TECHNICAL MEMORANDUM

DATE September 25, 2023 **Project No.** CA0004169.0042_Rev1

TO Andrea Kausel
Wild Rose 2 Wind LP

CC

FROM Andrew Faszer **EMAIL andrew.faszer@wsp.com**

WILD ROSE 2 WIND POWER PROJECT AMENDMENT – NOISE AND SHADOW FLICKER UPDATE

1.0 INTRODUCTION

Wild Rose 2 Wind LP (Wild Rose 2) are the owners of the approved but not yet constructed Wild Rose 2 Wind Power Project (the Project), which will be located in Cypress County, Alberta, approximately 30 kilometres (km) southeast of Medicine Hat. The Alberta Utilities Commission (AUC) approved the Project in April 2017 (Approved Layout; AUC 2017).

In Proceeding 27729, Wild Rose 2 is proposing modifications to the Approved Layout of the Project. Wild Rose 2 retained WSP Canada Inc. (WSP) to assess potential noise and shadow flicker impacts from the modified Project. WSP prepared noise and shadow flicker assessments for the modified Project in December 2022 (WSP 2022a, 2022b). The December 2022 noise assessment was prepared in accordance with Rule 012 (AUC 2021). The December 2022 shadow flicker assessment was prepared in accordance with Rule 007 (AUC 2022).

The December 2022 noise and shadow flicker assessments (WSP 2022a, 2022b) were filed as Exhibits 27729-X0039 and 27729-X0040, respectively, on January 6, 2023. As such, the version of the Project considered in the December 2022 noise and shadow flicker assessments will hereafter be referred to as the January 2023 Layout.

In response to new environmental features discovered during 2023 field work (Blakes 2023), Wild Rose 2 has made further modifications to the January 2023 Layout. In particular, Wild Rose 2 has adjusted the location of some Project wind turbines (Updated Layout) relative to the January 2023 Layout. The Updated Layout wind turbine locations are presented in Table 1.

Please note there have been no changes to the wind turbine technology or substation relative to the January 2023 Layout. In particular, the Project still consists of 38 Siemens-Gamesa SG 5.0-145 wind turbine generators with a hub height of 95.5 metres (m), a rotor diameter of 145 m, and a nominal power rating of 5.2 megawatts (MW), operating in mode AM+1 with a maximum sound power level of 106.3 A-weighted decibels (dBA).

Table 1: Updated Layout Locations for Project Wind Turbines

Turbine Identification Code	Universal Transverse Mercator Coordinates [Zone 12]	
	Easting [m]	Northing [m]
T01	527899	5519590
T02	528000	5519087
T03	527991	5518649
T04	531182	5520833
T05	531474	5520144
T06	532168	5519290
T07	532315	5518843
T10	531124	5515547
T11	531514	5515106
T12	532098	5516799
T13	532453	5516414
T15	533583	5517116
T16	533808	5516737
T17	534395	5516405
T18	534896	5516156
T19	535510	5515878
T20	534494	5517964
T21	534913	5517550
T22	535503	5517270
T23	530508	5513883
T24	536398	5515188
T25	536468	5514686
T26	536598	5513725
T27	536614	5513253
T28	537273	5513183
T29	535551	5513016
T30	536197	5512433
T31	537348	5512184
T32	535463	5512398
T33	535409	5511832
T34	530743	5513437
T35	537076	5511169
T36	537358	5510726
T37	536875	5510002
T38	537171	5509679
A05	536429	5511941
A07	536041	5516840
A09	533831	5518370

Wild Rose 2 directed WSP to assess potential noise and shadow flicker impacts from the Updated Layout. The results of WSP's noise and shadow flicker assessment are summarized in this technical memorandum.

Rule 012 requires that potential noise impacts be assessed at receptors corresponding to occupied dwellings located within 1.5 km of the Project wind turbines or substation (AUC 2021). Similarly, Rule 007 requires that potential shadow flicker impacts be assessed at receptors corresponding to occupied dwellings located within 1.5 km of the Project wind turbines (AUC 2022). However, the noise assessment for the January 2023 Layout (WSP 2022a) included additional receptors located more than 1.5 km from Project wind turbines and/or substation for consistency with the noise assessment prepared for the Approved Layout (DNV-GL 2016). In contrast, the shadow flicker assessment for the January 2023 Layout (WSP 2022b) only considered receptors located 1.5 km from the Project wind turbines since there was no shadow flicker assessment prepared for the Approved Layout.

Table 2 presents the location of dwelling receptors considered in the December 2022 noise and shadow flicker assessments (WSP 2022a, 2022b). For each dwelling receptor, Table 2 identifies the closest Project wind turbine from the Updated Layout and provides the distance to this closest wind turbine. In Table 2, receptors located more than 1.5 km from the Project turbines and substation have been shaded grey. For consistency with the assessments prepared for the January 2023 Layout (WSP 2022a, 2022b), potential noise impacts from the Updated Layout were assessed at all receptors from Table 2, while potential shadow flicker impacts were not assessed at the receptors shaded grey.

Table 2: Dwelling Receptors

Receptor	Receptor Description	Universal Transverse Mercator Coordinates [Zone 12]		Closest Updated Layout Project Wind Turbine	Distance to Closest Updated Layout Project Wind Turbine [m]
		Easting [m]	Northing [m]		
R01	one-storey dwelling	531357	5522150	T04	1,329
R02A	one-storey dwelling	527348	5521380	T01	1,873
R02B	one-storey dwelling	527395	5521285	T01	1,768
R02C	one-storey dwelling	527361	5521235	T01	1,731
R02D	one-storey dwelling	527407	5521178	T01	1,662
R03	one-storey dwelling	530032	5520760	T04	1,152
R04	one-storey dwelling	530025	5520370	T04	1,246
R05	one-storey dwelling	532473	5519970	T06	745
R06	one-storey dwelling	536748	5519270	T22	2,356
R07	one-storey dwelling	529165	5519210	T02	1,171
R08	one-storey dwelling	534431	5519140	A09	976
R09	one-storey dwelling	533361	5519060	A09	835

