ADDENDUM 3.5-A

VEGETATION STUDY

VEGETATION STUDY

STRATA ENERGY

ROSS ISR PROJECT

Prepared by

Intermountain Resources
P.O. Box 1589
Laramie, Wyoming 82073
307-745-3803

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ADDENDUM 3.5-A

VEGETATION STUDY

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ADDENDA

VEGETATION STUDY

1.0 LOCATION

Vegetation baseline surveys were completed during the 2010 field season by Intermountain Resources on the Ross ISR Project proposed by Peninsula Minerals Ltd, dba Strata Energy Inc. (Strata). This study area is located in northwest Crook County, Wyoming, approximately 25 miles north of Moorcroft. Access to the site is via the D Road. The permit area encompasses approximately 1,721.31 acres. The permit area is situated Sections 12, 13, 14 and 24 T53N R68W, and Sections 7, 18 and 19 T53N R67W as shown on ER Figure 3.5-2.

2.0 METHODS

Plant community types and map units within the study area were mapped during field surveys in 2009-2010 and included one half mile beyond the permit boundary. The plant community and map unit types were delineated based on topographical locations and plant species dominating the vegetation. Aerial photography from 2006 and 2009 was used to map pre-existing disturbance areas and current plant community types. Photographs were taken of each vegetation type found within the study area. A detailed species list of plants observed within each plant community type within the study area is included in Addendum 3.5-B.

The Upland Grassland, Sagebrush Shrubland and Pastureland were the major vegetation types identified within the permit area. These vegetation types were sampled separately for vegetation cover. Additional map units found within the permit area included Hayland, Reservoir/Stockpond, Wetland, Disturbed Land, Cropland and Wooded Draw. These map units were not required to be sampled in this study. The Wetland and Reservoir/Stockpond map units were inventoried using US Corps of Engineers criteria and are described in Section 3.4.2 of the Environmental Report. The cover samplings for the three plant community types were completed

from June 21 through June 24 of 2010. The extended reference area concept will be used for final bond release studies as discussed later in this report. The random sample sites were selected using two sets of computer generated random numbers, one set corresponding to the x axis of a grid and the other corresponding to the y axis. Grids are always orientated North/South and East/West to avoid bias. Sample site grid intervals were no more than 65 meters on the ground. The grid intersections represented the prospective sample points and were located in the field using aerial photography and topographic maps. Sampling sites were randomly located with cover transects situated in random compass directions (from a random numbers table, 0^{o} to 359^{o}) from this point. If a transect ran out of the vegetation type sampled then a new random compass direction (from a random numbers table, 0^{o} to 180^{o}) was selected, at the point the transect left the type, that returned the transect back into the currently sampled vegetation type without overlapping the current transect. Vegetation and ground cover class data were collected from these 50 meter transects with a vertical pin (one meter long by 1/8 inch around and sharpened to a point) dropped by hand at one meter intervals for 50 data points per transect. The first hit encountered from each pin drop was recorded for data analysis. Sample adequacy followed WDEQ-LQD Guideline No. 2. Production and shrub density data were not required as approved by the WDEQ-LQD.

Trees present within the permit area were inventoried. The tree data collected on the permit area included numbers, locations, and sizes (DBH – Diameter at Breast Height in inches and height of each tree in feet). Surveys were also completed for the Ute ladies-tresses orchid (*Spiranthes diluvialis*) as discussed in the results section of this report. The sampling plan for this vegetation study was presented to the WDEQ-LQD and approved by that agency. That sampling plan is included in Addendum 3.5-B of this report.

3.0 RESULTS

3.1 Plant Community Types / Map Units

Surveys of the study area identified nine vegetation or other map units of which three were sampled for vegetative and total ground cover under this study. The plant community types observed and sampled for vegetative and total ground cover were the Upland Grassland, Sagebrush Shrubland and Pastureland. The other map units within the permit area included Hayland, Reservoir/Stockpond, Wetland, Disturbed Land, Cropland and Wooded Draw but these map units were not sampled for vegetative or total ground cover. Table 1 provides the acreages for each plant community or map unit types within the study area and proposed permit area. A list of plant species observed during the 2010 study is included in Addendum 3.5-B and Addendum 3.5-C shows photographs of the plant community/map unit types. Vegetation cover descriptions for the Upland Grassland, Sagebrush Shrubland and Pastureland types are based on the cover data presented in Section 3.3 of this report.

Upland Grassland (G)

The Upland Grassland plant community type occurs on approximately 917.55 acres or 53.3 percent of the permit area. The perennial grass life form dominated this type in terms of cover. The most dominant individual species recorded was needleandthread (*Stipa comata*) followed by western wheatgrass (*Agropyron smithii*), bulbous bluegrass (*Poa bulbosa*), Kentucky bluegrass (*Poa pratensis*), buffalograss (*Buchloe dactyloides*) and prairie junegrass (*Koeleria macrantha*). The Upland Grassland type is found throughout the permit area on relatively flat to steep slopes with generally shallow sandy to sandy loam and loamy soils.

Table 1 Vegetation or Map Unit Type Acreages for the Ross Project Area, 2010

Permit Area		
Vegetation or Map Unit Type	**Acres**	**%**
Upland Grassland (G)	917.55	53.3
Sagebrush Shrubland (S)	377.05	21.9
Pastureland (P)	125.94	7.3
Hayland (H)	121.15	7.0
Reservoir/Stockpond (R)[1]	33.85	2.0
Wetland (W)[1]	31.15	1.8
Disturbed Land (D)	56.99	3.3
Cropland (C)	48.71	2.8
Wooded Draw (T)	8.92	0.5
Total	**1,721.31**	**100.0**

[1] Potential wetland areas identified in Section 3.4.2 of the Environmental Report (refer to Table 3.4-18) include both Wetland and Reservoir/Stockpond vegetation or map units in this table.

Sagebrush Shrubland (S)

The Sagebrush Shrubland vegetation type occupies approximately 377.05 acres or 21.9 percent of the entire permit area. This type is dominated by the perennial grass and shrub life forms. The most common individual species recorded on this type was Kentucky bluegrass followed by bulbous bluegrass, western wheatgrass, big sagebrush (*Artemisia tridentata*), buffalograss and silver sagebrush (*Artemisia cana*). This vegetation type is found throughout the study area and occurs on relatively flat to gentle slopes within a variety of soil types from shallow to moderately deep, primarily loams.

Pastureland (P)

The Pastureland vegetation type (approximately 125.94 acres or about 7.3 percent of the permit area) was mapped primarily in the western portion of the study area. This type was dominated by perennial grass species. The most dominant plant species recorded was intermediate wheatgrass (*Agropyron intermedium*). Other common plant species recorded on this type were smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), bulbous bluegrass and western wheatgrass. This vegetation type is found on relatively flat to gently sloping areas with moderately deep, sandy loam to loamy soils. The Pasturelands within the permit area are primarily grazed by cattle but may also be hayed.

Hayland (H)

This map unit is dominated by the perennial grass life form. The most dominant species observed were smooth brome and crested wheatgrass. Another common plant species observed was alfalfa (*Medicago sativa*). This plant community type is found on relatively flat to gently sloping areas with moderately deep, sandy loam to loamy soils. This vegetation type occupies

about 121.15 acres or 7.0 percent of the permit area. These Haylands are generally harvested every year in July and may be grazed following harvest.

Reservoir/Stockpond (R)

The Reservoir/Stockpond map unit (approximately 33.85 acres or about 2.0 percent of the permit area) was made up primarily of the Oshoto Reservoir. Several smaller stockponds exist within the permit area but may not hold water throughout the entire summer. The Oshoto Reservoir holds water year round and is supplied by springs, Deadman Creek and the Little Missouri River.

Wetland (W)

This map unit occupies approximately 31.15 acres or about 1.8 percent of the permit area This map unit transects the northern and central portion of the permit area and is primarily associated with Deadman Creek, Little Missouri River and its' tributaries and the Oshoto Reservoir. Topography is relatively flat with shallow to deep soils underlain by sand or gravel which allows for natural subirrigation. Mapping was based on aerial photography and surveying completed by Intermountain Resources. A complete description of wetland attributes is detailed in the wetlands report (Appendix D10).

Disturbed Lands (D)

This map unit consists primarily of past oil and gas development related disturbance and existing roads. Mapping was based on aerial photography and surveying completed by Intermountain Resources. These sites are generally lacking vegetation and topsoil. This map unit occupies approximately 56.99 acres or about 3.3 percent of the permit area.

Cropland (C)

This map unit was seeded to wheat (*Triticum aestivum*) in 2010 but has also been used for the production of oats (*Avena sativa*) and barley (*Hordeum vulgare*) in the past. This map unit is found on relatively flat to gently sloping areas with moderately deep, sandy loam to loamy soils. This map unit occupies about 48.71 acres or 2.8 percent of the permit area.

Wooded Draw (W)

The Wooded Draw vegetation type comprised approximately 8.92 acres or about 0.5 percent of the permit area. Dominant woody species are plains cottonwood (*Populus deltoides*), boxelder maple (*Acer negundo*), peachleaf willow (*Salix amygdaloides*), snowberry (*Symphoricarpos occidentalis*), big sagebrush and silver sagebrush. Common understory species are Kentucky bluegrass, smooth brome, Japanese chess (*Bromus japonicus*) and stinging nettle (*Urtica dioica*). The Wooded Draw type is only found in a few small stands within ephemeral drainages and will not be disturbed by mining activities. Soils are generally loamy and moderately deep to deep.

3.2 Extended Reference Area

The extended reference area concept for final bond release will be used for lands disturbed by mining activities in this permit area. The extended reference area will consist of all undisturbed lands within the permit area and may be delineated by individual plant community types. Due to the nature of solution mining proposed for this site, sufficient acreage of each plant community type within the permit area will remain undisturbed for use as extended reference area(s).

3.3 Cover Data

Cover data was collected on the Ross ISR Project Permit Area from June 21 through June 24, 2010. The Upland Grassland, Sagebrush Shrubland, and Pastureland plant community/habitat types were sampled. Cover sampling was not required on the other map units as agreed upon with the WDEQ-LQD. Twenty-one cover samples were collected on the Upland Grassland type while 20 samples where collected on the Sagebrush Shrubland and the Pastureland types in 2010. Note that two cover sample sites for the Upland Grassland are located immediately north of the current permit boundary. That area was proposed as part of the permit area at the time of sampling but those lands were removed from consideration at a later date. Table 2 provides the results of the cover sampling for the three plant community types inventoried in 2010 and Addendum 3.5-D contains the computer generated field data sheets.

3.4 Statistical Evaluations

Statistical evaluations were made on the total perennial plant cover, total vegetation cover and total ground cover data for each of the vegetation types surveyed. Sample adequacy was met based on LQD Guideline No. 2 for all parameters as shown in Table 3.

3.5 Species Diversity

Table 4 shows the diversity of plant species encountered in cover sampling for each vegetation type sampled on the Ross ISR Project in 2010. The Sagebrush Shrubland vegetation type exhibited the highest total number of individual plant species recorded in cover transects during the 2010 survey followed by the Upland Grassland and Pastureland vegetation types. The Upland Grassland type exhibited the highest number of species with greater than 2% relative cover followed by the Sagebrush Shrubland and Pastureland.

Table 2 Absolute and Relative Percent Vegetation Cover Data for the Ross ISR Project Area by Vegetation Type, 2010*

	Vegetation Type					
	Upland Grassland		**Sagebrush Shrubland**		**Pastureland**	
Life Form / Species	% Cover	Relative Cover	% Cover	Relative Cover	% Cover	Relative Cover
Perennial Grass						
Agropyron cristatum	0.9	1.2	0.6	0.9	9.0	14.1
Agropyron dasystachyum	-	-	0.3	0.4	-	-
Agropyron intermedium	-	-	-	-	15.2	23.8
Agropyron smithii	7.0	10.1	6.2	8.9	5.4	8.4
Agropyron spicatum	0.3	0.4	-	-	-	-
Aristida purpurea	0.5	0.7	-	-	-	-
Bouteloua gracilis	2.3	3.3	1.1	1.6	-	-
Bromus inermis	2.8	4.0	0.6	0.9	14.7	23.0
Buchloe dactyloides	3.6	5.2	3.4	4.9	3.2	5.0
Calamovilfa longifolia	1.0	1.5	0.6	0.9	-	-
Distichlis stricta	-	-	0.4	0.6	-	-
Koeleria macrantha	2.9	4.1	2.2	3.1	-	-
Poa bulbosa	6.8	9.8	7.0	10.0	6.9	10.8
Poa pratensis	6.2	9.0	11.4	16.3	-	-
Poa secunda	2.0	2.9	1.1	1.6	3.2	5.0
Schizachyrium scoparium	1.2	1.8	0.4	0.6	-	-
Sporobolus airoides	-	-	0.2	0.3	-	-
Sporobolus cryptandrus	0.5	0.7	-	-	-	-
Stipa comata	9.3	13.5	2.5	3.6	0.1	0.2
Stipa viridula	2.4	3.4	2.0	2.9	1.0	1.6
Subtotal	49.5	71.7	40.0	57.2	58.7	91.7
Grasslike						
Carex filifolia	1.9	2.8	0.7	1.0	-	-
Carex pensylvanica	1.4	2.1	0.2	0.3	-	-
Subtotal	3.3	4.8	0.9	1.3	-	-
Perennial Forb						
Achillea millefolium	0.6	0.8	1.0	1.4	-	-
Allium textile	-	-	0.1	0.1	-	-
Ambrosia psilostachya	0.3	0.4	-	-	-	-
Antennaria dimorpha	0.1	0.1	-	-	-	-
Antennaria rosea	0.5	0.7	0.2	0.3	-	-
Arnica fulgens	0.8	1.1	0.2	0.3	-	-
*Astragalus bisulcatus****	0.2	0.3	0.3	0.4	-	-
Astragalus spp.	0.5	0.7	0.7	1.0	-	-
Besseya wyomingensis	0.2	0.3	0.1	0.1	-	-
Cerastium arvense	0.5	0.7	1.0	1.4	0.1	0.2
Comandra umbellata	-	-	0.1	0.1	-	-
Erigeron pumilus	0.1	0.1	-	-	-	-

Table 2. Absolute and Relative Percent Vegetation Cover Data (Continued)

Life Form / Species	Upland Grassland % Cover	Upland Grassland Relative Cover	Sagebrush Shrubland % Cover	Sagebrush Shrubland Relative Cover	Pastureland % Cover	Pastureland Relative Cover
	Vegetation Type					
Perennial Forb (Cont.)						
*Euphorbia esula***	-	-	0.5	0.7	-	-
Gaura coccinea	0.4	0.6	0.1	0.1	-	-
Geum triflorum	-	-	0.1	0.1	-	-
Haplopappus spinulosus	0.2	0.3	-	-	-	-
Helianthus maximiliani	0.1	0.1	-	-	-	-
Heterotheca villosa	0.1	0.1	0.2	0.3	-	-
Hymenoxys acaulis	0.1	0.1	-	-	-	-
Liatris punctata	0.4	0.6	0.3	0.4	-	-
Lithospermum incisum	0.1	0.1	0.1	0.1	-	-
Lupinus argentea	0.5	0.7	0.3	0.4	-	-
Lygodesmia juncea	0.2	0.3	0.1	0.1	-	-
Medicago sativa	-	-	0.2	0.3	2.5	3.9
Melilotus officinalis	0.6	0.8	0.9	1.3	0.2	0.3
Musineon divaricatum	-	-	0.2	0.3	-	-
Oxytropis spp.	0.1	0.1	0.2	0.3	-	-
Phlox hoodii	0.3	0.4	0.3	0.4	-	-
Psoralea argophylla	2.2	3.2	1.0	1.4	-	-
Psoralea esculenta	0.1	0.1	-	-	-	-
Ratibida columnifera	-	-	0.1	0.1	-	-
Sphaeralcea coccinea	0.6	0.8	0.4	0.6	0.5	0.8
Taraxacum officinale	1.2	1.8	2.2	3.1	0.3	0.5
Vicia americana	-	-	1.1	1.6	1.1	1.7
Zigadenus venenosus	0.2	0.3	0.1	0.1	-	-
Subtotal	10.9	15.7	12.1	17.3	4.7	7.3
Subshrub						
Artemisia frigida	0.6	0.8	1.0	1.4	0.4	0.6
Artemisia ludoviciana	0.1	0.1	0.7	1.0	-	-
Atriplex gardneri	-	-	0.1	0.1	-	-
Gutierrezia sarothrae	0.1	0.1	0.1	0.1	-	-
Yucca glauca	0.4	0.6	-	-	-	-
Subtotal	1.1	1.7	1.9	2.7	0.4	0.6
Shrub						
Artemisia cana	-	-	2.8	4.0	0.1	0.2
Artemisia tridentata	0.1	0.1	5.4	7.7	-	-
Chrysothamnus nauseosus	-	-	0.2	0.3	-	-
Sarcobatus vermiculatus	-	-	0.2	0.3	-	-
Symphoricarpos occidentalis	-	-	1.0	1.4	-	-
Subtotal	0.1	0.1	9.6	13.7	0.1	0.2

Table 2 Absolute and Relative Percent Vegetation Cover Data (Continued)

Life Form / Species	Vegetation Type: Upland Grassland % Cover	Upland Grassland Relative Cover	Sagebrush Shrubland % Cover	Sagebrush Shrubland Relative Cover	Pastureland % Cover	Pastureland Relative Cover
Succulent						
Opuntia polyacantha	0.1	0.1	0.5	0.7	-	-
Total Perennials	**65.0**	**94.2**	**65.0**	**93.0**	**63.9**	**99.8**
Annual Grass						
Bromus japonicus	2.6	3.7	2.6	3.7	-	-
Bromus tectorum	0.2	0.3	0.7	1.0	-	-
Subtotal	2.8	4.0	3.3	4.7	-	-
Annual Forb						
Alyssum alyssoides	1.0	1.4	0.6	0.9	-	-
Alyssum desertorum	-	-	-	-	0.1	0.2
Camelina microcarpa	-	-	0.1	0.1	-	-
Descurainia pinnata	-	-	0.3	0.4	-	-
Filago arvensis	0.1	0.1	0.3	0.4	-	-
Medicago lupulina	0.2	0.3	0.1	0.1	-	-
Plantago patagonica	-	-	0.1	0.1	-	-
Thlaspi arvense	-	-	0.1	0.1	-	-
Subtotal	1.2	1.8	1.6	2.3	0.1	0.2
Total Annuals	**4.0**	**5.8**	**4.9**	**7.0**	**0.1**	**0.2**
Total Vegetation Cover	69.0	100.0	69.9	100.0	64.0	100.0
Lichen	0.9	-	0.2	-	-	-
Litter	19.2	-	17.9	-	26.1	-
Rock	0.1	-	-	-	0.1	-
Total Ground Cover	89.2	-	88.0	-	90.2	-
Bare Ground	10.8	-	12.0	-	9.8	-

* = Subtotal and totals may not be exact due to computer rounding
** = State listed noxious weeds
*** = Selenium indicator species
% Cover = Percent absolute cover

Table 3 Statistical Evaluations for the Vegetation Cover Data Collected on the Ross ISR Project Area, 2010

Plant Community Type	Parameters			
	$\overline{X}$	s-1	N	Nmin
Upland Grassland (G)				
Total Perennial Cover	65.0	9.3	21	2
Total Vegetation Cover	69.0	8.0	21	5
Total Ground Cover	89.2	6.2	21	2
Sagebrush Shrubland (S)				
Total Perennial Cover	65.0	10.2	20	3
Total Vegetation Cover	69.9	11.5	20	9
Total Ground Cover	88.0	10.0	20	5
Pastureland (P)				
Total Perennial Cover	63.9	6.3	20	1
Total Vegetation Cover	64.0	6.3	20	4
Total Ground Cover	90.2	5.3	20	2

$\overline{X}$ = Mean
s-1 = Sample Standard Deviation
N = Number of Samples
Nmin = Minimum Number of Samples Needed to Meet Sample Adequacy

Table 4 Number of Plant Species Recorded in Cover Data for Each Vegetation Type Sampled on the Ross ISR Project in 2010

	Plant Community Type					
	Upland Grassland		Sagebrush Shrubland		Pastureland	
	Total	> 2% Relative Cover	Total	> 2% Relative Cover	Total	> 2% Relative Cover
PERENNIALS						
Grass	16	10	16	7	9	7
Grasslike	2	2	2	-	-	-
Forb	27	1	28	1	6	1
Subshrub	4	-	4	-	1	-
Full Shrub	1	-	5	2	1	-
Succulent	1	-	1	-	-	-
Subtotal	51	13	56	10	17	8
ANNUALS						
Grass	2	1	2	1	-	-
Forb	3	-	7	-	1	-
Subtotal	5	1	9	1	1	0
ALL TOTAL	**56**	**14**	**65**	**11**	**18**	**8**

3.6 Threatened, Endangered and Species of Concern

There were no threatened or endangered plant species encountered within the permit area during the 2010 surveys. Habitat for the Ute ladies'-tresses orchid (*Spiranthes diluvialis*) was encountered in the wetlands within the permit area. These wetlands were found primarily along Deadman Creek, Little Missouri River and along the Oshoto Reservoir. These wetland habitats were surveyed on August 11, 12 and 13 of 2010 but no orchids were observed. Typical habitat for the blowout penstemon (*Penstemon haydenii*) is not found on the permit area.

No rare or sensitive plant species of concern as listed by state agencies, federal agencies or the Wyoming Natural Diversity Data Base were found on the study area.

3.7 Noxious Weeds

Several species of designated and prohibited noxious weeds listed by the Wyoming Weed and Pest Control Act were identified on the permit area. These species included field bindweed (Convolvulus arvensis), perennial sow thistle (Sonchus arvensis), Quackgrass (*Agropyron repens*), Canada thistle (*Cirsium arvense*), hounds tongue (*Cynoglossum officinale*), leafy spurge (*Euphorbia esula*), common burdock (Arctium minus), Scotch thistle (*Onopordum acanthium*), Russian olive (*Eleagnus angustifolia*) and skeletonleaf bursage (*Ambrosia tomentosa*). These species may be abundant in small localities, especially around the Oshoto Reservoir and along the Little Missouri River and Deadman Creek, but were not common throughout the area.

Selenium indicator species identified on the permit area in 2010 included two-grooved milkvetch (*Astragalus bisulcatus*), woody aster (Xylorhiza glabriuscula) and Stemmy goldenweed (*Haplopappus multicaulis*). These selenium indicator species were not abundant on the permit area. Little larkspur (*Delphinium bicolor*), locoweed (*Oxytropis sericea* and *Oxytropis lambertii*)

and meadow deathcamus (*Zigadenus venenosus*) were poisonous plants commonly observed on the area in limited amounts. Cheatgrass although not a state listed noxious weed was abundant on some sites within the permit area.

3.8 Trees

A survey of the trees within the permit area shows that four species of trees were present and included boxelder maple, plains cottonwood, peachleaf willow and Russian olive. Table 5 shows the results of the tree survey within the permit area in 2010. The tree survey was summarized for the entire permit area as well as for each Quarter Quarter of each Section that trees were located in. The boxelder maple was the most common tree species recorded (Table 5) on the permit area followed by the plains cottonwood, peachleaf willow and Russian olive. The average height calculated for the boxelder maple for the entire permit area was 19.2 feet and exhibited an average DBH (Diameter at breast height) of 11.2 inches. The plains cottonwood averaged a height of 47.5 feet and an average DBH of 29.0 inches for the entire permit area. The average height calculated for the peachleaf willow for the entire permit area was 27.4 feet and exhibited an average DBH of 15.3 inches. The Russian olive averaged a height of 5.2 feet and an average DBH of 3.0 inches for the entire permit area. Due to the nature of solution mining proposed for the permit area, no trees should be removed by the operation.

4.0 IMPACTS AND MITIGATION

Operations will disturb several of the vegetation plant communities within the permit area. Some of these impacts will be long term such as the plant facilities while other temporary disturbances will be short term.

Table 5 Summary by Section and Quarter/Quarter for Trees Located on the Ross ISR Project Area, 2010.

	Permit Area											
	Boxelder Maple			Plains Cottonwood			Peachleaf Willow			Russian Olive		
Area	N	H	DBH	N	H	DBH	N	H	DBH	N	H	DBH
T53N R68W												
SWNE4, Section 13	4	18.8	11.3	-	-	-	-	-	-	-	-	-
SESE4, Section 13	1	10.0	3.0	-	-	-	-	-	-	-	-	-
SENE4, Section 13	-	-	-	1	30.0	15.0	-	-	-	-	-	-
NWNE4, Section 13	4	17.5	11.3	-	-	-	-	-	-	-	-	-
NESE4, Section 13	3	21.7	10.3	1	65.0	74.0	1	25.0	18.0	-	-	-
NENE4, Section 24	8	20.6	10.8	29	52.4	30.8	15	28.7	14.7	1	10.0	3.0
NWNE4, Section 24	69	19.4	12.2	9	40.0	25.2	25	27.4	15.9	-	-	-
T53N R67W												
SWSW4, Section 18	1	8.0	3.0	-	-	-	-	-	-	-	-	-
SENE4, Section 18	3	16.7	8.3	-	-	-	-	-	-	1	6.0	3.0
NWSW4, Section 18	-	-	-	1	6.0	1.0	-	-	-	-	-	-
NWNE4, Section 18	2	12.5	5.0	-	-	-	1	10.0	6.0	-	-	-
NENE4, Section 18	19	20.8	10.3	-	-	-	-	-	-	-	-	-
NWNW4, Section 19	1	15.0	7.0	1	15.0	7.0	3	3.3	0.0	3	-	-
ALL TOTAL	**115**	**19.2**	**11.2**	**42**	**47.5**	**29.0**	**42**	**27.4**	**15.3**	**5**	**5.2**	**3.0**

N - Number of Trees
H - Average Height of Trees (feet)
DBH - Average Diameter at Breast Height (inches)

The plant facilities will be located within the Hayland type so native vegetation types will not be affected by construction activities on this site. Following termination of operations the plant facility location will be reclaimed back to Hayland.

Disturbances related to well field, pipeline and road construction will occur primarily in the Upland Grassland and Sagebrush Shrubland vegetation types. Only a minor amount of disturbance may occur in other vegetation map units within the permit area. Temporary disturbances will be reclaimed as soon as possible following completion of construction which will reduce the amount of impacts and disturbed lands. Permanent surface features will remain for the life of mine.

Seed mixtures used in reclamation are presented in the Reclamation Plan. Native plant species will be seeded on the native vegetation types affected. These species are selected based on the ability of establishment and their values in supporting the post mine land uses of wildlife habitat and livestock grazing.

5.0 SUMMARY

The Ross ISR Project Permit Area shows a high diversity of plant species with needleandthread, Kentucky bluegrass, western wheatgrass, bulbous bluegrass, big sagebrush and buffalograss being the dominant species observed on the native Upland Grassland and Sagebrush Shrubland vegetation types. On the Pastureland type, which has been cultivated and seeded in the past, was dominated by intermediate wheatgrass, smooth brome, crested wheatgrass, bulbous bluegrass and western wheatgrass. Grass-like species, perennial forbs, subshrubs and shrubs were common on some locations. Trees were only common in the drainages along Deadman Creek, the Little Missouri River and various tributaries.

Cover data was collected on the Upland Grassland, Sagebrush Shrubland and Pastureland plant community/habitat types. All cover data met the required sample adequacy.

Noxious weeds and poisonous plants were common in localized areas. Selenium indicator plant species were uncommon and a few poisonous plants were present. No T&E plants were identified within the permit area.

6.0 SOURCES

Beetle A.A., 1977, Grasses of Wyoming, Agricultural Experiment Station, University of Wyoming, Laramie.

Dorn, R.D., 2001, Manual of the Vascular Plants of Wyoming. 2nd edition. Mountain West Publishing, Cheyenne.

International Environmental Consultants, Inc. 1980. Baseline Vegetation Studies for the Sundance Project, Crook County, Wyoming. Prepared for Nuclear Dynamics, Inc. Casper, Wyoming.

USDI - Fish and Wildlife Service, 2010, Endangered and Threatened Wildlife and Plants, Department of the Interior, U.S. Fish and Wildlife Service.

ADDENDUM 3.5-B

PLANT SPECIES LIST

List of Plant Species Recorded on the Ross ISR project in 2010.

Code	Scientific Name	Common Name
	PERENNIAL GRASS	
AGCR	Agropyron cristatum	Crested wheatgrass
AGDA	Agropyron dasystachyum (Elymus lanceolatus	Thickspike wheatgrass
AGEL	Agropyron elongatum (Elymus elongates)	Tall wheatgrass
AGIN	Agropyron intermedium (Elymus hispidus)	Intermediate wheatgrass
AGRE	Agropyron repens (Elymus repens)	Quackgrass
AGRI	Agropyron riparium (Elymus lanceolatus)	Streambank wheatgrass
AGSM	Agropyron smithii (Elymus smithii)	Western wheatgrass
AGSP	Agropyron spicatum (Elymus spicatus)	Bluebunch wheatgrass
AGTR	Agropyron trachycaulum (Elymus trachycaulus)	Slender wheatgrass
AGSC	Agrostis scabra	Winter bent
AGST	Agrostis stolonifera	Redtop bent
ALAR	Alopecurus arundinaceus	Reed foxtail
ARPU	Aristida purpurea	Threeawn
BOCU	Bouteloua curtipendula	Side oats grama
BOGR	Bouteloua gracilis	Blue grama
BRIN	Bromus inermis	Smooth brome
BUDA	Buchloe dactylodes	Buffalograss
CALO	Calomovifla longifolia	Prairie sandreed
CAMO	Calamagrosits montanensis	Plains reedgrass
DAGL	Dactylus glomeratus	Orchardgrass
DAUN	Danthonian unispicata	Onespike danthonia
DIST	Distichlis stricta	Inland saltgrass
ELCA	Elymus canadensis	Canada wildrye
ELCI	Elymus cinereus	Basin wildrye
ELJU	Elymus junceus	Russian wildrye

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Perennial Grass (Continued)	
HOJU	Hordeum jubatum	Foxtail barley
KOMA	Koeleria macrantha	Prairie junegrass
MUAS	Muhlenbergia asperifolia	Alkali muhly
MUCU	Muhlenbergia cuspidata	Stoneyhills muhly
ORHY	Oryzopsis hymenoides	Indian ricegrass
PHPR	Phleum pratensis	Timothy
POBU	Poa bulbosa	Bulbous bluegrass
POIN	Poa interior	Interior bluegrass
POJU	Poa juncifolia	Alkali bluegrass
POPR	Poa pratensis	Kentucky bluegrass
POSE	Poa secunda	Sandberg bluegrass
POA	Poa spp.	Bluegrass
PUNU	Puccinelia nuttalliana	Nuttall alkaligrass
SCPA	Schedonnardus paniculatus	Tumblegrass
SCSC	Schizachyrium scoparius	Little bluestem
SIHY	Sitanion hystrix	Bottlebrush squirreltail
SPAI	Sporobolus airoides	Alkali sacaton
SPCR	Sporobolus cryptandrus	Sand dropseed
SPGR	Spartina gracilis	Alkali cordgrass
SPPE	Spartina pectinata	Prairie cordgrass
STCO	Stipa comata	Needleandthread
STVI	Stipa viridula	Green needlegrass
	GRASSLIKE	
CAR	Carex spp.	Sedge
CAFI	Carex filifolia	Threadleaf sedge
CANE	Carex nebrascensis	Nebraska sedge
CAPE	Carex pensylvanica	Sun sedge
CAPEL	Carex pellita	Wooly sedge
CAPR	Carex praegracilis	Fieldclustered sedge
CAST	Carex stenophylla	Needleleaf sedge
EQLA	Equisetum laevigatum	Horsetail

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Grasslike (Continued)	
ELAC	Eleocharis acicularis	Slender spikerush
ELPA	Eleocharis palustris	Creeping spikerush
JUBA	Juncus balticus	Baltic rush
JUIN	Juncus interior	Inland rush
JUTE	Juncus tenuis	Poverty rush
JUTO	Juncus torreyi	Torrey rush
SCAC	Scirpus acutus (Schoenoplectus acutus)	Tule bulrush
SCMA	Scirpus maritimus (Bolboschoenus maritimus)	Bulrush
SCPU	Scirpus pungens (Schoenoplectus punngens)	Bulrush
TYLA	Typha latifolia	Cattail
	PERENNIAL FORB	
ACMI	Achillea millefolium	Western yarrow
AGGL	Agoseris gluaca	False dandelion
ALTE	Allium textile	Prairie onion
AMPS	Ambrosia psilostachya	Ragweed
AMTO	Ambrosia tomentosa	Skeletonleaf bursage
ANDI	Antennaria dimorpha	Low pussytoes
ANRO	Antennaria rosea	Rose pussytoes
ARHO	Arenaria hookeri	Hooker sandwort
ARHOL	Arabis holboellii	Holboell rockcress
ARFU	Arnica fulgens	Orange arnica
ASER	Aster ericoides	Heath aster
ASFA	Aster falcatus	Whiteprairie aster
ASPU	Asclepias pumila	Low milkweed
ASSP	Asclepias speciosa	Showy milkweed
ASAD	Astragalus adsurgens (Astragalus laxmanii)	Standing milkvetch
ASBI	Astragalus bisulcatus	Two-groved milkvetch
ASMI	Astragalus missouriensis	Missouri milkvetch

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Perennial Forb (Continued)	
ASPUR	Astragalus purshii	Pursh milkvetch
ASSPA	Astragalus spatulatus	Spoonleaf milkvetch
BEWY	Besseya wyomingensis	Wyoming kittentails
CANU	Calochortus nuttallii	Mariposa lily
CARO	Campanula rotundifolia	Harebell
CASE	Calylophus serrulata	Shrubby primrose
CASES	Castilleja sessiflora	Largeflowered paintbrush
CASU	Castilleja sulphurea	Sulphur paintbrush
CEAR	Cerastium arvense	Field cerastium
CIAR	Cirsium arvense	Canada thistle
CICA	Cirsium canescens	Platte thistle
CIUN	Cirsium undulatum	Wavyleaf thistle
CIVU	Cirsium vulgare	Bull thistle
CLSE	Cleome serrulata	Rockymountain beeplant
COUM	Comadra umbellata	Bastardtoadflax
COAR	Convolvulus arvensis	Field bindweed
CRAC	Crepis acuminata	Tapertip hawksbeard
CYAC	Cymopterus acaulis	Stemless springparsley
CYMO	Cymopterus montanus	Mountain springparsley
DAPU	Dalea purpurea	Purple prairieclover
DEBI	Dephinium bicolor	Little larkspur
ECAN	Echinacea angustifolia	Blacksamson echinacea
EPCI	Epilobium ciliatum	Fringed willowherb
ERAS	Erysimum asperum	Plains wallflower
EROC	Erigeron ochroleucus	Buff fleabane
ERPU	Erigeron pumilus	Low fleabane
EUES	Euphorbia esula	Leafy spurge
GABO	Galium boreale	Northern bedstraw
GACO	Gaura coccinea	Scarlet gaura
GETR	Geum triflorum	Prairie smoke
GLLE	Glycyrrhiza lepidota	American licorice
GRSQ	Grindelia squarrosa	Curlycup gumweed
HAMU	Haplopappus multicaulis	Stemmy goldenweed

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Perennial Forb (Continued)	
HASP	Haplopappus spinulosus	Ironplant goldenweed
HEMA	Helianthus maximiliana	Maximilian sunflower
HEPA	Helianthus pauciflorus	Stiff sunflower
HEVI	Heterotheca villosa	Golden aster
HYAC	Hymenoxis acaulis	Stemless actinea
IPCO	Ipomopsis congesta	Ipomopsis
IVAX	Iva axillaris	Povertyweed
LAPU	Lactuca puchella	Chickory lettuce
LASE	Lactuca serriola	Prickly lettuce
LELU	Lesquerella ludoviciana	Bladderpod
LEMO	Leucocrinum montanum	Starlily
LERE	Lewisia rediviva	Bitterroot
LILE	Linum lewisii	Lewis flax
LIPU	Liatris punctata	Gay feather
LIIN	Lithospermum incisum	Narrowleaf gromwell
LIRU	Lithospermum ruderale	Wayside gromwell
LIPA	Lithophragma parviflorum	Woodland star
LOFO	Lomatium foeniculum	Hairyseed lomatium
LOOR	Lomation orientale	Idaho biscuitroot
LUAR	Lupinus argenteus	Silvery lupine
LYJU	Lygodesmia juncea	Skeleton plant
MACA	Machaeranthera canescens	Hoary aster
MAGR	Machaeranthera grindelioides	Nuttall goldenweed
MEAL	Melilotus albus	White sweetclover
MELA	Mertensia lanceolata	Bluebell
MEAR	Mentha arvensis	Field mint
MEOF	Melilotus officinalis	Yellow sweetclover
MESA	Medicago sativa	Alfalfa
MINU	Microseris nutans	Nodding microseris
MOFI	Monarda fistulosa	Horsemint
MUDI	Musineon divaricatum	Musineon
OECO	Oenothera coronopifolia	Crownleaf eveningprimrose

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Perennial Forb (Continued)	
OECE	Oenothera cespitosa	Gumbo lily
ONAC	Onopordum acanthium	Scotch thistle
ORFA	Orobanche fasciculata	Cancer root
OXSE	Oxytropis sericea	Silky loco
OXLA	Oxytropis lambertii	Locoweed
PEAL	Penstemon albidus	White penstemon
PEGL	Penstemon glaber	Smooth beardtongue
PHHO	Phlox hoodii	Hoods phlox
PIOP	Picradeniopsis oppositifolia	Bahia
POAR	Potentilla arguta	Tall cinquefoil
POGR	Potentilla gracilis	Cinquefoil
PSAR	Psoralea argophylla	Silverleaf scurfpea
PSES	Psoralea esculenta	Indian breadroot
PSTE	Psoralea tenuiflora	Slimflower Scurfpea
RAAQ	Ranunculus aquatilis	Water buttercup
RACO	Ratibida columnifera	Prairie coneflower
RUCR	Rumex crispus	Curly dock
RUSA	Rumex salicifolius	Willowleaf dock
SACU	Sagitaria cuneata	Arrowhead
SELA	Sedum lanceolatum	Stonecrop
SEDA	Selaginella densa	Little club moss
SIDR	Silene drummondii	Drummond campion
SOAR	Sonchus arvensis	Sow thistle
SOMI	Solidago missouriensis	Missouri goldenrod
SOMO	Solidago mollis	Velvety goldenrod
SPCO	Sphaeralcea coccinea	Scarlet globemallow
TAOF	Taraxacum officinale	Dandelion
THRH	Thermopsis rhombifolia	Prairie thermopsis
TRDU	Tragopogon dubius	Yellow salsify
TRI	Trifolium spp.	Clover

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Perennial Forb (Continued)	
URDI	Urtica dioica	Stinging nettle
VEBR	Verbena bracteata	Bigtract verbena
VIAM	Vicia americana	American vetch
XYGL	Xylorhiza glabriuscula	Woody aster
ZIVE	Zigadenus venenosus	Meadow Deathcamas
	SUBSHRUB	
ARFR	Artemisia frigida	Fringed sagewort
ARLU	Artemisia ludoviciana	Louisiana sagewort
ATGA	Atriplex gardneri	Gardner saltbush
ERFL	Eriogonum flavum	Golden wildbuckwheat
ERMI	Eriogonum microthecum	Slender wildbuckwheat
ERPA	Eriogonum pauciflorum	Wildbuckwheat
GUSA	Gutierrezia sarothrae	Broom snakeweed
LEPU	Leptodactylon pungens	Pricklygilia
YUGL	Yucca glauca	Small soapweed
	SHRUB	
ATCA	Artemisia cana	Silver sagebrush
ARTR	Artemisia tridentata	Big sagebrush
CHNA	Chrysothamnus nauseosus	Rubber rabbitbrush
CHVI	Chrisothamnus viscidiflorus	Douglas rabbitbrush
CRCH	Crataegus chrysocarpa	Hawthorn
PRVI	Prunus virginiana	Chokecherry
RHTR	Rhus trilobata	Skunkbush sumac
RIAU	Ribes aureum	Golden current
RIB	Ribes sp.	Current
ROWO	Rosa woodsii	Woods rose
SAVE	Sarcobatus vermiculatus	Black greasewood
SYOC	Symphoricarpos occidentalis	Western snowberry

List of Plant Species Continued.

Code	Scientific Name	Common Name
	SUCCULENT	
OPPO	Opuntia polyacantha	Prickly pear
PESO	Pediocactus simpsonii	Barrel cactus
	TREE	
ACNE	Acer negundo	Boxelder maple
ELAN	Eleagnus angustifolia	Russian olive
PODE	Populus deltoides	Plains cottonwood
SAAM	Salix amygdaloides	Peach-leaved willow
	ANNUAL GRASS	
ALCA	Alopecurus carolinianus	Carolina foxtail
BESY	Beckmania syzigachne	American sloughgrass
BRCO	Bromus commutatus	Hairy brome
BRJA	Bromus japonicus	Japanese chess
BRTE	Bromus tectorum	Cheatgrass
ECCR	Echinochloa crusgalli	Barnyardgrass
ERTR	Eremopyrum triticeum	Falsewheatgrass
PACA	Panicum capillare	Witchgrass panic
VUOC	Vulpia octoflora	Sixweeksgrass
	ANNUAL FORB	
ALAR	Alyssum alyssoides	Pale alyssum
ALDE	Alyssum desertorum	Desert alyssum
AMBL	Amaranthus blitoides	Prostrate pigweed
AMRE	Amaranthus retroflexus	Redroot pigweed
ARMI	Arctium minus	Burdock
ATAR	Atriplex argentea	Silvery orache
CAPU	Capsella bursa-pastoris	Sheperd’s purse
CAMI	Camelina microcarpa	Smallseed falseflax
CHAL	Chenopodium album	Goosefoot

List of Plant Species Continued.

Code	Scientific Name	Common Name
	Annual Forb (Continued)	
CHFR	Chenopodium femontii	Fremont goosefoot
CHTE	Chorispora tenella	Blue mustard
CLSE	Cleome serrulata	Rockymountain beeplant
COLI	Collomia linearis	Collomia
COCA	Conyza canadensis	Canada horseweed
DEPI	Descurainia pinnata	Pinnate tansymustard
DESO	Descurainia Sophia	Flixweed
ERGL	Euphorbia glytosperma	Ridgeseed spurge
FIAR	Filago arvensis	Filago
HEHI	Hedeoma hispida	False pennyroyal
HEAN	Helianthus annuus	Annual sunflower
HELA	Heracleum lanatum	Cow parsnip
IVXA	Iva xanthifolia	Marsh-elder
KOSC	Kochia scoparia	Summer cypress
LARE	Lappula redowski	Bluebur stickseed
LEDE	Lepidium densiflorum	Prairie pepperweed
LEPE	Lepidium perfoliatum	Clasping pepperweed
LUPU	Lupinus pusillus	Low lupine
MANE	Malva neglecta	Common mallow
MELU	Medicago lupulina	Black medic
OEAL	Oenothera albicaulis	Evening primrose
ORLU	Orthocarpus luteus	Owl Clover
PHLI	Phacelia linearis	Bluebell phacelia
PLPA	Plantago patagonica	Wooly plantain
POAV	Polygonum aviculare	Prostrate knotweed
POLA	Polygonum lapathifolium	Curlythumb knotweed
RATE	Ranunculus testicularis	Testiculate buttercup
SAKA	Salsola kali	Russian thistle
SIAL	Sisymbrium altissimum	Tumbling hedge mustard
THAR	Thlaspi arvensis	Field pennycress
VIVI	Vicia villosa	Winter vetch
XAST	Xanthium strumarium	Cocklebur

ADDENDUM 3.5-C

VEGETATION PHOTOGRAPHS

Photo 1. Ross ISR Project Upland Grassland Vegetation Type in June of 2010.

Photo 2. Ross ISR Project Upland Grassland Vegetation Type in June of 2010.

Photo . Ross ISR Project Sagebrush Shrubland Vegetation Type in June of 2010.

Photo . Ross ISR Project Sagebrush Shrubland Vegetation Type in June of 2010.

Photo . Ross ISR Project Pastureland Vegetation Type in June of 2010.

Photo . Ross ISR Project Pastureland Vegetation Type in June of 2010.

Photo . Ross ISR Project Hayland Vegetation Type in June of 2010.

Photo . Ross ISR Project Hayland Vegetation Type in June of 2010.

Photo . Ross ISR Project Wetland Vegetation Type in June of 2010.

Photo 10. Ross ISR Project Reservoir Stockpond Vegetation Type in June of 2010.

Photo 11. Ross ISR Project Cropland Map Unit in June of 2010.

Photo 12. Ross ISR Project Cropland Map Unit in June of 2010.

Photo 1 . Ross ISR Project Wooded Draw Vegetation Type in June of 2010.

Photo 1 . Ross ISR Project Wooded Draw Vegetation Type in June of 2010.

ADDENDUM 3.5-D

COMPUTER GENERATED DATA SHEETS

Computer Generated Data Sheets

Table of Contents

Ross ISR Project
UPLAND GRASSLAND
Cover Data (21-2 2010)

						Transect									
Life Form Species	1	2								10	11	12	1	1	1
Perennial Grass															
Agropyron cristatum	0	0	0	0	0	0		0	0	0	1	0	0	0	0
Agropyron smithii		2			0	2		1	1	1					1
Agropyron spicatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aristida purpurea	0	0	0	0	0	1	0	0	0	0	0	0	0		0
Bouteloua gracilis	1	0	0	0	1	0	0	2	0	1	0	1	0		0
Bromus inermis				0	0	2	0	0	0	0	11	0	0	0	0
Buchloe dactyloides	0	0		0	0	1	2		0	0	1	0	0	0	2
Calamovilfa longifolia	0	0	0	0	0	0	0	0		2	0	0	0	0	1
Koeleria macrantha	1	0	0		0	0	0		0	10	0	2	0	1	2
Poa bulbosa	0	0	1			2				2		2	2	0	
Poa pratensis	0	1	2				0	0						0	1
Poa secunda	1	0	1	2	1	0	0	2	0	0	0	0	2	2	2
Schizachyrium scoparium	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Sporobolus cryptandrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stipa comata			1		1		0		2	0	1	1			1
Stipa viridula	0	0	1	0	0	0	0	0		0	1			2	0
Grass-like															
Carex filifolia	2	0	0	0	0	0	0	0	1		0	2	0	0	2
Carex pensylvanica	0	1	0	0	0		0	1	0	1	1	2	0	0	1
Perennial Forb															
Achillea millefolium	0	1	0	0	0	0	0	0	2	0	1	0	1	0	0
Ambrosia psilostachya	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0
Antennaria dimorpha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antennaria rosea	0	0	0	0	1	0	0	0	1	0	0	2	1	0	0
Arnica fulgens	0		0	0	0	0	0	0	1	0	0	1	2	0	0
Astragalus bisulcatus	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Astragalus spp.	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Besseya wyomingensis	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Cerastium arvense	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
Erigeron pumilus	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Gaura coccinea	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1
Haplopappus spinulosus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Helianthus maximiliani	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Heterotheca villosa	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Hymenoxys acaulis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liatris punctata	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0
Lithospermum incisum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lupinus argentea	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1
Lygodesmia juncea	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Melilotus officinalis	0	0	0	0	0	0		0	0	0	0	0	0	1	0
Oxytropis spp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Phlox hoodii	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
Psoralea argophylla	1	0	0	1		0	0	1	1	1	1		0	0	0

Ross ISR Project
UPLAND GRASSLAND
Cover Data (21-2 2010)

Life Form Species	Transect 1	1	1	1	20	21	Total	Mean	Cover	Relative Cover
Perennial Grass										
Agropyron cristatum	0	0	0	0	0			0.	0.	1.2
Agropyron smithii	0	1	1		2			.	.0	10.1
Agropyron spicatum		0	0	0	0	0		0.1	0.	0.
Aristida purpurea	0	0	0	0	1	0		0.2	0.	0.
Bouteloua gracilis	0		2	0	1		2	1.1	2.	.
Bromus inermis	0	0	0	0	0	0	2	1.	2.	.0
Buchloe dactyloides	0	2	0	1	2	0		1.	.	.2
Calamovilfa longifolia	0	0		0	0	0	11	0.	1.0	1.
Koeleria macrantha	2	1	0	0		0	0	1.	2.	.1
Poa bulbosa			2	1			1	.	.	.
Poa pratensis	0	2	2	0	1	0		.1	.2	.0
Poa secunda	0	0		2	2	1	21	1.0	2.0	2.
Schizachyrium scoparium	11	0	0	0	0	0	1	0.	1.2	1.
Sporobolus cryptandrus	0	0	0	0	0	0		0.2	0.	0.
Stipa comata		1	1	1				.	.	1 .
Stipa viridula	0	0	0	0		0	2	1.2	2.	.
Grass-like										
Carex filifolia	1	0	1	0	0	2	20	1.0	1.	2.
Carex pensylvanica	0	0		0	0	2	1	0.	1.	2.1
Perennial Forb										
Achillea millefolium	0	0	0	0	1	0		0.	0.	0.
Ambrosia psilostachya	0	0	0	0	0	0		0.1	0.	0.
Antennaria dimorpha	1	0	0	0	0	0	1	0.0	0.1	0.1
Antennaria rosea	0	0	0	0	0	0		0.2	0.	0.
Arnica fulgens	0	0	0	0	0	0		0.	0.	1.1
Astragalus bisulcatus	0	0	0	0	0	0	2	0.1	0.2	0.
Astragalus spp.	0	0	1	0	1	0		0.2	0.	0.
Besseya wyomingensis	0	0	0	0	0	0	2	0.1	0.2	0.
Cerastium arvense	1	1	0	0	0	0		0.2	0.	0.
Erigeron pumilus	0	0	0	0	0	0	1	0.0	0.1	0.1
Gaura coccinea	0	0	0	0	1	0		0.2	0.	0.
Haplopappus spinulosus	0	0	0	0	1	0	2	0.1	0.2	0.
Helianthus maximiliani	0	0	0	0	0	0	1	0.0	0.1	0.1
Heterotheca villosa	0	0	0	0	0	0	1	0.0	0.1	0.1
Hymenoxys acaulis	1	0	0	0	0	0	1	0.0	0.1	0.1
Liatris punctata	0	0	0	0	0	0		0.2	0.	0.
Lithospermum incisum	0	0	0	1	0	0	1	0.0	0.1	0.1
Lupinus argentea	0	0	0	0	0	0		0.2	0.	0.
Lygodesmia juncea	0	0	0	0	0	0	2	0.1	0.2	0.
Melilotus officinalis	0	0	0	0	0	0		0.	0.	0.
Oxytropis spp.	0	0	0	0	0	0	1	0.0	0.1	0.1
Phlox hoodii	0	0	0	0	0	0		0.1	0.	0.
Psoralea argophylla	0	2	0	2	1	1	2	1.1	2.2	.2

Ross ISR Project
UPLAND GRASSLAND
Cover Data (21-2 2010)

	Transect														
Life Form Species	1	2								10	11	12	1	1	1
Psoralea esculenta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaeralcea coccinea	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0
Taraxacum officinale	1	2	0	0	0	1	2	0	1	0	1	1	1	2	0
Zigadenus venenosus	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Subshrub															
Artemisia frigida	0	0	1	0	0	1	0	2	0	1	0	0	0	0	0
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gutierrezia sarothrae	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Yucca glauca	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Shrub															
Artemisia tridentata	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Succulent															
Opuntia polyacantha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Perennials	**24**	**35**	**35**	**34**	**42**	**26**	**28**	**35**	**38**	**34**	**37**	**39**	**29**	**29**	**28**
Annual Grass															
Bromus japonicus	1		0	2	0	0	1	0	1	0	1	2		2	1
Bromus tectorum	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Forb															
Alyssum alyssoides	1	0	0	0	0		0	1	0	2	0	0	1	0	0
Filago arvensis	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Medicago lupulina	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Total Veg Cover	2				2	2	1					1		1	2
Lichens	0	0	0	0	0		0	0	0	0	0		0	0	0
Litter	11	12	1			10	12						10		1
Rock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare Ground	11	0	1						2			0		10	
Total Ground Cover		0				2		2				0		0	

Ross ISR Project
UPLAND GRASSLAND
Cover Data (21-2 2010)

Life Form Species	Transect 1	1	1	1	20	21	Total	Mean	Cover	Relative Cover
Psoralea esculenta	0	0	0	0	0	1	1	0.0	0.1	0.1
Sphaeralcea coccinea	0	0	1	0	0	1		0.	0.	0.
Taraxacum officinale	0	1	0	0	0	0	1	0.	1.2	1.
Zigadenus venenosus	0	0	0	0	0	0	2	0.1	0.2	0.
Subshrub										
Artemisia frigida	0	0	1	0	0	0		0.	0.	0.
Artemisia ludoviciana	0	0	0	0	0	0	1	0.0	0.1	0.1
Gutierrezia sarothrae	0	0	0	0	0	0	1	0.0	0.1	0.1
Yucca glauca	0	1	1	0	0	0		0.2	0.	0.
Shrub										
Artemisia tridentata	0	0	0	0	0	0	1	0.0	0.1	0.1
Succulent										
Opuntia polyacantha	0	0	1	0	0	0	1	0.0	0.1	0.1
Total Perennials	**29**	**31**	**37**	**29**	**31**	**33**	**683**	**32.5**	**65.0**	**94.2**

S-1	Nmin
.	2

Life Form Species										
Annual Grass										
Bromus japonicus	0		0		2	0	2	1.	2.	.
Bromus tectorum	0	0	0	0	0	0	2	0.1	0.2	0.
Annual Forb										
Alyssum alyssoides	0	1	0	1	0	0	10	0.	1.0	1.
Filago arvensis	0	0	0	0	0	0	1	0.0	0.1	0.1
Medicago lupulina	0	0	0	0	0	0	2	0.1	0.2	0.

		S-1	Nmin
Total Veg Cover	2	2 . .0	.02	

Lichens	0	0	0	0	0	0		0.	0.	
Litter	11		11	11	10	12	202	.	1 .2	
Rock	1	0	0	0	0	0	1	0.0	0.1	
Bare Ground			2				11	.	10.	

