paleontological resources within the Big Sandy Valley.

3.2.2.6 Mitigation and Residual Impacts

If adopted, the following measures would be implemented to avoid or reduce significant impacts:

- If unknown invertebrate fossils (or suspected invertebrate fossils) are encountered, construction activities in the immediate area would cease and a qualified paleontologist would be contacted. Construction activities would not re-commence until the area is cleared, or the area is avoided.

- If the eastern portion of corridor segment T5 more than 100 feet east of the Mead-Phoenix Project 500-kV transmission line right-of-way is selected for construction, a paleontological field survey would be conducted at the crossings of Sycamore Creek and Bitter Creek. If significant fossil localities are found in these areas, construction activities would not re-commence until the area is cleared, or the area avoided.

With the implementation of these measures, there would be no residual significant impacts.

3.3 SOILS

This section describes the affected environment and environmental consequences as they relate to soils in the vicinity of the Proposed Action.

3.3.1 Affected Environment

The following sections describe the various soils in the vicinity of the Proposed Action. The location and description of each soil type serves as a baseline for the assessment of environmental consequences, and assists in determining appropriate mitigation measures.

3.3.1.1 Region of Influence

The region of influence for assessing impacts on soils includes the power plant site and ancillary facilities, access roads, rights-of-way where ground-disturbing activities (e.g., water pipelines) could occur, the proposed gas pipeline corridor, the alternate gas pipeline corridors, and the areas of disturbance associated with the potential installation of the OPGW. The region of influence also is considered to be all surface areas that could be impacted by soil erosion.

3.3.1.2 Existing Conditions

Soils in the region of influence were surveyed and mapped by the Natural Resources Conservation Service (NRCS) in 1974. The survey is described by the NRCS as "tentative and subject to revision, correction, or completion," and has not yet been published. The soils survey data were compiled onto a map and described in the *Big Sandy Energy Project Soils Report* (Caithness 2000).

Figures 3.3-1 through 3.3-4 (taken from the above-named soils report) show 36 soil map units in the region of influence, based on the soils survey data provided by the NRCS. These figures also show locations of steep slopes (greater than 20 percent) and identify four areas along the corridors where steep slopes coincide with soil types that have severe or very severe erosion potential. Mapping of potential pulling and tensioning sites for the OPGW installation was not done, since these have not yet been located.

- The 36 soil map units presented on Figures 3.3-1 through 3.3-4 represent 25 soil types or associations, which are listed in Table 3.3-1 by soil name and associated map unit number(s). Table 3.3-1 includes the description, setting, and parent material of each soil type/association, range in slope, percentage rock fragments, permeability, runoff, depth, drainage, pH, water erosion hazard, wind erosion hazard, and shrink-

swell potential. Table 3.3-1 also indicates whether each soil type falls within the footprint of the proposed power plant site and ancillary facilities, or within any of the pipeline corridor segments. Of the 36 soil map units, 25 are intersected by either the proposed power plant site and/or pipeline corridor segments.

- It should be noted that the 1974 soils survey was not completed in Township 21 North, in corridor segment T1, in the vicinity of I-40. For this area, the NRCS STATSCO database (NRCS 1998) was used to identify the two soil associations included at the end of the bulleted list (Romero-Rock Outcrop-Gila and Continental-Rillino-Gila). The other 23 entries are soil types.

In general, most of the soils within the Project area are classified as gravelly sandy loam derived from alluvium from mixed sources. The soils typically are alkaline, and the percentage of rock fragments is high. Slopes range from 1 to 70 percent. Most soils are deep and well drained, with slow to moderate permeability and slow to medium runoff. Water erosion hazard typically ranges from moderate to severe, whereas wind erosion hazard ranges from slight to moderately high. Shrink-swell potential is low for most soil types.

A preliminary geotechnical evaluation of the proposed power plant site was performed (Westech 2000). The geotechnical report includes detailed descriptions of subsurface soils to depths of 30 feet below ground surface. The report describes the soils at the proposed power plant site as severely corrosive to concrete, and recommends that Type V (or equivalent) sulfate-resistant cement be used.

Some soil types are known to uniquely support special status species. The only known threatened or endangered plant species that is dependent on a unique soil in the region of influence is the Arizona cliffrose, which grows only on Tertiary limestone lakebed deposits and is restricted to the nutrient-poor lakebed clays. There are two small deposits along corridor segment T5 and others may exist.

3.3.2 Environmental Consequences

The following sections outline the environmental issues related to soils, the significance criteria used in assessing impacts, and the methodology and conclusions of the impact assessment. Also described are measures that would be used to prevent significant impacts on soils.

