

Appendix J

Shadow Flicker Report



MEMORANDUM

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TO: Ian Kerr; Brookfield Power
FROM: Dan Bernadett, Chief Engineer
DATE: 17 October 2007
RE: **Gosfield Shadow Flicker Analysis**

Summary

AWS Truewind, LLC performed a shadow flicker analysis of the proposed Gosfield and Comber Wind Projects in Ontario, Canada at the request of Brookfield Power. The Gosfield project consists of 48 turbines while the Comber project consists of 103 turbines. Each turbine has a rotor diameter of 82m and a hub height of 80m.

Using a computer model called WindPro, color-coded shadow flicker maps were produced, showing conservative estimates of the number of hours per year that shadows could be cast by the rotating turbine blades across the project site. A Geographic Information System (GIS) was then used to determine the number of hour per year that each receptor would be subject to shadow flicker.

Background Information

Shadow flicker is the occurrence of periodic changes in light intensity due to the shadow of a wind turbine blade passing over a point of interest. The shadow flicker computer model simulates the path of the sun over the year and assesses at regular time intervals the possible shadow flicker across a project area. The outputs of the model are useful in the design phase of a wind plant to assure that planning requirements are fulfilled.

Other than within approximately two rotor diameters from the base of a turbine, shadow flicker usually occurs in the morning and evening hours when the sun is low in the horizon and the shadows are elongated. Further, shadow flicker does not occur when the turbine rotor is oriented parallel to the receptor, or when the turbine is not operating. In addition, no shadow flicker will be present when the sun seen from a receptor is obscured by clouds, fog, or other obstacles already casting a shadow such as buildings and trees.

Shadow intensity, or how "light" or "dark" a shadow appears at a specific receptor, will vary with the distance from the turbine. Closer to a turbine, the blades will block out a larger portion of the sun's rays and shadows will tend to be wider and darker. Receptors located farther away from a turbine will experience much thinner and less distinct shadows since the blades will not block out as much sunlight. Clouds, fog, trees and other obstructions, wind direction, and the orientation of windows and doors in a residence will also influence the perceived intensity of shadow flicker. Shadow flicker will be greatly reduced or eliminated within a residence when buildings, trees, blinds or curtains are located between the turbine and the receptor. Additionally, if a room is illuminated by artificial lighting or by other windows unaffected by the shadow flicker, the shadow intensity within the room will be greatly reduced. Shadow flicker consultants generally agree that flicker is not noticeable beyond about 10 rotor diameters from a wind turbine, or approximately 820 m from the nearest turbine. Shadow flicker statistics for this project were calculated to a distance of 1000 m from each turbine to add an element of conservatism to the analysis.

Modeling Methodology

Before any calculations are made, the following inputs are defined:

Once the above parameters are defined, the model uses a series of equations to determine the position of the sun at any time during the year at the project location.

