



Star Valley Conservation District

Example of a subdivision review with significant natural resources concerns. In this case, the SVCD asked that future lot owners be given a copy of a geotechnical report completed for the site and plat warnings regarding active landslides and other hazards.

May 12, 2008

Lincoln County
Office of Planning and Development
P. O. Box 468
Kemmerer, WY 83101

STAR VALLEY CONSERVATION DISTRICT Board of Supervisors has reviewed the proposed James Ted Terry Salt River Ranch, LLC Forest River Reserve major subdivision south of Alpine, Wyoming.

Due to the severe soils, dormant and active landslides, slope and highly erodible soils on the property and proximity to the Salt River, the SVCD recommends the National Pollutant Discharge Elimination System (NPDES) storm water permit requirements be addressed by a Wyoming Licensed Engineer experienced in design and implementation of storm water plans.

Each lot owner should receive a copy of the Geotechnical Investigation Report, Salt River Ranch, Alpine, Wyoming by Womack and Associates, Inc. dated February 25, 2008 as part of the land sale contract.

The SVCD requests the severe soils, dormant and active landslides, drainage, storm water, slope, highly erodible soils, and the Geotechnical Investigation Report, Salt River Ranch, Alpine Wyoming by Womack and Associates, Inc. dated February 25, 2008 be included as a plat warning for each lot within this subdivision.

Due to the severe soils, dormant and active landslides, drainage and storm water related issues on this property, the SVCD recommends individual lot owners obtain a site specific geotechnical investigation by a Wyoming Licensed Engineer prior to building.

The SVCD recommends the Lincoln County Office of Planning and Development receive engineered stamped drawings by Wyoming Licenses Engineer prior to issuing building permits for this subdivision. Constructions of engineered foundations, drains, fill, etc. should be inspected by a Wyoming Licensed Engineer.

The SVCD recommends formation of an improvement district to oversee long term maintenance of roads, drains, water and wastewater systems.

The SVCD recommends landscaping plans be provided and/or reviewed by a Wyoming Licensed Landscape Architect for landscaping, grading and drainage issues. The plan should be site specific to each lot and take into consideration severe soils, dormant and active landslides, water and storm water related issues of the subdivision.

The SVCD requests information regarding *e. coli* impacts to the Salt River be included as a plat warning for lots within this subdivision.

Due to snow cover at the time of application, Lincoln County Weed and Pest was unable to conduct a weed inventory of this property. The SVCD recommends the property owner contact Lincoln County Weed and Pest to obtain a weed management plan and appropriate measure be taken to control these weeds and disturbed areas be monitored for new infestations. Lincoln County Weed and Pest has requested a \$4,000 weed control deposit for this site and the property owner contact Weed and Pest in the spring to conduct a weed inventory of this parcel.

This report satisfies the Conservation District Review as required by Wyoming State Statute 18-5-306. No other use is intended or implied. If there is any more information we can provide for you, please let us know.

Yours truly,

STAR VALLEY CONSERVATION DISTRICT

Garry M. Crook
Chairman

Salt River

The Salt River is listed on Table C (Water Bodies with Water Quality Threats) of the Wyoming Department of Environmental Quality (WDEQ) 2008 Section 303(d) List. The Salt River is listed as impaired for contact recreation designated use due to high levels of fecal coliform bacteria.

In response to this listing, the Star Valley Conservation District (SVCD) initiated watershed-planning activities for the Salt River Watershed in 2003. The Salt River Watershed Plan has been completed, was formally submitted to WDEQ and was accepted and signed by WDEQ in July 2005. The Salt River Watershed Plan was submitted to Lincoln County in October 2005 and was accepted by the Lincoln County Commissioners and Planning and Zoning for inclusion into the Lincoln County Comprehensive Plan in December 2005.

The Salt River Watershed Plan identifies rural subdivisions as adversely affecting water quality in the Salt River Watershed. Storm water run-off from this subdivision should be managed using best management practices to ensure that pollutants do not reach the Salt River or other surface waters.

National Pollutant Discharge Elimination System (NPDES)

The Wyoming Department of Environmental Quality (WYDEQ) requires all construction sites that disturb 1 acre or more to have a construction NPDES permit. The areas do not have to be contiguous. The permit requires construction site operators to implement appropriate erosion and sediment control best management practices, control waste such as discarded building materials, concrete truck wash-out, chemicals, litter and sanitary wastes.

Due to the severe soils, dormant and active landslides, slope and highly erodible soils on the property and proximity to the Salt River, the SVCD recommends the National Pollutant Discharge Elimination System (NPDES) storm water permit requirements be addressed by a Wyoming Licensed Engineer experienced in design and implementation of storm water plans.

Operators of construction activities must develop a Storm Water Pollution Prevention Plan (SWPPP) that describes the measures to be implemented at the construction site that will eliminate or minimize pollutants from the project from reaching surface waters.

The terms and conditions of the permit must be implemented until the land disturbed by construction activities has been 'finally stabilized'. Finally stabilized is defined as "all soil disturbing activities at the site have been completed, and a uniform perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all disturbed unpaved areas and areas not covered by permanent structures".

For more information regarding the NPDES requirements please contact Barb Sahl, WYDEQ Program Coordinator at 307-777-7570 or (bsahl@state.wy.us).

Slope and Landslides

Alteration of steeply sloped grades may result in excessive runoff, erosion, or hillside slippage. Such effects pose a danger not only to the property owner, but also to adjacent property owners

and the Salt River. The naturally occurring vegetation on such sites stabilizes the slopes, preventing severe erosion or landslides. Gully and rill erosion can occur on the road surface and on its cut and fill slopes. Sediment generated from the road and motorized vehicle use may be delivered directly to the Salt River.

