Howse Mineral Limited

DSO Howse Property Environmental Assessment – Ambient Light Technical Report

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Executive Summary

In accordance with the Canadian Environmental Assessment Agency (CEAA) document *Guidelines for the Preparation of an Environmental Impact Statement – Howse Property Iron Mine (July 14, 2014),* a night-time light level (or ambient light) assessment is required to be completed for the operation of the Howse Mining site. This report documents the night-time light levels on selected sensitive receptors surrounding the Howse Mining Site.

The proposed Howse mining site is located in Newfoundland and Labrador, approximately twenty-three kilometres northwest of Schefferville, Quebec, near the provincial border of Newfoundland and Labrador, and Quebec. The site will be located in close proximity to the Direct Shipping Ore 3 (DSO3) project. DSO3 consists of Timmins 3, Timmins 4, Timmins 7, and Fleming 7 mining sites, in addition to a processing plant complex. The ore from the Howse mining area will be transported to a processing plant located east of the rail loop and comprising a crusher/screener and 2 dryers. The processed Howse ore is then shipped by rail.

The Howse Mining Project will have limited impact on ambient light levels since:

- no power lines will be constructed to bring electricity to the Howse Mining site due to its relatively remote location, consequently no permanent light fixtures will be installed at the mine site;
- most activities at the site will be during the day time;
- limited mining activities will occur during the winter months, when the nights are longer and there is snow on the ground which reflects light (artificial or natural).

Light pollution is an issue that has gained prominence within the context of environmental assessment. However, standardized quantification methods, procedures and standards are limited to non-existent, particularly in a remote location such as the region of Schefferville where artificial light is minimal and the sky and air are clear (compared to more densely populated areas).

Taking the above project specificities into consideration, TSMC decided to use an innovative assessment methodology that combines on-site ambient light measurements, a radiative transfer model and the most recent available satellite images in order to characterize ambient light on a set of identified sensitive receptors in the vicinity of the Howse/DSO project region.

In November 2014, an ambient light measurement program was conducted on-site. A Sky Quality Meter (SQM Model SQM-LU-DL by Unihedron) was used to measure sky brightness at 7 sites located in the vicinity of the project site. The SQM provides measurements in units of “magnitudes per square arcsecond" which are commonly used in astronomy to measure sky brightness. Measurements were conducted under strict night sky conditions in order to be representative and useable for modeling purposes. These measurements were then used to calibrate the radiative transfer model (Illumina). Using the Illumina model, it was possible to conduct an assessment of ambient light in the project region for the winter season (with snow cover and clear skies) and the summer season (without snow on the ground, with clear skies or during sporadic air pollution events caused by forest fires). The Illumina model outputs were used to generate maps and tables of the sky radiance for different seasons and air quality levels at 8 sensitive receptors; these are available in this report.

The modelling results demonstrate that:

a) During the wintertime (with snow cover), the ratio of artificial sky radiance to natural sky radiance increase by a factor of 3 to 10, compared to summertime (no snow cover).

b) In Schefferville and Kawawachikamach, sky radiance is almost entirely due (>99.5%) to the artificial lighting of these towns; the Howse/DSO mining complex lighting has minimal effect, if any, on the ambient light of these two towns.

c) Conversely, the artificial lighting of Schefferville and Kawawachikamach contributes for approximately 10% to the ambient light levels at receptors located close the Howse mining site (such as Irony Mountain and Pinette Lake).

d) At more distant locations (>15 km) North of the Howse mining site, where the DSO4 mining areas (Goodwood, Sunny, Kiviviks) will be located, the contribution of artificial sky radiance is approximately equal between the towns Schefferville/ Kawawachikamach and the activities of the DSO3 complex and Howse.

Table of Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

In accordance with the Canadian Environmental Assessment Agency (CEAA) document *Guidelines for the Preparation of an Environmental Impact Statement – Howse Property Iron Mine,* an environmental assessment is required to be completed for the operation of the Howse Mine site. The proposed Howse Mine is located in close proximity to the Direct Shipping Ore 3 (DSO3) project site. This report documents the night-time light levels on selected sensitive receptors surrounding the Howse Mining Site.

A radiative transfer model called Illumina is used to determine the complete field of artificial light for different observer positions and for different periods of the year. Seasonal variations in aerosol content of the atmosphere along with changes in ground reflectivity (vegetation and snow cover changes) are considered. In order to assure a tight link between model estimations and the ground conditions, sky brightness measurements were acquired on site with a Sky Quality Meter (SQM) and used as reference points for model calibration. Night time and day time satellite images are used to infer the installed luminosity and the ground reflectance respectively which are inputs to the model. Ground elevation is derived from the digital elevation model obtained from the Shuttle Radar Topography Mission [29]. Along with the sky brightness, Illumina provides a set of contribution maps. The contribution maps allow an easy identification of the geographical origin of the sky brightness while giving the percentage of contribution per sq km. Results are analyzed with a focus on a set of identified sensitive receptors.

2. Background

From the 1980s, the astrophysical research community conducted the first studies regarding light pollution. They originally focused on the impact of artificial lighting on the starry sky. In recent years, however, the study of light pollution was updated due to the varied effects on the integrity of the nocturnal environment being discovered. These effects impact both the balance of the natural environment (flora and fauna) [1-10] and the social and economic activities of humans [11-15]. Light pollution even has significant impact on human health [16–18].

To characterize light pollution, we must conduct both field measurements and numerical modelling relying on satellite data. The interaction of artificial light at night (ALAN) with the environment shows an extremely complex and non-linear behavior, which to-date cannot be analytically solved. To overcome this limitation, several numerical models of radiative transfer were developed in recent years [19-22]. These new developments were made possible thanks to the increasing availability of high-performance computers, as well as the availability of satellite datasets, such as the Visible/Infrared Imager/Radiometer Suite – Day-Night Band (VIIRS-DNB) data [23]. Multiple variables affect the propagation of light pollution in the environment including: 1) the optical properties of the atmosphere; 2) the spectral reflectance properties of the ground; 3) the presence of masking by terrain and obstacles (e.g., trees, buildings); and 4) the optical characteristics of lighting devices and their geographical distribution.

Light pollution can reach the environment via three main paths. The first, which generally has the highest light intensity, is direct illumination. This is a short distance effect that rapidly vanishes due to terrain and obstacles blocking it. The second largest contributor is the scattering of artificial light by cloud cover. The importance of scattering by clouds in comparison to the backscatter from the clear atmosphere is generally many times greater for sites near sources of light, such as urban and suburban environments and is generally lower for remote rural sites. Finally, the last contribution, which will be main topic for this study, is indirect illumination in clear sky conditions. This process is prevalent in cases where direct illumination does not reach the observer and where clouds are darker than the starry sky, as is often the case in areas far from major cities.

Our methodology involved in-situ sampling of the night sky brightness over a limited number of observing locations and time periods combined with numerical modeling using a radiative transfer model. The in-situ data is used for model calibration and the extraction of the natural background sky brightness. Use of the numerical model permits

inference of results across the study area and for additional periods of the year from what was collected as a part of the in-situ sampling.

The proposed Howse Project site is located in Newfoundland and Labrador, approximately twenty-three kilometres northwest of Schefferville, Quebec, near the provincial border of Quebec and Newfoundland and Labrador. The site will be located in the vicinity of the DSO3 project. The DSO3 operations include the Timmins 3, Timmins 4, Timmins 7, and Fleming 7 mine sites, in addition to the production plants (Main Processing Plant and Plant 2).

3. Model Description

The radiative transfer model used for this study is Illumina, Version 2 [19]. Illumina acts as a ray-tracing software where a set of photons is thrown from light fixtures located above ground level pixels, and then reaches the observer's Field Of View (FOV) following four different light paths: 1) first scattering by molecules and aerosols in voxels of the line of sight, 2) first scattering after a lambertian reflexion on the ground, and 3) a second scattering in a voxel of the line of sight after a first scattering from atmospheric voxels contained in a surrounding volume. The fourth path is the same path as 3, but it occurs after a reflexion on the ground pixel, whereas path 3) occurs after a first scatting from atmospheric voxels contained in a surrounding volume. For all of the light paths considered, the scattering processes toward the observer and the extinction by aerosols (scattering and absorption) and molecules (scattering only) are computed. Illumina computes the first and second orders of scattering of light. The second order of scattering may have a significant impact on sky radiances, up to 40% of the total sky radiance especially when the observer is far from urban areas [23]. At this time, Illumina is the only model available that computes explicitly the second order of scattering which requires a considerable computing time and consequently requires access to a supercomputer. In our opinion, it is for this reason that Illumina is the most reliable tool to infer accurately the sky brightness field for remote sites such as the Howse mining project site and the entire DSO complex.

4. In-situ measurements

The measurement of the sky brightness (S_s) is historically based on the units defined by astronomers, the magnitude per squared arc second (mag/sq arcsec). The sky brightness is defined by Equation 1.

$$S_s = S_0 - 2.5\log\left(E_m + E_n\right) \tag{1}$$

S_s is the sky brightness at a given point of the territory, E_m is the modelled sky radiance (i.e the sky radiance produced by ALAN), and E_n the natural sky radiance in the absence of light pollution. S_0 is the reference brightness. Equation 1 can be reorganized to solve for E_m.

$$E_m = 10^{\left(\frac{S_s - S_0}{2.5}\right)} - E_n \tag{2}$$

$$E_m = 10^{-\left(\frac{S_0}{2.5}\right)} 10^{\left(\frac{S_s}{2.5}\right)} - E_n \tag{3}$$

With a minimum number of E_m (modeled radiance) values and corresponding in-situ measured sky brightness, it is possible to derive the constants S_0 and E_n by plotting E_m versus 10^(S_s /2.5). For the Howse Mine site project, sky brightness measurements were obtained at different sites in the vicinity of the DSO complex site, as shown on the sky quality location map presented in Appendix 1. The measurements were obtained with a Sky Quality Meter (SQM), manufactured by Unihedron. Unihedron Model No. SQM-LU-DL with data logger was used for the in-situ measurements for the Howse Mine project evaluation, as shown in Figure 1. Field data sheets and output files of

recorded data are included in Appendix 2. Systematic measurement conditions and methodology were used during the sampling program to obtain a variety of sky brightness conditions.

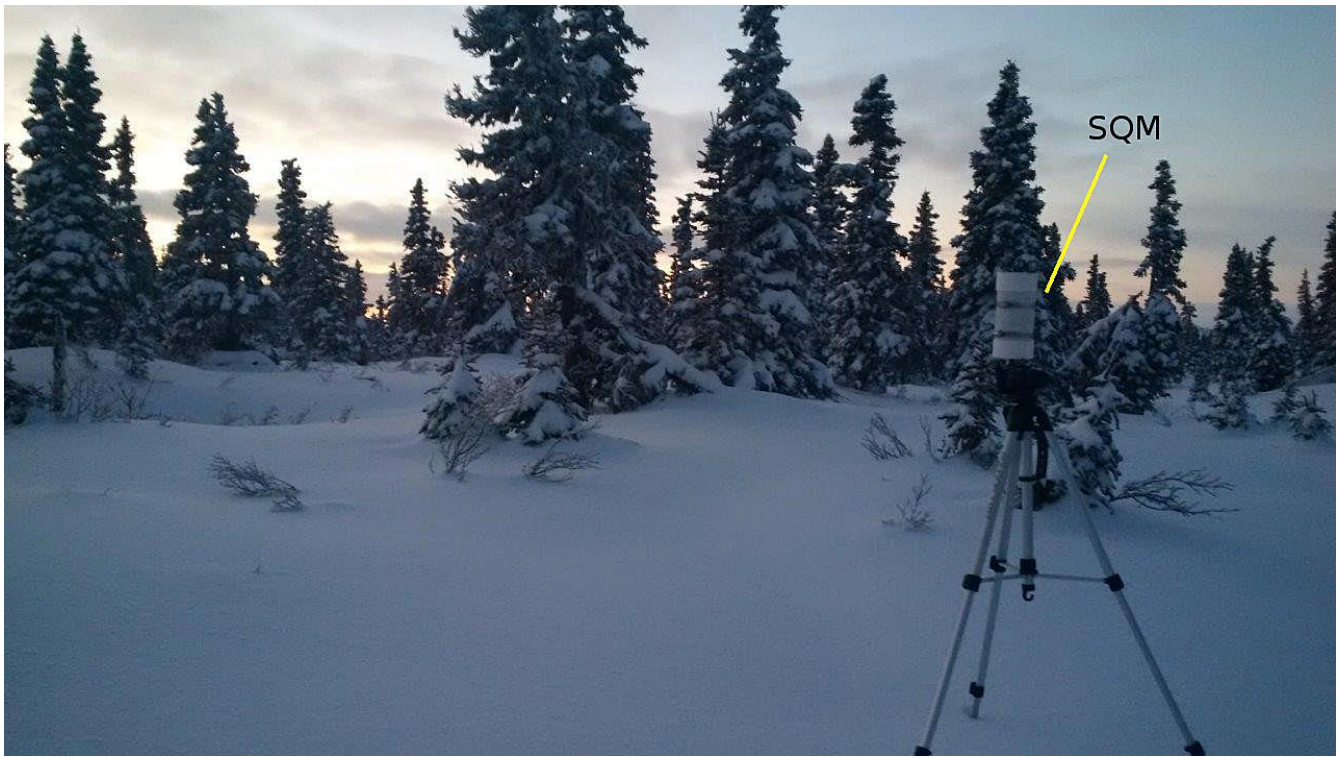

Figure 1 SQM-LU-DL with a protective housing mounted on a tripod. Credits: Denis Lalonde. AECOM

This instrument allows for automated measurements of the sky brightness. Clear weather conditions during the data collection period have allowed for the collection of 7 data points, 5 of which were used for modeling purposes. Table 1 shows the measurement results. SQM sky brightness measurements can have significant uncertainties and therefore the more data that is available for analysis, the more representative the analysis will be. Having less than 5 measuring points may result in an inaccurate evaluation. Uncertainties not only comes from the instrument itself but also from changes in atmospheric conditions (clouds & aerosols), stellar background in the area of the sky sampled and the presence or absence of atmospheric emission lines (northern lights). In order to be representative and useable for modeling purposes, measurements were conducted under strict night sky conditions. Based on best practices found in the literature review, strict night sky conditions can be described as follows:

- Moonless night.
- No clouds or fog.
- The Sun is at least 18 degrees below the horizon (astronomical twilight).
- No direct light from artificial sources reaches the detector of the device.

Note that all data were collected after astronomical twilight to exclude indirect solar radiation. By linear regression of the E_m vs 10^(S_s / 2.5) plot, the intercept (-E_n) and slope (10^(S_0 / 2.5) were obtained. This is shown in Figure 2.

Table 1 In Situ Night-Time Illumination Results, November 26 to 28, 2014

SITE ID	DESCRIPTION	DATE AND TIME OF MEASUREMENT	AVG. SQM READING mag/arcsec^2
Irony Mountain / Howse	Important site for First Nations and project site ≈1.5 km west of Howse	27-Nov-14 00:37 to 00:43	20.52
Pinette Lake	Innu camp, hunting site and potential migratory birds area. ≈2 km southeast of Howse	26-Nov-14 23:14 to 23:20	20.50
Kawawachikamach-1	Town center ≈26 km east to south-east of Howse	26-Nov-14 20:40 to 20:46	19.95
Kawawachikamach-2	On the road out of town	26-Nov-14 21:05 to 21:11	21.16
Schefferville-1	Town center ≈24 km east-south-east of Howse	26-Nov-14 21:30 to 21:36	19.13
Schefferville-2	On the road out of town	26-Nov-14 21:49 to 21:54	20.50
Dark point	Old Goodwood Rd, on the way to Kivivik. ≈13 km from Howse.	27-Nov-14 to 28-Nov-14 21:14 to 05:09	21.74*

* Maximum reading over the period of unattended sampling

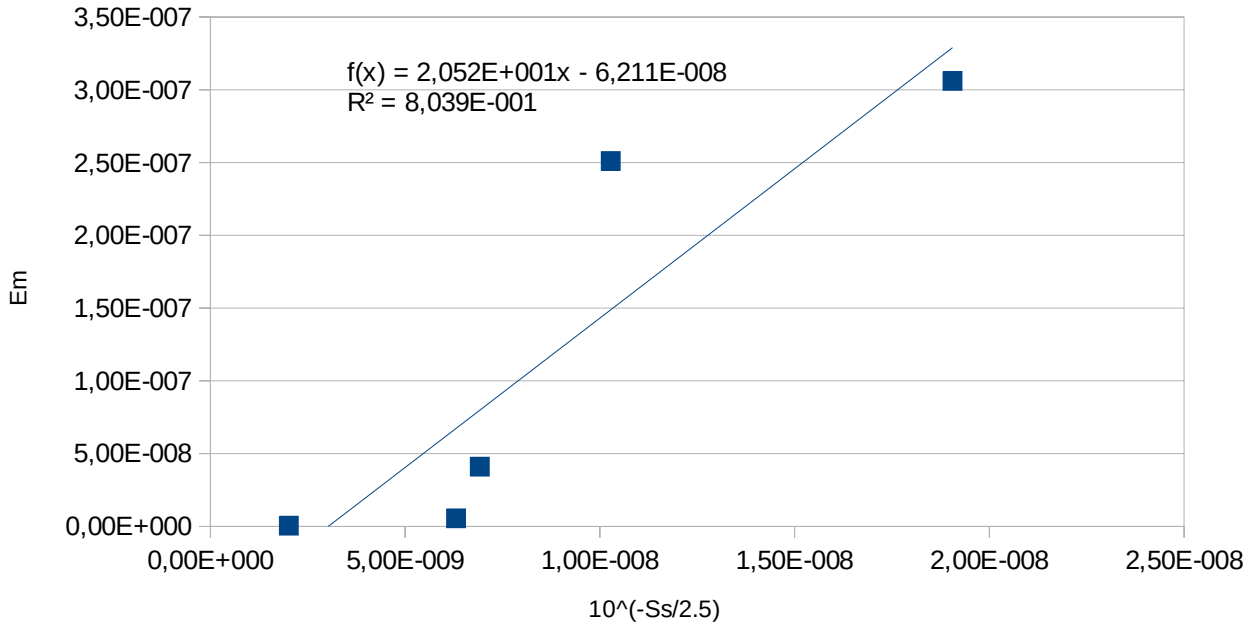

Figure 2 Linearization of Equation 3
The regression line is shown along with the corresponding equation and the correlation coefficient

Using the intercept ($-E_n$) value of 6.211x10^{-8} and slope (10^(S_0 / 2.5)) value of 20.52 obtained from Figure 2, and a reference brightness (S_0) of 3.28, these constants are used to transform the artificial radiance calculated by the model into sky brightness values using Equation 1. When considering a null artificial sky radiance (E_n), we obtain a natural sky brightness of 21.30, which is the very minimum brightness that one can measure in that region.

