C71-NP | Non-P | 665,137.00 | 4,988,378.00 | 595.6 | 7:25 | 3,448 |
| CR1-C39-NP | Non-P | 660,144.00 | 4,991,670.00 | 588.0 | 6:57 | 2,605 |
| CR1-C40-NP | Non-P | 657,865.00 | 4,991,818.00 | 583.7 | 6:46 | 2,690 |
| CR1-C109-NP | Non-P | 653,780.18 | 4,996,828.35 | 588.0 | 6:39 | 4,797 |
| CR1-C16-NP | Non-P | 661,960.00 | 4,986,288.00 | 606.0 | 6:18 | 2,648 |
| CR1-C38-NP | Non-P | 660,639.00 | 4,991,557.00 | 597.0 | 6:06 | 3,474 |
| CR1-C18-NP | Non-P | 663,651.00 | 4,987,157.00 | 610.4 | 6:00 | 3,409 |
| CR1-C111-NP | Non-P | 653,857.19 | 4,995,573.17 | 591.0 | 5:43 | 6,289 |
| CR1-C3-NP | Non-P | 657,888.00 | 4,984,697.00 | 604.2 | 4:12 | 3,294 |
| CR1-C55-NP | Non-P | 660,914.00 | 4,995,169.00 | 607.5 | 2:52 | 3,360 |
| CR1-C28-NP | Non-P | 665,429.00 | 4,988,598.00 | 590.9 | 2:44 | 2,831 |
| CR1-C15-NP | Non-P | 663,291.00 | 4,986,026.00 | 615.0 | 2:17 | 2,175 |
| CR1-C45-NP | Non-P | 653,390.00 | 4,993,503.00 | 573.2 | 1:42 | 5,673 |
| CR1-C65-NP | Non-P | 665,805.00 | 4,995,305.00 | 579.0 | 1:30 | 3,884 |
| CR1-C112-NP | Non-P | 660,001.53 | 4,984,907.81 | 604.6 | 0:44 | 5,627 |
| CR1-C1-NP | Non-P | 656,743.00 | 4,983,525.00 | 596.0 | 0:00 | 5,541 |
| CR1-C27-NP | Non-P | 656,876.00 | 4,988,683.00 | 583.0 | 0:00 | 5,974 |

Table C-3: Crowned Ridge Sound Level Tabular Results Sorted by Real Case Shadow Flicker Hours/Year Updated 7/27/19

6 turbines removed as suggested by Mr. Hessler
 Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
 UTM NAD83 Zone 14
 Codrington County
 continued

