40.4883.R3:ZSC

24th November, 2010

Communities NSW
Locked Bag 1422
SILVERWATER NSW 2128

Attention: Mr D. Clout

ACOUSTIC COMPLIANCE TESTING
SOUTHERN HIGHLANDS REGIONAL SHOOTING COMPLEX
WATTLE RIDGE ROAD, HILL TOP

The purpose of this report is to present the results of an acoustic compliance test carried out in relation to operations of the existing 800 metre range at the Southern Highlands Regional Shooting Complex.

The Southern Highlands Shooting Complex is required under conditions of consent from the Minister of Planning to undertake acoustic compliance monitoring of noise emission from the existing rifle range.

Noise measurements for shooting ranges have since the early 1980s been based on a "Linear Peak Hold" measurement. This descriptor indicates the absolute maximum level measured using a Linear (no weighting) frequency response.

Typical noise level measurements for general noise matters utilise the A-weighting response. The A-weighted filter has rise times that are too slow for a peak impulse from a rifle shot and therefore cannot be used for the measurements of rifles.

Utilising the Linear Peak Hold method results in the measurement of pressure fluctuations (including the wind).Testing undertaken by GHD In June 2010 was subject to excessive wind that on examination of previous testing results made the "compliance" measurement results somewhat questionable.

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To this end a site visit was carried out on Saturday 9th October 2010 and Sunday 10th October 2010 to conduct compliance testing of the existing range operations at reference locations in Hill Top. Supplementary measurements were conducted at locations between the range and Hill Top (utilising the cleared area under power lines) to provide an identification of the number of shots occurring at the same time.

Additional short term measurements were conducted on Sunday 14th November 2010 at two of the residential locations.

Measurement Techniques

For the purpose of compliance testing, measurements were conducted as unattended and attended measurements.

Attended sound level measurements in the residential area of Hill Top were carried out using three Bruel & Kjaer Modular Sound Level Meters Type 2260 with Sound Enhanced Software Package BZ7206. One meter is NATA Calibrated and the other two meters are calibrated to manufacturer's standards. All meters hold current calibration certificates.

Attended measurements at the various power line locations and the residence west of the range (location A4) used a Larson Davis LD831 Sound Level Meter. The meter holds current calibration to manufacturer's standards.

Unattended measurements were conducted using two SVAN 957 Sound Level Meter and one BWSA 801 Sound Level Meter with the data being recorded for subsequent analysis. These sound level meters all have current calibration to manufacturer's standards.

All sound level meters are classified as Type 1 meters.

The reference calibration level of each meter was checked prior to and after measurements with a NATA Calibrated Bruel & Kjaer Sound Level Calibrators Type 4231.

All attended measurements incorporated time splice recording for subsequent analysis if required.

Measurement Procedures & Results

Appendix A shows the location of the Southern Highlands Shooting Complex off Wattle Ridge Road. The Google map shows the existing 800 metre range and 8 measurement locations used for the compliance testing.

The nature of the distance from the range to the residential receiver locations A1, A2, A3, A4 and B2 (reference locations identified by GHD) can result in many of the shots being inaudible. Providing a logarithmic average of the measured levels without identifying the number of inaudible (or un-measureable shots that were audible) provides an incorrect average.

Accordingly unattended (logger) measurements were recorded using ½ second sampling at intermediate locations L1, L2 & L3 to provide an indication of the number of shots.

Due to the propagation of noise associated with the discharge of a firearm, for a constant distance to the side of a range the noise level measured perpendicular to the firing position will be lower than for a location on the same distance to the side and forward of the firing position.

As the targets remain in a fixed position, the use of different firing distances involves the firing position moving back from the targets. Therefore for fixed receiver locations there can be a significant difference in noise levels – dependent upon the firing position, which can vary from day to day and even on a single day.

For the distances to residential receivers used in this compliance test the influence of ambient noise and wind can result in peak hold linear levels greater than that of shooting.

It is noted that there is some confusion in the GHD reports as to identification of the location in Starlight Place (location B2). For some firing positions Location B2 appears to be the nearest residential boundary location to the existing (and future) range, and is considered by some residents to be the most critical/nearest residential receiver location.

The B2 location was identified by GHD as a test site for military weapons and became a request for monitoring from residents. In one GHD report location B2 is identified as A2 with a description of Rocky Holes Road. On this basis the compliance monitoring for this test program utilised GHD locations B2 and A2, that were then were supplemented by a spot check on another day for locations A1 & A2. It is note that during the principal testing regime the monitoring staff at the Hill Top residential locations were approached by residents to ascertain on what basis testing was being conducted (principally for whom).

Whereas instrumentation used in the 1980s and 1990s had dedicated peak hold detectors with a manual push button release, modern instrumentation no longer has such facilities. Testing that I have conducted at a number of rifle ranges to compare different digital instrumentation has found the display of peak hold values on some instruments to be inconsistent – hence in my opinion requiring the need for attended measurements at residential locations and time splice recordings as a backup.