5. Seasonal changes in the sky brightness

When excluding sky brightness variations due to the moon, the stellar background and the northern lights, the main factors that influence the night sky brightness changes is the amount of aerosols (small particles) in the air and the change in the reflectance of the ground.

In the region of Schefferville, the aerosol optical depth (AOD), which is an indicator of the interaction between light and aerosols, is relatively stable and has averaged value 0.1. However, this value is significantly increased during sporadic pollution events, which occur mainly in the summer and fall seasons and are typically the result of transport of wildfire smoke. In such circumstances, the AOD averaged value is higher at 0.8. These AOD values are taken from the database of the AERONET network [24] (http://aeronet.gsfc.nasa.gov/) maintained by the NASA. We chose the site of Kuujjuarapik (55N, 77W) to accomplish this estimate. This site is located on the shores of the Hudson Bay. Although the site is 680km away from our study site, in our opinion it is the AERONET site that has an atmospheric pattern that is most similar to the atmospheric pattern of the Howse mining site.

The change in the reflectance of the ground is primarily determined by the presence or absence of snow. Indeed, snow is a very effective reflector, which has the effect of returning to the sky much of the light emitted towards the ground. For bare soil, the typical reflectance is approximately 8%, whereas it can increase to 95% for a snow covered ground. The presence or absence of snow has a major impact because the most common type of lighting installed in the Schefferville area is the cobrahead style that projects about 7% of its light directly above the horizon (i.e. 93% toward the ground), as shown in Figure 3. Thus, for bare soil, 14.4% (93% x 8% + 7% = 14.4%) of the light is projected towards the sky (direct and reflected). When snow covers the ground 95.4% (93% x 95% + 7% = 95.4%) of the light that is projected is projected into the sky. Consequently, snow cover acts as an efficient amplifying factor for the night sky brightness.

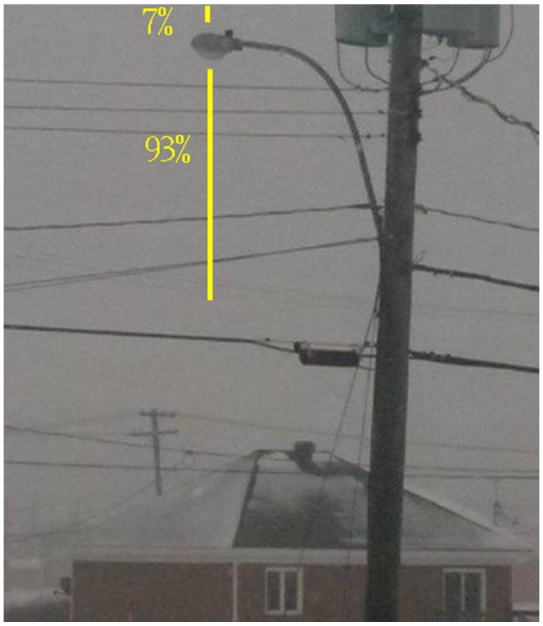

Figure 3 Cobrahead fixture typically used in the Schefferville area

6. Modelling results

The model Illumina requires satellite images as inputs (night radiance VIIRS-DNB [25], MODIS ground reflectance [26] and SRTM topography [27]). The abundance of satellite data available allows for evaluation of large territories and then refinement using in-situ data to define local environmental properties. Three scenarios presented below include most scenarios of sky brightness for all seasons in the region of the Howse project:

1. Winter with AOD=0.1: This scenario includes a period with snow cover.
2. Summer with AOD=0.1: This scenario includes the majority of time with bare soil cover. Such situation occurs most of the time in late spring, summer and early fall.
3. Summer with AOD=0.8: This scenario covers sporadic air pollution events caused by forest fires. This scenario typically occurs in summer and early fall.

The satellite data from 2013 is used for the three scenarios described above. At the time of writing this report, the most recent valid acquisition of the night time lights by VIIRS-DNB is January 2013. On the satellite image, a certain amount of light was detected in the region between Pinette Lake and Innu camp (see Figure 4). This light is coming from human activity already taking place in this area in January 2013.

In addition to satellite images and SQM calibration data, a number of global parameters must be defined for the modeling domain. In this case we have defined the average height of light fixtures relative to the ground to be 7 m. The spatial resolution is 1 km by 1 km, the relative humidity is estimated at 70%, the typical distance between sub-grid obstacles (i.e., trees, buildings) and averaged obstacle height are 40 m and 5 m, respectively. Calculations were made for a wavelength of 550 nm which corresponds to the maximum sensitivity of the human eye. Finally, a light fixture photometry was used corresponding to the Cobrahead style fixture. The modeling domain is 400 km by 400 km in an area centered at 55^{o}N 67^{o}W to consider all potential sources of light pollution. However, sky radiance was only calculated over a subdomain area of 65 km (east to west) by 69 km (north to south). This subdomain includes all sensitive receptors and mining/construction sites. The modelling domain is shown on Figure 5.

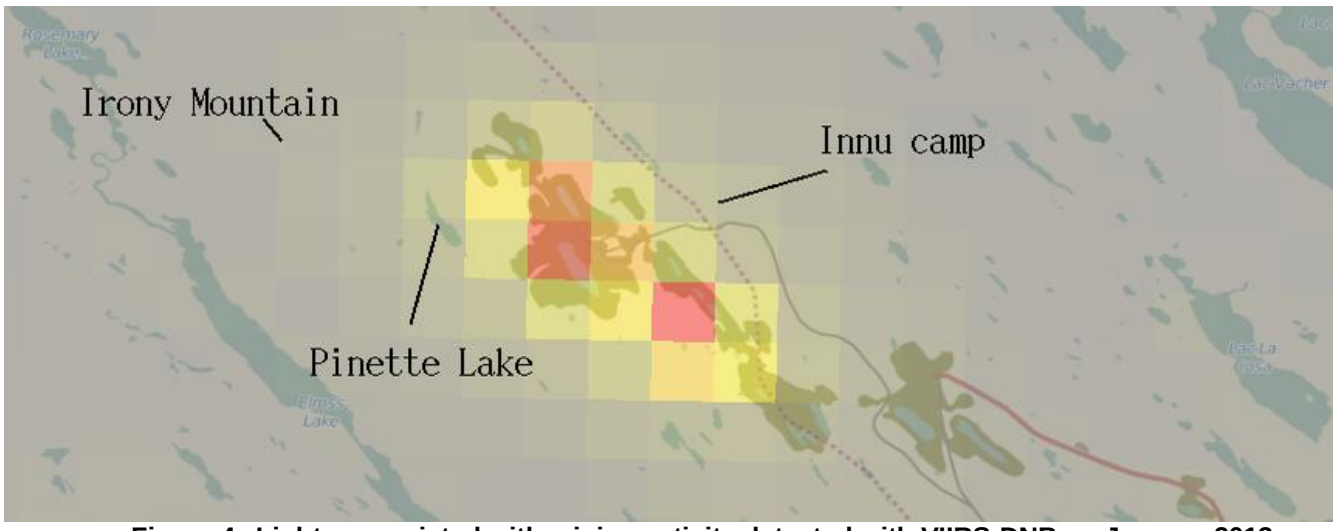

Figure 4 Lights associated with mining activity detected with VIIRS-DNB on January 2013

Figure 5 Modelling domain extent

6.1 Results

6.1.1 Sky brightness maps

The sky brightness results according to different seasonal conditions and for different sites or sensitive receptors identified in this study are detailed in Table 3, which is presented in Section 7 of this report. However, prior to presenting these data, figures showing the zenith sky brightness on the territory surrounding the Howse project is presented for the three seasonal/atmospheric scenarios described earlier as Figures 6 through 8.

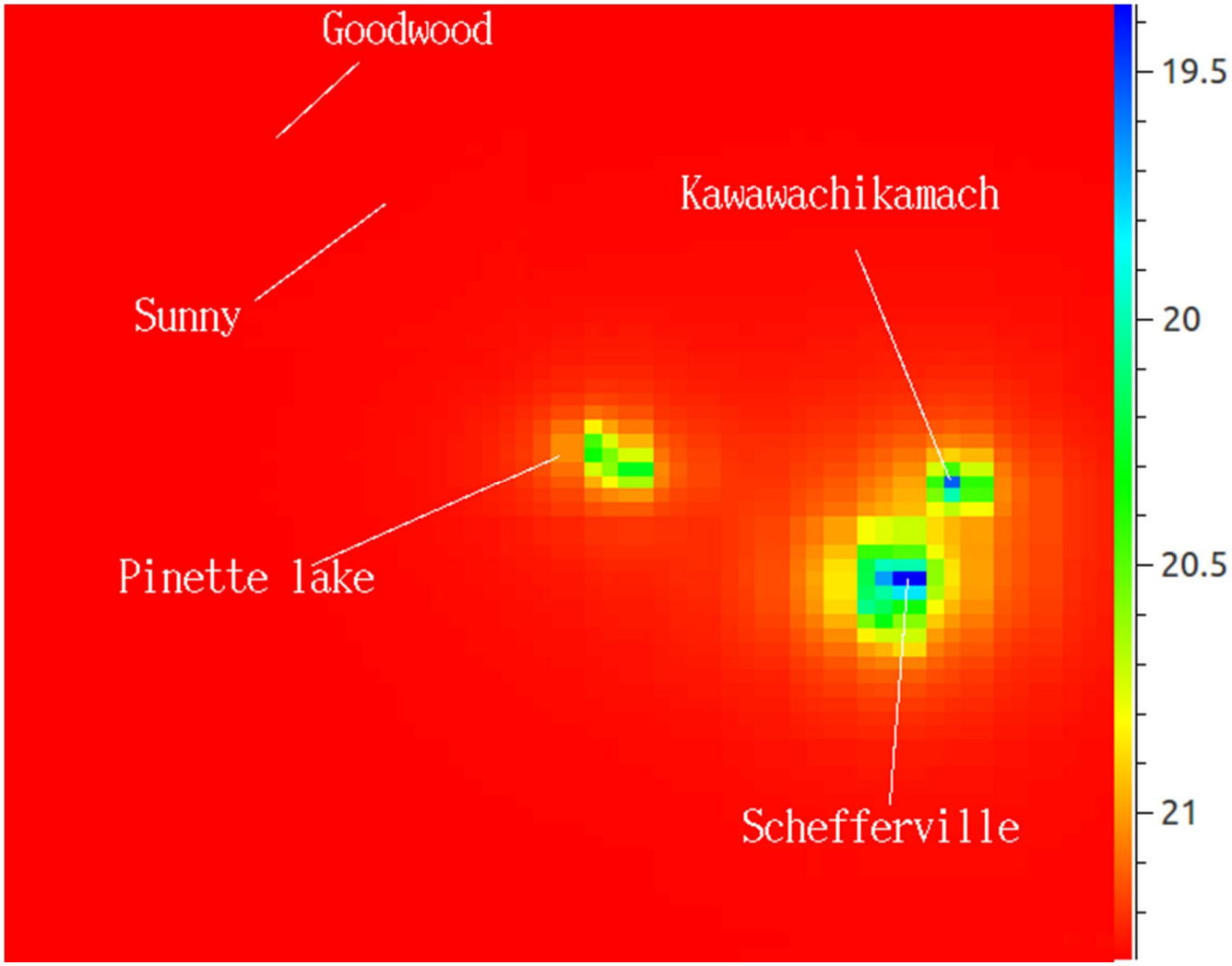

Figure 6 Scenario 1 - Winter sky brightness in units of mag per squared arcsec with an aerosol optical depth of 0.1 (clean atmosphere)

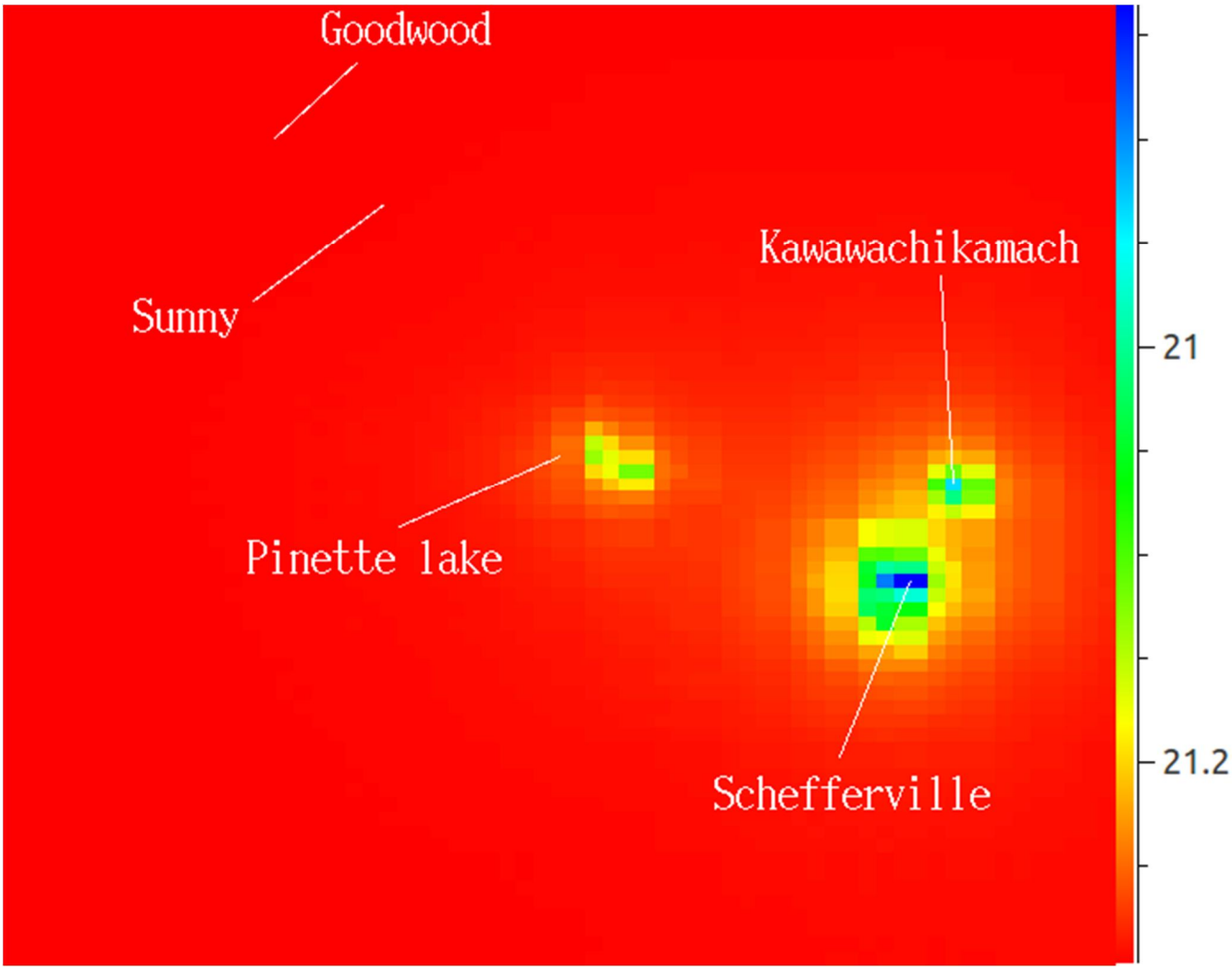

Figure 7 Scenario 2 - Summer sky brightness in units of mag per squared arcsec with an aerosol optical depth of 0.1 (clean atmosphere)