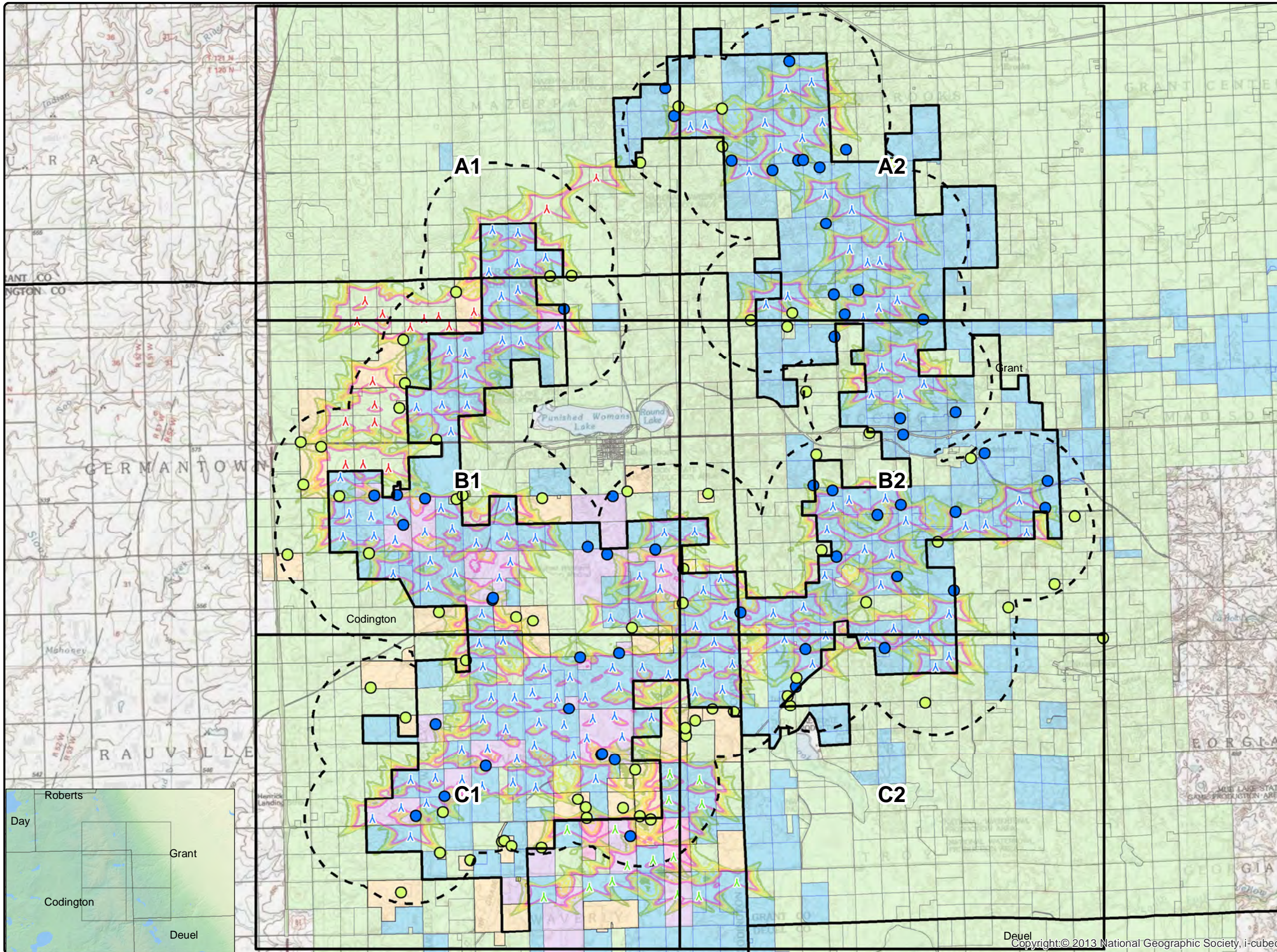
| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|-------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-C29-NP | Non-P | 666,572.00 | 4,988,867.00 | 575.9 | 0:00 | 2,457 |
| CR1-C2-NP | Non-P | 658,791.00 | 4,984,483.00 | 602.0 | 0:00 | 6,273 |
| CR1-C31-NP | Non-P | 665,939.00 | 4,988,950.00 | 585.4 | 0:00 | 2,126 |
| CR1-C32-NP | Non-P | 655,843.00 | 4,989,581.00 | 568.8 | 0:00 | 9,708 |
| CR1-C33-NP | Non-P | 656,839.00 | 4,990,404.00 | 569.8 | 0:00 | 7,418 |
| CR1-C4-NP | Non-P | 659,744.00 | 4,984,749.00 | 606.0 | 0:00 | 5,981 |
| CR1-C54-NP | Non-P | 663,421.00 | 4,995,376.00 | 583.4 | 0:00 | 5,351 |
| CR1-C5-NP | Non-P | 659,958.00 | 4,984,794.00 | 604.8 | 0:00 | 5,659 |
| CR1-C66-NP | Non-P | 659,718.00 | 4,985,032.00 | 606.0 | 0:00 | 5,800 |
| CR1-C67-NP | Non-P | 659,789.00 | 4,985,057.00 | 606.0 | 0:00 | 5,791 |
| CR1-C7-NP | Non-P | 660,893.00 | 4,984,861.00 | 593.2 | 0:00 | 3,022 |
| CR1-C53-NP | Non-P | 663,376.00 | 4,996,043.00 | 578.8 | 0:00 | 7,201 |
| CR1-C10-P | Participant | 663,510.00 | 4,985,195.00 | 609.0 | 29:30 | 1,634 |
| CR1-C50-P | Participant | 656,806.00 | 4,994,388.00 | 621.0 | 28:17 | 1,591 |
| CR1-C17-P | Participant | 658,031.00 | 4,986,373.00 | 609.1 | 26:48 | 1,886 |
| CR1-C51-P | Participant | 657,455.00 | 4,995,160.00 | 621.0 | 24:47 | 1,768 |
| CR1-C30-P | Participant | 661,699.00 | 4,988,957.00 | 615.0 | 23:33 | 1,614 |
