

Appendix D
Soils Supporting Data

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

[Minor map unit components are excluded from this report]

Map unit: BA - Berino loamy fine sand, 0 to 3 percent slopes

Component: Berino (100%)

The Berino component makes up 100 percent of the map unit. Slopes are 0 to 3 percent. This component is on fan piedmonts, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC007NM Loamy ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The soil has a very slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.

Map unit: BB - Berino complex, 0 to 3 percent slopes, eroded

Component: Berino (60%)

The Berino component makes up 60 percent of the map unit. Slopes are 0 to 3 percent. This component is on fan piedmonts, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC003NM Loamy Sand ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The soil has a very slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 1 within 30 inches of the soil surface.

Component: Pajarito (25%)

The Pajarito component makes up 25 percent of the map unit. Slopes are 0 to 3 percent. This component is on sand dunes, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC003NM Loamy Sand ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 30 percent. There are no saline horizons within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

Map unit: BD - Berino-Dune land complex, 0 to 3 percent slopes

Component: Berino (45%)

The Berino component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on fan piedmonts, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC007NM Loamy ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The soil has a very slightly saline horizon within 30 inches of the soil surface.

Component: Dune land (40%)

Generated brief soil descriptions are created for major soil components. The Dune land is a miscellaneous area.

Map unit: GA - Gypsum land

Component: Gypsum land (100%)

Generated brief soil descriptions are created for major soil components. The Gypsum land is a miscellaneous area.

Map unit: GP - Gravel pit

Component: Gravel pit (100%)

Generated brief soil descriptions are created for major soil components. The Gravel pit is a miscellaneous area.

Map unit: KM - Kermit-Berino fine sands, 0 to 3 percent slopes

Component: Kermit (50%)

The Kermit component makes up 50 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is very high. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC005NM Deep Sand ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

Map unit: KM - Kermit-Berino fine sands, 0 to 3 percent slopes

Component: Berino (35%)

The Berino component makes up 35 percent of the map unit. Slopes are 0 to 3 percent. This component is on uplands, fan piedmonts. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC003NM Loamy Sand ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The soil has a very slightly saline horizon within 30 inches of the soil surface.

Map unit: KT - Kimbrough-Stegall loams, 0 to 3 percent slopes

Component: Kimbrough (70%)

The Kimbrough component makes up 70 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer, petrocalcic, is 8 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R042XC025NM Shallow ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Component: Stegall (25%)

The Stegall component makes up 25 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer, petrocalcic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R042XC007NM Loamy ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 65 percent. There are no saline horizons within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

Map unit: LA - Largo loam, 1 to 5 percent slopes

Component: Largo (100%)

The Largo component makes up 100 percent of the map unit. Slopes are 1 to 5 percent. This component is on alluvial fans, uplands. The parent material consists of calcareous alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC007NM Loamy ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Map unit: LS - Likes loamy fine sand, 1 to 5 percent slopes

Component: Likes (100%)

The Likes component makes up 100 percent of the map unit. Slopes are 1 to 5 percent. This component is on alluvial fans, uplands. The parent material consists of calcareous alluvium and/or colluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC005NM Deep Sand ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent. There are no saline horizons within 30 inches of the soil surface.

Map unit: ML - Mined land

Component: Mined land (100%)

Generated brief soil descriptions are created for major soil components. The Mined land is a miscellaneous area.

Map unit: PA - Pajarito loamy fine sand, 0 to 3 percent slopes, eroded

Component: Pajarito (100%)

The Pajarito component makes up 100 percent of the map unit. Slopes are 0 to 3 percent. This component is on uplands, sand dunes. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC003NM Loamy Sand ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

Map unit: PD - Pajarito-Dune land complex, 0 to 3 percent slopes

Component: Dune land (45%)

Generated brief soil descriptions are created for major soil components. The Dune land is a miscellaneous area.

Component: Pajarito (45%)

The Pajarito component makes up 45 percent of the map unit. Slopes are 0 to 3 percent. This component is on uplands, sand dunes. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC003NM Loamy Sand ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Map unit: PS - Potter-Simona complex, 5 to 25 percent slopes

Component: Potter (80%)

The Potter component makes up 80 percent of the map unit. Slopes are 5 to 25 percent. This component is on hills, uplands. The parent material consists of alluvium. Depth to a root restrictive layer inches, petrocalcic,. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC025NM Shallow ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 50 percent. There are no saline horizons within 30 inches of the soil surface.

Component: Simona (15%)

The Simona component makes up 15 percent of the map unit. Slopes are 5 to 10 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer, petrocalcic, is 7 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC002NM Shallow Sandy ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

Map unit: RG - Reeves-Gypsum land complex, 0 to 3 percent slopes

Component: Reeves (55%)

The Reeves component makes up 55 percent of the map unit. Slopes are 0 to 1 percent. This component is on uplands, gypsum hills. The parent material consists of residuum weathered from gypsum. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC007NM Loamy ecological site. Nonirrigated land capability classification is 7s. Irrigated land capability classification is 3s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 20 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 2 within 30 inches of the soil surface.

Component: Gypsum land (30%)

Generated brief soil descriptions are created for major soil components. The Gypsum land is a miscellaneous area.

Map unit: RO - Rock land

Component: Rock land (100%)

Generated brief soil descriptions are created for major soil components. The Rock land is a miscellaneous area.

Map unit: SG - Simona gravelly fine sandy loam, 0 to 3 percent slopes

Component: Simona (95%)

The Simona component makes up 95 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer, petrocalcic, is 7 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC002NM Shallow Sandy ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Eddy Area, New Mexico

Map unit: SM - Simona-Bippus complex, 0 to 5 percent slopes

Component: Simona (55%)

The Simona component makes up 55 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer, petrocalcic, is 7 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC002NM Shallow Sandy ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Component: Bippus (30%)

The Bippus component makes up 30 percent of the map unit. Slopes are 0 to 5 percent. This component is on alluvial fans, alluvial plains. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R042XC017NM Bottomland ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 30 percent. There are no saline horizons within 30 inches of the soil surface.

Map unit: SR - Stony and Rough broken land

Component: Stony and rough broken land (100%)

Generated brief soil descriptions are created for major soil components. The Stony and rough broken land is a miscellaneous area.

Map unit: TF - Tonuco loamy fine sand, 0 to 3 percent slopes

Component: Tonuco (100%)

The Tonuco component makes up 100 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, uplands. The parent material consists of mixed alluvium and/or eolian sands. Depth to a root restrictive layer, petrocalcic, is 6 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC004NM Sandy ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Appendix E
Land Cover Support Data

NLCD Barren Lands Types

(Rock/Sand/Clay)-Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulation of earthen material. Generally, vegetation accounts for less than 15% of total cover.

S018 NORTH AMERICAN WARM DESERT ACTIVE AND STABILIZED DUNE

Division 302, Barren, CES302.744

Spatial Scale & Pattern: Large Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Non-vegetated (<10% vasc.), Upland

Diagnostic Classifiers: Dune (Landform), Dune field, Dune (Substrate), Temperate [Temperate Xeric], Sand Soil Texture, W-Landscape/High Intensity

Non-Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Herbaceous, Dune (undifferentiated), Tropical/Subtropical [Tropical Xeric], Gypsiferous, Aridic

Concept Summary: This ecological system occurs across the warm deserts of North America and is composed of unvegetated to sparsely vegetated (generally <10% plant cover) active dunes and sandsheets derived from quartz or gypsum sands. Common vegetation includes *Ambrosia dumosa*, *Abronia villosa*, *Eriogonum deserticola*, *Larrea tridentata*, *Pleuraphis rigida*, *Poliomintha* spp., *Prosopis* spp., *Psorothamnus* spp., *Artemisia filifolia*, and *Rhus microphylla*. Dune "blowouts" and subsequent stabilization through succession are characteristic processes.

DISTRIBUTION

Range: Occurs across the warm deserts of North America.

Ecological Divisions: 302

TNC Ecoregions: 17:C, 22:C, 23:C, 24:C

Subnations/Nations: AZ:c, CA:c, MXBC:c, MXBS:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

- ABRONIA VILLOSA SPARSELY VEGETATED ALLIANCE (A.1852)
Abronia villosa Sparse Vegetation [Placeholder] (CEGL003001)
- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816)
Artemisia filifolia - Psorothamnus scoparius - Dalea lanata Gypsum Dune Shrubland (CEGL004561)
Artemisia filifolia / Andropogon hallii - Achnatherum hymenoides Gypsum Dune Shrubland (CEGL004559)
Artemisia filifolia / Sporobolus flexuosus Shrubland (CEGL001547)
Artemisia filifolia / Sporobolus giganteus Shrubland (CEGL001078)
- CLEOME ISOMERIS - EPHEDRA CALIFORNICA - ERICAMERIA LINEARIFOLIA SHRUBLAND ALLIANCE (A.819)
Cleome isomeris - Ephedra californica - Ericameria linearifolia Shrubland [Placeholder] (CEGL003056)
- ERIOGONUM DESERTICOLA SPARSELY VEGETATED ALLIANCE (A.1856)
Eriogonum deserticola Sand Dune Sparse Vegetation (CEGL001962)
- HELIOTROPIUM CONVULVACEUM SPARSELY VEGETATED ALLIANCE (A.1853)
Heliotropium convulvaceum - Psoralidium lanceolatum - Polanisia jamesii Sparse Vegetation (CEGL004581)
- HELIOTROPIUM RACEMOSUM SPARSELY VEGETATED ALLIANCE (A.1854)
Heliotropium racemosum - Chamaesyce sp. Sparse Vegetation (CEGL004582)
- POLIOMINTHA INCANA SHRUBLAND ALLIANCE (A.862)
Poliomintha incana / Muhlenbergia pungens Shrubland (CEGL002672)
- PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE (A.1031)
Prosopis glandulosa / Atriplex canescens Shrubland (CEGL001382)
Prosopis glandulosa / Sporobolus flexuosus Shrubland (CEGL001386)
- PSOROTHAMNUS POLYDENIUS SHRUBLAND ALLIANCE (A.1039)
Psorothamnus polydenius var. polydenius / Achnatherum hymenoides Shrubland (CEGL001353)
- PSOROTHAMNUS SPINOSUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2520)
Psorothamnus spinosus Shrubland [Placeholder] (CEGL002701)
- SPOROBOLUS FLEXUOSUS HERBACEOUS ALLIANCE (A.1268)
Sporobolus flexuosus - Dasyochloa pulchella Herbaceous Vegetation (CEGL001693)
Sporobolus flexuosus - Paspalum setaceum Herbaceous Vegetation (CEGL001694)
Sporobolus flexuosus - Sporobolus contractus Herbaceous Vegetation (CEGL001696)

California community types:

- Cismontane and Desert Interior Dunes (22.000.00)
- Active Desert Dunes and Sand Fields (22.010.00)

- Desert Sand-verbena (22.100.00)
- Stabilized and Partially Stabilized Desert Dunes (22.300.00)
- Stabilized and Partially Stabilized Desert Sand Fields (22.400.00)
- San Joaquin Valley Dunes (22.500.00)
- Sonoran Dune Scrub (33.010.02)
- Creosote Bush - Big Galleta (33.010.13)
- Creosote Bush - Big Galleta - Anderson's Wolfberry (33.010.14)
- Big Galleta (41.030.01)
- Big Galleta - Rayless Goldenhead (41.030.02)
- Big Galleta - Cooper's Goldenbush (41.030.03)
- Big Galleta - Downy Dalea (41.030.04)
- Desert Needlegrass Grassland (41.090.00)
- Indian Ricegrass (41.120.00)
- Mesquite Dune Scrub (61.510.01)

SOURCES

References: Bowers 1982, Bowers 1984, Holland and Keil 1995, MacMahon 1988, Powell and Turner 1974, Thomas et al. 2003a

Last updated: 20 Feb 2003

Concept Author: NatureServe Western Ecology Team

Stakeholders: WCS, SCS

LeadResp: WCS

S020 NORTH AMERICAN WARM DESERT WASH

Division 302, Woody Wetland, CES302.755

Spatial Scale & Pattern: Linear

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland

Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Toeslope/Valley Bottom, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Riverine / Alluvial, Intermittent Flooding

Non-Diagnostic Classifiers: Sideslope, Short (50-100 yrs) Persistence

Concept Summary: This ecological system is restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of North America. Although often dry, the intermittent fluvial processes define this system, which are often associated with rapid sheet and gully flow. This system occurs as linear or braided strips within desert scrub- or desert grassland-dominated landscapes. The vegetation of desert washes is quite variable ranging from sparse and patchy to moderately dense and typically occurs along the banks, but may occur within the channel. The woody layer is typically intermittent to open and may be dominated by shrubs and small trees such as *Acacia greggii*, *Brickellia laciniata*, *Baccharis sarothroides*, *Chilopsis linearis*, *Fallugia paradoxa*, *Hymenoclea salsola*, *Hymenoclea monogyra*, *Juglans microcarpa*, *Prosopis* spp., *Psoralea argemonea*, *Prunus fasciculata*, *Rhus microphylla*, *Salazaria mexicana*, or *Sarcobatus vermiculatus*.

DISTRIBUTION

Range: Restricted to intermittently flooded washes or arroyos that dissect bajadas, mesas, plains and basin floors throughout the warm deserts of North America.

Ecological Divisions: 302

TNC Ecoregions: 17:C, 22:C, 23:C, 24:C

Subnations/Nations: AZ:c, CA:c, MXBC:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

- (A.0)
Baccharis emoryi Shrubland [Provisional] (CEGL002974)
- ACACIA GREGGII SHRUBLAND ALLIANCE (A.1036)
Acacia greggii - Parkinsonia microphylla Shrubland (CEGL001340)
- BACCHARIS SALICIFOLIA - BACCHARIS NEGLECTA SEASONALLY FLOODED SHRUBLAND ALLIANCE (A.987)
Baccharis salicifolia - Baccharis neglecta / Eustoma exaltatum Shrubland (CEGL004590)
- BACCHARIS SALICIFOLIA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.933)
Baccharis salicifolia / Muhlenbergia rigens Shrubland (CEGL004572)
- BACCHARIS SAROTHROIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.840)
Baccharis sarothroides - Baccharis salicifolia Shrubland (CEGL001160)
Baccharis sarothroides - Parkinsonia microphylla Shrubland (CEGL001159)
- BACCHARIS SERGILOIDES INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2531)

- Baccharis sergiloides Shrubland [Placeholder] (CEGL002953)
- BRICKELLIA LACINIATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.940)
Brickellia laciniata - Hymenoclea monogyra Shrubland (CEGL001953)
- CHILOPSIS LINEARIS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1044)
Chilopsis linearis / Brickellia laciniata Shrubland (CEGL004933)
Chilopsis linearis Shrubland (CEGL001164)
- ENCELIA VIRGINENSIS SHRUBLAND ALLIANCE (A.860)
Encelia virginensis Shrubland (CEGL001335)
- EPHEDRA CALIFORNICA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2536)
Ephedra californica Shrubland [Placeholder] (CEGL002958)
- ERICAMERIA PANICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2509)
Ericameria paniculata Shrubland [Placeholder] (CEGL002706)
- FORESTIERA PUBESCENS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.969)
Forestiera pubescens Mojave Desert Shrubland [Provisional] (CEGL002959)
- GRAYIA SPINOSA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1045)
Grayia spinosa - Lycium andersonii Shrubland (CEGL001347)
Grayia spinosa - Lycium pallidum Shrubland (CEGL001348)
- HYMENOCLEA MONOXYRA SHRUBLAND ALLIANCE (A.1034)
Hymenoclea monogyra Thicket Shrubland (CEGL001169)
- HYMENOCLEA SALSOLA SHRUBLAND ALLIANCE (A.2512) Hymenoclea
salsola - (Ambrosia eriocentra) Shrubland (CEGL002702) Hymenoclea salsola -
Salazaria mexicana Shrubland (CEGL002703)
- HYPITIS EMORYI INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2537) Hyptis
emoryi Shrubland [Placeholder] (CEGL002960)
- JUGLANS MICROCARPA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.945) Juglans
microcarpa / Cladium mariscus ssp. jamaicense Shrubland (CEGL004593)
Juglans microcarpa / Sorghastrum nutans Shrubland (CEGL004594) Juglans
microcarpa Shrubland (CEGL001103)
- LEPIDOSPARTUM SQUAMATUM INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.838)
Lepidospartum squamatum Intermittently Flooded Shrubland [Placeholder] (CEGL003060)
- PANICUM BULBOSUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1356) Panicum
bulbosum - Alopecurus aequalis Herbaceous Vegetation (CEGL001653)
Panicum bulbosum - Lycurus phleoides Herbaceous Vegetation (CEGL001654)
- PROSOPIS (GLANDULOSA, VELUTINA) WOODLAND ALLIANCE (A.661) Prosopis
(glandulosa var. torreyana, velutina) Woodland [Placeholder] (CEGL003082)
- PROSOPIS GLANDULOSA SHRUB HERBACEOUS ALLIANCE (A.1550)
Prosopis glandulosa / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001510)
- PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE (A.1031) Prosopis
glandulosa - Atriplex spp. Shrubland (CEGL002193) Prosopis glandulosa /
Atriplex canescens Shrubland (CEGL001382) Prosopis glandulosa / Bouteloua
gracilis Shrubland (CEGL001383) Prosopis glandulosa / Mixed Grasses
Shrubland (CEGL001384) Prosopis glandulosa / Muhlenbergia porteri Shrubland
(CEGL001511) Prosopis glandulosa / Sporobolus airoides Shrubland
(CEGL001385)
Prosopis glandulosa var. glandulosa / Bouteloua gracilis - Buchloe dactyloides Shrubland (CEGL003877) Prosopis
glandulosa var. torreyana Shrubland (CEGL001381)
- PROSOPIS GLANDULOSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.637) Prosopis
glandulosa Temporarily Flooded Woodland (CEGL004934)
- PROSOPIS GLANDULOSA WOODLAND ALLIANCE (A.611)
Prosopis glandulosa / Bouteloua curtipendula - Nassella leucotricha Woodland (CEGL002133)
- PROSOPIS PUBESCENS SHRUBLAND ALLIANCE (A.1042) Prosopis
pubescens Shrubland (CEGL001387)
- PROSOPIS VELUTINA SHRUBLAND ALLIANCE (A.1043) Prosopis
velutina - Acacia greggii Shrubland (CEGL001388)
- PRUNUS FASCICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2519) Prunus
fasciculata Shrubland [Placeholder] (CEGL002704)
- PSOROTHAMNUS SPINOSUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2520)
Psorothamnus spinosus Shrubland [Placeholder] (CEGL002701)
- RHUS MICROPHYLLA SHRUBLAND ALLIANCE (A.1040)
Rhus microphylla / Bouteloua curtipendula Shrubland (CEGL001354)
- SAPINDUS SAPONARIA TEMPORARILY FLOODED FOREST ALLIANCE (A.303) Sapindus
saponaria - Juglans major Forest (CEGL000557)
- VIGUIERA RETICULATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.2539) Viguiera
reticulata Shrubland [Placeholder] (CEGL002962)

- **California community types:**
- Scalebroom Scrub (32.070.00)
- California Buckwheat - Scalebroom (32.070.01)
- Scalebroom - Hairy Yerba Santa - Chaparral Yucca (32.070.02)
- Scalebroom / Mixed Ephemeral Herbs (32.070.03)
- Creosote Bush Wash Scrub (33.010.06)
- Creosote Bush - Cheesebush (33.010.08)
- Creosote Bush - Cheesebush - Woolly Brickellia (33.010.15)
- Catclaw Acacia Thorn Scrub (33.040.00)
- Catclaw Acacia-wash association (33.040.01)
- Catclaw Acacia Savanna (33.040.02)
- Catclaw Acacia / Desert Lavender (33.040.03)
- Catclaw Acacia / Cheesebush (33.040.04)
- Catclaw Acacia - Cheesebush - Virgin River Encelia (33.040.05)
- Catclaw Acacia - Desert Sunflower (33.040.06)
- Catclaw Acacia - Desert Almond (33.040.07)
- Catclaw Acacia - Woolly Bursage (33.040.08)
- Catclaw Acacia - Blue Sage (33.040.09)
- Catclaw Acacia - Sweetbush (33.040.10)
- Catclaw Acacia/Naked buckwheat (33.040.11)
- Desert Lavender Wash Scrub (33.190.00)
- Cheesebush - wash association (33.200.01)
- Cheesebush - California Buckwheat (33.200.02)
- Cheesebush - Blackstem Rabbitbrush (33.200.03)
- Cheesebush - Shadscale (33.200.04)
- Cheesebush - Sweetbush (33.200.05)
- Cheesebush - Woolly Bursage (33.200.06)
- Cheesebush - Woolly Brickellia (33.200.07)
- Cheesebush - Spiny Senna (33.200.08)
- Mojave Wash Scrub (33.213.00)
- Desert Almond Scrub (33.300.00)
- Desert Almond (33.300.01)
- Desert Almond - Bladder Sage (33.300.02)
- Desert Almond - Skunkbrush (33.300.03)
- Desert Almond - Stansbury's Antelope Bush (33.300.04)
- Desert Almond - Woolly Bursage (33.300.05)
- Desert Almond - Net-veined Viguiera - (Utah Mortonia) (33.300.06)
- Bladder Sage (33.310.01)
- Blue Palo Verde - Ironwood - Smoke Tree Woodland (61.530.00)
- Blue Palo Verde Woodland (61.540.00)
- Blue Palo Verde Wash Woodland (61.540.01)
- Blue Palo Verde / Desert Lavender (61.540.02)
- Desert-willow Woodland (61.550.00)
- Desert-willow / Cheesebush (61.550.02)
- Desert-willow - Desert Almond - Cheesebush (61.550.03)
- Desert-willow - Desert Almond (61.550.04)
- Desert-willow - Blue Sage (61.550.05)
- Desert-willow - Desert Sunflower (61.550.06)
- Desert-willow - Blackstem Rabbitbrush (61.550.07)
- Ironwood Woodland (61.560.01)
- Ironwood / Desert Lavender (61.560.02)
- Smoke Tree Woodland and Scrub (61.570.00)
- Smoketree Wash Woodland (61.570.01)
- Smoketree - Cheesebush - Sweetbush (61.570.02)
- Smoketree / California Ephedra (61.570.03)
- Smoketree - Desert Lavender - Catclaw Acacia (61.570.04)
- Mulefat Scrub (63.510.00)
- Arrow Weed Scrub (63.710.00)
- Sandy to Cobbly wash bottom (99.900.01)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, MacMahon 1988, Muldavin et al. 2000b, Szaro 1989, Thomas et al. 2003a

Last updated: 20 Feb 2003

Concept Author: NatureServe Western Ecology Team

Stakeholders: WCS, SCS

LeadResp: WCS

NLCD Shrub/Scrub Types

Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early sucesional stage or trees stunted from environmental conditions.

S048 WESTERN GREAT PLAINS SANDHILL SHRUBLAND

Division 303, Shrubland, CES303.671

Spatial Scale & Pattern: Large Patch

Classification Confidence: high

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated), Sand Soil Texture, Ustic, F-Landscape/Medium Intensity, G-Landscape/Medium Intensity

Concept Summary: This system is found mostly in south-central areas of the Western Great Plains Division ranging from the Nebraska Sandhill region south to central Texas, although some examples may reach as far north as the Badlands of South Dakota. The climate is semi-arid to arid for much of the region in which this system occurs. This system is found on somewhat excessively to excessively well-drained, deep sandy soils that are often associated with dune systems and ancient floodplains. In some areas, this system may actually occur as a result of overgrazing in Western Great Plains Tallgrass Prairie (CES303.673) or Western Great Plains Sand Prairie (CES303.670). This system is characterized by a sparse to moderately dense woody layer dominated by *Artemisia filifolia*. Associated species can vary with geography, amount and season of precipitation, disturbance and soil texture. Several graminoid species such as *Andropogon hallii*, *Schizachyrium scoparium*, *Sporobolus cryptandrus*, *Calamovilfa gigantea*, *Hesperostipa comata*, and *Bouteloua* spp. can be connected with this system. Other shrub species may also be present including *Yucca glauca*, *Prosopis glandulosa*, *Rhus trilobata*, and *Prunus angustifolia*. In the southern range of this system, *Quercus havardii* may also be present and represents one succession pathway that develops over time following a disturbance. *Quercus havardii* is able to resprout following a fire and thus may persist for long periods of time once established. Fire and grazing are the most important dynamic processes for this type, although drought stress can impact this system significantly in some areas. Overgrazing can lead to decreasing dominance of some of the grass species such as *Andropogon hallii*, *Calamovilfa gigantea*, and *Schizachyrium scoparium*.

Comments: This system may overlap in concept with Crosstimbers Southern Xeric Sandhill (CES205.897).

DISTRIBUTION

Range: This system is found primarily within the south-central areas of the Western Great Plains Division ranging from the Nebraska Sandhills south into central Texas. However, examples of this system can be found as far north as the Badlands in South Dakota.

Ecological Divisions: 303

TNC Ecoregions: 26:C, 27:C, 28:C, 33:C

Subnations/Nations: CO:c, KS:c, NE:c, OK:c, TX:?

CONCEPT

Alliances and Associations:

- ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (A.816)
 - Artemisia filifolia / Andropogon hallii Shrubland (CEGL001459)
 - Artemisia filifolia / Bouteloua (curtipendula, gracilis) Shrubland (CEGL002176)
 - Artemisia filifolia / Calamovilfa longifolia Shrubland (CEGL002177)
 - Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii Shrubland (CEGL002178)
 - Artemisia filifolia / Sporobolus cryptandrus Shrubland (CEGL002179)
- PRUNUS ANGUSTIFOLIA SHRUBLAND ALLIANCE (A.1884)
 - Prunus angustifolia / Schizachyrium scoparium Shrubland (CEGL002180)
- QUERCUS HAVARDII SHRUBLAND ALLIANCE (A.780)
 - Quercus havardii / Sporobolus cryptandrus - Schizachyrium scoparium Shrubland (CEGL002171)

Environment: This system is found primarily in semi-arid to arid areas of the Western Great Plains Division. It occurs on somewhat excessively to excessively well-drained and deep sandy soils. This system is often found associated with dune systems and/or ancient floodplains but may occur in soils derived from sandstone residuum.

Vegetation: This system is distinguished by a sparse to a moderately dense shrub layer dominated by *Artemisia filifolia*. Graminoid species such as *Andropogon hallii*, *Schizachyrium scoparium*, *Sporobolus cryptandrus*, *Calamovilfa gigantea*, *Hesperostipa comata*, and *Bouteloua* spp. can also be found within this system. Other shrub species such as *Yucca glauca*, *Rhus trilobata*, and *Prunus angustifolia* may be present. *Quercus havardii* and

Prosopis glandulosa may also be present in the southern extent of this system.

Dynamics: Fire and grazing constitute the most important processes impacting this system. Burning shrublands reduces cover of *Artemisia filifolia* for several years resulting in grassland patches that form a mosaic pattern with shrublands. Composition of grasslands depends on precipitation and management. Drought stress can also influence this system in some areas.

SOURCES

References: Ramaley 1939b, Sims et al. 1976, Tolstead 1942

Last updated: 05 Mar 2003

Concept Author: S. Menard and K. Kindscher

Stakeholders: MCS, WCS

LeadResp: MCS

S058 APACHERIAN-CHIHUAHUAN MESQUITE UPLAND SCRUB

Division 302, Shrubland, CES302.733

Spatial Scale & Pattern: Matrix

Classification Confidence: low

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Shrubland (Shrub-dominated), Thorn Shrub, *Prosopis* spp.-dominated

Non-Diagnostic Classifiers: Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Aridic, Intermediate Disturbance Interval, F-Patch/High Intensity [Seasonality/Winter Fire]

Concept Summary: This ecological system occurs as upland shrublands that are concentrated in the extensive grassland-shrubland transition in foothills and piedmont in the Chihuahuan Desert. It extends into the Sky Island region to the west, and the Edwards Plateau to the east. Substrates are typically derived from alluvium, often gravelly without a well-developed argillic or calcic soil horizon that would limit infiltration and storage of winter precipitation in deeper soil layers. *Prosopis* spp. and other deep-rooted shrubs exploit this deep soil moisture that is unavailable to grasses and cacti. Vegetation is typically dominated by *Prosopis glandulosa* or *Prosopis velutina* and succulents. Other desert scrub that may codominate or dominate includes *Acacia neovernicosa*, *Acacia constricta*, *Juniperus monosperma*, or *Juniperus coahuilensis*. Grass cover is typically low. During the last century, the area occupied by this system has increased through conversion of desert grasslands as a result of drought, overgrazing by livestock, and/or decreases in fire frequency. It is similar to Chihuahuan Mixed Desert and Thorn Scrub (CES302.734), but is generally found at higher elevations where *Larrea tridentata* and other desert scrub is not codominant. It is also similar to Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub (CES302.737), but does not occur on eolian-deposited substrates.

DISTRIBUTION

Range: Foothills and piedmont in the Chihuahuan Desert, extending into the Sky Island region and into lower Mogollon Rim to the west, and the Edwards Plateau to the east.

Ecological Divisions: 302

TNC Ecoregions: 22:C, 24:C, 29:P, 30:P

Subnations/Nations: AZ:c, MXCH:c, MXSO:p, NM:c, TX:c

CONCEPT

Alliances and Associations:

- ACACIA NEOVERNICOSA SHRUBLAND ALLIANCE (A.1037)
 - Acacia neovernicosa / Flourensia cernua Shrubland (CEGL001341)
 - Acacia neovernicosa / Muhlenbergia porteri Shrubland (CEGL001342)
- JUNIPERUS COAHUILENSIS WOODLAND ALLIANCE (A.503)
 - Juniperus coahuilensis / Canotia holacantha Woodland (CEGL000701)
- JUNIPERUS MONOSPERMA WOODLAND ALLIANCE (A.504)
 - Juniperus monosperma / Bouteloua eriopoda Woodland (CEGL000709)
 - Juniperus monosperma / Prosopis glandulosa Woodland (CEGL000719)
- PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE (A.1031)
 - Prosopis glandulosa / Atriplex canescens Shrubland (CEGL001382)
 - Prosopis glandulosa / Bouteloua gracilis Shrubland (CEGL001383)
 - Prosopis glandulosa / Muhlenbergia porteri Shrubland (CEGL001511)
 - Prosopis glandulosa / Sporobolus airoides Shrubland (CEGL001385)
 - Prosopis glandulosa / Sporobolus flexuosus Shrubland (CEGL001386)
 - Prosopis glandulosa var. torreyana Shrubland (CEGL001381)

- PROSOPIS VELUTINA SHRUBLAND ALLIANCE (A.1043)
Prosopis velutina - Acacia greggii Shrubland (CEGL001388)
Prosopis velutina / Celtis laevigata var. reticulata Shrubland (CEGL001390)
Prosopis velutina / Muhlenbergia porteri Shrubland (CEGL001391)

SOURCES

References: MacMahon 1988, McAuliffe 1995, McPherson 1995, Muldavin et al. 2002

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS, LACD

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

S062 CHIHUAHUAN CREOSOTEBUSH, MIXED DESERT AND THORN SCRUB

Division 302, Shrubland

Spatial Scale & Pattern: Matrix

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Shrubland (Shrub-dominated)

Non-Diagnostic Classifiers: Toeslope/Valley Bottom, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Aridic, Xeromorphic Shrub, Thorn Shrub

Concept Summary: This widespread Chihuahuan Desert land cover type is composed of two ecological systems the Chihuahuan Creosotebush Xeric Basin Desert Scrub (CES302.731) and the Chihuahuan Mixed Desert and Thorn Scrub (CES302.734). This cover type includes xeric creosotebush basins and plains and the mixed desert scrub in the foothill transition zone above, sometimes extending up to the lower montane woodlands. Vegetation is characterized by *Larrea tridentata* alone or mixed with thornscrub and other desert scrub such as *Agave lechuguilla*, *Aloysia wrightii*, *Fouquieria splendens*, *Dasyllirion leiophyllum*, *Flourensia cernua*, *Leucophyllum minus*, *Mimosa aculeaticarpa* var. *biuncifera*, *Mortonia scabrella* (= *Mortonia sempervirens* ssp. *scabrella*), *Opuntia engelmannii*, *Parthenium incanum*, *Prosopis glandulosa*, and *Tiquilia greggii*. Stands of *Acacia constricta* *Acacia neovernicosa* or *Acacia greggii* dominated thornscrub are included in this system, and limestone substrates appear important for at least these species. Grasses such as *Dasyochloa pulchella*, *Bouteloua curtipendula*, *Bouteloua eriopoda*, *Bouteloua ramosa*, *Muhlenbergia porteri* and *Pleuraphis mutica* may be common, but generally have lower cover than shrubs.

DISTRIBUTION

Range: This landcover type is characteristic of the Chihuahuan Desert.

Ecological Divisions: 302

TNC Ecoregions: 22:C, 24:C

Subnations/Nations: AZ:c, MXCH:c, MXSO:c, NM:c, TX:c

CONCEPT

Alliances and Associations:

- ACACIA NEOVERNICOSA SHRUBLAND ALLIANCE (A.1037) *Acacia neovernicosa* / *Flourensia cernua* Shrubland (CEGL001341) *Acacia neovernicosa* / *Muhlenbergia porteri* Shrubland (CEGL001342)
- BOUTELOUA HIRSUTA - BOUTELOUA GRACILIS - BOUTELOUA ERIPODA SHRUB HERBACEOUS ALLIANCE (A.1548)
Acacia neovernicosa / *Bouteloua hirsuta* - *Bouteloua gracilis* - *Bouteloua eriopoda* Shrub Herbaceous Vegetation (CEGL004244)
Larrea tridentata / *Bouteloua hirsuta* - *Bouteloua gracilis* - *Bouteloua eriopoda* Shrub Herbaceous Vegetation (CEGL004246)
- FLOURENSIA CERNUA SHRUBLAND ALLIANCE (A.861) *Flourensia cernua* / *Achnatherum eminens* Shrubland (CEGL001338) *Flourensia cernua* / *Bouteloua curtipendula* Shrubland (CEGL001336) *Flourensia cernua* / *Pleuraphis mutica* Shrubland (CEGL001541) *Flourensia cernua* / *Sporobolus airoides* Shrubland (CEGL001337)
- FOUQUIERIA SPLENDENS SHRUBLAND ALLIANCE (A.863) *Fouquieria splendens* / *Bouteloua curtipendula* Shrubland (CEGL001376) *Fouquieria splendens* / *Bouteloua hirsuta* Shrubland (CEGL001377) *Fouquieria splendens* / *Parthenium incanum* Shrubland (CEGL001378) *Fouquieria splendens* / *Petrophyton caespitosum* Shrubland (CEGL001379)
- LARREA TRIDENTATA SHRUBLAND ALLIANCE (A.851) *Larrea tridentata* - *Flourensia cernua* Shrubland (CEGL001270) *Larrea tridentata* - *Hechtia texensis* Shrubland (CEGL004565)
Larrea tridentata - *Jatropha dioica* var. *graminea* Shrubland (CEGL004566) *Larrea tridentata* - *Parthenium incanum* Shrubland (CEGL001274)
Larrea tridentata - *Prosopis glandulosa* Shrubland (CEGL001275) *Larrea*

- tridentata / *Bouteloua eriopoda* Shrubland (CEGL001265) *Larrea tridentata* / *Bouteloua gracilis* Shrubland (CEGL001266) *Larrea tridentata* / *Bouteloua ramosa* Shrubland (CEGL004563) *Larrea tridentata* / *Dasyochloa pulchella* Shrubland (CEGL001269) *Larrea tridentata* / *Muhlenbergia porteri* Shrubland (CEGL001272) *Larrea tridentata* / Sparse Understory Shrubland (CEGL001276) *Larrea tridentata* / *Sporobolus airoides* Shrubland (CEGL001277)
- *Larrea tridentata* / *Tiquilia hispidissima* Shrubland (CEGL001267)
 - MORTONIA SEMPERVIRENS SHRUBLAND ALLIANCE (A.859) *Mortonia scabrella* / *Dasyilirion wheeleri* Shrubland (CEGL001279)

SOURCES

References: Brown 1982, Dick-Peddie 1993, MacMahon 1988, Muldavin et al. 2000b, Muldavin et al. 2002

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS, LACD

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

S068 CHIHUAHUAN STABILIZED COPPICE DUNE AND SAND FLAT SCRUB

Division 302, Shrubland, CES302.737

Spatial Scale & Pattern: Large Patch

Classification Confidence: low

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Plain, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Sand Soil Texture, Aridic, Very Short Disturbance Interval, W-Landscape/High Intensity, Thorn Shrub, *Prosopis* spp.-dominated

Concept Summary: This ecological system includes the open shrublands of vegetated coppice dunes and sandsheets found in the Chihuahuan Desert. Usually dominated by *Prosopis glandulosa* but includes *Atriplex canescens*, *Ephedra torreyana*, *Ephedra trifurca*, *Poliomintha incana*, and *Rhus microphylla* coppice sand scrub with 10-30% total vegetation cover. *Yucca elata*, *Gutierrezia sarothrae*, and *Sporobolus flexuosus* are commonly present.