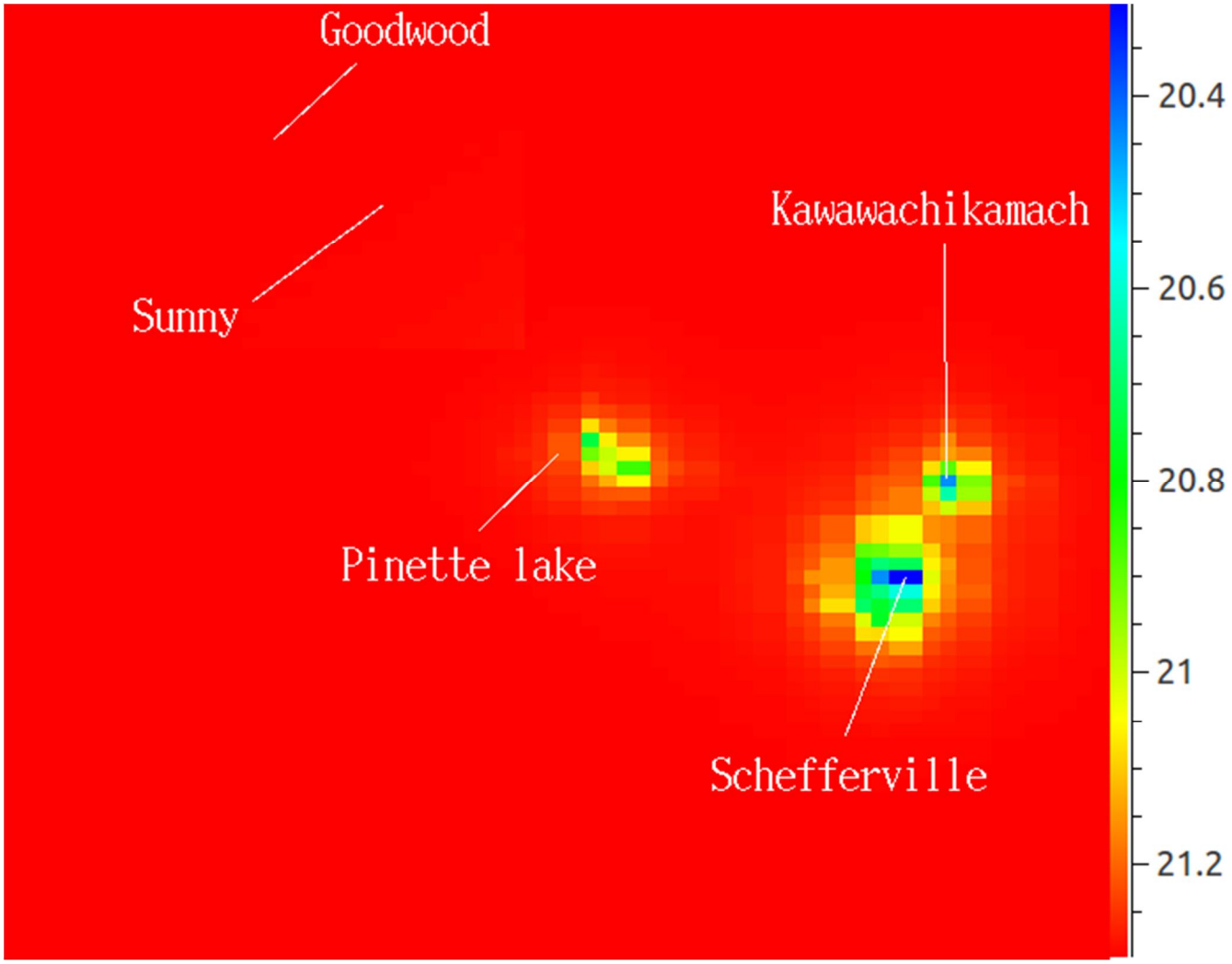

Figure 8 Scenario 3 - Summer sky brightness in units of mag per squared arcsec with an aerosol optical depth of 0.8 (polluted atmosphere)

As expected, the sky brightness level is much higher when there is snow cover. As an example, it can be seen that the center of Schefferville has a sky brightness of approximately 19.3 in the winter, but has a value of approximately 20.9 in the summer. This presents a difference in magnitude of 1.6 per squared arc second, which is equivalent to a decrease of radiance by a factor of 4.2 times (i.e. the radiance of the sky is 4.2 times larger in winter compared to summer). Note that the color scales of Figures 6 to 8 vary from one to another. However, the minimum level of sky brightness shown on all figures (i.e. red color) is the same (i.e. 21.3 mag/arcsec^2). This can be explained by the fact that far from the source, the brightness of the sky is dominated by the natural sky brightness while artificial sky brightness becomes negligible. A natural sky brightness of 21.3 mag / arcsec^2 was found regardless of the conditions of ground reflectance and regardless aerosol content. This value is 0.4 mag / arcsec^2 higher than the minimal level of 21.7 provided in the Berry (1976) [28] sky brightness scale (Table 2). A 0.4 mag difference indicates that the sky radiance is 44% higher than the absolute natural sky brightness. One important element to consider to explain the difference between the natural sky brightness measured in the Howse project region and the one defined by Berry (1976), is the presence of a constant background atmospheric excitation in the northern regions. This background atmospheric excitation can be understood as the minimal level of northern lights activity that are indistinguishable from the pure natural background for a visual observer or for the SQM measurement.

Table 2 Reference night sky brightness scale as defined by Berry (1976)

Sky Glow* (Mag/Arcsec^2)	Naked-Eye Appearance of the Sky (M.W. = Milky Way)
21.7	The sky is crowded with stars, extending to the horizon in all directions. In the absence of haze the M.W. can be seen to the horizon. Clouds appear as black silhouettes against the sky. Stars look large and close.
21.6	Essentially as above, but a glow in the direction of one or more cities is seen on the horizon. Clouds are bright near the city glow.
21.1	The M.W. is brilliant overhead but cannot be seen near the horizon. Clouds have a greyish glow at the zenith and appear bright in the direction of one or more prominent city glows.
20.4	To a city dweller the M.W. is magnificent, but contrast is markedly reduced, and delicate detail is lost. Limiting magnitude is noticeably reduced. Clouds are bright against the zenith sky. Stars no longer appear large and near.
19.5	M.W. is marginally visible, and only near the zenith. Sky is bright and discoloured near the horizon in the direction of cities. The sky looks dull grey.
18.5	Stars are weak and washed out, and reduced to a few hundred. The sky is bright and discoloured everywhere.

** Referred to as Sky Brightness in this report.*

7. Sensitive receptors

Some sensitive receptors were selected based on the features of the area occupied by the local population and/or on the basis of their cultural significance (e.g. Naskapi, Irony Mountain, Innu camp center Schefferville, and Kawawachikamach center). Other sensitive receptors were chosen for their importance to the preservation of the environmental conditions in light of their particular wildlife population (Sunny, Innu camp, Pinette Lake). Finally, a third category of sensitive receptors are evaluated due to their proximity to the proposed mining sites (Sunny, Goodwood, Kiviviks). The list of sensitive receptors with their coordinates is presented in Table 3 and Appendix 1 provides a figure showing receptor locations on a map.

For each sensitive receptor, the value of the sky brightness was calculated for the three season / atmospheric scenarios evaluated. This data are presented in Table 4. The sky brightness values include sky brightness from both natural and artificial origins. This data may serve as a comparative basis for quantifying future sky brightness changes as a result of a future increase in mining activity for the area.

In Table 4, it is noted that the sky radiance for Goodwood and Sunny is equal to the natural sky brightness previously estimated at 21.30. Therefore, the only significant light related to mining activity were located at the Pinette Lake and Innu camp receptors, whereas, Goodwood and Sunny receptors are free of light pollution. Light pollution in winter remains low for Naskapi camp/activity and Irony Mountain receptors, where there is a decrease of 0.04 mag/sq arcsec and 0.1 mag/sq arcsec, each respectively. These values correspond to 4% and 10% increases in the sky radiance compared to the natural sky radiance. For the Innu camp and Pinette Lake receptors, the sky radiance is respectively 38% and 66% higher than the natural sky radiance. Such an increase is noteworthy, but it is not surprising given there are light sources located in this area which is within 2 km from each sensitive receptor. For further analysis, the ratio of artificial radiance on the natural radiance was calculated for each season/atmosphere and each sensitive receptor. These percentages are presented in Table 5.

Table 3 Coordinates of the sensitive receptors and corresponding SQM measurement

Receptor ID	Description	Latitude	Longitude	Quality checked measured sky brightness (Mag/Arcsec^2)
Goodwood	Northernmost proposed mine site. ≈25 km from Howse, far from artificial lights	55° 6'2.87"N	67°20'12.05"W	-
Sunny	Proposed mine site. ≈17 km from Howse, far from artificial lights	55° 2'59.99"N	67°14'47.30"W	-
Naskapi camp/activity	Curlingstone Lake. Fishing. ≈4.2 km north-west of Howse	54°56'06.48"N	67°11'19.19"W	-
Irony Mountain	Important site for First Nations. ≈1.5 km west of Howse	54°54'3.71"N	67° 9'29.59"W	20.50
Innu camp	Lac Inukshuk. ≈5.7 east of Howse. Northeast of main plant and rail loop	54°53'37.10"N	67° 3'9.10"W	-
Pinette Lake	Innu camp, hunting site and potential migratory birds area. ≈2 km southeast of Howse	54°53'16.91"N	67° 6'43.63"W	20.40
Kawawachikamach	Town center. Population 600 (approx.). ≈26 km east-south-east of Howse	54°51'49.03"N	66°45'39.00"W	19.97
Schefferville	Town center. Population 900 (approx.). ≈24 km east-south-east of Howse	54°48'7.09"N	66°48'57.18"W	19.30
Dark point	Old Goodwood Rd, on the way to Kivivik. Considered as a darkest point during the measurement program. ≈13 km from Howse.	55° 0'43.00"N	67°14'42.00"W	21.74

Table 4 Summary of Sky Brightness Results by Modelling Scenario

Receptor ID	Winter AOD=0.1	Summer AOD=0.1	Summer AOD=0.8
	Mag/sq arcsec	*Mag/sq arcsec*	*Mag/sq arcsec*
Goodwood	21.29	21.30	21.30
Sunny	21.29	21.29	21.30
Naskapi camp/activity	21.26	21.29	21.29
Irony Mountain	21.20	21.28	21.28
Innu camp	20.95	21.23	21.16
Pinette Lake	20.75	21.20	21.10
Kawawachikamach	19.54	20.94	20.44
Schefferville	19.36	20.84	20.30

Table 5 Summary of Artificial Sky Radiance to Natural Sky Radiance ratios by Modelling Scenario

Receptor ID	Winter AOD=0.1	Summer AOD=0.1	Summer AOD=0.8
	%	%	%
Goodwood	0.2	0.1	0.0
Sunny	0.5	0.2	0.0
Naskapi camp/activity	3.5	0.9	0.5
Irony Mountain	8.9	1.9	2.0
Innu camp	37.5	6.3	13.6
Pinette Lake	66.1	9.1	19.6
Kawawachikamach	404.3	39.5	120.0
Schefferville	492.8	53.0	149.6

Among many outputs of the Illumina model, the contribution map is one of the most powerful when used as a tool to assess and control light pollution. Each 1 km by 1 km ground pixel of the contribution map contains its percentage of contribution to the artificial sky radiance. To better understand the origin of the artificial sky radiance for each sensitive receptor and separate the contribution of nearby villages from the mining activity contribution, AECOM integrated the contribution map values around the towns of Schefferville and Kawawachikamach. For Schefferville, the values within a radius of 4 km were added, whereas a radius of 3 km was used for Kawawachikamach. Each evaluation radius was chosen to comprise the complete contribution of each village. The result of that analysis is presented in Table 6.

Table 6 Origin of the artificial sky radiance at each sensitive receptor by Scenario

Receptor site	Winter AOD=0.1		Summer AOD=0.1		Summer AOD=0.8	
	%	%	%	%	%	%
	Schefferville	Kawawa.	Schefferville	Kawawa.	Schefferville	Kawawa.
Goodwood	30.3	15.8	34.0	18.7	20.7	10.8
Sunny	25.4	12.5	31.5	15.4	13.1	7.2
Naskapi camp/activity	12.7	4.9	19.6	7.3	3.4	1.5
Irony Mountain	7.5	2.9	13.4	5.2	2.0	0.8
Innu camp	3.4	1.4	6.7	2.6	0.7	0.3
Pinette Lake	1.6	0.6	4.3	1.7	0.7	0.2
Kawawachikamach	2.4	97.4	5.8	92.6	1.5	97.4
Schefferville	98.9	0.9	97.5	1.9	99.3	0.5

It should be noted that the percentages listed in Table 6 provides the portion of the corresponding Table 5 value that originates from a given town. As an example, for the case of Irony Mountain, in winter, the artificial sky radiance level is 8.9% of the natural radiance (Table 5) but 7.5% of that amount is coming from Schefferville (Table 6). In other words, 8.9% x 7.5% = 0.7% is the artificial radiance to natural radiance ratio that can be assigned to Schefferville at Irony mountain. Currently, the winter artificial sky radiance at the Goodwood receptor is coming from Schefferville (30.3%) and Kawawachikamach (15.8%). In other words, 53.9% (100%-30.3%-15.8%) of the artificial sky brightness at the Goodwood receptor is coming from ongoing mining and construction activities. For the Sunny receptor, 62.1%

of the artificial sky brightness is coming from ongoing mining/construction activities. This higher percentage compared to Goodwood receptor may be explained by the fact that Sunny is closer to the mining/construction activities sites in comparison to Goodwood. The same analysis can be made with any other sensitive receptor. In the case of Irony Mountain, 89.6% of the artificial sky radiance is coming from the nearby mining/construction activities.

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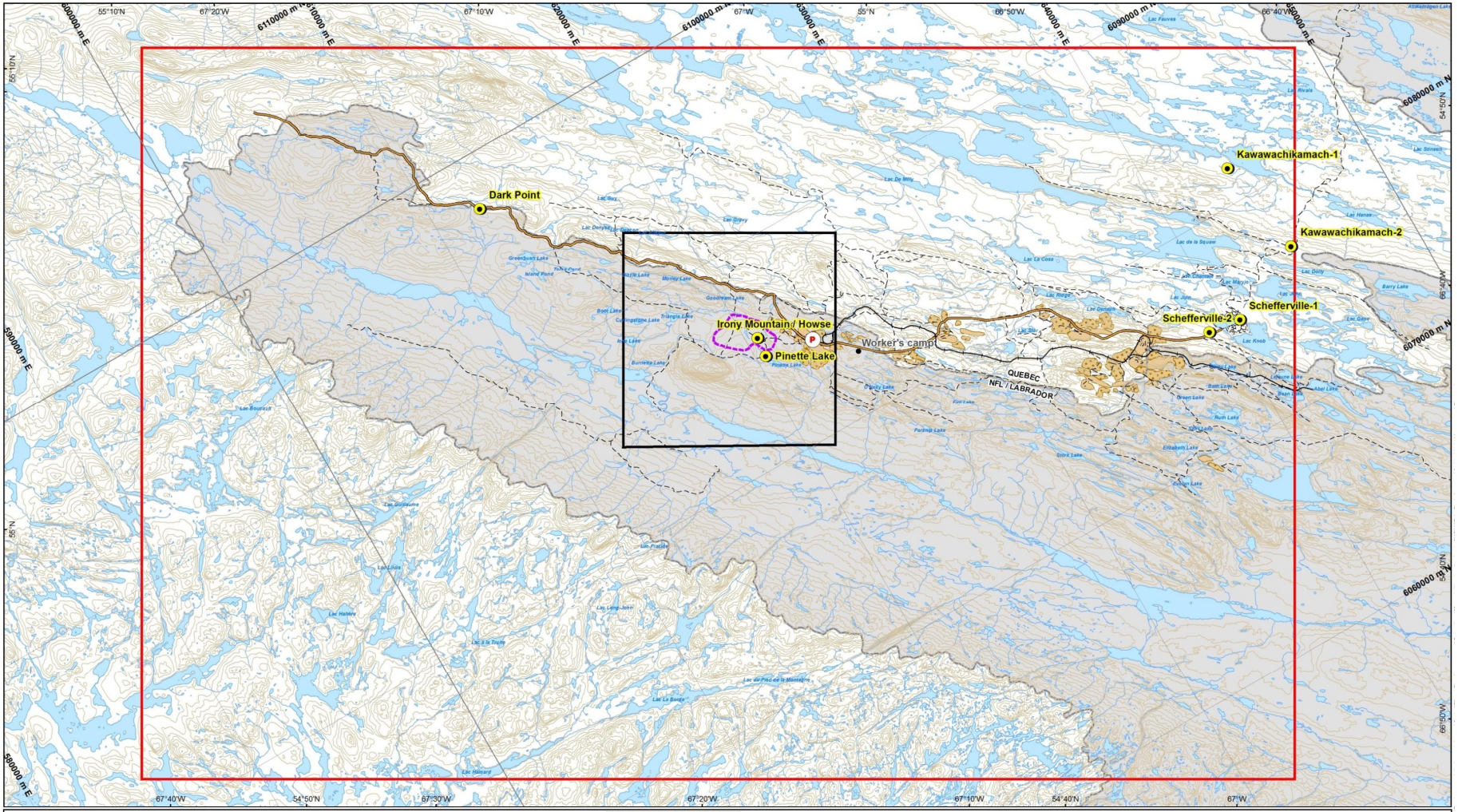
Appendix

Appendix 1
Study Areas and Sky Quality Measurement Locations and Sensitive Receptor Locations Maps



Legend

- Sky Quality Measurement Sites
- Regional Study Area
- Local Study Area
- Border

Infrastructure and Mining Components

- Existing Mined-out Pit
- Existing Waste Dump
- Main Access Road
- Road
- Howse Mining Area (approximative)
- Main Processing Plant Area
- Railway

1:170 000

0 2 4 km

UTM 19N NAD 83

SOURCES:

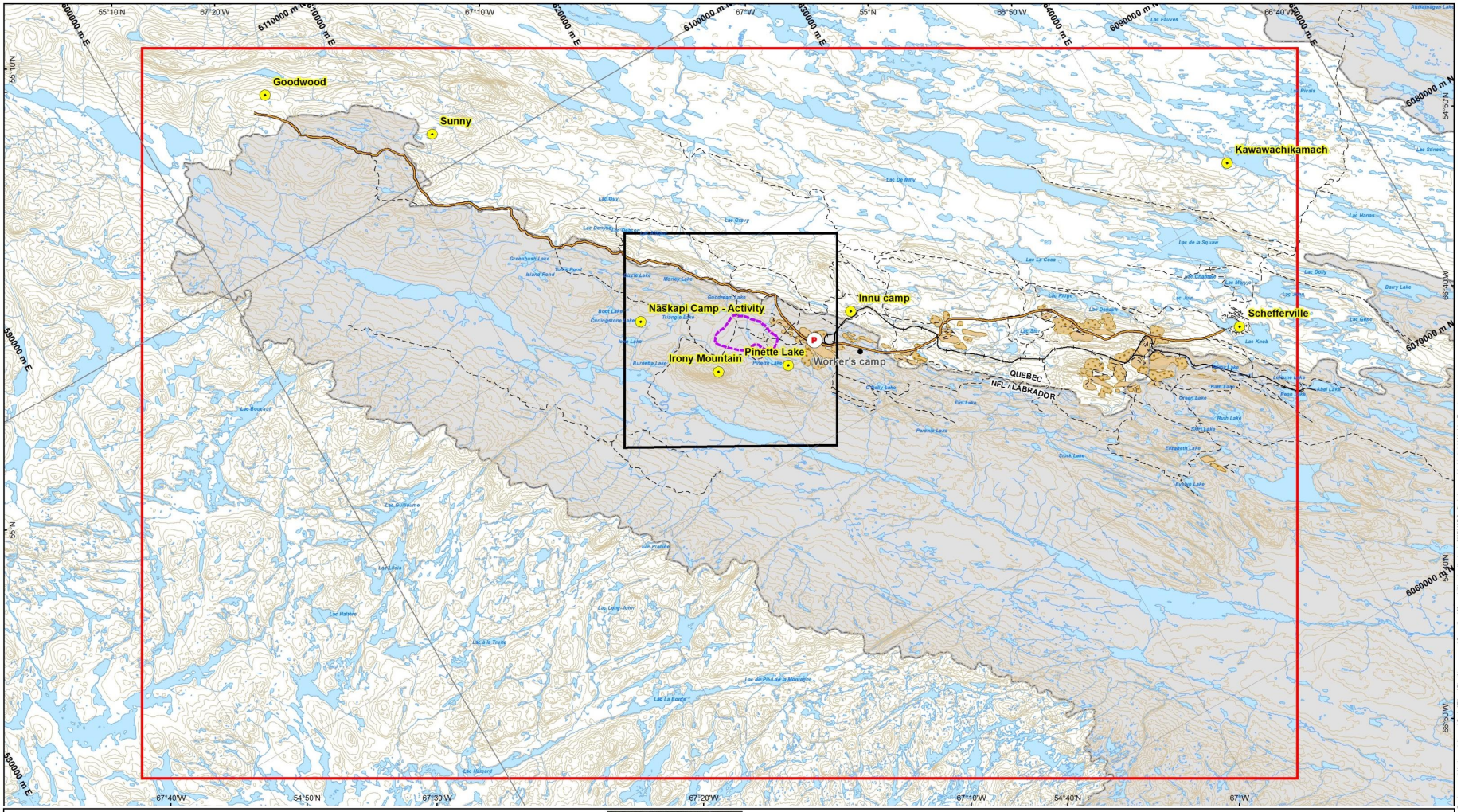
NTDB, 1:50,000, edition 3.1
Gov. of NL and Gov. of Qc, Border
NML, Mining sites and roads
GH, Hydrology update, 2008

DSO Howse Project EIS

Study Areas and Ambiant Light Measurement Sites

January 2015 MAP 1

AECOM



Legend

- Sky Radiance Receptors used in modelling
- Regional Study Area
- Local Study Area
- Border

Infrastructure and Mining Components

- Existing Mined-out Pit
- Existing Waste Dump
- Main Access Road
- Road
- Howse Mining Area (approximative)
- Main Processing Plant Area
- Railway

1:170 000

0 2 4 km

UTM 19N NAD 83

SOURCES:

NTDB, 1:50,000, edition 3.1
Gov. of NL and Gov. of Qc, Border
NML, Mining sites and roads
GH, Hydrology update, 2008

DSO Howse Project EIS

Study Areas and Ambiant Light Modeled Receptors

January 2015 MAP 2

AECOM

Appendix

Appendix 2:
In-situ measurement datasheets, SQM-LU-DL data output and pictures

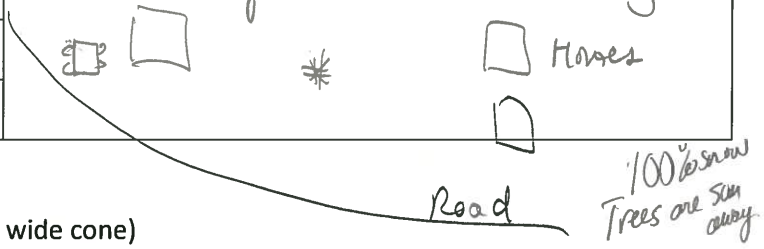
UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

			GPS Garmin	Smartphone app
Site name	KAWAWA - CENTER	Lat.	N 54° 51' 38.6"	N 54° 51.6417'
Date	26/NOV/14	Long.	W 066° 45' 40.3"	W 066° 45.6725'
Observer name	M. Lewis / D. Lalonde	Elevation	495m	487m

Timing		**Describe Sky conditions (clouds, humidity, etc...)**
End Twilight (HH:MIN)	15:53	Clear sky 100%
Begin Twilight - following day (HH:MIN)	6:37	Very light wind
Moonset (HH:MIN)	19:54	* Snowmobile passed by @ 20:42
Next moonrise - following day (HH:MIN)	11:10	
New moon date (DD-MM-YR)	22-11-14	**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)	-14°C	Surrounded by homes at ≥50m away
SQM placed in Outdoor housing (Y/N)?	N	
SQM data logging frequency (sec or min)	10 sec	



PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
4. Point the SQM directly overhead (at the zenith). The meter should be held above head level so that shadows or reflections from your body do not interfere with the reading. Keep it steady.
5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)	✓
For short term measurement, take readings for about 5 minutes per site	✓
Start time (HH:MIN)	≈ 20:40
End time (HH:MIN)	≈ 20:46
Disconnect battery pack when finished (This turns off the SQM)	✓

NOTES:

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

1- Program the SQM using the Unihedron Device Manager software
2- Connect the SQM and click Find to ensure the SQM has been detected
3- Go to the "Data Logging" tab
4- Click on "Settings" button under Device Clock. Ensure SQM and computer times are synchronized.
5- If data stored in the SQM have already been saved, you can "Erase all", this will free up memory.
6- For short term measurements, set "Every x seconds (always on)" at 10 s.
7- For long term measurements, set "Every x minutes (power save mode)" at 5 m.

Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 Twi: 6:51 Sunrise: 7:29 Sunset: 16:52 Twi: 17:31 Moonrise: 14:35 Moonset: 0:23 Day length: 9h 23m
2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 ○ Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 ◑ Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 ● Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
23 Twi: 6:31 Sunrise: 7:13 Sunset: 15:14 Twi: 15:56 Moonrise: 8:04 Moonset: 16:35 Day length: 8h 2m	24 Twi: 6:32 Sunrise: 7:14 Sunset: 15:13 Twi: 15:55 Moonrise: 9:03 Moonset: 17:33 Day length: 7h 59m	25 Twi: 6:34 Sunrise: 7:16 Sunset: 15:12 Twi: 15:54 Moonrise: 9:53 Moonset: 18:40 Day length: 7h 56m	26 Twi: 6:35 Sunrise: 7:18 Sunset: 15:11 Twi: 15:53 Moonrise: 10:35 Moonset: 19:54 Day length: 7h 53m	27 Twi: 6:37 Sunrise: 7:20 Sunset: 15:10 Twi: 15:52 Moonrise: 11:10 Moonset: 21:12 Day length: 7h 50m	28 Twi: 6:39 Sunrise: 7:21 Sunset: 15:09 Twi: 15:51 Moonrise: 11:40 Moonset: 22:31 Day length: 7h 47m	29 ◐ Twi: 6:40 Sunrise: 7:23 Sunset: 15:08 Twi: 15:51 Moonrise: 12:07 Moonset: 23:50 First Qtr: 5:07 Day length: 7h 44m

UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

			GPS Garmin	Smartphone app
Site name	KAWAWA - OUT OF TOWN	Lat.	N 54° 49' 07.1"	N 54° 49.1194'
Date	26/NOV/14	Long.	W 066° 45' 05.5"	W 066° 45.0898'
Observer name	M. Lewis / D. Lalonde	Elevation	594m	600m

Timing		**Describe Sky conditions (clouds, humidity, etc...)**
End Twilight (HH:MIN)	15:53	Clear Sky - 100% Bright stars, almost see milky way Light wind.
Begin Twilight - following day (HH:MIN)	6:37	
Moonset (HH:MIN)	19:54	
Next moonrise - following day (HH:MIN)	11:10	
New moon date (DD-MM-YR)	22-11-14	**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)	-15°C	Corner of road 100% snow cover ≥100 ft from trees 1 car + 1 snowmobile passed by.
SQM placed in Outdoor housing (Y/N)?	N	
SQM data logging frequency (sec or min)	10 sec	

PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
4. Point the SQM directly overhead (at the zenith). The meter should be held above head level so that shadows or reflections from your body do not interfere with the reading. Keep it steady.
5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)	✓
For short term measurement, take readings for about 5 minutes per site	✓
Start time (HH:MIN)	≈ 21:05
End time (HH:MIN)	≈ 21:11
Disconnect battery pack when finished (This turns off the SQM)	✓

NOTES:

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

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3- Go to the "Data Logging" tab
4- Click on "Settings" button under Device Clock. Ensure SQM and computer times are synchronized.
5- If data stored in the SQM have already been saved, you can "Erase all", this will free up memory.
6- For short term measurements, set "Every x seconds (always on)" at 10 s.
7- For long term measurements, set "Every x minutes (power save mode)" at 5 m.

Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone: -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 Twi: 6:51 Sunrise: 7:29 Sunset: 16:52 Twi: 17:31 Moonrise: 14:35 Moonset: 0:23 Day length: 9h 23m
2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 ○ Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 ◑ Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 ● Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
23 Twi: 6:31 Sunrise: 7:13 Sunset: 15:14 Twi: 15:56 Moonrise: 8:04 Moonset: 16:35 Day length: 8h 2m	24 Twi: 6:32 Sunrise: 7:14 Sunset: 15:13 Twi: 15:55 Moonrise: 9:03 Moonset: 17:33 Day length: 7h 59m	25 Twi: 6:34 Sunrise: 7:16 Sunset: 15:12 Twi: 15:54 Moonrise: 9:53 Moonset: 18:40 Day length: 7h 56m	26 Twi: 6:35 Sunrise: 7:18 Sunset: 15:11 Twi: 15:53 Moonrise: 10:35 Moonset: 19:54 Day length: 7h 53m	27 Twi: 6:37 Sunrise: 7:20 Sunset: 15:10 Twi: 15:52 Moonrise: 11:10 Moonset: 21:12 Day length: 7h 50m	28 Twi: 6:39 Sunrise: 7:21 Sunset: 15:09 Twi: 15:51 Moonrise: 11:40 Moonset: 22:31 Day length: 7h 47m	29 ◐ Twi: 6:40 Sunrise: 7:23 Sunset: 15:08 Twi: 15:51 Moonrise: 12:07 Moonset: 23:50 First Qtr: 5:07 Day length: 7h 44m

UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

GPS Garmin Smartphone app

Site name	SCHEFFERVILLE - CENTER	Lat.	N 54° 48' 12.4"	N 54° 48.2098'
Date	26/Nov/14	Long.	W 066° 48' 41.8"	W 066° 48.7035'
Observer name	M. Lewis / D. Lalonde	Elevation	514m	526 m

Timing		**Describe Sky conditions (clouds, humidity, etc...)**
End Twilight (HH:MIN)	15:53	100% clear sky
Begin Twilight - following day (HH:MIN)	6:37	
Moonset (HH:MIN)	19:54	
Next moonrise - following day (HH:MIN)	11:10	
New moon date (DD-MM-YR)	22-11-14	**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)	-15°C	Snow Cover 100% In baseball park
SQM placed in Outdoor housing (Y/N)?	N	
SQM data logging frequency (sec or min)	10sec	

PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
4. Point the SQM directly overhead (at the zenith). The meter should be held above head level so that shadows or reflections from your body do not interfere with the reading. Keep it steady.
5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)	✓
For short term measurement, take readings for about 5 minutes per site	✓
Start time (HH:MIN)	≈21:30
End time (HH:MIN)	≈21:36
Disconnect battery pack when finished (This turns off the SQM)	✓

NOTES:

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

1- Program the SQM using the Unihedron Device Manager software
2- Connect the SQM and click Find to ensure the SQM has been detected
3- Go to the "Data Logging" tab
4- Click on "Settings" button under Device Clock. Ensure SQM and computer times are synchronized.
5- If data stored in the SQM have already been saved, you can "Erase all", this will free up memory.
6- For short term measurements, set "Every x seconds (always on)" at 10 s.
7- For long term measurements, set "Every x minutes (power save mode)" at 5 m.

Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone: -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 Twi: 6:51 Sunrise: 7:29 Sunset: 16:52 Twi: 17:31 Moonrise: 14:35 Moonset: 0:23 Day length: 9h 23m
2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 ○ Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 ◑ Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 ● Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
23 Twi: 6:31 Sunrise: 7:13 Sunset: 15:14 Twi: 15:56 Moonrise: 8:04 Moonset: 16:35 Day length: 8h 2m	24 Twi: 6:32 Sunrise: 7:14 Sunset: 15:13 Twi: 15:55 Moonrise: 9:03 Moonset: 17:33 Day length: 7h 59m	25 Twi: 6:34 Sunrise: 7:16 Sunset: 15:12 Twi: 15:54 Moonrise: 9:53 Moonset: 18:40 Day length: 7h 56m	26 Twi: 6:35 Sunrise: 7:18 Sunset: 15:11 Twi: 15:53 Moonrise: 10:35 Moonset: 19:54 Day length: 7h 53m	27 Twi: 6:37 Sunrise: 7:20 Sunset: 15:10 Twi: 15:52 Moonrise: 11:10 Moonset: 21:12 Day length: 7h 50m	28 Twi: 6:39 Sunrise: 7:21 Sunset: 15:09 Twi: 15:51 Moonrise: 11:40 Moonset: 22:31 Day length: 7h 47m	29 ◐ Twi: 6:40 Sunrise: 7:23 Sunset: 15:08 Twi: 15:51 Moonrise: 12:07 Moonset: 23:50 First Qtr: 5:07 Day length: 7h 44m

UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

			GPS Garmin	Smartphone app
Site name	SCHEFFERVILLE - OUT OF TOWN	Lat.	N 54°48' 20.5"	N 54° 48. 3448'
Date	26/NOV/14	Long.	W 066°50' 08.8"	W 066° 50. 1434'
Observer name	M. Lewis / D. Lalonde	Elevation	532 m	531 m

Timing		**Describe Sky conditions (clouds, humidity, etc...)**
End Twilight (HH:MIN)		Clear Sky 100% Light wind
Begin Twilight - following day (HH:MIN)		
Moonset (HH:MIN)		
Next moonrise - following day (HH:MIN)		
New moon date (DD-MM-YR)		**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)		100% snow cover In field besides road No trees / no building
SQM placed in Outdoor housing (Y/N)?		
SQM data logging frequency (sec or min)		

PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
4. Point the SQM directly overhead (at the zenith). The meter should be held above head level so that shadows or reflections from your body do not interfere with the reading. Keep it steady.
5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)	✓
For short term measurement, take readings for about 5 minutes per site	✓
Start time (HH:MIN)	21:51
End time (HH:MIN)	21:56
Disconnect battery pack when finished (This turns off the SQM)	✓

NOTES:

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

1- Program the SQM using the Unihedron Device Manager software
2- Connect the SQM and click Find to ensure the SQM has been detected
3- Go to the "Data Logging" tab
4- Click on "Settings" button under Device Clock. Ensure SQM and computer times are synchronized.
5- If data stored in the SQM have already been saved, you can "Erase all", this will free up memory.
6- For short term measurements, set "Every x seconds (always on)" at 10 s.
7- For long term measurements, set "Every x minutes (power save mode)" at 5 m.

Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone: -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 Twi: 6:51 Sunrise: 7:29 Sunset: 16:52 Twi: 17:31 Moonrise: 14:35 Moonset: 0:23 Day length: 9h 23m
2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 ○ Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 ◑ Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 ● Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
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UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

			GPS Garmin	Smartphone app
Site name	PINETTE LAKE	Lat.	N54° 53' 44.1"	N 54° 53.7311'
Date	26/NOV/14	Long.	W067° 07' 19.0"	W067° 07.3198'
Observer name	M.Lewis / D.Lalonde	Elevation	631 m	633 m

Timing		**Describe Sky conditions (clouds, humidity, etc...)**
End Twilight (HH:MIN)		100% clear sky - Light wind Small aurora borealis. Green - north direction See light "candles" from main plant, almost like Las Vegas light going straight up.
Begin Twilight - following day (HH:MIN)		
Moonset (HH:MIN)		
Next moonrise - following day (HH:MIN)		
New moon date (DD-MM-YR)		**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)		On lake shore Small trees 100% snow cover.
SQM placed in Outdoor housing (Y/N)?		
SQM data logging frequency (sec or min)		

PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
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5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)	✓
For short term measurement, take readings for about 5 minutes per site	✓
Start time (HH:MIN)	23:14
End time (HH:MIN)	23:20
Disconnect battery pack when finished (This turns off the SQM)	✓

NOTES:

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

1- Program the SQM using the Unihedron Device Manager software
2- Connect the SQM and click Find to ensure the SQM has been detected
3- Go to the "Data Logging" tab
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Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone: -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 ○ Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 ◑ Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 ● Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
23 Twi: 6:31 Sunrise: 7:13 Sunset: 15:14 Twi: 15:56 Moonrise: 8:04 Moonset: 16:35 Day length: 8h 2m	24 Twi: 6:32 Sunrise: 7:14 Sunset: 15:13 Twi: 15:55 Moonrise: 9:03 Moonset: 17:33 Day length: 7h 59m	25 Twi: 6:34 Sunrise: 7:16 Sunset: 15:12 Twi: 15:54 Moonrise: 9:53 Moonset: 18:40 Day length: 7h 56m	26 Twi: 6:35 Sunrise: 7:18 Sunset: 15:11 Twi: 15:53 Moonrise: 10:35 Moonset: 19:54 Day length: 7h 53m	27 Twi: 6:37 Sunrise: 7:20 Sunset: 15:10 Twi: 15:52 Moonrise: 11:10 Moonset: 21:12 Day length: 7h 50m	28 Twi: 6:39 Sunrise: 7:21 Sunset: 15:09 Twi: 15:51 Moonrise: 11:40 Moonset: 22:31 Day length: 7h 47m	29 ◐ Twi: 6:40 Sunrise: 7:23 Sunset: 15:08 Twi: 15:51 Moonrise: 12:07 Moonset: 23:50 First Qtr: 5:07 Day length: 7h 44m

UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

GPS Garmin Smartphone app.