In view of the need to obtain Linear Peak Hold measurements each B & K 2260 meter was set to measure and display the Linear Peak Hold value with the observer at each location manually writing down the results (level and time) when a shot was audible. At times a shot may be audible but show no measureable increase on the meter.

The B & K 2260 meter display provides the maximum value in each second and permits identification of the noise level, whereas other digital displays have different updates and may not actually show the maximum level. Furthermore it is essential to utilise attended measurements at critical residential locations in view of the ambient noise and wind in the area that can give rise to levels higher than shooting.

Use of the unattended meter time splice recordings necessitates manual processing of the data.

On the Saturday 9th October 2010 measurements there was negligible wind in the morning during shooting of Rimfire off the 100 metre firing position.

The Saturday afternoon shooting was associated with the Full Bore discipline (predominately .303, .308 and .223 calibres) from the 300 metre position with occasional wind puffs up to 3 km/hr from the NE being recorded with a portable wind speed meter. At times this light wind produced ambient peak hold levels at the residential receiver locations greater than that of shooting.

On the Sunday 10th October measurements shooting occurred in the morning being Full Bore operations (.303, .308 and .223 calibres) from the 300 metre firing position. There was a W wind present that varied from 4 to 12 km/hr. The shooting finished at midday. Some of the measured levels were influenced by the wind. Accordingly test location A4 was not measured on that day.

On Sunday 14th November attended monitoring at two residential locations recorded levels for shooting at the 200 metre position. The calibres used that morning were .308, .22, .250 and .223. There was a light NW wind that varied from 0 – 7 km/hr at the monitoring locations and influenced some of the results.

Appendix B sets out the results of the Saturday 9th October 2010 attended monitoring in relation to the 4 residential assessment locations. The results for the operator observed levels correlated with the audible shot. The basis time period for attended monitoring was 1 hour for locations A2, B2 and A3.

The results of the unattended monitoring utilised the time splice graphs (with some attended monitoring). To overcome the ambient noise influence that may give a false reading, the time splice graphs synchronised the Linear Peak Hold results with the A-weighted Peak Hold results to obtain the level attributed to the shot. For assessment purposes the peak levels that have an equivalent a-weighted peak level above 40 dB(A) were noted. On this basis the time splice graphs permit identification of the shooting events (see Appendix E).

Appendix C sets out the results of the monitoring on Sunday 10th October 2010. The wind increase in the morning period and no shooting occurred after 11.30am. The attended monitoring locations covered a 1- 1½ hour period of shooting.

Appendix D sets out the results of the short monitoring on Saturday 14th November 2010 for 15 minute samples. There were wind gusts during that sample that influenced the results.

Assessment Criteria

Under the Noise Control Act 1975 rifle and pistol shooting ranges were classified as Scheduled Premises and the matter of responsibility for noise lay with the State Pollution Control Commission.

In the early 1980s the SPCC convened a State Shooter's Liaison Committee to address noise emission from ranges. Noise criteria suggested by the National Acoustics Laboratories for Commonwealth rifle ranges recommended the use of Linear (Un-weighted) Peak Hold based on a large number of shots per day. Extrapolation of the data indicated a sliding scale of noise levels per number of shots/days per week.

I prepared a draft set of guidelines based upon the NAL criteria and testing at various ranges that was then amended by the SPCC and issued as the noise limits set out in Chapter 164 in the SPCC's *Environmental Noise Control Manual.*

Various ranges were assessed by the SPCC/State Shooter's Liaison Committee under the guideline (attached) that provided practical use of the guideline and clarification of the use of the guideline.

Many ranges are multi-disciplinary ranges that are utilized on different days/nights. In such cases since the issue of the guideline the SPCC/EPA procedure has been to determine the energy (logarithmic) average of each firearm classification. For multi-discipline ranges there will be a range of noise levels for the different types of firearms/ranges leading to different permissible operating days per week.

The SPCC became the EPA, then the DEC, then the DECC and at present the DECCW. With the change to the EPA and then the introduction of the *Protection of the Environment Operations Act* rifle and pistol target shooting ranges were removed from the list of Scheduled Premises, thereby placing the responsibility for noise with the Council. Additional noise policy guidelines from the EPA/DEC/DECC/DECCW have replaced the Environmental Noise Control Manual have not provided any new noise limits for pistol and rifle ranges.

The following table provides a summary of the range of noise levels identified in Appendices B, C & D.