Model Limitations and Discussion

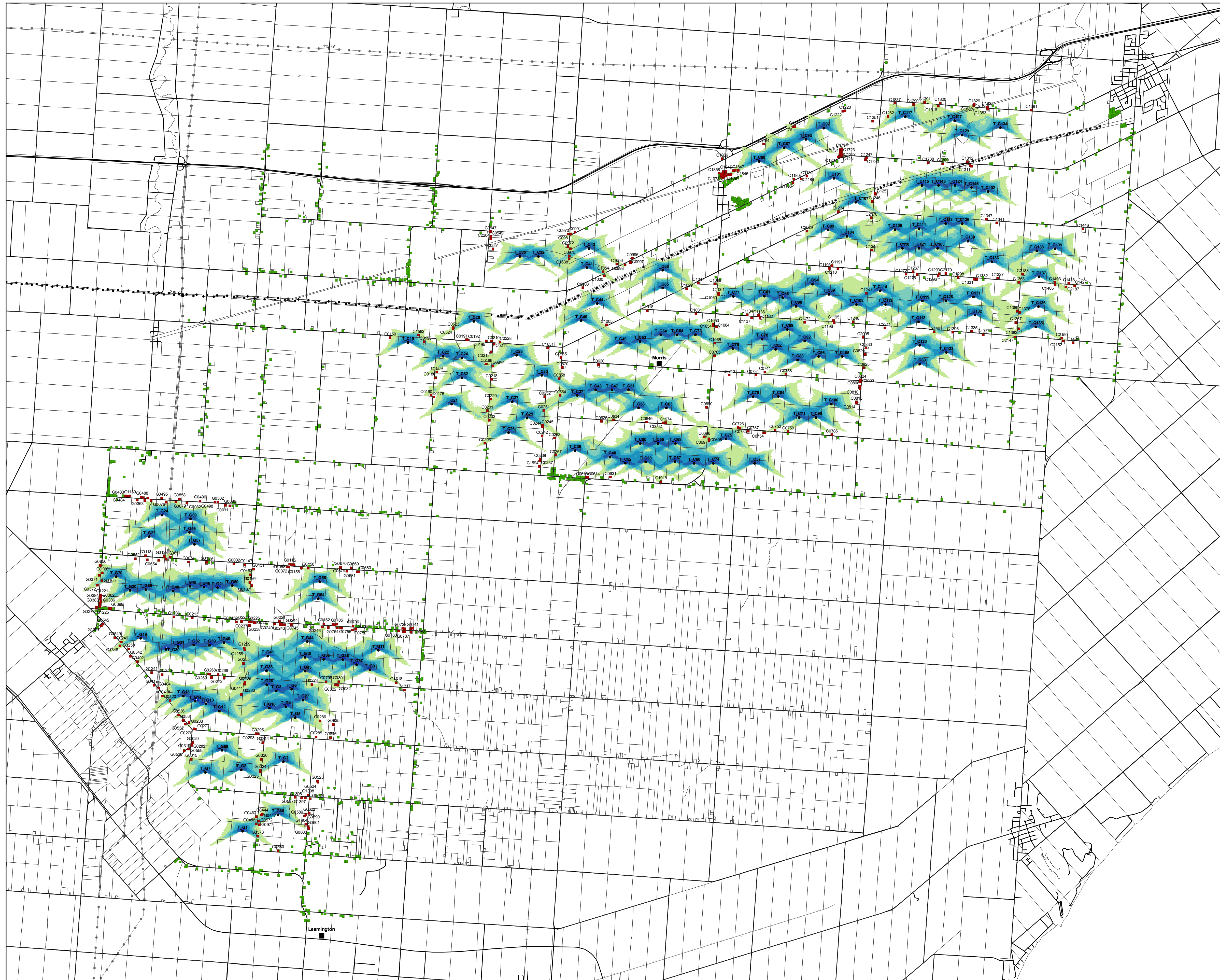
- Turbine coordinates, rotor diameters and hub heights
- Digital elevation contours
- Minimum elevation angle of the sun to calculate shadow effects (3° above horizon)
- Calculation time step (5 minutes)
- Calculation day step (7 days)
- Resolution of calculation points (20 meter grid)
- Maximum distance from the center of each turbine for calculation (1000 m)
- Wind speed and direction frequency distribution
- Monthly sunshine probabilities

The occurrence of shadow flicker is then determined by examining the wind turbine position in relation to the sun's position. Using vector geometry, the model calculates whether a shadow is produced at a point of interest at regular time intervals. Calculations are performed every 7 days since the sun's path does not change dramatically during the course of a week. On each calculation day, calculations are carried out every 5 minutes during daylight hours. The topography of the site is taken into account in these calculations, with the model determining if the direct line of sight between receptor and turbine or between turbine and sun is blocked by terrain features. Average monthly sunshine probabilities recorded over the past 31 years in Detroit, Michigan (the closest long-term data collection stations for this type of information) in addition to wind speed and direction frequencies measured at the project site are taken into account during the modeling process. The calculations are repeated on a grid of points across the project area, which is defined by the maximum calculation distance from the center of each turbine (1000 m) and the calculation resolution (20 m). The end result is a color-coded map showing the cumulative number of hours per year that shadow flicker could potentially occur across the project site. The number of hours shown on the map is an indication of the predicted flicker to be experienced over the course of an entire year, not during a single flicker event. The flicker map is attached as well as a listing of the number of hours per year shadow flicker is expected at each receptor.

In our opinion, the estimated shadow flicker as presented is a conservative estimate of the actual shadow flicker that could occur across the project area. The conservative nature of the model is due to a number of simplifications including:

- Shadow intensity is not considered. Only the presence or non-presence of shadow flicker is modeled.
- The limit of human perception of the shadow flicker is not considered. In other words, some people may be more sensitive to the presence of flicker than others. When a receptor is far away from a turbine, the shadows will be faint and some people may notice them while others may not.
- Obstacles other than terrain features (buildings, vegetation, etc) are not considered.

As a result of these simplifications, the shadow flicker impact across the site is likely to be lower than the model predicts. Hence, marginally affected areas are likely to either experience no shadow flicker at all or a very low intensity of flicker, when it does occur.