3.3.2.1 Identification of Issues

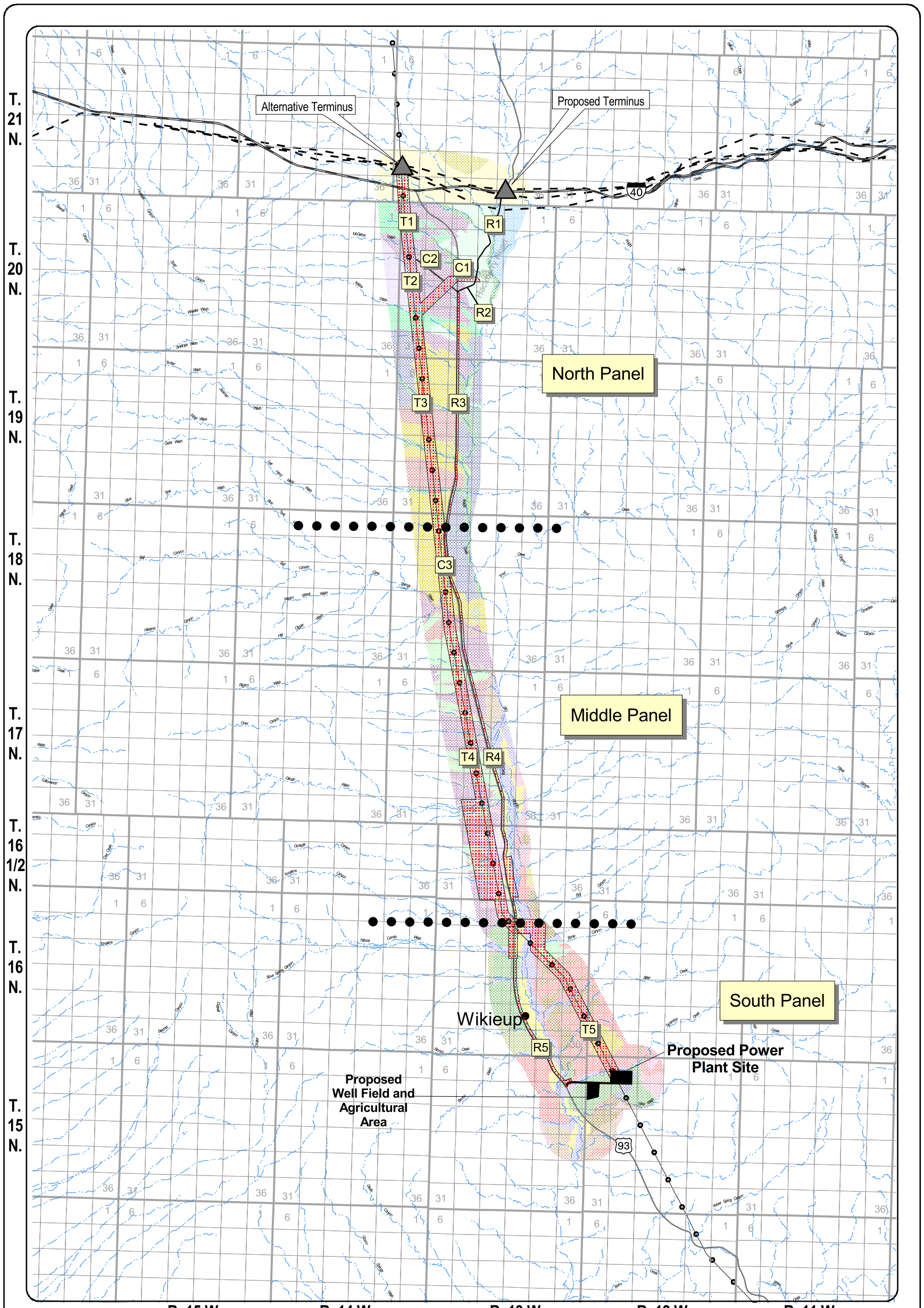
The primary issues related to soils that form the basis for the assessment of potential impacts are as follows:

- potential impacts on soils from wind or water erosion
- potential impacts on soils that uniquely support special status plant species

3.3.2.2 Significance Criteria

The effects of the Proposed Action or alternatives would be considered significant if any of the following were to occur:

- proposed construction on areas of steep slopes (greater that 20 percent) that coincide with soils having a high or severe erosion potential, where mitigation cannot reduce impacts
- loss of soils that uniquely support threatened or endangered plant species
- alterations of stormwater runoff from the Proposed Action that could cause substantial soil erosion



Legend

Soil Types are Indentified on the Individual Soil Panel Maps

Project Components

- Pipeline Corridor Segments
  - Proposed Pipeline Corridor - R1,C1,T3,C3,T4,R5
  - Alternative R Corridor - R1,R2,R3,C3,R4,R5
  - Alternative T Corridor - T1,T2,T3,C3,T4,T5
- Proposed Plant Facilities

General Reference

- Existing Pipelines
- Mead-Liberty/Mead-PhoenixTransmission Lines
- Stream/River
- Interstate (40)
- U.S. Route (93)

