



United States Department of the Interior

NATIONAL PARK SERVICE

Water Resources Division
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Fort Collins, Colorado 80525-5596

IN REPLY REFER TO:

December 4, 1997

L54(2380)

LAME

Memorandum

To: Superintendent, Lake Mead National Recreation Area

Through: Chief, Water Operations Branch *MSF 12-4-97*

From: Hydrologist, Water Operations Branch

Subject: Trip Report on Travel to Lake Mead NRA (LAME) Shivwits Area on October 19-22, 1997

Purpose - LAME Resource Management staff requested the assistance of a WRD Hydrologist to provide professional support and technical expertise in the field during an erosion prevention project in the Pleasant Valley Meadow. The purpose of the trip was to evaluate the necessity of erosion control measures in Pleasant Valley and, if needed, to design and implement the structures. The trip was used to further evaluate the proposed Horse Valley road closure nearby which was discussed in an earlier trip report of Jan. 23, 1996.

Itinerary - Departed Fort Collins on Sunday Oct. 19th and arrived at the Shivwits area the same day. Returned to Fort Collins on Oct. 22nd.

Contacts - Curt Deuser, LAME Resource Management Specialist

Discussion - The Shivwits Plateau area is undergoing intensive vegetative management by LAME with prescribed fires, exotic weed control and cooperation with the livestock permittee to improve the grazing program. The entire Shivwits area of the park has historically been heavily grazed by cattle which may have partially caused the degradation processes evident today. Commercial grazing is considered marginal in the Shivwits area because of no reliable water, extremely long distance to paved roads, difficulty of fence maintenance, and scarce forage due to extensive stands of pinion and juniper. Previous grazing programs were largely year-around because of the mild winters and the difficulty in moving livestock. Year-around grazing continually stresses the few forage species thus

favoring sagebrush and other shrubs and woody species. However, forage species and grasses are better plants for adding organic material and protecting soils from erosion.

The Pleasant Valley Meadow area has many valuable natural resources composed of native grasses and relic vegetative communities, relatively uneroded terrain and semi-intact drainage systems. Many of these communities are not found elsewhere on the Shivwits Plateau. Sagebrush and junipers are increasing in the area, but whether its solely due to reduced grass cover from previous grazing or lack of wild fires or other distinct cause is unknown. Park staff discovered that erosion features have recently formed in the meadow. The reduction of sod forming roots and more exposed soil in the meadow has allowed initial stages of rill erosion and shallow gullies to form. This meadow has significant resource value to the park since it is the last remaining meadow dominated by native grasses. Most of the other meadows have severe erosion gullies with deeply cut banks that dry out soils and accelerate the seasonal lowering of the water table. The lowered water tables lead to sagebrush dominated communities replacing the native grass meadows. The restoration of these eroded meadows is extremely difficult, if possible at all.

Pleasant Valley Meadow is an area of flat terrain on rolling volcanic bedrock of the Shivwits area. Ponderosa and pinion pine as well as junipers, cover the shallow soils on the basaltic bedrock. Deep soils have accumulated in the meadow which are brought in from the surrounding hillslopes in a system of small drainages. At the transition between the hillslope and meadow, the drainages are very active. As the gradient of the stream decrease, considerable sediment is deposited over time forming a shallow alluvial fan or "delta" on the edge of the meadow. The area of concern has a main channel starting to entrench through its fan and, in many places, eroding tributaries. Continued grazing is still believed to be the major contributing factor to the accelerated erosion.

It was determined to be feasible to stabilize the Pleasant Valley Meadow since the erosion has just initiated. The construction utilized volunteer labor, no heavy machinery, appropriate hand tools, minimal vehicle access and incorporated safety training. The strategy was to implement a volunteer work crew the week of October 20, 1997 to construct erosion prevention structures. The project was on a fast track because it was desired to complete the project before the forecasted El Niño potentially accelerated the erosional processes. These structures may only provide short term stabilization, but due to the uniqueness of the meadow, installing the soft structures are considered worth the effort to protect the native grasses. Additionally, the opportunity for training was utilized to discuss with the volunteers and park staff to better understand the hydrologic and erosional processes in the meadow.