		S-1	Nmin
Total Ground Cover	1	. .2	.12	2

Ross ISR Project
SAGEBRUSH SHRUBLAND
Cover Data (21-2 2010)

	Transect														
Life Form Species	1	2								10	11	12	1	1	1
Perennial Grass															
Agropyron cristatum	0	0	0		0	2	0	0	0	0	0	1	0	0	0
Agropyron dasystachyum	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Agropyron smithii			2					1	1	1		0	2	11	
Bouteloua gracilis	0	0	0	1	0	2	0	0	0	0		0	2	0	0
Bromus inermis	0	0	2	1	0	0	0	0	0	0	0		0	0	0
Buchloe dactyloides	1	0	2	0	1	0			0	2		0	0		0
Calamovilfa longifolia	0	0	0	0	0	0	0	0		0	0	0	0	0	0
Distichlis stricta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Koeleria macrantha		0	0	0	1	0	1	0		2	1	0		1	0
Poa bulbosa					0	1	1		0						
Poa pratensis		1			10			10		1	0	2			
Poa secunda	0	1	0	0	0	0	0	1	0		1	0	0	2	1
Schizachyrium scoparium	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0
Sporobolus airoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stipa comata		2		0	0	0	0	0	2	0	1	0	1	0	0
Stipa viridula	0	0	0	0		1	0	1		0	1	1	0	1	0
Grass-like															
Carex filifolia		0	0	0	0	0	0	0	2	0	0	0	1	0	0
Carex pensylvanica	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Perennial Forb															
Achillea millefolium	1	2	0	2	1	1	0	0	0	0	0	0	0	0	1
Allium textile	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Antennaria rosea	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Arnica fulgens	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Astragalus bisulcatus	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
Astragalus spp.	1	0	0	0	2	2	0	1	0	0	0	0	0	0	0
Besseya wyomingensis	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Cerastium arvense	0	0	0	1	1	1	1	1	0	0	0	0	2	0	0
Comandra umbellatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euphorbia esula	0	0	0		0	0	0	0	0	0	0	0	0	0	0
Gaura coccinea	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Geum triflorum	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Heterotheca villosa	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Liatris punctata	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0
Lithospermum incisum	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Lupinus argentea	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
Lygodesmia juncea	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Medicago sativa	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Melilotus officinalis	0	0		0	0	1	0	0	0	1	0	2	0	0	0
Musineon divaricatum	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Oxytropis spp.	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Phlox hoodii	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0
Psoralea argophylla	1	0	0	0	1	1	1		2	0	0	0	1	0	0

Ross ISR Project
SAGEBRUSH SHRUBLAND
Cover Data (21-2 2010)

Life Form Species	Transect 1	1	1	1	20	Total	Mean	Cover	Relative Cover
Perennial Grass									
Agropyron cristatum	0	0	0	0	0		0.	0.	0.
Agropyron dasystachyum	0	0	0	0	1		0.2	0.	0.
Agropyron smithii				1	1	2	.1	.2	.
Bouteloua gracilis	2	0	0	1	0	11	0.	1.1	1.
Bromus inermis	0	0	0	0	0		0.	0.	0.
Buchloe dactyloides	0	1	0		0		1.	.	.
Calamovilfa longifolia	0	0	0	2	0		0.	0.	0.
Distichlis stricta	0		0	0	0		0.2	0.	0.
Koeleria macrantha	0	1	0	1	0	22	1.1	2.2	.1
Poa bulbosa						0	.	.0	10.0
Poa pratensis		2	1		2	11	.	11.	1 .
Poa secunda	0	0	0	0	1	11	0.	1.1	1.
Schizachyrium scoparium	0	0	0	0	0		0.2	0.	0.
Sporobolus airoides	0	2	0	0	0	2	0.1	0.2	0.
Stipa comata		0	0	0	2	2	1.	2.	.
Stipa viridula		1	0		0	20	1.0	2.0	2.
Grass-like									
Carex filifolia	0	0	0	0	0		0.	0.	1.0
Carex pensylvanica	0	0	0	0	0	2	0.1	0.2	0.
Perennial Forb									
Achillea millefolium	1	0	0	1	0	10	0.	1.0	1.
Allium textile	0	0	0	0	0	1	0.1	0.1	0.1
Antennaria rosea	0	0	0	0	0	2	0.1	0.2	0.
Arnica fulgens	0	0	0	1	0	2	0.1	0.2	0.
Astragalus bisulcatus	0	0	0	0	0		0.2	0.	0.
Astragalus spp.	0	0	0	1	0		0.	0.	1.0
Besseya wyomingensis	0	0	0	0	0	1	0.1	0.1	0.1
Cerastium arvense	1	0	1	1	0	10	0.	1.0	1.
Comandra umbellatum	1	0	0	0	0	1	0.1	0.1	0.1
Euphorbia esula	0	0	0	0	0		0.	0.	0.
Gaura coccinea	0	0	0	0	0	1	0.1	0.1	0.1
Geum triflorum	0	0	0	0	0	1	0.1	0.1	0.1
Heterotheca villosa	0	0	0	0	0	2	0.1	0.2	0.
Liatris punctata	0	0	0	0	0		0.2	0.	0.
Lithospermum incisum	0	0	0	0	0	1	0.1	0.1	0.1
Lupinus argentea	0	0	0	1	0		0.2	0.	0.
Lygodesmia juncea	0	0	0	0	0	1	0.1	0.1	0.1
Medicago sativa	0	0	0	0	0	2	0.1	0.2	0.
Melilotus officinalis	1	0	0	0	1		0.	0.	1.
Musineon divaricatum	0	0	0	0	0	2	0.1	0.2	0.
Oxytropis spp.	0	0	0	0	0	2	0.1	0.2	0.
Phlox hoodii	0	0	0	0	0		0.2	0.	0.
Psoralea argophylla	0	0	0	0	0	10	0.	1.0	1.

Ross ISR Project
SAGEBRUSH SHRUBLAND
Cover Data (21-2 2010)

	Transect														
Life Form Species	1	2								10	11	12	1	1	1
Ratibida columnifera	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Sphaeralcea coccinea	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Taraxacum officinale	1		0	0	1		1	0	0	1	1		1	0	
Vicia americana	0	0	0	0	0	0		0	0		0	0	0	0	2
Zigadenus venenosus	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Subshrub															
Artemisia frigida		0	0	0	0	1	0	2	0	1	0	0	2	0	1
Artemisia ludoviciana	0	0	0	0	1	0		0	0	0	0	0	0	0	2
Atriplex gardneri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Shrub															
Artemisia cana	2			2	0	0	0	1	0	0	0		0	0	0
Artemisia tridentata	0	0	0	0					2			0		2	
Chrysothamnus nauseosus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Sarcobatus vermiculatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Symphoricarpos occidentalis	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Succulent															
Opuntia polyacantha	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0
Total Perennials	**40**	**37**	**32**	**40**	**35**	**32**	**35**	**42**	**33**	**29**	**29**	**23**	**33**	**31**	**33**
Annual Grass															
Bromus japonicus	1		0	0	0	1	0	0	0	0	2	10	0	0	1
Bromus tectorum	0	0	2	0	0	0	0	0	0	0	0		0	0	0
Annual Forb															
Alyssum alyssoides	0	0	2	1	0	0	0	0	0	0	1	2	0	0	0
Camelina microcarpa	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Descurainia pinnata	0		0	0	0	0	0	0	0	0	0	0	0	0	0
Filago arvensis	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Medicago lupulina	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Plantago patagonica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thlaspi arvense	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Veg Cover	1			1				2		0	2	1			
Lichens	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Litter		1	10		10	1	11		1					12	
Bare Ground	2	0		0		2		1		1	12		10		10
Total Ground Cover		0		0									0		0

Ross ISR Project
SAGEBRUSH SHRUBLAND
Cover Data (21-2 2010)

Life Form Species	Transect 1	1	1	1	20	Total	Mean	Cover	Relative Cover
Ratibida columnifera	0	0	0	0	0	1	0.1	0.1	0.1
Sphaeralcea coccinea	0	0	0	0	0		0.2	0.	0.
Taraxacum officinale	1	1	0	2	0	22	1.1	2.2	.1
Vicia americana	0	0	1	0	1	11	0.	1.1	1.
Zigadenus venenosus	0	0	0	0	0	1	0.1	0.1	0.1
Subshrub									
Artemisia frigida	0	0	0	0	0	10	0.	1.0	1.
Artemisia ludoviciana	1	0	0	0	0		0.	0.	1.0
Atriplex gardneri	0	1	0	0	0	1	0.1	0.1	0.1
Gutierrezia sarothrae	0	0	0	0	0	1	0.1	0.1	0.1
Shrub									
Artemisia cana	1	1		0	0	2	1.	2.	.0
Artemisia tridentata	1	1					2.	.	.
Chrysothamnus nauseosus	0	1	0	0	0	2	0.1	0.2	0.
Sarcobatus vermiculatus	0	1	0	0	0	2	0.1	0.2	0.
Symphoricarpos occidentalis		0	0	0	0	10	0.	1.0	1.
Succulent									
Opuntia polyacantha	0	0	0	1	1		0.	0.	0.
Total Perennials	**33**	**25**	**32**	**33**	**23**	**650**	**32.5**	**65.0**	**93.0**
Annual Grass									
Bromus japonicus	1	2	0	0	0	2	1.	2.	.
Bromus tectorum	0	0	0	0	0		0.	0.	1.0
Annual Forb									
Alyssum alyssoides	0	0	0	0	0		0.	0.	0.
Camelina microcarpa	0	0	0	0	0	1	0.1	0.1	0.1
Descurainia pinnata	0	0	0	0	0		0.2	0.	0.
Filago arvensis	0	0	0	0	0		0.2	0.	0.
Medicago lupulina	0	0	0	0	0	1	0.1	0.1	0.1
Plantago patagonica	1	0	0	0	0	1	0.1	0.1	0.1
Thlaspi arvense	0	0	0	0	0	1	0.1	0.1	0.1
Total Veg Cover		2	2		2		.	.	
Lichens	0	0	0	0	0	2	0.1	0.2	
Litter	10	1	12	10		1	.0	1 .	
Bare Ground					1	120	.0	12.0	
Total Ground Cover					1	0	.0	.0	

S-1	Nmin
.1	

S-1	Nmin
.	

S-1	Nmin
.01	

Ross ISR Project
PASTURE
Cover Data (21-2 2010)

	Transect														
Life Form Species	1	2								10	11	12	1	1	1
Perennial Grass															
Agropyron cristatum	0	0	0	0		2	1	2		12	0	0	0	1	1
Agropyron intermedium	10	12		12	0	1	0	10	0	0	0		1	0	
Agropyron smithii	0		0	1	0	1	0		1		0	2	0	2	
Bromus inermis		0	1		2	0	21		1	2	2	1		0	
Buchloe dactyloides	0	0	0	0	0	0	0	1	12		0	0	0		0
Poa bulbosa		0			0		1								
Poa secunda	2		1		0	2	2		0	0	1	0	0	0	2
Stipa comata	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stipa viridula	0		0	0	0	0		0	0	0	0	0	0	0	1
Perennial Forb															
Cerastium arvense	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Medicago sativa	1	1		1	1	0	1	1	0	0		2		0	0
Melilotus officinalis	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaeralcea coccinea	0	0	0	0	0	0	0	0	2	2	0	0	0	1	0
Taraxacum officinale	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Vicia americana	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0
Subshrub															
Artemisia frigida	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrub															
Artemisia cana	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Total Perennials	**28**	**30**	**31**	**30**	**33**	**32**	**29**	**35**	**36**	**33**	**31**	**29**	**29**	**36**	**36**
Annual Forb															
Alyssum desertorum	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Veg Cover	2	1	1	0		2	2				1	2	2		
Litter	1	1	1	1	1	1	1	11		11	1	10	1	10	10
Rock	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Bare Ground					1							11			
Total Ground Cover															

Ross ISR Project
PASTURE
Cover Data (21-2 2010)

Life Form Species	Transect 1	1	1	1	20	Total	Mean	Cover	Relative Cover
Perennial Grass									
Agropyron cristatum	0	0		0	0	0	.	.0	1 .1
Agropyron intermedium	1	2	11	11		1 2	.	1 .2	2 .
Agropyron smithii							2.	.	.
Bromus inermis		0	0	0		1	.	1 .	2 .0
Buchloe dactyloides		1	1	0	0	2	1.	.2	.0
Poa bulbosa	0	0			2		.	.	10.
Poa secunda	2	0		2	2	2	1.	.2	.0
Stipa comata	0	0	0	0	0	1	0.1	0.1	0.2
Stipa viridula	1	0	0	0	1	10	0.	1.0	1.
Perennial Forb									
Cerastium arvense	0	0	0	0	0	1	0.1	0.1	0.2
Medicago sativa	2	0	0	0	1	2	1.	2.	.
Melilotus officinalis	1	0	0	0	0	2	0.1	0.2	0.
Sphaeralcea coccinea	0	0	0	0	0		0.	0.	0.
Taraxacum officinale	0	0	2	0	0		0.2	0.	0.
Vicia americana	2	0	1	0		11	0.	1.1	1.
Subshrub									
Artemisia frigida	0	0	0	2	1		0.2	0.	0.
Shrub									
Artemisia cana	0	0	0	0	0	1	0.1	0.1	0.2

S-1	Nmin
.1	1

Total Perennials	**36**	**34**	**35**	**25**	**31**	**639**	**32.0**	**63.9**	**99.8**
Annual Forb									
Alyssum desertorum	0	0	0	0	0	1	0.1	0.1	0.2

S-1	Nmin
.1	

Total Veg Cover				2	1	0	2.0	.0
Litter	1	1	10	1	1	2 1	1 .1	2 .1
Rock	0	0	0	0	0	1	0.1	0.1
Bare Ground	0	1		10			.	.

S-1	Nmin
2.	2

Total Ground Cover	0			0		02	.1	0.2

ADDENDUM 3.5-E

VEGETATION SAMPLING PLAN

Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Dave Freudenthal, Governor

John Corra, Director

June 1, 2010

Mr. John Berry
WWC Engineering
1849 Terra Avenue
Sheridan, WY 82801

RE: Ross ISR Vegetation Sampling Plan, TFN 5 6/110

Dear John:

I have reviewed the sampling plan for the above referenced project and find it acceptable. Attached is the sampling plan with my signature on Page 3.

If you have questions please call me.

Sincerely,

Stacy Page

Stacy Page

sp\

attachment

xc: Cheyenne File w/attachment

MJR 6/4/10

1866 SOUTH SHERIDAN AVENUE • SHERIDAN, WY 82801
AIR, LAND AND WATER DIVISIONS
(307) 673-9337 • FAX (307) 672-2213

WWC ENGINEERING
1849 Terra Avenue - Sheridan, WY 82801 - (307) 672-0761
Fax (307) 674-4265 - Email: infoshr@wwcengineering.com

June 1, 2010

Ms. Stacy Page
Senior Analyst
Wyoming Department of Environmental Quality
1866 South Sheridan Avenue
Sheridan, WY 82801

RE: Ross ISR Vegetation Baseline Inventory Sampling Plan Approval

Ms. Page:

On behalf of Strata Energy, Inc., WWC Engineering is submitting two copies of the *2010 Strata Energy-Ross Project Appendix D-8 Vegetation Baseline Inventory Sampling Plan* for the Ross ISR Uranium Project. The plan was prepared by Mr. Jim Orpet of Intermountain Resources and incorporates changes suggested by WDEQ/LQD based on your review of the original sampling plan. We are requesting that you review the attached plan and, if you are in agreement, please sign and date Page 3 of the documents. One signed document is intended for your files and one signed document should be returned to our office. Mr. Orpet has scheduled the field mapping/sampling for the week of June 14 or June 21, 2010, contingent on your approval.

Please contact me if you have questions regarding this revised vegetation baseline sampling plan and we appreciate your participation at this stage.

Respectfully,

John Berry

John Berry, Biologist

Enclosures: as noted

cc: Tony Simpson, Strata Energy - Gillette Business Office
Ben Schiffer, WWC Engineering - Sheridan
K:\Peninsula_Minerals\09142\Correspondence\Veg Sampling Approv.doc

2010 Strata Energy - Ross Project
Appendix D-8 Vegetation Baseline Inventory Sampling Plan

INTRODUCTION

This study plan is proposed to sample approximately 1,699.9 acres in western Crook County Wyoming for an in situ recovery (ISR) uranium mining operation. The proposed permit area is shown on the enclosed map labeled Attachment No. 1. The vegetation baseline sampling will be conducted with the expectation that the Extended Reference Area (EXREFA) concept will be utilized during revegetation success evaluations. Discussion pertaining to the EXREFA commitment will be presented in the Reclamation Plan.

Intermountain Resources, in accordance with this study plan, will complete vegetation inventories on this area during the 2010 growing season. Vegetation type mapping and plant species surveys (plant species list) have already been initiated and will continue into September of 2010. The actual vegetation cover sampling will be completed between the beginning of June and the end of July of 2010. All vegetation sampling, once started, will be completed within a three week period. This plan proposes to complete the vegetation sampling under the extended reference area concept. As discussed in this proposal, quantitative sampling will only be conducted for cover as required.

SAMPLING PLAN

1) Mapping

Mapping for the proposed permit area was initiated in November of 2009 using high quality aerial photography. **Additional mapping will be completed in 2010 as needed to revise existing mapping and will include a one half mile buffer surrounding the proposed permit boundary**. All mapping, photo locations and sample transect locations will be shown on the map submitted with the Appendix D-8 Vegetation Baseline report.

2) Species List

The study area will be surveyed monthly during the growing season of April through September to develop a representative plant species list. The species list will be presented by species (common/scientific names) and life-forms with a notation of the vegetation types in which each species was present.

3) Sample Site Location and Numbers

All sample sites will be located randomly. The random sample sites will be selected using two sets of computer generated random numbers, one set corresponding to the x axis of a grid and the other corresponding to the y axis. Grids are always oriented North/South and East/West to avoid bias. Sample site grid intervals will be no more than 65 meters on the ground. The grid intersections will represent the prospective sample

points and will be located in the field using aerial photograph, topographic maps or GPS. The minimum and maximum sample numbers are shown in Attachment No. 3.

4) **Percent (%) Cover Data**

Cover data will be collected using 50-meter line transects with a meter-long pin dropped at one meter intervals for 50 points per transect. The tape used for the cover transect will be pulled tight over the vegetation. The sampling device will be a meter long pin (1/8 inch diameter straight rod sharpened to a point) dropped vertically at each meter mark along the 50 meter tape. The pin is dropped vertically with the point of the pin beginning at each meter mark and gravity ensures the pin drops straight down. Data will be recorded by plant species and ground cover class (lichens, litter, rock, bare ground). The minimum and maximum numbers of samples collected will correspond to Wyoming Department of Environmental Quality (WDEQ)/Land Quality Division (LQD) Guideline No. 2 (1997 Revision) or as otherwise agreed upon in this plan with the WDEQ/LQD.

Sample adequacy will be determined using the formula presented in WDEQ/LQD Guideline No. 2. Since this is a baseline study used for description purposes, sample adequacy will be computed using the absolute vegetation cover data and sample standard deviation value calculations for the sums inclusive of all plant species (perennials, annuals, subshrubs, shrubs, etc.). Sample adequacy will not be required for total ground cover.

The absolute vegetation cover data will be presented in the report by plant species and by life-form in a tabular format. The ground cover data for each category will also be presented in the table. Computerized field data will be included in the report and will also present the data by species, life-form and ground cover class for each transect sampled.

5) **Photographs**

Photographs will be taken of each vegetation type and map unit. The photographs will be included in the report.

6) **Herbaceous Production Data**

Production data is not required for non-coal mines and will not be collected for this permit area.

7) **Shrub Density Data**

Shrub density data is not required for non-coal mines and will not be collected for this permit area.

8) **Wetlands**

Wetland acreages will be separated from the other vegetation types and will be evaluated by others following the US Army Corps of Engineers (COE) wetlands inventory report is methodology. The wetland separate from the vegetation report and will be submitted in Appendix D-10. Wetland descriptions will also be provided in Appendix D-8.

9) **Trees**

Trees are present within the permit area and will be inventoried. The species, numbers, locations and sizes (DBH and Height) will be determined and presented in the report.

10) **Weedy Species**

Known and observed concentrations of State of Wyoming Department of Agriculture listed Prohibited and Restricted Noxious (Designated) Weed species will be shown on a map and described by species. Any sensitive species or selenium indicator species observed will also be reported.

11) **Threatened or Endangered and Sensitive Species**

The Ute ladies'-tresses orchid is the only currently listed plant species with habitat present within the proposed permit area. Surveys will be completed for this species using the methods currently recommended by the USFWS. The results of those surveys will be described in Appendix D8. The sensitive species lists will be reviewed to determine if known occurrence or habitat for any of those species exist within the permit area. Individual species inventories will be conducted during the species list development with emphasis on within areas of suspected disturbance. The results of those surveys will also be described in Appendix D8.

REPORTING

This vegetation study will be paginated so as to be independent of all other permit document sections. The report format will follow the format outlined in WDEQ/LQD Guideline No.2.

2010 Strata Energy - Ross Project Sampling Plan Approval

This Sampling Plan is Approved By:

Stacy Page

WDEQ/LQD Date

6/1/10

WWC Engineering Date
for Strata Energy, Inc.

Strata Energy – Ross Project
5/27/10 Rev.

Attachment 1. Ross Project Preliminary Vegetation Work Map on 2009 NAIP Photo

(Please note that this work map does not include areas within the ½ mile buffer. These areas will be mapped during the 2010 sampling season and will be included in follow up discussions)

Attachment 2. Ross Project Vegetation Types and Estimated Acreages for Proposed Permit Area

Vegetation Type	Acreage	Percent
G - Upland Grassland	968.9	57.0
S - Sagebrush Shrubland	356.4	21.0
P - Pastureland	163.2	9.6
H - Hayland	63.9	3.7
R - Reservoir	33.9	2.0
W - Wetland	17.2	1.0
D - Disturbed Land	45.7	2.7
C - Cropland	42.1	2.5
T - Wooded Draw	8.6	0.5
Total	**1,699.9**	**100.0**

Attachment 3. Sample Numbers and Sample Adequacy for the Ross Project Vegetation Sampling

Vegetation Type	Acreage	Cover	Production	Shrub Density
Upland Grassland	968.9	20 min, 50 max	none	none
Sagebrush Shrubland	356.4	20 min, 50 max	none	none
Pastureland	163.2	20 min, 50 max	none	none
Hayland	63.9	None*	none	none
Reservoir	33.9	None*	none	none
Wetland	17.2	None*	none	none
Disturbed Land	45.7	None*	none	none
Cropland	42.1	None*	none	none
Wooded Draw	8.6	None*	none	none

* Sampling is not required for the Hayland, Reservoir, Disturbed Land or Cropland types. Wetlands will be inventoried and described using COE wetland criteria as required. The Wooded Draw type only occupies 8.6 acres and will not be disturbed by mining activities so sampling is not required.

Sample Adequacy Determination

Sample adequacy will be determined using the formula presented in WDEQ/LQD Guideline No. 2. Since this is a baseline study used for description purposes, sample adequacy will be computed using the absolute vegetation cover data and sample standard deviation value calculations for the sums inclusive of all plant species. Sample adequacy is not required for total ground cover.

ADDENDUM 3.5-F

WILDLIFE INVENTORY

F T

ST ATA G

SS S P T

By

Intermountain Resources
P.O. Box 1
Laramie WY 20
0 - - 0

October 2010

TA F T TS

ST F TA S

TABLE OF CONTENTS (CONTINUED)

LIST OF ADDENDA

F T

1.0 escri tion o the Stu Area

Intermountain Resources completed wildlife surveys on the Ross ISR Project proposed by Peninsula Minerals Ltd dba Strata Energy Inc. (Strata) in late November of 200 through September of 2010. Surveys were completed as required by state and federal agencies. This study was completed to permit an in-situ uranium mine.

The study area is located in Crook County Wyoming about 2 miles north of the town of Moorcroft. The permit area is situated within Sections 12 1 1 and 2 T N R W and Sections 1 and 1 T N R W. This area is shown on ER Figure . - . The wildlife study area includes the permit area and one to two mile perimeter for selected species.

The permit area is under primarily private ownership but some state of Wyoming and Bureau of Land Management (BLM) lands exist within the site. Intermittent waters (Deadman Creek Little Missouri River and its tributaries) as well as the Oshoto Reservoir exist within the permit area. Several other ephemeral water sources (stockponds) are also located within the permit area.

1.1 Agencies Consulted

Field surveys and reporting specific to this project were completed by Intermountain Resources personnel. Agencies contacted included the Wyoming Game and Fish Department (WG FD) the Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD) the Bureau of Land Management (BLM) and the United States Fish and Wildlife Service (USFWS). Written correspondence with some of the agencies is provided in Addendum . -I.

2.0 abitat escri tion

The permit area is predominantly upland grassland with some sagebrush shrubland pastureland hayland reservoir stockpond wetland disturbed land cropland and wooded draw habitats. Table 1 provides acreages by habitat type for the permit area while the habitat locations are shown on ER Figure . -2. No cliffs or perennial streams exist within the permit area.

The upland grassland habitat type is characterized by flat to steeply sloping gradients with variable relief. The dominant plant species of the upland grassland type include western wheatgrass followed by needleandthread bulbous bluegrass Kentucky bluegrass buffalograss and smooth brome. A variety of forbs is also present within this habitat type.

The sagebrush shrubland habitat type is characterized by gently rolling to steep slopes minor draws and drainages. The dominant plant species for this type include Kentucky bluegrass followed by bulbous bluegrass western wheatgrass big sagebrush buffalograss silver sagebrush and Japanese chess.

The pastureland habitat type is characterized by gently rolling to flat slopes with moderately deep soils. This habitat type is used primarily for grazing cattle and is rarely hayed. Dominant plant species are intermediate wheatgrass smooth brome crested wheatgrass and western wheatgrass.

The hayland habitat type is characterized by gently rolling to flat slopes with moderately deep soils. This habitat type was used primarily for grass hay and alfalfa production and winter time pasture land for cattle and horses. Dominant species are alfalfa crested wheatgrass smooth brome and intermediate wheatgrass.

Table 1 Habitat Types and Acreages for the Ross ISR Project Permit Area

Habitat Unit	Permit Area Acres	Percent
Upland Grassland	1 .	.
Sagebrush Shrubland	.0	21.
Pastureland	12 .	.
Hayland	121.1	.0
Reservoir Stockpond	.	2.0
Wetland	1.1	1.
Disturbed Land	.	.
Cropland	. 1	2.
Wooded Draw	. 2	0.
Total	**1721.31**	**100.0**

The reservoir stockpond habitat type occurs along major drainage bottoms (Deadman Creek Little Missouri River and Oshoto Reservoir) found within the permit area. A detailed wetland inventory is provided in the Addendum . -A. Oshoto Reservoir provides a permanent water source but is not considered a viable fisheries. The other reservoir stockpond sites are relatively small and are semi-permanent to ephemeral in nature.

The wetland habitat type occurs along major drainage bottoms (Deadman Creek Little Missouri River and Oshoto Reservoir) found within the permit area. A detailed wetland inventory is provided in the wetland report (Addendum . -A). The wetlands are generally vegetated with sedges rushes and bulrushes.

The disturbed habitat type occurs where roads cross the area and sites of energy (oil gas) development and production. Little to no vegetation is established on these disturbed sites.

The cropland habitat type is characterized by moderate to deep topsoil with moderate to little slope. The crops planted and harvested on this type have been wheat oats and barley.

The wooded draw habitat type is found in a few small drainage bottoms and typically has moderately deep soils. The most common woody plant species encountered on this habitat type includes plains cottonwood boxelder maple peachleaf willow and snowberry. Common understory species are Kentucky bluegrass smooth brome big sagebrush silver sagebrush and Japanese chess.

3.0 S ecies ist

A list of wildlife species with common and scientific names that may potentially occur on the permit area or within several miles is provided in Addendum . -G. All species that were actually observed on the permit or adjacent areas are indicated on the list with an asterisk. The observations recorded are based on November of 200 through September of 2010 surveys. The

2010 WG FD computer printouts from their wildlife observation system and other studies completed in the area were also used for compilation of the species list.

4.0 etho s

File searches and field surveys were the basis of data collection for this inventory. These methods are described in the following section.

.1 File Searches

File searches were the primary sources of agency data collection for this study. These searches included applicable independent publications BLM sources Wyoming Natural Diversity data base USFWS WG FD Publications and the WG FD computerized Wildlife Observation System.

.2 Field Surveys

The 200 and 2010 field surveys covered the entire permit area and a one to two mile perimeter for selected species. These surveys were designed to locate any proposed candidate or T E species including habitat for those species (i.e. prairie dog towns nest sites roosts leks etc.) Migratory Birds of High Federal Interest (MBHFI species) BLM sensitive species document raptor nest sites and record any wildlife species or their sign observed. Surveys were completed by traversing the area and suitable habitats in a four-wheel drive vehicle ATV or on foot. Specific survey methods for individual species or groups of species are included in the results sections for those species. The sampling plan submitted to the WG FD and USFWS is provided in Addendum . -H. Two sage-grouse leks have been documented within about two miles of the permit area.

5.0 esults

The following sections provide the results of the file searches and field inventories. ER Figure . - shows the permit area location and selected wildlife information. Addendum . -G provides a list of common names and scientific names for wildlife species that have been observed or which have the potential for occurring in the study area. Addendum . -H contains the wildlife sampling plan submitted to the WG FD and USFWS. Addendum . -I includes correspondence with state and federal agencies.

.1 Big Game

Specific surveys for big game animals were not required by the WG FD for this permit area in 2010. Mule deer pronghorn and white-tailed deer were the only big game species recorded on the study area in 200 and 2010 based on records kept from opportunistic observations. Mule deer and pronghorn were common but not abundant on the study area. Mule deer had an affinity for the sagebrush shrubland habitats while pronghorn were observed in the sagebrush shrubland and upland grassland habitats. Mule deer and pronghorn frequented haylands and cultivated lands in the spring and fall. The white-tailed deer was not very abundant and was observed in the riparian habitats as well as the cultivated fields on the permit area in 200 -2010.

Mule deer pronghorn white-tailed deer and elk were the big game animals recorded for the study area by the WG FD. Their observations conclude that mule deer and pronghorn are the most common species in the area. Mule deer utilized all habitats pronghorn were most common on sagebrush and upland grassland habitats the white-tailed deer typically used the riparian areas and the elk used sagebrush and upland grassland habitats.

Mule deer use of the area as determined by the WG FD is winter yearlong. Pronghorn use was classified by the WG FD as yearlong. The white-tailed deer use was classified by the WG FD as primarily out of normal range with some yearlong use. The permit area is out of the normal use range for elk. No crucial winter ranges have been delineated on the permit or adjacent areas.

The study area is located within the WG FD Powder River Mule Deer Herd Unit the North Black Hills Pronghorn Herd Unit and the Thunder Basin white-tailed deer herd unit. The mine permit is not within a specific elk herd unit but is included in hunt area 12 .

.2 Upland Game Birds

The mourning dove wild turkey sharp-tailed grouse and sage-grouse were the only upland game bird species observed on the study area in 200 -2010. The mourning dove is a common summer resident and undoubtedly breed and nest in the area. Mourning doves were recorded using the area during the spring and summer months in various habitat types. Four wild turkeys were observed within pine habitat within two miles east of the permit area in January of 2010. A flock of wild turkeys also wintered around ranch facilities about two miles northwest of the permit area in 200 -2010. Marginal habitat is present on the permit area for the wild turkey.

Sharp-tailed grouse and sage-grouse strutting ground surveys were conducted for the permit area and two mile perimeter on March 1 April 1 1 2 and 2 of 2010. Surveys were conducted by surveying all suitable habitat at dawn using a four-wheel drive vehicle and ATV. Searches were conducted for new strutting grounds during all survey dates while previously identified strutting grounds were surveyed on April 1 and 2 of 2010. The permit area is not located within a designated sage-grouse core breeding area. Sharp-tailed grouse were only recorded on the area during the 200 winter surveys but are considered yearlong residents in the

area. No sharp-tailed grouse strutting grounds were identified on or within two miles of the permit area. Two sage-grouse strutting grounds are known to occur within two miles of the permit area. The Oshoto Lek (Sections 2 and 2 T N R W) and the Cap'n Bob Lek (Section 2 T N R W) were identified from the WG FD sage-grouse database. No other sage-grouse leks were identified during the 2010 surveys. Details of sage-grouse strutting activities for these leks is summarized in Table 2. Ground surveys of the Oshoto and Cap'n Bob leks were conducted on April 1 and 2 of 2010. On the Cap'n Bob Lek a total of two males and one female were observed on April 1 and two males were recorded on this lek on April 2 during the 2010 surveys. No sage-grouse were observed on the Oshoto Lek during either of these survey dates. No broods or brood rearing areas were identified during the 2010 field surveys. No sage-grouse wintering areas were identified within the permit area during the 2010 surveys.

. Waterfowl and Shorebirds

Other than the Oshoto Reservoir only small ponds intermittent and ephemeral water is found within the permit area. Excluding the Oshoto Reservoir these small waterbodies provide primarily seasonal and limited habitat for waterfowl and shorebirds. The waterbodies present consist of the Oshoto Reservoir small stockponds and intermittent ephemeral streams which are fed by spring or storm water run off. Some perennial springs and seeps are also present. The majority of the water birds were observed during spring migration when most of the waterbodies present contained water. The most common species observed were the Canada goose mallard widgeon gadwall pintail blue-winged teal and American coot. As the smaller waterbodies dried up the water birds either left the area or moved to the Oshoto Reservoir or other sites where

Table 2 Ross ISR Project Sage-grouse Lek Activity Summary

	Sage-grouse Lek Data											
	-Oshoto						-Cap'n Bob					
Year Date	SWSE SENW	Sec.	2	T	N	R	W	SESW	Sec.	2	T	N	R	W
1985	males						-							
1986	nc						-							
1987	nc						-							
1988														
1	0						-							
22	0						-							
1989	nc						-							
1990	nc						-							
1991	0						-							
1992	nc						-							
1993	nc						-							
1994	0						-							
1995	nc						-							
1996	nc						-							
1997	0						-							
1998	nc						-							
1999	nc						-							
2000														
12	0						-							
2001														
1	males						-							

Table 2 Ross ISR Project Sage-grouse Activity Summary (Continued).

	Sage-grouse Lek Data											
	-Oshoto						-Cap'n Bob					
Year Date	SWSE SENW	Sec.	2	T	N	R	W	SESW	Sec.	2	T	N	R	W
2002	nc						-							
2003	nc						-							
2004														
1	2 males						-							
2005	nc						-							
2006	nc						-							
2007														
	0						10 males							
1	0						10 males							
2008	nc						nc							
2009	nc						nc							
2010														
1	0						2 males 1 female							
2	0						2 males							

Past sage-grouse data obtained from the WG FD.
nc not checked

water was present. Several waterfowl broods were observed on the area in 2010. The species list in Addendum . -G provides all the waterfowl and shorebirds identified on the area.

. Raptors

Raptor nest searches were conducted on the ground over suitable habitats from January through August of 2010. A total of eight intact nest sites were recorded on the study area in 2010 as shown on ER Figure . - and Table . The raptor species that were recorded nesting on the permit area in 2010 included the ferruginous hawk and red-tailed hawk. Other species of raptors observed in the area during 2010 include the golden eagle bald eagle great horned owl Cooper's hawk northern harrier Swainson's hawk rough-legged hawk American kestrel short-eared owl and osprey. The northern harrier short-eared owl and American kestrel may have nested on the permit area in 2010 but due to the nature and location of their nest sites those nests have remained undetected during the breeding season. The golden eagle great horned owl and Cooper's hawk nest in the region but no nest sites were located within two miles of the permit area. The bald eagle osprey and rough-legged hawk are migrants to the area.

A detailed summary of nesting raptor species nest sites activity and nest production for the 2010 study is exhibited in Table .

. Passerine Birds

Specific surveys for passerine bird species were conducted in 2010 on this study area. These surveys consisted of walking 1000 meter by 100 meter belt transects and counting all bird species heard or seen within that transect. The passerine bird surveys were completed twice on the four major habitat types first on May 2 and again on June 10 of 2010. Surveys were conducted between hour prior to sunrise and 0 AM. The passerine bird transects covered

Table Ross ISR Project Raptor Production Summary for Nests Located Within One Mile of the Permit Area in 2010

Species	Nest No.	Legal Description	Nest Substrate Condition	Survey Year 2010
Ferru inous a k				
	FH-1a	SENE Sec. 12 T N R W	Hilltop Good	A-T
	FH-1b	SWNW Sec. T N R W	Hilltop Poor	ALT
	FH-1c	NESW Sec. 10 T N R W	Power pole D-N	D-N
	FH-2a	NWNW Sec. 12 T N R W	Hilltop Good	I
	FH-2b	SWNW Sec. 12 T N R W	Hilltop Poor	ALT
	FH-2c	SWNW Sec. 12 T N R W	Hilltop Good	ALT
		TOTAL	intact nests	1 0 0
T - e -taile a k				
	RTH-1	SENW Sec. 2 T N R W	Cottonwood Good	A 0 0
	RTH-2	NESE Sec. 1 T N R W	Cottonwood Good	A 2 2
		TOTAL	2 intact nests	2 2 2
S - S ainson s a k				
	SH-1	SWNE Sec. 1 T N R W	Boxelder Maple Good	I
		TOTAL	1 intact nest	0 0 0
Total estin Success		**8 total intact nests**		**3 2 2**

Table Ross ISR Project Raptor Production Summary (Continued).

Legend

A 2 2	- Active two young hatched two fledged
D-N	- Nest destroyed by natural causes
A	- Active undetermined undetermined
I	- Inactive
ALT	- Alternate nest site for same pair

during the 2010 surveys are shown on ER Figure . - and included the upland grassland sagebrush shrubland pastureland and reservoir stockpond wetland habitat types. All such species observed during the course of other field work or by other sources are also documented with an asterisk on the species list in Addendum . -G. The permit area and adjacent lands have the potential habitats to support a good diversity of passerine species. The most common species observed on the permit area overall were the western meadowlark red-winged blackbird horned lark killdeer grasshopper sparrow Brewers sparrow and brown-headed cowbird. A detailed list of all bird species recorded during the passerine surveys is shown in Table . In the upland grassland type the western meadowlark was the most common species followed by the horned lark killdeer and grasshopper sparrow. The western meadowlark was the most common bird species in the sagebrush shrubland followed by the killdeer Brewer's sparrow and brown-headed cowbird. In the pastureland the western meadowlark was also the most common species observed followed by the grasshopper sparrow rough-winged swallow red-winged blackbird and eastern kingbird. The red-winged blackbird was the most common species in the reservoir stockpond wetland habitat type followed by the American coot western meadowlark American widgeon brown-headed cowbird and rough-winged swallow.

. Other Mammals

Specific surveys for other mammals (i.e. small mammal trapping lagomorph surveys and predator surveys) were not conducted in 2010. All mammal species or their sign observed during the course of other field work were recorded and are documented with an asterisk on the species list in Addendum . -G. Other mammal species recorded by the WG FD for the study area are also included. A total of 2 mammal species other than big game have been documented on or within several miles of the permit area. The permit area and one mile

Table Bird Species Observed During Passerine Bird Belt Transect Surveys Completed on the Ross ISR Project Permit Area 2010.

	Habitat Type Survey Period							
	Pastureland		Sagebrush Shrubland		Reservoir Stock pond Wetland		Upland Grassland	
Species	May	June	May	June	May	June	May	June
Western Meadowlark	1	1	11	1		2	10	
Red-winged Blackbird		0	2	0	11	1	0	0
Horned Lark	0	0	0	0	0	0		
Killdeer	0	0			2	1	2	0
Grasshopper Sparrow	1		0	0	0	0	0	2
Brewer's Sparrow	1	0			0	0	0	0
Brown-headed Cowbird	0	2	2			0	0	0
Rough-winged swallow		0	0	0		0	0	0
American Coot	0	0	0	0		2	0	0
Cliff Swallow	0		0	0	0	2	0	0
Canada Goose	0	0	0	2	0		0	0
Mallard	2	0	0	0	2	0	0	0
American Widgeon	0	0	0	0		0	0	0
Gadwall	0	0	0	0	1		0	0
Vesper Sparrow	1	0	1	0	0	0	1	0
Eastern Kingbird	2	1	0	0	0	0	0	0
Mourning Dove	0	0	1	0	1	0	0	1
Say's Phoebe	0	0	2	0	0	0	0	0
Tree Swallow	0	0	0	0	2	0	0	0
Cliff Swallow	0	0	0	0	2	0	0	0
Great Blue Heron	0	0	0	0	1	1	0	0
Spotted Sandpiper	0	0	0	0	1	1	0	0
American Robin	0	2	0	0	0	0	0	0
European Starling	0	0	1	0	0	0	0	0
Pied-billed Grebe	0	0	0	0	1	0	0	0
Rock Wren	0	0	0	0	0	1	0	0
Blue-wing Teal	0	0	0	0	0	1	0	0

perimeter were searched for prairie dog towns but no prairie dog towns were observed. However a black-tailed prairie dog town is known to exist over two miles northeast of the permit area.

The white-tailed jackrabbit and cottontail rabbit were the most common mammal species observed. The coyote red fox raccoon striped skunk and bobcat were the mammalian predators observed in 2010.

All site visits included surveys for the swift fox. These swift fox surveys were generally conducted during early morning and evening hours when this species is active. Daylight surveys included the investigation of potential den sites. Night surveys were conducted in conjunction with other night time wildlife surveys. No swift fox were recorded on the area during the 200 - 2010 wildlife surveys and no records of prior swift fox observations in the area were found.

. Migratory Birds of High Federal Interest (MBHFI)

Field surveys were completed in November and December of 200 and January through September of 2010 for MBHFI species. This was accomplished by searching all suitable or potentially suitable habitats and recording any species encountered. Breeding bird surveys were also conducted as discussed in Section . of this report. Discussions here will concentrate on level 1 species based on the USFWS list of May 2 2002. These species are listed in Table .

Level 1 MBHFI species observed on the study area in 200 -2010 include the sage-grouse ferruginous hawk Brewer's sparrow Wilson's phalarope Swainson s hawk short-eared owl bald eagle and upland sandpiper. The trumpeter swan was observed on the area during the mid 1 0's but not in 200 or 2010.

Table Level I Species Migratory Birds of High Federal Interest (MBHFI) (USFWS 2002)

Species	Primary Habitat Type(s)	Regional Status	Recorded on Study Area 200 2010	Expected Occurrence
Mountain Plover	Shortgrass Prairie Shrub-steppe	Breeder	No	Rare
Trumpeter Swan	Wetlands	Migrant	No	Rare
Sage-grouse	Shrub-steppe	Breeder	Yes	Common
McCown s Longspur	Shortgrass Prairie Shrub-steppe	Breeder	No	Uncommon
Baird s Sparrow	Shortgrass Prairie	Breeder	No	Rare
Ferruginous Hawk	Shrub-steppe Shortgrass Prairie	Breeder	Yes	Common
Brewer s Sparrow	Shrub-steppe Mountain-foothills	Breeder	Yes	Common
Wilson's Phalarope	Wetlands	Breeder	Yes	Uncommon
Franklin's Gull	Wetlands	Migrant	No	Rare
Sage Sparrow	Mountain-foothills Shrub Steppe	Breeder	No	Rare
Swainson s Hawk	Plains Basin Riparian	Breeder	Yes	Common
Long-billed Curlew	Shortgrass Prairie	Migrant Breeder	No	Uncommon
Short-eared Owl	Short grass Prairie	Breeder	Yes	Uncommon
Northern Goshawk	High Mid Elevation Conifer and Aspen	Migrant	No	Rare
Peregrine Falcon	Cliffs	Migrant	No	Rare
Burrowing Owl	Shortgrass Prairie	Breeder	No	Uncommon
Forster's Tern	Wetlands	Migrant	No	Rare
Bald Eagle	Montane and Basin Riparian Plains	Winter Migrant	Yes	Occasional
Upland Sandpiper	Shortgrass Prairie	Breeder	Yes	Uncommon
Black Tern	Wetlands	Migrant	No	Rare
Whooping Crane	Wetlands	Migrant	No	Rare
Piping Plover	Wetlands Aquatic	Migrant	No	Rare

Habitat types based on USFWS 2002 List.
This species was recorded in the area in the past by the WG FD.

The mountain plover is a MBHFI species that has not been recorded in the study area. Suitable habitat for the mountain plover is very limited on the study area due to good vegetation cover and this species was not observed in 200 -2010. The sage-grouse ferruginous hawk Brewer's sparrow and Swainson's hawk were observed as breeders in suitable habitats on the study area in 2010. The short-eared owl bald eagle and upland sandpiper were only observed as migrants or transients during 2010. The trumpeter swan was observed in the past by the WG FD on or near the Oshoto Reservoir

. BLM Sensitive Species

In 2010 the BLM provided direction to their list of sensitive wildlife species for the Newcastle Field Office in whose jurisdiction the project is located. Only about 0 acres of surface controlled by the BLM located in the NWSE of Section 1 T N R W is found within the permit area. Surveys for BLM sensitive species were conducted in conjunction with all other wildlife surveys completed on the area.

The 0 acres of BLM surface within the permit area is all upland grassland habitat with the exception of disturbed lands composed of an oil well located in the center of this parcel. No BLM sensitive species were recorded on this 0 acre tract during the 200 -2010 surveys and no sensitive species have previously been recorded on this site.

Table provides the list of BLM sensitive wildlife species for the area covered by the Newcastle Field Office. As shown on this list the ferruginous hawk sage-grouse sage thrasher loggerhead shrike Brewer's sparrow and northern leopard frog were recorded on the study area (but not BLM surface) during the 200 -2010 surveys. The ferruginous hawk was discussed in Section . the sage-grouse was presented in Section .2 and the northern

Table BLM Sensitive Wildlife Species List for Newcastle Field Office

Species	Primary Habitat Type(s)	Regional Status	Recorded on Study Area 200 2010	Expected Occurrence
Long-eared Myotis	Coniferous and Deciduous Forests Caves and Mines	Breeder	No	Uncommon
Fringed Myotis	Coniferous Forests Woodland Chaparrals Caves and Mines	Breeder	No	Rare
Swift Fox	Grasslands	Breeder	No	Uncommon
Black-tailed Prairie Dog	Grasslands prairie shrub	Breeder	No	Common
White-faced Ibis	Marshes Wet Meadows	Migrant	No	Uncommon
Trumpeter Swan	Lakes Ponds Rivers	Migrant	No	Rare
Northern Goshawk	Conifer and Deciduous Forests	Migrant	No	Rare
Ferruginous Hawk	Basin-Prairie Shrub Grassland Rock Outcrops	Breeder	Yes	Common
Sage-grouse	Basin-Prairie Shrub Mountain-Foothill Shrub	Breeder	Yes	Common
Long-billed Curlew	Grassland Plains Foothills Wet Meadows	Migrant Breeder	No	Uncommon
Yellow-billed Cuckoo	Open Woodlands Streamside Willow and Alder Groves	Breeder	No	Uncommon
Burrowing Owl	Grassland Basin-Prairie Shrub	Breeder	No	Uncommon
Sage Thrasher	Basin-Prairie Shrub Mountain-Foothills Shrub	Breeder	Yes	Common
Loggerhead Shrike	Basin-Prairie Shrub Mountain-Foothill Shrub	Breeder	Yes	Common
Brewer s Sparrow	Basin-Prairie Shrub	Breeder	Yes	Common
Sage Sparrow	Basin-Prairie Shrub Mountain-Foothill Shrub	Breeder	No	Rare
Baird s Sparrow	Grassland Weedy Fields	Breeder	No	Rare
Mountain Plover	Grasslands Prairie Shrub	Breeder	No	Rare
Northern Leopard Frog	Beaver ponds Permanent Water in Plains and Foothills	Breeder	Yes	Common

Habitat types based on BLM (2002).
This species was recorded in the area in the past by the WG FD.

leopard frog is discussed in Section .10 of this report. The sage thrasher loggerhead shrike and Brewer's sparrow were recorded as seasonal breeders primarily in the sagebrush shrubland habitat type.

. Threatened or Endangered Species (T E) and Candidate Species

T E species and other wildlife species surveys were conducted during November and December of 200 and January through September of 2010. One former T E (bald eagle) and one candidate (sage-grouse) wildlife species were observed during those surveys. As of July 2010 the USFWS has listed two individual wildlife species and one individual plant species for Crook County Wyoming. The wildlife species listed are the sage-grouse (Candidate) and mountain plover (Proposed). The plant species listed is the threatened Ute Ladies'-tresses (*Spiranthes diluvialis*).

The bald eagle (a former T E species) was observed on the study area during December 200 and during January of 2010. This species was removed from the T E list in July of 200 but is still discussed in this section for informative purposes. Potential nesting and roosting habitat (large trees) is present but very limited on the study area. Bald eagle roosts or concentration areas were not observed during the 200 (December) or 2010 (January) roost surveys. The bald eagle appears to be a transient on the site for foraging in the winter or during migration.

Prairie dog towns provide habitat for black-footed ferrets. No prairie dog towns were observed on the study area or within one mile as presented in Section . . Black-footed ferret surveys are currently not required for black-tailed prairie dog towns statewide (USFWS 200).

The sage-grouse was listed as a candidate species in 2010. Two leks have been recorded within several miles of the permit area. The sage-grouse was observed infrequently on the study

area but was not recorded within the permit area. More discussion on this species was presented previously in the upland game bird Section .2 of this report. The permit area is not located within a designated sage-grouse core area.

The mountain plover is an MBHFI species that is currently listed as a proposed species. This bird has not been recorded during wildlife surveys completed on this area as discussed in Section . and the permit area does not contain optimal habitat for this species.

No T E plant species were recorded on the permit area during the 2010 surveys. The T E plant species surveys conducted on the permit area are discussed in Addendum . -A.

.10 Reptiles and Amphibians

Specific surveys for reptiles and amphibians were conducted for this project. Two frog species were recorded during vocalization surveys and during other field surveys. These frog species included the leopard frog and the chorus frog. During vocalization surveys completed in May and June of 2010 at the six sites (F1-F) shown on ER Figure . - the leopard frog appeared to be uncommon while the chorus frog appeared to be common and abundant. No egg masses were definitively identified during the egg mass surveys completed in early June of 2010. The reason may have been that recent high winds could have broken up the masses and dispersed the eggs. During walking surveys along shorelines and riparian areas in August of 2010 the leopard frog appeared to be quite common (over 00 individual adults counted) while the chorus frog was uncommon. A listing of potentially occurring reptile and amphibian species and observations from the 200 -2010 surveys or from other sources are documented in Addendum . -G.

.11 Fish

Specific collections of fish were conducted for this project as a component of the radiological study. Part of the radiological surveys included analyzing fish species caught in the Oshoto Reservoir for radiation levels. During this survey several fish species were caught. This survey was conducted under a Chapter Permit from the WG FD issued to WWC Engineering. Fish species encountered during this survey included green sunfish black bullhead and white sucker. The black bullhead was by far the most common fish species collected. Numerous schools of black bullhead fry were observed during the shoreline surveys conducted in August of 2010. Waterbodies within the permit area are not considered as viable sport fisheries.

6.0 acts

The major contiguous block disturbance within the permit area will be the construction and operation of the plant and associated facilities. This disturbance will occur on haylands so native habitats will not be affected. The other disturbances will consist of well fields roads and pipelines. These disturbances will affect primarily upland grassland and sagebrush shrubland habitats. Many of these disturbances will be temporary and short-term since they may be reclaimed immediately following installation.

Crucial or critical wildlife habitats have not been documented on the permit or adjacent areas so will not be affected. A few big game animals may be displaced during mining activities but based on the limited disturbance and animal densities these numbers would be insignificant.

Habitat for waterfowl and shorebirds is limited to the Deadman Creek Little Missouri River Oshoto Reservoir and several ponds within the permit area. These habitats will not be

disturbed by mining so habitat for waterfowl shorebirds fish amphibians and other species with an affinity for water or wetlands should not be affected.

Impacts to sage-grouse should be minimal if at all. The reason low impacts are expected is this species does not frequent the area and the site does not contain an abundance of suitable sagebrush shrubland habitat. Suitable habitat is present east of the permit area but there is the potential for this species to be transient on the project site.

Raptor species may be affected by mining activities or by altered prey abundance due to removal of vegetation and soils. Raptor nest sites could be impacted by the location of the well fields or facilities. A total of about eight currently known intact nest sites exist within the permit area. Raptor nest impacts will be mitigated through avoiding activities in these areas during the breeding season or moving nests when impacts are unavoidable.

Other bird mammal reptile or amphibian species may be displaced from areas where vegetation and soils are removed. Displacement or impacts could also occur from increased human activity in the area.

Currently several MBHFI raptor species may be impacted by this operation. The ferruginous hawk and Swainson s hawk have intact nest sites on or adjacent to the permit area but were not productive within the permit area during 2010. Other MBHFI species which probably nest in suitable habitats on the permit area include the Brewer s sparrow and short-eared owl. There is also the potential for the sage-grouse McCown's longspur Wilson's phalarope burrowing owl upland sandpiper and long-billed curlew to nest on the site. Even if they do not nest on the permit area these species may be impacted as transients. Mountain plovers have not been recorded in the area and only a minor amount of sparsely vegetated habitat

is present in the permit area so this species should not be affected. Due to the small size of this project all impacts to MBHFI species would be minor and should not affect overall populations.

BLM sensitive species should not be affected by disturbances on the 0 acres of BLM surface within the permit area. This is because these species either do not have habitat within that 0 acre parcel or have not been found there. Potential impacts to BLM sensitive species are discussed in general terms within the other paragraphs of this section.

T E or other species of concern should not be greatly impacted by this operation. The bald eagle (a former T E species) is only a winter transient and migrant through the area and should not be adversely affected by this project. There were no active or historic prairie dog towns existing on or within one mile of the permit area so potential habitat for black-footed ferrets is not present. The mountain plover (Proposed species) has not been recorded on the area. The sage-grouse (Candidate species) has not been recorded on the permit area and does not appear to frequent the area. The Ute ladies'-tresses orchid was not recorded along any of the wetland portions of the permit area.

7.0 iti ation an onitorin

Impacted wildlife habitats will be mitigated following disturbance by establishing vegetation in accordance with the approved seeding and reclamation plan. Fences if needed will be constructed to the required WG FD standards. Raptor nests will be protected or relocated. New powerlines will be constructed in accordance with the Avian Power Line Interaction Committee (APLIC) 200 Suggested Practices for Avian Protection on Power Lines The state of the Art in 200 . All ponds with toxic water will be covered or otherwise protected to prevent wildlife use. Controlled speed limits will be implemented to reduce wildlife vehicle collisions. Employees will be educated about wildlife protection sensitive

species and game laws through use of applicable publications and during safety meetings. The implementation of all of the above commitments will help alleviate impacts to wildlife.

Wildlife monitoring may be completed for game birds raptors T E MBHFI and proposed or candidate species as required by the USFWS and or WG FD.

8.0 onclusion

This report provides wildlife baseline data for the Strata Ross ISR Project Permit area. Investigated were big game game birds raptors migratory birds of high federal interest BLM sensitive species threatened or endangered species proposed or candidate species reptiles and amphibians and fish. One proposed species the mountain plover one candidate species the sage-grouse and two threatened or endangered species the black-footed ferret and Ute ladies'-tresses orchid have habitat within the region locally or seasonally. However the permit area itself only contains preferred habitat for the Ute ladies-tresses orchid. The bald eagle (a former T E species) has been observed on site but is only a transient or migrant to the area. The Ute ladies'-tresses orchid was not observed in 2010 on the permit area. The sage-grouse has been observed infrequently within two miles of the permit area and the mountain plover has not been recorded on the area. The limited amount of disturbance projected by this mining operation will have minimal impacts on most wildlife species. No crucial big game winter ranges or critical endangered species habitats will be affected. Wildlife monitoring will be implemented as required but is not projected at this time.

