3.3 Soils

The Quitchupah Creek Road alignment and all proposed Alternatives would traverse a total of three soil mapping units within Fishlake National Forest (which have been mapped and described by the USFS) and 39 soil mapping units on lands administered by the BLM, SITLA, and private lands (which were surveyed by NRCS in 2000). Soil boundaries and mapping unit designations within the entire Project Area are presented in Final Soils Technical Report, Quitchupah Creek Road EIS (JBR, 2001d).

Near the east end of the existing road are Quaternary deposits consisting of coarse sands to cobbles and boulders with minor fine sand and silt. These alluvial deposits make a substantial portion of the existing road surface.

Throughout the location of the proposed project there may be the possibility of slumping, soil creep, and rock fall that have not been identified on a published map or specifically observed in the field. Numerous slides, slumps, mass movement, and rock fall have occurred in the area in the past and would continue to take place in the future.

Shales and clays are interbedded with sandstones. These clays would have the potential of buckling, warping, slumping, and offsetting of the proposed road surface. Proper road construction techniques and construction designs would be implemented and followed in order to minimize these types of movements. Erosion and salinity are of particular importance to the project. Soil erodibility is based only upon the physical characteristics of a given soil. For water, erodibility is described by the erodibility factor (K) factor; it rates a soil's susceptibility to detachment and transport by rainfall and runoff. The rating is based upon the interaction of a given soil's properties, including texture, structure, and permeability; because it is based upon inherent soil properties, the K factor is not affected by vegetation that may or may not be present on a soil surface. K values can range from 0.02 to 0.69, with greater values representing higher inherent erodibility. Erosion hazard (by water) is a qualitative ranking that takes into account the soil's inherent erodibility (K value), the slope of the land on which the soil typically occurs, and the soil's permeability class. A given soil may have a high inherent erodibility (as described by its K value), but if it occurs on flat or low gradient slopes and has a rapid permeability, it would have a low erosion hazard ranking. Because of the presence of erodible saline soils, sediments produced by the erosion of saline soils can affect surface water quality.

Similarly, a Wind Erodibility Group (WEG) value is a wind erodibility grouping that indicates a soil's susceptibility to wind erosion based upon its particle resistance as described by the percentage of dry soil aggregates larger than 0.033 inches. WEG values range from one to eight with one being the most erodible; one subgroup is indicated by the letter L, denoting the presence of lime.

Salinity is a measure of a soil's soluble salts as measured by its electrical conductivity. Salinity can range from 0 to greater than 16 millimhos/centimeter. **Table 3.3-1** provides correlations for erodibility and salinity rating values and their standard qualitative descriptors of level.

Soils with water soluble minerals (salts) can be a special concern in road building due to uneven settling caused by improper road drainage.

Table 3.3-1 Soil Ratings and Descriptors

Numerical Rating	Description of Level	Numerical Rating	Description of Level	Numerical Rating	Description of Level

Wind Erodibility Group		K Value		Salinity	
8	non	.20 or less	low	0 to 2	non-saline
5,6,7	slight	.21-.40	moderate	2 to 4	slightly
3,4,4L	moderate	> .40	high	4 to 8	moderately
2	high			8 to 16	strongly
1	very high			> 16	very strongly

A summary of the soils present within the Project Area is presented in **Appendix G**. Their locations within the Proposed Action area are presented in **Figure 3-2.**

Limitations

The NRCS has developed criteria by which they assess the limitations of various soil types in regard to their potential uses. These limitations are typically contained in tables within published soil surveys. Because the Project Area soils mapping has not been conducted (Sevier County) or is in the initial stages (Emery County) (NRCS 2005), these tables have not yet been developed. However, because many of the soils are equivalent to soils in the Carbon Area survey, that information is applicable to much of the Project Area. In addition, some of the limitation-type information can be inferred from the soils descriptions even where the limitations tables have not been derived. Therefore, **Table 3.3-2** provides, where available or through synthesis of applicable data, some indication of limitations of the soils in regard to the proposed road construction project. Where information is not available, or cannot be derived from the available information, the symbol N/A (not available) is used.

