May 15, 1980

TO; Mr. Bruce Gallaher, Geohydrologist
Water Pollution Control Bureau
Environmental Improvement Division
P.O. Box 968
Santa Fe, New Mexico 87503

FROM: Dr. Stephen G. Wells, Consultant
Department of Geology
University of New Mexico
Albuquerque, NM 87131

SUBJECT: Comments on Groundwater Discharge Plan & Site Visit-
Mt. Talyor Uranium Mill Project, Gulf Mineral Resources

I have summarized my comments concerning my site visit of the La Polvadera Canyon mill wastes disposal site in Part A and a few comments on the discharge plan in Part B.

Part A.

The general geomorphic (landscape) setting of the mill waste disposal site in La Polvadera Canyon is:

1. rounded, upland ridges composed weathered mantle resting on the Dilco Coal and Mulatto Tongue Members of the Menefee Formation,

2. broad, shallow alluvial valleys filled with Quaternary alluvium.

This site is just east of a steep (vertical in places) cliff. The regional slope of the landscape is to the east. In the mill waste disposal site, slopes of the bedrock ridges are approximately 1:20 (vertical:horizontal); whereas, slopes in the intervening alluvial valleys are approximately 1:30 (vertical: horizontal). The depth of the weathered mantle on the ridges is unknown, but it is probably very variable. It was observed during the field site visit that the mantle had characteristic hues of yellow and orange-red. The thickness of valley alluvium is variable, but it appears to have a maximum thickness of 20 to 30 ft in the trench area.

The alluvium, colluvium (hillslope debris) and weathered mantle in the trench area of La Polvadera Canyon is undissected by deep arroyos or gully systems. Shallow swales and poorly integrated drainage lines are typical.

The interpretation of this site based on the limited field visit and material provided in the December, 1979 Groundwater Discharge Plan is given below:

The mill waste disposal site is relatively stable in terms of base level changes (base level refers to the level to which a stream will erode). The lack of deeply incised arroyos or gullies, multiple fill or strath terraces and integrated drainage systems suggests relative base level stability over the Holocene (past 10,000 to 12,000 years). The late Quaternary geomorphic history of the site may be generalized as follows:

1. formation of a pediment (erosion surface cut on dipping bedrock) as a continuous surface along the base of the steep western cliff,
2. dissection of the pediment after a period of base level stability and the formation of the alluvial valleys,
3. base level stability and lateral migration of the streams forming the broad (750-1000 ft) wide valleys,
4. and slow aggradation as the valleys filled with sediment.

The amount of base level change is 50 to 60 ft as measured from the average ridge top to the base of the alluvium in the valley. The amount of time this change in stream level has occurred over is not known and may vary from a few thousand years to tens of thousands of years. The deep weathering mantle on the ridges suggests that it has been a relatively long time period since dramatic base level fluctuations.

The lack of headward cutting and incising arroyo systems suggests base level stability over the past tens of years. It appears that runoff from the trench area is dominanted by sheetwash (unchannelized flow) rather than channelized flow. The lack of arroyo cutting in this portion of the La Polvadera Canyon probably is not due to a lack of precipitation as suggested in the Groundwater Discharge Plan (page II-11); rather, it may be related to local geomorphic and hydrologic conditions. One possibility for the lack of arroyo cutting is given by the relationship between valley slope and drainage basin size (see Fig. 1). Low valley slopes for a given drainage basin are typically ungullied; whereas, steep valley slopes for the same basin size are gullied (see Fig. 1). The valley slopes of the

the trench area may have slopes below the threshold shown in Figure 1, thus are not incised. Oversteepening of the valley slopes result from aggradation (local) via stream avulsion or fan deposition. Since the trench area is dominanted by pediment surfaces (erosional) rather than depositional surfaces (e.g. alluvial fans) and runoff is unchannelized, valley oversteepening would not be expected.