| CR1-C19-P | Participant | 659,243.00 | 4,987,276.00 | 611.6 | 21:25 | 1,722 |
| CR1-C64-P | Participant | 659,436.00 | 4,992,174.00 | 581.0 | 19:54 | 1,614 |
| CR1-C56-P | Participant | 655,953.00 | 4,995,244.00 | 606.5 | 18:18 | 1,972 |
| CR1-C20-P | Participant | 663,054.00 | 4,987,455.00 | 606.0 | 14:42 | 2,336 |
| CR1-C36-P | Participant | 663,181.00 | 4,990,600.00 | 615.0 | 14:36 | 1,532 |
| CR1-C42-P | Participant | 659,458.00 | 4,992,229.00 | 580.0 | 11:58 | 1,801 |
| CR1-C35-P | Participant | 662,025.00 | 4,990,475.00 | 609.0 | 11:49 | 2,123 |
| CR2-C150-P | Participant | 657,178.00 | 4,985,788.00 | 612.0 | 10:01 | 1,640 |
| CR1-C57-P | Participant | 656,628.00 | 4,995,266.00 | 615.0 | 9:55 | 1,568 |
| CR1-C59-P | Participant | 661,548.00 | 5,000,754.00 | 584.2 | 7:39 | 1,644 |
| CR1-C68-P | Participant | 662,652.00 | 4,987,606.00 | 609.0 | 6:46 | 2,146 |
| CR1-C26-P | Participant | 657,767.00 | 4,988,493.00 | 597.0 | 6:39 | 3,484 |
| CR1-C69-P | Participant | 662,685.00 | 4,987,619.00 | 609.0 | 6:07 | 2,185 |
| CR1-C47-P | Participant | 662,825.00 | 4,993,508.00 | 613.9 | 5:03 | 3,750 |
| CR1-C48-P | Participant | 664,247.00 | 4,993,646.00 | 588.0 | 3:48 | 1,847 |
| CR1-C49-P | Participant | 662,250.00 | 4,993,731.00 | 609.0 | 1:12 | 5,148 |
| CR1-C6-P | Participant | 662,989.00 | 4,995,228.00 | 599.8 | 0:00 | 6,102 |
| | | | | | | |
| | | | | | | |