9.0 e erences

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ADDENDUM 3.5-G

WILDLIFE SPECIES LIST

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
MAMMALS				
INSECTIVORES				
Masked Shrew *Sorex cinereus*	--			
Hayden's Shrew *Sorex haydeni*	--		**Yes (NSS4*)**	
Merriam's Shrew *Sorex merriami*	--			
Vagrant Shrew *Sorex vagrans*	--		**Yes (NSS3*)**	
BATS				
Long-eared Myotis *Myotis evotis*	--	**Yes**	**Yes (NSS2*)**	
Northern Myotis *Myotis septentrionalis*	--		**Yes (NSS2*)**	
Little Brown Myotis *Myotis lucifugus*	--		**Yes (NSS3*)**	
Long-legged Myotis *Myotis volans*	--		**Yes (NSS2*)**	
Fringed myotis Myotis thysanodes	--	**Yes**	**Yes (NSS2*)**	
Hoary Bat *Lasiurus cinereus*	--		**Yes (NSS4*)**	
Silver-haired Bat *Lasionycteris noctivagans*	--		**Yes (NSS4*)**	
Big Brown Bat *Eptesicus fuscus*	--		**Yes (NSS3*)**	
LAGOMORPHS				
Desert Cottontail *Sylvilagus audubonii*	--			**Yes**
Mountain Cottontail *Sylvilagus nuttallii*	--			
Black-tailed Jackrabbit *Lepus californicus*	--			**Yes**
White-tailed Jackrabbit *Lepus townsendii*	--			**Yes**
RODENTS				
Least Chipmunk *Tamias minimus*	--			**Yes**
Yellow-bellied Marmot *Marmota flaviventris*	--			
Thirteen-lined Ground Squirrel *Spermophilus tridecemlineatus*	--			**Yes**
Black-tailed Prairie Dog *Cynomys ludovicianus*	--		**Yes (NSS3*)**	**Yes**
Eastern Fox Squirrel *Sciurus niger*	--			**Yes**
Red Squirrel *Tamiasciurus hudsonicus*				

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Northern Pocket Gopher *Thomomys talpoides*	--			**Yes**
Plains Pocket Gopher *Geomys bursarius*	--		**Yes (NSS4*)**	
Olive-backed Pocket Mouse *Perognathus fasciatus*	--		**Yes (NSS3*)**	
Silky Pocket Mouse *Perognathus flavus*	--		**Yes (NSS3*)**	
Hispid Pocket Mouse *Chaetodipus hispidus*	--			
Ord's Kangaroo Rat *Dipodomys ordii*	--			**Yes**
Beaver *Castor Canadensis*	--			**Yes**
Western Harvest Mouse *Reithrodontomys megalotis*	--		**Yes (NSS3*)**	
Plains Harvest Mouse *Reithrodontomysmontanus*	--			
White-footed Mouse *Peromyscus leucopus*				
Deer Mouse *Peromyscus maniculatus*	--			**Yes**
Northern Grasshopper Mouse *Onychomys leucogaster*	--			
Bushy-tailed Woodrat *Neotoma cinerea*	--			**Yes**
Long-tailed Vole *Microtus longicaudus*	--			
Prairie Vole *Microtus 0ochrogaster*	--		**Yes (NSS3*)**	**Yes**
Meadow Vole *Microtus pennsylvanicus*	--			
Sagebrush Vole *Lemmiscus curtatus*	--		**Yes (NSS4*)**	
Muskrat *Ondatra zibethicus*	--			**Yes**
Norway Rat *Rattus norvegicus*	--			
House Mouse *Mus musculus*	--			
Meadow Jumping Mouse *Zapus hudsonius*	--			
Western Jumping Mouse *Zapus princeps*	--			
Porcupine *Erethizon dorsatum*	--			**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
CARNIVORES				
Coyote *Canis latrans*	--			**Yes**
Swift Fox *Vulpes velox*	--	**Yes**	**Yes (NSS4*)**	
Red Fox *Vulpes vulpes*	--			**Yes**
Gray Fox *Urocyon cinereoargenteus*	--			
Black Bear *Ursus americanus*	--			
Raccoon *Procyon lotor*	--			**Yes**
Short-tailed Weasel *Mustela ermine*	--			
Long-tailed Weasel *Mustela frenata*	--			**Yes**
Black-footed Ferret *Mustela nigripes*	--		**Yes (NSS1*)**	
Mink *Mustela vison*	--			
Badger *Taxidea taxus*	--			**Yes**
Eastern Spotted Skunk *Spilogale putorius*	--			
Striped Skunk *Mephitis mephitis*	--			**Yes**
Mountain Lion *Felis concolor*	--			**Yes**
Bobcat *Felis rufus*	--			**Yes**
EVEN-TOED UNGULATES				
American Elk *Cervus elaphus*	--			**Yes**
Mule Deer *Odocoileus hemionus*	--			**Yes**
White-tailed Deer *Odocoileus virginianus*	--			**Yes**
Pronghorn *Antilocapra Americana*	--			**Yes**
BIRDS				
WATERFOWL				
Snow Goose *Chen caerulescens*				
Canada Goose *Branta canadensis*				**Yes**
Trumpeter swan Cygnus buccinator		**Yes**	**Yes (NSS2)**	**Yes**
Tundra Swan *Cygnus columbianus*				**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Wood Duck *Aix sponsa*				
Gadwall *Anas strepera*				**Yes**
American Wigeon *Anas americana*				**Yes**
Mallard *Anas platyrhynchos*				**Yes**
Blue-winged Teal *Anas discors*				**Yes**
Green-winged Teal *Anas crecca*				**Yes**
Cinnamon Teal *Anas cyanoptera*				**Yes**
Northern Shoveler *Anas clypeata*				**Yes**
Northern Pintail *Anas acuta*			**Yes (NSS3)**	**Yes**
Canvasback *Aythya valisineria*			**Yes (NSS3)**	**Yes**
Redhead *Aythya americana*			**Yes (NSS3)**	**Yes**
Ring-necked Duck *Aythya collaris*				**Yes**
Lesser Scaup *Aythya affinis*			**Yes (NSS3)**	**Yes**
Bufflehead *Bucephala albeola*				**Yes**
Common Goldeneye *Bucephala clangula*				
Common Merganser *Mergus merganser*				
Ruddy Duck *Oxyura jamaicensis*				**Yes**
GREBES				
Pied-billed Grebe *Podilymbus podiceps*				**Yes**
Horned Grebe *Podiceps auritus*	**Yes (NL)**			**Yes**
Eared Grebe *Podiceps nigricollis*				**Yes**
Western Grebe Aechmophorus occidentalis			**Yes (NSS4)**	
PELICANS				
White Pelican *Pelecanus erythrorhynchos*			**Yes (NSS3)**	**Yes**
Double-crested Cormorant *Phalacrocorax auritus*				**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
HERONS				
American Bittern (*Botauosus lentiginosus*)	**Yes (I)**		**Yes (NSS3)**	
Great Blue Heron *Ardea Herodias*			**Yes (NSS4)**	**Yes**
Green Heron *Butorides striatus*				
Black-crowned Night-Heron *Nycticorax nycticorax*			**Yes (NSS3)**	
White-faced Ibis *Plegadis chihi*		**Yes**	**Yes (NSS3)**	
VULTURES, HAWKS, AND FALCONS				
Turkey Vulture *Cathartes aura*				**Yes**
Osprey *Pandion haliaetus*				**Yes**
Bald Eagle *Haliaeetus leucocephalus*	**Yes (I)**		**Yes (NSS2)**	**Yes**
Northern Harrier *Circus cyaneus*				**Yes**
Sharp-shinned Hawk *Accipiter striatus*				**Yes**
Cooper's Hawk *Accipiter cooperii*				**Yes**
Northern Goshawk *Accipiter gentilis*		**Yes**	**Yes (NSS4*)**	
Swainson's Hawk *Buteo swainsoni*			**Yes (NSS4)**	**Yes**
Red-tailed Hawk *Buteo jamaicensis*				**Yes**
Ferruginous Hawk *Buteo regalis*	**Yes (I)**	**Yes**	**Yes (NSS3*)**	**Yes**
Rough-legged Hawk *Buteo lagopus*				**Yes**
Golden Eagle *Aquila chrysaetos*	**Yes (III)**			**Yes**
American Kestrel *Falco sparverius*				**Yes**
Merlin *Falco columbarius*			**Yes (NSS3*)**	
Gyrfalcon *Falco rusticolus*				
Peregrine Falcon *Falco peregrinus*	**Yes (I)**		**Yes (NSS3*)**	
Prairie Falcon *Falco mexicanus*	**Yes (III)**			**Yes**
GALLINACEOUS BIRDS				
Gray Partridge *Perdix perdix*				
Greater Sage-grouse *Centrocercus urophasianus*		**Yes**	**Yes (NSS2)**	**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Sharp-tailed grouse *Tympanuchus phasianellus*				**Yes**
Turkey *Meleagris gallopavo*				**Yes**
CRANES AND RAILS				
Sora Rail *Porzana Carolina*				**Yes**
American Coot *Fulica americana*				**Yes**
Sandhill Crane *Grus canadensis*			**Yes (NSS3)**	
SHOREBIRDS				
Semipalmated Plover *Charadrius semipalmatus*				
Killdeer *Charadrius vociferus*				**Yes**
Mountain Plover *Charadrius montanus*	**Yes (I)**	**Yes**	**Yes (NSS4*)**	
Black-necked Stilt *Himantopus mexicanus*				
American Avocet *Recurvirostra americana*				**Yes**
Greater Yellowlegs *Tringa melanoleuca*				
Lesser Yellowlegs *Tringa flavipes*				
Solitary Sandpiper *Tringa solitaria*				
Willet *Catoptrophorus semipalmatus*				
Spotted Sandpiper *Actitis macularia*				**Yes**
Upland Sandpiper *Bartramia longicauda*	**Yes (I)**		**Yes (NSS4)**	**Yes**
Whimbrel *Numenius phaeopus*				
Marbled Godwit (*Limosa fedoa*)	**Yes (NL)**			
Long-billed Curlew *Numenius americanus*	**Yes (I)**	**Yes**	**Yes (NSS3*)**	
Semipalmated Sandpiper *Calidris pusilla*				
Western Sandpiper *Calidris mauri*				
Least Sandpiper *Calidris minutilla*				
Baird's Sandpiper *Calidris bairdii*				
Pectoral Sandpiper *Calidris melanotos*				

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Long-billed Dowitcher *Limnodromus scolopaceus*				
Wilson's Snipe *Gallinago delicata*				**Yes**
Wilson's Phalarope *Phalaropus tricolor*				**Yes**
Red-necked Phalarope *Phalaropus lobatus*				
Franklin's Gull *Larus pipixcan*			**Yes (NSS3)**	
Bonaparte's Gull *Larus philladelphia*				
Ring-billed Gull *Larus delawarensis*				
California Gull *Larus californicus*				**Yes**
Herring Gull *Larus argentatus*				**Yes**
Common Tern *Sterna hirundo*				
Forster's Tern *Sterna forsteri*			**Yes (NSS3)**	
Black Tern *Chlidonias niger*			**Yes (NSS3)**	**Yes**
PIGEONS AND DOVES				
Rock Pigeon *Columba livia*				**Yes**
Eurasian Collard-dove *Streptopelia decaocto*				
Mourning Dove *Zenaida macroura*				**Yes**
CUCKOOS				
Black-billed Cuckoo *Coccyzus erythropthalmus*	**Yes (II)**			
Yellow-billed Cuckoo *Coccyzus americanus*	**Yes (II)**	**Yes**	**Yes (NSS2*)**	
OWLS				
Barn Owl *Tyto alba*				
Eastern Screech-Owl *Otus asio*				
Great Horned Owl *Bubo virginianus*				**Yes**
Burrowing Owl *Athene cunicularia*	**Yes (I)**	**Yes**	**Yes (NSS4)**	
Long-eared Owl *Asio otus*				
Short-eared Owl *Asio flammeus*	**Yes (I)**		**Yes (NSS4)**	**Yes**
Northern Saw-whet Owl *Aegolius acadicus*				

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
GOATSUCKERS				
Common Nighthawk *Chordeiles minor*				**Yes**
Common Poorwill *Phalaenoptilus nuttallii*				
SWIFTS				
Chimney Swift *Chaetura pelagica*				
White-throated Swift *Aeronautes saxatalis*				
HUMMINGBIRDS				
Broad-tailed Hunningbird *Selasphorus platycercus*				
Rufous Hummingbird *Selasphorus rufus*				
KINGFISHERS				
Belted Kingfisher *Ceryle alcyon*				**Yes**
WOODPECKERS				
Lewis's Woodpecker *Melanerpes lewis*	**Yes (II)**		**Yes (NSS3*)**	
Red-headed Wooodpecker *Melanerpes erythrocephalus*				
Red-naped Sapsucker *Sphyrapicus varius*				
Downy Woodpecker *Picoides pubescens*				
Hairy Woodpecker *Picoides villosus*				**Yes**
Northern Flicker *Colaptes auratus*				**Yes**
FLYCATCHERS				
Western Wood-Pewee *Contopus sordidulus*				**Yes**
Willow Flycatcher *Empidonax traillii*	**Yes (II)**		**Yes (NSS3)**	
Least Flycatcher *Empidonax minimus*				
Cordilleran Flycatcher *Empidonax occidentalis*				
Say's Phoebe *Sayornis saya*				**Yes**
Cassin's Kingbird *Tyrannus vociferous*				
Western Kingbird *Tyrannus verticalis*				**Yes**
Eastern Kingbird *Tyrannus tyrannus*				**Yes**
LARKS				
Horned Lark *Eremophila alpestris*				**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
SWALLOWS				
Tree Swallow *Tachyceneta bicolor*				**Yes**
Violet-green Swallow *Tachycineta thalassina*				**Yes**
Northern Rough-winged Swallow *Stelgidopteryx serripennis*				**Yes**
Bank Swallow *Riparia riparia*				**Yes**
Cliff Swallow *Hirundo pyrrhonota*				**Yes**
Barn Swallow *Hirundo rustica*				**Yes**
JAYS ANS CROWS				
Gray Jay *Perisoreus Canadensis*				
Blue jay *Cyanocitta cristata*				**Yes**
Pinyon Jay *Gymnorhinus cyanocephalus*	**Yes (IV)**			
Clark's nutcracker *Nicifraga columbiana*				
Black-billed Magpie *Pica pica*				**Yes**
American Crow *Corvus brachyrhynchos*				**Yes**
Common Raven *Corvus corax*				**Yes**
CHICKADEES				
Black-capped Chickadee *Parus atricapillus*				**Yes**
Mountain Chickadee *Parus gambeli*				
NUTHATCHES				
Red-breasted Nuthatch *Sitta canadensis*				**Yes**
White-breasted Nuthatch *Sitta carolinensis*				
Pygmy Nuthatch *Sitta pygmaea*			**Yes (NSS4*)**	
WRENS				
Rock Wren *Salpinctes obsoletus*				**Yes**
House Wren *Troglodytes aedon*				**Yes**
THRUSHES, SOLITARES, AND BLUEBIRDS				
Golden-crowned Kinglet *Regulus satrapa*				
Ruby-crowned Kinglet *Regulus calendula*				

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Mountain Bluebird *Sialia currucoides*				**Yes**
Townsend's Solitaire *Myadestes townsendii*				
Veery *Cartharus fuscens*				
Swainson's Thrush *Catharus ustulatus*				
Hermit Thrush *Catharus gattatus*				
American Robin *Turdus migratorius*				**Yes**
MOCKINGBIRDS AND THRASHERS				
Gray Catbird *Dumetalla carolinensis*				
Northern Mockingbird *Mimus polyglottos*				
Sage Thrasher *Oreoscoptes montanus*	**Yes (II)**	**Yes**	**Yes (NSS4*)**	**Yes**
Brown Thrasher *Toxostoma rufum*				**Yes**
STARLINGS				
European Starling *Sturnus vulgaris*				**Yes**
PIPITS AND WAGTAILS				
American Pipit *Anthus rubescens*				
WAXWINGS				
Bohemian Waxwing *Bombycilla garrulus*				
Cedar Waxwing *Bombycilla cedrorum*				
SHRIKES				
Northern Shrike *Lanius excubitor*				
Loggerhead Shrike *Lanius ludovicianus*	**Yes (II)**	**Yes**		**Yes**
VIREOS				
Solitary Vireo *Vireo solitarius*				
Warbling Vireo *Vireo gilvus*				
Red-eyed Vireo *Vireo olivaceus*				
WARBLERS				
Orange-crowned Warbler *Vermivora celata*				**Yes**
Yellow Warbler *Dendroica petechia*				**Yes**
Chestnut-sided Warbler *Dendroica pensylvanica*				

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Yellow-rumped Warbler *Dendroica coronata*				**Yes**
Townsend's Warbler *Dendroica townsendi*				
Black-and-white Warbler *Mniotilta varia*				
American Redstart *Setophaga ruticilla*				
Northern Waterthrush *Seiurus noveboracensis*				
MacGillivray's Warbler *Oporornis tolmiei*				
Common Yellowthroat *Geothlypis trichas*				**Yes**
Wilson's Warbler *Wilsonia pusilla*				**Yes**
Yellow-breasted Chat *Icteria virens*				
TANAGERS				
Western Tanager *Piranga ludoviciana*				
GROSBEAKS AND BUNTINGS				
Rose-breasted Grosbeak *Pheucticus ludovicianus*				
Black-headed Grosbeak *Pheucticus meloncephalus*				
Lazuli Bunting *Passerina amoena*				
Indigo Bunting *Passerina cyanea*				
CROSSBILLS				
Dickcissel *Spiza americana*	**Yes (II)**		**Yes (NSS4)**	
Red Crossbill *Loxia curvirostra*				
TOWHEES				
Green-tailed Towhee *Pipilo chlorurus*				
Spotted Towhee *Pipilo maculatus*				
SPARROWS				
American Tree Sparrow *Spizella arborea*				
Chipping Sparrow *Spizella passerina*				**Yes**
Clay-colored Sparrow *Spizella pallida*				
Brewer's Sparrow *Spizella breweri*	**Yes (I)**	**Yes**	**Yes (NSS4)**	**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Field Sparrow *Spizella pusilla*				
Vesper Sparrow *Pooecetes gramineus*				**Yes**
Lark Sparrow *Chondestes grammacus*				**Yes**
Sage Sparrow *Amphispoza belli*	**Yes (I)**	**Yes**	**Yes (NSS4)**	
Lark Bunting *Calamospiza melanocorys*	**Yes (II)**		**Yes (NSS4)**	**Yes**
Savannah Sparrow *Passerculus sandwichensis*				
Baird's Sparrow *Ammodramus bairdii*	**Yes (I)**	**Yes**		
Grasshopper Sparrow *Ammodramus savannarum*	**Yes (II)**		**Yes (NSS4)**	**Yes**
Fox Sparrow *Passerella iliaca*				
Song Sparrow *Melospiza melodia*				
Lincoln's Sparrow *Melospiza lincolnii*				
White-throated Sparrow *Zonotrichia albicollis*				
White-crowned Sparrow *Zonotrichia leucophrys*				
Harris' Sparrow *Zonotrichia querula*				
Dark-eyed Junco *Junco hyemalis*				**Yes**
LONGSPURS				
McCown's Longspur *Calcarius mccownii*	**Yes (I)**		**Yes (NSS4)**	**Yes**
Lapland Longspur *Calcarius lapponicus*				
Chestnut-collared Longspur *Calcarius ornatus*			**Yes (NSS4)**	
Snow Bunting *Plectrophenax nivalis*				
BLACKBIRDS, ORIOLES, AND COWBIRDS				
Bobolink *Dolichonyz oryzivorus*			**Yes (NSS4)**	
Red-winged Blackbird *Agelaius phoeniceus*				**Yes**
ROSY FINCHES, FINCHES, AND REDPOLLS				
Western Meadowlark *Sturnella neglecta*				**Yes**
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*				**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Brewer's Blackbird *Euphagus cyanocephalus*				**Yes**
Common Grackle *Quiscalus quiscula*				**Yes**
Brown-headed Cowbird *Molothrus ater*				**Yes**
Bullock's Oriole *Icterus bullockii*				**Yes**
Gray-crowned Rosy Finch *Leucosticte tephrocotis*				
Cassin's Finch *Carpodacus cassinii*	**Yes (IV)**			
House Finch *Carpodacus mexicanus*				**Yes**
Common Redpoll *Carduelis flammea*				
Pine Siskin *Carduelis pinus*				**Yes**
American Goldfinch *Carduelis tristis*				
Evening Grosbeak *Coccothraustes vespertinus*				
WEAVER FINCHES				
House sparrow *Passer domesticus*				**Yes**
AMPHIBIANS				
Tiger Salamander *Ambystoma tigrinum*	--		**Yes (NSS4*)**	**Yes**
Plains Spadefoot *Scaphiopus bombifrons*	--		**Yes (NSS4*)**	
Great Plains Toad *Bufo cognatus*	--		**Yes (NSS4*)**	
Woodhouse's Toad *Bufo woodhousei woodhousei*	--			
Boreal Chorus Frog *Pseudaris triseriata maculate*	--		**Yes (NSS4*)**	**Yes**
Bullfrog *Rana catesbeiana*	--		**Yes (NSS4*)**	
Northern Leopard Frog *Rana pipiens*	--	**Yes**	**Yes (NSS4*)**	**Yes**
REPTILES				
Eastern Short-horned Lizard *Phrynosoma douglassi brevirostre*	--			**Yes**
Northern Sagebrush Lizard *Sceloporus graciosus graciosus*	--		**Yes (NSS4*)**	**Yes**
Common Snapping Turtle *Chelydra serpentina serpentina*	--			**Yes**
Western Painted Turtle Chrysemys picta belli	--		**Yes (NSS4*)**	**Yes**
Prairie Rattlesnake *Crotalus viridis viridis*	--		**Yes (NSS3*)**	**Yes**

List of wildlife species with the potential of occurring on or within several miles of the Strata Energy Ross Project Area.

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern Region 7 (Level[1])**	**BLM Sensitive Species (Newcastle Field Office)**	**Wyoming Species of Concern (Status[2])**	**Observed in the Area**
Plains Hognose Snake *Heterondon nasicus nasicus*	--		**Yes (NSS4*)**	
Bullsnake *Pituophis melanoleucas sayi*	--		**Yes (NSS4*)**	**Yes**
Wandering Garter Snake *Thamnophis elegans vagrans*	--		**Yes (NSS4*)**	**Yes**
Eastern Yellowbelly Racer *Coluber constrictor flaviventris*	--		**Yes (NSS4*)**	
FISH				
Common Carp *Cyprinus carpio*	--			
Golden Shiner *Notemigonus crysoleucas*	--			
Fathead Minnow *Pimephales promelas*	--			
Plains Minnow Hybognathus placitus	--			
Black Bullhead *Ameiurus melas*	--			**Yes**
Green Sunfish *Lepomis cyanellus*	--			**Yes**
Bluegill *Lepomis macrochirus*	--			**Yes**
White Sucker *Catastomus commersoni*				**Yes**

[1]USFWS Level:

Level I (Conservation Action): Species clearly needs conservation action

Level II (Monitoring): The action and focus for the species is monitoring (M). Declining population trend and habitat loss are not significant at this point

Level III (Local Interest): Species that Wyoming Partners In Flight may recommend for conservation action (CA) that are not otherwise high priority but are of local interest (LI)

Level IV (Not Considered Priority): Additional species of concern, but not considered a priority species

Source: USFWS, Wyoming Ecological Services http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BirdsConsvConcern.html

[2]WGFD Status:

NSS1: 1996 Nongame Bird and Mammal Plan Species of Special Concern with a Native Species Status of 1

NSS2: 1996 Nongame Bird and Mammal Plan Species of Special Concern with a Native Species Status of 2

NSS3: 1996 Nongame Bird and Mammal Plan Species of Special Concern with a Native Species Status of 3

NSS4: 1996 Nongame Bird and Mammal Plan Species of Special Concern with a Native Species Status of 4

* - Species listed wholly or in part due to absence of data

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abitat a in an escri tions

Wildlife habitats will be mapped and defined as required with data included in Appendix D . Any habitat information presented in Appendix D for this area will also be referenced in Appendix D . Surveys already completed indicate that upland grassland is the major habitat type. Some sagebrush shrubland habitats are present also but in lesser amounts. Other habitats present are wetlands along ephemeral or intermittent streams reservoirs pastureland hayland and cropland. Prior disturbance is present on the site from oil wells and county roads. No crucial or critical habitats are currently known to exist within the area. Table 1 presents a preliminary delineation of habitat types and acreages present within the proposed permit area and the site is shown on the attached map.

abitat A init

Habitat affinities for wildlife species on the area will be determined by seasonal data to be collected for each class of wildlife discussed in the following sections.

i Ga e

Specific big game surveys will not be required for this permit area. A review of WGFD information indicates that no crucial big game ranges are present. Incidental observations of big game species will be recorded for the habitat affinity analyses.

lan Ga e ir s

Lek surveys for sage-grouse and sharp-tailed grouse will be completed during the late March to early May period. Surveys will be conducted for the permit area and two mile perimeter. An initial search of BLM and WGFD records indicates no sage-grouse leks are present in the permit area. This may be due to the lack of extensive sagebrush shrublands within the permit area. However the Oshoto Lek is located about two miles away and the Cap'n Bob Lek is about 2. miles away. If a sage-grouse lek is found within two miles of the permit area then a total of three counts will be made for each lek discovered. Brood surveys will not be required.

a tors

Raptor nest surveys will be conducted during the breeding season and during all survey periods beginning in February of 200 and will follow WGFD and USFWS protocols. Surveys will include the permit area and one mile perimeter. Nest activity and production surveys will be completed in March through July.

ater o l an Shorebir s

The permit area contains the Oshoto Reservoir several small stock ponds and ephemeral or intermittent drainages. Some of these areas may contain water during the waterfowl migration or breeding season. Opportunistic observations will be made during the various surveys for other species (game birds raptors T E MBHFI etc.) to document use of the area by waterbirds.

Passerine ir s

The USFW has requested breeding bird surveys as a method of identifying Migratory Birds of High Federal Interest that may inhabit the area. These surveys will consist of belt transects 1000 meters long by 100 meters wide. At least one belt transect will be located within each of the major habitat types of Upland Grassland Sagebrush Shrubland Pastureland Hayland and Wetland Reservoir as listed in Table 1. The width and length of transects will have to be adjusted for the Wetland Reservoir habitats. Each transect will be surveyed twice approximately two weeks apart between May 1 and June 1 . The transects will be surveyed by walking the centerline and recording each bird observed or heard within 0 meters on either side of the observer. The surveys will be completed between hour prior to sunrise and 0AM. All species of passerine or other bird species observed during other surveys will also be recorded.

ther a als Pre ators S all a als a o or hs

Surveys will be completed for the presence of swift fox and den sites as requested by the WGFD. No specific surveys are proposed for other predators or small mammals. However all species of mammals observed during other surveys will be recorded.

Threatene or n an ere S ecies

The surveys required by the USFWS will be completed for T E species that have the potential for inhabiting the area. At this time the USFWS Ecological Services Office in Cheyenne Wyoming does not include any wildlife on their list of T E species that occur or may be affected by projects located in Crook County. The site does contain habitat for the Ute Ladies'-tresses orchid. Surveys for that plant species will be completed with the vegetation surveys.

i rator ir s o i h Fe eral nterest F

MBHFI and BLM Sensitive Species surveys will be completed as required for species that have habitat present on the permit area. Additional MBHFI surveys will be completed as the breeding bird surveys presented in a previous section for passerine birds. Bald eagle winter roost surveys will be conducted in December and January.

e tiles an A hibians

The WGFD requested surveys for leopard frogs. Specific s surveys for leopard frogs and other amphibians or reptiles will be completed during the May-June period. These surveys will consist of three aural surveys completed right after dark. The first survey will be about the second week of May the second survey will be about the last week in May and the third survey will be about the first week of June. Survey locations will be approximately 0. miles apart and will incorporate some form of calling index. Egg mass surveys will be completed in June. Additional surveys may include walking suitable habitats such as wetland and other aquatic sites and recording species observations or vocalizations. Any amphibians or reptiles observed during other surveys completed on the area will also be documented.

Fish an enthic n ertebrates

The proposed permit area does not contain any perennial streams but does contain the Oshoto Reservoir. However Oshoto Reservoir is relatively small and shallow and has not been documented to support a fishery. The Little Missouri River is also within the permit area. This drainage is not perennial within the proposed permit area but is ephemeral and intermittent. Aquatic surveys will not be conducted due to the lack of suitable waters that would support viable fisheries lack of perennial streams and the fact there will be minimal to no disturbance of aquatic habitats from this project. The WGFD has agreed with this determination.

S ecies ist

A wildlife species list will be prepared for the permit area. This list will include species actually observed in the area and species with the potential to occur within the area.

etlan s

Wetland surveys will be completed by others as directed by the Corps and will be included in Appendix D10 as required.

Table 1. Estimated Acreages for Pre-mine Wildlife Habitat Types on the Ross ISR Uranium Project Permit Area.

Habitat Type	Acreage	Percent of Area
Upland Grassland	.1	.
Sagebrush Shrubland	.	21.0
Pastureland Hayland	22 .1	1 .
Wetland Reservoir	2.	.1
Disturbed Land	.	2.
Cropland	2.1	2.
Wooded Draw	.	0.
Totals	1 .	100.0

A 3.5-

F SP

Intermountain Resources
Permit Preparation · Baseline Inventories · Wildlife · Wetlands · Vegetation · Soils
P.O. Box 1589 · Laramie, Wyoming 82073 (307) 745-3803

January 13, 2010

Mr. Scott Gamo
Wildlife Habitat Protection Program
Wyoming Game and Fish Department
5400 Bishop Blvd.
Cheyenne, WY 82006

RE: Ross ISR Project at Oshoto

Dear Mr. Gamo,

This letter is a follow up to our discussion in your office on December 11 of 2009 concerning proposed wildlife baseline sampling on the Ross ISR Project near Oshoto, Wyoming. We have attached a map with the updated proposed permit boundary. The permit area is about 1700 acres, includes Oshoto Reservoir and contains the upper reaches of the Little Missouri River. Oshoto Reservoir appears to have been used primarily for irrigating adjacent fields and for stock water. Observations in late 2009 and prior years indicate the Little Missouri River is ephemeral in the late summer and fall at this location. The mine operation does not propose to affect the reservoir and local drainages may only be affected by a few road crossings.

While in your office we talked to an aquatic biologist and the decision was made to include surveys for the leopard frog for this project due to the abundance of wetlands and concerns for this species. The biologist also indicated there may be a concern with the Western Silvery Minnow but indicated he would have to check with someone else to see if that species would occur that far up the Little Missouri River. The question I had was whether we needed to include benthic invertebrate and/or fish surveys in the sampling plan for the Oshoto Reservoir and Little Missouri River. The biologist indicated if fish surveys needed to be conducted the WGFD would probably want their own personnel to complete those surveys.

We would like to get the wildlife sampling plan to you for review as soon as possible so we would appreciate a decision on what aquatic surveys would be needed, if any. Feel free to contact me if you have any questions.

Sincerely,

Jim Orpet

Jim Orpet

From: Nate_West@blm.gov
Sent: Thursday, February 11, 2010 6:59 AM
To: John Berry
Cc: James Bashor
Subject: Re: BLM Sensitive Species List for NFO
Attachments: pic32662.jpg; pic32757.gif

John,

Use the list from the 2002 sensitive species policy. I will let you know when the new one is signed. When the new list is signed it should not have any affect on your project. The botany websites are not correct and need to be updated. No BLM sensitive plants occur in your project area.

If you or Jim have questions please feel free to give me a call.

(Embedded image moved to file: pic32662.jpg)

John Berry
<jberry@wwcengineering.com>
02/09/2010 04:55 PM

To: Nate West <Nate_West@blm.gov>
cc: James Bashor <James_Bashor@blm.gov>
Subject: BLM Sensitive Species List for NFO

Nate,

I need some help. I found a list of BLM sensitive species on line at http://www.blm.gov/pgdata/etc/medialib/blm/wy/wildlife.Par.9226.File.dat/02species.pdf . This list covers plants, birds, mammals, etc. for the state, with field offices indicated. I also found a list of sensitive plant species for the Newcastle Field Office at http://www.wy.blm.gov/botany/fieldoffices/nfo.htm. The only problem is that the two lists don't match. There also is a plant list for Crook County (http://www.wy.blm.gov/botany/counties.php) that differs from the NFO plant list. I'm wondering if there may be inconsistencies with the other classes, also. I think that was why Jim Orpet requested the most current list you have that is specific to the Ross area - it would save him from having to verify.

Thanks,

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006
Phone: (307) 777-4600 Fax: (307) 777-4610
Web site: http://gf.state.wy.us

February 12, 2010

WER 12050
Intermountain Resources
Proposed Wildlife Baseline Sampling
Ross ISR Project at Oshoto
Crook County

Jim Orpet
Intermountain Resources
PO Box 1589
Laramie, WY 82073

Dear Mr. Orpet:

The staff of the Wyoming Game and Fish Department has reviewed the proposed wildlife baseline sampling on the Ross ISR Project at Oshoto in Crook County. We offer the following comments for your consideration.

Terrestrial Considerations:

The project boundary does not lie within a sage grouse Core Area. The closest sage grouse lek to this project is the Oshoto Lek which is located in T53N R67W Sec. 28. We recommend surveying the project area for additional leks and monitoring leks within a 2-mile radius of the project boundary. In addition, there is potential for swift fox to occur within the area and we advise that surveys be conducted for presence of swift fox and/or den sites as well. Raptor surveys should be conducted in accordance with WGFD and USFWS protocols.

Aquatic Considerations:

We agree with your conclusion that the Little Missouri River is ephemeral and does not pick up significant flows until downstream of the confluence with the North Fork of Little Missouri. Therefore, we do not recommend that surveys of benthic invertebrates or fish of the Little Missouri River be completed.

Amphibian and Reptiles

We recommend that surveys for the northern leopard frog be completed. The protocol outlined below is very broad and we encourage you to contact Zack Walker, Herpetologist, regarding specific protocols.

1. Perform aural surveys for amphibians during periods of spring breeding. Surveys should be conducted at least three times during the northern leopard frog breeding season. Survey locations should be spaced at least .5 miles apart, and incorporate some form of calling index. All amphibians heard during surveys should be documented.

2. Perform visual encounter egg mass surveys on a subsection of breeding habitat. This should focus on areas where egg deposition is likely to occur. While performing egg mass counts, all life stages of amphibians should be documented. Egg mass surveys should immediately follow aural surveys. If egg mass surveys cannot be conducted due to time constraints, later tadpole surveys could be substituted.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Paul Mavrakis, Sheridan Region Fisheries Supervisor, at 307-672-7418 Ext. 236, or Zack Walker, Herpetologist, at 307-473-3406.

Sincerely,

John Emmerich
Deputy Director

JE: MF: sg

cc: USFWS
Paul Mavrakis, Lynn Jahnke, Heather Obrien- WGFD, Sheridan
Zack Walker- WGFD, Casper

Intermountain Resources
Permit Preparation • Baseline Inventories • Wildlife • Wetlands • Vegetation • Soils
P.O. Box 1589 • Laramie, Wyoming 82073 (307) 745-3803

March 10, 2010

Mr. Scott Gamo
Wildlife Habitat Protection Program
Wyoming Game and Fish Department
5400 Bishop Blvd.
Cheyenne, WY 82006

RE: WER 12050, Ross ISR Project at Oshoto

Dear Mr. Gamo,

We have incorporated the comments from the WGFD letter of February 12, 2010 into the wildlife sampling plan for this project. The sage grouse lek survey area will include a two mile radius from the project boundary, surveys will be conducted for swift fox, raptor surveys will follow WGFD and USFWS protocols and inventories will be conducted for the northern leopard frog.

The entire survey plan is included for your review and approval. Feel free to contact me if you have any further questions or comments.

Sincerely,

Jim Orpet

Intermountain Resources

Permit Preparation • Baseline Inventories • Wildlife • Wetlands • Vegetation • Soils

P.O. Box 1589 • Laramie, Wyoming 82073 (307) 745-3803

March 10, 2010

USFWS Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009

RE: Strata Energy, Ross ISR Uranium Project

Intermountain Resources is working with Western Water Consultants of Sheridan and Strata Energy to permit an ISR Uranium Mine north of Moorcroft in northeastern Wyoming. The location and legal description are shown on the map attached to the enclosed wildlife sampling plan. This sampling plan is provided for your review and approval.

We would appreciate any additional information and concerns you may have on this specific area. Please contact me if you have any questions.

Sincerely,

Jim Orpet

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

In Reply Refer To:
ES-61411/WY10CPA0108

APR 14 2010

Mr. Jim Orpet
Intermountain Resources
P.O. Box 1589
Laramie, Wyoming 82073

Dear Mr. Orpet:

Thank you for your letter of March 10, 2010, received in our office on March 15, and attached Wildlife Baseline Inventory Sampling Plan (Plan), for the Strata Energy - Ross In Situ Recovery (ISR) Uranium Project (Project). This Project will be located in Crook County, Wyoming at Sections 12, 13, and 24, T. 53 N., R. 68 W., and Sections 7, 18, and 19, T. 53 N., R. 67 W., north of Moorcroft. The Project includes land administered by the U.S. Bureau of Land Management (Bureau). In your letter, you requested our review of the Plan as well as any additional information or concerns we have for this area.

Comments on the Wildlife Baseline Inventory Sampling Plan

The Plan includes survey information for general habitat, sage grouse leks, raptor nests, leopard frogs, wetlands, passerine birds, swift fox, Ute ladies'-tresses, and Migratory Birds of High Federal Interest including bald eagles. The Service finds the Plan satisfactory with the exception of the Threatened or Endangered Species section. This section states that "the USFWS Ecological Services Office in Cheyenne, Wyoming does not include any wildlife on their list of T&E species that occur or may be affected by projects located in Crook County". The species list for Crook County includes Ute ladies'-tresses (*Spiranthes diluvialis)* and Sage grouse (*Centrocercus urophasianus)*, and these species are addressed in more detail below. Additionally, the Plan does not address black-tailed prairie dog or mountain plover, which are species of concern in Crook County. Information for these species is also included below.

Pursuant to Wyoming regulations, mining applicants are required to consult with the Service prior to submission of the permit application to the Wyoming Department of Environmental Quality (Chapter 2, Regular Noncoal Mine Permit Applications, Section 1(f)). Therefore, we are providing general information that may assist the applicant in preparing their application. Please also note that because the Project requires an action (e.g., an approval) from another Federal agency, the Service is required to consult directly with the other Federal agency related

to endangered and threatened species unless that agency formally designates a non-Federal representative (50 CFR 402.08). The Bureau will evaluate and consult with the Service as may be appropriate concerning the effects of this Project to listed species and other areas of Service responsibility.

In response to your request, the U.S. Fish and Wildlife Service (Service) is providing you with information pursuant to the Endangered Species Act of 1973, as amended (Act), 16 U.S.C. 1531 *et seq.*, the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 *et seq.*, and the Fish and Wildlife Act of 1956, as amended, 16 U.S.C. 742a-742j.

In your Plan, you mentioned that the area has the potential for Migratory Birds of High Federal Interest (MBHFI) to nest within or adjacent to the proposed permit area. The Service does not maintain site specific information on the nesting locations of the birds on the MBHFI list (copy enclosed). Site-specific nest location information may be available from the Wyoming Game and Fish Department (WGFD), other applicable land management agencies, or can be determined through the use of species-specific surveys conducted on site. If site-specific information indicates that MBHFI do occur at or in the vicinity (e.g., 1 mile) of the proposed Project area, we can provide additional site and species-specific recommendations.

In accordance with Section 7(c) of the Act, we have determined that the following species or their designated habitat may be present in the proposed Project area. We would appreciate receiving information as to the current status of each of these species within the proposed Project area.

Listed, Proposed, Candidate Species and their Designated and Proposed Critical Habitat that may be in the proposed Project Area

Species	Scientific Name	Status	Habitat
Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 ft. elevation
Greater Sage-grouse	*Centrocercus urophasianus*	Candidate	Sagebrush communities

Ute ladies'-tresses: Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early

October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens. The Service does not maintain a list of "qualified" surveyors but can refer those wishing to become familiar with the orchid to experts who can provide training or services.

Greater sage-grouse: The Service has determined that the greater sage-grouse (Centrocercus urophasianus) warrants listing under the Act (75 FR 13910). At this time, the development of the listing proposal is precluded by other higher priority listing actions. Candidates are reviewed annually to determine if they continue to warrant listing or to reassess their listing priority. Ideally, sufficient threats can be removed to eliminate the need for listing in which case sage-grouse would no longer be a candidate. If threats are not addressed or the status of the species declines, a candidate species can move up in priority for a listing proposal.

Greater sage-grouse are dependent on sagebrush habitats year-round. Please see our *Federal Register* notice on sage-grouse for detailed information concerning the status of the species (75 FR 13910). Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations rangewide. Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting or brood rearing habitat) is present in the Project area, the Service recommends no Project-related disturbance March 15 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage-grouse persistence within these areas. Likewise, if important winter habitats are present, we recommend no Project-related disturbance November 15 through March 14.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the Project area, and appropriate measures to minimize potential impacts from the proposed Project. The Service also recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in Project planning, to minimize potential impacts to this species. No Project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

Species of Concern

Black-tailed prairie dog: . Black-tailed prairie dogs (*Cynomys ludovicianus*) may be found scattered in remnant populations throughout much of the range that it once occupied. A significant portion of existing occupied habitat rangewide occurs in a few large complexes. We encourage you to protect all prairie dog towns for their value to the prairie ecosystem and the many species that rely on them. We further encourage you to analyze potentially disturbed prairie dog towns for their value to future black-footed ferret reintroduction.

Mountain Plover: The Service has agreed to reopen the comment period in 2010 on the proposed rule to list the mountain plover as a threatened species (67 FR 72396, December 5, 2002) and to complete a new final determination on the proposal by May 1, 2011. Once the comment period is reopened and pending the completion of the new final determination, the mountain plover will be proposed for listing. Section 7(a)(4) of the Act, requires Federal agencies to confer with us on any action that is likely to jeopardize the continued existence of any species proposed for listing. Federal action agencies may also request a conference on any proposed action that may affect a species proposed for listing.

We encourage Project planners to develop and implement protective measures should mountain plovers occur within Project areas. Measures to protect the mountain plover from further decline may include: (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. We strongly encourage you to develop protective measures with an assurance of implementation should mountain plovers be found within the Project areas.

Migratory Birds

The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving

resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the Project area, timing is a significant consideration and needs to be addressed in Project planning.

If nest manipulation is proposed for this Project, the Project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this Project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the Project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

The Service's Wyoming Field Office has compiled a list of Migratory Bird Species of High Federal Interest (Enclosure) from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List.

Enclosed please find our general recommendations for the protection of raptor species. We strongly encourage Project proponents to fully implement the protective measures described in the enclosures in order to help ensure compliance with the MBTA. We are also available to assist you in developing a Project specific plan to address the MBTA concerns.

Wetlands/Riparian Areas

Wetlands may be impacted by the proposed Project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the Project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and

potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the Project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the Project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.

ISR Uranium Mining

High selenium concentrations can occur in wastewater from in situ mining of uranium ore asuranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of grassland irrigated with wastewater from an in situ uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the in situ wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds and aquatic species. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving in situ wastewater. Waterborne selenium concentrations 2 ig/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally,

water with more than 20 ig'L is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994), which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002).

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 ig/g in pondweed (Potamogeton vaginatus) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 .tg/L.

For our internal tracking purposes, the Service would appreciate notification of any decision made on this Project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Pauline Schuette of my office at the letterhead address or phone (307) 684-1069.

Sincerely,

Brian T. Kelly
Field Supervisor
Wyoming Field Office

Enclosures (2)

cc: WDEQ, Land Quality Division, Sheridan, WY (D. McKenzie)
WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)
BLM, Endangered Species Program Lead, Cheyenne, WY (T. Abbott)

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Migratory Bird Species of Management Concern in Wyoming

(Migratory Birds of High Federal Interest)

Based on the *Wyoming Bird Conservation Plan* (Cerovski et al. 2000)

May 2, 2002

U.S. Fish and Wildlife Service, Wyoming Field Office,
5353 Yellowstone Road, Suite 308A, Cheyenne, Wyoming 82009

The Wyoming Field Office of the U.S. Fish and Wildlife Service (Service) has compiled the following list from the ongoing work among State and Federal agencies, non-governmental organizations, and the interested public that produced the Wyoming Bird Conservation Plan. This list will now serve as our list of Migratory Bird Species of Management Concern in Wyoming, in place of the previous list based on the Migratory Nongame Birds of Management Concern in the United States: the 1995 List. The Wyoming Bird Conservation Plan identified priority species based on a number of criteria (see below) using the best information available for these generally un-studied species. In many cases, this list reflects identified threats to habitat because no information is available on the species population trends. In some cases it reflects identified population declines though no causal factors have been identified.

The following tables and explanatory text are taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). For more information on this listing process, this report is available from our Wyoming Field Office, 5353 Yellowstone Road, Suite 308A, Cheyenne, Wyoming 82009; or Wyoming Game and Fish Department (WGFD), Nongame Branch, 260 Buena Vista, Lander, Wyoming 82520.

Table 1. **Level I Species (Conservation Action)**. Species clearly needs conservation action. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, and the need for additional knowledge through monitoring and research into basic natural history, distribution, etc.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Mountain Plover[d]	28	4	3	Shortgrass Prairie, Shrub-steppe
Trumpeter Swan	26	3	3	Wetlands
Sage Grouse	26	5	3	Shrub-steppe
McCown's Longspur	26	3	2	Shortgrass Prairie, Shrub-steppe
Baird's Sparrow	26	2	3	Shortgrass Prairie
Ferruginous Hawk	23	4	3	Shrub-steppe, Shortgrass Prairie
Brewer's Sparrow	23	5	5	Shrub-steppe, Mountain-foothills Shrub
Wilson's Phalarope	22	3	5	Wetlands
Franklin's Gull	22	3	3	Wetlands
Sage Sparrow	22	5	2	Shrub-steppe, Mountain-foothills Shrub

Table 1. **Level I Species (Conservation Action)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Swainson's Hawk	21	3	3	Plains/Basin Riparian
Long-billed Curlew	21	2	3	Shortgrass Prairie
Short-eared Owl	20	3	3	Shortgrass Prairie
Northern Goshawk	19	4	3	High Elevation Conifer, Mid Elevation Conifer, Aspen
Peregrine Falcon	19	3	3	Specialized (cliffs)
Burrowing Owl	19	3	4	Shortgrass Prairie
Forster's Tern	19	2	3	Wetlands
Bald Eagle	18	3	3	Montane Riparian, Plains/Basin Riparian
Upland Sandpiper	18	2	2	Shortgrass Prairie
Black Tern	18	3	3	Wetlands
Whooping Crane	n/a	n/a	n/a	Wetlands
Piping Plover	n/a	n/a	n/a	Wetlands, Aquatic

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database, Carter et al. 1997).
[c] PT ' Population Trend (from the PIF Priority Database, Carter et al. 1997).
[d] Species in all capital letters previously appeared on the Service's 1995 list.

Table 2. **Level II Species (Monitoring).** The action and focus for the species is monitoring. Includes species of which Wyoming has a high percentage of and responsibility for the breeding population, species whose population trend is unknown, species that are peripheral for breeding in the habitat or state, or species for which additional knowledge is needed.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Calliope Hummingbird	23	5	3	Mid Elevation Conifer, Montane Riparian
Lewis' Woodpecker	23	3	3	Low Elevation Conifer, Plains/Basin Riparian
Cassin's Kingbird	22	3	3	Juniper Woodland, Plains/Basin Riparian
Lark Bunting	22	4	4	Shortgrass Prairie, Shrub-steppe
American White Pelican	21	3	3	Aquatic
Williamson's Sapsucker	21	3	3	Mid Elevation Conifer
Black-backed Woodpecker	21	3	3	Mid Elevation Conifer, High Elevation Conifer
Gray Flycatcher	21	3	3	Juniper Woodland, Mountain-foothills Shrub
Juniper Titmouse [d]	21	3	3	Juniper Woodland
Dickcissel	21	3	3	Shortgrass Prairie
Chestnut-collared Longspur	21	2	3	Shortgrass Prairie
Harlequin Duck	20	3	3	Montane Riparian
Snowy Plover	20	3	3	Wetlands
Black-chinned Hummingbird	20	2	3	Plains/Basin Riparian, Shrub-steppe
Rufous Hummingbird	20	2	3	Mid Elevation Conifer
Red-naped Sapsucker	20	3	2	Aspen
Three-toed Woodpecker	20	4	3	Mid Elevation Conifer, High Elevation Conifer
Willow Flycatcher	20	3	4	Montane Riparian, Plains/Basin Riparian
Hammond's Flycatcher	20	2	3	High Elevation Conifer with Aspen, Montane Riparian
Cordilleran Flycatcher	20	3	3	Montane Riparian, Mid Elevation Conifer
Pygmy Nuthatch	20	3	3	Low Elevation Conifer
Marsh Wren	20	3	4	Wetlands
American Dipper	20	3	3	Montane Riparian
Plumbeous Vireo	20	3	3	Mid Elevation Conifer, Low Elevation Conifer
Townsend's Warbler	20	3	3	High Elevation Conifer, Mid Elevation Conifer
Dusky Flycatcher	19	3	2	Low Elevation Conifer, Aspen, Mountain-foothills Shrub

Table 2. **Level II Species (Monitoring)**, continued.

Species	PIF Score[a]	AI[b]	PT[c]	Primary Habitat Type(s)
Western Bluebird	19	3	3	Juniper Woodland, Low Elevation Conifer
Sage Thrasher	19	5	2	Shrub-steppe
Grasshopper Sparrow	19	3	5	Shortgrass Prairie, Shrub-steppe
Bobolink	19	2	3	Shortgrass Prairie, Shrub-steppe
Common Loon	18	3	3	Wetlands
Black-billed Cuckoo	18	2	3	Plains/Basin Riparian
Red-headed Woodpecker	18	2	3	Plains/Basin Riparian, Low Elevation Conifer
Yellow-billed Cuckoo	18	3	3	Plains/Basin Riparian
Eastern Screech-Owl	18	3	3	Plains/Basin Riparian
Western Screech-Owl	18	3	3	Plains/Basin Riparian
Great Gray Owl	18	3	3	Mid Elevation Conifer, High Elevation Conifer
Boreal Owl	18	3	3	High Elevation Conifer
Broad-tailed Hummingbird	18	2	2	Montane Riparian, Plains/Basin Riparian, Mid Elevation Conifer
Western Scrub-Jay[d]	18	3	3	Juniper Woodland
Loggerhead Shrike	18	3	3	Shrub-steppe
Vesper Sparrow	18	5	4	Shrub-steppe
Lark Sparrow	18	3	4	Shrub-steppe
Golden-crowned Kinglet	17	3	3	High Elevation Conifer
MacGillivray's Warbler	17	3	1	Montane Riparian, Plains/Basin Riparian
Ash-throated Flycatcher[d]	16	2	3	Juniper Woodland
Bushtit[d]	16	3	3	Juniper Woodland
Brown Creeper	16	3	3	Mid Elevation Conifer, High Elevation Conifer
Merlin	15	3	3	Low Elevation Conifer
Sprague's Pipit	n/a	n/a	n/a	Grassland, Plains/Basin Riparian, Shortgrass Prairie
Barn Owl	n/a	n/a	n/a	Shortgrass Prairie, Urban
White-faced Ibis	n/a	n/a	n/a	Wetlands, Aquatic
American Bittern	n/a	n/a	n/a	Wetlands, Aquatic
Common Tern	n/a	n/a	n/a	Wetlands, Aquatic
Purple Martin	n/a	n/a	n/a	Wetlands, Aquatic/Basin Riparian, Montane Riparian

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI ' Area Importance (from the PIF Priority Database).
[c] PT ' Population Trend (from the PIF Priority Database).
[d] Nicholoff, S. 2002. Wyoming Bird Conservation Plan, Version 1.1. Wyoming Partners In Flight and Wyoming Game and Fish Department, Lander. In press.

Wyoming Partners In Flight Process for Prioritizing Species

Wyoming Partners In Flight participants developed the current list of priority species based on a combination of the seven criteria in the national Partners In Flight Priority Database (Carter et al. 1997). This database serves as a defensible method of prioritizing both species and habitats in need of conservation. The criteria include Wyoming-dependent and Wyoming-independent factors. The Wyoming-independent criteria are constant over a species' range and do not vary for each species. The Wyoming-dependent criteria were the key components used to prioritize species and their conservation action needs. In the absence of any more rigorous statewide surveys, Breeding Bird Survey data dating back to 1968 were used to determine population trends in Wyoming.

Criteria

Within each criterion below, a species was given a rank score ranging from 1 to 5, with 1 being the least critical rank and 5 the most critical. Each ranked species could potentially receive a low score of 7 and a high score of 35. However, setting conservation goals based only on total score could be misleading; therefore, each total score was reviewed in conjunction with its component parts. In Wyoming, species were initially ranked using total score, area importance, and population trend.

1. Relative Abundance (RA) - The abundance of a bird, in appropriate habitat within its entire range, relative to other bird species. This criterion gives an indication of a species' vulnerability to withstand cataclysmic environmental changes. A low score would indicate a higher relative abundance, therefore reducing the risk of complete extirpation from losses in one or more regions. Higher scores indicate a lower relative abundance, thus more vulnerability to drastic losses or population changes.

2. Breeding Distribution (BD) - A relative measure of breeding range size as a proportion of North America (defined as the main body of the continent, excluding Greenland, through Panama and the islands of the Caribbean, comprising an area of 22,059,680 km^2 [National Geographic Society 1993]), and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized breeding, thus a higher likelihood of serious decline from drastic environmental changes. Low scores indicate wide breeding distribution, therefore less likelihood of extirpation. Used for breeding birds only.

3. Non-breeding Distribution (ND) - A relative measure of non-breeding, or winter, range size as a proportion of North America, and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized distribution on the non-breeding grounds. Low scores indicate wide distribution on the non-breeding grounds, therefore less likelihood of extirpation. Used for wintering birds only.

4. Threats on Breeding Grounds (TB) - The ability of a habitat in an area to support populations of a species in that area. Two factors are considered here: 1) each species' demographic and ecological vulnerability (the potential inability of a species to recover from population loss by normal reproductive effort due to low reproductive rate, high juvenile mortality, or both; and the level of ecological specialization of a species and, hence, its potential inability to withstand environmental change), and 2) habitat loss or disruption (a combination of the amount of habitat or conditions necessary for survival and reproductive success that has been

lost since 1945, and the amount that is anticipated to be lost in the future). High scores indicate either a large loss of habitat or a species that is an extreme ecological specialist. Low scores indicate a stable or increasing habitat or a species that is an ecological generalist. Used for both breeding and wintering birds.

5. Threats on Non-breeding Grounds (TN) - Range-wide threats on non-breeding, or winter, grounds. This is scored using the same criteria as threats on breeding grounds but reflects non-breeding issues, including migratory habitat. Used for wintering birds only.

6. Population Trend (PT) - The overall population trend of each species assigned independently for each state, province, or physiographic area. This criterion must meet two thresholds, reliability and magnitude, to warrant either a very high or very low score. When possible, a score was assigned using BBS data, which incorporated a population trend uncertainty score based on the statistical validity of the BBS data (i.e. a species must be detected on a minimum of 14 BBS routes per state for population trends to have statistical significance). This criterion was chosen to alert managers to species with modest, but certain, population declines.

7. Area Importance (AI) - The abundance of a species within a state, province, or physiographic area relative to its abundance throughout its range. This criterion helps direct conservation efforts toward areas that are most important to a species' survival. Area Importance is scored locally; therefore, high scores indicate that a large proportion of the species' breeding or winter range occurs in Wyoming, or a species is using a habitat that is only available in Wyoming. Low scores indicate that a small proportion of the species' range occurs in Wyoming, or the preferred habitat is widespread across its range. Used for both breeding and wintering birds.

Priority Species

Priority bird species in Wyoming were identified from the PIF Priority Database (Carter et al. 1997) and by qualitative, informed decisions. Those species with a total score of 18 or above, Area Importance (AI) of 3 or above, and/or Population Trend (PT) of 3 or above from the database, or with a total score less than 18 but of significant local interest were identified as the highest priority species. However, as more information becomes available, the highest priority species for Wyoming may change, as this is a dynamic database that allows for updated information to be periodically inserted and reviewed. The primary habitat type or types required for breeding were identified for each species to determine the highest priority habitat types for the state.

Literature Cited

Carter, M. F., W. C. Hunter, D. N. Pashley, J. S. Bradley, C. S. Aid, J. Price, and G. S. Butcher. 1997. Setting landbird conservation priorities for states, provinces, and physiographic areas of North America. Partners In Flight Priority Database Final Report, Colorado Bird Observatory, Brighton.

Cerovski, A., M. Gorges, T. Byer, K. Duffy, and D. Felley. 2000. Wyoming Bird Conservation Plan, Version 1.0. Wyoming Partners In Flight, Lander, WY.

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U.S. Fish and Wildlife Service, Wyoming Ecological Services Field Office

Protections for Raptors

Raptors, or birds of prey, and the majority of other birds in the United States are protected by the Migratory Bird Treaty Act, 16 U.S.C. 703 (MBTA). A complete list of migratory bird species can be found in the Code of Federal Regulations at 50 CFR 10.13. Eagles are also protected by the Bald and Golden Eagle Protection Act, 16 U.S.C. 668 (Eagle Act).

The MBTA protects migratory birds, eggs and nests from possession, sale, purchase, barter, transport, import, export, and take. The regulatory definition of take, defined in 50 CFR 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect a migratory bird. Activities that result in the unpermitted take (e.g., result in death, possession, collection, or wounding) of migratory birds or their eggs are illegal and fully prosecutable under the MBTA. Removal or destruction of active nests (i.e., nests that contain eggs or young), or causing abandonment of an active nest, could constitute a violation of the MBTA, the Eagle Act, or both statutes. Removal of any active migratory bird nest or any structure that contains an active nest (e.g., tree) where such removal results in take is prohibited. Therefore, if nesting migratory birds are present on or near a project area, project timing is an important consideration during project planning. As discussed below, the Eagle Act provides additional protections for bald and golden eagles and their nests. For additional information concerning nests and protections under the MBTA, please see the U.S. Fish and Wildlife Service's (Service) Migratory Bird Permit Memorandum, MBMP-2.

The Service's Wyoming Ecological Services Field Office works to raise public awareness about the possible occurrence of birds in proposed project areas and the risk of violating the MBTA, while also providing guidance to minimize the likelihood that take will occur. We encourage you to coordinate with our office before conducting actions that could lead to the take of a migratory bird, their young, eggs, or active nests (e.g., construction or other activity in the vicinity of a nest that could result in a take). If nest manipulation is proposed for a project in Wyoming, the project proponent should also contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued. Permits generally are not issued for an active nest of any migratory bird species, unless removal of the nest is necessary for human health and safety. If a permit cannot be issued, the project may need to be modified to ensure take of migratory birds, their young or eggs will not occur.

For infrastructure (or facilities) that have potential to cause direct avian mortality (e.g., wind turbines, guyed towers, airports, wastewater disposal facilities, transmission lines), we recommend locating structures away from high avian-use areas such as those used for nesting, foraging, roosting or migrating, and the travel zones between high-use areas. If the wildlife survey data available for the proposed project area and vicinity do not provide the detail needed to identify normal bird habitat use and movements, we recommend collecting that information prior to determining locations for any infrastructure that may create an increased potential for avian mortalities. We also recommend contacting the Service's Wyoming Ecological Services office for project-specific recommendations.

Additional Protections for Eagles

The Eagle Act protections include provisions not included in the MBTA, such as the protection of unoccupied nests and a prohibition on disturbing eagles. Specifically, the Eagle Act prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagle or their body parts, nests, chicks or eggs, which includes collection, possession, molestation, disturbance, or killing. The term "disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (50 CFR 22.3 and see also 72 FR 31132).