TABLE 1: Linear Peak Hold Levels

Shooting Position	Discipline	Location	Measured Shooting Levels			
			Min	Max	Log Ave	No of shots
Saturday 9th October 2010						
100m	Rimfire	A2	55	74	69	32
		B2	55	69	63	19
		A3	NA	NA	NA	0
		A4	NA	NA	NA	0
		L1	58	81	70	97

Shooting Position	Discipline	Location	Measured Shooting Levels			
			Min	Max	Log Ave	No of shots
300m	Big Bore	A2	65	80	74	59
		B2	54	77	69	68
		A3	65	68	68	4
		A4	61	63	62	2
		L1	82	107	101	439
		L2	63	103	95	513
		L3	61	104	95	438
Sunday 10th October 2010						
300m	Mixed	A2	65	71	68	4
		B2	52	62	59	6
		A3	NA	NA	NA	0
		L1	79	103	91	114
		L2	70	109	103	216
		L3	60	91	81	296
Sunday 14th November 2010						
200m	Mixed	A1	65	77	74	28
		B2	63	80	76	7

Comparison of the number of shots detected at the residential reference locations with that recorded at the unattended locations reveals a significant number of shots were inaudible at the residential locations. Accordingly the derivation of a logarithmic average of the shots to be compared with the SPCC Guidelines requires an identification of the number of shots not detected, as to omit those shots would overestimate the noise contribution.

As can be seen in Table 1 the intermediate locations along the power line received a different number of total shots for over the same monitoring period, which is to be expected for different types of firearms and locations to the side of a firing range.

The physical separation of the monitoring locations and the logistics involved in getting the observers to the monitoring locations resulted in different monitoring time periods for the residential monitoring locations versus the unattended monitoring locations (which ran for longer periods).

By use of the time splice graphs I have ascertained the number of shots that occurred during the monitoring period at the residential locations in Hill Top. From that material I have determined the number of shots that correspond to the Hill Top locations (for the unattended monitoring that went for a longer period for the Saturday afternoon) or extrapolated the shorter sample times to that of the Hill Top residential locations (for the Saturday and Sunday mornings), as follows:

TABLE 2: Linear Peak Hold Levels

Shooting Position	Discipline	Location	Measured Shooting Levels				No shots		
			Min	Max	Log Ave	No of shots	L1	L2	L3
Saturday 9th October 2010									
100m	Rimfire	A2	55	74	69	32	291		
		B2	55	69	63	19	194		
		A3	NA	NA	NA	0	145		
		A4	NA	NA	NA	0	44		
300m	Big Bore	A2	65	80	74	59	121	155	148
		B2	54	77	69	68			
		A3	65	68	68	4			
		A4	61	63	62	2			
Sunday 10th October 2010									
300m	Mixed	A2	65	71	68	4	55	120	95
		B2	52	62	59	6	30	50	45
		A3	NA	NA	NA	0			

The operation of a multi-disciplinary range leads to different noise levels for the different classification (or grouping) of firearms which will also change as the firing positions change.

Therefore is terms of assessing the acoustic compliance of an existing or future range one needs to identify the classification of the weapons being used and the position from which shooting occurs.

On a statistical basis for compliance testing (separately from site selection) the more shots fired the more meaningful the logarithmic average.

The results in Table 1 provide the logarithmic average of the shots actually heard at the residential monitoring sites and were in fact significantly less than the actual number of shots fired. For the purpose of evaluating the logarithmic average of the shots and as the lowest Peak Hold Linear level measured at the residential locations was 52 dB for the purpose of this assessment I have considered the inaudible/unmeasurable shots to have a level of 50 dB.

Table 3 below provides the logarithmic average at the residential locations in terms of the average of the measured shots measured, and an average of the total shots fired in the same period of attendance at the residential monitoring location (on the basis as described in the preceding paragraph) for the first two days of testing.

The short term testing on Sunday 14th November 2010 is excluded from such an evaluation as there was no intermediate location to identify the number of shots and the wind produced Peak Hold Linear levels greater than that generated by the shooting. The testing was for comparison purposes between A1 and B2 identify by GHD in the compliance report as A2) and in view of the weather at the time would not be used for compliance testing.

TABLE 3: Logarithmic Average - Peak Hold Levels

Shooting Position	Discipline	Location	Measured		Total Shots Fired	
			Log Ave	No of shots	Log Ave	No of shots
Saturday 9th October 2010						
100m	Rimfire	A2	69	32	60	291
		B2	63	19	55	194
		A3	NA	0		
		A4	NA	0		
300m	Big Bore	A2	74	59	70	155
		B2	69	68	66	155
		A3	68	4	54	155
		A4	62	2	51	155
Sunday 10th October 2010						
300m	Mixed	A2	68	4	55	120
		B2	59	6	53	50
		A3	NA	0		

The SPPC Guidelines provide a range of days shooting versus noise levels for both existing ranges and future ranges. The range used at the complex is an existing range and has been in existence for many years. The range has different firing positions and therefore can have different noise emission levels depending upon the bench at which firing occurs.

Approval has been given for additional firing ranges at the complex which will be located further away from Hill Top and therefore would automatically fall under the future range classification.

With respect to the SPCC Guideline for an existing range on the basis of the actual measured levels, Rimfire at 100 metres, Mixed Use from 300 metres and Big Bore from 300 metres would be permitted seven days shooting a week. If one evaluates the average level on the basis of the total number of shots then the existing range would be permitted to operate 7 days a week.