Site name	IRONY MOUNTAIN	Lat.	N 54° 54' 13.9"	—
Date	27/NOV/14	Long.	W 067° 07' 12.6"	—
Observer name	M.Lewis / D.Lalonde	Elevation	670 m	—

Timing		**Describe Sky conditions (clouds, humidity, etc...)**
End Twilight (HH:MIN)	15:53	Sky = 90% clear - 10% light clouds Small/green aurora borealis Can see main plant lights - in the sky
Begin Twilight - following day (HH:MIN)	6:37	
Moonset (HH:MIN)	19:54	
Next moonrise - following day (HH:MIN)	11:10	
New moon date (DD-MM-YR)	22-11-14	**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)	-18°C	On the road unplowed. 100% snow cover. 15% trees around In front of us is future house + Irony Mountain
SQM placed in Outdoor housing (Y/N)?	N	
SQM data logging frequency (sec or min)	10 sec	

PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
4. Point the SQM directly overhead (at the zenith). The meter should be held above head level so that shadows or reflections from your body do not interfere with the reading. Keep it steady.
5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)	✓
For short term measurement, take readings for about 5 minutes per site	✓
Start time (HH:MIN)	00:37
End time (HH:MIN)	00:43
Disconnect battery pack when finished (This turns off the SQM)	✓

NOTES:

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

1- Program the SQM using the Unihedron Device Manager software
2- Connect the SQM and click Find to ensure the SQM has been detected
3- Go to the "Data Logging" tab
4- Click on "Settings" button under Device Clock. Ensure SQM and computer times are synchronized.
5- If data stored in the SQM have already been saved, you can "Erase all", this will free up memory.
6- For short term measurements, set "Every x seconds (always on)" at 10 s.
7- For long term measurements, set "Every x minutes (power save mode)" at 5 m.

Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone: -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 Twi: 6:51 Sunrise: 7:29 Sunset: 16:52 Twi: 17:31 Moonrise: 14:35 Moonset: 0:23 Day length: 9h 23m
2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 ○ Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 ◑ Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 ● Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
23 Twi: 6:31 Sunrise: 7:13 Sunset: 15:14 Twi: 15:56 Moonrise: 8:04 Moonset: 16:35 Day length: 8h 2m	24 Twi: 6:32 Sunrise: 7:14 Sunset: 15:13 Twi: 15:55 Moonrise: 9:03 Moonset: 17:33 Day length: 7h 59m	25 Twi: 6:34 Sunrise: 7:16 Sunset: 15:12 Twi: 15:54 Moonrise: 9:53 Moonset: 18:40 Day length: 7h 56m	26 Twi: 6:35 Sunrise: 7:18 Sunset: 15:11 Twi: 15:53 Moonrise: 10:35 Moonset: 19:54 Day length: 7h 53m	27 Twi: 6:37 Sunrise: 7:20 Sunset: 15:10 Twi: 15:52 Moonrise: 11:10 Moonset: 21:12 Day length: 7h 50m	28 Twi: 6:39 Sunrise: 7:21 Sunset: 15:09 Twi: 15:51 Moonrise: 11:40 Moonset: 22:31 Day length: 7h 47m	29 ◐ Twi: 6:40 Sunrise: 7:23 Sunset: 15:08 Twi: 15:51 Moonrise: 12:07 Moonset: 23:50 First Qtr: 5:07 Day length: 7h 44m

Light Pollution Monitoring Data Format 1.0
URL: http://www.darksky.org/measurements
Number of header lines: 35+
This data is released under the following license: ODbL 1.0 http://opendatacommons.org/licenses/odbl/summary/
Device type: SQM-LU-DL
Instrument ID: TSMC_SQM
Data supplier: TSMC
Location name: Schefferville - Howse Project
Position (lat, lon, elev(m)): 54.799999, -66.833336, 549
Local timezone: America/Montreal
Time Synchronization:
Moving / Stationary position: STATIONARY
Moving / Fixed look direction: FIXED
Number of channels: 1
Filters per channel: HOYA CM-500
Measurement direction per channel: up - zenith
Field of view (degrees): 20
Number of fields per line: 5
SQM serial number: 2913
SQM firmware version: 4-6-32
SQM cover offset value:
SQM readout test ix: i,00000004,00000006,00000032,00002913
SQM readout test rx: r, 11.81m,0000001697Hz,0000000000c,0000000.000s,-012.3C
SQM readout test cx: c,00000019.88m,0000124.363s, 020.3C,00000008.71m, 020.9C
Comment: SQM purchased by AECOM on behlaf of TSMC
Comment: For HOWSE Env Impact Statement
Comment: November 2014
Comment:
Comment:
UDM version: 1.0.0.40
UDM setting: DL Retrieve All
blank line 32
UTC Date & Time, Local Date & Time, Temperature, Voltage, MSAS
YYYY-MM-DDTHH:mm:ss.fff YYYY-MM-DDTHH:mm:ss.fff Celsius Volts mag/arcsec^2
END OF HEADER

2014-11-27 at 00:03:39	2014-11-26 at 19:03:39	19.3	5.04	21.34	Not valid
2014-11-27 at 00:03:51	2014-11-26 at 19:03:51	19.3	5.04	21.34	
2014-11-27 at 00:04:43	2014-11-26 at 19:04:43	18.6	4.88	10.65	
2014-11-27 at 00:07:41	2014-11-26 at 19:07:41	19	5.04	9.12	
2014-11-27 at 00:07:51	2014-11-26 at 19:07:51	19.3	5.04	8.83	
2014-11-27 at 00:08:01	2014-11-26 at 19:08:01	19	5.04	9.13	
2014-11-27 at 01:40:10	2014-11-26 at 20:40:10	15.4	4.88	19.69	
2014-11-27 at 01:40:20	2014-11-26 at 20:40:20	15.4	4.88	18.18	

Kawawa - Center	**54° 51.6417' N**	**066° 45.6725' W**	**487 m**	**Prise avec Smartphone app**
	54° 51' 38.6" N	**066° 45' 40.3" W**	**495 m**	**Prise avec GPS Garmin**
	54°51'38.5020"	**-066°45'40.3500"**		**Conversion for use in Google Map**

2014-11-27 at 01:40:30	2014-11-26 at 20:40:30	15.1	4.88	19.52
2014-11-27 at 01:40:40	2014-11-26 at 20:40:40	14.8	4.88	19.98
2014-11-27 at 01:40:50	2014-11-26 at 20:40:50	14.5	4.88	19.89
2014-11-27 at 01:41:00	2014-11-26 at 20:41:00	13.8	4.88	19.92
2014-11-27 at 01:41:10	2014-11-26 at 20:41:10	13.5	4.88	20.01
2014-11-27 at 01:41:20	2014-11-26 at 20:41:20	13.2	4.88	19.96
2014-11-27 at 01:41:30	2014-11-26 at 20:41:30	12.5	4.88	19.98
2014-11-27 at 01:41:40	2014-11-26 at 20:41:40	12.2	4.88	19.98
2014-11-27 at 01:41:50	2014-11-26 at 20:41:50	11.6	4.88	19.97
2014-11-27 at 01:42:00	2014-11-26 at 20:42:00	10.9	4.88	19.96
2014-11-27 at 01:42:10	2014-11-26 at 20:42:10	10.6	4.88	19.96
2014-11-27 at 01:42:20	2014-11-26 at 20:42:20	10.3	4.88	19.85
2014-11-27 at 01:42:30	2014-11-26 at 20:42:30	9.3	4.88	19.9
2014-11-27 at 01:42:40	2014-11-26 at 20:42:40	9	4.88	19.93
2014-11-27 at 01:42:50	2014-11-26 at 20:42:50	8.7	4.88	19.97
2014-11-27 at 01:43:00	2014-11-26 at 20:43:00	8	4.88	19.96
2014-11-27 at 01:43:10	2014-11-26 at 20:43:10	7.4	4.88	19.94
2014-11-27 at 01:43:20	2014-11-26 at 20:43:20	7	4.88	19.96
2014-11-27 at 01:43:30	2014-11-26 at 20:43:30	6.4	5.76	19.9
2014-11-27 at 01:43:40	2014-11-26 at 20:43:40	6.1	4.88	19.96
2014-11-27 at 01:43:50	2014-11-26 at 20:43:50	5.8	4.88	19.97
2014-11-27 at 01:44:00	2014-11-26 at 20:44:00	5.1	4.88	19.97
2014-11-27 at 01:44:10	2014-11-26 at 20:44:10	4.8	4.88	19.98
2014-11-27 at 01:44:20	2014-11-26 at 20:44:20	4.5	4.88	19.97
2014-11-27 at 01:44:30	2014-11-26 at 20:44:30	3.8	4.88	19.95
2014-11-27 at 01:44:40	2014-11-26 at 20:44:40	3.5	4.88	19.98

2014-11-27 at 01:44:50	2014-11-26 at 20:44:50	2.9	4.88	19.98
2014-11-27 at 01:45:00	2014-11-26 at 20:45:00	2.5	4.88	19.96
2014-11-27 at 01:45:10	2014-11-26 at 20:45:10	2.2	4.88	19.95
2014-11-27 at 01:45:20	2014-11-26 at 20:45:20	1.6	4.88	19.97
2014-11-27 at 01:45:30	2014-11-26 at 20:45:30	1.2	4.88	19.98
2014-11-27 at 01:45:40	2014-11-26 at 20:45:40	0.9	4.88	19.97
2014-11-27 at 01:45:50	2014-11-26 at 20:45:50	0.6	4.88	19.96
2014-11-27 at 01:46:00	2014-11-26 at 20:46:00	0.3	4.88	19.97
2014-11-27 at 01:46:10	2014-11-26 at 20:46:10	0.1	4.88	20
2014-11-27 at 01:46:20	2014-11-26 at 20:46:20	-0.4	4.88	19.95
2014-11-27 at 01:46:30	2014-11-26 at 20:46:30	-0.7	4.88	19.96
2014-11-27 at 01:46:40	2014-11-26 at 20:46:40	-1	4.88	19.98

Kawawa - Out of town	**54° 49.1194' N**	**066° 45.0898' W**	**600 m**	**Prise avec Smartphone app**
	54° 49' 07.1" N	**066° 45' 05.5" W**	**594 m**	**Prise avec GPS Garmin**
	54.8186567°	**-066.7514967°**		**Conversion for use in Google Map**

2014-11-27 at 02:05:19	2014-11-26 at 21:05:19	-1.3	4.88	21.14
2014-11-27 at 02:05:29	2014-11-26 at 21:05:29	-1.3	4.88	21.03
2014-11-27 at 02:05:39	2014-11-26 at 21:05:39	-1.7	4.88	21.17
2014-11-27 at 02:05:49	2014-11-26 at 21:05:49	-2	4.88	21.17
2014-11-27 at 02:05:59	2014-11-26 at 21:05:59	-2.3	4.88	21.17
2014-11-27 at 02:06:09	2014-11-26 at 21:06:09	-2.6	4.88	21.18
2014-11-27 at 02:06:19	2014-11-26 at 21:06:19	-2.6	4.88	21.19
2014-11-27 at 02:06:29	2014-11-26 at 21:06:29	-3	4.88	21.26
2014-11-27 at 02:06:39	2014-11-26 at 21:06:39	-3.3	4.88	21.24
2014-11-27 at 02:06:49	2014-11-26 at 21:06:49	-3.6	4.88	21.19
2014-11-27 at 02:06:59	2014-11-26 at 21:06:59	-3.6	4.88	21.18
2014-11-27 at 02:07:09	2014-11-26 at 21:07:09	-3.9	4.88	21.19
2014-11-27 at 02:07:19	2014-11-26 at 21:07:19	-4.2	4.88	21.24
2014-11-27 at 02:07:29	2014-11-26 at 21:07:29	-4.2	4.88	21.24
2014-11-27 at 02:07:39	2014-11-26 at 21:07:39	-4.6	4.88	21.11
2014-11-27 at 02:07:49	2014-11-26 at 21:07:49	-4.9	4.88	21.24
2014-11-27 at 02:07:59	2014-11-26 at 21:07:59	-4.9	4.88	21.2
2014-11-27 at 02:08:09	2014-11-26 at 21:08:09	-5.2	4.88	21.1
2014-11-27 at 02:08:19	2014-11-26 at 21:08:19	-5.5	4.88	21.04
2014-11-27 at 02:08:29	2014-11-26 at 21:08:29	-5.5	4.88	21.19
2014-11-27 at 02:08:39	2014-11-26 at 21:08:39	-5.9	4.88	21.17
2014-11-27 at 02:08:49	2014-11-26 at 21:08:49	-6.2	4.88	21.2
2014-11-27 at 02:08:59	2014-11-26 at 21:08:59	-6.2	4.88	21.18
2014-11-27 at 02:09:09	2014-11-26 at 21:09:09	-6.5	4.88	21.21
2014-11-27 at 02:09:19	2014-11-26 at 21:09:19	-6.8	4.88	21.18
2014-11-27 at 02:09:29	2014-11-26 at 21:09:29	-6.8	4.88	21.16
2014-11-27 at 02:09:39	2014-11-26 at 21:09:39	-7.1	4.88	21.18
2014-11-27 at 02:09:49	2014-11-26 at 21:09:49	-7.1	4.88	21.12
2014-11-27 at 02:09:59	2014-11-26 at 21:09:59	-7.5	4.88	21.18
2014-11-27 at 02:10:19	2014-11-26 at 21:10:19	-7.8	4.88	20.64
2014-11-27 at 02:10:29	2014-11-26 at 21:10:29	-7.8	4.88	21.02
2014-11-27 at 02:10:39	2014-11-26 at 21:10:39	-8.1	4.88	21.15
2014-11-27 at 02:10:49	2014-11-26 at 21:10:49	-8.1	4.88	21.2
2014-11-27 at 02:10:59	2014-11-26 at 21:10:59	-8.1	4.88	21.18
2014-11-27 at 02:11:01	2014-11-26 at 21:11:01	-8.4	4.88	21.18
2014-11-27 at 02:11:19	2014-11-26 at 21:11:19	-8.4	4.88	21.19
2014-11-27 at 02:11:29	2014-11-26 at 21:11:29	-8.8	4.88	21.2

Schefferville - Town Center	**54° 48.2098' N**	**066° 48.7035' W**	**526 m**	**Prise avec Smartphone app**
	54° 48' 12.4" N	**066° 48' 41.8" W**	**514 m**	**Prise avec GPS Garmin**
	54.8034967°	**-066.8117250°**		**Conversion for use in Google Map**

2014-11-27 at 02:30:24	2014-11-26 at 21:30:24	0.9	4.88	19.06
2014-11-27 at 02:30:34	2014-11-26 at 21:30:34	0.6	4.88	19.25
2014-11-27 at 02:30:44	2014-11-26 at 21:30:44	0.3	4.88	19.17
2014-11-27 at 02:30:54	2014-11-26 at 21:30:54	0.1	4.88	19.23
2014-11-27 at 02:31:04	2014-11-26 at 21:31:04	-0.4	4.88	19.1
2014-11-27 at 02:31:14	2014-11-26 at 21:31:14	-0.7	4.88	19.03
2014-11-27 at 02:31:24	2014-11-26 at 21:31:24	-1	4.88	19.08
2014-11-27 at 02:31:34	2014-11-26 at 21:31:34	-1.3	4.88	19.04
2014-11-27 at 02:31:44	2014-11-26 at 21:31:44	-1.7	4.88	19.08
2014-11-27 at 02:31:54	2014-11-26 at 21:31:54	-2	4.88	19.16
2014-11-27 at 02:32:04	2014-11-26 at 21:32:04	-2	4.88	18.81
2014-11-27 at 02:32:14	2014-11-26 at 21:32:14	-2.6	4.88	18.91
2014-11-27 at 02:32:24	2014-11-26 at 21:32:24	-2.6	4.88	19.03