Soils Key Map

Big Sandy Energy Project EIS

0 5

Scale in Miles

Universal Transverse Mercator Projection
1927 North American Datum
Zone 12

N

Figure 3.3-1

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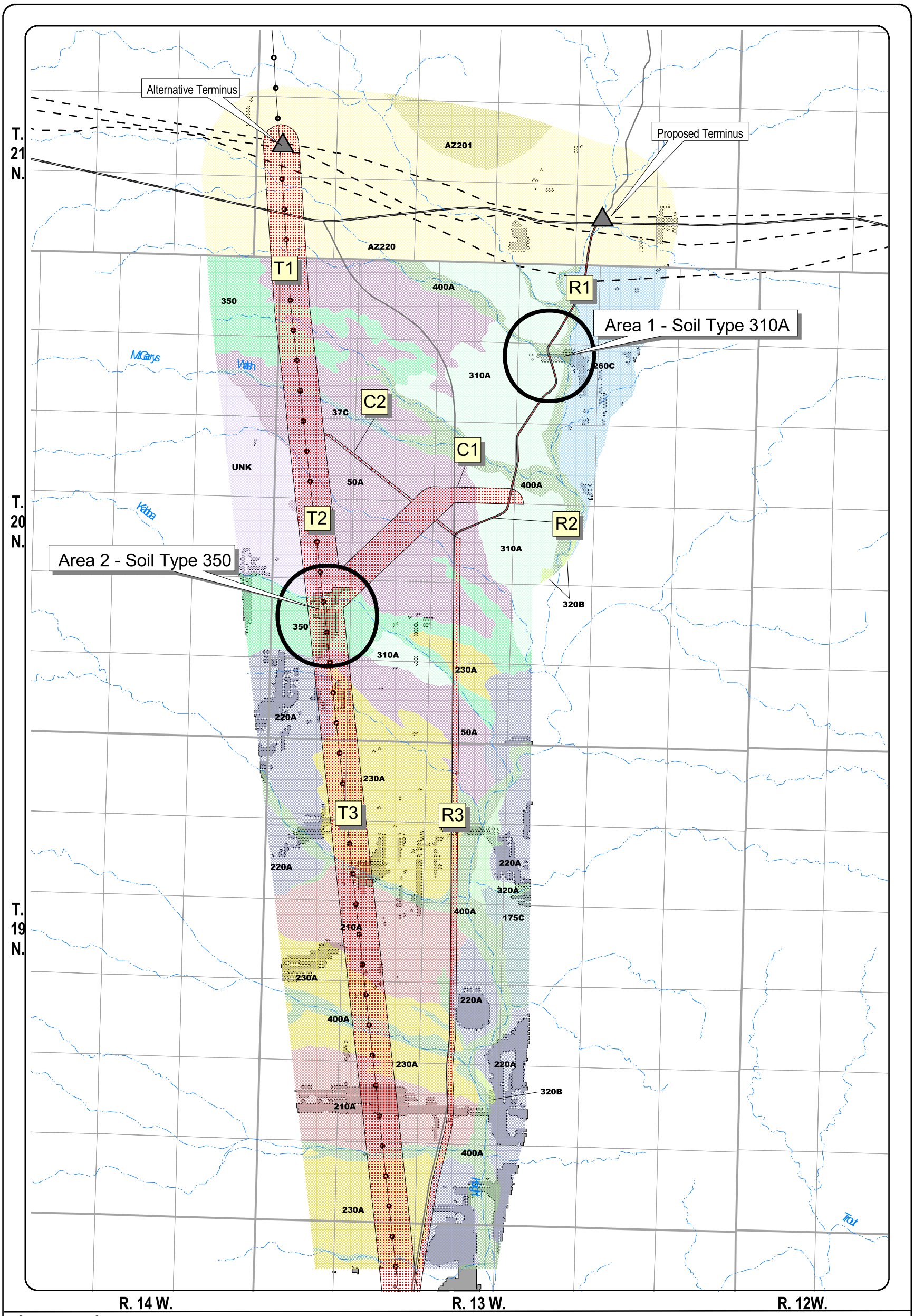

Legend

Resource Components
- 175C Wikieup-Rock outcrop complex, 20-60 percent slopes
- 210A Vekol gravelly loamy sand, dry, 2-7 percent slopes
- 220A Nickel-Topawa family-Eba family complex, 10-50 percent slopes
- 230A Mohon-Kinley complex, 2-5 percent slopes
- 260C Goodsprings gravelly loam, 10-5 percent slopes
- 310A Kinley gravelly loamy sand, 15-35 percent slopes
- 320A Gila-Glendale complex, 1-3 percent slopes
- 320B Gila-Glendale complex, 1-3 percent slopes
- 350 White House family very gravelly loamy sand, 2-15 percent slopes
- 37C Arizo-Franconia-Riverwash complex, 1-3 percent slopes
- 400A Ireteba-Arizo complex, 1-3 percent slopes
- 50A Dutchflat fine sandy loam, 1-3 percent slopes
- AZ201 Romero-Rock Outcrop-Tombstone
- AZ220 Continental-Rillino-Gila
- UNK Areas of Slope Greater than or Equal to 20%

Project Components
- Pipeline Corridor Segments
  - Proposed Pipeline Corridor - R1,C1,T3,C3,T4,R5
  - Alternative R Corridor - R1,R2,R3,C3,R4,R5
  - Alternative T Corridor - T1,T2,T3,C3,T4,T5
- Proposed Plant Facilities

General Reference
- Existing Pipelines
- Mead-Liberty/Mead-PhoenixTransmission Lines
- Stream/River
- Interstate (40) / U.S. Route (93)