With respect to the SPCC Guideline for a future range on the basis of the actual measured levels, Rimfire at 100 metres would be permitted seven days shooting a week. Mixed use from 300 metres would be permitted five days shooting a week and Big Bore from 300 metres would be permitted four days shooting a week. If one evaluates the average level on the basis of the total number of shots then the existing range under a future range classification would be permitted to operate Rimfire off 100 metres and Mixed Use off 300 metres 7 days a week, with Big Bore off 300 metres permitted 5 days a week.

Conclusion

Compliance testing of the Southern Highlands regional Sporting complex was conducted by GHD in June 2010 under excessive wind conditions that should have automatically cancelled any testing program.

Compliance testing was carried out on Saturday 9th October 2010 under suitable weather conditions and testing on the morning of Sunday 10 the October under weather conditions that deteriorated towards the end of the testing.

The results of the testing are set out in the attached Appendices with the range of measured levels identified in Table 1.

The assessment procedure for rifle ranges adopted by the SPCC since the 1985 utilises an energy (logarithmic) average which was not identified by GHD as the correct method of assessment.

The SPCC guidelines provide an existing range and a future range classification in terms of a sliding scale for the number of days, dependent upon the noise level and daytime operations or night time operations.

Utilising the shooting noise guidelines issued by the SPCC/EPA when such premises were Scheduled Premises under the Noise Control Act (and its derivatives) there is no issue with respect to current operations of the Range for the firing positions that were monitored.

The logarithmic average of the actual measured levels was found to be less than the 75 limit that permits 7 days and 2 nights usage per week for an existing range.

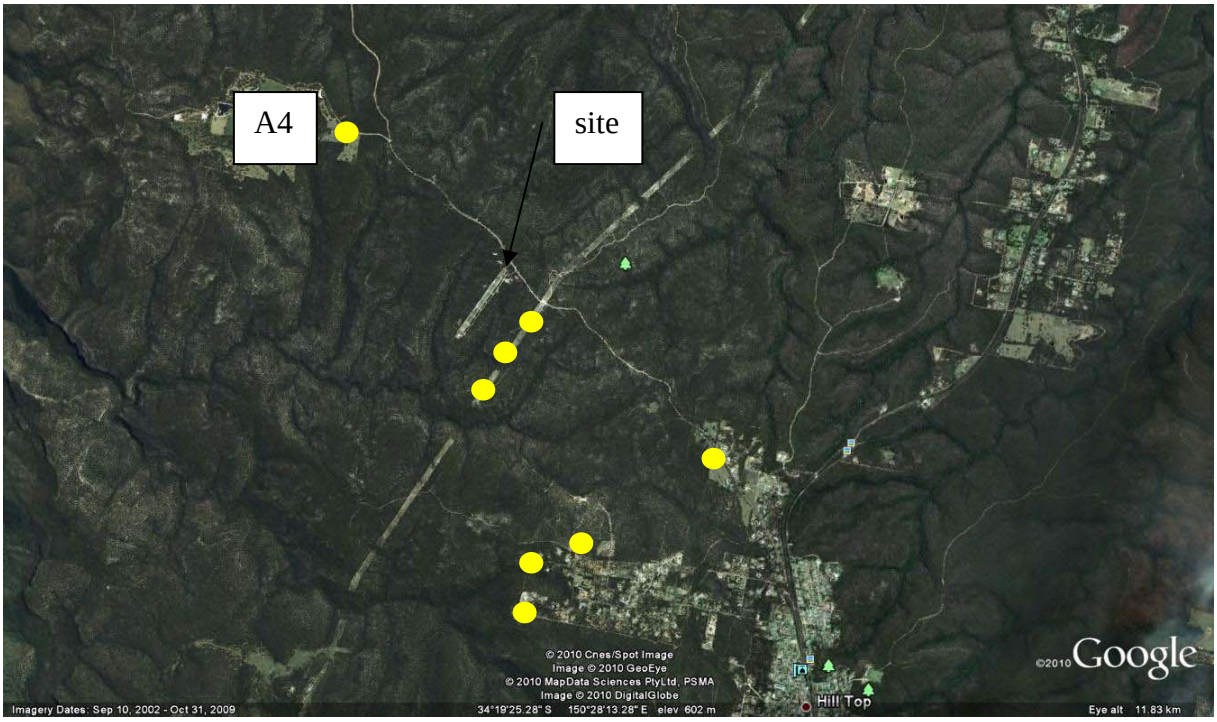
We trust the above satisfies your immediate requirements.