Table 2: Dwelling Receptors

Receptor	Receptor Description	Universal Transverse Mercator Coordinates [Zone 12]		Closest Updated Layout Project Wind Turbine	Distance to Closest Updated Layout Project Wind Turbine [m]
		Easting [m]	Northing [m]		
R10	one-storey dwelling	525448	5518800	T03	2,547
R12	one-storey dwelling	531072	5518040	T07	1,480
R13	two-storey dwelling	531085	5518010	T07	1,486
R14	one-storey dwelling	528246	5517920	T03	772
R15	one-storey dwelling	537366	5517800	A07	1,636
R16	one-storey dwelling	537442	5517740	A07	1,665
R17	one-storey dwelling	527856	5517720	T03	939
R18	one-storey dwelling	529439	5517420	T03	1,899
R19	one-storey dwelling	529015	5517100	T03	1,857
R21	one-storey dwelling	527144	5516750	T03	2,079
R22	one-storey dwelling	523864	5516360	T03	4,719
R23[(a)]	one-storey dwelling	531251	5516250	T10	714
R24	one-storey dwelling	527378	5515990	T03	2,729
R25	one-storey dwelling	529829	5515580	T10	1,295
R26	one-storey dwelling	532750	5515539	T13	924
R27	one-storey dwelling	532807	5515430	T13	1,046
R28	one-storey dwelling	537446	5515420	T24	1,073
R29	one-storey dwelling	534057	5515050	T18	1,388
R30	one-storey dwelling	534830	5514990	T19	1,118
R31	one-storey dwelling	527899	5514930	T23	2,811
R32	one-storey dwelling	524143	5514820	T03	5,428
R33	one-storey dwelling	531330	5514040	T23	837
R34	one-storey dwelling	538605	5513840	T28	1,485

Table 2: Dwelling Receptors

Receptor	Receptor Description	Universal Transverse Mercator Coordinates [Zone 12]		Closest Updated Layout Project Wind Turbine	Distance to Closest Updated Layout Project Wind Turbine [m]
		Easting [m]	Northing [m]		
R36	one-storey dwelling	524501	5513630	T23	6,012
R39	one-storey dwelling	530491	5511430	T34	2,023
R40	one-storey dwelling	531311	5511370	T34	2,144
R42.1	one-storey dwelling	532379	5509643	T33	3,738
R43	one-storey dwelling	530619	5509290	T34	4,149
R45	one-storey dwelling	530705	5509190	T34	4,247
R46	one-storey dwelling	539407	5509170	T38	2,293
R47	one-storey dwelling	537417	5508850	T38	865
R48	one-storey dwelling	538623	5507270	T38	2,813
R50	one-storey dwelling	534133	5505410	T38	5,240
R51	one-storey dwelling	532923	5503720	T38	7,318
R52	one-storey dwelling	529967	5522344	T04	1,939
R53	one-storey dwelling	537345	5520350	T22	3,589
R54	one-storey dwelling	529863	5522450	T04	2,087

Note: Receptors located more than 1.5 km from the Project wind turbines and substation have been shaded grey.

(a) WSP understands that R23 is leased by Wild Rose 2 and will not be a dwelling receptor once Project operations commence per AUC Rule 012 (AUC 2021).

2.0 UPDATE TO NOISE ASSESSMENT

Table 3 presents predicted cumulative noise levels based on the Updated Layout from Table 1. Predicted cumulative noise levels are presented for each receptor in Table 2. Figure 1 presents predicted Project noise level contours for the Updated Layout at a height of 1.5 m above ground (consistent with one-storey dwelling receptors), and Figure 2 presents predicted Project noise level contours for the Updated Layout at a height of 4.5 m above ground (consistent with two-storey dwelling receptors).

As noted previously, there have been no changes to noise emissions from the Project wind turbines or substation relative to the January 2023 Layout. Noise emissions from the Project wind turbines can be found in Table 6, and noise emissions from the Project substation can be found in Table 7 of the December 2022 noise assessment (WSP 2022a). WSP used these same emissions to model Project noise for Table 3, Figure 1, and Figure 2 of the present technical memorandum. Similarly, environmental parameters used in computer modelling for the present technical memorandum were the same as Table 4 of the December 2022 noise assessment (WSP 2022a). Finally, there have been no material changes to baseline facilities since the December 2022 noise assessment. As such, the noise contribution from baseline facilities in Table 3 of the present technical memorandum has been taken directly from the December 2022 noise assessment (WSP 2022a).

Table 3: Cumulative Noise Levels for the Updated Layout

Receptor	Ambient Sound Level [dBA]		Baseline Facility Noise Contribution [dBA]			Updated Layout Noise Contribution [dBA]	Application Case Cumulative Noise Level [dBA]	
	Daytime	Nighttime	AER-Regulated	Cypress Wind Project	Buffalo Trail Wind Project		Daytime	Nighttime
R01	45	35	nil[(a)]	12.1	18.3	29.6	45.1	36.2
R02A	45	35	nil[(a)]	nil[(a)]	nil[(a)]	26.1	45.1	35.5
R02B	45	35	nil[(a)]	nil[(a)]	nil[(a)]	26.7	45.1	35.6
R02C	45	35	nil[(a)]	nil[(a)]	nil[(a)]	23.9	45.0	35.3
R02D	45	35	nil[(a)]	nil[(a)]	nil[(a)]	24.3	45.0	35.4
R03	45	35	nil[(a)]	7.9	nil[(a)]	32.1	45.2	36.8
R04	45	35	nil[(a)]	7.7	nil[(a)]	32.2	45.2	36.8
R05	45	35	nil[(a)]	17.0	15.8	37.4	45.7	39.4
R06	45	35	nil[(a)]	20.7	23.7	28.4	45.1	36.2
R07	45	35	nil[(a)]	nil[(a)]	nil[(a)]	33.7	45.3	37.4
R08	45	35	nil[(a)]	18.4	20.7	35.4	45.5	38.3
R09	45	35	nil[(a)]	16.6	17.7	37.1	45.7	39.2
R10	45	35	nil[(a)]	nil[(a)]	nil[(a)]	24.2	45.0	35.3
R12	45	35	nil[(a)]	7.4	nil[(a)]	33.5	45.3	37.3
R13	45	35	nil[(a)]	7.5	nil[(a)]	35.3	45.4	38.2
R14	45	35	nil[(a)]	nil[(a)]	nil[(a)]	35.6	45.5	38.3
R15	45	35	nil[(a)]	17.7	16.8	27.2	45.1	35.8
R16	45	35	nil[(a)]	18.1	16.0	27.0	45.1	35.8
R17	45	35	nil[(a)]	nil[(a)]	nil[(a)]	33.7	45.3	37.4
R18	45	35	nil[(a)]	nil[(a)]	nil[(a)]	30.0	45.1	36.2
R19	45	35	nil[(a)]	nil[(a)]	nil[(a)]	29.1	45.1	36.0