Scale in Miles: 0 1 2

Universal Transverse Mercator Projection
1927 North American Datum
Zone 12

N

Soils - North Panel

Big Sandy Energy Project EIS

Figure 3.3-2

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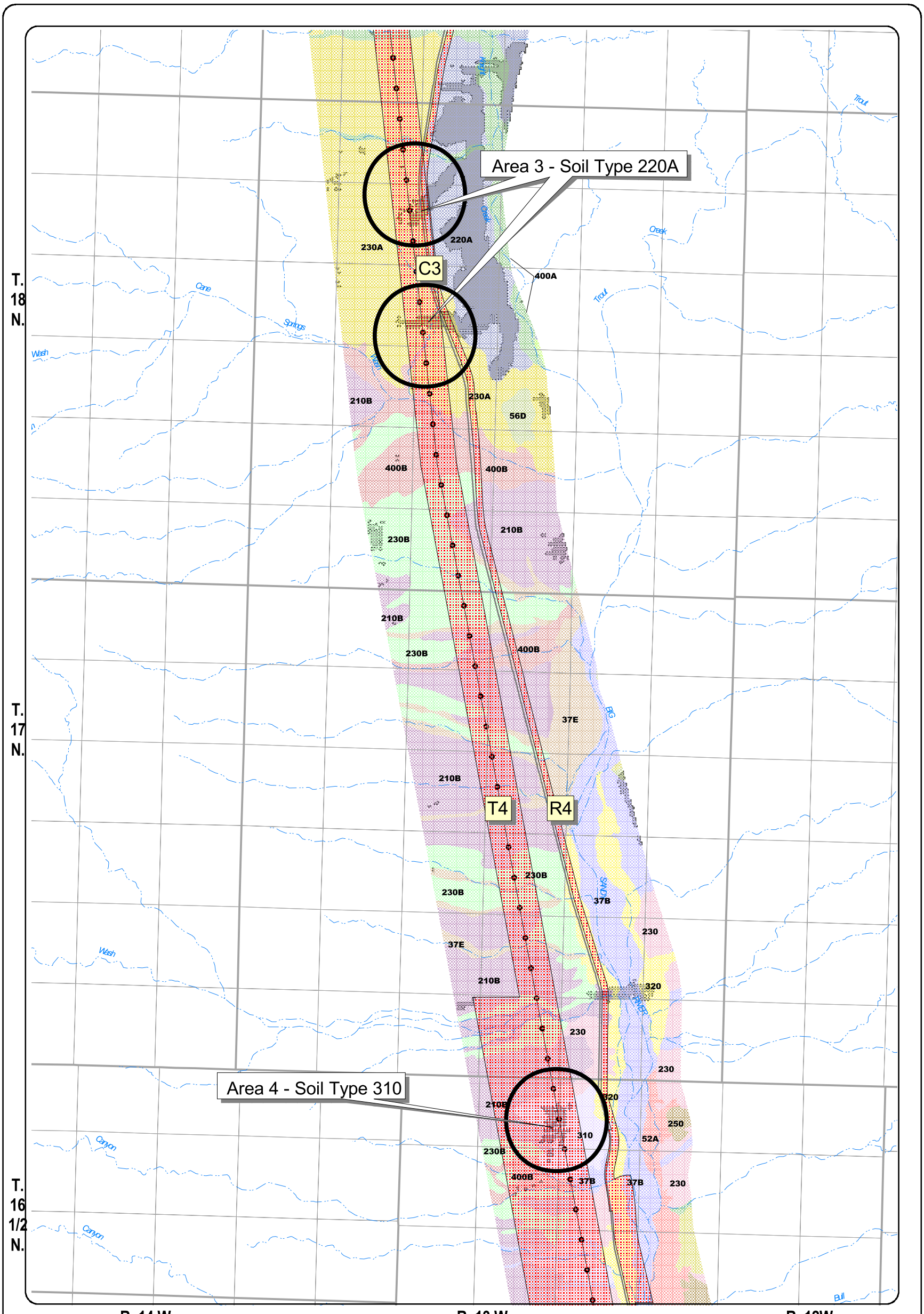

Legend

- 210 Vekol gravelly loamy sand, dry, 2 to 7 percent slopes
- 210B Vekol gravelly loamy sand, 2 to 7 percent slopes
- 220A Nickel-Topawa family-Eba family complex, 10 to 50 percent slopes
- 220B Stagecoach-Topawa-Eba complex, 10 to 50 percent slopes
- 230 Continental-Rillino complex, dry, 2 to 15 percent slopes
- 230A Mohon-Kinley complex, 2 to 15 percent slopes
- 230B Continental-Rillino complex, 2 to 15 percent slopes
- 250 Torriorthents, dry, 35 to 65 percent slopes
- 250B Torriorthents, 35 to 60 percent slopes
- 310 Rillino gravelly loamy sand, 15 to 35 percent slopes
- 320 Gila-Glendale complex, dry, 1 to 3 percent slopes
- 320B Gila-Glendale complex, 1 to 3 percent slopes
- 37B Kokan-Vinton-Riverwash complex, dry, 1 to 3 percent slopes
- 37E Kokan-Vinton-Riverwash complex, 1 to 3 percent slopes
- 400A Ireteba-Arizo complex, 1 to 3 percent slopes
- 400B Anthony-Kokan complex, 1 to 3 percent slopes
- 52A Cacique extremely gravelly loam, 1 to 7 percent slopes
- 56D Wikieup-Rock outcrop complex, 20 to 60 percent slopes
- Areas of Slope Greater than or Equal to 20%

Project Components

- Pipeline Corridor Segments
  - Proposed Pipeline Corridor - R1,C1,T3,C3,T4,R5
  - Alternative R Corridor - R1,R2,R3,C3,R4,R5
  - Alternative T Corridor - T1,T2,T3,C3,T4,T5
- Proposed Plant Facilities

General Reference

- Existing Pipelines
- Mead-Liberty/Mead-PhoenixTransmission Lines
- Stream/River
- Interstate (40)
- U.S. Route (93)