The Eagle Act includes limited exceptions to its prohibitions through a permitting process. The Service has issued regulations concerning the permit procedures for exceptions to the Eagle Act's prohibitions

(74 FR 46836), including permits to take golden eagle nests which interfere with resource development or recovery operations (50 CFR 22.25). The regulations identify the conditions under which a permit may be issued (i.e., status of eagles, need for action), application requirements, and other issues (e.g., mitigation, monitoring) necessary in order for a permit to be issued.

For additional recommendations specific to Bald Eagles please see our Bald Eagle information web page (http://www.fws.gov/wyominges).

Recommended Steps for Addressing Raptors in Project Planning

Using the following steps in early project planning, agencies and proponents can more easily minimize impacts to raptors, streamline planning and permitting processes, and incorporate measures into an adaptive management program:

1. Coordinate with appropriate Service offices, Wyoming Game and Fish Department, Tribal governments, and land-management agencies at the earliest stage of project planning.
2. Identify species and distribution of raptors occurring within the project area by searching existing data sources (e.g., Wyoming Game and Fish Department, Federal land-management agencies) and by conducting on-site surveys.
3. Plan and schedule short-term and long-term project disturbances and human-related activities to avoid raptor nesting and roosting areas, particularly during crucial breeding and wintering periods
4. Determine location and distribution of important raptor habitat, nests, roost sites, migration zones and, if feasible, available prey base in the project impact area.
5. Document the type, extent, timing, and duration of raptor activity in important use areas to establish a baseline of raptor activity.
6. Ascertain the type, extent, timing, and duration of development or human activities proposed to occur, and the extent to which this differs from baseline conditions.
7. Consider cumulative effects to raptors from proposed projects when added to past, present, and reasonably foreseeable actions. Ensure that project mitigation adequately addresses cumulative effects to raptors.
8. Minimize loss of raptor habitats and avoid long-term habitat degradation. Mitigate for unavoidable losses of high-valued raptor habitats, including (but not limited to) nesting, roosting, migration, and foraging areas.
9. Monitor and document the status of raptor populations and, if feasible, their prey base post project completion, and evaluate the success of mitigation efforts.
10. Document meaningful data and evaluations in a format that can be readily shared and incorporated into wildlife databases (contact the Service's Wyoming Ecological Services office for details).

Protection of nesting, wintering (including communal roost sites), and foraging activities is considered essential to conserving raptors. In order to promote the conservation of migratory bird populations and their habitats, Federal agencies should implement those strategies directed by Executive Order 13186, "Responsibilities of Federal Agencies To Protect Migratory Birds" (66 FR 3853).

Recommended Seasonal and Spatial Buffers to Protect Nesting Raptors

Because many raptors are particularly sensitive to disturbance (that may result in take) during the breeding season, we recommend implementing spatial and seasonal buffer zones to protect individual nest sites/territories (Table 1). The buffers serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees. The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there is little or no forested or topographical separation, distance alone must serve as the buffer. Adequate nesting buffers will help ensure activities do not take breeding birds, their young or eggs. For optimal conservation benefit, we recommend that no temporary or permanent surface occupancy occur within species-specific spatial buffer zones. For some activities with very substantial auditory impacts (e.g., seismic exploration and blasting) or visual impacts (e.g., tall drilling rig), a larger buffer than listed in

Table 1 may be necessary, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

As discussed above, for infrastructure that may create an increased potential for raptor mortalities, the spatial buffers listed in Table 1 may not be sufficient to reduce the incidence of raptor mortalities (for example, if a wind turbine is placed outside a nest disturbance buffer, but inadvertently still within areas of normal daily or migratory bird movements); therefore, please contact the Service's Wyoming Ecological Services office for project specific recommendations on adequate buffers.

Buffer recommendations may be modified on a site-specific or project-specific basis based on field observations and local conditions. The sensitivity of raptors to disturbance may be dependent on local topography, density of vegetation, and intensity of activities. Additionally, individual birds may be habituated to varying levels of disturbance and human-induced impacts. Modification of protective buffer recommendations may be considered where biologically supported and developed in coordination with the Service's Wyoming Ecological Services Field Office.

Because raptor nests are often initially not identified to species (e.g., preliminary aerial surveys in winter), we first recommend a generic raptor nest seasonal buffer guideline of January 15th – August 15th. Similarly, for spatial nesting buffers, until the nesting species has been confirmed, we recommend applying a 1-mile spatial buffer around the nest. Once the raptor species is confirmed, we then make species-specific and site-specific recommendations on seasonal and spatial buffers (Table 1).

Activities should not occur within the spatial/seasonal buffer of any nest (occupied or unoccupied) when raptors are in the process of courtship and nest site selection. Long-term land-use activities and human-use activities should not occur within the species-specific spatial buffer of occupied nests. Short-term land use and human-use activities proposed to occur within the spatial buffer of an occupied nest should only proceed during the seasonal buffer after coordination with the Service, State, and Tribal wildlife resources management agencies, and/or land-management agency biologists. If, after coordination, it is determined that due to human or environmental safety or otherwise unavoidable factors, activities require temporary incursions within the spatial and seasonal buffers, those activities should be planned to minimize impacts and monitored to determine whether impacts to birds occurred. Mitigation for habitat loss or degradation should be identified and planned in coordination with applicable agencies.

Please contact the Service's Wyoming Ecological Services Field Office if you have any questions regarding the status of the bald eagle, permit requirements, or if you require technical assistance regarding the MBTA, Eagle Act, or the above recommendations. The recommended spatial and seasonal buffers are voluntary (unless made a condition of permit or license) and are not regulatory, and they do not supersede provisions of the MBTA, Eagle Act, Migratory Bird Permit Memorandum (MBMP-2), and Endangered Species Act. Assessing legal compliance with the MBTA or the Eagle Act and the implementing regulations is ultimately the authority and responsibility of the Service's law enforcement personnel. Our recommendations also do not supersede Federal, State, local, or Tribal regulations or permit conditions that may be more restrictive.

Table 1. Service's Wyoming Ecological Services Field Office's Recommended Spatial and Seasonal Buffers for Breeding Raptors

Raptors of Conservation Concern (see below for more information)

Common Name	Spatial buffer (miles)	Seasonal buffer
Golden Eagle	0.5	January 15 - July 31
Ferruginous Hawk	1	March 15 - July 31
Swainson's Hawk	0.25	April 1 - August 31
Bald Eagle	see our Bald Eagle information web page	

Prairie Falcon	0.5	March 1 - August 15
Peregrine Falcon	0.5	March 1 - August 15
Short-eared Owl	0.25	March15- August 1
Burrowing Owl	0.25	April 1 – September 15
Northern Goshawk	0.5	April 1 - August 15

Additional Wyoming Raptors

Common Name	Spatial buffer (miles)	Seasonal buffer
Osprey	0.25	April 1 - August 31
Cooper's Hawk	0.25	March 15 – August 31
Sharp-shinned Hawk	0.25	March 15 – August 31
Red-tailed Hawk	0.25	February 1 – August 15
Rough-legged Hawk (winter resident only)	----	----
Northern Harrier	0.25	April 1 - August 15
Merlin	0.5	April 1 - August 15
American Kestrel	0.125	April 1 – August 15
Common Barn Owl	0.125	February 1 – September 15
Northern Saw-whet Owl	0.25	March 1 - August 31
Boreal Owl	0.25	February 1 – July 31
Long-eared Owl	0.25	February 1 – August 15
Great Horned Owl	0.125	December 1 – September 30
Northern Pygmy-Owl	0.25	April 1 – August 1
Eastern Screech -owl	0.125	March 1 – August 15
Western Screech-owl	0.125	March 1 – August 15
Great Gray Owl	0.25	March 15 – August 31

Raptors of Conservation Concern

The Service's Birds of Conservation Concern (2008) report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Endangered Species Act (16 U.S.C 1531 et seq.). This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners. The Wyoming Partners in Flight Wyoming Bird Conservation Plan identifies priority bird species and habitats, and establishes objectives for bird populations and habitats in Wyoming. This plan also recommends conservation actions to accomplish the population and habitat objectives.

We encourage project planners to develop and implement protective measures for the Birds of Conservation Concern as well as other high-priority species identified in the Wyoming Bird Conservation Plan. For additional information on the Birds of Conservation Concern that occur in Wyoming, please see our Birds of Conservation Concern web page.

Additional Planning Resources

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Edison Electric Institute and the Raptor Research Foundation. 1996. Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1996. Washington, D.C.

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U.S. Fish and Wildlife Service. 2000. Siting, Construction, Operation and Decommissioning of Communications Towers and Tower Site Evaluation Form (Directors Memorandum September 14, 2000), Arlington, Virginia.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. United States Department of Interior, Fish and Wildlife Service, Arlington, Virginia. 23 pp.

Wyoming Game and Fish Department Internet Link to Raptor Information

References

50 CFR 10.12 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 10.13– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 10--General Provisions.

50 CFR 22.3 – Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

50 CFR 22.25– Code of Federal Regulations. Title 50--Wildlife and Fisheries, Chapter I--United States Fish and Wildlife Service, Department of the Interior, Part 22—Eagle Permits.

66 FR 3853 - Presidential Documents. Executive Order 13186 of January 10, 2001. Responsibilities of Federal Agencies To Protect Migratory Birds. Federal Register, January 17, 2001.

72 FR 31132 - Protection of Eagles; Definition of "Disturb". Final Rule. Federal Register, June 5, 2007.

74 FR 46836 - Eagle Permits; Take Necessary To Protect Interests in Particular Localities. Final Rule. Federal Register, September 11, 2009.

U.S. Fish and Wildlife Service. 2003. Migratory Bird Permit Memorandum, MBMP-2, Nest Destruction (Directors Memorandum April 15, 2003), Washington, D.C.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

Federal Threatened, Proposed, and Candidate Species that Occur in or may be Affected by Projects in CROOK County, Wyoming
Last Updated July 2010

Species	Scientific Name	Status	Habitat
Greater Sage-grouse	*Centrocercus urophasianus*	Candidate	Sagebrush communities
Mountain Plover	*Charadrius montanus*	Proposed	Grasslands and prairie dog towns
Ute Ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 ft. elevation

U.S. Fish and Wildlife Service (Service) biologists have used the best scientific information available to formulate this list, which is updated annually or soon after listing changes occur. The purpose of a species list is to help provide information on endangered and threatened species that may be present in a project area.

A current version of this species list fulfills the Service's requirement, under section 7(c) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.), to provide a list of endangered and threatened species upon request for federal actions and National Environmental Policy Act (NEPA) compliance. Federal agency responsibilities under section 7 of the Act, including an outline of the section 7 consultation process and information needed in a biological assessment may be found at the following link: http://endangered.fws.gov/consultations. Non-Federal entities who believe that their projects or activities may affect listed species may contact the Service regarding the potential need for a section 10 permit, under the Act.

Measures may also be required for the project to protect migratory birds under the Migratory Bird Treaty Act, 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act, 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Additional information that may be important for project planning concerning other important fish and wildlife resources is available from the Service's Wyoming Ecological Services office.

For additional information please call the Wyoming Ecological Services Field Office at 307-772-2374.

ADDENDUM 3.6-A

METEOROLOGICAL MONITORING

AND AIR SAMPLING PLAN

Ross ISR Uranium Project
Strata Energy

Addendum 3.6-A

Meteorological Monitoring and Air Sampling Plan

Updated November 13, 2010

Prepared by:

Air Science
a division of Inter-Mountain Laboratories, Inc.
555 Absaraka
Sheridan, Wyoming 82801
(307) 674-7506
www.imlairscience.co

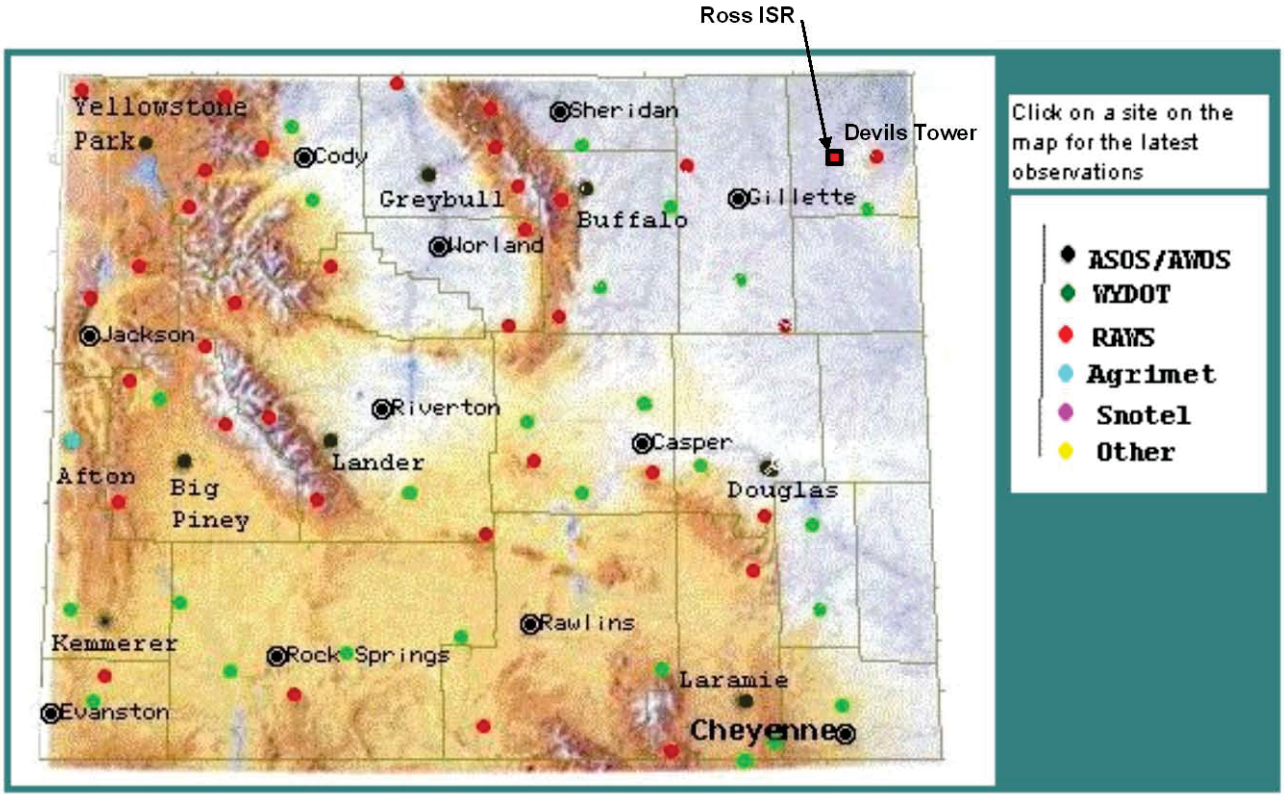
Introduction

The following baseline meteorological monitoring and ambient air sampling plan is being followed at the Ross ISR Project in conformance with published NRC standards and guidelines. The results of this monitoring program will be:

1. Twelve months of on-site hourly meteorological data to support NRC licensing, air permitting through the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ-AQD), and dispersion modeling.
2. Four quarters of particulate sampling and radionuclide analysis for five project locations, to support NRC licensing. A sixth location was added in October of 2010, after cumulative wind monitoring made it clear that prevailing winds are from the South.

Meteorological monitoring will be supplemented with hourly National Weather Service (NWS) data available from two Meteorological data sources within 80 kilometers of the project area. These include a NWS station at the Gillette, Wyoming airport (approximately 35 miles from the project), and a Remote Automated Weather Station (RAWS) station operated by the Bureau of Land Management near Devils Tower (approximately 15 miles from the project). Figure 1 shows NWS stations in Wyoming. The Gillette and Devils Tower sites are labeled on the map. The nearest available upper air data will be obtained from the NWS station in Rapid City, South Dakota (approximately 100 miles from the project).

FIGURE 1 – National Weather Service Stations in Wyoming



Hourly meteorological data from surface coal mines in the region will be compared to data from the Ross ISR meteorological station. For at least the past 15 years, IML Air Science has operated meteorological stations at Dry Fork Mine, located 25 miles west-southwest of the project site, and Buckskin Mine, located 30 miles west-southwest of the project site. In addition, some hourly meteorological data are available from the Thunder Basin National Grassland monitoring station, located 18 miles west of the project site.

On-Site Meteorological Monitoring Plan

Meteorological data collection, management and reporting methods conform to NRC atmospheric dispersion modeling requirements for uranium milling operations, and meet the acceptance criteria established in the NRC's NUREG-1569. The on-site monitoring program has been developed according to NRC Regulatory Guide 3.63, "Onsite Meteorological Measurement Program For Uranium Recovery Facilities – Data Acquisition and Reporting." The meteorological monitoring program will also meet the Wyoming Department of Environmental Quality requirements for land and air quality permit applications and compliance.

The project site meteorology is being monitored for a minimum of 12 months, at the site labeled "Met Station" in Figure 3. A collocated air sampler will collect air particulates as part of the air quality baseline monitoring program (see below). Prevailing winds at the Gillette airport are typically from the southwest and northwest, as shown in Figure 4. According to Section 2.5.3 of the original Nubeth application to NRC for an exploration license just south of the project site, winds are predominantly westerly. Based on these information sources, the "Met Station" location was chosen to represent conditions upwind from the project area. It is situated on an unobstructed knoll roughly two miles northwest of the proposed plant site. The meteorological station is approximately 150 feet higher in elevation than the plant site. The terrain in the area is characterized by mildly rolling hills and ephemeral drainages. There are no pronounced topographic features in the area that would create weather conditions significantly different between the meteorological station and the plant site. Figure 2 shows a view from the meteorological station looking to the east, and a view of the meteorological site from a point north of the site. Figure 3 shows a map of the project area, including permit boundary and monitoring locations. The site labeled "MET" in the northwest corner of the map is the meteorological monitoring station.

FIGURE 2 – Meteorological (Met Station) Site

Hourly meteorological values are recorded for wind speed, wind direction, standard deviation of wind direction (sigma theta), ambient temperature, relative humidity, precipitation, evaporation, and evaporation pan temperature. These values are generated by field instruments and recorded by a continuous data logger, all operated and maintained by IML Air Science. The data logger polls all instruments every second, and invalidates any hourly record for which an instrument output is missing for more than 10 seconds during that hour. This assures continuous temporal representation and surpasses the NRC requirement of at least 15 minutes of data in each hour.

Meteorological Data Quality Assurance

The Ross ISR Project meteorological station is inspected on a weekly basis. Meteorological instruments were calibrated upon installation in January, 2010 and again in July of 2010, according to the requirements of NRC Regulatory Guide 3.63. Appendix 1 to this document contains calibration and audit records for all meteorological instruments, along with specified tolerances for each parameter. These instruments meet the accuracy and threshold specifications listed in the EPA's "On-Site Meteorological Program Guidance for Regulatory Modeling Applications," which match or exceed NRC requirements in Regulatory Guide 3.63. Table 1 presents specifications for each instrument. Audit procedures are specified in EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 4: Meteorological Measurements. The Standard Operation Procedure (SOP) employed by IML Air Science appears in Appendix 3 to this document.

All hourly data are downloaded weekly from the data logger to IML Air Science's relational database. The database software provides for quality assurance, invalidation of suspect or erroneous data, and various forms of data presentation. Data are summarized in weekly reports, which also include data recovery statistics and diagnosis of invalidated records. The level of rigor associated with collecting and validating on-site meteorological data is comparable, or superior to National Weather Service standards. Data recovery for the Ross ISR Project so far has been over 95% for wind data and over 97% for other parameters. This is typical of meteorological monitoring conducted by IML Air Science in Wyoming.

FIGURE 3

Ross ISR Air and Radiological Monitoring Sites

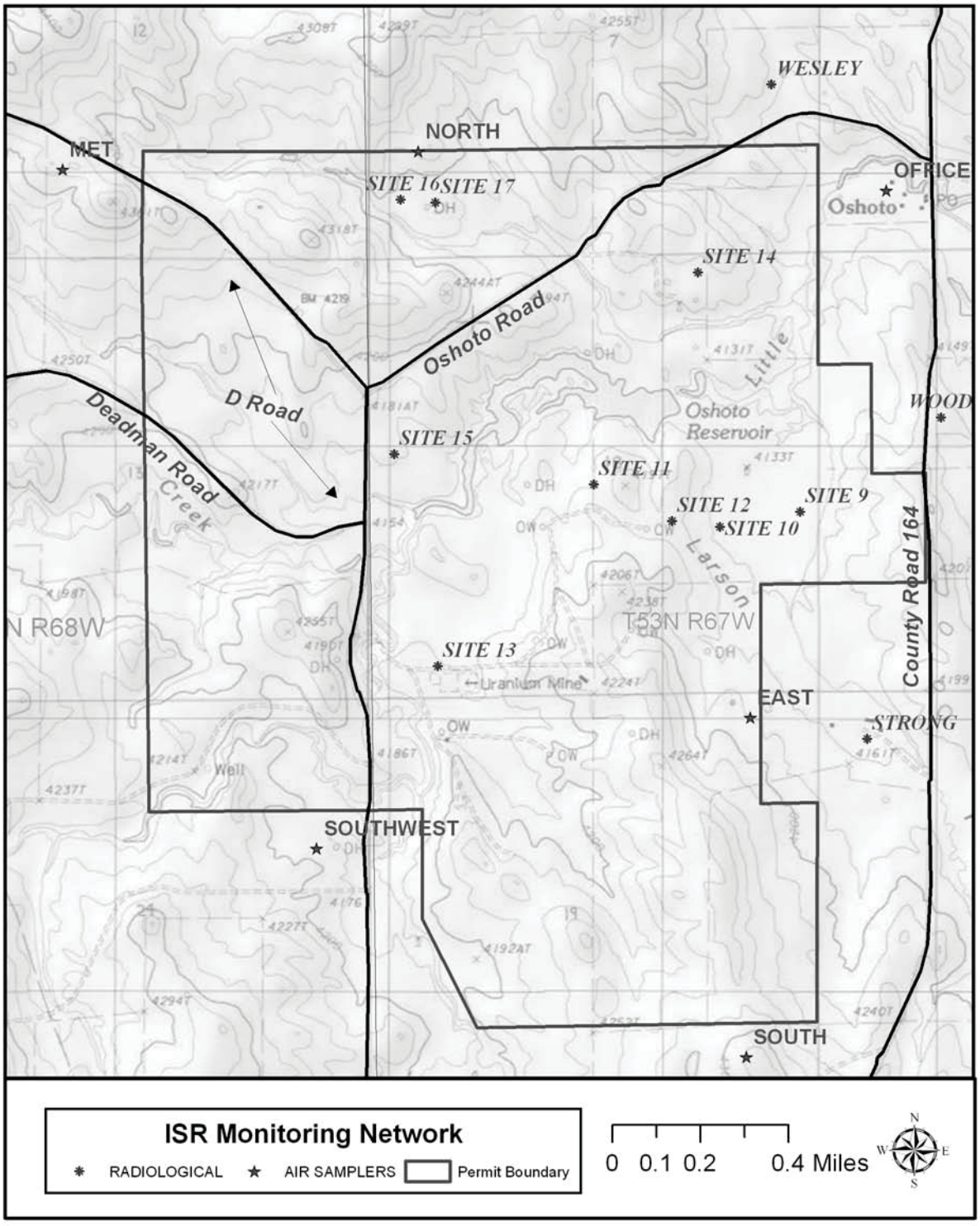
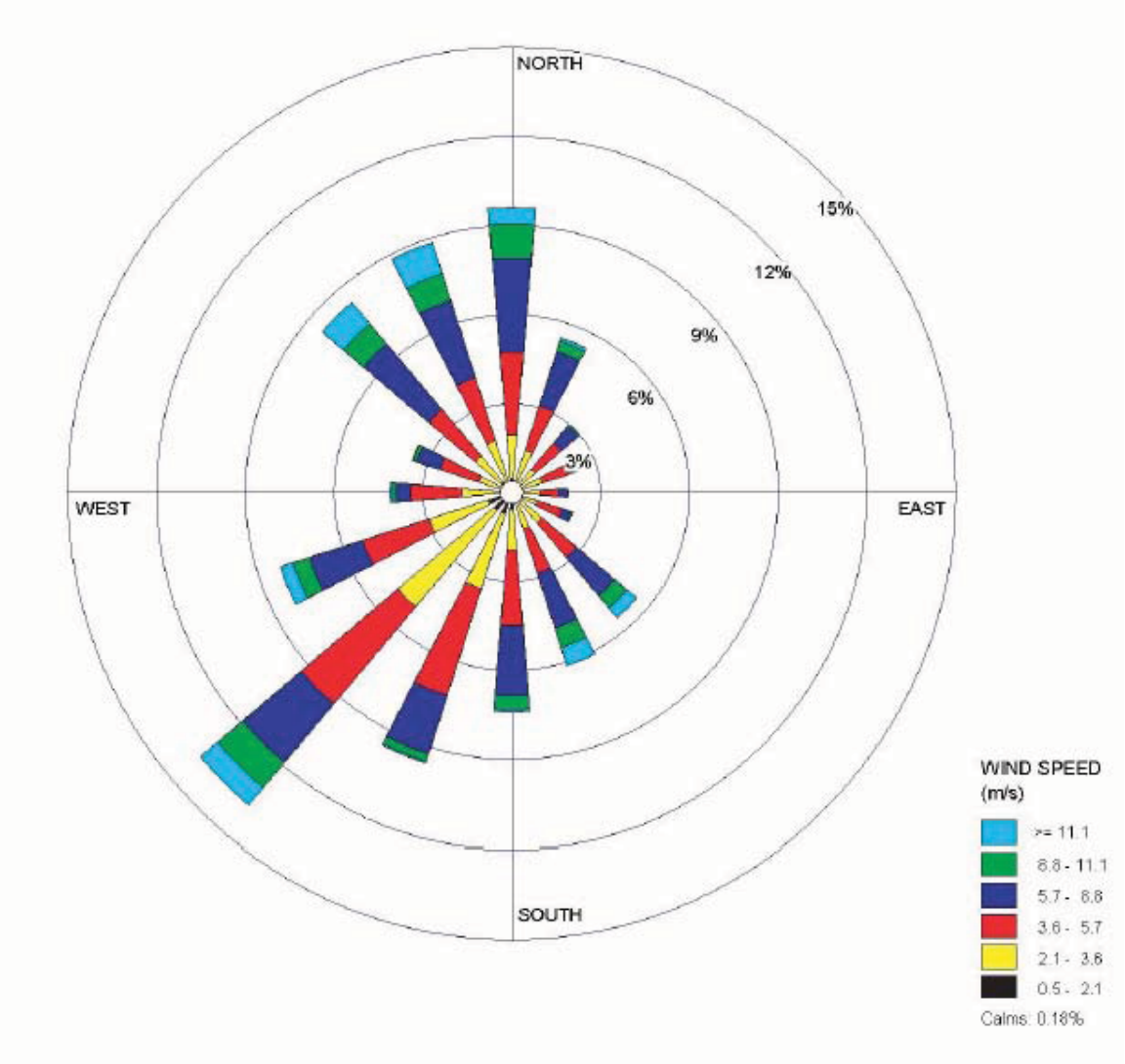


TABLE 1

Ross ISR Met Station					
Parameter	Instrument	Range	Accuracy	Threshold	Instrument Height
Wind Speed	RM Young 05305 Winder Monitor AQ	0 to 112 mph	±0.4 mph or 1% of reading	0.9 mph	10 meters
Wind Dir	RM Young 05305 Winder Monitor AQ	0 to 360º	±3º	1.0 mph	10 meters
Temp	Vaisalla HMP50-L15 Temp and RH Probe	-25º to 50º C	±0.5º C @ given range	-- º C	2 meters
Rel Humidity	Vaisalla HMP50-L15 Temp and RH Probe	0 to 98%	±3% at 20 º C	--	2 meters
Precip	Hydrologic Services TB3/0.01P Tipping Bucket Rain Gauge	Temp: -20ºto 50º C	±0.5% @ 0.5 in/hr rate	--	1 meter
Evaporation	Novalynx 255-100 Evaporation Gauge	0 to 944"	0.25%	--	1 meter
Evaporation Pan Temperature Gauge	Fenwal 107 Temperature Probe	-35º to 50º C	±0.2º C @ 0 - 60º C, ±0.4º C @ -35º C	--	1 meter
Data Logger	Campbell Scientific CR1000 Data Logger	--	--	--	--

FIGURE 4 – Gillette, Wyoming Wind Rose (2000 – 2007)

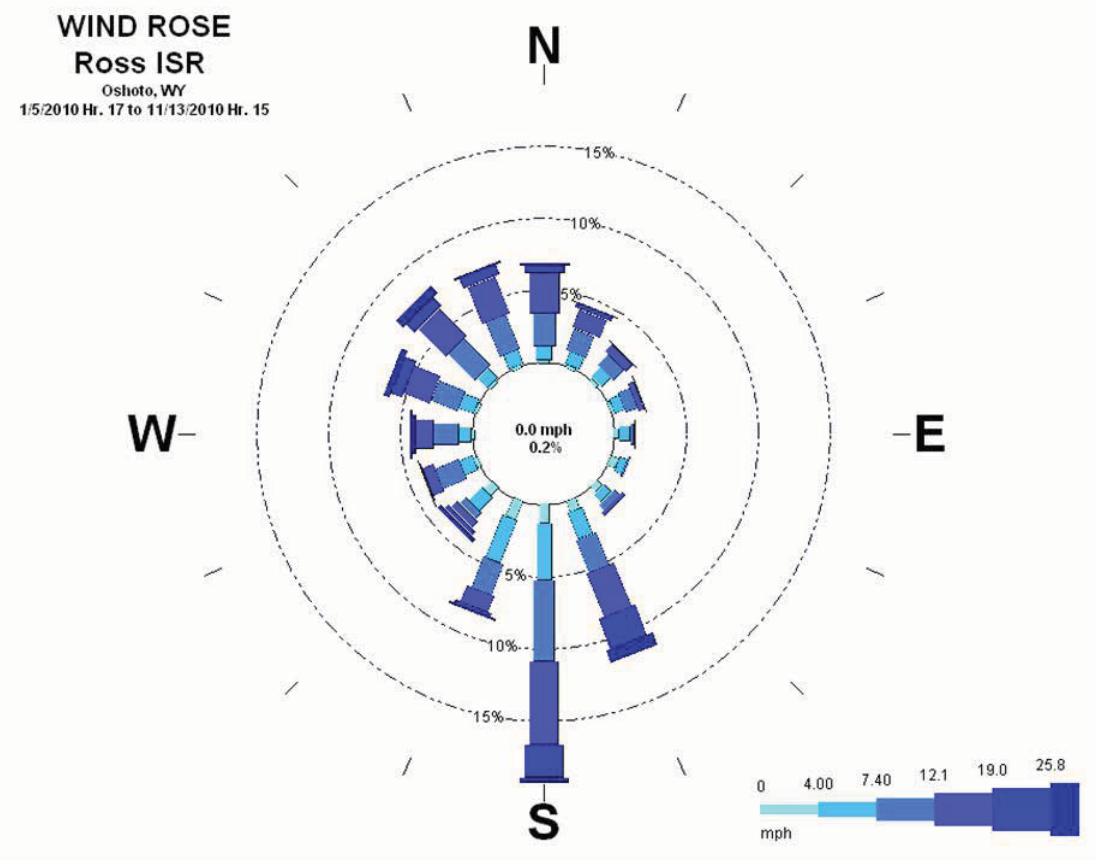


Baseline Air Sampling Plan

IML Air Science conducts baseline air quality sampling in accordance with NRC Regulatory Guide 4.14. Ambient air is sampled continuously for total suspended particulates (TSP), using low-volume air samplers positioned at five sites in the project vicinity. Figure 3 shows the locations of these sites. Three of these are situated near the permit boundary, labeled "Southwest", "East" and "South" on the Figure 3. As recommended in NRC Regulatory Guide 4.14, the East site was positioned where the air at the permit boundary is closest to, or most likely to be impacted by the proposed milling operation. A fourth sampler was placed at the Met Station site, along with the meteorological monitoring tower and instruments. AC power is not available at any of the above sites, necessitating solar power supplies and battery operation. The fifth site was located in Oshoto, near the Ross ISR project office (labeled "Office"). At less than 400 meters from the Ross ISR permit boundary, this site originally represented the nearest dwelling or occupiable structure outside the permit boundary as stipulated in NRC Regulatory Guide 4.14. AC power, available at this location, is used to operate the air sampler.

Historical data from the northeast Wyoming region indicate that the dominant winds are from the west or northwest, with a secondary mode from the southwest. Six months of meteorological monitoring at the Ross ISR Project, however, demonstrated that prevailing winds in this locale are from the south, with a secondary mode from the northwest. This pattern has persisted through the latter part of 2010 (Figure 5).

FIGURE 5 – Ross ISR Wind Rose (Jan - Nov 2010)



Since there is a residence a few hundred meters north of the permit boundary (and in a northerly direction from the proposed plant site), a decision was made to install a sixth air sampler at this residence ("North" site on Figure 3) to comply with the intent of Regulatory Guide 4.14:

> "Air particulate samples should be collected continuously at a minimum of three locations at or near the site boundary. If there are residences or occupiable structures within 10 kilometers of the site, a continuous outdoor air sample should be collected at or near the structure with the highest predicted airborne radionuclide concentration due to milling operations and at or near at least one structure in any area where predicted doses exceed 5 percent of the standards in 40 CFR Part 190. A continuous air sample should also be collected at a remote location that represents background conditions at the mill site; in general, a suitable location would be in the least prevalent wind direction from the site and unaffected by mining or other milling operations."

The North site is intended to account for prevailing south winds that could impact airborne radionuclide concentrations at the Wesley residence (Figure 3). The secondary mode of northwest winds is covered by the East sampler, located on the permit boundary a few hundred meters from the Strong residence. The Southwest site is least likely to be impacted either by the primary or secondary wind direction mode, and is therefore intended to represent the area unaffected by mining or milling operations.

Air particulates are sampled continuously by a low-volume, continuous air sampler installed at each of the five monitoring sites. The air samplers pull ambient air continuously through 47-millimeter, Teflon filters. The samplers are housed in weather enclosures and equipped with gooseneck inlets to insure unobstructed access to ambient air (Figure 6). The exposed filters are collected and replaced with clean filters on a weekly basis. After each quarter (13 weeks) all exposed filters from a given site are combined into a composite sample and analyzed for the radionuclides specified in NRC Guide 4.14: Uranium-238, Thorium-230, Radium-226 and Lead-210. Teflon membrane filters are used to minimize radiological interference during laboratory analysis.

FIGURE 6 – Southwest Sampler Setup

Sampler flow rates range from 20 to 30 liters/minute for the solar-operated samplers (F&J Specialty Products, Model DF-40L-AC) and from 60 to 80 liters/minute for the AC-powered sampler (F&J Specialty Products, Model LV-1D). Sampler flow rates are recorded for the AC-powered sampler before and after the weekly filter exchange. The air volume associated with this sample is calculated as the average sampler flow rate multiplied by the elapsed time between change-outs. The DC-powered samplers display cumulative time and flow volume directly; these data are recorded at each filter change-out. Each sampler is checked for air flow rate every week. All sampler calibrations are performed by the manufacturer and are represented as valid for one year. Calibration records for the air samplers appear in Appendix 2 to this document.

Data Reporting and Analysis

At the conclusion of the baseline monitoring period, meteorological data will be presented in the form of a 1-year meteorological summary, wind rose, wind speed frequency graph, precipitation and evaporation summaries, and diurnal graphs of temperature and wind speed. The report will also include a Joint Frequency Distribution for the mine sites using Pasquill atmospheric stability classes. Data recovery statistics will be reported for all logged parameters. The information from this report, along with NWS data from the region, will provide the basis for the baseline meteorological analysis submitted in the NRC License Application.

Air particulate sampling results will be reported for each of the four quarters sampled, as well as in summary fashion. This report will include air volumes sampled by each sampler, results from composite filter analysis, and implied radio-isotope concentrations (if detectable) at each of the five sampler sites. A demonstration will be made that sampled air volumes, coupled

with laboratory detection limits, meet the requirement for minimum detectable ambient concentrations of radionuclides as specified in Regulatory Guide 4.14. The information from this report will provide the basis for the baseline air quality analysis submitted in the NRC License Application.

A draft of this monitoring plan was submitted to WDEQ-AQD, the state agency responsible for issuing an air quality permit as necessary to construct a uranium mining and milling facility. A letter from WDEQ-AQD approving this monitoring plan is presented in Appendix 4 to this document.

References

1. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements; EPA/600/4-90/003; August 1989; U.S. Environmental Protection Agency

2. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume V. Precipitation Measurement Systems; EPA/600/R-94/038e; April 1994; U.S. Environmental Protection Agency

3. On-Site Meteorological Program Guidance for Regulatory Modeling Applications; EPA-450/4-87-013; June, 1987; U.S. Environmental Protection Agency

4. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD); EPA-450/4-87-007; May, 1987; U.S. Environmental Protection Agency

APPENDIX 1

METEOROLOGICAL CALIBRATIONS

IML Air Science
a division of Inter-Mountain Laboratories, Inc.
555 Absaraka, Sheridan, WY 82801

Meteorological Station Audit

Page 1 of 2

Network: Strata

Date: 1-6-10 Auditors: MB·CM DAS time off-line: startup

Notes; system as found:

Standards

Parameter	Reference Device	Mfr./Model	SN/ID
Wind Speed	Quartz Drive Motor		IML 0858
Wind Direction Alignment	Compass		IML900
Temperature	Digital Thermistor		IML858
Relative Humidity	Collocated Sensor		IML0892
Pressure	Digital Barometer	NA	
Precipitation	Lab Grade Burette	N/A	N/A
Solar Radiation	Collocated Sensor	NA	

Sensors

	Mfr./Model	SN/ID
DAS:	CR1000	28552
Wind Speed:	RM Young AQ	WM98154
Wind Direction:	"	"
Temp/Asp 2m:	CS215	E4478
Temp/Asp 10m:	NA	
Precipitation:	Hydrological Services	09-86
Barometric Pressure :	NA	
Relative Humidity:	CS215	E4478
Solar Radiation:	NA	

System Audit

Temperature

Height: 2m

reference		DAS	after adj.
°F	°C	44.85	
°F	°C	84.34	
°F	°C	33.63	

43.3 43.80 85.88 32.11

Temperature

Height: 10m

reference		DAS	after adj.
°F	°C	NA	
°F	°C		
°F	°C		

Barometric Pressure

ref.	NA
DAS	

Relative Humidity

ref. RH	77.5	ref. RH Temp	30.1
DAS RH	80.21	DAS RH Temp	27.69

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Page 2 of 2

Wind Speed

starting torque gm-cm

reference		DAS	after adj.
0	rpm		
300	rpm / mph	3.435	
800	rpm / mph	9.16	
3000	rpm / mph	34.35	
8000	rpm / mph	91.6	

Wind Direction

starting torque
ccw: cw: gm-cm
initial alignment:

reference	DAS	after adj.
360	.53	
060		
090	89.86	
120		
180	180.86	
240		
270	269.76	
300		

Precipitation (Tipping Bucket)

mls/weight	tips	in. equiv.
81.8	10	0.10
86.2	10	0.10
84.8	10	0.10

Heater working?
Inspection
DAS precip start:
DAS precip end: .30

Solar Radiation

	Ref	DAS
Covered	NA	
Un-covered		

DAS Day: 2010-01-06
DAS Time:
DAS Year:
DAS Battery
SM Battery OK ?
Enclosure Humidity OK?
WS Channel:
WD Channel:
Ta Channel:
Precip. Channel:
RH Channel:
Pa Channel:
Batt. Channel:
Solar Radiation Channel:

Notes:

End System Audit

DAS time on-line: 1720

Evaporation Pan Calibration Sheet

Mine: Strata - Ross ISR Date: **6/24/2010**

Values to be entered in this sheet during the calibration appear in RED.

Starting Slope: **1**
Starting Offset: **0**

Yard Stick Reading - taken at the pan outlet to the gauge

Empty Pan Logger Reading: **0.00048**

Calibration Point	Yardstick Reading (in)	Logger Reading
1	**1.25**	**0.00050**
2	**1.75**	**0.05471**
3	**4**	**0.30416**
4	**6.5**	**0.57440**
5	**8.25**	**0.76915**

EvapSpan	**9.116612**	
EvapOffset	**1.245044**	
Correlation	**0.99999**	The correlation should be greater than .9900

Step 1 With evaporation pan empty, record the EvapLevel from the CR1000 as the Empty Pan Logger Reading.

Step 2 Start filling the evaporation pan. Watch for the EvapLevel reading on the CR1000 to change. As soon as the value starts to increase, record the water depth in inches (at the pan outlet to the gauge) and the EvapLevel on the CR1000 as Calibration Point 1.

Step 3 Add water to the pan until the depth at the outlet to the gauge is approximately 2 inches. Record both the yardstick reading and the reading from the CR1000 as Calibration Point 2. Be sure to allow the reading on the CR1000 to stabilize before taking the measurements.

Step 4 Repeat Step 3 adding approximately 2 inches of water for calibration points 3, 4, and 5.

Step 5 Once all five calibration points have been completed, enter the EvapSpan and the EvapOffset from this sheet into the EvapSpan and EvapOffset location on the CR1000. The EvapLevel from the CR1000 should now be the same as the water depth in the evaporation pan in inches.

METEOROLOGICAL STATION AUDIT SUMMARY

Met Station: Strata
Audit Date: 15-Jul-10
Audit Performed By: S. Hansen, Tim Mendenhall, IML -- Air Science

Sensor	Mfr./Model	Serial Number	Reference Device	Serial/ID Number
Wind Speed (WS):	RM Young Wind Monitor AQ		quartz referenced drive motor	IML 1407
Wind Direction (WD):	RM Young Wind Monitor AQ		transit, compass	IML 1405
Temperature @ 2 Meters:	CS215		digital thermistor	IML 1402
Relative Humidity:	CS215		digital hygrometer	IML 0892
Evaporation:	Novalynx Evap Pan		N/A	N/A
Precipitation:	Hydrological TB3		lab grade burette	N/A
Data acquisition system:	CSI CR1000 datalogger		N/A	N/A

Audit Results

		Reference RPM	Reference mph	DAS Value	|Difference|	Specification	
WS (m/sec)		0	0.00	0.00	0.00	below threshold	
		300	3.44	3.44	0.00	0.56	(2)
		800	9.16	9.16	0.00	0.56	(2)
		3000	34.34	34.35	0.01	0.56	(2)
		8000	91.60	91.60	0.00	0.56	(2)
			Reference	DAS Value	|Difference|	Specification	
WS start torque (gm-cm)			t<1	1	0	1.0	(3)
Crossarm Alignment:			183°	181.5			
WD (degrees)	Clockwise		0.0	0.7	0.7	5.0	(2)
			90.0	90.6	0.6	5.0	(2)
			180.0	180.4	0.4	5.0	(2)
			270.0	270.4	0.4	5.0	(2)
	Counter clockwise		0.0	0.2	0.2	5.0	(2)
			90.0	90.8	0.8	5.0	(2)
			180.0	180.2	0.2	5.0	(2)
			270.0	270.2	0.2	5.0	(2)
Temp. (°F):			36.09	36.11	0.02	0.9	(2)
			80.26	80.02	0.24	0.9	(2)
			120.60	120.05	0.55	0.9	(2)
Relative Humidity (%)			16.0	17.3	1.3	7.0	(2)
Evaporation:			6.875	6.885	0.01	5.0	(4)
		DAS Value (in)	Reference (ml)	DAS Equivalent	|Difference|	Specification	
Precipitation (0.1" equiv.)		0.11	88.2	87.7	0.5	8.7	(2)
		0.10	79.8	79.9	0.1	7.9	(2)
		0.10	75.8	79.9	4.1	7.9	(2)
				Average Diff:	1.6	7.9	(2)

BOLD difference values exceed performance specifications

(1)= Performance specification listed in facilities' Quality Assurance Project Plan

(2)= EPA Quality Assurance Manual for Air Pollution Measurement Systems, Vol. IV, 1989

(3)= Manufacturer's Specifications

(4)= EPA On-Site Meteorological Program Guidance for Regulatory Modeling Applications

Notes, Recommendations

System taken offline at 15:07 MST and returned online at 16:20 MST.
Calibrated evap.

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Meteorological Station Audit

Page 1 of 2

Network: Strata

Date: 8-20-10 Auditors: SH, TM DAS time off-line: 15:07 MDT

Notes; system as found: OK

Standards

Parameter	Reference Device	Mfr./Model	SN/ID
Wind Speed	Quartz Drive Motor		1407
Wind Direction Alignment	Compass		IML 1405
Temperature	Digital Thermistor		1402
Relative Humidity	Collocated Sensor		0892
Precipitation	Lab Grade Burette		N/A

Sensors

	Mfr./Model	SN/ID
DAS:	CSI CR1000 Datalogger	
Wind Speed:	RM Young Wind Monitor AQ	
Wind Direction:	RM Young Wind Monitor AQ	
Temperature:	CS215	
Precipitation:	Hydrological Services TB3	
Relative Humidity:	CS215	
Evaporation Pan	Nova Lynx Class A Evap Pan	

System Audit

Temperature Spec: .9° F

Height:	2m
Reference	DAS
36.09 °F	36.11
80.26 °F	79.80.02
120.60 °F	120.05

Relative Humidity Spec: 7%

ref. RH 16.0	ref. RH Temp
DAS RH 17.3	DAS RH Temp

Evaporation Spec: 5%

Ref Depth	DAS Depth
6.875	6.885

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Page 2 of 2

Wind Speed Spec: .56 mph

starting torque 165 <1 gm-cm

reference	DAS	after adj.
0 rpm	0	
300 rpm 3.435 mph	3.435	
800 rpm 9.160 mph	9.16	
3000 rpm 34.35 mph	34.35	
8000 rpm 91.60 mph	91.6	

Wind Direction Spec: 5°

starting torque

ccw: cw: gm-cm DAS Reading

crossarm alignment: 183° 181.5°

reference	CW	CCW	After Adj
360	.67	.23	
060			
090	90.6	90.8	
120			
180	180.4	180.2	
240			
270	270.4	270.2	
300			

Precipitation (Tipping Bucket) (79.7) Spec: 10%

mls/weight	tips	in. equiv.
88.2	11	0.11
79.8	10	0.10
75.8	10	0.10

Heater working?

Inspection

DAS precip start: 0.00

DAS precip end: 0.31

DAS Day:

DAS Time:

DAS Year:

DAS Battery:

SM Battery OK ?

Enclosure Humidity OK?

Notes: Calibrated Evap

End System Audit

DAS time on-line: 1620 MDT

APPENDIX 2

SAMPLER CALIBRATIONS

F&J SPECIALTY PRODUCTS, INC.

PO Box 2888
Ocala, Florida 34478-2888
Tel: (352) 680-1177 • (352) 680-1178
Fax: (352) 680-1454
Email: fandj@fjspecialty.com **Internet:** www.fjspecialty.com
The Nucleus of Quality Air Monitoring Programs

Quality Control Procedure
Actual Flow Rate vs. Indicated Flow Rate

General Information **Serial Number:** 003610

PO #: 236608

Calibration Type: New Unit

Customer: INTER-MOUNTAIN LAB

1. **A** **Test Facility :** F&J Calibration Lab
   B. **Elevation :** Sea Level
   C **Date of Test :** 11/12/2009
   D **Atmospheric Pressure :** 29.7
   E. **Inlet Temperature to System :** 73.5
   F. **Digital Venturi Calibrator :**
   (A) Manufacturer : F&J SPECIALTY PRODUCTS, INC.
   (B) Model # : D-812V.2
   (C) Serial # : 3581
   G **Air Sampler System Model** LV-1D

(1) Air Sampler Observed Flow Rate LPM	(2) Temp. & Pressure Correction	Air Sampler STP Flow Rate (1) x (2)	Digital Calibrator STP Flow Rate
100.00	0.8691	86.91	86.30
80.00	0.9071	72.57	73.40
60.00	0.9352	56.11	57.50
40.00	0.9425	37.70	39.60

*** **The AVERAGE PERCENT DEVIATION ACROSS THE RANGE IS :** 2.26

The Reference Flow Meter Device bears letters of certification traceable to the National Institute of Standards and Technology(NIST).

CAL002 Rev. 1
Pg 2
4/28/2003

ACTUAL FLOW RATE vs. INDICATED FLOW RATE
QUALITY CONTROL PROCEDURE FJ-1

Serial #: 003610

New Unit

II. TEST DATA

Filters Utilized:

Particulate: FP47

Charcoal / Silver Zeolite: NONE

(1) Flow Indicated on Rotometer (LPM)	(2) Atmospheric Pressure (in. Hg)	(3) Inlet Temperature (Degrees F)	(4) Gauge Pressure (in. Hg)	(5) Temperature and Pressure Correction	(6) Calculated Flow (1) X (5) (SLPM)	(7) Digital Calibrator STP Flow (SLPM)	(8) Percent Deviation ((7) - (6))/(7) (%)
100	29.7	73.5000	6.9531	0.8691	86.91	86.30	0.70
80	29.7	73.5000	4.9172	0.9071	72.57	73.40	1.13
60	29.7	73.5000	3.3590	0.9352	56.11	57.50	2.41
40	29.7	73.5000	2.9474	0.9425	37.70	39.60	4.80

(5) Temperature and Pressure Correction = Sqr((((2) - (4)) / 29.92) * (530 / (460 + (3))))

Average Deviation: 2.26

Performed by: NOE MORALES

Date: 11/12/2009

REV. 6/21/1999

FJ010, Rev.: 0
08/10/09

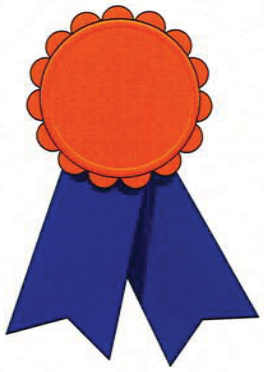
F&J SPECIALTY PRODUCTS, INC.

Certificate of Dielectric / Ground Bond Test

F&J SPECIALTY PRODUCTS, INC. hereby certifies that Model LU-10,

Serial No. 003610, has been tested in accordance with Dielectric Test Procedure

AS-DWI-DVWTP and has met all acceptance criteria for this test. This test is identical to the test performed on all ETL Listed products manufactured by ***F&J SPECIALTY PRODUCTS, INC.*** This unit has also been Ground Bond Tested for assurance of an electrically safe manufactured unit.



Calibrations / Air Sampler Department

Paul J Chrisco — Inspector

11-13-09 — Date

Digital Air Sampler Records

CAL039 Rev. 2
8/7/2008

Air Sampler Information

Serial #	Model #	Software Ver	AutoZero Feature	STATUS
10276	DF-30L-BL-AC	V4.53	Yes	ORIGINAL

Customer Unit ID Number: N/A

Calibrator Type	COMMENTS:
Orifice	

RS232: Yes **Voltage:** 100/240V **Battery Voltage:** N/A

Calibration Information

Calibration Date	Technician
11/ 9/2009	JON BLEWETT

QA Manual Revision and Date: Company Quality Manual, Rev. 7, 01/08/2009
Calibration Procedure: DWI-CAL-001
Revision and Date of Procedure: Rev. 3, 1/22/2009
Reference Instrument: CME 60B
Reference Serial Number: 60-627/13777
Reference Calibration Date: 4/13/2009
Reference Due Date: 4/13/2010
Reference Instrument Manufacturer: CME DIVISION OF AEROSPACE CONTROL PRODUCTS

Customer/Order Information

Order #	Purchase Order #
FO0900952	236608

Company: INTER-MOUNTAIN LABS
Facility: Procurement
Customer #: C5551
Contact: Accounts Payable
Telephone: 307 674 7056

FJ010, Rev.: 0
08/10/09

F&J SPECIALTY PRODUCTS, INC.

Certificate of Dielectric / Ground Bond Test

F&J SPECIALTY PRODUCTS, INC. hereby certifies that Model DF-30L-BL-AC,

Serial No. 10276, has been tested in accordance with Dielectric Test Procedure *AS-DWI-DVWTP* and has met all acceptance criteria for this test. This test is identical to the test performed on all ETL Listed products manufactured by ***F&J SPECIALTY PRODUCTS, INC.*** This unit has also been Ground Bond Tested for assurance of an electrically safe manufactured unit.

Calibrations / Air Sampler Department

Paul J Chrisa — Inspector

11-16-09 — Date

CERTIFICATE OF CALIBRATION

MQ003R01

F&J SPECIALTY PRODUCTS, INC.
PO Box 2888
Ocala, Florida 34478-2888
Tel: (352) 680-1177 • (352) 680-1178
Fax: (352) 680-1454
Email: fandj@fjspecialty.com
Internet: www.fjspecialty.com

The Nucleus of Quality Air Monitoring Programs

CALIBRATED INSTRUMENT: **DIGITAL AIR SAMPLER**

P.O. NUMBER: 236608
CUSTOMER: INTER-MOUNTAIN LABS
MODEL #: DF-30L-BL-AC
SERIAL #: 10276
SENSOR RANGE: 0.155 to 1.060 SCFM = 4.4 to 30.0 SLPM

REFERENCE SERIAL #: 13777, 0-50 SLPM
CALIBRATION DATE: Nov 09, 2009
LOKAL VERSION: V2.18 (B15144)
RECAL DUE DATE: Nov 09, 2010

BAROMETRIC P: 29.94 InHg = 760.5 mmHg
CORRECTED TO: 29.92 InHg = 760.0 mmHg
TEMPERATURE: 73.5 °F = 23.1 °C
CORRECTED TO: 77.0 °F = 25.0 °C

(X) NEW UNIT ( ) CALIBRATION AS FOUND ( ) RE-CALIBRATION REFERENCE

	DIGITAL INSTUMENT FLOW		REFERENCE INSTRUMENT FLOW		DEVIATION AT READINGS		DEVIATION AT READING	DEVIATION AT READING (FULL SCALE)
	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[%]	[%]
1	1.282	36.31	1.295	36.67	-0.013	-0.36	-1.00	-1.20
2	1.240	35.11	1.250	35.40	-0.010	-0.28	-0.81	-0.93
3	1.129	31.97	1.134	32.10	-0.005	-0.13	-0.41	-0.43
4	1.004	28.43	1.003	28.41	0.001	0.02	0.08	0.07
5	0.854	24.19	0.851	24.11	0.003	0.08	0.34	0.27
6	0.667	18.89	0.663	18.78	0.004	0.11	0.58	0.37
7	0.530	15.02	0.527	14.93	0.003	0.08	0.55	0.27
8	0.435	12.33	0.433	12.26	0.002	0.06	0.51	0.20
9	0.324	9.17	0.323	9.15	0.001	0.02	0.22	0.07
10	0.147	4.15	0.151	4.29	-0.005	-0.13	-3.20	-0.43
	AVERAGE DEVIATION ACROSS THE RANGE AT READING:						0.76	0.42

INSTRUMENT ACCURACY: 4.0 % of full scale = 0.04 SCFM = 1.20 SLPM

This is to certify that F&J Specialty Products in Ocala, Florida, has on this date certified Digital Instrument model # DF-30L-BL-AC serial # 10276 to be within the instrument accuracy specified above. The Reference Flow Meter Device bears letters of certification traceable to the National Institute of Standards and Technology.