Table C-3: Crowned Ridge Sound Level Tabular Results Sorted by Real Case Shadow Flicker Hours/Year Updated 7/27/19

6 turbines removed as suggested by Mr. Hessler
 Results using GE 2.3-116-90 m HH, GE 2.3-116-80 m HH WTG's
 UTM NAD83 Zone 14
 Grant County
continued

| Receptor ID | Participation Status | Easting (m) | Northing (m) | Elevation AMSL (m) | Real Case Shadow (hrs/year) | Distance to Nearest Turbine (ft) |
|-------------|----------------------|-------------|--------------|--------------------|-----------------------------|----------------------------------|
| CR1-G114-NP | Non-P | 666,214.00 | 5,006,667.00 | 521.1 | 23:23 | 2,205 |
| CR1-G43-NP | Non-P | 661,141.00 | 5,001,721.00 | 583.6 | 18:26 | 1,909 |
| CR1-G125-NP | Non-P | 668,289.00 | 5,000,643.00 | 543.0 | 15:49 | 1,716 |
| CR1-G115-NP | Non-P | 664,933.00 | 5,006,731.00 | 544.6 | 8:01 | 2,188 |
| CR1-G113-NP | Non-P | 666,228.00 | 5,005,549.00 | 537.0 | 7:09 | 2,746 |
| CR1-G23-NP | Non-P | 670,471.00 | 4,992,104.00 | 560.0 | 5:11 | 2,185 |
| CR1-G27-NP | Non-P | 676,630.00 | 4,994,642.00 | 480.8 | 2:55 | 4,944 |
| CR1-G44-NP | Non-P | 661,781.00 | 5,001,732.00 | 583.7 | 2:50 | 3,123 |
| CR1-G68-NP | Non-P | 669,159.00 | 4,993,632.00 | 565.6 | 2:07 | 2,113 |
| CR1-G117-NP | Non-P | 663,801.00 | 5,005,084.00 | 581.3 | 1:54 | 4,501 |
| CR1-G34-NP | Non-P | 671,320.00 | 4,995,798.00 | 531.0 | 1:28 | 2,238 |
| CR1-G109-NP | Non-P | 667,064.00 | 5,000,425.00 | 566.2 | 0:59 | 2,152 |
| CR1-G12-NP | Non-P | 668,229.00 | 4,989,039.00 | 575.0 | 0:00 | 4,623 |
| CR1-G16-NP | Non-P | 668,419.00 | 4,989,861.00 | 576.0 | 0:00 | 2,070 |
| CR1-G14-NP | Non-P | 668,156.00 | 4,989,332.00 | 574.1 | 0:00 | 3,940 |
| CR1-G22-NP | Non-P | 674,670.00 | 4,991,955.00 | 527.6 | 0:00 | 5,781 |
| CR1-G13-NP | Non-P | 672,216.00 | 4,989,142.00 | 558.0 | 0:00 | 3,576 |
| CR1-G77-NP | Non-P | 676,031.00 | 4,992,629.00 | 502.7 | 0:00 | 5,728 |
| CR1-G37-NP | Non-P | 668,998.00 | 4,996,452.00 | 549.0 | 0:00 | 5,246 |
| CR1-G42-NP | Non-P | 670,566.00 | 4,997,097.00 | 518.9 | 0:00 | 3,819 |
| CR1-G36-NP | Non-P | 673,559.00 | 4,996,344.00 | 498.0 | 0:00 | 6,211 |
| CR1-G105-NP | Non-P | 668,696.00 | 4,998,325.00 | 549.0 | 0:00 | 6,345 |
| CR1-G110-NP | Non-P | 671,218.00 | 5,005,064.00 | 456.2 | 0:00 | 5,889 |
| CR1-G130-NP | Non-P | 668,147.00 | 5,000,233.00 | 549.0 | 0:00 | 3,005 |
| CR1-G70-NP | Non-P | 677,464.53 | 4,991,043.11 | 492.0 | 0:00 | 12,651 |
| CR1-G600-NP | Non-P | 674,300.70 | 5,005,772.78 | 393.0 | 0:00 | 13,186 |
| CR1-G65-P | Participant | 671,496.00 | 4,994,973.00 | 537.0 | 29:59 | 1,539 |
| CR1-G21-P | Participant | 666,766.00 | 4,991,807.00 | 577.1 | 29:12 | 1,555 |
| CR1-G138-P | Participant | 664,809.00 | 5,006,456.00 | 549.0 | 25:26 | 1,824 |
| CR1-G28-P | Participant | 673,113.00 | 4,994,772.00 | 513.9 | 23:01 | 1,614 |
| CR1-G18-P | Participant | 668,678.00 | 4,990,722.00 | 585.0 | 22:35 | 1,585 |
| CR1-G32-P | Participant | 669,477.00 | 4,995,401.00 | 546.0 | 20:01 | 1,545 |
| CR1-G124-P | Participant | 669,843.00 | 5,000,605.00 | 525.0 | 19:27 | 1,791 |
| CR1-G137-P | Participant | 666,501.00 | 5,005,136.00 | 529.3 | 18:42 | 1,939 |
| CR1-G66-P | Participant | 670,802.00 | 4,994,681.00 | 539.7 | 16:45 | 1,801 |
| CR1-G128-P | Participant | 670,242.00 | 5,001,314.00 | 513.0 | 15:02 | 2,612 |
| CR1-G25-P | Participant | 671,391.00 | 4,992,858.00 | 549.0 | 14:41 | 1,804 |
| CR1-G59-P | Participant | 675,755.00 | 4,994,888.00 | 487.7 | 12:50 | 2,605 |