DISTRIBUTION

Range: Dunes and sandsheets found in the Chihuahuan Desert.

Ecological Divisions: 302

TNC Ecoregions: 24:C

Subnations/Nations: MXCH:c, NM:c, TX:c

CONCEPT

Alliances and Associations:

- ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869)
Atriplex canescens / *Sporobolus wrightii* Shrubland (CEGL001292)
- EPHEDRA TORREYANA SHRUBLAND ALLIANCE (A.2572)
Ephedra torreyana - *Achnatherum hymenoides* Hummock Shrubland (CEGL005802)
- PROSOPIS GLANDULOSA SHRUBLAND ALLIANCE (A.1031)
Prosopis glandulosa / *Atriplex canescens* Shrubland (CEGL001382)
Prosopis glandulosa / *Bouteloua gracilis* Shrubland (CEGL001383)
Prosopis glandulosa / *Muhlenbergia porteri* Shrubland (CEGL001511)
Prosopis glandulosa / *Sporobolus flexuosus* Shrubland (CEGL001386)
- PSOROTHAMNUS SCOPARIUS SHRUBLAND ALLIANCE (A.837)
Psoralea scoparius / *Sporobolus flexuosus* Shrubland (CEGL001695)
- RHUS MICROPHYLLA SHRUBLAND ALLIANCE (A.1040)
Rhus microphylla / *Bouteloua curtipendula* Shrubland (CEGL001354)

SOURCES

References: Bowers 1982, Bowers 1984, Dick-Peddie 1993, Muldavin et al. 2000b

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS, LACD

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

S116 CHIHUAHUAN MIXED SALT DESERT SCRUBDivision 302, Shrubland, CES302.017

Spatial Scale & Pattern: Large Patch**Classification Confidence:** medium**Required Classifiers:** Natural/Semi-natural, Vegetated (>10% vasc.), Upland**Diagnostic Classifiers:** Lowland [Lowland], Shrubland (Shrub-dominated), Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], *Atriplex* spp.

Concept Summary: This system includes extensive open-canopied shrublands of typically saline basins in the Chihuahuan Desert. Stands often occur on alluvial flats and around playas. Substrates are generally fine-textured, saline soils. Vegetation is typically composed of one or more *Atriplex* species such as *Atriplex canescens*, *Atriplex obovata*, or *Atriplex polycarpa* along with species of *Allenrolfea*, *Flourensia*, *Salicornia*, *Suaeda*, or other halophytic plants. Graminoid species may include *Sporobolus airoides*, *Pleuraphis mutica*, or *Distichlis spicata* at varying densities.

DISTRIBUTION**Range:** Saline basins in the Chihuahuan Desert.**Ecological Divisions:** 302**TNC Ecoregions:** 22:C, 24:C, 28:C, 29:P, 30:P**Subnations/Nations:** AZ:c, MXCH:c, MXCO:c, MXDU:c, MXNU:c, MXSO:c, NM:c, TX:c**CONCEPT****Alliances and Associations:**

- ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869)
Atriplex canescens / *Parthenium confertum* Shrubland (CEGL001290)
Atriplex canescens / *Sporobolus airoides* Shrubland (CEGL001291)
Atriplex canescens / *Sporobolus wrightii* Shrubland (CEGL001292)
- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108)
Atriplex obovata / *Tidestromia carnosa* Dwarf-shrubland (CEGL004575)
- ATRIPLEX POLYCARPA SHRUBLAND ALLIANCE (A.873)
Atriplex polycarpa / *Pleuraphis mutica* Shrubland (CEGL001319)
- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332)
Distichlis spicata Herbaceous Vegetation (CEGL001770)
- FLOURENSIA CERNUA SHRUBLAND ALLIANCE (A.861)
Flourensia cernua / *Achnatherum eminens* Shrubland (CEGL001338)
Flourensia cernua / *Bouteloua curtipendula* Shrubland (CEGL001336)
Flourensia cernua / *Pleuraphis mutica* Shrubland (CEGL001541)
Flourensia cernua / *Sporobolus airoides* Shrubland (CEGL001337)

SOURCES**References:** Brown 1982, Dick-Peddie 1993, Muldavin et al. 2000b, Muldavin et al. 2002, Shreve and Wiggins 1964**Last updated:** 24 Mar 2003**Stakeholders:** WCS, LAC**Concept Author:** NatureServe Western Ecology Team**LeadResp:** WCS**NLCD Grassland/Herbaceous Types**

Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

S077 APACHERIAN-CHIHUAHUAN PIEDMONT SEMI-DESERT GRASSLAND AND STEPPEDivision 302, Herbaceous, CES302.735

Spatial Scale & Pattern: Large Patch**Classification Confidence:** medium**Required Classifiers:** Natural/Semi-natural, Vegetated (>10% vasc.), Upland**Diagnostic Classifiers:** Lowland [Foothill], Lowland [Lowland], Herbaceous, Temperate [Temperate Xeric], Short Disturbance Interval, F-Patch/High Intensity [Seasonality/Winter Fire], Graminoid**Non-Diagnostic Classifiers:** Tropical/Subtropical [Tropical Xeric], Aridic, Broad-Leaved Evergreen Tree, Xeromorphic Tree, Xeromorphic Shrub, Thorn Shrub, Succulent Shrub

Concept Summary: This ecological system is a broadly defined desert grassland, mixed shrub-succulent or xeromorphic tree savanna that is typical of the Borderlands of Arizona, New Mexico and northern Mexico

[Apacherian region], but extends west to the Sonoran Desert, north into the Mogollon Rim and throughout much of the Chihuahuan Desert. It is found on gently sloping bajadas that supported frequent fire throughout the Sky Islands and on mesas and steeper piedmont and foothill slopes in the Chihuahuan Desert. It is characterized by a typically diverse perennial grasses. Common grass species include *Bouteloua eriopoda*, *B. hirsuta*, *B. rothrockii*, *B. curtipendula*, *B. gracilis*, *Eragrostis intermedia*, *Muhlenbergia porteri*, *Muhlenbergia setifolia*, *Pleuraphis jamesii*, *Pleuraphis mutica*, and *Sporobolus airoides*, succulent species of *Agave*, *Dasyllirion*, and *Yucca*, and tall shrub/short tree species of *Prosopis* and various oaks (e.g., *Quercus grisea*, *Quercus emoryi*, *Quercus arizonica*). Many of the historical desert grassland and savanna areas have been converted, some to Chihuahuan Mesquite Upland Scrub (CES302.733) (*Prosopis* spp.-dominated), through intensive grazing and other land uses.

DISTRIBUTION

Range: Borderlands of Arizona, New Mexico and northern Mexico [Apacherian region], extending to the Sonoran Desert and throughout much of the Chihuahuan Desert.

Ecological Divisions: 302

TNC Ecoregions: 22:C, 24:C, 28:C

Subnations/Nations: AZ:c, MXCH:c, NM:c, TX:c

CONCEPT

Alliances and Associations:

- BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (A.1244)
 - Bouteloua curtipendula - Bothriochloa barbinodis Herbaceous Vegetation (CEGL001590)
 - Bouteloua curtipendula - Hilaria belangeri - Bouteloua eriopoda Herbaceous Vegetation (CEGL001591)
 - Bouteloua curtipendula - Schizachyrium cirratum Herbaceous Vegetation (CEGL001592)
- BOUTELOUA CURTIPENDULA SHRUB HERBACEOUS ALLIANCE (A.1552)
 - Dasyllirion wheeleri / Bouteloua curtipendula Shrub Herbaceous Vegetation (CEGL001593)
- BOUTELOUA ERIOPODA DWARF-SHRUB HERBACEOUS ALLIANCE (A.1570)
 - Artemisia bigelovii / Bouteloua eriopoda Dwarf-shrub Herbaceous Vegetation (CEGL001741)
- BOUTELOUA ERIOPODA HERBACEOUS ALLIANCE (A.1284)
 - Bouteloua eriopoda - Bouteloua curtipendula Herbaceous Vegetation (CEGL001747)
 - Bouteloua eriopoda - Bouteloua gracilis Herbaceous Vegetation (CEGL001748)
 - Bouteloua eriopoda - Bouteloua hirsuta Herbaceous Vegetation (CEGL001749)
 - Bouteloua eriopoda - Bouteloua trifida Herbaceous Vegetation (CEGL001750)
 - Bouteloua eriopoda - Hesperostipa neomexicana Herbaceous Vegetation (CEGL001753)
 - Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation (CEGL001751)
 - Bouteloua eriopoda - Semi-desert Herbaceous Vegetation (CEGL001752)
- BOUTELOUA ERIOPODA XEROMORPHIC SHRUB HERBACEOUS ALLIANCE (A.1553)
 - Ayenia microphylla / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001729)
 - Dasyllirion wheeleri / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001730)
 - Parthenium incanum / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001734)
- BOUTELOUA GRACILIS DWARF-SHRUB HERBACEOUS ALLIANCE (A.1571)
 - Artemisia bigelovii / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation (CEGL001742)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282)
 - Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation (CEGL001754)
 - Bouteloua gracilis - Bouteloua hirsuta Herbaceous Vegetation (CEGL001755)
 - Bouteloua gracilis - Buchloe dactyloides Herbaceous Vegetation (CEGL001756)
 - Bouteloua gracilis - Eragrostis intermedia Herbaceous Vegetation (CEGL001758)
 - Bouteloua gracilis - Hesperostipa neomexicana Herbaceous Vegetation (CEGL001763)
 - Bouteloua gracilis - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001761)
 - Bouteloua gracilis - Sporobolus flexuosus Herbaceous Vegetation (CEGL001762)
- BOUTELOUA HIRSUTA - BOUTELOUA GRACILIS - BOUTELOUA ERIOPODA SHRUB HERBACEOUS ALLIANCE (A.1548)
 - Yucca faxoniana / Bouteloua hirsuta - Bouteloua gracilis - Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL004248)
- BOUTELOUA HIRSUTA HERBACEOUS ALLIANCE (A.1285)
 - Bouteloua hirsuta - Bouteloua curtipendula Herbaceous Vegetation (CEGL001764)
 - Bouteloua hirsuta - Bouteloua radicata Herbaceous Vegetation (CEGL001765)
 - Bouteloua hirsuta - Digitaria californica Herbaceous Vegetation (CEGL001767)
 - Bouteloua hirsuta - Hesperostipa neomexicana Herbaceous Vegetation (CEGL001766)
- BOUTELOUA RAMOSA HERBACEOUS ALLIANCE (A.1275)
 - Bouteloua ramosa Herbaceous Vegetation (CEGL004522)
- DASYLLIRION LEIOPHYLLUM - (AGAVE LECHUGUILLA, VIGUIERA STENOLOBA) SHRUBLAND ALLIANCE (A.850)
 - Dasyllirion leiophyllum - Agave lechuguilla / Bouteloua hirsuta - Bouteloua gracilis - Bouteloua eriopoda Shrubland (CEGL004245)

- Dasyliirion leiophyllum - Viguiera stenoloba - Agave lechuguilla / Bouteloua ramosa Shrubland (CEGL004604)
- FOUQUIERIA SPLENDENS SHRUBLAND ALLIANCE (A.863)
Fouquieria splendens / Bouteloua curtipendula Shrubland (CEGL001376)
Fouquieria splendens / Bouteloua hirsuta Shrubland (CEGL001377)
- HESPEROSTIPA NEOMEXICANA HERBACEOUS ALLIANCE (A.1272)
Hesperostipa neomexicana - Bouteloua curtipendula Herbaceous Vegetation (CEGL001709)
Hesperostipa neomexicana - Dasyliirion wheeleri Herbaceous Vegetation (CEGL001710)
- MUHLENBERGIA EMERSLEYI HERBACEOUS ALLIANCE (A.1259)
Muhlenbergia emersleyi - Bouteloua curtipendula Herbaceous Vegetation (CEGL001644)
Muhlenbergia emersleyi - Bouteloua hirsuta Herbaceous Vegetation (CEGL001645)
- MUHLENBERGIA SETIFOLIA / ARTEMISIA BIGELOVII SHRUB HERBACEOUS ALLIANCE (A.1530)
Artemisia bigelovii / Muhlenbergia setifolia Shrub Herbaceous Vegetation (CEGL001544)
- MUHLENBERGIA SETIFOLIA SHRUB HERBACEOUS ALLIANCE (A.1541)
Dasyliirion wheeleri / Muhlenbergia setifolia Shrub Herbaceous Vegetation (CEGL001512)
Fouquieria splendens / Muhlenbergia setifolia Shrub Herbaceous Vegetation (CEGL001513)
- PLEURAPHIS JAMESII HERBACEOUS ALLIANCE (A.1287)
Pleuraphis jamesii - Sporobolus airoides Herbaceous Vegetation (CEGL001778)
- PLEURAPHIS MUTICA SHRUB HERBACEOUS ALLIANCE (A.1551)
Larrea tridentata / Pleuraphis mutica Shrub Herbaceous Vegetation (CEGL001542)
Prosopis glandulosa / Pleuraphis mutica Shrub Herbaceous Vegetation (CEGL001641)
- PROSOPIS GLANDULOSA SHRUB HERBACEOUS ALLIANCE (A.1550)
Prosopis glandulosa / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001510)
- QUERCUS ARIZONICA WOODLAND ALLIANCE (A.482)
Quercus arizonica / Bouteloua curtipendula Woodland (CEGL000680)
Quercus arizonica / Muhlenbergia emersleyi Woodland (CEGL000681)
- QUERCUS EMORYI WOODLAND ALLIANCE (A.483)
Quercus emoryi / Bouteloua curtipendula Woodland (CEGL000683)
Quercus emoryi / Muhlenbergia emersleyi Woodland (CEGL000685)
Quercus emoryi / Schizachyrium cirratum Woodland (CEGL000687)
- QUERCUS GRISEA WOODLAND ALLIANCE (A.478)
Quercus grisea / Bouteloua curtipendula Woodland (CEGL000689)
- SCHIZACHYRIUM SCOPARIUM BUNCH HERBACEOUS ALLIANCE (A.1266)
Schizachyrium scoparium var. scoparium - Muhlenbergia pungens Herbaceous Vegetation (CEGL001684)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267)
Sporobolus airoides - Muhlenbergia porteri Herbaceous Vegetation (CEGL001689)

SOURCES

References: Brown 1982, Burgess 1995, Dick-Peddie 1993, McAuliffe 1995, McPherson 1995, Muldavin et al. 2000b, Muldavin et al. 2002

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS, LACD

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

S080 CHIHUAHUAN GYPSOPHILOUS GRASSLAND AND STEPPE

Division 302, Herbaceous, CES302.732

Spatial Scale & Pattern: Large Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Herbaceous, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Alkaline Soil, Gypsiferous, Dwarf-Shrub, Graminoid

Non-Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Oligotrophic Soil, Aridic

Concept Summary: This ecological system is restricted to gypsum outcrops or sandy gypsiferous and/or often alkaline soils that occur in basins and slopes in the Chihuahuan Desert. Elevation range is from 1100-2000 m. These typically sparse grasslands, steppes or dwarf-shrublands are dominated by a variety of gypsophilous plants, many of which are endemic to these habitats. Characteristic species include *Tiquilia hispidissima*, *Atriplex canescens*, *Calylophus hartwegii*, *Ephedra torreyana*, *Frankenia jamesii*, *Bouteloua breviseta*, *Mentzelia perennis*, *Nama carnosum*, *Calylophus hartwegii* (= *Oenothera hartwegii*), *Selinocarpus lanceolatus*, *Sporobolus nealleyi*, *Sporobolus airoides*, and *Sartwellia flaveriae*. This system does not include the sparsely vegetated gypsum dunes that are included in North American Warm Desert Active and Stabilized Dunes (CES302.744).

Distribution

Range: Basins and slopes in the Chihuahuan Desert; elevation range from 1100-2000 m.

Ecological Divisions: 302

TNC Ecoregions: 22:P, 24:C

Subnations/Nations: AZ:p, MXCH:c, NM:c, TX:c

CONCEPT

Alliances and Associations:

- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108)
Atriplex obovata / Tidestromia carnosa Dwarf-shrubland (CEGL004575)
- BOUTELOUA BREVISETA SPARSELY VEGETATED ALLIANCE (A.1870)
Bouteloua breviseta Sparse Vegetation (CEGL004609)
- SCHIZACHYRIUM SCOPARIUM BUNCH HERBACEOUS ALLIANCE (A.1266)
Schizachyrium scoparium var. scoparium - Muhlenbergia pungens Herbaceous Vegetation (CEGL001684)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267)
Sporobolus airoides - Scleropogon brevifolius Herbaceous Vegetation (CEGL001692)
- SPOROBOLUS NEALLEYI HERBACEOUS ALLIANCE (A.1269)
Sporobolus nealleyi - Bouteloua eriopoda Herbaceous Vegetation (CEGL001697)
Sporobolus nealleyi - Calylophus hartwegii Herbaceous Vegetation (CEGL001698)
- SPOROBOLUS NEALLEYI SHRUB HERBACEOUS ALLIANCE (A.1542)
Fouquieria splendens / Sporobolus nealleyi Shrub Herbaceous Vegetation (CEGL001517)
- TIDESTROMIA CARNOSA SPARSELY VEGETATED ALLIANCE (A.1873)
Tidestromia carnosa - Kallstroemia grandiflora Sparse Vegetation (CEGL004580)
- TIQUILIA HISPIDISSIMA DWARF-SHRUBLAND ALLIANCE (A.1101)
Tiquilia hispidissima - Yucca torreyi / Sporobolus nealleyi Dwarf-shrubland (CEGL003959)
Tiquilia hispidissima / Bouteloua breviseta - Mentzelia humilis Dwarf-shrubland (CEGL004573)
Tiquilia hispidissima / Sporobolus airoides Dwarf-shrubland (CEGL004574)
Tiquilia hispidissima / Sporobolus nealleyi Dwarf-shrubland (CEGL001546)
Tiquilia hispidissima Dwarf-shrubland [Provisional] (CEGL008425)

SOURCES

References: Dick-Peddie 1993, Henrickson et al. 1985, MacMahon 1988, Muldavin et al. 2000b, Muldavin et al. 2002, Powell and Turner 1974

Last updated: 20 Feb 2003

Concept Author: NatureServe Western Ecology Team

Stakeholders: WCS, SCS, LACD

LeadResp: WCS

S088 WESTERN GREAT PLAINS SHORTGRASS PRAIRIE

Division 303, Herbaceous, CES303.672

Spatial Scale & Pattern: Matrix

Classification Confidence: high

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Non-Diagnostic Classifiers: Herbaceous, Loam Soil Texture, Ustic, F-Landscape/Low Intensity

Concept Summary: This system is found primarily in the western half of the Western Great Plains Division in the rain shadow of the Rocky Mountains and ranges from the Nebraska Panhandle south into Texas and New Mexico, although grazing impacted examples may reach as far north as southern Canada where it grades into Northwestern Great Plains Mixedgrass Prairie (CES303.674). This system occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey. In much of its range, this system forms the matrix system with *Bouteloua gracilis* dominating this system. Associated graminoids may include *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Buchloe dactyloides*, *Hesperostipa comata*, *Koeleria macrantha* (= *Koeleria cristata*), *Pascopyrum smithii* (= *Agropyron smithii*), *Pleuraphis jamesii*, *Sporobolus airoides* and *Sporobolus cryptandrus*. Although mid-height grass species may be present especially on more mesic land positions and soils, they are secondary in importance to the sod-forming short grasses. Sandy soils have higher cover of *Hesperostipa comata*, *Sporobolus cryptandrus*, and *Yucca elata*. Scattered shrub and dwarf-dwarf species such as *Artemisia filifolia*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Eriogonium effusum*, *Gutierrezia sarothrae*, *Lycium palida*, may also be present. Also, because this system spans a wide range, there can be some differences in the relative dominance of some species from north to south and from east to west. Large-scale processes such as climate, fire and grazing influence this system. High variation in amount and timing of annual precipitation impacts the relative cover of cool and warm season herbaceous species. In contrast to other prairie systems, fire is less

important, especially in the western range of this system, because the often dry and xeric climate conditions can decrease the fuel load and thus the relative fire frequency within the system. However, historically, fires that did occur were often very expansive. Currently, fire suppression and more extensive grazing in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. A large part of the range for this system (especially in the east and near rivers) has been converted to agriculture. Areas of the central and western range have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s. The short grasses that dominate this system are extremely drought- and grazing- tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing. This system in combination with the associated wetland systems represents one of the richest areas for mammals and birds. Endemic bird species to the shortgrass system may constitute one of the fastest declining bird populations.

DISTRIBUTION

Range: This system is found primarily in the western half of the Western Great Plains Division east of the Rocky Mountains and ranges from the Nebraska Panhandle south into panhandles of Oklahoma and Texas and New Mexico, although some examples may reach as far north as southern Canada where it grades into Northwestern Great Plains Mixedgrass Prairie (CES303.674).

Ecological Divisions: 303

TNC Ecoregions: 26:P, 27:C, 28:C, 33:P

Subnations/Nations: CO:c, KS:c, NE:c, NM:c, OK:c, TX:c, WY:c

CONCEPT

Alliances and Associations:

- (COMPLEX)
 - Blacktailed Prairie Dog Town Grassland Complex (CECX005703)
- ARISTIDA PURPUREA HERBACEOUS ALLIANCE (A.2570) Aristida purpurea Herbaceous Vegetation (CEGL005800)
- BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (A.1244) Bouteloua curtipendula - Bouteloua (eriopoda, gracilis) Herbaceous Vegetation (CEGL002250)
- BOUTELOUA ERIPODA HERBACEOUS ALLIANCE (A.1284) Bouteloua eriopoda - Bouteloua gracilis Herbaceous Vegetation (CEGL001748) Bouteloua eriopoda - Bouteloua hirsuta Herbaceous Vegetation (CEGL001749)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282) Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation (CEGL001754) Bouteloua gracilis - Bouteloua hirsuta Herbaceous Vegetation (CEGL001755) Bouteloua gracilis - Buchloe dactyloides - Pleuraphis jamesii Herbaceous Vegetation (CEGL002271) Bouteloua gracilis - Buchloe dactyloides Herbaceous Vegetation (CEGL001756) Bouteloua gracilis - Buchloe dactyloides Xeric Soil Herbaceous Vegetation (CEGL002270) Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation (CEGL001759) Bouteloua gracilis Herbaceous Vegetation (CEGL001760)
- BOUTELOUA HIRSUTA HERBACEOUS ALLIANCE (A.1285) Bouteloua hirsuta - Bouteloua curtipendula Herbaceous Vegetation (CEGL001764) Bouteloua hirsuta Herbaceous Vegetation [Placeholder] (CEGL002673)
- HESPEROSTIPA NEOMEXICANA HERBACEOUS ALLIANCE (A.1272) Hesperostipa neomexicana Mixed Prairie Herbaceous Vegetation (CEGL001711)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267) Sporobolus airoides Southern Plains Herbaceous Vegetation (CEGL001685)
- YUCCA GLAUCA SHRUB HERBACEOUS ALLIANCE (A.1540) Yucca glauca / Calamovilfa longifolia Shrub Herbaceous Vegetation (CEGL002675)

Environment: Climate is continental with mean annual precipitation is generally about 300 mm ranging to 500 mm to the south in Texas. Most of the annual precipitation occurs during the growing season as thunderstorms.

Precipitation events are mostly <10 cm with occasional larger events.

This system is located on primarily flat to rolling uplands. Soils typically are loamy and ustic and range from sandy to clayey.

Vegetation: This system spans a wide range and thus there can be some differences in the relative dominance of some species from north to south and from east to west. This system is primarily dominated by *Bouteloua gracilis* throughout its range with various associated graminoid species depending on precipitation, soils and management. Associated graminoids may include *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Buchloe dactyloides*, *Carex filifolia*, *Hesperostipa comata*, *Koeleria macrantha* (= *Koeleria cristata*), *Muhlenbergia torreyana*, *Pascopyrum smithii* (= *Agropyron smithii*), *Pleuraphis jamesii*, *Sporobolus airoides* and *Sporobolus cryptandrus*. Although mid-height grass species may be present especially on more mesic land positions and soils, they are secondary in importance to the sod-

forming short grasses. Sandy soils have higher cover of *Hesperostipa comata*, *Sporobolus cryptandrus*, and *Yucca elata*. Scattered shrub and dwarf-dwarf species such as *Artemisia filifolia*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Eriogonum effusum*, *Gutierrezia sarothrae*, *Lycium palida*, may also be present. High annual variation in amount and timing of precipitation impacts relative cover of herbaceous species. Cover of cool season grasses are dependant on winter and early spring precipitation.

Dynamics: Climate, fire and grazing constitute the primary processes impacting this system. Drought tolerant shortgrass species have root systems that extend up near the soil surface where they can utilize low precipitation events (Sala and Lauenroth 1982). However, fire is less important in this system compared to other Western Great Plains prairie systems, especially in the western portion of its range. Previous comments in the literature citing *Opuntia* spp. increasing with overgrazing may not be borne out by more recent research (R. Rondeau pers. com.). Conversion to agriculture and pastureland with the subsequent irrigation has degraded and extirpated this system in some areas of its range.

SOURCES

References: Barbour and Billings 1988, Dick-Peddie 1993, Lauenroth and Milchunas 1991, Milchunas et al. 1989, Ricketts et al. 1999, Sala and Lauenroth 1982

Sala, O.E. and W.K. Lauenroth. 1982. Small rainfall events: an ecological role in semi-arid regions. *Oecologia* Berlin, 53:301-304.

Last updated: 21 Aug 2003

Stakeholders: MCS, WCS

Concept Author: S. Menard and K. Kindscher

LeadResp: MCS

S113 CHIHUAHUAN SANDY PLAINS SEMI-DESERT GRASSLAND

Division 302, Herbaceous, CES302.736

Spatial Scale & Pattern: Large Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Herbaceous, Sand Soil Texture, Graminoid

Non-Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Mesa, Plain, Toeslope/Valley Bottom, Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Continental], Temperate [Temperate Xeric], Aridic, Xeromorphic Shrub, Succulent Shrub

Concept Summary: This ecological system occurs across the Chihuahuan Desert and extends into the southern Great Plains where soils have a high sand content. These dry grasslands or steppe are found on sandy plains and sandstone mesas. The graminoid layer is dominated or codominated by *Achnatherum hymenoides*, *Bouteloua eriopoda*, *Bouteloua hirsuta*, *Hesperostipa neomexicana*, *Pleuraphis jamesii*, *Sporobolus cryptandrus*, *Sporobolus airoides* or *Sporobolus flexuosus*. Typically, there are found scattered desert shrubs and stem succulents such as *Ephedra torreyana*, *Ephedra trifurca*, *Fallugia paradoxa*, *Prosopis glandulosa*, *Yucca elata*, and *Yucca torreyi* that are characteristic of the Chihuahuan Desert.

DISTRIBUTION

Range: Chihuahuan Desert extending into the southern Great Plains where soils have a high sand content.

Ecological Divisions: 302

TNC Ecoregions: 22:C, 24:C, 28:C

Subnations/Nations: AZ:c, MXCH:c, NM:c, TX:c

CONCEPT

Alliances and Associations:

- BOUTELOUA ERIPODA XEROMORPHIC SHRUB HERBACEOUS ALLIANCE (A.1553)
 - Ephedra torreyana / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001731)
 - Ephedra trifurca / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001732)
 - Yucca elata / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001735)
- SPOROBOLUS FLEXUOSUS HERBACEOUS ALLIANCE (A.1268)
 - Sporobolus flexuosus - Paspalum setaceum Herbaceous Vegetation (CEGL001694)
 - Sporobolus flexuosus - Sporobolus contractus Herbaceous Vegetation (CEGL001696)

SOURCES

References: Dick-Peddie 1993, Muldavin et al. 2000b, Muldavin et al. 2002

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS, LACD

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

NLCD Woody Wetland Types

Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

S094 NORTH AMERICAN WARM DESERT LOWER MONTANE RIPARIAN WOODLAND AND SHRUBLAND

Division 302, Woody Wetland, CES302.748

Spatial Scale & Pattern: Linear

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland

Diagnostic Classifiers: Forest and Woodland (Treed), Shrubland (Shrub-dominated), Riverine / Alluvial

Non-Diagnostic Classifiers: Lowland [Lowland], Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Short (50-100 yrs) Persistence

Concept Summary: This ecological system occurs in mountain canyons and valleys of southern Arizona and New Mexico, and adjacent Mexico and consists of mid- to low-elevation (1100-1800 m) riparian corridors along perennial and seasonally intermittent streams. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Populus angustifolia*, *Populus deltoides ssp. wislizeni*, *Populus fremontii*, *Platanus wrightii*, *Juglans major*, *Fraxinus velutina*, and *Sapindus saponaria*. Shrub dominants include *Salix exigua*, *Prunus spp.*, *Alnus oblongifolia*, and *Baccharis salicifolia*. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction.

DISTRIBUTION

Range: Southern Arizona and New Mexico, and adjacent Mexico.

Ecological Divisions: 302

TNC Ecoregions: 17:C, 22:C, 23:C, 24:C

Subnations/Nations: AZ:c, CA:c, MXBC:c, MXBS:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

- ALHAGI MAURORUM SEMI-NATURAL SHRUBLAND ALLIANCE (A.2567)
Alhagi maurorum Semi-natural Shrubland (CEGL002784)
- BETULA OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.967)
Populus fremontii / Betula occidentalis Wooded Shrubland (CEGL002981)
- JUGLANS MAJOR TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.957)
Juglans major - Pinus edulis / Bromus carinatus Shrubland (CEGL001101)
Juglans major Shrubland [Provisional] (CEGL001102)
- JUGLANS MICROCARPA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.945)
Juglans microcarpa / Cladium mariscus ssp. jamaicense Shrubland (CEGL004593)
Juglans microcarpa / Sorghastrum nutans Shrubland (CEGL004594)
Juglans microcarpa Shrubland (CEGL001103)
- PLATANUS WRIGHTII TEMPORARILY FLOODED FOREST ALLIANCE (A.309)
Platanus wrightii - Alnus oblongifolia / Baccharis salicifolia Forest (CEGL002686)
Platanus wrightii - Fraxinus velutina Forest (CEGL000644)
Platanus wrightii - Juglans major Forest (CEGL000645)
- PLATANUS WRIGHTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.643)
Platanus wrightii Woodland (CEGL000937)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE (A.310)
Populus angustifolia / Rosa woodsii Forest (CEGL000653)
- POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.641)
Populus angustifolia - Juniperus deppeana / Brickellia californica Woodland (CEGL000933)
Populus angustifolia / Alnus oblongifolia Woodland (CEGL000938)
Populus angustifolia / Salix exigua Woodland (CEGL000654)
Populus angustifolia / Salix irrorata Woodland (CEGL002647)
- POPULUS DELTOIDES SSP. WISLIZENI TEMPORARILY FLOODED FOREST ALLIANCE (A.312)
Populus deltoides ssp. wislizeni / Baccharis sarothroides Forest (CEGL000663)
- POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (A.636)
Populus deltoides ssp. wislizeni / Rhus trilobata Woodland (CEGL000940)
- POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE (A.654)
Populus fremontii / Muhlenbergia rigens Woodland (CEGL001455)
Populus fremontii / Salix geyeriana Woodland (CEGL000943)
- POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE (A.313)

- Populus fremontii - Platanus wrightii Forest (CEGL000665)
- Populus fremontii - Salix gooddingii / Baccharis salicifolia Forest (CEGL002683)
- Populus fremontii - Salix gooddingii / Salix exigua Forest (CEGL002684)
- Populus fremontii / Acer negundo Forest (CEGL000662)
- Populus fremontii Forest [Placeholder] (CEGL000661)
- POPULUS FREMONTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.644)
 - Populus fremontii - Fraxinus velutina Woodland (CEGL000942)
 - Populus fremontii - Salix gooddingii Woodland (CEGL000944)
 - Populus fremontii / Baccharis emoryi Woodland [Provisional] (CEGL002946)
 - Populus fremontii / Baccharis salicifolia Woodland (CEGL000941)
- RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.938)
 - Rhus trilobata - Prunus serotina Shrubland (CEGL001119)
- ROBINIA NEOMEXICANA SHRUBLAND ALLIANCE (A.924)
 - Robinia neomexicana / Thalictrum fendleri Shrubland (CEGL001125)
- SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.947)
 - Salix exigua / Agrostis stolonifera Shrubland (CEGL001199)
 - Salix exigua / Elymus X pseudorepens Shrubland (CEGL001198)
- SALIX BONPLANDIANA TEMPORARILY FLOODED FOREST ALLIANCE (A.314)
 - Salix bonplandiana Forest (CEGL000679)
- SALIX EXIGUA SEASONALLY FLOODED WOODLAND ALLIANCE (A.649)
 - Salix exigua / Baccharis salicifolia - Baccharis neglecta / Schoenoplectus spp. Woodland (CEGL004587)
- SALIX GOODDINGII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.640)
 - Salix gooddingii - Fraxinus velutina Temporarily Flooded Woodland (CEGL003729)
 - Salix gooddingii Woodland [Provisional] (CEGL002743)
- SALIX IRRORATA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.976)
 - Salix irrorata Shrubland (CEGL001214)
- SALIX LAEVIGATA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.646)
 - Salix laevigata - Fraxinus velutina Woodland (CEGL000950)
 - Salix laevigata Woodland [Provisional] (CEGL002952)
- TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.842)
 - Tamarix spp. Temporarily Flooded Shrubland (CEGL003114)

SOURCES

References: Brown 1982, Dick-Peddie 1993, Muldavin et al. 2000a, Szaro 1989, Thomas et al. 2003a

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

S097 NORTH AMERICAN WARM DESERT RIPARIAN WOODLAND AND SHRUBLAND

Division 302, Woody Wetland, CES302.753

Spatial Scale & Pattern: Linear

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland

Diagnostic Classifiers: Lowland [Lowland], Forest and Woodland (Treed), Shrubland (Shrub-dominated), Tropical/Subtropical [Tropical Xeric], Temperate [Temperate Xeric], Riverine / Alluvial

Non-Diagnostic Classifiers: Toeslope/Valley Bottom, Short (50-100 yrs) Persistence

Concept Summary: This ecological system consists of low-elevation (<1200 m) riparian corridors along medium to large perennial streams throughout canyons and the desert valleys of the southwestern United States and adjacent Mexico. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include *Acer negundo*, *Fraxinus velutina*, *Populus fremontii*, *Salix gooddingii*, *Salix lasiolepis*, *Celtis laevigata* var. *reticulata*, and *Juglans major*. Shrub dominants include *Salix geyeriana*, *Shepherdia argentea*, and *Salix exigua*. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and/or annual rise in the water table for growth and reproduction.

DISTRIBUTION

Range: Throughout canyons and the desert valleys of the southwestern United States and adjacent Mexico.