CALIBRATED BY: _____ QUALITY ASSURANCE: Paul J Cherries

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL AIR SAMPLER			SERIAL #:	10276
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

ELECTRONIC CALIBRATION

		PHYSICAL READING	DIGITAL READING
TEMPERATURE	[degC]	23.0	2069
BP1	[mmHg]	760.5	3256
BP2	[mmHg]	530.1	1105
DELTA P1	[mmHg]	0.000	1102
DELTA P2	[mmHg]	17.116	3895

VENTURI TUBE CALIBRATION

	DELTA P [mmHg]	FLOW RATE [SLPM]	TEMPERATURE [degC]	INLET P [mmHg]
1	17.116	38.56	23.1	722.6
2	15.554	36.72	23.0	724.6
3	12.827	33.20	23.0	728.2
4	10.038	29.26	23.0	732.3
5	7.152	24.69	23.0	736.9
6	4.265	19.08	23.0	742.4
7	2.654	15.06	23.1	746.3
8	1.753	12.30	23.0	748.9
9	1.005	9.33	23.0	751.5
10	0.202	4.28	23.0	756.2

BAROMETRIC PRESSURE = 760.5 [mmHg]

CURVE FITTING

EQUATION :	Y=0.45024*exp(0.49569*log(X))
STD. DEVIATION:	0.005812

PCAL EQUATION: Y=((((-0.000094*X+0.002545)*X-0.026152)*X+0.130828)*X-0.446471)*X+29.809034

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL AIR SAMPLER			SERIAL #:	10276
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

BP SENSOR CALIBRATION CHECK

	DUT [mmHg]	LOKAL [mmHg]	ERROR [%]
1	530.6	531.1	-0.10
2	640.8	642.1	-0.20
3	750.1	751.1	-0.14

DP SENSOR AND FLOW MEASUREMENT CALIBRATION CHECK

	DP DUT [mmHg]	DP LOKAL [mmHg]	DP ERROR [%]	FLOW DUT [SLPM]	FLOW LOKAL [SLPM]	FLOW ERROR [%]
1	16.858	16.852	0.04	36.31	36.67	-0.99
2	15.675	15.638	0.24	35.11	35.40	-0.80
3	12.854	12.742	0.88	31.97	32.10	-0.41
4	10.020	9.883	1.39	28.43	28.41	0.08
5	7.143	7.006	1.95	24.19	24.11	0.34
6	4.278	4.204	1.78	18.89	18.78	0.59
7	2.672	2.597	2.88	15.02	14.93	0.55
8	1.781	1.719	3.62	12.33	12.26	0.51
9	0.972	0.953	1.96	9.17	9.15	0.22
10	0.199	0.187	6.70	4.15	4.29	-3.10

QUALITY PROOF

F.S. ACCURACY [%]:	0.42
PERFORMED BY:	
APPROVED BY:	Paul J Herrera
COMMENTS:	

Digital Air Sampler Records

CAL039 Rev. 2
8/7/2008

Air Sampler Information

Serial #	Model #	Software Ver	AutoZero Feature	STATUS
10277	DF-30L-BL-AC	V4.53	Yes	ORIGINAL

Customer Unit ID Number: N/A

Calibrator Type	COMMENTS:
Orifice	

RS232: Yes **Voltage:** 100/240V **Battery Voltage:** N/A

Calibration Information

Calibration Date	Technician
11/ 9/2009	JON BLEWETT

QA Manual Revision and Date: Company Quality Manual, Rev. 7, 01/08/2009
Calibration Procedure: DWI-CAL-001
Revision and Date of Procedure: Rev. 3, 1/22/2009
Reference Instrument: CME 60B
Reference Serial Number: 60-627/13777
Reference Calibration Date: 4/13/2009
Reference Due Date: 4/13/2010
Reference Instrument Manufacturer: CME DIVISION OF AEROSPACE CONTROL PRODUCTS

Customer/Order Information

Order #	Purchase Order #
FO0900952	236608

Company: INTER-MOUNTAIN LABS
Facility: Procurement
Customer #: C5551
Contact: Accounts Payable
Telephone: 307 674 7056

FJ010, Rev.: 0
08/10/09

F&J SPECIALTY PRODUCTS, INC.

Certificate of Dielectric / Ground Bond Test

F&J SPECIALTY PRODUCTS, INC. hereby certifies that Model DF-30L-BL-AC,

Serial No. 10277, has been tested in accordance with Dielectric Test Procedure

AS-DWI-DVWTP and has met all acceptance criteria for this test. This test is identical to the test performed on all ETL Listed products manufactured by ***F&J SPECIALTY PRODUCTS, INC.*** This unit has also been Ground Bond Tested for assurance of an electrically safe manufactured unit.

Calibrations / Air Sampler Department

Paul J Chevrier — Inspector

11-16-09 — Date

CERTIFICATE OF CALIBRATION

MQ003R01

F&J SPECIALTY PRODUCTS, INC.
PO Box 2888
Ocala, Florida 34478-2888
Tel: (352) 680-1177 • (352) 680-1178
Fax: (352) 680-1454
Email: fandj@fjspecialty.com
Internet: www.fjspecialty.com

The Nucleus of Quality Air Monitoring Programs

CALIBRATED INSTRUMENT: **DIGITAL CALIBRATOR**

P.O. NUMBER: 236608
MODEL #: DF-30L-BL-AC
SENSOR RANGE: 0.155 to 1.060 SCFM = 4.4 to 30.0 SLPM

CUSTOMER: INTER-MOUNTAIN LABS
SERIAL #: 10277

REFERENCE SERIAL #: 13777, 0-50 SLPM
LOKAL VERSION: V2.18 (B15144)

CALIBRATION DATE: Nov 09, 2009
RECAL DUE DATE: Nov 09, 2010

BAROMETRIC P: 29.95 InHg = 760.7 mmHg
TEMPERATURE: 75.0 °F = 23.9 °C

CORRECTED TO: 29.92 InHg = 760.0 mmHg
CORRECTED TO: 77.0 °F = 25.0 °C

(X) NEW UNIT ( ) CALIBRATION AS FOUND ( ) RE-CALIBRATION REFERENCE

	DIGITAL INSTUMENT FLOW		REFERENCE INSTRUMENT FLOW		DEVIATION AT READINGS		DEVIATION AT READING	DEVIATION AT READING (FULL SCALE)
	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[%]	[%]
1	1.474	41.73	1.480	41.92	-0.007	-0.19	-0.45	-0.63
2	1.413	40.02	1.418	40.16	-0.005	-0.14	-0.35	-0.47
3	1.288	36.47	1.289	36.50	-0.001	-0.03	-0.08	-0.10
4	1.144	32.39	1.141	32.31	0.003	0.08	0.26	0.27
5	0.973	27.56	0.969	27.45	0.004	0.11	0.41	0.37
6	0.754	21.36	0.752	21.30	0.002	0.06	0.29	0.20
7	0.605	17.14	0.606	17.16	-0.001	-0.02	-0.13	-0.07
8	0.486	13.76	0.488	13.83	-0.003	-0.07	-0.51	-0.23
9	0.364	10.32	0.371	10.50	-0.007	-0.18	-1.78	-0.60
10	0.157	4.45	0.165	4.67	-0.008	-0.22	-5.03	-0.73
					AVERAGE DEVIATION ACROSS THE RANGE AT READING:		0.90	0.37

INSTRUMENT ACCURACY: 4.0 % of full scale = 0.04 SCFM = 1.20 SLPM

This is to certify that F&J Specialty Products in Ocala, Florida, has on this date certified Digital Instrument model # DF-30L-BL-AC serial # 10277 to be within the instrument accuracy specified above. The Reference Flow Meter Device bears letters of certification traceable to the National Institute of Standards and Technology.

CALIBRATED BY: QUALITY ASSURANCE: Paul J Ehrlich

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL CALIBRATOR			SERIAL #:	10277
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

ELECTRONIC CALIBRATION

		PHYSICAL READING	DIGITAL READING
TEMPERATURE	[degC]	24.0	2066
BP1	[mmHg]	760.7	3274
BP2	[mmHg]	531.4	1130
DELTA P1	[mmHg]	0.000	1024
DELTA P2	[mmHg]	16.866	3807

VENTURI TUBE CALIBRATION

	DELTA P [mmHg]	FLOW RATE [SLPM]	TEMPERATURE [degC]	INLET P [mmHg]
1	16.866	44.14	23.9	716.5
2	15.260	41.90	23.9	718.7
3	12.836	38.27	23.9	722.5
4	9.994	33.64	23.9	727.2
5	7.163	28.35	23.9	732.8
6	4.273	21.84	23.9	739.1
7	2.721	17.42	24.0	743.6
8	1.776	14.08	24.0	746.8
9	0.994	10.57	24.0	750.1
10	0.212	4.78	24.1	755.4

BAROMETRIC PRESSURE = 760.7 [mmHg]

CURVE FITTING

EQUATION :	Y=0.50941*exp(0.50642*log(X))
STD. DEVIATION:	0.003610

PCAL EQUATION: Y=((((-0.000110*X+0.002982)*X-0.030688)*X+0.153548)*X-0.525650)*X+29.788738

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL CALIBRATOR			SERIAL #:	10277
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

BP SENSOR CALIBRATION CHECK

	DUT [mmHg]	LOKAL [mmHg]	ERROR [%]
1	531.4	532.4	-0.19
2	645.4	647.2	-0.28
3	748.0	749.6	-0.20

DP SENSOR AND FLOW MEASUREMENT CALIBRATION CHECK

	DP DUT [mmHg]	DP LOKAL [mmHg]	DP ERROR [%]	FLOW DUT [SLPM]	FLOW LOKAL [SLPM]	FLOW ERROR [%]
1	17.008	17.095	-0.51	41.73	41.92	-0.45
2	15.569	15.544	0.16	40.02	40.16	-0.35
3	12.817	12.742	0.59	36.47	36.50	-0.08
4	10.008	9.883	1.26	32.39	32.31	0.26
5	7.174	7.025	2.13	27.56	27.45	0.41
6	4.260	4.185	1.79	21.36	21.30	0.29
7	2.728	2.672	2.10	17.14	17.16	-0.13
8	1.756	1.700	3.30	13.76	13.83	-0.51
9	0.990	0.972	1.92	10.32	10.50	-1.75
10	0.187	0.187	0.00	4.45	4.67	-4.79

QUALITY PROOF

F.S. ACCURACY [%]:	0.37
PERFORMED BY:	
APPROVED BY:	Paul J Chenier
COMMENTS:	

Digital Air Sampler Records

CAL039 Rev. 2
8/7/2008

Air Sampler Information

Serial #	Model #	Software Ver	AutoZero Feature	STATUS
10278	DF-30L-BL-AC	V4.53	Yes	ORIGINAL

Customer Unit ID Number: N/A

Calibrator Type	COMMENTS:
Orifice	

RS232: Yes **Voltage:** 100/240V **Battery Voltage:** N/A

Calibration Information

Calibration Date	Technician
11/ 9/2009	JON BLEWETT

QA Manual Revision and Date: Company Quality Manual, Rev. 7, 01/08/2009
Calibration Procedure: DWI-CAL-001
Revision and Date of Procedure: Rev. 3, 1/22/2009
Reference Instrument: CME 60B
Reference Serial Number: 60-627/13777
Reference Calibration Date: 4/13/2009
Reference Due Date: 4/13/2010
Reference Instrument Manufacturer: CME DIVISION OF AEROSPACE CONTROL PRODUCTS

Customer/Order Information

Order #	Purchase Order #
FO0900952	236608

Company: INTER-MOUNTAIN LABS
Facility: Procurement
Customer #: C5551
Contact: Accounts Payable
Telephone: 307 674 7056

FJ010, Rev.: 0
08/10/09

F&J SPECIALTY PRODUCTS, INC.

Certificate of Dielectric / Ground Bond Test

F&J SPECIALTY PRODUCTS, INC. hereby certifies that Model DF-30L-BL-AC,

Serial No. 10278, has been tested in accordance with Dielectric Test Procedure

AS-DWI-DVWTP and has met all acceptance criteria for this test. This test is identical to the test performed on all ETL Listed products manufactured by ***F&J SPECIALTY PRODUCTS, INC.*** This unit has also been Ground Bond Tested for assurance of an electrically safe manufactured unit.

Calibrations / Air Sampler Department

Paul J Chenier — Inspector

11-16-09 — Date

CERTIFICATE OF CALIBRATION

MQ003R01

F&J SPECIALTY PRODUCTS, INC.
PO Box 2888
Ocala, Florida 34478-2888
Tel: (352) 680-1177 • (352) 680-1178
Fax: (352) 680-1454
Email: fandj@fjspecialty.com
Internet: www.fjspecialty.com

The Nucleus of Quality Air Monitoring Programs

CALIBRATED INSTRUMENT: **DIGITAL CALIBRATOR**

P.O. NUMBER: 236608
CUSTOMER: INTER-MOUNTAIN LABS
MODEL #: DF-30L-BL-AC
SERIAL #: 10278
SENSOR RANGE: 0.155 to 1.060 SCFM = 4.40 to 30.00 SLPM

REFERENCE SERIAL #: 13777, 0-50 SLPM
CALIBRATION DATE: Nov 09, 2009
LOKAL VERSION: V2.18 (B15144)
RECAL DUE DATE: Nov 09, 2010

BAROMETRIC P: 29.97 InHg = 761.2 mmHg
CORRECTED TO: 29.92 InHg = 760.0 mmHg
TEMPERATURE: 76.3 °F = 24.6 °C
CORRECTED TO: 77.0 °F = 25.0 °C

(X) NEW UNIT ( ) CALIBRATION AS FOUND ( ) RE-CALIBRATION REFERENCE

	DIGITAL INSTUMENT FLOW		REFERENCE INSTRUMENT FLOW		DEVIATION AT READINGS		DEVIATION AT READING	DEVIATION AT READING (FULL SCALE)
	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[%]	[%]
1	1.421	40.23	1.418	40.15	0.003	0.08	0.19	0.27
2	1.351	38.26	1.357	38.43	-0.006	-0.17	-0.44	-0.57
3	1.237	35.02	1.231	34.87	0.005	0.15	0.43	0.50
4	1.089	30.84	1.088	30.82	0.001	0.02	0.06	0.07
5	0.913	25.84	0.920	26.05	-0.007	-0.20	-0.78	-0.67
6	0.727	20.59	0.721	20.41	0.007	0.19	0.91	0.63
7	0.588	16.65	0.580	16.43	0.008	0.22	1.34	0.73
8	0.466	13.20	0.469	13.27	-0.003	-0.07	-0.56	-0.23
9	0.341	9.66	0.355	10.04	-0.014	-0.39	-3.99	-1.30
10	0.170	4.81	0.161	4.56	0.009	0.25	5.18	0.83
	AVERAGE DEVIATION ACROSS THE RANGE AT READING:						1.40	0.58

INSTRUMENT ACCURACY: 4.0 % of full scale = 0.04 SCFM = 1.20 SLPM

This is to certify that F&J Specialty Products in Ocala, Florida, has on this date certified Digital Instrument model # DF-30L-BL-AC serial # 10278 to be within the instrument accuracy specified above. The Reference Flow Meter Device bears letters of certification traceable to the National Institute of Standards and Technology.

CALIBRATED BY: _____ QUALITY ASSURANCE: _____

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL CALIBRATOR			SERIAL #:	10278
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

ELECTRONIC CALIBRATION

		PHYSICAL READING	DIGITAL READING
TEMPERATURE	[degC]	24.6	2098
BP1	[mmHg]	761.2	3310
BP2	[mmHg]	532.6	1164
DELTA P1	[mmHg]	0.000	1040
DELTA P2	[mmHg]	17.077	3881

VENTURI TUBE CALIBRATION

	DELTA P [mmHg]	FLOW RATE [SLPM]	TEMPERATURE [degC]	INLET P [mmHg]
1	17.077	42.35	24.6	719.2
2	15.610	40.40	24.6	721.2
3	12.827	36.44	24.6	725.3
4	9.972	31.97	24.5	729.9
5	7.189	27.04	24.6	735.0
6	4.274	20.80	24.6	741.3
7	2.657	16.44	24.6	745.7
8	1.761	13.42	24.7	748.7
9	1.022	10.19	24.7	751.5
10	0.192	4.58	24.8	756.8

BAROMETRIC PRESSURE = 761.2 [mmHg]

CURVE FITTING

EQUATION :	Y=((((0.00010874*X-0.0029351)*X+0.030031)*X-0.14918)*X+0.48765)*X+0.12054
STD. DEVIATION:	0.007089

PCAL EQUATION: Y=((((-0.000101*X+0.002733)*X-0.028028)*X+0.140612)*X-0.490913)*X+29.834659

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL CALIBRATOR			SERIAL #:	10278
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

BP SENSOR CALIBRATION CHECK

	DUT [mmHg]	LOKAL [mmHg]	ERROR [%]
1	533.1	533.9	-0.14
2	646.4	647.7	-0.20
3	750.1	751.1	-0.14

DP SENSOR AND FLOW MEASUREMENT CALIBRATION CHECK

	DP DUT [mmHg]	DP LOKAL [mmHg]	DP ERROR [%]	FLOW DUT [SLPM]	FLOW LOKAL [SLPM]	FLOW ERROR [%]
1	17.107	17.114	-0.04	40.23	40.15	0.19
2	15.632	15.563	0.44	38.26	38.43	-0.44
3	12.854	12.723	1.03	35.02	34.87	0.43
4	10.020	9.846	1.77	30.84	30.82	0.06
5	7.100	6.950	2.15	25.84	26.05	-0.77
6	4.316	4.185	3.12	20.59	20.41	0.92
7	2.753	2.672	3.03	16.65	16.43	1.36
8	1.775	1.719	3.26	13.20	13.27	-0.55
9	1.009	0.972	3.85	9.66	10.04	-3.84
10	0.193	0.187	3.30	4.81	4.56	5.46

QUALITY PROOF

F.S. ACCURACY [%]:	0.58
PERFORMED BY:	
APPROVED BY:	Frank J Chavez
COMMENTS:	

Digital Air Sampler Records

CAL039 Rev. 2
8/7/2008

Air Sampler Information

Serial #	Model #	Software Ver	AutoZero Feature	STATUS
10279	DF-30L-BL-AC	V4.53	Yes	ORIGINAL

Customer Unit ID Number: N/A

Calibrator Type	COMMENTS:
Orifice	

RS232: Yes **Voltage:** 100/240V **Battery Voltage:** N/A

Calibration Information

Calibration Date	Technician
11/ 9/2009	JON BLEWETT

QA Manual Revision and Date: Company Quality Manual, Rev. 7, 01/08/2009
Calibration Procedure: DWI-CAL-001
Revision and Date of Procedure: Rev. 3, 1/22/2009
Reference Instrument: CME 60B
Reference Serial Number: 60-627/13777
Reference Calibration Date: 4/13/2009
Reference Due Date: 4/13/2010
Reference Instrument Manufacturer: CME DIVISION OF AEROSPACE CONTROL PRODUCTS

Customer/Order Information

Order #	Purchase Order #
FO0900952	236608

Company: INTER-MOUNTAIN LABS
Facility: Procurement
Customer #: C5551
Contact: Accounts Payable
Telephone: 307 674 7056

FJ010, Rev.: 0
08/10/09

F&J SPECIALTY PRODUCTS, INC.

Certificate of Dielectric / Ground Bond Test

F&J SPECIALTY PRODUCTS, INC. hereby certifies that Model DF-30L-BL-AC,

Serial No. 10279, has been tested in accordance with Dielectric Test Procedure

AS-DWI-DVWTP and has met all acceptance criteria for this test. This test is identical to the test performed on all ETL Listed products manufactured by ***F&J SPECIALTY PRODUCTS, INC.*** This unit has also been Ground Bond Tested for assurance of an electrically safe manufactured unit.

Calibrations / Air Sampler Department

Paul J. Chevis — Inspector

11-16-09 — Date

CERTIFICATE OF CALIBRATION

MQ003R01

F&J SPECIALTY PRODUCTS, INC.
PO Box 2888
Ocala, Florida 34478-2888
Tel: (352) 680-1177 • (352) 680-1178
Fax: (352) 680-1454
Email: fandj@fjspecialty.com
Internet: www.fjspecialty.com

The Nucleus of Quality Air Monitoring Programs

CALIBRATED INSTRUMENT: **DIGITAL CALIBRATOR**

P.O. NUMBER: 236608
CUSTOMER: INTER-MOUNTAIN LABS
MODEL #: DF-30L-BL-AC
SERIAL #: 10279
SENSOR RANGE: 0.155 to 1.060 SCFM = 4.4 to 30.0 SLPM

REFERENCE SERIAL #: 13777, 0-50 SLPM
CALIBRATION DATE: Nov 09, 2009
LOKAL VERSION: V2.18 (B15144)
RECAL DUE DATE: Nov 09, 2010

BAROMETRIC P: 29.96 InHg = 761.0 mmHg
CORRECTED TO: 29.92 InHg = 760.0 mmHg
TEMPERATURE: 75.8 °F = 24.3 °C
CORRECTED TO: 77.0 °F = 25.0 °C

(X) NEW UNIT ( ) CALIBRATION AS FOUND ( ) RE-CALIBRATION REFERENCE

	DIGITAL INSTUMENT FLOW		REFERENCE INSTRUMENT FLOW		DEVIATION AT READINGS		DEVIATION AT READING	DEVIATION AT READING (FULL SCALE)
	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[%]	[%]
1	1.338	37.90	1.338	37.89	0.000	0.00	0.01	0.00
2	1.284	36.35	1.282	36.30	0.002	0.05	0.13	0.17
3	1.182	33.48	1.179	33.38	0.003	0.10	0.29	0.33
4	1.048	29.68	1.045	29.59	0.003	0.09	0.31	0.30
5	0.889	25.18	0.887	25.13	0.002	0.06	0.22	0.20
6	0.689	19.51	0.691	19.55	-0.002	-0.04	-0.22	-0.13
7	0.550	15.57	0.555	15.71	-0.005	-0.14	-0.93	-0.47
8	0.444	12.57	0.451	12.78	-0.007	-0.21	-1.64	-0.70
9	0.326	9.24	0.337	9.53	-0.010	-0.29	-3.19	-0.97
10	0.150	4.25	0.159	4.49	-0.009	-0.24	-5.73	-0.80
	AVERAGE DEVIATION ACROSS THE RANGE AT READING:						1.22	0.41

INSTRUMENT ACCURACY: 4.0 % of full scale = 0.04 SCFM = 1.20 SLPM

This is to certify that F&J Specialty Products in Ocala, Florida, has on this date certified Digital Instrument model # DF-30L-BL-AC serial # 10279 to be within the instrument accuracy specified above. The Reference Flow Meter Device bears letters of certification traceable to the National Institute of Standards and Technology.

CALIBRATED BY: _____ QUALITY ASSURANCE: Paul J. Marino

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL CALIBRATOR			SERIAL #:	10279
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

ELECTRONIC CALIBRATION

		PHYSICAL READING	DIGITAL READING
TEMPERATURE	[degC]	24.3	2084
BP1	[mmHg]	761.0	3293
BP2	[mmHg]	531.9	1132
DELTA P1	[mmHg]	0.005	1040
DELTA P2	[mmHg]	17.072	3897

VENTURI TUBE CALIBRATION

	DELTA P [mmHg]	FLOW RATE [SLPM]	TEMPERATURE [degC]	INLET P [mmHg]
1	17.072	40.43	24.3	720.6
2	15.585	38.50	24.2	722.7
3	12.825	34.78	24.2	726.6
4	10.048	30.70	24.3	730.6
5	7.174	25.86	24.3	735.5
6	4.307	19.98	24.3	741.4
7	2.760	16.00	24.3	745.2
8	1.798	12.94	24.5	747.9
9	1.021	9.75	24.5	750.9
10	0.233	4.43	24.6	755.9

BAROMETRIC PRESSURE = 761.0 [mmHg]

CURVE FITTING

EQUATION :	Y=0.46087*exp(0.51106*log(X))
STD. DEVIATION:	0.003969

PCAL EQUATION: Y=((((-0.000128*X+0.003323)*X-0.032542)*X+0.154218)*X-0.491906)*X+29.808165

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL CALIBRATOR			SERIAL #:	10279
REF.T. [degC]:	25.0	RANGE [SLPM]:	4.40 - 30.00	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Nov 09, 2009	SENSOR REF #:	802

BP SENSOR CALIBRATION CHECK

	DUT [mmHg]	LOKAL [mmHg]	ERROR [%]
1	529.1	530.4	-0.24
2	641.1	642.9	-0.28
3	748.5	750.1	-0.20

DP SENSOR AND FLOW MEASUREMENT CALIBRATION CHECK

	DP DUT [mmHg]	DP LOKAL [mmHg]	DP ERROR [%]	FLOW DUT [SLPM]	FLOW LOKAL [SLPM]	FLOW ERROR [%]
1	16.615	16.553	0.38	37.90	37.89	0.01
2	15.233	15.171	0.41	36.35	36.30	0.13
3	12.860	12.742	0.93	33.48	33.38	0.29
4	10.051	9.902	1.51	29.68	29.59	0.31
5	7.187	7.043	2.03	25.18	25.13	0.23
6	4.297	4.185	2.68	19.51	19.55	-0.22
7	2.728	2.672	2.10	15.57	15.71	-0.92
8	1.794	1.738	3.23	12.57	12.78	-1.62
9	0.972	0.934	4.00	9.24	9.53	-3.09
10	0.206	0.187	10.00	4.25	4.49	-5.42

QUALITY PROOF

F.S. ACCURACY [%]:	0.41
PERFORMED BY:	
APPROVED BY:	Paul J Chavira
COMMENTS:	

Digital Air Sampler Records

CAL039 Rev. 2
8/7/2008

Air Sampler Information

Serial #	Model #	Software Ver	AutoZero Feature	STATUS
10288	DF-30L-BL-AC	V4.53	Yes	ORIGINAL

Customer Unit ID Number: N/A

Calibrator Type	COMMENTS:
Orifice	

RS232: Yes **Voltage:** 100/240V **Battery Voltage:** N/A

Calibration Information

Calibration Date	Technician
7/20/2010	JON BLEWETT

QA Manual Revision and Date: Company Quality Manual, Rev. 7, 01/08/2009
Calibration Procedure: DWI-CAL-001
Revision and Date of Procedure: Rev. 3, 1/22/2009
Reference Instrument: CME 60B
Reference Serial Number: 60-627/13777
Reference Calibration Date: 4/1/2010
Reference Due Date: 4/1/2011
Reference Instrument Manufacturer: CME DIVISION OF AEROSPACE CONTROL PRODUCTS

Customer/Order Information

Order #	Purchase Order #
FO1000687	Warranty Loaner

Company: INTER-MOUNTAIN LABS
Facility: Procurement
Customer #: C5551
Contact: Ron Smith
Telephone: 307 674 7506

FJ010, Rev.: 0
08/10/09

F&J SPECIALTY PRODUCTS, INC.

Certificate of Dielectric / Ground Bond Test

F&J SPECIALTY PRODUCTS, INC. hereby certifies that Model DF-30L-BL-AC,

Serial No. 10288, has been tested in accordance with Dielectric Test Procedure

AS-DWI-DVWTP and has met all acceptance criteria for this test. This test is identical to the test performed on all ETL Listed products manufactured by ***F&J SPECIALTY PRODUCTS, INC.*** This unit has also been Ground Bond Tested for assurance of an electrically safe manufactured unit.

Calibrations / Air Sampler Department

Inspector

7/20/2010
Date

CERTIFICATE OF CALIBRATION

MQ003R01

F&J SPECIALTY PRODUCTS, INC.
PO Box 2888
Ocala, Florida 34478-2888
Tel: (352) 680-1177 • (352) 680-1178
Fax: (352) 680-1454
Email: fandj@fjspecialty.com
Internet: www.fjspecialty.com

The Nucleus of Quality Air Monitoring Programs

CALIBRATED INSTRUMENT: **DIGITAL AIR SAMPLER**

P.O. NUMBER: WARRANTY LOANER
CUSTOMER: INTER-MOUNTAIN LABS
MODEL #: DF-30L-BL-AC
SERIAL #: 10288
SENSOR RANGE: 0.180 to 1.230 SCFM = 5.10 to 34.83 SLPM

REFERENCE SERIAL #: 13777, 0-50 SLPM
CALIBRATION DATE: Jul 20, 2010
LOKAL VERSION: V2.18 (B15144)
RECAL DUE DATE: Jul 20, 2011

BAROMETRIC P: 29.99 InHg = 761.7 mmHg
CORRECTED TO: 29.92 InHg = 760.0 mmHg
TEMPERATURE: 73.6 °F = 23.1 °C
CORRECTED TO: 77.0 °F = 25.0 °C

(X) NEW UNIT ( ) CALIBRATION AS FOUND ( ) RE-CALIBRATION REFERENCE

	DIGITAL INSTUMENT FLOW		REFERENCE INSTRUMENT FLOW		DEVIATION AT READINGS		DEVIATION AT READING	DEVIATION AT READING (FULL SCALE)
	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[SCFM]	[SLPM]	[%]	[%]
1	1.266	35.85	1.265	35.83	0.001	0.02	0.06	0.06
2	1.172	33.18	1.176	33.29	-0.004	-0.11	-0.34	-0.33
3	1.109	31.41	1.106	31.32	0.003	0.10	0.31	0.28
4	1.013	28.69	1.010	28.61	0.003	0.08	0.27	0.22
5	0.900	25.49	0.905	25.62	-0.005	-0.13	-0.50	-0.37
6	0.779	22.07	0.783	22.18	-0.004	-0.11	-0.50	-0.32
7	0.644	18.24	0.635	17.98	0.009	0.26	1.43	0.75
8	0.440	12.47	0.438	12.41	0.002	0.05	0.43	0.15
9	0.300	8.50	0.314	8.88	-0.014	-0.39	-4.53	-1.11
10	0.154	4.35	0.147	4.18	0.006	0.18	4.03	0.50
	AVERAGE DEVIATION ACROSS THE RANGE AT READING:						1.24	0.41

INSTRUMENT ACCURACY: 4.0 % of full scale = 0.049 SCFM = 1.39 SLPM

This is to certify that F&J Specialty Products in Ocala, Florida, has on this date certified Digital Instrument model # DF-30L-BL-AC serial # 10288 to be within the instrument accuracy specified above. The Reference Flow Meter Device bears letters of certification traceable to the National Institute of Standards and Technology.

CALIBRATED BY: _____ QUALITY ASSURANCE: _____

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL AIR SAMPLER			SERIAL #:	10288
REF.T. [degC]:	25.0	RANGE [SLPM]:	5.10 - 34.83	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Jul 20, 2010	SENSOR REF #:	802

ELECTRONIC CALIBRATION

		PHYSICAL READING	DIGITAL READING
TEMPERATURE	[degC]	23.3	2083
BP1	[mmHg]	762.3	3297
BP2	[mmHg]	532.6	1140
DELTA P1	[mmHg]	0.000	1049
DELTA P2	[mmHg]	13.286	3236

VENTURI TUBE CALIBRATION

	DELTA P [mmHg]	FLOW RATE [SLPM]	TEMPERATURE [degC]	INLET P [mmHg]
1	13.286	36.90	23.1	732.1
2	11.706	34.62	23.0	733.9
3	10.157	32.14	23.0	735.9
4	8.402	29.23	23.1	738.4
5	6.749	26.17	23.1	740.8
6	4.969	22.44	23.1	743.7
7	3.268	18.24	23.2	746.9
8	1.555	12.64	23.3	751.3
9	0.771	9.00	23.7	754.0
10	0.146	4.14	24.0	757.8

BAROMETRIC PRESSURE = 761.7 [mmHg]

CURVE FITTING

EQUATION :	Y=((((0.00033405*X-0.0070132)*X+0.055897)*X-0.21698)*X+0.55195)*X+0.11087
STD. DEVIATION:	0.006262

PCAL EQUATION: Y=((((-0.000283*X+0.006035)*X-0.048579)*X+0.188315)*X-0.474734)*X+29.863397

CALIBRATION REPORT

IDENTIFICATION **MQ003R01**

MODEL:	DIGITAL AIR SAMPLER			SERIAL #:	10288
REF.T. [degC]:	25.0	RANGE [SLPM]:	5.10 - 34.83	SENSOR:	DP.
REF.P. [mmHg]:	760.0	CALIBR. DATE:	Jul 20, 2010	SENSOR REF #:	802

BP SENSOR CALIBRATION CHECK

	DUT [mmHg]	LOKAL [mmHg]	ERROR [%]
1	531.6	532.4	-0.14
2	646.9	648.2	-0.20
3	750.3	751.6	-0.17

DP SENSOR AND FLOW MEASUREMENT CALIBRATION CHECK

	DP DUT [mmHg]	DP LOKAL [mmHg]	DP ERROR [%]	FLOW DUT [SLPM]	FLOW LOKAL [SLPM]	FLOW ERROR [%]
1	13.327	13.302	0.19	35.85	35.83	0.06
2	11.471	11.434	0.33	33.18	33.29	-0.34
3	10.151	10.089	0.62	31.41	31.32	0.31
4	8.445	8.389	0.67	28.69	28.61	0.27
5	6.738	6.651	1.31	25.49	25.62	-0.50
6	5.001	4.951	1.01	22.07	22.18	-0.50
7	3.270	3.213	1.74	18.24	17.98	1.45
8	1.526	1.495	2.09	12.47	12.41	0.43
9	0.747	0.729	2.56	8.50	8.88	-4.34
10	0.149	0.149	0.00	4.35	4.18	4.20

QUALITY PROOF

F.S. ACCURACY [%]:	0.41
PERFORMED BY:	
APPROVED BY:	
COMMENTS:	

APPENDIX 3

STANDARD OPERATING PROCEDURE

Standard Operating Procedure
For
Meteorological Station Audit
SOP AIR-12

Procedural Section

1.0 Scope and Application

1.1 In 1970 the Clean Air Act (CAA) was signed into law. The CAA and its amendments provide the framework for all pertinent organizations to protect air quality. On July 18, 1997, in Federal Register: Vol. 62, No. 138, the United States Environmental Protection Agency (EPA) revised the particulate matter ambient air standards. Along with the establishment of the standard is the requirement for a national monitoring network utilizing a filter-based method adopted by EPA.

1.2 This procedure applies to the following equipment: RM Young 0535 Wind Monitor AQ, Hydrologic Services TB3/0.01P tipping bucket precipitation device, Vaisalla CS215-L11 Temperature and RH Probe, and Campbell Scientific CR-1000 data logger, which are used in the particulate monitoring network.

1.3 The elements of this SOP are applicable for all sampling frequencies.

1.4 To ensure that the recorded meteorological data for wind speed, wind direction, temperature, and precipitation match readings provided by known references, within acceptable limits.

2.0 Summary of Method

2.1 IML Air Science is responsible for the accuracy audit of their Meteorological station. The procedure is performed by IML field personnel.

2.2 The meteorological audit consists of checking current readings for all parameters against reference values.

3.0 Health and Safety Warnings

3.1 General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions.

3.2 General precautions for working with heavy equipment and electro-mechanical equipment should be taken.

4.0 Cautions

4.1 Damage to the instrument may result if caution is not taken to properly install and maintain the device. Follow the manufacturer's instructions for maintenance of all equipment and for safe, secure installation.

5.0 Personnel Qualifications

5.1 Persons performing this SOP must be familiar with the operation of environmental measurement instrumentation.

5.2 Computer skills are necessary for programming the sampler and for troubleshooting.

5.3 Familiarity with electronic and mechanical test equipment is required.

6.0 Equipment

6.1 Quartz-referenced wind speed motor, with adapters

6.2 Starting torque measurement disc and weights

6.3 NIST traceable thermometer

6.4 Two insulated containers (one with ice water and the other with hot water)

6.5 Engineer's transit

6.6 Class B pipette

6.7 Field data sheet

6.8 Miscellaneous tools

7.0 Meteorological Station Audit Procedure

7.1 Record the date, station ID, auditor(s), description of sensors, and note any visible anomalies in the field log book. Check that the data logger is displaying reasonable current readings.

7.2.1 Check the initial alignment of the wind direction sensor using the transit, being sure to adjust for the local declination of 12° East.

7.3 Locate the reference, aspirated thermometer near the met station's temperature sensor, allow each sensor to reach equilibrium and record both readings.

7.4 Record the "time system off line", just before lowering the tower. Remove the appropriate base mounting bolts, detach the guy wire perpendicular to the base hinge, and ***carefully*** lower the tower.

7.5 Remove the anemometer propeller. Attach the propeller torque disc to the shaft and record the starting torque in the counter-clockwise direction.

7.6 Attach the anemometer drive motor to the shaft and rotate at speeds corresponding to approximately 3 mph, 9 mph, 30 mph, and 90 mph, recording the motor speeds and wind speed readings from the data logger.

7.7 Assess the linearity of the wind direction sensor by physically holding the anemometer at 0°, 90°, 180°, and 270°, recording the corresponding readings from the data logger.

7.8 Immerse the reference thermometer and met station temperature sensor in an ice bath. After the sensors have attained equilibrium, record the measurements from both. Repeat the procedure for a warm water bath (approximately 80°F - 100°F).

7.9 After all measurements on the tower have been taken, inspect the sensors and all cables and mounting hardware. Repair or replace any damaged components if indicated.

7.10 Make sure all cables and mounting hardware are sound and secure. ***Carefully*** raise the tower, secure the base, and equalize the guy wire tensions.

7.11 Using the pipette, admit water slowly into the inlet of the precipitation gauge (*as found, i.e. do not clean)* until the bucket tips 10 times (0.1" precipitation equivalent). Record the amount of water required for the 10 tips, and the amount registered on the data logger. Repeat the procedure two more times. After the readings have been taken, clean the inlet, and perform any indicated adjustments and/or repairs can be performed and noted. Note the condition of the gauge prior to, and after the audit. If the ambient temperature is cold enough, assess whether the heater is working.

7.12 Record any findings, repairs, replacements and any other anomalies in the field log book. Record the time the station was returned to normal operating condition.

STANDARD OPERATING PROCEDURE NO. 03
AIR PARTICULATE SAMPLING

Rev 3

Ross Uranium ISR Project
Crook County, Wyoming

Prepared for:
WWC Engineering
Sheridan, Wyoming

Prepared by:

SENES Consultants Limited
Englewood, Colorado

December, 2009

STANDARD OPERATING PROCEDURE NO. 03
AIR PARTICULATE SAMPLING
Version 0.0

CONTENTS

1.0 INTRODUCTION AND PURPOSE

The purpose of this document is to define the standard operating procedure (SOP) to be followed for the collection of air sampling filters used to determine the concentrations of radionuclides in air as part of the Baseline Radiological Monitoring Program at the Ross ISR project, Crook County, Wyoming. Air particulate samples are collected using F & J Specialty Products Models DF -30L-BL-AC and LV-1D (see operating manuals for these devices attached herewith), which have been previously installed at permanent locations. A filter is collected from each air-sampling unit on approximately a weekly basis during a three-month quarter. The collected set of filters (typically about 13, one per week) for each air sampling unit is sent for contract laboratory analysis at the end of each quarter.

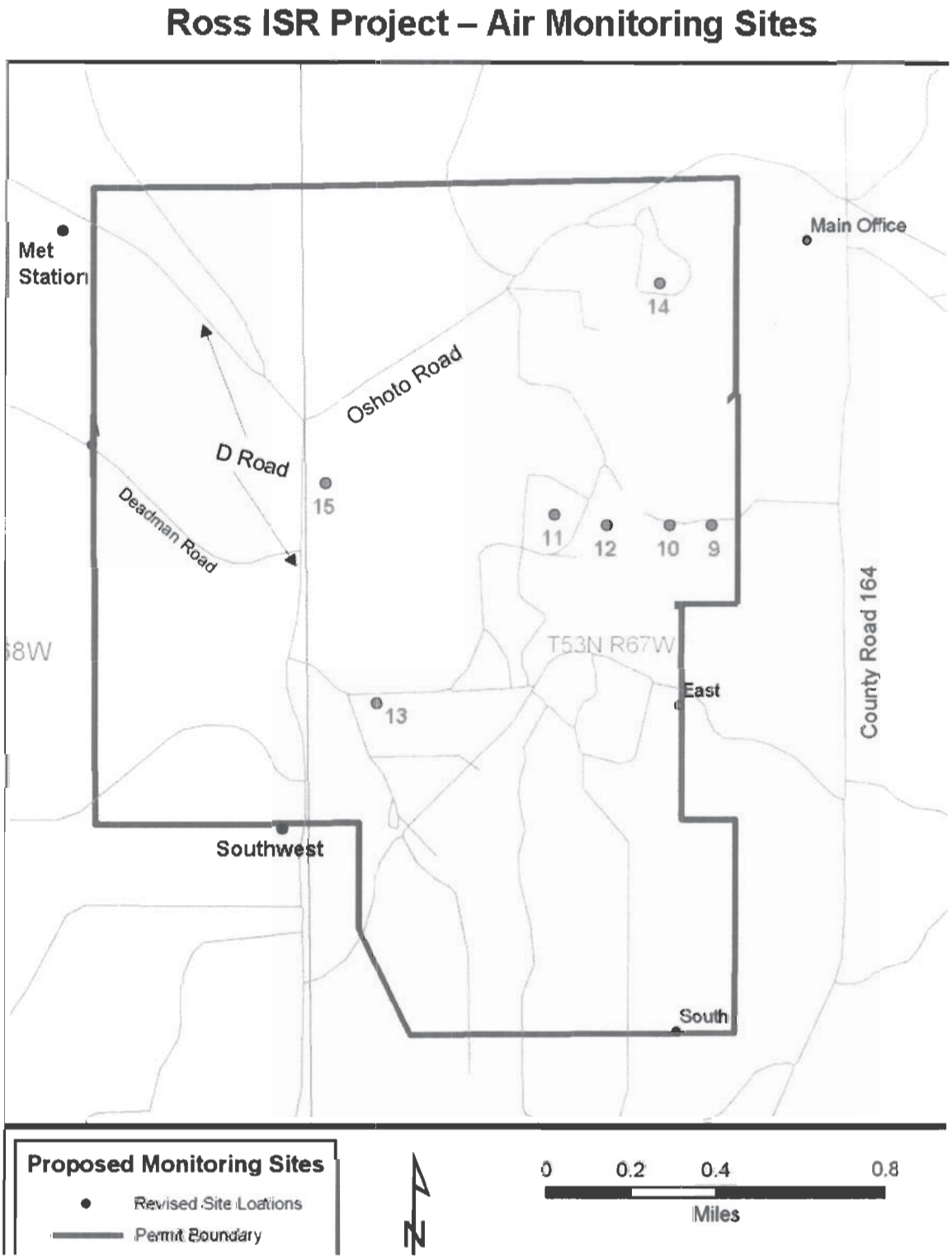
The United States (U.S.) Nuclear Regulatory Commission's (NRC) Regulatory Guide 4.14 (*Radiological Effluent and Environmental Monitoring at Uranium Mills*) requires a year of preoperational data collection via continuously operating air samplers. Quarterly composites are to be analyzed for naturally occurring radionuclides as discussed below. Figure 1 presents the location of the Ross project air particulate samplers. Table 1 presents their GPS locations. The technical basis and rationale for selection of these locations, in accordance with the guidance presented in NRC Regulatory Guide 4.14, is described in the Ross project Sampling and Analysis Plan (SAP).

TABLE 1: GPS Coordinates of Air Particulate Samplings Locations *

Location # / Description	Easting	Northing
(1) East Particulate Monitoring Station		
(2) South Particulate Monitoring Station		
(3) Southwest Particulate Monitoring Station		
(4) Meteorological Monitoring Station		
(5) Main Office Particulate Monitoring Station		

* exact coordinates to be determined at time of initial placement

FIGURE 1: Location Map of Air Particulate Sampling Locations



The requirement for weekly collection and replacement of air filters is flexible. Unsafe weather conditions are sufficient cause to delay filter replacement for a day or more. The principal driver for this SOP is that air sampling should be essentially continuous, allowing the contract laboratory to meet minimum detectable activity (MDA) requirements for specific radionuclides as specified in Regulatory Guide 4.1.4 and in accordance with the quality assurance requirements described in NRC Regulatory Guide 4.15 (*Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment*). This means that, if a specific filter exchange is delayed for a day or several days, the sampling record remains continuous and the MDA can be met, since one filter may represent eight or more days of sampling while the next may represent six or fewer days, but the collection of sample filters during any quarter still represents 13 weeks of essentially continuous air sample collection.

A warning in this context is necessary, although it is not expected to be an issue in rural NE Wyoming. In severely dusty conditions, the sampling filters could become plugged with dust after fewer than 7 days. This will be apparent since the air sampler flow rate will drop significantly from the normal 28-30 liters per minute (lpm at local temperature and pressure) if filter plugging occurs. A sampler flow rate less than about 25 lpm is evidence of such dust plugging. During a period (such as a severe dust storm) when such plugging is likely, filters should be exchanged more often than the normal weekly requirement, recognizing the overriding need for personnel safety during such an exchange. Experience will determine whether early filter exchanges may be necessitated by extremely dusty conditions. To gain this experience, following a dust storm the sampling units should be visited and the air sampler pump displays checked to determine whether the flow rate has been significantly reduced. If the flow rate is approaching the lower limit of 25 lpm, the filter should be exchanged (using this SOP).

Air sample filters will be analyzed by a contract laboratory for radiological constituents to determine airborne concentrations. Air samplers draw air and suspended particulate matter through the 47 millimeter (mm) collection filters at known volumetric flow rates for known periods of time. All respirable air particulate matter is assumed to be captured by the filters. The filters are analyzed by a radiochemical laboratory to determine activity of each specified radionuclide (Ra-226, Th-230, Pb-210, Natural (total) Uranium and Gross Alpha). Laboratory-reported specific radionuclide activities for the composite filter set are divided by the total volume of air that passed through the air filters over the quarterly sampling period to determine the average air concentrations for each radionuclide for the period sampled at that specific sampling location.

2.0 RESPONSIBILITIES AND QUALIFICATIONS

The following sections summarize personnel responsibilities.

2.1 PROJECT MANAGER OR SITE MANAGER

The Project Manager or Site Manager is responsible for:

- Providing appropriate support and resources to support the air particulate monitoring program
- Ensuring the oversight of all monitoring activities
- Ensuring that all individuals involved with implementing the air particulate monitoring are properly trained in the procedures outlined in this SOP

2.2 PROJECT OR SITE RADIATION SAFETY OFFICER (RSO)

The Radiation Safety Officer is responsible for:

- Ensuring compliance with radiation safety requirements during all sampling operations
- Providing appropriate radiation safety training for the sampling technician(s) as required
- Reviewing vendor supplied data when received for completeness and accuracy and using this data to calculate results for the air particulate monitoring program and to ensure program technical objectives are being met

2.3 FIELD TECHNICIAN

Field Technicians are responsible for:

- Observing all safety requirements
- Following this SOP and completing all required documentation with the appropriate information
- Completing and maintaining quality assurance records (i.e. sample chain of custody forms and logbook entries as specified herein)
- Informing the Project Manager or Site Supervisor of monitoring activities which do not conform to specific requirements, and for carrying out any directions from the Site Supervisor or RSO to address any non-compliant monitoring activities

3.0 PRECAUTIONS

The following precautions should be taken when working at the air particulate monitoring stations:

- Regularly survey the area surrounding the air sampler location to be sure it is free of snakes or other hazardous biota or poisonous plants. Pay particular attention to areas that

are not clearly visible and avoid stepping in or placing hands in locations with potential hidden dangers.

- Watch out for loose rocks and unstable footing.
- Inspect air filter sample envelopes and ziplock bags for cleanliness prior to use. Such containers shall not be reused, nor shall they be used if there is any question as to their origin. If applicable, sample containers supplied by or recommended by the contract laboratory shall be used.
- Clean hands immediately prior to sample collection and wear latex or nitrile gloves to ensure that samples are not contaminated. Clean sample handling tweezers between uses.
- Latex gloves should be discarded after sample collection at each location and new gloves worn.
- Appropriate footwear, long trousers and snake chaps should be used as determined to be appropriate by the site manager.
- Operate and handle all equipment, filters, and other key items in accordance with manufacturer specifications.

4.0 EQUIPMENT AND MATERIALS

The following equipment is required for air filter collection:

- Appropriate safety clothing and other safety gear
- Air filter containers (new air filter sample Petri dishes and new plastic ziplock bags)
- Permanent marking pen (Sharpie, e.g.)
- New air filters (47 mm Teflon filters, specified by contract laboratory)
- Tweezers (to grasp edge of filter without contacting sampling area)
- Field log book
- Disposable gloves
- Water and clean, soft cotton cloth.

5.0 SAMPLE LOCATIONS AND FREQUENCY

Air filter samples will be removed and properly protected and stored approximately weekly at

each air sampler location, and replaced with new filters. Air filter collections from each air sampler station will be shipped quarterly (every three months) to a contract laboratory for radiochemical analysis as specified herein and in the Sampling and Analysis Plan (SAP).

6.0 PROCEDURES

6.1 AIR SAMPLER OPERATION

See F & J Specialty Products operating manuals for Models DF -30L-BL-AC and LV-1D provided as attachments to this procedure. For each solar-powered sampler, perform the following steps when changing filter.

- Write down sampler location and sampler ID in field log book.
- Turn off sampler pump by setting display to "Flow" mode and pressing the "Reset" button.
- Set display to "Total Volume"mode and record sampler flow volume (standard liters). After recording volume, press "Reset" button to zero the accumulated volume.
- Set display to "Time mode and record elapsed time (days, hours, minutes). After recording time, press "Reset" button to zero the accumulated time.
- Replace the exposed filter with a clean filter as outlined in 6.2 below, .
- Set display to "Flow" mode and press "Reset" button to start the sampler pump.

For the AC-powered sampler, perform the following steps when changing filter.

- Write down sampler location and sampler ID in field log book.
- Record ending sampler flow rate by reading the rotometer flow gauge (liter/min).
- Turn off sampler pump using the on/off toggle switch.
- Replace the exposed filter with a clean filter as outlined in 6.2 below, .
- Turn on the sampler pump using the on/off toggle switch.
- Adjust the flow regulator if needed so that the flow rate on the rotometer reads approximately 70 liters/min. Record the actual flow rate as the beginning flow rate for the clean filter.

6.2 SAMPLING FILTER REPLACEMENT

The following section describes how to properly replace air sample filters.

- Extract air sample filter holder using the quick disconnect under the protective hood that shields the filter holder; unscrew filter holder ring and, using tweezers, gently remove air filter without contacting either surface of the filter. Take care in a windy environment not to allow the filter to blow loose or particulate to fall off the filter.

- Place the removed filter inside a clean, protective Petri dish and close the Petri dish.
- Place the closed Petri dish into a clean, pink zip-lock bag and seal the bag.
- With the Sharpie pen, mark today's date, the air sampler location and the air sampler's ID number on the zip-lock bag.
- Note filter removal date, sampler location, sampler ID and other information as specified in this SOP in the field logbook.
- Clean the air sample filter holder using a soft cloth. Using the tweezers carefully install a new filter without touching either side of the sampling area. Hand-tighten the filter holder ring, keeping the filter centered properly.
- Reconnect the air sample filter holder to the quick disconnect under the protective hood.
- Record current conditions (time of day, weather, temperature, any unusual conditions) in the sampling log book.

6.3 SAMPLE HANDLING

The following describes procedures for handling air filter samples.

- Place all five marked zip-lock bags (with samples inside) in a larger zip-lock bag and deliver to the IML Air Science office in Sheridan.
- Weekly air filters collected from each air sampler should be transferred to one of five, larger zip-lock bags marked with that sampler's location and ID #.
- No special preservation measures are required during collection and storage of each quarter's (three months) of air filters. The ziplock bags holding each collection of filters should be stored securely in a locked cabinet to prevent tampering or loss.
- At the end of each quarter, each large ziplock bag, containing the 13 air filters in their envelopes inside the smaller ziplock bags, should be packaged and delivered as quickly as possible to the designated contract laboratory, accompanied by paperwork as required by the laboratory and specified herein. Of critical importance is that the large bags be properly marked and sealed, and shipped in strong, tight containers suitable for rough handling and long distance shipment, with complete instructions for contract laboratory processing, analysis and data reporting included.

7.0 DOCUMENTATION AND RECORD KEEPING

All information pertinent to field sampling must be recorded in a log book. The field log book should be a bound book, with consecutively numbered pages. A log entry shall contain at a minimum the following information:

- Air sampler identification number
- Purpose of sampling ("Radionuclide air concentration measurement.")
- Location of sampler
- Name of sampling technician
- Date and time of sampling
- Analyses t o be pe rformed (Uranium-238, T horium-230, Radium -226 and L ead-210).

Sampling situations can vary. The best guideline is to record sufficient information such that the sampling event could be reconstructed if necessary, without relying on the sampling technician's memory. Completed field log book(s) shall be maintained and filed chronologically.

8.0 REFERENCES

United States NRC Regulatory Guide 4.14, *Radiological Effluent and Environmental Monitoring at Uranium Mills, Revision 1.* 1980

United States NRC Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment.* 1979

APPENDIX 4

WDEQ APPROVAL

Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Dave Freudenthal, Governor

John Corra, Director

February 23, 2010

Ms. Dalene Ruby
Strata Energy, Inc.
P.O. Box 2318
Gillette, WY 82717

RE: Ross ISR Uranium Project Meteorological Monitoring and Air Sampling Plan

Dear Ms. Ruby:

This letter is written to provide approval from the Air Quality Division (AQD) Monitoring Section and the AQD New Source Review (NSR) Group of the preliminary baseline monitoring plan for the Ross ISR Uranium Project. No additional air quality or meteorological monitoring beyond what is currently in place for the project will be required for the air quality permitting of the project.

Our letter dated February 16, 2010 that requested a revision to the monitoring plan in preparation for AERMOD dispersion modeling was in error. Prior conversations between project representatives and the NSR Group had already established that AERMOD dispersion modeling would not be required for the air quality permit.

We do require that you submit the locations (UTM coordinates) of the monitoring sites for the project. If you have any questions, please contact Amber Potts (Monitoring Project Advisor) at (307) 777-2489.