APPENDIX D: STANDARD RESOLUTION SHADOW FLICKER MAPS



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Crowned Ridge Wind Farm Shadow Flicker Iso-Lines Overview Map

Client
SWCA Environmental Consultants

Project Description
Wind turbine layout with occupied structures within 2 km.

Predicted shadow flicker levels at existing residences.

Location: Watertown, SD
Project #: 20174430

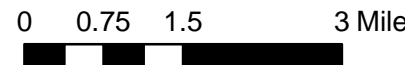
Issue Dates

| # | Description | Date |
|---|-------------|------------|
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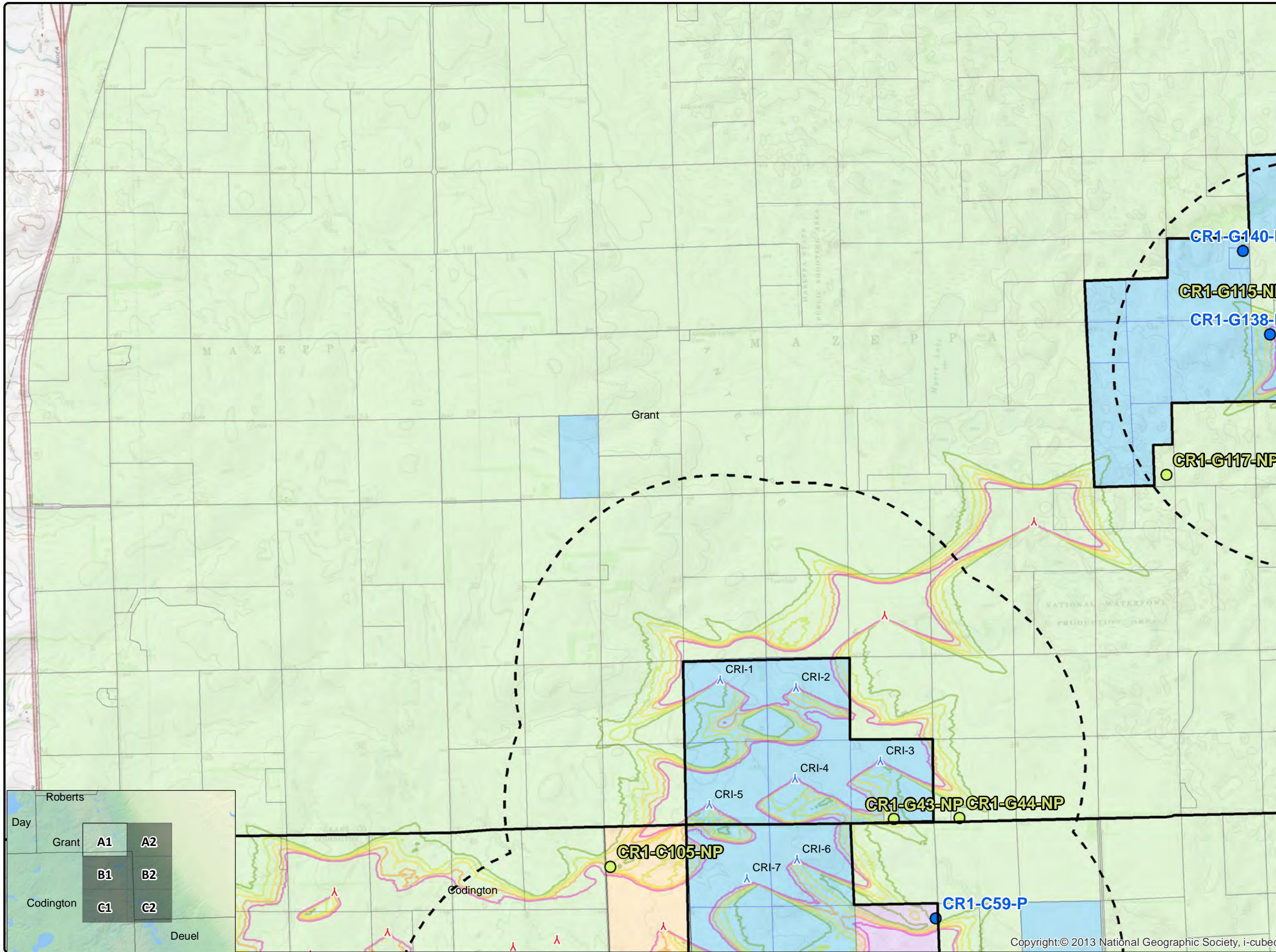
Drawn By: AS Checked By: JH

- Legend**
- Crowned Ridge Turbines
 - Crowned Ridge II Turbines
 - Dakota Range Turbines
 - 2 km Turbine Buffer
 - County Lines
 - CR1 Project Boundary
 - Non Participants
 - Participants
- Shadow Flicker (hr/yr)**
- 10
 - 15
 - 20
 - 25
 - 30
- Non-Part. Occupied Codington Parcels
 - Participating Occupied Codington Parcels
 - Non-Participating Parcels
 - Participating Parcels
 - Pending Parcels

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Crowned Ridge Wind Farm Shadow Flicker Iso-Lines

Client
SWCA Environmental Consultants

Project Description
Wind turbine layout with occupied structures within 2 km.
Predicted shadow flicker levels at existing residences.

Location: Watertown, SD
Project #: 20174430

Issue Dates

| # | Description | Date |
|---|-------------|------------|
| 1 | Original | 2019.07.27 |

Drawn By: AS Checked By: JH

Legend

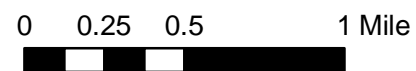
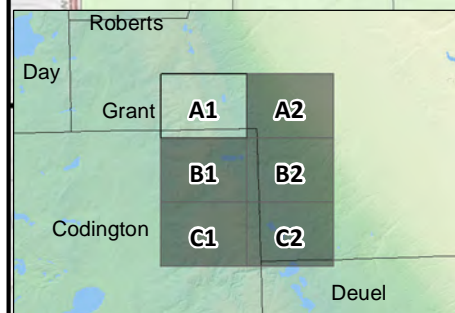
- Crowned Ridge Turbines
- Crowned Ridge II Turbines
- Dakota Range Turbines
- 2 km Turbine Buffer
- County Lines
- CR1 Project Boundary
- Non Participants
- Participants

Shadow Flicker (hr/yr)