Soil erosion, active and dormant landslide hazard exist within this subdivision. In addition, the initiation of new landslides is possible. Slopes and hillsides are generally balanced with precipitation, vegetative cover and underlying geology. According to Soil Survey of Star Valley Area, Wyoming – Idaho the Cowdrey clay loam (COE) and Greyback-Rooset association (GRE) soils are highly erodible. Any disturbance to these slopes such as construction and road building may result in over-steepening of the slope, soil erosion and loss of vegetative cover, thereby increasing the risk of landslides.

In addition, such slopes serve as natural boundaries and buffers between land uses. Changing the character of a slope, such as adding a road or trail, can bring adjacent incompatible land uses into more direct conflict. In addition, vegetation in place provides wildlife habitat and wildlife exist in relative safety due to the limited accessibility of such sites.

Soils

Due to the severe soils, dormant and active landslides, drainage and storm water related issues on this property, the SVCD recommends individual lot owners obtain a site specific geotechnical investigation by a Wyoming Licensed Engineer prior to building and obtain a copy of the Geotechnical Investigation Report, Salt River Ranch, Alpine Wyoming by Womack and Associates, Inc. dated February 25, 2008.

The following soils information provided by the Natural Resources Conservation Service (NRCS) Soil Survey of Star Valley Area, Wyoming – Idaho. This information does not eliminate the need for onsite investigation of the soils or for testing and analysis of these soils by a Wyoming Licensed Engineer experienced in the design and construction of engineering work.

The proposed subdivisions are comprised of three soil types identified as the Cowdrey clay loam, 10 to 30% slopes (COE), Cryaquolls and Cryaquepts (CR) and Greyback-Rooset association, hilly (GRE).

Limitations: ‘not limited’ indicates that the soil has features that are favorable for the specified use. Good performance and very low maintenance can be expected. **‘somewhat limited’** indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design and installation. Fair performance and moderate maintenance can be expected. Soils with **‘very limited’** designations indicate that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Dwelling with and without basements: The degrees of limitations for dwellings with and without basements are very limited for the Cowdrey (COE) and Greyback (GRE) soils due to shrink-swell and slope. The Cryaquolls and Cryaquepts (CR) soils are very limited due to flooding, depth to saturated zone, shrink-swell and ponding. Soil cuts were not conducted as part of this review.

Care should be taken not to locate buildings in the intermittent drainage or any drainage channel where overland flooding could occur during early spring snowmelt or heavy thunderstorms.

Hydric Soils: The Cryaquolls and Cryaquepts (CR) soils are rated as hydric soils. Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Sewage Disposal: The degree of limitations for septic tank absorption fields and sewage lagoons is very limited for the Cowdrey (COE) and Greyback (GRE) soils due to slow water movement and slope. The Cryaquolls and Cryaquepts (CR) soils are very limited due to flooding, depth to saturated zone, shrink-swell and ponding.

Roads and streets: The degree of limitations for roads and streets is very limited for the Cowdrey (COE) and Greyback (GRE) soils due to frost action, low strength, shrink-swell and slope. Cryaquolls and Cryaquepts (CR) soils are very limited due to flooding, low strength, depth to saturated zone, shrink-swell and ponding.

Shallow excavations: The degree of limitations for shallow excavations is very limited for Cowdrey (COE) and Greyback (GRE) soils slope, too clayey and cutbank cave. The Cryaquolls and Cryaquepts (CR) soils are very limited due to flooding, depth to saturated zone, and cutbank cave.

Erosion hazard: The erosion hazard of natural surface roads and construction sites is severe for the Cowdrey (COE) and Greyback (GRE) due to slope and erodibility. The erosion hazard for the Cryaquolls and Cryaquepts (CR) soils is slight.

In order to avoid potential erosion or sedimentation problems all disturbed areas during subdivision construction, especially road banks, need to be mulched and seeded back to adapted grass/legumes and trees/shrubs as soon as possible. Topsoil should be stockpiled and saved during construction so adequate seedbeds can be prepared in the disturbed areas. Appropriate erosion and sediment control best management practices should be installed and maintained for the duration of the project.

Landscaping: When landscaping, the SVCD recommends selecting plants that have low requirements for water, fertilizers, and pesticides. Cultivate plants that discourage pests and minimize high maintenance grassed areas.

The SVCD recommends landscaping plans be provided and/or reviewed by a Wyoming Licensed Landscape Architect for landscaping, grading and drainage issues. The plan should be site specific to each lot and take into consideration severe soils, dormant and active landslides, water and storm water related issues of the subdivision.

It is the policy of the Star Valley Conservation District to promote the conservation and efficient use of water and to prevent the waste of this valuable resource. We encourage greater water

efficiency in landscape design, installation and maintenance. The waters of the state are of limited supply and are subject to ever increasing demands.

Noxious Weeds

Information on this subdivision was provided to Mr. Scott Nield with Lincoln County Weed and Pest. Due to the snow cover at the time of this report, a site inspection for noxious weeds was not conducted. The SVCD recommends the property owner contact Lincoln County Weed and Pest to obtain a weed management plan and appropriate measure be taken to control these weeds and disturbed areas be monitored for new infestations. Lincoln County Weed and Pest has requested a \$4,000 weed control deposit for this site.

Small Acreage Grazing/Livestock Management

It is our understanding that no restriction will be placed on grazing animals. Please be aware, grazing animals on small acreages can have a significant impact on the condition of soil, water, plants, and other natural resources.

Care should be taken to ensure agricultural activities such as grazing, corrals, pastures, feedlots, animal waste storage or spreading does not take place within any wellhead protection zone.

Best management practices should be implemented on these parcels to ensure animal wastes does not reach surface waters during times of high water, snow melt, or storm run-off. This can be done by using berms, filters strips, grassed swales and catch ponds. The SVCD recommends the individual lot owners obtain a site specific grazing and waste management conservation plan from the local Natural Resources Conservation Service office in Afton. The plans are provided free of charge.