Table 3: Cumulative Noise Levels for the Updated Layout

Receptor	Ambient Sound Level [dBA]		Baseline Facility Noise Contribution [dBA]			Updated Layout Noise Contribution [dBA]	Application Case Cumulative Noise Level [dBA]	
	Daytime	Nighttime	AER-Regulated	Cypress Wind Project	Buffalo Trail Wind Project		Daytime	Nighttime
R21	45	35	nil[a]	nil[a]	nil[a]	26.1	45.1	35.5
R22	45	35	nil[a]	nil[a]	nil[a]	15.3	45.0	35.0
R23[b]	45	35	nil[a]	nil[a]	nil[a]	38.1	45.8	39.8
R24	45	35	nil[a]	nil[a]	nil[a]	24.6	45.0	35.4
R25	45	35	nil[a]	nil[a]	nil[a]	32.0	45.2	36.8
R26	45	35	nil[a]	nil[a]	nil[a]	36.6	45.6	38.9
R27	45	35	nil[a]	nil[a]	nil[a]	35.9	45.5	38.5
R28	45	35	19.3	nil[a]	nil[a]	34.9	45.4	38.0
R29	45	35	16.3	nil[a]	nil[a]	35.0	45.4	38.0
R30	45	35	17.8	nil[a]	nil[a]	36.5	45.6	38.9
R31	45	35	nil[a]	nil[a]	nil[a]	24.9	45.0	35.4
R32	45	35	nil[a]	nil[a]	nil[a]	nil[a]	45.0	35.0
R33	45	35	nil[a]	nil[a]	nil[a]	37.4	45.7	39.4
R34	45	35	26.1	nil[a]	nil[a]	32.1	45.3	37.2
R36	45	35	nil[a]	nil[a]	nil[a]	nil[a]	45.0	35.0
R39	45	35	nil[a]	nil[a]	nil[a]	24.8	45.0	35.4
R40	45	35	nil[a]	nil[a]	nil[a]	24.7	45.0	35.4
R42.1	45	35	nil[a]	nil[a]	nil[a]	22.7	45.0	35.2
R43	45	35	nil[a]	nil[a]	nil[a]	16.4	45.0	35.1
R45	45	35	nil[a]	nil[a]	nil[a]	16.2	45.0	35.1
R46	45	35	24.5	nil[a]	nil[a]	26.7	45.1	35.9
R47	45	35	21.7	nil[a]	nil[a]	34.7	45.4	38.0
R48	45	35	16.4	nil[a]	nil[a]	22.4	45.0	35.3
R50	45	35	nil[a]	nil[a]	nil[a]	nil[a]	45.0	35.0
R51	45	35	nil[a]	nil[a]	nil[a]	nil[a]	45.0	35.0
R52	45	35	nil[a]	7.1	5.4	26.3	45.1	35.6
R53	45	35	nil[a]	27.3	30.1	23.5	45.2	36.9
R54	45	35	nil[a]	6.7	5.3	25.7	45.1	35.5

Note: Receptors located more than 1.5 km from the Project wind turbines and substation have been shaded grey.

(a) Noise level is too small to be meaningfully quantified.

(b) WSP understands that R23 is leased by Wild Rose 2 and will not be a dwelling receptor once Project operations commence per AUC Rule 012 (AUC 2021).

Table 4 assesses potential noise impacts from the Updated Layout by comparing predicted cumulative noise levels to permissible sound level (PSL) limits from Rule 012 (AUC 2021). At all receptors, the Updated Layout is predicted to be compliant with applicable PSL limits.

Table 4: Compliance Assessment for the Updated Layout

Receptor	Application Case Cumulative Noise Level[a] [dBA]		Permissible Sound Level [dBA]		Margin of Compliance[b] [dBA]		Assessment
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	
R01	45	36	50	40	5	4	compliant
R02A	45	36	50	40	5	4	compliant
R02B	45	36	50	40	5	4	compliant
R02C	45	35	50	40	5	5	compliant
R02D	45	35	50	40	5	5	compliant
R03	45	37	50	40	5	3	compliant
R04	45	37	50	40	5	3	compliant
R05	46	39	50	40	4	1	compliant
R06	45	36	50	40	5	4	compliant
R07	45	37	50	40	5	3	compliant
R08	46	38	50	40	4	2	compliant
R09	46	39	50	40	4	1	compliant
R10	45	35	50	40	5	5	compliant
R12	45	37	50	40	5	3	compliant
R13	45	38	50	40	5	2	compliant
R14	46	38	50	40	4	2	compliant
R15	45	36	50	40	5	4	compliant
R16	45	36	50	40	5	4	compliant
R17	45	37	50	40	5	3	compliant
R18	45	36	50	40	5	4	compliant
R19	45	36	50	40	5	4	compliant
R21	45	36	50	40	5	4	compliant
R22	45	35	50	40	5	5	compliant
R23[c]	46	40	50	40	4	0	compliant
R24	45	35	50	40	5	5	compliant
R25	45	37	50	40	5	3	compliant
R26	46	39	50	40	4	1	compliant
R27	46	39	50	40	4	1	compliant
R28	45	38	50	40	5	2	compliant
R29	45	38	50	40	5	2	compliant
R30	46	39	50	40	4	1	compliant
R31	45	35	50	40	5	5	compliant
R32	45	35	50	40	5	5	compliant
R33	46	39	50	40	4	1	compliant
R34	45	37	50	40	5	3	compliant
R36	45	35	50	40	5	5	compliant
R39	45	35	50	40	5	5	compliant
R40	45	35	50	40	5	5	compliant
R42.1	45	35	50	40	5	5	compliant

