

**APPENDIX H: COMPUTER MODEL STUDY 3:
Alternate Temperature and Relative Humidity Conditions
Sites 1 and 2 with Base Range Orientations
Typical Day Scenario
20 ft. tall berms**

A series of experiments were conducted for the base range orientations on Sites 1 and 2 to study the effects of individual variables involved in the computer model studies under controlled conditions where only one of the variables were changed in each computer run. Computer model study 3 was conducted for alternate temperature and relative humidity conditions on Site 1: MCRC with the direction of fire to the north with the typical day scenario and Site 2: Sands West with the direction of fire to the north with the typical day scenario.

1. The typical day scenario has one shooter on the 300 yard range firing a .223 rifle; one shooter on the 40 yard range firing a 12 gauge shotgun and one shooter on the 25 yard range firing a 0.40 caliber handgun in the same one second time period.
2. Weather conditions were modeled as downwind with 1 to 11 mph wind as the other in computer model studies 1 and 2.
3. The 50°F and 80% relative humidity condition was used in the reference model.
4. Four other temperature and relative humidity combinations were run in this study:
 - A. 0°F and 50% R.H.
 - B. 32°F and 50% R.H.
 - C. 50°F and 50% R.H.
 - D. 70°F and 50% R.H.
5. The direction of fire was to the north for Site 1 and Site 2.
6. The berm height of 20 ft. was used in each of the models.
7. The sound levels shown on the noise contour maps are LA eq in dBA.

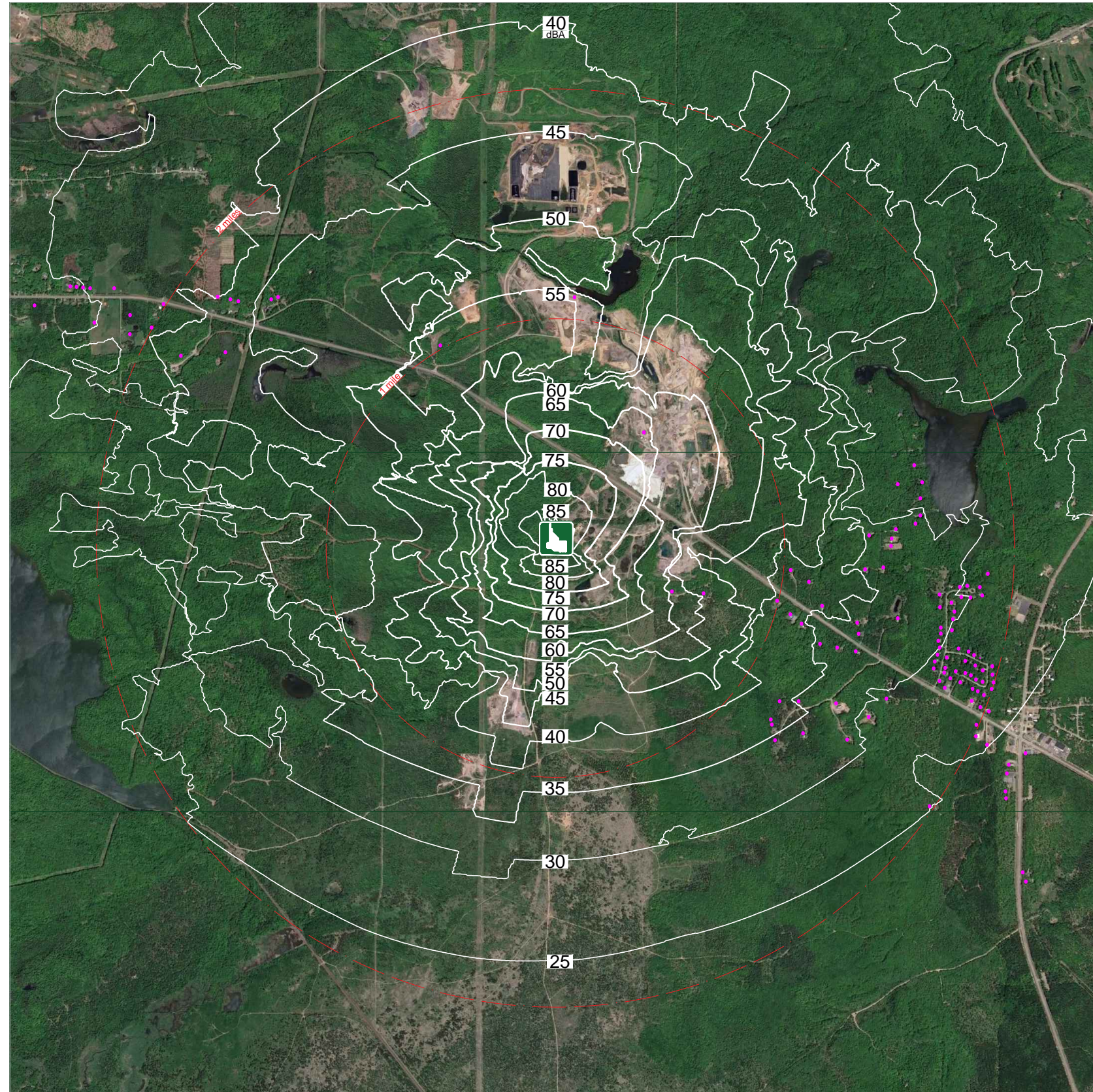
The base air temperature in degrees Fahrenheit (F) and relative humidity (R.H.) in % for the iterations of the computer model experiments were selected as 50° F and 80% R.H. because experiment 3 demonstrated that other air temperatures and relative humidities representative of different seasons of the year resulted in lower linear pressure and dB points.

This means that the 50° F and 80% R.H. condition resulted in a worst case scenario for producing the greatest potential noise impacts at properties in the vicinity of the proposed range sites than the other conditions modeled.

The 0°F and 50% R.H. condition is representative of a winter day. The 32°F and 50% R.H. condition is representative of a late Fall or early spring day. The 50°F and 50% R.H. condition is representative of an early Fall or late Spring day. The 70°F and 50% R.H. condition is representative of a cool summer day.

Table H-1. Summary table of rating points for each scenario tested in Experiment 3.

TYPICAL DAY 3 SHOOTERS 20 FT BERM TEMPERATURE AND RELATIVE HUMIDITY					
Site	DOF	Temperature and Relative Humidity	Lin Press	dB	PTS
SITE 1: MCRC	N	00F 50% RH	18	63	155
SITE 1: MCRC	N	30F 50% RH	77	69	380
SITE 2: Sands	N	00F 50% RH	114	71	746
SITE 1: MCRC	N	70F 50% RH	268	74	293
SITE 1: MCRC	N	50F 50% RH	292	75	329
SITE 1: MCRC Reference	N	70F 80% RH	359	76	354
SITE 2: Sands	N	30F 50% RH	518	77	864
SITE 2: Sands	N	70F 50% RH	705	78	899
SITE 2: Sands	N	50F 50% RH	850	79	955
SITE 2: Sands Reference	N	70F 80% RH	989	80	992



MARQUETTE CRC

MODEL H-1

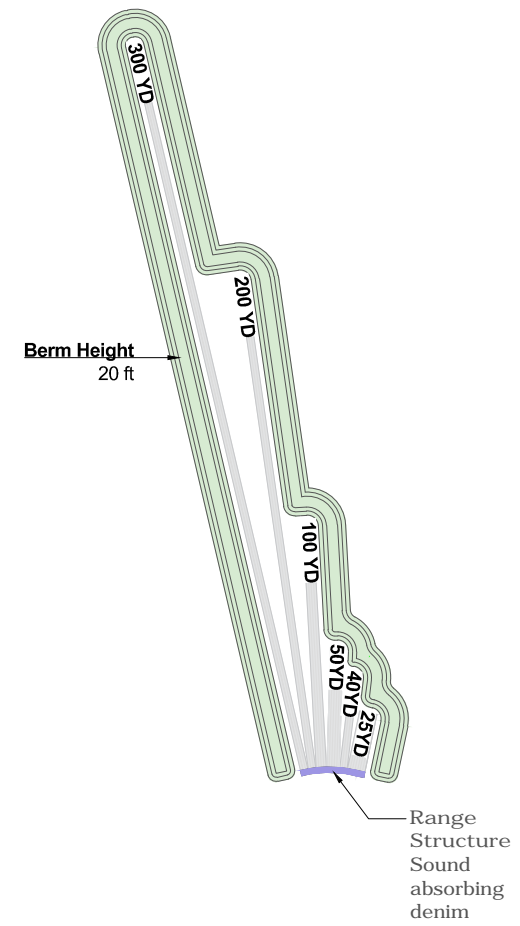
20 ft. Tall Berms | Alternate Weather Conditions

Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

00°F and 50% R.H.