Wildlife

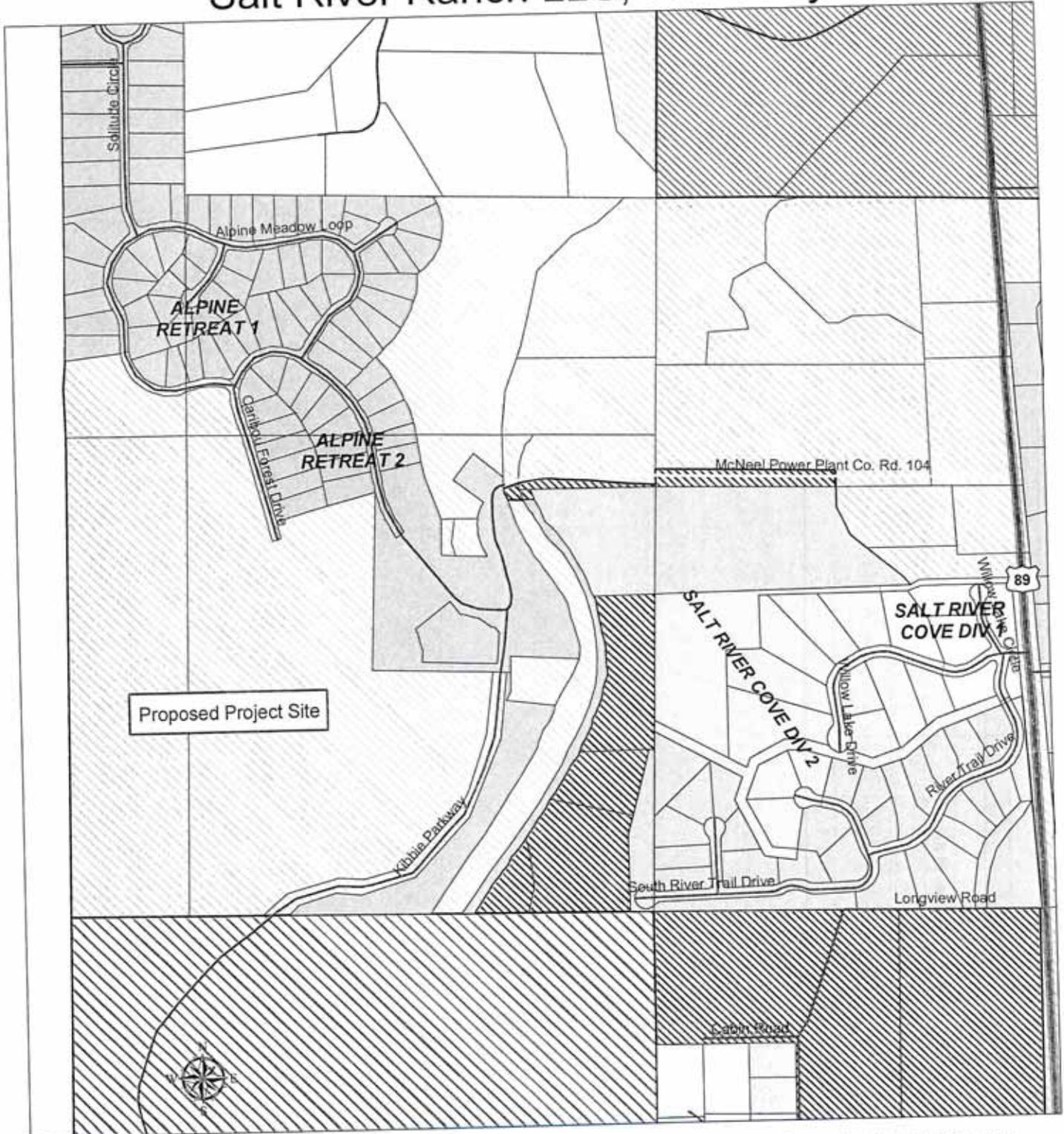
Homeowners should protect ornamental shrubs used for landscaping and future homeowners should know that, by state statute, the Wyoming Game and Fish Department is not liable for damage caused to ornamental plants by wildlife.

Fences cause the direct mortality of wildlife through entanglement and prohibition of movement to seasonal ranges. Fences constructed or currently in existence on the property should be designed to allow free and unrestricted movement of wildlife. Wyoming Game and Fish Department recommends fences be built to minimally restrict livestock and horses, while allowing free movement of wildlife (e.g. a smooth bottom wire 16-18 inches above ground, a 39-inch maximum height and at least 12 inches between the top two wires). Wildlife can benefit from any area of open space as long as it is not intensively used as horse pasture. For more information please see Fencing Guidelines for Wildlife Wyoming Game & Fish Habitat Extension Bulletin No. 53 at the Wyoming Game and Fish website <http://gf.state.wy.us/downloads/pdf/habitat/Bulletin%20No.%2053.pdf>.