Ecological Divisions: 302

TNC Ecoregions: 17:C, 22:C, 23:C, 24:C, 29:P

Subnations/Nations: AZ:c, CA:c, MXBC:c, MXCH:c, MXSO:c, NM:c, NV:c, TX:c

CONCEPT

Alliances and Associations:

- ARUNDO DONAX TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1339)
Arundo donax Riverbank Herbaceous Vegetation (CEGL004101)
 - CELTIS LAEVIGATA VAR. RETICULATA SHRUBLAND ALLIANCE (A.1033)
Celtis laevigata var. reticulata / Celtis pallida Shrubland (CEGL001163)
 - JUGLANS MAJOR TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.957)
Juglans major - Pinus edulis / Bromus carinatus Shrubland (CEGL001101)
Juglans major Shrubland [Provisional] (CEGL001102)
 - JUGLANS MICROCARPA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.945)
Celtis laevigata var. reticulata - Juglans microcarpa / Leptochloa dubia Shrubland (CEGL002166)
Juglans microcarpa / Cladium mariscus ssp. jamaicense Shrubland (CEGL004593)
Juglans microcarpa / Sorghastrum nutans Shrubland (CEGL004594)
Juglans microcarpa Shrubland (CEGL001103)
 - PLATANUS RACEMOSA TEMPORARILY FLOODED WOODLAND ALLIANCE (A.634)
Platanus racemosa Temporarily Flooded Woodland [Placeholder] (CEGL003079)
 - PLATANUS WRIGHTII TEMPORARILY FLOODED FOREST ALLIANCE (A.309)
Platanus wrightii - Alnus oblongifolia / Baccharis salicifolia Forest (CEGL002686)
Platanus wrightii - Fraxinus velutina Forest (CEGL000644)
Platanus wrightii - Juglans major Forest (CEGL000645)
 - PLATANUS WRIGHTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.643)
Platanus wrightii Woodland (CEGL000937)
 - POPULUS DELTOIDES SSP. WISLIZENI TEMPORARILY FLOODED FOREST ALLIANCE (A.312)
Populus deltoides / Muhlenbergia asperifolia Forest (CEGL000678)
Populus deltoides ssp. wislizeni / Baccharis sarothroides Forest (CEGL000663)
 - POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (A.636)
Populus deltoides ssp. wislizeni / Rhus trilobata Woodland (CEGL000940)
 - POPULUS FREMONTII SEASONALLY FLOODED WOODLAND ALLIANCE (A.654)
Populus fremontii / Leymus triticoides Woodland (CEGL002756)
Populus fremontii / Muhlenbergia rigens Woodland (CEGL001455)
 - POPULUS FREMONTII TEMPORARILY FLOODED FOREST ALLIANCE (A.313)
Populus fremontii - Celtis laevigata var. reticulata / Salvia pinguifolia Forest (CEGL000664)
Populus fremontii - Platanus wrightii Forest (CEGL000665)
Populus fremontii - Salix gooddingii / Baccharis salicifolia Forest (CEGL002683)
Populus fremontii - Salix gooddingii / Salix exigua Forest (CEGL002684)
Populus fremontii / Acer negundo Forest (CEGL000662)
Populus fremontii Forest [Placeholder] (CEGL000661)
 - POPULUS FREMONTII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.644)
Populus fremontii - Fraxinus velutina Woodland (CEGL000942)
Populus fremontii - Salix gooddingii Woodland (CEGL000944)
Populus fremontii / Baccharis salicifolia Woodland (CEGL000941)
 - PARKINSONIA FLORIDA - OLNEYA TESOTA WOODLAND ALLIANCE (A.588)
 - Parkinsonia florida - Olneya tesota Woodland [Placeholder] (CEGL003035)
 - SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.947)
Salix exigua / Agrostis stolonifera Shrubland (CEGL001199)
Salix exigua / Barren Shrubland (CEGL001200)
 - SALIX GOODDINGII TEMPORARILY FLOODED WOODLAND ALLIANCE (A.640)
Salix gooddingii - Fraxinus velutina Temporarily Flooded Woodland (CEGL003729)
Salix gooddingii Woodland [Provisional] (CEGL002743)
 - TAMARIX SPP. SEMI-NATURAL TEMPORARILY FLOODED SHRUBLAND ALLIANCE (A.842)
Tamarix spp. Temporarily Flooded Shrubland (CEGL003114)
- **California community types:**
- Sonoran Cottonwood - Willow Riparian (61.130.05)
 - Arroyo Willow Riparian Forests and Woodlands (61.201.00)
 - Central Coast Arroyo Willow Riparian (61.201.01)
 - Southern Arroyo Willow Riparian (61.201.02)
 - Arroyo Willow / Blackberry Riparian (61.201.03)
 - Arroyo Willow - Shining Willow (61.201.04)
 - Black Willow Riparian Forests and Woodlands (61.202.00)

- Red Willow Riparian Forests (61.205.00)
- Red Willow (61.205.01)
- Red Willow / Arroyo Willow (61.205.02)
- Gooding Willow (61.211.01)
- Desert Olive Scrub (61.580.00)
- Desert Olive (61.580.01)
- Oregon Ash Riparian Forest (61.960.00)
- Narrowleaf Willow (63.110.00)
- Narrowleaf Willow - Desert Baccharis (63.110.01)
- Narrow-leaf Willow Riparian Scrub (63.110.02)
- Lemmon's Willow Riparian Scrub (63.113.00)
- Lemmon's Willow (63.113.01)
- Tamarisk Scrubs and Woodlands (63.810.00)
- Shrub Tamarisk (63.810.02)

SOURCES

References: Barbour and Major 1988, Brown 1982, Dick-Peddie 1993, Holland and Keil 1995, Muldavin et al. 2000a, Szaro 1989

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

NLCD Emergent Herbaceous Wetland Types

Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

S100 NORTH AMERICAN ARID WEST EMERGENT MARSH

Division 300, Herbaceous Wetland, CES300.729

Spatial Scale & Pattern: Small Patch

Classification Confidence: high

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland

Diagnostic Classifiers: Herbaceous, Mineral: W/ A-Horizon >10 cm, Graminoid, Aquatic Herb, Depressional [Lakeshore], Depressional [Pond], Deep (>15 cm) Water, Saturated Soil

Non-Diagnostic Classifiers: Montane [Montane], Montane [Lower Montane], Lowland [Foothill], Lowland [Lowland], Backwater, Drainage bottom (undifferentiated), Floodplain, Marsh, Oxbow, Pond, Temperate [Temperate Continental], Forb, Alga, Clay Subsoil Texture

Concept Summary: This widespread ecological system occurs throughout much of the arid and semi-arid regions of western North America. Natural marshes may occur in depressions in the landscape (ponds, kettle ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes are also referred to as sloughs). Marshes are frequently or continually inundated, with water depths up to 2 m. Water levels may be stable, or may fluctuate 1 m or more over the course of the growing season. Marshes have distinctive soils that are typically mineral, but can also accumulate organic material. Soils have characteristics that result from long periods of anaerobic conditions in the soils (e.g., gleyed soils, high organic content, redoximorphic features). The vegetation is characterized by herbaceous plants that are adapted to saturated soil conditions. Common emergent and floating vegetation includes species of *Scirpus* and/or *Schoenoplectus*, *Typha*, *Juncus*, *Potamogeton*, *Polygonum*, *Nuphar*, and *Phalaris*. This system may also include areas of relatively deep water with floating-leaved plants (*Lemna*, *Potamogeton*, and *Brasenia*) and submergent and floating plants (*Myriophyllum*, *Ceratophyllum*, and *Elodea*).

DISTRIBUTION

Range: Occurs throughout much of the arid and semi-arid regions of western North America.

Ecological Divisions: 301, 302, 303, 304, 305, 306

TNC Ecoregions: 11:C, 17:C, 18:C, 19:C, 20:C, 21:C, 23:C, 24:C, 26:C, 27:C, 28:C, 29:C, 30:C, 6:C, 7:C, 8:C, 9:C

Subnations/Nations: AB:c, AZ:c, BC:c, CA:c, CO:c, ID:c, MT:c, MXBC:c, MXCH:c, MXSO:c, ND:c, NE:c, NM:c, NV:c, OK:c, OR:c, SD:c, TX:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- (POTAMOGETON DIVERSIFOLIUS, STUCKENIA FILIFORMIS) PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1763)
Potamogeton diversifolius Herbaceous Vegetation (CEGL002007)

- Stuckenia filiformis Herbaceous Vegetation (CEGL002008)
- CALAMAGROSTIS CANADENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1400)
Calamagrostis canadensis Western Herbaceous Vegetation (CEGL001559)
- CAREX (ROSTRATA, UTRICULATA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1403)
Carex utriculata Herbaceous Vegetation (CEGL001562)
- CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1417)
Carex nebrascensis Herbaceous Vegetation (CEGL001813)
- CAREX VESICARIA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.2501)
Carex vesicaria Herbaceous Vegetation (CEGL002661)
- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332)
Distichlis spicata - (Scirpus nevadensis) Herbaceous Vegetation (CEGL001773)
- ELEOCHARIS (MONTEVIDENSIS, PALUSTRIS, QUINQUEFLORA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1371)
Eleocharis (montevidensis, palustris, quinqueflora) Seasonally Flooded Herbaceous Vegetation [Placeholder] (CEGL003050)
- GLYCERIA BOREALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1445)
Glyceria borealis Herbaceous Vegetation (CEGL001569)
- JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1374)
Juncus balticus - Carex rossii Herbaceous Vegetation (CEGL001839)
Juncus balticus Herbaceous Vegetation (CEGL001838)
- LEMNA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1747)
Lemna spp. Permanently Flooded Herbaceous Vegetation (CEGL003059)
- MYRIOPHYLLUM SIBIRICUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1761)
Myriophyllum sibiricum Herbaceous Vegetation (CEGL002000)
- NYMPHAEA ODORATA - NUPHAR SPP. PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (A.1984)
Nuphar lutea ssp. polysepala Herbaceous Vegetation (CEGL002001)
- PHALARIS ARUNDINACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1381)
Phalaris arundinacea Western Herbaceous Vegetation (CEGL001474)
- PHRAGMITES AUSTRALIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1431)
Phragmites australis Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)
- POTAMOGETON FOLIOSUS PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.2518)
Potamogeton foliosus Herbaceous Vegetation (CEGL002742)
- POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1754)
Potamogeton natans Herbaceous Vegetation (CEGL002925)
- RANUNCULUS AQUATILIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1679)
Ranunculus aquatilis - Callitriche palustris Herbaceous Vegetation (CEGL001984)
- RUPPIA (CIRRHOSEA, MARITIMA) PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1755)
Ruppia (cirrhosa, maritima) Permanently Flooded Herbaceous Vegetation [Placeholder] (CEGL003119)
- SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1818)
Salicornia rubra Herbaceous Vegetation (CEGL001999)
- SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1443)
Schoenoplectus acutus Herbaceous Vegetation (CEGL001840)
Schoenoplectus tabernaemontani Temperate Herbaceous Vegetation (CEGL002623)
- SCHOENOPLECTUS AMERICANUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1432)
Schoenoplectus americanus - Carex spp. Herbaceous Vegetation (CEGL004144)
Schoenoplectus americanus - Eleocharis palustris Herbaceous Vegetation (CEGL001585)
Schoenoplectus americanus - Eleocharis spp. Herbaceous Vegetation (CEGL001586)
Schoenoplectus americanus - Flaveria chlorifolia - (Helianthus paradoxus) Herbaceous Vegetation (CEGL004592)
Schoenoplectus americanus Western Herbaceous Vegetation (CEGL001841)
- SCHOENOPLECTUS MARITIMUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1444)
Schoenoplectus maritimus Herbaceous Vegetation (CEGL001843)
- SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1433)
Schoenoplectus pungens Herbaceous Vegetation (CEGL001587)
- SPARGANIUM ANGUSTIFOLIUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1760)
Sparganium angustifolium Herbaceous Vegetation (CEGL001990)
- SPARGANIUM EURYCARPUM PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.2598)
Sparganium eurycarpum Herbaceous Vegetation (CEGL003323)
- SPARTINA GRACILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1407)
Spartina gracilis Herbaceous Vegetation (CEGL001588)
- SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1347)
Spartina pectinata Western Herbaceous Vegetation (CEGL001476)

- TRIGLOCHIN MARITIMA SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1681)
Triglochin maritima Herbaceous Vegetation (CEGL001995)
- TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1436)
Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani) Sandhills Herbaceous Vegetation (CEGL002030)
Typha latifolia Western Herbaceous Vegetation (CEGL002010)
- TYPHA DOMINGENSIS SEASONALLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (A.1392)
Typha domingensis Western Herbaceous Vegetation (CEGL001845)

SOURCES

References: Brown 1982, Cooper 1986b, Dick-Peddie 1993, Faber-Langendoen et al. 1997, Hansen et al. 1995, Kittel et al. 1994, Neely et al. 2001, Padgett et al. 1989, Rondeau 2001, Szaro 1989, Ungar 1965, Ungar 1972

Last updated: 20 Feb 2003

Stakeholders: WCS, SCS

Concept Author: NatureServe Western Ecology Team

LeadResp: WCS

S108 WESTERN GREAT PLAINS SALINE DEPRESSION WETLAND

Division 303, Herbaceous Wetland, CES303.669

Spatial Scale & Pattern: Small Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Wetland

Non-Diagnostic Classifiers: Herbaceous, Depression, Saline Water Chemistry

Concept Summary: This system is very similar to Northwestern Great Plains Open Freshwater Depression (CES303.675) and Western Great Plains Closed Depression Wetland (CES303.666). However, strongly saline soils cause both the shallow lakes and depressions and the surrounding areas to be more brackish. Salt encrustations can occur on the surface in some examples of this system, and the soils are severely affected and have poor structure. Species that typify this system are salt-tolerant and halophytic species such as *Distichlis spicata*, *Sporobolus airoides*, and *Hordeum jubatum*. During exceptionally wet years, an increase in precipitation can dilute the salt concentration in the soils of some of examples of this system which may allow for less salt-tolerant species to occur. Communities found within this system may also occur in floodplains (i.e., more open depressions), but probably should not be considered a separate system unless they transition to areas outside the immediate floodplain.

Comments: Open and emergent saline marshes may be a separate system from saline wet meadows and prairies.

DISTRIBUTION

Range: This system can occur throughout the Western Great Plains, but is likely more prevalent in the south-central portions of the division.

Ecological Divisions: 303

TNC Ecoregions: 26:?, 27:C, 28:C, 33:C, 34:?

Subnations/Nations: CO:c, KS:c, MT:p, ND:c, NE:c, NM:c, OK:c, SD:c, WY:c

CONCEPT

Alliances and Associations:

- CAREX SPP. - PLANTAGO ERIPODA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1350)
Calamagrostis stricta - Carex sartwellii - Carex praegracilis - Plantago eriopoda Saline Herbaceous Vegetation (CEGL002255)
- DISTICHLIS SPICATA - (HORDEUM JUBATUM) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1341)
Distichlis spicata - (Hordeum jubatum, Poa arida, Sporobolus airoides) Herbaceous Vegetation (CEGL002042)
Distichlis spicata - Hordeum jubatum - (Poa arida, Iva annua) Herbaceous Vegetation (CEGL002031)
Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis Herbaceous Vegetation (CEGL002273)
Distichlis spicata - Schoenoplectus maritimus - Salicornia rubra Herbaceous Vegetation (CEGL002043)
Distichlis spicata - Spartina spp. Herbaceous Vegetation (CEGL002275)
- DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1332)
Distichlis spicata Herbaceous Vegetation (CEGL001770)
- HORDEUM JUBATUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1358)
Hordeum jubatum Herbaceous Vegetation (CEGL001798)
- PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1354)
Pascopyrum smithii - Distichlis spicata Herbaceous Vegetation (CEGL001580)
Pascopyrum smithii - Hordeum jubatum Herbaceous Vegetation (CEGL001582)
- PUCCINELLIA NUTTALLIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1335)
Puccinellia nuttalliana Herbaceous Vegetation (CEGL001799)

- SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1818)
Salicornia rubra Herbaceous Vegetation (CEGL001999)
- SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUB HERBACEOUS ALLIANCE (A.1554)
Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation (CEGL001508)
- SARCOBATUS VERMICULATUS SHRUB HERBACEOUS ALLIANCE (A.1535)
Sarcobatus vermiculatus / Distichlis spicata - (Puccinellia nuttalliana) Shrub Herbaceous Vegetation (CEGL002146)
- SCHOENOPECTUS AMERICANUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1432)
Schoenoplectus americanus - Carex spp. Herbaceous Vegetation (CEGL004144)
Schoenoplectus americanus Great Plains Herbaceous Vegetation (CEGL002226)
- SCHOENOPECTUS MARITIMUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1444)
Schoenoplectus maritimus - Schoenoplectus acutus - (Triglochin maritima) Herbaceous Vegetation (CEGL002227)
Schoenoplectus maritimus Herbaceous Vegetation (CEGL001843)
- SCHOENOPECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1433)
Schoenoplectus pungens - Suaeda calceoliformis Alkaline Herbaceous Vegetation (CEGL002040)
Schoenoplectus pungens Herbaceous Vegetation (CEGL001587)
- SCOLOCHLOA FESTUCACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1401)
Scolochloa festucacea Herbaceous Vegetation (CEGL002260)
- SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (A.1347)
Spartina pectinata - Schoenoplectus pungens Herbaceous Vegetation (CEGL001478)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267)
Sporobolus airoides Monotype Herbaceous Vegetation (CEGL001688)
Sporobolus airoides Northern Plains Herbaceous Vegetation (CEGL002274)
Sporobolus airoides Southern Plains Herbaceous Vegetation (CEGL001685)
- STUCKENIA PECTINATA PERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1764)
Stuckenia pectinata - Ruppia maritima Herbaceous Vegetation (CEGL002004)
Stuckenia pectinata - Zannichellia palustris Herbaceous Vegetation (CEGL002005)
- TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (A.1436)
Typha spp. - Schoenoplectus spp. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228)
Typha spp. Great Plains Herbaceous Vegetation (CEGL002389)

Environment: This system is distinct from the freshwater depression systems by its brackish nature caused by strongly saline soils. Salt encrustations could occur near the surface in some examples of this system.

Vegetation: Salt-tolerant and halophytic species such as *Distichlis spicata*, *Sporobolus airoides*, and *Hordeum jubatum* typify the system.

Dynamics: Hydrology processes primarily drive this system. Increases in precipitation and/or runoff can dilute the salt concentration and allow for less salt tolerant species to occur. Conversion to agriculture and pastureland can also impact this system, especially when it alters the hydrology of the system.

SOURCES

References: Hoagland 2000, Lauver et al. 1999, Steinauer and Rolfsmeier 2000

Last updated: 05 Mar 2003

Concept Author: S. Menard and K. Kindscher

Stakeholders: MCS, WCS

LeadResp: MCS

Appendix F
Wildlife and Plant Survey Report



CEHMM

505 North Main Street, Carlsbad, NM 88220 • 575-885-3700 • www.cehmm.org

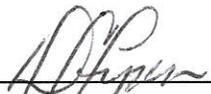
Foth – Intrepid AMAX Surveys

The Center of Excellence for Hazardous Materials Management (CEHMM) was contracted by Foth Infrastructure to conduct noxious weed, burrowing owl, and raptor nest surveys for two pipeline routes at the Intrepid AMAX Expansion site. CEHMM dispatched wildlife technicians to the field on February 18, 2015 and February 19, 2015. Two technicians walked the length of the flagged pipeline routes, proposed roads, and well sites for the presence of African Rue, Malta Starthistle, and raptor and burrowing owl nests within 200 meters of the proposed right-of-way. GPS coordinates and photographs of all observations were taken. All work conducted was in full compliance with the Bureau of Land Management (BLM) specifications.

No noxious weeds were identified during these surveys, although *Lepidium* and *Phacelia* were found in abundance. Although these weeds are not a concern to the BLM, they were noted by the technicians due to their abundance at the site. Two long-eared owls and a Cooper's hawk were flushed during these surveys. One raptor nest was observed. Whitewash and castings suggesting the presence of raptors were also observed in an existing draw. No evidence of burrowing owls was observed. Small mammal burrows were observed throughout the length of the pipeline but were not recorded. Surveys concluded on February 19, 2015.

Below please find our datasheets (Figure 1 and Figure 2), map depicting observation locations (Figure 3), and photographs (Figures 4-12).

Please call Emily Wirth at CEHMM with any questions (575-885-3700).



Douglas C. Lynn, Executive Director
Center of Excellence for Hazardous Materials Management


Date

Intrepid AMAX Surveys Datasheet

Date: 02.19.15 Survey start time: 0819 Survey end time: 1320
 Starting UTMs: N 32° 40' 20.5" W 103° 58' 34.0" Ending UTMs: N 32° 39' 11.7" W 103° 57' 21.2"
 Data recorder: Allynn Observers: J. Hines Camera # 4 GPS # 1
 Start Temp (F): 45° End Temp (F): 74° Weather conditions: Sunny Wind speed(mph): 0-5 mph

Observation (ie, Raptor Nest, etc.)	Waypoint Number	Photo Number	Notes
Pepper Grass (<i>Lepidium</i>)	764	#3,4	Very abundant
2 Long-eared Owls	765	no photo owls - flushed	Living in salt cedars where pipeline will be laid on the edge.
		Picture of salt cedars #5	
Cooper's Hawk	766	Flushed	Right on staked area.
Raptor Nest	767	#6,7	
	768	#8,9	* From waypoint 767 to waypoint 768 evidence of diurnal & nocturnal raptors (ie whitewash, castings) in the draw system. The system is about 200' from proposed pipeline.
Whitewash in draw	769	#10	* about 100' from draw with raptors/evidenced by whitewash
Seedling weed abundant throughout proposed lines esp. in disturbed areas. (Phacelia)	770	↓ #11	Very abundant

Created 2/9/2015 EKW

Figure 2. Datasheet February 19, 2015.

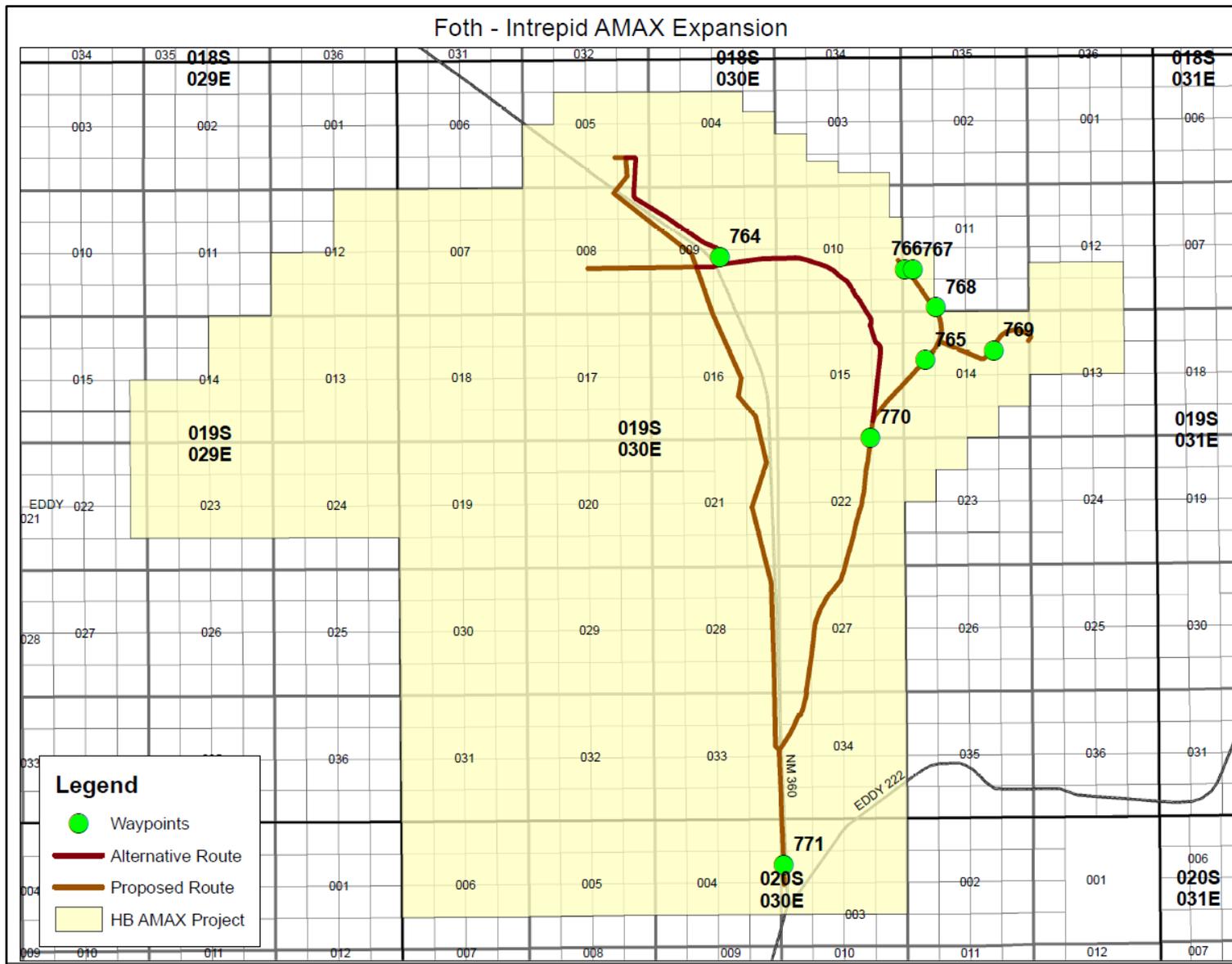


Figure 3. Map depicting locations of observations.



Figure 4. *Lepidium* (Photo #3, Waypoint 764).



Figure 5. *Lepidium* (Photo #4, Waypoint 764).



Figure 6. Salt Cedars where long-eared owls were observed (Photo #5, Waypoint 765).



Figure 7. Raptor nest (Photo #6, Waypoint 767).



Figure 8. Raptor nest (Photo #7, Waypoint 767).



Figure 9. Whitewash in draw system (Photo #8, Waypoint 768).



Figure 10. Whitewash in draw system (Photo #9, Waypoint 768).



Figure 11. Whitewash in draw system (Photo #10, Waypoint 769).



Figure 12. *Phacelia* (Photo #11, Waypoint 771).

Appendix G
Air Dispersion Modeling

**AMBIENT AIR QUALITY
MODELING REPORT**

INTREPID POTASH

NEW HB MILL

Carlsbad, Eddy County, New Mexico

Prepared by **Intrepid Potash – New Mexico, LLC**
with assistance by:

Nov. 2010

FC&E Engineering, LLC
Brandon, Mississippi
(601) 824-1860



Table of Contents

1.0 INTRODUCTION 2
 1.1 Purpose of Modeling 2
 1.2 Facility Description 2
 1.3 Facility Identification and Location 4
2.0 Model Input Options 4
 2.1 Building Downwash and Cavity Concentrations..... 5
 2.2 Point Sources 5
 2.3 Haul Roads 6
 2.4 Plume Depletion and Deposition..... 7
3.0 Receptor Grid Description 7
4.0 Meteorological Data..... 8
5.0 Radius of Impact (ROI) Analysis and Cumulative Impact Analysis (CIA) 8
 5.1 Radius of Impact (ROI) Analysis 8
 5.2 Competing Source Inventory..... 9
 5.2 PSD Increment Modeling 11
 5.3 NAAQS Modeling 11
 5.2.1 Background 11
 5.2.2 NAAQS Analysis 12
6.0 Class I Areas Analysis 12
7.0 Conclusions..... 12

Figures

- Figure 1 – HB Mill Project Area
- Figure 2 – Proposed Structures and Point Sources
- Figure 3 – Preliminary Analysis Receptor Grid
- Figure 4 – HB Mill TSP ROI
- Figure 5 – HB Mill PM10 ROI
- Figure 6 – HB Mill PM2.5 ROI
- Figure 7 – HB Mill NO_x ROI
- Figure 8 – North Compaction Plant TSP ROI

Appendices

- Appendix A – Offsite Inventory Determination
- Appendix B – CD Key
- Appendix C - NMED Correspondence

Intrepid Potash Inc.
HB In-Situ Project
Eddy County, New Mexico

1.0 INTRODUCTION

Intrepid Potash Inc. is planning to construct and operate a solution mining facility which will be an in-situ project to be located in Eddy County in southeastern New Mexico. The operation when completed will involve miles of pipeline and numerous injection points and extraction wells. Additionally, a large solar evaporation pond area will be constructed to facilitate the removal of moisture such that potassium chloride salt may be harvested, slurried, and pumped to the new proposed HB Potash Solution Mill (HB Mill) for processing. The product will then be dried and screened prior to shipment via trucks. The proposed project will be beneficial to the area by providing numerous job opportunities and will result in a safe and more efficient way of producing potash from mining areas previously believed to be depleted and unsafe to mine via traditional methods. This modeling report has been prepared to describe the modeling analysis that has been performed and submitted to the NMED's air quality bureau for review.

1.1 Purpose of Modeling

The purpose of the modeling being performed for this project is to provide documentation to the New Mexico Environment Department that ambient air quality impacts beyond the property fenceline as a result of the construction and operation of the proposed equipment will not result in a violation of ambient air quality standards or the allowable increment. The following sections describe the facilities proposed for construction and operation in Eddy County, New Mexico. This ambient air quality analysis has been prepared in accordance with the "New Mexico Air Quality Bureau Air Dispersion Modeling Guidelines, Revised April 2010" and addresses all regulated air pollutants that are greater than the threshold requiring modeling as specified in the Bureau's modeling guidelines.

1.2 Facility Description

The facility to be constructed will consist of The HB Mill and Solar Evaporation Ponds which involve the flooding of designated portions of former underground mine workings with brine (salt – saturated water) to selectively extract potash left in the pillars and fringe ore areas after conventional mining was completed. Once the workings are flooded and required dissolution times are achieved, the pregnant (potash – laden) brine is pumped to the surface and routed to an approximate 500 acre solar pond system. Natural net evaporative characteristics of the area will concentrate and precipitate a sodium chloride (NaCl)/ potassium chloride (KCl) product which will be harvested and sent to a nearby processing facility (HB Mill). Through a series of sequential flotation steps within the HB Mill, KCl will be separated from NaCl. The KCl product will be transferred via truck to Intrepid's North compaction facility (about 12 miles by road to the east/northeast) for final preparation and shipping as a commercial product. The NaCl will either be sold as commercial product or returned to the mine workings as injectate.

Intrepid Potash Inc.
HB In-Situ Project
Eddy County, New Mexico

Project operations consist of:

- Brine make-up along with injection and extraction to and from underground mine workings
- Solar pond management and harvesting
- Product refinement in the HB Mill
- Safety, administrative, and environmental compliance support

Brine Makeup, Injection, and Extraction Operations

Injectate to be pumped into four underground mine working areas to selectively dissolve the KCl contained therein is made up at the HB Mill and consists of saline groundwater that is mixed with NaCl to create a salt-saturated brine. The injectate is then pumped via HDPE pipelines to six injection wells located in an up-gradient area of the four inactive underground mine working areas. The brine fills the mine workings to a specified elevation and selectively dissolves KCl left in the pillars and fringe ore areas. The resulting pregnant brine is pumped via five extraction wells and associated pipelines to the solar pond complex.

Brine conveyance will be managed and operated by a mechanical / electrical / instrumentation crew to assure that submersible pumps, booster stations, control and monitoring infrastructure, and pipelines function as required. Both automated data acquisition systems and manual observations will be used to monitor operations and all pipeline circuits will be inspected weekly. An on-call crew will be available 24 hours per day to maintain and control the system.

Solar Pond Management

The solar pond complex consists of approximately 25 ponds with an area of approximately 20 acres each, as well as associated access roads. Operation of the solar ponds complex will involve two components: 1) routing of the brines within the ponds to maximize potash precipitation, and (2) harvesting the precipitated solids. Each sub-pond will be filled with pregnant brine pumped from the underground workings via manifolded piping runs. As evaporation occurs, a designated crew will measure fluids levels in the ponds, chemistry of the brine, and deposition of KCl / NaCl precipitate. Brines will be transferred from pond to pond using portable pumps and siphons to manage brine chemistry. Once the KCl / NaCl product has precipitated, the ponds will be drained of free fluids and the precipitated solids will be harvested with scrapers. Up to two feet of precipitated solids will be removed and transported to a slurry system within the solar pond network. The harvested salt mixture is then fluidized with mill brine and pumped to the HB Mill via a slurry pipeline for refining.

Product Refinement

The product slurry consists of a mixture of NaCl and KCl which requires further beneficiation at the HB Mill. The NaCl and KCl are separated using an amine flotation process. After flotation, leaching, standard classification, filtration and dewatering methods are applied to further concentrate the KCl product. The KCl product is then

Intrepid Potash Inc.
HB In-Situ Project
Eddy County, New Mexico

transported from the HB Mill to the existing Intrepid North compaction facility for further drying, grading and load-out for sale.

1.3 Facility Identification and Location

The proposed facility is identified as the HB In-Situ Project. The area for proposed location of this project is in the southeastern portion of the state of New Mexico in Eddy County approximately halfway between Carlsbad and Hobbs along Highway 62/180 (Figure 1). The majority of the site is leased land from the Bureau of Land Management (BLM). An agreement between Intrepid Potash and the BLM has allowed the area proposed for this project to be fenced such that Intrepid has control of the land surrounding the proposed project and subsequently, the ambient air modeling proposed will utilize the fence line and public roads as receptors for purposes of demonstrating compliance with state and federal ambient air quality standards at any offsite receptors.

The specific physical address for the site is uncertain at this time and will encompass many acres. However, the mailing address will be:

*Intrepid Potash – New Mexico, LLC
c/o HB In-Situ Project
1996 Potash Mines Road
Carlsbad, NM 88220*

2.0 Model Input Options

The latest version of AERMOD was used to determine compliance with the New Mexico Ambient Air Quality Standards. AERMOD is the recommended model for a wide range of regulatory applications in all types of terrain. AERMOD is appropriate for the following applications:

- Point, volume, and area sources;
- Surface, near-surface, and elevated releases;
- Rural or urban areas;
- Simple and complex terrain;
- Transport distances over which steady-state assumptions are appropriate, up to 50km;
- 1-hour to annual averaging times; and
- Continuous toxic air emissions.

The model was executed with all regulatory default options. The DFAULT option requires the use of terrain elevation data, stack-tip downwash, sequential date checking, and does not permit the use of the model in the SCREEN mode. Additionally, the most current version of the AERMOD model imposes a restriction on the urban roughness parameter to be 1 meter for regulatory default applications. In the regulatory default mode, pollutant half life or decay options are not employed, except in the case of an urban source of sulfur dioxide where a four-hour half life is applied.

Intrepid Potash Inc.
HB In-Situ Project
Eddy County, New Mexico

As the site is located in a rural area, urban source control options will not be used. A building downwash analysis using the latest version of BPIP-Prime was conducted and incorporated into the modeling analysis to account for potential effluent downwash due to structures.

2.1 Building Downwash and Cavity Concentrations

The atmospheric flow and turbulence around buildings and other obstacles determines how pollutants are dispersed. The height above the ground of undisturbed atmospheric flow, H_g , is called the good engineering practice (GEP) height. Determining the GEP height is the initial phase of the air quality modeling analysis. GEP stack height is defined as the height necessary to ensure that emissions from the stack will not result in excessive concentrations of any air pollutant in the immediate vicinity of the sources as a result of atmospheric downwash, eddies, or wakes, which may be created by the source itself, nearby structures, or nearby terrain obstacles. A GEP analysis was conducted for all structures, combinations of structures (those within 1L of each other,) and terrain features that have a region of influence (5L) extending to one or more emission sources using the Prime Plume Rise and Building Downwash Model (BPIP-PRM-Version 04274) which follows the *Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations)*. These structures, along with the point sources, are depicted in Figure 2.

GEP stack height is calculated using the following equation:

$$H_g = H + 1.5L$$

Where, H_g = good engineering practice stack height; H = height of the adjacent structure or nearby structure; and L = lesser dimension (height or maximum projected width of the adjacent or nearby structure or terrain feature height).

The obstacle resulting in the largest GEP stack height (H_g) for each source is identified as the critical structure for that source. GEP was determined for each point source based upon the critical structure. It was determined that all of the structures were below GEP.

It is assumed that if a stack is within 5L downwind, $\frac{1}{2}$ L crosswind or 2L upwind of a structure, that structure will cause downwash effects on that stack. AERMOD was used the Prime algorithms to determine the concentrations for receptors that fall within this region.