Soils - Middle Panel

Big Sandy Energy Project EIS

N

Scale in Miles
0 1 2

Universal Transverse Mercator Projection
1927 North American Datum
Zone 12

x:/bigsandy/projects/Soils.apr

Figure 3.3-3

T. 16 1/2 N.

T. 16 N.

T. 15 N.

R. 13 W.

R. 12W.

T4

R4

R5

T5

Wikieup

Proposed Power Plant Site

Proposed Well Pad and Agricultural Area

Bull Canyon

Boner Canyon

Bitter Creek

Sycamore Creek

Bronco Creek

Bronco Wash

Gray Wash

93

Legend

- 150A Continental-Dona Ana complex, dry, 2 to 15 percent slopes
- 190A Stagecoach very gravelly sandy loam, dry, 5 to 35 percent slopes
- 210 Vekol gravelly loamy sand, dry, 2 to 7 percent slopes
- 210B Vekol gravelly loamy sand, 2 to 7 percent slopes
- 220 Stagecoach-Topawa-Eba complex, dry, 10 to 50 percent slopes
- 220B Stagecoach-Topawa-Eba complex, 10 to 50 percent slopes
- 230 Continental-Rillino complex, dry, 2 to 15 percent slopes
- 230B Continental-Rillino complex, 2 to 15 percent slopes
- 250 Torriorthents, dry, 35 to 65 percent slopes
- 250B Torriorthents, 35 to 60 percent slopes
- 310 Rillino gravelly loamy sand, 15 to 35 percent slopes
- 320 Gila-Glendale complex, dry, 1 to 3 percent slopes
- 37B Kokan-Vinton-Riverwash complex, dry, 1 to 3 percent slopes
- 400B Anthony-Kokan complex, 1 to 3 percent slopes
- 52A Cacique extremely gravelly loam, 1 to 7 percent slopes
- 56 Cellar-Rock outcrop complex, dry, 20 to 60 percent slopes
- 56F Cellar-Rock outcrop complex, 20 to 60 percent slopes
- 80C Cline very stony loam, dry, 2 to 15 percent slopes
- 80F Cline very stony loam, dry, 40 to 70 percent slopes
- 95B Alela-Rock outcrop-Rubble land complex, dry, 40-70 percent slopes
- Areas of Slope Greater than or Equal to 20%

Project Components

- Pipeline Corridor Segments
  - Proposed Pipeline Corridor - R1,C1,T3,C3,T4,R5
  - Alternative R Corridor - R1,R2,R3,C3,R4,R5
  - Alternative T Corridor - T1,T2,T3,C3,T4,T5
- Proposed Plant Facilities

General Reference

- Existing Pipelines
- Mead-Liberty/Mead-PhoenixTransmission Lines
- Stream/River
- Interstate (40)
- U.S. Route (93)

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Soils - South Panel

Big Sandy Energy Project EIS

N

Scale in Miles

0 1 2

Universal Transverse Mercator Projection
1927 North American Datum
Zone 12

Figure 3.3-4

TABLE 3.3-1
SOILS

Map Unit No.	Intersected by Pipeline or Plant Site	Soil Name	Soil Description and Setting	Slope (%)	Parent Material	Rock Fragments (%)	Permeability	Runoff	Depth and Drainage	pH	Water Erosion Hazard	Wind Erosion Hazard	Shrink-Swell Potential
150A	T5	Continental - Dona Ana Complex	Gravelly sandy loam to clay loam formed on alluvial fans and fan terraces (50 percent Continental, 25 percent Dona Ana).	2 – 15	alluvium from sedimentary and igneous rocks	<15	slow to moderate	slow to medium	deep, well drained	slightly acid to moderately alkaline	moderate	slight	moderate to high
175C	--------	Wikieup-Rock Outcrop Complex	Extremely cobbly coarse sandy loam formed on hills and mountains.	20 – 60	alluvium and colluvium from igneous and metamorphic rocks	35 – 70	moderately rapid	very rapid	very shallow to shallow, well drained	slightly to moderately alkaline	severe	slight	low
56D	--------												
190A	--------	Stagecoach	Very gravelly sandy loam formed on fan terraces.	5 – 35	alluvium from mixed sources	35 – 85	moderately rapid	medium	very deep, well drained	slightly to strongly alkaline	slight	slight	low
210	PS, R4, R5, T5	Vekol	Gravelly loamy sand formed on basin floors.	2 – 7	alluvium from mixed sources	0 – 50	slow	slow	deep, well drained	moderately alkaline	moderate	moderately high	high
210A	R3, T3												
210B	R4, T4												
220	R5	Stagecoach-Topawa-Eba Complex	Very gravelly sandy loam formed on fan terraces (35 percent Stagecoach, 30 percent Topowa, 25 percent Eba).	10 – 50	alluvium from mixed sources	35 – 85	slow to moderately rapid	slow to medium	very deep, well drained	slightly to strongly alkaline	severe	slight	low to high
220B	--------												
220A	C3, R3, T3	Nickel-Topawa Family-Eba Family Complex	Gravelly sandy loam formed on fan terraces, erosional fan remnants, and alluvial flats (35 percent Nickel, 30 percent Topawa, 25 percent Eba).	10 - 50	alluvium from mixed igneous and metamorphic sources	35 – 75	slow to moderately slow	slow to medium	very deep, well drained	neutral to strongly alkaline	severe to very severe	slight	low to high
230	R4, T4	Continental-Rillino Complex	Gravelly sandy loam to gravelly fine sandy loam formed on fan terraces (50 percent Continental, 35 percent Rillino).	2 – 15	alluvium from mixed sources	15 – 35	slow to moderate	slow to medium	very deep, well drained	slightly acid to moderately alkaline	moderate	slight	low
230B	R4, T4												
230A	C3, R3, R4, T3, T4	Mohon-Kinley Complex	Gravelly sandy loam to very cobbly loam formed on fan terraces (50 percent Mohon, 35 percent Kinley).	2 – 15	alluvium from volcanic rocks and mixed sources	0 – 35	slow to moderately rapid	medium	very deep, well drained	slightly to moderately alkaline	moderate	slight to moderately high	low
250	T5	Torriorthents	Soils formed on the distal portions of fans and lake-bed deposits.	35 – 65	alluvium from fans and lake-bed deposits		variable	very rapid	variable depth, well drained	--------	very severe	slight	variable
250B	--------												
260C	R1	Goodsprings	Gravelly loam formed on alluvial fans and valley-fill plains.	10 – 35	alluvium from limestone and sandstone	15 – 35	moderate	medium to rapid	shallow, well drained, soil over a lime-cemented hardpan	moderately to very strongly alkaline	severe	slight	low
310	R4, T4	Rillino	Gravelly loamy sand formed on fan terraces.	10 – 35	alluvium from mixed sources	15 – 35	moderate	rapid	deep, well drained	moderately alkaline	severe	moderately high	low
310A	C1, R1, R2, R3	Kinley	Gravelly sandy loam formed on fan terraces.	15 – 35	alluvium from mixed sources	15 – 35	moderately rapid	medium to rapid	very deep, well drained	slightly to moderately alkaline	severe	moderately high	low
320	R4, R5, T5	Gila-Glendale Complex	Loam formed on alluvial fans and floodplains (50 percent Glendale, 30 percent Gila).	1 – 3	stratified alluvium from mixed sources	0 – 15	moderate	slow	deep, well drained	neutral to very strongly alkaline	moderate to moderately high	moderate to moderately high	moderate
320A	--------												
320B	--------												
350	C1, R3, T1, T2, T3	White House Family Loamy Sand	Very gravelly loamy sand formed on fan terraces.	2 – 15	alluvium from mixed sources	<35	slow to very slow	slow to medium	very deep, well drained	moderately acid to moderately alkaline	slight to severe	slight to moderately high	high