Table 4: Compliance Assessment for the Updated Layout

Receptor	Application Case Cumulative Noise Level[(a)] [dBA]		Permissible Sound Level [dBA]		Margin of Compliance[(b)] [dBA]		Assessment
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	
R43	45	35	50	40	5	5	compliant
R45	45	35	50	40	5	5	compliant
R46	45	36	50	40	5	4	compliant
R47	45	38	50	40	5	2	compliant
R48	45	35	50	40	5	5	compliant
R50	45	35	50	40	5	5	compliant
R51	45	35	50	40	5	5	compliant
R52	45	36	50	40	5	4	compliant
R53	45	37	50	40	5	3	compliant
R54	45	36	50	40	5	4	compliant

Note: Receptors located more than 1.5 km from the Project wind turbines and substation have been shaded grey.

(a) In accordance with Rule 012 (AUC 2021), cumulative noise levels from Table 3 have been rounded to the nearest whole number before assessing compliance with PSL limits.

(b) Margin of compliance is the difference between the PSL limit and the cumulative noise level. A margin of compliance ≥0 dBA indicates compliance with Rule 012.

(c) WSP understands that R23 is leased by Wild Rose 2 and will not be a dwelling receptor once Project operations commence per AUC Rule 012 (AUC 2021).

A table comparing predicted noise levels for the Updated Layout and the January 2023 Layout are attached at the end of the present technical memorandum (Table 6). As noted above, cumulative noise levels for the Updated Layout are predicted to remain compliant with Rule 012 PSL limits at all receptors, including R17.

3.0 UPDATE TO SHADOW FLICKER ASSESSMENT

Table 5 presents predicted shadow flicker levels based on the Updated Layout of wind turbine locations from Table 1. In accordance with Rule 007 (AUC 2022), predicted shadow flicker levels are presented for each receptor from Table 2 that is located within 1.5 km of a Project wind turbine in the Updated Layout. These are the same receptors considered in the December 2022 shadow flicker assessment (WSP 2022b).

For consistency with the December 2022 shadow flicker assessment (WSP 2022b), Table 5 presents shadow flicker predictions for two assessment cases.

- Assessment Case A (sometimes called “worst case”) assumes the sun is always shining during daylight hours (i.e., there are no cloudy periods), all wind turbines are always active (i.e., rotors turning), and all wind turbines are always oriented with the rotors perpendicular to the line joining the sun and all receptor points.
- Assessment Case B (sometimes called “adjusted case”) uses statistical weather data to reduce some of the conservatism inherent in Assessment Case A. In particular, Assessment Case B uses statistical weather data to estimate the probability of sunshine for each month of the year and to estimate the probability of different wind directions (and hence turbine orientations).

Both Assessment Case A and Assessment Case B assume that receptors are sensitive to shadow flicker from any direction. This is sometimes called “greenhouse mode” modelling.

Table 5: Shadow Flicker Predictions for the Updated Layout

Receptor	Assessment Case A			Assessment Case B
	Total Hours of Shadow Flicker Per Year	Number of Days Per Year with Shadow Flicker	Maximum Minutes of Shadow Flicker on a Single Day	Total Hours of Shadow Flicker Per Year
R01	0.00	0	0	0.00
R03	21.22	67	30	6.77
R04	24.60	82	28	9.17
R05	36.87	123	34	11.87
R07	25.75	100	26	8.50
R08	27.08	56	36	6.95
R09	64.10	128	56	16.77
R12	11.18	52	18	4.72
R13	8.60	58	13	3.18
R14	0.00	0	0	0.00
R17	0.00	0	0	0.00
R23	25.63	93	25	10.30
R25	14.83	57	26	4.53
R26	19.85	88	26	6.65
R27	22.60	114	25	7.92
R28	37.85	114	32	11.63
R29	7.17	46	14	3.03
R30	7.65	44	17	2.43
R33	75.50	134	43	21.07
R34	7.37	31	23	2.37
R47	0.00	0	0	0.00

Figure 3 presents predicted Project shadow flicker levels for Assessment Case B. Statistical weather data used to model Assessment Case B in the present memorandum were taken directly from Table 3 and Table 4 of the December 2022 shadow flicker assessment (WSP 2022b).

There are no federal or provincial guidelines or regulations that specify limits or criteria for assessing shadow flicker from wind power facilities in Alberta. In the absence of federal or provincial guidance, the December 2022 shadow flicker assessment for the Project (WSP 2022b) compared predicted shadow flicker to widely used guidelines, which recommend that exposure to shadow flicker be limited to a maximum of 30 hours per year and a maximum of 30 minutes per day (Koppen et al. 2017; LUNG 2017; Nova Scotia 2021). These same guideline values were used to assess potential shadow flicker impacts from the Updated Layout.

The results presented in Table 5 indicate that seventeen receptors may experience some shadow flicker from the Updated Layout. In Assessment Case A, modelling predicts that four receptors may experience more than 30 hours of shadow flicker per year (R05, R09, R28, and R33) and that five receptors may experience more than 30 minutes of shadow flicker on a single day (R05, R08, R09, R28, and R33). As described above, the modelling assumptions used in Assessment Case A are highly conservative (i.e., tending to overestimate potential shadow flicker).

Assessment Case B predicts shadow flicker under more realistic, but still conservative, environmental conditions. For Assessment Case B, modelling predicts that no receptor will experience more than 30 hours of shadow flicker per year from the Updated Layout.