2014-11-27 at 02:32:34	2014-11-26 at 21:32:34	-3	4.88	19.03
2014-11-27 at 02:32:44	2014-11-26 at 21:32:44	-3.3	4.88	19.08
2014-11-27 at 02:32:54	2014-11-26 at 21:32:54	-3.6	4.88	19.06
2014-11-27 at 02:33:04	2014-11-26 at 21:33:04	-3.9	4.88	19.05
2014-11-27 at 02:33:14	2014-11-26 at 21:33:14	-4.2	4.88	19.13
2014-11-27 at 02:33:24	2014-11-26 at 21:33:24	-4.2	4.88	19
2014-11-27 at 02:33:34	2014-11-26 at 21:33:34	-4.6	4.88	19.14
2014-11-27 at 02:33:44	2014-11-26 at 21:33:44	-4.9	4.88	19.16
2014-11-27 at 02:33:54	2014-11-26 at 21:33:54	-4.9	4.88	19.21
2014-11-27 at 02:34:04	2014-11-26 at 21:34:04	-5.2	4.88	19.2
2014-11-27 at 02:34:14	2014-11-26 at 21:34:14	-5.5	4.88	19.15
2014-11-27 at 02:34:24	2014-11-26 at 21:34:24	-5.5	4.88	19.16
2014-11-27 at 02:34:34	2014-11-26 at 21:34:34	-5.5	4.88	19.21
2014-11-27 at 02:34:44	2014-11-26 at 21:34:44	-5.9	4.88	19.25
2014-11-27 at 02:34:54	2014-11-26 at 21:34:54	-6.2	4.88	19.28
2014-11-27 at 03:55:04	2014-11-26 at 22:55:04	-6.2	4.88	19.24
2014-11-27 at 02:35:14	2014-11-26 at 21:35:14	-6.5	4.88	19.18
2014-11-27 at 02:35:24	2014-11-26 at 21:35:24	-6.5	4.88	19.33
2014-11-27 at 02:35:34	2014-11-26 at 21:35:34	-6.8	4.88	18.97
2014-11-27 at 02:35:44	2014-11-26 at 21:35:44	-6.8	4.88	19.23
2014-11-27 at 02:35:54	2014-11-26 at 21:35:54	-7.1	4.88	19.3

Schefferville - out of town	**54° 48.3448' N**	**066° 50.1434' W**	**531 m**	**Prise avec Smartphone app**
	54° 48' 20.5" N	**066° 50' 08.8" W**	**532 m**	**Prise avec GPS Garmin**
	54.8057467°	**-066.8357233°**		**Conversion for use in Google Map**

2014-11-27 at 02:49:03	2014-11-26 at 21:49:03	-5.9	4.88	21.11
2014-11-27 at 02:49:13	2014-11-26 at 21:49:13	-5.9	4.88	20.45
2014-11-27 at 02:49:23	2014-11-26 at 21:49:23	-5.9	4.88	20.44
2014-11-27 at 02:49:33	2014-11-26 at 21:49:33	-6.2	4.88	20.47
2014-11-27 at 02:49:43	2014-11-26 at 21:49:43	-6.2	4.88	20.41
2014-11-27 at 02:49:53	2014-11-26 at 21:49:53	-6.5	4.88	20.43
2014-11-27 at 02:50:03	2014-11-26 at 21:50:03	-6.5	4.88	20.41
2014-11-27 at 02:50:13	2014-11-26 at 21:50:13	-6.5	4.88	20.46
2014-11-27 at 02:50:23	2014-11-26 at 21:50:23	-6.8	4.88	20.47
2014-11-27 at 02:50:33	2014-11-26 at 21:50:33	-6.8	4.88	20.44
2014-11-27 at 02:50:43	2014-11-26 at 21:50:43	-7.1	4.88	20.44
2014-11-27 at 02:50:53	2014-11-26 at 21:50:53	-7.1	4.88	20.47
2014-11-27 at 02:51:03	2014-11-26 at 21:51:03	-7.1	4.88	20.48
2014-11-27 at 02:51:13	2014-11-26 at 21:51:13	-7.5	4.88	20.49
2014-11-27 at 02:51:23	2014-11-26 at 21:51:23	-7.5	4.88	20.52
2014-11-27 at 02:51:33	2014-11-26 at 21:51:33	-7.8	4.88	20.48
2014-11-27 at 02:51:43	2014-11-26 at 21:51:43	-7.8	4.88	20.52
2014-11-27 at 02:51:53	2014-11-26 at 21:51:53	-8.1	4.88	20.5
2014-11-27 at 02:52:03	2014-11-26 at 21:52:03	-8.1	4.88	20.49
2014-11-27 at 02:52:13	2014-11-26 at 21:52:13	-8.1	4.88	20.48
2014-11-27 at 02:52:23	2014-11-26 at 21:52:23	-8.4	4.88	20.49
2014-11-27 at 02:52:33	2014-11-26 at 21:52:33	-8.4	4.88	20.54
2014-11-27 at 02:52:43	2014-11-26 at 21:52:43	-8.8	4.88	20.63
2014-11-27 at 02:52:53	2014-11-26 at 21:52:53	-8.8	4.88	20.55
2014-11-27 at 02:53:03	2014-11-26 at 21:53:03	-9.1	4.88	20.54
2014-11-27 at 02:53:13	2014-11-26 at 21:53:13	-9.1	4.88	20.54
2014-11-27 at 02:53:23	2014-11-26 at 21:53:23	-9.1	4.88	20.54
2014-11-27 at 02:53:33	2014-11-26 at 21:53:33	-9.1	4.88	20.54
2014-11-27 at 02:53:43	2014-11-26 at 21:53:43	-9.4	4.88	20.04

Pinette Lake	**54° 53.7311' N**	**067° 07.3198' W**	**633 m**	**Prise avec Smartphone app**
	54° 53' 44.1" N	**067° 07' 19.0" W**	**631 m**	**Prise avec GPS Garmin**
	54.8955183°	**-067.1219967°**		**Conversion for use in Google Map**

2014-11-27 at 04:14:34	2014-11-26 at 23:14:34	1.2	4.88	20.5
2014-11-27 at 04:14:44	2014-11-26 at 23:14:44	0.9	4.88	20.4
2014-11-27 at 04:14:54	2014-11-26 at 23:14:54	0.6	4.88	20.44
2014-11-27 at 04:15:04	2014-11-26 at 23:15:04	0.6	4.88	20.45
2014-11-27 at 04:15:14	2014-11-26 at 23:15:14	0.3	4.88	20.43
2014-11-27 at 04:15:24	2014-11-26 at 23:15:24	0.1	4.88	20.44
2014-11-27 at 04:15:34	2014-11-26 at 23:15:34	-0.4	4.88	20.43
2014-11-27 at 04:15:44	2014-11-26 at 23:15:44	-0.7	4.88	20.44
2014-11-27 at 04:15:54	2014-11-26 at 23:15:54	-1	4.88	20.75
2014-11-27 at 04:16:04	2014-11-26 at 23:16:04	-1.3	4.88	20.52
2014-11-27 at 04:16:14	2014-11-26 at 23:16:14	-1.7	4.88	20.52
2014-11-27 at 04:16:24	2014-11-26 at 23:16:24	-2	4.88	20.51
2014-11-27 at 04:16:34	2014-11-26 at 23:16:34	-2.3	4.88	20.53
2014-11-27 at 04:16:44	2014-11-26 at 23:16:44	-2.6	4.88	20.53

2014-11-27 at 04:16:54	2014-11-26 at 23:16:54	-3	4.88	20.52	
2014-11-27 at 04:17:04	2014-11-26 at 23:17:04	-3.3	4.88	20.56	
2014-11-27 at 04:17:14	2014-11-26 at 23:17:14	-3.3	4.88	20.55	
2014-11-27 at 04:17:24	2014-11-26 at 23:17:24	-3.6	4.88	20.53	
2014-11-27 at 04:17:34	2014-11-26 at 23:17:34	-3.9	4.88	20.49	
2014-11-27 at 04:17:44	2014-11-26 at 23:17:44	-4.2	4.88	20.49	
2014-11-27 at 04:17:54	2014-11-26 at 23:17:54	-4.6	4.88	20.4	
2014-11-27 at 04:18:04	2014-11-26 at 23:18:04	-4.9	4.88	20.54	
2014-11-27 at 04:18:14	2014-11-26 at 23:18:14	-5.2	4.88	20.52	
2014-11-27 at 04:18:24	2014-11-26 at 23:18:24	-5.5	4.88	20.52	
2014-11-27 at 04:18:34	2014-11-26 at 23:18:34	-5.5	4.88	20.52	
2014-11-27 at 04:18:44	2014-11-26 at 23:18:44	-5.9	4.88	20.52	
2014-11-27 at 04:18:54	2014-11-26 at 23:18:54	-6.2	4.88	20.53	
2014-11-27 at 04:19:04	2014-11-26 at 23:19:04	-6.5	4.88	20.53	
2014-11-27 at 04:19:14	2014-11-26 at 23:19:14	-6.5	4.88	20.55	
2014-11-27 at 04:19:24	2014-11-26 at 23:19:24	-6.8	4.88	20.4	
2014-11-27 at 04:19:34	2014-11-26 at 23:19:34	-7.1	4.88	20.55	
2014-11-27 at 04:19:44	2014-11-26 at 23:19:44	-7.1	4.88	20.51	
2014-11-27 at 04:19:54	2014-11-26 at 23:19:54	-7.5	4.88	20.34	
2014-11-27 at 04:20:04	2014-11-26 at 23:20:04	-7.5	4.88	20.5	
2014-11-27 at 04:20:14	2014-11-26 at 23:20:14	-7.8	4.88	20.49	
2014-11-27 at 04:20:24	2014-11-26 at 23:20:24	-8.1	4.88	20.49	
2014-11-27 at 04:20:34	2014-11-26 at 23:20:34	-8.1	4.88	20.53	

Irony Mountain - Howse	**n/a**	**n/a**		**n/a**	**Prise avec Smartphone app**
	54° 54' 13.9" N	**067° 07' 12.6" W**		**670 m**	**Prise avec GPS Garmin**
	54.9038611°	**-067.1201667°**			**Conversion for use in Google Map**

2014-11-27 at 05:37:03	2014-11-27 at 00:37:03	-11	4.88	20.53	
2014-11-27 at 05:37:13	2014-11-27 at 00:37:13	-11	4.88	20.16	
2014-11-27 at 05:37:23	2014-11-27 at 00:37:23	-11	4.88	20.66	
2014-11-27 at 05:37:33	2014-11-27 at 00:37:33	-11	4.88	20.52	
2014-11-27 at 05:37:43	2014-11-27 at 00:37:43	-11	4.88	20.52	
2014-11-27 at 05:37:53	2014-11-27 at 00:37:53	-11.3	4.88	20.58	
2014-11-27 at 05:38:03	2014-11-27 at 00:38:03	-11.3	4.88	20.38	
2054-11-27 at 05:38:13	2054-11-27 at 00:38:13	-11.3	4.88	20.52	
2014-11-27 at 05:38:23	2014-11-27 at 00:38:23	-11.7	4.88	20.57	
2014-11-27 at 05:38:33	2014-11-27 at 00:38:33	-11.7	4.88	20.62	
2014-11-27 at 05:38:43	2014-11-27 at 00:38:43	-11.7	4.88	20.56	
2014-11-27 at 05:38:53	2014-11-27 at 00:38:53	-12	4.88	20.61	
2014-11-27 at 05:39:03	2014-11-27 at 00:39:03	-12	4.88	20.35	
2014-11-27 at 05:39:13	2014-11-27 at 00:39:13	-12.3	4.88	20.6	
2014-11-27 at 05:39:23	2014-11-27 at 00:39:23	-12.3	4.88	20.7	
2014-11-27 at 05:39:33	2014-11-27 at 00:39:33	-12.6	4.88	20.72	
2014-11-27 at 05:39:43	2014-11-27 at 00:39:43	-12.6	4.88	20.65	
2014-11-27 at 05:39:53	2014-11-27 at 00:39:53	-12.6	4.88	20.46	
2014-11-27 at 05:40:03	2014-11-27 at 00:40:03	-12.9	4.88	20.54	
2014-11-27 at 05:40:13	2014-11-27 at 00:40:13	-12.9	4.88	20.58	
2014-11-27 at 05:40:23	2014-11-27 at 00:40:23	-12.9	4.88	20.55	
2014-11-27 at 05:40:33	2014-11-27 at 00:40:33	-13.3	4.88	20.58	
2014-11-27 at 05:40:43	2014-11-27 at 00:40:43	-13.3	4.88	20.07	
2014-11-27 at 05:40:53	2014-11-27 at 00:40:53	-13.3	4.88	20.63	
2014-11-27 at 05:41:03	2014-11-27 at 00:41:03	-13.6	4.88	20.61	
2014-11-27 at 05:41:13	2014-11-27 at 00:41:13	-13.6	4.88	20.64	
2014-11-27 at 05:41:23	2014-11-27 at 00:41:23	-13.6	4.88	20.69	
2014-11-27 at 05:41:33	2014-11-27 at 00:41:33	-13.9	4.88	20.28	
2014-11-27 at 05:41:43	2014-11-27 at 00:41:43	-13.9	4.88	20.55	
2014-11-27 at 05:41:53	2014-11-27 at 00:41:53	-13.9	4.88	20.4	
2014-11-27 at 05:42:03	2014-11-27 at 00:42:03	-13.9	4.88	20.62	
2014-11-27 at 05:42:13	2014-11-27 at 00:42:13	-14.2	4.88	20.61	
2014-11-27 at 05:42:23	2014-11-27 at 00:42:23	-14.2	4.88	20.58	
2014-11-27 at 05:42:33	2014-11-27 at 00:42:33	-14.2	4.88	20.26	
2014-11-27 at 05:42:43	2014-11-27 at 00:42:43	-14.2	4.88	20.39	
2014-11-27 at 05:42:53	2014-11-27 at 00:42:53	-14.6	4.88	19.95	

2014-11-27 at 06:25:50	2014-11-27 at 01:25:50	-14.9	5.04	11.83	Not valid
2014-11-27 at 06:26:00	2014-11-27 at 01:26:00	-14.6	5.04	11.83	
2014-11-27 at 06:26:10	2014-11-27 at 01:26:10	-14.2	5.04	11.84	

UNIHEDRON SQM-LU-DL MEASUREMENT DATASHEET
Ambient light - TSMC

* ***Before measurement, program the Sky Quality Meter (SQM). See back of page.***

** ***Before measurement, plan for acceptable time and weather conditions. See back of page.***

			GPS Garmin	Smartphone app
Site name	Old Goodwood Rd ≈ km 18	Lat.	55° 00' 43.0" N	N55° 00.7121'
Date	27/NOV/14	Long.	067° 14' 41.6" W	W067° 14.7040'
Observer name	M. Lewis + D. Lalonde	Elevation	651 m	648 m

Timing		Describe Sky conditions (clouds, humidity, etc...)
End Twilight (HH:MIN)	15:52	At time of installation, we could see the moon and clouds were apparent
Begin Twilight - following day (HH:MIN)	06:39	
Moonset (HH:MIN)	21:12	
Next moonrise - following day (HH:MIN)	11:40	
New moon date (DD-MM-YR)	22-11-14	**Describe surroundings (% snow cover, trees, buildings, etc...)**
Outside Temperature (°C)	-18°C at installation	100% snow cover. Chose a clear area, surrounded by trees
SQM placed in Outdoor housing (Y/N)?	Yes	Close to Innu teepee structure.
SQM data logging frequency (sec or min)	5 min	

PROCEDURE:

1. No artificial light directly on lens (lens reads a 20° wide cone)
2. No aircraft passing close to the zenith
3. Avoid using the SQM near lights like streetlights and in areas that are shaded by trees or buildings. A rule of thumb for the SQM is to be as far from the object as it is high. For streetlights, stand at least 7.5 meters (or 25 feet) away. Keep away from objects that can reflect light
4. Point the SQM directly overhead (at the zenith). The meter should be held above head level so that shadows or reflections from your body do not interfere with the reading. Keep it steady.
5. The meter is somewhat temperature dependent. Leave the meter outside for at least 5 minutes to reach ambient temperature before taking any measurements.
6. Clean lens (from SQM and outdoor housing if used) with a soft cloth. Ensure no condensation on lense.

MEASUREMENT:

Connect the battery pack when ready to measure (This turns on the SQM)		✓
For short term measurement, take readings for about 5 minutes per site		✓
Start time (HH:MIN)	27/NOV/14	15:40
End time (HH:MIN)	28/NOV/14	9:30
Disconnect battery pack when finished (This turns off the SQM)		No. Turned off at the office.

NOTES: Test to get dark night data. Unaffected by artificial light.

INSTRUCTIONS

* ***Before measurement, program the Sky Quality Meter (SQM).***

1- Program the SQM using the Unihedron Device Manager software
2- Connect the SQM and click Find to ensure the SQM has been detected
3- Go to the "Data Logging" tab
4- Click on "Settings" button under Device Clock. Ensure SQM and computer times are synchronized.
5- If data stored in the SQM have already been saved, you can "Erase all", this will free up memory.
6- For short term measurements, set "Every x seconds (always on)" at 10 s.
7- For long term measurements, set "Every x minutes (power save mode)" at 5 m.

Note: There is no display on the SQM, consequently, you must ensure the device is correctly programmed, before any measurement

** ***Before measurement, plan for acceptable time and weather conditions.***

1. Measurements should be taken on clear nights
2. Moon is < ¼ full
3. Moon is NOT up
4. 1.5 hours after end of civil twilight (http://www.sunrisesunset.com/Canada/Quebec/Schefferville.asp)
5. 1.5 hours before beginning of civil twilight
6. No aurora borealis

Example : For measurement on November 25th, 2014.