MARQUETTE CRC
MODEL H-2

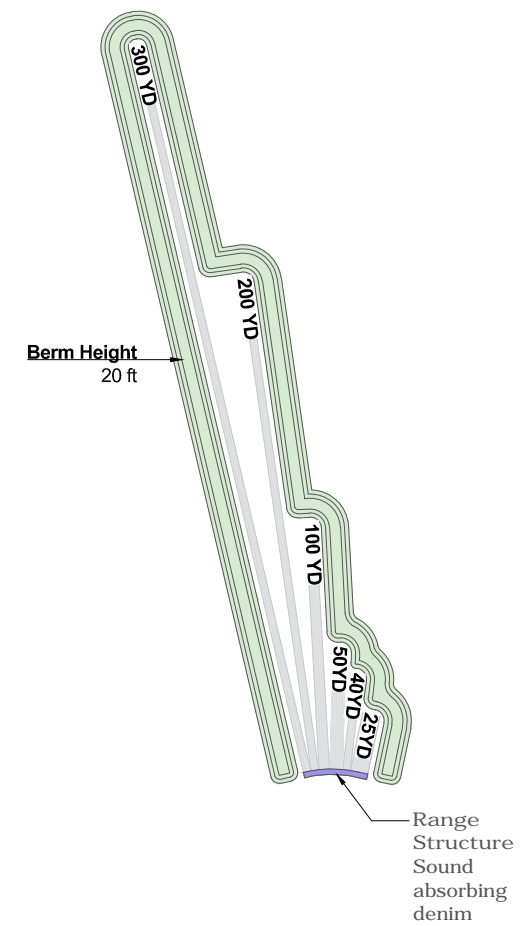
20 ft. Tall Berms | Alternate Weather Conditions

Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

30°F and 50% R.H.





MARQUETTE CRC
MODEL H-3

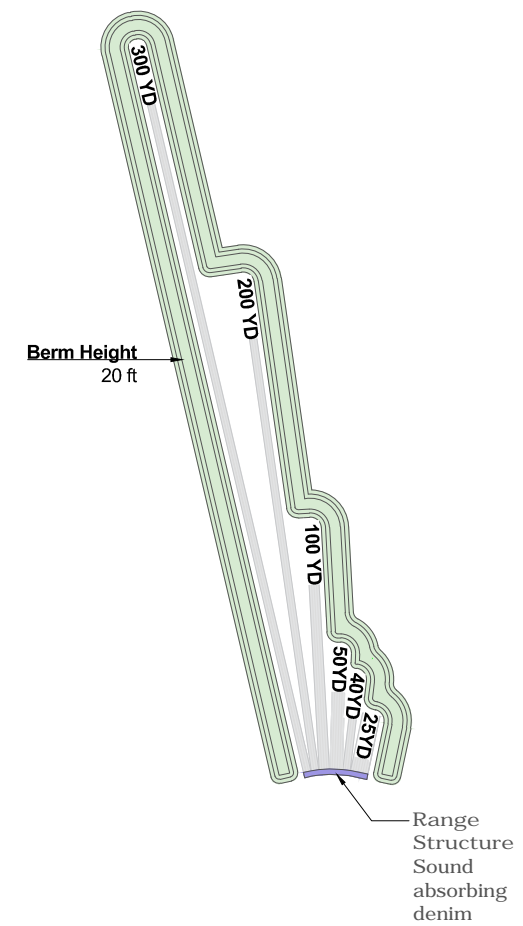
20 ft. Tall Berms | Alternate Weather Conditions

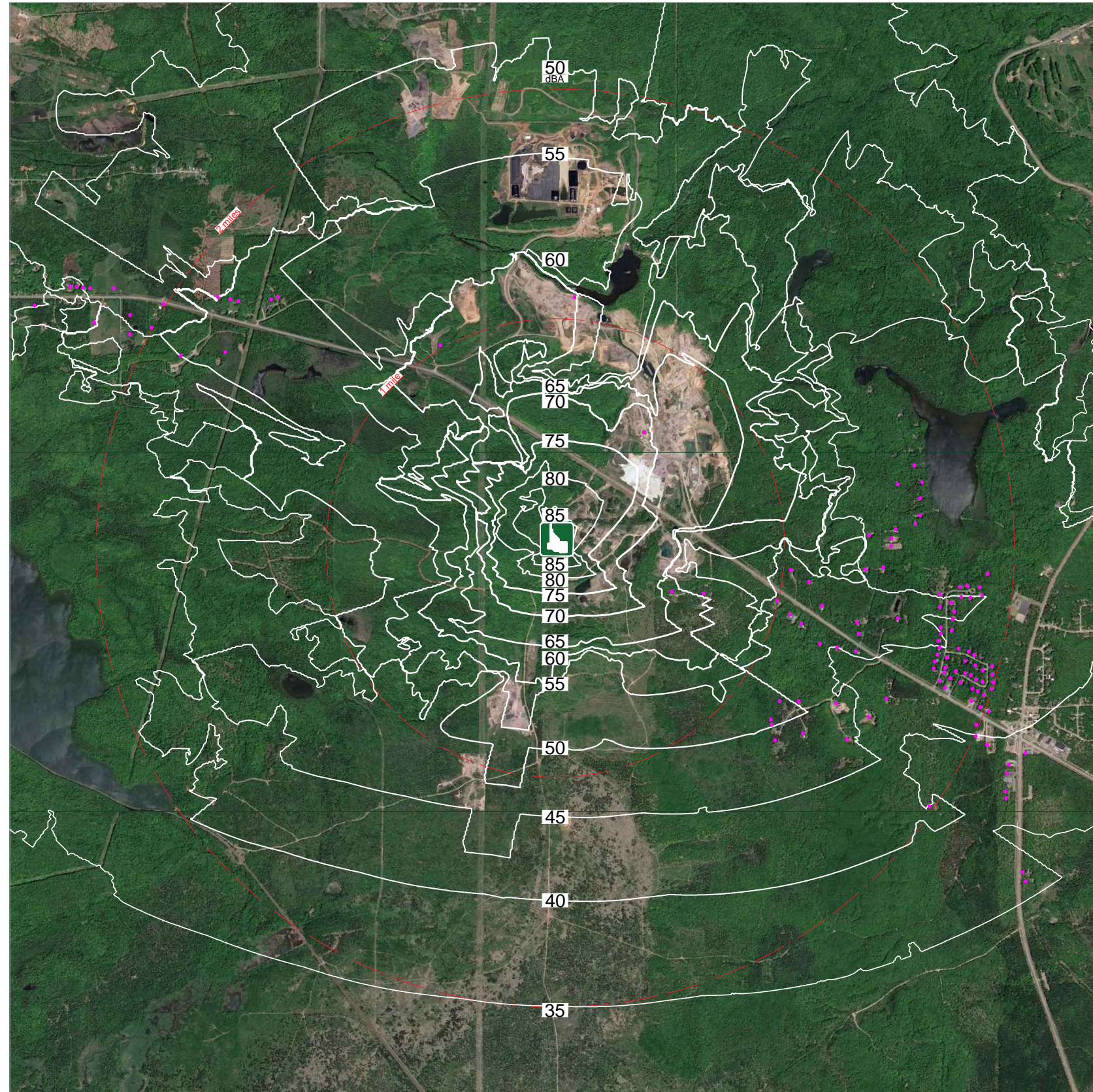
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

50°F and 50% R.H.