2.2 Point Sources

The project contains six (6) vertical stacks which were modeled as point sources. The base elevation, stack height and stack diameter used for these sources was based upon the project design. Emissions for the sources were based on the maximum hourly controlled emission rates. Table 2 and Table 2 summarize the parameters used in the modeling for the point sources.

Table 1 - Point source modeled parameters.

Source ID	Source Description	UTM-X	UTM-Y	Elevation (m)	Height (m)	Temp. °K	Velocity (m/s)	Diameter (m)
EP 01	Fluidized Bed Dryer	599500.1	3595191	1005.8	17.80032	328.705	9.85	1.2192
EP 02	Hydronic Boiler	599550.7	3595236	1005.8	6.5532	355.37	4.13	0.1524
EP 03a	Amine Water Heater	599554.1	3595230	1005.8	7.4676	355.37	4.8	0.4064
EP 03b	Amine Water Heater	599554	3595233	1005.8	7.4676	355.37	4.8	0.4064
EP 04a	Baghouse	599508.4	3595189	1005.8	8.5344	Ambient	5.93	0.7112
EP 04b	Baghouse	599520.2	3595193	1005.8	8.5344	Ambient	4.52	0.6096
EP 05a	Cooling Tower Fan	599504.1	3595272	1005.8	2.4765	Ambient	13.28	0.8128
EP 05b	Cooling Tower Fan	599505.8	3595272	1005.8	2.4765	Ambient	13.28	0.8128

Table 2 - Point source modeled emissions (lb/hr).

Source ID	CO	NO _x	PM ₁₀	PM _{2.5}	TSP
EP_01	1.28	1.52	1.20	0.60	1.20
EP_02	0.05	0.06	4.85E-03	2.42E-03	4.85E-03
EP_03a	0.48	0.57	0.04	0.02	0.04
EP_03b	0.48	0.57	0.04	0.02	0.04
EP_04a	-	-	0.86	0.43	0.86
EP_04b	-	-	0.48	0.24	0.48
EP_05a	-	-	0.03	0.03	0.03
EP_05b	-	-	0.03	0.03	0.03

2.3 Haul Roads

The project contains emissions from paved and unpaved haul roads. Daily emissions were based upon the maximum number of vehicles traveling the road segment in a 24-hour period. Emissions from these roads were approximated using a series of alternating volume sources. As recommended in the New Mexico Air Quality Bureau Air Dispersion Modeling Guidelines, the input parameters for the volume sources were as follows:

- Volume height (H) - Twice the vehicle height rounded to the nearest meter.
- Release height (RH) - One-half the volume height (H/2)
- Initial vertical sigma - H/2.15
- Adjusted road width (W) - Actual road width plus 6 meters
- Initial horizontal sigma - 2W/2.15

Intrepid Potash Inc.
 HB In-Situ Project
 Eddy County, New Mexico

Since alternating sources were used, the number of volume sources used to approximate the road segment was equal to one-half the road segment length divided by the adjusted road width. Where the road segment intersected a public road, volume sources used to approximate the road segment were excluded from the model if the volume source was within 50 meters of the public road. The road segment's estimated emissions were distributed evenly across each of the volume sources used to approximate the segment. Table 3 and Table 4 summarize the modeled road source parameters and emission rates.

Table 3 - Road source modeled parameters.

Source	Source Description	Release Height	Initial σ_y	Initial σ_z
HBP_XXX	HB Mill Paved Road	4	12.39	3.72
NP_XX	North Compaction Plant Paved Road	4	12.39	3.72
SP_XXX	Solar Pond Perimeter Road	4	14.09	3.72
SR_XX	Solar Pond North-South Road	4	16.93	3.72

Table 4 - Road source modeled emissions lb/hr.

Source	TSP	PM10	PM25
HBP_XXX	4.92	0.96	0.14
NP_XX	0.63	0.12	0.02
SP_XXX	17.95	4.57	0.46
SR_XX	3.66	0.93	0.09

2.4 Plume Depletion and Deposition

Plume depletion and deposition options were not used in the model

3.0 Receptor Grid Description

The following grids of receptors were used at and beyond the facility boundary:

Type	Spacing (meters)	Placement
Coarse	1000	5 kilometers beyond the fence line out to the ROI
Intermediate	250	Between 1 to 3 kilometers from the facility fence line
Fine	100	Between 500 meters and 1 kilometer out from facility fence line
Very Fine	50	Within 500 meters of the facility fence line
Boundary	50	On property boundary line
Discrete	N/A	Monitoring sites and any sites requested by the regulating authority

Intrepid Potash Inc.
HB In-Situ Project
Eddy County, New Mexico

Receptors were processed in the Universal Transverse Mercator (UTM, Zone 13) coordinate system (NAD 83) with the respective spacing extending at the listed distance in all directions from the facility fence line as pictured in Figure 3. As can be seen in the figure a receptor network was placed around the North Compaction Plant to determine impacts due to vehicle traffic coming from the proposed HB Mill to the North Compaction Plant.

Terrain elevations based on United States Geological Service (USGS) National Elevation Data (NED) were input to the AERMOD model for each receptor. A complete 1/3 arc second data set is available for the area surrounding the facility. The 1/3 arc second NED was used in the AERMAP (Version 09040) processor to develop elevations and hill heights for the receptors. AERMAP implementation guidance recommends that terrain data be included to a distance that captures a 10% slope from each receptor. An area of terrain data extending 5 kilometers beyond all receptors was used to incorporate adequate terrain information.

4.0 Meteorological Data

The one year Empire Abo met data set, EMPABO93_94.SFC & .PFL, collected in 1993-1994 and available on the NMED website was used to conduct the modeling. The corresponding base elevation, 1080 meters, is also posted on the NMED website. This elevation was used in the meteorology pathway of AERMOD with the PROFBASE keyword to define the base elevation for the potential temperature profile.

This met station is considered representative of meteorological conditions at facilities located in southeast New Mexico.

5.0 Radius of Impact (ROI) Analysis and Cumulative Impact Analysis (CIA)

5.1 Radius of Impact (ROI) Analysis

A significant impact analysis for each pollutant's emissions from the facility sources was conducted. The highest-first-highest short term modeled impact and the highest annual average modeled impact was compared to the significance levels listed in the following tables. The modeling results show the project to be below the modeling significance levels for CO.

Intrepid Potash Inc.
 HB In-Situ Project
 Eddy County, New Mexico

Table 5 - HB Mill ROI analysis results

Pollutant	Averaging Period	Significant Impact Level ($\mu\text{g}/\text{m}^3$)	ROI (km)	Modeled Results ($\mu\text{g}/\text{m}^3$)	UTM X (M)	UTM Y (M)	Event (YYMMDDHH)
TSP	Annual	1	4.7	17.42049	597715.25	3598547.38	PERIOD
	24-hour	5		56.52669	598043.00	3598506.00	94020224
PM ₁₀	Annual	1	2.9	4.46133	597715.25	3598547.38	PERIOD
	24-hour	5		14.64470	598043.00	3598506.00	94020224
PM _{2.5}	Annual	0.3	3.0	0.65160	599238.47	3595283.27	PERIOD
	24-hour	1.2		4.24259	599494.19	3594894.47	94011224
NO _x	Annual	1	2.2	1.17823	599544.18	3594894.99	PERIOD
	24-hour	5		9.94216	599544.18	3594894.99	94011224
CO	8-hour	500	0	17.84109	599594.18	3594895.52	94012908
	1-hour	2,000		75.98526	599293.00	3595006.00	93123005

Table 6 - North Compaction Plant ROI analysis results.

Pollutant	Averaging Period	Significant Impact Level ($\mu\text{g}/\text{m}^3$)	ROI (km)	Modeled Results ($\mu\text{g}/\text{m}^3$)	UTM X (M)	UTM Y (M)	Event (YYMMDDHH)
TSP	Annual	1	0.8	2.28345	612342.07	3604090.87	PERIOD
	24-hour	5		18.17224	612342.07	3604090.87	94011224
PM ₁₀	Annual	1	0	0.44891	612342.07	3604090.87	PERIOD
	24-hour	5		3.53685	612342.07	3604090.87	94011224
PM _{2.5}	Annual	0.3	0	0.06734	612342.07	3604090.87	PERIOD
	24-hour	1.2		0.52399	612342.07	3604090.87	94011224

Where ambient impacts greater than the significance level were predicted, the maximum extent of the significant impact area was determined as measured from the center of the facility to the furthest extent of the significant impact. The center of the HB Mill facility was determined to be the center of the east-west and north-south extents of the boundary as (599193.3996, 3596801.511). The Radius of Impact (ROI) was determined as the distance from this point to the furthest significant receptor rounded up to the nearest 100 meters. The area within the ROI then was used as the modeling domain for the CIA. Figures 4 through 7 depict the determined pollutant specific ROIs.

A separate ROI was determined for the HB Mill impacts at the North Compaction Plant. The center of the North Compaction Plant was determined to be (612521, 3604807). The area within the ROI then was used as the modeling domain for the CIA at the North Compaction Plant. This ROI was determined using only the emissions resulting from the HB Mill project. Figure 8 depicts the ROI for TSP, which was the only pollutant that exceeded the significance level at the North Compaction Plant.

The results of the ROI analysis for NO_x, TSP, PM₁₀ and PM_{2.5} showed an exceedance of the significance levels, therefore, a NAAQS and PSD increment analysis was conducted.

5.2 Competing Source Inventory

An inventory of sources contained within the screening area were obtained from the MergeMaster regional sources database available on the NMED website. The most current version of MergeMaster on the NMED website is dated August 20, 2009.

Intrepid Potash Inc.
 HB In-Situ Project
 Eddy County, New Mexico

The NAAQS and PSD increment cumulative impact analysis contained all sources within the screening area which met the criteria of the following table:

Table 7 - Surrounding Source Retention Criteria

Between	And less than	Retain neighboring source if total emissions within 2.5 km of that source exceed:	
Facility	ROI+10 km	Retain all sources	
ROI+10 km	ROI+20 km	24 lb/hr	105.12 lb/hr
ROI+20 km	ROI+30 km	53 lb/hr	232.14 lb/hr
ROI+30 km	ROI+40 km	86 lb/hr	376.68 lb/hr
ROI+40 km	ROI+50 km	119 lb/hr	521.22 lb/hr
ROI+50 km	∞	Sources beyond ROI + 50 km may be discarded (Subject to 65 km minimum for PSD Increment consuming sources)	
100 km	∞	No sources past an absolute distance of 100 km from the facility need to be included, regardless of the size of the ROI.	
Facility	65 km	Retain all PSD increment consuming sources that are less than 65 km from the facility.	

The PSD increment analysis contained all sources within 65 km of the proposed project. Appendix A contains the competing source determination for each pollutant for the NAAQS cumulative analysis. Adjustments to the inventory were made as follows:

- The Intrepid Potash - East Plant was included in the model as a separate "included" file to be consistent with a recent submitted application.
- The North Compaction Plant was included as a separate "included" file for the TSP cumulative impact analysis of the receptors surrounding the North Compaction Plant. This file included the downwash parameters for the North Compaction Plant.
- The James Hamilton Construction - HMA No1 GCP3-3135 facility was determined to be out of business or no longer at the location. The source entries were left in the "included" file, but were remarked out using "***".
- The Southwest Asphalt Paving - 13040ADM Cedarapids No0360 was determined to be out of business or no longer at the location. The source entries were left in the "included" file, but were remarked out using "***".
- Emissions from the West Flotation Plant No. 421 facility were adjusted to the permitted limit of 22.5 lb/hr TSP. PM₁₀ and PM_{2.5} were assumed to be limited at the same rate.
- The exit velocity was set to 0.001 m/s and stack diameter to 1 m for sources identified as having a horizontal release.
- Sources having exact same parameters in the inventory (location and stack) were merged to one source and the emission rate used was the sum of the individual sources. The source ID used was the last source ID in the list of the identical sources.

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 HB In-Situ Project
 Eddy County, New Mexico

- A stack exit velocity of 32.6 m/s was used for sources having missing data indicated (-9999).

5.2 PSD Increment Modeling

The proposed project is located in Air Quality Control Region (AQCR) 155. The minor source baseline dates for this AQCR are as follows:

Pollutant	Minor Source Baseline Date
NO ₂	March 16, 1988
SO ₂	July 28, 1978
PM ₁₀	February 20, 1979

Emissions of NO₂, SO₂, and PM₁₀ from the proposed project will consume increment because the minor source baseline date for these pollutants has been set. Modeling was not required for SO₂. The results of the NO₂ and PM₁₀ PSD increment cumulative analysis are presented in the following table.

Table 8 - PSD increment modeled results.

Pollutant	Averaging Period	Modeled Results (µg/m ³)	Increment (µg/m ³)	UTM X (M)	UTM Y (M)	Event (YYMMDDHH)
PM ₁₀	Annual	5.02346	17	597715.25	3598547.38	PERIOD
	24-hour	17.55345	30	598108.68	3598475.21	93102124
NO ₂ *	Annual	2.8 (3.70067)	25	599229.29	3595510.40	PERIOD

*Modeled NO_x values were adjusted with an ARM of 0.75 to determine the NO₂ impacts. Values in parentheses represent the modeled NO_x values.

The highest-first-highest short term modeled impact and the highest annual average modeled impact were compared to the Class II PSD increments and the facility was found to be in compliance; therefore, no additional analysis was required. The maximum impacts were within 50 meter grid spacing and below 75% of the standard, so no additional receptors were required to ensure controlling concentrations were within the fine grid.

5.3 NAAQS Modeling

5.3.1 Background

Background concentrations for NO_x, CO and SO₂ are not used unless the source is very near to Bernalillo County or El Paso. The proposed project is not located in these areas, therefore, only the modeled concentrations were compared to the ambient air quality standards to determine compliance.

The following background concentrations were added to the ambient air quality standards to determine compliance for the particulate matter analyses:

PM _{2.5} (ug/m ³)	PM ₁₀ (ug/m ³)	TSP (ug/m ³)
7.3	20	26.6

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 HB In-Situ Project
 Eddy County, New Mexico

5.2.2 NAAQS Analysis

A NAAQS Analysis was conducted for TSP, PM₁₀, PM_{2.5} and NO₂. The results of the analysis are presented in the following table.

Pollutant	Averaging Period	Modeled Results (µg/m ³)	Background (µg/m ³)	Total (µg/m ³)	NMAAQS (µg/m ³)	UTM X (M)	UTM Y (M)	Event (YYMMDDHH)
TSP	Annual	18.23126	26.6	44.8	60	597715.25	3598547.38	PERIOD
	24-hour	58.66950	26.6	85.3	150	598108.68	3598475.21	93102124
PM ₁₀	Annual	5.15941	20	25.1	revoked	597715.25	3598547.38	PERIOD
	24-hour	17.60951	20	37.6	150	598108.68	3598475.21	93102124
PM _{2.5}	Annual	1.73233	7.3	9.0	15	599222.93	3595482.14	PERIOD
	24-hour	8.39213	7.3	15.6	35	599189.66	3595356.20	93080324
NO ₂ *	Annual	2.4 (3.19770)	N/A	1 ppb	50 ppb	599229.29	3595510.40	PERIOD
	24-hour	10.8 (14.44559)	N/A	6 ppb	100 ppb	599174.06	3595403.71	93080324

*Modeled NO_x values were adjusted with an ARM of 0.75 to determine the NO₂ impacts. Values in parentheses represent the modeled NO_x values.

Conversion of NO₂ from ug/m³ to ppm

$$ppm = 4.553 \times 10^{-5} \times \frac{C \times T}{M_w} \times 10^{Z \times 1.598 \times 10^{-5}}$$

Annual

$$NO_2 ppm = 4.553 \times 10^{-5} \times \frac{2.4 \times 520}{46} \times 10^{3359 \times 1.598 \times 10^{-5}} = 0.001 ppm$$

24-hr

$$NO_2 ppm = 4.553 \times 10^{-5} \times \frac{10.8 \times 520}{46} \times 10^{3350 \times 1.598 \times 10^{-5}} = 0.006 ppm$$

All of the pollutant impacts were found to be below the New Mexico Air Quality Standards, therefore, no additional analysis was required. The maximum impacts were within 50 meter grid spacing and below 75% of the standard, so no additional receptors were required to ensure controlling concentrations were within the fine grid.

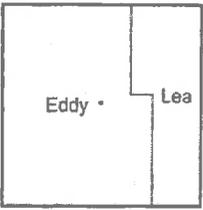
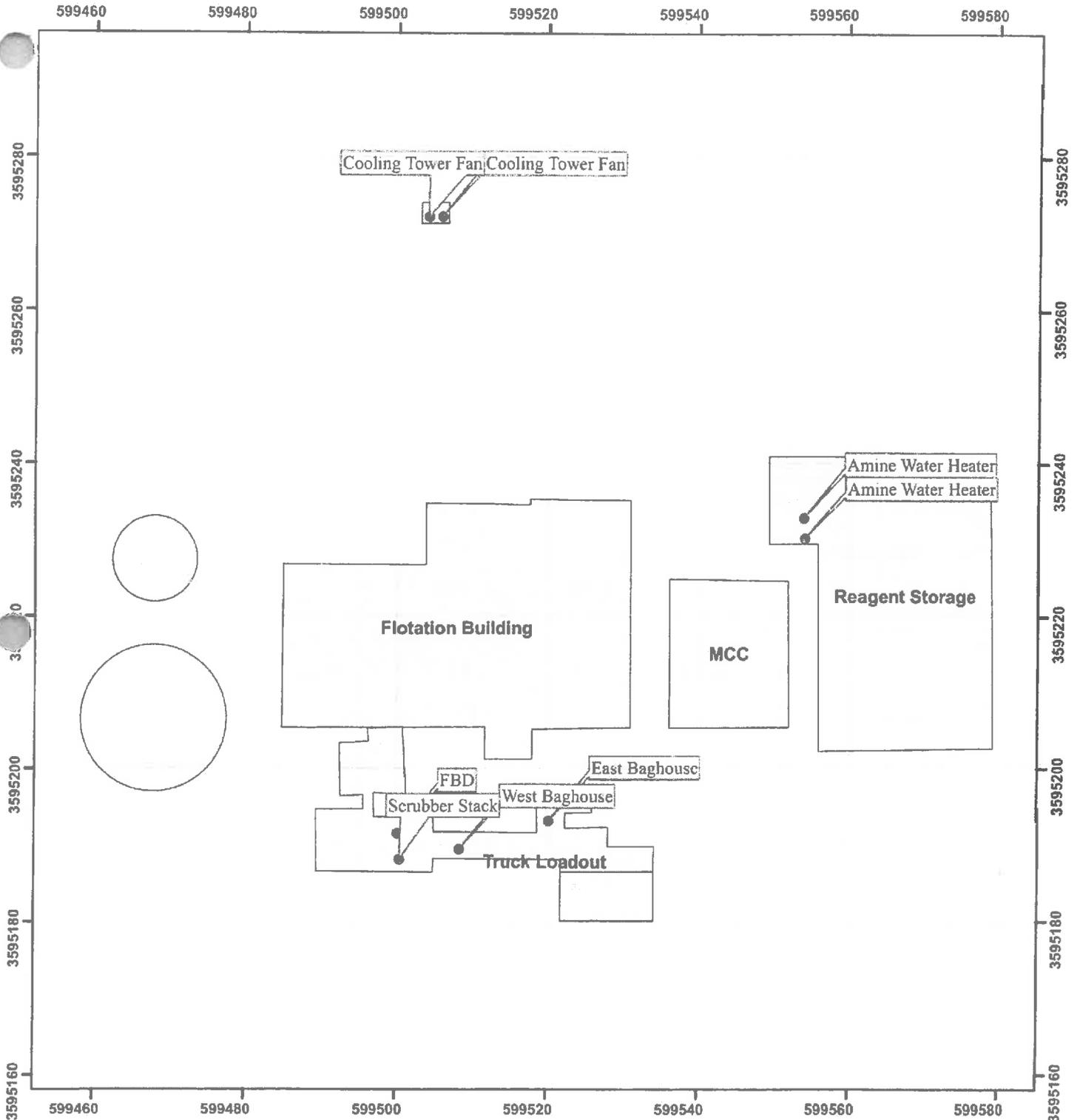
6.0 Class I Areas Analysis

Since the nearest Class I area is Carlsbad Caverns National Park, at 52 km from the facility, the Class I Area analysis is not applicable.

7.0 Conclusions

The modeling conducted in accordance with the in accordance with the "New Mexico Air Quality Bureau Air Dispersion Modeling Guidelines, Revised April 2010" as described in this report demonstrates that the proposed facility will not violate the New Mexico Ambient Air Quality Standards or the PSD increment.

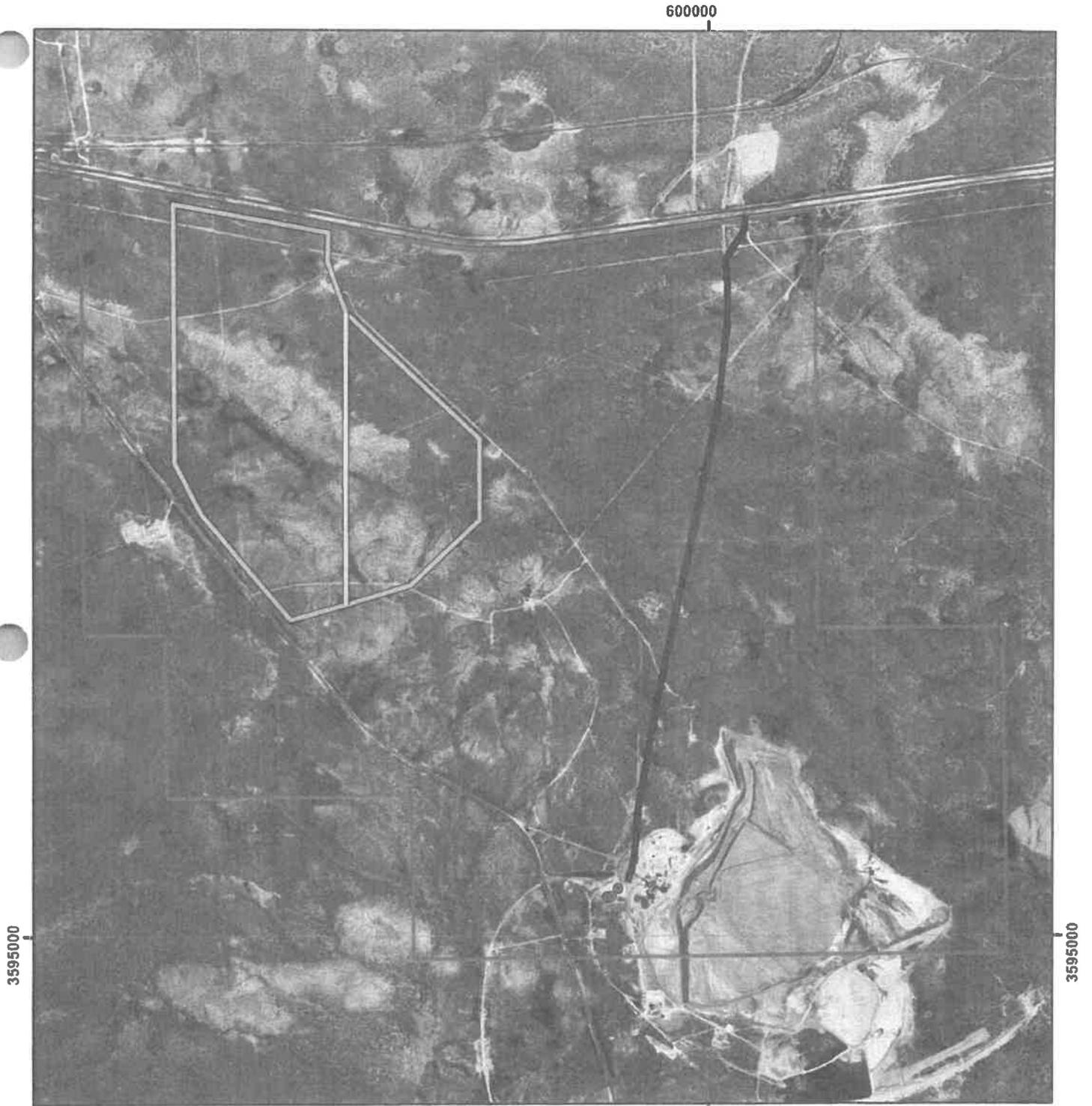
HB Mill Proposed Structures and Point Sources



1:670
 0.00 0.002 0.004 0.006 0.008
 Miles

- Legend
- Point Sources
 - ▭ Project Boundary
 - ▭ Buildings

HB Mill Project Roads

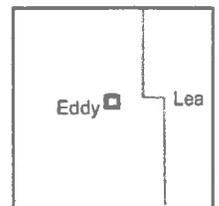
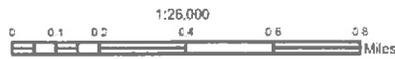


Legend

- Point Sources
- ▬ Paved Road
- ▬ Unpaved Pond Road
- ▬ Unpaved Pond Perimeter Road
- HB Mill Boundary

World Imagery

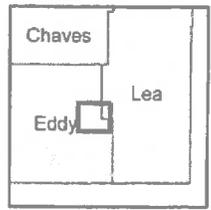
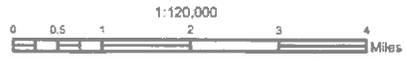
Low-Resolution (15m) Imagery



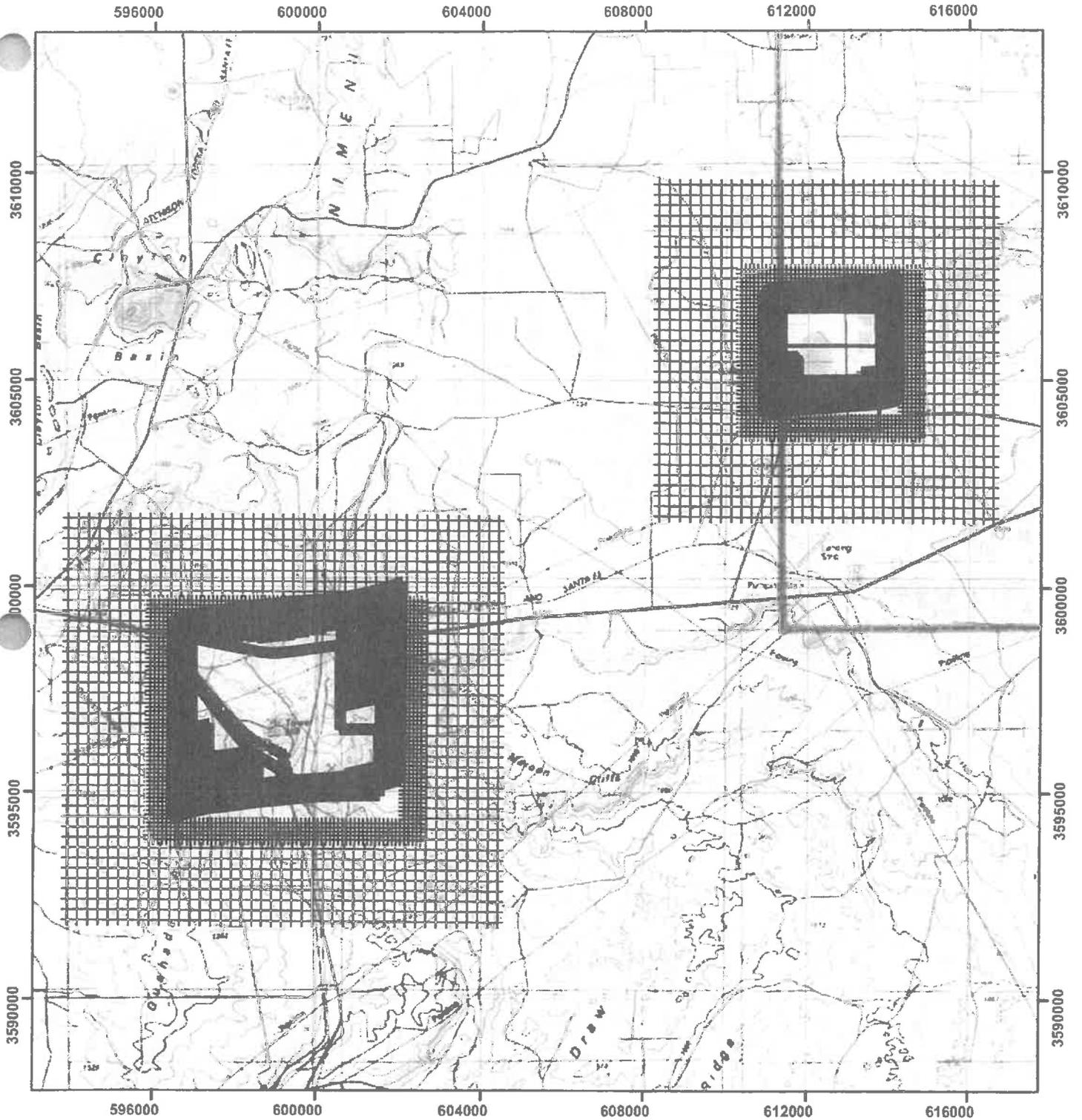
HB Mill Project Area



Legend
North Plant Boundary
HB Mill Boundary
USA Topo Maps



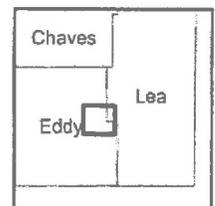
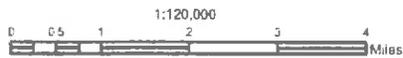
Preliminary Analysis Receptor Grid



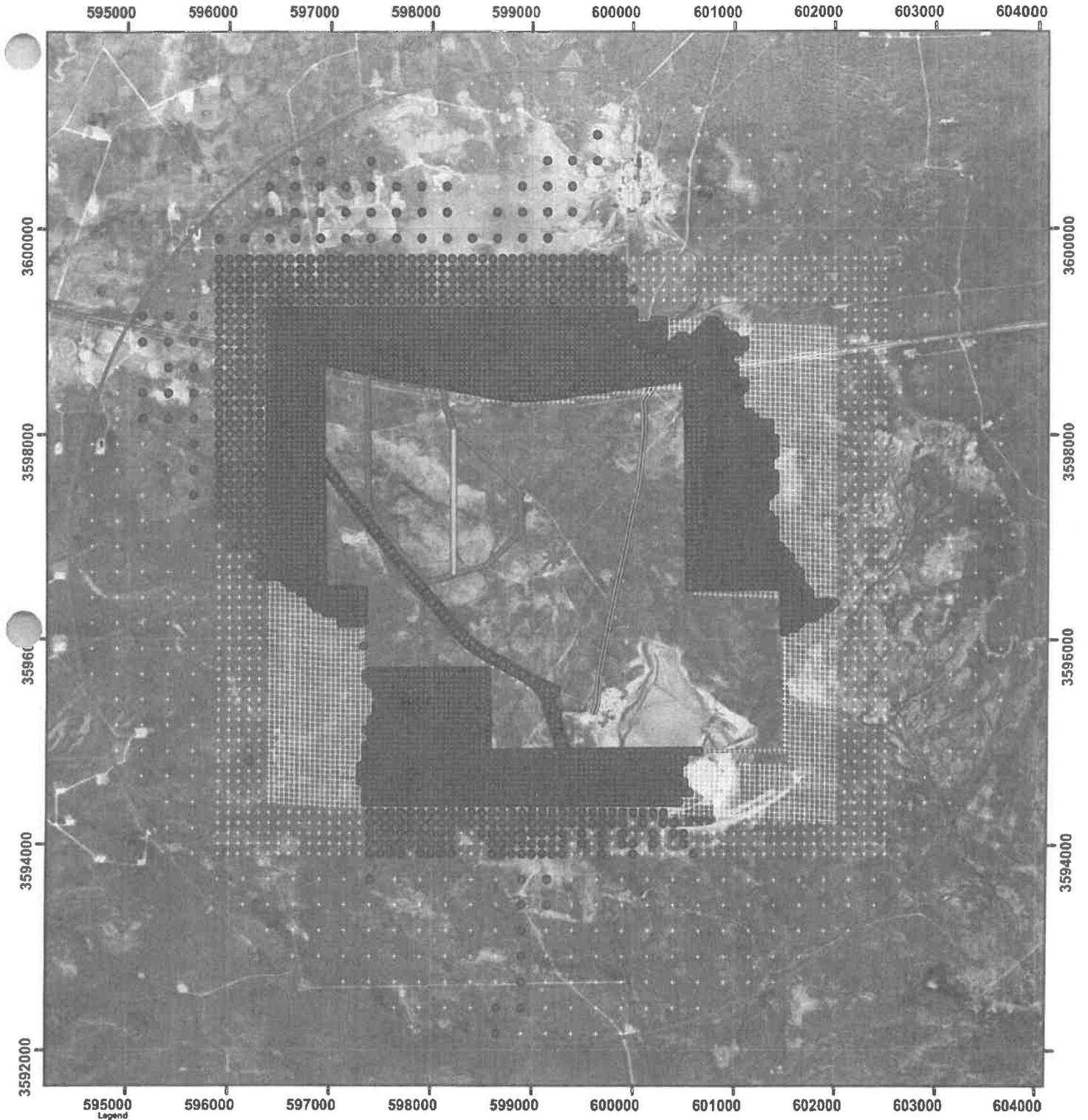
Legend

- + North Plant Receptors
- + HB M4 Receptors
- + North Plant Boundary
- + HB M4 Boundary

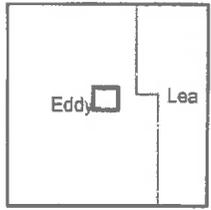
USA Topo Maps



HB Mill TSP ROI

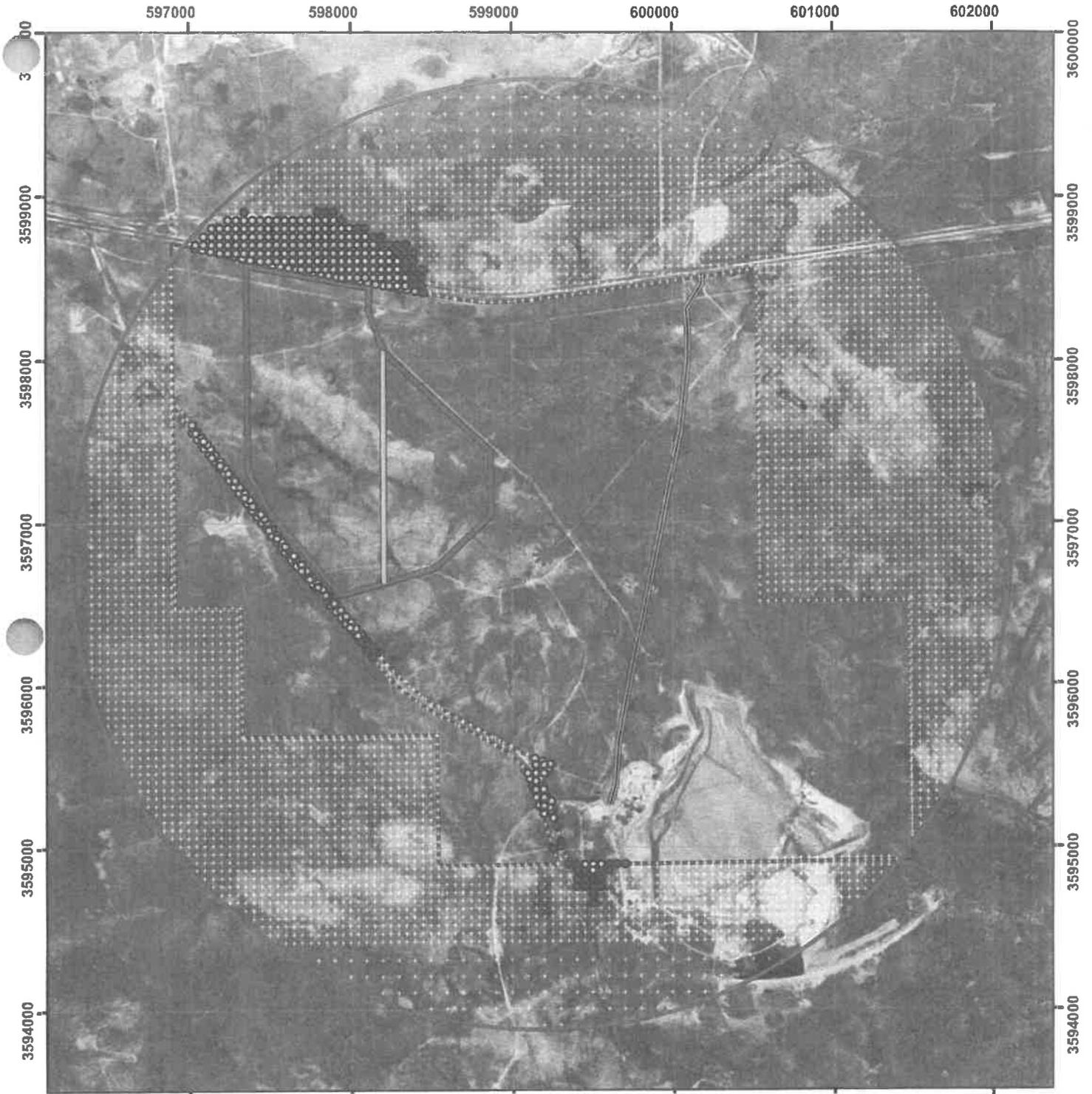


- Legend**
- TSP Annual >= 1
 - TSP 24hr >= 5
 - TSP ROI Receptors
 - ▬ Paved Road
 - ▬ Pond Road
 - ▬ Pond Perimeter Road
 - ▬ Project Boundary
 - World Imagery