- 10
- 15
- 20
- 25
- 30

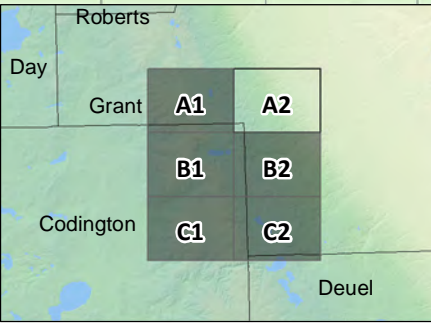
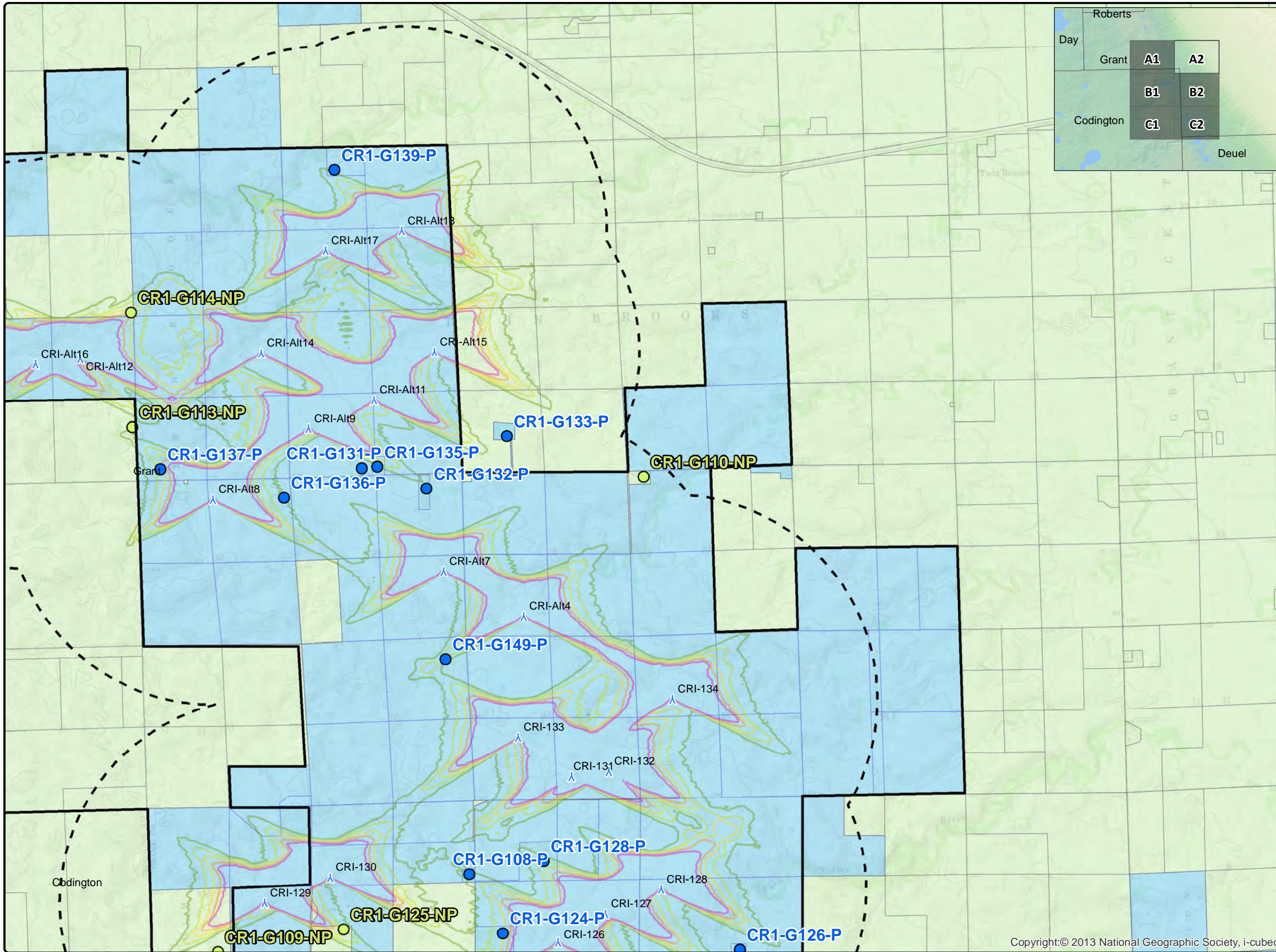
- Non-Part. Occupied Codington Parcels
- Participating Occupied Codington Parcels
- Non-Participating Parcels
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- Pending Parcels

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Crowned Ridge Wind Farm Shadow Flicker Iso-Lines

Client
SWCA Environmental Consultants

Project Description
Wind turbine layout with occupied structures within 2 km.

Predicted shadow flicker levels at existing residences.

Location: Watertown, SD
Project #: 20174430

Issue Dates

| # | Description | Date |
|---|-------------|------------|
| 1 | Original | 2019.07.27 |

Drawn By: AS Checked By: JH

Legend

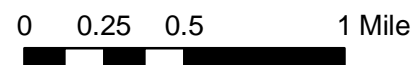
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- 2 km Turbine Buffer
- County Lines
- CR1 Project Boundary
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- Participants

Shadow Flicker (hr/yr)