Table 3.3-2 Soil Characterizations and Limitations Regarding Proposed Project

Soil Name	Typically poor for road fill[1]	Shrink swell concern[2]	Frost heave concern[3]	Inundation Class[4]	Erodibility Ratings[5]		Salinity Rating[6]
					Wind	Water	
Beebe	No	No	No	Rare	X	XX	X
Cabba	Yes	No	Yes	None	–	--	--
Chipeta	Yes	Yes	No	None	X	XX	XX
Chupadera	Yes	No	Yes	None	X	X	--
Clifsand	No	No	No	None	--	X	--
Colorow	No	No	Yes	Rare	X	X	--
Comodore	Yes	No	Yes	None	--	--	--
Datino Var.	Yes	No	Yes	None	--	--	--
Doney	Yes	No	Yes	None	--	--	--
Ferron	No	No	Yes	None	--	XX	XX
Gerst	Yes	Yes	Yes	None	--	--	--

Soil Name	Typically poor for road fill[1]	Shrink swell concern[2]	Frost heave concern[3]	Inundation Class[4]	Erodibility Ratings[5]		Salinity Rating[6]
					Wind	Water	
Beebe	No	No	No	Rare	X	XX	X
Glenberg	No	No	Yes	None	X	X	--
Green River	No	No	Yes	Frequent	X	XX	--
Greybull	Yes	No	No	None	X	X	--
Haverdad	No	Yes	Yes	None	X	X	--
Hernandez	No	No	Yes	None	X	X	--
Hunting	No	Yes	Yes	None	X	XX	XX
Juva Var.	No	No	Yes	None	X	X	--
Lazear	Not Known	No	No	None	--	X	--
Libbings	Yes	Yes	Yes	None	X	XX	XX
Minchey	No	Yes	Yes	None	X	X	--
Mivida	No	No	Yes	None	X	XX	--
Moffat	No	No	No	None	X	X	--
Pathead	Yes	No	Yes	None	--	--	–
Penoyer	No	No	Yes	None	X	XX	--
Persayo	Yes	Yes	No	None	X	X	XX
Pherson	No	No	Yes	None	X	X	--
Pinon	N/A	No	No	None	--	X	--
Podo	Yes	No	Yes	None	--	--	--
Ravola	No	No	No	None	X	XX	X
Shupert	No	Yes	Yes	None	--	X	--
Stormitt	Yes	No	Yes	None	--	--	--
Strych	No	No	Yes	None	--	--	--
Toddler	N/A	N/A	N/A	None	--	X	XX
Travessilla	Yes	No	Yes	None		X	--
Trook	No	No	No	None	X	X	--
USFS 21A	Yes	No	No	None	--	X	--
USFS 69	No	No	No	Rare	XX	XX	--

Soil Name	Typically poor for road fill[1]	Shrink swell concern[2]	Frost heave concern[3]	Inundation Class[4]	Erodibility Ratings[5]		Salinity Rating[6]
					Wind	Water	
Beebe	No	No	No	Rare	X	XX	X
USFS 78	Yes	No	No	None	--	–	--
Utaline	N/A	N/A	N/A	N/A	--	X	--
Winetti	No	No	Yes	No	--	--	--

-- = not of concern   X = moderate   XX = high for erodibility, strongly saline for salinity

[1]Soils may have properties that may adversely affect the stability of the roadbed.

[2]The shrinking of soil when dry and swelling when wet may affect roadbed stability.

[3]Frost heave causes the soil to expand upward affecting structures.

[4]The frequency of flooding at the soil surface.

[5]The susceptibility of the soil surface to erosion by water and wind.

[6]The relative amount of soluble salts in the soil profile.