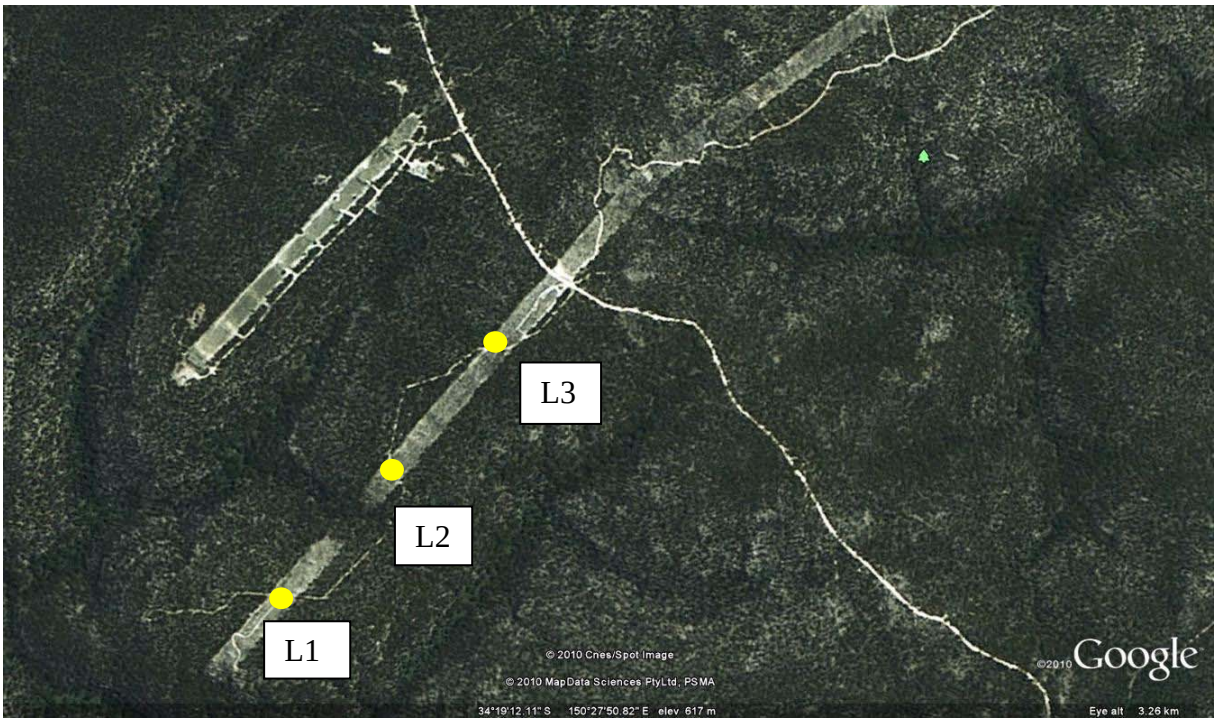
Yours faithfully,

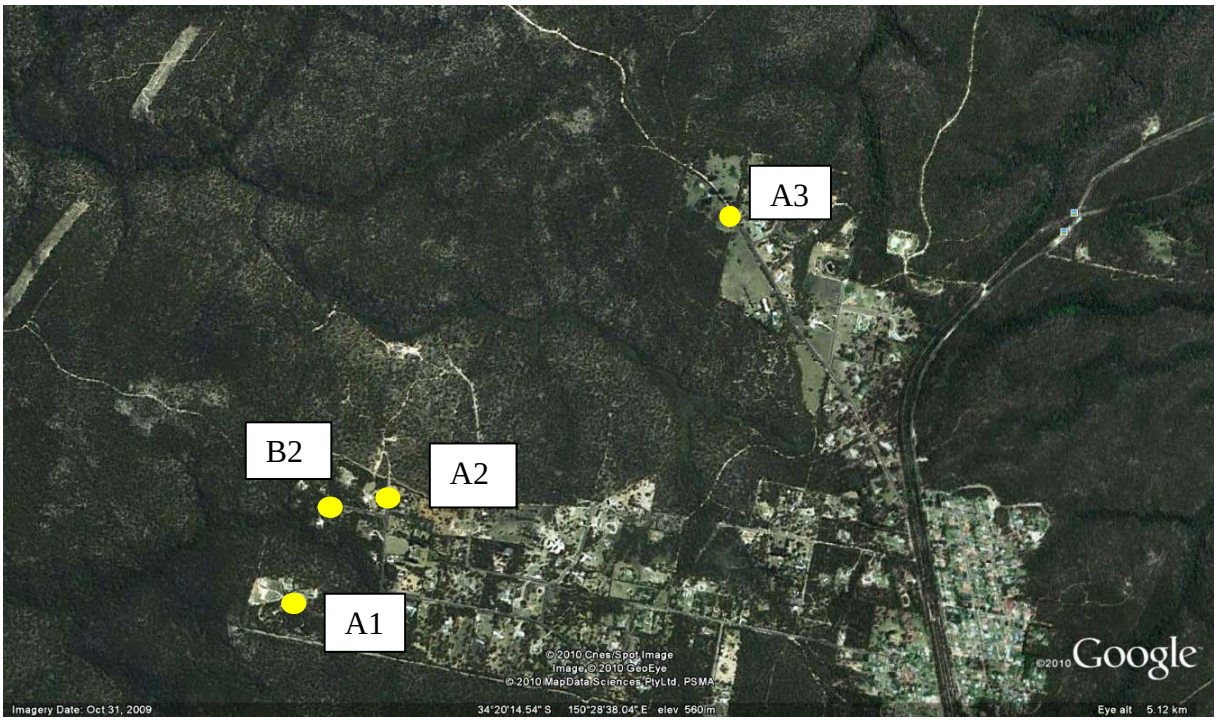
THE ACOUSTIC GROUP PTY LTD

STEVEN E. COOPER

APPENDIX A: Measurement Locations






A3
B2
A2
A1
© 2010 Cnes/Spot Image
Image © 2010 GeoEye
© 2010 MapData Sciences Pty Ltd, PSMA
©2010 Google
Imagery Date: Oct 31, 2009
34°20'14.54" S 150°28'38.04" E elev 560 m
Eye alt 5.12 km

APPENDIX B: Measurement Results – Saturday 9th October 2010

Location L1 (Svan) - Rimfire

70	64	63	66	62	66	73	66	73	66
73	66	71	78	65	66	69	66	61	66
65	61	62	61	62	69	68	72	71	68
65	68	67	75	75	74	72	65	73	68
64	67	64	74	66	71	78	72	65	75
70	63	65	68	68	72	77	68	73	68
66	64	71	68	66	64	70	68	69	69
62	62	70	63	60	64	60	60	59	60
61	64	63	63	63	61	58	61	79	64
81	64	67	67	64	71	66			

Log average 70 over 97 shots (observations for 30 minutes)

Location A2 – Rimfire

64	70	62	65	65	61	55	63	66	68
67	67	68	67	62	68	74	73	76	74
66	70	62	66	60	62	69	69	67	71
64	68								

Log average 69 over 32 shots (observations for 1 ½ hours)

Location B2– Rimfire

69	62	68	56	62	68	60	61	55	61
60	60	58	57	64	61	60	58	64	

Log average 63 over 19 shots (observations for 1 hour)

Location A3– Rimfire

No shots detected (observations for 45 minutes)

Location A4– Rimfire

No shots detected (observations for 15 minutes)

Location L1 (Svan) - Big Bore

87	90	88	84	90	92	82	92	89	96
92	89	93	90	92	92	103	94	87	89
86	87	91	90	91	92	91	93	91	89
90	89	89	84	88	93	88	107	103	99