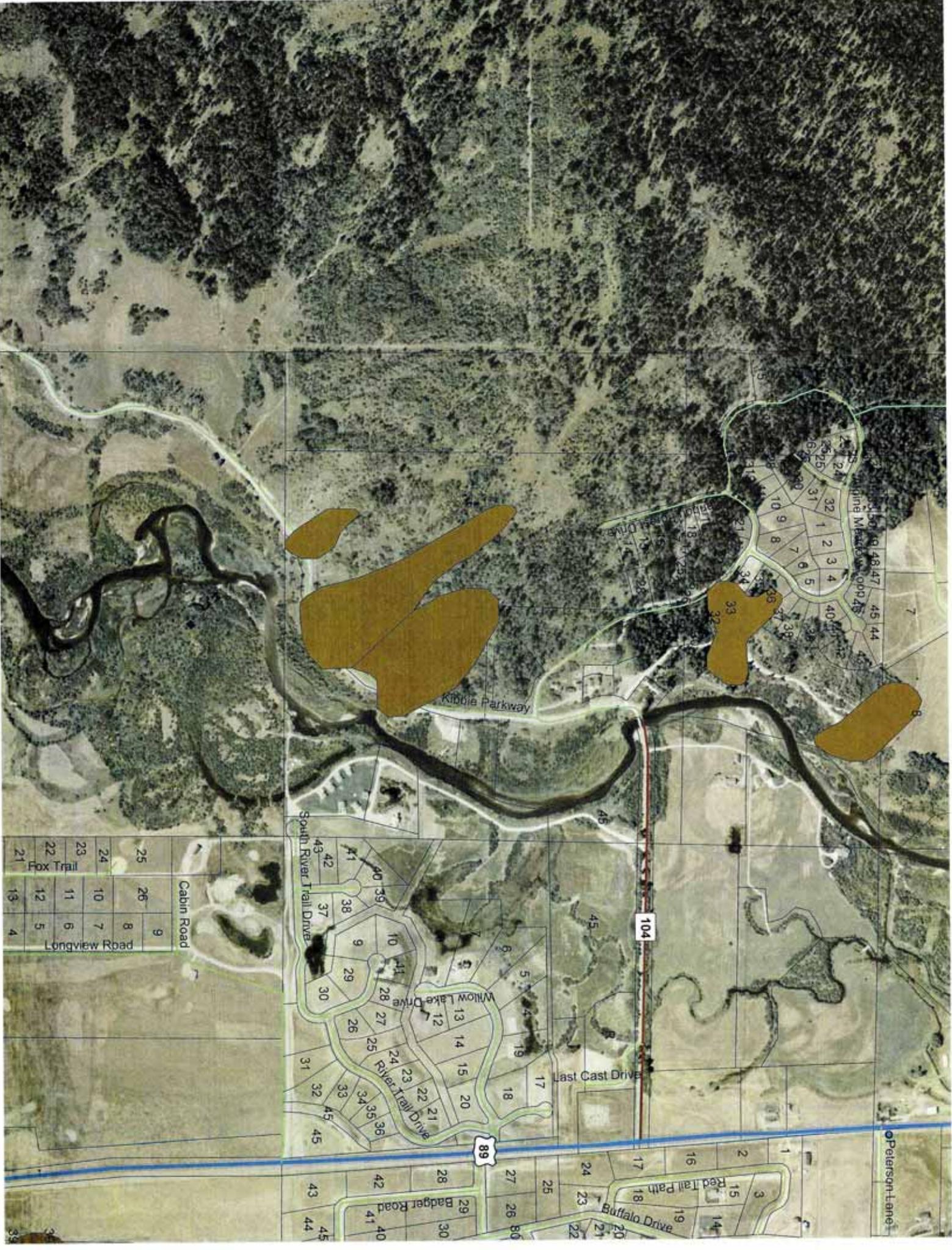
The potential exists for wildlife conflicts, especially between wildlife and free-ranging domestic pets. The landowner should take precautions to minimize harassment of wildlife by dogs and cats. It is illegal to allow pets to chase or kill wildlife. Likewise, rural landowners should recognize that black bears, mountain lions, and other carnivores may come in close proximity to their dwellings and may pose a threat to pets allowed to range freely.

Rezone Application from "Rural" to "Mixed" 604 PZ 07

Salt River Ranch LLC, Ted Terry



Drawn by Jeanette Fagnant
May 16, 2007
Based on the best available information.



25	26	9
24	10	8
23	11	7
22	12	6
21	13	5
	4	

Cabin Road

Longview Road

Fox Trail

Kibbie Parkway

104

89

Petersen Lane

Last Cast Drive

Buffalo Drive

Red Tail Path

South River Trail Drive

Willow Lake Drive
River Trail Drive

Badger Road



25	26	9
24	8	26
23	10	7
22	11	6
21	12	5
20	13	4
Fox Trail		
Cabin Road		
Longview Road		

Component Legend

Star Valley Area, Wyoming-Idaho

Map unit symbol and name	Pct. of map unit	Component name	Component kind	Pct. Slope		
				Low	RV	High
COE:						
Cowdrey clay loam, 10 to 30 percent slopes						
	70	Cowdrey	Series	10	20	30
	20	Buckskin	Series	10	15	20
	5	Decross I	---	---	---	---
	3	Lail sil	---	---	---	---
	2	Rooset gr-l	---	---	---	---
CR:						
Cryaquolls and Cryaquepts						
	45	Cryaquepts	Taxon above family	0	1.5	3
	45	Cryaquolls	Taxon above family	0	1.5	3
	5	Dipman	---	---	---	---
	5	Narrows	---	---	---	---
GRD:						
Greyback-Rooset association, hilly						
	30	Decross	Series	10	20	30
	30	Greyback	Series	10	20	30
	30	Rooset	Series	10	20	30
	5	Robana sil	---	---	---	---
	5	Willow Creek sil	---	---	---	---

Dwellings and Small Commercial Buildings

Star Valley Area, Wyoming-Idaho

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations]

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
COE:							
Cowdrey	70	Very limited Shrink-swell Slope	1.00 1.00	Very limited Shrink-swell Slope	1.00 1.00	Very limited Slope Shrink-swell	1.00 1.00
Buckskin	20	Very limited Shrink-swell Slope	1.00 1.00	Very limited Shrink-swell Slope	1.00 1.00	Very limited Slope Shrink-swell	1.00 1.00
Decross I	5	Not rated		Not rated		Not rated	
Lail sil	3	Not rated		Not rated		Not rated	
Rooset gr-I	2	Not rated		Not rated		Not rated	
CR:							
Cryaquepts	45	Not rated		Not rated		Not rated	
Cryaquolls	45	Not rated		Not rated		Not rated	
Dipman	5	Not rated		Not rated		Not rated	
Narrows	5	Not rated		Not rated		Not rated	
GRD:							
Decross	30	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope Shrink-swell	1.00 0.50
Greyback	30	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Slope	1.00
Rooset	30	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope Shrink-swell	1.00 0.50	Very limited Slope Shrink-swell	1.00 0.50
Robana sil	5	Not rated		Not rated		Not rated	
Willow Creek sil	5	Not rated		Not rated		Not rated	