In summary, the trench area appears to be in an relatively stable regime with respect to erosion. It will be important to maintain this erosional stability during the operation period and post-reclamation.

Part B.

The reclamation plan given in the Discharge Plans (page II-8) are very brief. There is not enough information provided to quantitatively evaluate their reclamation plan. A post-reclamation reconstruction of the topography would provide information on the geometry of the reclaimed land and relationship to the surrounding features. Measurements of infiltration rates on the present landscape cover would provide guidelines for the top soil cover to be used in reclamation.

Groundwater discharge plans should contain information pertaining to the local geomorphic setting as well as the bedrock geology, especially if reclamation operations are to be considered. Although time may not permit their inclusion in this plan, the type of information necessary to describe and to infer the landscape age is not difficult to obtain. To date the surficial cover and the landscape it rests on can provide information on the erosional stability of a particular site. My discussion in Part A is limited due to the lack of time to investigate the details. One aspect that might be required on groundwater discharge plans includes the types of surficial cover and associated soils. Soil-landscape information can provide details on landscape age thus erosional stability. Figure 2 and Table 1 illustrate the use of soil development to interpret the landscape age. In addition this soil information can be used in the reclamation considerations of these plans.

Soil-landscape relationships provide information on the erosion rates of a given area. Although techniques, such as dividing the total thickness of bedrock units removed by the youngest bedrock unit, can give first approximation long-term erosion rates, soil-landscape studies give spatial and temporal variations in erosion rates.

I have enclosed two figures (Figures 3 and 4) which illustrate areas that may be susceptible to accelerated ersoion due to natural conditions or due to post-reclamation landscape geometry. Area 1 on Figure 3 may have gully incision if the reclaimed land increases the slope leading into this valley. A similar situation may occur in area 2 on Figure 4. A map illustrating the general geometry of the reclaimed landscape is needed to further evaluate this potential problem.

It is also important to note that a presently stable landscape can be made unstable by oversteepening slopes, reducing vegetation or channelizing flow.