Prior to the trip, consultation on the phone was followed by transmittal of diagrams of erosion control structures which were reviewed by the park. These sketches included point bars constructed with loose rock, wooden stakes to slow water and collect sediment, and the use of sagebrush mats to be constructed on site. Design considerations of these "soft structures" are not meant to be permanent, but to be biodegradable, appropriate for the site, constructed with available material and work with natural biological and physical

processes. Presence of a knowledgeable professional during the project implementation insured that the devices were properly installed.

At Pleasant Valley, a single loose-rock diversion structure was constructed to "freeze in place" several small actively eroding gullies. The position of the structure rerouted runoff from the gullies to a more gradual slope with better herbaceous plant cover. The small gullies will no longer be actively eroding because runoff is prevented from entering. Plants will be able to colonize the gullied area because the soil is now more stable and downcutting and erosive action of the runoff has been eliminated.

Several large brush mats (constructed from sagebrush cut from nearby) were installed on the gradual slope that will receive additional runoff from the diversion structure. Short logs from junipers were placed on the chopped sagebrush to provide more contact with the soil and to anchor the mats in place. The intent is not to let the runoff concentrate into a single channel and increase its erosive power. The brush mats will disperse the runoff over a wider area allowing more infiltration and deposition of sediments. The mats were located where plant cover was thinner and should assure more moisture, shading and protection for new shoots in order to increase vegetative cover to provide long term protection against the erosive forces of the runoff.

A stake field was installed across the main channel. It is composed of numerous rows of wooden stakes driven in about one foot apart extending from bank to bank in the channel. Its function is to reduce the velocity of the flow and to trap debris and cause aggradation in the main channel. It was not covered by a brush mat in order to not "plug" the channel. A blocked channel could cause a vertical drop of the flow gradient which could initiate a headcut. The location of the stake field was at the upstream end of several large meanders (indicating slow moving water) and downstream of a straight and relatively entrenched reach of the channel (indicating relatively fast water). The entrenchment was seen as a partial cause of gully formation by activating tributary channel erosion through the mechanism of accelerating runoff over the steeper gradients into the main channel.

Three brush mat filters were constructed downstream of the meanders where flow was collecting and draining through an extensive sagebrush thicket. The edge of the thicket is where the relic grass communities showing signs of rill erosion occur. Between the base of each sagebrush plant is bare dirt and, apparently little opportunity for a sod forming plants to get established. Flows were beginning to scour the bare dirt causing formation of a distinct channel and increasing the concentration of energy of the flowing water into one path. A tributary drainage network (rill erosion) was starting to form through the relic grass community feeding into the newly formed channel within the sagebrush. The purpose of the brush mat filters is to trap sediment and prevent flow from concentrating in one channel. The deposited sediment in the main channel should prevent further downcutting of the rill erosion in the grass community.

The meadow at Horse Valley has active erosion problems related to downcutting of the two primitive roads crossing the area. The two roads are forks going to the same

destination and may have developed because one route or the other tended to be muddy and motorists tend to choose the alternative route when it is dryer. The more entrenched road has short circuited the drainage from the meadow allowing faster moving flows which are able to carry out more sediment than is being deposited. This problem is compounded because of year-around grazing pressure has reduced grass cover and a network of gullies are draining into the entrenched road. The expanding gully network is severely cutting into the sedge and grass meadow.

Recommendations - Determining a long term strategy for maintaining the Pleasant Valley Meadow should include balancing grazing with sustaining a dense cover of grasses. If grazing is to be continued, it is highly recommended to put up a grazing exclosure around the unique grass community. Post construction follow-up should include photo and vegetation monitoring of structures and deposition zones, and annual maintenance of animal damage or vandalism. An evaluation the ultimate fate and function of the structures would be valuable to guide erosion prevention projects elsewhere.

It is recommended to close the downcut road at Horse Valley and gravel the other route to encourage and/or restrict motorists from driving across the open meadow. Flow retarding structures should be designed for the entrenched portion of the road and erosion control devices place in the gully network. Most important is improving grazing management to encourage recovery of the grass and sod forming species native to the meadow.

Action Items - None at this time.

Please call me at (970)223-3517 or Bill Jackson at (970)225-3503 if you have any questions regarding this request and/or project.

Richard R. Inglis Jr.

cc: LAME - Deuser
PWR - Kolipinski, Woo