End Twilight is 15:54 + 1.5 hour = 17:23 Begin Twilight (following day) is 6:35 – 1.5 hour = 5:05 Moonset is 18:40 Next moonrise (following day) is 10:35	Measurements can be taken: From: November 25th at 18:40 To: November 26th at 5:05 *New moon date: Nov. 22nd*

November 2014

Schefferville, Québec, Canada

Latitude, Longitude: 54 48.0' N, 66 48.6' W Time zone: -5:00 (Eastern) DST observance: North America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 Twi: 6:51 Sunrise: 7:29 Sunset: 16:52 Twi: 17:31 Moonrise: 14:35 Moonset: 0:23 Day length: 9h 23m
2 DST Ends Twi: 5:53 Sunrise: 6:31 Sunset: 15:50 Twi: 16:29 Moonrise: 14:01 Moonset: 0:43 Day length: 9h 19m	3 Twi: 5:55 Sunrise: 6:33 Sunset: 15:48 Twi: 16:27 Moonrise: 14:26 Moonset: 2:03 Day length: 9h 15m	4 Twi: 5:57 Sunrise: 6:35 Sunset: 15:46 Twi: 16:25 Moonrise: 14:52 Moonset: 3:23 Day length: 9h 11m	5 Twi: 5:59 Sunrise: 6:37 Sunset: 15:44 Twi: 16:23 Moonrise: 15:19 Moonset: 4:43 Day length: 9h 7m	6 Twi: 6:01 Sunrise: 6:40 Sunset: 15:42 Twi: 16:21 Moonrise: 15:50 Moonset: 6:01 Full Moon: 17:24 Day length: 9h 3m	7 Twi: 6:02 Sunrise: 6:42 Sunset: 15:40 Twi: 16:19 Moonrise: 16:26 Moonset: 7:16 Day length: 8h 59m	8 Twi: 6:04 Sunrise: 6:44 Sunset: 15:38 Twi: 16:18 Moonrise: 17:08 Moonset: 8:24 Day length: 8h 55m
9 Twi: 6:06 Sunrise: 6:46 Sunset: 15:37 Twi: 16:16 Moonrise: 17:57 Moonset: 9:25 Day length: 8h 51m	10 Twi: 6:08 Sunrise: 6:48 Sunset: 15:35 Twi: 16:14 Moonrise: 18:51 Moonset: 10:16 Day length: 8h 47m	11 Twi: 6:10 Sunrise: 6:50 Sunset: 15:33 Twi: 16:13 Moonrise: 19:51 Moonset: 10:58 Day length: 8h 43m	12 Twi: 6:12 Sunrise: 6:52 Sunset: 15:31 Twi: 16:11 Moonrise: 20:53 Moonset: 11:32 Day length: 8h 40m	13 Twi: 6:13 Sunrise: 6:54 Sunset: 15:29 Twi: 16:10 Moonrise: 21:57 Moonset: 12:01 Day length: 8h 36m	14 Twi: 6:15 Sunrise: 6:55 Sunset: 15:28 Twi: 16:08 Moonrise: 23:01 Moonset: 12:25 Last Qtr: 10:17 Day length: 8h 32m	15 Twi: 6:17 Sunrise: 6:57 Sunset: 15:26 Twi: 16:07 Moonrise: none Moonset: 12:47 Day length: 8h 29m
16 Twi: 6:19 Sunrise: 6:59 Sunset: 15:24 Twi: 16:05 Moonrise: 0:06 Moonset: 13:08 Day length: 8h 25m	17 Twi: 6:20 Sunrise: 7:01 Sunset: 15:23 Twi: 16:04 Moonrise: 1:12 Moonset: 13:28 Day length: 8h 22m	18 Twi: 6:22 Sunrise: 7:03 Sunset: 15:21 Twi: 16:02 Moonrise: 2:19 Moonset: 13:49 Day length: 8h 18m	19 Twi: 6:24 Sunrise: 7:05 Sunset: 15:20 Twi: 16:01 Moonrise: 3:28 Moonset: 14:12 Day length: 8h 15m	20 Twi: 6:26 Sunrise: 7:07 Sunset: 15:18 Twi: 16:00 Moonrise: 4:38 Moonset: 14:38 Day length: 8h 11m	21 Twi: 6:27 Sunrise: 7:09 Sunset: 15:17 Twi: 15:59 Moonrise: 5:49 Moonset: 15:09 Day length: 8h 8m	22 Twi: 6:29 Sunrise: 7:11 Sunset: 15:16 Twi: 15:57 Moonrise: 6:58 Moonset: 15:48 New Moon: 7:33 Day length: 8h 5m
23 Twi: 6:31 Sunrise: 7:13 Sunset: 15:14 Twi: 15:56 Moonrise: 8:04 Moonset: 16:35 Day length: 8h 2m	24 Twi: 6:32 Sunrise: 7:14 Sunset: 15:13 Twi: 15:55 Moonrise: 9:03 Moonset: 17:33 Day length: 7h 59m	25 Twi: 6:34 Sunrise: 7:16 Sunset: 15:12 Twi: 15:54 Moonrise: 9:53 Moonset: 18:40 Day length: 7h 56m	26 Twi: 6:35 Sunrise: 7:18 Sunset: 15:11 Twi: 15:53 Moonrise: 10:35 Moonset: 19:54 Day length: 7h 53m	27 Twi: 6:37 Sunrise: 7:20 Sunset: 15:10 Twi: 15:52 Moonrise: 11:10 Moonset: 21:12 Day length: 7h 50m	28 Twi: 6:39 Sunrise: 7:21 Sunset: 15:09 Twi: 15:51 Moonrise: 11:40 Moonset: 22:31 Day length: 7h 47m	29 Twi: 6:40 Sunrise: 7:23 Sunset: 15:08 Twi: 15:51 Moonrise: 12:07 Moonset: 23:50 First Qtr: 5:07 Day length: 7h 44m

Light Pollution Monitoring Data Format 1.0
URL: http://www.darksky.org/measurements
Number of header lines: 35+
This data is released under the following license: ODbL 1.0 http://opendatacommons.org/licenses/odbl/summary/
Device type: SQM-LU-DL
Instrument ID: TSMC_SQM
Data supplier: TSMC
Location name: Schefferville - Howse Project
Position (lat, lon, elev(m)): 54.799999, -66.833336, 549
Local timezone: America/Montreal
Time Synchronization:
Moving / Stationary position: STATIONARY
Moving / Fixed look direction: FIXED
Number of channels: 1
Filters per channel: HOYA CM-500
Measurement direction per channel: up - zenith
Field of view (degrees): 20
Number of fields per line: 5
SQM serial number: 2913
SQM firmware version: 4-6-32
SQM cover offset value:
SQM readout test ix: i,00000004,00000006,00000032,00002913
SQM readout test rx: r, 08.68m,0000030377Hz,0000000000c,0000000.000s, 004.5C
SQM readout test cx: c,00000019.88m,0000124.363s, 020.3C,00000008.71m, 020.9C
Comment: SQM purchased by AECOM on behlaf of TSMC
Comment: For HOWSE Env Impact Statement
Comment: November 2014
Comment:
Comment:
UDM version: 1.0.0.40
UDM setting: DL Retrieve All
blank line 32
UTC Date & Time, Local Date & Time, Temperature, Voltage, MSAS
YYYY-MM-DDTHH:mm:ss.fff YYYY-MM-DDTHH:mm:ss.fff Celsius Volts mag/arcsec^2
END OF HEADER

Dark point on Goodwood Rd.	**55° 00.7121' N**	**067° 14.7040' W**	**648 m**	**Prise avec Smartphone app**
	55° 00' 43.0" N	**067° 14' 41.6" W**	**651 m**	**Prise avec GPS Garmin**
	55.0118683°	**-067.2450667°**		**Conversion for use in Google Map**

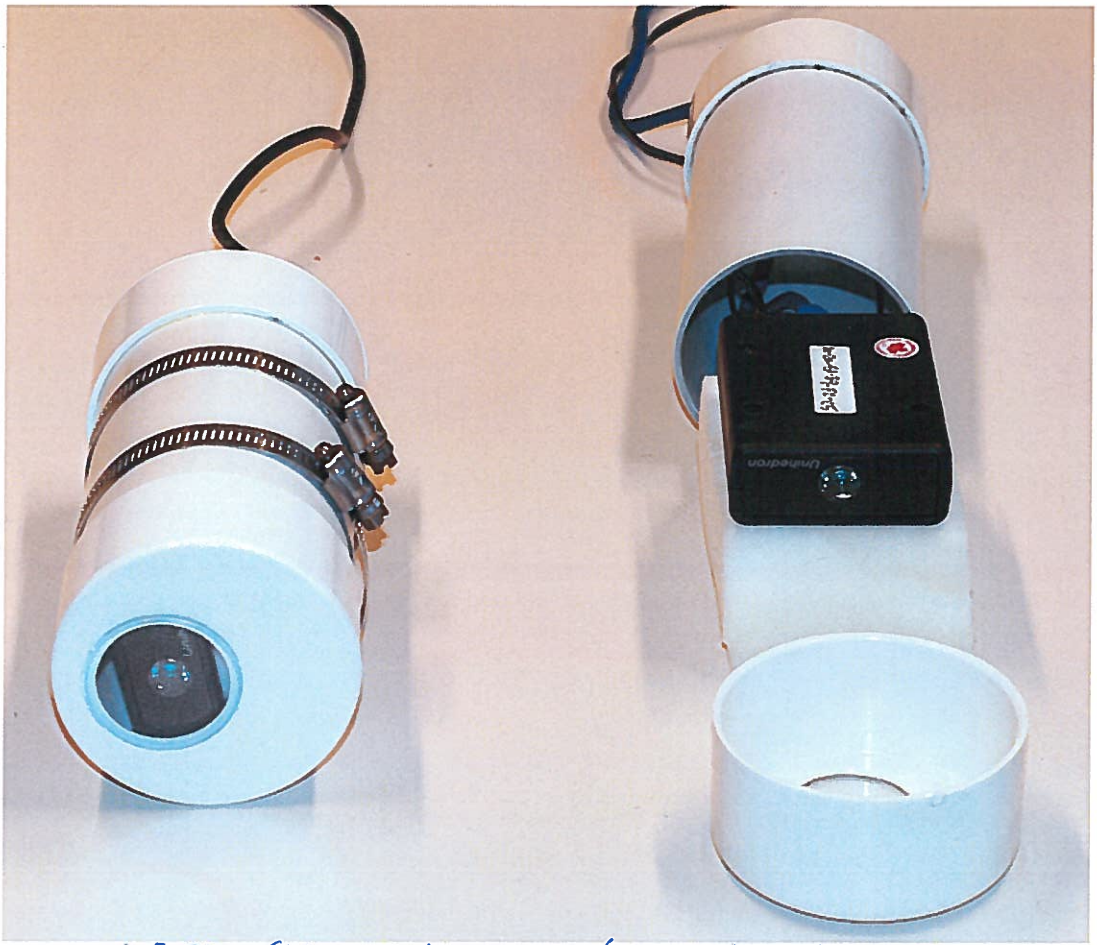
# YYYY-MM-DDTHH:mm:ss.fff	YYYY-MM-DDTHH:mm:ss.fff	Celsius	Volts	mag/arcsec^2	
2014-11-27 at 20:39:08	2014-11-27 at 15:39:08	6.7	4.88	10.92	Dark spot
2014-11-27 at 20:44:08	2014-11-27 at 15:44:08	4.8	4.88	11.78	
2014-11-27 at 20:49:08	2014-11-27 at 15:49:08	1.6	4.88	12.66	
2014-11-27 at 20:54:08	2014-11-27 at 15:54:08	-1.7	4.88	13.53	Twilight 15:52
2014-11-27 at 20:59:08	2014-11-27 at 15:59:08	-4.6	4.88	14.38	
2014-11-27 at 21:04:08	2014-11-27 at 16:04:08	-7.1	4.88	15.15	
2014-11-27 at 21:09:08	2014-11-27 at 16:09:08	-9.4	4.88	15.91	
2014-11-27 at 21:14:08	2014-11-27 at 16:14:08	-11.3	4.88	16.66	
2014-11-27 at 21:19:08	2014-11-27 at 16:19:08	-12.9	4.88	17.29	
2014-11-27 at 21:24:07	2014-11-27 at 16:24:07	-14.2	4.88	17.9	
2014-11-27 at 21:29:07	2014-11-27 at 16:29:07	-15.5	4.88	18.47	
2014-11-27 at 21:34:07	2014-11-27 at 16:34:07	-16.5	4.88	18.91	
2014-11-27 at 21:39:07	2014-11-27 at 16:39:07	-17.5	4.88	19.31	
2014-11-27 at 21:44:07	2014-11-27 at 16:44:07	-18.1	4.88	19.6	
2014-11-27 at 21:49:07	2014-11-27 at 16:49:07	-18.7	4.88	19.94	
2014-11-27 at 21:54:07	2014-11-27 at 16:54:07	-19.1	4.88	20.2	
2014-11-27 at 21:59:07	2014-11-27 at 16:59:07	-19.4	4.88	20.19	
2014-11-27 at 22:04:07	2014-11-27 at 17:04:07	-19.7	4.88	20.14	
2014-11-27 at 22:09:07	2014-11-27 at 17:09:07	-19.7	4.88	19.7	
2014-11-27 at 22:14:07	2014-11-27 at 17:14:07	-19.7	4.88	19.9	
2014-11-27 at 22:19:07	2014-11-27 at 17:19:07	-19.7	4.88	20.13	
2014-11-27 at 22:24:07	2014-11-27 at 17:24:07	-19.7	4.88	19.38	Twilight 15:52 + 1.5 hours
2014-11-27 at 22:29:07	2014-11-27 at 17:29:07	-19.4	4.88	19.51	
2014-11-27 at 22:34:07	2014-11-27 at 17:34:07	-19.1	4.88	20.04	
2014-11-27 at 22:39:07	2014-11-27 at 17:39:07	-19.1	4.88	19.71	
2014-11-27 at 22:44:07	2014-11-27 at 17:44:07	-19.1	4.88	19.73	
2014-11-27 at 22:49:07	2014-11-27 at 17:49:07	-18.7	4.88	20.12	
2014-11-27 at 22:54:07	2014-11-27 at 17:54:07	-18.7	4.88	20.25	
2014-11-27 at 22:59:08	2014-11-27 at 17:59:08	-19.1	4.88	20.35	
2014-11-27 at 23:04:07	2014-11-27 at 18:04:07	-19.1	4.88	20.33	