TABLE 3.3-1
SOILS

Map Unit No.	Intersected by Pipeline or Plant Site	Soil Name	Soil Description and Setting	Slope (%)	Parent Material	Rock Fragments (%)	Permeability	Runoff	Depth and Drainage	pH	Water Erosion Hazard	Wind Erosion Hazard	Shrink-Swell Potential
37B	R4, R5, T4, T5	Kokan-Vinton-Riverwash Complex	Coarse sandy loam to very gravelly coarse sand formed on alluvial fans and in washes (40 percent Kokan, 30 percent Vinton, 20 percent Riverwash).	1 – 3	alluvium from mixed sources	--------	moderately rapid to very rapid	very slow to medium	deep, excessively drained	neutral to strongly alkaline	slight	moderately high	low
37E	R4, T4												
37C	T1	Arizo-Franconia-Riverwash Complex	Sandy loam to very gravelly fine sand formed on alluvial fans, stream terraces, and floodplains (40 percent Arizo, 30 percent Franconia, 20 percent Riverwash).	1 – 3	alluvium from mixed sources	0 – 85	moderate to very rapid	very slow to medium	very deep, excessively drained	neutral to strongly alkaline	slight	slight	low
400A	R1, R3, T3	Iretiba-Arizo Complex	Loam to very gravelly fine sand formed on alluvial fans, stream terraces, floodplains and flat basins (45 percent Iretiba, 30 percent Arizo).	1 – 3	alluvium from mixed sources	0 – 85	moderately rapid to rapid	very slow to medium	very deep, excessively drained	neutral to strongly alkaline	slight	slight	low
400B	R4, T4	Anthony-Kokan Complex	Gravelly sand to sandy loam formed on alluvial fans and floodplains (45 percent Anthony, 30 percent Kokan).	1 – 3	stratified and wash alluvium from mixed sources	5 – 70	moderately rapid to very rapid	very slow to medium	very deep, well drained	neutral to strongly alkaline	slight	slight	low
50A	C1, C2, R2, R3, T1, T2	Dutchflat	Fine sandy loam formed on fan terraces.	1 – 3	alluvium from igneous and metamorphic sources	<35	moderate	medium	very deep, well drained	slightly to moderately alkaline	slight	moderately high	moderate
52A	R5, T5	Cacique	Extremely gravelly loam formed on basin floors.	1 – 7	sandy alluvium	--------	moderately slow	medium	moderately deep, well drained	slightly to moderately alkaline	moderate	slight	moderate
56	PS	Cellar-Rock Outcrop Complex	Very gravelly sandy loam formed on hills and mountains (50 percent Cellar, 25 percent Rock Outcrop).	20 – 60	slope alluvium from granitic rock	30 – 60	moderately rapid	--------	shallow to very shallow, somewhat excessively drained	slightly acid to moderately alkaline	very severe	very slight	low
56F	--------												
80C	T5	Cline	Very stony loam formed on mesas.	2 – 70	alluvium from volcanic rock	35 – 70	moderate	medium to rapid	shallow to very shallow, well drained	slightly alkaline	moderate	slight	low
80F	--------												
95B	--------	Akela-Rock Outcrop-Rubble Land Complex	Very gravelly loam formed on uplands, rolling hills, and basalt mountain sides.	40 – 70	alluvium from basalt and rhyolitic tuff	35 – 80	moderate	medium to rapid	shallow, well drained	---------	high	slight	low
AZ201	--------	Romero-Rock Outcrop-Tombstone Association	Gravelly sandy loam to very gravelly loam formed on pediments, hills, and mountains.	3 – 35	slope alluvium from schist or granitic rock	35 – 90	moderately rapid	medium	shallow to very shallow, well drained	slightly acid to mildly alkaline	moderate to high	low	--------
AZ220	R1, T1	Continental-Rillino-Gila Association	Loam to gravelly loam formed on lower mountain slopes.	0 – 10	alluvium from mixed sources	---------	slow to moderate	slow to medium	deep, well drained	slightly acid to moderately alkaline	slight to moderate	slight to moderate	--------