MARQUETTE CRC
MODEL H-4

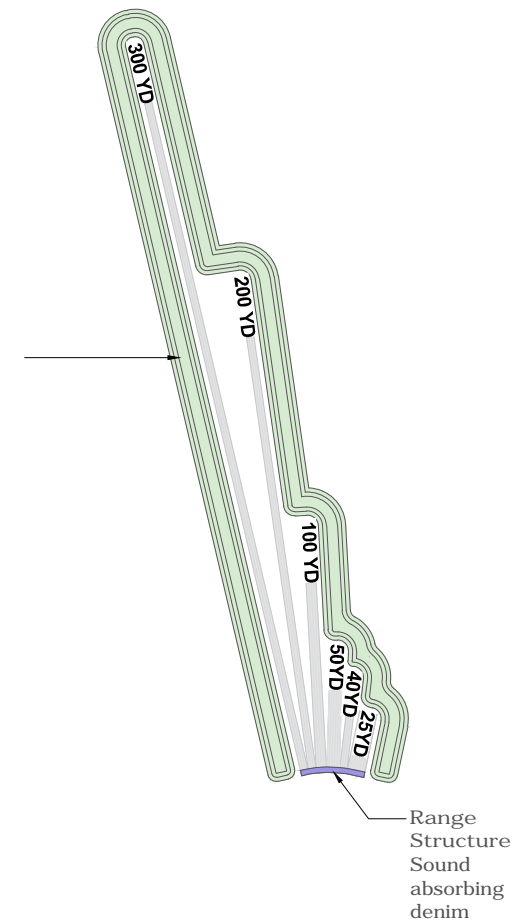
20 ft. Tall Berms | Alternate Weather Conditions

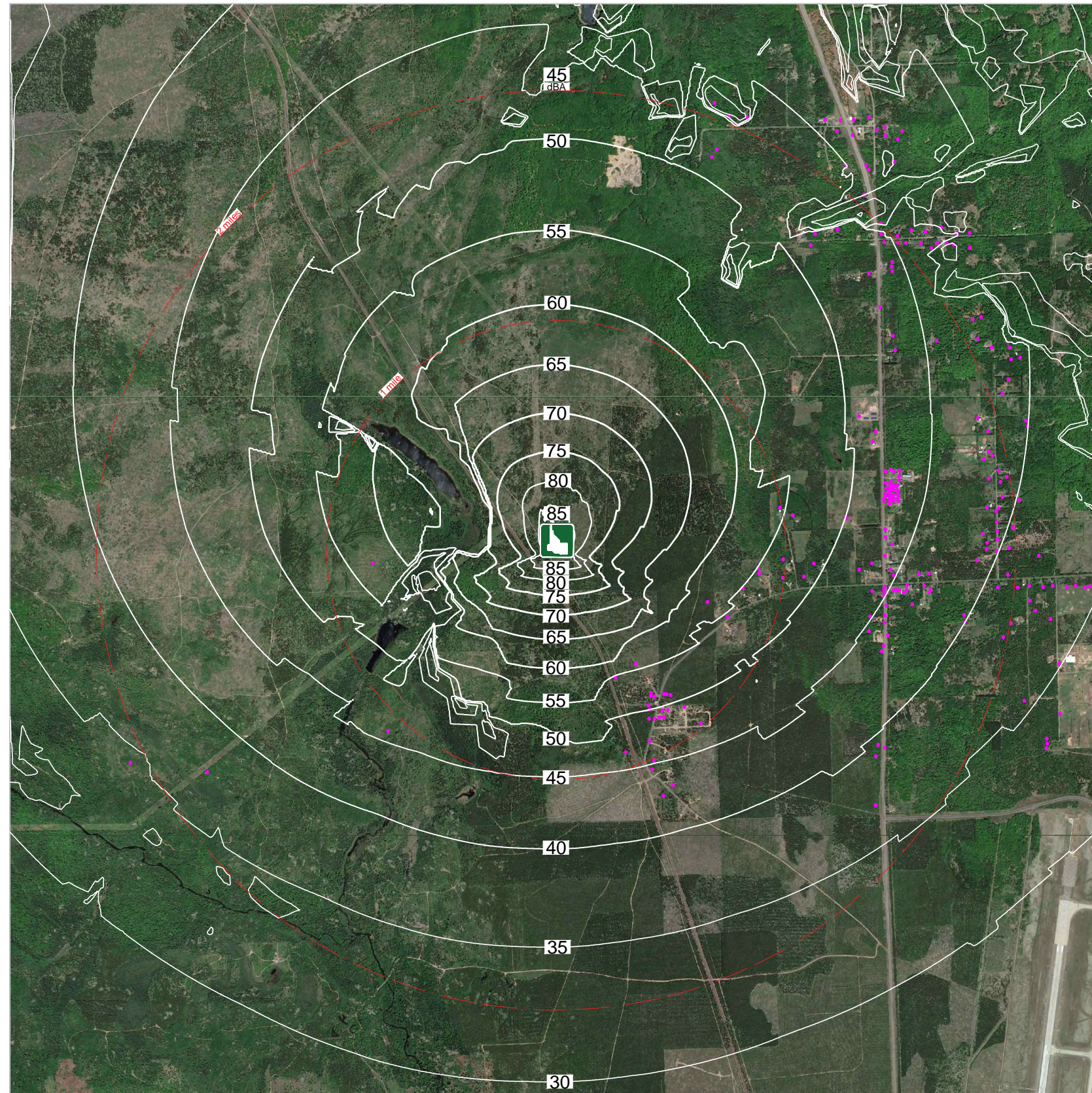
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

70°F and 50% R.H.





SANDS
MODEL H-5

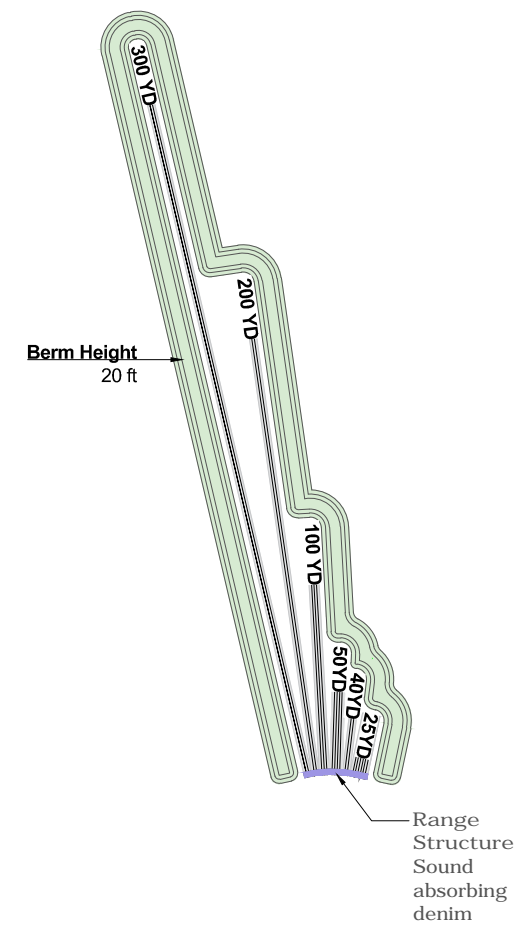
20 ft. Tall Berms | Alternate Weather Conditions