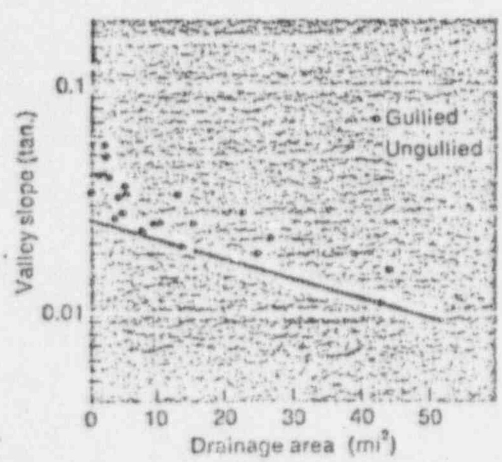
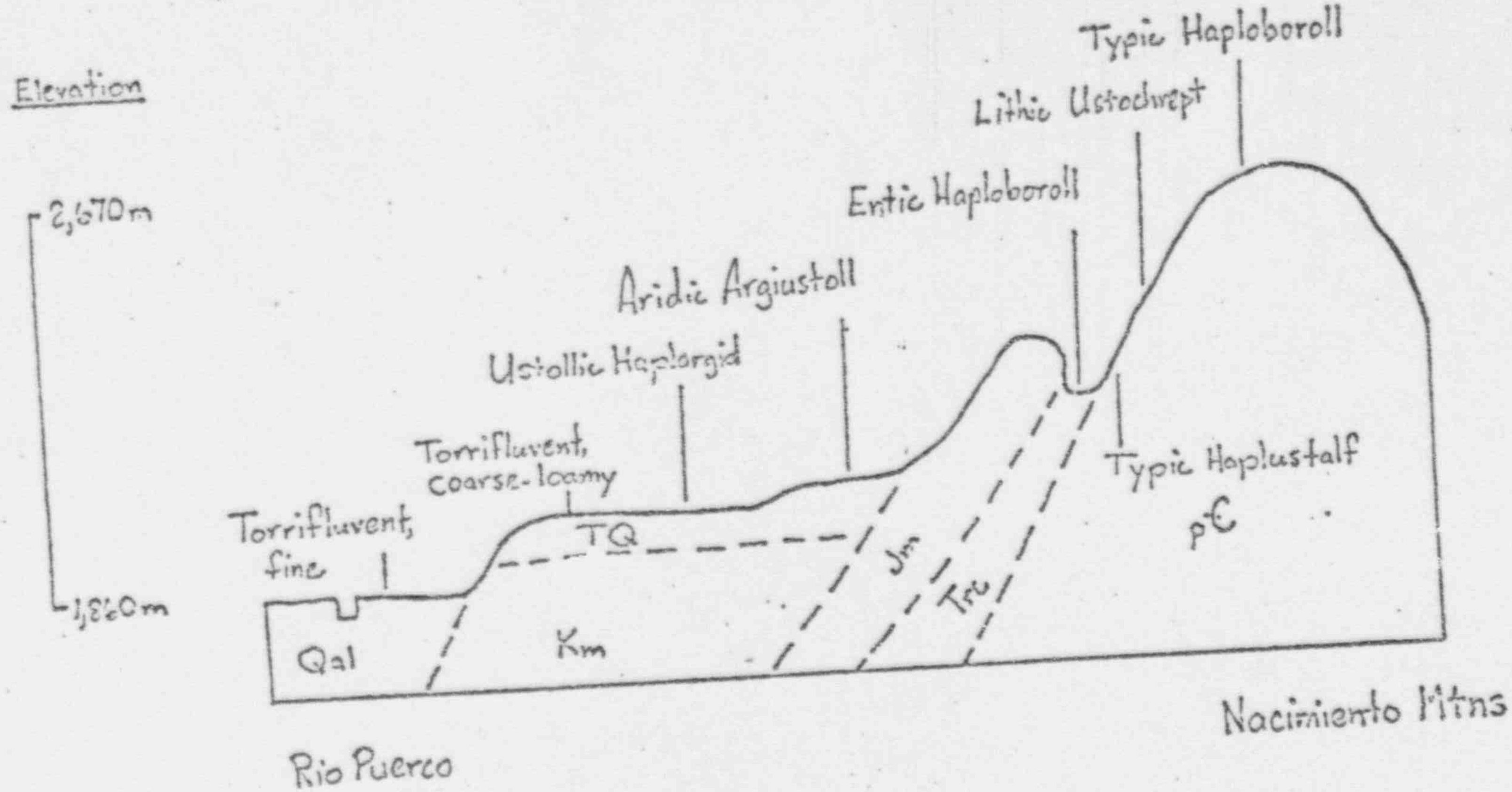