Sincerely,

Cara Keslar
Ambient Monitoring Supervisor
Air Quality Division

Cc: Tanner Shatto/AQD District Engineer
Mark Taylor/LQD (proj ref #TFN5 6\110)
Ronn Smith/IML
Monitoring File

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ADMIN/OUTREACH	ABANDONED MINES	AIR QUALITY	INDUSTRIAL SITING	LAND QUALITY	SOLID & HAZ. WASTE	WATER QUALITY
(307) 777-7937	(307) 777-6145	(307) 777-7391	(307) 777-7369	(307) 777-7756	(307) 777-7752	(307) 777-7781
FAX 777-3610	FAX 777-6462	FAX 777-5616	FAX 777-5973	FAX 777-5864	FAX 777-5973	FAX 777-5973

ADDENDUM 3.6-B

SITE – SPECIFIC METEOROLOGY AND CLIMATOLOGY

DATA

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Table 1. Ross ISR Maximum, Minimum, and Average Monthly Temperatures

MONTH	Average Temperature (°F)	Minimum Temperature (°F)	Maximum Temperature (°F)
Jan	22.1	-15.9	43.2
Feb	20.8	-8.6	40.8
Mar	37.5	19.2	67.0
Apr	42.9	25.5	66.7
May	51.1	32.1	81.9
Jun	60.9	42.6	90.0
Jul	68.5	47.0	92.6
Aug	70.5	46.0	98.0
Sep	59.6	35.6	88.3
Oct	51.8	24.9	85.2
Nov	41.1	18.9	71.7
Dec			
Year-Round	47.9	24.3	75.0

Source: IML (2010)

Table 2. Ross ISR Joint Frequency Distribution for 2010

Ross ISR Project Oshoto, Wyoming	Frequency Distribution Hourly Average Wind Speed, Wind Direction and Sigma	IML Air Science Sheridan, WY

Calm Readings 14 Total Readings 7135 Possible Readings 7511 Data Capture 95.0%

From 1/5/2010 To 11/13/2010

Stability Class A **Wind Speed (mph)**

Direction	**< 3.4**	**3.4 – 6.9**	**6.9 – 11.5**	**11.5 - 18.4**	**18.4 - 24.0**	**> 24.0**	**Row Total**
E	0.00072	0.00168	0.00014				0.00255
ENE	0.00072	0.00168	0.00098	0.00028			0.00367
ESE	0.00072	0.00182					0.00255
N	0.00029	0.00238	0.00112				0.00379
NE	0.00058	0.00280	0.00112				0.00450
NNE	0.00014	0.00224	0.00084				0.00323
NNW	0.00043	0.00322	0.00182	0.00014			0.00562
NW	0.00029	0.00294	0.00210				0.00533
S	0.00130	0.00126	0.00084				0.00340
SE	0.00072	0.00182	0.00042				0.00297
SSE	0.00116	0.00224	0.00098	0.00014			0.00452
SSW	0.00043	0.00140	0.00126				0.00310
SW	0.00087	0.00252	0.00168	0.00014	0.00014		0.00535
W	0.00014	0.00294	0.00140	0.00014			0.00463
WNW	0.00043	0.00308	0.00238	0.00014			0.00604
WSW	0.00043	0.00266	0.00252	0.00014			0.00576
Sum	0.00940	0.03672	0.01962	0.00112	0.00014		0.06701

Table 2. Ross ISR Joint Frequency Distribution for 2010 (Continued)

From 1/5/2010 To 11/13/2010

Stability Class B **Wind Speed (mph)**

Direction	< 3.4	3.4 – 6.9	6.9 – 11.5	11.5 - 18.4	18.4 - 24.0	> 24.0	Row Total
E	0.00014	0.00014					0.00028
ENE	0.00014	0.00056	0.00028				0.00099
ESE	0.00014	0.00056	0.00014				0.00085
N		0.00042	0.00098	0.00014			0.00154
NE	0.00014	0.00042	0.00042	0.00028			0.00127
NNE	0.00014		0.00042				0.00057
NNW		0.00028	0.00140	0.00042		0.00014	0.00224
NW	0.00014	0.00056	0.00224	0.00070			0.00365
S	0.00072	0.00126	0.00112	0.00028			0.00339
SE	0.00014	0.00042	0.00028	0.00014			0.00099
SSE	0.00087	0.00084	0.00084	0.00070			0.00325
SSW	0.00058	0.00070	0.00098	0.00042			0.00268
SW		0.00070	0.00140	0.00028	0.00014		0.00252
W		0.00056	0.00154				0.00210
WNW	0.00014	0.00028	0.00126	0.00014	0.00014	0.00014	0.00211
WSW	0.00029		0.00098	0.00042			0.00169
Sum	0.00362	0.00771	0.01430	0.00392	0.00028	0.00028	0.03011

Table 2. Ross ISR Joint Frequency Distribution for 2010 (Continued)

From 1/5/2010 To 11/13/2010

Stability Class C **Wind Speed (mph)**

Direction	< 3.4	3.4 – 6.9	6.9 – 11.5	11.5 - 18.4	18.4 - 24.0	> 24.0	Row Total
E	0.00029	0.00028	0.00014				0.00071
ENE	0.00014	0.00014	0.00056				0.00085
ESE	0.00014	0.00084	0.00014	0.00014			0.00127
N		0.00028	0.00154	0.00280	0.00014		0.00477
NE			0.00182	0.00014			0.00196
NNE	0.00014	0.00042	0.00084	0.00168		0.00014	0.00323
NNW		0.00014	0.00112	0.00266	0.00028		0.00420
NW		0.00028	0.00238	0.00280	0.00028	0.00014	0.00589
S	0.00072	0.00224	0.00434	0.00224	0.00014		0.00969
SE	0.00043	0.00084	0.00056	0.00042	0.00014		0.00240
SSE	0.00029	0.00168	0.00224	0.00280	0.00028		0.00730
SSW	0.00058	0.00126	0.00210	0.00238			0.00632
SW	0.00043	0.00084	0.00056	0.00196	0.00056		0.00436
W		0.00042	0.00070	0.00056			0.00168
WNW		0.00112	0.00154	0.00280	0.00042		0.00589
WSW	0.00014	0.00028	0.00056	0.00084			0.00183
Sum	0.00333	0.01107	0.02116	0.02425	0.00224	0.00028	0.06233

Table 2. Ross ISR Joint Frequency Distribution for 2010 (Continued)

From 1/5/2010 To 11/13/2010

Stability Class D **Wind Speed (mph)**

Direction	< 3.4	3.4 – 6.9	6.9 – 11.5	11.5 - 18.4	18.4 - 24.0	> 24.0	Row Total
E	0.00029	0.00266	0.00252	0.00168			0.00716
ENE	0.00014	0.00182	0.00463	0.00589	0.00098	0.00028	0.01374
ESE	0.00058	0.00266	0.00154	0.00042			0.00520
N	0.00029	0.00210	0.00925	0.02705	0.00687	0.00140	0.04696
NE	0.00072	0.00196	0.00336	0.00799	0.00154		0.01558
NNE	0.00101	0.00182	0.00603	0.01345	0.00392	0.00168	0.02792
NNW	0.00029	0.00210	0.00757	0.02733	0.00771	0.00350	0.04850
NW		0.00266	0.00575	0.02523	0.00897	0.00813	0.05074
S	0.00203	0.02242	0.03308	0.05858	0.02313	0.00771	0.14694
SE	0.00014	0.00322	0.00294	0.00294	0.00028	0.00014	0.00968
SSE	0.00087	0.00925	0.01388	0.03027	0.02200	0.01261	0.08888
SSW	0.00289	0.01962	0.01416	0.01079	0.00252	0.00336	0.05335
SW	0.00188	0.00631	0.00252	0.00406	0.00280	0.00350	0.02108
W		0.00112	0.00519	0.01416	0.00238	0.00266	0.02551
WNW		0.00238	0.00505	0.01808	0.00771	0.00617	0.03938
WSW	0.00072	0.00308	0.00491	0.00897	0.00126	0.00098	0.01992
Sum	0.01186	0.08521	0.12235	0.25690	0.09208	0.05214	0.62055

Table 2. Ross ISR Joint Frequency Distribution for 2010 (Continued)

From 1/5/2010 To 11/13/2010

Stability Class E **Wind Speed (mph)**

Direction	< 3.4	3.4 – 6.9	6.9 – 11.5	11.5 - 18.4	18.4 - 24.0	> 24.0	Row Total
E	0.00058	0.00210	0.00112				0.00380
ENE		0.00224	0.00266				0.00491
ESE	0.00058	0.00070	0.00056				0.00184
N	0.00029	0.00280	0.00799				0.01108
NE	0.00043	0.00210	0.00491				0.00744
NNE	0.00029	0.00266	0.00827				0.01122
NNW	0.00029	0.00294	0.01261				0.01585
NW	0.00058	0.00252	0.01163				0.01473
S	0.00145	0.01065	0.01528				0.02737
SE	0.00101	0.00098	0.00182				0.00382
SSE	0.00130	0.00463	0.00589				0.01181
SSW	0.00260	0.00897	0.00603				0.01760
SW	0.00159	0.00350	0.00084				0.00594
W	0.00029	0.00168	0.00953				0.01150
WNW	0.00058	0.00224	0.00897				0.01179
WSW	0.00029	0.00224	0.00939				0.01192
Sum	0.01215	0.05298	0.10750				0.17263

)

Table 2. Ross ISR Joint Frequency Distribution for 2010 (Continued)

From 1/5/2010 To 11/13/2010

Stability Class F **Wind Speed (mph)**

Direction	< 3.4	3.4 – 6.9	6.9 – 11.5	11.5 - 18.4	18.4 - 24.0	> 24.0	Row Total
E	0.00174	0.00084					0.00258
ENE	0.00072	0.00210					0.00283
ESE	0.00231	0.00140					0.00372
N	0.00043	0.00182					0.00226
NE	0.00159	0.00084					0.00243
NNE	0.00101	0.00126					0.00227
NNW	0.00101	0.00070					0.00171
NW	0.00087	0.00196					0.00283
S	0.00304	0.00252					0.00556
SE	0.00217	0.00112					0.00329
SSE	0.00159	0.00252					0.00411
SSW	0.00275	0.00224					0.00499
SW	0.00101	0.00126					0.00227
W	0.00101	0.00168					0.00269
WNW	0.00072	0.00098					0.00170
WSW	0.00087	0.00126					0.00213
Sum	0.02285	0.02453					0.04738

Source: IML (2010)

Table 3. Ross ISR 1st Quarter Joint Frequency Distribution
Source: IML (2010)

Stability Class	Wind Direction	Wind Speed (nots) - 1st Quarter 2010						
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	Row Total
A	N							
	NNE	0.000525						0.000525
	NE							
	ENE	0.001576	0.000978					0.002553
	E	0.000525						0.000525
	ESE	0.000525	0.001955					0.002480
	SE		0.000978					0.000978
	SSE	0.001051	0.000978					0.002028
	S	0.002626	0.000489	0.000978				0.004093
	SSW	0.001576		0.001466				0.003042
	SW	0.000525	0.001466	0.000978				0.002969
	WSW	0.001051	0.000978	0.001466				0.003494
	W		0.000978					0.000978
	WNW		0.000978	0.001466				0.002444
	NW	0.001051	0.000489					0.001539
	NNW	0.000525	0.001955					0.002480
B	N		0.000489		0.000489			0.000978
	NNE							
	NE	0.000525	0.000489					0.001014
	ENE		0.000489					0.000489
	E	0.000525	0.000489					0.001014
	ESE		0.001466					0.001466
	SE		0.000489					0.000489
	SSE	0.001576	0.000978					0.002553
	S	0.001576	0.001955	0.000489	0.000489			0.004508
	SSW		0.001466					0.001466
	SW		0.001466	0.000978	0.000978			0.003421
	WSW			0.000978				0.000978
	W		0.000489	0.000978				0.001466
	WNW	0.000525					0.000489	0.001014
	NW	0.000525	0.000489					0.001014
	NNW		0.000489					0.000489
C	N			0.000489	0.000978			0.001466
	NNE							
	NE							
	ENE	0.000525						0.000525
	E		0.000489					0.000489
	ESE	0.000525						0.000525
	SE	0.001051	0.001466					0.002517
	SSE		0.002933	0.000489				0.003421
	S	0.001051	0.002933	0.001466	0.000978			0.006427
	SSW	0.001051	0.003421	0.000489	0.000978			0.005938
	SW	0.001051	0.000978	0.000489	0.000489	0.000489		0.003494
	WSW	0.000525	0.000489		0.000489			0.001503
	W							
	WNW		0.001955		0.000489			0.002444
	NW		0.000489		0.000978			0.001466
	NNW				0.000978			0.000978

Table 3. Ross ISR 1st Quarter Joint Frequency Distribution (continued)

Stability Class	Wind Direction	Wind Speed (nots) - 1st Quarter 2010						
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	Row Total
D	N	0.000525	0.003910	0.008798	0.036168	0.011241		0.060643
	NNE	0.001576	0.000489	0.001955	0.009286	0.001955		0.015261
	NE	0.001576	0.002933		0.000978			0.005486
	ENE		0.001466					0.001466
	E		0.001955	0.000489				0.002444
	ESE	0.001051	0.002444	0.000489				0.003983
	SE		0.002933	0.003421	0.000489			0.006843
	SSE	0.002101	0.010264	0.014174	0.021505	0.010753	0.000489	0.059286
	S	0.004202	0.032258	0.044966	0.081134	0.024927	0.007331	0.194818
	SSW	0.004202	0.032747	0.022483	0.012219	0.001466	0.000978	0.074095
	SW	0.002626	0.009286	0.001466	0.003421	0.002444	0.001955	0.021199
	WSW	0.000525	0.003421	0.004888	0.009775		0.000978	0.019587
	W		0.000978	0.004888	0.017107	0.002444	0.000489	0.025904
	WNW		0.004399	0.001466	0.020039	0.006354	0.002444	0.034702
	NW		0.003910	0.003910	0.022972	0.008798	0.017595	0.057185
	NNW	0.001051	0.004888	0.006843	0.034702	0.007331	0.002444	0.057258
E	N	0.001051	0.005865	0.009286				0.016202
	NNE	0.000525	0.002933	0.002444				0.005902
	NE	0.000525	0.001466	0.000978				0.002969
	ENE		0.001466	0.000489				0.001955
	E	0.000525	0.001955					0.002480
	ESE	0.001051	0.000489	0.000489				0.002028
	SE	0.001051	0.000489	0.000978				0.002517
	SSE	0.002101	0.006843	0.006354				0.015298
	S	0.002101	0.015640	0.024438				0.042179
	SSW	0.005778	0.018084	0.013685				0.037547
	SW	0.003152	0.004399	0.001955				0.009506
	WSW	0.000525	0.002933	0.012708				0.016166
	W	0.000525	0.001955	0.012708				0.015188
	WNW	0.001051	0.003910	0.014174				0.019135
	NW	0.002101	0.002444	0.018573				0.023118
	NNW	0.000525	0.004399	0.015152				0.020076
F	N							
	NNE	0.001576						0.001576
	NE	0.002101	0.000489					0.002590
	ENE		0.000489					0.000489
	E	0.001576						0.001576
	ESE	0.002626	0.000978					0.003604
	SE	0.002101	0.000978					0.003079
	SSE	0.001051	0.003421					0.004472
	S	0.003677	0.002933					0.006609
	SSW	0.004202	0.001466					0.005668
	SW	0.001576	0.000978					0.002553
	WSW	0.001051	0.001955					0.003006
	W	0.002101	0.000978					0.003079
	WNW	0.000525	0.000978					0.001503
	NW	0.002101	0.000978					0.003079
	NNW	0.000525	0.000489					0.001014

Table 4. Ross ISR 2nd Quarter Joint Frequency Distribution
Source: IML (2010)

Stability Class	Wind Direction	Wind Speed (nots) - 2nd Quarter 2010						Row Total
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	
A	N	0.000496	0.001489					0.001985
	NNE		0.002481	0.000993				0.003474
	NE		0.003970	0.000993				0.004963
	ENE		0.001489	0.000496				0.001985
	E	0.000993	0.002481					0.003474
	ESE		0.001985					0.001985
	SE	0.001489	0.001489	0.000993				0.003970
	SSE	0.000496	0.002481	0.000993	0.000496			0.004467
	S	0.000993	0.000993	0.000993				0.002978
	SSW		0.000993	0.000993				0.001985
	SW		0.001985	0.000496				0.002481
	WSW		0.000496	0.000496				0.000993
	W		0.001985	0.001985				0.003970
	WNW	0.000993	0.001985	0.001489	0.000496			0.004963
	NW		0.003474	0.000496				0.003970
	NNW		0.001489	0.000993				0.002481
B	N		0.000993	0.001489				0.002481
	NNE			0.000496				0.000496
	NE			0.000993	0.000496			0.001489
	ENE			0.000496				0.000496
	E							
	ESE			0.000496				0.000496
	SE		0.000993	0.000496				0.001489
	SSE	0.001489	0.000496	0.000993	0.000993			0.003970
	S		0.001489	0.000496	0.000496			0.002481
	SSW	0.000496	0.000496	0.001489				0.002481
	SW		0.000993	0.000993				0.001985
	WSW			0.000993	0.001489			0.002481
	W			0.000496				0.000496
	WNW			0.000993	0.000496			0.001489
	NW			0.002481	0.000496			0.002978
	NNW			0.000993	0.000993		0.000496	0.002481
C	N		0.000496	0.000496	0.001489			0.002481
	NNE		0.000993	0.000993	0.000993			0.002978
	NE			0.002978				0.002978
	ENE		0.000496	0.000496				0.000993
	E	0.000993	0.000496	0.000496				0.001985
	ESE		0.001985	0.000496	0.000496			0.002978
	SE		0.000993	0.000993	0.001489			0.003474
	SSE	0.000496	0.000993	0.002978	0.005459			0.009926
	S		0.001985	0.006452	0.002481			0.010918
	SSW	0.000496		0.001489	0.001985			0.003970
	SW	0.000496	0.000993	0.000496	0.004963	0.001489		0.008437
	WSW			0.001489	0.002481			0.003970
	W			0.001489	0.001985			0.003474
	WNW		0.000496	0.001489	0.006948	0.000496		0.009429
	NW		0.000496	0.002978	0.003474			0.006948
	NNW		0.000496	0.001489	0.003474	0.000993		0.006452

Table 4. Ross ISR 2nd Quarter Joint Frequency Distribution (continued)

Stability Class	Wind Direction	Wind Speed (nots) - 2nd Quarter 2010						
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	Row Total
D	N		0.001489	0.008437	0.022829	0.004963	0.001489	0.039206
	NNE		0.001985	0.009429	0.018362	0.004963	0.001985	0.036725
	NE	0.000496	0.002978	0.004963	0.012903	0.002481		0.023821
	ENE	0.000496	0.001489	0.008437	0.009926	0.001985	0.000993	0.023325
	E	0.000993	0.003474	0.003970	0.002978			0.011414
	ESE	0.000993	0.002978	0.000993	0.000496			0.005459
	SE	0.000496	0.002978	0.002978	0.005955	0.000496		0.012903
	SSE	0.000496	0.008437	0.011414	0.041687	0.033747	0.037221	0.133002
	S	0.000496	0.014392	0.016873	0.039702	0.025310	0.012407	0.109181
	SSW	0.001985	0.009926	0.005955	0.006452	0.000993	0.003474	0.028784
	SW	0.001985	0.003970	0.004467	0.004963	0.002978	0.004467	0.022829
	WSW	0.000993	0.002978	0.004963	0.014888	0.003474	0.001985	0.029280
	W		0.000993	0.005955	0.013896	0.005955	0.008437	0.035236
	WNW		0.001985	0.008933	0.016873	0.009429	0.013400	0.050620
	NW		0.001985	0.005955	0.022829	0.006948	0.000496	0.038213
	NNW		0.000496	0.007444	0.024814	0.013400	0.008933	0.055087
E	N		0.001985	0.008933				0.010918
	NNE		0.000993	0.011911				0.012903
	NE		0.001985	0.007444				0.009429
	ENE		0.001985	0.004963				0.006948
	E	0.000993	0.002978	0.001985				0.005955
	ESE	0.000496	0.000993	0.000496				0.001985
	SE	0.001489	0.001985	0.002978				0.006452
	SSE		0.002481	0.007444				0.009926
	S	0.001489	0.006452	0.012903				0.020844
	SSW	0.000496	0.003474	0.002481				0.006452
	SW	0.000496	0.002481	0.000993				0.003970
	WSW	0.000496	0.001489	0.007444				0.009429
	W	0.000496	0.001489	0.008437				0.010422
	WNW	0.000496	0.000496	0.004467				0.005459
	NW		0.001489	0.006948				0.008437
	NNW		0.002481	0.015881				0.018362
F	N	0.000496	0.001985					0.002481
	NNE	0.000993	0.001985					0.002978
	NE	0.000496	0.000496					0.000993
	ENE	0.000496	0.001985					0.002481
	E	0.000993	0.000496					0.001489
	ESE	0.001985	0.000993					0.002978
	SE	0.001489	0.001489					0.002978
	SSE	0.000993	0.000993					0.001985
	S	0.002481	0.001985					0.004467
	SSW	0.000993	0.003474					0.004467
	SW	0.001985	0.000496					0.002481
	WSW	0.000993	0.000993					0.001985
	W	0.000993	0.001985					0.002978
	WNW		0.000496					0.000496
	NW		0.001489					0.001489
	NNW	0.000496	0.000496					0.000993

Table 5. Ross ISR 3rd Quarter Joint Frequency Distribution
Source: IML (2010)

Stability Class	Wind Direction	Wind Speed (nots) - 3rd Quarter 2010						Row Total
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	
A	N	0.000497	0.006907	0.003947				0.011351
	NNE		0.005427	0.001973				0.007400
	NE	0.001492	0.005427	0.002960				0.009879
	ENE	0.000497	0.002960	0.002960	0.000987			0.007404
	E	0.000995	0.001973	0.000493				0.003461
	ESE	0.001989	0.001480					0.003469
	SE	0.000995	0.002960	0.000493				0.004448
	SSE	0.001989	0.003453	0.002467				0.007909
	S	0.000497	0.002467	0.000493				0.003457
	SSW		0.001973	0.001480				0.003453
	SW	0.001989	0.004440	0.004440	0.000493	0.000493		0.011856
	WSW	0.000497	0.005427	0.006413	0.000493			0.012831
	W	0.000497	0.005920	0.002960	0.000493			0.009871
	WNW		0.007893	0.004933				0.012827
	NW		0.006413	0.006413				0.012827
	NNW	0.000497	0.007400	0.005427	0.000493			0.013818
B	N			0.001973				0.001973
	NNE	0.000497		0.000987				0.001484
	NE		0.000987	0.000493				0.001480
	ENE		0.001480	0.000493				0.001973
	E							
	ESE	0.000497						0.000497
	SE	0.000497			0.000493			0.000991
	SSE		0.000987	0.001480	0.001480			0.003947
	S		0.000987	0.001973				0.002960
	SSW	0.000497	0.000493	0.001973	0.001480			0.004444
	SW			0.001480		0.000493		0.001973
	WSW	0.000497		0.000987				0.001484
	W		0.001480	0.001480				0.002960
	WNW		0.000987	0.001973		0.000493		0.003453
	NW		0.000987	0.003453	0.001973			0.006413
	NNW		0.000493	0.003947	0.000493			0.004933
C	N		0.000493	0.003947	0.006413	0.000493		0.011347
	NNE	0.000497	0.000493	0.001973	0.003453		0.000493	0.006911
	NE			0.002960	0.000493			0.003453
	ENE			0.000987				0.000987
	E							
	ESE		0.000493					0.000493
	SE		0.000493	0.000987		0.000493		0.001973
	SSE	0.000497	0.000493	0.002960	0.003947	0.000987		0.008884
	S	0.000497	0.001973	0.005427	0.004440	0.000493		0.012831
	SSW	0.000497	0.000987	0.004933	0.004440			0.010857
	SW		0.000987	0.000987	0.001480			0.003453
	WSW		0.000493	0.000493				0.000987
	W			0.000987				0.000987
	WNW		0.001480	0.002467	0.001480	0.000987		0.006413
	NW			0.003453	0.002467	0.000987	0.000493	0.007400
	NNW			0.001973	0.003453			0.005427

Table 5. Ross ISR 3rd Quarter Joint Frequency Distribution (continued)

Stability Class	Wind Direction	Wind Speed (nots) - 3rd Quarter 2010						
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	Row Total
D	N		0.001480	0.013814	0.030587	0.005427	0.002467	0.053774
	NNE	0.001492	0.002467	0.009373	0.017267	0.006907	0.003947	0.041453
	NE	0.000497	0.000987	0.004933	0.012333	0.002960		0.021711
	ENE		0.003453	0.007400	0.008387	0.001480		0.020720
	E		0.003947	0.003947	0.002960			0.010853
	ESE		0.001480	0.003453	0.000987			0.005920
	SE		0.004440	0.002960	0.003947	0.000493	0.000493	0.012333
	SSE	0.000497	0.007893	0.010360	0.028614	0.026147	0.001973	0.075485
	S	0.001989	0.012827	0.028614	0.055254	0.020720	0.004933	0.124338
	SSW	0.002984	0.013320	0.011840	0.009373	0.004440	0.003947	0.045905
	SW	0.001492	0.005920	0.002960	0.001480	0.001973	0.002960	0.016786
	WSW	0.000497	0.003947	0.005920	0.003947	0.000987	0.000493	0.015791
	W		0.001973	0.004440	0.006907			0.013320
	WNW		0.001480	0.003453	0.009867	0.004933	0.000493	0.020227
	NW		0.001973	0.005920	0.023680	0.003453	0.001973	0.037000
	NNW		0.000987	0.009867	0.019734	0.003453	0.000987	0.035027
E	N		0.001480	0.004933				0.006413
	NNE	0.000497	0.005427	0.013320				0.019244
	NE	0.000995	0.003453	0.007400				0.011848
	ENE		0.003947	0.003947				0.007893
	E	0.000497	0.002467	0.001973				0.004937
	ESE		0.000493	0.000987				0.001480
	SE	0.000497	0.000987	0.001480				0.002964
	SSE	0.002487	0.004933	0.004933				0.012354
	S	0.000995	0.005427	0.007400				0.013822
	SSW	0.001492	0.004440	0.001973				0.007905
	SW	0.000995	0.003453					0.004448
	WSW		0.001480	0.006413				0.007893
	W		0.000987	0.004440				0.005427
	WNW		0.001480	0.003453				0.004933
	NW		0.002960	0.008880				0.011840
	NNW		0.001480	0.004933				0.006413
F	N	0.000497	0.003453					0.003951
	NNE	0.000497	0.002467					0.002964
	NE	0.002487	0.001973					0.004460
	ENE	0.001989	0.003453					0.005443
	E	0.002487	0.002467					0.004953
	ESE	0.002487	0.002467					0.004953
	SE	0.003481	0.000493					0.003975
	SSE	0.002984	0.002960					0.005944
	S	0.002487	0.001973					0.004460
	SSW	0.002487	0.001973					0.004460
	SW		0.001973					0.001973
	WSW	0.000497	0.000987					0.001484
	W		0.001480					0.001480
	WNW	0.001492	0.000987					0.002479
	NW	0.000995	0.002960					0.003955
	NNW	0.001492	0.001480					0.002972

Table 6. Ross ISR 4th Quarter Joint Frequency Distribution
Source: IML (2010)

Stability Class	Wind Direction	Wind Speed (nots) - 4th Quarter 2010						Row Total
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	
A	N							
	NNE							
	NE	0.000955	0.000955					0.001910
	ENE	0.000955	0.000955					0.001910
	E		0.002865					0.002865
	ESE		0.001910					0.001910
	SE		0.001910					0.001910
	SSE	0.000955	0.001910					0.002865
	S	0.000955	0.000955	0.000955				0.002865
	SSW		0.003820	0.000955				0.004776
	SW	0.000955	0.001910					0.002865
	WSW		0.004776	0.000955				0.005731
	W		0.002865					0.002865
	WNW	0.000955		0.000955				0.001910
	NW			0.000955				0.000955
	NNW	0.000955	0.000955					0.001910
B	N							
	NNE							
	NE				0.000955			0.000955
	ENE	0.000955						0.000955
	E							
	ESE		0.000955					0.000955
	SE			0.000955				0.000955
	SSE		0.000955	0.000955				0.001910
	S	0.001910		0.001910				0.003820
	SSW	0.001910						0.001910
	SW			0.002865				0.002865
	WSW	0.000955		0.000955				0.001910
	W			0.004776				0.004776
	WNW			0.002865				0.002865
	NW		0.000955	0.003820				0.004776
	NNW							
C	N			0.000955	0.001910			0.002865
	NNE				0.002865			0.002865
	NE			0.000955				0.000955
	ENE			0.000955				0.000955
	E							
	ESE		0.000955					0.000955
	SE	0.000955						0.000955
	SSE		0.002865	0.002865	0.000955			0.006686
	S	0.001910	0.001910	0.003820				0.007641
	SSW			0.000955	0.001910			0.002865
	SW							
	WSW							
	W		0.002865					0.002865
	WNW			0.002865	0.001910			0.004776
	NW			0.003820	0.005731			0.009551
	NNW			0.000955	0.002865			0.003820

Table 6. Ross ISR 4th Quarter Joint Frequency Distribution (continued)

Stability Class	Wind Direction	Wind Speed (nots) - 4th Quarter 2010						
		3	3 - 6	6 - 10	10 - 16	16 - 21	21	Row Total
D	N	0.000955	0.000955	0.002865	0.010506	0.004776	0.001910	0.021968
	NNE	0.000955	0.002865	0.000955	0.004776			0.009551
	NE			0.003820	0.003820			0.007641
	ENE			0.000955	0.004776			0.005731
	E			0.000955				0.000955
	ESE		0.004776	0.000955				0.005731
	SE		0.001910	0.001910				0.003820
	SSE		0.011461	0.024833	0.028653	0.013372	0.009551	0.087870
	S	0.000955	0.037249	0.049666	0.057307	0.020057	0.004776	0.170010
	SSW	0.001910	0.024833	0.018147	0.019102	0.003820	0.006686	0.074499
	SW	0.000955	0.005731		0.008596	0.004776	0.005731	0.025788
	WSW	0.000955	0.000955	0.002865	0.005731			0.010506
	W			0.005731	0.022923		0.000955	0.029608
	WNW		0.000955	0.007641	0.032474	0.012416	0.010506	0.063992
	NW		0.002865	0.008596	0.037249	0.023878	0.016237	0.088825
	NNW		0.001910	0.004776	0.032474	0.005731		0.044890
E	N		0.000955	0.009551				0.010506
	NNE			0.002865				0.002865
	NE		0.000955	0.002865				0.003820
	ENE		0.000955					0.000955
	E							
	ESE	0.000955	0.000955					0.001910
	SE	0.000955		0.001910				0.002865
	SSE		0.003820	0.003820				0.007641
	S	0.000955	0.019102	0.017192				0.037249
	SSW	0.002865	0.010506	0.005731				0.019102
	SW	0.001910	0.003820					0.005731
	WSW		0.003820	0.012416				0.016237
	W		0.002865	0.015282				0.018147
	WNW	0.000955	0.003820	0.018147				0.022923
	NW		0.003820	0.012416				0.016237
	NNW	0.000955	0.003820	0.016237				0.021012
F	N	0.000955	0.001910					0.002865
	NNE	0.000955						0.000955
	NE	0.000955						0.000955
	ENE		0.002865					0.002865
	E	0.001910						0.001910
	ESE	0.001910	0.000955					0.002865
	SE	0.000955	0.001910					0.002865
	SSE	0.000955	0.002865					0.003820
	S	0.003820	0.003820					0.007641
	SSW	0.003820	0.001910					0.005731
	SW		0.001910					0.001910
	WSW	0.000955	0.000955					0.001910
	W	0.000955	0.002865					0.003820
	WNW	0.000955	0.001910					0.002865
	NW		0.002865					0.002865
	NNW	0.001910						0.001910

Ross ISR

Meteorological Data Summary

1/5/2010 - 11/13/2010

Hourly Data

	Average/Total	Max	Min
Wind Speed (mph)	11.5	45.6	0.5
Sigma-Theta (°)	11.9	74.0	0.5
Temperature (F)	48.7	98.0	-15.9
Relative Humidity (%)	63.9	99.7	7.0
Precipitation (in)	9.78	0.29	

Predominant wind direction was from the S sector,
accounting for 19.6% of the possible winds

Data Recovery

Parameter	Possible (hours)	Reported (hours)	Recovery
Wind Speed	7486	7135	95.31%
Wind Direction	7486	7135	95.31%
Sigma-Theta	7486	7135	95.31%
Temperature	7486	7314	97.70%
Relative Humidity	7486	7314	97.70%
Precipitation	7486	7314	97.70%

Figure 1. Ross ISR Meteorological Summary for 2010
Source: IML (2010)

Gillette Airport

Meteorological Data Summary

1/5/2010 - 11/13/2010

Hourly Data

	Average/Total	Max	Min
Wind Speed (mph)	9.9	41.0	0.0
Sigma-Theta (°)	9.6	10.0	0.3
Temperature (F)	49.5	98.0	-8.0
Relative Humidity (%)	60.4	100.0	8.0
Precipitation (in)	12.79	0.78	
Bar. Pressure (in Hg)	25.5	26.1	24.8

Predominant wind direction was from the N sector,
accounting for 20.2% of the possible winds

Data Recovery

Parameter	Possible (hours)	Reported (hours)	Recovery
Wind Speed	7486	7467	99.75%
Wind Direction	7486	7467	99.75%
Sigma-Theta	7486	7470	99.79%
Temperature	7486	7471	99.80%
Relative Humidity	7486	7461	99.67%
Precipitation	7486	7476	99.87%
Bar. Pressure	7486	7476	99.87%

Figure 2. 2010 Gillette AP Meteorological Summary
Sources: IML (2010), WRCC (2010)

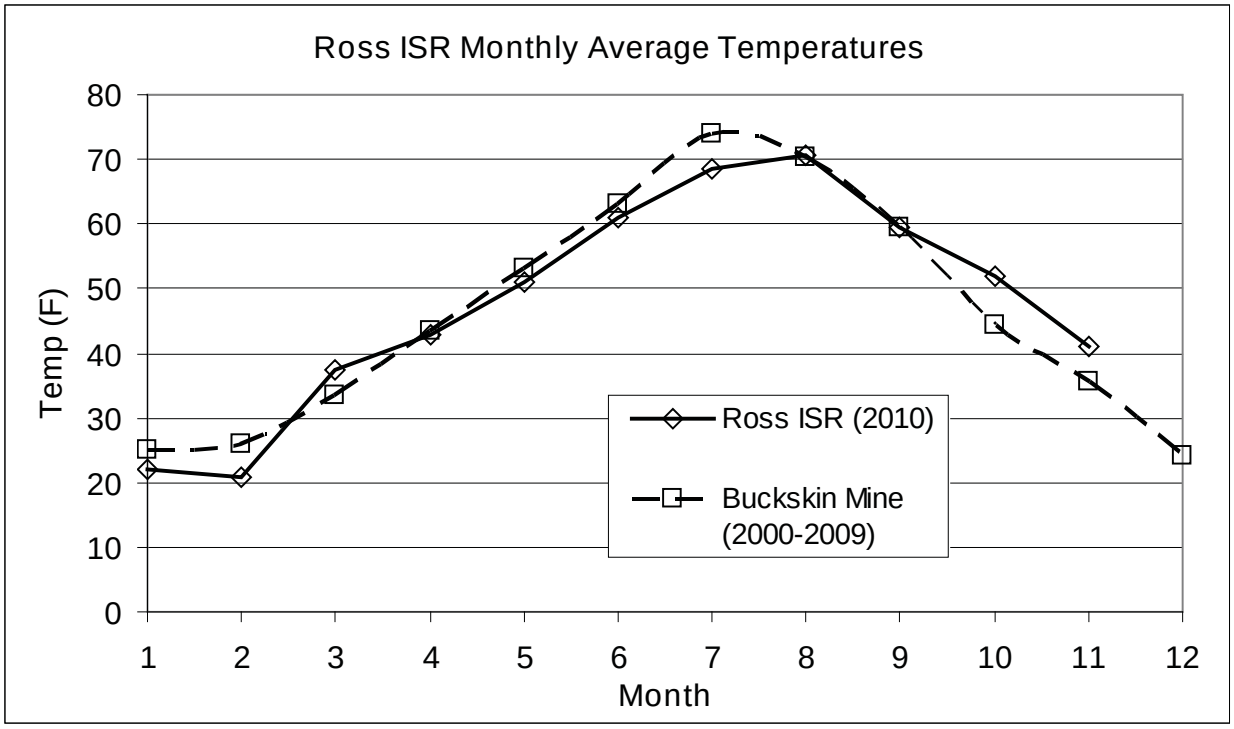

Figure 3. Ross ISR (Oshoto) Monthly Average Temperatures
Sources: IML (2009), IML (2010)

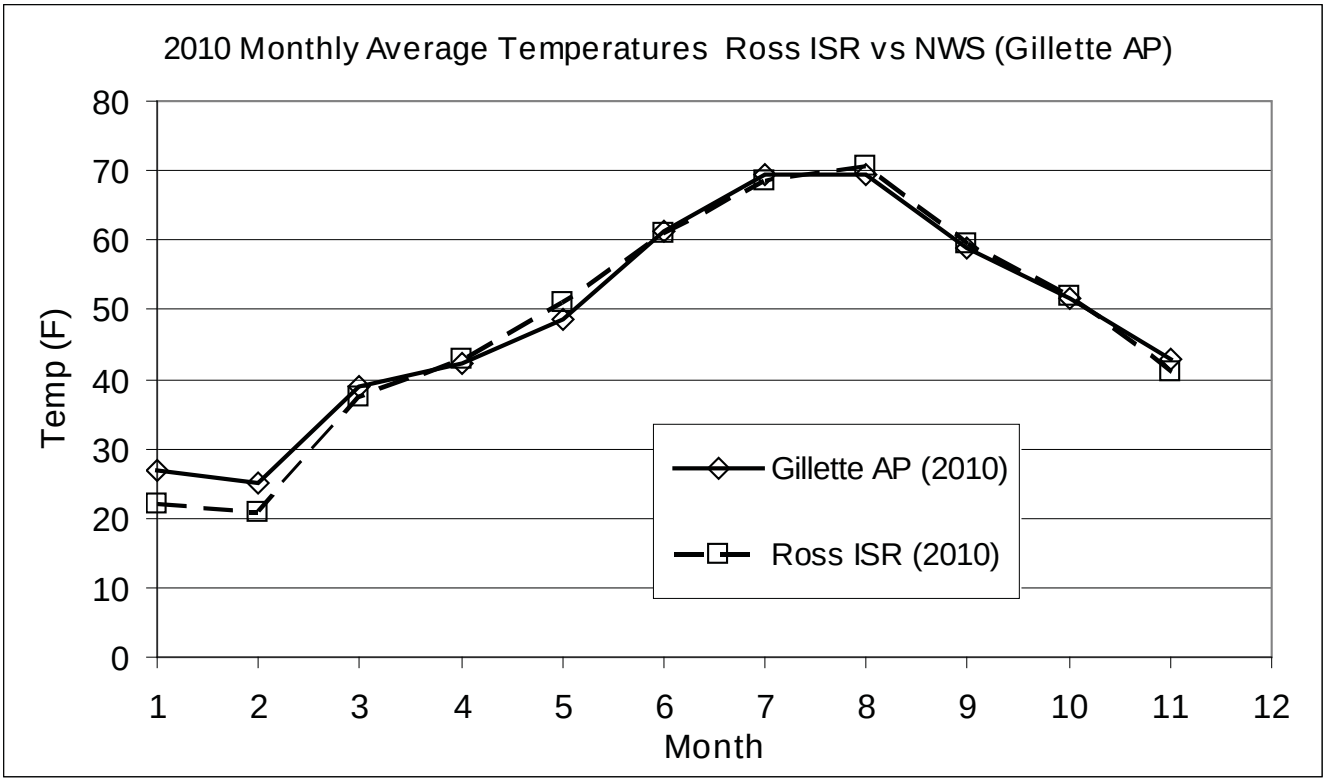

Figure 4. 2010 Average Monthly Temperatures: Ross ISR vs. Gillette AP
Sources: IML (2010), WRCC (2010)

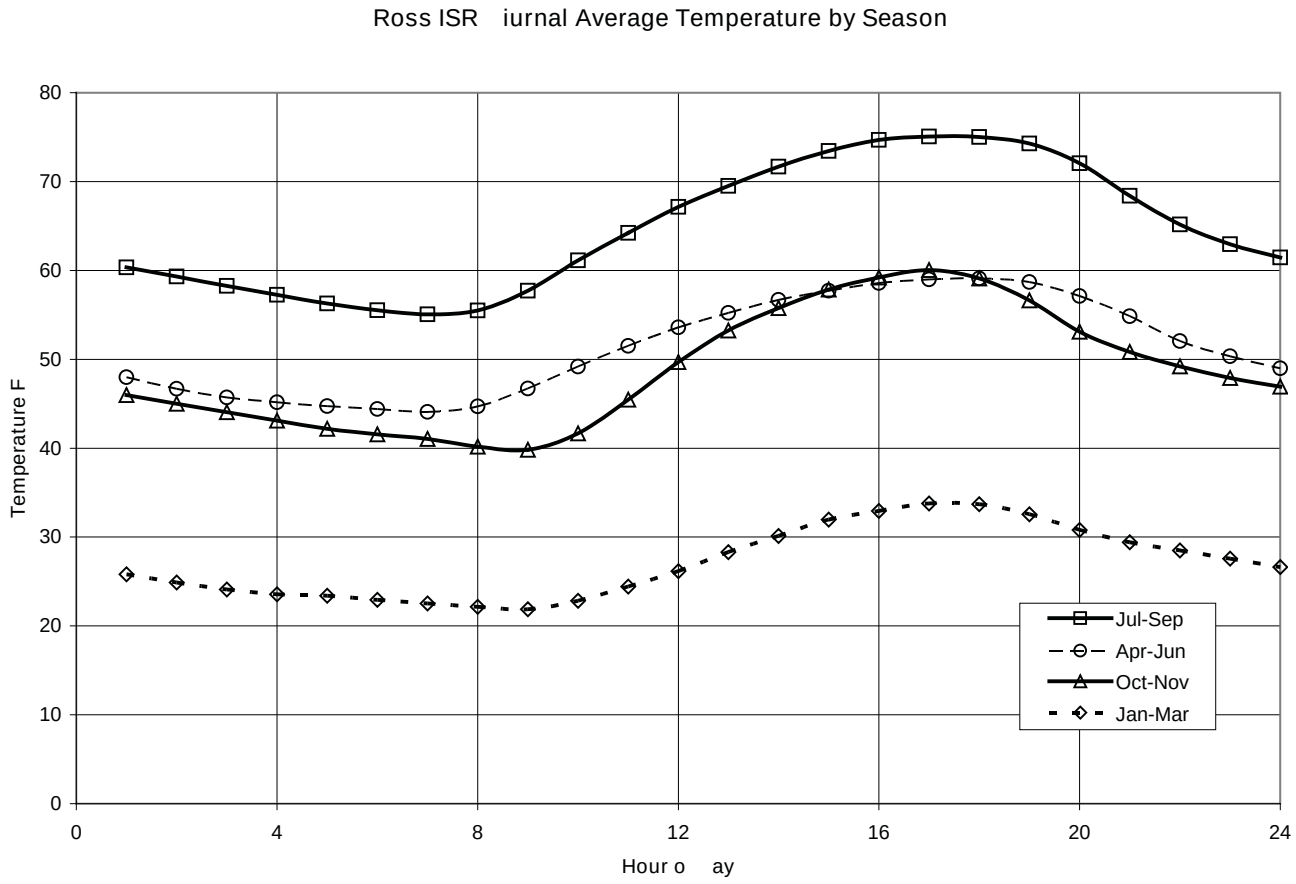

Figure 5. Ross ISR Diurnal Average Temperatures
Source: IML (2010)

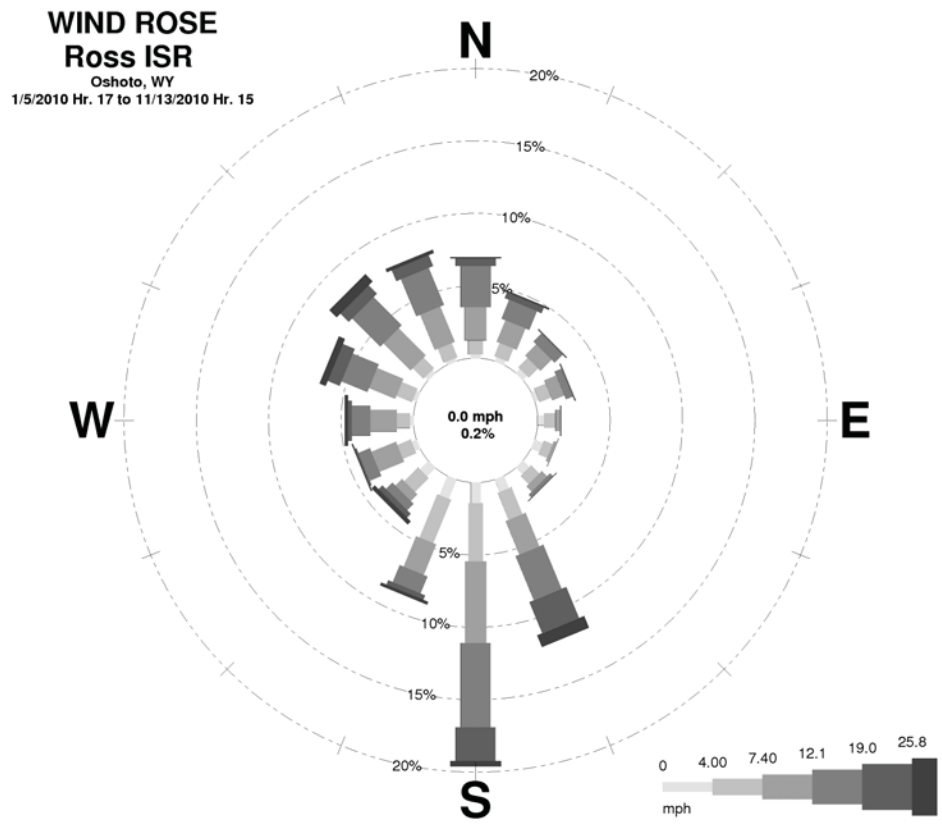

Figure 6. Ross ISR Project Wind Rose
Source: IML (2010)

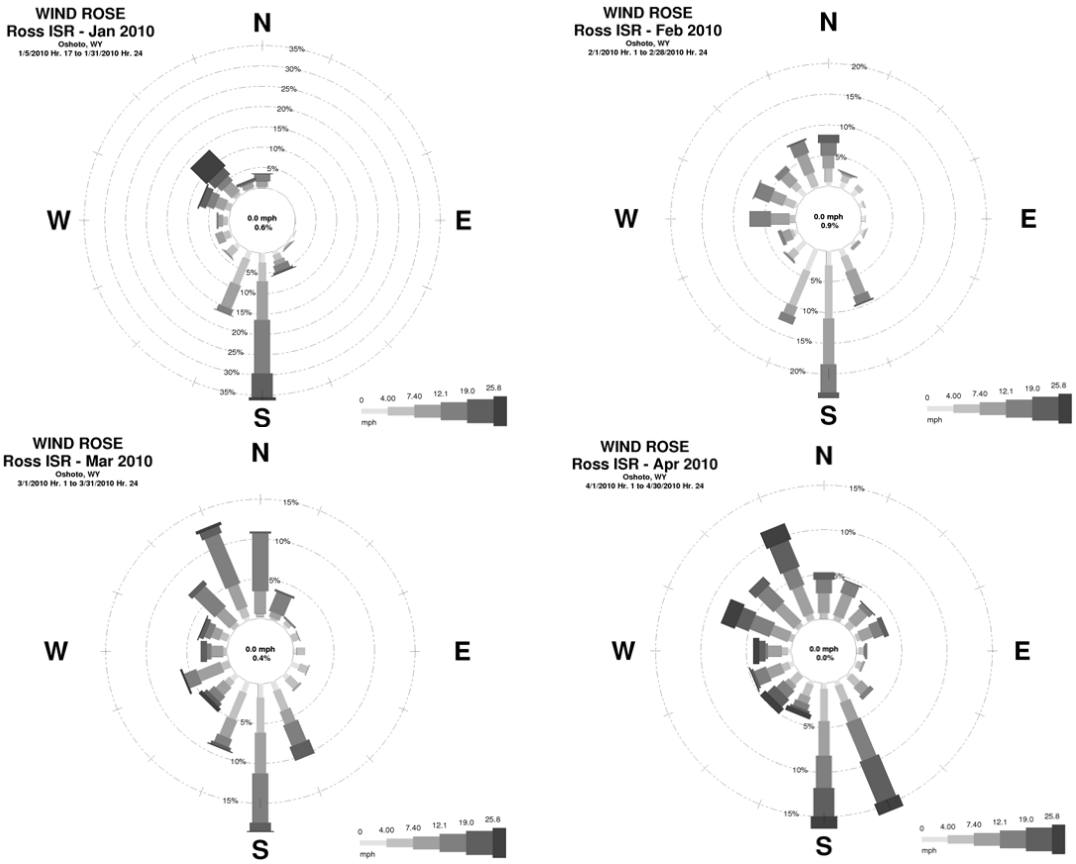

Figure 7. Ross ISR Monthly Wind Roses: January – April
Source: IML (2010)

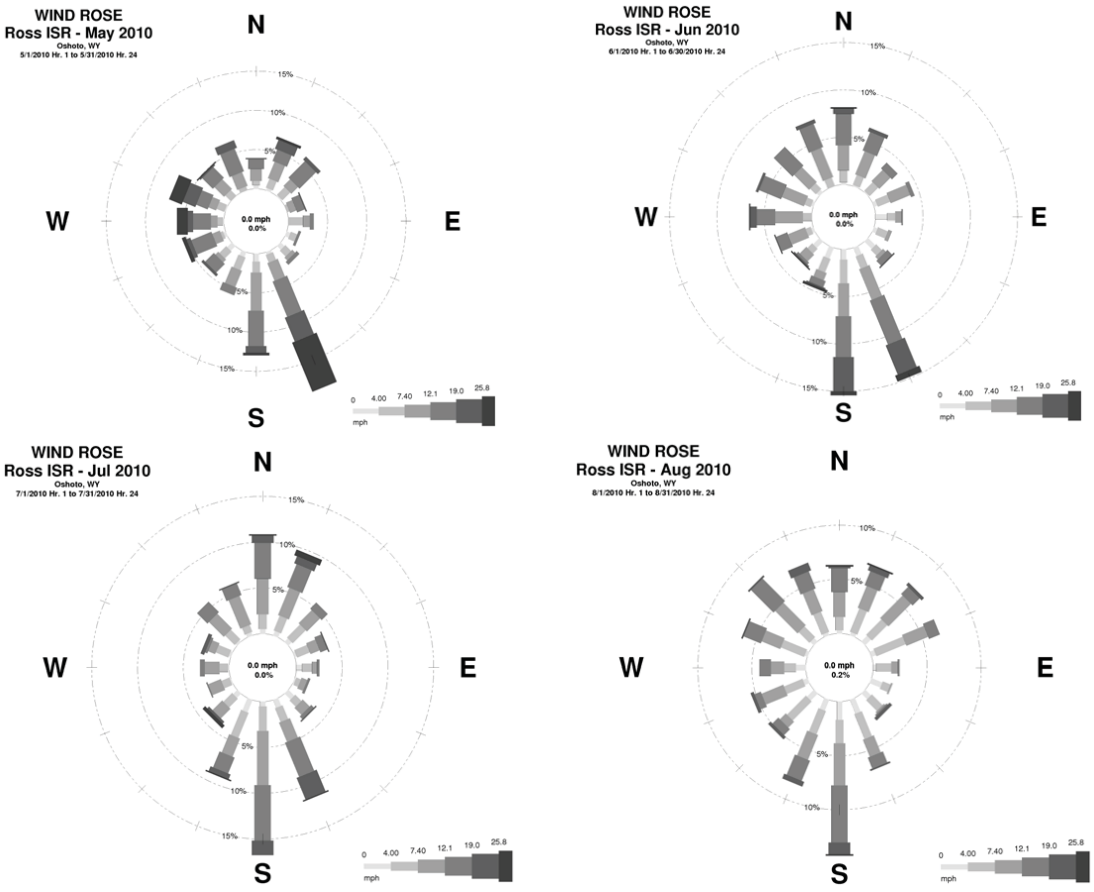

Figure 8. Ross ISR Monthly Wind Roses: May – August
Source: IML (2010)

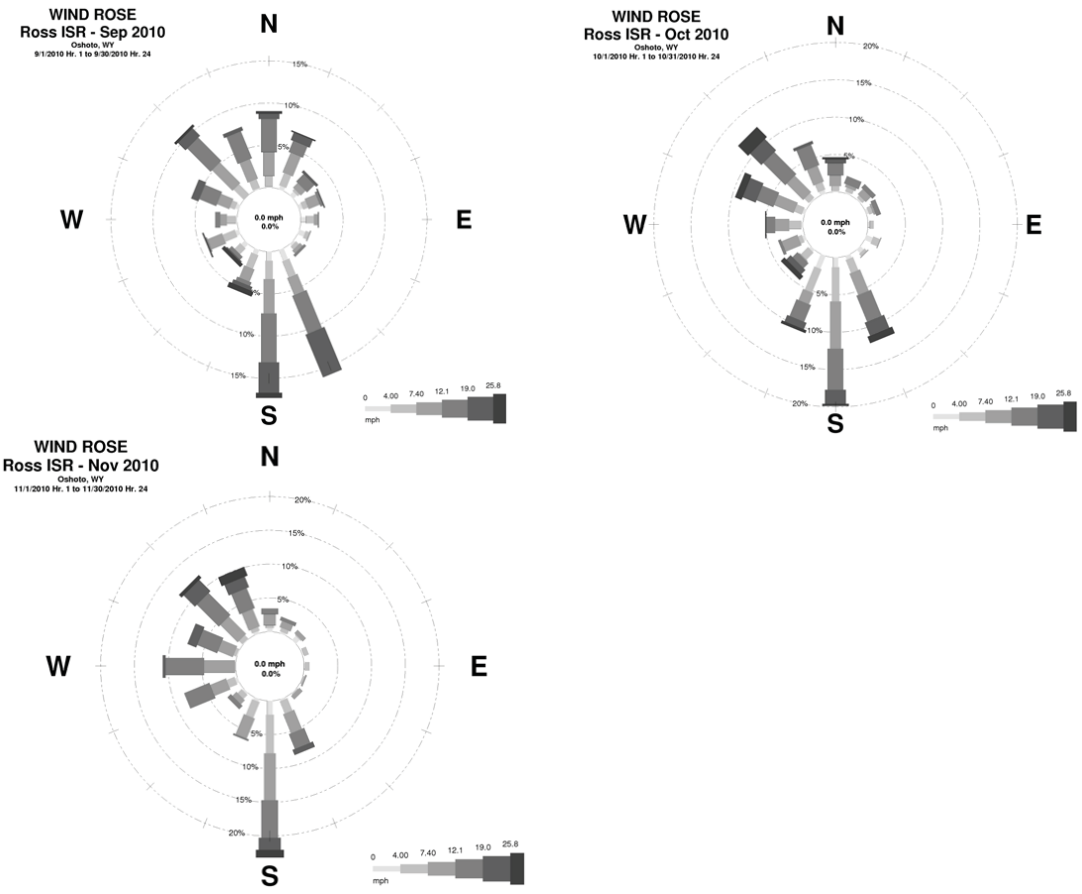

Figure 9. Ross ISR Monthly Wind Roses: September – December
Source: IML (2010)

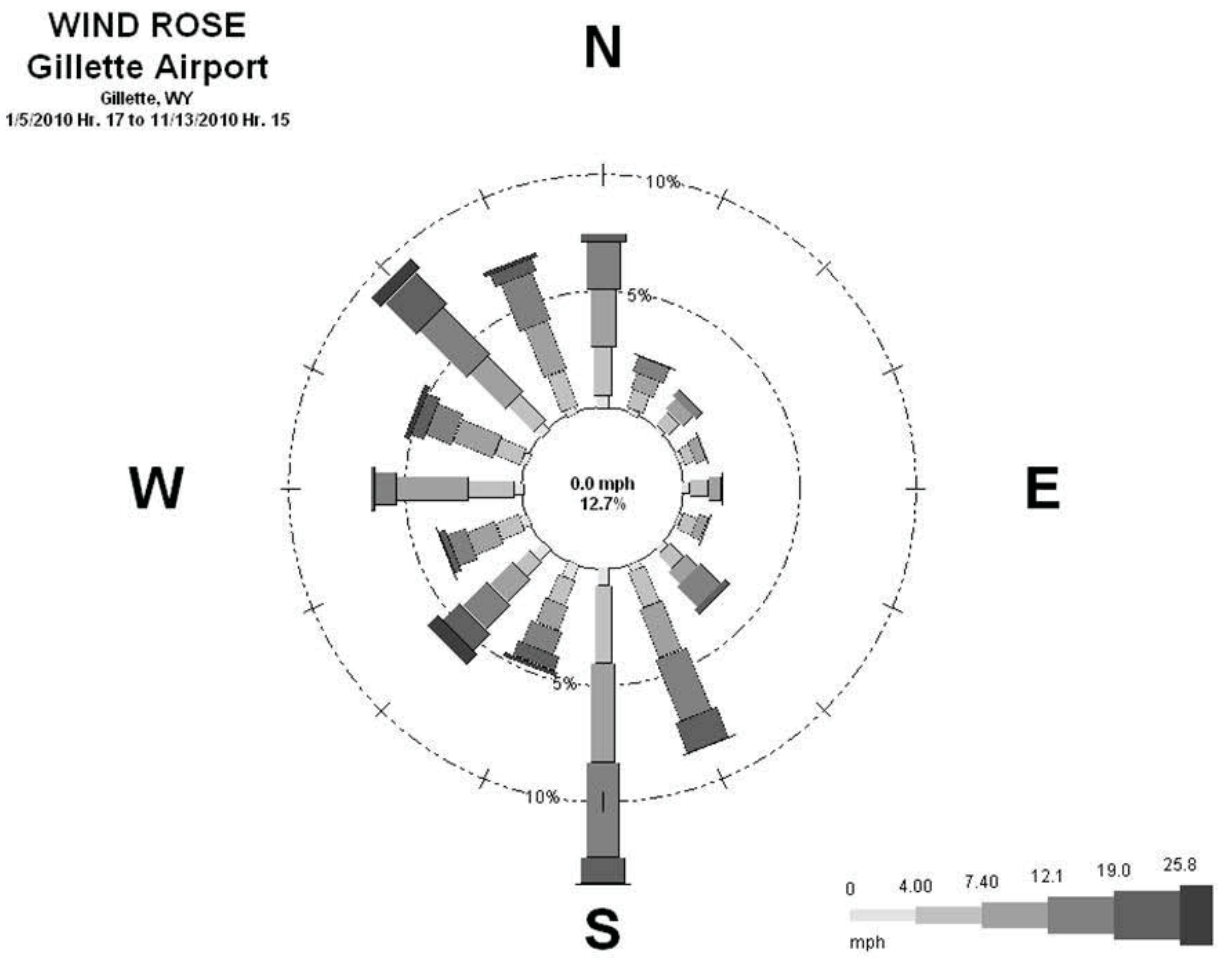

Figure 10. 2010 Gillette AP Wind Rose
Sources: IML (2010), WRCC (2010)

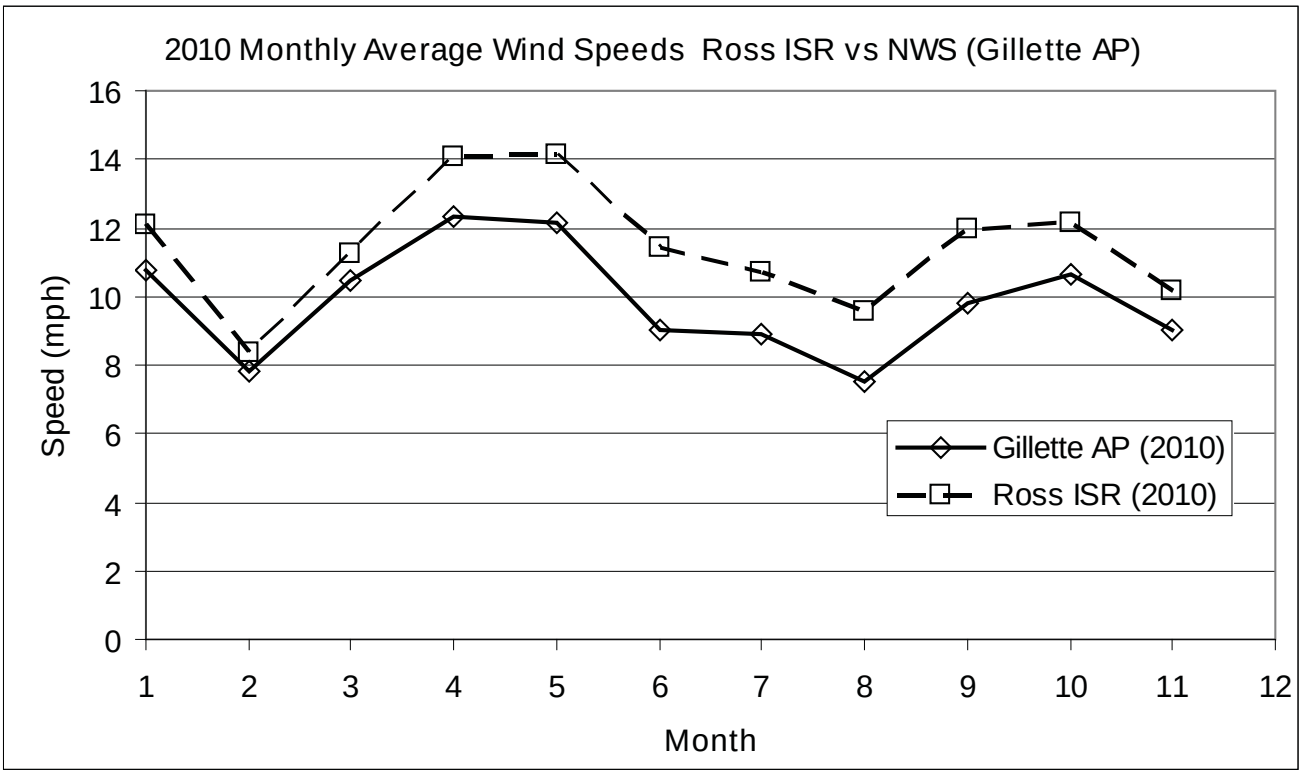

Figure 11. 2010 Average Monthly Wind Speeds: Ross ISR vs. Gillette AP
Sources: IML (2010), WRCC (2010)

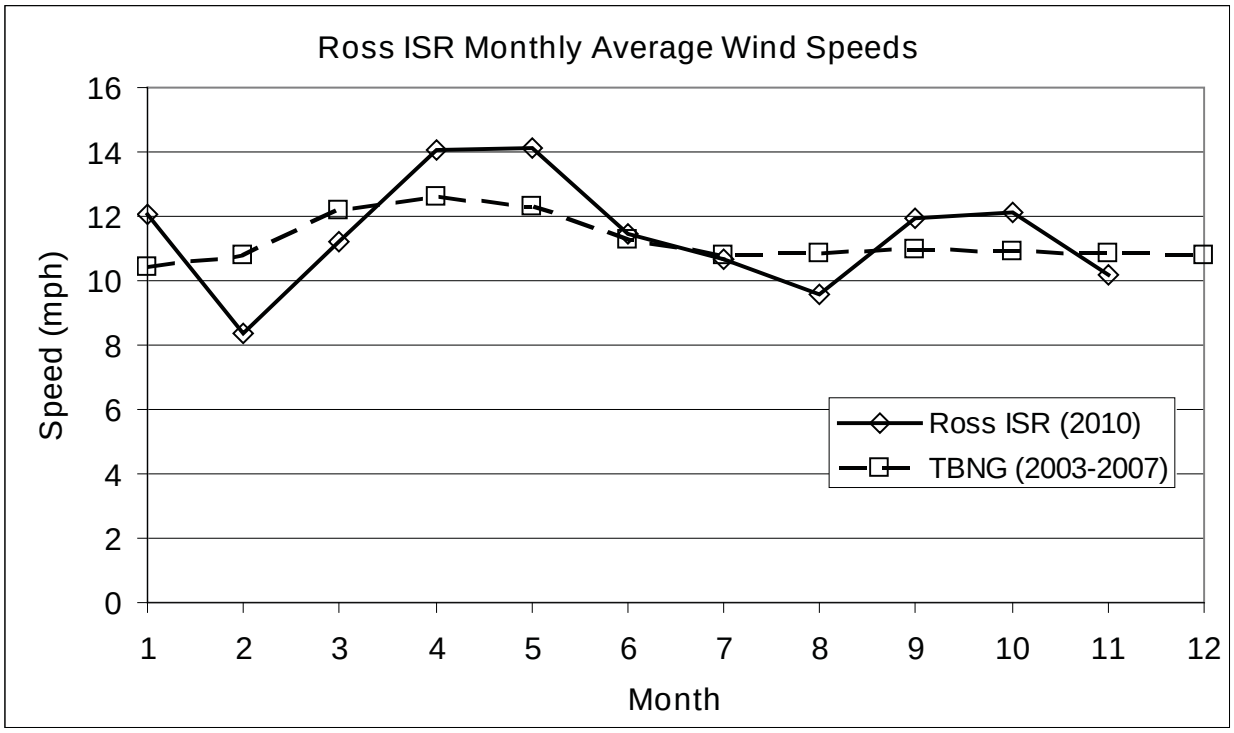

Figure 12. Project Area Monthly Average Wind Speeds
Sources: IML (2010b), WDEQ/AQD (2010)

Ross ISR

Wind Data Summary

1/5/2010 5:00:00 PM - 11/13/2010 3:00:00 PM

Hourly Data

	Average	Max	Min
Wind Speed (mph)	11.51	45.63	0.51
Sigma Theta (º)	11.93	73.99	0.47
Wind Direction			
N	12.22	33.04	2.00
NNE	11.36	31.68	0.79
NE	9.22	22.45	0.68
ENE	9.05	24.93	0.94
E	6.22	18.25	0.54
ESE	5.17	17.13	0.73
SE	7.28	25.60	1.41
SSE	13.86	35.96	0.98
S	11.79	33.36	0.51
SSW	8.60	42.43	0.95
SW	10.49	45.63	0.53
WSW	10.03	34.08	1.19
W	11.52	38.01	1.37
WNW	13.30	34.23	0.55
NW	13.79	35.17	1.26
NNW	12.85	40.06	1.18

Predominant wind direction was from the S sector, accounting for 19.6% of the winds, the average wind direction was 223 .