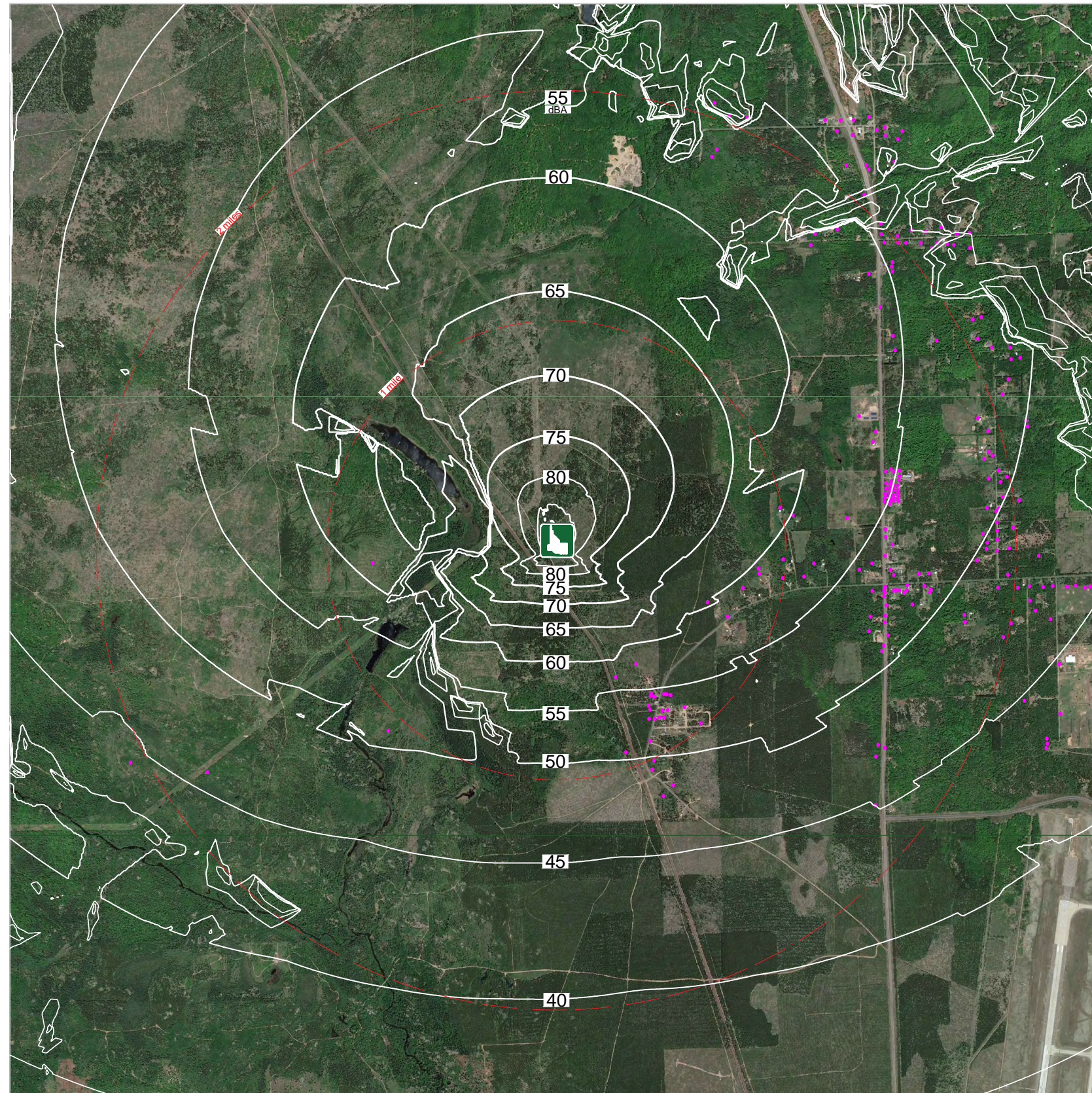
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

00°F and 50% R.H.





SANDS
MODEL H-6

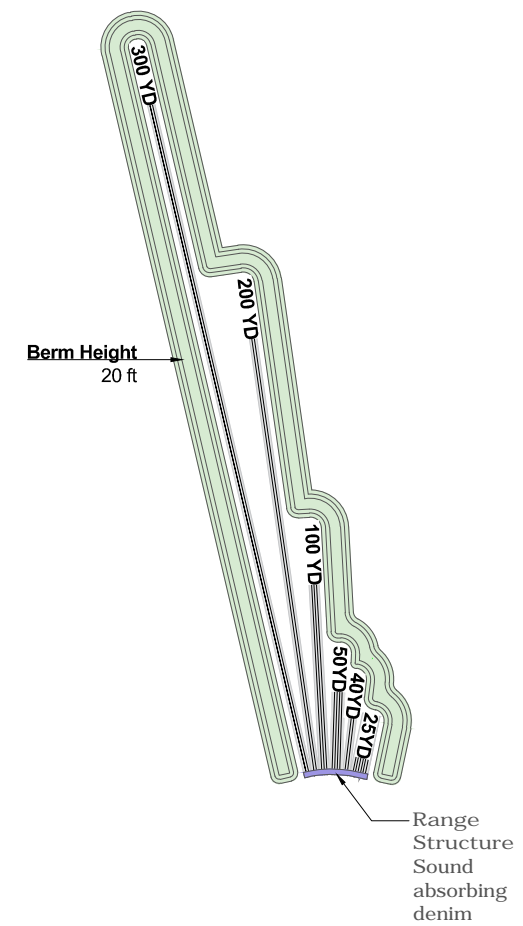
20 ft. Tall Berms | Alternate Weather Conditions

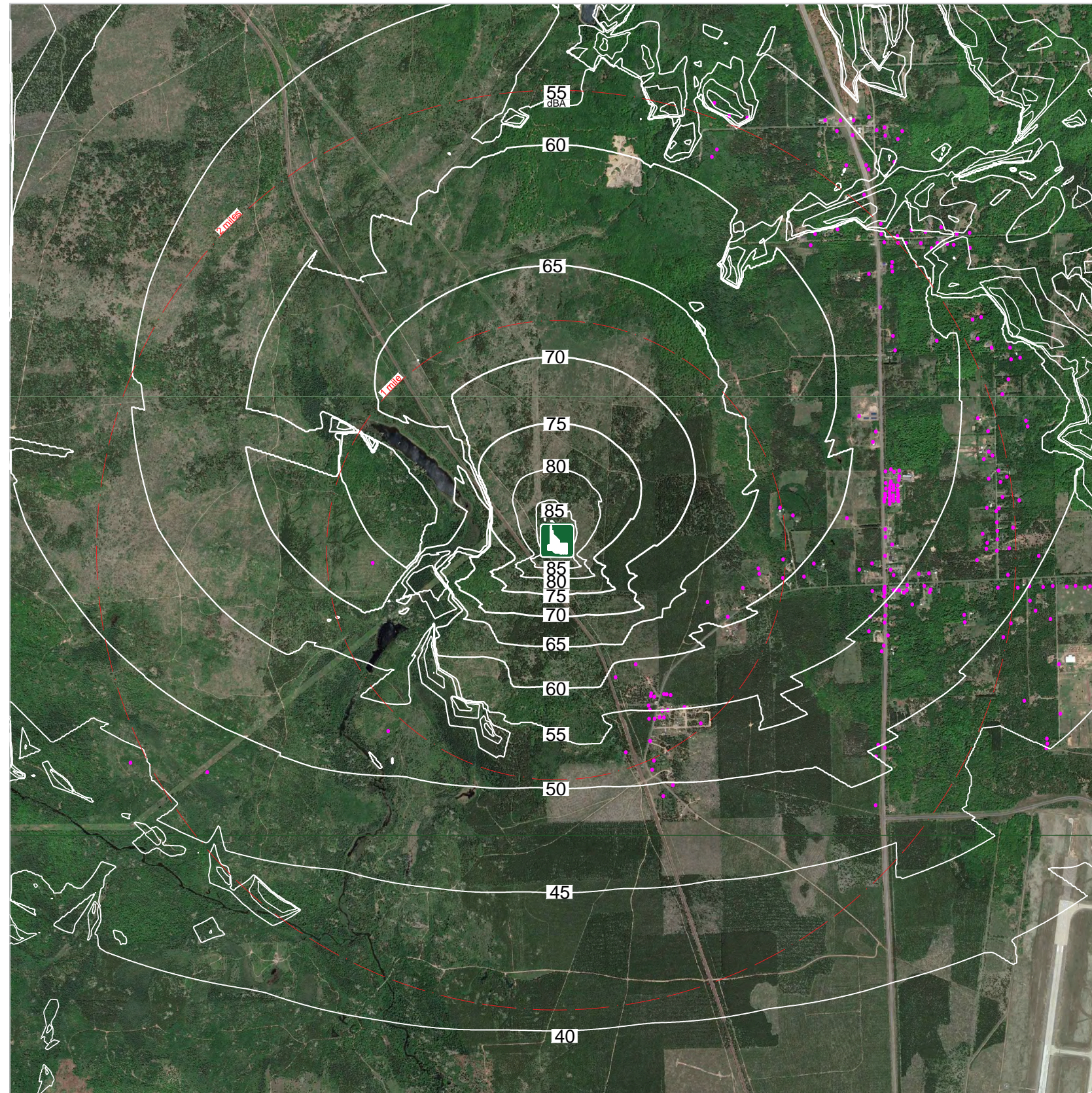
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

30°F and 50% R.H.