Where the available data indicate a range of values that span different ratings, the upper value was used to determine the limitation.

Prime or Unique Farmlands

Several soils in the Project Area, in the vicinity of Quitchupah Creek, are classed by the NRCS as Prime Farmlands. Prime or unique farmlands are lands best suited to produce food, feed, fiber, forage, and oilseed crops. These soils meet the criteria only when irrigated. When not irrigated, these soils would be neither Prime Farmland nor would they be considered to be of "Statewide Importance" by the NRCS in Utah. They are mapping units TY (Green River-Juva Variant Complex), PeB (Penoyer Variant loam), TrC (Trook gravelly fine sandy loam), RIA2 (Ravola -Toddler Complex), RIB (Ravola loam), and CIC (Shupert-Winetti Complex). Only the Trook soil is irrigated. Within the Project Area, there are 20 acres of irrigable land and 145 acres of cultivated land.

Potential Impacts To Soils

The Environmental Consequences of each Alternative, in regard to soils, are discussed below. First, regulatory consequences are described and then potential impacts to the resource itself.

REGULATORY

The COE would oversee regulatory requirements in the areas where hydric soils are located (JBR, 2001d). Construction and related soil disturbance within areas mapped as Prime or Unique Farmlands would come under the Farmland Protection Policy Act, which regulates to minimize the impact Federal actions have on the unnecessary and irreversible conversion of farmland to non-agricultural use.

NO ACTION - ALTERNATIVE A

Soil resources would continue to respond to natural forces in the way they currently do, should the No Action Alternative be chosen. Soils that are erodible would continue to have the potential to easily erode, and saline soils would continue to supply salts to surface waters via runoff and sediments. Erosion of unmaintained two-track road would continue to produce sediments and salinity to Quitchupah Creek.

QUITCHUPAH CREEK ROAD ALIGNMENT - ALTERNATIVE B

Table 3.3-3 shows soil mapping units and approximate linear feet of each unit that would be disturbed for this alignment. It is organized by the approximate order in which the soils are encountered from west to east. Note that much of the area is within the existing road footprint and thus has been previously disturbed.

A comparison of **Tables 3.3-2** and **3.3-3** indicates that: approximately 9,200 feet or 19 percent of this alignment may cross soils that are typically poor for road fill; approximately 15,700 feet or 32 percent of this alignment may cross soils that have shrink-swell concerns; 17,300 feet or 36 percent of this alignment may cross soils that have frost heave concerns; and 5,800 feet or 12 percent of this alignment may have rare flooding problems and potential subsidence due to soluble salts. All of these soil characteristics can adversely affect the stability of the roadbed. The incorporation of 12 inches of granular borrow in the roadbed, and the option to use up to 36 inches of granular borrow and geotextile fabric in the construction of the roadbed in particularly unstable areas would, by design, overcome the poor soils conditions underlying the roadbed (JBR 2001d).

Approximately 40,700 feet or 87 percent of this alignment has the potential to cross soils with moderate or severe erodibility ratings and 9,000 feet or 18 percent has the potential to cross moderate to strongly saline soils. These numbers do not include the soils for which this information is not available. In addition, several of the soil mapping units in this area include rock outcrop and badlands, for which soils descriptions are not applicable because these miscellaneous land types are not considered as soil. Rock outcrops are stable and non-eroding, while Badlands are erodible and saline.

These limitations suggest that many of the areas presently disturbed by road construction activities have experienced increased erosion, either by wind or water. Given the proximity of the present alignment to Quitchupah Creek, increased erosion could be increasing sediment loading and increasing salinity to the stream. The inclusion of BMPs in the proposed road design for drainage control and subsequently for erosion and sedimentation, and reclamation of the existing road would help to reduce sediment loading and salinity in the creek from this source.