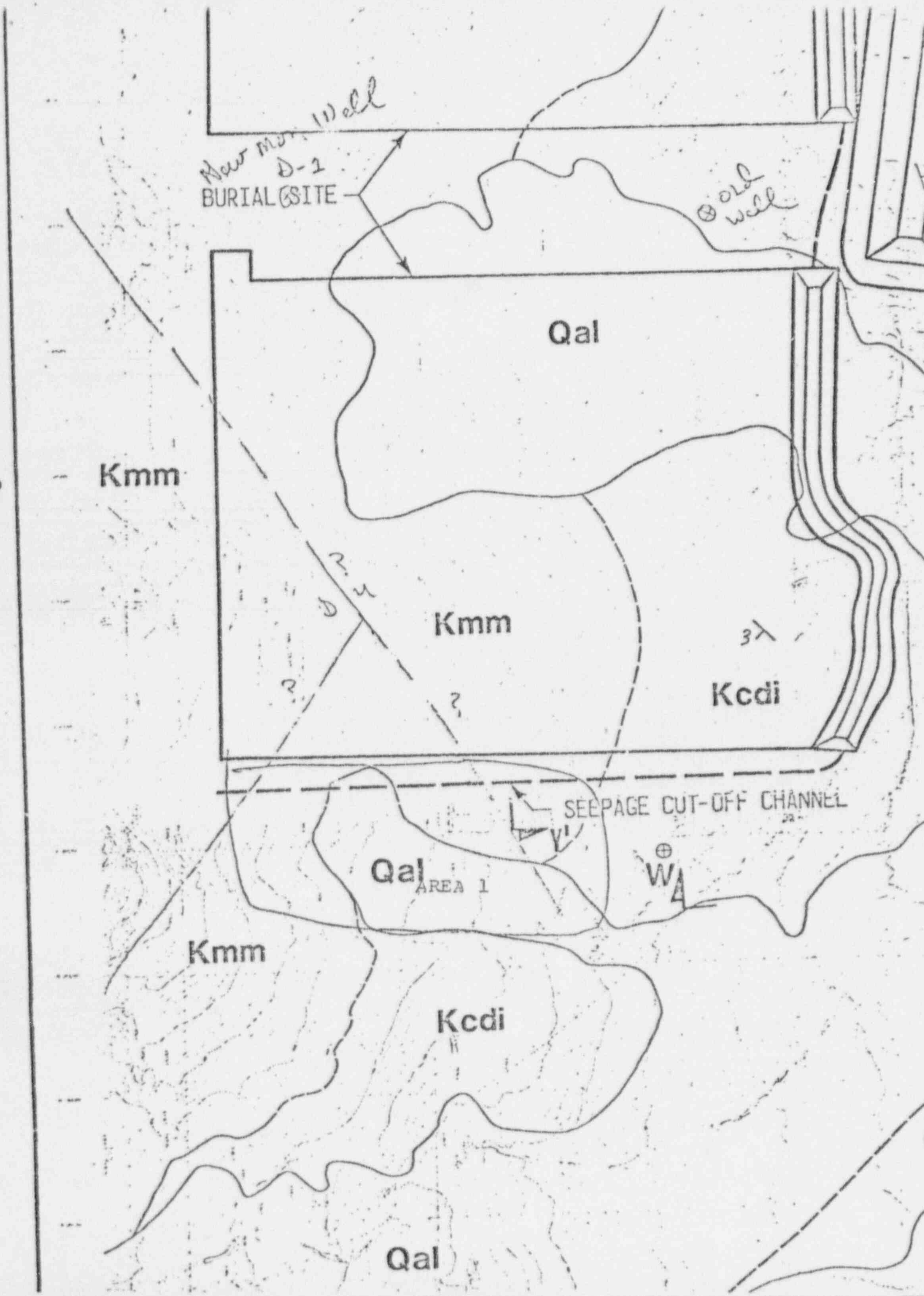
Figure 1. Threshold relationship between gullied and ungullied valley floors in several drainage basins of northwest Colorado. (From Patton and Schumm 1975, with permission of the Geologic Society of America)

igure 1.