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

"Dwellings" are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

"Small commercial buildings" are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Sewage Disposal

Star Valley Area, Wyoming-Idaho

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations]

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
COE:					
Cowdrey	70	Very limited Slow water movement Slope	1.00 1.00	Very limited Slope	1.00
Buckskin	20	Very limited Slow water movement Slope	1.00 1.00	Very limited Slope Seepage	1.00 0.53
Decross I	5	Not rated		Not rated	
Lail sil	3	Not rated		Not rated	
Rooset gr-I	2	Not rated		Not rated	
CR:					
Cryaquepts	45	Not rated		Not rated	
Cryaquolls	45	Not rated		Not rated	
Dipman	5	Not rated		Not rated	
Narrows	5	Not rated		Not rated	
GRD:					
Decross	30	Very limited Slope Slow water movement	1.00 0.46	Very limited Slope Seepage	1.00 0.53
Greyback	30	Very limited Seepage Slope	1.00 1.00	Very limited Slope Seepage	1.00 1.00
Rooset	30	Very limited Slow water movement Slope	1.00 1.00	Very limited Slope	1.00
Robana sil	5	Not rated		Not rated	
Willow Creek sil	5	Not rated		Not rated	

Sewage Disposal

This table shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

"Septic tank absorption fields" are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

"Sewage lagoons" are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, Ksat, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Ksat is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a Ksat rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Star Valley Area, Wyoming-Idaho

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations]

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
COE:							
Cowdrey	70	Very limited		Very limited		Very limited	
		Frost action	1.00	Slope	1.00	Slope	1.00
		Low strength	1.00	Too clayey	0.13		
		Shrink-swell	1.00	Cutbanks cave	0.10		
		Slope	1.00				
Buckskin	20	Very limited		Very limited		Very limited	
		Frost action	1.00	Slope	1.00	Slope	1.00
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00				
		Slope	1.00				
Decross l	5	Not rated		Not rated		Not rated	
Lail sil	3	Not rated		Not rated		Not rated	
Rooset gr-l	2	Not rated		Not rated		Not rated	
CR:							
Cryaquepts	45	Not rated		Not rated		Not rated	
Cryaquolls	45	Not rated		Not rated		Not rated	
Dipman	5	Not rated		Not rated		Not rated	
Narrows	5	Not rated		Not rated		Not rated	
GRD:							
Decross	30	Very limited		Very limited		Very limited	
		Frost action	1.00	Slope	1.00	Slope	1.00
		Slope	1.00	Cutbanks cave	0.10		
		Low strength	1.00				
		Shrink-swell	0.50				
Greyback	30	Very limited		Very limited		Very limited	
		Slope	1.00	Cutbanks cave	1.00	Slope	1.00
		Frost action	0.50	Slope	1.00	Gravel content	0.44
						Droughty	0.16
						Large stones content	0.03

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Star Valley Area, Wyoming-Idaho

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
GRD:							
Rooset	30	Very limited		Very limited		Very limited	
		Slope	1.00	Cutbanks cave	1.00	Slope	1.00
		Shrink-swell	0.50	Slope	1.00	Gravel content	0.70
		Frost action	0.50			Droughty	0.03
						Large stones content	0.01
Robana sil	5	Not rated		Not rated		Not rated	
Willow Creek sil	5	Not rated		Not rated		Not rated	

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

"Local roads and streets" have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

"Shallow excavations" are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

"Lawns and landscaping" require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Erosion Hazard of Natural Surface Roads and Construction Sites

Star Valley Area, Wyoming-Idaho

[[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]]

Map symbol and soil name	Pct. of map unit	Potential Erosion of Unsurfaced Roads and Trails		Potential Erosion of Construction Sites	
		Rating class and limiting features	Value	Rating class and limiting features	Value
COE:					
Cowdrey	70	Severe Slope/erodibility	0.95	Moderate Slope/erodibility	0.50
Buckskin	20	Severe Slope/erodibility	0.95	Moderate Slope/erodibility	0.50
Decross I	5	Not rated		Not rated	
Lail sil	3	Not rated		Not rated	
Rooset gr-I	2	Not rated		Not rated	
CR:					
Cryaquepts	45	Not rated		Not rated	
Cryaquolls	45	Not rated		Not rated	
Dipman	5	Not rated		Not rated	
Narrows	5	Not rated		Not rated	
GRD:					
Decross	30	Severe Slope/erodibility	0.95	Moderate Slope/erodibility	0.50
Greyback	30	Severe Slope/erodibility	0.95	Moderate Slope/erodibility	0.50
Rooset	30	Severe Slope/erodibility	0.95	Moderate Slope/erodibility	0.50
Robana sil	5	Not rated		Not rated	
Willow Creek sil	5	Not rated		Not rated	

Erosion Hazard of Natural Surface Roads and Construction Sites

This table can help land owners or land users plan the use of soils for unpaved roads. Interpretive ratings are given for the soils according to the limitations that affect unpaved roads. The ratings are both verbal and numerical. Some rating class terms indicate the degree to which the soils are suited to a specified practice. Well suited indicates that the soil has features that are favorable for the specified practice and has no limitations. Good performance can be expected, and little or no maintenance is needed. Moderately suited indicates that the soil has features that are moderately favorable for the specified practice. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. Poorly suited indicates that the soil has one or more properties that are unfavorable for the specified practice. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. Unsuitable indicates that the expected performance of the soil is unacceptable for the specified practice or that extreme measures are needed to overcome the undesirable soil properties. Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified practice (1.00) and the point at which the soil feature is not a limitation (0.00). The paragraphs that follow indicate the soil properties considered in rating the soils for forest management practices. More detailed information about the criteria used in the ratings is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the Internet. Ratings in the column hazard of off-road or off-trail erosion are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of slight indicates that erosion is unlikely under ordinary climatic conditions; moderate indicates that some erosion is likely and that erosion-control measures may be needed; severe indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and very severe indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical. Ratings in the column hazard of erosion on roads and trails are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of slight indicates that little or no erosion is likely; moderate indicates that some erosion is likely, that the roads or trails may require occasional maintenance; and that simple erosion-control measures are needed; and severe indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed. Ratings in the column suitability for roads (natural surface) are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