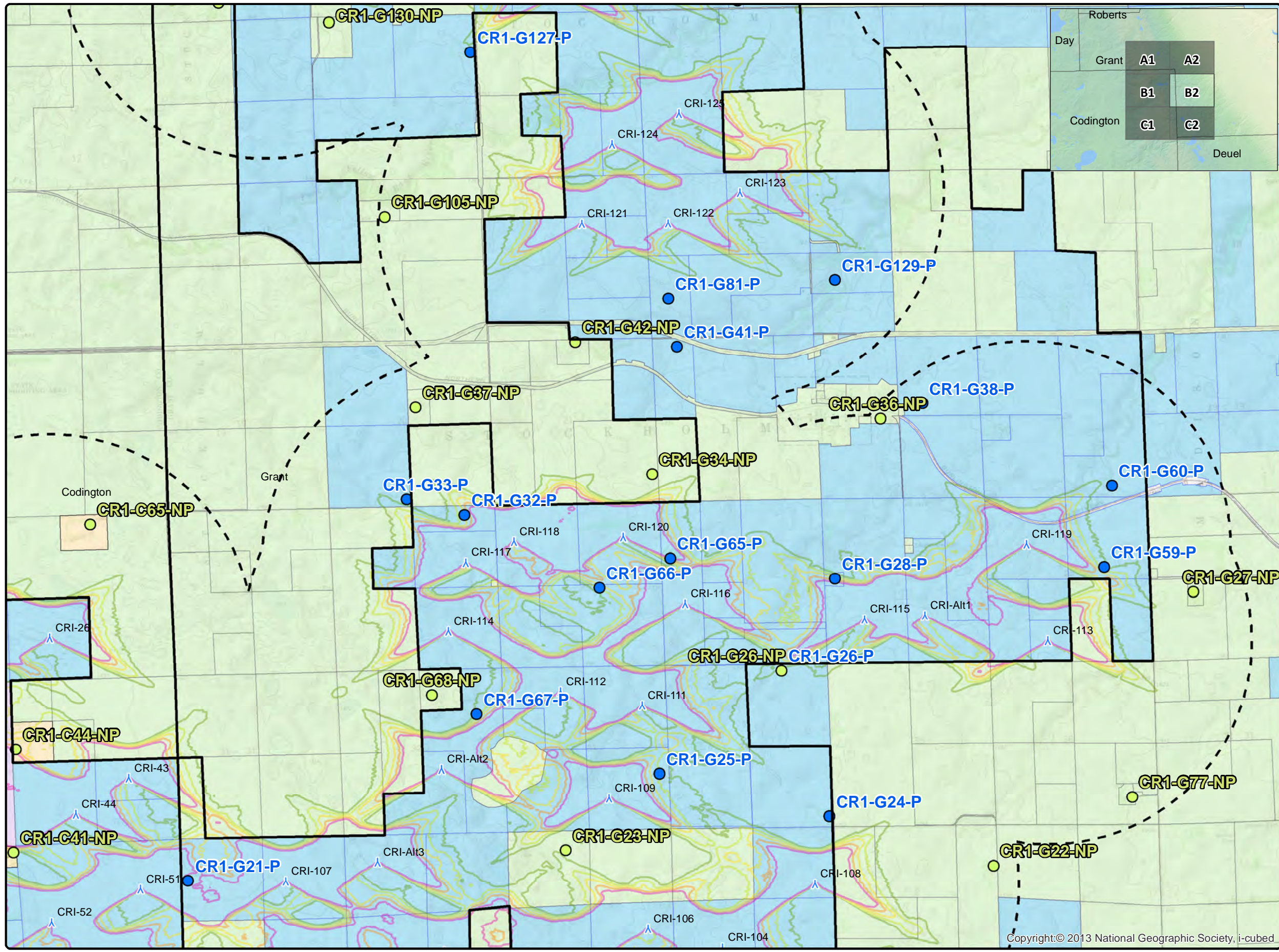
- 10
- 15
- 20
- 25
- 30

- Non-Part. Occupied Codington Parcels
- Participating Occupied Codington Parcels
- Non-Participating Parcels
- Participating Parcels
- Pending Parcels

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Crowned Ridge Wind Farm Shadow Flicker Iso-Lines

Client
SWCA Environmental Consultants

Project Description
Wind turbine layout with occupied structures within 2 km.

Predicted shadow flicker levels at existing residences.