SANDS MODEL H-7

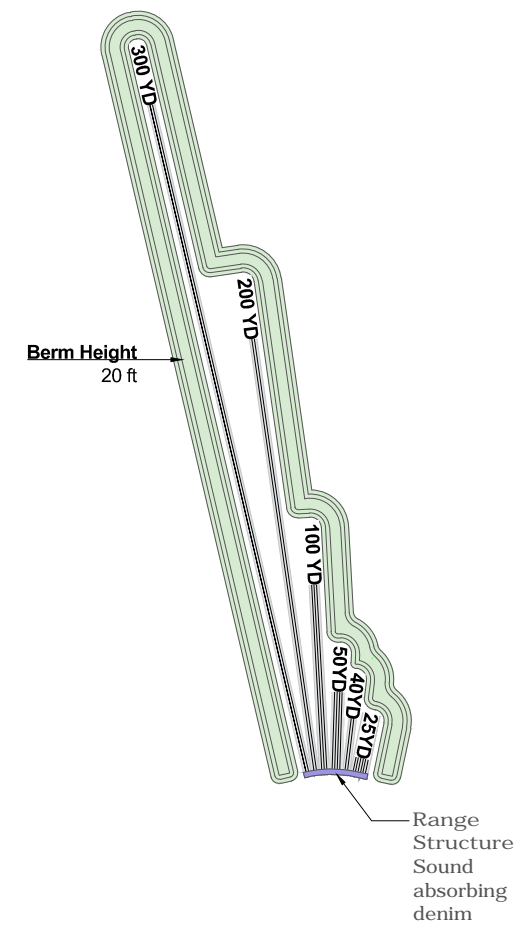
20 ft. Tall Berms | Alternate Weather Conditions

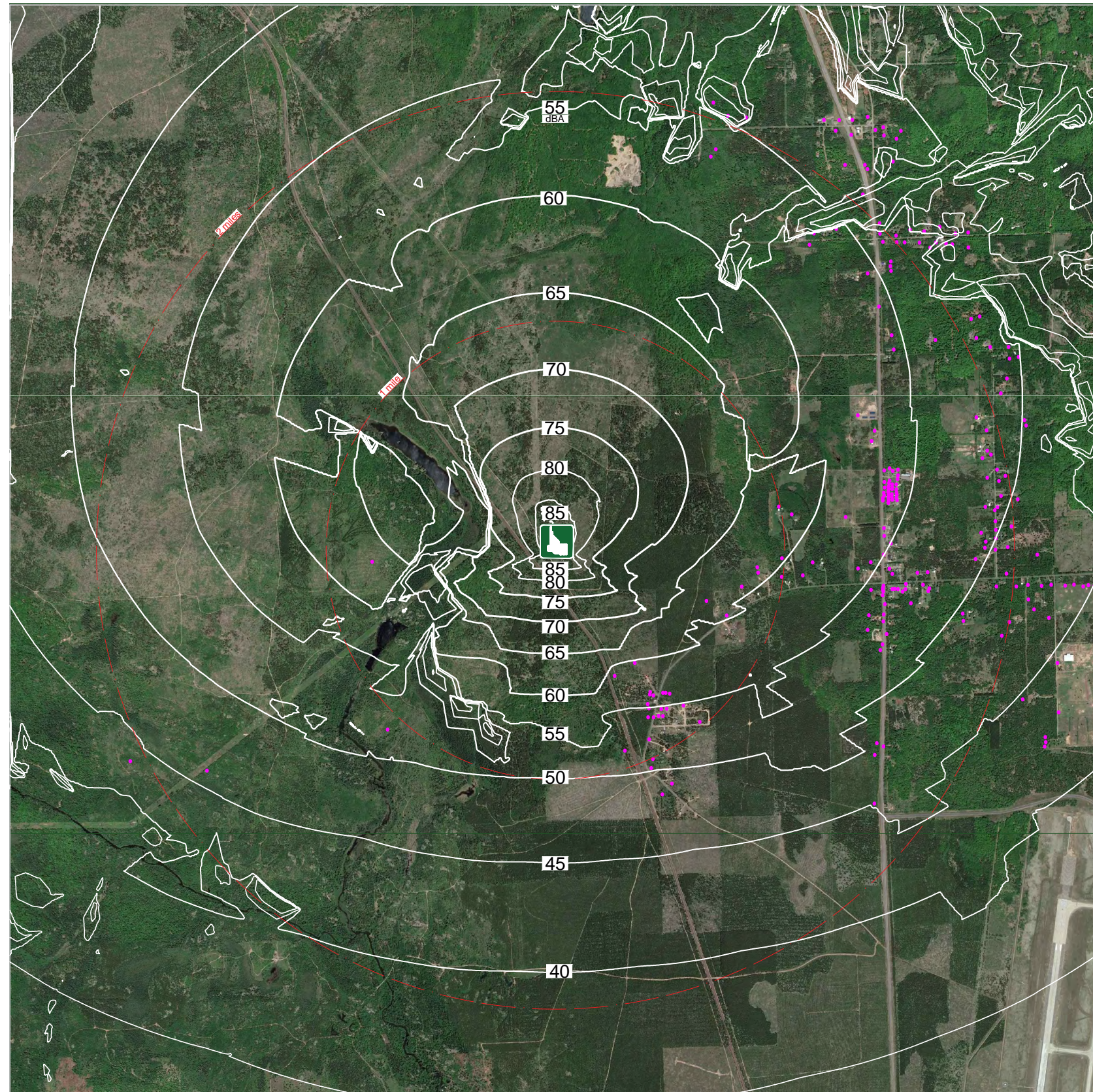
Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

50°F and 50% R.H.





SANDS
MODEL H-8

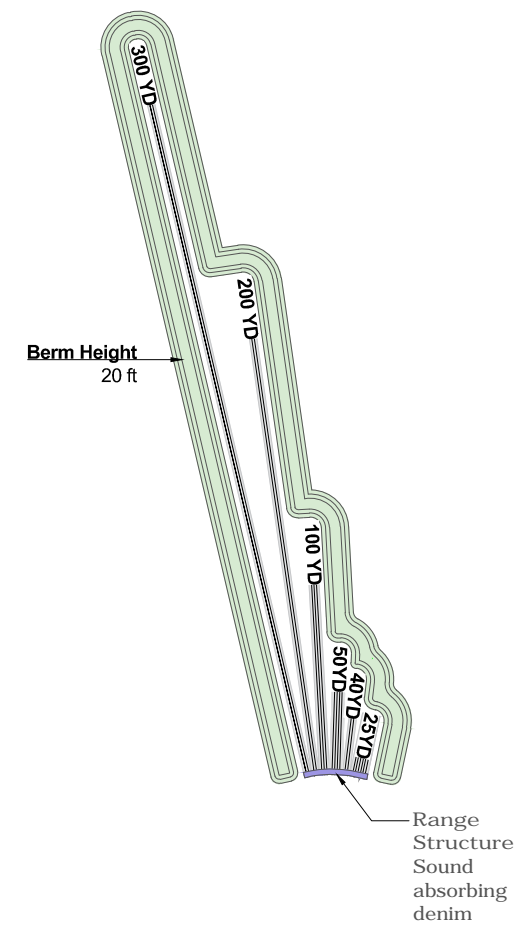
20 ft. Tall Berms | Alternate Weather Conditions

Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

70°F and 50% R.H.



APPENDIX I: COMPUTER MODEL STUDY 4:

**Alternate Wind Conditions
 Sites 1 and 2 with Base Range Orientation
 Typical Day Scenario
 20 ft. tall berm**

Computer model study 4 was conducted for alternate wind conditions on Site 1: County Road Commission with the direction of fire to the north for the typical day scenario and Site 2: Sands West with the direction of fire to the north with the typical day scenario.