- Impacted Receptors 15Oct07
- Dwellings Not Impacted 15Oct07
- Turbine Layout 21Sep07


Shadow Flicker (Hours / Year)

- 1 - 10
- 10 - 20
- 20 - 30
- 30 - 50
- 50 - 100
- 100 - 200
- 200 - 300

- Abandoned Railway
- ~ Road

Existing Transmission Lines

- 230 kV
- 115 kV
- Unknown


AWS Truewind

Projection: Universal Transverse Mercator
 NAD 83 UTM Zone 17
 This map was created by AWS Truewind
 using the SiteWind system and historical weather
 data. Although it is believed to represent an accurate
 overall picture of the wind energy resource, estimates
 at any location should be confirmed by measurement.



Name	ID	X	Y	ZVI (Hours_Per_Year)
R_G580	G0580	361108.64	4660893.42	5.093
R_G573	G0573	360618.01	4661237.53	28.523
R_G600	G0600	361850.76	4661429.75	7.131
R_G601	G0601	361841.46	4661474.76	5.093
Rs_G977	G0977	360662.52	4661519.16	11.205
R_G1404	G1404	361782.13	4661528.50	6.112
RP_G452	G0452	360583.52	4661538.79	27.504
R_G572	G0572	360640.89	4661604.02	30.560
R_G467	G0467	360590.64	4661715.19	13.243
R_G589	G0589	361755.19	4661730.18	4.075
RP_G448	G0448	360708.66	4661755.44	17.317
RP_G447	G0447	360724.82	4661751.16	18.336
R_G590	G0590	361782.67	4661764.93	4.075
RP_G444	G0444	360728.76	4661775.82	16.299
R_G622	G0622	361867.52	4661794.86	3.056
R_G624	G0624	361888.66	4662148.43	2.037
R_G1397	G1397	361773.28	4662169.05	3.056
Rs_G597	G0597	361527.23	4662182.64	2.037
Rs_G1396	G1396	361684.04	4662172.01	6.112
Rs_G1398	G1398	361838.50	4662240.08	4.075
R_G524	G0524	362076.94	4662542.34	1.019
R_G525	G0525	362066.33	4662565.94	1.019
RsP_G325	G0325	360683.64	4662792.31	22.411
RP_G324	G0324	360684.68	4662830.98	25.467
RsP_G15	G0015	359011.40	4663100.85	16.299
R_G320	G0320	360710.50	4663098.41	14.261
R_G530	G0530	358839.71	4663314.77	2.037
Rs_G559	G0559	358945.77	4663349.14	3.056
RP_G319	G0319	359028.01	4663437.83	3.056
RsP_G292	G0292	359021.86	4663452.61	3.056
RsP_G20	G0020	359047.13	4663506.32	3.056
R_G314	G0314	360741.18	4663506.09	5.093
R_G846	G0846	362377.54	4663627.85	3.056
R_G285	G0285	362031.93	4663644.21	3.056
R_G293	G0293	360581.52	4663719.44	2.037
R_G295	G0295	360619.45	4663713.05	7.131
RP_G277	G0277	359112.59	4663831.66	4.075
RsP_G276	G0276	359077.71	4663836.98	4.075
R_G835	G0835	362447.10	4663941.91	2.037
Rs_G532	G0532	358872.22	4663953.10	6.112
Rs_G288	G0288	358959.65	4663990.66	10.187
R_G286	G0286	362125.13	4664028.19	11.205
Rs_G531	G0531	358823.91	4664037.57	3.056
Rs_G536	G0536	358705.58	4664169.02	15.280
RsP_G420	G0420	358497.27	4664521.75	37.691
RP_G418	G0418	358316.61	4664631.79	11.205