Table 3.3-3 Soil Disturbance by Mapping Units - Alternative B

Mapping Unit Designation	Major Soils In Unit	Approximate linear feet of disturbance
21A	Torriorthents with rock outcrop	1,700
69	Haplustolls	11,500
CIC	Shupert, Winetti	2,900
255	Gerst, Travessilla , Strych, Rock Outcrop	2,000
224	Mivida	2,500
569	Gerst, Strych, Badland	1,200
OCA2	Haverdad	3,700
GLC	Glenberg, Pherson, Colorow	4,500
TrC	Trook	5,000
131	Persayo, Badland, Rock Outcrop	2,800
RlA2	Ravola, Toddler	5,200

SMD2	Stormitt, Minchey	1,500
BeB	Beebe	1,000
PeB	Penoyer Variant	1,200
TY	Green River, Juva Variant	300
	Total	47,000

A simple application of the Universal Soil Loss Equation (USLE) was done to provide a general indication of the order-of-magnitude change in erosion rate from sheet erosion processes that may occur as a result of roadway disturbances (without the application of the proscribed BMPs). USLE calculates long-term average annual erosion rate in tons/acre/year based upon inputs of rainfall factor, soil erodibility factor, slope length/steepness factor, and cover/practices factor.

To perform this application, a conservative, worst-case type approach was used. By this, the steepest planned road cut or fill slope, of 2h:1v, was used to provide the slope steepness factor. A K factor represented by the worst-case native soils on the Project Area was used in the calculation, and the cover/practice factor was based upon essentially compacted, bare ground that has been seeded but with negligible growth.

Factors used were:

R = 30 (from old SCS statewide R factor map for Utah)
K = .55 (from NRCS mapping information)
LS = 9.5 based upon 2:1 slopes over a 30' length
CP = .8

This results in an estimated sheet erosion rate of 125 tons per acre per year from the disturbed road cut/fill areas. Using a conservative, appropriate area-derived sediment delivery ratio of .4, this estimate results in 50 tons/acre/year of sediment entering Quitchupah Creek from the disturbed, unreclaimed road fill/cut slope areas.

In contrast, the USLE equation was run using more of an existing scenario, assuming a typical plot of ground where the road disturbance would be would have the same R and K values, but that native slope would be 10 percent, length 100' and CP .29 due to some vegetative cover. This results in a background erosion rate of 2 tons/acre/year. Applying the same sediment delivery ratio of 0.4 gives an estimate of .8 tons/acre per year currently from that type of slope.

It is important to note that, for the background and for the roadbed conditions, the calculation represents only one scenario; in reality many other numbers for most of those factors would occur through both the entire watershed and the roadway disturbance, and expected calculation results would vary. Further, application of all of the applicant-committed measures and BMPs would greatly reduce this USLE calculated number; it is presented for illustrative purposes only.

It is also important to note that USLE predicts sheet erosion, not gullying or other forms or slope failure or mass wasting.

Soil characteristics and disturbance figures in **Tables 3.3-2** and **3.3-3** suggest that disturbed areas would experience moderate to severe erosion potential, either by wind or water. Erosion of soils would lead to localized declines in soil quantity, fine litter, and coarse woody debris, as well as increases in bulk density from compaction. Declines in the upper layer of soil, litter, and debris would diminish the quality of the soil structure by the loss of organic matter necessary for supporting vegetative growth. Vegetation would thus be less likely to establish and stabilize the soil, increasing the potential for further erosion. Increases in bulk density from compaction would lead to decreased infiltration and increased runoff, which may increase the TDS load to Quitchupah Creek (see Water Quality, Section 3.2). Measures would be implemented for erosion control, however, to reduce soil losses and compaction (see **Appendix B**).

Approximately 14,600 feet of this alignment would cross soils mapped as Prime or Unique Farmlands, none of which is currently irrigated, and therefore not considered Prime or Unique Farmland at this location. Approximately 600 linear feet (1.4 acres) of the alignment would be within irrigated pasture mapped as Trook gravelly fine sandy loam, a Prime or Unique Farmland.