Please note that a shadow flicker assessment was not prepared for the approved version of the Project since applications for the Approved Layout were filed and approved before the AUC required shadow flicker assessments for wind power facilities. As such, there are no shadow flicker predictions available for the Approved Layout. A table comparing predicted shadow flicker levels for the Updated Layout and the January 2023 Layout are attached at the end of the present technical memorandum (Table 7).

4.0 SUMMARY

The analysis presented in this technical memorandum demonstrates the following.

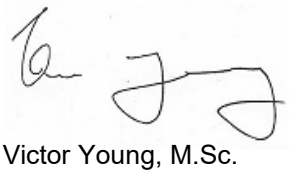
- For all receptors, the Updated Layout is predicted to comply with PSL limits from Rule 012.
- There are no receptors that will experience more than 30 hours of shadow flicker per year from the Updated Layout.

5.0 CLOSURE

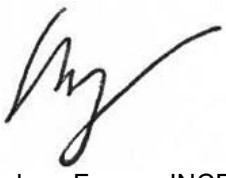
We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

Yours Truly,

WSP Canada Inc.



Victor Young, M.Sc.
Acoustic Scientist



Andrew Faszer, INCE, P.Eng.
Senior Engineer

VY/AF/crm/es

Attachments: Figure 1: Project Noise Levels – One-Storey Receptors
Figure 2: Project Noise Levels – Two-Storey Receptors
Figure 3: Project Shadow Flicker (Statistical Sunshine and Wind Direction)
Table 6: Comparison of Predicted Noise – Updated Layout vs. January 2023 Layout
Table 7: Comparison of Predicted Shadow Flicker – Updated Layout vs. January 2023 Layout

6.0 REFERENCES

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ATTACHMENTS

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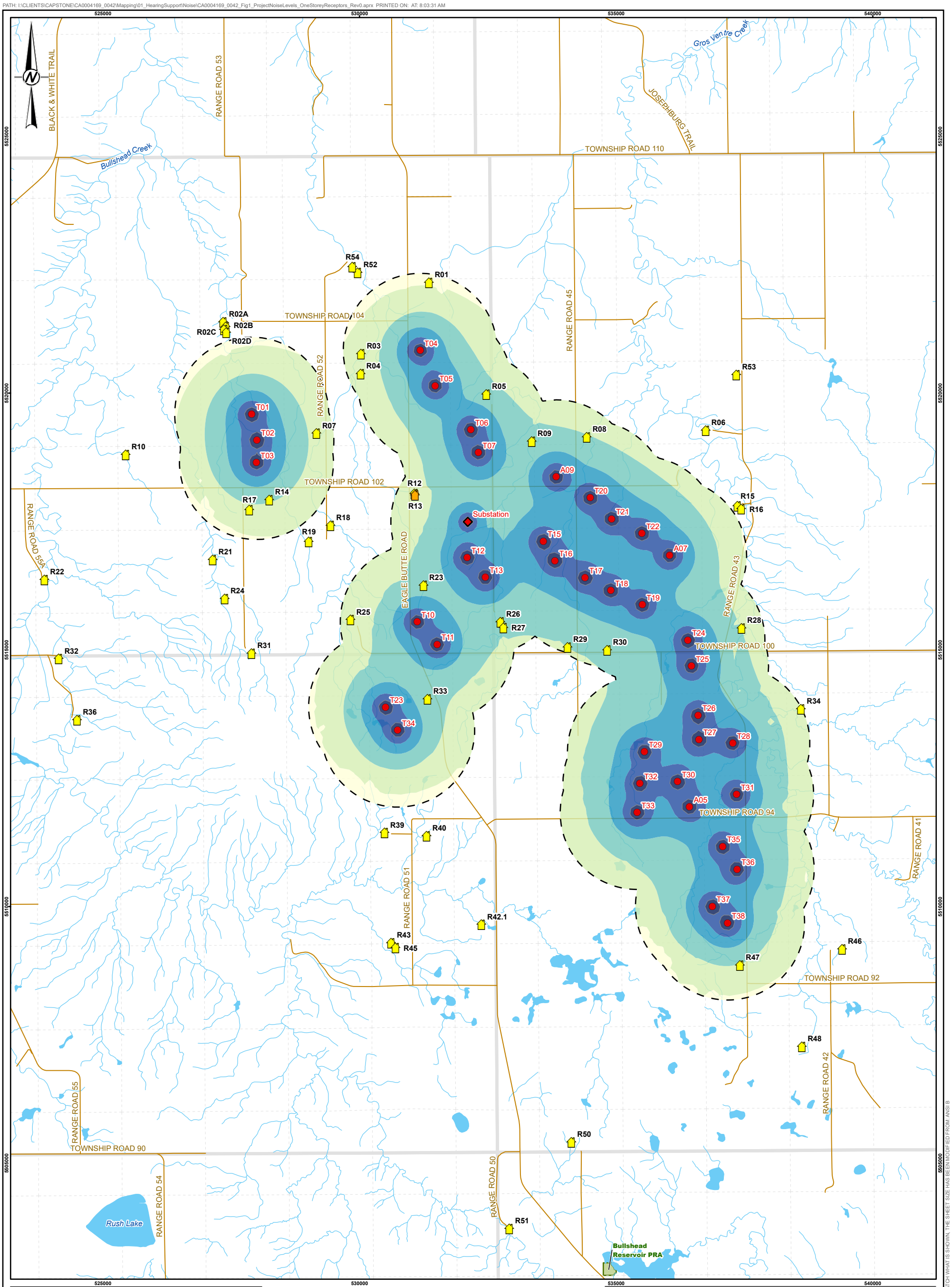

LEGEND

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- PARK / PROTECTED AREA

PROJECT NOISE SOURCES

- SUBSTATION
- TURBINE

NOISE RECEPTORS

- ONE-STOREY
- TWO-STOREY
- 1.5 km BUFFER ON PROJECT NOISE SOURCES

PREDICTED PROJECT NOISE LEVELS [dBA]