1. The typical day scenario has one shooter on the 300 yard range firing a .223 rifle; one shooter on the 40 yard range firing a 12 gauge shotgun and one shooter on the 25 yard range firing a 0.40 caliber handgun in the same one second time period.
2. The wind condition in the base model was modeled as with 1 to 11 mph wind as in computer model studies 1 and 2.
3. The 50°F and 80% relative humidity condition was used in the models.
4. The alternate wind condition was 10 miles per hour from the south-southwest which is the average wind speed and direction for this area for a typical year; and 15 miles per hour from the south-southwest representative of the maximum wind speed.
5. The direction of fire was to the north for Site 1 and Site 2.
6. The berm height of 20 ft. was used in each of the models.
7. The sound levels shown on the noise contour maps are LAeq in dBA.

The base wind speed of 1-11 mile per hour (m.p.h.) wind in a downwind path was used in the computer model experiments. Computer model study 4 demonstrates that the downwind condition is a worst case condition compared to the 10 m.p.h. wind from the southwest which is the average wind speed and direction. The downwind conditions also showed greater impacts on properties in the vicinity of the range than the maximum wind speed and direction at Site 1: County Road Commission and Site 2: Sands West.

Table I-1. Summary table of rating points for each scenario tested in Experiment 4.

TYPICAL DAY 3 SHOOTERS 20 FT BERM WIND SPEED AND DIRECTION					
Site	DOF	Wind Speed and Direction	Lin Press	dB	PTS
SITE 1: MCRC	N	Average Wind Speed and Direction	274	74	299
SITE 1: MCRC	N	Maximum Wind Speed and Direction	317	75	302
SITE 1: MCRC	N	1-11 mph downwind	359	76	354
SITE 2: Sands	N	Average Wind Speed and Direction	705	78	915
SITE 2: Sands	N	Maximum Wind Speed and Direction	762	79	928
SITE 2: Sands	N	1-11 mph downwind	989	80	992



MARQUETTE CRC

MODEL I-1

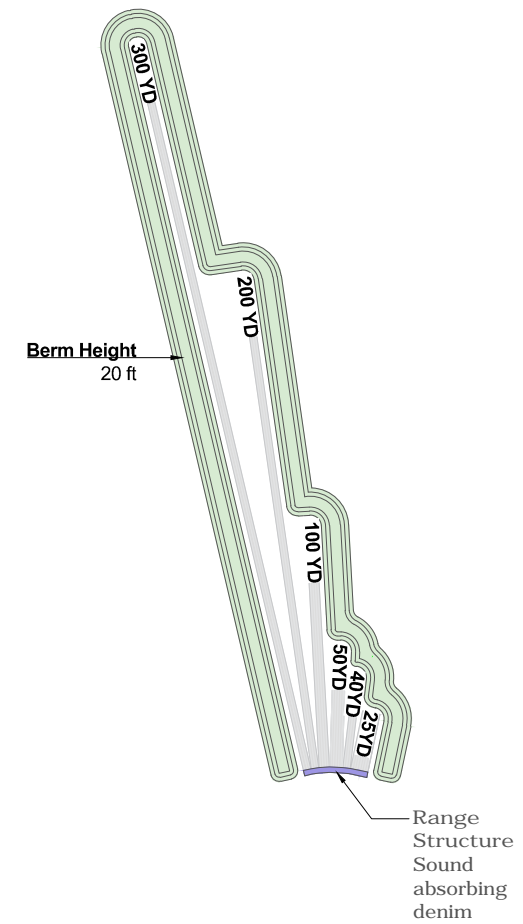
20 ft. Tall Berms | Average Wind Conditions

Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 10 mph, SSW

50°F and 80% R.H.





MARQUETTE CRC
MODEL I-2

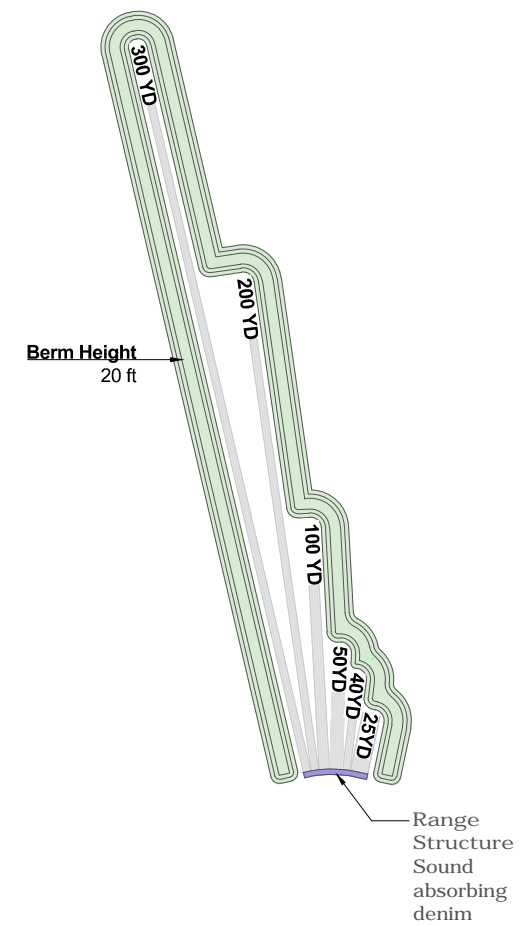
20 ft. Tall Berms | Maximum Wind Conditions

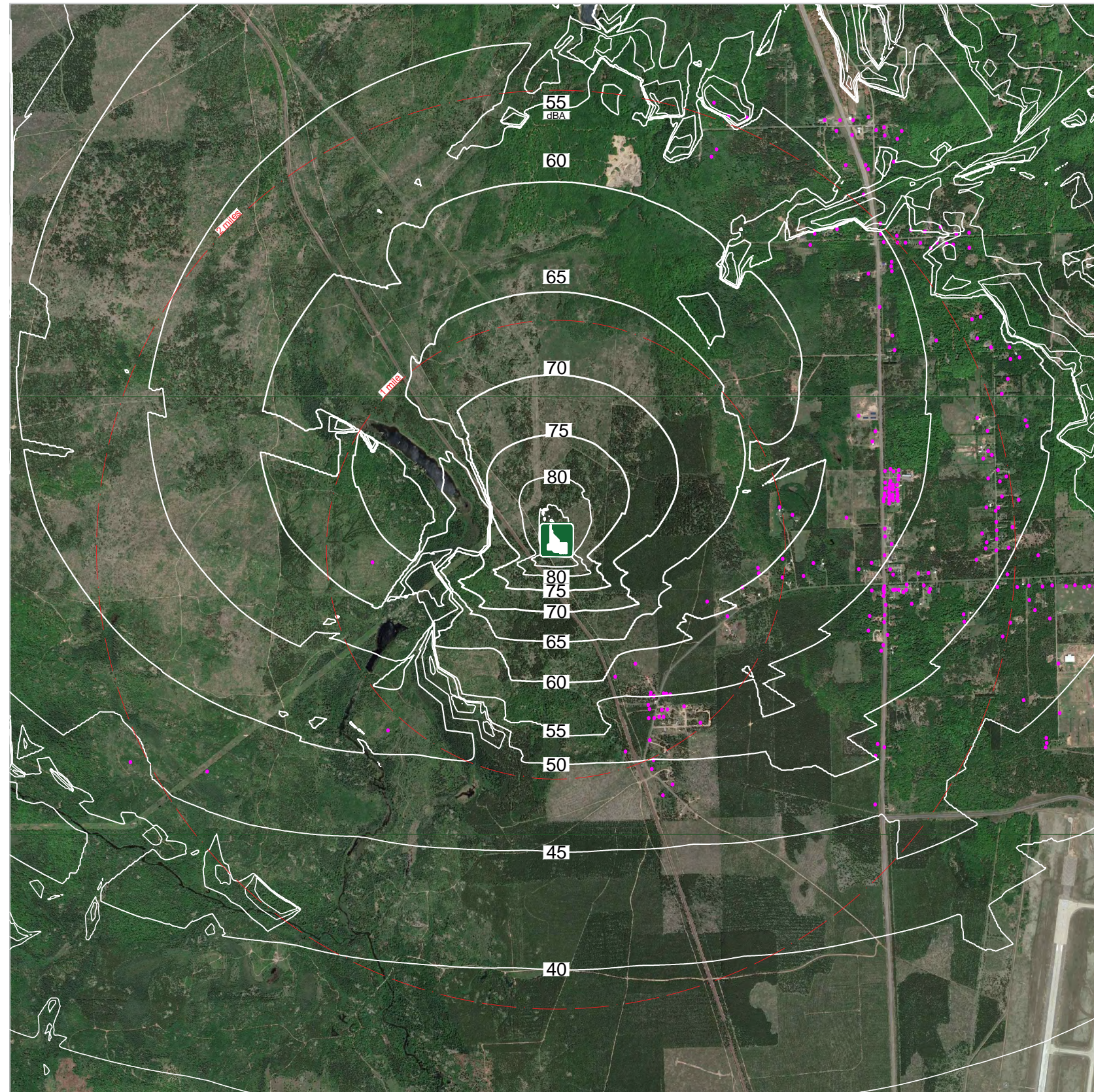
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 15 mph, SSW

50°F and 80% R.H.