R_G280	G0280	360220.49	4664671.10	26.485
R_G1317	G1317	364165.77	4664773.64	3.056
RP_G404	G0404	358234.83	4664824.00	5.093
RP_G417	G0417	358112.90	4664891.24	3.056
RsP_G274	G0274	361929.42	4664907.40	10.187
RsP_G818	G0818	362502.94	4664900.44	19.355
R_G32	G0032	362535.75	4664899.87	18.336
Rs_G822	G0822	362562.06	4664891.45	15.280
RP_G411	G0411	360302.40	4664911.97	9.168
RsP_G409	G0409	360313.39	4664965.35	10.187
R_G1318	G1318	363966.62	4664956.49	10.187
RP_G798	G0798	362273.27	4664976.38	20.373
RP_G801	G0801	362578.92	4664976.42	12.224
RP_G812	G0812	359504.70	4665064.61	4.075
R_G272	G0272	359808.58	4665074.78	2.037
RsP_G270	G0270	359504.79	4665096.30	5.093
RP_G1340	G1340	358312.28	4665148.14	1.019
Rs_G266	G0266	359661.51	4665147.08	2.037
Rs_G269	G0269	359429.91	4665161.54	1.019
Rs_G268	G0268	359463.70	4665159.72	2.037
RP_G1341	G1341	358053.68	4665199.04	3.056
RP_G255	G0255	360277.46	4665423.13	21.392
RP_G402	G0402	357715.59	4665459.33	12.224
R_G542	G0542	357540.31	4665590.85	3.056
RsP_G1258	G1258	360303.94	4665747.54	26.485
Rs_G250	G0250	357502.02	4665762.83	2.037
R_G1259	G1259	360294.78	4665786.50	18.336
R_G1348	G1348	357289.20	4665843.58	17.317
RP_G249	G0249	357321.41	4665932.87	12.224
R_G549	G0549	357166.17	4666043.50	5.093
R_G785	G0785	364144.93	4666191.14	6.112
R_G786	G0786	364175.15	4666186.56	5.093
R_G787	G0787	364319.56	4666176.49	2.037
R_G783	G0783	364025.81	4666198.88	2.037
RsP_G759	G0759	362912.67	4666224.48	5.093
R_G760	G0760	362986.54	4666240.60	3.056
R_G765	G0765	364170.19	4666250.97	4.075
R_G756	G0756	364314.39	4666248.16	3.056
R_G728	G0728	364127.96	4666263.32	1.019
R_G758	G0758	364339.97	4666265.36	3.056
R_G741	G0741	364363.97	4666262.57	2.037
RsP_G31	G0031	362325.98	4666289.69	6.112
RsP_G752	G0752	362543.34	4666283.20	3.056
R_G755	G0755	362646.57	4666281.70	2.037
Rs_G754	G0754	362616.92	4666278.06	2.037
Rs_G246	G0246	362182.52	4666301.72	7.131
Rs_G706	G0706	362922.48	4666322.05	1.019

R_G1351	G1351	356838.61	4666331.93	1.019
Rs_G238	G0238	360417.42	4666337.82	6.112
R_G545	G0545	356881.77	4666365.74	1.019
R_G242	G0242	361168.11	4666359.14	4.075
Rs_G243	G0243	361204.72	4666362.49	4.075
Rs_G745	G0745	361271.31	4666356.50	6.112
R_G244	G0244	361432.52	4666358.96	3.056
Rs_G162	G0162	362221.45	4666369.57	2.037
R_G746	G0746	362445.95	4666357.56	5.093
R_G673	G0673	362490.14	4666352.96	3.056
Rs_G705	G0705	362529.61	4666365.70	3.056
R_G240	G0240	361027.16	4666372.02	2.037
R_G228	G0228	360529.34	4666404.68	4.075
R_G227	G0227	360562.51	4666403.55	3.056
Rs_G743	G0743	360103.40	4666417.01	1.019
R_G237	G0237	360414.33	4666417.02	3.056
R_G226	G0226	360462.93	4666420.58	4.075
R_G225	G0225	360230.54	4666437.52	3.056
R_G221	G0221	361142.51	4666438.86	4.075
R_G213	G0213	359036.29	4666516.32	3.056
RsP_G1236	G1236	358594.60	4666537.64	2.037
Rs_G399	G0399	357035.92	4666750.58	3.056
R_G373	G0373	356718.92	4666770.58	4.075
Rs_G1225	G1225	357062.92	4666752.26	4.075
Rs_G390	G0390	356803.61	4666798.14	5.093
Rs_G389	G0389	356802.17	4666835.71	9.168
Rs_G388	G0388	356802.77	4666861.56	10.187
Rs_G387	G0387	356804.90	4666883.27	10.187
R_G386	G0386	356832.92	4666914.58	9.168
Rs_G385	G0385	356814.90	4666968.28	6.112
Rs_G384	G0384	356813.20	4666995.40	5.093
Rs_G383	G0383	356815.90	4667021.82	5.093
Rs_G382	G0382	356824.46	4667047.56	4.075
Rs_G1221	G1221	356822.09	4667077.05	4.075
R_G372	G0372	356747.54	4667309.04	14.261
RP_G167	G0167	360479.39	4667299.96	9.168
Rs_G164	G0164	360430.78	4667373.18	10.187
Rs_G165	G0165	356848.86	4667414.75	34.635
Rs_G371	G0371	356789.89	4667545.73	14.261
Rs_G163	G0163	360438.94	4667559.11	10.187
RsP_G160	G0160	356861.57	4667606.33	16.299
Rs_G679	G0679	362773.75	4667646.15	4.075
Rs_G681	G0681	363026.54	4667638.08	1.019
Rs_G680	G0680	363066.47	4667634.90	1.019
RsP_G151	G0151	360520.45	4667695.09	8.149
R_G156	G0156	361679.07	4667726.52	8.149
R_G158	G0158	361839.95	4667716.57	7.131