- 25 TO 30
- 30 TO 35
- 35 TO 40
- 40 TO 45
- 45 TO 50
- >50

0 1,500 3,000

1:70,000 METRES

REFERENCE(S)

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PROJECTED COORDINATE SYSTEM: NAD 1983 UTM ZONE 12N

CLIENT
WILD ROSE 2 WIND LP

PROJECT
WILD ROSE 2 WIND POWER PROJECT

CONSULTANT
wsp

YYYY-MM-DD	2023-09-15
DESIGNED	VY
PREPARED	SP
REVIEWED	VY
APPROVED	AF

TITLE
PROJECT NOISE LEVELS – ONE-STOREY RECEPTORS

PROJECT NO.	CONTROL	REV.	FIGURE
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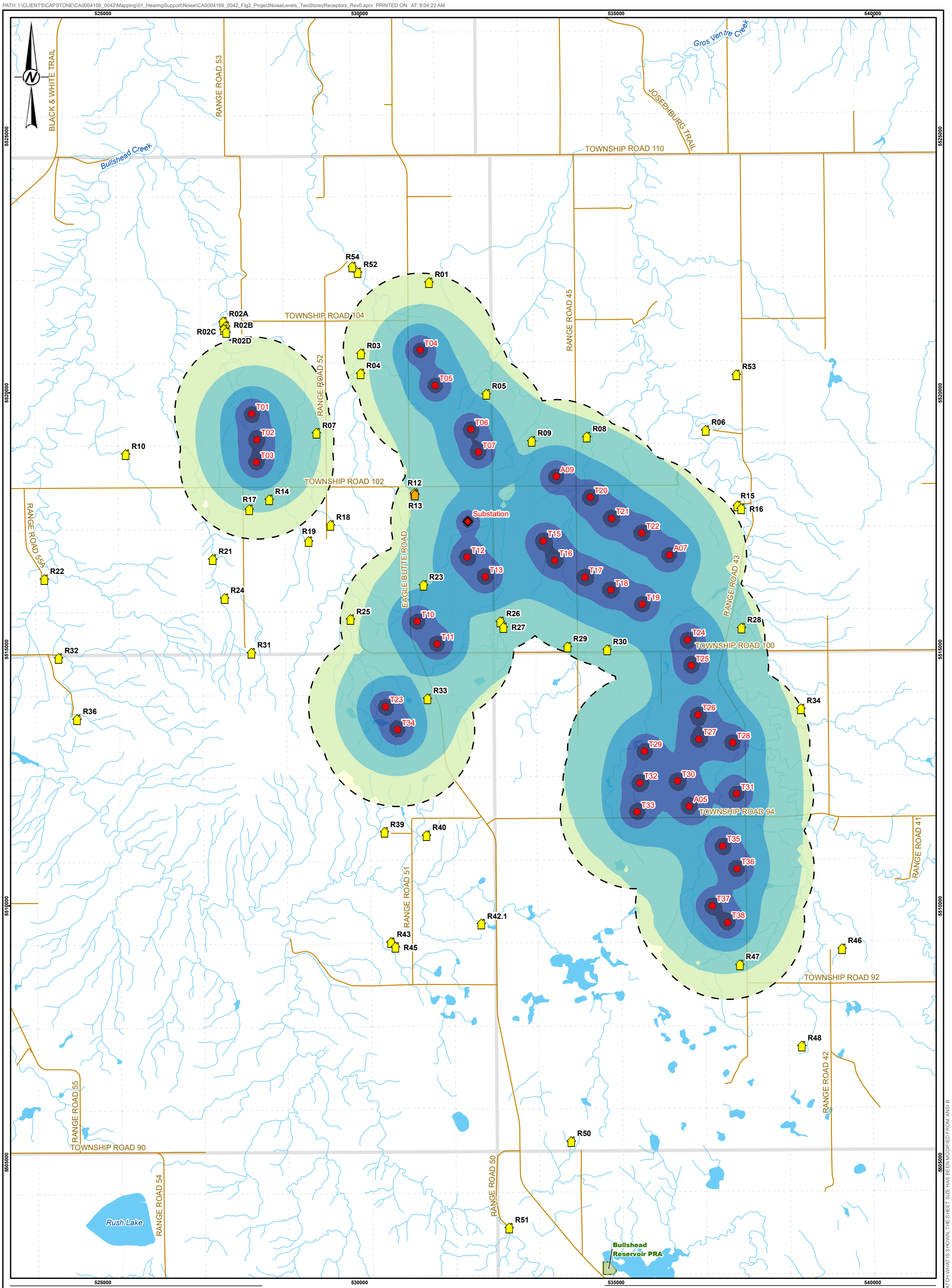

LEGEND

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- PARK / PROTECTED AREA

PROJECT NOISE SOURCES

- SUBSTATION
- TURBINE

NOISE RECEPTORS

- ONE-STOREY
- TWO-STOREY
- 1.5 km BUFFER ON PROJECT NOISE SOURCES

PREDICTED PROJECT NOISE LEVELS [dBA]

- 25 TO 30
- 30 TO 35
- 35 TO 40
- 40 TO 45
- 45 TO 50
- >50

0 1,500 3,000

1:70,000 METRES

REFERENCE(S)

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PROJECT
WILD ROSE 2 WIND POWER PROJECT

CONSULTANT
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YYYY-MM-DD	2023-09-15
DESIGNED	VY
PREPARED	SP
REVIEWED	VY
APPROVED	AF