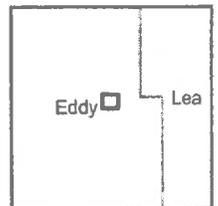
Low-Resolution (15m) Imagery

HB Mill PM10 ROI

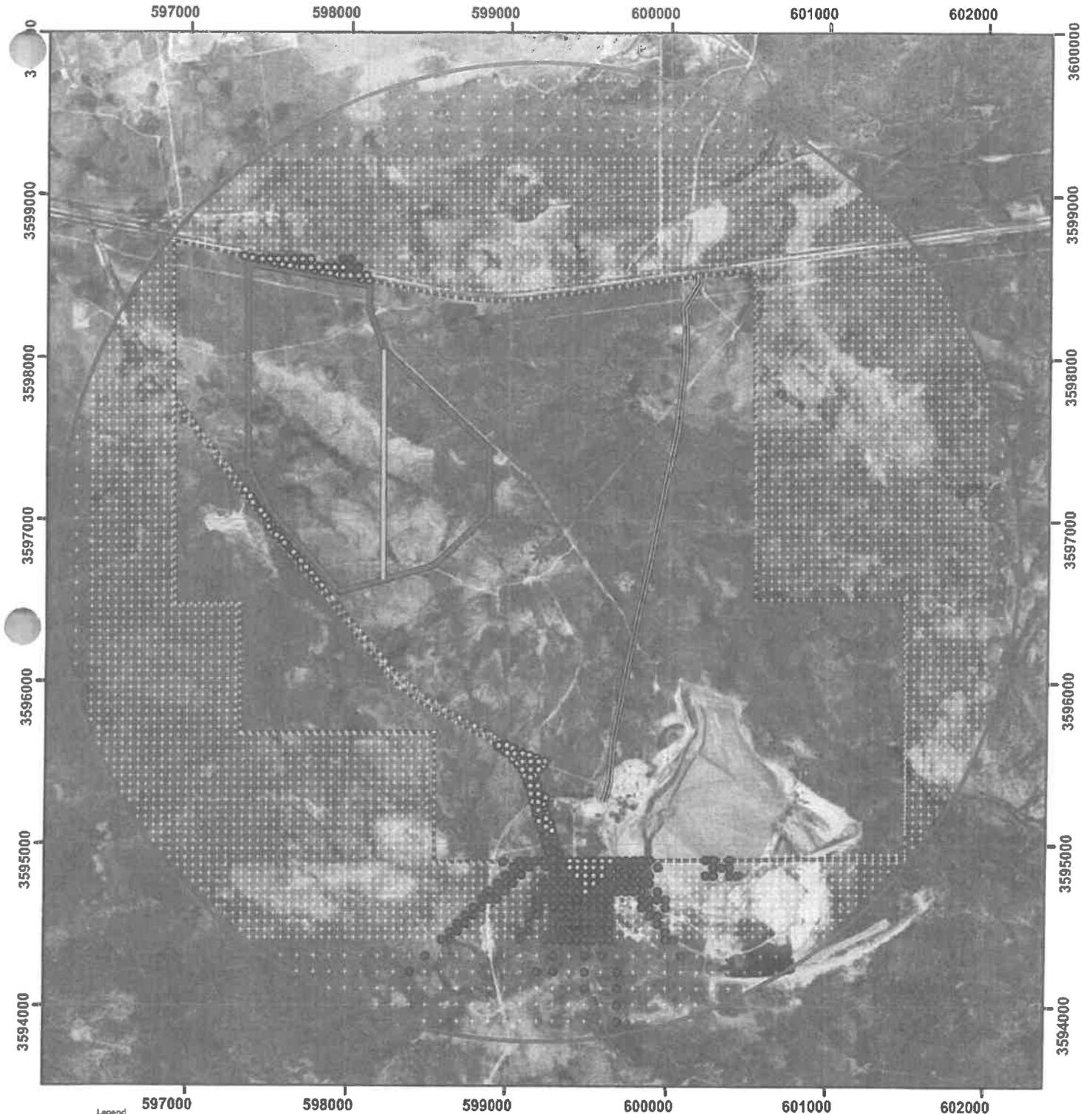


Legend

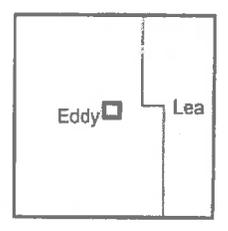
- PM10 Annual ≥ 1
- PM10 24hr ≥ 5
- PM10 ROI Receptors
- ▬ Paved Road
- ▬ Pond Road
- ▬ Pond Perimeter Road
- ▬ Project Boundary
- World Imagery
- Low-Resolution (15m) Imagery



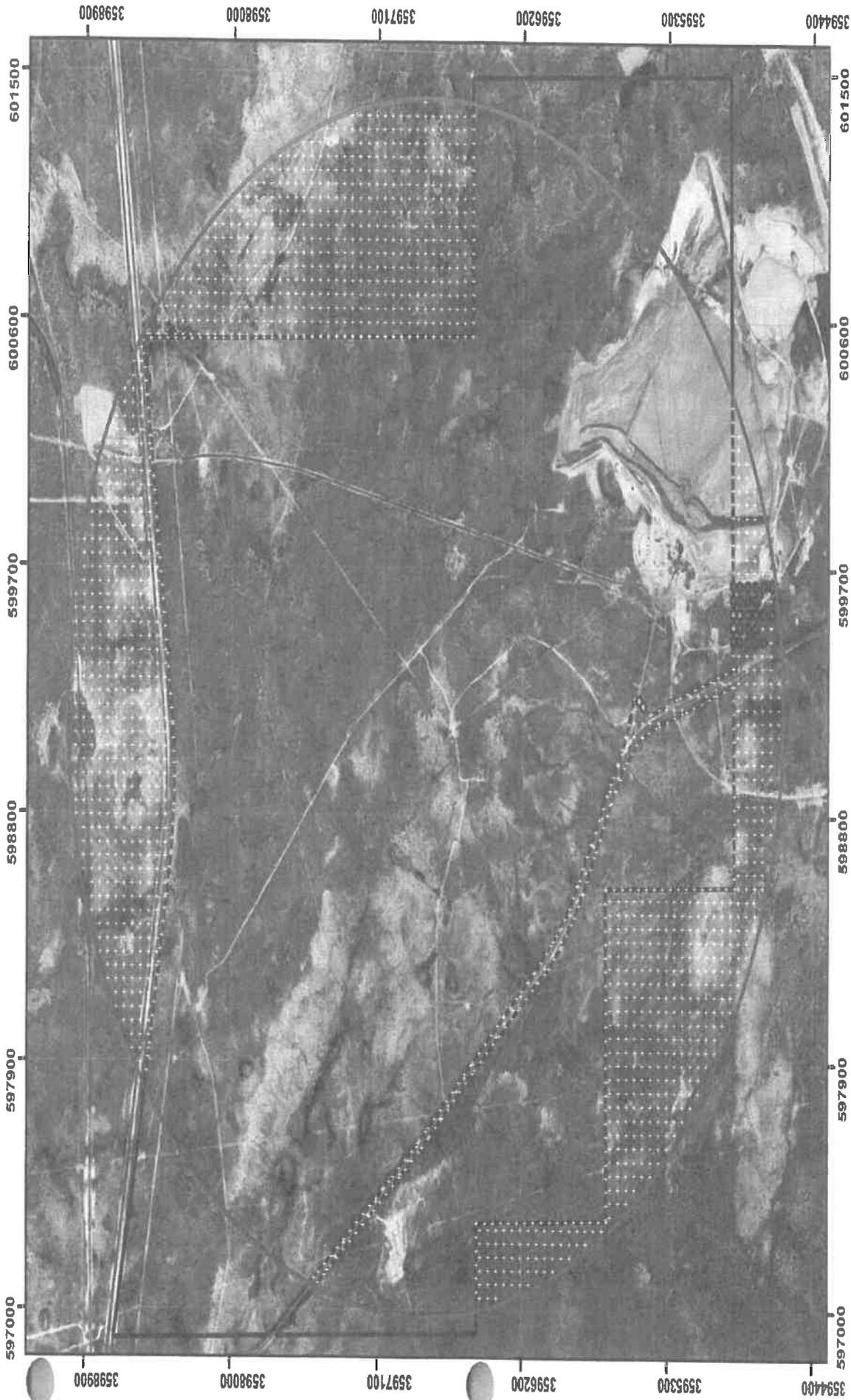
HB Mill PM25 ROI



- Legend**
- PM25 Annual >= 1
 - PM25 24hr >= 1.2
 - PM25 ROI Receptors
 - ▬ Paved Road
 - ▬ Pond Road
 - ▬ Pond Perimeter Road
 - ▭ Project Boundary
 - World Imagery
 - Low-Resolution (15m) imagery



HB Mill NOx ROI

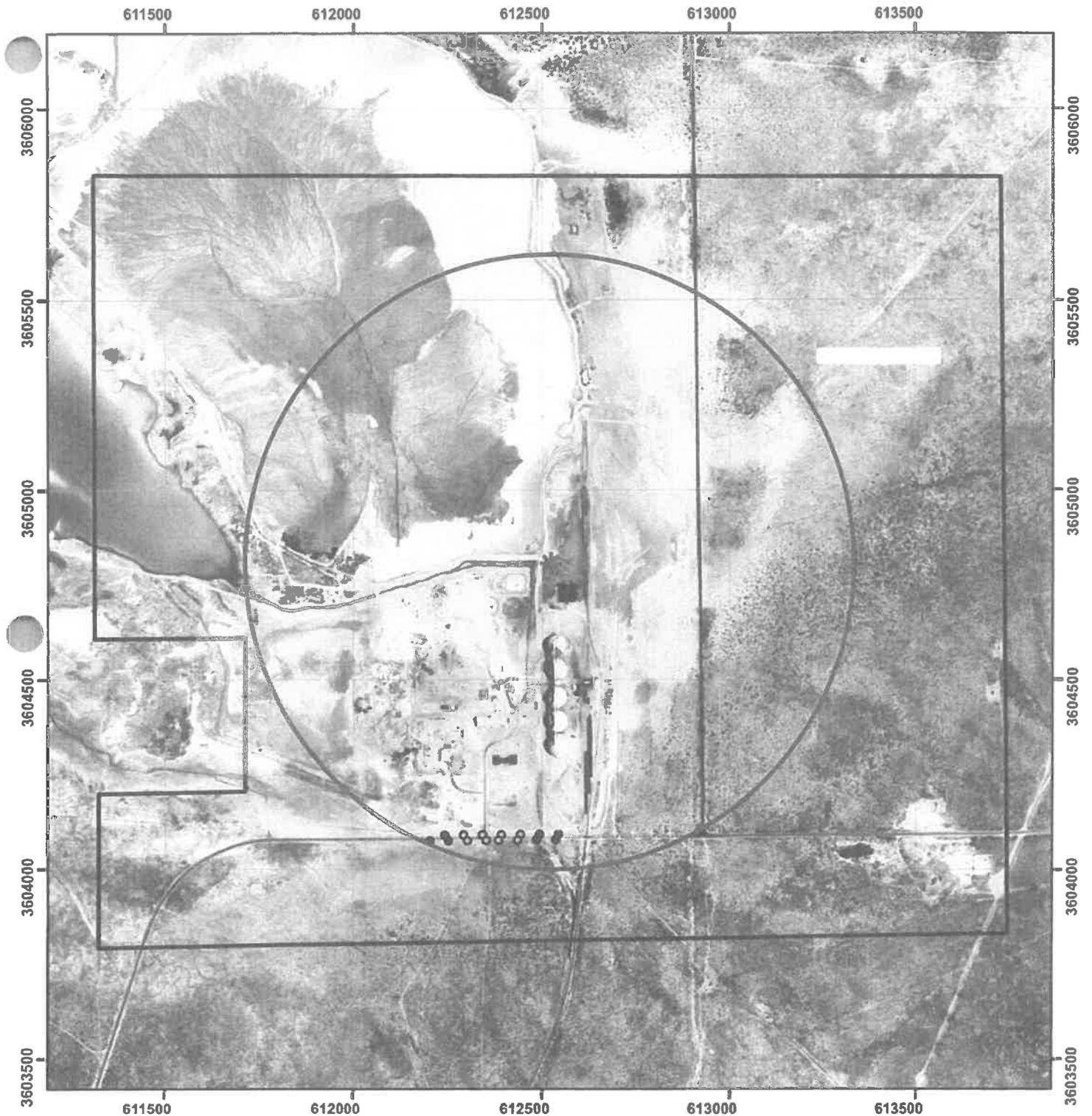


- Legend**
- NOx 24hr >= 6
 - NOx Annual >= 1
 - ROI Receptors
 - ▭ Project Boundary
 - World Imagery

Low Resolution (15m) Imagery



North Compaction Plant TSP ROI

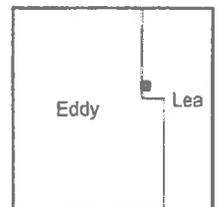


Legend

- TSP Annual ≥ 1
- TSP 24hr ≥ 5
- TSP ROI Receptors
- North Compaction Plant Boundary

1:14,000

0 112.5 225 450 675 900 Meters



Appendix A

MASTER_AI_NAME	Distance	Facility TSP		Model	Emissions within 2.5 km	
		lb/hr	TPY		TSP_PPH	TSP_TPY
Southwest Asphalt Paving - J3040ADM Cedarapids No0360	0.90	47.78	8.60	YES	173.05	107.19
West Flotation Plant No. 421	1.81	125.27	98.59	YES	173.05	107.19
New Mexico Salt and Minerals	3.20	1.71	7.50	YES	1.71	7.50
United Salt - Salt Drying Plant	10.01	13.74	60.20	YES	251.85	985.72
Mosaic Potash Carlsbad Inc	10.14	238.11	925.52	YES	251.85	985.72
Sand Point Landfill No52311	10.78	6.46	28.30	YES	6.46	28.30
Transwestern Pipeline - WT1 Compressor Station	13.15	42.77	10.69	YES	42.77	10.69
Dome Technology USA Inc - Intrepid East, GCP5-3531	15.19	43.38	190.00	YES	126.78	546.40
North Compaction Plant	15.27	20.50	89.79	NO	20.50	89.79
Intrepid Potash - East Plant	16.08	83.40	356.40	YES	126.78	546.40
Enterprise Products - Chaparral Gas Plant NSR No 3662	17.09	0.50	2.20	NO	0.50	2.20
James Hamilton Construction - HMA No1 GCP3-3135	18.28	220.03	190.00	YES	110.02	95.00
Las Animas Natural Gas - Dublin Ranch Compressor GCP43750	18.78	0.09	0.00	NO	0.09	0.00
New Mexico Salt and Minerals - Salt Drying Plant	19.96	0.03	0.12	NO	0.03	0.12
Waste Isolation Pilot Plant	20.44	6.66	0.80	NO	6.66	0.80
Lusk Booster Station	21.40	1.40	0.00	NO	1.40	0.00
TransColorado - Blanco Compressor Station	23.91	0.37	1.60	NO	0.37	1.60
Carlsbad Power Station	27.61	0.59	2.59	NO	0.59	2.59
Paige Booster Station GCP4-2424	28.22	0.11	0.00	NO	0.11	0.00
Baish Federal Production Facility	29.77	0.01	0.00	NO	0.01	0.00
Maverick 14 Federal Corn No1 Compressor Station	30.12	0.11	0.00	NO	0.11	0.00
Southeast Read-Mix - Carlsbad Plant GCP5-2096	30.15	43.38	190.00	YES	55.39	202.50
Constructors Inc - Southeast Materials GCP3-2792	30.86	21.69	95.00	YES	55.39	202.50
300TPH Asphalt Plant No1346	31.12	12.01	12.50	YES	55.39	202.50
Oxy USA Palladium 7 Federal No1 battery	32.31	0.00	0.00	NO	0.00	0.00
Crawford Compressor Station	33.06	0.26	1.17	NO	0.26	1.17
Bounds Junction Booster Station	33.14	0.00	0.00	NO	0.26	1.17
Kathleen Compressor Station GCP4-1923	34.19	0.41	0.90	NO	0.41	0.90
Cheasapeake - Queen Lake 20 FED 2H Compressor Station	34.75	0.14	0.00	NO	0.14	0.00
DCP Midstream - RJ Booster GCP4-3808	34.96	0.62	0.00	NO	0.62	0.00
Loco Hills Booster Station GCP4-1406	35.33	5.71	0.00	NO	5.71	0.00
Artesia Gas Plant	37.37	1.70	8.20	NO	1.70	8.20
Frontier Field Services - Maljamar Gas Plant	37.80	0.18	0.00	NO	0.18	0.00
Chevron USA - Levers No4 C.S and Tank Battery GCP4-3664	38.17	0.04	0.00	NO	0.04	0.00
DCP Midstream - Mesalero Booster Station, GCP4-3648	38.45	0.21	0.00	NO	0.21	0.00
Filaree 18 Fed No 1 Production facility	39.08	0.01	0.00	NO	0.01	0.00
Square Lake Booster Station GCP4-0855	40.15	0.41	0.00	NO	0.41	0.00
James Hamilton Construction Co - Crusher No1 NSR 0785	41.21	15.45	18.00	NO	15.45	18.00
Empire Abo Gas Plant	41.90	1.42	0.00	NO	3.91	10.60
Las Cruces Chile Plant	41.99	2.11	9.29	NO	3.91	10.60
Pecos Diamond Gas Plant	42.52	0.40	1.40	NO	3.91	10.60
PLU Pierce Canyon 17 Central Production Facility	42.61	0.14	0.00	NO	0.14	0.00
Gaucho Unit No2Y	44.72	0.01	0.06	NO	0.01	0.06
2008 January Pioneer VSI Crusher GCP2-1775	45.06	43.38	95.00	NO	43.38	95.00
Grama No1 and Booster Comp Station GCP4-3757	45.55	0.11	0.50	NO	0.11	0.50
Atoka No3 Compressor Station	47.03	0.30	0.00	NO	0.30	0.00
Outland 5t Unit No3	47.83	0.02	0.09	NO	0.02	0.09
Shadow Booster Station GCP4-1421	48.61	0.20	0.00	NO	0.20	0.00
PLU Ross Ranch 6 Central Production Facility	48.92	0.18	0.00	NO	0.18	0.00
Compressor Station No167	50.32	1.18	5.16	NO	1.18	5.16
Chevron USA - Buckeye CO2 Plant	51.14	2.67	11.19	NO	2.67	11.19
Lovington Booster Station	51.36	87.10	2.60	NO	87.10	2.60
Southwest Asphalt Paving - GCP3-3621	52.18	43.50	95.00	NO	43.50	95.00
Armstrong Construction Co Inc - Crushing & Screening GCP2-3444	55.62	7.20	16.00	NO	7.20	16.00
Navajo Refining - Artesia Refinery	56.14	10.41	12.09	NO	43.65	12.09
Navajo Refining - Artesia Refinery	56.81	29.54	0.00	NO	44.15	13.23
Navajo Refining - Artesia Refinery	57.66	3.70	0.00	NO	58.96	60.83
Holly Asphalt Company	58.28	14.82	47.60	NO	19.02	48.74
Land O' Lakes Purina Feed - Artesia Feed Mill	58.72	0.50	1.14	NO	48.56	48.74
Indian Basin Gas Plant	59.18	2.60	10.80	NO	2.60	10.80
Enstor Operating - Grama Ridge No1 Compressor Station	59.55	0.10	0.00	NO	0.10	0.00
Xcel Energy - Cunningham Station	60.59	17.64	27.00	NO	17.64	27.00
Monument Gas Plant	60.87	1.50	0.00	NO	1.50	0.00
Carlsbad Compressor Station	61.26	0.27	1.20	NO	0.27	1.20
Lipham Construction - Mri 400TPH Crusher No0427	61.36	40.00	9.60	NO	40.12	9.60
DCP Midstream - Eunice Gas Plant	61.83	2.57	11.50	NO	2.57	11.50

TSP Offsite Inventory Determination

ROI = 4.7 km

MASTER_AI_NAME	Distance	Facility TSP		Model	Emissions within 2.5 km	
		lb/hr	TPY		TSP_PPH	TSP_TPY
Federal 33 No1 Compressor Station GCP4-1743	62.53	0.12	0.00 NO		0.12	0.00
Oil Center Compressor Station, GCP4-3673	62.69	0.23	0.00 NO		0.23	0.00
Bogle Flats No18 Compressor Station	63.03	21.71	95.10 NO		21.71	95.10
Apex Booster Station	63.68	0.12	0.00 NO		80.53	104.69
Hobbs Generating Station	64.46	17.80	36.66 NO		40.53	95.09
Maddox Station	64.51	22.61	58.43 NO		40.53	95.09
Oil Center Booster Station	64.55	0.52	2.28 NO		0.52	2.28

MASTER_AI_NAME	Distance	Facility PM10		Model	Emissions within 2.5 km	
		lb/hr	TPY		TSP_PPH	TSP_TPY
Southwest Asphalt Paving - 13040ADM Cedarapids No0360	0.90	47.78	8.60	YES	173.05	107.19
West Flotation Plant No. 421	1.81	125.27	98.59	YES	173.05	107.19
New Mexico Salt and Minerals	3.20	0.82	3.52	YES	1.71	7.50
United Salt - Salt Drying Plant	10.01	13.74	60.20	YES	251.85	985.72
Mosaic Potash Carlsbad Inc	10.14	219.08	853.33	YES	251.85	985.72
Sand Point Landfill No52311	10.78	1.71	7.50	YES	6.46	28.30
Transwestern Pipeline - WT1 Compressor Station	13.15	42.77	0.70	YES	42.77	10.69
Dome Technology USA Inc - Intrepid East, GCP5-3531	15.19	43.38	0.00	YES	126.78	546.40
North Compaction Plant	15.27	20.50	89.79	NO	20.50	89.79
Intrepid Potash - East Plant	16.08	73.30	318.80	YES	126.78	546.40
Enterprise Products - Chaparral Gas Plant NSR No 3662	17.09	0.50	2.20	NO	0.50	2.20
James Hamilton Construction - HMA No1 GCP3-3135	18.28	220.03	0.00	YES	110.02	95.00
Las Animas Natural Gas - Dublin Ranch Compressor GCP43750	18.78	0.09	0.40	NO	0.09	0.00
New Mexico Salt and Minerals - Salt Drying Plant	19.96	0.03	0.12	NO	0.03	0.12
Waste Isolation Pilot Plant	20.44	6.66	0.80	NO	6.66	0.80
Lusk Booster Station	21.40	1.40	5.50	NO	1.40	0.00
TransColorado - Blanco Compressor Station	23.91	0.37	1.60	NO	0.37	1.60
Carlsbad Power Station	27.61	0.59	2.59	NO	0.59	2.59
Paige Booster Station GCP4-2424	28.22	0.11	0.50	NO	0.11	0.00
Baish Federal Production Facility	29.77	0.01	0.02	NO	0.01	0.00
Maverick 14 Federal Com No1 Compressor Station	30.12	0.11	0.25	NO	0.11	0.00
Southeast Read-Mix - Carlsbad Plant GCP5-2096	30.15	43.38	0.00	NO	55.39	202.50
Constructors Inc - Southeast Materials GCP3-2792	30.86	21.69	95.00	NO	55.39	202.50
300TPH Asphalt Plant No1346	31.12	5.76	6.00	NO	55.39	202.50
Oxy USA Palladium 7 Federal No1 battery	32.31	0.00	0.01	NO	0.00	0.00
Crawford Compressor Station	33.06	0.26	1.17	NO	0.26	1.17
Bounds Junction Booster Station	33.14	0.00	0.02	NO	0.26	1.17
Kathleen Compressor Station GCP4-1923	34.19	0.41	1.80	NO	0.41	0.90
Cheasapeake - Queen Lake 20 FED 2H Compressor Station	34.75	0.14	0.60	NO	0.14	0.00
DCP Midstream - RJ Booster GCP4-3808	34.96	0.62	2.70	NO	0.62	0.00
Loco Hills Booster Station GCP4-1406	35.33	5.71	25.00	NO	5.71	0.00
Artesia Gas Plant	37.37	1.86	7.52	NO	1.70	8.20
Frontier Field Services - Maljamar Gas Plant	37.80	0.18	0.80	NO	0.18	0.00
Chevron USA - Levers No4 C.S and Tank Battery GCP4-3664	38.17	0.04	0.17	NO	0.04	0.00
DCP Midstream - Mescalero Booster Station, GCP4-3648	38.45	0.21	0.90	NO	0.21	0.00
Filaree 18 Fed No 1 Production facility	39.08	0.01	0.04	NO	0.01	0.00
Square Lake Booster Station GCP4-0855	40.15	0.41	1.80	NO	0.41	0.00
James Hamilton Construction Co - Crusher No1 NSR 0785	41.21	4.54	5.39	NO	15.45	18.00
Empire Abo Gas Plant	41.90	1.42	5.80	NO	3.91	10.60
Las Cruces Chile Plant	41.99	15.43	67.63	NO	3.91	10.60
Pecos Diamond Gas Plant	42.52	0.40	1.40	NO	3.91	10.60
PLU Pierce Canyon 17 Central Production Facility	42.61	0.14	0.60	NO	0.14	0.00
Gaucho Unit No2Y	44.72	0.01	0.06	NO	0.01	0.06
2008 January Pioneer VSI Crusher GCP2-1775	45.06	43.38	0.00	NO	43.38	95.00
Gramma No1 and Booster Comp Station GCP4-3757	45.55	0.11	0.50	NO	0.11	0.50
Atoka No3 Compressor Station	47.03	0.30	1.50	NO	0.30	0.00
Outland St Unit No3	47.83	0.02	0.09	NO	0.02	0.09
Shadow Booster Station GCP4-1421	48.61	0.20	0.80	NO	0.20	0.00
PLU Ross Ranch 6 Central Production Facility	48.92	0.18	15.42	NO	0.18	0.00
Compressor Station No167	50.32	2.40	10.20	NO	1.18	5.16
Chevron USA - Buckeye CO2 Plant	51.14	2.67	11.19	NO	2.67	11.19
Lovington Booster Station	51.36	87.10	2.60	NO	87.10	2.60
Southwest Asphalt Paving - GCP3-3621	52.18	43.50	0.00	NO	43.50	95.00
Armstrong Construction Co Inc - Crushing & Screening GCP2-3444	55.62	3.40	7.50	NO	7.20	16.00
Navajo Refining - Artesia Refinery	56.14	10.41	44.69	NO	43.65	12.09
Navajo Refining - Artesia Refinery	56.81	29.54	129.30	NO	44.15	13.23
Navajo Refining - Artesia Refinery	57.66	3.70	15.80	NO	58.96	60.83
Holly Asphalt Company	58.28	3.37	11.38	NO	19.02	48.74

PM10 Offsite Inventory Determination

ROI = 2.9

MASTER_AI_NAME	Distance	Facility PM10			Emissions within 2.5 km	
		lb/hr	TPY	Model	TSP_PPH	TSP_TPY
Land O' Lakes Purina Feed - Artesia Feed Mill	58.72	0.50	1.14	NO	48.56	48.74
Indian Basin Gas Plant	59.18	2.60	11.39	NO	2.60	10.80
Enstor Operating - Grama Ridge No1 Compressor Station	59.55	0.10	0.50	NO	0.10	0.00
Xcel Energy - Cunningham Station	60.59	16.80	54.10	NO	17.64	27.00
Monument Gas Plant	60.87	1.50	6.50	NO	1.50	0.00
Carlsbad Compressor Station	61.26	0.27	1.20	NO	0.27	1.20
Lipham Construction - Mri 400TPH Crusher No0427	61.36	40.00	9.60	NO	40.12	9.60
DCP Midstream - Eunice Gas Plant	61.83	3.29	11.50	NO	2.57	11.50
Federal 33 No1 Compressor Station GCP4-1743	62.53	0.12	0.51	NO	0.12	0.00
Oil Center Compressor Station, GCP4-3673	62.69	0.23	1.00	NO	0.23	0.00
Bogle Flats No18 Compressor Station	63.03	21.71	95.10	NO	21.71	95.10
Apex Booster Station	63.68	0.12	0.53	NO	80.53	104.69
Hobbs Generating Station	64.46	17.60	36.06	NO	40.53	95.09
Maddox Station	64.51	22.61	58.43	NO	40.53	95.09
Oil Center Booster Station	64.55	0.52	2.27	NO	0.52	2.28

MASTER_AI_NAME	Distance	Facility PM25		Model	Emissions within 2.5 km	
		lb/hr	TPY		TSP_PPH	TSP_TPY
Southwest Asphalt Paving - 13040ADM Cedarapids No0360	0.90	11.94	0.00	YES	137.22	0.00
West Flotation Plant No. 421	1.81	125.27	0.00	YES	137.22	0.00
New Mexico Salt and Minerals	3.20	0.54	0.00	YES	0.54	0.00
United Salt - Salt Drying Plant	10.01	13.74	0.00	YES	141.95	0.00
Mosaic Potash Carlsbad Inc	10.14	128.20	0.00	YES	141.95	0.00
Sand Point Landfill NoS2311	10.78	0.43	0.00	YES	0.43	0.00
Transwestern Pipeline - WT1 Compressor Station	13.15	42.77	0.00	YES	42.77	0.00
Dome Technology USA Inc - Intrepid East, GCP5-3531	15.19	43.38	0.00	YES	101.50	34.70
North Compaction Plant	15.27	14.75	0.00	NO	14.75	0.00
Intrepid Potash - East Plant	16.08	58.13	34.70	YES	101.50	34.70
Enterprise Products - Chaparral Gas Plant NSR No 3662	17.09	0.50	2.20	NO	0.50	2.20
James Hamilton Construction - HMA No1 GCP3-3135	18.28	220.03	0.00	YES	110.02	0.00
Las Animas Natural Gas - Dublin Ranch Compressor GCP43750	18.78	0.09	0.00	NO	0.09	0.00
New Mexico Salt and Minerals - Salt Drying Plant	19.96	0.01	0.00	NO	0.01	0.00
Waste Isolation Pilot Plant	20.44	6.66	0.00	NO	6.66	0.00
Lusk Booster Station	21.40	1.40	6.40	NO	1.40	6.40
TransColorado - Blanco Compressor Station	23.91	0.37	0.00	NO	0.37	0.00
Carlsbad Power Station	27.61	0.59	0.00	NO	0.59	0.00
Paige Booster Station GCP4-2424	28.22	0.11	0.00	NO	0.11	0.00
Baish Federal Production Facility	29.77	0.00	0.00	NO	0.00	0.00
Maverick 14 Federal Com No1 Compressor Station	30.12	0.10	0.00	NO	0.10	0.00
Southeast Read-Mix - Carlsbad Plant GCP5-2096	30.15	43.38	0.00	NO	32.87	0.00
Constructors Inc - Southeast Materials GCP3-2792	30.86	5.42	0.00	NO	32.87	0.00
300TPH Asphalt Plant No1346	31.12	5.76	0.00	NO	32.87	0.00
Oxy USA Palladium 7 Federal No1 battery	32.31	0.00	0.00	NO	0.00	0.00
Crawford Compressor Station	33.06	0.26	0.00	NO	0.26	0.00
Bounds Junction Booster Station	33.14	0.00	0.00	NO	0.26	0.00
Kathleen Compressor Station GCP4-1923	34.19	0.41	1.80	NO	0.41	1.80
Cheasapeake - Queen Lake 20 FED 2H Compressor Station	34.75	0.14	0.00	NO	0.14	0.00
DCP Midstream - RJ Booster GCP4-3808	34.96	0.62	0.00	NO	0.62	0.00
Loco Hills Booster Station GCP4-1406	35.33	5.71	0.00	NO	5.71	0.00
Artesia Gas Plant	37.37	1.70	11.70	NO	1.70	11.70
Frontier Field Services - Maljamar Gas Plant	37.80	0.11	0.00	NO	0.11	0.00
Chevron USA - Levers No4 C.5 and Tank Battery GCP4-3664	38.17	0.01	0.00	NO	0.01	0.00
DCP Midstream - Mescalero Booster Station, GCP4-3648	38.45	0.21	0.00	NO	0.21	0.00
Filaree 18 Fed No 1 Production facility	39.08	0.00	0.00	NO	0.00	0.00
Square Lake Booster Station GCP4-0855	40.15	0.41	0.00	NO	0.41	0.00
James Hamilton Construction Co - Crusher No1 NSR 0785	41.21	1.13	0.00	NO	1.13	0.00
Empire Abo Gas Plant	41.90	1.33	0.00	NO	5.31	3.20
Las Cruces Chile Plant	41.99	4.16	1.80	NO	5.31	3.20
Pecos Diamond Gas Plant	42.52	0.40	1.40	NO	5.31	3.20
PLU Pierce Canyon 17 Central Production Facility	42.61	0.14	0.00	NO	0.14	0.00
Gaucho Unit No2Y	44.72	0.00	0.00	NO	0.00	0.00
2008 January Pioneer VSI Crusher GCP2-1775	45.06	43.38	0.00	NO	43.38	0.00
Grama No1 and Booster Comp Station GCP4-3757	45.55	0.11	0.50	NO	0.11	0.50
Atoka No3 Compressor Station	47.03	0.30	1.50	NO	0.30	1.50
Outland St Unit No3	47.83	0.01	0.00	NO	0.01	0.00
Shadow Booster Station GCP4-1421	48.61	0.20	0.00	NO	0.20	0.00
PLU Ross Ranch 6 Central Production Facility	48.92	0.18	0.00	NO	0.18	0.00
Compressor Station No167	50.32	2.40	10.20	NO	2.40	10.20
Chevron USA - Buckeye CO2 Plant	51.14	2.60	0.00	NO	2.60	0.00
Lovington Booster Station	51.36	87.10	0.00	NO	87.10	0.00
Southwest Asphalt Paving - GCP3-3621	52.18	43.50	0.00	NO	43.50	0.00
Armstrong Construction Co Inc - Crushing & Screening GCP2-3444	55.62	1.10	2.40	NO	1.10	2.40
Navajo Refining - Artesia Refinery	56.14	9.43	0.00	NO	42.56	0.00
Navajo Refining - Artesia Refinery	56.81	29.48	0.00	NO	42.69	0.00
Navajo Refining - Artesia Refinery	57.66	3.65	0.00	NO	44.23	0.50
Holly Asphalt Company	58.28	1.54	0.50	NO	5.32	0.50
Land O' Lakes Purina Feed - Artesia Feed Mill	58.72	0.13	0.00	NO	34.80	0.50
Indian Basin Gas Plant	59.18	2.60	0.00	NO	2.60	0.00
Enstor Operating - Grama Ridge No1 Compressor Station	59.55	0.10	0.00	NO	0.10	0.00
Xcel Energy - Cunningham Station	60.59	16.73	0.00	NO	16.73	0.00