101	92	96	99	101	92	96	99	98	95
99	100	98	107	102	93	99	97	97	100
94	97	100	96	92	93	98	100	92	94
99	95	100	93	96	95	84	102	99	95
95	93	105	97	93	95	92	96	90	95
93	93	91	95	91	99	98	98	91	95
100	94	93	91	97	92	92	98	91	96
92	93	88	89	90	86	95	91	94	89
93	89	91	95	95	95	89	94	85	88
94	86	90	90	90	91	86	89	92	89
99	91	95	93	95	92	96	96	97	105
102	97	92	88	92	93	94	93	101	86
92	90	101	94	93	89	95	89	94	93
102	94	99	96	96	94	97	105	97	96
90	99	99	94	100	96	92	96	95	98
99	95	92	86	85	90	89	92	98	99
97	95	95	90	89	96	98	92	93	101
93	92	94	96	96	91	97	97	94	94
97	92	92	93	94	92	92	94	89	90
94	88	92	95	96	98	92	94	92	94

95	96	92	99	89	100	96	94	97	95
92	101	97	91	87	90	102	88	95	91
93	88	94	92	93	86	88	89	88	91
90	89	95	93	92	91	89	94	92	94
93	92	89	90	94	101	101	91	88	90
100	89	98	94	94	91	94	93	94	98
95	93	96	83	92	91	90	88	95	90
91	92	89	91	93	87	92	93	96	94
92	93	86	96	89	94	93	87	93	93
92	98	90	90	95	86	94	93	83	87
90	87	91	89	94	96	88	88	98	98
89	99	95	87	90	83	88	92	92	98
96	102	91	103	97	95	96	93	99	89
87	93	94	89	91	87	91	96	91	89
86	91	88	88	92	91	89	88	91	89
88	88	92	91	89	88	91	91	100	90
87	94	96	87	93	88	96	95	93	95
85	98	85	92	87	80	97	97	81	91
85	101	88	97	85	94	86	90	97	85
94	86	90	97	85	94	99	95	97	

Log average 101 over 439 shots (monitoring for 3 hours)

Location L2 (Svan) - Big Bore

77	81	78	67	72	83	76	92	76	66
70	63	74	74	82	85	94	93	87	66
90	79	80	80	88	77	72	78	91	80
75	87	85	80	70	69	82	79	80	71
74	65	78	77	77	77	71	85	72	80