TITLE
PROJECT NOISE LEVELS – TWO-STOREY RECEPTORS

PROJECT NO.	CONTROL	REV.	FIGURE
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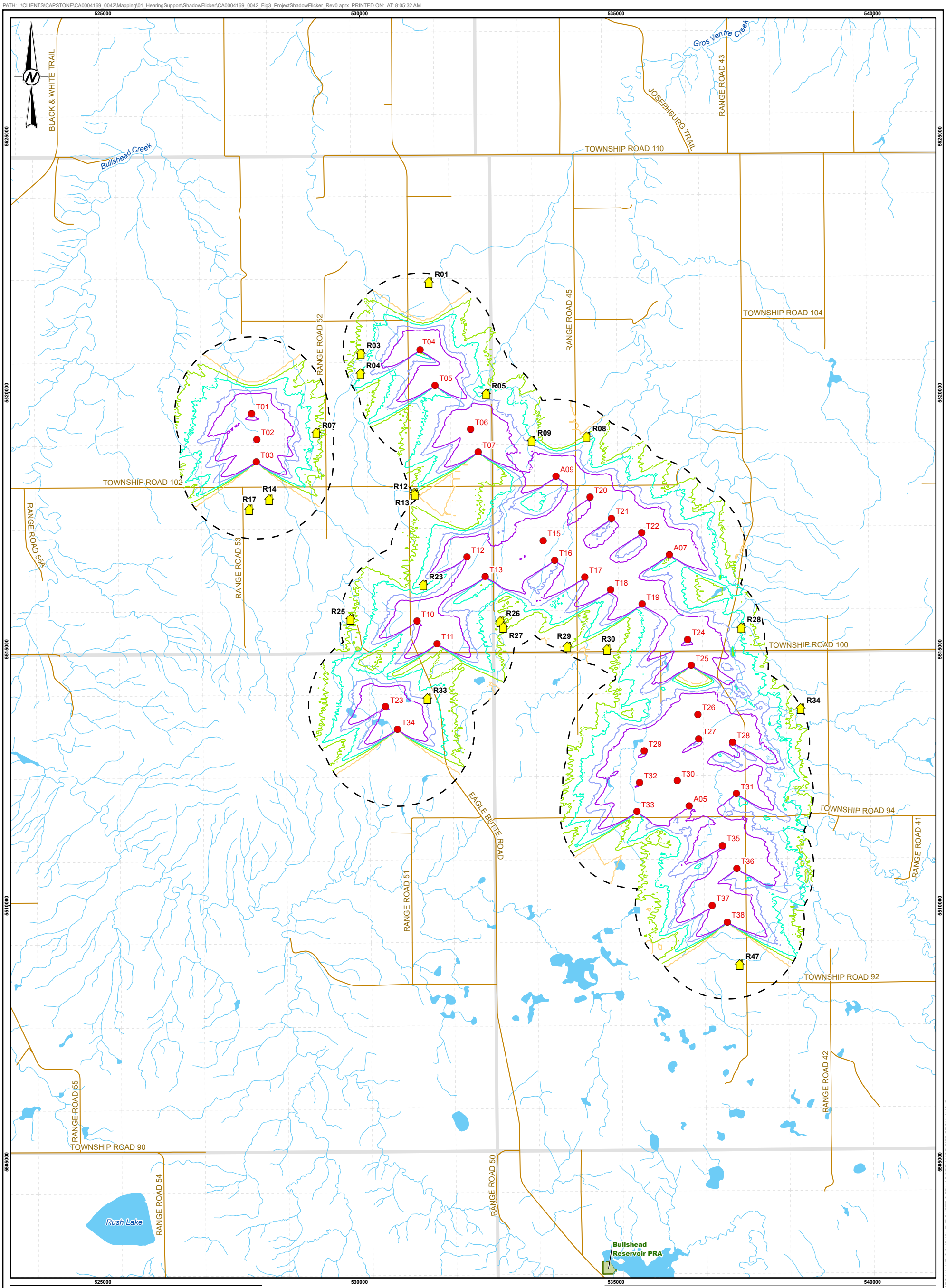

LEGEND

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- PARK / PROTECTED AREA
- SHADOW FLICKER RECEPTOR
- TURBINE
- 1.5 km BUFFER ON PROJECT TURBINES

PREDICTED PROJECT SHADOW FLICKER (HOURS/YEAR)

- ~0
- 5
- 10
- 20
- 30

0 1,500 3,000

1:70,000 METRES

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PROJECTED COORDINATE SYSTEM: NAD 1983 UTM ZONE 12N

CLIENT
WILD ROSE 2 WIND LP

PROJECT
WILD ROSE 2 WIND POWER PROJECT

CONSULTANT
wsp

YYYY-MM-DD	2023-09-15
DESIGNED	VY
PREPARED	SP
REVIEWED	VY
APPROVED	AF

TITLE
PROJECT SHADOW FLICKER (STATISTICAL SUNSHINE AND WIND DIRECTION)

PROJECT NO.	CONTROL	REV.	FIGURE
CA0004169.0042		0	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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Table 6: Comparison of Predicted Noise - Updated Layout vs. January 2023 Layout