PM2.5 Offsite Inventory Determination

ROI = 3.0 km

Monument Gas Plant	60.87	1.50	0.00	NO	1.50	0.00
Carlsbad Compressor Station	61.26	0.27	0.00	NO	0.27	0.00
Lipham Construction - Mri 400TPH Crusher No0427	61.36	10.00	0.00	NO	10.12	0.00
DCP Midstream - Eunice Gas Plant	61.83	3.24	0.00	NO	3.24	0.00
Federal 33 No1 Compressor Station GCP4-1743	62.53	0.12	0.00	NO	0.12	0.00
Oil Center Compressor Station, GCP4-3673	62.69	0.23	0.00	NO	0.23	0.00
Bogle Flats No18 Compressor Station	63.03	21.71	0.00	NO	21.71	0.00
Apex Booster Station	63.68	0.12	0.00	NO	49.96	0.00
Hobbs Generating Station	64.46	17.23	0.00	NO	39.96	0.00
Maddox Station	64.51	22.61	0.00	NO	39.96	0.00
Oil Center Booster Station	64.55	0.52	0.00	NO	0.52	0.00

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
West Flotation Plant No. 421	1.81	37.34	29.39	YES	37.34	29.39
New Mexico Salt and Minerals	3.20	6.80	14.90	YES	6.80	14.90
Mewbourne Oil - Esperanza 11 Facility	7.06	1.25	21.50	YES	1.25	21.50
Temperate BEC Federal No1 Facility	7.41	5.40	23.50	YES	5.40	23.50
Big Eddy 2 Dehydrator	7.62	0.03	0.13	YES	0.03	0.13
United Salt - Salt Drying Plant	10.01	2.01	8.80	YES	23.53	79.35
Mosaic Potash Carlsbad Inc	10.14	21.52	70.55	YES	23.53	79.35
Eland Compressor Station	11.17	4.41	19.30	YES	7.91	34.60
Cabin Lake Compressor Station GCP4-1120	11.68	6.29	27.52	YES	6.29	27.52
BOPCO LP - Big Eddy 1 Dehydrator GCP1-3751	12.08	0.05	0.20	YES	0.05	0.20
Yates Petroleum Corporation - Zia AHZ No1	12.59	3.50	15.30	NO	11.61	49.10
Transwestern Pipeline - WT1 Compressor Station	13.15	19.00	4.75	NO	19.09	5.15
Transwestern Pipeline Co - Portable Remediation Site	13.20	0.09	0.40	NO	19.09	5.15
Gazelle Compressor Station	13.39	3.70	14.50	NO	14.00	59.60
Pickett Draw Federal Well No1	14.51	1.30	5.69	NO	4.60	20.19
Dome Technology USA Inc - Intrepid East, GCP5-3531	15.19	43.38	190.00	YES	89.73	387.19
North Compaction Plant	15.27	22.60	99.00	NO	22.60	99.00
Parkway Delaware Unit Oil and Gas Facility	15.29	1.70	0.14	NO	18.58	74.14
Magnum Compressor Station GCP1-0913	15.31	6.80	29.80	NO	10.50	44.30
BOPCO LP - Big Eddy Natural Gas Gathering System	15.35	3.31	14.50	NO	4.60	20.19
Freedom 31 Fed Com No1	16.17	4.12	17.83	YES	34.06	148.94
Fitz Compressor Station	16.36	16.88	74.00	NO	18.58	74.14
Intrepid Potash - East Plant	16.36	46.35	197.19	YES	89.73	387.19
Big Eddy Compressor Station GCP1-2512	16.39	18.32	80.26	NO	18.51	81.06
Apache 13-1 Compressor Station	16.50	1.42	6.20	NO	6.64	29.08
NE Carlsbad Booster Station	16.62	24.32	106.51	YES	48.79	213.40
Devon Energy - Arenoso 22 Federal Com No 1	16.98	2.20	9.80	NO	2.20	9.80
Enterprise Products - Chaparral Gas Plant NSR No 3662	17.09	36.32	97.65	YES	62.94	214.25
Apache Compressor Station	17.94	5.22	22.88	NO	6.64	29.08
Burton Flats Compressor Station	18.19	20.35	89.06	YES	44.67	195.57
James Hamilton Construction - HMA No1 GCP3-3135	18.28	220.03	190.00	YES	110.02	95.00
Liberty 36 Facility	18.30	5.62	24.60	NO	9.74	42.43
Shugart Compressor Station GCP1-2535	18.67	26.62	116.60	YES	63.54	216.75
Las Animas Natural Gas - Dublin Ranch Compressor GCP43750	18.78	1.64	7.20	NO	1.69	7.41
Cetane Energy - Deoxygenation Plant	18.84	0.18	0.80	NO	18.51	81.06
Strawberry 7 Fed No2 Battery	19.46	0.60	2.50	YES	27.22	119.10
Lucy State Tank Battery	19.62	0.09	0.41	NO	2.48	10.92
Oxy USA - Lost Tank 35 State No4	19.70	2.30	10.10	NO	2.48	10.92
Antongiovanni MJ No1 Facility	19.95	3.30	14.50	NO	16.50	71.90
New Mexico Salt and Minerals - Salt Drying Plant	19.96	0.66	2.90	NO	0.66	2.90
Flora State Tank Battery	20.24	0.09	0.41	NO	2.48	10.92
Devon Energy - Indian Draw 6 Fee Com 1 Battery	20.27	2.90	12.90	NO	9.27	40.89
Lusk Booster Station	20.30	4.20	18.40	YES	134.31	588.28
Waste Isolation Pilot Plant	20.44	93.32	11.18	YES	93.32	11.18
North Compressor Station, GCP1-1141	20.49	14.82	88.31	YES	20.46	113.01
BOPCO LP - Las Animas Dehy, GCP1-3888	20.83	0.05	0.21	NO	1.69	7.41
North Carlsbad Compressor Station	20.89	8.07	35.43	NO	8.07	35.43
West Turkey Track Compressor Station	21.06	12.89	56.38	NO	12.89	56.38

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Old Indian Draw Tanks UT 1 Tank Battery	21.18	0.50	2.20	NO	4.20	18.50
Zia Gas Plant	21.31	0.62	2.69	YES	130.73	572.57
Lusk Booster Station	21.40	126.80	555.40	YES	134.93	590.97
Zia Gas Plant	21.52	3.31	14.48	YES	134.93	590.97
Devon Energy Production - Indian Draw 13 Fed No3	21.78	3.70	16.30	NO	9.77	43.09
Delta Fee Compressor Station	21.96	2.67	11.69	NO	16.70	73.51
Nash Draw Compressor Station	22.14	16.80	73.20	NO	16.80	73.20
DCP Midstream - B3 Compressor Station	22.34	6.60	28.70	NO	16.50	71.90
Compressor Systems Inc - Caterpillar G399 TALE No1266	22.34	6.60	28.70	NO	16.50	71.90
Otis 2 Compressor Station	22.66	5.03	22.02	NO	10.10	44.31
DCP Midstream Angel Ranch Booster GCP1-1592	22.77	8.08	35.40	NO	22.23	97.40
Urquidez No2 Compressor Station	22.80	5.64	24.70	NO	35.87	178.77
Exterran Energy - Caterpillar 3306 TA No1501	22.82	8.65	37.90	NO	22.23	97.40
Superior Pipeline - Compressor Station No1036	22.85	5.50	24.10	NO	22.23	97.40
Rambo Booster Station GCP1-2923	23.27	17.18	75.22	NO	17.18	75.22
Bta Compressor Station	23.53	13.68	22.69	NO	33.86	137.45
Telltale 11 Fed Com NO1 Battery	23.57	2.40	10.60	NO	10.10	44.31
Oryx Pardue Compressor Station	23.58	5.07	22.20	NO	39.50	162.15
South Hat Mesa Booster Station	23.74	41.80	181.20	NO	46.89	203.49
Turkey Track Compressor Station, G3306TA	23.86	8.61	37.70	NO	8.61	37.70
TransColorado - Blanco Compressor Station	23.91	7.40	32.00	YES	57.18	249.78
Frontier Field Services - Lusk Compressor Station	23.91	15.00	65.60	YES	57.18	249.78
Cougar Federal No1 Compressor Station	24.02	5.37	23.50	NO	8.77	38.30
East Carlsbad Gas Plant	24.26	10.34	43.56	NO	39.50	162.15
Oxy - Cougar Federal No1	24.26	3.40	14.80	NO	8.77	38.30
Chesapeake Operating - Lost Tank 16 State 1	24.45	4.40	19.10	NO	4.40	19.10
Parkway Booster Station	24.59	25.70	112.40	NO	48.10	210.00
Livingston Ridge Compressor Station	24.67	5.66	24.81	NO	5.66	24.81
West Shugart 19 Federal No 5	24.77	0.14	0.63	NO	0.14	0.63
Carrasco Compressor Station GCP1-2306	24.83	4.77	49.00	NO	33.86	137.45
Harroun Compressor Station GCP4-3350	24.94	4.40	19.04	NO	4.40	19.04
Cedar Lake Compressor Station	25.20	3.96	17.37	NO	3.96	17.37
Triple C Booster	25.56	9.08	39.78	NO	31.48	137.38
Burton Flat Facility	25.57	3.30	14.40	NO	7.38	32.26
North Bilbrey Federal 7 No1 Compressor Station	25.83	5.09	22.29	NO	46.89	203.49
Devon Energy - Sito 27 Fee NO 1	26.38	3.30	14.50	NO	12.74	55.70
Burton Flat 7 Federal No1 Compressor Station	26.52	4.08	17.86	NO	7.38	32.26
Devon Energy - Lovelace 27 Fee No2	26.69	5.10	22.20	NO	12.74	55.70
Avalon Federal No2 Facility	26.75	0.48	2.10	NO	4.48	19.40
La Huerta 30 Fee Com No1Y	26.76	4.00	17.30	NO	4.48	19.40
Apache 24 No3 Battery Production Facility	26.89	0.10	0.40	NO	0.10	0.40
Sauza Compressor Station GCP4-2968	27.05	2.79	12.22	NO	2.79	12.22
Mewbourne Oil - Waukesha F1197G No2162	27.15	4.92	21.54	NO	6.43	28.14
West Shugart 19 Federal No1	27.34	0.03	0.11	NO	0.03	0.11
GPM Mandano No1329 Compressor Station	27.56	4.79	21.00	NO	4.79	21.00
Carlsbad Power Station	27.61	17.42	76.30	NO	22.94	100.45
South Carlsbad Compressor Station	27.95	56.00	245.40	YES	56.00	245.40
Devon Energy Production - Compressor Station No1891	28.07	4.34	19.00	NO	12.74	55.70
Avalon 360 Compressor Station	28.08	1.51	6.60	NO	6.43	28.14

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Douglas Com No1	28.22	5.52	24.15	NO	44.63	195.45
Paige Booster Station GCP4-2424	28.22	7.70	33.70	NO	7.70	33.70
HB State No1and HB State No2 Production Facility	28.76	2.86	12.51	NO	2.86	12.51
OXY USA - Lion Federal No1	28.86	3.40	14.80	NO	3.40	14.80
Pure Gold 28 Compressor Station	28.88	8.85	38.62	NO	8.85	38.62
Mewbourne Oil - Layla 35 Fee Compressor No1	29.25	7.91	17.36	NO	7.91	17.36
Shugart Booster Station	29.26	19.70	86.40	NO	36.83	161.09
Turkey Track Compressor Station	29.31	17.13	74.69	NO	36.83	161.09
OXY USA - Hopsing Federal No2	29.35	3.40	14.80	NO	8.70	38.00
Baish Federal Production Facility	29.77	2.21	9.68	NO	2.21	9.68
EOG Resources Inc - Sand Tank Compressor Site	29.78	3.30	14.50	NO	3.30	14.50
Penroc Compressor Station	29.84	5.30	23.20	NO	43.84	191.79
Federal East No1 Compressor Station	30.09	4.59	20.10	NO	9.52	41.70
Maverick 14 Federal Com No1 Compressor Station	30.12	2.30	10.05	NO	2.30	10.05
Todd Federal 26 SWD Reinjection Facility	30.14	5.50	24.10	NO	5.50	24.10
Southeast Read-Mix - Carlsbad Plant GCP5-2096	30.15	43.38	190.00	YES	59.66	225.34
Double X Compressor Station	30.21	7.26	31.79	NO	7.26	31.79
Sunbright No1 Compressor Station	30.30	4.99	21.87	NO	4.99	21.87
Mewbourne Oil - Waukesha F1197G No2339	30.34	4.93	21.60	NO	9.52	41.70
Penroc Compressor Station	30.72	31.74	138.99	NO	40.44	176.99
YatesPetroleum - Avalon Compressor Station GCP1-2385	30.79	7.72	33.85	NO	24.62	68.40
Mesquite Tank Battery	30.79	4.03	17.69	NO	24.62	68.40
Constructors Inc - Southeast Materials GCP3-2792	30.86	21.69	95.00	YES	54.14	201.19
Lakeshore Federal No2 Compressor Station	31.00	12.75	16.36	NO	24.62	68.40
300TPH Asphalt Plant No1346	31.12	10.76	11.19	YES	54.14	201.19
Cedar Canyon Compressor Station	31.18	12.44	54.68	NO	12.44	54.68
Sand Dunes Booster Station	31.23	36.74	159.90	YES	54.00	235.40
Oxy USA - Buffalo Bill No1	31.43	3.40	14.80	NO	40.44	176.99
Arnold Federal Compressor Station	31.45	5.02	22.00	NO	5.02	22.00
Todd 26BC Battery Production Facility	31.50	0.20	0.50	YES	54.00	235.40
Todd 26 Fed No 1 Production Facility	31.53	3.90	17.40	YES	54.00	235.40
Loving Gas Plant	31.84	4.38	19.20	NO	4.38	19.20
Carlsbad 15 Federal No1Compressor Station	32.07	0.11	0.50	NO	25.25	71.17
Ranch Hand 5 Fee Compressor No1	32.18	5.00	21.90	NO	13.74	60.20
Oxy USA Palladium 7 Federal No1 battery	32.31	0.04	0.17	NO	0.04	0.17
Cal/Mon Compressor Station GCP4-1248	32.43	13.16	57.60	NO	57.63	251.29
Joel-Little Jewell Compressor Station, GCP4-3208	32.78	2.14	9.40	NO	13.74	60.20
Crawford Compressor Station	33.06	6.38	28.00	NO	14.13	61.96
Bounds Junction Booster Station	33.14	6.85	30.06	NO	14.13	61.96
South Carlsbad Compressor Station	33.19	6.60	28.90	NO	17.70	77.54
Elbow Canyon 4 Fed No 1 Production Facility	33.36	3.00	13.16	NO	3.00	13.16
Red Tank Compressor Station	33.37	4.38	19.20	NO	4.38	19.20
Devon Energy Production - Tomcat 16 State Battery Production Facility	33.40	0.20	0.40	NO	0.30	0.80
HB Ore ida Compressor	33.50	4.80	21.20	NO	4.82	21.30
Oxy USA Red Tank 34 Federal No2 Bat	33.61	0.10	0.40	NO	5.10	22.40
Constructors Inc - Caviness Pit GCP2-2873	33.61	13.00	29.93	NO	13.00	29.93
Devon Energy - Tomcat 21 Federal Battery	33.76	0.10	0.40	NO	0.30	0.80
Ocotillo Hills Compressor Station No1	33.78	0.63	2.77	NO	0.75	3.27
Samson Resources - Loving 1 State CS, GCP4-3627	33.80	0.90	3.90	NO	14.13	61.96

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Alisha Booster Station	33.97	5.00	22.00	NO	5.10	22.40
Mobile Unit 1 Compressor Station	34.07	3.63	15.89	NO	16.79	73.49
Chesapeake Operating Co - Lotus Federal 4	34.14	1.90	8.50	NO	1.90	8.50
Kathleen Compressor Station GCP4-1923	34.19	9.80	43.10	NO	14.91	65.49
Craft Dehy	34.20	0.02	0.10	NO	4.82	21.30
Smith Ranch Compressor Station	34.25	5.60	24.60	NO	5.60	24.60
Loco Hills Compressor Station	34.25	8.80	38.80	NO	34.07	149.49
Mewbourne Oil - Caterpillar G3306 NA LCR No2447	34.58	3.96	17.34	NO	10.56	46.24
Winchester Compressor Station	34.70	12.83	55.17	NO	16.13	69.67
Chesapeake - Queen Lake 20 FED 2H Compressor Station	34.75	3.80	16.40	NO	3.80	16.40
Westside 4 State Com No1 Production Facility	34.91	5.10	22.20	NO	6.56	28.57
DCP Midstream - RJ Booster GCP4-3808	34.96	6.00	26.10	NO	6.00	26.10
Mesa Arriba Compressor Station	35.14	3.30	14.50	NO	3.30	14.50
Loco Hills Booster Station GCP4-1406	35.33	25.27	110.69	NO	34.07	149.49
Deep Units Compressor Station	35.43	5.11	22.39	NO	14.91	65.49
Nash Draw Compressor Station, GCP4-3224	35.45	5.00	22.00	NO	5.00	22.00
Parrot Federal No2 Facility	35.53	3.30	14.50	NO	6.60	29.00
Huber Pecos River Deep No6 Facility	36.20	3.30	14.50	NO	19.43	84.17
Fortson Compressor Station, GCP4-3223	36.48	2.70	11.80	NO	2.70	11.80
Jackson Booster Station	36.58	22.56	99.06	NO	27.16	119.16
Maljamar Compressor Station	36.59	17.12	74.89	YES	126.26	358.19
Avalon 31 No1 Compressor Station	36.66	1.78	7.80	NO	1.78	7.80
Wisetail Compressor Station	36.77	5.60	24.40	NO	7.27	31.80
Yates Petroleum - Pierre State No1 Facility	36.99	1.67	7.40	NO	8.86	38.76
Skelly Compressor Station	37.01	34.43	149.10	NO	34.43	149.10
Pecos River Deep Unit No8, GCP4-3023	37.02	1.08	4.72	NO	2.54	11.09
Grayburg Booster Station	37.22	58.70	100.60	NO	61.91	114.66
Tropicana Fed Com No1, GCP4-3022	37.36	1.46	6.37	NO	7.64	33.29
Artesia Gas Plant	37.37	102.70	449.70	YES	102.70	449.70
MCA Tank Battery No2	37.55	12.40	28.50	YES	126.26	358.19
Read and Stevens Compressor Station	37.57	1.41	6.19	NO	28.41	124.09
Rustler Breaks - 26 Fee Compressor No1	37.65	3.96	17.34	NO	6.36	27.84
Trunk A Compressor Station	37.68	8.58	37.69	NO	13.88	60.89
Transwestern Booster Station, GCP1-2598	37.79	3.21	14.06	NO	61.91	114.66
Frontier Field Services - Maljamar Gas Plant	37.80	96.74	254.80	YES	126.26	358.19
Chevron USA - Levers No4 C.S and Tank Battery GCP4-3664	38.17	1.06	4.63	NO	2.40	10.53
Yates - Eastern Shores QW No1 Facility	38.42	4.17	18.30	NO	4.17	18.30
DCP Midstream - Mescalero Booster Station, GCP4-3648	38.45	6.10	26.70	NO	6.10	26.70
Muskegon 17 Well 1 Compressor Station	38.60	4.60	20.10	NO	48.86	214.36
State Line Booster Station	38.66	5.30	23.20	NO	28.41	124.09
Lynch Booster Station	38.66	21.70	94.70	NO	28.41	124.09
Chalk Compressor Station	38.75	1.59	6.96	NO	5.13	22.56
Illinois Camp Booster Station	38.80	21.20	92.80	YES	108.10	220.20
Aid State Compressor Station	38.93	21.70	95.20	NO	26.30	115.30
Filaree 18 Fed No 1 Production facility	39.08	2.75	12.04	NO	10.32	45.35
Chesapeake Operating Inc - Mosaic 34 Federal 2H	39.28	2.40	10.50	NO	6.36	27.84
ConocoPhillips - MCA Battery No4 GCP4-3138	39.30	0.51	2.00	NO	9.01	39.30
Devon Energy - Federal N1 Battery	39.40	2.16	9.50	NO	2.16	9.50

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Grayburg Booster Station	39.42	14.90	65.70	NO	35.79	157.58
Caviness Ranch Compressor Station	39.47	3.52	15.44	NO	3.52	15.44
Catclaw Draw Compressor Station GCP1-3418	39.48	5.60	24.40	NO	12.43	54.30
Exxon S Carlsbad Compressor Station	39.72	7.19	31.50	NO	11.15	48.84
Texmack 11 Federal Central Facility	39.75	4.92	21.55	NO	4.92	21.55
Catclaw No1 Compressor Station	39.78	5.48	24.00	NO	11.08	48.40
Pinnacle Natural Gas - Catclaw Compressor Station	39.84	1.35	5.90	NO	8.00	34.93
Devon Energy Production - Filaree 24 Fed No1	40.03	7.57	33.31	NO	10.32	45.35
Compressor Systems Inc - Caterpillar G333 NA No1344	40.03	5.30	23.20	NO	13.88	60.89
Kemnitz Compressor Station	40.10	8.50	37.30	NO	20.81	91.10
Square Lake Booster Station GCP4-0855	40.18	20.89	91.88	NO	35.79	157.58
Transwestern Pipeline - Atoka No1 Compressor Station	40.30	86.90	127.40	YES	108.72	222.90
Black River 35 State Compressor Station	40.37	3.96	17.34	NO	11.15	48.84
Atoka No2 Compressor Station	40.50	21.40	95.40	NO	21.40	95.40
Federal South No1 Compressor Station	40.52	1.87	8.20	NO	17.06	74.36
Karlsbad Corral Compressor Station	40.53	1.00	4.20	NO	1.00	4.20
Kemnitz Compressor Station	40.88	11.80	51.80	NO	20.30	89.10
Monument Lateral Compressor Station	41.58	6.56	28.72	NO	6.56	28.72
Empire Abo Gas Plant	41.90	612.10	2680.10	YES	650.51	2846.80
Las Cruces Chile Plant	41.99	7.90	35.10	YES	650.51	2846.80
Logan Draw	42.13	0.62	2.70	YES	131.95	324.26
Natural Gas Pipeline Co of America - Compressor Station No166	42.29	6.96	30.50	NO	45.05	196.86
Spurck 16 State Com No2, GCP4-3024	42.58	1.03	4.52	NO	1.03	4.52
PLU Pierce Canyon 17 Central Production Facility	42.61	2.60	11.60	NO	2.60	11.60
Pecos Diamond Gas Plant	42.69	30.51	131.60	YES	650.51	2846.80
Pecos Booster Station	42.97	13.60	59.20	NO	17.45	76.08
Logan Draw Booster GCP1-2308	43.05	10.57	46.06	NO	45.05	196.86
Cotton Draw Unit No76 Facility	43.32	2.50	10.95	NO	7.98	34.95
DCP Midstream - Black River Compressor Station GCP1-1953	43.52	11.82	51.76	NO	11.82	51.76
Cotton Draw Well No64 Compressor	43.57	5.48	24.00	NO	7.98	34.95
Mewbourne Oil - Caterpillar G3306 NA No1565	43.57	5.25	23.00	NO	5.25	23.00
Bootleg Compressor Station	43.67	5.39	23.60	NO	2.69	11.80
Mckittrick 30 Compressor Station	44.04	3.11	13.60	NO	3.11	13.60
Southern Union Compressor Station	44.36	26.90	117.60	NO	45.05	196.86
Enterprise Products - Pecos Compressor Station GCP4-3373	44.63	10.52	45.80	NO	10.52	45.80
Gaicho Unit No3	44.79	1.75	7.66	NO	10.80	32.82
Gaicho Unit No4	44.80	6.61	14.50	NO	10.80	32.82
Peterson Com No1 Compressor Station	44.81	1.98	8.68	NO	15.58	67.88
Gaicho Unit No2Y	44.93	2.44	10.66	NO	11.58	36.13
Pen Fed 9-1 Compressor Station, GCP4-3311	45.02	0.80	3.50	NO	3.93	17.10
Grama Ridge Federal No2 Compressor Station	45.03	3.91	17.12	NO	53.89	236.41
Revelation Compressor Station	45.05	5.48	24.00	NO	5.48	24.00
2008 January Pioneer VSI Crusher GCP2-1775	45.06	43.38	95.00	NO	43.38	95.00
Wadi Petroleum - Pen Fed 9-3 Compressor Station	45.15	3.13	13.60	NO	3.93	17.10
Hackberry No1 Compressor Station	45.27	5.25	23.00	NO	5.25	23.00
Grama Ridge Compressor Station	45.50	2.81	12.30	NO	53.89	236.41
Grama No1 and Booster Comp Station GCP4-3757	45.55	29.19	127.60	NO	48.99	214.31

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Devon Energy - Bell Lake No21	45.60	0.60	2.50	NO	3.22	13.97
Grama Booster Station	45.61	7.46	32.69	NO	48.99	214.31
Enstor Operating - Grama Ridge No1 Compressor Station	45.66	4.90	22.10	NO	32.05	140.99
North Indian Hills Gas Facility	45.69	3.13	15.25	NO	3.13	15.25
Enstor Operating Co - Grama Ridge No4 Compressor Station	45.69	2.71	11.85	NO	19.72	86.97
Grama Ridge 1a Compressor Station	45.87	5.62	24.60	NO	66.00	289.43
Enstor Operating Co - Grama Ridge No2 Compressor Station	45.87	12.11	53.02	NO	25.33	111.57
Bell Lake Unit 21	46.06	0.18	0.81	NO	3.22	13.97
Devon Energy - Atoka San Andreas Unit Battery	46.21	0.05	0.20	NO	41.57	182.40
Wadi Petroleum - Fed Com 22-1 Compressor Station	46.26	3.13	13.70	NO	3.13	13.70
Cotton Draw Compressor Station	46.32	39.99	89.90	NO	39.99	89.90
Atoka Dehydration Facility	46.91	0.23	1.00	NO	41.57	182.40
Atoka No3 Compressor Station	47.03	41.30	181.20	NO	41.57	182.40
OXY USA WTP LP - Ijam State No1	47.58	3.40	14.80	NO	3.40	14.80
Outland State No5 Production Facility	47.63	1.70	7.40	NO	24.10	86.34
St Mary Connie 19-1 Oil and Gas Production Facility	47.64	1.70	0.37	NO	1.70	0.37
Prairie Fire State No 1	47.65	2.90	13.00	NO	15.13	47.21
Wadi Petroleum - Exxon 17-2 Compressor Station	47.77	1.00	4.40	NO	1.00	4.40
Outland St Unit No3	47.83	2.52	11.02	NO	19.18	64.49
ConocoPhillips - Corner Pocket 14 State Com	47.86	6.31	27.50	NO	19.18	64.49
Kaiser-Francis - Bell Lake Compressor Station	47.99	2.25	9.84	NO	26.38	73.13
Outland State Unit No4 Production Facility	48.21	1.72	7.50	NO	24.10	86.34
Outland State Unit No2	48.41	6.79	10.46	NO	24.10	86.34
Outland State Unit No1-Y	48.43	0.14	0.61	NO	21.20	73.34
Devon Energy Production - State R No2 Production Facility	48.44	2.02	8.85	NO	15.27	47.82
Devon Energy - Rio Blanco 4 Federal No3	48.51	2.60	11.40	NO	15.94	69.85
Shadow Booster Station GCP4-1421	48.61	14.07	61.50	NO	14.07	61.50
Rio Blanco 9 St No 1 Production Facility	48.81	2.21	9.70	NO	15.94	69.85
Bell Lake Compressor Station GCP4-2208	48.86	4.77	20.89	NO	26.38	73.13
PLU Ross Ranch 6 Central Production Facility	48.92	3.57	15.64	NO	3.72	16.24
PitchFork Ranch Compressor Station No 0908	49.06	19.36	42.40	NO	26.38	73.13
Pecos River Compressor Station	49.39	159.30	699.00	YES	159.30	699.00
Maxus A1 Compressor	49.70	4.17	18.25	NO	19.59	85.85
BTA Oil - Antelope Ridge Compressor Station	49.88	3.65	16.00	NO	14.78	64.75
State 35 Compressor Station	49.89	9.68	42.40	NO	106.72	459.90
Yates Federal 8 No2 Gas Plant	50.30	0.15	0.60	NO	3.72	16.24
Compressor Station No167	50.32	270.80	1185.30	YES	270.80	1185.30
7 Rivers Compressor Station	50.44	3.09	13.52	NO	3.09	13.52
Triste Low Pressure Compressor	50.61	0.10	0.44	NO	0.10	0.44
BTA Oil - Antelope Ridge Low CS	50.74	6.96	30.50	NO	19.59	85.85
Dobbs Booster Station GCP1-2949	51.00	49.20	49.70	NO	49.20	49.70
Parker and Parley (P and P) Malaga Compressor Station	51.01	6.32	27.70	NO	6.32	27.70
Chevron USA - Buckeye CO2 Plant	51.13	6.84	22.30	NO	106.72	459.90
Potash Compressor Station	51.13	8.98	39.34	NO	8.98	39.34
Rock Tank 4 Compressor Station	51.18	3.33	14.60	NO	3.33	14.60

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Lightning 24 Federal Com Compressor Station GCP4-3320	51.19	1.70	7.40	NO	1.70	7.40
Buckeye Compressor Station	51.25	90.20	395.20	NO	106.72	459.90
Yates Petroleum - Opuntia Draw Facility GCP4-3172	51.31	3.00	13.20	NO	3.00	13.20
Lovington Booster Station	51.36	81.10	28.30	NO	89.60	65.73
Frontier Field Services - Anderson Ranch Compressor Station	51.38	3.24	14.19	NO	3.24	14.19
Dazed Compressor Station	51.49	2.40	10.50	NO	10.09	44.51
Antelope Ridge Gas Plant	51.55	48.19	210.69	NO	49.29	215.59
Mad Dog 15 No1 Production Facility	51.71	1.10	4.90	NO	49.29	215.59
Mystery	52.02	0.09	0.41	NO	10.09	44.51
Penasco Compressor Station	52.10	21.68	94.99	NO	24.25	106.19
Southwest Asphalt Paving - GCP3-3621	52.18	43.50	95.00	NO	43.50	95.00
Lady Luck No1 Facility	52.24	2.90	12.73	NO	89.60	65.73
Triste Low Pressure Compressor	52.25	2.65	11.61	NO	4.85	21.01
Triste Compressor Station	52.25	2.20	9.40	NO	4.85	21.01
Agave Dagger Draw Gas Plant	52.38	2.57	11.20	NO	24.25	106.19
Dilly Bar Compressor Station	52.44	6.28	27.50	NO	11.58	50.70
Barrel Facility	52.47	1.17	5.00	NO	1.17	5.00
Fasken Oil & Ranch Ltd - State 32 No 1 Compressor Station	52.50	7.60	33.60	NO	10.09	44.51
Yates - Bellagio Facility	52.72	4.20	18.30	NO	4.20	18.30
Bold Energy LP - Antelope Ridge Compression	52.85	2.62	11.60	NO	4.52	19.94
Blackbird 8 No1 Production Facility	53.02	2.90	12.72	NO	2.90	12.72
Yates - Anemone Compressor Station GCP1-1705	53.12	5.58	24.39	NO	26.38	115.19
Citation Oil and Gas - Antelope Ridge Unit	53.18	1.90	8.34	NO	4.52	19.94
Lucky Lobo ASX #2 Facility	53.39	5.60	24.70	NO	89.60	65.73
Chesapeake Operating - KF4 State Com 2	53.57	5.30	23.20	NO	11.58	50.70
Jay Booster Station	53.58	12.66	27.40	NO	71.45	232.84
Yates Petroleum - Chosa ATR Federal No1	53.67	11.26	49.40	NO	11.26	49.40
Ross Draw 25 No1 Gas Plant	54.16	0.18	0.79	NO	0.18	0.79
Baldrige Canyon 6 State No1 Compressor Station	54.17	4.07	17.84	NO	4.07	17.84
Shell Federal No1 Compressor Station	54.18	3.30	14.40	NO	8.55	37.40
Carbon Valley 14 Fed Com No2	54.53	3.30	14.50	NO	13.76	60.30
Paducah Compressor Station	54.65	7.53	33.00	NO	7.53	33.00
Nagooltee Peak Facility CS, GCP1-2769	54.95	11.20	48.80	NO	73.39	318.28
Old Ranch Knoll, GCP1-2768	54.97	9.60	42.00	NO	64.40	279.16
Oxy USA - 129 Generator Station	55.15	7.40	24.50	NO	61.94	263.55
Indian Basin 32 St 1 Y	55.49	4.05	17.70	NO	75.70	320.39
Encore Operating - Encore 12 State Com No1	55.55	2.80	12.00	NO	2.80	12.00
OXY USA - Indian Basin Central Tank Battery	55.57	2.80	12.20	NO	58.82	254.77
Kemnitz Booster Station	55.66	7.48	32.78	NO	7.48	32.78
East Indian Basin CF Compressor Station	55.68	28.70	125.75	NO	57.79	245.25
Rat Camp Compressor Station	55.72	10.46	45.80	NO	13.76	60.30
East Vacuum Liquid Recovery	55.76	58.80	205.44	NO	71.45	232.84
Hickory Compressor Station	55.88	6.53	28.60	NO	47.62	205.97
Geronimo 28 State Com No1 GCP1-2878	55.90	0.28	1.22	NO	0.28	1.22
Pitchfork Ranch Compressor Station No 2194	55.91	3.53	15.46	NO	3.53	15.46
Feagan South Booster Station	55.93	19.99	87.56	NO	86.70	184.76
Martha Creek Battery and Compressor Site GCP1-2709	55.94	21.69	95.00	NO	78.74	336.75
Baldrige 1 State No1 Compressor Station	56.06	3.77	16.50	NO	17.17	75.21