ALTERNATE JUNCTION AND ALTERNATE DESIGN - ALTERNATIVE C

Table 3.3-4 shows soil mapping units and approximate linear feet of each unit that would be disturbed for this Alternative. Note that a significant part of the area is within the existing road footprint and so has been previously disturbed.

Table 3.3-4 Soil Disturbance by Mapping Units - Alternative C

Mapping Unit Designation	Major Soils In Unit	Approximate linear feet of disturbance
21A	Torriorthents with rock outcrops	1,700
69	Haplustolls	11,500
CIC	Shupert, Winetti	2,900
255	Gerst, Travessilla , Strych, Rock Outcrop	1,400
224	Mivida	8350
569	Gerst, Strych, Badland	4350
OCA2	Haverdad	3,700
GLC	Glenberg, Pherson, Colorow	1150
TrC	Trook	4550
131	Persayo, Badland, Rock Outcrop	6850
SlD2	Clifsand	250
MsB	Minchey, Clifsand	1550
NFE	Lazear, Pinyon, Gerst	200
NNE2	Gerst, Lazear, Badland	1,200
	Total	49,650

This alignment is the same as for Alternative B, except for the easternmost leg. Therefore, the impacts would be similar. A comparison of **Tables 3.3-2** and **3.3-4** indicates that: approximately 10,700 feet or

22 percent of this alignment may cross soils that are typically poor for road fill; approximately 19,400 feet or 40 percent of this alignment may cross soils that have shrink-swell concerns; 18,200 feet or 37 percent of this alignment may cross soils that have frost heave concerns; and 2,400 feet or five percent may have occasional flooding problems. The incorporation of 12 inches of granular borrow in the roadbed, and the option to use up to 36 inches of granular borrow in the construction of the roadbed in particularly unstable areas would, by design, overcome the poor soils conditions underlying it.

Approximately 42,800 feet or 86 percent of the alignment has the potential to cross soils with moderate or severe erodibility ratings and 6,000 feet or 12 percent has the potential to cross moderate to strongly saline soils. These limitations suggest that many of the areas presently disturbed by road construction activities have experienced increased erosion, either by wind or water. Given the proximity of the present alignment to Quitchupah Creek, increased erosion could be increasing sediment loading and increasing salinity to the stream. The inclusion of BMPs in the proposed road design for drainage control and subsequently for erosion and sedimentation, and reclamation of existing road would help to reduce sediment loading and salinity in the creek from this source.

The effects of soil loss and sediment production would be similar to that of Alternative B.

Approximately 10,400 feet of this alignment would cross soils mapped as Prime or Unique Farmlands; none of which is currently irrigated, and therefore not considered Prime or Unique Farmland at this location. Approximately 600 linear feet (1.4 acres) of the alignment would be within irrigated pasture mapped as Trook gravelly fine sandy loam, a Prime and Unique Farmland.

WATER HOLLOW ALTERNATE ALIGNMENT - ALTERNATIVE D

Table 3.3-5 shows soil mapping units and approximate linear feet of each unit that would be disturbed for this Alternative.

Table 3.3-5 Soil Disturbance by Mapping Units - Alternative D

Mapping Unit Designation	Major Soils In Unit	Approximate linear feet of disturbance
21A	Torriorthents with rock outcrops	1,700
69	Haplustolls	9,200
78	Ustorthents and rubblelands	2,400
CIC	Shupert, Winetti	2,300
MUE	Podo, Caba, Doney	400
261	Cabba, Strych, Badland	2,300
569	Gerst, Strych, Badland	4,100
OCA2	Haverdad	2,600
254	Gerst, Travessilla, Chupadera	19,800
AKC2	Hernandez, Chupadera	1,000
NNE2	Gerst, Lazear, Badland	3,000
255	Gerst, Travessilla, Strych, Rock Outcrop	1,100