Receptor	Application Case Cumulative Noise Level: Updated Layout[(a)] [dBA]		Application Case Cumulative Noise Level: January 2023 Layout[(b)] [dBA]		Change in Application Case Cumulative Noise Level: Updated Layout minus January 2023 Layout [dBA]	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
R01	45.1	36.2	45.1	36.2	0.0	0.0
R02A	45.1	35.5	45.1	35.5	0.0	0.0
R02B	45.1	35.6	45.1	35.6	0.0	0.0
R02C	45.0	35.3	45.0	35.3	0.0	0.0
R02D	45.0	35.4	45.0	35.4	0.0	0.0
R03	45.2	36.8	45.2	36.8	0.0	0.0
R04	45.2	36.8	45.2	36.9	0.0	-0.1
R05	45.7	39.4	45.7	39.2	0.0	0.2
R06	45.1	36.2	45.1	36.2	0.0	0.0
R07	45.3	37.4	45.4	38.1	-0.1	-0.7
R08	45.5	38.3	45.4	38.2	0.1	0.1
R09	45.7	39.2	45.8	39.6	-0.1	-0.4
R10	45.0	35.3	45.0	35.3	0.0	0.0
R12	45.3	37.3	45.3	37.5	0.0	-0.2
R13	45.4	38.2	45.5	38.5	-0.1	-0.3
R14	45.5	38.3	45.4	38.0	0.1	0.3
R15	45.1	35.8	45.1	35.6	0.0	0.2
R16	45.1	35.8	45.1	35.6	0.0	0.2
R17	45.3	37.4	45.2	36.9	0.1	0.5
R18	45.1	36.2	45.2	36.3	-0.1	-0.1
R19	45.1	36.0	45.1	36.0	0.0	0.0
R21	45.1	35.5	45.0	35.5	0.1	0.0
R22	45.0	35.0	45.0	35.0	0.0	0.0
R23[(c)]	45.8	39.8	45.8	39.8	0.0	0.0
R24	45.0	35.4	45.0	35.4	0.0	0.0
R25	45.2	36.8	45.2	36.8	0.0	0.0
R26	45.6	38.9	45.6	38.9	0.0	0.0
R27	45.5	38.5	45.5	38.5	0.0	0.0
R28	45.4	38.0	45.4	37.9	0.0	0.1
R29	45.4	38.0	45.4	38.0	0.0	0.0
R30	45.6	38.9	45.6	38.8	0.0	0.1
R31	45.0	35.4	45.0	35.4	0.0	0.0
R32	45.0	35.0	45.0	35.0	0.0	0.0
R33	45.7	39.4	45.7	39.4	0.0	0.0
R34	45.3	37.2	45.3	37.1	0.0	0.1
R36	45.0	35.0	45.0	35.0	0.0	0.0
R39	45.0	35.4	45.0	35.4	0.0	0.0
R40	45.0	35.4	45.0	35.4	0.0	0.0
R42.1	45.0	35.2	45.0	35.2	0.0	0.0
R43	45.0	35.1	45.0	35.1	0.0	0.0
R45	45.0	35.1	45.0	35.1	0.0	0.0
R46	45.1	35.9	45.1	35.9	0.0	0.0
R47	45.4	38.0	45.4	38.0	0.0	0.0
R48	45.0	35.3	45.0	35.3	0.0	0.0
R50	45.0	35.0	45.0	35.0	0.0	0.0
R51	45.0	35.0	45.0	35.0	0.0	0.0
R52	45.1	35.6	45.1	35.6	0.0	0.0
R53	45.2	36.9	45.2	36.9	0.0	0.0
R54	45.1	35.5	45.1	35.5	0.0	0.0

Note: Receptors located more than 1.5 km from the Project wind turbines and substation have been shaded grey.

(a) Application Case cumulative noise levels for the Updated Layout were taken directly from Table 3 of this technical memorandum.

(b) Application Case cumulative noise levels for the January 2023 Layout were taken directly from Table B-1 of the December 2022 noise assessment (WSP 2022a).

(c) WSP understands that R23 is leased by Wild Rose 2 and will not be a dwelling receptor once Project operations commence per AUC Rule 012 (AUC 2021).

Table 7: Comparison of Predicted Shadow Flicker - Updated Layout vs. January 2023 Layout

Receptor	Predicted Shadow Flicker: Updated Layout[a]				Predicted Shadow Flicker: January 2023 Layout[b]				Change in Shadow Flicker: Updated Layout minus January 2023 Layout			
	Assessment Case A			Assessment Case B	Assessment Case A			Assessment Case B	Assessment Case A			Assessment Case B
	Total Hours of Shadow Flicker Per Year	Number of Days Per Year with Shadow Flicker	Maximum Minutes of Shadow Flicker on a Single Day	Total Hours of Shadow Flicker Per Year	Total Hours of Shadow Flicker Per Year	Number of Days Per Year with Shadow Flicker	Maximum Minutes of Shadow Flicker on a Single Day	Total Hours of Shadow Flicker Per Year	Total Hours of Shadow Flicker Per Year	Number of Days Per Year with Shadow Flicker	Maximum Minutes of Shadow Flicker on a Single Day	Total Hours of Shadow Flicker Per Year
R01	0.00	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00
R03	21.22	67	30	6.77	21.30	68	30	6.82	-0.08	-1	0	-0.05
R04	24.60	82	28	9.17	24.75	82	29	9.22	-0.15	0	-1	-0.05
R05	36.87	123	34	11.87	47.07	135	39	14.60	-10.20	-12	-5	-2.73
R07	25.75	100	26	8.50	41.87	123	39	13.52	-16.12	-23	-13	-5.02
R08	27.08	56	36	6.95	36.55	74	34	9.47	-9.47	-18	2	-2.52
R09	64.10	128	56	16.77	40.45	126	32	11.52	23.65	2	24	5.25
R12	11.18	52	18	4.72	14.73	58	24	6.15	-3.55	-6	-6	-1.43
R13	8.60	58	13	3.18	21.10	94	23	8.42	-12.50	-36	-10	-5.24
R14	0.00	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00
R17	0.00	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00
R23	25.63	93	25	10.30	25.63	93	25	10.30	0.00	0	0	0.00
R25	14.83	57	26	4.53	14.83	57	26	4.53	0.00	0	0	0.00
R26	19.85	88	26	6.65	19.85	88	26	6.65	0.00	0	0	0.00
R27	22.60	114	25	7.92	22.62	114	25	7.93	-0.02	0	0	-0.01
R28	37.85	114	32	11.63	37.68	112	31	11.58	0.17	2	1	0.05
R29	7.17	46	14	3.03	7.32	47	14	3.10	-0.15	-1	0	-0.07
R30	7.65	44	17	2.43	7.58	44	17	2.42	0.07	0	0	0.01
R33	75.50	134	43	21.07	75.58	134	43	21.08	-0.08	0	0	-0.01
R34	7.37	31	23	2.37	7.37	31	22	2.37	0.00	0	1	0.00
R47	0.00	0	0	0.00	0.00	0	0	0.00	0.00	0	0	0.00

[a] Shadow flicker Levels for the Updated Layout were taken directly from Table 5 of this technical memorandum.

[b] Shadow flicker levels for the January 2023 Layout were taken directly from Table 5 of the December 2022 shadow flicker assessment (WSP 2022b).