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
Navajo Refining - Artesia Refinery	56.14	60.88	265.64	NO	221.48	968.54
Federal 6 No1 Compressor Station	56.19	5.25	23.00	NO	24.76	108.34
C2 Compressor Station	56.21	5.59	24.50	NO	5.59	24.50
Old Ranch Canyon Compressor Station	56.26	14.46	60.59	NO	79.67	345.67
Indian Hills No7 Compressor Station	56.34	4.77	20.90	NO	26.00	113.87
Winston Lease Battery and CS, GCP1-2485	56.62	0.10	0.60	NO	110.32	475.20
Vaca Compressor Station	56.65	4.72	4.69	NO	4.72	4.69
Baldrige Canyon 12 State No1 Compressor Station	56.71	5.02	22.00	NO	17.17	75.21
Indian Hills No5 Compressor Station	56.72	4.77	20.90	NO	26.00	113.87
Indian Hill No3 Compressor Station	56.76	2.79	12.22	NO	20.75	90.87
Devon Energy - Keller 4 State No1	56.78	2.10	9.20	NO	2.10	9.20
Navajo Refining - Artesia Refinery	56.81	104.60	457.60	NO	222.32	972.24
Old Ranch Canyon 7 No6 Compressor Station	56.83	8.80	38.80	NO	75.62	327.97
Dagger Draw Compressor Station	56.85	66.71	97.20	NO	86.70	184.76
Lisa EIB No1 Compressor Station	56.94	16.80	73.20	NO	126.18	550.09
KCS Medallion Resources - State of New Mexico 35 No1	57.04	5.66	24.79	NO	13.16	57.69
Marathon Oil Company - DPC360 Compressor Station No1189	57.24	2.78	12.19	NO	29.88	130.82
Smith Federal No1 Compressor Station	57.42	5.43	23.78	NO	47.62	205.97
Encore 36 State No1, GCP1-3826	57.62	7.50	32.90	NO	13.16	57.69
Navajo Refining - Artesia Refinery	57.66	56.00	245.30	NO	226.19	989.24
Dagger Draw Compressor Station	57.72	3.10	13.60	NO	22.41	77.00
Yates Petroleum - Big Hat No3 Facility	57.78	1.68	7.35	NO	1.68	7.35
Federal No3 Compressor Station	58.09	3.88	16.95	NO	37.66	164.96
Holly Asphalt Company	58.28	3.87	17.00	NO	60.71	266.00
Chaves Compressor Station	58.35	16.80	73.62	NO	16.80	73.62
Notserp Compressor Station	58.42	5.63	24.66	NO	24.63	107.82
Yates Petroleum - Portable Caterpillar G3304NA	58.42	3.31	14.50	NO	103.87	454.69
Yates Petroleum - Portable Unit	58.42	3.31	14.50	NO	103.87	454.69
Yates Petroleum - Portable Cummins G83	58.42	3.31	14.50	NO	103.87	454.69
Low State No1 Compressor Station	58.42	31.05	136.40	NO	103.87	454.69
Low State No1 Portable	58.43	4.18	18.29	NO	103.87	454.69
Baldrige Canyon 11 No2 Compressor Station	58.45	8.38	36.71	NO	19.98	87.50
7 Rivers Draw Compressor Station	58.49	14.96	44.40	NO	22.41	77.00
Pinnacle Natural Gas - Shoebar Compressor Station	58.55	1.53	6.69	NO	1.53	6.69
The Ranch Compressor Station	58.58	1.56	6.84	NO	1.56	6.84
Production Operators - Waukesha L3521 GL No1566	58.62	2.37	10.39	NO	15.32	78.57
Land O' Lakes Purina Feed - Artesia Feed Mill	58.72	0.84	3.70	NO	165.31	723.60
North Indian Basin No11 Compressor Station	58.80	20.12	88.16	NO	24.00	105.11
HOC Federal Compressor Station	58.82	1.32	5.78	NO	93.41	408.86
Low State No2 Compressor Station	58.89	2.61	11.43	NO	93.41	408.86
DD Federal Compressor Station	58.93	4.35	19.00	NO	22.41	77.00
Indian Basin Gas Plant	58.96	3.00	12.90	NO	144.37	632.70
Indian Basin Gas Plant	59.13	101.42	444.90	NO	146.85	643.59
Oxy - Indian Basin Remediation Project	59.39	0.84	3.68	NO	146.85	643.59
Roaring Springs Compressor Station	59.51	8.40	36.70	NO	139.11	609.62
Enstor Operating - Grama Ridge No1 Compressor Station	59.55	6.40	39.50	NO	15.32	78.57
Gamma Ridge No1 Booster	59.57	6.55	28.68	NO	15.32	78.57
Yates Petroleum - Red Bone BP Facility	59.64	2.81	12.29	NO	11.19	49.00

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx		Model	Emissions within 2.5 km	
		lb/hr	TPY		NO2_PPH	NO2_TPY
South Indian Basin Compressor Station	59.82	15.42	67.56	NO	175.49	769.50
Federal No1 Compressor Station	59.84	1.18	5.19	NO	79.09	346.36
West Blevins Compressor Station GCP-3814	59.97	16.80	73.20	NO	22.25	96.70
Conoco State Compressor Station	59.98	13.68	59.54	NO	79.09	346.36
Larue Compressor Station GCP1-0849	60.22	39.30	172.14	NO	39.30	172.14
Station 235 Production Facility	60.24	7.60	33.20	NO	88.83	388.61
Marathon Oil Company - AG Station	60.35	7.16	31.38	NO	157.63	690.92
Xcel Energy - Cunningham Station	60.59	1078.60	4013.30	NO	1078.60	4013.30
Eunice A Compressor Station	60.74	823.90	3607.00	NO	1067.39	4664.89
Monument Compressor Station	60.76	111.20	486.20	NO	409.86	1812.10
Monument Gas Plant	60.87	298.66	1325.90	NO	409.86	1812.10
Bogle Flats No1 Compressor Station	60.87	4.96	21.73	NO	49.48	215.65
Federal Iba Com K No1 Compressor Station	61.11	8.12	35.58	NO	147.39	646.06
Marathon Oil Company - Ajax 280 Compressor Station No1205	61.17	2.49	10.89	NO	174.35	818.30
Oxy USA - North Indian Basin No1 210 Facility	61.24	5.19	22.70	NO	27.76	121.47
Carlsbad Compressor Station	61.26	2.49	10.89	NO	37.74	165.30
Four Dinkus Compressor Station GCP4-3091	61.29	5.45	23.50	NO	22.25	96.70
Page Compressor Station	61.43	1.80	7.88	NO	1.80	7.88
Bogle Flats No10 Compressor Station	61.55	2.58	11.30	NO	45.55	198.44
Bogle Flats No16 Compressor Station	61.65	11.23	49.18	NO	64.69	217.16
Federal Helbing No15-4 Compressor Station	61.66	4.05	17.74	NO	64.69	217.16
Eunice B&C Compressor Station	61.74	38.90	170.50	NO	1067.39	4664.89
DCP Midstream - Eunice Gas Plant	61.83	204.59	887.39	NO	1067.39	4664.89
Hobbs Gas Plant	62.29	8.12	35.21	NO	725.36	2336.51
BV No2 Compressor Station	62.44	4.34	19.00	NO	4.34	19.00
Apache Corp - Fed 28-1 CS GCP1-3999	62.46	15.10	92.00	NO	36.50	213.50
Federal 33 No1 Compressor Station GCP4-1743	62.53	2.41	10.57	NO	96.45	443.11
Bogle Flats No15 Compressor Station	62.55	3.57	15.64	NO	79.25	313.87
Bogle Flats No17 Compressor Station	62.55	3.57	15.64	NO	79.25	313.87
Bogle Flats No2 Compressor Station GCP4-1741	62.56	0.80	3.30	NO	71.65	280.67
Federal 33 No2 Compressor Station	62.57	0.18	0.40	NO	96.45	443.11
Red Hills Compressor Station, GCP1-3574	62.58	4.90	21.40	NO	4.90	21.40
Bright Federal No4	62.62	1.92	8.39	NO	54.80	294.03
Oil Center Compressor Station, GCP4-3673	62.69	15.30	67.30	NO	15.30	67.30
W Indian No2 Compressor Station	62.75	3.56	15.60	NO	62.48	327.62
Bright Federal No2 Compressor Station	62.75	2.81	12.45	NO	57.29	304.92
Fed 28-1 Compressor Station	62.76	7.11	59.17	NO	36.50	213.50
Bogle Flats No17 Compressor Station	62.84	5.01	21.93	NO	128.73	464.93
Apex Booster Station	62.86	11.10	48.63	NO	725.36	2336.51
Bogle Flats No18 Compressor Station	63.03	21.80	95.50	NO	64.69	217.16
Shoebar Compressor Station	63.29	8.66	38.00	NO	8.66	38.00
Bogle Flats No5 Compressor Station	63.62	4.34	19.02	NO	64.69	217.16
Apex Booster Station	63.68	6.34	27.77	NO	766.36	2412.71
Kerr-McGee - Ajax DPC 360 No1466	63.70	0.92	4.03	NO	37.03	216.18
Bogle Flats No13 Compressor Station	63.87	18.26	13.79	NO	76.69	294.56
A 14 Compressor Station, GCP4-3489	63.90	9.40	41.10	NO	9.40	41.10
Zingaro Compressor Station	63.92	8.62	13.00	NO	8.62	13.00
Bogle Flats No11 Compressor Station	64.21	36.56	102.76	NO	64.11	247.64
West Indian Basin Unit No1-Y Compressor Station GCP1- 2432	64.22	5.61	24.54	NO	14.82	65.01

NOx Offsite Inventory Determination

ROI = 2.2 km

MASTER_AI_NAME	Distance	Facility NOx			Emissions within 2.5 km	
		lb/hr	TPY	Model	NO2_PPH	NO2_TPY
Apache Corp - Bogle Flats 11 CS GCP1-4000	64.24	12.00	77.40	NO	82.37	261.43
C4 Compressor Station	64.26	4.28	18.78	NO	8.68	37.88
Chesapeake Operating - Langley Greer No4	64.39	4.40	19.10	NO	8.68	37.88
Hobbs Generating Station	64.46	41.00	76.20	NO	747.14	2328.87
Maddox Station	64.51	699.80	2224.90	NO	766.36	2412.71
Oil Center Booster Station	64.55	125.35	549.20	NO	125.35	549.20

Appendix B – CD Key

The directory structure for the attached CD is as follows

HB Mill\AERMAP – Contains input/output and database files for the preliminary analysis grid at the HB Mill

HB Mill\AERMAP\North Plant – Contains the input/output and database files for the North Compaction Plant receptor grid

HB Mill\BPIP\HB Mill – Contains the input/output files for the bpip runs on the HB Mill structures/sources

HB Mill\BPIP\North Plant – Contains the input/output files for the bpip runs on the North Compaction Plant structures/sources

HB Mill\CIA\NO2, \PM10, \PM25, \TSP – Contains the input/output files for the NAAQS cumulative impacts AERMOD runs at the HB Mill

HB Mill\CIA\North Plant\TSP – Contains the input/output files for the NAAQS cumulative impacts analysis at the North Compaction Plant

HB Mill\INCREMENT\NO2, \PM10 – Contains the input/output files for the increment cumulative analysis at the HB Mill

HB Mill\Offsite Inventory – Contains the mergemaster excel spreadsheet outputs

HB Mill\SIA\NO2, \PM10, \PM25, \TSP – Contains the input/output files for the preliminary analysis runs at the HB Mill

HB Mill\SIA\North Plant\PM10, \PM25, \TSP – Contains the input/output files for the preliminary analysis runs at the North Compaction Plant

Included receptor files are contained in the model run folder with the “.rou” extension.

Included offsite source files are contained in the model run folder with the “.inc” extension



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DAVE MARTIN
CABINET SECRETARY

RAJ SOLOMON, PE
DEPUTY SECRETARY

NEW SOURCE REVIEW PERMIT

Issued under 20.2.72 NMAC

Certified Mail No: 7008 0500 0001 1252 0423

Return Receipt Requested

NSR Permit No:	4332
Facility Name:	HB Plant (HB In-Situ Project)
Permittee Name:	Intrepid Potash, Inc.
Mailing Address:	PO Box 101 Carlsbad, NM 88220
TEMPO/IDEA ID No:	29939-PRN201000001
AIRS No:	35 0150563
Permitting Action:	New NSR Permit
Air Quality Bureau Contact	Cember Hardison
Main AQB Phone No.	(505) 476-4300


 Richard L. Goodyear, PE
 Acting Bureau Chief
 Air Quality Bureau

JUL 29 2011

 Date

TABLE OF CONTENTS

Part A FACILITY SPECIFIC REQUIREMENTS 3

 A100 Introduction - Not Required..... 3

 A101 Permit Duration (expiration)..... 3

 A102 Facility: Description..... 3

 A103 Facility: Applicable Regulations..... 4

 A104 Facility: Regulated Sources 4

 A105 Facility: Control Equipment 5

 A106 Facility: Allowable Emissions 6

 A107 Facility: Allowable Startup, Shutdown, & Maintenance (SSM) 7

 A108 Facility: Allowable Operations 7

 A109 Facility: Reporting Schedules 7

 A110 Facility: Fuel and Sulfur Requirements 7

 A111 Facility: 20.2.61 NMAC Opacity..... 8

 A112 Facility: Production Limits 8

 A113 Facility: Source Defined 8

EQUIPMENT SPECIFIC REQUIREMENTS 9

 A200 Oil and Gas Industry – Not Required 9

 A300 Construction Industry – Not Required..... 9

 A400 Power Generation Industry – Not Required..... 9

 A500 Solid Waste Disposal Industry – Not Required 9

Mining Industry 9

 A600 Mining Operations 9

 A601 Dryer and Amine Heaters 9

 A602 Material Transfer and Loadout – Stack Emissions 11

 A603 Fugitives - Material Handling and Haul Roads 13

 A604 Cooling Tower 14

Part B GENERAL CONDITIONS 16

 B100 Introduction..... 16

 B101 Legal 16

 B102 Authority 17

 B103 Annual Fee 17

 B104 Appeal Procedures 18

 B105 Submittal of Reports and Certifications..... 18

 B106 NSPS and/or MACT Startup, Shutdown, and Malfunction Operations 18

 B107 Startup, Shutdown, and Maintenance Operations..... 19

 B108 General Monitoring Requirements 19

 B109 General Recordkeeping Requirements 20

 B110 General Reporting Requirements..... 21

 B111 General Testing Requirements..... 22

 B112 Compliance 25

 B113 Permit Cancellation and Revocation..... 26

 B114 Notification to Subsequent Owners 26

 B115 Asbestos Demolition..... 26

B116 Short Term Engine Replacement 27
 Part C MISCELLANEOUS 30
 C100 Supporting On-Line Documents 30
 C101 Definitions 30
 C102 Acronyms 32

PART A FACILITY SPECIFIC REQUIREMENTS

A100 Introduction - Not Required

A101 Permit Duration (expiration)

- A. The term of this permit is permanent unless withdrawn or cancelled by the Department or cancelled by the permittee in writing.

A102 Facility: Description

- A. The function of the facility is to produce potash product, using a brine extraction and evaporation method, for transport to Intrepid’s North Plant for further processing.
- B. This facility is located at UTM Zone 13, UTM Easting 599.5 km, UTM Northing 3595.2 km, in Township 21S, Range 29E, Section 12, approximately 20.3 miles east, northeast of Carlsbad, New Mexico in Eddy County.
- C. [Table 102.A](#) and [Table 102.B](#) show the total potential emissions from this facility for information only, not an enforceable condition, excluding exempt sources or activities.

Table 102.A: Total Potential Criteria Pollutant Emissions from Entire Facility that exceed 1.0 ton per year

Pollutant	Emissions (tons per year) HB Plant Only	Emissions (tons per year) HB, North, & West Plants
Nitrogen Oxides (NOx)	15.1	143.1
Carbon Monoxide (CO)	12.7	156.9
Volatile Organic Compounds (VOC)	0.8	3.3
Total Suspended Particulates (TSP)	91.2	279.6
Particulate Matter less than 10 microns (PM ₁₀)	31.1	219.5
Particulate Matter less than 2.5 microns (PM _{2.5})	14.0	14.0

Table 102.B: Total Potential HAPS that exceed 1.0 ton per year

Pollutant	Emissions (tons per year) HB Plant Only	Emissions (tons per year) HB, North, & West Plants
Individual and Total HAPs less than 1 tpy		

A103 Facility: Applicable Regulations

- A. The permittee shall comply with all applicable sections of the requirements listed in [Table 103](#).

Table 103: Applicable Requirements

Applicable Requirements	Federally Enforceable	Unit No.
20.2.1 NMAC General Provisions	X	Entire Facility
20.2.3 NMAC Ambient Air Quality Standards	X	Entire Facility
20.2.7 NMAC Excess Emissions	X	Entire Facility
20.2.19 NMAC Potash, Salt or Sodium Sulfate Processing Equipment – Particulate Matter	X	EP-01, EP-04a, EP-04b, and F1-F4.
20.2.61 NMAC Smoke and Visible Emissions	X	EP-03a and EP-03b
20.2.70 NMAC Operating Permits	X	Entire Facility
20.2.71 NMAC Operating Permit Emission Fees	X	Entire Facility
20.2.72 NMAC Construction Permit	X	Entire Facility
20.2.73 NMAC Notice of Intent and Emissions Inventory Requirements	X	Entire Facility
20.2.75 NMAC Construction Permit Fees	X	Entire Facility
40 CFR 50 National Ambient Air Quality Standards	X	Entire Facility
40 CFR 64 Compliance Assurance Monitoring	X	EP-01, EP-04a, and EP-04b

A104 Facility: Regulated Sources

- A. [Table 104](#) lists all of the emission units authorized for this facility. Emission units that were identified as exempt activities and/or equipment (as defined in 20.2.72.202 NMAC) not regulated pursuant to the Act are not included.

Table 104: Regulated Sources List

Unit No.	Source Description	Make Model	Serial No.	Capacity	Manufacture Date
EP-01	Fluidized Bed Dryer	Custom Design	TBD	16 MMBtu/hr / 42.0 tph	TBD
EP-03a	Amine Water Heater	TBD	TBD	6 MMBtu/hr	TBD
EP-03b	Amine Water Heater	TBD	TBD	6 MMBtu/hr	TBD

Unit No.	Source Description	Make Model	Serial No.	Capacity	Manufacture Date
EP-04a	Emissions Stack – Bins 1 & 2, & two Truck Loadouts	TBD	TBD	42.0 tph (21.0 tph per bin & loadout)	TBD
EP-04b	Emissions Stack – Material Transfer units F1 to F4	TBD	TBD	42.0 tph (21.0 tph per conveyor)	TBD
F1	Enclosed Product Weighbelt (CY-003)	TBD	TBD	42.0 tph	TBD
F2	Enclosed Product Bucket Elevator (CY-004)	TBD	TBD	21.0 tph	TBD
F3	Enclosed Product Screw Conveyor No. 1	TBD	TBD	21.0 tph	TBD
F4	Enclosed Product Screw Conveyor No. 2	TBD	TBD	21.0 tph	TBD
EP-05	Cooling Tower	Niagra Blower Co.	A4408	12,180 gal/h	TBD
F5	Paved Haul Road	N/A	N/A	N/A	N/A
F6	Unpaved Haul Road	N/A	N/A	N/A	N/A
HBTK156	38% HCl Storage Tank	TBD	TBD	25,550 gal/y	TBD

- B. The permittee shall report to the Compliance Reporting Section all information listed as TBD (to be determined) in Table 104 within 15 days after the startup of a unit and in accordance with Condition B110.B(2).

A105 Facility: Control Equipment

- A. [Table 105](#) lists the pollution control equipment required for this facility. Each emission point is identified by the same number that was assigned to it in the permit application.

Table 105: Control Equipment List:

Control Equipment Unit No.	Control Description	Pollutant being controlled	Control for Unit Numbers ¹
EP-01	Cyclone and Venturi Scrubber with 99.8% control efficiency	TSP, PM ₁₀ , PM _{2.5}	EP-01
EP-04a	Baghouse with 99.9% control efficiency Passive Fugitive Controls (described below) - 100% capture and control with pick up to BH Bin Controls: Bin vents equipped with socks	TSP, PM ₁₀ , PM _{2.5}	EP-04a

	<p>Truck loadout controls: Partial enclosures located in truck loadout area consist of two sided pull through with roof and curtained entry and exit ways. Reduces wind generated dusting during truck loading. Loading spouts on truck loadout bin discharge chutes to minimize dust. Reduced energy consumption - The passive controls are designed to increase efficiency and reduce energy consumption of the active dust collection BH at the truck loadout. Negative pressure truck bed curtains</p>		
EP-04b / F1-F4	<p>Baghouse with 99.9% control efficiency Passive Fugitive Controls are full enclosures on conveyors and other transfer points with 100% capture and control with pick up to the BH.</p>	TSP, PM ₁₀ , PM _{2.5}	EP-04b / F1-F4
EP-05	Drift Eliminator with 0.002% drift rate (limited to 0.005%)	TSP, PM ₁₀ , PM _{2.5}	EP-05
F5	Paving and Sweeping (or other method of cleaning) at a minimum	TSP, PM ₁₀ , PM _{2.5}	F5
F6	Gravel or Base Course at a minimum	TSP, PM ₁₀ , PM _{2.5}	F6

1. Control for unit number refers to a unit number from the Regulated Equipment List

A106 Facility: Allowable Emissions

A. The following section lists the emission units and their allowable emission limits. (40 CFR 50, 20.2.19 NMAC; 20.2.72.210.A and B.1 NMAC).

Table 106: Allowable Emissions

Unit No.	NO _x ¹ pph	NO _x ¹ tpy	CO pph	CO tpy	TSP pph	TSP tpy	PM ₁₀ pph	PM ₁₀ tpy	PM _{2.5} pph	PM _{2.5} tpy	gr/dscf ²
EP-01	1.9	8.4	1.6	7.1	1.2	5.3	1.2	5.3	1.2	5.3	0.10
EP-03a	1.4	6.3	1.2	5.3	< ³	<	<	<	<	<	NA
EP-03b	Emission limits with EP-03a										
EP-04a	- ⁴	-	-	-	0.9	3.8	0.9	3.8	0.9	3.8	0.04
EP-04b	-	-	-	-	0.5	2.1	0.5	2.1	0.5	2.1	0.04
F1-F4	-	-	-	-	0.0 ⁵	0.0	0.0	0.0	0.0	0.0	NA
F5	-	-	-	-	5.6	16.2	1.1	3.2	0.2	0.5	NA
F6	-	-	-	-	21.6	63.1	5.5	16.1	0.6	1.6	NA

Unit No.	NO _x ¹ pph	NO _x ¹ tpy	CO pph	CO tpy	TSP pph	TSP tpy	PM ₁₀ pph	PM ₁₀ tpy	PM _{2.5} pph	PM _{2.5} tpy	gr/dscf ²
EP-05	-	-	-	-	0.1	0.3	0.1	0.3	0.1	0.3	NA
Totals ⁶		14.7		12.4		90.8		30.8		13.6	NA

- 1 Nitrogen dioxide emissions include all oxides of nitrogen expressed as NO₂
- 2 Particulate matter grain loading limits required by 20.2.19.109.A(1) and 20.2.19.109.A(2) NMAC.
- 3 “<” indicates the application represented uncontrolled emissions are less than 1.0 pph or 1.0 tpy for this pollutant. Allowable limits are not imposed on this level of emissions, except for flares and pollutants with controls.
- 4 “-” indicates the application represented emissions of this pollutant are not expected.
- 5 F1-F4 fugitive emissions are controlled 100% and routed to EP-04b.
- 6 Totals are for information and are not enforceable conditions.

B. Fugitive emissions points associated with EP-04a and EP-04b (F1-F4) are subject to 20.2.19.110.B NMAC using Best Engineering Practices as defined in 20.2.19.7.A NMAC.

A107 Facility: Allowable Startup, Shutdown, & Maintenance (SSM)

A. SSM emissions do not exceed the allowable limits in Table 106. The permittee shall maintain all applicable records in accordance with Section B109.

A108 Facility: Allowable Operations

A. This facility is authorized for continuous operation. No monitoring, recordkeeping, and reporting are required to demonstrate compliance with continuous hours of operation.

A109 Facility: Reporting Schedules

A. For reporting requirements see this permit’s specific conditions and B109.

A110 Facility: Fuel and Sulfur Requirements

A. Fuel Type and Fuel Sulfur Limits – Dryer EP-01 and Heaters EP-03a/b

Requirement: Units EP-01, EP-03a, and EP-03b shall combust only natural gas containing no more than 1 grain of total sulfur per 100 dry standard cubic feet of fuel.
Monitoring: None
Recordkeeping: The permittee shall demonstrate compliance with the natural gas limit on total sulfur content by maintaining records of a current, valid purchase contract, tariff sheet or transportation contract for the fuel, or fuel gas analysis, specifying the total sulfur content. If fuel gas analysis is used, the analysis shall not be older than one year.
Reporting: The permittee shall report according to Section B110.

A111 Facility: 20.2.61 NMAC Opacity

A. 20.2.61 NMAC Opacity Limits - Amine Heaters EP-03A and EP-03b

Requirement: Units EP-03a and EP-03b stack exhaust shall not exceed 20% opacity.
Monitoring: Use of natural gas fuel meet the fuel sulfur content of A110.A constitutes compliance with 20.2.61 NMAC unless opacity exceeds 20% averaged over a 10-minute period. When any visible emissions are observed during steady state operation, opacity shall be measured over a 10-minute period, in accordance with the procedures at 40 CFR 60, Appendix A, Method 9 as required by 20.2.61.114 NMAC
Recordkeeping: The permittee shall record dates of any opacity measures and the corresponding opacity readings.
Reporting: The permittee shall report according to Section B110.

A112 Facility: Production Limits

A. HB Mill Production Limits – Unit EP-01

Requirement: The dried potash throughput rate for Unit EP-01, the Fluidized Bed Dryer, shall not exceed 42.0 tph based on a monthly average.
Monitoring: At all times of operation, the permittee shall monitor the tph throughput rate at the outlet of Unit EP-01 with weigh belt HBCV-103. Weigh belt HBCV-103 shall be capable of measuring the totalized throughput in tons per hour and be capable of transmitting the data to the data capture system.
Recordkeeping: The following records shall be kept: <ul style="list-style-type: none"> • hourly data capture system records of the ton per hour throughput rate measured by weigh belt HBCV-103 and the dates and times when EP-01 is operating • monthly records of the monthly average tph throughput rates • records of the calculations used to determine the monthly average throughput rate
Reporting: The permittee shall report according to Section B110.

A113 Facility: Source Defined

- A. **Source Defined – Intrepid’s HB Plant, North Plant, and West Plant** – Intrepid’s HB Plant (AI 29939), North Plant (AI 692), and West Plant (AI 213) are considered a single source for purposes of Title V (20.2.70 NMAC), Prevention of Significant Deterioration (20.2.74 NMAC), and Nonattainment permitting (20.2.79 NMAC).
- (1) The permittee shall submit a complete Title V application within 12 months after issuance of this permit that includes, at a minimum, all units which have commenced operation.
 - (2) The facilities may operate under separate minor source NSR permits (20.2.72 NMAC). However for future NSR permit applications to revise or modify any of the three facilities, the permittee shall complete a project applicability

determination that considers the combined existing emission rates, changes to emission rates, and any associated emissions of all three facilities.

EQUIPMENT SPECIFIC REQUIREMENTS

A200 Oil and Gas Industry – Not Required

A300 Construction Industry – Not Required

A400 Power Generation Industry – Not Required

A500 Solid Waste Disposal Industry – Not Required

MINING INDUSTRY

A600 Mining Operations

A601 Dryer and Amine Heaters

A. Operational Inspections – Dryer EP-01 and Heaters EP-03a/b

<p>Requirement: For Units EP-01, EP-03a, and EP-04a, the permittee shall demonstrate on-going compliance with allowable NOx, CO, and VOC emission limits in Table 106 through operational inspections.</p>

<p>Monitoring: The permittee shall conduct annual operational inspections to determine that the dryer and heaters are operating properly. The operational inspections shall include checks for indications of insufficient excess air, or too much excess combustion air. These checks shall include observation of common physical indications of improper combustion, including those specified by the manufacturers and based on operational experience with these units.</p>

<p>Recordkeeping: The permittee shall maintain records of operational inspections, describing the results of all inspections noting chronologically any adjustments needed to bring a unit into compliance. Records shall be maintained according Section B109.</p>
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<p>Reporting: The permittee shall report according to Section B110.</p>
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B. Initial NOx, CO, and PM Compliance Tests - Dryer EP-01

<p>Requirement: The permittee shall demonstrate compliance with the allowable emission limits in Table 106 for Dryer EP-01 by conducting EPA Method tests for NOx, CO, TSP, and condensable PM (CPM) in accordance with Section B111.</p>
--

<p>Test results of filterable TSP and CPM shall be combined to verify compliance with allowable TSP, PM10, and PM2.5 limits. Compliance with the TSP emission limit shall be deemed to</p>
--

demonstrate compliance with PM10 and PM2.5 emission limits.

EPA Method 5 test results, which measures filterable PM, shall be used to demonstrate compliance with the gr/dscf limit in Table 106. The 20.2.19 NMAC gr/dscf limit does not apply to CPM.

Compliance with the NOx and CO emission limits shall be deemed to demonstrate compliance with the VOC emission limit.

Monitoring: The permittee shall monitor all parameters necessary to meet the recordkeeping requirements of this condition.

Recordkeeping: Test records shall include the level of excess air; the tph production rate during each test run; the pph emission rates of filterable TSP and CPM; the total (filterable plus CPM) pph emission rates of TSP; the filterable TSP emission rates in gr/dscf; the volumetric stack flow rate; and the scrubber pressure drop and water flow rate during each TSP and CPM test run.

The permittee shall maintain the test records and shall meet the recordkeeping requirements in Conditions B109 and B111.D(3).

Reporting: The permittee shall meet the reporting requirements in Conditions B110.D and B111.D(3). Additionally, the permittee shall include in the test report all records required by this condition.

C. 20.2.19 NMAC Periodic PM Tests – Dryer EP-01

Requirement: Dryer EP-01 is subject to 20.2.19.109(A)(1) NMAC and shall demonstrate compliance with the allowable gr/dscf emission limit in Table 106 by the following periodic testing. The gr/dscf limit applies only to filterable particulate matter.

Every calendar year the permittee shall conduct EPA Method tests for TSP in accordance with Section B111. The first periodic test shall be required during the first calendar year after completion of the initial EPA Method 5 compliance test required in Condition A601.B.

Monitoring: The permittee shall monitor all parameters necessary to meet the recordkeeping requirements of this condition.

Recordkeeping: Test records shall include the level of excess air; the tph production rate during each test run; the filterable TSP emission rates in pph and gr/dscf; the volumetric stack flow rate; and the scrubber pressure drop and water flow rate during each test run.

The permittee shall maintain the test records and shall meet the recordkeeping requirements in Conditions B109 and B111.D(3).

Reporting: The permittee shall meet the reporting requirements in Conditions B110.D and B111.D(3). Additionally, the permittee shall include in the test report all records required by this condition.

D. Cyclone and Scrubber Controls – Dryer EP-01

Requirement: At all times Dryer EP-01 is operating, exhaust emissions shall be routed to and

particulate matter controlled with a cyclone and venturi scrubber.

The permittee shall verify that the cyclone and scrubber are started and working properly before commencing dryer operations.

The scrubber pressure drop and water flow rate shall meet the manufacturer's recommended specifications and/or the values measured during the most recent Department approved EPA Methods 5 and 202 stack tests.

Monitoring

Scrubber: To verify proper operation of the scrubber, the differential pressure across the venturi shall be continuously monitored by the use of a differential pressure gauge and the water flow rate monitored with a flow meter.

Gauges, flow meters, and recording devices shall be maintained, replaced, and calibrated according to manufacturer's specifications and as required so that they consistently provide correct and accurate readings.

Cyclone: At least once each month during operations, the permittee shall check for damage to the cyclone structure such as holes or breaks in seams, and shall check the dump valve operation.

Recordkeeping

Scrubber: During operations, the permittee shall record the scrubber pressure drop and water flow rate three times per 24-hour period. These records shall include, for comparison, the range in scrubber pressure drop and the water flow rate specified by the manufacturer and recorded during the most recent, Department approved, EPA 5 and 202 Method tests. Electronic pressure drop and water flow rate records shall be maintained.

Cyclone: The permittee shall record the dates and times of cyclone inspections, any damage to the cyclone structure, and malfunctions in the dump valve operation. The dates and description of cyclone repairs shall also be recorded.

Manufacturer Specifications: Manufacturer specifications of the cyclone, scrubber, flow meters, gauges, and recording devices shall be kept. Records of gauge and flow meter inspections and calibrations shall also be kept.

Reporting: The permittee shall report according to Section B110.

A602 Material Transfer and Loadout – Stack Emissions

- A. Initial PM Compliance Tests - Material Transfer and Loadout, Units EP-04a and EP-04b

Requirement: The permittee shall demonstrate compliance with the allowable emission limits in Table 106 for Units EP-04a and EP-04b by completing EPA Method tests for TSP in accordance with Section B111.

Compliance with the TSP emission limit shall be deemed to demonstrate compliance with PM10 and PM2.5.

Monitoring: The permittee shall monitor all parameters necessary to meet the recordkeeping requirements of this condition.

Recordkeeping: Test records shall include the tph production rate during each test run; the filterable TSP emission rates in pph and gr/dscf; the volumetric stack flow rate; and the baghouse pressure drop during each test run.

The permittee shall maintain the test records and shall meet the recordkeeping requirements in Conditions B109 and B111.D(3).

Reporting: The permittee shall meet the reporting requirements in Conditions B110.D and B111.D(3). Additionally, the permittee shall include in the test report all records required by this condition.

B. 20.2.19 NMAC Periodic PM Tests – Material Transfer and Loadout, Units EP-04a and EP-04b

Requirement: Units EP-04a and EP-04b are subject to 20.2.19.109(A)(2) NMAC and shall demonstrate compliance with the allowable gr/dscf emission limit in Table 106 by the following periodic testing. The gr/dscf applies only to filterable particulate matter.

Every calendar year, the permittee shall conduct EPA Method tests for TSP in accordance with Section B111. The first periodic test shall be required during the first calendar year after completion of the initial EPA Method 5 compliance test required in Condition A602.A.

Monitoring: The permittee shall monitor all parameters necessary to meet the recordkeeping requirements of this condition.

Recordkeeping: Test records shall include the tph production rate during each test run; the filterable TSP emission rates in pph and gr/dscf; the volumetric stack flow rate; and the baghouse pressure drop during each test run.

The permittee shall maintain the test records and shall meet the recordkeeping requirements in Conditions B109 and B111.D(3).

Reporting: The permittee shall meet the reporting requirements in Conditions B110.D and B111.D(3). Additionally, the permittee shall include in the test report all records required by this condition.

C. Baghouse Control – Material Transfer and Loadout, Units EP-04a and EP-04b (F1-F4)

Requirement: At all times units EP-04a, EP-04b, and F1-F4 are operating particulate matter emissions shall be routed to and controlled with a baghouse. The permittee shall maintain the baghouse, using at a minimum, the manufacturer's specifications.

The permittee shall verify that the baghouse is started and working properly before commencing operations.

The baghouse pressure drop shall meet the manufacturer's recommended specifications and/or the values measured during the most recent and Department approved EPA Method 5 stack test.

Additionally, there shall be no visible particulate emissions from the baghouse outlet.

Monitoring

Differential Pressure: To verify proper operation of the baghouse, the differential pressure across the baghouse shall be continuously monitored by the use of a differential pressure gauge.

Opacity: At least once per week during operations, the permittee shall perform visible emissions observations at the baghouse outlet for a minimum of 6 minutes using EPA's Method 22 in 40 CFR 60, Appendix A.

Manufacturer Specifications: Gauges and recording devices shall be maintained, replaced, and calibrated according to manufacturer's specifications and as required so that they consistently provide correct and accurate readings.

Recordkeeping

Differential Pressure: During operations, the permittee shall record the baghouse pressure drop three times per 24-hour period. These records shall include, for comparison, the range in baghouse pressure drop specified by the manufacturer and recorded during the most recent, Department approved, EPA Method 5 test. Electronic pressure records shall be maintained.

Opacity: The permittee shall record each EPA Method 22 observation and the results, including if any visible emissions were observed.

Manufacturer Specifications: Manufacturer specifications of the baghouse, gauge, and recording device shall be kept. Records of gauge inspections, maintenance, and calibrations shall also be kept.

Corrective Actions and Maintenance: The permittee shall record any adjustments, repairs, or bag replacements made to the baghouse in response to the required monitoring and that are necessary to meet the requirements of this condition. The permittee shall keep records of all maintenance activities completed on the baghouse.

Reporting: The permittee shall report according to Section B110.