Mapping Unit Designation	Major Soils In Unit	Approximate linear feet of disturbance
522	Moffat	3,000
Not Mapped	Not Mapped	6,500
	Total	59,400

The first two miles of this alignment would be the same as for Alternative B & C. Approximately 10 percent of the alignment would be in soils that have not yet been mapped by the NRCS. For the remaining soils, a comparison of **Tables 3.3-2** and **3.3-5** indicates that: approximately 31,700 feet or 54 percent of this alignment would cross soils that are typically poor for road fill; approximately 33,900 feet or 58 percent of this alignment would cross soils that have shrink-swell concerns; and 36,000 feet or 61 percent of this alignment would cross soils that have frost heave concerns. The incorporation of 12 inches of granular borrow in the roadbed, and the option to use up to 36 inches of granular borrow in the construction of the roadbed in particularly unstable areas would, by design, overcome the poor soils conditions underlying the roadbed.

Approximately 42,000 feet or 71 percent of alignment has the potential to cross soils with moderate or severe erodibility ratings. No moderate to strongly saline soils are crossed by this alignment. Several of the soil mapping units crossed by the alignment include rock outcrop and badlands, for which soils descriptions are also unavailable. Rock outcrops are stable and badlands erosive and saline. Effects of soil loss would be similar to Alternative B, although potential sediment introduction relative to Alternative B would be reduced. The incorporation of BMPs for drainage and erosion control would help to reduce the production of sediments from the road corridor. This alignment's distance from perennial waters would reduce the potential for eroded material to result in increased sediment loading.

Approximately 2,300 feet of this alignment would cross soils mapped as Prime or Unique Farmlands, none of which is currently irrigated, and therefore not considered Prime or Unique Farmland at this location.

MITIGATION AND MONITORING FOR BUILD ALTERNATIVES

Sources of fill material would need to be aggregate based and non-saline to reduce the potential for increased salinity within Quitchupah Creek (See **Appendix B)**. The road drainage system would be monitored for three years minimum to ensure it is fully functional; thus, reducing sediment discharge into the natural drainages.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES AND RESIDUAL ADVERSE IMPACTS

Depending on the alignment selected, between 45 and 55 acres of permanent disturbance would occur to soil resources. The selected Alternative would result in 92.3 to 146.3 total acres of disturbance, of which approximately 57 to 106 acres of soil resources would be reclaimed depending on the Alternative alignment that is selected. The Proposed Action would cross 600 feet of irrigated and 14,600 feet of non-irrigated Prime Farmland. For Alternative C, the same 600 feet of irrigated Prime and Unique Farmland would be crossed; however, 10,400 feet of non-irrigated Prime Farmland would be affected. Alternative D crosses 2,300 feet of non-irrigated Prime and Unique Farmland.

CUMULATIVE EFFECTS

Past and present impacts to soils include erosion due to the Quitchupah Creek road, livestock trailing/grazing, mining, and recreation. These uses and related activities may have contributed to exacerbated erosion of already erosion-prone soils. Approximately 25 to 30 percent of the proposed road alignment in the Quitchupah Creek area is located on erodible soils as defined by NRCS. The disturbance of erosive soils contributes sediments and salts to the creek. The Proposed Action would stabilize some of this erosion. Unstable soil areas could be a high maintenance item in the future as evidenced by maintenance requirements in the unstable areas within the SR-10 alignment. Reclaimed portions of the existing road surfaces (7.6, 5.6, or 1.8 acres depending on Alternative) would become available through natural processes for productivity. While the SUFCO mine's erosion is mitigated by BMPs and includes sedimentation reduction treatments such as silt fences, erosion from grazing remains untreated. The proposed project would also have the potential to contribute to erosion. Under all build alternatives, the BMPs and applicant committed measures have been designed to reduce soil erosion to the extent possible. The applicant committed measure to install riparian fencing on public land adjacent to Quitchupah Creek could also provide reductions in erosion over time. There would be no cumulative effects to soils.