Location: Watertown, SD
Project #: 20174430

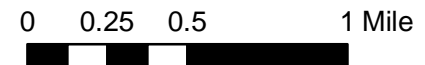
Issue Dates

| # | Description | Date |
|---|-------------|------------|
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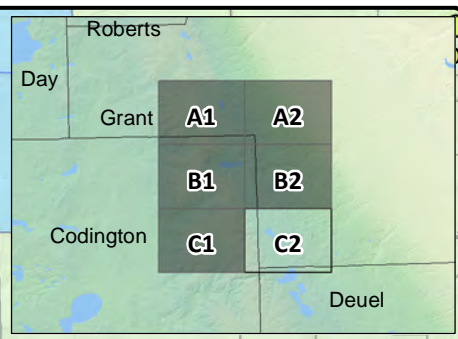
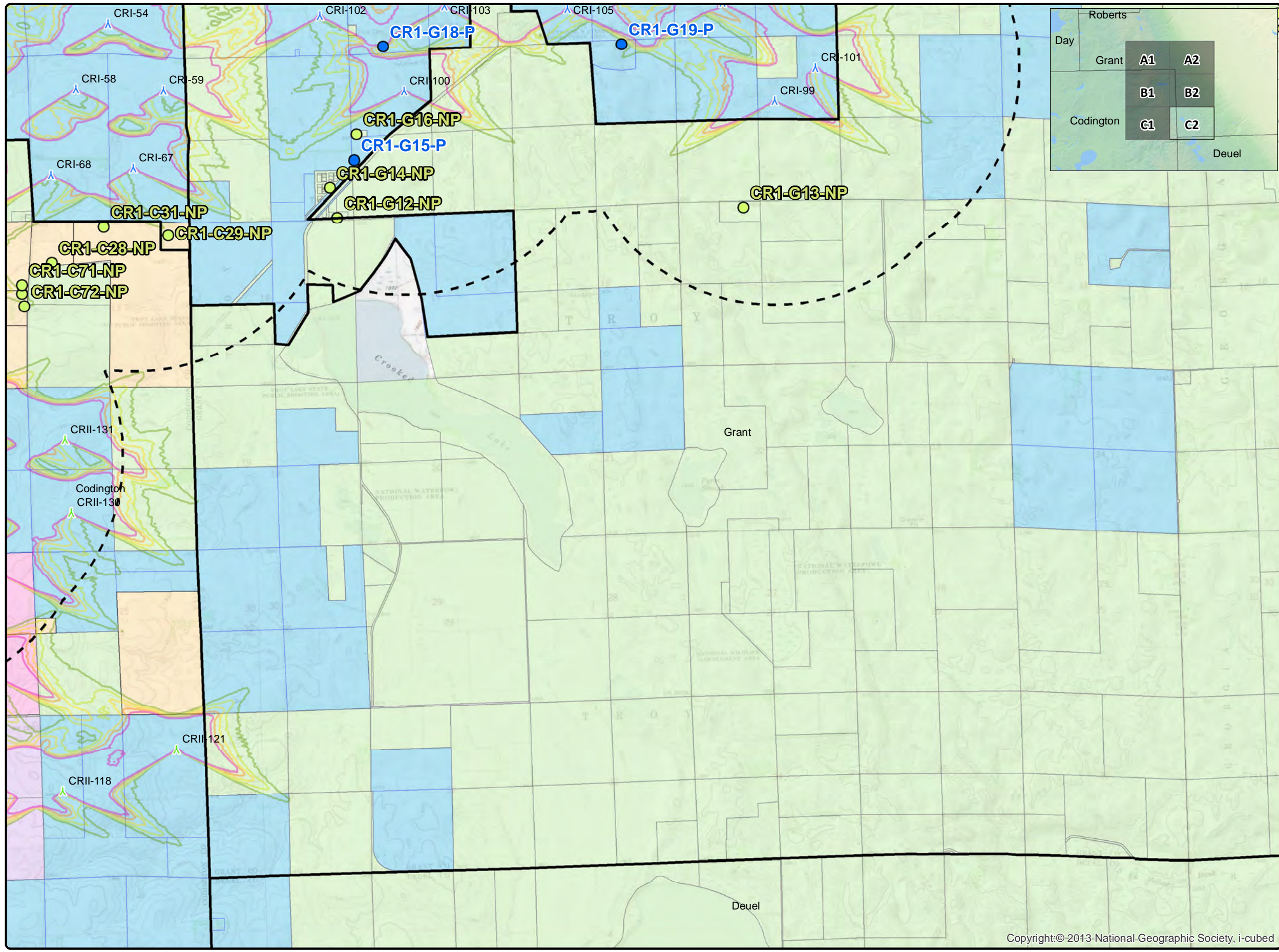
Drawn By: AS Checked By: JH

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 - Non Participants
 - Participants
- Shadow Flicker (hr/yr)**
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 - Participating Occupied Codington Parcels
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Crowned Ridge Wind Farm Shadow Flicker Iso-Lines

Client
SWCA Environmental Consultants

Project Description
Wind turbine layout with occupied structures within 2 km.

Predicted shadow flicker levels at existing residences.

Location: Watertown, SD
Project #: 20174430

Issue Dates

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|---|-------------|------------|
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Drawn By: AS Checked By: JH

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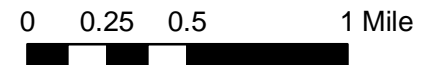
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