A603 Fugitives - Material Handling and Haul Roads

- A. Fugitive Controls & 20.2.19 NMAC – Material Transfer and Loadout, Units EP-04a and EP-04b (F1-F4)

Requirement: Fugitive emissions points associated with Units EP-04a and EP-04b (F1-F4) are subject to 29.2.19.110.B NMAC which requires Best Engineering Practices (BEP) as defined in

<p>20.2.19.7.A NMAC. Additionally, fugitive emissions from these fugitive emission points shall be controlled 100% resulting in no visible emissions and in accordance with the control description in Table 105.</p>
<p>Monitoring: The permittee shall have a Qualified Engineer conduct semi-annual inspections of fugitive emission sources and certify that they are controlled in accordance with 20.2.19.110.B and according to the control description in Table 105.</p> <p>At a minimum, semi-annual inspections shall include visual checks for malfunctions and deficiencies in dust control effectiveness, such as breaches in the physical barriers controlling dust emissions and/or any other dust control equipment deficiencies or malfunctions.</p> <p>If the emissions point is found not to be compliant with 20.2.19.110.B or with the controls required by Table 105, then the permittee shall take the necessary action to make the emission point compliant no later than 30 days after discovery.</p>
<p>Recordkeeping: The permittee shall generate and keep records of the semi-annual inspections including all emission points found to be non-compliant, the date of non-compliance, and the date(s) and actions taken to remedy the non-compliance.</p>
<p>Reporting: The permittee shall submit the semi-annual inspection reports to the Department with the Title V semi-annual monitoring reports and meet the requirements of Section B110.</p>

B. Paved Haul Road Control Requirements – Unit F5

<p>Requirement: The 4.73 mile section of private paved haul road starting at the HB Plant and running north where it intersects with highway 62/180 shall be paved. This paved haul road shall be swept, or cleaned by some other method, to control fugitive particulate emissions.</p>
<p>Monitoring: The permittee shall monitor the frequency and any methods used to remove fugitive dust from the paved haul road.</p>
<p>Recordkeeping: The permittee shall keep records of the monitoring required in this condition including the dates that the haul road is cleaned.</p>
<p>Reporting: The permittee shall report according to Section B110.</p>

C. Unpaved Haul Road Control Requirements – Unit F6

<p>Requirement: The unpaved truck traffic areas and haul road located at the HB Plant shall, at a minimum, be treated with the application of base course or gravel to control fugitive particulate emissions.</p>
<p>Monitoring: The permittee shall monitor the frequency, quantity, and locations of the base course or gravel application, or other additional control measures.</p>
<p>Recordkeeping: The permittee shall keep records of the monitoring required in this condition including the dates that the truck traffic areas and haul roads are treated.</p>
<p>Reporting: The permittee shall report according to Section B110</p>

A604 Cooling Tower

A. Cooling Tower – Unit EP-05

Requirement: The permittee shall demonstrate compliance with the Cooling Tower EP-05 allowable emissions in Table 106 by the following.

- EP-05 shall be equipped with a drift eliminator with a manufacturer specified drift rate of 0.005% or less and shall be operated and maintained according to manufacturer's specifications, or equivalent.
- The total dissolved solids (TDS) in EP-05's water shall not exceed 12,000 ppmw.
- The circulation rate of EP-05's cooling water pump shall not exceed 12,180 gallons per hour (gph).

Monitoring: The permittee shall monitor the following parameters at least once each calendar month during operation of Cooling Tower EP-05.

- inspect the cooling tower and the drift eliminator to ensure it is in place and in good repair
- monitor the TDS of the cooling tower water
- monitor the circulation rate of the cooling water pump

Recordkeeping: Records shall be kept of the following:

- the monthly inspections of the drift eliminator including any repairs or maintenance;
- the manufacturer's design specifications and manufacturer's recommended, or equivalent, maintenance procedures; and
- the monthly cooling water TDS.

Records shall also include the maximum circulation rate of the cooling water pump each month and the methods used to determine the cooling water pump circulation rate.

Reporting: The permittee shall report according to Section B110

PART B GENERAL CONDITIONS**B100 Introduction**

- A. The Department has reviewed the permit application for the proposed construction/modification/revision and has determined that the provisions of the Act and ambient air quality standards will be met. Conditions have been imposed in this permit to assure continued compliance. 20.2.72.210.D NMAC, states that any term or condition imposed by the Department on a permit is enforceable to the same extent as a regulation of the Environmental Improvement Board.

B101 Legal

- A. The contents of a permit application specifically identified by the Department shall become the terms and conditions of the permit or permit revision. Unless modified by conditions of this permit, the permittee shall construct or modify and operate the Facility in accordance with all representations of the application and supplemental submittals that the Department relied upon to determine compliance with applicable regulations and ambient air quality standards. If the Department relied on air quality modeling to issue this permit, any change in the parameters used for this modeling shall be submitted to the Department for review. Upon the Department's request, the permittee shall submit additional modeling for review by the Department. Results of that review may require a permit modification. (20.2.72.210.A NMAC)
- B. Any future physical changes, changes in the method of operation or changes in restricted area may constitute a modification as defined by 20.2.72 NMAC, Construction Permits. Unless the source or activity is exempt under 20.2.72.202 NMAC, no modification shall begin prior to issuance of a permit. (20.2.72 NMAC Sections 200.A.2 and E, and 210.B.4)
- C. Changes in plans, specifications, and other representations stated in the application documents shall not be made if they cause a change in the method of control of emissions or in the character of emissions, will increase the discharge of emissions or affect modeling results. Any such proposed changes shall be submitted as a revision or modification. (20.2.72 NMAC Sections 200.A.2 and E, and 210.B.4)
- D. The permittee shall establish and maintain the property's Restricted Area, as identified in the most recent modeling plan for which the permittee received Department approval. (20.2.72 NMAC Sections 200.A.2 and E, and 210.B.4)
- E. Applications for permit revisions and modifications shall be submitted to:
Program Manager, Permits Section

New Mexico Environment Department
Air Quality Bureau
1301 Siler Road, Building B
Santa Fe, New Mexico 87507-3113

- F. Pursuant to 20.2.72.210 NMAC, at all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate the source including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. (20.2.72.210.A, 20.2.72.210.B, 20.2.72.210.C, 20.2.72.210.E NMAC)

B102 Authority

- A. This permit is issued pursuant to the Air Quality Control Act (Act) and regulations adopted pursuant to the Act including Title 20, Chapter 2, Part 72 of the New Mexico Administrative Code (NMAC), (20.2.72 NMAC), Construction Permits and is enforceable pursuant to the Act and the air quality control regulations applicable to this source.
- B. The Department is the Administrator for 40 CFR Parts 60, 61, and 63 pursuant to the delegation and exceptions of Section 10 of 20.2.77 NMAC (NSPS), 20.2.78 NMAC (NESHAP), and 20.2.82 NMAC (MACT).

B103 Annual Fee

- A. The Department will assess an annual fee for this Facility. The regulation 20.2.75 NMAC set the fee amount at \$1,500 through 2004 and requires it to be adjusted annually for the Consumer Price Index on January 1. The current fee amount is available by contacting the Department or can be found on the Department's website. The AQB will invoice the permittee for the annual fee amount at the beginning of each calendar year. This fee does not apply to sources which are assessed an annual fee in accordance with 20.2.71 NMAC. For sources that satisfy the definition of "small business" in 20.2.75.7.F NMAC, this annual fee will be divided by two. (20.2.75.11 NMAC)
- B. All fees shall be remitted in the form of a corporate check, certified check, or money order made payable to the "NM Environment Department, AQB" mailed to the address shown on the invoice and shall be accompanied by the remittance slip attached to the invoice.

B104 Appeal Procedures

- A. Any person who participated in a permitting action before the Department and who is adversely affected by such permitting action, may file a petition for hearing before the Environmental Improvement Board. The petition shall be made in writing to the Environmental Improvement Board within thirty (30) days from the date notice is given of the Department's action and shall specify the portions of the permitting action to which the petitioner objects, certify that a copy of the petition has been mailed or hand-delivered and attach a copy of the permitting action for which review is sought. Unless a timely request for hearing is made, the decision of the Department shall be final. The petition shall be copied simultaneously to the Department upon receipt of the appeal notice. If the petitioner is not the applicant or permittee, the petitioner shall mail or hand-deliver a copy of the petition to the applicant or permittee. The Department shall certify the administrative record to the board. Petitions for a hearing shall be sent to: (20.2.72.207.F NMAC)

Secretary, New Mexico Environmental Improvement Board
1190 St. Francis Drive, Runnels Bldg. Rm. N2153
P.O. Box 5469
Santa Fe, New Mexico 87502

B105 Submittal of Reports and Certifications

- A. Stack Test Protocols and Stack Test Reports shall be submitted electronically to Stacktest.AQB@state.nm.us.
- B. Excess Emission Reports shall be submitted electronically to eereports.aqb@state.nm.us. (20.2.7.110 NMAC)
- C. Regularly scheduled reports shall be submitted to:
Manager, Compliance and Enforcement Section
New Mexico Environment Department
Air Quality Bureau
1301 Siler Road, Building B
Santa Fe, New Mexico 87507-3113

B106 NSPS and/or MACT Startup, Shutdown, and Malfunction Operations

- A. If a facility is subject to a NSPS standard in 40 CFR 60, each owner or operator that installs and operates a continuous monitoring device required by a NSPS regulation shall comply with the excess emissions reporting requirements in accordance with 40 CFR 60.7(c), unless specifically exempted in the applicable subpart.

- B. If a facility is subject to a NSPS standard in 40 CFR 60, then in accordance with 40 CFR 60.8(c), emissions in excess of the level of the applicable emission limit during periods of startup, shutdown, and malfunction shall not be considered a violation of the applicable emission limit unless otherwise specified in the applicable standard.
- C. If a facility is subject to a MACT standard in 40 CFR 63, then the facility is subject to the requirement for a Startup, Shutdown and Malfunction Plan (SSM) under 40 CFR 63.6(e)(3), unless specifically exempted in the applicable subpart.

B107 Startup, Shutdown, and Maintenance Operations

- A. The permittee shall operate in accordance with the procedures set forth in the plan to minimize emissions during routine or predictable start up, shut down, and scheduled maintenance (SSM work practice plan), except for operations or equipment subject to Section **B106** above. (20.2.7.14.A NMAC)

B108 General Monitoring Requirements

- A. These requirements do not supersede or relax requirements of federal regulations.
- B. The following monitoring requirements shall be used to determine compliance with applicable requirements and emission limits. Any sampling, whether by portable analyzer or EPA reference method, that measures an emission rate over the applicable averaging period greater than an emission limit in this permit constitutes noncompliance with this permit. The Department may require, at its discretion, additional tests pursuant to EPA Reference Methods at any time, including when sampling by portable analyzer measures an emission rate greater than an emission limit in this permit; but such requirement shall not be construed as a determination that the sampling by portable analyzer does not establish noncompliance with this permit and shall not stay enforcement of such noncompliance based on the sampling by portable analyzer.
- C. If the emission unit is shutdown at the time when periodic monitoring is due to be accomplished, the permittee is not required to restart the unit for the sole purpose of performing the monitoring. Using electronic or written mail, the permittee shall notify the Department's Compliance and Enforcement Section of a delay in emission tests prior to the deadline for accomplishing the tests. Upon recommencing operation, the permittee shall submit any pertinent pre-test notification requirements set forth in the current version of the Department's Standard Operating Procedures For Use Of Portable Analyzers in Performance Test, and shall accomplish the monitoring.
- D. The requirement for monitoring during any monitoring period is based on the percentage of time that the unit has operated. However, to invoke monitoring exemptions at B108.D(2), hours of operation shall be monitored and recorded.

- (1) If the emission unit has operated for more than 25% of a monitoring period, then the permittee shall conduct monitoring during that period.
 - (2) If the emission unit has operated for 25% or less of a monitoring period then the monitoring is not required. After two successive periods without monitoring, the permittee shall conduct monitoring during the next period regardless of the time operated during that period, except that for any monitoring period in which a unit has operated for less than 10% of the monitoring period, the period will not be considered as one of the two successive periods.
 - (3) A minimum of one of each type of monitoring activity shall be conducted during any five-year period for sources not subject to 20.2.70 NMAC, Operating Permits.
- E. For all periodic monitoring events, except when a federal or state regulation is more stringent, three test runs shall be conducted at 90% or greater of the unit's capacity as stated in this permit, or in the permit application if not in the permit, and at additional loads when requested by the Department. If the 90% capacity cannot be achieved, the monitoring will be conducted at the maximum achievable load under prevailing operating conditions except when a federal or state regulation requires more restrictive test conditions. The load and the parameters used to calculate it shall be recorded to document operating conditions and shall be included with the monitoring report.
- F. When requested by the Department, the permittee shall provide schedules of testing and monitoring activities. Compliance tests from previous NSR and Title V permits may be re-imposed if it is deemed necessary by the Department to determine whether the source is in compliance with applicable regulations or permit conditions.
- G. If monitoring is new or is in addition to monitoring imposed by an existing applicable requirement, it shall become effective 120 days after the date of permit issuance. For emission units that have not commenced operation, the associated new or additional monitoring shall not apply until 120 days after the units commence operation. All pre-existing monitoring requirements incorporated in this permit shall continue to apply from the date of permit issuance.

B109 General Recordkeeping Requirements

- A. The permittee shall maintain records to assure and verify compliance with the terms and conditions of this permit and any other applicable requirements that become effective after permit issuance. The minimum information to be included in these records is:
- (1) equipment identification (include make, model and serial number for all tested equipment and emission controls);
 - (2) date(s) and time(s) of sampling or measurements;

- (3) date(s) analyses were performed;
 - (4) the qualified entity that performed the analyses;
 - (5) analytical or test methods used;
 - (6) results of analyses or tests; and
 - (7) operating conditions existing at the time of sampling or measurement.
- B. Except as provided in the Specific Conditions, records shall be maintained on-site for a minimum of two (2) years from the time of recording and shall be made available to Department personnel upon request. Records for unmanned sites may be kept at the nearest company office. Sources subject to 20.2.70 NMAC "Operating Permits" shall maintain records on-site for a minimum of five (5) years from the time of recording.
- C. Malfunction emissions and routine and predictable emissions during startup, shutdown, and scheduled maintenance (SSM):
- (1) The permittee shall keep records of all events subject to the plan to minimize emissions during routine or predictable SSM. (20.2.7.14.A NMAC)
 - (2) If the facility has allowable SSM emission limits in this permit, the permittee shall record all SSM events, including the date, the start time, the end time, and a description of the event. This record also shall include a copy of the manufacturer's, or equivalent, documentation showing that any maintenance qualified as scheduled. Scheduled maintenance is an activity that occurs at an established frequency pursuant to a written protocol published by the manufacturer or other reliable source.
 - (3) If the facility has allowable malfunction emission limits in this permit, the permittee shall record all malfunction events to be applied against these limits, including the date, the start time, the end time, and a description of the event. Malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes, or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions. (40 CFR 63.2)

B110 General Reporting Requirements

(20.2.72 NMAC Sections 210 and 212)

- A. Records and reports shall be maintained on-site unless specifically required to be submitted to the Department or EPA by another condition of this permit or by a state or federal regulation. Records for unmanned sites may be kept at the nearest company office.

- B. The permittee shall notify the Department's Compliance Reporting Section using the current Submittal Form posted to NMED's Air Quality web site under Compliance and Enforcement/Submittal Forms in writing of, or provide the Department with (20.2.72.212.A and B):
- (1) the anticipated date of initial startup of each new or modified source not less than thirty (30) days prior to the date. Notification may occur prior to issuance of the permit, but actual startup shall not occur earlier than the permit issuance date;
 - (2) after receiving authority to construct, the equipment serial number as provided by the manufacturer or permanently affixed if shop-built and the actual date of initial startup of each new or modified source within fifteen (15) days after the startup date; and
 - (3) the date when each new or modified emission source reaches the maximum production rate at which it will operate within fifteen (15) days after that date.
- C. The permittee shall notify the Department's Permitting Program Manager, in writing of, or provide the Department with (20.2.72.212.C and D):
- (1) any change of operators or any equipment substitutions within fifteen (15) days of such change;
 - (2) any necessary update or correction no more than sixty (60) days after the operator knows or should have known of the condition necessitating the update or correction of the permit.
- D. Results of emission tests and monitoring for each pollutant (except opacity) shall be reported in pounds per hour (unless otherwise specified) and tons per year. Opacity shall be reported in percent. The number of significant figures corresponding to the full accuracy inherent in the testing instrument or Method test used to obtain the data shall be used to calculate and report test results in accordance with 20.2.1.116.B and C NMAC. Upon request by the Department, CEMS and other tabular data shall be submitted in editable, MS Excel format.
- E. The permittee shall submit reports of excess emissions in accordance with 20.2.7.110.A NMAC.

B111 General Testing Requirements

A. Compliance Tests

- (1) Compliance test requirements from previous permits (if any) are still in effect, unless the tests have been satisfactorily completed. Compliance tests may be re-imposed if it is deemed necessary by the Department to determine whether the source is in compliance with applicable regulations or permit conditions. (20.2.72 NMAC Sections 210.C and 213)

- (2) Compliance tests shall be conducted within sixty (60) days after the unit(s) achieve the maximum normal production rate. If the maximum normal production rate does not occur within one hundred twenty (120) days of source startup, then the tests must be conducted no later than one hundred eighty (180) days after initial startup of the source.
- (3) Unless otherwise indicated by Specific Conditions or regulatory requirements, the default time period for each test run shall be **at least** 60 minutes and each performance test shall consist of three separate runs using the applicable test method. For the purpose of determining compliance with an applicable emission limit, the arithmetic mean of results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs must be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances, beyond the owner or operator's control, compliance may, upon the Department approval, be determined using the arithmetic mean of the results of the two other runs.
- (4) Testing of emissions shall be conducted with the emissions unit operating at 90 to 100 percent of the maximum operating rate allowed by the permit. If it is not possible to test at that rate, the source may test at a lower operating rate, subject to the approval of the Department.
- (5) Testing performed at less than 90 percent of permitted capacity will limit emission unit operation to 110 percent of the tested capacity until a new test is conducted.
- (6) If conditions change such that unit operation above 110 percent of tested capacity is possible, the source must submit a protocol to the Department within 30 days of such change to conduct a new emissions test.
- (7) The physical configuration of the Facility shall conform to the emissions testing requirements of 20.2.72.210.C NMAC and of 40 CFR 60.8(e), which is imposed under the authority of 20.2.72.210.C.4 NMAC.

B. EPA Reference Method Tests

- (1) All compliance tests required by this permit, unless otherwise specified by Specific Conditions of this permit, shall be conducted in accordance with the requirements of CFR Title 40, Part 60, Subpart A, General Provisions, and the following EPA Reference Methods as specified by CFR Title 40, Part 60, Appendix A:
 - (a) Methods 1 through 4 for stack gas flowrate
 - (b) Method 5 for TSP
 - (c) Method 6C and 19 for SO₂

- (d) Method 7E for NO_x (test results shall be expressed as nitrogen dioxide (NO₂) using a molecular weight of 46 lb/lb-mol in all calculations (each ppm of NO/NO₂ is equivalent to 1.194 x 10⁻⁷ lb/SCF)
 - (e) Method 9 for opacity
 - (f) Method 10 for CO
 - (g) Method 19 may be used in lieu of Methods 1-4 for stack gas flowrate upon approval of the Department. A justification for this proposal must be provided along with a contemporaneous fuel gas analysis (preferably on the day of the test) and a recent fuel flow meter calibration certificate (within the most recent quarter).
 - (h) Method 7E or 20 for Turbines per 60.335 or 60.4400
 - (i) Method 29 for Metals
 - (j) Method 201A for filterable PM₁₀ and PM_{2.5}
 - (k) Method 202 for condensable PM
 - (l) Method 320 for organic Hazardous Air Pollutants (HAPs)
 - (m) Method 25A for VOC reduction efficiency
- (2) Alternative test method(s) may be used if the Department approves the change

C. Portable Analyzer Requirements

- (1) The permittee shall follow the *SOP for Use of Portable Analyzers in Performance Tests* posted to NMED's Air Quality web site under Compliance and Enforcement/Testing.
- (2) A portable analyzer that is used for periodic emissions tests must meet the requirements of ASTM D 6522 – 00. However, if a facility has met a previously approved Department criterion for portable analyzers, the analyzer may be used until it is replaced.
- (3) The portable emissions analyzer shall be setup and operated in accordance with the manufacturer's instructions, with the requirements of ASTM D-6522-00, or with the criterion of an analyzer previously approved by the Department.
- (4) During emissions tests, pollutant, O₂ concentration and fuel flow rate shall be monitored and recorded. This information shall be included with the test report furnished to the Department.
- (5) Pollutant emission rate shall be calculated in accordance with 40 CFR 60, Appendix A, Method 19 utilizing fuel flow rate (scf) and fuel heating value (Btu/scf) obtained during the test.

D. Test Procedures:

- (1) The permittee shall notify the Department's Program Manager, Compliance and Enforcement Section at least thirty (30) days before the test date and allow a representative of the Department to be present at the test.
- (2) Equipment shall be tested in the "as found" condition. Equipment may not be adjusted or tuned prior to any test for the purpose of lowering emissions, and then returned to previous settings or operating conditions after the test is complete.
- (3) Contents of test notifications, protocols and test reports shall conform to the format specified by the Department's Universal Test Notification, Protocol and Report Form and Instructions. Current forms and instructions are posted to NMED's Air Quality web site under Compliance and Enforcement Testing.
- (4) The permittee shall provide (a) sampling ports adequate for the test methods applicable to the facility, (b) safe sampling platforms, (c) safe access to sampling platforms and (d) utilities for sampling and testing equipment. Sample ports of a size compatible with the test methods shall be located on the stack with the provisions of EPA Method 1 of 40 CFR 60, Appendix A. The stack shall be of sufficient height and diameter so that a representative test of the emissions can be performed in accordance with EPA Method 1.
- (5) Where necessary to prevent cyclonic flow in the stack, flow straighteners shall be installed.

B112 Compliance

- A. The Department shall be given the right to enter the facility at all reasonable times to verify the terms and conditions of this permit. Required records shall be organized by date and subject matter and shall at all times be readily available for inspection. The permittee, upon verbal or written request from an authorized representative of the Department who appears at the facility, shall immediately produce for inspection or copying any records required to be maintained at the facility. Upon written request at other times, the permittee shall deliver to the Department paper or electronic copies of any and all required records maintained on site or at an off-site location. Requested records shall be copied and delivered at the permittee's expense within three business days from receipt of request unless the Department allows additional time. Required records may include records required by permit and other information necessary to demonstrate compliance with terms and conditions of this permit. (NMSA 1978, Section 74-2-13)
- B. A copy of the most recent permit(s) issued by the Department shall be kept at the permitted facility or (for unmanned sites) at the nearest company office and shall be made available to Department personnel for inspection upon request. (20.2.72.210.B.4 NMAC)

- C. Emissions limits associated with the energy input of a Unit, i.e. lb/MMBtu, shall apply at all times unless stated otherwise in a Specific Condition of this permit. The averaging time for each emissions limit, including those based on energy input of a Unit (i.e. lb/MMBtu) is one (1) hour unless stated otherwise in a Specific Condition of this permit or in the applicable requirement that establishes the limit.

B113 Permit Cancellation and Revocation

- A. The Department may revoke this permit if the applicant or permittee has knowingly and willfully misrepresented a material fact in the application for the permit. Revocation will be made in writing, and an administrative appeal may be taken to the Secretary of the Department within thirty (30) days. Appeals will be handled in accordance with the Department's Rules Governing Appeals From Compliance Orders.
- B. The Department shall automatically cancel any permit for any source which ceases operation for five (5) years or more, or permanently. Reactivation of any source after the five (5) year period shall require a new permit. (20.2.72 NMAC)
- C. The Department may cancel a permit if the construction or modification is not commenced within two (2) years from the date of issuance or if, during the construction or modification, work is suspended for a total of one (1) year. (20.2.72 NMAC)

B114 Notification to Subsequent Owners

- A. The permit and conditions apply in the event of any change in control or ownership of the Facility. No permit modification is required in such case. However, in the event of any such change in control or ownership, the permittee shall notify the succeeding owner of the permit and conditions and shall notify the Department's Program Manager, Permits Section of the change in ownership within fifteen (15) days of that change. (20.2.72.212.C NMAC)
- B. Any new owner or operator shall notify the Department's Program Manager, Permits Section, within thirty (30) days of assuming ownership, of the new owner's or operator's name and address. (20.2.73.200.E.3 NMAC)

B115 Asbestos Demolition

- A. Before any asbestos demolition or renovation work, the permittee shall determine whether 40 CFR 61 Subpart M, National Emissions Standards for Asbestos applies. If required, the permittee shall notify the Department's Program Manager, Compliance and Enforcement Section using forms furnished by the Department.

B116 Short Term Engine Replacement

- A. The following Alternative Operating Scenario (AOS) addresses engine breakdown or periodic maintenance and repair, which requires the use of a short term replacement engine. The following requirements do not apply to engines that are exempt per 20.2.72.202.B(3) NMAC. Changes to exempt engines must be reported in accordance with 20.2.72.202.B NMAC. A short term replacement engine may be substituted for any engine allowed by this permit for no more than 120 days in any rolling twelve month period per permitted engine. The compliance demonstrations required as part of this AOS are in addition to any other compliance demonstrations required by this permit.
- (1) The permittee may temporarily replace an existing engine that is subject to the emission limits set forth in this permit with another engine regardless of manufacturer, model, and horsepower without modifying this permit. The permittee shall submit written notification to the Department within 15 days of the date of engine substitution according to condition B110.C(1).
 - (a) The potential emission rates of the replacement engine shall be determined using the replacement engine's manufacturer specifications and shall comply with the existing engine's permitted emission limits.
 - (b) The direction of the exhaust stack for the replacement engine shall be either vertical or the same direction as for the existing engine. The replacement engine's stack height and flow parameters shall be at least as effective in the dispersion of air pollutants as the modeled stack height and flow parameters for the existing permitted engine. The following equation may be used to show that the replacement engine disperses pollutants as well as the existing engine. The value calculated for the replacement engine on the right side of the equation shall be equal to or greater than the value for the existing engine on the left side of the equation. The permitting page of the Air Quality Bureau website contains a spreadsheet that performs this calculation.

EXISTING ENGINEREPLACEMENT ENGINE

$$\frac{[(g) \times (h1)] + [(v1)^2/2] + [(c) \times (T1)]}{q1} \leq \frac{[(g) \times (h2)] + [(v2)^2/2] + [(c) \times (T2)]}{q2}$$

Where

g = gravitational constant = 32.2 ft/sec²

h1 = existing stack height, feet

v1 = exhaust velocity, existing engine, feet per second

c = specific heat of exhaust, 0.28 BTU/lb-degree F

T1 = absolute temperature of exhaust, existing engine = degree F + 460

q1 = permitted allowable emission rate, existing engine, lbs/hour

h2 = replacement stack height, feet

v2 = exhaust velocity, replacement engine, feet per second

T2 = absolute temperature of exhaust, replacement engine = degree F + 460

q2 = manufacturer's potential emission rate, replacement engine, lbs/hour

The permittee shall keep records showing that the replacement engine is at least as effective in the dispersion of air pollutants as the existing engine.

- (c) Test measurement of NO_x and CO emissions from the temporary replacement engine shall be performed in accordance with Section B111 with the exception of Condition B111A(3) and B111B for EPA Reference Methods Tests or Section B111C for portable analyzer test measurements. Compliance test(s) shall be conducted within fifteen (15) days after the unit begins operation, and records of the results shall be kept according to section B109.B. This test shall be performed even if the engine is removed prior to 15 days on site.
- i. These compliance tests are not required for an engine certified under 40CFR60, subparts IIII, or JJJJ, or 40CFR63, subpart ZZZZ if the permittee demonstrates that one of these requirements causes such engine to comply with all emission limits of this permit. The permittee shall submit this demonstration to the Department within 48 hours of placing the new unit into operation. This submittal shall include documentation that the engine is certified, that the engine is within its useful life, as defined and specified in the applicable requirement, and shall include calculations showing that the applicable emissions standards result in compliance with the permit limits.
 - ii. These compliance tests are not required if a test was conducted by portable analyzer or by EPA Method test (including any required by 40CFR60, subparts IIII and JJJJ and 40CFR63, subpart ZZZZ)

within the last 12 months. These previous tests are valid only if conducted at the same or lower elevation as the existing engine location prior to commencing operation as a temporary replacement. A copy of the test results shall be kept according to section B109.B.

- (d) Compliance tests for NO_x and CO shall be conducted if requested by the Department in writing to determine whether the replacement engine is in compliance with applicable regulations or permit conditions.
 - (e) Upon determining that emissions data developed according to B116.A.1(c) fail to indicate compliance with either the NO_x or CO emission limits, the permittee shall notify the Department within 48 hours. Also within that time, the permittee shall implement one of the following corrective actions:
 - i. The engine shall be adjusted to reduce NO_x and CO emissions and tested per B116.A.1(c) to demonstrate compliance with permit limits.
 - ii. The engine shall discontinue operation or be replaced with a different unit.
- (2) Short term replacement engines, whether of the same manufacturer, model, and horsepower, or of a different manufacturer, model, or horsepower, are subject to all federal and state applicable requirements, regardless of whether they are set forth in this permit (including monitoring and recordkeeping), and shall be subject to any shield afforded by this permit.
- (3) The permittee shall maintain a contemporaneous record documenting the unit number, manufacturer, model number, horsepower, emission factors, emission test results, and serial number of any existing engine that is replaced, and the replacement engine. Additionally, the record shall document the replacement duration in days, and the beginning and end dates of the short term engine replacement.
- (4) The permittee shall maintain records of a regulatory applicability determination for each replacement engine (including 40CFR60, subparts IIII and JJJJ and 40CFR63, subpart ZZZZ) and shall comply with all associated regulatory requirements.
- B. Additional requirements for replacement of engines at sources that are major as defined in regulation 20.2.74 NMAC, Permits – Prevention of Significant Deterioration, section 7.AF. For sources that are major under PSD, the total cumulative operating hours of the replacement engine shall be limited using the following procedure:

- (1) Daily, the actual emissions from the replacement engine of each pollutant regulated by this permit for the existing engine shall be calculated and recorded.
 - (2) The sum of the total actual emissions since the commencement of operation of the replacement engine shall not exceed the significant emission rates in Table 2 of 20.2.74 NMAC, section 502 for the time that the replacement engine is located at the facility.
- C. All records required by this section shall be kept according to section B109.

PART C MISCELLANEOUS

C100 Supporting On-Line Documents

- A. Copies of the following documents can be downloaded from NMED's web site under Compliance and Enforcement or requested from the Bureau.
- (1) Excess Emission Form (for reporting deviations and emergencies)
 - (2) Universal Stack Test Notification, Protocol and Report Form and Instructions
 - (3) SOP for Use of Portable Analyzers in Performance Tests

C101 Definitions

- A. **"Daylight"** is defined as the time period between sunrise and sunset, as defined by the Astronomical Applications Department of the U.S. Naval Observatory. (Data for one day or a table of sunrise/sunset for an entire year can be obtained at <http://aa.usno.navy.mil/>. Alternatively, these times can be obtained from a Farmer's Almanac or from <http://www.almanac.com/rise/>).
- B. **"Exempt Sources"** and **"Exempt Activities"** is defined as those sources or activities that are exempted in accordance with 20.2.72.202 NMAC. Note; exemptions are only valid for most 20.2.72 NMAC permitting actions.
- C. **"Fugitive Emission"** means those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.
- D. **"Insignificant Activities"** means those activities which have been listed by the department and approved by the administrator as insignificant on the basis of size, emissions or production rate. Note; insignificant activities are only valid for 20.2.70 NMAC permitting actions.
- E. **"Natural Gas"** is defined as a naturally occurring fluid mixture of hydrocarbons that contains 20.0 grains or less of total sulfur per 100 standard cubic feet (SCF) and is

either composed of at least 70% methane by volume or has a gross calorific value of between 950 and 1100 Btu per standard cubic foot. (40 CFR 60.631)

- F. **“Natural Gas Liquids”** means the hydrocarbons, such as ethane, propane, butane, and pentane that are extracted from field gas. (40 CFR 60.631)
- G. **“National Ambient air Quality Standards”** means, unless otherwise modified, the primary (health-related) and secondary (welfare-based) federal ambient air quality standards promulgated by the US EPA pursuant to Section 109 of the Federal Act.
- H. **“Night”** is the time period between sunset and sunrise, as defined by the Astronomical Applications Department of the U.S. Naval Observatory. (Data for one day or a table of sunrise/sunset for an entire year can be obtained at <http://aa.usno.navy.mil/>. Alternatively, these times can be obtained from a Farmer’s Almanac or from <http://www.almanac.com/rise/>).
- I. **“Night Operation or Operation at Night”** is operating a source of emissions at night.
- J. **“NO₂”** or "Nitrogen dioxide" means the chemical compound containing one atom of nitrogen and two atoms of oxygen, for the purposes of ambient determinations. The term **"nitrogen dioxide,"** for the purposes of stack emissions monitoring, shall include nitrogen dioxide (the chemical compound containing one atom of nitrogen and two atoms of oxygen), nitric oxide (the chemical compound containing one atom of nitrogen and one atom of oxygen), and other oxides of nitrogen which may test as nitrogen dioxide and is sometimes referred to as NO_x or NO_x. (20.2.2 NMAC)
- K. **“NO_x”** see NO₂
- L. **“Potential Emission Rate”** means the emission rate of a source at its maximum capacity to emit a regulated air contaminant under its physical and operational design, provided any physical or operational limitation on the capacity of the source to emit a regulated air contaminant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored or processed, shall be treated as part of its physical and operational design only if the limitation or the effect it would have on emissions is enforceable by the department pursuant to the Air Quality Control Act or the federal Act.
- M. **“Restricted Area”** is an area to which public entry is effectively precluded. Effective barriers include continuous fencing, continuous walls, or other continuous barriers approved by the Department, such as rugged physical terrain with a steep grade that would require special equipment to traverse. If a large property is completely enclosed by fencing, a restricted area within the property may be identified with signage only. Public roads cannot be part of a Restricted Area.

- N. **"Shutdown"** for requirements under 20.2.72 NMAC, means the cessation of operation of any air pollution control equipment, process equipment or process for any purpose, except routine phasing out of batch process units.
- O. **"SSM"** for requirements under 20.2.7 NMAC, means routine or predictable startup, shutdown, or scheduled maintenance.
 - (1) **"Shutdown"** for requirements under 20.2.7 NMAC, means the cessation of operation of any air pollution control equipment or process equipment.
 - (2) **"Startup"** for requirements under 20.2.7 NMAC, means the setting into operation of any air pollution control equipment or process equipment.
- P. **"Startup"** for requirements under 20.2.72 NMAC, means the setting into operation of any air pollution control equipment, process equipment or process for any purpose, except routine phasing in of batch process units.

C102 Acronyms

2SLB	2-stroke lean burn
4SLB	4-stroke lean burn
4SRB	4-stroke rich burn
acfm	actual cubic feet per minute
AFR	air fuel ratio
AP-42	EPA Air Pollutant Emission Factors
AQB	Air Quality Bureau
AQCR	Air Quality Control Region
ASTM	American Society for Testing and Materials
BTU	British Thermal Unit
CAA	Clean Air Act of 1970 and 1990 Amendments
CEM	continuous emissions monitoring
cfh	cubic feet per hour
cfm	cubic feet per minute
CFR	Code of Federal Regulation
CI	compression ignition
CO	carbon monoxides
COMS	continuous opacity monitoring system
EIB	Environmental Improvement Board
EPA	United States Environmental Protection Agency
gr./100 cf	grains per one hundred cubic feet
gr./dscf	grains per dry standard cubic foot
GRI	Gas Research Institute
HAP	hazardous air pollutant
hp	horsepower
H ₂ S	hydrogen sulfide

IC	internal combustion
KW/hr	kilowatts per hour
lb/hr	pounds per hour
lb/MMBtu	pounds per million British Thermal Unit
MACT	Maximum Achievable Control Technology
MMcf/hr	million cubic feet per hour
MMscf	million standard cubic feet
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NG	natural gas
NGL	natural gas liquids
NMAAQs	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statues Annotated
NO _x	nitrogen oxides
NSCR	non-selective catalytic reduction
NSPS	New Source Performance Standard
NSR	New Source Review
PEM	parametric emissions monitoring
PM	particulate matter (equivalent to TSP, total suspended particulate)
PM ₁₀	particulate matter 10 microns and less in diameter
PM _{2.5}	particulate matter 2.5 microns and less in diameter
pph	pounds per hour
ppmv	parts per million by volume
PSD	Prevention of Significant Deterioration
RATA	Relative Accuracy Test Assessment
RICE	reciprocating internal combustion engine
rpm	revolutions per minute
scfm	standard cubic feet per minute
SI	spark ignition
SO ₂	sulfur dioxide
SSM	Startup Shutdown Maintenance (see SSM definition)
TAP	Toxic Air Pollutant
TBD	to be determined
THC	total hydrocarbons
TSP	Total Suspended Particulates
tpy	tons per year
ULSD	ultra low sulfur diesel
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator Coordinate system
UTMH	Universal Transverse Mercator Horizontal
UTMV	Universal Transverse Mercator Vertical

VHAP.....volatile hazardous air pollutant
VOC volatile organic compounds