Non Technical Soil Description

Soil Survey Area Star Valley Area, Wyoming-Idaho

Mapunit COE Cowdrey clay loam, 10 to 30 percent slopes

Soil Component Name Buckskin 20 % of the mapunit

Slope range (%): 10 to 20
Depth class: Very deep
Drainage class Well drained
Land capability: nonirrigated= 4e irrigated= 4e
Ecological Site: LOAMY (15-19W)
Restrictive layers (in): - NA

Permeability: Slow
Available water capacity class: High
Total available water in top five feet (in.): 11.9
Flooding frequency: None
Depth to seasonal high water table (in): NA -

Horizon Information

	<u>Depth (in)</u>	<u>Textures</u>	<u>pH range</u>	<u>Sodium</u>	<u>Salinity (mmhos/cm)</u>
Ap	0 - 9	silt loam	6.6 - 7.3	NA -	NA -
Bw	9 - 13	silty clay loam	6.1 - 7.3	NA -	NA -
Bt	13 - 60	silty clay loam	6.6 - 7.3	NA -	NA -

Soil Component Name Cowdrey 70 % of the mapunit

Slope range (%): 10 to 30
Depth class: Very deep
Drainage class Well drained
Land capability: nonirrigated= 6e irrigated= 6e
Ecological Site:
Restrictive layers (in): - NA

Permeability: Slow
Available water capacity class: High
Total available water in top five feet (in.): 10.4
Flooding frequency: None
Depth to seasonal high water table (in): NA -

Horizon Information

	<u>Depth (in)</u>	<u>Textures</u>	<u>pH range</u>	<u>Sodium</u>	<u>Salinity (mmhos/cm)</u>
A	0 - 17	clay loam	6.1 - 6.5	NA -	NA -
Bt	17 - 40	clay	6.1 - 7.3	NA -	NA -
C	40 - 60	clay loam	6.1 - 7.3	NA -	NA -

pH classes: 3.5-4.4 extremely acid; 4.5-5.0 very strongly acid; 5.1-5.5 strongly acid; 5.6-6.0 moderately acid; 6.1-6.5 slightly acid; 6.6-7.3 neutral; 7.4-7.8 mildly alkaline; 7.9-8.4 moderately alkaline; 8.5-9.0 strongly alkaline; >9.0 very strongly alkaline.
Salinity classes (if applicable): 0-2 non saline; 2-4 very slightly saline; 4-8 slightly saline; 8-16 moderately saline; >=16 saline.

Mapunit GRD Greyback-Rooset association, hilly**Soil Component Name** Greyback 30 % of the mapunit

Slope range (%): 10 to 30
 Depth class: Very deep
 Drainage class Somewhat excessively drained
 Land capability: nonirrigated= 6e irrigated= 6e
 Ecological Site: LOAMY (15-19W)
 Restrictive layers (in): - NA

Permeability: Moderate
 Available water capacity class: Low
 Total available water in top five feet (in.): 4.2
 Flooding frequency: None
 Depth to seasonal high water table (in): NA -

Horizon Information

	Depth (in)	Textures	pH range	Sodium	Salinity (mmhos/cm)
A	0 - 7	gravelly loam	6.6 - 7.8	NA -	NA -
Bw	7 - 18	gravelly loam	7.4 - 8.4	NA -	NA -
2Ck1	18 - 28	very gravelly sandy loam	7.9 - 9	NA -	NA -
2Ck2	28 - 60	very gravelly loamy sand	7.9 - 9	NA -	NA -

Soil Component Name Rooset 30 % of the mapunit

Slope range (%): 10 to 30
 Depth class: Very deep
 Drainage class Well drained
 Land capability: nonirrigated= 6e irrigated= 6e
 Ecological Site: LOAMY (15-19W)
 Restrictive layers (in): - NA

Permeability: Moderately slow
 Available water capacity class: Low
 Total available water in top five feet (in.): 5.0
 Flooding frequency: None
 Depth to seasonal high water table (in): NA -

Horizon Information

	Depth (in)	Textures	pH range	Sodium	Salinity (mmhos/cm)
A	0 - 7	gravelly loam	6.1 - 7.3	NA -	NA -
Bw	7 - 11	gravelly clay loam	6.6 - 7.8	NA -	NA -
Bt	11 - 24	very gravelly clay loam	6.6 - 7.8	NA -	NA -
Bk	24 - 30	extremely gravelly clay loam	6.6 - 7.8	NA -	NA -
Ck	30 - 60	extremely gravelly clay loam	7.9 - 9	NA -	NA -

Soil Component Name Decross 30 % of the mapunit

Slope range (%): 10 to 30
 Depth class: Very deep
 Drainage class Well drained
 Land capability: nonirrigated= 6e irrigated= 6e
 Ecological Site: LOAMY (15-19W)
 Restrictive layers (in): - NA

Permeability: Moderate
 Available water capacity class: High
 Total available water in top five feet (in.): 11.0
 Flooding frequency: None
 Depth to seasonal high water table (in): NA -

Horizon Information

	Depth (in)	Textures	pH range	Sodium	Salinity (mmhos/cm)
A	0 - 8	loam	6.6 - 7.8	NA -	NA -
Bt	8 - 36	clay loam	6.6 - 7.8	NA -	NA -
Ck	36 - 60	loam	7.9 - 8.4	NA -	NA -

pH classes: 3.5-4.4 extremely acid; 4.5-5.0 very strongly acid; 5.1-5.5 strongly acid; 5.6-6.0 moderately acid; 6.1-6.5 slightly acid; 6.6-7.3 neutral; 7.4-7.8 mildly alkaline; 7.9-8.4 moderately alkaline; 8.5-9.0 strongly alkaline; >9.0 very strongly alkaline.
 Salinity classes (if applicable): 0-2 non saline; 2-4 very slightly saline; 4-8 slightly saline; 8-16 moderately saline; >=16 saline.