R_G669	G0669	362882.95	4667725.57	3.056
R_G68	G0068	361326.55	4667745.37	3.056
RsP_G72	G0072	361371.98	4667743.20	3.056
Rs_G670	G0670	362622.95	4667737.58	8.149
Rs_G856	G0856	356816.56	4667788.23	11.205
Rs_G147	G0147	360305.76	4667802.23	2.037
Rs_G153	G0153	361441.37	4667806.58	3.056
R_G141	G0141	361493.13	4667805.57	4.075
RP_G2	G0002	360044.74	4667817.61	3.056
R_G115	G0115	361391.33	4667818.57	3.056
RsP_G74	G0074	358948.03	4667866.38	1.019
Rs_G139	G0139	359382.22	4667858.50	2.037
R_G13	G0013	357951.38	4667922.79	2.037
Rs_G654	G0654	358225.26	4667913.12	9.168
Rs_G652	G0652	357657.57	4667947.18	4.075
R_G132	G0132	358404.80	4667933.88	6.112
Rs_G651	G0651	358504.30	4667989.56	3.056
Rs_G128	G0128	358363.93	4668002.58	11.205
RP_G113	G0113	357909.47	4668020.58	4.075
RsP_G11	G0011	359945.06	4669222.68	1.019
R_G86	G0086	359840.79	4669241.29	2.037
Rs_G1147	G1147	358407.86	4669310.89	4.075
R_G82	G0082	358913.78	4669299.22	4.075
R_G79	G0079	358638.73	4669317.12	12.224
R_G498	G0498	359583.97	4669314.08	6.112
Rs_G502	G0502	359654.50	4669310.64	4.075
R_G1148	G1148	357891.62	4669349.14	9.168
R_G496	G0496	359223.65	4669340.09	2.037
R_G75	G0075	357892.14	4669361.80	8.149
R_G76	G0076	358043.93	4669354.91	3.056
Rs_G363	G0363	357706.42	4669376.00	4.075
Rs_G858	G0858	358730.75	4669393.98	5.093
R_G489	G0489	357854.42	4669427.07	5.093
R_G1143	G1143	357964.15	4669418.42	1.019
Rs_G495	G0495	358297.10	4669414.16	4.075
Rs_G488	G0488	357801.86	4669438.07	5.093
R_G483	G0483	357425.55	4669463.48	2.037
R_G486	G0486	357506.47	4669460.12	2.037
R_G485	G0485	357480.01	4669461.83	2.037
R_G484	G0484	357450.10	4669462.30	2.037
R_G1139	G1139	357532.23	4669467.80	3.056

Name	ID	X	Y	ZVI (Hours_Per_Year)
Rs_C1918	C1918	370367.68	4669812.14	9.002
R_C613	C0613	368570.87	4669917.29	4.001
R_C614	C0614	368598.22	4669914.18	4.001
R_C631	C0631	369149.77	4669919.47	8.002
Rs_C1594	C1594	367427.21	4670181.21	8.002
R_C237	C0237	367436.16	4670311.61	3.001
Rs_C238	C0238	367446.74	4670357.84	3.001
R_C267	C0267	367826.70	4670454.24	14.003
R_C203	C0203	366113.88	4670744.18	12.003
RP_C698	C0698	371526.01	4670807.07	18.004
RP_C697	C0697	371524.78	4670846.04	17.004
Rs_C696	C0696	371414.11	4670897.49	11.002
R_C242	C0242	367493.05	4670918.38	5.001
Rs_C786	C0786	374497.45	4670950.16	7.002
R_C742	C0742	372852.19	4670997.64	9.002
R_C754	C0754	372880.81	4670995.52	10.002
R_C759	C0759	373439.68	4671023.35	7.002
R_C737	C0737	372476.82	4671028.20	5.001
R_C752	C0752	373128.05	4671059.85	4.001
R_C730	C0730	372268.85	4671104.63	14.003
Rs_C726	C0726	372229.50	4671118.78	13.003
Rs_C245	C0245	367507.66	4671170.28	18.004
RP_C662	C0662	370422.49	4671231.61	3.001
RsP_C1974	C1974	370480.22	4671240.39	10.002
Rs_C626	C0626	368926.11	4671265.50	4.001
RP_C646	C0646	370018.36	4671250.88	4.001
R_C202	C0202	366214.80	4671296.28	13.003
R_C634	C0634	369217.67	4671308.35	14.003
R_C201	C0201	366168.73	4671529.57	15.003
Rs_C690	C0690	371468.34	4671612.50	2.000
Rs_C814	C0814	375095.31	4671704.75	4.001
R_C252	C0252	367558.89	4671861.00	6.001
R_C160	C0160	364810.90	4671906.14	6.001
RP_C564	C0564	367928.90	4671900.75	19.004
R_C810	C0810	375174.17	4672063.41	3.001
Rs_C806	C0806	375168.91	4672111.35	3.001
R_C835	C0835	375191.42	4672229.70	3.001
R_C2000	C2000	375199.29	4672266.54	3.001
R_C218	C0218	366268.67	4672280.81	3.001
RP_C558	C0558	367908.28	4672299.81	20.004
Rs_C713	C0713	372014.79	4672391.34	2.000
R_C734	C0734	372663.29	4672386.42	1.000
Rs_C758	C0758	373386.57	4672407.44	7.002
RN_C1559	C1559	364945.78	4672463.18	6.001
R_C825	C0825	375264.56	4672558.70	10.002
R_C570	C0570	367986.30	4672571.01	9.002