76	85	80	79	84	83	85	79	82	82
92	81	85	73	81	78	76	77	88	92
85	92	95	91	81	80	76	82	78	100
90	86	88	86	94	99	94	94	91	81
82	94	92	76	88	89	86	82	84	88
90	91	89	93	85	87	89	86	88	87
86	88	89	90	79	74	74	76	71	79
75	71	69	73	85	88	70	80	85	90
85	87	85	86	79	86	88	87	90	84
88	86	86	83	85	80	81	89	70	82
91	86	83	85	87	90	86	86	73	79
86	80	97	98	92	86	92	97	87	93
83	88	97	86	88	96	76	85	82	97
94	87	85	86	93	89	89	94	98	99
101	98	93	100	85	95	103	90	86	83
75	83	86	99	89	98	93	91	92	100
91	81	80	88	82	76	84	79	75	79
81	78	89	83	74	87	81	94	94	75
85	82	93	88	84	80	92	86	89	88
81	86	84	86	96	94	85	83	87	83
83	79	84	92	93	78	81	97	87	93
96	99	89	95	92	94	94	90	90	94
89	96	93	102	92	87	101	93	96	94
89	90	85	86	87	73	86	75	88	78
87	78	83	84	80	83	92	86	84	89
91	84	80	95	90	94	92	86	83	81
92	81	82	91	82	83	84	80	81	80
88	81	85	85	86	86	89	85	85	81
88	86	86	88	79	90	72	84	83	70

82	83	73	73	83	76	72	80	92	94
86	85	81	69	82	75	80	83	79	69
83	84	79	95	82	76	83	82	82	81
92	86	81	77	82	80	73	73	80	75
90	93	85	77	80	89	84	75	85	83
85	82	92	95	88	84	84	77	79	74
84	90	87	80	87	85	81	82	88	83
88	79	78	80	82	84	85	85	79	85
83	93	92	81	85	82	85	69	83	76
86	88	82	86	79	84	81	85	82	77
78	85	78	82	77	83	77	82	80	82
85	81	76	82	79	75	77	79	81	82
88	83	84	86	80	85	76	84	91	82
84	79	88	82	73	70	84	85	69	77
72	63	68	74	79	77	77	82	83	81
83	75	74	69	73	72	83	82	82	75
74	83	68	68	84	79	74	83	79	76
82	82	81							

Log 95 average over 513 shots (monitoring for 3½ hours)

Location L3 (BWSA) - Big Bore

85	71	67	66	77	70	71	71	67	81
81	91	85	76	65	78	76	73	81	94
91	92	75	95	91	92	92	92	79	94
88	83	87	73	79	69	70	84	79	69
67	64	69	70	65	84	75	80	70	68
65	72	75	68	70	67	61	67	81	83
76	70	75	70	74	76	85	82	69	72
71	72	66	72	76	83	77	78	85	71

79	73	76	80	75	89	86	73	83	91
88	84	83	85	97	88	91	90	98	79
73	74	77	86	83	80	84	85	82	78
78	79	78	73	72	83	78	76	77	77
83	75	72	75	83	90	83	76	75	87
92	88	91	90	85	88	80	84	80	79
84	66	69	79	82	79	80	82	66	73
102	82	76	77	87	77	80	71	84	77
94	89	91	84	77	69	85	77	78	83
86	76	75	81	88	88	83	93	78	86
82	87	94	99	100	93	87	101	95	95
83	100	75	75	77	77	65	65	68	76
77	68	79	65	96	95	92	84	91	88
89	99	89	90	82	79	107	85	79	84
72	87	65	77	80	83	88	92	91	84
104	92	102	95	101	99	99	93	88	84
89	77	98	80	93	94	95	92	92	72
85	102	97	89	77	65	71	72	69	85
78	70	89	84	80	83	73	72	74	95
70	72	65	73	73	82	84	71	70	70
79	77	81	82	72	67	68	63	78	75
73	65	68	71	72	72	74	64	72	76
70	70	68	69	84	76	70	71	74	69
74	71	67	64	69	66	66	70	74	72
72	75	69	71	71	68	65	63	68	75
69	68	62	70	73	79	91	71	81	87
83	90	83	70	68	71	68	71	65	63
65	68	68	81	83	83	85	89	83	84
78	95	73	76	83	81	84	73	68	67

80	75	62	70	66	78	69	69	72	75
95	68	71	73	79	89	84	79	74	78
67	80	89	99	82	82	84	94	82	83
87	91	86	89	91	90	87	80	76	69
84	70	72	69	70	81	75	72	73	71
69	65	70	68	63	75	67	61	71	72
67	73	73	68	69	63	67	63		

Log average 95 over 438 shots (monitoring for 3 hours)

Residential Location A2 – Big Bore

78	70	71	67	62	68	67	71	66	70
70	68	73	80	65	71	71	67	72	69
70	70	67	65	78	69	72	75	79	72
72	78	80	72	71	69	71	75	73	71
71	67	69	69	75	74	73	82	79	72
77	77	71	77	78	79	62	77	68	