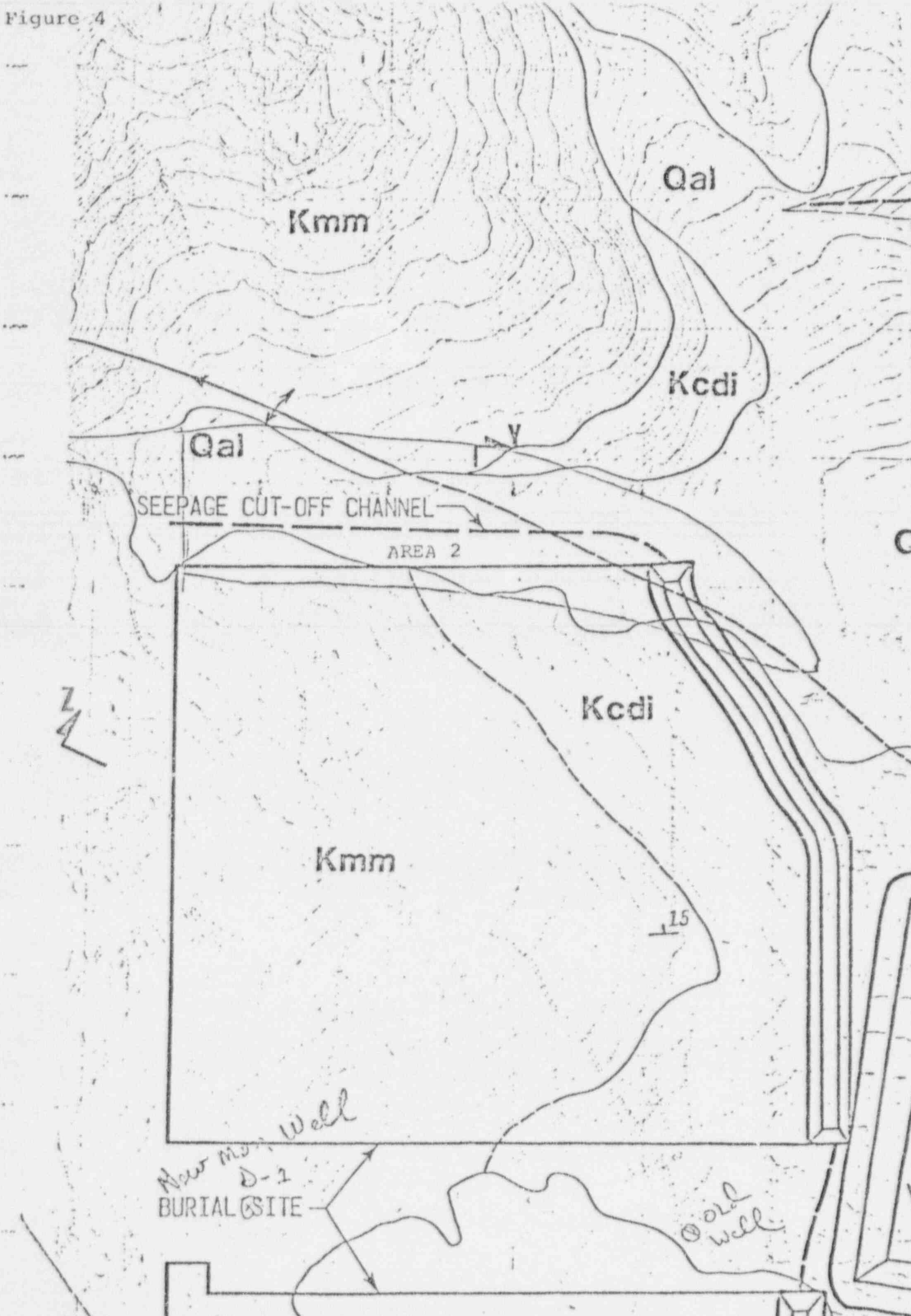
Soil-Landscape Relationships

		Low Carbonate Parent Material		High Carbonate Parent Material	
oil Age		Low Gravel	High Gravel	Low Gravel	High Gravel
ate	HOLOCENE			Torrifluvents (coarse loamy, fire)	
Mi					
arly					
500 ears B.P.					
atest	PLEISTOCENE	Haploborolls (Entic + Typic)	Ustochrepts Haplustalfs (Argillic)		
			Argiustolls (Argillic)		
Late		Haplargids (calcic)			
Mid					



New Mon. Well
D-1
BURIAL SITE
⊕ old well
Qal
Kmm
Kmm
Kcdi
SEEPAGE CUT-OFF CHANNEL
Qal
AREA 1
W
Kmm
Kcdi
Qal

Figure 4


Qal
Kmm
Kcdi
Qal
SEEPAGE CUT-OFF CHANNEL
AREA 2
Kcdi
Kmm
15
New Mon. Well
D-1
BURIAL SITE
Old Well