Rs_C217	C0217	366305.95	4672605.26	19.004
Rs_C620	C0620	368855.33	4672644.23	2.000
R_C199	C0199	366145.95	4672652.60	16.004
R_C565	C0565	367947.13	4672816.35	2.000
R_C829	C0829	375296.00	4672883.37	6.001
R_C213	C0213	366259.24	4672948.03	7.002
R_C1631	C1631	367629.84	4673044.53	2.000
R_C830	C0830	375324.23	4673041.77	4.001
R_C211	C0211	366335.86	4673138.00	7.002
Rs_C1065	C1065	371675.13	4673158.33	28.006
R_C228	C0228	366475.50	4673185.93	10.002
R_C1420	C1420	380332.93	4673171.48	3.001
Rs_C153	C0153	364639.65	4673192.55	21.005
R_C195	C0195	366147.63	4673208.10	9.002
Rs_C210	C0210	366271.79	4673202.65	7.002
Rs_C2152	C2152	380093.60	4673203.94	8.002
R_C191	C0191	365668.26	4673246.04	7.002
R_C192	C0192	365704.95	4673237.70	6.001
Rs_C2150	C2150	380056.49	4673283.12	13.003
R_C150	C0150	363818.31	4673295.60	8.002
R_C2005	C2005	375253.79	4673300.88	2.000
Rs_C2147	C2147	378920.57	4673306.07	6.001
Rs_C1562	C1562	364502.53	4673350.52	24.005
R_C1337	C1337	378160.38	4673362.93	1.000
RP_C1306	C1306	377419.73	4673423.49	6.001
RsP_C2140	C2140	376972.44	4673434.07	9.002
R_C524	C0524	365344.24	4673504.20	18.004
R_C1382	C1382	379012.96	4673498.78	15.003
Rs_C523	C0523	365348.04	4673533.20	14.003
Rs_C2311	C2311	375777.73	4673528.89	6.001
Rs_C1064	C1064	371707.65	4673555.22	7.002
R_C1005	C1005	369050.31	4673597.70	8.002
R_C1196	C1196	374554.39	4673644.60	3.001
RP_C1172	C1172	373840.80	4673662.91	9.002
Rs_C1162	C1162	372760.61	4673757.50	7.002
RP_C1137	C1137	372560.57	4673767.03	2.000
Rs_C1136	C1136	372723.53	4673828.29	6.001
R_C1134	C1134	372455.70	4673846.90	8.002
R_C1369	C1369	378978.13	4673930.95	17.004
R_C1018	C1018	370040.62	4673948.45	3.001
RP_C2111	C2111	371771.13	4674325.34	16.004
RP_C1241	C1241	375328.54	4674364.61	58.013
R_C1029	C1029	370991.96	4674475.62	6.001
R_C983	C0983	368477.52	4674495.15	4.001
R_C2187	C2187	380155.94	4674518.14	13.003
R_C1427	C1427	380365.04	4674549.85	2.000
R_C1405	C1405	379892.98	4674564.11	11.002