Physical Soil Properties

Star Valley Area, Wyoming-Idaho

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth In	Sand Pct	Silt Pct	Clay Pct	Moist bulk density g/cc	Saturated hydraulic conductivity micro m/sec	Available water capacity In/In	Linear extensibility Pct	Organic matter Pct	Erosion factors			Wind erodibility group	Wind erodibility index	
										Kw	Kf	T			
COE:															
Cowdrey	0-17	---	---	27-40	1.20-1.30	1.41-4.23	0.18-0.20	0.0-2.9	0.5-1.0	.37	.37	5	6	48	
	17-40	---	---	40-50	1.25-1.35	0.42-1.41	0.14-0.16	6.0-8.9	0.0-0.5	.28	.28				
	40-60	---	---	30-40	1.25-1.35	1.41-4.23	0.18-0.20	3.0-5.9	0.0	.28	.28				
Buckskin	0-9	---	---	10-18	1.10-1.20	4.23-14.11	0.18-0.20	3.0-5.9	2.0-4.0	.43	.43	5	5	56	
	9-13	---	---	30-35	1.15-1.25	4.23-14.11	0.19-0.21	3.0-5.9	1.0-3.0	.43	.43				
	13-60	---	---	35-45	1.20-1.30	0.42-1.41	0.19-0.21	6.0-8.9	0.0-1.0	.37	.37				
Decross l	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Lall sil	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Rooset gr-l	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
CR:															
Cryaquepts	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Cryaquolls	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Dipman	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Narrows	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
GRD:															
Decross	0-8	---	---	15-25	1.15-1.25	4.23-14.11	0.16-0.18	0.0-2.9	2.0-3.0	.28	.28	2	4L	86	
	8-36	---	---	18-35	1.25-1.35	4.23-14.11	0.19-0.21	3.0-5.9	0.5-1.0	.37	.37				
	36-60	---	---	25-35	1.25-1.35	4.23-14.11	0.16-0.18	3.0-5.9	0.0-0.5	.43	.43				

Physical Soil Properties

Star Valley Area, Wyoming-Idaho

Map symbol and soil name	Depth In	Sand Pct	Silt Pct	Clay Pct	Moist bulk density g/cc	Saturated hydraulic conductivity micro m/sec	Available water capacity In/In	Linear extensibility Pct	Organic matter Pct	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
GRD: Greyback	0-7	---	---	15-25	1.15-1.25	4.23-14.11	0.12-0.14	0.0-2.9	1.0-3.0	.20	.32	3	5	56
	7-18	---	---	15-25	1.25-1.35	4.23-14.11	0.12-0.14	0.0-2.9	0.5-1.0	.20	.32			
	18-28	---	---	10-20	1.30-1.40	14.11-42.34	0.05-0.07	0.0-2.9	0.0-0.5	.10	.28			
	28-60	---	---	0-8	1.45-1.55	42.34-141.14	0.03-0.05	0.0-2.9	0.0-0.5	.05	.20			
Rooset	0-7	---	---	15-25	1.15-1.25	4.23-14.11	0.12-0.14	0.0-2.9	2.0-3.0	.20	.32	5	7	38
	7-11	---	---	30-35	1.25-1.35	4.23-14.11	0.14-0.16	3.0-5.9	1.0-2.0	.20	.32			
	11-24	---	---	35-50	1.20-1.30	1.41-4.23	0.09-0.11	3.0-5.9	0.5-1.0	.10	.28			
	24-30	---	---	35-50	1.20-1.30	1.41-4.23	0.05-0.07	3.0-5.9	0.0-0.5	.05	.28			
30-60	---	---	30-40	1.25-1.35	1.41-4.23	0.05-0.07	3.0-5.9	0.0-0.5	.05	.32				
Robana sil	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Willow Creek sil	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

"Depth" to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

"Sand" as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

"Silt" as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

"Clay" as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

"Moist bulk density" is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

"Saturated hydraulic conductivity" refers to the ability of a soil to transmit water or air. The term "permeability" indicates saturated hydraulic conductivity (Ksat). The estimates in the table indicate the rate of water movement, in micrometers per second, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Ksat is considered in the design of soil drainage systems and septic tank absorption fields.

"Available water capacity" refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

"Linear extensibility" refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

"Organic matter" is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Physical Soil Properties

"Erosion factors" are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

"Erosion factor Kf" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

"Erosion factor T" is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

"Wind erodibility groups" are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

"Wind erodibility index" is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (<http://www.statlab.iastate.edu/soils/nssh/>)