PS = Proposed plant site
C1-C3, R1-R5, T1-T5 = Gas pipeline corridor segments

3.3.2.3 Impact Assessment Methods

In order to assess the potential impacts on soils within the region of influence, soil survey maps and reports from available sources were compiled and reviewed, including all relevant reports prepared by Caithness and its consultants, as well as reports and maps prepared by the NRCS. The objective of this task was to independently evaluate and verify the accuracy and comprehensiveness of information provided by Caithness and supplement this information as needed. The data compilation and review resulted in the preparation of Figures 3.3-1 through 3.3.-4, and Table 3.3-1.

After data were compiled and reviewed, and information provided was verified, potential direct and indirect impacts on soils were assessed. Particular consideration was given to the identified issues described in Section 3.2.2.1, and the significance criteria described in Section 3.3.2.2 to assess whether significant impacts potentially could occur.

3.3.2.4 Actions to Reduce or Prevent Impacts Incorporated Into the Proposed Action

The Proposed Action includes the following measures to reduce or prevent adverse environmental impacts on soils:

- During design, the pipeline would be routed to avoid steep slopes, if at all possible. OPGW pulling and tensioning sites would be sited to avoid steep slopes.
- For segments of the pipeline corridor that cannot be altered to avoid steep slopes and erosive soils, soil loss would be minimized during revegetation through the use of erosion control measures such as mulching, water bars, silt fences, and staked hay bales. Section 2.2.8.5 describes the erosion control measures proposed in more detail.
- No permanent access would be built along the pipeline corridor, and steep washes would be inspected on foot.
- Grading would be done only where necessary.
- Local soil conservation specialists would be consulted to select the best seed mixes and best management practices (BMPs) for soils disturbed by the Proposed Action. The BLM Kingman Field Office will have the final approval on plant seed mixes on BLM-managed lands within the Project area.
- Soil loss from wind erosion during construction would be controlled through implementation of standard BMPs for controlling fugitive dust emissions, including wet suppression, limiting vehicle speeds, chemical suppression, physical suppression, and vegetative stabilization. The dust control measures included in the Proposed Action are listed in Section 2.2.8.1.
- The potential impacts of expansive soils would be minimized through avoidance or the use of special engineering and construction methods.
- If excessive percentages of rock fragments were encountered during pipeline construction, potential impacts would be reduced through the use of sand or other bedding material, which would assist in preventing damage to the pipeline.
- The potential impacts of corrosive soils would be avoided through the use of corrosion-resistant materials, such as Type V (or equivalent) sulfate-resistant materials.

3.3.2.5 Impact Assessment

Proposed Action

Soil Erosion

The potential for soil loss through water and wind erosion is of primary concern. Many of the soils that would be impacted during construction are susceptible to water erosion and, to a lesser extent, wind erosion.

Soil erosion can occur wherever ground is disturbed. The Proposed Action (the power plant and associated facilities and the proposed pipeline) would involve the permanent or temporary disturbance of land. Erosion potential is dependent on several factors, including slope, vegetation cover, climate, and the physical and chemical characteristics of the soil. Increased soil erosion may occur when vegetation is removed during construction or in areas where the surface is disturbed by heavy equipment. Compaction of soils, loss of topsoil, and mixing of topsoils and subsoils may inhibit natural revegetation, which may cause increased soil erosion and further loss of soils after construction is complete. Increased water erosion may reduce the productivity of the soil as well as affect the water quality of streams by accelerated sediment loading. Loss of productivity of grazing land due to soil compaction and/or increased erosion may result from Project activities.

Steep slopes (exceeding 20 percent) were mapped in the vicinity of the power plant and along the pipeline corridors. No steep slopes occur in the footprint of the power plant and associated facilities, including the wells and access road. Steep slopes do exist along the pipeline corridors, as shown on Figures 3.3-2 through 3.3-4. Significant impacts could occur where these steep slope areas coincide with soils having high or severe erosion potential. Figures 3.3-2 through 3.3-4 identify four such areas of potentially significant impact within the pipeline corridors:

- Area 1 – in corridor segment R1
- Area 2 – at the intersection of corridor segments T2, T3, and C1
- Area 3 – in corridor segment C3
- Area 4 – in corridor segment T4 near the Carrow-Stephens Ranches ACEC

All four areas are located within the proposed pipeline corridor. Crossing Area 1 in corridor segment R1 would not result in significant impacts, since the pipeline alignment would fall within the already-graded Hackberry Road right-of-way. Area 2 may be difficult to avoid, since it extends almost the entire width of the corridor. Area 3 could be avoided if the final alignment is sited in the western portion of the corridor. Area 4 could be avoided with a route along the western side of the corridor, outside the Carrow-Stephens Ranches ACEC.

If the final alignment falls within these areas, the measures included in the Proposed Action to minimize soil loss in areas of steep slopes that cannot be avoided would reduce these impacts to less than significant.