R_C1049	C1049	371681.58	4674593.69	7.002
R_C1428	C1428	380227.29	4674605.23	8.002
Rs_C1047	C1047	371274.99	4674618.06	7.002
Rs_C1363	C1363	379017.86	4674627.65	21.005
R_C1403	C1403	379890.03	4674629.65	23.005
RP_C1331	C1331	377947.15	4674705.79	4.001
Rs_C1332	C1332	377998.84	4674702.18	4.001
R_C1298	C1298	377550.79	4674744.34	7.002
R_C1327	C1327	378505.13	4674732.02	6.001
Rs_C1000	C1000	368999.94	4674784.61	15.003
Rs_C1296	C1296	377068.56	4674784.49	2.000
R_C1272	C1272	376293.21	4674822.39	4.001
RP_C1276	C1276	376563.99	4674817.63	2.000
Rs_C2183	C2183	379107.54	4674822.79	18.004
R_C1293	C1293	377094.22	4674837.98	2.000
Rs_C2179	C2179	377257.97	4674844.19	3.001
R_C1654	C1654	368972.21	4674886.24	19.004
R_C1210	C1210	374647.22	4674956.51	4.001
R_C1191	C1191	374504.41	4675037.26	3.001
Rs_C998	C0998	369500.61	4675050.30	7.002
Rs_C1656	C1656	369302.60	4675070.22	9.002
Rs_C997	C0997	369633.44	4675104.12	6.001
R_C1638	C1638	368150.55	4675202.30	14.003
R_C996	C0996	369679.85	4675210.78	3.001
R_C1245	C1245	375461.98	4675406.64	9.002
R_C551	C0551	366307.38	4675438.83	4.001
Rs_C979	C0979	368175.93	4675441.74	14.003
R_C972	C0972	368118.97	4675497.61	10.002
R_C2204	C2204	366252.86	4675678.46	3.001
R_C549	C0549	366255.95	4675735.80	4.001
Rs_C970	C0970	368129.09	4675794.52	10.002
R_C981	C0981	368197.03	4675790.98	12.003
R_C991	C0991	368291.94	4675840.39	2.000
R_C547	C0547	366244.95	4675855.61	3.001
Rs_C2029	C2029	373893.61	4675869.73	10.002
R_C1446	C1446	380569.93	4675921.61	5.001
R_C1341	C1341	378481.00	4676061.78	5.001
Rs_C1347	C1347	378237.50	4676153.91	5.001
R_C2170	C2170	375452.25	4676191.37	9.002
Rs_C1234	C1234	374654.53	4676341.64	3.001
R_C1257	C1257	375553.02	4676758.87	6.001
R_C1256	C1256	375551.53	4676783.31	7.002
Rs_C1186	C1186	373561.22	4677037.17	2.000
Rs_C1184	C1184	373761.58	4677123.80	3.001
Rs_C1180	C1180	373583.86	4677127.33	8.002
R_C1079	C1079	371868.95	4677152.64	8.002
R_C1071	C1071	371817.95	4677180.63	4.001

R_C1070	C1070	371819.95	4677166.64	5.001
R_C1080	C1080	371882.95	4677174.64	8.002
R_C1072	C1072	371815.95	4677194.64	3.001
R_C1081	C1081	371870.36	4677193.13	5.001
R_C1091	C1091	371935.95	4677190.64	9.002
R_C1182	C1182	373892.59	4677191.60	5.001
R_C1073	C1073	371815.95	4677213.64	4.001
R_C1082	C1082	371886.95	4677243.64	5.001
R_C1090	C1090	371923.95	4677231.64	6.001
R_C1100	C1100	372020.95	4677229.81	11.002
R_C1099	C1099	371991.95	4677232.63	11.002
R_C1111	C1111	372060.62	4677228.72	10.002
R_C1856	C1856	371819.68	4677252.30	3.001
R_C1083	C1083	371874.95	4677253.64	4.001
R_C1857	C1857	371844.27	4677249.80	4.001
R_C1110	C1110	372062.95	4677249.64	12.003
R_C1858	C1858	371773.40	4677270.23	3.001
R_C1084	C1084	371866.54	4677276.05	4.001
R_C1089	C1089	371937.95	4677284.65	5.001
R_C1085	C1085	371875.95	4677300.64	4.001
R_C1088	C1088	371938.95	4677308.64	4.001
R_C1311	C1311	377875.05	4677434.56	2.000
R_C1310	C1310	377840.99	4677457.66	3.001
R_C1309	C1309	377176.00	4677500.34	3.001
Rs_C1738	C1738	376825.30	4677519.65	3.001
Rs_C1312	C1312	377773.07	4677547.95	3.001
R_C1736	C1736	375314.11	4677594.74	3.001
R_C1066	C1066	371844.48	4677617.58	3.001
R_C1247	C1247	375335.28	4677628.53	2.000
Rs_C1227	C1227	374652.09	4677654.65	6.001
Rs_C1228	C1228	374689.26	4677672.29	7.002
Rs_C1229	C1229	374690.97	4677703.72	6.001
Rs_C1231	C1231	374738.18	4677692.62	4.001
Rs_C1230	C1230	374693.97	4677714.92	5.001
Rs_C1715	C1715	374714.35	4677721.26	4.001
Rs_C1232	C1232	374752.82	4677714.20	3.001
Rs_C1732	C1732	374696.38	4677736.59	4.001
Rs_C1733	C1733	374696.38	4677726.55	4.001
Rs_C1716	C1716	374714.88	4677733.95	4.001
Rs_C1717	C1717	374719.90	4677744.79	4.001
Rs_C1730	C1730	374700.61	4677757.48	4.001
Rs_C1731	C1731	374698.23	4677747.69	4.001
Rs_C1718	C1718	374720.70	4677755.36	3.001
Rs_C1729	C1729	374702.99	4677778.36	3.001
Rs_C1719	C1719	374723.87	4677774.92	4.001
Rs_C1720	C1720	374725.98	4677784.44	4.001
Rs_C1728	C1728	374706.95	4677799.51	4.001