Chemical Soil Properties

Star Valley Area, Wyoming-Idaho

[Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	<i>In</i>	<i>meq/100 g</i>	<i>meq/100 g</i>	<i>pH</i>	<i>Pct</i>	<i>Pct</i>	<i>mmhos/cm</i>	
COE:								
Cowdrey	0-17	15-20	---	6.1 - 6.5	0	0	0.0	0
	17-40	20-25	---	6.1 - 7.3	0	0	0.0	0
	40-60	15-25	---	6.1 - 7.3	0	0	0.0	0
Buckskin	0-9	10-15	---	6.6 - 7.3	0	0	0.0	0
	9-13	15-20	---	6.1 - 7.3	0	0	0.0	0
	13-60	20-25	---	6.6 - 7.3	0	0	0.0	0
Decross I	---	---	---	---	---	---	---	---
Lail sil	---	---	---	---	---	---	---	---
Rooset gr-I	---	---	---	---	---	---	---	---
CR:								
Cryaquepts	---	---	---	---	---	---	---	---
Cryaquolls	---	---	---	---	---	---	---	---
Dipman	---	---	---	---	---	---	---	---
Narrows	---	---	---	---	---	---	---	---
GRD:								
Decross	0-8	10-15	---	6.6 - 7.8	0-5	0	0.0	0
	8-36	10-20	---	6.6 - 7.8	15-40	0	0.0	0
	36-60	10-15	---	7.9 - 8.4	0-5	0-5	0.0-2.0	0
Greyback	0-7	10-20	---	6.6 - 7.8	0-5	0	0.0-2.0	0
	7-18	5.0-15	---	7.4 - 8.4	3-14	0	0.0-2.0	0
	18-28	5.0-10	---	7.9 - 9.0	3-14	0-5	0.0-2.0	0-5
	28-60	0.0-5.0	---	7.9 - 9.0	0	0-5	0.0-2.0	0-5
Rooset	0-7	15-25	---	6.1 - 7.3	0	0	0.0	0
	7-11	15-20	---	6.6 - 7.8	0	0	0.0	0
	11-24	20-25	---	6.6 - 7.8	0-5	0	0.0	0
	24-30	20-25	---	6.6 - 7.8	5-15	0	0.0	0
	30-60	15-20	---	7.9 - 9.0	0	0-5	0.0-2.0	0-5
Robana sil	---	---	---	---	---	---	---	---
Willow Creek sil	---	---	---	---	---	---	---	---

Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

"Depth" to the upper and lower boundaries of each layer is indicated.

"Cation-exchange capacity" is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

"Effective cation-exchange capacity" refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

"Soil reaction" is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

"Calcium carbonate" equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

"Gypsum" is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

"Salinity" is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

"Sodium adsorption ratio" (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Engineering Properties

Star Valley Area, Wyoming-Idaho

[Absence of an entry indicates that the data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--					Liquid limit	Plasticity index	
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200	Pct			Pct
COE:														
Cowdrey	0-17 17-40 40-60	Clay loam Clay Clay loam	CL CH CL	A-7 A-7 A-7	0 0 0	0-5 0-5 0-1	95-100 95-100 95-100	90-100 90-100 90-95	70-90 55-85 45-80	55-70 50-75 35-65	35-55 55-65 35-55	15-35 35-40 20-35		
Buckskin	0-9 9-13 13-60	Silt loam Silty clay loam Silty clay, silty clay loam	CL-ML CL CH	A-4 A-6 A-7	0 0 0	0 0 0	100 100 100	100 100 100	90-100 95-100 95-100	80-95 85-95 85-95	20-25 35-45 45-60	5-10 20-25 25-40		
Decross I	---	---	---	---	---	---	---	---	---	---	---	---		
Lail silt	---	---	---	---	---	---	---	---	---	---	---	---		
Rooseet gr-I	---	---	---	---	---	---	---	---	---	---	---	---		
CR:														
Cryaquepts	---	---	---	---	---	---	---	---	---	---	---	---		
Cryaquolls	---	---	---	---	---	---	---	---	---	---	---	---		
Dipman	---	---	---	---	---	---	---	---	---	---	---	---		
Narrows	---	---	---	---	---	---	---	---	---	---	---	---		
GRD:														
Decross	0-8 8-36 36-60	Loam Clay loam, loam Clay loam, loam	CL CL CL	A-6 A-6 A-6	0 0 0	0 0 0-5	90-100 90-100 95-100	85-100 85-100 90-100	70-85 70-95 45-90	50-75 65-80 40-70	25-30 25-45 30-45	10-15 10-25 15-25		

Engineering Properties

Star Valley Area, Wyoming-Idaho

Map symbol and soil name	Depth <i>in</i>	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit <i>Pct</i>	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
GRD: Greyback	0-7	Gravelly loam	GC, GC-GM	A-6	0	0-15	50-80	45-75	45-65	35-50	25-30	10-15
	7-18	Gravelly loam	GC, GC-GM	A-2	0	0-15	50-75	50-75	45-65	30-50	25-30	10-15
	18-28	Very gravelly loam, very gravelly sandy loam	GC-GM	A-2	0	0-15	25-40	20-35	15-25	10-15	20-30	5-10
	28-60	Very gravelly loamy sand, very gravelly sand	GW, GW- GM	A-1	0	0-15	25-40	20-35	10-20	0-10	0-15	NP-5
Rooset	0-7	Gravelly loam	GC, SC	A-6	0	0-10	50-80	40-75	35-60	35-50	25-30	10-15
	7-11	Gravelly clay loam	GC, SC	A-6	0	0-10	60-85	50-75	40-60	35-50	35-45	20-25
	11-24	Very gravelly clay, very gravelly clay loam	GC	A-2	0	0-15	50-70	25-50	20-40	20-35	45-65	25-40
	24-30	Extremely gravelly clay, extremely gravelly clay loam	GC, GW-GC	A-2	0	10-25	20-40	10-20	10-20	10-20	45-65	25-40
	30-60	Extremely gravelly clay loam	GC	A-2	0	0-25	30-50	15-25	15-25	15-25	35-55	20-35
Robana sil	---	---	---	---	---	---	---	---	---	---	---	---
Willow Creek sil	---	---	---	---	---	---	---	---	---	---	---	---

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

"Depth" to the upper and lower boundaries of each layer is indicated.

"Texture" is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

"Classification" of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

"Rock fragments" larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

"Percentage (of soil particles) passing designated sieves" is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

"Liquid limit" and "plasticity index" (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition. American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.