2014-11-27 at 23:09:07	2014-11-27 at 18:09:07	-19.4	4.88	20.08	
2014-11-27 at 23:14:07	2014-11-27 at 18:14:07	-19.4	4.88	20.07	
2014-11-27 at 23:19:07	2014-11-27 at 18:19:07	-19.7	4.88	20.02	
2014-11-27 at 23:24:07	2014-11-27 at 18:24:07	-19.7	4.88	19.68	
2014-11-27 at 23:29:08	2014-11-27 at 18:29:08	-19.7	4.88	19.51	
2014-11-27 at 23:34:07	2014-11-27 at 18:34:07	-19.4	4.88	19.77	
2014-11-27 at 23:39:07	2014-11-27 at 18:39:07	-19.4	4.88	19.94	
2014-11-27 at 23:44:07	2014-11-27 at 18:44:07	-19.1	4.88	20.17	
2014-11-27 at 23:49:07	2014-11-27 at 18:49:07	-19.1	4.88	20.23	
2014-11-27 at 23:54:07	2014-11-27 at 18:54:07	-19.4	4.88	20.16	
2014-11-27 at 23:59:08	2014-11-27 at 18:59:08	-19.4	4.88	20.2	
2014-11-28 at 00:04:07	2014-11-27 at 19:04:07	-19.4	4.88	20.37	
2014-11-28 at 00:09:07	2014-11-27 at 19:09:07	-19.7	4.88	20.33	
2014-11-28 at 00:14:07	2014-11-27 at 19:14:07	-19.7	4.88	20.19	
2014-11-28 at 00:19:07	2014-11-27 at 19:19:07	-20	4.88	20.04	
2014-11-28 at 00:24:08	2014-11-27 at 19:24:08	-20	4.88	19.88	
2014-11-28 at 00:29:07	2014-11-27 at 19:29:07	-20	4.88	19.95	
2014-11-28 at 00:34:08	2014-11-27 at 19:34:08	-19.7	4.88	20.51	
2014-11-28 at 00:39:07	2014-11-27 at 19:39:07	-19.7	4.88	20.36	
2014-11-28 at 00:44:08	2014-11-27 at 19:44:08	-20	4.88	20.33	
2014-11-28 at 00:49:07	2014-11-27 at 19:49:07	-20	4.88	20.03	
2014-11-28 at 00:54:07	2014-11-27 at 19:54:07	-19.7	4.88	19.99	
2014-11-28 at 00:59:07	2014-11-27 at 19:59:07	-19.7	4.88	19.73	
2014-11-28 at 01:04:07	2014-11-27 at 20:04:07	-19.7	4.88	20.07	
2014-11-28 at 01:09:07	2014-11-27 at 20:09:07	-19.4	4.88	20.08	
2014-11-28 at 01:14:07	2014-11-27 at 20:14:07	-19.4	4.88	20.07	
2014-11-28 at 01:19:07	2014-11-27 at 20:19:07	-19.4	4.88	19.7	
2014-11-28 at 01:24:07	2014-11-27 at 20:24:07	-19.4	4.88	20.09	
2014-11-28 at 01:29:07	2014-11-27 at 20:29:07	-19.4	4.88	19.87	
2014-11-28 at 01:34:17	2014-11-27 at 20:34:17	-19.1	4.88	20.07	
2014-11-28 at 01:39:07	2014-11-27 at 20:39:07	-19.1	4.88	20.43	
2014-11-28 at 01:44:07	2014-11-27 at 20:44:07	-19.1	4.88	20.31	
2014-11-28 at 01:49:07	2014-11-27 at 20:49:07	-19.1	4.88	19.72	
2014-11-28 at 01:54:07	2014-11-27 at 20:54:07	-19.1	4.88	20.4	
2014-11-28 at 01:59:08	2014-11-27 at 20:59:08	-19.1	4.88	20.5	
2014-11-28 at 02:04:07	2014-11-27 at 21:04:07	-19.1	4.88	20.41	
2014-11-28 at 02:09:08	2014-11-27 at 21:09:08	-19.4	4.88	20.44	
2014-11-28 at 02:14:07	2014-11-27 at 21:14:07	-19.4	4.88	20.08	Moonset 21:12
2014-11-28 at 02:19:07	2014-11-27 at 21:19:07	-19.4	4.88	20.35	
2014-11-28 at 02:24:08	2014-11-27 at 21:24:08	-19.1	4.88	20.41	
2014-11-28 at 02:29:07	2014-11-27 at 21:29:07	-19.4	4.88	20.41	
2014-11-28 at 02:34:07	2014-11-27 at 21:34:07	-19.1	4.88	20.23	
2014-11-28 at 02:39:07	2014-11-27 at 21:39:07	-19.4	4.88	20.11	
2014-11-28 at 02:44:07	2014-11-27 at 21:44:07	-19.4	4.88	20.19	
2014-11-28 at 02:49:08	2014-11-27 at 21:49:08	-19.1	4.88	20.19	
2014-11-28 at 02:54:08	2014-11-27 at 21:54:08	-19.1	4.88	20.1	
2014-11-28 at 02:59:07	2014-11-27 at 21:59:07	-19.1	4.88	20.16	
2014-11-28 at 03:04:07	2014-11-27 at 22:04:07	-19.1	4.88	20.15	
2014-11-28 at 03:09:07	2014-11-27 at 22:09:07	-19.1	4.88	20.29	
2014-11-28 at 03:14:07	2014-11-27 at 22:14:07	-19.1	4.88	20.34	
2014-11-28 at 03:19:07	2014-11-27 at 22:19:07	-19.1	4.88	20.28	
2014-11-28 at 03:24:07	2014-11-27 at 22:24:07	-19.1	4.88	20.14	
2014-11-28 at 03:29:07	2014-11-27 at 22:29:07	-19.1	4.88	20.11	
2014-11-28 at 03:34:08	2014-11-27 at 22:34:08	-19.1	4.88	20.25	
2014-11-28 at 03:39:07	2014-11-27 at 22:39:07	-19.1	4.88	20.28	
2014-11-28 at 03:44:07	2014-11-27 at 22:44:07	-19.1	4.88	20.19	
2014-11-28 at 03:49:07	2014-11-27 at 22:49:07	-19.1	4.88	20.43	
2014-11-28 at 03:54:07	2014-11-27 at 22:54:07	-19.1	4.88	20.2	
2014-11-28 at 03:59:07	2014-11-27 at 22:59:07	-19.4	4.88	20.11	
2014-11-28 at 04:04:07	2014-11-27 at 23:04:07	-19.4	4.88	20.23	
2014-11-28 at 04:09:07	2014-11-27 at 23:09:07	-19.4	4.88	20.32	
2014-11-28 at 04:14:07	2014-11-27 at 23:14:07	-19.4	4.88	20.23	
2014-11-28 at 04:19:07	2014-11-27 at 23:19:07	-19.4	4.88	20.39	
2014-11-28 at 04:24:07	2014-11-27 at 23:24:07	-19.4	4.88	19.85	
2014-11-28 at 04:29:07	2014-11-27 at 23:29:07	-19.4	4.88	20.25	
2014-11-28 at 04:34:07	2014-11-27 at 23:34:07	-19.4	4.88	20.2	
2014-11-28 at 04:39:07	2014-11-27 at 23:39:07	-19.4	4.88	20.15	
2014-11-28 at 04:44:07	2014-11-27 at 23:44:07	-19.4	4.88	20.43	
2014-11-28 at 04:49:07	2014-11-27 at 23:49:07	-19.4	4.88	20.09	
2014-11-28 at 04:54:07	2014-11-27 at 23:54:07	-19.4	4.88	20.2	
2014-11-28 at 04:59:08	2014-11-27 at 23:59:08	-19.4	4.88	20.74	

2014-11-28 at 05:04:08	2014-11-28 at 00:04:08	-19.4	4.88	20.56	
2014-11-28 at 05:09:07	2014-11-28 at 00:09:07	-19.4	4.88	20.7	
2014-11-28 at 05:14:08	2014-11-28 at 00:14:08	-19.4	4.88	20.74	
2014-11-28 at 05:19:08	2014-11-28 at 00:19:08	-19.4	4.88	20.76	
2014-11-28 at 05:24:09	2014-11-28 at 00:24:09	-19.4	4.88	20.88	
2014-11-28 at 05:29:09	2014-11-28 at 00:29:09	-19.4	4.88	20.92	
2014-11-28 at 05:34:10	2014-11-28 at 00:34:10	-19.7	4.88	20.92	
2014-11-28 at 05:39:07	2014-11-28 at 00:39:07	-19.7	4.88	20.97	
2014-11-28 at 05:44:07	2014-11-28 at 00:44:07	-19.7	4.88	20.96	
2014-11-28 at 05:49:09	2014-11-28 at 00:49:09	-19.7	4.88	20.92	
2014-11-28 at 05:54:07	2014-11-28 at 00:54:07	-20	4.88	20.97	
2014-11-28 at 05:59:10	2014-11-28 at 00:59:10	-20	4.88	20.95	
2014-11-28 at 06:04:09	2014-11-28 at 01:04:09	-20	4.88	20.92	
2001-01-01 at 01:01:01	2000-12-31 at 20:01:01	-20	4.88	20.98	
2014-11-28 at 06:14:08	2014-11-28 at 01:14:08	-20	4.88	21.05	
2014-11-28 at 06:19:09	2014-11-28 at 01:19:09	-20	4.88	21.15	
2014-11-28 at 06:24:08	2014-11-28 at 01:24:08	-20	4.88	21.07	
2014-11-28 at 06:29:10	2014-11-28 at 01:29:10	-20.4	4.88	21.24	
2014-11-28 at 06:34:10	2014-11-28 at 01:34:10	-20.4	4.88	21.28	
2014-11-28 at 06:21:11	2014-11-28 at 01:21:11	-20.4	4.88	21.33	
2014-11-28 at 06:44:12	2014-11-28 at 01:44:12	-20.7	4.88	21.38	
2014-11-28 at 06:49:11	2014-11-28 at 01:49:11	-20.7	4.88	21.37	
2014-11-28 at 06:54:11	2014-11-28 at 01:54:11	-21	4.88	21.33	
2014-11-28 at 06:59:11	2014-11-28 at 01:59:11	-21	4.88	21.39	
2014-11-28 at 07:04:12	2014-11-28 at 02:04:12	-21.3	4.88	21.42	
2014-11-28 at 07:09:11	2014-11-28 at 02:09:11	-21.3	4.88	21.36	
2014-11-28 at 07:14:09	2014-11-28 at 02:14:09	-21.6	4.88	21.22	
2014-11-28 at 07:19:10	2014-11-28 at 02:19:10	-21.6	4.88	21.27	
2014-11-28 at 07:24:10	2014-11-28 at 02:24:10	-21.6	4.88	21.27	
2014-11-28 at 07:29:09	2014-11-28 at 02:29:09	-21.6	4.88	21.25	
2014-11-28 at 07:34:09	2014-11-28 at 02:34:09	-21.6	4.88	21.2	
2014-11-28 at 07:39:09	2014-11-28 at 02:39:09	-21.6	4.88	21.24	
2014-11-28 at 07:44:10	2014-11-28 at 02:44:10	-21.6	4.88	21.28	
2014-11-28 at 07:49:10	2014-11-28 at 02:49:10	-21.6	4.88	21.32	
2014-11-28 at 07:54:09	2014-11-28 at 02:54:09	-21.6	4.88	21.52	
2014-11-28 at 07:59:11	2014-11-28 at 02:59:11	-21.6	4.88	21.67	
2014-11-28 at 08:04:11	2014-11-28 at 03:04:11	-22	4.88	21.72	
2014-11-28 at 08:09:11	2014-11-28 at 03:09:11	-22.3	4.88	21.74	
2014-11-28 at 08:14:11	2014-11-28 at 03:14:11	-22.6	4.88	21.74	
2014-11-28 at 08:19:11	2014-11-28 at 03:19:11	-22.9	4.88	21.74	
2014-11-28 at 08:24:11	2014-11-28 at 03:24:11	-23.3	4.88	21.74	
2014-11-28 at 08:29:11	2014-11-28 at 03:29:11	-23.6	4.88	21.74	
2014-11-28 at 08:34:10	2014-11-28 at 03:34:10	-24.2	4.88	21.74	
2014-11-28 at 08:39:10	2014-11-28 at 03:39:10	-24.5	4.88	21.74	
2014-11-28 at 08:44:10	2014-11-28 at 03:44:10	-24.9	4.88	21.72	
2014-11-28 at 08:49:14	2014-11-28 at 03:49:14	-24.9	4.88	21.66	
2014-11-28 at 08:54:12	2014-11-28 at 03:54:12	-24.9	4.88	21.57	
2014-11-28 at 08:59:12	2014-11-28 at 03:59:12	-24.9	4.88	21.57	
2014-11-28 at 09:04:11	2014-11-28 at 04:04:11	-24.5	4.88	21.51	
2014-11-28 at 09:09:13	2014-11-28 at 04:09:13	-24.5	4.88	21.57	
2014-11-28 at 09:14:12	2014-11-28 at 04:14:12	-24.2	4.88	21.53	
2014-11-28 at 09:19:11	2014-11-28 at 04:19:11	-23.9	4.88	21.45	
2014-11-28 at 09:24:11	2014-11-28 at 04:24:11	-23.6	4.88	21.47	
2014-11-28 at 09:29:11	2014-11-28 at 04:29:11	-23.6	4.88	21.42	
2014-11-28 at 09:34:11	2014-11-28 at 04:34:11	-23.3	4.88	21.39	
2014-11-28 at 09:39:12	2014-11-28 at 04:39:12	-22.9	4.88	21.47	
2014-11-28 at 09:44:12	2014-11-28 at 04:44:12	-22.6	4.88	21.51	
2014-11-28 at 09:49:13	2014-11-28 at 04:49:13	-22.3	4.88	21.49	
2014-11-28 at 09:54:10	2014-11-28 at 04:54:10	-22.3	4.88	21.35	
2014-11-28 at 09:59:12	2014-11-28 at 04:59:12	-22	4.88	21.46	
2014-11-28 at 10:04:12	2014-11-28 at 05:04:12	-22	4.88	21.47	
2014-11-28 at 10:09:12	2014-11-28 at 05:09:12	-22	4.88	21.46	Twilight 6:39 - 1.5 hours
2014-11-28 at 10:14:12	2014-11-28 at 05:14:12	-22	4.88	21.44	
2014-11-28 at 10:19:12	2014-11-28 at 05:19:12	-21.6	4.88	21.43	
2014-11-28 at 10:24:11	2014-11-28 at 05:24:11	-21.6	4.88	21.35	
2014-11-28 at 10:29:10	2014-11-28 at 05:29:10	-21.6	4.88	21.33	
2014-11-28 at 10:34:09	2014-11-28 at 05:34:09	-21.6	4.88	21.16	
2014-11-28 at 10:39:09	2014-11-28 at 05:39:09	-21.6	4.88	20.95	
2014-11-28 at 10:44:07	2014-11-28 at 05:44:07	-21.6	4.88	20.69	
2014-11-28 at 10:49:07	2014-11-28 at 05:49:07	-21.6	4.88	20.28	
2014-11-28 at 10:54:07	2014-11-28 at 05:54:07	-21.6	4.88	19.83	

2014-11-28 at 10:59:07	2014-11-28 at 05:59:07	-21.6	4.88	19.28	
2014-11-28 at 11:04:07	2014-11-28 at 06:04:07	-21.6	4.88	18.71	
2014-11-28 at 11:09:07	2014-11-28 at 06:09:07	-21.6	4.88	18.05	
2014-11-28 at 11:14:07	2014-11-28 at 06:14:07	-22	4.88	17.38	
2014-11-28 at 11:19:07	2014-11-28 at 06:19:07	-22	4.88	16.66	
2014-11-28 at 11:24:07	2014-11-28 at 06:24:07	-22.3	4.88	15.92	
2014-11-28 at 11:29:07	2014-11-28 at 06:29:07	-22.3	4.88	15.16	
2014-11-28 at 11:34:07	2014-11-28 at 06:34:07	-22.3	4.88	14.38	
2014-11-28 at 11:39:07	2014-11-28 at 06:39:07	-22.3	4.88	13.58	Twilight 6:39
2014-11-28 at 11:44:07	2014-11-28 at 06:44:07	-22.3	4.88	12.76	
2014-11-28 at 11:49:07	2014-11-28 at 06:49:07	-22.6	4.88	11.92	
2014-11-28 at 11:54:07	2014-11-28 at 06:54:07	-22.6	4.88	11.12	
2014-11-28 at 11:59:07	2014-11-28 at 06:59:07	-22.9	4.88	10.35	
2014-11-28 at 12:04:07	2014-11-28 at 07:04:07	-22.9	4.88	9.63	
2014-11-28 at 12:09:07	2014-11-28 at 07:09:07	-22.9	4.88	9.01	
2014-11-28 at 12:14:07	2014-11-28 at 07:14:07	-22.9	4.88	8.46	
2014-11-28 at 12:19:07	2014-11-28 at 07:19:07	-22.6	4.88	7.99	Sunrise 7:21
2014-11-28 at 12:24:07	2014-11-28 at 07:24:07	-22.9	4.88	7.57	
2014-11-28 at 12:29:07	2014-11-28 at 07:29:07	-22.9	4.88	7.22	
2014-11-28 at 12:34:07	2014-11-28 at 07:34:07	-22.6	4.88	6.91	
2014-11-28 at 12:39:07	2014-11-28 at 07:39:07	-22.6	4.88	6.64	
2014-11-28 at 12:44:07	2014-11-28 at 07:44:07	-22.6	4.88	6.44	
2014-11-28 at 12:49:07	2014-11-28 at 07:49:07	-22.9	4.88	6.24	
2014-11-28 at 12:54:07	2014-11-28 at 07:54:07	-22.6	4.88	6.06	
2014-11-28 at 12:59:07	2014-11-28 at 07:59:07	-22.9	4.88	5.92	
2014-11-28 at 13:04:07	2014-11-28 at 08:04:07	-22.6	4.88	0	
2014-11-28 at 13:09:07	2014-11-28 at 08:09:07	-22.9	4.88	0	
2014-11-28 at 13:14:07	2014-11-28 at 08:14:07	-22.6	4.88	0	
2014-11-28 at 13:19:07	2014-11-28 at 08:19:07	-22.3	4.88	0	
2014-11-28 at 13:24:07	2014-11-28 at 08:24:07	-22.6	4.88	0	
2014-11-28 at 13:29:07	2014-11-28 at 08:29:07	-22.3	4.88	0	
2014-11-28 at 13:34:07	2014-11-28 at 08:34:07	-22	4.88	0	
2014-11-28 at 13:39:07	2014-11-28 at 08:39:07	-22.3	4.88	0	
2014-11-28 at 13:44:07	2014-11-28 at 08:44:07	-22.6	4.88	0	
2014-11-28 at 13:49:07	2014-11-28 at 08:49:07	-22	4.88	0	
2014-11-28 at 13:54:07	2014-11-28 at 08:54:07	-22	4.88	0	
2014-11-28 at 13:59:07	2014-11-28 at 08:59:07	-22	4.88	0	
2014-11-28 at 14:04:07	2014-11-28 at 09:04:07	-21.6	4.88	0	
2014-11-28 at 14:09:07	2014-11-28 at 09:09:07	-21	4.88	0	
2014-11-28 at 14:14:07	2014-11-28 at 09:14:07	-21.3	4.88	0	
2014-11-28 at 14:19:07	2014-11-28 at 09:19:07	-21.3	4.88	0	
2014-11-28 at 14:24:08	2014-11-28 at 09:24:08	-21	4.88	0	
2014-11-28 at 14:29:07	2014-11-28 at 09:29:07	-21.3	4.88	0	
2014-11-28 at 14:34:07	2014-11-28 at 09:34:07	-21.3	4.88	0	
2014-11-28 at 14:39:07	2014-11-28 at 09:39:07	-20.7	4.88	11.34	Back in the truck
2014-11-28 at 14:44:07	2014-11-28 at 09:44:07	-17.8	4.88	11.64	
2014-11-28 at 14:49:08	2014-11-28 at 09:49:08	-13.3	4.88	11.39	
2014-11-28 at 14:54:08	2014-11-28 at 09:54:08	-9.4	4.88	11.59	
2014-11-28 at 14:59:08	2014-11-28 at 09:59:08	-5.9	4.88	11.61	
2014-11-28 at 15:04:08	2014-11-28 at 10:04:08	-3	4.88	11.4	
2014-11-28 at 15:09:08	2014-11-28 at 10:09:08	-0.4	4.88	11.59	
2014-11-28 at 15:14:08	2014-11-28 at 10:14:08	1.2	4.88	10.52	
2014-11-28 at 15:19:08	2014-11-28 at 10:19:08	2.5	4.88	0	
2014-11-28 at 15:24:08	2014-11-28 at 10:24:08	3.2	4.88	6.75	
2014-11-28 at 15:27:41	2014-11-28 at 10:27:41	4.5	5.04	8.64	

SCHEFFERVILLE AT NIGHT 26-NOV-14



UNIMEDRON SKY QUALITY METER (GENERIC IMAGE)

SQM AT DARK POINT ON 2nd GOODWOOD RD. - 27/NOV/14

NIGHT PICTURE FROM HOUSE LOOKING TOWARDS MAN PLANT - 26/NOV/14