SANDS
MODEL I-3

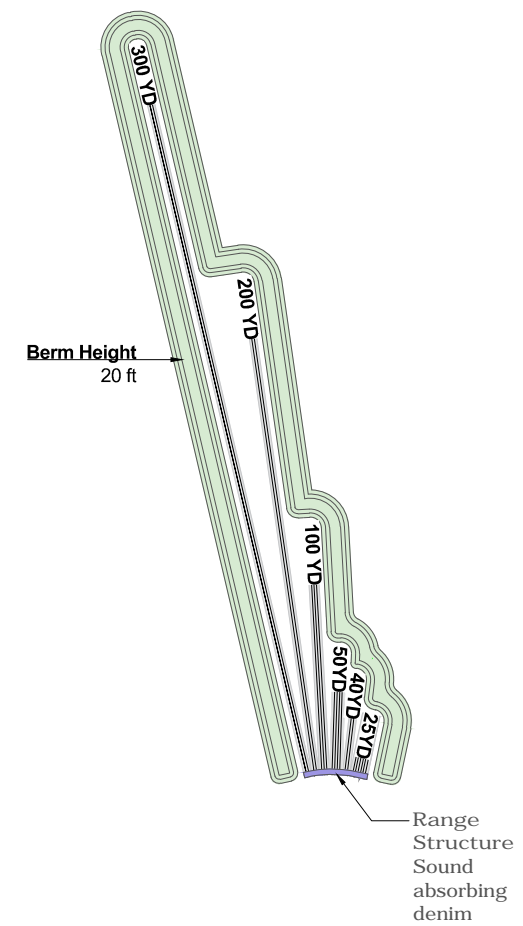
20 ft. Tall Berms | Average Wind Conditions

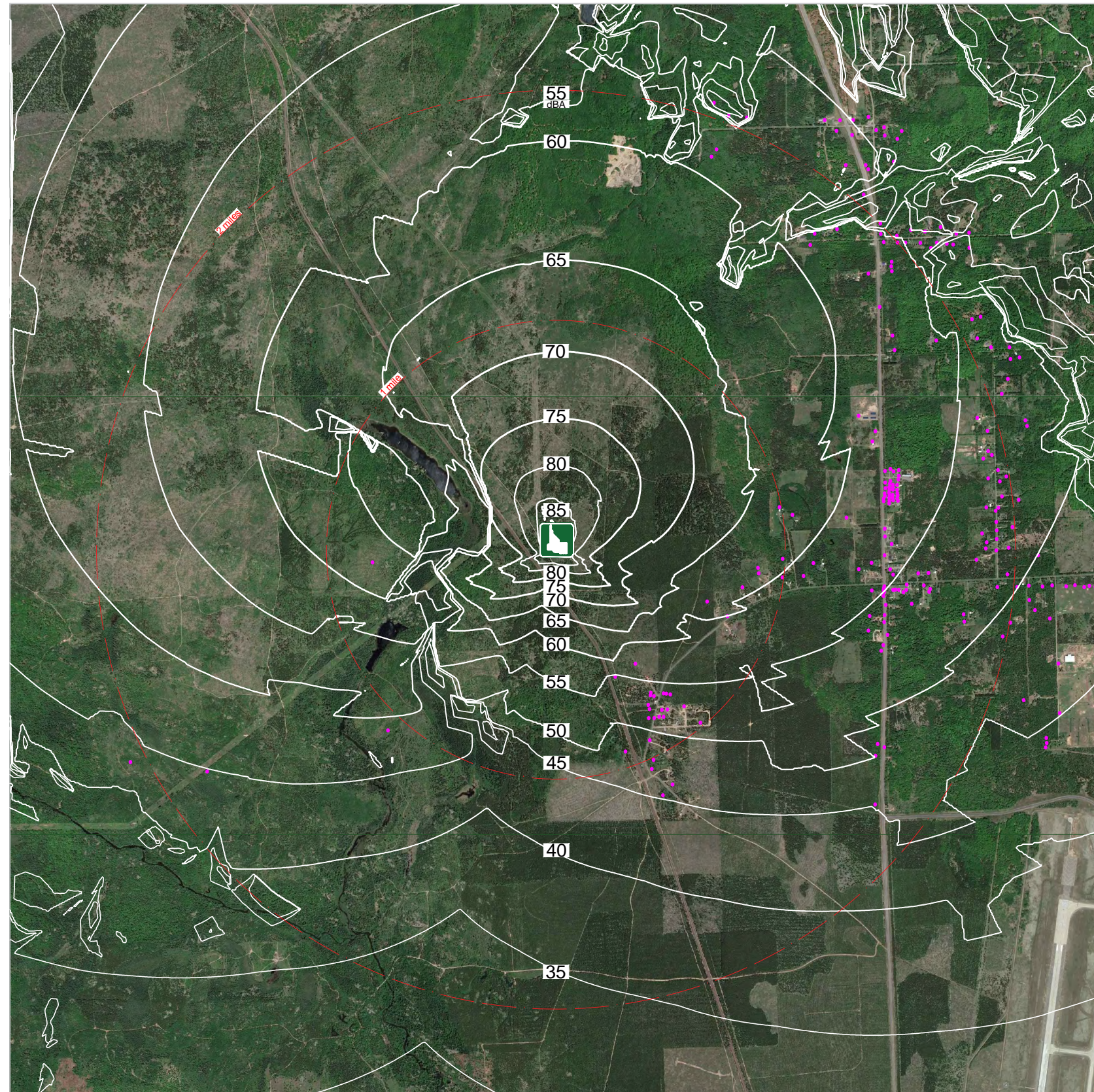
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 10 mph, SSW

50°F and 80% R.H.





SANDS MODEL I-4

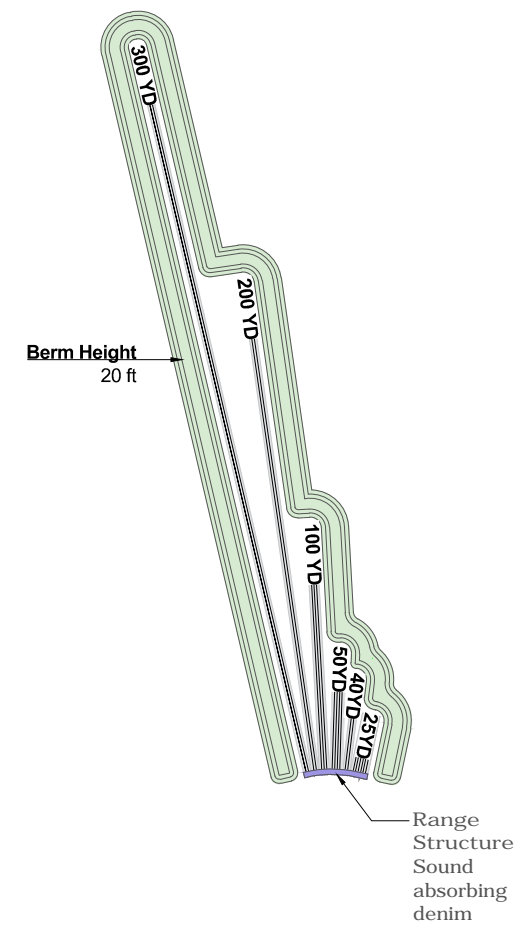
20 ft. Tall Berms | Maximum Wind Conditions

Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. N

Wind: 15 mph, SSW

50°F and 80% R.H.