Rs_C1721	C1721	374727.83	4677796.60	3.001
Rs_C1726	C1726	374709.86	4677819.07	3.001
Rs_C1727	C1727	374709.86	4677810.35	3.001
Rs_C1724	C1724	374713.03	4677840.75	3.001
Rs_C1725	C1725	374711.71	4677828.59	3.001
Rs_C1722	C1722	374733.65	4677831.49	2.000
Rs_C1723	C1723	374738.14	4677842.33	2.000
Rs_C1734	C1734	374738.41	4677855.55	2.000
Rs_C1164	C1164	372848.44	4677967.52	7.002
Rs_C1176	C1176	373572.33	4678391.17	13.003
R_C1175	C1175	373600.29	4678397.75	12.003
R_C1251	C1251	375481.81	4678525.25	3.001
R_C1222	C1222	374763.69	4678760.90	6.001
R_C1220	C1220	374814.98	4678771.90	6.001
R_C1391	C1391	379321.04	4678788.24	2.000
Rs_C1353	C1353	378264.45	4678809.11	2.000
R_C1827	C1827	378259.30	4678867.25	2.000
Rs_C1318	C1318	377074.56	4678884.06	11.002
R_C1830	C1830	377930.67	4678900.92	11.002
R_C1829	C1829	377943.05	4678925.23	9.002
Rs_C1290	C1290	376473.61	4678928.86	5.001
Rs_C1837	C1837	376022.12	4678956.67	4.001
R_C1320	C1320	377118.04	4678959.57	2.000
R_C1291	C1291	376741.98	4678977.66	11.002
RP_C263	C0263	367793.27	4670866.59	6.001
RP_C244	C0244	367506.25	4671139.99	7.002
RP_C251	C0251	367537.50	4671530.13	22.005
RP_C813	C0813	375094.60	4671739.08	4.001
RsP_C220	C0220	366255.54	4671804.37	10.002
RP_C176	C0176	364874.58	4671849.27	8.002
RP_C824	C0824	375189.71	4672273.03	1.000
RsP_C180	C0180	364920.04	4672322.16	5.001
RsP_C741	C0741	372878.94	4672458.50	7.002
RsP_C705	C0705	371662.74	4672857.87	21.005
RsP_C1335	C1335	377874.50	4673448.31	3.001
RsP_C1054	C1054	371625.66	4673582.17	10.002
RP_C1053	C1053	371625.69	4673614.92	9.002
RP_C1367	C1367	378944.66	4673656.64	7.002
RsP_C1240	C1240	375014.42	4673676.70	4.001
RsP_C1195	C1195	374537.63	4673706.21	8.002
RP_C1031	C1031	371216.42	4673870.82	8.002
RP_C1378	C1378	379037.69	4673900.07	30.007
RP_C1060	C1060	371746.20	4674340.77	13.003
RsP_C1061	C1061	371763.77	4674368.74	13.003
RsP_C1267	C1267	376462.89	4674886.49	2.000
RP_C1193	C1193	374441.30	4674965.60	7.002
RP_C975	C0975	368153.47	4675266.44	29.006

RsP_C1246	C1246	375476.92	4676579.76	10.002
RN_C1845	C1845	372115.70	4677326.92	11.002
RN_C1846	C1846	372164.05	4677330.57	17.004
RN_C1847	C1847	372233.09	4677335.14	15.003
RP_C1262	C1262	375858.49	4678635.70	13.003