Log average 74 over 59 shots (observations for 1½ hours)

Residential Location B2 – Big Bore

71	64	63	63	67	66	60	64	68	70
61	59	54	62	59	68	67	59	75	72
64	59	61	68	72	70	76	69	67	67
75	68	61	64	68	67	71	67	67	70
69	72	70	73	59	71	73	65	65	66
63	64	68	62	67	67	64	64	74	63
71	77	66	67	71	74	74	65		

Log average 69 over 68 shots (observations over 1½ hours)

Residential Location A3 – Big Bore

68	65	68	68

Log average 68 over 4 shots (observations for 1 hour)

Residential Location A4 – Big Bore

61	63

Log average 62 over 2 shots (observations for 15 minutes)

APPENDIX C: Sunday 10th October 2010

L1 Svan

87	94	86	84	79	83	85	92	82	81
96	91	87	85	80	90	92	93	90	90
103	102	91	91	93	90	93	89	89	97
93	86	93	88	87	81	84	87	94	83
86	87	87	87	92	84	93	91	81	82
90	86	85	81	92	95	85	83	86	85
92	87	88	81	82	82	77	83	81	88
86	83	82	85	80	84	84	78	80	84
81	82	82	80	91	90	89	88	90	89
95	98	97	96	88	89	91	91	91	83
86	84	89	89	88	90	89	83	85	82
94	83	82	84						

Log average 91 over 114 shots (monitoring for 1½ hours)

L2 SVAN

79	70	72	108	98	87	102	106	99	101
84	82	102	98	103	99	92	99	96	89
84	78	78	77	101	87	88	93	81	80
83	98	99	103	89	80	104	89	84	87
102	104	93	86	90	93	78	88	76	84
86	80	80	92	95	99	80	84	92	79
96	108	94	78	76	78	71	86	79	81
82	80	81	81	89	90	82	89	89	82
83	80	82	74	71	81	84	77	91	81

98	100	92	92	101	102	106	102	104	101
103	96	97	104	100	94	94	86	73	82
91	95	90	102	89	93	101	103	102	106
92	100	87	94	105	88	90	90	89	84
78	80	75	84	78	80	75	84	84	85
80	87	101	98	81	90	89	97	93	102
99	88	77	84	76	77	99	96	94	95
96	101	102	84	75	104	97	104	102	96
90	100	104	108	103	109	101	101	100	91
97	103	87	75	97	75	86	93	117	95
74	74	97	110	94	87	102	87	86	86
104	101	102	100	89	108	86	100	103	92
88	105	99	107	105	102				

Log average 103 over 216 shots (monitoring over 2 hours)

Sunday L3 (BWSA)

84	82	79	75	82	74	71	69	71	82
65	76	67	73	70	77	83	74	71	69
67	76	75	69	65	65	83	83	91	78
64	69	77	75	64	66	69	61	64	69
72	65	65	65	75	68	67	76	75	68
69	70	78	77	83	74	71	69	73	69
71	72	69	62	65	64	61	63	62	60
63	61	60	66	65	60	61	61	60	62
63	64	70	66	63	62	61	62	70	64
66	65	60	62	69	66	66	83	85	83
77	73	74	81	80	81	74	82	78	74

91	79	85	79	77	76	80	77	79	80
75	77	77	81	89	83	85	79	79	71
77	72	68	73	67	65	63	62	63	66
69	62	64	71	79	70	74	74	73	73
66	65	64	66	65	64	80	63	67	70
65	67	71	69	77	74	70	72	86	79
77	69	68	87	79	83	69	84	84	74
75	74	76	79	78	76	72	68	69	77
89	73	69	67	76	70	70	75	78	75
72	72	74	72	70	64	63	72	68	73
74	73	77	74	74	79	73	79	78	70
72	75	69	63	65	68	70	66	68	67
67	68	70	69	63	61	66	67	72	76
72	70	67	68	67	74	70	68	67	68
68	75	65	62	65	61	62	59	67	66
67	66	62	65	65	64	71	79	77	73
66	70	68	64	77	78	71	73	77	73
69	77	65	68	65	64	66	69	67	70
66	60	73	64	74	69				

log average 81 over 296 shots (monitoring results for 2 hours)

Residential Location A2

68	65	68	71

log average 68 over 4 shots (observations for 1 hour)

Residential Location A3

No shots audible over 1 hour of monitoring

Residential Location B2

52	57	58	60	58	62

log average 59 over 6 shots (over 1 hour)

APPENDIX D: Sunday 14th November 2010

Residential Location A1

68	72	73	77	68	74	74	76	73	76
77	75	72	70	65	74	71	73	73	75
68	78	70	76	75	71	68	77		

Log average 74 over 28 shots (observations over 15 minutes)

Residential Location B2

71	63	71	76	80	79	75			

Log average 76 over 7 shots (observations over 15 minutes)

APPENDIX E: Sample of Time Splice from Unattended Monitoring