**APPENDIX J: COMPUTER MODEL STUDY 5:
 Coniferous Vegetation Added
 Sites 1 and 2 with Base Range Orientation
 Typical Day Scenario
 20 ft. tall berm**

Computer model study 5 was conducted with the coniferous vegetation added on Site 1: County Road Commission with the direction of fire to the north for the typical day scenario and Site 2: Sands West with the direction of fire to the north with the typical day scenario.

1. The typical day scenario has one shooter on the 300 yard range firing a .223 rifle; one shooter on the 40 yard range firing a 12 gauge shotgun and one shooter on the 25 yard range firing a 0.40 caliber handgun in the same one second time period.
2. The wind condition in the base model was modeled as downwind with 1 to 11 mph wind as the other in computer model studies 1 and 2.
3. The 50°F and 80% relative humidity condition was used in the models.
4. The coniferous vegetation was added in areas identified from aerial photo views during winter months to locate stands of coniferous vegetation in the vicinity of the range sites. It was assumed that the coniferous trees were 30 ft. tall in the computer models.
5. The direction of fire was to the north for Site 1 and Site 2.
6. The berm height of 20 ft. was used in each of the models.
7. The sound levels shown on the noise contour maps are LAeq in dBA.

The linear pressure score for the addition of stands of coniferous trees (vegetation) at Site 1: County Road Commission, with the range oriented to the north, decreased by approximately 34% compared to the base range model that did not have stands of coniferous vegetation included. The linear pressure score at Site 2: Sands West with the range oriented towards the north decreased by approximately 11% when the coniferous vegetation was added to the model. This experiment indicates that the models without coniferous vegetation present a worst case scenario for the ranges.

Table J-1. Summary table of rating points for each scenario tested in Experiment 5.

TYPICAL DAY 3 SHOOTERS 20 FT BERM VEGETATION					
Site	DOF	Wind Speed and Direction	Lin Press	dB	PTS
SITE 1: MCRC	N	Vegetation	303	75	349
SITE 1: MCRC	N	No Vegetation	359	76	354
SITE 2: Sands	N	Vegetation	986	80	989
SITE 2: Sands	N	No Vegetation	989	80	992



MARQUETTE CRC
MODEL J-1

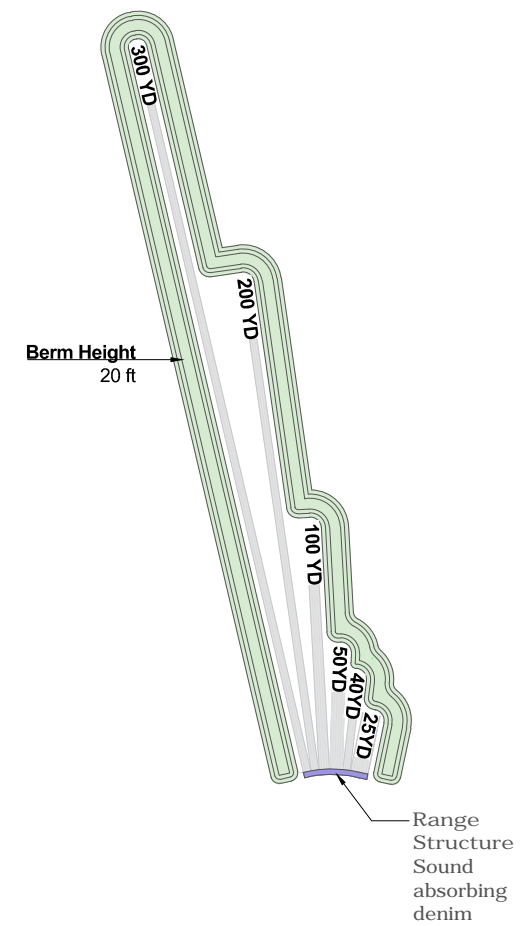
20 ft. Tall Berms | Coniferous Vegetation Added

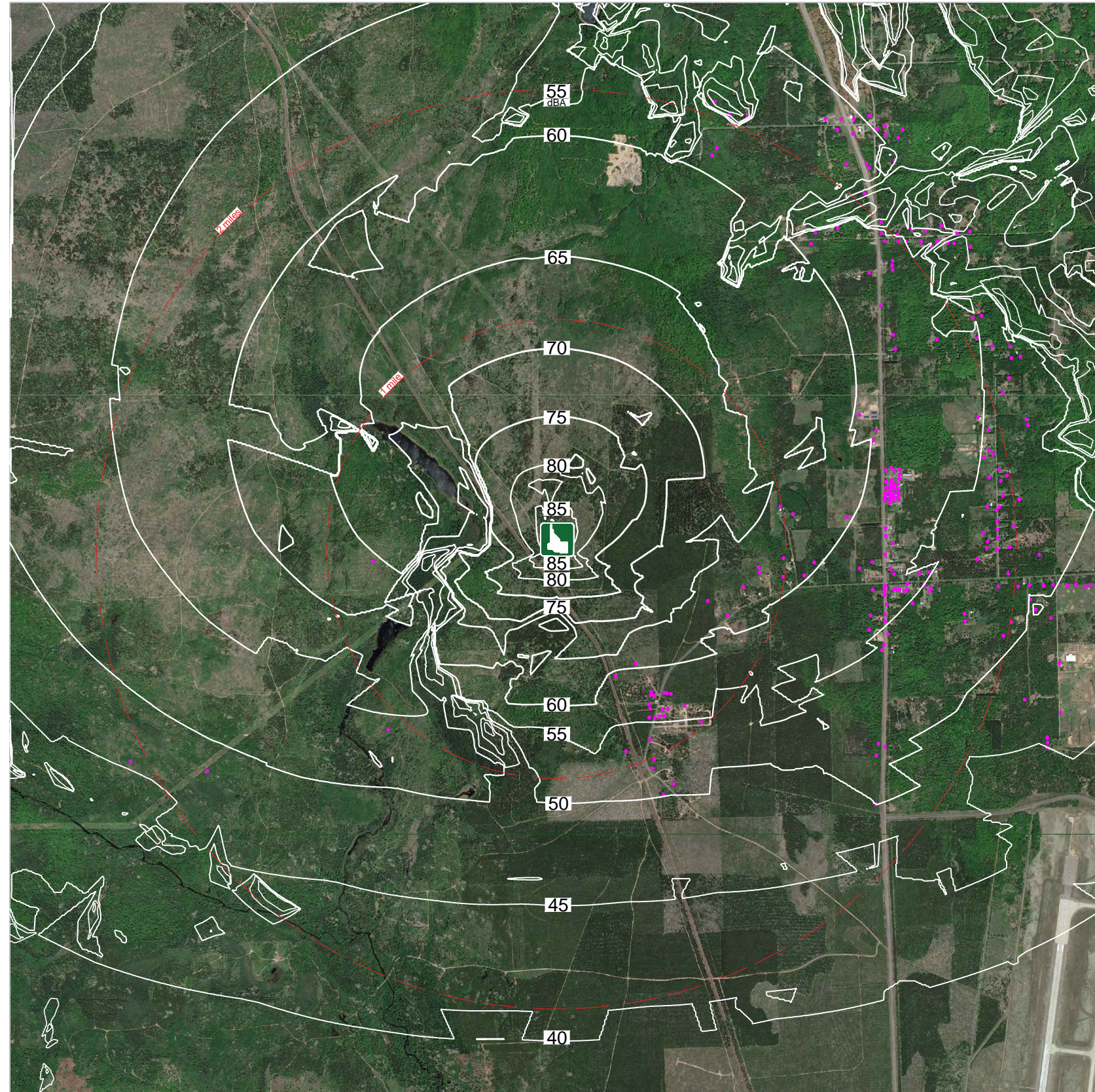
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS MODEL J-2

20 ft. Tall Berms | Coniferous Vegetation Added

Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. N

Wind: 1 to 11 mph downward

50°F and 80% R.H.