Data Recovery

	Possible (hours)	Reported (hours)	Recovery
Wind Speed	7510	7144	95.13%
Sigma Theta	7510	7144	95.13%
Wind Direction	7510	7144	95.13%

Figure 13. Ross ISR Wind Summary
Source: IML (2010)

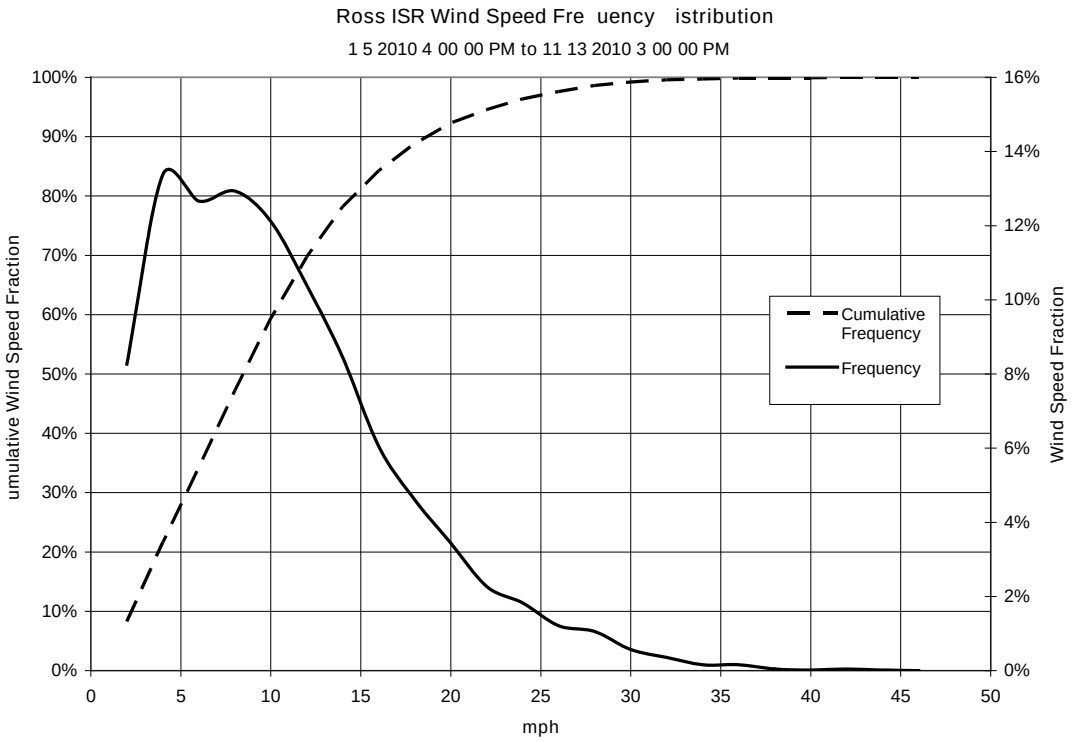

Figure 14. Ross ISR Wind Speed Frequency Distribution
Source: IML (2010)

Ross ISR 1st Quarter

Wind Data Summary

1/5/2010 5:00:00 PM - 3/31/2010

Hourly Data

	Average	Max	Min
Wind Speed (mph)	10.55	43.19	0.51
Sigma Theta (º)	10.02	61.91	1.89
Wind Direction			
N	12.58	23.79	2.47
NNE	10.29	20.50	0.79
NE	4.68	15.95	0.68
ENE	4.29	9.62	0.94
E	3.89	7.22	0.54
ESE	3.97	8.84	0.73
SE	5.67	12.13	2.05
SSE	10.23	27.13	0.98
S	11.14	29.67	0.51
SSW	7.05	26.02	1.10
SW	8.36	43.19	0.53
WSW	9.52	28.31	1.19
W	11.11	24.90	1.48
WNW	11.88	32.76	0.55
NW	15.34	35.17	1.26
NNW	12.16	29.17	2.36

Predominant wind direction was from the S sector, accounting for 25.9% of the winds, the average wind direction was 222 .

Data Recovery

	Possible (hours)	Reported (hours)	Recovery
Wind Speed	2047	2046	99.95%
Sigma Theta	2047	2046	99.95%
Wind Direction	2047	2046	99.95%

Figure 15. Ross ISR 1st Quarter Wind Summary
Source: IML (2010)

Ross ISR 2nd Quarter

Wind Data Summary

4/1/2010 - 6/30/2010

Hourly Data

	Average	Max	Min
Wind Speed (mph)	13.17	45.63	1.36
Sigma Theta (º)	11.33	67.89	2.25
Wind Direction			
N	11.94	28.51	2.00
NNE	11.60	27.27	2.31
NE	10.51	22.37	3.10
ENE	10.50	24.93	1.51
E	6.82	18.25	2.00
ESE	5.85	17.13	1.58
SE	8.08	23.87	2.63
SSE	17.18	35.96	1.64
S	13.19	33.36	1.83
SSW	9.99	42.43	2.68
SW	12.56	45.63	1.73
WSW	12.34	34.08	1.36
W	14.42	38.01	1.37
WNW	15.69	34.23	2.97
NW	12.37	29.94	3.48
NNW	15.12	40.06	2.75

Predominant wind direction was from the SSE sector, accounting for 16.3% of the winds, the average wind direction was 217 .

Data Recovery

	Possible (hours)	Reported (hours)	Recovery
Wind Speed	2184	2015	92.26%
Sigma Theta	2184	2015	92.26%
Wind Direction	2184	2015	92.26%

Figure 16. Ross ISR 2nd Quarter Wind Summary
Source: IML (2010)

Ross ISR 3rd Quarter

Wind Data Summary

7/1/2010 - 9/30/2010

Hourly Data

	Average	Max	Min
Wind Speed (mph)	10.82	37.90	0.95
Sigma Theta (º)	15.16	73.99	0.47
Wind Direction			
N	11.97	33.04	2.68
NNE	11.61	31.68	2.44
NE	9.20	22.45	1.48
ENE	8.69	23.86	1.41
E	6.67	16.71	1.40
ESE	5.79	14.33	1.32
SE	7.81	25.60	1.41
SSE	12.64	27.04	1.97
S	12.53	30.65	1.60
SSW	9.77	37.90	0.95
SW	9.62	36.03	1.36
WSW	8.64	28.70	2.52
W	8.59	17.16	3.00
WNW	10.87	24.97	2.03
NW	11.66	26.98	2.71
NNW	11.11	24.34	1.18

Predominant wind direction was from the S sector, accounting for 16.2% of the winds, the average wind direction was 222 .

Data Recovery

	Possible (hours)	Reported (hours)	Recovery
Wind Speed	2208	2027	91.80%
Sigma Theta	2208	2027	91.80%
Wind Direction	2208	2027	91.80%

Figure 17. Ross ISR 3rd Quarter Wind Summary
Source: IML (2010)

Ross ISR 4th Quarter

Wind Data Summary

10/1/2010 - 11/13/2010 3:00:00 PM

Hourly Data

	Average	Max	Min
Wind Speed (mph)	11.55	32.63	1.29
Sigma Theta (º)	10.54	56.17	1.59
Wind Direction			
N	12.79	27.90	3.18
NNE	10.26	17.38	1.56
NE	9.38	16.26	2.51
ENE	9.23	16.11	3.29
E	4.60	6.92	2.26
ESE	4.62	10.01	1.59
SE	5.49	9.66	3.16
SSE	12.44	28.47	2.10
S	10.45	31.04	1.29
SSW	9.33	28.09	2.35
SW	12.55	29.99	1.83
WSW	8.42	16.24	1.98
W	10.16	28.34	3.28
WNW	14.03	29.36	3.19
NW	15.64	32.63	3.49
NNW	12.40	23.33	1.92

Predominant wind direction was from the S sector, accounting for 22.7% of the winds, the average wind direction was 231 .

Data Recovery

	Possible (hours)	Reported (hours)	Recovery
Wind Speed	1071	1056	98.60%
Sigma Theta	1071	1056	98.60%
Wind Direction	1071	1056	98.60%

Figure 18. Ross ISR 4th Quarter Wind Summary
Source: IML (2010)

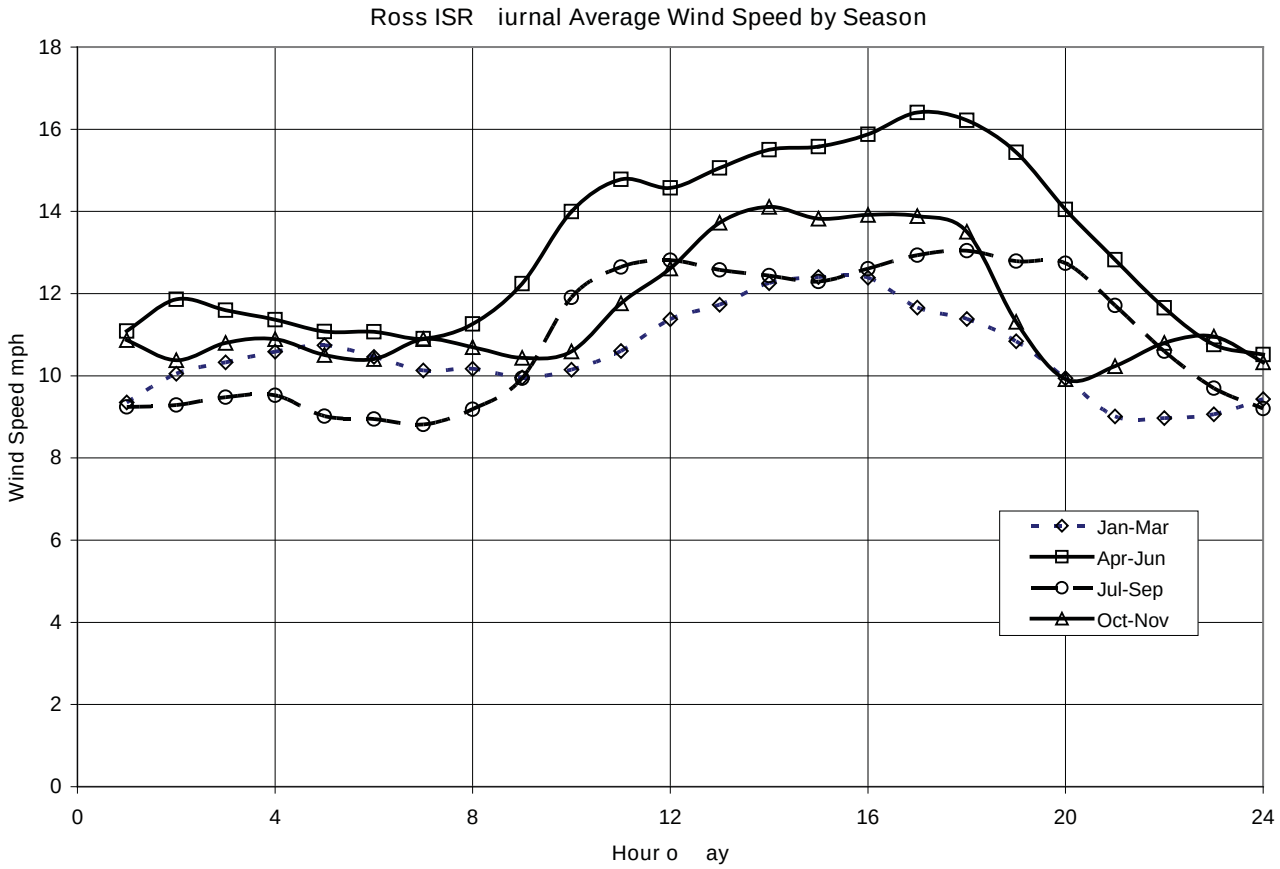

Figure 19. Ross ISR (Oshoto) Diurnal Average Wind Speeds
Source: IML (2010)

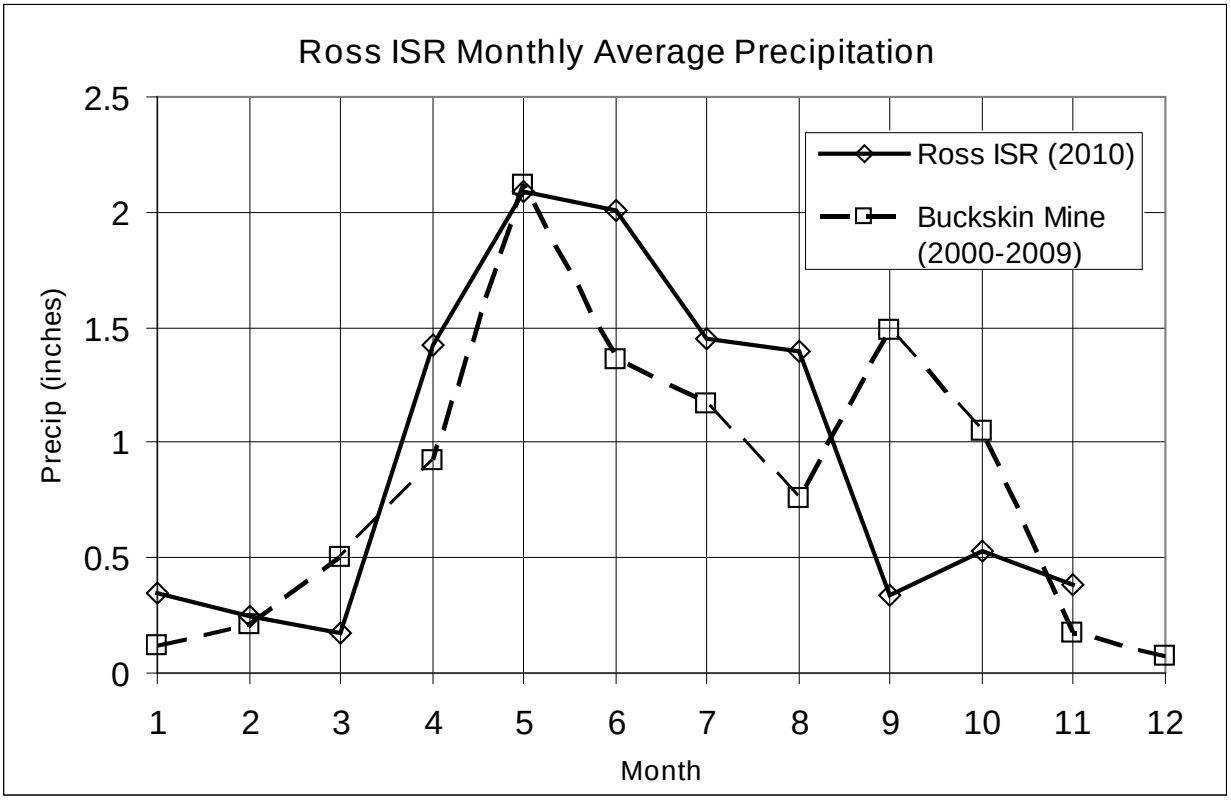

Figure 20. Ross ISR Monthly Precipitation
Sources: IML (2009a), IML (2010)

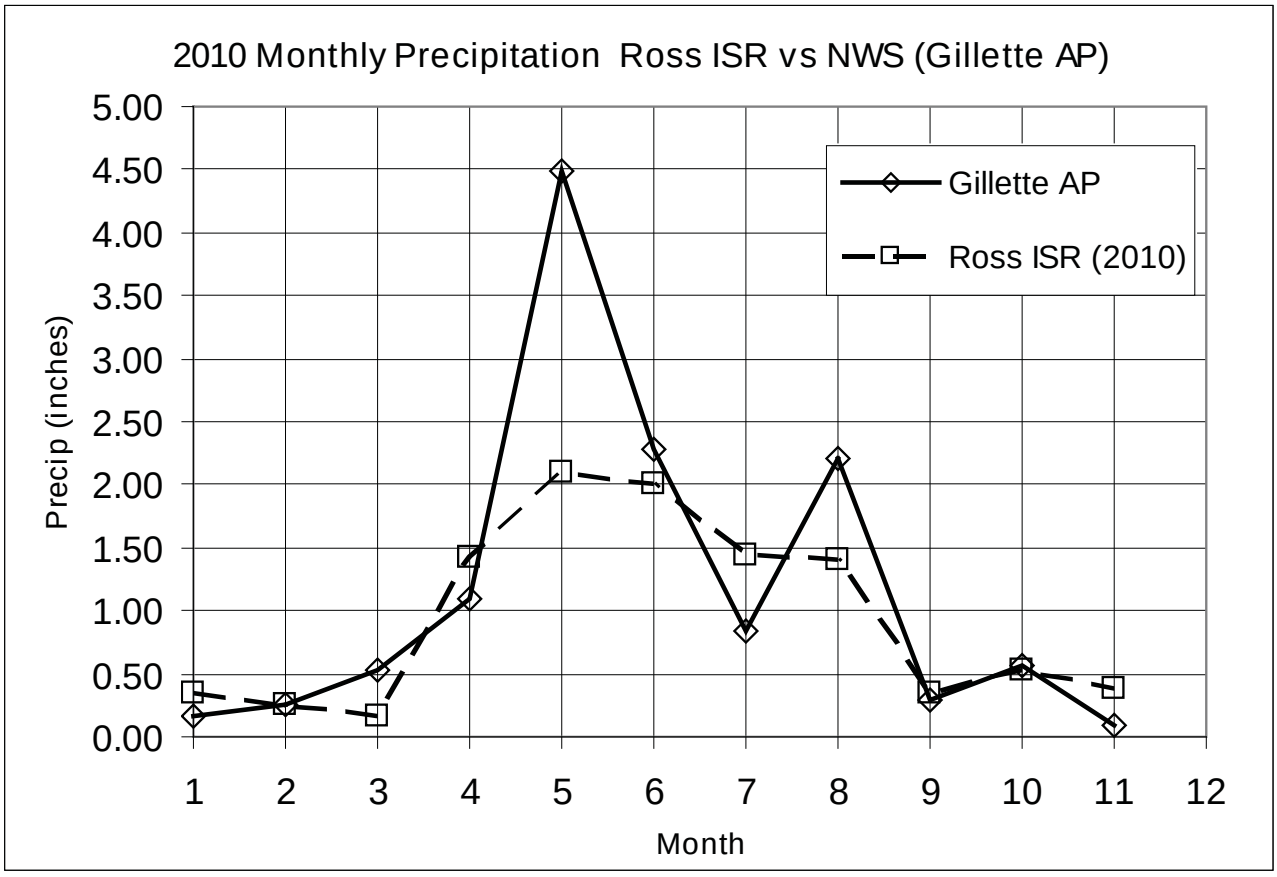

Figure 21. 2010 Monthly Precipitation: Ross ISR vs. Gillette AP
Sources: IML (2010), WRCC (2010)

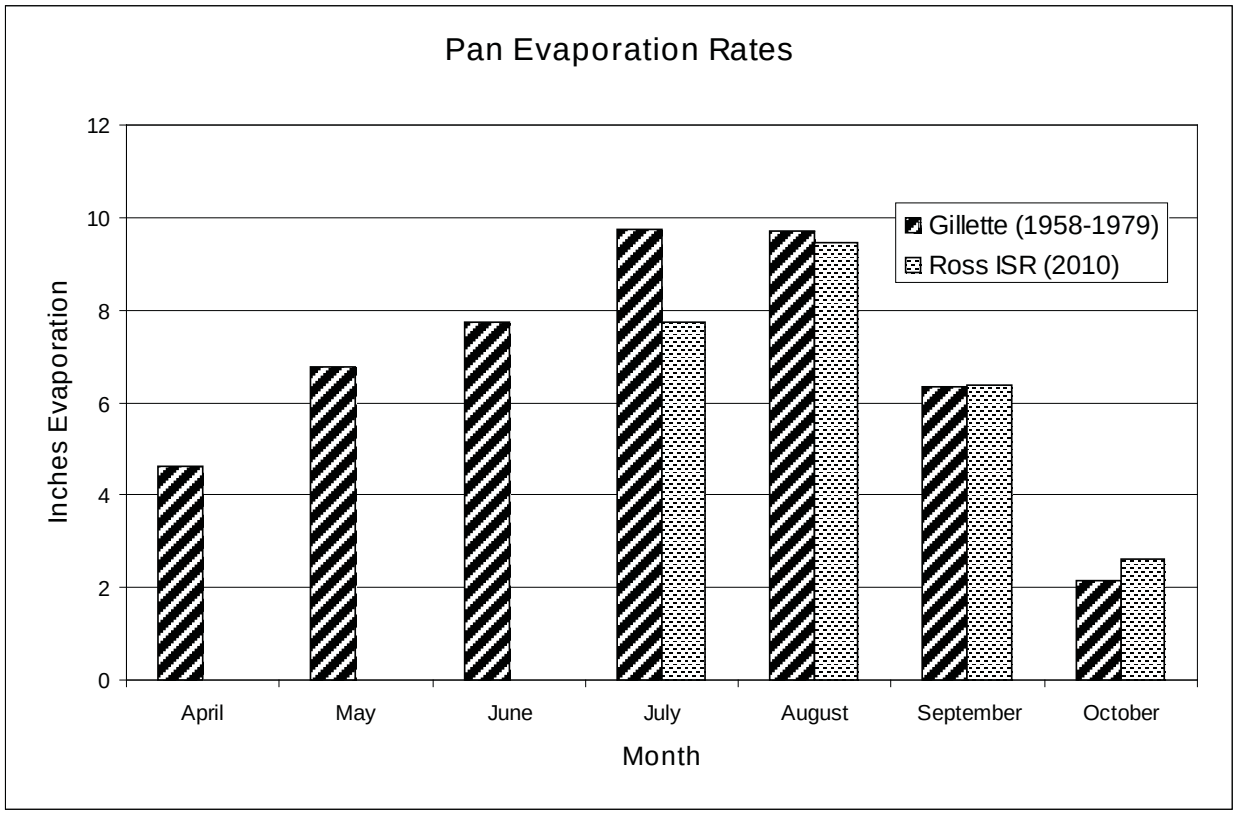

Figure 22. Ross ISR Monthly Evaporation
Sources: IML (2010), Martner (1986)

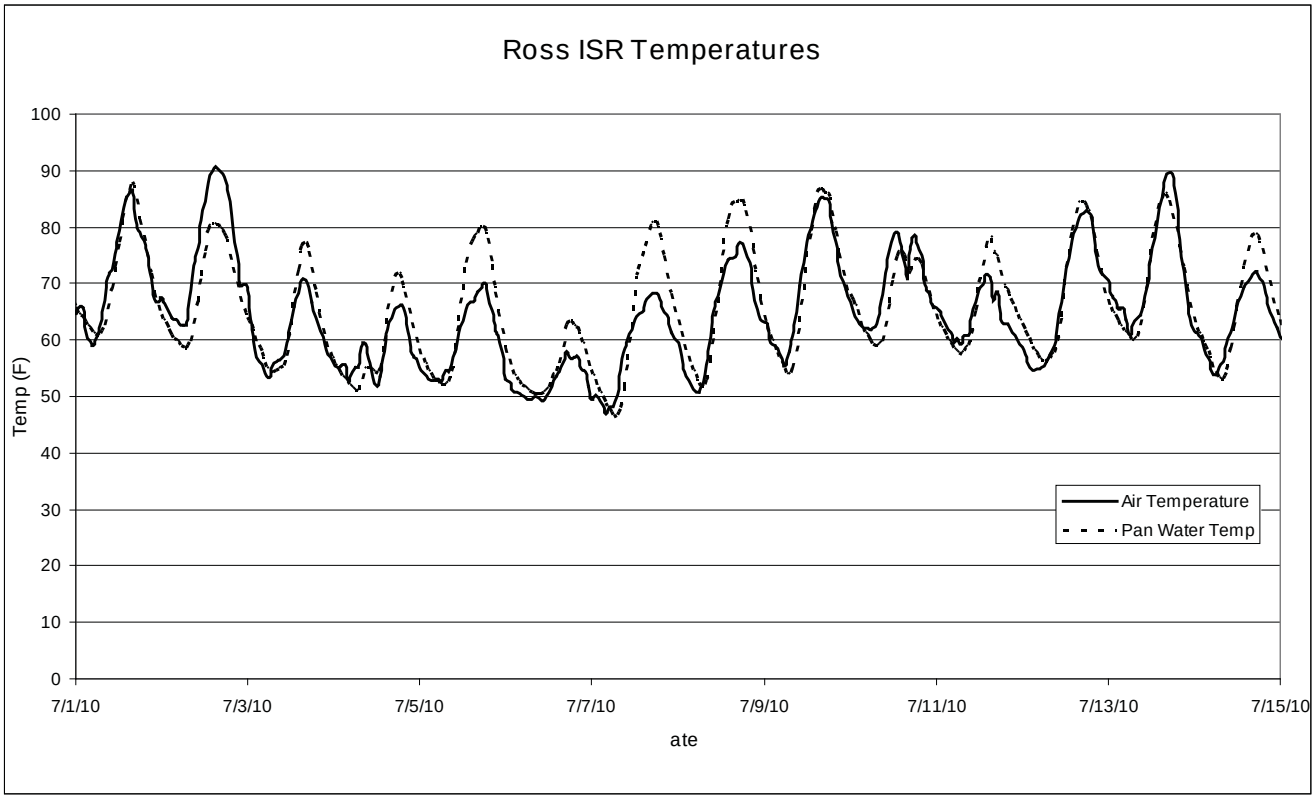

Figure 23. Ross ISR Typical Evaporation Pan Water Temperature Correlation
Source: IML (2010)

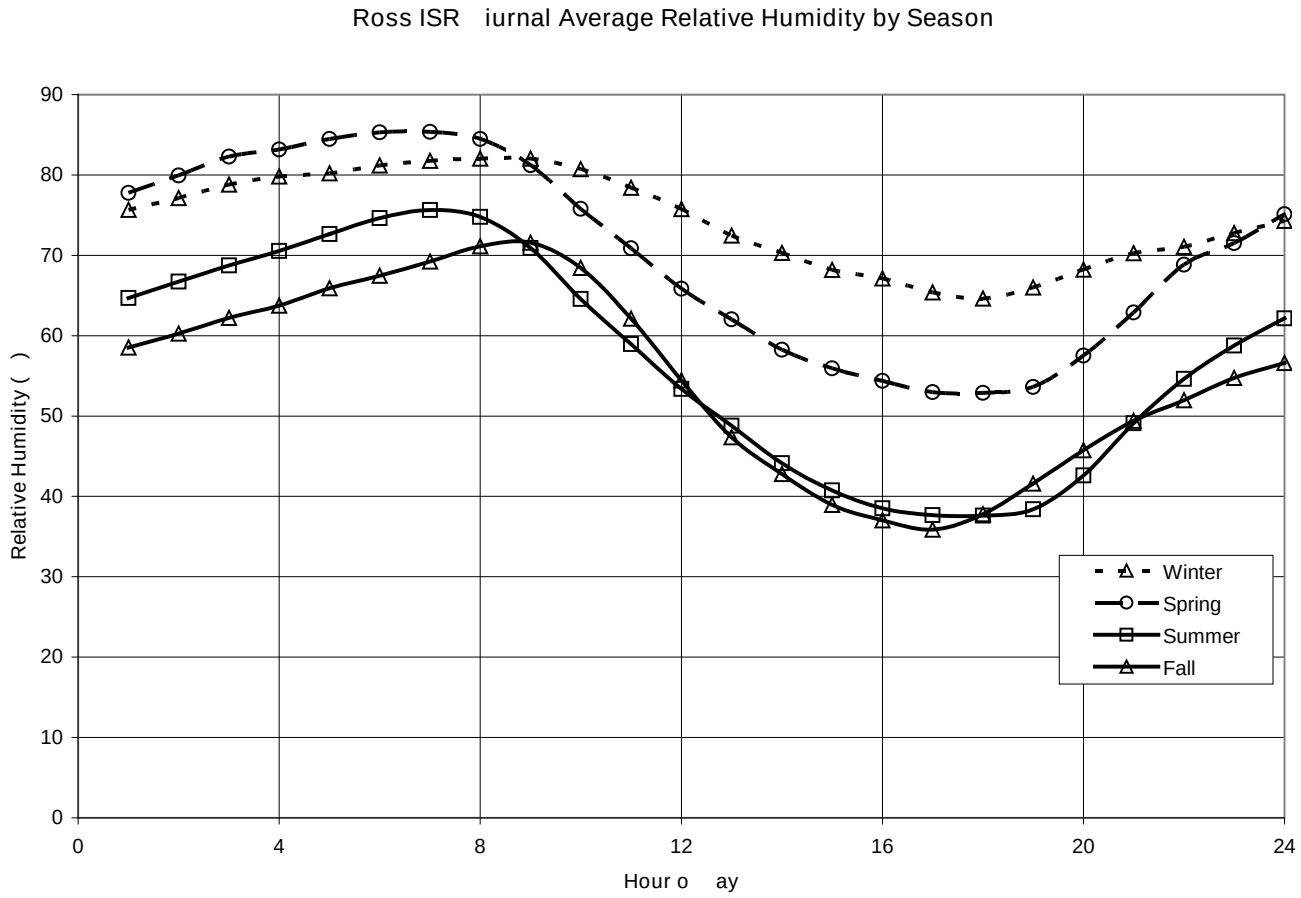

Figure 24. Ross ISR Diurnal Average Relative Humidity
Source: IML (2010)

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_____, 2009, Northern Powder River Basin Mine Meteorological Database (1986-2009).

Martner, B.E., 1986, Wyoming Climate Atlas, University of Nebraska Press, Lincoln, NE.

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ADDENDUM 3.7-A

NOISE STUDY RESULTS

Ross ISR Project
Results of Noise Study at N-1 Residence

Direction	Date	Time	Avg. Noise Level (dBA)	Max. Noise Level (dBA)	Min. Noise Level (dBA)	Wind Speed (mph)	Wind Direc-tion (°)	Air Temp. (°F)
North	2/15/2010	10:23 AM	31.1	37.7	27.7	4.5	211.6	10.7
	2/15/2010	10:23 AM	30.1	32.9	27.5			
	2/15/2010	10:24 AM	29.6	32.3	27.0			
	2/15/2010	10:24 AM	29.4	32.3	27.1			
	2/15/2010	10:25 AM	29.0	32.1	27.1			
	2/15/2010	10:25 AM	28.2	30.5	26.9			
	Avg., max. or min.		**29.6**	**37.7**	**26.9**			
South	2/15/2010	10:28 AM	28.4	31.4	27.5	4.5	211.6	10.7
	2/15/2010	10:28 AM	29.1	30.0	28.3			
	2/15/2010	10:29 AM	29.4	30.5	28.2			
	2/15/2010	10:29 AM	28.1	29.3	27.4			
	2/15/2010	10:30 AM	29.2	30.7	27.9			
	2/15/2010	10:30 AM	29.1	30.9	27.9			
	Avg., max. or min.		**28.9**	**31.4**	**27.4**			
East	2/15/2010	10:32 AM	65.9	72.1	49.6	4.5	211.6	10.7
	2/15/2010	10:33 AM	60.4	71.4	37.8			
	2/15/2010	10:33 AM	40.0	42.5	36.7			
	2/15/2010	10:34 AM	39.8	41.9	37.7			
	2/15/2010	10:34 AM	40.6	42.4	38.3			
	2/15/2010	10:35 AM	40.3	42.6	36.5			
	Avg., max. or min.		**47.8**	**72.1**	**36.5**			
West	2/15/2010	10:46 AM	37.2	51.3	26.9	4.5	211.6	10.7
	2/15/2010	10:47 AM	27.1	28.4	26.7			
	2/15/2010	10:47 AM	29.7	32.3	27.6			
	2/15/2010	10:48 AM	27.8	29.0	27.3			
	2/15/2010	10:48 AM	52.8	61.0	29.0			
	2/15/2010	10:49 AM	38.3	45.0	28.0			
	Avg., max. or min.		**35.5**	**61.0**	**26.7**			
Overall Average (dBA)			**35.4**	**50.6**	**29.4**			
Overall Range (dBA)				**72.1**	**26.7**			

Notes:

1) Measurements were recorded near the N-1 (Strong) residence facing each of the four cardinal directions. Refer to ER Figure 3.7-2 for measurement locations.

2) Climatological data were obtained from the Ross ISR MET station.

3) Wind direction: 0° is N, 90° is E, 180° is S and 270° is W.

4) Measurements were recorded with a Quest SoundPro DL-2 handheld sound level meter.

5) The duration of each measurement was 30 seconds.

Ross ISR Project
Results of Noise Study at N-2 Residence

Direction	Date	Time	Avg. Noise Level (dBA)	Max. Noise Level (dBA)	Min. Noise Level (dBA)	Wind Speed (mph)	Wind Direc-tion (°)	Air Temp. (°F)
North	2/15/2010	11:17 AM	40.5	54.7	27.3	3.2	170.9	7.7
	2/15/2010	11:18 AM	27.5	29.1	26.9			
	2/15/2010	11:18 AM	37.5	45.1	27.0			
	2/15/2010	11:19 AM	41.0	46.4	30.9			
	2/15/2010	11:19 AM	36.3	44.8	27.2			
	2/15/2010	11:20 AM	37.3	46.8	27.5			
	Avg., max. or min.		**36.7**	**54.7**	**26.9**			
South	2/15/2010	11:22 AM	33.2	45.6	28.3	3.2	170.9	7.7
	2/15/2010	11:22 AM	37.7	45.3	29.4			
	2/15/2010	11:23 AM	45.7	55.6	34.7			
	2/15/2010	11:23 AM	63.9	73.4	30.6			
	2/15/2010	11:24 AM	30.5	33.6	28.6			
	2/15/2010	11:24 AM	29.7	30.9	28.6			
	Avg., max. or min.		**40.1**	**73.4**	**28.3**			
East	2/15/2010	11:26 AM	33.5	43.1	29.4	3.2	170.9	7.7
	2/15/2010	11:26 AM	32.1	35.1	29.5			
	2/15/2010	11:27 AM	31.9	34.4	29.4			
	2/15/2010	11:27 AM	31.3	34.5	29.6			
	2/15/2010	11:28 AM	31.1	32.8	29.9			
	2/15/2010	11:28 AM	31.8	35.4	29.6			
	Avg., max. or min.		**32.0**	**43.1**	**29.4**			
West	2/15/2010	11:30 AM	41.5	46.0	35.1	3.2	170.9	7.7
	2/15/2010	11:30 AM	58.3	68.8	35.1			
	2/15/2010	11:31 AM	45.1	49.8	32.9			
	2/15/2010	11:31 AM	33.1	37.0	31.1			
	2/15/2010	11:32 AM	35.0	38.4	32.5			
	2/15/2010	11:32 AM	32.9	35.7	29.8			
	Avg., max. or min.		**41.0**	**68.8**	**29.8**			
Overall Average (dBA)			**37.4**	**60.0**	**28.6**			
Overall Range (dBA)				**73.4**	**26.9**			

Notes:

1) Measurements were recorded near the N-2 (Wood) residence facing each of the four cardinal directions. Refer to ER Figure 3.7-2 for measurement locations.

2) Climatological data were obtained from the Ross ISR MET station.

3) Wind direction: 0° is N, 90° is E, 180° is S and 270° is W.

4) Measurements were recorded with a Quest SoundPro DL-2 handheld sound level meter.

5) The duration of each measurement was 30 seconds.

Ross ISR Project
Results of Noise Study at N-3 Pump Jack

Facing Pump Jack from Direction	Date	Time	Avg. Noise Level (dBA)	Max. Noise Level (dBA)	Min. Noise Level (dBA)	Wind Speed (mph)	Wind Direc-tion (°)	Air Temp. (°F)
North	2/19/2010	11:18 AM	43.6	46.9	40.6	5.0	169.3	19.2
	2/19/2010	11:19 AM	42.6	45.5	39.4			
	2/19/2010	11:19 AM	43.6	48.5	39.2			
	2/19/2010	11:20 AM	43.0	46.4	39.9			
	2/19/2010	11:20 AM	42.2	45.7	39.2			
	2/19/2010	11:21 AM	42.4	46.2	39.1			
	Avg., max. or min.		**42.9**	**48.5**	**39.1**			
South	2/19/2010	11:23 AM	42.8	48.5	38.6	5.0	169.3	19.2
	2/19/2010	11:23 AM	42.2	46.2	38.9			
	2/19/2010	11:24 AM	42.3	47.4	38.8			
	2/19/2010	11:24 AM	42.4	46.6	39.2			
	2/19/2010	11:25 AM	42.3	46.8	39.2			
	2/19/2010	11:25 AM	42.7	47.0	39.0			
	Avg., max. or min.		**42.5**	**48.5**	**38.6**			
East	2/19/2010	11:27 AM	43.5	47.4	39.9	5.0	169.3	19.2
	2/19/2010	11:28 AM	43.7	47.9	40.2			
	2/19/2010	11:28 AM	43.6	48.1	40.3			
	2/19/2010	11:29 AM	43.4	47.3	40.5			
	2/19/2010	11:29 AM	44.5	47.8	40.9			
	2/19/2010	11:30 AM	44.6	47.7	41.7			
	Avg., max. or min.		**43.9**	**48.1**	**39.9**			
West	2/19/2010	11:31 AM	45.0	47.3	41.5	5.0	169.3	19.2
	2/19/2010	11:32 AM	43.2	45.8	40.2			
	2/19/2010	11:32 AM	42.7	45.3	40.7			
	2/19/2010	11:33 AM	43.2	45.5	41.3			
	2/19/2010	11:33 AM	42.7	45.1	39.8			
	2/19/2010	11:34 AM	42.3	44.4	39.2			
	Avg., max. or min.		**43.2**	**47.3**	**39.2**			
Overall Average (dBA)			**43.1**	**48.1**	**39.2**			
Overall Range (dBA)				**48.5**	**38.6**			

Notes:

1) Measurements were recorded a distance of approximately 130 feet from the pump jack, facing the pump jack from each direction.

2) Climatological data were obtained from the Ross ISR MET station.

3) Wind direction: 0° is N, 90° is E, 180° is S and 270° is W.

4) Measurements were recorded with a Quest SoundPro DL-2 handheld sound level meter.

5) The duration of each measurement was 30 seconds.

Ross ISR Project
Results of Noise Study at N-4 Drill Rigs

Sample Set	Date	Time	Avg. Noise Level (dBA)	Max. Noise Level (dBA)	Min. Noise Level (dBA)	Wind Speed (mph)	Wind Direc-tion (°)	Air Temp. (°F)
1	2/19/2010	11:56 AM	43.2	46.9	40.8	5.0	169.3	19.2
	2/19/2010	11:57 AM	45.4	48.3	43.8			
	2/19/2010	11:57 AM	44.6	45.3	43.1			
	2/19/2010	11:58 AM	43.8	44.4	42.8			
	2/19/2010	11:58 AM	44.0	45.0	42.9			
	2/19/2010	11:59 AM	43.9	44.6	43.2			
	Avg., max. or min.		**44.2**	**48.3**	**40.8**			
2	2/19/2010	12:06 PM	44.3	46.5	43.2	8.5	208.3	23.7
	2/19/2010	12:06 PM	45.3	47.1	42.6			
	2/19/2010	12:07 PM	48.9	51.8	44.8			
	2/19/2010	12:07 PM	49.4	51.0	48.0			
	2/19/2010	12:08 PM	53.3	56.9	50.5			
	2/19/2010	12:08 PM	53.6	56.9	49.1			
	Avg., max. or min.		**49.1**	**56.9**	**42.6**			
3	2/19/2010	12:34 PM	55.1	59.2	51.6	8.5	208.3	23.7
	2/19/2010	12:34 PM	57.8	59.7	55.3			
	2/19/2010	12:35 PM	56.3	58.6	52.9			
	2/19/2010	12:35 PM	59.1	61.5	57.0			
	2/19/2010	12:36 PM	59.9	61.6	57.3			
	2/19/2010	12:36 PM	59.8	62.2	57.4			
	Avg., max. or min.		**58.0**	**62.2**	**51.6**			
4	2/19/2010	12:38 PM	58.9	60.9	56.8	8.5	208.3	23.7
	2/19/2010	12:39 PM	58.7	60.9	56.1			
	2/19/2010	12:39 PM	58.9	61.2	57.0			
	2/19/2010	12:40 PM	58.8	61.4	56.3			
	2/19/2010	12:40 PM	57.2	60.4	53.6			
	2/19/2010	12:41 PM	56.3	59.4	52.8			
	Avg., max. or min.		**58.1**	**61.4**	**52.8**			
Overall Average (dBA)			**52.4**	**57.2**	**47.0**			
Overall Range (dBA)				**62.2**	**40.8**			

Notes:

1) Measurements were recorded a distance of approximately 200 feet from the nearest of two operating exploration drill rigs. All measurements were collected from the same location south of the drill rigs and facing the rigs.

2) Climatological data were obtained from the Ross ISR MET station.

3) Wind direction: 0° is N, 90° is E, 180° is S and 270° is W.

4) Measurements were recorded with a Quest SoundPro DL-2 handheld sound level meter.

5) The duration of each measurement was 30 seconds.

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
2/23/2010 Tuesday (Daytime)	8:00 - 9:00	42.7	83.0	9.1	194.3	14.4
	9:00 - 10:00	45.5	86.5	8.6	176.3	15.5
	10:00 - 11:00	45.1	85.0	10.0	177.1	16.4
	11:00 - 12:00	41.5	82.6	9.4	184.5	17.2
	12:00 - 13:00	41.9	86.2	10.1	173.4	18.7
	13:00 - 14:00	39.9	83.1	9.9	168.4	20.5
	14:00 - 15:00	39.7	83.9	8.7	174.1	22.9
	15:00 - 16:00	38.8	84.3	6.6	170.2	25.8
	16:00 - 17:00	42.6	79.6	2.6	209.8	30.6
	17:00 - 18:00	37.1	88.0	5.7	283.0	33.7
	18:00 - 19:00	37.1	76.3	3.2	103.0	31.1
	19:00 - 20:00	35.9	82.0	3.8	207.6	28.1
	20:00 - 21:00	36.7	74.0	4.2	217.3	27.6
	21:00 - 22:00	33.3	66.0	4.3	195.0	26.6
2/23/2010 Tuesday (Nighttime)	22:00 - 23:00	35.0	63.9	3.5	220.2	25.5
	23:00 - 0:00	32.8	39.3	4.3	187.2	22.9
2/24/2010 Wednesday (Nighttime)	0:00 - 1:00	35.3	48.2	7.1	183.2	21.4
	1:00 - 2:00	33.8	45.0	7.9	178.8	19.3
	2:00 - 3:00	35.5	78.5	8.1	183.1	19.2
	3:00 - 4:00	36.9	79.8	9.1	186.2	17.8
	4:00 - 5:00	38.5	84.4	10.3	190.9	17.7
	5:00 - 6:00	39.7	85.7	12.1	189.3	16.1
	6:00 - 7:00	39.9	85.8	12.7	190.5	16.1
2/24/2010 Wednesday (Daytime)	7:00 - 8:00	46.3	83.5	15.2	179.0	16.8
	8:00 - 9:00	45.9	80.5	16.6	180.4	16.3
	9:00 - 10:00	45.5	85.6	15.7	173.5	17.0
	10:00 - 11:00	44.7	83.2	14.9	172.2	19.4
	11:00 - 12:00	42.1	82.1	17.2	177.4	21.9
	12:00 - 13:00	43.9	85.8	12.5	194.8	24.6
	13:00 - 14:00	40.2	81.7	12.7	172.0	28.1
	14:00 - 15:00	37.7	73.9	12.1	164.0	32.2
	15:00 - 16:00	43.6	81.8	9.6	172.3	33.8
	16:00 - 17:00	41.6	84.6	12.4	187.8	33.3
	17:00 - 18:00	38.8	73.4	10.2	178.3	34.1
	18:00 - 19:00	37.0	77.4	15.2	173.0	33.6
	19:00 - 20:00	36.9	70.0	10.0	186.3	31.0
	20:00 - 21:00	36.9	69.5	5.0	185.9	32.0
	21:00 - 22:00	35.2	69.0	3.2	22.3	33.5

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
2/24/2010 Wednesday (Nighttime)	22:00 - 23:00	37.1	68.4	3.0	28.6	30.6
	23:00 - 0:00	37.5	46.1	5.6	351.2	31.9
2/25/2010 Thursday (Nighttime)	0:00 - 1:00	37.5	46.1	8.0	329.0	29.0
	1:00 - 2:00	37.8	45.1	9.3	323.6	31.9
	2:00 - 3:00	36.5	46.6	8.9	313.3	32.0
	3:00 - 4:00	35.6	44.9	12.1	289.4	30.9
	4:00 - 5:00	29.3	67.9	14.5	285.3	31.5
	5:00 - 6:00	30.9	65.5	11.5	295.6	30.9
	6:00 - 7:00	34.1	80.0	9.4	294.6	30.8
2/25/2010 Thursday (Daytime)	7:00 - 8:00	37.7	80.0	12.0	287.8	31.4
	8:00 - 9:00	42.9	84.0	10.5	275.3	31.7
	9:00 - 10:00	44.6	78.6	15.0	273.7	32.1
	10:00 - 11:00	40.9	68.9	16.2	293.6	33.0
	11:00 - 12:00	44.8	78.2	14.9	292.4	34.3
	12:00 - 13:00	39.6	77.9	15.9	285.0	35.3
	13:00 - 14:00	37.4	78.9	16.5	287.9	36.1
	14:00 - 15:00	39.2	87.2	14.9	290.3	36.6
	15:00 - 16:00	38.8	83.2	11.7	302.8	38.1
	16:00 - 17:00	35.2	77.7	13.8	318.3	37.9
	17:00 - 18:00	36.1	80.3	11.0	317.2	37.7
	18:00 - 19:00	35.6	86.0	11.6	315.6	36.9
	19:00 - 20:00	34.5	75.0	9.7	312.3	36.3
	20:00 - 21:00	34.3	52.0	6.7	318.0	35.7
	21:00 - 22:00	33.9	72.1	7.1	303.1	35.0
2/25/2010 Thursday (Nighttime)	22:00 - 23:00	33.4	48.6	11.8	276.5	33.9
	23:00 - 0:00	34.4	41.3	11.0	271.9	32.7
2/26/2010 Friday (Nighttime)	0:00 - 1:00	35.1	41.3	11.2	277.4	32.0
	1:00 - 2:00	34.5	40.9	11.4	270.0	30.2
	2:00 - 3:00	32.5	42.6	12.6	268.7	30.0
	3:00 - 4:00	33.6	77.0	14.1	261.9	28.6
	4:00 - 5:00	37.4	84.0	15.3	261.8	28.1
	5:00 - 6:00	36.8	88.3	14.8	261.6	27.8
	6:00 - 7:00	36.7	83.0	13.4	262.7	27.8

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
2/26/2010 Friday (Daytime)	7:00 - 8:00	39.2	84.2	12.3	270.4	28.1
	8:00 - 9:00	39.1	83.8	13.2	265.2	27.5
	9:00 - 10:00	35.9	85.1	14.0	271.5	28.6
	10:00 - 11:00	34.4	82.8	12.1	275.5	30.7
	11:00 - 12:00	38.9	82.9	12.0	262.9	32.8
	12:00 - 13:00	39.7	85.4	10.1	276.2	35.5
	13:00 - 14:00	39.6	81.1	6.3	278.4	37.5
	14:00 - 15:00	42.1	80.9	6.2	290.5	39.2
	15:00 - 16:00	40.4	79.0	6.5	281.0	39.7
	16:00 - 17:00	37.0	83.0	4.0	275.7	40.8
	17:00 - 18:00	36.5	77.0	4.2	169.7	38.2
	18:00 - 19:00	38.0	76.1	2.5	178.6	38.8
	19:00 - 20:00	37.2	77.3	2.6	201.5	36.1
	20:00 - 21:00	35.9	80.2	2.5	195.7	34.9
	21:00 - 22:00	33.9	66.6	2.3	136.0	34.1
2/26/2010 Friday (Nighttime)	22:00 - 23:00	35.5	67.5	4.3	177.3	32.0
	23:00 - 0:00	33.8	41.9	5.7	200.8	30.0
2/27/2010 Saturday (Nighttime)	0:00 - 1:00	36.7	44.9	6.1	186.1	28.1
	1:00 - 2:00	38.1	45.3	5.3	184.8	26.4
	2:00 - 3:00	35.3	44.2	5.6	166.7	25.1
	3:00 - 4:00	34.2	40.8	8.3	161.2	24.3
	4:00 - 5:00	36.4	44.5	9.6	170.4	25.0
	5:00 - 6:00	36.2	69.2	8.0	149.9	23.6
	6:00 - 7:00	38.0	65.1	15.6	162.2	22.9

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
2/27/2010 Saturday (Daytime)	7:00 - 8:00	36.4	85.7	9.0	145.7	22.8
	8:00 - 9:00	39.3	83.2	12.0	165.6	23.2
	9:00 - 10:00	39.7	81.3	7.4	182.3	24.5
	10:00 - 11:00	40.1	77.4	11.3	167.2	25.6
	11:00 - 12:00	44.2	82.9	14.1	167.6	28.1
	12:00 - 13:00	44.5	82.2	18.0	182.2	29.7
	13:00 - 14:00	40.8	81.0	18.7	182.0	32.0
	14:00 - 15:00	40.5	75.1	20.4	168.5	34.2
	15:00 - 16:00	42.4	81.6	21.4	170.4	35.1
	16:00 - 17:00	41.6	77.7	15.9	160.1	36.6
	17:00 - 18:00	36.9	67.4	16.6	166.6	36.8
	18:00 - 19:00	38.5	79.5	17.1	167.3	36.3
	19:00 - 20:00	36.9	70.7	14.4	163.9	35.0
	20:00 - 21:00	37.9	65.3	8.2	159.1	33.3
	21:00 - 22:00	38.4	80.2	5.2	159.4	33.1
2/27/2010 Saturday (Nighttime)	22:00 - 23:00	37.1	43.3	11.1	174.5	32.5
	23:00 - 0:00	37.1	78.3	10.4	182.2	32.1
2/28/2010 Sunday (Nighttime)	0:00 - 1:00	37.4	43.9	8.5	185.1	32.0
	1:00 - 2:00	34.6	45.2	10.5	160.8	32.8
	2:00 - 3:00	35.5	43.8	12.1	169.1	32.3
	3:00 - 4:00	39.8	48.7	11.5	176.8	33.6
	4:00 - 5:00	36.5	46.3	16.2	165.3	34.4
	5:00 - 6:00	41.4	50.2	19.3	171.3	34.0
	6:00 - 7:00	37.5	43.5	8.0	178.4	32.8

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
2/28/2010 Sunday (Daytime)	7:00 - 8:00	39.5	75.7	15.4	170.9	32.1
	8:00 - 9:00	37.9	75.2	14.0	160.6	31.0
	9:00 - 10:00	41.1	83.4	11.6	161.1	30.1
	10:00 - 11:00	36.4	63.2	9.0	171.1	31.5
	11:00 - 12:00	36.0	75.2	4.2	123.4	31.1
	12:00 - 13:00	39.1	77.6	4.1	73.7	29.5
	13:00 - 14:00	37.6	81.6	2.2	64.5	31.3
	14:00 - 15:00	35.1	71.2	4.1	101.6	32.9
	15:00 - 16:00	35.9	76.2	9.1	163.7	35.1
	16:00 - 17:00	38.2	72.1	9.0	170.3	35.1
	17:00 - 18:00	39.6	76.3	7.3	184.8	34.3
	18:00 - 19:00	36.7	74.5	6.7	162.1	33.1
	19:00 - 20:00	37.1	72.1	6.8	150.2	32.6
	20:00 - 21:00	40.5	66.0	7.9	147.2	31.4
	21:00 - 22:00	40.7	64.4	12.0	166.2	31.3
2/28/2010 Sunday (Nighttime)	22:00 - 23:00	40.1	50.6	14.6	192.0	31.4
	23:00 - 0:00	38.7	47.4	14.4	192.2	31.1
3/1/2010 Monday (Nighttime)	0:00 - 1:00	36.2	41.8	14.4	194.5	31.0
	1:00 - 2:00	36.3	42.2	14.8	192.4	30.8
	2:00 - 3:00	37.1	42.1	10.3	215.0	30.8
	3:00 - 4:00	37.8	44.6	8.5	205.1	30.9
	4:00 - 5:00	38.6	80.8	8.1	205.4	30.7
	5:00 - 6:00	38.4	88.0	5.3	183.5	29.5
	6:00 - 7:00	35.0	87.9	4.6	193.5	27.7

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
3/1/2010 Monday (Daytime)	7:00 - 8:00	39.6	83.3	4.5	164.7	27.1
	8:00 - 9:00	38.6	86.9	5.8	201.6	26.1
	9:00 - 10:00	40.7	82.4	4.0	190.0	28.1
	10:00 - 11:00	39.6	84.7	4.2	196.7	30.8
	11:00 - 12:00	36.9	84.2	5.4	162.3	32.4
	12:00 - 13:00	39.6	82.5	9.3	177.1	32.4
	13:00 - 14:00	36.5	84.0	8.0	179.3	34.0
	14:00 - 15:00	35.6	80.4	6.3	182.1	35.4
	15:00 - 16:00	38.3	81.6	3.7	162.8	36.9
	16:00 - 17:00	40.7	80.4	2.9	161.6	38.4
	17:00 - 18:00	40.5	76.8	2.0	168.8	41.6
	18:00 - 19:00	38.4	81.9	1.2	193.5	42.9
	19:00 - 20:00	34.6	80.0	0.8	22.7	39.7
	20:00 - 21:00	33.2	41.3	1.5	299.9	37.5
	21:00 - 22:00	36.8	66.2	2.3	228.3	36.1
3/1/2010 Monday (Nighttime)	22:00 - 23:00	39.1	80.1	3.3	234.9	35.9
	23:00 - 0:00	35.6	60.6	3.5	222.5	36.1
3/2/2010 Tuesday (Nighttime)	0:00 - 1:00	35.0	42.6	3.1	192.7	32.6
	1:00 - 2:00	34.7	42.3	4.0	198.1	31.0
	2:00 - 3:00	35.2	62.4	4.5	181.8	28.0
	3:00 - 4:00	35.0	80.2	6.6	193.3	27.8
	4:00 - 5:00	34.4	80.8	7.2	185.4	29.0
	5:00 - 6:00	36.4	83.8	6.3	189.3	28.0
	6:00 - 7:00	36.0	75.7	5.3	200.5	28.6

Ross ISR Project
Results of 7-Day Noise Study at Strata Field Office

Date and Weekday (Daytime/ Nighttime)	Time Interval	Average Hourly Noise Level (dBA)	Peak Hourly Noise Level (dBA)	Wind Speed (mph)	Wind Direction (°)	Air Temp. (°F)
3/2/2010 Tuesday (Daytime)	7:00 - 8:00	38.6	70.1	5.4	199.3	29.0
	8:00 - 9:00	38.2	82.9	5.6	204.1	29.2
	9:00 - 10:00	39.5	85.5	3.9	214.0	30.9
	10:00 - 11:00	35.0	83.8	5.6	213.3	32.2
	11:00 - 12:00	40.0	80.3	5.7	195.2	35.5
	12:00 - 13:00	39.4	82.1	4.3	144.6	34.6
	13:00 - 14:00	40.7	82.7	5.3	197.2	36.6
	14:00 - 15:00	37.2	74.4	5.2	184.9	39.2
	15:00 - 16:00	40.7	82.9	3.6	155.6	42.0
	16:00 - 17:00	42.7	84.0	3.3	145.6	43.6
Average		**38.0**	**71.5**	**9.1**	**202.3**	**30.6**

Notes:

1) Measurements were recorded at the Strata Field Office near Oshoto.