Erosion also is of concern in the installation of the OPGW for the redundant communication system. However, selection of OPGW pulling and tensioning sites would avoid steep slopes and utilize already disturbed areas to the extent feasible along the Mead-Liberty 345-kV transmission line right-of-way, thus eliminating or minimizing adverse impacts to soils. The microwave dishes would be installed on existing towers and would have no impact on soils.

Trenching for the gas pipeline across the Big Sandy River would result in less than significant soil erosion. The directional drilling option for the crossing of Big Sandy River would result in less soil erosion than trenching.

Expansive Soils

Expansive soils tend to swell and increase in volume in response to increase in moisture content. Conversely, some soils tend to develop swell pressures if their volume change is restricted.

Special engineering and construction methods or avoidance are proposed for expansive soils encountered during construction. The geotechnical report describes the soils in the vicinity of the spring near the proposed power plant as highly expansive and recommends that those soils be avoided during construction (Westech 2000). No adverse impact would be expected.

Rock Fragments

The percentages of rock fragments in each of the soil types are highly variable, but may range from less than 35 to more than 85 percent. Where the gas pipeline would be buried within soils with high rock fragment content, special construction methods would be employed to protect the pipeline from damage during and after construction. No adverse impact would be expected.

Corrosivity

Because sulfate-resistant cement would be used in areas with highly corrosive soils, no adverse impacts from corrosive soils would be expected.

Soils that Uniquely Support Threatened or Endangered Plant Species

The soil type that is known to uniquely support the Arizona cliffrose would not be affected by the Proposed Action. Therefore, no impacts related to this concern would be expected.

Alterations in Stormwater Runoff

There would be alterations to stormwater runoff from the construction activities that would occur in all locations. However, there are no areas of steep slopes in the proposed power plant area and very few steep areas along the proposed gas pipeline route or OPGW route. Also, environmental protection measures would be applied in all areas. Therefore, it is unlikely that substantial soil erosion would occur from stormwater diversions or changes in flow, and no significant impacts would be expected.

Alternative Gas Pipeline Corridors

Soil Erosion

Similar concerns with soil erosion would exist for the alternative gas pipeline corridors. There are areas of steep slopes located along both of these corridors, including the same four areas where steep slopes coincide with highly erodible soils as discussed under the Proposed Action (Figures 3.3-2 through 3.3-4). As discussed previously under the assessment of the Proposed Action, there may be alignments that can avoid these areas, except perhaps for Area 2, which extends across the corridor. Construction and operation of the alternative pipeline routes would include the same measures as described for the Proposed Action to reduce these impacts to below the level of significance.

Expansive Soils

Several of the soil types listed in Table 3.3-1 are described as having high, or low to high, shrink-swell potential, indicating that the soils are expansive. As with the Proposed Action, no adverse impacts from expansive soils encountered during pipeline construction would be expected.

Rock Fragments

As with the Proposed Action, no adverse impacts would be expected.

Corrosivity

Because sulfate-resistant cement would be used in areas with highly corrosive soils, no adverse impacts from corrosive soils would be expected.

Soils that Uniquely Support Threatened or Endangered Plant Species

As with the Proposed Action, there would be no adverse impacts expected in the Alternative R gas pipeline corridor. The Alternative T gas pipeline corridor may cross exposures of the nutrient-poor calcareous soils that uniquely support the Arizona cliffrose. If these areas are not avoided, significant impacts may result.

Alterations in Stormwater Runoff

Alterations in stormwater runoff would be as described for the proposed pipeline, and no significant impacts would be expected.

No-Action Alternative

If the Proposed Action were not constructed there would be no impact on soils within the Big Sandy basin associated with the proposed Project. The groundwater production and monitoring wells and associated access roads and well pads completed on private land that were used to identify and test the lower aquifer would remain.

3.3.2.6 Mitigation and Residual Impacts

If adopted, the following measures would be implemented to avoid or reduce significant impacts:

- If corridor segment T5 is selected, the nutrient-poor calcareous soils derived from the Tertiary limestone lakebed deposits would be avoided.

If this measure is adopted, no residual impacts would remain.

3.4 GROUNDWATER

This section describes the affected environment and environmental consequences with regard to groundwater resources. Supporting information for this section is provided in Appendices D, E, and F.

3.4.1 Affected Environment

The following sections describe current groundwater conditions in the vicinity of the Proposed Action. The description of current conditions provides a baseline for the assessment of impacts and environmental consequences.

3.4.1.1 Region of Influence

The region of influence for assessing impacts on groundwater includes all aquifers within the southern portion of the Big Sandy groundwater basin that potentially could be impacted by groundwater pumping to supply the proposed Project, or by discharge of pollutants from the evaporation pond or any other activities related to the Proposed Action.

3.4.1.2 Existing Conditions

Hydrogeologic Setting

The proposed power plant site, ancillary facilities, and gas pipeline corridors are located within the Big Sandy basin, a north-south trending alluvial groundwater basin that covers an area of approximately 800 square miles (Figure 3.4-1). The Big Sandy basin is located within the Basin and Range structural and physiographic province, a region of the southwestern United States characterized by alluvial basins and fault block mountain ranges. The basin is bounded by the Hualapai Mountains on the west and southwest, the Aquarius Cliffs and Aquarius Mountains on the east, the Cottonwood Mountains on the northeast, and the Peacock Mountains on the northwest (Davidson 1973).