2) Climatological data were obtained from the Ross ISR MET station.

3) Wind direction: 0° is N, 90° is E, 180° is S and 270° is W.

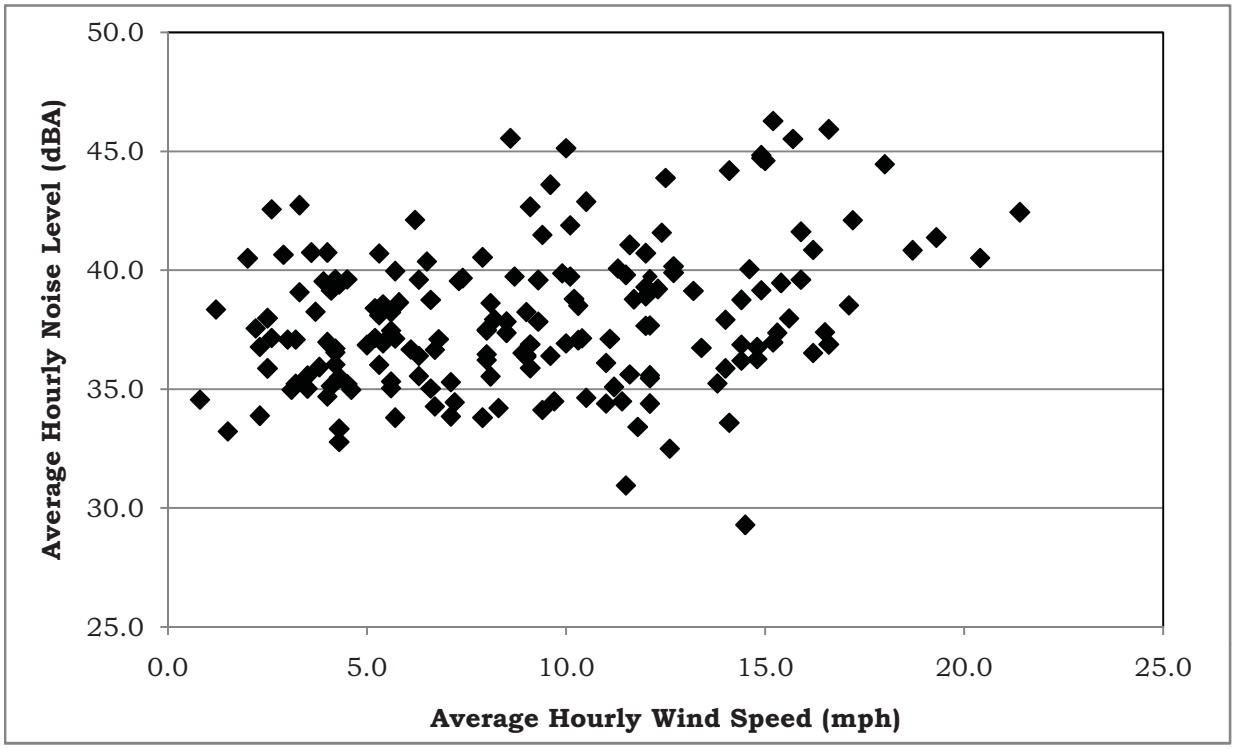
4) Measurements were recorded with a Quest SoundPro DL-2 handheld sound level meter.

5) The duration of each measurement was 30 seconds. The hourly average and peak noise levels were calculated from all 120 measurements recorded each hour.

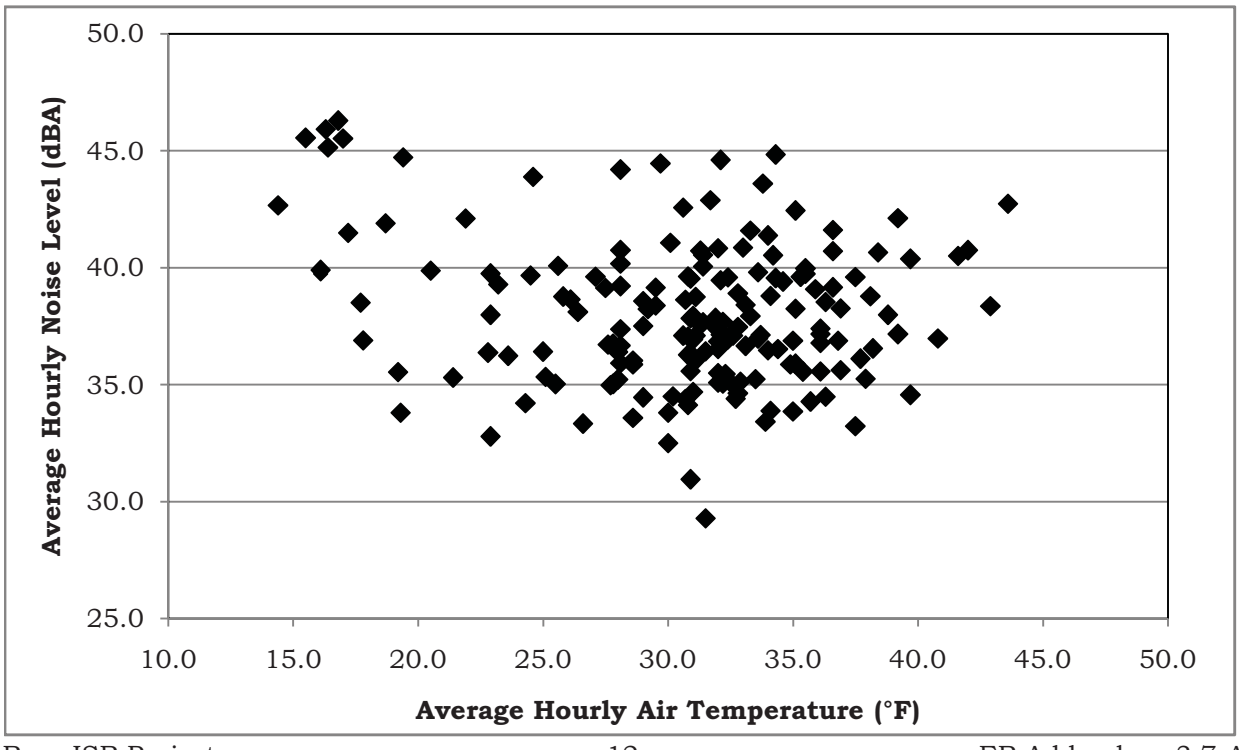
6) Daytime hours defined as 7:00 a.m. to 10:00 p.m. per EPA (1974).

7) In ER Table 3.7-4, the noise levels on Tuesday include February 23 and March 2 measurements.

Comparison between Average Hourly Noise Level and Wind Speed



Comparison between Average Hourly Noise Level and Air Temperature



ADDENDUM 4.6-A

PRELIMINARY EMISSIONS INVENTORY

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LIST OF TABLES

1.0 INTRODUCTION

A preliminary emissions inventory for the proposed Ross ISR Project was completed by Strata to estimate potential combustion and fugitive emissions during each of the four phases (construction, operation, aquifer restoration and decommissioning). Since the greatest source of combustion emissions will be from industrial equipment, Strata did not calculate combustion emissions for passenger vehicles or shipments traveling to and from the site. The following provides an overview of the methods and the results of the preliminary emissions inventory for the proposed project. A final emissions inventory is planned to be completed in February 2011 to accompany the application for the WDEQ Air Quality Permit for the proposed Ross ISR Project.

2.0 EQUIPMENT SUMMARY

The equipment accounted for in the preliminary emissions inventory was based on typical equipment anticipated for the proposed activities (i.e., wellfield drilling, access road construction, etc.). In order to estimate annual hours of operation, specific details of the proposed project were utilized. These included:

1. Area of disturbance associated with wellfields, roads, CPP, etc. (Section 4.1 of the ER)
2. Number of proposed wells (injection, recovery, monitor and deep disposal from Section 3.1 of the TR)
3. Proposed project schedule (Section 1.3 of the ER)

Table 1 provides a summary of the anticipated operating hours and power rating for the equipment during each phase of the project. The make and model of each piece of equipment was based on typical construction equipment, while specific details, such as power rating and gross vehicle weight, were based on manufacturer specifications, when available. Actual equipment used at the Ross ISR Project may differ from that presented in this report; however, combustion and fugitive emissions should not vary significantly.

3.0 COMBUSTION EMISSIONS

Combustion emissions were calculated using emission factors obtained from the EPA NONROAD2008 emissions model (EPA 2010a). EPA originally developed the model in 2002 to assist state and local regulatory agencies in developing emission inventories. The model is primarily used to estimate emissions for a specific geographic area over a set period of time. In the case of the proposed Ross ISR Project, the emission factors were used in conjunction with estimated annual operating hours, presented in Table 1, to calculate combustion emissions. Combustion emissions using NONROAD2008 emission factors were calculated using the following equation:

$$E = Power \times LF \times A \times EF \times U$$

Where:
- E = Emissions (tons/yr)
- Power = Power rating (hp)
- LF = Load factor (fraction of available power)
- A = Activity (hrs/yr)
- EF = Emission Factor (g/hp-hr)
- U = Unit conversion (ton/2000 lb) (lb/453.6 g)

Inputs into the NONROAD2008 model were limited to the diesel sulfur content. In June 2010, the EPA lowered the diesel fuel standard for non-road diesel fuel production from 500 ppm to 15 ppm. The lower sulfur fuel is known as ultra-low sulfur diesel (ULSD) and is required for diesel-powered engines constructed after 2007 to meet EPA's Tier 4 emission standards. Although older equipment will be capable of burning ULSD, the Tier 4 emissions standards will not apply to pre-2007 diesel engines. To provide a conservatively high estimate of sulfur emissions, a sulfur content of 500 ppm was entered into the model.

Load factors for each piece of equipment were obtained from an EPA guidance document for the NONROAD2008 model (EPA 2010b). Table 2 provides the diesel engine emission factors generated from the NONROAD2008 model for the 2011 calendar year.

3.1 Preliminary Combustion Emission Estimates using NONROAD2008

Results of the preliminary combustion emissions inventory are summarized in Table 3. Calculations of emissions by equipment and phase are provided in detail in Appendix A. The emissions presented in the table are meant to provide conservatively high estimates. For example, for the construction phase it was assumed that all proposed construction will be completed within the first year with the exception of the wellfields, which will be developed over three to five years as stated in Section 1.3 of the ER.

Table 3 shows that the construction and decommissioning phases are expected to generate the highest levels of combustion emissions, while operation and aquifer restoration will generate similarly lower combustion emissions. Overall, drilling rigs associated with ISR wellfield development and deep disposal wells are expected to contribute the most (about 40% of the total combustion emissions) during the construction phase.

3.2 Preliminary Combustion Emission Estimates using AP-42

The WDEQ/AQD emission inventory guidance for minor sources (WDEQ/AQD 2010) references EPA AP-42 guidance (EPA 1995) for emission factors associated with construction and heavy equipment. Strata completed a separate emissions inventory to allow comparison between combustion emissions calculated using NONROAD2008 and AP-42 emission factors.

The AP-42 report provides emission factors for various pieces of equipment, sources and activities. Emission factors in AP-42 Chapter 3, Stationary Internal Combustion Sources, were used to estimate emissions during each phase of the project. Engines less than 600 HP utilized emission factors from AP-42 Table 3.3-1, while emission factors for larger engines were obtained from AP-42 Table 3.4-1. Emissions for each pollutant were calculated using the following equations:

$$E = A \times EF \times LF \times U$$

Where:
- E = Emissions (tons/yr)
- A = Activity (hrs/yr)
- EF = Emission factor (g/hp-hr)
- LF = Load factor (fraction of available power)
- U = Unit conversion (ton/2000 lb) (lb/453.6 g)

Strata estimated a 40 percent load factor for all emission calculations. This is believed to be a conservatively high estimate based on actual operation and idle time. The results of the combustion emissions estimates using AP-42 guidance are summarized in Table 4.

A comparison of the two sources (NONROAD2008 and AP-42) indicate similar combustion emissions estimates for CO and CO_2, while the AP-42 methods estimates higher emissions of , SO_2, PM_{10} and NO_x. The difference in emissions may be attributed to AP-42 basing emission factors from uncontrolled diesel engines, while NONROAD2008 accounts for changes to the sulfur content of fuel and the Tier 4 emission standards.

Overall, the combustion emissions estimated by both sources are expected to be conservatively high since they are based on load factor rather than actual fuel consumption. This was confirmed by a mass balance calculation completed for the drill rigs used for pre-application monitoring. Combustion emissions were calculated using the actual fuel consumption for the drill rigs used during installation of the regional baseline monitor wells, the NONROAD2008 and AP-42 emission factors, and heat content of diesel fuel. Based on similar hours of annual operation the combustion emission were approximately 80 percent lower than those estimated using a load factor. The CO_2 and NO_x emissions estimated using a drill rig load factor of 0.59 were 2,189 and 23.8 tons/yr, respectively. Using the mass balance method the CO_2 emissions were calculated as 452 tons/yr, while NO_x emissions were 5 tons/yr. Calculations and assumptions for the mass balance are presented in Appendix B.

4.0 FUGITIVE EMISSIONS

Fugitive particulate matter emissions, as PM_{10}, were estimated for each phase of the project using the following chapters from the EPA AP-42 report:

Chapter 11.9	Western Surface Coal Mining
Chapter 13.2.2	Unpaved Roads
Chapter 13.2.3	Heavy Construction Equipment
Chapter 13.2.4	Aggregate Handling and Storage Piles

The fugitive emissions were calculated based on the operation summarized in Table 1 and the estimated daily travel distance for each piece of equipment. Additionally, during the construction and decommissioning phases, fugitive emissions were also calculated for activities associated with

earthwork including construction or reclamation of the wellfields, roads and central plant area. The preliminary fugitive emissions results are summarized in Table 5. Appendix C provides the calculations and assumptions.

Table 1. Estimated Power Rating and Operation Hours of Diesel Engine Construction Equipment

Equipment	Make/ Model[1]	HP	Equipment Operation (hrs/yr)			
			Construction	Operation	Aquifer Restoration	Decommissioning
Cementing unit	Unknown	75	4,939	-	-	4,360
Drilling rig	Unknown	475	13,376	-	-	
Deep drilling rig	Unknown	1,500	3,600	-	-	
Pulling unit	SEMCO	75	4,459	1,300	1,300	2,320
Backhoe	CAT 420E	101	22,235	1,820	1,820	5,872
Bulldozer	CAT D7	235	2,120	-	-	2,256
Front end loader	CAT 420E	101	1,940	-	-	1,144
Grader	CAT 140M	183	2,830	520	520	1,892
Roller compactor	CAT 815F	253	1,390	-	-	585
Scraper	CAT 627	330	3,080	-	-	3,140
Trackhoe	CAT 953D	148	3,030	-	-	4,096
Trencher	Vermier RTX1250	120	3,540	-	-	40
Dump truck	Kenworth	260	1,715	-	-	1,600
Hydraulic crane	Link-Belt RTC-8050	174	560	-	-	-
Mix truck	Kenworth	260	1,410	-	-	-
Semi-haul truck	Kenworth	260	3,032	-	-	12,488
Water truck	Kenworth	260	15,256	520	520	3,888
Disc tractor	John Deere	101	760	-	-	716
Seed drill tractor	John Deere	101	576	-	-	475
Forklift	CAT RC60	83	5,799	1,040	520	-
Manlift	Genie S-60X	46	2,000	-	-	-
Picker	CAT TL1255	141	1,280	-	-	-
Skid-steer loader	CAT 256C	84	576	-	-	1,464
Welding machine	Perkins	10	6,909	780	780	-
Air compressor	Ingersoll-Rand	25	780	-	-	-
Generator	Wacker Newson GP4000	9	3,789	780	780	6,656
Integrity testing unit	Ford 350	6	4,459	3,120	1,560	-
Flat bed truck	Ford 450	8	209	-	-	-
Logging truck	Ford 350	6	3,344	-	-	-
Pickup truck	Ford 350	6	8,919	8,840	5,200	4,000
Swab rig	Ford 350	6	-	4,160	2,080	-

[1] Typical make/model for anticipated type of equipment. Actual equipment may differ.

Table 2. EPA NONROAD2008 Emission Factors

Equipment	Emission Factors (g/hp-hr)					
	THC	**NO_x**	**CO**	**PM_{10}**	**SO_2**	**CO_2**
Cementing unit	0.4477	4.6024	4.0350	0.6030	0.1822	594.7
Drilling rig	0.3837	5.7681	1.8598	0.3178	0.1600	529.8
Deep drilling rig	0.3198	10.8864	2.4948	0.3175	0.1835	526.2
Pulling unit	0.4477	4.6024	4.0350	0.6030	0.1822	594.7
Backhoe	0.9288	5.9484	3.8524	0.6954	0.1911	623.6
Bulldozer	0.2369	3.1904	1.0992	0.2476	0.1586	536.1
Front end loader	0.9288	5.9484	3.8524	0.6954	0.1911	623.6
Grader	0.2351	3.1595	1.0949	0.2470	0.1585	536.1
Roller compactor	0.2575	3.5428	1.1749	0.2625	0.1595	536.0
Scraper	0.2073	3.8871	1.6115	0.2491	0.1603	536.2
Trackhoe	0.2586	3.3247	1.4265	0.3437	0.1642	536.0
Trencher	0.3251	4.2397	1.6670	0.3611	0.1642	535.8
Dump truck	0.1955	2.5837	1.0311	0.2448	0.1550	536.2
Hydraulic crane	0.2878	4.0041	1.0028	0.2584	0.1624	530.1
Mix truck	0.4352	5.7512	1.6821	0.3270	0.1599	529.7
Semi-haul truck	0.1955	2.5837	1.0311	0.2448	0.1550	536.2
Water truck	0.1955	2.5837	1.0311	0.2448	0.1550	536.2
Disc tractor	0.3213	4.2044	1.6457	0.3590	0.1642	535.8
Seed drill tractor	0.3213	4.2044	1.6457	0.3590	0.1642	535.8
Forklift	2.1962	6.2593	8.1968	1.1762	0.2111	689.0
Manlift	2.1962	6.2593	8.1968	1.1762	0.2111	689.0
Picker	2.1962	6.2593	8.1968	1.1762	0.2111	689.0
Skid-steer loader	1.5859	6.5081	8.1442	1.2687	0.2117	690.9
Welding machine	2.0370	7.2416	10.6755	1.4502	0.2112	689.5
Air compressor	0.3916	4.8088	1.7272	0.3606	0.1806	589.3
Generator	0.9416	6.1520	4.7813	0.7367	0.1800	587.4

Table 3. Ross ISR Project Combustion Emissions Estimates using NONROAD2008 Model

Equipment Type	Maximum Combustion Emissions (short tons/yr)					
	THC	**NO_x**	**CO**	**PM_{10}**	**SO_2**	**CO_2**
Construction	6.32	97.5	36.0	5.9	2.9	9,254
Operation	0.97	12.8	6.6	1.0	0.4	1,445
Aquifer Restoration	0.59	7.8	4.0	0.6	0.3	892
Decommissioning	1.73	21.7	10.3	2.0	1.0	3,441

Table 4. Ross ISR Project Combustion Emissions Estimates using EPA AP-42

Equipment Type	Combustion Emissions (short tons/yr)					
	TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Construction	13.3	181.8	39.5	11.9	10.8	7,015
Operation	3.1	38.8	8.4	2.8	2.6	1,439
Aquifer Restoration	1.8	22.7	4.9	1.6	1.5	843
Decommissioning	5.1	64.3	13.9	4.6	4.3	2,385

Table 5. PM_{10} Fugitive Emissions Estimates for the Proposed Ross ISR Project

Phase	**PM_{10} Emissions (short tons/yr)**
Construction	171.8
Operation	14.3
Aquifer Restoration	9.8
Decommissioning	82.9

5.0 REFERENCES

EPA, 2010a, NONROAD Model. Available from website on the Internet as of November 2010: <http://www.epa.gov/oms/nonrdmdl.htm>

____, 2010b, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, EPA-420-R-10-016.

____, 1995, Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, AP-42.

WDEQ/AQD (Wyoming Department of Environmental Quality/Air Quality Division), 2010, 2008 Annual Minor Source Inventory. Available from website on the Internet as of November 2010: <http://deq.state.wy.us/aqd/ei.asp>

Appendix A

Combustion Emissions Calculations

by Equipment/Phase

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Equipment Description	Standard Classification Code	Fuel	HP	Make/Model[1]	GVW (tons)	Load Factor[2] (%)	NONROAD2008 Emission Factors (g/hp-hr)[2]						AP-42 Emission Factors (lb/hp-hr)[3]					
							THC[4]	NOx	CO	PM10	SO2	CO2	TOC[5]	NOx	CO	PM10	SO2	CO2
Cementing unit	2270002081	Diesel	75	Unknown	20	0.59	0.4477	4.6024	4.0350	0.6030	0.1822	594.7	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Drilling rig	2270002033	Diesel	475	Unknown	20	0.59	0.3837	5.7681	1.8598	0.3178	0.1600	529.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Deep drilling rig	2270002033	Diesel	1,400	Unknown	43	0.59	0.3198	10.8864	2.4948	0.3175	0.1835	526.2	0.0007	0.024	0.0055	0.0007	0.0004	1.16
Pulling unit	2270002081	Diesel	75	SEMCO	8	0.59	0.4477	4.6024	4.0350	0.6030	0.1822	594.7	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Backhoe	2270002066	Diesel	101	CAT 420E	8	0.21	0.9288	5.9484	3.8524	0.6954	0.1911	623.6	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Bulldozer	2270002069	Diesel	235	CAT D7	28	0.59	0.2369	3.1904	1.0992	0.2476	0.1586	536.1	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Front end loader	2270002066	Diesel	101	CAT 420E	8	0.21	0.9288	5.9484	3.8524	0.6954	0.1911	623.6	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Grader	2270002048	Diesel	183	CAT 140M	18	0.59	0.2351	3.1595	1.0949	0.2470	0.1585	536.1	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Roller compactor	2270002015	Diesel	253	CAT 815F	23	0.59	0.2575	3.5428	1.1749	0.2625	0.1595	536.0	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Scraper	2270002018	Diesel	330	CAT 627	41	0.59	0.2073	3.8871	1.6115	0.2491	0.1603	536.2	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Trackhoe	2270002036	Diesel	148	CAT 953D	17	0.59	0.2586	3.3247	1.4265	0.3437	0.1642	536.0	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Trencher	2270002030	Diesel	120	Vermier RTX1250	7	0.59	0.3251	4.2397	1.6670	0.3611	0.1642	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Dump truck	2270002051	Diesel	260	Kenworth	20	0.59	0.1955	2.5837	1.0311	0.2448	0.1550	536.2	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Hydraulic crane	2270002045	Diesel	174	Link-Belt RTC-8050	36	0.43	0.2878	4.0041	1.0028	0.2584	0.1624	530.1	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Mix truck	2270002042	Diesel	260	Kenworth	20	0.43	0.4352	5.7512	1.6821	0.3270	0.1599	529.7	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Semi-haul truck	2270002051	Diesel	260	Kenworth	20	0.59	0.1955	2.5837	1.0311	0.2448	0.1550	536.2	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Water truck	2270002051	Diesel	260	Kenworth	20	0.59	0.1955	2.5837	1.0311	0.2448	0.1550	536.2	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Disc tractor	2270002081	Diesel	101	John Deere	4	0.59	0.3213	4.2044	1.6457	0.3590	0.1642	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Seed drill tractor	2270002081	Diesel	101	John Deere	4	0.59	0.3213	4.2044	1.6457	0.3590	0.1642	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Forklift	2270003020	Diesel	83	CAT RC60	14	0.59	2.1962	6.2593	8.1968	1.1762	0.2111	689.0	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Manlift	2270003010	Diesel	46	Genie S-60X	10	0.21	2.1962	6.2593	8.1968	1.1762	0.2111	689.0	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Picker	2270003010	Diesel	141	CAT TL1255	18	0.21	2.1962	6.2593	8.1968	1.1762	0.2111	689.0	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Skid-steer loader	2270002072	Diesel	84	CAT 256C	4	0.21	1.5859	6.5081	8.1442	1.2687	0.2117	690.9	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Welding machine	2270006025	Diesel	10	Perkins	N/A	0.21	2.0370	7.2416	10.6755	1.4502	0.2112	689.5	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Air compressor	2270006015	Diesel	25	Ingersoll-Rand	N/A	0.43	0.3916	4.8088	1.7272	0.3606	0.1806	589.3	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Generator	2270006005	Diesel	9	Wacker Newson GP4000	N/A	0.43	0.9416	6.1520	4.7813	0.7367	0.1800	587.4	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Integrity testing unit	2270002081	Diesel	350	Ford 350	6	0.12	0.3149	4.8867	2.3447	0.3428	0.1613	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Flat bed truck	2270002081	Diesel	390	Ford 450	8	0.59	0.3149	4.8867	2.3447	0.3428	0.1613	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Logging truck	2270002081	Diesel	350	Ford 350	6	0.12	0.3149	4.8867	2.3447	0.3428	0.1613	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Pickup truck	2270002081	Diesel	350	Ford 350	6	0.59	0.3149	4.8867	2.3447	0.3428	0.1613	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15
Swab rig	2270002081	Diesel	350	Ford 350	6	0.12	0.3149	4.8867	2.3447	0.3428	0.1613	535.8	0.0025	0.031	0.0067	0.0022	0.0021	1.15

[1] Typical make/model for anticipated type of equipment. Actual equipment may differ.

[2] Values from EPA's NONROAD2008 Emissions Model (EPA 2010a)

[3] Values from EPA's AP-42 Table 3.3-1 and Table 3.4-1 (EPA 1995)

[4] Total hydrocarbon

[5] Total ogranic carbon

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Equipment Type	Total Operating Hours	NONROAD2008 Combustion Emissions (tons/yr)[1]						AP-42 Combustion Emissions (tons/yr)[2]					
		THC	NO_x	CO	PM_{10}	SO_2	CO_2	TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Cementing Unit	4,939	0.11	1.11	0.97	0.15	0.04	143.3	0.18	2.30	0.49	0.16	0.15	85.2
Drilling rig	13,376	1.59	23.83	7.68	1.31	0.66	2,189.3	3.14	39.39	8.49	2.80	2.60	1,461.3
Deep Drilling rig	3,600	1.05	35.68	8.18	1.04	0.60	1,724.7	0.71	24.19	5.54	0.71	0.41	1,169.3
Pulling Unit	4,459	0.10	1.00	0.88	0.13	0.04	129.3	0.17	2.07	0.45	0.15	0.14	76.9
Backhoe	22,235	0.48	3.09	2.00	0.36	0.10	324.2	1.11	13.92	3.00	0.99	0.92	516.5
Bulldozer	2,120	0.08	1.03	0.36	0.08	0.05	173.7	0.25	3.09	0.67	0.22	0.20	114.6
Front end loader	1,940	0.04	0.27	0.17	0.03	0.01	28.3	0.10	1.21	0.26	0.09	0.08	45.1
Grader	2,830	0.08	1.06	0.37	0.08	0.05	180.6	0.26	3.21	0.69	0.23	0.21	119.1
Roller compactor	1,390	0.06	0.81	0.27	0.06	0.04	122.6	0.17	2.18	0.47	0.15	0.14	80.9
Scraper	3,080	0.14	2.57	1.07	0.16	0.11	354.4	0.50	6.30	1.36	0.45	0.42	233.8
Trackhoe	3,030	0.08	0.97	0.42	0.10	0.05	156.3	0.22	2.78	0.60	0.20	0.18	103.1
Trencher	3,540	0.09	1.17	0.46	0.10	0.05	148.0	0.21	2.63	0.57	0.19	0.17	97.7
Dump truck	1,715	0.06	0.75	0.30	0.07	0.04	155.5	0.22	2.76	0.60	0.20	0.18	102.5
Hydraulic crane	560	0.01	0.18	0.05	0.01	0.01	24.5	0.05	0.60	0.13	0.04	0.04	22.4
Mix truck	1,410	0.08	1.00	0.29	0.06	0.03	92.0	0.18	2.27	0.49	0.16	0.15	84.3
Semi-haul truck	3,032	0.10	1.32	0.53	0.13	0.08	274.9	0.39	4.89	1.05	0.35	0.32	181.3
Water truck	15,256	0.50	6.67	2.66	0.63	0.40	1,383.2	1.96	24.59	5.30	1.75	1.63	912.3
Disc tractor	760	0.02	0.21	0.08	0.02	0.01	26.7	0.04	0.48	0.10	0.03	0.03	17.7
Seed drill tractor	576	0.01	0.16	0.06	0.01	0.01	20.3	0.03	0.36	0.08	0.03	0.02	13.4
Forklift	5,799	0.69	1.96	2.57	0.37	0.07	215.7	0.24	2.98	0.64	0.21	0.20	110.7
Manlift	2,000	0.05	0.13	0.17	0.03	0.00	14.7	0.05	0.57	0.12	0.04	0.04	21.2
Picker	1,280	0.09	0.26	0.34	0.05	0.01	28.8	0.09	1.12	0.24	0.08	0.07	41.5
Skid-steer loader	576	0.02	0.07	0.09	0.01	0.00	7.7	0.02	0.30	0.06	0.02	0.02	11.1
Welding machine	6,909	0.03	0.12	0.17	0.02	0.00	11.0	0.03	0.43	0.09	0.03	0.03	15.9
Air compressor	780	0.00	0.04	0.02	0.00	0.00	5.4	0.01	0.12	0.03	0.01	0.01	4.5
Generator	3,789	0.02	0.10	0.08	0.01	0.00	9.5	0.02	0.21	0.05	0.02	0.01	7.8
Integrity testing unit	4,459	0.07	1.01	0.48	0.07	0.03	110.6	0.77	9.68	2.08	0.69	0.64	358.9
Flat bed truck	209	0.02	0.26	0.12	0.02	0.01	28.4	0.04	0.51	0.11	0.04	0.03	18.7
Logging truck	3,344	0.05	0.76	0.36	0.05	0.02	83.0	0.58	7.26	1.56	0.51	0.48	269.2
Pickup truck	8,919	0.64	9.92	4.76	0.70	0.33	1,087.8	1.54	19.35	4.17	1.37	1.28	718.0
TOTAL		**6.32**	**97.53**	**35.96**	**5.87**	**2.85**	**9,254.3**	**13.27**	**181.77**	**39.50**	**11.89**	**10.83**	**7,014.9**

[1] Combustion emissions calculated using EPA NONROAD2008 Emission Factors

[2] Combustion emissions calculated using AP-42, Table 3.3-1 and Table 3.4-1 emission factors and 40% load factor

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Equipment Type	Total Operating Hours	NONROAD2008 Combustion Emissions (tons/yr)[1]						AP-42 Combustion Emissions (tons/yr)[2]					
		THC	NO_x	CO	PM_{10}	SO_2	CO_2	TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Pulling unit	1,300	0.03	0.29	0.26	0.04	0.01	37.7	0.05	0.60	0.13	0.04	0.04	22.4
Backhoe	1,820	0.04	0.25	0.16	0.03	0.01	26.5	0.09	1.14	0.25	0.08	0.08	42.3
Grader	520	0.01	0.20	0.07	0.02	0.01	33.2	0.05	0.59	0.13	0.04	0.04	21.9
Water truck	520	0.02	0.23	0.09	0.02	0.01	47.1	0.07	0.84	0.18	0.06	0.06	31.1
Forklift	1,040	0.12	0.35	0.46	0.07	0.01	38.7	0.04	0.54	0.12	0.04	0.04	19.9
Welding machine	780	0.00	0.01	0.02	0.00	0.00	1.2	0.00	0.05	0.01	0.00	0.00	1.8
Generator	780	0.00	0.02	0.02	0.00	0.00	2.0	0.00	0.04	0.01	0.00	0.00	1.6
Integrity testing unit	3,120	0.05	0.71	0.34	0.05	0.02	77.4	0.54	6.77	1.46	0.48	0.45	251.2
Pickup truck	8,840	0.63	9.83	4.72	0.69	0.32	1,078.2	1.53	19.18	4.13	1.36	1.27	711.6
Swab rig	4,160	0.06	0.94	0.45	0.07	0.03	103.2	0.72	9.03	1.95	0.64	0.60	334.9
TOTAL		**0.97**	**12.83**	**6.58**	**0.98**	**0.43**	**1,445.2**	**3.09**	**38.78**	**8.36**	**2.75**	**2.56**	**1,438.6**

[1] Combustion emissions calculated using EPA NONROAD2008 Emission Factors

[2] Combustion emissions calculated using AP-42, Table 3.3-1 and Table 3.4-1 emission factors and 40% load factor

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Equipment Type	Total Operating Hours	NONROAD2008 Combustion Emissions (tons/yr)[1]						AP-42 Combustion Emissions (tons/yr)[2]					
		THC	NO_x	CO	PM_{10}	SO_2	CO_2	TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Pulling unit	1,300	0.03	0.29	0.26	0.04	0.01	37.7	0.05	0.60	0.13	0.04	0.04	22.4
Backhoe	1,820	0.04	0.25	0.16	0.03	0.01	26.5	0.09	1.14	0.25	0.08	0.08	42.3
Grader	520	0.01	0.20	0.07	0.02	0.01	33.2	0.05	0.59	0.13	0.04	0.04	21.9
Water truck	520	0.02	0.23	0.09	0.02	0.01	47.1	0.07	0.84	0.18	0.06	0.06	31.1
Forklift	520	0.06	0.18	0.23	0.03	0.01	19.3	0.02	0.27	0.06	0.02	0.02	9.9
Welding machine	780	0.00	0.01	0.02	0.00	0.00	1.2	0.00	0.05	0.01	0.00	0.00	1.8
Generator	780	0.00	0.02	0.02	0.00	0.00	2.0	0.00	0.04	0.01	0.00	0.00	1.6
Integrity testing unit	1,560	0.02	0.35	0.17	0.02	0.01	38.7	0.27	3.39	0.73	0.24	0.22	125.6
Pickup truck	5,200	0.37	5.78	2.78	0.41	0.19	634.2	0.90	11.28	2.43	0.80	0.75	418.6
Swab rig	2,080	0.03	0.47	0.23	0.03	0.02	51.6	0.36	4.51	0.97	0.32	0.30	167.4
TOTAL		**0.59**	**7.78**	**4.01**	**0.61**	**0.27**	**891.6**	**1.8**	**22.7**	**4.9**	**1.61**	**1.50**	**842.6**

[1] Combustion emissions calculated using EPA NONROAD2008 Emission Factors

[2] Combustion emissions calculated using AP-42, Table 3.3-1 and Table 3.4-1 emission factors and 40% load factor

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Equipment Type	Total Operating Hours	NONROAD2008 Combustion Emissions (tons/yr)[1]						AP-42 Combustion Emissions (tons/yr)[2]					
		THC	NO_x	CO	PM_{10}	SO_2	CO_2	TOC	NO_x	CO	PM_{10}	SO_2	CO_2
Cementing unit	4,360	0.10	0.98	0.86	0.13	0.04	126.5	0.16	2.03	0.44	0.14	0.13	75.2
Pulling unit	2,320	0.05	0.52	0.46	0.07	0.02	67.3	0.09	1.08	0.23	0.08	0.07	40.0
Backhoe	5,872	0.13	0.82	0.53	0.10	0.03	85.6	0.29	3.68	0.79	0.26	0.24	136.4
Bulldozer	2,256	0.08	1.10	0.38	0.09	0.05	184.8	0.26	3.29	0.71	0.23	0.22	121.9
Grader	1,892	0.05	0.71	0.25	0.06	0.04	120.7	0.17	2.15	0.46	0.15	0.14	79.6
Roller compactor	585	0.02	0.34	0.11	0.03	0.02	51.6	0.07	0.92	0.20	0.07	0.06	34.1
Scraper	3,140	0.14	2.62	1.09	0.17	0.11	361.3	0.51	6.42	1.38	0.46	0.42	238.3
Trackhoe	4,096	0.10	1.31	0.56	0.14	0.06	211.3	0.30	3.76	0.81	0.27	0.25	139.4
Semi-haul truck	12,488	0.41	5.46	2.18	0.52	0.33	1,132.3	1.60	20.13	4.34	1.43	1.33	746.8
Water truck	3,888	0.13	1.70	0.68	0.16	0.10	352.5	0.50	6.27	1.35	0.44	0.41	232.5
Disc tractor	716	0.02	0.20	0.08	0.02	0.01	25.2	0.04	0.45	0.10	0.03	0.03	16.6
Seed drill tractor	475	0.01	0.13	0.05	0.01	0.01	16.7	0.02	0.30	0.06	0.02	0.02	11.0
Skid-steer loader	1,464	0.05	0.19	0.23	0.04	0.01	19.7	0.06	0.76	0.16	0.05	0.05	28.3
Generator	6,656	0.03	0.17	0.14	0.02	0.01	16.7	0.03	0.37	0.08	0.03	0.02	13.8
Pickup truck	4,000	0.29	4.45	2.13	0.31	0.15	487.9	0.69	8.68	1.87	0.62	0.57	322.0
TOTAL		**1.73**	**21.72**	**10.32**	**1.95**	**1.02**	**3,441.3**	**5.1**	**64.3**	**13.9**	**4.56**	**4.25**	**2,385.0**

[1] Combustion emissions calculated using EPA NONROAD2008 Emission Factors

[2] Combustion emissions calculated using AP-42, Table 3.3-1 and Table 3.4-1 emission factors and 40% load factor

Appendix B

Combustion Emissions

Alternate Calculations for Drill Rigs

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Assumptions

1400-1600	injection/recovery wells	
140-200	monitor wells	
1740	wells (average)	
580	wells per year (3 years of construction)	
12	drilling rigs	
23	hrs/well	Average drilling time per well[1]
13,376	hrs/yr	
3	gal/hr	Fuel consumption[2]
40,128	gal/yr	Annual fuel use
137,000	btu/gal	Heat content of diesel fuel

Pollutant	AP-42 Emission Factor[1] (lb/MMBtu)	NONROAD2008 Emission Factor for Drill Rig (lb/MMBtu)	AP-42 Emissions (tons/yr)	NONROAD2008 Emissions (tons/yr)
NO_x	4.41	1.79	12.12	4.92
CO	0.95	0.58	2.61	1.59
SO_2	0.29	0.05	0.80	0.14
PM_{10}	0.31	0.10	0.85	0.27
CO_2	164	164.55	450.8	452.30
THC	-	0.12	-	0.33
TOC	0.35	-	0.96	-

[1] Based on installation of regional baseline monitor wells

[2] Personal communication between R. Taylor, Kid Pronghorn and B. Kelly, WWC Engineering, December 1, 2010.

[3] Uncontrolled Diesel Industrial Engines (EPA AP-42)

Appendix C

Fugitive Emission Calculations

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Inputs:

CPP Area Material Moisture Content (%) - Overburden	11.7	Ross 2010 Soil Survey
CPP Area Material Moisture Content (%) - Topsoil	9.8	Ross 2010 Soil Survey
CPP Area Material Silt Content (%) - Overburden	39.8	Ross 2010 Soil Survey
CPP Area Material Silt Content (%) - Topsoil	38.6	Ross 2010 Soil Survey
Mean Vehicle Speed (mph)	5	WWC Estimate
Wellfield Material Moisture Content (%) - Overburden	9.5	Ross 2010 Soil Survey
Wellfield Material Moisture Content (%) - Topsoil	8.1	Ross 2010 Soil Survey
Wellfield Material Silt Content (%) - Overburden	29	Ross 2010 Soil Survey
Wellfield Material Silt Content (%) - Topsoil	23.8	Ross 2010 Soil Survey
Average Wind Speed (mph)	11.5	IML (1/5-11/13/10)
Scraper Mean Vehicle Weight (tons)	41	CAT Spec Sheet
Road Base Material Moisture Content (%)	15	WWC Estimate

Site Preparation Central Plant Area

Activity	TSP <30 µm	< 15 µm	Scaling Factor <10 µm	Scaling Factor <2.5 µm	<10 µm	<5 µm	<2.5 µm	Rating Adjustment (Table 13.2.3-1)
Bulldozing Overburden (Table 11.9-1) lb/hr	19.37	8.02	0.52	0.03	4.17		0.58	-1/-2
Scrapers unloading topsoil (13.2.4) lb/ton	0.0008	0.0005			0.0010	0.0006	0.0002	-1
Scrapers in travel (13.2.2 Eqn 1a) lb/VMT	15.62				4.76		0.48	-0/-1
Scrapers removing topsoil (Table 13.2.3-1) lb/VMT					20.20			E
Truck dumping of fill material, road base, or other material (13.2.4) lb/ton	0.0012	0.0008			0.0006	0.0003	0.0001	-0/-1
Compacting (Table 11.9-1) lb/hr	19.37	8.02	0.52	0.03	4.17		0.58	-1/-2
Motor grading (11.9-1) lb/VMT	2.24	1.28	0.60	0.03	0.77		0.07	-1/-2

VMT - vehicle mile traveled

Site Preparation Wellfield

Activity	TSP <30 µm	< 15 µm	Scaling Factor <10 µm	Scaling Factor <2.5 µm	<10 µm	<5 µm	<2.5 µm	Rating Adjustment (Table 13.2.3-1)
Bulldozing Overburden (Table 11.9-1) lb/hr	17.37	6.68	0.52	0.03	3.47		0.52	-1/-2
Scrapers unloading topsoil (13.2.4) lb/ton	0.0029	0.0019			0.0014	0.0008	0.0002	-1
Scrapers in travel (13.2.2 Eqn 1a) lb/VMT	13.50				3.94		0.39	-0/-1
Scrapers removing topsoil (Table 13.2.3-1) lb/VMT					20.20			E
Truck dumping of fill material, road base, or other material (13.2.4) lb/ton	0.0012	0.0008			0.0006	0.0003	0.0001	-0/-1
Compacting (Table 11.9-1) lb/hr	17.37	6.68	0.52	0.03	3.47		0.52	-1/-2
Motor grading (11.9-1) lb/VMT	2.24	1.28	0.60	0.03	0.77		0.07	-1/-2

VMT - vehicle mile traveled

Vehicles Traveling Unpaved Roads (AP-42, 13.2.2 Eqn 1a)

Unpaved Surfaces at Industrial Sites, lb/VMT

Equipment	Mean Vehicle Weight (tons)	Emission Factor (lb/VMT)		
		$PM_{2.5}$	PM_{10}	PM_{30}
Backhoe	8	0.516027	5.16027	14.1297
Bulldozer	28	0.906782	9.06782	24.8293
Cementing unit	20	0.779373	7.79373	21.3406
Disc tractor	4	0.377754	3.77754	10.3436
Drilling rig	20	0.779373	7.79373	21.3406
Dump truck	20	0.779373	7.79373	21.3406
Forklift	14	0.663803	6.63803	18.1761
Front end loader	8	0.516027	5.16027	14.1297
Grader	18	0.743283	7.43283	20.3524
Hydraulic crane	36	1.015355	10.1535	27.8022
Manlift	10	0.570534	5.70534	15.6222
Mix truck	20	0.779373	7.79373	21.3406
Picker	18	0.743283	7.43283	20.3524
Pulling unit	8	0.516027	5.16027	14.1297
Roller compactor	23	0.829964	8.29964	22.7259
Scraper	41	1.076551	10.7655	29.4779
Seed drill tractor	4	0.377754	3.77754	10.3436
Semi-haul truck	20	0.779373	7.79373	21.3406
Skid-steer loader	4	0.377754	3.77754	10.3436
Trackhoe	17	0.724409	7.24409	19.8356
Trencher	7	0.485932	4.85932	13.3057
Water truck	20	0.779373	7.79373	21.3406

Vehicles Traveling Unpaved Roads (AP-42, 13.2.2 Eqn 1b) - Light Duty Vehicles

Unpaved Surfaces on Publicly Accessible Roads, lb/VMT

Surface silt content (%)	23.8	Ross 2010 Soil Survey
Surface moisture content (%)	11	Estimate
Speed Limit (mph)	15	Planned

Equipment	Emission Factor (lb/VMT)		
	$PM_{2.5}$	PM_{10}	PM_{30}
Light duty vehicle	0.1356806	1.359936	3.82347

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Construction Phase Estimated Total Fugitive PM_{10} Emissions **171.80 tons/yr**

Heavy Construction Operations (AP-42)

Activity		Site Preparation Central Plant Area	Wellfield and Roads Preparation
Bulldozing	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	680	2,080
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.71**	**1.81**
Scraper Unloading Topsoil	Emission Factor (lb/ton)	0.0010	0.0014
	Area (ac/yr)	55	160
	Stripping Depth (ft)	2	2
	Topsoil (CY/yr)	177,467	516,267
	Density of Topsoil (tons/CY)	1.25	1.25
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.06**	**0.22**
Scrapers in Travel	Emission Factor (lb/VMT)	4.76	3.94
	Scraper VMT (mi/day)	15	15
	Scraper Operation (day/yr)	200	185
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**3.57**	**2.74**
Scrapers Removing Topsoil	Emission Factor (lb/VMT)	20.2	20.2
	Scraper VMT (mi/day)	5	5
	Scraper Operation (day/yr)[2]	200	185
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**5.05**	**4.67**
Truck Dumping Fill Material	Emission Factor (lb/ton)	0.0006	0.0006
	Aggregate Material (CY)	2,800	16,000
	Material Density (tons/CY)	1.5	1.5
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**1.20**	**6.87**
Compacting	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	910	480
	Control Efficiency (%)[1]	50	50
	PM10 Emissions (tons/yr)	**0.95**	**0.42**
Grading	Emission Factor (lb/hr)	0.77	0.77
	Activity (hr/yr)	790	3,960
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.15**	**0.76**
Heavy Contstruction Fugitvie PM_{10} Emissions (tons/yr)		**11.69**	**17.48**

[1] Assume 50% control efficiency

[2] Based on 8 hr work days

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment[1]	PM_{10} Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Equipment Operating Days (days/yr)	VMT (mi/yr)	PM_{10} Emissions (tons/yr)
Cementing unit	7.79	0.5	617	309	0.60
Drilling rig	7.79	0.5	1,672	836	1.63
Pulling unit	5.16	0.5	557	279	0.36
Backhoe	5.16	3	2,779	8,338	10.76
Bulldozer	9.07	5	265	1,325	3.00
Front end loader	5.16	5	243	1,213	1.56
Grader	7.43	20	354	7,075	13.15
Roller compactor	8.30	10	174	1,738	3.61
Trackhoe	7.24	2	379	758	1.37
Trencher	4.86	2	443	885	1.08
Dump truck	7.79	15	214	3,215	6.26
Hydraulic crane	10.15	0.2	70	14	0.04
Mix truck	7.79	2	176	353	0.69
Semi-haul truck	7.79	15	379	5,685	11.08
Water truck	7.79	20	1,907	38,140	74.31
Disc tractor	3.78	10	95	950	0.90
Seed drill tractor	3.78	10	72	720	0.68
Forklift	6.64	0.5	725	362	0.60
Manlift	5.71	0.25	250	63	0.09
Picker	7.43	0.25	160	40	0.07
Skid-steer loader	3.78	5	72	360	0.34
Integrity testing unit	1.36	1	557	557	0.19
Flat bed truck	1.36	10	26	261	0.09
Logging truck	1.36	5	418	2,090	0.71
Pickup truck	1.36	25	1,115	27,871	9.48
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**142.64**

[1] Scraper not included, accounted for in Heavy Construction Operations Fugitive Emissions

Operation Phase Total Estimated Fugitive PM_{10} Emissions **14.29 tons/yr**

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment	PM_{10} Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Annual Operation[1] (hrs/yr)	Activity (mi/yr)	PM_{10} Emissions (tons/yr)
Pulling unit	5.16	5	1,300	813	1.05
Backhoe	5.16	5	1,820	1,138	1.47
Grader	7.43	5	520	325	0.60
Water truck	7.79	20	520	1,300	2.53
Forklift	6.64	0.5	1,040	65	0.11
Integrity testing unit	1.36	1	3,120	390	0.13
Pickup truck	1.36	20	8,840	22,100	7.51
Swab rig	1.36	5	4,160	2,600	0.88
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**14.29**

[1] Based on 8 hr work days

Aquifer Restoration Phase Total Estimated Fugitive PM_{10} Emissions: 9.80 tons/yr

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment	PM^{10} Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Annual Operation[1] (hrs/yr)	Activity (mi/yr)	PM_{10} Emissions (tons/yr)
Pulling unit	5.16	1	1,300	163	0.21
Backhoe	5.16	5	1,820	1,138	1.47
Grader	7.43	5	520	325	0.60
Water truck	7.79	20	520	1,300	2.53
Forklift	6.64	0.5	520	33	0.05
Integrity testing unit	1.36	1	1,560	195	0.07
Pickup truck	1.36	20	5,200	13,000	4.42
Swab rig	1.36	5	2,080	1,300	0.44
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**9.80**

[1] Based on 8 hr work days

Ross ISR Project
Proposed Equipment Summary and Emission Factors

Decommissioning Phase Total Estimated Fugitive PM_{10} Emissions **85.07 tons/yr**

Heavy Construction Operations (AP-42)

Activity		Site Preparation Central Plant Area	Wellfield and Roads Preparation
Bulldozing	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	496	1760
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.52**	**1.53**
Scraper Unloading Topsoil	Emission Factor (lb/ton)	0.0010	0.0014
	Area (ac/yr)	55	160
	Stripping Depth (ft)	2	2
	Topsoil (CY/yr)	177467	516267
	Density of Topsoil (tons/CY)	1.25	1.25
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.06**	**0.22**
Scrapers in Travel	Emission Factor (lb/VMT)	4.76	3.94
	Scraper VMT (mi/day)	10	10
	Scraper Operation (day/yr)[2]	120	273
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**1.43**	**2.69**
Compacting	Emission Factor (lb/hr)	4.17	3.47
	Activity (hr/yr)	152	433
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.16**	**0.38**
Grading	Emission Factor (lb/hr)	0.77	0.77
	Activity (hr/yr)	272	1620
	Control Efficiency (%)[1]	50	50
	PM_{10} Emissions (tons/yr)	**0.05**	**0.31**
Heavy Contstruction Fugitvie PM_{10} Emissions (tons/yr)		**2.21**	**5.12**

[1] Assume 50% control efficiency

[2] Based on 8 hr work days

Fugitive Emissions from Vehicles Traveling Unpaved Roads (AP-42 13.2.2 Eqn 1a)

Equipment[1]	PM10 Emission Factor (lb/VMT)	Est Max Distance Traveled (mi/day)	Annual Operation[2] (hrs/yr)	Activity (mi/yr)	PM10 Emissions (tons/yr)
Cementing unit	7.79	5	4360	2725	5.31
Pulling unit	5.16	5	2320	1450	1.87
Backhoe	5.16	5	5872	3670	4.73
Bulldozer	9.07	5	2256	1410	3.20
Front end loader	5.16	5	1144	715	0.92
Grader	7.43	10	1892	2365	4.39
Roller compactor	8.30	2	585	146	0.30
Trackhoe	7.24	0.5	4096	256	0.46
Trencher	4.86	0.5	40	3	0.00
Dump truck	7.79	5	1600	1000	1.95
Semi-haul truck	7.79	10	12488	15610	30.42
Water truck	7.79	20	3888	9720	18.94
Disc tractor	3.78	10	716	895	0.85
Seed drill tractor	3.78	10	475	593	0.56
Manlift	5.71	0.25	1440	45	0.06
Picker	7.43	0.25	320	10	0.02
Skid-steer loader	3.78	2	1464	366	0.35
Pickup truck	1.36	20	4000	10000	3.40
Vehichle Traveling Unpaved Roads Fugitive PM_{10} Emissions (tons/yr)					**77.73**

[1] Scraper not included, accounted for in Heavy Construction Operations Fugitive Emissions

[2] Based on 8 hr work days